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

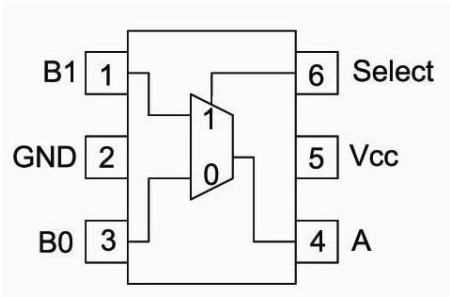
- Cellular Phone
- PDA
- Portable Media Player

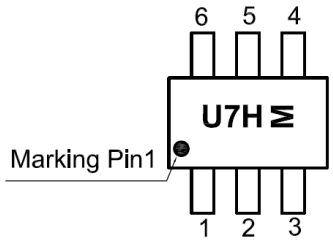
Features

- 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	℃
T_{STG}	Storage Temperature Range	- 65 to +150	
T_L	Junction Lead Temperature (Soldering, 10seconds)	+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	℃

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 ℃)			Unit
					Min	Typ	Max	
DC Electrical Characteristics								
I_{IN}	Control Leakage Current	$0 \le V_{IN} \le Vcc$	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} =Vcc or GND I_O=0	4.3	Full	-3		3	μA
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	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 (Note4)	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 (Note5)	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: $\Delta R_{ON} = \left| R_{ON(B0)} - R_{ON(B1)} \right|$ 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 ℃)			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 = 1.0 nF, V_{GEN} = 0 V 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 = 100 kHz, R_L=50Ω, C_L = 5pF(Stray)	1.65 to 4.3	Room		-75		dB
Xtalk	Crosstalk	f = 100 kHz, 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	-3 dB 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		0.03 6		
		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

