Features

- Transient protection for high-speed data lines
  IEC61000-4-2 (ESD) ±15kV (Air)
  ±14kV (Contact)
  IEC61000-4-5 (Lightning) 7A (8/20μs)
- Small package saves board space
- Protects one I/O line (unidirectional)
- Low capacitance: 0.24pF@0V (Typical) (I/O-GND)
- Low leakage current: 10nA @ V_{RWM} (Maximum)
- Low clamping voltage
- Each I/O pin can withstand over 1000 ESD strikes for ±14kV contact discharge

Applications

- Protable applications
- Communication systems
- Computers and peripherals
- High speed data lines
  - USB 2.0/3.0/3.1/3.2
  - Thunderbolt
  - eSATA
  - DisplayPort
  - PCI-e

Description

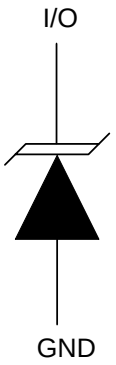
TT0311SA-FxX is an ultra-low capacitance Transient Voltage Suppressor (TVS) designed to provide electrostatic discharge (ESD) protection for high-speed data interfaces. With typical capacitance of 0.24pF only, it is designed to protect parasitic-sensitive systems against over-voltage and over-current transient events.

The TT0311SA-FxX comes in a RoHS compliant and Halogen Free 0.6mm x 0.3mm x 0.3mm DFN0603-2L package.

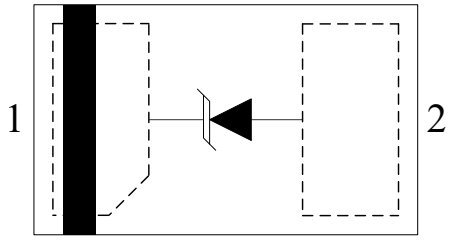
Mechanical Characteristics

- Package: DFN0603-2L
- Marking: Part number
- Packaging: Tape and Reel
- ROHS compliant

Circuit Diagram



Pin Configuration

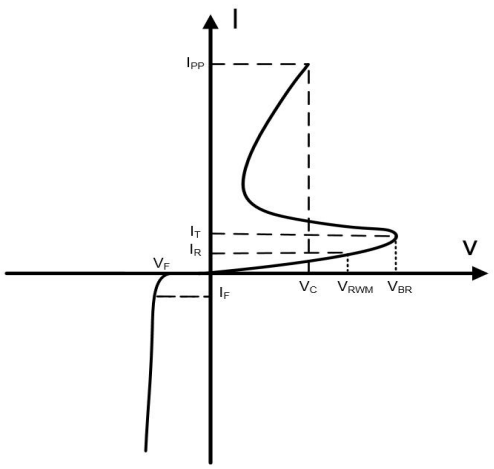


DFN0603-2L
(Top View)

Absolute Maximum Rating

Symbol	Parameter	Value	Units
I_{PP}	Peak Pulse Current (8/20μs)	7.0	A
P_{PK}	Peak Pulse Power (8/20μs)	40	W
V_{ESD}	ESD per IEC61000-4-2 (Air) ESD per IEC61000-4-2 (Contact)	±15 ±14	kV
T_{OPT}	Operating Temperature	-55/+125	°C
T_{STG}	Storage Temperature	-55/+150	°C

Electrical Characteristics (T = 25°C)

Symbol	Parameter	Diagram
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	
I_F	Forward Current	
V_F	Forward Voltage @ I_F	
C_{ESD}	Parasitic Capacitance	
R_{dyn}	Dynamic Resistance	
α_{IL}	Insertion Loss	
f_{-3db}	Cut-off frequency at -3dB	

