SGM3005
Ultra Low On-Resistance,
Low Voltage, Dual, SPDT Analog Switch

GENERAL DESCRIPTION

The SGM3005 is a dual bidirectional SPDT (single-pole/double-throw), TTL/CMOS compatible analog switch. It operates from a 1.8V to 5.5V single power supply.

The SGM3005 features low on-resistance, low voltage and fast switching times. The high performances make it very suitable for multiple applications, such as portable equipment, audio and video signal routing, etc. In addition, the SGM3005 can be used as a dual 2-to-1 multiplexer because it has two normally open and two normally close switches. Low power consumption is also one of the important reasons that make it a good choice.

The SGM3005 is available in Green TDFN-3×3-10L and MSOP-10 packages. It operates over an ambient temperature range of -40℃ to +125℃.

FEATURES

- **Single Supply Voltage Range: 1.8V to 5.5V**
- **-3dB Bandwidth: 15MHz**
- **Ultra Low On-Resistance: 0.5Ω (TYP)**
- **Low On-Resistance Flatness**
- **Low Crosstalk: -90dB (TYP) at 100kHz**
- **Fast Switching Times (V$_+$ = 5V):**
    t_{ON}: 50ns
    t_{OFF}: 15ns
- **Off-Isolation: -69dB at 100kHz**
- **Low Power Consumption**
- **Rail-to-Rail Input and Output Operation**
- **TTL/CMOS Compatible**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green TDFN-3×3-10L and MSOP-10 Packages**

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
SGM3005	MSOP-10	-40℃ to +125℃	SGM3005XMS/TR	SGM3005 XMS XXXXX	Tape and Reel, 4000
	TDFN-3×3-10L	-40℃ to +125℃	SGM3005XD/TR	SGM 3005D 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.......................±300mA
Peak Current NO, NC, or COM................................±500mA
Package Thermal Resistance @ T_A = +25℃
TDFN-3×3-10L, θ_{JA} .... 33℃/W
MSOP-10, θ_{JA} .... 205℃/W
Junction Temperature..+150℃
Storage Temperature Range ....-65℃ to +150℃
Lead Temperature (Soldering, 10s)...........................+260℃
ESD Susceptibility
HBM..2000V
MM...400V

NOTE:
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.

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range ....-40℃ to +125℃

OVERSTRESS CAUTION

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

ESD SENSITIVITY 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.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time.

PIN CONFIGURATIONS

(TOP VIEW)

MSOP-10

(TOP VIEW)

