

ESD5345H
**4-Lines, Uni-directional, Ultra-low Capacitance
Transient Voltage Suppressors**
<http://www.sh-willsemi.com>
Descriptions

The ESD5345H is an ultra-low capacitance TVS (Transient Voltage Suppressor) array designed to protect high speed data interfaces. It has been specifically designed to protect sensitive electronic components which are connected to data and transmission lines from over-stress caused by ESD (Electrostatic Discharge).

The ESD5345H incorporates four pairs of ultra-low capacitance TVS diodes and one separate TVS diode plus.

The ESD5345H may be used to provide ESD protection up to $\pm 20\text{kV}$ (contact and discharge) according to IEC61000-4-2, and withstand peak pulse current up to 5A (8/20 μs) according to IEC61000-4-5.

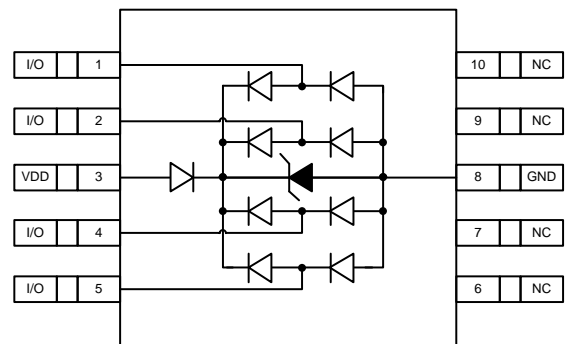
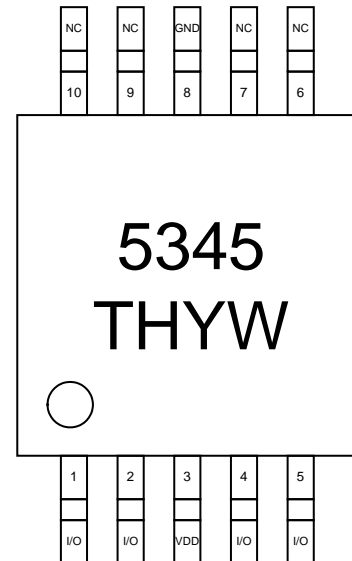
The ESD5345H is available in MSOP-10L package. Standard products are Pb-free and Halogen-free.

Features

- Stand-off voltage: 5V max.
- Transient protection for each line according to IEC61000-4-2 (ESD): $\pm 20\text{kV}$ (contact and air discharge)
IEC61000-4-5 (surge): 5A (8/20 μs)
- Low capacitance: $C_{\text{I/O-GND}} = 0.45\text{pF}$ typ.
- Ultra-low leakage current: $I_{\text{R}} < 1\text{nA}$ typ.
- Low clamping voltage: $V_{\text{CL}} = 13.4\text{V}$ @ $I_{\text{TLP}} = 16\text{A}$

Applications

- USB 3.0 and USB 2.0
- HDMI 1.3 and HDMI 1.4
- SATA and eSATA
- DVI
- IEEE 1394
- PCI Express
- Portable Electronics
- Notebooks


