Low-Power, Two-Port, High-Speed, USB2.0 (480Mbps) DPDT Analog Switch BL1530

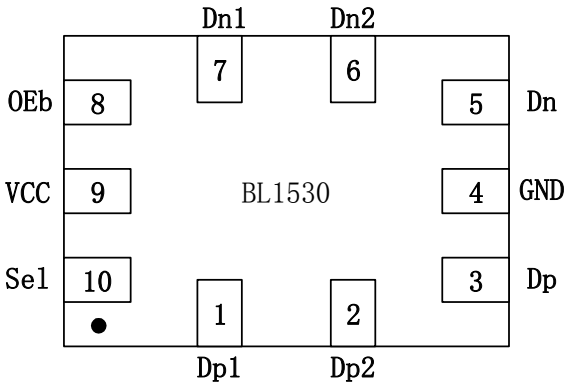
Description

The BL1530 is a Low-Power, Two-Port, High-Speed, USB2.0 (480Mbps) double –pole double-throw (DPDT) Analog Switch featuring an On-Resistance of 4.5 ohm at VCC=3V and a Low On Capacitance 3.7pf Typical.

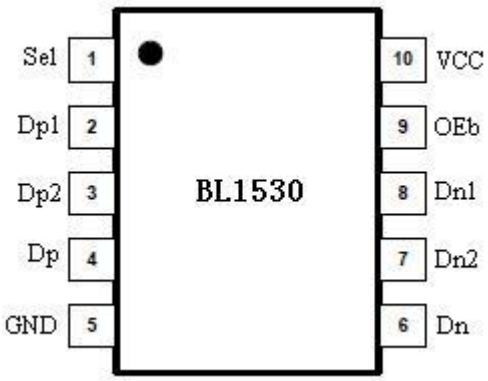
The BL1530 is compatible with the requirements of USB2.0 and the wide bandwidth needed to pass the third harmonic, resulting in signals with minimum edge and phase distortion. Superior channel-to channel crosstalk also minimizes interference. Break-before-make function for both parts eliminates signal disruption during switching from preventing both switches being enabled simultaneously.

The BL1530 contains special circuitry on the switch I/O pins for applications where the VCC supply is powered-off (VCC=0), which allows the device to withstand an over-voltage condition. This device is designed to minimize current consumption even when the control voltage applied to the Sel pin is lower than the supply voltage (VCC). This feature is especially valuable to ultra-portable applications, such as cell phones, allowing for direct interface with the general purpose I/Os of the baseband processor. Other applications include switching and connector sharing in portable cell phones, PDAs, digital cameras, printers, and notebook computers.

Pin Configuration



UTQFN1.8×1.4-10L



MSOP10L

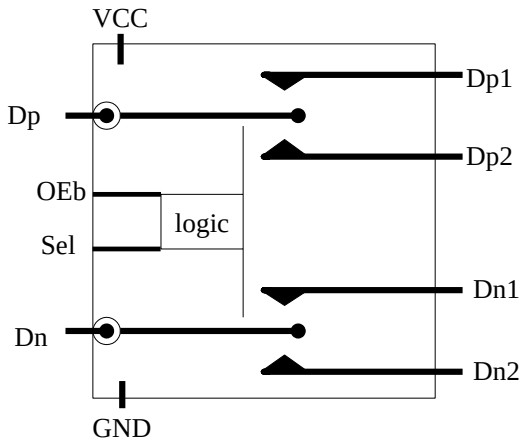
Features

- Wide Power Supply Range: 2.3V to 5V
- Low On Capacitance 3.7pf Typical
- Low On Resistance 4.5Ω (typ) at 3V VDD when V_{SW}=0.4V
- High Bandwidth (-3db): >720MHz without C_L and >550MHz with C_L=5pF
- Low Power Consumption: 1uA Maximum
- ESD: pass 8kV HBM test
- Over voltage tolerance (OVT) on all USB ports up to 5.25V without external components
- TTL/CMOS Compatible
- Break-Before-Make Switching
- Operation Temperature Range: -40℃ to 85℃
- UTQFN1.8×1.4-10L and MSOP10L Package

