

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

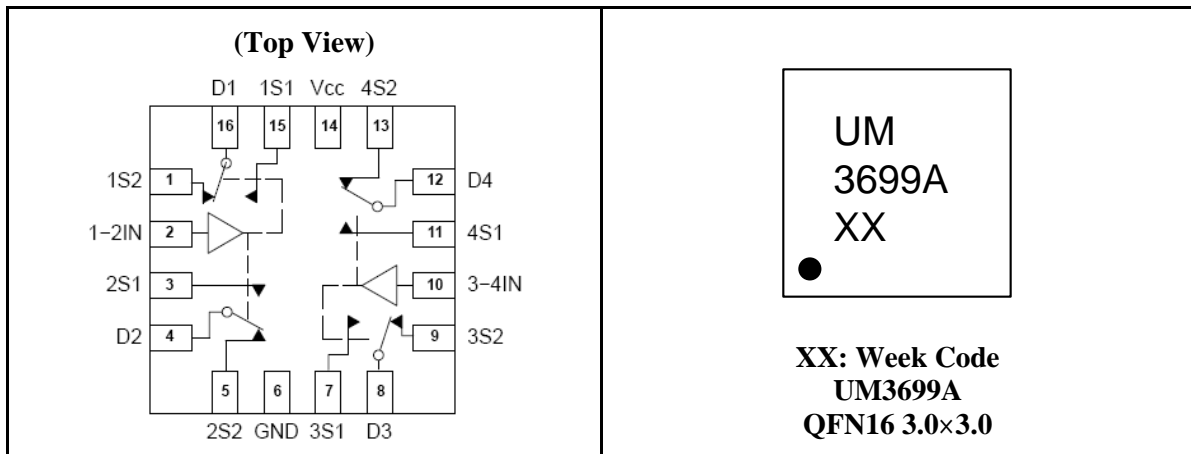
- Cell Phone Speaker/Microphone Switching
- Ring-Tone Chip/Amplifier Switching
- Four Unbalanced (Single-Ended) Switches
- Stereo Balanced (Push-Pull) Switching

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



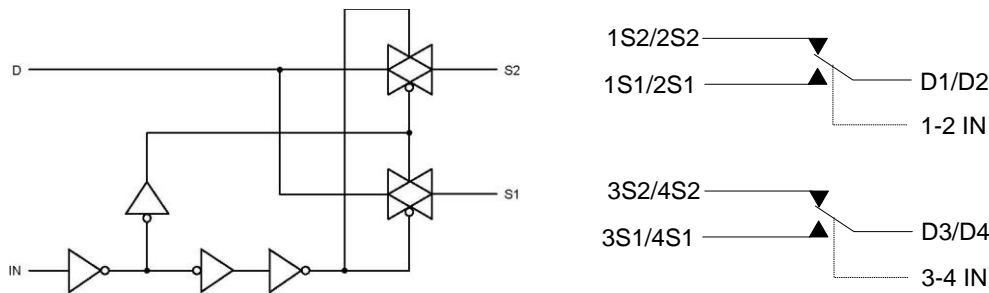
Ordering Information

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 ≤ V _{IS} ≤ V _{CC}	V
V _{IN}	Digital Select Input Voltage	-0.5 ≤ V _{IN} ≤ 5.5	V
I _{anl}	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} ≤ V _{IL} or V _{IN} ≥ V _{IH} V _{IS} = GND to V _{CC} , I _{IN} ≤ 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	
Δ 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: $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$ 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	$R_L=50\Omega$, $C_L=35pF$ (Figure 2&3)	2.3 to 4.5	1.5	50	60	ns
t_{OFF}	Turn-Off Time	$R_L=50\Omega$, $C_L=35pF$ (Figure 2&3)	2.3 to 4.5	1.5	30	40	ns
t_{BBM}	Minimum Break-Before-Make Time	$R_L=50\Omega$, $C_L=35pF$ (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, $R_{IS}=0\Omega$, $C_L=1nF$ $Q=C_L \times V_{OUT}$	1.65 to 4.5	50	pC
THD	Total Harmonic Distortion THD+ Noise	$f_{IS}=20Hz$ to 20kHz, $R_L=R_{GEN}=600\Omega$, $C_L=50pF$, $V_{IS}=2V_{PP}$	4.5	0.01	%
V_{CT}	Channel-to-Channel Crosstalk (Figure 9)	$f=100kHz$, $V_{IS}=1VRMS$, $C_L=5pF$, $R_L=50\Omega$, V_{IN} Centered between V_{CC} and GND	1.65 to 4.5	-62	dB

