SGM44603
4.5Ω, High Speed, Low Voltage Quad, SPDT Analog Switch

GENERAL DESCRIPTION

The SGM44603 is a high-speed, low-voltage, quad single-pole/double-throw (SPDT) CMOS analog switch multiplexer that is designed to operate from a single +1.8V to +5.5V power supply.

SGM44603 features guaranteed on-resistance (4.5Ω TYP), on-resistance matching (3.6Ω MAX) between switches and guaranteed on-resistance flatness over the signal range (3Ω TYP). This ensures excellent linearity and low distortion when switching audio signals. Fast switching speed, coupled with high signal bandwidth (300MHz), also makes the parts suitable for video signal switching. CMOS construction ensures ultra low power dissipation, making the parts ideally suited for portable and battery powered instruments.

SGM44603 is available in Pb-free TQFN-16 (2.6mm× 1.8mm) package.

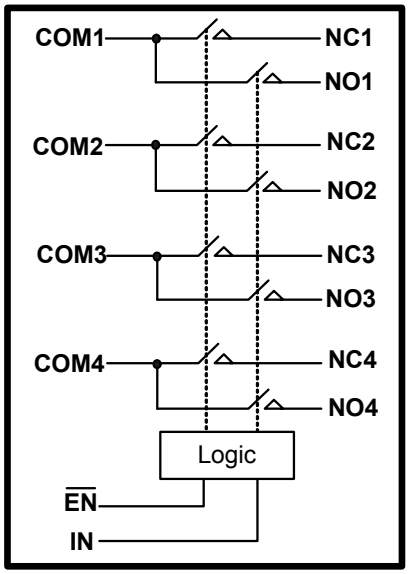
APPLICATIONS

Battery-Powered Systems
USB 1.1 Signal Switching Circuits
Communication Systems
Portable Instrumentation
Audio and Video Switching
Computer Peripherals
Cell Phones
PDAs

FEATURES

- **Low Voltage Operation: 1.8V to 5.5V**
- **R_{ON} is Typically 4.5Ω at 5V**
- **Low On-Resistance Flatness**
- **-3dB Bandwidth: 300MHz**
- **Rail-to-Rail Input and Output Operation**
- **Typical Power Consumption (<0.01μW)**
- **TTL/CMOS Compatible**
- **-40℃ to +85℃ Operating Temperature Range**
- **Lead (Pb) Free TQFN-16 (2.6mm × 1.8mm) Package**

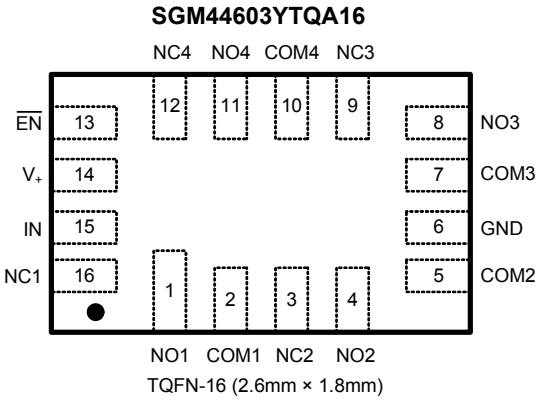
BLOCK DIAGRAM



ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM44603	TQFN-16 (2.6mm×1.8mm)	- 40℃ to +85℃	SGM44603YTQA16/TR	44603	Tape and Reel, 3000

PIN CONFIGURATION (TOP VIEW)



TQFN-16 (2.6mm × 1.8mm)

PIN DESCRIPTION

NAME	PIN	FUNCTION
V_+	14	Power supply
GND	6	Ground
IN	15	Digital control pin to connect the COM terminal to the NO or NC terminals.
$\overline{EN}$	13	Digital Enable Input. Normally connect to GND. Drive to logic high to set all switches off.
COM_X	2,5,7,10	Common terminal
NO_X	1,4,8,11	Normally-open terminal
NC_X	16,3,9,12	Normally-closed terminal

Note: NO_X, NC_X and COM_X terminals may be an input or output.

