SGM8704
Micro-Power, CMOS Input, RRIO, 1.4V, Push-Pull Output Comparator

GENERAL DESCRIPTION

The SGM8704 is a single, rail-to-rail input CMOS comparator with typical 300nA ultra-low power supply current. The comparator operates from a wide range of 1.4V to 5.5V supply voltage, and is guaranteed to operate at 1.4V, 2.5V and 5.0V. This feature is suitable for battery-powered applications.

The SGM8704 is optimized for micro-power, single-supply operation. The push-pull output stage supports rail-to-rail output swing and allows the operation with absolute minimum power consumption when driving any capacitive or resistive load. The SGM8704 also has a latch enable input pin ($\overline{LE}$) and complementary outputs.

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 Quiescent Current:**
  300nA (TYP) at V_S = 1.4V
- **V_{OUT} and $\overline{V_{OUT}}$ Dual Outputs**
- **Wide Single-Supply Voltage Range: 1.4V to 5.5V**
- **Typical 6μs Propagation Delay at V_S = 1.4V**
- **Latch Function Included**
- **Rail-to-Rail Input and Output**
- **Push-Pull Output Current Drive:**
  19mA (TYP) at V_S = 5V
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in Green SOIC-8 and MSOP-8 Packages**

APPLICATIONS

Portable and Battery-Powered Applications
Alarm and Surveillance Circuits
Mobile Phones
RC Timers
Hand-Held Electronics
Window Detectors
IR Receiver

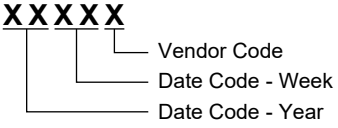
PACKAGE/ORDERING INFORMATION

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

MARKING INFORMATION

NOTE: XXXXX = Date Code and Vendor Code.

SOIC-8/MSOP-8



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℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 3000V
MM 300V

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range ..... -40℃ to +85℃

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

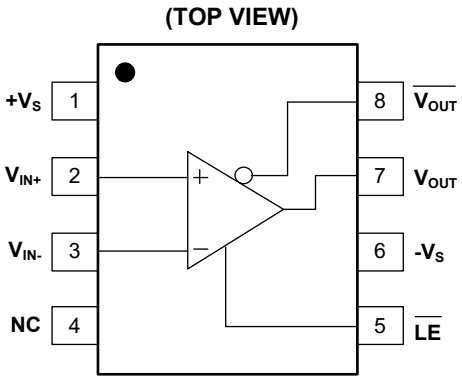
This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATIONS

(TOP VIEW)



SOIC-8/MSOP-8

ELECTRICAL CHARACTERISTICS

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

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Current	I_S	V_{CM} = 0.3V			300	1000	nA
		V_{CM} = 1.1V			250	1000	
Input Offset Voltage	V_{OS}	V_{CM} = 0V		-3	0.5	3	mV
		V_{CM} = 1.4V		-3	0.5	3	
Input Offset Average Drift					2		μV/℃
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_{IH}, I_{IL}	$V_{\overline{LE}}$ = 0V and $V_{\overline{LE}}$ = 1.4V			3		nA
Large Signal Voltage Gain	A_{VO}				100		dB
Output Swing High	V_{OH}	V_{OUT}, $\overline{V_{OUT}}$	V_S = 1.8V, I_{OUT} = 500μA	1.598	1.669		V
			-40℃ ≤ T_A ≤ +85℃	1.581			
			V_S = 1.8V, I_{OUT} = 1mA	1.324	1.508		
			-40℃ ≤ T_A ≤ +85℃	1.288			
Output Swing Low	V_{OL}	V_{OUT}, $\overline{V_{OUT}}$	V_S = 1.8V, I_{OUT} = -500μA		82	112	mV
			-40℃ ≤ T_A ≤ +85℃			127	
			V_S = 1.8V, I_{OUT} = -1mA		167	225	
			-40℃ ≤ T_A ≤ +85℃			253	
Output Current	I_{OUT}	Source	V_{OUT}, $\overline{V_{OUT}}$		0.7		mA
		Sink	V_{OUT}, $\overline{V_{OUT}}$		2.0		
Propagation Delay (High to Low)		V_{OUT}, $\overline{V_{OUT}}$	Overdrive = 10mV		12		μs
			Overdrive = 100mV		6		
Propagation Delay (Low to High)		V_{OUT}, $\overline{V_{OUT}}$	Overdrive = 10mV		26		μs
			Overdrive = 100mV		17		
Rise Time	t_{Rise}	V_{OUT}, $\overline{V_{OUT}}$	Overdrive = 10mV, C_L = 30pF, R_L = 1MΩ		220		ns
			Overdrive = 100mV, C_L = 30pF, R_L = 1MΩ		220		
Fall Time	t_{Fall}	V_{OUT}, $\overline{V_{OUT}}$	Overdrive = 10mV, C_L = 30pF, R_L = 1MΩ		250		ns
			Overdrive = 100mV, C_L = 30pF, R_L = 1MΩ		250		

ELECTRICAL CHARACTERISTICS (continued)

