



SGM8704

1.4V, Micro-Power, Rail-to-Rail I/O, CMOS Input, Push-Pull Output Comparator

GENERAL DESCRIPTION

The SGM8704 is an ultra-low power comparator, which consumes only 300nA (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 SGM8704 a good choice for battery-powered applications.

The SGM8704 has a latch enable input (\overline{LE}). It has complementary outputs and features a push-pull output structure. When driving any resistive or capacitive load, it is capable of consuming the absolute minimum power.

The SGM8704 has a great trade-off between low power and high speed, and the propagation delay is only 6 μ s with 100mV overdrive at 1.4V.

In addition, the SGM8704 fits in small packages, so it is also suitable for mobile phone and handheld electronic devices.

The SGM8704 is available in Green SOIC-8 and MSOP-8 packages. It is rated over the -40°C to +85°C temperature range.

FEATURES

- **Ultra-Low Supply Current:**
300nA (TYP) at $V_S = 1.4V$
- **Supply Voltage Range: 1.4V to 5.5V**
- **Push-Pull Output**
- **Output Drive Capability: 19mA (TYP) at $V_S = 5V$**
- **Rail-to-Rail Input and Output**
- **Propagation Delay: 6 μ s (TYP) at $V_S = 1.4V$**
- **Latch Function Included**
- **-40°C to +85°C Operating Temperature Range**
- **Available in Green SOIC-8 and MSOP-8 Packages**

APPLICATIONS

Infrared Receivers
Window Detectors
RC Timers
Monitoring and Alarm Systems
Multivibrators

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8704	SOIC-8	-40°C to +85°C	SGM8704YS8G/TR	SGM8704YS8 XXXXX	Tape and Reel, 2500
	MSOP-8	-40°C to +85°C	SGM8704YMS8G/TR	SGM8704 YMS8 XXXXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XXXXX = Date Code and Vendor Code.

SOIC-8/MSOP-8

XXXXX



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, +V _S to -V _S	6V
V _{IN} Differential	±2.5V
Voltage at Input/Output Pins	(-V _S) - 0.3V to (+V _S) + 0.3V
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility	
HBM	3000V
MM	300V

RECOMMENDED OPERATING CONDITIONS

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

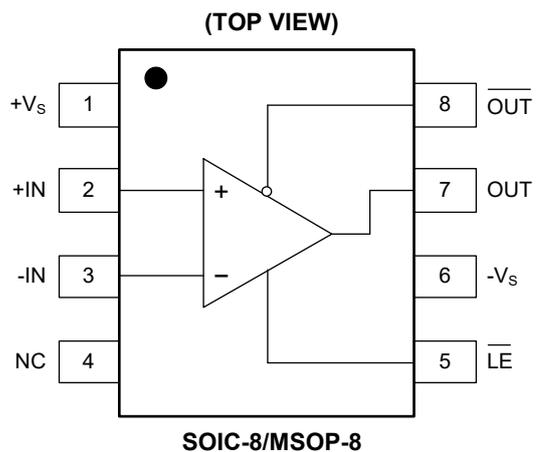
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle

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



ELECTRICAL CHARACTERISTICS

(At $T_A = +25^\circ\text{C}$, $+V_S = 1.4\text{V}$, $-V_S = 0\text{V}$, $V_{\overline{\text{LE}}} = 1.4\text{V}$, $V_{\text{CM}} = +V_S/2$ and $V_{\text{OUT}} = -V_S$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Current	I_S	$V_{\text{CM}} = 0.3\text{V}$			300	1000	nA
		$V_{\text{CM}} = 1.1\text{V}$			250	1000	
Input Offset Voltage	V_{OS}	$V_{\text{CM}} = 0\text{V}$		-3	0.5	3	mV
		$V_{\text{CM}} = 1.4\text{V}$		-3	0.5	3	
Input Offset Average Drift					2		$\mu\text{V}/^\circ\text{C}$
Common Mode Rejection Ratio	CMRR	V_{CM} stepped from 0V to 0.3V			65		dB
		V_{CM} stepped from 0.8V to 1.4V			75		
		V_{CM} stepped from 0V to 1.4V			75		
Power Supply Rejection Ratio	PSRR			66	95		dB
Latch Enable Pin High Input Voltage	V_{IH}			1.0			V
Latch Enable Pin Low Input Voltage	V_{IL}					0.25	V
Latch Enable Pin Bias Current	$I_{\text{IH}}, I_{\text{IL}}$	$V_{\overline{\text{LE}}} = 0\text{V}$ and $V_{\overline{\text{LE}}} = 1.4\text{V}$			3		nA
Large-Signal Voltage Gain	A_{VO}				100		dB
Output Swing High	V_{OH}	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	$V_S = 1.8\text{V}, I_{\text{OUT}} = 500\mu\text{A}$	1.598	1.669		V
			$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$	1.581			
			$V_S = 1.8\text{V}, I_{\text{OUT}} = 1\text{mA}$	1.324	1.508		
			$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$	1.288			
Output Swing Low	V_{OL}	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	$V_S = 1.8\text{V}, I_{\text{OUT}} = -500\mu\text{A}$		82	112	mV
			$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$			127	
			$V_S = 1.8\text{V}, I_{\text{OUT}} = -1\text{mA}$		167	225	
			$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$			253	
Output Current	I_{OUT}	Source	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$		0.7		mA
		Sink	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$		2.0		
Propagation Delay (High to Low)		$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	Overdrive = 10mV		12		μs
			Overdrive = 100mV		6		
Propagation Delay (Low to High)		$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	Overdrive = 10mV		26		μs
			Overdrive = 100mV		17		
Rise Time	t_{RISE}	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	Overdrive = 10mV, $C_L = 30\text{pF}, R_L = 1\text{M}\Omega$		220		ns
			Overdrive = 100mV, $C_L = 30\text{pF}, R_L = 1\text{M}\Omega$		220		
Fall Time	t_{FALL}	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	Overdrive = 10mV, $C_L = 30\text{pF}, R_L = 1\text{M}\Omega$		250		ns
			Overdrive = 100mV, $C_L = 30\text{pF}, R_L = 1\text{M}\Omega$		250		

