

PROTECTION PRODUCTS
Absolute Maximum Rating

Rating	Symbol	Value	Units
DP, DM, USB ID TVS			
Peak Pulse Power (tp = 8/20μs)	P_{pk}	60	Watts
Peak Pulse Current (tp = 8/20μs)	I_{pp}	3	A
ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	V_{ESD}	±15 ±15	kV
Operating Temperature	T_j	-55 to +125	°C
Storage Temperature	T_{STG}	-55 to +150	°C
VBus TVS			
Peak Pulse Power (tp = 8/20μs)	P_{pk}	3000	Watts
Peak Pulse Current (tp = 8/20μs)	I_{pp}	80	A
ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	V_{ESD}	±30 ±30	kV
Operating Temperature	T_j	-55 to +125	°C
Storage Temperature	T_{STG}	-55 to +150	°C

Electrical Characteristics (T=25°C)

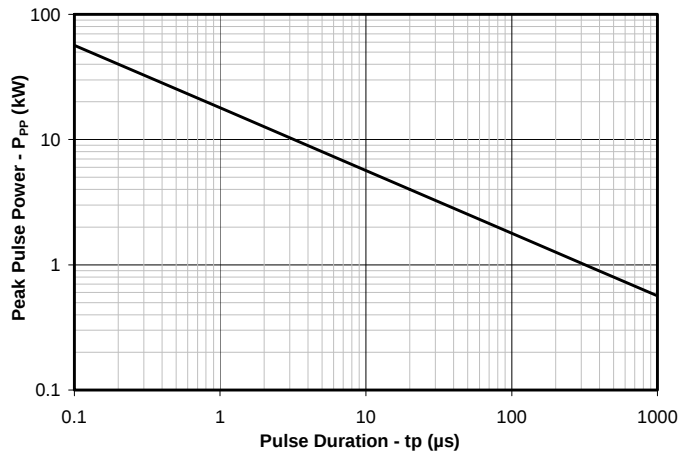
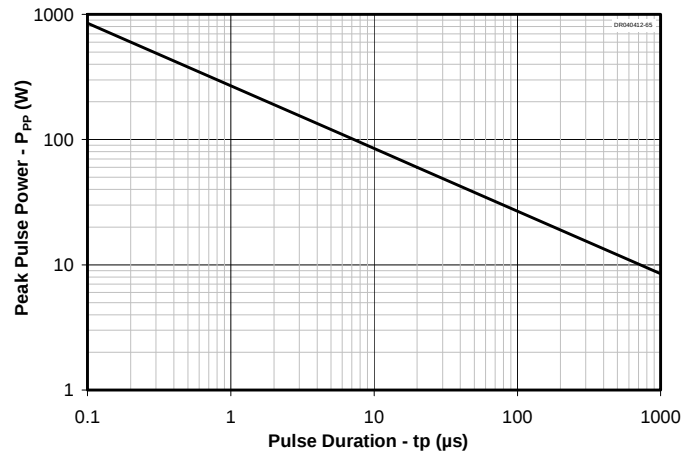
