



Features

- ❑ Transient protection for high-speed data lines
 - IEC 61000-4-2 (ESD) $\pm 27\text{kV}$ (Air)
 - $\pm 17\text{kV}$ (Contact)
 - IEC 61000-4-4 (EFT) 40A (5/50 ns)
 - Cable Discharge Event (CDE)
- ❑ Small package (2.9mm $\times$ 2.8mm $\times$ 1.4mm)
- ❑ Protects four data lines
- ❑ Low capacitance: 0.7pF Typical (I/O- GND)
- ❑ Low leakage current: 0.1 μA @ V_{RWM} (Typical)
- ❑ Low clamping voltage
- ❑ Each I/O pin can withstand over 1000 ESD strikes for $\pm 8\text{kV}$ contact discharge
- ❑ Green Part

Description

TT0514VL is a low capacitance Transient Voltage Suppressor (TVS) designed to provide electrostatic discharge (ESD) protection for high-speed data interfaces. With typical capacitance of 0.7pF only, TT0514VL is designed to protect parasitic-sensitive systems against over-voltage and over-current transient events. It complies with IEC 61000-4-2 (ESD), Level 4 ($\pm 15\text{kV}$ air, $\pm 8\text{kV}$ contact discharge), IEC 61000-4-4 (electrical fast transient - EFT) (40A, 5/50 ns), very fast charged device model (CDM) ESD and cable discharge event (CDE), etc.

TT0514VL uses SOT23-6L package. Each TT0514VL device can protect four high-speed data lines. The combined features of low capacitance, small size and high ESD robustness make TT0514VL ideal for high-speed data ports and high-frequency lines (e.g., HDMI & DVI) applications. The low clamping voltage of the TT0514VL guarantees a minimum stress on the protected IC.

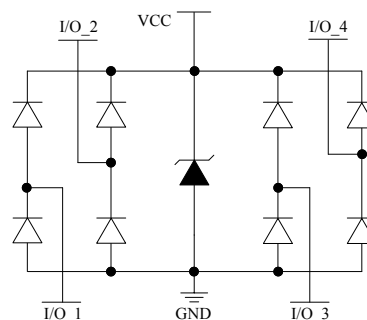
Applications

- ❑ Video Graphics Cards
- ❑ Desktops, Servers and Notebooks
- ❑ IEEE 1394 Ports
- ❑ USB 2.0/3.0 Power and Data Line Protection
- ❑ Display Ports
- ❑ SIM Ports

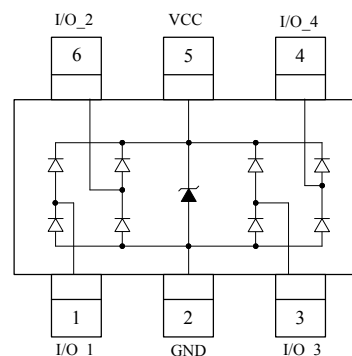
Mechanical Characteristics

- ❑ SOT23-6L package
- ❑ Flammability Rating: UL 94V-0
- ❑ Marking: Part number
- ❑ Packaging: Tape and Reel

Circuit Diagram



Pin Configuration



SOT23-6L

(Top View)

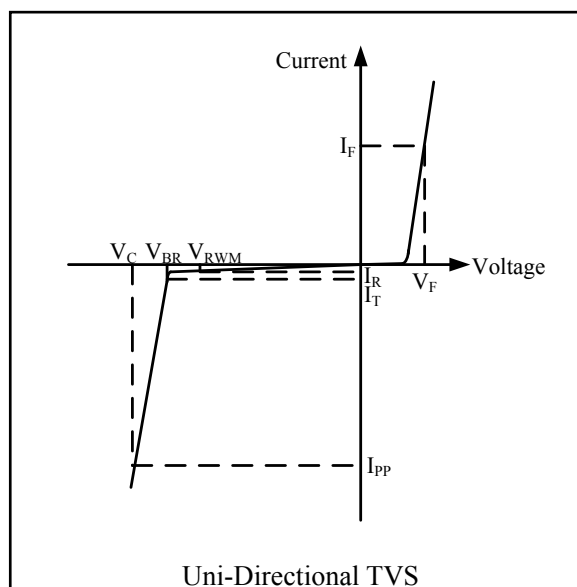


Absolute Maximum Rating

Symbol	Parameter	Value	Units
V_{ESD}	ESD per IEC 61000-4-2 (Air)	± 27	kV
	ESD per IEC 61000-4-2 (Contact)	± 17	
T_{OPT}	Operating Temperature	-55/+125	$^{\circ}\text{C}$
T_{STG}	Storage Temperature	-55/+150	$^{\circ}\text{C}$

