



SGM3005

Ultra Low ON-Resistance, Low Voltage, Dual, SPDT Analog Switch

GENERAL DESCRIPTION

The SGM3005 is a dual, low on-resistance, low voltage, bidirectional, single-pole/double-throw (SPDT) CMOS analog switch designed to operate from a single 1.8V to 5.5V power supply. Targeted applications include battery powered equipment that benefit from low R_{ON} (0.5Ω) and fast switching speeds ($t_{ON} = 50ns$, $t_{OFF} = 15ns$).

The on resistance profile is very flat over the full analog signal range. This ensures excellent linearity and low distortion when switching audio signals.

The SGM3005 is a committed dual single-pole/double-throw (SPDT) that consist of two normally open (NO) and two normally close (NC) switches. This configuration can be used as a dual 2-to-1 multiplexer.

SGM3005 is available in a MSOP-10 and DFN-10 packages.

APPLICATIONS

Battery-powered, Handheld, and Portable Equipment

Cellular/Mobile Phones

Laptops, Notebooks, Palmtops

Communication Systems

Sample-and-Hold Circuits

Audio Signal Routing

Audio and Video Switching

Portable Test and Measurement

Medical Equipment

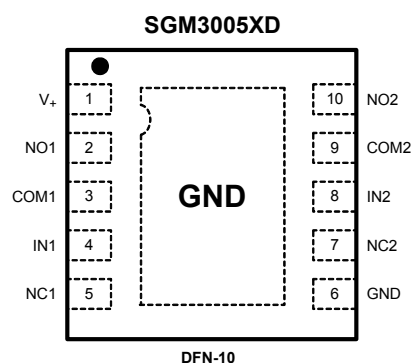
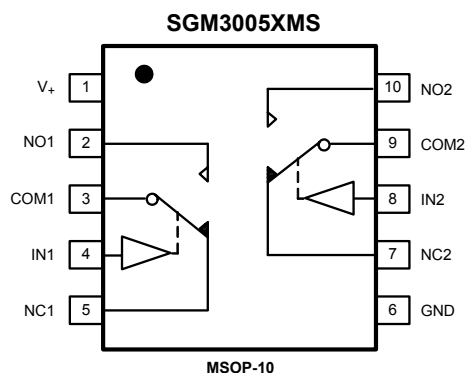
FUNCTION TABLE

LOGIC	NC1, NC2	NO1, NO2
0	ON	OFF
1	OFF	ON

FEATURES

- Low Voltage Operation: 1.8V to 5.5V
- Low On-Resistance: 0.5Ω (TYP)
- Low On-Resistance Flatness
- -3dB Bandwidth: 15MHz
- Fast Switching Times
 - t_{ON} 50ns
 - t_{OFF} 15ns
- Rail-to-Rail Operation
- Typical Power Consumption ($<0.01\mu W$)
- TTL/CMOS Compatible
- Microsize Packages

PIN CONFIGURATIONS (TOP VIEW)



ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM3005	MSOP-10	-40°C to +125°C	SGM3005XMS/TR	SGM3005XMS	Tape and Reel, 3000
	DFN-10	-40°C to +125°C	SGM3005XD/TR	3005D	Tape and Reel, 3000

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.....±300mA
 Peak Current NO, NC, or COM.....±500mA
 Operating Temperature Range-40°C to +125°C
 Junction Temperature150°C
 Storage Temperature.....-65°C to +150°C

Package Thermal Resistance @ $T_A = 25^\circ\text{C}$
 DFN-10, θ_{JA}33°C/W
 MSOP-10, θ_{JA}205°C/W
 Lead Temperature (soldering, 10s).....260°C
 ESD Susceptibility
 HBM.....2000V
 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	PIN	FUNCTION
V_+	1	Power supply.
GND	6	Ground.
IN1, IN2	4,8	Digital control pin to connect the COM terminal to the NO or NC terminals.
COM1, COM2	3,9	Common terminal.
NO1, NO2	2,10	Normally-open terminal.
NC1, NC2	5,7	Normally-closed terminal.

Note: NO, NC and COM terminals may be an input or output.



