

LOW POWER DUAL SPDT HI-SPEED USB 2.0 (480MBPS) SWITCH
IDTUS8030
Description

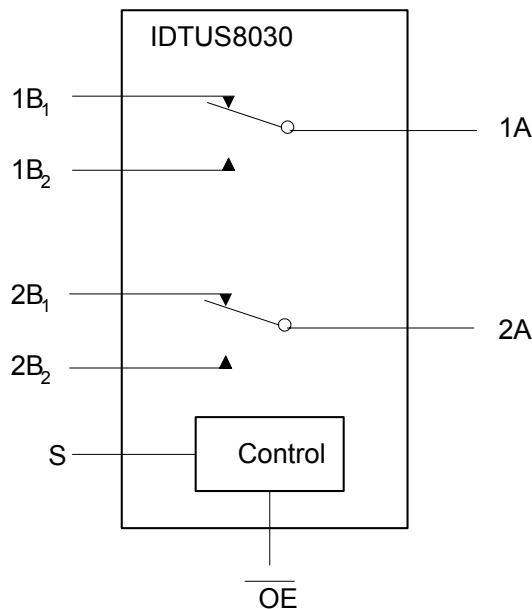
The IDTUS8030 is a low power, dual SPDT 2-port hi-speed USB 2.0 switch. This part is configured as a single pole, double throw switch and is optimized for switching or isolating a hi-speed (480 Mbps) source or a hi-speed and full-speed (12 Mbps) source. The IDTUS8030 is compatible with the requirements of USB2.0 and features an extremely low ON capacitance (C_{ON}) of 3.7 pF. The wide bandwidth of this device (>720 MHz) exceeds the bandwidth needed to pass the 3rd harmonic, resulting in signals with minimum edge and phase distortion. Superior channel-to-channel crosstalk also minimizes interference.

Applications

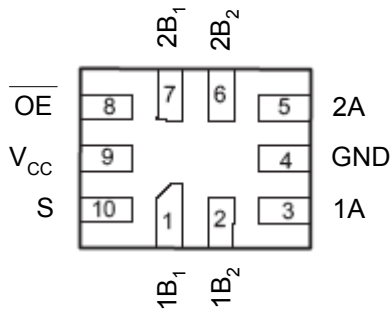
- Notebooks, PDAs
- Cellular phones, Digital cameras
- LCD monitors, TVs, Set-top Boxes

Features

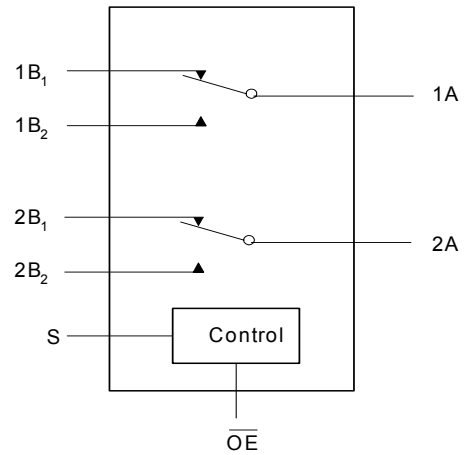
- Low On capacitance, 3.7 pF (typical)
- Low On resistance, 6.5Ω (typical)
- Low power consumption (1 μ A maximum)
 - 10 μ A maximum ICCT over an expanded control voltage range ($V_{IN}=2.6$ V, $V_{CC}=4.3$ V)
- Wide -3dB bandwidth, > 850 MHz
- Bi-directional operation
- 8 kV ESD protection
- Packaged in RoHS compliant 10-lead μ MLP (1.4 x1.8mm)
- Industrial temperature range (-40 to +85°C)

Block Diagram


Pin Assignment (10 μ MLP)



Analog Symbol



Truth Table

S	\overline{OE}	Function
X	H	Disconnect
L	L	A = B ₁
H	L	A = B ₂

Pin Descriptions

Pin Name	Pin Description
\overline{OE}	Bus switch enable
S	Select Input
A	Bus A
B ₁ , B ₂	Bus B

Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the IDTUS8030. These ratings, which are standard values for IDT commercially rated parts, are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect product reliability. Electrical parameters are guaranteed only over the recommended operating temperature range. All voltages referenced to ground.

Symbol	Parameter	Rating
V_{CC}	Supply Voltage	-0.5 V to 4.6 V
V_{CNTRL}	DC Input Voltage ¹	-0.5 V to 4.6 V
V_{SW}	DC Switch Voltage ¹	-0.5 V to $V_{CC} + 0.3$ V -0.5 V to 5.25 V
I_{IK}	DC Input Diode Current	-50 mA
I_{OUT}	DC Output Current	50 mA
T_{STG}	Storage Temperature	-65°C to 150°C
ESD	ESD (Human Body Mode) All Pins I/O to GND	8.0 kV 8.0 kV

Recommended Operating Conditions ²

Symbol	Parameter	Rating
V_{CC}	Supply Voltage	3.0 V to 4.3 V
V_{SW}	Switch Voltage	0V to V_{CC}
V_{IN}	Control Input Voltage	0V to V_{CC}
T_A	Operating Temperature	-40°C to +85°C

Note 1: The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed. DC switch voltage may never exceed 4.6V

Note 2: Control input must be held HIGH or LOW and it must not float.

