# Raychem Circuit Protection Products
# Gas Discharge Tubes

Tyco Electronics

Our commitment. Your advantage.

Raychem GDTs (Gas Discharge Tubes) are placed in front of, and in parallel with, sensitive telecom equipment such as power lines, communication lines, signal lines and data transmission lines to help protect them from damage caused by transient surge voltages that may result from lightning strikes and equipment switching operations. These devices do not influence the signal in normal operation. However, in the event of an overvoltage surge, such as a lightning strike, the GDT switches to a low impedance state and diverts the energy away from the sensitive equipment.

Raychem GDTs offer a high level of surge protection, a broad voltage range, low capacitance, and many form factors including new surface mount devices, which makes them suitable for applications such as MDF (Main Distribution Frame) modules, high data-rate telecom applications (e.g. ADSL, VDSL), and surge protection on power lines. Their low capacitance also results in less signal distortion. When used in a coordinated circuit protection solution with PolySwitch devices, SiBar thyristor surge protection devices, and MOV (Metal Oxide Varistor) devices, they can help equipment manufacturers meet stringent safety regulatory standards.

## Benefits

- Helps provide overvoltage fault protection against high energy surges
- Suitable for sensitive equipment due to impulse sparkover response
- Suitable for high-frequency applications
- Highly reliable performance
- **New surface-mount devices for automated manufacturing**

## Features

- RoHS compliant
- Halogen free
  (refers to: Br≤900ppm, Cl≤900ppm, Br+Cl≤1500ppm)
- Wide range of voltages (75V-600V)
- Wide range of form factors
  (3mm, 5mm, 6mm, 7mm, 8mm diameter devices)
- Low capacitance and insertion loss
- Crowbar device with low arc voltage
- High accuracy spark-over voltages for high precision designs
- Devices tested per ITU K.12 recommendations
- Various lead configurations and surface-mount options
- Optional fail-short mechanism
- Non radioactive materials

## Applications

- Telecommunications
  - MDF modules, xDSL equipment, RF system protection, antenna, base stations
- Industrial and Consumer electronics, such as
  - Power supplies, surge protectors, alarm systems, irrigation systems

**Figure G1** Two electrode devices for ungrounded circuits

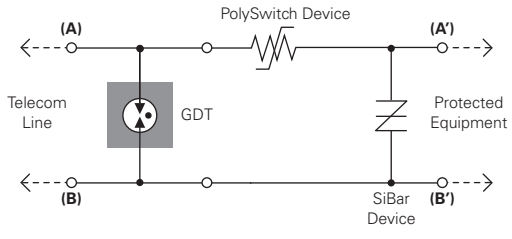
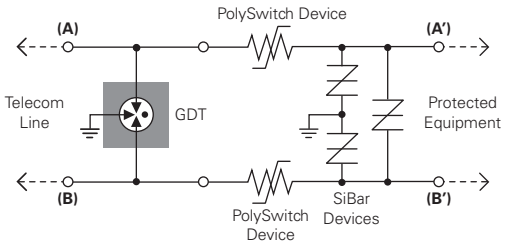



**Figure G2** Three electrode devices for grounded circuits




RoHS Compliant, ELV Compliant  HF Halogen Free

## Table G1 Device Voltage Ratings

| Part Number | DC Sparkover Voltage @ 100V/s ± 20% Tolerance | Impulse Sparkover Voltage @ 1kV/µs |
|---|---|---|
| GTCS23-XXXM-R01 | 75* | 600 |
| | 90 | 600 |
| | 140 | 600 |
| | 150 | 600 |
| | 200 | 700 |
| | 230 | 700 |
| | 300 | 900 |
| | 350 | 1000 |
| | 400 | 1000 |

