SGM3158
4.5Ω Dual SPDT Analog Switch in 12-pin TDFN

GENERAL DESCRIPTION

The SGM3158 is a dual, bidirectional, single-pole/ double-throw (SPDT) CMOS analog switch designed to operate from a single +1.8V to +5.5V supply. It features high-bandwidth (270MHz) and low on-resistance (4.5Ω TYP), targeted applications for audio switching.

SGM3158 features guaranteed on-resistance matching (0.3Ω MAX) between switches and guaranteed on-resistance flatness over the signal range (2.3Ω TYP). This ensures excellent linearity and low distortion when switching audio signals.

SGM3158 is available in a TDFN-12 package.

FEATURES

- **Voltage Operation: 1.8V to 5.5V**
- **On-Resistance: 4.5Ω (TYP) at 5.0V**
- **Fast Switching Times**
  - **t_{ON} 20ns**
  - **t_{OFF} 15ns**
- **High Bandwidth: 270MHz**
- **High Off-Isolation: -51dB at 10MHz**
- **Rail-to-Rail Operation**
- **TTL/CMOS Compatible**
- **Break-Before-Make Switching**
- **Extended Industrial Temperature Range:**
  -40℃ to +85℃
- **Lead (Pb) Free TDFN-12 Package**

APPLICATIONS

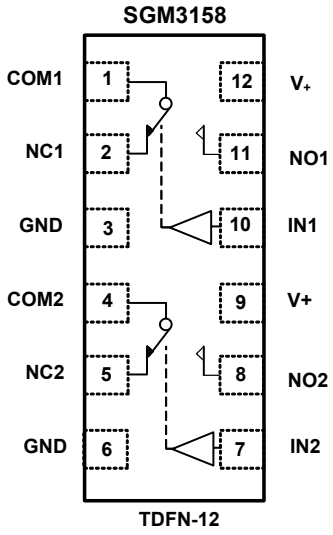
Portable Instrumentation
Battery-Operated Equipment
Computer Peripherals
Cell Phones
PDAs
MP3s

FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

Switches Shown for Logic “0” Input

PIN CONFIGURATION (TOP VIEW)



ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM3158	TDFN-12	-40℃ to +85℃	SGM3158YD/TR	3158	Tape and Reel, 3000

ABSOLUTE MAXIMUM RATINGS

V_+, IN to GND.....-0.3V to 6V
Analog, Digital voltage range (1)..... -0.3V to (V_+) + 0.3V
Continuous Current NO, NC, or COM.....±50mA
Peak Current NO, NC, or COM .....±80mA
Operating Temperature Range.....-40℃ to +85℃
Junction Temperature.....150°C
Storage Temperature.....- 65°C to +150°C
Lead Temperature (soldering, 10s).....260°C
ESD (HBM).....2000V
ESD (MM).....400V

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 exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

CAUTION

This integrated circuit can be damaged by ESD if you don’t pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.
ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PIN DESCRIPTION

NAME	FUNCTION
NO1, NO2	Normally-open terminal
GND	Ground
NC1, NC2	Normally-closed terminal
COM1, COM2	Common terminal
V_+	Power supply
IN1, IN2	Digital control pin to connect the COM terminal to the NO or NC terminals

Note: NO1 or NO2, NC1 or NC2, and COM1 or COM2 terminals may be an input or output.

