Dual DPDT Ultra-Low R_{ON} Analog Switch

UM3699A *QFN16 3.0×3.0*

General Description

The UM3699A are dual independent ultra low R_{ON} DPDT analog switches. These devices are designed for low operating voltage, high current switching of speaker output for cell phone applications. They can switch a balanced stereo output and can handle a balanced microphone/speaker/ring−tone generator in a monophone mode. The UM3699A have no internal shunt resistors, which make it compatible for switching data lines that keep a specific voltage when the NO or NC terminals are not connected, avoiding power loss on the shunt resistors. The devices also have a break-before-make feature that further reduces popping.

Applications

- Cell Phone Speaker/Microphone Switching
- Ring-Tone Chip/Amplifier Switching
- Four Unbalanced (Single-Ended) Switches
- Stereo Balanced (Push-Pull) Switching

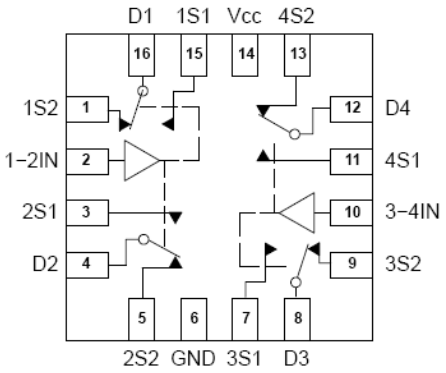
Features

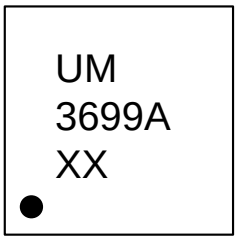
- Single Supply Operation: 1.65V to 5.5V
- Function Directly from Battery
- Maximum Breakdown Voltage: 6 V
- Low Static Power
- Tiny 3.0mm×3.0mm QFN16 Pb-Free Package

Pin Configurations

Top View

(Top View)





XX: Week Code
UM3699A
QFN16 3.0×3.0

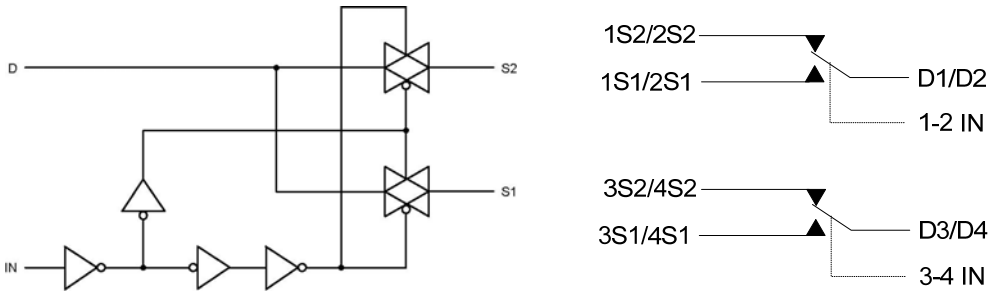
Ordering Information

Part Number	Packaging Type	Marking Code	Shipping Qty
UM3699A	QFN16 3.0×3.0	UM3699A	3000pcs/13 Inch Tape & Reel

Pin Description

Pin Number	Symbol	Name and Function
1, 3, 5, 7, 9, 11, 13, 15	1S1 to 4S1, 1S2 to 4S2	Independent Channels
2, 10	1−2IN, 3−4IN	Controls
4, 8, 12, 16	D1 to D4	Common Channels
6	GND	Ground (V)
14	V_{CC}	Positive Supply Voltage

Internal Circuit and Diagram of UM3699A



Truth Table

IN	S1	S2
H	ON	OFF
L	OFF	ON

Absolute Maximum Ratings

Symbol	Parameter	Value		Unit
V_{CC}	Positive DC Supply Voltage	-0.5 to +5.5		V
V_{IS}	Analog Input Voltage ($V_{NO\_}$, $V_{NC\_}$, or $V_{COM\_}$)	$-0.5 \le V_{IS} \le V_{CC}$		V
V_{IN}	Digital Select Input Voltage	$-0.5 \le V_{IN} \le 5.5$		V
I_{anl1}	Continuous DC Current from COM to NC/NO	±300		mA
I_{anl-pk}	Peak Current from COM to NC/NO, 10 Duty Cycle (Note 1)	±500		mA
I_{clmp}	Continuous DC Current into COM/NO/NC with Respect to V_{CC} or GND	±100		mA
t_r, t_f	Input Rise or Fall Time, V_{CC}=3.0 V to 4.5V	0	10	ns/V

