SMF3.3
3.3 Volt TVS Array
For ESD and Latch-Up Protection

PROTECTION PRODUCTS

Description

The SMF series of TVS arrays are designed to protect sensitive electronics from damage or latch-up due to ESD, lightning, and other voltage-induced transient events. Each device will protect up to four lines operating at **3.3 volts**.

The SMF3.3 is a solid-state devices designed specifically for transient suppression. It is constructed using Semtech's proprietary EPD process technology. The EPD process provides low standoff voltages with significant reductions in leakage currents and capacitance over traditional pn junction processes. They offer desirable characteristics for board level protection including fast response time, low clamping voltage and no device degradation.

The SMF3.3 may be used to meet the immunity requirements of IEC 61000-4-2, level 4 (±15kV air, ±8kV contact discharge). The small SC70-5L package makes them ideal for use in portable electronics such as cell phones, PDAs, and notebook computers.

Features

- ESD protection for data lines to
  IEC 61000-4-2 (ESD) ±15kV (air), ±8kV (contact)
  IEC 61000-4-4 (EFT) 40A (5/50ns)
- Small package for use in portable electronics
- Protects four I/O lines
- Working voltage: 3.3V
- Low leakage current
- Low operating and clamping voltages
- Solid-state EPD TVS technology

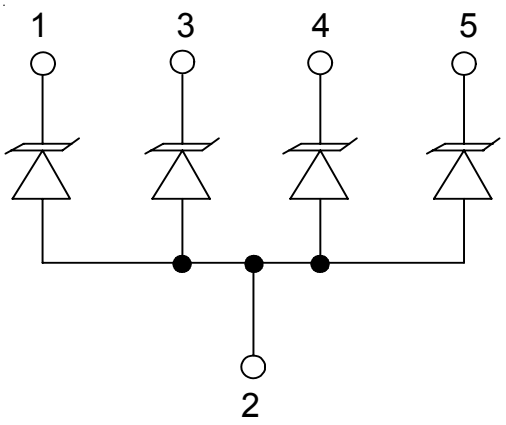
Mechanical Characteristics

- EIAJ SC70-5L package
- Molding compound flammability rating: UL 94V-0
- Marking : Marking Code
- Packaging : Tape and Reel

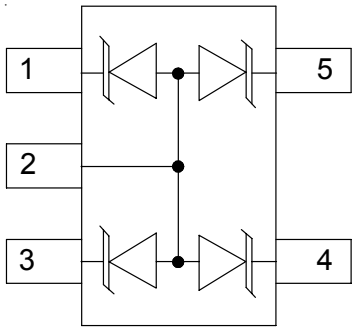
Applications

- Cellular Handsets and Accessories
- Cordless Phones
- Personal Digital Assistants (PDAs)
- Notebooks and Handhelds
- Portable Instrumentation
- Digital Cameras
- Peripherals
- MP3 Players

Circuit Diagram



Schematic & PIN Configuration



SC70-5L (Top View)

Absolute Maximum Rating

Rating	Symbol	Value	Units
Peak Pulse Power (tp = 8/20µs)	P_{pk}	40	Watts
Peak Pulse Current (tp = 8/20µs)	I_{PP}	5	A
ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	V_{ESD}	20 15	kV
Lead Soldering Temperature	T_L	260 (10 seconds)	°C
Operating Temperature	T_J	-55 to +125	°C
Storage Temperature	T_{STG}	-55 to +150	°C

