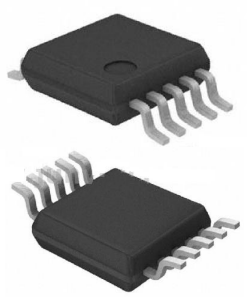
High-Speed USB2.0 DPDT Analog Switch

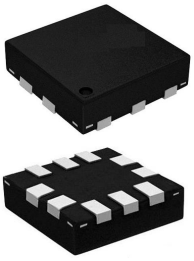
PRODUCT DESCRIPTION

The MSUSB30/MSUSB30N is a high-speed, low power-dissipation double-pole double-throw(DPDT) analog switch. The operating voltage range is +1.8V to +5.5V. It is featured by low bit-to-bit shift, high channel-to-channel noise isolation and wide bandwidth.

The main applications include the handheld devices and consumer electronics with USB2.0, such as mobile phone, digital camera, laptop and so on.



MSOP10



QFNWB10

FEATURES

- On-resistance : 4.5Ω typically at 3V
- Bit-to-Bit Shift : 50ps(Typ)
- Low Operating Voltage : +1.8V to +5.5V
- Fast Switch Speed
  On Time : 10ns
  Off Time : 22ns
- Crosstalk : -41dB at 250MHz
- Channel-to-Channel Isolation : -41dB at 250MHz
- Rail-to-Rail Input, Output Operation Range
- Industrial Temperature Range
- MSOP10, QFNWB10 Package

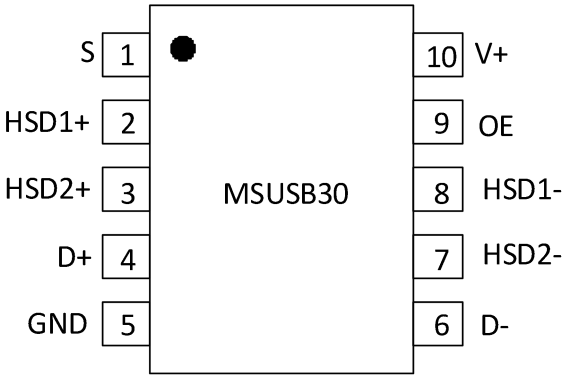
APPLICATIONS

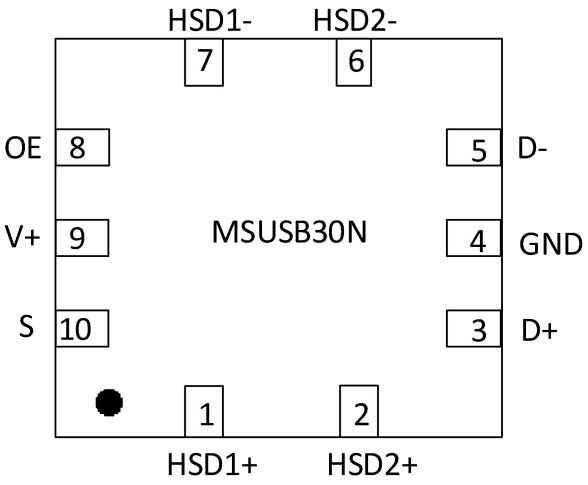
- Industry Automation
- Process Control
- Motion Control
- Handheld Device

PRODUCT SPECIFICATION

Part Number	Package	Marking
MSUSB30	MSOP10	MSUSB30
MSUSB30N	QFNWB10	7222

PIN CONFIGURATION





PIN DESCRIPTION

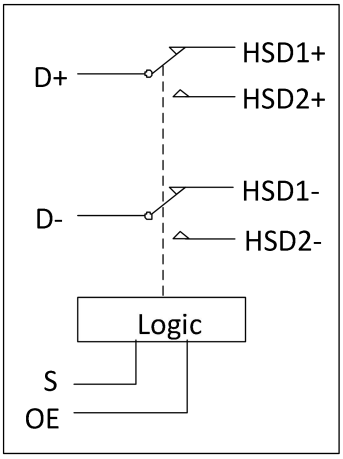
MSUSB30

Pin	Name	Type	Description
10	V+	-	Power Supply
5	GND	-	Ground
1	S	I	Select Terminal
9	OE	I	Output Enable
2,3, 8,7, 4,6	HSD1+, HSD2+, HSD1-, HSD2-, D+, D-	I/O	Data Terminal

