# RClamp1265P

## Low Capacitance RailClamp® Surge Protection for USB Interfaces

**PROTECTION PRODUCTS**

## Description

RClamp®1265P provides dedicated surge and ESD protection for uUSB ports. It features low capacitance TVS diodes for protection of the USB data (DP, DM) and USB ID pins operating up to +/- 6.5 volts. These diodes provide ESD protection to ±25kV contact discharge per IEC 61000-4-2. Loading capacitance on these lines is 0.95pF (maximum). An integrated 12 volt TVS diode is used for protection of the USB voltage bus. The VBus TVS is designed with a high surge current capability of 100A (tp=8/20us) and low clamping voltage.

RClamp1265P is in a 6-pin SLP2018P6 package measuring 2.0 x 1.8 mm with a nominal height of 0.57mm. Leads are finished with NiPdAu. This highly integrated device requires less board space than existing solutions. The combination of small size, low capacitance, and high level of surge and ESD protection makes this device a flexible solution for protection of USB interfaces in mobile phones, laptops, and other portable electonics.

## Features

- High ESD withstand voltage
  - IEC 61000-4-2 (ESD) 30kV (air), 25kV (contact)
- Surge protection for USB voltage bus to 100A (8/20µs) and data pins to 8A (8/20µs)
- USB DP, DM, and ID Pin operating voltage: +/- 6.5V
- USB VBus operating voltage: 12V
- Low ESD clamping
- Low capacitance: 0.95pF maximum
- Dynamic resistance: 0.55 Ohms (Typ)
- Solid-state silicon-avalanche technology

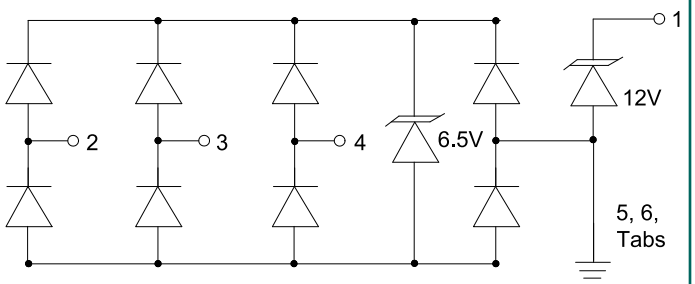
## Mechanical Characteristics

- SLP2018P6 6L package
- Pb-Free, Halogen Free, RoHS/WEEE Compliant
- Nominal Dimensions: 2.0 x 1.8 x 0.57 mm
- Lead Finish: NiPdAu
- Marking : Marking code + date code
- Packaging : Tape and Reel

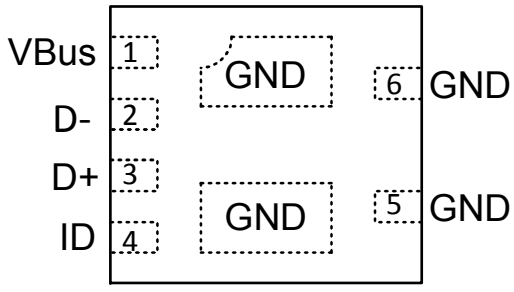
## Applications

- USB Type C
- USB 2.0
- USB OTG
- uUSB

## Circuit Diagram




## Pin Configuration




**Top View**

## Absolute Maximum Ratings

| Rating | Symbol | Value | Units |
|---|---|---|---|
| **DP, DM, USB ID TVS (Pins 2, 3, 4)** | | | |
| Peak Pulse Power (tp = 8/20µs) | $P_{PK}$ | 160 | W |
| Peak Pulse Current (tp = 8/20µs) | $I_{PP}$ | 8 | A |
| ESD per IEC 61000-4-2 (Air)(1)<br>ESD per IEC 61000-4-2 (Contact)(1) | $V_{ESD}$ | ±30<br>±25 | kV |
| Operating Temperature | $T_J$ | -40 to +85 | °C |
| Storage Temperature | $T_{STG}$ | -55 to +150 | °C |
| **VBus TVS (Pin 1)** | | | |
| Peak Pulse Power (tp = 8/20µs) | $P_{PK}$ | 3000 | W |
| Peak Pulse Current (tp = 8/20µs) | $I_{PP}$ | 100 | A |
| ESD per IEC 61000-4-2 (Air)(1)<br>ESD per IEC 61000-4-2 (Contact)(1) | $V_{ESD}$ | ±30<br>±30 | kV |
| Operating Temperature | $T_J$ | -40 to +85 | °C |
| Storage Temperature | $T_{STG}$ | -55 to +150 | °C |