MSOP-10L

Circuit diagram


5345 = Device code

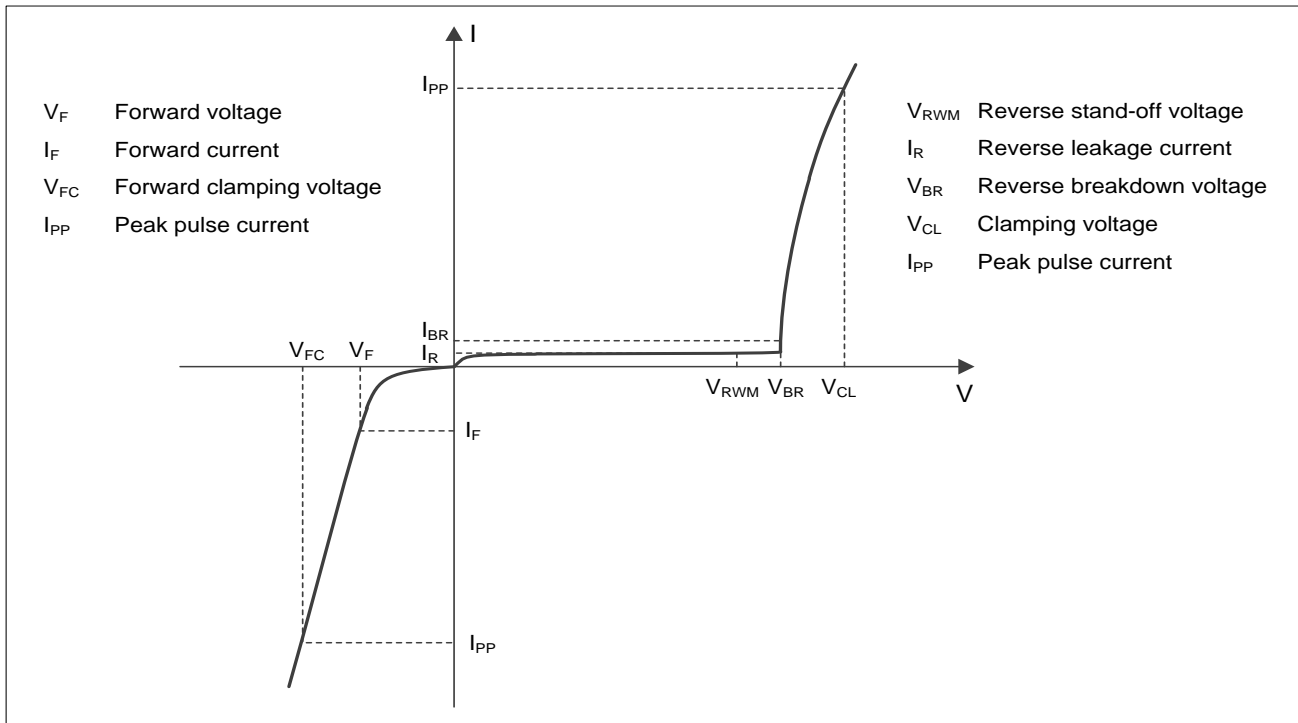
THYW = Date code

Marking (Top View)
Order information

Device	Package	Shipping
ESD5345H-10/TR	MSOP-10L	3000/Tape&Reel

Absolute maximum ratings

Parameter	Symbol	Rating	Unit
Junction temperature	T_J	125	$^{\circ}\text{C}$
Operation temperature	T_{OP}	-40 to 85	$^{\circ}\text{C}$
Storage temperature	T_{STG}	-55 to 150	$^{\circ}\text{C}$
Lead temperature	T_L	260	$^{\circ}\text{C}$
I/O Pins			
ESD according to IEC61000-4-2 air discharge	V_{ESD}	± 20	kV
ESD according to IEC61000-4-2 contact discharge		± 20	
Peak pulse power ($t_p = 8/20\mu\text{s}$)	P_{pk}	65	W
Peak pulse current ($t_p = 8/20\mu\text{s}$)	I_{PP}	5	A
VDD Pins			
ESD according to IEC61000-4-2 air discharge	V_{ESD}	± 30	kV
ESD according to IEC61000-4-2 contact discharge		± 30	
Peak pulse power ($t_p = 8/20\mu\text{s}$)	P_{pk}	168	W
Peak pulse current ($t_p = 8/20\mu\text{s}$)	I_{PP}	12	A

