

### GENERAL DESCRIPTION

The SGM8709 is an ultra-low power comparator, which consumes only 318nA (TYP) supply current at 1.4V. The device can operate from 1.4V to 5.5V single supply, and is guaranteed to operate at 1.4V, 2.5V and 5V. It supports rail-to-rail input operation. The above features make the SGM8709 a good choice for battery-powered applications.

The SGM8709 has an open-drain output structure. When driving any resistive or capacitive load, it is capable of consuming the absolute minimum power.

The SGM8709 has a great trade-off between low power and high speed, and the propagation delay is only 6 $\mu$ s with 100mV overdrive at 1.4V.

In addition, the SGM8709 fits in small packages, so it is also suitable for mobile phone and handheld electronic devices.

The SGM8709 is available in Green SOT-23-5 and SC70-5 packages. It is rated over the -40°C to +85°C temperature range.

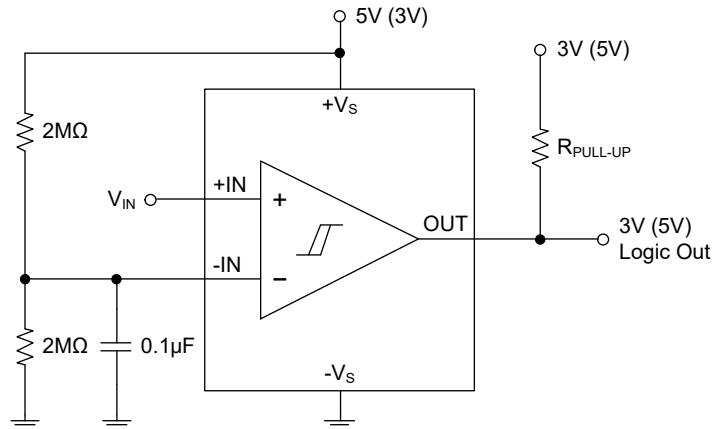
### FEATURES

- Ultra-Low Supply Current:  
318nA (TYP) at  $V_s = 1.4V$
- Supply Voltage Range: 1.4V to 5.5V
- N-MOSFET Open-Drain Output
- Output Drive Capability: 18.7mA (TYP) at  $V_s = 5V$
- Rail-to-Rail Input
- Propagation Delay: 6 $\mu$ s (TYP) at  $V_s = 1.4V$
- -40°C to +85°C Operating Temperature Range
- Available in Green SOT-23-5 and SC70-5 Packages

### APPLICATIONS

Infrared Receivers  
 Window Detectors  
 RC Timers  
 Monitoring and Alarm Systems  
 Multivibrators

### TYPICAL APPLICATION

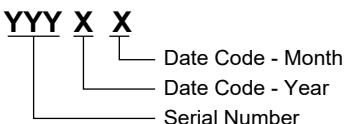


## PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8709	SOT-23-5	-40°C to +85°C	SGM8709YN5G/TR	SBBXX	Tape and Reel, 3000
	SC70-5	-40°C to +85°C	SGM8709YC5G/TR	SA5XX	Tape and Reel, 3000

## MARKING INFORMATION

NOTE: XX = Date Code.

**SOT-23-5/SC70-5**

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

Supply Voltage, +Vs to -Vs	.....	6V
V <sub>IN</sub> Differential	.....	±2.5V
Voltage at Input Pins	(-Vs) - 0.3V to (+Vs) + 0.3V	
Voltage at Output Pin	.....	6V
Junction Temperature	.....	+150°C
Storage Temperature Range	.....	-65°C to +150°C
Lead Temperature (Soldering, 10s)	.....	+260°C
ESD Susceptibility		
HBM	.....	2000V
MM	.....	400V

## RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range ..... -40°C to +85°C

## 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

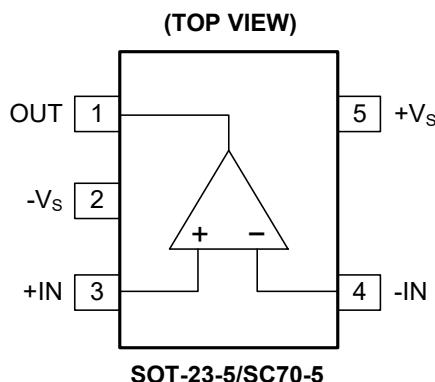
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions.

