

**500 WATT MULTI-LINE LOW CAPACITANCE TVS ARRAY**

**SO-16 PACKAGE**
**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 $\mu$ s waveshape. This device series meets the IEC 61000-4-2, IEC 61000-4-4 and IEC 61000-4-5 requirements.

**FEATURES**

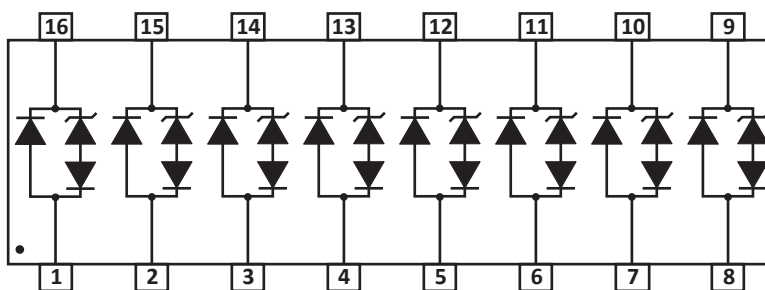
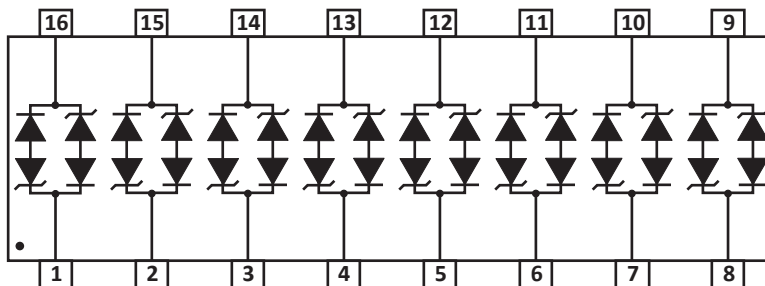
- Compatible with IEC 61000-4-2 (ESD): Air - 15kV, Contact - 8kV
- Compatible with IEC 61000-4-4 (EFT): 40A - 5/50ns
- Compatible with IEC 61000-4-5 (Surge): 12A, 8/20 $\mu$ s - Level 1(Line-Gnd) & Level 2(Line-Line)
- 500 Watts Peak Pulse Power per Line (tp = 8/20 $\mu$ s)
- Unidirectional and Bidirectional 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<br>(Note 1) | RATED STAND-OFF VOLTAGE<br><br>$V_{WM}$<br>VOLTS | MINIMUM BREAKDOWN VOLTAGE<br><br>@1mA<br>$V_{(BR)}$<br>VOLTS | MAXIMUM CLAMPING VOLTAGE (Fig. 2)<br><br>@ $I_p = 1A$<br>$V_c$<br>VOLTS | MAXIMUM CLAMPING VOLTAGE (Fig. 2)<br><br>@ 8/20μs<br>$V_c @ I_{PP}$ | MAXIMUM LEAKAGE CURRENT<br><br>@ $V_{WM}$<br>$I_D$<br>μA | MAXIMUM CAPACITANCE<br><br>@0V, 1MHz<br>C<br>pF | TEMPERATURE COEFFICIENT OF $V_{(BR)}$<br><br>$qV_{(BR)}$<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