ELECTRICAL CHARACTERISTICS(V₊ = +5V ± 10%, GND = 0V, T_A = -40°C to +125°C, typical values are at T_A = + 25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	SGM3005			
			+25°C	-40°C to +125°C	UNITS	MIN/ MAX
ANALOG SWITCH						
Analog Signal Range	V _{NO} , V _{NC} , V _{COM}			0	V	MIN
				V ₊	V	MAX
On-Resistance	R _{ON}	0 ≤ V _{NO} or V _{NC} ≤ V ₊ , I _{COM} = -10mA, Test Circuit 1	0.5		Ω	TYP
			0.9	1.1	Ω	MAX
On-Resistance Match Between Channels	ΔR _{ON}	0 ≤ V _{NO} or V _{NC} ≤ V ₊ , I _{COM} = -10mA, Test Circuit 1	0.05		Ω	TYP
			0.09	0.12	Ω	MAX
On-Resistance Flatness	R _{FLAT(ON)}	0 ≤ V _{NO} or V _{NC} ≤ V ₊ , I _{COM} = -10mA, Test Circuit 1	0.25		Ω	TYP
			0.3	0.4	Ω	MAX
LEAKAGE CURRENTS						
Source OFF Leakage Current	I _{NC(OFF)} , I _{NO(OFF)}	V _{NO} or V _{NC} = 4.5V/1V, V _{COM} = 1V/4.5V, V ₊ = +5.5V, Test Circuit 2	±4		nA	TYP
			±10	±1000	nA	MAX
Channel ON Leakage Current	I _{NC(ON)} , I _{NO(ON)} , I _{COM(ON)}	V _{NO} or V _{NC} = V _{COM} = 1V or 4.5V, V ₊ = +5.5V, Test Circuit 3	±4		nA	TYP
			±10	±1000	nA	MAX
DIGITAL INPUTS						
Input High Voltage	V _{INH}			2.4	V	MIN
Input Low Voltage	V _{INL}			0.8	V	MAX
Input Current	I _{INL} or I _{INH}	V _{IN} = V _{INH} or V _{INL}	±0.01		μA	TYP
			±0.1	±1	μA	MAX
DYNAMIC CHARACTERISTICS						
Turn-On Time	t _{ON}	V _{NO} or V _{NC} = 3V, R _L = 300Ω, C _L = 35pF, Test Circuit 4	50		ns	TYP
Turn-Off Time	t _{OFF}	V _{NO} or V _{NC} = 3V, R _L = 300Ω, C _L = 35pF, Test Circuit 4	15		ns	TYP
Charge Injection	Q	C _L = 1.0nF, V _G = 0V, R _G = 0Ω, Test Circuit 5	20		pC	TYP
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 6	10		ns	TYP
Off Isolation	O _{ISO}	R _L = 50Ω, C _L = 5pF, Test Circuit 7	f = 100kHz	-69	dB	TYP
			f = 10kHz	-85	dB	TYP
Channel-to-Channel Crosstalk	X _{TALK}	R _L = 50Ω, C _L = 5pF, Test Circuit 8	f = 100kHz	-90	dB	TYP
			f = 10kHz	-105	dB	TYP
Total Harmonic Distortion	THD	f = 20Hz to 20kHz, V _{COM} = 3.5V _{P-P} , R _L = 600Ω, C _L = 50pF	0.065		%	TYP
-3dB Bandwidth	BW	R _L = 50Ω, C _L = 5pF, Test Circuit 9	15		MHz	TYP
Source OFF Capacitance	C _{NC(OFF)} , C _{NO(OFF)}		82		pF	TYP
Channel ON Capacitance	C _{NC(ON)} , C _{NO(ON)} , C _{COM(ON)}		380		pF	TYP
POWER REQUIREMENTS						
Power Supply Current	I ₊	V ₊ = +5.5V, V _{IN} = 0V or 5V	0.001		μA	TYP
				1	μA	MAX

Specifications subject to changes without notice.

