

ESD Protection Device LXES Series - Ceramic



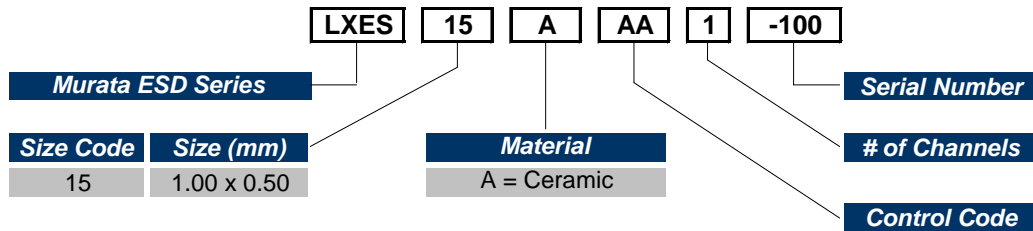
Features

- Ultra low capacitance (0.05pF)
- Bi-directional
- RoHS complaint, Halogen free, Lead free
- IEC 61000-4-2 Level 4 (8kV Contact and 15kV Air Discharge)
- Fast response time (<1ns)

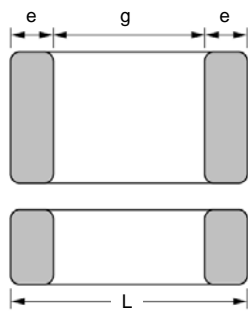
Applications

- Ideal for high speed data lines
- HDMI 1.3, USB 2.0/3.0, IEEE 1394b
- Computer and peripherals
- Cell phones
- A/V Equipment, STB, DVD, HDTV, etc.
- Antenna Ports

Part Numbering System



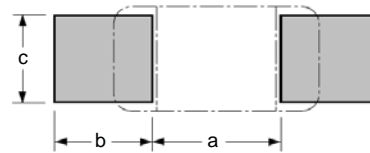
Dimensions & Land Patterns Recommendation



Chip Dimensions

Part Number	L	W	T	e	g	a	b	c
LXES15AAA1-100	1.00±0.05	0.50±0.05	0.33 max	0.20±0.10	0.40 min	0.40	0.4	0.5

(unit: mm)



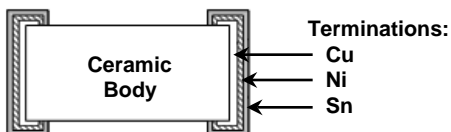
Land Patterns Recommendation

Schematic

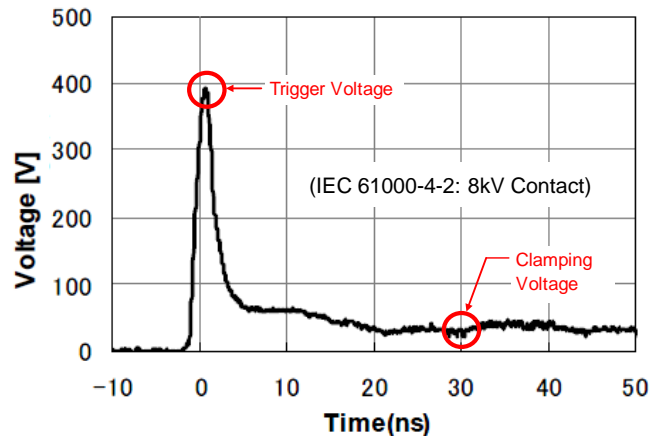


Bi-directional
Single channel

Product Structure



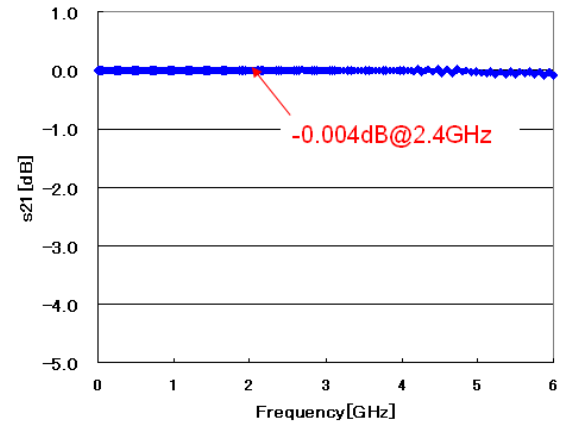
Typical ESD Response



Electrical Characteristics

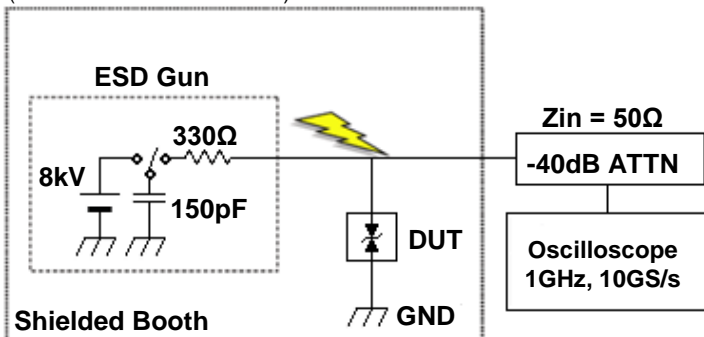
Characteristic	Value
Rated Voltage	15V
ESD Capability (IEC 61000-4-2 Level 4 Procedure)	
Contact Discharge	±15kV
Air Discharge	±15kV
Trigger Voltage (typical)	350V
Clamping Voltage (typical @ 30ns)	40V
Response Time	< 1ns
Leakage Current (typical)	< 1μA
ESD Pulse Withstand	> 1000 pulses
Attenuation Change (typical @ 2.4GHz)	-0.004dB
Capacitance (Vbias=0V, 1MHz, 25°C)	0.05pF (typical)
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +85°C

Frequency Characteristic

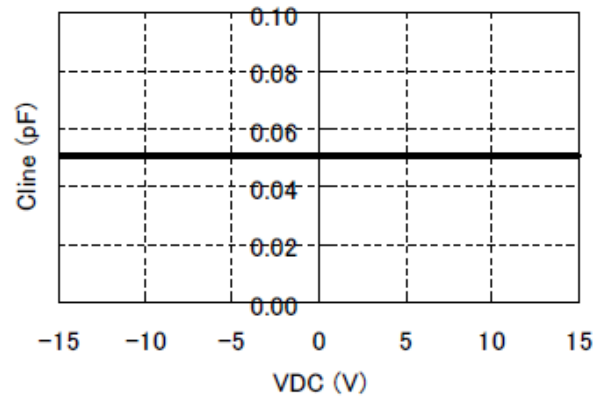


ESD Test Measurement System

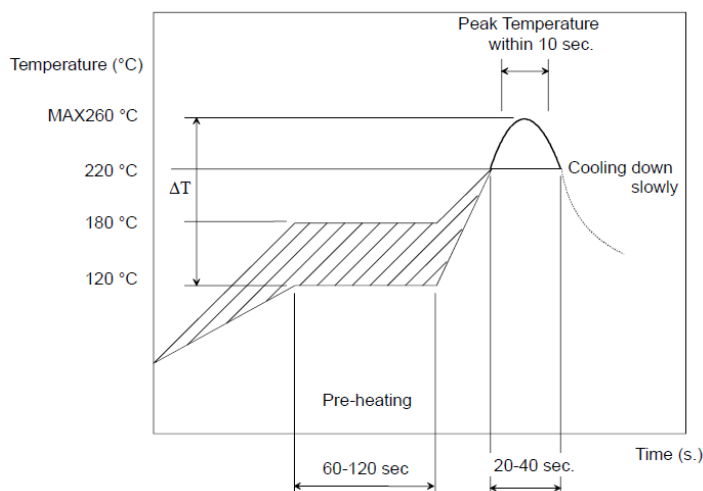
(IEC 61000-4-2: 8kV Contact)



Capacitance-vs-Voltage Characteristic

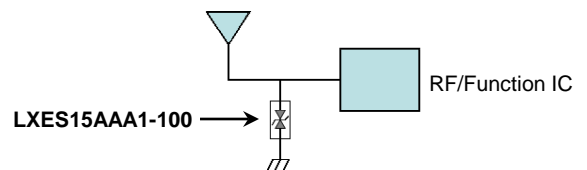


Reflow Soldering Condition

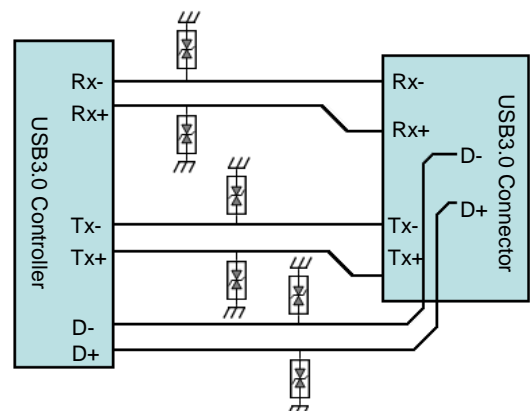


Application Examples

Antenna Port Protection

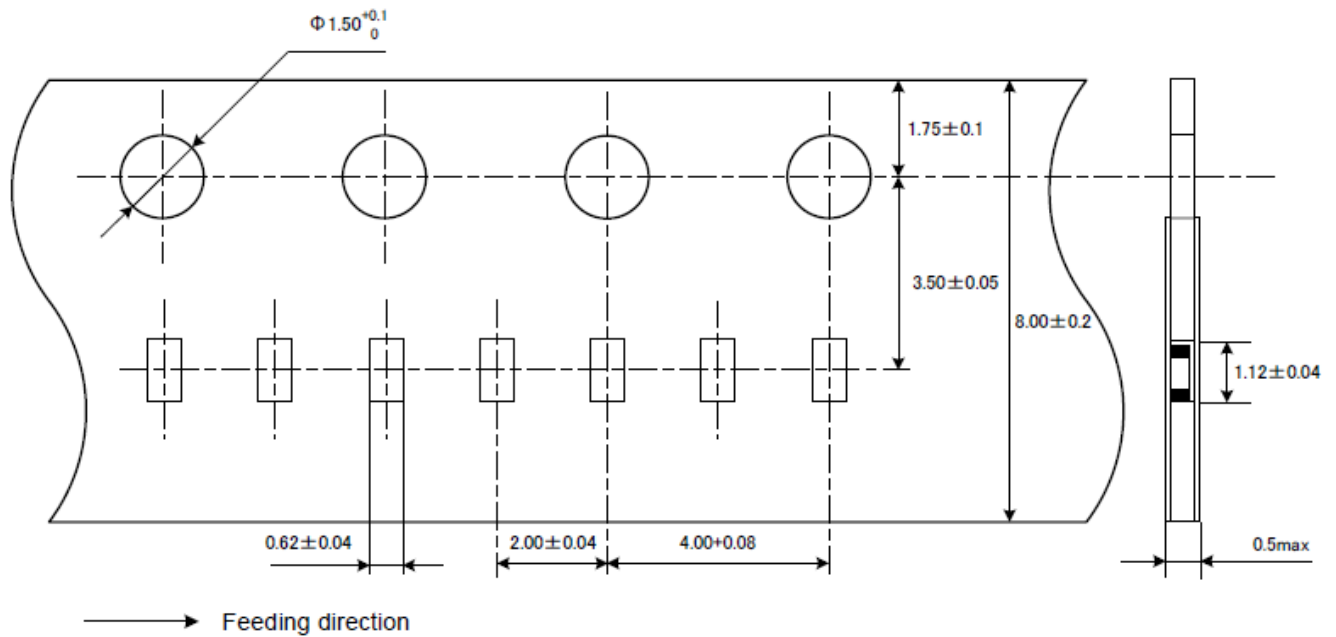


USB3.0 Port Protection (discrete solution)

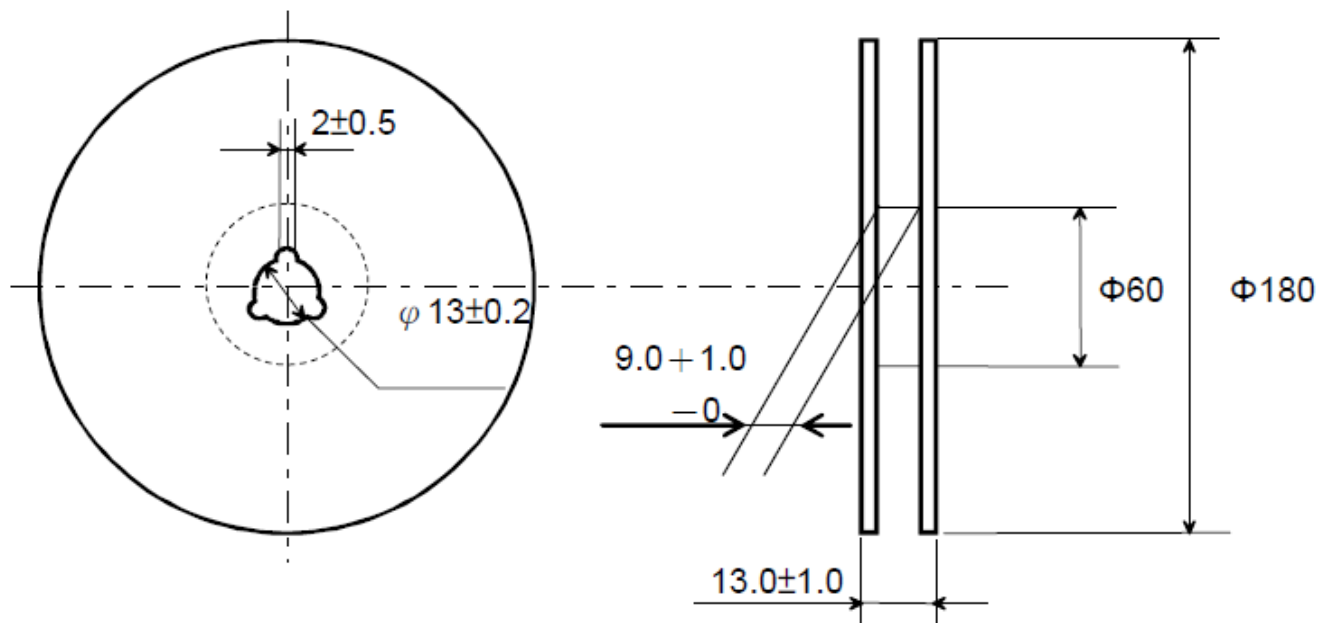


■ Packaging Specifications (Tape/Reel Only)

1) Dimensions of Paper Tape (in mm):



2) Dimensions of Reel (in mm):



3) Packaging Quantity:

10,000 pcs/reel

ESD Protection Device LXES Series – Silicon Based

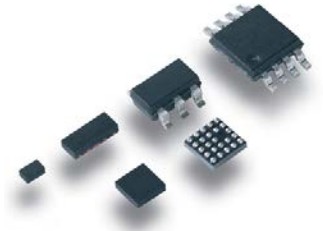


Features

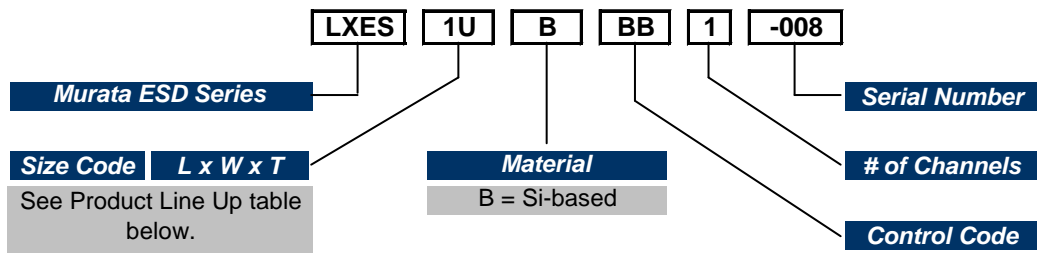
- Low capacitance (0.25pF and up)
- Single or Multi-channel
- IEC 61000-4-2 Level 4 (as noted)
- Fast response time (<1ns)
- Low Clamping Voltage

Applications

- Ideal for high speed data lines
- HDMI 1.3, USB 2.0/3.0, IEEE 1394b
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- Antenna Ports



Part Numbering System



Product Line Up

# of Channels	Part number	Capacitance (pF - typical)	Breakdown Voltage*		L x W (mm)	T (mm max)	Appearance
			Min.	Max.			
1	LXES1UBBB1-008	0.50	7	10	1.0 x 0.6	0.6	<i>(not to scale)</i>
	LXES1UBAB1-007		18.7		1.0 x 0.6	0.6	
	LXES1UBAA1-096	7.50	5.8		1.0 x 0.6	0.55	
2	LXES1TBBB2-004	0.55	6	9	1.6 x 1.6	0.55	
	LXES1TBAA2-013		6	9			
4	LXES1TBAA4-005	1.30	6	9	1.6 x 1.6	0.6	
	LXES2SBAA4-016	0.55	6	9	2.9 x 2.8	1.45	
	LXES2SBBB4-026	1.00	6	9			
	LXES2TBBB4-028	0.50	6	10	2.5 x 1.0	0.6	
6	LXES4XBAA6-027	0.25	6	10	4.9 x 3.0	1.1	
	LXESEABAA6-046	0.27	6		4.1 x 2.0	0.4	