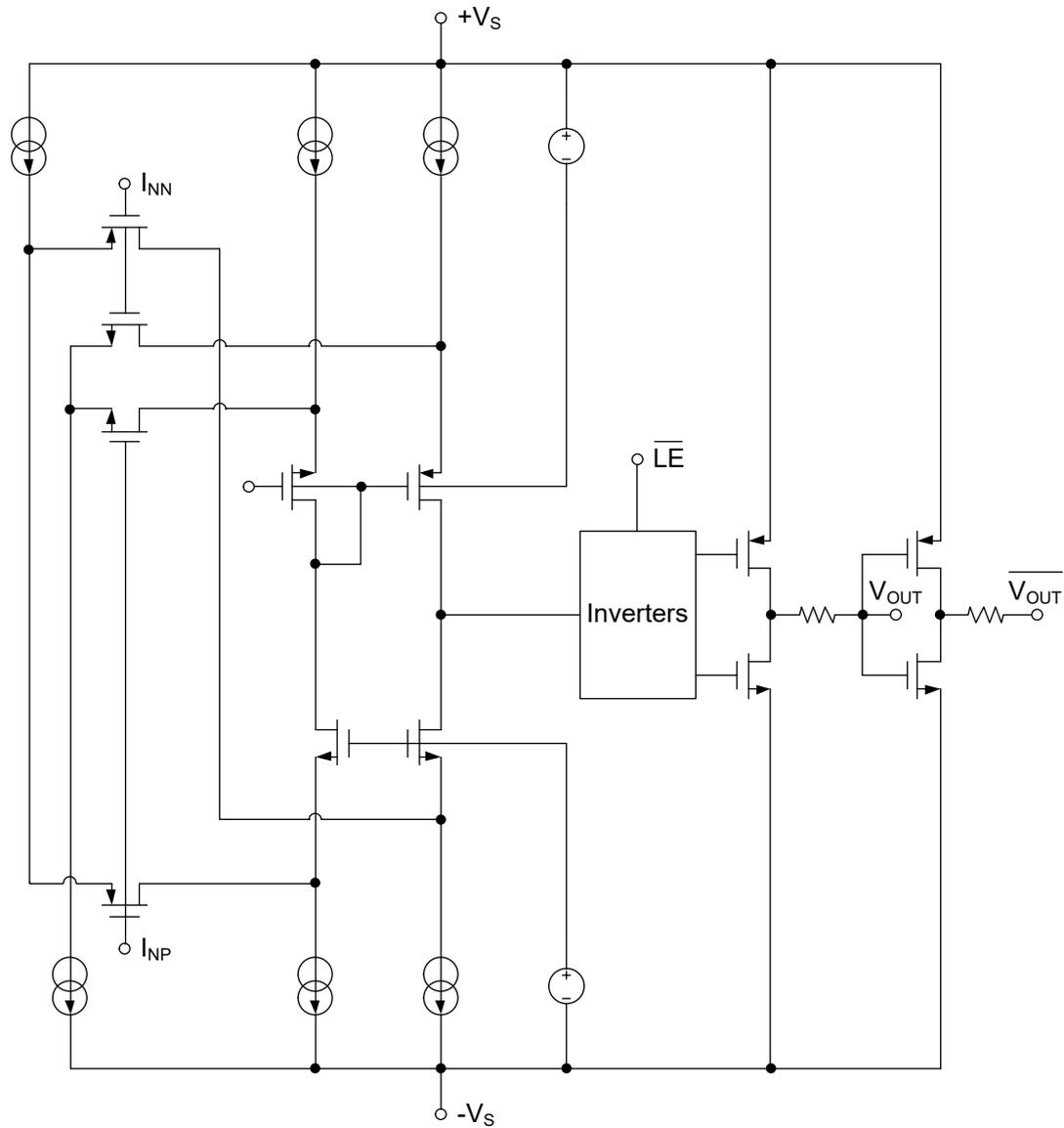
ELECTRICAL CHARACTERISTICS (continued)(At $T_A = +25^\circ\text{C}$, $+V_S = 2.5\text{V}$, $-V_S = 0\text{V}$, $V_{\overline{\text{LE}}} = 2.5\text{V}$, $V_{\text{CM}} = +V_S/2$ and $V_{\text{OUT}} = -V_S$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Current	I_S	$V_{\text{CM}} = 0.3\text{V}$			310		nA
		$V_{\text{CM}} = 2.2\text{V}$			260		
Input Offset Voltage	V_{OS}	$V_{\text{CM}} = 0\text{V}$			0.5		mV
		$V_{\text{CM}} = 2.5\text{V}$			0.5		
Input Offset Average Drift		$V_{\text{CM}} = 0\text{V}$			2		$\mu\text{V}/^\circ\text{C}$
Common Mode Rejection Ratio	CMRR	V_{CM} stepped from 0V to 1.4V			75		dB
		V_{CM} stepped from 1.9V to 2.5V			80		
		V_{CM} stepped from 0V to 2.5V			80		
Power Supply Rejection Ratio	PSRR				95		dB
Latch Enable Pin High Input Voltage	V_{IH}			1.2			V
Latch Enable Pin Low Input Voltage	V_{IL}					0.4	V
Latch Enable Pin Bias Current	$I_{\text{IH}}, I_{\text{IL}}$	$V_{\overline{\text{LE}}} = 0\text{V}$ and $V_{\overline{\text{LE}}} = 2.5\text{V}$			15		nA
Large-Signal Voltage Gain	A_{VO}				100		dB
Output Swing High	V_{OH}	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	$I_{\text{OUT}} = 500\mu\text{A}$		2.419		V
			$I_{\text{OUT}} = 1\text{mA}$		2.333		
Output Swing Low	V_{OL}	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	$I_{\text{OUT}} = -500\mu\text{A}$		66		mV
			$I_{\text{OUT}} = -1\text{mA}$		133		
Output Current	I_{OUT}	Source	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$		5.3		mA
		Sink	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$		7.7		
Propagation Delay (High to Low)		$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	Overdrive = 10mV		12		μs
			Overdrive = 100mV		5		
Propagation Delay (Low to High)		$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	Overdrive = 10mV		28		μs
			Overdrive = 100mV		19		
Rise Time	t_{RISE}	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	Overdrive = 10mV, $C_L = 30\text{pF}$, $R_L = 1\text{M}\Omega$		120		ns
			Overdrive = 100mV, $C_L = 30\text{pF}$, $R_L = 1\text{M}\Omega$		120		
Fall Time	t_{FALL}	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	Overdrive = 10mV, $C_L = 30\text{pF}$, $R_L = 1\text{M}\Omega$		75		ns
			Overdrive = 100mV, $C_L = 30\text{pF}$, $R_L = 1\text{M}\Omega$		75		

