



SGM3167

600MHz, Low Voltage SPDT Analog Switch in 6-Pin SC70

GENERAL DESCRIPTION

The SGM3167 is a single, bidirectional, single-pole/double-throw (SPDT) CMOS analog switches designed to operate from a single 1.8V to 5.5V supply. It features high-bandwidth (600MHz) and low on-resistance (9Ω TYP), targeted applications for audio switching.

SGM3167 features guaranteed on-resistance matching (0.3Ω MAX) between switches and guaranteed on-resistance flatness over the signal range (2.5Ω TYP). This ensures excellent linearity and low distortion when switching audio signals.

SGM3167 is available in Green SC70-6 package.

APPLICATIONS

Portable Instrumentation
Battery-Operated Equipment
Computer Peripherals
Cell Phones
PDAs
MP3s

FUNCTION TABLE

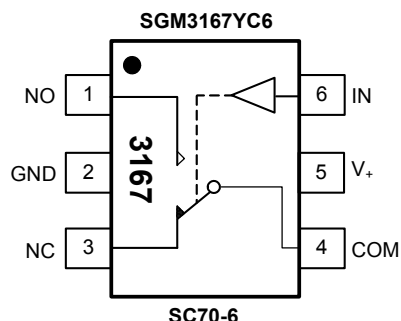
LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

Switches Shown For Logic "0" Input

FEATURES

- **Voltage Operation:** 1.8V to 5.5V
- **On-Resistance:** 9Ω (TYP) at 5.0V
- **Fast Switching Times**
 t_{ON} 20ns
 t_{OFF} 15ns
- **High Bandwidth:** 600MHz
- **High Off-Isolation:** -63dB at 10MHz
- **Rail-to-Rail Operation**
- **TTL/CMOS Compatible**
- **Break-Before-Make Switching**
- **Extended Industrial Temperature Range:**
 -40°C to $+85^{\circ}\text{C}$
- **Available in Green SC70-6 Package**

PIN CONFIGURATION (TOP VIEW)



PIN DESCRIPTION

NAME	PIN	FUNCTION
NO	1	Normally-Open Terminal.
GND	2	Ground.
NC	3	Normally-Closed Terminal.
COM	4	Common Terminal.
V+	5	Power Supply.
IN	6	Digital Control Pin to Connect the COM Terminal to the NO or NC Terminals.

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

PACKAGE/ORDERING INFORMATION

MODEL	PIN- PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM3167	SC70-6	-40°C to +85°C	SGM3167YC6/TR	3167	Tape and Reel, 3000

ABSOLUTE MAXIMUM RATINGS

V₊, IN to GND.....-0.3V to 6V
Analog, Digital voltage range ⁽¹⁾..... -0.3V to (V₊) + 0.3V
Continuous Current NO, NC, or COM.....±30mA
Peak Current NO, NC, or COM.....±50mA
Operating Temperature Range.....-40°C to +85°C

Junction Temperature.....150°C
Storage Temperature Range.....-65°C to +150°C
Lead Temperature (soldering, 10s).....260°C
ESD (HBM).....2000V
ESD (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.

ELECTRICAL CHARACTERISTICS

($V_+ = +4.5V$ to $+5.5V$, $V_{IH} = +2.0V$, $V_{IL} = +0.8V$, $T_A = -40^\circ C$ to $+85^\circ C$, Typical values are at $V_+ = 5.0V$, $T_A = +25^\circ C$, unless otherwise noted.)

