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_{ON} of 10 Ω Typical
- Insertion loss: -1dB@200MHz, -2dB@650MHz, -3dB@1GHz
- C_{ON} 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℃ to +85℃	Tape and Reel,3000
HX7227-MS	MSOP10	-40℃ to +85℃	Tape and Reel,3000

PIN CONFIGURATION

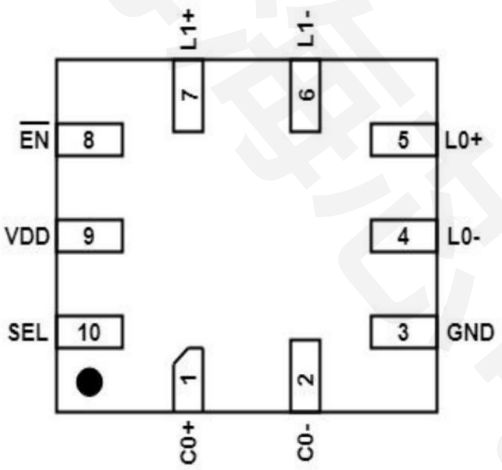


Figure 1. UQFN 1.4x1.8-10L

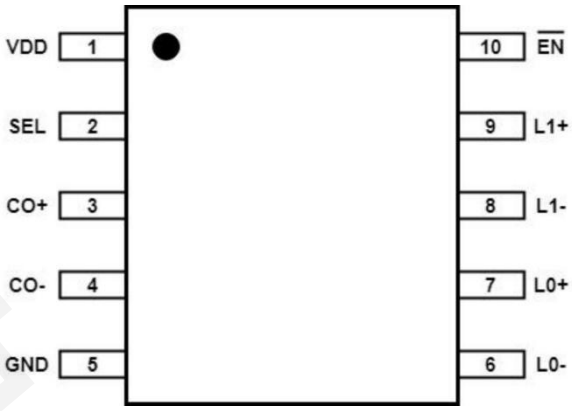


Figure 2. MSOP10

PIN DESCRIPTION

UQFN1.4x1.8-10L	MSOP10	Pin Name	Signal Type	Description
1	3	C0+	I/O	Signal I/O, Common Port
2	4	C0-	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: C0→L0, when SEL=1: C0→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

