SGM3700

4Ω, High Speed, Low Voltage, Dual, DPDT Negative Signal Handling Analog Switch

GENERAL DESCRIPTION

The SGM3700 is a high speed, low voltage, advanced dual independent double-pole/double-throw (DPDT) CMOS analog switch that is designed to operate from a single +2.5V to +5.5V power supply. It features high bandwidth (380MHz) and low on-resistance (4Ω TYP), and the switches can handle negative signal down to -2.5V.

The SGM3700 is configured as a dual double-pole/ double-throw (DPDT) device with two logic control inputs, each controlling two multiplexers/demultiplexers. The configuration can also be used as a dual differential 2-to-1 multiplexer/demultiplexer.

SGM3700 is available in Green TQFN-3×3-16L package.

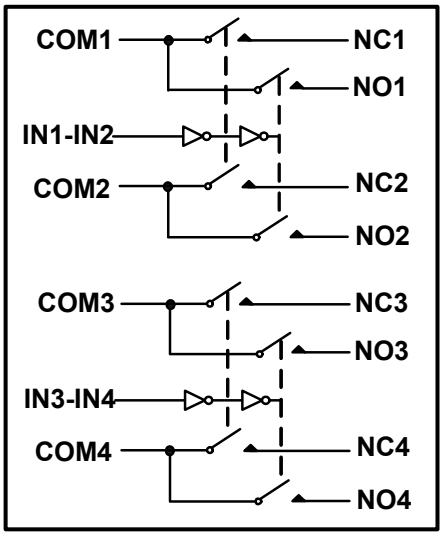
APPLICATIONS

Communication Systems
Cell Phones
Portable Instrumentation
Audio Signal Routing
Audio and Video Switching
PCMCIA Cards
Computer Peripherals
Modems
PDAs

FEATURES

- **Supply Range: +2.5V to +5.5V**
- **Negative Signal Swing Capability: -2.5V to V_+**
- **On-Resistance: 4Ω (TYP) at +5.0V**
- **Low On-Resistance Flatness**
- **-3dB Bandwidth: 380MHz**
- **High Off-Isolation: -67dB at 1MHz**
- **Low Crosstalk: -77dB at 1MHz**
- **Typical Power Supply Current: 0.5μA**
- **1.8V Logic Control**
- **Available in Green TQFN-3×3-16L Package**
- **Extended Industrial Temperature Range: -40℃ to +85℃**

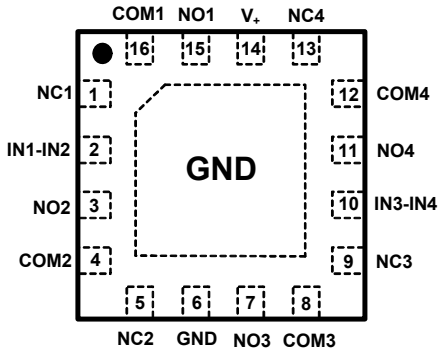
BLOCK DIAGRAM



PACKAGE/ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM3700	TQFN-3×3-16L	-40℃ to +85℃	SGM3700YTQ16G/TR	3700TQ	Tape and Reel, 3000

PIN CONFIGURATION (TOP VIEW)



TQFN-3×3-16L

FUNCTION TABLE

IN1-IN2	FUNCTION	
	NC1 and NC2	NO1 and NO2
0	ON	OFF
1	OFF	ON

IN3-IN4	FUNCTION	
	NC3 and NC4	NO3 and NO4
0	ON	OFF
1	OFF	ON

PIN DESCRIPTION

NAME	PIN	FUNCTION
V_+	14	Power Supply.
GND	6	Ground.
IN_X	2, 10	Digital Control Pin to Connect the COM Terminal to the NO or NC Terminals.
COM_X	16, 4, 8, 12	Common Terminal.
NO_X	15, 3, 7, 11	Normally-Open Terminal.
NC_X	1, 5, 9, 13	Normally-Closed Terminal.