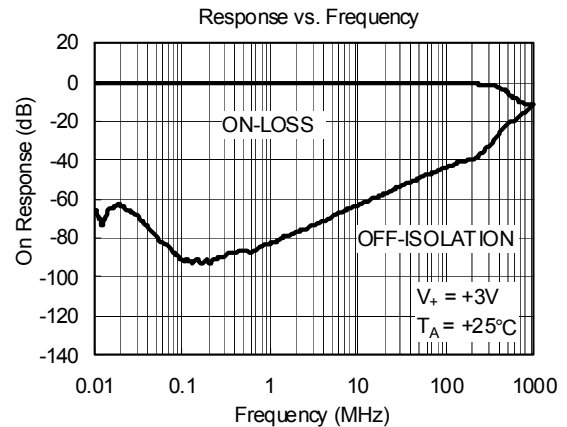
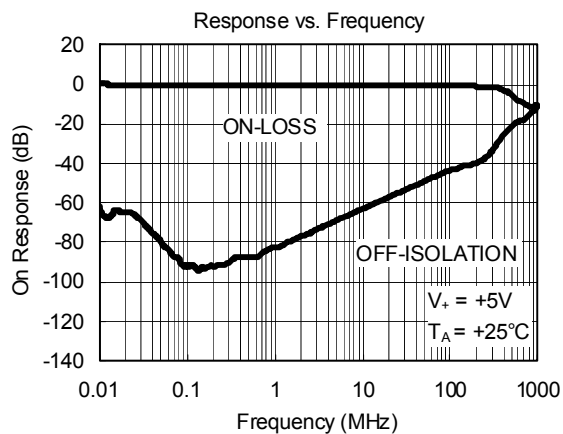
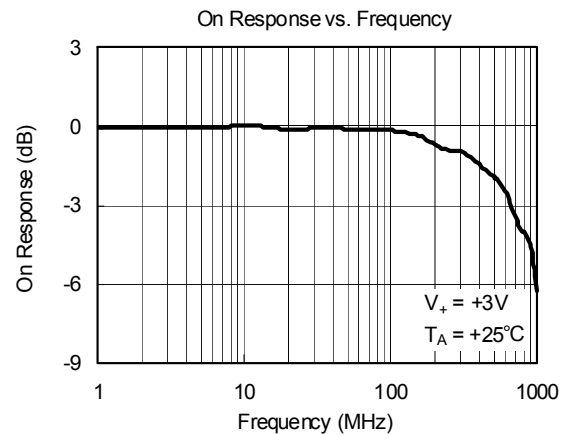
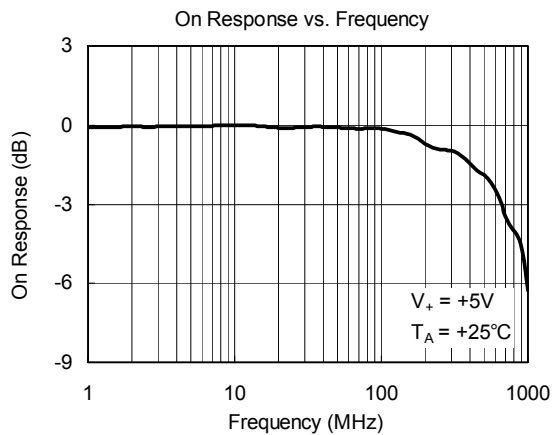
PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}		$-40^\circ C$ to $+85^\circ C$	0		V_+	V
On-Resistance	R_{ON}	$V_+ = 4.5V$, V_{NO} or $V_{NC} = 3.5V$, $I_{COM} = -10mA$, Test Circuit 1	$+25^\circ C$		9	14	Ω
			$-40^\circ C$ to $+85^\circ C$			16	Ω
On-Resistance Match Between Channels	ΔR_{ON}	$V_+ = 4.5V$, V_{NO} or $V_{NC} = 3.5V$, $I_{COM} = -10mA$, Test Circuit 1	$+25^\circ C$		0.3	0.6	Ω
			$-40^\circ C$ to $+85^\circ C$			0.8	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_+ = 4.5V$, V_{NO} or $V_{NC} = 1.0V, 2.0V, 3.5V$, $I_{COM} = -10mA$, Test Circuit 1	$+25^\circ C$		4	5.5	Ω
			$-40^\circ C$ to $+85^\circ C$			6	Ω
Source OFF Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_+ = 5.5V$, V_{NO} or $V_{NC} = 1.0V, 4.5V$, $V_{COM} = 4.5V, 1.0V$	$-40^\circ C$ to $+85^\circ C$			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	$-40^\circ C$ to $+85^\circ C$			1	μA
DIGITAL INPUTS							
Input High Voltage	V_{INH}		$-40^\circ C$ to $+85^\circ C$	1.5			V
Input Low Voltage	V_{INL}		$-40^\circ C$ to $+85^\circ C$			0.6	V