* DCSO 60~105

| Part Number | DC Sparkover Voltage @ 100V/s ± 20% Tolerance | Impulse Sparkover Voltage @ 100V/µs | Impulse Sparkover Voltage @ 1kV/µs | DC Holdover Voltage Per ITU K.12 | On-State Voltage Nominal (@1A) (V) |
|---|---|---|---|---|---|
| | 75 | 450 | 550 | <52 | 20 |
| | 90 | 450 | 550 | <52 | 20 |
| | 140 | 500 | 600 | <80 | 20 |
| | 150 | 500 | 600 | <80 | 20 |
| GTCX25-XXXM-R02 | 200 | 600 | 700 | <135 | 20 |
| GTCX26-XXXM-R05 | 230 | 600 | 700 | <135 | 20 |
| GTCX28-XXXM-R05 | 250 | 600 | 700 | <135 | 20 |
| GTCX28-XXXM-R10 | 260 | 700 | 800 | <135 | 20 |
| GTCX28-XXXM-R20** | 300 | 800 | 900 | <150 | 20 |
| GTCX35-XXXM-R05 | 350 | 900 | 1000 | <150 | 20 |
| GTCX36-XXXM-R10 | 400 | 900 | 1000 | <150 | 20 |
| GTCX37-XXXM-R10 | 420 | 900 | 1000 | <150 | 20 |
| GTCX38-XXXM-R10 | 470 | 1050 | 1150 | <150 | 20 |
| | 500 | 1100 | 1200 | <150 | 20 |
| | 550 | 1300 | 1400 | <150 | 20 |
| | 600 | 1300 | 1400 | <150 | 20 |

** GTCX28-XXXM-R20 parts only up to 230V

## Table G2 Device Surge Rating, Capacitance, Insulation Resistance, and Agency Approval

| Part Number | Impulse Discharge Current 8x20µs 10 hits | Impulse Discharge Current 8x20µs 300 hits | Impulse Withstand Voltage 10x700µs 10 hits | Capacitance @ 1MHz | Insulation Resistance @ 100V† | UL Rating UL497B #E179610 |
|---|---|---|---|---|---|---|
| GTCS23-XXXM-R01 | 1kA | 100A | 4kV | <0.5pF | 1,000 (MΩ) | All Devices |

| Part Number | Impulse Discharge Current 8x20µs 10 hits | Impulse Life 10x100µs 300 hits | AC Discharge Current (1sec duration; 10 hits) @ 50 Hz | Capacitance @ 1MHz | Insulation Resistance @ 100V† | UL Rating UL497B #E179610 |
|---|---|---|---|---|---|---|
| GTCX25-XXXM-R02 | 2.5kA | 100A | 2.5Arms | <1pF | 10,000 (MΩ) | All Devices |
| GTCX26-XXXM-R05 | 5kA | 100A | 5Arms | <1pF | 10,000 (MΩ) | All Devices |
| GTCX28-XXXM-R05 | 5kA | 100A | 5Arms | <1pF | 10,000 (MΩ) | All Devices |
| GTCX28-XXXM-R10 | 10kA | 100A | 10Arms | <1pF* | 10,000 (MΩ) | All Devices |
| GTCX28-XXXM-R20 | 20kA | 100A | 20Arms | <1.5pF | 10,000 (MΩ) | All Devices |
| GTCX35-XXXM-R05 | 5kA | 100A | 5Arms | <1pF | 10,000 (MΩ) | All Devices |
| GTCX36-XXXM-R10 | 10kA | 200A | 10Arms | <1pF | 10,000 (MΩ) | All Devices |
| GTCX37-XXXM-R10 | 10kA | 200A | 10Arms | <1pF | 10,000 (MΩ) | All Devices |
| GTCX38-XXXM-R10 | 10kA | 200A | 10Arms | <1pF | 10,000 (MΩ) | All Devices |

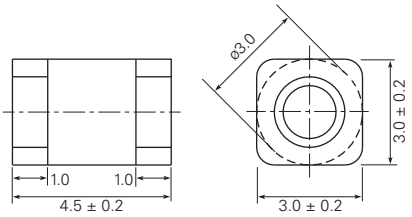
* <1.2pF for 75V and 90V devices.

† Insulation resistance measured at 50V for devices less than 90V.
Insulation resistance measured at 250V for devices more than 500V.

