Absolute Maximum Rating

Rating	Symbol	Value	Units
DP, DM, USB ID, FM Radio (Pins 3, 4, 5, 6)			
Peak Pulse Power (tp = 8/20µs)	P_{pk}	75	Watts
Peak Pulse Current (tp = 8/20µs)	I_{PP}	5	A
ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	V_{ESD}	±18 ±12	kV
Operating Temperature	T_J	-55 to +125	°C
Storage Temperature	T_{STG}	-55 to +150	°C
VBus (Pin 1)			
Peak Pulse Power (tp = 8/20µs)	P_{pk}	350	Watts
Peak Pulse Current (tp = 8/20µs)	I_{PP}	4	A
ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	V_{ESD}	±18 ±12	kV
Operating Temperature	T_J	-55 to +125	°C
Storage Temperature	T_{STG}	-55 to +150	°C

Electrical Characteristics (T = 25°C)

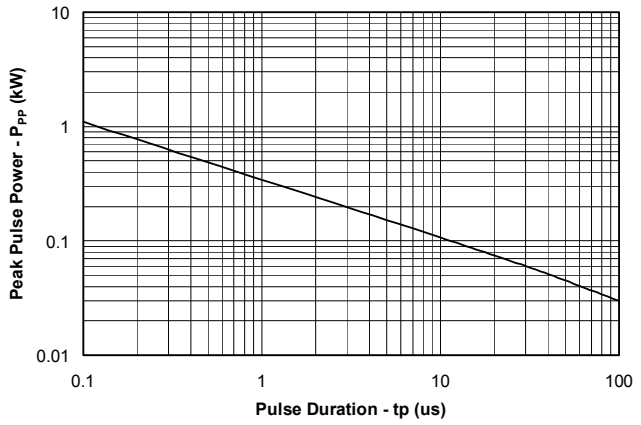
DM, DP, USB ID, FM Radio (Pins 3, 4, 5, 6)						
Parameter	**Symbol**	**Conditions**	**Minimum**	**Typical**	**Maximum**	**Units**
Reverse Stand-Off Voltage	V_{RWM}	Pin 3, 4, 5, or 6 to GND			5	V
Reverse Breakdown Voltage	V_{BR}	I_t = 1mA, Pin 3, 4, 5, or 6 to GND	6.5	8	11	V
Reverse Leakage Current	I_R	V_{RWM} = 5.0V, Pin 3, 4, 5, or 6 to GND		0.005	0.100	µA
Forward Voltage	V_F	I_f = 15mA GND to Pin 3, 4, 5, or 6	0.6		1.2	V
Clamping Voltage	V_C	I_{PP} = 1A, tp = 8/20µs Pin 3, 4, 5, or 6 to GND			12	V
Clamping Voltage	V_C	I_{PP} = 5A, tp = 8/20µs Pin 3, 4, 5, or 6 to GND			15	V
Junction Capacitance	C_j	V_R = 0V, f = 1MHz, Pin 3, 4, 5, or 6 to GND		0.7	0.80	pF
		V_R = 0V, f = 1MHz, Between I/O pins			0.4	pF

Electrical Characteristics (T = 25°C)

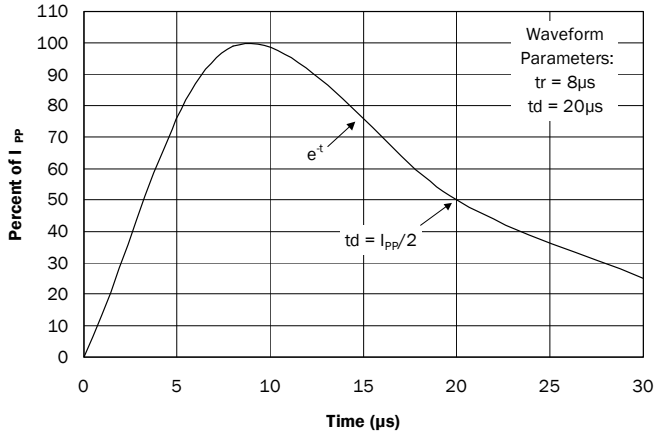
VBus TVS (Pin 1)						
Parameter	**Symbol**	**Conditions**	**Minimum**	**Typical**	**Maximum**	**Units**
Reverse Stand-Off Voltage	V_{RWM}	Pin 1 to GND			28	V
Reverse Breakdown Voltage	V_{BR}	I_t = 1mA, Pin 1 to GND	32	36	40	V
Reverse Leakage Current	I_R	V_{RWM} = 28V Pin 1 to GND		0.010	0.250	µA
Forward Voltage	V_F	I_f = 10mA GND to Pin 1	0.6		1.0	V
Forward Clamping Voltage	V_{FC}	I_{PP} = 10A, tp = 8/20µs Ground to Pin 1			3	V
Clamping Voltage	V_C	I_{PP} = 1A, tp = 8/20µs Pin 1 to Ground			48	V
Junction Capacitance	C_j	V_R = 0V, f = 1MHz Pin 1 to GND		28	40	pF