SGM3005

Ultra Low ON-Resistance, Low Voltage, Dual, SPDT Analog Switch

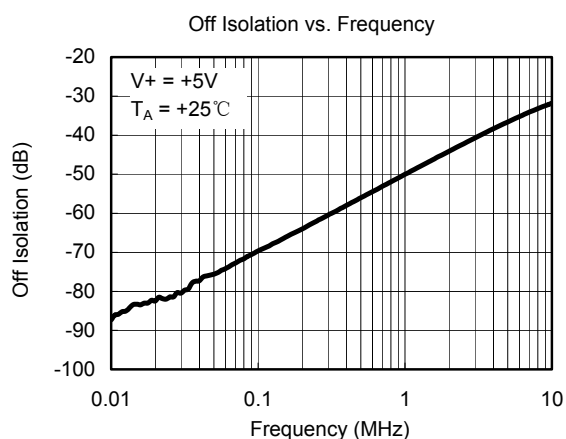
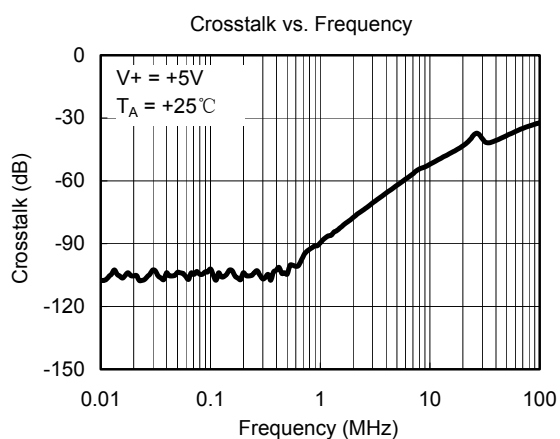
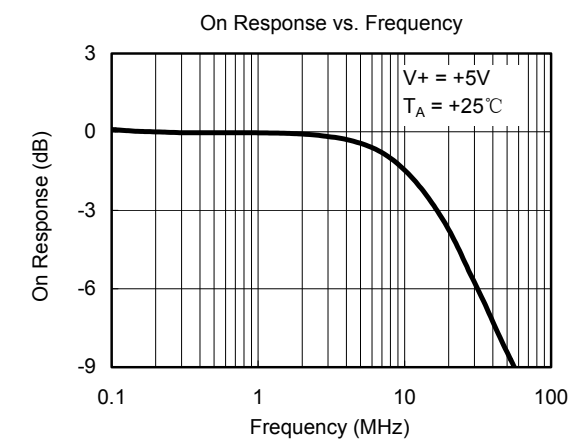
ELECTRICAL CHARACTERISTICS

($V_+ = +3V \pm 10\%$, GND = 0V, $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$, typical values are at $T_A = +25^\circ\text{C}$, unless otherwise noted.)

