

500 WATT MULTI-LINE LOW CAPACITANCE TVS ARRAY



DESCRIPTION

The SM16LCxx and SM16LCxxC Series are low capacitance multi-line transient voltage suppressor arrays that provides board level protection for standard TTL and MOS bus line applications against the damaging effects of ESD, tertiary lightning and switching transients.

This series has a peak pulse power rating of 500 Watts for an 8/20 μ s waveshape. This device series meets the IEC 61000-4-2, IEC 61000-4-4 and IEC 61000-4-5 requirements.

FEATURES

- Compatible with IEC 61000-4-2 (ESD): Air - 15kV, Contact - 8kV
- Compatible with IEC 61000-4-4 (EFT): 40A - 5/50ns
- Compatible with IEC 61000-4-5 (Surge): 12A, 8/20 μ s - Level 1(Line-Gnd) & Level 2(Line-Line)
- 500 Watts Peak Pulse Power per Line ($t_p = 8/20\mu$ s)
- Unidirectional and Bidirectional Configurations
- ESD Protection > 25 kilovolts
- Available in Multiple Voltages Ranging from 3.3V to 36V
- Protects up to 8 Lines
- Low Capacitance: 15pF
- RoHS Compliant
- REACH Compliant

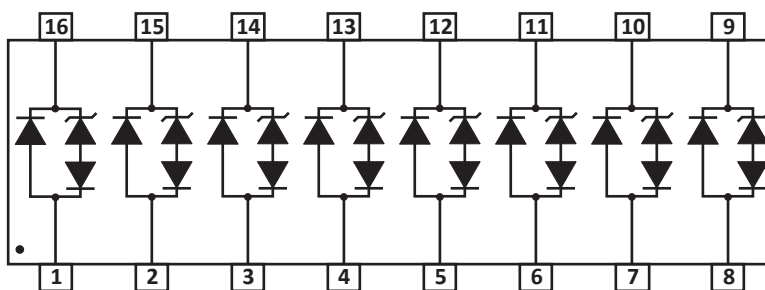
APPLICATIONS

- Wireless Communication Circuits
- RS-422, RS-432 & RS-485
- Low Voltage ASICs
- Ethernet Interfaces

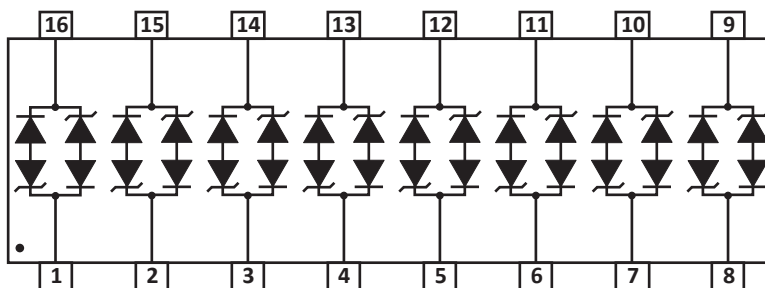
MECHANICAL CHARACTERISTICS

- Molded JEDEC SO-16 Package
- Approximate Weight: 0.15 grams
- Lead-Free Pure-Tin Plating (Annealed)
- Solder Reflow Temperature:
Pure-Tin - Sn, 100: 260-270°C
- 16mm Tape and Reel Per EIA Standard 481
- Flammability Rating UL 94V-0

PIN CONFIGURATIONS



UNIDIRECTIONAL



BIDIRECTIONAL

TYPICAL DEVICE CHARACTERISTICS
MAXIMUM RATINGS @ 25°C Unless Otherwise Specified

PARAMETER	SYMBOL	VALUE	UNITS
Operating Temperature	T_L	-55 to 150	°C
Storage Temperature	T_{STG}	-55 to 150	°C
Peak Pulse Power (tp = 8/20µs) - See Figure 1	P_{PP}	500	Watts
Forward Voltage @ 50mA, 300µs - Square Wave (See Note 1)	V_F	1.5	Volts
Soldering Temperature for 10 seconds	T_{II}	260	°C