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{CC}	DC Supply Voltage	1.65	5.5	V
V_{IN}	Digital Select Input Voltage	GND	V_{CC}	V
V_{IS}	Analog Input Voltage (NC, NO, COM)	GND	V_{CC}	V
T_A	Operating Temperature Range	-40	+85	°C
t_r, t_f	Input Rise or Fall Time, V_{CC}=3.0V to 4.5V	0	10	ns/V

DC Characteristics − Digital Section (Voltages Referenced to GND)

Symbol	Parameter	Condition	V_{CC}	Guaranteed Limit		Unit
				-40°C to 25°C	85°C	
V_{IH}	Minimum High Level Input Voltage, Select Inputs		1.8	1.2	1.2	V
			2.5	1.5	1.5	
			2.8	1.6	1.6	
			3.6	2.8	2.8	
V_{IL}	Maximum Low Level Input Voltage, Select Inputs		1.8	0.4	0.4	V
			2.5	0.5	0.5	
			2.8	0.6	0.6	
			3.6	1.0	1.0	
I_{IN}	Maximum Input Leakage Current, Select Inputs	V_{IN}=V_{CC} or GND	3.6	0.1	1.0	μA
I_{OFF}	Power Off Leakage Current	V_{IN}=V_{CC} or GND	0	0.5	2.0	μA
I_{CC}	Maximum Quiescent Supply Current (Note 1)	Select and V_{IS}=V_{CC} or GND	1.65 to 5.5	1.0	2.0	μA

DC Electrical Characteristics − Analog Section

Symbol	Parameter	Condition	V_{CC}	Guaranteed Maximum Limit				Unit
				-40°C to 25°C		85°C		
				Min	Max	Min	Max	
R_{ON}	NC/NO On Resistance (Note 1)	$V_{IN}\leq V_{IL}$ or $V_{IN}\geq V_{IH}$ V_{IS}=GND to V_{CC}, $I_{INI}\leq$100mA	2.5		0.65		0.75	Ω
			3.0		0.6		0.75	
			3.6		0.55		0.7	
R_{FLAT}	NC/NO On Resistance Flatness (Note 1, 3)	I_{COM}=100mA V_{IS}=0 to V_{CC}	2.5		0.15		0.15	Ω
			3.0		0.15		0.15	
			3.6		0.15		0.15	
$\triangle R_{ON}$	On-Resistance Match Between Channels (Note 1, 2)	V_{IS}=1.3V, I_{COM}=100mA	2.5		0.06		0.06	Ω
		V_{IS}=1.5V, I_{COM}=100mA	3.0		0.05		0.05	
		V_{IS}=2.2V, I_{COM}=100mA	3.6		0.05		0.05	
$I_{NC(OFF)}$ $I_{NO(OFF)}$	NC or NO Off Leakage Current (Note 1)	$V_{IN}=V_{IL}$ or V_{IH} V_{COM}=3.3V	3.6	-0.1	0.1	-1	1	μA
$I_{COM(ON)}$	COM ON Leakage Current (Note 1)	$V_{IN}=V_{IL}$ or V_{IH} V_{COM}=0.3V/3.3V V_{NO} or V_{NC} =0.3V/3.3V or Floating	3.6	-0.1	0.1	-1	1	μA

Note 1: Guaranteed by design. Resistance measurements do not include test circuit or package resistance.

Note 2: $\triangle R_{ON}=R_{ON(MAX)}-R_{ON(MIN)}$ between nS1 or nS2.

Note 3: Flatness is defined as the difference between the maximum and minimum value of on resistance as measured over the specified analog signal ranges.

AC Electrical Characteristics (Input t_r=t_f=3.0ns)

Symbol	Parameter	Test Conditions	V_{CC} (V)	V_{IS} (V)	Guaranteed Maximum Limit		Unit
					-40°C to 25°C	85°C	
t_{ON}	Turn-On Time	R_L=50Ω, C_L=35pF (Figure 2&3)	2.3 to 4.5	1.5	50	60	ns
t_{OFF}	Turn-Off Time	R_L=50Ω, C_L=35pF (Figure 2&3)	2.3 to 4.5	1.5	30	40	ns
t_{BBM}	Minimum Break-Before-Make Time	R_L=50Ω, C_L=35pF (Figure 1)	3.0	1.5	15	15	ns