NOTE: NO_X, NC_X and COM_X terminals may be an input or output.

ABSOLUTE MAXIMUM RATINGS

V_+, IN to GND..... -0.3V to +6V
Analog, Digital Voltage Range…..... (V_+) - 6.0V to (V_+) + 0.3V
Continuous Current NO, NC, or COM .....±100mA
Operating Temperature Range.....-40℃ to +85℃
Junction Temperature.....150℃
Storage Temperature Range..... -65℃ to +150℃
Lead Temperature (soldering, 10s).....260℃
ESD Susceptibility
HBM 8000V
MM 400V

NOTE:
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.

ELECTRICAL CHARACTERISTICS

(V_+ = +4.5V to +5.5V, Full = -40°C to +85°C, typical values are at V_+ = +5.0V, T_A = +25℃, unless otherwise noted.)

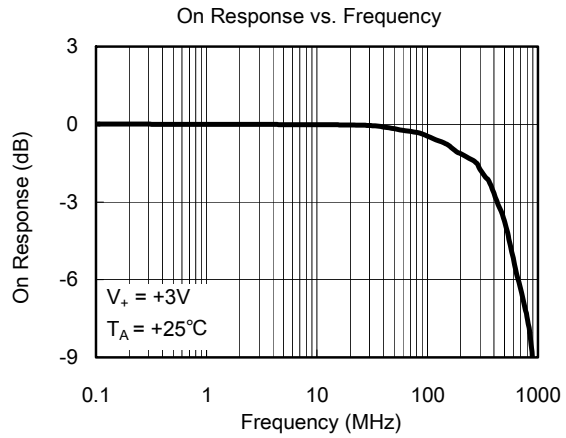
PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}			Full	(V_+) - 5.0		V_+	V
On-Resistance	R_{ON}	V_+ = 4.5V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -10mA, Test Circuit 1		+25℃		4	5.7	Ω
				Full			6.7	
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 4.5V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -10mA, Test Circuit 1		+25℃		0.15	0.6	Ω
				Full			0.8	
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 4.5V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -10mA, Test Circuit 1		+25℃		1.5	2	Ω
				Full			2.2	
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		Full			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		Full			1	μA
Power Off Leakage Current	$I_{Power\ Off}$	V_+ = 0V, V_{NO} or V_{NC} = 0V, V_{COM} = 5.0V		Full			10	μA
DIGITAL INPUTS								
Input High Voltage	V_{INH}			Full	1.5			V
Input Low Voltage	V_{INL}			Full			0.5	V
Input Leakage Current	I_{IN}	V_+ = 5.5V, V_{IN} = 0V or 5.5V		Full			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 3.0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2		+25℃		15		ns
Turn-Off Time	t_{OFF}	V_{NO} or V_{NC} = 3.0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2		+25℃		9		ns
Break-Before-Make Time Delay	t_D	V_{NO} or V_{NC} = 3.0V, R_L = 300Ω, C_L = 35pF, Test Circuit 3		+25℃		7		ns
Off Isolation	O_{ISO}	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 4	f = 1MHz	+25℃		-67		dB
			f = 10MHz	+25℃		-47		dB
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 5	f = 1MHz	+25℃		-77		dB
			f = 10MHz	+25℃		-57		dB
-3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 6		+25℃		380		MHz
Charge Injection	Q	V_G = GND, R_G = 0Ω, C_L = 1.0nF, Test Circuit 7		+25℃		21		pC
Switch ON Capacitance	C_{ON}			+25℃		21		pF
Switch OFF Capacitance	C_{OFF}			+25℃		8		pF
POWER REQUIREMENTS								
Power Supply Current	I_+	V_+ = 5.5V, V_{IN} = 0V or V_+		Full		0.5	15	μA

