![SGMICRO logo]

SGM3001/SGM3002
Low ON-Resistance, Low Voltage, SPDT Analog Switch

GENERAL DESCRIPTION

The SGM3001 (single) and SGM3002 (dual) are bidirectional, low on-resistance, low voltage, single-pole/double-throw (SPDT) CMOS analog switches designed to operate from a single +1.8V to +5.5V supply. Targeted applications include battery powered equipment that benefit from low R_{ON} (2.5Ω) and fast switching speeds SGM3001 (t_{ON} = 11ns, t_{OFF} = 30ns) and SGM3002 (t_{ON} = 11ns, t_{OFF} = 8ns).

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 SGM3002 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.

The single version SGM3001 is available in Green SC70-6 package. The dual version SGM3002 is available in Green MSOP-10 package.

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

FEATURES

- **Low Voltage Operation : 1.8V to 5.5V**
- **Low On-Resistance: 2.5Ω (TYP)**
- **Low On-Resistance Flatness**
- **-3dB Bandwidth: 120MHz**
- **Fast Switching Times**
    - t_{ON} **11ns**
    - t_{OFF} **30ns (SGM3001)**
    - t_{OFF} **8ns (SGM3002)**
- **Rail-to-Rail Operation**
- **Typical Power Consumption (< 0.01µW)**
- **TTL/CMOS Compatible**
- **Microsize Package**

PIN CONFIGURATIONS (TOP VIEW)

SGM3001XC6

SC70-6

SGM3002XMS

MSOP-10
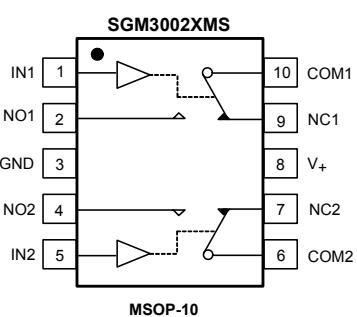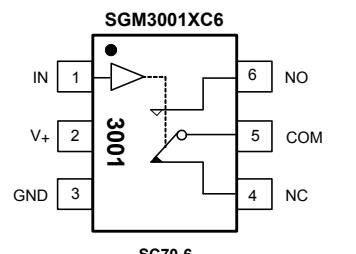
FUNCTION TABLE

LOGIC	NO, NO1, NO2	NC, NC1, NC2
0	OFF	ON
1	ON	OFF

PACKAGE/ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM3001	SC70-6	-40℃ to +125℃	SGM3001XC6/TR	3001	Tape and Reel, 3000
SGM3002	MSOP-10	-40℃ to +125℃	SGM3002XMS/TR	SGM3002XMS	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...........................±150mA
Peak Current NO, NC, or COM ....±250mA
Package Thermal Resistance @ T_A = 25℃
SC70-6, $θ_{JA}$...333℃/W
MSOP-10, $θ_{JA}$..205℃/W
Operating Temperature Range.........................-40℃ to +125℃
Junction Temperature ....150℃
Storage Temperature Range.............................-65℃ to +150℃
Lead Temperature (soldering, 10s)................................. 260℃
ESD Susceptibility
HBM..2000V
MM..400V

NOTES:
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.
2. 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.

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.

SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

PIN DESCRIPTION

NAME	SC70-6 PIN	MSOP-10 PIN	FUNCTION
V_+	2	8	Power Supply.
GND	3	3	Ground.
IN(IN1, IN2)	1	1, 5	Digital Control Pin to Connect the COM Terminal to the NO or NC Terminals.
COM(COM1, COM2)	5	6, 10	Common Terminal.
NO(NO1, NO2)	6	2, 4	Normally-Open Terminal.
NC(NC1, NC2)	4	7, 9	Normally-Closed Terminal.