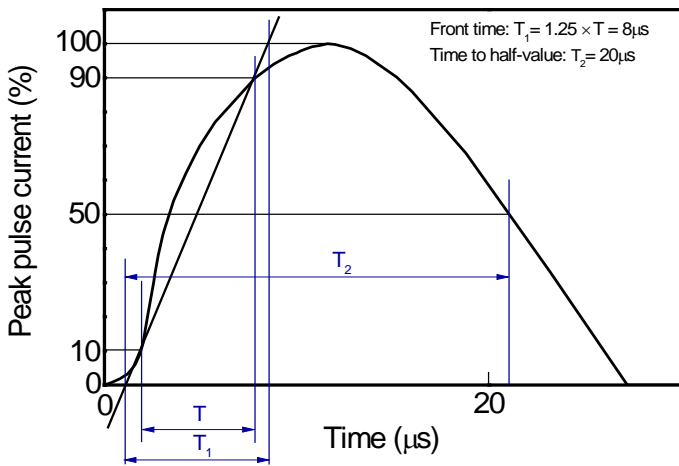
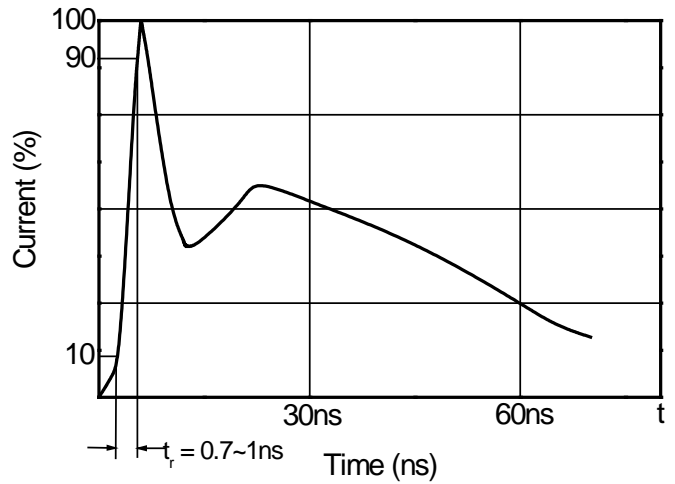
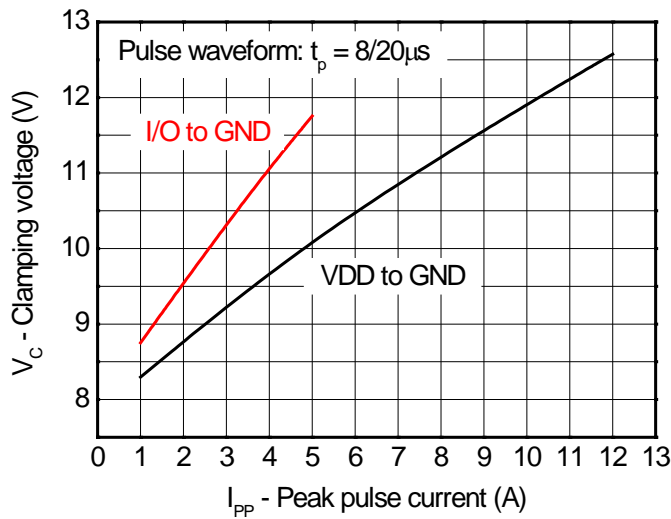
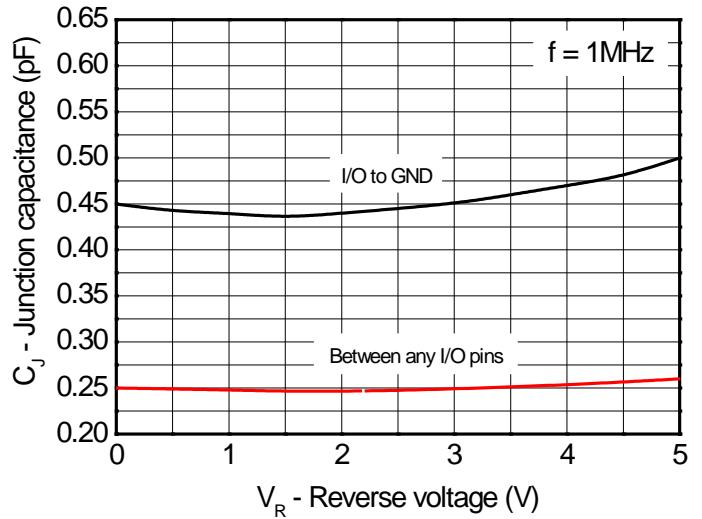