(At T_A = +25℃, $+V_S$ = 2.5V, $-V_S$ = 0V, $V_{\overline{LE}}$ = 2.5V, V_{CM} = $+V_S$/2 and V_{OUT} = $-V_S$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Current	I_S	V_{CM} = 0.3V			310		nA
		V_{CM} = 2.2V			260		
Input Offset Voltage	V_{OS}	V_{CM} = 0V			0.5		mV
		V_{CM} = 2.5V			0.5		
Input Offset Average Drift		V_{CM} = 0V			2		μV/℃
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_{IH}, I_{IL}	$V_{\overline{LE}}$ = 0V and $V_{\overline{LE}}$ = 2.5V			15		nA
Large Signal Voltage Gain	A_{VO}				100		dB
Output Swing High	V_{OH}	V_{OUT}, $\overline{V_{OUT}}$	I_{OUT} = 500μA		2.419		V
			I_{OUT} = 1mA		2.333		
Output Swing Low	V_{OL}	V_{OUT}, $\overline{V_{OUT}}$	I_{OUT} = -500μA		66		mV
			I_{OUT} = -1mA		133		
Output Current	I_{OUT}	Source	V_{OUT}, $\overline{V_{OUT}}$		5.3		mA
		Sink	V_{OUT}, $\overline{V_{OUT}}$		7.7		
Propagation Delay (High to Low)		V_{OUT}, $\overline{V_{OUT}}$	Overdrive = 10mV		12		μs
			Overdrive = 100mV		5		
Propagation Delay (Low to High)		V_{OUT}, $\overline{V_{OUT}}$	Overdrive = 10mV		28		μs
			Overdrive = 100mV		19		
Rise Time	t_{Rise}	V_{OUT}, $\overline{V_{OUT}}$	Overdrive = 10mV, C_L = 30pF, R_L = 1MΩ		120		ns
			Overdrive = 100mV, C_L = 30pF, R_L = 1MΩ		120		
Fall Time	t_{Fall}	V_{OUT}, $\overline{V_{OUT}}$	Overdrive = 10mV, C_L = 30pF, R_L = 1MΩ		75		ns
			Overdrive = 100mV, C_L = 30pF, R_L = 1MΩ		75		

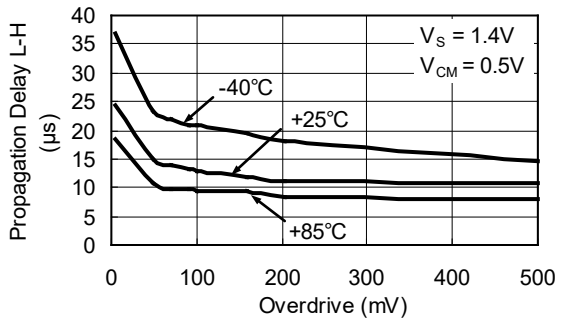
ELECTRICAL CHARACTERISTICS (continued)

(At T_A = +25℃, $+V_S$ = 5V, $-V_S$ = 0V, $V_{\overline{LE}}$ = 5V, V_{CM} = $+V_S$/2 and V_{OUT} = $-V_S$, unless otherwise noted.)

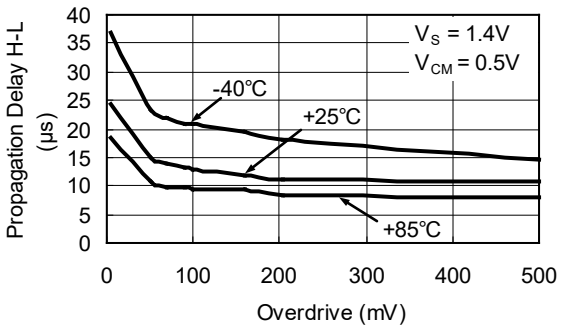
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Current	I_S	V_{CM} = 0.3V			350	2000	nA
		V_{CM} = 4.7V			300	2000	
Input Offset Voltage	V_{OS}	V_{CM} = 0V		-3	0.5	3	mV
		V_{CM} = 5V		-3	0.5	3	
Input Offset Average Drift		V_{CM} = 0V			2		μV/℃
Common Mode Rejection Ratio	CMRR	V_{CM} Stepped from 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_{IH}, I_{IL}	$V_{\overline{LE}}$ = 0V and $V_{\overline{LE}}$ = 5V			60		nA
Latch Propagation Delay	t_{LPD}	V_S = 3V			90		ns
Large Signal Voltage Gain	A_{VO}				105		dB
Output Swing High	V_{OH}	V_{OUT}, $\overline{V_{OUT}}$	I_{OUT} = 500μA	4.923	4.952		V
			-40℃ ≤ T_A ≤ +85℃	4.916			
			I_{OUT} = 1mA	4.864	4.904		
			-40℃ ≤ T_A ≤ +85℃	4.848			
Output Swing Low	V_{OL}	V_{OUT}, $\overline{V_{OUT}}$	I_{OUT} = -500μA		52	80	mV
			-40℃ ≤ T_A ≤ +85℃			90	
			I_{OUT} = -1mA		104	131	
			-40℃ ≤ T_A ≤ +85℃			143	
Output Current	I_{OUT}	Source	V_{OUT}, $\overline{V_{OUT}}$	14	18		mA
			-40℃ ≤ T_A ≤ +85℃	12			
		Sink	V_{OUT}, $\overline{V_{OUT}}$	15	19		
			-40℃ ≤ T_A ≤ +85℃	12.9			
Propagation Delay (High to Low)		V_{OUT}, $\overline{V_{OUT}}$	Overdrive = 10mV		13		μs
			Overdrive = 100mV		6		
Propagation Delay (Low to High)		V_{OUT}, $\overline{V_{OUT}}$	Overdrive = 10mV		42		μs
			Overdrive = 100mV		33		
Rise Time	t_{Rise}	V_{OUT}, $\overline{V_{OUT}}$	Overdrive = 10mV, C_L = 30pF, R_L = 1MΩ		85		ns
			Overdrive = 100mV, C_L = 30pF, R_L = 1MΩ		85		
Fall Time	t_{Fall}	V_{OUT}, $\overline{V_{OUT}}$	Overdrive = 10mV, C_L = 30pF, R_L = 1MΩ		70		ns
			Overdrive = 100mV, C_L = 30pF, R_L = 1MΩ		60		

