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ELECTRONICS, INC.

FUSES

And other circuit protection devices

- Polymeric PTC Resettable Fuses
- Gas Filled Surge Arresters
- Integrated Circuit Protectors
- Thermal Cut-Offs
- Metal Oxide Varistors
- Overvoltage Transient Suppressors
- SIDACS
- Thermal Circuit Breakers



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1ST EDITION

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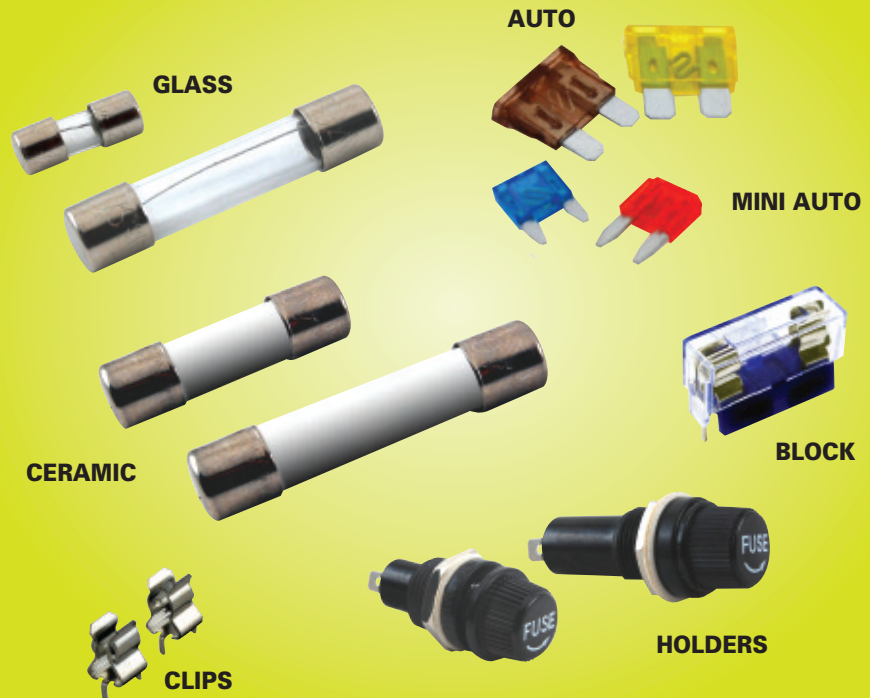
INTRODUCTION

Technical Guide:

NTE is pleased to present the **1st edition** of their Fuse Technical Guide. This Technical Guide is designed to give engineers, technicians and buyers assistance in selecting the NTE component best suited for their specific application or circuit.

- **Technical specifications should be consulted to assure the proper replacement has been identified**
- **"TYPICAL" parameters can and do vary in different applications**
- **All operating parameters, including "TYPICALS," must be validated for each application by customers' technical experts**
- **NTE reserves the right to make any changes without further notice to any product herein**

Extensive New Fuse Line!



To order call us at: 973-748-5089 or fax: 973-748-6224 or visit www.nteinc.com

WARRANTY

2 Year Warranty: NTE products are warranted to be free from defects in materials and workmanship and meet applicable specifications when tested to ratings. This warranty is in lieu of any other warranty expressed, implied, or statutory. NTE's liability under this warranty is limited to repairing, replacing, or issuing credit (at the discretion of NTE) for such products that become defective or fail to meet specification during the warranty period of two years from the date of sale. The technical data shown is intended to provide safe areas of operation for NTE products. Determination as to whether a product is actually defective rests with NTE. In no event will NTE be liable for consequential or special damages.

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Technical Assistance: For further detailed product information first check out our web site at www.nteinc.com. If the information you need is not there, or you don't have internet access, you may also call us at 973-748-5089 or fax us at 973-748-6224.

Safety Warning: NTE devices are not to be used as critical components in life support equipment. Testing of solid state devices should be performed by experienced personnel using test instruments specifically designed for such purposes.

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3.6 x 10mm Glass Microfuse, Fast Acting

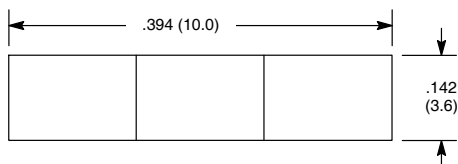


Features

- RoHS Compliant
- Available in Blister (B Suffix) & Clamshell (C Suffix) Package



F-01



Specifications

Rated Voltage: 125V / 250V

Breaking Capacity: 125VAC, 50A; 250VAC, 50A

Time Current Characteristics:

% of Ampere Rating	Opening Time
110%	4 hours min.
150%	10 minutes max.
200%	5 seconds max.

Ordering Information:

NTE Type No. (Note 1)	Rated Current	Diag No.
74-3FG100MA	100mA	F-01
74-3FG125MA	125mA	F-01
74-3FG1A	1.0A	F-01
74-3FG2A	2.0A	F-01
74-3FG2.5A	2.5A	F-01
74-3FG4A	4.0A	F-01
74-3FG5A	5.0A	F-01

Note 1. For blister package, add a "B" suffix. For clamshell package, add a "C" suffix.

3.6 x 10mm Glass Microfuse, Slow Blow

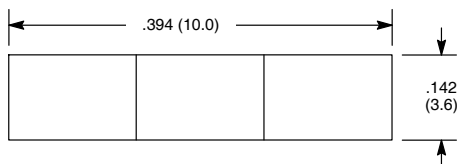


Features

- RoHS Compliant
- Available in Blister (B Suffix) & Clamshell (C Suffix) Package



F-01



Specifications

Rated Voltage: 125V / 250V

Breaking Capacity: 125VAC, 50A; 250VAC, 50A

Time Current Characteristics:

% of Ampere Rating	Opening Time
110%	4 hours min.
150%	10 minutes max.
200%	120 seconds max.

Ordering Information:

NTE Type No. (Note 1)	Rated Current	Diag No.
74-3SG500MA	500mA	F-01
74-3SG800MA	800mA	F-01
74-3SG1A	1.0A	F-01
74-3SG1.25A	1.25A	F-01
74-3SG2A	2.0A	F-01
74-3SG2.5A	2.5A	F-01
74-3SG4A	4.0A	F-01
74-3SG5A	5.0A	F-01
74-3SG6A	6.0A	F-01

Note 1. For blister package, add a "B" suffix. For clamshell package, add a "C" suffix.

5 x 20mm Miniature Glass

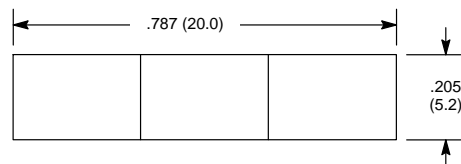


Features

- Available in Fast Acting and Slow Blow Types
- RoHS Compliant
- Available in Blister (B Suffix) & Clamshell (C Suffix) Package



F- 02



Specifications

Rated Voltage: 125V / 250V

Breaking Capacity: 125VAC, 10KA; 250VAC, 20A

Time Current Characteristics:

% of Ampere Rating	Opening Time
110%	4 hours min.
135%	1 hour max.
200%	120 seconds max.

Ordering Information:

NTE Type No. (Note 1)		Rated Current	Diag No.
Fast Acting	Slow Blow		
74-5FG100MA		100mA	F- 02
74-5FG125MA		125mA	F- 02
74-5FG160MA		160mA	F- 02
74-5FG200MA	74-5SG200MA **	200mA	F- 02
74-5FG250MA	74-5SG250MA **	250mA	F- 02
	74-5SG300MA **	300mA	F- 02
74-5FG315MA		315mA	F- 02
74-5FG400MA	74-5SG400MA **	400mA	F- 02
74-5FG500MA	74-5SG500MA	500mA	F- 02
	74-5SG600MA	600mA	F- 02
74-5FG630MA		630mA	F- 02
	74-5SG750MA	750mA	F- 02
74-5FG800MA	74-5SG800MA	800mA	F- 02
74-5FG1A	74-5SG1A	1.0A	F- 02
74-5FG1.25A	74-5SG1.25A	1.25A	F- 02
74-5FG1.6A	74-5SG1.6A	1.6A	F- 02
74-5FG2A	74-5SG2A	2.0A	F- 02
74-5FG2.5A	74-5SG2.5A	2.5A	F- 02
	74-5SG3A	3.0A	F- 02
74-5FG3.15A	74-5SG3.15A	3.15A	F- 02
74-5FG4A	74-5SG4A	4.0A	F- 02
74-5FG5A	74-5SG5A	5.0A	F- 02
74-5FG6.3A		6.3A	F- 02
	74-5SG7A	7.0A	F- 02
74-5FG8A		8.0A	F- 02
74-5FG10A		10A	F- 02

Note 1. For blister package, add a "B" suffix. For clamshell package, add a "C" suffix.

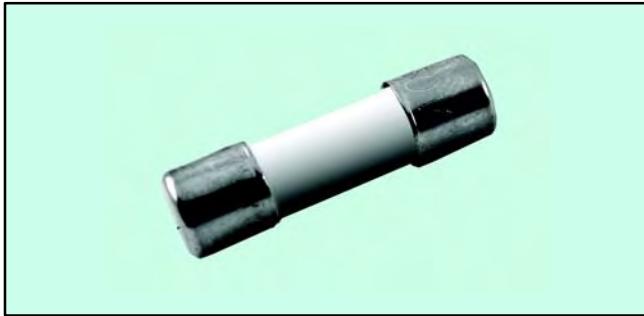
** Not UL Approved.

5 x 20mm Miniature Ceramic

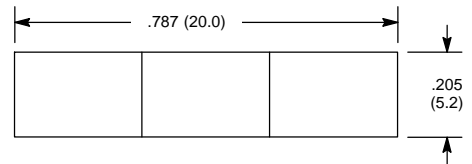


Features

- Available in Fast Acting and Slow Blow Types
- RoHS Compliant
- Available in Blister (B Suffix) & Clamshell (C Suffix) Package



F-03



Specifications

Rated Voltage: 250V

Breaking Capacity: 250VAC, 1500A

Time Current Characteristics:

Fast Acting

% of Ampere Rating	Opening Time	
	100mA to 3.15A	4A to 5A
150%	60 minutes min.	60 minutes min.
210%	30 minutes max.	30 minutes max.
275%	0.1 - 2 seconds	0.1 - 3 seconds
400%	0.03 - 0.3 seconds	0.03 - 0.3 seconds
1000%	0.2 seconds max.	0.2 seconds max.

Slow Blow

% of Ampere Rating	Opening Time		
	100mA to 3.15A	4A to 6.3A	8A to 10A
150%	60 minutes min.	60 minutes min.	60 minutes min.
210%	30 minutes max.	30 minutes max.	30 minutes max.
275%	1 - 80 seconds	1 - 80 seconds	-
400%	0.095 - 5 seconds	0.15 - 5 seconds	0.06 - 5 seconds
1000%	0.01 - 0.1 seconds	0.02 - 0.1 seconds	0.01 - 0.1 seconds

Ordering Information:

NTE Type No. (Note 1)		Rated Current	Diag No.
Fast Acting	Slow Blow		
74-5FC100MA		100mA	F-03
74-5FC125MA		125mA	F-03
74-5FC160MA		160mA	F-03
74-5FC200MA	74-5SC200MA	200mA	F-03
74-5FC250MA	74-5SC250MA	250mA	F-03
74-5FC315MA	74-5SC315MA	315mA	F-03
74-5FC400MA	74-5SC400MA	400mA	F-03
74-5FC500MA	74-5SC500MA	500mA	F-03
74-5FC630MA	74-5SC630MA	630mA	F-03
74-5FC800MA	74-5SC800MA	800mA	F-03
74-5FC1A	74-5SC1A	1.0A	F-03
74-5FC1.25A	74-5SC1.25A	1.25A	F-03
74-5FC1.6A	74-5SC1.6A	1.6A	F-03
74-5FC2A	74-5SC2A	2.0A	F-03
74-5FC2.5A	74-5SC2.5A	2.5A	F-03
74-5FC3.15A	74-5SC3.15A	3.15A	F-03
74-5FC4A	74-5SC4A	4.0A	F-03
74-5FC5A	74-5SC5A	5.0A	F-03
	74-5SC6.3A	6.3A	F-03
	74-5SC8A	8.0A	F-03
	74-5SC10A	10A	F-03

Note 1. For blister package, add a "B" suffix. For clamshell package, add a "C" suffix.

