

## **HX7227-Q/HX7227-MS Dual 2:1 USB 2.0**

# **Multiplexer/Demultiplexer with DC 30V Over-Voltage Protection**

### **DESCRIPTION**

The HX7227-Q/HX7227-MS is a bidirectional, low-power dual-port high-speed USB 2.0 analog switch that features integrated protection for USB Type-C™ systems. This device can be configured as either a dual 2:1 or 1:2 switch and is optimized for use with the USB 2.0 DP/DM lines in a USB Type-C™ environment.

The HX7227-Q/HX7227-MS incorporates over-voltage protection on the C0+/- pins, capable of withstanding up to DC 30V, along with automatic shutoff circuitry designed to safeguard system components located behind the switch. The GPIO controls for SEL and EN are compatible with 1.8V logic levels.

Available in UQFN 1.4x18-10L and MSOP10 packages, both Pb-free and Halogen-free, the HX7227-Q/HX7227-MS is an ideal choice for mobile applications and environments where space is constrained.

### **FEATURES**

- ★ Supply Range 2.5 V to 5.5 V
- ★ Differential 2:1 or 1:2 Switch/Multiplexer
- ★ Up to DC 30V Overvoltage Protection (OVP) on C0+/- Ports
- ★ IEC 64000-4-5 Surge Protection w/o External TVS onto C0+/- Ports: ±30V
- ★ System Side Clamp Voltage Pulse Less than 9V, Duration Less than 200nS
- ★ Powered Off Protection When VDD = 0 V
- ★ Low R<sub>ON</sub> of 10 Ω Typical
- ★ Insertion loss: -1dB@200MHz, -2dB@650MHz, -3dB@1GHz
- ★ C<sub>ON</sub> of 4.8 pF
- ★ 1.8-V Compatible Logic Inputs Standard Temperature Range of -40°C to 85°C

### **APPLICATIONS**

- ★ Anywhere a USB Type-C™ or Micro-B Connector is Used
- ★ USB 2.0 Signal Routing
- ★ Digital Cameras and Camcorders
- ★ Portable Instrumentation
- ★ Set-Top Box
- ★ PADS the withstand USB devices
- ★ Mobile Phones, Tablets and Notebooks

## ORDER INFORMATION

Model	Package	SPECIFIED TEMPERATURE RANGE	PACKING OPTION
HX7227-Q	UQFN 1.4x1.8-10L	-40°C to +85°C	Tape and Reel,3000
HX7227-MS	MSOP10	-40°C to +85°C	Tape and Reel,3000