TDFN-3×3-10L
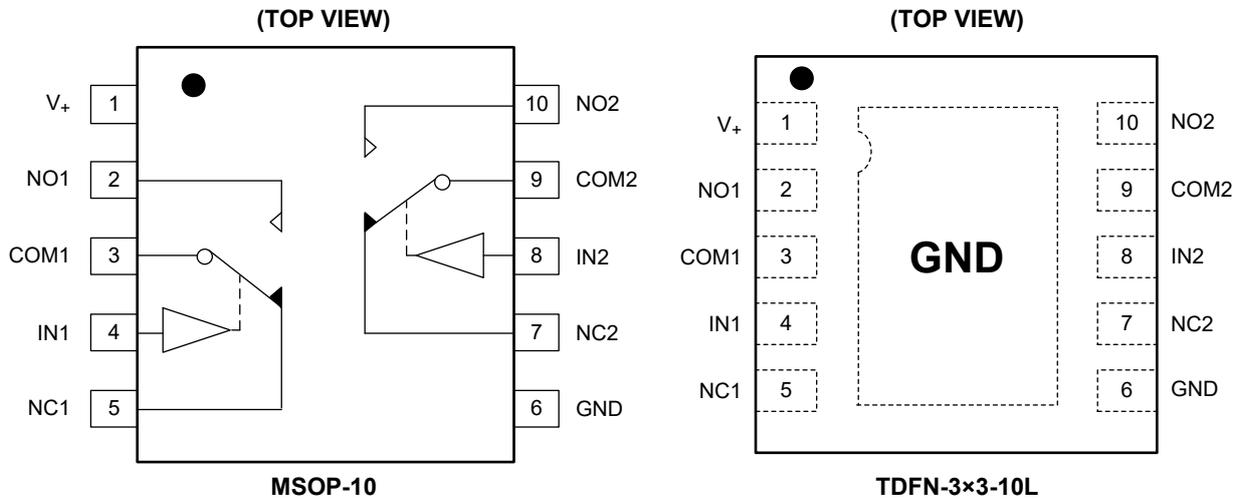
PIN DESCRIPTION

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

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

FUNCTION TABLE

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

ELECTRICAL CHARACTERISTICS

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

| PARAMETER	SYMBOL	CONDITIONS		SGM3005		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		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$_S$ = 0V, R$_S$ = 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

ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER	SYMBOL	CONDITIONS		SGM3005		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		0.6		Ω	TYP
				1.0	1.3	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
				0.1	0.13	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$_{NC}$ = 3V/1V, V$_{COM}$ = 1V/3V, V$_+$ = 3.3V, 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 3V, V$_+$ = 3.3V, 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$_{INL}$ 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		50		ns	TYP
Turn-Off Time	t$_{OFF}$	V$_{NO}$ or V$_{NC}$ = 2V, R$_L$ = 300Ω, C$_L$ = 35pF, Test Circuit 4		17		ns	TYP
Charge Injection	Q	C$_L$ = 1.0nF, V$_S$ = 0V, R$_S$ = 0Ω, Test Circuit 5		25		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 = 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$_{COM}$ = 2V$_{P-P}$, R$_L$ = 600Ω, C$_L$ = 50pF		0.06		%	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$_+$ = 3.3V, V$_{IN}$ = 0V or 3V		0.001		µA	TYP
					1	µA	MAX

