Micro-Power, Push-Pull Output CMOS Comparators

FEATURES

- **Low Power Consumption: 500nA (TYP)**
- **Wide Supply Voltage: 2.7V to 5.5V**
- **Fast Response: 6μs Propagation Delay with 100mV Overdrive**
- **Input Common-Mode Range Extends 300mV**
- **2.7mV Internal Hysteresis**
- **Push-Pull Output**
- **Offset Voltage: ±4.5mV Maximum**
- **Operating Temperature Range: -40℃ to +85℃**
- **Packages: SOT-23-5L, SOP8, MSOP8, SOP14, TSSOP14**

PRODUCT DESCRIPTION

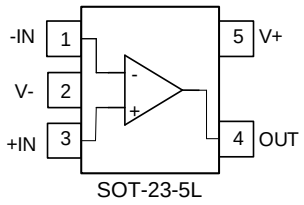
The TS2631 family of products are low-voltage, micro-power CMOS comparators which draw less than 500nA per-channel of quiescent current. These devices support rail-to-rail input, also the input common-mode range extends beyond the supply rails.

These devices are calibrated to specified at the full temperature range of −40˚C to +85˚C and operate with a single or dual power supply ranged from 2.7V to 5.5V. The devices have a push-pull output stage that can drive milliampere-level current loads.

APPLICATIONS

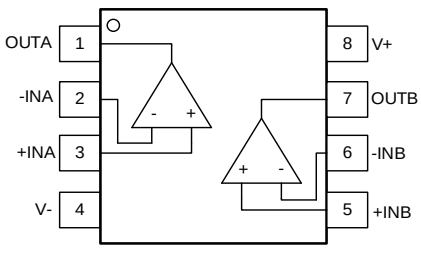
- **RC Timers**
- **Portable and Battery-Powered Devices**
- **IR Receivers**
- **Threshold Detectors and Discriminators**
- **Rotary Position Encoders**
- **Zero-Crossing Detectors**

TS2331



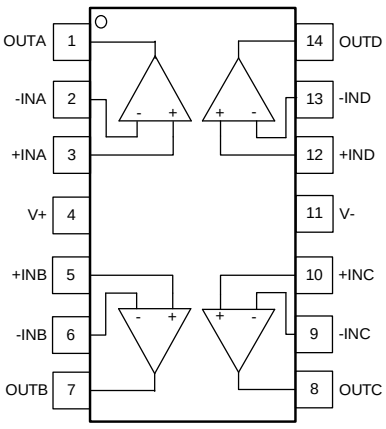
SOT-23-5L

TS2631



SOP8, MSOP8

TS2831



SOP14, TSSOP14

ORDERING INFORMATION

Model	Part Number	Eco Plan	Package	CMP	Container, Pack Qty
TS2331	TS2331SOT235LR	RoHS	SOT-23-5L	1	Reel, 3000
TS2631	TS2631SOP8R	RoHS	SOP8	2	Reel, 2500
TS2631	TS2631MSOP8R	RoHS	MSOP8	2	Reel, 3000
TS2831	TS2831SOP14R	RoHS	SOP14	4	Reel, 2500
TS2831	TS2831TSSOP14R	RoHS	TSSOP14	4	Reel, 3000

ABSOLUTE MAXIMUM RATINGS

Over operating free-air temperature range (unless otherwise noted) (1)

Parameter	Min	Max	Unit
Supply Voltage		6	V
Signal Input Terminal Voltage	(V_-) - 0.3	(V_+) + 0.3	V
Operating Temperature	-40	85	˚C
Junction Temperature		150	˚C
Storage Temperature Range	-65	150	˚C
Lead Temperature (Soldering, 10s)		260	˚C
ESD HBM		±2000	V
ESD MM		±200	V
ESC CDM		±1000	V

(1) Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ESD CAUTION

ESD (electrostatic discharge) sensitive device
Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjects to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

ELECTRICAL CHARACTERISTICS: V_S = +2.7V to +5.5V

Boldface limits apply over the specified temperature range, **T_A = −40℃ to +85℃.**

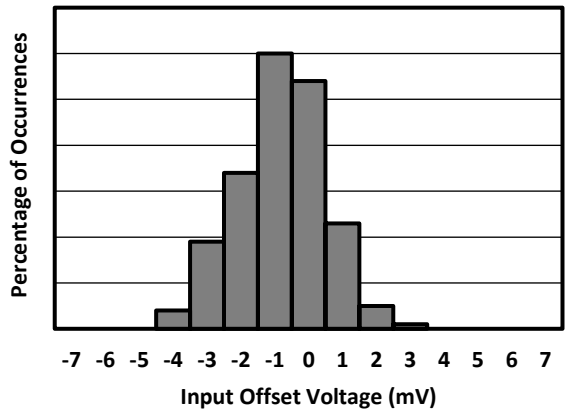
At T_A = +25℃, V_{CM} = V_S / 2, R_{Load} = 100kΩ, C_{Load} = 36pF (unless otherwise noted)

