

APPLICATIONS

- ✓ Ethernet - 10/100 Base T
- ✓ Cellular Phones
- ✓ Audio & Video Inputs
- ✓ FireWire, SCSI & USB Interfaces

IEC COMPATIBILITY (EN61000-4)

- ✓ 61000-4-2 (ESD): Air - 15kV, Contact - 8kV
- ✓ 61000-4-4 (EFT): 40A - 5/50ns
- ✓ 61000-4-5 (Surge): 12A, 8/20 μ s - Level 1(Line-Gnd) & Level 2(Line-Line)

FEATURES

- ✓ 500 Watts Peak Pulse Power per Line (tp=8/20 μ s)
- ✓ Unidirectional & Bidirectional Configurations
- ✓ Available in Multiple Voltage Types Ranging From 3V to 24V
- ✓ Protects One Line
- ✓ ESD Protection > 40 kilovolts
- ✓ Low Leakage
- ✓ Low Capacitance: 5pF per Line Pair
- ✓ RoHS Compliant in Lead-Free Versions

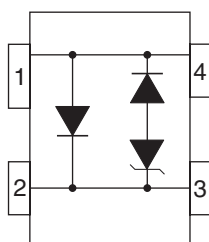
MECHANICAL CHARACTERISTICS

- ✓ Molded JEDEC SOT-143 Package
- ✓ Weight 9 milligrams (Approximate)
- ✓ Available in Tin-Lead or Lead-Free Pure-Tin Plating(Annealed)
- ✓ Solder Reflow Temperature:
 - Tin-Lead - Sn/Pb, 85/15: 240-245°C
 - Pure-Tin - Sn, 100: 260-270°C
- ✓ Flammability Rating UL 94V-0
- ✓ 8mm Tape and Reel Per EIA Standard 481
- ✓ Marking: Marking Code

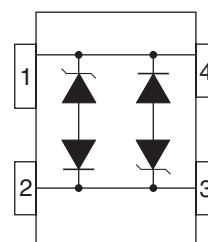


PIN CONFIGURATIONS

UNIDIRECTIONAL



BIDIRECTIONAL



USB0403 thru USB0424C

DEVICE CHARACTERISTICS

MAXIMUM RATINGS @ 25°C Unless Otherwise Specified

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|-----------|----------------|-------|
| Peak Pulse Power ($t_p = 8/20\mu s$) - See Figure 1 | P_{PP} | 500 | Watts |
| Operating Temperature | T_J | -55°C to 150°C | °C |
| Storage Temperature | T_{STG} | -55°C to 150°C | °C |

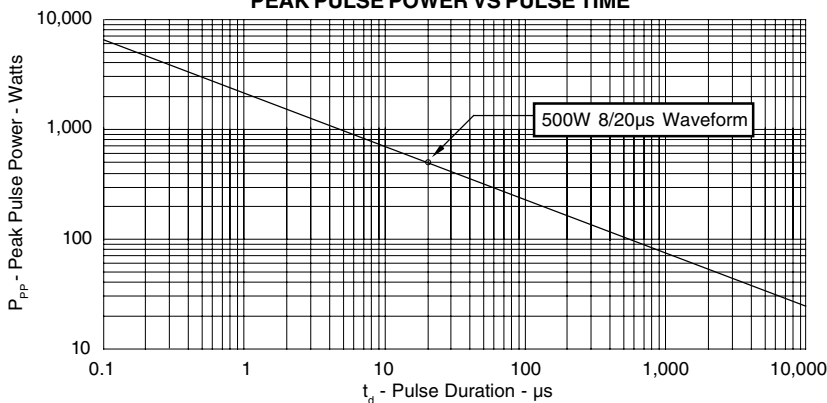
ELECTRICAL CHARACTERISTICS PER LINE @ 25°C Unless Otherwise Specified