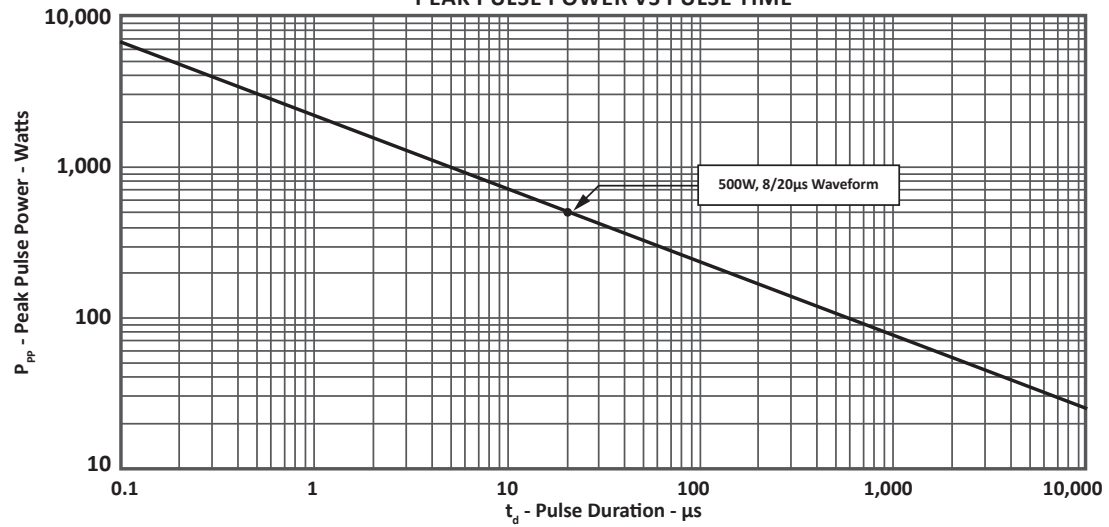


FIGURE 2  
PULSE WAVE FORM

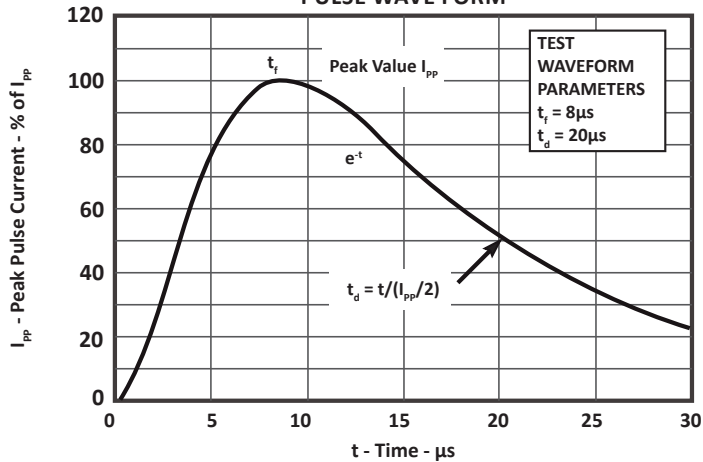
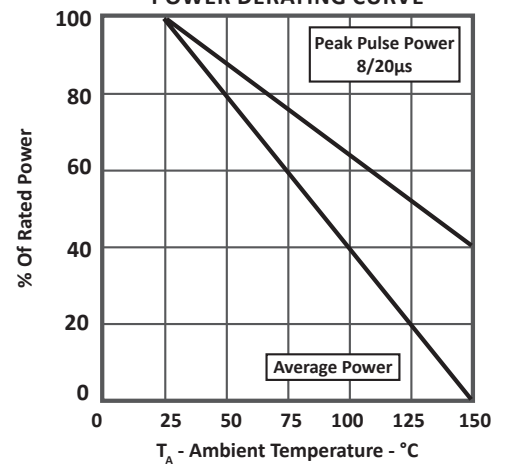
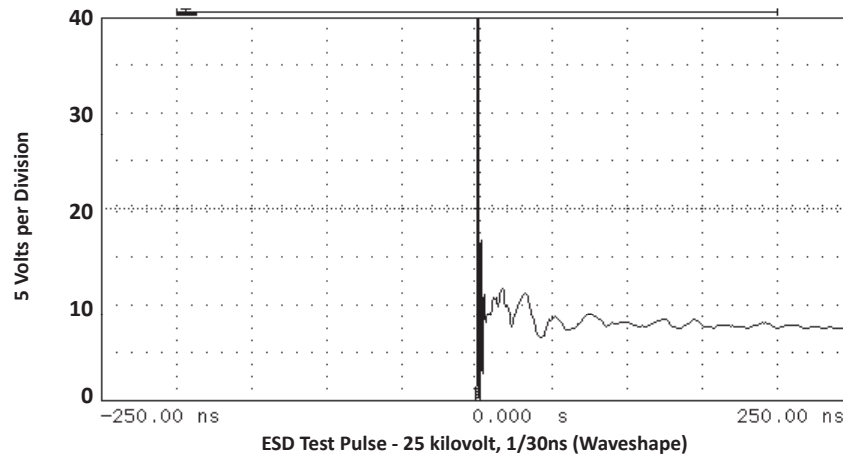