Electrical Characteristics (T = 25°C)

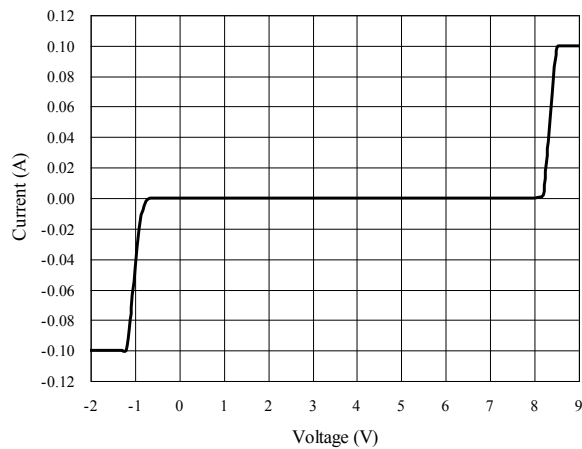
Symbol	Parameter
V_{RWM}	Nominal Reverse Working Voltage
I_R	Reverse Leakage Current @ V_{RWM}
V_{BR}	Reverse Breakdown Voltage @ I_T
I_T	Test Current for Reverse Breakdown
V_C	Clamping Voltage @ I_{PP}
I_{PP}	Maximum Peak Pulse Current
C_{ESD}	Parasitic Capacitance
V_R	Reverse Voltage
f	Small Signal Frequency
I_F	Forward Current
V_F	Forward Voltage @ I_F



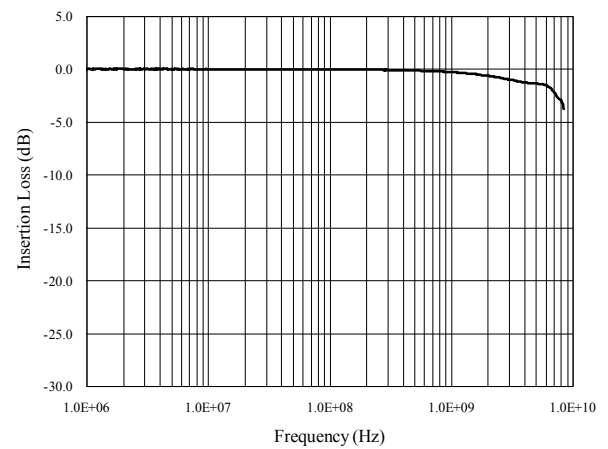
Symbol	Test Condition	Minimum	Typical	Maximum	Units
V_{RWM}				5.0	V
I_R	$V_{RWM} = 5\text{V}$, T = 25°C Between I/O and GND		0.1	1.0	μA
V_{BR}	$I_T = 1\text{mA}$ Between I/O and GND	6.0	8.0	10.0	V
V_C	$I_{PP} = 1\text{A}$, $t_p = 8/20\mu\text{s}$ Between I/O and GND			12	V
C_{ESD}	$V_R = 0\text{V}$, f = 1MHz Between I/O and GND		0.7	0.8	pF
C_{ESD}	$V_R = 0\text{V}$, f = 1MHz Between I/O and I/O		0.35		pF



