

PROTECTION PRODUCTS

Absolute Maximum Rating

Rating	Symbol	Value	Units
DP, DM, USB ID (Pins 2, 3, 4)			
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}	125	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

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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 2, 3, or 4 to GND			5	V
Reverse Breakdown Voltage	V_{BR}	$I_t = 1\text{mA}$, Pin 2, 3, or 4 to GND	6.5	8	11	V
Reverse Leakage Current	I_R	$V_{RWM} = 5.0\text{V}$, Pin 2, 3, or 4 to GND		0.005	0.100	μA
Forward Voltage	V_F	$I_f = 15\text{mA}$ Pin 2, 3, or 4 to GND	0.6		1.2	V
Clamping Voltage	V_C	$I_{pp} = 1\text{A}$, $t_p = 8/20\mu\text{s}$ Pin 2, 3, or 4 to GND			12	V
Clamping Voltage	V_C	$I_{pp} = 5\text{A}$, $t_p = 8/20\mu\text{s}$ Pin 2, 3, or 4 to GND			15	V
Junction Capacitance	C_j	$V_R = 0\text{V}$, $f = 1\text{MHz}$, Pin 2, 3, or 4 to GND		0.7	0.80	pF
		$V_R = 0\text{V}$, $f = 1\text{MHz}$, Between I/O pins			0.4	pF

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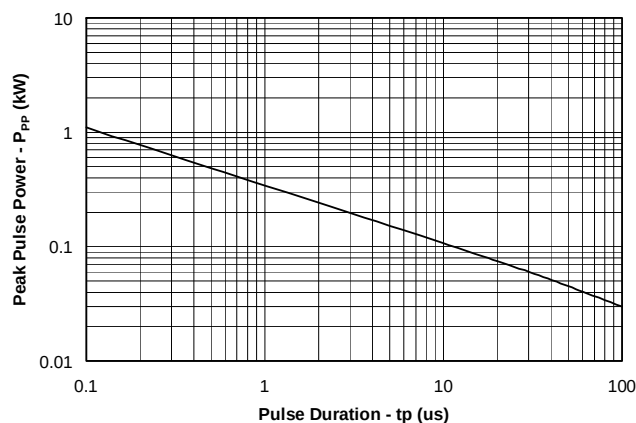
Electrical Characteristics (T = 25°C)

VBus TVS (Pin 1)						
Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
Reverse Stand-Off Voltage	V_{RWM}	Pin 1 to GND			12	V
Reverse Breakdown Voltage	V_{BR}	$I_t = 1mA$, Pin 1 to GND	15	16.5	18	V
Reverse Leakage Current	I_R	$V_{RWM} = 12V$ Pin 1 to GND		0.005	0.05	μA
Forward Voltage	V_F	$I_f = 10mA$ GND to Pin 1	0.6		1.0	V
Clamping Voltage	V_C	$I_{PP} = 5A$, $t_p = 8/20\mu s$ Pin 1 to Ground			25	V
Forward Clamping Voltage	V_{FC}	$I_{PP} = 10A$, $t_p = 8/20\mu s$ Ground to Pin 1			3	V
Junction Capacitance	C_j	$V_R = 0V$, $f = 1MHz$ Pin 1 to GND		50	75	pF

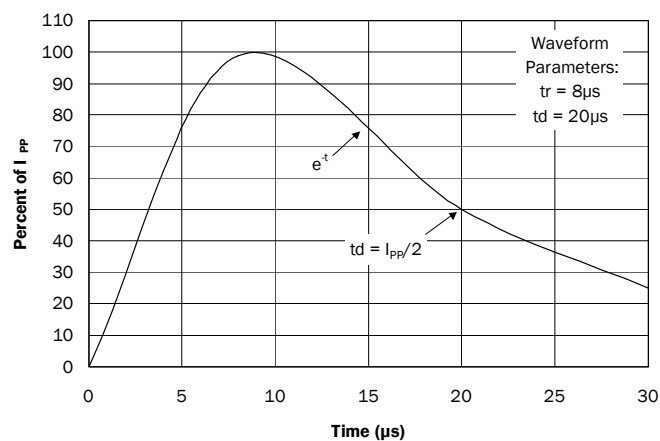
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Typical Characteristics