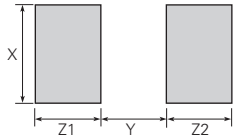
RoHS Compliant, ELV Compliant HF Halogen Free

## Figure G3 Two Electrode 3mm Product Dimensions

**Surface-mount (GTCS23-XXXM-R01)**




**Pad Layout - Surface-mount Devices (GTCS23-XXXM-R01)**

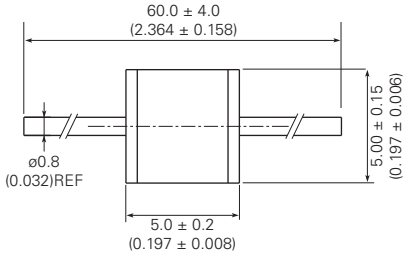



| | X NOM | Y NOM | Z1 NOM | Z2 NOM |
|---|---|---|---|---|
| mm | 3.0 | 2.0 | 2.0 | 2.0 |
| in* | (0.118) | (0.079) | (0.079) | (0.079) |

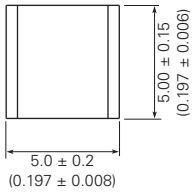
* Rounded off approximation

## Figure G4 Two Electrode 5mm Product Dimensions

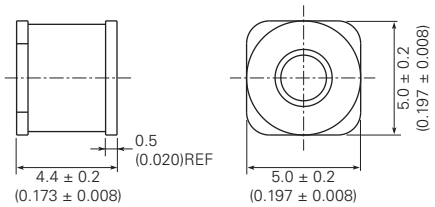
**Axial Leads (GTCA25-XXXM-R02)**



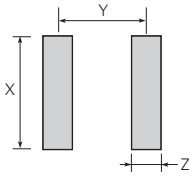

**No Leads (GTCN25-XXXM-R02)†**




**Surface-mount (GTCS25-XXXM-R02)**




**Pad Layout - Surface-mount Devices (GTCS25-XXXM-R02)**

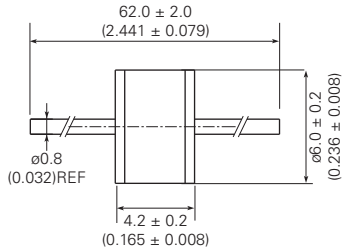



| | X NOM | Y NOM | Z NOM |
|---|---|---|---|
| mm | 6.0 | 3.9 | 1.3 |
| in* | (0.197) | (0.154) | (0.051) |

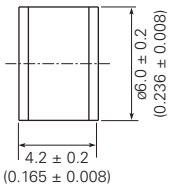
* Rounded off approximation
† Parts with no leads are non-solderable; meant for insertion into magazine clips

## Figure G5 Two Electrode 6mm Product Dimensions

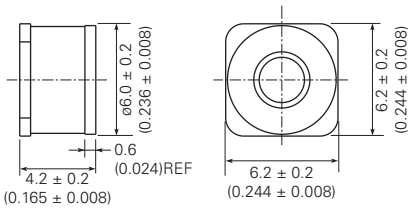
**Axial Leads (GTCA26-XXXM-R05)**



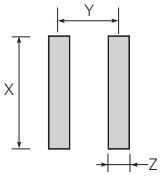

**No Leads (GTCN26-XXXM-R05)†**




**Surface-mount (GTCS26-XXXM-R05)**




**Pad Layout - Surface-mount Devices (GTCS26-XXXM-R05)**

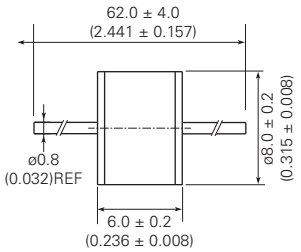



| | X NOM | Y NOM | Z NOM |
|---|---|---|---|
| mm | 7.0 | 3.7 | 1.3 |
| in* | (0.276) | (0.146) | (0.051) |

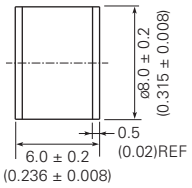
* Rounded off approximation
† Parts with no leads are non-solderable; meant for insertion into magazine clips

## Figure G6 Two Electrode 8mm Product Dimensions

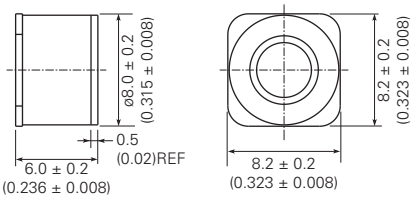
**Axial Leads (GTCA28-XXXM-R05, R10 & R20)**



