

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

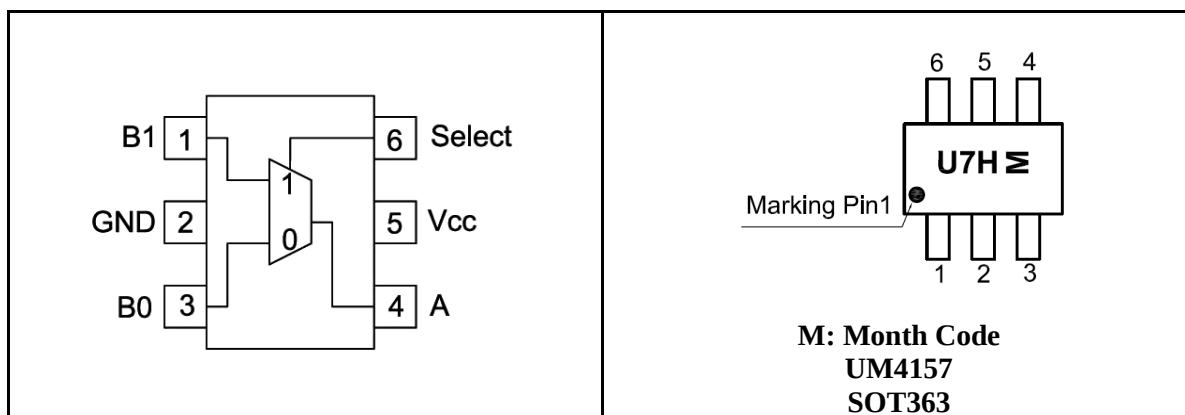
- Cellular Phone
- PDA
- Portable Media Player

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



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 _{CC} (V)	Temp	Limits (-40 °C to 85 °C)			Unit
					Min	Typ	Max	
DC Electrical Characteristics								
I _{IN}	Control Leakage Current	0≤V _{IN} ≤V _{CC}	1.65 to 4.3	Full	-0.5		+0.5	μA
I _{OFF(NO/NC)}	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	μA
R _{ON}	On-Resistance (Note 3)	I _{OUT} =100mA, B ₀ or B ₁ =0V,0.7V,3.6V,4.3V	4.3	Full		0.6	1.0	Ω
		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	
ΔR _{ON}	On Resistance Match Between Channels (Note 4)	I _{OUT} =100mA, B ₀ or B ₁ =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 _{FLAT}	On Resistance Flatness (Note 5)	I _{OUT} =100mA, B ₀ or B ₁ =0V to V _{CC}	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_{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	V _{CC} (V)	Temp	Limits (-40 °C to 85 °C)			Unit
					Min	Typ	Max	
AC Electrical Characteristics								
t _{ON}	Turn-On Time	B ₀ or B ₁ =1.5V, R _L =50Ω, C _L =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 _{OFF}	Turn-Off Time	B ₀ or B ₁ =1.5V, R _L =50Ω, C _L =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 _{BBM}	Break Before Make Time	B ₀ or B ₁ =1.5V, R _L =50Ω, C _L =35pF	1.65 to 4.3	Full	5			ns
Q _{INJ}	Charge Injection	C _L =1.0nF, V _{GEN} =0V R _{GEN} =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 _{IRR}	Off Isolation	f=100kHz, R _L =50Ω, C _L =5pF (Stray)	1.65 to 4.3	Room		-75		dB
Xtalk	Crosstalk	f=100kHz, R _L =50Ω, C _L =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 _L =50Ω	1.65 to 4.3	Room		70		MHz
THD	Total Harmonic Distortion		3.6 to 4.3					%
		R _L =32Ω, V _{IN} =2V _{P-P} f=20Hz to 20kHz	2.7 to 3.6	Room		0.02		
		R _L =32Ω, V _{IN} =1.5V _{P-P} f=20Hz to 20kHz	2.3 to 2.7	Room		0.036		
		R _L =32Ω, V _{IN} =1.2V _{P-P} f=20Hz to 20kHz	1.65 to 1.95	Room		0.01		
Capacitance								
C _{IN}	Control Pin Input Capacitance	f=1MHz	0.0	Room		1.5		pF
C _{IO-B}	B Port Off Capacitance	f=1MHz	4.5	Room		21.0		pF
C _{IOA-ON}	A Port Capacitance when Switch is Enabled	f=1MHz	4.5	Room		90.0		pF