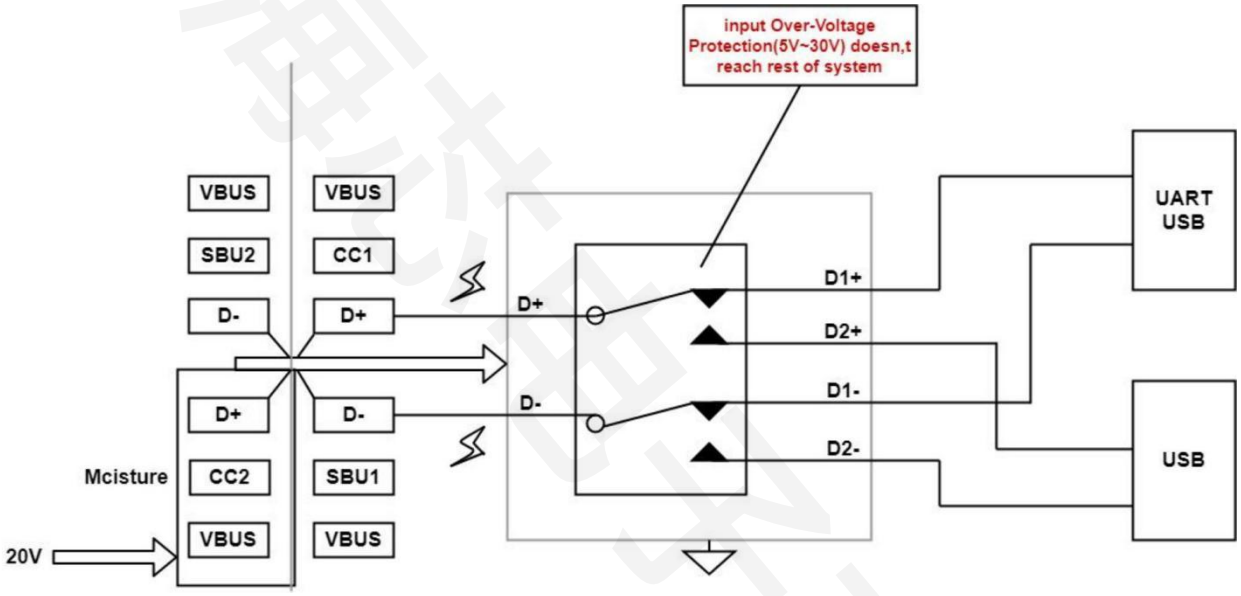


Figure 3. HX7227-Q/HX7227-MS Application circuit

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

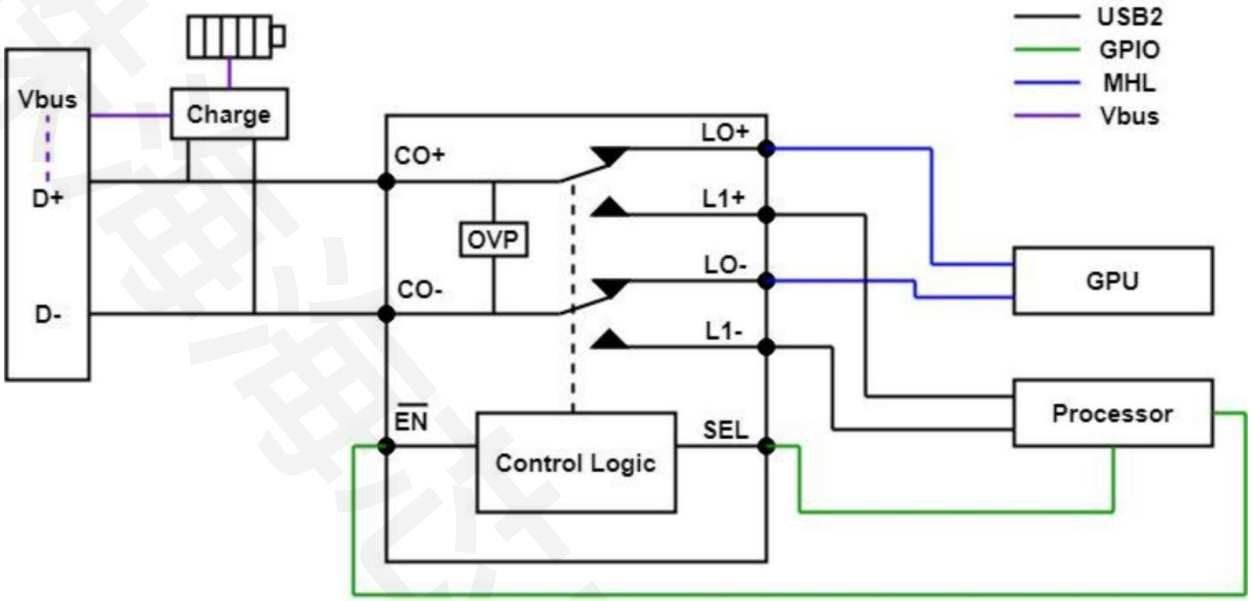


Figure 4. Function Diagram

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.