## PIN CONFIGURATION

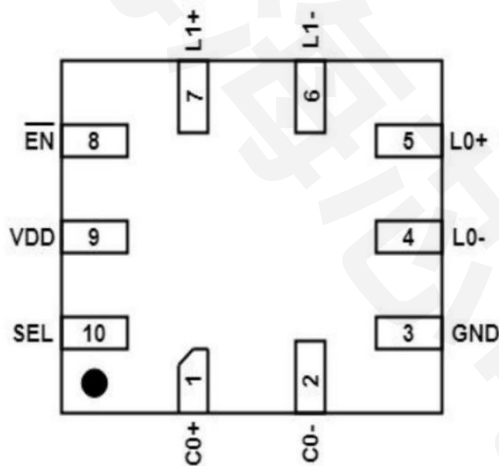


Figure 1. UQFN 1.4x1.8-10L

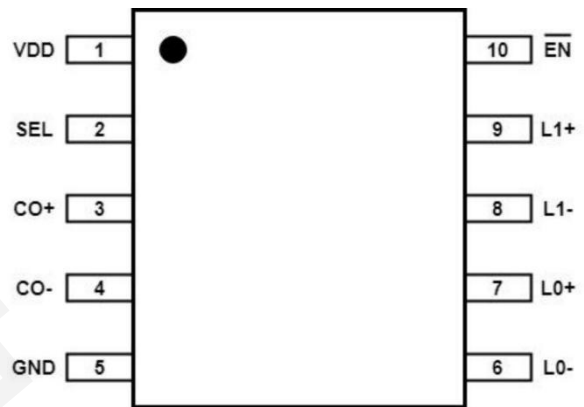


Figure 2. MSOP10

## PIN DESCRIPTION

UQFN1.4x1.8-10L	MSOP10	Pin Name	Signal Type	Description
1	3	CO+	I/O	Signal I/O, Common Port
2	4	CO-	I/O	Signal I/O, Common Port
7	9	L1+	I/O	Signal I/O, Channle 1
6	8	L1-	I/O	Signal I/O, Channle 1
5	7	L0+	I/O	Signal I/O, Channle 0
4	6	L0-	I/O	Signal I/O, Channle 0
10	2	SEL	I	Operation Model Select (when SEL=0: CO→L0, when SEL=1: CO→L1)
8	10	_EN	I	_EN= 1, Power Down is Enabled
9	1	VDD	PWR	Positive Supply Voltage
3	5	GND	GND	Power Ground

## TRUTH TABLE

Function	SEL	_EN
C0+/- to L0+/-	L	L
C0+/- to L1+/-	H	L
All Switches Hi-Z	X	H

## Typical Application

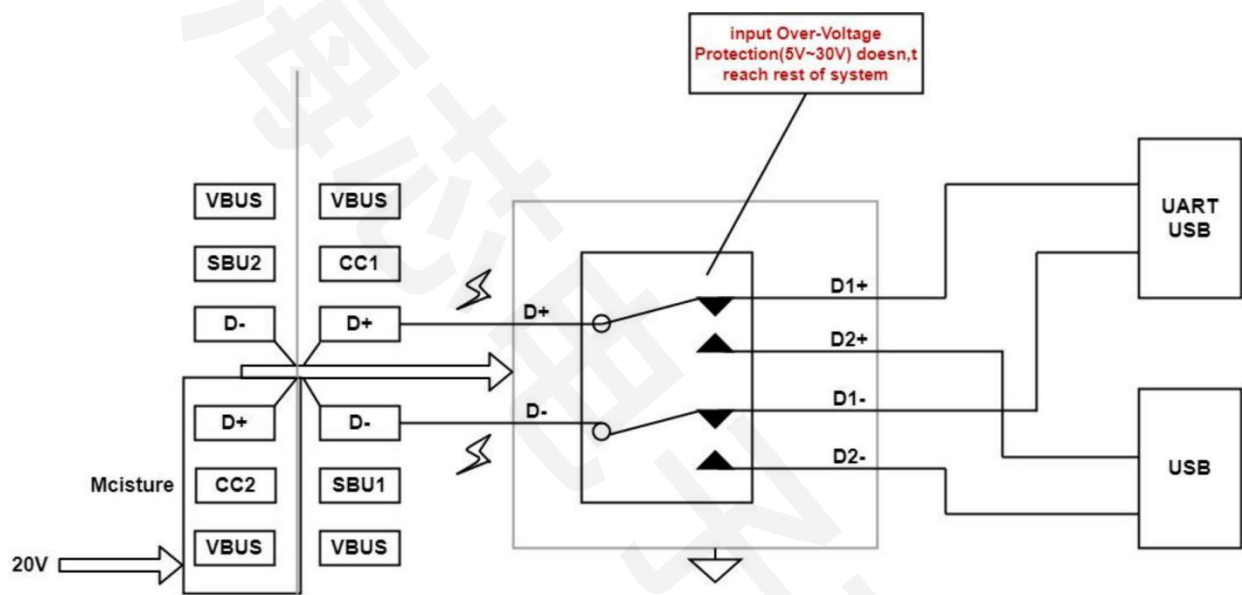


Figure 3. HX7227-Q/HX7227-MS Application circuit

In addition, considering the power consumption requirements of portable products, HX7227-Q/HX7227-MS is designed to minimize static power consumption. As shown in Figure5 below, HX7227-Q/HX7227-MS integrates pull-down resistance up to 6 MΩ on both SEL and / OE pins. The weak pull-down resistance on the SEL pin saves power and ensures that channel 1 is opened in the default state, and the weak pull-down resistance on the OE pins ensures that the chip can work after power on.

