High-Speed UART USB2.0 (480 Mbps) DPDT Switch

UM7227QA *QFN10 1.8×1.4*
UM7227MA *MSOP10*

General Description

The UM7227QA/UM7227MA is a dual port high-speed, low-power data switch optimized for USB2.0 signal switching. The UM7227QA/UM7227MA switch is configured as double-pole/ double-throw DPDT. It handles bidirectional signal flow, achieving a 750 MHz -3dB bandwidth, and a port to port crosstalk and isolation at -42dB at 250MHz.
The UM7227QA/UM7227MA operates from a single +2.7V to +5.5V supply, with current consumption less than 1μA.
The UM7227QA/UM7227MA features wide bandwidth and low bit-to-bit skew allow it to pass high-speed differential signal with good signal integrity, offers little or no attenuation of the high-speed signals at the outputs. Its high channel-to-channel crosstalk rejection results in minimal noise interface. Its bandwidth is wide enough to pass high-speed USB2.0 differential signals (480Mbps). The control logic threshold is guaranteed to be compatible with 1.8V logic.
The UM7227QA is available in Pb-free QFN10 package (1.4mm×1.8mm×0.55mm), the UM7227MA is available in Pb-free MSOP10 package. It is ideal for portable high speed mix signal switching application.

Applications

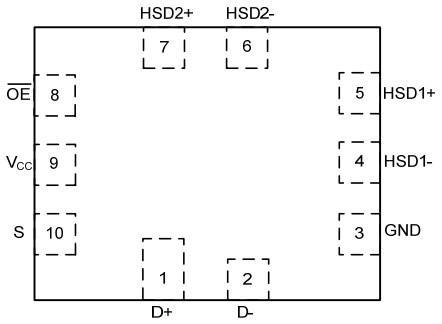
- Differential Signal Data Routing
- USB2.0 Signal Routing
- Cell Phone, PDA, Digital Camera and Notebook
- LCD Monitor, TV and Set-Top Box
- MIPI Signal Routing

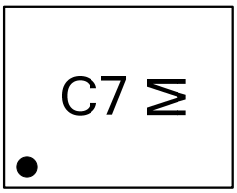
Features

- Ron is Typically 9.9Ω at V_{CC}=3.6V
- OVT on D+ and D- up to 5.5V
- Power OFF Protection:
  When V_{CC}=0V, D+ and D- can Tolerate up to 5.5V
- Low Crosstalk: -42dB (250MHz)
- Low Current Consumption: <1μA
- Near-Zero Propagation Delay: 250ps
- Channel On-Capacitance: 6.5pF(Typical)
- V_{CC} Operating Range: +2.7V to +5.5V
- 550MHz Bandwidth (or Data Frequency)
- Lead (Pb)-Free QFN10 Package
- Pb-Free MSOP10 Package
- ESD Rating: ±5kV I/O to GND

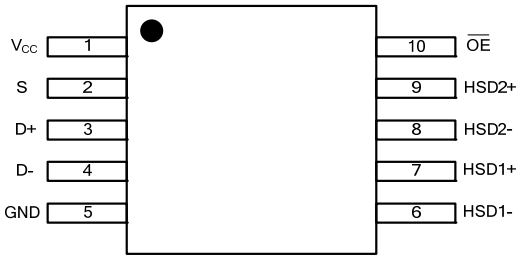
Pin Configurations **Top View**

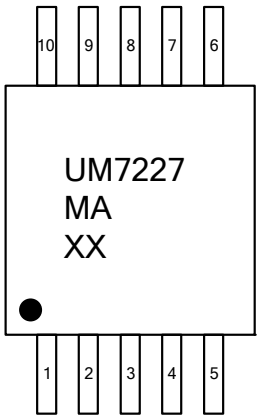
(Top View)





M: Month Code
UM7227QA
QFN10 1.8×1.4





XX: Week Code
UM7227MA
MSOP10

Pin Description

Pin		Name	Function
UM7227QA	UM7227MA		
1	3	D+	Data Ports
2	4	D-	Data Ports
3	5	GND	Ground Connection
4	6	HSD1-	Data Ports
5	7	HSD1+	Data Ports
6	8	HSD2-	Data Ports
7	9	HSD2+	Data Ports
8	10	$\overline{OE}$	Output Enable
9	1	V_{CC}	Positive Supply Voltage
10	2	S	Select Input

Ordering Information

Part Number	Packaging Type	Marking Code	Shipping Qty
UM7227QA	QFN10 1.8×1.4	C7	3000pcs/7 Inch Tape & Reel
UM7227MA	MSOP10	UM7227MA	3000pcs/13 Inch Tape & Reel

