

## GENERAL DESCRIPTION

The GS7227 is a high-speed, low-power double-pole/ double-throw (DPDT) analog switch that operates from a single 1.8V to 4.3V power supply.

GS7227 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 GS7227 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 (480 Mbps). 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 (480 Mb/s) with good signal integrity.

The GS7227 contains special circuitry on the D+/D<sub>u</sub>0002pins which allows the device to withstand a VBUS short to D+ or D- when the USB devices are either powered off or powered on.

GS7227 is available in Green UTQFN1.8×1.4-10L and MSOP10 packages. It operates over an ambient temperature range of -40°C to +85°C.

## Feature

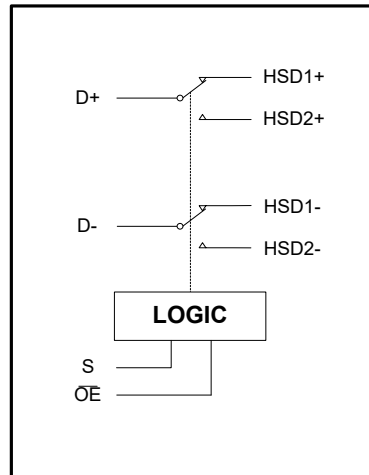
- R<sub>ON</sub> is Typically 5Ω at 3.0V
- Voltage Operation: 1.8V to 4.3V
- Fast Switching Times:
  - $t_{ON}$  15ns
  - $t_{OFF}$  20ns
- Crosstalk: -30dB at 250MHz
- Off-Isolation: -35dB at 250MHz
- Rail-to-Rail Input and Output Operation
- Break-Before-Make Switching
- Extended Industrial Temperature Range: -40°C to +85°C
- Available in Green UTQFN1.8×1.4-10L and MSOP10 Packages

## APPLICATIONS

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

**ORDERING INFORMATION**

Model	PIN-PACKAGE	Ordering Number	Packing Option
GS7227	MSOP10	GS7227-MR	3000ea/Reel
	UTQFN1.8×1.4-10L	GS7227-FR	3000ea/Reel

**BLOCK DIAGRAM**

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Min.	Typ.	Max.	Unit	Note
$V_{CC}$ to GND	0		4.6	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.

## Pin Description

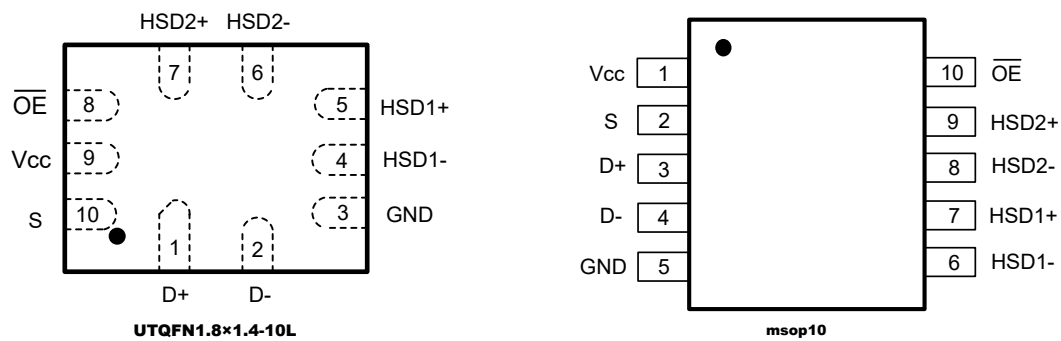


Table 1 Pin Description

PIN		NAME	FUNCTION
UTQFN1.8x1.4-10L	MSOP10		
9	1	V <sub>CC</sub>	Power Supply
3	5	GND	Ground
10	2	S	Select Input
8	10	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