## Electrical Characteristics (T=25°C unless otherwise specified)

| **VBus TVS (Pin 1)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Conditions** | | **Min.** | **Typ.** | **Max.** | **Units** |
| Reverse Stand-Off Voltage | $V_{RWM}$ | -40°C to 85°C<br>Pin 1 to GND | | | | 12 | V |
| Reverse Breakdown Voltage | $V_{BR}$ | $I_t$ = 1mA,<br>Pin 1 to GND | -40°C to 85°C | 13 | 16 | 19 | V |
| Reverse Leakage Current | $I_R$ | $V_{RWM}$ = 12V | T = 25°C | | 0.002 | 0.100 | µA |
| | | | T = 85°C | | 0.01 | 0.250 | µA |
| Forward Voltage | $V_F$ | $I_F$ = 10mA<br>GND to Pin 1 | | | 0.75 | 1.1 | V |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 40A, tp = 8/20µs<br>Pin 1 to GND | | | | 20 | V |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 100A, tp = 8/20µs<br>Pin 1 to GND | | | | 30 | V |
| Dynamic Resistance[2, 3] | $R_{DYN}$ | tp = 0.2/100ns (TLP)<br>Pin 1 to GND | | | 0.06 | | Ohms |
| Junction Capacitance | $C_J$ | $V_R$ = 0V, f = 1MHz<br>Pin 1 to GND | T = 25°C | | | 650 | pF |

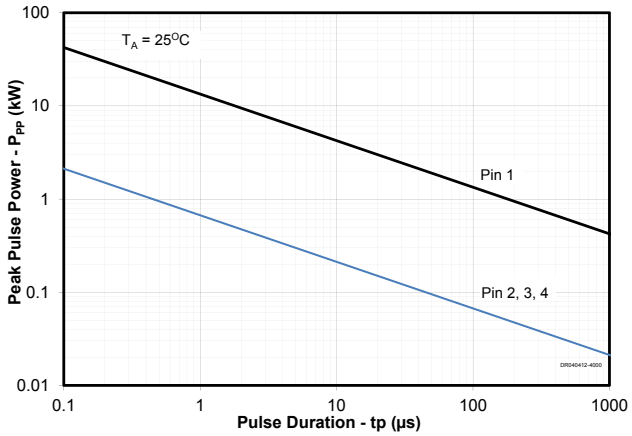
# Electrical Characteristics (T=25°C unless otherwise specified)

| DP, DM, USB ID TVS (Pin 2, 3, 4) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Conditions** | | **Min.** | **Typ.** | **Max.** | **Units** |
| Reverse Stand-Off Voltage | $V_{RWM}$ | -40°C to 85°C<br>Pin 2, 3, 4 to GND | | | | 6.5 | V |
| Reverse Breakdown Voltage | $V_{BR}$ | $I_t$ = 10mA,<br>Pin 2, 3, 4 to GND | -40°C to 85°C | 7.5 | 9.5 | 11.5 | V |
| Reverse Leakage Current | $I_R$ | $V_{RWM}$ = 6.5V | T = 25°C | | 0.01 | 0.100 | µA |
| | | | T = 85°C | | 0.02 | 0.250 | µA |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 8A, tp = 8/20µs,<br>Pin 2, 3, 4 to GND | | | | 20 | V |
| ESD Clamping Voltage[2] | $V_C$ | $I_{PP}$ = 4A, tp = 0.2/100ns (TLP)<br>Pin 2, 3, 4 to GND | | | 13.5 | | V |
| ESD Clamping Voltage[2] | $V_C$ | $I_{PP}$ = 16A, tp = 0.2/100ns (TLP)<br>Pin 2, 3, 4 to GND | | | 20 | | V |
| Dynamic Resistance[2, 3] | $R_{DYN}$ | tp = 0.2/100ns (TLP)<br>Pin 2, 3, 4 to GND | | | 0.55 | | Ohms |
| Junction Capacitance | $C_J$ | $V_R$ = 0V, f = 1MHz<br>Pin 2, 3, 4 to GND | T = 25°C | | 0.85 | 0.95 | pF |