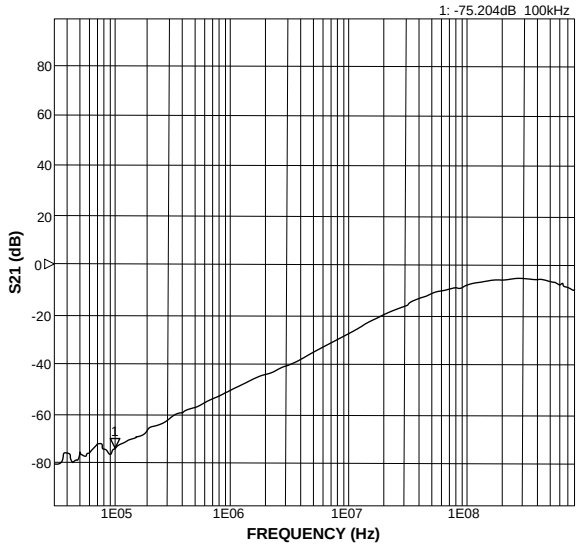


Figure1. Off-Isolation at VCC=3.3V

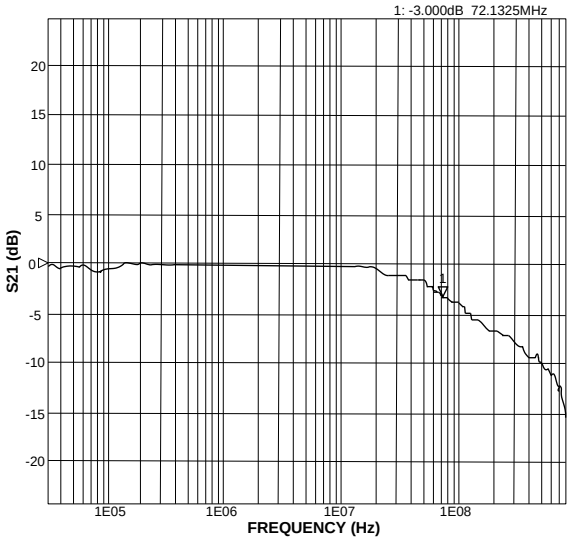


Figure2. Bandwidth at VCC=-3.3V

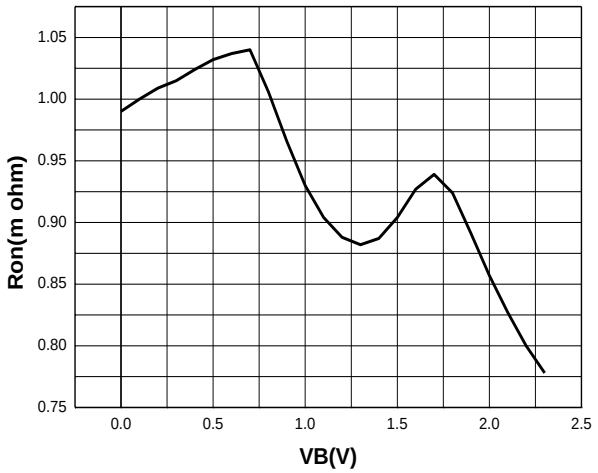


Figure3. Switch On Resistance, Ion=100mA, Vcc=2.3V, B1

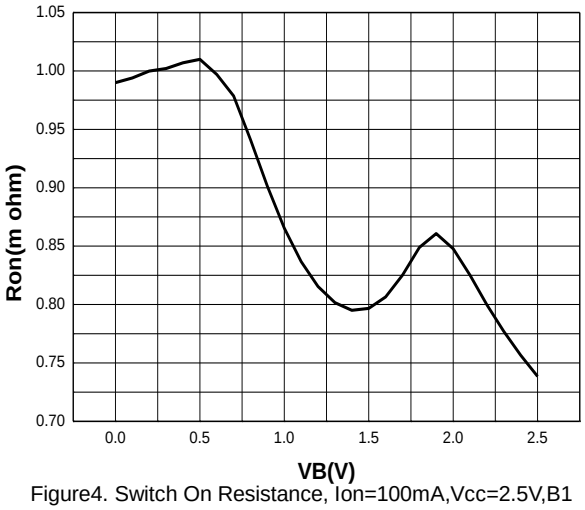


Figure4. Switch On Resistance, Ion=100mA,Vcc=2.5V,B1

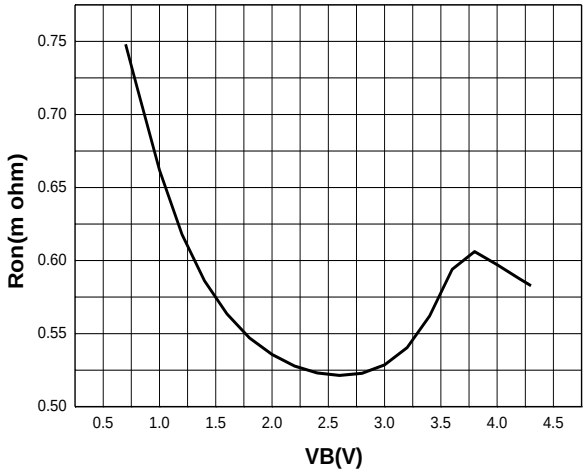
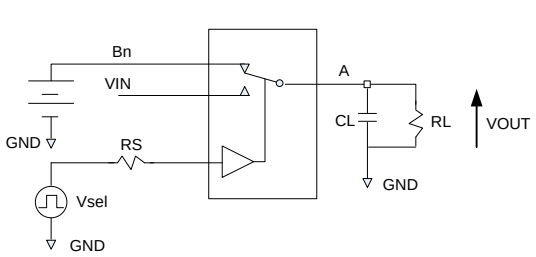
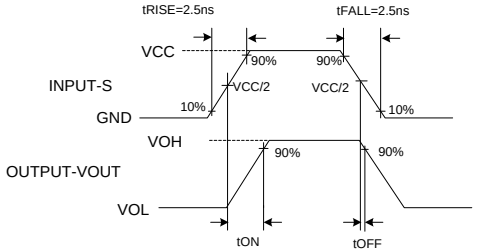


Figure5. Switch On Resistance, Ion=100mA, Vcc=4.3V, B1

Test Circuits/Timing Diagrams



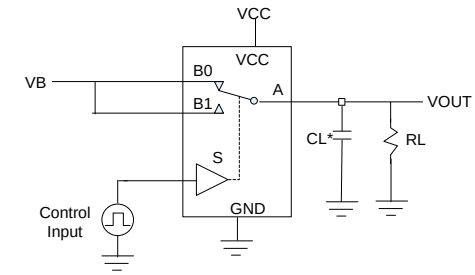


Notes:

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

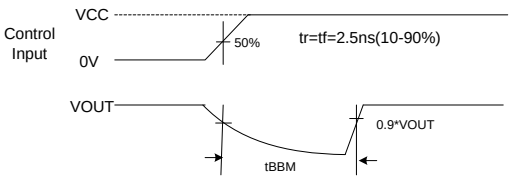
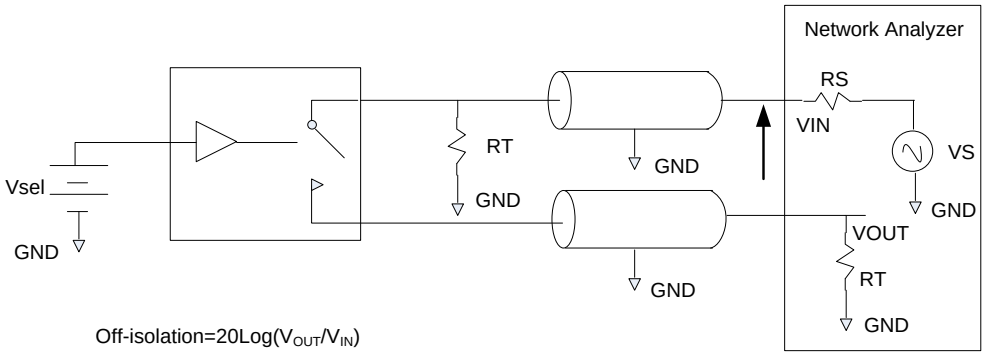


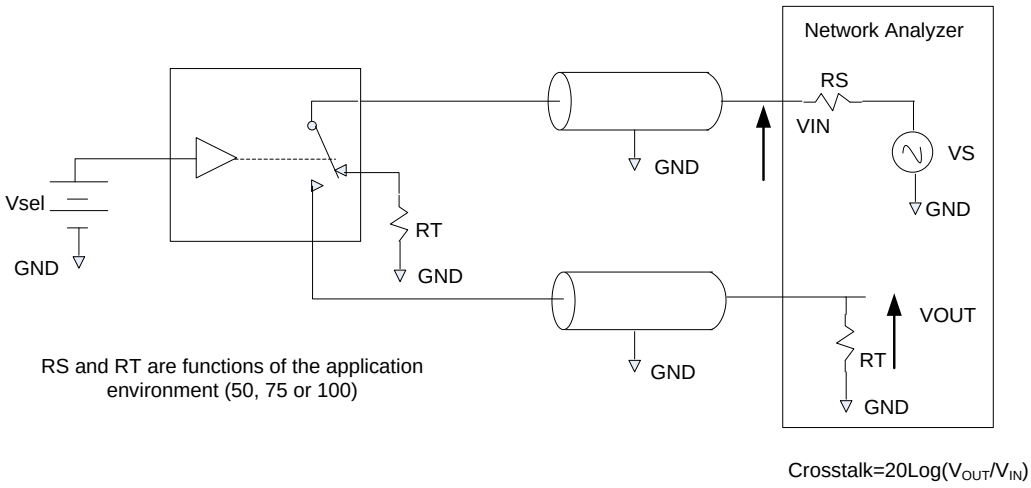
Figure 7. Break-Before-Make Timing



Off-isolation=20Log(V_{OUT}/V_{IN})

Figure 8. Off-Isolation

Test Circuits/Timing Diagrams (Continued)



Crosstalk=20Log(V_{OUT}/V_{IN})

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

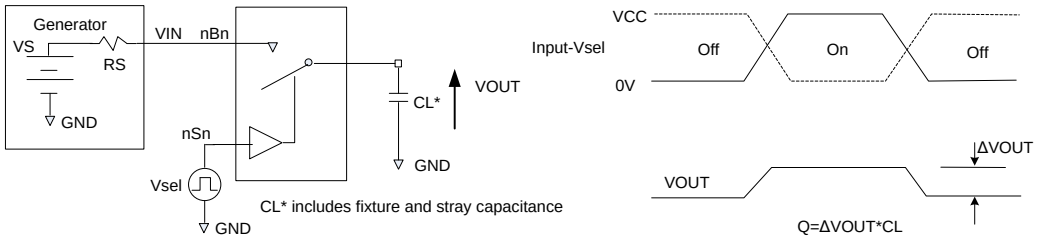


Figure 10. Charge Injection Test

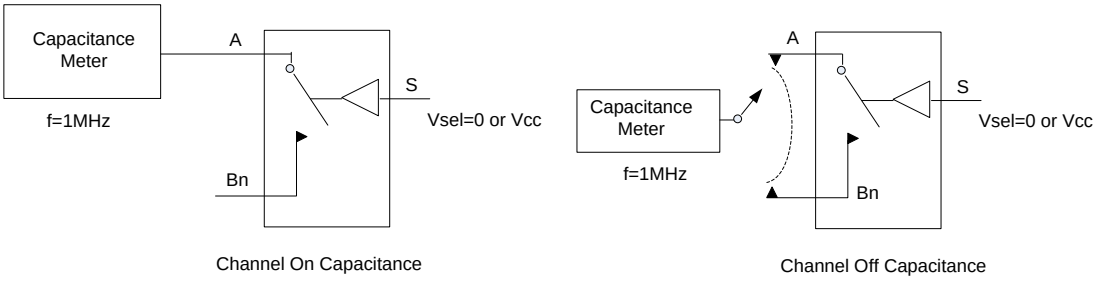


Figure 11. On/Off Capacitance Measurement Setup

Test Circuits/Timing Diagrams (Continued)