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



SOT-23-5/SC70-5

**ELECTRICAL CHARACTERISTICS**(At  $T_A = +25^\circ\text{C}$ ,  $+V_S = 1.4\text{V}$ ,  $-V_S = 0\text{V}$ ,  $V_{CM} = +V_S/2$ ,  $V_{OUT} = -V_S$  and  $R_L = 20\text{k}\Omega$  connected to  $+V_S$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current	$I_S$	$V_{CM} = 0.3\text{V}$		318	1000	nA
		$V_{CM} = 1.1\text{V}$		263	1000	
Input Offset Voltage	$V_{OS}$	$V_{CM} = 0\text{V}$		0.6	3	mV
		$V_{CM} = 1.4\text{V}$		0.4	3	
Input Offset Average Drift				2		$\mu\text{V}/^\circ\text{C}$
Common Mode Rejection Ratio	CMRR	$V_{CM}$ stepped from $0\text{V}$ to $0.3\text{V}$		61		dB
		$V_{CM}$ stepped from $0.8\text{V}$ to $1.4\text{V}$		59		
		$V_{CM}$ stepped from $0\text{V}$ to $1.4\text{V}$		67		
Power Supply Rejection Ratio	PSRR	$V_S = 1.8\text{V}$ to $5.5\text{V}$ , $V_{CM} = 0\text{V}$		87		dB
Open-Loop Voltage Gain	$A_{OL}$			81		dB
Output Voltage Swing from Rail	$V_{OL}$	$V_S = 1.8\text{V}$ , $I_{OUT} = 500\mu\text{A}$		81	106	mV
		$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$			137	
		$V_S = 1.8\text{V}$ , $I_{OUT} = 1\text{mA}$		165	213	
		$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$			290	
Output Current	$I_{OUT}$	Sink	0.7	1.8		mA
		$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$	0.5			
Leakage Current	$I_{LEAKAGE}$	$V_{OUT} = +V_S$		1		nA
Propagation Delay (High to Low)		Overdrive = $10\text{mV}$		12		$\mu\text{s}$
		Overdrive = $100\text{mV}$		6		
Fall Time	$t_{FALL}$	Overdrive = $10\text{mV}$ , $C_L = 30\text{pF}$ , $R_L = 1\text{M}\Omega$		156		ns
		Overdrive = $100\text{mV}$ , $C_L = 30\text{pF}$ , $R_L = 1\text{M}\Omega$		155		

