



SGM3001/SGM3002

Low On-Resistance, Low Voltage, SPDT Analog Switch

GENERAL DESCRIPTION

The SGM3001 (single) and SGM3002 (dual) are bidirectional SPDT (single-pole/double-throw), TTL/CMOS compatible analog switches. They both operate from a 1.8V to 5.5V single power supply.

The SGM3001 and SGM3002 feature low on-resistance, low voltage and fast switching times. The high performances make them very suitable for multiple applications, such as portable equipment, audio and video signal routing, etc. In addition, the SGM3002 can be used as a dual 2-to-1 multiplexer because it has two normally open and two normally close switches.

The single version SGM3001 is available in a Green SC70-6 package. The dual version SGM3002 is available in a Green MSOP-10 package. They both operate over an ambient temperature range of -40°C to +125°C.

FEATURES

- **Single Supply Voltage Range:** 1.8V to 5.5V
- **-3dB Bandwidth:** 120MHz
- **Low On-Resistance:** 2.5Ω (TYP)
- **Low On-Resistance Flatness**
- **Low Crosstalk:** -35dB (TYP) at 10MHz (SGM3002)
- **Fast Switching Times:**
 - t_{ON} : 11ns
 - t_{OFF} : 30ns (SGM3001)
 - t_{OFF} : 8ns (SGM3002)
- **Off-Isolation:** -45dB at 10MHz
- **Low Power Consumption**
- **Rail-to-Rail Input and Output Operation**
- **TTL/CMOS Compatible**
- **-40°C to +125°C Operating Temperature Range**
- **SGM3001:** Available in a Green SC70-6 Package
- **SGM3002:** Available in a Green MSOP-10 Package

APPLICATIONS

Cellular Phones
Portable Equipment
Medical Equipment
Sample-and-Hold Circuits
Personal Digital Assistants
Battery-Powered Systems
Audio and Video Signal Routing

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM3001	SC70-6	-40°C to +125°C	SGM3001XC6/TR	3001	Tape and Reel, 3000
SGM3002	MSOP-10	-40°C to +125°C	SGM3002XMS/TR	SGM3002 XMS XXXXX	Tape and Reel, 3000

NOTE: XXXXX = Date Code and Vendor Code.

Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

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 ± 150 mA
 Peak Current NO, NC, or COM ± 250 mA
 Package Thermal Resistance @ $T_A = +25^\circ\text{C}$
 SC70-6, θ_{JA} 333°C/W
 MSOP-10, θ_{JA} 205°C/W
 Junction Temperature $+150^\circ\text{C}$
 Storage Temperature Range -65°C to $+150^\circ\text{C}$
 Lead Temperature (Soldering, 10s) $+260^\circ\text{C}$
 ESD Susceptibility
 HBM 2000V
 MM 400V

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range -40°C to $+125^\circ\text{C}$

NOTE:

1. Internal diodes will clamp voltages on NC, NO, or COM that exceed V_+ . Limit the current through the forward diode to the maximum ratings.

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

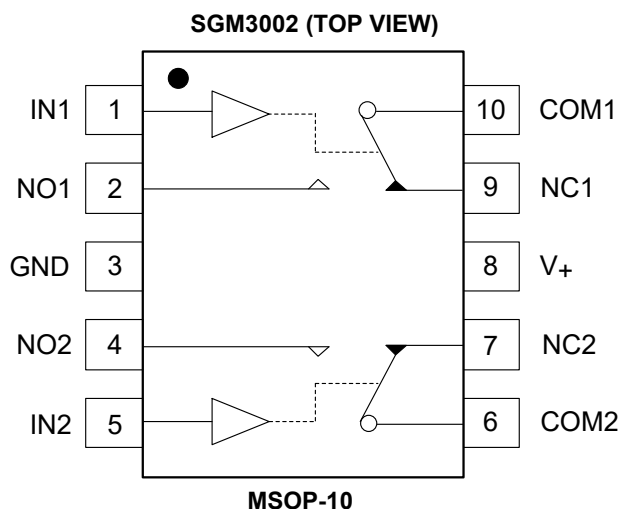
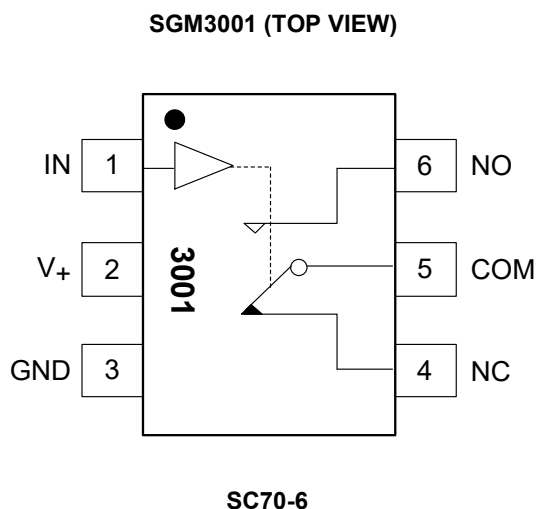
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. 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 even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATIONS



PIN DESCRIPTION

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

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

FUNCTION TABLE

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

ELECTRICAL CHARACTERISTICS

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

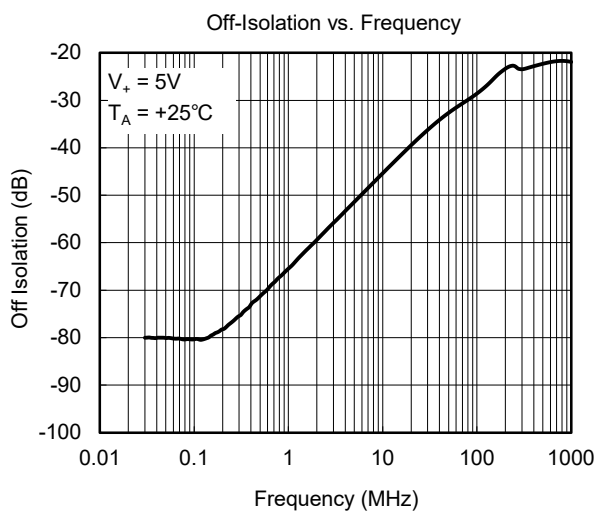
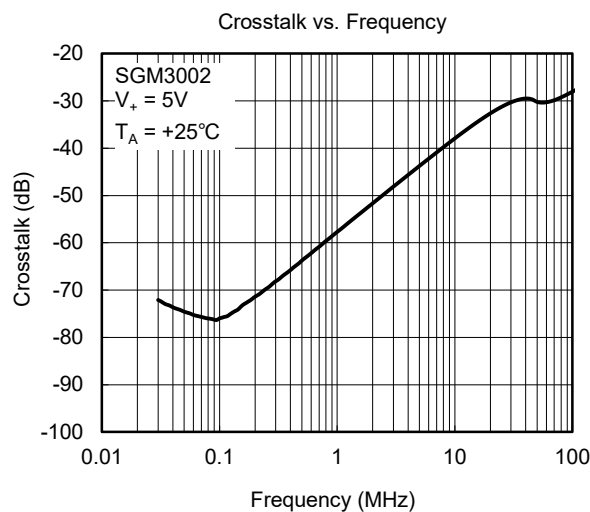
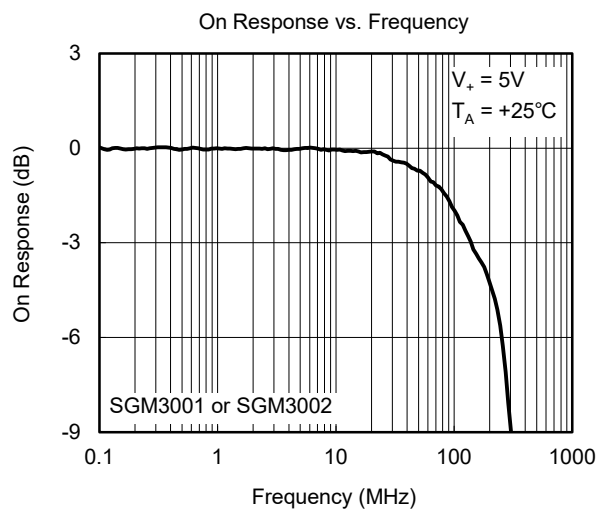
PARAMETER		SYMBOL	CONDITIONS	SGM3001/SGM3002			
				+25°C	-40°C to +125°C	UNITS	MIN/ MAX
Analog Switch							
Analog Signal Range	V _{NO} , V _{NC} , V _{COM}			0	V	MIN	
				V ₊	V	MAX	
On-Resistance	R _{ON}	0 ≤ V _{NO} or V _{NC} ≤ V ₊ , I _{COM} = -10mA, Test Circuit 1	2.5		Ω	TYP	
			3.7	4.5	Ω	MAX	
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	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 _S = 0V, R _S = 0Ω, Test Circuit 5	3		pC	TYP	
Break-Before-Make Delay Time	t _D	V _{NO1} = V _{NC1} or V _{NO2} = V _{NC2} = 3V, R _L = 300Ω, C _L = 35pF, Test Circuit 6	10		ns	TYP	
Off-Isolation	O _{ISO}	R _L = 50Ω, Test Circuit 7	f = 10MHz	-45	dB	TYP	
			f = 1MHz	-65	dB	TYP	
Channel-to-Channel Crosstalk (SGM3002 Only)	X _{TALK}	R _L = 50Ω, 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, 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 (continued)