DC Electrical Characteristics

Unless stated otherwise, typical values are at 25°C

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = -40°C to +85°C			Units
				Min.	Typ.	Max.	
V _{IK}	Clamp Diode Voltage	I _{IN} = -18 mA	3.0			-1.2	V
V _{IH}	Input Voltage HIGH		3.0 to 3.6	1.3			V
			4.3	1.7			
V _{IL}	Input Voltage LOW		3.0 to 3.6			0.5	V
			4.3			0.7	
I _{IN}	Control Input Leakage	V _{SW} = 0V to V _{CC}	4.3	-1.0		1.0	μA
I _{OZ}	OFF State Leakage	0 ≤ Dn, HSD1 _n , HSD2 _n ≤ V _{CC}	4.3	-2.0		2.0	μA
I _{OFF}	Power OFF Leakage Current (D+, D-)	V _{SW} = 0V to 4.3 V V _{CC} = 0V	0	-2.0		2.0	μA
R _{ON}	Switch On Resistance ¹	V _{SW} = 0.4 V, I _{ON} = -8 mA	3.0		6.5	10.0	Ω
		V _{SW} = 0V, I _O = 30 mA @ 25°C	3.6			7.0	
ΔR _{ON}	Delta R _{ON} ²	V _{SW} = 0.4 V, I _{ON} = -8 mA	3.0		0.35	1	Ω
R _{ON} Flatness	R _{ON} Flatness ¹	V _{SW} = 0V to 1.0 V, I _{ON} = -8 mA	3.0		2.0		Ω
I _{CC}	Quiescent Supply Current	V _{CNTRL} = 0V or V _{CC} , I _{OUT} = 0	4.3		1.0		μA
I _{CCT}	Increase in I _{CC} Current per Control voltage and V _{CC} levels	V _{CNTRL} (Control Input) = 2.6 V	4.3			10.0	μA

Notes:

- Measured by the voltage drop between A and B pins at the indicated current through the switch. On Resistance is determined by the lower of the voltage on the two pins.
- Guaranteed by design.

AC Electrical Characteristics

Unless stated otherwise, typical values are for V_{CC} = 3.3 V at 25°C

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = -40°C to +85°C			Units
				Min.	Typ.	Max.	
t _{ON}	Turn ON Time S, \overline{OE} to output	V _{IN} = 0.8 V, R _L = 50Ω, C _L = 5 pF	3.0 to 3.6		13.0	30.0	ns
t _{OFF}	Turn OFF Time S, \overline{OE} to output	V _{IN} = 0.8 V, R _L = 50Ω, C _L = 5 pF	3.0 to 3.6		12.0	25.0	ns
t _{PD}	Propagation Delay ¹	R _L = 50Ω, C _L = 5 pF	3.3		0.25		ns
T _{BMM}	Break-Before-Make	V _{IN} = 0.8 V, R _L = 50Ω, C _L = 5 pF	3.0 to 3.6	2.0		6.5	ns
O _{IRR}	OFF Isolation (non-adjacent)	R _T = 50Ω, f = 240 MHz	3.0 to 3.6		-30.0		dB
Xtalk	Non-adjacent Channel Crosstalk	R _T = 50Ω, f = 240 MHz	3.0 to 3.6		-45.0		dB
BW	-3dB Bandwidth	R _T = 50Ω, C _L = 0 pF	3.0 to 3.6		850		MHz
		R _T = 50Ω, C _L = 5 pF			650		

Note 1: Guaranteed by design.