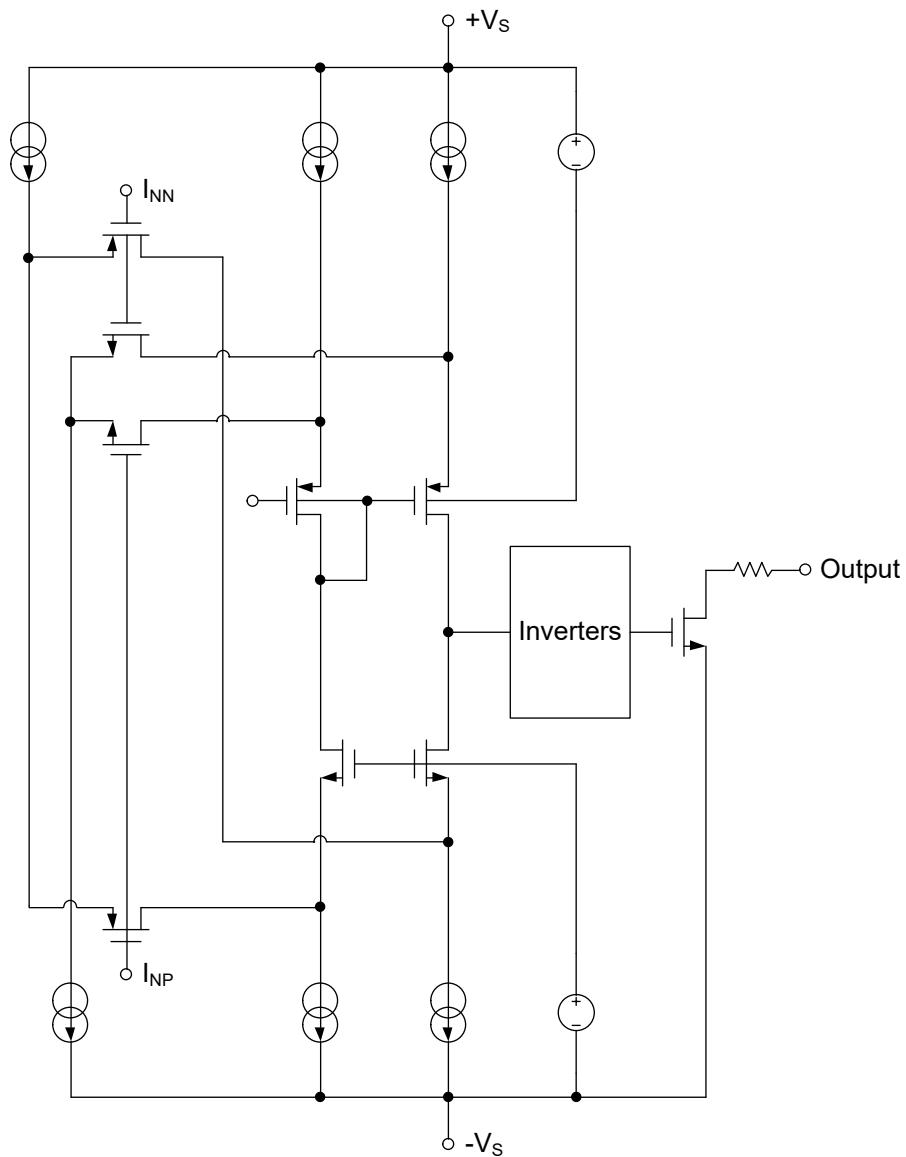
**ELECTRICAL CHARACTERISTICS (continued)**(At  $T_A = +25^\circ\text{C}$ ,  $+V_S = 2.5\text{V}$ ,  $-V_S = 0\text{V}$ ,  $V_{CM} = +V_S/2$ ,  $V_{OUT} = -V_S$  and  $R_L = 20\text{k}\Omega$  connected to  $+V_S$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current	$I_S$	$V_{CM} = 0.3\text{V}$		330		nA
		$V_{CM} = 2.2\text{V}$		275		
Input Offset Voltage	$V_{OS}$	$V_{CM} = 0\text{V}$		0.6		mV
		$V_{CM} = 2.5\text{V}$		0.4		
Input Offset Average Drift				2		$\mu\text{V}/^\circ\text{C}$
Common Mode Rejection Ratio	CMRR	$V_{CM}$ stepped from $0\text{V}$ to $1.4\text{V}$		69		dB
		$V_{CM}$ stepped from $1.9\text{V}$ to $2.5\text{V}$		68		
		$V_{CM}$ stepped from $0\text{V}$ to $2.5\text{V}$		72		
Power Supply Rejection Ratio	PSRR	$V_S = 1.8\text{V}$ to $5.5\text{V}$ , $V_{CM} = 0\text{V}$		87		dB
Open-Loop Voltage Gain	$A_{OL}$			80		dB
Output Voltage Swing from Rail	$V_{OL}$	$I_{OUT} = 500\mu\text{A}$		66		mV
		$I_{OUT} = 1\text{mA}$		131		
Output Current	$I_{OUT}$	Sink		7.1		mA
Leakage Current	$I_{LEAKAGE}$	$V_{OUT} = +V_S$		2		nA
Propagation Delay (High to Low)		Overdrive = $10\text{mV}$		11		$\mu\text{s}$
		Overdrive = $100\text{mV}$		5		
Fall Time	$t_{FALL}$	Overdrive = $10\text{mV}$ , $C_L = 30\text{pF}$ , $R_L = 1\text{M}\Omega$		64		ns
		Overdrive = $100\text{mV}$ , $C_L = 30\text{pF}$ , $R_L = 1\text{M}\Omega$		48		

