

## 0.8Ω Low-Voltage SPDT Analog Switch

### UM4157 SOT363

#### General Description

The UM4157 is a low on resistance, low-power, Single Pole Double Throw (SPDT) analog switch. This product has been designed for switching audio signals in applications such as cell phones and portable media players. The ultra-low 0.8Ω impedance, sub μA current consumption, and 1.65V to 4.3V operating voltage range make this product ideal for battery-powered applications. The UM4157 also features bidirectional operation and break-before-make functionality. This device is fully specified for operation at 1.8V, 2.5V, and 3.3V.

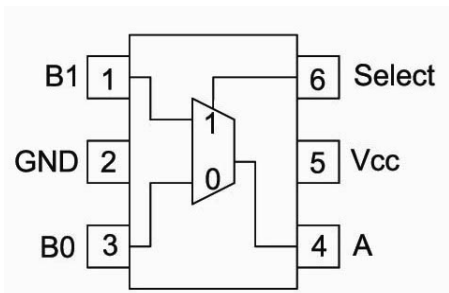
#### Applications

- Cellular Phone
- PDA
- Portable Media Player

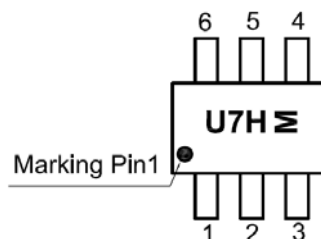
#### Features

- Typical 0.8Ω On Resistance ( $R_{ON}$ ) for 2.7V Supply
- 0.23Ω Typical  $R_{ON}$  Flatness for 2.7V Supply
- Broad  $V_{CC}$  Operating Range: 1.65V to 4.3V
- Low THD (0.02% Typical for 32Ω Load)
- Control Logic is 1.8V CMOS Logic Compatible

#### Pin Configurations



#### Top View



**M: Month Code**  
**UM4157**  
**SOT363**

#### Ordering Information

Part Number	Packaging Type	Marking Code	Shipping Qty
UM4157	SOT363	U7H	3000pcs/7 Inch Tape & Reel

#### Function Table

Select Input	Function
L	B0 Connected to A
H	B1 Connected to A

**Absolute Maximum Ratings**

Symbol	Parameter	Limit	Unit
$V_{CC}$	Supply Voltage	-0.5 to +5.5	V
$V_S$	DC Switch Voltage (Note 1)	-0.5 to ( $V_{CC}+0.3$ )	
$V_{IN}$	DC IN Voltage (Note 1)	-0.5 to $+V_{CC}$	
$I_{IK}$	DC Input Diode Current	-50	mA
$I_{SW}$	DC Switch Current	100	
$I_{SWPEAK}$	Peak Switch Current (Pulsed at 1ms Duration, <10% Duty Cycle)	150	
$T_J$	Junction Temperature Under Bias	+150	°C
$T_{STG}$	Storage Temperature Range	-65 to +150	
$T_L$	Junction Lead Temperature (Soldering, 10 Seconds)	+260	
ESD	Human Body Model	2000	V
$P_D$	SOT363 Package	180	mW

Note 1: The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

**Recommended Ratings**

Symbol	Parameter	Limit	Unit
$V_{CC}$	Supply Voltage Operating	1.65 to 4.3	V
$V_{IN}$	Control Input Voltage (Note 2)	0 to $V_{CC}$	
$V_{IN}$	Switch Input Voltage	0 to $V_{CC}$	
$T_A$	Operating Temperature	-45 to +85	°C

Note 2: Unused inputs must be held HIGH or LOW, it must not float.

