

## PROTECTION PRODUCTS

### Description

RClamp®0542ZA is an ultra low capacitance ESD protection device designed to protect two high-speed lines in an 0201 footprint. This revolutionary package design reduces board space requirements by more than 50% over existing single line solutions. RClamp0542ZA is a three pin device with identical low capacitance TVS diodes connected to each pin. Any two pins may be connected to high-speed lines, while the third pin is connected to ground. This gives the designer maximum flexibility in pcb routing. Each line has a maximum capacitance of only 0.30pF resulting in a typical corner frequency of 12GHz.

RClamp0542ZA is in a 3-pin SLP0603P3X3F package. It measures 0.62 x 0.32 mm with a nominal height of only 0.25mm. Leads are finished with lead-free NiAu. The combination of small size and high ESD surge capability makes them ideal for use in portable applications such as cellular phones, digital cameras, and tablets.

### Features

- High ESD withstand voltage
  - ♦ IEC 61000-4-2 (ESD) 17kV (air), 12kV (contact)
- Very small PCB area
- Protects two high-speed data lines
- Working voltage: 5V
- Low reverse leakage current: <1nA typ at VR=5V
- Low capacitance: 0.30pF maximum
- Dynamic resistance: 1.17 Ohms (Typ)
- Solid-state silicon-avalanche technology

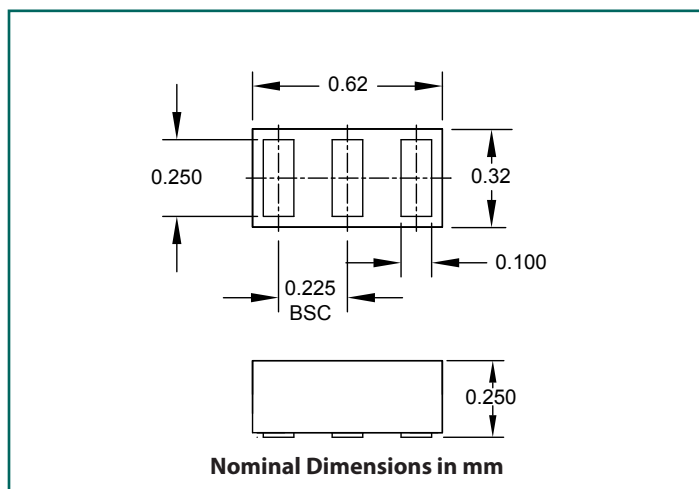
### Mechanical Characteristics

- SLP0603P3X3F package
- Pb-Free, Halogen Free, RoHS/WEEE Compliant
- Nominal Dimensions: 0.62 x 0.32 x 0.25 mm
- Lead Finish: NiAu
- Marking : Marking code
- Packaging : Tape and Reel

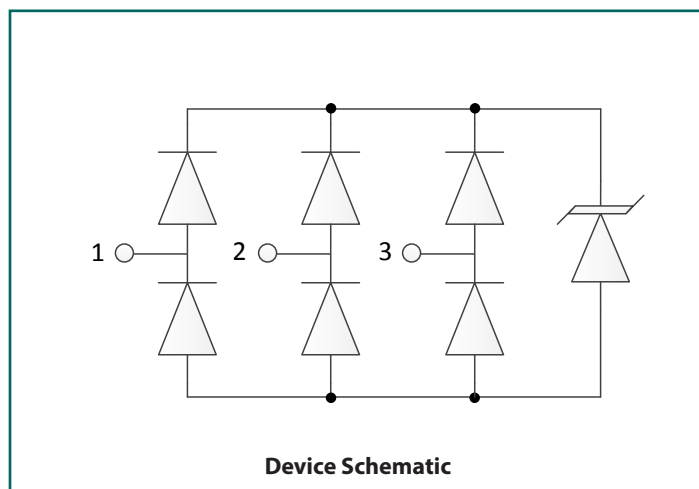
### Applications

- High-Speed Lines
- MIPI / MDDI
- USB 3.0
- HDMI
- MHL
- eDP

### Nominal Dimensions



### Functional Schematic



## Absolute Maximum Ratings

Rating	Symbol	Value	Units
Peak Pulse Power (tp = 8/20μs)	P <sub>PK</sub>	40	W
Peak Pulse Current (tp = 8/20μs)	I <sub>PP</sub>	2	A
ESD per IEC 61000-4-2 (Air) <sup>(1)</sup> ESD per IEC 61000-4-2 (Contact) <sup>(1)</sup>	V <sub>ESD</sub>	±17 ±12	kV
Operating Temperature	T <sub>J</sub>	-40 to +85	°C
Storage Temperature	T <sub>STG</sub>	-55 to +150	°C