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

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ELECTRICAL CHARACTERISTICS

(V$_+$ = +5V ± 10%, GND = 0V, all specifications -40℃ to +125℃. Typical values are at T$_A$ = +25℃, unless otherwise noted.)

| PARAMETER		SYMBOL	CONDITIONS		SGM3001/3002		UNITS	MIN/ MAX
					+25℃	-40℃ to +125℃		
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		2.5		Ω	TYP
					3.7	4.5	Ω	MAX
On-Resistance Match Between Channels		ΔR$_{ON}$	0 ≤ V$_{NO}$ or V$_{NC}$ ≤ V+, I$_{COM}$ = -10mA, Test Circuit 1		0.1		Ω	TYP
					0.8	0.9	Ω	MAX
On-Resistance Flatness		R$_{FLAT(ON)}$	0 ≤ V$_{NO}$ or V$_{NC}$ ≤ V+, I$_{COM}$ = -10mA, Test Circuit 1		0.75		Ω	TYP
					0.85	0.9	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		±5		nA	TYP
					±11	±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		±5		nA	TYP
					±11	±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		11		ns	TYP
Turn-Off Time	SGM3001	t$_{OFF}$	V$_{NO}$ or V$_{NC}$ = 3V, R$_L$ = 300Ω, C$_L$ = 35pF, Test Circuit 4		30		ns	TYP
	SGM3002				8		ns	TYP
Charge Injection		Q	C$_L$ = 1.0nF, V$_G$ = 0V, R$_G$ = 0Ω, Test Circuit 5		3		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 = 10MHz	-45		dB	TYP
				f = 1MHz	-65		dB	TYP
Channel-to-Channel Crosstalk (SGM3002 Only)		X$_{TALK}$	R$_L$ = 50Ω, C$_L$ = 5pF, Test Circuit 8	f = 10MHz	-35		dB	TYP
				f = 1MHz	-55		dB	TYP
Total Harmonic Distortion		THD	f = 20Hz to 20kHz, V$_{COM}$ = 3.5V$_{P-P}$, R$_L$ = 600Ω, C$_L$ = 50pF		0.006		%	TYP
-3dB Bandwidth		BW	R$_L$ = 50Ω, C$_L$ = 5pF, Test Circuit 9		120		MHz	TYP
Source OFF Capacitance		C$_{NC(OFF)}$, C$_{NO(OFF)}$			14		pF	TYP
Channel ON Capacitance		C$_{NC(ON)}$, C$_{NO(ON)}$, C$_{COM(ON)}$			53		pF	TYP
POWER REQUIREMENTS								
Power Supply Current		I$_+$	V$_+$ = +5.5V, V$_{IN}$ = 0V or 5V		0. 001		µA	TYP
						1	µA	MAX

ELECTRICAL CHARACTERISTICS

(V$_+$ = +3V ± 10%, GND = 0V, all specifications -40℃ to +125℃. Typical values are at T$_A$ = +25℃, unless otherwise noted.)

