

## MCS7227 High Speed USB 2.0(480Mbps) DPDT Analog Switch

### 1 Features

- Ron is Typically 50 at 3.0V
- Voltage Operation: 1.8V to 5.5V
- Fast Switching Times:  
ton 15ns  
toff 20ns
- Crosstalk: -30dB at 250MHz
- Off-Isolation: -35dB at 250MHz
- Rail-to-Rail Input and Output Operation
- Break-Before-Make Switching
- Extended Industrial Temperature Range:  
-40°C to +85°C
- Available in Green UTQFN1.8x1.4-10L and MSOP10 Packages

### 2 Applications

- Route Signals for USB 2.0
- MP3 and Other Personal Media Players
- Digital Cameras and Camcorders
- Portable Instrumentation
- Set-Top Box
- PDAs

### 3 Description

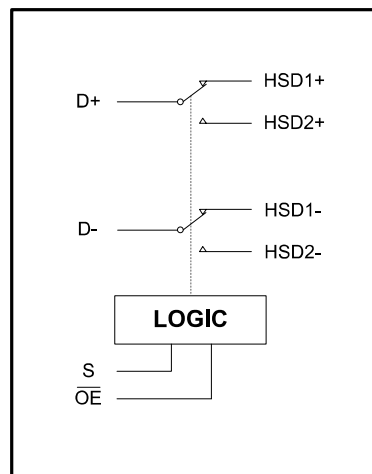
The MCS7227 is a high-speed, low-power double-pole/double-throw (DPDT) analog switch that operates from a single 1.8V to 5.5V power supply.

MCS7227 is designed for the switching of high-speed USB 2.0 signals in handset and consumer applications, such as cell phones, digital cameras, and notebooks with hubs or controllers with limited USB I/Os. The MCS7227 has low bit-to-bit skew and high channel-to-channel noise isolation, and is compatible with various standards, such as high-speed USB 2.0 (480Mbps). Each switch is bidirectional and offers little or no attenuation of the high-speed signals at the outputs. Its bandwidth is wide enough to pass high-speed USB 2.0 differential signals (480Mb/s) with good signal integrity.

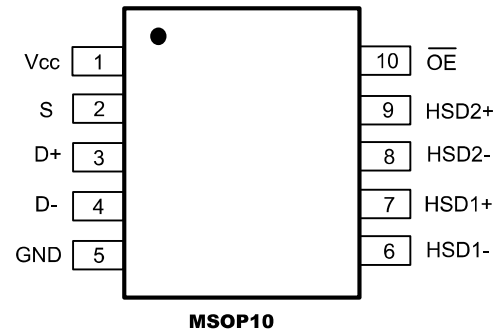
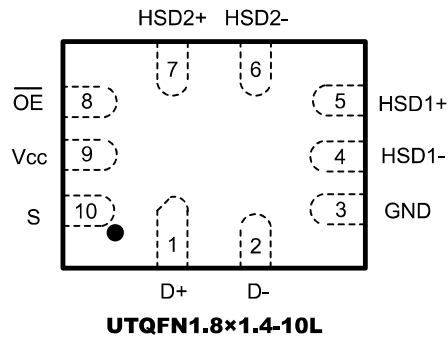
The MCS7227 contains special circuitry on the D+/D- pins which allows the device to withstand a VBus short to D+ or D- when the USB devices are either powered off or powered on.

MCS7227 is available in Green UTQFN1.8x1.4-10L and MSOP10 packages. It operates over an ambient temperature range of -40°C to +85°C.