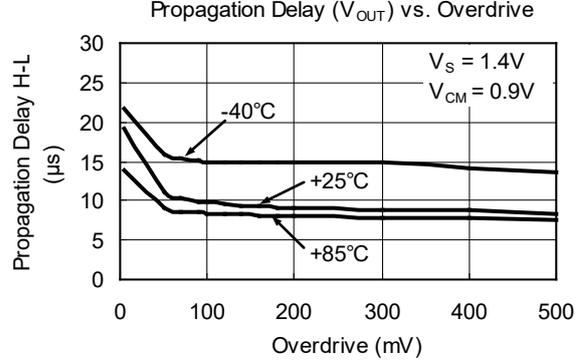
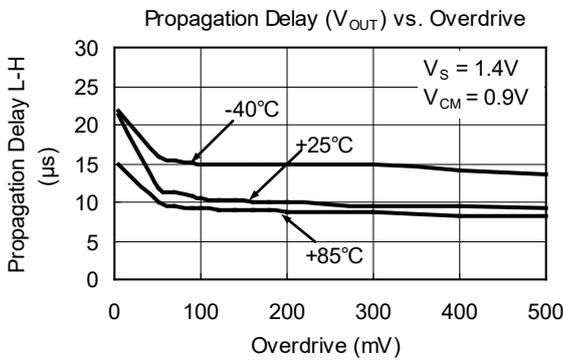
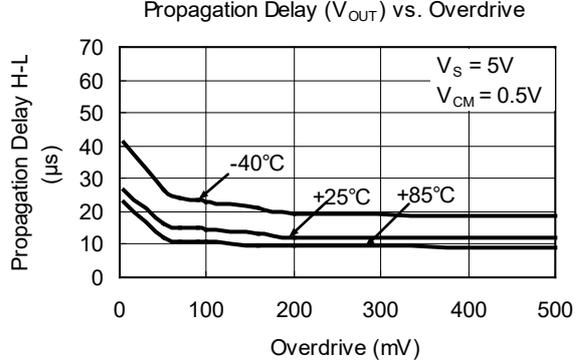
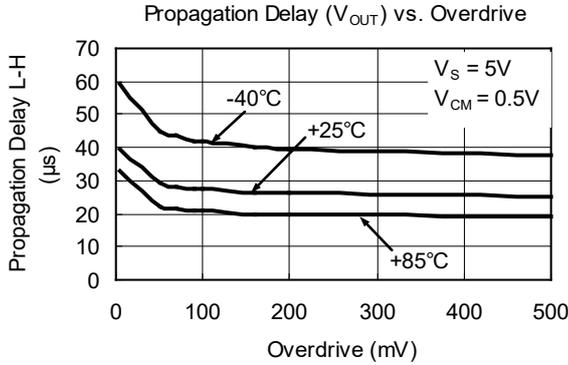
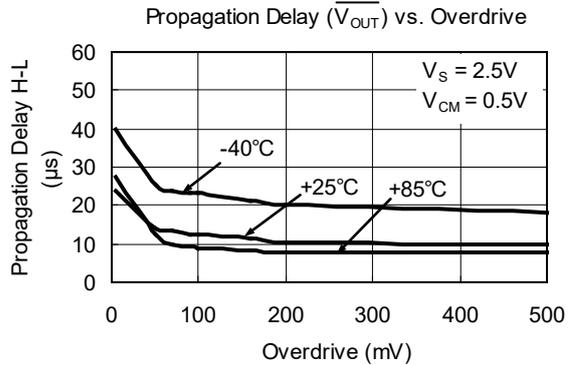
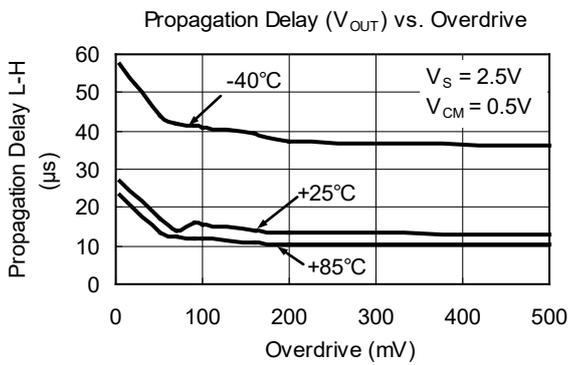
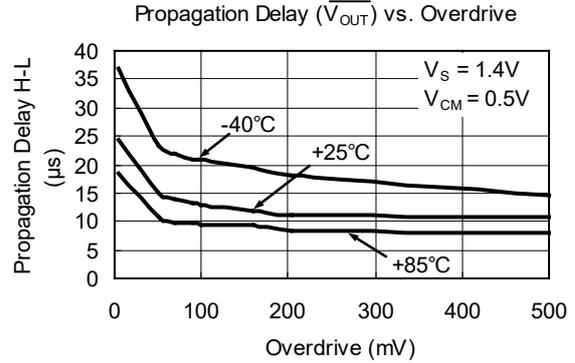
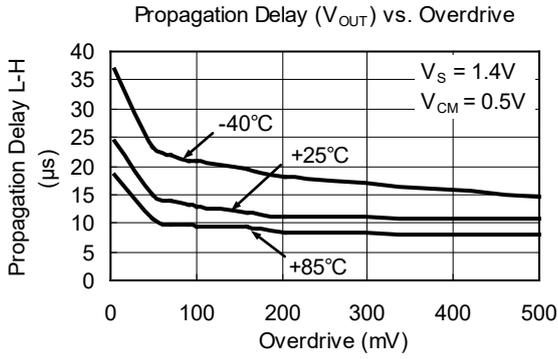
ELECTRICAL CHARACTERISTICS (continued)(At $T_A = +25^\circ\text{C}$, $+V_S = 5\text{V}$, $-V_S = 0\text{V}$, $V_{\overline{\text{LE}}} = 5\text{V}$, $V_{\text{CM}} = +V_S/2$ and $V_{\text{OUT}} = -V_S$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Current	I_S	$V_{\text{CM}} = 0.3\text{V}$			350	2000	nA
		$V_{\text{CM}} = 4.7\text{V}$			300	2000	
Input Offset Voltage	V_{OS}	$V_{\text{CM}} = 0\text{V}$		-3	0.5	3	mV
		$V_{\text{CM}} = 5\text{V}$		-3	0.5	3	
Input Offset Average Drift		$V_{\text{CM}} = 0\text{V}$			2		$\mu\text{V}/^\circ\text{C}$
Common Mode Rejection Ratio	CMRR	V_{CM} stepped from 0V to 3.9V			85		dB
		V_{CM} stepped from 4.4V to 5V			85		
		V_{CM} stepped from 0V to 5V			85		
Power Supply Rejection Ratio	PSRR			66	95		dB
Latch Enable Pin High Input Voltage	V_{IH}			2.0			V
Latch Enable Pin Low Input Voltage	V_{IL}					0.8	V
Latch Enable Pin Bias Current	$I_{\text{IH}}, I_{\text{IL}}$	$V_{\overline{\text{LE}}} = 0\text{V}$ and $V_{\overline{\text{LE}}} = 5\text{V}$			60		nA
Latch Propagation Delay	t_{LPD}	$V_S = 3\text{V}$			90		ns
Large-Signal Voltage Gain	A_{VO}				105		dB
Output Swing High	V_{OH}	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	$I_{\text{OUT}} = 500\mu\text{A}$	4.923	4.952		V
			$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$	4.916			
			$I_{\text{OUT}} = 1\text{mA}$	4.864	4.904		
			$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$	4.848			
Output Swing Low	V_{OL}	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	$I_{\text{OUT}} = -500\mu\text{A}$		52	80	mV
			$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$			90	
			$I_{\text{OUT}} = -1\text{mA}$		104	131	
			$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$			143	
Output Current	I_{OUT}	Source	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	14	18		mA
			$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$	12			
		Sink	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	15	19		
			$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$	12.9			
Propagation Delay (High to Low)		$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	Overdrive = 10mV		13		μs
			Overdrive = 100mV		6		
Propagation Delay (Low to High)		$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	Overdrive = 10mV		42		μs
			Overdrive = 100mV		33		
Rise Time	t_{RISE}	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	Overdrive = 10mV, $C_L = 30\text{pF}$, $R_L = 1\text{M}\Omega$		85		ns
			Overdrive = 100mV, $C_L = 30\text{pF}$, $R_L = 1\text{M}\Omega$		85		
Fall Time	t_{FALL}	$V_{\text{OUT}}, \overline{V_{\text{OUT}}}$	Overdrive = 10mV, $C_L = 30\text{pF}$, $R_L = 1\text{M}\Omega$		70		ns
			Overdrive = 100mV, $C_L = 30\text{pF}$, $R_L = 1\text{M}\Omega$		60		

