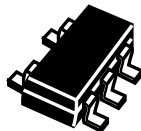


## Rail-to-rail 0.9 V open-drain output, nanopower comparators



SC70-5



SOT23-5



MiniSO8



DFN8 2x2

### Features

- Ultra low current consumption: 250 nA typ./op.
- Propagation delay: 2  $\mu$ s typ.
- Rail-to-rail inputs
- Open-drain outputs
- Supply operation from 0.9 V to 5.5 V
- Wide temperature range: -40 to +125 °C
- ESD tolerance: 8 kV HBM
- Single version available in SC70-5 and SOT23-5 package
- Dual version available in MiniSO8 and DFN8 2x2 mm package

### Applications

- Portable systems
- Signal conditioning
- Medical

### Description

The open-drain series of nanopower comparator integrates a single version [TS880](#) and a dual version [TS883](#). They feature an ultra low supply current of 250 nA typical per operator with rail-to-rail input capability and open-drain output. The performance of these comparators allows them to be used in a wide range of portable applications. The [TS880](#) and [TS883](#) minimize battery supply leakage and therefore enhance battery lifetime.

Operating from 0.9 to 5.5V supply voltage, these comparators can be used over a wide temperature range (-40 to +125 °C) keeping the current consumption at an ultra low level.

Product status link	
<a href="#">TS880</a>	
<a href="#">TS883</a>	
Related products	
<a href="#">TS881</a>	See the datasheet for push-pull output version
<a href="#">TS882</a>	
<a href="#">TS884</a>	

# 1 Pin description

Figure 1. Pin connection TS880 (top view)

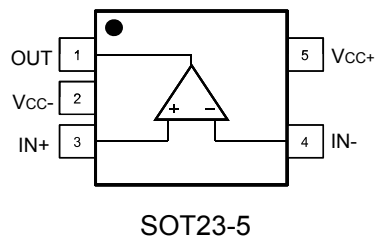
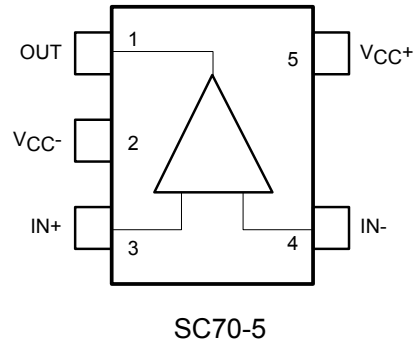
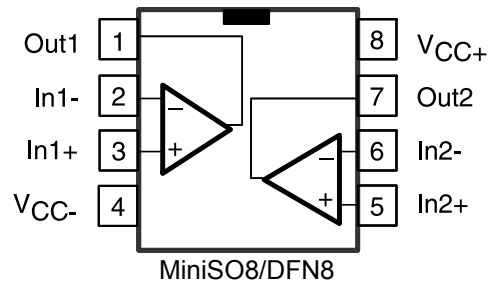


Figure 2. Pin connection TS883 (top view)



## 2 Absolute maximum ratings and operating conditions

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply voltage <sup>(1)</sup>	6	V
$V_{ID}$	Differential input voltage <sup>(2)</sup>	$\pm V_{CC}$	V
$V_{IN}$	Input voltage range	$(V_{CC-}) - 0.3$ to $(V_{CC+}) + 0.3$	V
$I_{IN}$	Input current <sup>(3)</sup>	$\pm 10$	mA
$V_{OUT}$	Output voltage	6	V
$R_{THJA}$	Thermal resistance junction to ambient SC70-5	205	°C/W
	Thermal resistance junction to ambient SOT23-5	250	
	Thermal resistance junction to ambient MiniSO8	190	
	Thermal resistance junction to ambient DFN8 2x2 mm	57	
$T_{STG}$	Storage temperature	-65 to +150	°C
$T_J$	Junction temperature	150	°C
$T_{LEAD}$	Lead temperature (soldering 10 s)	260	°C
ESD	Human body model (HBM) <sup>(4)</sup>	8000	V
	Charged device model (CDM) <sup>(5)</sup>	1500	

1. All voltage values, except differential voltages, are referenced to  $V_{CC-}$ .  $V_{CC}$  is defined as the difference between  $V_{CC+}$  and  $V_{CC-}$ .
2. The magnitude of input and output voltages must never exceed the supply rail  $\pm 0.3$  V.
3. Input current must be limited by a serial resistor with inputs when the input voltage is beyond supply voltage.
4. According to JEDEC standard JESD22-A114F.
5. According to ANSI/ESD STM5.3.1.

**Table 2. Operating conditions**

Symbol	Parameter	Value	Unit
$T_{oper}$	Operating temperature range	-40 to +125	°C
$V_{CC}$	Supply voltage	0.9 to 5.5	V
$V_{ICM}$	Common mode input voltage range $0.9 < V_{CC} < 1.1$ V <sup>(1)</sup>	$(V_{CC-}) - 0.2$ to $(V_{CC-}) + 0.2$ and $(V_{CC+}) - 0.2$ to $(V_{CC+}) + 0.2$	V
	Common mode input voltage range $1.1 \leq V_{CC} < 5.5$ V	$(V_{CC-}) - 0.2$ to $(V_{CC+}) + 0.2$	
$V_{OUT}$	Output voltage	0 to 5.5	V

1. See Figure 13. Input offset voltage vs. input common mode voltage,  $V_{CC}=0.9$  V, Figure 14. Input hysteresis voltage vs. input common mode voltage,  $V_{CC}=0.9$  V, Figure 27. Propagation delay  $T_{PLH}$  vs. input common mode voltage,  $V_{CC}=0.9$  V and Figure 28. Propagation delay  $T_{PHL}$  vs. input common mode voltage,  $V_{CC}=0.9$  V.

### 3 Electrical characteristics

**Table 3. Electrical characteristics  $V_{CC} = +0.9\text{ V}$ ,  $T_{amb} = 25\text{ °C}$ ,  $V_{ICM} = 0\text{ V}$  (unless otherwise specified)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{IO}$	Input offset voltage <sup>(1)</sup>	$T_{amb} = +25\text{ °C}$	-10	1	10	mV
		$-40\text{ °C} < T_{amb} < +85\text{ °C}$	-12		12	
$\Delta V_{IO}$	Input offset voltage drift	$-40\text{ °C} < T_{amb} < +85\text{ °C}$		3		$\mu\text{V}/\text{°C}$
$V_{HYST}$	Input hysteresis voltage <sup>(2)</sup>	$T_{amb} = +25\text{ °C}$		2.6		mV
		$-40\text{ °C} < T_{amb} < +85\text{ °C}$	1		4.2	
$I_{IO}$	Input offset current <sup>(3)</sup>	$T_{amb} = +25\text{ °C}$		1	10	pA
		$-40\text{ °C} < T_{amb} < +85\text{ °C}$			100	
$I_{IB}$	Input bias current <sup>(3)</sup>	$T_{amb} = +25\text{ °C}$		5	10	pA
		$-40\text{ °C} < T_{amb} < +85\text{ °C}$			100	
$I_{CC}$	Supply current per operator	Output low, $V_{ID} = -0.1\text{ V}$		300	480	nA
		$-40\text{ °C} < T_{amb} < +85\text{ °C}$			500	
		Output high, $V_{ID} = +0.1\text{ V}$		250	410	
		$-40\text{ °C} < T_{amb} < +85\text{ °C}$			440	
$I_{sink}$	Output sink current	$V_{OUT} = V_{CC+}$ , $V_{ID} = -0.1\text{ V}$		1.2		mA
$I_{OH}$	High level output current	$V_{OUT} = V_{CC+}$ , $V_{ID} = 0.1\text{ V}$		17	30	pA
		$-40\text{ °C} < T_{amb} < +85\text{ °C}$			15	nA
$V_{OL}$	Output voltage low	$I_{sink} = 50\text{ }\mu\text{A}$ , $V_{ID} = -0.1\text{ V}$		10	50	mV
		$-40\text{ °C} < T_{amb} < +85\text{ °C}$			70	
$T_{PLH}$	Propagation delay <sup>(4)</sup> (low to high)	$f = 1\text{ kHz}$ , $C_L = 10\text{ pF}$ , overdrive = 10 mV $V_{PU} = V_{CC+}$				$\mu\text{s}$
		$R_{PU} = 10\text{ k}\Omega$ , $T_{amb} = +25\text{ °C}$		7	10	
		$R_{PU} = 10\text{ k}\Omega$ , $40\text{ °C} < T_{amb} < +85\text{ °C}$			12	
		$R_{PU} = 1\text{ M}\Omega$ , $T_{amb} = +25\text{ °C}$		20	22	
		$R_{PU} = 1\text{ M}\Omega$ , $-40\text{ °C} < T_{amb} < +85\text{ °C}$			24	
		$f = 1\text{ kHz}$ , $C_L = 10\text{ pF}$ , overdrive = 100 mV $V_{PU} = V_{CC+}$				
		$R_{PU} = 10\text{ k}\Omega$ , $T_{amb} = +25\text{ °C}$		2.5	4	
		$R_{PU} = 10\text{ k}\Omega$ , $40\text{ °C} < T_{amb} < +85\text{ °C}$			4.5	
		$R_{PU} = 1\text{ M}\Omega$ , $T_{amb} = +25\text{ °C}$		18	20	
		$R_{PU} = 1\text{ M}\Omega$ , $-40\text{ °C} < T_{amb} < +85\text{ °C}$			21	