Parameter		Operating Conditions		Min	Typ	Max	Unit
V_S	Power Supply Voltage			2.7		5.5	V
I_S	Supply Current (Per Comparator)	V_S = 5V, I_{OUT} = 0			500	700	nA
PSRR	Power Supply Rejection Ratio	V_S = 2.7V to 5.5V, V_{CM} = 0 **T_A = −40℃ to +85℃**			55	200 **300**	µV/V **µV/V**
Input Characteristics							
V_{OS} **$\Delta V_{OS}/\Delta T_A$**	Input Offset Voltage **Average Drift**	V_S = 5V, V_{CM} = V_S / 2 **T_A = −40℃ to +85℃**			1.5 **3**	±4.5	mV **µV/℃**
V_{HYST} **$\Delta V_{HYST}/\Delta T_A$**	Input Hysteresis Voltage **Average Drift**	V_S = 5V, V_{CM} = V_S / 2 **T_A = −40℃ to +85℃**			2.7 **10**	4	mV **µV/℃**
I_B I_{OS}	Input Bias Current Input Offset Current				10 10		pA pA
CMRR	Common Mode Rejection Ratio	V_S = 5.5V, -0.3V < V_{CM} < 5.8V **T_A = −40℃ to +85℃**		60 **57**	72		dB **dB**
V_{CMR}	Input Voltage Range			(V-) - 0.3	-	(V+) + 0.3	V
Output Characteristics							
V_{OH}	Output Voltage High	V_S = 5V, V_{CM} = 0V	I_{OUT} = 2mA **T_A = −40℃ to +85℃**	4.8 **4.7**			V
V_{OL}	Output Voltage Low		I_{OUT} = -2mA **T_A = −40℃to +85℃**		100	150 **200**	mV **mV**
I_{SC}	Short-Circuit Current	V_S = 5V, Sourcing **T_A = −40℃ to +85℃**		20 **19**	24		mA
		V_S = 5V, Sinking **T_A = −40℃ to +85℃**		20 **19**	25		
Dynamic Performance							
t_R	Rise Time	V_S = 5V, Overdrive = 100mV	20% to 80%		35		ns
t_F	Fall Time		80% to 20%		45		ns
t_{PHL}	Propagation Delay (High to Low)	Overdrive = 100mV	V_S = 5V **T_A = −40℃ to +85℃**		6	10 **15**	µs µs
			V_S = 2.7V **T_A = −40℃ to +85℃**		5	10 **15**	µs µs
t_{PLH}	Propagation Delay (Low to High)		V_S = 5V **T_A = −40℃ to +85℃**		5	10 **15**	µs µs
			V_S = 2.7V **T_A = −40℃ to +85℃**		4.5	10 **15**	µs µs
t_{PDS}	Propagation Delay Skew				-1		µs
Temperature Range							
	Specified Range			−40		+85	℃
	Operating Range			−40		+85	℃
	Storage Range			−65		+150	℃
θ_{JA}	Thermal Resistance						
	SOT-23-5L				200		℃/W
	MSOP8, SOP8				150		℃/W
	SOP14, TSSOP14				100		℃/W

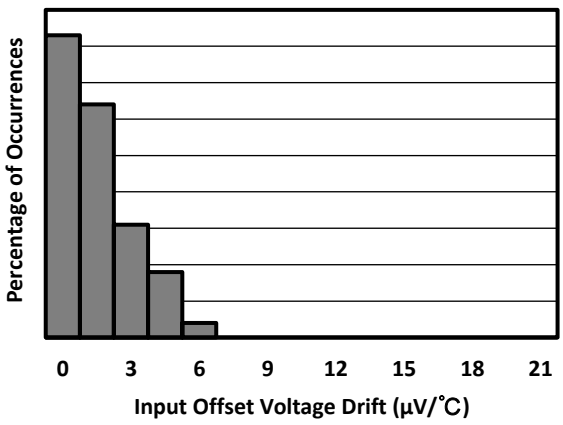
TYPICAL CHARACTERISTICS

At T_A = +25°C, V_S = 5V, R_{Load} = 100kΩ , C_{Load} = 36pF, and V_{CM} = V_S / 2 (unless otherwise noted)

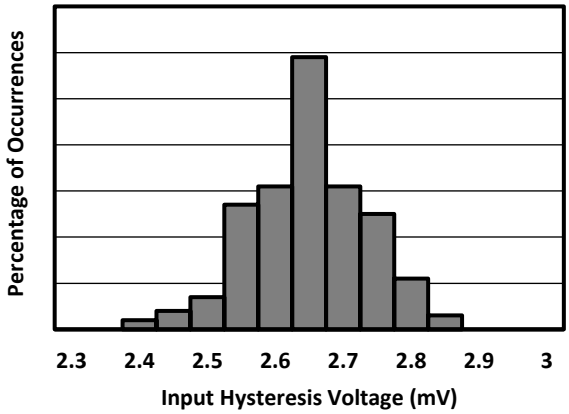
Input Offset Voltage Production Distribution



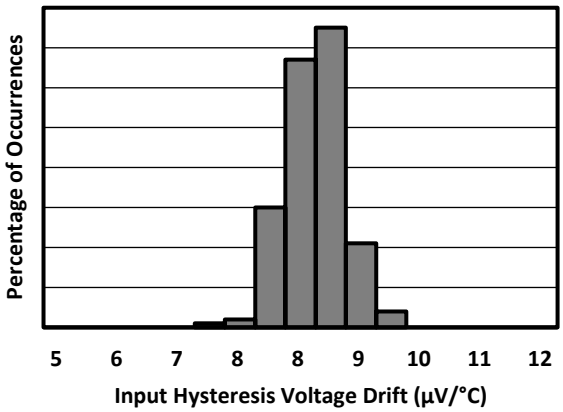
Input Offset Voltage Drift Production Distribution