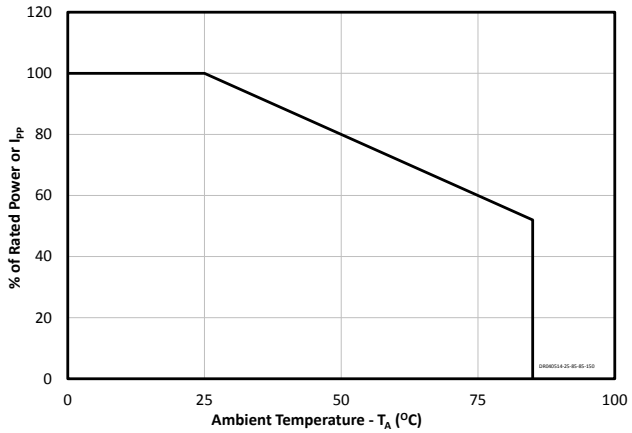
Notes:
(1): Measured with a 40dB attenuator, 50 Ohm scope input impedance, 2GHz bandwidth. ESD gun return path connected to ESD ground plane
(2): Transmission Line Pulse Test (TLP) Settings: tp = 100ns, tr = 0.2ns, $I_{TLP}$ and $V_{TLP}$ averaging window: $t_1$ = 70ns to $t_2$ = 90ns
(3): Dynamic resistance calculated from $I_{TLP}$ = 4A to $I_{TLP}$ = 16A

# Typical Characteristics

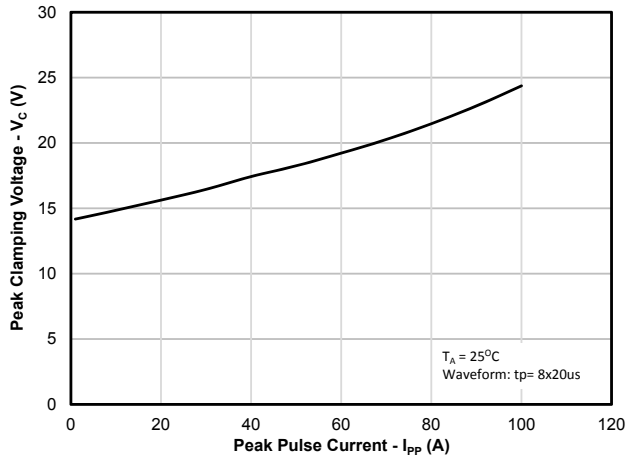
### Non-Repetitive Peak Pulse Power vs. Pulse Time