ELECTRICAL CHARACTERISTICS

(V_+ = +4.5V to +5.5V, V_{IH} = +2.0 V, V_{IL} = +0.8V, 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, V_{NO} or V_{NC} = 3.5V, I_{COM} = -10mA, Test Circuit 1	+25℃		4.5	8	Ω
			-40℃ to +85℃			8.5	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 4.5V, V_{NO} or V_{NC} = 3.5V, I_{COM} = -10mA, Test Circuit 1	+25℃		0.15	0.3	Ω
			-40℃ to +85℃			0.4	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 4.5V, V_{NO} or V_{NC} = 1.0V, 2.0V, 3.5V, I_{COM} = -10mA, Test Circuit 1	+25℃		2.3	3.3	Ω
			-40℃ to +85℃			3.7	Ω
Source OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+ = 5.5V, V_{NO} or V_{NC} = 1.0V, 4.5V, V_{COM} = 4.5V, 1.0V	-40℃ to +85℃			1	μA
Channel ON Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$	V_+ = 5.5V, V_{COM} = 1.0V, 4.5V, V_{NO} or V_{NC} = 1.0V, 4.5V, 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℃			0.6	V
Input Leakage Current	I_{IN}	V_+ = 5.5V, V_{IN} = 0 or 5.5V	-40℃ to +85℃			1	μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 3.0V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2	+25℃		20		ns
Turn-Off Time	t_{OFF}	V_{NO} or V_{NC} = 3.0V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2	+25℃		15		ns
Break-Before-Make Time Delay	t_D	V_{NO1} or V_{NC1} = V_{NO2} or V_{NC2} = 3V, R_L = 300Ω, C_L = 35pF, Test Circuit 3	+25℃		5		ns
Skew	t_{SKEW}	R_S = 39Ω, C_L = 50pF, Test Circuit 4	+25℃		5		ns
Off Isolation	O_{ISO}	R_L = 50Ω, C_L = 5pF, Signal = 0dBm, Test Circuit 5, f = 10MHz	+25℃		-51		dB
		R_L = 50Ω, C_L = 5pF, Signal = 0dBm, Test Circuit 5, f = 1MHz	+25℃		-72		dB
–3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 6	+25℃		270		MHz
Source OFF Capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	f = 1MHz	+25℃		5.5		pF
Channel ON Capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$	f = 1MHz	+25℃		15.5		pF
POWER REQUIREMENTS							
Power Supply Range	V_+		- 40℃ to +85℃	1.8		5.5	V
Power Supply Current	I_+	V_+ = 5.5V, V_{IN} = 0V or V_+	- 40℃ to +85℃			5	μA

Specifications subject to change without notice.

ELECTRICAL CHARACTERISTICS

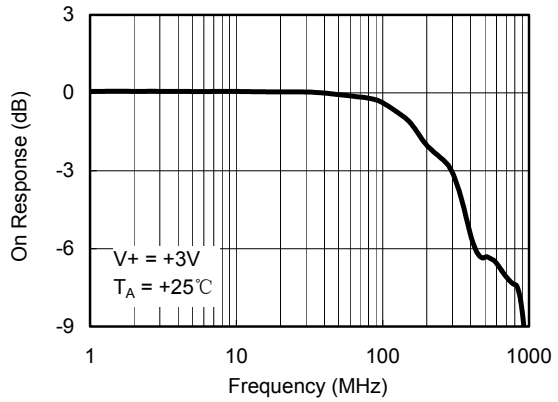
(V_+ = +2.7V to +3.6V, V_{IH} = +1.4V, V_{IL} = +0.5V, T_A = -40℃ to +85℃, Typical values are at V_+ = 3.0V, T_A = + 25℃, unless otherwise noted.)

