

# ESD Protection Diode

## Low Capacitance

### SL05T1G Series

This family of surge protection offers transient overvoltage protection with significantly reduced capacitance. The capacitance is lowered by integrating a compensating diode in series. This integrated solution offers ESD protection for high speed interfaces such as communication systems, computers, and computer peripherals.

#### Features

- Surge protection Diode in Series with a Compensating Diode Offers <5 pF Capacitance
- ESD Protection Meeting IEC 61000-4-2, 4-4, 4-5
- Peak Power Rating of 300 W,  $8 \times 20 \mu\text{s}$
- Bi-Direction Protection Can Be Achieved By Using Two Devices
- Flammability Rating UL 94 V-0
- SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### Mechanical Characteristics:

**CASE:** Void-free, transfer-molded, thermosetting plastic case

**FINISH:** Corrosion resistant finish, easily solderable

**MAXIMUM CASE TEMPERATURE FOR SOLDERING PURPOSES:**

260°C for 10 Seconds

Package designed for optimal automated board assembly

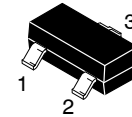
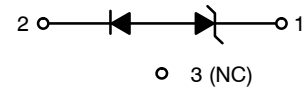
Small package size for high density applications

Available in 8 mm Tape and Reel

Use the Device Number to order the 7 inch/3,000 unit reel.

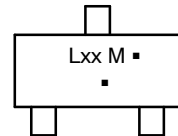
Replace the "T1" with "T3" in the Device Number to order the

13 inch/10,000 unit reel.



**SOT-23 (TO-236)  
CASE 318  
STYLE 26**

#### MARKING DIAGRAM



Lxx = Device Code  
xx = 05, 12, 15, or 24  
M = Date Code\*  
■ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or overbar may vary depending upon manufacturing location.

#### ORDERING INFORMATION

Device	Package	Shipping†
SL05T1G	SOT-23 (Pb-Free)	3000/Tape & Reel
SZSL05T1G	SOT-23 (Pb-Free)	3000/Tape & Reel
SL12T1G	SOT-23 (Pb-Free)	3000/Tape & Reel
SL15T1G	SOT-23 (Pb-Free)	3000/Tape & Reel
SZSL15T1G	SOT-23 (Pb-Free)	3000/Tape & Reel
SL24T1G	SOT-23 (Pb-Free)	3000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

#### DEVICE MARKING INFORMATION

See specific marking information in the device marking column of the table on page 2 of this data sheet.

# SL05T1G Series

## MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Power Dissipation @ 8x20 usec (Note 1) @ $T_L \leq 25^\circ\text{C}$	$P_{pk}$	300	W
IEC 61000-4-2 Level 4 Contact Discharge Air Discharge IEC 61000-4-4 EFT IEC 61000-4-5 Lightning	$V_{pp}$	$\pm 8$ $\pm 16$ 40 12	kV kV A A
Total Power Dissipation on FR-5 Board (Note 2) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	225 1.8	mW mW/ $^\circ\text{C}$
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	556	$^\circ\text{C}/\text{W}$
Total Power Dissipation on Alumina Substrate (Note 3) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	300 2.4	mW mW/ $^\circ\text{C}$
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to +150	$^\circ\text{C}$
Lead Solder Temperature – Maximum (10 Second Duration)	$T_L$	260	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

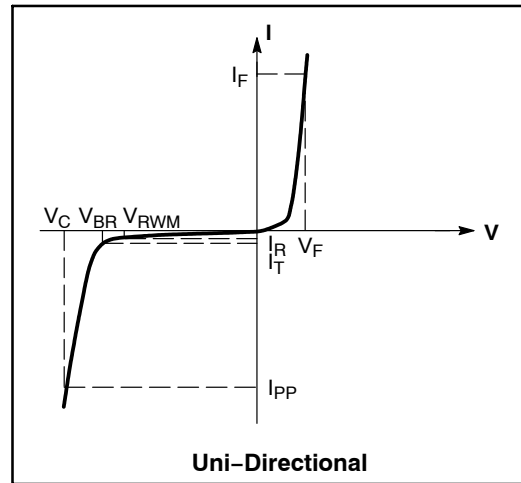
1. Non-repetitive current pulse per Figure 2
2. FR-5 = 1.0 x 0.75 x 0.62 in.
3. Alumina = 0.4 x 0.3 x 0.024 in., 99.5% alumina

## ELECTRICAL CHARACTERISTICS

( $T_A = 25^\circ\text{C}$  unless otherwise noted)

### UNIDIRECTIONAL

Symbol	Parameter
$I_{PP}$	Maximum Reverse Peak Pulse Current
$V_C$	Clamping Voltage @ $I_{PP}$
$V_{RWM}$	Working Peak Reverse Voltage
$I_R$	Maximum Reverse Leakage Current @ $V_{RWM}$
$V_{BR}$	Breakdown Voltage @ $I_T$
$I_T$	Test Current
$\Theta V_{BR}$	Maximum Temperature Coefficient of $V_{BR}$
$I_F$	Forward Current
$V_F$	Forward Voltage @ $I_F$
$Z_{ZT}$	Maximum Zener Impedance @ $I_{ZT}$
$I_{ZK}$	Reverse Current
$Z_{ZK}$	Maximum Zener Impedance @ $I_{ZK}$