PARAMETER		SYMBOL	CONDITIONS		SGM3001/3002		UNITS	MIN/MAX
					+25℃	-40℃ to +125℃		
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		2.9	3	Ω	TYP
					4.4	6	Ω	MAX
On-Resistance Match Between Channels		ΔR$_{ON}$	0 ≤ V$_{NO}$ or V$_{NC}$ ≤ V$_+$, I$_{COM}$ = -10mA, Test Circuit 1		0.1		Ω	TYP
					0.8	0.9	Ω	MAX
On-Resistance Flatness		R$_{FLAT(ON)}$	0 ≤ V$_{NO}$ or V$_{NC}$ ≤ V$_+$, I$_{COM}$ = -10mA, Test Circuit 1		0.9		Ω	TYP
					1	1.2	Ω	MAX
LEAKAGE CURRENTS								
Source OFF Leakage Current		I$_{NC(OFF)}$, I$_{NO(OFF)}$	V$_{NO}$ or V$_{NC}$ = 3V/1V, V$_{COM}$ = 1V/3V, V$_+$ = +3.3V, Test Circuit 2		±7		nA	TYP
					±13	±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 3V, V$_+$ = +3.3V, Test Circuit 3		±7		nA	TYP
					±13	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$_{INL}$ 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$_{NC}$ = 2V, R$_L$ = 300Ω, C$_L$ = 35pF, Test Circuit 4		12		ns	TYP
Turn-Off Time	SGM3001	t$_{OFF}$	V$_{NO}$ or V$_{NC}$ = 2V, R$_L$ = 300Ω, C$_L$ = 35pF, Test Circuit 4		31		ns	TYP
	SGM3002				9		ns	TYP
Charge Injection		Q	C$_L$ = 1.0nF, V$_G$ = 0V, R$_G$ = 0Ω, Test Circuit 5		3		pC	TYP
Break-Before-Make Time Delay		t$_D$	V$_{NO1}$ or V$_{NC1}$ = V$_{NO2}$ or V$_{NC2}$ = 2V, R$_L$ = 300Ω, C$_L$ = 35pF, Test Circuit 6		11		ns	TYP
Off Isolation		O$_{ISO}$	R$_L$ = 50Ω, C$_L$ = 5pF, Test Circuit 7	f = 10MHz	-45		dB	TYP
				f = 1MHz	-65		dB	TYP
Channel-to-Channel Crosstalk (SGM3002 Only)		X$_{TALK}$	R$_L$ = 50Ω, C$_L$ = 5pF, Test Circuit 8	f = 10MHz	-35		dB	TYP
				f = 1MHz	-55		dB	TYP
Total Harmonic Distortion		THD	f = 20Hz to 20kHz, V$_{COM}$ = 2V$_{P-P}$, R$_L$ = 600Ω, C$_L$ = 50pF		0.005		%	TYP
-3dB Bandwidth		BW	R$_L$ = 50Ω, C$_L$ = 5pF, Test Circuit 9		120		MHz	TYP
Source OFF Capacitance		C$_{NC(OFF)}$, C$_{NO(OFF)}$			14		pF	TYP
Channel ON Capacitance		C$_{NC(ON)}$, C$_{NO(ON)}$, C$_{COM(ON)}$			53		pF	TYP
POWER REQUIREMENTS								
Power Supply Current		I$_+$	V$_+$ = +3.3V, V$_{IN}$ = 0V or 3V		0. 001		µA	TYP
						1	µA	MAX

TYPICAL PERFORMANCE CHARACTERISTICS

On Response vs. Frequency

Crosstalk vs. Frequency

Off Isolation vs. Frequency
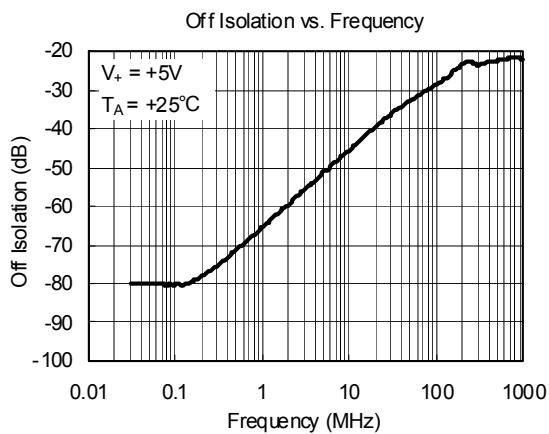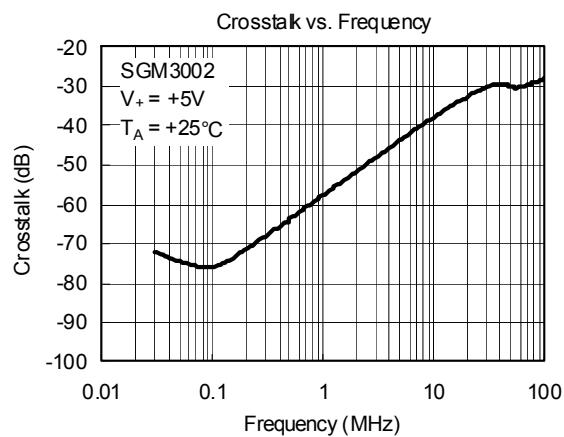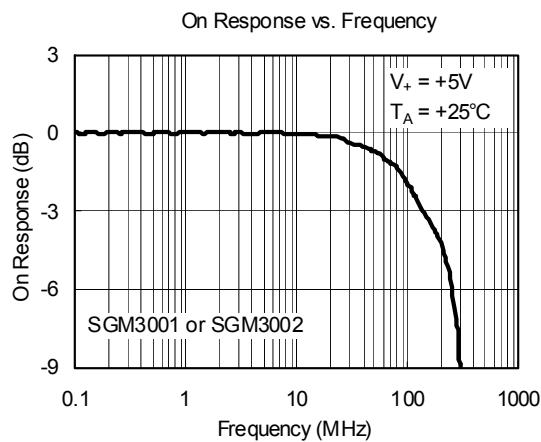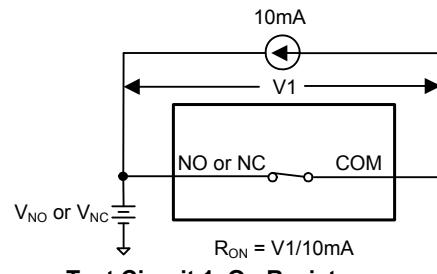
TEST CIRCUITS