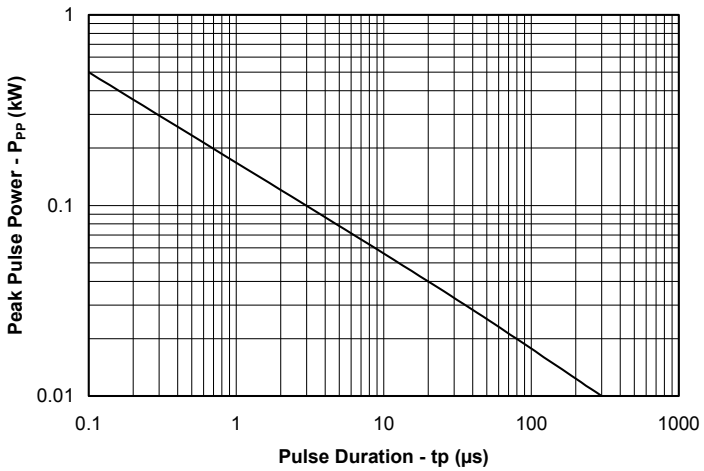
Electrical Characteristics

SMF3.3

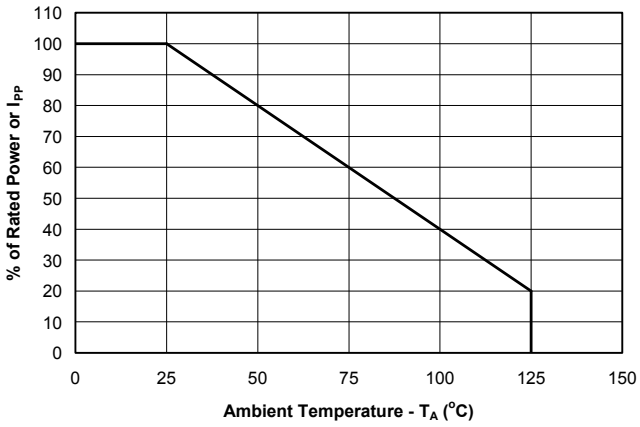
Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
Reverse Stand-Off Voltage	V_{RWM}				3.3	V
Punch-Through Voltage	V_{PT}	I_{PT} = 2µA	3.5			V
Snap-Back Voltage	V_{SB}	I_{SB} = 50mA	2.8			V
Reverse Leakage Current	I_R	V_{RWM} = 3.3V		0.05	0.5	µA
Clamping Voltage	V_C	I_{PP} = 1A, tp = 8/20µs			5.5	V
Clamping Voltage	V_C	I_{PP} = 5A, tp = 8/20µs			8.0	V
Steering Diode Forward Voltage	V_F	I_{PP} = 1A, tp = 8/20µs Ground to any I/O			2.4	V
Junction Capacitance	C_j	Each I/O pin and Ground V_R = 0V, f = 1MHz		25	30	pF
		I/O to I/O V_R = 0V, f = 1MHz		12		pF

Typical Characteristics

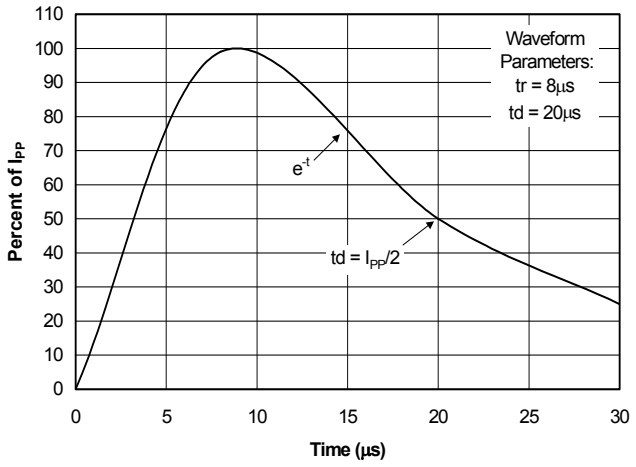
Non-Repetitive Peak Pulse Power vs. Pulse Time