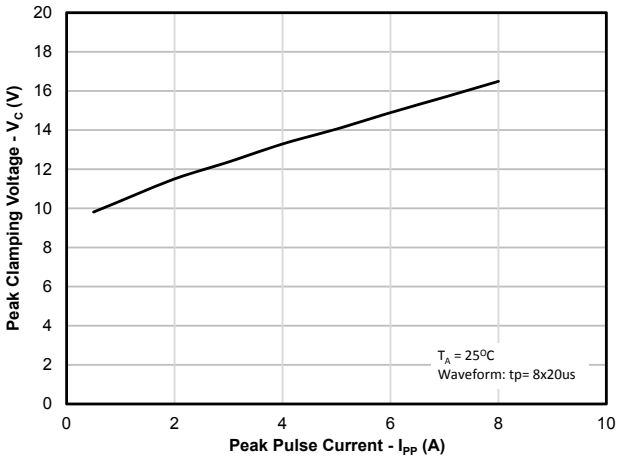

### Pulse Derating Curve vs. Temperature



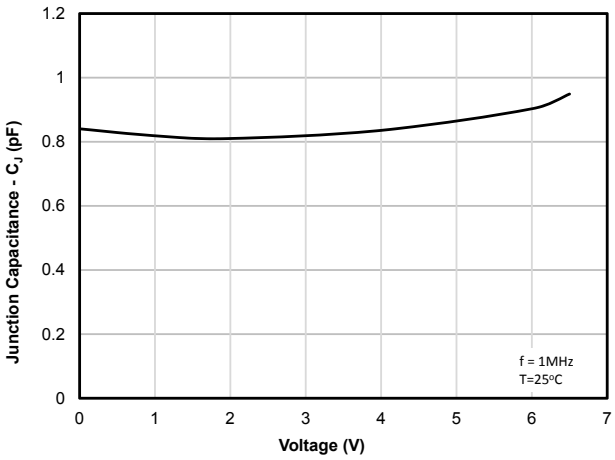

### Clamping Voltage vs. Peak Pulse Current - Pin 1



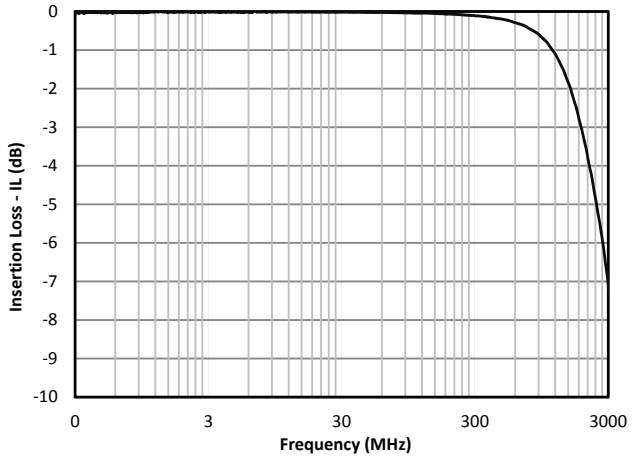

### Clamping Voltage vs. Peak Pulse Current - Pin 2, 3, 4




### Capacitance vs. Reverse Voltage - Pin 2, 3, 4

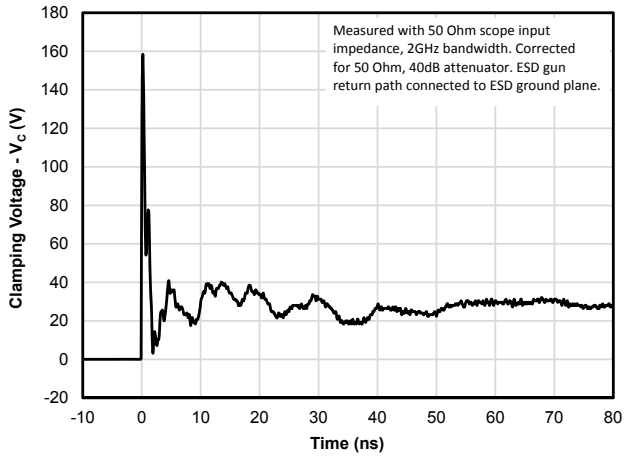



### Insertion Loss - S21 (dB) - Pin 2, 3, 4

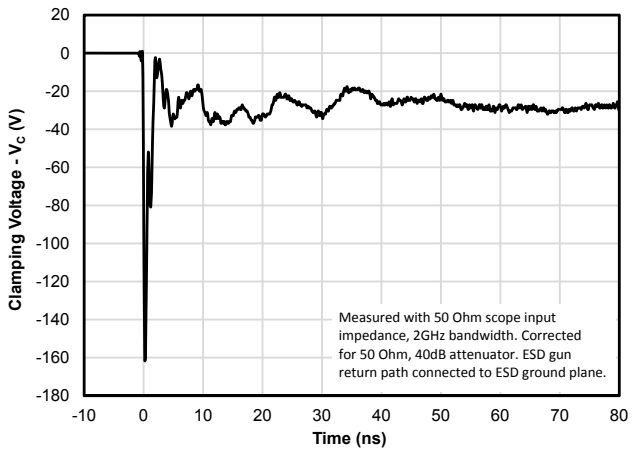


# Typical Characteristics (Continued)

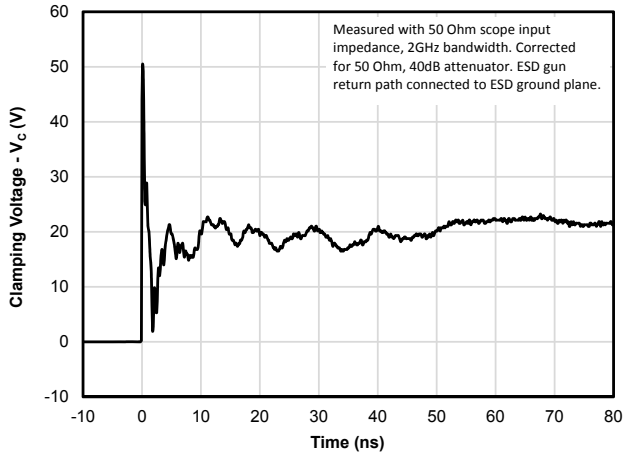
### ESD Clamping (+8kV Contact per IEC 61000-4-2) - Pin 2, 3, 4