ABSOLUTE MAXIMUM RATINGS

V_+ to GND.....-0.3V to 6V
Analog, Digital voltage range (1).....-0.3V to (V_+) +0.3V
Continuous Current NO, NC, or COM .....±100mA
Operating Temperature Range.....-40℃ to +85℃
Junction Temperature.....150℃
Storage Temperature..... -65℃ to +150℃
Lead Temperature (soldering, 10s).....260℃

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

(1) Signals on NC, NO, or COM or IN_X exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

FUNCTION TABLE

$\overline{EN}$	IN	NO	NC
L	L	OFF	ON
L	H	ON	OFF
H	√	All Switches Open	

√ = Don’t Care.

ELECTRICAL CHARACTERISTICS

(V_+ = +4.5V to +5.5V, GND = 0V, V_{IH} = +1.6V, V_{IL} = +0.5V, T_A = -40℃ to +85℃. Typical values are at V_+ = +5.0V, T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}			-40℃ to +85℃	0		V_+	V
On-Resistance	R_{ON}	V_+ = 4.5V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100mA, Test Circuit 1		+25℃		4.5	7	Ω
				-40℃ to +85℃			8	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 4.5V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100mA, Test Circuit 1		+25℃		0.8	3.6	Ω
				-40℃ to +85℃			4.2	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 4.5V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100mA, Test Circuit 1		+25℃		3	3.7	Ω
				-40℃ to +85℃			4.5	Ω
Source OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+ = 5.5V, V_{NO} or V_{NC} = 3.3V/ 0.3V, V_{COM} = 0.3V/ 3.3V		-40℃ to +85℃			1	μA
Channel ON Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$	V_+ =5.5V, V_{COM} = 0.3V/ 3.3V, V_{NO} or V_{NC} = 0.3V/ 3.3V, or floating		-40℃ to +85℃			1	μA
DIGITAL INPUTS								
Input High Voltage	V_{INH}			-40℃ to +85℃	1.6			V
Input Low Voltage	V_{INL}			-40℃ to +85℃			0.5	V
Input Leakage Current	I_{IN}	V_+ =5.5V, V_{IN}, $V_{\overline{EN}}$ = 0V or V_+		-40℃ to +85℃			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 3V, C_L = 35pF, R_L = 300Ω, Test Circuit2		+25℃		40		ns
Turn-Off Time	t_{OFF}			+25℃		30		ns
Break-Before-Make Time Delay	t_D	V_{NO} or V_{NC} = 3V, R_L = 300Ω, C_L = 35pF, Test Circuit 4		+25℃		18		ns
Off Isolation	O_{ISO}	R_L = 50Ω, Signal = 0dBm, Test Circuit5	1MHz	+25℃		-70		dB
			10MHz	+25℃		-50		dB
Channel-to-Channel Crosstalk	X_{TALK}	R_L = 50Ω, Signal = 0dBm, Test Circuit6	1MHz	+25℃		-90		dB
			10MHz	+25℃		-60		dB
-3dB Bandwidth	BW	R_L = 50Ω, Signal = 0dBm, Test Circuit7		+25℃		300		MHz
Charge Injection Select Input to Common I/O	Q	V_G = GND, R_G = 0Ω, C_L = 1nF, Q = C_L × V_{OUT}, Test Circuit3		+25℃		20		pC
Channel ON Capacitance	C_{ON}			+25℃		64		pF
POWER REQUIREMENTS								
Power Supply Range	V_+			-40℃ to +85℃	1.8		5.5	V
Power Supply Current	I_+	V_+ = 5.5V, V_S, $V_{\overline{EN}}$ = 0V or V_+		-40℃ to +85℃			1	μA

Specifications subject to changes without notice.

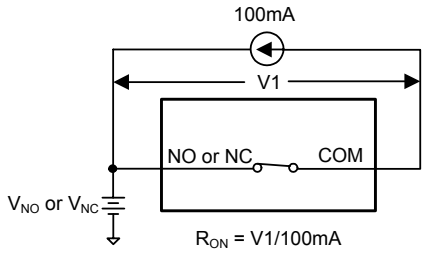
ELECTRICAL CHARACTERISTICS

(V_+ = +2.7V to +3.6V, V_{IH} = +1.6V, V_{IL} = +0.4V, T_A = -40℃ to +85℃. Typical values are at V_+ = +3.0V, T_A = +25℃, unless otherwise noted.)