* at 1mA

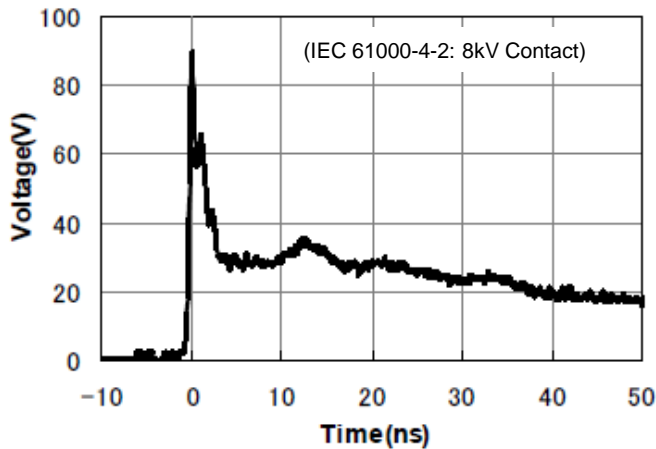
Maximum Ratings

Parameter	Value
Rated Voltage	±6V
ESD Capability (IEC 61000-4-2 Level 4 Procedure)	
Contact Discharge	±8kV
Air Discharge	±15kV
Response Time	< 1ns
Soldering Temperature (≤10 sec.)	260°C
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +125°C

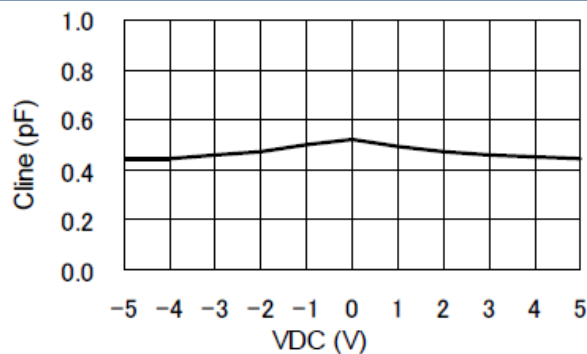
Electrical Characteristics (at 25°C)

Parameter	Min.	Typ.	Max.
Leakage Current (at ±5V)			1μA
Breakdown Voltage (at 1mA)	7V		10V
Capacitance (I/O - GND) at 0V, 1MHz		0.5pF	

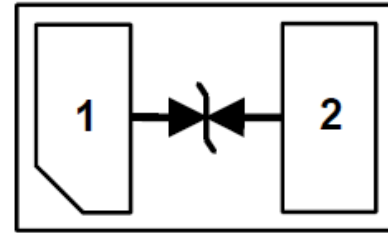
Typical ESD Response



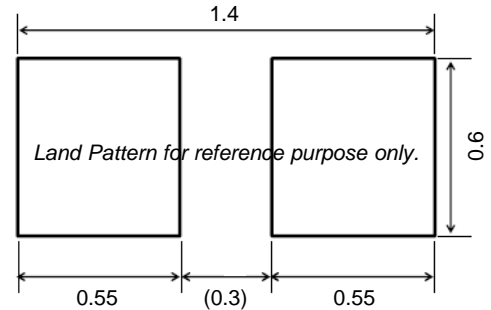
Typical Capacitance-vs-Voltage



Schematic & Land Pattern

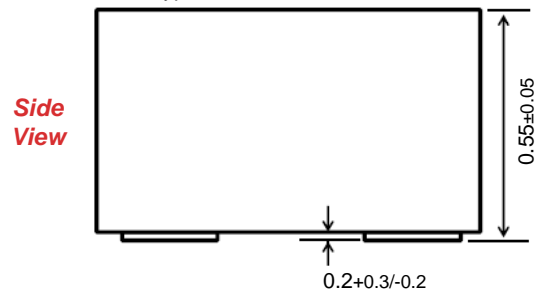
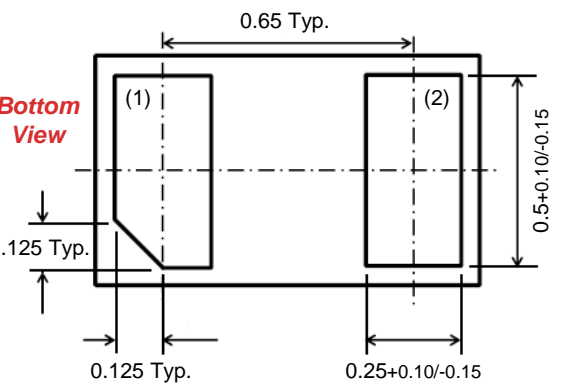
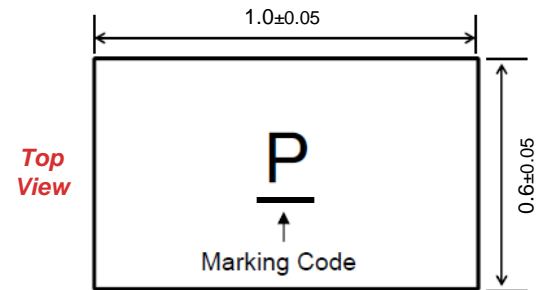


Bottom View



Land Pattern for reference purpose only.

Dimensions (unit: mm)



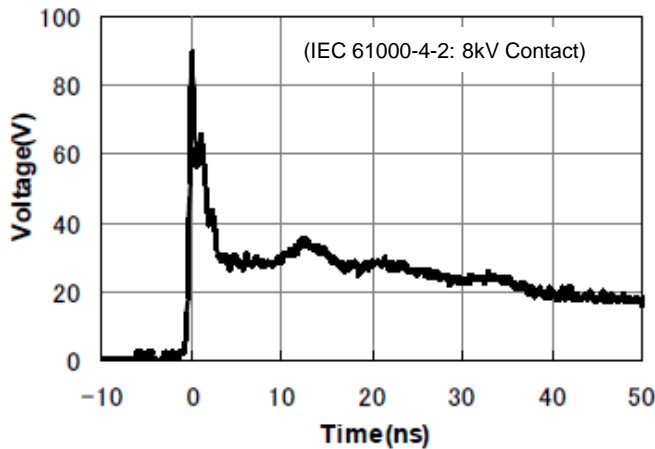
Maximum Ratings

Parameter	Value
Rated Voltage	±18V
ESD Capability (IEC 61000-4-2 Level 4 Procedure)	
Contact Discharge	±8kV
Air Discharge	±15kV
Response Time	< 1ns
Soldering Temperature (≤10 sec.)	260°C
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +125°C

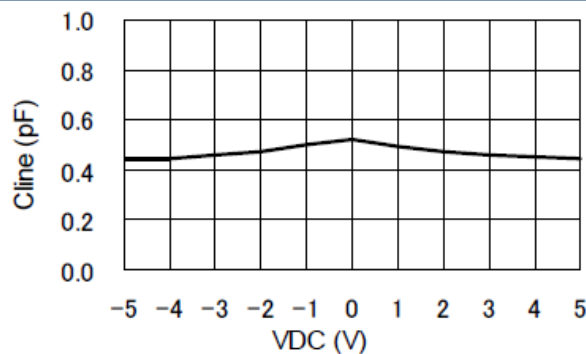
Electrical Characteristics (at 25°C)

Parameter	Min.	Typ.	Max.
Leakage Current (at ±17V)			1μA
Breakdown Voltage (at 1mA)	18.7V		
Capacitance (I/O - GND) at 0V, 1MHz		0.5pF	

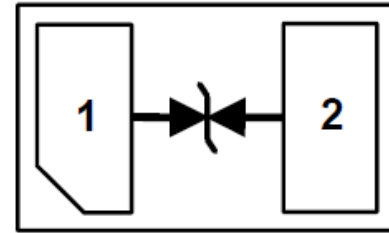
Typical ESD Response



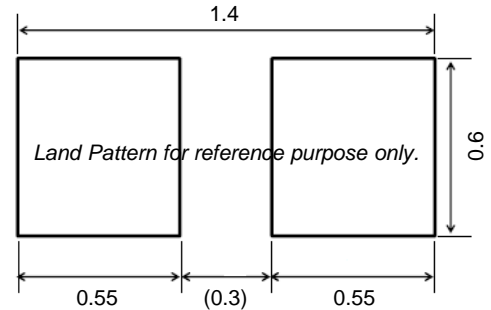
Typical Capacitance-vs-Voltage



Schematic & Land Pattern

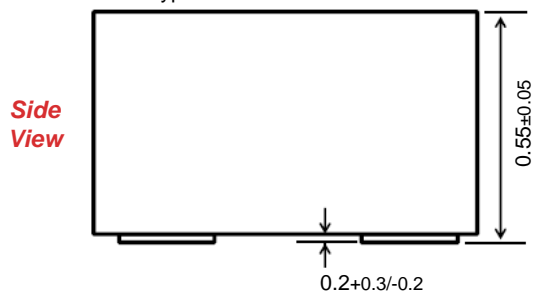
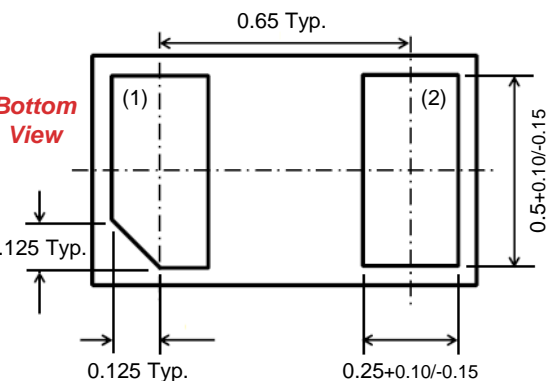
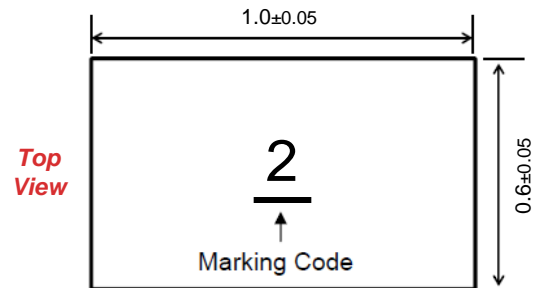


Bottom View



Land Pattern for reference purpose only.

Dimensions (unit: mm)



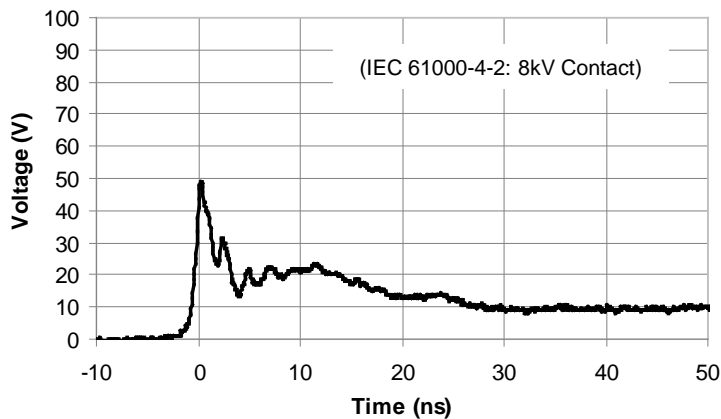
Maximum Ratings

Parameter	Value
Rated Voltage	±5.5V
ESD Capability (IEC 61000-4-2 Level 4 Procedure)	
Contact Discharge	±8kV
Air Discharge	±15kV
Response Time	< 1ns
Soldering Temperature (≤10 sec.)	260°C
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +125°C

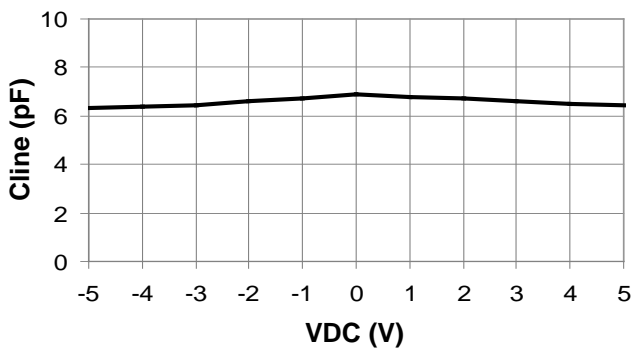
Electrical Characteristics (at 25°C)

Parameter	Min.	Typ.	Max.
Leakage Current (at ±5V)			1μA
Breakdown Voltage (at 1mA)	5.8V		
Capacitance (I/O - GND) at 0V, 1MHz		7.5pF	

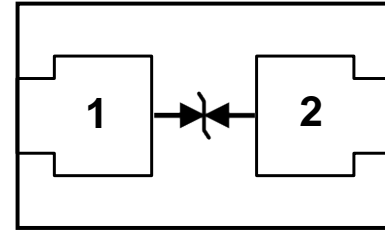
Typical ESD Response



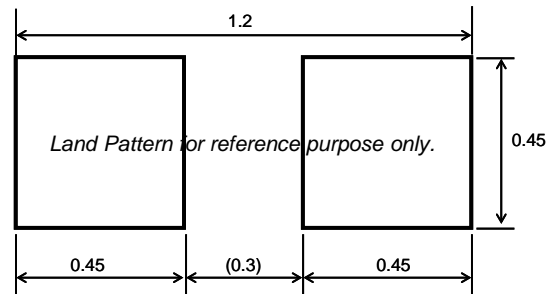
Typical Capacitance-vs-Voltage



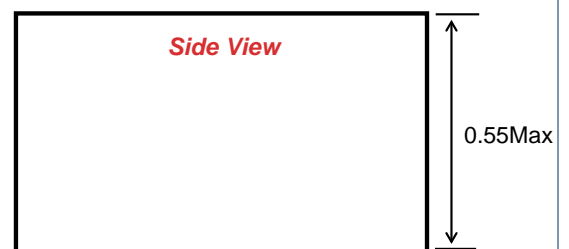
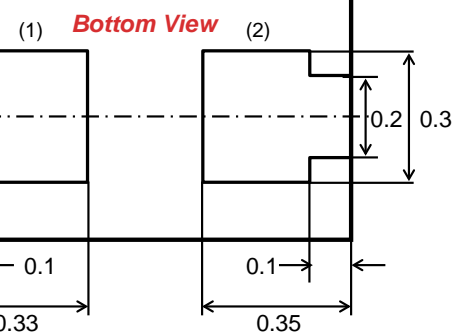
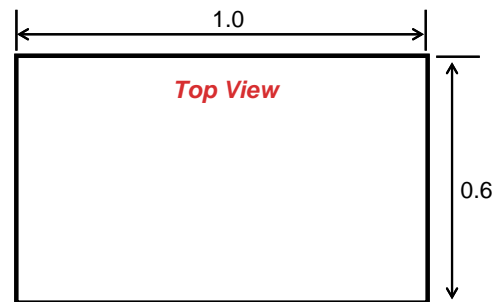
Schematic & Land Pattern



Bottom View

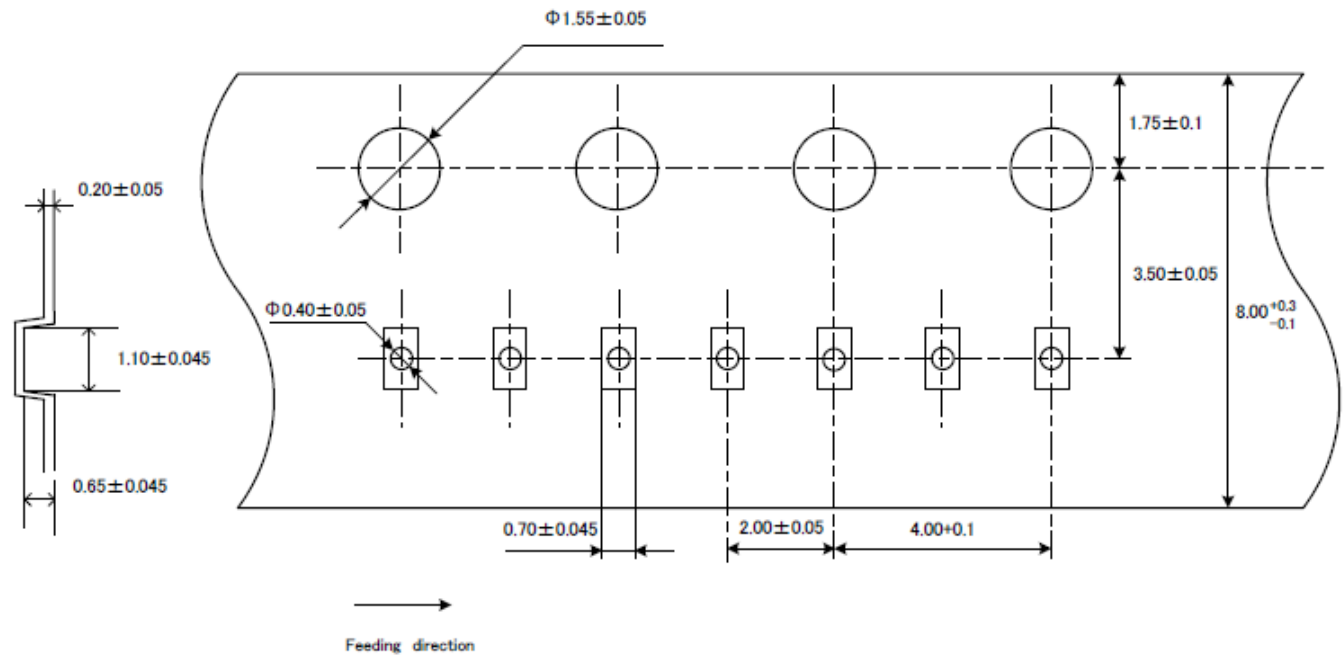


Dimensions (unit: mm)