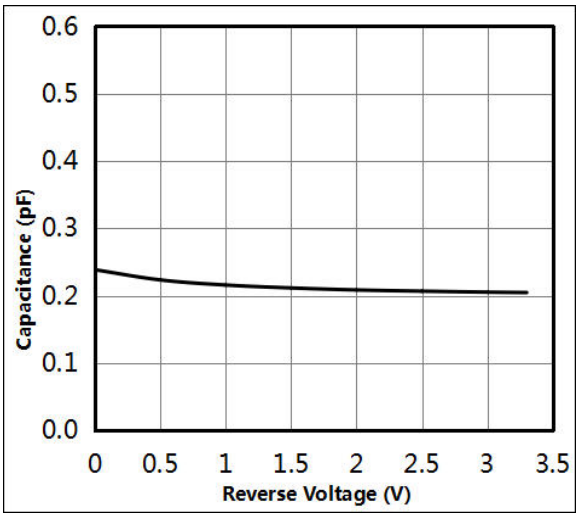
Symbol	Test Condition	Minimum	Typical	Maximum	Units
V_{RWM}			3.3	3.6	V
I_R	V_{RWM} = 3.6V , T = 25°C		1	10	nA
V_{BR}	I_T = 1mA	5.5	6.2		V
V_C	I_{PP} = 7.0A, t_p = 8/20μs		6.4		V
V_C	I_{PP} = 8.0A, t_p = 100ns(1)		5.0		V
	I_{PP} = 16.0A, t_p = 100ns(1)		7.0		V
R_{dyn}	I_{PP} = 12.0A, t_p = 100ns(1)		0.25		Ω

Notes:(1)Measurements performed using a 100ns Transmission Line Pulse(TLP) system.

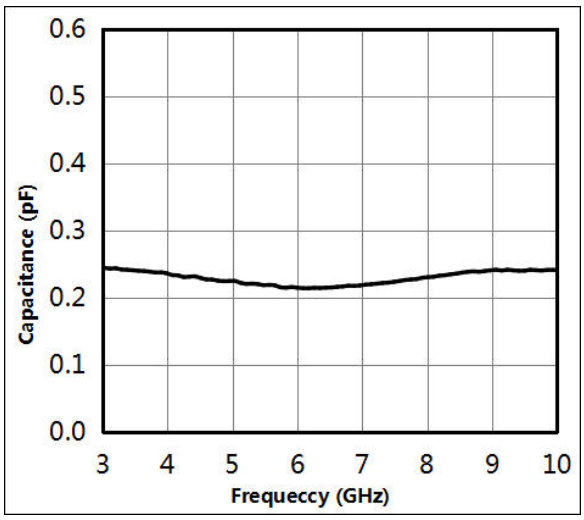
Symbol	Test Condition	Minimum	Typical	Maximum	Units
C_{ESD}	V_R = 0V, f = 1MHz		0.24		pF
	V_R = 0V, f = 5GHz		0.22		pF
α_{IL}	f = 5GHz		-0.03		dB
	f = 10GHz		-1.4		dB

Typical Performance Characteristics

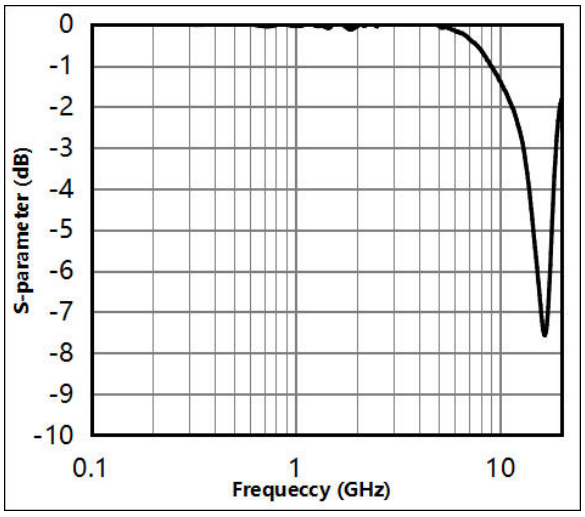
Capacitance vs Reverse Voltage of I/O to GND