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, V_{NO} or V_{NC} = 1.5V, I_{COM} = -10mA, Test Circuit 1	+25℃		7	10	Ω
			-40℃ to +85℃			10.5	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 2.7V, V_{NO} or V_{NC} = 1.5V, I_{COM} = -10mA, Test Circuit 1	+25℃		0.15	0.3	Ω
			-40℃ to +85℃			0.4	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 2.7V, V_{NO} or V_{NC} = 1.0V, 1.5V, 2.0V, I_{COM} = -10mA, Test Circuit 1	+25℃		3	4	Ω
			-40℃ to +85℃			4.3	Ω
Source OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+ = 3.6V, V_{NO} or V_{NC} = 0.3V, 3.3V, V_{COM} = 3.3V, 0.3V	-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			V
Input Low Voltage	V_{INL}		-40℃ to +85℃			0.5	V
Input Leakage Current	I_{IN}	V_+ = 5.5V, V_{IN} = 0V or 3.6V	-40℃ to +85℃			1	μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 1.5V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2	+25℃		30		ns
Turn-Off Time	t_{OFF}	V_{NO} or V_{NC} = 1.5V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2	+25℃		25		ns
Break-Before-Make Time Delay	t_D	V_{NO1} or V_{NC1} = V_{NO2} or V_{NC2} = 3V, R_L = 300Ω, C_L = 35pF, Test Circuit 3	+25℃		8		ns
Skew	t_{SKEW}	R_S = 39Ω, C_L = 50pF, Test Circuit 4	+25℃		2		ns
Off Isolation	O_{ISO}	R_L = 50Ω, C_L = 5pF, Signal = 0dBm, Test Circuit 5, f = 10MHz	+25℃		-51		dB
		f = 1MHz	+25℃		-72		dB
–3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 6	+25℃		270		MHz
Source OFF Capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	f = 1MHz	+25℃		5.5		pF
Channel ON Capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$	f = 1MHz	+25℃		15.5		pF
POWER REQUIREMENTS							
Power Supply Range	V_+		-40℃ to +85℃	1.8		5.5	V
Power Supply Current	I_+	V_+ = 5.5V, V_{IN} = 0V or V_+	-40℃ to +85℃			5	μA

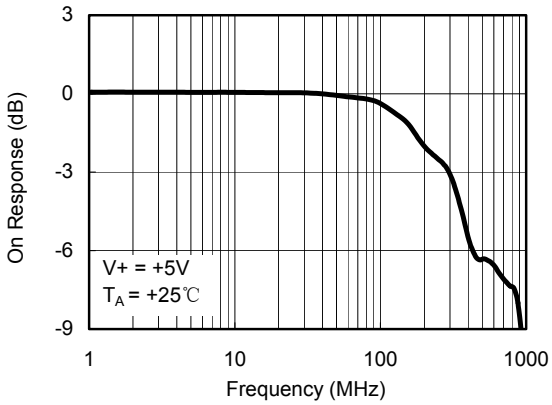
Specifications subject to change without notice.

