

## 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.

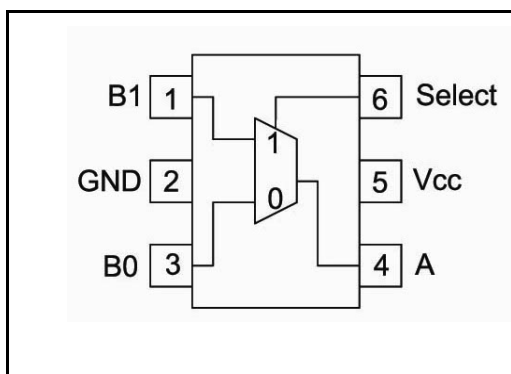
#### Applications

- Cellular Phone
- PDA
- Portable Media Player

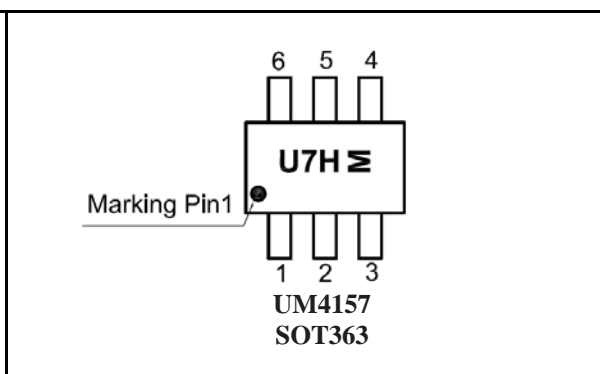
#### Features

- Typical 0.8Ω On Resistance (R<sub>ON</sub>) for 2.7V Supply
- 0.23Ω typical R<sub>ON</sub> Flatness for 2.7V Supply
- Broad V<sub>CC</sub> 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



#### 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 <sub>CC</sub>	Supply Voltage	- 0.5 to + 5.5	V
V <sub>S</sub>	DC Switch Voltage (Note 1)	- 0.5 to (V <sub>CC</sub> + 0.3)	
V <sub>IN</sub>	DC IN Voltage (Note 1)	- 0.5 to + V <sub>CC</sub>	
I <sub>IK</sub>	DC Input Diode Current	-50	mA
I <sub>SW</sub>	DC Switch Current	100	
I <sub>SWPEAK</sub>	Peak Switch Current (Pulsed at 1ms duration, < 10% Duty Cycle)	150	
T <sub>J</sub>	Junction Temperature Under Bias	+150	°C
T <sub>STG</sub>	Storage Temperature Range	- 65 to +150	
T <sub>L</sub>	Junction Lead Temperature (Soldering, 10seconds)	+260	
ESD	Human Body Model	2000	V
P <sub>D</sub>	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 <sub>CC</sub>	Supply Voltage Operating	1.65 to 4.3	V
V <sub>IN</sub>	Control Input Voltage (Note 2)	0 to V <sub>CC</sub>	
V <sub>IN</sub>	Switch Input Voltage	0 to V <sub>CC</sub>	
T <sub>A</sub>	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	Vcc(V)	Temp	Limits (-40 to 85 °C)			Unit	
					Min	Typ	Max		
<b>DC Electrical Characteristics</b>									
$I_{IN}$	Control Leakage Current	$0 \leq V_{IN} \leq V_{CC}$	1.65 to 4.3	Full	-0.5		+0.5	$\mu A$	
$I_{OFF(NO/N C)}$	OFF State Leakage Current	A=0.3V, $V_{CC}$ -0.3V, $B_0$ or $B_1$ =0.3V, $V_{CC}$ -0.3V or Floating	1.95 to 4.3	Room Full	-10 -50		+10 +50	nA	
$I_{ON(A)}$	On State Leakage Current	A=0.3V, $V_{CC}$ -0.3V, $B_0$ or $B_1$ =0.3V, $V_{CC}$ -0.3V or Floating	1.95 to 4.3	Room Full	-20 -100		+20 +100	nA	
$V_{IH}$	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				
$V_{IL}$	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		
$I_{CC}$	Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND $I_O = 0$	4.3	Full	-3		3	$\mu A$	
$R_{ON}$	On-Resistance (Note3)		$I_{OUT} = 100mA$ , $B_0$ or $B_1 = 0V, 0.7V, 3.6V, 4.3V$	4.3	Full		0.6	1.0	$\Omega$
			$I_{OUT} = 100mA$ , $B_0$ or $B_1 = 0V, 0.7V, 2.0V, 2.7V$	2.7	Full		0.8	1.2	
			$I_{OUT} = 100mA$ , $B_0$ or $B_1 = 0V, 0.7V, 2.0V, 2.3V$	2.3	Full		0.9	1.3	
			$I_{OUT} = 100mA$ , $B_0$ or $B_1 = 0.7V$	1.65	Room Full		1.5	2.5 3.0	
$\Delta R_{ON}$	On Resistance Match Between Channels (Note4)	$I_{OUT} = 100mA$ , $B_0$ or $B_1 = 0.7V$	4.3	Full		0.04	0.75	$\Omega$	
			2.7	Full		0.06	0.13		
			2.3	Full		0.12	0.20		
			1.65	Full		1.0			
$R_{FLAT}$	On Resistance Flatness (Note5)	$I_{OUT} = 100mA$ , $B_0$ or $B_1 = 0V$ to $V_{CC}$	4.3	Full		0.18	0.5	$\Omega$	
			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:  $\Delta R_{ON} = |R_{ON(B0)} - R_{ON(B1)}|$  measured at identical  $V_{CC}$ , 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	Vcc(V)	Temp	Limits (-40 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>INI</sub>	Charge Injection	C <sub>L</sub> = 1.0 nF, V <sub>GEN</sub> = 0 V 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 = 100 kHz, R <sub>L</sub> =50Ω, C <sub>L</sub> = 5pF(Stray),	1.65 to 4.3	Room		-75		dB
Xtalk	Crosstalk	f = 100 kHz, 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	-3 dB Bandwidth	R <sub>L</sub> =50Ω	1.65 to 4.3	Room		70		MHz
THD	Total Harmonic Distortion		3.6 to 4.3					%
			2.7 to 3.6	Room		0.02		
			2.3 to 2.7	Room		0.036		
			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 Characteristics**