Applications

Cell phone, PDAs, Digital camera, Notebook, LCD Monitor, TV, SET-TOP BOX

Block Diagram



Function Table

OEb	Sel	Function
1	X	Disconnect
0	0	Dp, Dn=Dp1, Dn1
0	1	Dp, Dn=Dp2, Dn2

Pin Description

PIN num		Pin Name	Type	Description
UTQFN10L	MSOP10L			
1	2	Dp1	Input/Output	Data Port
2	3	Dp2	Input/Output	Data Port
3	4	Dp	Input/Output	USB Data BUS
4	5	GND	Ground	Ground
5	6	Dn	Input/Output	USB Data BUS
6	7	Dn2	Input/Output	Data Port
7	8	Dn1	Input/Output	Data Port
8	9	OEb	Input	Switch enable
9	10	VCC	PWR	Power Supply
10	1	Sel	Input	Switch select

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Units
DC Supply Voltage	VCC	-0.5	5.5	V
DC Switch Voltage	Dpn / Dnn / Dp / Dn	-0.5	VCC+ 0.3	V
DC Input Voltage	V_{Oeb} / V_{Sel}	-0.5	VCC	V
Continuous Current	$I_{(Dpn/Dnn/Dp/Dn)}$	-50	+50	mA
Peak Current(1)	$I_{PEAK(Dpn/Dnn/Dp/Dn)}$	-100	+100	mA
Operating Temperature Range	T_A	-40	85	℃

Notes:

(1) Pulsed at 1ms, 50% duty circle

(2) Stress beyond above listed “Absolute Maximum Ratings” may lead permanent damage to the device. These are stress ratings only and operations of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ORDERING INFORMATION

MODEL	PIN- PACKAGE	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING	ACKAGE OPTION
BL1530TQFN	UTQFN1.8×1.4-10L	- 40℃ to +85℃	IYW(1)	Tape and Reel, 3000
BL1530MSOP	MSOP10L	- 40℃ to +85℃	I1G YWW	Tape and Reel, 3000

WHERE(1):

"IYW" IS 3 DIGITS PRODUCTION ID COLOUR: LASER MARKING

"I" stands for the product BL1530.

"Y"stands for the product year, for example, "1" stands for the year 2011.

"W" stands for the product week, for example, "a" stands for the first week, "A" stands for the 27th week.

DC ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Conditions	Guaranteed Limit			Unit
			Min.	Typ.(1)	Max.	
Analog Switch						
Analog Signal Range	$V_{Pn}/V_{Nn}/V_p/V_n$		0		VCC	V
On-Resistance(2)	R_{ON}	VCC = 3V,V_{SW}=0.4V, I_{ON}=-8mA		4.5		Ω
On-Resistance Match Between Channels(3)	ΔR_{ON}	VCC = 3V,V_{SW}=0.4V, I_{ON}=-8mA		0.1		Ω
Current						
Source Off Leakage Current	$I_{Pn\ /\ Nn\ (OFF)}$	VCC=3.6V,V_p/V_n= 3.6/0.3V, V_{Pn}/V_{Nn}=0.3/3.6V	-1		1	uA
Channel on Leakage Current	$I_{Pn\ /\ Nn\ (ON)}$	VCC=3.6V,V_p/V_n= 3.6/0.3V, V_{Pn}/V_{Nn}=3.6/0.3V	-1		1	uA
POWER OFF leakage current	I_{OFF}	VCC = 0V,V_{SW}=0V to 3.6V, Vcontrol=0 or VCC	-1		1	uA
Quiescent supply current	I_{CC}	VCC=3V, Vcontrol=0 or VCC, Iout=0			1	uA
Increase in I_{CC} current per control voltage and VCC	I_{CCT}	VCC=3.6V, Vcontrol=2.6V			4	uA
Input Leakage Current	$I_{OEb\ /Sel}$	$V_{OEb\ /\ Sel}$ = 0 or VCC			1	uA
Digital I/O						
Input Voltage High	V_{IH}	VCC = 3.0-3.6V	1.6			V
Input Voltage Low	V_{IL}	VCC = 3.0-3.6V			0.5	V