Typical Characteristics

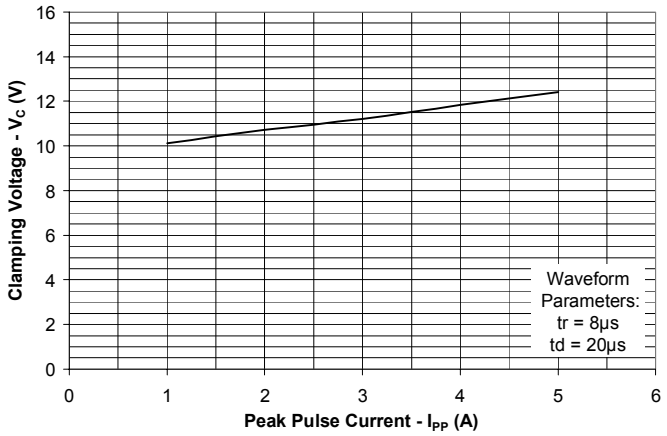
Non-Repetitive Peak Pulse Power vs. Pulse Time (Data Lines - Pins 3, 4, 5, or 6 to GND)



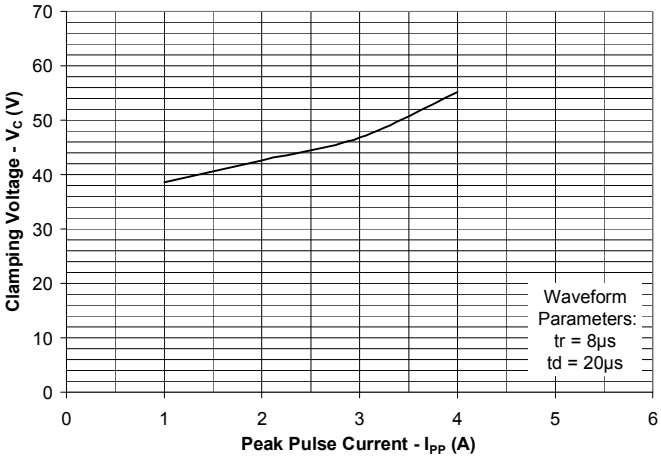
Pulse Waveform



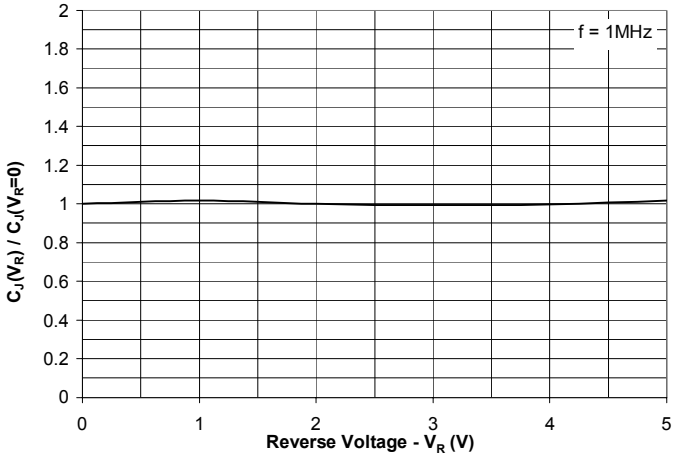
Clamping Voltage vs. Peak Pulse Current (Data Lines - Pins 3, 4, 5, or 6 to GND)