3AG Equivalent - 6 x 30mm Miniature Glass

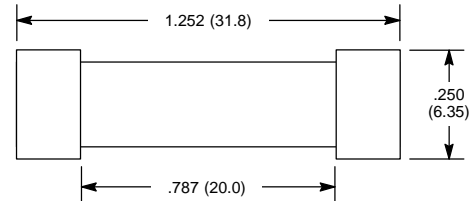


Features

- Available in Fast Acting and Slow Blow Types
- RoHS Compliant
- Available in Blister (B Suffix) & Clamshell (C Suffix) Package



F-04



Specifications

Rated Voltage: 125V / 250V

Breaking Capacity: 125VAC, 10kA; 250VAC, 200A

Time Current Characteristics:

Fast Acting

% of Ampere Rating	Opening Time
110%	4 hours min.
135%	1 hour max.
200%	120 seconds max.

Slow Blow

% of Ampere Rating	Opening Time	
	100mA to 3A	4A to 20A
110%	4 hours min.	4 hours min.
135%	1 hour max.	1 hour max.
200%	5 - 120 seconds	12 - 120 seconds

Ordering Information:

NTE Type No. (Note 1)		Rated Current	Diag No.
Fast Acting	Slow Blow		
74-6FG100MA **	74-6SG100MA	100mA	F-04
74-6FG125MA **	74-6SG125MA	125mA	F-04
74-6FG150MA **	74-6SG150MA	150mA	F-04
74-6FG175MA **	74-6SG175MA	175mA	F-04
74-6FG187MA **	74-6SG187MA	187mA	F-04
74-6FG200MA **	74-6SG200MA	200mA	F-04
74-6FG250MA **	74-6SG250MA	250mA	F-04
74-6FG300MA **	74-6SG300MA	300mA	F-04
74-6FG375MA **	74-6SG375MA	375mA	F-04
	74-6SG400MA	400mA	F-04
74-6FG500MA	74-6SG500MA	500mA	F-04
74-6FG600MA	74-6SG600MA	600mA	F-04
74-6FG750MA	74-+6SG750MA	750mA	F-04
74-6FG1A	74-6SG1A	1.0A	F-04
74-6FG1.25A	74-6SG1.25MA	1.25A	F-04
74-6FG1.5A	74-6SG1.5MA	1.5A	F-04
74-6FG1.6A	74-6SG1.6A	1.6A	F-04
74-6FG2A	74-6SG2A	2.0A	F-04
74-6FG2.5A	74-6SG2.5A	2.5A	F-04
74-6FG3A	74-6SG3A	3.0A	F-04
74-6FG4A	74-6SG4A	4.0A	F-04
74-6FG5A	74-6SG5A	5.0A	F-04
74-6FG6A		6.0A	F-04
74-6FG7A	74-6SG7A	7.0A	F-04
74-6FG8A	74-6SG8A	8.0A	F-04
74-6FG10A	74-6SG10A	10A	F-04
	74-6SG12A	12A	F-04
	74-6SG15A	15A	F-04
	74-6SG20A	20A	F-04

Note 1. For blister package, add a "B" suffix. For clamshell package, add a "C" suffix.

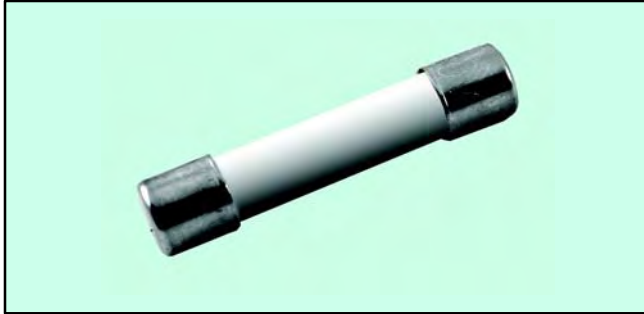
** Not UL Approved.

3AB Equivalent - 6 x 30mm Miniature Ceramic

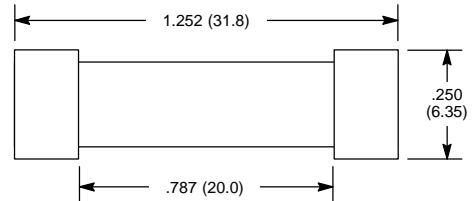


Features

- Available in Fast Acting and Slow Blow Types
- RoHS Compliant
- Available in Blister (B Suffix) & Clamshell (C Suffix) Package



F-04



Specifications

Rated Voltage: 125V / 250V

Breaking Capacity: 125VAC, 10kA; 250VAC, 200A

Time Current Characteristics:

Fast Acting

% of Ampere Rating	Opening Time
110%	4 hours min.
135%	1 hour max.
200%	120 seconds max.

Slow Blow

% of Ampere Rating	Opening Time	
	100mA to 3A	4A to 20A
110%	4 hours min.	4 hours min.
135%	1 hour max.	1 hour max.
200%	5 - 120 seconds	12 - 120 seconds

Ordering Information:

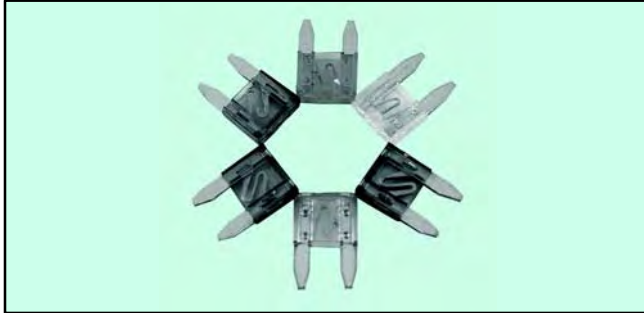
NTE Type No. (Note 1)		Rated Current	Diag No.
Fast Acting	Slow Blow		
	74-6SC100MA	100mA	F-04
74-6FC125MA	74-6SC125MA	125mA	F-04
	74-6SC150MA	150mA	F-04
	74-6SC175MA	175mA	F-04
	74-6SC187MA	187mA	F-04
	74-6SC200MA	200mA	F-04
74-6FC250MA	74-6SC250MA	250mA	F-04
	74-6SC300MA	300mA	F-04
74-6FC375MA	74-6SC375MA	375mA	F-04
	74-6SC400MA	400mA	F-04
74-6FC500MA	74-6SC500MA	500mA	F-04
	74-6SC600MA	600mA	F-04
	74-6SC700MA	700mA	F-04
74-6FC750MA	74-6SC750MA	750mA	F-04
74-6FC1A	74-6SC1A	1.0A	F-04
	74-6SC1.25A	1.25A	F-04
	74-6SC1.5A	1.5A	F-04
	74-6SC1.6A	1.6A	F-04
74-6FC2A	74-6SC2A	2.0A	F-04
	74-6SC2.5A	2.5A	F-04
74-6FC3A	74-6SC3A	3.0A	F-04
74-6FC4A	74-6SC4A	4.0A	F-04
74-6FC5A	74-6SC5A	5.0A	F-04
74-6FC6A		6.0A	F-04
	74-6SC6.25A	6.25A	F-04
74-6FC7A	74-6SC7A	7.0A	F-04
74-6FC8A	74-6SC8A	8.0A	F-04
74-6FC10A	74-6SC10A	10A	F-04
74-6FC12A	74-6SC12A	12A	F-04
74-6FC15A	74-6SC15A	15A	F-04
74-6FC20A	74-6SC20A	20A	F-04

Note 1. For blister package, add a "B" suffix. For clamshell package, add a "C" suffix.

ATM Equivalent - Low Voltage Miniature Automotive, Fast Acting

Features

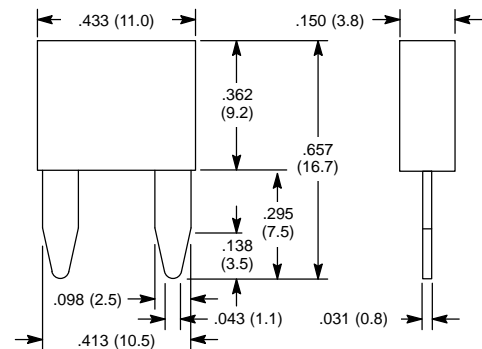
- Miniature Blade Type
- RoHS Compliant
- Available in Blister Package (B Suffix)



NTE Type No. (Note 1)	Rated Current	Color Code	Diag No.
74-MAF5A	5A	Tan	F-05
74-MAF7.5A	7.5A	Brown	F-05
74-MAF10A	10A	Red	F-05
74-MAF15A	15A	Blue	F-05
74-MAF20A	20A	Yellow	F-05
74-MAF25A	25A	Natural	F-05
74-MAF30A	30A	Green	F-05

Note 1. For blister package, add a "B" suffix.

F-05



Specifications

Rated Voltage: 32V

Time Current Characteristics:

% of Ampere Rating	Opening Time
110%	4 hours min.
135%	0.75 - 1800 seconds
200%	0.15 - 5 seconds
300%	0.08 seconds max.

ATC Equivalent - Low Voltage Automotive, Fast Acting

Features

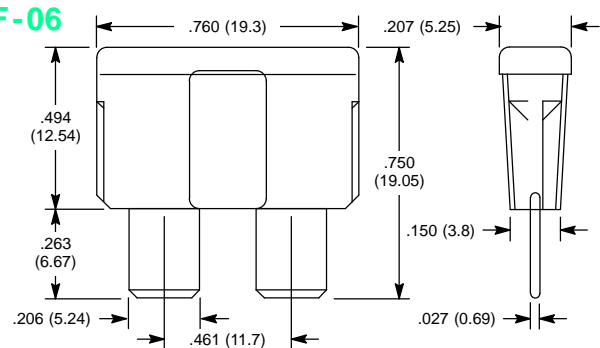
- Fast Acting
- Clip, Hold Automotive Type
- RoHS Compliant
- Available in Blister Package (B Suffix)



NTE Type No. (Note 1)	Rated Current	Color Code	Diag No.
74-AF5A	5A	Tan	F-06
74-AF7.5A	7.5A	Brown	F-06
74-AF10A	10A	Red	F-06
74-AF15A	15A	Blue	F-06
74-AF20A	20A	Yellow	F-06
74-AF25A	25A	Natural	F-06
74-AF30A	30A	Green	F-06

Note 1. For blister package, add a "B" suffix.

F-06



Specifications

Rated Voltage: 32V

Time Current Characteristics:

% of Ampere Rating	Opening Time
110%	100 hours min.
135%	1800 seconds max.
200%	5 seconds max.
300%	0.08 seconds max.

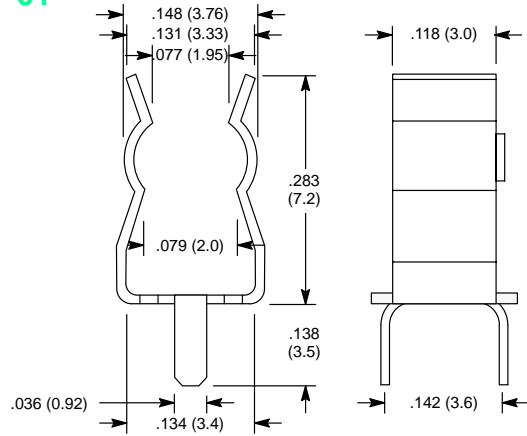
74- FC3, Fuse Clips

Specifications:

- For 3.6 x 10mm Fuse
- Contact Resistance: - 10MΩ Max
- Rating: 6A / 250VAC



FA-01



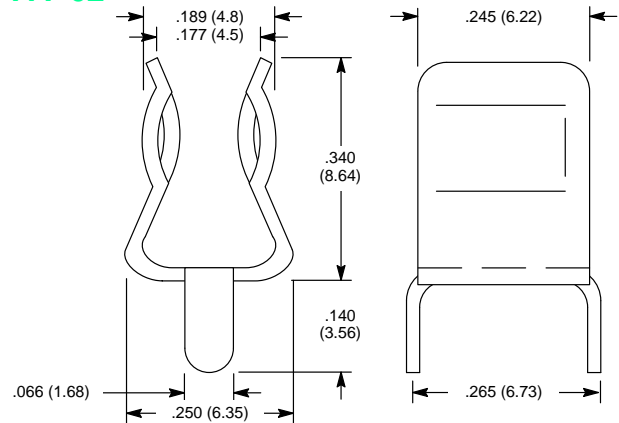
74- FC5, Fuse Clips (Double Fluted)

Specifications:

- For 5 x 20mm Fuse
- Contact Resistance: - 10MΩ Max
- Rating: 5A / 250VAC



FA-02



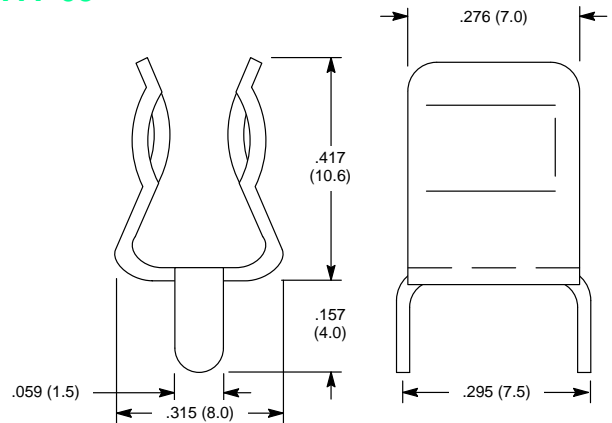
74- FC6, Fuse Clips

Specifications:

- For 6 x 30mm Fuse
- Contact Resistance: - 10MΩ Max
- Rating: 12A / 250VAC



FA- 03



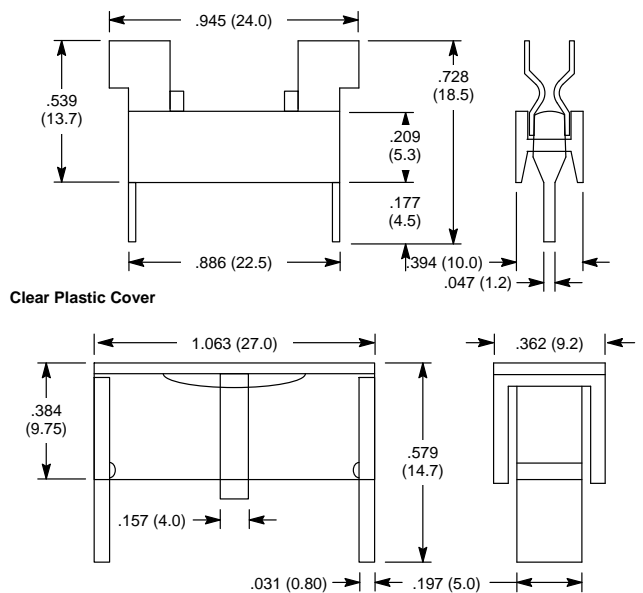
74- FB5, Fuse Block w/Clear Cover

Specifications:

- For 5 x 20mm Fuse
- PC Mount
- Rated for Current up to 10A



FA- 04



74- FH5, Fuse Holder

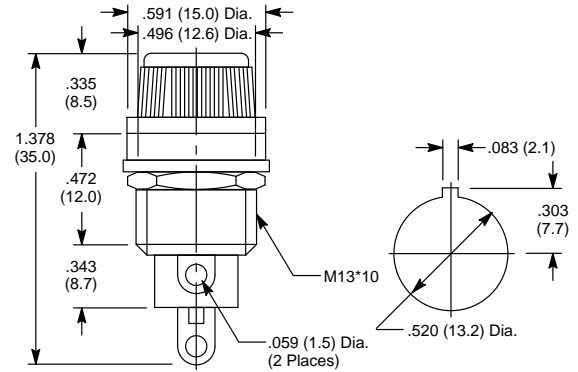


Specifications:

- For 5 x 20mm Fuse
- Rating: 10A / 250VAC
- Panel Mount
- Finger- Grip Fuse Extractor Type Knob



FA-05



74- FH6, Fuse Holder

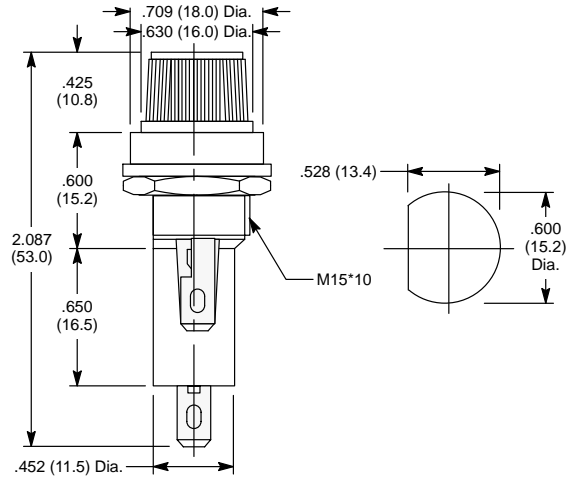


Specifications:

- For 6 x 30mm & 6.3 x 32mm Fuses
- Rating: 10A / 250VAC
- Panel Mount
- Finger- Grip Fuse Extractor Type Knob



FA-06



R58 Series Thermal Circuit Breaker



Features

- .250" (6.35mm) Quick Connect Terminals
- Cannot be Manually Tripped
- Visual Trip Indicator
- Push Button to Reset Breaker

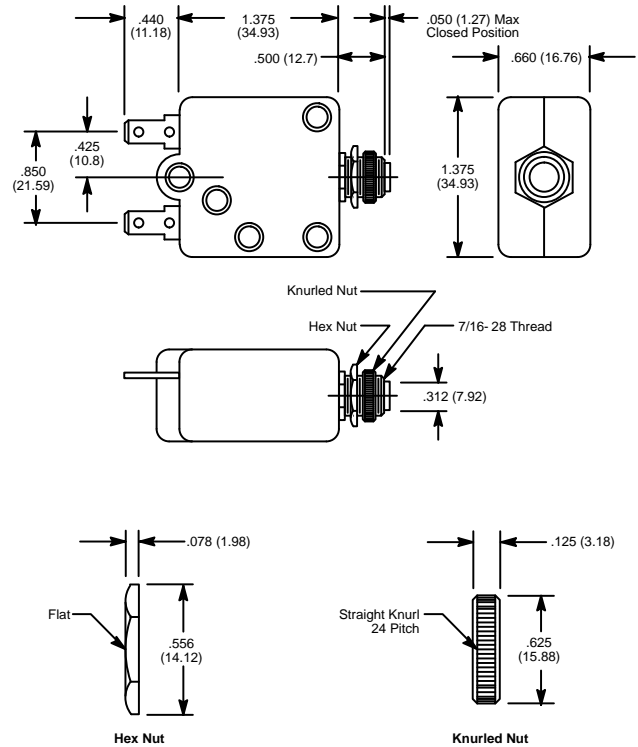


NTE Type No.	Current Rating Amps	Typical Resistance Ohms
R58- 1A	1.0	1.35
R58- 2A	2.0	0.32
R58- 3A	3.0	0.18
R58- 4A	4.0	0.10
R58- 5A	5.0	0.026
R58- 6A	6.0	0.026
R58- 7A	7.0	0.020
R58- 8A	8.0	0.020
R58- 10A	10.0	0.014
R58- 12A	12.0	0.010
R58- 15A	15.0	0.010
R58- 20A	20.0	0.006
R58- 25A	25.0	0.005
R58- 30A	30.0	0.004

Trip Times

1 to 4 Amp Types		5 to 35 Amp Types	
Rated Load	Trip Times	Rated Load	Trip Times
100%	No Trip	100%	No Trip
145%	Trip in 1 Hour	145%	Trip in 1 Hour
200%	10 to 45 Sec.	200%	6.0 to 30 Sec.
400%	3.0 to 14.0 Sec.	400%	1.6 to 4.5 Sec.
600%	1.4 to 7.0 Sec.	600%	0.60 to 1.7 Sec.
800%	0.75 to 4.3 Sec.	800%	0.25 to 0.90 Sec.
1000%	0.50 to 3.4 Sec.	1000%	0.15 to 0.65 Sec.

D40



Electrical Specifications

Electrical Characteristics (@ 25°C)

Calibration: Will continuously carry 100% of rating. May trip between 101% and 144%, but must trip at 145% of rating at +25°C

Maximum Operating Voltages: 50 VDC; 250 VAC, @ 50/60 Hz

Dielectric Strength: 1500VAC RMS

Resettable Overload Capacity: Ten times rated current

Interrupt Capacity:

- 2000 Amps at 50 VDC
- 1000 Amps at 250 VAC

Mechanical Characteristics

Termination: .250 (6.35) Quick Connect Terminals

NOTE: Soldering to terminals is not recommended.

Shock: Withstands to 10 g

Endurance Cycling: Over 1000 cycles at 200% of rated load.

Vibration: Withstands to 10 g at 10 to 55 Hz.

Weight: Less than 1.5 ozs. (42.5 g)

NOTE: 30A devices NOT UL or CSA.

R59 Series Thermal Circuit Breaker

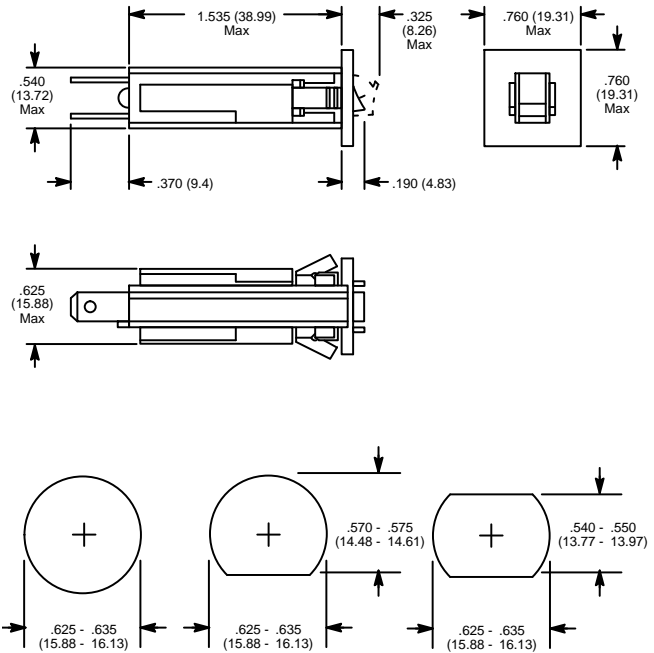


Features

- Replaces Slow Blow Glass Cartridge Fuse
- .250" (6.35mm) Quick Connect Terminals
- Snap- In Mounting
- Visual Trip Indicator
- Push Button to Reset Breaker



D41



Recommended Panel Cutouts
Recommended Panel Thickness: .032 - .062 (.813 - 1.574)

NTE Type No.	Current Rating Amps	Typical Resistance Ohms
R59-0.25A	0.25	14.0
R59-0.5A	0.50	3.55
R59-1A	1.0	0.89
R59-2A	2.0	0.17
R59-3A	3.0	0.069
R59-4A	4.0	0.043
R59-5A	5.0	0.030
R59-6A	6.0	0.026
R59-7A	7.0	0.017
R59-8A	8.0	0.016
R59-10A	10.0	0.011
R59-12A	12.0	0.009
R59-15A	15.0	0.007
R59-20A	20.0	0.007

Trip Times

0.25 to 2 Amp Types		3.0 to 20 Amp Types	
Rated Load	Trip Times	Rated Load	Trip Times
100%	No Trip	100%	No Trip
175%	Trip in 1 Hour	135%	Trip in 1 Hour
200%	4.5 to 28.0 Sec.	200%	2.2 to 15.0 Sec.
400%	1.0 to 6.5 Sec.	400%	0.55 to 1.8 Sec.
600%	0.4 to 4.0 Sec.	600%	0.27 to 0.7 Sec.
		800%	0.17 to 0.45 Sec.
		1000%	0.12 to 0.3 Sec.

Electrical Specifications

Electrical Characteristics (@ 25°C)

Calibration: Will continuously carry 100% of rating.
 0.25 to 2 Amp types: May trip between 101% and 174%, but must trip at 175% of rating within one hour at +25°C
 3.0 to 20 Amp types: May trip between 101% and 134%, but must trip at 135% of rating within one hour at +25°C

Maximum Operating Voltages: 32 VDC; 250 VAC, @ 50/60 Hz

Dielectric Strength: 1500VAC RMS

Resettable Overload Capacity:

0.25 to 2 Amp types: Six times rated current
 3.0 to 20 Amp types: Ten times rated current

Reset Time:

0.25 to 2 Amp types: 180 seconds max.
 3.0 to 20 Amp types: 10 to 60 seconds typ.

Interrupt Capacity: 1000 Amps @ 250 VAC, 50/60 Hz. and 32 VDC in accordance with UL standard 1077

Mechanical Characteristics

Termination: .250 (6.35) Quick Connect Terminals

NOTE: Soldering to terminals is not recommended.