Test Circuit 1. On Resistance

$R_{ON} = V1/10mA$
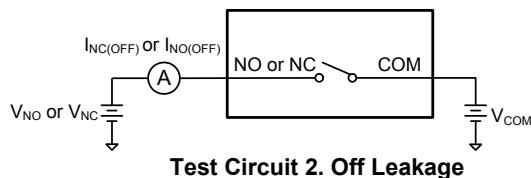
**Test Circuit 2. Off Leakage**
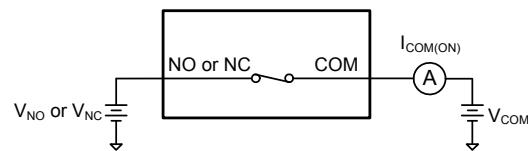
**Test Circuit 3. On Leakage**
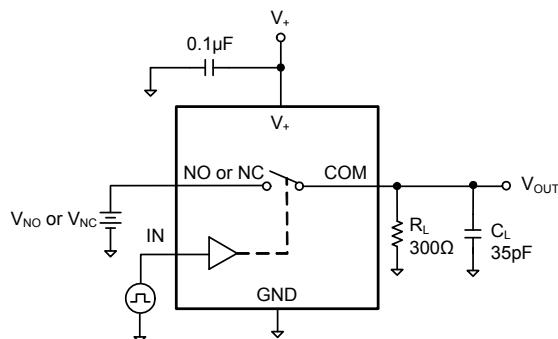

Test Circuit 4. Switching Times
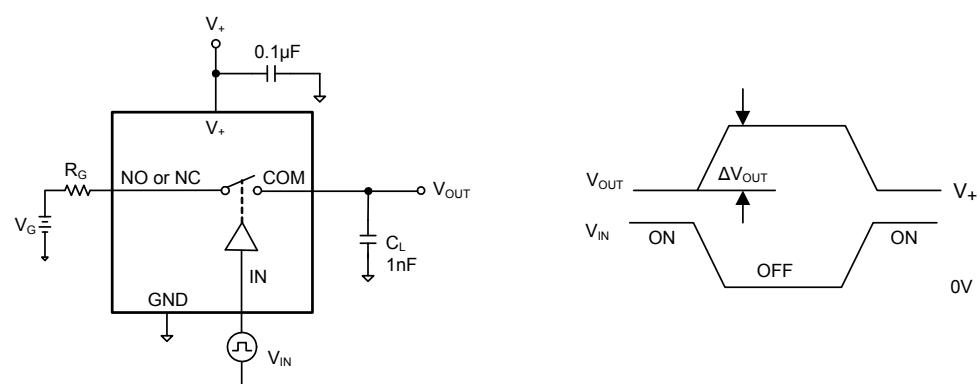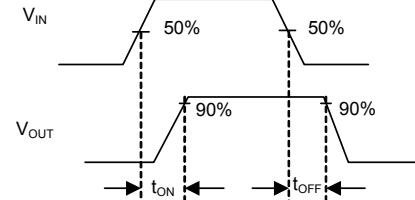
Test Circuit 5. Charge Injection

TEST CIRCUITS (Cont.)