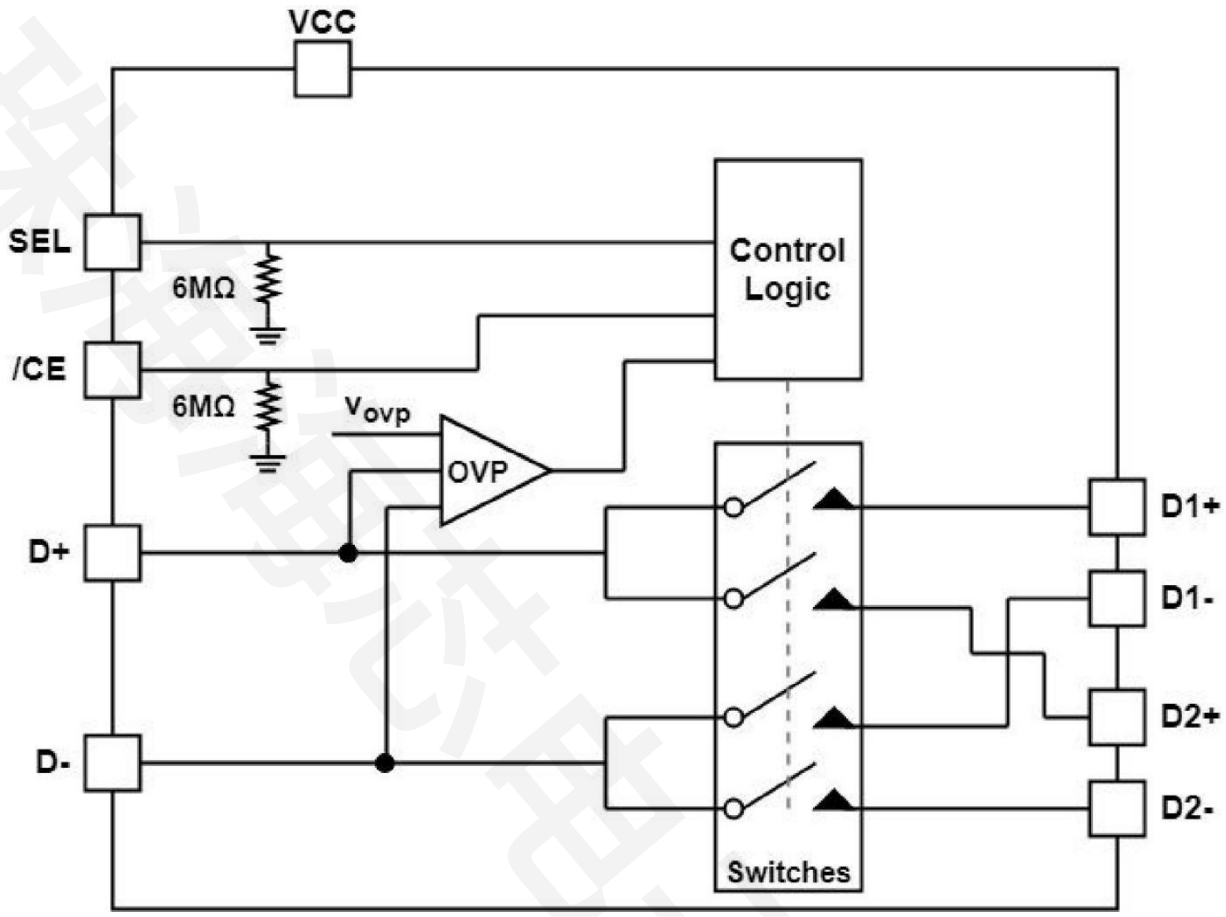
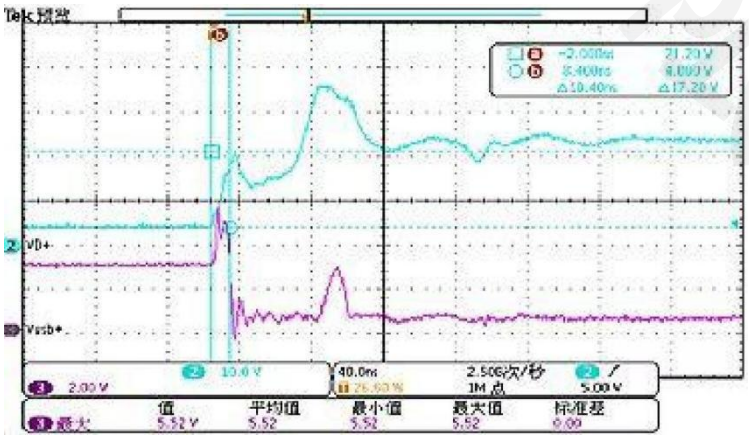