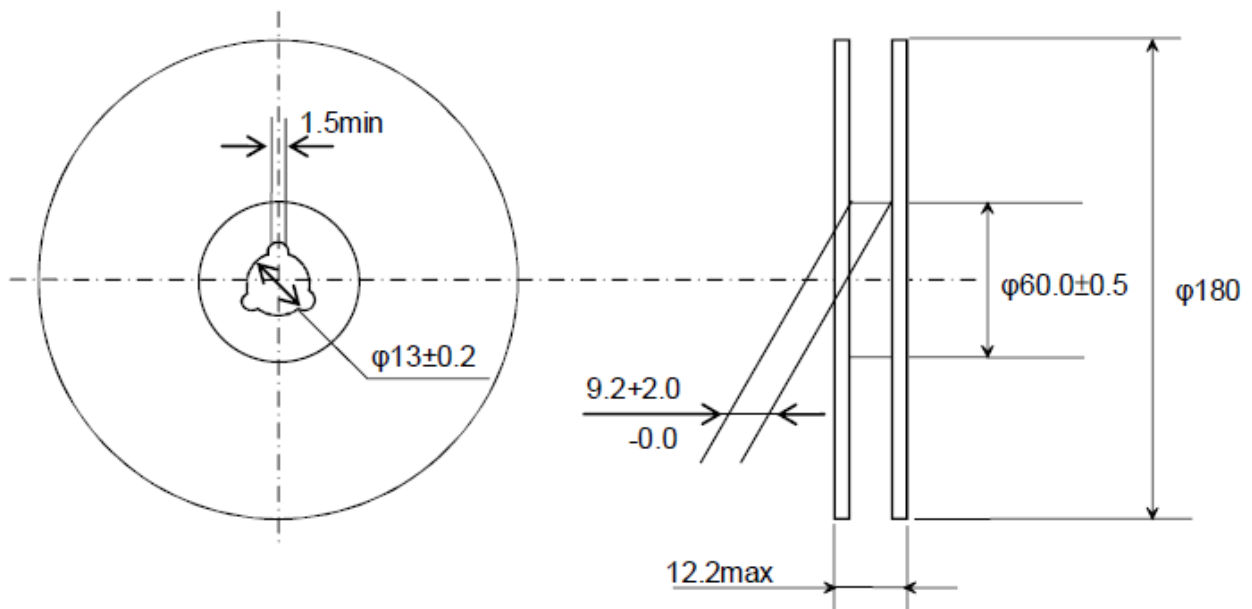


■ Packaging Specifications (Tape/Reel Only)

1) Dimensions of Plastic Tape (in mm):



2) Dimensions of Reel (in mm):



3) Packaging Quantity:

3,000 pcs/reel

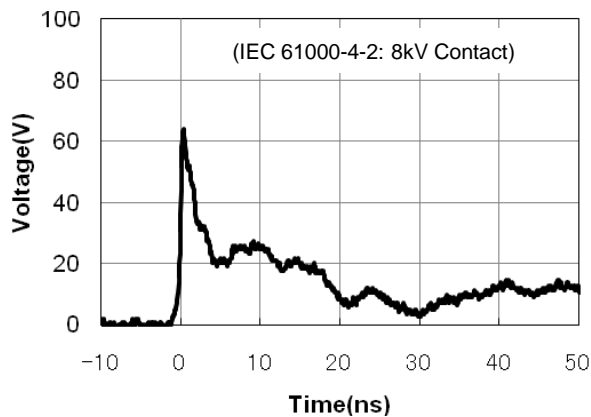
Maximum Ratings

Parameter	Value
Operating Voltage (VDD-GND)	6V
ESD Capability (IEC 61000-4-2 Level 4 Procedure)	
Contact Discharge	±12kV
Air Discharge	±15kV
Response Time	< 1ns
Soldering Temperature (≤10 sec.)	260°C (10 sec.)
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +125°C

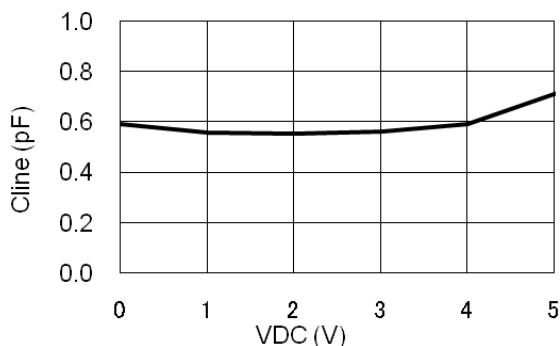
Electrical Characteristics (at 25°C)

Parameter	Min.	Typ.	Max.
Leakage Current (I/O-GND) ($V_{pin5}=5V, V_{pin2}=0V, V_{CH}=0\sim 5V$)			1μA
Breakdown Voltage (at 1mA)	6V		9V
Capacitance (I/O-GND) ($V_{pin5}=5V, V_{pin2}=0V, V_{IN}=2.5V, f=1MHz$)		0.55pF	

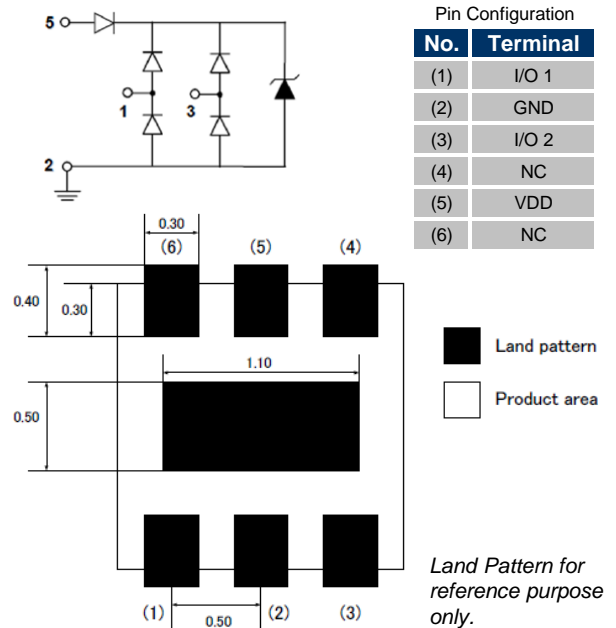
Typical ESD Response



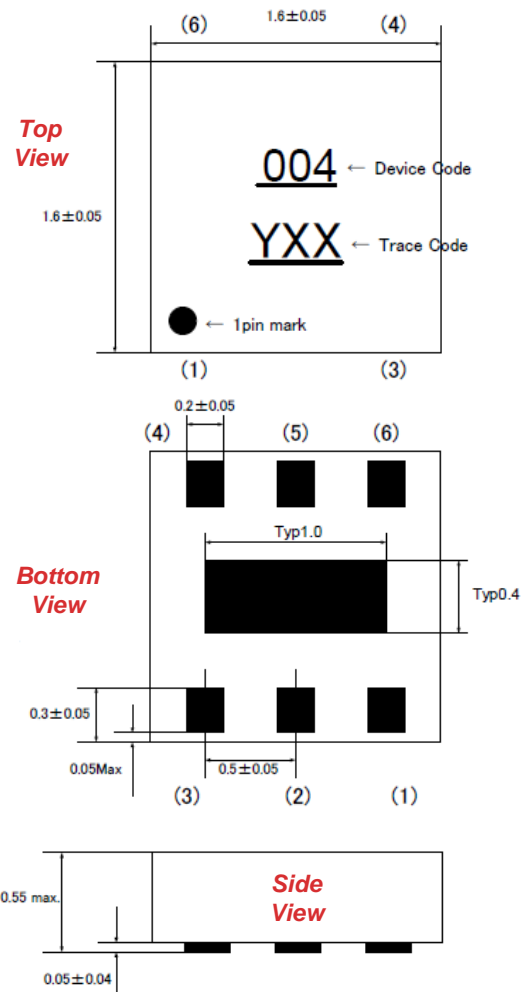
Typical Capacitance-vs-Voltage



Schematic & Land Pattern

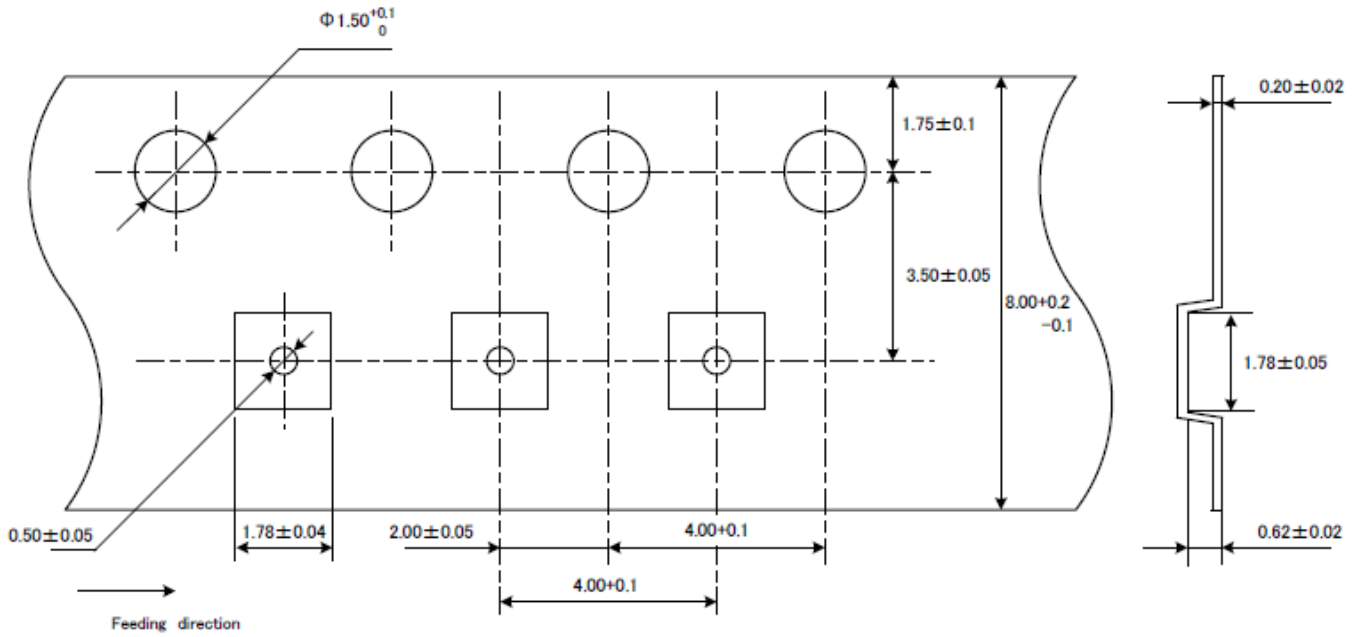


Dimensions (unit: mm)

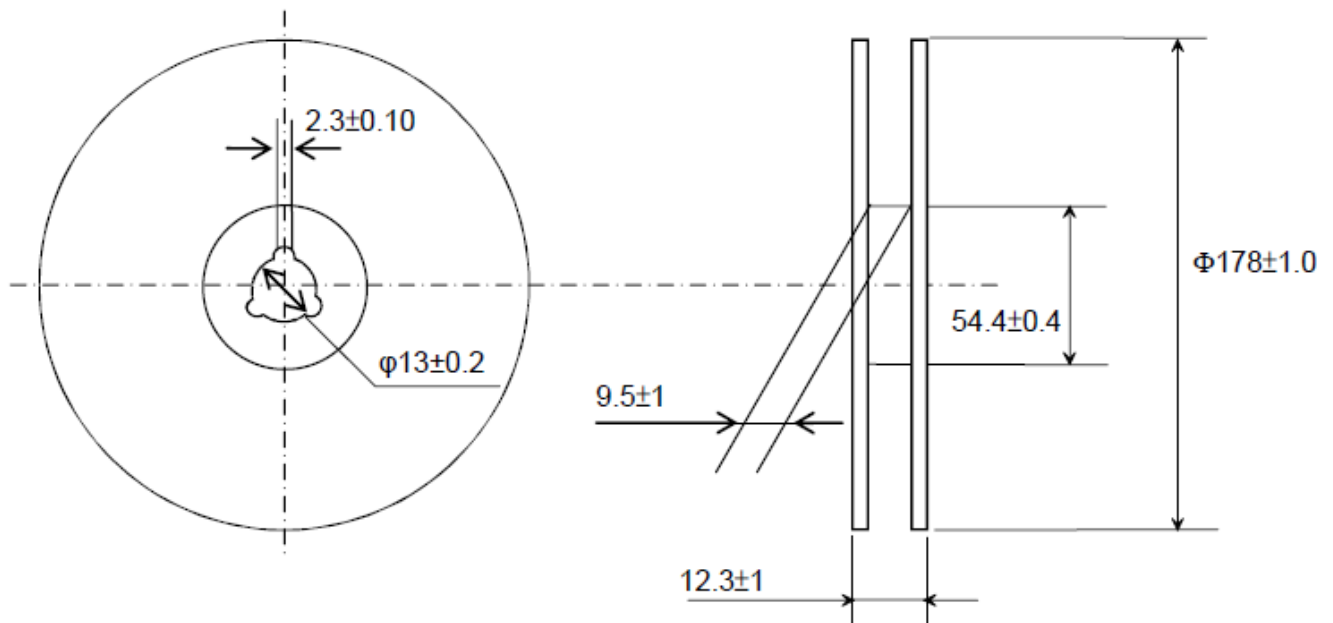


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3) Packaging Quantity:

3,000 pcs/reel

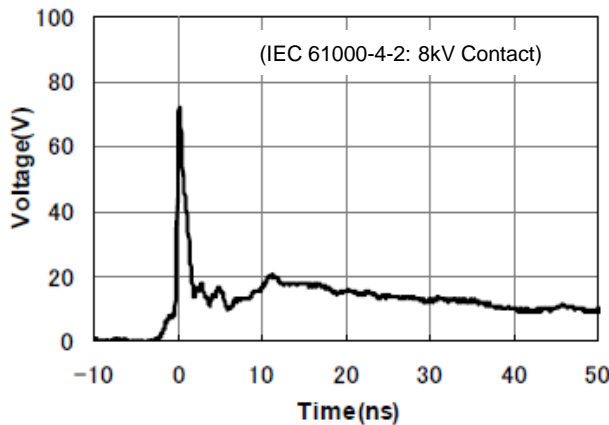
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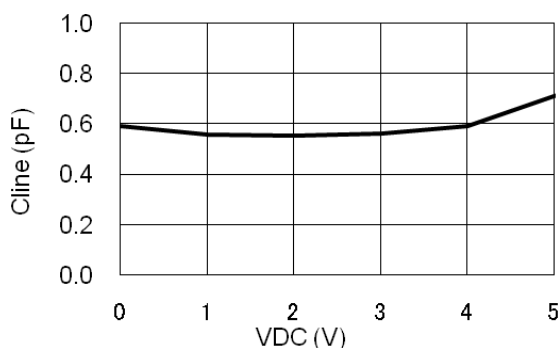
Electrical Characteristics (at 25°C)

Parameter	Min.	Typ.	Max.
Leakage Current (I/O-GND) ($V_{pin5}=0V, V_{pin2}=5V, V_{CH}=0-5V$)			1μA
Breakdown Voltage (at 1mA)	6V		9V
Capacitance (I/O-GND) ($V_{pin5}=0V, V_{pin2}=5V, V_{IN}=2.5V, f=1MHz$)		0.55pF	

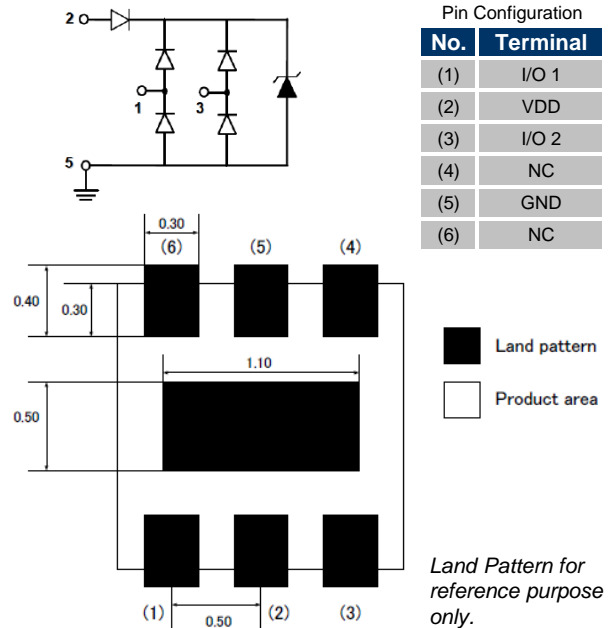
Typical ESD Response



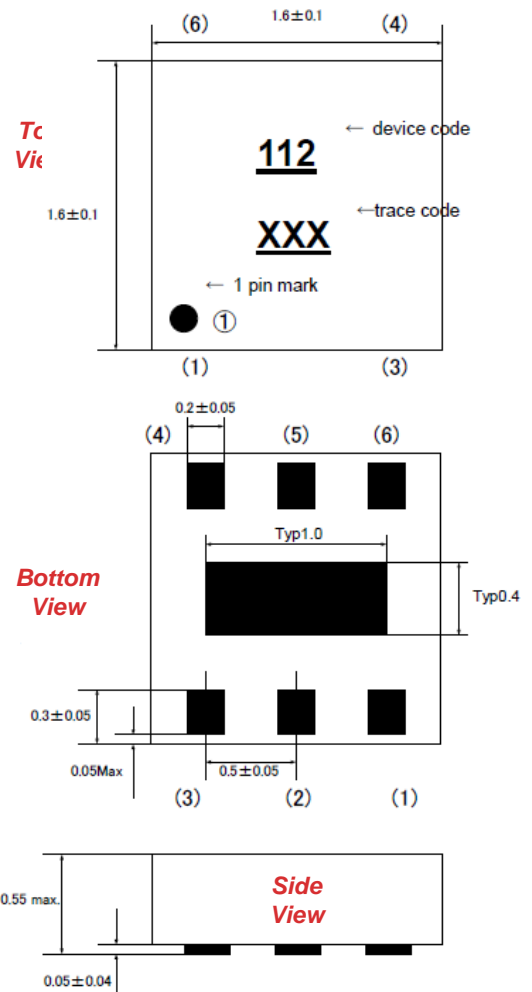
Typical Capacitance-vs-Voltage



Schematic & Land Pattern

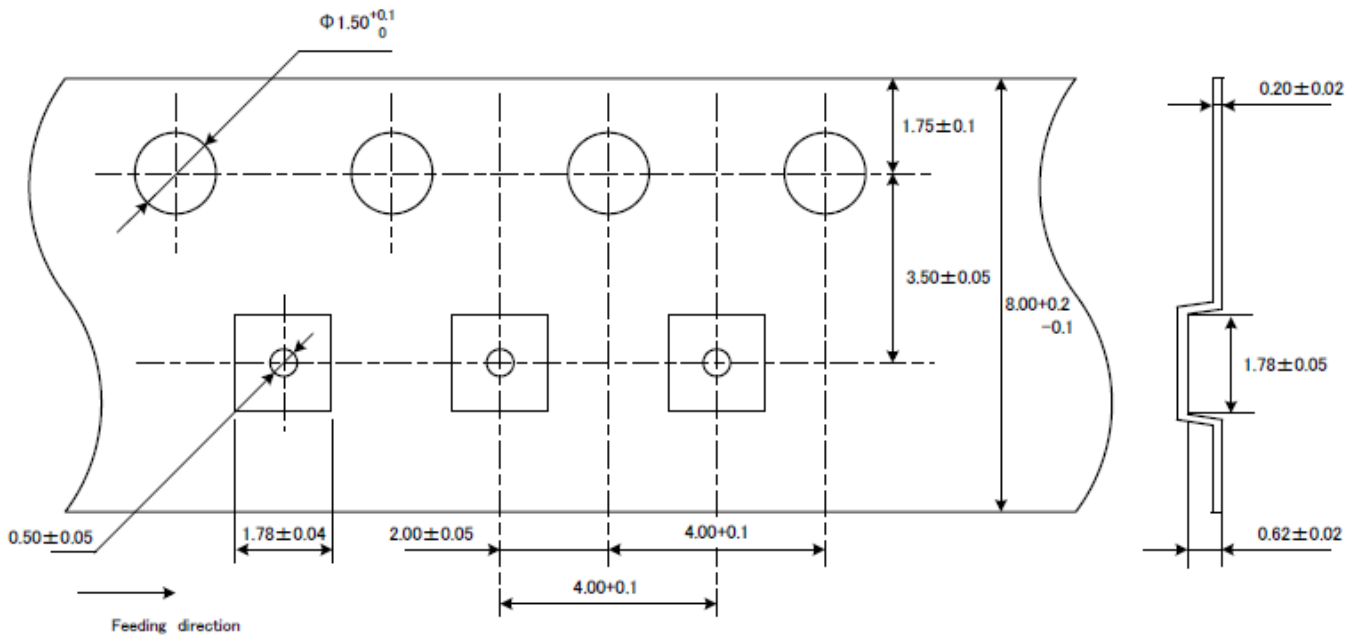


Dimensions (unit: mm)