FIGURE 3  
POWER DERATING CURVE

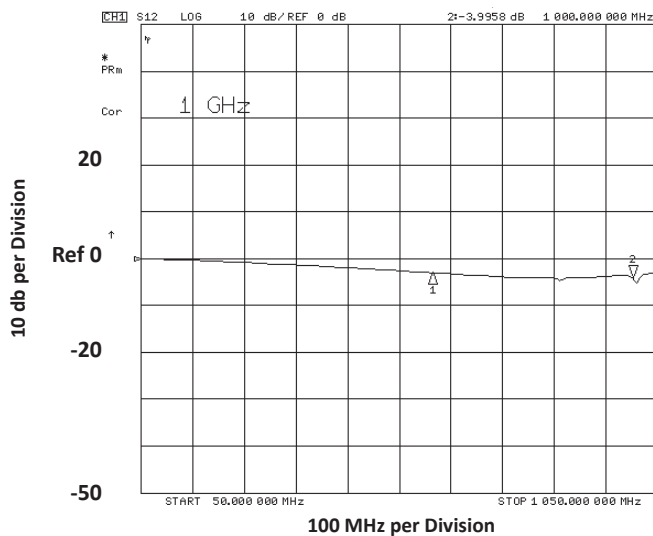


## TYPICAL DEVICE CHARACTERISTICS

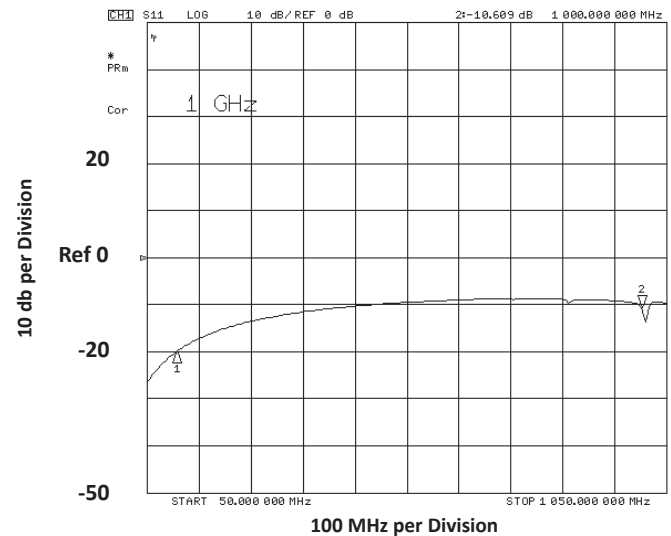
**FIGURE 4**  
**OVERSHOOT & CLAMPING VOLTAGE FOR SM16LC05**



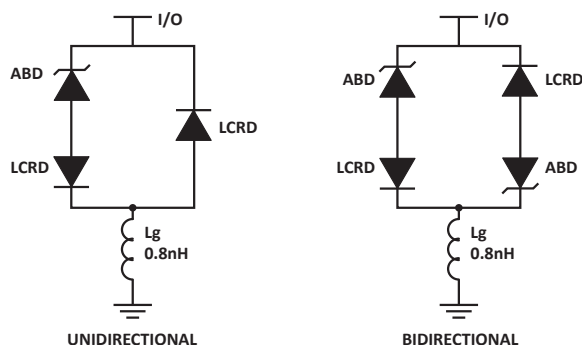
**FIGURE 5**  
**INSERTION LOSS - SM16LC12**