Typical Operating Characteristics

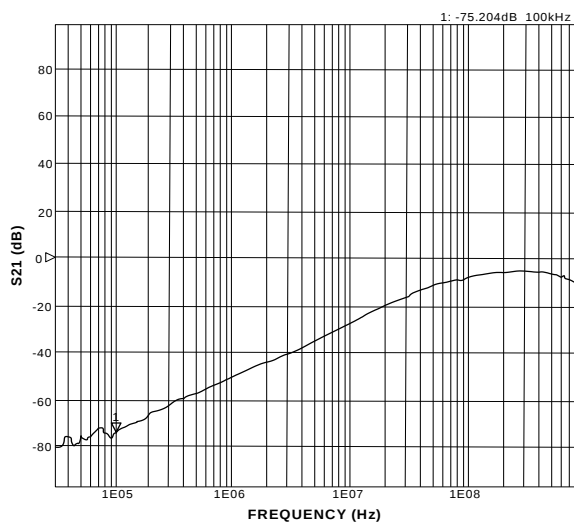


Figure 1. Off-Isolation at $V_{CC}=3.3V$

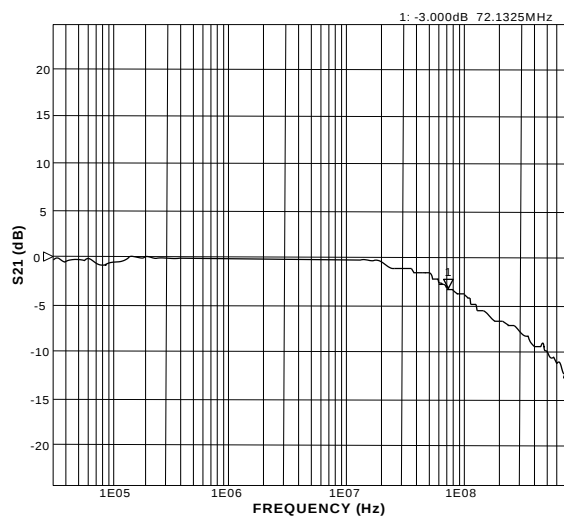


Figure 2. Bandwidth at $V_{CC}=-3.3V$

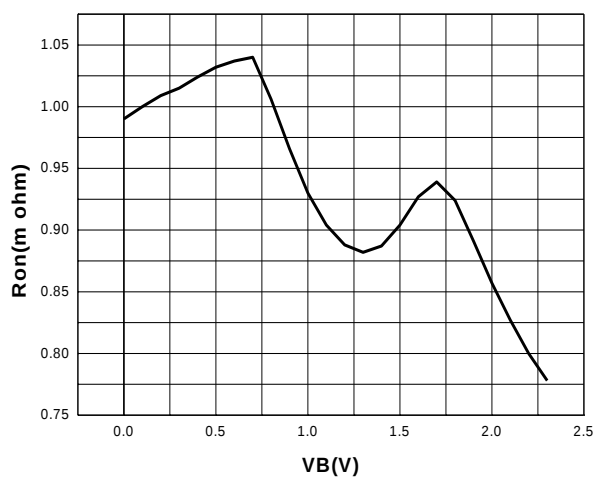


Figure 3. Switch On Resistance, $I_{on}=100mA$, $V_{CC}=2.3V$, B1

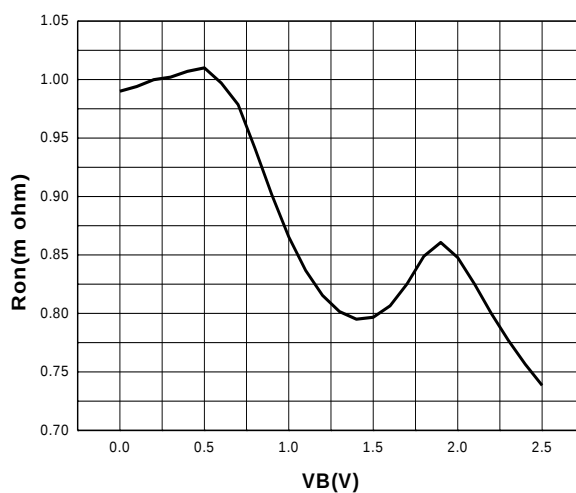


Figure 4. Switch On Resistance, $I_{on}=100mA$, $V_{CC}=2.5V$, B1

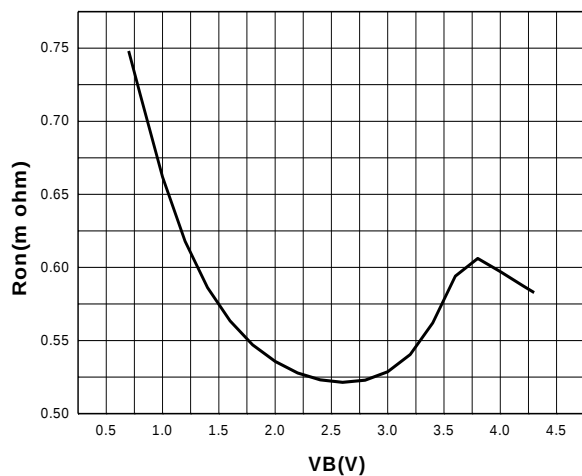
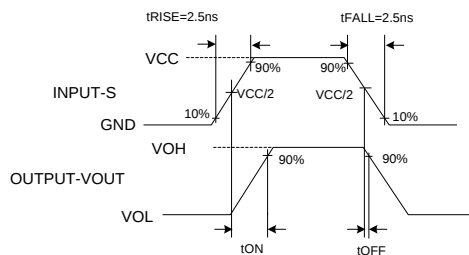