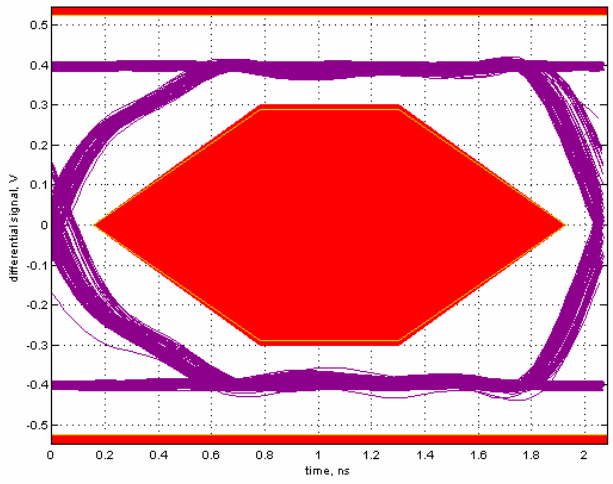
Clamping Voltage vs. Peak Pulse Current (VBus - Pin 1 to GND)



Normalized Capacitance vs. Reverse Voltage (Data Lines - Pin 3, 4, 5, or 6 to GND)

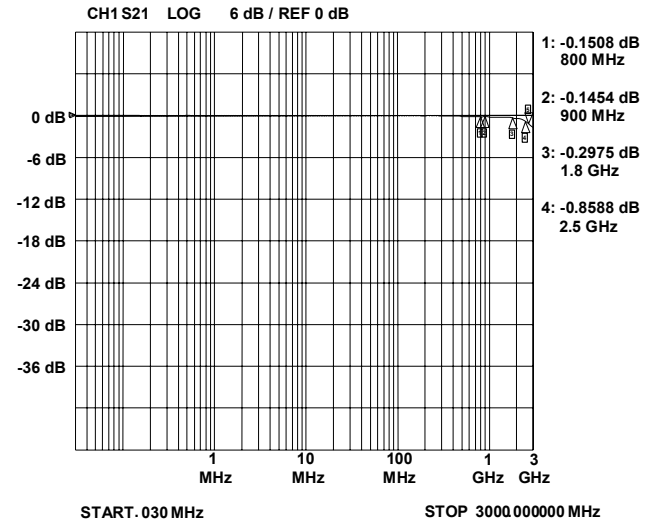


USB 2.0 Eye Pattern with RClamp3655P (Data Lines - Pin 3 and 4)

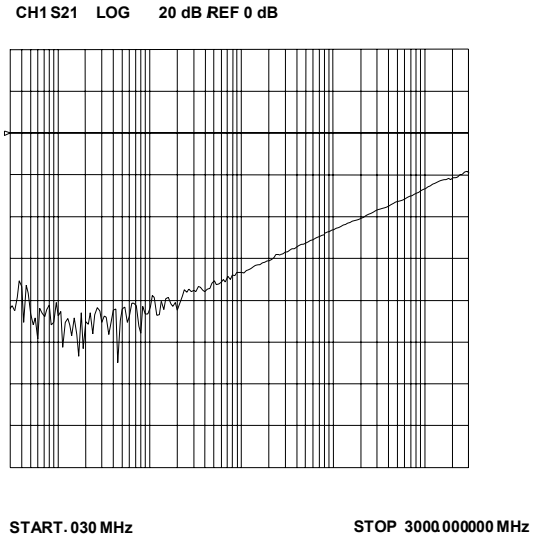


Typical Characteristics

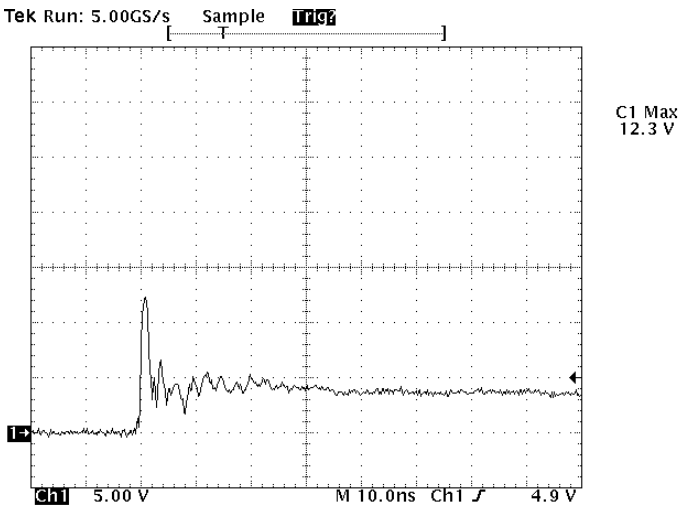
Insertion Loss S21 (Pin 3, 4, 5, or 6 to GND)