TYPICAL PERFORMANCE CHARACTERISTICS

On Response vs. Frequency

$V_+ = +5V$
$T_A = +25°C$

Crosstalk vs. Frequency

$V_+ = +5V$
$T_A = +25°C$

Off Isolation vs. Frequency

$V_+ = +5V$
$T_A = +25°C$

TEST CIRCUITS

$$R_{ON} = V1/I_{COM}$$
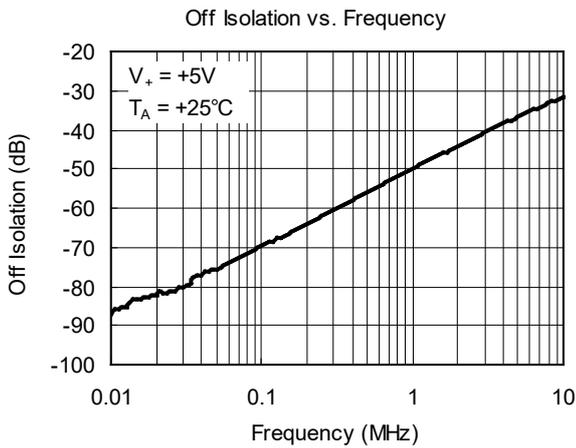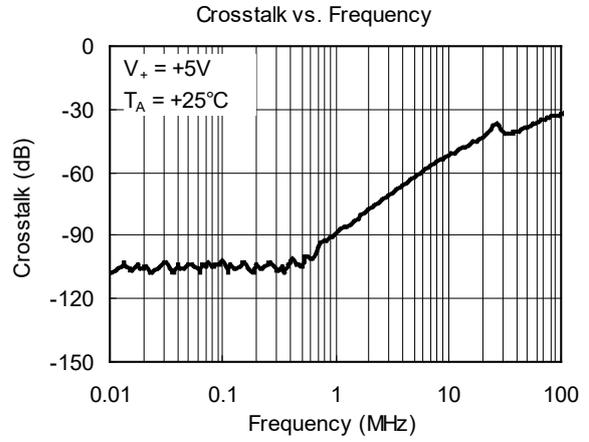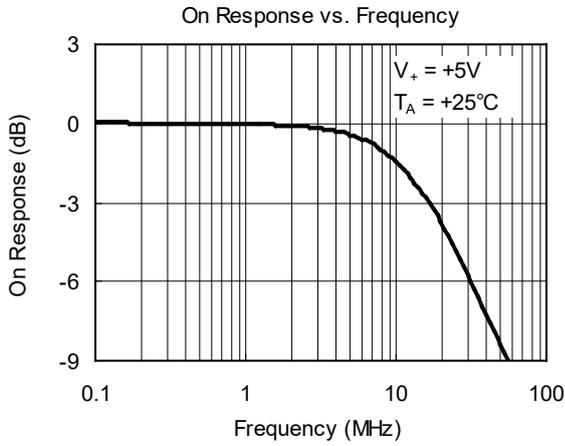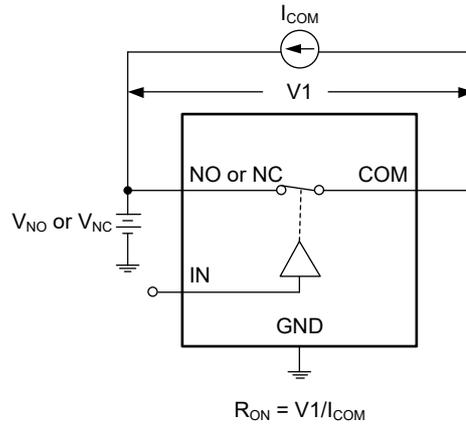
Test Circuit 1. On-Resistance
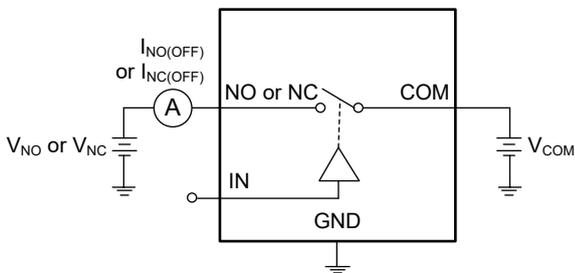
Test Circuit 2. Off Leakage
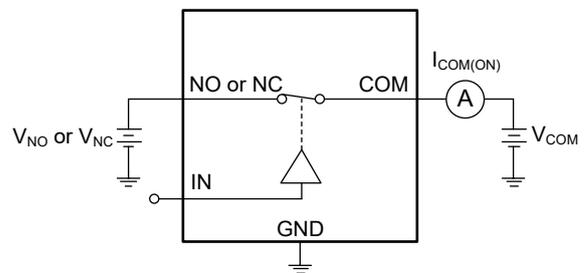
Test Circuit 3. On Leakage
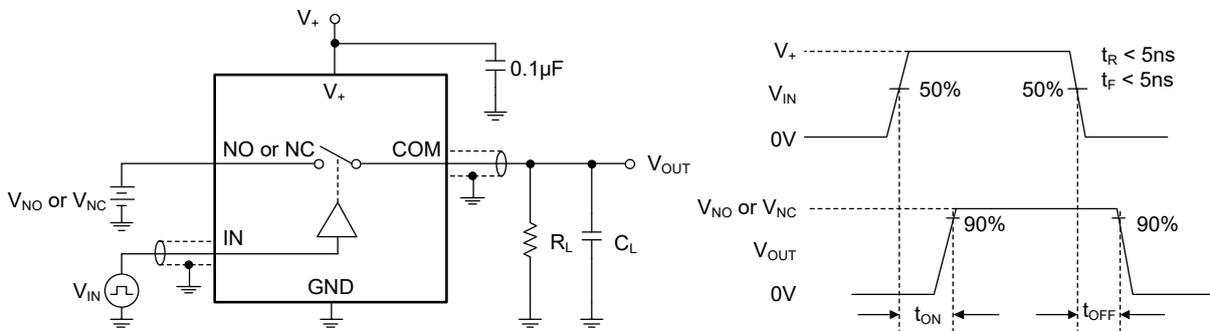
Test Circuit 4. Switching Times