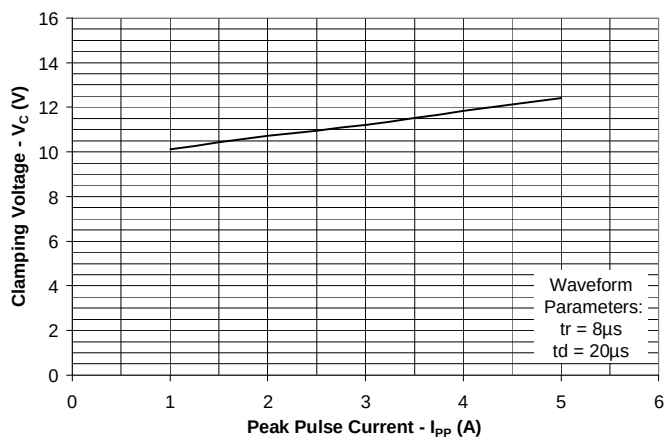
Non-Repetitive Peak Pulse Power vs. Pulse Time
(Data Lines - Pins 2, 3, 4 to GND)



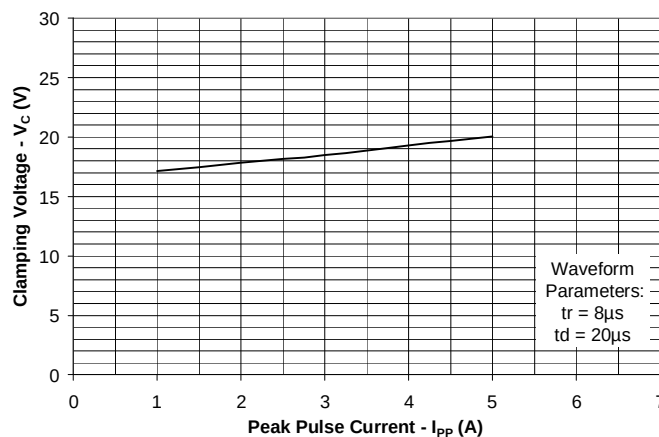
Pulse Waveform



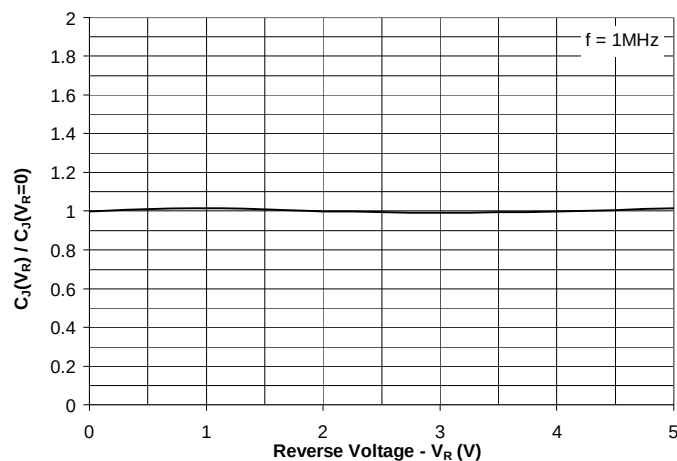
Clamping Voltage vs. Peak Pulse Current
(Data Lines - Pins 2, 3, 4 to GND)



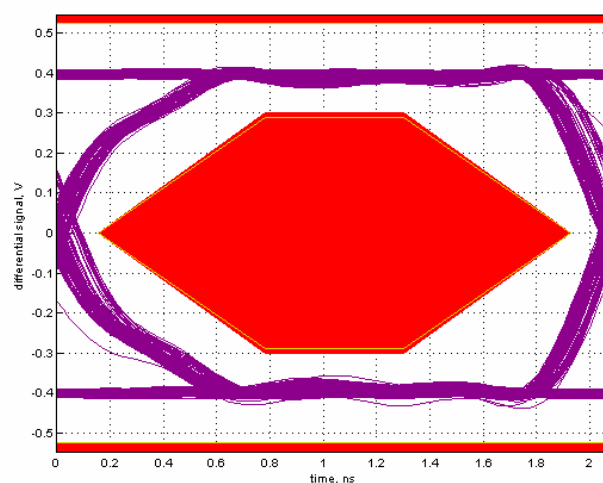
Clamping Voltage vs. Peak Pulse Current
(VBus - Pin 1 to GND)



Normalized Capacitance vs. Reverse Voltage
(Data Lines - Pins 2, 3, 4 to GND)