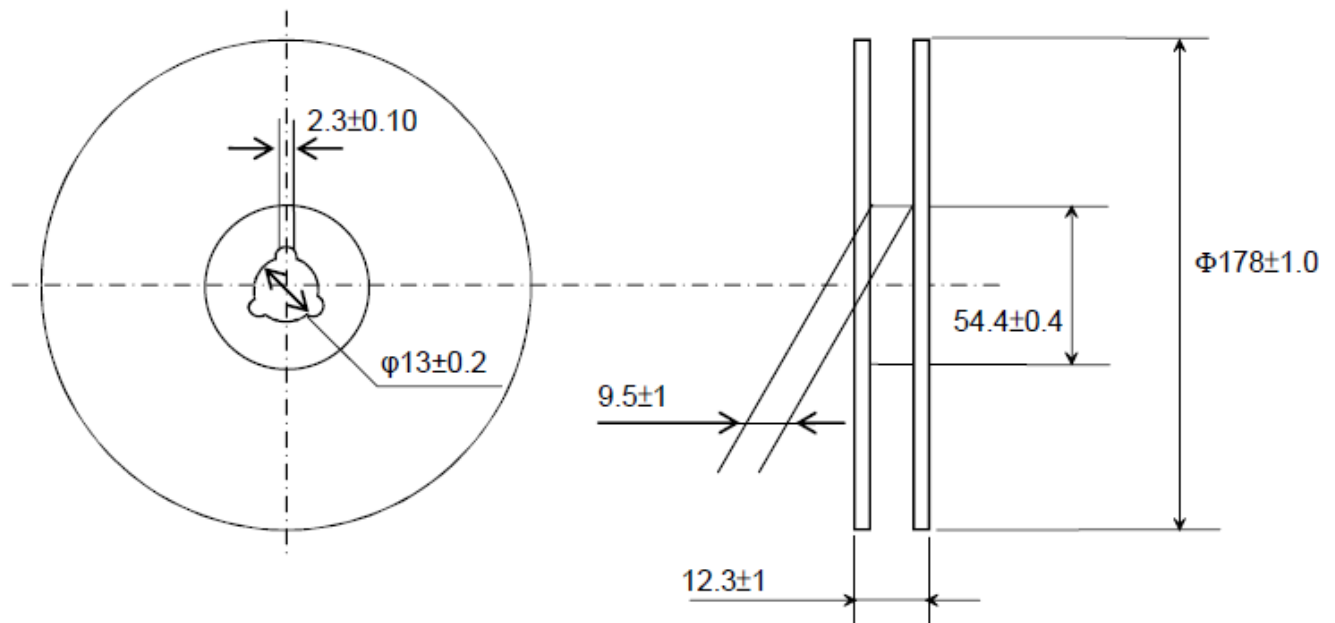


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3,000 pcs/reel

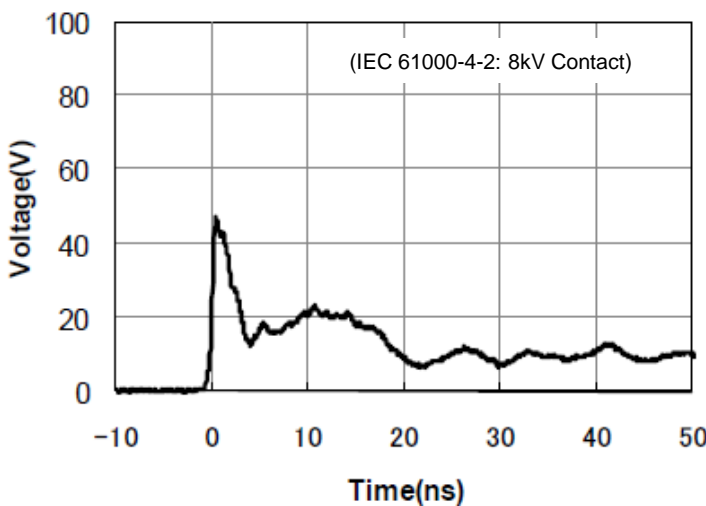
Maximum Ratings

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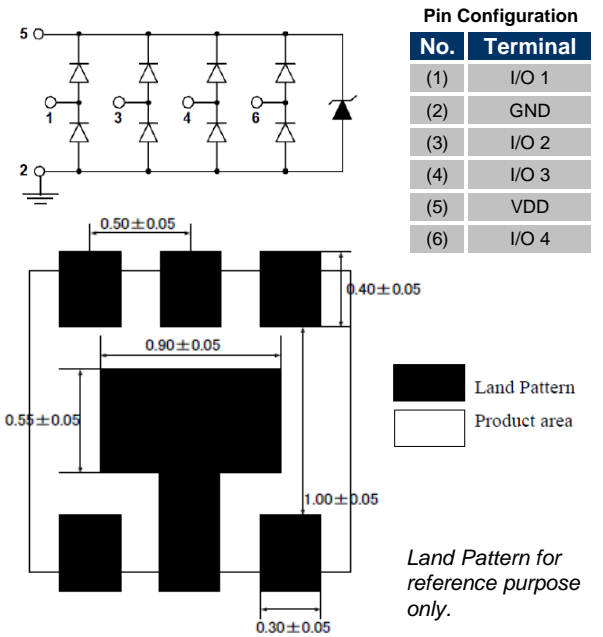
Electrical Characteristics (at 25°C)

Parameter	Min.	Typ.	Max.
Leakage Current (I/O-GND) ($V_{pin5}=5V, V_{pin2}=0V, V_{CH}=0-5V$)			1μA
Breakdown Voltage (at 1mA)	6V		9V
Capacitance (I/O-GND) ($V_{pin5}=5V, V_{pin2}=0V, V_{IN}=2.5V, f=1MHz$)		1.3pF	

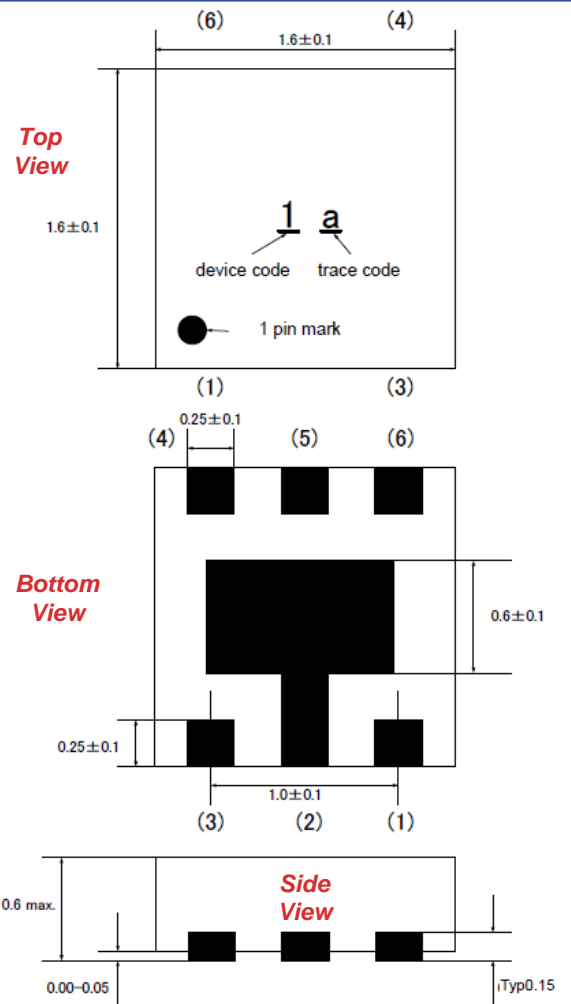
Typical ESD Response



Schematic & Land Pattern

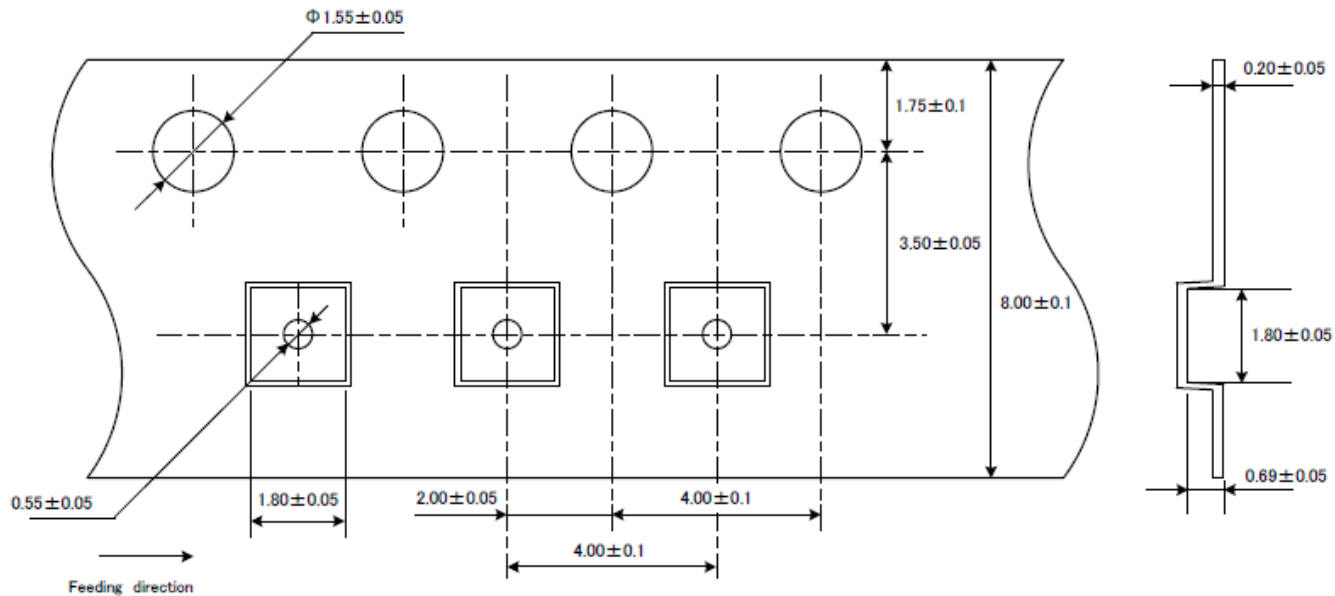


Dimensions (unit: mm)

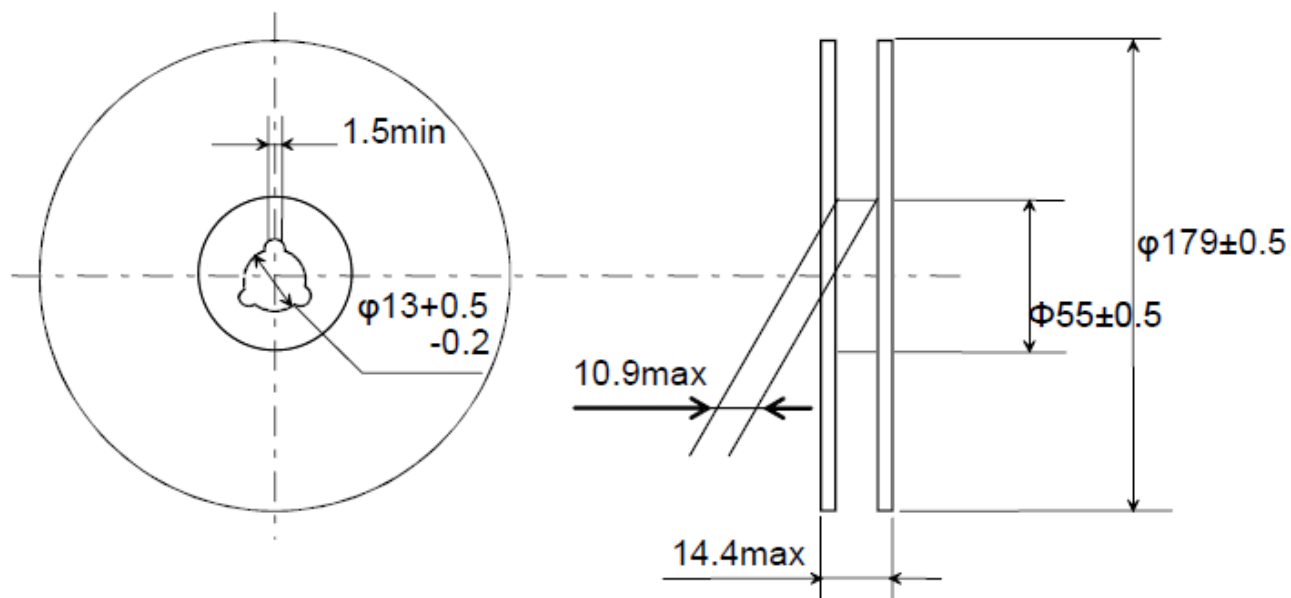


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3,000 pcs/reel

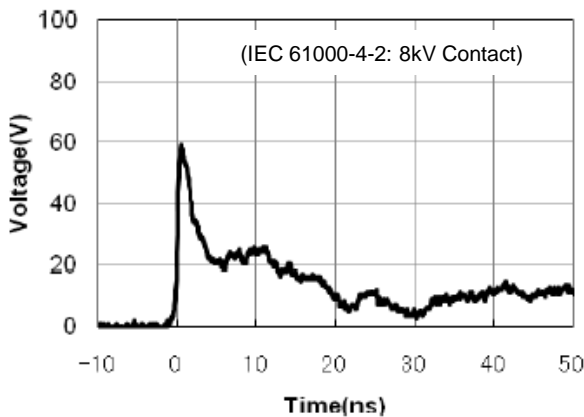
Maximum Ratings

Parameter	Value
Operating Voltage (VDD-GND)	6V
ESD Capability (IEC 61000-4-2 Level 4 Procedure)	
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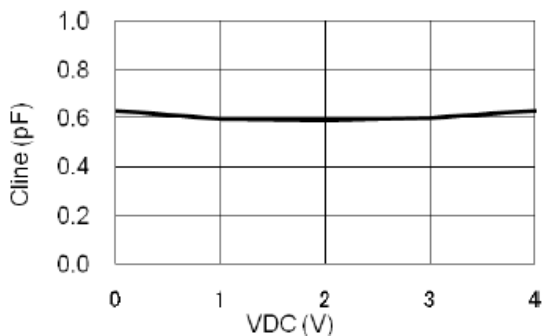
Electrical Characteristics (at 25°C)

Parameter	Min.	Typ.	Max.
Leakage Current (I/O-GND) ($V_{pin5}=0V, V_{pin2}=5V, V_{CH}=0-5V$)			1μA
Breakdown Voltage (at 1mA)	6V		9V
Capacitance (I/O-GND) ($V_{pin5}=0V, V_{pin2}=5V, V_{IN}=2.5V, f=1MHz$)		0.55pF	

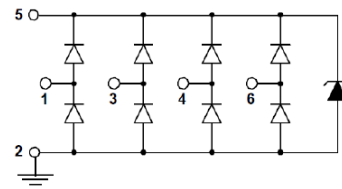
Typical ESD Response



Typical Capacitance-vs-Voltage



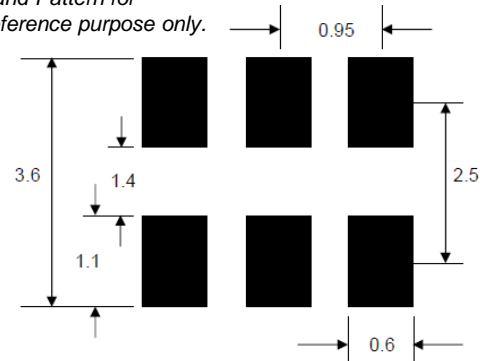
Schematic & Land Pattern



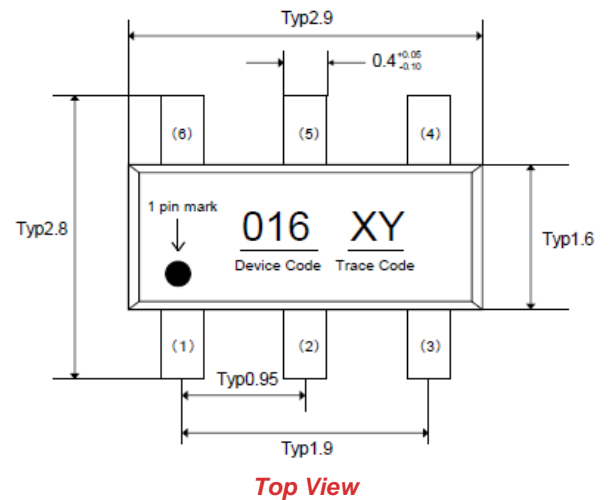
Pin Configuration

No.	Terminal
(1)	I/O 1
(2)	GND
(3)	I/O 2
(4)	I/O 3
(5)	VDD
(6)	I/O 4

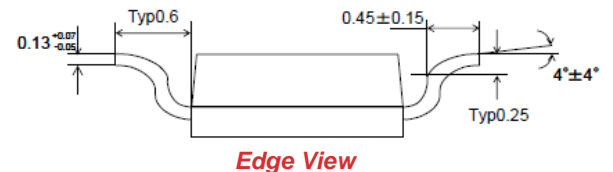
Land Pattern for reference purpose only.