Test Circuits

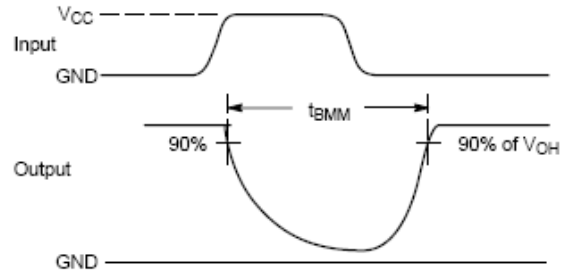
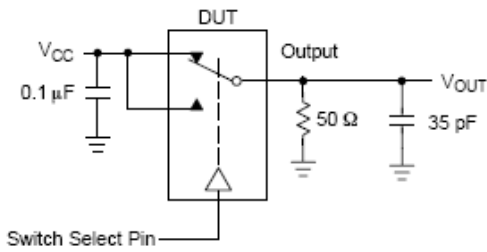


Figure 1. t_{BMM} (Time Break-Before-Make)

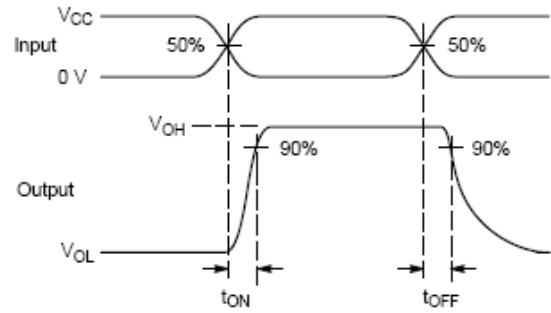
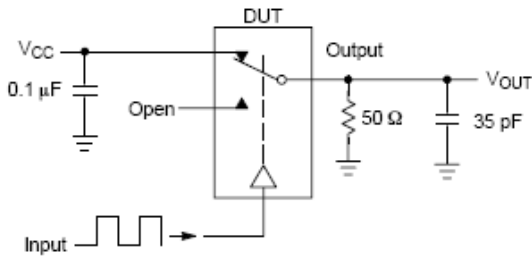


Figure 2. t_{ON}/t_{OFF}

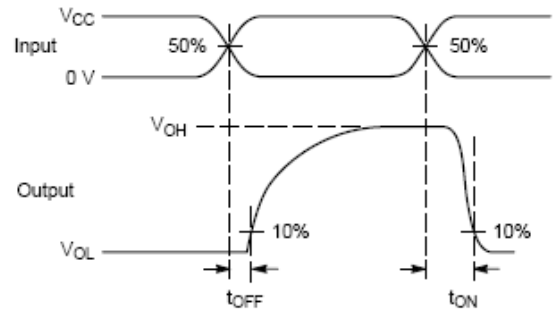
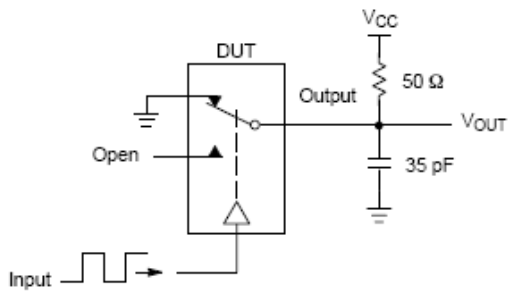
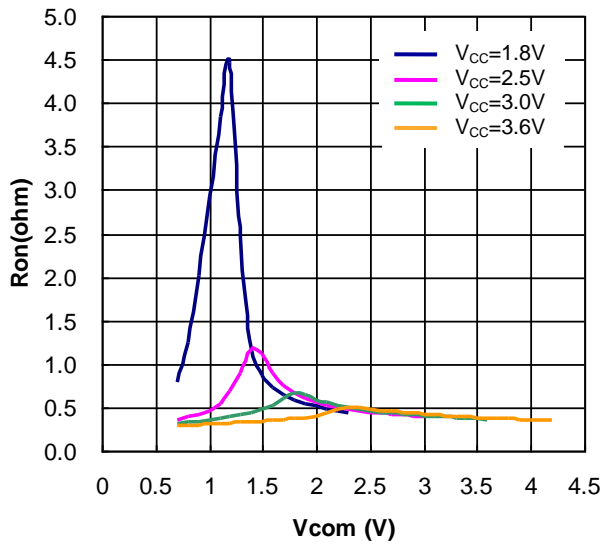