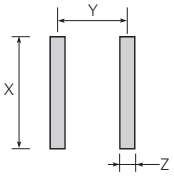

**No Leads (GTCN28-XXXM-R05, R10 & R20)†**




**Surface-mount (GTCS28-XXXM-R05, R10 & R20)**




**Pad Layout - Surface-mount Devices (GTCS28-XXXM-R05, R10 & R20)**

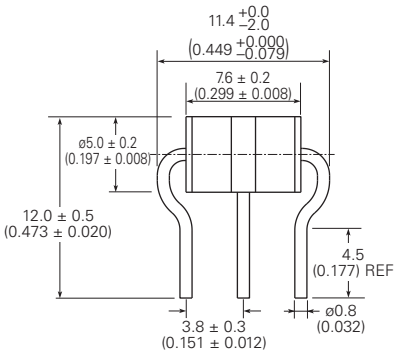



| | X | Y | Z |
|---|---|---|---|
| | NOM | NOM | NOM |
| mm | 9.0 | 5.6 | 1.2 |
| in* | (0.354) | (0.22) | (0.047) |

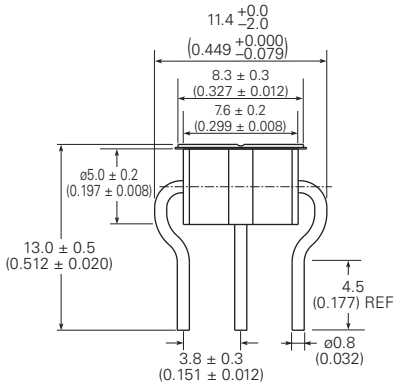
* Rounded off approximation
† Parts with no leads are non-solderable; meant for insertion into magazine clips

## Figure G7 Three Electrode 5mm Product Dimensions

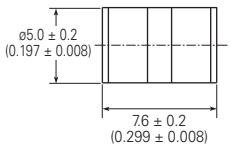
**Axial Leaded (GTCA35-XXXM-R05)**



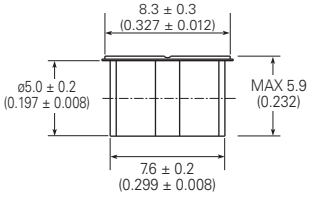

**Axial Leaded with-FT (GTCA35-XXXM-R05-FT)**



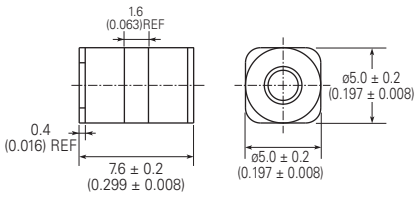

**No Leads (GTCN35-XXXM-R05)†**



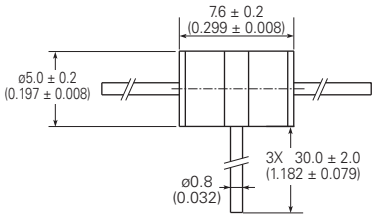

**No Leads with-FT (GTCN35-XXXM-R05-FT)†**



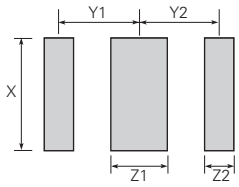

**Surface-mount (GTCS35-XXXM-R05)**




**T Leaded (GTCT35-XXXM-R05)**




**Pad Layout - Surface-mount Devices (GTCS35-XXXM-R05)**

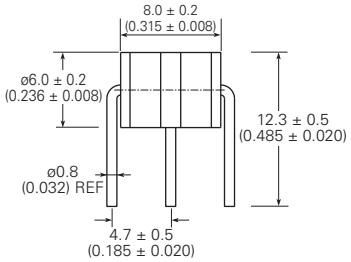



| | X | Y1 | Y2 | Z1 | Z2 |
|---|---|---|---|---|---|
| | NOM | NOM | NOM | NOM | NOM |
| mm | 6.0 | 3.6 | 3.6 | 2.5 | 1.3 |
| in* | (0.236) | (0.142) | (0.142) | (0.098) | (0.051) |

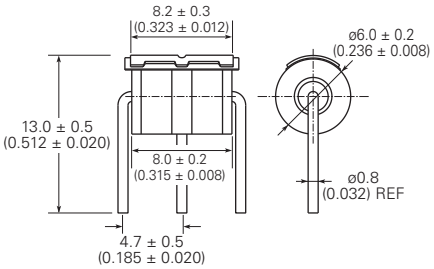
* Rounded off approximation
† Parts with no leads are non-solderable; meant for insertion into magazine clips