**Electrical Characteristics**

Symbol	Parameter	Test Conditions	V <sub>CC</sub> (V)	Temp	Limits (-40°C to 85°C)			Unit
					Min	Typ	Max	
<b>DC Electrical Characteristics</b>								
I <sub>IN</sub>	Control Leakage Current	0 ≤ V <sub>IN</sub> ≤ V <sub>CC</sub>	1.65 to 4.3	Full	-0.5		+0.5	μA
I <sub>OFF(NO/NC)</sub>	OFF State Leakage Current	A=0.3V, V <sub>CC</sub> =0.3V, B <sub>0</sub> or B <sub>1</sub> =0.3V, V <sub>CC</sub> =0.3V or Floating	1.95 to 4.3	Room Full	-10 -50		+10 +50	nA
I <sub>ON(A)</sub>	On State Leakage Current	A=0.3V, V <sub>CC</sub> =0.3V, B <sub>0</sub> or B <sub>1</sub> =0.3V, V <sub>CC</sub> =0.3V or Floating	1.95 to 4.3	Room Full	-20 -100		+20 +100	nA
V <sub>IH</sub>	Input High Voltage		3.6 to 4.3	Full	1.4			V
			2.7 to 3.6		1.3			
			2.3 to 2.7		1.1			
			1.65 to 1.95		0.9			
V <sub>IL</sub>	Input Low Voltage		3.6 to 4.3	Full			0.7	V
			2.7 to 3.6				0.5	
			2.3 to 2.7				0.4	
			1.65 to 1.95				0.4	
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND I <sub>O</sub> = 0	4.3	Full	-3		3	μA
R <sub>ON</sub>	On-Resistance (Note 3)	I <sub>OUT</sub> = 100mA, B <sub>0</sub> or B <sub>1</sub> = 0V, 0.7V, 3.6V, 4.3V	4.3	Full		0.6	1.0	Ω
		I <sub>OUT</sub> = 100mA, B <sub>0</sub> or B <sub>1</sub> = 0V, 0.7V, 2.0V, 2.7V	2.7	Full		0.8	1.2	
		I <sub>OUT</sub> = 100mA, B <sub>0</sub> or B <sub>1</sub> = 0V, 0.7V, 2.0V, 2.3V	2.3	Full		0.9	1.3	
		I <sub>OUT</sub> = 100mA, B <sub>0</sub> or B <sub>1</sub> = 0.7V	1.65	Room Full		1.5	2.5 3.0	
ΔR <sub>ON</sub>	On Resistance Match Between Channels (Note 4)	I <sub>OUT</sub> = 100mA, B <sub>0</sub> or B <sub>1</sub> = 0.7V	4.3	Full		0.04	0.75	Ω
			2.7	Full		0.06	0.13	
			2.3	Full		0.12	0.20	
			1.65	Full		1.0		
R <sub>FLAT</sub>	On Resistance Flatness (Note 5)	I <sub>OUT</sub> = 100mA, B <sub>0</sub> or B <sub>1</sub> = 0V to V <sub>CC</sub>	4.3	Full		0.18	0.5	Ω
			2.7	Full		0.23	0.5	
			2.3	Full		0.28	0.6	
			1.65	Room		0.3		

Note 3: 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 voltages on the two (A or B Ports).

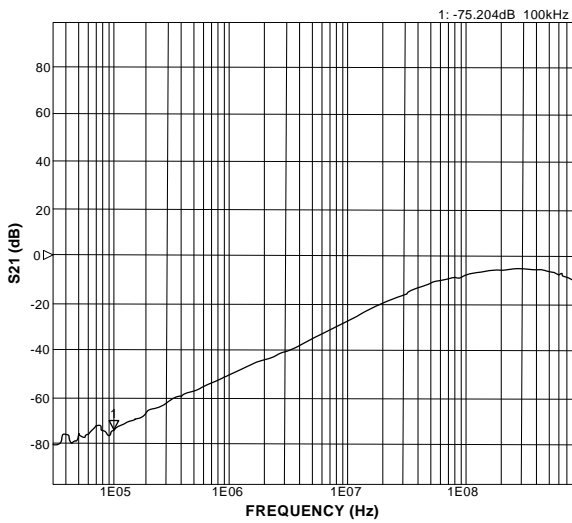
Note 4: ΔR<sub>ON</sub> = | R<sub>ON(B0)</sub> - R<sub>ON(B1)</sub> | measured at identical V<sub>CC</sub>, temperature and voltage levels.

Note 5: Flatness is defined as the difference between the maximum and minimum value of On Resistance over the specified range of input voltage.