Analog Crosstalk

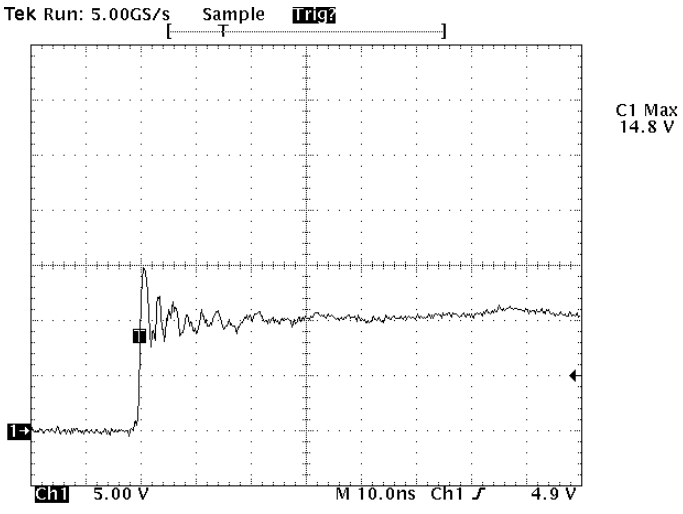


ESD Clamping (Pin 3, 4, 5, or 6 to GND) (+8kV Contact per IEC 61000-4-2)



Note: Data is taken with a 10x attenuator

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



Note: Data is taken with a 10x attenuator

Applications Information

Device Connection and Layout Options for Protecting One USB Port

The RClamp3655P is optimized for use on systems that utilize the uUSB interface with an additional FM radio pin. Low capacitance protection is provided for the USB data (DM, DP), USB ID, and FM radio pins. The maximum capacitance on these lines is <1pF for maximum signal integrity. USB Data, FM radio, and ID lines are connected at pins 3, 4, 5, and 6. 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 28 volts. Note that there is no internal connection to the VBat pin. 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. The package is designed for easy trace routing as shown in the Figure 2 examples. The top example is preferred as it utilizes an extended ground connection using multiple micro vias. Note that it is not necessary to connect both ground pins of the device as both are connected internally. In this example, the VBat pin is routed on a separate layer. The VBus pin is connected to the voltage layer of the PCB with a micro via. If connection to the VBat pin is required, the bottom layout can be used. This example utilizes one via to ground due to space constraints.