USB Hi-Speed Related AC Electrical Characteristics

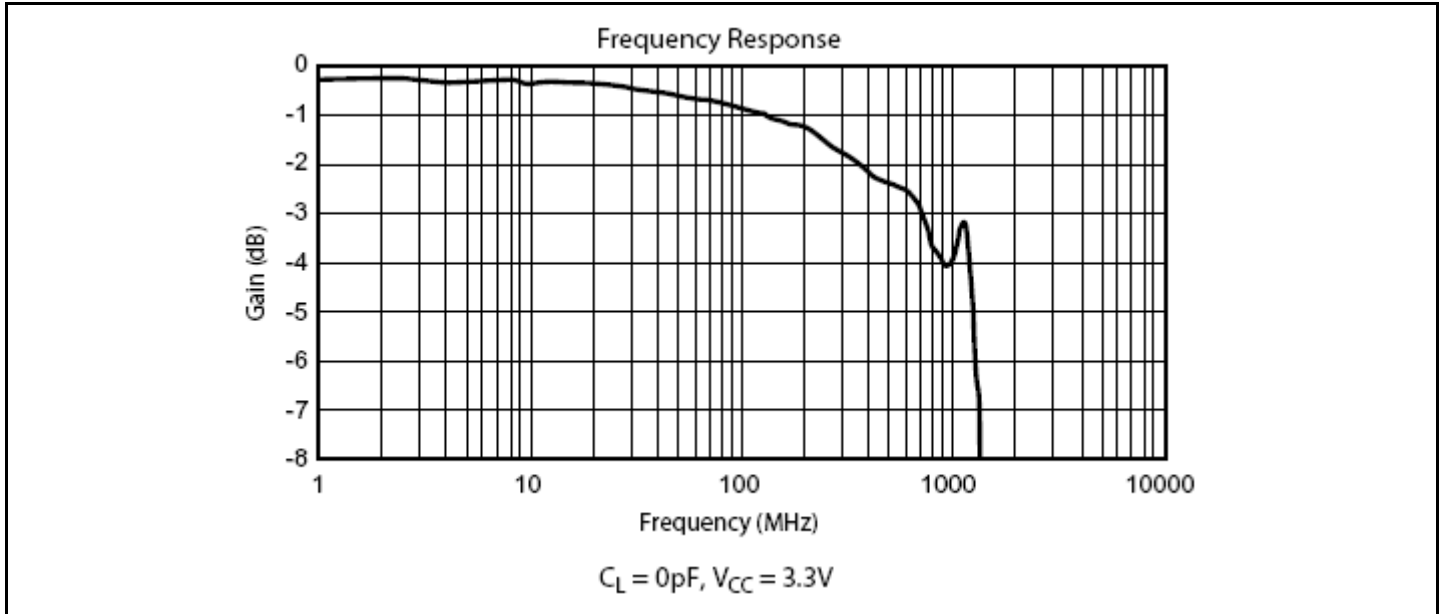
Symbol	Parameter	Conditions	V _{CC} (V)	T _A = -40°C to +85°C			Units
				Min.	Typ.	Max.	
t _{SK(O)}	Channel-to-channel Skew ¹	C _L = 5 pF, R _L = 50Ω	3.0 to 3.6		50.0		ps
t _{SK(P)}	Skew of the Opposite Transitions of the Same Output ¹	C _L = 5 pF, R _L = 50Ω	3.0 to 3.6		20.0		ps
t _J	Total Jitter ¹	R _L = 50Ω, C _L = 5 pF, t _R = t _F = 500 ps at 480 Mbps (PRBS = 2 ¹⁵ - 1)	3.0 to 3.6		200		ps

Note 1: Guaranteed by design.

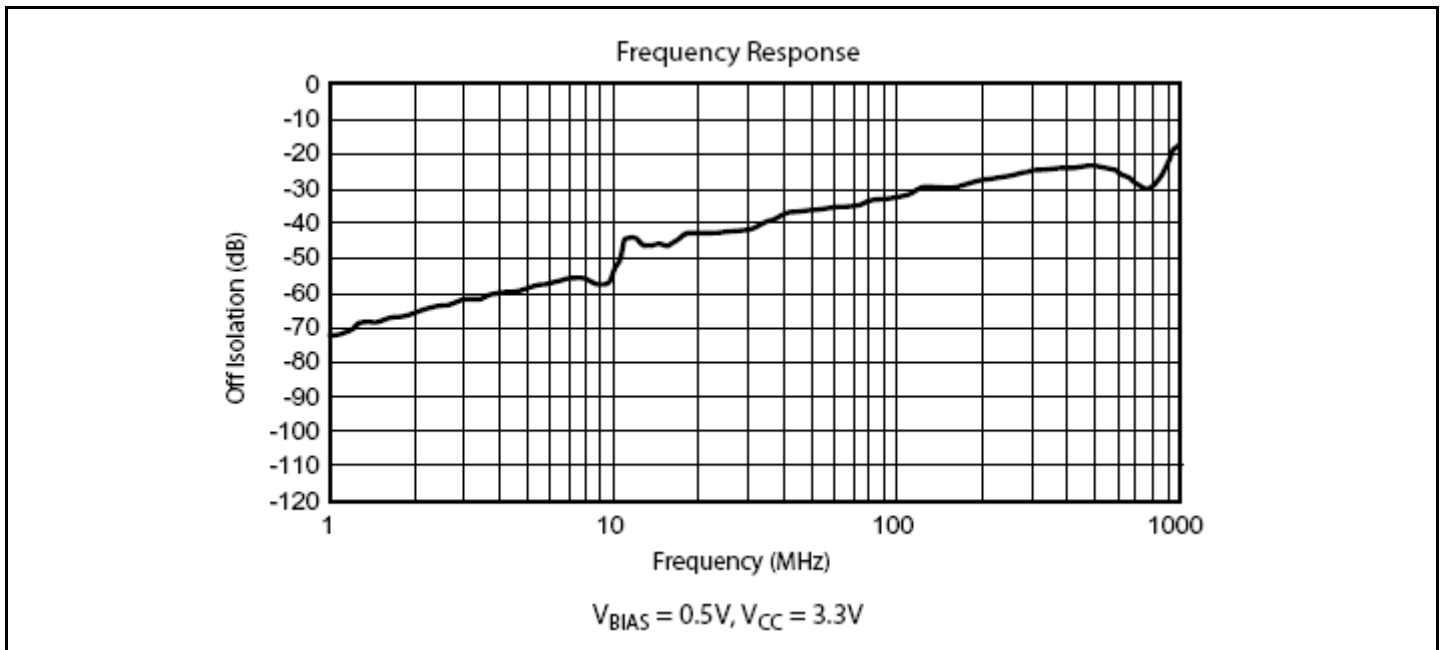
Capacitance

Symbol	Parameter	Conditions	T _A = -40°C to +85°C			Units
			Min.	Typ.	Max.	
C _{IN}	Control Pin Input Capacitance	V _{CC} = 0V		1.5		pF
C _{ON}	A and B ON Capacitance	V _{CC} = 3.3, \overline{OE} = 0V		3.7		pF
C _{OFF}	Port B OFF Capacitance	V _{CC} and \overline{OE} = 3.3		2.5		pF