## Electrical Characteristics (T=25°C unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Reverse Stand-Off Voltage	V <sub>RWM</sub>	-40°C to 85°C Between any two pins				5	V
Reverse Breakdown Voltage	V <sub>BR</sub>	I <sub>t</sub> = 10mA, Between any two pins	-40°C to 85°C	6.5	9.5	11.5	V
Reverse Leakage Current	I <sub>R</sub>	V <sub>RWM</sub> = 5V	T = 25°C		0.01	0.050	μA
			T = 85°C		0.05	0.250	μA
Clamping Voltage	V <sub>C</sub>	I <sub>pp</sub> = 2A, tp = 8/20μs, Between any two pins			12	20	V
ESD Clamping Voltage <sup>2</sup>	V <sub>C</sub>	I <sub>pp</sub> = 4A, tp = 0.2/100ns (TLP) Pin 1 to 2, Pin 3 to 2			16		V
ESD Clamping Voltage <sup>2</sup>	V <sub>C</sub>	I <sub>pp</sub> = 16A, tp = 0.2/100ns (TLP) Pin 1 to 2, Pin 3 to 2			30		V
Dynamic Resistance <sup>2, 3</sup>	R <sub>DYN</sub>	tp = 0.2/100ns (TLP) Pin 1 to 2, Pin 3 to 2			1.17		Ohms
Cut-Off Frequency	f <sub>C</sub>	Insertion Loss (S21) = -3dB			12		GHz
Junction Capacitance	C <sub>J</sub>	V <sub>R</sub> = 0V, f = 1MHz Between any two pins	T = 25°C		0.27	0.30	pF
Change in Capacitance over VR	ΔC <sub>JVR</sub>	VR = 0 - 5V, f = 1MHz				0.030	pF

Notes:

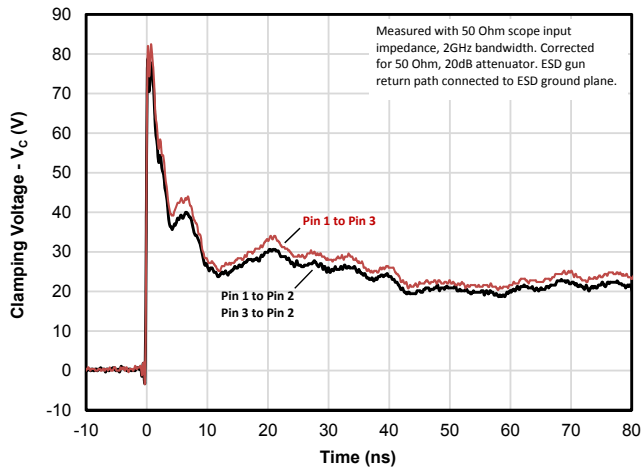
(1): ESD Gun return path to Ground Reference Plane (GRP)

(2): Transmission Line Pulse Test (TLP) Settings: tp = 100ns, tr = 0.2ns, I<sub>TLP</sub> and V<sub>TLP</sub> averaging window: t<sub>1</sub> = 70ns to t<sub>2</sub> = 90ns.

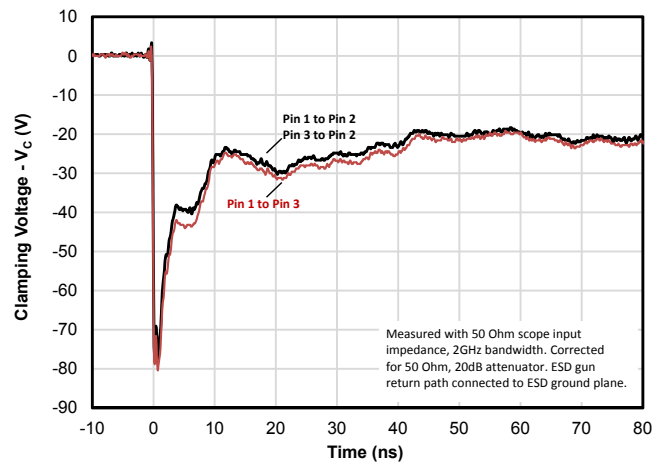
(3): Dynamic resistance calculated from I<sub>TLP</sub> = 4A to I<sub>TLP</sub> = 16A