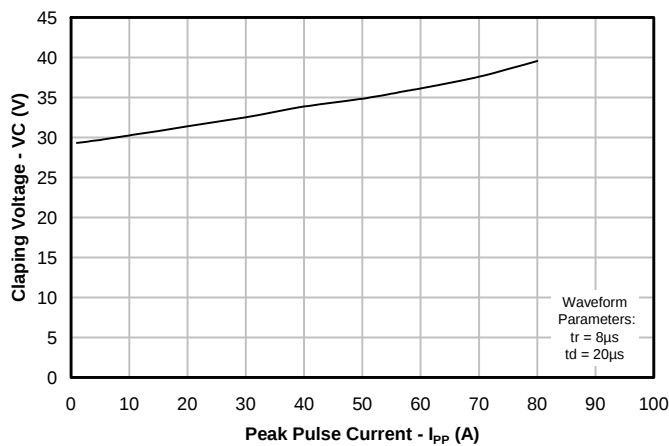
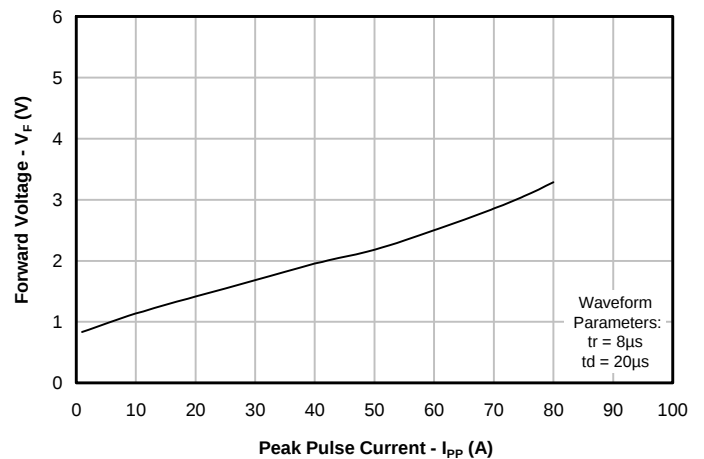
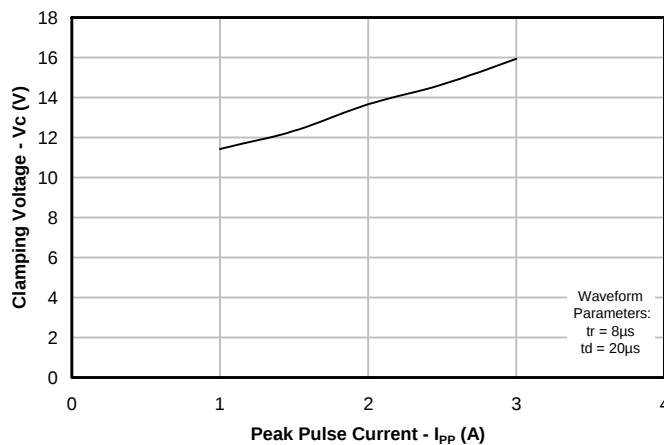
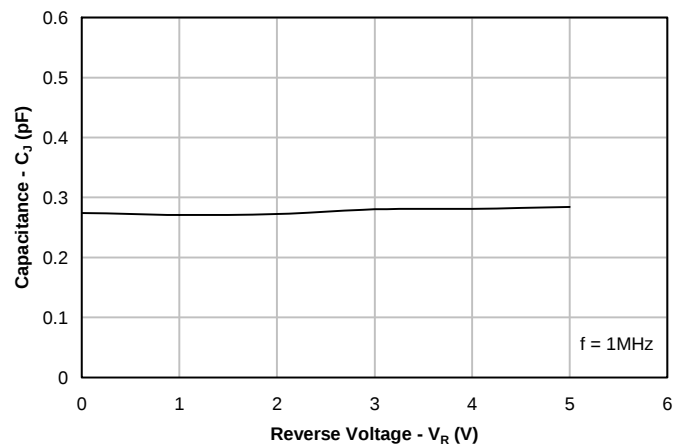
VBus TVS (Pin 1)						
Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
Reverse Stand-Off Voltage	V_{RWM}	Pin 1 to GND			26	V
Reverse Breakdown Voltage	V_{BR}	$I_t = 1mA$, Pin 1 to GND	28	30.5	31.9	V
Reverse Leakage Current	I_R	$V_{RWM} = 26V$ Pin 1 to GND		0.010	0.250	μA
Forward Voltage	V_F	$I_f = 10mA$ GND to Pin 1	0.6	0.7	1.0	V
Clamping Voltage	V_C	$I_{pp} = 10A$, tp = 8/20μs Pin 1 to Ground			35	V
Clamping Voltage	V_C	$I_{pp} = 58A$, tp = 8/20μs Pin 1 to Ground		39	43	V
Junction Capacitance	C_j	$V_R = 0V$, f = 1MHz Pin 1 to GND		620	750	pF