| PART NUMBER (See Notes 1-2) | DEVICE MARKING | RATED STAND-OFF VOLTAGE V_{WM} VOLTS | MINIMUM BREAKDOWN VOLTAGE @ 1mA $V_{(BR)}$ VOLTS | MAXIMUM CLAMPING VOLTAGE (See Fig. 2) @ $I_p = 5A$ V_C VOLTS | MAXIMUM CLAMPING VOLTAGE (See Fig. 2) @ 8/20 μs $V_C @ I_{PP}$ | MAXIMUM LEAKAGE CURRENT @ V_{WM} I_b μA | MAXIMUM CAPACITANCE 0V @ 1 MHz C pF |
|--------------------------------|----------------|--|---|--|--|---|--|
| USB0403 | 3U | 3.3 | 4.0 | 9.0 | 19.0V @ 20.0A | 125 | 5 |
| USB0403C | 3B | 3.3 | 4.0 | 9.0 | 19.0V @ 20.0A | 125 | 5 |
| USB0405 | 5U | 5.0 | 6.0 | 11.0 | 18.3V @ 17.0A | 20 | 5 |
| USB0405C | 5B | 5.0 | 6.0 | 11.0 | 18.3V @ 17.0A | 20 | 5 |
| USB0408 | 8U | 8.0 | 8.5 | 16.6 | 18.5V @ 17.0A | 10 | 5 |
| USB0408C | 8B | 8.0 | 8.5 | 16.6 | 18.5V @ 17.0A | 10 | 5 |
| USB0412 | 12U | 12.0 | 13.3 | 24.0 | 28.6V @ 11.0A | 1 | 5 |
| USB0412C | 12B | 12.0 | 13.3 | 24.0 | 28.6V @ 11.0A | 1 | 5 |
| USB0415 | 15U | 15.0 | 16.6 | 30.0 | 31.8V @ 10.0A | 1 | 5 |
| USB0415C | 15B | 15.0 | 16.6 | 30.0 | 31.8V @ 10.0A | 1 | 5 |
| USB0424 | 24U | 24.0 | 26.7 | N/A | 56.0V @ 6.0A | 1 | 5 |
| USB0424C | 24B | 24.0 | 26.7 | N/A | 56.0V @ 6.0A | 1 | 5 |

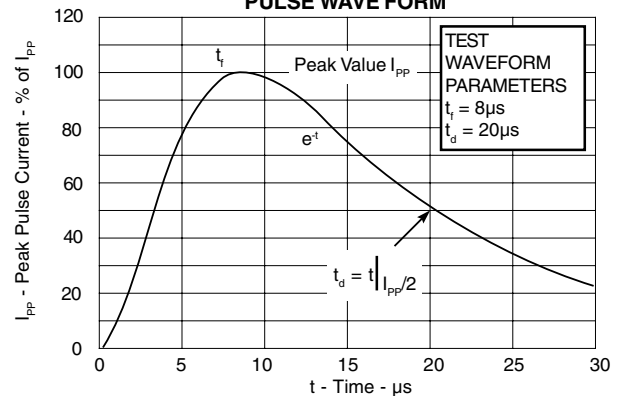
Note 1: Part numbers with an additional "C" suffix are bidirectional devices, i.e., USB0405C.

Note 2: *Unidirectional Only:* Positive potential is applied from pin 2 to 1 or pin 3 to 4.