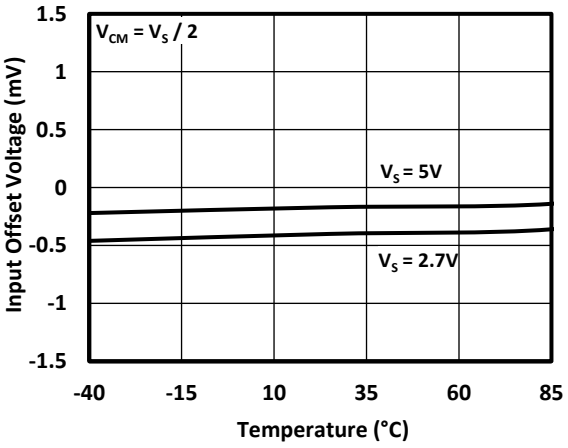
Input Hysteresis Voltage Production Distribution



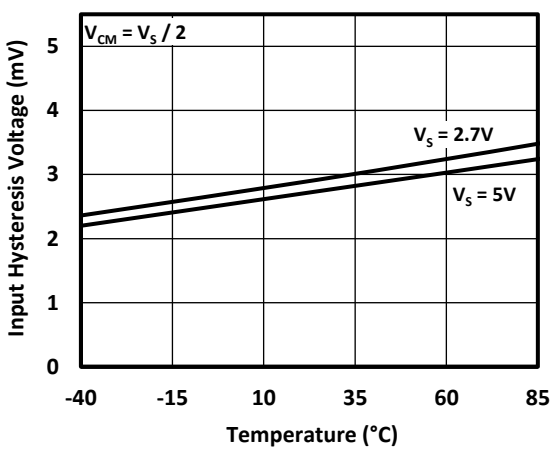
Input Hysteresis Voltage Drift Production Distribution



Input Offset Voltage vs Temperature



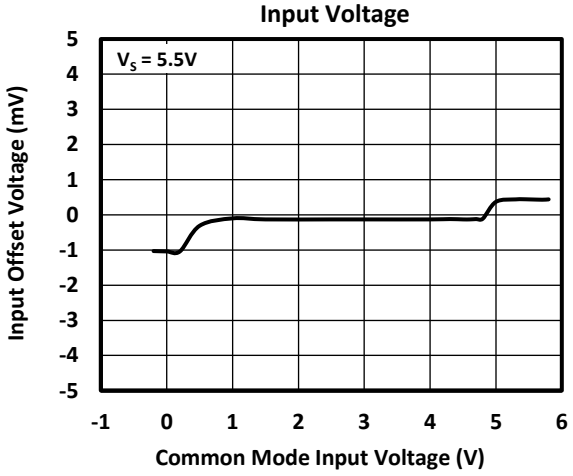
Input Hysteresis Voltage vs Temperature



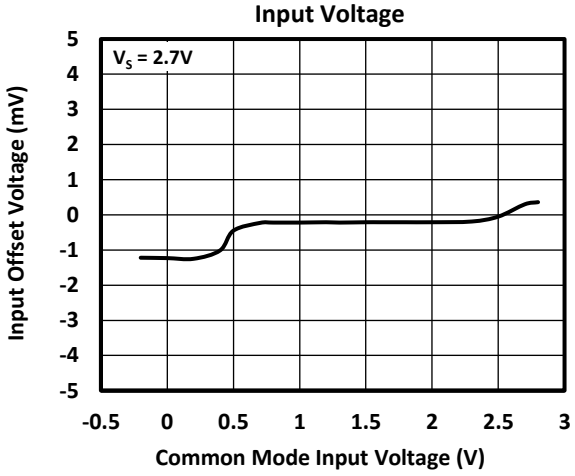
TYPICAL CHARACTERISTICS

At T_A = +25°C, V_S = 5V, R_{Load} = 100kΩ , C_{Load} = 36pF, and V_{CM} = V_S / 2 (unless otherwise noted)

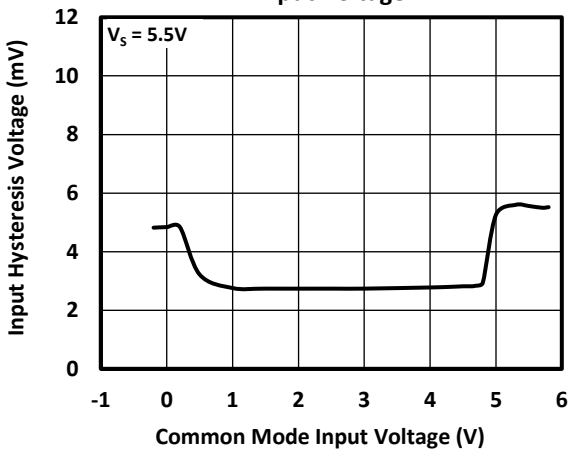
Input Offset Voltage vs Common Mode Input Voltage