## Figure G8 Three Electrode 6mm Product Dimensions

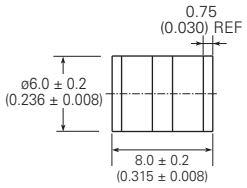
### Axial Leaded (GTCA36-XXXM-R10)



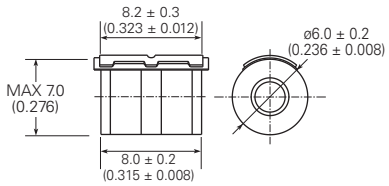

### Axial Leaded with-FT (GTCA36-XXXM-R10-FT)



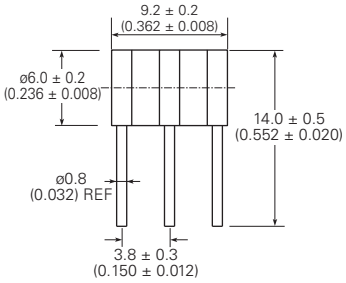

### No Leads (GTCN36-XXXM-R10)†



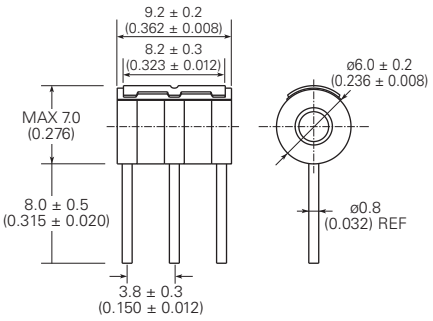

### No Leads with-FT (GTCN36-XXXM-R10-FT)†



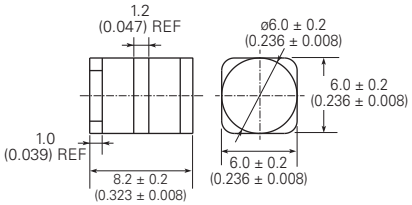

### Radial Leaded (GTCR36-XXXM-R10)



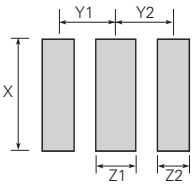

### Radial Leaded with-FT (GTCR36-XXXM-R10-FT)




### Surface-mount (GTCS36-XXXM-R10)




### Pad Layout - Surface-mount Devices (GTCS36-XXXM-R10)

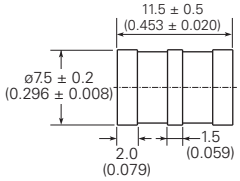



| | X | Y1 | Y2 | Z1 | Z2 |
|---|---|---|---|---|---|
| | NOM | NOM | NOM | NOM | NOM |
| mm | 7.0 | 3.6 | 3.6 | 2.5 | 2.0 |
| in* | (0.276) | (0.142) | (0.142) | (0.098) | (0.079) |

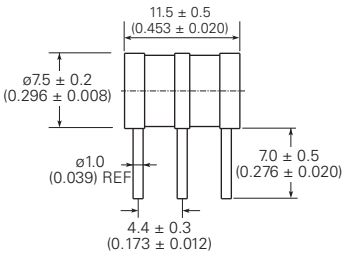
* Rounded off approximation
† Parts with no leads are non-solderable; meant for insertion into magazine clips

## Figure G9 Three Electrode 7mm Product Dimensions

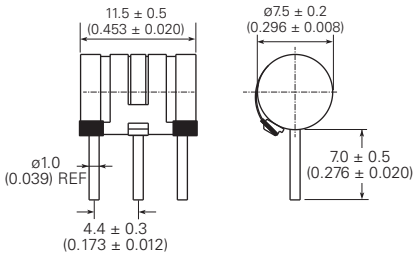
### No Leads (GTCN37-XXXM-R10)†




### Radial Leaded (GTCR37-XXXM-R10)



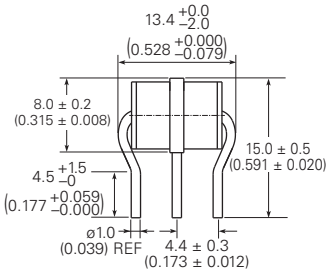

### Radial Leaded with-FS (GTCR37-XXXM-R10-FS2)



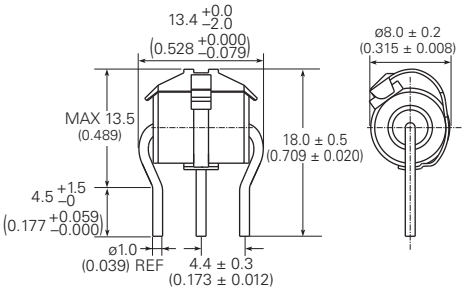

† Parts with no leads are non-solderable; meant for insertion into magazine clips