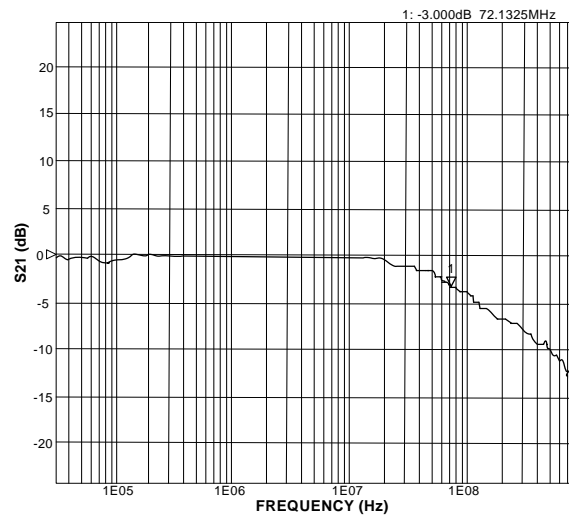
**Electrical Characteristics (Continued)**

Symbol	Parameter	Test Conditions	V <sub>CC</sub> (V)	Temp	Limits (-40°C to 85°C)			Unit
					Min	Typ	Max	
<b>AC Electrical Characteristics</b>								
t <sub>ON</sub>	Turn-On Time	B <sub>0</sub> or B <sub>1</sub> =1.5V, R <sub>L</sub> =50Ω, C <sub>L</sub> =35pF	3.6 to 4.3	Room Full			55 60	ns
			2.7 to 3.6	Room Full			60 65	
			2.3 to 2.7	Room Full			65 70	
			1.65 to 1.95	Full		70	90	
t <sub>OFF</sub>	Turn-Off Time	B <sub>0</sub> or B <sub>1</sub> =1.5V, R <sub>L</sub> =50Ω, C <sub>L</sub> =35pF	3.6 to 4.3	Room Full			30 35	ns
			2.7 to 3.6	Room Full			35 40	
			2.3 to 2.7	Room Full			40 45	
			1.65 to 1.95	Full		40	55	
t <sub>BBM</sub>	Break Before Make Time	B <sub>0</sub> or B <sub>1</sub> =1.5V, R <sub>L</sub> =50Ω, C <sub>L</sub> =35pF	1.65 to 4.3	Full	5			ns
Q <sub>INJ</sub>	Charge Injection	C <sub>L</sub> =1.0nF, V <sub>GEN</sub> =0V R <sub>GEN</sub> =0Ω	3.6 to 4.3	Room		6		pC
			2.7 to 3.6	Room		6		
			2.3 to 2.7	Room		6		
			1.65 to 1.95	Room				
O <sub>IRR</sub>	Off Isolation	f=100kHz, R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF (Stray)	1.65 to 4.3	Room		-75		dB
Xtalk	Crosstalk	f=100kHz, R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF (Stray)	3.6 to 4.3	Room		-75		dB
			2.7 to 3.6	Room		-75		
			2.3 to 2.7	Room		-75		
			1.65 to 1.95	Room		-70		
BW	-3dB Bandwidth	R <sub>L</sub> =50Ω	1.65 to 4.3	Room		70		MHz
THD	Total Harmonic Distortion		3.6 to 4.3					%
		R <sub>L</sub> =32Ω, V <sub>IN</sub> =2V <sub>P-P</sub> f=20Hz to 20kHz	2.7 to 3.6	Room		0.02		
		R <sub>L</sub> =32Ω, V <sub>IN</sub> =1.5V <sub>P-P</sub> f=20Hz to 20kHz	2.3 to 2.7	Room		0.036		
		R <sub>L</sub> =32Ω, V <sub>IN</sub> =1.2V <sub>P-P</sub> f=20Hz to 20kHz	1.65 to 1.95	Room		0.01		
<b>Capacitance</b>								
C <sub>IN</sub>	Control Pin Input Capacitance	f=1MHz	0.0	Room		1.5		pF
C <sub>IO-B</sub>	B Port Off Capacitance	f=1MHz	4.5	Room		21.0		pF
C <sub>IOA-ON</sub>	A Port Capacitance when Switch is Enabled	f=1MHz	4.5	Room		90.0		pF