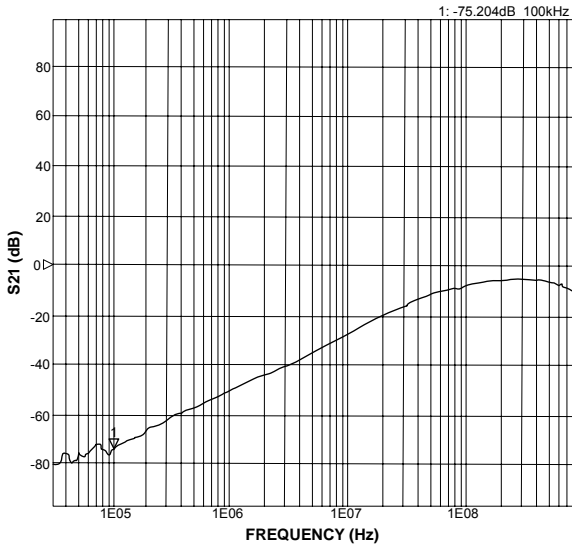


Figure1. Off-Isolation at VCC=3.3V

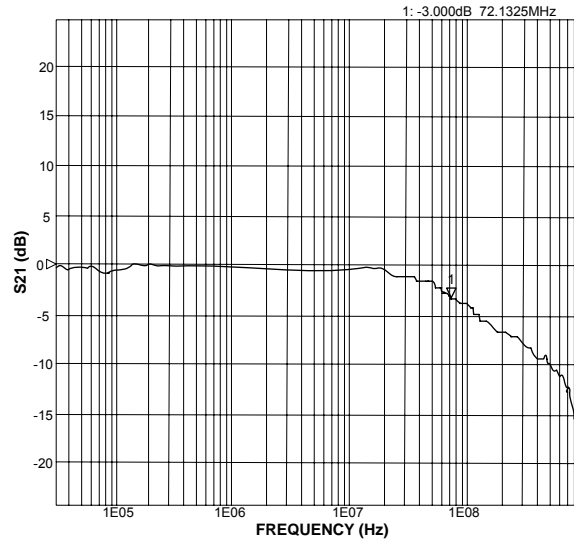


Figure2. Bandwidth at VCC=-3.3V

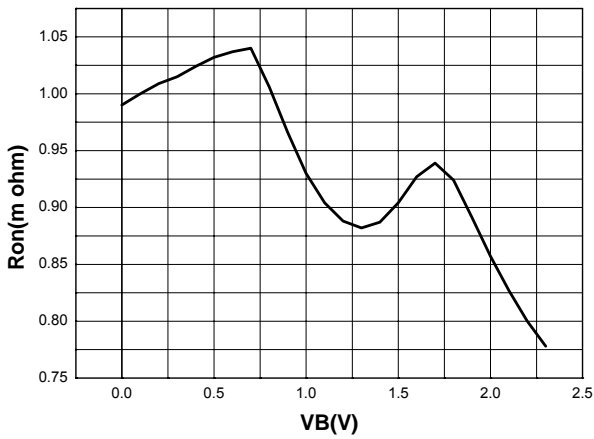


Figure3. Switch On Resistance, Ion=100mA, Vcc=2.3V, B1

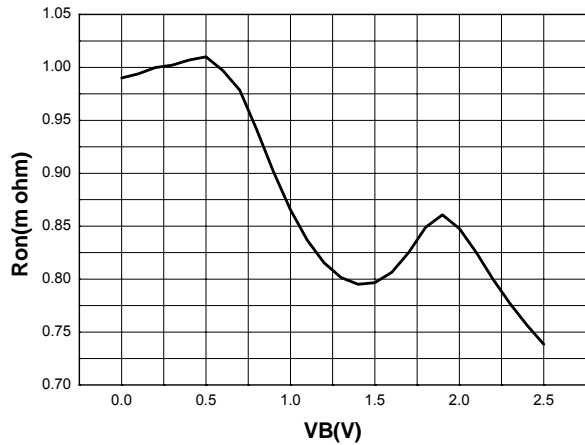


Figure4. Switch On Resistance, Ion=100mA, Vcc=2.5V, B1

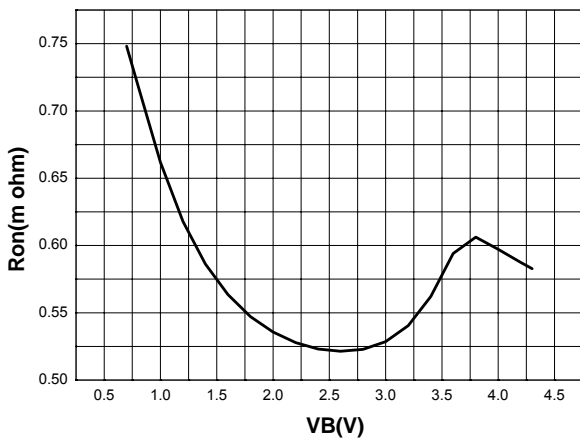
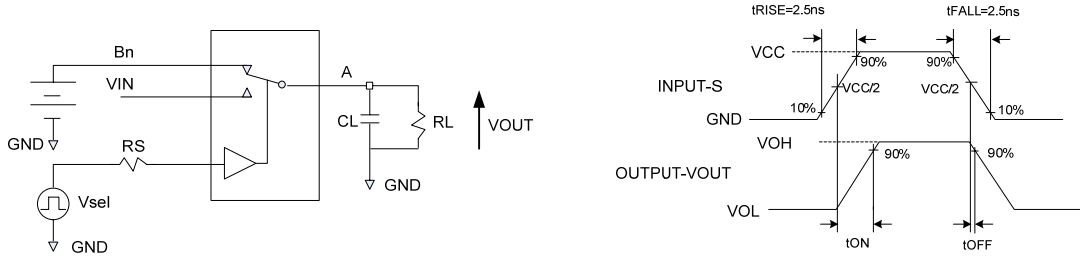


Figure5. Switch On Resistance, Ion=100mA, Vcc=4.3V, B1

**Test Circuits/Timing Diagrams**

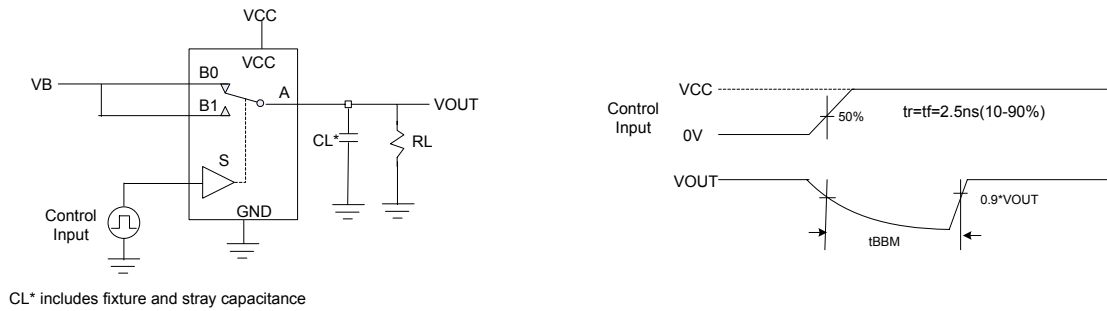


Notes:

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

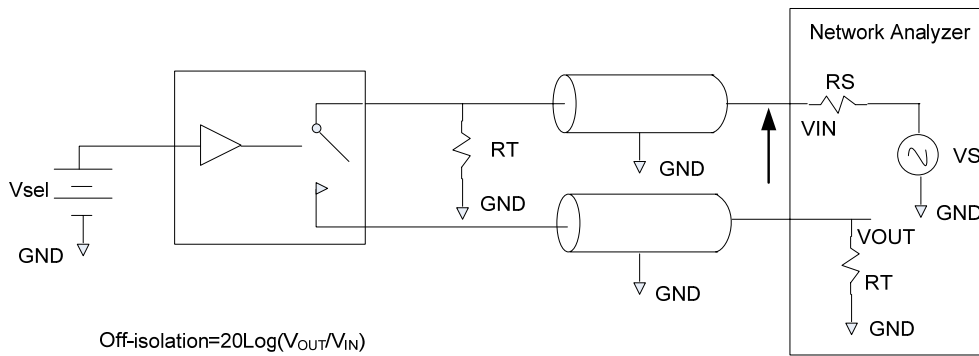
7. CL includes test fixture and stray capacitance.

**Figure 6. Turn-Off Timing**



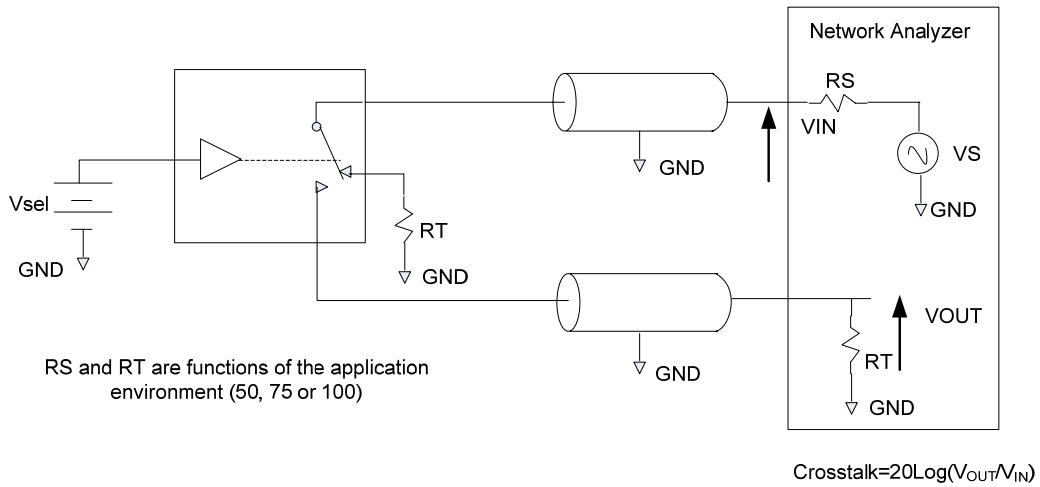
CL\* includes fixture and stray capacitance