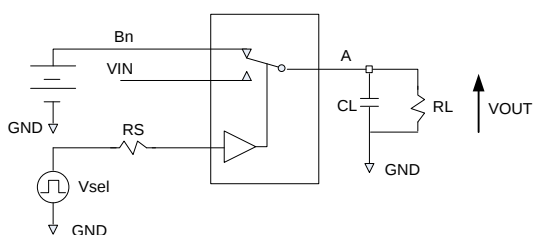


Figure 5. Switch On Resistance, $I_{on}=100mA$, $V_{cc}=4.3V$, B1

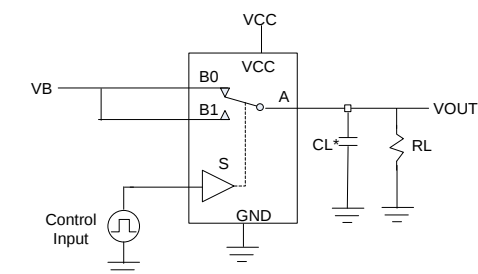
Test Circuits/Timing Diagrams



Note 6: R_L , R_S and C_L are functions of the application environment. (see AC Electrical table for specific values)

Note 7: C_L includes test fixture and stray capacitance.

Figure 6. Turn-Off Timing



CL* includes fixture and stray capacitance

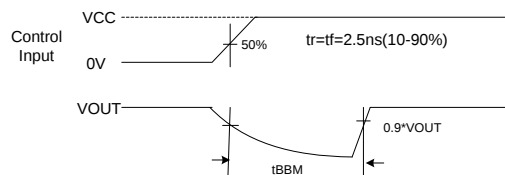
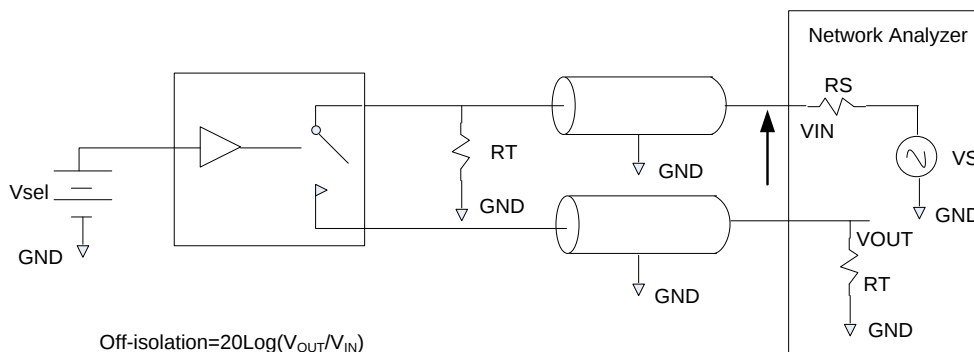