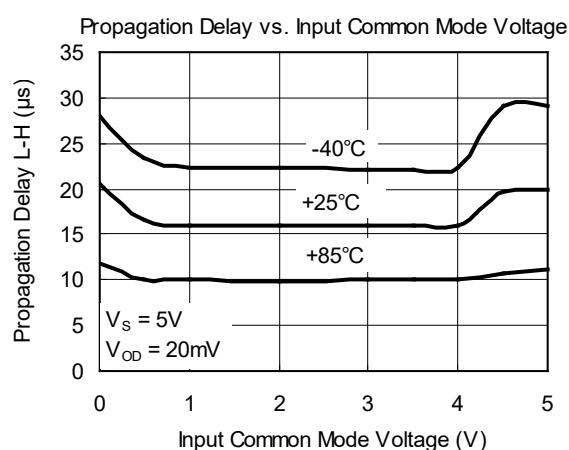
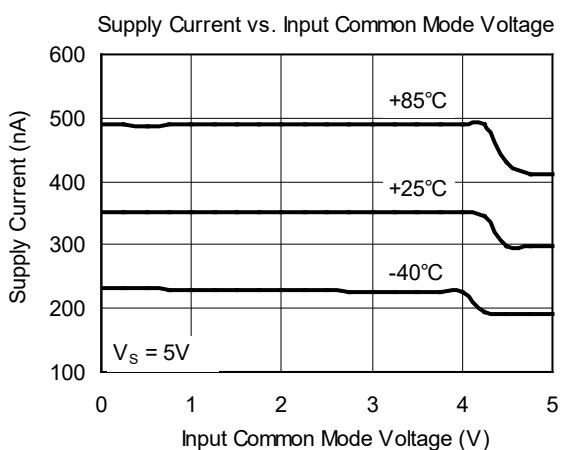
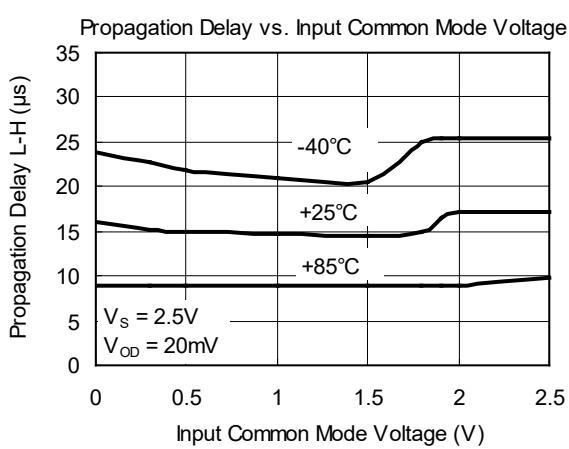
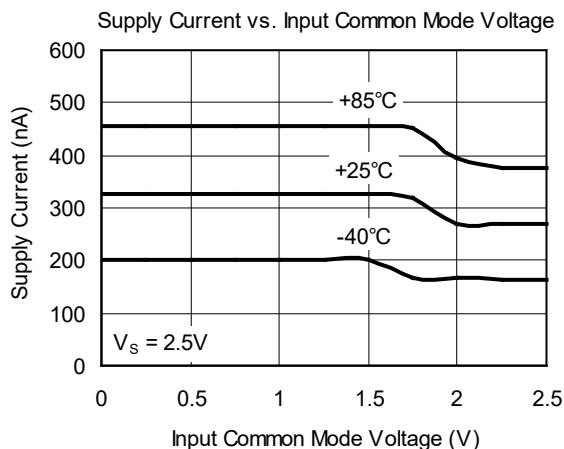
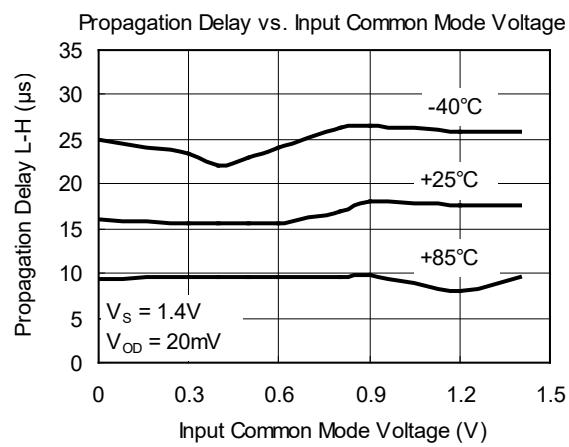
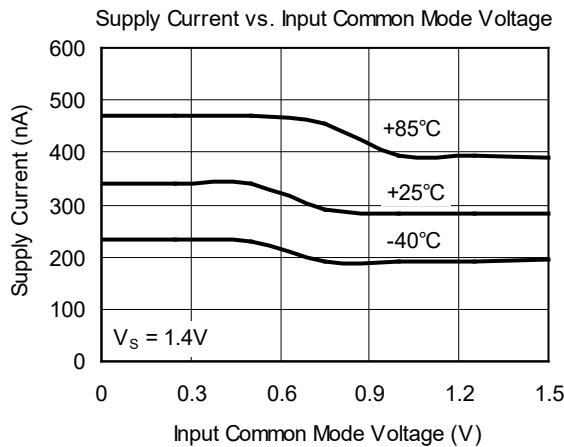
**ELECTRICAL CHARACTERISTICS (continued)**(At  $T_A = +25^\circ\text{C}$ ,  $+V_S = 5.0\text{V}$ ,  $-V_S = 0\text{V}$ ,  $V_{CM} = +V_S/2$ ,  $V_{OUT} = -V_S$  and  $R_L = 20\text{k}\Omega$  connected to  $+V_S$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current	$I_S$	$V_{CM} = 0.3\text{V}$		366	2000	nA
		$V_{CM} = 4.7\text{V}$		311	2000	
Input Offset Voltage	$V_{OS}$	$V_{CM} = 0\text{V}$		0.6	3	mV
		$V_{CM} = 5\text{V}$		0.4	3	
Input Offset Average Drift				2		$\mu\text{V}/^\circ\text{C}$
Common Mode Rejection Ratio	CMRR	$V_{CM}$ stepped from $0\text{V}$ to $3.9\text{V}$		69		dB
		$V_{CM}$ stepped from $4.4\text{V}$ to $5.0\text{V}$		75		
		$V_{CM}$ stepped from $0\text{V}$ to $5.0\text{V}$		77		
Power Supply Rejection Ratio	PSRR	$V_S = 1.8\text{V}$ to $5.5\text{V}$ , $V_{CM} = 0\text{V}$		87		dB
Open-Loop Voltage Gain	$A_{OL}$			81		dB
Output Voltage Swing from Rail	$V_{OL}$	$I_{OUT} = 500\mu\text{A}$		53	72	mV
		$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$			92	
		$I_{OUT} = 1\text{mA}$		104	124	
		$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$			152	
Output Current	$I_{OUT}$	Sink	15.3	18.7		mA
		$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$	12.1			
Leakage Current	$I_{LEAKAGE}$	$V_{OUT} = +V_S$		5		nA
Propagation Delay (High to Low)		Overdrive = $10\text{mV}$		13		$\mu\text{s}$
		Overdrive = $100\text{mV}$		5		
Fall Time	$t_{FALL}$	Overdrive = $10\text{mV}$ , $C_L = 30\text{pF}$ , $R_L = 1\text{M}\Omega$		40		ns
		Overdrive = $100\text{mV}$ , $C_L = 30\text{pF}$ , $R_L = 1\text{M}\Omega$		36		