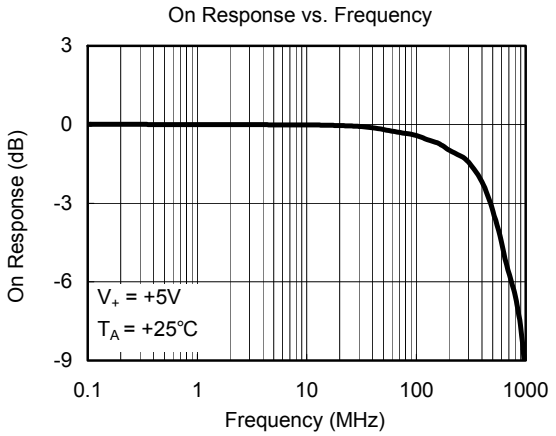
ELECTRICAL CHARACTERISTICS

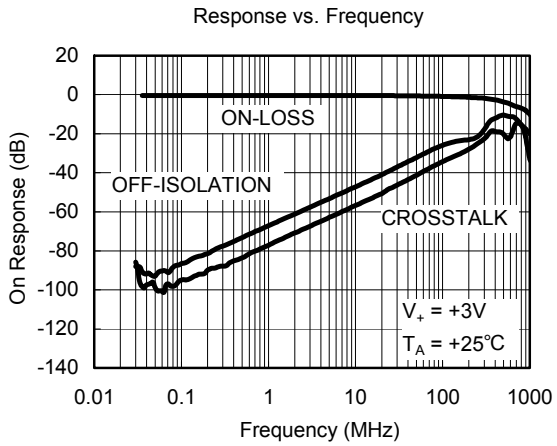
(V_+ = +2.7V to +3.6V, Full = -40°C to +85°C, typical values are at V_+ = +3.0V, T_A = +25℃, unless otherwise noted.)

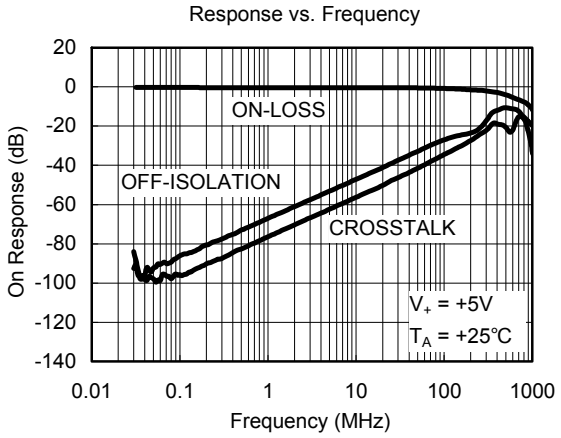
PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}			Full	(V_+) - 5.0		V_+	V
On-Resistance	R_{ON}	V_+ = 2.7V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -10mA, Test Circuit 1		+25℃		6	11	Ω
				Full			12	
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 2.7V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -10mA, Test Circuit 1		+25℃		0.2	0.7	Ω
				Full			0.9	
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 2.7V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -10mA, Test Circuit 1		+25℃		3	5	Ω
				Full			5.3	
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		Full			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		Full			1	μA
Power Off Leakage Current	$I_{Power\ Off}$	V_+ = 0V, V_{NO} or V_{NC} = 0V, V_{COM} = 3.0V		Full			10	μA
DIGITAL INPUTS								
Input High Voltage	V_{INH}			Full	1.5			V
Input Low Voltage	V_{INL}			Full			0.4	V
Input Leakage Current	I_{IN}	V_+ = 3.6V, V_{IN} = 0V or 3.6V		Full			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 1.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 2		+25℃		30		ns
Turn-Off Time	t_{OFF}	V_{NO} or V_{NC} = 1.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 2		+25℃		20		ns
Break-Before-Make Time Delay	t_D	V_{NO} or V_{NC} = 1.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 3		+25℃		11		ns
Off Isolation	O_{ISO}	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 4	f = 1MHz	+25℃		-67		dB
			f = 10MHz	+25℃		-47		dB
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 5	f = 1MHz	+25℃		-77		dB
			f = 10MHz	+25℃		-57		dB
-3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 6		+25℃		380		MHz
Charge Injection	Q	V_G = GND, R_G = 0Ω, C_L = 1.0nF Test Circuit 7		+25℃		13		pC
Switch ON Capacitance	C_{ON}			+25℃		21		pF
Switch OFF Capacitance	C_{OFF}			+25℃		8		pF
Total Harmonic Distortion	THD	V_+ = 3.3V, $V_{NC/NO}$ = 2.0V_{PP}, f = 20Hz to 20kHz, Test Circuit 8	R_L = 600Ω	+25℃		0.025		%
		V_+ = 3.3V, $V_{NC/NO}$ = 1.0V_{PP}, f = 20Hz to 20kHz, Test Circuit 8	R_L = 32Ω	+25℃		0.3		
POWER REQUIREMENTS								
Power Supply Current	I_+	V_+ = 3.6V, V_{IN} = 0V or V_+		Full			5	μA