### 4 Block Diagram



## 5. Pin Description



Pin Description

PIN		NAME	FUNCTION
UTQFN1.8×1.4-10L	MSOP10		
9	1	V <sub>CC</sub>	Power Supply
3	5	GND	Ground
10	2	S	Select Input
8	10	$\overline{\text{OE}}$	Output Enable
5	7	HSD1+	Multiplexed Source Inputs
4	6	HSD1-	Multiplexed Source Inputs
7	9	HSD2+	Multiplexed Source Inputs
6	8	HSD2-	Multiplexed Source Inputs
1	3	D+	USB Data Bus
2	4	D-	USB Data Bus

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

## 6. Absolute Maximum Ratings

Parameter	Min.	Typ.	Max.	Unit	Note
$V_{CC}$ to GND	0		6	V	
Analog, Digital voltage range	-0.3		$V_{CC}+0.3$	V	
Continuous Current HSDn or Dn	-50		+50	mA	
Peak Current HSDn or Dn	-100		+100	mA	
Operating Temperature Range	-40		+85	°C	
Junction Temperature			+150	°C	
Storage Temperature	-65		+150	°C	
Lead Temperature (soldering, 10s)			+260	°C	
ESD Susceptibility			4000V	V	HBM (UTQFN1.8×1.4-10L)
			400V	V	MM (UTQFN1.8×1.4-10L)

**Note:** Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## 7 Specifications

### 7.1 Electrical Characteristics

(At  $V_S = +3.3V$ , and  $T_A = +25^\circ C$ , unless otherwise noted.)

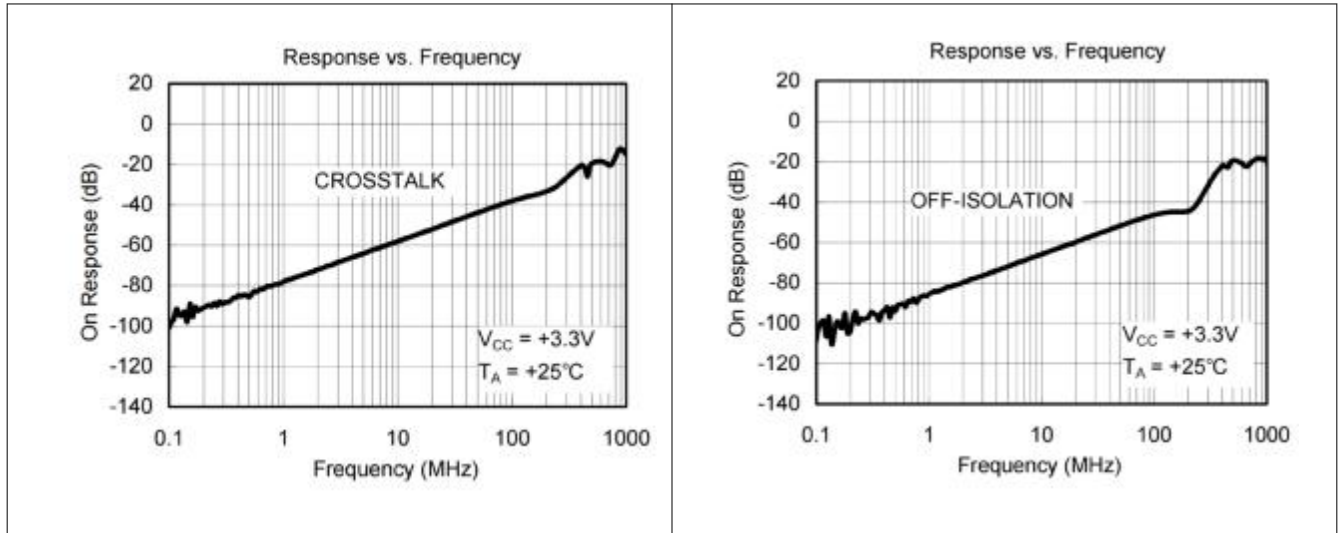
Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Analog Switch						
Analog I/O Voltage (HSD1+, HSD1-, HSD2+, HSD2-)	V <sub>IS</sub>	0		V <sub>CC</sub>	V	
On-Resistance	R <sub>ON</sub>		5	9	Ω	V <sub>CC</sub> =3.0V, V <sub>IS</sub> =0V to 0.4V, I <sub>D</sub> =8mA, Test Circuit 1
On-Resistance Match Between Channels	ΔR <sub>ON</sub>		0.3	0.8	Ω	V <sub>CC</sub> =3.0V, V <sub>IS</sub> =0V to 0.4V, I <sub>D</sub> =8mA, Test Circuit 1
