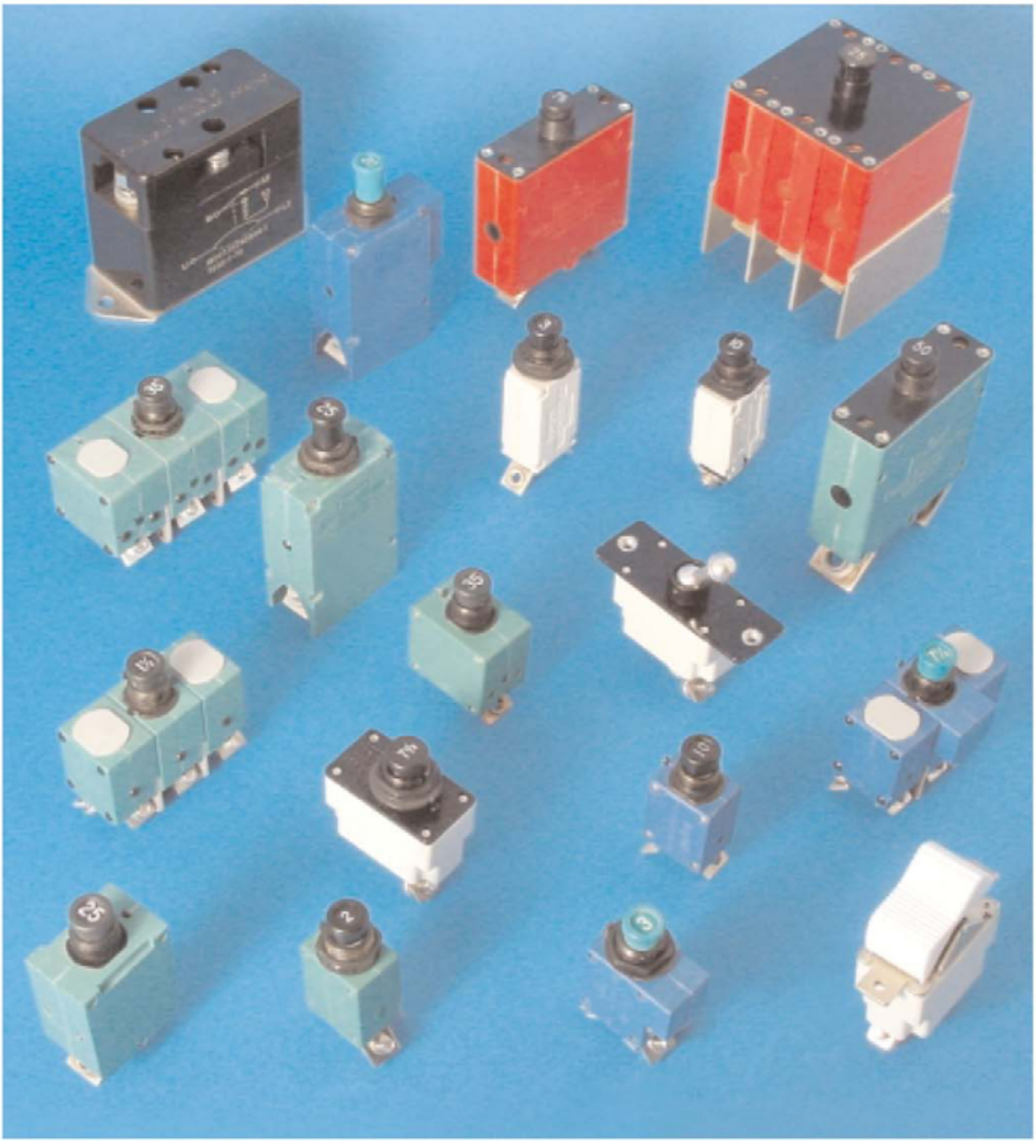
KLIXON®

Precision Products Aircraft Circuit Breakers



KLIXON®

Aircraft Circuit Breakers

2TC14 2TC66 3TC14

3TC7

2TC49

5TC50

6752-12

6752-305

6752-100

7277-2 7277-1

20TC

7274-2 7274-4 7274-11 and 7274-69

7270-7 7271-8 7271-3 7270-1

6TC 9TC

3SB2 3SB4

KLIXON®

Condensed Aircraft Circuit Breaker Guide

This guide gives a brief description of most circuit breakers manufactured by Texas Instruments. For more information, please consult the appropriate section of this catalog.

CIRCUIT BREAKER TYPE NUMBER	TYPE	APPROVAL	ACTUATING OR RESET MEANS	MANUAL TRIP	INDICATING	RATING IN AMPS	MAJOR DIMENSIONS IN INCHES APPROX. L x W x H	APPROX. WT. IN GRAMS	APPROX. 200% TIME SECONDS TIME TO TRIP AT TWICE RATED CURRENT
2TC 3TC	Aircraft	MS 3320 MS 14105	Button	Yes	Yes	1 - 25 15 - 35	.75 x .56 x 1.2 1.10 x .75 x 1.2	25.0 36.0	10 10
5TC	Aircraft	—	Button	Yes	Yes	20 - 50	1.65 x .77 x 1.92	57.5 (std.) 59.4 (aux.)	10
6TC 9TC	Aircraft	MS 14154 MS 14153	Button	Yes	Yes	2 - 20 1, 15 - 35	.75 x 1.78 x 1.2 1.10 x 2.35 x 1.2	65.0 110.0	10 10
2TC49	Aircraft	M5809/1	Button	Yes	Yes	2.5 - 15	1.21 x .75 x .56	25.0	10
3TC7	Aircraft	MS 25244	Button	Yes	Yes	5 - 35	1.1 x .75 x 1.49	38.9	35
6752-12 6752-100 6752-305	Aircraft	MS 24571 MS25361	Button	Yes	Yes	2.5 - 50 50 - 100 2.5 - 90	2.2 x .75 x 3.3 2.2 x .75 x 3.3 2.2 x 2.25 x 3.3	91.0 91.0 292.0	35
7274	Aircraft	MS 26574 MS 22073	Button	Yes	Yes	1/2 - 20	.750 x .562 x 2.2	28.0 32.0	10
7277	Aircraft	—	Button	Yes	Yes	1/2 - 20	.750 x .562 x 2.2	25.0	10
7270 7271	Aircraft	MS 24509 MS 24510	Toggle Button	Yes	Yes	3 - 35	1.37 x .75 x 2.25 1.37 x .75 x 2.00	39.0	50 50
20TC2	Aircraft	—	Rocker	Yes	Yes	3 - 35	2 x .750 x 2	39.0	50
3SB	Simulator	—	Button	Yes	Yes	—	.750 x .562 x 2.2	30.0	—

MIL Approved Aircraft Circuit Breakers

MS Number	TI Number	Page	MS Number	TI Number	Page	MS Number	TI Number	Page
MS 3320	2TC2	4, 5	MS 14154V	6TC63	6, 7	MS 26574	7274-2	18, 19
MS 3320L	2TC27	4, 5	MS 5809/1	2TC49	8, 9	MS 26574A	7274-4	18, 19
MS 3320V	2TC63	4, 5	MS 24571	6752-12	12, 13	MS 26574L	7274-70	18, 19
MS 14105	3TC2	4, 5	MS 24571V	6752-12	12, 13	MS 24509A	7270-1	22, 23
MS 14105L	3TC27	4. 5	MS 25361	6752-100	14, 15	MS 24509B	7270-7	22, 23
MS 14153	9TC2	6, 7	MS 25361V	6752-102	14, 15	MS 24510A	7271-8	22, 23
MS 14154	6TC2	6, 7	MS 22073	7274-11	18, 19	MS 24510B	7271-3	22, 23
MS 14154L	6TC37	6, 7	MS 22073V	7274-69	18, 19	MS 25244	3TC7	16, 17

*Note: For cross reference information, refer to page 28.

KLIXON®

Condensed Aircraft Circuit Breaker Guide

CIRCUIT BREAKER TYPE NUMBER	FAULT INTERRUPTING CAPACITY AMPS @ VOLTS & CYCLES	REMARKS	TYPICAL APPLICATIONS
2TC 3TC	6000 @ 28 VDC 2500 @ 120 VAC, 400 Hz 6000 @ 28 VDC 2000 @ 120 VAC, 400 Hz	Subminiature, ambient compensated 1 pole auxiliary switch available	Aircraft power distribution
5TC	4000 @ 28 VDC 2000 @ 115 VAC, 400 Hz	Ambient compensated	Aircraft, avionics, and electrical systems
6TC 9TC	2000 @ 120 VAC, 400 Hz 2000 @ 120 VAC, 400 Hz	Subminiature, ambient compensated, 3 pole	Aircraft power distribution
2TC49	6000 @ 28 VDC 2500 @ 120 VAC, 400 Hz	Dual Safety 2TC	Aircraft power distribution
3TC7	6000 @ 30 VDC 3500 @ 120 VAC, 400 Hz	Lightweight, high performance, non-ambient temperature compensated	Aircraft, avionics, and electrical systems
6752-12 6752-100 6752-305	6000 @ 30 VDC 120 VAC, 400 Hz	1 Pole – 6752-12 1 Pole – 6752-100 3 Pole – 6752-305	Aircraft power distribution ground support
7274	2000 @ 28 VDC 500 @ 125 VAC, 400 Hz	Quick acting, subminiature auxiliary switch available	Aircraft power distribution, Avionics, ground support, missile systems
7277	2000 @ 28 VDC 500 @ 120 VAC, 400 Hz	Wide calibration version of 7274	Protection of wire, motors, solenoids, transformers in electronics
7270 7271	4000 @ 30 VDC 3500 @ 120 VAC, 400 Hz	Toggle or push button	Aircraft power distribution
20TC2	2000 @ 30 VDC 1000 @ 120 VAC, 400 Hz	Rocker switch type	Combination circuit switching & protection light aircraft, electronics, vehicles
3SB	—	Push button	Commercial and military simulators

*Note: For FAA/PMA approved devices, go to www.klixon.com

For more information contact our product manager:
Tel: (508) 236-3573

For more information on temperature compensated circuit breakers contact:
Tel: (508) 236-3536

For more information on non-temperature compensated circuit breakers contact:
Tel: (508) 236-3539

email: klixon@ti.com

Website address: www.klixon.com

KLIXON®

Single Phase TC Series Circuit Breakers

Miniature Ambient Compensated

Features

- **Miniature size**
- **Light weight**
- **Trip free**
- **Mil-qualification**
- **Current rating 1-35 amperes**
- **Coordinated ratings**
- **High vibration resistance**
- **High interrupt capacity**

2TC14 2TC66 3TC14

Overview

Klixon® single-phase TC devices are the smallest, lightest aircraft circuit breakers available today. They represent "state-of-the-art" protection for today's aerospace power systems. Their light weight and small size make them especially well suited for aircraft, avionics and electronic systems.

The Klixon trademark has set the standard for aerospace circuit breakers. Despite the small size, the TC series offers the endurance and reliability required by exacting military specifications, and are available in standard current ratings from 1 – 35 amperes.

Coordination

The 2, 3, 6 and 9TC breaker ratings are coordinated so any rating will trip before another circuit breaker, twice its rating, in the event of a fault of up to 6000 amps let-thru current. This results in improved overall equipment performance, since only the smallest faulted circuit is interrupted, while larger circuits remain operational (see pages 6 and 7 for 6/9TC details).

Ambient Temperature Compensation

Ambient compensated circuit breakers permit system designers to specify smaller gauge wire where the circuit breaker and wiring are exposed to different ambient temperatures. They are especially suited for applications where the ambient temperature exceeds the 160^{O}F maximum of non-ambient compensated thermal circuit breakers. The TC series may be applied where operating temperatures are as high as 250^{O}F (121^{O}C), with no derating of the circuit breaker. This eliminates the need for cooling air and allows substantial weight, space and cost savings.

Options*

- Longer push buttons
- High vibration
- Random vibration
- Metric mounting thread
- Metric terminal thread
- Dust boot†
- Auxiliary switch - male and female contacts available
- Terminal barriers
- Plug-in terminals

Trip Free

The complete line of TC series circuit breakers is trip free. The circuit breaker cannot be maintained closed during an overload even with the actuator button held closed.

High Short Circuit Capacity

For its miniature size, the 2/3TC series offers unusually high current interrupting capacity. Overloads up to 6000 amps at 28 VDC or 2000-3500 amps at 120 VAC, 400 Hz can be safely interrupted without affecting calibration or operating performance in the standard 2/3TC series.

Qualifications

MS3320 - 2TC2

MS3320L - 2TC27

MS3320V - 2TC63

MS14105 - 3TC2

MS14105L - 3TC27

European standards

SAE standards

All U.S. aircraft OEM's

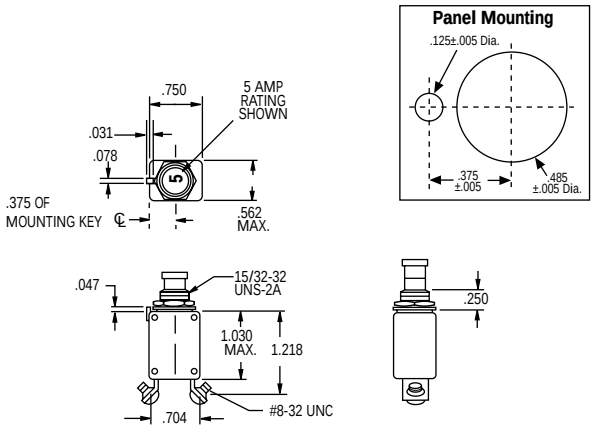
Most European aircraft OEM's

* Contact factory for details

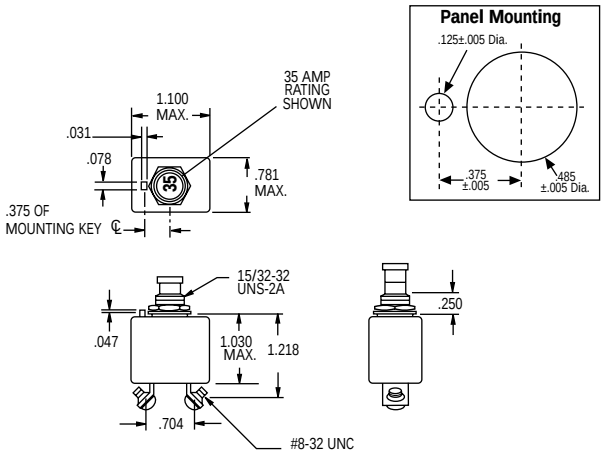
† Part Number 14500-1 Fits 15/32 Bushing
Part Number 14500-5 Fits 7/16 Bushing

Characteristics

2TC14



3TC14



Calibration: 1-25 amps

TEMP °C	MIN ULT TRIP	MAX ULT TRIP	TRIP TIME - SECONDS		
			200%	500%	1000%
+25	115%	138%	4-16	.4-1.6	.10-.40
-54	115%	165%	7-35	.6-3.0	.15-.70
+121	85%	145%	2-13	.25-1.0	.06-.25

Calibration: 15-35 amps

TEMP °C	MIN ULT TRIP	MAX ULT TRIP	TRIP TIME - SECONDS		
			200%	500%	1000%
+25	115%	138%	4-20	.40-1.7	.10-.40
-54	115%	165%	6-35	.55-3.0	.15-.70
+121	85%	145%	2-15	.25-1.0	.06-.25

Vibration*..... 10 G's minimum, 50 - 500 Hz
Mechanical Shock..... 50 G's
Acceleration..... 10 G's
Weight..... 2TC14 - 24 gm max.
3TC14 - 36 gm max.

Interrupt Current

1-20 amps: 6000 amps at 28 VDC
25 amps: 1625 amps at 28 VDC
1-15 amps: 2500 amps at 120 VAC, 400 Hz
20 amps: 2000 amps at 120 VAC, 400 Hz
25 amps: 1800 amps at 120 VAC, 400 Hz

Endurance

2500 cycles 120 VAC, 400 Hz Inductive
5000 cycles 120 VAC, 400 Hz Resistive
2500 cycles 30 VDC Inductive
5000 cycles 30 VDC Resistive
10,000 cycles Mechanical, no load

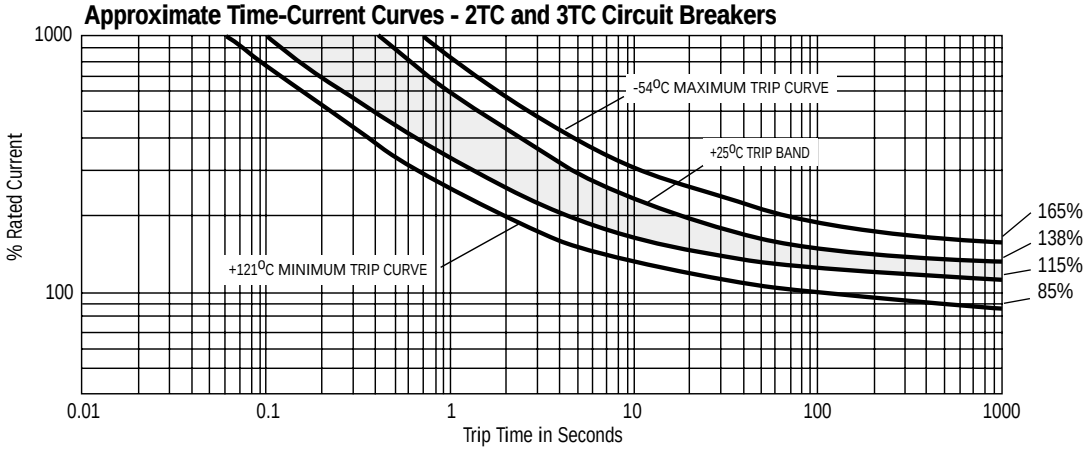
* Other vibration levels available. Contact factory for details.

TI Number	Voltage Drop (max.)**
2TC14-1	1.10
2TC14-2	0.70
2TC14-2½	0.50
2TC14-3	0.40
2TC14-4	0.45
2TC14-5	0.35
2TC14-7½	0.30
2TC14-10	0.28
2TC14-15	0.25
2TC14-20	0.25
2TC14-25	0.20

TI Number	Voltage Drop (max.)**
3TC14-15	0.25
3TC14-20	0.25
3TC14-25	0.25
3TC14-30	0.25
3TC14-35	0.25

**Max. voltage drop at nominal rated current.

Approximate Time-Current Curves - 2TC and 3TC Circuit Breakers



REVISIONS						
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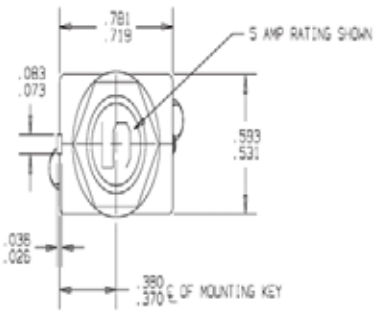
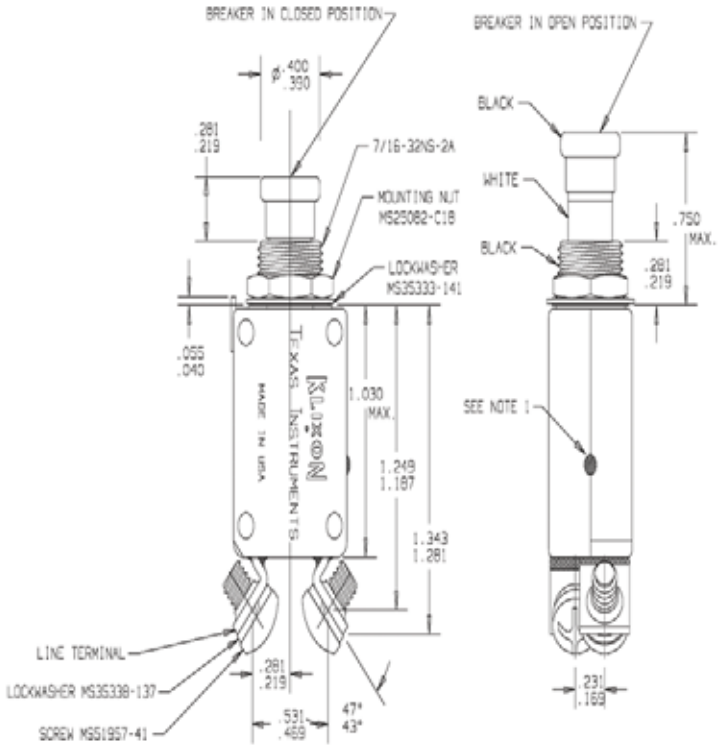


NOTES:

1. EPOXY SURFACES ARE NON-DIMENSIONED, ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
2. TERMINAL AND MOUNTING HARDWARE MAY BE PACKAGED RATHER THAN INSTALLED
3. COUNTRY OF ORIGIN IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. COUNTRY OF ORIGIN TO BE IDENTIFIED AS REQUIRED.
4. DATE CODE PER 10588-885.
5. MARK IN APPROXIMATE POSITION SHOWN WITH BLACK INK PER 12506-70.



PERFORMANCE CHARACTERISTICS

DETAIL PERFORMANCE PER MIL-C-5809G

OVERLOAD CYCLING	100 CYCLES AT 200% RATING
VIBRATION	10 G'S MINIMUM 50-500 HZ
MECHANICAL SHOCK	50 G'S
ACCELERATION	10 G'S
SAND AND DUST	12 HOURS
CORROSION	SALT SPRAY 50 HOURS
HUMIDITY	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	2500 CYCLES
	400 HZ RESISTIVE	5000 CYCLES
30 VDC	INDUCTIVE	2500 CYCLES
	RESISTIVE	5000 CYCLES
MECHANICAL	NO LOAD	10000 CYCLES

CALIBRATION: 1 AMP THRU 25 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	500%	1000%
+25°C, +77°F	115% RATING	138% RATING	5-20 SEC.	.5-2.0 SEC.	.12-.53 SEC.
-55°C, -65°F	115% RATING	160% RATING	7-40 SEC.	.6-3.0 SEC.	.16-.8 SEC.
+121°C, +250°F	100% RATING	138% RATING	3-13 SEC.	.33-1.1 SEC.	.07-.3 SEC.

RUPTURE:

1 AMP	120 VAC, 400 HZ	3500 AMPS
2 AND 2 1/2 AMP	120 VAC, 400 HZ	2800 AMPS
3 THRU 15 AMP	120 VAC, 400 HZ	2500 AMPS
20 AMP	120 VAC, 400 HZ	2000 AMPS
1 THRU 20 AMP	28 VDC	6000 AMPS
25 AMP	28 VDC	1625 AMPS
25 AMP	120 VAC, 400 HZ	1800 AMPS

MAXIMUM OPERATING FORCES

PULL OUT	5 LBS. MAX. (22.2 N)
RESET	5 LBS. MAX. (22.2 N)

OPERATING ALTITUDE: 70,000 FT. (21,000 M)

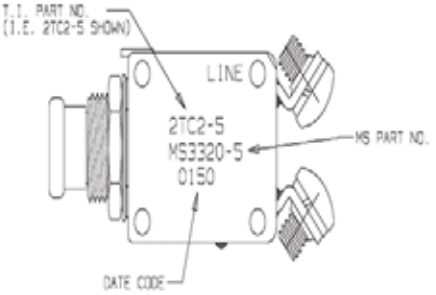
WEIGHT: 25.0 GRAMS MAX.

VOLTAGE DROP:

1 AMP	1.10 VOLTS MAX.
2 AMP	0.70 VOLTS MAX.
2.5 AMP	0.50 VOLTS MAX.
3 AMP	0.40 VOLTS MAX.
4 AMP	0.37 VOLTS MAX.
5 AMP	0.35 VOLTS MAX.
7.5 AMP	0.30 VOLTS MAX.
10 AMP	0.28 VOLTS MAX.
15 AMP	0.25 VOLTS MAX.
20 AMP	0.25 VOLTS MAX.
25 AMP	0.20 VOLTS MAX.

2TC2-25	N/A
2TC2-20	MS 3320-20
2TC2-15	MS 3320-15
2TC2-10	MS 3320-10
2TC2-7 1/2	MS 3320-7 1/2
2TC2-5	MS 3320-5
2TC2-4	MS 3320-4
2TC2-3	MS 3320-3
2TC2-2 1/2	MS 3320-2 1/2
2TC2-2	MS 3320-2
2TC2-1	MS 3320-1
T.I. PART NO.	MS PART NO.

MARKING TABLE



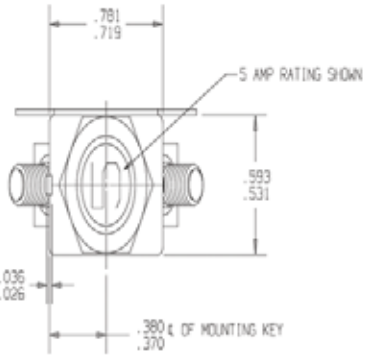
MARKING
(SEE TABLE)

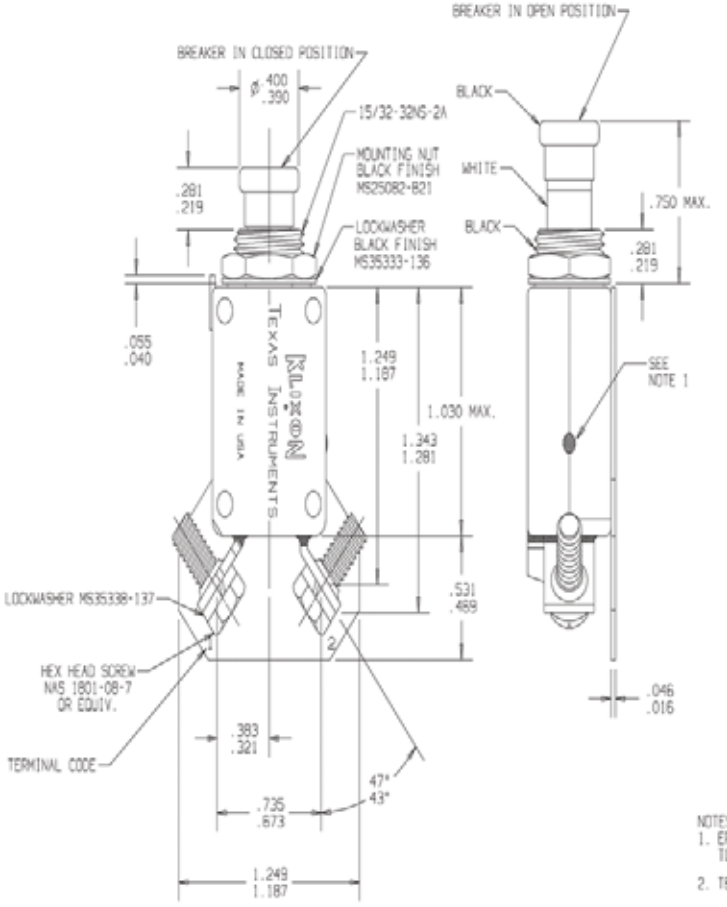
THIS IS A CAD DRAWING. THE GEOMETRY IN THE ASSOCIATED CAD COMPUTER FILE IS DIMENSIONALLY ACCURATE. WHEN DRAWING IS BEING REVISED, THE GEOMETRY MUST BE UPDATED IN ALL VIEWS AND ON ALL SHEETS.

03 P2 P19

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN TOM DAIL	DATE 10-30-89	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703 — CONTROL PRODUCTS DIVISION
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER JACQUES CHAMMAS	12-4-89	TITLE: PART NO. 2TC2 AMBIENT COMPENSATED, HIGH TEMP. CIRCUIT BREAKER PUSH-PULL, TRIP FREE ENVELOPE DRAWING
	APPROVED N/A		
	APPROVED N/A		
MATERIAL			SIZE C | CODE IDENT NO. 82647 | 2TC2
			SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE. | SCALE: 4X | SHEET 1 OF 1

REVISIONS					
ZONE	LTR	DESCRIPTION	PROJ. 1041	DATE	APPROVED
	AH	SEE ECN	ECN017504 PAF	8-19-04	D.A.





PERFORMANCE CHARACTERISTICS

DETAIL PERFORMANCE PER MIL-C-5809G

OVERLOAD CYCLING	100 CYCLES AT 200% RATING
VIBRATION	10 G'S MINIMUM 50-500 HZ
MECHANICAL SHOCK	50 G'S
ACCELERATION	10 G'S
SAND AND DUST	12 HOURS
CORROSION	SALT SPRAY 50 HOURS
HUMIDITY	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	2500 CYCLES
	400 HZ RESISTIVE	5000 CYCLES
30 VDC	INDUCTIVE	2500 CYCLES
	RESISTIVE	5000 CYCLES
MECHANICAL	NO LOAD	10000 CYCLES

CALIBRATION: 1 AMP THRU 20 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	500%	1000%
+25°C, +77°F	115% RATING	138% RATING	5-20 SEC.	.5-2.0 SEC.	.12-.53 SEC.
-54°C, -65°F	115% RATING	165% RATING	7-35 SEC.	.6-3.0 SEC.	.15-.70 SEC.
+121°C, +250°F	85% RATING	145% RATING	2-13 SEC.	.25-1.0 SEC.	.06-.25 SEC.

RUPTURE:

1 THRU 10 AMP	120 VAC, 400 CPS	2800 AMPS
1 THRU 20 AMP	28 VDC	6000 AMPS
15 AMP	120 VAC, 400 CPS	2500 AMPS
20 AMP	120 VAC, 400 CPS	2000 AMPS
25 AMP	28 VDC	1625 AMPS
25 AMP	120 VAC, 400 CPS	1800 AMPS

MAXIMUM OPERATING FORCES

PULL OUT	1.5 - 5.0 LBS
RESET	1.0 - 5.0 LBS

OPERATING ALTITUDE: 70,000 FT (21,000 M)

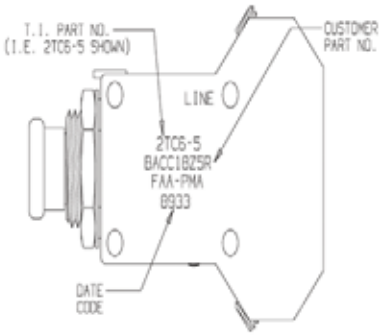
WEIGHT: 27.0 GRAMS MAX.

VOLTAGE DROP:

1 AMP	1.10 VOLTS MAX.
2 AMP	0.70 VOLTS MAX.
2.5 AMP	0.50 VOLTS MAX.
3 AMP	0.40 VOLTS MAX.
5 AMP	0.35 VOLTS MAX.
7.5 AMP	0.30 VOLTS MAX.
10 AMP	0.28 VOLTS MAX.
15 AMP	0.25 VOLTS MAX.
20 AMP	0.25 VOLTS MAX.
25 AMP	0.20 VOLTS MAX.

VIBRATION RANDOM: PER BPS-C-144
9dB/OCT RISE, 5-15 HZ; PSD OF 0.2(G^2/HZ) FROM 15 TO 100 HZ:
9dB/OCT FALL 100 TO 2000 HZ

NOTES:
1. EPOXY SURFACES ARE NON-DIMENSIONED, ENVELOPE DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
2. TERMINAL AND MOUNTING HARDWARE MAY BE PACKAGED RATHER THAN INSTALLED
3. COUNTRY OF ORIGIN IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. COUNTRY OF ORIGIN TO BE IDENTIFIED AS REQUIRED.
4. DATE CODE PER 10588-285.
5. MARK IN APPROXIMATE POSITION SHOWN IN BLACK INK PER 12506-70.

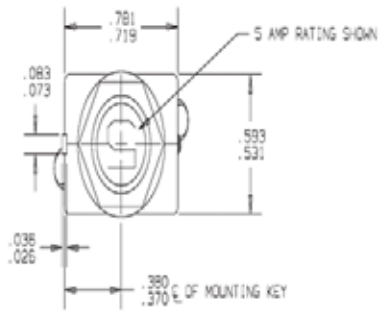


MARKING
(SEE TABLE)

T.I. PART NO.	CUSTOMER PART NO.	PMA APPROVED
2TC6-25	N/A	NO
2TC6-20	N/A	NO
2TC6-15	N/A	NO
2TC6-10	BACC1BZ10R	YES
2TC6-7 1/2	BACC1BZ7R	YES
2TC6-5	BACC1BZ5R	YES
2TC6-3	BACC1BZ3R	YES
2TC6-2 1/2	BACC1BZ2R	YES
2TC6-2	BACC1BZ02R	YES
2TC6-1	BACC1BZ1R	YES

P2	Q3	P18		
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN: CHAS. FLEURANT	DATE: 9-22-92	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703	KLIXON® CONTROL PRODUCTS DIVISION
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER: J. MASCI	10-1-92	TITLE: PART NO 2TC6 AMBIENT COMPENSATED, HIGH TEMP. CIRCUIT BREAKER PUSH-PULL, TRIP FREE ENVELOPE DRAWING	
	APPROVED: N/A			
	APPROVED: N/A			
MATERIAL			SIZE: C	CODE IDENT NO.: 82647
			SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.	2TC6

REVISIONS						
ZONE	LTR	2TC27	DESCRIPTION	PROJ. 1041	DATE	APPROVED
	R	SEE ECN	ECN0017504 PAF		8-19-04	D.A.



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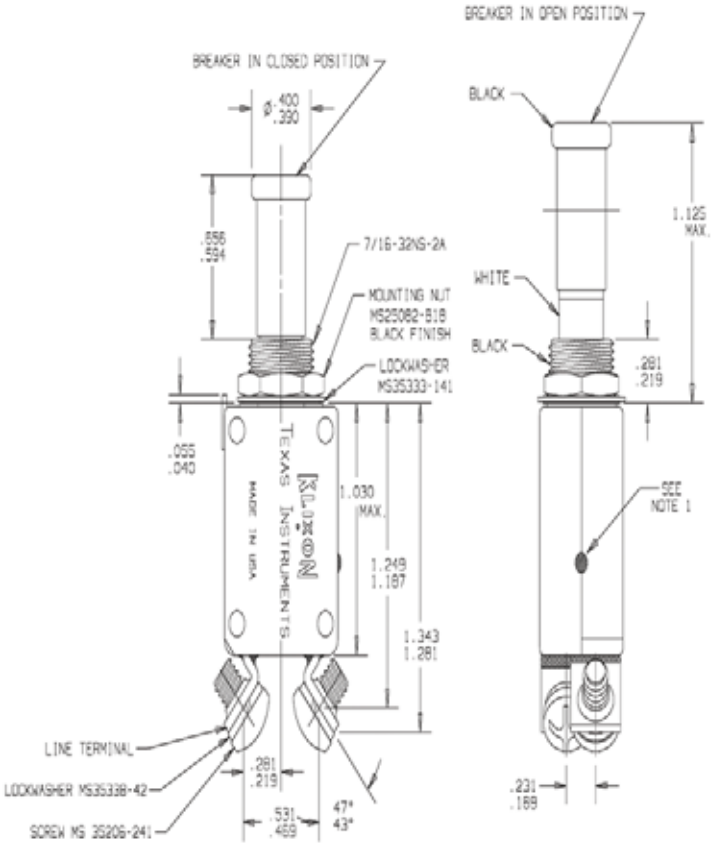


PERFORMANCE CHARACTERISTICS

DETAIL PERFORMANCE PER MIL-C-5809

OVERLOAD CYCLING	100 CYCLES AT 200% RATING
VIBRATION	10 G'S MINIMUM 50-500 HZ
MECHANICAL SHOCK	50 G'S
ACCELERATION	10 G'S
SAND AND DUST	12 HOURS
CORROSION	SALT SPRAY 50 HOURS
HUMIDITY	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	2500 CYCLES
	400 HZ RESISTIVE	5000 CYCLES
30 VDC	INDUCTIVE	2500 CYCLES
	RESISTIVE	5000 CYCLES
MECHANICAL	NO LOAD	10000 CYCLES

CALIBRATION: 1 AMP THRU 25 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	500%	1000%
+25°C, +77°F	115% RATING	138% RATING	5-20 SEC.	.5-2.0 SEC.	.12-.53 SEC.
-55°C, -65°F	115% RATING	160% RATING	7-40 SEC.	.6-3.0 SEC.	.16-.8 SEC.
+121°C, +250°F	100% RATING	138% RATING	3-13 SEC.	.33-1.1 SEC.	.07-.3 SEC.

RUPTURE:

1 AMP	120 VAC, 400 CPS	3500 AMPS
2 AND 2 1/2 AMP	120 VAC, 400 CPS	2800 AMPS
3 THRU 15 AMP	120 VAC, 400 CPS	2500 AMPS
20 AMP	120 VAC, 400 CPS	2000 AMPS
1 THRU 20 AMP	28 VDC	6000 AMPS
25 AMP	28 VDC	1625 AMPS
25 AMP	120 VAC, 400 CPS	1800 AMPS

MAXIMUM OPERATING FORCES

PULL OUT	5 LBS. MAX. (22.2 N)
RESET	5 LBS. MAX. (22.2 N)

OPERATING ALTITUDE: 70,000 FT. (21,000 M)

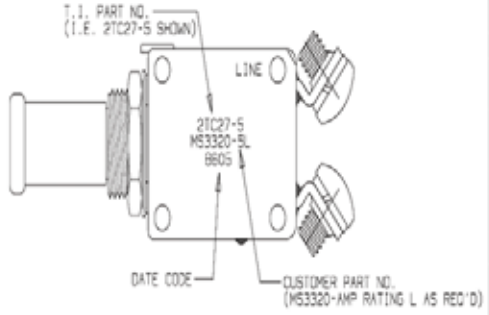
WEIGHT: 25.0 GRAMS MAX.

VOLTAGE DROP:

1 AMP	1.10 VOLTS MAX.
2 AMP	0.70 VOLTS MAX.
2.5 AMP	0.50 VOLTS MAX.
3 AMP	0.40 VOLTS MAX.
4 AMP	0.37 VOLTS MAX.
5 AMP	0.35 VOLTS MAX.
7.5 AMP	0.30 VOLTS MAX.
10 AMP	0.28 VOLTS MAX.
15 AMP	0.25 VOLTS MAX.
20 AMP	0.25 VOLTS MAX.
25 AMP	0.20 VOLTS MAX.

T.I. PART NO.	MS PART NO.
2TC27-25	N/A
2TC27-20	MS 3320-20L
2TC27-15	MS 3320-15L
2TC27-10	MS 3320-10L
2TC27-7 1/2	MS 3320-7 1/2L
2TC27-5	MS 3320-5L
2TC27-4	MS 3320-4L
2TC27-3	MS 3320-3L
2TC27-2 1/2	MS 3320-2 1/2L
2TC27-2	MS 3320-2L
2TC27-1	MS 3320-1L

MARKING TABLE

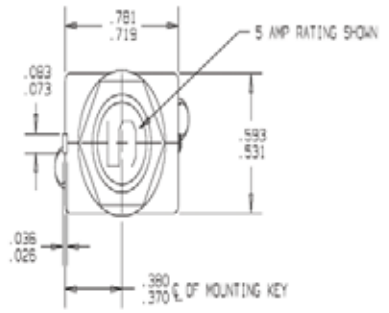


MARKING
(SEE TABLE)

THIS IS A CAD DRAWING. THE GEOMETRY IN THE ASSOCIATED CAD COMPUTER FILE IS DIMENSIONALLY ACCURATE. WHEN DRAWING IS BEING REVISED, THE GEOMETRY MUST BE UPDATED IN ALL VIEWS AND ON ALL SHEETS.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN: TOM DAIL	DATE: 10-30-89	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703 — CONTROL PRODUCTS DIVISION
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER: JACQUES CHAMMAS	12-4-89	TITLE: PART NO. 2TC27 AMBIENT COMPENSATED, HIGH TEMP. CIRCUIT BREAKER PUSH-PULL, TRIP FREE ENVELOPE DRAWING
	APPROVED		
	APPROVED		
MATERIAL			SIZE: C — CODE IDENT NO.: 82647 — 2TC27 SH1
			SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE. — SCALE: 4X — SHEET 1 OF 1

REVISIONS						
ZONE	LTR	2TC63	DESCRIPTION	PROJ. 1041	DATE	APPROVED
	H	SEE EDN		EDN0017504 PAF	8-20-04	D.A.