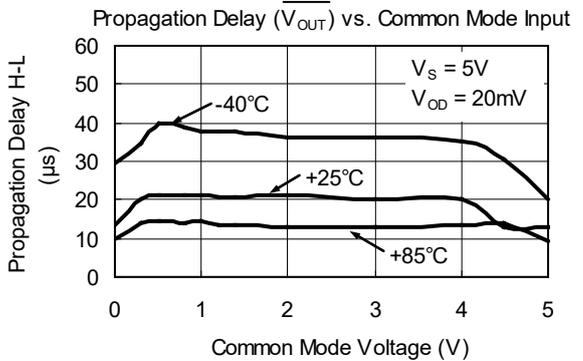
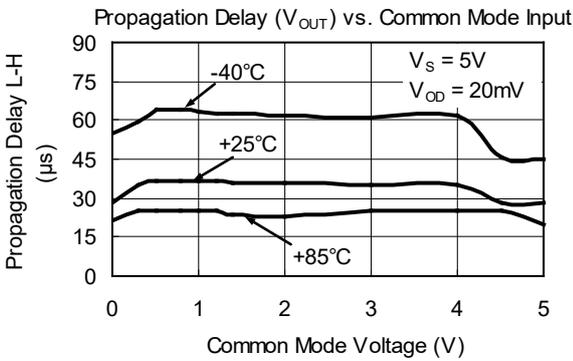
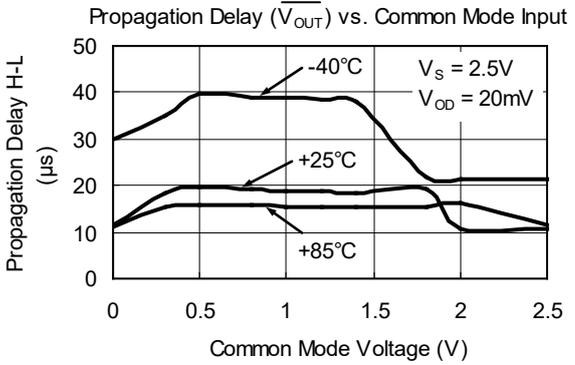
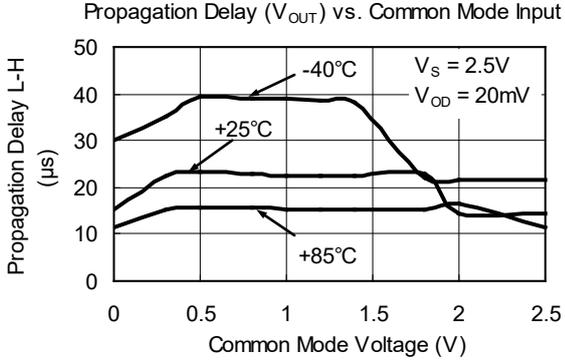
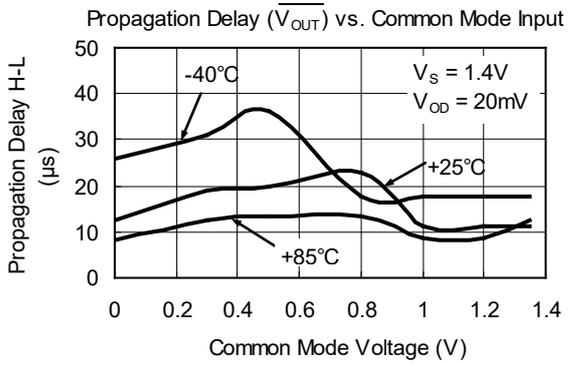
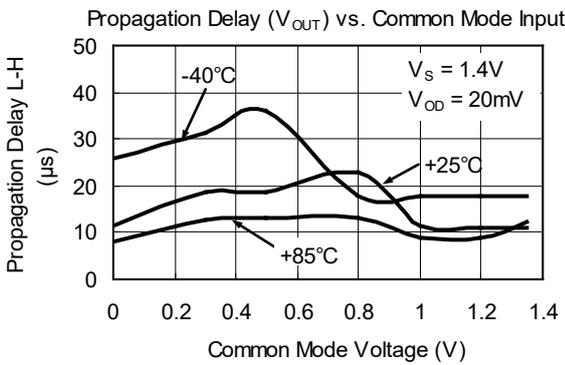
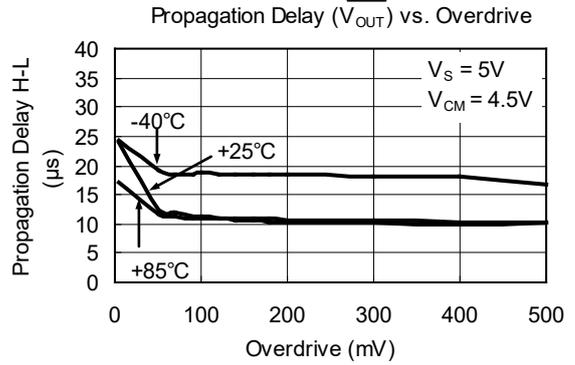
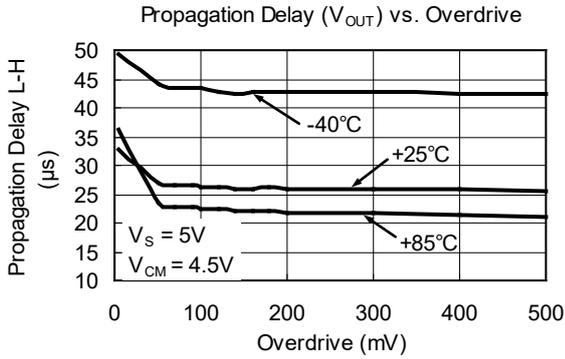
SIMPLIFIED SCHEMATIC DIAGRAM