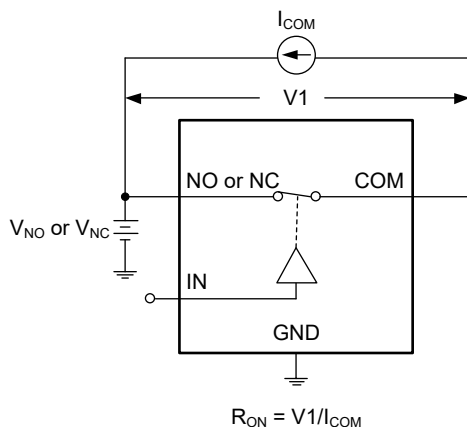
(V₊ = 3V ± 10%, GND = 0V, Full = -40°C to +125°C. Typical values are at T_A = +25°C, unless otherwise noted.)

PARAMETER		SYMBOL	CONDITIONS	SGM3001/SGM3002			
				+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}	$0 \leq V_{NO}$ or $V_{NC} \leq V_+, I_{COM} = -10mA$, Test Circuit 1	2.9	3	Ω	TYP
				4.4	6	Ω	MAX
On-Resistance Match between Channels		ΔR_{ON}	$0 \leq V_{NO}$ or $V_{NC} \leq V_+, I_{COM} = -10mA$, Test Circuit 1	0.1		Ω	TYP
				0.8	0.9	Ω	MAX
On-Resistance Flatness		$R_{FLAT(ON)}$	$0 \leq V_{NO}$ or $V_{NC} \leq V_+, I_{COM} = -10mA$, 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 $V_{NC} = 2V, R_L = 300\Omega$, $C_L = 35pF$, Test Circuit 4	12		ns	TYP
Turn-Off Time	SGM3001	t_{OFF}	V_{NO} or $V_{NC} = 2V, R_L = 300\Omega$, $C_L = 35pF$, Test Circuit 4	31		ns	TYP
	SGM3002			9		ns	TYP
Charge Injection		Q	$C_L = 1.0nF, V_S = 0V, R_S = 0\Omega$, Test Circuit 5	3		pC	TYP
Break-Before-Make Delay Time		t_D	$V_{NO1} = V_{NC1}$ or $V_{NO2} = V_{NC2} = 2V$, $R_L = 300\Omega, C_L = 35pF$, Test Circuit 6	11		ns	TYP
Off-Isolation		O_{ISO}	$R_L = 50\Omega$, Test Circuit 7	f = 10MHz	-45	dB	TYP
				f = 1MHz	-65	dB	TYP
Channel-to-Channel Crosstalk (SGM3002 Only)		X_{TALK}	$R_L = 50\Omega$, Test Circuit 8	f = 10MHz	-35	dB	TYP
				f = 1MHz	-55	dB	TYP
Total Harmonic Distortion		THD	f = 20Hz to 20kHz, $V_{COM} = 2V_{P-P}$, $R_L = 600\Omega, C_L = 50pF$	0.005		%	TYP
-3dB Bandwidth		BW	$R_L = 50\Omega$, 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