TYPICAL PERFORMANCE CHARACTERISTICS

Propagation Delay (V_{OUT}) vs. Overdrive



Propagation Delay ($\overline{V_{OUT}}$) vs. Overdrive



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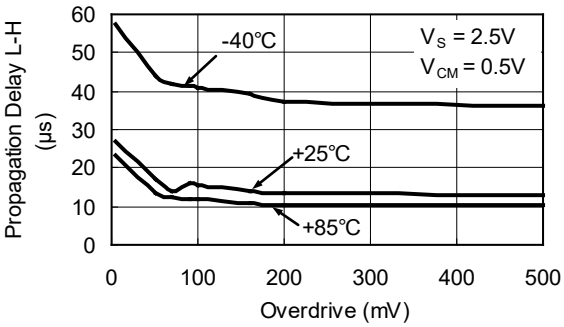
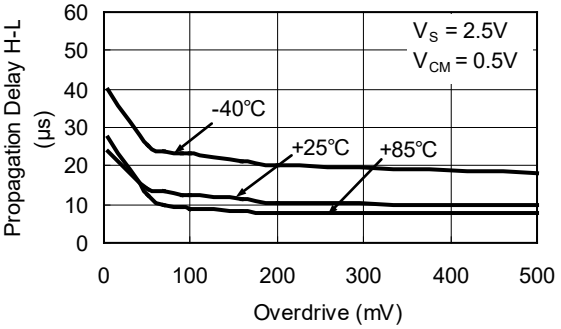
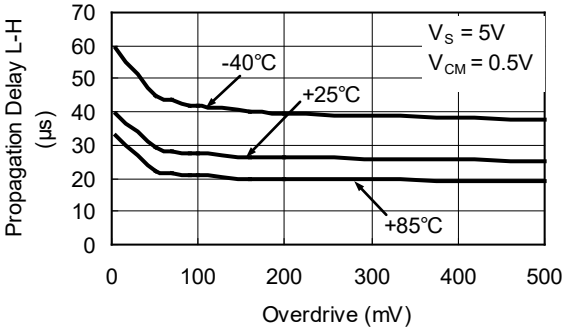


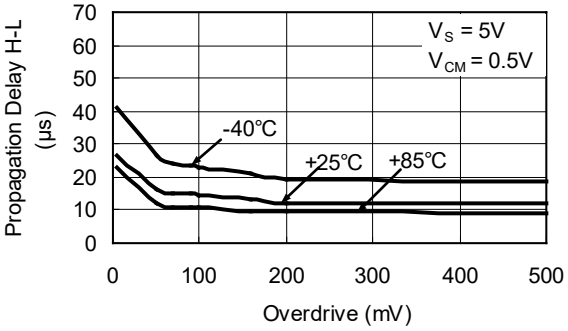
Propagation Delay ($\overline{V_{OUT}}$) vs. Overdrive



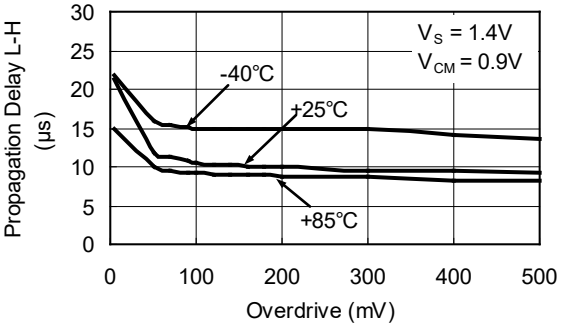
Propagation Delay (V_{OUT}) vs. Overdrive



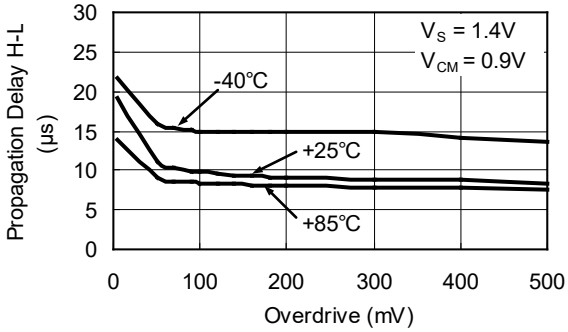
Propagation Delay ($\overline{V_{OUT}}$) vs. Overdrive



Propagation Delay (V_{OUT}) vs. Overdrive

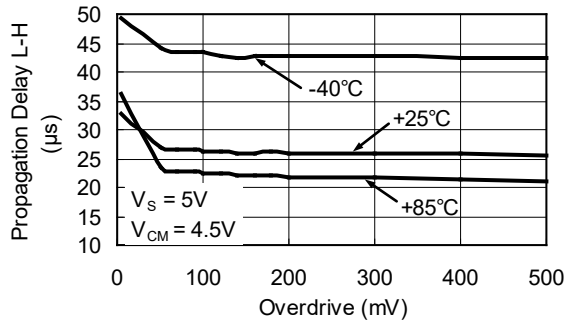


Propagation Delay ($\overline{V_{OUT}}$) vs. Overdrive

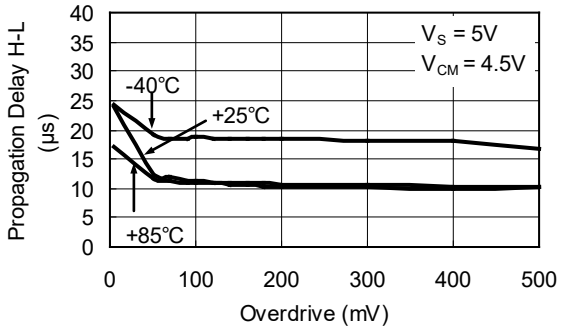


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

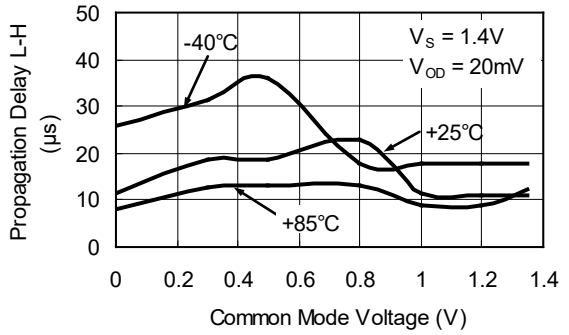
Propagation Delay (V_{OUT}) vs. Overdrive