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
T <sub>PHL</sub>	Propagation delay <sup>(5)</sup> (high to low)	f = 1 kHz, C <sub>L</sub> = 10 pF, overdrive = 10 mV V <sub>PU</sub> = V <sub>CC+</sub>				μs	
		R <sub>PU</sub> = 10 kΩ, T <sub>amb</sub> = +25 °C		6	9		
		R <sub>PU</sub> = 10 kΩ, 40 °C < T <sub>amb</sub> < +85 °C			10		
		R <sub>PU</sub> = 1 MΩ, T <sub>amb</sub> = +25 °C		7	9		
		R <sub>PU</sub> = 1 MΩ, -40 °C < T <sub>amb</sub> < +85 °C			10		
		f = 1 kHz, C <sub>L</sub> = 10 pF, overdrive = 100 mV V <sub>PU</sub> = V <sub>CC+</sub>					
		R <sub>PU</sub> = 10 kΩ, T <sub>amb</sub> = +25 °C		2	3.5		
		R <sub>PU</sub> = 10 kΩ, 40 °C < T <sub>amb</sub> < +85 °C			4		
		R <sub>PU</sub> = 1 MΩ, T <sub>amb</sub> = +25 °C		2	4		
		R <sub>PU</sub> = 1 MΩ, -40 °C < T <sub>amb</sub> < +85 °C			5		
T <sub>R</sub>	Rise time (10% to 90%)	C <sub>L</sub> = 10 pF, R <sub>PU</sub> = 10 kΩ, overdrive = 100 mV		500		ns	
T <sub>F</sub>	Fall time (90% to 10%)	C <sub>L</sub> = 10 pF, R <sub>PU</sub> = 10 kΩ, overdrive = 100 mV		600		ns	
T <sub>ON</sub>	Power-up time			0.9	1.3	ms	

1. The offset is defined as the average value of positive and negative trip points (input voltage differences requested to change the output state in each direction).
2. The hysteresis is a built-in feature. It is defined as the voltage difference between the trip points.
3. Maximum values include unavoidable inaccuracies of the industrial tests.
4. T<sub>PLH</sub> is measured when the output signal crosses a voltage level at 50% of V<sub>CC</sub> with the following conditions: inverting input voltage (IN-) = V<sub>ICM</sub> and non-inverting input voltage (IN+) moving from V<sub>ICM</sub> - 100 mV to V<sub>ICM</sub> + overdrive.
5. T<sub>PHL</sub> is measured when the output signal crosses a voltage level at 50% of V<sub>CC</sub> with the following conditions: inverting input voltage (IN-) = V<sub>ICM</sub> and non-inverting input voltage (IN+) moving from V<sub>ICM</sub> + 100 mV to V<sub>ICM</sub> - overdrive

**Note:** All values over the temperature range are guaranteed through correlation and simulation. No production test is performed at the temperature range limits.

**Table 4. Electrical characteristics  $V_{CC} = +1.2\text{ V}$ ,  $T_{amb} = 25\text{ }^\circ\text{C}$ ,  $V_{ICM} = V_{CC}/2$  (unless otherwise specified)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{IO}$	Input offset voltage <sup>(1)</sup>	$T_{amb} = +25\text{ }^\circ\text{C}$	-5	1	5	mV
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$	-6		6	
$\Delta V_{IO}$	Input offset voltage drift	$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$		3		$\mu\text{V}/^\circ\text{C}$
$V_{HYST}$	Input hysteresis voltage <sup>(2)</sup>	$T_{amb} = +25\text{ }^\circ\text{C}$		2.5		mV
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$	1.6		4.2	
$I_{IO}$	Input offset current <sup>(3)</sup>	$T_{amb} = +25\text{ }^\circ\text{C}$		2	10	pA
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$			100	
$I_{IB}$	Input bias current <sup>(3)</sup>	$T_{amb} = +25\text{ }^\circ\text{C}$		1	10	pA
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$			100	
$I_{CC}$	Supply current per operator	Output low, $V_{ID} = -0.1\text{ V}$		320	490	nA
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$			510	
		Output high, $V_{ID} = +0.1\text{ V}$		240	360	
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$			390	
$I_{sink}$	Output sink current	$V_{OUT} = V_{CC+}$ , $V_{ID} = -0.1\text{ V}$		3.6		mA
$I_{OH}$	High level output current	$V_{OUT} = V_{CC+}$ , $V_{ID} = 0.1\text{ V}$		22	36	pA
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$			15	nA
$V_{OL}$	Output voltage low	$I_{sink} = 0.2\text{ mA}$		25	50	mV
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$			70	
CMRR	Common mode rejection ratio	$0 < V_{ICM} < V_{CC}$		68		dB
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$	50			
$T_{PLH}$	Propagation delay (low to high)	$f = 1\text{ kHz}$ , $C_L = 10\text{ pF}$ , overdrive = 10 mV $V_{PU} = V_{CC+}$				$\mu\text{s}$
		$R_{PU} = 10\text{ k}\Omega$ , $T_{amb} = +25\text{ }^\circ\text{C}$		5	7.5	
		$R_{PU} = 10\text{ k}\Omega$ , $40\text{ }^\circ\text{C} < T_{amb} < +85\text{ }^\circ\text{C}$			8	
		$R_{PU} = 1\text{ M}\Omega$ , $T_{amb} = +25\text{ }^\circ\text{C}$		20	21	
		$R_{PU} = 1\text{ M}\Omega$ , $-40\text{ }^\circ\text{C} < T_{amb} < +85\text{ }^\circ\text{C}$			22	
		$f = 1\text{ kHz}$ , $C_L = 10\text{ pF}$ , overdrive = 100 mV $V_{PU} = V_{CC+}$				
		$R_{PU} = 10\text{ k}\Omega$ , $T_{amb} = +25\text{ }^\circ\text{C}$		1.9	3	
		$R_{PU} = 10\text{ k}\Omega$ , $40\text{ }^\circ\text{C} < T_{amb} < +85\text{ }^\circ\text{C}$			3.5	
		$R_{PU} = 1\text{ M}\Omega$ , $T_{amb} = +25\text{ }^\circ\text{C}$		17	18	
$R_{PU} = 1\text{ M}\Omega$ , $-40\text{ }^\circ\text{C} < T_{amb} < +85\text{ }^\circ\text{C}$			19			