## FUNCTIONAL DIAGRAM

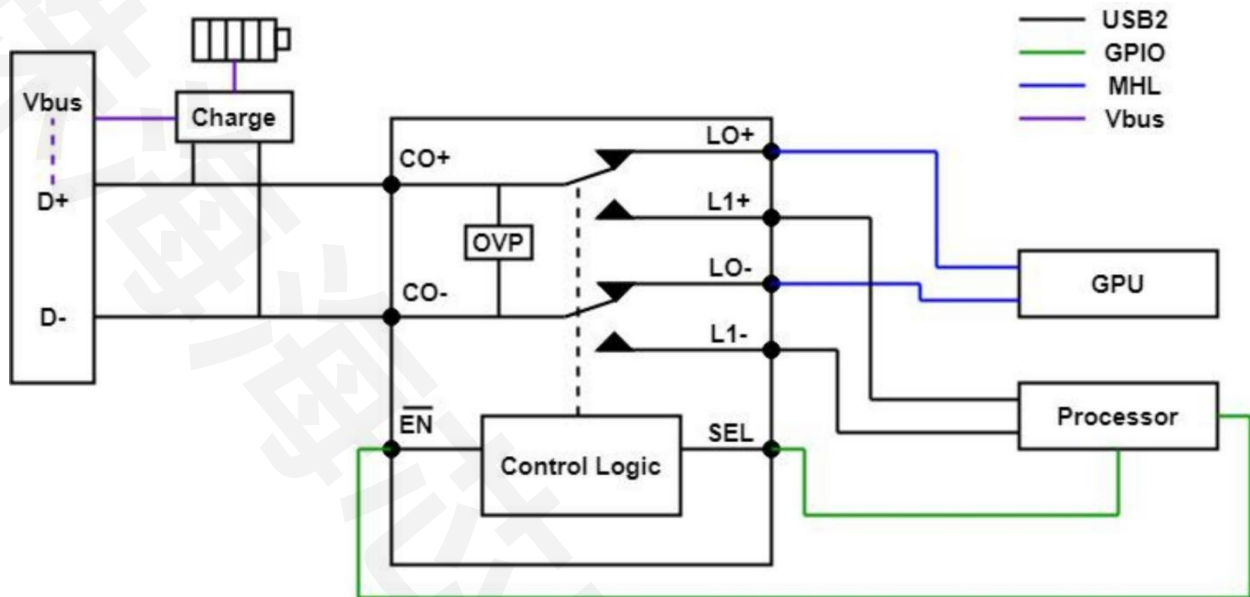


Figure 4. Function Diagram

The HX7227-Q/HX7227-MS is a high-speed, low-power dual-pole/dual-throw (DPDT) analog switch with 30V overvoltage protection and 2-way self-power supply. 5V to 5.5V. The HX7227-Q/HX7227-MS is used for high-speed USB 2.0 signal switching in handheld devices such as mobile phones, digital cameras, laptops, with hubs or controllers.

Overvoltage protection. As shown in Figure 5 below, the HX7227-Q/HX7227-MS has a special overvoltage protection circuit on the D + / D pin. When the USB device is powered on or off, the circuit can withstand the Vbus short circuit to D + or up to 30V, ensuring that the device is not damaged, and isolate the high voltage from the downstream circuit, protecting the downstream circuit. The OVP circuit integrated into the switch chip also greatly simplifies the design, reduces the size of the scheme, and solves the pain points of designers in practical applications. Please refer to the figure below.