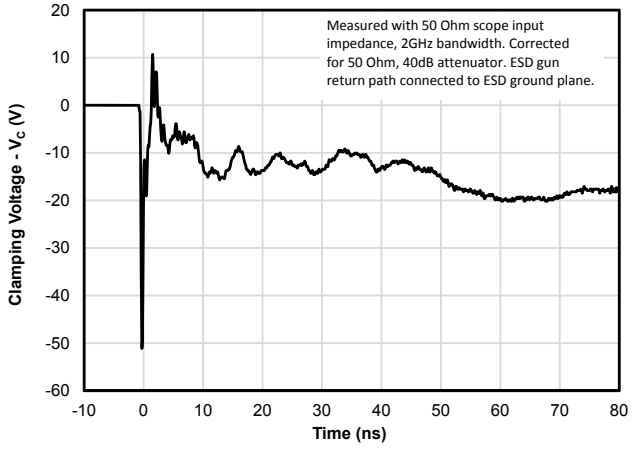

### ESD Clamping (-8kV Contact per IEC 61000-4-2) - Pin 2, 3, 4



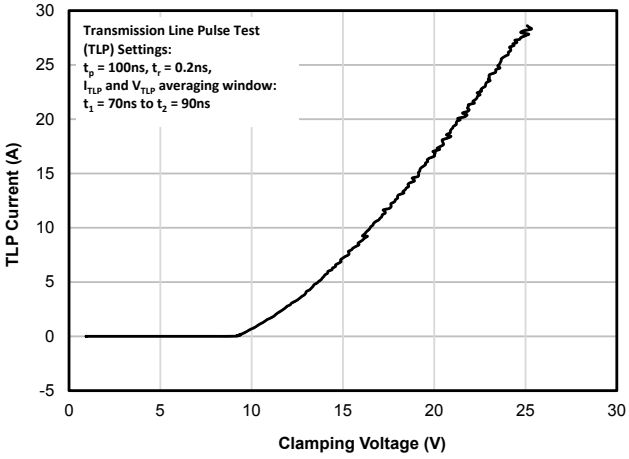

### ESD Clamping (+8kV Contact per IEC 61000-4-2) - Pin 1



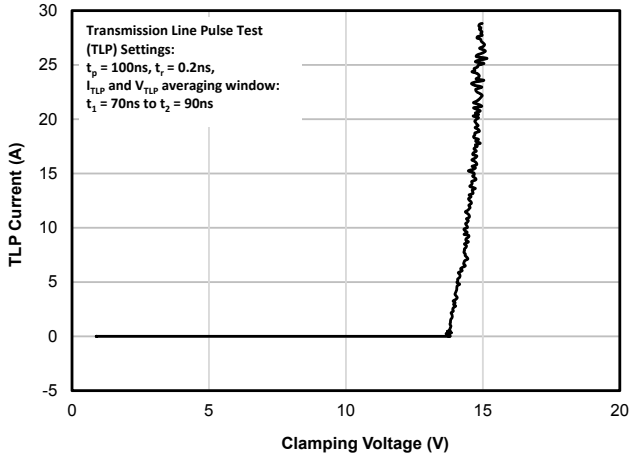

### ESD Clamping (-8kV Contact per IEC 61000-4-2) - Pin 1




### TLP Characteristic - Pin 2, 3, 4

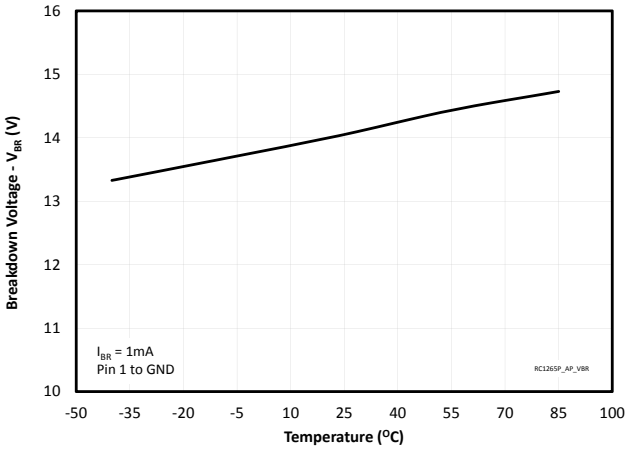



### TLP Characteristic - Pin 1

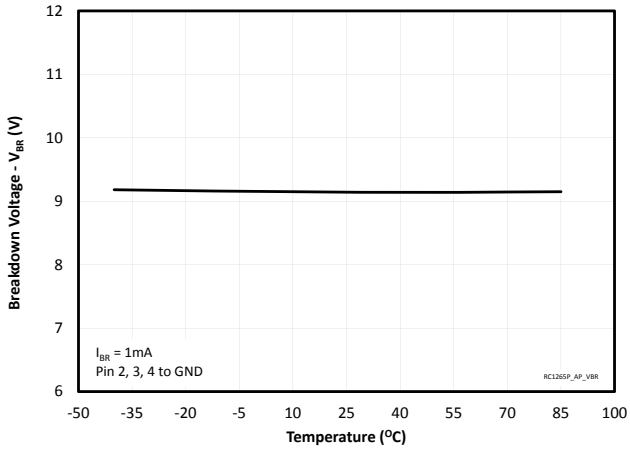


# Typical Characteristics (Continued)

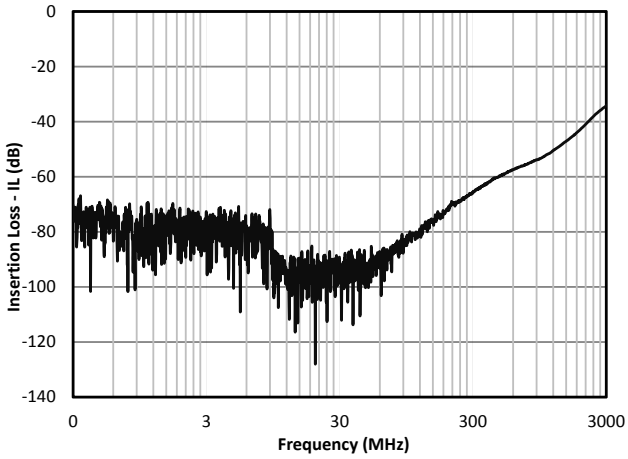
### VBR vs. Temperature - Pin 1




### VBR vs. Temperature - Pin 2, 3, 4




### Analog Crosstalk - Pin 2, 3, 4



# Applications Information

### Assembly Guidelines

The small size of this device means that some care must be taken during the mounting process to insure reliable solder joint. The figure at the right details Semtech's recommended mounting pattern. Recommended assembly guidelines are shown in Table 1. Note that these are only recommendations and should serve only as a starting point for design since there are many factors that affect the assembly process. Exact manufacturing parameters will require some experimentation to get the desired solder application. Semtech's recommended mounting pattern is based on the following design guidelines:

### Land Pattern

The recommended land pattern follows IPC standards and is designed for maximum solder coverage. Detailed dimensions are shown elsewhere in this document.

