

Dual 2:1 USB2.0 Mux/De-Mux With DC 30V Over-Voltage Protection

DESCRIPTION

The FSW7227 is a bidirectional low-power dual port, high-speed, USB 2.0 analog switch with integrated protection for USB Type-C™ systems. The device is configured as a dual 2:1 or 1:2 switch. It is optimized for use with the USB 2.0 DP/DM lines in a USB Type-C™ system.

The FSW7227 integrated over-voltage protection on the C0+/- pins can withstand up to DC 30V with automatic shutoff circuitry in order to protect system components behind the switch. GPIO controls of SEL and $\overline{\text{EN}}$ are 1.8V logic compatible.

The FSW7227 is available in UQFN 1.4x.18-10L and MSOP10 with Pb-free and Halogen-free making it a perfect candidate for mobile and space constrained applications.

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: $\pm 30\text{V}$
- 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	ORDERING NUMBER	PACKING OPTION
FSW7227	UQFN 1.4x1.8-10L	-40°C to +85°C	FSW7227YUWQ10G/TR	Tape and Reel, 3000
	MSOP10	-40°C to +85°C	FSW7227YMS10G/TR	Tape and Reel, 3000

PIN CONFIGURATION

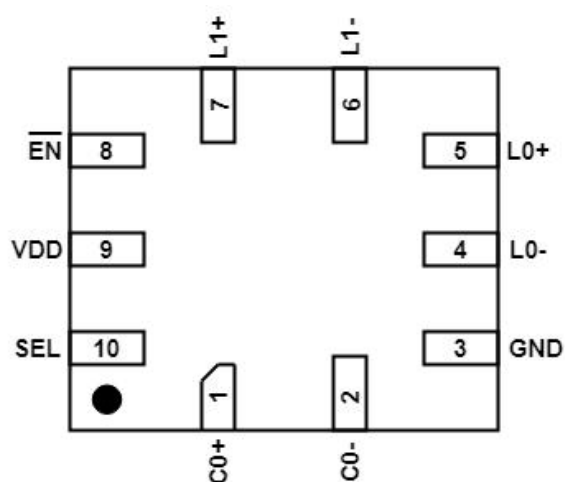


Figure 1. UQFN 1.4x1.8-10L

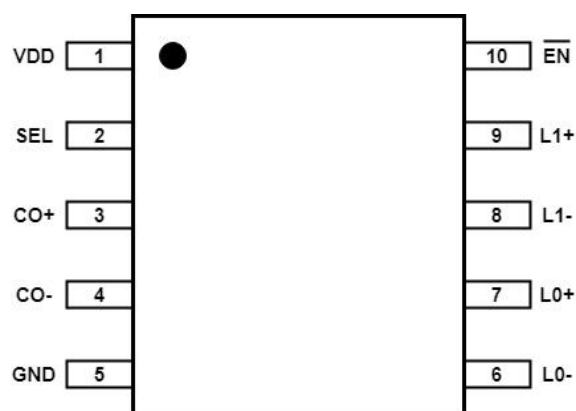


Figure 2. MSOP10

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: 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