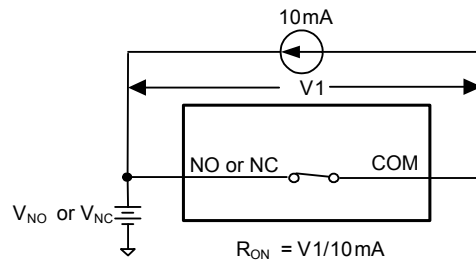
PARAMETER	SYMBOL	CONDITIONS	SGM3005			
			+25°C	-40°C to +125°C	UNITS	MIN/ MAX
ANALOG SWITCH						
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}			0	V	MIN
				V_+	V	MAX
On-Resistance	R_{ON}	$0 \leq V_{NO} \text{ or } V_{NC} \leq V_+, I_{COM} = -10\text{mA}$, Test Circuit 1	0.6		Ω	TYP
			1.0	1.3	Ω	MAX
On-Resistance Match Between Channels	ΔR_{ON}	$0 \leq V_{NO} \text{ or } V_{NC} \leq V_+, I_{COM} = -10\text{mA}$, Test Circuit 1	0.05		Ω	TYP
			0.1	0.13	Ω	MAX
On-Resistance Flatness	$R_{FLAT(ON)}$	$0 \leq V_{NO} \text{ or } V_{NC} \leq V_+, I_{COM} = -10\text{mA}$, Test Circuit 1	0.25		Ω	TYP
			0.3	0.4	Ω	MAX
LEAKAGE CURRENTS						
Source OFF Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{NO} \text{ or } V_{NC} = 3\text{V}/1\text{V}, V_{COM} = 1\text{V}/3\text{V}$, $V_+ = +3.3\text{V}$, Test Circuit 2	± 5		nA	TYP
			± 11	± 1000	nA	MAX
Channel ON Leakage Current	$I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$	$V_{NO} \text{ or } V_{NC} = V_{COM} = 1\text{V} \text{ or } 3\text{V}$, $V_+ = +3.3\text{V}$, Test Circuit 3	± 5		nA	TYP
			± 11	± 1000	nA	MAX
DIGITAL INPUTS						
Input High Voltage	V_{INH}			2.0	V	MIN
Input Low Voltage	V_{INL}			0.4	V	MAX
Input Current	$I_{INL} \text{ or } I_{INH}$	$V_{IN} = V_{INH} \text{ or } V_{INL}$	± 0.01		μA	TYP
			± 0.1	± 1	μA	MAX
DYNAMIC CHARACTERISTICS						
Turn-On Time	t_{ON}	$V_{NO} \text{ or } V_{NC} = 2\text{V}$, $R_L = 300\Omega, C_L = 35\text{pF}$, Test Circuit 4	50		ns	TYP
Turn-Off Time	t_{OFF}	$V_{NO} \text{ or } V_{NC} = 2\text{V}$, $R_L = 300\Omega, C_L = 35\text{pF}$, Test Circuit 4	17		ns	TYP
Charge Injection	Q	$C_L = 1.0\text{nF}, V_G = 0\text{V}, R_G = 0\Omega$, Test Circuit 5	25		pC	TYP
Break-Before-Make Time Delay	t_D	$V_{NO1} \text{ or } V_{NC1} = V_{NO2} \text{ or } V_{NC2} = 2\text{V}$, $R_L = 300\Omega, C_L = 35\text{pF}$, Test Circuit 6	11		ns	TYP
Off Isolation	O_{ISO}	$R_L = 50\Omega, C_L = 5\text{pF}$, Test Circuit 7	f = 100kHz	-69	dB	TYP
			f = 10kHz	-85	dB	TYP
Channel-to-Channel Crosstalk	X_{TALK}	$R_L = 50\Omega, C_L = 5\text{pF}$, Test Circuit 8	f = 100kHz	-90	dB	TYP
			f = 10kHz	-105	dB	TYP
Total Harmonic Distortion	THD	f = 20Hz to 20kHz, $V_{COM} = 2V_{P-P}$, $R_L = 600\Omega, C_L = 50\text{pF}$	0.06		%	TYP
-3dB Bandwidth	BW	$R_L = 50\Omega, C_L = 5\text{pF}$, Test Circuit 9	15		MHz	TYP
Source OFF Capacitance	$C_{NC(OFF)}, C_{NO(OFF)}$		82		pF	TYP
Channel ON Capacitance	$C_{NC(ON)}, C_{NO(ON)}, C_{COM(ON)}$		380		pF	TYP
POWER REQUIREMENTS						
Power Supply Current	I_+	$V_+ = +3.3\text{V}, V_{IN} = 0\text{V} \text{ or } 3\text{V}$	0.001		μA	TYP
				1	μA	MAX

Specifications subject to changes without notice.