**FIGURE 5**  
**RETURN LOSS - SM16LC12**



## SPICE MODEL

**FIGURE 1**  
**SPICE MODEL**


ABD - Avalanche Breakdown Diode (TVS)

LCRD: Low Capacitance Rectifier Diode

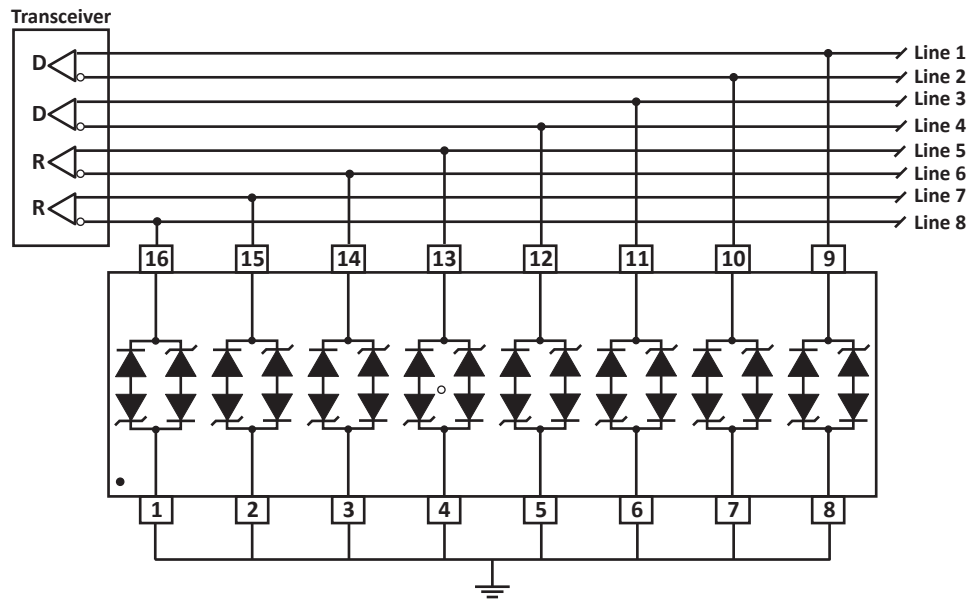
 $L_g$  - Lead Inductance**TABLE 1 - SPICE PARAMETERS**

| PARAMETER | UNIT    | ABD(TVS)    | LCRD  |
|-----------|---------|-------------|-------|
| BV        | V       | See Table 2 | 200   |
| IBV       | $\mu A$ | 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) | $R_s$ (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.