Table 2 Function table

OE	S	HSD1+, HSD1-	HSD2+, HSD2-
0	0	ON	OFF
0	1	OFF	ON
1	x	OFF	OFF

**Note:** Switches Shown For Logic "0" Input.

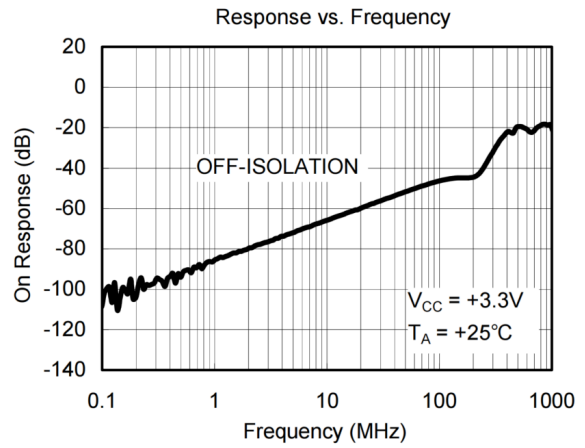
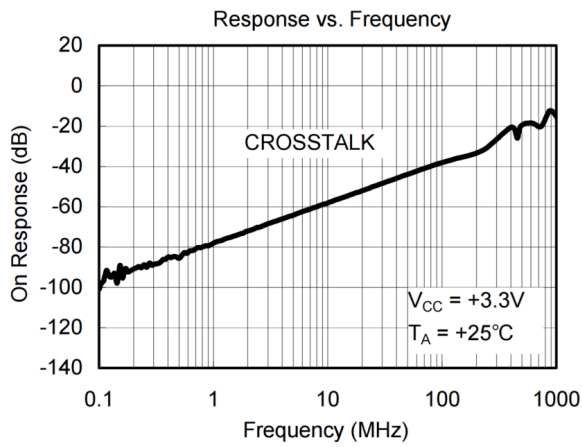
## ELECTRICAL CHARACTERISTICS

( $V_{CC} = +3.3V$ ,  $T_A = +25^{\circ}C$ , unless otherwise noted.)

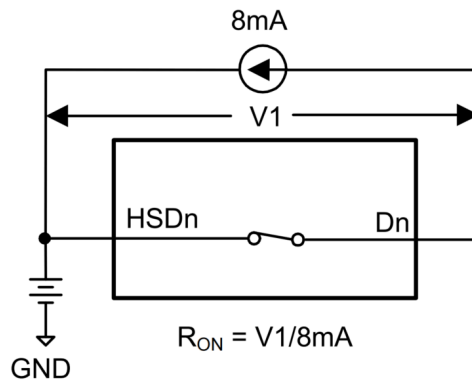
Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
<b>ANALOG SWITCH</b>						
Analog I/O Voltage (HSD1+, HSD1-, HSD2+, HSD2-)	$V_{IS}$	0		$V_{CC}$	V	
On-Resistance	$R_{ON}$		5	9	$\Omega$	$V_{CC}=3.0V$ , $V_{IS}=0V$ to $0.4V$ , $I_D=8mA$ , Test Circuit 1
On-Resistance Match Between Channels	$\Delta R_{ON}$		0.3	0.8	$\Omega$	$V_{CC}=3.0V$ , $V_{IS}=0V$ to $0.4V$ , $I_D=8mA$ , Test Circuit 1
On-Resistance Flatness	$R_{FLAT(ON)}$		1	2	$\Omega$	$V_{CC}=3.0V$ , $V_{IS}=0V$ to $1.0V$ , $I_D=8mA$ , Test Circuit 1
Power Off Leakage Current (D+, D-)	$I_{OFF}$			1	$\mu A$	$V_{CC}=0V$ , $V_D=0V$ to $3.6V$ , $V_S, V_{OE}=0V$ or $3.6V$
Increase in $I_{CC}$ per Control Voltage	$I_{CCT}$			5	$\mu A$	$V_{CC}=3.6V$ , $V_S, V_{OE}=2.6V$
Source Off Leakage Current	$I_{HSD2(OFF)}$ $I_{HSD1(OFF)}$			1	$\mu A$	$V_{CC}=3.6V$ , $V_{IS}=3.3V/0.3V$ , $V_D=0.3V/3.3V$
Channel On Leakage Current	$I_{HSD2(ON)}$ $I_{HSD1(ON)}$			1	$\mu A$	$V_{CC}=3.6V$ , $V_{IS}=3.3V/0.3V$ , $V_D=0.3V/3.3V$ or floating
<b>DIGITAL INPUTS</b>						
Input High Voltage	$V_{IH}$	1.6			V	
Input Low Voltage	$V_{IL}$			0.5	V	
Input Leakage Current	$I_{IN}$			1	$\mu A$	$V_{CC}=3.0V$ , $V_S, V_{OE}=0V$ or $V_{CC}$
<b>DYNAMIC CHARACTERISTICS</b>						
Turn-On Time	$t_{ON}$			15	ns	$V_{IS}=0.8V$ , $R_L=50\Omega$ , $C_L=10pF$ , Test Circuit 2
Turn-Off Time	$t_{OFF}$			20	ns	
Break-Before-Make Time Delay	$t_D$			3.5	ns	$V_{IS}=0.8V$ , $R_L=50\Omega$ , $C_L=10pF$ , Test Circuit 3
Propagation Delay	$t_{PD}$			0.5	ns	$R_L=50\Omega$ , $C_L=10pF$
Off Isolation	$O_{ISO}$			-35	dB	Signal = 0dBm, $R_L = 50\Omega$ , $f=250MHz$ , Test Circuit 4