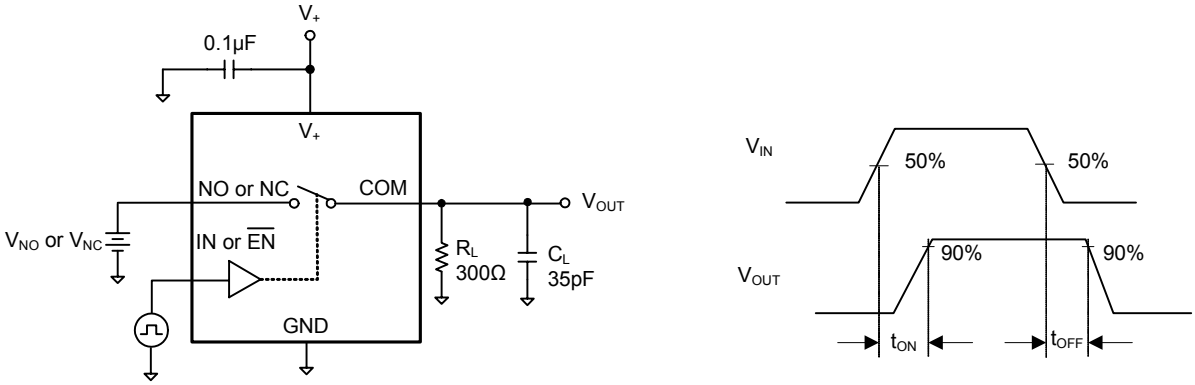
PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}			-40℃ to +85℃	0		V_+	V
On-Resistance	R_{ON}	V_+ = 2.7V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100mA, Test Circuit 1		+25℃		11	15.5	Ω
				-40℃ to +85℃			18.5	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 2.7V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100mA, Test Circuit 1		+25℃		1.6	4	Ω
				-40℃ to +85℃			4.6	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 2.7V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100mA, Test Circuit 1		+25℃		7	9.4	Ω
				-40℃ to +85℃			13	Ω
Source OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+ = 3.6V, V_{NO} or V_{NC} = 3.3V / 0.3V, V_{COM} = 0.3V/ 3.3V		-40℃ to +85℃			1	μA
Channel ON Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$	V_+ = 3.6V, V_{COM} = 0.3V/ 3.3V, V_{NO} or V_{NC} = 0.3V/ 3.3V, or floating		-40℃ to +85℃			1	μA
DIGITAL INPUTS								
Input High Voltage	V_{INH}			-40℃ to +85℃	1.5			V
Input Low Voltage	V_{INL}			-40℃ to +85℃			0.4	V
Input Leakage Current	I_{IN}	V_+ = 2.7V, V_{IN}, $V_{\overline{EN}}$ = 0V or V_+		-40℃ to +85℃			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 1.5V, C_L = 35pF, R_L = 300Ω, Test Circuit2		+25℃		48		ns
Turn-Off Time	t_{OFF}			+25℃		45		ns
Break-Before-Make Time Delay	t_D	V_{NO} or V_{NC} = 1.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 4		+25℃		20		ns
Off Isolation	O_{ISO}	R_L = 50Ω, Signal = 0dBm, Test Circuit5	1MHz	+25℃		-70		dB
			10MHz	+25℃		-50		dB
Channel-to-Channel Crosstalk	X_{TALK}	R_L = 50 Ω, Signal = 0dBm, Test Circuit6	1MHz	+25℃		-90		dB
			10MHz	+25℃		-60		dB
-3dB Bandwidth	BW	R_L = 50Ω, Signal = 0dBm, Test Circuit7		+25℃		300		MHz
Charge Injection Select Input to Common I/O	Q	V_G = GND, R_G = 0Ω, C_L =1nF, Q = C_L × V_{OUT}, Test Circuit3		+25℃		20		pC
Channel ON Capacitance	C_{ON}			+25℃		64		pF

Specifications subject to changes without notice.