Mounting: Snaps into panel from front
 (See Recommended Panel Cutouts)

Weight: 0.35 ozs. (10 g) approx.

Thermal Cut Off (TCO)



Features

- Maximum Current Rating: 15 Amps
- Typical Opening Temperature Tolerance: +0°C, - 5°C
- 18 Gauge Solid Copper Wire
- Full 1 1/3" leads to fit all replacement configurations
- Each device comes packaged with 2 crimp splices for solder less connection (Poly- bag orders only)
- All types meet the requirements of Underwriters Laboratories Specifications, CSA, and VDE
 - UL File No. E49429
 - UL File No. E117626 (Guide # XCMQ2)
 - C- UL File No. E117626 (Guide # XCMQ8)
 - CSA File No. LR43279
 - VDE File No. 115369

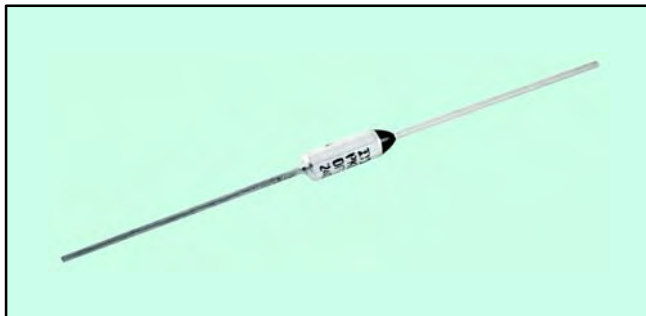
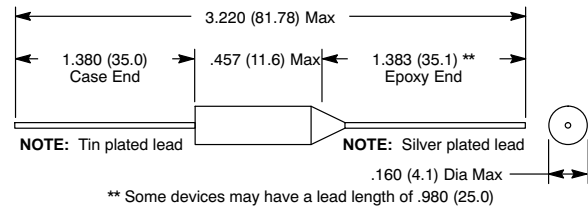


Diagram 193



Specifications

Electrical Rating Volts	Interrupting	Continuous
120/250 VAC	15A	10A
240 VAC	25A RES	16.7 RES
277 VAC	20A RES	15A RES
120-277 VAC	125VA Pilot Duty	
180 VAC	3A Motor Rating	

Twenty One Thermal Cut-offs (also known as Thermal Fuses) are now included in the NTE product line. They are miniature, NON-RESETTABLE temperature sensitive devices designed to prevent appliances and electronic equipment from overheating. NTE thermal cutoffs are UL and CSA listed.

Literally thousands of different applications have been devised for thermal-cutoffs, thus providing a large replacement market. Such applications include:

- Hair Dryers
- Irons
- Electric Motors
- Microwave Ovens
- Toasters
- Refrigerators
- Hot Plates
- Window Fans
- Popcorn Poppers
- UPS
- Battery Chargers
- Glue Guns
- Coffee Makers
- Dishwashers
- And hundreds of others

The TCO (Thermal Cut-Off) responds to temperature by interrupting an electrical circuit when the operating and/or environmental temperature exceeds the thermal rating of the device. This is accomplished when the internal organic pellet experiences a phase change, allowing the spring activated contacts to permanently open the circuit.

NTE Type No.	Diag. No.	Functioning Temperature		Holding Temperature		Maximum Temperature	
		°C	°F	°C	°F	°C	°F
8065	193	66	151	42	108	130	266
8070	193	72	162	50	122	115	239
8076	193	77	171	-	-	-	-
8081	193	84	184	60	140	125	257
8085	193	87	189	-	-	-	-
8090	193	93	200	-	-	-	-
8096	193	98	209	76	169	140	284
8098	193	100	212	-	-	-	-
8103	193	104	220	80	176	150	302
8108	193	109	229	88	190	140	284
8115	193	117	243	-	-	-	-

NTE Type No.	Diag. No.	Functioning Temperature		Holding Temperature		Maximum Temperature	
		°C	°F	°C	°F	°C	°F
8118	193	121	250	95	203	170	338
8125	193	128	263	106	223	155	311
8139	193	141	286	117	243	171	340
8149	193	152	306	128	262	176	349
8167	193	169	336	146	295	300	572
8181	193	184	364	160	320	300	572
8182	193	192	378	162	324	290	554
8213	193	216	421	191	376	241	466
8226	193	228	443	-	-	-	-
8242	193	240	464	200	392	290	554

Note 1: Temperature sensitive devices. Do not store above +48°C (+120°F).

Note 2: Color Band does not denote temperature group.

Note 3: The electrical resistance of the NTE series thermal cut-off is comparable to that found in an equal length of 18 gauge solid copper wire. With proper air flow, heat generation below 15 Amps is minimal, above 15Amps the upper limit on the current capacity will depend on the environment for each specific application.

Note 4: A general rule of thumb for continuous operating temperature for thermal cut-offs is 30°C less than the Maximum Opening Temperature.

Metal Oxide Varistor (MOV)

Features

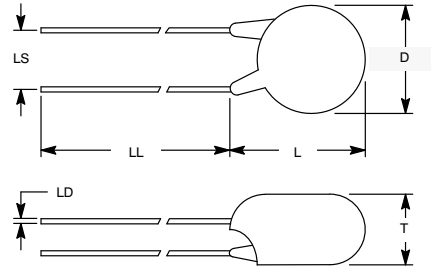
- Available in 8.5mm, 16mm, and 23mm
- Increased power dissipation
- Low leakage
- Low overshoot characteristics
- High suppression capability

Applications

- Protect equipment from external transients on AC power lines and transients on telephone/signal lines
- Protect semiconductor components from transients caused by external equipment like motors, transformers, relay coils and solenoids



Diagram 192/301/302



Dimensions (in/mm)

Diag. No.	D	L	T	LL	LS	LD
192	.945 (24.0)	1.230 (31.0)	.291 (7.4)	1.063 (27.0)	.394 (10.0)	.039 (1.0)
301	.345 (9.0)	.475 (12.07)	.235 (5.96)	1.000 (25.4)	.200 (5.08)	.024 (0.6)
302	.699 (17.75)	.787 (20.0)	.275 (7.0)	1.000 (25.4)	.315 (8.0)	.031 (0.78)

Note 1. All dimensions are "Maximum" except "LD".

Specifications

NTE Type Number	Diagram Number/ Case Diameter	Maximum Ratings (T _A = 25°C)				Characteristics		
		Continuous		Transient		Nominal Varistor Voltage @ 1mA DC Test Current (Volts)	Maximum Clamping Voltage, V _C @ Test Current (8/20µs) (Volts)	Transient Power Dissipation (Watts)
		RMS Voltage (Volts) V _m (AC)	DC Voltage (Volts) V _m (DC)	Energy (10/1000µs) (Joules) W _{TM}	Peak Current (8/20µs) (Amps) I _{TM}			
1V010	301 (8.5mm)	10	12	0.8	250	18	45	0.25
2V010	302 (16mm)	10	12	3.5	1000	18	45	0.60
1V014	301 (8.5mm)	14	18	1.2	250	22	55	0.25
2V014	302 (16mm)	14	18	4.0	1000	22	55	0.60
1V015	301 (8.5mm)	15	20	1.0	250	24	52	0.25
2V015	302 (16mm)	15	20	4.5	1000	24	48	0.60
1V017	301 (8.5mm)	17	22	1.3	250	27	60	0.25
2V017	302 (16mm)	17	22	5.0	1000	27	60	0.60
1V020	301 (8.5mm)	20	26	1.5	250	33	70	0.25
2V020	302 (16mm)	20	26	6.0	1000	33	70	0.60
1V025	301 (8.5mm)	25	31	1.7	250	39	80	0.25
2V025	302 (16mm)	25	31	7.0	1000	39	80	0.60
1V030	301 (8.5mm)	30	38	2.3	250	47	95	0.25
2V030	302 (16mm)	30	38	8.5	1000	47	95	0.60
1V035	301 (8.5mm)	35	45	2.7	250	56	110	0.25
2V035	302 (16mm)	35	45	10.0	1000	56	110	0.60
1V040	301 (8.5mm)	43	55	3.2	250	68	135	0.25
2V040	302 (16mm)	43	55	13.0	1000	68	135	0.60
1V050	301 (8.5mm)	52	66	4.0	250	82	150	0.25
2V050	302 (16mm)	52	66	14.0	1000	82	150	0.60
1V060	301 (8.5mm)	63	80	6.0	1200	100	175	0.25
2V060	302 (16mm)	63	80	18.0	4500	100	175	0.60
1V075	301 (8.5mm)	75	95	5.0	1200	120	205	0.25
2V075	302 (16mm)	75	95	21.0	4500	120	205	0.60

Metal Oxide Varistor (MOV) (Continued)

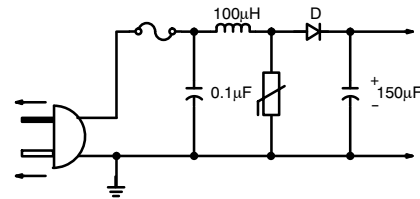
Specifications (Cont'd)

NTE Type Number	Diagram Number/ Case Diameter	Maximum Ratings ($T_A = 25^\circ\text{C}$)				Characteristics		
		Continuous		Transient		Nominal Varistor Voltage @ 1mA DC Test Current (Volts)	Maximum Clamping Voltage, V_C @ Test Current (8/20 μs) (Volts)	Transient Power Dissipation (Watts)
		RMS Voltage (Volts)	DC Voltage (Volts)	Energy (10/1000 μs) (Joules)	Peak Current (8/20 μs) (Amps)			
		V_m (AC)	V_m (DC)	W_{TM}	I_{TM}	V_{NOM}	V_{CL}	P_D
1V095	301 (8.5mm)	95	125	7.0	1200	150	250	0.25
2V095	302 (16mm)	95	125	29.0	4500	150	250	0.60
1V115	301 (8.5mm)	115	150	10.0	1200	171	295	0.25
2V115	302 (16mm)	115	150	35.0	4500	171	300	0.60
1V130	301 (8.5mm)	135	180	10.0	1200	216	355	0.25
2V130	302 (16mm)	135	180	39.0	4500	216	355	0.60
524V13	192 (23mm)	135	180	72.0	6500	216	355	1.00
1V150	301 (8.5mm)	160	210	10.0	1200	240	410	0.25
2V150	302 (16mm)	160	210	40.0	4500	240	410	0.60
524V15	192 (23mm)	160	210	80.0	6500	240	410	1.00
1V175	301 (8.5mm)	170	225	12.0	1200	270	450	0.25
524V17	192 (23mm)	170	225	90.0	6500	270	450	1.00
1V250	301 (8.5mm)	240	320	20.0	1200	390	630	0.25
2V250	302 (16mm)	240	320	70.0	4500	390	630	0.60
524V25	192 (23mm)	240	320	129.0	6500	390	630	1.00
1V275	301 (8.5mm)	260	330	20.0	1200	430	685	0.25
2V275	302 (16mm)	260	330	72.0	4500	430	685	0.60
524V27	192 (23mm)	260	330	135.0	6500	430	685	1.00
1V300	301 (8.5mm)	280	370	22.0	1200	470	740	0.25
2V300	302 (16mm)	280	370	79.0	4500	470	740	0.60
524V30	192 (23mm)	280	370	149.0	6500	470	740	1.00
2V420	302 (16mm)	420	560	90.0	4500	680	1110	0.60
524V42	192 (23mm)	420	560	160.0	6500	680	1110	1.00
2V480	302 (16mm)	480	640	105.0	4500	750	1240	0.60
524V48	192 (23mm)	480	640	180.0	6500	750	1240	1.00

SELECTING THE PROPER MOV VOLTAGE RATING:

1. **Determine the required voltage rating.**

First, the maximum steady-state operating voltage of the circuit must be determined. Care must be taken to use the upper tolerance limit of the voltage source, e.g., for a 220VAC line, a 10% high line condition should be assumed, resulting in 242 Volts. Once the level is determined, refer to the column in the data table headed "Maximum Continuous Voltage" and select a group having the nearest greater value to this level.