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Channel-to-Channel Crosstalk	$X_{TALK}$			-30	dB	Signal = 0dBm, $R_L = 50\Omega$ , $f = 250\text{MHz}$ , Test Circuit 5
-3dB Bandwidth	BW			550	MHz	Signal = 0dBm, $R_L = 50\Omega$ , $C_L = 5\text{pF}$ , Test Circuit 6
Channel-to-Channel Skew	$t_{SKEW}$			130	ps	$R_L = 50\Omega$ , $C_L = 10\text{pF}$
Charge Injection Select Input to Common I/O	Q			10	pC	$V_G = \text{GND}$ , $C_L = 1.0\text{nF}$ , $R_G = 0\Omega$ , $Q = C_{Lx} V_{OUT}$ , Test Circuit 7
HSD+, HSD-, D+, D- ON Capacitance	$C_{ON}$			6.5	pF	$f = 1\text{MHz}$
				7		$f = 250\text{MHz}$
<b>POWER REQUIREMENTS</b>						
Power Supply Range	$V_{CC}$	1.8		4.3	V	
Power Supply Current	$I_{CC}$			1	$\mu\text{A}$	$V_{CC} = 3.0\text{V}$ , $V_S, V_{OE} = 0\text{V}$ or $V_{CC}$

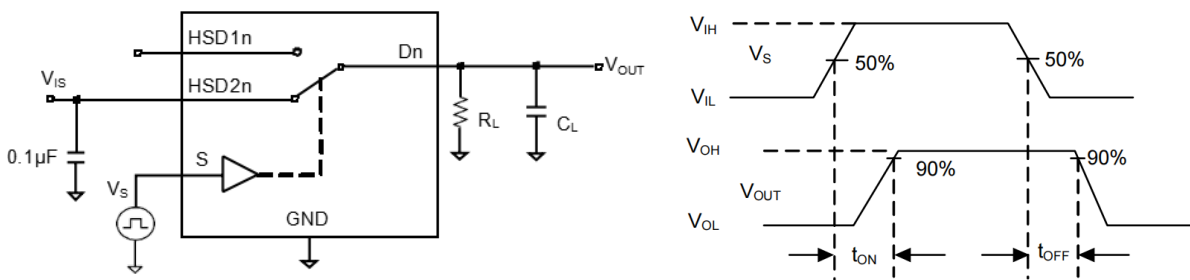
**TYPICAL PERFORMANCE CHARACTERISTICS**



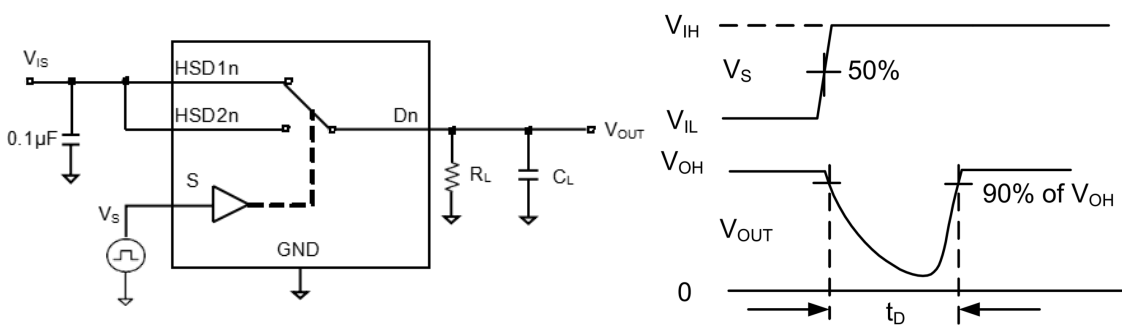
**TEST CIRCUITS**



**Figure 1 Off Isolation**



**Figure 2 Switching Times ( $t_{ON}, t_{OFF}$ )**



**Figure 3 Break-Before-Make Time ( $t_D$ )**

TEST CIRCUITS(Cont.)