Input Leakage Current	I_{IN}	$V_+ = 5.5V$, $V_{IN} = 0V$ or $5.5V$	$-40^\circ C$ to $+85^\circ C$			1	μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	V_{NO} or $V_{NC} = 3.0V$, $V_{IH} = 1.5V$, $V_{IL} = 0V$, $R_L = 300\Omega$, $C_L = 35pF$, Test Circuit 2	$+25^\circ C$		20		ns
Turn-Off Time	t_{OFF}	V_{NO} or $V_{NC} = 3.0V$, $V_{IH} = 1.5V$, $V_{IL} = 0V$, $R_L = 300\Omega$, $C_L = 35pF$, Test Circuit 2	$+25^\circ C$		15		ns
Break-Before-Make Time Delay	t_D	V_{NO1} or $V_{NC1} = V_{NO2}$ or $V_{NC2} = 3V$, $R_L = 300\Omega$, $C_L = 35pF$, Test Circuit 3	$+25^\circ C$		5		ns
Skew	t_{SKEW}	$R_S = 39\Omega$, $C_L = 50pF$, Test Circuit 4	$+25^\circ C$		5		ns
Off Isolation	O_{ISO}	$R_L = 50\Omega$, V_{NO} or $V_{NC} = 1V_{P-P}$, $C_L = 5pF$, Test Circuit 5	$f = 10MHz$	$+25^\circ C$		-63	dB
			$f = 1MHz$	$+25^\circ C$		-83	dB
-3dB Bandwidth	BW	Signal = 0dBm, $R_L = 50\Omega$, $C_L = 5pF$, Test Circuit 6	$+25^\circ C$		600		MHz
Source OFF Capacitance	$C_{NC(OFF)}, C_{NO(OFF)}$	$f = 1MHz$	$+25^\circ C$		5.5		pF
Channel ON Capacitance	$C_{NC(ON)}, C_{NO(ON)}, C_{COM(ON)}$	$f = 1MHz$	$+25^\circ C$		9		pF
POWER REQUIREMENTS							
Power Supply Range	V_+		$-40^\circ C$ to $+85^\circ C$	1.8		5.5	V
Power Supply Current	I_+	$V_+ = +5.5V$, $V_{IN} = 0V$ or V_+	$-40^\circ C$ to $+85^\circ C$			5	μA