MSUSB30N

Pin	Name	Type	Description
9	V+	-	Power Supply
4	GND	-	Ground
10	S	I	Select Terminal
8	OE	I	Output Enable
1,2, 7,6, 3,5	HSD1+, HSD2+, HSD1-, HSD2-, D+, D-	I/O	Data Terminal

BLOCK DIAGRAM



Function Table

OE	S	HSD1+ , HSD1-	HSD2+ , HSD2-
0	0	On	Off
0	1	Off	On
1	X	Off	Off

ABSOLUTE MAXIMUM RATINGS

Any exceeding absolute maximum rating application causes permanent damage to device. Because long-time absolute operation state affects device reliability. Absolute ratings just conclude from a series of extreme tests. It doesn't represent chip can operate normally in these extreme conditions.

Parameter	Range	Unit
Input, Power Supply Range	-0 ~ +6.0	V
Analog, Digital Voltage	-0 ~ +6.0	V
Maximum Current on Data Terminal	±100	mA
Maximum Peak Current on Data Terminal	±100	mA
Operating Temperature	-40 ~ +85	V
Maximum Junction	+150	℃
Storage Temperature	-60 ~ +150	℃
Maximum Lead Temperature (Soldering, 10s)	+260	℃
ESD(HBM)	8000	V

ELECTRICAL CHARACTERISTICS

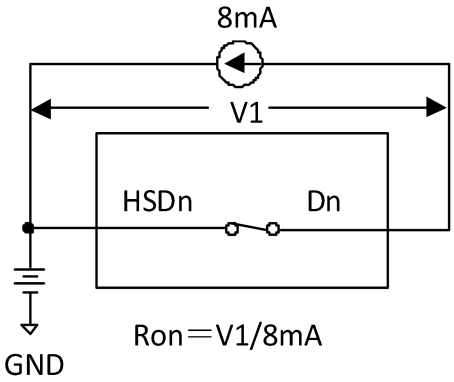
V+ = +1.8V to +5.5V, GND = 0V, VIH = +1.6V, VIL = +0.5V, TA = -40°C to + 85°C。

Typical values are tested at V+ = +3.3V, TA = +25°C, unless other noted.

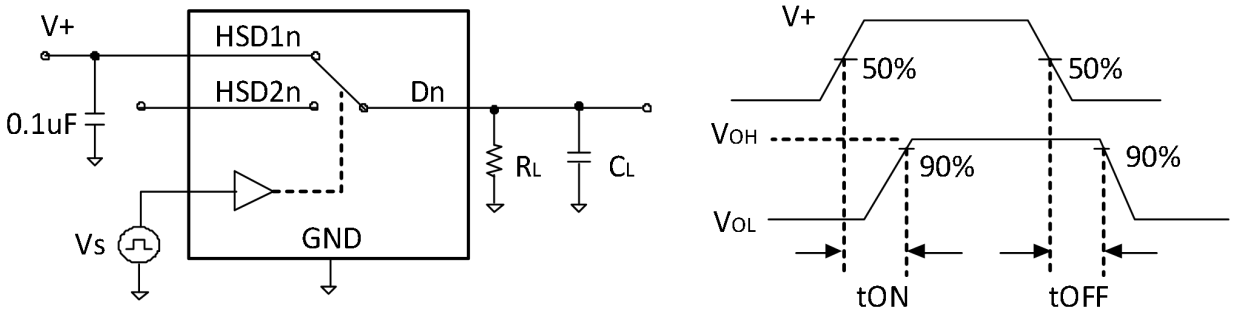
Parameter	Symbol	Condition	TA	Min	Typ	Max	Unit
Analog Switch							
Analog Input and Output Voltage	VIS		-40~85	0		V+	V
On-resistance	RON	Test Circuit1, V+ = 3.0V, VIS = 0~0.4V, ID = 8mA	+25		4.5	8.5	Ω
			-40~85			9	
On-resistance Match between Channels	ΔRON	Test Circuit1, V+ = 3.0V, VIS = 0~0.4V, ID = 8mA	+25		0.15	0.6	Ω
			-40~85			1.6	
On-resistance Flatness	RFLAT(ON)	Test Circuit 1, V+ = 3.0V, VIS = 0~1.0V, ID = 8mA	+25		1.5	2.0	Ω
			-40~85			2.6	
Power-down Leakage Current (D+,D-)	IOFF	V+ = 0V,VD = 0~3.6 V, VS ,VOE = 0 or 3.6 V	-40~85			1	uA
ICC Current Increment at Differential Control Voltages	ICCT	V+ = 3.6V, VS, VOE = 2.6 V	-40~85			5	uA
Off Leakage Current	IHSD2(OFF) IHSD1(OFF)	V+ = 3.6V, VIS = 3.3V / 0.3V, VD = 0.3V / 3.3V	-40~85			1	uA
On Leakage Current	IHSD2(ON) IHSD1(ON)	V+ = 3.6V, VIS = 3.3V / 0.3V, VD = 3.3V/ 0.3V or Float	-40~85			1	uA
Digital Input							
Input High Voltage	VIH		-40~85	1.6			V
Input Low Voltage	VIL		-40~85			0.5	V
Input Leakage Current	IIN	V+ = 3.0V, VS ,VOE = 0 or V+	-40~85			1	uA