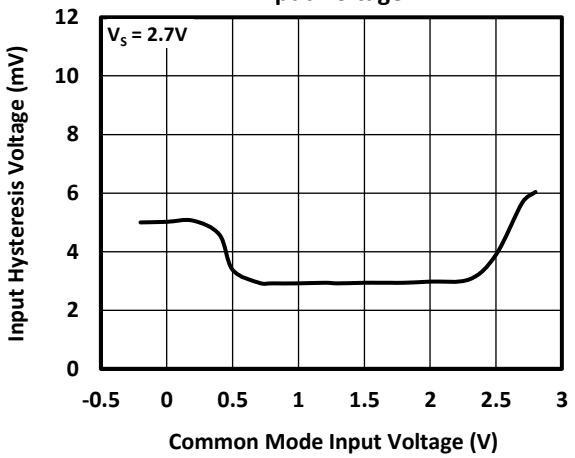
Input Offset Voltage vs Common Mode Input Voltage



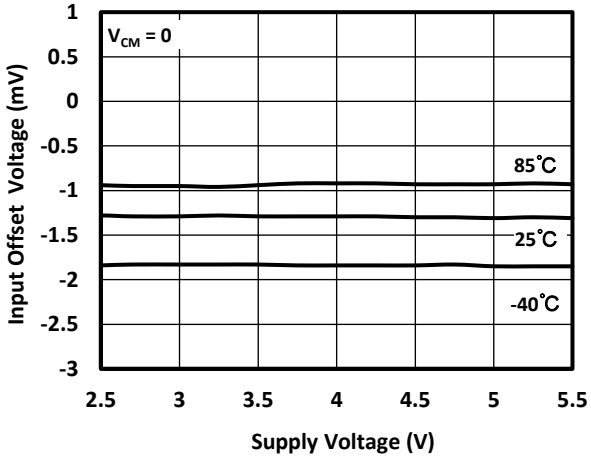
Input Hysteresis Voltage vs Common Mode Input Voltage



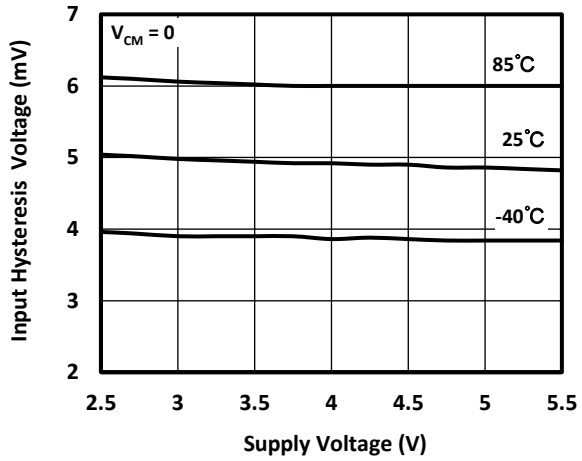
Input Hysteresis Voltage vs Common Mode Input Voltage



Input Offset Voltage vs Supply Voltage



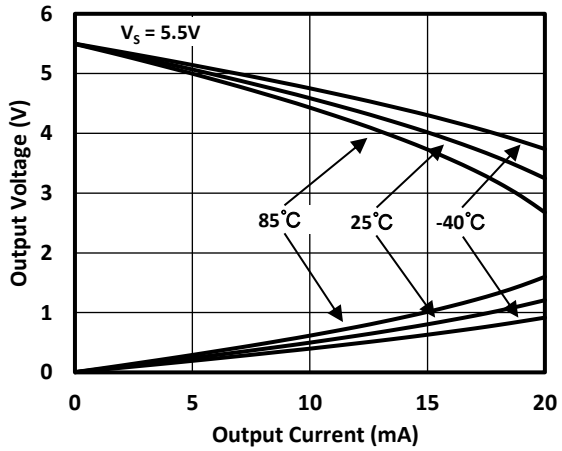
Input Hysteresis Voltage vs Supply Voltage



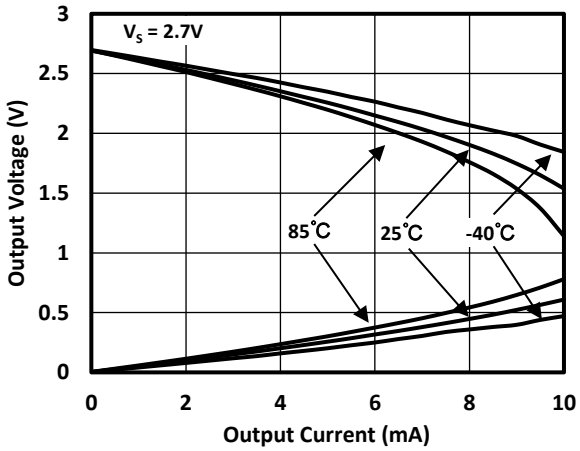
TYPICAL CHARACTERISTICS

At T_A = +25°C, V_S = 5V, R_{Load} = 100kΩ , C_{Load} = 36pF, and V_{CM} = V_S / 2 (unless otherwise noted)