### Solder Stencil

Stencil design is one of the key factors which will determine the volume of solder paste which is deposited onto the land pad. The area ratio of the stencil aperture will determine how well the stencil will print. The area ratio takes into account the aperture shape, aperture size, and stencil thickness. An area ratio of 0.70 – 0.75 is preferred for the subject package. The area ratio of a rectangular aperture is given as:

Area Ratio = (L * W )/ (2 * (L + W) * T)

Where:
L = Aperture Length
W = Aperture Width
T = Stencil Thickness

Semtech recommends a stencil thickness of 0.100mm for this device. The stencil should be laser cut with electro-polished finish. The stencil should have a positive taper of approximately 5 degrees. Electro polishing and tapering the walls results in reduced surface friction and better paste release. For small pitch components, Semtech recommends a square aperture with rounded corners for consistent solder release. Due to the aperture size, a solder paste with Type 3 or smaller particles are recommended.

### Recommended Mounting Pattern

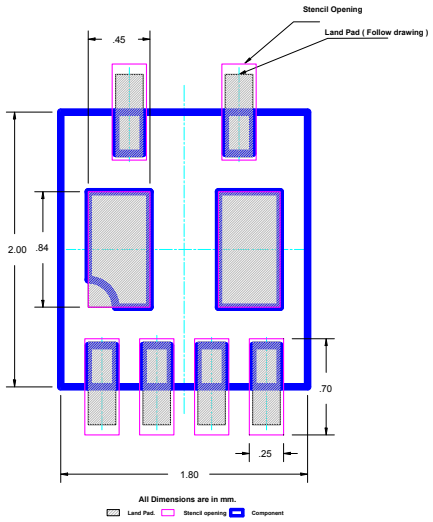
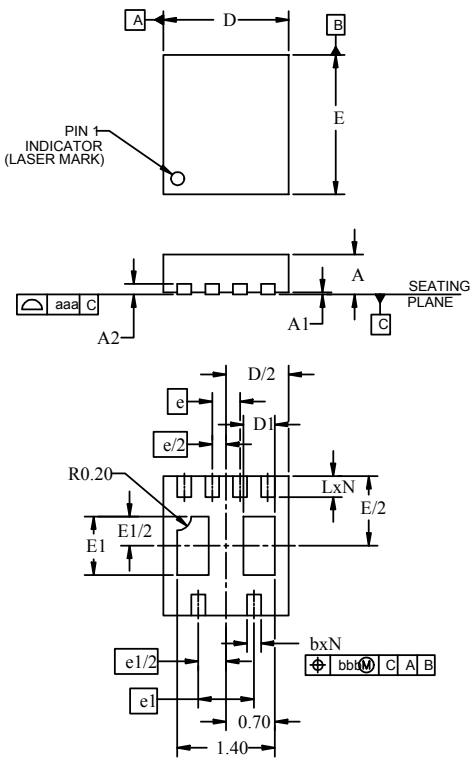



**Table 1 - Recommended Assembly Guidelines**

| Assembly Parameter | Recommendation |
|---|---|
| Solder Stencil Design | Laser Cut, Electro-Polished |
| Aperture Shape | Rectangular with rounded corners |
| Solder Stencil Thickness | 0.100mm (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 |

