

# SGM4157YC

# SPDT 0.8Ω Analog Switch

## GENERAL DESCRIPTION

The SGM4157YC is a single Low ON-Resistance (0.8Ω), fast single-pole double-throw (SPDT) CMOS switch. It is designed for low operating voltage, high current switching of speaker output for cell phone applications. The SGM4157YC can handle a balanced microphone/speaker/ring tone generator in a monophone mode. The device contains a break-before-make (BBM) feature.

The control input, IN, tolerates input drive signals up to 5.5V, independent of supply voltage.

SGM4157YC is available in SC70-6 package.

## APPLICATIONS

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

## PIN DESCRIPTION

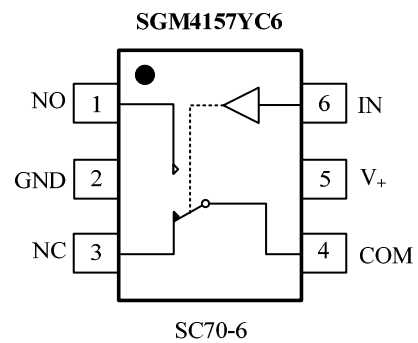
NAME	PIN	FUNCTION
NO	1	Normally-open terminal
GND	2	Ground
NC	3	Normally-closed terminal
COM	4	Common terminal
V+	5	Power supply
IN	6	Digital control pin to connect the COM terminal to the NO or NC terminals

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

## FEATURES

- Voltage Operation: 1.8V to 4.2V
- On-Resistance: 0.8Ω (TYP)
- -3dB Bandwidth: 100MHz
- High Off-Isolation: -50dB at 10MHz
- Rail-to-Rail Operation
- Low Static Power
- TTL/CMOS Compatible
- Break-Before-Make Switching
- Extended Industrial Temperature Range: -40°C to +85°C
- Microsize Package

## PIN CONFIGURATION (TOP VIEW)



## FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

Switches Shown For Logic "0" Input



# ELECTRICAL CHARACTERISTICS

(V<sub>+</sub> = +4.2V, GND = 0V, V<sub>IH</sub> = +1.6V, V<sub>IL</sub> = +0.4V, T<sub>A</sub> = - 40°C to +85°C, Typical values are at V<sub>+</sub> = +4.2V, T<sub>A</sub> = + 25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TPY	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	V <sub>NO</sub> , V <sub>NC</sub> , V <sub>COM</sub>		- 40°C to +85°C	0		V <sub>+</sub>	V
On-Resistance	R <sub>ON</sub>	V <sub>+</sub> = 4.2V, V <sub>NO</sub> or V <sub>NC</sub> = 1V, I <sub>COM</sub> = -100mA, Test Circuit 1	+25°C		0.8	1.4	Ω
			- 40°C to +85°C			1.8	Ω
On-Resistance Match Between Channels	ΔR <sub>ON</sub>	V <sub>+</sub> = 4.2V, V <sub>NO</sub> or V <sub>NC</sub> = 1V, I <sub>COM</sub> = -100mA, Test Circuit 1	+25°C		0.03	0.2	Ω
			- 40°C to +85°C			0.3	Ω
On-Resistance Flatness	R <sub>FLAT(ON)</sub>	V <sub>+</sub> = 4.2V, V <sub>NO</sub> or V <sub>NC</sub> = 1V, I <sub>COM</sub> = -100mA, Test Circuit 1	+25°C		0.24	0.5	Ω
			- 40°C to +85°C			0.6	Ω
Source OFF Leakage current	I <sub>NC(OFF)</sub> , I <sub>NO(OFF)</sub>	V <sub>+</sub> = 4.2V, V <sub>NO</sub> or V <sub>NC</sub> = 0.3V, 3.3V, V <sub>COM</sub> = 3.3V, 0.3V	- 40°C to +85°C			1	μA
Channel ON Leakage current	I <sub>NC(ON)</sub> , I <sub>NO(ON)</sub> , I <sub>COM(ON)</sub>	V <sub>+</sub> = 4.2V, V <sub>COM</sub> = 0.3V, 3.3V, V <sub>NO</sub> or V <sub>NC</sub> = 0.3V, 3.3V, or floating	- 40°C to +85°C			1	μA
<b>DIGITAL INPUTS</b>							
Input High Voltage	V <sub>INH</sub>		- 40°C to +85°C	1.5			V
Input Low Voltage	V <sub>INL</sub>		- 40°C to +85°C			0.5	V
Input Leakage Current	I <sub>IN</sub>	V <sub>+</sub> = 4.2V, V <sub>IN</sub> = 0V or 4.2V	- 40°C to +85°C			1	μA
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	t <sub>ON</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 3.0V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, V <sub>IH</sub> = 1.5V, V <sub>IL</sub> = 0V, Test Circuit 2	+25°C		36		ns
Turn-Off Time	t <sub>OFF</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 3.0V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, V <sub>IH</sub> = 1.5V, V <sub>IL</sub> = 0V, Test Circuit 2	+25°C		26		ns
Break-Before-Make Time Delay	t <sub>D</sub>	V <sub>NO1</sub> or V <sub>NC1</sub> = V <sub>NO2</sub> or V <sub>NC2</sub> = 3V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Test Circuit 3	+25°C		18		ns
Skew	t <sub>SKEW</sub>	R <sub>S</sub> = 39Ω, C <sub>L</sub> = 50pF, Test Circuit 4	+25°C		34		ns
Off Isolation	O <sub>ISO</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Signal = 0dBm, Test Circuit 5	10MHz	+25°C		-50	dB
			1MHz	+25°C		-70	dB
Bandwidth -3 dB	BW	Signal = 0dBm, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 6	+25°C		100		MHz
Channel ON Capacitance	C <sub>NC(ON)</sub> , C <sub>NO(ON)</sub> , C <sub>COM(ON)</sub>	f = 1MHz	+25°C		60		pF
<b>POWER REQUIREMENTS</b>							
Power Supply Range	V <sub>+</sub>		- 40°C to +85°C	1.8		4.2	V
Power Supply Current	I <sub>+</sub>	V <sub>+</sub> = +4.2V, V <sub>IN</sub> = 0V or V <sub>+</sub>	- 40°C to +85°C			1	μA