NOTES:

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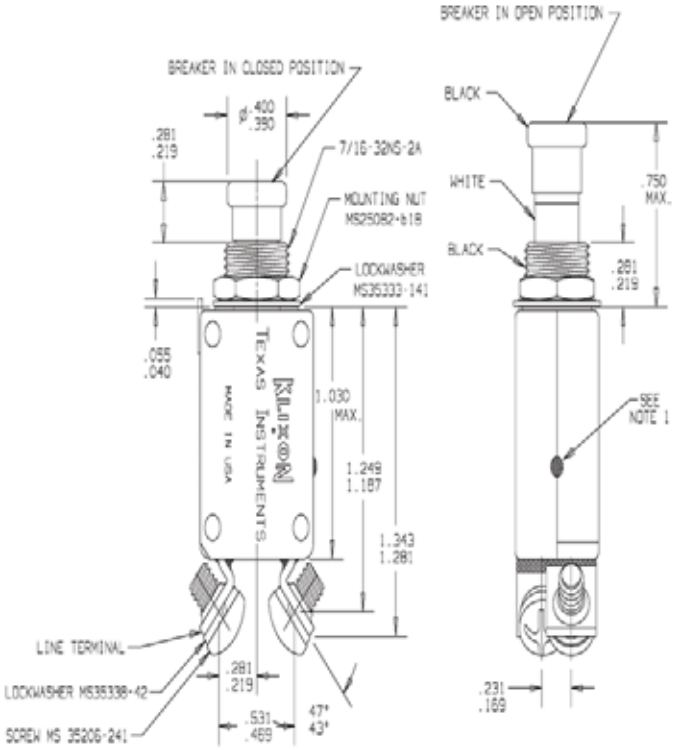
2. TERMINAL AND MOUNTING HARDWARE MAY BE PACKAGED RATHER THAN INSTALLED.
3. COUNTRY OF ORIGIN IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. COUNTRY OF ORIGIN TO BE IDENTIFIED AS REQUIRED.
4. DATE CODE PER 10588-285.
5. MARK IN APPROXIMATE POSITION SHOWN IN BLACK INK PER 12506-70.



PERFORMANCE CHARACTERISTICS

DETAIL PERFORMANCE PER MIL-C-5809 AND MS 3320 "V"

OVERLOAD CYCLING	100 CYCLES AT 200% RATING
VIBRATION	10 G'S CONDITION "C" 55-2000 HZ AND 15 G'S CONDITION "B" 10-2000 HZ
MECHANICAL SHOCK	50 G'S
ACCELERATION	10 G'S
SAND AND DUST	12 HOURS
CORROSION	SALT SPRAY 50 HOURS
HUMIDITY	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	2500 CYCLES
	400 HZ RESISTIVE	5000 CYCLES
30 VDC	INDUCTIVE	2500 CYCLES
	RESISTIVE	5000 CYCLES
MECHANICAL	NO LOAD	10000 CYCLES

CALIBRATION: 1 AMP THRU 25 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	500%	1000%
+25°C, +77°F	115% RATING	138% RATING	5-20 SEC.	.5-2.0 SEC.	.12-.53 SEC.
+121°C, +250°F	115% RATING	160% RATING	7-40 SEC.	.6-3.0 SEC.	.16-.8 SEC.
+121°C, +250°F	100% RATING	138% RATING	3-13 SEC.	.33-1.1 SEC.	.07-.3 SEC.

RUPTURE:

1 AMP	120 VAC, 400 HZ	3500 AMPS
2 AND 2 1/2 AMP	120 VAC, 400 HZ	2800 AMPS
3 THRU 15 AMP	120 VAC, 400 HZ	2500 AMPS
20 AMP	120 VAC, 400 HZ	2000 AMPS
1 THRU 20 AMP	28 VDC	6000 AMPS
25 AMP	28 VDC	1625 AMPS
25 AMP	120 VAC, 400 HZ	1800 AMPS

MAXIMUM OPERATING FORCES

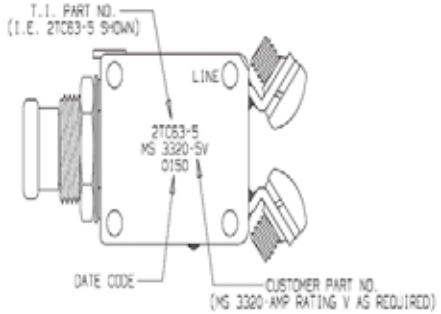
PULL OUT	5 LBS. MAX. (22.2 N)
RESET	5 LBS. MAX. (22.2 N)

OPERATING ALTITUDE: 70,000 FT. (21,000 M)

WEIGHT: 25.0 GRAMS MAX.

VOLTAGE DROP:

1 AMP	1.10 VOLTS MAX.
2 AMP	0.70 VOLTS MAX.
2.5 AMP	0.50 VOLTS MAX.
3 AMP	0.40 VOLTS MAX.
4 AMP	0.37 VOLTS MAX.
5 AMP	0.35 VOLTS MAX.
7.5 AMP	0.30 VOLTS MAX.
10 AMP	0.28 VOLTS MAX.
15 AMP	0.25 VOLTS MAX.
20 AMP	0.25 VOLTS MAX.
25 AMP	0.20 VOLTS MAX.



MARKING
(SEE TABLE)

T.I. PART NO.	MS PART NO.
2TC63-25	N/A
2TC63-20	MS 3320-20V
2TC63-15	MS 3320-15V
2TC63-10	MS 3320-10V
2TC63-7 1/2	MS 3320-7 1/2V
2TC63-5	MS 3320-5V
2TC63-4	MS 3320-4V
2TC63-3	MS 3320-3V
2TC63-2 1/2	MS 3320-2 1/2V
2TC63-2	MS 3320-2V
2TC63-1	-

MARKING TABLE

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCE ON FRACTIONS DECIMALS ANGLES

MATERIAL

DRAWN	TOM DAIL	DATE 10-30-89
ENGINEER	JACQUES CHAMMAS	12-4-89
APPROVED		
APPROVED		

SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

CONTROL PRODUCTS DIVISION

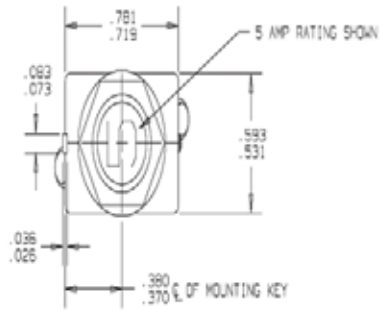
TITLE

PART NO. 2TC63
AMBIENT COMPENSATED, HIGH TEMP. CIRCUIT BREAKER
PUSH-PULL, TRIP FREE
ENVELOPE DRAWING

SIZE	CODE IDENT NO.	
C	82647	2TC63

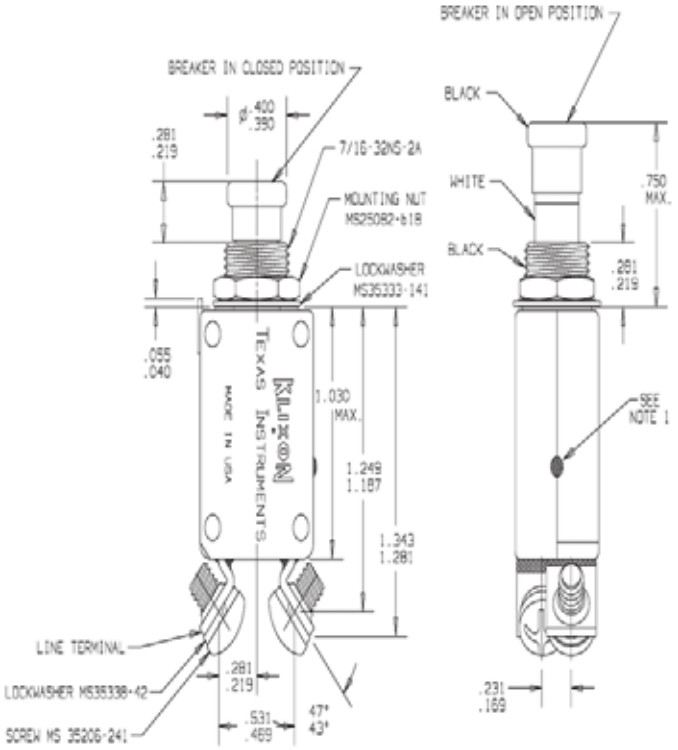
SCALE: 4X SHEET 1 OF 1

REVISIONS						
ZONE	LTR	2TC63	DESCRIPTION	PROJ. 1041	DATE	APPROVED
	H	SEE EDN		EDN0017504 PAF	8-20-04	D.A.



NOTES:

1. EPOXY SURFACES ARE NON-DIMENSIONED. ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
2. TERMINAL AND MOUNTING HARDWARE MAY BE PACKAGED RATHER THAN INSTALLED.
3. COUNTRY OF ORIGIN IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. COUNTRY OF ORIGIN TO BE IDENTIFIED AS REQUIRED.
4. DATE CODE PER 10588-285.
5. MARK IN APPROXIMATE POSITION SHOWN IN BLACK INK PER 12506-70.



PERFORMANCE CHARACTERISTICS

DETAIL PERFORMANCE PER MIL-C-5809 AND MS 3320 "V"

OVERLOAD CYCLING	100 CYCLES AT 200% RATING
VIBRATION	10 G'S CONDITION "C" 55-2000 HZ AND 15 G'S CONDITION "B" 10-2000 HZ
MECHANICAL SHOCK	50 G'S
ACCELERATION	10 G'S
SAND AND DUST	12 HOURS
CORROSION	SALT SPRAY 50 HOURS
HUMIDITY	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	2500 CYCLES
	400 HZ RESISTIVE	5000 CYCLES
30 VDC	INDUCTIVE	2500 CYCLES
	RESISTIVE	5000 CYCLES
MECHANICAL	NO LOAD	10000 CYCLES

CALIBRATION: 1 AMP THRU 25 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	500%	1000%
+25°C, +77°F	115% RATING	138% RATING	5-20 SEC.	.5-2.0 SEC.	.12-.53 SEC.
+121°C, +250°F	115% RATING	160% RATING	7-40 SEC.	.6-3.0 SEC.	.16-.8 SEC.
+121°C, +250°F	100% RATING	138% RATING	3-13 SEC.	.33-1.1 SEC.	.07-.3 SEC.

RUPTURE:

1 AMP	120 VAC, 400 HZ	3500 AMPS
2 AND 2 1/2 AMP	120 VAC, 400 HZ	2800 AMPS
3 THRU 15 AMP	120 VAC, 400 HZ	2500 AMPS
20 AMP	120 VAC, 400 HZ	2000 AMPS
1 THRU 20 AMP	28 VDC	6000 AMPS
25 AMP	28 VDC	1625 AMPS
25 AMP	120 VAC, 400 HZ	1800 AMPS

MAXIMUM OPERATING FORCES

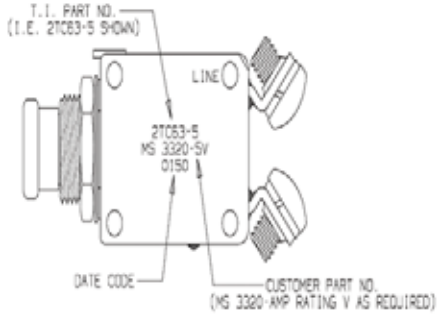
PULL OUT	5 LBS. MAX. (22.2 N)
RESET	5 LBS. MAX. (22.2 N)

OPERATING ALTITUDE: 70,000 FT. (21,000 M)

WEIGHT: 25.0 GRAMS MAX.

VOLTAGE DROP:

1 AMP	1.10 VOLTS MAX.
2 AMP	0.70 VOLTS MAX.
2.5 AMP	0.50 VOLTS MAX.
3 AMP	0.40 VOLTS MAX.
4 AMP	0.37 VOLTS MAX.
5 AMP	0.35 VOLTS MAX.
7.5 AMP	0.30 VOLTS MAX.
10 AMP	0.28 VOLTS MAX.
15 AMP	0.25 VOLTS MAX.
20 AMP	0.25 VOLTS MAX.
25 AMP	0.20 VOLTS MAX.



MARKING
(SEE TABLE)

T.I. PART NO.	MS PART NO.
2TC63-25	N/A
2TC63-20	MS 3320-20V
2TC63-15	MS 3320-15V
2TC63-10	MS 3320-10V
2TC63-7 1/2	MS 3320-7 1/2V
2TC63-5	MS 3320-5V
2TC63-4	MS 3320-4V
2TC63-3	MS 3320-3V
2TC63-2 1/2	MS 3320-2 1/2V
2TC63-2	MS 3320-2V
2TC63-1	-

MARKING TABLE

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCE ON FRACTIONS DECIMALS ANGLES

MATERIAL

DRAWN	TOM DAIL	DATE 10-30-89
ENGINEER	JACQUES CHAMMAS	12-4-89
APPROVED		
APPROVED		

SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

CONTROL PRODUCTS DIVISION

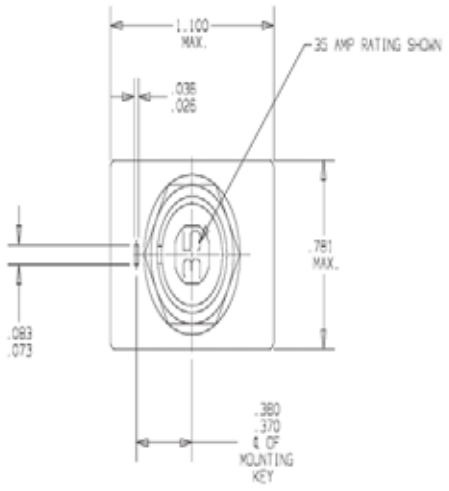
TITLE

PART NO. 2TC63
AMBIENT COMPENSATED, HIGH TEMP. CIRCUIT BREAKER
PUSH-PULL, TRIP FREE
ENVELOPE DRAWING

SIZE	CODE IDENT NO.	
C	82647	2TC63

SCALE: 4X SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION 1294	DATE	APPROVED
	M	UPDATED PER MARKUP AND REDRAWN IN CAD. EDN0225542 PAF	1-5-06	DM



PERFORMANCE CHARACTERISTICS

OVERLOAD CYCLING	100 CYCLES AT 200% RATING
VIBRATION	10 G'S MINIMUM 50 - 500 HZ
MECHANICAL SHOCK	25 G'S
ACCELERATION	10 G'S
SAND & DUST	12 HOURS
CORROSION	SALT SPRAY 50 HOURS
HUMIDITY	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:			
	120 VAC	400 HZ INDUCTIVE	2,500 CYCLES
		400 HZ RESISTIVE	5,000 CYCLES
	MECHANICAL	NO LOAD	10,000 CYCLES

CALIBRATION: 15 AMP THRU 35 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	500%	1000%
+25°C. (+77°F.)	115% RATING	138% RATING	4 - 20 SEC.	.4 - 1.7 SEC.	.1 - .4 SEC.
+54°C. (+65°F.)	115% RATING	165% RATING	6 - 35 SEC.	.55 - 3.0 SEC.	.15 - .7 SEC.
+71°C. (+160°F.)	100% RATING	138% RATING	3.0 - 15 SEC.	.33 - 1.5 SEC.	.08 - .35 SEC.

RUPTURE: 15 AMP THRU 35 AMP — 120 VAC 400 HZ — 2000 AMPERES

MAXIMUM OPERATING FORCES:

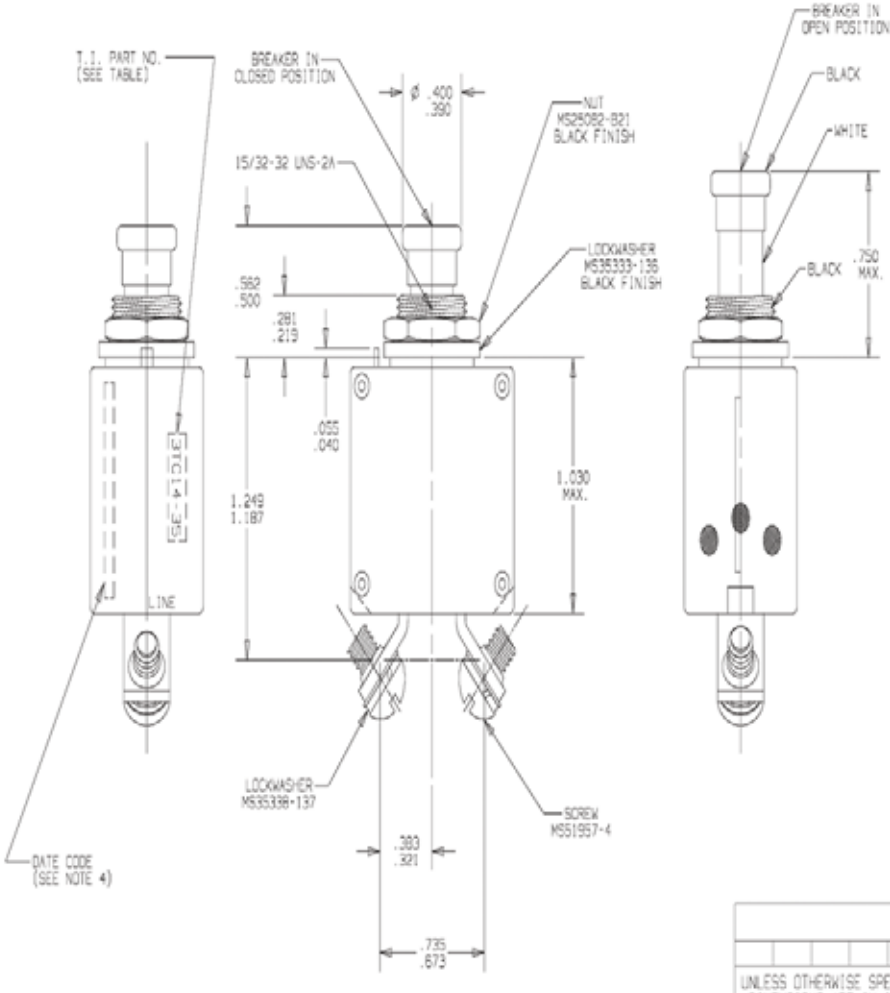
PULL OUT	5 LBS MAX. (22.2N)
RESET	5 LBS MAX. (22.2N)

OPERATING ALTITUDE: 70,000 FT. (21,000m)

WEIGHT/MASS: 37 GRAMS MAX. (.082 LBS.)
35 GRAMS NOMINAL (.077 LBS.)

VOLTAGE DROP:

15 THRU 35 AMP	0.25 VOLTS MAX.



T.I. PART NO.	AMP RATING
3TC14-15	15
3TC14-20	20
3TC14-25	25
3TC14-30	30
3TC14-35	35

NOTES:

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3. COUNTRY OF ORIGIN TO BE IDENTIFIED AS REQUIRED.
4. DATE CODE PER 10588-285.
5. ALL MARKINGS TO BE MADE IN APPROXIMATE POSITIONS SHOWN, WITH BLACK INK PER 12508-70: 3/32 INCH HIGH CHARACTERS.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN B. NICKERSON	DATE 2-12-70	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703 — CONTROL PRODUCTS DIVISION
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER		TITLE: PART NO. 3TC14 AMBIENT COMPENSATED, HIGH TEMP PUSH-PULL TRIP-FREE CIRCUIT BREAKER ENVELOPE DRAWING
	APPROVED T. BRASSARD	2-12-70	
	APPROVED T. BRASSARD	2-12-70	
MATERIAL			SIZE C — CODE IDENT NO. 82647 — 3TC14
			SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

KLIXON®

Three Phase TC Series Circuit Breakers

Miniature Ambient Compensated

Features

- **One phase trips all**
- **Protective shields between each phase's terminals**
- **Pads increase mounting stability**
- **Also includes identical features as 2TC and 3TC**

6TC 9TC

Overview

The 6TC and 9TC circuit breakers provide ambient compensated circuit protection in a lightweight, subminiature package size. The three phase design integrates each individual phase to provide overcurrent protection in the event of simultaneous or unbalanced overloads, including short circuit conditions.

Coordination

The 6TC and 9TC are compatible with their single phase 2TC and 3TC cousins. The 6TC and 9TC are available in ratings from 1-35 amps, with military and various commercial approvals on most styles.

Ambient Temperature Compensation

The 6TC and 9TC are ambient compensated circuit breakers. This allows usage of smaller gauge wire.

The 6TC and 9TC can operate over a temperature range of -54^{O}C to 121^{O}C, however, care should be taken to understand the specification limits at elevated ambient temperatures.

Options*

- Longer push buttons
- High vibration
- Metric mounting thread
- Metric terminal thread
- Dust boot†
- Auxiliary switch device available††

* Contact factory for details

† Part Number 14500-1 fits 15/32 bushing
Part Number 14500-5 fits 7/16 bushing

†† 6TC Device

Trip Free

The complete line of TC series circuit breakers is trip free. The circuit breaker cannot be maintained closed during an overload, even with the actuator button held closed.

High Short Circuit Capacity

For its miniature size, the 6/9TC series offers unusually high current interrupting capacity. Overloads up to 2000 amps at 120 VAC, 400 Hz can be safely interrupted without affecting calibration or operating performance in the standard 6/9TC series.

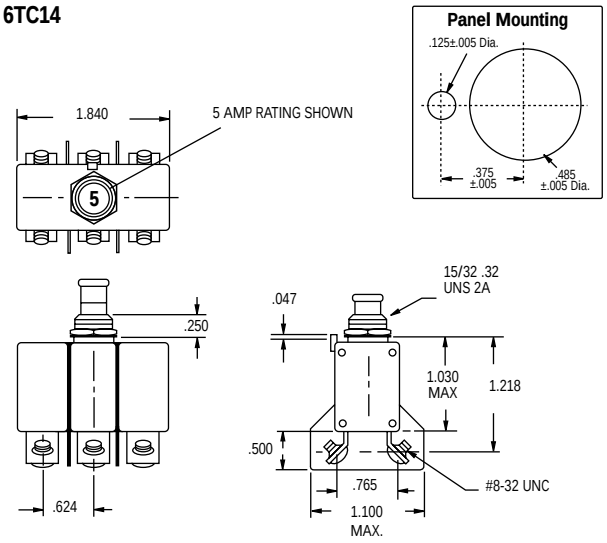
Qualifications

MS14154	6TC2
MS14154L	6TC37
MS14154V	6TC63
MS14153	9TC2

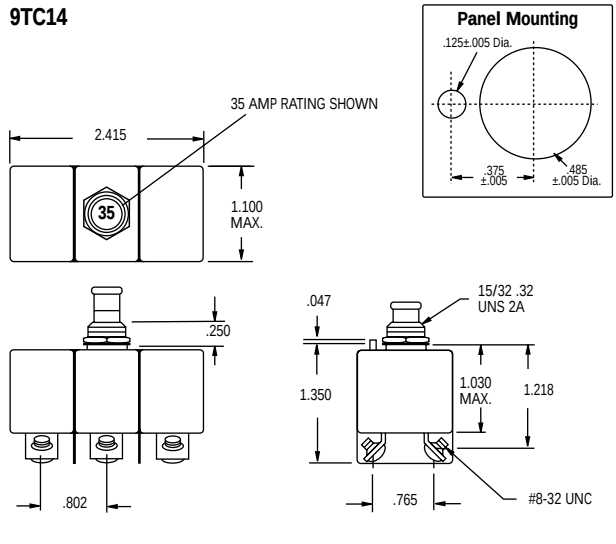
European standards
SAE standards
All U.S. aircraft OEM's
Most European aircraft OEM's

Characteristics

6TC14



9TC14



Calibration: 2-20 amps

TEMP °C	MIN ULT TRIP	MAX ULT TRIP	TRIP TIME - SECONDS		
			200%	500%	1000%
+25	110%	145%	4-20	.40-2.0	.10-.53
-54	110%	165%	6-40	.55-3.5	.15-.80
+90	100%	145%	3-20	.33-1.7	.08-.40
+121	90%	145%	3-20	.33-1.7	.08-40

† Single phase max. ult. trip values apply with other two phases carrying 100% of rated current.

Calibration: 1, 15-35 amps

TEMP °C	MIN ULT TRIP	MAX ULT TRIP	TRIP TIME - SECONDS		
			200%	500%	1000%
+25	110%	145%	4-20	.40-2.0	.10-.53
-54	110%	165%	6-40	.55-3.5	.15-.80
+90	100%	145%	3-20	.33-1.7	.08-.40
+121	90%	145%	3-20	.33-1.7	.08-40

† Single phase max. ult. trip values apply with other two phases carrying 100% of rated current.

Vibration* ..... 10 G's minimum, 50-500 Hz
Mechanical Shock ..... 50 G's
Acceleration ..... 10 G's
Weight ..... 6TC14 - 65 gm max.
9TC14 - 110 gm max.

Interrupt Current

2-20 amps: 2000 amps at 120 VAC, 400 Hz
1, 15-35 amps: 2000 amps at 120 VAC, 400 Hz

Endurance

2500 cycles ..... 120 VAC, 400 Hz Inductive
5000 cycles ..... 120 VAC, 400 Hz Resistive
5000 cycles ..... Mechanical, no load

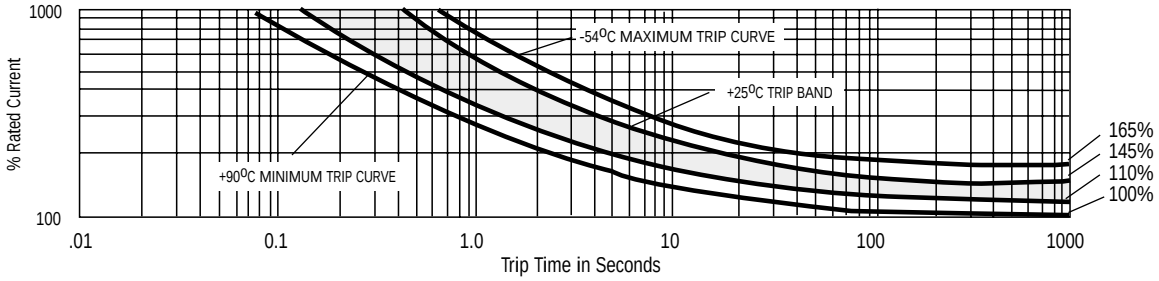
* Other vibration levels available. Contact factory for details.

TI Number	Voltage Drop (max.)
6TC14-2	0.70
6TC14-2½	0.50
6TC14-3	0.40
6TC14-4	0.37
6TC14-5	0.35
6TC14-7½	.192
6TC14-10	.176
6TC14-15	.176
6TC14-20	.176

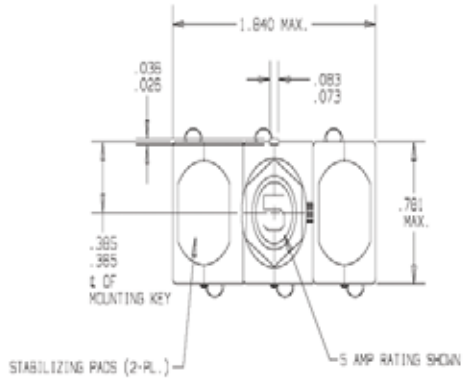
TI Number	Voltage Drop (max.)**
9TC14-1	1.10
9TC14-15	0.25
9TC14-20	0.25
9TC14-25	0.25
9TC14-30	0.25
9TC14-35	0.25

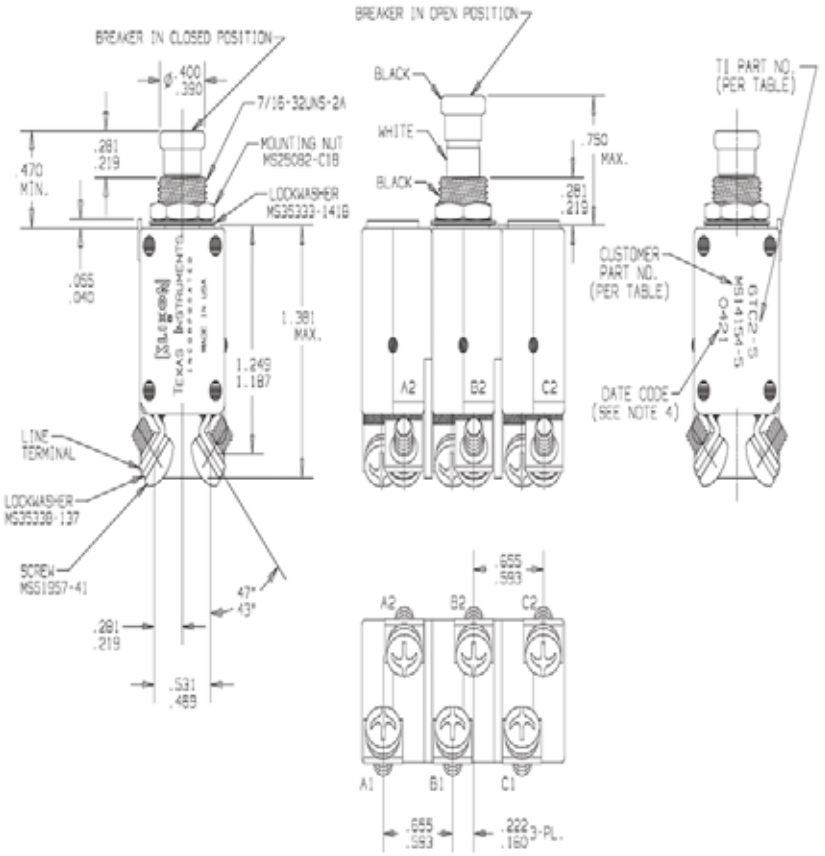
** Max voltage drop at nominal rated current.
(25 amp 6TC pending qualification.)

Approximate Time-Current Curves - 6TC and 9TC Circuit Breakers



REVISIONS					
ZONE	LTR	DESCRIPTION		DATE	APPROVED
	R	MODIFIED PRINT PER MARK-UP	ECN022546 GML	12-20-05	D.M.





TI PART NO.	CUSTOMER PART NO.
6TC2-20	MS14154-20
6TC2-15	MS14154-15
6TC2-10	MS14154-10
6TC2-7 1/2	MS14154-7 1/2
6TC2-5	MS14154-5
6TC2-4	MS14154-4
6TC2-3	MS14154-3
6TC2-2 1/2	MS14154-2 1/2
6TC2-2	MS14154-2

PERFORMANCE CHARACTERISTICS

DETAIL PERFORMANCE PER MIL-C-5809

OVERLOAD CYCLING	100 CYCLES AT 200% RATING
VIBRATION	10 G'S MINIMUM 50-500 HZ
MECHANICAL SHOCK	50 G'S
ACCELERATION	10 G'S
SAND AND DUST	12 HOURS
CORROSION	SALT SPRAY 50 HOURS
HUMIDITY	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	2500 CYCLES
	400 HZ RESISTIVE	5000 CYCLES
MECHANICAL	NO LOAD	5000 CYCLES

SINGLE ϕ OR THREE PHASE CALIBRATION: 2 AMP THRU 20 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	500%	1000%
+25°C, +77°F	110% RATING	145% RATING	4-20 SEC.	.40-2.0 SEC.	.10-.53 SEC.
-55°C, -65°F	110% RATING	165% RATING	6-40 SEC.	.55-3.5 SEC.	.15-.80 SEC.
+71°C, +160°F	100% RATING	145% RATING	3-20 SEC.	.33-1.7 SEC.	.08-.40 SEC.

RUPTURE:

2 AMP THRU 20 AMP	120 VAC, 400 HZ	2000 AMPS

MAXIMUM OPERATING FORCES

PULL OUT	12 LBS. MAX. (53.4 N)
RESET	12 LBS. MAX. (53.4 N)

OPERATING ALTITUDE: 70,000 FT. (21,000 M)

WEIGHT: 85.0 GRAMS MAX. (.143 LBS.)

VOLTAGE DROP:

2 AMP	0.70 VOLTS MAX.
2.5 AMP	0.50 VOLTS MAX.
3 AMP	0.40 VOLTS MAX.
4 AMP	0.37 VOLTS MAX.
5 AMP	0.35 VOLTS MAX.
7.5 AMP	.192 VOLTS MAX.
10 AMP	.176 VOLTS MAX.
12 AMP	.211 VOLTS MAX.
15 AMP	.176 VOLTS MAX.
20 AMP	.176 VOLTS MAX.

* SINGLE PHASE MAXIMUM ULTIMATE TRIP VALUES APPLY WITH OTHER TWO PHASES CARRYING 100% OF RATED CURRENT

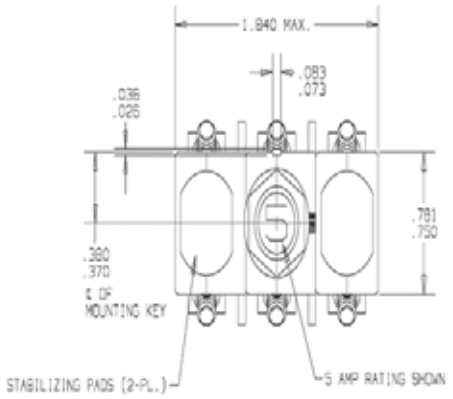
NOTES:

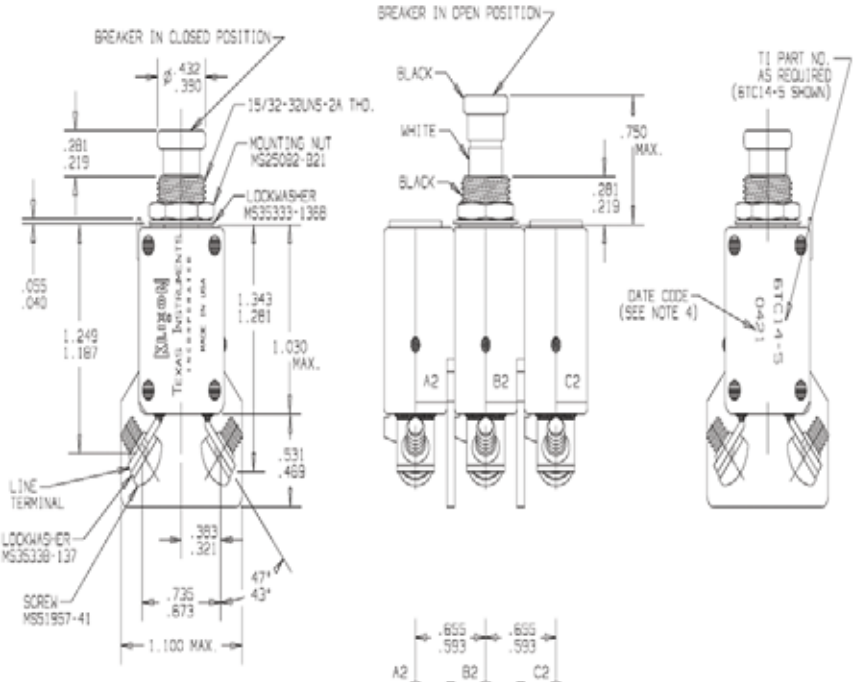
1. EPOXY SURFACES ARE NON-DIMENSIONED, ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
2. TERMINAL AND MOUNTING HARDWARE MAY BE PACKAGED RATHER THAN INSTALLED.
3. COUNTRY OF ORIGIN IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. COUNTRY OF ORIGIN TO BE IDENTIFIED AS REQUIRED.
4. DATE CODE PER 10588-285.
5. ALL MARKINGS TO BE MADE IN APPROXIMATE POSITIONS SHOWN WITH BLACK INK PER 12566-70, 3/32 HIGH CHARACTERS.

03 | P1B

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN: CHAS. FLEURANT	DATE: 4-4-94	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703 — CONTROL PRODUCTS DIVISION
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER: J.R. FOWLER	4-4-94	TITLE: PART NO:6TC2 AMBIENT COMPENSATED CIRCUIT BREAKE PUSH-PULL, TRIP FREE ENVELOPE DRAWING
	APPROVED		
	APPROVED		
MATERIAL			SIZE: C — CODE IDENT NO.: 82647 — 6TC2
			SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE. — SCALE: 4X — SHEET 1 OF 1

REVISIONS					
ZONE	LTR	DESCRIPTION 1112		DATE	APPROVED
	AB	MODIFIED PRINT PER MARK-UP	ECN022546 GML	12-20-05	D.M.





PERFORMANCE CHARACTERISTICS

DETAIL PERFORMANCE PER MIL-C-5809D

OVERLOAD CYCLING	100 CYCLES AT 200% RATING
VIBRATION	10 G'S MINIMUM 50-500 HZ
MECHANICAL SHOCK	50 G'S
ACCELERATION	10 G'S
SAND AND DUST	12 HOURS
CORROSION	SALT SPRAY 50 HOURS
HUMIDITY	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	2500 CYCLES
	400 HZ RESISTIVE	5000 CYCLES
MECHANICAL	NO LOAD	5000 CYCLES

SINGLE ϕ OR THREE PHASE CALIBRATION: 2 AMP THRU 20 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	500%	1000%
+25°C, +77°F	110% RATING	145% RATING	4-20 SEC.	40-2.0 SEC.	.10-.53 SEC.
-55°C, -65°F	110% RATING	165% RATING	6-40 SEC.	55-3.5 SEC.	.15-.80 SEC.
+71°C, +160°F	100% RATING	145% RATING	3-20 SEC.	.33-1.7 SEC.	.08-.40 SEC.

RUPTURE:

2 AMP THRU 20 AMP	120 VAC, 400 HZ	2000 AMPS

MAXIMUM OPERATING FORCES

PULL OUT	12 LBS. MAX. (53.4 N)
RESET	12 LBS. MAX. (53.4 N)

OPERATING ALTITUDE: 70,000 FT. (21,000 M)

WEIGHT: 65.0 GRAMS MAX. (.143 LBS.); 63 GRAMS NOMINAL (.137 LBS)

VOLTAGE DROP:

2 AMP	0.70 VOLTS MAX.
2.5 AMP	0.50 VOLTS MAX.
3 AMP	0.40 VOLTS MAX.
4 AMP	0.37 VOLTS MAX.
5 AMP	0.35 VOLTS MAX.
7.5 AMP	.192 VOLTS MAX.
10 AMP	.176 VOLTS MAX.
15 AMP	.176 VOLTS MAX.
20 AMP	.176 VOLTS MAX.

* SINGLE PHASE MAXIMUM ULTIMATE TRIP VALUES APPLY WITH OTHER TWO PHASES CARRYING 100% OF RATED CURRENT

NOTES:

1. EPOXY SURFACES ARE NON-DIMENSIONED, ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
2. TERMINAL AND MOUNTING HARDWARE MAY BE PACKAGED RATHER THAN INSTALLED.
3. COUNTRY OF ORIGIN IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. COUNTRY OF ORGIN TO BE IDENTIFIED AS REQUIRED.
4. DATE CODE PER 10888-285.
5. ALL MARKINGS TO BE MADE IN APPROXIMATE POSITIONS SHOWN WITH BLACK INK PER 12506-70, 3/32 HIGH CHARACTERS.

P2 | 01 | P18

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN CHAS. FLEURANT	DATE 4-4-94
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER J.R. FOWLER	4-4-94
	APPROVED	
	APPROVED	
MATERIAL		
	SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.	