Figure 5. Internal function diagram

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_A=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	I_{CC}	_EN = 1 disconnection		0.6	2	uA
		_EN =0 connection		33		uA
SEL/_EN DIGITAL INPUT CONTOL						
control input logic high	V_{IH}		1.6		5.5	V
control input logic low	V_{IL}		-0.1		0.5	V
Internal pull-down resistor	R_{PD}			2		M Ω
SWITCH ON RESISTANCE AND OFF LEAKAGE						
On-Resistance	R_{ON}	V_{IS}= 0V~0.4V I_{OUT}=8mA		10	11	Ω
R_{ON} Flatness(1)	R_{FLAT}	V_{IS}= 0V~0.4V I_{OUT}=8mA		0.3	0.5	Ω
R_{ON} Matching Between Channels(2)	ΔR_{ON}	V_{IS}= 0V~0.4V IOUT=8mA		0.1	0.2	Ω
OFF Leakage Current	I_{LEAK}	$V_{C0+/-}$= 10V $V_{L1+/-}$= $V_{D2+/-}$ =0V		31	50	uA
SWITCH DYNAMICS						
On Capacitance	C_{ON}	$V_{C0+/-}$ = 0.2V, f= 1MHz		4		pF
Off Capacitance	C_{OFF}	$V_{C0+/-}$ = 0.2V, f= 1MHz		3		pF
Off Isolation	Off	f= 250MHz, R_T = 50Ω , C_L = 0pF		-38		dB
Crosstalk(3) (Channel-to-Channel)	X_{TALK}	f= 250MHz, R_T = 50Ω , C_L = 0pF		-41		dB
-3dB Bandwidth	BW	R_T=50 Ω , C_L=0pF Signal Power 0dBm	0.9	1		GHz
Break-Before-Make	BBM	$V_{L1+/-}$ = $V_{D2+/-}$ = 0.4V, R_L=50Ω		1.5		uS
Turn-on Time	t_{ON}	$V_{C0+/-}$ = 0.4V, R_L=50Ω _EN switches from High to Low		20		uS
Turn-off Time	t_{OFF}	$V_{C0+/-}$ = 0.4V, R_L=50Ω _EN switches from Low to High		1.2		uS
Propagation Delay	t_{PD}	$V_{C0+/-}$ = 0.4V, R_L=50Ω		200		pS
OVER VOLTAGE PROTECTION						
OVP Lockout Threshold	V_{OVP}	$V_{C0+/-}$ Rising Edge	4.6	4.9	5.2	V
OVP Hysteresis	V_{HYS}	$V_{C0+/-}$ Falling Edge		200		mV
Clamp Voltage on L1+/- and D2+/-	V_{CLAMP}	10V shorts to C0+/- with R_L= 1KΩ @ L1+/- and D2+/-		6.5	8	V
OVP Response Time	t_{FP}	10V shorts to C0+/- with R_L= 1KΩ @ L1+/- and D2+/-		200	300	nS
OVP Recovery Time	t_{FPR}	$V_{C0+/-}$ 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 Ron value from the channel with the highest max Ron value.