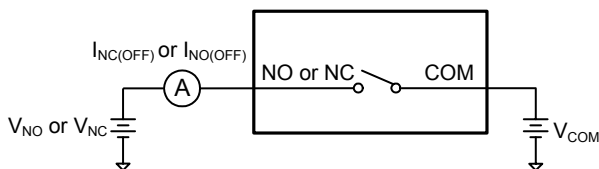
TYPICAL PERFORMANCE CHARACTERISTICS



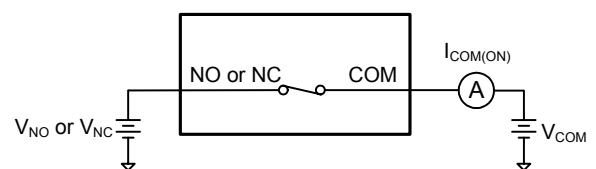
TEST CIRCUITS



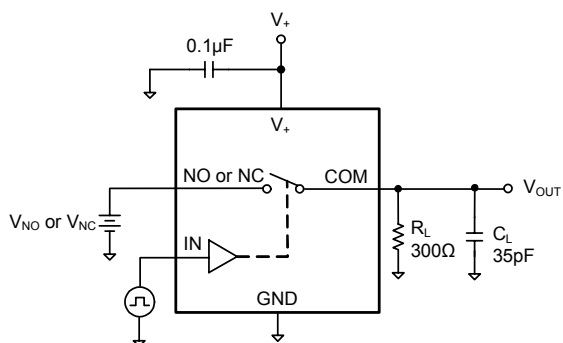
Test Circuit 1. On Resistance



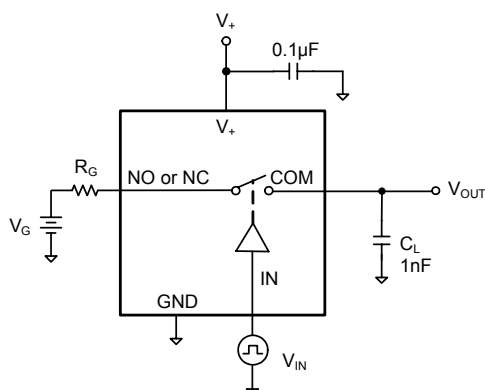
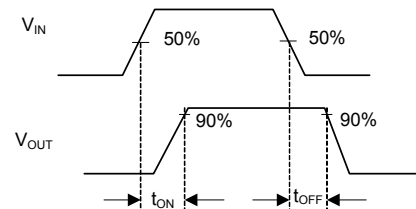
Test Circuit 2. Off Leakage



Test Circuit 3. On Leakage

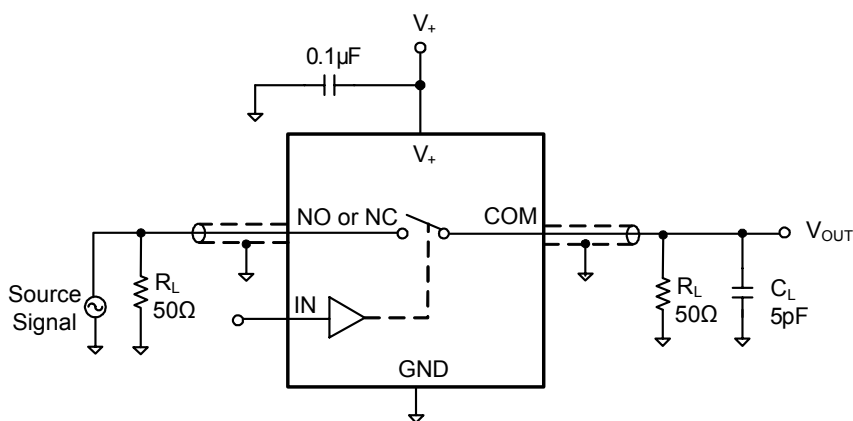
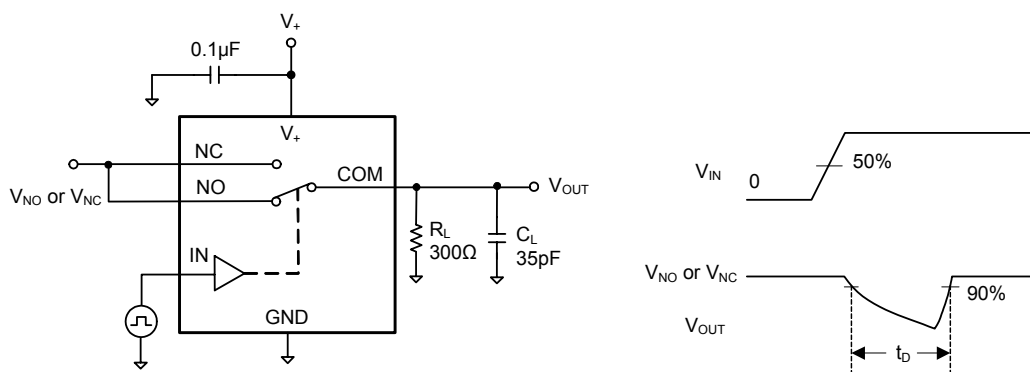