On-Resistance Flatness	R <sub>FLAT(ON)</sub>		1	2	Ω	V <sub>CC</sub> =3.0V, V <sub>IS</sub> =0V to 1.0V, I <sub>D</sub> =8mA, Test Circuit 1
Increase in I <sub>CC</sub> per Control Voltage	I <sub>CCT</sub>			5	μA	V <sub>CC</sub> =3.6V, V <sub>S</sub> , V <sub>OE</sub> =2.6V
Source Off Leakage Current	I <sub>HSD2(OFF)</sub> I <sub>HSD1(OFF)</sub>			1	μA	V <sub>CC</sub> =3.6V, V <sub>IS</sub> =3.3V/0.3V, V <sub>D</sub> =0.3V/3.3V
Channel On Leakage Current	I <sub>HSD2(ON)</sub> I <sub>HSD1(ON)</sub>			1	μA	V <sub>CC</sub> =3.6V, V <sub>IS</sub> =3.3V/0.3V, V <sub>D</sub> =0.3V/3.3V or floating
Digital Inputs						
Input High Voltage	V <sub>IH</sub>	1.6			V	
Input Low Voltage	V <sub>IL</sub>			0.5	V	
Input Leakage Current	I <sub>IN</sub>			1	μA	V <sub>CC</sub> =3.0V, V <sub>S</sub> , V <sub>OE</sub> =0V or V <sub>CC</sub>
Dynamic Characteristics						
Turn-On Time	t <sub>ON</sub>			15	ns	V <sub>IS</sub> =0.8V, R <sub>L</sub> =50Ω, C <sub>L</sub> =10pF, Test Circuit 2
Turn-Off Time	t <sub>OFF</sub>			20	ns	
Break-Before-Make Time Delay	t <sub>D</sub>			3.5	ns	V <sub>IS</sub> =0.8V, R <sub>L</sub> =50Ω, C <sub>L</sub> =10pF, Test Circuit 3
Propagation Delay	t <sub>PD</sub>			0.5	ns	R <sub>L</sub> =50Ω, C <sub>L</sub> =10pF
Off Isolation	O <sub>ISO</sub>			-35	dB	Signal = 0dBm, R <sub>L</sub> = 50Ω, f=250MHz, Test Circuit 4
Channel-to-Channel Crosstalk	X <sub>TALK</sub>			-30	dB	Signal = 0dBm, R <sub>L</sub> = 50Ω, f=250MHz, Test Circuit 5
–3dB Bandwidth	BW			550	MHz	Signal = 0dBm, R <sub>L</sub> = 50Ω, C <sub>L</sub> =5pF, Test Circuit 6