(3) Crosstalk is inversely proportional to source impedance

TYPICAL PERFORMANCE CURVES

T_A=25°C, VDD=3.0V, CAP=0. 1uF, unless otherwise noted

Fig 7. Switch Bandwidth or Insertion Loss

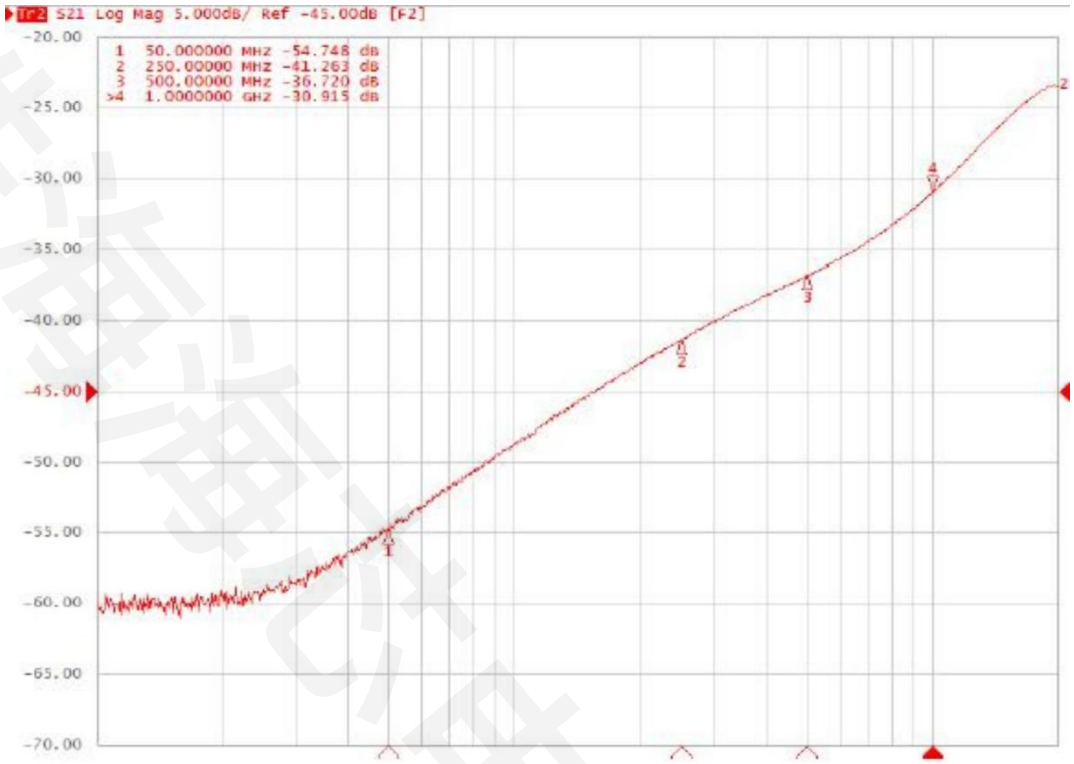


Fig 8. Switch Channel to Channel Cross-Talk

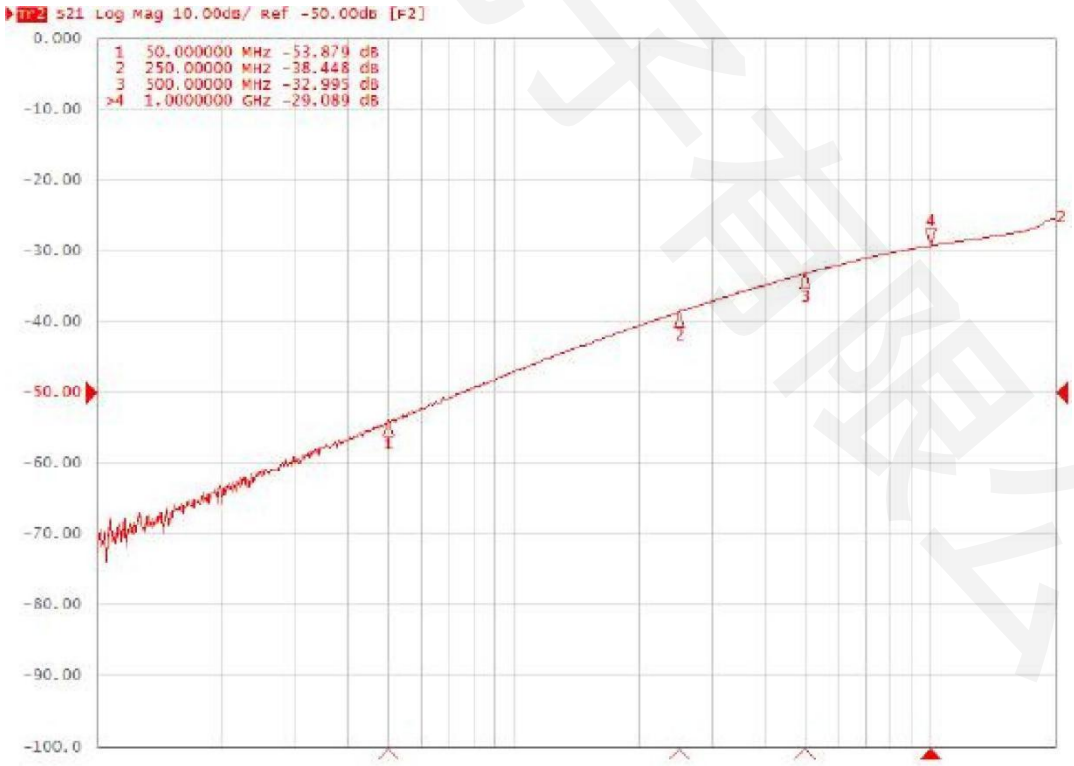
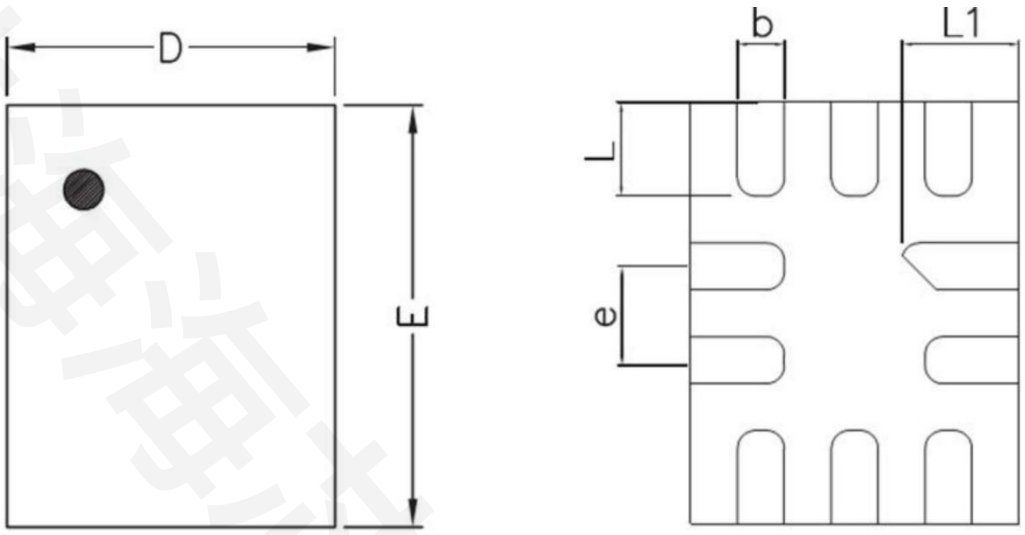
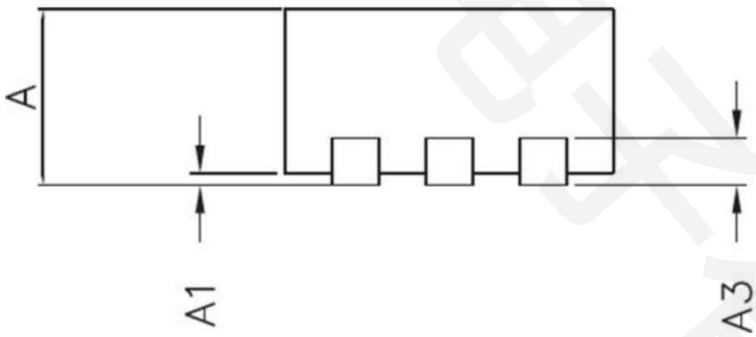