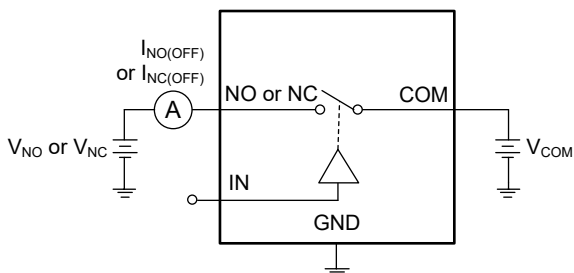
TYPICAL PERFORMANCE CHARACTERISTICS



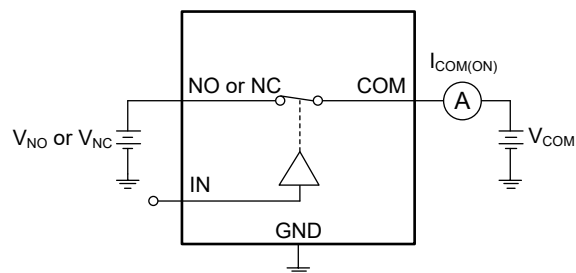
TEST CIRCUITS



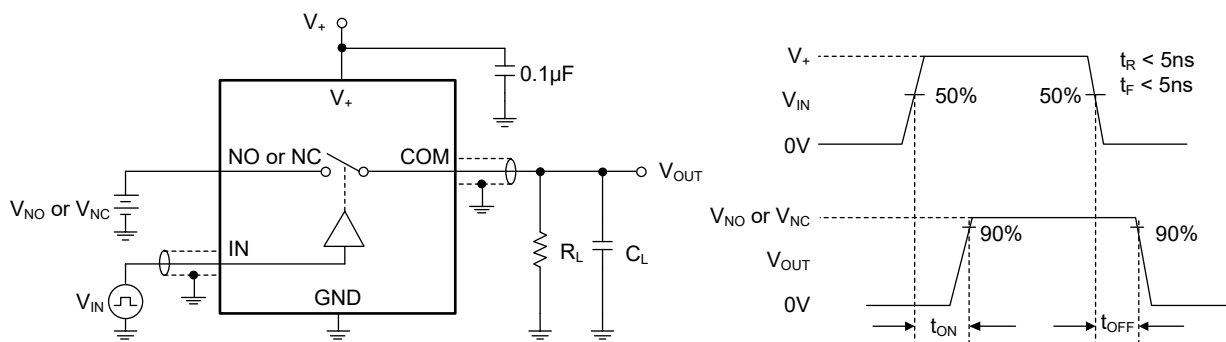
Test Circuit 1. On-Resistance



Test Circuit 2. Off Leakage

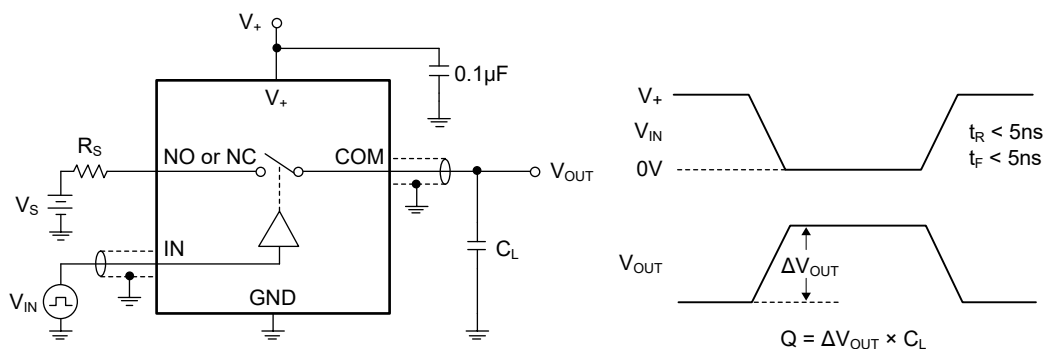


Test Circuit 3. On Leakage

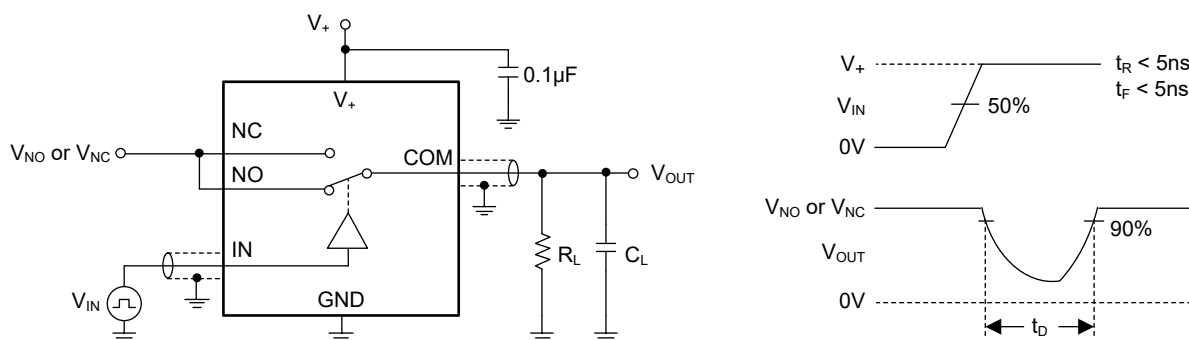
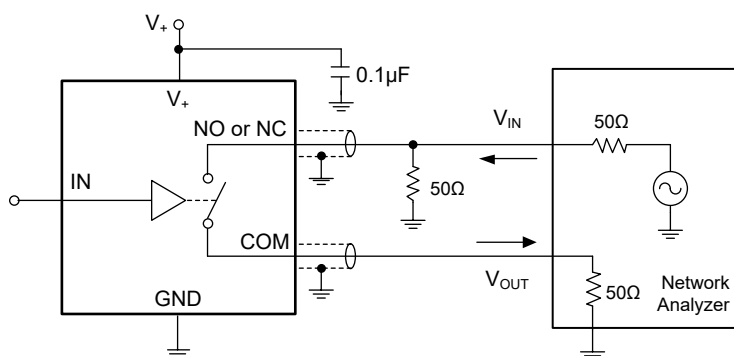


Test Circuit 4. Switching Times

TEST CIRCUITS (continued)

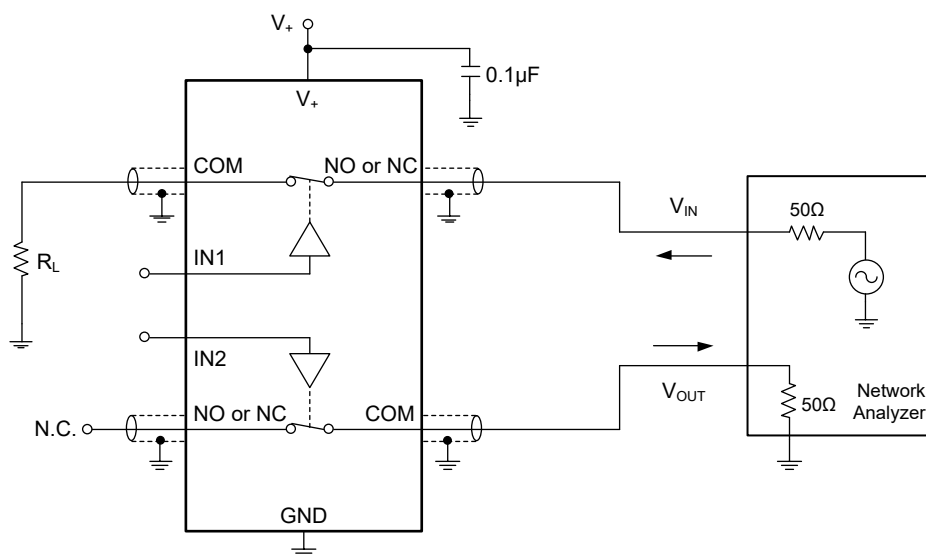