Typical Power Supply Circuit

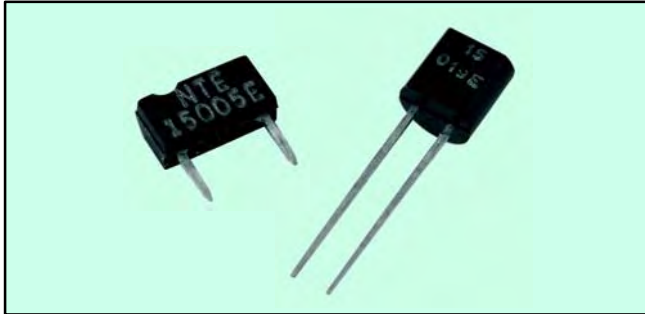
IC Protector (ICP)

Features

- Precise and extremely stable cut-off characteristics
- Small internal resistance with low voltage drop
- Nonflammable
- Compact
- Available in both "F" and "N" Types

Applications

- Overcurrent protection



The IC Protector (ICP) is an overcurrent protection device having stable and high-speed circuit tripping characteristics which enables these devices to shut off the circuit quickly and safely. This quick shut-off response protects valuable semiconductor devices and circuits from common load short-circuit failures.

Specifications

NTE Type Number	Diagram Number	Case Style	Maximum Rated Voltage (Volts)	Maximum Rated Current (Amps)	Typical Internal Resistance (Ω)	Operating Temperature ($^{\circ}\text{C}$)	Storage Temperature ($^{\circ}\text{C}$)
						T_{opr}	T_{stg}
15005E	480	"F" Type	50	0.4	0.220	- 55 to +125	- 55 to +125
15006E	480	"F" Type	50	0.6	0.135	- 55 to +125	- 55 to +125
15007E	480	"F" Type	50	0.8	0.100	- 55 to +125	- 55 to +125
15008E	480	"F" Type	50	1.0	0.070	- 55 to +125	- 55 to +125
15009E	480	"F" Type	50	1.5	0.042	- 55 to +125	- 55 to +125
15019E	481	"N" Type	50	0.25	0.350	- 55 to +125	- 55 to +125
15020E	481	"N" Type	50	0.4	0.220	- 55 to +125	- 55 to +125
15021E	481	"N" Type	50	0.6	0.135	- 55 to +125	- 55 to +125
15022E	481	"N" Type	50	0.8	0.100	- 55 to +125	- 55 to +125
15023E	481	"N" Type	50	1.0	0.070	- 55 to +125	- 55 to +125

Diagram 480

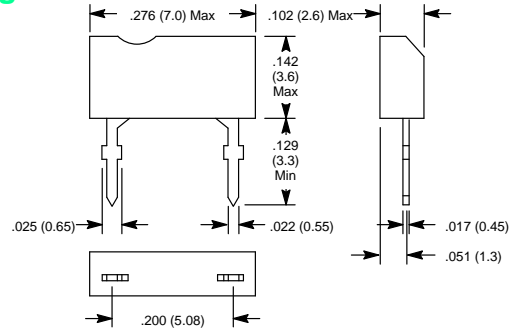


Diagram 481

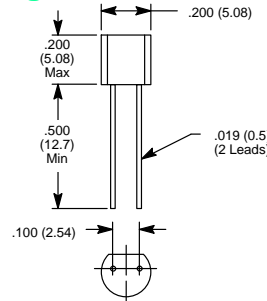
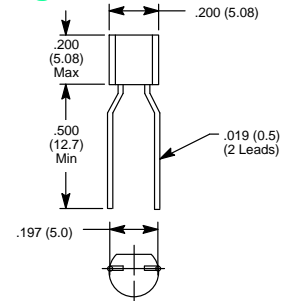


Diagram 481 alt.



Unidirectional Overvoltage Transient Suppressors

Features

- Axial Lead Package
- DC Unidirectional Surge Clamping Diodes

Applications

- Transient Protection for 5.0V, TTL, DTL, and MOS Circuitry

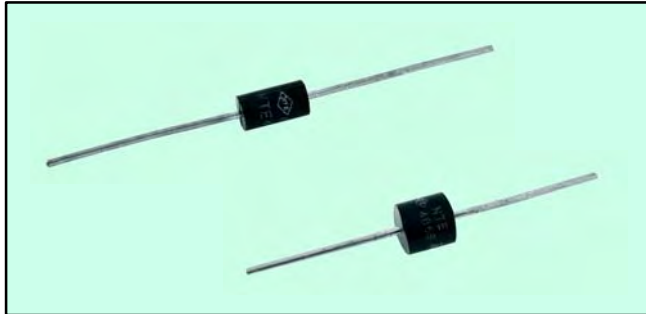


Diagram 182

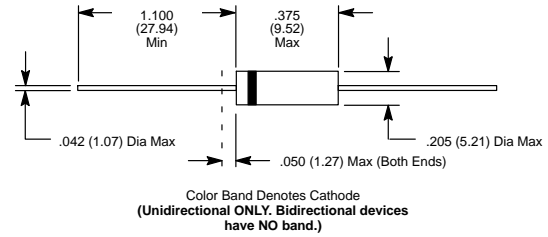
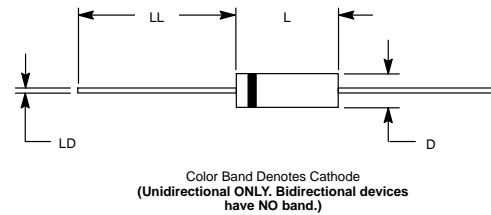


Diagram 183/596



Dimensions (in/mm)

Diag. No.	D	L	LL	LD
183	.205 (5.21)	.375 (9.52)	1.100 (27.94)	.042 (1.07)
596	.360 (9.1)	.360 (9.1)	1.100 (27.94)	.052 (1.3)

Note 1. All dimensions are "Maximum" except "LL" (Minimum).

Specifications

(1500 Watts of Peak Pulse Power Dissipation @ +25°C for 1msec)

NTE Type Number	Application	Diagram Number	Maximum Reverse Stand Off Voltage (See Note 1) (Volts)	Maximum Reverse Leakage Current @ V_R (μA)	Minimum Breakdown Voltage @ 1mA (Volts)	Maximum Clamping Voltage @ I_{PP}/I_{RSM} (Volts)		
			V_R	I_R	B_V	V_C		
4900	Transient Protection for 5.0V TTL, DTL and MOS Circuitry	182	5	300	6	$I_{PP} = 30A$	$I_{PP} = 60A$	$I_{RSM} = 120A$
						7.6	8.0	8.5

NTE Type Number	Diagram Number	Maximum Reverse Stand Off Voltage (Volts)	Breakdown Voltage @ I_T (Volts)				Maximum Ratings			Temperature Coefficient of $BV\%/^{\circ}C$
			V_{BR}				V_C	I_R	I_{PP}	
			Min	Typ	Max	I_T mA				
4902	183	5.80	6.45	6.80	7.14	10.0	10.5	1000.0	143.00	0.057
4904	183	6.40	7.13	7.50	7.88	10.0	11.3	500.0	132.00	0.061
4906	183	7.02	7.79	8.20	8.61	10.0	12.1	200.0	124.00	0.065
4910	183	8.55	9.50	10.00	10.50	1.0	14.5	10.0	103.00	0.073
4914	183	10.20	11.40	12.00	12.60	1.0	16.7	5.0	90.00	0.078
4918	183	11.10	12.40	13.00	13.70	1.0	18.2	5.0	82.00	0.081
4920	183	12.80	14.30	15.00	15.80	1.0	21.2	5.0	71.00	0.084
4922	183	13.60	15.20	16.00	16.80	1.0	22.5	5.0	67.00	0.086
4926	183	15.30	17.10	18.00	18.90	1.0	25.2	5.0	59.50	0.088
4928	183	17.10	19.00	20.00	21.00	1.0	27.7	5.0	54.00	0.090
4932	183	20.50	22.80	24.00	25.20	1.0	33.2	5.0	45.00	0.094
4934	183	23.10	25.70	27.05	28.40	1.0	37.5	5.0	40.00	0.096
4936	183	25.60	28.50	30.00	31.50	1.0	41.4	5.0	36.00	0.097
4938	183	28.20	31.40	33.00	34.70	1.0	45.7	5.0	33.00	0.098
4940	183	30.80	34.20	36.00	37.80	1.0	49.9	5.0	30.00	0.099
4942	183	33.30	37.10	39.00	41.00	1.0	53.9	5.0	28.00	0.100
4944	183	36.80	40.90	43.00	45.20	1.0	59.3	5.0	25.30	0.101

Note 1: A Transient Suppressor is usually selected according to the "Reverse Stand Off Voltage (V_R)" which should be equal to or greater than the DC or continuous peak operating voltage level.

Note 2: Steady State Power Dissipation is 5 Watts. Forward Surge Current is 200 Amps. Storage & Operating Temperature Range is -65°C to +175°C.

Unidirectional Overvoltage Transient Suppressors

Specifications (Cont'd)

(1500 Watts of Peak Pulse Power Dissipation @ +25°C for 1msec)

NTE Type Number	Diagram Number	Maximum Reverse Stand Off Voltage (Volts)	Breakdown Voltage @ I _T (Volts)				Maximum Ratings			Temperature Coefficient of BV%/°C
							Clamping Voltage @ I _{pp} (1msec) (Volts)	Reverse Leakage Current @ V _R (μA)	Peak Pulse Current (Amps)	
							V _C	I _R	I _{pp}	
		V _R	V _{BR}							
4946	183	40.20	44.70	47.00	49.40	1.0	64.8	5.0	23.20	0.101
4950	183	43.60	48.50	51.05	53.60	1.0	70.1	5.0	21.40	0.102
4952	183	47.80	53.20	56.00	58.80	1.0	77.0	5.0	19.50	0.103
4954	183	53.00	58.90	62.00	65.10	1.0	85.0	5.0	17.70	0.104
4958	183	58.10	64.60	68.00	71.40	1.0	92.0	5.0	16.30	0.104
4960	183	64.10	71.30	75.00	78.80	1.0	103.0	5.0	14.60	0.105
4962	183	70.10	77.90	82.00	86.10	1.0	113.0	5.0	13.30	0.105
4964	183	77.80	86.50	91.00	95.50	1.0	125.0	5.0	12.00	0.106
4966	183	85.50	95.00	100.00	105.00	1.0	137.0	5.0	11.00	0.106
4968	183	94.00	105.00	110.00	116.00	1.0	152.0	5.0	9.90	0.107
4970	183	102.00	114.00	120.00	126.00	1.0	165.0	5.0	9.10	0.107
4972	183	111.00	124.00	130.00	137.00	1.0	179.0	5.0	8.40	0.107
4974	183	121.00	135.00	150.00	165.00	1.0	215.0	5.0	7.00	0.108
4976	183	136.00	152.00	160.00	168.00	1.0	219.0	5.0	6.80	0.108
4978	183	145.00	162.00	170.00	179.00	1.0	234.0	5.0	6.40	0.108
4980	183	154.00	171.00	180.00	189.00	1.0	246.0	5.0	6.10	0.108
4982	183	185.00	209.00	220.00	231.00	1.0	328.0	5.0	4.60	0.109
4984	183	214.00	237.00	250.00	263.00	1.0	344.0	5.0	5.00	0.109
4988	183	171.00	190.00	200.00	210.00	1.0	274.0	5.0	5.50	0.108
4990	183	256.00	285.00	300.00	315.00	1.0	414.0	5.0	3.58	0.110
4992	183	273.00	304.00	320.00	336.00	1.0	438.0	5.0	4.50	0.110
4994	183	300.00	333.00	350.00	368.00	1.0	482.0	5.0	3.08	0.110
4996	183	342.00	380.00	400.00	420.00	1.0	548.0	5.0	2.78	0.110
4998	183	376.00	418.00	440.00	462.00	1.0	603.0	5.0	3.50	0.110

(5000 Watts of Peak Pulse Power Dissipation @ +25°C for 1msec)

NTE Type Number	Diagram Number	Maximum Reverse Stand Off Voltage (Volts)	Breakdown Voltage @ I _T (Volts)				Maximum Ratings			Temperature Coefficient of BV%/°C
							Clamping Voltage @ I _{pp} (1msec) (Volts)	Reverse Leakage Current @ V _R (μA)	Peak Pulse Current (Amps)	
							V _C	I _R	I _{pp}	
		V _R	V _{BR}							
			Min	Typ	Max	I _T mA				
4828	596	15.0	16.7	-	20.4	5.0	24.4	10.0	206.00	0.094
4840	596	24.0	26.7	-	29.5	5.0	38.9	10.0	128.00	0.101
4846	596	30.0	33.3	-	36.8	5.0	48.4	10.0	103.00	0.103
4848	596	33.0	36.7	-	40.6	5.0	53.3	10.0	94.00	0.104
4850	596	36.0	40.0	-	44.2	5.0	58.1	10.0	85.00	0.104
4858	596	48.0	53.3	-	58.9	5.0	77.4	10.0	65.00	0.106
4868	596	64.0	71.1	-	78.6	5.0	103.0	10.0	49.00	0.108

Note 1: A Transient Suppressor is usually selected according to the "Reverse Stand Off Voltage (V_R)" which should be equal to or greater than the DC or continuous peak operating voltage level.