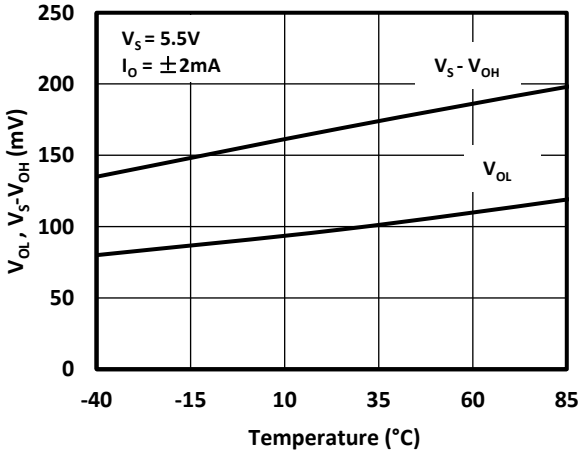
Output Voltage Swing vs Output Current



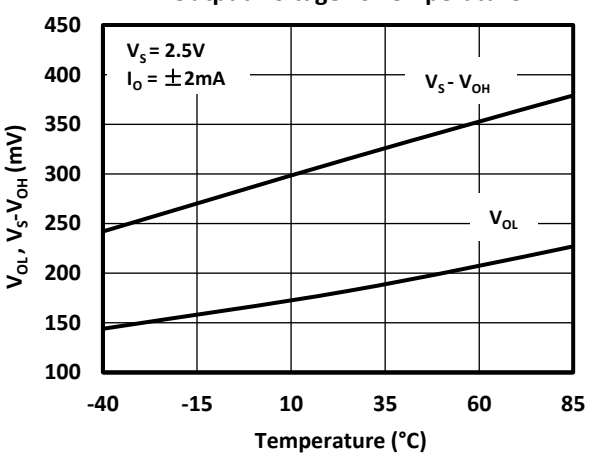
Output Voltage Swing vs Output Current



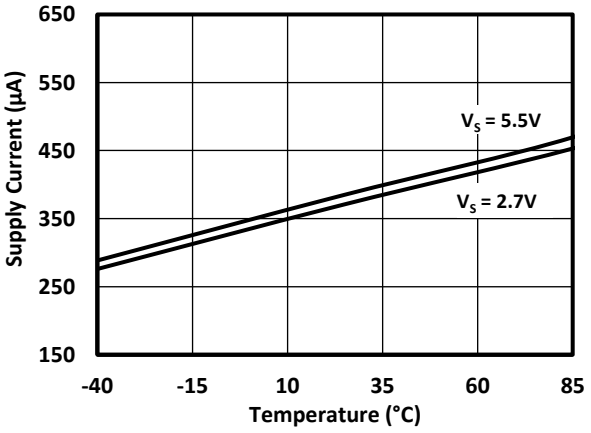
Output Voltage vs Temperature



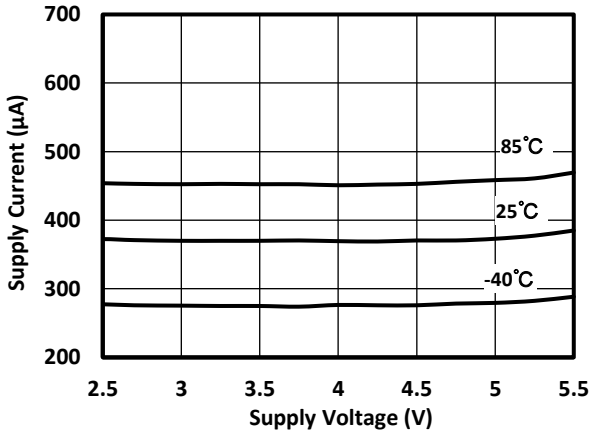
Output Voltage vs Temperature



Supply Current vs Temperature



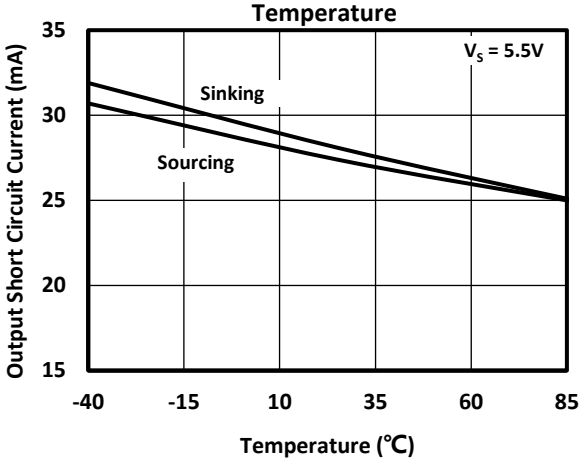
Supply Current vs Supply Voltage



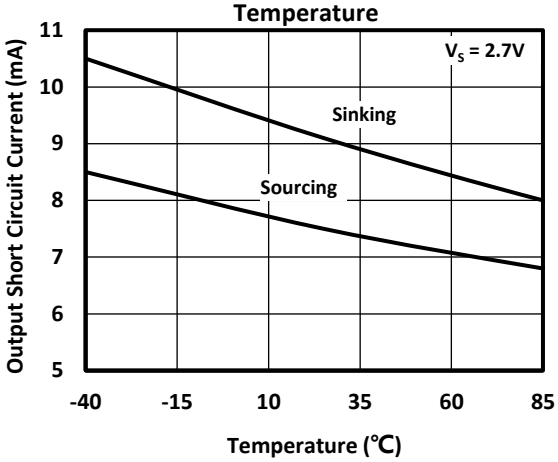
TYPICAL CHARACTERISTICS

At T_A = +25°C, V_S = 5V, R_{Load} = 100kΩ , C_{Load} = 36pF, and V_{CM} = V_S / 2 (unless otherwise noted)