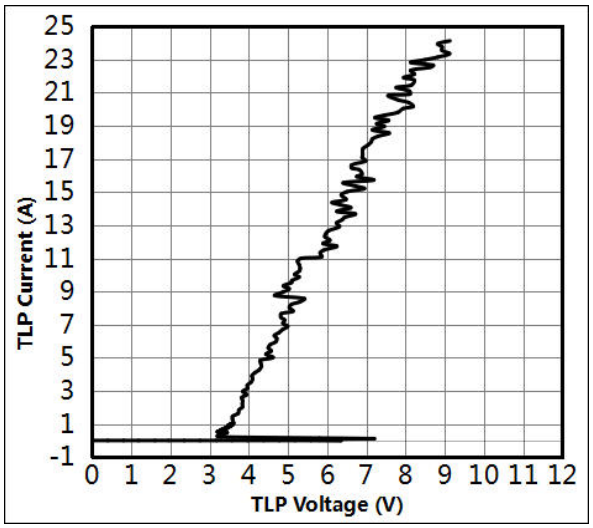
Capacitance vs Frequency of I/O to GND



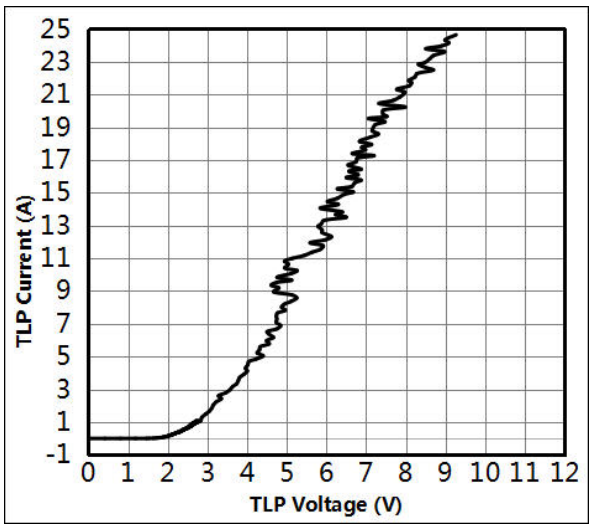
Insertion loss



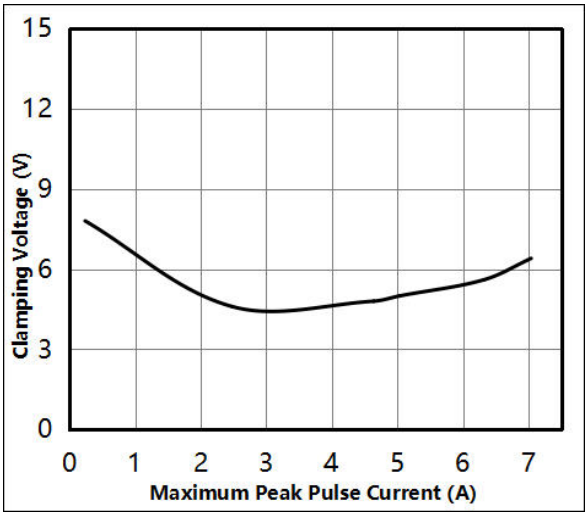