Voltage Sweeping of I/O to GND

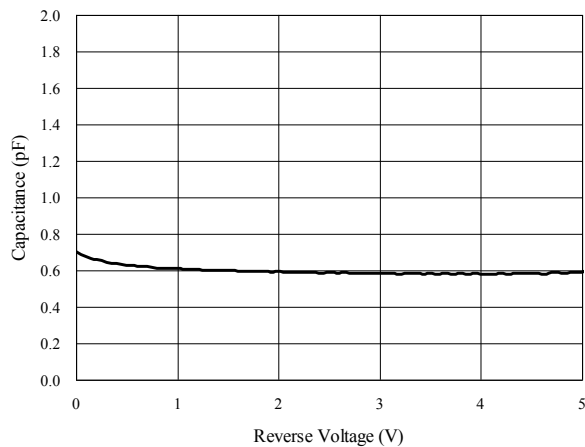


Insertion Loss S21 of I/O to GND

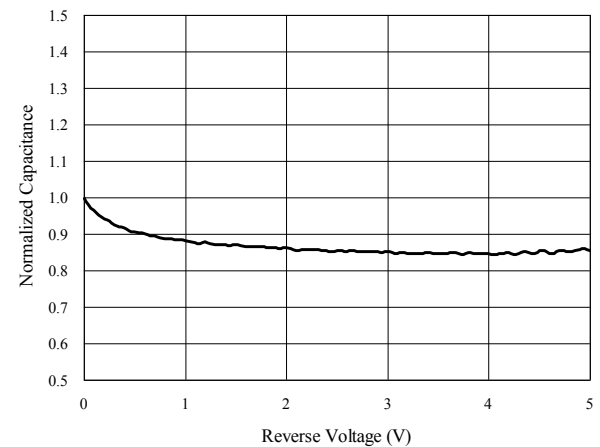


Capacitance vs. Voltage of I/O to GND (f = 1MHz)

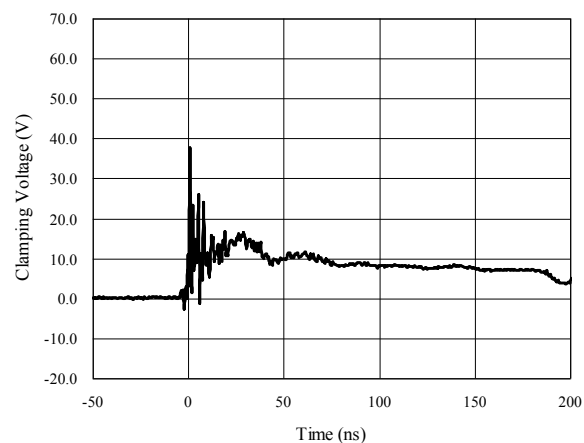
Capacitance vs. Reverse Voltage



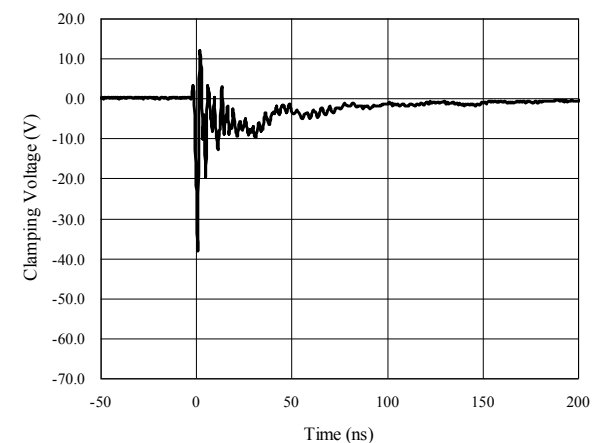
Normalized Capacitance vs. Reverse Voltage



ESD Clamping of I/O to GND (+8kV Contact per IEC 61000-4-2)



ESD Clamping of I/O to GND (-8kV Contact per IEC 61000-4-2)





Application Information

Pin Connection in PCB

TT0514VL is capable to provide ESD protection for four data lines simultaneously. The pin connection is shown in Figure 1.

Four parallel data lines, from inner IC to I/O port connector, could connect to TT0514VL four I/O pins directly. Pin 2 of TT0514VL is the negative reference pin, which should connect to the GND of PCB. The connection wires should be as short as possible in order to minimize the parasitic inductance.