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

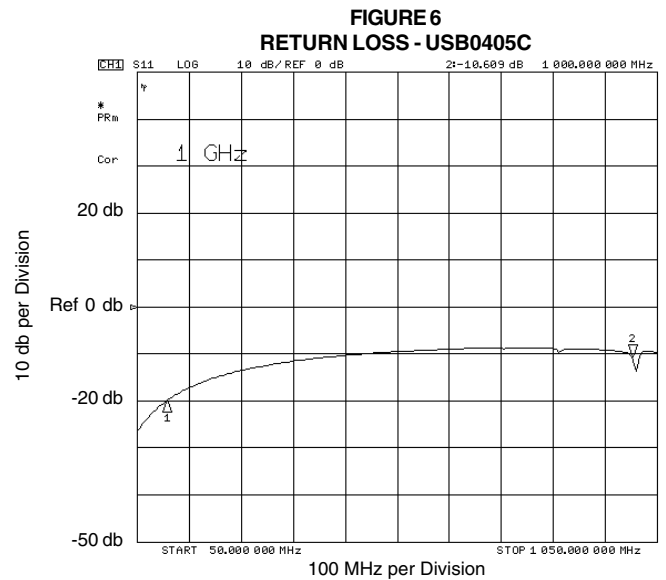
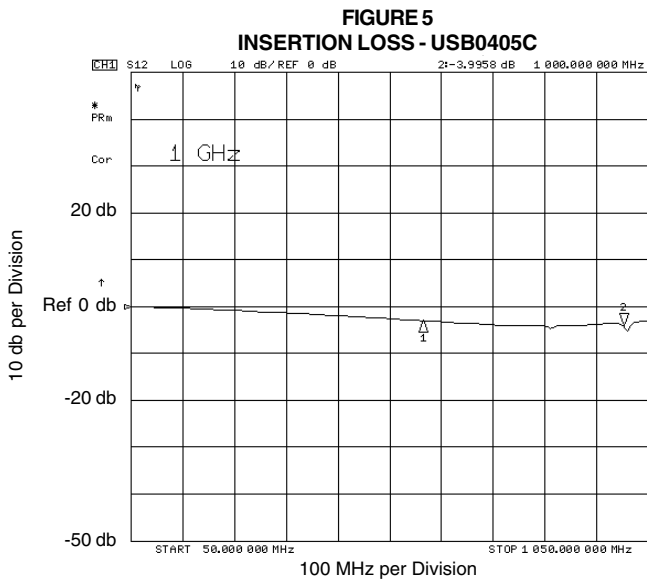
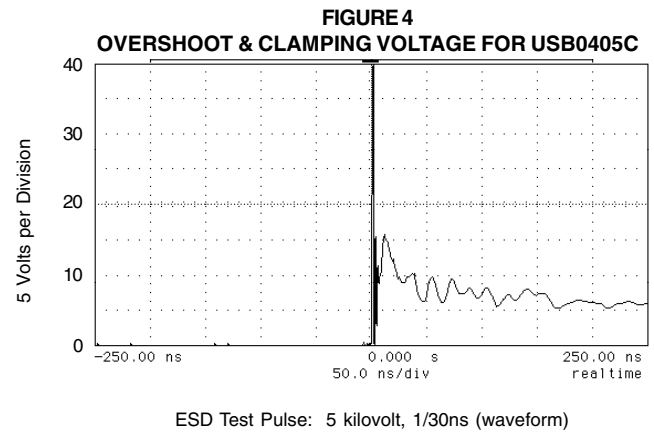
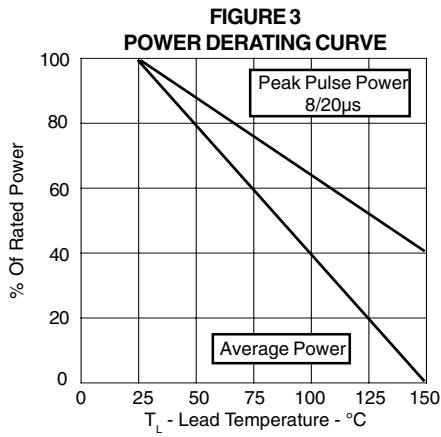


**FIGURE 2
PULSE WAVEFORM**



USB0403 thru USB0424C

GRAPHS



USB0403 thru USB0424C

APPLICATIONS

The USB04 Series are TVS arrays designed to protect I/O or data lines from the damaging effects of ESD and EFT. This product series provides both unidirectional and bidirectional protection, with a surge capability of 500 Watts P_{PP} per line for an 8/20 μ s waveform and ESD protection > 40kV.

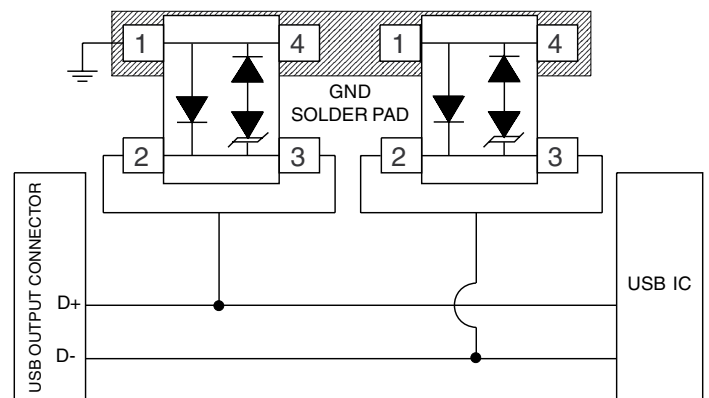
UNIDIRECTIONAL COMMON-MODE CONFIGURATION (Figure 1)

The two USB04 Series devices provide protection in a common-mode configuration as depicted in Figure 1.