TYPICAL PERFORMANCE CHARACTERISTICS

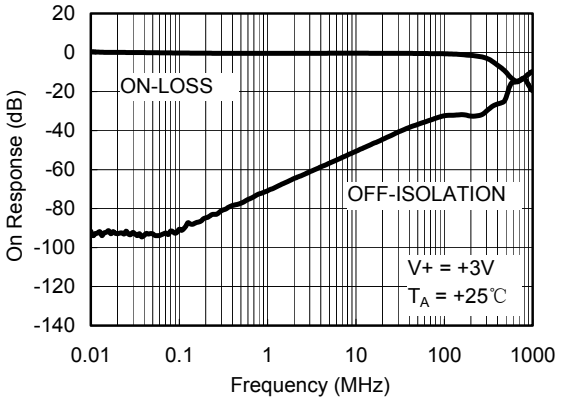
On Response vs. Frequency



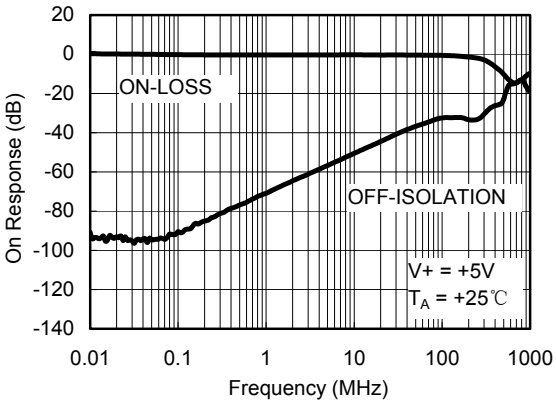
On Response vs. Frequency



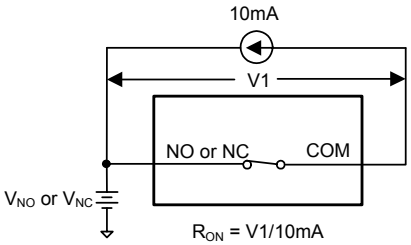
Response vs. Frequency



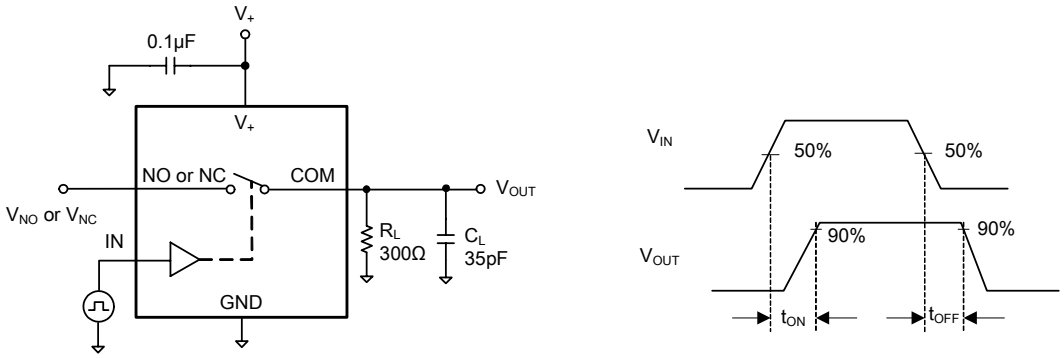
Response vs. Frequency



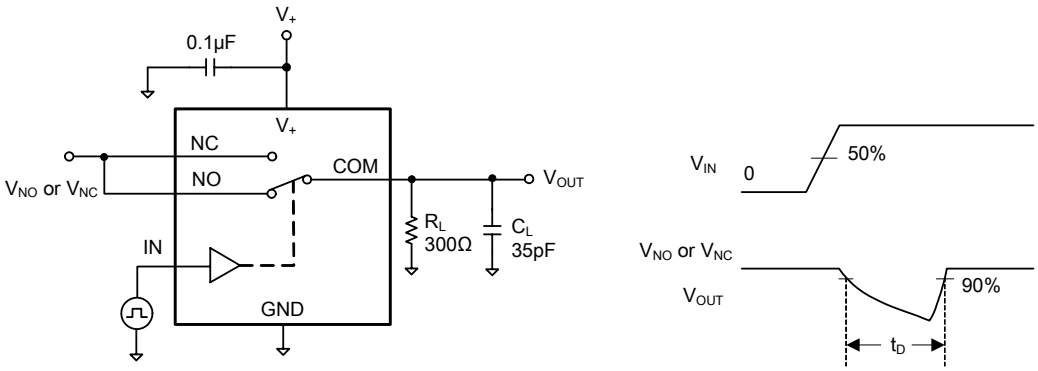