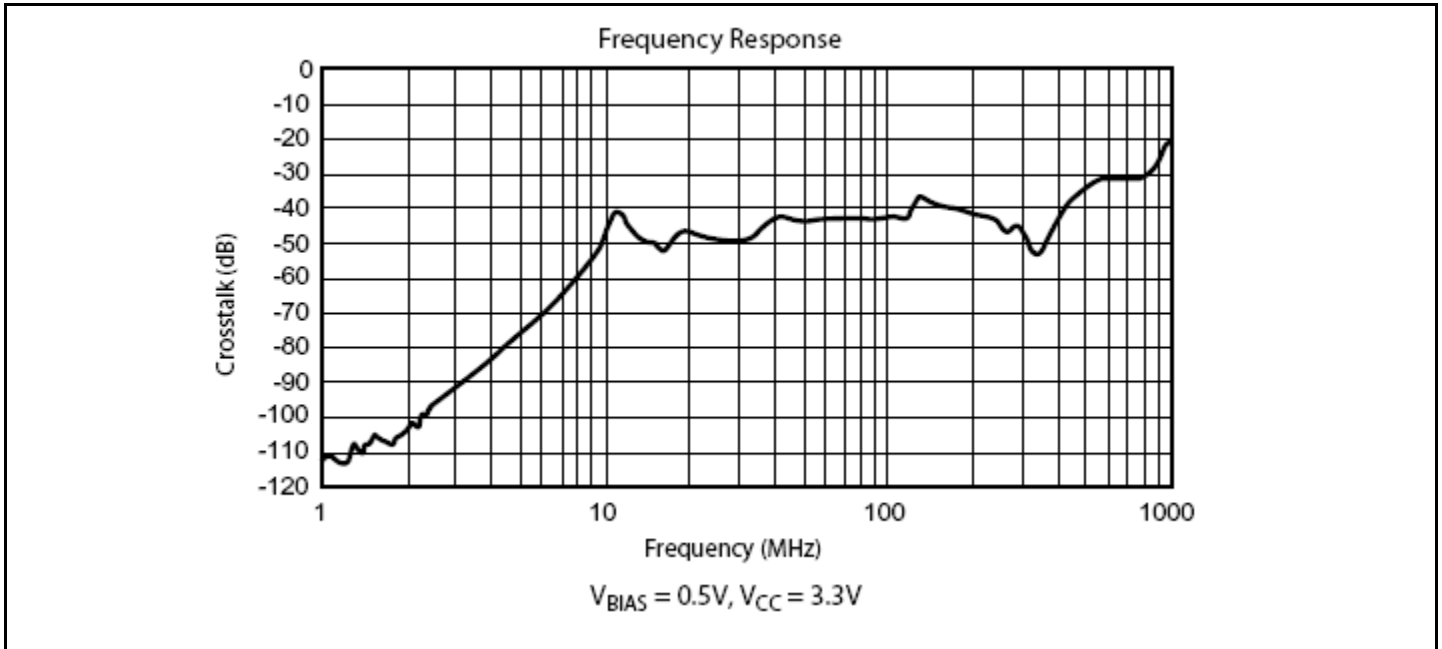
Test Circuits and Timing Diagrams



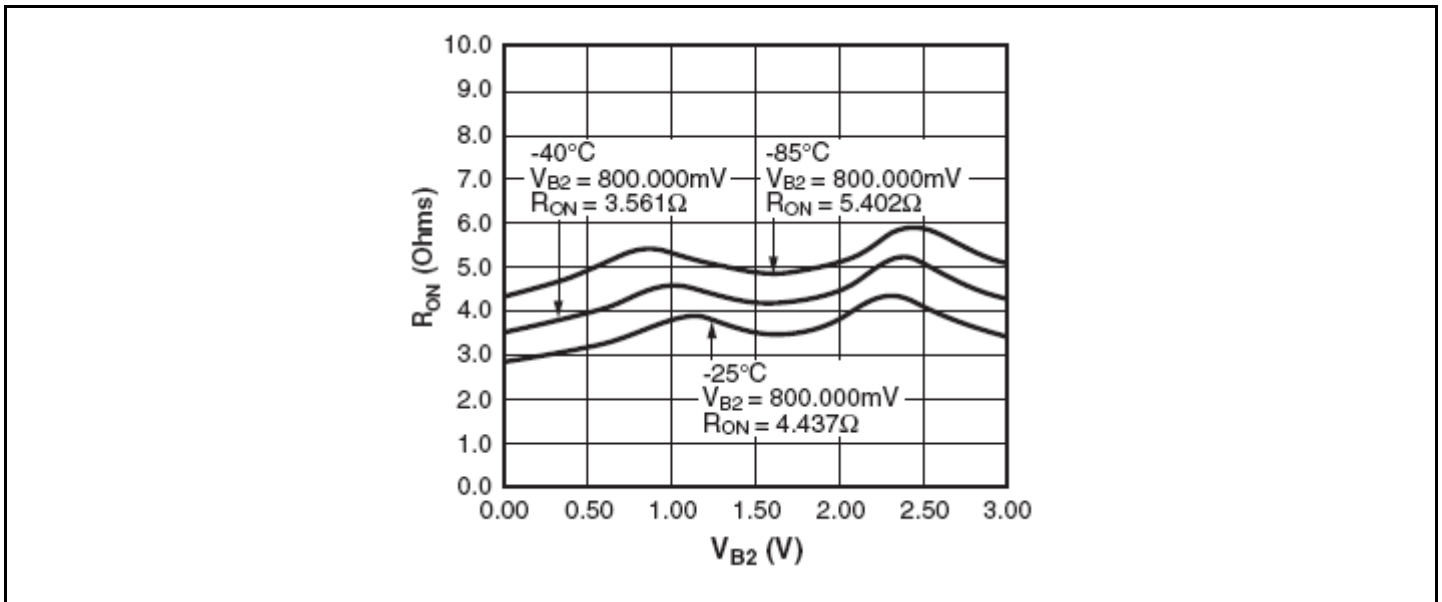
Gain vs. Frequency



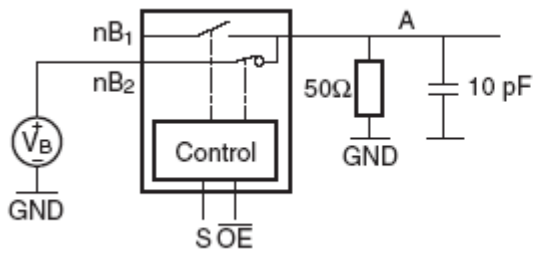
OFF Isolation