Circuit connectivity is as follows:

- ✓ TVS Device 1: Line 1(D+) is connected to Pins 2 & 3.
- ✓ TVS Device 2: Line 2(D-) is connected to Pins 2 & 3.
- ✓ Both TVS Devices: Pins 1 & 4 connected to ground.

Figure 1 - Unidirectional Configuration (Two TVS Devices)
Common-Mode USB Protection



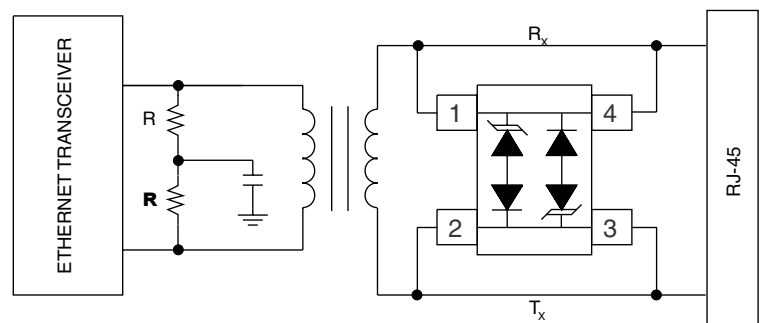
BIDIRECTIONAL DIFFERENTIAL-MODE CONFIGURATION (Figure 2)

The USB04xxC Series provides protection in a differential-mode configuration as depicted in Figure 2.

Circuit connectivity is as follows:

- ✓ Line 1(R_x) is connected to Pins 1 & 4.
- ✓ Line 2(T_x) is connected to Pins 2 & 3.

Figure 2 - Bidirectional Configuration
Differential-Mode Ethernet Protection



CIRCUIT BOARD LAYOUT RECOMMENDATIONS

Circuit board layout is critical for Electromagnetic Compatibility (EMC) 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.

USB0403 thru USB0424C

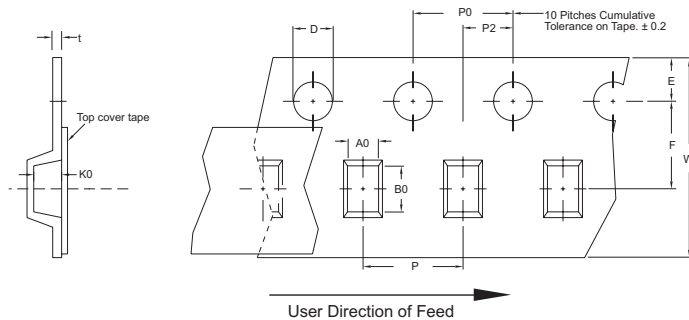
SOT-143 PACKAGE OUTLINE & DIMENSIONS

| PACKAGE OUTLINE | | SOT-143 | | | |
|---------------------------|-------------|---------|--------|-------|--|
| | | | | | |
| PACKAGE DIMENSIONS | | | | | |
| DIM | MILLIMETERS | | INCHES | | |
| | MIN | MAX | MIN | MAX | |
| A | 2.80 | 3.04 | 0.110 | 0.120 | |
| B | 1.20 | 1.39 | 0.047 | 0.055 | |
| C | 0.84 | 1.14 | 0.033 | 0.045 | |
| D | 0.39 | 0.50 | 0.015 | 0.020 | |
| F | 0.79 | 0.93 | 0.031 | 0.037 | |
| G | 1.78 | 2.03 | 0.070 | 0.080 | |
| H | 0.013 | 0.10 | 0.0005 | 0.004 | |
| J | 0.08 | 0.15 | 0.003 | 0.006 | |
| K | 0.46 | 0.60 | 0.018 | 0.024 | |
| L | 0.445 | 0.60 | 0.0175 | 0.024 | |
| R | 0.72 | 0.83 | 0.028 | 0.033 | |
| S | 2.11 | 2.48 | 0.083 | 0.098 | |