Symbol	Parameter	Typical @ 25°C V_{CC}=4.5V	Unit
C_{IN}	Control Pin Input Capacitance	7.0	pF
C_{SN}	Sn Port Capacitance	72	pF
C_D	D Port Capacitance When Switch is Enabled	230	pF

Additional Application Characteristics (Voltages Referenced to GND Unless Noted)

Symbol	Parameter	Condition	V_{CC} (V)	Typ	Unit
BW	Maximum On-Channel -3dB Bandwidth or Minimum Frequency Response (Figure 7)	V_{IN} Centered between V_{CC} and GND	1.65 to 4.5	20	MHz
V_{ISO}	Off-Channel Isolation (Figure 8)	f=100kHz, V_{IS}=1VRMS, C_L=5pF V_{IN} Centered between V_{CC} and GND	1.65 to 4.5	-62	dB
Q	Charge Injection Select Input to Common I/O	V_{IN}=V_{CC} to GND, R_{IS}=0Ω, C_L=1nF Q=C_L×V_{OUT}	1.65 to 4.5	50	pC
THD	Total Harmonic Distortion THD+ Noise	f_{IS}=20Hz to 20kHz, R_L=R_{GEN}=600Ω, C_L=50pF, V_{IS}=2V_{PP}	4.5	0.01	%
V_{CT}	Channel-to-Channel Crosstalk (Figure 9)	f=100kHz, V_{IS}=1VRMS, C_L=5pF, R_L=50Ω, V_{IN} Centered between V_{CC} and GND	1.65 to 4.5	-62	dB

Test Circuits

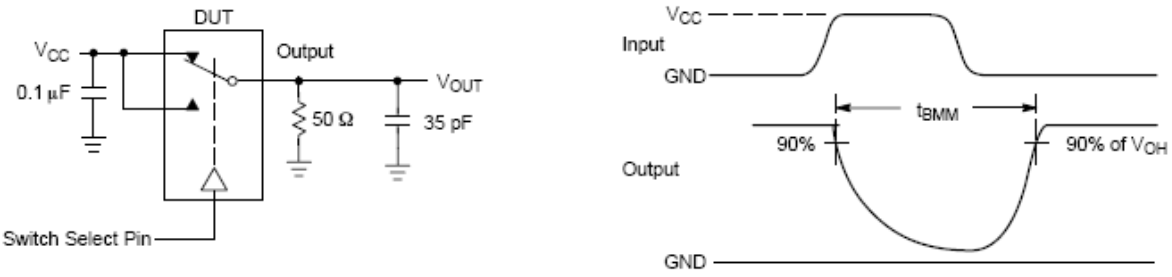


Figure 1. t_{BBM} (Time Break–Before–Make)