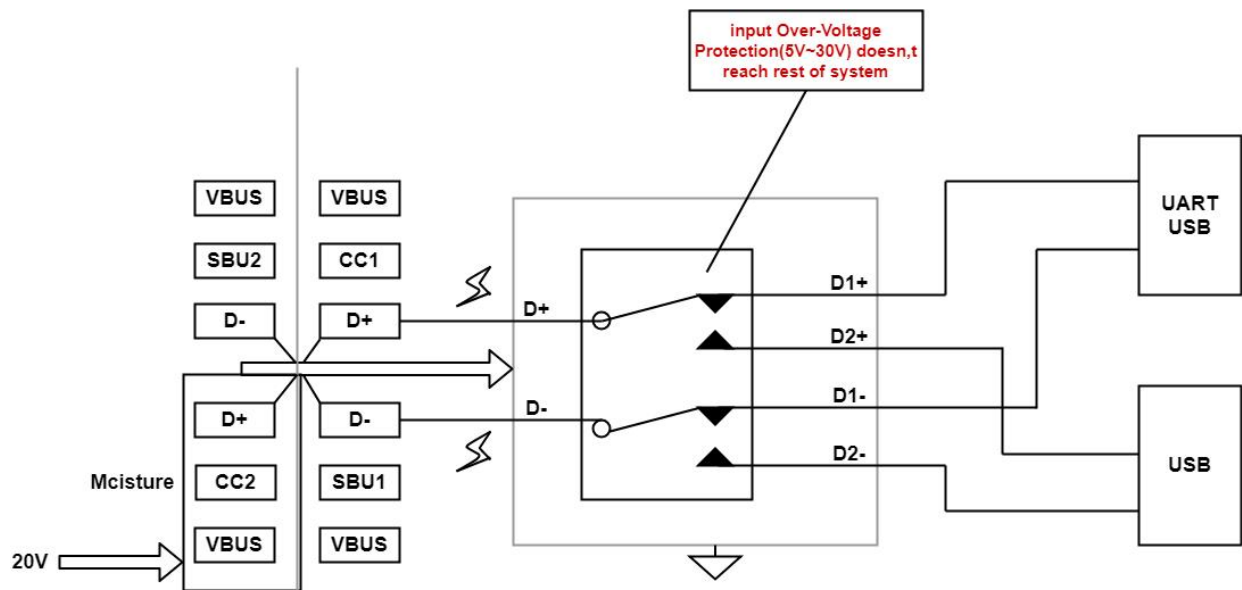


Figure 3. FSW7227 Application circuit

In addition, considering the power consumption requirements of portable products, FSW7227 is designed to minimize static power consumption. As shown in Figure 5 below, FSW7227 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