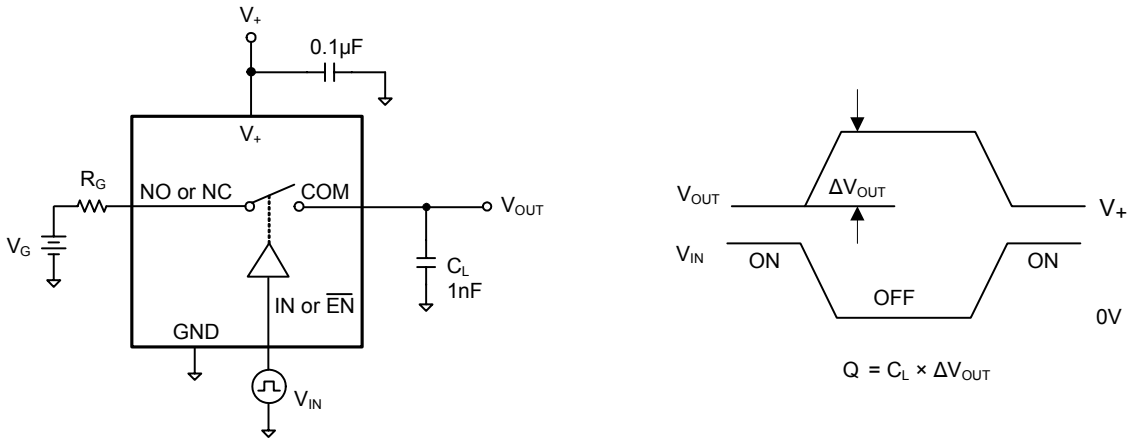
TEST CIRCUITS



Test Circuit 1. On Resistance

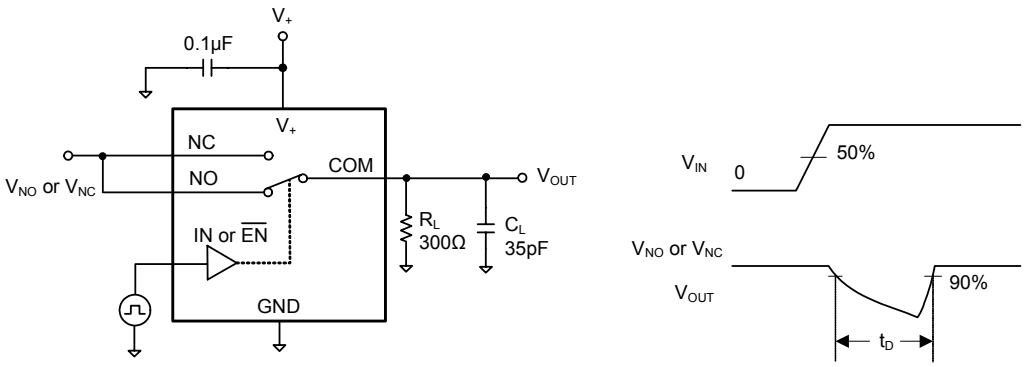


Test Circuit 2. Switching Times

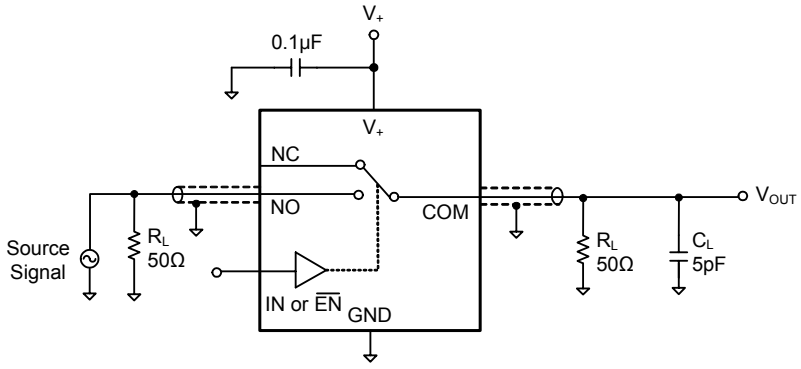


Test Circuit 3. Charge Injection

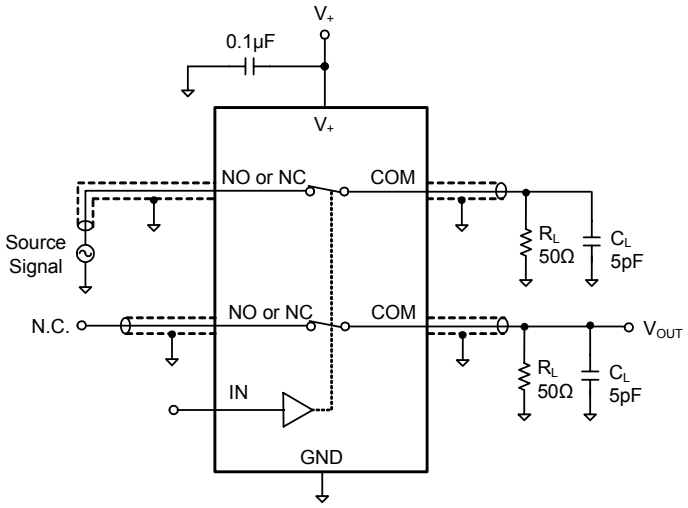
TEST CIRCUITS (Cont.)