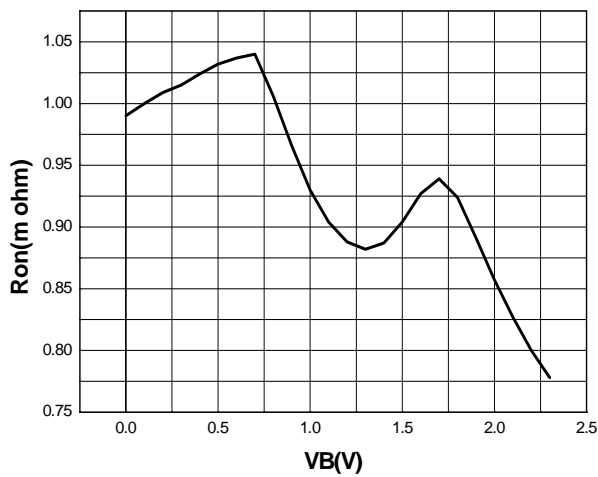
**Typical Operating Characteristics**



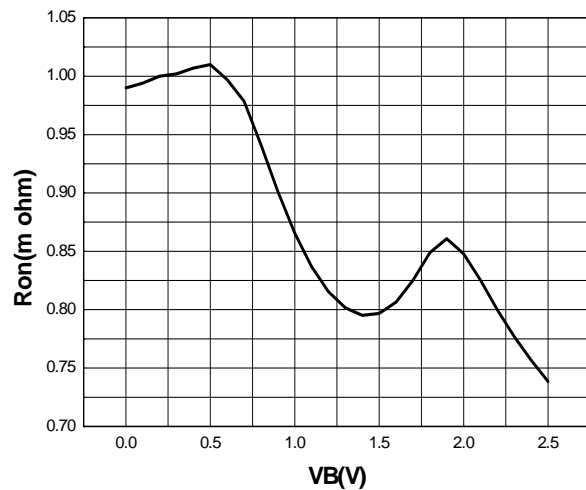
**Figure 1. Off-Isolation at  $V_{CC}=3.3V$**



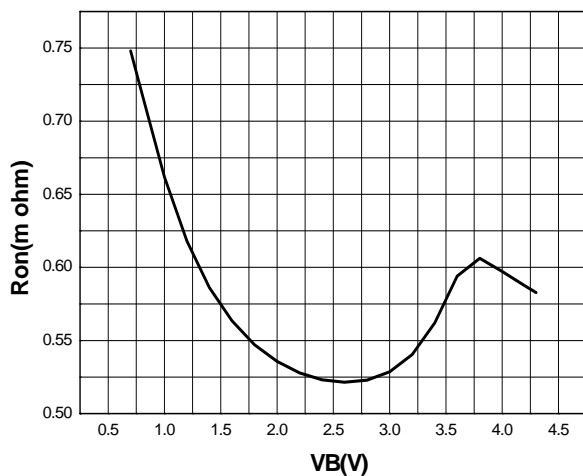
**Figure 2. Bandwidth at  $V_{CC}=3.3V$**



**Figure 3. Switch On Resistance,  $I_{on}=100mA$ ,  $V_{CC}=2.3V$ , B1**

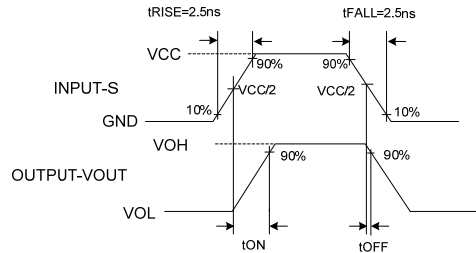
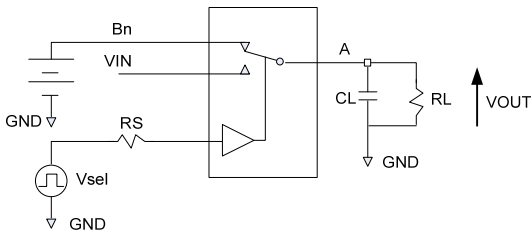


**Figure 4. Switch On Resistance,  $I_{on}=100mA$ ,  $V_{CC}=2.5V$ , B1**



**Figure 5. Switch On Resistance,  $I_{on}=100mA$ ,  $V_{CC}=4.3V$ , B1**

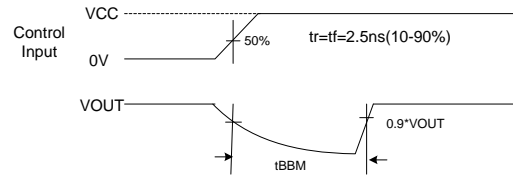
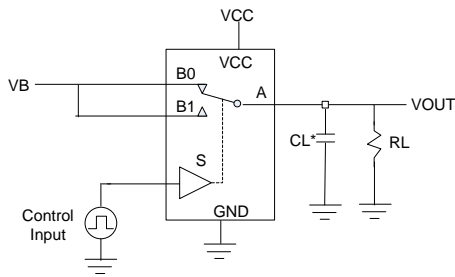
**Test Circuits/Timing Diagrams**