Crosstalk



On Resistance

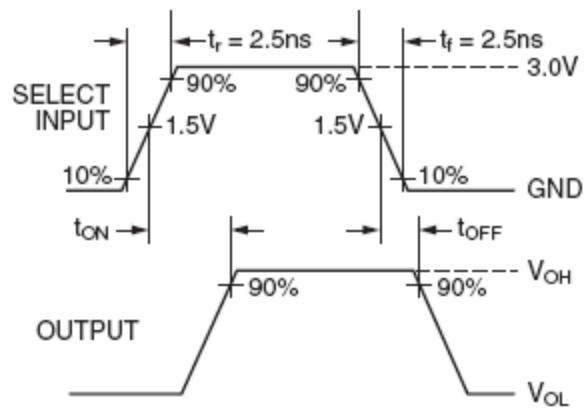


Note: Input driven by 50Ω source terminated in 50Ω

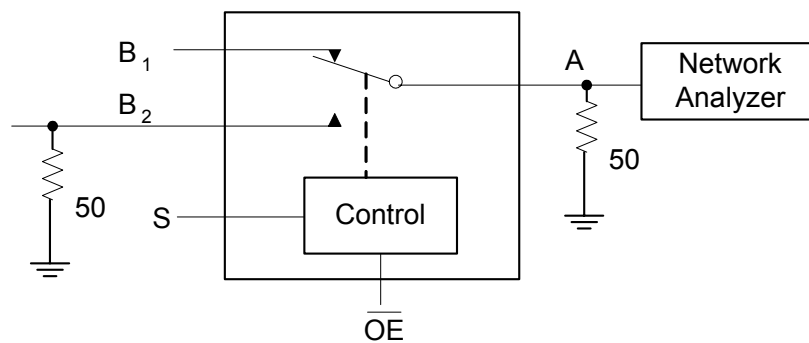
Note: C_L includes load and stray capacitance