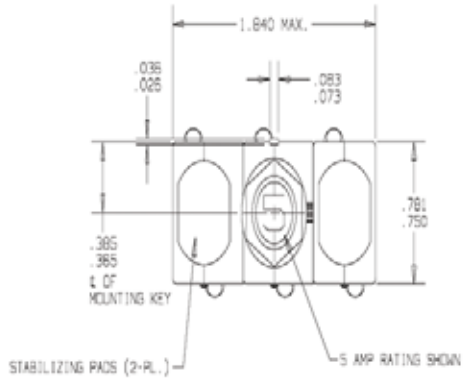
TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

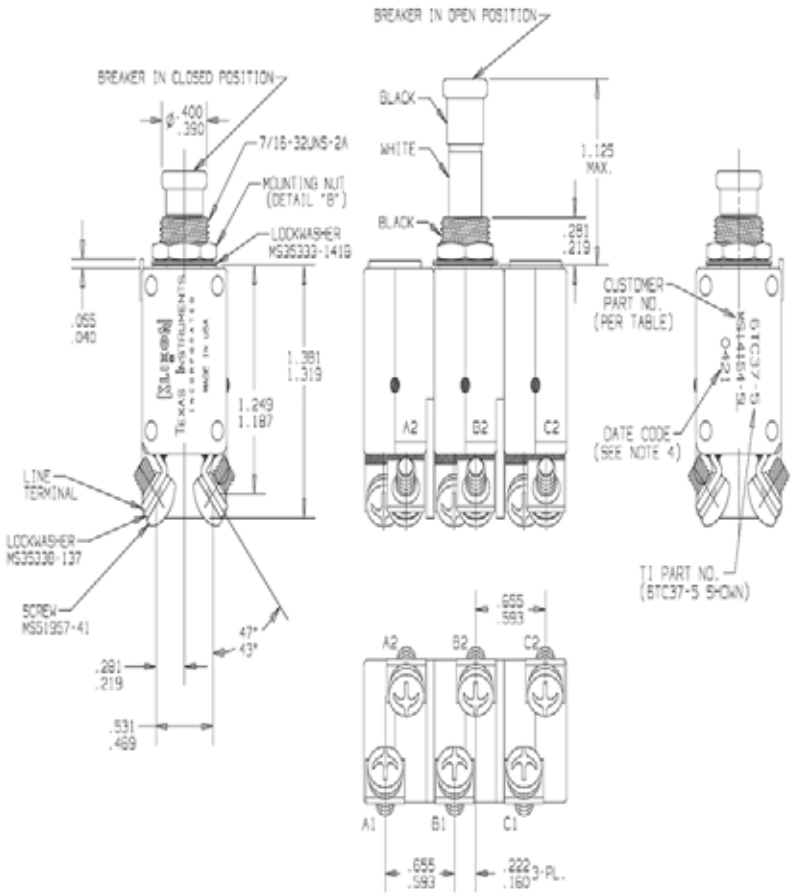
CONTROL PRODUCTS DIVISION

TITLE
PART NO: 6TC14
AMBIENT COMPENSATED CIRCUIT BREAKER
PUSH-PULL, TRIP FREE
ENVELOPE DRAWING

SIZE	CODE IDENT NO.	
C	82647	6TC14 SH. 1

REVISIONS					
ZONE	LTR	DESCRIPTION 1112		DATE	APPROVED
	H	MODIFIED PRINT PER MARK-UP	ECN022546 GML	12-20-05	D.M.





PERFORMANCE CHARACTERISTICS

DETAIL PERFORMANCE PER MIL-C-5809

OVERLOAD CYCLING	100 CYCLES AT 200% RATING
VIBRATION	10 G'S MINIMUM 50-500 HZ
MECHANICAL SHOCK	50 G'S
ACCELERATION	10 G'S
SAND AND DUST	12 HOURS
CORROSION	SALT SPRAY 50 HOURS
HUMIDITY	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	2500 CYCLES
	400 HZ RESISTIVE	5000 CYCLES
MECHANICAL	NO LOAD	5000 CYCLES

SINGLE * OR THREE PHASE CALIBRATION: 2 AMP THRU 20 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	500%	1000%
+25°C, +77°F	110% RATING	145% RATING	4-20 SEC.	.40-2.0 SEC.	.10-.53 SEC.
+55°C, +85°F	110% RATING	165% RATING	6-40 SEC.	.55-3.5 SEC.	.15-.80 SEC.
+71°C, +160°F	100% RATING	145% RATING	3-20 SEC.	.33-1.7 SEC.	.08-.40 SEC.

RUPTURE:

2 AMP THRU 20 AMP	120 VAC, 400 HZ	2000 AMPS

MAXIMUM OPERATING FORCES

PULL OUT	12 LBS. MAX. (53.4 N)
RESET	12 LBS. MAX. (53.4 N)

OPERATING ALTITUDE: 70,000 FT. (21,000 M)

WEIGHT: 85.0 GRAMS MAX. (.143 LBS.)

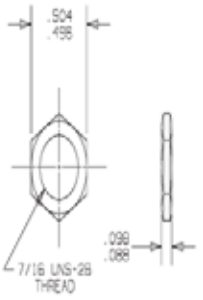
VOLTAGE DROP:

2 AMP	0.70 VOLTS MAX.
2.5 AMP	0.50 VOLTS MAX.
3 AMP	0.40 VOLTS MAX.
4 AMP	0.37 VOLTS MAX.
5 AMP	0.35 VOLTS MAX.
7.5 AMP	.192 VOLTS MAX.
10 AMP	.176 VOLTS MAX.
15 AMP	.176 VOLTS MAX.
20 AMP	.176 VOLTS MAX.

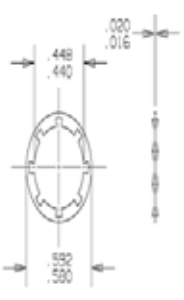
* SINGLE PHASE MAXIMUM ULTIMATE TRIP VALUES APPLY WITH OTHER TWO PHASES CARRYING 100% OF RATED CURRENT

NOTES:

1. EPOXY SURFACES ARE NON-DIMENSIONED. ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
2. TERMINAL AND MOUNTING HARDWARE MAY BE PACKAGED RATHER THAN INSTALLED.
3. COUNTRY OF ORIGIN IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. COUNTRY OF ORIGIN TO BE IDENTIFIED AS REQUIRED.
4. DATE CODE PER 10588-285.
5. ALL MARKINGS TO BE MADE IN APPROXIMATE POSITIONS SHOWN WITH BLACK INK PER 12606-70, 3/32 HIGH CHARACTERS.



DETAIL "A"
MOUNTING NUT
BLACK FINISH
MS25082-C18

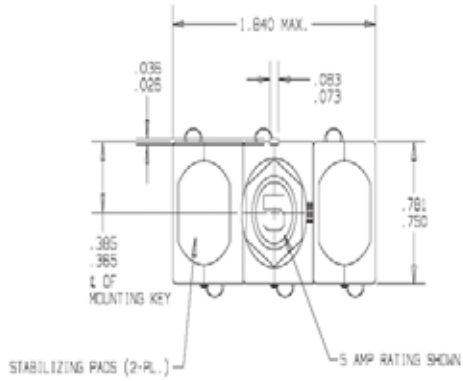


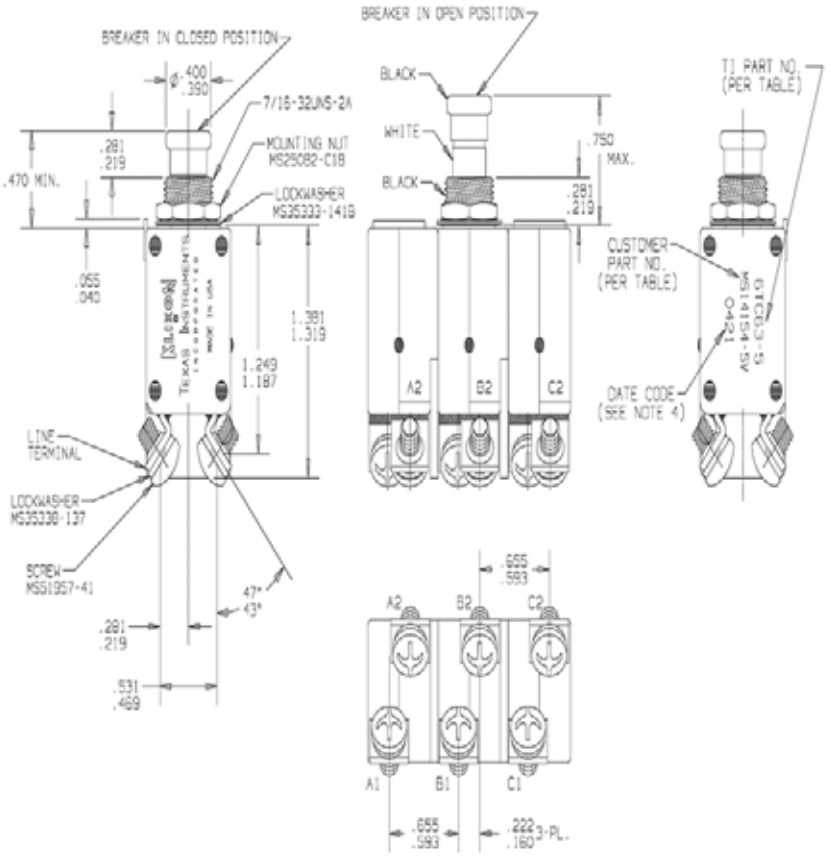
DETAIL "B"
LOCKWASHER
MS35333-141

TI PART NO.	CUSTOMER PART NO.
6TC37-20	MS14154-20L
6TC37-15	MS14154-15L
6TC37-10	MS14154-10L
6TC37-7 1/2	MS14154-7 1/2L
6TC37-5	MS14154-5L
6TC37-4	MS14154-4L
6TC37-3	MS14154-3L
6TC37-2 1/2	MS14154-2 1/2L
6TC37-2	MS14154-2L

			03	P18
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN CHAS. FLEURANT	DATE 4-6-94	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703	CONTROL PRODUCTS DIVISION
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER J.R. FOWLER	4-6-94	TITLE PART NO:6TC37 AMBIENT COMPENSATED CIRCUIT BREAKE PUSH-PULL, TRIP FREE ENVELOPE DRAWING	
	APPROVED			
	APPROVED			
MATERIAL			SIZE C	CODE IDENT NO. 82647
			6TC37	
	SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.		SCALE: 4X	SHEET 1 OF 1

REVISIONS					
ZONE	LTR	DESCRIPTION 1112		DATE	APPROVED
	B	MODIFIED PRINT PER MARK-UP	ECN022546 GML	12-20-05	D.M.





TI PART NO.	CUSTOMER PART NO.
6TC63-20	MS14154-20V
6TC63-15	MS14154-15V
6TC63-10	MS14154-10V
6TC63-7 1/2	MS14154-7 1/2V
6TC63-5	MS14154-5V
6TC63-4	MS14154-4V
6TC63-3	MS14154-3V
6TC63-2 1/2	MS14154-2 1/2V
6TC63-2	MS14154-2V

PERFORMANCE CHARACTERISTICS

DETAIL PERFORMANCE PER MIL-C-5809 AND MS14154 "V"

OVERLOAD CYCLING	100 CYCLES AT 200% RATING
VIBRATION	10 G'S CONDITION "C" 55-2000 Hz AND 15 G'S CONDITION "B" 10-2000 Hz
MECHANICAL SHOCK	50 G'S
ACCELERATION	10 G'S
SAND AND DUST	12 HOURS
CORROSION	SALT SPRAY 50 HOURS
HUMIDITY	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:

120 VAC	400 HZ INDUCTIVE		2500 CYCLES
	400 HZ RESISTIVE		5000 CYCLES
MECHANICAL	NO LOAD		5000 CYCLES

SINGLE * OR THREE PHASE CALIBRATION: 2 AMP THRU 20 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	500%	1000%
+25°C, +77°F	110% RATING	145% RATING	4-20 SEC.	.40-2.0 SEC.	.10-.53 SEC.
+55°C, +85°F	110% RATING	165% RATING	6-40 SEC.	.55-3.5 SEC.	.15-.80 SEC.
+71°C, +160°F	100% RATING	145% RATING	3-20 SEC.	.33-1.7 SEC.	.08-.40 SEC.

RUPTURE:

2 AMP THRU 20 AMP	120 VAC, 400 HZ	2000 AMPS

MAXIMUM OPERATING FORCES

PULL OUT	12 LBS. MAX. (53.4 N)
RESET	12 LBS. MAX. (53.4 N)

OPERATING ALTITUDE: 70,000 FT. (21,000 M)

WEIGHT: 65.0 GRAMS MAX. (.143 LBS.)

VOLTAGE DROP:

2 AMP	0.70 VOLTS MAX.
2.5 AMP	0.50 VOLTS MAX.
3 AMP	0.40 VOLTS MAX.
4 AMP	0.37 VOLTS MAX.
5 AMP	0.35 VOLTS MAX.
7.5 AMP	.192 VOLTS MAX.
10 AMP	.176 VOLTS MAX.
12 AMP	.211 VOLTS MAX.
15 AMP	.176 VOLTS MAX.
20 AMP	.176 VOLTS MAX.

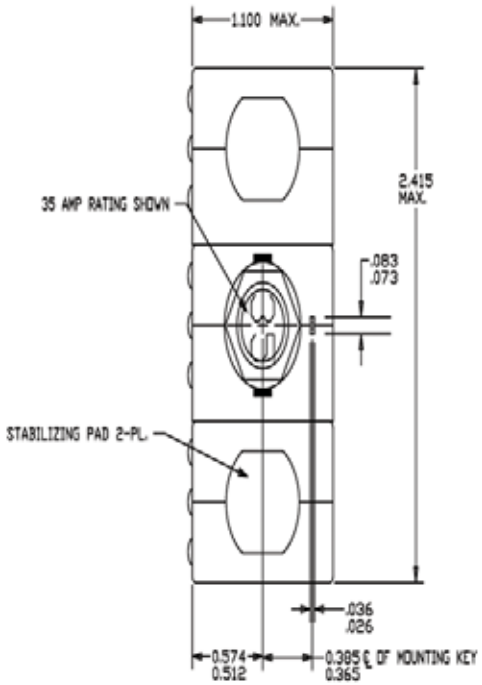
* SINGLE PHASE MAXIMUM ULTIMATE TRIP VALUES APPLY WITH OTHER TWO PHASES CARRYING 100% OF RATED CURRENT

NOTES:

1. EPOXY SURFACES ARE NON-DIMENSIONED. ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
2. TERMINAL AND MOUNTING HARDWARE MAY BE PACKAGED RATHER THAN INSTALLED.
3. COUNTRY OF ORIGIN IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. COUNTRY OF ORIGIN TO BE IDENTIFIED AS REQUIRED.
4. DATE CODE PER 10588-285.
5. ALL MARKINGS TO BE MADE IN APPROXIMATE POSITIONS SHOWN WITH BLACK INK PER 12606-70, 3/32 HIGH CHARACTERS.

			03	P1B
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN JM	DATE 02-12-95	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703	CONTROL PRODUCTS DIVISION
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER M.A. VIDAL	02-12-95	TITLE PART NO: 6TC63 AMBIENT COMPENSATED CIRCUIT BREAKE PUSH-PULL, TRIP FREE ENVELOPE DRAWING	
	APPROVED			
	APPROVED			
MATERIAL			SIZE C	CODE IDENT NO. 82647
				6TC63
	SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.		SCALE: 4X	SHEET 1 OF 1

REVISIONS					
ZONE	LTR	DEVICE/9TC DESCRIPTION PROJ. #1112	DATE	APPROVED
	V	ADDED ALL CODING AND MARKING INFORMATION; REDRAWN IN CADRA. ECN0025548, BP	11-30-05	D.M.



PERFORMANCE CHARACTERISTICS

DETAIL PERFORMANCE PER MIL-C-5809

OVERLOAD CYCLING	100 CYCLES AT 200%RATING
VIBRATION	10 G'S MINIMUM 50-500 CPS
MECHANICAL SHOCK	50 G'S
ACCELERATION	10 G'S
SAND AND DUST	12 HOURS
CORROSION	SALT SPRAY 48 HOURS
HUMIDITY	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	2500 CYCLES
	400 HZ RESISTIVE	5000 CYCLES
MECHANICAL	NO LOAD	5000 CYCLES

SINGLE * OR THREE PHASE CALIBRATION: 1 AMP, 15 AMP THRU 35 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	500%	1000%
+25°C, +77°F	110% RATING	145% RATING	4-20 SEC.	.40-2.0 SEC.	.10-.53 SEC.
-55°C, -65°F	110% RATING	165% RATING	6-40 SEC.	.55-3.5 SEC.	.15-.80 SEC.
+71°C, +160°F	100% RATING	145% RATING	3-20 SEC.	.33-1.7 SEC.	.08-.40 SEC.

RUPTURE:
1 AMP, 15 AMP THRU 35 AMP — 120 VAC, 400 HZ — 2000 AMPS

MAXIMUM OPERATING FORCES

PULL OUT	12 LBS. MAX. (53.4 N)
RESET	12 LBS. MAX. (53.4 N)

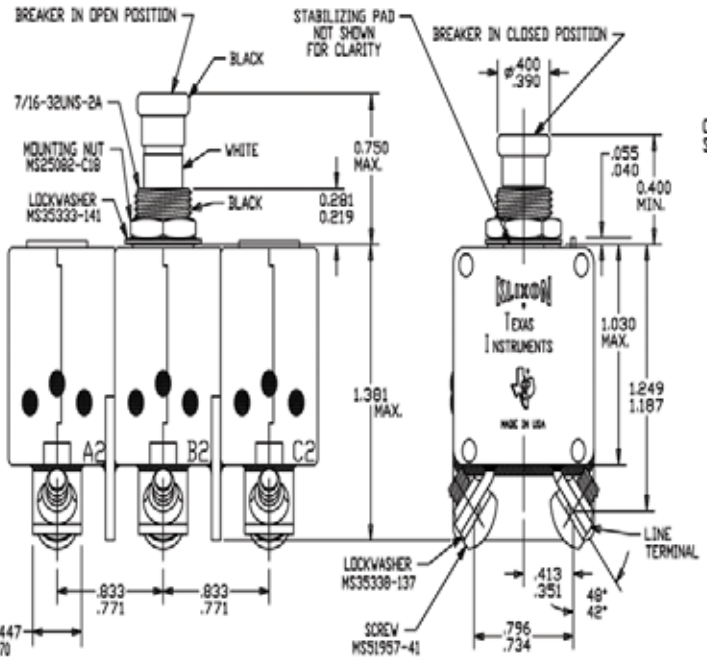
OPERATING ALTITUDE: 70,000 FT. (21,000 M)

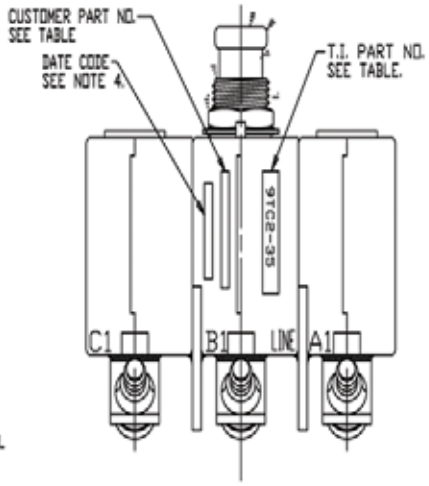
WEIGHT: 110.0 GRAMS MAX. (0.242 LBS.)

VOLTAGE DROP:

1 AMP	1.10 VOLTS MAX.
15 AMP	0.25 VOLTS MAX.
20 AMP	0.25 VOLTS MAX.
25 AMP	0.25 VOLTS MAX.
30 AMP	0.25 VOLTS MAX.
35 AMP	0.25 VOLTS MAX.

* SINGLE PHASE MAXIMUM ULTIMATE TRIP VALUES APPLY WITH OTHER TWO PHASES CARRYING 100% OF RATED CURRENT.





9TC2-35	MS 14153-35
9TC2-30	MS 14153-30
9TC2-25	MS 14153-25
9TC2-20	MS 14153-20
9TC2-15	MS 14153-15
9TC2-1	MS 14153-1
T.I. PART NO.	CUSTOMER PART NO.

NOTES:

1. EPOXY SURFACES ARE NON-DIMENSIONED. ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
2. TERMINAL AND MOUNTING HARDWARE MAY BE PACKAGED RATHER THAN INSTALLED.
3. COUNTRY OF ORIGIN IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. COUNTRY OF ORIGIN TO BE IDENTIFIED AS REQUIRED.
4. DATE CODE PER 10588-285.
5. ALL MARKINGS TO BE MADE IN APPROXIMATE POSITIONS SHOWN, WITH BLACK INK PER 12506-70, 3/32 INCH HIGH CHARACTERS.

THIS IS A CAD DRAWING. THE GEOMETRY IN THE ASSOCIATED CAD COMPUTER FILE IS DIMENSIONALLY ACCURATE. WHEN DRAWING IS BEING REVISED, THE GEOMETRY MUST BE UPDATED IN ALL VIEWS AND ON ALL SHEETS.

Q3 | P18 | P2

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCE ON FRACTIONS DECIMALS ANGLES

MATERIAL

DRAWN	TDM DAIL	DATE 3-6-90
ENGINEER		
APPROVED		
APPROVED		

SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

CLIXON® CONTROL PRODUCTS DIVISION

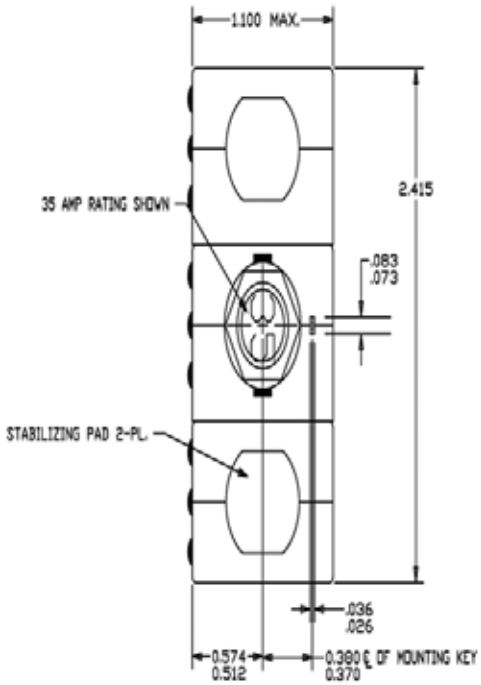
TITLE

AMBIENT COMPENSATED, HIGH TEMP CIRCUIT BREAKER PUSH-PULL, TRIP FREE ENVELOPE DRAWING

SIZE	CODE IDENT NO.	
C	82647	9TC2

SCALE: 2:1 SHEET 1 OF 1

REVISIONS					
ZONE	LTR	DEVICE/9TC DESCRIPTION PROJ. #1112	DATE	APPROVED
	T	ADDED ALL CODING AND MARKING INFORMATION) REDRAWN IN CADRA. ECN0025548, DP	2-2-05	D.M.



PERFORMANCE CHARACTERISTICS

DETAIL PERFORMANCE PER MIL-C-5809

OVERLOAD CYCLING	100 CYCLES AT 200%RATING
VIBRATION	10 G'S MINIMUM 50-500 HZ
MECHANICAL SHOCK	25 G'S
ACCELERATION	10 G'S
SAND AND DUST	12 HOURS
CORROSION	SALT SPRAY 50 HOURS
HUMIDITY	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	2500 CYCLES
	400 HZ RESISTIVE	5000 CYCLES
MECHANICAL	NO LOAD	5000 CYCLES

SINGLE * OR THREE PHASE CALIBRATION: 1 AMP, 15 AMP THRU 35 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	500%	1000%
+25°C, +77°F	110% RATING	145% RATING	4-20 SEC.	.40-2.0 SEC.	.10-.53 SEC.
-54°C, -65°F	110% RATING	165% RATING	6-40 SEC.	.55-3.5 SEC.	.15-.80 SEC.
+71°C, +160°F	100% RATING	145% RATING	3-20 SEC.	.33-1.7 SEC.	.08-.40 SEC.

RUPTURE:
1 AMP, 15 AMP THRU 35 AMP — 120 VAC, 400 HZ — 2000 AMPS

MAXIMUM OPERATING FORCES

PULL OUT	12 LBS. MAX. (53.4 N)
RESET	12 LBS. MAX. (53.4 N)

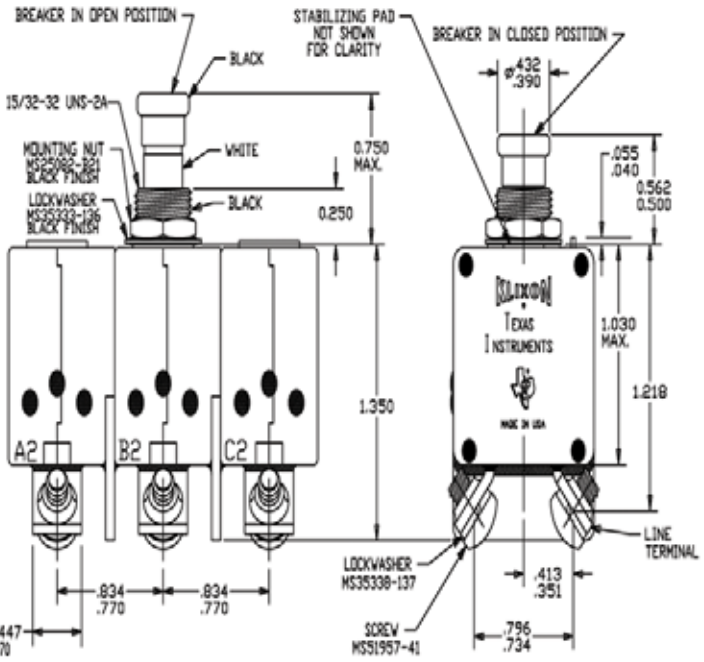
OPERATING ALTITUDE: 70,000 FT. (21,000 M)

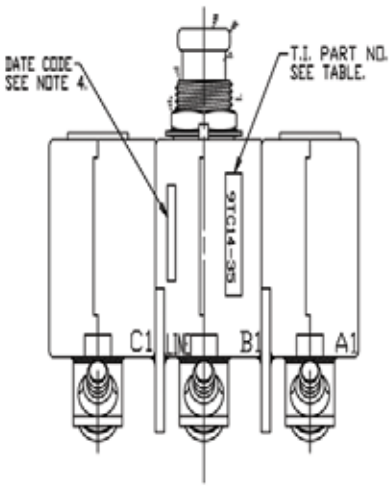
WEIGHT/MASS: 110.0 GRAMS MAX. (0.242 LBS); 98 GRAMS NOMINAL (.216 LBS).

VOLTAGE DROP:

1 AMP	1.10 VOLTS MAX.
15 AMP	0.25 VOLTS MAX.
20 AMP	0.25 VOLTS MAX.
25 AMP	0.25 VOLTS MAX.
30 AMP	0.25 VOLTS MAX.
35 AMP	0.25 VOLTS MAX.

* SINGLE PHASE MAXIMUM ULTIMATE TRIP VALUES APPLY WITH OTHER TWO PHASES CARRYING 100% OF RATED CURRENT.





9TC14-35	35
9TC14-30	30
9TC14-25	25
9TC14-20	20
9TC14-15	15
9TC14-1	1
T.I. PART NO.	AMP

NOTES:

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2. TERMINAL AND MOUNTING HARDWARE MAY BE PACKAGED RATHER THAN INSTALLED.
3. COUNTRY OF ORIGIN IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. COUNTRY OF ORIGIN TO BE IDENTIFIED AS REQUIRED.
4. DATE CODE PER 10588-285.
5. ALL MARKINGS TO BE MADE IN APPROXIMATE POSITIONS SHOWN, WITH BLACK INK PER 12506-70, 3/32 INCH HIGH CHARACTERS.

THIS IS A CAD DRAWING. THE GEOMETRY IN THE ASSOCIATED CAD COMPUTER FILE IS DIMENSIONALLY ACCURATE. WHEN DRAWING IS BEING REVISED, THE GEOMETRY MUST BE UPDATED IN ALL VIEWS AND ON ALL SHEETS.

Q3-3P18-1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCE ON FRACTIONS DECIMALS ANGLES
/ ±.031 /

MATERIAL

DRAWN	B. NICKERSON	DATE 2-11-70
ENGINEER		
APPROVED	T. BRASSARD	2-11-70
APPROVED	T. BRASSARD	2-11-70

SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

CONTROL PRODUCTS DIVISION

TITLE
PART NO. 9TC14
AMBIENT COMPENSATED, PUSH-PULL TRIP FREE CIRCUIT BREAKER ENVELOPE DRAWING

SIZE	CODE IDENT NO.	
C	82647	9TC14

SCALE: 2:1 SHEET 1 OF 1

KLIXON®

2TC49 Series

"Dual Safety™" Circuit Breakers

Features

- **Extension of 2TC series**
- **Redundant protection in hard fault catastrophic conditions**
- **Separable link feature**
- **Case color distinguishes 2TC49 from 2TC series**
- **Uses less space and weighs less than other circuit breaker packages**
- **Rating 2½ - 15 amps**

2TC49
"Dual Safety" Circuit Breaker

Overview

The 2TC49 "Dual Safety™" circuit breaker represents a refinement in electrical control and circuit protection. The 2TC dual safety circuit breaker incorporates a fusible element in a standard 2TC (MS 3320) package size to provide redundant protection in hard fault conditions.

"Hard Fault" Tripping

The 2TC dual safety circuit breaker operates identically to a standard circuit breaker under all normal conditions, including short circuit. In the event of circumstances which disable the internal circuit breaker mechanisms, such that the device is able to carry current but unable to clear an overload via its normal means, the dual safety element acts as a built in fuse to provide redundant circuit protection.

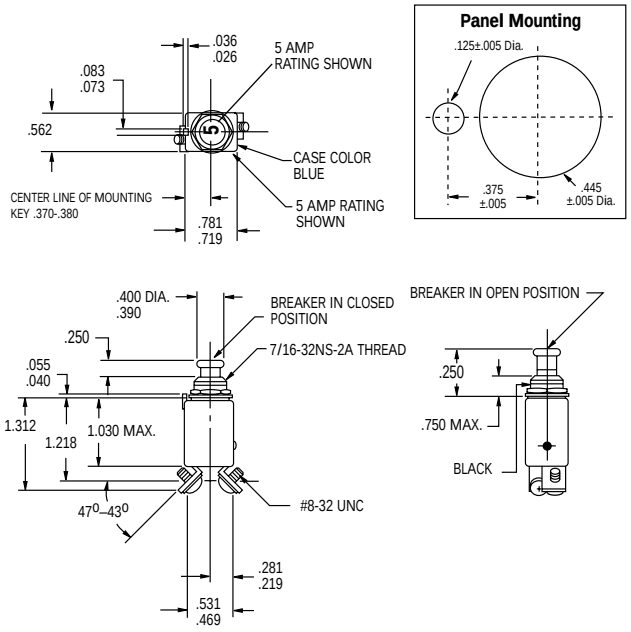
The key part in the dual safety design is a two part current carrying element joined by a special alloy. The geometry and material of the element determine its heating properties. The elements heating properties are slower than the bimetal sensor but faster than the smoke curve of the wire the rating is designed to protect. In the case where the standard mechanism is disabled or cannot operate normally, the separable element "fuses" open, interrupting the current.

The benefits of the dual safety design result in calibrated overcurrent protection (based on fuse times) and specified post fuse dielectric properties for system and human protection.

Characteristics

"Dual Safety™" 2TC49

2TC49



Link Separation Characteristics

Maximum circuit breaker link separation times for locked contact condition as a function of overload

% Overload Rated Current

Amp Rating	400%	500%	600%	700%	800%	900%	1000%
2½	–	–	34.0	20.0	13.0	9.0	6.0
3	–	–	34.0	20.0	13.0	9.0	6.0
5	–	95.0	36.0	18.0	10.0	6.0	3.5
7½	69.0	28.0	14.0	8.0	4.0	3.5	2.0
10	60.0	35.0	20.0	12.0	7.0	4.0	2.5

Time (seconds)

Calibration: 2½–15 amps

Temp °C	Min ULT Trip	Max ULT Trip	Trip Time – Seconds		
			200%	500%	1000%
+25	115%	138%	5-20	.5-2.0	.12-.53
-54	115%	165%	7-40	.6-3.0	.16-.8
+121	90%	138%	3-13	.33-1.1	.07-.3

Vibration* ..... 10 G's minimum, 50-500 Hz
Mechanical Shock ..... 50 G's
Acceleration ..... 10 G's
Weight ..... 2TC49 - 25 gm max.

Post-short circuit dielectric .....1125 VAC Min (1mA)
Post-link separation dielectric ..... 900 VAC (1mA)

Interrupt Current

2½ - 15 amps: 6000 amps at 28 VDC
2½ amps: 2800 amps at 120 VAC, 400 Hz
3 - 15 amps: 2500 amps at 120 VAC, 400 Hz

Endurance

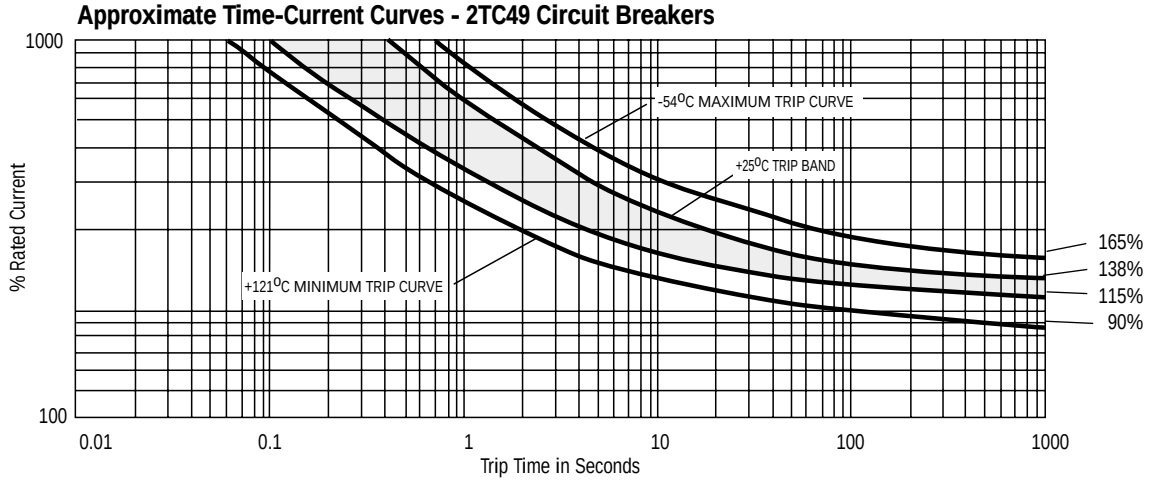
2500 cycles ..... 120 VAC, 400 Hz Inductive
5000 cycles ..... 120 VAC, 400 Hz Resistive
2500 cycles ..... 30 VDC, Inductive
5000 cycles ..... 30 VDC, Resistive
10,000 cycles ..... Mechanical, no load

* Other vibration levels available. Contact factory for details.

TI Number	Voltage Drop (max.)**
2TC49-2½	0.70
2TC49-3	0.55
2TC49-5	0.35
2TC49-7½	0.30
2TC49-10	0.28

** Max. voltage drop at nominal rated current

Approximate Time-Current Curves - 2TC49 Circuit Breakers



CONVERSION CHART	
INCHES	MM
.035	0.89
.036	0.91
.040	1.02
.055	1.40
.073	1.85
.083	2.11
.250	6.35
.352	8.94
.370	9.40
.380	9.65
.390	9.91
.400	10.16
.562	14.27
.704	17.88
.750	19.05
1.030	26.16
1.218	30.94
1.312	33.32

REVISIONS					
ZONE	LTR	2TC49 DESCRIPTION	PROJ. 1041	DATE	APPROVED
	L	SEE ECN	ECN0017504 PAF	9-20-04	D.A.

NOTES:

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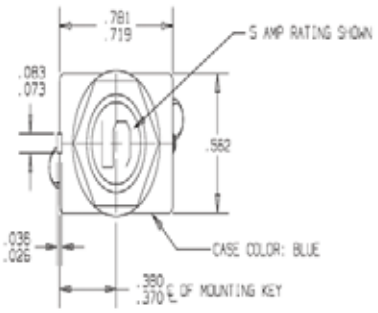
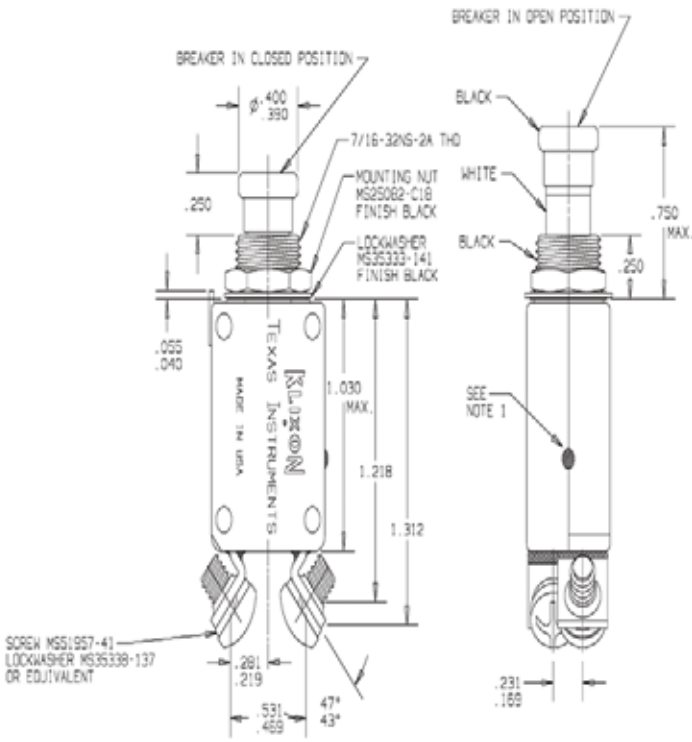
4. DATE CODE PER 10588-285.
5. MARK IN APPROXIMATE POSITION SHOWN IN BLACK INK PER 12506-70.





PERFORMANCE CHARACTERISTICS

DETAIL PERFORMANCE PER MIL-C-5809

OVERLOAD CYCLING	100 CYCLES AT 200% RATING
VIBRATION	10 G'S MINIMUM 50-500 HZ
MECHANICAL SHOCK	50 G'S
ACCELERATION	10 G'S
SAND AND DUST	12 HOURS
CORROSION	SALT SPRAY 50 HOURS
HUMIDITY	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS
POST RUPTURE DIELECTRIC	1125 VAC MIN. (1 MA)
POST LINK SEPARATION DIELECTRIC	900 VAC MIN. (1 MA)

ENDURANCE:

120 VAC	400 HZ RESISTIVE	5000 CYCLES
	INDUCTIVE	2500 CYCLES
30 VDC	RESISTIVE	5000 CYCLES
	INDUCTIVE	2500 CYCLES
MECHANICAL	NO LOAD	10000 CYCLES

CALIBRATION: 2.5, 3, 5, 7.5 AND 10 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	500%	1000%
+25°C, +77°F	115% RATING	135% RATING	5-20 SEC.	.5-2.0 SEC.	.12-.53 SEC.
+54°C, +65°F	115% RATING	165% RATING	7-40 SEC.	.6-3.0 SEC.	.16-.8 SEC.
+121°C, +250°F	90% RATING	136% RATING	3-13 SEC.	.33-1.1 SEC.	.07-.3 SEC.

RUPTURE:

2 1/2 AMP	120 VAC, 400	2600 AMPS.
3 THRU 10 AMP	120 VAC, 400	2500 AMPS.
2 1/2 THRU 10 AMP	28 VDC	6000 AMPS.

MAXIMUM OPERATING FORCES

PULL OUT	5 LBS. MAX. (22.2 N)
RESET	5 LBS. MAX. (22.2 N)

OPERATING ALTITUDE: 70,000 FT. (21,000 M)

WEIGHT: 25.0 GRAMS MAX.