Figure 7. Break-Before-Make Timing



$$\text{Off-isolation} = 20 \log(V_{OUT}/V_{IN})$$

Figure 8. Off-Isolation

Test Circuits/Timing Diagrams (Continued)

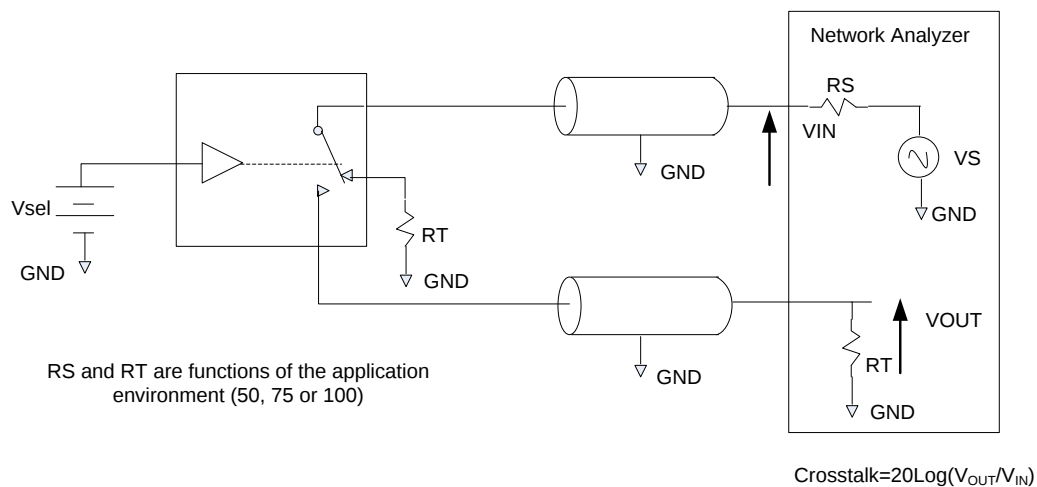


Figure 9. Non-Adjacent Channel-to-Channel Crosstalk

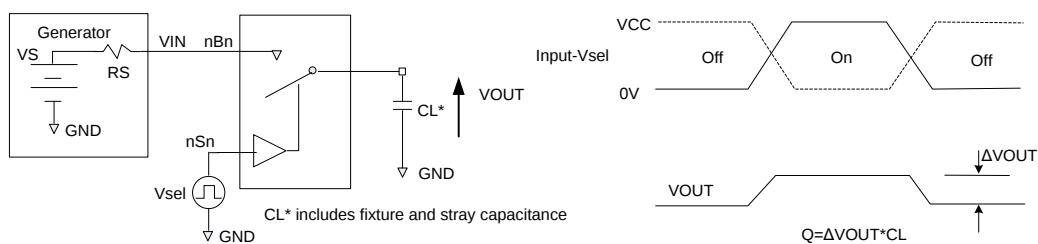


Figure 10. Charge Injection Test

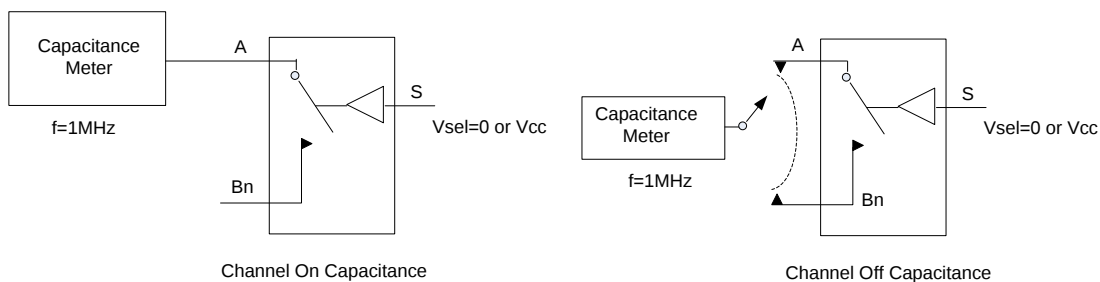


Figure 11. On/Off Capacitance Measurement Setup

Test Circuits/Timing Diagrams (Continued)