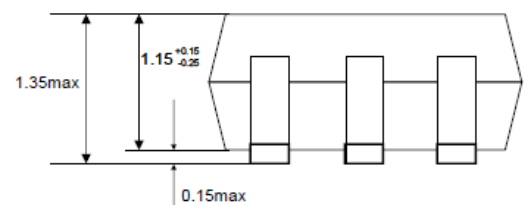
Dimensions (unit: mm)



Top View



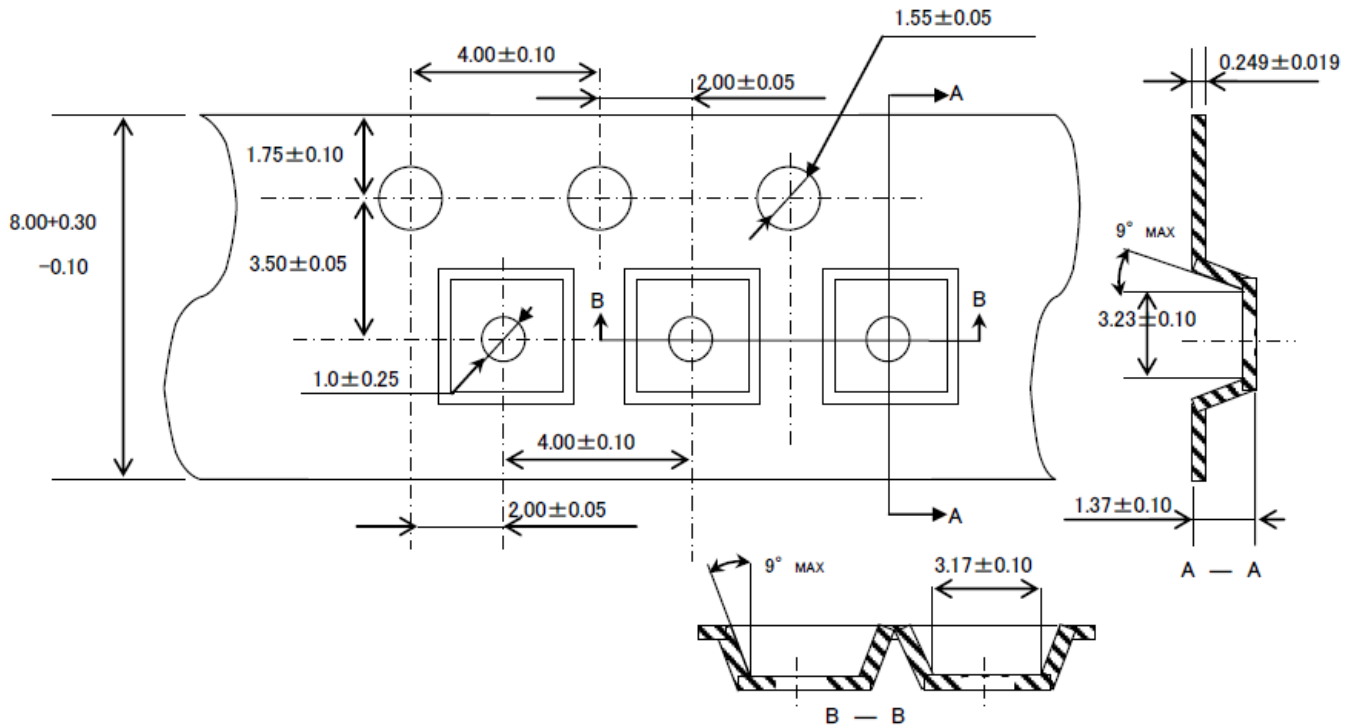
Edge View



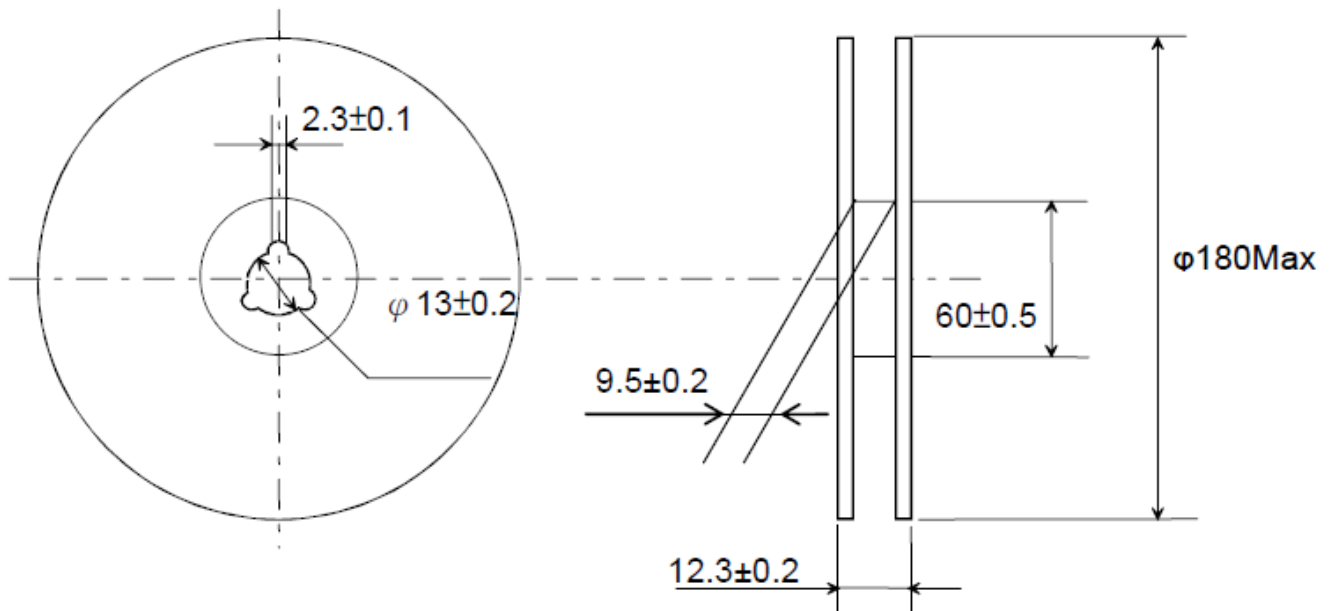
Side View

■ Packaging Specifications (Tape/Reel Only)

1) Dimensions of Plastic Tape (in mm):



2) Dimensions of Reel (in mm):



3) Packaging Quantity:

3,000 pcs/reel

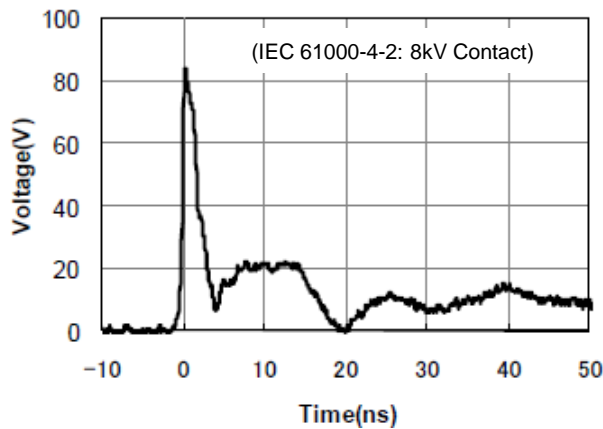
Maximum Ratings

Parameter	Value
Operating Voltage (VDD-GND)	6V
ESD Capability (IEC 61000-4-2 Level 4 Procedure)	
Contact Discharge	±10kV
Air Discharge	±15kV
Response Time	< 1ns
Soldering Temperature (≤10 sec.)	260°C (10 sec.)
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +125°C

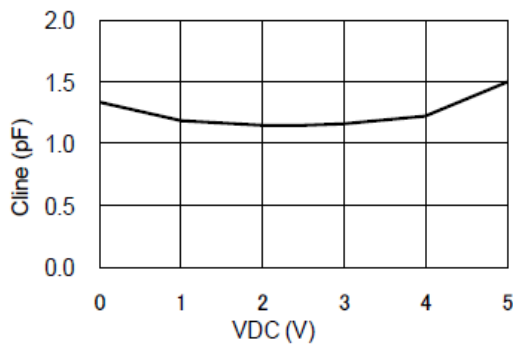
Electrical Characteristics (at 25°C)

Parameter	Min.	Typ.	Max.
Leakage Current (I/O-GND) ($V_{pin5}=5V, V_{pin2}=0V, V_{CH}=0\sim 5V$)			1μA
Breakdown Voltage (at 1mA)	6V		9V
Capacitance (I/O-GND) ($V_{pin5}=5V, V_{pin2}=0V, V_{IN}=2.5V, f=1MHz$)		1.0pF	

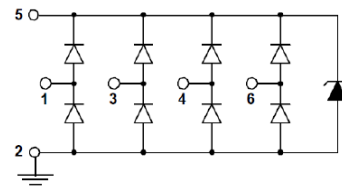
Typical ESD Response



Typical Capacitance-vs-Voltage



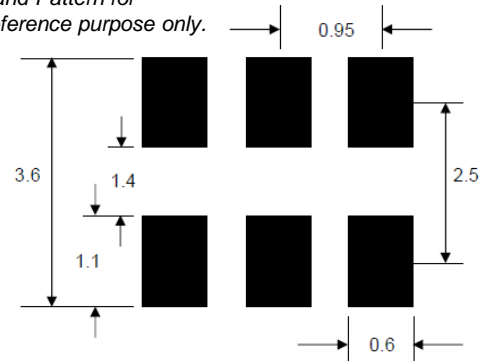
Schematic & Land Pattern



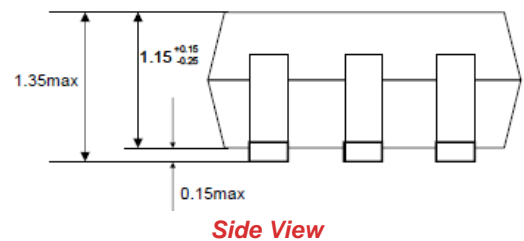
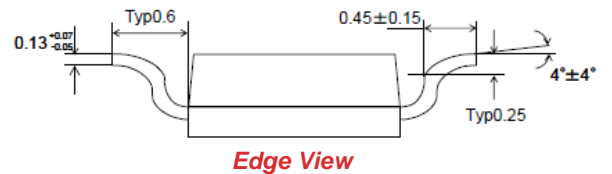
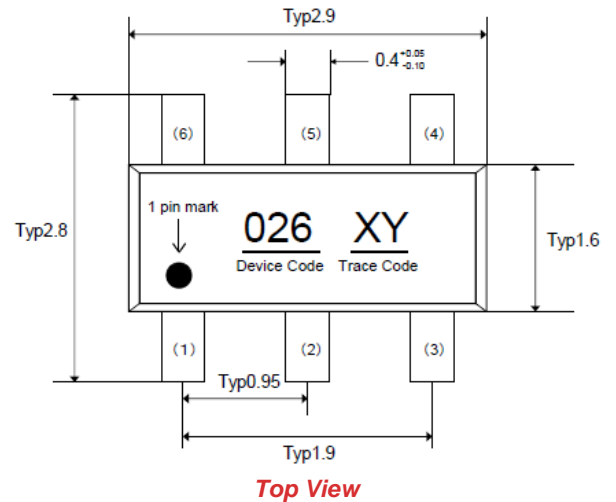
Pin Configuration

No.	Terminal
(1)	I/O 1
(2)	GND
(3)	I/O 2
(4)	I/O 3
(5)	VDD
(6)	I/O 4

Land Pattern for reference purpose only.

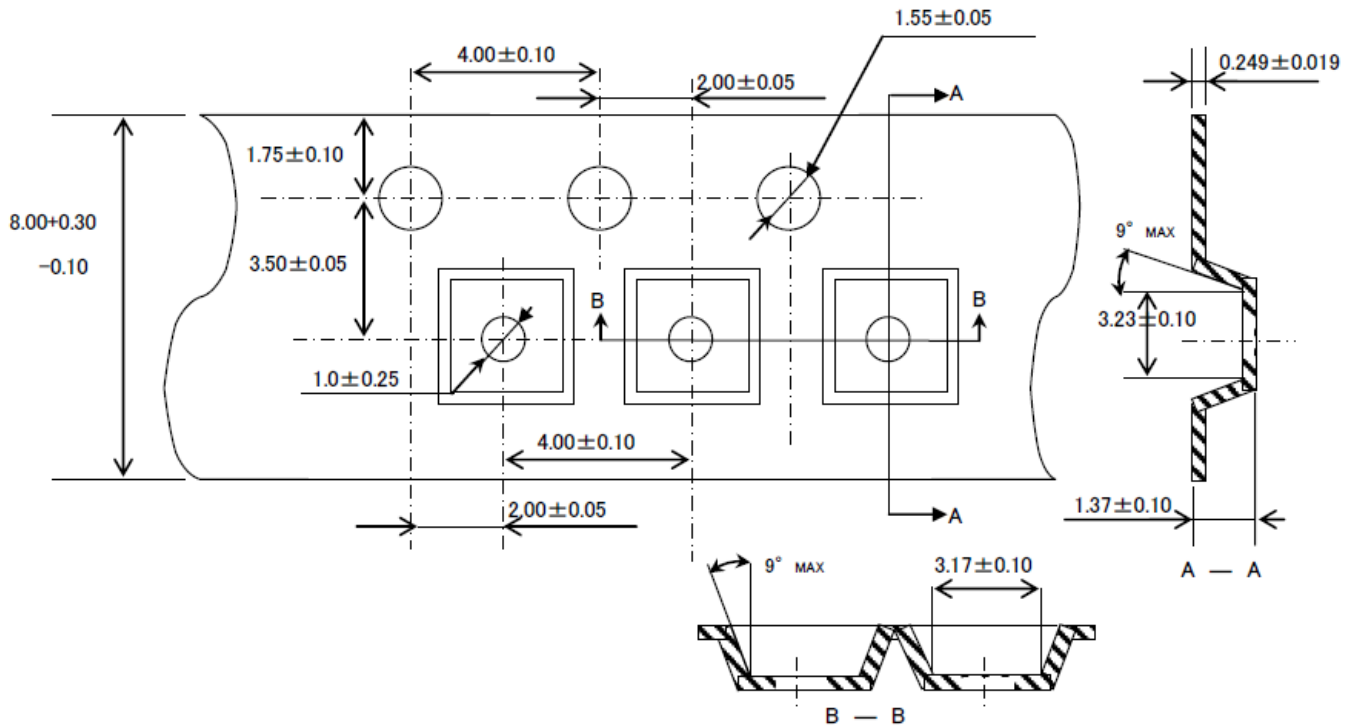


Dimensions (unit: mm)