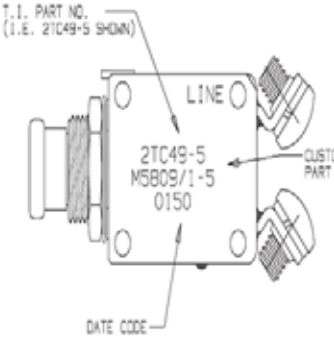
VOLTAGE DROP:

2.5 AMP	0.70 VOLTS MAX.
3 AMP	0.55 VOLTS MAX.
5 AMP	0.35 VOLTS MAX.
7.5 AMP	0.30 VOLTS MAX.
10 AMP	0.28 VOLTS MAX.

CIRCUIT BREAKER LINK SEPARATION CHARACTERISTICS

MAXIMUM CIRCUIT BREAKER LINK SEPARATION TIMES (IN SECONDS) FOR LOCKED CONTACT CONDITION AS A FUNCTION OF OVERLOAD

	400%	500%	600%	700%	800%	900%	1000%
2 1/2	---	---	34.0	20.0	13.0	9.0	6.0
3	---	---	34.0	20.0	13.0	9.0	6.0
5	---	95.0	36.0	18.0	10.0	6.0	3.5
7 1/2	69.0	28.0	14.0	8.0	4.0	3.5	2.0
10	60.0	35.0	20.0	12.0	7.0	4.0	2.5



MARKING
(SEE TABLE)

MARKING TABLE

T.I. PART NO.	MS PART NO.
2TC49-2 1/2	MS809/1-2 1/2
2TC49-3	MS809/1-3
2TC49-5	MS809/1-5
2TC49-7 1/2	MS809/1-7 1/2
2TC49-10	MS809/1-10

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P2 | Q3 | P10

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCE ON FRACTIONS DECIMALS ANGLES
±.031

MATERIAL

DRAWN	H.H	9-10-82
ENGINEER	B.J.NM.	10-4-82
APPROVED	N/A	
APPROVED	H.HIRSHERUNER	9-27-82

SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

CONTROL PRODUCTS DIVISION

TITLE
PART NO. 2TC49
AMBIENT COMPENSATED, HIGH TEMP.
CIRCUIT BREAKER
PUSH-PULL, TRIP FREE
ENVELOPE DRAWING

SIZE	CODE IDENT NO.	
C	82647	2TC49

SCALE: 4X | SHEET 1 OF 1

KLIXON®

5TC Series

Single Phase, Ambient Compensated

Features

- **Trip free**
- **Current ratings (20 - 50amps)**
- **Coordinated ratings**
- **High vibration resistance**
- **High interrupting capacity**

Overview

Klixon® single-phase TC devices represent "state-of-the-art" protection for today's aerospace power systems.

The Klixon trademark has set the standard for aerospace circuit breakers. The TC series offers the endurance and reliability required by exacting military specifications and is available in standard current ratings from 20 – 50 amperes.

Coordination

The single phase 5TC rating is coordinated so it will trip before another circuit breaker, twice its rating, in the event of a fault of up to 600 amps let through current. This results in improved overall equipment performance, since only the smallest faulted circuit is interrupted, while larger circuits remain operational.

Ambient Temperature Compensation

The 5TC serves as an ambient compensated circuit breaker. It permits system designers to specify smaller gauge wire where the circuit breaker and wiring are exposed to different ambient temperatures. They are especially suited for application where ambient temperature exceeds the 160°F (71°C) maximum of non-ambient compensated thermal circuit breakers. The 5TC series may be applied where operating temperatures are as high as 250°F (121°C), with no derating of the circuit breaker. This eliminates the need for cooling air and allows substantial weight, space and cost savings.

Options

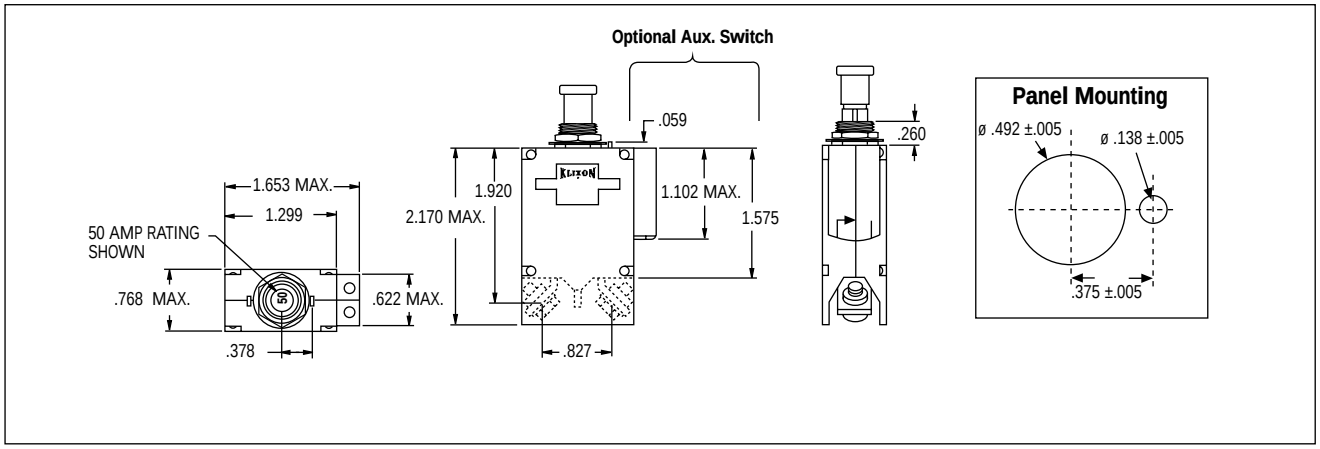
- Longer pushbuttons
- Standard or auxiliary switch configuration
- Terminal barriers

Qualifications

ASNE0732-005 .....5TC65
NSA931321 .....5TC50

Characteristics

5TC



Calibration: 20-50 Amps

Temp ^{O}C	Min. ULT. Trip	Max. ULT. Trip	Trip Time - Seconds		
			200%	500%	1000%
+23	110%	145%	2-18	.15 - 2.5	.045 - .6
-54	110%	165%	70 sec. max.	.15 - 2.5	.045 - .6
+70	105%	145%	1.5 sec. min.	.15 - 2.5	.045 - .6
+125	90%	145%	1.5 sec. min.	.15 - 2.5	.045 - .6

The above calibration chart is representative of a standard commercial device. TI offers specific variants with similar performance dependant on military or customer specifications. Temperatures are ±5^{O}C.

Performance

Vibration ..... 10 G's minimum, 80-500 Hz
Mechanical Shock ..... 50 G's
Acceleration ..... 10 G's
Weight
Standard Device ..... 53 grams (w/o hw), 58 grams (w/hw)
Auxiliary Device ..... 55 grams (w/o hw), 59 grams (w/hw)

Interrupting Capacity

20-50 amps.....4000 amps at 28 VDC
20-50 amps..... 2000 amps at 115 VAC,400 Hz

Endurance

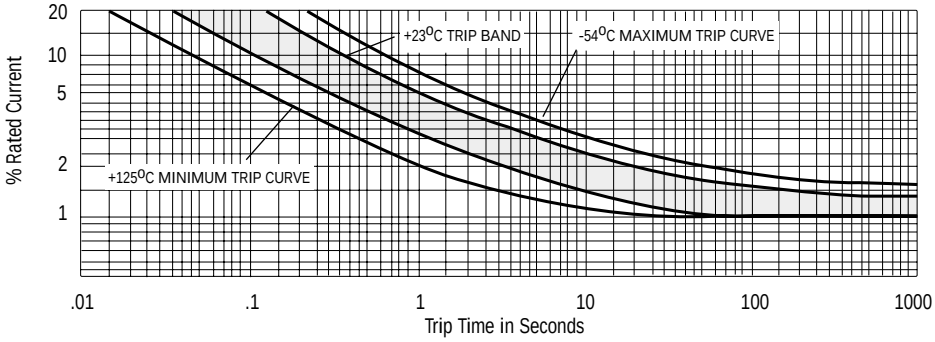
2500 cycles.....115 VAC, 400 Hz,Inductive
2500 cycles.....28 VDC, Inductive
2500 cycles.....28 VDC, Resistive
5000 cycles.....Mechanical, no load

Basic Type – Amps (20 – 50)
5TC50–XX: Std. Version
5TC65–XX: Auxilary
XX – denotes Amp rating

Amp Rating	Voltage Drop (max)*
20	0.150
25	0.150
35	0.150
50	0.120

* Max. voltage drop at nominal rated current

Approximate Time-Current Curves - 5TC Circuit Breakers



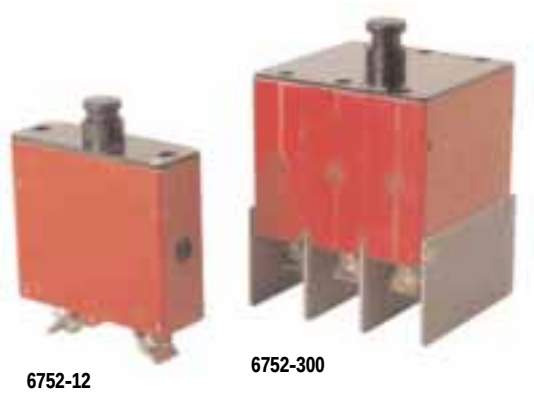
KLIXON®

6752 Series Circuit Breakers

Ambient Compensated Single & Three Phase High Short Circuit Capacity

Features

- **Useable on large electrical systems – 6000 amperes interrupting capacity**
- **Circuit protection unaffected by temperature fluctuation – ambient compensated from -65°F to +250°F**
- **Only faulted line circuits opened – coordination of ratings ensures that branch circuit breakers trip first under fault conditions**
- **Long trouble-free operation – 20,000 operating cycles**
- **Military approved**
- **High amp devices available (65A & 90A)**



6752-12 6752-300

Overview

The Klixon 6752-12 and -300 series thermal-magnetic circuit breakers are ambient compensated and trip-free. They are designed and manufactured to meet the more stringent military standards of today's jet aircraft, specifically MIL-C-22715 (USAF).

The higher short circuit capacity, vibration resistance and longer cycling life of the 6752-12 and -300 series exceed previous military standards. In addition, the 6752-12 and -300 series provide ambient compensation, fault coordination of all ratings, and an option for auxiliary circuits.

High Short Circuit Capacity

A deionizing grid and magnetic assist enable the 6752-12 and -300 series to successfully interrupt four fault currents of 6000 amperes – two at sea level and two at 60,000 feet – on either a 120 VAC , 400 Hz system or a 30 VDC system.

Ambient Temperature Compensation

Substantially unaffected by ambient temperature, the 6752-12 and -300 series circuit breakers maintain their performance capabilities by means of a thermal compensator in the temperature range of -54°C to+121°C.

Coordination

The 6752-12 and -300 series breaker ratings are coordinated so any rating will trip before another rating, twice its capacity, in the event of a fault. This results in improved over-all equipment performance, since only the smallest faulted circuit is removed while larger circuits remain in operation.

Auxiliary Circuit

The 6752-12 and -300 series are available with auxiliary switch. For part numbers and characteristics, please consult the factory.

MIL Qualification

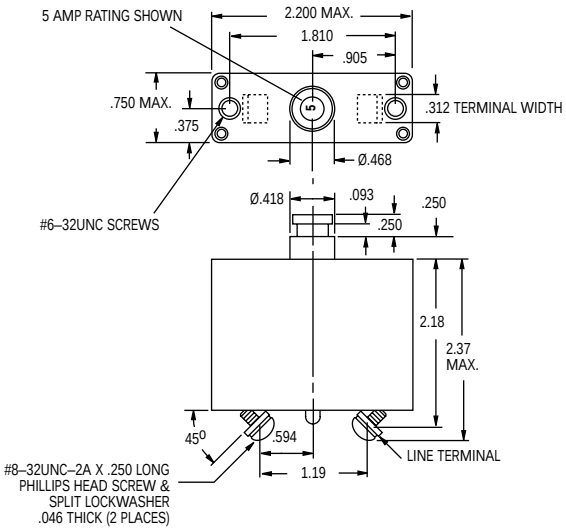
TI Number	MS Number	
6752-12-2½	MS 24571-2	MS 24571-2V
6752-12-5	MS 24571-5	MS 24571-5V
6752-12-7½	MS 24571-7	MS 24571-7V
6752-12-10	MS 24571-10	MS 24571-10V
6752-12-15	MS 24571-15	MS 24571-15V
6752-12-20	MS 24571-20	MS 24571-20V
6752-12-25	MS 24571-25	MS 24571-25V
6752-12-35	MS 24571-35	MS 24571-35V
6752-12-50	MS 24571-50	MS 24571-50V

When ordering MS 24571-XX(V) style breaker by TI part number, designator must include S.R. 12507-356

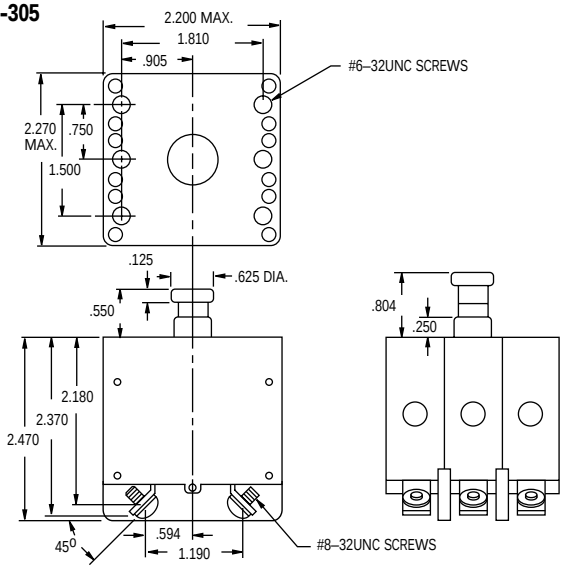
Example: 6752-12-2½ is S.R. 12507-356

Characteristics

6752-12



6752-305



6752-12 Calibration: 2½ - 50 amps

TI Part Number	200%	400%	1000%
6752-12-2½	12-32	2.3-6.5	.32-1.1
6752-12-5	14-36	2.5-6.5	.45-1.1
6752-12-7½	16-40	2.5-7.0	.34-1.1
6752-12-10	18-42	2.7-7.75	.45-1.2
6752-12-15	20-45	2.7-8.0	.36-1.2
6752-12-20	20-48	2.7-8.0	.36-1.2
6752-12-25	20-50	2.7-8.0	.36-1.2
6752-12-35	20-53	2.7-9.5	.36-1.2
6752-12-50	20-55	2.7-8.0	.36-1.4

TI Part Number		Voltage Drop
Single Phase	Three Phase	Max**
6752-12-2½	6752-305-2½	0.60
6752-12-5	6752-305-5	0.40
6752-12-7½	6752-305-7½	0.30
6752-12-10	6752-305-10	0.25
6752-12-15	6752-305-15	0.25
6752-12-20	6752-305-20	0.25
6752-12-25	6752-305-25	0.25
6752-12-35	6752-305-35	0.25
6752-12-50	6752-305-50	0.25

** Max voltage drop at nominal rated current.

6752-305 Calibration: 2½ -50 amps

TEMP °C	MIN ULT TRIP	MAX ULT TRIP	TRIP TIME - SECONDS		
			200%	400%	1000%
+25	110%	138%	12-65	2.3-10	.33-1.4
-54	110%	160%	15-65	2.3-10	.33-1.4
+93	105%	138%	12-65	2.3-10	.33-1.4
+121	100%	138%	12-65	2.3-10	.33-1.4

† Single phase max. ult. trip values apply with other two phases carrying 100% of rated current.

Performance Characteristics

Vibration* ..... 10 G's minimum, 50-2000 Hz
Mechanical Shock ..... 25 G's
Acceleration ..... 10 G's
Weight ..... 6752-12 – 91 gm max.
6752-305 – 292 gm max.

Interrupt Current

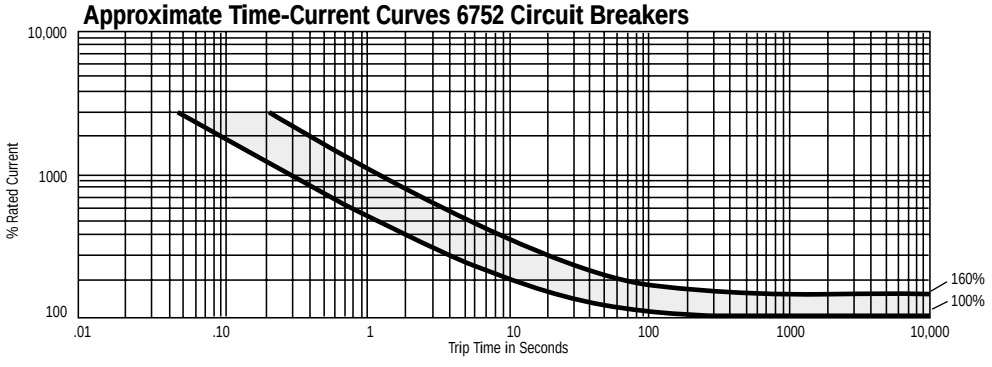
2½ - 50 amps: 6000 amps at 30 VDC (6752-12 only)
2½ - 50 amps: 6000 amps at 120 VAC, 400 Hz
2½ - 50 amps: 4200 amps at 205 VAC, 400 Hz

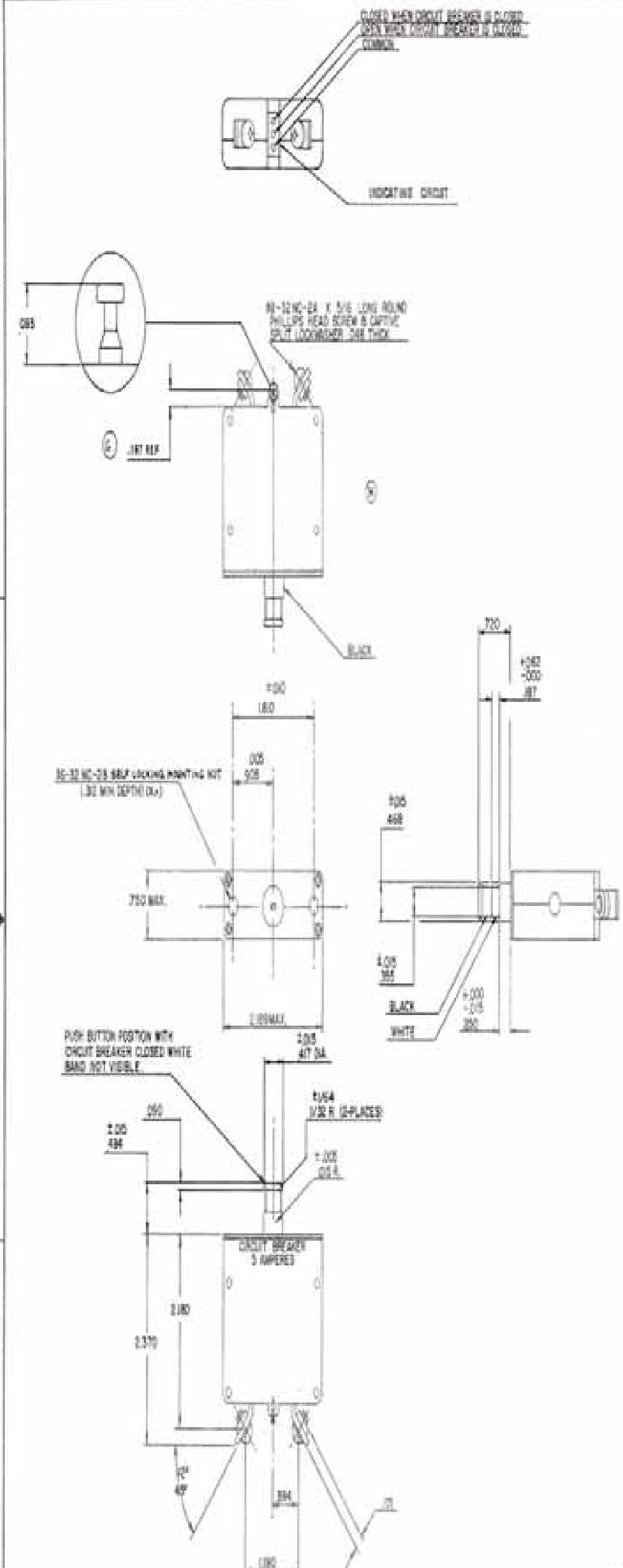
Endurance

5000 cycles ..... 120 VAC, 400 Hz Inductive
5000 cycles ..... 120 VAC, 400 Hz Resistive
10,000 cycles ..... Mechanical, no load
20,000 cycles ..... Total

* Other vibration levels available. Contact factory for details.

Approximate Time-Current Curves 6752 Circuit Breakers





REVISIONS

PERFORMANCE CHARACTERISTICS
TESTED TO AND MEETS REQUIREMENTS OF MIL-C-27715 (USAF)

1. CALIBRATION

AMBIENT TEMPERATURE	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	400%	1000%	3000%
-65°F	110 %	160 %	SEE TABLE BELOW			
77°F	110 %	138 %	VALUES FOR -65°F TO 200°F			
200°F	105 %	139 %				
250°F	100 %	138 %				

2. RUPTURE

120 VAC	400 CYCLE	6,000 AMPS
200 VAC	400 CYCLE	4,200 AMPS
30VDC		6,000 AMPS

3. DURABILITY

120 VAC	400 CYCLE	
MECHANICAL	(NO LOAD)	10,000 CYCLES
RESISTIVE LOAD		5,000 CYCLES
INDUCTIVE LOAD		5,000 CYCLES
TOTAL		20,000 CYCLES

4. VOLTAGE DROP WHILE CARRYING RATED CURRENT

AMP RATING	MAXIMUM VOLTAGE DROP
2.5	0.6 V
5	0.4 V
7.5	0.3 V
ALL OTHERS	0.25 V

5. VIBRATION

FREQUENCY	G LEVEL
5 - 10 CPS	0.2 DOUBLE AMPLITUDE
10 - 23 CPS	± 1 G
23 - 74 CPS	0.036 DOUBLE AMPLITUDE
74 - 300 CPS	± 10 G
300-600 CPS	± 10 G
600-700 CPS	± 14 G
700-1500 CPS	± 10 G

6. COORDINATION

BETWEEN RATINGS
2.5 - 5
5 - 10
7.5 - 15
10 - 20
15 - 35

7. OPERATING FORCE

OPENING: 15 LBS. - 60 LBS.
CLOSING: 4.0 LBS. - 12 LBS.

8. DIELECTRIC STRENGTH — 1500 VAC, RMS.
9. INSULATION RESISTANCE — 100 MEGOHMS AT 500 VDC
10. EXPLOSION PROOF — WHILE INTERRUPTING RUPTURE CURRENTS
11. HUMIDITY — 240 HOURS
12. CORROSION RESISTANCE — 50 HOURS
13. SAND AND DUST — 12 HOURS
14. MECHANICAL SHOCK — 25 G FOR 11 ± 1 MILLISECONDS
15. OVERLOAD CYCLING — 100 CYCLES AT 200% RATED CURRENT
16. FUNGUS RESISTANCE — 28 DAYS
17. STRENGTH OF TERMINALS — 25 LB. TENSILE LOAD, 20 IN-LB. TORQUE LOAD
18. STRENGTH OF MOUNTING PROVISIONS — 30 LB. AXIAL LOAD, 10 IN-LB TORQUE LOAD
19. STRENGTH OF ACTUATOR — 25 LB. AXIAL LOAD, 40 LB NORMAL LOAD
20. ACCELERATION — 10 G'S FOR 1 MINUTE
21. RECLOSING — NO AUTOMATIC RECLOSE
22. TRIP FREE — RESETTABLE ONLY AFTER MOVING THE ACTUATOR TO THE FULL OPEN POSITION.
23. INDICATING CONTACT RATING

28 VDC 7 AMPS RESISTIVE
4 AMPS INDUCTIVE (SEA LEVEL)
2.5 AMPS INDUCTIVE AT 50,000 FT.
115/250 VAC 60 CYCLES 7 AMPS RESISTIVE & INDUCTIVE

THIS DRAWING TAKES PRECEDENCE OVER MIL-C-27715 (USAF)

PART NUMBER		AMP RATING	CALIBRATION IN SECONDS -65°F TO 200°F 200%	400%	1000%	3000%
6752-13-2½		2.5	10-40	2.3-6.5	.32-1.1	.04-.16
6752-13-5		5	11-45	2.5-6.5	.45-1.1	.06-.15
6752-13-7½		7.5	12-50	2.5-7.0	.34-1.1	.04-.12
6752-13-10		10	14-52	2.7-7.8	.48-1.2	.05-.13
6752-13-15		15	15-56	2.7-8.0	.36-1.2	.04-.13
6752-13-20		20	16-57	2.8-8.0	.37-1.2	.06-.12
6752-13-25		25	17-59	2.9-8.5	.38-1.2	.05-.12
6752-13-35		35	18-62	3.0-9.0	.39-1.2	.05-.12
6752-13-50		50	20-65	3.1-10.0	.40-1.4	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS DECIMALS ANGLES
±.030

MATERIAL

BY [signature] DATE 4/2/63
CH [signature]
ENG [signature]
APPROVED [signature]

KLIXON SPENCER PRODUCTS
METALS & CONTROLS INC.
ATTLEBORO, MASSACHUSETTS, U.S.A.
A CORPORATE DIVISION OF TEXAS INSTRUMENTS INCORPORATED

6752-13 TYPE
PUSH PULL CIRCUIT BREAKER
ENVELOPE DRAWING

CODE IDENT NO. 82647 SIZE D 6752-13

SCALE FULL WT ACT .2 LBS. MAX. SHEET 1 OF 1

KLIXON®

6752-100 Series Circuit Breakers

Ambient Compensated Single & Three Phase High, Short Circuit Capacity

Features

- **Current ratings from 50-100 amps**
- **Proven reliability and performance of the 6752 series circuit breaker**
- **Usable on large electrical systems – 6000 amperes interrupting capacity**
- **Circuit protection unaffected by temperature fluctuations – ambient compensated from -40°F to +160°F**
- **Military approved (including high sine vibration capability) to MS 25361 and MS 25361 (V)**

6752-100

Overview

The Klixon® 6752-100 series thermal-magnetic circuit breakers are ambient compensated and trip-free. These circuit breakers are designed and manufactured to meet stringent military standards with the reliability of the original 6752 design. The 6752-100 is similar to the 6752-12 in size, and includes current ratings ranging from 50-100 amps.

The higher short circuit capacity, vibration resistance and longer cycling life of the 6752-12 and -300 series exceed previous military standards. In addition, the 6752-12 and -300 series provide ambient compensation, fault coordination of all ratings, and an option for auxiliary circuits.

High Short Circuit Capacity

A deionizing grid and magnetic assist enable the 6752-100 series to successfully interrupt four fault 6000 amp currents, two at sea level and two at 60,000 feet, on either a 120 VAC , 400 Hz system or a 30 VDC system.

Ambient Temperature Compensation

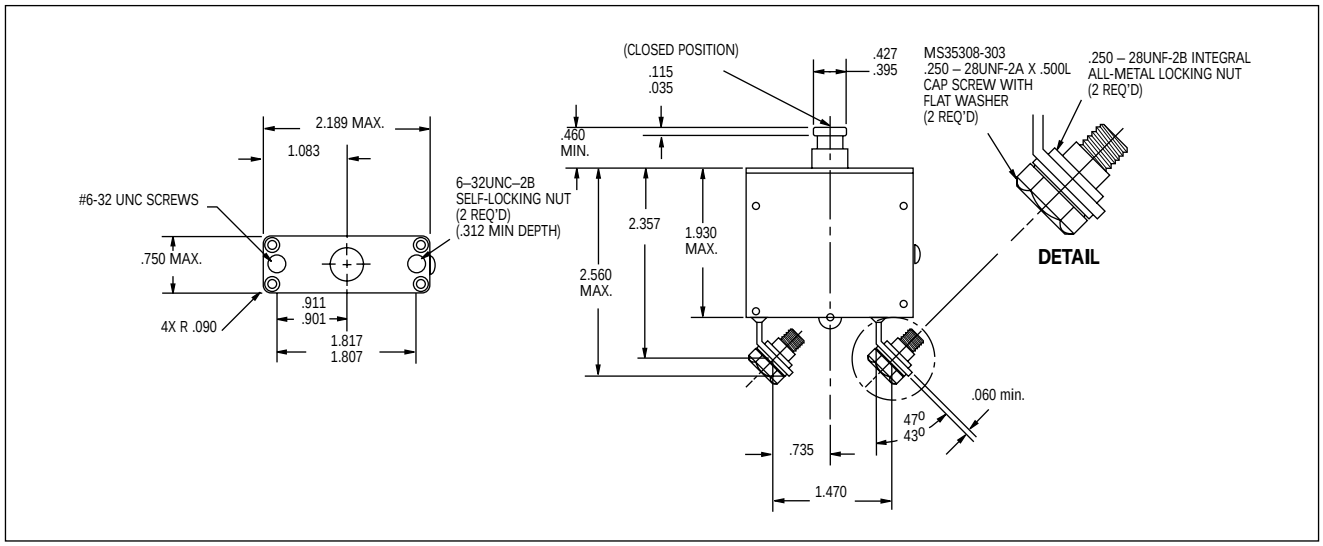
The 6752-100 series circuit breakers maintains its performance capabilities by means of a thermal compensator in the temperature range of -40°C to +70°C.

MIL Qualification

TI Number	MS Number	TI Number	MS Number
6752-100-50	MS 25361-50	6752-102-50	MS25361-50V
6752-100-60	MS 25361-60	6752-102-60	MS25361-60V
6752-100-70	MS 25361-70	6752-102-70	MS25361-70V
6752-100-75	MS 25361-75	6752-102-75	MS25361-75V
6752-100-80	MS 25361-80	6752-102-80	MS25361-80V
6752-100-90	MS 25361-90	6752-102-90	MS25361-90V
6752-100-100	MS 25361-100	6752-102-100	MS25361-100V

Characteristics 6752-100

Envelope Dimensions



Performance Characteristics

Vibration* ..... 10 G's minimum, 50-2000 Hz
Mechanical Shock ..... 30 G's
Acceleration ..... 10 G's
Weight ..... 0.25 lbs (114 gm) max.

Interrupt Current

120 VAC, 400 Hz: 3500 amps
28 VDC: 6000 amps

Endurance

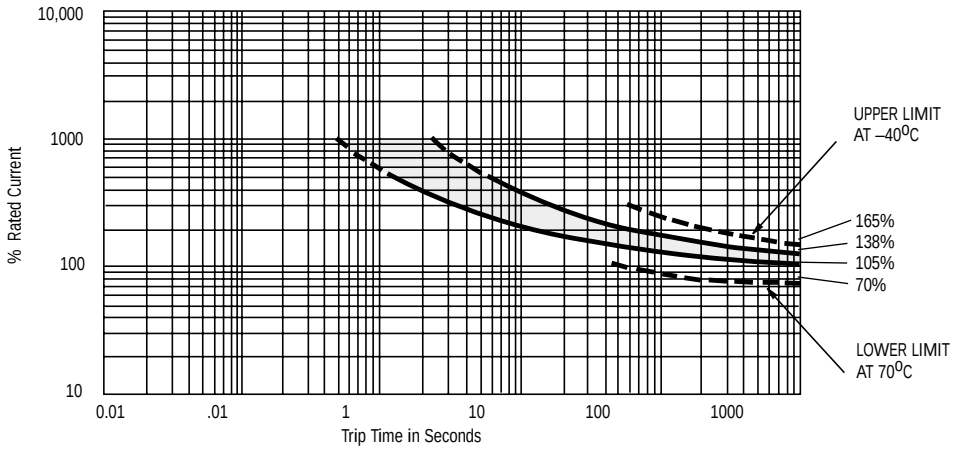
5000 cycles ..... 120 VAC, 400 Hz Resistive
5000 cycles ..... 120 VAC, 400 Hz Inductive
5000 cycles ..... 28 VDC, 400 Hz Resistive
2500 cycles ..... 28 VDC, 400 Hz Inductive
5000 cycles ..... no load

* Other vibration levels available. Contact factory for details.

6752-100 Calibration

Temp °C	Min ULT Trip	Max ULT Trip	Trip Time – Seconds		
			200%	400%	1000%
+25	105%	138%	15-65	2-10	1.4
-40	125%	165%	15-65	2-10	1.4
+70	70%	125%	15-65	2-10	1.4

Approximate Time-Current Curves – 6752-100 Circuit Breakers



KLIXON®

3TC7 Series

Single Phase, Non Ambient Compensated, High Short Circuit Interrupting Capacity

Features

- **Lightweight**
- **Miniature size**
- **High interrupting capacity**
- **High vibration resistance**
- **MIL-C-5809 (MS25244)**
- **Available in 5-35 amperes**

3TC7

Overview

The Klixon 3TC7 style circuit breaker is a lightweight, high performance, non ambient temperature compensated circuit breaker that is well suited for aircraft, avionics and electrical systems. The 3TC7 series features a trip free design that prevents the circuit breaker from being closed manually on overloads. The 3TC7 interrupting a 6,000A circuit at 30 VDC, or 3,500A circuit at 120 VAC, 400 Hz.

The Klixon trademark continues to set the standard for lightweight configurations and offers the endurance and reliability required by exacting military specifications. The 3TC7 is currently available in 5-35 amperes.

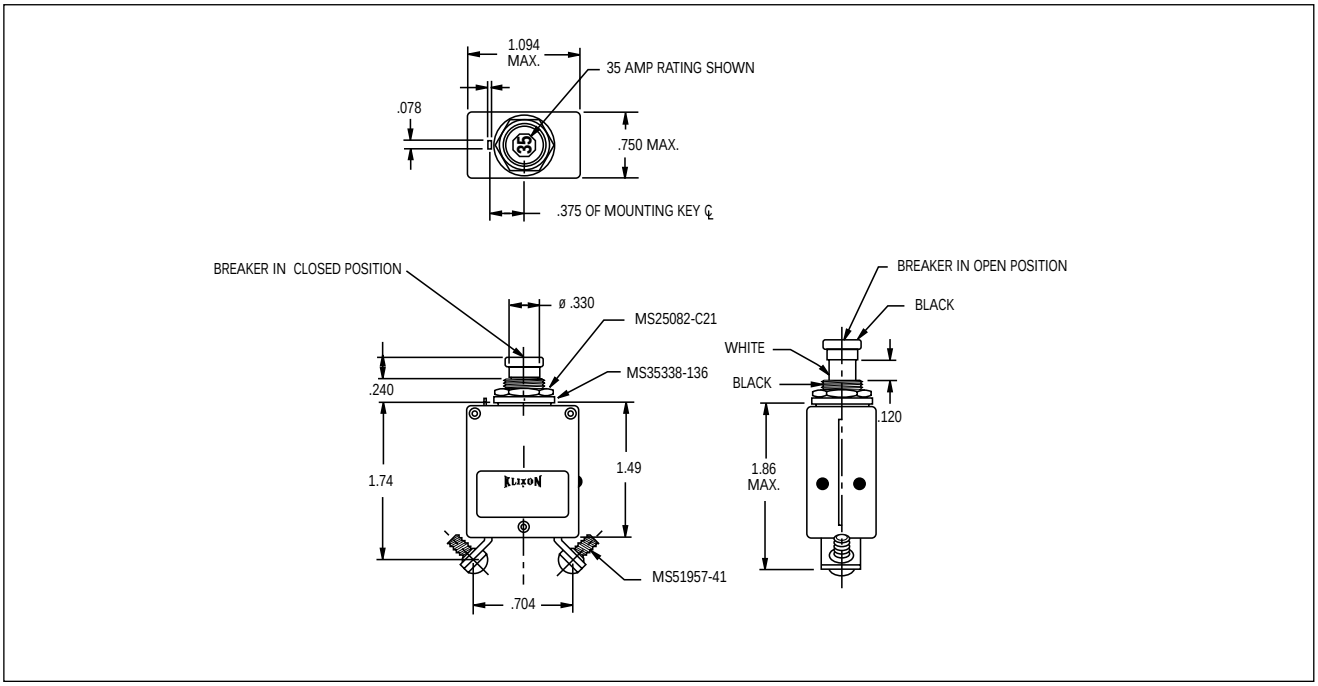
Detailed Performance Data

Interrupting Capacity	6000 Amperes at 30VC	3500 Amperes at 120 VAC, 400 Hz
Endurance	120 VAC, 400 Hz Inductive	2,500 Cycles
	120 VAC, 400 Hz Resistive	5,000 Cycles
	30 VDC, Inductive	2,500 Cycles
	30 VDC, Resistive	5,000 Cycles
	Mechanical, no load	5,000 Cycles
Vibration	10 G's	
Mechanical Shock	30 G's peak	
Acceleration	10 G's	
Weight	39 gm	
Operating Altitude	65,000 ft	

TI Number	MS Number	Amp Rating	Voltage Drop
3TC7-5	MS25244-5	5	.25
3TC7-7½	MS25244-7½	7½	.25
3TC7-10	MS25244-10	10	.25
3TC7-15	MS25244-15	15	.25
3TC7-20	MS25244-20	20	.25
3TC7-25	MS25244-25	25	.25
3TC7-30	MS25244-30	30	.25
3TC7-35	MS25244-35	35	.25

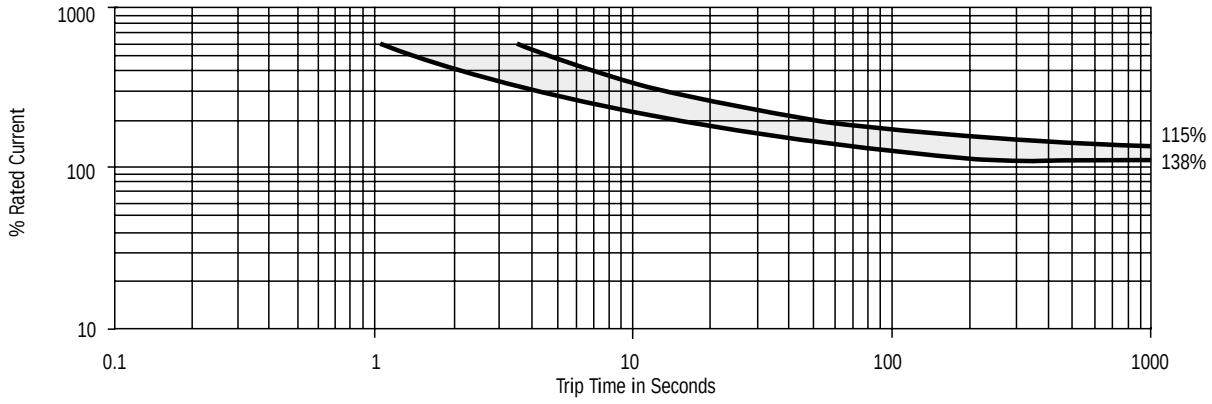
Characteristics

3TC7

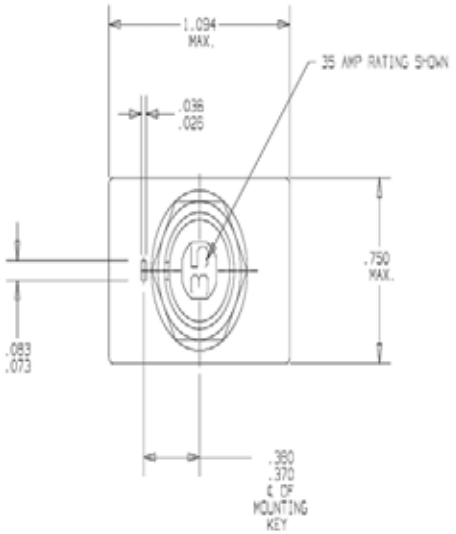


Calibration	Min Ult Trip	Max Ult Trip	200%	400%	600%
+25^{0}C	115%	138%	15 - 55 sec	2.0 - 7.0 sec	1.0 - 3.5 sec
-40^{0}C	148%	178%	-	-	-
+71^{0}C	70%	114%	-	-	-

Approximate Time-Current Curve 3TC7 Circuit Breakers



REVISIONS					
ZONE	LTR	DESCRIPTION 1294		DATE	APPROVED
	C	UPDATED PER MARKUP.	ECN0025542 PAF	1-3-06	DM



DETAIL PERFORMANCE PER MIL-C-5809 + MS25244

OVERLOAD CYCLING	100 CYCLES AT 200% RATED CURRENT
VIBRATION	10 G'S
MECHANICAL SHOCK	30 G'S PEAK
ACCELERATION	10 G'S
SAND & DUST	12 HOURS
CORROSION	SALT SPRAY 96 HOURS
MOISTURE RESISTANCE	10 DAYS
EXPLOSION PROOF	WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	2,500 CYCLES
	400 HZ RESISTIVE	5,000 CYCLES
30 VDC	INDUCTIVE	2,500 CYCLES
	RESISTIVE	5,000 CYCLES
MECHANICAL	NO LOAD	5,000 CYCLES

CALIBRATION:

15 AMP THRU 35 AMP

	MIN. ULT. TRIP	MAX. ULT. TRIP	200%	400%	600%
+25°C. (+77°F.)	115%	138%	15 - 55 SEC.	2 - 7 SEC.	1.0 - 3.5 SEC.
-40°C. (-40°F.)	148%	178%			
+71°C. (+160°F.)	70%	114%			

RUPTURE:

5 AMP THRU 35 AMP	120 VAC 400 HZ	3500 AMPERES
5 AMP THRU 35 AMP	30 VDC	6000 AMPERES

MAXIMUM OPERATING FORCES:

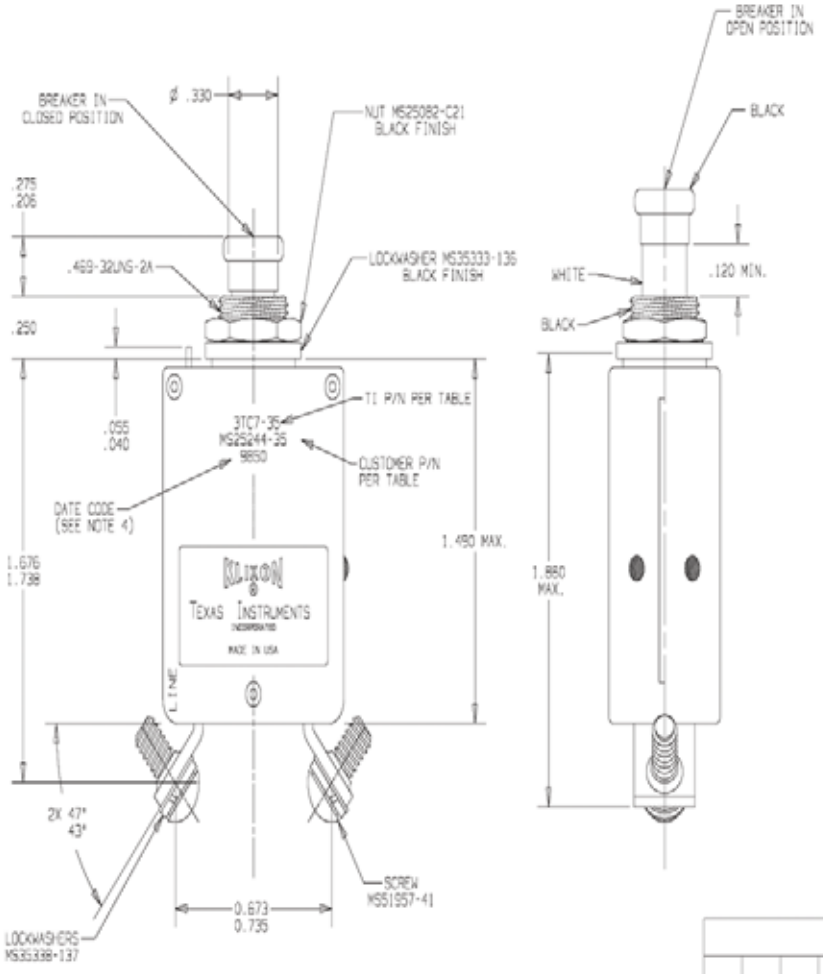
PULL OUT	1.2-8 LBS.
RESET	1.8-12 LBS.