NOTES

1. Only applies to unidirectional devices.

ELECTRICAL CHARACTERISTICS PER LINE @ 25°C Unless Otherwise Specified

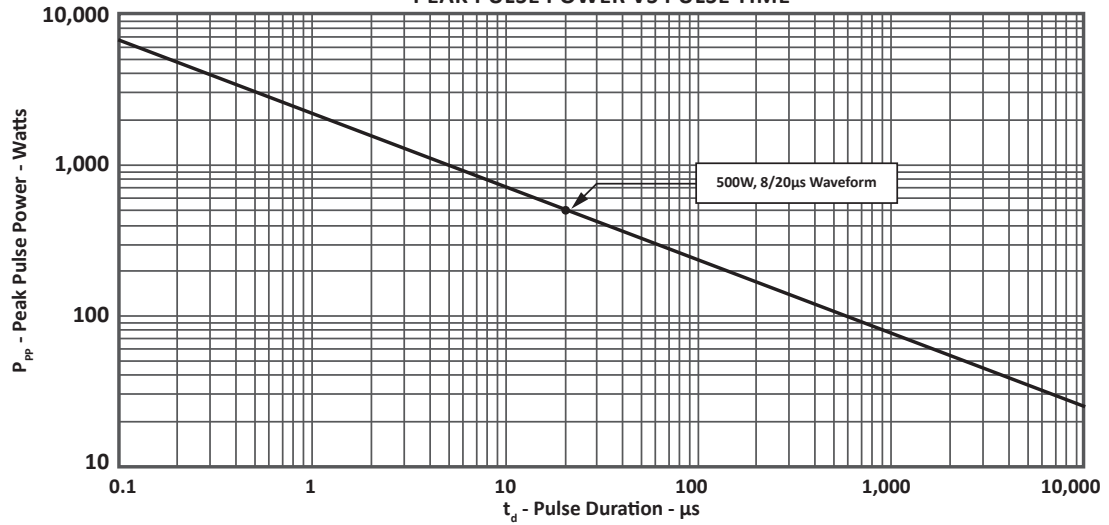
PART NUMBER (Note 1)	RATED STAND-OFF VOLTAGE V_{WM} VOLTS	MINIMUM BREAKDOWN VOLTAGE @1mA $V_{(BR)}$ VOLTS	MAXIMUM CLAMPING VOLTAGE (Fig. 2) @ $I_p = 1A$ V_C VOLTS	MAXIMUM CLAMPING VOLTAGE (Fig. 2) @ 8/20µs $V_C @ I_{PP}$	MAXIMUM LEAKAGE CURRENT @ V_{WM} I_D µA	MAXIMUM CAPACITANCE @0V, 1MHz C pF	TEMPERATURE COEFFICIENT OF $V_{(BR)}$
							$qV_{(BR)}$ mV/°C
SM16LC03	3.3	4.5	7.0	20.0V @ 35A	125	15	-3
SM16LC03C	3.3	4.5	7.0	20.0V @ 35A	125	15	-3
SM16LC05	5.0	6.0	9.8	24.0V @ 42A	20	15	3
SM16LC05C	5.0	6.0	9.8	24.0V @ 42A	20	15	3
SM16LC08	8.0	8.5	13.4	26.0V @ 30A	10	15	9
SM16LC08C	8.0	8.5	13.4	26.0V @ 30A	10	15	9
SM16LC12	12.0	13.3	19.0	33.0V @ 21A	2	15	16
SM16LC12C	12.0	13.3	19.0	33.0V @ 21A	2	15	16
SM16LC15	15.0	16.7	25.5	39.0V @ 15A	2	15	17
SM16LC15C	15.0	16.7	25.5	39.0V @ 15A	2	15	17
SM16LC24	24.0	26.7	40.0	57.0V @ 10A	2	15	26
SM16LC24C	24.0	26.7	40.0	57.0V @ 10A	2	15	26
SM16LC36	36.0	40.0	53.0	72.0V @ 7A	2	15	36
SM16LC36C	36.0	40.0	53.0	72.0V @ 7A	2	15	36

NOTES

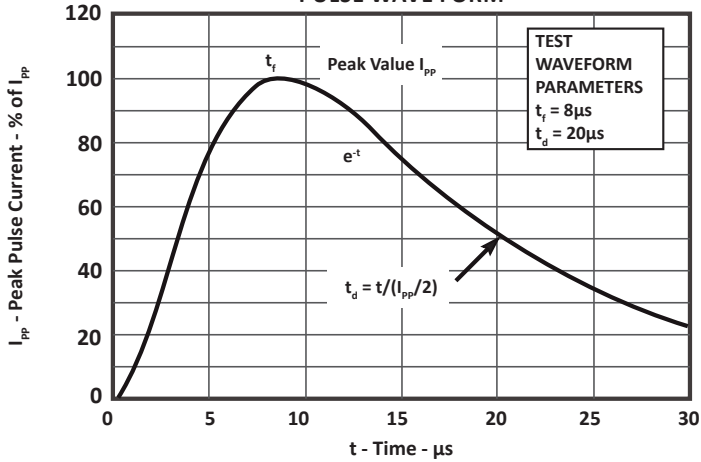
1. Part numbers with a "C" suffix are bidirectional devices, i.e., SM16LC05C.