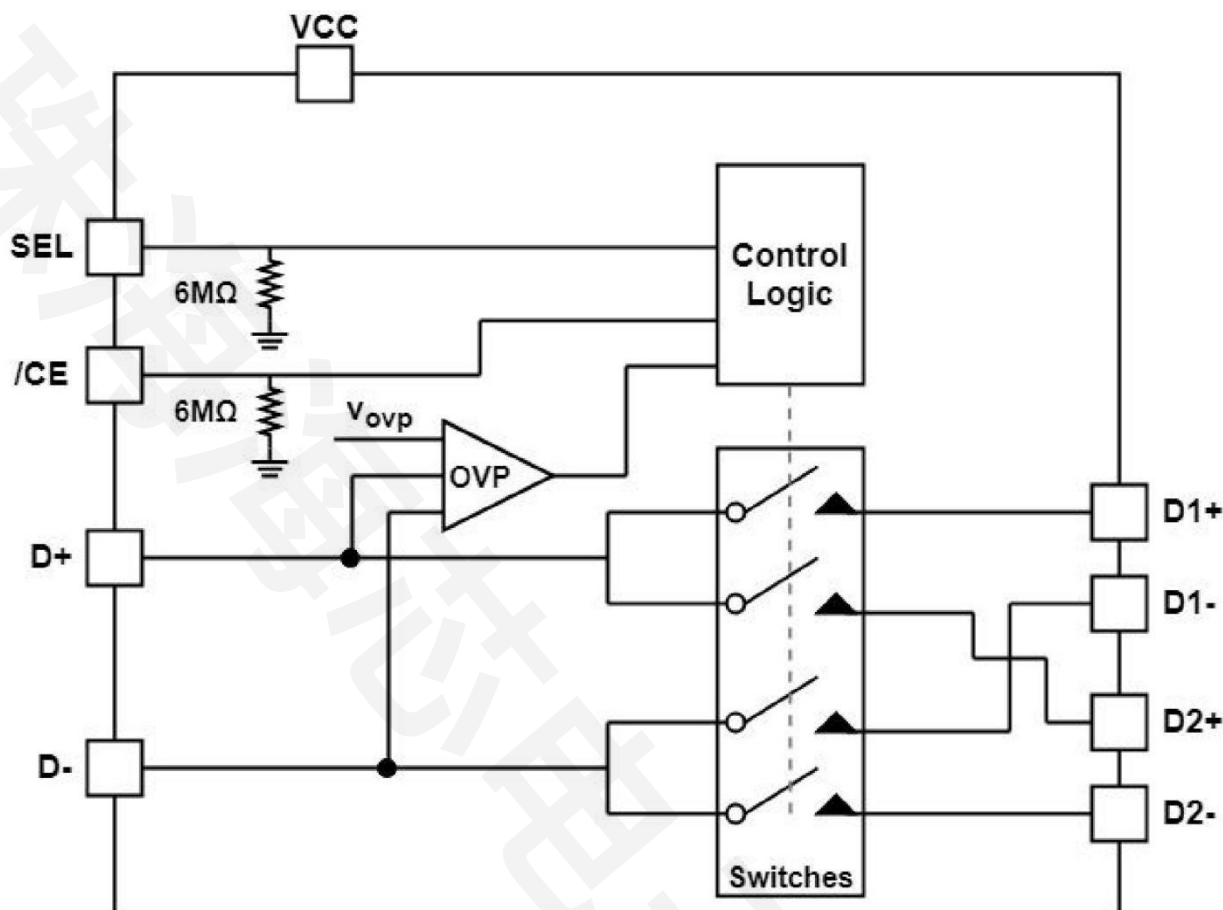
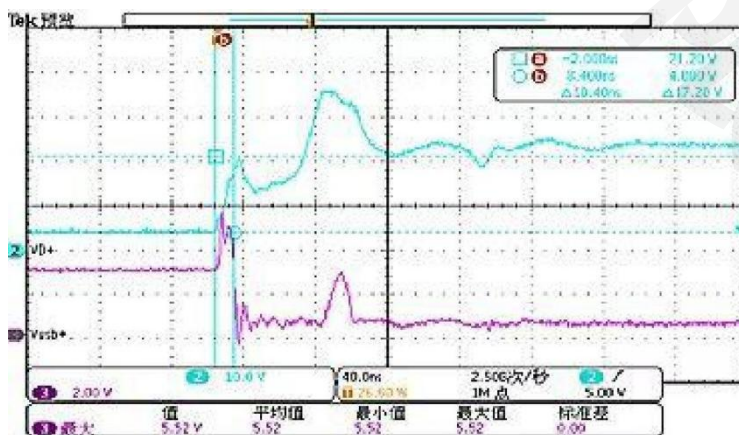


Figure 5. Internal function diagram

As shown in Figure 6 below, when the voltage on the data line is too high, the OVP protection circuit inside HX7227-Q/HX7227-MS starts to work, and the maximum voltage is as high as 5.5V, OVP responds, and the response speed is very fast, the average response time is 10.4nS, which can quickly disconnect, and protect the internal circuit from being damaged by high voltage loading.