OPERATING ALTITUDE: 65,000 FT. (20,000m)

WEIGHT/MASS: .1 LBS. MAX. (45 GRAMS)

VOLTAGE DROP:

5 THRU 35 AMP ..... 0.25 VOLTS MAX.



TI P/N	CUSTOMER P/N	AMP RATING
3TC7-5	MS25244-5	5
3TC7-71/2	MS25244-71/2	7 1/2
3TC7-10	MS25244-10	10
3TC7-15	MS25244-15	15
3TC7-20	MS25244-20	20
3TC7-25	MS25244-25	25
3TC7-30	MS25244-30	30
3TC7-35	MS25244-35	35

NOTES:

1. EPOXY SURFACES ARE NON-DIMENSIONED. ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
2. TERMINAL AND MOUNTING HARDWARE MAY BE PACKAGED RATHER THAN INSTALLED.
3. COUNTRY OF ORIGIN IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. COUNTRY OF ORIGIN TO BE IDENTIFIED AS REQUIRED.
4. DATE CODE PER 10588-285.
5. ALL MARKINGS TO BE MADE IN APPROXIMATE POSITIONS SHOWN, WITH BLACK INK PER 12596-70: 3/32 INCH HIGH CHARACTERS.

			03	RS P18
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN: JOSE GONZALEZ	DATE: 12/21/98	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703	CONTROL PRODUCTS DIVISION
TOLERANCE ON FRACTIONS DECIMALS ANGLES ±.015	ENGINEER: M. LAVADO	12/21/98	TITLE: 3TC7 PUSH-PULL TRIP-FREE CIRCUIT BREAKER ENVELOPE DRAWING	
	APPROVED: B. CAREY	12/21/98		
	APPROVED: C. PELLON	12/21/98		
MATERIAL			SIZE: C	CODE IDENT NO.: 82647
			SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.	3TC7

KLIXON®

7274 Series Circuit Breakers

Low Amperage, High Performance

Features

- **Uses minimum space**
- **Light weight**
- **Ratings: 1/2 – 20 amperes**
- **Military approved**

7274-2 **7274-4** **7274-11 and 7274-69**

Overview

The 7274 series are small, light weight, low amperage devices that are specifically designed to protect aircraft / aerospace cable such as flat ribbon, fused multi-conductor tape and printed circuit conductors now being used in lighter weight power distribution systems and components in airborne vehicles and equipment.

The 7274 series features a trip-free indicating-type reset button. Also, a "wiping action" contact design assures low voltage drop, faster trip time and high reliability in low voltage applications. They are available in standard ratings from 1/2 – 20 amps.

A water resistant panel seal* designed to fit over the push button actuator is available for applications that require this type of protection.

Options

Long push buttons

Auxiliary switch

Waterproof panel seal

High vibration

* Part number 14500-1 fits 7274-11 and other types with 15/32" mounting bushing.
14500-5 fits 7274-2 (7/16").

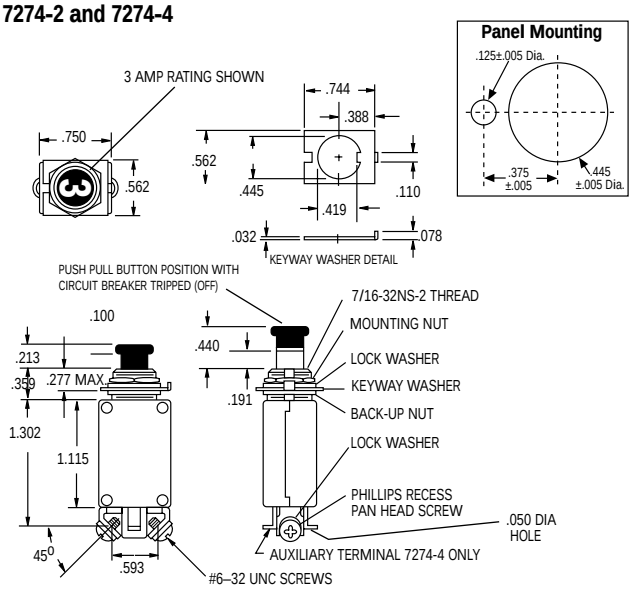
TI Number	MS Number	TI Number	MS Number
7274-2-½	MS 26574-½	7274-4-½	MS 26574-½A
7274-2-¾	MS 26574-¾	7274-4-¾	MS 26574-¾A
7274-2-1	MS 26574-1	7274-4-1	MS 26574-1A
7274-2-1½	MS 26574-1½	7274-4-1½	MS 26574-1½A
7274-2-2	MS 26574-2	7274-4-2	MS 26574-2A
7274-2-2½	MS 26574-2½	7274-4-2½	MS 26574-2½A
7274-2-3	MS 26574-3	7274-4-3	MS 26574-3A
7274-2-4	MS 26574-4	7274-4-4	MS 26574-4A
7274-2-5	MS 26574-5	7274-4-5	MS 26574-5A
7274-2-7½	MS 26574-7½	7274-4-7½	MS 26574-7½A
7274-2-10	MS 26574-10	7274-4-10	MS 26574-10A
7274-2-15	N/A	7274-4-15	N/A
7274-2-20	N/A	7274-4-20	N/A

TI Number	MS Number	TI Number	MS Number
7274-11-½	MS 22073-½	7274-69-½	MS 22073-½V
7274-11-¾	MS 22073-¾	7274-69-¾	MS 22073-¾V
7274-11-1	MS 22073-1	7274-69-1	MS 22073-1V
7274-11-1½	MS 22073-1½	7274-69-1½	MS 22073-1½V
7274-11-2	MS 22073-2	7274-69-2	MS 22073-2V
7274-11-2½	MS 22073-2½	7274-69-2½	MS 22073-2½V
7274-11-3	MS 22073-3	7274-69-3	MS 22073-3V
7274-11-4	MS 22073-4	7274-69-4	MS 22073-4V
7274-11-5	MS 22073-5	7274-69-5	MS 22073-5V
7274-11-7½	MS 22073-7½	7274-69-7½	MS 22073-7½V
7274-11-10	MS 22073-10	7274-69-10	MS 22073-10V
7274-11-15	N/A	7274-69-15	N/A
7274-11-20	N/A	7274-69-20	N/A

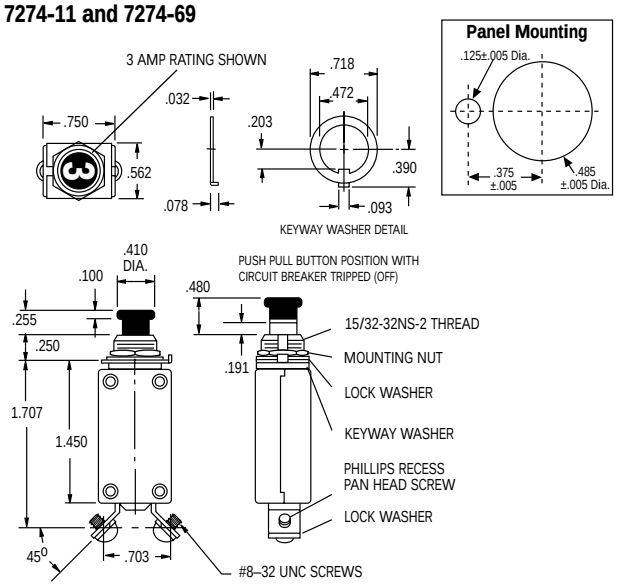
7274-70 Qualified to MS 26547L for ratings 1/2 amp to 10 amp.

Characteristics

7274-2 and 7274-4



7274-11 and 7274-69



Vibration* ..... 10 G's minimum, 50-500 Hz
Mechanical Shock ..... 35 G's
Acceleration ..... 10 G's minimum
Weight ..... 7274-2: 28 gm max.
7274-4: 28 gm max.
7274-11: 33 gm max.
7274-69: 33 gm max.

Interrupt Current

1/2 - 5 amps: unlimited at 28 VDC
7½ - 15 amps: 2000 amps at 28 VDC
1/2 - 1½ amps: 800 amps at 120 VAC, 400 Hz
2 - 5 amps: 800 amps at 120 VAC, 400 Hz
7½ - 20 amps: 500 amps at 120 VAC, 400 Hz

Endurance

2500 cycles ..... 120 VAC, 400 Hz Inductive
5000 cycles ..... 120 VAC, 400 Hz Resistive
2500 cycles ..... 30 VDC, Inductive
5000 cycles ..... 30 VDC, Resistive
5000 cycles ..... Mechanical, no load

* Other vibration levels available. Contact factory for details.

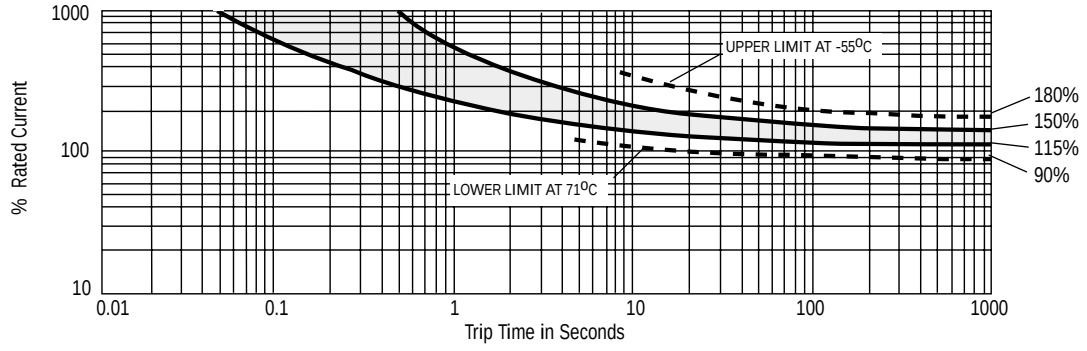
Calibration: 1/2–20 amps

Temp °C	Min ULT Trip	Max ULT Trip	Trip Time – Seconds		
			200%	500%	1000%
+25	115%	150%	2-20	.16-1.2	.046-.8
-55	135%	180%	–	–	–
+71	90%	130%	–	–	–

TI Number	Voltage Drop (Max.)**
7274-XX-½	2.00
7274-XX-¾	1.45
7274-XX-1	1.10
7274-XX-1½	0.75
7274-XX-2	0.75
7274-XX-2½	0.70
7274-XX-3	0.55
7274-XX-4	0.45
7274-XX-5	0.35
7274-XX-7½	0.30
7274-XX-10	0.28
7274-XX-15	0.25
7274-XX-20	0.25

**Max voltage drop at nominal rated current.

Approximate Time-Current Curves 7274 Circuit Breakers



REVISIONS					
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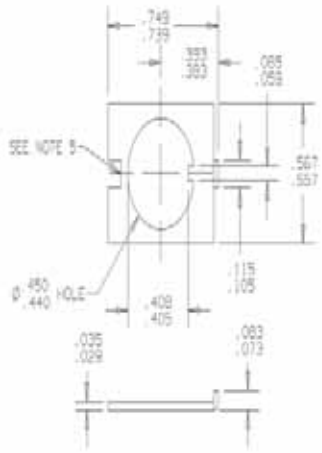
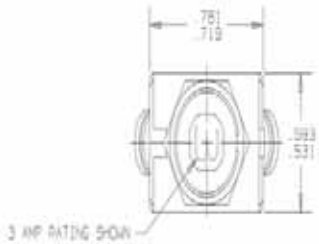
	AJ	ADDED PART NO. AND DATE CODE	CRH6903 JPB	11-5-99	K.H.S.



KEYWAY WASHER DETAIL



PERFORMANCE CHARACTERISTICS (DETAIL PERFORMANCE PER MIL-C-5809)

OVERLOAD CYCLING ---------- 100 CYCLES AT 200% RATING
SINUSOIDAL VIBRATION ------ 10 G'S 50-500 HZ
MECHANICAL SHOCK ---------- 30 G'S AT 11.0 MILLISECOND DURATION
ACCELERATION ------------- 10 G'S MINIMUM
SAND AND DUST ------------ 12 HOURS
CORROSION ---------------- SALT SPRAY 48 HOURS
HUMIDITY ----------------- 10 DAYS
EXPLOSION PROOF ---------- WHILE INTERRUPTING RUPTURE CURRENTS
MOUNTING NUT TORQUE ------ 40 LB.-IN. MAX.

MAXIMUM OPERATING ALTITUDE: 80,000 FT. (24,384 M)

WEIGHT: 28.0 GRAMS MAX.

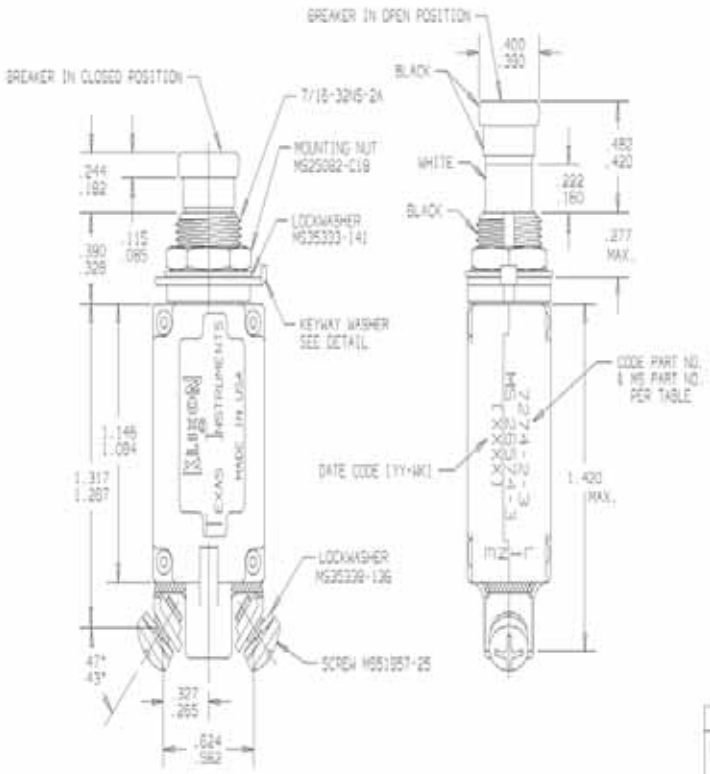
MAXIMUM OPERATING FORCES:
PULL OUT ----- 5 LBS. MAX. (22.2 N)
RESET -------- 5 LBS. MAX. (22.2 N)

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	2500 CYCLES
120 VAC	400 HZ RESISTIVE	5000 CYCLES
30 VDC	INDUCTIVE	2500 CYCLES
30 VDC	RESISTIVE	5000 CYCLES
NO LOAD	MECHANICAL	5000 CYCLES

CALIBRATION:

AMBIENT TEMP.	HOLD	TRIP	200%	500%	1000%
+25°C (+77°F)	115% RATING	150% RATING	2-20 SEC.	.16-1.2 SEC.	.046-0.8 SEC.
-55°C (-67°F)	135% RATING	180% RATING	----------	----------	----------
+71°C (+160°F)	90% RATING	130% RATING	----------	----------	----------



PART NO.	MS PART NO.	AMP RATING	MAXIMUM VOLTAGE DROP	CURRENT INTERRUPTING CAPACITY 120 VAC, 400 HZ	CURRENT INTERRUPTING CAPACITY 28 VDC
7274-2-1/2	MS 26574-1/2	1/2	2.00	UNLIMITED	UNLIMITED
7274-2-3/4	MS 26574-3/4	3/4	1.45	UNLIMITED	UNLIMITED
7274-2-1	MS 26574-1	1	1.10	UNLIMITED	UNLIMITED
7274-2-1 1/2	MS 26574-1 1/2	1 1/2	0.75	UNLIMITED	UNLIMITED
7274-2-2	MS 26574-2	2	0.75	800 AMPS	UNLIMITED
7274-2-2 1/2	MS 26574-2 1/2	2 1/2	0.70	800 AMPS	UNLIMITED
7274-2-3	MS 26574-3	3	0.55	800 AMPS	UNLIMITED
7274-2-3 1/2	MS 26574-3 1/2	3 1/2	0.50	800 AMPS	UNLIMITED
7274-2-4	MS 26574-4	4	0.45	800 AMPS	UNLIMITED
7274-2-5	MS 26574-5	5	0.35	800 AMPS	UNLIMITED
7274-2-7 1/2	MS 26574-7 1/2	7 1/2	0.30	500 AMPS	2000 AMPS
7274-2-10	MS 26574-10	10	0.28	500 AMPS	2000 AMPS
7274-2-15		15	0.25	500 AMPS	2000 AMPS
7274-2-20		20	0.25	500 AMPS	800 AMPS

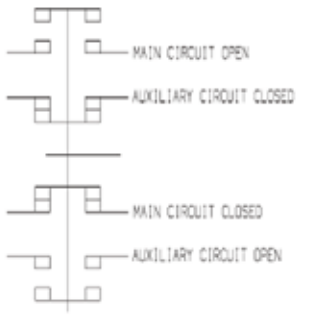
NOTES:

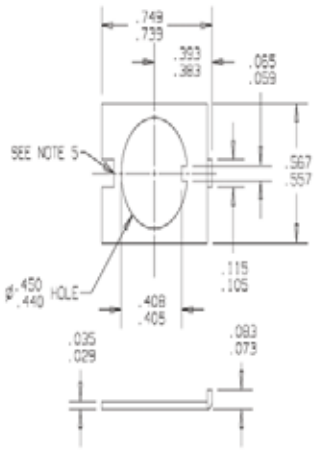
1. ALL MOUNTING HARDWARE HAS A DULL BLACK FINISH.
2. CIRCUIT BREAKERS ARE SUITABLE FOR MOUNTING IN A 1/8" THICK PANEL OR LESS.
3. EPOXY SURFACES ARE NON-DIMENSIONAL. ENVELOPE DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
4. 1/2 THRU 10 AMP CIRCUIT BREAKERS ARE QUALIFIED TO MS 26574.
5. NON FUNCTIONAL NOTCH ON THE BACK OF THE KEYWAY WASHER IS OPTIONAL.
6. DATE CODE PER 108288-285.

THIS DWG. SUPERSEDES 7274-2 REV "AH", DATED 9-9-97

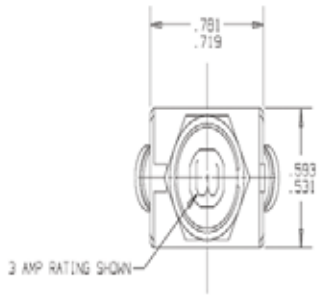
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN TOM DAIL	DATE 1-14-91	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703	CONTROL PRODUCTS DIVISION
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER K.B. GASSER	11-4-92	TITLE 7274-2 STYLE CIRCUIT BREAKER PUSH-PULL, TRIP FREE ENVELOPE DRAWING	
	APPROVED D.R. PETRIE	12-21-94		
	APPROVED			
MATERIAL			SIZE C	CODE IDENT NO. 82647
			SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.	7274-2

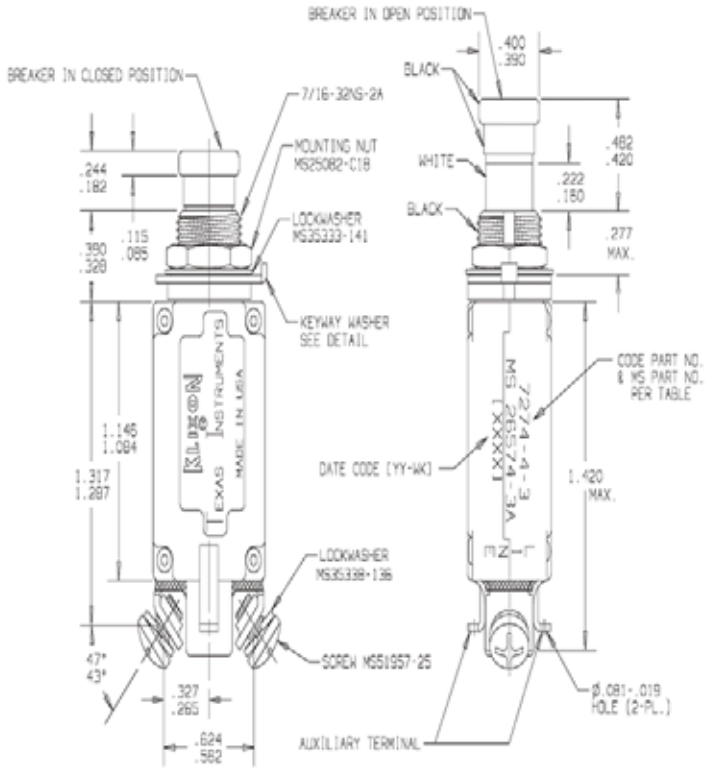
REVISIONS					
ZONE	LTR	DESCRIPTION	PROJ. 3438	DATE	APPROVED
	U	ADDED PART NO. AND DATE CODE	CRM6903 JRB	11-5-99	K.H.S.





KEYWAY WASHER DETAIL





PERFORMANCE CHARACTERISTICS (DETAIL PERFORMANCE PER MIL-C-5809)

OVERLOAD CYCLING ---------- 100 CYCLES AT 200% RATING
SINUSOIDAL VIBRATION ------ 10 G'S 50-500 HZ
MECHANICAL SHOCK ---------- 30 G'S AT 11.0 MILLISECOND DURATION
ACCELERATION ------------- 10 G'S MINIMUM
SAND AND DUST ------------ 12 HOURS
CORROSION ---------------- SALT SPRAY 48 HOURS
HUMIDITY ----------------- 10 DAYS
EXPLOSION PROOF ---------- WHILE INTERRUPTING RUPTURE CURRENTS
MOUNTING NUT TORQUE ------- 40 LB.-IN. MAX.

MAXIMUM OPERATING ALTITUDE: 80,000 FT. (24,384 M)

WEIGHT: 29.0 GRAMS MAX.

MAXIMUM OPERATING FORCES:
PULL OUT ----- 5 LBS. MAX. (22.2 N)
RESET -------- 5 LBS. MAX. (22.2 N)

ENDURANCE:

120 VAC	400 HZ	INDUCTIVE	2500 CYCLES
120 VAC	400 HZ	RESISTIVE	5000 CYCLES
30 VDC		INDUCTIVE	2500 CYCLES
30 VDC		RESISTIVE	5000 CYCLES
NO LOAD		MECHANICAL	5000 CYCLES

AUXILIARY CIRCUIT ENDURANCE

5 - 120 VAC	INDUCTIVE 2 AMP	5000 CYCLES
	RESISTIVE 3 AMP	5000 CYCLES
5 - 30 VDC	INDUCTIVE 3 AMP	5000 CYCLES
	RESISTIVE 5 AMP	5000 CYCLES

CALIBRATION:

AMBIENT TEMP.	HOLD	TRIP	200%	500%	1000%
+25°C (+77°F)	115% RATING	150% RATING	2-20 SEC.	.16-1.2 SEC.	.046-0.8 SEC.
-55°C (-67°F)	135% RATING	180% RATING	----------	----------	----------
+71°C (+160°F)	90% RATING	130% RATING	----------	----------	----------

PART NO.	MS PART NO.	AMP RATING	MAXIMUM VOLTAGE DROP	CURRENT INTERRUPTING CAPACITY 120 VAC, 400 HZ	CURRENT INTERRUPTING CAPACITY 28 VDC
7274-4-1/2	MS 26574-1/2A	1/2	2.00	UNLIMITED	UNLIMITED
7274-4-3/4	MS 26574-3/4A	3/4	1.45	UNLIMITED	UNLIMITED
7274-4-1	MS 26574-1A	1	1.10	UNLIMITED	UNLIMITED
7274-4-1 1/2	MS 26574-1 1/2A	1 1/2	0.75	UNLIMITED	UNLIMITED
7274-4-2	MS 26574-2A	2	0.75	800 AMPS	UNLIMITED
7274-4-2 1/2	MS 26574-2 1/2A	2 1/2	0.70	800 AMPS	UNLIMITED
7274-4-3	MS 26574-3A	3	0.55	800 AMPS	UNLIMITED
7274-4-4	MS 26574-4A	4	0.45	800 AMPS	UNLIMITED
7274-4-5	MS 26574-5A	5	0.35	800 AMPS	UNLIMITED
7274-4-7 1/2	MS 26574-7 1/2A	7 1/2	0.30	500 AMPS	2000 AMPS
7274-4-10	MS 26574-10A	10	0.28	500 AMPS	2000 AMPS
7274-4-15		15	0.25	500 AMPS	2000 AMPS
7274-4-20		20	0.25	500 AMPS	800 AMPS

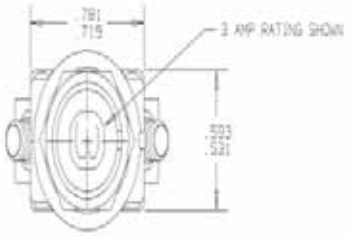
SUPERSEDES DWG. 7274-4 REV. "T", DATED 9-9-97

NOTES:

1. ALL MOUNTING HARDWARE HAS A DULL BLACK FINISH.
2. CIRCUIT BREAKERS ARE SUITABLE FOR MOUNTING IN A 1/8" THICK PANEL OR LESS.
3. EPOXY SURFACES ARE NON-DIMENSIONED. ENVELOPE DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
4. 1/2 THRU 10 AMP CIRCUIT BREAKERS ARE QUALIFIED TO MS 26574.
5. NON FUNCTIONAL NOTCH ON THE BACK OF THE KEYWAY WASHER IS OPTIONAL.
6. DATE CODE PER 105288-285.

			03	P18
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN TOM DAIL	DATE 1-14-91	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703	CONTROL PRODUCTS DIVISION
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER K.B. GASSER	11-4-52	TITLE 7274-4 STYLE CIRCUIT BREAKER PUSH-PULL, TRIP FREE ENVELOPE DRAWING	
	APPROVED			
	APPROVED			
MATERIAL			SIZE C	CODE IDENT NO. 82647
				7274-4
	SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.			

REVISIONS					
ZONE	LTR	DESCRIPTION	PROJ. #3439	DATE	APPROVED
	AD	ADDED PART NO. AND DATE CODE	DRM6803 JAB	11-5-99	K.H.S.



PERFORMANCE CHARACTERISTICS (DETAIL PERFORMANCE PER MIL-C-5809)

OVERLOAD CYCLING ..... 100 CYCLES AT 200% RATING
SINUSOIDAL VIBRATION ..... 10 G'S MINIMUM 50-500 HZ
MECHANICAL SHOCK ..... 50 G'S AT 11.0 MILLISECOND DURATION
ACCELERATION ..... 10 G'S MINIMUM
SAND AND DUST ..... 12 HOURS
CORROSION ..... SALT SPRAY 48 HOURS
HUMIDITY ..... 10 DAYS
EXPLOSION PROOF ..... WHILE INTERRUPTING RUPTURE CURRENTS

MAXIMUM OPERATING ALTITUDE: 80,000 FT. (24,384 M)

WEIGHT: 33.0 GRAMS MAX.

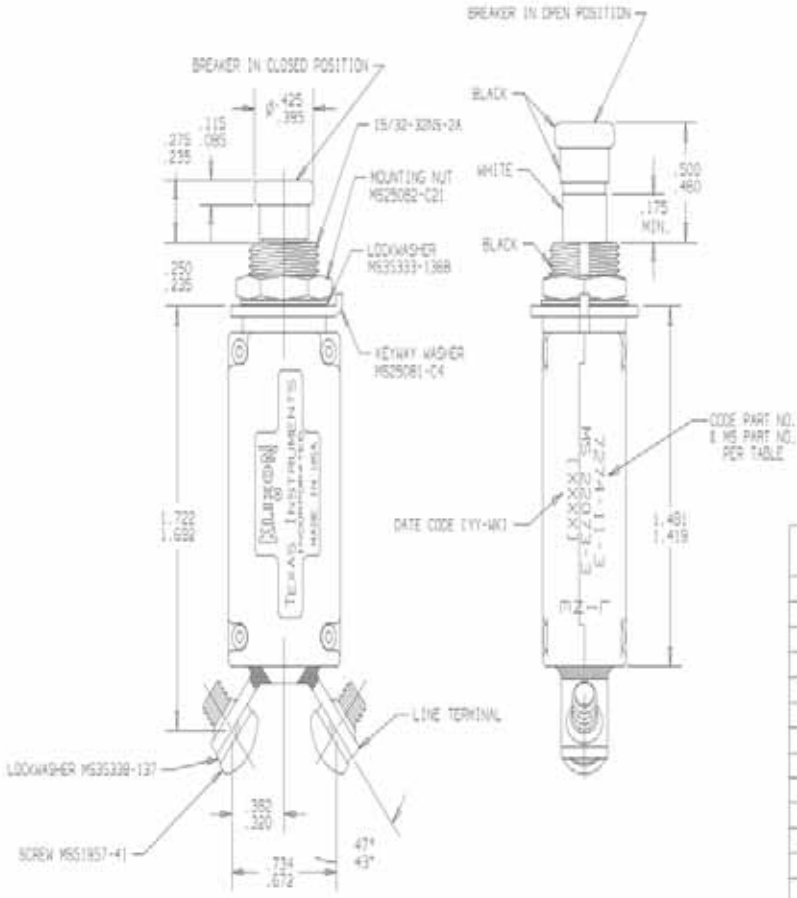
MAXIMUM OPERATING FORCES:
PULL OUT ..... 5 LBS. MAX. (22.2 N)
RESET ..... 5 LBS. MAX. (22.2 N)

ENDURANCE:

120 VAC	400 HZ RESISTIVE	5000 CYCLES
120 VAC	400 HZ RESISTIVE	5000 CYCLES
28 VDC	INDUCTIVE	2500 CYCLES
30 VDC	RESISTIVE	5000 CYCLES
NO LOAD	MECHANICAL	5000 CYCLES

CALIBRATION:

AMBIENT TEMP.	HOLD	TRIP	200%	500%	1000%
+25°C (+77°F)	115% RATING	150% RATING	2-20 SEC.	.16-2 SEC.	.046-.8 SEC.
-55°C (-67°F)	135% RATING	180% RATING	.....	.....	.....
+71°C (+160°F)	90% RATING	130% RATING	.....	.....	.....



PART NO.	MS PART NO.	AMP RATING	MAXIMUM VOLTAGE DROP	CURRENT INTERRUPTING CAPACITY	
				120 VAC, 400 HZ	28 VDC
7274-11-1/2	MS 22073-1/2	1/2	2.00	UNLIMITED	UNLIMITED
7274-11-3/4	MS 22073-3/4	3/4	1.45	UNLIMITED	UNLIMITED
7274-11-1	MS 22073-1	1	1.10	UNLIMITED	UNLIMITED
7274-11-1 1/2	MS 22073-1 1/2	1 1/2	0.75	UNLIMITED	UNLIMITED
7274-11-2	MS 22073-2	2	0.75	800 AMPS	UNLIMITED
7274-11-2 1/2	MS 22073-2 1/2	2 1/2	0.70	800 AMPS	UNLIMITED
7274-11-3	MS 22073-3	3	0.55	800 AMPS	UNLIMITED
7274-11-4	MS 22073-4	4	0.45	800 AMPS	UNLIMITED
7274-11-5	MS 22073-5	5	0.35	800 AMPS	UNLIMITED
7274-11-7 1/2	MS 22073-7 1/2	7 1/2	0.30	500 AMPS	2000 AMPS
7274-11-10	MS 22073-10	10	0.28	500 AMPS	2000 AMPS
7274-11-15		15	0.25	500 AMPS	2000 AMPS
7274-11-20		20	0.25	500 AMPS	800 AMPS

SUPERSEDES DWG. 7274-11 REV."AC", DATED 1-8-95

NOTES:

1. ALL MOUNTING HARDWARE HAS A DULL BLACK FINISH.
2. CIRCUIT BREAKERS ARE SUITABLE FOR MOUNTING IN A 1/8" THICK PANEL OR LESS.
3. EPOXY SURFACES ARE NON-DIMENSIONED. ENVELOPE DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
4. 1/2 THRU 10 AMP CIRCUIT BREAKERS ARE QUALIFIED TO MS 22073.
5. DATE CODE PER 105088-285.

03 P10

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCE ON FRACTIONS DECIMALS ANGLES

MATERIAL

		DATE
DRAWN: TOM DAIL		5-30-95
ENGINEER: K.B.GASSER		6-26-92
APPROVED: D.R. PETRIE		12-22-94
APPROVED		

SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

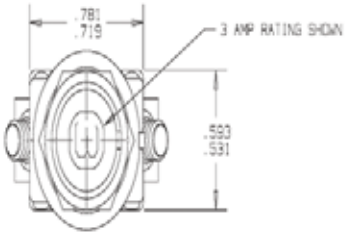
TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

CONTROL PRODUCTS DIVISION

TITLE
7274-11 STYLE CIRCUIT BREAKER
PUSH-PULL, TRIP FREE
ENVELOPE DRAWING

SIZE	CODE IDENT NO.	
C	82647	7274-11

REVISIONS					
ZONE	LTR	DESCRIPTION	PROJ.	DATE	APPROVED
	C	ADDED PART NO. AND DATE CODE	CRM46903 JRB	11-6-99	K.H.S.



PERFORMANCE CHARACTERISTICS (DETAIL PERFORMANCE PER MIL-C-5809)

OVERLOAD CYCLING ---------- 100 CYCLES AT 200% RATING
SINUSOIDAL VIBRATION ------ 10 G'S 10-2000 HZ WITH 100% RATED LOAD
15 G'S 10-2000 HZ WITH NO LOAD
MECHANICAL SHOCK ---------- 50 G'S AT 11.0 MILLISECOND DURATION
ACCELERATION ------------- 10 G'S MINIMUM
SAND AND DUST ------------ 12 HOURS
CORROSION ---------------- SALT SPRAY 48 HOURS
HUMIDITY ----------------- 10 DAYS
EXPLOSION PROOF ---------- WHILE INTERRUPTING RUPTURE CURRENTS

MAXIMUM OPERATING ALTITUDE: 80,000 FT. (24,384 M)

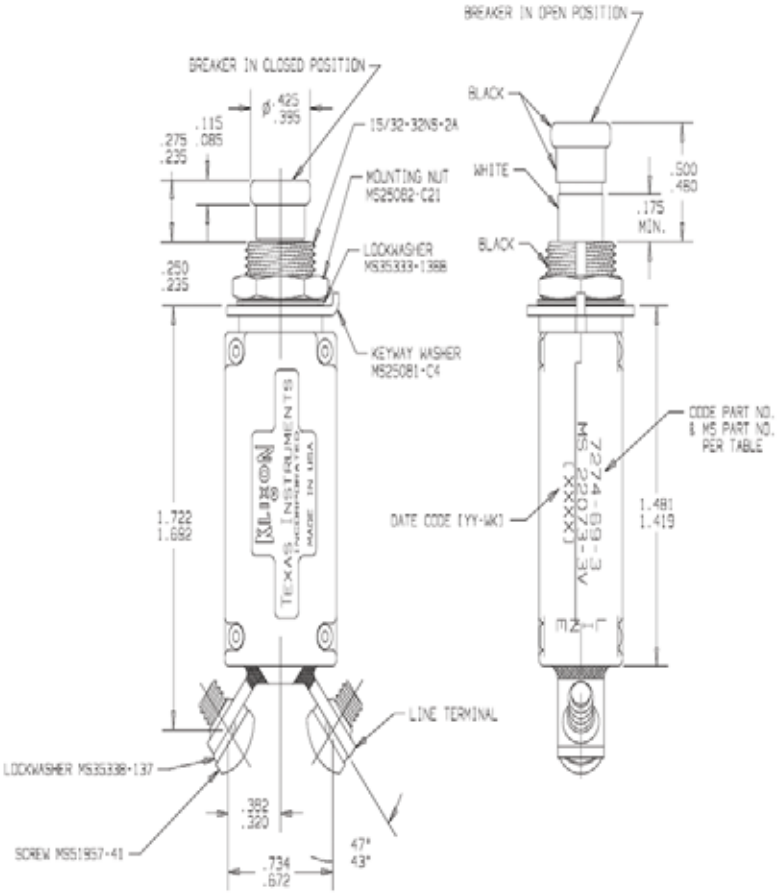
WEIGHT: 33.0 GRAMS MAX.

MAXIMUM OPERATING FORCES:
PULL OUT ----- 5 LBS. MAX. (22.2 N)
RESET -------- 5 LBS. MAX. (22.2 N)

ENDURANCE:
120 VAC ---------- 400 HZ INDUCTIVE ------- 2500 CYCLES
120 VAC ---------- 400 HZ RESISTIVE ------- 5000 CYCLES
30 VDC ----------- INDUCTIVE ------- 2500 CYCLES
30 VDC ----------- RESISTIVE ------- 5000 CYCLES
NO LOAD ---------- MECHANICAL ------ 5000 CYCLES

CALIBRATION:

AMBIENT TEMP.	HOLD	TRIP	200%	500%	1000%
+25°C (+77°F)	115% RATING	150% RATING	2-20 SEC.	.16-2 SEC.	.046-.8 SEC.
-55°C (-67°F)	135% RATING	180% RATING	.....	.....	.....
+71°C (+160°F)	90% RATING	130% RATING	.....	.....	.....