Note 6: RL, RS and CL are functions of the application environment. (see AC Electrical table for specific values)

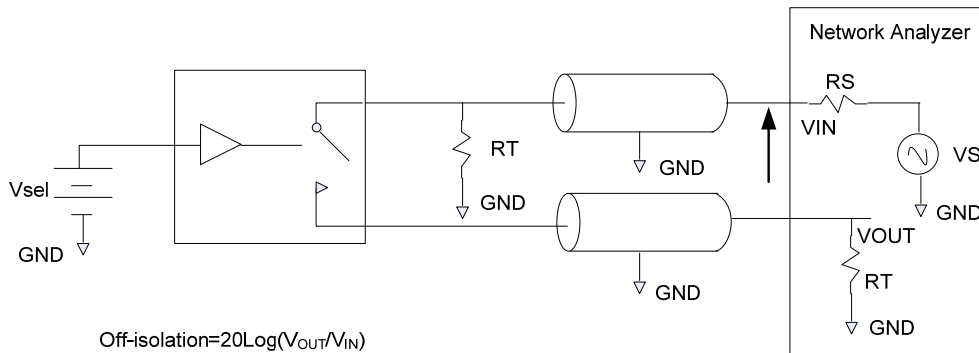
Note 7: CL includes test fixture and stray capacitance.

**Figure 6. Turn-Off Timing**



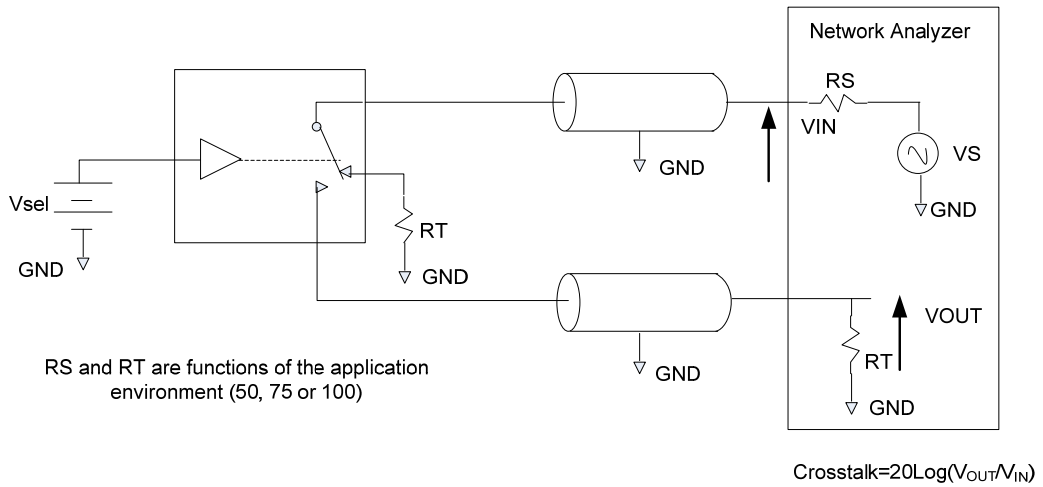
CL\* includes fixture and stray capacitance