Note: Input PRR = 1.0 MHz, t_W = 500ns

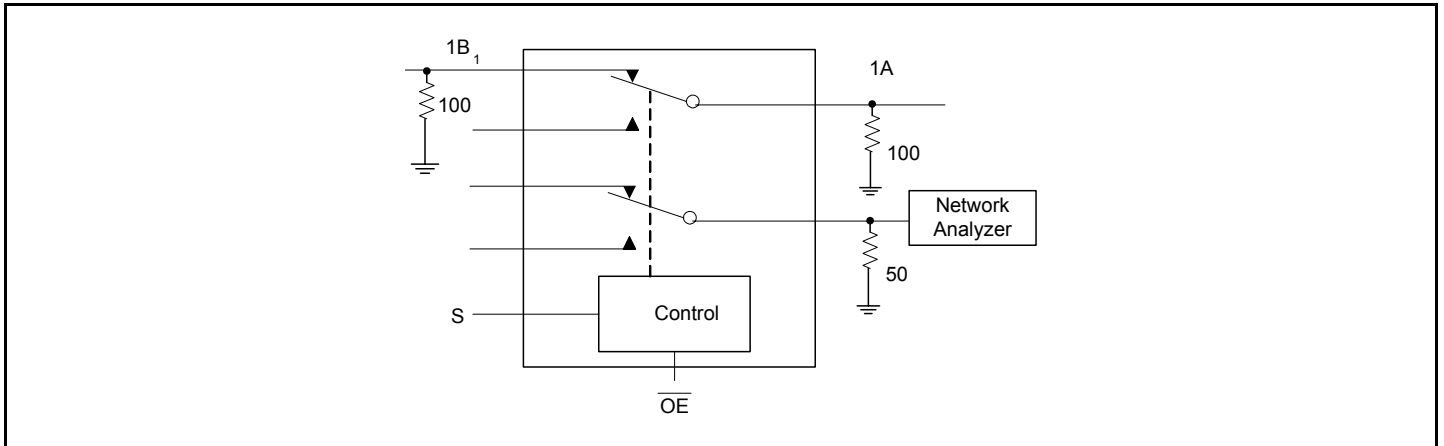
AC Test Circuit



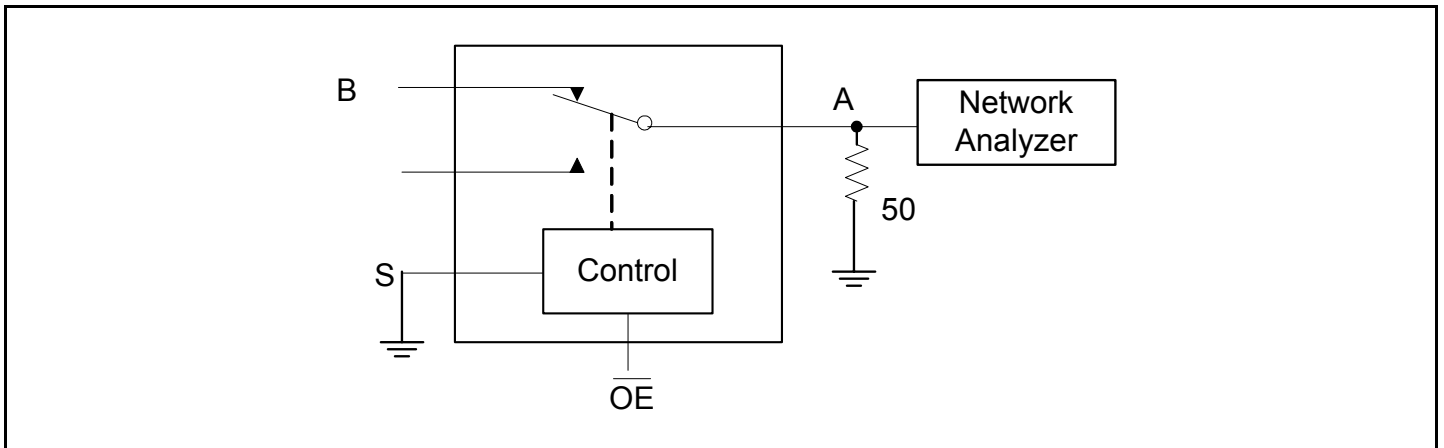
AC Waveforms



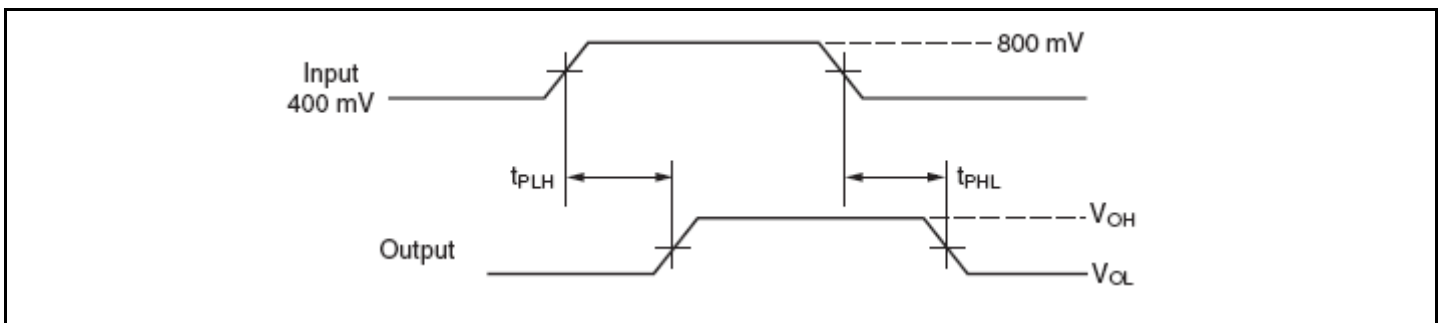
OFF Isolation Test



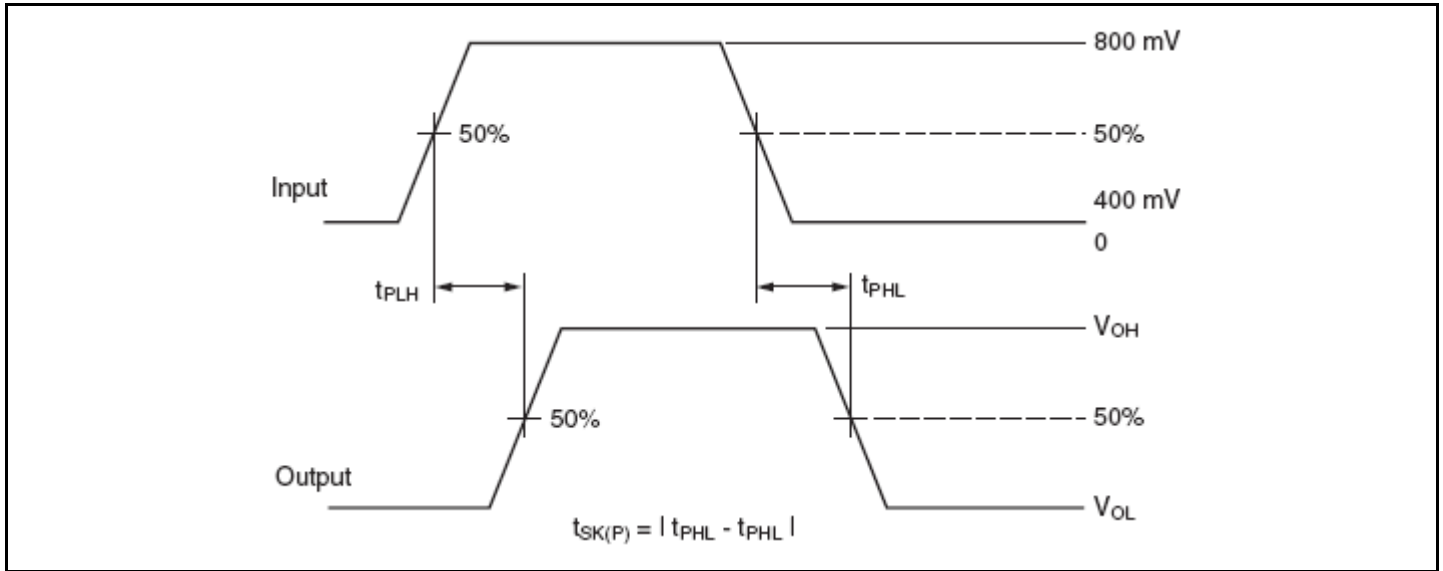
Crosstalk Test



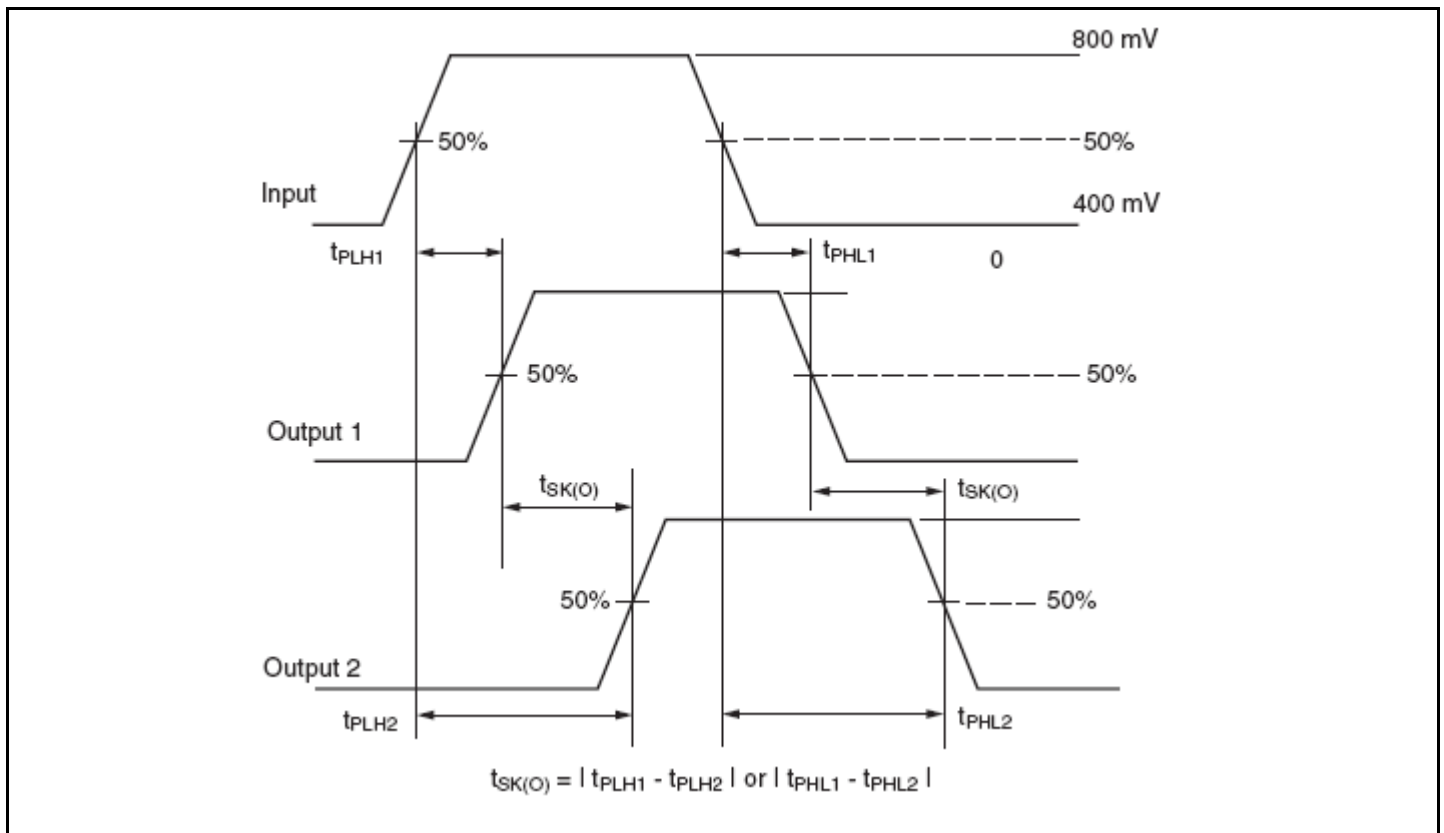
Bandwidth Test



Propagation Delay

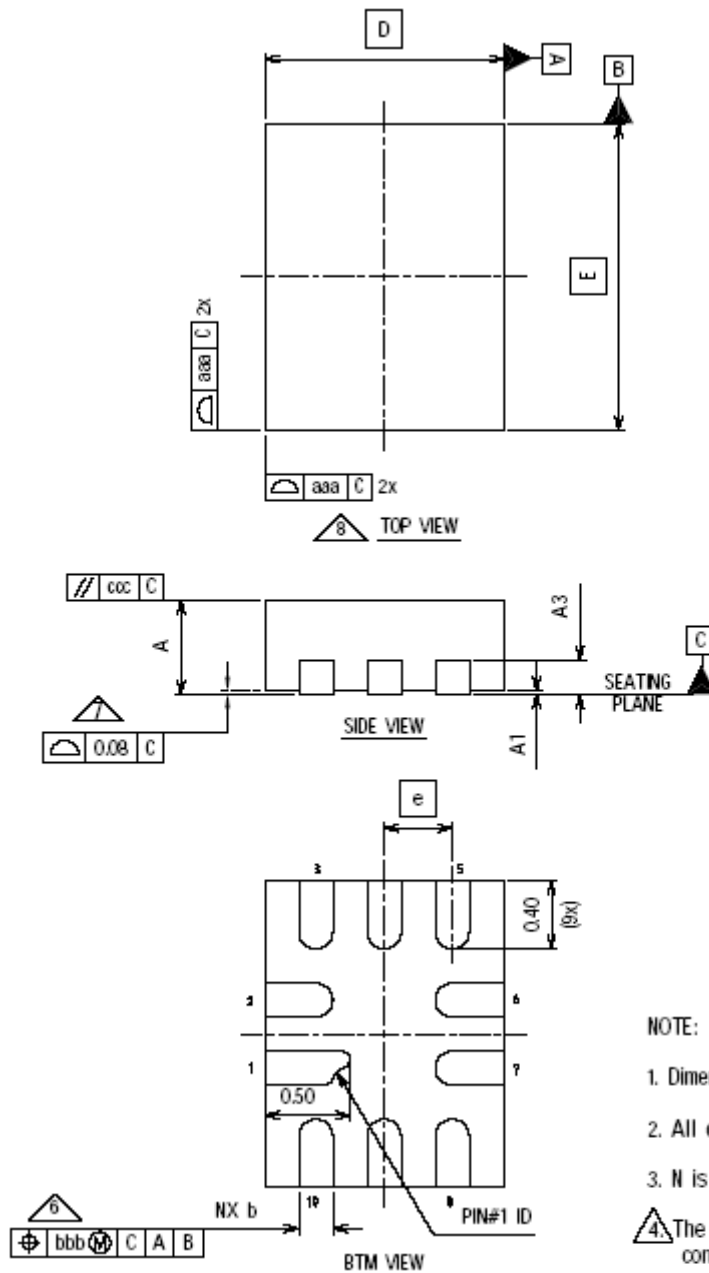


Pulse Skew $t_{SK(P)}$



Output Skew $t_{SK(O)}$

Package Outline and Package Dimensions (10-pin μ MLP)



SYMBOL	Millimeters			Notes
	MIN	NOM	MAX	
A	0.51	0.55	0.60	1, 2
A1	0.00	0.02	0.05	1, 2
A3		0.15 ref		1, 2
b	0.15	0.20	0.25	