TYPICAL DEVICE CHARACTERISTICS

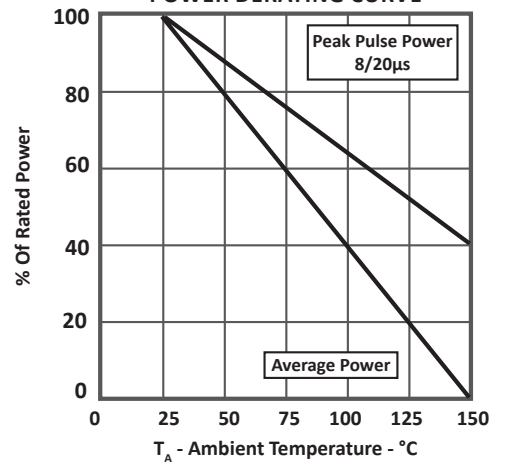
**FIGURE 1
PEAK PULSE POWER VS PULSE TIME**



**FIGURE 2
PULSE WAVE FORM**

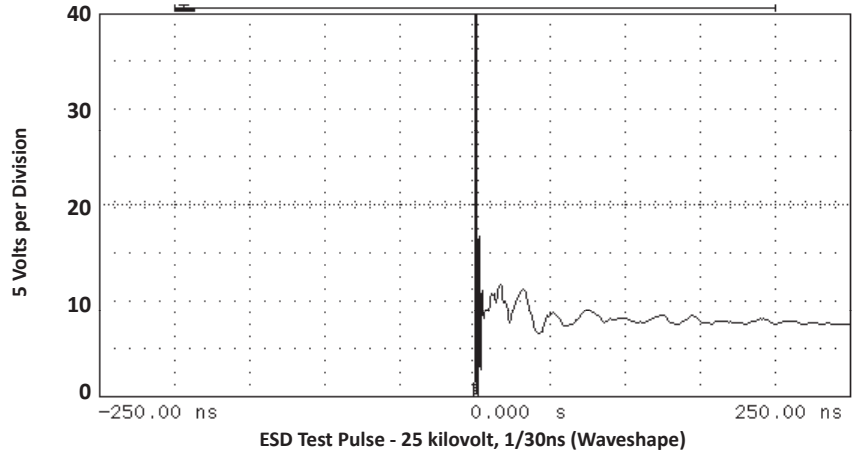


**FIGURE 3
POWER DERATING CURVE**

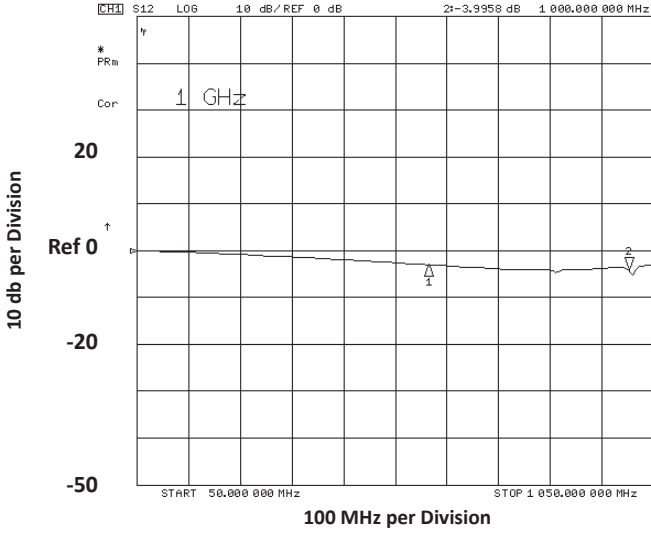


TYPICAL DEVICE CHARACTERISTICS

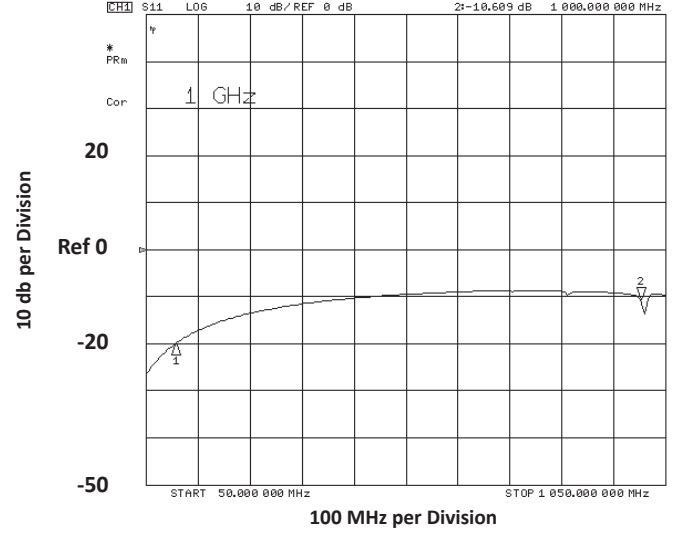
**FIGURE 4
OVERSHOOT & CLAMPING VOLTAGE FOR SM16LC05**



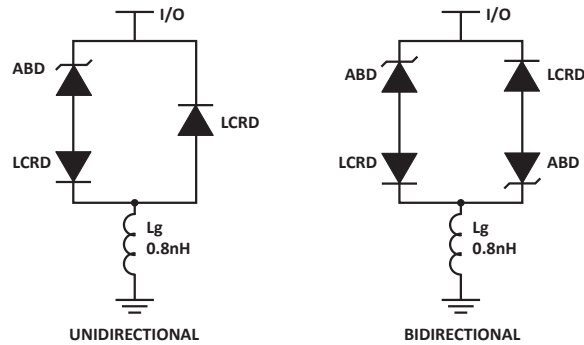
**FIGURE 5
INSERTION LOSS - SM16LC12**



**FIGURE 5
RETURN LOSS - SM16LC12**



SPICE MODEL

FIGURE 1
SPICE MODEL


ABD - Avalanche Breakdown Diode (TVS)
 LCRD: Low Capacitance Rectifier Diode
 Lg - Lead Inductance