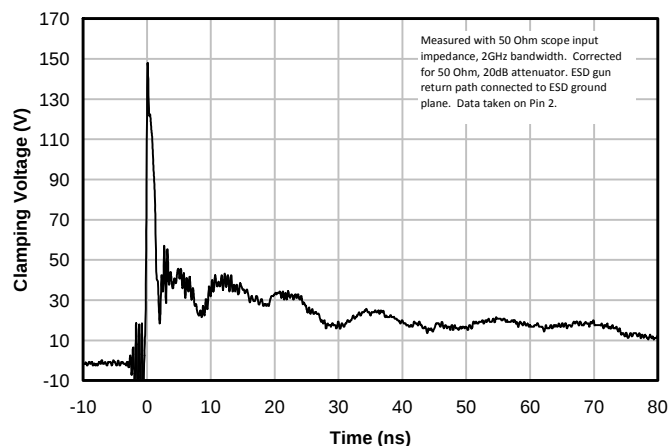
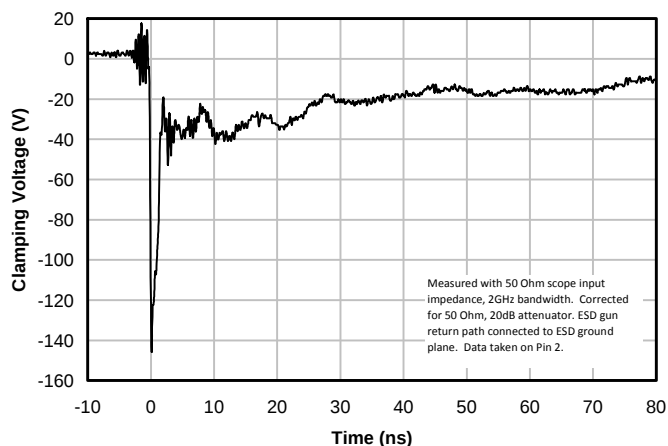
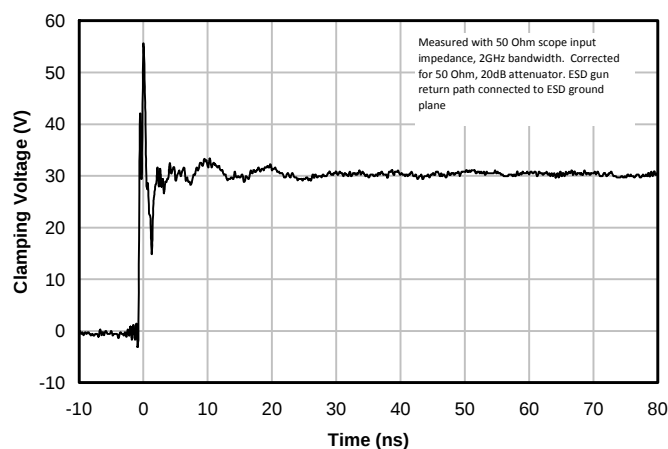
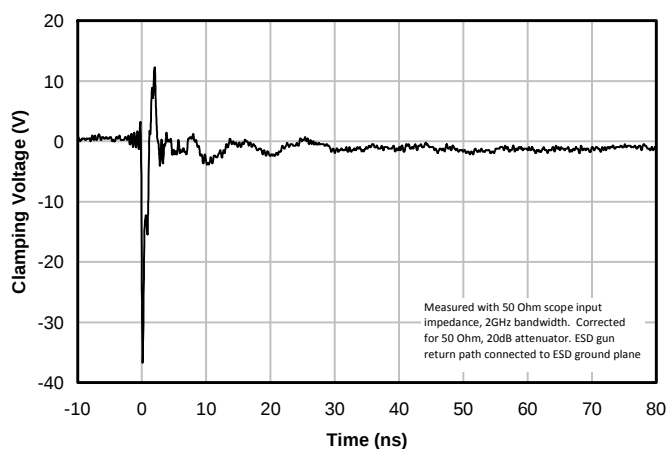
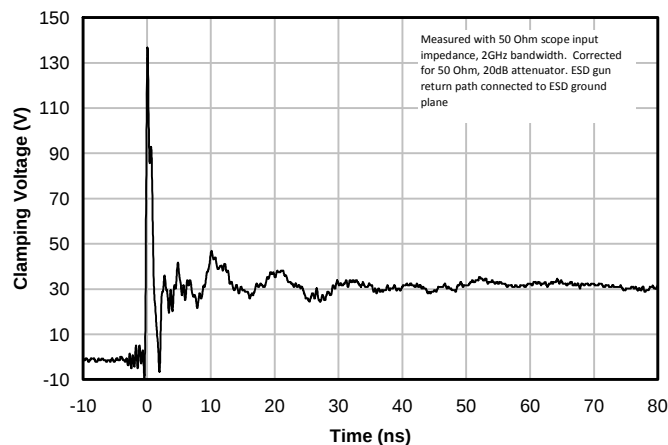
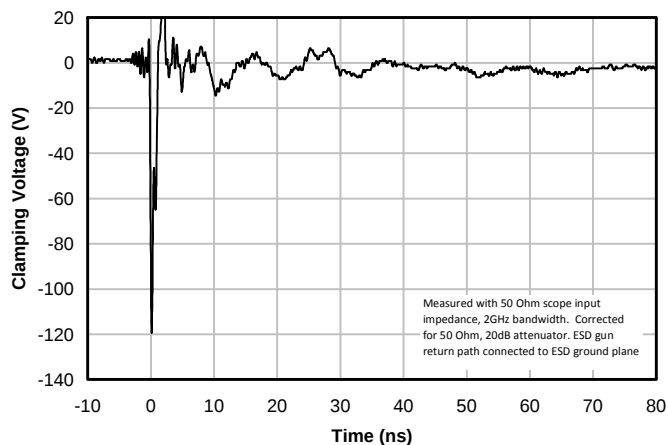
PROTECTION PRODUCTS
Electrical Characteristics (T=25°C)
DM, DP, USB ID (Pins 2, 3, 4)