# Typical Characteristics

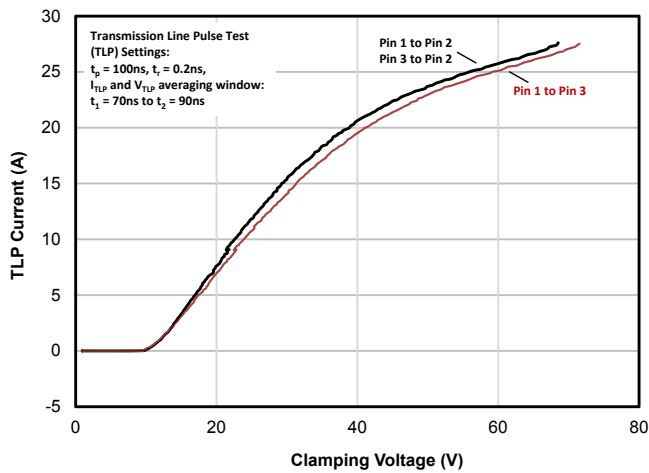
## ESD Clamping (+8kV Contact per IEC 61000-4-2)



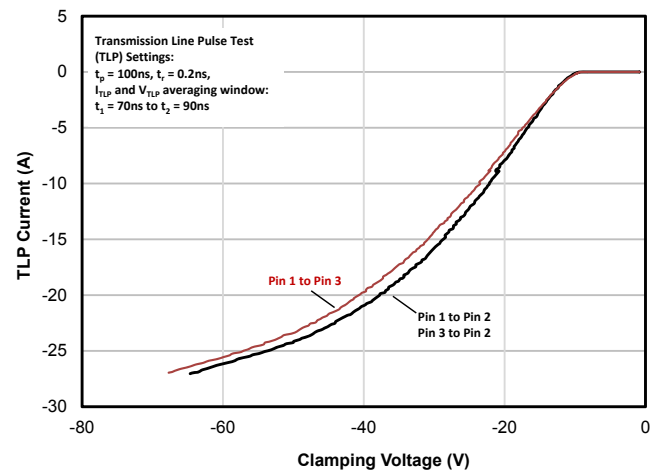
## ESD Clamping (-8kV Contact per IEC 61000-4-2)



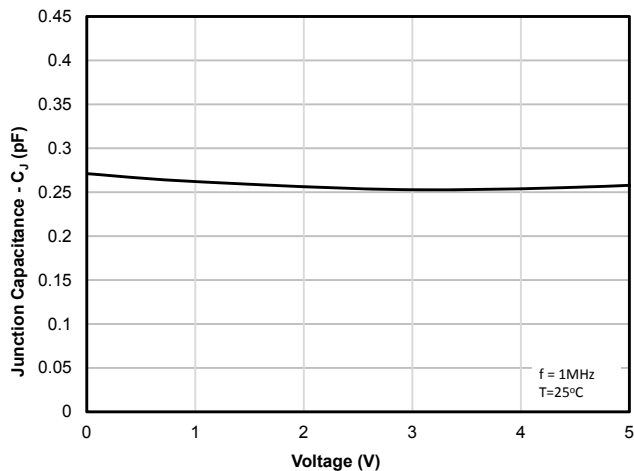
## TLP IV Curve (Positive Pulse)



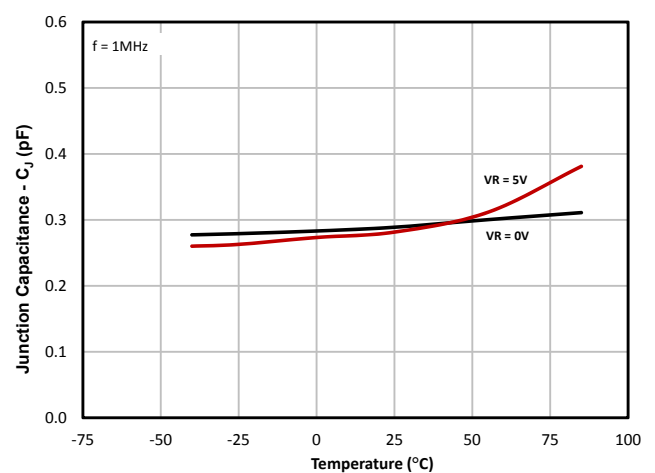
## TLP IV Curve (Negative Pulse)