Specifications subject to change without notice.

# ELECTRICAL CHARACTERISTICS

( $V_+ = +2.7V$  to  $+3.6V$ ,  $V_{IH} = +1.5V$ ,  $V_{IL} = +0.3V$ ,  $T_A = -40^\circ C$  to  $+85^\circ C$ , Typical values are at  $V_+ = +3.0V$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TPY	MAX	UNITS
<b>ANALOG SWITCH</b>							
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 $V_{NC} = 1.0V,$ $I_{COM} = -100mA$ , Test Circuit 1	$+25^\circ C$		1	1.5	$\Omega$
			$-40^\circ C$ to $+85^\circ C$			2	$\Omega$
On-Resistance Match Between Channels	$\Delta R_{ON}$	$V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1.0V,$ $I_{COM} = -100mA$ , Test Circuit 1	$+25^\circ C$		0.1	0.4	$\Omega$
			$-40^\circ C$ to $+85^\circ C$			0.5	$\Omega$
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1.0V,$ $I_{COM} = -100mA$ , Test Circuit 1	$+25^\circ C$		0.3	0.6	$\Omega$
			$-40^\circ C$ to $+85^\circ C$			0.8	$\Omega$
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	$\mu A$
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	$\mu A$
<b>DIGITAL INPUTS</b>							
Input High Voltage	$V_{INH}$		$-40^\circ C$ to $+85^\circ C$	1.4			V
Input Low Voltage	$V_{INL}$		$-40^\circ C$ to $+85^\circ C$			0.4	V
Input Leakage Current	$I_{IN}$	$V_+ = 2.7V, V_{IN} = 0$ or $2.7V$	$-40^\circ C$ to $+85^\circ C$			1	$\mu A$
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	$t_{ON}$	$V_{NO}$ or $V_{NC} = 1.5V,$ $R_L = 300\Omega, C_L = 35pF,$ $V_{IH} = 1.5V, V_{IL} = 0V$ , Test Circuit 2	$+25^\circ C$		36		ns
Turn-Off Time	$t_{OFF}$	$V_{NO}$ or $V_{NC} = 1.5V,$ $R_L = 300\Omega, C_L = 35pF,$ $V_{IH} = 1.5V, V_{IL} = 0V$ , Test Circuit 2	$+25^\circ C$		22		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	$+25^\circ C$		18		ns
Skew	$t_{SKEW}$	$R_S = 39\Omega, C_L = 50pF$ , Test Circuit 4	$+25^\circ C$		34		ns
Off Isolation	$O_{ISO}$	$R_L = 50\Omega, C_L = 5pF,$ Signal = 0dBm, Test Circuit 5	10MHz	$+25^\circ C$		-50	dB
			1MHz	$+25^\circ C$		-70	dB
Bandwidth -3 dB	BW	Signal = 0dBm, $R_L = 50\Omega, C_L = 5pF,$ Test Circuit 6	$+25^\circ C$		100		MHz
Channel ON Capacitance	$C_{NC(ON)}, C_{NO(ON)},$ $C_{COM(ON)}$	$f = 1MHz$	$+25^\circ C$		60		pF

Specifications subject to change without notice.

## ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM4157YC	SC70-6	- 40°C to +85°C	SGM4157YC6/TR	4157	Tape and Reel, 3000

## ABSOLUTE MAXIMUM RATINGS

V<sub>+</sub>, IN to GND..... 0V to 4.6V  
 Analog, Digital voltage range(1)..... -0.3V to (V<sub>+</sub> + 0.3V)  
 Continuous Current NO, NC, or COM..... ±200mA  
 Peak Current NO, NC, or COM..... ±350mA  
 Operating Temperature Range..... - 40°C to +85°C  
 Junction Temperature.....150°C

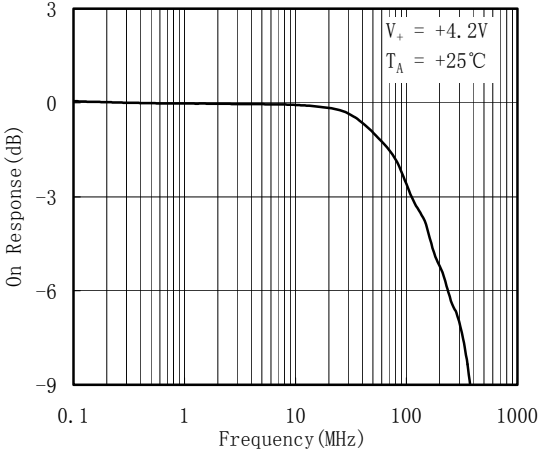
Storage Temperature..... -65°C to +150°C  
 Lead Temperature (soldering, 10s)..... 260°C  
 ESD Susceptibility  
 HBM..... 4000V  
 MM..... 400V

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.

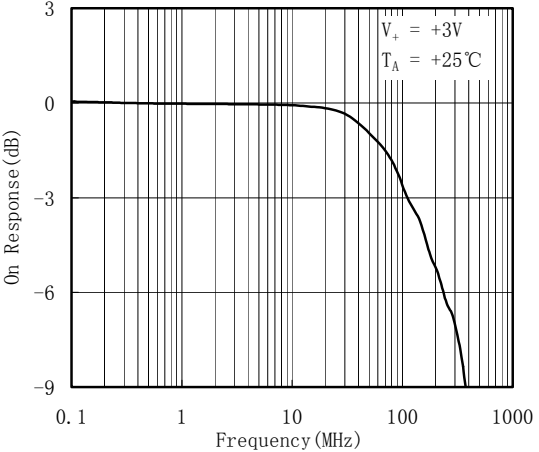
(1) Signals on NC, NO, or COM or IN exceeding V<sub>+</sub> will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