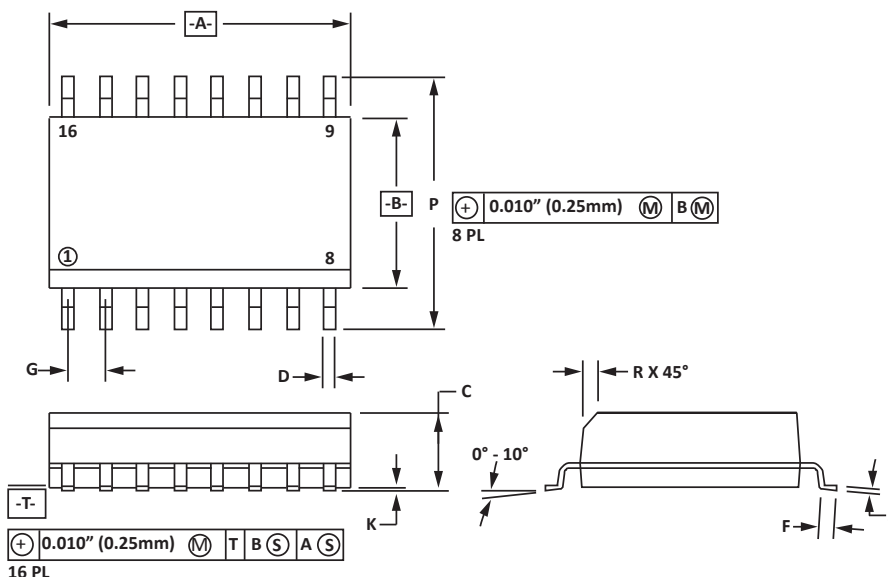
## SO-16 PACKAGE INFORMATION

## 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

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

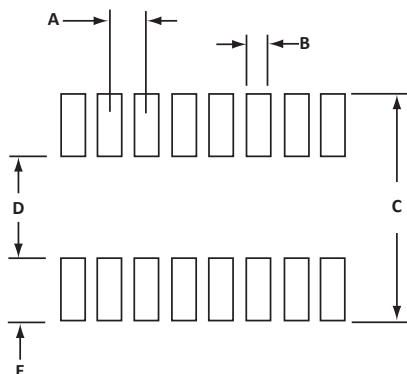


## PAD LAYOUT DIMENSIONS

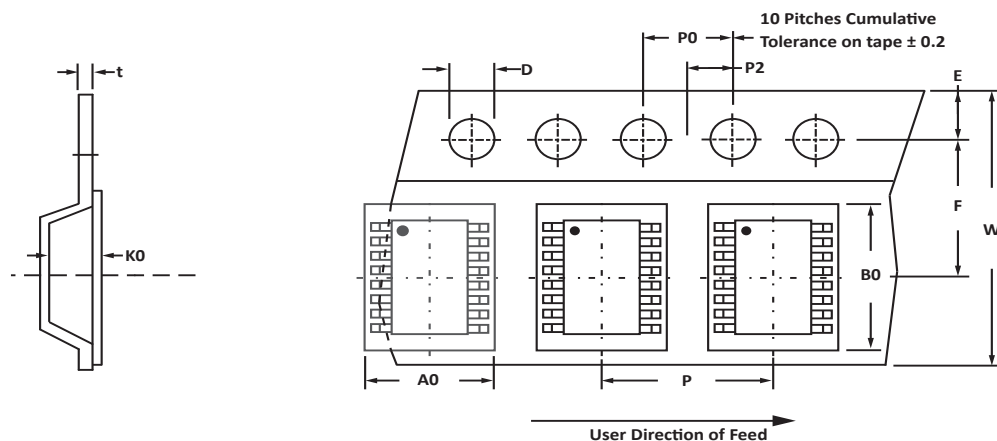
| DIM | MILLIMETERS |      | INCHES |       |
|-----|-------------|------|--------|-------|
|     | MIN         | MAX  | MIN    | MAX   |
| A   | 1.14        | 1.40 | 0.045  | 0.055 |
| B   | 0.64        | 0.89 | 0.025  | 0.035 |
| C   | 6.22        | -    | 0.245  | -     |
| D   | 3.94        | 4.17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

## NOTES

1. 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 | 4.00 ± 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.

Package outline per document number 06007.R3 1/11.

## ORDERING INFORMATION

| BASE PART NUMBER<br>(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

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### COMPANY PROFILE

In business more than 20 years, ProTek Devices™ is a privately-held company located in Tempe, Arizona, that offers a product line of transient voltage suppressors (TVS); avalanche breakdown diodes; steering diode TVS arrays and other surge suppressor component products. These TVS devices protect electronic systems from the effects of lightning, electrostatic discharge (ESD), nuclear electromagnetic pulses (NEMP), inductive switching and EMI / RFI. ProTek Devices also offers high performance interface and linear products that include analog switches; multiplexers; LED drivers; audio control ICs; RF and related high frequency products. The analog devices work in a host of consumer; industrial; automotive and other applications.

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