## 7.1 Electrical Characteristics (continued)

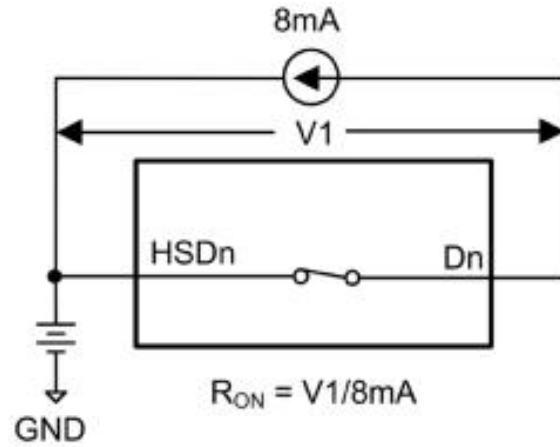
(At  $V_s = +3.3V$ , and  $T_A = +25^\circ C$ , unless otherwise noted.)

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Channel-to-Channel Skew	$t_{SKEW}$			130	ps	$R_L = 50\Omega$ , $C_L = 10pF$
Charge Injection Select Input to Common I/O	Q			10	pC	$V_G = GND$ , $C_L = 1.0nF$ , $R_G = 0\Omega$ , $Q = C_{Lx} V_{OUT}$ , Test Circuit 7
HSD+, HSD-, D+, D- ON Capacitance	$C_{ON}$			6.5	pF	$f = 1MHz$
				7		$f = 250MHz$
Power Requirements						
Power Supply Range	$V_{CC}$	1.8		5.5	V	
Power Supply Current	$I_{CC}$			1	$\mu A$	$V_{CC} = 3.0V$ , $V_S, V_{OE} = 0V$ or $V_{CC}$

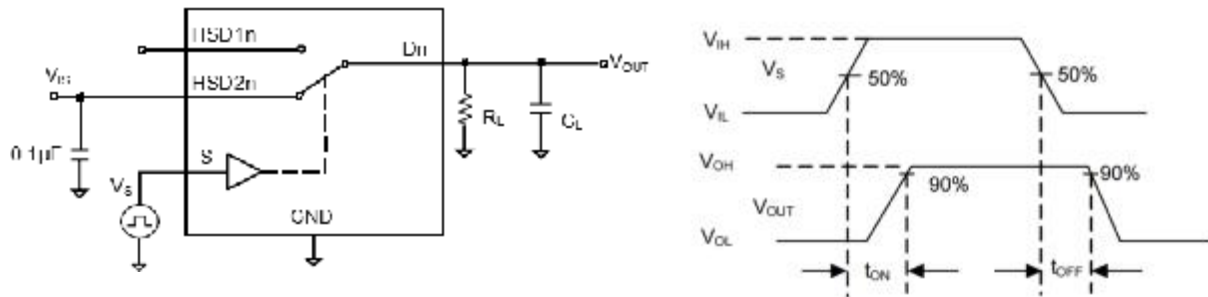
## 7.2 Typical Performance Characteristics