Parameter	Symbol	Condition	TA	Min	Typ	Max	Unit
Dynamic Characteristics							
On Time	tON	Test Circuit 2, VIS = 0.8V, RL = 50Ω, CL = 10pF	+25		10		ns
Off Time	tOFF		+25		22		ns
Off-before-On Time	tD	Test Circuit 3, VIS = 0.8V, RL = 50Ω, CL = 10pF	+25		4		ns
Propagation Delay	tPD	RL = 50Ω, CL = 10pF	+25		0.3		ns
Off Isolation	OISO	Test Circuit 4, Signal= 0dBm, RL = 50Ω, f = 250MHz	+25		-35		dB
Channel-to-Channel Crosstalk	XTALK	Test Circuit 5, Signal= 0dBm, RL = 50Ω, f = 250MHz	+25		-41		dB
-3dB Bandwidth	BW	Test Circuit 6, Signal= 0dBm, RL = 50Ω, CL = 5pF	+25		550		MHz
Channel-to-Channel Skew	tSKEW	RL = 50Ω, CL = 10pF	+25				ns
Charge Injection from Select Terminal to Common I/O Terminal	Q	Test Circuit 7, VG = GND, CL = 1.0nF, RG = 0Ω, Q = CL x*VOUT	+25			11	pC
HSD, HSD-, D+, D- On-Capacitance	CON		+25				pF
Power Requirements							
Power Supply	V+		-40~85	1.8		5.5	V
Power Supply Current	I+	V+ = 3.0V, VS , VOE = 0V or V+	-40~85			1	uA