Test Circuit 6. Break-Before-Make Time Delay, t_D

Test Circuit 7. Off Isolation
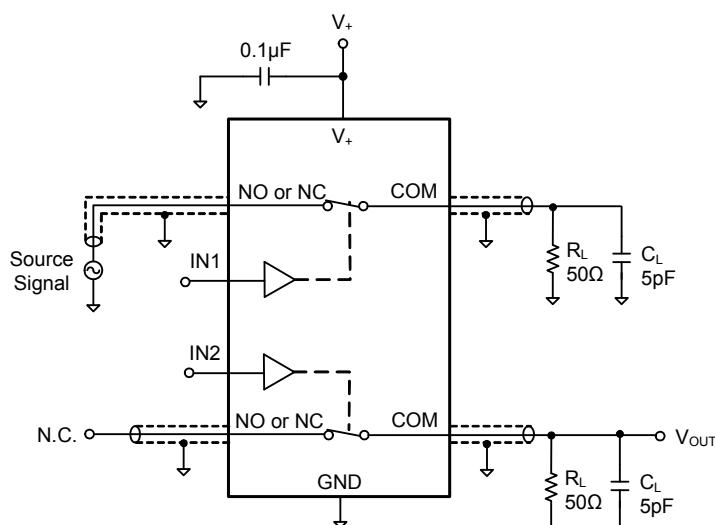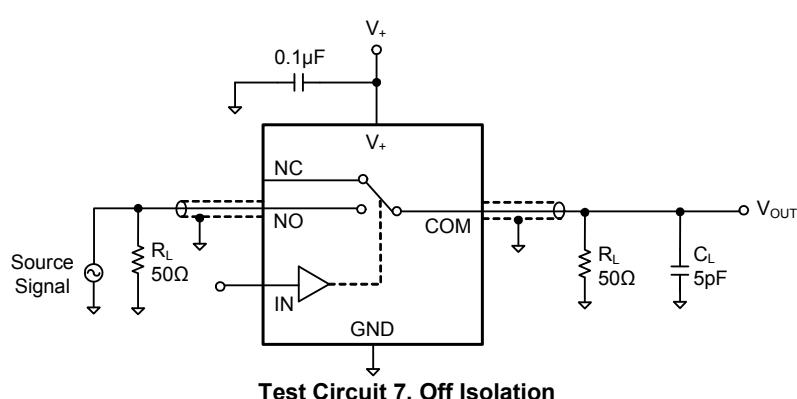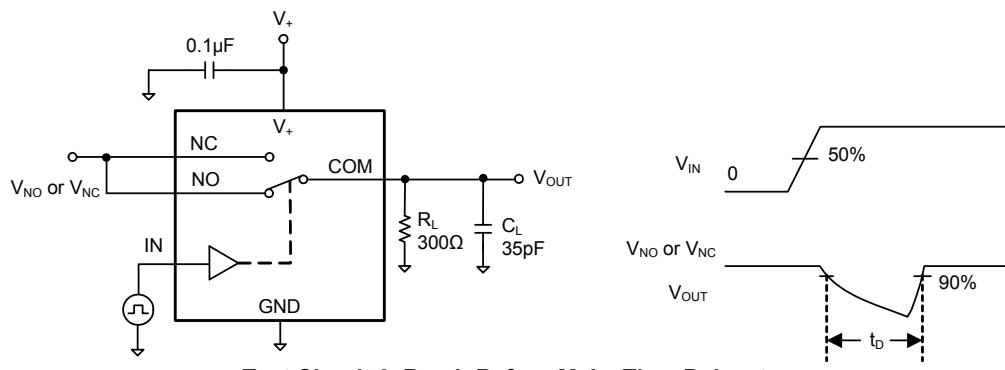
$$\text{Channel To Channel Crosstalk} = -20 \times \log \frac{V_{NO} \text{ or } V_{NC}}{V_{OUT}}$$