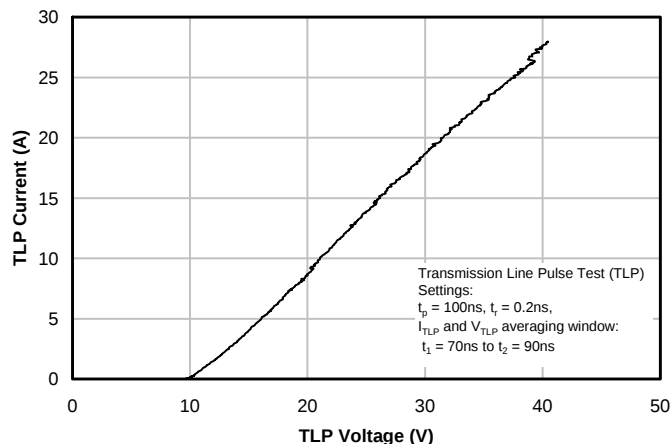
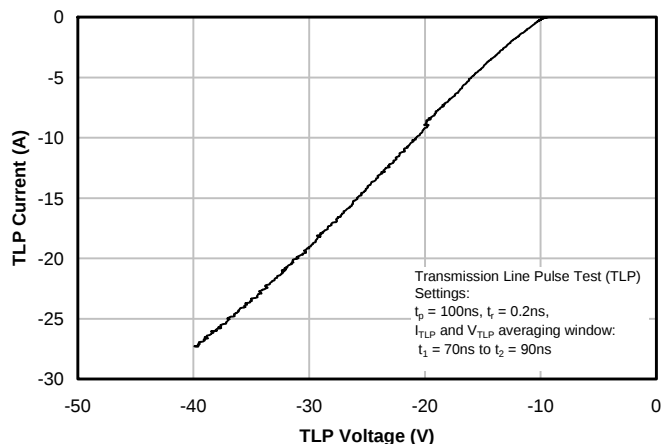
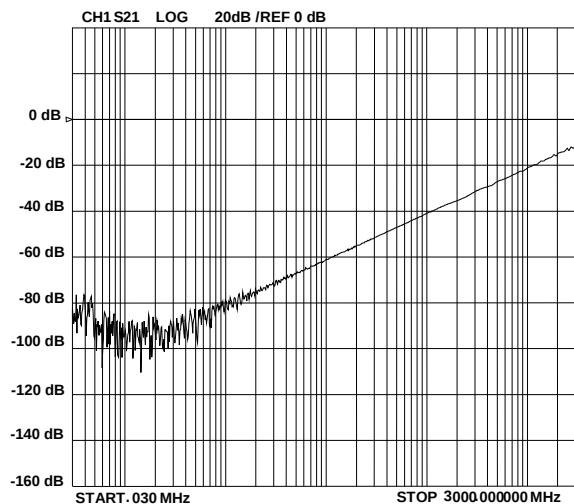
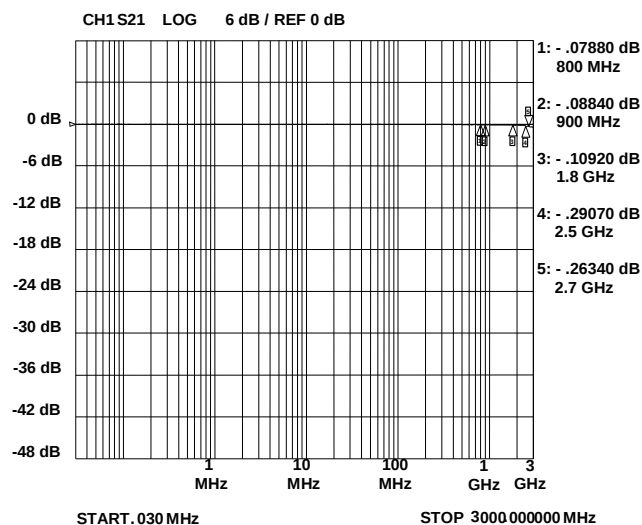
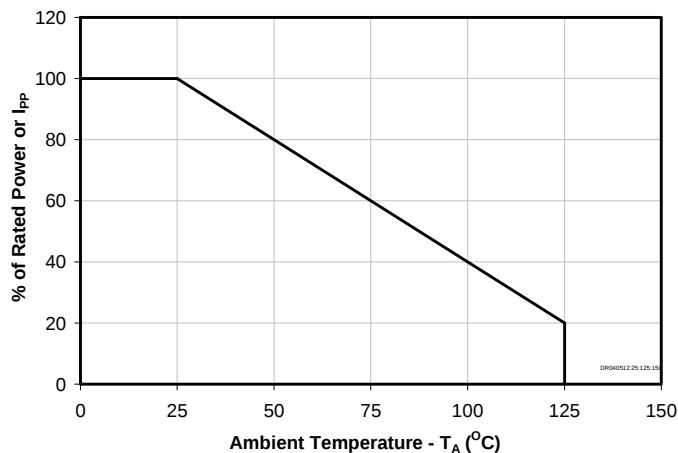
Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
Reverse Stand-Off Voltage	V_{RWM}	Pin 4, 5, or 6 to GND			5	V
Reverse Breakdown Voltage	V_{BR}	$I_t = 1mA$, Pin 4, 5, or 6 to GND	6.5	9	11	V
Reverse Leakage Current	I_R	$V_{RWM} = 2.0V$, Pin 4, 5, or 6 to GND		<0.005	0.020	μA
Reverse Leakage Current	I_R	$V_{RWM} = 5.0V$, Pin 4, 5, or 6 to GND		0.005	0.100	μA
Clamping Voltage	V_C	$I_{pp} = 1A$, $t_p = 8/20\mu s$ Pin 4, 5, or 6 to GND			15	V
Clamping Voltage	V_C	$I_{pp} = 3A$, $t_p = 8/20\mu s$ Pin 4, 5, or 6 to GND			20	V
Dynamic Resistance ¹	R_{Dyn}	$I_{pp} = 4A$ to $I_{pp} = 16A$		0.90		Ohms
		$I_{pp} = -4A$ to $I_{pp} = -16A$		0.90		Ohms
Junction Capacitance	C_j	$V_R = 0V$, $f = 1MHz$, Pin 4, 5, or 6 to GND		0.28	0.50	pF