Function Table

$\overline{OE}$	S	HSD1+, HSD1-	HSD2+, HSD2-
1	X	OFF	OFF
0	0	ON	OFF
0	1	OFF	ON

Absolute Maximum Ratings

Symbol	Parameter	Limit	Unit
V_{CC}	Supply Voltage	-0.5 to +6.5	V
V_{IS}	Analog Switch Input Voltage	-0.5 to +6.5	
V_{IN}	Digital Select Input Voltage	-0.5 to +6.5	
I_D	Continuous DC Current	50	mA
P_D	Power Dissipation	0.5	W
T_O	Operating Temperature Range	-40 to +85	°C
T_{STG}	Storage Temperature Range	-65 to +150	

DC Electrical Characteristics

(Typical: T_A = +25℃, unless otherwise noted.)

Symbol	Parameter	Test Conditions	V_{CC} (V)	Min	Typ	Max	Unit
I_{IN}	Input Leakage Current	$0 \le V_{IS} \le V_{CC}$	3.6	-1.0		1.0	μA
I_{OFF}	Power Off Leakage Current	$0 \le V_{IS} \le V_{CC}$	0	-1.0		1.0	μA
I_{CCT}	Increase in I_{CC} per Control Voltage	V_{IN}=2.6V	3.6			10	μA
I_{OZ}	OFF State Leakage Current	$0 \le V_{IS} \le V_{CC}$	3.6	-1.0		1.0	μA
I_{CC}	Quiescent Supply Current	V_{IS}=V_{CC} or GND	3.6			1.0	μA
V_{IH}	Input High Voltage		3.0 to 3.6	1.3			V
V_{IL}	Input Low Voltage		3.0 to 3.6			0.5	V
V_{IK}	Clamp Diode Voltage	I_{IS}=-18mA	3.0			-1.2	V
R_{ON}	On-Resistance (Note 1)	V_{IS}=0 to 0.4V I_D=8mA	3.0		9.8	13	Ω
ΔR_{ON}	On Resistance Match Between Channels (Note 1, 2)	V_{IS}=0 to 0.4V I_D=8mA	3.0		0.35		Ω
R_{FLAT}	On Resistance Flatness (Note 1, 2)	V_{IS}=0 to 1.0V I_D=8mA	3.0		2		Ω

Note 1: Guaranteed by design. Resistance measurements do not include test circuit or package resistance.

Note 2: Parameter is characterized but not tested in production.

AC Electrical Characteristics

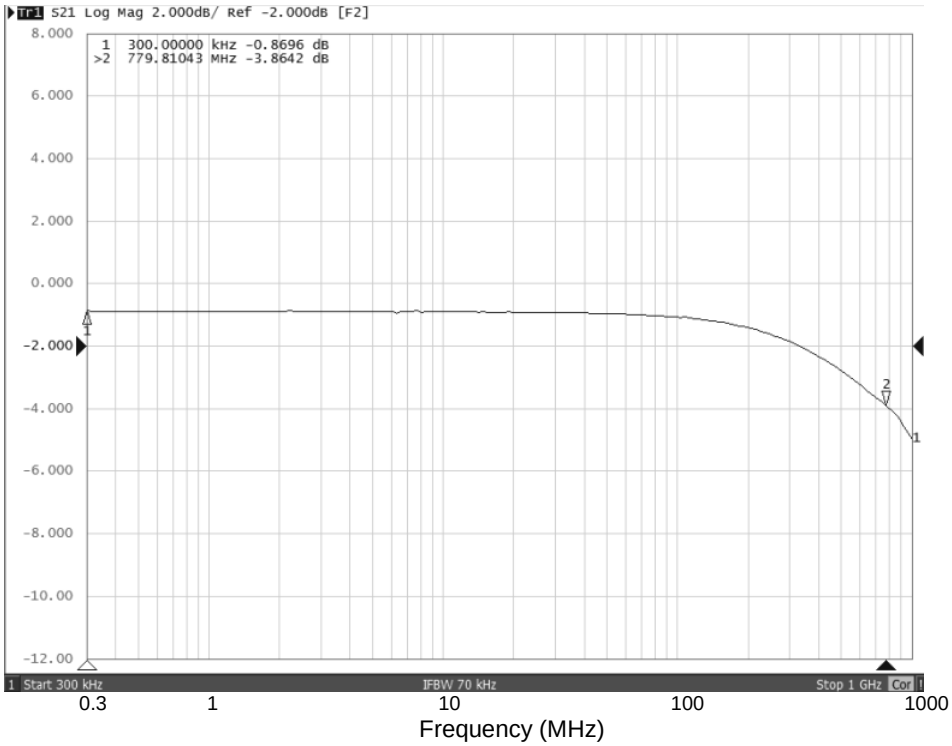
(Typical: T_A = +25℃, unless otherwise noted.)