Note:

(1) Typical characteristics are at +25℃

(2) Measured by the voltage drop between Dpn/Dnn and Dp/Dn pins at the indicated current through the switch. On resistance is determined by the lower of the voltage on the two (Dpn/Dnn and Dp/Dn ports).

(3) $\Delta R_{ON}= R_{ON(MAX)} - R_{ON(MIN)}$, between Dp and Dn .

DYNAMIC CHARACTERISTICS

Parameter	Symbol	Conditions	Guaranteed Limit			Unit
			Min.	Typ. (1)	Max.	
DRIVER CHARACTERISTICS						
Turn-On Time	t_{ON}	VCC=3.3V, R_L=50omh, C_L=5pF, V_{SW}=0.8V		10	30	ns
Turn-Off Time	t_{OFF}	VCC=3.3V, R_L=50omh, C_L=5pF,V_{SW}=0.8V		20	25	ns
Break-Before-Make Time	t_{BBM}	VCC=3.3V, R_L=50omh, C_L=5pF,$V_{SW1,2}$=0.8V	2.0	3	6.5	ns
Propagation Dalay	t_{PD}	VCC=3.3V, R_L=50omh, C_L=5pF		0.2		ns
CAPACITANCE						
Control Capacitance	C_{IN}	VCC=0V		1.5		pF
ON Capacitance	C_{ON}	VCC = 3.3V,OE=0V, f=240MHz		3.7		pF
OFF Capacitance	C_{OFF}	VCC = 3.3V,OE=3.3V, f=240MHz		2.0		pF
APPLICATION CHARACTERISTICS						
3dB Bandwidth	f_{3dB}	VCC = 3.3V,R_L=50omh,C_L=0pF		720		MHz
		VCC = 3.3V,R_L=50omh,C_L=5pF		550		MHz
Off Isolation(2)	V_{Iso}	VCC = 3.3V, R_L=50omh,f=250MHz		-30		dB
Channel crosstalk	XTALK	VCC = 3.3V, R_L=50omh,f=250MHz		-35		dB

Note:

(1) Typical characteristics are at 25℃

(2) Off Channel Isolation = $20\log_{10}[(V_{P1\backslash P2})/V_P]$ or $20\log_{10}[(V_{N1\backslash N2})/V_N]$