Note 2: Steady State Power Dissipation is 5 Watts. Forward Surge Current is 200 Amps. Storage & Operating Temperature Range is -65°C to +175°C.

Bidirectional Overvoltage Transient Suppressors

Features

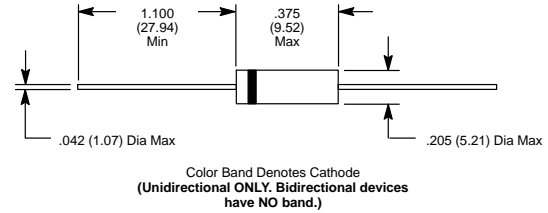
- Axial Lead Package
- AC Bidirectional Surge Clamping Diodes

Applications

- Bidirectional Transient Protection of Data Transmission, Digital Controls, Computer Systems, etc.



Diagram 183



Specifications

(1500 Watts of Peak Pulse Power Dissipation @ +25°C for 1msec)

NTE Type Number	Application	Diagram Number	Minimum Breakdown Voltage (Volts @ mA)		Maximum Reverse Stand-Off Voltage (Note 1) (Volts)	Maximum Reverse Leakage Current @ V_{RWM} (μ A)	Maximum Reverse Surge Current (Amps)	Maximum Clamping Voltage @ I_{RSM} (Volts)	Temperature Coefficient of BV%/°C
			V_{BR}	@ I_T	V_{RWM}	I_R	I_{RSM}	V_{RSM}	
4901	Transient Protection of Data Transmission, Digital Controls, Computer Systems, etc.	183	6.00	1.0	5.0	300	160	9.4	0.051

NTE Type Number	Diagram Number	Maximum Reverse Stand Off Voltage (Volts)	Breakdown Voltage @ I_T (Volts)				Maximum Ratings			Temperature Coefficient of BV%/°C
			V_{BR}				Clamping Voltage @ I_{pp} (1msec) (Volts)	Reverse Leakage Current @ V_R (μ A)	Peak Pulse Current (Amps)	
			Min	Typ	Max	I_T mA	V_C	I_R	I_{pp}	
4903	183	5.50	6.12	6.80	7.48	10.0	10.8	1000.0	139.00	0.057
4905	183	6.40	7.13	7.50	7.88	10.0	11.3	500.0	132.00	0.061
4907	183	7.02	7.79	8.20	8.61	10.0	12.1	200.0	124.00	0.065
4911	183	8.55	9.50	10.00	10.50	10.0	14.5	10.0	103.00	0.073
4915	183	10.20	11.40	12.00	12.60	1.0	16.7	5.0	90.00	0.078
4919	183	11.10	12.40	13.00	13.70	1.0	18.2	5.0	82.00	0.081
4921	183	12.80	14.30	15.00	15.80	1.0	21.1	5.0	71.00	0.084
4923	183	13.60	15.20	16.00	16.80	1.0	22.5	5.0	67.00	0.086
4927	183	15.30	17.10	18.00	18.90	1.0	25.2	5.0	59.50	0.088
4929	183	17.10	19.00	20.00	21.00	1.0	27.7	5.0	54.00	0.090
4933	183	20.50	22.80	24.00	25.20	1.0	33.2	5.0	45.00	0.094
4935	183	23.10	25.70	27.05	28.40	1.0	37.5	5.0	40.00	0.096
4937	183	25.60	28.50	30.00	31.50	1.0	36.0	5.0	41.40	0.097
4939	183	28.20	31.40	33.00	34.70	1.0	45.7	5.0	33.00	0.098
4941	183	30.80	34.20	36.00	37.80	1.0	49.9	5.0	30.00	0.099
4943	183	33.30	37.10	39.00	41.00	1.0	53.9	5.0	28.00	0.100
4945	183	36.80	40.90	43.00	45.20	1.0	59.3	5.0	25.30	0.101
4947	183	40.20	44.70	47.00	49.40	1.0	64.8	5.0	23.30	0.101
4951	183	43.60	48.50	51.05	53.60	1.0	70.1	5.0	21.40	0.102
4953	183	47.80	53.20	56.00	58.80	1.0	77.0	5.0	19.50	0.103
4955	183	53.00	58.90	62.00	65.10	1.0	85.0	5.0	17.70	0.104
4959	183	58.10	64.60	68.00	71.40	1.0	92.0	5.0	16.30	0.104
4961	183	64.10	71.30	75.00	78.80	1.0	103.0	5.0	14.60	0.105
4963	183	70.10	77.90	82.00	86.10	1.0	113.0	5.0	13.30	0.105
4965	183	77.80	86.50	91.00	95.50	1.0	125.0	5.0	12.00	0.106
4967	183	85.50	95.00	100.00	105.00	1.0	137.0	5.0	11.00	0.106

Note 1: A Transient Suppressor is usually selected according to the "Reverse Stand Off Voltage (V_R)" which should be equal to or greater than the DC or continuous peak operating voltage level.

Note 2: Steady State Power Dissipation is 5 Watts. Forward Surge Current is 200 Amps. Storage & Operating Temperature Range is -65°C to +175°C.

Bidirectional Overvoltage Transient Suppressors

Specifications (Cont'd)

(1500 Watts of Peak Pulse Power Dissipation @ +25°C for 1msec)

NTE Type Number	Diagram Number	Maximum Reverse Stand Off Voltage (Volts)	Breakdown Voltage @ I_T (Volts)				Maximum Ratings			Temperature Coefficient of BV%/°C
							Clamping Voltage @ I_{pp} (1msec) (Volts)	Reverse Leakage Current @ V_R (μ A)	Peak Pulse Current (Amps)	
							V_C	I_R	I_{pp}	
		V_R	V_{BR}							
			Min	Typ	Max	I_T mA				
4969	183	94.00	105.00	110.00	116.00	1.0	152.0	5.0	9.90	0.107
4971	183	102.00	114.00	120.00	126.00	1.0	165.0	5.0	9.10	0.107
4973	183	111.00	124.00	130.00	137.00	1.0	179.0	5.0	8.40	0.107
4975	183	128.00	143.00	150.00	158.00	1.0	207.0	5.0	7.20	0.108
4977	183	136.00	152.00	160.00	168.00	1.0	219.0	5.0	6.80	0.108
4979	183	145.00	162.00	170.00	179.00	1.0	234.0	5.0	6.40	0.108
4981	183	154.00	171.00	180.00	189.00	1.0	246.0	5.0	6.10	0.108
4983	183	185.00	209.00	220.00	231.00	1.0	328.0	5.0	4.60	0.109
4985	183	214.00	237.00	250.00	263.00	1.0	344.0	5.0	5.00	0.109
4989	183	171.00	190.00	200.00	210.00	1.0	274.0	5.0	5.50	0.108
4991	183	256.00	285.00	300.00	315.00	1.0	414.0	5.0	3.58	0.110
4993	183	273.00	304.00	320.00	336.00	1.0	438.0	5.0	4.50	0.110
4995	183	300.00	333.00	350.00	368.00	1.0	482.0	4.0	3.08	0.110
4997	183	342.00	380.00	400.00	420.00	1.0	548.0	4.0	2.78	0.110
4999	183	376.00	418.00	440.00	462.00	1.0	603.0	5.0	3.50	0.110

Note 1: A Transient Suppressor is usually selected according to the "Reverse Stand Off Voltage (V_R)" which should be equal to or greater than the DC or continuous peak operating voltage level.

Note 2: Steady State Power Dissipation is 5 Watts. Forward Surge Current is 200 Amps. Storage & Operating Temperature Range is - 65°C to +175°C.

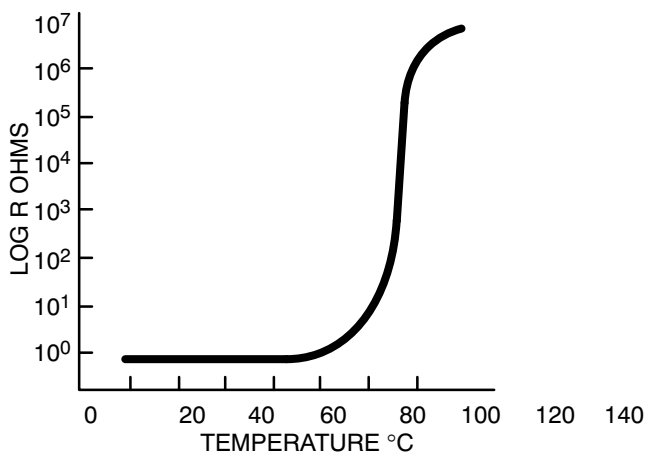
Resettable Fuse Introduction

Resettable Circuit Protection

When it comes to Polymeric Positive Temperature Coefficient (PPTC) circuit protection, you now have a choice.

Polymeric fuses are made from a conductive plastic formed into thin sheets, with electrodes attached to either side. The conductive plastic is manufactured from a non-conductive crystalline polymer and a highly conductive carbon black. The electrodes ensure even distribution of power through the device, and provide a surface for leads to be attached or for custom mounting.

The phenomenon that allows conductive plastic materials to be used for resettable overcurrent protection devices is that they exhibit a very large non-linear Positive Temperature Coefficient (PTC) effect when heated. PTC is a characteristic that many materials exhibit whereby resistance increases with temperature. What makes the polymeric conductive plastic material unique is the magnitude of its resistance increase. At a specific transition temperature, the increase in resistance is so great that it is typically expressed on a log scale.



How Polymeric Resettable Overcurrent Protectors Work

The conductive carbon black filler material in the polymeric device is dispersed in a polymer that has a crystalline structure. The crystalline structure densely packs the carbon particles into its crystalline boundary so they are close enough together to allow current to flow through the polymer insulator via these carbon "chains".

When the conductive plastic material is at normal room temperature, there are numerous carbon chains forming conductive paths through the material.

Under fault conditions, excessive current flows through the polymeric device. I^2R heating causes the conductive plastic material's temperature to rise. As this self heating continues, the material's temperature continues to rise until it exceeds its phase transformation temperature. As the material passes through this phase transformation temperature, the densely packed crystalline polymer matrix changes to an amorphous structure. This phase change is accompanied by a small expansion. As the conductive particles move apart from each other,

most of them no longer conduct current and the resistance of the device increases sharply.

The material will stay "hot", remaining in this high resistance state as long as the power is applied. The device will remain latched, providing continuous protection, until the fault is cleared and the power is removed. Reversing the phase transformation allows the carbon chains to re-form as the polymer re-crystallizes. The resistance quickly returns to its original value.

Product Selection

To select the correct polymeric circuit protection device, complete the information listed below for application, and then refer to the resettable overcurrent protector data sheets.

1. Determine the normal operating current:
_____ amps
2. Determine the maximum circuit voltage (V_{max}):
_____ volts
3. Determine the fault current (I_{max}):
_____ amps
4. Determine the operating temperature range:
Minimum Temperature: _____ °C
Maximum Temperature: _____ °C
5. Select a product family so that the maximum rating for V_{max} and I_{max} is higher than the maximum circuit voltage and fault current in the application.
6. Using the I_{Hold} vs. Temperature Table on the product family data sheet, select the polymeric device at the maximum operating temperature with an I_{Hold} greater than or equal to the normal operating current.
7. Verify that the selected device will trip under fault conditions by checking in the I_{Trip} table that the fault current is greater than I_{Trip} for the selected device, at the lowest operating temperature.
8. Order samples and test in application.

Applications

The benefits of polymeric Resettable Overcurrent Protectors are being recognized by more and more design engineers, and new applications are being discovered every day.