TLP Measurement of I/O to GND



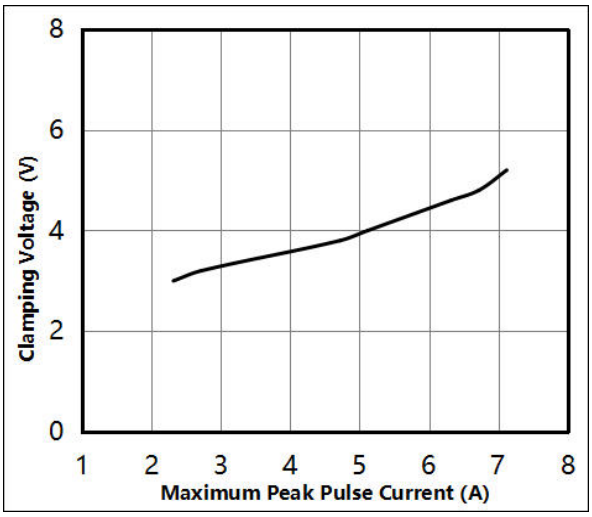
TLP Measurement of GND to I/O



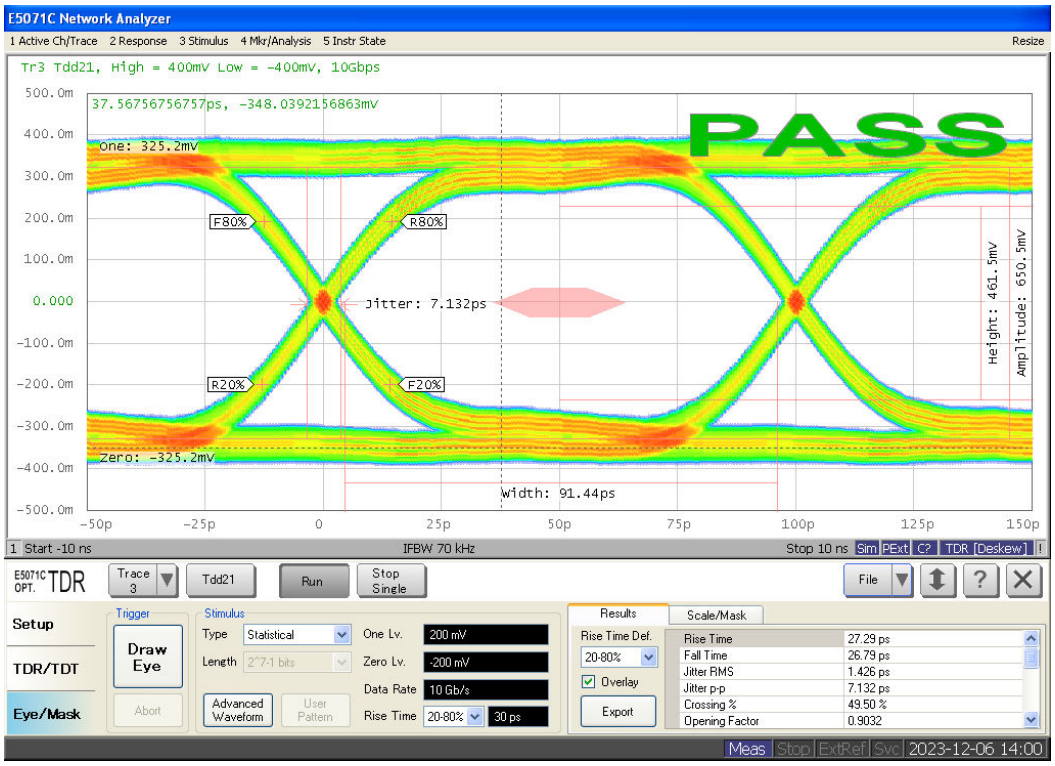
8/20us Current of I/O to GND