TEST SETUP CIRCUITS

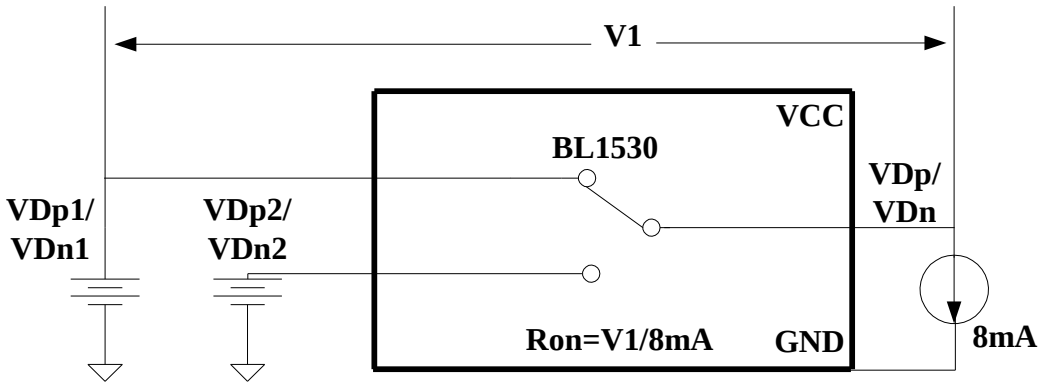


Figure1. Test Circuit for On Resister

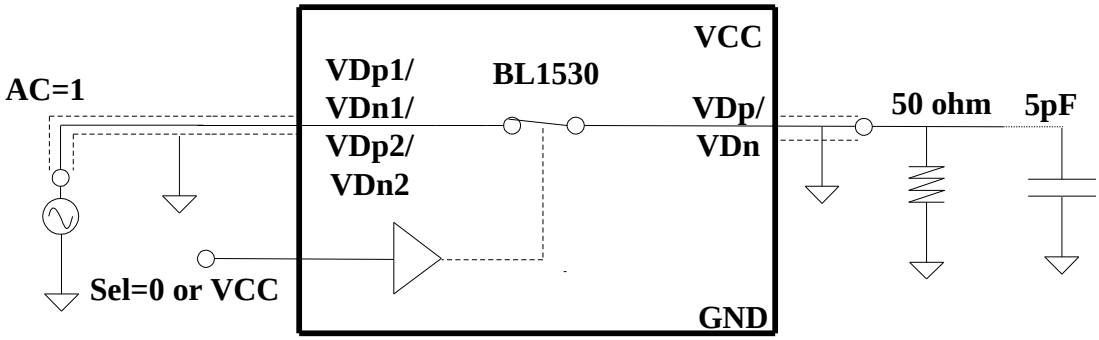