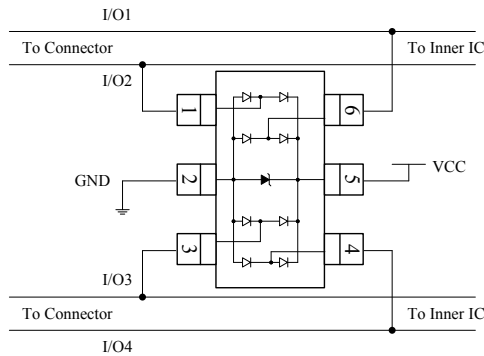


Figure 1 TT0514VL pin connection in PCB

PCB Layout Guidelines

For optimum ESD protection and the whole circuit performance, the following PCB layout guidelines are recommended:

- ❑ TT0514VLGND pin to the PCB GND rail path should be as short as possible. It could reduce the ESD transient return path to GND.
- ❑ The vias connecting TT0514VL VCC & GND pins to the PCB VCC & GND should be wide.
- ❑ Place TT0514VL as close to the connector port as possible. It could reduce the parasitic inductance and restrict ESD coupling into adjacent traces.
- ❑ Avoid running critical signals near board edges.

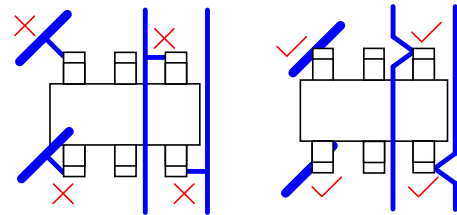
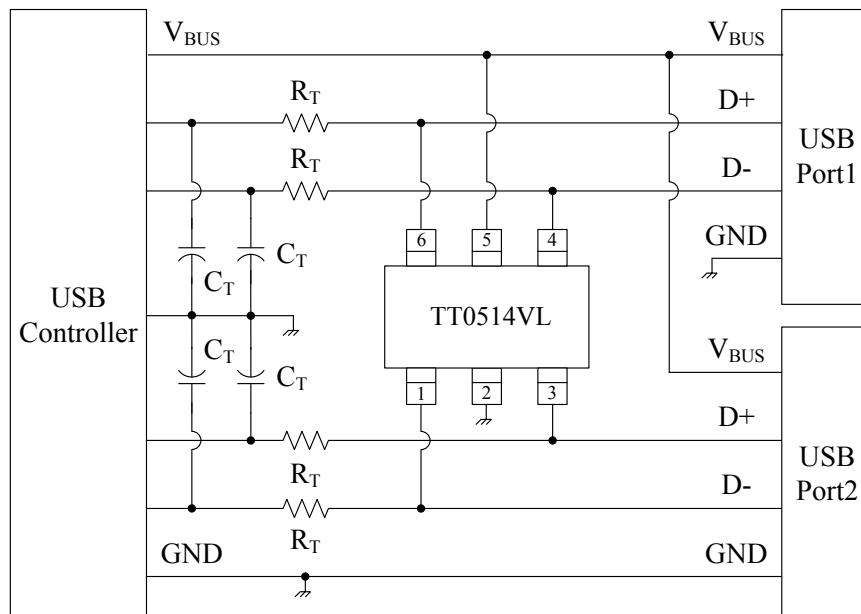