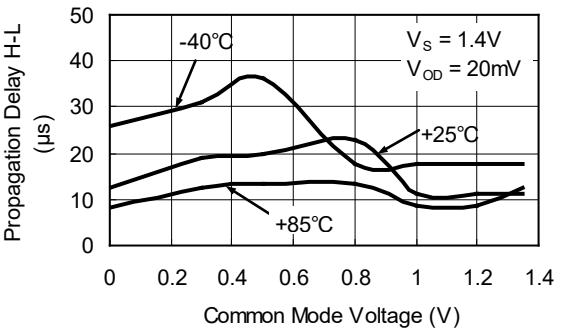
Propagation Delay ($\overline{V_{OUT}}$) vs. Overdrive



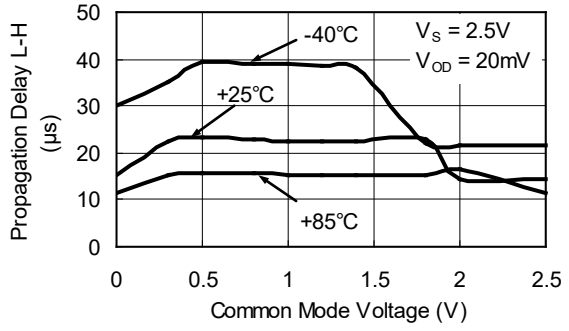
Propagation Delay (V_{OUT}) vs. Common Mode Input



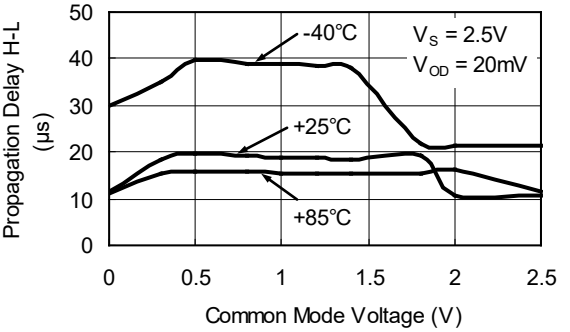
Propagation Delay ($\overline{V_{OUT}}$) vs. Common Mode Input



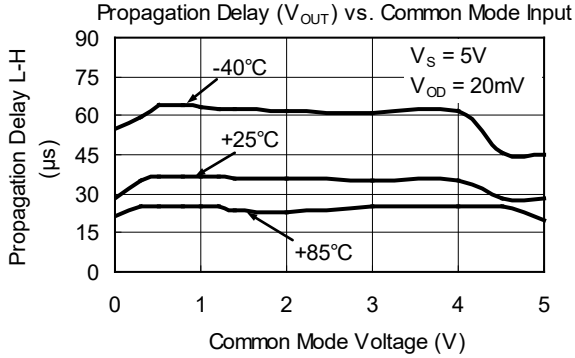
Propagation Delay (V_{OUT}) vs. Common Mode Input



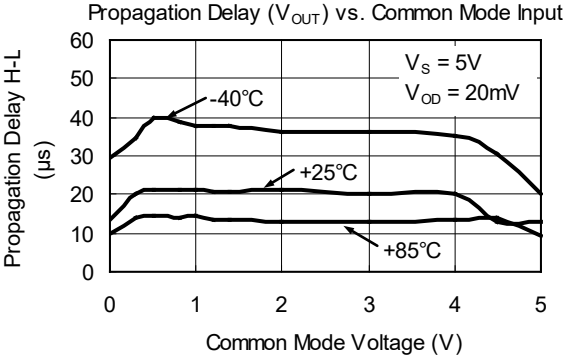
Propagation Delay ($\overline{V_{OUT}}$) vs. Common Mode Input



Propagation Delay (V_{OUT}) vs. Common Mode Input

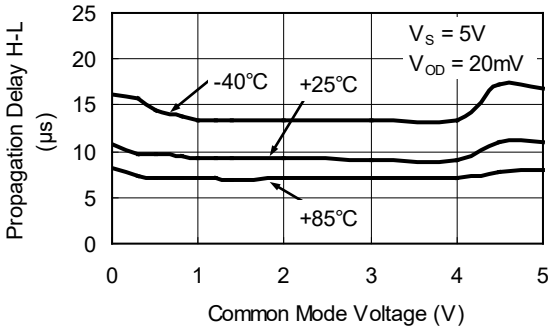


Propagation Delay ($\overline{V_{OUT}}$) vs. Common Mode Input

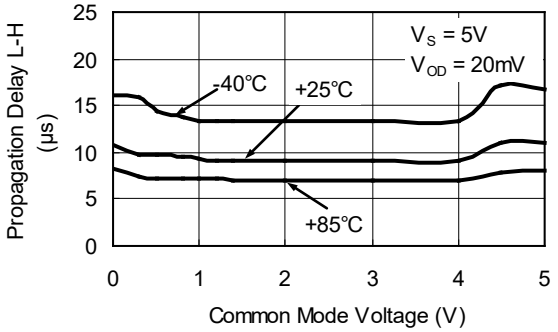


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

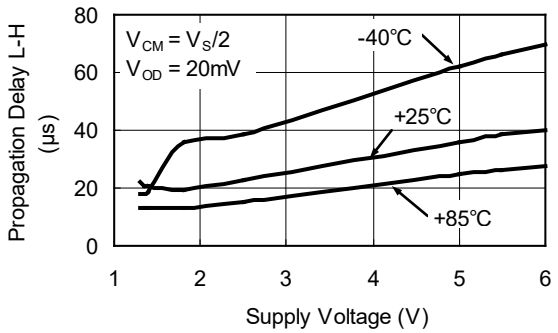
Propagation Delay (V_{OUT}) vs. Common Mode Input



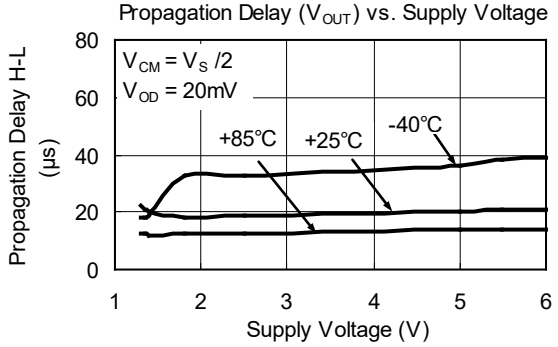
Propagation Delay ($\overline{V_{OUT}}$) vs. Common Mode Input