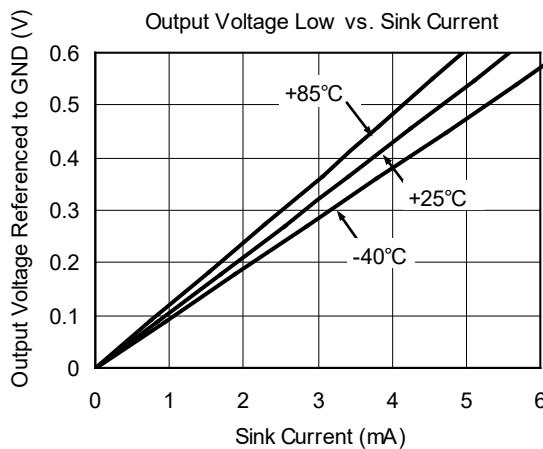
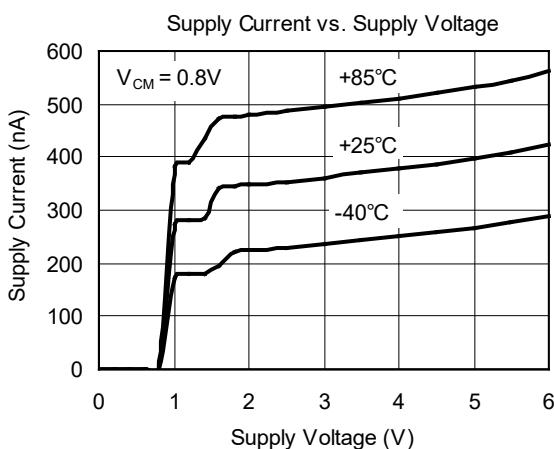
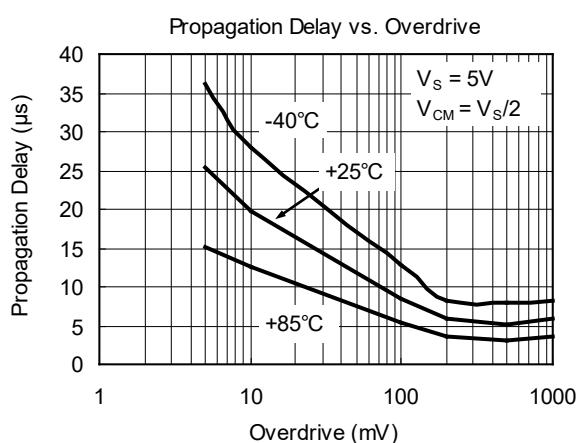
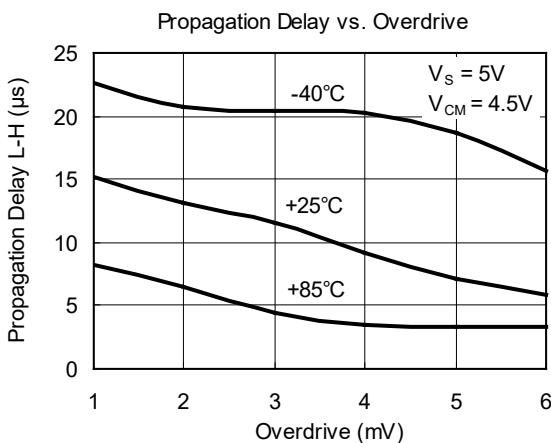
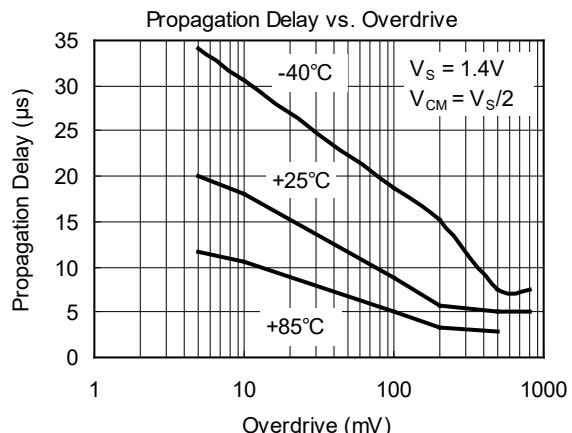
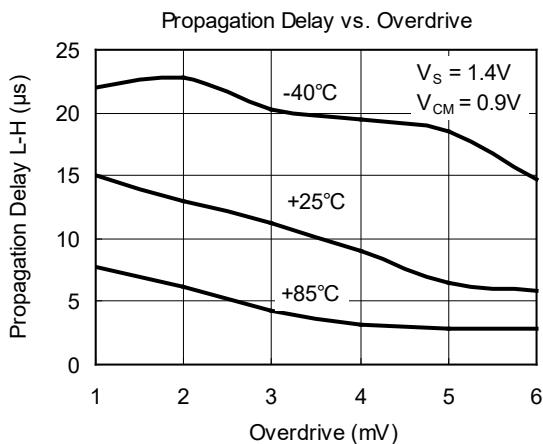
## SIMPLIFIED SCHEMATIC DIAGRAM