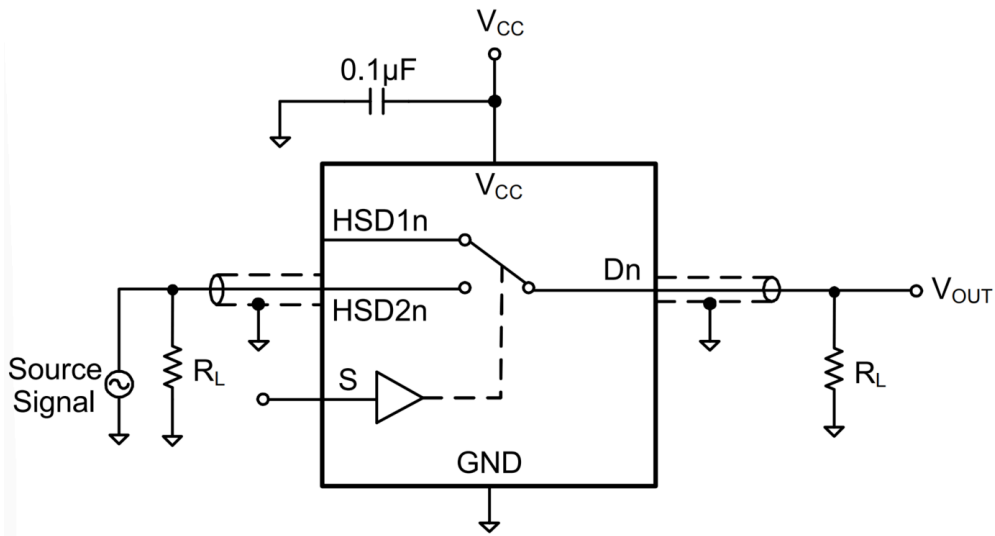
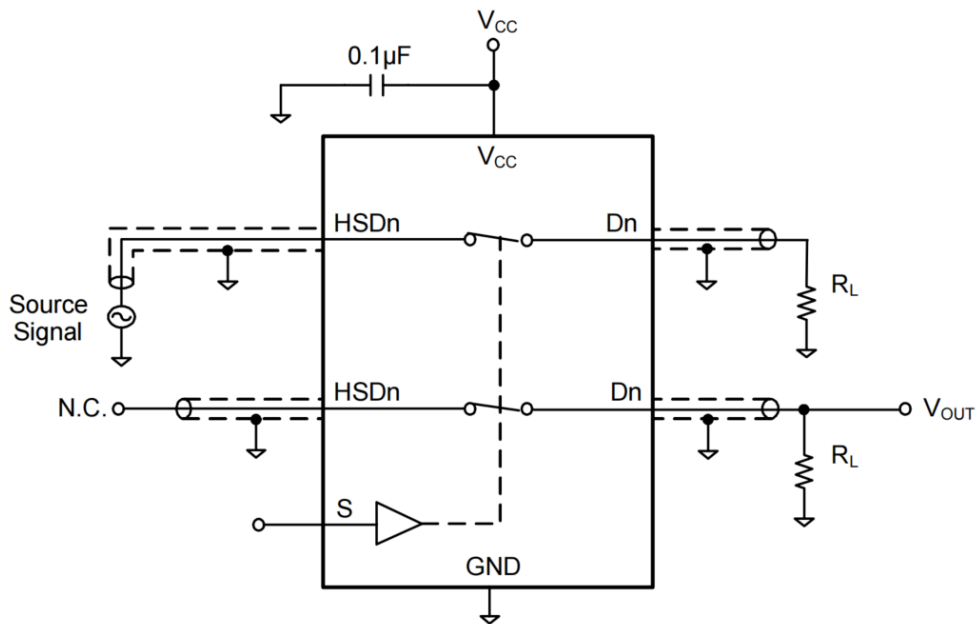