# TYPICAL PERFORMANCE CHARACTERISTICS

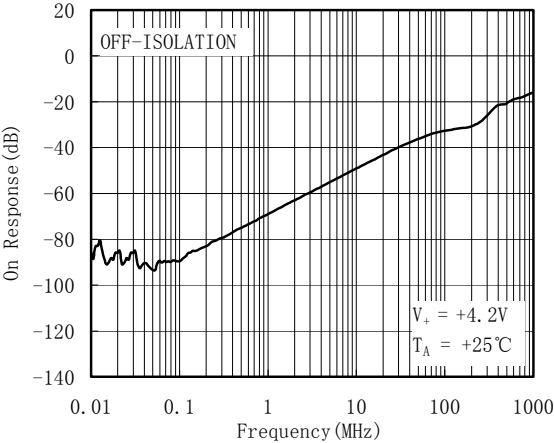
On Response vs. Frequency



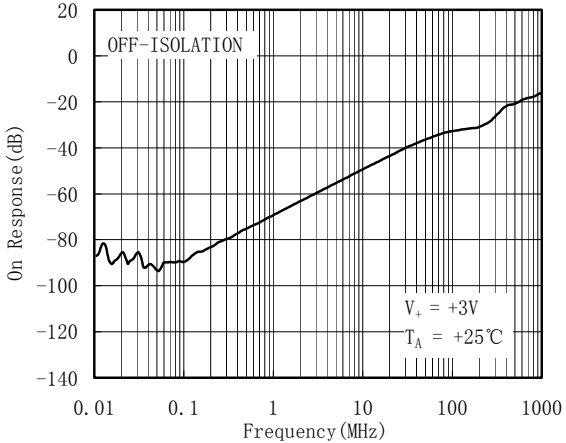
On Response vs. Frequency



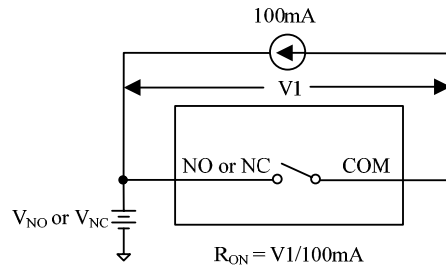
Response vs. Frequency



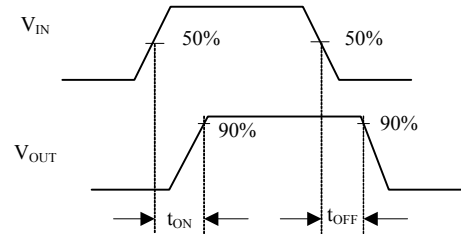
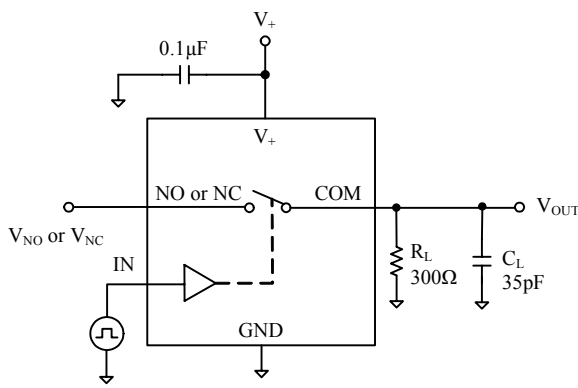
Response vs. Frequency



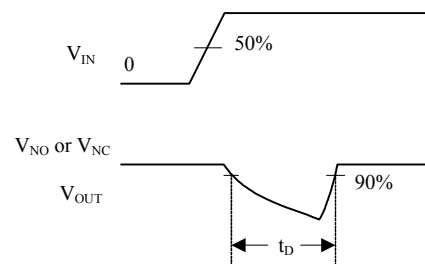
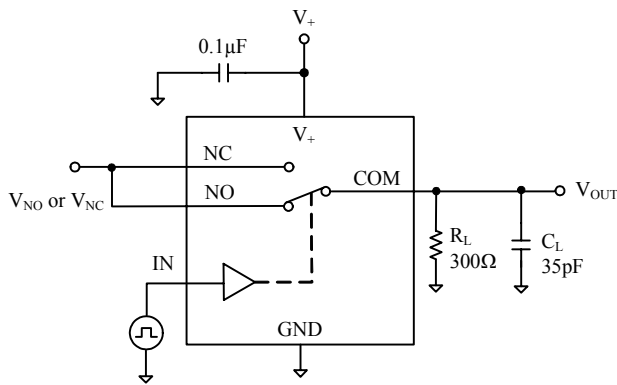
# TEST CIRCUITS



Test Circuit 1. On Resistance

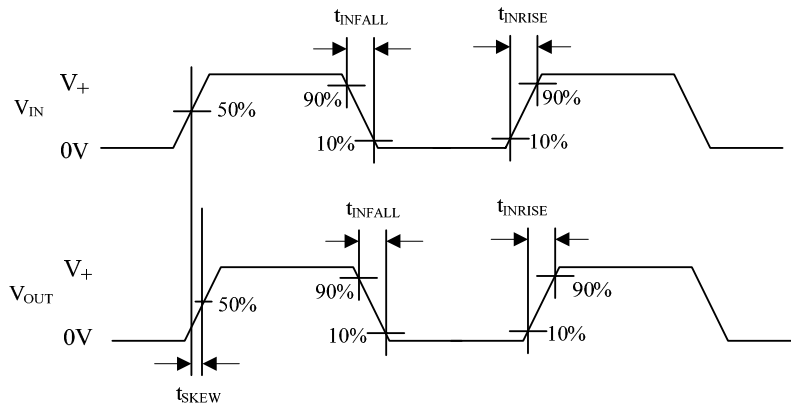
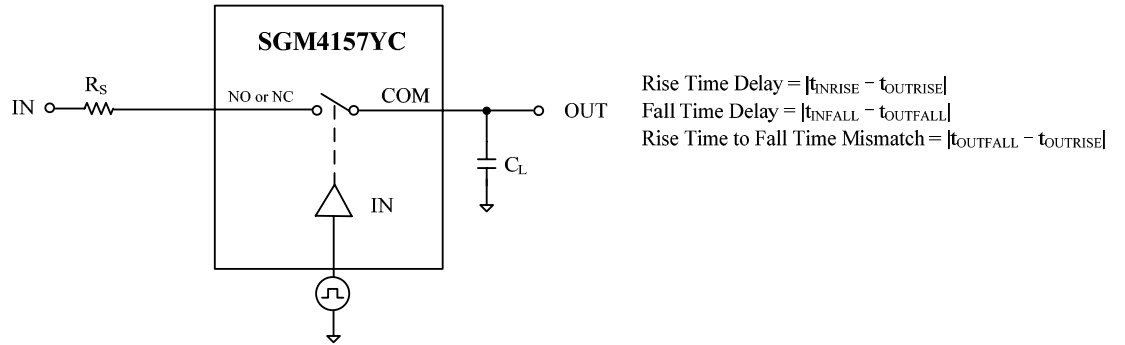