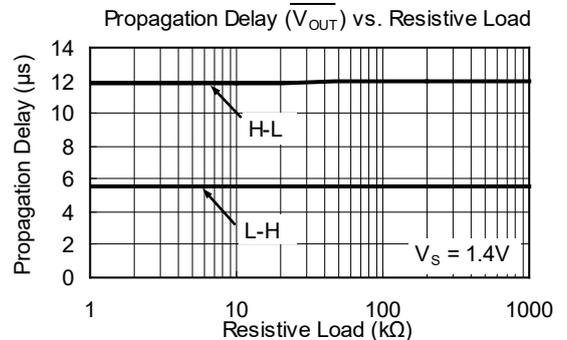
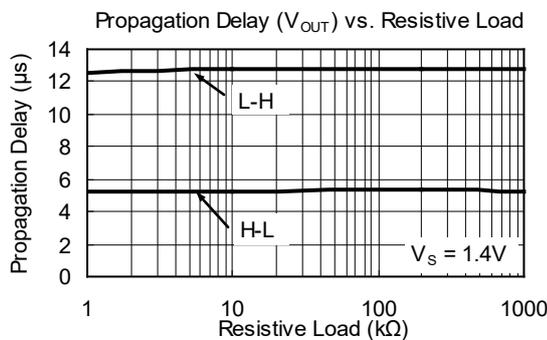
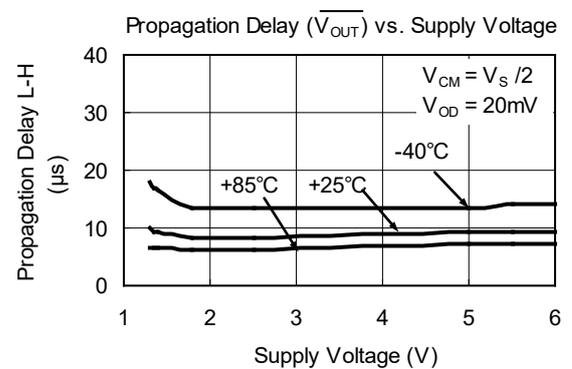
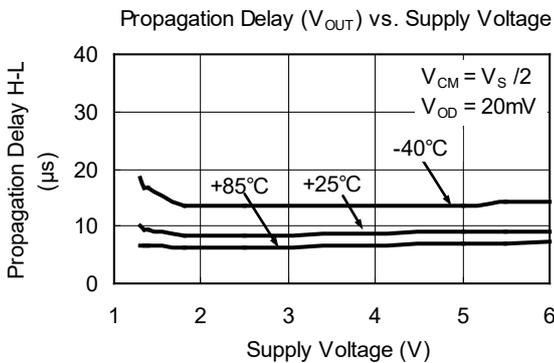
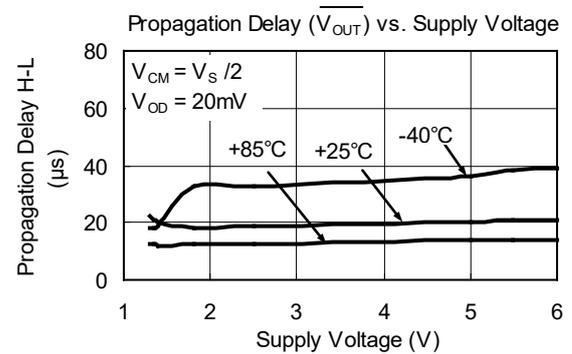
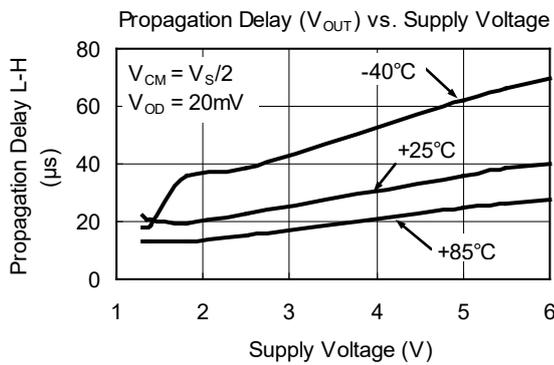
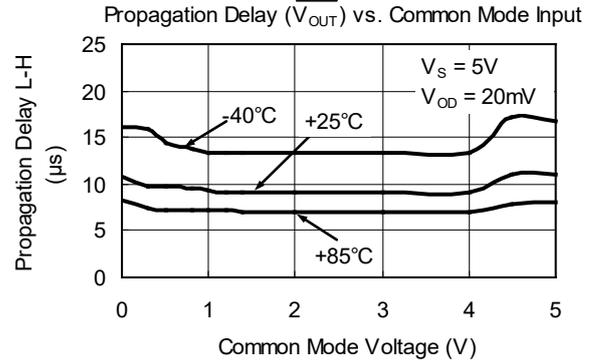
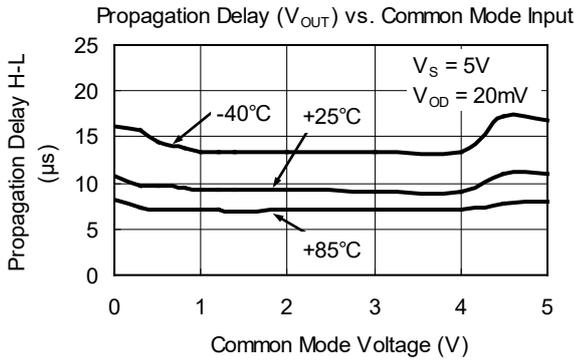
TYPICAL PERFORMANCE CHARACTERISTICS