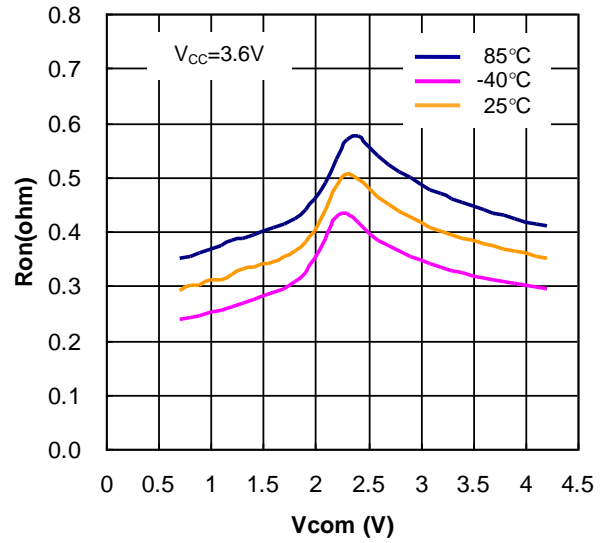
Figure 3. t_{ON}/t_{OFF}

Typical Operating Characteristics

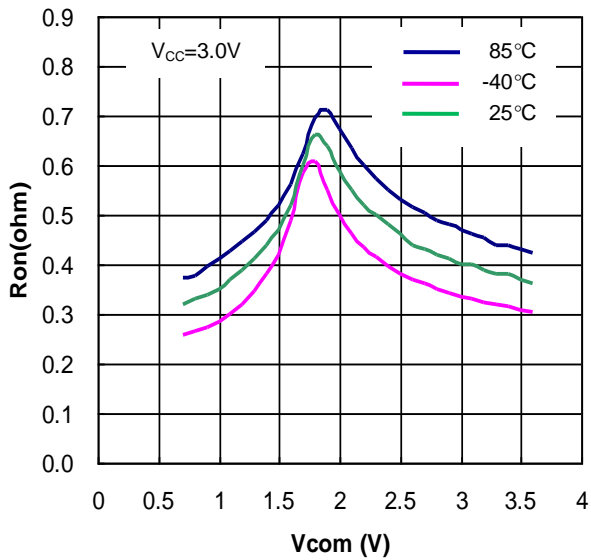
On Resistance vs. COM Voltage



On Resistance vs. COM Voltage

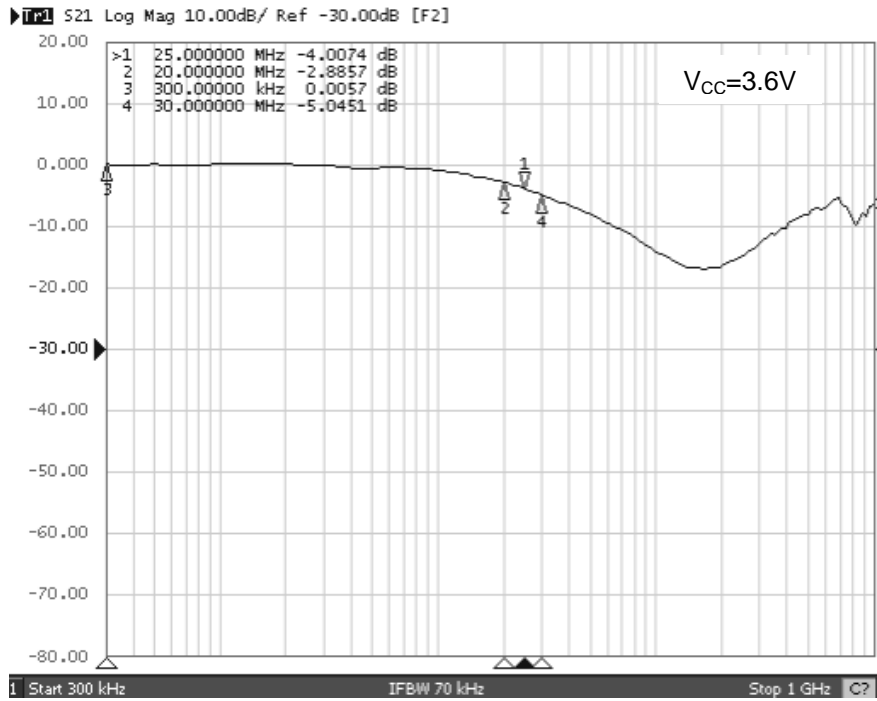