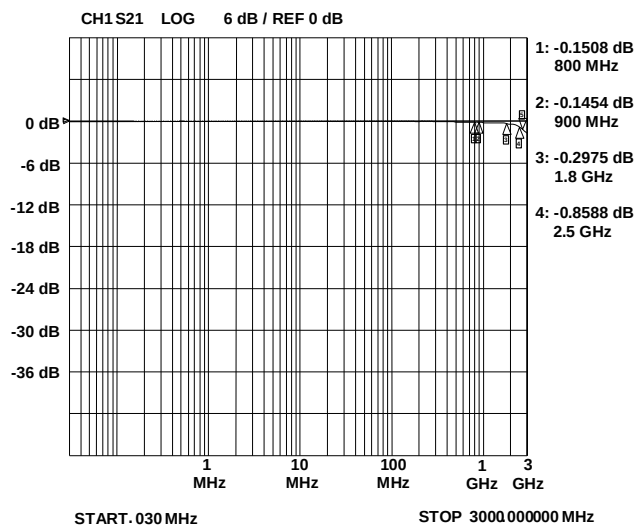
USB 2.0 Eye Pattern with RClamp1624T
(Data Lines - Pin 2 and 3)



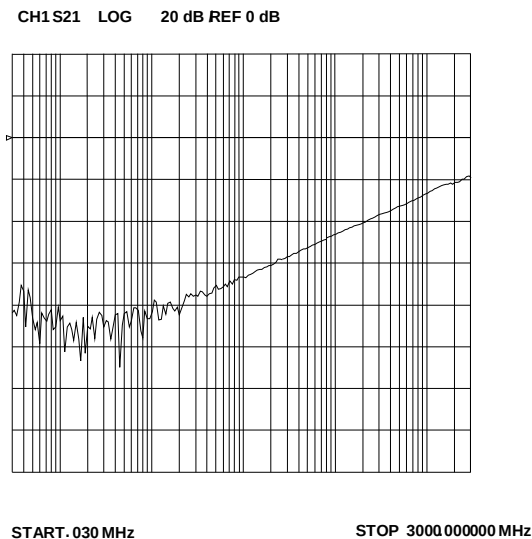
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Typical Characteristics

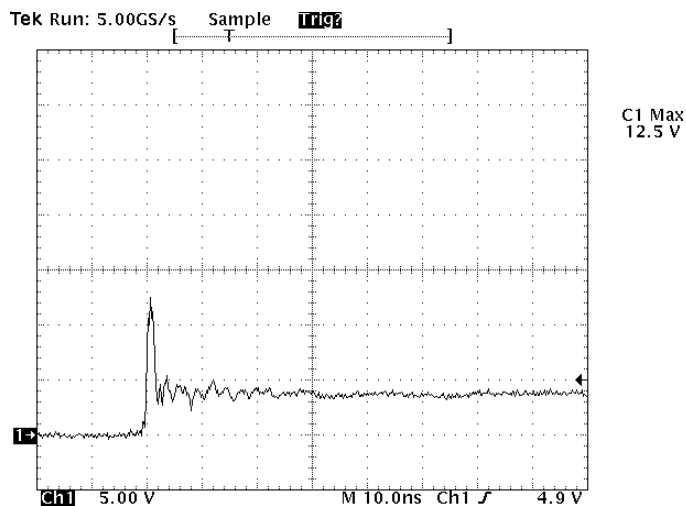
Insertion Loss S21
(Data Lines - Pins 2, 3, 4 to GND)



Analog Crosstalk

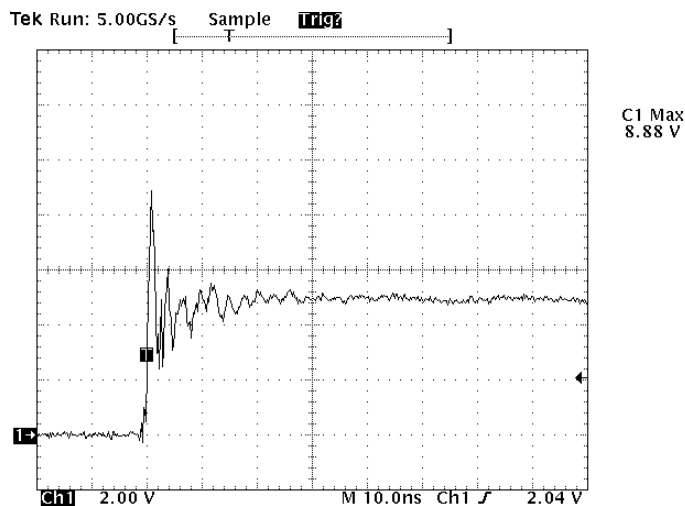


ESD Clamping (Pins 2, 3, 4 to GND)
(8kV Contact per IEC 61000-4-2)