Test Circuit 4. Break-Before-Make Time Delay (t_D)



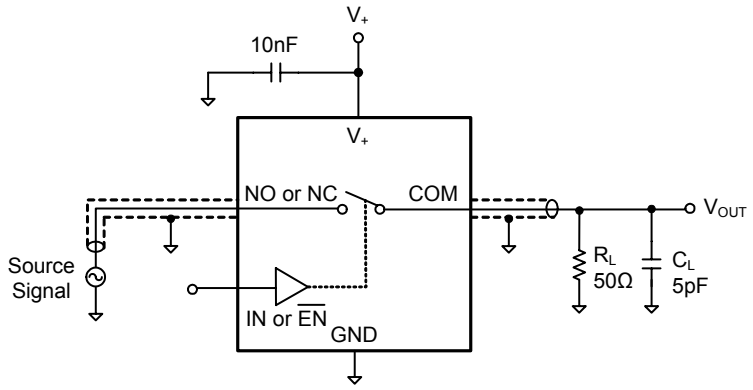
Test Circuit 5. Off Isolation



$$\text{Channel To Channel Crosstalk} = -20\times\log\frac{V_{NO}\text{ or }V_{NC}}{V_{OUT}}$$

Test Circuit 6. Channel-to-Channel Crosstalk

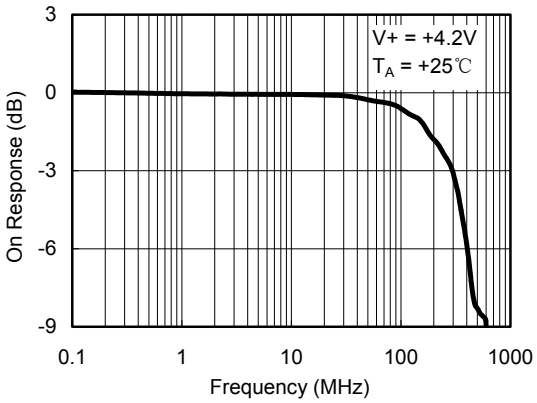
TEST CIRCUITS (Cont.)