Figure2. Test Circuit for Bandwidth

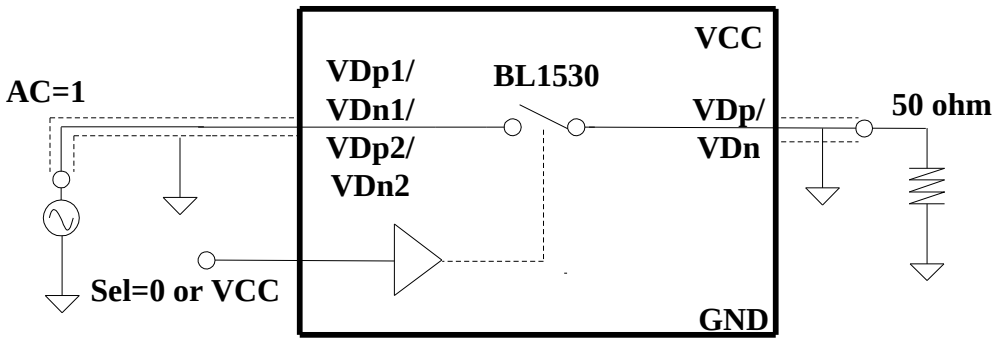


Figure3. Test Circuit for Off Isolation

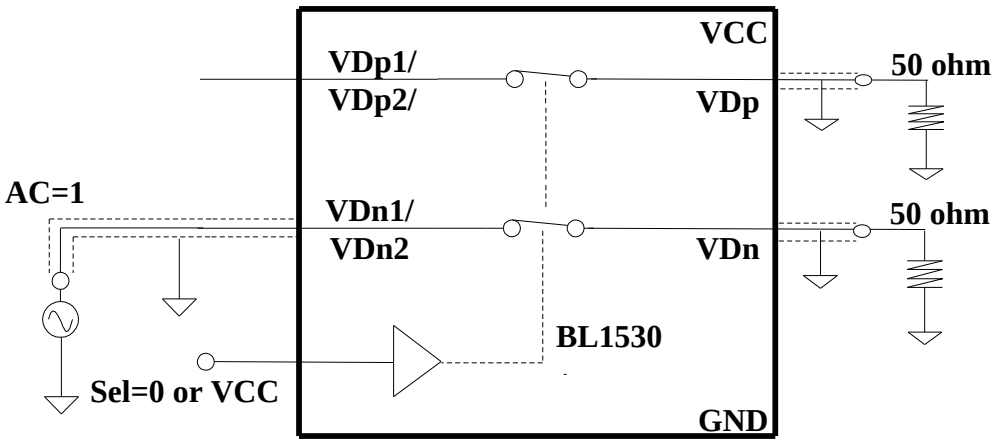