Figure 4 ff Isolation

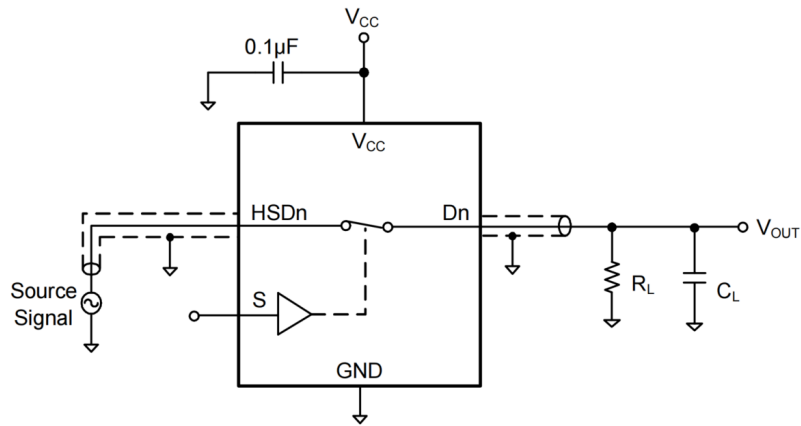


$$\text{Channel To Channel Crosstalk} = -20 \times \log \frac{V_{\text{HSDn}}}{V_{\text{OUT}}}$$