Test Circuit 4. Switching Times

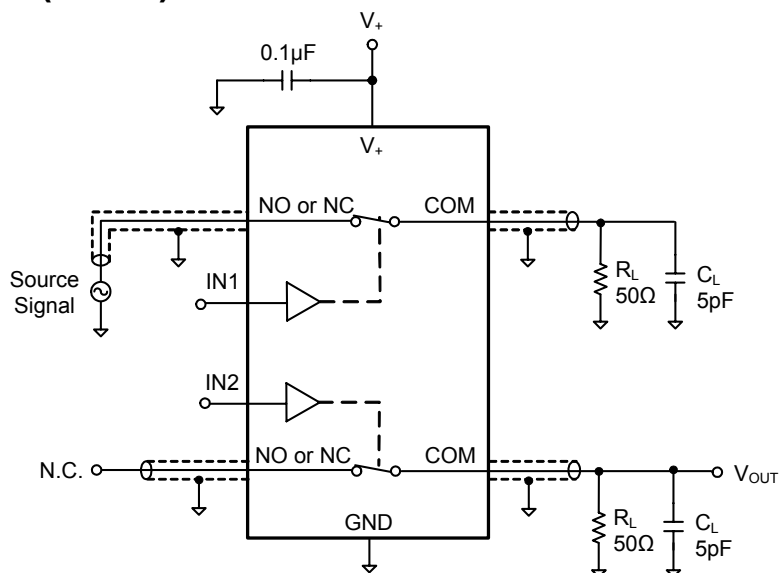


Test Circuit 5. Charge Injection

TEST CIRCUITS (Cont.)

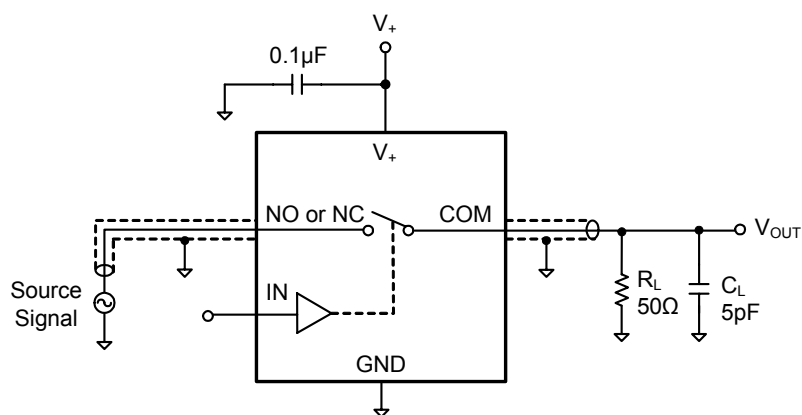


TEST CIRCUITS (Cont.)



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

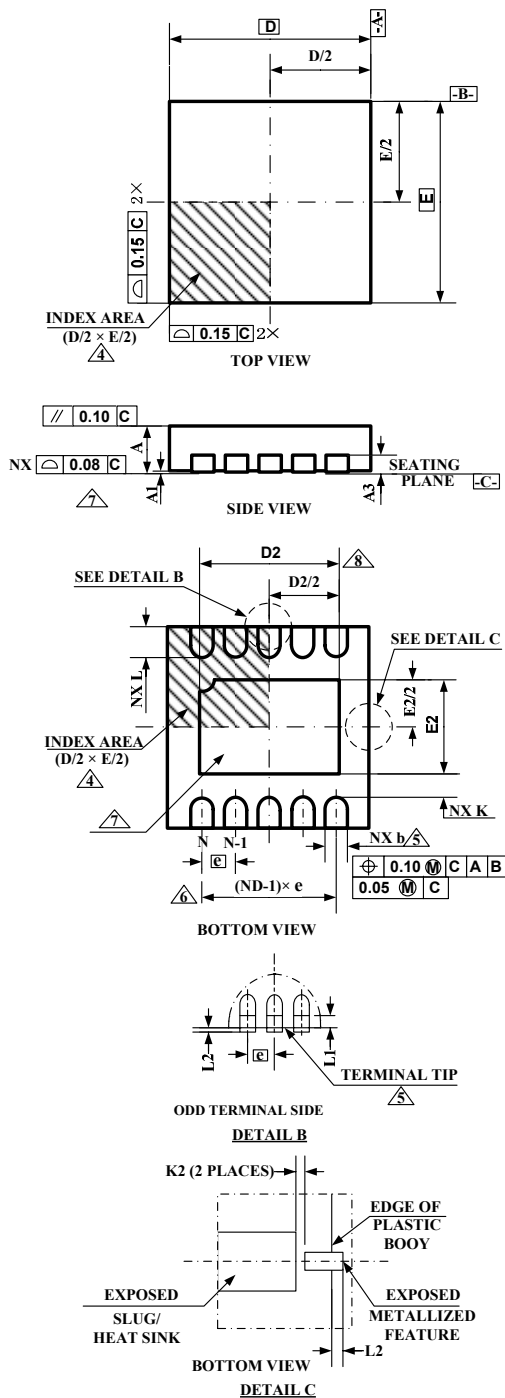
Test Circuit 8. Channel-to-Channel Crosstalk