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

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Applications Information

Device Connection and Layout Options for Protecting One USB Port

The RClamp1624T 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 <1pF 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 12 volts. Ground is provided at pins 5 and 6. Note that it is not necessary to connect both ground pins of the device as both are connected internally. 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 Figure 2. In this example, the VBus pin is connected to the voltage layer of the PCB with a micro via. Connection to ground is made at pin 6 using two micro vias. Connection to the ID pin is shown, however if the application does not utilize the ID function, pin 4 can be left not connected.

Figure 1- Pin Configuration

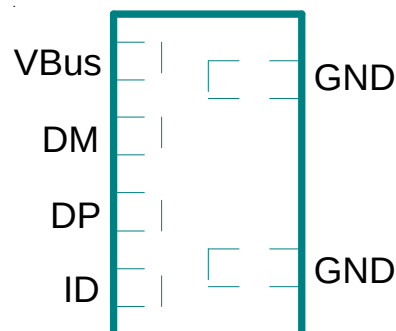
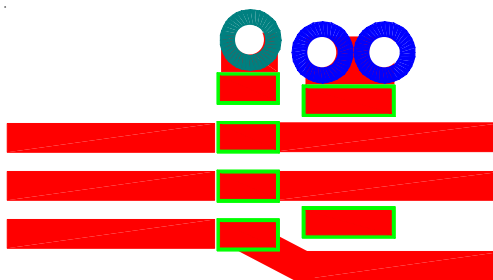
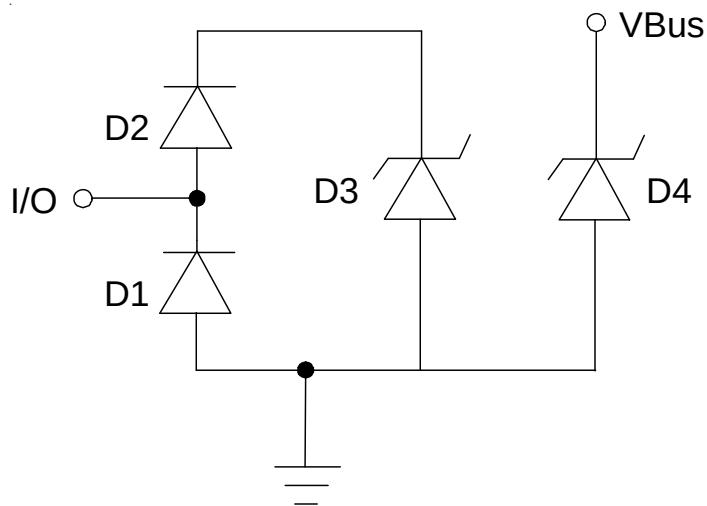


Figure 2 - Layout Example



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Applications Information - Spice Model