ELECTRICAL CHARACTERISTICS

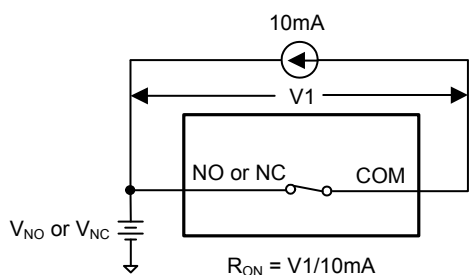
($V_+ = +2.7V$ to $+3.6V$, $V_{IH} = +1.4V$, $V_{IL} = +0.5V$, $T_A = -40^\circ C$ to $+85^\circ C$, Typical values are at $V_+ = 3.0V$, $T_A = +25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}		$-40^\circ C$ to $+85^\circ C$	0		V_+	V
On-Resistance	R_{ON}	$V_+ = 2.7V$, V_{NO} or $V_{NC} = 1.5V$, $I_{COM} = -10mA$, Test Circuit 1	$+25^\circ C$		14	25	Ω
			$-40^\circ C$ to $+85^\circ C$			28	Ω
On-Resistance Match Between Channels	ΔR_{ON}	$V_+ = 2.7V$, V_{NO} or $V_{NC} = 1.5V$, $I_{COM} = -10mA$, Test Circuit 1	$+25^\circ C$		0.3	0.6	Ω
			$-40^\circ C$ to $+85^\circ C$			0.8	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_+ = 2.7V$, V_{NO} or $V_{NC} = 1.0V, 1.5V, 2.0V$, $I_{COM} = -10mA$, Test Circuit 1	$+25^\circ C$		2.5	8	Ω
			$-40^\circ C$ to $+85^\circ C$			10	Ω
Source OFF Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_+ = 3.6V$, V_{NO} or $V_{NC} = 0.3V, 3.3V$, $V_{COM} = 3.3V, 0.3V$	$-40^\circ C$ to $+85^\circ C$			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	$-40^\circ C$ to $+85^\circ C$			1	μA
DIGITAL INPUTS							
Input High Voltage	V_{INH}		$-40^\circ C$ to $+85^\circ C$	1			V
Input Low Voltage	V_{INL}		$-40^\circ C$ to $+85^\circ C$			0.5	V
Input Leakage Current	I_{IN}	$V_+ = 5.5V$, $V_{IN} = 0V$ or $3.6V$	$-40^\circ C$ to $+85^\circ C$			1	μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	V_{NO} or $V_{NC} = 1.5V$, $V_{IH} = 1.5V$, $V_{IL} = 0V$, $R_L = 300\Omega$, $C_L = 35pF$, Test Circuit 2	$+25^\circ C$		30		ns
Turn-Off Time	t_{OFF}	V_{NO} or $V_{NC} = 1.5V$, $V_{IH} = 1.5V$, $V_{IL} = 0V$, $R_L = 300\Omega$, $C_L = 35pF$, Test Circuit 2	$+25^\circ C$		25		ns
Break-Before-Make Time Delay	t_D	V_{NO1} or $V_{NC1} = V_{NO2}$ or $V_{NC2} = 3V$, $R_L = 300\Omega$, $C_L = 35pF$, Test Circuit 3	$+25^\circ C$		8		ns
Skew	t_{SKEW}	$R_S = 39\Omega$, $C_L = 50pF$, Test Circuit 4	$+25^\circ C$		2		ns
Off Isolation	O_{ISO}	$R_L = 50\Omega$, V_{NO} or $V_{NC} = 1V_{P-P}$, $C_L = 5pF$, Test Circuit 5	$f = 10MHz$	$+25^\circ C$		-63	dB
			$f = 1MHz$	$+25^\circ C$		-83	dB
-3dB Bandwidth	BW	Signal = 0dBm, $R_L = 50\Omega$, $C_L = 5pF$, Test Circuit 6	$+25^\circ C$		600		MHz
Source OFF Capacitance	$C_{NC(OFF)}, C_{NO(OFF)}$	$f = 1MHz$	$+25^\circ C$		5.5		pF
Channel ON Capacitance	$C_{NC(ON)}, C_{NO(ON)}, C_{COM(ON)}$	$f = 1MHz$	$+25^\circ C$		9		pF
POWER REQUIREMENTS							
Power Supply Range	V_+		$-40^\circ C$ to $+85^\circ C$	1.8		5.5	V
Power Supply Current	I_+	$V_+ = +5.5V$, $V_{IN} = 0V$ or V_+	$-40^\circ C$ to $+85^\circ C$			5	μA