Fig 9. Switch Off Isolation

PACKAGE OUTLIHNE DIMENSIONS(All dimensions in mm.)

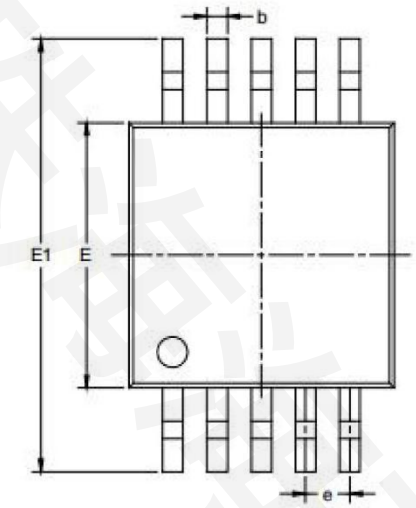
(1) Package Type: UQFN 1.4x1.8 -10L

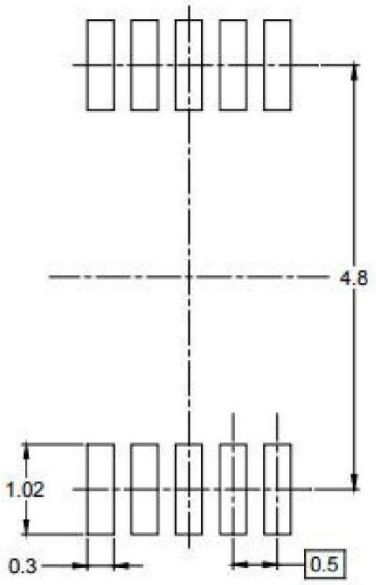




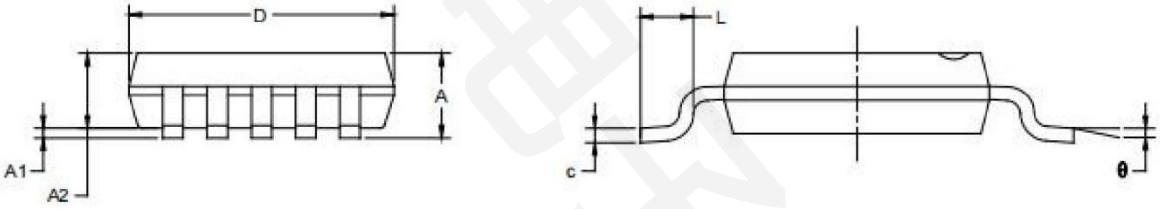
Symbol	Dimension in Millimeters	
	Min.	Max.
A	0.450	0.550
A1	0.000	0.050
A3	0.152 Ref.	
D	1.350	1.450
E	1.750	1.850
b	0.150	0.250
e	0.400 Typ.	
L	0.350	0.450
L1	0.450	0.550

(2) Package Type: MSOP10





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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- Any semiconductor product has a certain possibility of failure or malfunction under specific conditions. The buyer is responsible for complying with safety standards and taking safety measures when using our products for system design and overall manufacturing to avoid potential failure risks that may cause personal injury or property damage.
- The improvement of product quality is endless, our company will be dedicated to provide customers with better products.