## ELECTRICAL CHARACTERISTICS

Device	Device Marking	$V_{RWM}$ (V)	$I_R$ @ $V_{RWM}$ ( $\mu\text{A}$ )	Breakdown Voltage (Note 4)		$V_C$ , Clamping Voltage (Note 5)		Max $I_{PP}$ (A)	Capacitance @ $V_R = 0\text{ V}$ , 1 MHz (pF)	
				$V_{BR}$ @ 1 mA (Volts)		@ 1 A	@ 5 A		Typ	Max
				Min	Max	(V)	(V)			
SL05	L05	5.0	20	6.0	8.0	9.8	11	17	3.5	5.0
SL12	L12	12	1.0	13.3	15.5	19	24	12	3.5	5.0
SL15	L15	15	1.0	16.7	18.5	24	30	10	3.5	5.0
SL24	L24	24	1.0	26.7	29	43	55	5.0	3.5	5.0

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4.  $V_{BR}$  measured at pulse test current of 1 mA at an ambient temperature of  $25^\circ\text{C}$
5. Surge current waveform per Figure 2

# SL05T1G Series

## TYPICAL CHARACTERISTICS

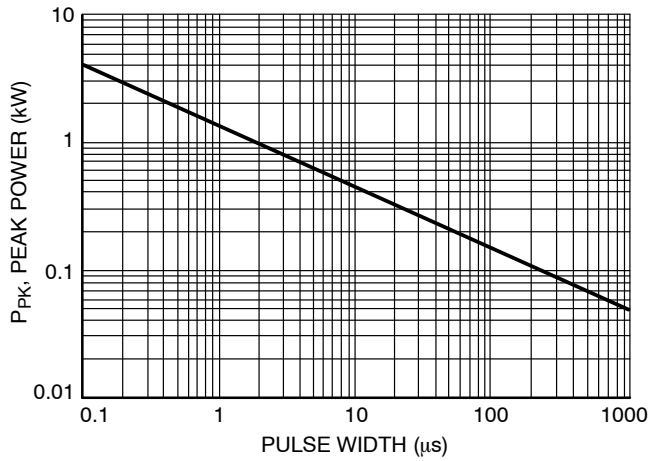


Figure 1. Maximum Peak Power Rating

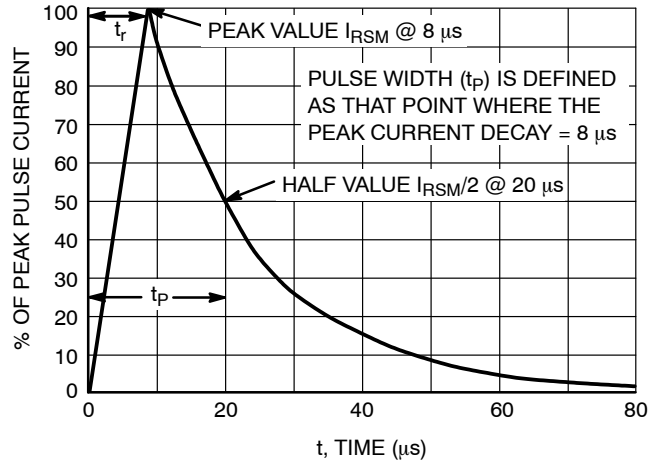


Figure 2. 8  $\times$  20  $\mu s$  Pulse Waveform

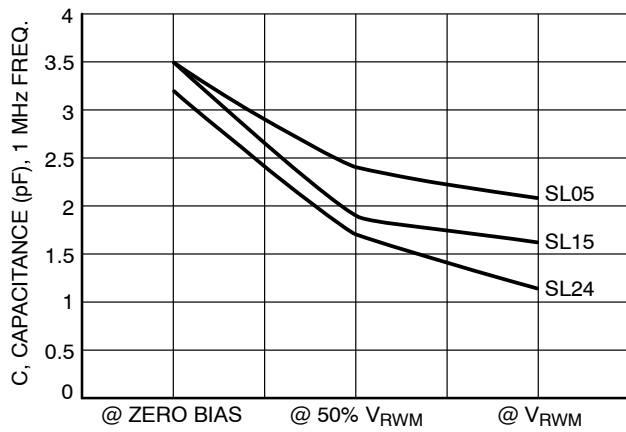


Figure 3. Typical Junction Capacitance

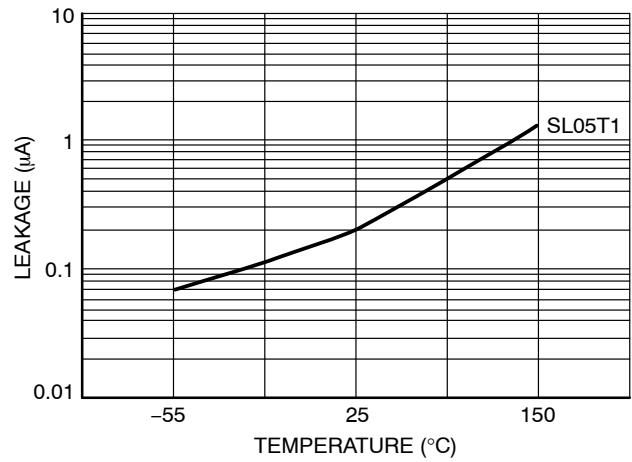


Figure 4. Typical Leakage Over Temperature

## SL05T1G Series

### Applications Background

This family of surge protection devices (SL05T1 series) are designed to protect sensitive electronics such as communications systems, computers, and computer peripherals against damage due to ESD conditions or transient voltage conditions. Because of their low capacitance value (less than 5 pF), they can be used in high speed I/O data lines. Low capacitance is achieved by integrating a compensating diode in series with the surge protection which is basically based in the below theoretical principle:

- Capacitance in parallel:  $C_T = C_1 + C_2 + \dots + C_n$
- Capacitance in series:  $1/C_T = (1/C_1) + (1/C_2) + \dots + (1/C_n)$

The Figure 5 shows the integrated solution of the SL05T1 series device:

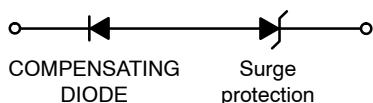


Figure 5.

In the case that an over-voltage condition occurs in the I/O line protected by the SL05T1 series device, the surge protection is reversed-biased while the compensation diode is forward-biased so the resulting current due to the transient voltage is drained to ground.

If protection in both polarities is required, an additional device is connected in inverse-parallel with reference to the first one, the Figure 6 illustrates the inverse-parallel connection for bi-directional or unidirectional lines:

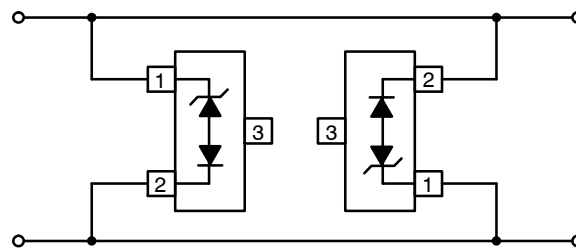


Figure 6.

An alternative solution to protect unidirectional lines, is to connect a fast switching steering diode in parallel with the SL05T1 series device. When the steering diode is forward-biased, the surge protection will avalanche and conduct in reverse direction. It is important to note that by adding a steering diode, the effective capacitance in the circuit will be increased, therefore the impact of adding a steering diode must be taken in consideration to establish whether the incremental capacitance will affect the circuit functionality or not. The Figure 7 shows the connection between the steering diode and the SL05T1 series device:

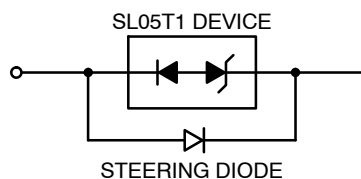


Figure 7.

Another typical application in which the SL05T1 series device can be utilized, is to protect multiple I/O lines. The protection in each of the I/O lines is achieved by connecting two devices in inverse-parallel. The Figure 8 illustrates how multiple I/O line protection is achieved:

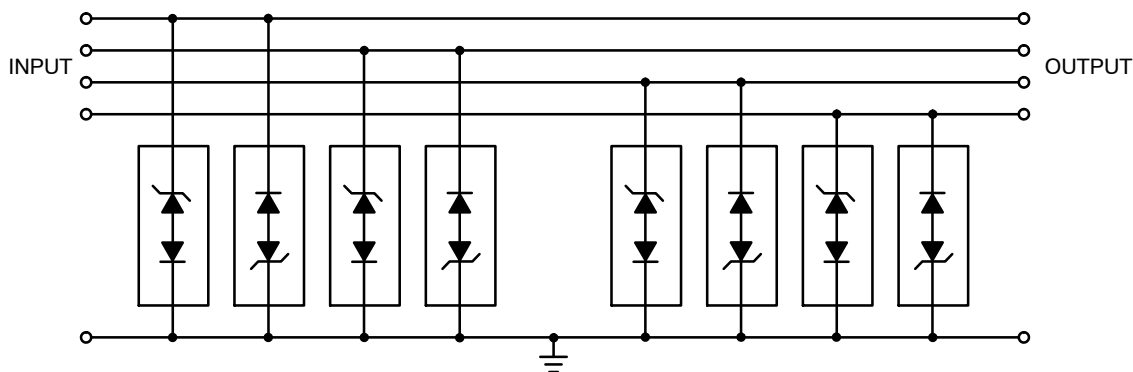


Figure 8.

For optimizing the protection, it is recommended to use ground planes and short path lengths to minimize the PCB's ground inductance.

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