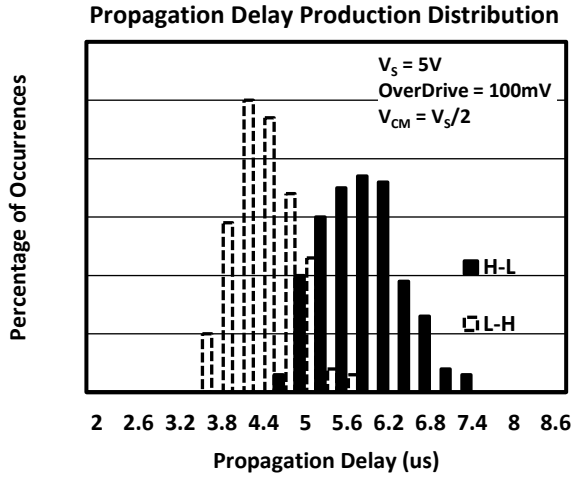
Output Short Circuit Current vs Temperature



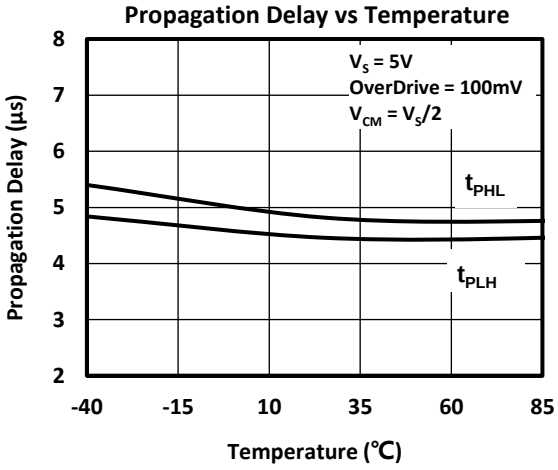
Output Short Circuit Current vs Temperature



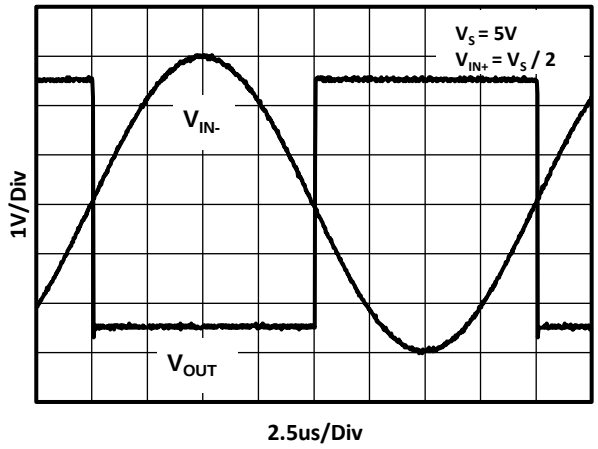
Propagation Delay Production Distribution



Propagation Delay vs Temperature

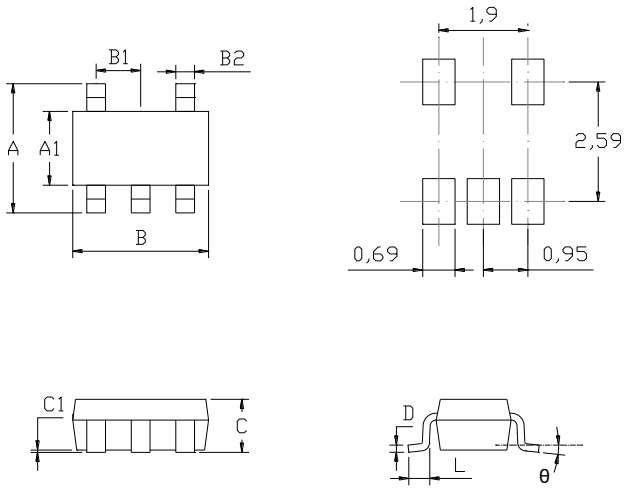


Input vs Output Signal



MECHANICAL DIMENSIONS

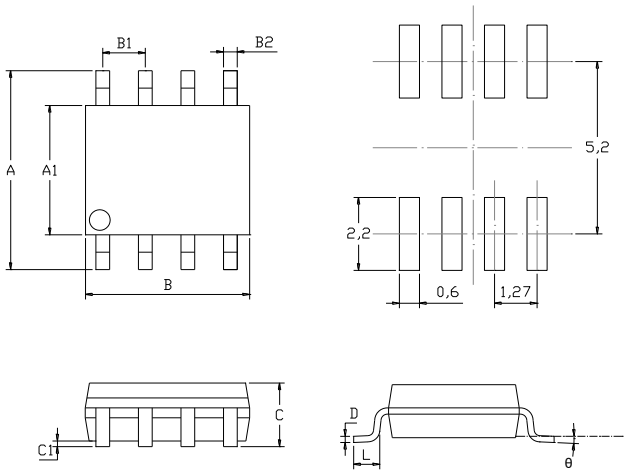
SOT-23-5L PACKAGE MECHANICAL DRAWING



SOT-23-5L PACKAGE MECHANICAL DATA

symbol	dimensions			
	millimeters		inches	
	min	max	min	max
A	2.650	2.950	0.104	0.116
A1	1.500	1.700	0.059	0.067
B	2.820	3.020	0.111	0.119
B1	0.950		0.037	
B2	0.300	0.500	0.012	0.020
C		1.250		0.049
C1	0	0.100	0	0.004
L	0.300	0.600	0.012	0.024
D	0.100	0.200	0.004	0.008
θ	0°	8°	0°	8°