Test Circuit 8. Channel-to-Channel Crosstalk

TEST CIRCUITS (Cont.)
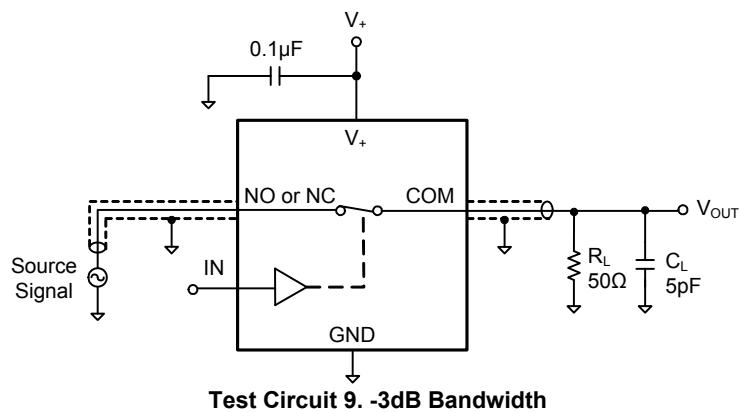
Test Circuit 9. -3dB Bandwidth

PACKAGE OUTLINE DIMENSIONS

SC70-6
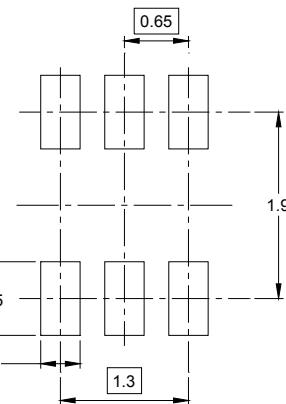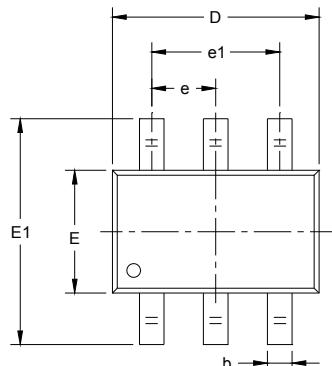
**RECOMMENDED LAND PATTERN** (Unit: mm)
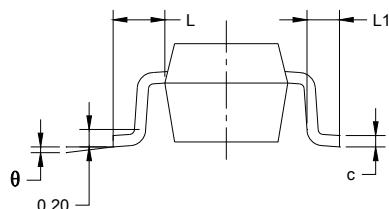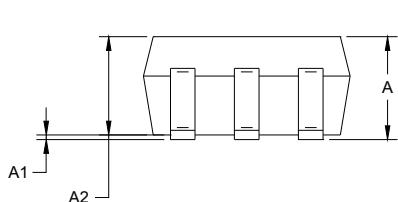
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.65 TYP		0.026 TYP	
e1	1.300 BSC		0.051 BSC	
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

PACKAGE OUTLINE DIMENSIONS

MSOP-10
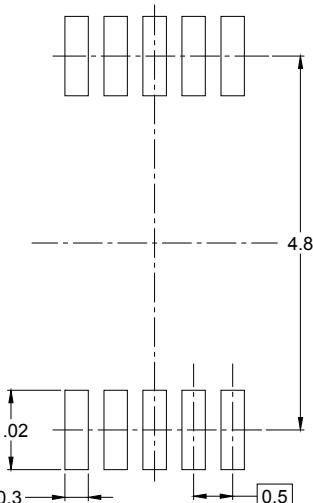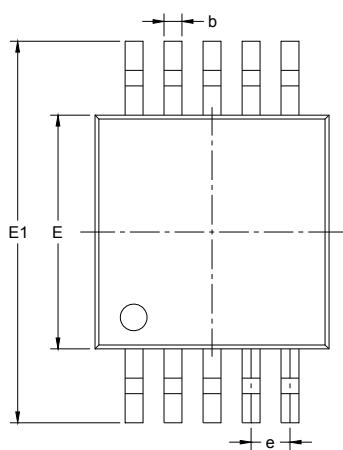
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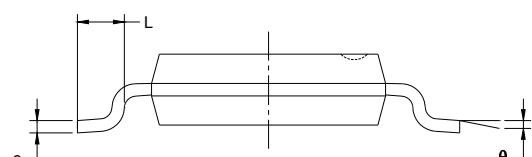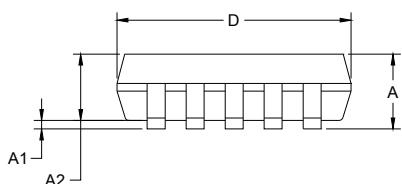
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	**MAX**	**MIN**	**MAX**
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.500 BSC		0.020 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