Notes

1)Transmission Line Pulse Test (TLP) Settings: $t_p = 100ns$, $t_r = 0.2ns$, I_{TLP} and V_{TLP} averaging window: $t_1 = 70ns$ to $t_2 = 90ns$

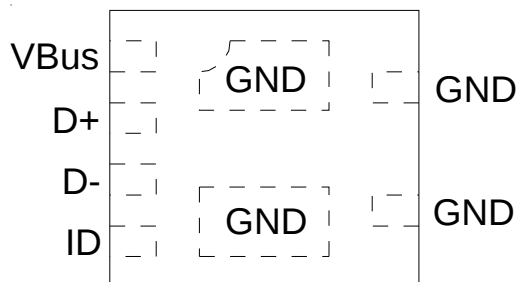
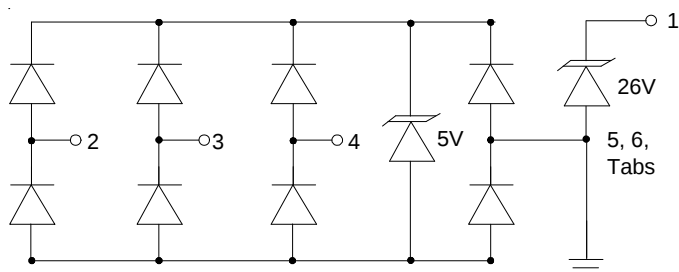
PROTECTION PRODUCTS
Typical Characteristics
**Non-Repetitive Peak Pulse Power vs. Pulse Time
VBus Pin (Pin 1)**

**Non-Repetitive Peak Pulse Power vs. Pulse Time
D+, D-, ID Pins (Pins 2, 3, 4)**

**Clamping Voltage vs. Peak Pulse Current
VBus Pin (Pin 1)**

**Forward Voltage vs. Peak Pulse Current
VBus Pin (Pin 1)**

**Clamping Voltage vs. Peak Pulse Current
D+, D-, ID Pins (Pins 2, 3, 4)**

**Capacitance vs. Reverse Voltage
D+, D-, ID Pins (Pins 2, 3, 4)**


PROTECTION PRODUCTS
Typical Characteristics
**ESD Clamping (+8kV Contact per IEC 61000-4-2)
D+, D-. ID Pins (Pins 2, 3, 4)**

**ESD Clamping (-8kV Contact per IEC 61000-4-2)
D+, D-. ID Pins (Pins 2, 3, 4)**

**ESD Clamping (+8kV Contact per IEC 61000-4-2)
VBus Pin (Pins 1)**

**ESD Clamping (-8kV Contact per IEC 61000-4-2)
VBus Pin (Pin 1)**

**ESD Clamping +30kV Contact per IEC 61000-4-2)
VBus Pin (Pin 1)**

**ESD Clamping -30kV Contact per IEC 61000-4-2)
VBus Pin (Pin 1)**


PROTECTION PRODUCTS
Typical Characteristics
TLP Characteristic (Positive Pulse)
D+, D-. ID Pins (Pins 2, 3, 4)

TLP Characteristic (Negative Pulse)
D+, D-. ID Pins (Pins 2, 3, 4)

Analog Crosstalk
D+, D-. ID Pins (Pins 2, 3, 4)

Typical Insertion Loss S21
D+, D-. ID Pins (Pins 2, 3, 4)

Non-Repetitive Peak Pulse Power Derating Curve


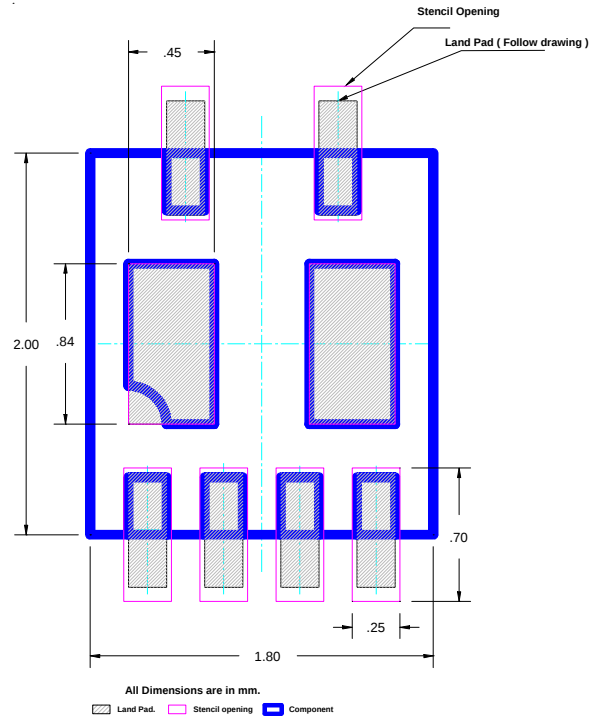
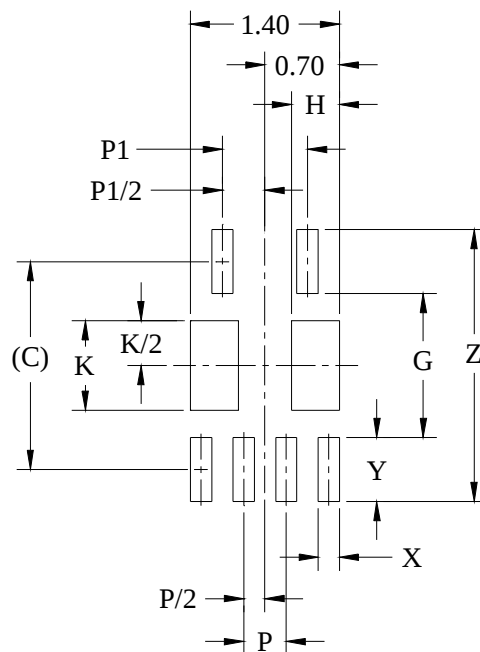
PROTECTION PRODUCTS
Applications Information
Device Connection and Layout Options for Protecting One USB Port