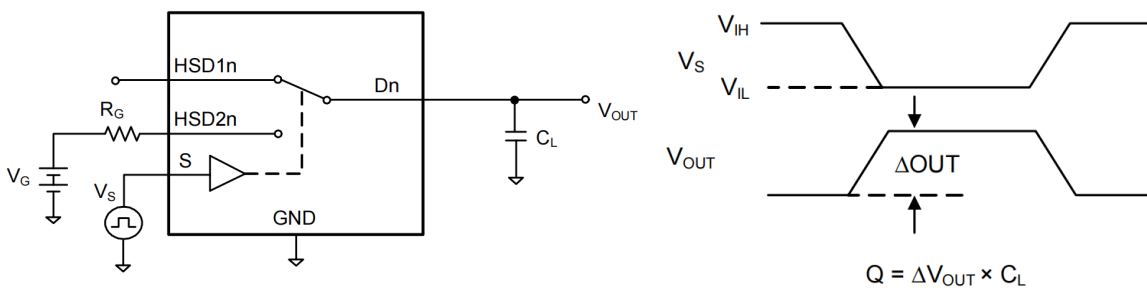
Figure 5 Channel-to-Channel Crosstalk



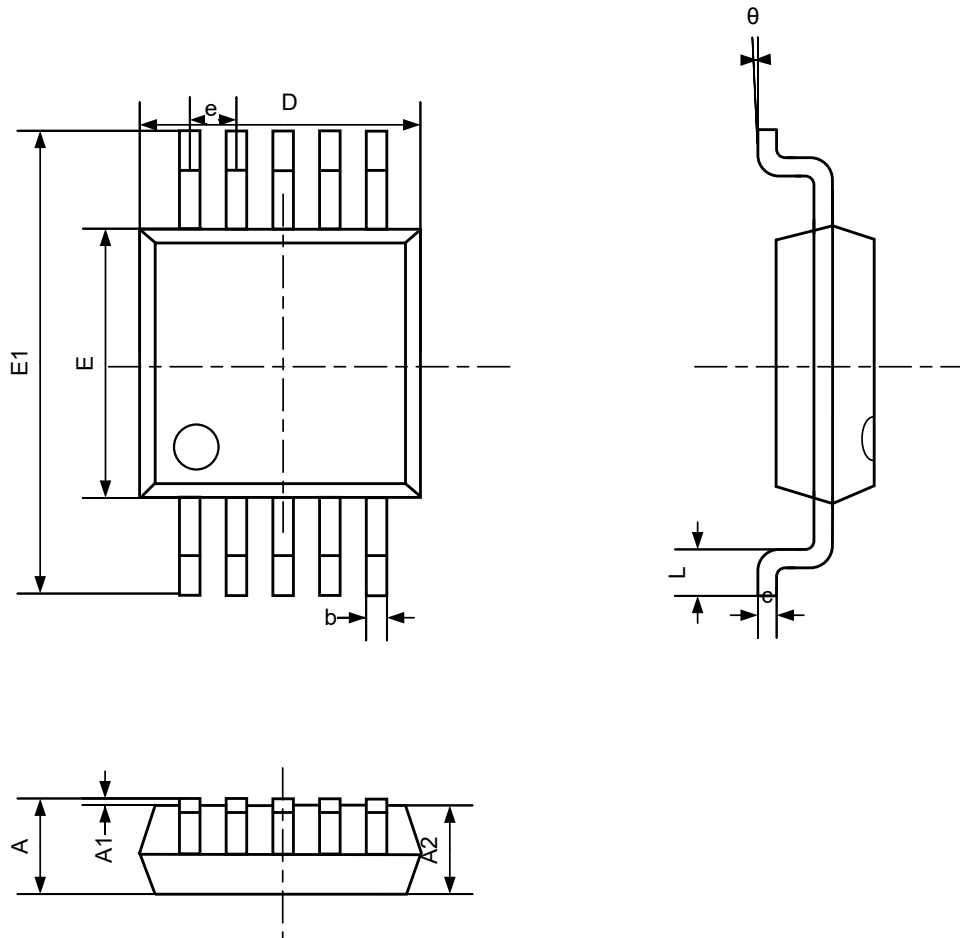
**TEST CIRCUITS(Cont.)**



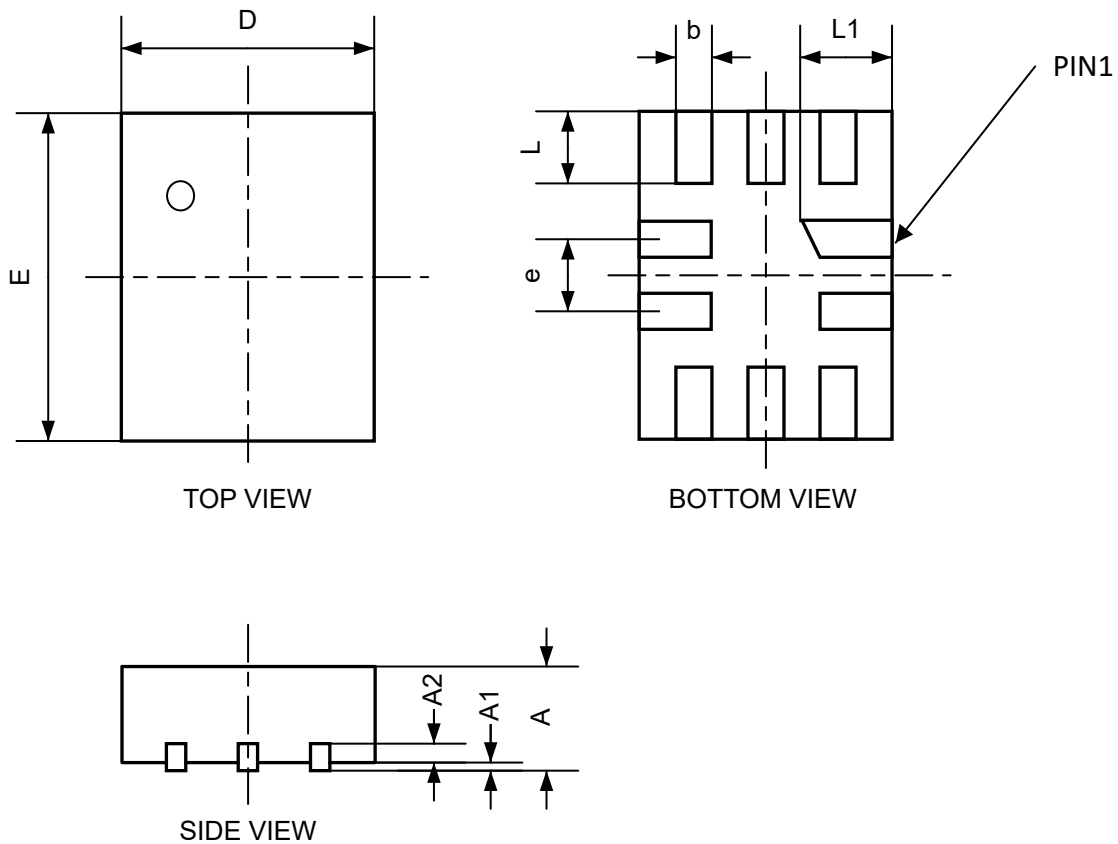
**Figure 6 -3dB Bandwidth**



**Figure 7 Charge Injection (Q)**

**Package Outline(MSOP10)**


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°	6°

**Package Outline(UTQFN1.8×1.4-10L)**


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