TAPE AND REEL INFORMATION

REEL DIMENSIONS
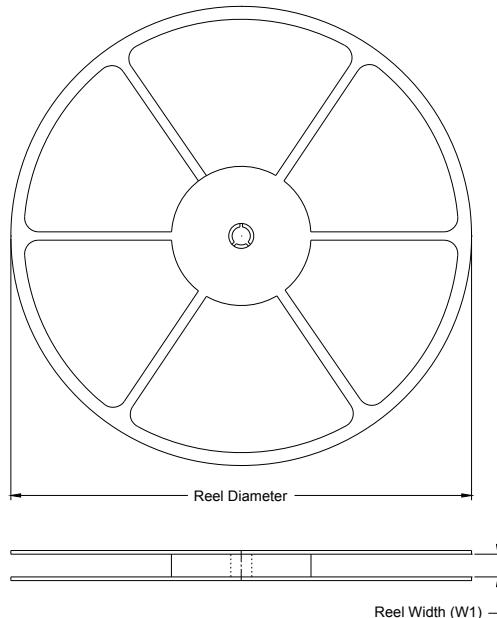
TAPE DIMENSIONS
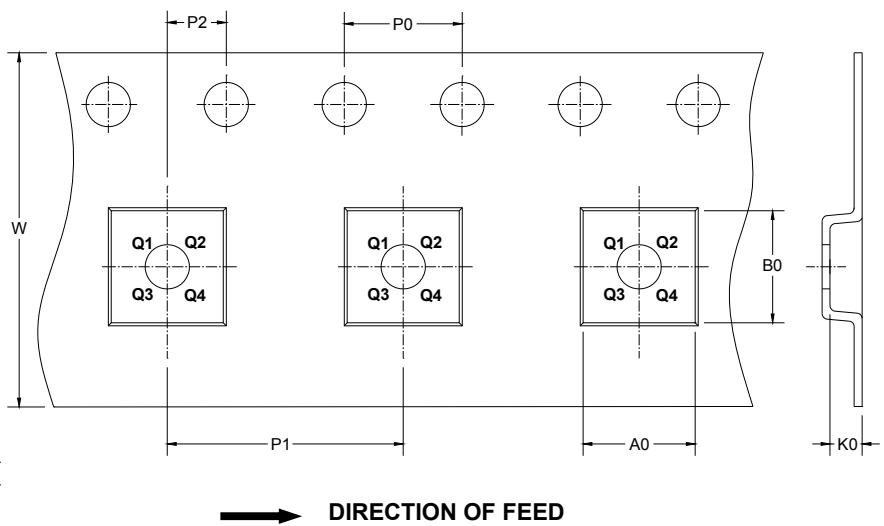
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
MSOP-10	13″	12.4	5.2	3.3	1.2	4.0	8.0	2.0	12.0	Q1
SC70-6	7″	9.5	2.4	2.5	1.2	4.0	4.0	2.0	8.0	Q3
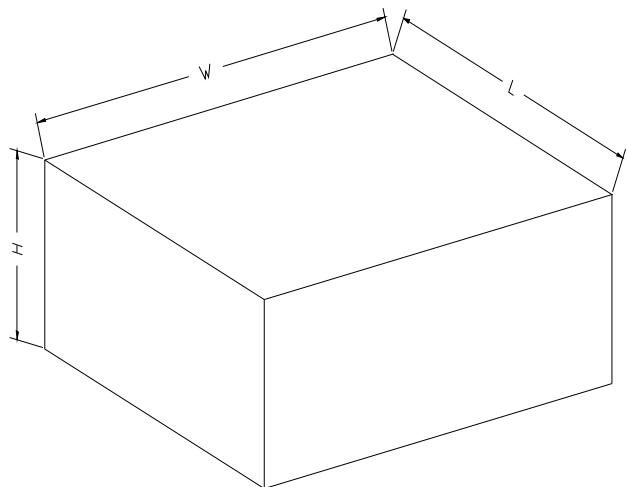
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CARTON BOX DIMENSIONS

NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7″ (Option)	368	227	224	8
7″	442	410	224	18
13″	386	280	370	5

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