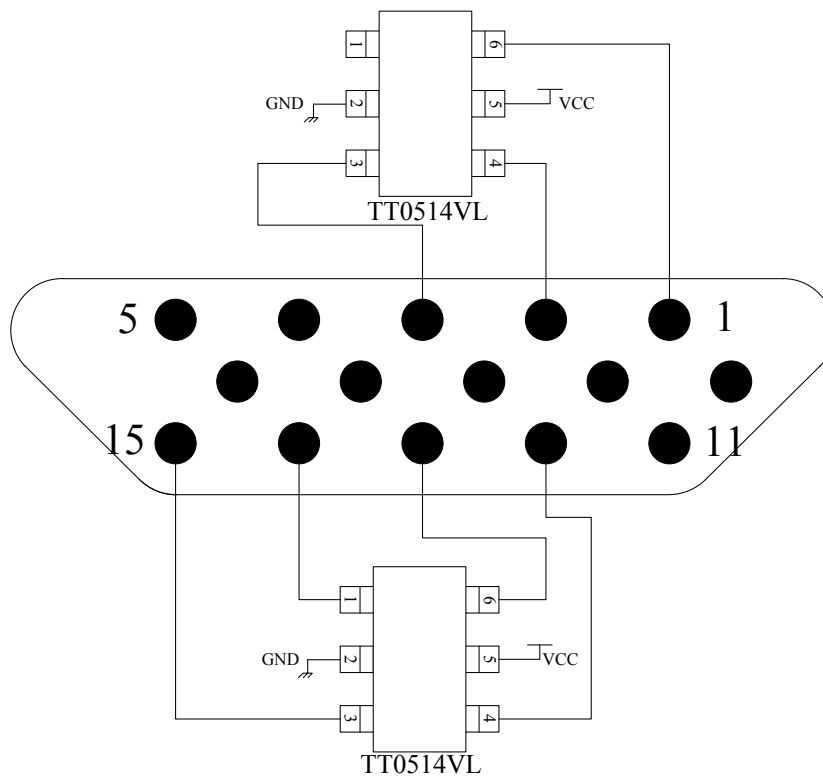
Figure 2 TT0514VL Layout Guideline

Universal Serial Bus ESD Protection

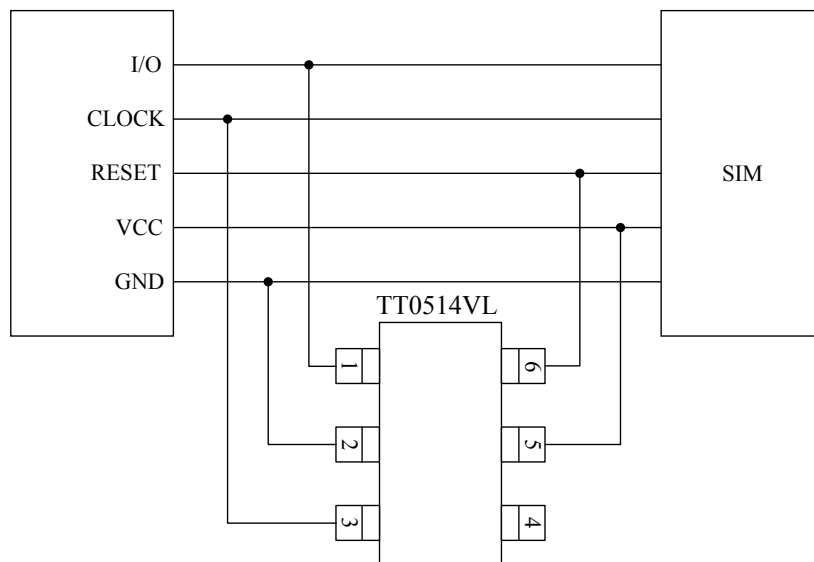




Application Information (continued)