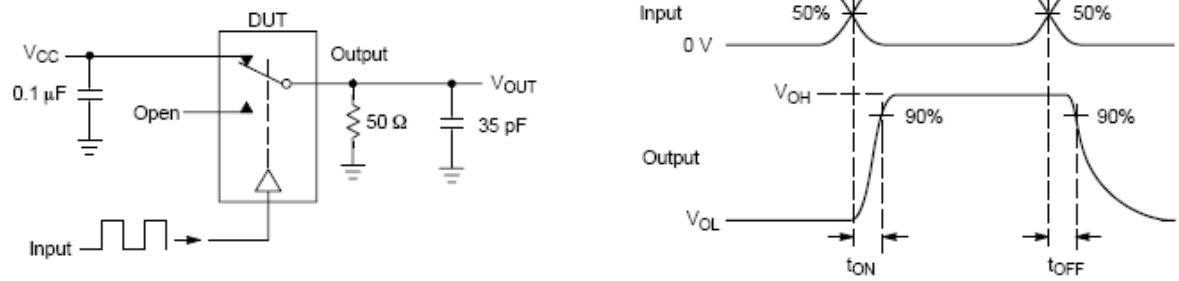


Figure 2. t_{ON}/t_{OFF}

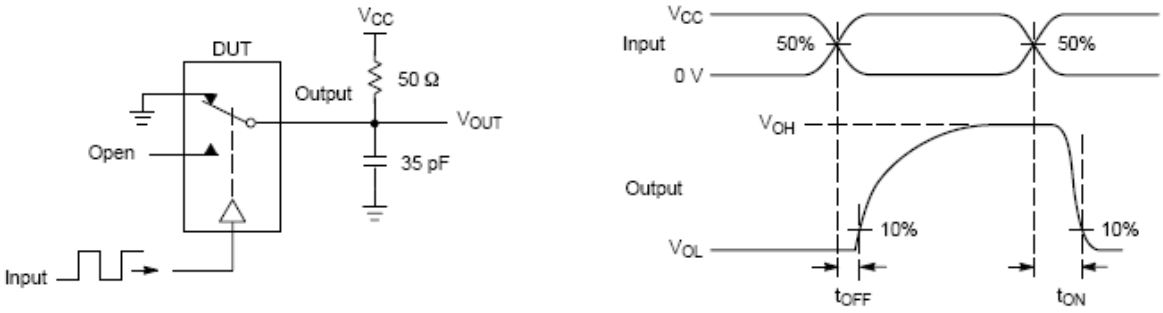
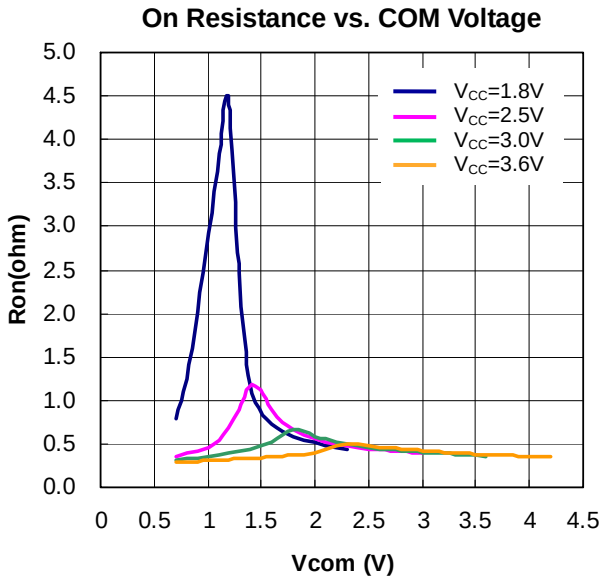
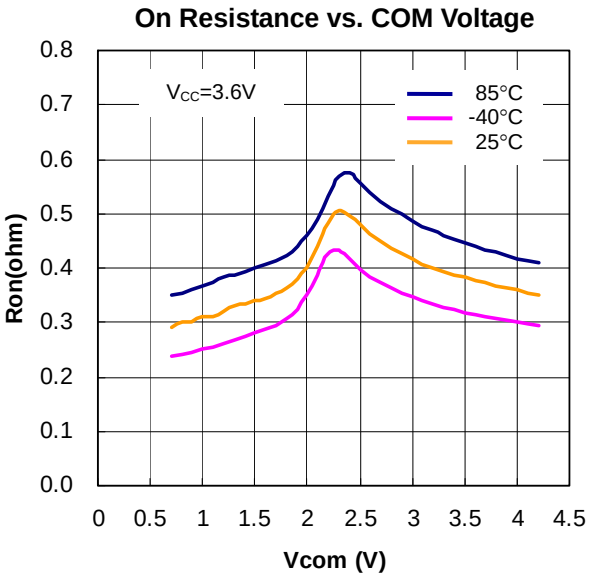
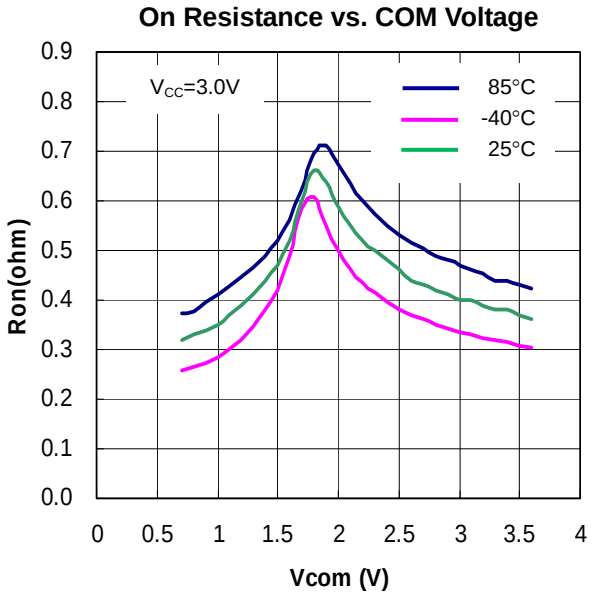