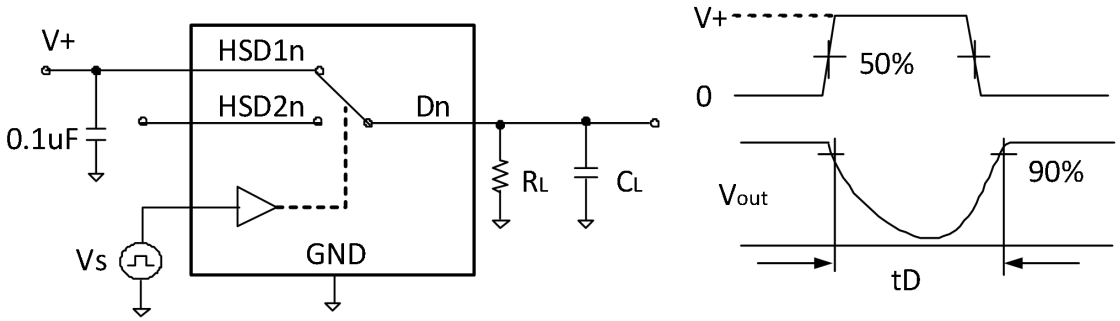
Test Circuit



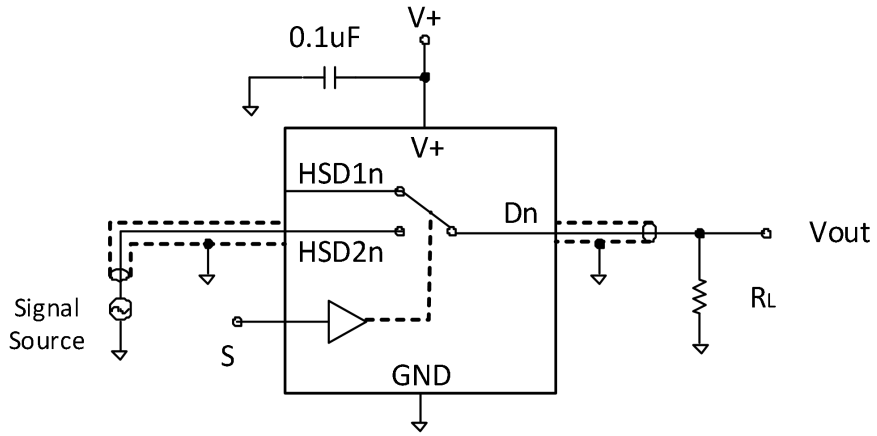
Test Circuit1. On-Resistance



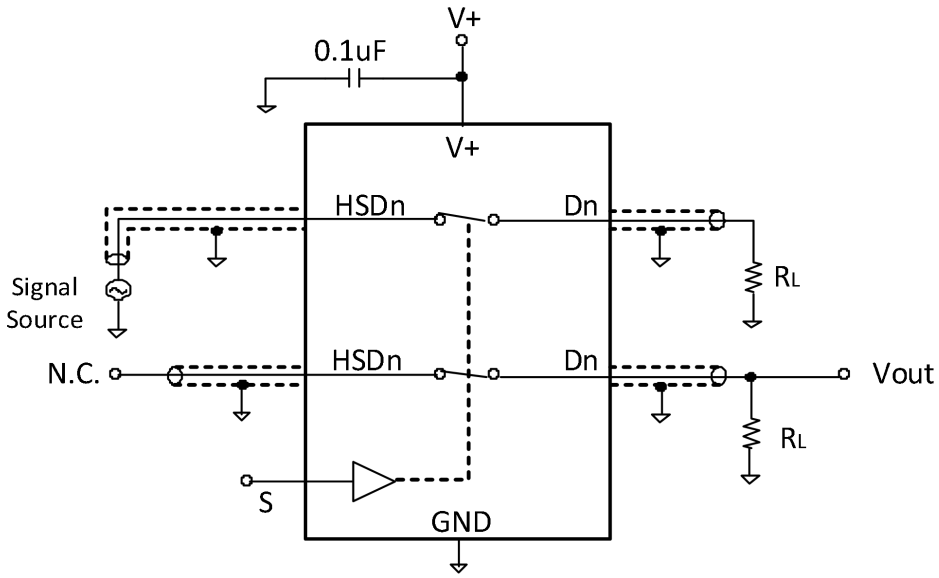
Test Circuit 2. Switch Time (tON, tOFF)



Test Circuit 3. Off-before-On Time (tD)