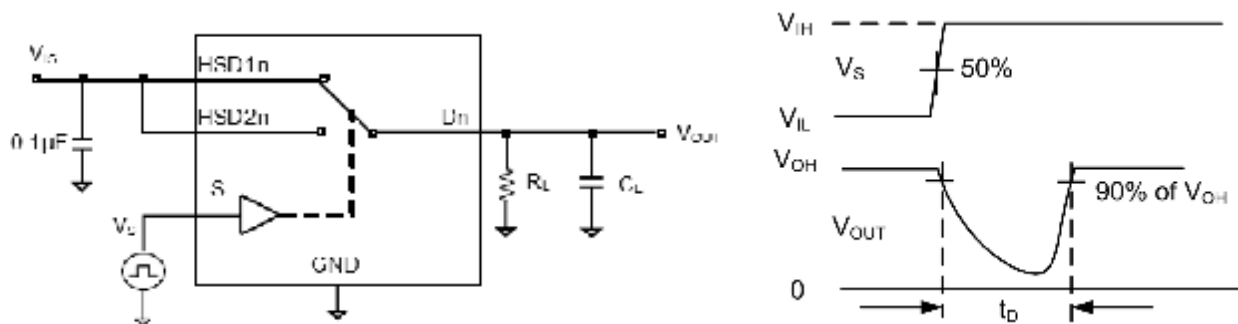
### 7.3 Test Circuits



Test Circuit 1, On-Resistance

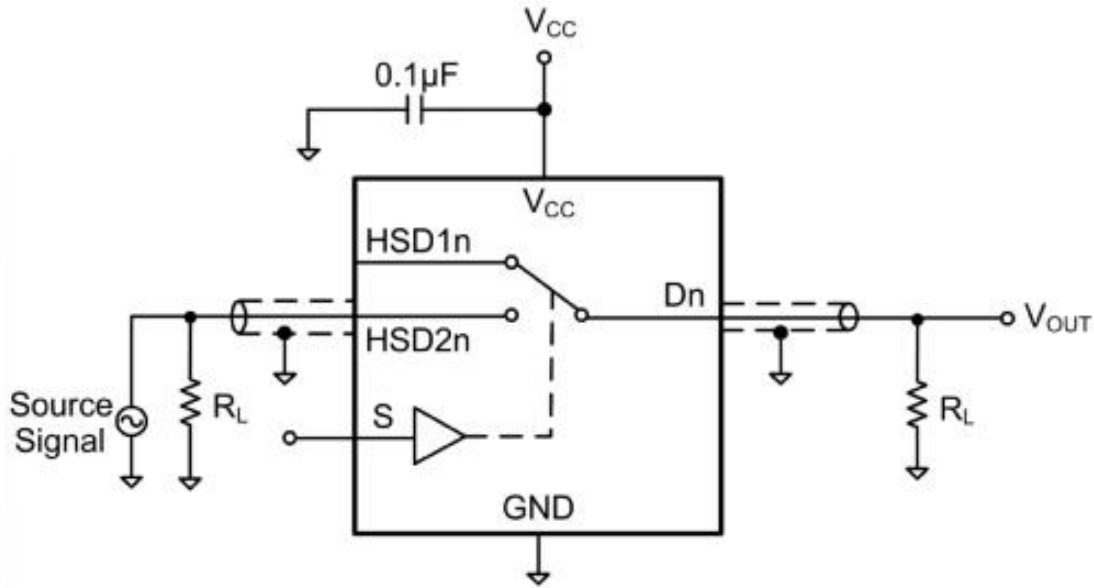


Test Circuit 2. Switching Times ( $t_{on}, t_{off}$ )

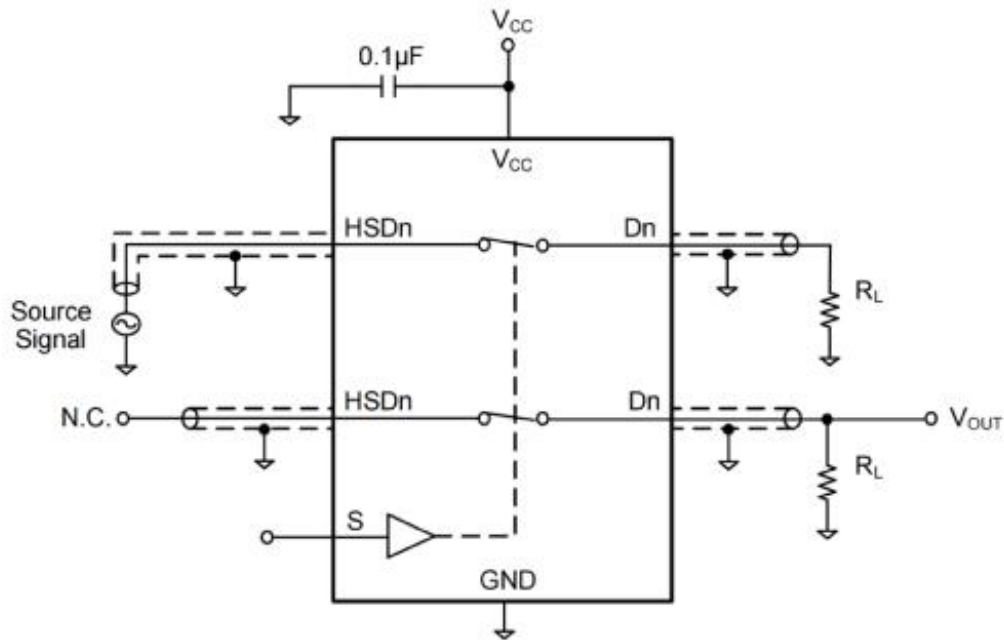


Test Circuit 3. Break-Before-Make Time( $t_0$ )