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

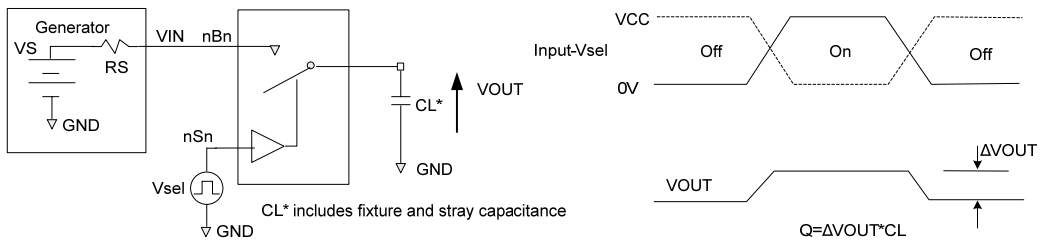


**Figure 8. Off-Isolation**

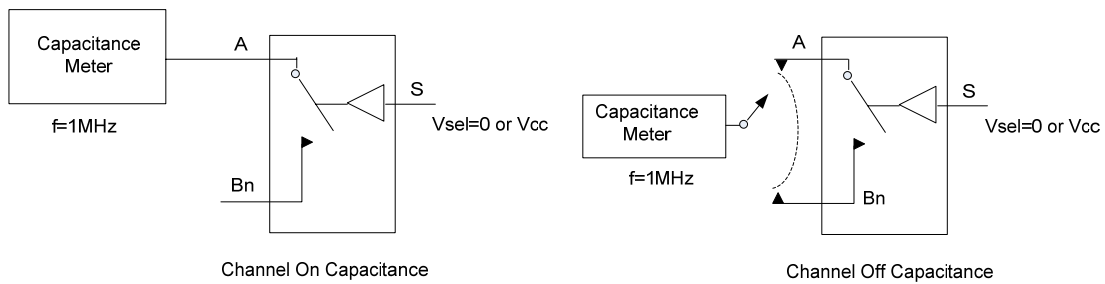
**Test Circuits/Timing Diagrams (Continued)**