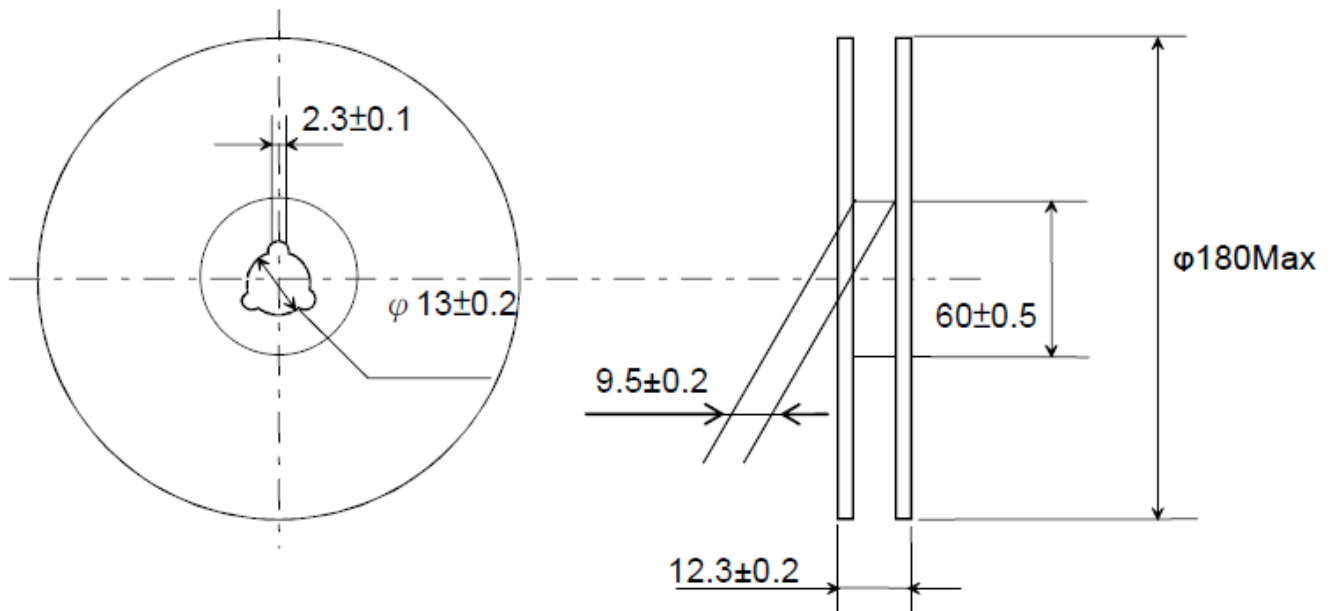


■ Packaging Specifications (Tape/Reel Only)

1) Dimensions of Plastic Tape (in mm):



2) Dimensions of Reel (in mm):



3) Packaging Quantity:

3,000 pcs/reel

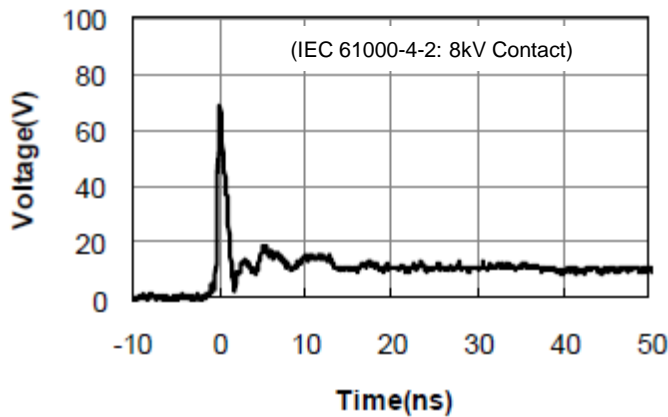
Maximum Ratings

Parameter	Value
Operating Voltage (VDD-GND)	6V
ESD Capability (IEC 61000-4-2 Level 4 Procedure)	
Contact Discharge	±10kV
Air Discharge	±15kV
Response Time	< 1ns
Soldering Temperature (≤10 sec.)	260°C (10 sec.)
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +125°C

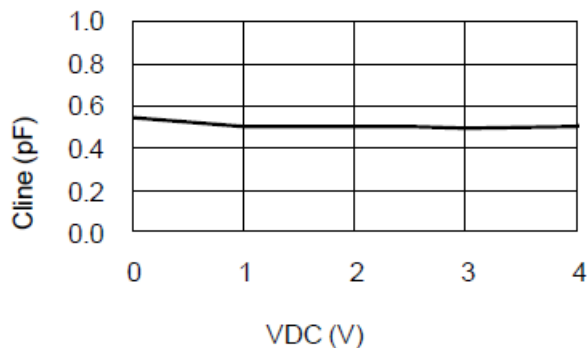
Electrical Characteristics (at 25°C)

Parameter	Min.	Typ.	Max.
Leakage Current (I/O-GND) ($V_{pin3,8}=0V, V_{pin1,2,4,5}=0-5V$)			1.5μA
Breakdown Voltage (at 1mA)	6V		10V
Capacitance (I/O-GND) ($V_{pin3,8}=0V, V_{IN}=2.5V, f=1MHz$)		0.5pF	

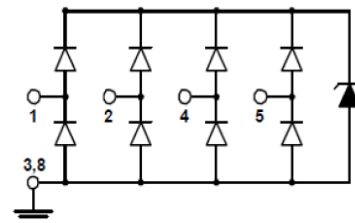
Typical ESD Response



Typical Capacitance-vs-Voltage



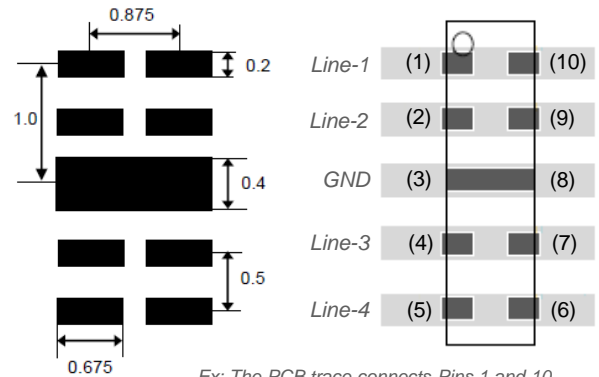
Schematic & Land Pattern



Pin Configuration

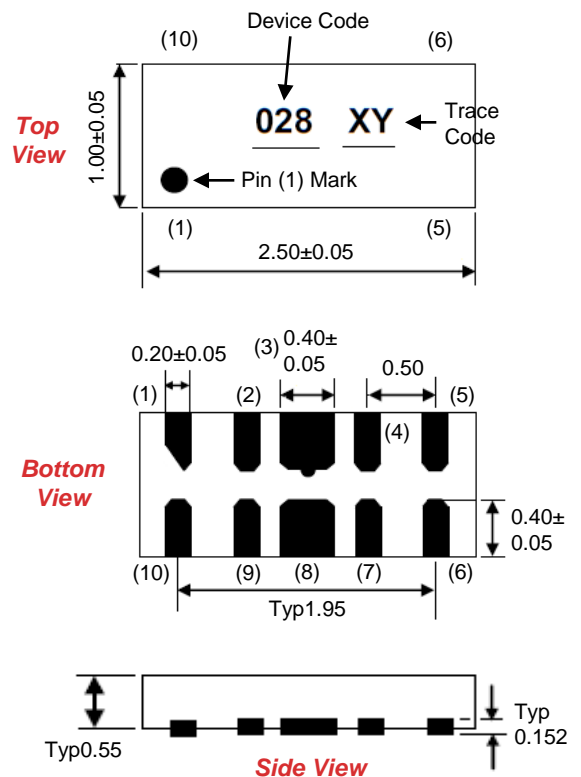
No.	Terminal
(1)	Line-1
(2)	Line-2
(3)	GND
(4)	Line-3
(5)	Line-4
(6)	NC
(7)	NC
(8)	GND
(9)	NC
(10)	NC

Land Pattern for reference purpose only.



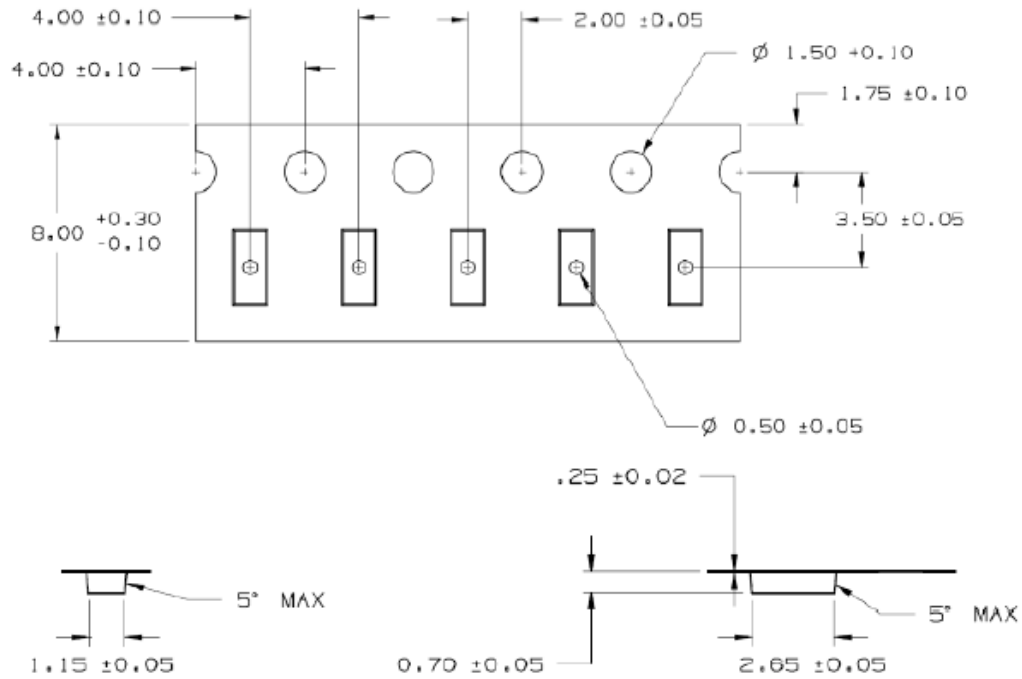
Ex: The PCB trace connects Pins 1 and 10.
Pins 3 and 8 connect to the PCB GND plane.

Dimensions (unit: mm)

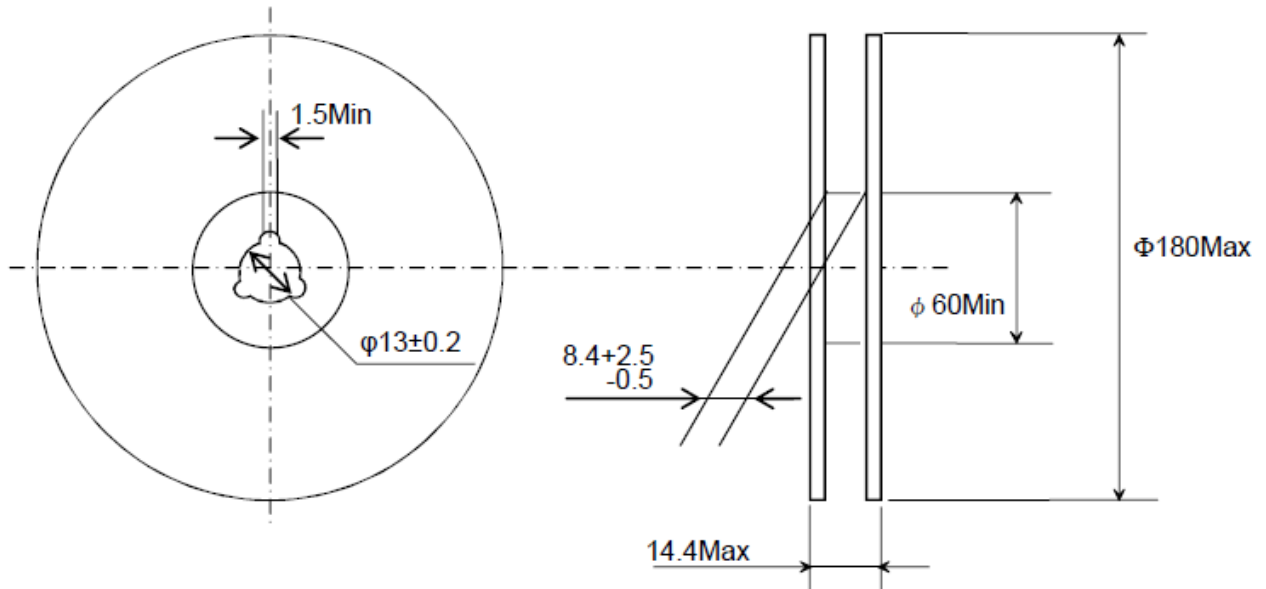


■ Packaging Specifications (Tape/Reel Only)

1) Dimensions of Plastic Tape (in mm):



2) Dimensions of Reel (in mm):



3) Packaging Quantity:

3,000 pcs/reel

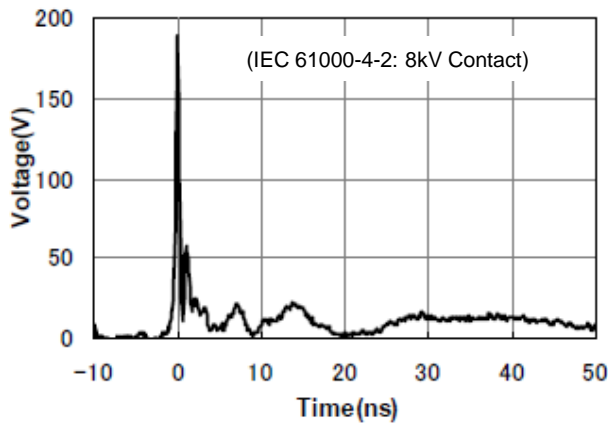
Maximum Ratings

Parameter	Value
Operating Voltage (VDD-GND)	6V
ESD Capability (IEC 61000-4-2 Level 4 Procedure)	
Contact Discharge	±8kV
Air Discharge	±8kV
Response Time	< 1ns
Soldering Temperature (≤10 sec.)	260°C (10 sec.)
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +125°C

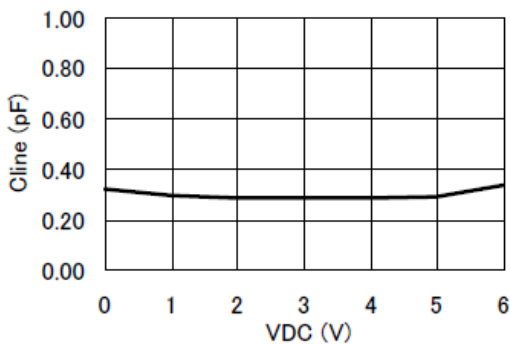
Electrical Characteristics (at 25°C)

Parameter	Min.	Typ.	Max.
Leakage Current (I/O-GND) ($V_{pin8}=5V, V_{pin7}=0-5V, V_{CH}=0-5V$)			1μA
Breakdown Voltage (at 1mA)	6V		10V
Capacitance (I/O-GND) ($V_{pin8}=5V, V_{pin7}=0V, V_{IN}=2.5V, f=1MHz$)		0.25pF	

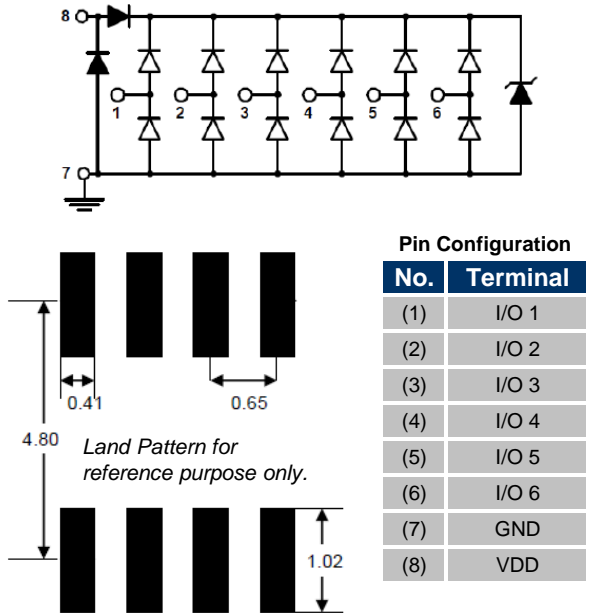
Typical ESD Response



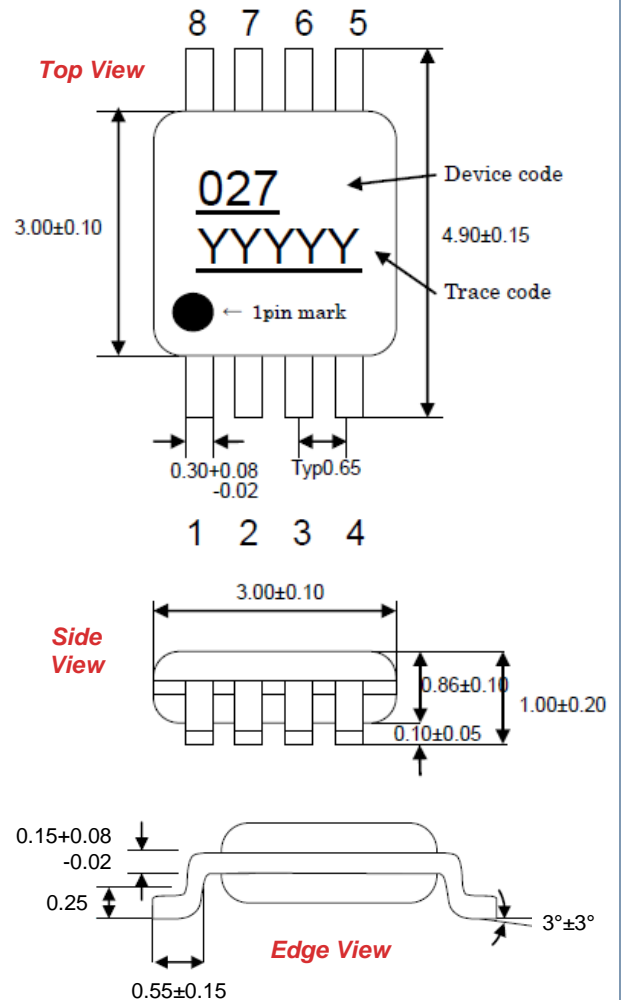
Typical Capacitance-vs-Voltage



Schematic & Land Pattern

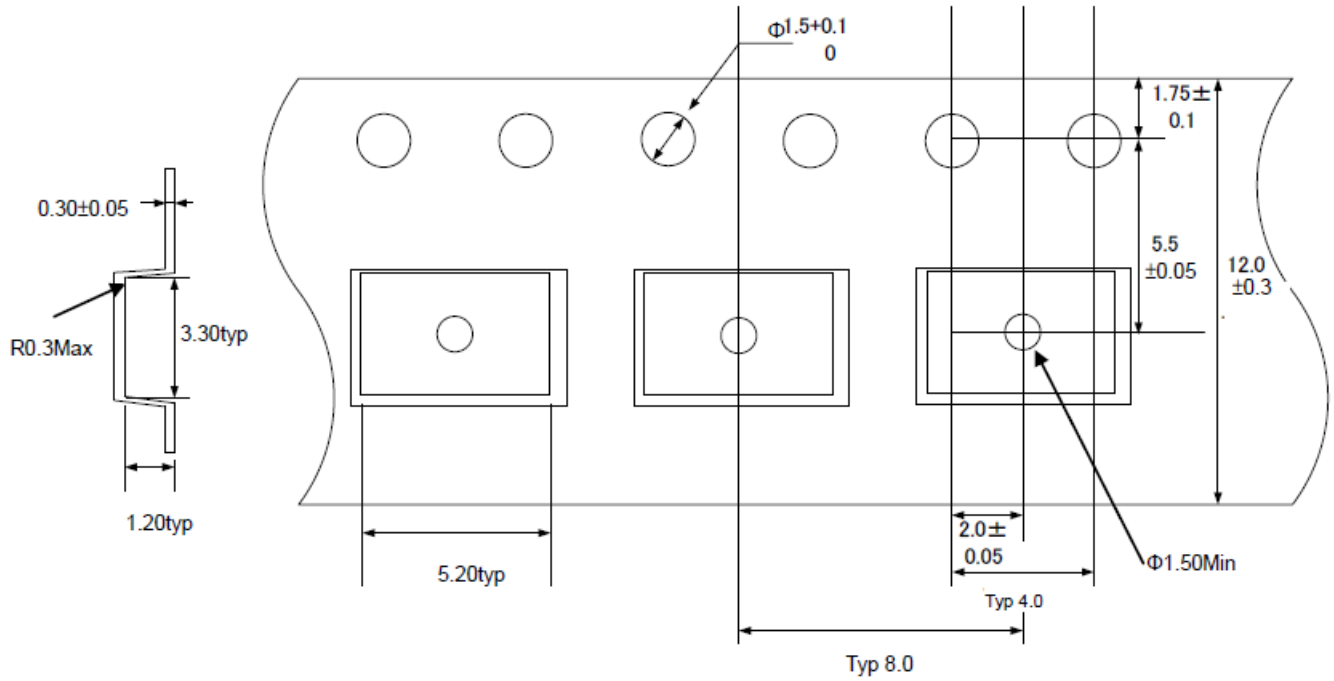


Dimensions (unit: mm)