### 7.3 Test Circuits(Cont)



Test Circuit 4. Off Isolation

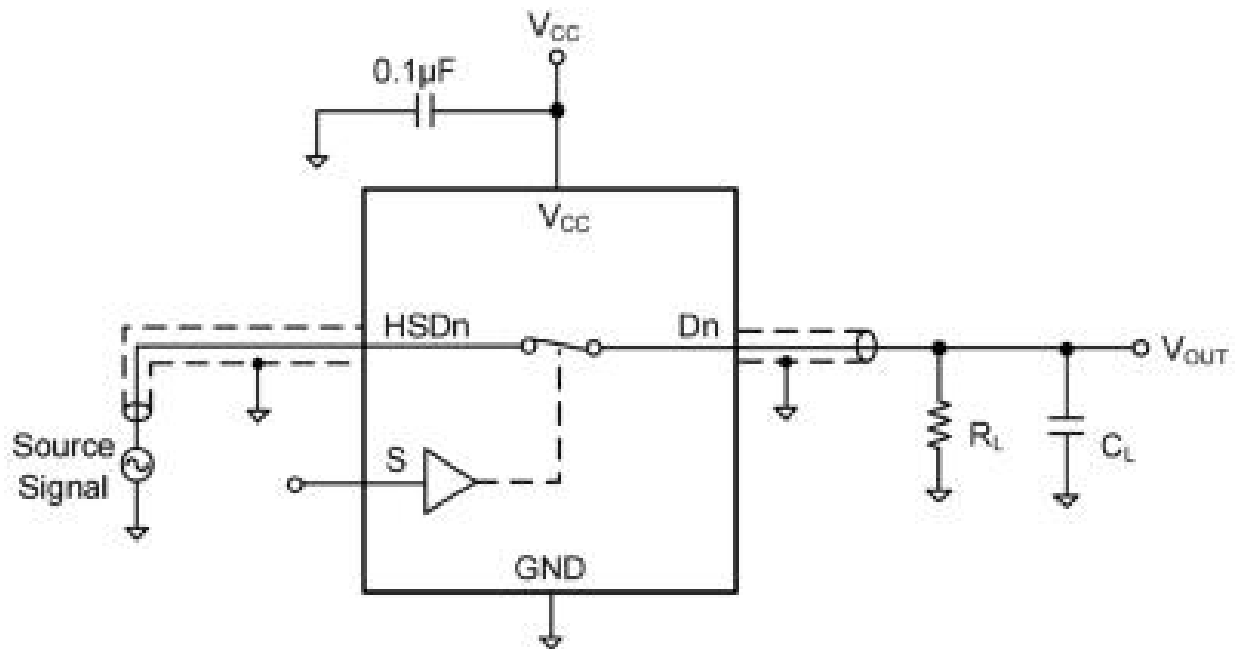


$$\text{Channel To Channel Crosstalk} = -20 \times \log \frac{V_{\text{HSDn}}}{V_{\text{OUT}}}$$

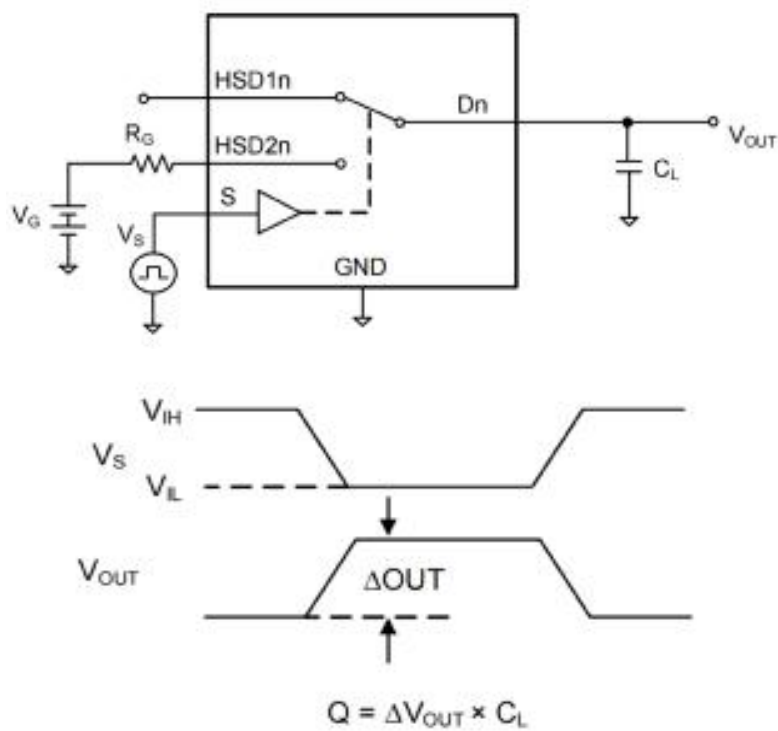
Test Circuit 5. Channel-to-Channel Crosstalk