$$Q = \Delta V_{OUT} \times C_L$$
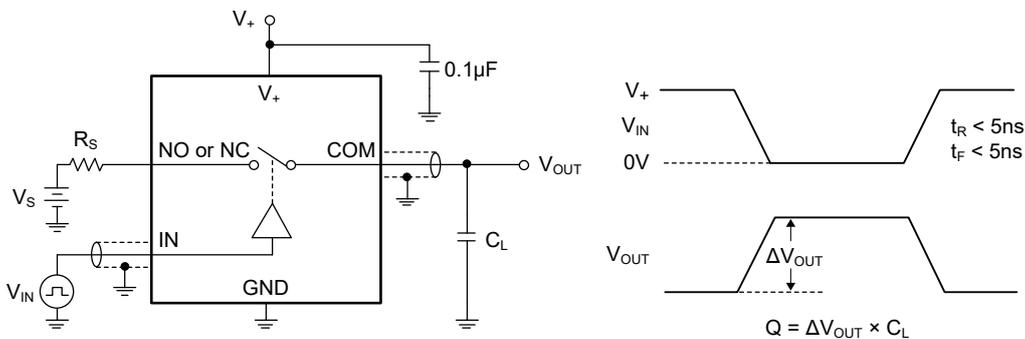
Test Circuit 5. Charge Injection

TEST CIRCUITS (continued)
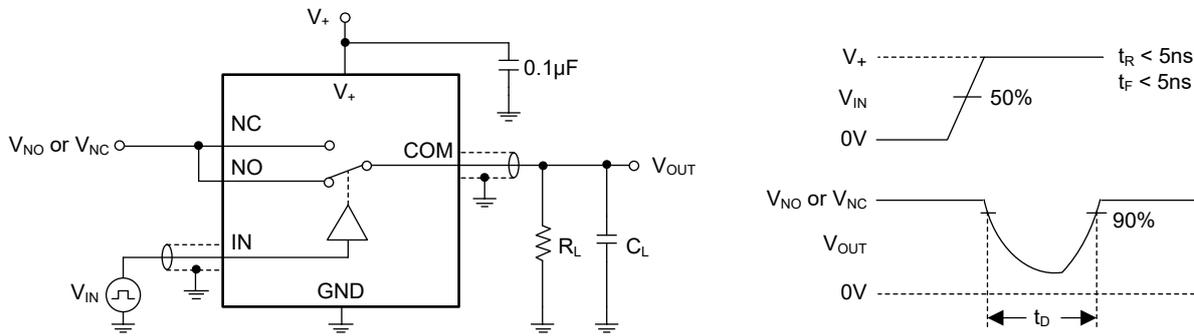
Test Circuit 6. Break-Before-Make Time Delay, t_D
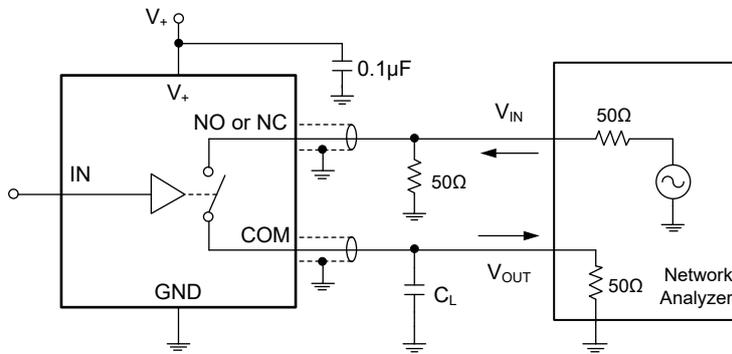
Test Circuit 7. Off Isolation
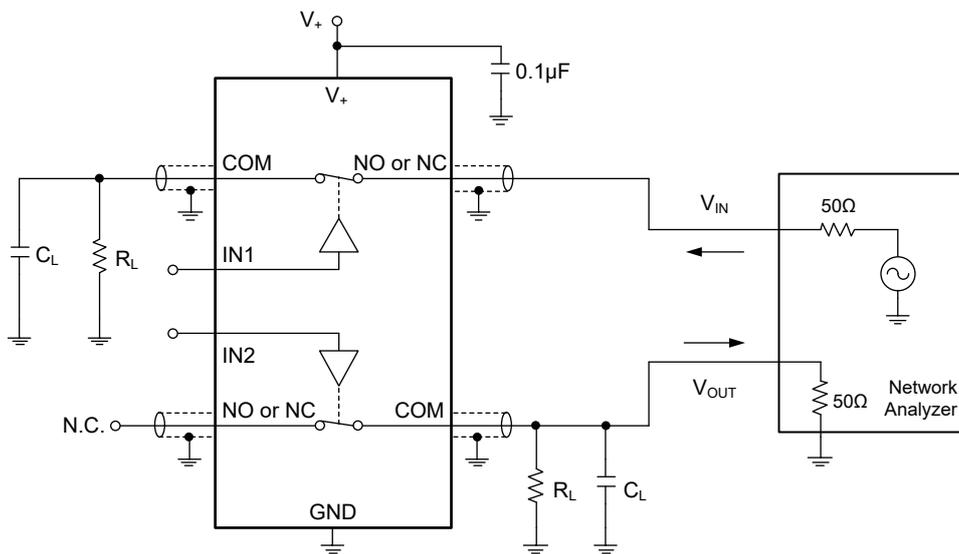
Channel-to-Channel Crosstalk = -20 log (V_{NO} or V_{NC}/V_{OUT})