PART NO.	MS PART NO.	AMP RATING	MAXIMUM VOLTAGE DROP	CURRENT INTERRUPTING CAPACITY 120 VAC, 400 HZ	CURRENT INTERRUPTING CAPACITY 28 VDC
7274-69-1/2	MS 22073-1/2V	1/2	2.00	UNLIMITED	UNLIMITED
7274-69-3/4	MS 22073-3/4V	3/4	1.45	UNLIMITED	UNLIMITED
7274-69-1	MS 22073-1V	1	1.10	UNLIMITED	UNLIMITED
7274-69-1 1/2	MS 22073-1 1/2V	1 1/2	0.75	UNLIMITED	UNLIMITED
7274-69-2	MS 22073-2V	2	0.75	800 AMPS	UNLIMITED
7274-69-2 1/2	MS 22073-2 1/2V	2 1/2	0.70	800 AMPS	UNLIMITED
7274-69-3	MS 22073-3V	3	0.55	800 AMPS	UNLIMITED
7274-69-4	MS 22073-4V	4	0.45	800 AMPS	UNLIMITED
7274-69-5	MS 22073-5V	5	0.35	800 AMPS	UNLIMITED
7274-69-7 1/2	MS 22073-7 1/2V	7 1/2	0.30	500 AMPS	2000 AMPS
7274-69-10	MS 22073-10V	10	0.28	500 AMPS	2000 AMPS
7274-69-15		15	0.25	500 AMPS	2000 AMPS
7274-69-20		20	0.25	500 AMPS	800 AMPS

NOTES:

1. ALL MOUNTING HARDWARE HAS A DULL BLACK FINISH.
2. CIRCUIT BREAKERS ARE SUITABLE FOR MOUNTING IN A 1/8" THICK PANEL OR LESS.
3. EPOXY SURFACES ARE NON-DIMENSIONED, ENVELOPE DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
4. 1/2 THRU 10 AMP CIRCUIT BREAKERS ARE QUALIFIED TO MS 22073V.
5. DATE CODE PER 105088-285.

THIS DRAWING SUPERSEDES 7274-69 REV 'B' DATED 12-22-94

03 | P10

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCE ON FRACTIONS DECIMALS ANGLES
MATERIAL

		DATE
DRAWN	TOM DAIL	5-1-92
ENGINEER	K.B. GASSER	5-4-92
APPROVED	D.R. PETRIE	12-22-94
APPROVED		

SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703
CONTROL PRODUCTS DIVISION

TITLE
7274-69 STYLE CIRCUIT BREAKER
PUSH-PULL, TRIP FREE
ENVELOPE DRAWING

SIZE	CODE IDENT NO.	
C	82647	7274-69

KLIXON®

7277 Series Circuit Breakers

Low Amperage, General Application

Features

The 7277 series is designed for applications that do not require the tighter performance characteristics and approvals of our military circuit breakers.

- **Small size**
- **Light weight**
- **Inexpensive**
- **Auxiliary switch**
- **Longer push buttons**

7277-2

7277-1

Overview

The 7277 series circuit breaker is physically and electrically identical to the 7274-2 style circuit breaker, with the exception that the 7277 series has wider calibration limits.

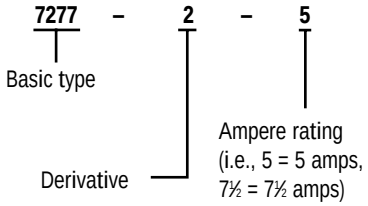
Originally developed as an alternative to slow blow fuses, the trip free 7277 is used extensively as primary electrical circuit protection on general aviation aircraft.

The wider calibration limits of the 7277 has also resulted in applications including protection for data processing and telecommunications equipment, computers, flight simulators, construction, material handling and other industrial,electronic equipment.

For use on trainer / simulator applications where all breakers are operated on low ampere control current, different ampere rating inserts (amp ratings on top of push button) can be ordered. Use TI part number 27515.

(Refer to 7274-2 and 7274-4 dimensions on previous page.)

Code System



7277–1: Aux. switch version
7277–2: Std. version

Ordering Information

Part Number	Ampere Rating	Max. Drop** (volts)
7277-2-½	1/2	2.00
7277-2-¾	3/4	1.45
7277-2-1	1	1.10
7277-2-1½	1½	0.75
7277-2-2	2	0.70
7277-2-2½	2½	0.50
7277-2-3	3	0.33
7277-2-4	4	0.30
7277-2-5	5	0.25
7277-2-7½	7½	0.20
7277-2-10	10	0.15
7277-2-15	15	0.15
7277-2-20	20	0.15

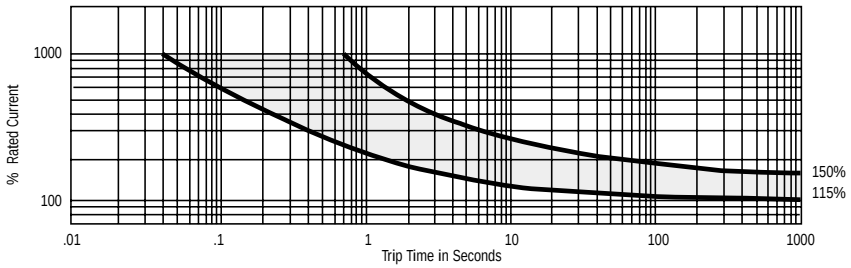
**Max voltage drop at nominal rated current.

Calibration: 1/2–20 amps*

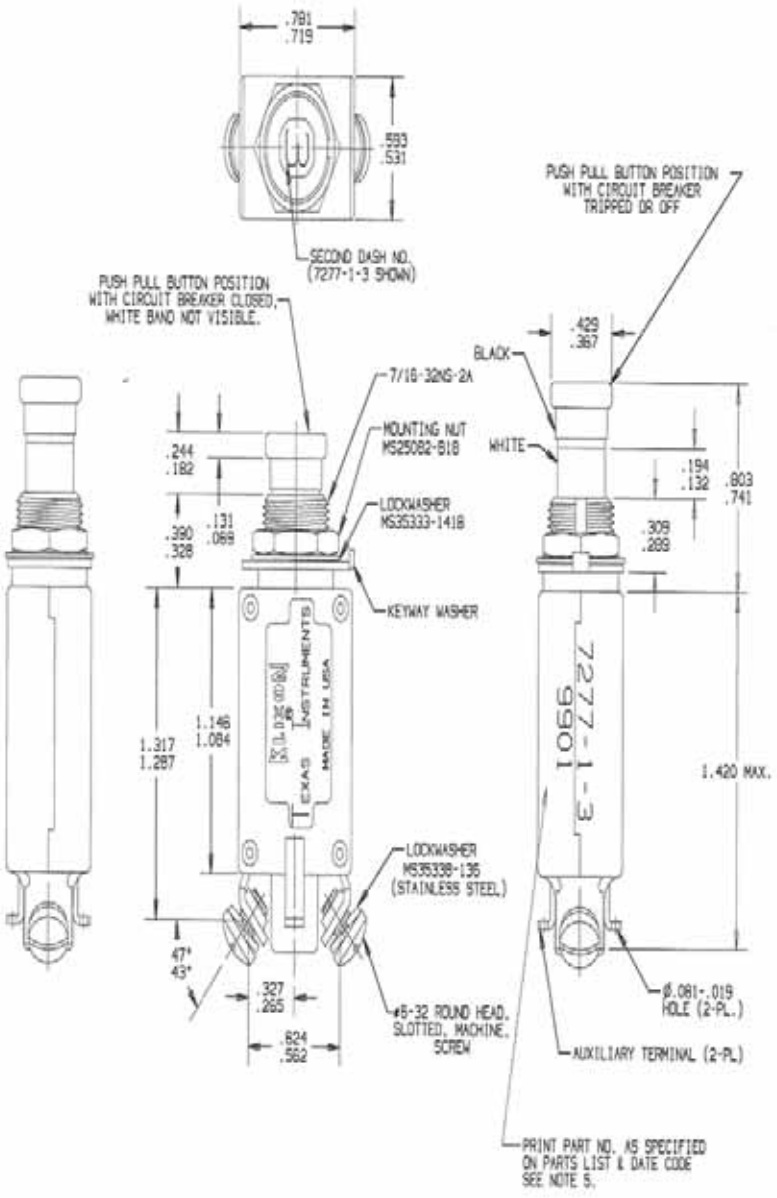
Temp °C	Min ULT Trip	Max ULT Trip	Trip Time – Seconds		
			200%	500%	1000%
+25	110%	150%	2-35	.15-1.70	.028-.55

* Performance characteristics and dimensions are equivalent to 7274 which are found on page 19.

Approximate Time-Current Curves 7277 Circuit Breakers



REVISIONS						
ZONE	LTR	DESCRIPTION	PROJ. 3436	DATE	APPROVED	
	L	MOVED CODING TO THE KEYWAY SIDE	CR#4947G JRB	6-28-00	M.J.L.	



PERFORMANCE CHARACTERISTICS (DETAIL PERFORMANCE PER MIL-C-5809)

OVERLOAD CYCLING ---------- 100 CYCLES AT 200% RATING
VIBRATION ---------- 10 G'S 50-500 HZ
MECHANICAL SHOCK ---------- 25 G'S AT 11.5 MILLISECOND DURATION
ACCELERATION ---------- 10 G'S MINIMUM
SAND AND DUST ---------- 12 HOURS
CORROSION ---------- SALT SPRAY 50 HOURS
HUMIDITY ---------- 10 DAYS
EXPLOSION PROOF ---------- WHILE INTERRUPTING RUPTURE CURRENTS

ENDURANCE:

120 VAC ----------	400 HZ	INDUCTIVE -------	2500 CYCLES
		RESISTIVE -------	5000 CYCLES
30 VDC ----------		INDUCTIVE -------	2500 CYCLES
		RESISTIVE -------	5000 CYCLES
MECHANICAL----------			5000 CYCLES

AUXILIARY CIRCUIT ENDURANCE

S -120 VAC	INDUCTIVE	2 AMP	5000 CYCLES
	RESISTIVE	3 AMP	5000 CYCLES
S - 30 VDC	INDUCTIVE	3 AMP	5000 CYCLES
	RESISTIVE	5 AMP	5000 CYCLES

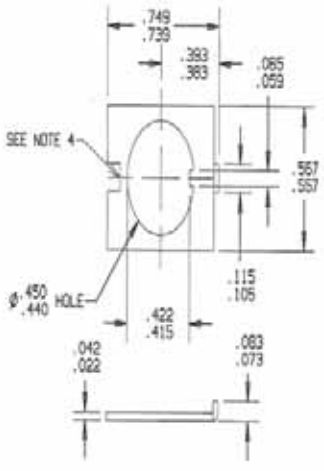
CALIBRATION: 1/2 AMP THRU 10 AMP

AMBIENT TEMP.	MIN.ULT.TRIP	MAX.ULT.TRIP	200%	500%	1000%
+25°C	110% RATING	150% RATING	2-35 SEC.	.15-1.75 SEC.	.028-.8 SEC.

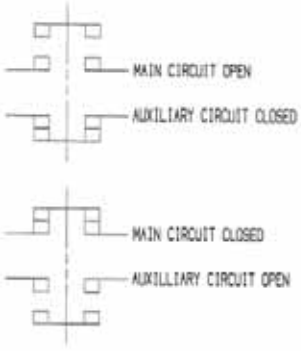
PART NO.	AMP RATING	MAXIMUM VOLTAGE DROP	CURRENT INTERRUPTING CAPACITY	
			120 VAC, 400 HZ	28 VDC
7277-1-1/2	1/2	2.00	UNLIMITED	UNLIMITED
7277-1-3/4	3/4	1.45	UNLIMITED	UNLIMITED
7277-1-1	1	1.10	UNLIMITED	UNLIMITED
7277-1-1 1/2	1 1/2	0.75	UNLIMITED	UNLIMITED
7277-1-2	2	0.70	800 AMPS	UNLIMITED
7277-1-2 1/2	2 1/2	0.50	800 AMPS	UNLIMITED
7277-1-3	3	0.33	800 AMPS	UNLIMITED
7277-1-4	4	0.30	800 AMPS	UNLIMITED
7277-1-5	5	0.25	800 AMPS	UNLIMITED
7277-1-7 1/2	7 1/2	0.20	500 AMPS	2000 AMPS
7277-1-10	10	0.15	500 AMPS	2000 AMPS
7277-1-15	15	0.15	500 AMPS	2000 AMPS
7277-1-20	20	0.15	500 AMPS	2000 AMPS

NOTES:

1. ALL MOUNTING HARDWARE HAS A DULL BLACK FINISH.
2. WEIGHT ACTUAL: 25 GRAMS
3. EPOXY SURFACES ARE NON-DIMENSIONED. ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
4. NON FUNCTIONAL NOTCH ON THE BACK OF THE KEYWAY WASHER IS OPTIONAL.
5. DATE CODE SPEC: 10588-285



KEYWAY WASHER DETAIL



SUPERSEDES DWG. 7277-1 REV.'K'. DATED 5-19-99

RS 03 P18

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCE ON FRACTIONS DECIMALS ANGLES

MATERIAL

DRAWN	CHAS. FLEURANT	10-30-91
ENGINEER	K.B. GASSER	3-9-92
APPROVED		
APPROVED		

SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703

KLIXON CONTROL PRODUCTS DIVISION

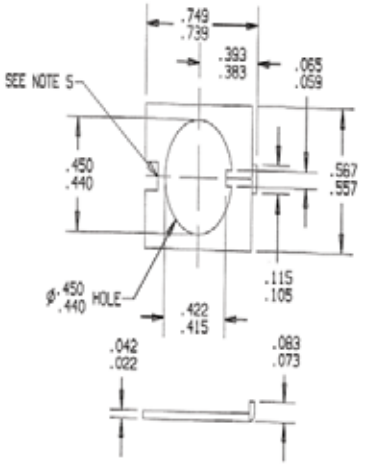
TITLE

7277-1 TYPE PUSH-PULL TRIP FREE CIRCUIT BREAKER WITH AUX. CIRCUIT ENVELOPE DRAWING

SIZE	CODE IDENT NO.	
C	82647	7277-1

SHEET 1 OF 1

REVISIONS					
ZONE	LTR	DESCRIPTION	PROJ.	DATE	APPROVED
	K	MOVED CODING TO THE KEYWAY SIDE	CRM49476 JRB	6-28-00	M.J.L.



KEYWAY WASHER DETAIL

PERFORMANCE CHARACTERISTICS (DETAIL PERFORMANCE PER MIL-C-5809)

OVERLOAD CYCLING ---------- 100 CYCLES AT 200% RATING
VIBRATION ---------- 10 G'S 50-500 HZ
MECHANICAL SHOCK ---------- 35 G'S AT 11.5 MILLISECOND DURATION
ACCELERATION ---------- 10 G'S MINIMUM
SAND AND DUST ---------- 12 HOURS
CORROSION ---------- SALT SPRAY 50 HOURS
HUMIDITY ---------- 10 DAYS
EXPLOSION PROOF ---------- WHILE INTERRUPTING RUPTURE CURRENTS

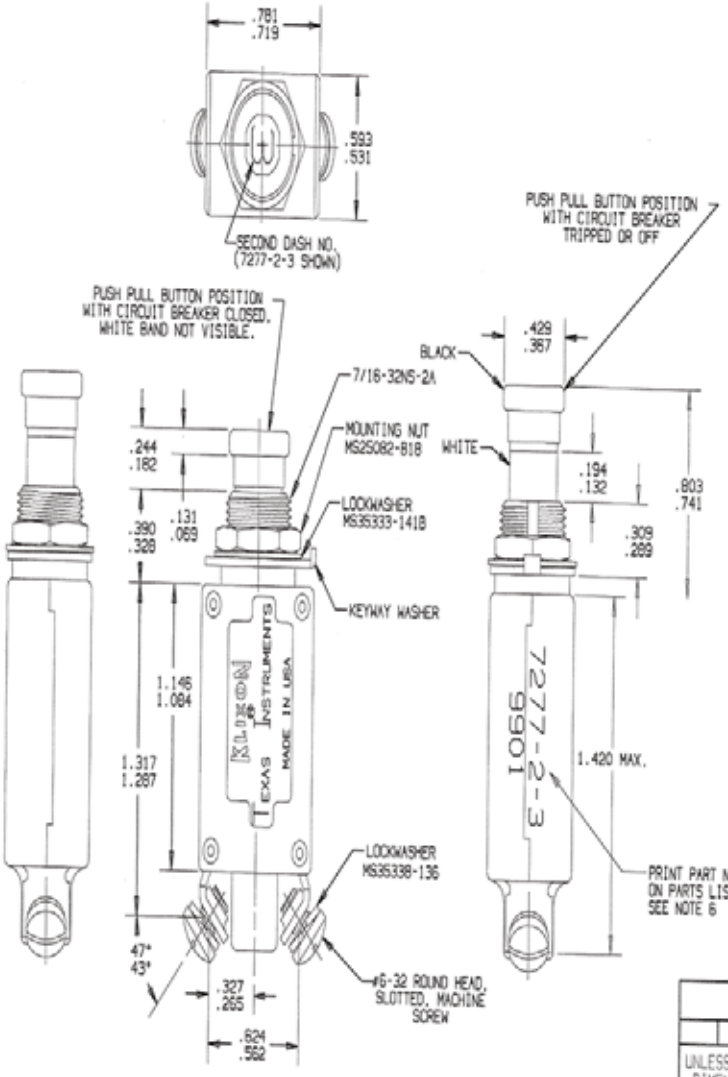
ENDURANCE:

120 VAC ---------- 400 HZ	INDUCTIVE -------	2500 CYCLES
	RESISTIVE -------	5000 CYCLES
30 VDC ----------	INDUCTIVE -------	2500 CYCLES
	RESISTIVE -------	5000 CYCLES
MECHANICAL ----------		5000 CYCLES

CALIBRATION: 1/2 AMP THRU 20 AMP

AMBIENT TEMP.	MIN.ULT.TRIP	MAX.ULT.TRIP	200%	500%	1000%
+25°C	110% RATING	150% RATING	2-35 SEC.	.15-1.7 SEC.	.028-.55 SEC.

PART NO.	AMP RATING	MAXIMUM VOLTAGE DROP	CURRENT INTERRUPTING CAPACITY	
			120 VAC, 400 HZ	28 VDC
7277-2-1/2	1/2	2.00	UNLIMITED	UNLIMITED
7277-2-3/4	3/4	1.45	UNLIMITED	UNLIMITED
7277-2-1	1	1.10	UNLIMITED	UNLIMITED
7277-2-1 1/2	1 1/2	0.75	UNLIMITED	UNLIMITED
7277-2-2	2	0.70	800 AMPS	UNLIMITED
7277-2-2 1/2	2 1/2	0.50	800 AMPS	UNLIMITED
7277-2-3	3	0.33	800 AMPS	UNLIMITED
7277-2-4	4	0.30	800 AMPS	UNLIMITED
7277-2-5	5	0.25	800 AMPS	UNLIMITED
7277-2-7 1/2	7 1/2	0.20	500 AMPS	2000 AMPS
7277-2-10	10	0.15	500 AMPS	2000 AMPS
7277-2-15	15	0.15	500 AMPS	2000 AMPS
7277-2-20	20	0.15	500 AMPS	2000 AMPS



NOTES:

1. ALL MOUNTING HARDWARE HAS A DULL BLACK FINISH.
2. CIRCUIT BREAKERS ARE SUITABLE FOR MOUNTING IN A 1/8" THICK PANEL OR LESS.
3. WEIGHT ACTUAL: 25 GRAMS
4. EPOXY SURFACES ARE NON-DIMENSIONED. ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
5. NON FUNCTIONAL NOTCH ON THE BACK OF THE KEYWAY WASHER IS OPTIONAL.
6. DATE CODE SPEC: 15088-285.

THIS DWG. SUPERSEDES 7277-2 REV. "J" DATED 9-9-97

RS | Q3 | P18

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN: CHAS FLEURANT	DATE: 10-30-91	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703 — CLIXON CONTROL PRODUCTS DIVISION
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER: K.B. GASSER	1-14-92	TITLE: 7277-2 TYPE PUSH-PULL TRIP FREE CIRCUIT BREAKER WITH AUX. CIRCUIT ENVELOPE DRAWING
	APPROVED: JON PETRIE	12-19-94	
	APPROVED		
MATERIAL			SIZE: C — CODE IDENT NO.: 82647 — 7277-2
			SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

KLIXON®

20TC Series Circuit Breakers

Rocker Actuated Switch Type

Features

- **Versatile rocker actuator – snap-on, switch type in various styles and colors for panel mounting**
- **Provides dual function – "ON/OFF" circuit switching and protection**

20TC2

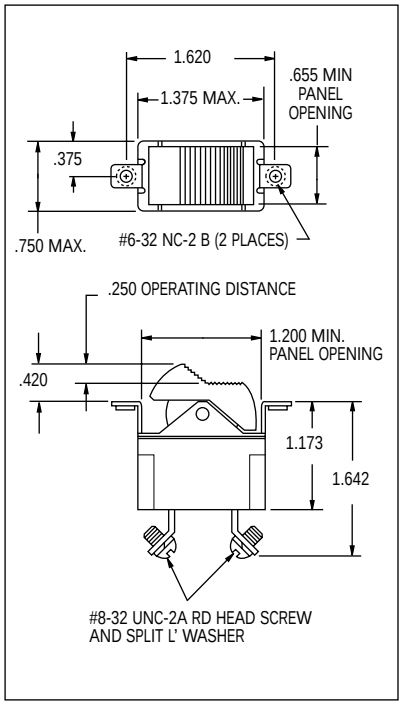
Overview

The Klixon 20TC series circuit breaker offers the advantages of integrating an on/off switch and a circuit protector in a trim, compact package. The snap-on actuators are available on request in a variety of colors, styles and indication markings. They are designed to provide a stylish console appearance to the panels of light aircraft, pleasure boats, home appliances, office reproducing and calculating machines, and data processing equipment.

Several different types of actuators are available. The translucent actuator permits quick identification of the actuator position under low ambient lighting conditions by emitting a soft glow from a light source, such as an edge lighted panel. Colored actuators will be hot letter stamped in white. White and translucent actuators will be stamped in black.

The growing demand for a highly stylized and aesthetic panel appearance has generated the need for the 20TC. The basic mechanism has been proven for reliability in a wide variety of applications.

Envelope Drawings



Rocker Button Options (SR12507-156-X)

-1	PUSH ON / LNDG LITE
-2	PUSH ON / NAV LITE
-3	PUSH ON / ANTI COLL
-4	PUSH ON / PITOT HEAT
-5	PUSH ON / BOOST PUMP
-6	PUSH ON / GLIDE SLOPE
-7	PUSH ON MKR BCN
-8	PUSH ON / STROBE LITE
-9	OFF
-10	OFF
-11	"SR TO INVERT MARKING"
-13	PUSH ON / ROT BCN
-16	PUSH ON / ELEV TRIM
-18	PUSH ON / RADIO MASTER
-19	PUSH ON / LDG LITE
-20	ON / OFF
-21	OFF
-22	"COLORED BOX"
-23	OFF
-25	ON /OFF
-26	OFF / ON
-27	PUSH ON / LOW BOOST
-28	PUSH ON / HIGH BOOST
-29	PUSH ON / WX RADAR
-30	PUSH ON / PROP DE ICE
-33	PUSH ON / STBY VAC
-34	NO ACTUATOR
-35	ON / OFF

Code System

20TC2 – A A – 5

Basic type
See dimensional drawing

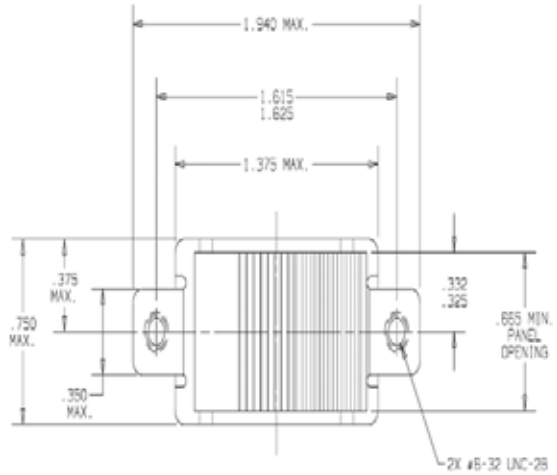
Actuator Style
A = Serrated
B = Smooth

Actuator Color
A = White (Serrated & Smooth)
B = Black (Smooth)

Ampere Rating
3 = 3 amps
5 = 5 amps
7½ = 7½ amps
10 = 10 amps
15 = 15 amps
20 = 20 amps
25 = 25 amps
30 = 30 amps
35 = 35 amps

Note: Performance Characteristics similar to 7270/7271 devices on page 22 and 23.

REVISIONS					
ZONE	LTR	20TC	DESCRIPTION PROJ. 1157	DATE	APPROVED
	H		ADDED MAX. OPERATING FORCES NOTE. ECN002B165 PAF	3/22/06	RG



(DETAIL PERFORMANCE PER MIL-C-5809)

OVERLOAD CYCLING----------100 CYCLES AT 200% RATING
VIBRATION----------10 G'S MINIMUM 50-500 CPS

MECHANICAL SHOCK----------25 G'S 11.5 MILLISECONDS DURATION
ACCELERATION----------10 G'S MINIMUM
CORROSION ----------SALT SPRAY 50 HOURS
HUMIDITY----------10 DAYS
EXPLOSION PROOF----------WHILE INTERRUPTING RUPTURE CURRENT
OPERATING ALTITUDE:-------70,000 FT.

VOLTAGE DROP----------3 AMP RATING .75 VOLTS
5 AMP RATING .65 VOLTS
7½AMP-35 AMP RATING .50 VOLTS

ENDURANCE:

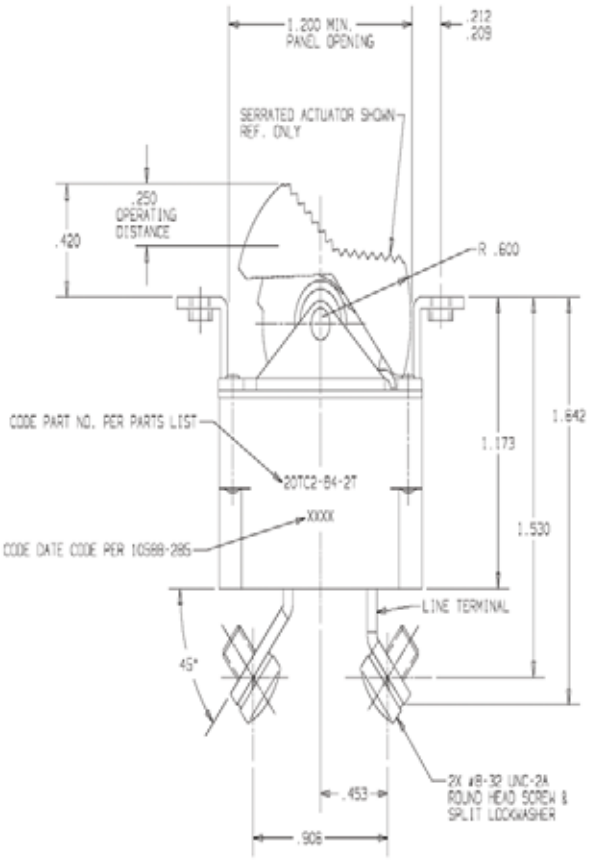
120 VAC-----60-400 CPS,	INDUCTIVE -------	5000 CYCLES
	RESISTIVE -------	5000 CYCLES
30 VDC----------	INDUCTIVE -------	2500 CYCLES
	RESISTIVE -------	5000 CYCLES
MECHANICAL----------		10000 CYCLES

CALIBRATION:

TEST	CIRCUIT BKR RATING	PERCENT RATED CURRENT	AMB TEMP.	TRIP TIME
MIN. ULT. TRIP	3-35	110	25°C	HOLD
MAX. ULT. TRIP	3-35	150	25°C	1 HR. MAX.
200% TIME	3-35	200	25°C	10-130 SEC.

RUPTURE:
3 AMP THRU 35 AMP
120 VAC, 400 C'S, 1000-AMPS
30 VDC, 2000 AMPS

MAXIMUM OPERATING FORCES:
"ON" POSITION.....10 LBS. MAX.
"OFF" POSITION.....10 LBS. MAX.



PART NO.	AMP RATING
20TC2- 3	3
20TC2- 5	5
20TC2- 7½	7½
20TC2- 10	10
20TC2- 15	15
20TC2- 20	20
20TC2- 25	25
20TC2- 30	30
20TC2- 35	35

THIS IS A CAD DRAWING. THE GEOMETRY IN THE ASSOCIATED CAD COMPUTER FILE IS DIMENSIONALLY ACCURATE. WHEN DRAWING IS BEING REVISED, THE GEOMETRY MUST BE UPDATED IN ALL VIEWS AND ON ALL SHEETS.

03 | P18

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCE ON FRACTIONS DECIMALS ANGLES

MATERIAL

		DATE
DRAWN	J. HORAN	8/5/66
ENGINEER		
APPROVED	B. FOLEY	8/26/66
APPROVED		

SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

CONTROL PRODUCTS DIVISION

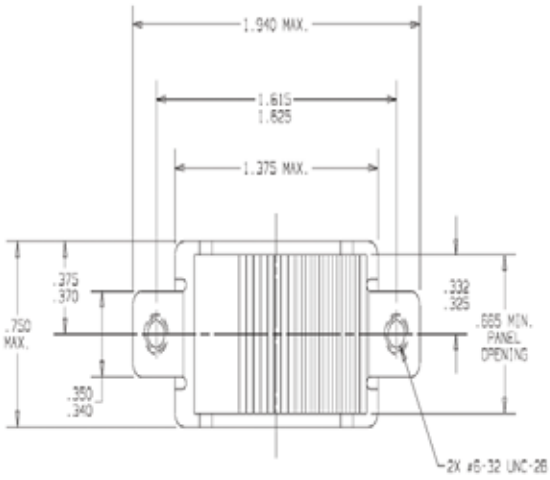
TITLE
ROCKER ACTUATED
CIRCUIT BREAKER
ENVELOPE DRAWING

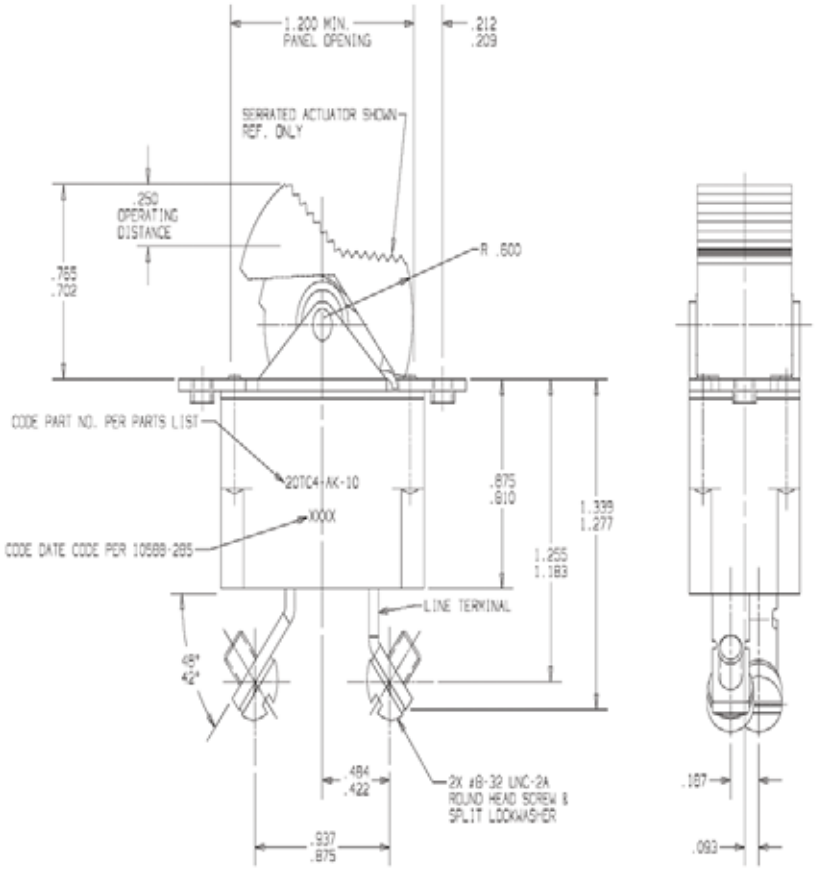
SIZE	CODE IDENT NO.	
C	82647	20TC2

SCALE: 4X SHEET 1 OF 1

3/4/05

REVISIONS					
ZONE	LTR	20TC	DESCRIPTION PROJ. 1157	DATE	APPROVED
	E		ADDED MAX. OPERATING FORCES NOTE. ECN0028165 PAF	3/22/06	RG





(DETAIL PERFORMANCE PER MIL-C-5809)

OVERLOAD CYCLING----------100 CYCLES AT 200% RATING
VIBRATION----------10 G'S MINIMUM 50-500 CPS

MECHANICAL SHOCK----------25 G'S 11.5 MILLISECONDS DURATION
ACCELERATION----------10 G'S MINIMUM
CORROSION ----------SALT SPRAY 50 HOURS
HUMIDITY----------10 DAYS
EXPLOSION PROOF----------WHILE INTERRUPTING RUPTURE CURRENT
OPERATING ALTITUDE:-------70,000 FT.

VOLTAGE DROP----------3 AMP RATING .75 VOLTS
5 AMP RATING .65 VOLTS
7½AMP-35 AMP RATING .50 VOLTS

ENDURANCE:

120 VAC-----60-400 CPS,	INDUCTIVE	5000 CYCLES
	RESISTIVE	5000 CYCLES
30 VDC----------	INDUCTIVE	2500 CYCLES
	RESISTIVE	5000 CYCLES
MECHANICAL----------		10000 CYCLES

CALIBRATION:

TEST	CIRCUIT BKR RATING	PERCENT RATED CURRENT	AMB TEMP.	TRIP TIME
MIN. ULT. TRIP	3-35	110	25°C	HOLD
MAX. ULT. TRIP	3-35	150	25°C	1 HR. MAX.
200% TIME	3-35	200	25°C	10-130 SEC.

RUPTURE:
3 AMP THRU 35 AMP
120 VAC, 400 C'S, 1000-AMPS
30 VDC, 2000 AMPS

MAXIMUM OPERATING FORCES:
'ON' POSITION.....10 LBS. MAX.
'OFF' POSITION.....10 LBS. MAX.

PART NO.	AMP RATING
20TC4- 3	3
20TC4- 5	5
20TC4- 7½	7½
20TC4- 10	10
20TC4- 15	15
20TC4- 20	20
20TC4- 25	25
20TC4- 30	30
20TC4- 35	35

THIS IS A CAD DRAWING. THE GEOMETRY IN THE ASSOCIATED CAD COMPUTER FILE IS DIMENSIONALLY ACCURATE. WHEN DRAWING IS BEING REVISED, THE GEOMETRY MUST BE UPDATED IN ALL VIEWS AND ON ALL SHEETS.

03 | P18

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCE ON FRACTIONS DECIMALS ANGLES

MATERIAL

		DATE
DRAWN	J. PEARSON	6/5/69
ENGINEER	B. FOLEY	6/6/69
APPROVED	B. FOLEY	6/6/69
APPROVED		

SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

CONTROL PRODUCTS DIVISION

TITLE
ROCKER ACTUATED CIRCUIT BREAKER ENVELOPE DRAWING

SIZE	CODE IDENT NO.	
C	82647	20TC4

SCALE: 4X SHEET 1 OF 1

KLIXON®

7270 & 7271 Series Circuit Breakers

Miniature Aircraft

Features

- **Trip free**
- **Snap-acting thermal element**
- **Simplicity of design**
- **High rupture capacity – 3500 amps, 120 VAC, 400 Hz, 4000 amps, 30VDC**
- **Light weight**
- **Small size**

Overview

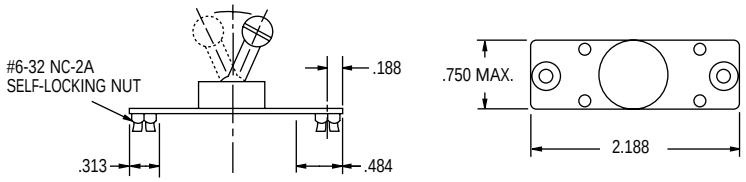
The Klixon 7270/7271 series circuit breakers were designed to utilize less space behind the panel space while protecting wire and cable in aircraft and ground support equipment on either 120 VAC, 400 Hz or 30 VDC systems. The units are available with neck mounting (7270-1 and 7271-8) or standard cover plate (7270-7 and 7271-3). In each of these Klixon circuit breakers, the bi-metallic element assures uniform current distribution throughout its responsive area. This design reduces current density at the critical areas, resulting in an element having a much higher interrupting capability than conventional design. Inherently resistant to shock and vibration, the Klixon disc element is capable of precise calibration settings and will retain the initial calibration within close tolerances throughout the service life of the breaker. Both circuit breakers have conventional actuator action; i.e., the toggle actuator on the 7270 moves to the OFF position for trip indication and the button of the 7271 pops out. A standard black button with a white collar is used.

Qualifications

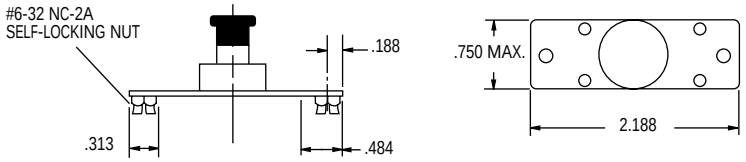
TI Number	MS Number	TI Number	MS Number	TI Number	MS Number
7270-1-3	N/A	7270-7-10	MS 24509-B-10	7271-3-25	N/A
7270-1-5	MS 24509-A-5	7270-7-15	MS 24509-B-15	7271-3-30	N/A
7270-1-7½	MS 24509-A-7½	7270-7-20	N/A	7271-3-35	N/A
7270-1-10	MS 24509-A-10	7270-7-25	N/A	7271-8-3	N/A
7270-1-15	MS 24509-A-15	7270-7-30	N/A	7271-8-5	MS 24510-A-5
7270-1-20	N/A	7270-7-35	N/A	7271-8-7½	MS 24510-A-7½
7270-1-25	N/A	7271-3-3	N/A	7271-8-10	MS 24510 A-10
7270-1-30	N/A	7271-3-5	MS 24510-B-5	7271-8-15	MS 24510-A-15
7270-1-35	N/A	7271-3-7½	MS 24510-B-7½	7271-8-20	N/A
7270-7-3	N/A	7271-3-10	MS 24510-B-10	7271-8-25	N/A
7270-7-5	MS 24509-B-5	7271-3-15	MS 24510-B-15	7271-8-30	N/A
7270-7-7½	MS 24509-B-7½	7271-3-20	N/A	7271-8-35	N/A

Optional Covers

7270-7

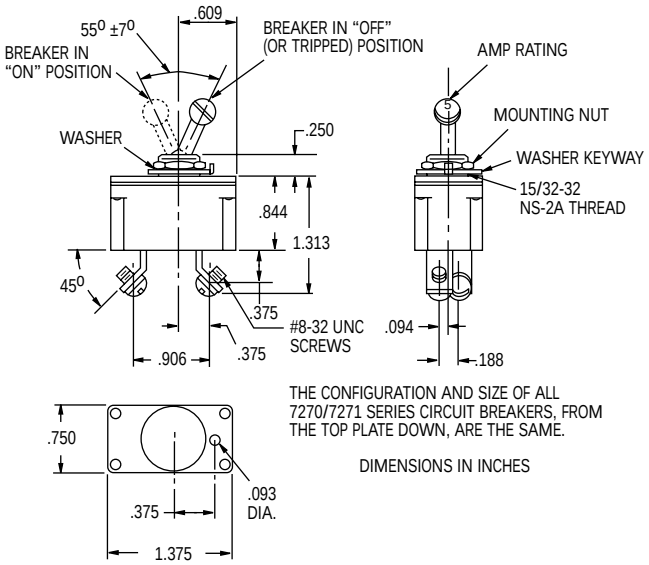


7271-3



Characteristics

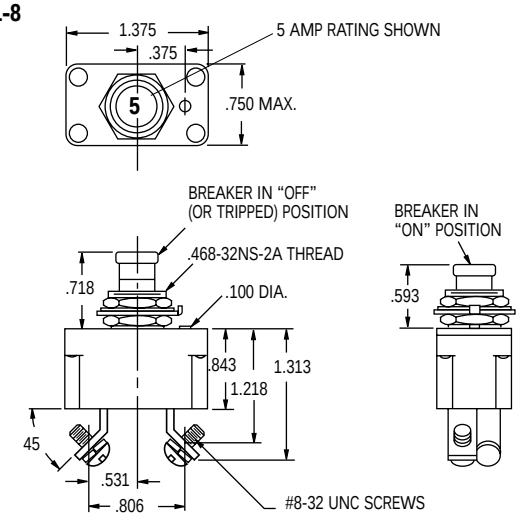
7270-1



THE CONFIGURATION AND SIZE OF ALL 7270/7271 SERIES CIRCUIT BREAKERS, FROM THE TOP PLATE DOWN, ARE THE SAME.