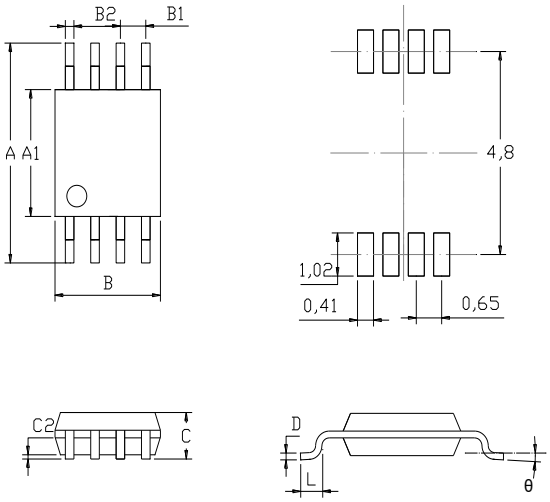
SOP8 PACKAGE MECHANICAL DRAWING



SOP8 PACKAGE MECHANICAL DATA

symbol	dimensions			
	millimeters		inches	
	min	max	min	max
A	5.800	6.200	0.228	0.244
A1	3.800	4.000	0.150	0.157
B	4.700	5.100	0.185	0.201
B1	1.270		0.050	
B2	0.330	0.510	0.013	0.020
C		1.750		0.069
C1	0.100	0.250	0.004	0.010
L	0.400	1.270	0.016	0.050
D	0.170	0.250	0.007	0.010
θ	0°	8°	0°	8°

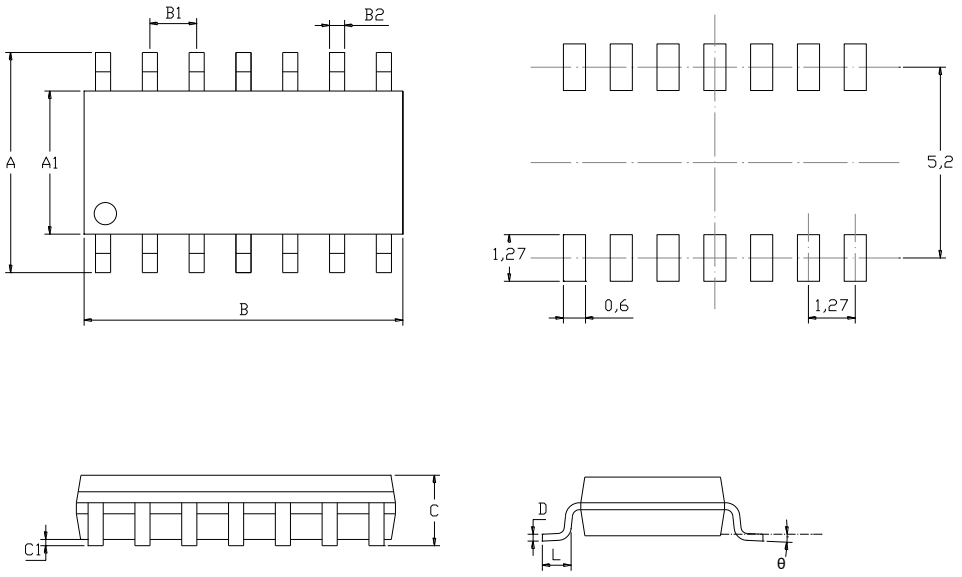
MSOP8 PACKAGE MECHANICAL DRAWING



MSOP8 PACKAGE MECHANICAL SPECIFICATIONS

symbol	dimensions			
	millimeters		inches	
	min	max	min	max
A	4.750	5.050	0.187	0.199
A1	2.900	3.100	0.114	0.122
B	2.900	3.100	0.114	0.122
B1	0.650		0.026	
B2	0.250	0.380	0.010	0.015
C	0.820	1.100	0.032	0.043
C2	0.020	0.150	0.001	0.006
L	0.400	0.800	0.016	0.031
D	0.090	0.230	0.004	0.009
θ	0º	6º	0º	6º