Layout Top View for Video (VGA) Interface with TT0514VL

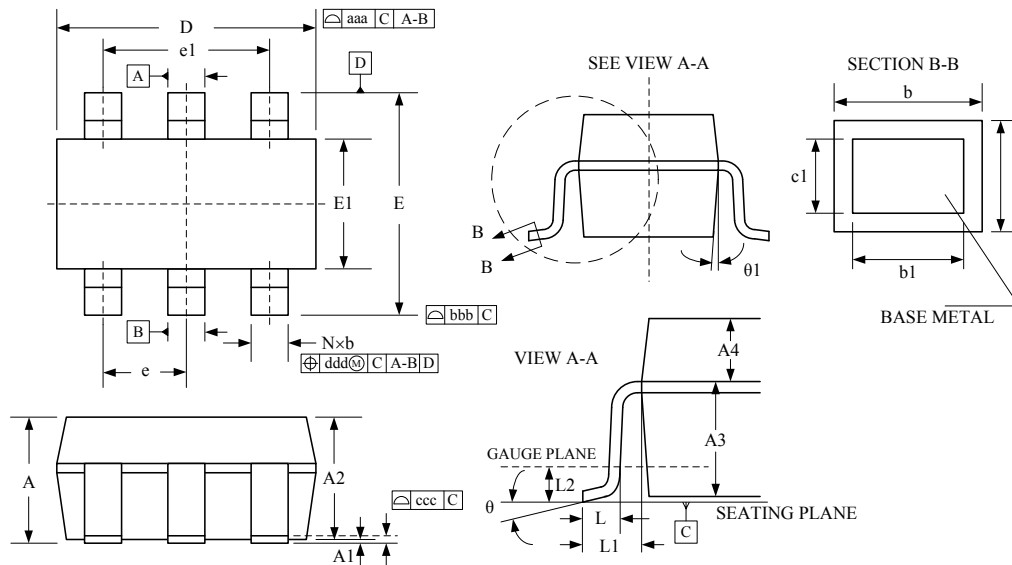


Layout Top View for SIM Port with TT0514VL



Package Outline

□ SOT23-6L package

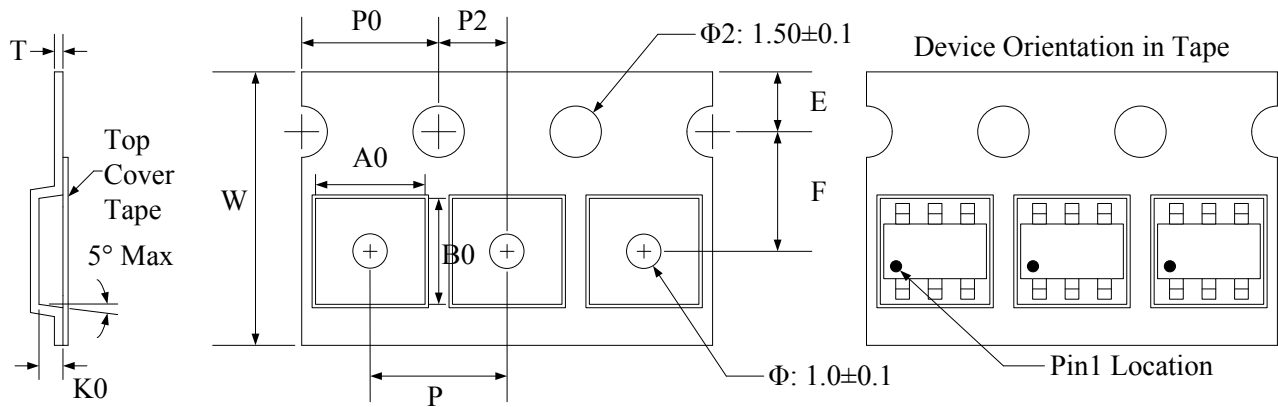


Package Dimensions (Controlling dimensions are in millimeters)