The use of polymeric types of devices have been widely accepted in the following applications and industries:

- Personal computers
- Laptop computers
- Personal digital assistants
- Transformers
- Small and medium electric motors
- Audio equipment and speakers
- Test and measurement equipment
- Security and fire alarm systems
- Personal care products
- Point-of-sale equipment
- Industrial controls
- Automotive electronics and harness protection
- Marine electronics
- Battery-operated toys

Polymeric PTC Resettable Fuses

Features

- Radial Leaded, High Hold Current, Solid State
- Operation Current: 100mA-9A
- Maximum Voltage: 30V
- Temperature Range: -40°C to +85°C
- Cured, Flame Retardant Epoxy Polymer Insulating Material Meets UL 94V-0

Applications

- Computers & Peripherals
- Security and Fire Alarm Systems
- General Electronics
- Loud Speakers
- Automotive Applications
- Power Transformers

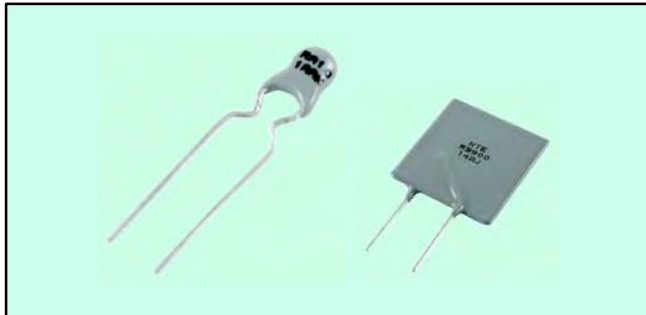


Diagram 629

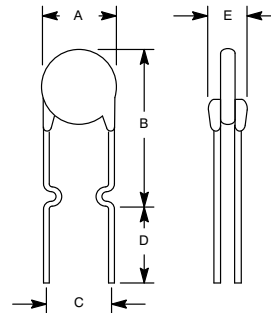
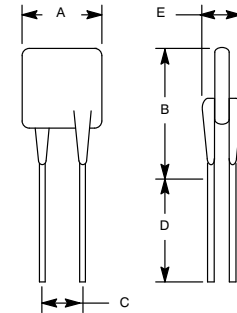


Diagram 630



NOTE: Shape changes from round to square starting with NTE16016-ECG.

Product Dimensions (Dimensions are in inches (mm))

NTE Type No.	A Max.	B Max.	C		D Min.	E Max.	Physical Characteristic		
			Nom.	Tol. ±			Diag. No.	Lead Dia.	Material
NTE16000- ECG	.290 (7.4)	.500 (12.7)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.122 (3.1)	629	.020 (0.51)	Sn/NiCu
NTE16001- ECG	.290 (7.4)	.500 (12.7)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.122 (3.1)	629	.020 (0.51)	Sn/CuFe
NTE16002- ECG	.290 (7.4)	.500 (12.7)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.122 (3.1)	629	.020 (0.51)	Sn/CuFe
NTE16003- ECG	.290 (7.4)	.500 (12.7)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.122 (3.1)	629	.020 (0.51)	Sn/CuFe
NTE16004- ECG	.290 (7.4)	.530 (13.4)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.122 (3.1)	629	.020 (0.51)	Sn/CuFe
NTE16005- ECG	.290 (7.4)	.540 (13.7)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.122 (3.1)	629	.020 (0.51)	Sn/CuFe
NTE16006- ECG	.310 (7.9)	.540 (13.7)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.122 (3.1)	629	.020 (0.51)	Sn/Cu
NTE16007- ECG	.380 (9.7)	.600 (15.2)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.122 (3.1)	629	.020 (0.51)	Sn/Cu
NTE16008- ECG	.410 (10.4)	.630 (16.0)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.122 (3.1)	629	.020 (0.51)	Sn/Cu
NTE16009- ECG	.460 (11.7)	.660 (16.7)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.122 (3.1)	629	.020 (0.51)	Sn/Cu
NTE16010- ECG	.290 (7.4)	.480 (12.2)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.120 (3.0)	630	.020 (0.51)	Sn/Cu
NTE16011- ECG	.350 (8.9)	.550 (14.0)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.120 (3.0)	629	.020 (0.51)	Sn/Cu
NTE16012- ECG	.350 (8.9)	.750 (18.9)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.120 (3.0)	629	.020 (0.51)	Sn/Cu
NTE16013- ECG	.400 (10.2)	.660 (16.8)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.120 (3.0)	629	.020 (0.51)	Sn/Cu
NTE16014- ECG	.470 (12.0)	.720 (18.4)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.120 (3.0)	629	.020 (0.51)	Sn/Cu
NTE16015- ECG	.470 (12.0)	.720 (18.3)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.120 (3.0)	630	.030 (0.81)	Sn/Cu
NTE16016- ECG	.470 (12.0)	.720 (18.3)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.120 (3.0)	630	.030 (0.81)	Sn/Cu
NTE16017- ECG	.570 (14.4)	.970 (24.8)	.200 (5.1)	.027 (0.7)	.300 (7.6)	.120 (3.0)	630	.030 (0.81)	Sn/Cu
NTE16018- ECG	.690 (17.4)	.980 (24.9)	.400 (10.2)	.027 (0.7)	.300 (7.6)	.120 (3.0)	630	.030 (0.81)	Sn/Cu
NTE16019- ECG	.760 (19.3)	1.260 (31.9)	.400 (10.2)	.027 (0.7)	.300 (7.6)	.120 (3.0)	630	.030 (0.81)	Sn/Cu
NTE16020- ECG	.870 (22.1)	1.170 (29.8)	.400 (10.2)	.027 (0.7)	.300 (7.6)	.120 (3.0)	630	.030 (0.81)	Sn/Cu
NTE16021- ECG	.960 (24.2)	1.300 (32.9)	.400 (10.2)	.027 (0.7)	.300 (7.6)	.120 (3.0)	630	.030 (0.81)	Sn/Cu
NTE16022- ECG	.960 (24.2)	1.300 (32.9)	.400 (10.2)	.027 (0.7)	.300 (7.6)	.120 (3.0)	630	.030 (0.81)	Sn/Cu

Polymeric PTC Resettable Fuses (Cont'd)

Specifications

NTE Type No.	Diag. No.	V max. Volts	I max. Amps	I _{Hold}	I _{Trip}	Initial resistance		1 Hour (R ₁) Post-Trip Resistance	Max. Time To Trip at 5*I _h	Tripped Power Dissipation
				Amperes at 23°C		Ohms at 23°C		Ohms at 23°C	Seconds at 23°C	Watts at 23°C
				Hold	Trip	Min.	Max	Max.		
16000- ECG	629	60	40	0.10	0.20	2.50	4.50	7.50	4.0	0.38
16001- ECG	629	60	40	0.17	0.34	2.00	3.20	8.00	3.0	0.48
16002- ECG	629	60	40	0.20	0.40	1.50	2.84	4.40	2.2	0.40
16003- ECG	629	60	40	0.25	0.50	1.00	1.95	3.00	2.5	0.45
16004- ECG	629	60	40	0.30	0.60	0.76	1.36	2.10	3.0	0.50
16005- ECG	629	60	40	0.40	0.80	0.52	0.86	1.29	3.8	0.55
16006- ECG	629	60	40	0.50	1.00	0.41	0.77	1.17	4.0	0.75
16007- ECG	629	60	40	0.65	1.30	0.27	0.48	0.72	5.3	0.90
16008- ECG	629	60	40	0.75	1.50	0.18	0.40	0.60	6.3	0.90
16009- ECG	629	60	40	0.90	1.80	0.14	0.31	0.47	7.2	1.00
16010- ECG	630	30	40	0.90	1.80	0.07	0.12	0.22	5.9	0.60
16011- ECG	629	30	40	1.10	2.20	0.10	0.18	0.27	6.6	0.70
16012- ECG	629	30	40	1.35	2.70	0.065	0.115	0.17	7.3	0.80
16013- ECG	629	30	40	1.60	3.20	0.055	0.105	0.15	8.0	0.90
16014- ECG	629	30	40	1.85	3.70	0.04	0.07	0.11	8.7	1.00
16015- ECG	630	30	40	2.50	5.00	0.025	0.048	0.07	10.3	1.20
16016- ECG	630	30	40	3.00	6.00	0.02	0.05	0.08	10.8	2.00
16017- ECG	630	30	40	4.00	8.00	0.01	0.03	0.05	12.7	2.50
16018- ECG	630	30	40	5.00	10.00	0.01	0.03	0.05	14.5	3.00
16019- ECG	630	30	40	6.00	12.00	0.005	0.02	0.04	16.0	3.50
16020- ECG	630	30	40	7.00	14.00	0.005	0.02	0.03	17.5	3.80
16021- ECG	630	30	40	8.00	16.00	0.005	0.02	0.03	18.8	4.00
16022- ECG	630	30	40	9.00	18.00	0.005	0.01	0.02	*20.0	4.20

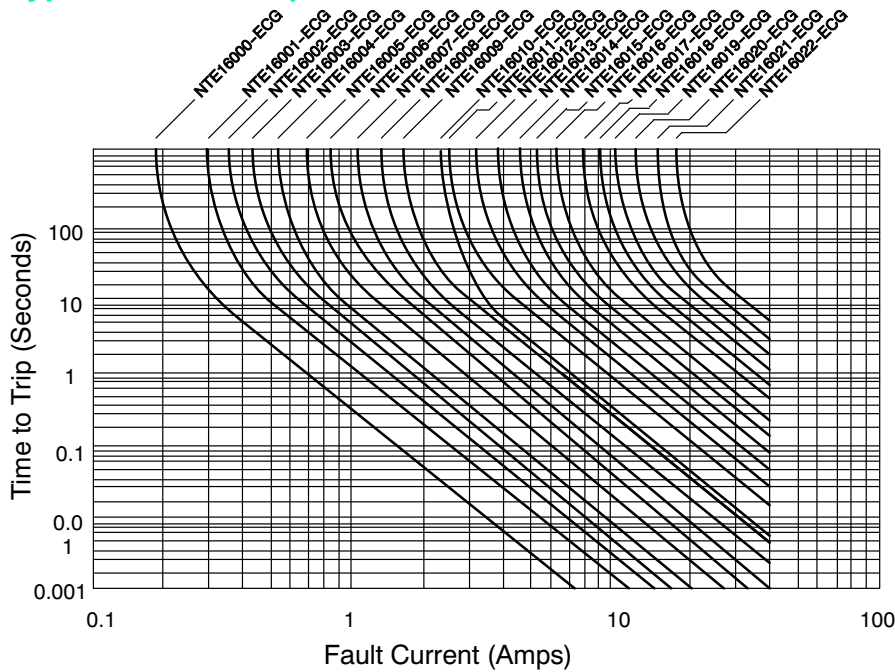
* Tested at 40 Amps.

Technical Data

Operating/Storage Temperature	-40°C to +85°C	
Maximum Device Surface Temperature in Tripped State	+125°C	
Passive Aging	+85°C, 1000 Hours	±5% Typical Resistance Change
Humidity Aging	+85°C, 85% R.H. 1000 Hours	±5% Typical Resistance Change
Thermal Shock	+125°C/-40°C 10 Times	±10% Typical Resistance Change
Mechanical Shock	MIL-STD-202, Method 213, Condition 1 (100g, 6 Seconds)	No Resistance Change
Solvent Resistance	MIL-STD-202, Method 215	No Change
Vibration	MIL-STD-883C, Method 2007.1, Condition A	No Change

Polymeric PTC Resettable Fuses (Cont'd)

Typical Time to Trip at +23°C



Thermal Derating Chart - I_{HOLD} (Amps) *

NTE Type No.	Ambient Operating Temperature								
	-40°C	-20°C	0°C	+23°C	+40°C	+50°C	+60°C	+70°C	+85°C
NTE16000- ECG	0.16	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04
NTE16001- ECG	0.26	0.23	0.20	0.17	0.14	0.12	0.11	0.09	0.07
NTE16002- ECG	0.31	0.27	0.24	0.20	0.16	0.14	0.13	0.11	0.08
NTE16003- ECG	0.39	0.34	0.30	0.25	0.20	0.18	0.16	0.14	0.10
NTE16004- ECG	0.47	0.41	0.36	0.30	0.24	0.22	0.19	0.16	0.12
NTE16005- ECG	0.62	0.54	0.48	0.40	0.32	0.29	0.25	0.22	0.16
NTE16006- ECG	0.78	0.68	0.60	0.50	0.41	0.36	0.32	0.27	0.20
NTE16007- ECG	1.01	0.88	0.77	0.65	0.53	0.47	0.41	0.35	0.26
NTE16008- ECG	1.16	1.02	0.89	0.75	0.61	0.54	0.47	0.41	0.30
NTE16009- ECG	1.40	1.22	1.07	0.90	0.73	0.65	0.57	0.49	0.36
NTE16010- ECG	1.40	1.22	1.07	0.90	0.73	0.65	0.57	0.49	0.36
NTE16011- ECG	1.60	1.43	1.27	1.10	0.91	0.85	0.75	0.67	0.57
NTE16012- ECG	1.96	1.76	1.55	1.35	1.12	1.04	0.92	0.82	0.70
NTE16013- ECG	2.32	2.08	1.84	1.60	1.33	1.23	1.09	0.98	0.83
NTE16014- ECG	2.68	2.41	2.13	1.85	1.54	1.42	1.26	1.13	0.96
NTE16015- ECG	3.63	3.25	2.88	2.50	2.08	1.93	1.70	1.53	1.30
NTE16016- ECG	4.35	3.90	3.45	3.00	2.49	2.31	2.04	1.83	1.56
NTE16017- ECG	5.80	5.20	4.60	4.00	3.32	3.08	2.72	2.44	2.08
NTE16018- ECG	7.25	6.50	5.75	5.00	4.15	3.85	3.40	3.05	2.60
NTE16019- ECG	8.70	7.80	6.90	6.00	4.98	4.62	4.08	3.66	3.12
NTE16020- ECG	10.15	9.10	8.05	7.00	5.81	5.39	4.76	4.27	3.64
NTE16021- ECG	11.60	10.40	9.20	8.00	6.64	6.16	5.44	4.88	4.16
NTE16022- ECG	13.05	11.70	10.35	9.00	7.47	6.39	6.12	5.49	4.68