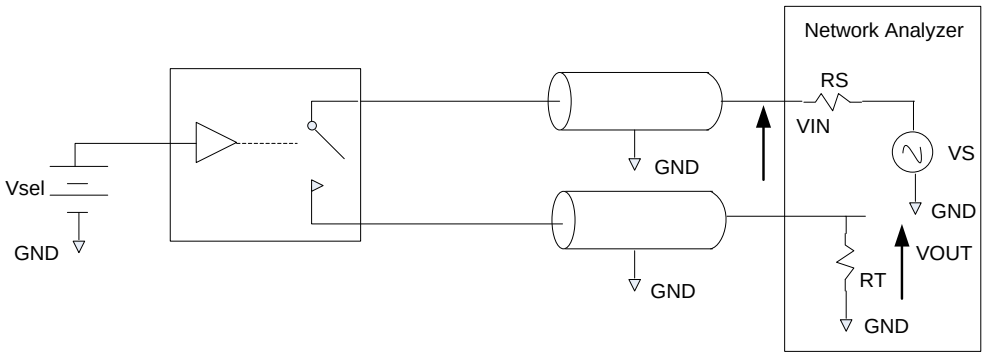


Figure 12. Bandwidth

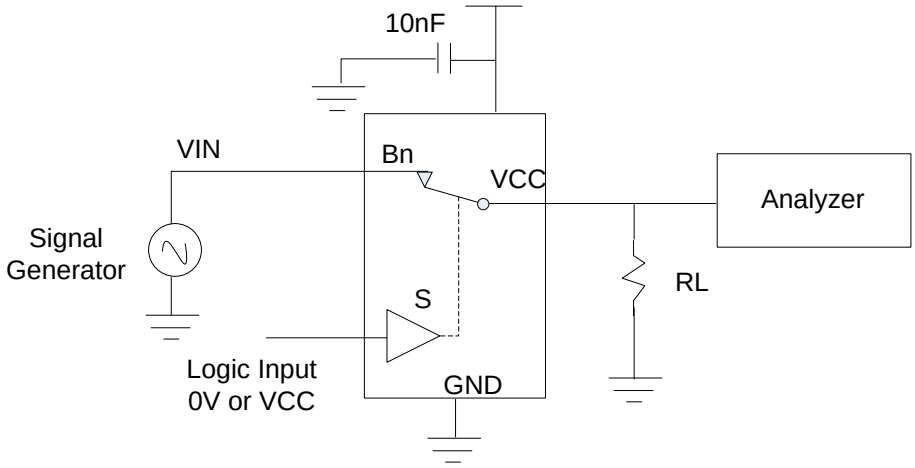
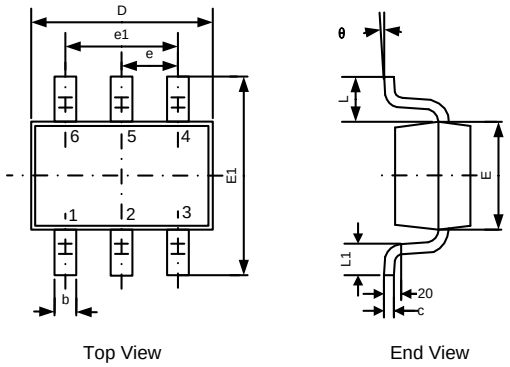


Figure 13. Harmonic Distortion

Package Information

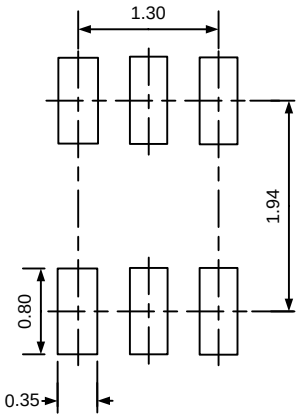
UM4157 SOT363

Outline Drawing



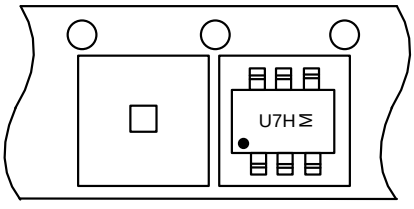
Symbol	DIMENSIONS			
	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650REF		0.026REF	
e1	1.200	1.400	0.047	0.055
L	0.525REF		0.021REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

Land Pattern



NOTES:
1. Compound dimension: 2.10×1.25;
2. Unit: mm;
3.General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation



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