**Test Circuit 8. Channel-to-Channel Crosstalk**

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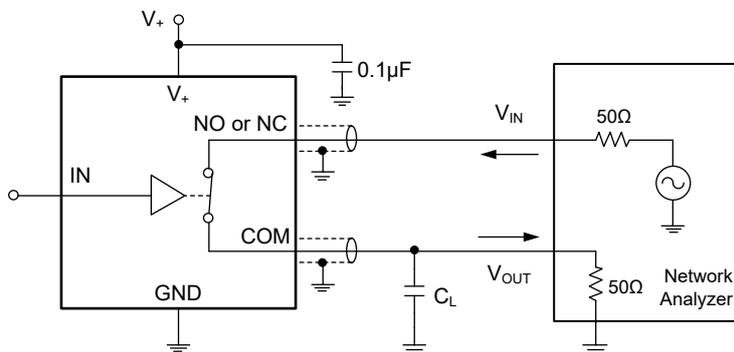
Test Circuit 9. -3dB Bandwidth

PACKAGE OUTLINE DIMENSIONS

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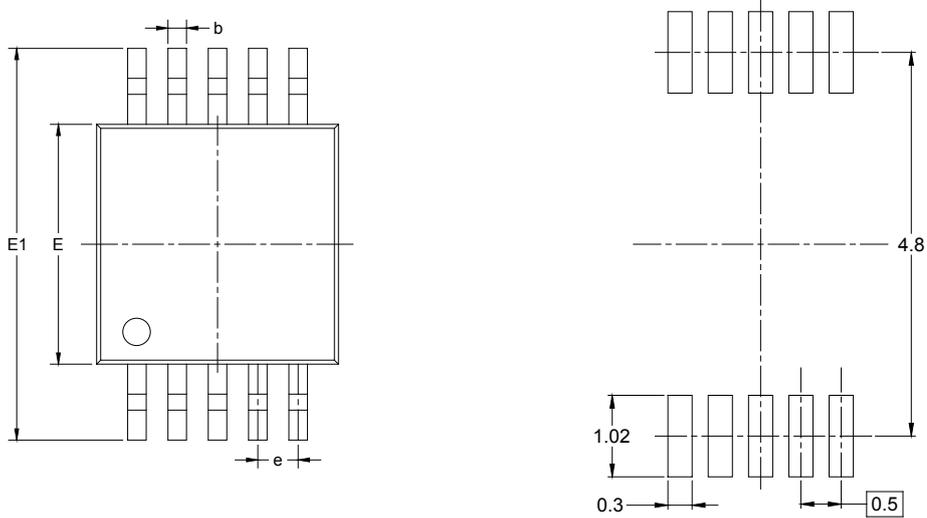
RECOMMENDED LAND PATTERN (Unit: mm)
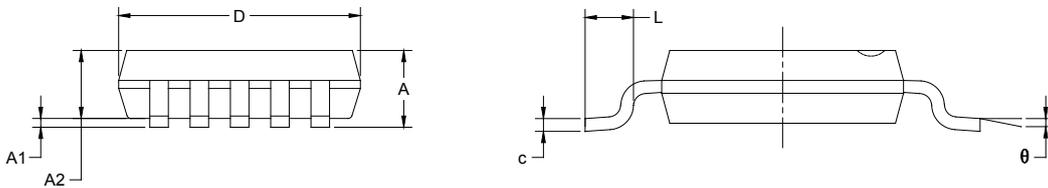
| Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.500 BSC		0.020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