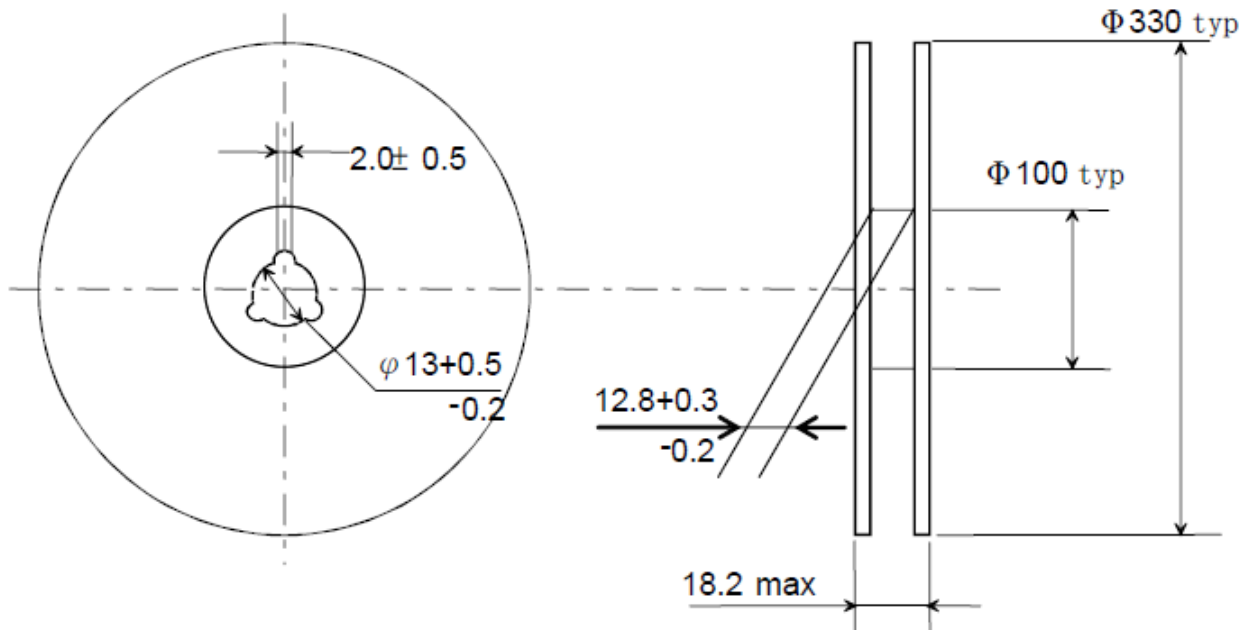


■ Packaging Specifications (Tape/Reel Only)

1) Dimensions of Plastic Tape (in mm):



2) Dimensions of Reel (in mm):



3) Packaging Quantity:

3,000 pcs/reel

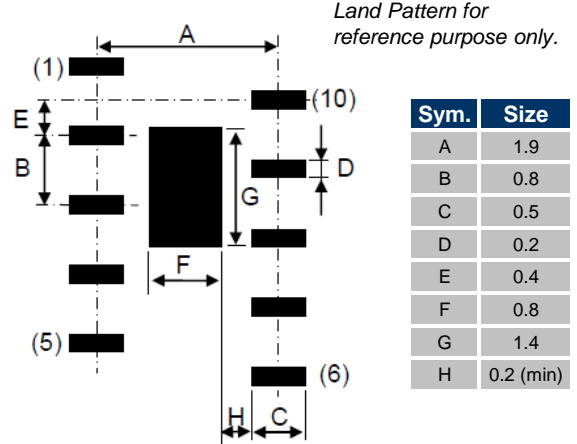
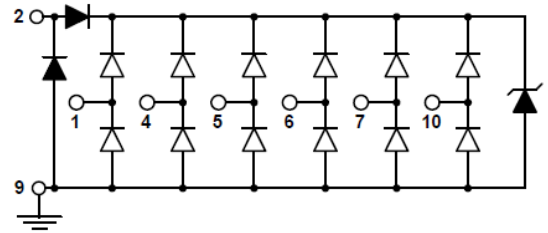
Maximum Ratings

Parameter	Value
Operating Voltage (VDD-GND)	6V
ESD Capability (IEC 61000-4-2 Level 4 Procedure)	
Contact Discharge	±8kV
Air Discharge	±8kV
Response Time	< 1ns
Soldering Temperature (≤10 sec.)	260°C (10 sec.)
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +125°C

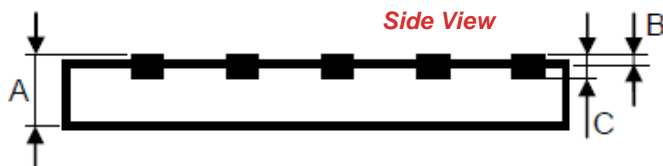
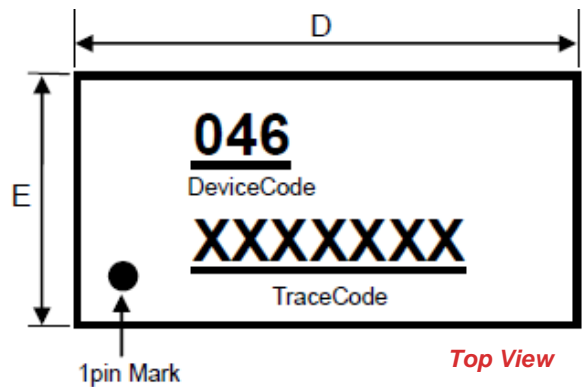
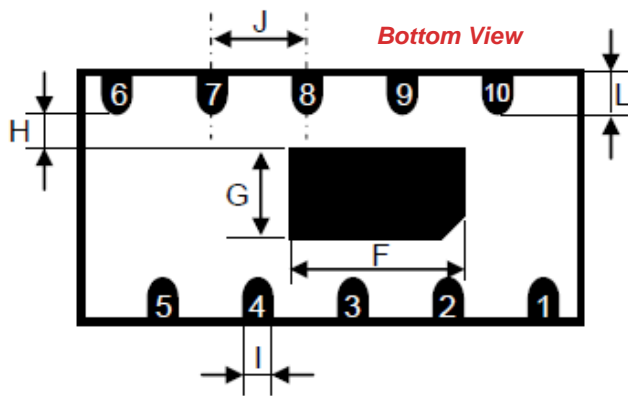
Electrical Characteristics (at 25°C)

Parameter	Min.	Typ.	Max.
Leakage Current (I/O-GND) ($V_{pin2}=5V, V_{pin9}=0V, V_{CH}=0.5V$)			1μA
Breakdown Voltage (at 1mA)	6V		
Capacitance (I/O-GND) ($V_{pin2}=5V, V_{pin9}=0V, V_{IN}=2.5V, f=1MHz$)		0.27pF	

Schematic & Land Pattern



Dimensions (unit: mm)



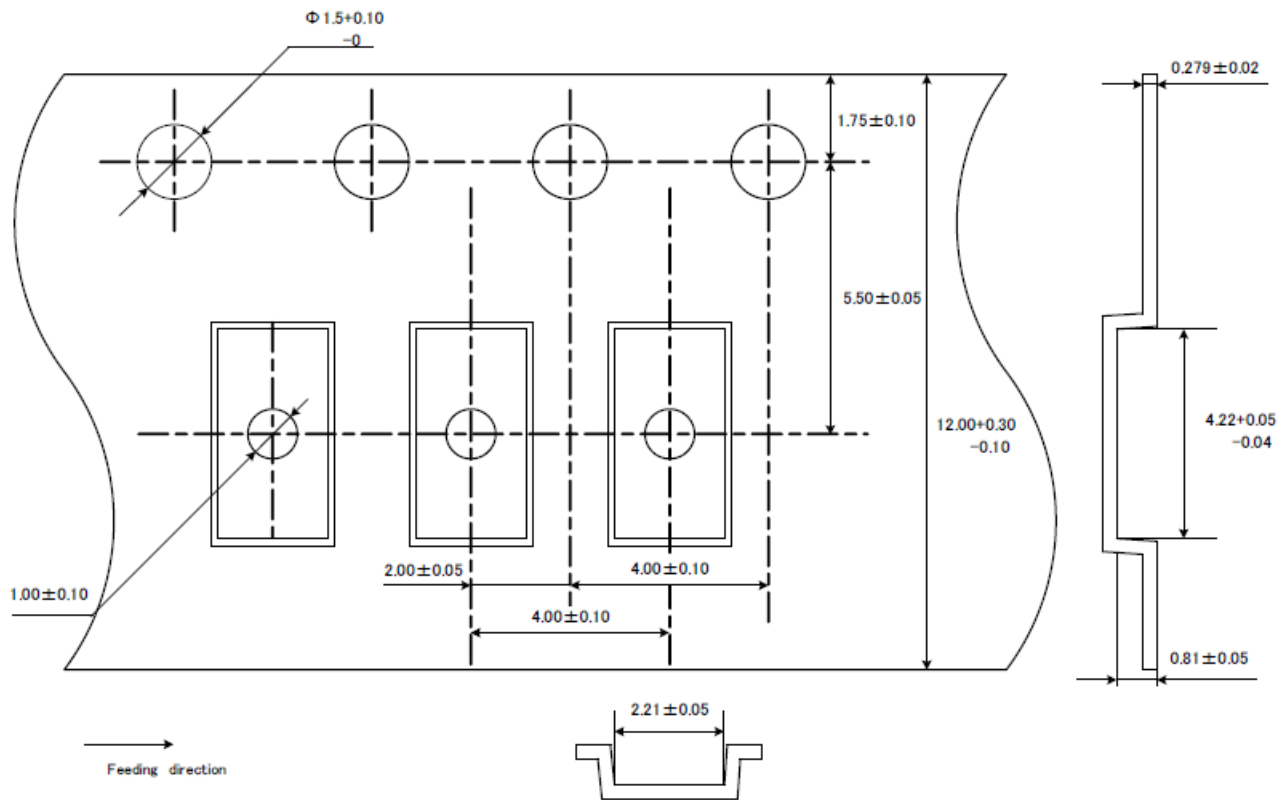
Pin Configuration

No.	Terminal	No.	Terminal
(1)	I/O 1	(6)	I/O 4
(2)	VDD	(7)	I/O 5
(3)	NC	(8)	NC
(4)	I/O 2	(9)	GND
(5)	I/O 3	(10)	I/O 6

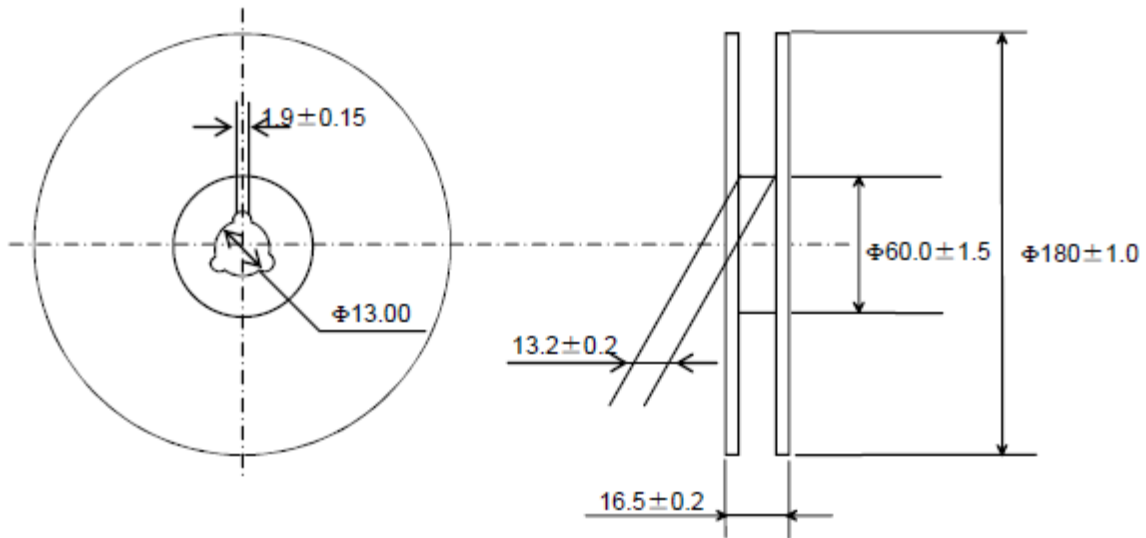
Sym.	Min.	Typ.	Max.
A	0.45	0.50	0.55
B	0	-	0.05
C	0.152 (ref)		
D	4.024	4.1	4.176
E	1.924	2.0	2.076
F	1.3	1.4	1.5
G	0.7	0.8	0.9
H	0.2 (min)		
I	0.15	0.20	0.25
J	0.8 (typ)		
L	0.224	0.30	0.376

■ Packaging Specifications (Tape/Reel Only)

1) Dimensions of Plastic Tape (in mm):



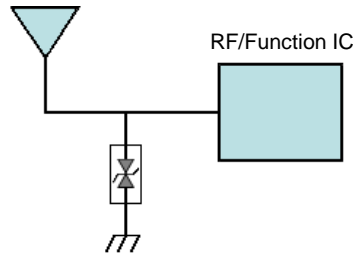
2) Dimensions of Reel (in mm):



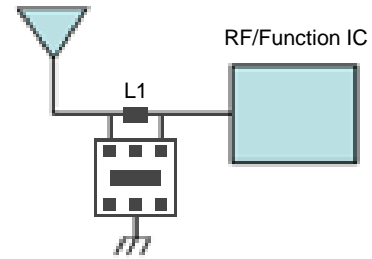
3) Packaging Quantity:

3,000 pcs/reel

Antenna Port Protection

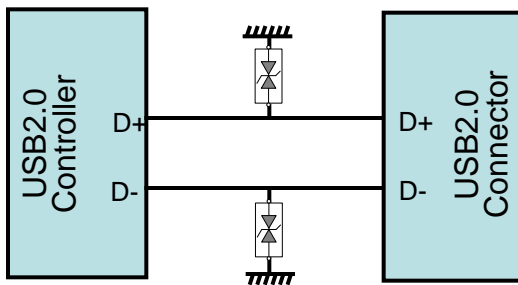


**LXES15AAA1-100 or
LXES1UBBB1-008 or
LXES1UBAB1-007**

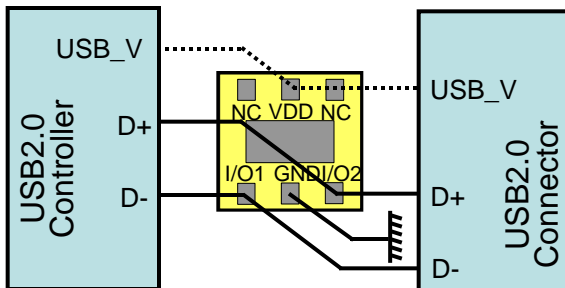


LXES1TBAA2-013

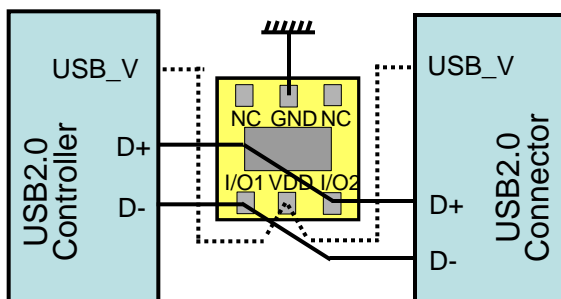
USB2.0 Single Port Protection



**LXES15AAA1-100 or
LXES1UBBB1-008**

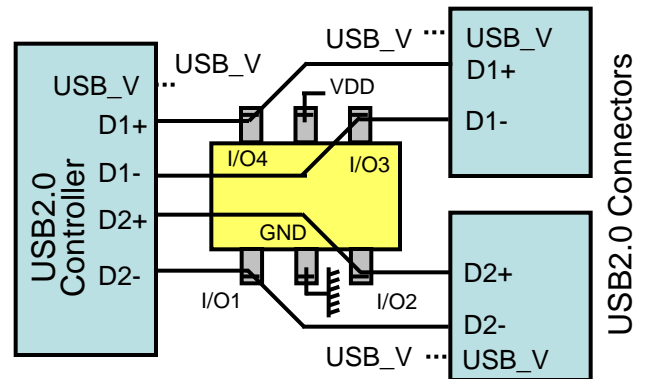


LXES1TBBB2-004

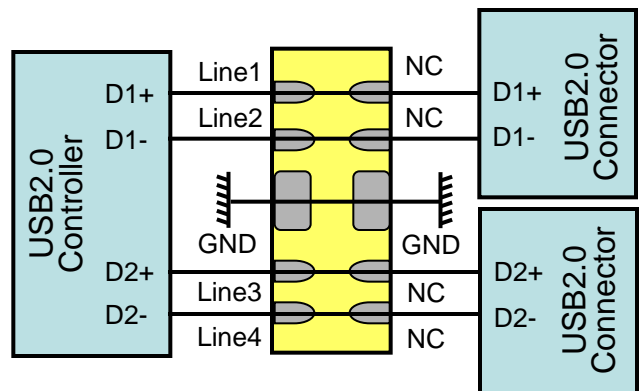


LXES1TBAA2-013

USB2.0 Dual Port Protection

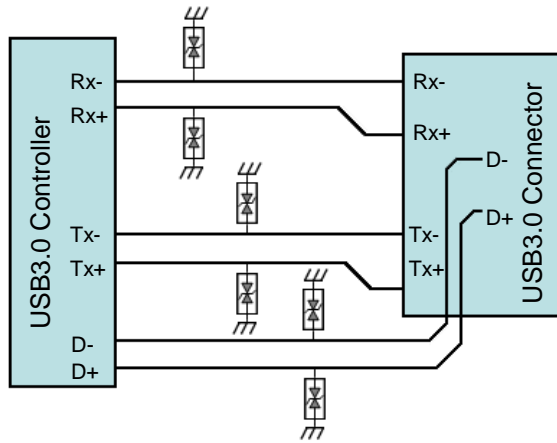


**LXES2SBBB4-026 or
LXES2SBAA4-045**

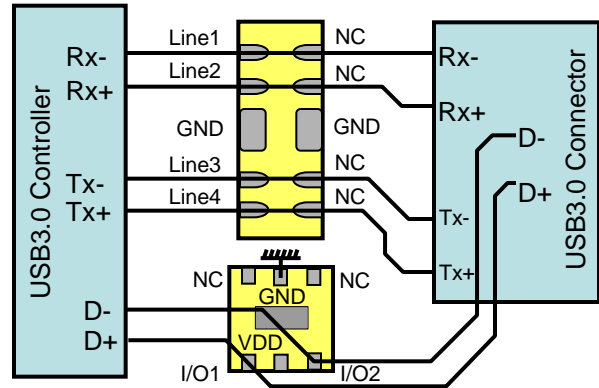


LXES2TBBB4-028

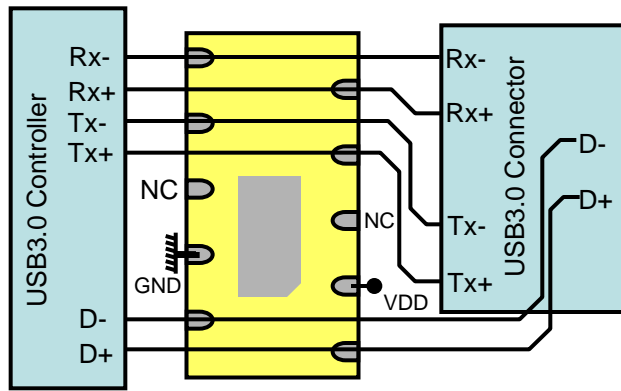
USB3.0 Port Protection



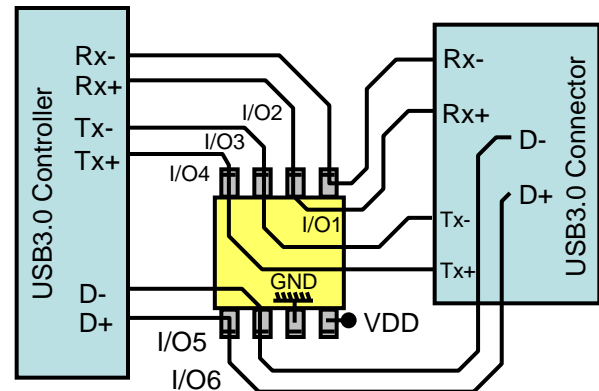
LXES15AAA1-100 or LXES1UBBB1-008



LXES2TBBB4-028 and LXES1TBAA2-013

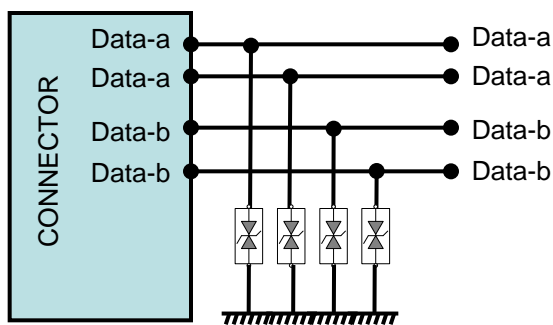


LXESEABAA6-046

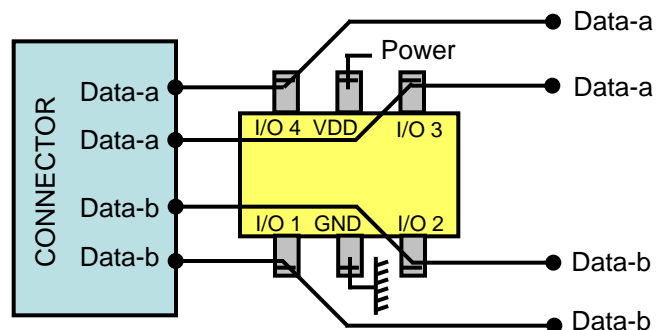


LXES4XBAA6-027

IEEE (Firewire, i.Link) Protection

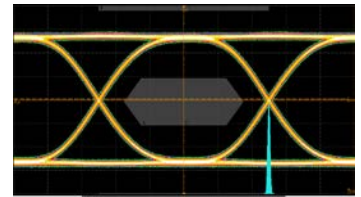
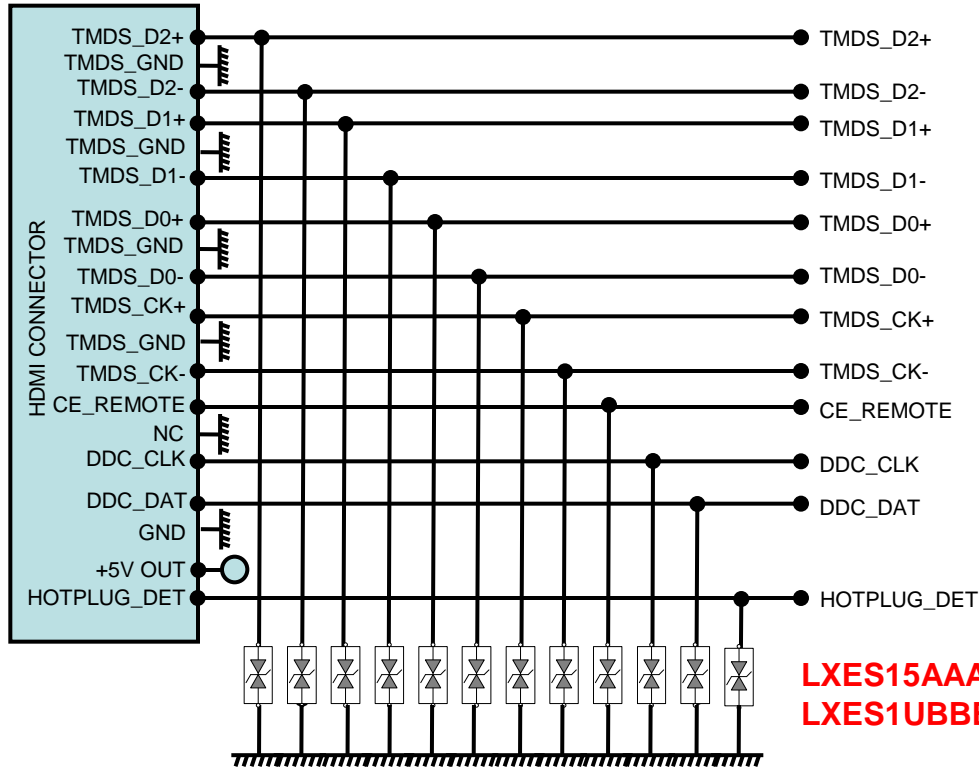


LXES15AAA1-100 or LXES1UBBB1-008

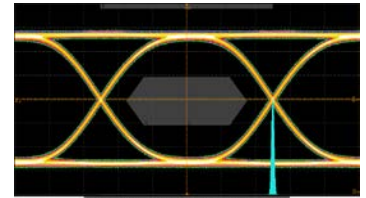


LXES2SBAA4-016 or LXES2SBBB4-026 or LXES2SBAA4-045

HDMI Port Protection

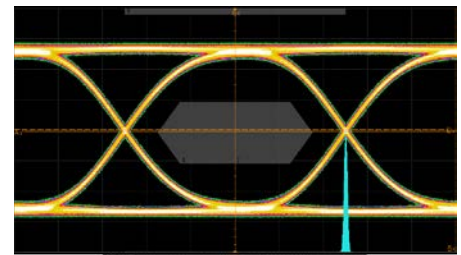
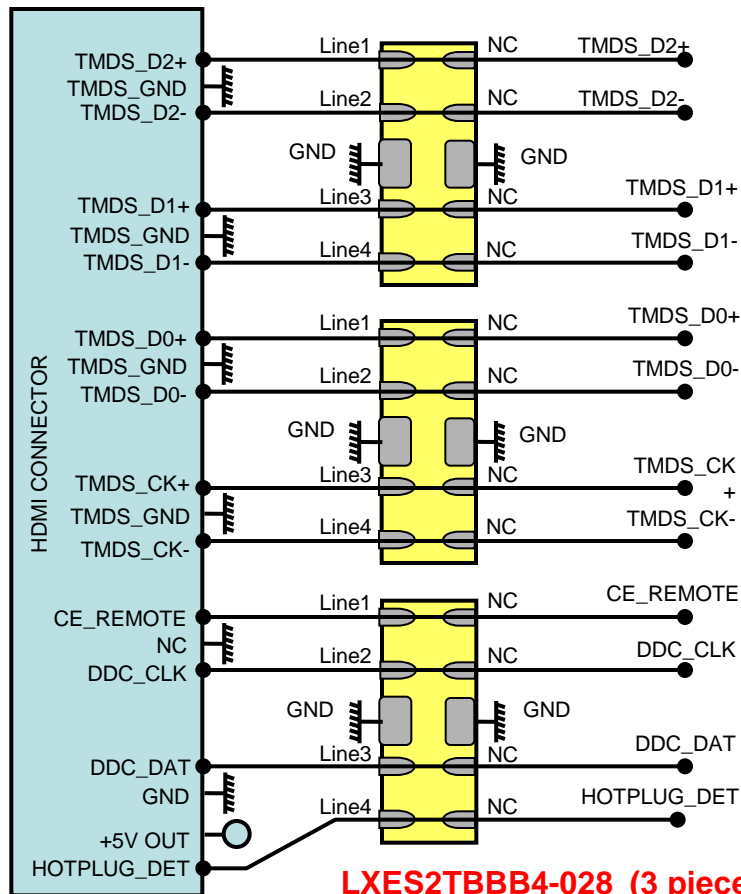


LXES15AAA1-100 (1ch)



LXES1UBBB1-008 (1ch)

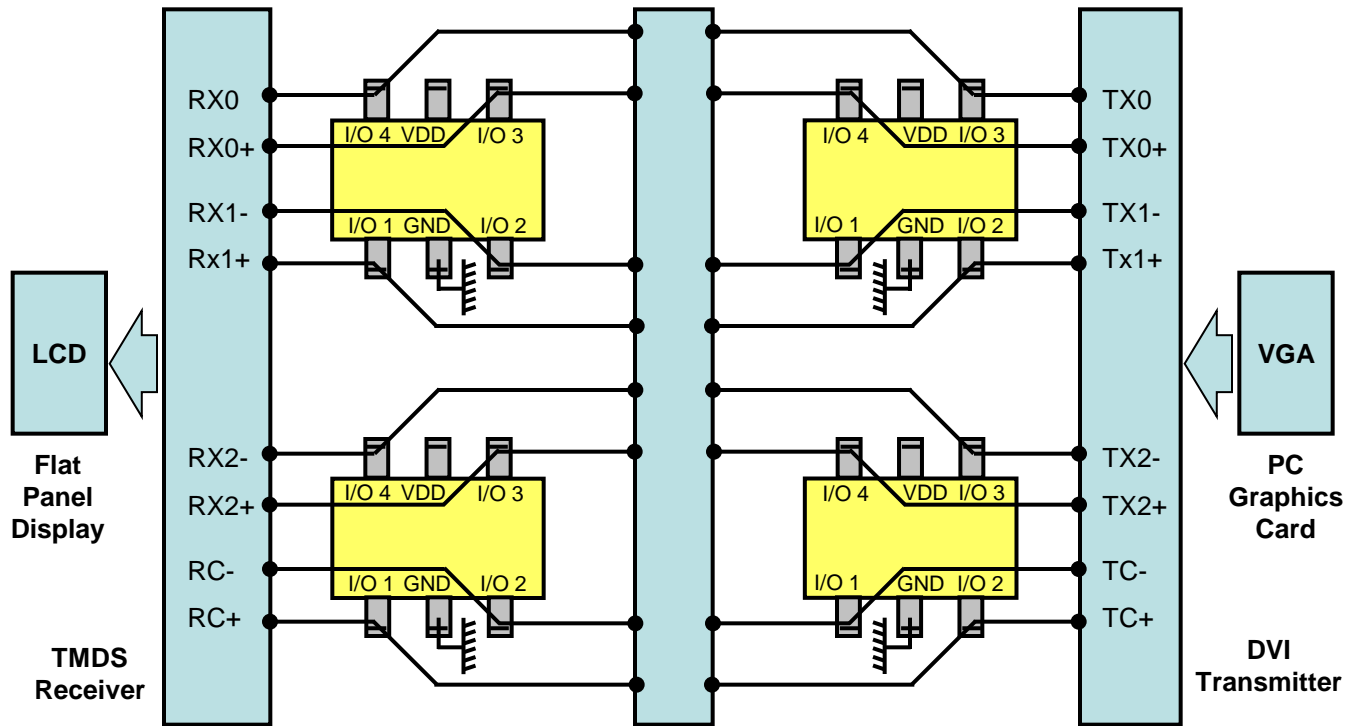
LXES15AAA1-100 or LXES1UBBB1-008



LXES2TBBB4-028 (4ch)

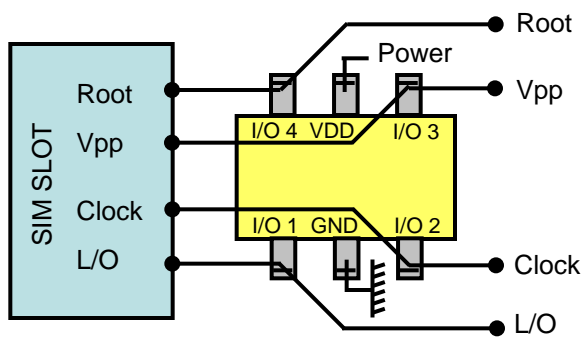
LXES2TBBB4-028 (3 pieces)

▪ DVI Port Protection



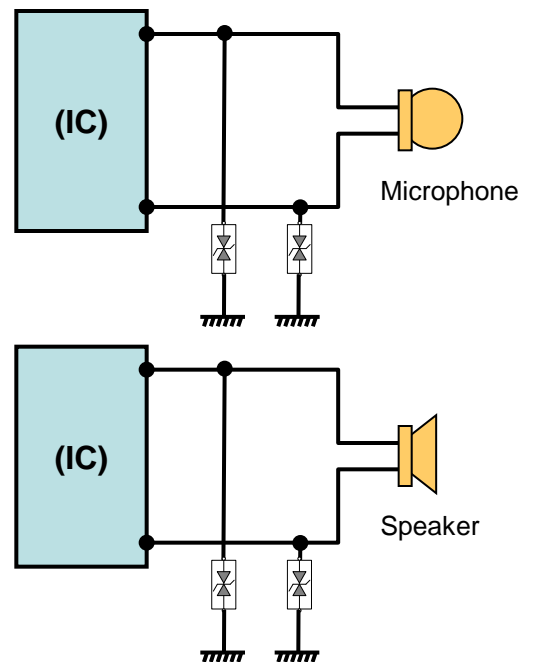
LXES2SBAA4-016 or LXES2SBBB4-026 or LXES2SBAA4-045

▪ SIM Slot Protection



LXES2SBAA4-016 or LXES2SBBB4-026 or LXES2SBAA4-045

▪ Microphone / Speaker Protection



LXES15AAA1-100 or LXES1UBAA1-096