TYPICAL PERFORMANCE CHARACTERISTICS

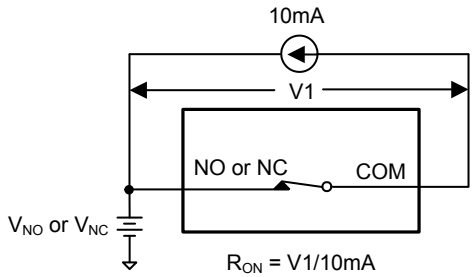




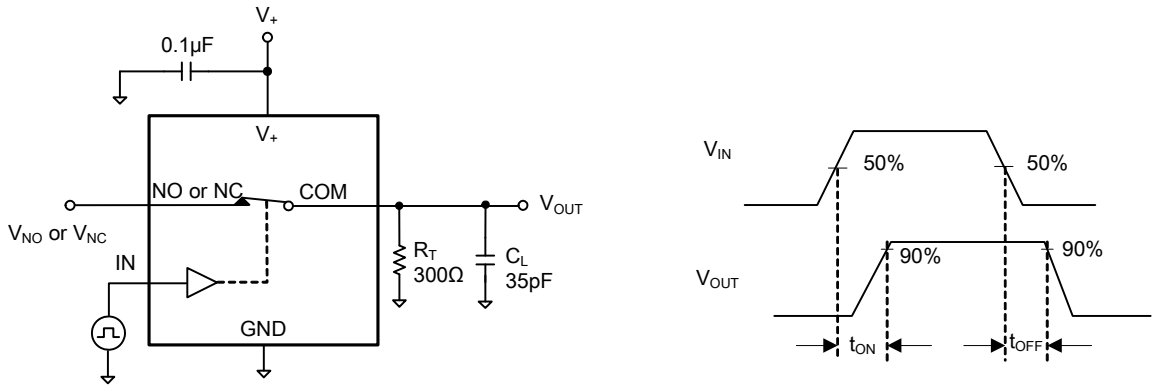




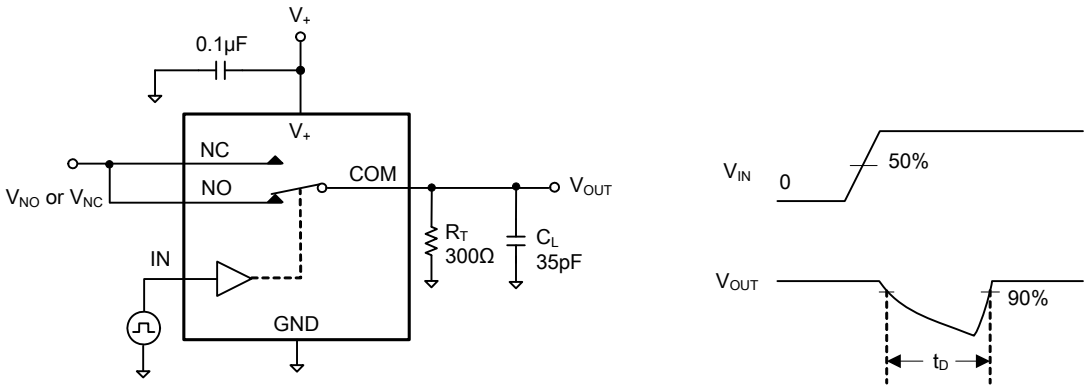
TEST CIRCUITS



Test Circuit 1. On Resistance

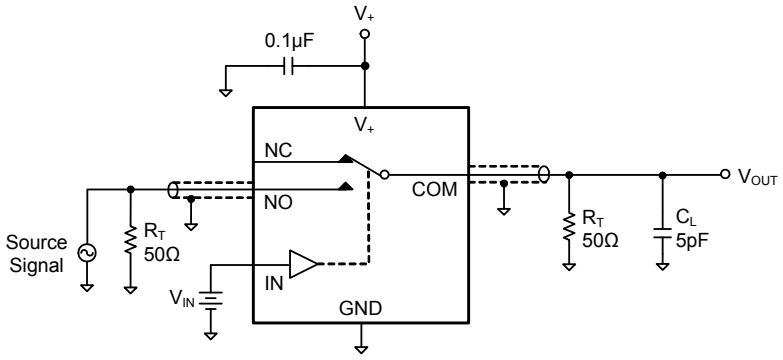