Figure 3. t_{ON}/t_{OFF}

Typical Operating Characteristics

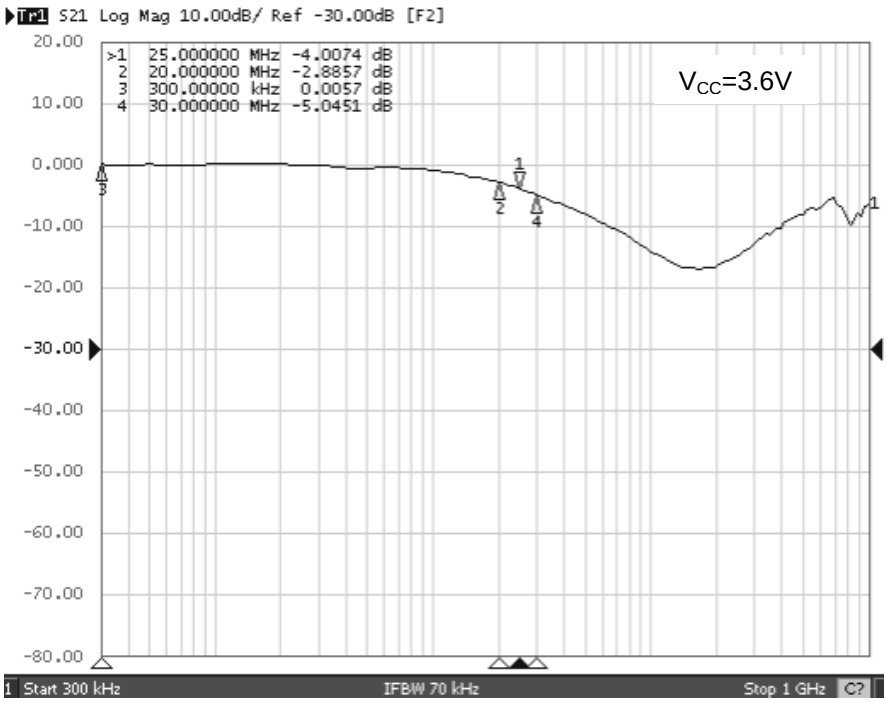




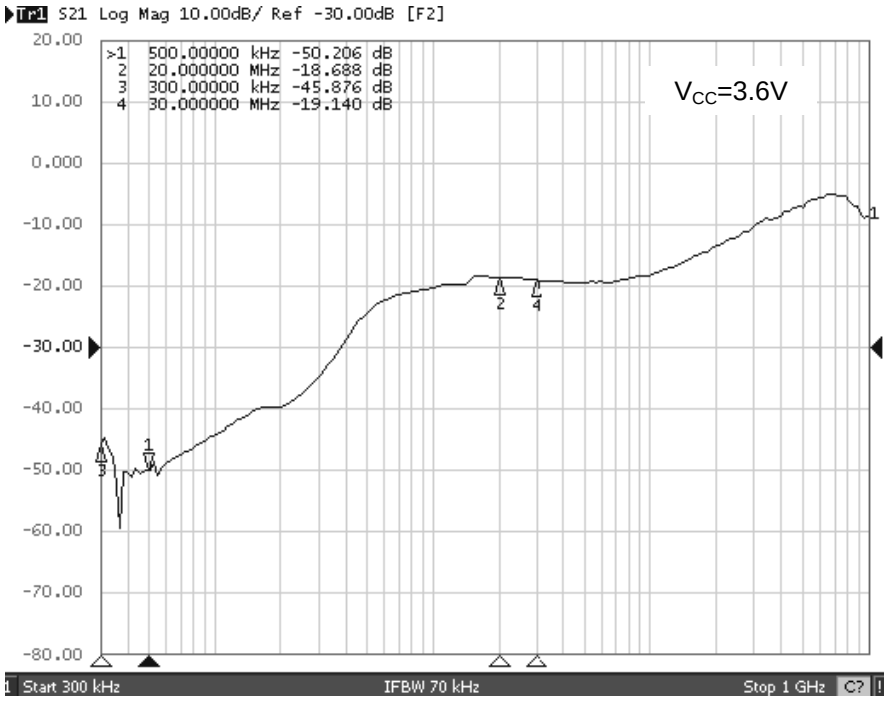


Typical Operating Characteristics (Continued)