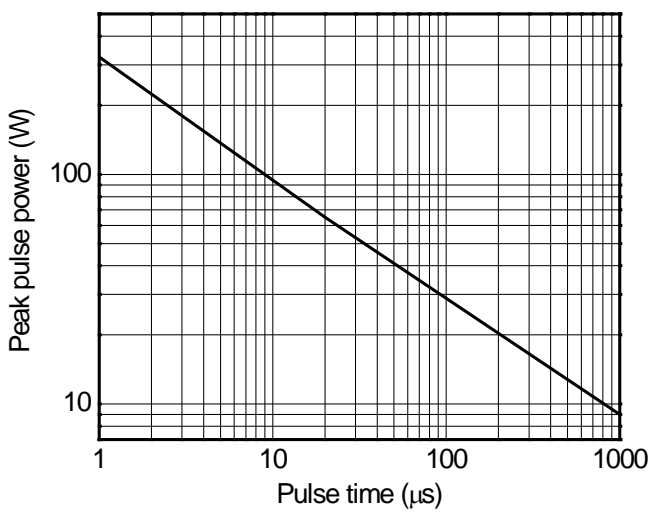
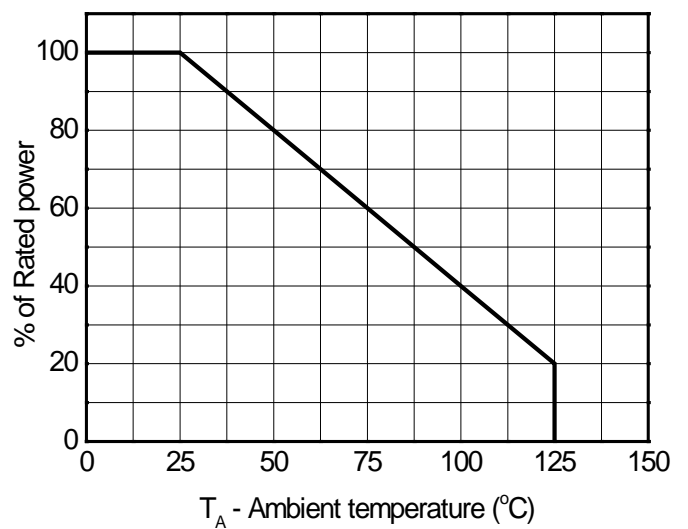
Electrical characteristics ($T_A = 25^{\circ}\text{C}$, unless otherwise noted)