**Figure 7. Break-Before-Make Timing**

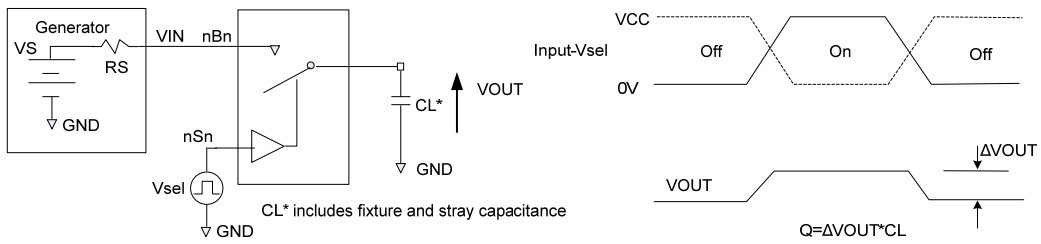


**Figure 8. Off-Isolation**

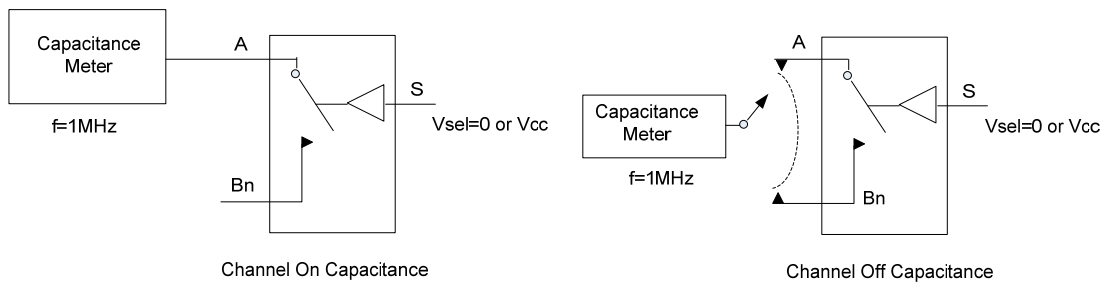
**Test Circuits/Timing Diagrams (Continued)**