## Capacitance vs. Reverse Voltage

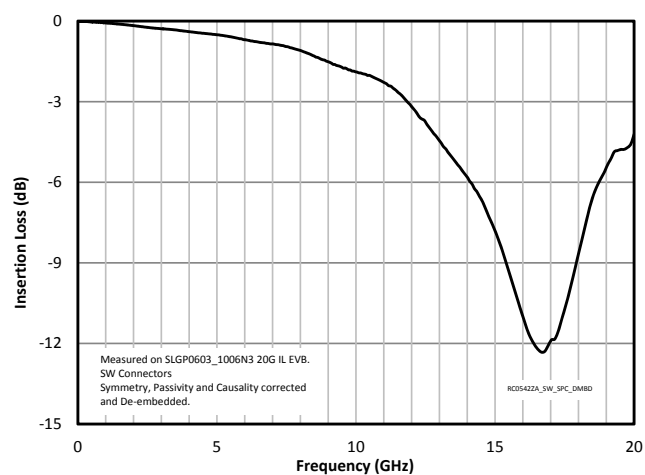


## Capacitance vs. Temperature

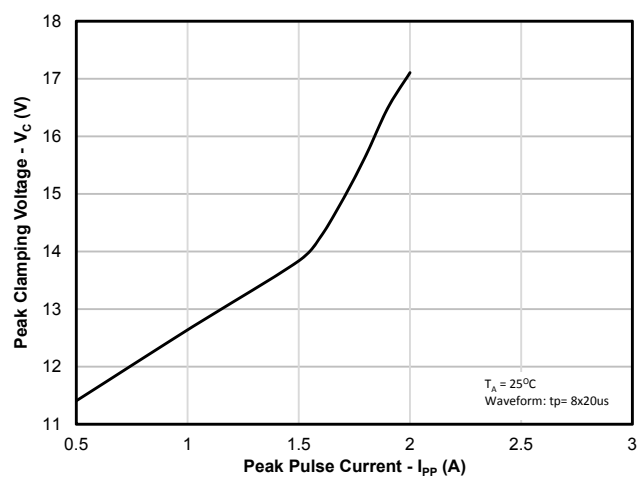


## Typical Characteristics (Continued)

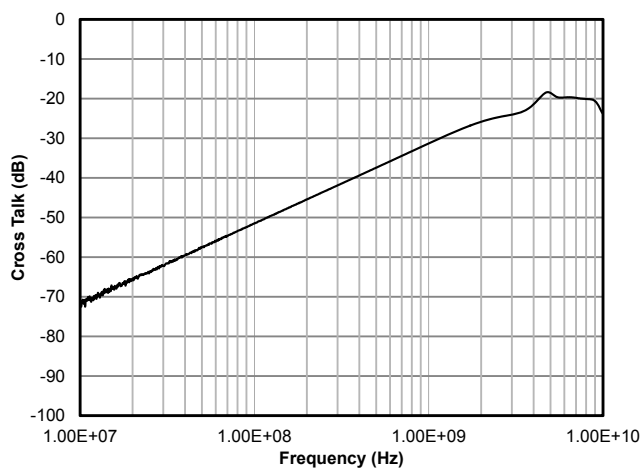
Insertion Loss - S21



Clamping Voltage vs. Peak Pulse Current ( $t_p=8/20\mu s$ )



Analog Crosstalk



# Applications Information

## Assembly Guidelines

The small size of this device means that some care must be taken during the mounting process to insure reliable solder joint. The figure at the right details Semtech's recommended mounting pattern. Recommended assembly guidelines are shown in Table 1. Note that these are only recommendations and should serve only as a starting point for design since there are many factors that affect the assembly process. Exact manufacturing parameters will require some experimentation to get the desired solder application. Semtech's recommended mounting pattern is based on the following design guidelines:

### Land Pattern

The recommended land pattern follows IPC standards and is designed for maximum solder coverage. Detailed dimensions are shown elsewhere in this document.