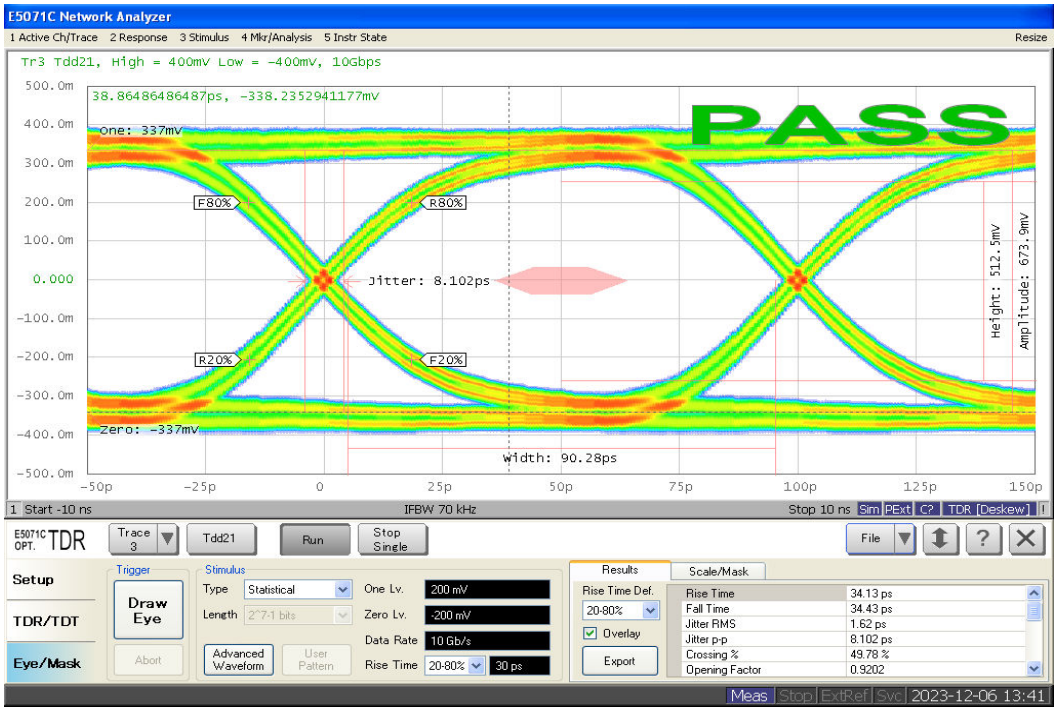
8/20us Current of GND to I/O



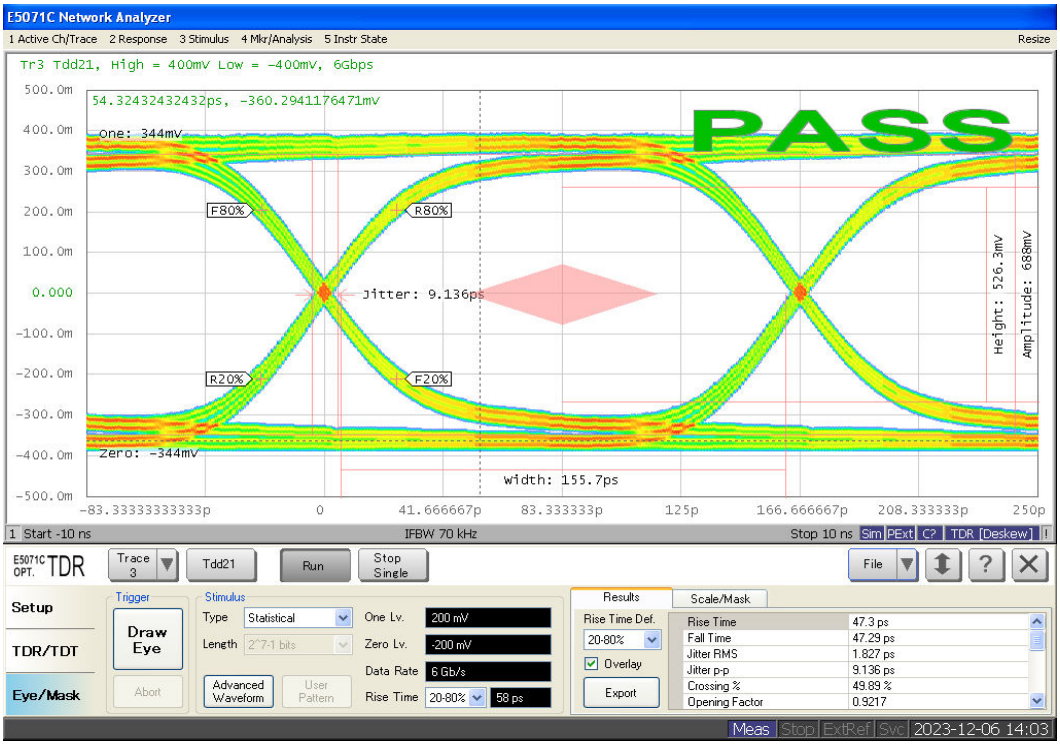
Application Curves



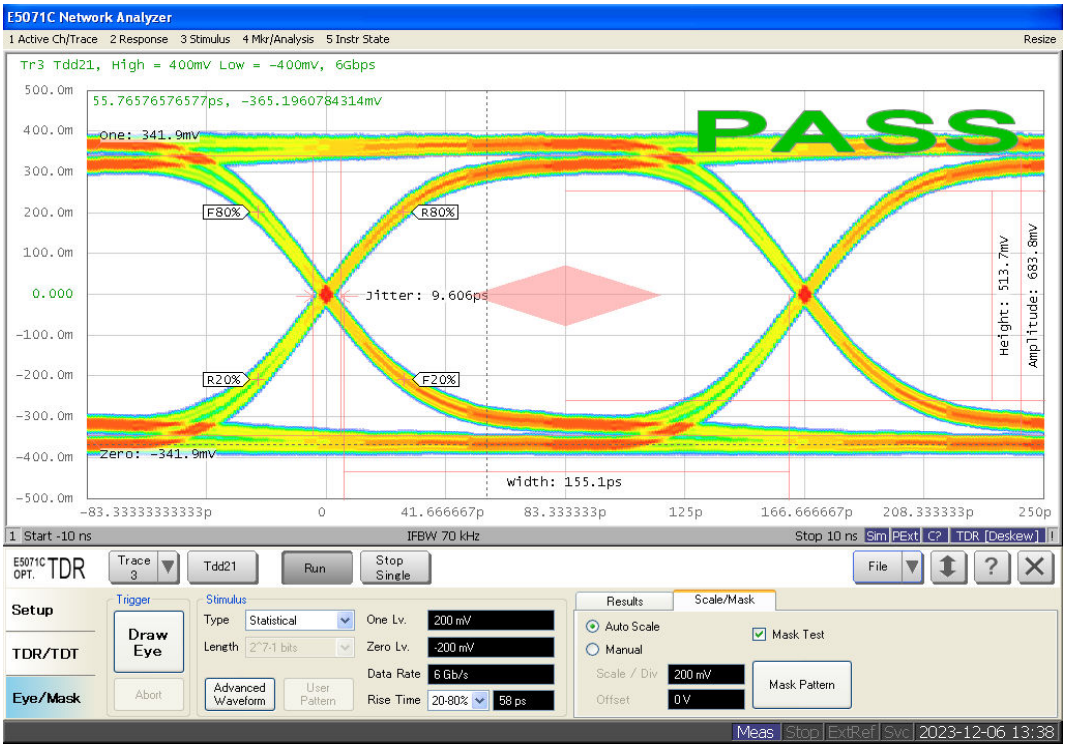