* $I_{Trip} = 2 \bullet I_{Hold}$

Surge Arresters, Gas Filled

Features

- Axial Lead Package

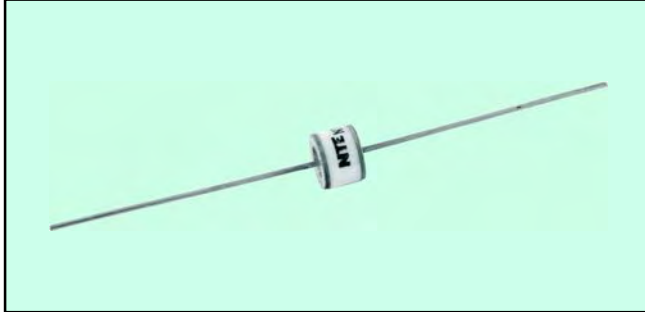
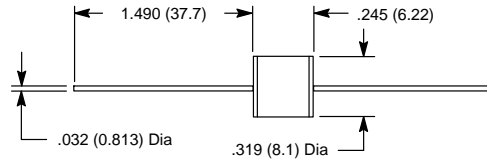


Diagram 628



Specifications

NTE Type No.	Diag. No.	DC Breakdown Voltage			Impulse Breakdown @ (100V/μs) Maximum Voltage	Maximum Capacitance Between Electronics @ 1MHz (pF)
		Nominal Voltage (VDC)	Minimum Volts	Maximum Volts		
15040- ECG	628	75	60	90	400	1.0
15041- ECG	628	90	72	108	400	1.0
15042- EGC	628	110	88	132	450	1.0
15043- ECG	628	145	116	174	500	1.0
15044- ECG	628	230	195	265	600	1.0
15045- ECG	628	300	255	345	700	1.0
15046- ECG	628	350	297	403	750	1.0
15047- ECG	628	470	400	540	850	1.0
15048- ECG	628	600	510	690	1000	1.0
15049AC	628	120VAC	225	-	700	1.0
15050AC	628	240VAC	425	-	800	1.0

Electrical Characteristics

Surge Life:

10A 10/1000μs Pulse	2500 Operations
500A 10/1000μs Pulse	1000 Operations
AC Suffix	2500 Operations

Surge Current:

8/20	20kA
------	------

AC Current:

10 Operations 60Hz for 1sec., with 3 min. Intervals	20A
AC Suffix	5A

AC Current:

11 Cycles 60Hz	20A
AC Suffix	5A

Insulation Resistance:

100 VDC	10,000 Megohms
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Operating Temperature

	- 65° to +125°C
--	-----------------

Response Time (Typical)

	< 100ns
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Typical Circuit Applications

Application	Protected Equipment	NTE Type
CATV	Trunk Amplifier	15043- ECG
	Cable Extender, Splitter, Grounding Block, Convert Box, 30 & 60 VAC Power Supply	15044- ECG
AC Line Protection	117 VAC Line	15049AC
	220 VAC Line, All AC Loads	15050AC
Communication	Modem	15046- ECG
	Antenna Connected Equipment	15041- ECG, 15043- ECG, 15044- ECG
Power Supplies	Voltage Doubler, Capacitors, Voltage Regulator, Rectifier Diodes	15044- ECG, 15047- ECG
Computer	Data Lines	15041- ECG, 15044- ECG
Test Equipment	Meter Inputs	15040- ECG, 15045- ECG
Capacitive Discharge	Ignition Circuit Components, Pulse Generator Components	15044- ECG, 15046- ECG
Signal Lines (Single Ended)	Alarm Circuits	15040- ECG
Communications (Lightning)	Telephone Line (Normal Mode)	15046- ECG
Power Line (Lightning)	AC Wall Output (Long Branch Circuit) 120 VAC	15049AC
	AC Wall Output (Long Branch Circuit) 120 VAC	15050AC
Process Control (24 MA Signal Loop)	Instrumentation Circuits	15040- ECG, 15041- ECG

SIDAC - Bidirectional Thyristor Diodes

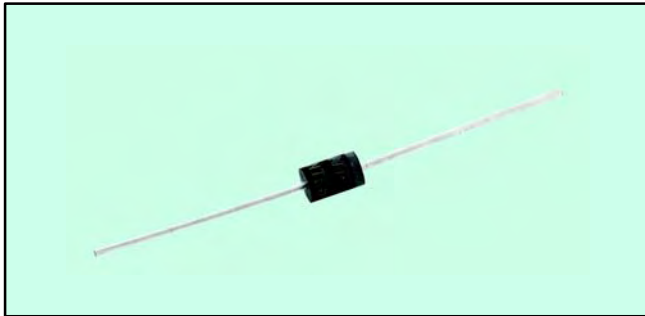
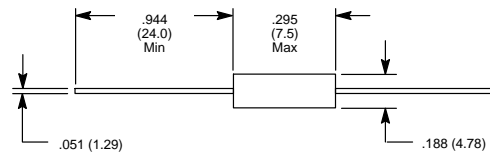
Features

- Axial Lead Package

Applications

- High voltage lamp ignitors
- Natural gas ignitors
- Gas oil ignitors
- High voltage power supplies
- Xenon ignitors
- Overvoltage protection
- Pulse generators
- Fluorescent lighting ignitors

Diagram 395



The SIDAC is a silicon bilateral voltage triggered switch with greater power handling capabilities than standard DIACs. Upon application of a voltage exceeding the SIDAC breakover voltage point, the SIDAC switches on through a negative resistance region to a low on-state voltage. Conduction will continue until the current is interrupted or drops below the minimum holding current of the device.

Specifications

Storage Temperature Range: -30° to +30°C

Junction Temperature: +125°C

NTE Type Number	Diagram Number	Breakover Voltage (Volts)	Maximum Ratings			Holding Current (mA)	Power Dissipation (mW)
			On Voltage (Volts)	Effective Current (Amps)	Surge Current (Amps)		
			V_{BO}	V_T	I_{TRMS}		
6415	395	40 to 60	1.5	1	13	50	850
6416	395	55 to 65	1.5	1	13	50	850
6417	395	95 to 113	1.5	1	13	50	850
6418	395	104 to 118	1.5	1	13	50	850
6419	395	110 to 125	1.5	1	13	50	850

SEMICONDUCTORS

POTENTIOMETERS

RELAYS

RESISTORS



SWITCHES

SOLDER IRON TIPS



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- Electronics Contact Cleaners with Lubes
- Heavy-Duty Flux Removers
- Jet Air Cleaners
- Heavy-Duty Cleaning Solvents
- Electronics Washes
- Hydroentangled Cellulose/Polyester C-Fold Wipes
- Silicone Lubricants
- Label and Adhesive Removers
- General Duty Defluxers
- Straw Holders
- Computer Glass and Plastic Cleaner
- CARB Compliant Types

ECG Butane/Electric Soldering and Heat Products

- Butane Fuel
- Butane Soldering Irons
- Butane Heat Guns
- Butane Torch
- Electric Corded Soldering Irons
- Electric De-soldering Irons
- Tips and Accessories
- Soldering Iron Kits
- Soldering Guns
- Industrial Heat Guns
- Economy Heat Guns

ECG LED Flashlights

- Emerge™ N See Wind Up Flashlight
- LED Flashlight with 14 Super Bright LEDs

ECG Rotors

- Precision Cut Steel Gears
- Rugged One-Piece Cast Aluminum Housing
- Large Bearing Surface; Strong Reinforced Mast
- High Torque
- Automatic Control
- Remote Control Programmable Version

ECG Surge Suppressor Outlet Strips

- Plug-in Protection for Office, Industrial, Institutional and Residential Applications
- Multi-Outlet Combinations
- Steel or Plastic Case
- Optional Phone-Line Protection
- General Purpose Protector
- Optional EMF/RFI Noise Filter
- Single and 3 Mode Protection
- 90° Rotated Outlets to Accommodate External Power Supplies
- Some with 15' Cords

ECG Test Equipment

- Analog Multimeters
- Digital Multimeters
- AC Clamp-On Digital Meters
- AC Clamp-On Current Adapter
- Digital Capacitance Meter
- Battery Tester
- Handheld Digital Thermometer
- Logic Probes
- Oscilloscope Probes
- Test Leads
- Digital Infrared Thermometer

NTE Cable Ties

- Standard Cable Ties
- Specialty Cable Ties
- Cable Tie Tension Tools
- Cable Tie Accessories
- Convenience Packs
- Split Loom
- Assorted Sizes & Colors

NTE Capacitors

- Aluminum Electrolytic
- Ceramic Disc
- Tantalum
- Mylar/Polyester Film
- Motor Start/Run
- Ceiling Fan
- Snap-in Mount
- Surface Mount Types
- Multilayer (Monolithic) Ceramic
- Prepackaged Kits

NTE Fuses

- Tube Type Case Sizes
3.6 x 10mm / 5 x 20mm / 6 x 30mm
- Glass and Ceramic
- Fast and Slow Blow
- Standard and Mini Automotive Blade Series
- Fuse Clips
- * Panel Mount Holders

NTE Heat Shrink Tubing

- Assortment Packs Available
- Thin Wall Cross-Linked Polyolefin
- Dual Wall Cross-Linked Polyolefin with Adhesive
- Medium Wall with Adhesive
- Thick Wall with Adhesive
- Available in 7 Colors
- Shrink Temperature: 120°C
- Shrink Ratio: 2:1Thin/3:1 Dual
- Cut / Marked Service

NTE Hook-Up Wire

- Automotive Wire
- 300V and 600V Solid and Stranded Wire
- Teflon® Coated Wire
- Speaker Wire Clear
- Black/Red Bonded Speaker Wire
- 10 Colors and Gauges from 10 to 26
- New High Performance Home Audio Speaker Cable
- Audio Speaker Cable

NTE LED Tubing

- For Interior Lighting
- Super Bright LEDs
- Blue, Green, Red, White, Amber, Multi
- Flexible
- Connectible - Up to 15 Tubes

NTE Relays

- Electromechanical
- Solid State
- Automotive Type
- Reed
- Time Delay
- I/O Modules
- Thermal Circuit Breakers
- Magnetic Latching
- Accessories
- Surface Mount Types
- Replacements for Over 83,400 Types
- Proximity Switches

NTE Resistors

- Flameproof 1/8W to 3W
- Power Wirewound 5W/10W/25W
- Fusible Power Oxide 1W/2W
- Prepackaged Kits
- Surface Mount Wirewound up to 4 Watt
- Metal Clad Aluminum Precision Wirewound
- 1% Metal Film
- Fixed & Adjustable Vitreous from 12 to 300 Watt
- Round Silicone Wirewound Ceramic from 1 to 10 Watt

NTE Semiconductors

- Super Bright LEDs
- Power Block/Hybrid Mod.
- Industrial Rectifiers/Bridges
- Small Signal/Power Transistors
- Voltage Regulators
- Transient Suppressors
- Thermal Cutoffs
- Thyristors
- Zener Diodes
- Integrated Circuits
- Surface Mount Types
- Replacements for Almost 400,000 Industry Types

NTE Switches

- Bat Handle
- Toggle and Mini-toggle
- Paddle
- Rocker
- Metal and Nylon Pushbutton
- Snap Action
- Sealed Automotive/Marine Types
- Anti-vandal
- Round Hole Rocker
- Pull Chain
- Waterproof

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