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
T <sub>PHL</sub>	Propagation delay <sup>(5)</sup> (high to low)	f = 1 kHz, C <sub>L</sub> = 10 pF, overdrive = 10 mV V <sub>PU</sub> = V <sub>CC+</sub>				μs	
		R <sub>PU</sub> = 10 kΩ, T <sub>amb</sub> = + 25 °C		5	6.5		
		R <sub>PU</sub> = 10 kΩ, 40 °C < T <sub>amb</sub> < + 85 °C			7		
		R <sub>PU</sub> = 1 MΩ, T <sub>amb</sub> = + 25 °C		5	6		
		R <sub>PU</sub> = 1 MΩ, -40 °C < T <sub>amb</sub> < + 85 °C			7		
		f = 1 kHz, C <sub>L</sub> = 10 pF, overdrive = 100 mV, V <sub>PU</sub> = V <sub>CC+</sub>					
		R <sub>PU</sub> = 10 kΩ, T <sub>amb</sub> = + 25 °C		1.7	2.5		
		R <sub>PU</sub> = 10 kΩ, 40 °C < T <sub>amb</sub> < + 85 °C			3		
		R <sub>PU</sub> = 1 MΩ, T <sub>amb</sub> = + 25 °C		2	3		
		R <sub>PU</sub> = 1 MΩ, -40 °C < T <sub>amb</sub> < + 85 °C			4		
T <sub>R</sub>	Rise time (10% to 90%)	C <sub>L</sub> = 10 pF, R <sub>PU</sub> = 10 kΩ overdrive = 100 mV		800		ns	
T <sub>F</sub>	Fall time (90% to 10%)	C <sub>L</sub> = 10 pF, R <sub>PU</sub> = 10 kΩ overdrive = 100 mV		250		ns	
T <sub>ON</sub>	Power-up time			0.9	1.3	ms	

1. The offset is defined as the average value of positive and negative trip points (input voltage differences requested to change the output state in each direction)
2. The hysteresis is a built-in feature. It is defined as the voltage difference between the trip points.
3. Maximum values include unavoidable inaccuracies of the industrial tests.
4. T<sub>PLH</sub> is measured when the output signal crosses a voltage level at 50% of V<sub>CC</sub> with the following conditions: inverting input voltage (IN-) = V<sub>ICM</sub> and non-inverting input voltage (IN+) moving from V<sub>ICM</sub> - 100 mV to V<sub>ICM</sub> + overdrive.
5. T<sub>PHL</sub> is measured when the output signal crosses a voltage level at 50% of V<sub>CC</sub> with the following conditions: inverting input voltage (IN-) = V<sub>ICM</sub> and non-inverting input voltage (IN+) moving from V<sub>ICM</sub> + 100 mV to V<sub>ICM</sub> - overdrive.

**Note:** All values over the temperature range are guaranteed through correlation and simulation. No production test is performed at the temperature range limits.

**Table 5. Electrical characteristics  $V_{CC} = +2.7\text{ V}$ ,  $T_{amb} = 25\text{ }^\circ\text{C}$ ,  $V_{ICM} = V_{CC}/2$  (unless otherwise specified)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{IO}$	Input offset voltage	$T_{amb} = +25\text{ }^\circ\text{C}$	-5	1	5	mV
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$	-6		6	
$\Delta V_{IO}$	Input offset voltage drift	$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$		3		$\mu\text{V}/^\circ\text{C}$
$V_{HYST}$	Input hysteresis voltage	$T_{amb} = +25\text{ }^\circ\text{C}$		2.7		mV
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$	1.6		4.2	
$I_{IO}$	Input offset current <sup>(3)</sup>	$T_{amb} = +25\text{ }^\circ\text{C}$		1	10	pA
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$			100	
$I_{IB}$	Input bias current <sup>(3)</sup>	$T_{amb} = +25\text{ }^\circ\text{C}$		5	10	pA
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$			100	
$I_{CC}$	Supply current per operator	Output low, $V_{ID} = -0.1\text{ V}$		350	520	nA
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$			540	
		Output high, $V_{ID} = +0.1\text{ V}$		250	370	
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$			400	
$I_{SINK}$	Output sink current	$V_{OUT} = V_{CC+}$ , $V_{ID} = -0.1\text{ V}$		22		mA
$I_{OH}$	High level output current	$V_{OUT} = V_{CC+}$ , $V_{ID} = 0.1\text{ V}$		40	60	pA
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$			18	nA
$V_{OL}$	Output voltage low	$I_{SINK} = 2\text{ mA}$		140	220	mV
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$			290	
CMRR	Common mode rejection ratio	$0 < V_{ICM} < V_{CC}$		74		dB
		$-40\text{ }^\circ\text{C} < T_{amb} < +125\text{ }^\circ\text{C}$	55			
$T_{PLH}$	Propagation delay (low to high)	$f = 1\text{ kHz}$ , $C_L = 10\text{ pF}$ , overdrive = 10 mV $V_{PU} = V_{CC+}$				$\mu\text{s}$
		$R_{PU} = 10\text{ k}\Omega$ , $T_{amb} = +25\text{ }^\circ\text{C}$		5.8	8.5	
		$R_{PU} = 10\text{ k}\Omega$ , $40\text{ }^\circ\text{C} < T_{amb} < +85\text{ }^\circ\text{C}$			10	
		$R_{PU} = 1\text{ M}\Omega$ , $T_{amb} = +25\text{ }^\circ\text{C}$		21	23	
		$R_{PU} = 1\text{ M}\Omega$ , $-40\text{ }^\circ\text{C} < T_{amb} < +85\text{ }^\circ\text{C}$			24	
		$f = 1\text{ kHz}$ , $C_L = 10\text{ pF}$ , overdrive = 100 mV $V_{PU} = V_{CC+}$				
		$R_{PU} = 10\text{ k}\Omega$ , $T_{amb} = +25\text{ }^\circ\text{C}$		2	3.3	
		$R_{PU} = 10\text{ k}\Omega$ , $40\text{ }^\circ\text{C} < T_{amb} < +85\text{ }^\circ\text{C}$			3.5	
		$R_{PU} = 1\text{ M}\Omega$ , $T_{amb} = +25\text{ }^\circ\text{C}$		18	19	
		$R_{PU} = 1\text{ M}\Omega$ , $-40\text{ }^\circ\text{C} < T_{amb} < +85\text{ }^\circ\text{C}$			20	



Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
T <sub>PHL</sub>	Propagation delay (high to low)	f = 1 kHz, C <sub>L</sub> = 10 pF, overdrive = 10 mV V <sub>PU</sub> = V <sub>CC+</sub>				μs	
		R <sub>PU</sub> = 10 kΩ, T <sub>amb</sub> = +25 °C		5.8	8.5		
		R <sub>PU</sub> = 10 kΩ, 40 °C < T <sub>amb</sub> < +85 °C			10		
		R <sub>PU</sub> = 1 MΩ, T <sub>amb</sub> = +25 °C		6	7		
		R <sub>PU</sub> = 1 MΩ, -40 °C < T <sub>amb</sub> < +85 °C			10		
		f = 1 kHz, C <sub>L</sub> = 10 pF, overdrive = 100 mV V <sub>PU</sub> = V <sub>CC+</sub>					
		R <sub>PU</sub> = 10 kΩ, T <sub>amb</sub> = +25 °C		1.9	3		
		R <sub>PU</sub> = 10 kΩ, 40 °C < T <sub>amb</sub> < +85 °C			3.5		
		R <sub>PU</sub> = 1 MΩ, T <sub>amb</sub> = +25 °C		2	3.5		
		R <sub>PU</sub> = 1 MΩ, -40 °C < T <sub>amb</sub> < +85 °C			4.5		
T <sub>R</sub>	Rise time (10% to 90%)	C <sub>L</sub> = 10 pF, R <sub>PU</sub> = 10 kΩ overdrive = 100 mV		1800		ns	
T <sub>F</sub>	Fall time (90% to 10%)	C <sub>L</sub> = 10 pF, R <sub>PU</sub> = 10 kΩ overdrive = 100 mV		170		ns	
T <sub>ON</sub>	Power-up time			0.9	1.3	ms	

1. The offset is defined as the average value of positive and negative trip points (input voltage differences requested to change the output state in each direction)
2. The hysteresis is a built-in feature. It is defined as the voltage difference between the trip points.
3. Maximum values include unavoidable inaccuracies of the industrial tests.
4. T<sub>PLH</sub> is measured when the output signal crosses a voltage level at 50% of V<sub>CC</sub> with the following conditions: inverting input voltage (IN-) = V<sub>ICM</sub> and non-inverting input voltage (IN+) moving from V<sub>ICM</sub> - 100 mV to V<sub>ICM</sub> + overdrive.
5. T<sub>PHL</sub> is measured when the output signal crosses a voltage level at 50% of V<sub>CC</sub> with the following conditions: inverting input voltage (IN-) = V<sub>ICM</sub> and non-inverting input voltage (IN+) moving from V<sub>ICM</sub> + 100 mV to V<sub>ICM</sub> - overdrive.