Symbol	Parameter	Test Conditions	V_{CC} (V)	Min	Typ	Max	Unit
t_{ON}	Turn On Time	V_{IS}=0.8V	3.0 to 3.6		13	30	ns
t_{OFF}	Turn Off Time	V_{IS}=0.8V	3.0 to 3.6		12	25	ns
t_{BBM}	Break Before Make Time (Note 3)	V_{IS}=0.8V	3.0 to 3.6	2	4.7	6.5	ns
t_{PD}	Propagation Delay	C_L=10pF	3.0 to 3.6		0.25		ns
$t_{SK(O)}$	Channel to Channel Skew	C_L=10pF	3.0 to 3.6		0.05		ns
O_{IRR}	Off Isolation	R_L=50Ω, f=250MHz	3.0 to 3.6		-42		dB
X_{TALK}	Crosstalk	R_L=50Ω, f=250MHz	3.0 to 3.6		-42		dB
BW	-3dB Bandwidth	R_L=50Ω C_L=0pF	3.0 to 3.6		750		MHz
		R_L=50Ω C_L=5pF	3.0 to 3.6		550		MHz
USB High-Speed-Related AC Electrical Characteristics							
$t_{SK(P)}$	Skew of Opposite Transitions of the Same Output (Note 3)	C_L=5pF R_L=50Ω			20		ps
t_J	Total Jitter (Note 3)	C_L=5pF R_L=50Ω t_R=t_F=500ps(10-90%) at 480Mbps(PRBS=2^{15}-1)			200		ps
Capacitance							
C_{IN}	Control Pin Input Capacitance (Note 4)	V_{CC}=0V			2.5		pF
C_{OFF}	HSD+ HSD- Off Capacitance (Note 4)	V_{CC}=V_{IS}=3.3V, OE=3.3V			4.5		pF
C_{ON}	HSD+ HSD- ON Capacitance (Note 4)	V_{CC}=3.3V, OE=0V			7.0		pF

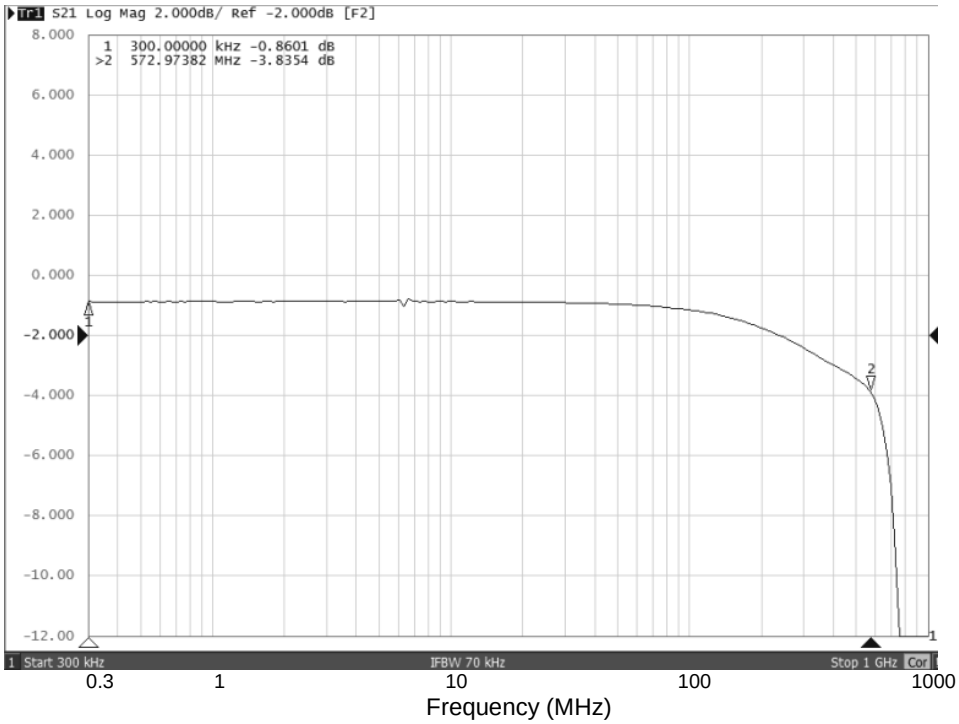
Note 3: Guaranteed by design.
Note 4: T_A=+25°C, f=1MHz, Capacitance is characterized but not tested in production.