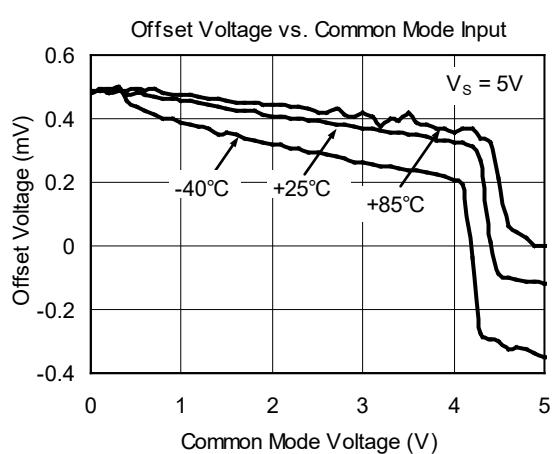
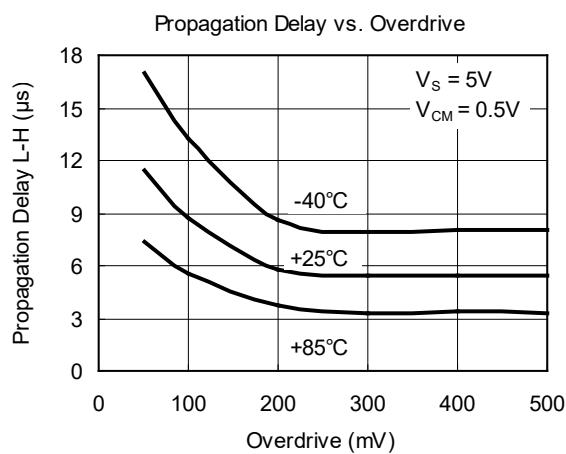
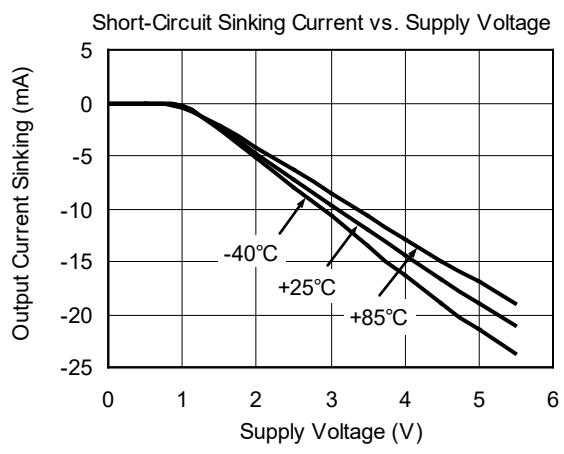
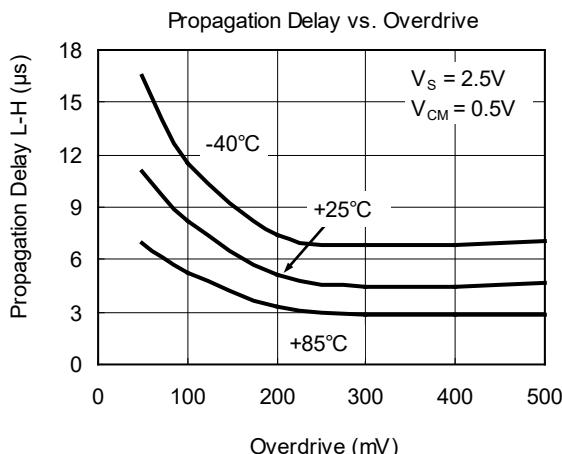
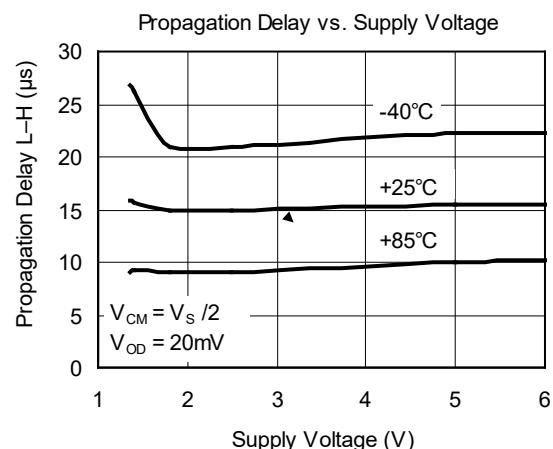
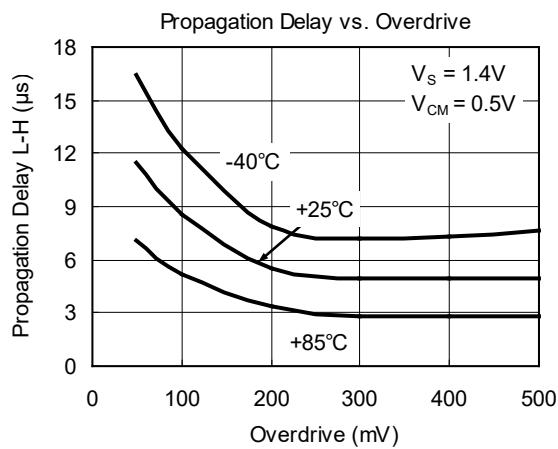
## TYPICAL PERFORMANCE CHARACTERISTICS