## Figure G10 Three Electrode 8mm Product Dimensions

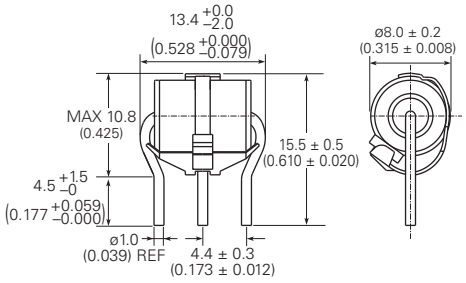
### Axial Leaded (GTCA38-XXXM-R10)




### Axial Leaded with-FS (GTCA38-XXXM-R10-FS)




### Axial Leaded with-FS (GTCA38-XXXM-R10-FS2)

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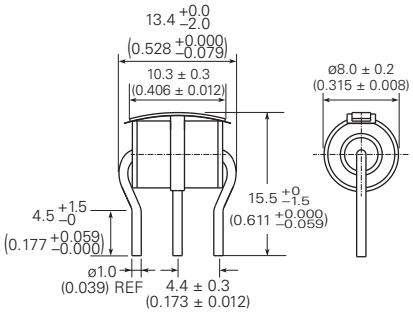
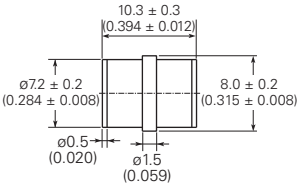
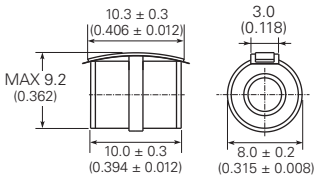


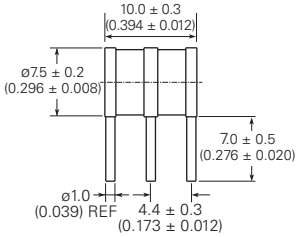

### No Leads (GTCN38-XXXM-R10)†



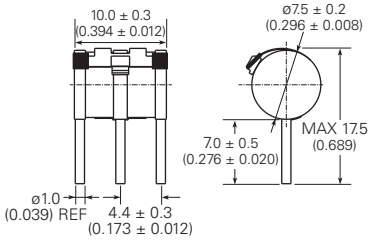

### No Leads with-FT (GTCN38-XXXM-R10-FT)†



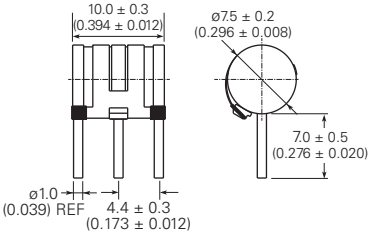

### Radial Leaded (GTCR38-XXXM-R10)



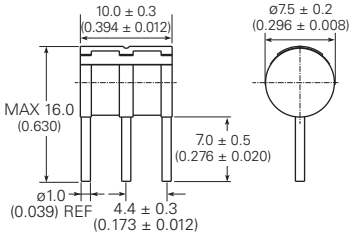

### Radial Leaded with-FS (GTCR38-XXXM-R10-FS)



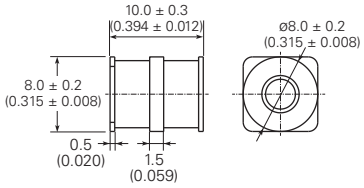

### Radial Leaded with-FS (GTCR38-XXXM-R10-FS2)



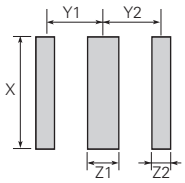

### Radial Leaded with-FT (GTCR38-XXXM-R10-FT)




### Surface-mount (GTCS38-XXXM-R10)




### Pad Layout - Surface-mount Devices (GTCS38-XXXM-R10)




| | X | Y1 | Y2 | Z1 | Z2 |
|---|---|---|---|---|---|
| | NOM | NOM | NOM | NOM | NOM |
| mm | 9.0 | 4.65 | 4.65 | 2.5 | 1.5 |
| in* | (0.354) | (0.183) | (0.183) | (0.098) | (0.059) |