Typical Performance Characteristics

Bandwidth (C_L=0pF)

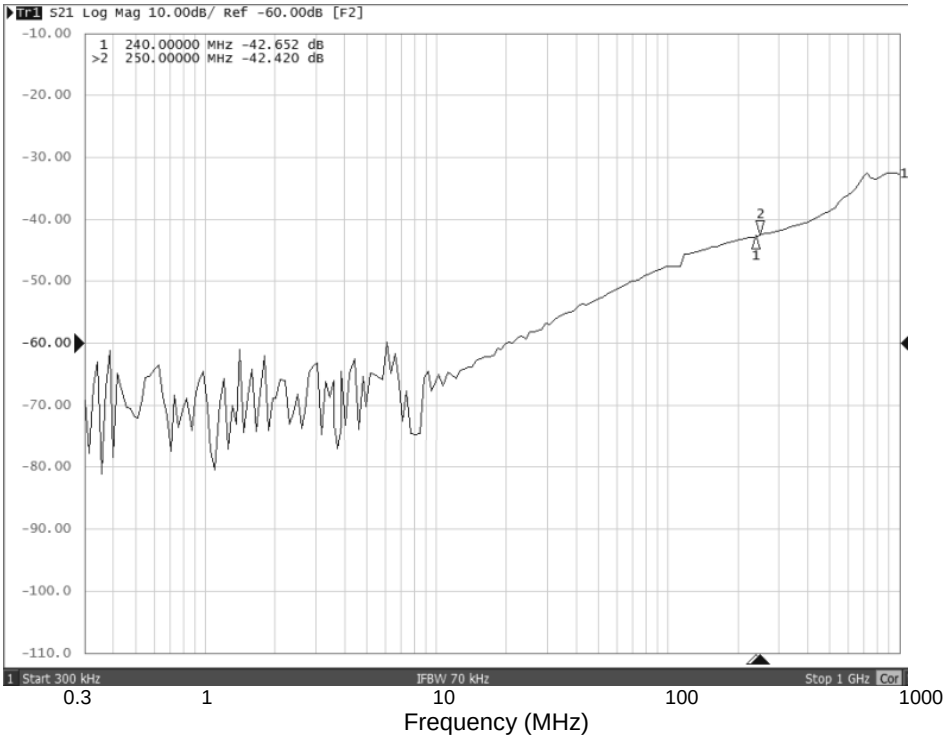


Bandwidth (C_L=5pF)

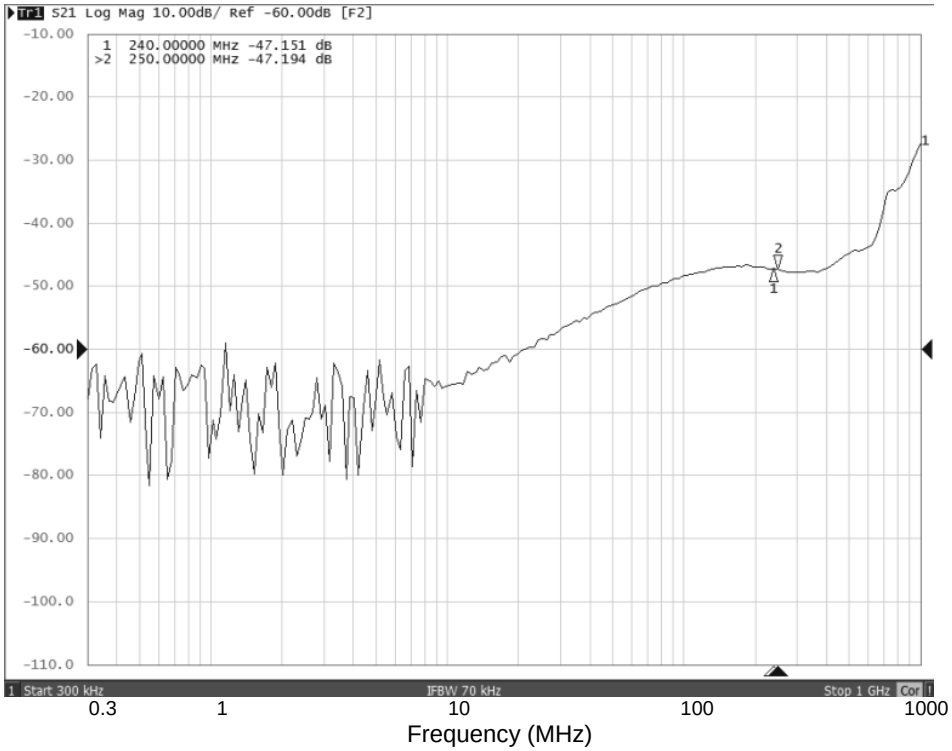


Typical Performance Characteristics (Continued)