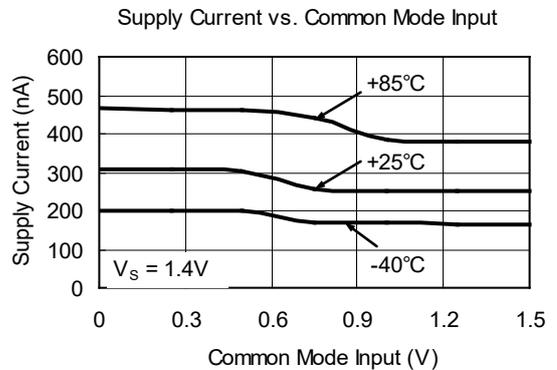
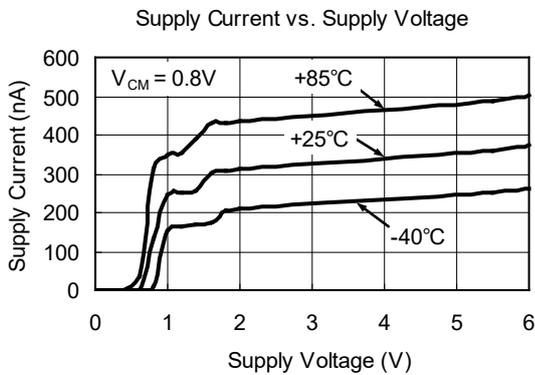
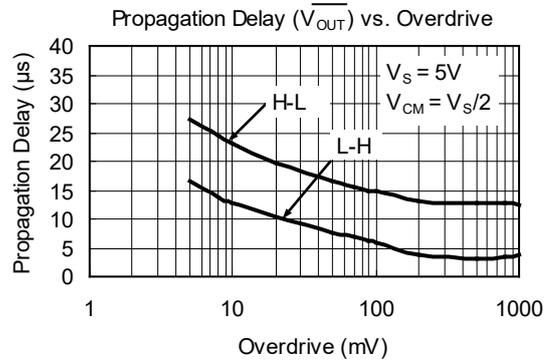
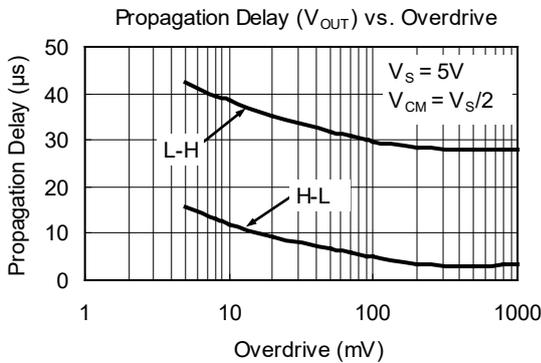
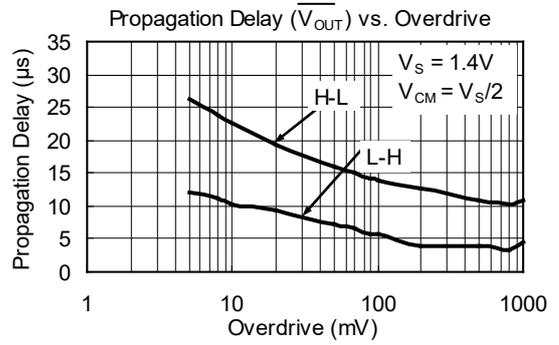
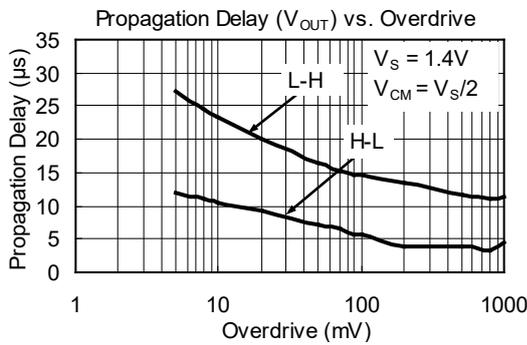
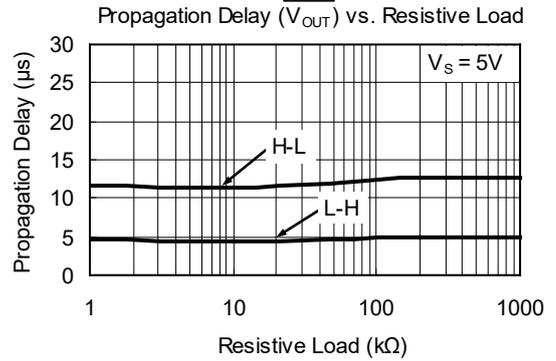
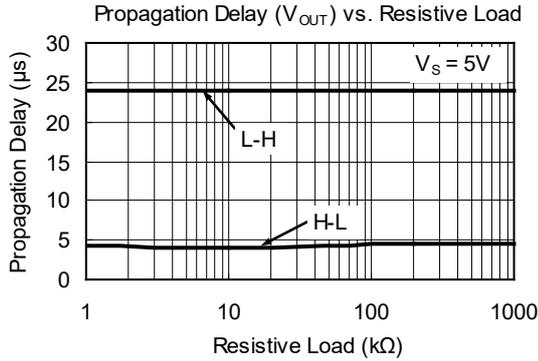
TYPICAL PERFORMANCE CHARACTERISTICS (continued)



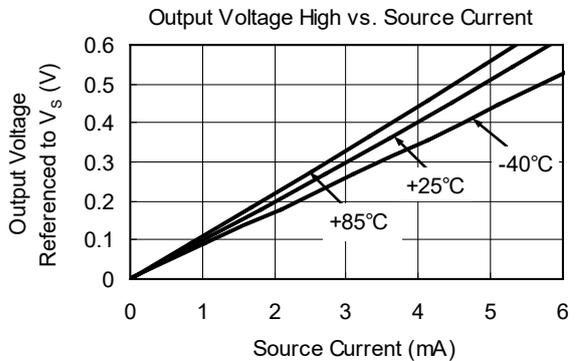
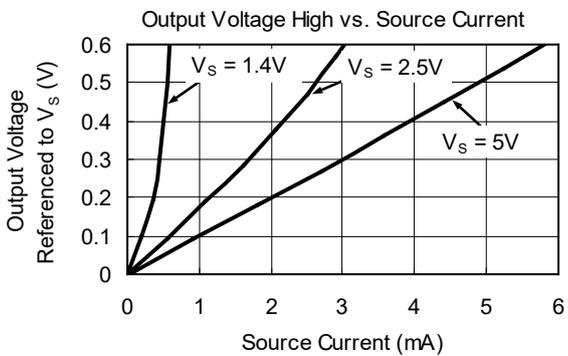
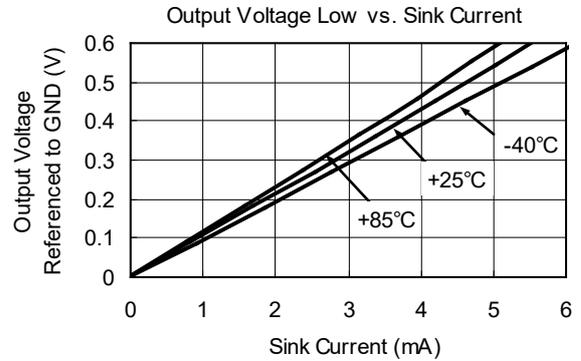
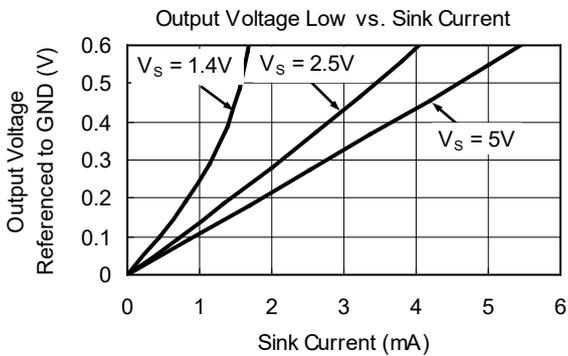
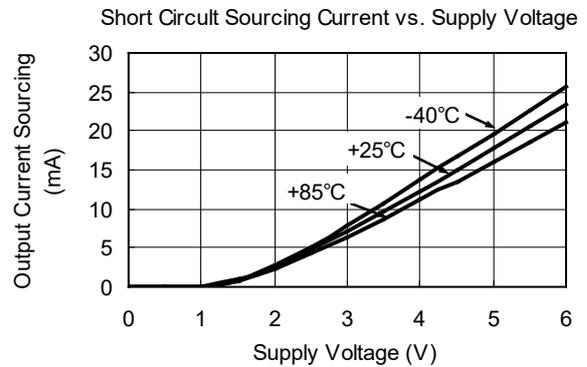
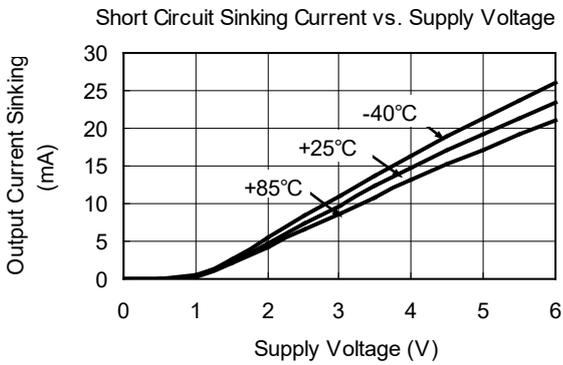
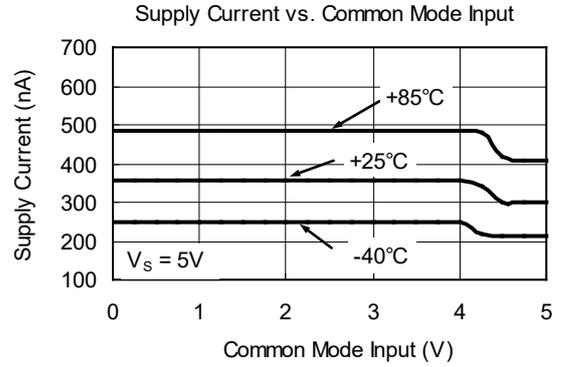
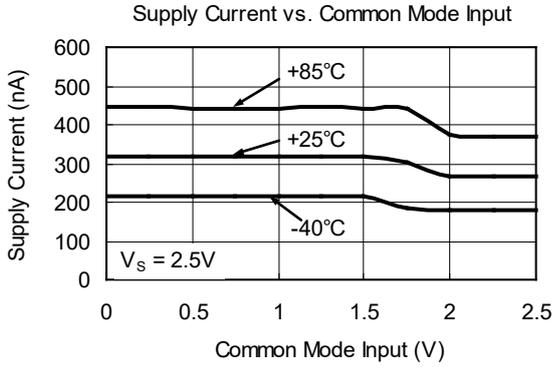
TYPICAL PERFORMANCE CHARACTERISTICS (continued)