USB3.2 Gen2 Eye Diagram WO Device (10Gbps)



USB3.2 Gen2 Eye Diagram WI Device (10Gbps)



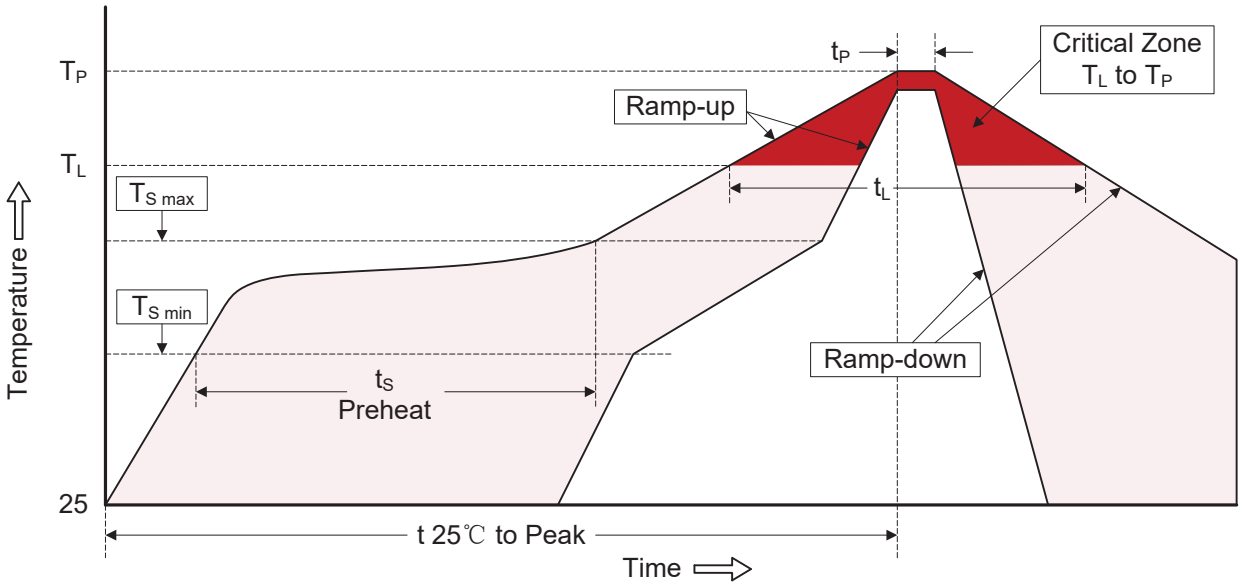
HDMI 2.0 Eye Diagram WO Device (6Gbps)