Test Circuit 2. Switching Times (t_{ON}, t_{OFF})

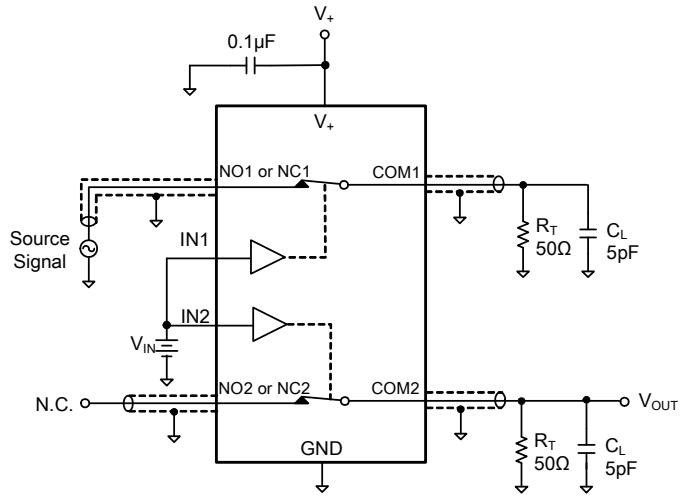


Test Circuit 3. Break-Before-Make Time Delay (t_D)

TEST CIRCUITS (Cont.)

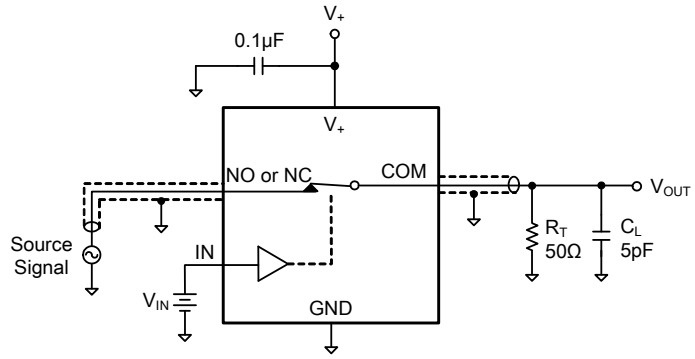


Test Circuit 4. Off Isolation (O_{ISO})