On Resistance vs. COM Voltage

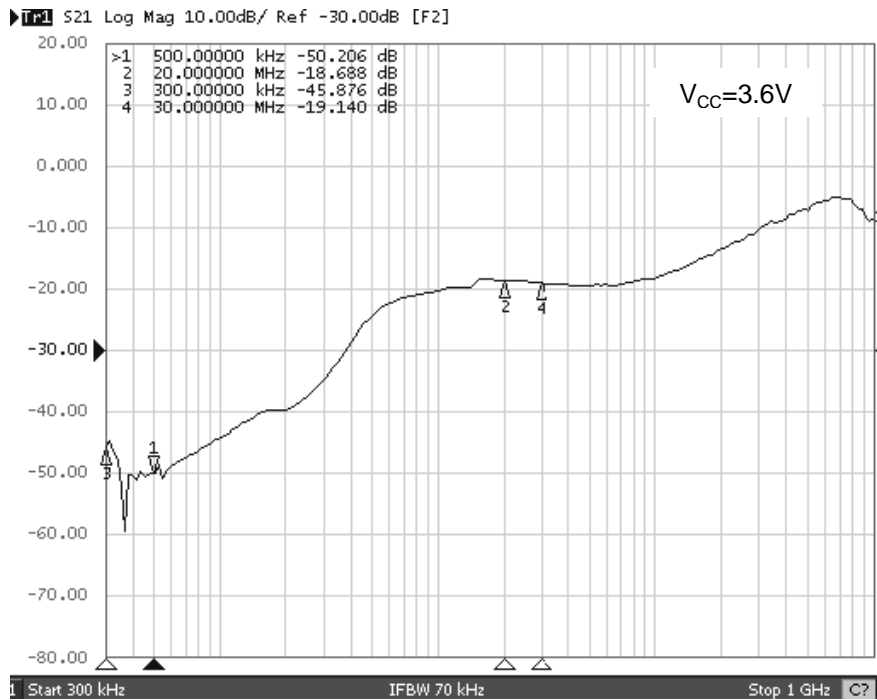


Typical Operating Characteristics (Continued)

Bandwidth vs. Frequency

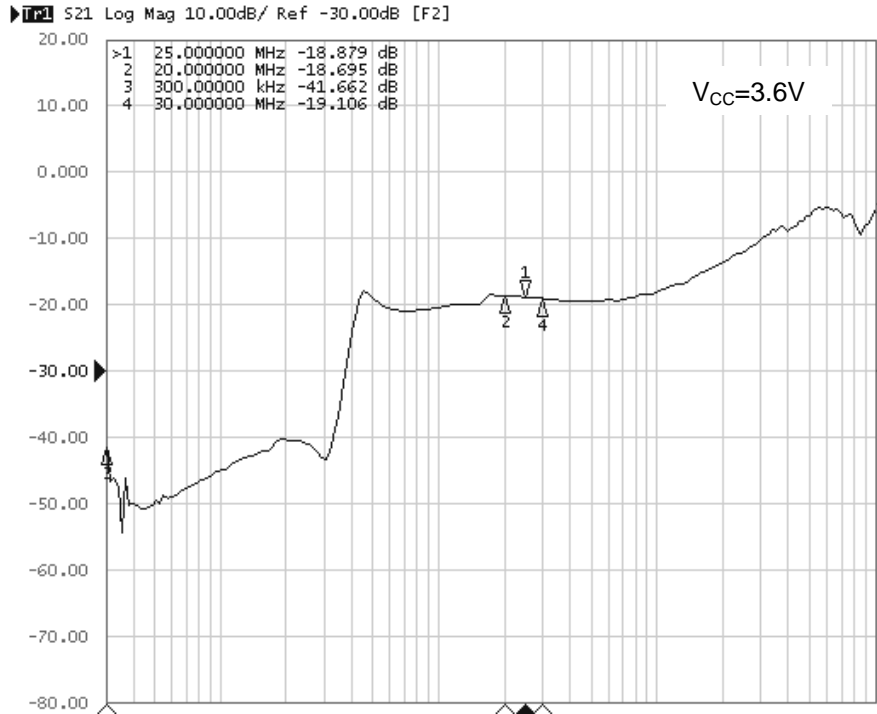


Off-Isolation vs. Frequency



Typical Operating Characteristics (Continued)