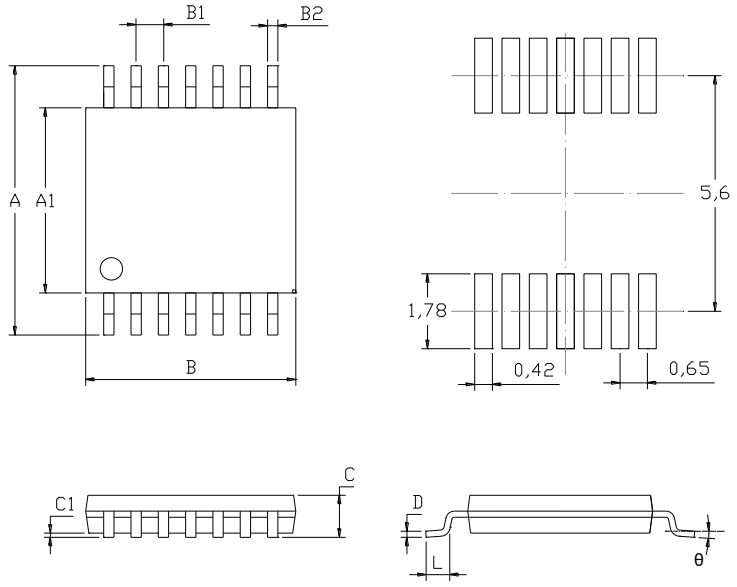
SOP14 PACKAGE MECHANICAL DRAWING



SOP14 PACKAGE MECHANICAL DATA

symbol	dimensions			
	millimeters		inches	
	min	max	min	max
A	5.800	6.200	0.228	0.244
A1	3.800	4.000	0.150	0.157
B	8.450	8.850	0.333	0.348
B1	1.270		0.050	
B2	0.310	0.510	0.012	0.020
C		1.750		0.069
C1	0.100	0.250	0.004	0.010
L	0.400	1.270	0.016	0.050
D	0.100	0.250	0.004	0. 010
θ	0°	8°	0°	8°

TSSOP14 PACKAGE MECHANICAL DRAWING

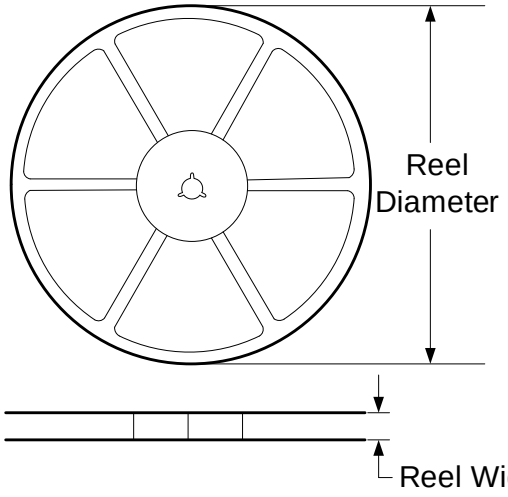


TSSOP14 PACKAGE MECHANICAL DATA

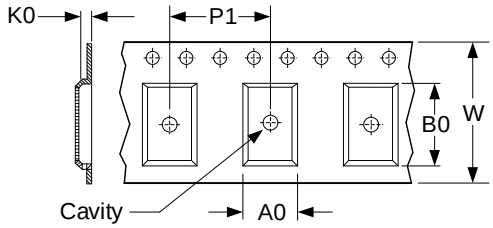
symbol	dimensions			
	millimeters		inches	
	min	max	min	max
A	6.250	6.550	0.246	0.258
A1	4.300	4.500	0.169	0.177
B	4.900	5.100	0.193	0.201
B1	0.650		0.026	
B2	0.190	0.300	0.007	0.012
C		1.200		0.047
C1	0.050	0.150	0.002	0.006
L	0.500	0.700	0.020	0.028
D	0.090	0.200	0.004	0.008
θ	1º	7º	1º	7º

TAPE AND REEL INFORMATION

REEL DIMENSIONS

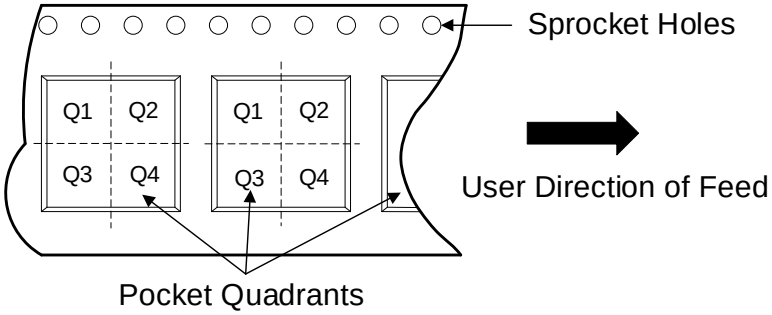


TAPE DIMENSIONS



A0	Dimensioon designed to accommodate the component width
B0	Dimensioon designed to accommodate the component length
K0	Dimensioon designed to accommodate the component width thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TS2331SOT235LR	SOT-23-5L	5	3000	180.0	9.0	3.2	3.3	1.4	4.0	8.0	Q3
TS2631SOP8R	SOP8	8	2500	330.0	12.4	6.4	5.4	2.1	8.0	12.0	Q1
TS2631MSOP8R	MSOP8	8	3000	330.0	12.4	5.2	3.3	1.5	8.0	12.0	Q1
TS2831SOP14R	SOP14	14	2500	330.0	12.4	6.5	9.0	2.1	8.0	16.0	Q1
TS2831TSSOP14R	TSSOP14	14	3000	330.0	12.4	6.8	5.4	1.2	8.0	12.0	Q1

REVISION HISTORY

NOTE: Page numbers for previous revisions may be different from that of the current version.

2020/11/26 — REV KY1.0.0A to REV KY1.0.1A

Updated chip pin definition ……1

2021/07/13 — REV KY1.0.1 to REV KY1.1.1

Updated TSSOP14 and MSOP8 SPQ……2,13

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