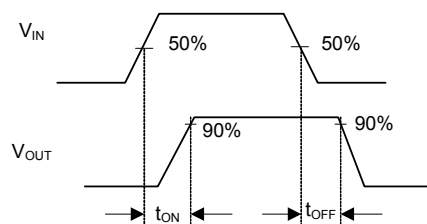
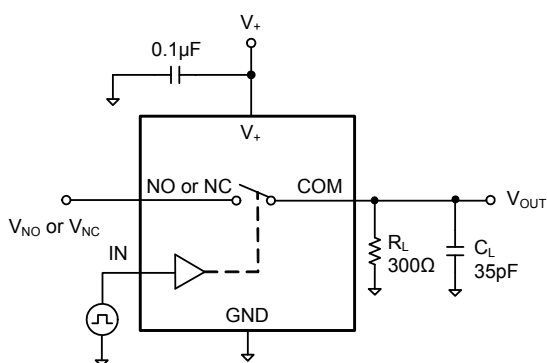
TYPICAL PERFORMANCE CHARACTERISTICS



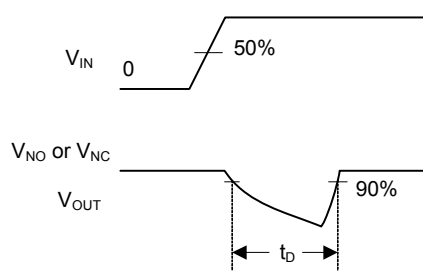
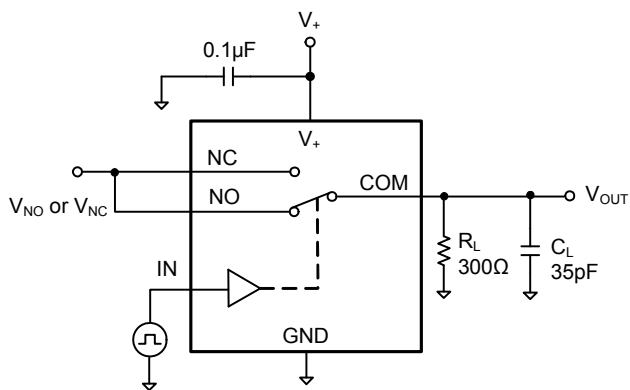
TEST CIRCUITS