* Rounded off approximation
† Parts with no leads are non-solderable; meant for insertion into magazine clips

RoHS Compliant, ELV Compliant  HF Halogen Free

## Fail-Short Mechanism

### Fail-Short Mechanism (FS)

The Fail-Short Mechanism is a short circuit spring mounted onto a solder pellet located at the center electrode of the gas tube. Under normal operating conditions, the pellet is positioned to make the spring float above the outer electrodes, as shown in Figure A.

When a prolonged discharge event causes the gas tube temperature to reach the melting point of the solder, the pellet softens allowing the short circuit spring to contact with both outer electrodes. This process results in a permanent short-circuit between all three electrodes creating a low resistance path that conducts the fault current to ground without generating a significant amount of heat.

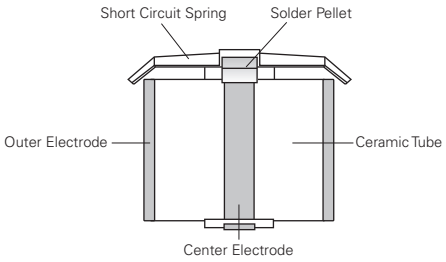



**Figure A**

### Fail-Short Mechanism (FT)

The Fail-Short Mechanism is a short circuit spring with a piece of plastic foil spot welded onto the center electrode. Under normal operating conditions, the plastic foil makes the spring insulated from the two outer electrodes.

When a prolonged discharge event causes the gas tube temperature to reach the melting point of the plastic foil, the plastic foil melts allowing the short circuit spring to contact both outer electrodes. This process results in a permanent short-circuit between all three electrodes creating a low resistance path that conducts the fault current to ground without generating a significant amount of heat.

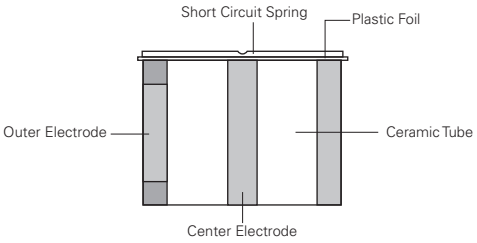



**Figure B**

## Temperature

**Operation Temperature Range**

Models without Fail-Short Mechanism : -40°C/+90°C
Models with Fail-Short Mechanism : -20°C/+65°C

**Storage Temperature Range**

Models without Fail-Short Mechanism : -40°C/+90°C
Models with Fail-Short Mechanism : -20°C/+65°C

## Packaging Information

| | Parts in Bulk | | Parts in Tape and Reel | |
|---|---|---|---|---|
| **Part Description** | **Min Order Quantity** | **Box Quantity** | **Tape & Reel Min Order Quantity** | **Box Quantity** |
| 3mm 2Pole Surface-mount | - | - | 2000 | 8000 |
| 5mm 2Pole No leads | 5000 | 20000 | - | - |
| 5mm 2Pole, Leads | 1000 | 5000 | - | - |
| 5mm 2Pole Surface-mount | 5000 | 20000 | 1500 | 12000 |
| 6mm 2Pole No leads | 2000 | 10000 | - | - |
| 6mm 2Pole, Leads | 1000 | 5000 | - | - |
| 6mm 2Pole Surface-mount | 2000 | 10000 | 750 | 6000 |
| 8mm 2pole No leads | 2000 | 10000 | - | - |
| 8mm 2Pole, Leads | 1000 | 5000 | - | - |
| 8mm 2Pole Surface-mount | 2000 | 10000 | 500 | 2500 |
| 5mm 3Pole No leads | 2500 | 10000 | - | - |
| 5mm 3Pole, Leads | 1000 | 5000 | - | - |
| 5mm 3Pole Surface-mount | 2500 | 10000 | 1000 | 8000 |
| 6mm 3Pole No leads | 2500 | 10000 | - | - |
| 6mm 3Pole, Leads | 1000 | 5000 | - | - |
| 6mm 3Pole Surface-mount | 2500 | 10000 | 750 | 6000 |
| 7mm 3Pole, Leads | 1000 | 5000 | - | - |
| 8mm 3Pole No leads | 1000 | 10000 | - | - |
| 8mm 3Pole, Leads | 1000 | 5000 | - | - |
| 8mm 3Pole Surface-mount | 1000 | 10000 | 500 | 2500 |