TABLE 1 - SPICE PARAMETERS

PARAMETER	UNIT	ABD(TVS)	LCRD
BV	V	See Table 2	200
IBV	μA	1	0.01
C _{jo}	pF	See Table 2	5
I _s	A	See Table 2	1E-13
Vj	V	0.6	0.6
M	-	0.33	0.33
N	-	1	1
R _s	Ohms	See Table 2	0.31
TT	s	1E-8	1E-9
EG	eV	1.11	1.11

TABLE 2 - ABD SPECIFIC SPICE PARAMETERS

PART NUMBER	B _v (VOLTS)	C _{jo} (pF)	I _s (AMPS)	Rs(OHMS)
SM16LC03	4.5	438	1E-11	0.21
SM16LC05	6.0	284	1E-11	0.14
SM16LC08	8.5	146	1E-11	0.28
SM16LC12	13.3	123	1E-13	0.40
SM16LC15	16.7	102	1E-13	0.52
SM16LC24	26.7	61	1E-13	1.54
SM16LC03C	4.5	438	1E-11	0.21
SM16LC05C	6.0	284	1E-11	0.14
SM16LC08C	8.5	146	1E-11	0.28
SM16LC12C	13.3	123	1E-13	0.40
SM16LC15C	16.7	102	1E-13	0.52
SM16LC24C	26.7	61	1E-13	1.54