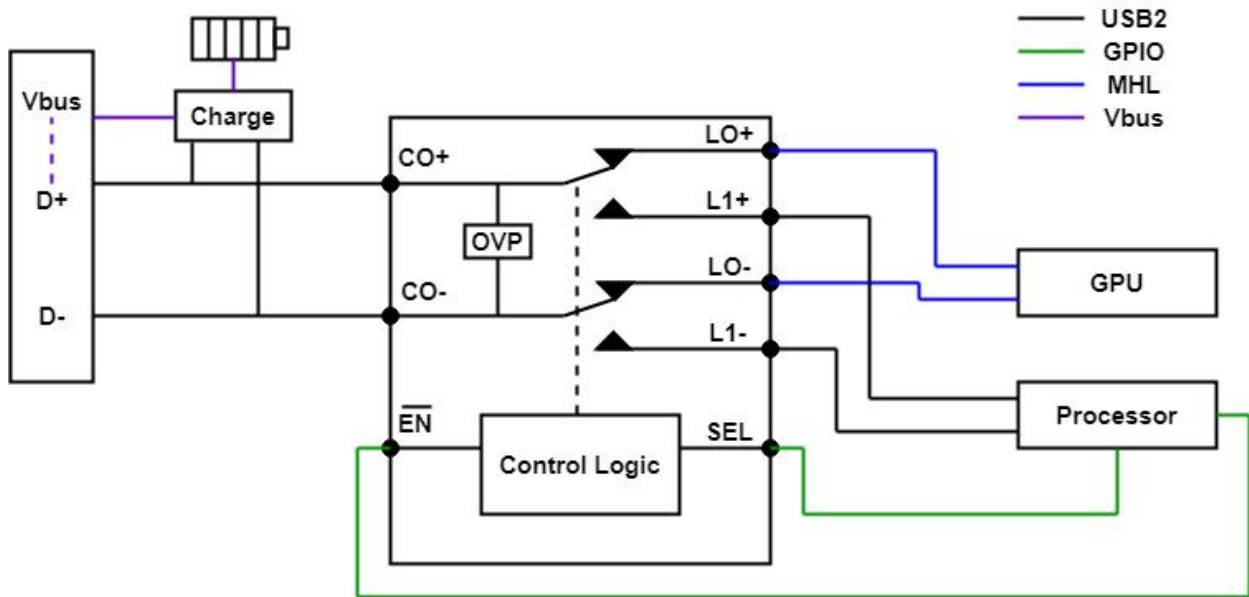


Figure 4. Function Diagram

FSW7227 Is a high-speed, low-power double knife / double throw (DPDT) analog switch with 30V overvoltage protection function, supporting power supply from 2.5V to 5.5V. FSW7227 Designed to switch high-speed USB 2.0 signals in handheld devices (such as mobile phones, digital cameras, and laptops, with hubs or controllers).

Overvoltage protection capability. As shown in Figure 5 below, FSW7227 has a special overvoltage protection circuit on the D + / D-pin. When the USB device is powered off or powered on, this circuit allows the device to withstand the Vbus short circuit to D + or D-up to 30V, ensuring that it is not damaged, and isolating the high voltage from the downstream circuit to protect the downstream circuit. The integration of the OVP circuit into the switch chip also greatly simplifies the design and reduces the size of the solution, solving the pain points in the practical applications of the designers. Please refer to the figure below.



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



Figure 6. FSW7227 High-pressure test

ELECTRICAL CHARACTERISTICS

($T_A=25^{\circ}\text{C}$, $V_{DD}=3.3\text{V}$, 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		MΩ
SWITCH ON RESISTANCE AND OFF LEAKAGE						
On-Resistance	RON	VIS= 0V~0.4V IOUT=8mA		10	11	Ω
RON Flatness ⁽¹⁾	RFLAT	VIS= 0V~0.4V IOUT=8mA		0.3	0.5	Ω
RON Matching Between Channels ⁽²⁾	ΔRON	VIS= 0V~0.4V IOUT=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, RT = 50Ω , CL = 0pF		-38		dB
Crosstalk ⁽³⁾ (Channel-to-Channel)	XTALK	f = 250MHz, RT = 50Ω , CL = 0pF		-41		dB
-3dB Bandwidth	BW	RT=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