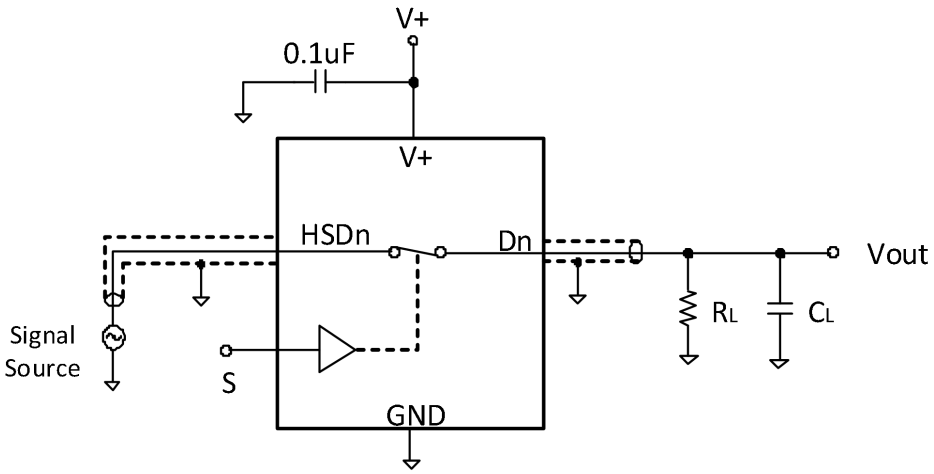


Test Circuit 4. Off Isolation

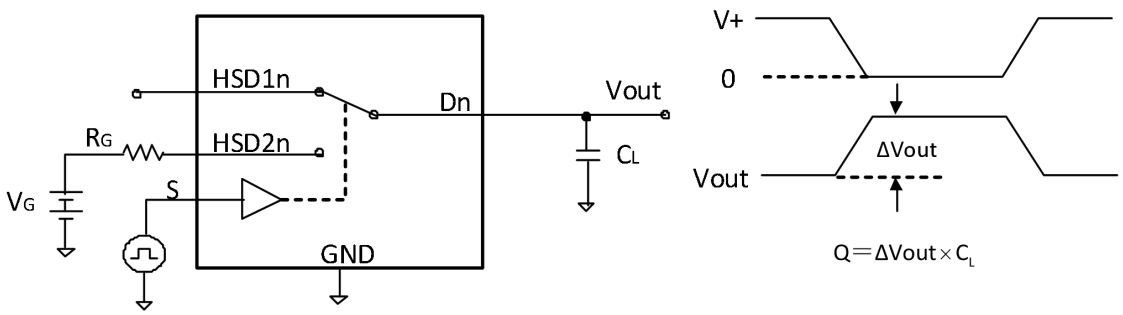


$$\text{Channel-to-Channel Crosstalk} = -20 \times \log \frac{V_{HSDn}}{V_{out}}$$

Test Circuit 5. Channel-to-Channel Crosstalk

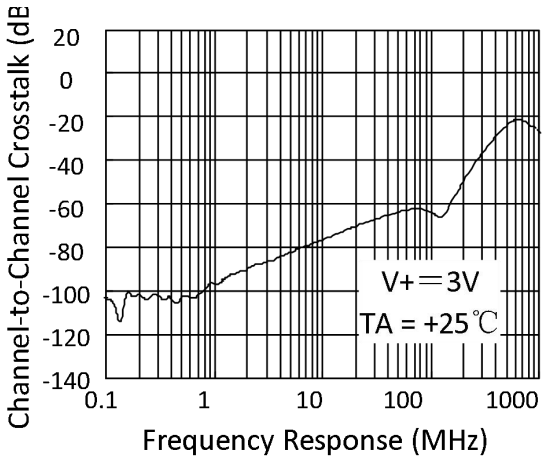


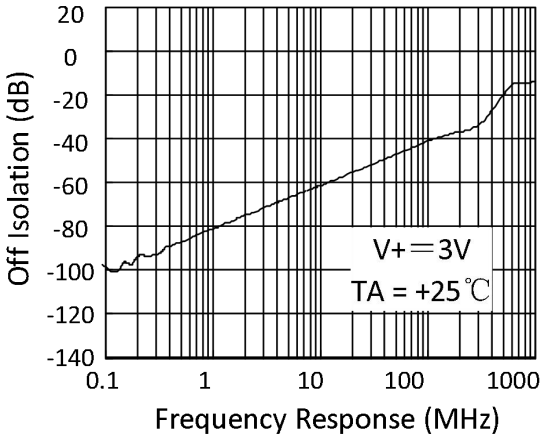
Test Circuit 6. -3dB Bandwidth



Test Circuit 7. Charge Injection (Q)

TYPICAL CHARACTERISTICS CURVES





APPLICATION NOTE

1. Meet USB2.0 Vbus Short-circuit Demand

In the selection 7.1.1 of USB2.0 specification, when USB device is powered down or powered on, it must be able to withstand Vbus shorted to D+ or D-. The MSUSB30/MSUSB30N can be successfully set to fully meet above two demands.

2. Power Down Protection

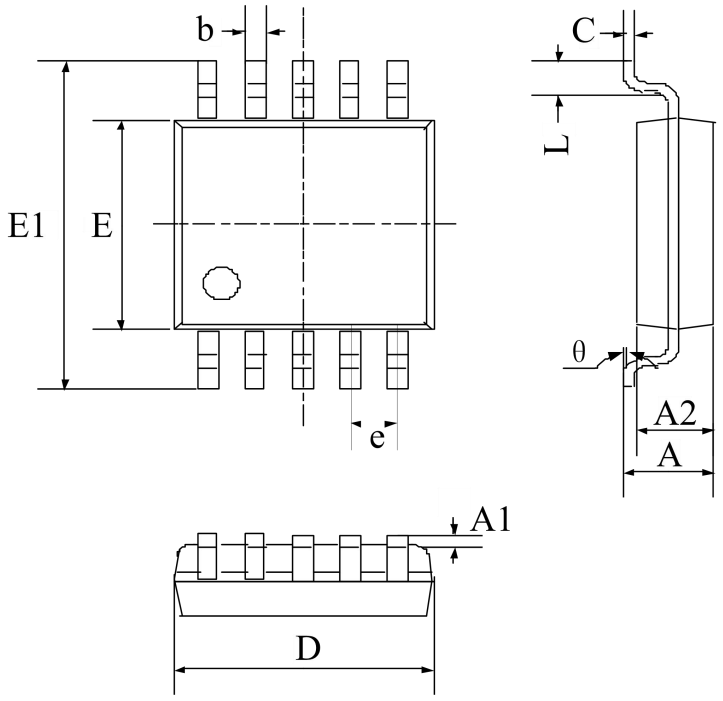
For Vbus shorted circuit, in this condition, the switch can withstand at least 24 hours. The MSUSB30/MSUSB30N has specified designed circuit to prevent the unintended signal passing. In addition, in the undervoltage and overvoltage conditions, system reliability is ensured. The protection circuit has been added to common terminal (D+, D-).