**Note:** All values over the temperature range are guaranteed through correlation and simulation. No production test is performed at the temperature range limits.

**Table 6. Electrical characteristics  $V_{CC} = +5\text{ V}$ ,  $T_{amb} = 25\text{ °C}$ ,  $V_{ICM} = V_{CC}/2$  (unless otherwise specified)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{IO}$	Input offset voltage	$T_{amb} = +25\text{ °C}$	-5	1	5	mV
		$-40\text{ °C} < T_{amb} < +125\text{ °C}$	-6		6	
$\Delta V_{IO}$	Input offset voltage drift	$-40\text{ °C} < T_{amb} < +125\text{ °C}$		3		$\mu\text{V}/\text{°C}$
$V_{HYST}$	Input hysteresis voltage <sup>(2)</sup>	$T_{amb} = +25\text{ °C}$		3.1		mV
		$-40\text{ °C} < T_{amb} < +125\text{ °C}$	1.6		4.2	
$I_{IO}$	Input offset current <sup>(3)</sup>	$T_{amb} = +25\text{ °C}$		1	10	pA
		$-40\text{ °C} < T_{amb} < +125\text{ °C}$			100	
$I_{IB}$	Input bias current <sup>(3)</sup>	$T_{amb} = +25\text{ °C}$		10	20	pA
		$-40\text{ °C} < T_{amb} < +125\text{ °C}$			100	
$I_{CC}$	Supply current per operator	Output low, $V_{ID} = -0.1\text{ V}$		400	600	nA
		$-40\text{ °C} < T_{amb} < +125\text{ °C}$			630	
		Output high, $V_{ID} = +0.1\text{ V}$		290	430	
		$-40\text{ °C} < T_{amb} < +125\text{ °C}$			480	
$I_{SINK}$	Output sink current	$V_{OUT} = V_{CC+}$ , $V_{ID} = -0.1\text{ V}$		50		mA
$I_{OH}$	High level output current	$V_{OUT} = V_{CC+}$ , $V_{ID} = 0.1\text{ V}$		80	100	pA
		$-40\text{ °C} < T_{amb} < +125\text{ °C}$			20	nA
$V_{OL}$	Output voltage low	$I_{SINK} = 2\text{ mA}$		110	180	mV
		$-40\text{ °C} < T_{amb} < +125\text{ °C}$			240	
CMRR	Common mode rejection ratio	$0 < V_{ICM} < V_{CC}$		78		dB
		$-40\text{ °C} < T_{amb} < +125\text{ °C}$	55			
SVR	Supply voltage rejection	$\Delta V_{CC} = 1.2\text{ V to }5\text{ V}$		80		dB
		$-40\text{ °C} < T_{amb} < +125\text{ °C}$	65			
$T_{PLH}$	Propagation delay <sup>(4)</sup> (low to high)	$f = 1\text{ kHz}$ , $C_L = 10\text{ pF}$ , overdrive = 10 mV $V_{PU} = V_{CC+}$				$\mu\text{s}$
		$R_{PU} = 10\text{ k}\Omega$ , $T_{amb} = +25\text{ °C}$		7	11	
		$R_{PU} = 10\text{ k}\Omega$ , $40\text{ °C} < T_{amb} < +85\text{ °C}$			13	
		$R_{PU} = 1\text{ M}\Omega$ , $T_{amb} = +25\text{ °C}$		21	23	
		$R_{PU} = 1\text{ M}\Omega$ , $-40\text{ °C} < T_{amb} < +85\text{ °C}$			24	
		$f = 1\text{ kHz}$ , $C_L = 10\text{ pF}$ , overdrive = 100 mV $V_{PU} = V_{CC+}$				
		$R_{PU} = 10\text{ k}\Omega$ , $T_{amb} = +25\text{ °C}$		3	4.4	
		$R_{PU} = 10\text{ k}\Omega$ , $40\text{ °C} < T_{amb} < +85\text{ °C}$			5	
		$R_{PU} = 1\text{ M}\Omega$ , $T_{amb} = +25\text{ °C}$		18	20	
$R_{PU} = 1\text{ M}\Omega$ , $-40\text{ °C} < T_{amb} < +85\text{ °C}$			21			

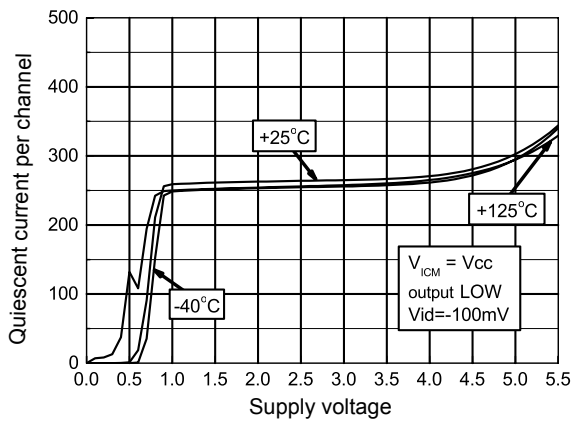
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
T <sub>PHL</sub>	Propagation delay <sup>(5)</sup> (high to low)	f = 1 kHz, C <sub>L</sub> = 10 pF, overdrive = 10 mV V <sub>PU</sub> = V <sub>CC+</sub>				μs
		R <sub>PU</sub> = 10 kΩ, T <sub>amb</sub> = +25 °C		7.5	11	
		R <sub>PU</sub> = 10 kΩ, 40 °C < T <sub>amb</sub> < +85 °C			12	
		R <sub>PU</sub> = 1 MΩ, T <sub>amb</sub> = +25 °C		9	11	
		R <sub>PU</sub> = 1 MΩ, -40 °C < T <sub>amb</sub> < +85 °C			13	
		f = 1 kHz, C <sub>L</sub> = 10 pF, overdrive = 100 mV V <sub>PU</sub> = V <sub>CC+</sub>				
		R <sub>PU</sub> = 10 kΩ, T <sub>amb</sub> = +25 °C		2	3.3	
		R <sub>PU</sub> = 10 kΩ, 40 °C < T <sub>amb</sub> < +85 °C			3.5	
		R <sub>PU</sub> = 1 MΩ, T <sub>amb</sub> = +25 °C		2	3	
		R <sub>PU</sub> = 1 MΩ, -40 °C < T <sub>amb</sub> < +85 °C			4	
T <sub>R</sub>	Rise time (10% to 90%)	C <sub>L</sub> = 10 pF, R <sub>PU</sub> = 10 kΩ overdrive = 100 mV		3.7		μs
T <sub>F</sub>	Fall time (90% to 10%)	C <sub>L</sub> = 10 pF, R <sub>PU</sub> = 10 kΩ overdrive = 100 mV		190		ns
T <sub>ON</sub>	Power-up time			0.9	1.3	ms

1. The offset is defined as the average value of positive and negative trip points (input voltage differences requested to change the output state in each direction).
2. The hysteresis is a built-in feature. It is defined as the voltage difference between the trip points.
3. Maximum values include unavoidable inaccuracies of the industrial tests
4. T<sub>PLH</sub> is measured when the output signal crosses a voltage level at 50% of V<sub>CC</sub> with the following conditions: inverting input voltage (IN-) = V<sub>ICM</sub> and non-inverting input voltage (IN+) moving from V<sub>ICM</sub> - 100 mV to V<sub>ICM</sub> + overdrive.
5. T<sub>PHL</sub> is measured when the output signal crosses a voltage level at 50% of V<sub>CC</sub> with the following conditions: inverting input voltage (IN-) = V<sub>ICM</sub> and non-inverting input voltage (IN+) moving from V<sub>ICM</sub> + 100 mV to V<sub>ICM</sub> - overdrive.