Test Circuit 9. -3dB Bandwidth

PACKAGE OUTLINE DIMENSIONS

DFN-10



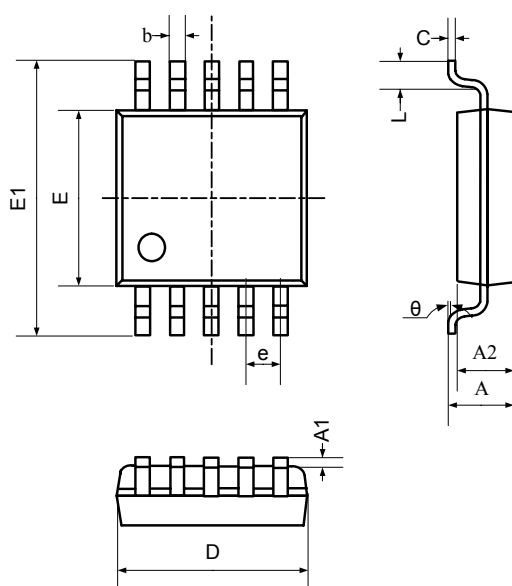
Symbol	Dimensions In Millimeters		
	Min	NOM	Max
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3	0.20 REF		
b	0.18	0.25	0.30
D	3.00 BSC		
D2	2.23	2.38	2.48
E	3.00 BSC		
E2	1.49	1.64	1.74
e	0.50 BSC		
K	0.20		
K2	0.17		
L	0.30	0.40	0.50
L1			0.15
L2			0.13
N	10		
ND	5		

NOTES:

1. Dimensioning and tolerancing conform to ASME Y14.5M-1994.
2. All dimensions are in millimeters, angle is in degrees (°).
3. N is the total number of terminals.
4. The terminal #1 identifier and terminal numbering convention shall conform to JESD 95-1 SPP-012. Details of terminal #1 identifier are optional, but must be located within the zone indicated. The terminal #1 identifier may be either a mold, embedded metal or mark feature.
5. Dimension b applies to metallized terminal and is measured between 0.15MM and 0.30MM from terminal tip.
6. ND refers to the maximum number of terminals on D side.
7. Unilateral coplanarity zone applies to the exposed heat sink slug as well as the terminals.
8. Dimensions D2 and E2 are for the exposed pads which provide improved electrical and thermal performance.

PACKAGE OUTLINE DIMENSIONS

MSOP-10



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.200	0.031	0.047
A1	0.000	0.200	0.000	0.008
A2	0.760	0.970	0.030	0.038
b	0.30 TYP		0.012 TYP	
C	0.152 TYP		0.006 TYP	
D	2.900	3.100	0.114	0.122
e	0.50 TYP		0.020 TYP	
E	2.900	3.100	0.114	0.122
E1	4.700	5.100	0.185	0.201
L	0.410	0.650	0.016	0.026
θ	0°	6°	0°	6°

05/2009 REV. D. 2

SGMICRO is dedicated to provide high quality and high performance analog IC products to customers. All SGMICRO products meet the highest industry standards with strict and comprehensive test and quality control systems to achieve world-class consistency and reliability.

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