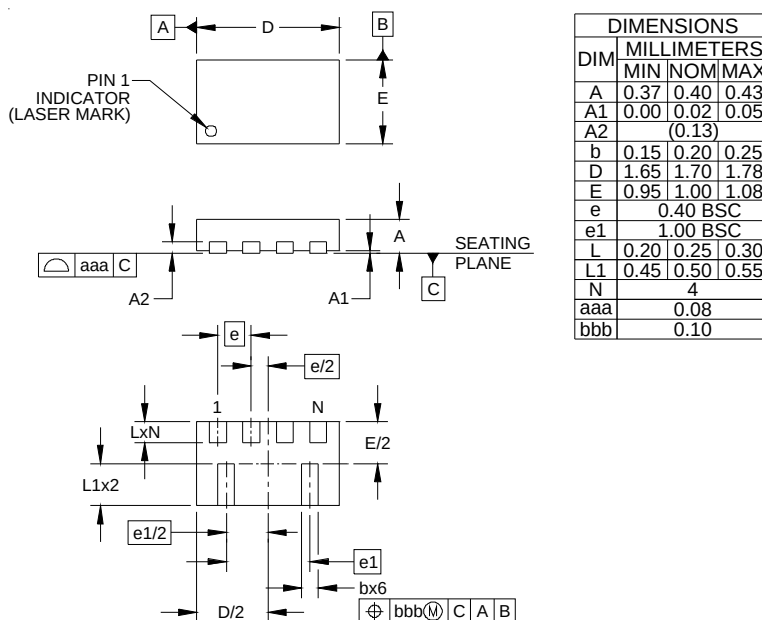


Spice Model

RClamp1624T Spice Parameters					
Parameter	Unit	D1	D2	D3	D4
IS	Amp	1E-20	1E-20	2E-12	7.38E-15
BV	Volt	100	100	8.2	16.4
VJ	Volt	0.83	0.83	0.6	0.73
RS	Ohm	1.5	0.6	0.2	0.735
IBV	Amp	1E-3	1E-3	1E-3	1E-3
CJO	Farad	0.25E-12	0.25E-12	56E-12	51E-12
TT	sec	2.541E-9	2.541E-9	2.541E-9	2.541E-9
M	—	0.01	0.01	0.23	0.30
N	—	1.1	1.1	1.1	1.1
EG	eV	1.11	1.11	1.11	1.11

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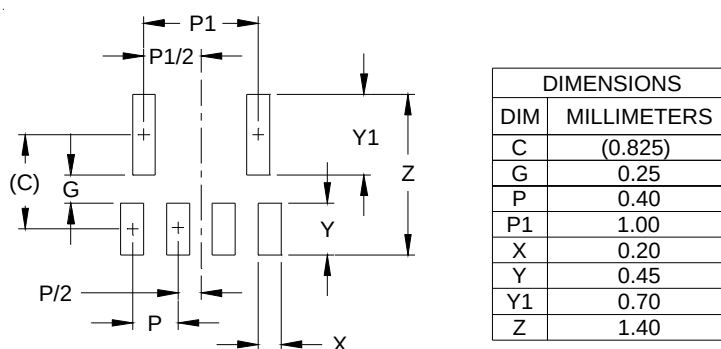
Outline Drawing - SLP1710P4T



NOTES:

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

Land Pattern - SLP1710P4T

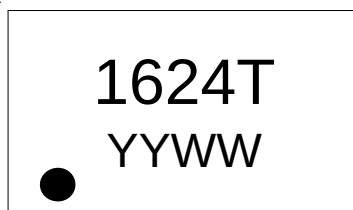


NOTES:

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.

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Marking



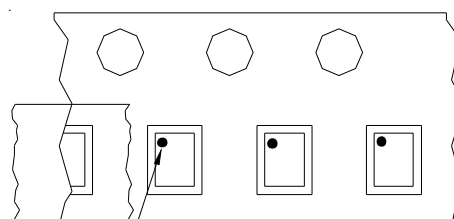
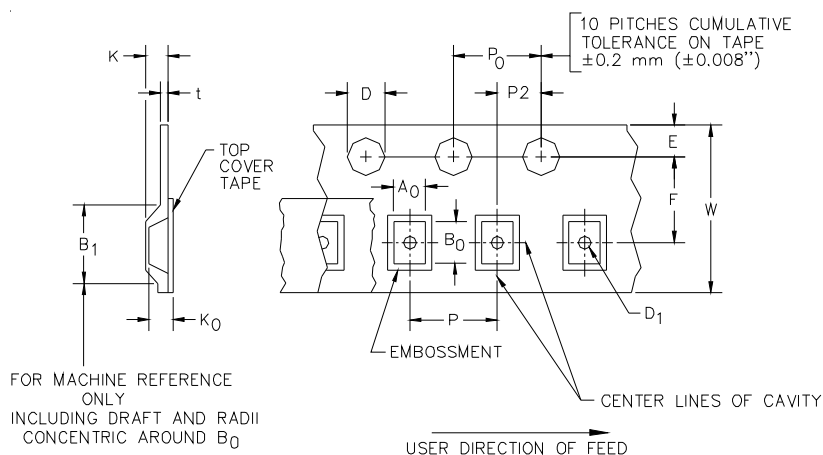
YYWW = Date Code

Ordering Information

Part Number	Lead Finish	Qty per Reel	Reel Size
RClamp1624T.TCT	Pb Free	3,000	7 Inch

RailClamp and RClamp are marks of Semtech Corporation

Tape and Reel Specification



Pin 1 Location

User Direction of feed

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

A0	B0	K0
1.18 +/-0.05 mm	1.88 +/-0.05 mm	0.53 +/-0.05 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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