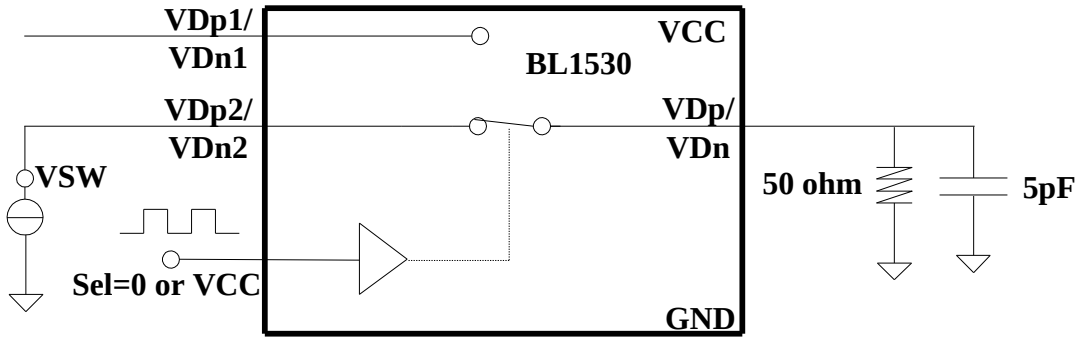
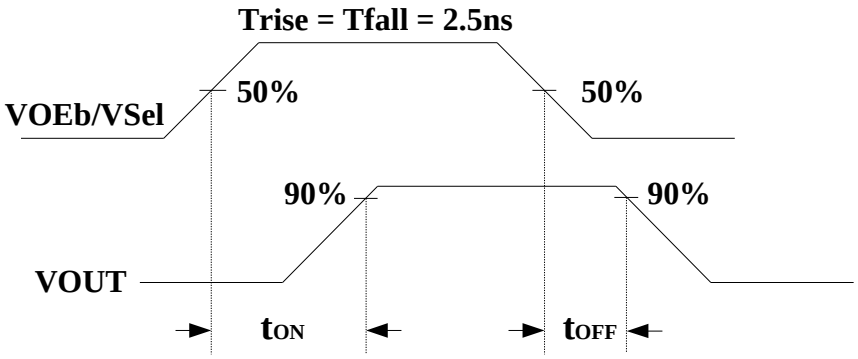
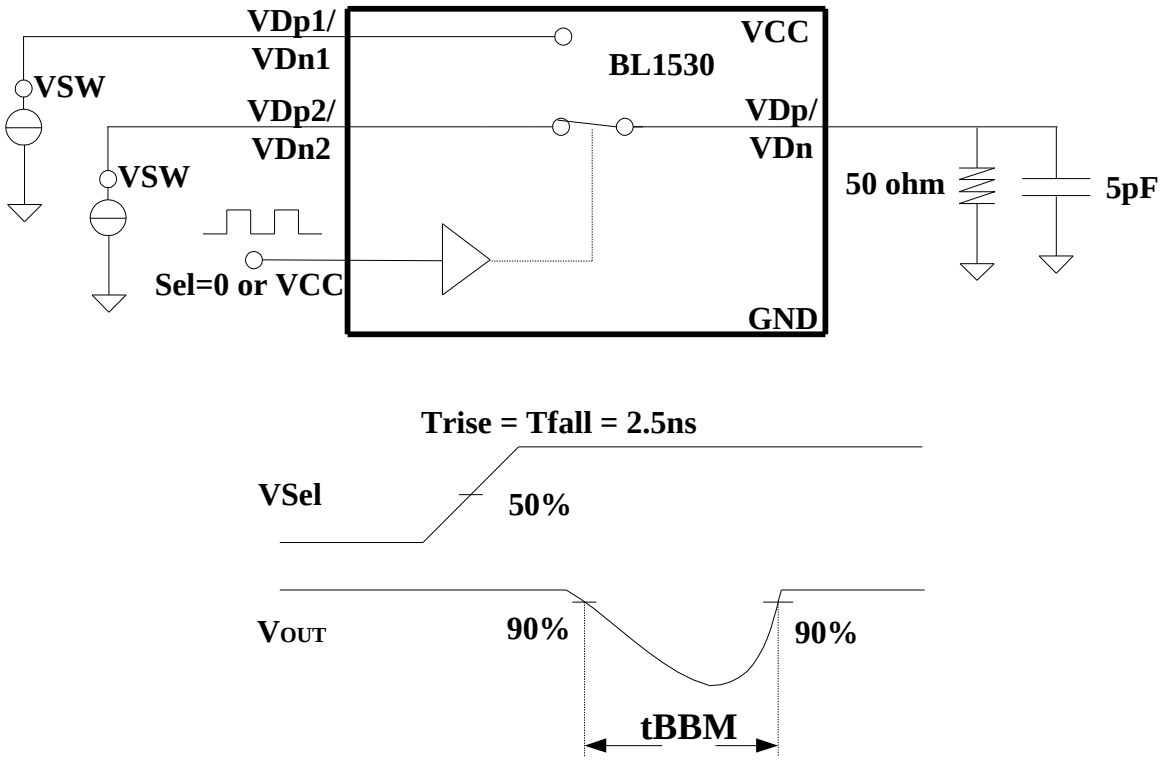