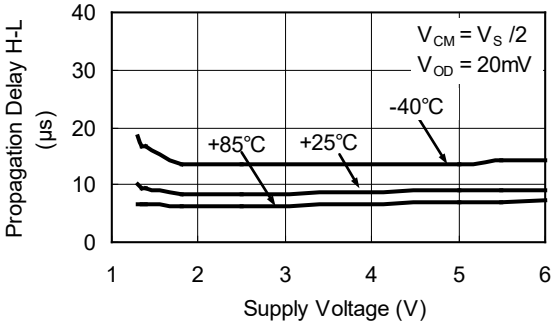
Propagation Delay (V_{OUT}) vs. Supply Voltage



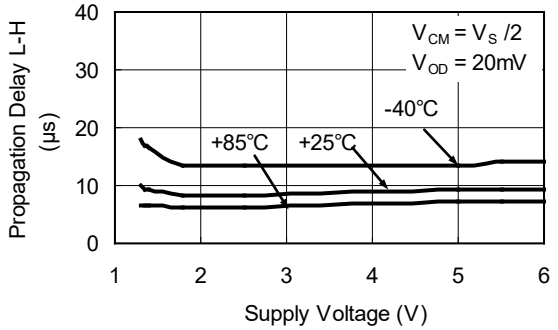
Propagation Delay ($\overline{V_{OUT}}$) vs. Supply Voltage



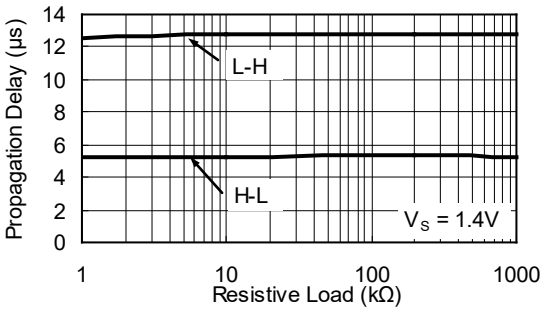
Propagation Delay (V_{OUT}) vs. Supply Voltage



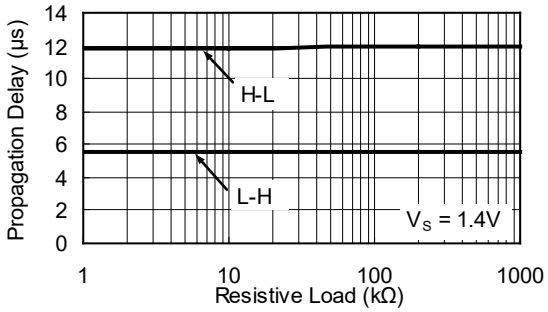
Propagation Delay ($\overline{V_{OUT}}$) vs. Supply Voltage



Propagation Delay (V_{OUT}) vs. Resistive Load

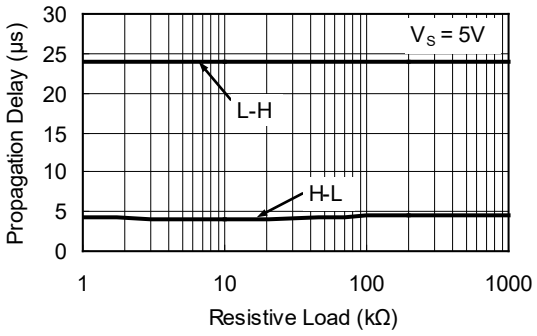


Propagation Delay ($\overline{V_{OUT}}$) vs. Resistive Load

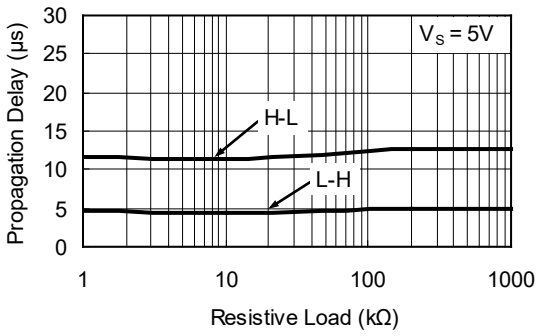


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

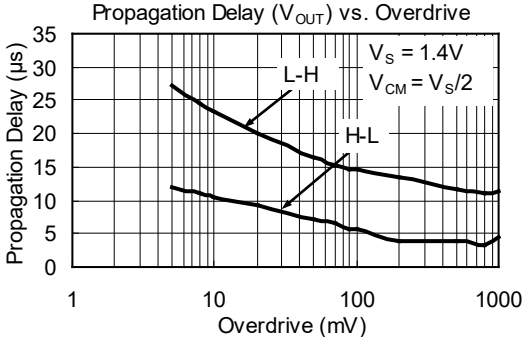
Propagation Delay (V_{OUT}) vs. Resistive Load



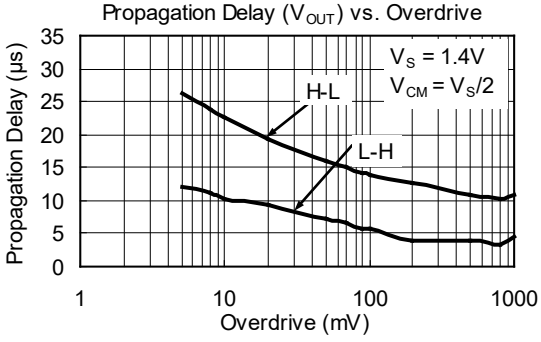
Propagation Delay ($\overline{V_{OUT}}$) vs. Resistive Load