### 7.3 Test Circuits(Cont)



Test Circuit 6 -3dB Bandwidth

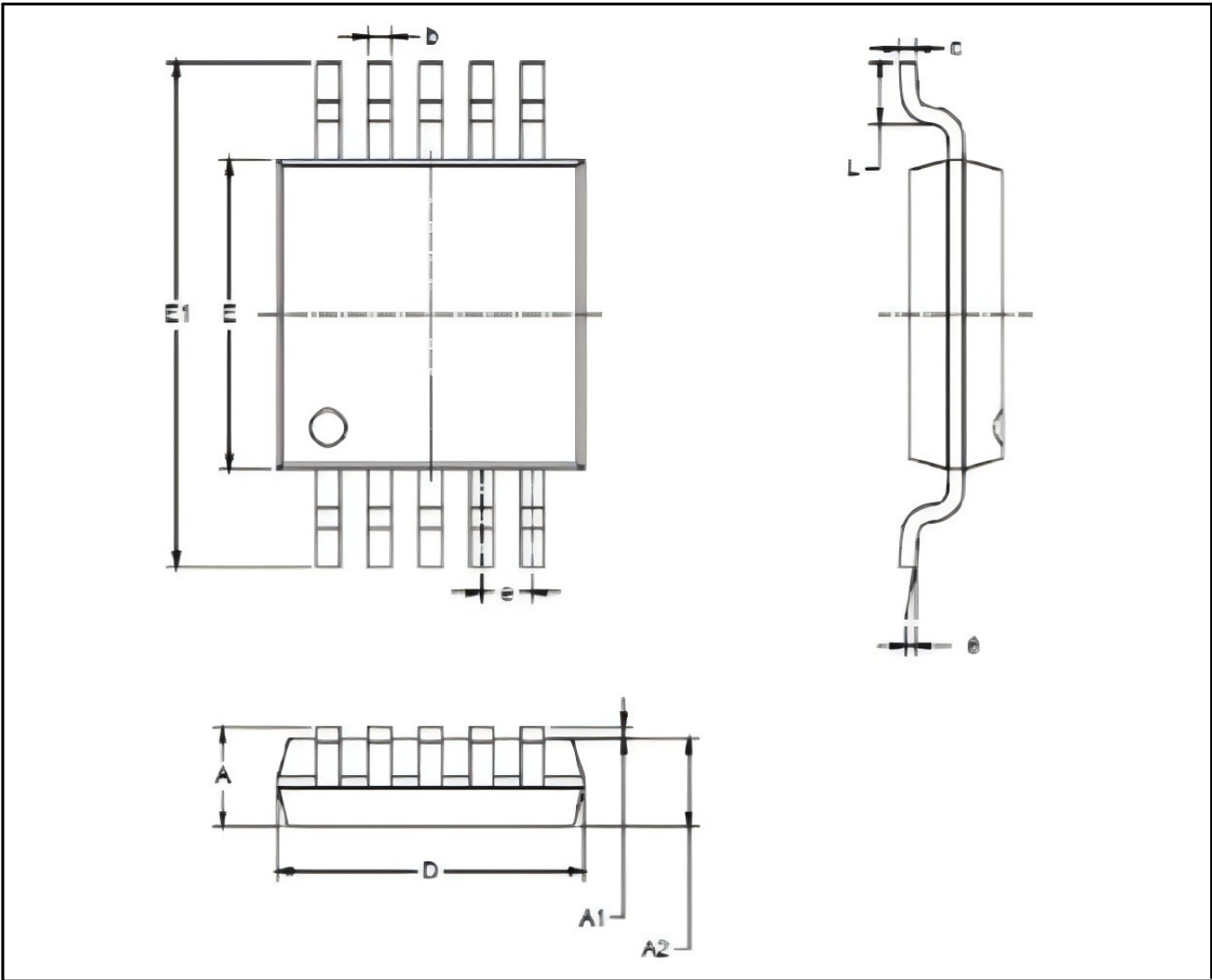


Test Circuit 7 . Charge Injection(Q)