3. Power On Protection

USB2.0 specification also indicates that USB device can withstand shorted Vbus when data is transmitted. When overvoltage happens, the improvement could limit current flow to VCC, thus to make current remain within safe operating range.

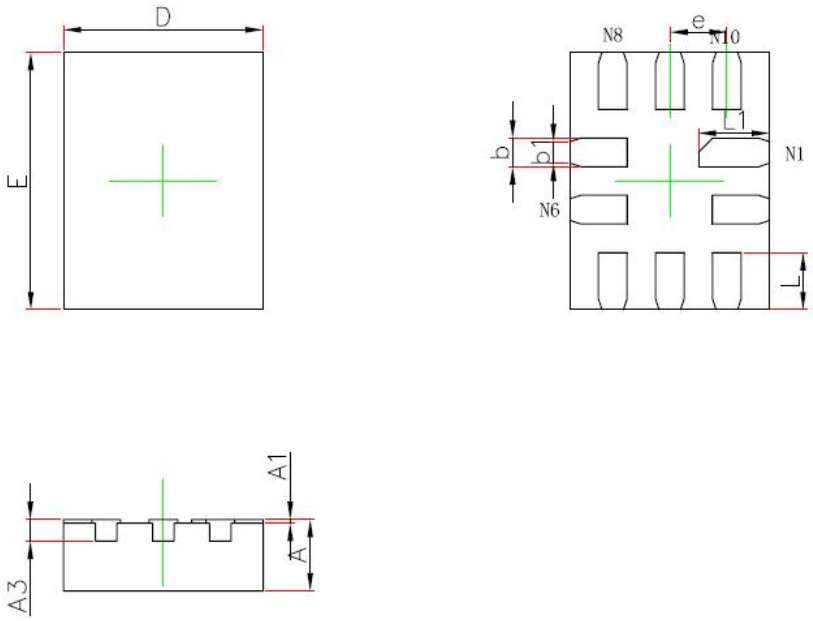
PACKAGE OUTLINE DIMENSIONS

MSOP10



Symbol	Dimensions in Millimeters	
	Min	Max
A	0.800	1.200
A1	0.000	0.200
A2	0.760	0.970
b	0.30 TYP	
c	0.152 TYP	
D	2.900	3.100
e	0.50 TYP	
E	2.900	3.100
E1	4.700	5.100
L	0.410	0.650
θ	0°	6°

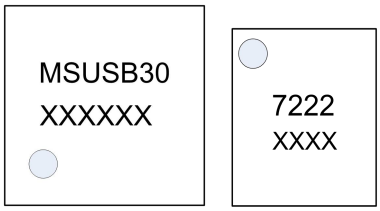
QFNWB10



Symbol	Dimensions in Millimeters	
	Min	Max
A	0.550	0.650
A1	0.000	0.050
A3	0.152REF	
D	1.350	1.450
E	1.750	1.850
D1	-	-
E1	-	-
k	-	
b	0.150	0.250
b1	0.100	0.200
e	0.400TYP	
L	0.350	0.450
L1	0.450	0.550

MARKING and PACKAGING SPECIFICATIONS

1. Marking Drawing Description



Product Name : MSUSB30, 7222

Product Code: XXXXXX, XXXX

2. Marking Drawing Demand

Laser printing, contents in the middle, font type Arial.

3. Packaging Specifications

Device	Package	Piece/Reel	Reel/Box	Piece/Box	Box/Carton	Piece/Carton
MSUSB30	MSOP10	3000	1	3000	8	24000
MSUSB30N	QFNWB10	3000	10	30000	4	120000

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MOS CIRCUIT OPERATION PRECAUTIONS

Static electricity can be generated in many places. The following precautions can be taken to effectively prevent the damage of MOS circuit caused by electrostatic discharge:

1. The operator shall ground through the anti-static wristband.
2. The equipment shell must be grounded.
3. The tools used in the assembly process must be grounded.
4. Must use conductor packaging or anti-static materials packaging or transportation.

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