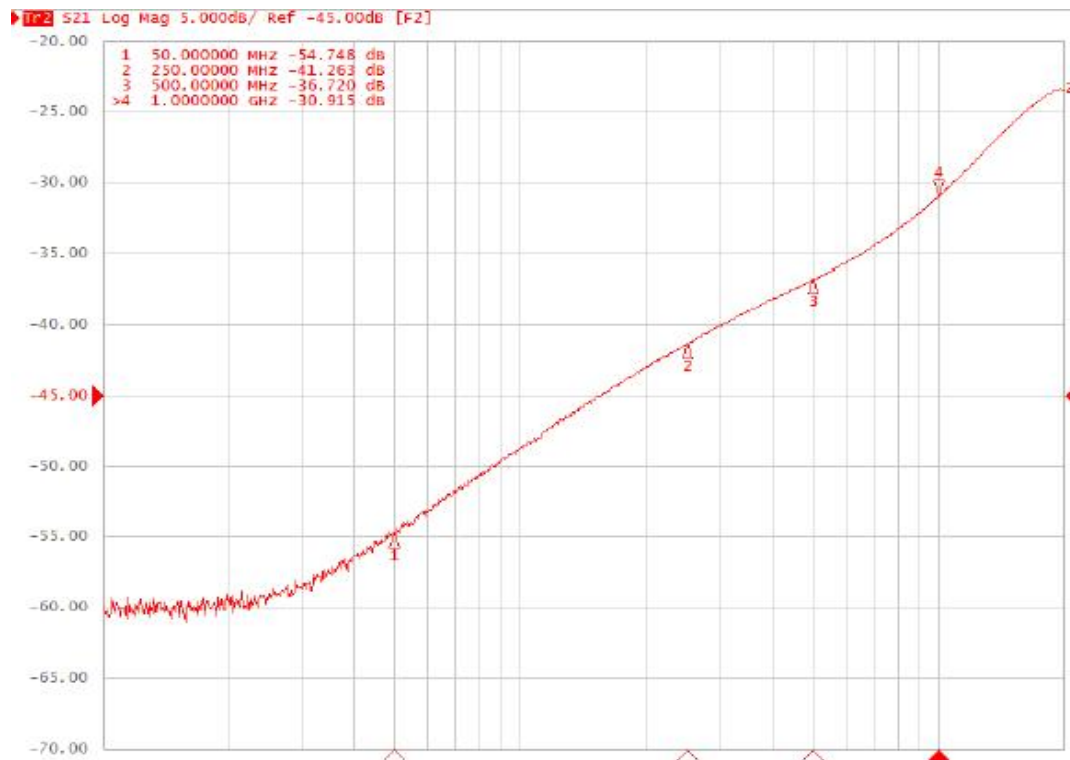


Fig 8. Switch Channel to Channel Cross-Talk