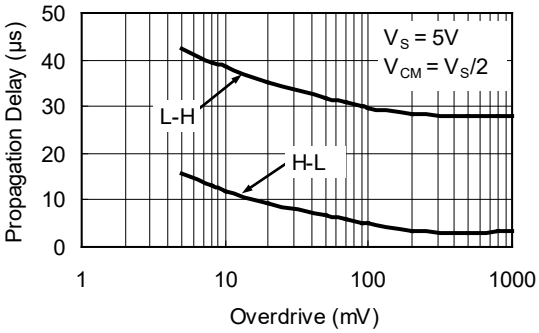
Propagation Delay (V_{OUT}) vs. Overdrive



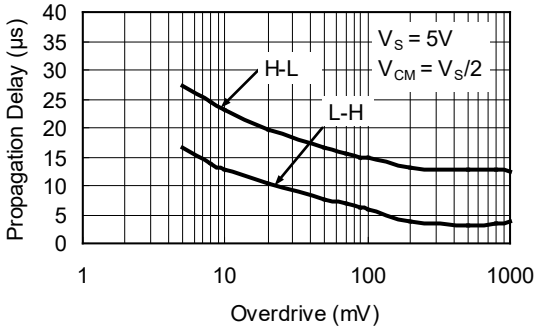
Propagation Delay ($\overline{V_{OUT}}$) vs. Overdrive



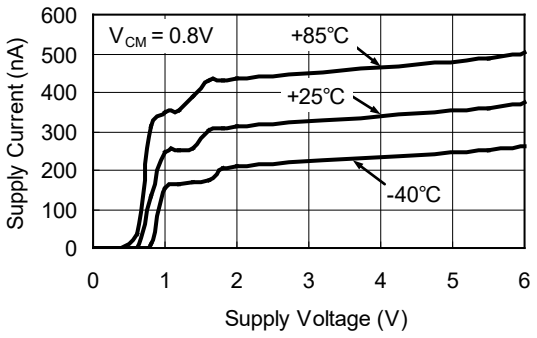
Propagation Delay (V_{OUT}) vs. Overdrive



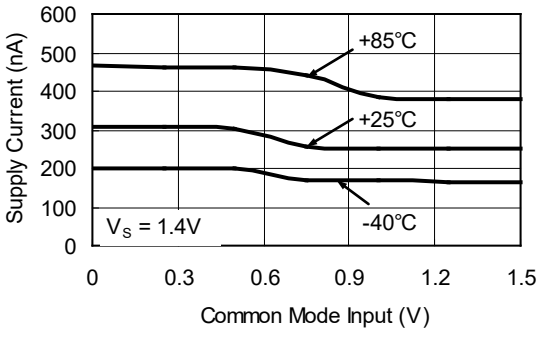
Propagation Delay ($\overline{V_{OUT}}$) vs. Overdrive



Supply Current vs. Supply Voltage

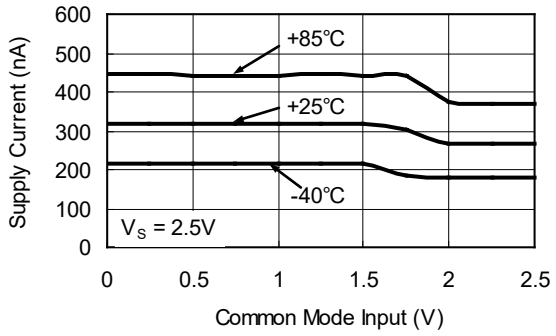


Supply Current vs. Common Mode Input

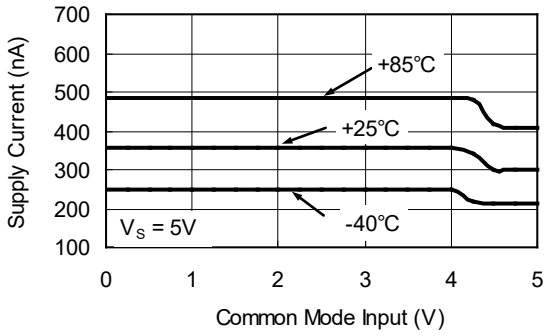


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

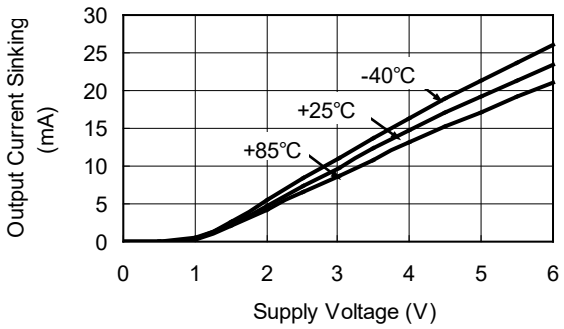
Supply Current vs. Common Mode Input



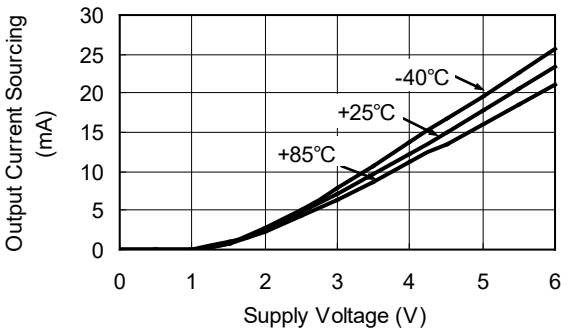
Supply Current vs. Common Mode Input



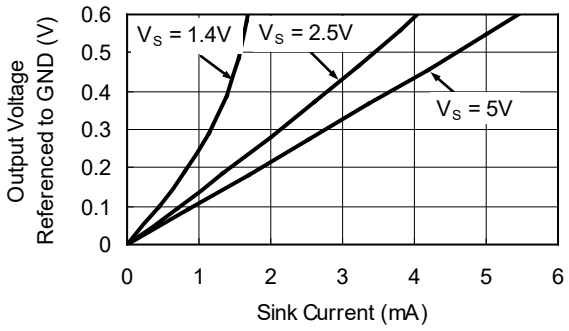
Short Circuit Sinking Current vs. Supply Voltage