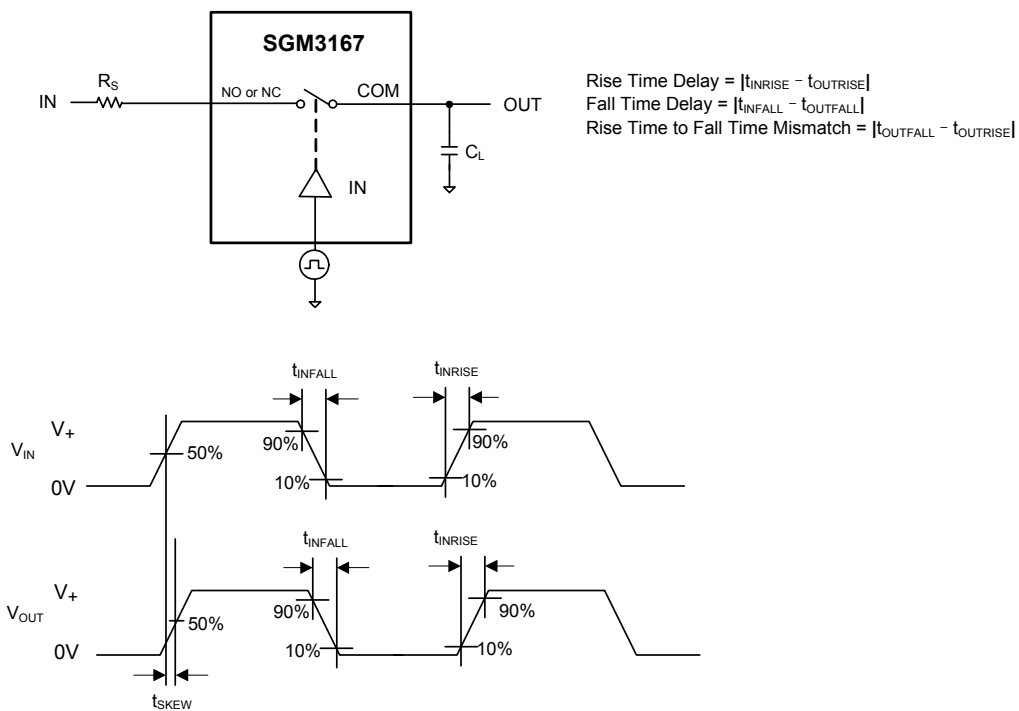
Test Circuit 1. On Resistance



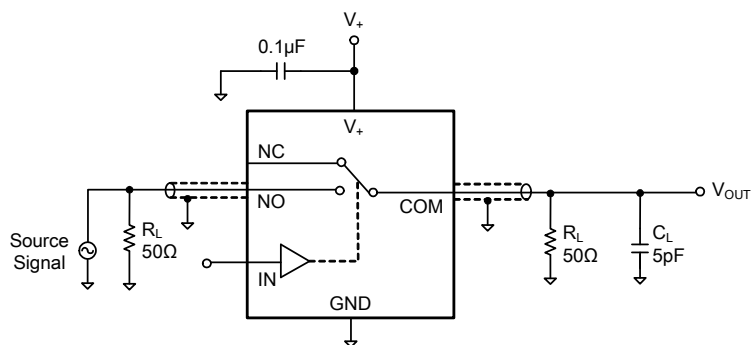
Test Circuit 2. Switching Times

Test Circuit 3. Break-Before-Make Time Delay, t_D

TEST CIRCUITS (Cont.)

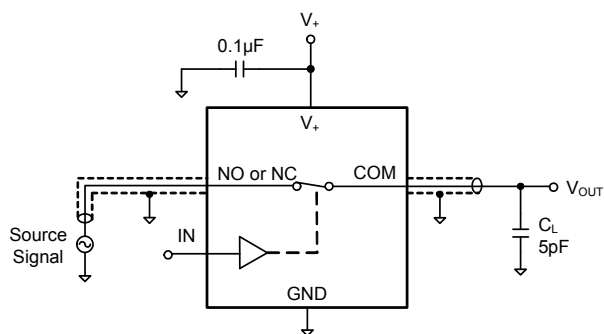


Test Circuit 4. Output Signal Skew



Test Circuit 5. Off Isolation

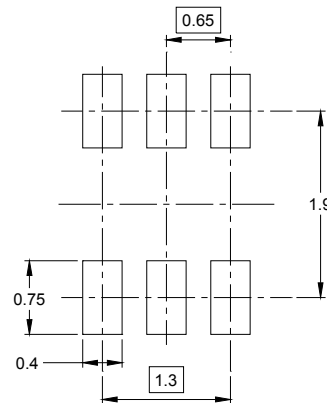
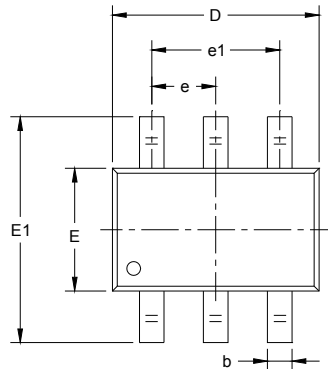
TEST CIRCUITS (Cont.)



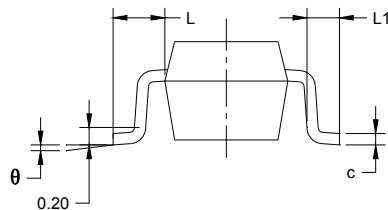
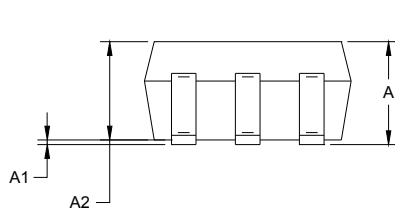
Test Circuit 6. -3dB Bandwidth