HDMI 2.0 Eye Diagram WI Device (6Gbps)

Recommended Soldering Conditions

Reflow Soldering

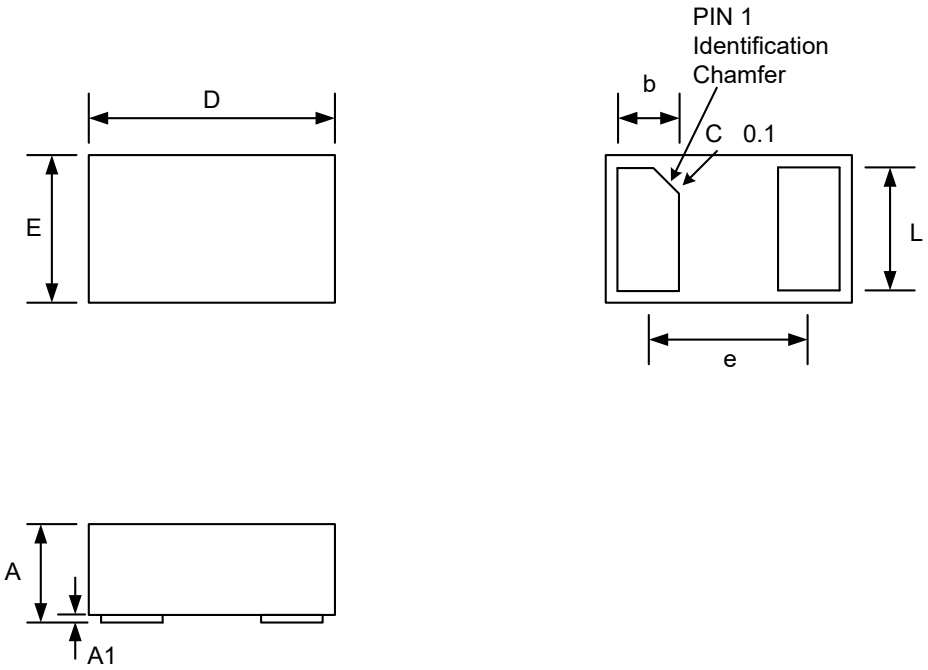


Recommended Conditions

Profile Feature	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	3℃/second max.
Preheat -Temperature Min ($T_{S\ min}$) -Temperature Max ($T_{S\ max}$) -Time (min to max) (ts)	 150℃ 200℃ 60-180 seconds
$T_{S\ max}$ to T_L -Ramp-up Rate	 3℃/second max.
Time maintained above: -Temperature (T_L) -Time (t_L)	 217℃ 60-150 seconds
Peak Temperature (T_P)	260℃
Time within 5℃ of actual Peak Temperature (t_P)	20-40 seconds
Ramp-down Rate	6℃/second max.
Time 25℃ to Peak Temperature	8 minutes max.