Figure 1- Pin Configuration

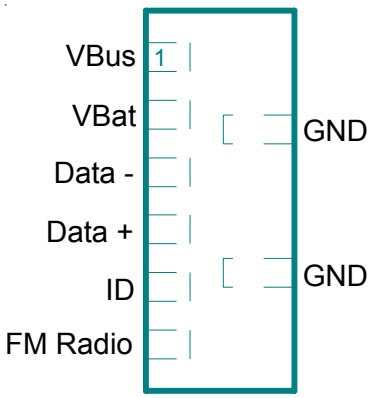
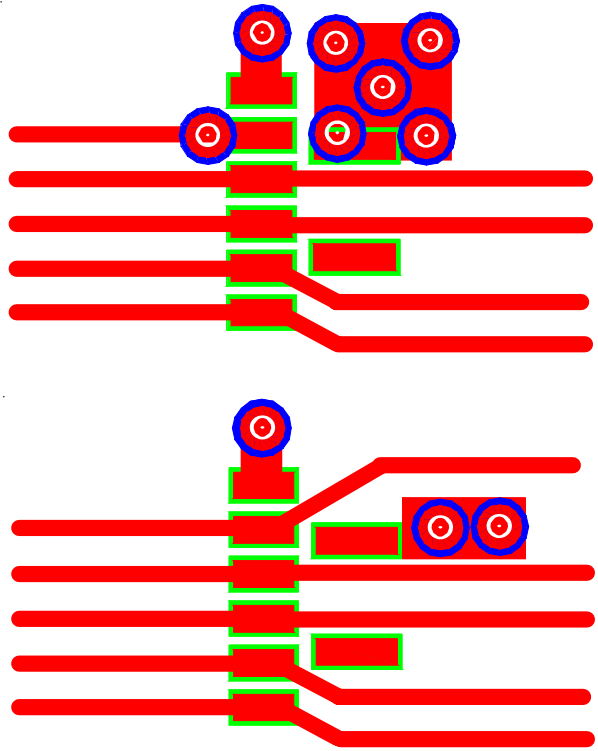
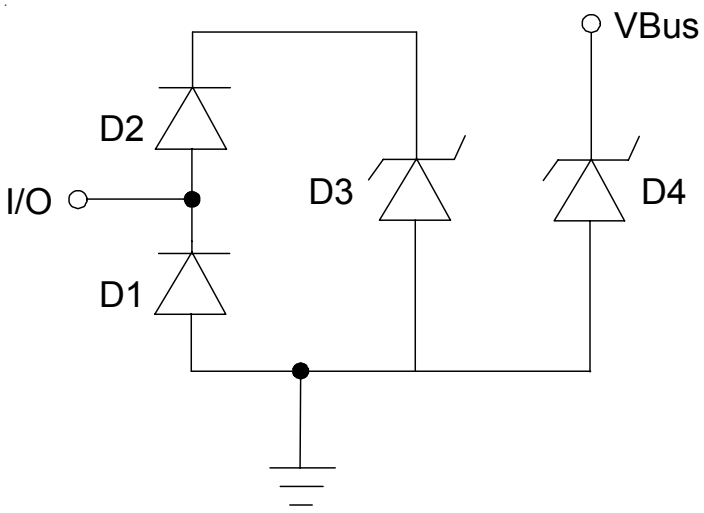


Figure 2 - Layout Examples

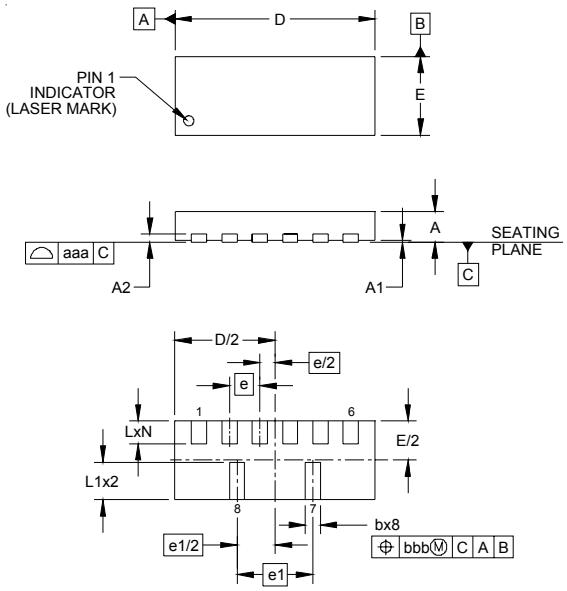




RClamp3655P Spice Model

RClamp3655P Spice Parameters					
Parameter	**Unit**	**D1**	**D2**	**D3**	**D4**
IS	Amp	1E-20	1E-20	2E-12	2.93E-12
BV	Volt	100	100	8.2	35
VJ	Volt	0.83	0.83	0.6	0.64
RS	Ohm	1.5	0.6	0.2	4.13
IBV	Amp	1E-3	1E-3	1E-3	1E-3
CJO	Farad	0.25E-12	0.25E-12	56E-12	25E-12
TT	sec	2.541E-9	2.541E-9	2.541E-9	2.541E-9
M	--	0.01	0.01	0.23	0.32
N	--	1.1	1.1	1.1	1.1
EG	eV	1.11	1.11	1.11	1.11