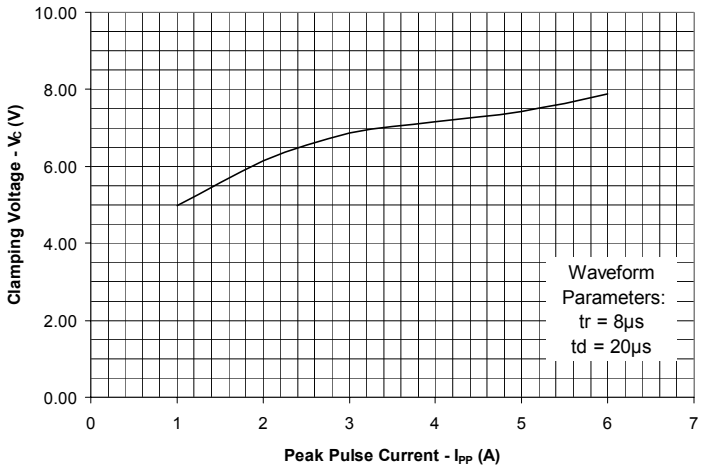
Power Derating Curve



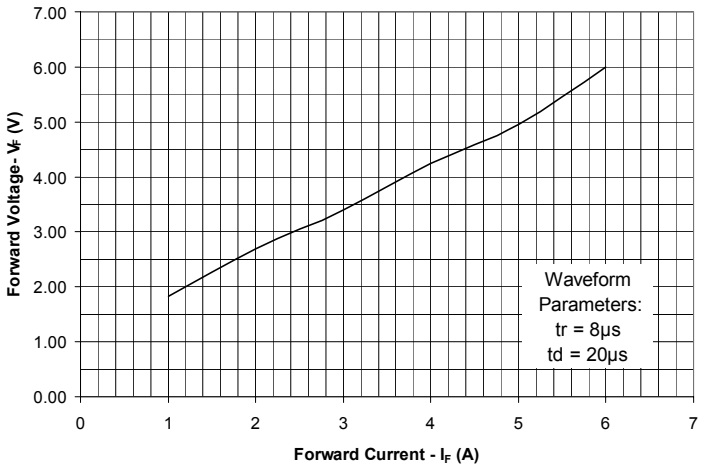
Pulse Waveform



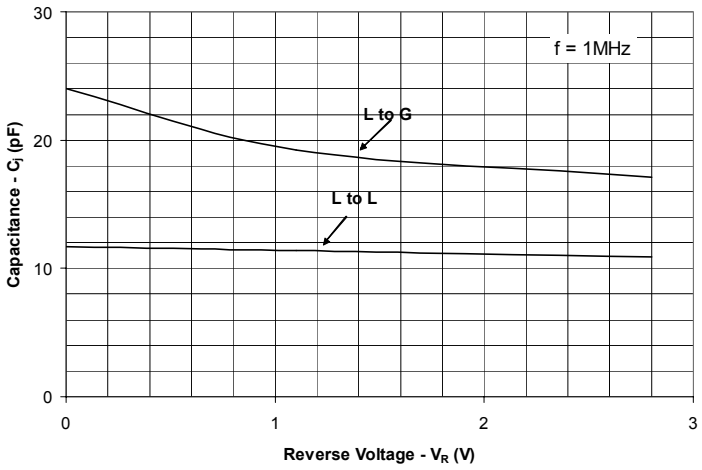
Clamping Voltage vs. Peak Pulse Current



Forward Voltage vs. Forward Current

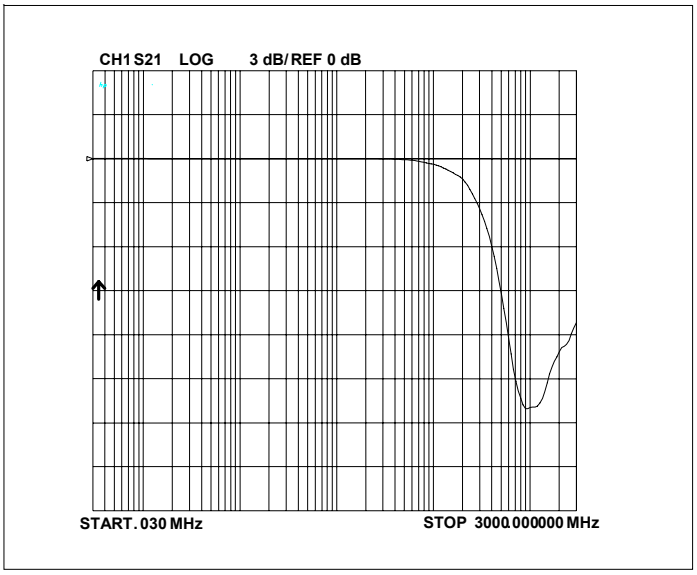


Capacitance vs. Reverse Voltage

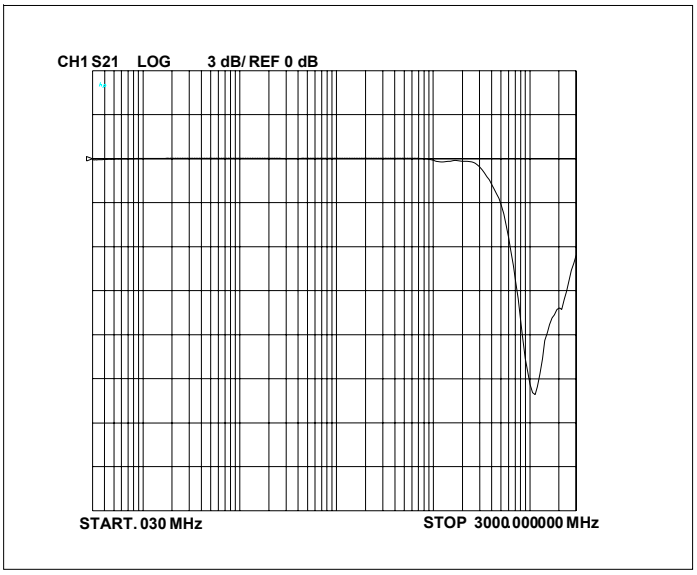


Typical Characteristics

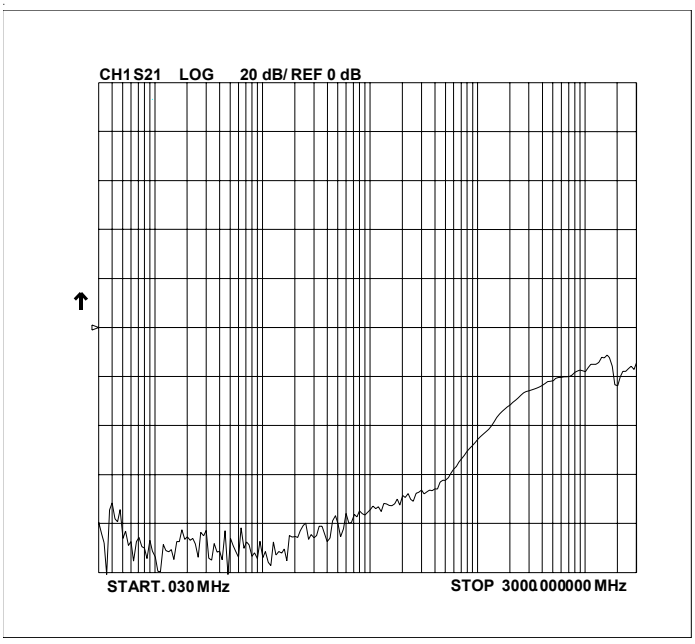
Insertion Loss S21, I/O to Ground



Insertion Loss S21, I/O to I/O



Analog Crosstalk (I/O to I/O)



Applications Information

Device Connection for Protection of Four Data Lines

The SMF3.3 is designed to protect up to four unidirectional data lines. The device is connected as follows:

1. Unidirectional protection of four I/O lines is achieved by connecting pins 1, 3, 4, and 5 to the data lines. Pin 2 is connected to ground. The ground connection should be made directly to the ground plane for best results. The path length is kept as short as possible to reduce the effects of parasitic inductance in the board traces.