### Solder Stencil

Stencil design is one of the key factors which will determine the volume of solder paste which is deposited onto the land pad. The area ratio of the stencil aperture will determine how well the stencil will print. The area ratio takes into account the aperture shape, aperture size, and stencil thickness. An area ratio of 0.70 – 0.75 is preferred for the subject package. The area ratio of a rectangular aperture is given as:

Area Ratio = (L \* W )/ ( 2 \* (L + W ) \* T)

Where:

L = Aperture Length

W = Aperture Width

T = Stencil Thickness

Semtech recommends a stencil thickness of 0.100mm for this device. The stencil should be laser cut with electro-polished finish. The stencil should have a positive taper of approximately 5 degrees. Electro polishing and tapering the walls results in reduced surface friction and better paste release. For small pitch components, Semtech recommends a square aperture with rounded corners for consistent solder release. Due to the small aperture size, a solder paste with Type 4 or smaller particles are recommended.

## Recommended Mounting Pattern

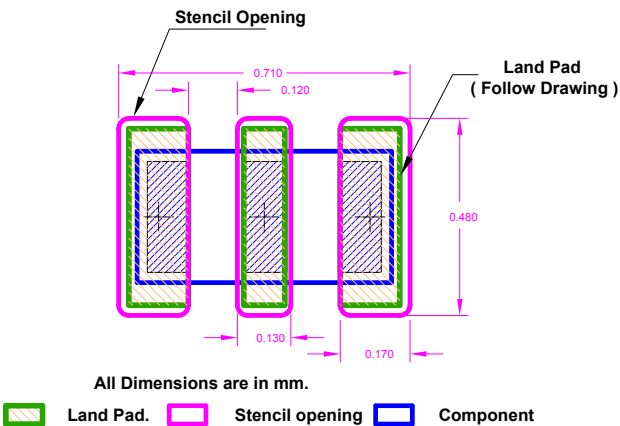
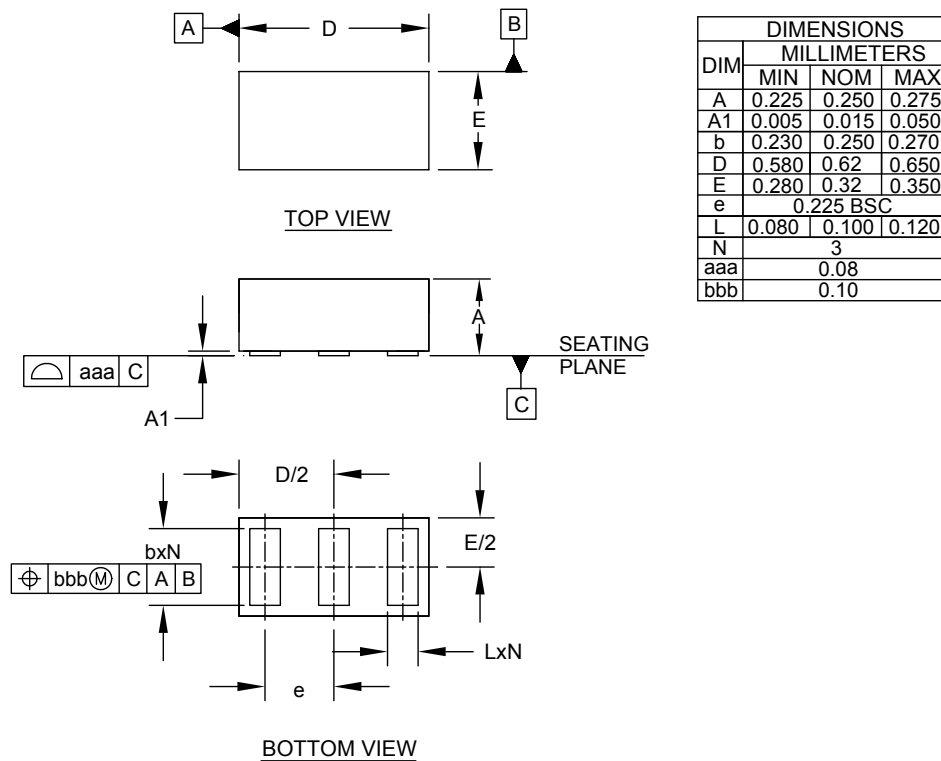
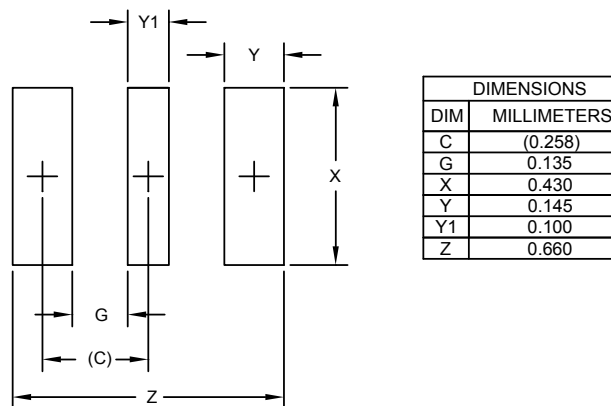