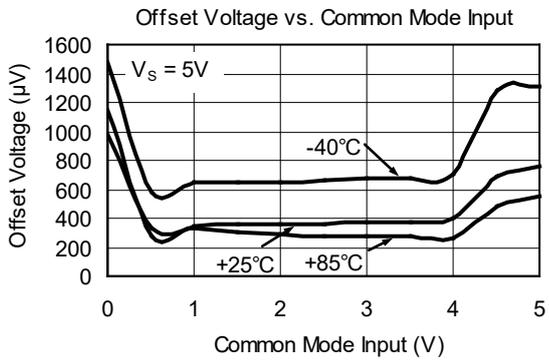
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TYPICAL PERFORMANCE CHARACTERISTICS (continued)



TYPICAL PERFORMANCE CHARACTERISTICS (continued)



TIMING DIAGRAM

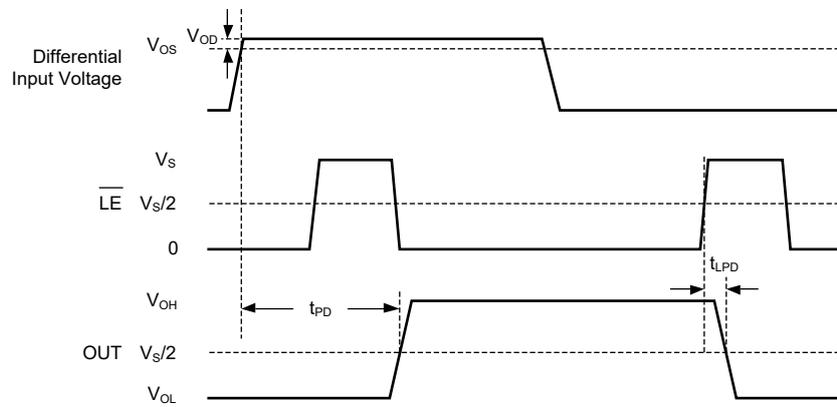


Figure 1. Timing Diagram with Latch Enable Input

REVISION HISTORY

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

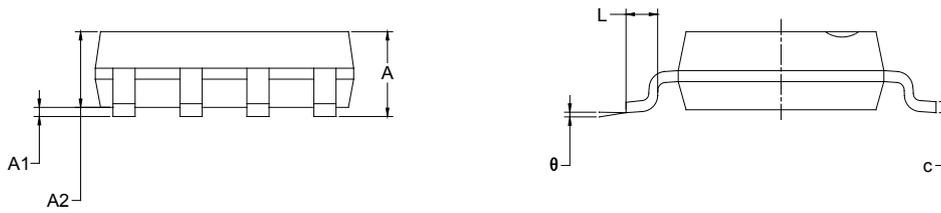
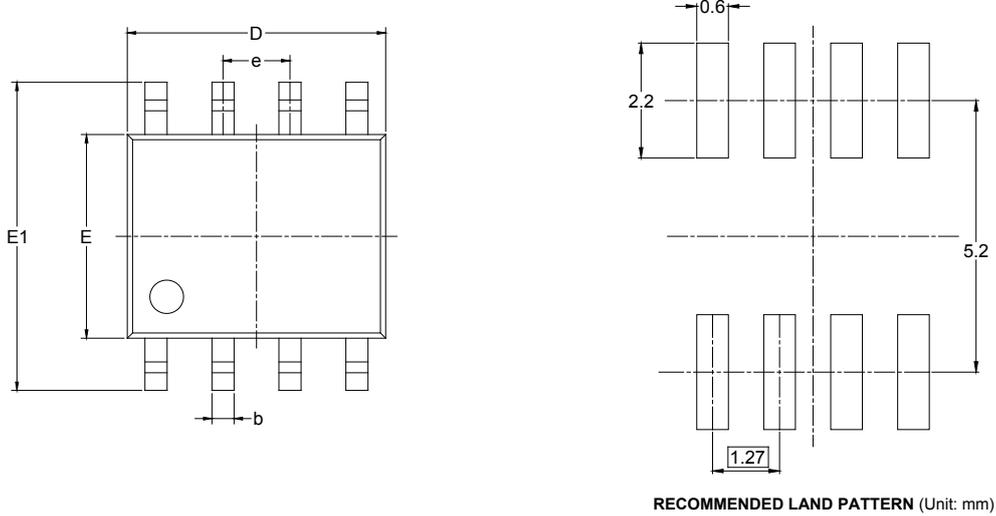
DECEMBER 2013 – REV.A.1 to REV.A.2	Page
Changed Electrical Characteristics section.....	4
Added Electrical Characteristics section.....	5
Added Timing Diagram section	13