**Figure 9. Non-Adjacent Channel-to-Channel Crosstalk**

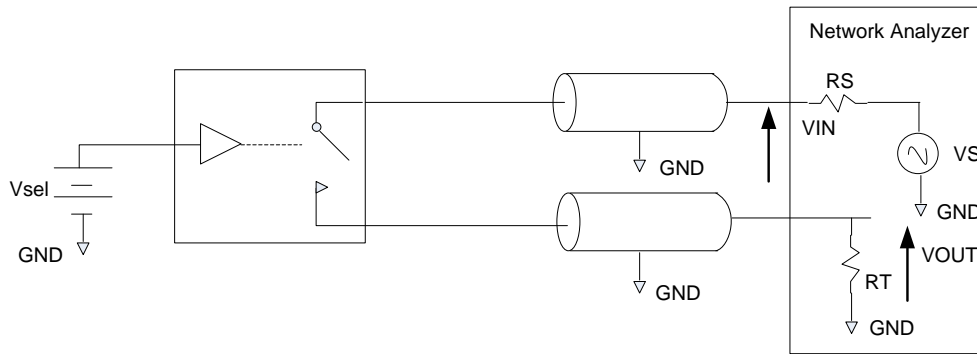


**Figure 10. Charge Injection Test**

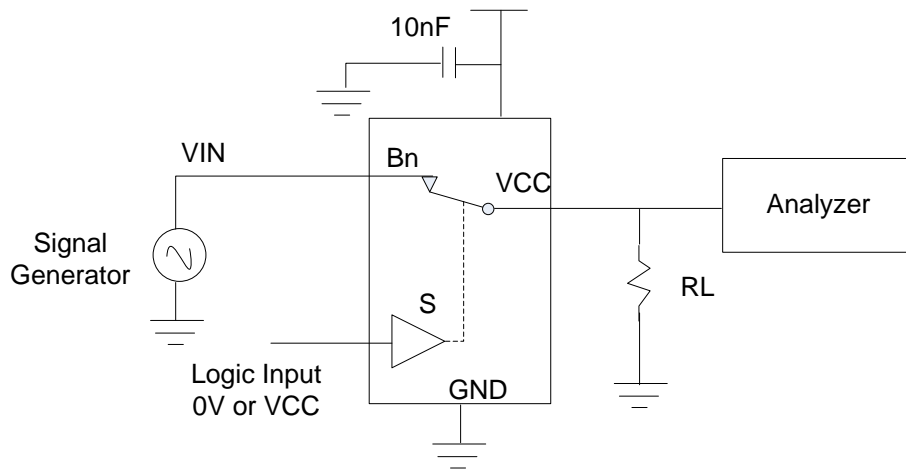


**Figure 11. On/Off Capacitance Measurement Setup**

**Test Circuits/Timing Diagrams (Continued)**



**Figure 12. Bandwidth**



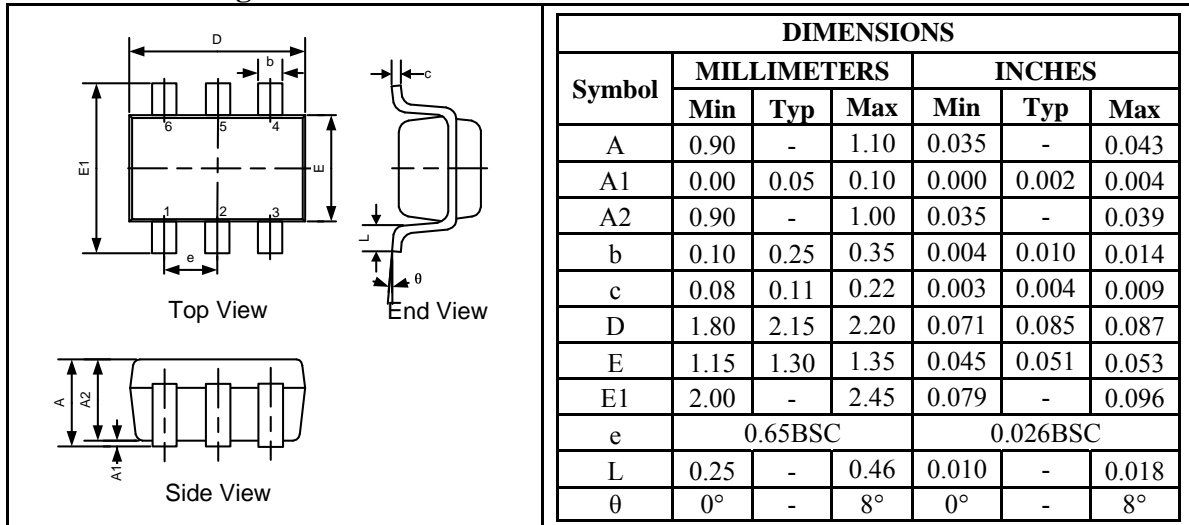
**Figure 13. Harmonic Distortion**



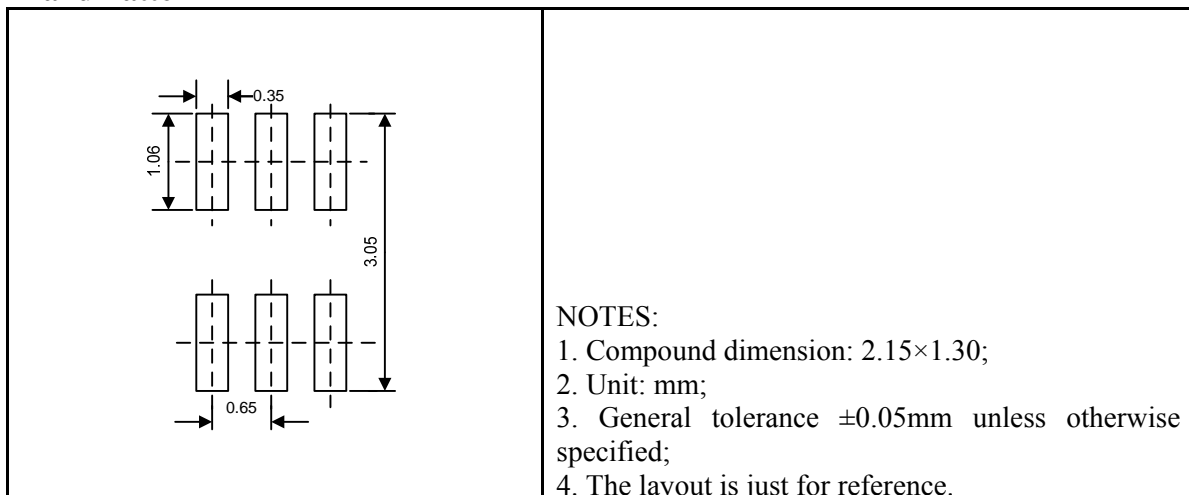
## Package Information

### UM4157 SOT363

#### Outline Drawing



#### Land Pattern



#### Tape and Reel Orientation



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