Off Isolation

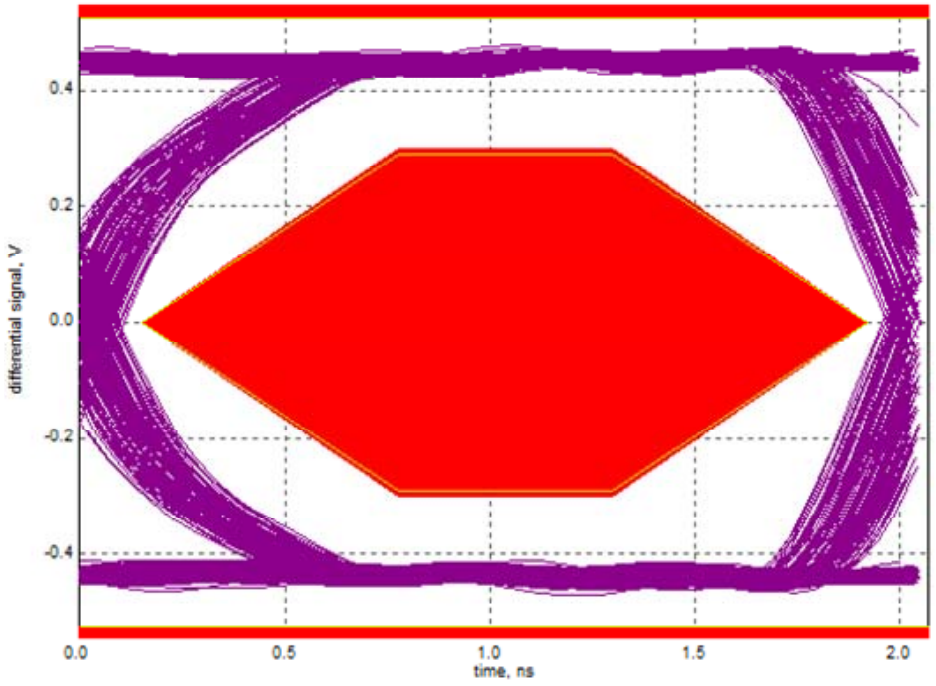


Crosstalk

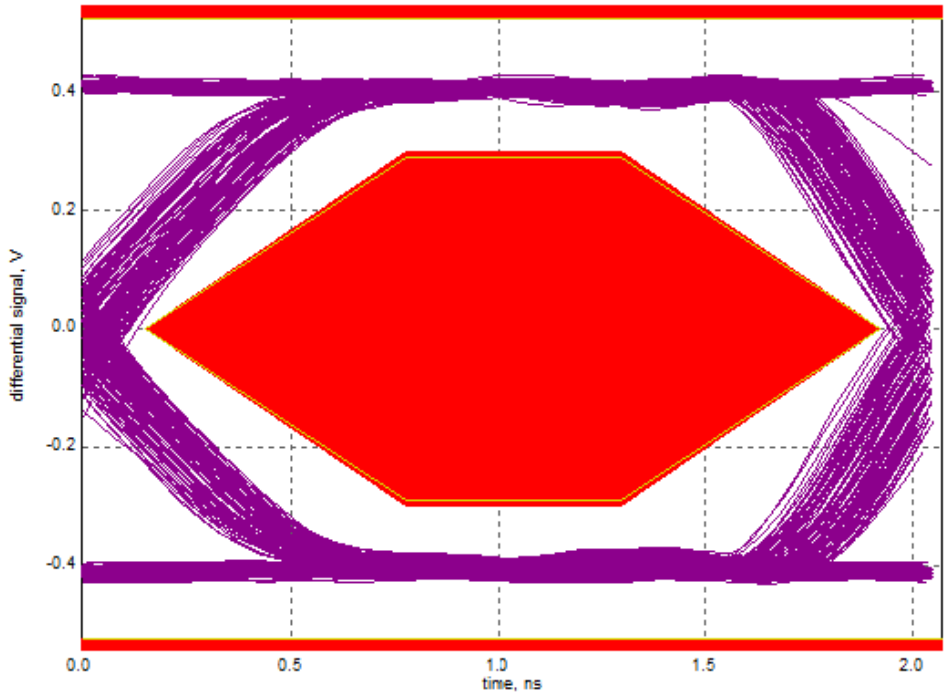


Typical Performance Characteristics (Continued)

Eye Pattern: 480Mbps USB Signal with No Switch (Through Path)