Test Circuit 5. Charge Injection

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

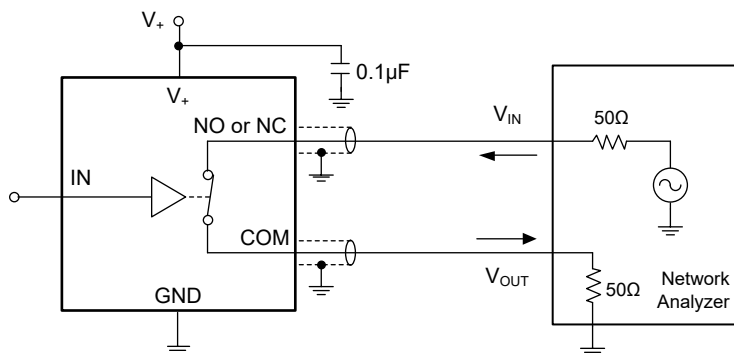
Test Circuit 7. Off-Isolation

TEST CIRCUITS (continued)



$$\text{Channel-to-Channel Crosstalk} = -20\log(V_{IN}/V_{OUT})$$

Test Circuit 8. Channel-to-Channel Crosstalk



Test Circuit 9. -3dB Bandwidth

REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

MAY 2023 – REV.C.4 to REV.D

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Updated Package Outline Dimensions..... 10