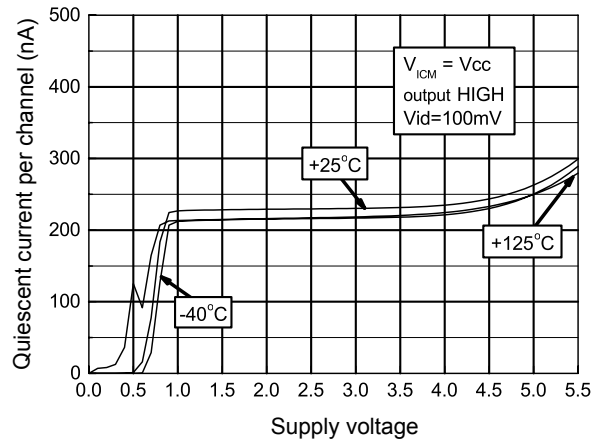
**Note:** All values over the temperature range are guaranteed through correlation and simulation. No production test is performed at the temperature range limits.

## 4 Typical characteristics and curves

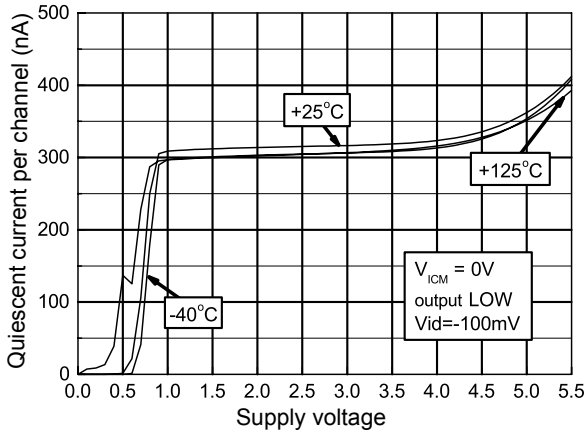
**Figure 3. Current consumption vs. supply voltage,  $V_{icm}=V_{cc}$ , output low**



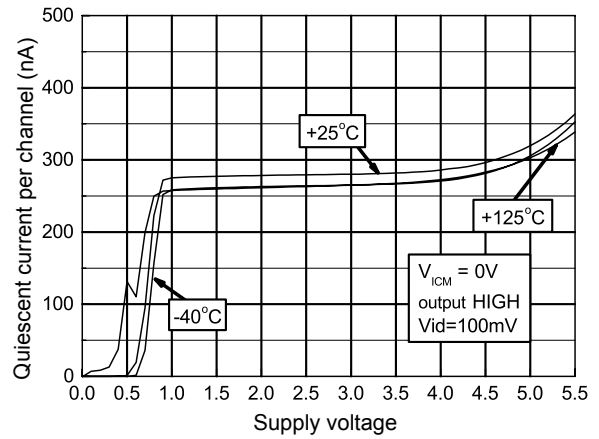
**Figure 4. Current consumption vs. supply voltage,  $V_{icm}=V_{cc}$ , output high**



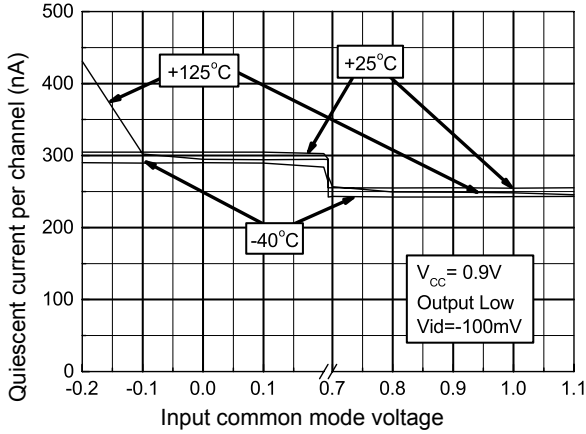
**Figure 5. Current consumption vs. supply voltage,  $V_{icm}=0$  V, output low**



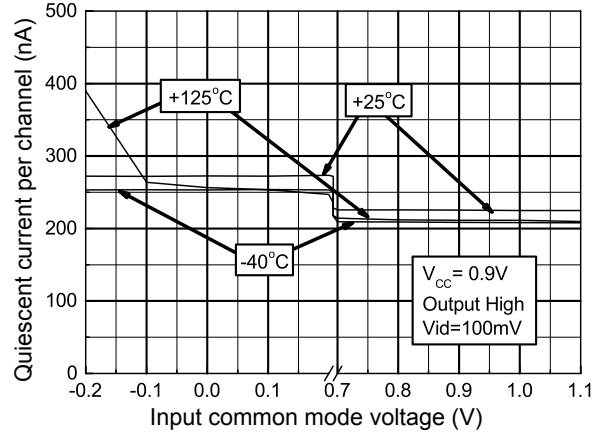
**Figure 6. Current consumption vs. supply voltage,  $V_{icm}=0$  V, output high**



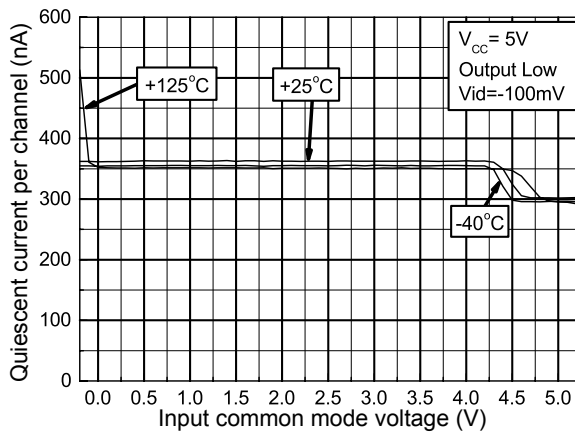
**Figure 7. Current consumption vs. input common mode voltage,  $V_{cc}=0.9\text{ V}$ , output low**



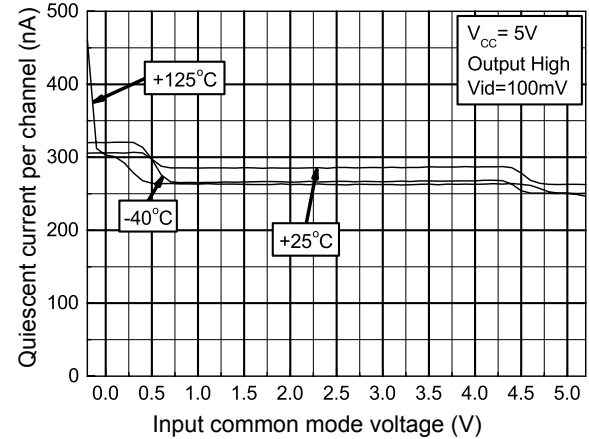
**Figure 8. Current consumption vs. input common mode voltage,  $V_{cc}=0.9\text{ V}$ , output high**