## Package/Ordering Information

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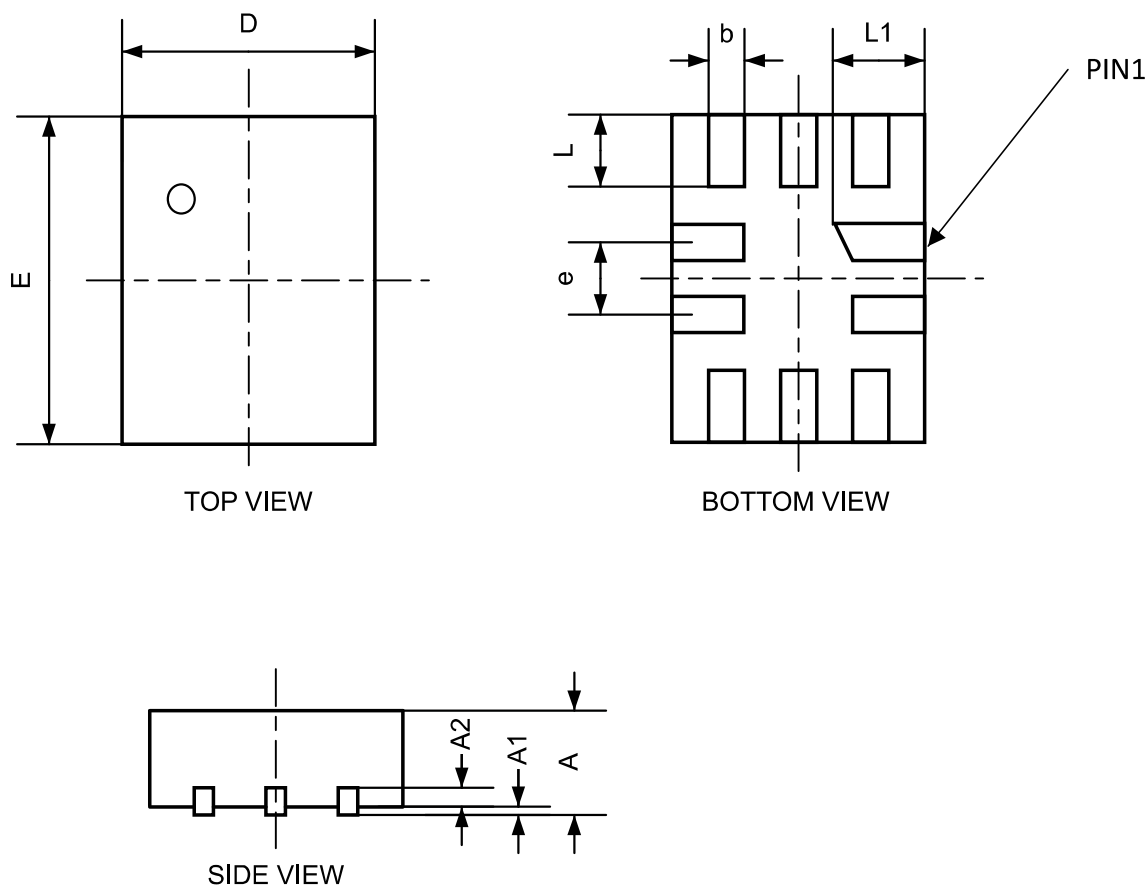
Model	Order number	Package Description	Package Option
MCS7227	MCS7227-MR	MSOP10	Tape and Reel,3000
	MCS7227-FR	UTQFN1.8×1.4-10L	Tape and Reel,3000



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	0.500 BSC		0.020 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	8°

# PACKAGE OUTLINE

UTQFN1.8×1.4-10L



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A2	0.152	0.152	0.006	0.006
b	0.150	0.250	0.006	0.010
D	1.350	1.450	0.053	0.057
E	1.750	1.850	0.069	0.073
e	0.400 TYP		0.016 TYP	
L	0.350	0.450	0.014	0.018
L2	0.450	0.550	0.015	0.002