## TYPICAL PERFORMANCE CHARACTERISTICS (continued)



## TYPICAL PERFORMANCE CHARACTERISTICS (continued)



**REVISION HISTORY**

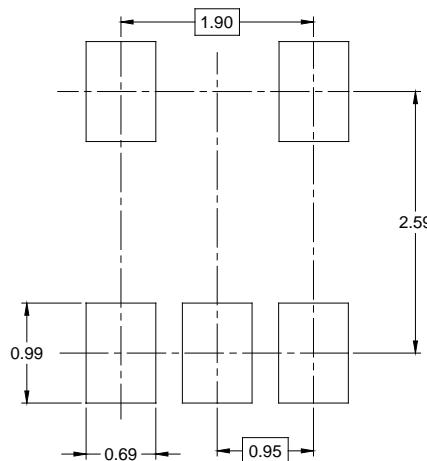
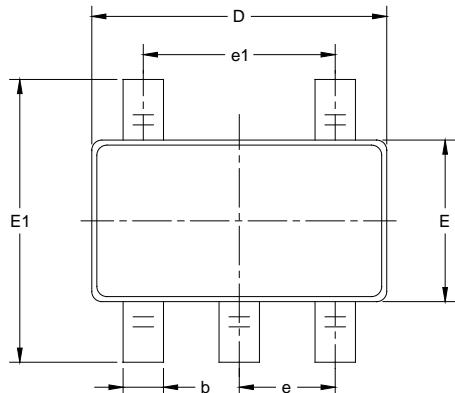
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

	Page
<b>FEBRUARY 2024 – REV.A.2 to REV.A.3</b>	
Updated Package Outline Dimensions section .....	12
<b>NOVEMBER 2013 – REV.A.1 to REV.A.2</b>	
Changed Electrical Characteristics section .....	4
<b>APRIL 2013 – REV.A to REV.A.1</b>	
Added Absolute Maximum Ratings section .....	2
<b>Changes from Original (SEPTEMBER 2012) to REV.A</b>	
Changed from product preview to production data .....	All