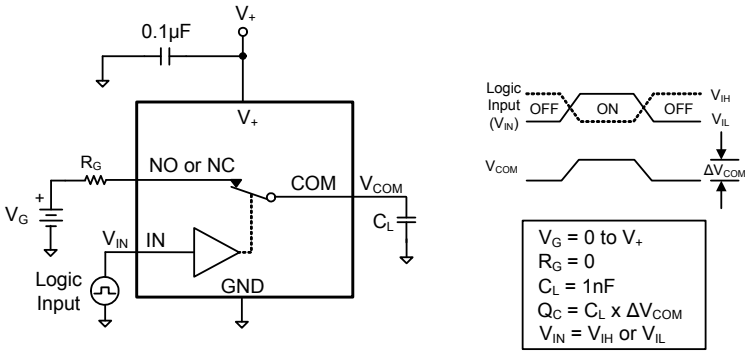
$$\text{Channel to Channel Crosstalk} = 20 \times \log \frac{V_{OUT}}{V_{NO} \text{ or } V_{NC}}$$

Test Circuit 5. Channel-to-Channel Crosstalk (X_{TALK})

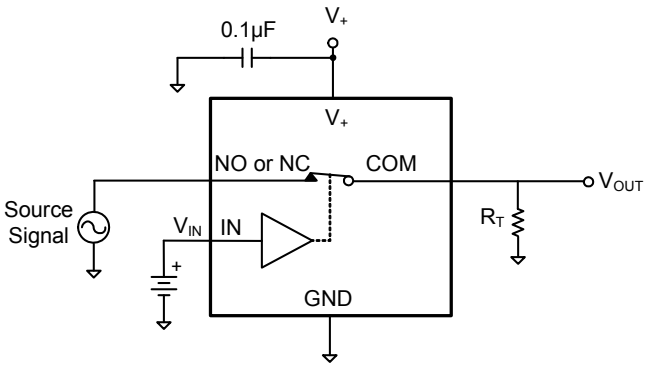


Test Circuit 6. -3dB Bandwidth (BW)

TEST CIRCUITS (Cont.)



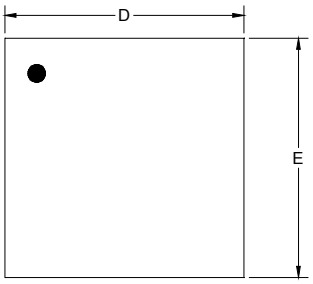
Test Circuit 7. Charge Injection (Q)



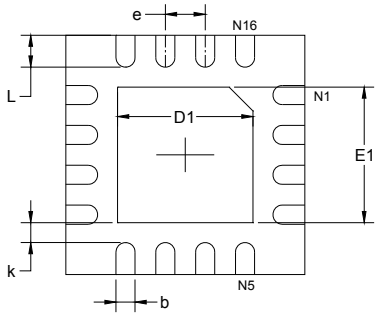
Test Circuit 8. Total Harmonic Distortion (THD)