PACKAGE OUTLINE DIMENSIONS

SC70-6



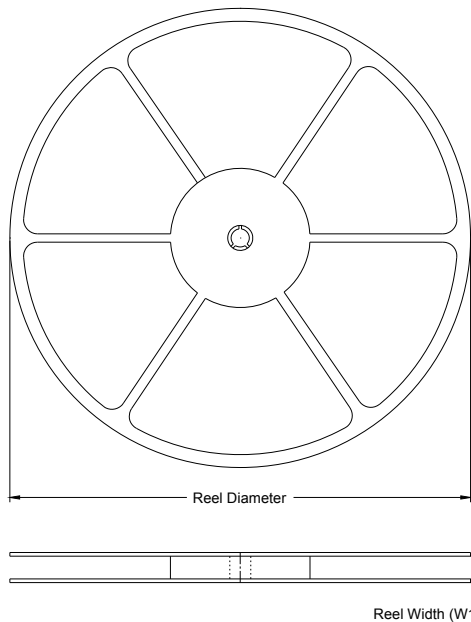
RECOMMENDED LAND PATTERN (Unit: mm)



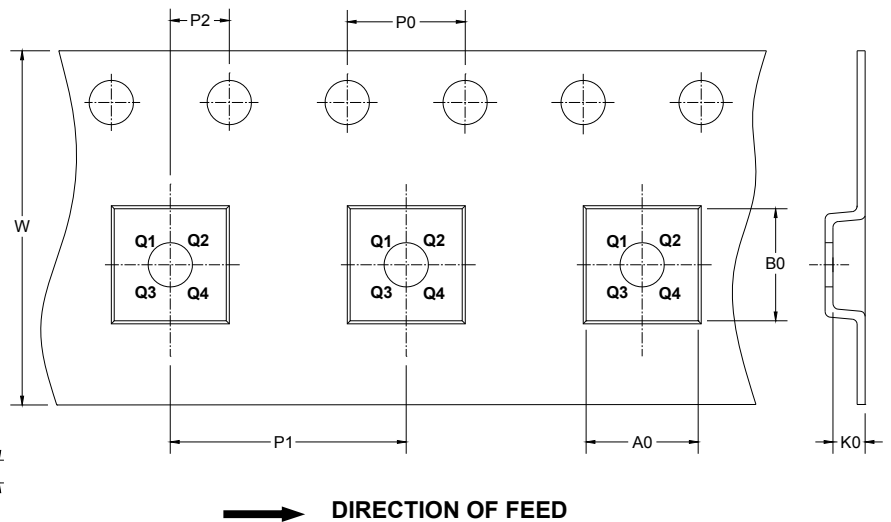
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.65 TYP		0.026 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°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



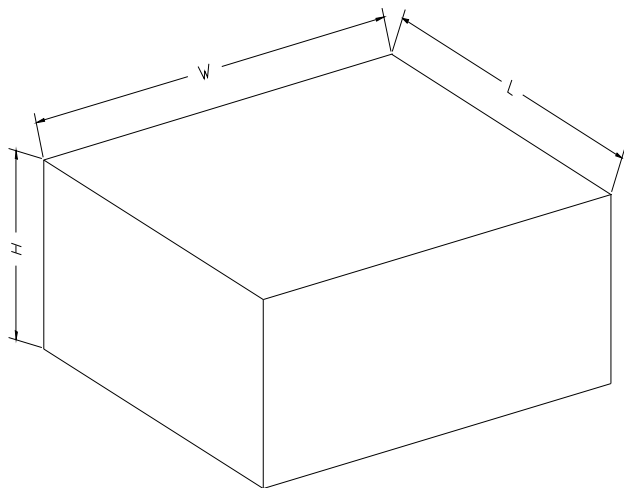
TAPE DIMENSIONS



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	2.4	2.5	1.2	4.0	4.0	2.0	8.0	Q3

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