APPLICATION INFORMATION

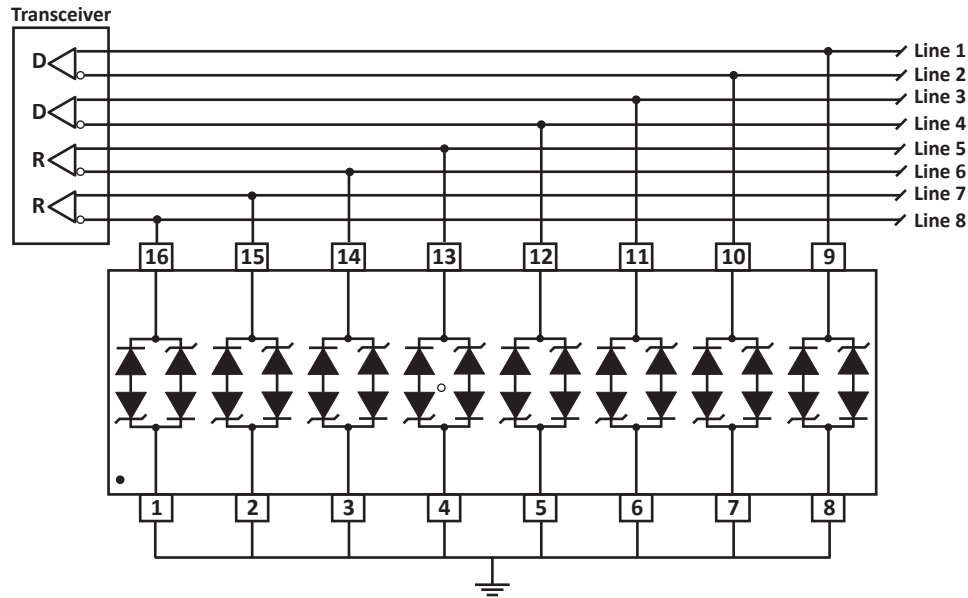


FIGURE 1 - BIDIRECTIONAL COMMON-MODE PROTECTION

Circuit connectivity is as follows:

- Line 1 connected to Pin 9.
- Line 2 connected to Pin 10.
- Line 3 connected to Pin 11.
- Line 4 connected to Pin 12.
- Line 5 connected to Pin 13.
- Line 6 connected to Pin 14.
- Line 7 connected to Pin 15.
- Line 8 connected to Pin 16.
- Pins 1 - 8 connected to ground.

CIRCUIT BOARD RECOMMENDATIONS

Circuit board layout is critical for electromagnetic compatibility protection. The following guidelines are recommended:

- The protection device should be placed near the input terminals or connectors, the device will divert the transient current immediately before it can be coupled into the nearby traces.
- The path length between the TVS device and the protected line should be minimized.
- All conductive loops including power and ground loops should be minimized.
- The transient current return path to ground should be kept as short as possible to reduce parasitic inductance.
- Ground planes should be used whenever possible. For multilayer PCBs, use ground vias.

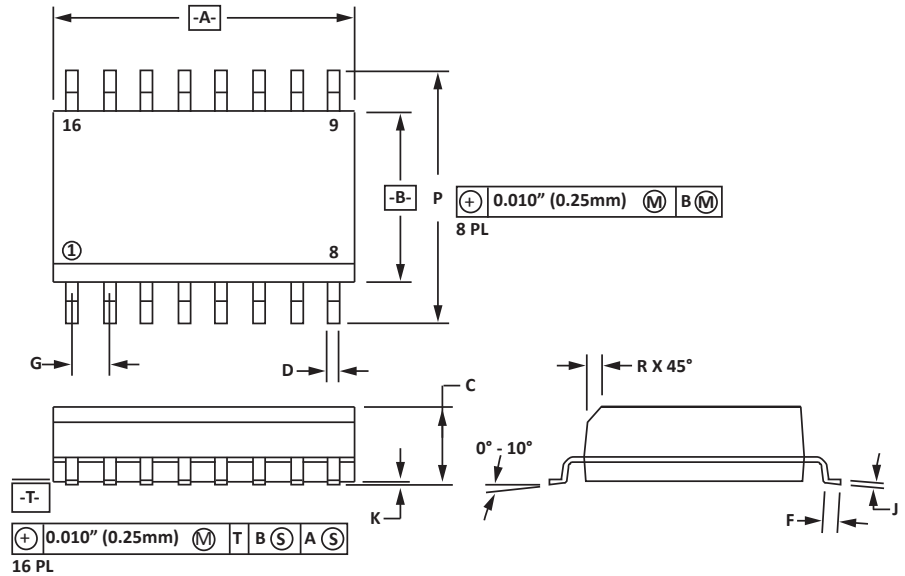
SO-16 PACKAGE INFORMATION

OUTLINE DIMENSIONS

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.05 BSC	
J	0.18	0.25	0.007	0.009
K	0.10	0.25	0.004	0.008
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

NOTES

- T = Seating plane and datum surface.
- Dimensions "A" and "B" are datum.
- Dimensions "A" and "B" do not include mold protrusion.
- Maximum mold protrusion is 0.015" (0.380mm) per side.
- Dimensioning and tolerances per ANSI Y14.5M, 1982.
- Dimensions are exclusive of mold flash and metal burrs.