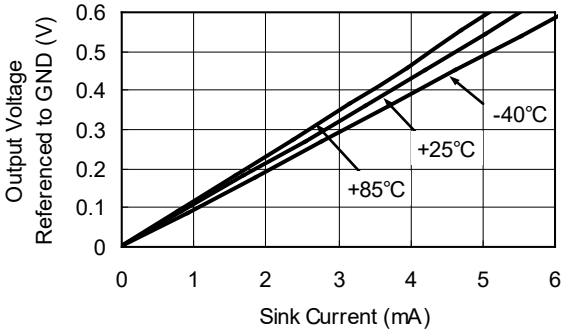
Short Circuit Sourcing Current vs. Supply Voltage



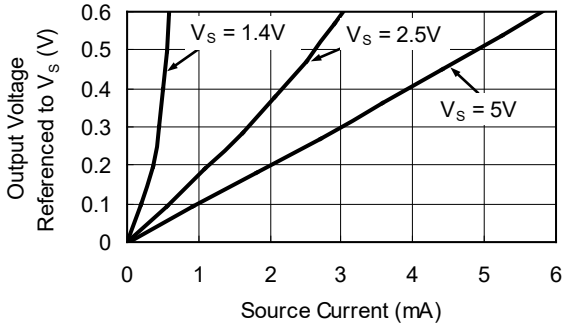
Output Voltage Low vs. Sink Current



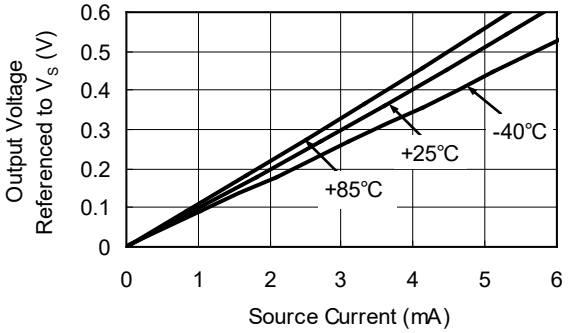
Output Voltage Low vs. Sink Current



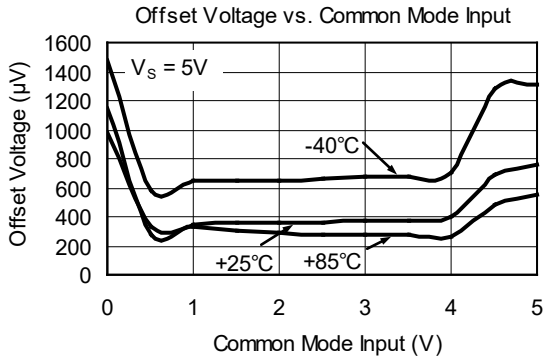
Output Voltage High vs. Source Current



Output Voltage High vs. Source Current



TYPICAL PERFORMANCE CHARACTERISTICS (continued)



TIMING DIAGRAM

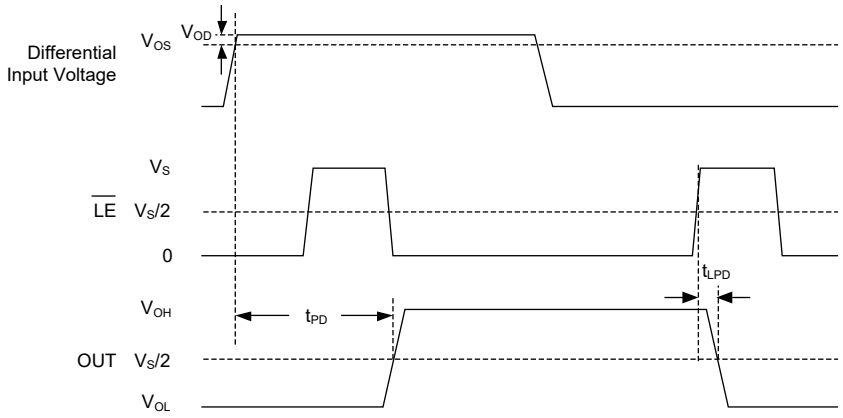


Figure 1. Timing Diagram with Latch Operator

REVISION HISTORY

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

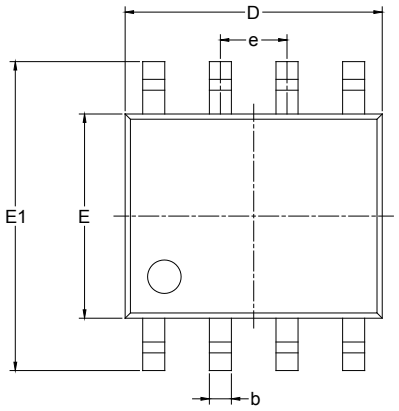
DECEMBER 2013 – REV.A.1 to REV.A.2	Page
Changed Electrical Characteristics section	4
Added Electrical Characteristics section	5
Added Timing Diagram section	13

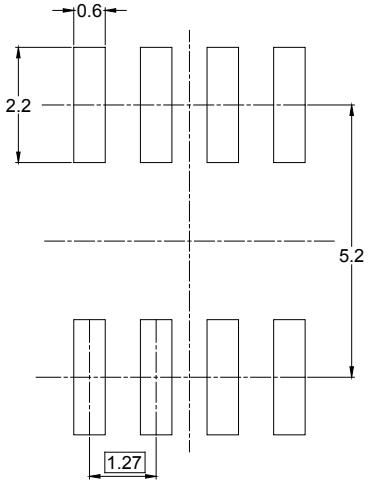
JUANUARY 2013 – REV.A to REV.A.1	Page
Added Tape and Reel Information section	15, 16