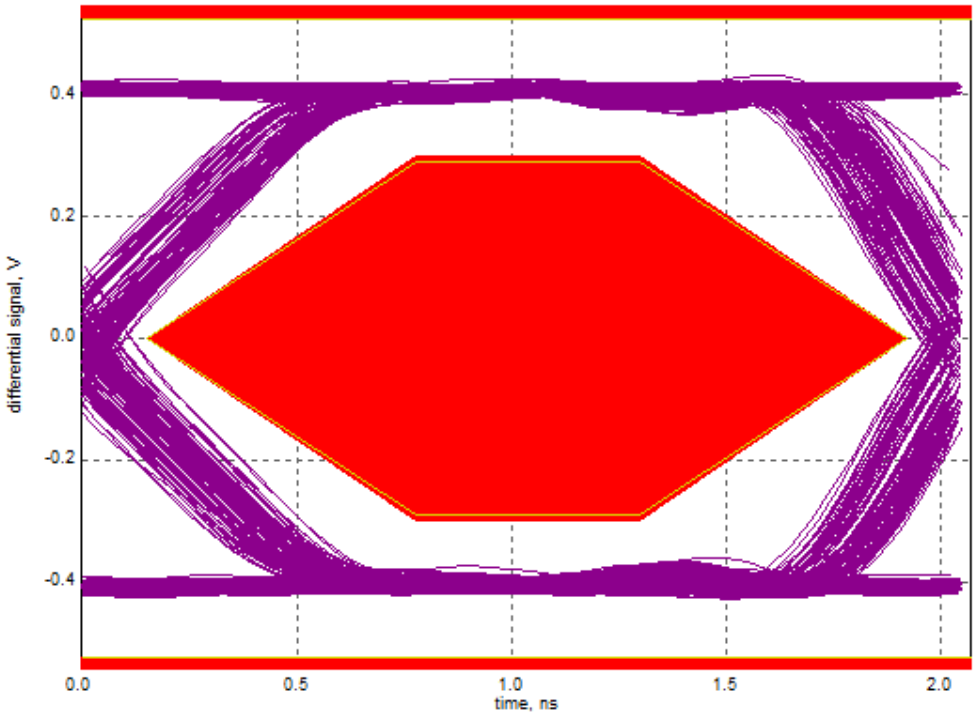


Eye Pattern: 480Mbps USB Signal with Switch HSD1+ and HSD1- Path

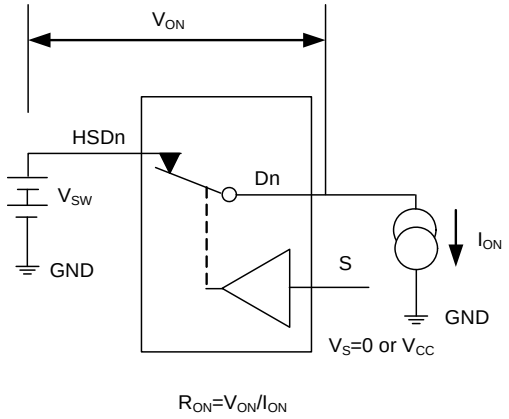


Typical Performance Characteristics (Continued)

Eye Pattern: 480Mbps USB Signal with Switch HSD2+ and HSD2- Path

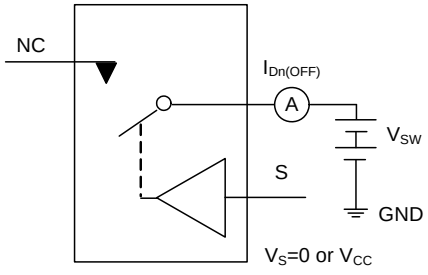


Test Diagrams



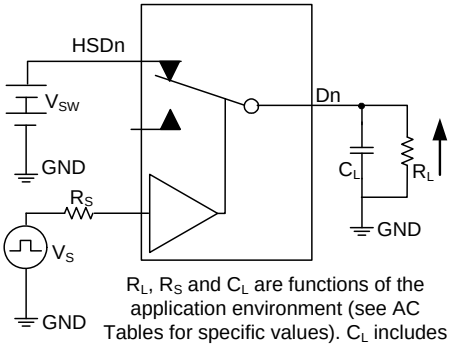
$R_{ON}=V_{ON}/I_{ON}$

Figure 1 On Resistance



Each switch port is tested separately

Figure 2 Off Leakage



R_L, R_S and C_L are functions of the application environment (see AC Tables for specific values). C_L includes test fixture and stray capacitance.