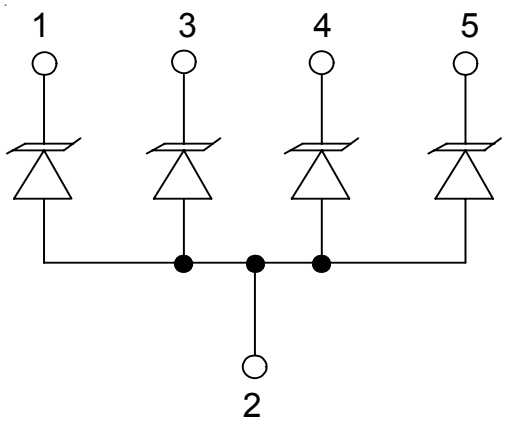
Due to the "snap-back" characteristics of the low voltage TVS, it is not recommended that any of the I/O lines be directly connected to a DC source greater than snap-back votlage (V_{SB}) as the device can latch on as described below.

EPD TVS Characteristics

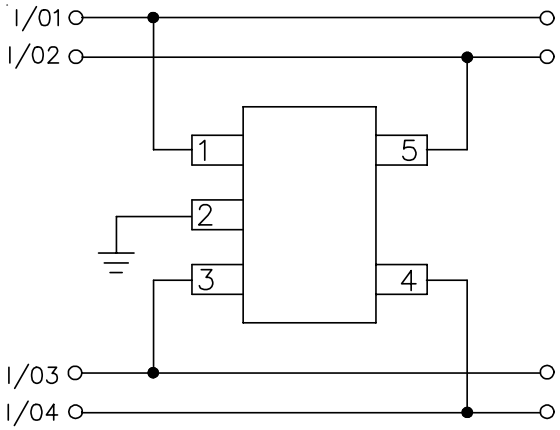
The SMF3.3 is constructed using Semtech's proprietary EPD technology. The structure of the EPD TVS is vastly different from the traditional pn-junction devices. At voltages below 5V, high leakage current and junction capacitance render conventional avalanche technology impractical for most applications. However, by utilizing the EPD technology, the SMF3.3 can effectively operate at 3.3V while maintaining excellent electrical characteristics.

The EPD TVS employs a complex nppn structure in contrast to the pn structure normally found in traditional silicon-avalanche TVS diodes. Since the EPD TVS devices use a 4-layer structure, they exhibit a slightly different IV characteristic curve when compared to conventional devices. During normal operation, the device represents a high-impedance to the circuit up to the device working voltage (V_{RWM}). During an ESD event, the device will begin to conduct and will enter a low impedance state when the punch through voltage (V_{PT}) is exceeded. Unlike a conventional device, the low voltage TVS will exhibit a slight negative resistance characteristic as it conducts current. This characteristic aids in lowering the clamping voltage of the device, but must be considered in applications where DC voltages are present.