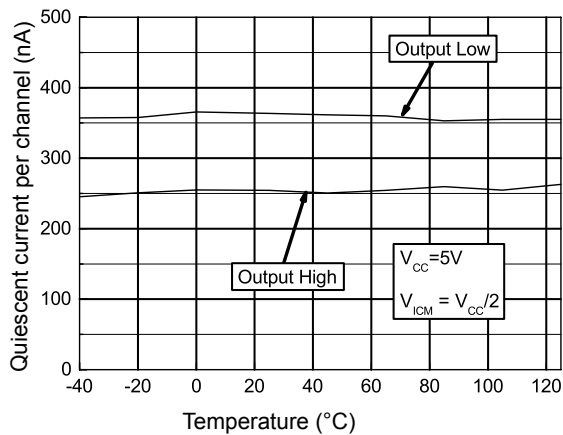
**Figure 9. Current consumption vs. input common mode voltage,  $V_{cc}=5\text{ V}$ , output low**



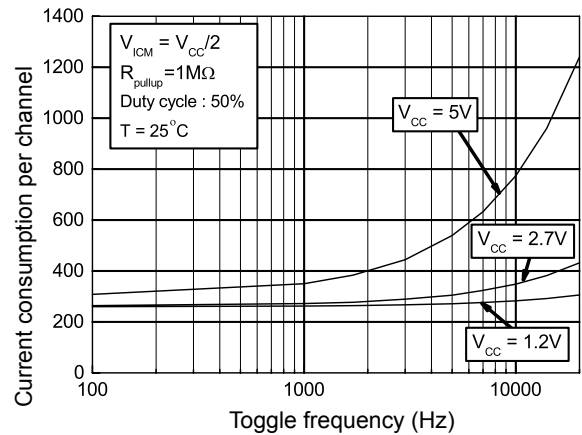
**Figure 10. Current consumption vs. input common mode voltage,  $V_{cc}=5\text{ V}$ , output high**



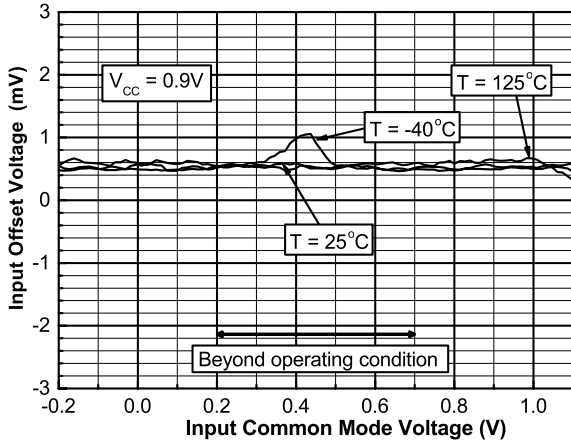
**Figure 11. Current consumption vs. temperature**



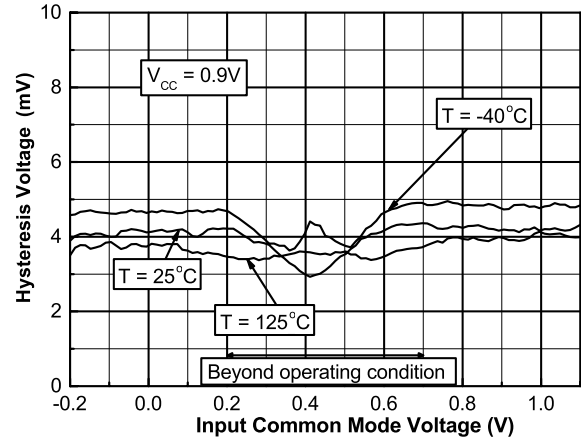
**Figure 12. Current consumption vs. toggle frequency**



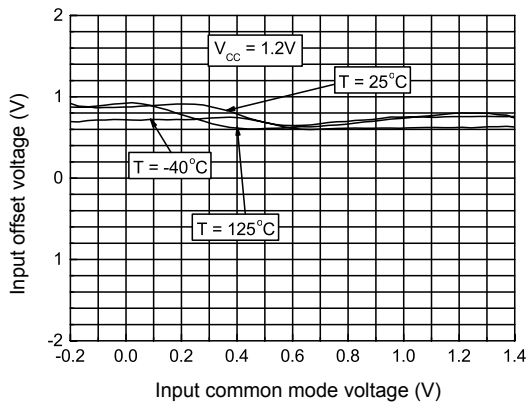
**Figure 13. Input offset voltage vs. input common mode voltage,  $V_{cc}=0.9\text{ V}$**



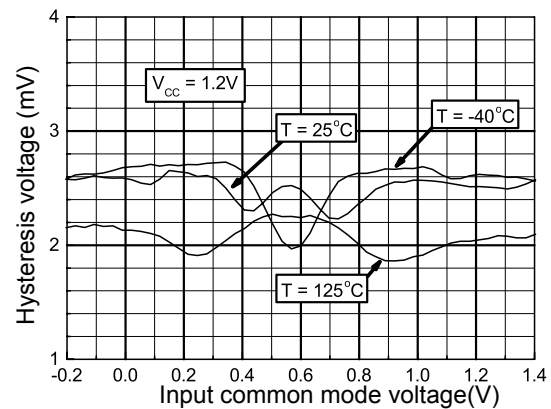
**Figure 14. Input hysteresis voltage vs. input common mode voltage,  $V_{cc}=0.9\text{ V}$**



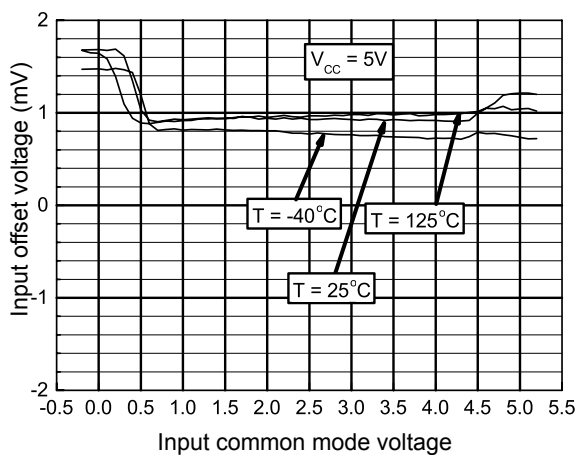
**Figure 15. Input offset voltage vs. input common mode voltage,  $V_{cc}=1.2\text{ V}$**