Package Outline

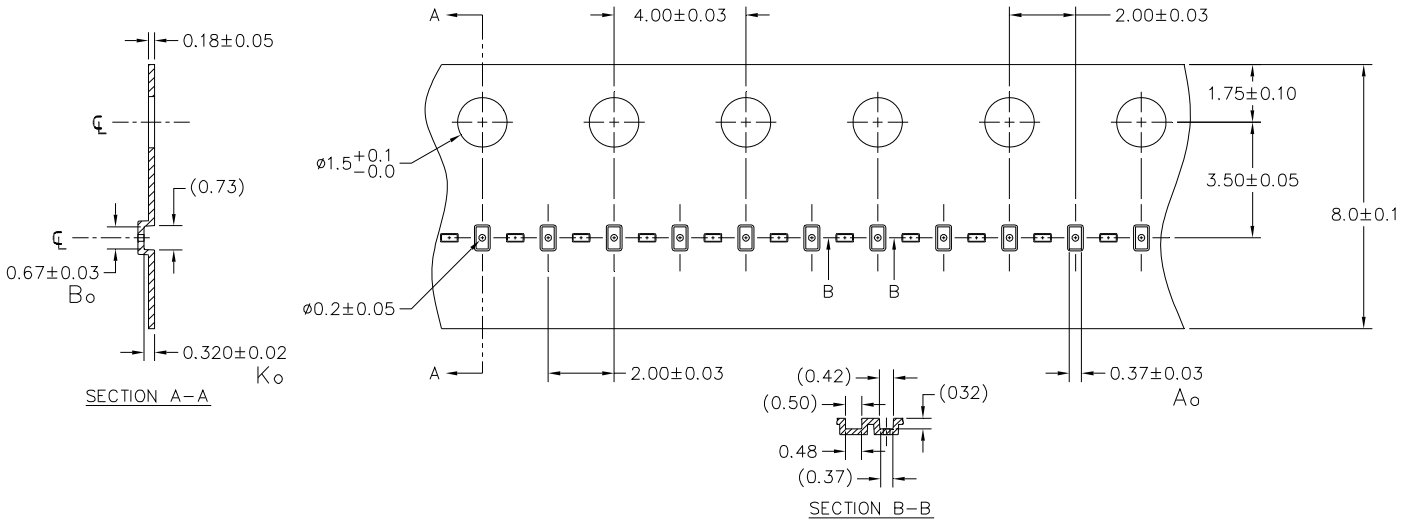
- ❑ DFN0603-2L package
- ❑ 2 leads, very small package
- ❑ MSL-1



Package Dimensions (Controlling dimensions are in millimeters)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Minimum	Maximum	Minimum	Maximum
A	0.270	0.330	0.011	0.013
A1	0.000	0.050	0.000	0.002
D	0.600	0.640	0.023	0.025
E	0.300	0.340	0.011	0.013
b	0.115	0.175	0.005	0.007
e	0.400 BSC		0.016 BSC	
L	0.215	0.275	0.008	0.011

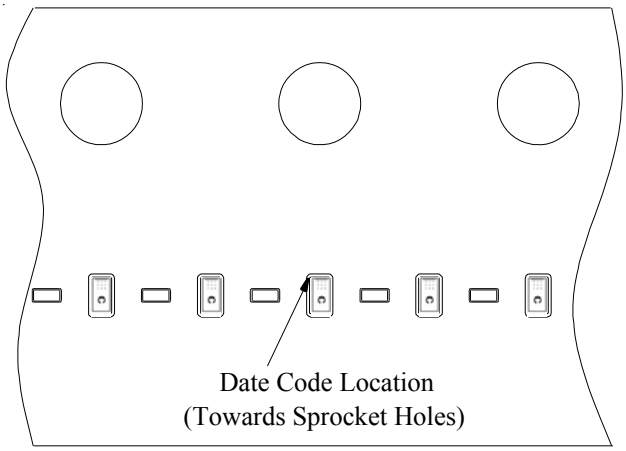
Carries Tape Specification



A0	B0	K0
0.37 +/-0.03	0.67 +/-0.03	0.32 +/-0.02 mm

Note: All dimensions in mm unless otherwise specified

Device Orientation in Tape



Marking Codes

Note:
(1) "S" is part number.
(2) "X" is the internal code.

Ordering Information

Part Number	Working Voltage	Quantity Per Reel	Reel Size
TT0311SA-FxX	3.3V	10,000	7 Inch