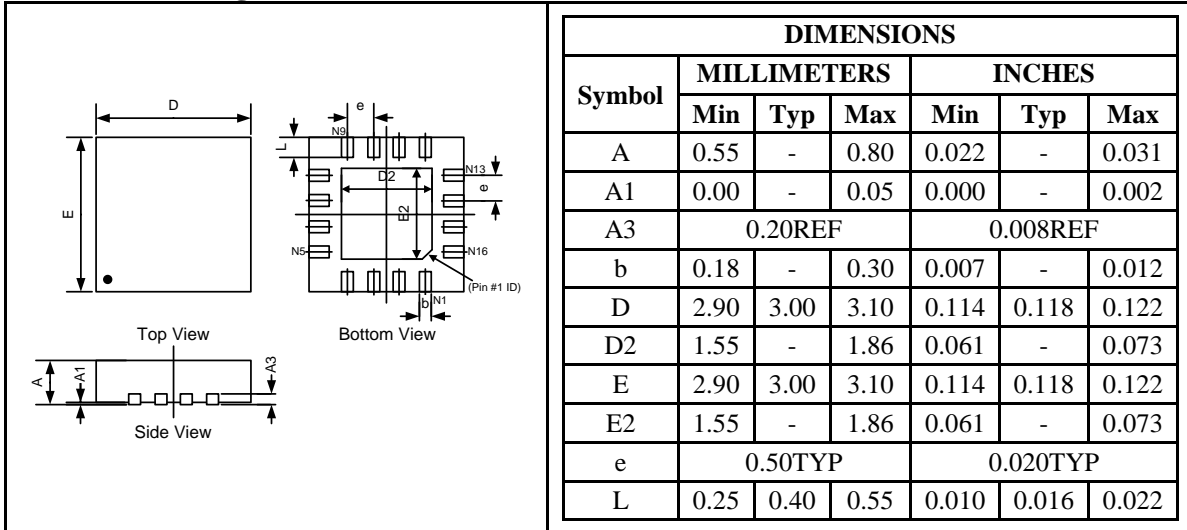
Crosstalk vs. Frequency



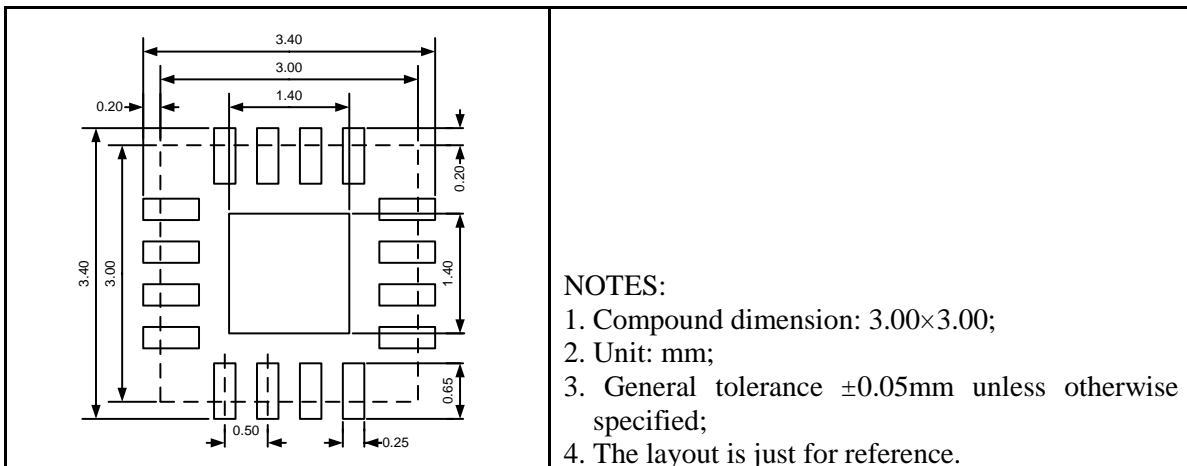
Package Information

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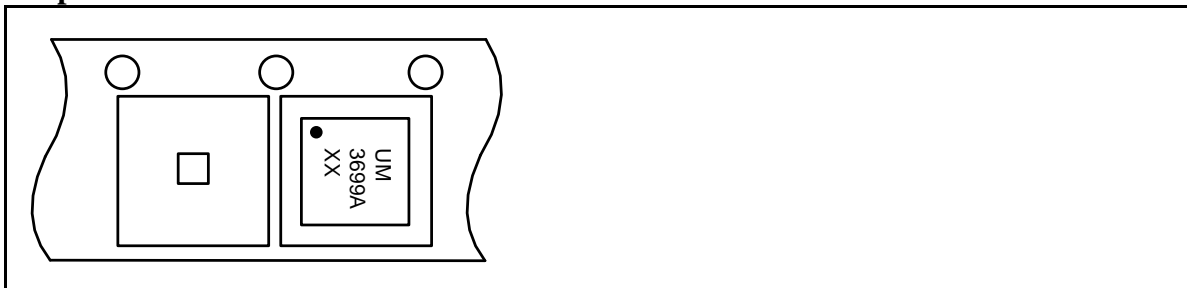
Outline Drawing



Land Pattern



Tape and Reel Orientation



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