JUANUARY 2013 – REV.A to REV.A.1	Page
Added Tape and Reel Information section.....	15, 16

Changes from Original (DECEMBER 2011) to REV.A	Page
Changed from product preview to production data.....	All

PACKAGE OUTLINE DIMENSIONS

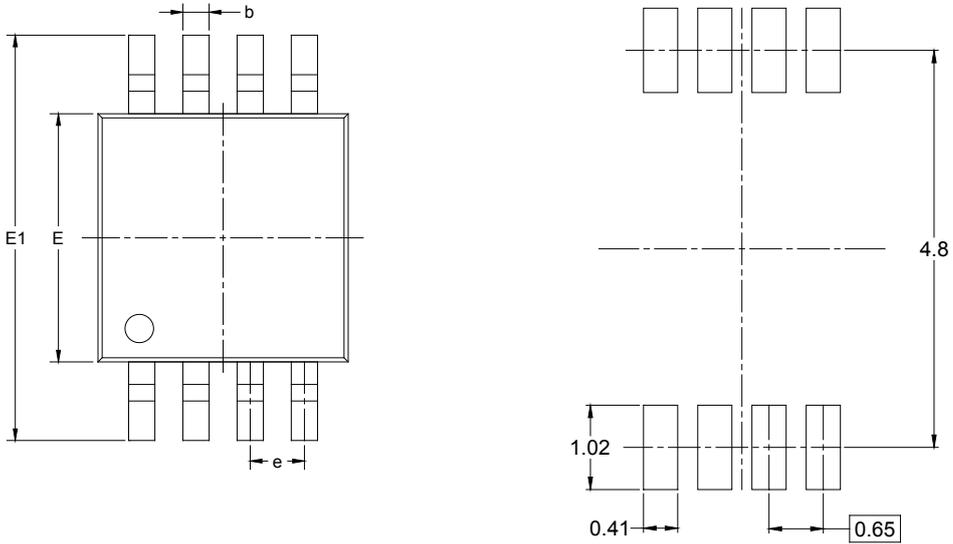
SOIC-8



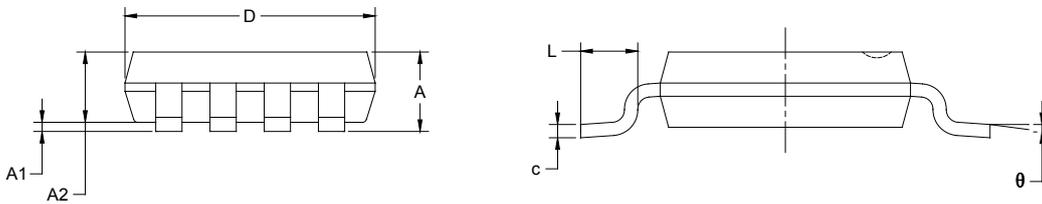
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

PACKAGE OUTLINE DIMENSIONS

MSOP-8



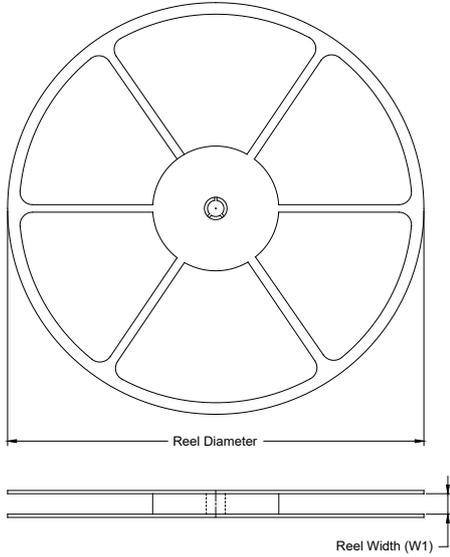
RECOMMENDED LAND PATTERN (Unit: mm)



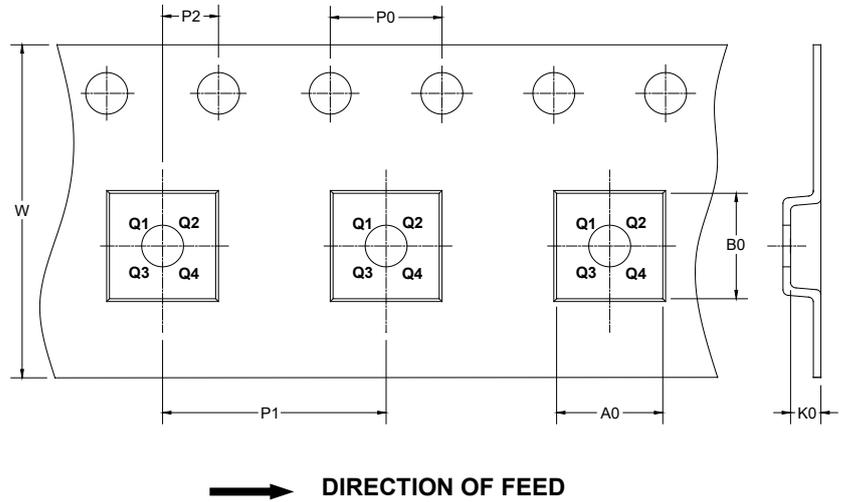
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

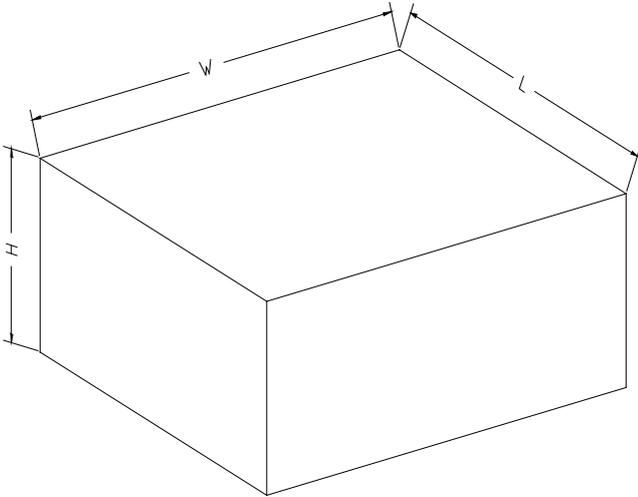
KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOIC-8	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
MSOP-8	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1

DD0001

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
13"	386	280	370	5

DD0002