The RClamp2656P is optimized for protection of USB ports. Low capacitance protection is provided for the USB data (DM, DP) and USB ID pins. The maximum capacitance on these lines is $<0.5\text{pF}$ for maximum signal integrity. USB Data and ID lines are connected at pins 2, 3, and 4. These inputs are referenced to an internal 5 volt TVS protection device. When the voltage on these lines exceed 5 volts, the TVS will conduct. Pin 1 is connected to the USB voltage bus (VBus). This device will conduct when the voltage on the bus exceeds 26 volts. Ground is provided at pins 5, 6, and the center tabs. Multiple micro vias connected to ground are recommended for best ESD performance. This will reduce parasitic inductance in the ground path and minimize the clamping voltage seen by the protected device.


Figure 1 - Pin Configuration (Top View)

Figure 2 - Schematic

PROTECTION PRODUCTS
Applications Information

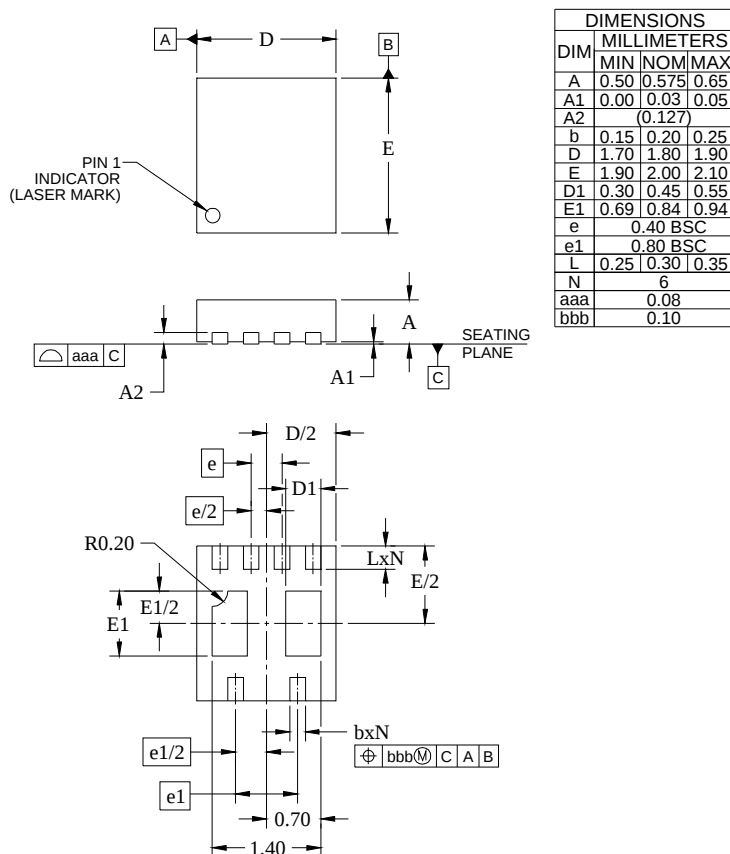
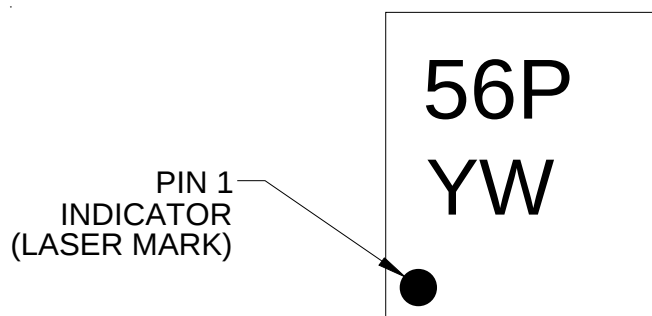
Assembly Parameter	Recommendation
Solder Stencil Design	Laser cut, Electro-polished
Aperture shape	Rectangular
Solder Stencil Thickness	0.100 mm (0.004")
Solder Paste Type	Type 3 size sphere or smaller
Solder Reflow Profile	Per JEDEC J-STD-020
PCB Solder Pad Design	Non-Solder mask defined
PCB Pad Finish	OSP OR NiAu