Definitions of electrical characteristics

Electrical characteristics (T_A=25°C, unless otherwise noted)

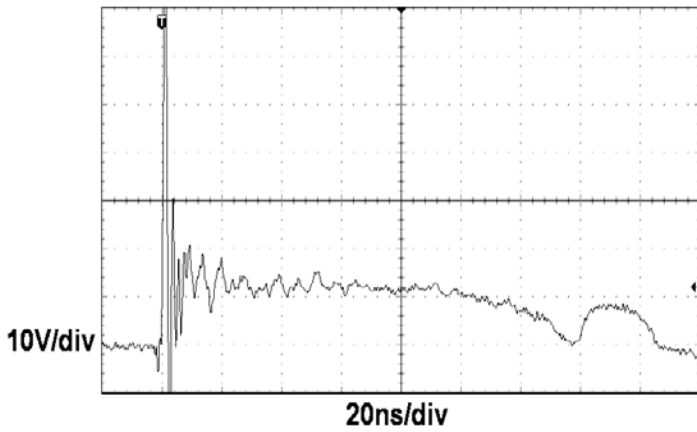
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
I/O Pins						
Reverse maximum working voltage	V _{RWM}				5.0	V
Reverse leakage current	I _R	V _{RWM} = 5V		<1	100	nA
Reverse breakdown voltage	V _{BR}	I _{BR} = 1mA	7.0	8.0	9.0	V
Forward voltage	V _F	I _F = 10mA	0.6	0.9	1.2	V
Clamping voltage ¹⁾	V _{CL}	I _{PP} = 16A, t _p = 100ns		13.4		V
Dynamic resistance ¹⁾	R _{DYN}	t _p = 100ns		0.30		Ω
Clamping voltage ²⁾	V _{CL}	V _{ESD} = 8kV		13.0		V
Clamping voltage ³⁾	V _{CL}	I _{PP} = 1A, t _p = 8/20μs			10	V
		I _{PP} = 5A, t _p = 8/20μs			13	V
Junction capacitance	C _{I/O - GND}	V _R = 0V, f = 1MHz, Any I/O to GND		0.45	0.65	pF
	C _{I/O - IO}	V _R = 0V, f = 1MHz, Any I/O to I/O		0.25	0.40	pF
VDD Pins						
Reverse maximum working voltage	V _{RWM}				5.0	V
Reverse leakage current	I _R	V _{RWM} = 5V		<1	100	nA
Reverse breakdown voltage	V _{BR}	I _{BR} = 1mA	7.0	8.0	9.0	V
Forward voltage	V _F	I _F = 10mA	0.6	0.9	1.2	V
Clamping voltage ¹⁾	V _{CL}	I _{PP} = 16A, t _p = 100ns		11.0		V
Dynamic resistance ¹⁾	R _{DYN}	t _p = 100ns		0.18		Ω
Clamping voltage ²⁾	V _{CL}	V _{ESD} = 8kV		11.0		V
Clamping voltage ³⁾	V _{CL}	I _{PP} = 1A, t _p = 8/20μs			10	V
		I _{PP} = 12A, t _p = 8/20μs			14	V

Notes:

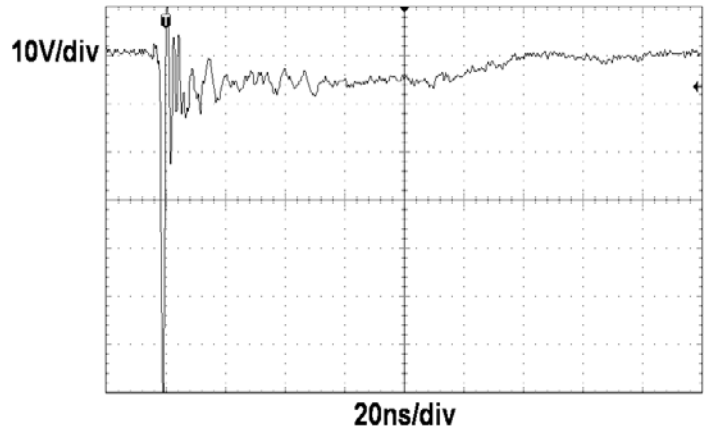
- 1) TLP parameter: Z₀ = 50Ω, t_p = 100ns, t_r = 2ns, averaging window from 60ns to 80ns. R_{DYN} is calculated from 4A to 16A.
- 2) Contact discharge mode, according to IEC61000-4-2.
- 3) Non-repetitive current pulse, according to IEC61000-4-5.

Typical characteristics ($T_A=25^\circ\text{C}$, unless otherwise noted)