Vcc=3.3V Full bandwidth VD=4.0-21V USB Load=50ohm Cusb += 5 pF



The maximum of 5.5V OVP response time was 10.4nS

Figure 6. HX7227-Q/HX7227-MS High-pressure test

## ELECTRICAL CHARACTERISTICS

(T<sub>A</sub>=25°C, VDD=3.3V, unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
POWER SUPPLY						
Supply Voltage Range	VDD		2.5	3.3	5.5	V
Supply Current	ICC	_EN = 1 disconnection		0.6	2	uA
		_EN = 0 connection		33		uA
SEL/_EN DIGITAL INPUT CONTROL						
control input logic high	VIH		1.6		5.5	V
control input logic low	VIL		-0.1		0.5	V
Internal pull-down resistor	RPD			2		M Ω
SWITCH ON RESISTANCE AND OFF LEAKAGE						
On-Resistance	RON	VIS= 0V~0.4V IOUΤ=8mA		10	11	Ω
RON Flatness <sup>(1)</sup>	RFLAT	VIS= 0V~0.4V IOUΤ=8mA		0.3	0.5	Ω
RON Matching Between Channels <sup>(2)</sup>	ΔRON	VIS= 0V~0.4V IOUΤ=8mA		0.1	0.2	Ω
OFF Leakage Current	ILEAK	VC0+/- = 10V VL1+/- = VD2+/- =0V		31	50	uA
SWITCH DYNAMICS						
On Capacitance	CON	VC0+/- = 0.2V, f= 1MHz		4		pF
Off Capacitance	COFF	VC0+/- = 0.2V, f= 1MHz		3		pF
Off Isolation	Off	f= 250MHz, Rτ = 50Ω , CL = 0pF		-38		dB
Crosstalk <sup>(3)</sup> (Channel-to-Channel)	XTALK	f= 250MHz, Rτ = 50Ω , CL = 0pF		-41		dB
-3dB Bandwidth	BW	Rτ=50 Ω , CL=0pF Signal Power 0dBm	0.9	1		GHz
Break-Before-Make	BBM	VL1+/- = VD2+/- = 0.4V, RL=50Ω		1.5		uS
Turn-on Time	ton	VC0+/- = 0.4V, RL=50Ω _EN switches from High to Low		20		uS
Turn-off Time	toff	VC0+/- = 0.4V, RL=50Ω _EN switches from Low to High		1.2		uS
Propagation Delay	tpD	VC0+/- = 0.4V, RL=50Ω		200		pS
OVER VOLTAGE PROTECTION						
OVP Lockout Threshold	VOVP	VC0+/- Rising Edge	4.6	4.9	5.2	V
OVP Hysteresis	VHYS	VC0+/- Falling Edge		200		mV
Clamp Voltage on L1+/- and D2+/-	VCLAMP	10V shorts to C0+/- with RL=1KΩ @ L1+/- and D2+/-		6.5	8	V
OVP Response Time	tfP	10V shorts to C0+/- with RL=1KΩ @ L1+/- and D2+/-		200	300	nS
OVP Recovery Time	tfPR	VC0+/- jumps from 6V to 1V step	30	45	60	uS

Note:

- (1) Flatness is defined as the difference between maximum and minimum value of ON-resistance at the specified analog signal voltage points.
- (2)  $R_{ON}$  matching between channels is calculated by subtracting the channel with the lowest max  $R_{ON}$  value from the channel with the highest max  $R_{ON}$  value.
- (3) Crosstalk is inversely proportional to source impedance