DIMENSIONS IN INCHES

7271-8



Calibration: 3-35 amps

Temp °C	Min ULT Trip	Max ULT Trip	Rating	Trip Time – Seconds		
				200%	400%	600%
+25	115%	145%	3 amps	40-120	3-26	1-12
			5 amps	40-100	3-22	1-10
			71/2-35	10-70	.75-7.0	.25-2.5
-40	138%	175%	–	–	–	–
+71	80%	125%	–	–	–	–

Vibration* ..... 10 G's minimum, 50-500 Hz
Mechanical Shock ..... 30 G's
Acceleration ..... 10 G's
Weight ..... 7270-1 – 39 gm max.
7271-8 – 39 gm max.

Interrupt Current

4000 amps, 30 VDC
3500 amps, 120 VAC, 400 Hz

Endurance

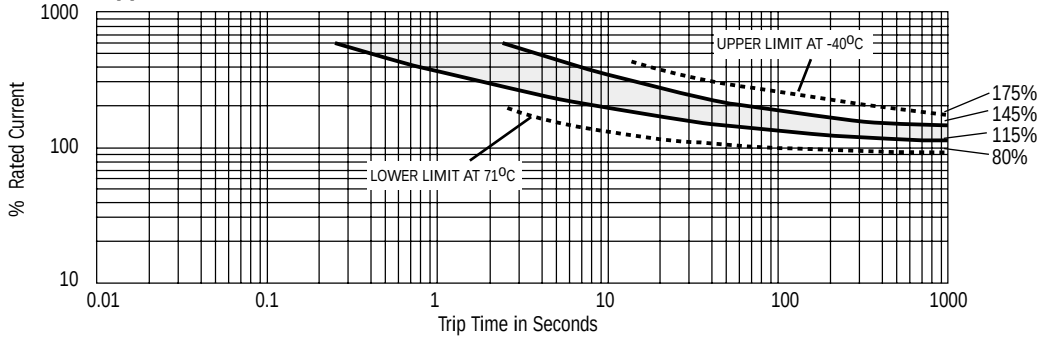
200 cycles ..... 30 VDC Inductive
5000 cycles ..... 120 VAC, 400 Hz Inductive
5000 cycles ..... 120 VAC, 400 Hz Resistive
5000 cycles ..... 30 VAC, 400 Hz Resistive
10,000 cycles ..... Mechanical, no load

* Other vibration levels available. Contact factory for details.

TI Number 7270's	TI Number 7271's	Voltage Drop (Max.)**
7270-x-3	7270-x-3	0.75
7270-x-5	7270-x-5	0.65
7270-x-7½	7270-x-7½	0.5
7270-x-10	7270-x-10	0.5
7270-x-15	7270-x-15	0.5
7270-x-20	7270-x-20	0.5
7270-x-25	7270-x-25	0.5
7270-x-30	7270-x-30	0.5
7270-x-35	7270-x-35	0.5

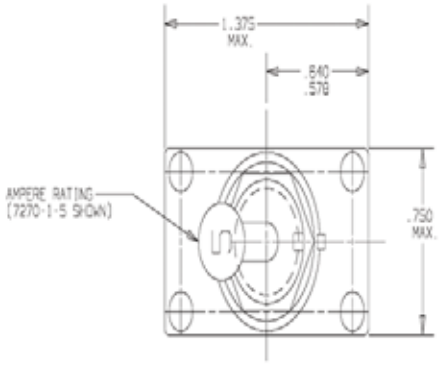
**Max voltage drop at nominal rated current.

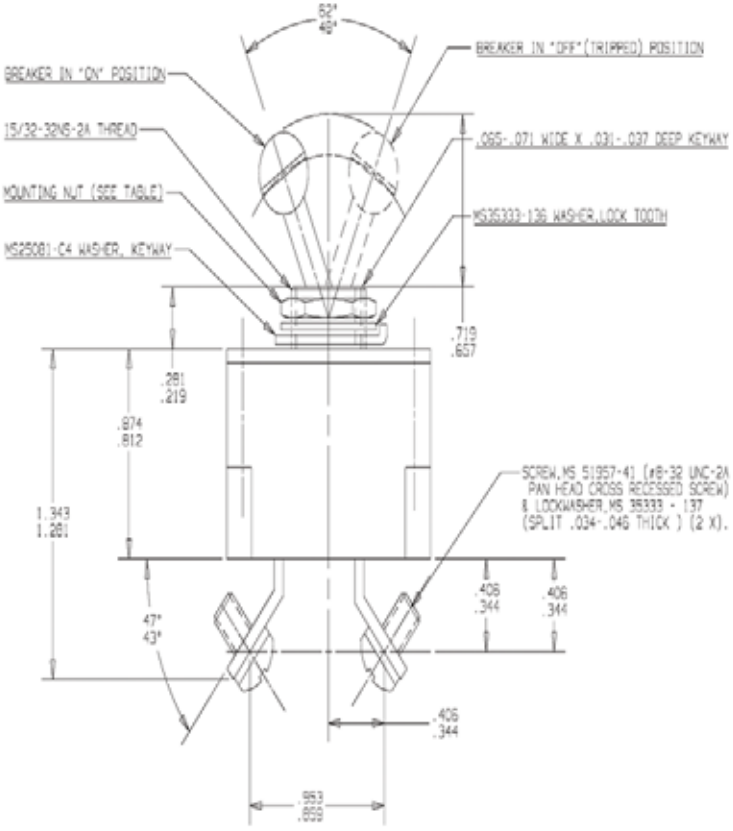
Approximate Time-Current Curves 7270 and 7271 Circuit Breakers

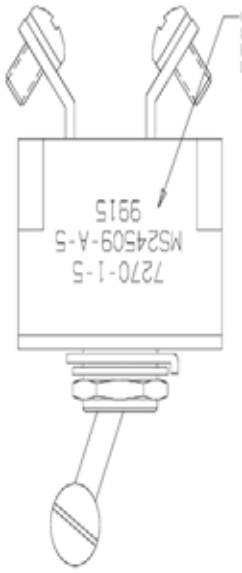


MAXIMUM VOLTAGE DROP	% RATED CURRENT 200	400	600	MOUNTING NUT	PART NO.	AMP. RATING	CUSTOMER PART NO.
0.75	40-120	3-26	1-12	TIN PLATED BRASS	7270-1-3	3	
0.65	40-100	3-22	1-10	MS25082-C21	7270-1-5	5	MS24509-A-5
0.50	10-70	.75-7.0	.25-2.5	MS25082-C21	7270-1-7½	7½	MS24509-A-7½
				MS25082-C21	7270-1-10	10	MS24509-A-10
				MS25082-C21	7270-1-15	15	MS24509-A-15
				TIN PLATED BRASS	7270-1-20	20	
				TIN PLATED BRASS	7270-1-25	25	
				TIN PLATED BRASS	7270-1-30	30	
				TIN PLATED BRASS	7270-1-35	35	
				TIN PLATED BRASS	7270-1-38	38	

REVISIONS					
ZONE	LTR	7270-1 DESCRIPTION	PROJ. 438	DATE	APPROVED
	R	MS24509-A-5 WAS MS24509-A-15.	ECN0021625, DP	3-31-09	R.G.







VIEW A-A

PERFORMANCE CHARACTERISICS
(DETAIL PERFORMANCE PER MIL-C-5809)

OVERLOAD CYCLING----------100 CYCLES AT 200% RATING
SINUSOIDAL VIBRATION------10 G'S 50-500 HZ

MECHANICAL SHOCK----------30 G'S AT 11.0 MILLISECOND DURATION
ACCELERATION--------------10 G'S MINIMUM
SAND & DUST---------------12 HOURS
CORROSION -----------------SALT SPRAY 48 HOURS
HUMIDITY------------------10 DAYS
EXPLOSION PROOF-----------WHILE INTERRUPTING RUPTURE CURRENTS

MAXIMUM OPERATING ALTITUDE: 70,000 FT.

WEIGHT: 39.0 GRAMS MAX.

MAXIMUM OPERATING FORCES:
PULL OUT------6 LBS. MAX.
RESET---------6 LBS. MAX.

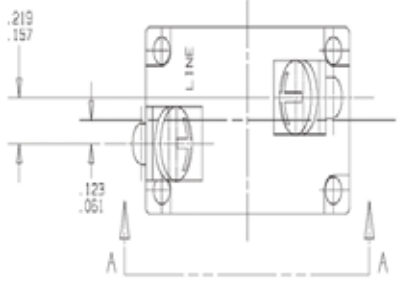
CURRENT INTERUPTION CAPACITY: 4,000 A @ 30 VDC.
3,500 A @ 120 VAC. 400-HZ.

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	5000 CYCLES
120 VAC	400 HZ RESISTIVE	5000 CYCLES
30 VDC	INDUCTIVE	200 CYCLES
30 VDC	RESISTIVE	5000 CYCLES
NO LOAD	MECHANICAL	10000 CYCLES

CALIBRATION:

AMBIENT TEMP.	HOLD	TRIP
+25°C	115% RATING	145% RATING
-40°C	138% RATING	175% RATING
+71°C	60% RATING	125% RATING



NOTES:

1. EPOXY SURFACES ARE NON-DIMENSIONED. ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.

03 | P18

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCE ON FRACTIONS DECIMALS ANGLES

MATERIAL

		DATE
DRAWN	D. LARSEN	5-3-95
ENGINEER	M. J. LAVADO	5-3-95
APPROVED	H. HIRSBRUNNER	5-16-89
APPROVED	PETER G. BERG	5-3-95

SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

CLIXON
CONTROL PRODUCTS DIVISION

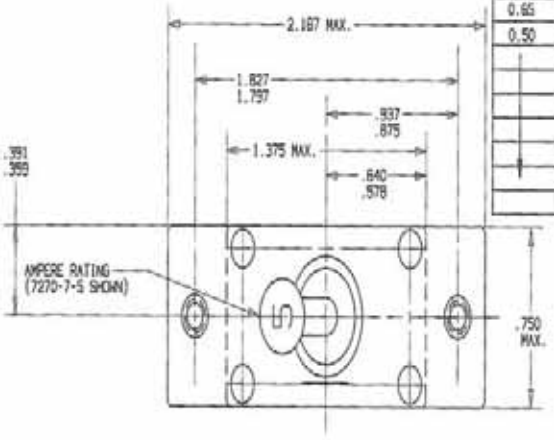
TITLE
7270-1 TYPE TRIP FREE SWITCH TYPE CIRCUIT BREAKER ENVELOPE DRAWING

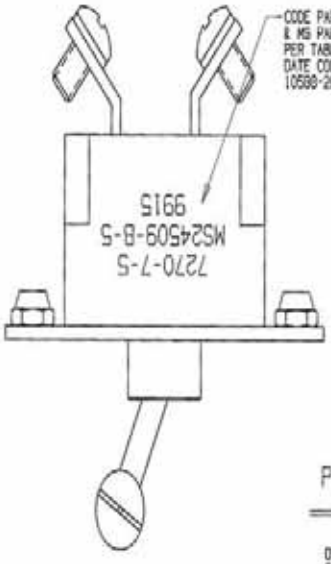
SIZE	CODE IDENT NO.	
C	82647	7270-1

SCALE: 2X SHEET 1 OF 1

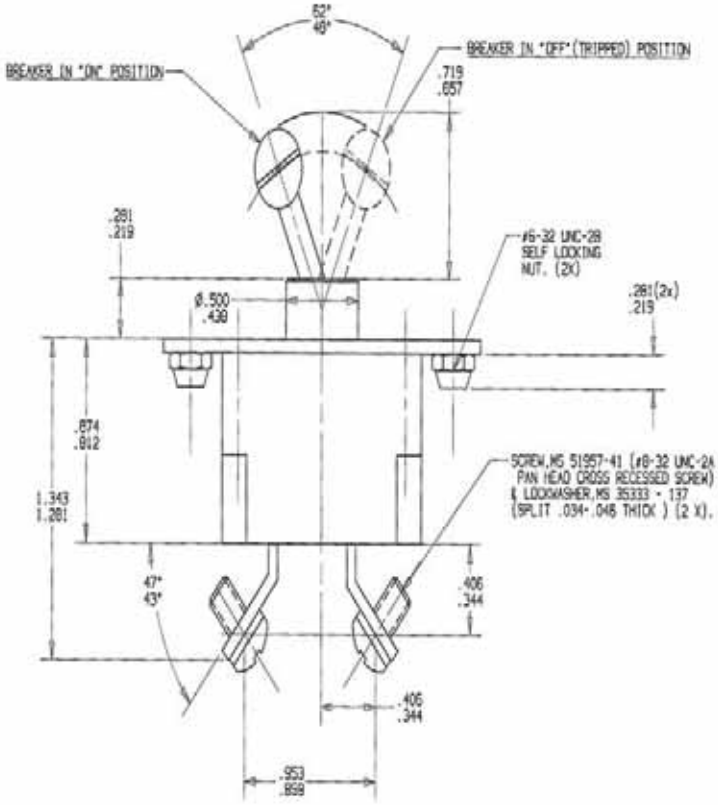
MAXIMUM VOLTAGE DROP	I RATED CURRENT			PART NO.	AMP. RATING	CUSTOMER PART NO.
	200	400	800			
0.75	40-120	3-26	1-12	7270-7- 3	3	
0.65	40-100	3-22	1-10	7270-7- 5	5	MS24509-B-5
0.50	10-70	.75-7.0	.25-2.5	7270-7- 7½	7½	MS24509-B-7½
				7270-7-10	10	MS24509-B-10
				7270-7-15	15	MS24509-B-15
				7270-7-20	20	
				7270-7-25	25	
				7270-7-30	30	
				7270-7-35	35	

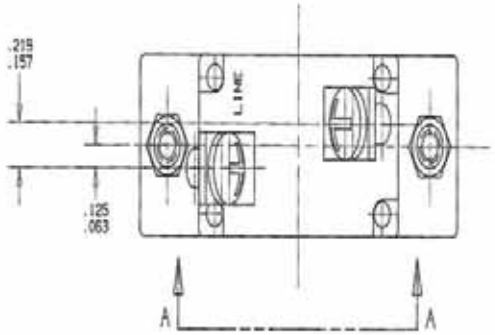
REVISIONS					
ZONE	LTR	7270-7 DESCRIPTION	PROJ. 439	DATE	APPROVED
	R	MOVED CODE STAMP TO FAR SIDE	CR951147 JRB	6-13-00	S.J.B.





VIEW A-A





PERFORMANCE CHARACTERISICS
(DETAIL PERFORMANCE PER MIL-C-5809)

OVERLOAD CYCLING----------100 CYCLES AT 200% RATING
SINUSOIDAL VIBRATION------10 G'S 50-500 HZ

MECHANICAL SHOCK----------30 G'S AT 11.0 MILLISECOND DURATION
ACCELERATION--------------10 G'S MINIMUM
SAND & DUST---------------12 HOURS
CORROSION ----------------SALT SPRAY 48 HOURS
HUMIDITY------------------10 DAYS
EXPLOSION PROOF-----------WHILE INTERRUPTING RUPTURE CURRENTS

MAXIMUM OPERATING ALTITUDE: 70,000 FT.

WEIGHT: 29.0 GRAMS MAX.

MAXIMUM OPERATING FORCES:
PULL OUT-------6 LBS. MAX.
RESET----------8 LBS. MAX.

CURRENT INTERUPTION CAPACITY: 4.000 A @ 30 VDC.
3.500 A @ 120 VAC, 400HZ.

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	5000 CYCLES
120 VAC	400 HZ RESISTIVE	5000 CYCLES
30 VDC	INDUCTIVE	200 CYCLES
30 VDC	RESISTIVE	5000 CYCLES
NO LOAD	MECHANICAL	10000 CYCLES

CALIBRATION:

AMBIENT TEMP.	HOLD	TRIP
+25°C	115% RATING	145% RATING
-40°C	138% RATING	175% RATING
+71°C	80% RATING	125% RATING

NOTES:

1. EPOXY SURFACES ARE NON-DIMENSIONED. ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.

SUPERSEDES 7270-7 REV "P" DATED 5-13-99

03 | P18

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN: Q. LARSEN	DATE: 5-3-99
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER: M. J. LAVADO	5-3-99
	APPROVED: H. HIRSBRUNNER	5-18-99
	APPROVED: PETER G. BERG	5-3-99
MATERIAL		
	SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.	

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

CENTRAL PRODUCTS DIVISION

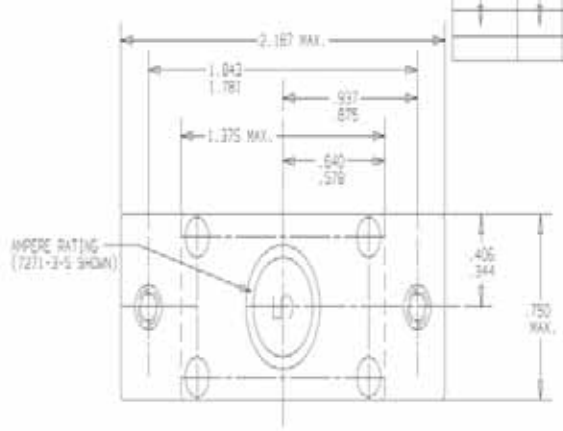
TITLE
7270-7 TYPE TRIP FREE SWITCH TYPE CIRCUIT BREAKER ENVELOPE DRAWING

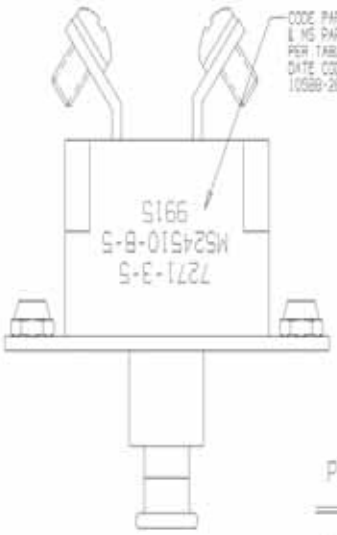
SIZE	CODE IDENT NO.	
C	82647	7270-7

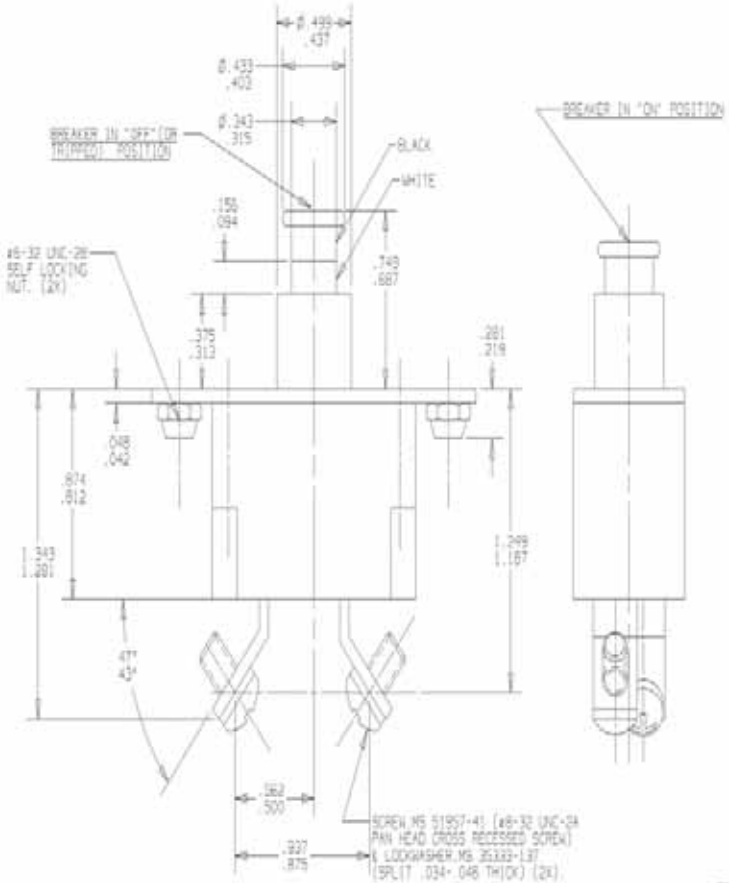
SCALE: 2X | SHEET 1 OF 1

MAXIMUM VOLTAGE DROP	% RATED CURRENT 200	400	600	PART NO.	AMP. RATING	CUSTOMER PART NO.
0.75	40-120	3-20	1-12	7271-3- 3	3	
0.85	40-100	3-22	1-10	7271-3- 5	5	MS24510-B-5
0.50	10-70	.75-7.0	.25-2.5	7271-3- 7½	7½	MS24510-B-7½
				7271-3-10	10	MS24510-B-10
				7271-3-15	15	MS24510-B-15
				7271-3-20	20	
				7271-3-25	25	
				7271-3-30	30	
				7271-3-35	35	

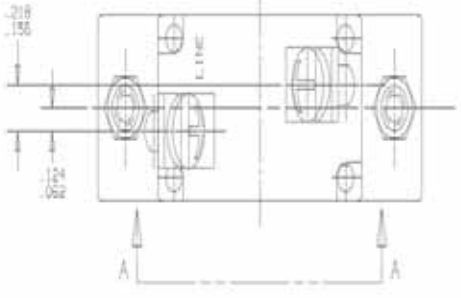
REVISIONS					
ZONE	LTR	7271-3 DESCRIPTION	PROJ. 439	DATE	APPROVED
	AA	MOVED CODE STAMP TO FAR SIDE	DR61147 JAB	6-13-00	S.J.B.







VIEW A-A



PERFORMANCE CHARACTERISICS
(DETAIL PERFORMANCE PER MIL-C-5809)

OVERLOAD CYCLING·····100 CYCLES AT 200% RATING
SINUSOIDAL VIBRATION·····10 G'S 50-500 HZ

MECHANICAL SHOCK·····20 G'S AT 11.0 MILLISECOND DURATION
ACCELERATION·····10 G'S MINIMUM
SAND & DUST·····12 HOURS
CORROSION·····SALT SPRAY 48 HOURS
HUMIDITY·····10 DAYS
EXPLOSION PROOF·····WHILE INTERRUPTING RUPTURE CURRENTS

MAXIMUM OPERATING ALTITUDE: 70,000 FT.

WEIGHT: 35.0 GRAMS MAX.

MAXIMUM OPERATING FORCES:
PULL OUT····· 8 LBS. MAX.
RESET·····12 LBS. MAX.

CURRENT INTERUPTION CAPACITY: 4,000 A @ 30 VDC.
3,500 A @ 120 VAC, 400HZ.

ENDURANCE:
120 VAC·····400 HZ INDUCTIVE ·····5000 CYCLES
120 VAC·····400 HZ RESISTIVE ·····5000 CYCLES
30 VDC·····INDUCTIVE ····· 300 CYCLES
30 VDC·····RESISTIVE ·····5000 CYCLES
NO LOAD·····MECHANICAL ·····10000 CYCLES

CALIBRATION:

AMBIENT TEMP.	HOLD	TRIP
+25°C	115% RATING	145% RATING
-40°C	138% RATING	175% RATING
+71°C	80% RATING	125% RATING

NOTES:

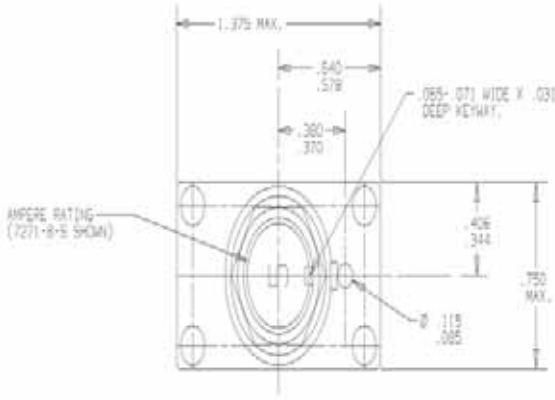
1. EPOXY SURFACES ARE NON-DIMENSIONED, ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.

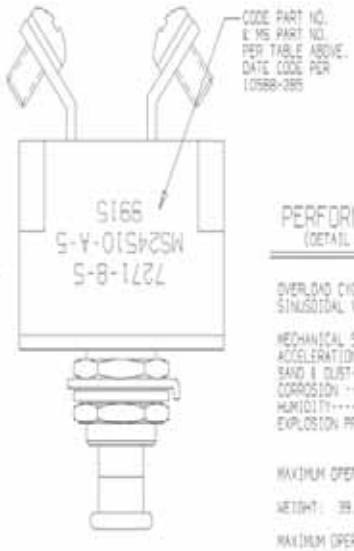
THIS DRAWING SUPERSEDES 7271-3 REV"Y" DATED 5-13-99

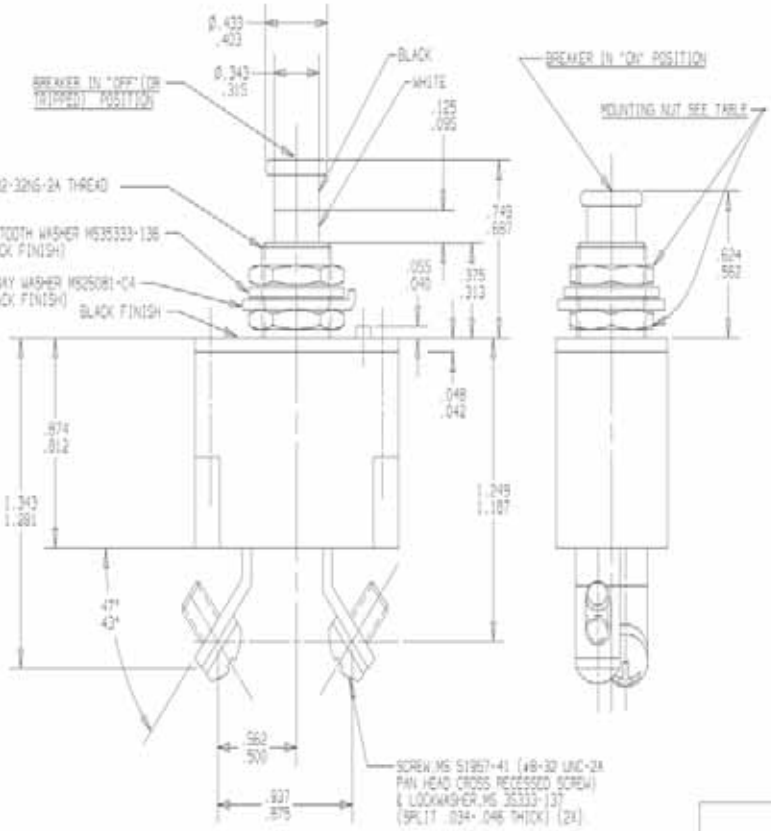
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN D. LARSEN	DATE 5-3-95	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703	CONTROL PRODUCTS DIVISION
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER M. J. LAVADO	5-3-95	TITLE 7271-3 TYPE PUSH-PULL TRIP-FREE CIRCUIT BREAKER ENVELOPE DRAWING	
	APPROVED H. HIRSBRUNNER	5-16-99		
	APPROVED PETER G. BERG	5-3-95		
MATERIAL			SIZE C · CODE IDENT NO. 82647 · 7271-3	
			SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.	SCALE: 2X · SHEET 1 OF 1

MOUNTING NUT	MAXIMUM VOLTAGE DROP	# RATED CURRENT 200	400	600	PART NO.	AMP.RATING	CUSTOMER PART NO.
MS 25082-B21	0.75	40-120	3-26	1-12	7271-8- 3	3	
MS 25082-C21 BLACK	0.65	40-100	3-22	1-10	7271-8- 5	5	MS24510-A-5
" " " "	0.50	10-70	.75-7.0	.25-2.5	7271-8- 7½	7½	MS24510-A-7½
" " " "	"	"	"	"	7271-8-10	10	MS24510-A-10
MS 25082-C21 BLACK	"	"	"	"	7271-8-15	15	MS24510-A-15
MS 25082-B21	"	"	"	"	7271-8-20	20	
" " "	"	"	"	"	7271-8-25	25	
" " "	"	"	"	"	7271-8-30	30	
MS 25082-B21	"	"	"	"	7271-8-35	35	

REVISIONS					
ZONE	LTR	7271-8 DESCRIPTION	PROJ. 438	DATE	APPROVED
	U	MOVED CODE STAMP TO FAR SIDE	DRN51147 JAB	5-13-00	S.J.B.







VIEW A-A

PERFORMANCE CHARACTERISICS
(DETAIL PERFORMANCE PER MIL-C-9805)

OVERLOAD CYCLING----------100 CYCLES AT 200% RATING
SINUSOIDAL VIBRATION------10 G'S 50-500 HZ

MECHANICAL SHOCK----------30 G'S AT 11.0 MILLISECOND DURATION
ACCELERATION--------------10 G'S MINIMUM
SAND & DUST---------------12 HOURS
CORROSION-----------------SALT SPRAY 48 HOURS
HUMIDITY------------------10 DAYS
EXPLOSION PROOF-----------WHILE INTERRUPTING RUPTURE CURRENTS

MAXIMUM OPERATING ALTITUDE: 70,000 FT.

WEIGHT: 89.0 GRAMS MAX.

MAXIMUM OPERATING FORCES:
PULL OUT------ 8 LBS. MAX.
RESET--------12 LBS. MAX.

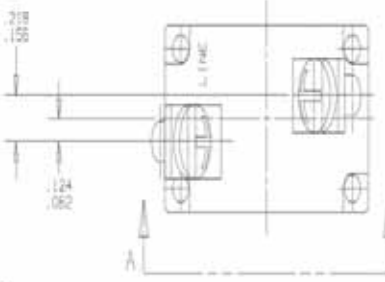
CURRENT INTERUPTION CAPACITY: 4,000 A @ 30 VDC.
3,500 A @ 120 VAC, 400HZ.

ENDURANCE:

120 VAC	400 HZ INDUCTIVE	5000 CYCLES
120 VAC	400 HZ RESISTIVE	5000 CYCLES
30 VDC	INDUCTIVE	2000 CYCLES
30 VDC	RESISTIVE	8000 CYCLES
NO LOAD	MECHANICAL	10000 CYCLES

CALIBRATION:

AMBIENT TEMP	HOLD	TRIP
+25°C	115% RATING	145% RATING
-40°C	138% RATING	175% RATING
+71°C	90% RATING	125% RATING



NOTES:

1. EPOXY SURFACES ARE NON-DIMENSIONED. ENVELOPE DRAWING DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.

SUPERSEDES 7271-8 REV"T" DATED 5-13-99

03 | P10

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN: D. LARSEN	DATE: 5-3-95
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER: M. J. LAVADO	5-3-95
	APPROVED: H. HIRSBRUNNER	5-16-89
	APPROVED: PETER G. BERG	5-3-95
MATERIAL		
	SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.	

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS UNITED
CONTROL PRODUCTS DIVISION

TITLE
7271-8 TYPE PUSH-PULL TRIP-FREE CIRCUIT BREAKER ENVELOPE DRAWING

SIZE	CODE IDENT NO.	
C	82647	7271-8

SCALE: 2X | SHEET 1 OF 1

KLIXON®

3SB Series Simulator Circuit Breakers

Features

- **Low amperage / fast trip response**
- **High performance**
- **Packaged in Military Standard configuration**
- **Tactile feel equivalent to industry accepted aircraft circuit breakers**
- **Lower total system cost**

3SB2

3SB4

Overview

The 3SB Series Simulator Circuit Breaker has been developed by the Precision Products Group of Texas Instruments to meet the growing needs of the commercial and military simulator industry. With more and more training now being conducted on simulators due to the high operational costs of live training, the realism and complexity of tomorrow's simulators will require a circuit breaker that can provide the same "look and feel" of industry accepted circuit breakers, creating a superior training environment.

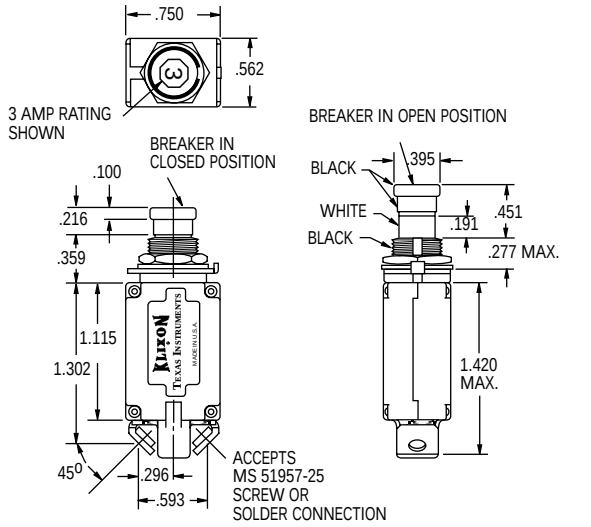
3SB electromechanical devices provide fast trip response with low current draw at 28 VDC, and are packaged in a standard MS26574 style thermal circuit breaker configuration for adaptability to aircraft cockpit panel mounting. This fast trip/low current performance provides the opportunity for system level savings by enabling the designer to potentially down size the system power source. This eliminates expensive I/O boards or other electronics while also reducing the amount of cabling required.

Changes in training schemes normally entail system rewiring to reconfigure the simulator, which becomes labor intensive and costly. With the incorporation of the 3SB device, training changes can easily be achieved through system software, without the time and cost associated with rewiring. TI's simulator circuit breakers also provide the same tactile feel as standard MIL qualified breakers to achieve superior training realism.

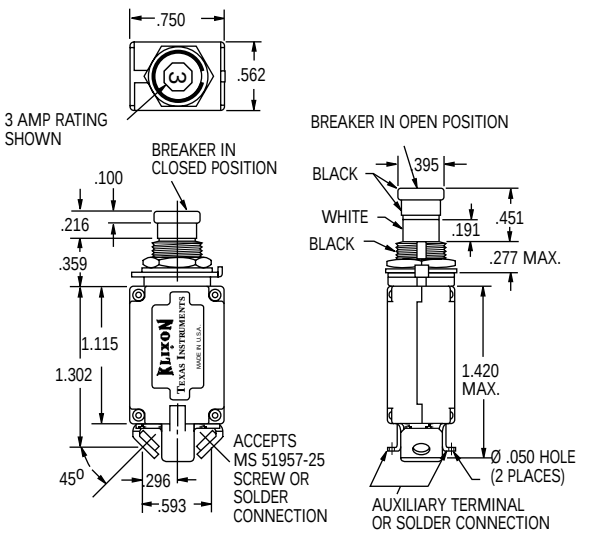
Klixon circuit breakers offer the flexibility of ordering replaceable ampere rating inserts. They are attached to the top of the push button actuator, to match the current rating used in the actual aircraft. These inserts can be rotated within the push button to meet your cockpit configuration needs. An optional auxiliary switch for remote indications, along with a variety of connection alternatives, are also available.

Characteristics

3SB2



3SB4



Open and Reset Force ...	5 lbs. max.
Calibration @ 25°C	200 mA max. current draw @ 28 VDC, 3 sec. max trip time
Endurance	5000 mechanical cycles, no load 1000 electrical trip cycles, minimum at 28 VDC
Vibration.....	5 G's maximum 50-500 Hz
Shock	5 G's maximum
Acceleration	5 G's maximum
Weight	30 grams maximum

Dummy Circuit Breakers

Texas Instruments has developed a derivative of our 7274 style circuit breaker expressly for applications in simulators, trainers and cockpit mock-ups.

7274-63D: Dummy breaker. Non-functional 7274-2 style

7274-64PS: Physical sample. 7274-2 style with operational push button. Can measure continuity across terminals.

7274-65PS: Physical sample. 7274-11 style with operational push button. Can measure continuity across terminals.

Part Numbering Code

3SB 2 - 1 - X

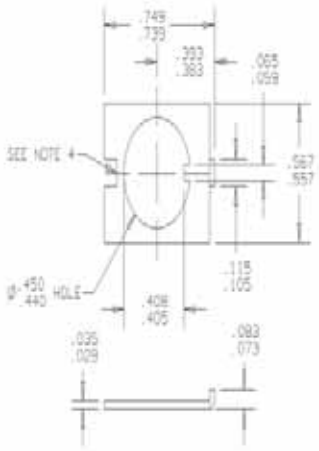
Basic Device Series

Physical Characteristics
2 = Standard device
4 = Auxiliary switch
21 = Standard device w/cover
22 = Standard device w/green push button
24 = Auxiliary switch w/green push button
41 = Auxiliary switch w/cover

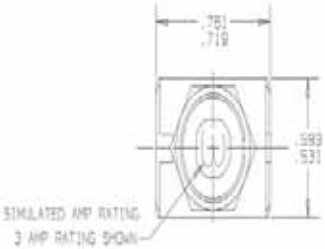
Calibration Requirements

Ampere Rating Inserts
N = No Insert
B = Blank Insert
D = "D" Rating Insert
AMP = Amp Rating (i.e., "5")

REVISIONS					
ZONE	LTR	DESCRIPTION	PROJ. 3457	DATE	APPROVED
	K	ADDED NOTES 5 & 6	ECN000943I GML	2-19-03	A.K.



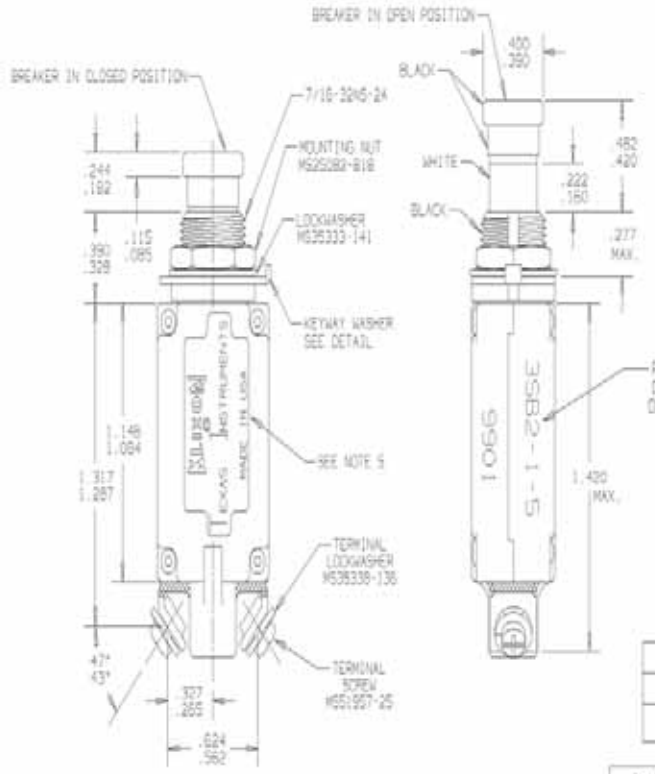
KEYWAY WASHER DETAIL



PERFORMANCE CHARACTERISTICS

VIBRATION ..... 5 G'S MAXIMUM 50-500 HZ
SHOCK ..... 5 G'S MAXIMUM
ACCELERATION ..... 5 G'S MAXIMUM
ENDURANCE ..... 5000 MECHANICAL CYCLES, NO LOAD
..... 5000 ELECTRICAL TRIP CYCLES AT 28 VDC
(POST ENDURANCE, MAXIMUM TRIP TIME IS 5 SECONDS)
OPERATING FORCES ..... 5LBS MAXIMUM, PULLOUT AND RESET
WEIGHT ..... 30 GRAMS MAXIMUM

CUSTOMER WILL SPECIFY THE AMP RATING THEY WOULD LIKE TO HAVE INDICATED ON THE PUSHBUTTON. EXAMPLE: 3SB3-1-5 SIGNIFIES A 5 AMP RATING ON THE PUSHBUTTON. A 3SB2-1-B SIGNIFIES A BLANK RATING INSERT. A 3SB2-1-N SIGNIFIES NO RATING INSERT.