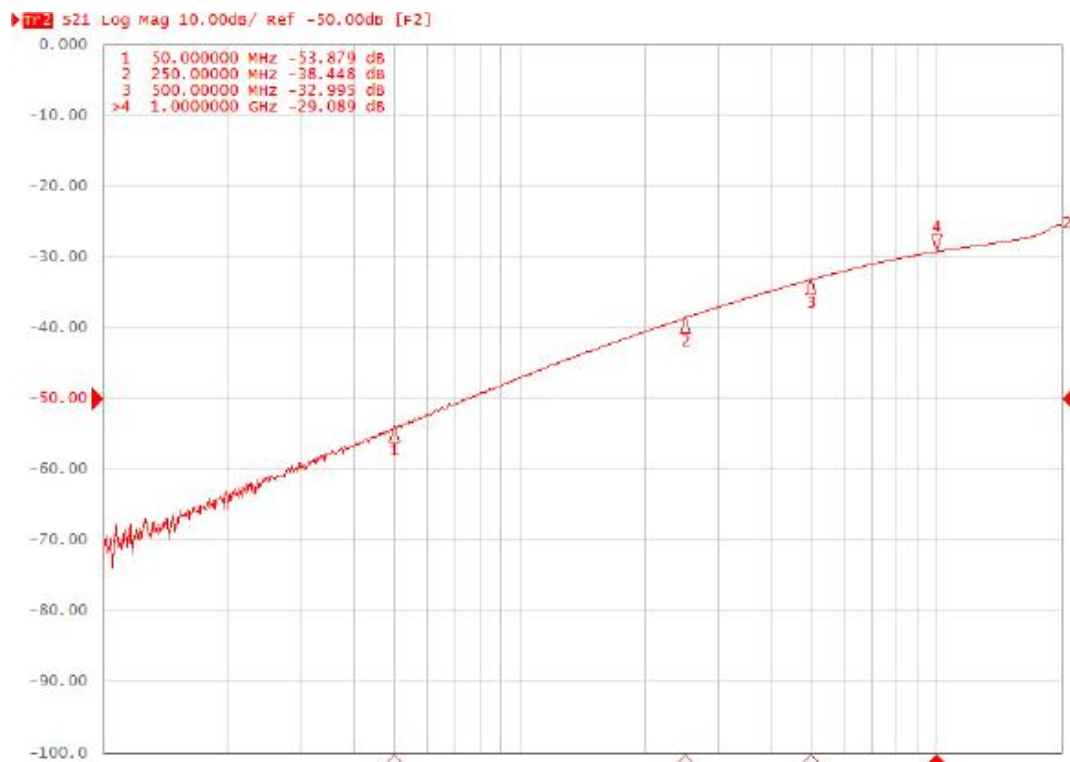
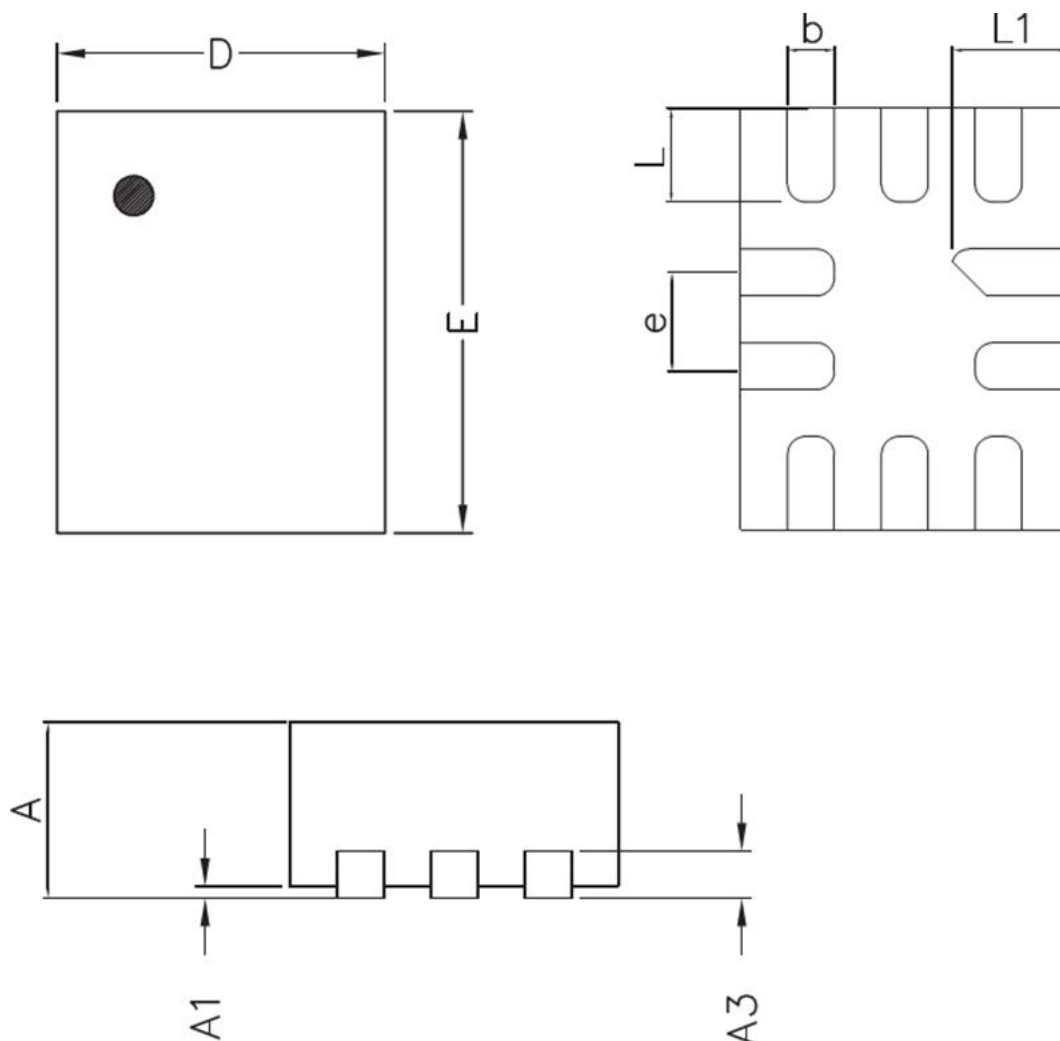