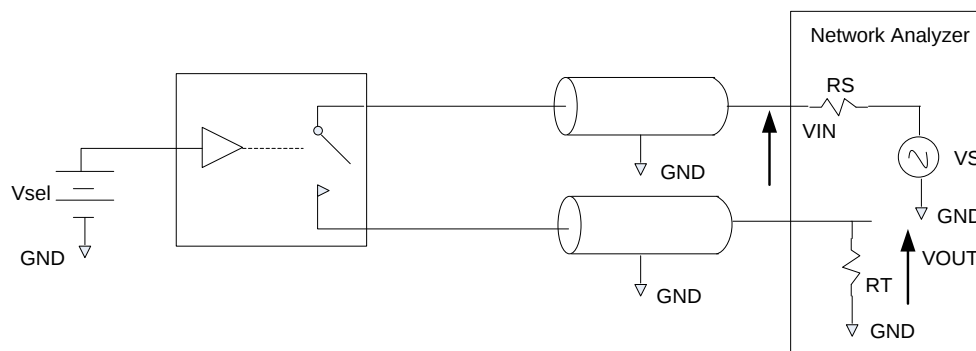


Figure 12. Bandwidth

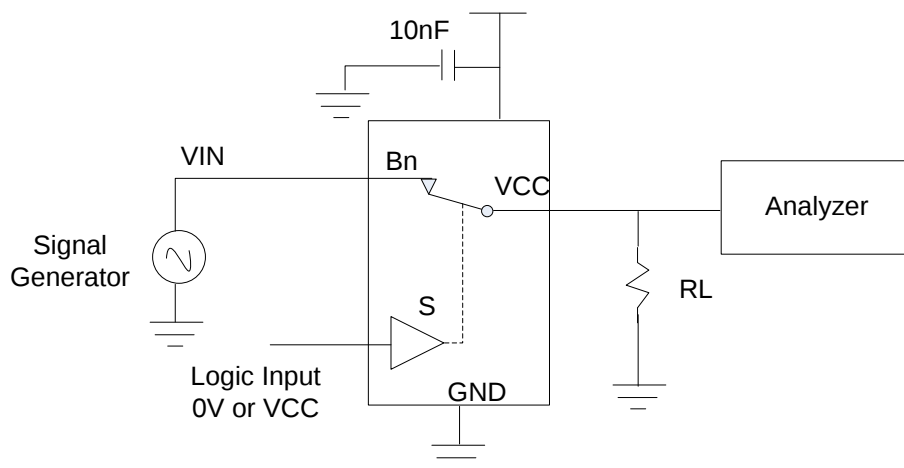
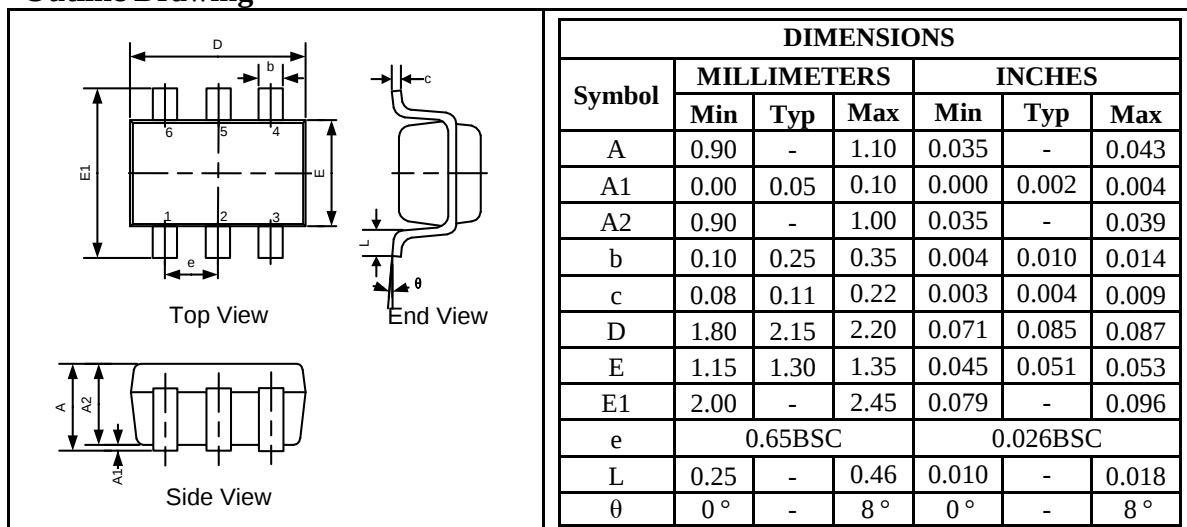