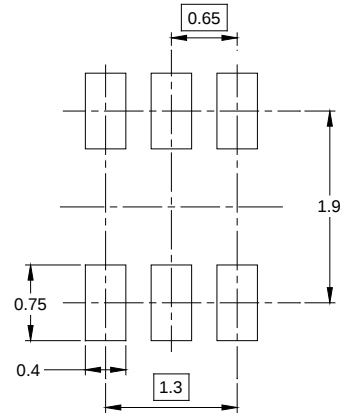
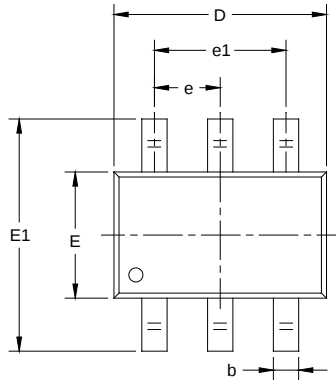
JANUARY 2013 – REV.C.4

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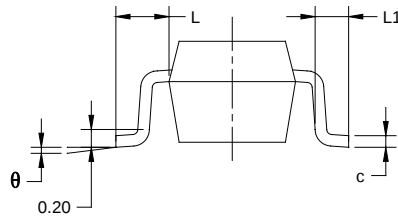
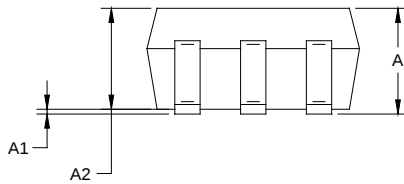
Added the Recommended Land Pattern and Tape and Reel Information section 9-12

PACKAGE OUTLINE DIMENSIONS

SC70-6



RECOMMENDED LAND PATTERN (Unit: mm)



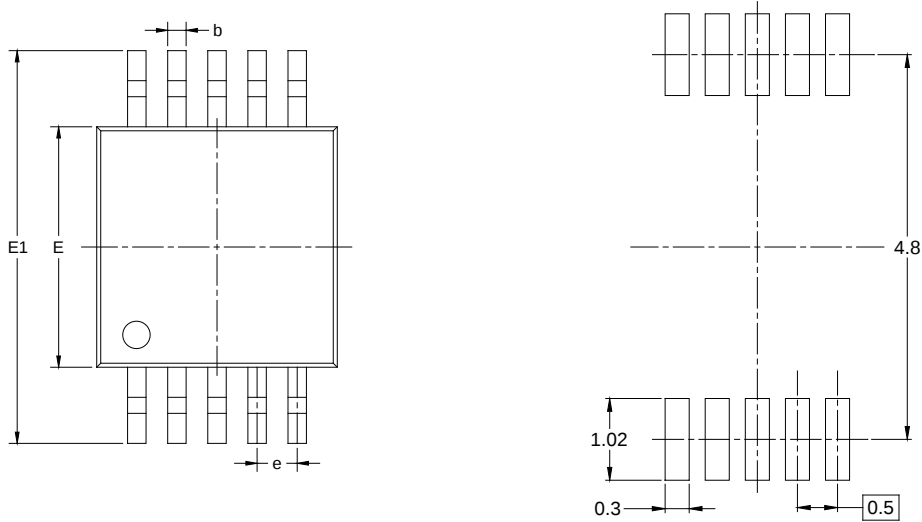
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.800	1.100	0.031	0.043
A1	0.000	0.100	0.000	0.004
A2	0.800	1.000	0.031	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.220	0.003	0.009
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.65 TYP		0.026 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°

NOTES:

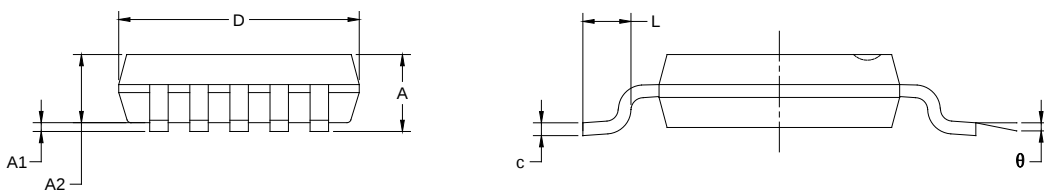
1. Body dimensions do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

MSOP-10



RECOMMENDED LAND PATTERN (Unit: mm)



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°

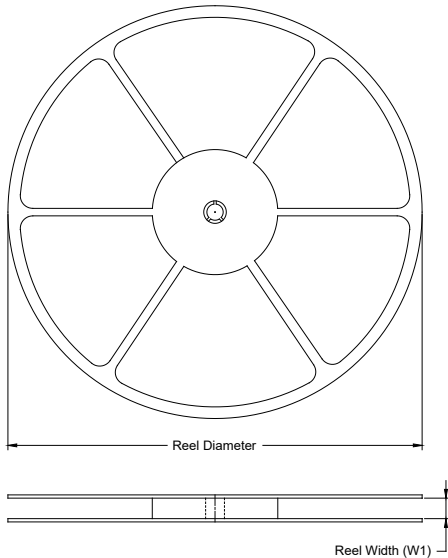
NOTES:

1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

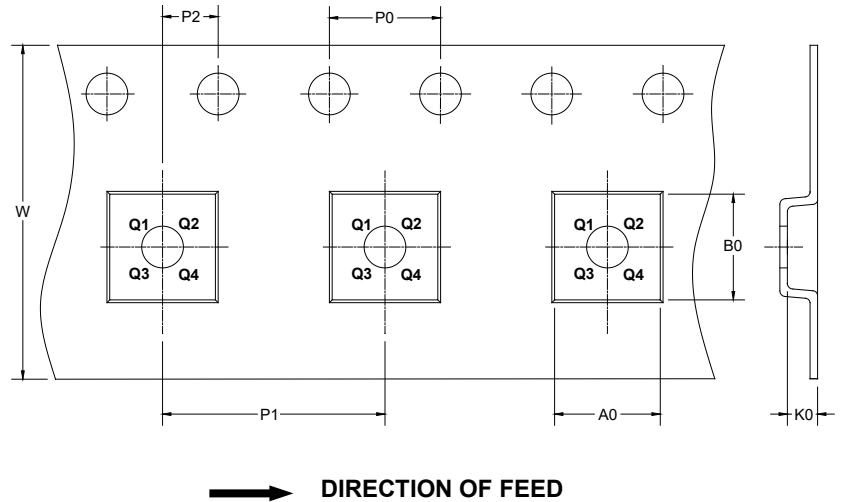
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

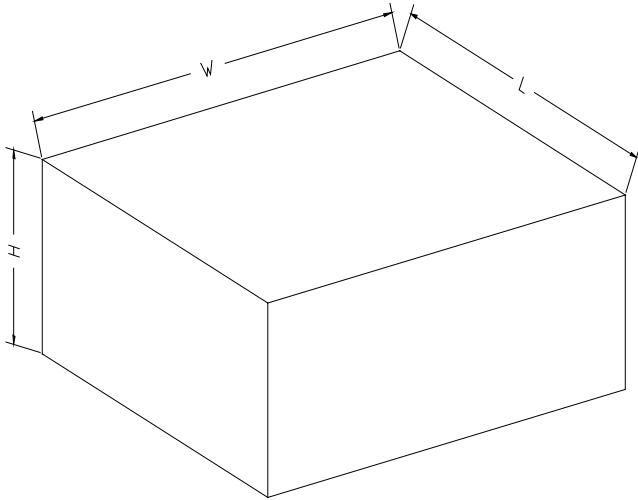
KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SC70-6	7"	9.5	2.40	2.50	1.20	4.0	4.0	2.0	8.0	Q3
MSOP-10	13"	12.4	5.20	3.30	1.20	4.0	8.0	2.0	12.0	Q1

DD0001

PACKAGE INFORMATION

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

DD0002