PACKAGE OUTLINE DIMENSIONS

TDFN-3×3-10L
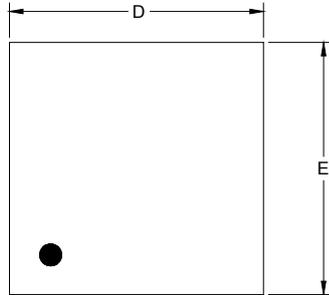
TOP VIEW
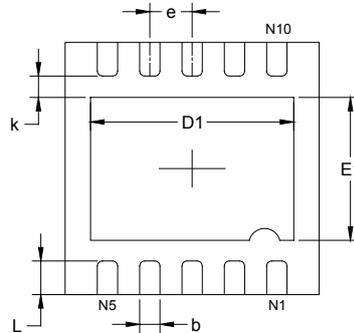
BOTTOM VIEW
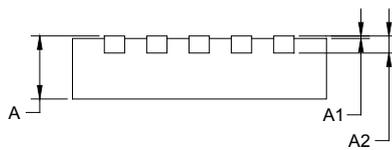
SIDE VIEW
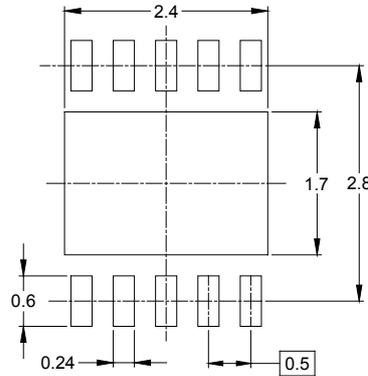
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	2.900	3.100	0.114	0.122
D1	2.300	2.600	0.091	0.103
E	2.900	3.100	0.114	0.122
E1	1.500	1.800	0.059	0.071
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.500 TYP		0.020 TYP	
L	0.300	0.500	0.012	0.020

TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSIONS
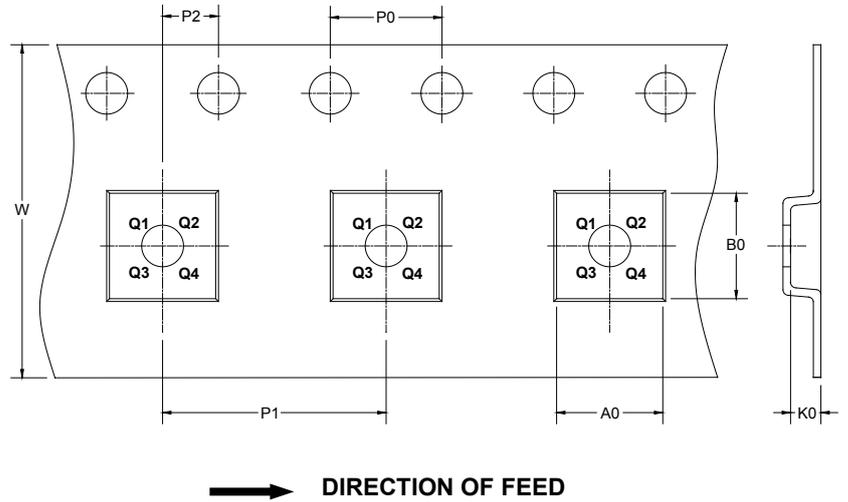
DIRECTION OF FEED

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	5.20	3.30	1.20	4.0	8.0	2.0	12.0	Q1
TDFN-3×3-10L	13″	12.4	3.35	3.35	1.13	4.0	8.0	2.0	12.0	Q1

DD0001

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
13″	386	280	370	5

DD0002