TEST CIRCUITS



Test Circuit 1. On Resistance

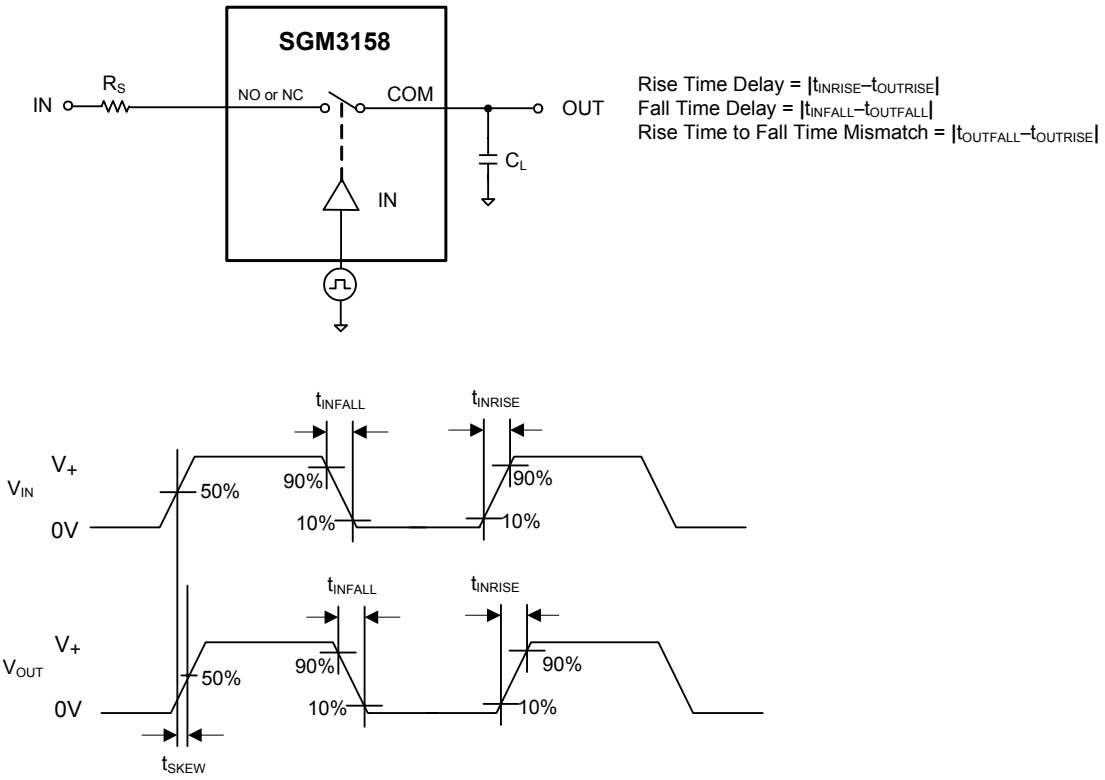


Test Circuit 2. Switching Times



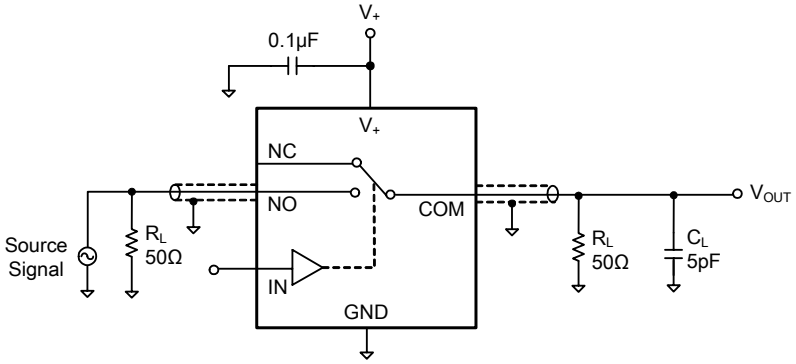
Test Circuit 3. Break-Before-Make Time Delay, t_D

TEST CIRCUITS (Cont.)

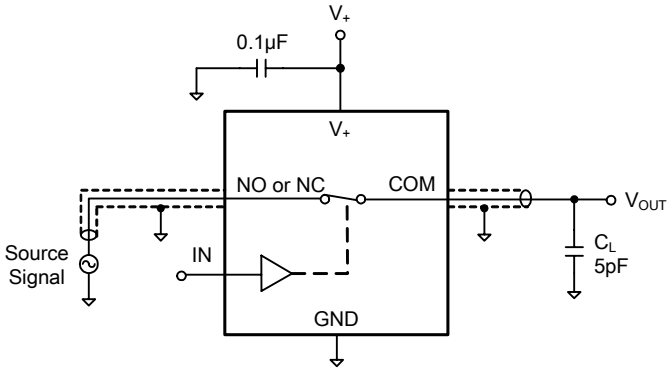


Test Circuit 4. Output Signal Skew

TEST CIRCUITS (Cont.)