8/20 μs waveform per IEC61000-4-5

Contact discharge current waveform per IEC61000-4-2

Clamping voltage vs. Peak pulse current

Capacitance vs. Reverse voltage

Non-repetitive peak pulse power vs. Pulse time

Power derating vs. Ambient temperature

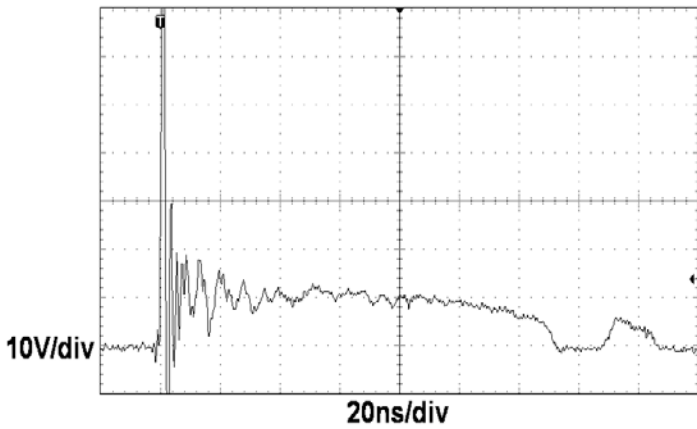
Typical characteristics ($T_A = 25^\circ\text{C}$, unless otherwise noted)



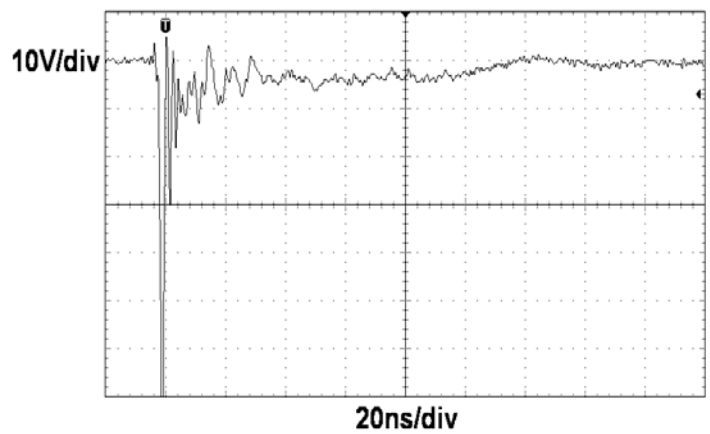
ESD clamping - I/O to GND
 (+8kV contact discharge per IEC61000-4-2)



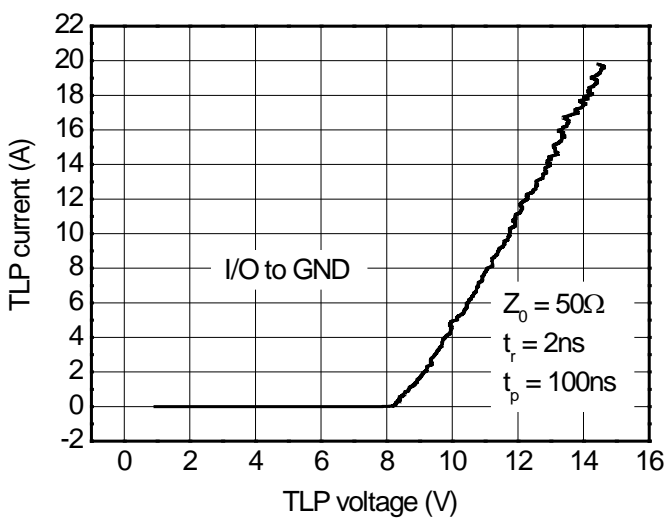
ESD clamping - I/O to GND
 (-8kV contact discharge per IEC61000-4-2)



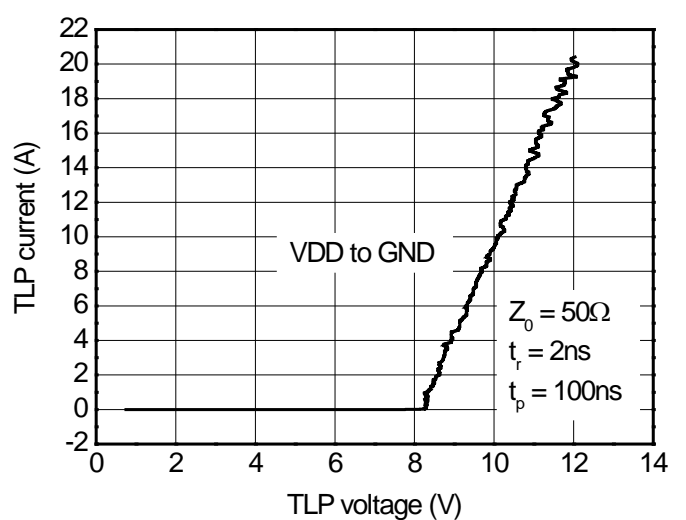
ESD clamping - VDD to GND
 (+8kV contact discharge per IEC61000-4-2)