Figure4. Test Circuit for Crosstalk

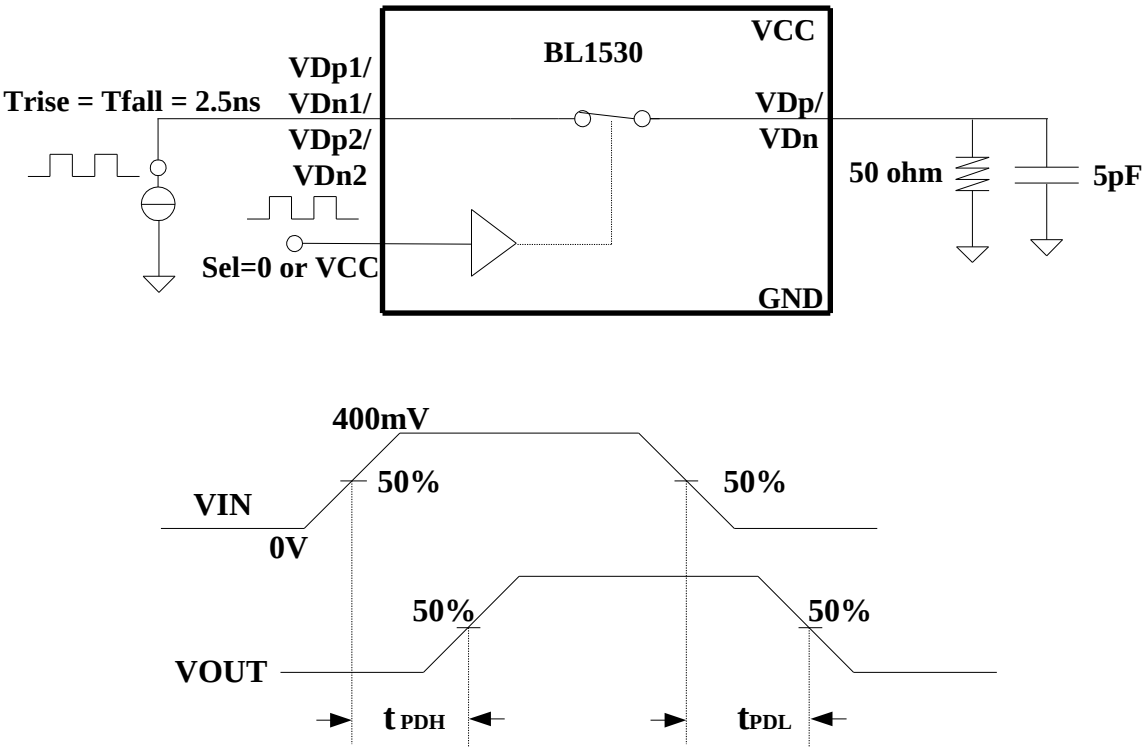




Test Circuit 5. Test Circuit for Switch Times



Test Circuit 5. Test Circuit for Break-Before-Make Time Delay, t_{BBM}



Test Circuit 6. Test Circuit for Propagation Delay, Tpd

APPLICATION NOTE

Meeting USB 2.0 V_{BUS} Short Requirements

(1) Power-Off Protection

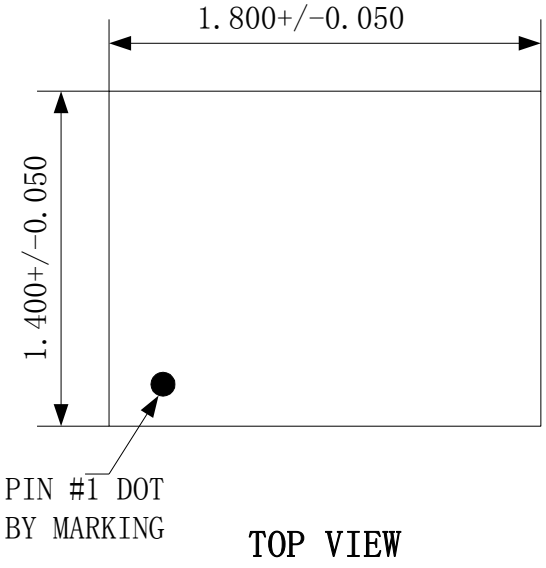
For a V_{BUS} short circuit the switch is expected to withstand such a condition for at least 24 hours. The BL1530 has the specially designed circuit which prevents unintended signal bleed through as well as guaranteed system reliability during a power-down, over-voltage condition. The protection has been added to the common pins (Dp, Dn).

(2) Power-On Protection

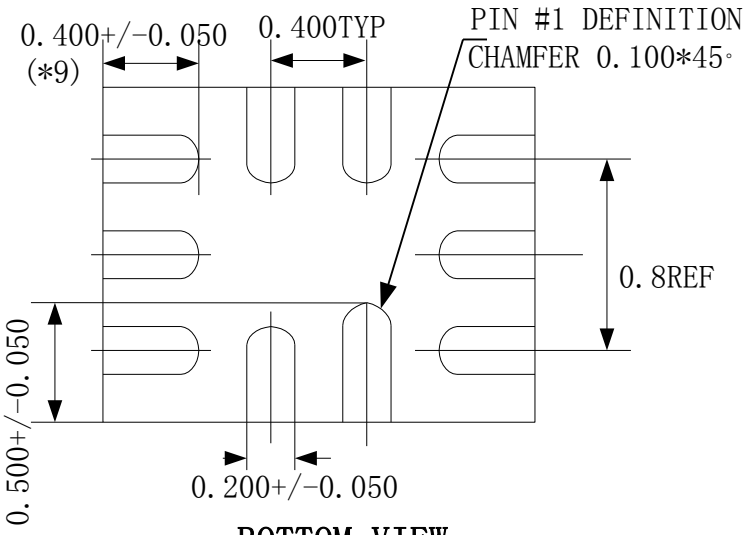
The USB 2.0 specification also notes that the USB device should be capable of withstanding a V_{BUS} short during transmission of data. This modification works by limiting current flow back into the VCC rail during the over-voltage event so current remains within the safe operating range.