| MOUNTING PAD | | | NOTES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|-------------|--------|---|--|--|-----|-------------|--------|---|------|-------|---|------|-------|---|------|-------|---|------|-------|---|------|-------|---|------|-------|---|------|-------|---|------|-------|---|------|-------|----|------|-------|----|------|-------|--|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="margin: auto;"> <thead> <tr> <th colspan="3">TYPICAL</th> </tr> <tr> <th>DIM</th> <th>Millimeters</th> <th>Inches</th> </tr> </thead> <tbody> <tr><td>1</td><td>2.85</td><td>0.112</td></tr> <tr><td>2</td><td>2.00</td><td>0.079</td></tr> <tr><td>3</td><td>1.80</td><td>0.071</td></tr> <tr><td>4</td><td>1.90</td><td>0.075</td></tr> <tr><td>5</td><td>1.05</td><td>0.041</td></tr> <tr><td>6</td><td>2.75</td><td>0.108</td></tr> <tr><td>7</td><td>1.20</td><td>0.047</td></tr> <tr><td>8</td><td>0.80</td><td>0.031</td></tr> <tr><td>9</td><td>0.85</td><td>0.033</td></tr> <tr><td>10</td><td>0.85</td><td>0.033</td></tr> <tr><td>11</td><td>0.85</td><td>0.033</td></tr> </tbody> </table> | | | TYPICAL | | | DIM | Millimeters | Inches | 1 | 2.85 | 0.112 | 2 | 2.00 | 0.079 | 3 | 1.80 | 0.071 | 4 | 1.90 | 0.075 | 5 | 1.05 | 0.041 | 6 | 2.75 | 0.108 | 7 | 1.20 | 0.047 | 8 | 0.80 | 0.031 | 9 | 0.85 | 0.033 | 10 | 0.85 | 0.033 | 11 | 0.85 | 0.033 | <p>1. Dimensioning and tolerances per ANSI Y14.5M, 1985.</p> <p>2. Controlling Dimension: Inches</p> <p>3. Dimensions are exclusive of mold flash and metal burrs.</p> <p>TAPE & REEL ORDERING NOMENCLATURE</p> <p>1. Surface mount product is taped and reeled in accordance with EIA-481.</p> <p>2. Suffix - T7 = 7 Inch Reel - 3,000 pieces per 8mm tape, i.e., <i>USB0405C-T7</i>.</p> <p>3. Suffix - T13 = 13 Inch Reel - 10,000 pieces per 8mm tape, i.e., <i>USB0405C-T13</i>.</p> <p>4. Suffix - LF = Lead-Free, Pure-Tin Plating, i.e., <i>USB0405C-LF-T7</i>.</p> |
| TYPICAL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DIM | Millimeters | Inches | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 2.85 | 0.112 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.00 | 0.079 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 1.80 | 0.071 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 1.90 | 0.075 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 1.05 | 0.041 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | 2.75 | 0.108 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 1.20 | 0.047 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | 0.80 | 0.031 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | 0.85 | 0.033 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 0.85 | 0.033 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | 0.85 | 0.033 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Outline & Dimensions: Rev 2 - 6/06, 06011 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Tape & Reel Specifications (Dimensions in millimeters)

| Reel Dia. | Tape Width | A0 | B0 | K0 | D | E | F | W | P0 | P2 | P | tmax |
|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------|
| 178mm (7") | 8mm | 3.10 ± 0.10 | 2.70 ± 0.10 | 1.35 ± 0.10 | 1.50 ± 0.10 | 1.75 ± 0.10 | 3.50 ± 0.05 | 8.00 ± 0.30 | 4.00 ± 0.10 | 2.00 ± 0.05 | 4.00 ± 0.10 | 0.25 |



COPYRIGHT © ProTek Devices 2003

SPECIFICATIONS: ProTek reserves the right to change the electrical and or mechanical characteristics described herein without notice (except JEDEC).

DESIGN CHANGES: ProTek reserves the right to discontinue product lines without notice, and that the final judgement concerning selection and specifications is the buyer's and that in furnishing engineering and technical assistance, ProTek assumes no responsibility with respect to the selection or specifications of such products.

ProTek Devices

2929 South Fair Lane, Tempe, AZ 85282

Tel: 602-431-8101 Fax: 602-431-2288

E-Mail: sales@protekdevices.com

Web Site: www.protekdevices.com