**Figure 16. Input hysteresis voltage vs. input common mode voltage,  $V_{cc}=1.2\text{ V}$**



**Figure 17. Input offset voltage vs. input common mode voltage,  $V_{cc}=5\text{ V}$**



**Figure 18. Input hysteresis voltage vs. input common mode voltage,  $V_{cc}=5\text{ V}$**

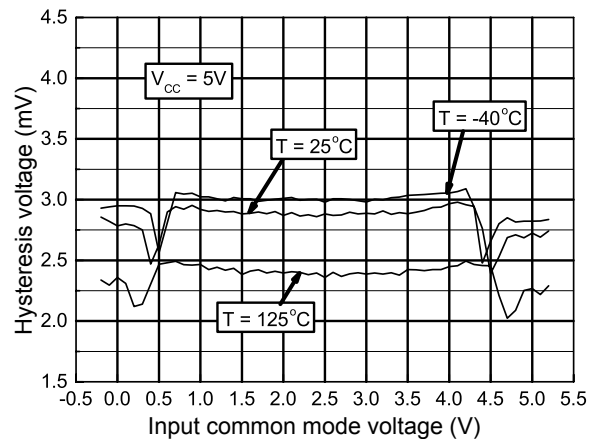


Figure 19. Input offset voltage vs. temperature

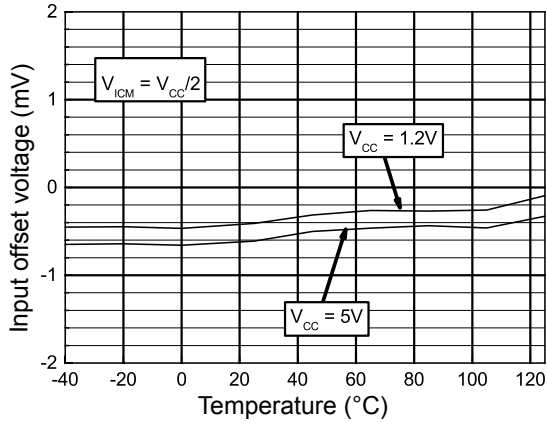


Figure 20. Input hysteresis voltage vs. temperature

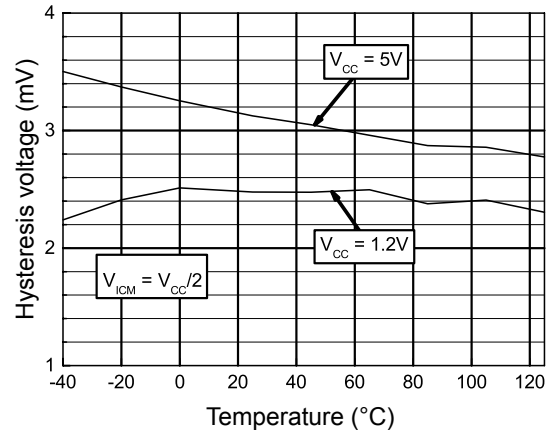


Figure 21. Output voltage drop vs. sink current,  $V_{CC}=1.2V$

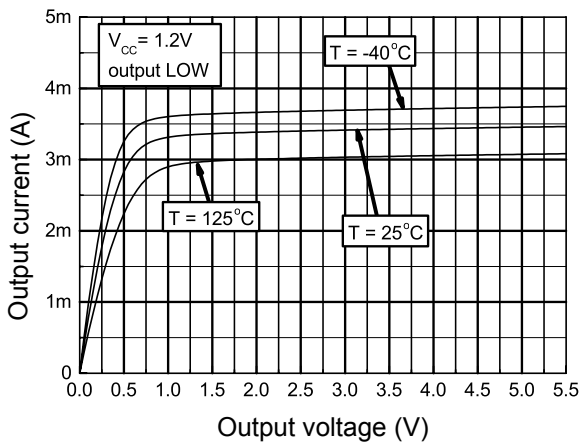


Figure 22. Output voltage drop vs. source current,  $V_{CC}=1.2V$

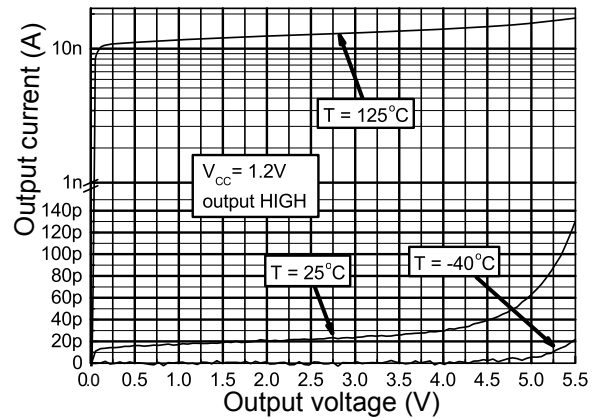


Figure 23. Output voltage drop vs. sink current,  $V_{CC}=2.7V$

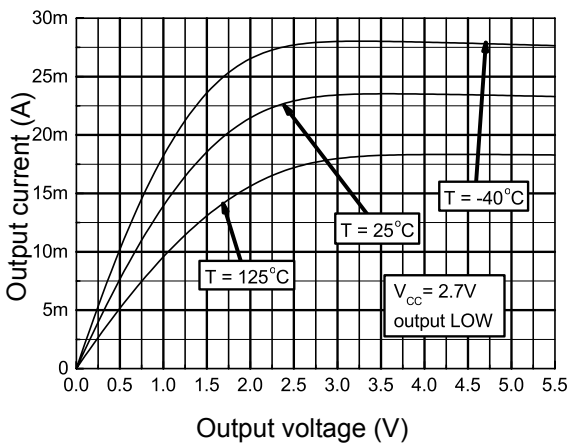


Figure 24. Output voltage drop vs. source current,  $V_{CC}=2.7V$

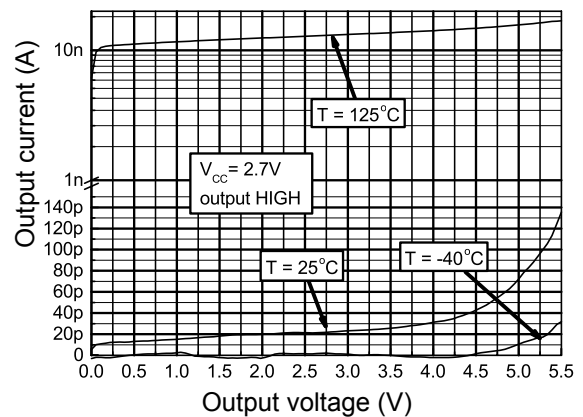


Figure 25. Output voltage drop vs. sink current,  $V_{CC}=5\text{ V}$

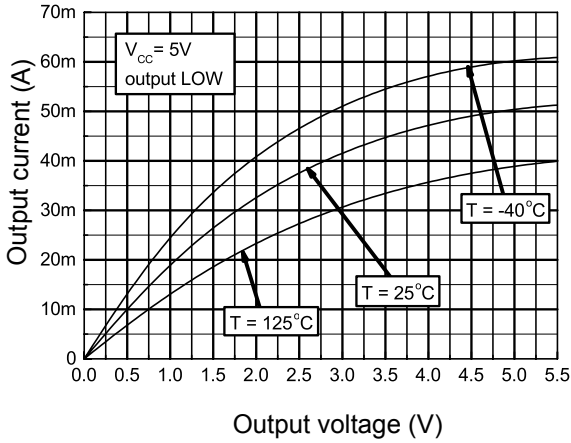


Figure 26. Output voltage drop vs. source current,  $V_{CC}=5\text{ V}$

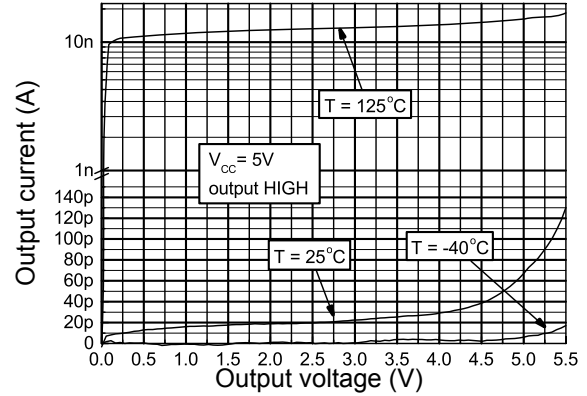


Figure 27. Propagation delay  $T_{PLH}$  vs. input common mode voltage,  $V_{CC}=0.9\text{ V}$

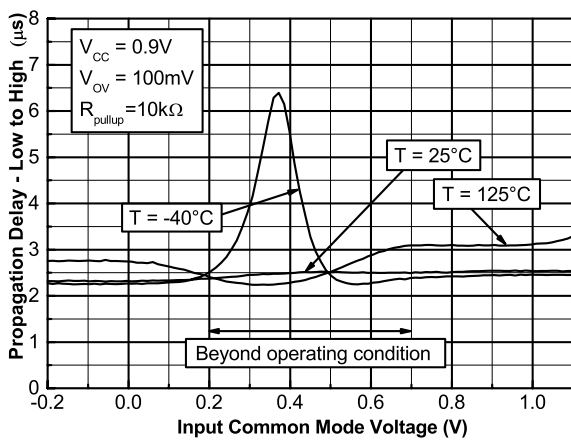


Figure 28. Propagation delay  $T_{PHL}$  vs. input common mode voltage,  $V_{CC}=0.9\text{ V}$