CALIBRATION AT 25°C

3SB2-1	200ms	3 SECONDS	
PART NO.	MAX. CURRENT DRAW AT 28 VDC	MAX. TRIP TIME	

NOTES:

1. ALL MOUNTING HARDWARE HAS A DULL BLACK FINISH.
2. CIRCUIT BREAKERS ARE SUITABLE FOR MOUNTING IN A 1/8" THICK PANEL OR LESS.
3. EPOXY SURFACES ARE NON-DIMENSIONED. ENVELOPE DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
4. NON FUNCTIONAL NOTCH ON THE BACK OF THE KEYWAY WASHER IS OPTIONAL.
5. COUNTRY OF ORIGIN IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. COUNTRY OF ORIGIN TO BE IDENTIFIED AS REQUIRED.
6. TERMINALS MOUNTING HARDWARE SHOWN FOR ILLUSTRATION PURPOSE.

THIS IS A CAD DRAWING. THE GEOMETRY IN THE ASSOCIATED CAD COMPUTER FILE IS DIMENSIONALLY ACCURATE. WHEN DRAWING IS BEING REVISED, THE GEOMETRY MUST BE UPDATED IN ALL VIEWS AND ON ALL SHEETS.

Q13 | P19

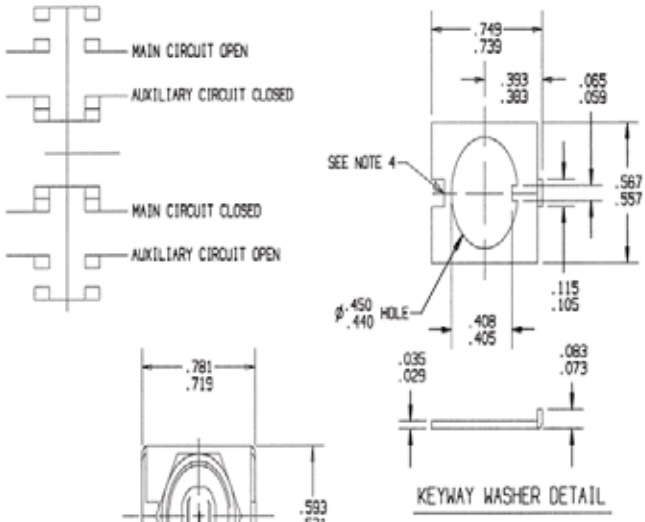
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN: CHAS. FLEURANT	DATE: 6-21-94
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER: K.B. GASSER	6-21-94
	APPROVED	
	APPROVED	
MATERIAL		
	SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.	

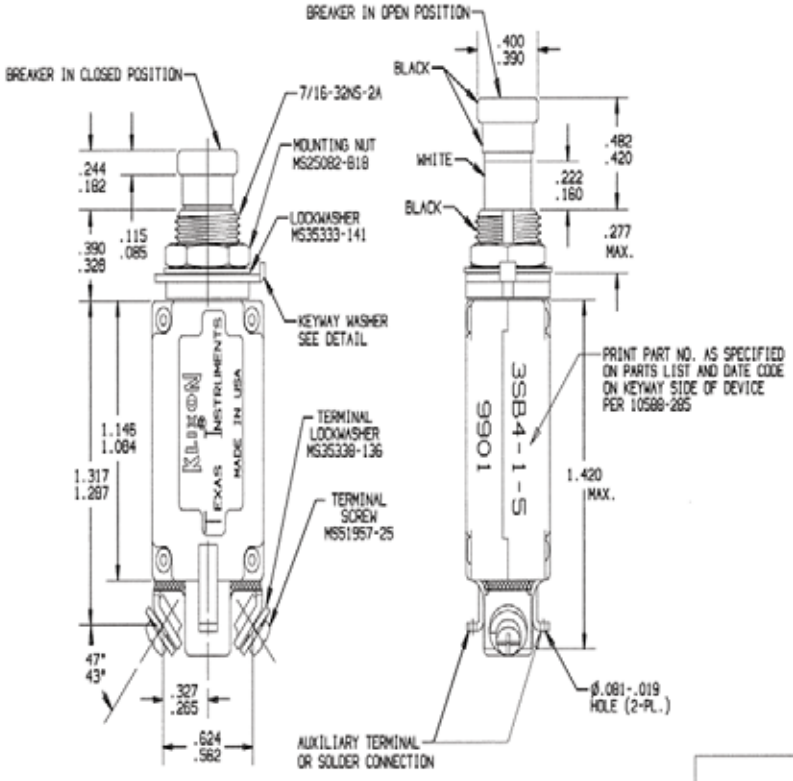
TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703
CONTROL PRODUCTS DIVISION

TITLE
3SB2 STYLE CIRCUIT BREAKER
PUSH-PULL
ENVELOPE DRAWING

SIZE	CODE IDENT NO.	
C	82647	3SB2

REVISIONS					
ZONE	LTR	DESCRIPTION	PROJ. 3457	DATE	APPROVED
	L	ADDED PART NO. & DATE CODE	CRM46193 D.S.	5/20/99	K.M.S.





PERFORMANCE CHARACTERISTICS

VIBRATION ---------- 5 G'S MAXIMUM 50-500 HZ
SHOCK ---------- 5 G'S MAXIMUM
ACCELERATION ---------- 5 G'S MAXIMUM
ENDURANCE ---------- 5000 MECHANICAL CYCLES, NO LOAD
---------- 5000 ELECTRICAL TRIP CYCLES AT 28 VDC
(POST ENDURANCE, MAXIMUM TRIP TIME IS 5 SECONDS)
OPERATING FORCES---------- 5LBS MAXIMUM, PULLOUT AND RESET
WEIGHT---------- 30 GRAMS MAXIMUM

AUXILIARY CIRCUIT ENDURANCE

5 - 120 VAC.	INDUCTIVE	2 AMP	5000 CYCLES
	RESISTIVE	3 AMP	5000 CYCLES
5 - 30 VDC.	INDUCTIVE	3 AMP	5000 CYCLES
	RESISTIVE	5 AMP	5000 CYCLES

CUSTOMER WILL SPECIFY THE AMP RATING THEY WOULD LIKE TO HAVE INDICATED ON THE PUSHBUTTON. EXAMPLE, 3SB4-1-5 SIGNIFIES A 5 AMP RATING ON THE PUSHBUTTON. A 3SB4-1-B SIGNIFIES A BLANK RATING INSERT. A 3SB4-1-N SIGNIFIES NO RATING INSERT.

CALIBRATION AT 25°C

3SB4-1	200ma	3 SECONDS	
PART NO.	MAX. CURRENT DRAW AT 28 VDC	MAX. TRIP TIME	

SUPERSEDES DWG. 3SB4 REV.'K', DATED 5-20-99

THIS IS A CAD DRAWING. THE GEOMETRY IN THE ASSOCIATED CAD COMPUTER FILE IS DIMENSIONALLY ACCURATE. WHEN DRAWING IS BEING REVISED, THE GEOMETRY MUST BE UPDATED IN ALL VIEWS AND ON ALL SHEETS.

013 | P18

NOTES:

1. ALL MOUNTING HARDWARE HAS A DULL BLACK FINISH.
2. CIRCUIT BREAKERS ARE SUITABLE FOR MOUNTING IN A 1/8" THICK PANEL OR LESS.
3. EPOXY SURFACES ARE NON-DIMENSIONED, ENVELOPE DIMENSIONS DO NOT APPLY TO THESE PROJECTED EPOXY SURFACES.
4. NON FUNCTIONAL NOTCH ON THE BACK OF THE KEYWAY WASHER IS OPTIONAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN: CHAS. FLEURANT	DATE: 6-21-94	TEXAS INSTRUMENTS, ATTLEBORO, MASSACHUSETTS 02703
TOLERANCE ON FRACTIONS DECIMALS ANGLES	ENGINEER: K.B. GASSERS	6-21-94	ELECTRO CONTROL PRODUCTS DIVISION
	APPROVED		TITLE: 3SB4 STYLE CIRCUIT BREAKER PUSH-PULL ENVELOPE DRAWING
	APPROVED		
MATERIAL			SIZE: C; CODE IDENT NO.: 82647; 3SB4
			SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.

KLIXON®

APD Series Circuit Breakers

Arc Fault Protection Device

Features

- **Small and lightweight**
- **Current ratings 1-25 amperes**
- **Detects arcs over considerable distances**
- **Senses small arc currents in presence of large current loads**
- **Insensitive to RFI/EMI and cross talk signals**
- **Differentiates between normal load current and arc current**
- **Immune to load start up transients**
- **Retrofitable – fits into existing panel designs**

Overview

The Arc Fault Circuit Breaker series has been developed by Texas Instruments to meet the evolving needs of the aerospace industry. Traditional circuit breakers were only designed to detect over-current (I^2t) conditions. However, many serious electrical incidents are caused by low level arc fault conditions resulting from damaged or aging wire which present generation circuit breakers are not designed to detect or protect against.

TI recognizes the evolving requirements of the aerospace industry and the need for supplemental arc fault protection. TI developed a small, lightweight package configuration based around proven Klixon® commercial and mil-spec circuit breaker designs, integrating the traditional over-current trip features of today's circuit breakers with new supplemental arc fault detection and protection features. shut down for motor, fan, strobe light, or fluorescent light.

The two arc fault catalog pages represent the first generation of arc fault circuit breakers that will be used in the commercial aerospace market. The first generation design is based upon the industry need to support 120VAC, 400 Hz aircraft applications.

Future design considerations for the arc fault circuit breakers under development by TI comprehend and include:

- Arc fault trip indication
- 28VDC
- Operating temperature range expansion
- Single phase 30–100A
- Three–phase development
- Ground fault detection
- Variable voltage and frequency options

Ambient Temperature Compensation

The arc fault series of circuit breakers are based on the design of our existing ambient compensated circuit breakers product family permitting system designers to specify smaller gauge wire where the circuit breaker and wiring are exposed to different ambient temperatures. The arc fault circuit breakers can operate over a temperature range of -54^oC to 71^oC however, care should be taken to understand the specification limits at elevated ambient temperatures.

Trip Free

The complete line of arc fault series circuit breakers is trip free. The circuit breaker cannot be maintained closed during an overload, even when the actuator is held closed.

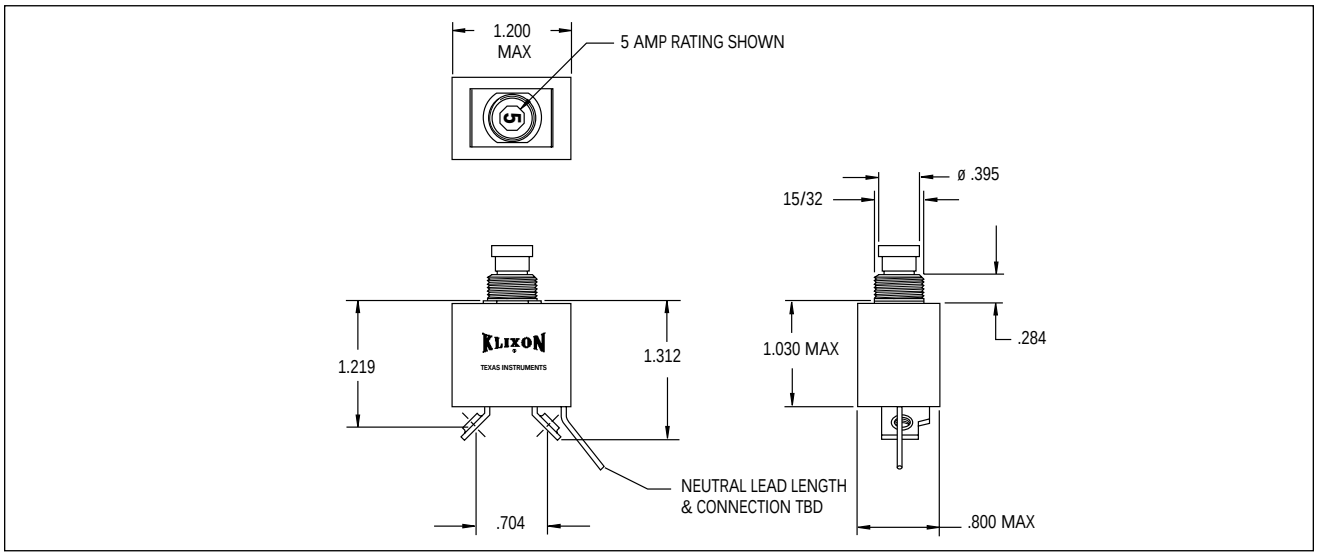
High Short Circuit Capacity

The arc fault series of circuit breakers offers unusually high short circuit current interrupting capacity. Depending on the device, overloads of up to 3500 amps at 120VAC, 400 Hz can be safely interrupted.

Options

Longer push buttons
High vibration
Random vibration capability
U.S. terminals (offset/inline)
Metric mounting threads

Characteristics



Calibration: 1-25 amps

TEMP ^{0}C	MIN ULT TRIP	MAX ULT TRIP	TRIP TIME - SECONDS		
			200%	500%	1000%
+25	115%	138%	4-16	.4-1.6	.10-.40
-54	115%	165%	7-35	.6-3.0	.15-.70
+121	85%	145%	2-13	.25-1.0	.06-.25

Vibration*..... 10 G's minimum, 50 - 500 Hz
Mechanical Shock..... 50 G's
Acceleration..... 10 G's
Weight..... 42 gm max

Interrupt Current

1-20 amps: 6000 amps at 28 VDC
25 amps: 1625 amps at 28 VDC
1-15 amps: 2500 amps at 120 VAC, 400 Hz
20 amps: 2000 amps at 120 VAC, 400 Hz
25 amps: 1800 amps at 120 VAC, 400 Hz

Endurance

2500 cycles 120 VAC, 400 Hz Inductive
5000 cycles 120 VAC, 400 Hz Resistive
2500 cycles 30 VDC Inductive
5000 cycles 30 VDC Resistive
10,000 cycles Mechanical, no load

* Other vibration levels available. Contact factory for details.

Performance:

Discrimination (resistance to nuisance trips)
Devices manufactured by TI have demonstrated success on start up, bus transfer, and shut down for motor, fan, strobe light, and fluorescent light.

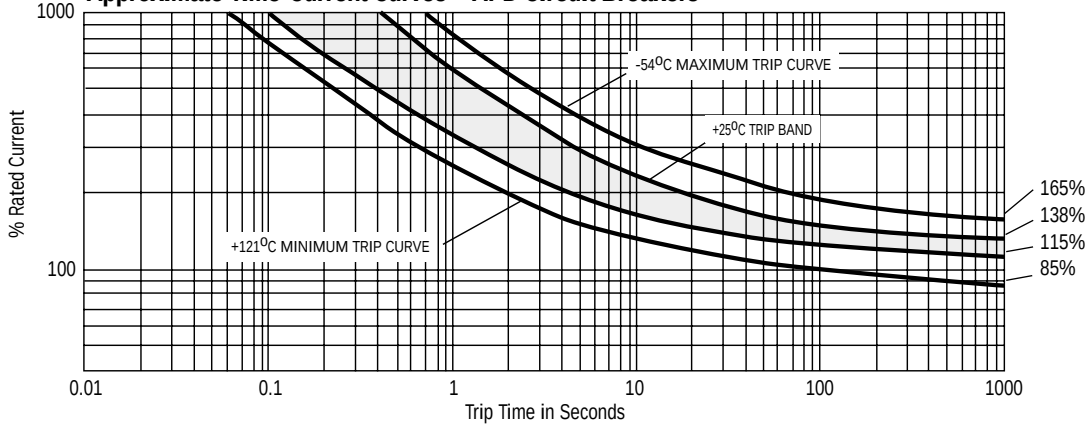
Detail performance per test document 76508
Phase to Phase and Phase to Ground 400 Hz, 120/205VAC

Guillotine Arc Test:
Guillotine Arc Current .....Less than 700% RC rms
Steady State Load .....None to rated current
Maximum Arcing Cycles ....Eight
Arcing Time Duration .....Less than 100ms

Loose Terminal Arc Detection
Steady State Load .....Less than 40% RC rms
Tripping Time: .....Less than 2 minutes
Vibration Source .....Eccentric motor vibratory table

Wet Arc Detection
MIL-STD-2223 Method 3005, wire per MIL-W-81381/11

Approximate Time-Current Curves – APD Circuit Breakers



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Cross Reference

QPL approved Aircraft Circuit Breakers specifications have been or are in the process of being converted to SAE industry standard. The specification requirements and part marking remains as per the original military slash sheet. The only difference is the SAE industry designation for the military slash sheet.

AS Number	TI Number
AS 33201	2TC2
AS 33201L	2TC27
AS 33201V	2TC63
AS 14105	3TC2
AS 14105L	3TC27
AS 14153	9TC2
AS 14154	6TC2
AS 14154L	6TC37

AS Number	TI Number
AS 14154V	6TC63
AS 22073	7274-11
AS 22073V	7274-69
AS 26574	7274-2

MS Number	TI Number
AS 26574A	7274-4
AS 26574L	7274-70
AS 24509A	7270-1
AS 24509B	7270-7
AS 24510A	7271-8
AS 24510B	7271-3

Commercial Aircraft Circuit Breaker Cross Reference

Boeing Basic Specification	TI Style
BACC18U	7274-21
BACC18W	7276-13
BACC18Z	2TC6
BACC18AA	2TC14
BACC18AC	6TC6
BACC18AD	2TC47
BACC18AE	9TC6
10-60806-XX	6752-304
10-60806-XXXX	6752-311
Boeing (DPD)	
5D0001	7274-62
None	7274-55
None	7276-115

Airbus Basic Specification	TI Style
NSA931303	6752-12
NSA931304	6752-305
NSA931320	2TC50
NSA931321	5TC50
NSA931322	6TC50
NSA931323	15TC50
NSA931324	2TC64
NSA931325	6TC64
E0730-005	2TC65
E0731-005	6TC65
E0732-005	5TC65
E0733-005	15TC65

Lockheed Basic Specification	TI Style
LS10158	2TC20, 3TC20
	2TC26/3TC26
LS10159S	6TC20, 9TC20
	6TC26/9TC26

For FAA/PMA part availability go to **www.klixon.com**

European Norms

EN2495
EN2592
EN2794
EN2995
EN2996
EN3661
EN3662
EN3773
EN3774

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Simplified Glossary of Circuit Breaker Terms

Circuit breaker – A device designed to carry a specific value of current and automatically open a circuit upon overloads or short circuits.

Thermal circuit breaker – A circuit breaker that senses a current overload based on thermal heating of the sensing element.

Time-current curve – An approximate graph showing the minimum and maximum time a specific breaker will take to trip on various degrees of overload.

Ambient compensation – A feature of some thermal breakers that limits or eliminates thermal derating due to ambient temperature.

Minimum ultimate trip – Current rating at which a breaker will not trip within a certain period (usually 1 hour) at a specified temperature.

Maximum ultimate trip – Current rating at which a breaker must trip within a certain period (usually 1 hour) at a specified temperature.

Thermal derating – Tendency of a breaker to trip at lower current levels due to higher ambient temperatures, and to trip at higher levels due to lower ambient temperatures.

Trip-free – Feature of certain breakers that makes it impossible to hold the breaker closed against an overload.

Manual reset – Method of accomplishing reclosure after circuit interruption has occurred.

Indicating, non-indicating – Whether or not breaker gives prominent visual indication of opening, such as exposing a white band around button, or moving toggle to off position.

Manual trip – Ability of breaker to be opened manually.

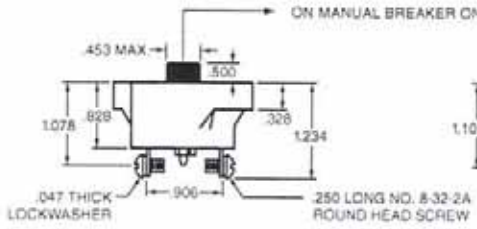
Auxiliary circuit – An integrally housed, electrically independent switch linked mechanically to operate with the main circuit breaker contacts.

Voltage drop – The voltage decrease across the breaker due to internal resistance of the device.

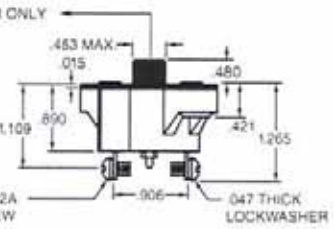
COMMERCIAL TYPE

2-40 Amp Commercial Circuit Breakers CA, CDA, CM, CDM (Screw Type Terminals)

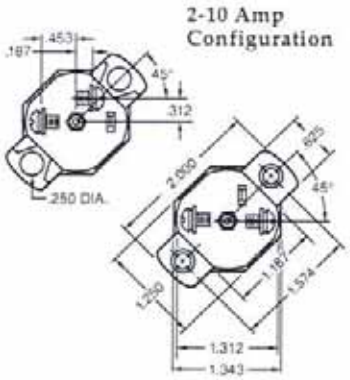
Side View of CA & CM



Side View of CDA & CDM



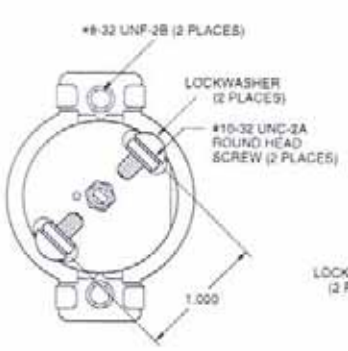
Bottom View of CA, CM, CDA & CDM



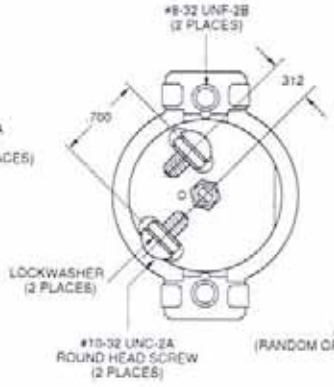
Typical self-locking nut (applies to all configurations)

Note: Eyelets for #10 screw are standard. Self-locking nuts for 8-32 screws furnished only when specified on order.

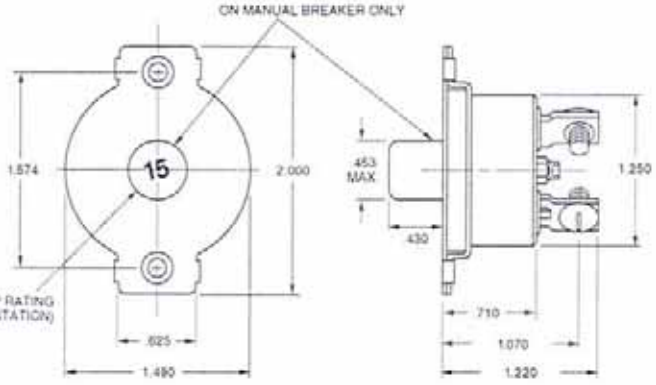
2-50 Amp Commercial Circuit Breakers 6790 (Screw Type Terminals)



25-50 Amp Configuration

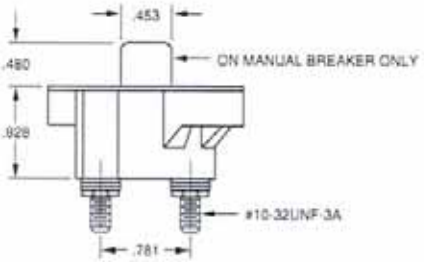


2-20Amp Configuration

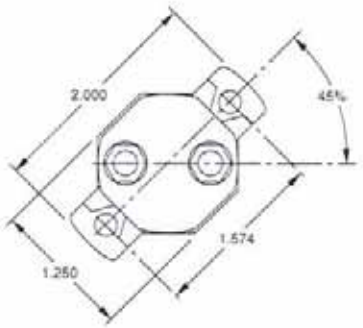


12½-60 Amp Commercial Circuit Breakers 7851, 7854 (Stud Type Terminals)

Side View of 7851 & 7854



Bottom View



Typical self-locking nut (applies to all configurations)

Note: Eyelets for #10 screw are standard. Self-locking nuts for 8-32 screws furnished only when specified on order.

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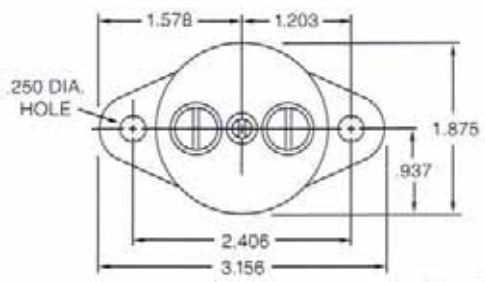
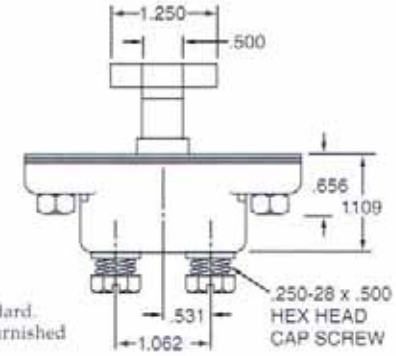
COMMERCIAL TYPES

35-150 Amp Commercial, Switchable Circuit Breakers
6766-19

Bottom View of 6766-19



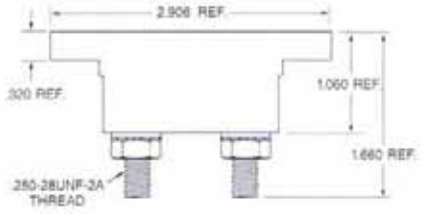
Side View of 6766-19



Note: Eyelets for #10 screw are standard. Self-locking nuts for 10-32 screws furnished only when specified on order.

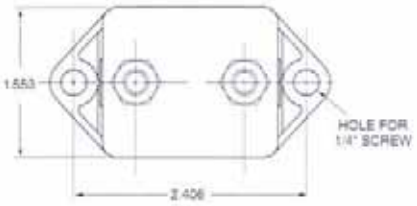
35-150 Amp Commercial Circuit Breakers
SDLA, SDLM

Side View of SDLA



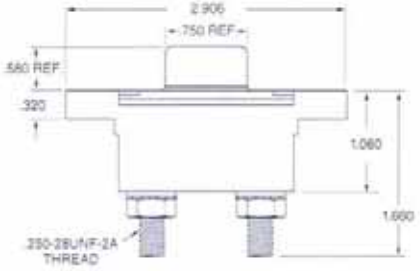
AUTOMATIC

Bottom View of SDLA/SDLM



Note: Eyelets for #10 screw are standard. Self-locking nuts for 10-32 screws furnished only when specified on order.

Side View of SDLM



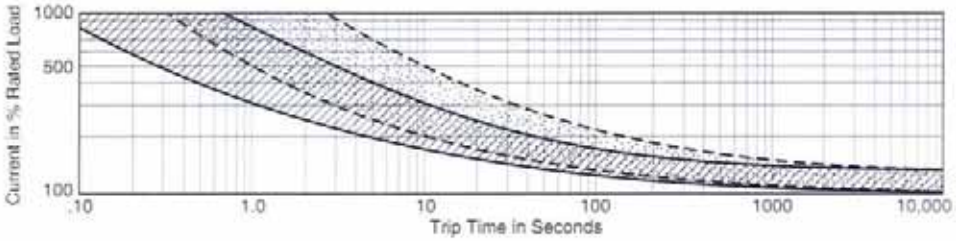
MANUAL

Commercial Breakers

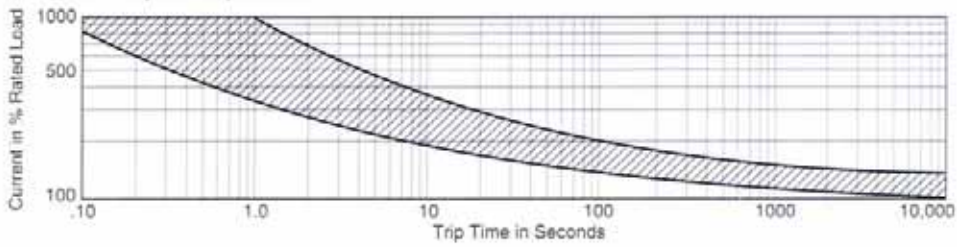
Approximate Time – Current Characteristics at 77°F

Dotted Lines Represent Range of CA, CM, CDA, CDM (10 amps and below), 6790-1, 6790-2 (20 amps & below)

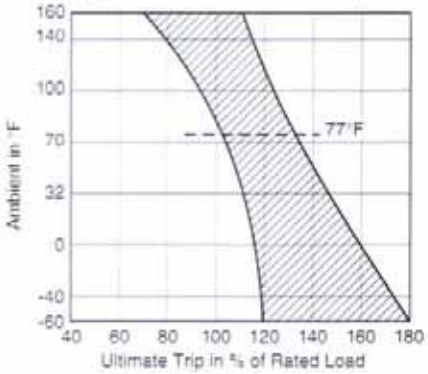
Solid Lines Represent Range of CA, CM, CDA, CDM, 7851, 7854 (above 10 amp), 6790-1, 6790-2 (above 20 amps)



SDLA, SDLM, 6766-19



Approximate Effect of Ambient Temperature on Ultimate Trip



KLIXON

PRECISION TYPES

2 to 40 Amp Precision Circuit Breakers – Weatherproof
PDM, PDA

PDM – Manual reset
PDA – Automatic reset

PDM

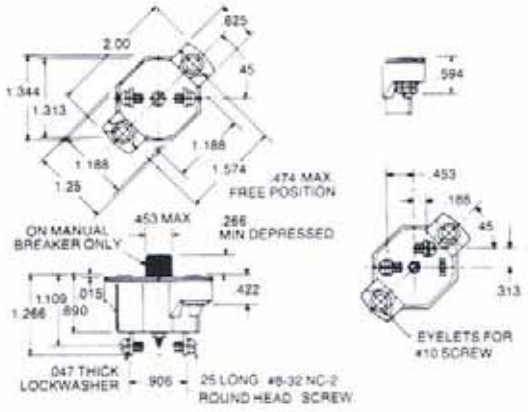
Amp Rating	Part Number
2	PDM-2
3	PDM-3
4	PDM-4
5	PDM-5
6	PDM-6
8	PDM-8
10	PDM-10
12½	PDM-12½
15	PDM-15
17½	PDM-17½
20	PDM-20
25	PDM-25
30	PDM-30
35	PDM-35
40	PDM-40

PDA

Amp Rating	Part Number
2	PDA-2
3	PDA-3
4	PDA-4
5	PDA-5
6	PDA-6
8	PDA-8
10	PDA-10
12½	PDA-12½
15	PDA-15
17½	PDA-17½
20	PDA-20
25	PDA-25
30	PDA-30
35	PDA-35
40	PDA-40

Note: Eyelets for #10 screw are standard. Eyelets for #8 screw or self-locking nuts for 10-32 screws furnished only when specified on order.

PDM and PDA Envelope drawing



35 to 150 Amp Precision/Military Circuit Breakers – Weatherproof
PDLM, PDLA

PDLM – Manual reset
PLDA – Automatic reset

PDLM

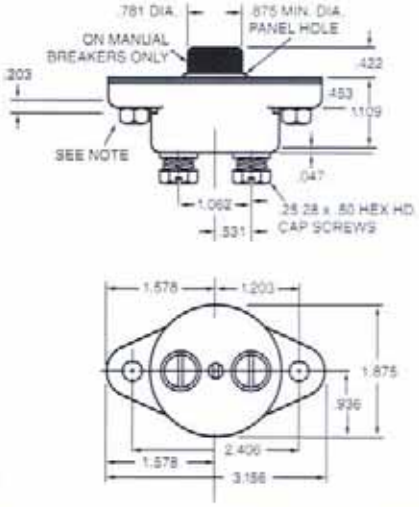
Amp Rating	Part Number
35	PDLM-35
40	PDLM-40
45	PDLM-45
50	PDLM-50
60	PDLM-60
70	PDLM-70
80	PDLM-80
90	PDLM-90
105	PDLM-105
120	PDLM-120
135	PDLM-135
150	PDLM-150

PDLA

Amp Rating	Part Number
35	PDLA-35
40	PDLA-40
45	PDLA-45
50	PDLA-50
60	PDLA-60
70	PDLA-70
80	PDLA-80
90	PDLA-90
105	PDLA-105
120	PDLA-120
135	PDLA-135
150	PDLA-150

Note: Eyelets for #10 screw are standard. Eyelets for #8 screw or self-locking nuts for 10-32 screws furnished only when specified on order.

PDLM and PDLA Envelope drawing



175 & 200 Amp Precision/Military Circuit Breakers – Weatherproof
7855, 7856

7855-6 – Manual reset (10 oz or 283.49 gms)
7855-7 – Automatic reset (8⅓ oz or 248.05 gms)

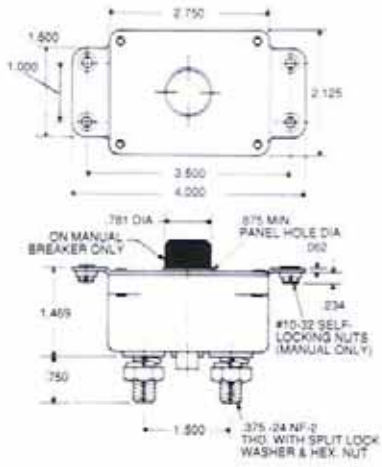
7855-6

Amp Rating	Part Number
175	7855-6-175
200	7855-6-200

7855-7

Amp Rating	Part Number
175	7855-7-175
200	7855-7-200

7855-6 and 7855-7 Envelope drawing



PRECISION TYPES

2 to 10 Amp Precision Circuit Breakers

PSA, PSM, PSM-N

PSM-N – Manual reset
PSM – Manual reset
PSA – Automatic reset

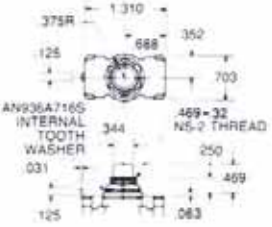
PSM (or PSA)

Amp Rating	Part Number
2	PSM-2
3	PSM-3
4	PSM-4
5	PSM-5
6	PSM-6
8	PSM-8
10	PSM-10

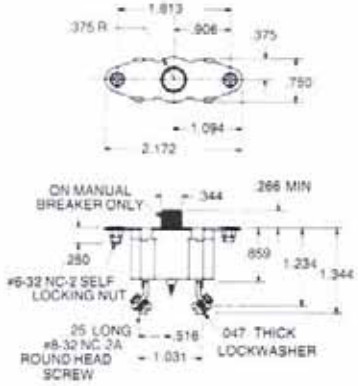
PSM-N

Amp Rating	Part Number
2	PSM-2N
3	PSM-3N
4	PSM-4N
5	PSM-5N
6	PSM-6N
8	PSM-8N
10	PSM-10N

PSM-N Envelope drawing



PSM and PSA Envelope drawing



12½ to 35 Amp Precision Circuit Breakers
PSA, PSM, PSM-N

PSM-N – Manual reset
PSM – Manual reset
PSA – Automatic reset

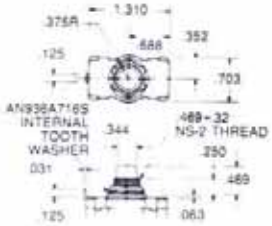
PSM

Amp Rating	Part Number
12½	PSM-12½
15	PSM-15
17½	PSM-17½
20	PSM-20
25	PSM-25
30	PSM-30
35	PSM-35

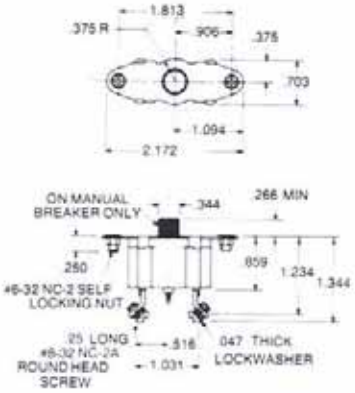
PSA

Amp Rating	Part Number
12½	PSA-12½
15	PSA-15
17½	PSA-17½
20	PSA-20
25	PSA-25
30	PSA-30
35	PSA-35

PSM-N Envelope drawing



PSM and PSA Envelope drawing



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Ordering Information

Commercial Breakers

2-40 Amps

X – X – I *

Configuration	Amp Rating
CA CM CDA CDM	2, 3, 4, 5, 6, 8, 10, 12½, 15, 17½, 20, 25, 30, 35, 40

2-50 Amps

X – X – X

Configuration	Operation	Amp Rating
6790	1 – Manual 2 – Automatic	2, 3, 4, 5, 6, 8, 10, 12½, 15, 17½, 20, 25, 30, 35, 40, 45, 50

12½-60 Amps

X – X – X – I *

Configuration	Stud Length (Approx)	Amp Rating
7851	18 (0.310") 37 (0.455") 13 (0.610")	12½, 15, 17½, 20, 25, 30, 35, 40, 50, 60
7854	18 (0.310") 26 (0.455") 15 (0.610")	12½, 15, 17½, 20, 25, 30, 35, 40, 50, 60

35-150 Amps

X – X – I *

Configuration	Amp Rating
6766-19	35, 40, 45, 50, 60, 70, 80, 90, 105, 120, 135, 150

35-150 Amps

X – X – **

Configuration	Amp Rating
SDLA SDLM	35, 40, 45, 50, 60, 70, 80, 90, 105, 120, 135, 150

** Options
1 – Self locking nuts
2 – No terminal hardware
3 – Self locking nuts and no terminal hardware

Precision and Military Circuit Breakers

2-10 Amps

X – X

Configuration	Amp Rating
PSM-N PSM PSA	2, 3, 4, 5, 6, 8, 10

12½-35 Amps

X – X

Configuration	Amp Rating
PSM-N PSM PSA	12½, 15, 17½, 20, 25, 30, 35

2-40 Amps

X – X – I *

Configuration	Amp Rating
PDA PDM	2, 3, 4, 5, 6, 8, 10, 12½, 15, 17½, 20, 25, 30, 35, 40

35-150 Amps

X – X – I *

Configuration	Amp Rating
PDLA PDLM	35, 40, 45, 50, 60, 70, 80, 90, 105, 120, 135, 150

175 & 200 Amps

X – X

Configuration	Amp Rating
7855-6 7855-7	175, 200

* Optional – Denotes self-locking nuts
** Leave blank (omit) for standard product without options

KLIXON

Performance Characteristics

Dielectric Strength	1500 VAC minimum
Insulation Resistance	100 megohms minimum
Vibration Resistance	10G
Mechanical Shock Resistance	100G
Interrupt Current Capacity	
Small frame size	In accordance with SAE J553, and ABYC E-9
Large frame size	In accordance with SAE J1625, and ABYC E-9
Endurance	
Automatic except SDLA	2000 cycles at 200% of rated current
Automatic SDLA	Cycles for 1 hour minimum at 600% of rated current
Manual except 6790, SDLM	500 cycles at 200% of rated current
Manual 6790	200 cycles at 200% of rated current
Manual SDLM	100 cycles at 600% of rated current

Ultimate trip at 77°F (% of rated current)	MUST HOLD	MUST TRIP
Commercial	100%	130%
Precision	110%	138%

Calibration at 200% of rated current and 77°F	TIME
CA, CDA, CM, CDM (10 amps and below)	20 to 150 seconds
CA, CDA, CM, CDM (over 10 amps)	5 to 55 seconds
PDA, PDM, PSA, PSM, PSM-N (10 amps and below)	20 to 150 seconds
PDA, PDM, PSA, PSM, PSM-N (over 10 amps)	8 to 50 seconds
PDLA, PDLM	8 to 100 seconds
SDLA, SDLM	8 to 100 seconds
6790 (20 amps and below)	150 seconds maximum
6790 (over 20 amps)	55 seconds maximum
7851, 7854	5 to 55 seconds
7855	8 to 100 seconds