Fig 9. Switch Off Isolation

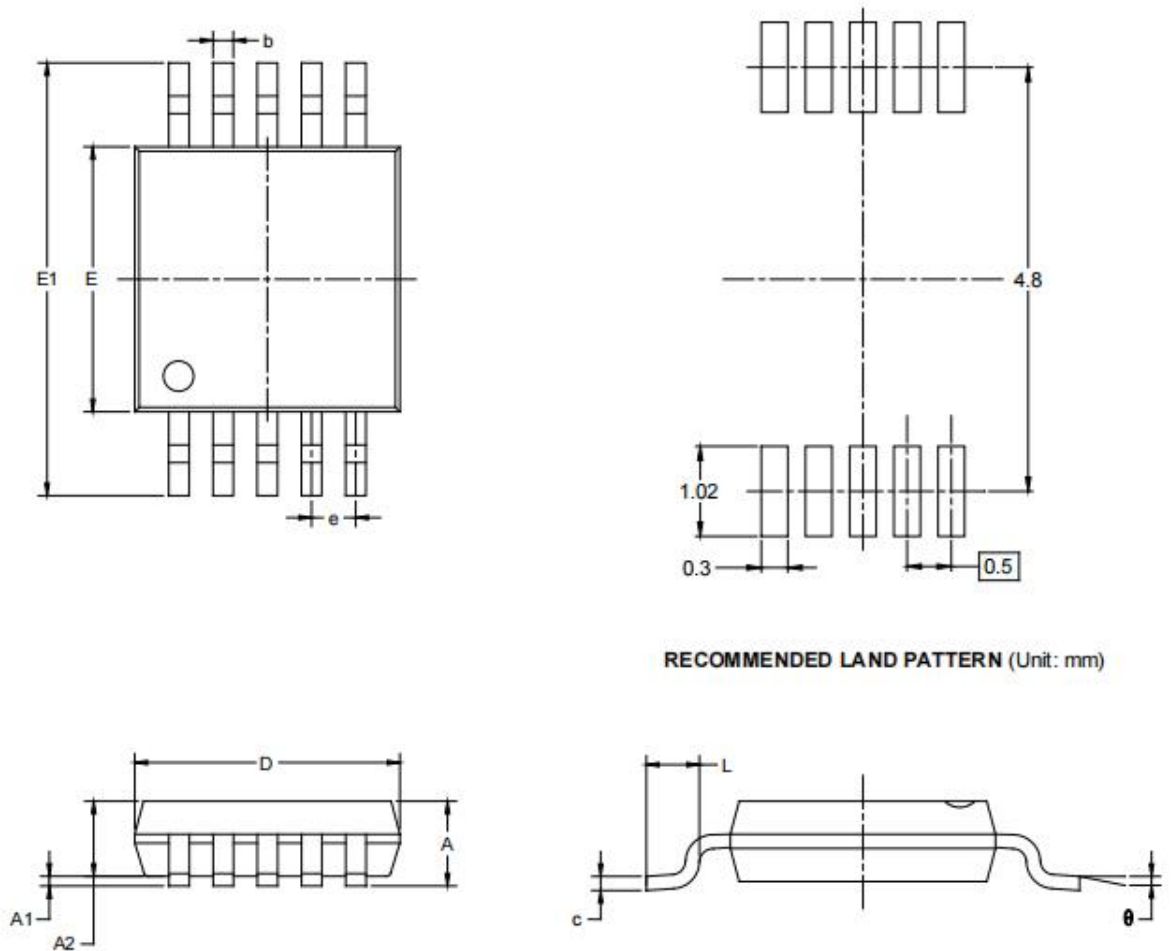
PACKAGE OUTLINE DIMENSIONS(All dimensions in mm.)

(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

(2) Package Type: MSOP10



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°

Important Notice And Disclaimer

- We reserves the right to change the instruction manual without prior notice.
- 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.

Version Modification Record

Version Number	Revision
first edition	
V1.0	1. Update the Important Notice And Disclaimer on page 11.