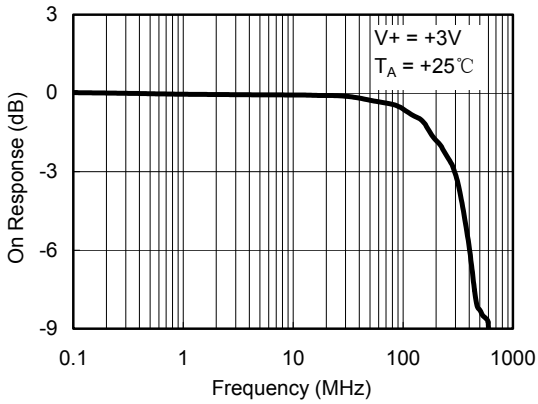
Test Circuit 7. -3dB Bandwidth

TYPICAL PERFORMANCE CHARACTERISTICS

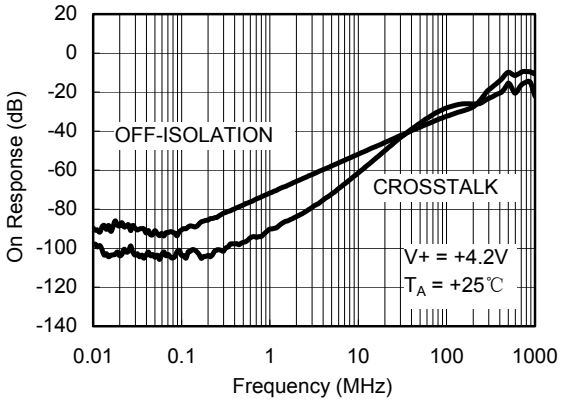
On Response vs. Frequency



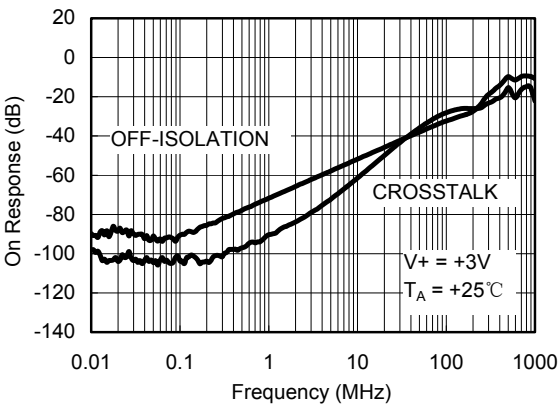
On Response vs. Frequency



Response vs. Frequency

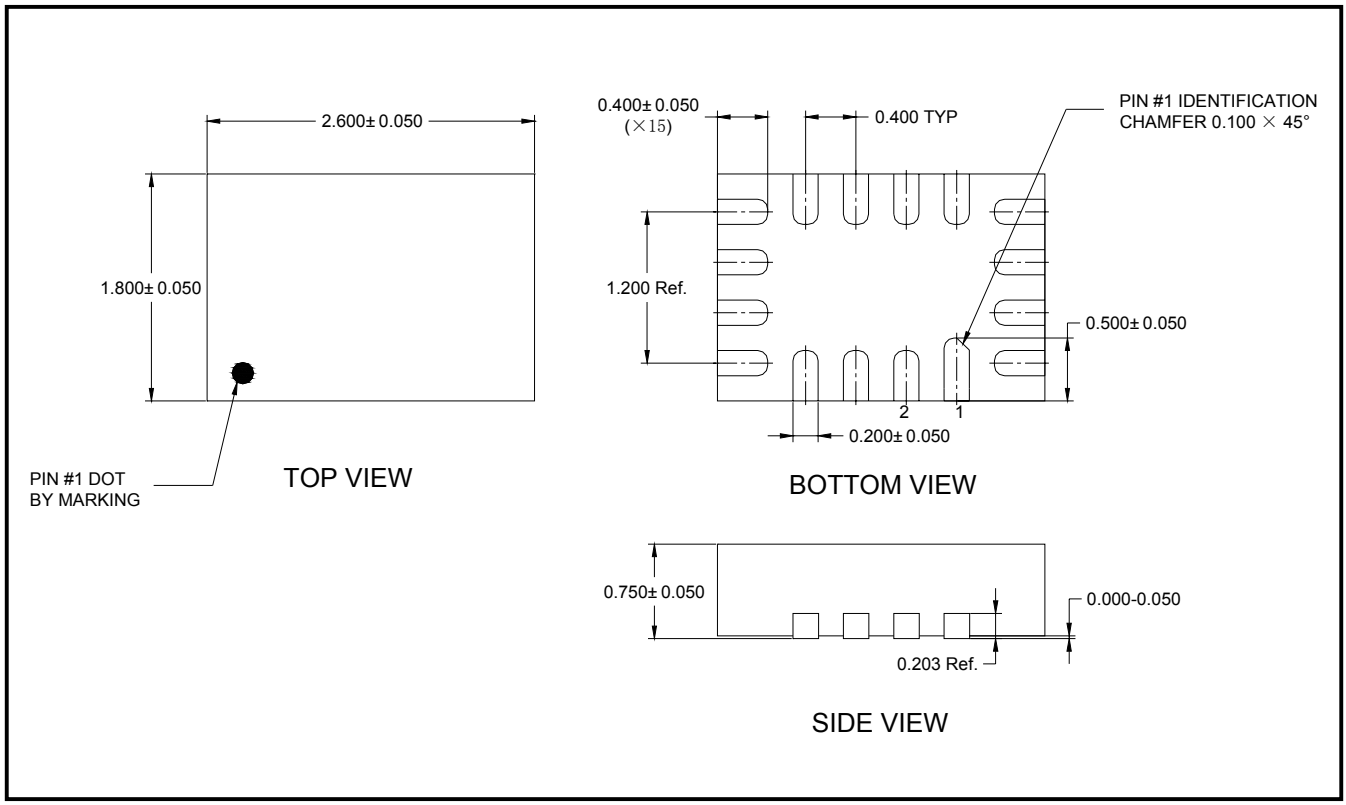


Response vs. Frequency



PACKAGE OUTLINE DIMENSIONS

TQFN-16 (2.6mm × 1.8mm)



Note: All linear dimensions are in millimeters.