# Outline Drawing - SLP2018P6

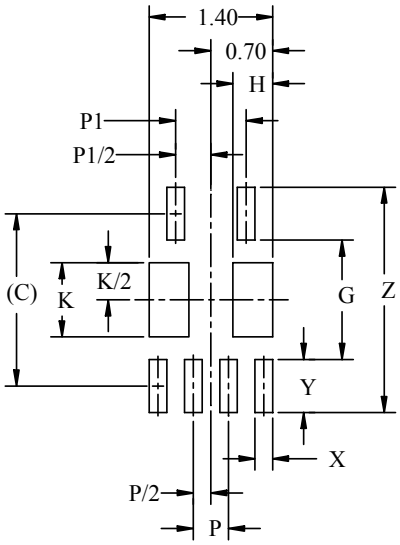



| DIMENSIONS | | | |
|---|---|---|---|
| DIM | MILLIMETERS | | |
| | MIN | NOM | MAX |
| A | 0.50 | 0.575 | 0.65 |
| A1 | 0.00 | 0.03 | 0.05 |
| A2 | | (0.127) | |
| b | 0.15 | 0.20 | 0.25 |
| D | 1.70 | 1.80 | 1.90 |
| E | 1.90 | 2.00 | 2.10 |
| D1 | 0.30 | 0.45 | 0.55 |
| E1 | 0.69 | 0.84 | 0.94 |
| e | | 0.40 BSC | |
| e1 | | 0.80 BSC | |
| L | 0.25 | 0.30 | 0.35 |
| N | | 6 | |
| aaa | | 0.08 | |
| bbb | | 0.10 | |

NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).

# Land Pattern - SLP2018P6

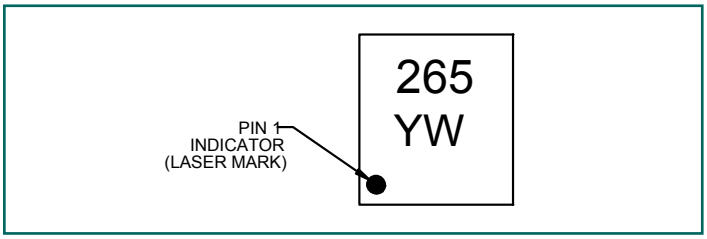



| DIMENSIONS | |
|---|---|
| DIM | MILLIMETERS |
| C | (1.95) |
| G | 1.35 |
| H | 0.45 |
| K | 0.84 |
| P | 0.40 |
| P1 | 0.80 |
| X | 0.20 |
| Y | 0.60 |
| Z | 2.55 |

NOTES:

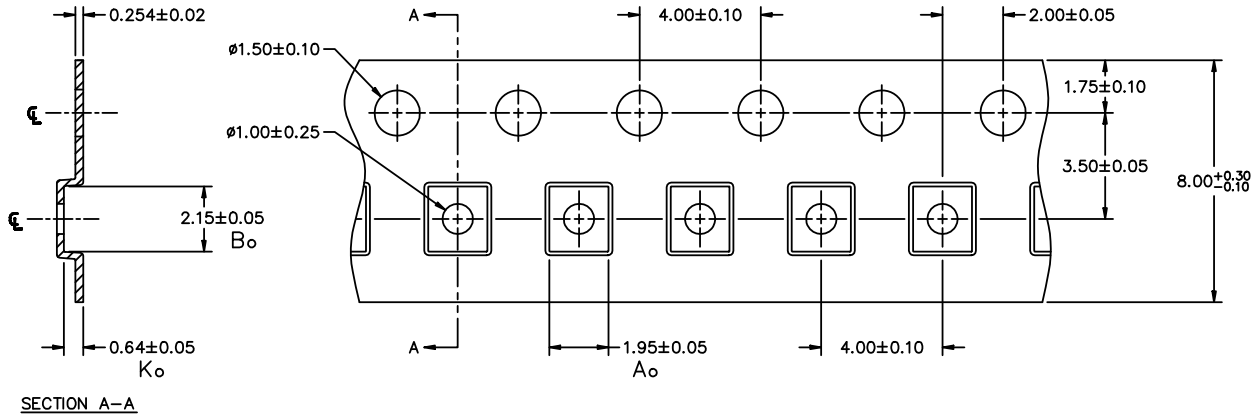
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.

## Marking Code

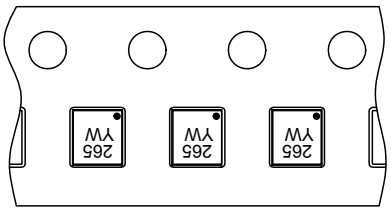



Notes: YW = Date Code

## Tape and Reel Specification




NOTE: ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.




## Ordering Information

| Part Number | Qty per Reel | Reel Size |
|---|---|---|
| RClamp1265P.TGT | 10000 | 13 Inch |

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## Contact Information

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