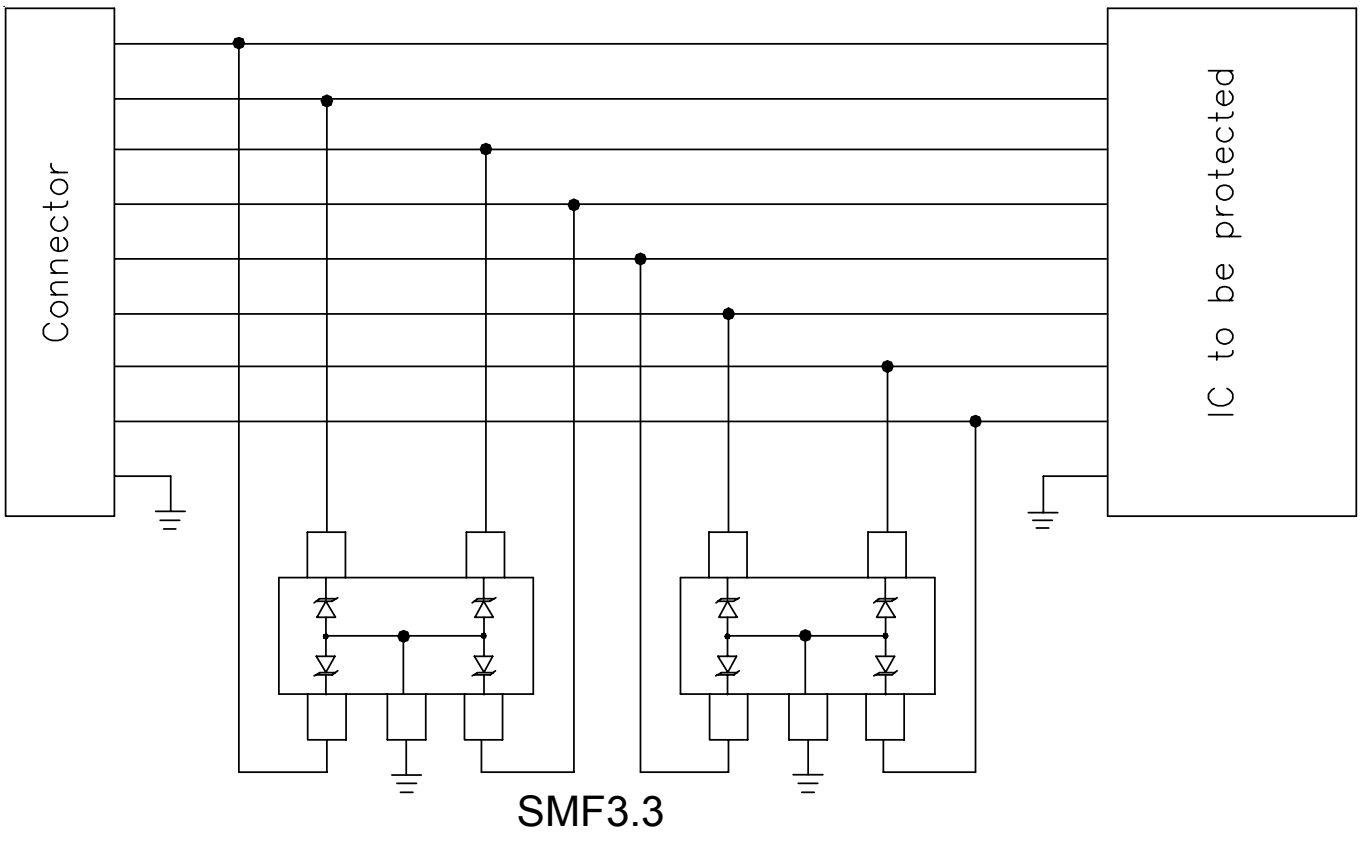
SMF Circuit Diagram



Protection of Four Unidirectional Lines



When the TVS is conducting current, it will exhibit a slight "snap-back" or negative resistance characteristics due to its structures. This point is defined on the curve by the snap-back voltage (V_{SB}) and snap-back current (I_{SB}). To return to a non-conducting state, the current through the device must fall below the I_{SB} (approximately <50mA) and the voltage must fall below the V_{SB} (normally 2.8 volts for a 3.3V device). If a 3.3V TVS is connected to 3.3V DC source, it will never fall below the snap-back voltage of 2.8V and will therefore stay in a conducting state.



Typical Application Diagram

Circuit Board Layout Recommendations for Suppression of ESD.