Figure 3 AC Test Circuit Load

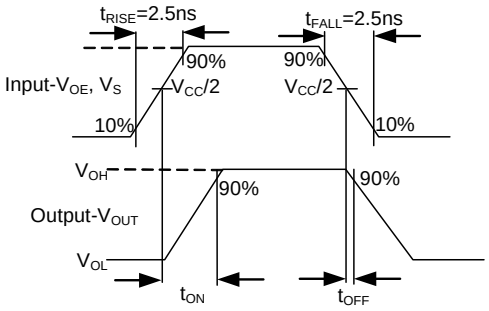
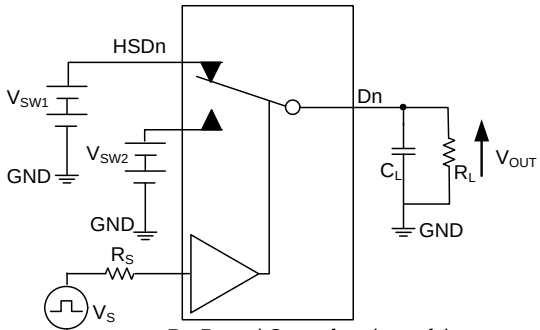


Figure 4 Turn-On/Turn-Off Waveforms



R_L, R_S and C_L are functions of the application environment (see AC Tables for specific values). C_L includes test fixture and stray capacitance.

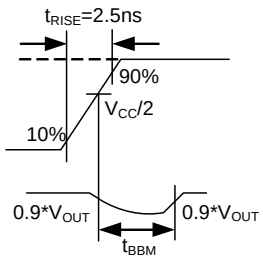


Figure 5 Break-Before-Make Interval Timing

Test Diagrams (Continued)

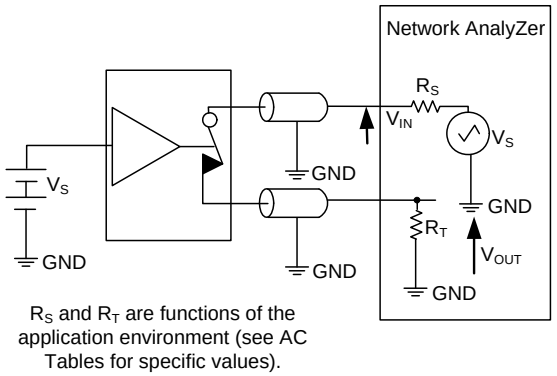


Figure 6 Bandwidth

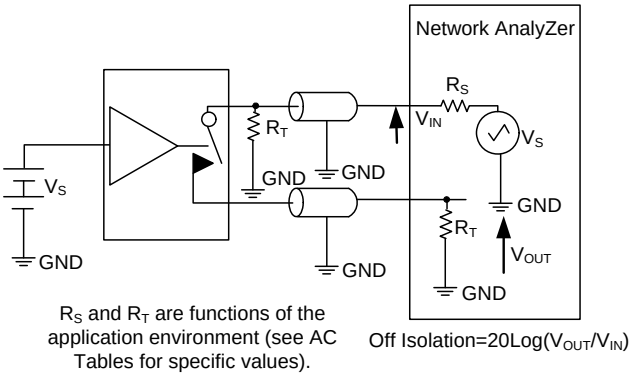


Figure 7 Channel Off Isolation

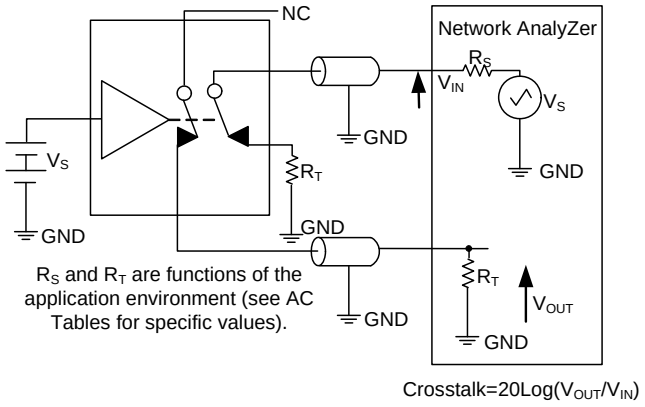


Figure 8 Non-Adjacent Channel-to-Channel Crosstalk

Applications Information

Power-Off Protection

For a VBUS short circuit, the switch is expected to withstand such a condition for at least 24 hours. The UM7227QA/UM7227MA has specially designed circuitry 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 (D+, D-).