PACKAGE OUTLINE DIMENSIONS

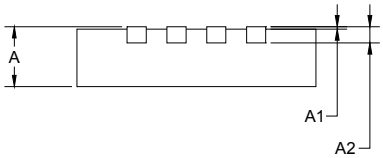
TQFN-3×3-16L



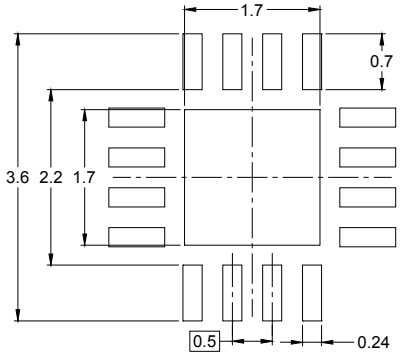
TOP VIEW



BOTTOM VIEW



SIDE VIEW

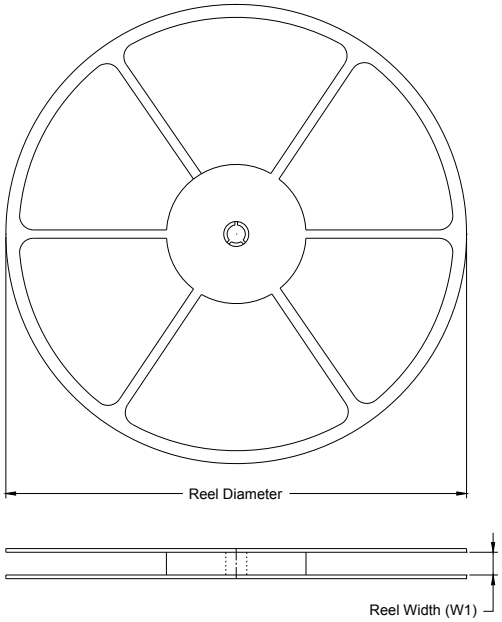


RECOMMENDED LAND PATTERN (Unit: mm)

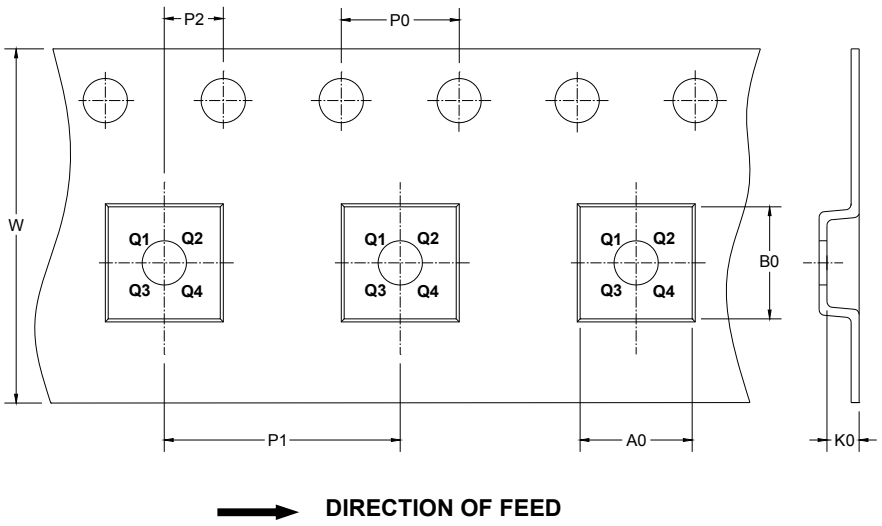
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	2.900	3.100	0.114	0.122
D1	1.600	1.800	0.063	0.071
E	2.900	3.100	0.114	0.122
E1	1.600	1.800	0.063	0.071
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	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

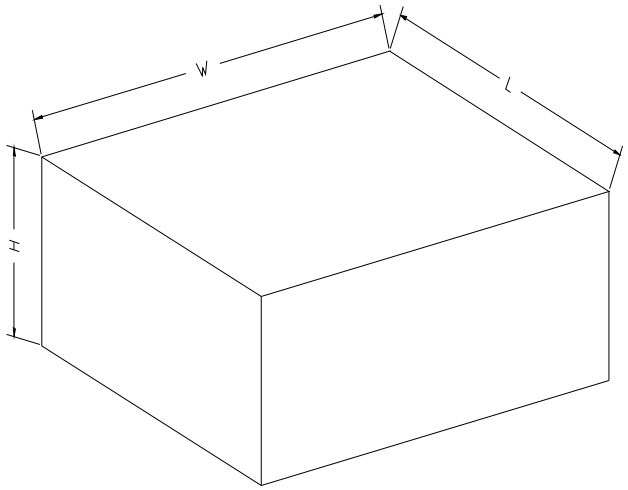


NOTE: The picture is only for reference. Please make the object as the standard.

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
TQFN-3×3-16L	13″	12.40	3.35	3.35	1.13	4.00	4.00	2.00	12.00	Q1

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