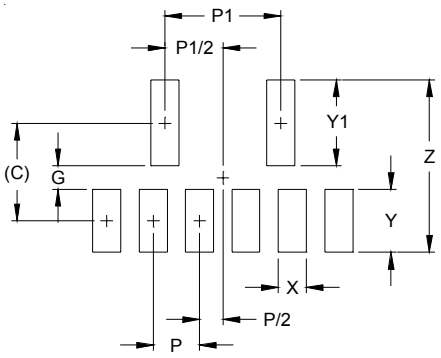
Outline Drawing - SLP3313P6



DIMENSIONS			
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.45	0.50	0.55
A1	0.00	0.02	0.05
A2		(0.13)	
b	0.20	0.25	0.30
D	3.25	3.30	3.38
E	1.25	1.30	1.38
e		0.50 BSC	
e1		1.25 BSC	
L	0.30	0.38	0.43
L1	0.54	0.62	0.67
N		6	
aaa		0.08	
bbb		0.10	

NOTES:
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

Land Pattern - SLP3313P6



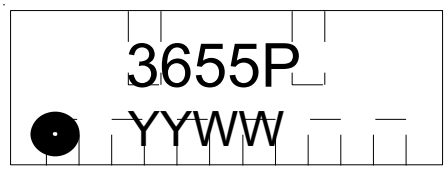
DIMENSIONS	
DIM	MILLIMETERS
C	(1.05)
G	0.25
P	0.50
P1	1.25
X	0.30
Y	0.68
Y1	0.92
Z	1.85

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.

SEMTECH INTERNATIONAL AG

PROTECTION PRODUCTS

Marking



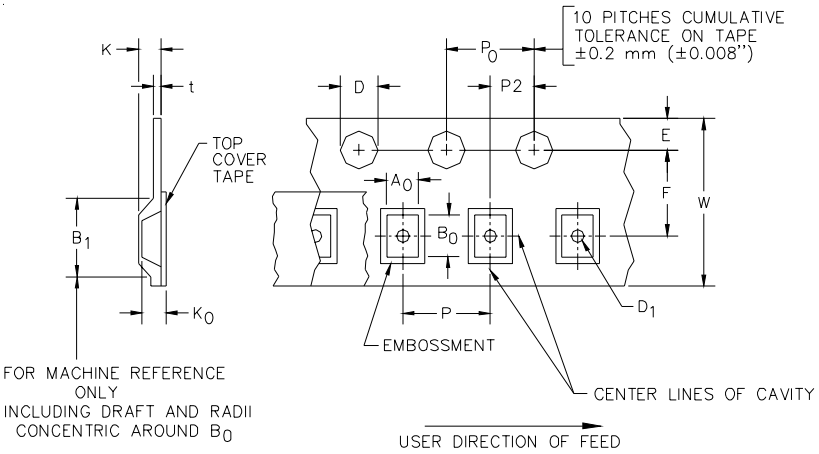
YYWW = Date Code

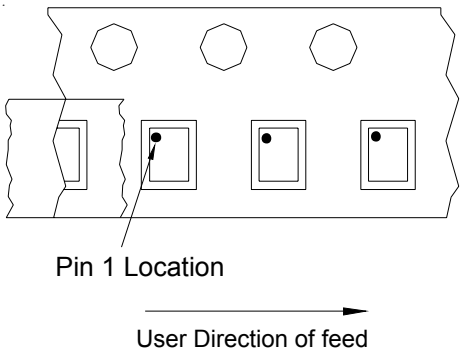
Ordering Information

Part Number	Lead Finish	Qty per Reel	Reel Size
RClamp3655P.TCT	Pb Free	3,000	7 Inch

RailClamp and RClamp are marks of Semtech Corporation

Tape and Reel Specification





Device Orientation in Tape
Pin 1 in upper left towards sprocket holes

A0	B0	K0
1.51 +/-0.10 mm	3.51 +/-0.10 mm	0.66 +/-0.10 mm

Tape Width	B, (Max)	D	D1	E	F	K (MAX)	P	P0	P2	T(MAX)	W
8 mm	4.2 mm	1.5 + 0.1 mm - 0.0 mm)	0.5 mm ±0.05	1.750±.10 mm	3.5±0.05 mm	2.4 mm	4.0±0.1 mm	4.0±0.1 mm	2.0±0.05 mm	0.4 mm	8.0 mm + 0.3 mm - 0.1 mm

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