PACKAGE OUTLINE DIMENSIONS (UTQFN1.8×1.4-10L)

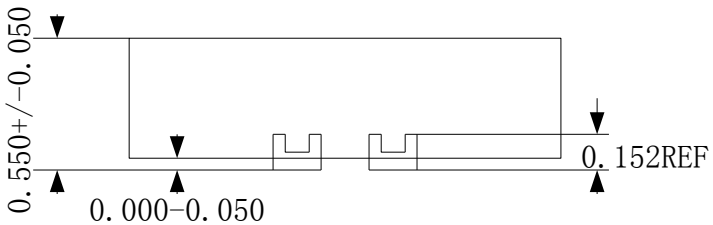
UTQFN1.8×1.4-10L



TOP VIEW



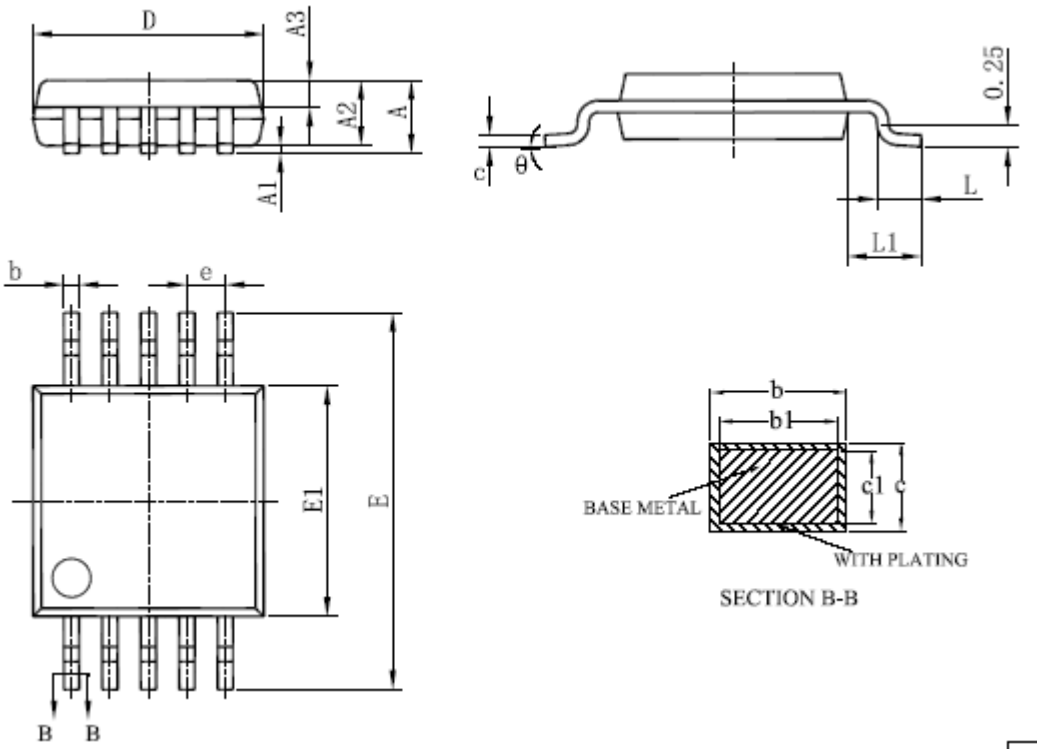
BOTTOM VIEW



SIDE VIEW

NOTE: All linear dimensions are in millimeters.

MSOP10L



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.10
A1	0.05	—	0.15
A2	0.75	0.85	0.95
A3	0.30	0.35	0.40
b	0.19	—	0.28
b1	0.18	0.20	0.23
c	0.15	—	0.20
c1	0.14	0.152	0.16
D	2.90	3.00	3.10
E	4.70	4.90	5.10
E1	2.90	3.00	3.10
e	0.50BSC		
L	0.40	—	0.70
L1	0.95BSC		
θ	0	—	8°
L/F载体尺寸 (mil)	71*96		