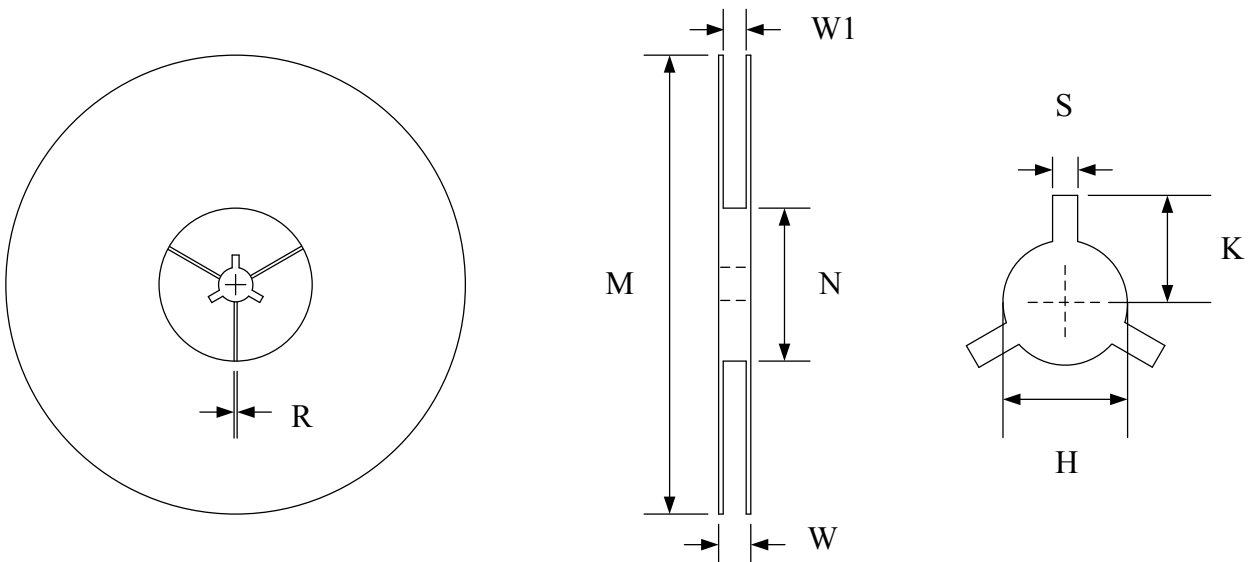
Symbol	Dimensions (mm)			Dimensions (Inches)		
	Minimum	Typical	Maximum	Minimum	Typical	Maximum
A	—	—	1.450	—	—	0.057
A1	0.000	—	0.150	0.000	—	0.006
A2	0.900	1.200	1.300	0.035	0.047	0.012
A3	0.637	0.787	0.837	0.025	0.031	0.033
A4	0.263	0.413	0.463	0.010	0.016	0.018
b	0.300	—	0.500	0.012	—	0.020
b1	0.300	0.400	0.450	0.012	0.016	0.018
c	0.080	—	0.220	0.003	—	0.009
c1	0.080	0.130	0.200	0.003	0.005	0.008
D	2.90 BSC			0.114 BSC		
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
E	2.80 BSC			0.110 BSC		
E1	1.60 BSC			0.063 BSC		
L	0.300	0.450	0.600	0.012	0.018	0.024
L1	0.600 REF			0.024 REF		
L2	0.250 BSC			0.010 BSC		
θ	0°	4°	8°	0°	4°	8°
θ1	5°	10°	15°	5°	10°	15°
aaa	0.150			0.006		
bbb	0.200			0.008		
ccc	0.100			0.004		
ddd	0.100			0.004		



Tape and Reel Specification



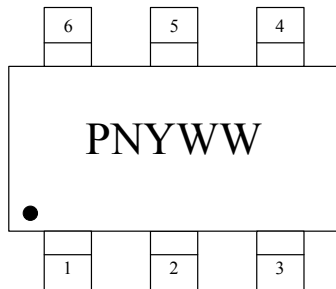
Symbol	W	A0	B0	K0	E	F	P	P0	P2	T
Dimensions (mm)	8.00 ± 0.3 -0.1	3.23 ± 0.05	3.17 ± 0.05	1.37 ± 0.05	1.75 ± 0.1	3.5 ± 0.05	4.0 ± 0.1	4.0 ± 0.1	2.0 ± 0.05	0.25 ± 0.02



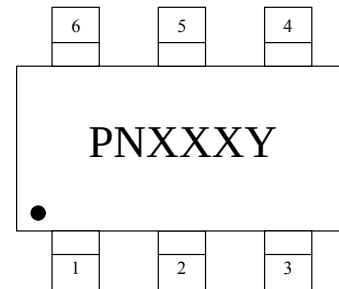
Symbol	Reel Size	M	N	W	W1	H	S	K	R
Dimensions (mm)	$\Phi 178$	178.0 ± 1.0	60.0 ± 1.0	11.5 ± 0.5	9.0 ± 0.5	13.0 ± 0.5	2.0 ± 0.1	11.0 ± 0.2	1.0 ± 0.05



Marking Codes



Or



Note:

- (1) PN is "16" or "6U", and is part number, fixed.
- (2) "XXX" is internal code.

Note:

- (1) PN is "16" or "6U", and is part number, fixed.
- (2) "XXX" is the last 3 characters of the wafer's Lot No., "Y" is the internal code.

Ordering Information

Part Number	Working Voltage	Quantity Per Reel	Reel Size
TT0514VL	5V	3,000	7 Inch