Recommended Mounting Pattern
Land Pattern - SLP2018P6


DIMENSIONS	
DIM	MILLIMETERS
C	(1.95)
G	1.35
H	0.45
K	0.84
P	0.40
P1	0.80
X	0.20
Y	0.60
Z	2.55

NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.

PROTECTION PRODUCTS
Outline Drawing - SLP2018P6

Marking


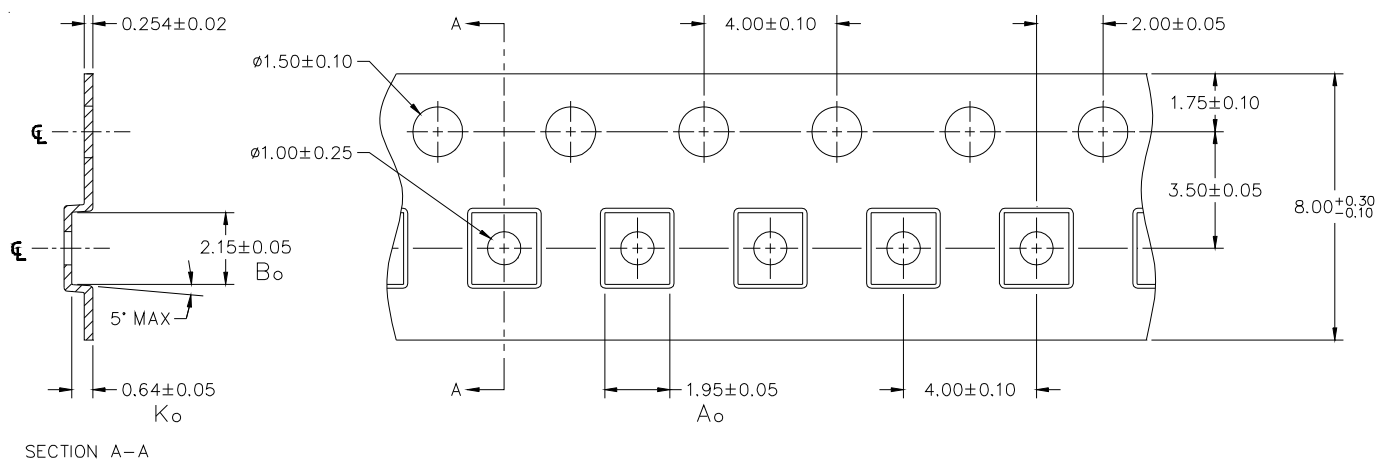
YW = Date Code

Ordering Information

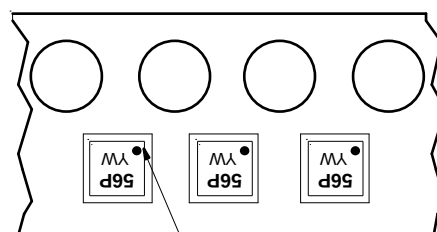
Part Number	Qty per Reel	Reel Size
RClamp2656P.TGT	10,000	13 Inch

RailClamp and RClamp are trademarks of Semtech Corporation.

Carrier Tape Specification



NOTE: ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.



Pin 1 Location
(Towards Sprocket Holes)

Device Orientation in Tape

Contact Information

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Phone: (805)498-2111 FAX (805)498-3804