Test Circuit 2. Switching Times

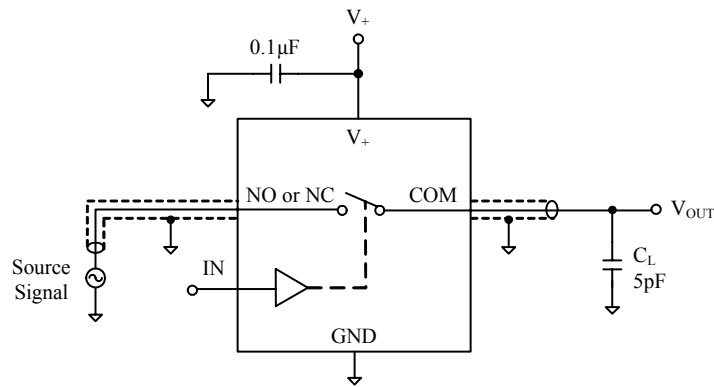


Test Circuit 3. Break-Before-Make Time Delay,  $t_D$

# TEST CIRCUITS (Cont.)

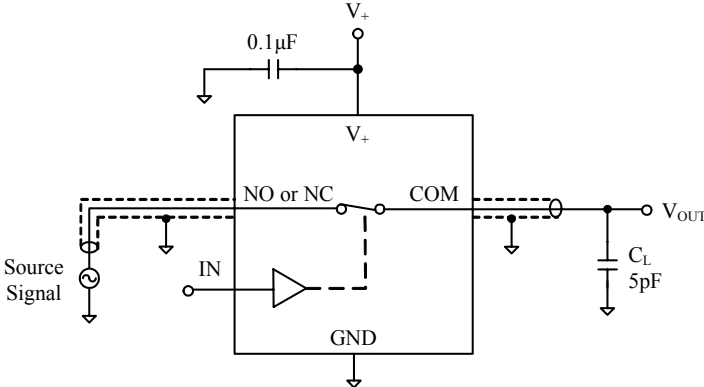


Test Circuit 4. Output Signal Skew



Test Circuit 5. Off Isolation

# TEST CIRCUITS (Cont.)

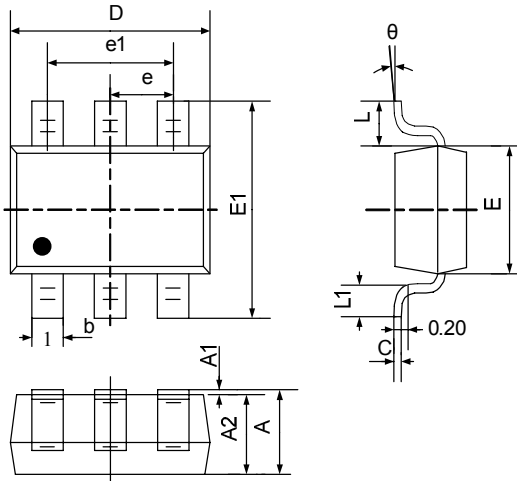


Test Circuit 6. Bandwidth -3dB



# PACKAGE OUTLINE DIMENSIONS

## SC70-6



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	0.650TYP		0.026TYP	
e1	1.200	1.400	0.047	0.055
L	0.525REF		0.021REF	
L1	0.260	0.460	0.010	0.018
$\theta$	0°	8°	0°	8°

## REVISION HISTORY

Location

Page

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11/2007—Preliminary Datasheet

01/2008—Data Sheet REV.A

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