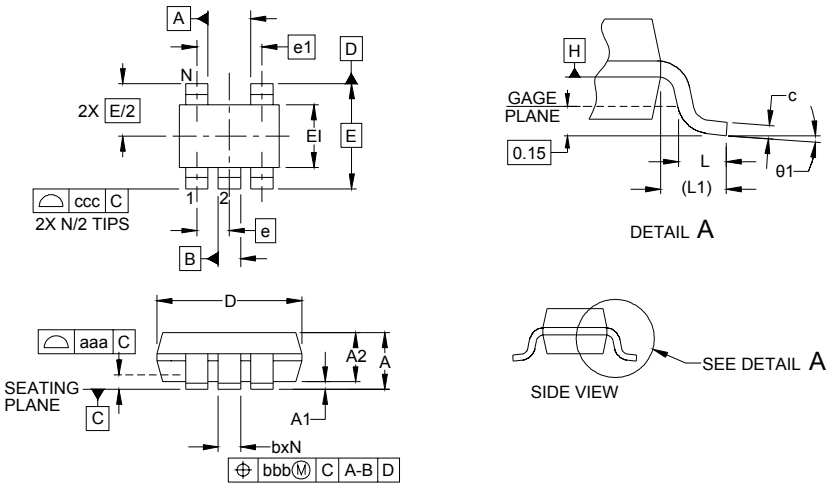
Good circuit board layout is critical for the suppression of ESD induced transients. The following guidelines are recommended:

- Place the TVS near the input terminals or connectors to restrict transient coupling.
- Minimize the path length between the TVS and the protected line.
- Minimize all conductive loops including power and ground loops.
- The ESD transient return path to ground should be kept as short as possible.
- Never run critical signals near board edges.
- Use ground planes whenever possible.

Matte Tin Lead Finish

Matte tin has become the industry standard lead-free replacement for SnPb lead finishes. A matte tin finish is composed of 100% tin solder with large grains. Since the solder volume on the leads is small compared to the solder paste volume that is placed on the land pattern of the PCB, the reflow profile will be determined by the requirements of the solder paste. Therefore, these devices are compatible with both lead-free and SnPb assembly techniques. In addition, unlike other lead-free compositions, matte tin does not have any added alloys that can cause degradation of the solder joint.

Outline Drawing - SC-70 5L

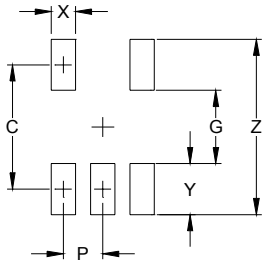


DIM	INCHES			MILLIMETERS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	-	-	.043	-	-	1.10
A1	.000	-	.004	0.00	-	0.10
A2	.028	.035	.039	0.70	0.90	1.00
b	.006	-	.012	0.15	-	0.30
c	.003	-	.009	0.08	-	0.22
D	.075	.079	.083	1.90	2.00	2.10
E1	.045	.049	.053	1.15	1.25	1.35
E	.083 BSC			2.10 BSC		
e	.026 BSC			0.65 BSC		
e1	.051			1.30 BSC		
L	.010	.014	.018	0.26	0.36	0.46
L1	(.017)			(0.42)		
N	5			5		
θ1	0°	-	8°	0°	-	8°
aaa	.004			0.10		
bbb	.004			0.10		
ccc	.012			0.30		

NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. DATUMS -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-
3. DIMENSIONS "E1" AND "D" DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
4. REFERENCE JEDEC STD MO-203, VARIATION AA.

Land Pattern - SC-70 5L



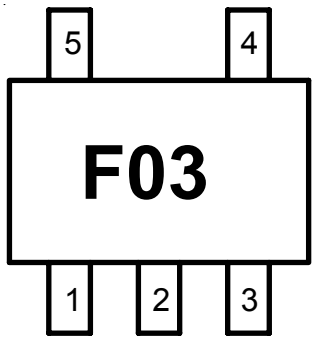
DIM	INCHES	MILLIMETERS
C	(.073)	(1.85)
G	.039	1.00
P	.026	0.65
X	.016	0.40
Y	.033	0.85
Z	.106	2.70

NOTES:

1. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.

Marking Codes

Part Number	Marking Code
SMF3.3	F03



Ordering Information

Part Number	Lead Finish	Qty per Reel	Reel Size
SMF3.3.TC	SnPb	3,000	7 Inch
SMF3.3.TCT	Pb free	3,000	7 Inch

Contact Information

Semtech Corporation
Protection Products Division
200 Flynn Road, Camarillo, CA 93012
Phone: (805)498-2111 FAX (805)498-3804