c	0.09		0.20	
D	1.40 BASIC			
E	1.80 BASIC			
E1	6.00		6.20	
N	10			3
ND	3			5
NE	2			5
e	0.40			
aaa	0.15			
bbb	0.10			
ccc	0.10			

NOTE:

1. Dimensioning and tolerancing conform to ASME Y14.5M-1994.
2. All dimensions are in millimeters, angles are in degrees($^{\circ}$).
3. N is the total number of terminals.
4. The location of the terminal #1 identifier and terminal numbering convention conforms to JEDEC publication 95 SPP-002.
5. ND and NE refer to the number of terminals on each D and E side respectively.
6. Dimension b applies to metallized terminal and is measured between 0.15mm and 0.30mm from the terminal tip. If the terminal has the optional radius on the other end of the terminal, the dimension b should not be measured in that radius area.
7. Coplanarity applies to the terminals and all other bottom surface metallization.
8. Drawing shown are for illustration only.

Ordering Information

Part / Order Number	Marking	Shipping Packaging	Package	Temperature
US8030NDGI	TBD	Tubes	10-pin μ MLP	-40 to +85° C
US8030NDGI8		Tape and Reel	10-pin μ MLP	-40 to +85° C

Parts that are ordered with a “G” after the two-letter package code are the Pb-Free configuration and are RoHS compliant.

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