## TYPICAL PERFORMANCE CURVES

$T_A=25^{\circ}\text{C}$ ,  $V_{DD}=3.0\text{V}$ ,  $CAP=0.1\mu\text{F}$ , unless otherwise noted



Fig 7. Switch Bandwidth or Insertion Loss



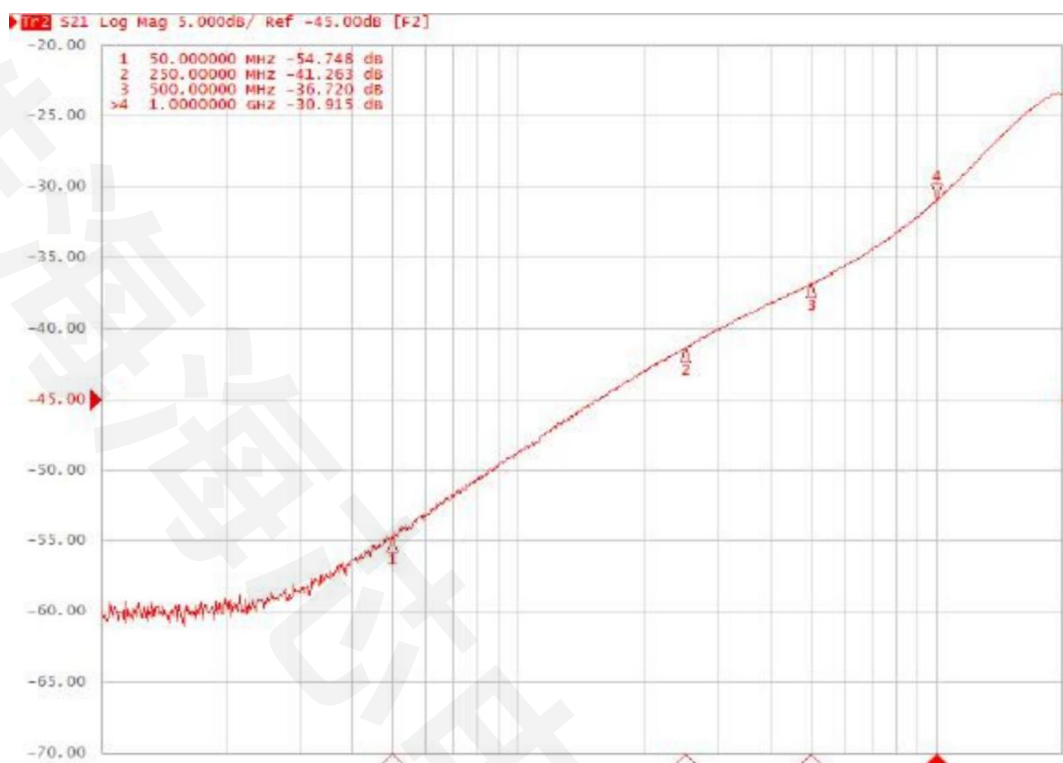


Fig 8. Switch Channel to Channel Cross-Talk

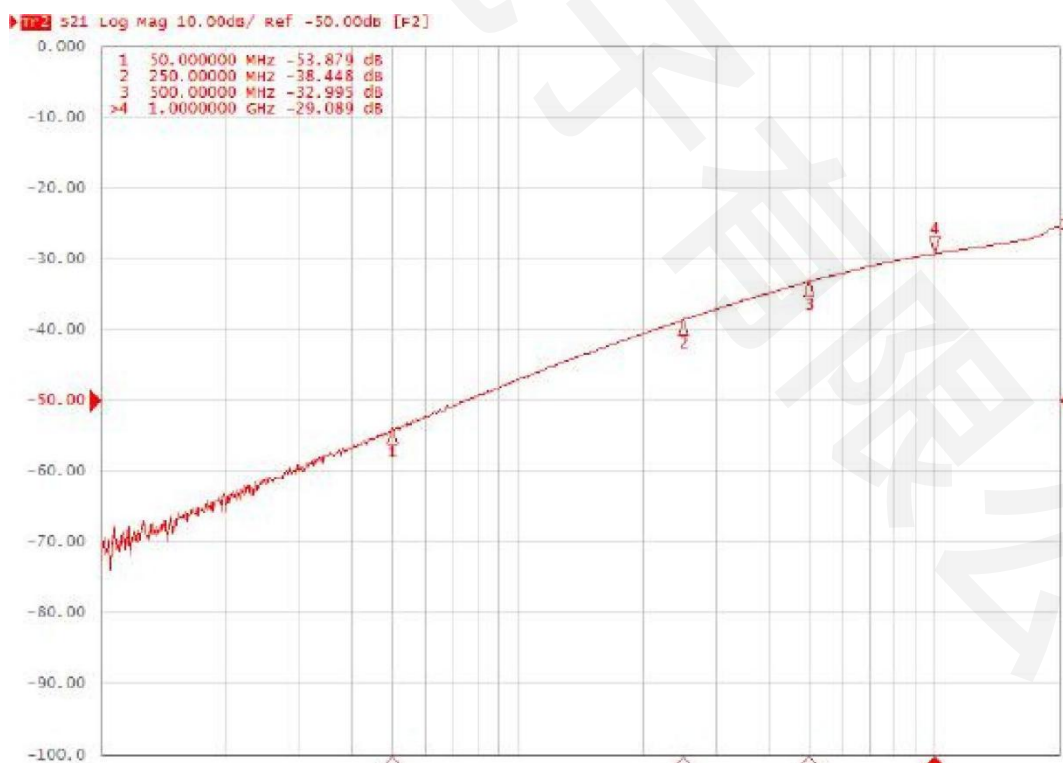
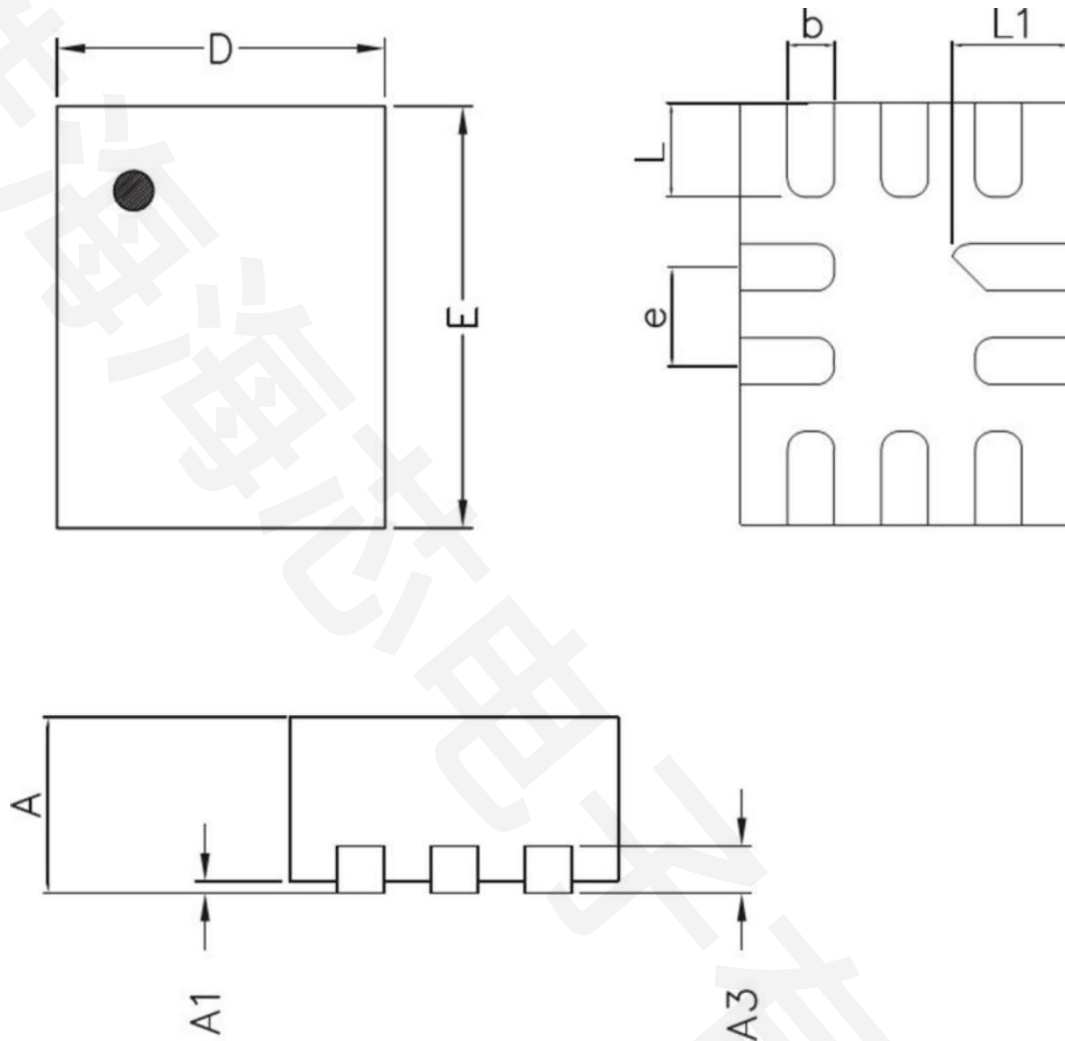