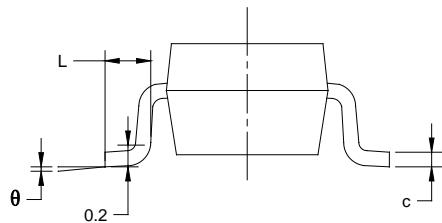
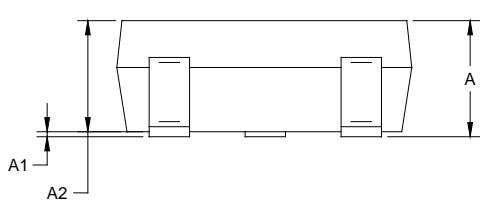
# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

SOT-23-5



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

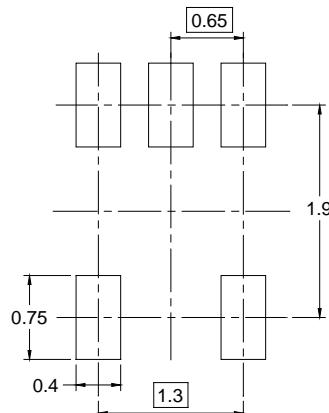
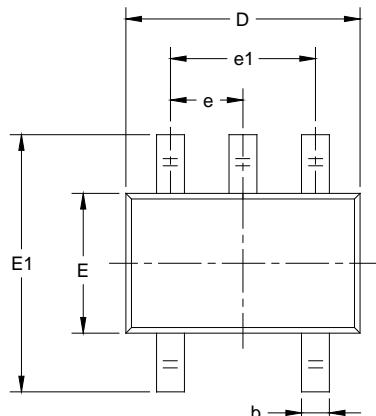
### NOTES:

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

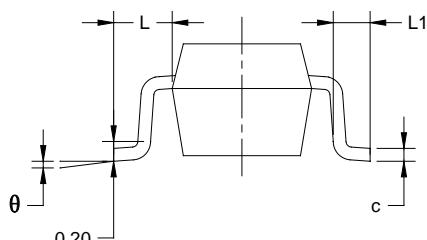
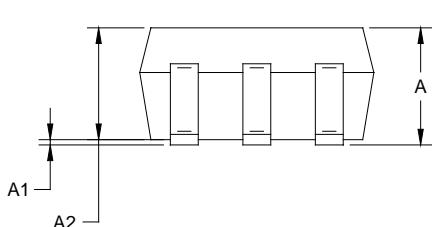
# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

**SC70-5**



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°

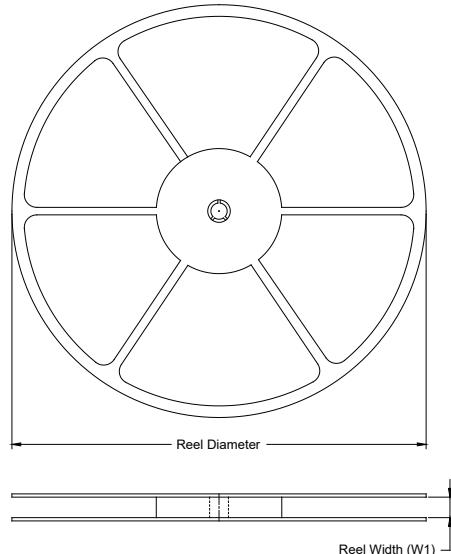
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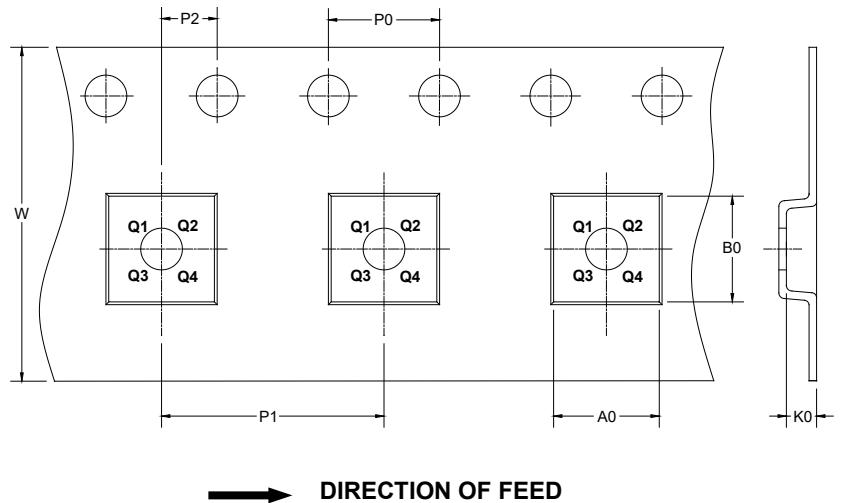
# PACKAGE INFORMATION

## 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
SOT-23-5	7"	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3
SC70-5	7"	9.5	2.40	2.50	1.20	4.0	4.0	2.0	8.0	Q3

## 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

D0002