## Installation

Care should be taken when installing Gas Discharge Tubes equipped with Fail-Short Mechanisms into arrester magazines, printed circuit boards, etc. Too much downward pressure may force the short circuit spring through the thin insulation tube creating a shorted condition.

## Solder Reflow Recommendations for Surface-mount GDT Devices

Surface-mount GDTs can be soldered using standard Pb-free reflow profile.

## Part Numbering System

### Two Electrode GDT - Example Part Number for R Series Devices

**GT C S 2 3 - 231 M - R 01 - 2**

**Packaging**
2 = Tape & reel
Nothing = Tray packaging

**Surge Rating**
01 = 8x20µs 1kA, 10 hits
02 = 8x20µs 2.5kA, 10 hits
05 = 8x20µs 5kA, 10 hits
10 = 8x20µs 10kA, 10 hits
20 = 8x20µs 20kA, 10 hits

**Product Family Designator**
R = R series

**Tolerance of 20% on DC Switch Voltage**

**DC Switch Voltage of 230V (at 100V/s)**

**Diameter**
3 = 3mm
5 = 5mm
6 = 6mm
8 = 8mm

**2 Electrode Device**

**Lead Configuration**

A = Axial Leads
N = No leads
(Parts with no leads are not solderable and are meant for insertion into magazine clips.)
S = Surface-mount

**Ceramic**

**Gas Tube**

**NOTE:** GTCS23-XXXM-R01 parts available only in surface-mount and tape and reel packaging

## Three Electrode GDT - Example Part Number for R Series Devices

**GT C R 3 8 - 231 M - R 10 - FS - 2**

**Packaging**
2 = Tape & reel
Nothing = Tray packaging

**FS = solder pellet fail short mechanism on top**
**FS2 = solder pellet fail short mechanism on bottom**
**FT = plastic fail short mechanism on top**

**Surge Rating**
05 = 8x20µs 5kA, 10 hits
10 = 8x20µs 10kA, 10 hits

**Product Family Designator**
R = R series

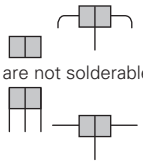
**Tolerance of 20% on DC Switch Voltage**

**DC Switch Voltage of 230V (at 100V/s)**

**Diameter**
5 = 5mm
6 = 6mm
7 = 7mm
8 = 8mm

**3 Electrode Device**

**Lead Configuration**
A = Axial Leads
N = No leads
(Parts with no leads are not solderable and are meant for insertion into magazine clips.)
R = Radial Leads
S = Surface-mount
T = T-shape Leads



**Ceramic**

**Gas Tube**

## Marking Reference Guide - Example

**⋇ 35 R 05 GN**

**Year and Week of Manufacture**
G = First half of 2004
N = Week 14
Per manufacturer's lot number system

**8x20µs 10 hits Surge Current (05=5kA)**

**Product Family Designator**
R = R series

**Voltage Designator (35 = 350V)**

**Manufacturer's mark**

**NOTES:** GTCS23-XXXM-R01 parts will have no marking.
Devices with no leads (GTCNxx-xxxx-xx) are not able to be soldered as their electrodes are Nickel plated.
They should be installed by insertion into a magazine clip.

## ⚠ Warning :

- Operation beyond the maximum ratings or improper use may result in device damage and possible electrical arcing and flame.
- The devices are intended for protection against occasional overvoltage fault conditions and should not be used when repeated fault conditions or prolonged trip events are anticipated.
- Device performance can be impacted negatively if devices are handled in a manner inconsistent with recommended electronic, thermal, and mechanical procedures for electronic components.


**Raychem Circuit Protection Product Headquarters**
308 Constitution Drive, Building H
Menlo Park, CA USA 94025-1164
Tel : (800) 227-7040, (650) 361-6900
Fax : (650) 361-4600

www.circuitprotection.com
www.circuitprotection.com.hk (Chinese)
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