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

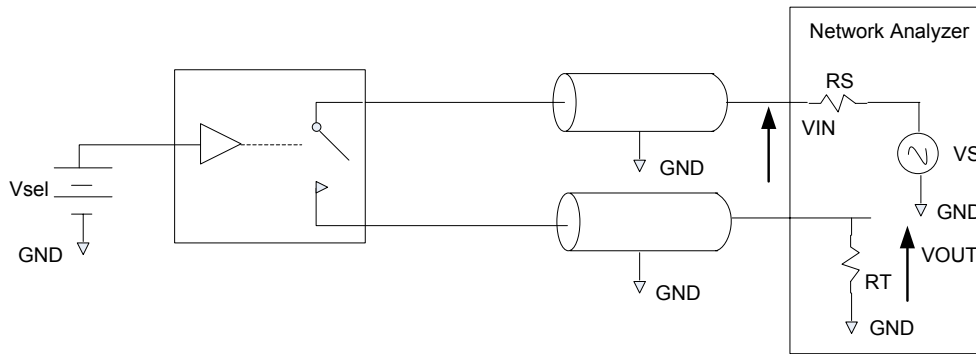


**Figure 10. Charge Injection Test**

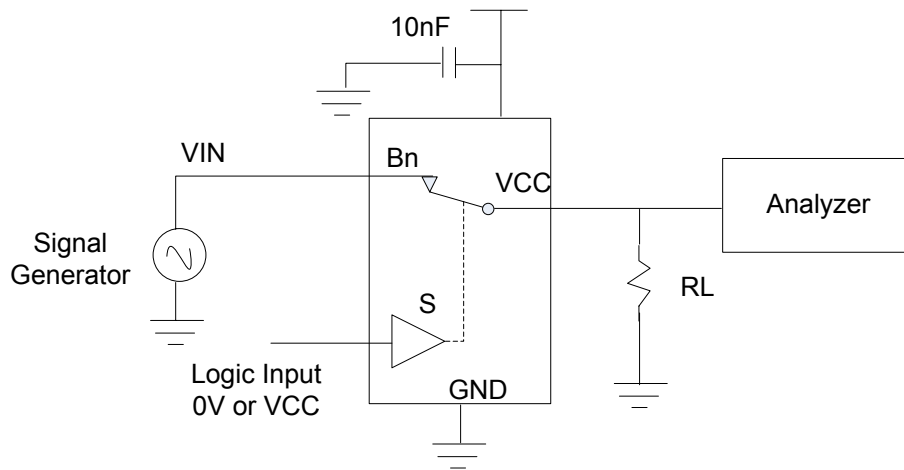


**Figure 11. On/Off Capacitance Measurement Setup**

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



**Figure 12. Bandwidth**

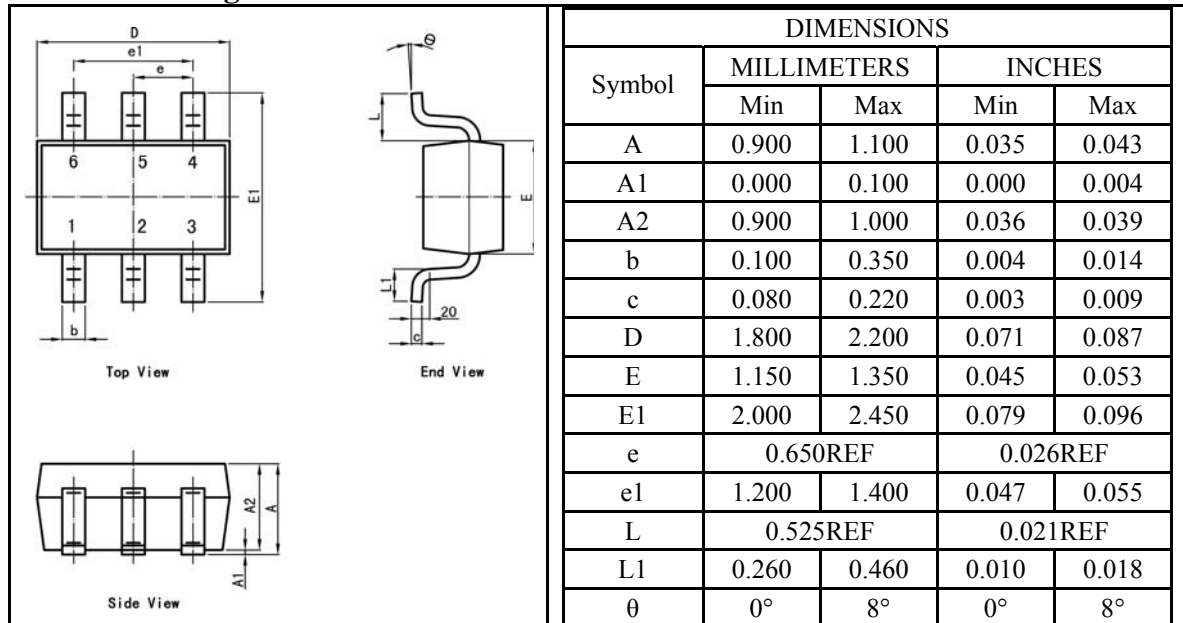


**Figure 13. Harmonic Distortion**

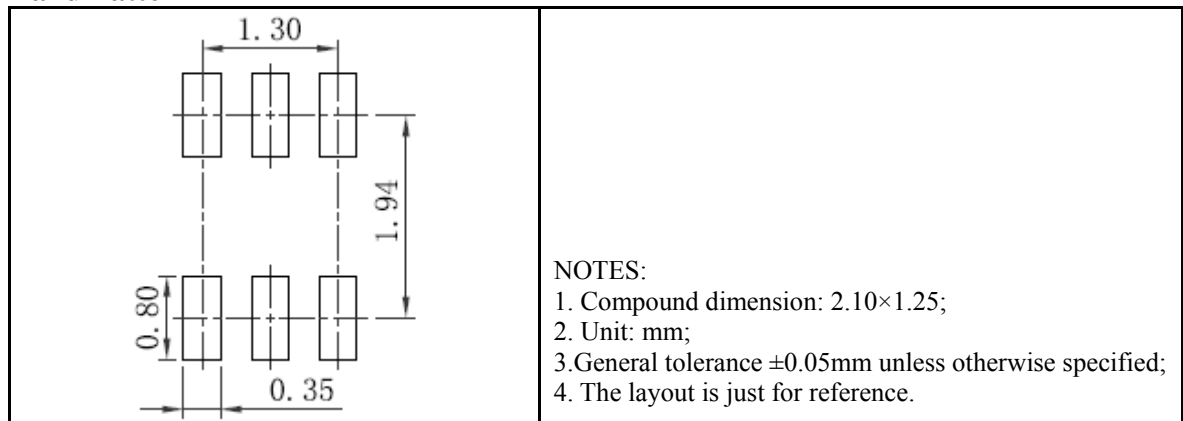
## Package Information

### UM4157 SOT363

#### Outline Drawing



#### Land Pattern



#### Tape and Reel Orientation



---

**IMPORTANT NOTICE**

The information in this document has been carefully reviewed and is believed to be accurate. Nonetheless, this document is subject to change without notice. Union assumes no responsibility for any inaccuracies that may be contained in this document, and makes no commitment to update or to keep current the contained information, or to notify a person or organization of any update. Union reserves the right to make changes, at any time, in order to improve reliability, function or design and to attempt to supply the best product possible.



Union Semiconductor, Inc

Add: 7F, No. 5, Bibo Road, Shanghai 201203

Tel: 021-51097928

Fax: 021-51026018

Website: [www.union-ic.com](http://www.union-ic.com)