Figure 13. Harmonic Distortion

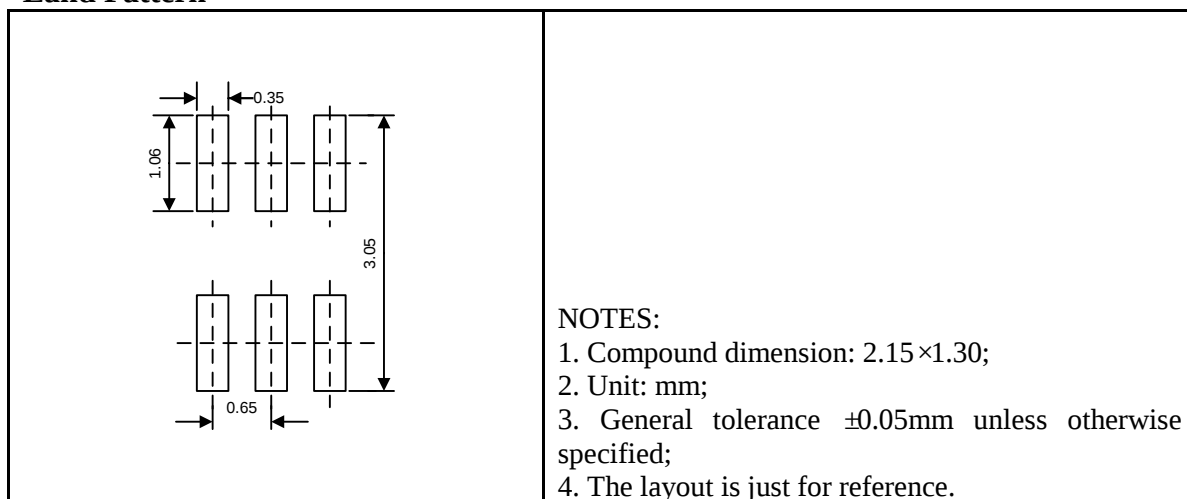
Package Information

UM4157 SOT363

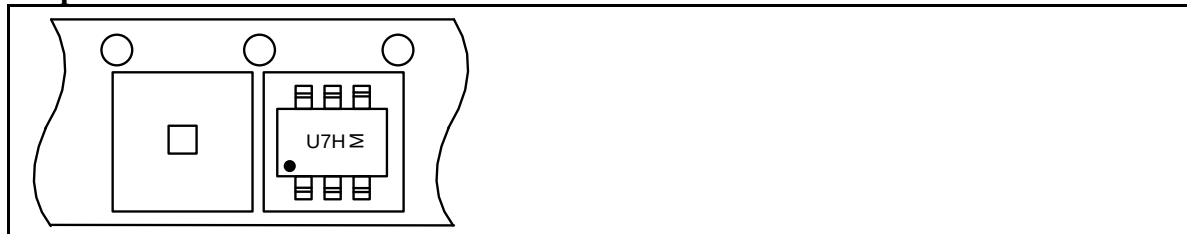
Outline Drawing



Land Pattern



Tape and Reel Orientation



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