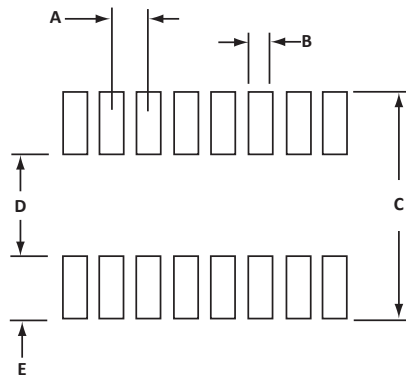


PAD LAYOUT DIMENSIONS

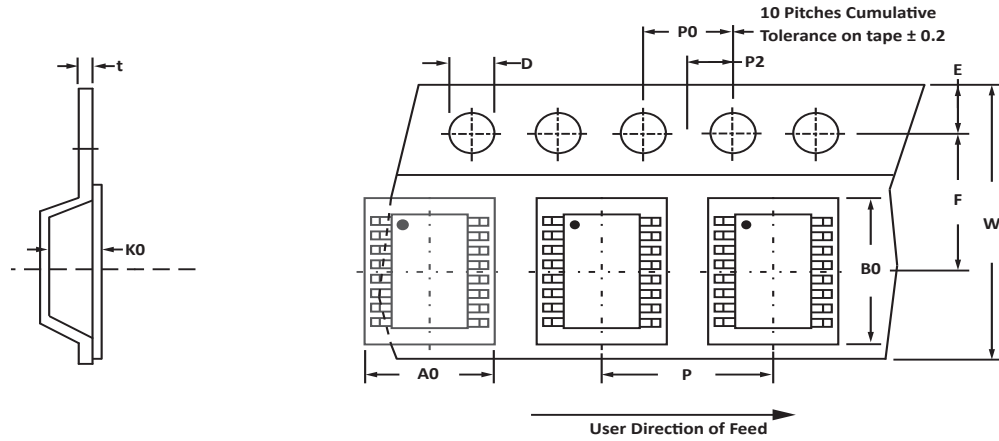
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.14	1.40	0.045	0.055
B	0.64	0.89	0.025	0.035
C	6.22	-	0.245	-
D	3.94	4.17	0.155	0.165
E	1.02	1.27	0.040	0.050

NOTES

- Controlling dimension: inches.



TAPE AND REEL



SPECIFICATIONS

REEL DIA.	TAPE WIDTH	A0	B0	K0	D	E	F	W	P0	P2	P	tmax
178mm (7")	16mm	6.50 ± 0.10	10.30 ± 0.10	2.10 ± 0.10	1.50 ± 0.10	1.75 ± 0.10	3.50 ± 0.05	16.00 ± 0.30	4.00 ± 0.12	2.00 ± 0.10	8.00 ± 0.10	0.25

NOTES

- Dimensions are in millimeters.
- Surface mount product is taped and reeled in accordance with EIA-481.
- Suffix - T7 = 7" Reel - 1,000 pieces per 16mm tape.
- Suffix - T13 = 13" Reel - 2,500 pieces per 16mm tape.
- Bulk product shipped in tubes of 48 pieces per tube.
- Marking on Part - part number, date code, logo and pin one defined by dot on top of package.

ORDERING INFORMATION

BASE PART NUMBER (xx = Voltage)	LEADFREE SUFFIX	TAPE SUFFIX	QTY/REEL	REEL SIZE	TUBE QTY
SM16LCxx/SM16LCxxC	-LF	-T7	1,000	7"	48
SM16LCxx/SM16LCxxC	-LF	-T13	2,500	13"	48

This device is only available in a Lead-Free configuration.

COMPANY INFORMATION

COMPANY PROFILE

In business more than 25 years, ProTek Devices™ is a privately held semiconductor company. The company offers a product line of overvoltage protection and overcurrent protection components. These include transient voltage suppressor array (TVS arrays) avalanche breakdown diode, steering diode TVS array and electronics SMD chip fuses. These components deliver circuit protection in electronic systems from numerous overvoltage and overcurrent events. They include lightning; electrostatic discharge (ESD); nuclear electromagnetic pulses (NEMP); inductive switching; and electromagnetic interference (EMI) / radio frequency interference (RFI). ProTek Devices also offers LED wafer die for ESD protection and related high frequency products. ProTek Devices is ISO 9001:2015 certified.

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