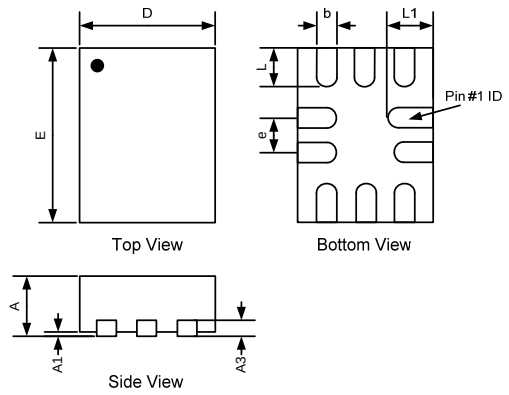
Power-On Protection

The USB2.0 specification also notes that the USB device should be capable of withstanding a VBUS short during transmission of data. This modification works by limiting current flow back into the V+ rail during the over-voltage event so current remains within the safe operating range. In this application, the switch passes the full 5.25V input signal through to the selected output while maintaining specified off isolation on the un-selected pins.

Package Information

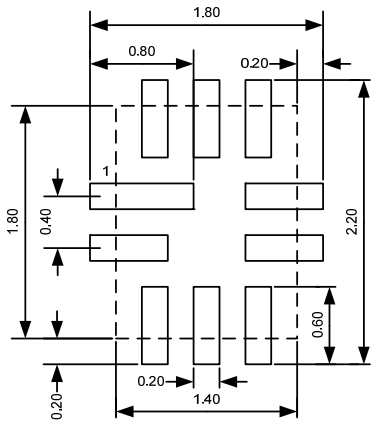
UM7227QA QFN10 1.8×1.4

Outline Drawing



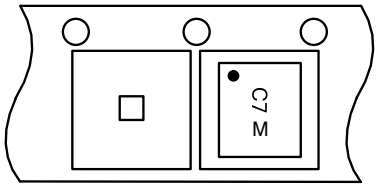
Symbol	DIMENSIONS					
	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	0.50	0.55	0.60	0.020	0.022	0.024
A1	0.00	-	0.05	0.000	-	0.002
A3	0.15REF			0.006REF		
b	0.15	0.20	0.25	0.006	0.008	0.010
D	1.35	1.40	1.45	0.053	0.055	0.057
E	1.75	1.80	1.85	0.069	0.071	0.073
e	0.40BSC			0.016BSC		
L	0.30	0.40	0.50	0.012	0.016	0.020
L1	0.40	0.50	0.60	0.016	0.020	0.024

Land Pattern



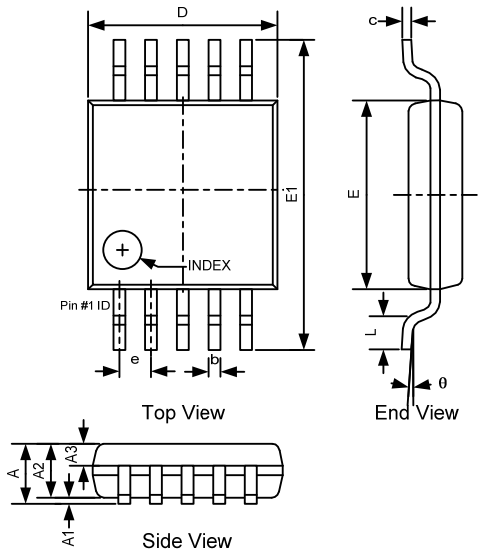
NOTES:
1. Compound dimension: 1.80×1.40;
2. Unit: mm
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation



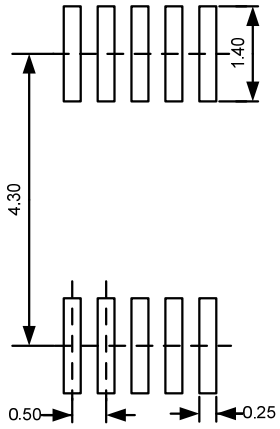
UM7227MA MSOP10

Outline Drawing



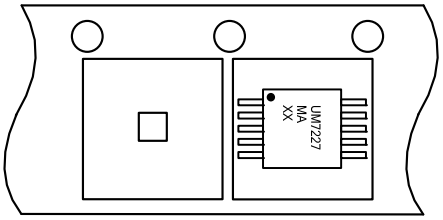
DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	-	-	1.10	-	-	0.043
A1	0.00	-	0.15	0.000	-	0.006
A2	0.75	0.85	0.95	0.030	0.033	0.037
A3	0.25	0.35	0.39	0.010	0.014	0.015
b	0.18	-	0.28	0.007	-	0.011
c	0.09	-	0.23	0.004	-	0.009
D	2.90	3.00	3.10	0.114	0.118	0.122
E	2.90	3.00	3.10	0.114	0.118	0.122
E1	4.70	4.90	5.10	0.185	0.193	0.201
e	0.50BSC			0.020BSC		
L	0.40	0.60	0.80	0.016	0.024	0.031
θ	0°	-	8°	0°	-	8°

Land Pattern



NOTES:
1. Compound dimension: 3.00×3.00;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation



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