Bandwidth vs. Frequency

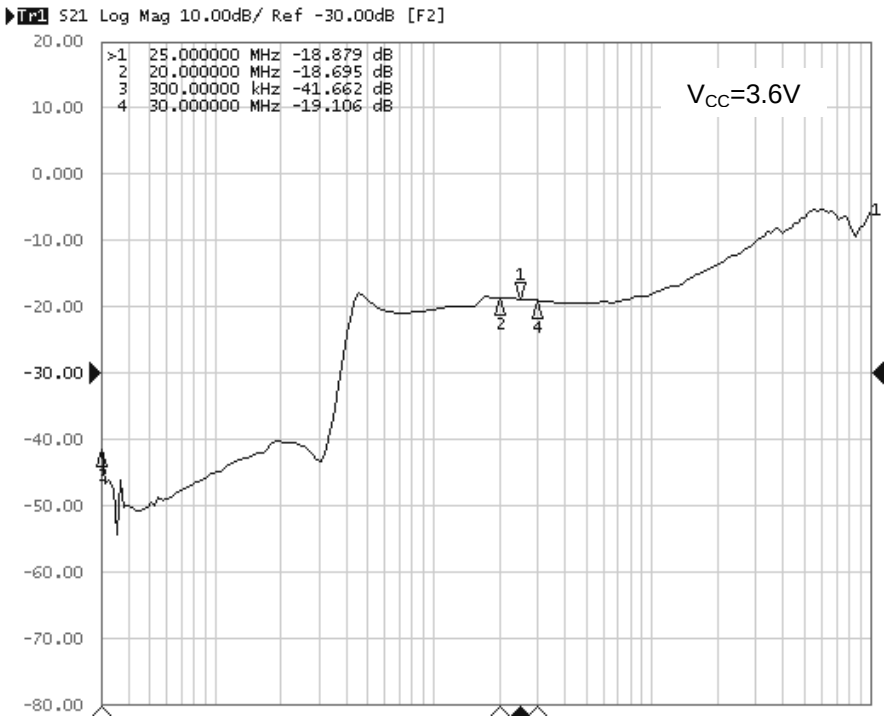


Off-Isolation vs. Frequency



Typical Operating Characteristics (Continued)

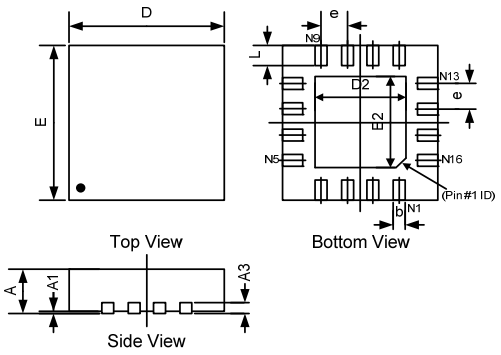
Crosstalk vs. Frequency



Package Information

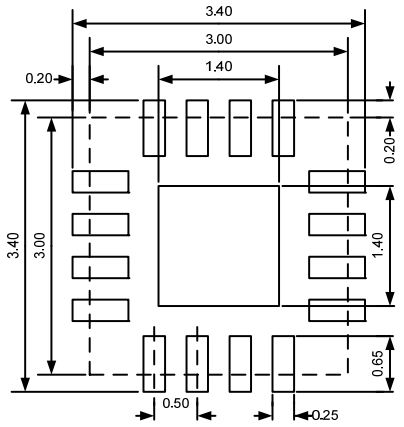
UM3699A QFN16 3.0×3.0

Outline Drawing



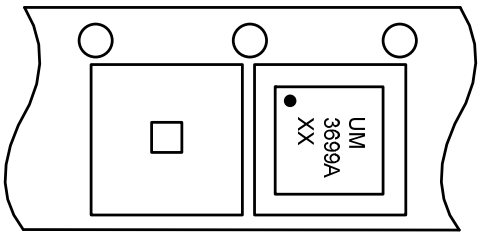
Symbol	DIMENSIONS					
	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	0.55	-	0.80	0.022	-	0.031
A1	0.00	-	0.05	0.000	-	0.002
A3	0.20REF			0.008REF		
b	0.18	-	0.30	0.007	-	0.012
D	2.90	3.00	3.10	0.114	0.118	0.122
D2	1.55	-	1.86	0.061	-	0.073
E	2.90	3.00	3.10	0.114	0.118	0.122
E2	1.55	-	1.86	0.061	-	0.073
e	0.50TYP			0.020TYP		
L	0.25	0.40	0.55	0.010	0.016	0.022

Land Pattern



NOTES:
1. Compound dimension: 3.00×3.00;
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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