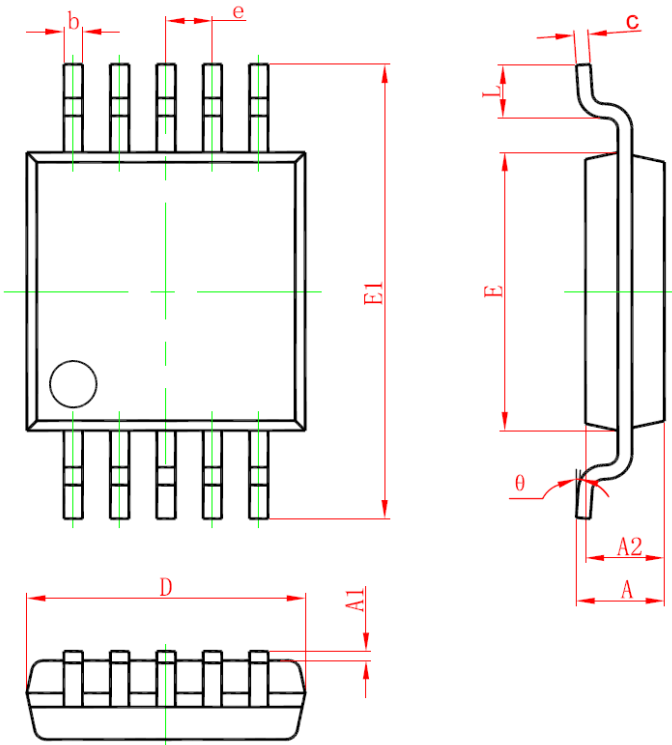
ESD clamping - VDD to GND
 (-8kV contact discharge per IEC61000-4-2)



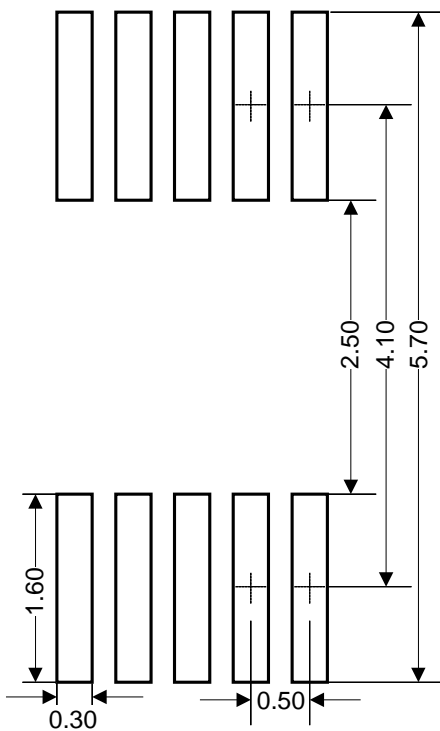
TLP Measurement - I/O to GND



TLP Measurement - VDD to GND

Package outline dimensions
MSOP-10L


Symbol	Dimensions In Millimeters		
	Min.	Typ.	Max.
A	0.82	--	1.10
A1	0.02	--	0.15
A2	0.75	--	0.95
b	0.18	0.23	0.28
c	0.09	--	0.23
D	2.90	3.00	3.10
e	0.50(BSC)		
E	2.90	3.00	3.10
E1	4.75	4.90	5.05
L	0.40	0.60	0.80
θ	0°	--	6°

Recommended land pattern (Unit: mm)

Notes:

This recommended land pattern is for reference purposes only. Please consult your manufacturing group to ensure your PCB design guidelines are met.