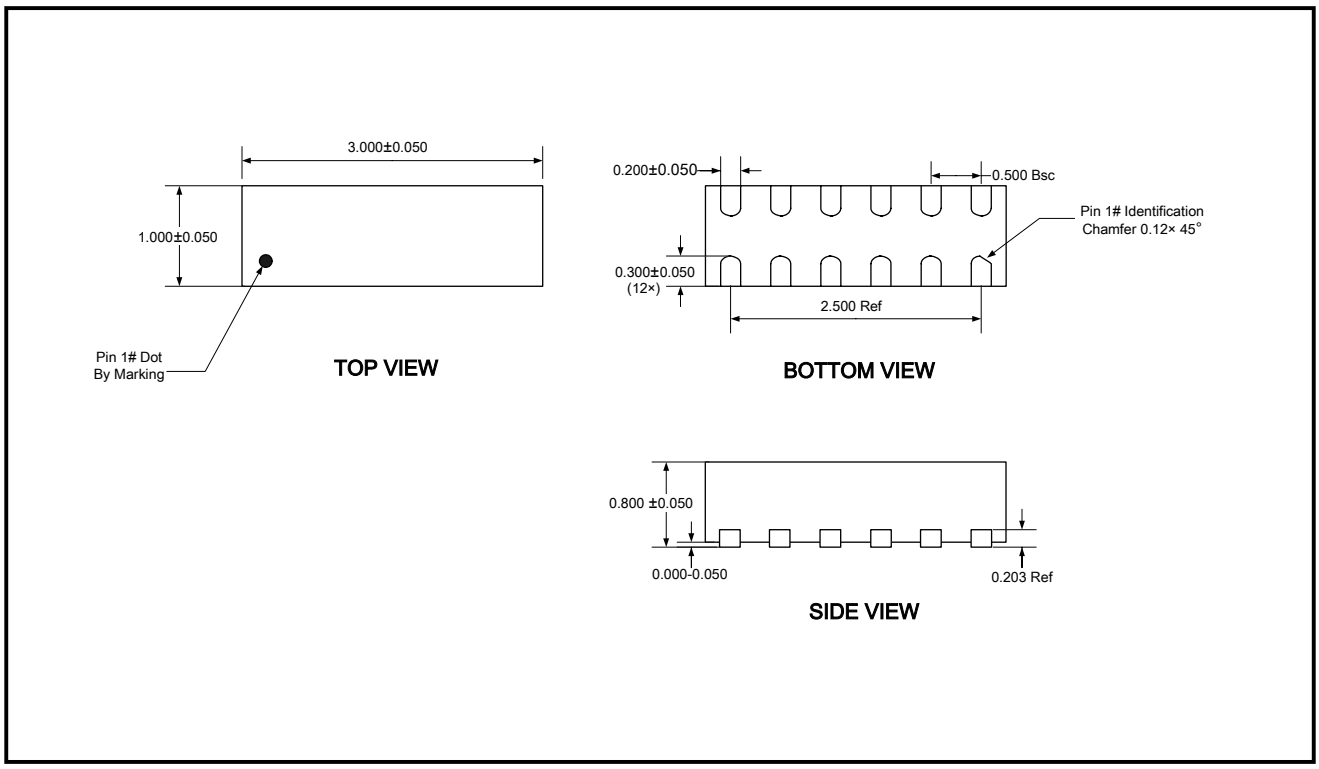
Test Circuit 5. Off Isolation



Test Circuit 6. -3dB Bandwidth

PACKAGE OUTLINE DIMENSIONS

TDFN-12



NOTES: All linear dimensions are in millimeters.

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