Fig 9. Switch Off Isolation

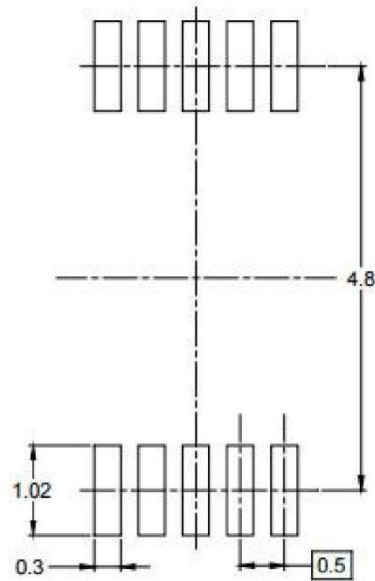
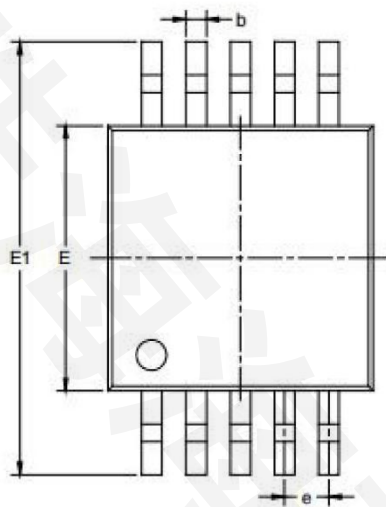


## PACKAGE OUTLINE DIMENSIONS(All dimensions in mm.)

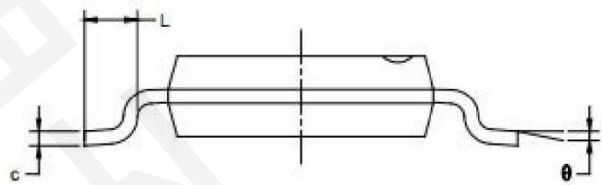
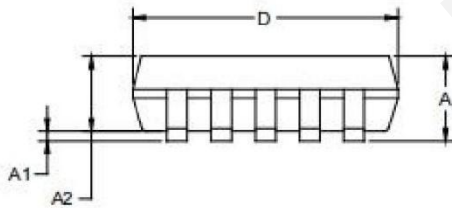
(1) Package Type: UQFN 1.4x1.8 -10L



Symbol	Dimension in Millimeters	
	Min.	Max.
A	0.450	0.550
A1	0.000	0.050
A3	0.152 Ref.	
D	1.350	1.450
E	1.750	1.850
b	0.150	0.250
e	0.400 Typ.	
L	0.350	0.450
L1	0.450	0.550



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.500BSC		0.020BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

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