Table 1 - Recommended Assembly Guidelines	
Assembly Parameter	Recommendation
Solder Stencil Design	Laser Cut, Electro-Polished
Aperture Shape	Rectangular with rounded corners
Solder Stencil Thickness	0.100mm (0.004")
Solder Paste Type	Type 4 size sphere or smaller
Solder Reflow Profile	Per JEDEC J-STD-020
PCB Solder pad Design	Non-Solder Mask Defined
PCB Pad Finish	OSP or NiAu

## Outline Drawing - SLP0603P3X3F



## Land Pattern - SLP0603P3X3F



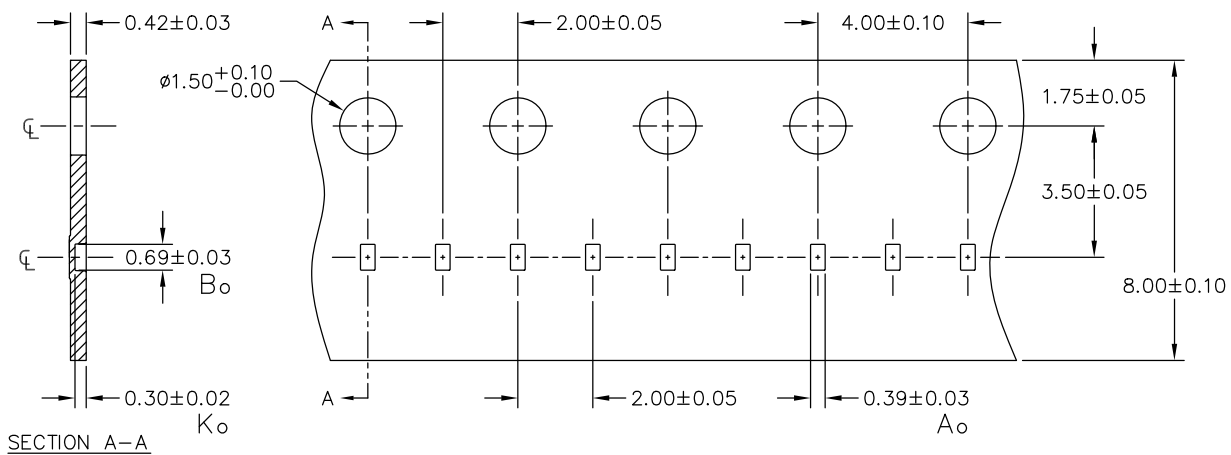
- NOTES:**
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
  2. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY.  
CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR  
COMPANY'S MANUFACTURING GUIDELINES ARE MET.

### Marking Code

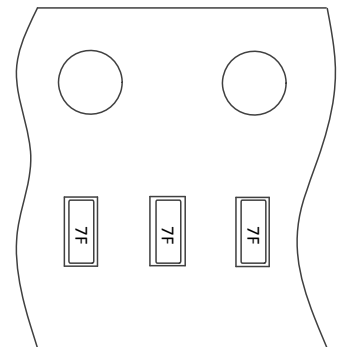
7F

Notes: Device is electrically symmetrical

## Tape and Reel Specification



NOTES: ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.



## Ordering Information

Part Number	Qty per Reel	Reel Size
RClamp0542ZATFT	15000	7 Inch
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