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

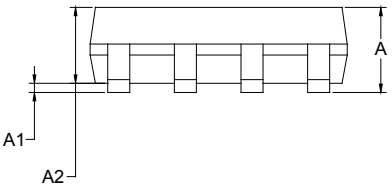
PACKAGE OUTLINE DIMENSIONS

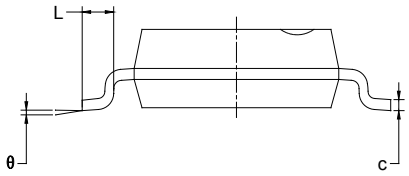
SOIC-8





RECOMMENDED LAND PATTERN (Unit: mm)

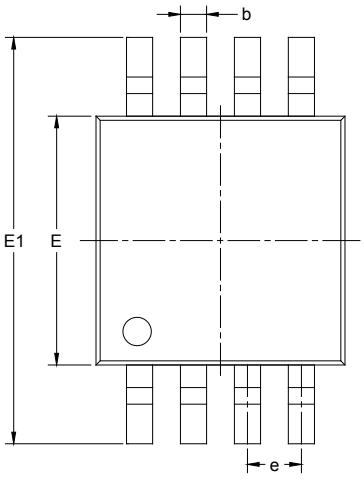


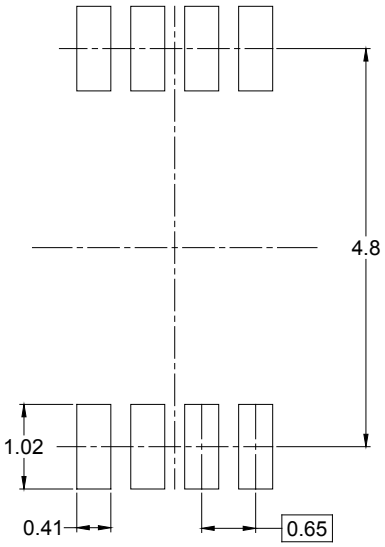


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

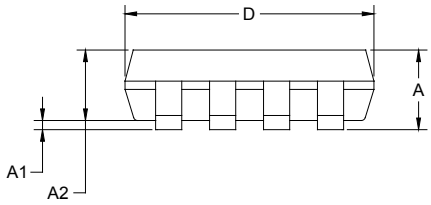
PACKAGE OUTLINE DIMENSIONS

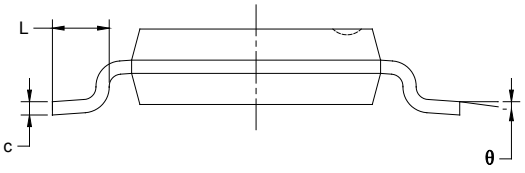
MSOP-8





RECOMMENDED LAND PATTERN (Unit: mm)

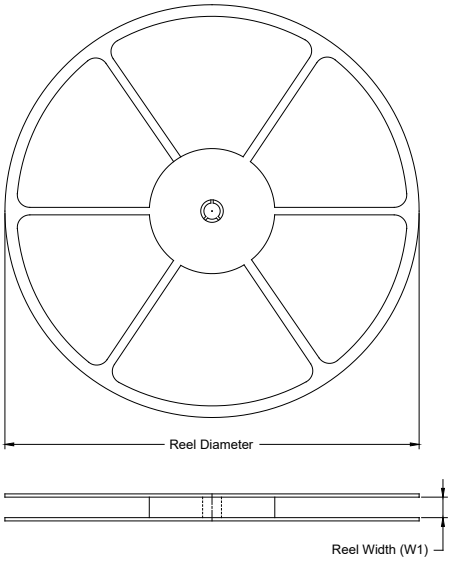




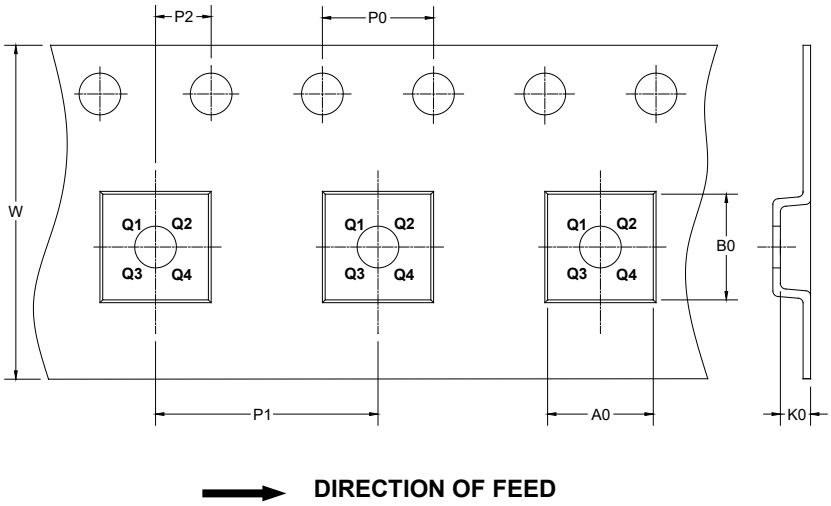
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



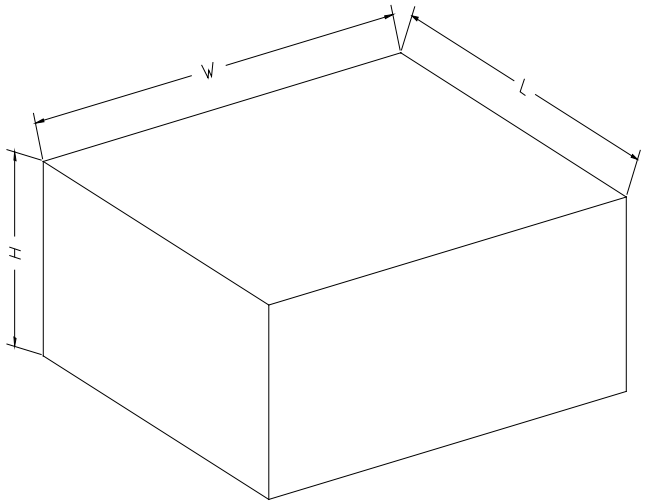
NOTE: The picture is only for reference. Please make the object as the standard.

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

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