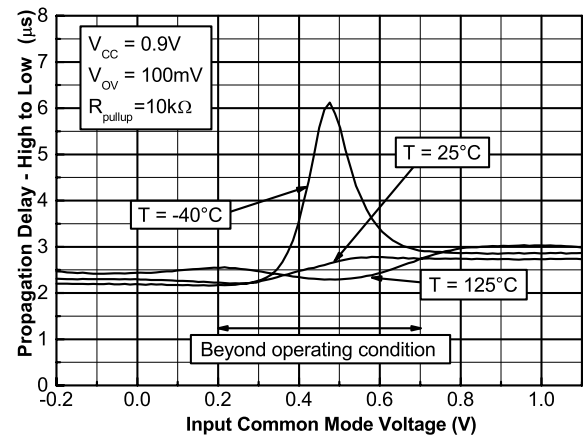


Figure 29. Propagation delay  $T_{PLH}$  vs. input common mode voltage,  $V_{CC}=1.2\text{ V}$

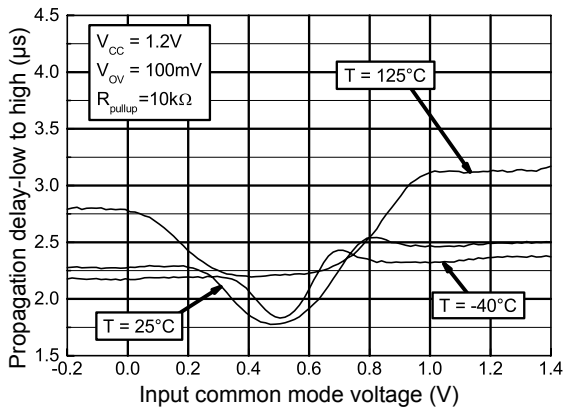
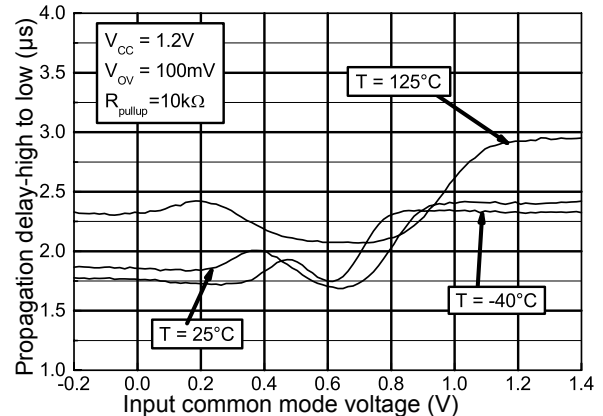
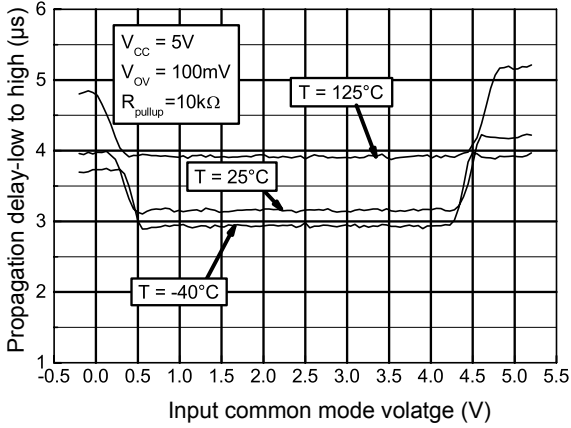


Figure 30. Propagation delay  $T_{PHL}$  vs. input common mode voltage,  $V_{CC}=1.2\text{ V}$

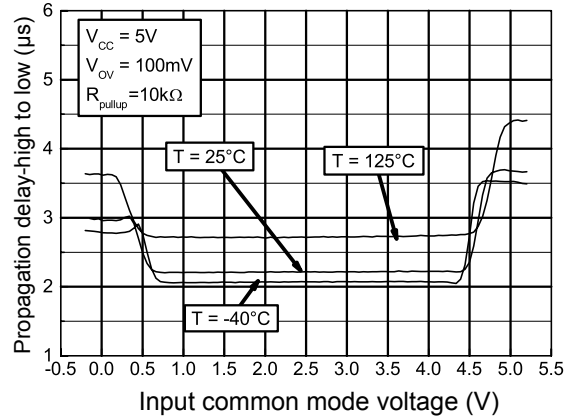




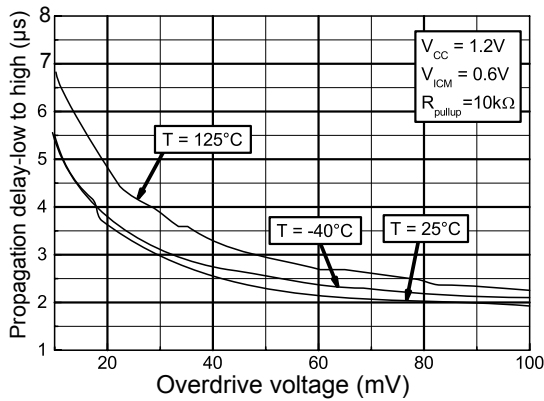
**Figure 31. Propagation delay  $T_{PLH}$  vs. input common mode voltage,  $V_{CC}=5V$**



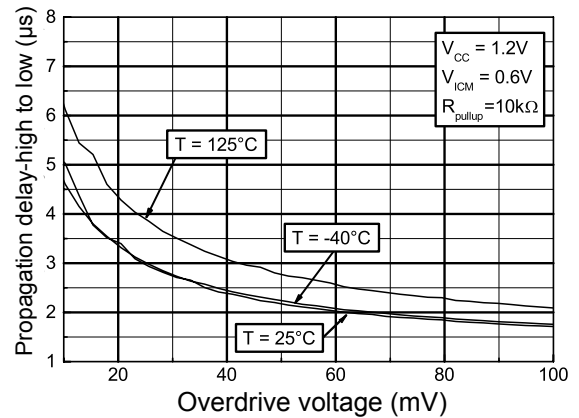
**Figure 32. Propagation delay  $T_{PHL}$  vs. input common mode voltage,  $V_{CC}=5V$**



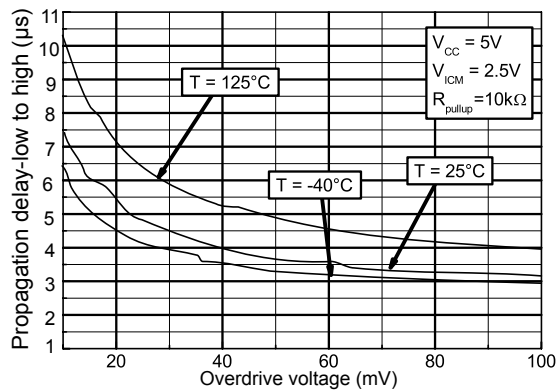
**Figure 33. Propagation delay  $T_{PLH}$  vs. input signal overdrive,  $V_{CC}=1.2V$**



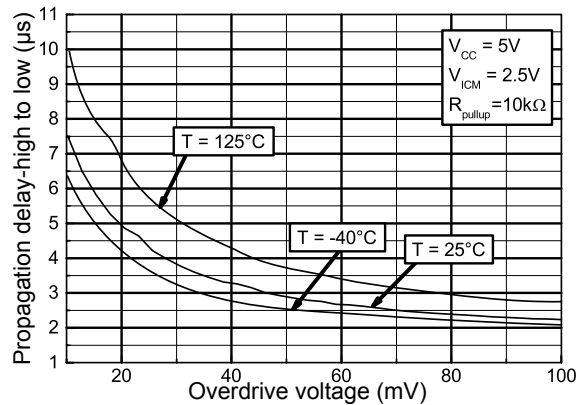
**Figure 34. Propagation delay  $T_{PHL}$  vs. input signal overdrive,  $V_{CC}=1.2V$**



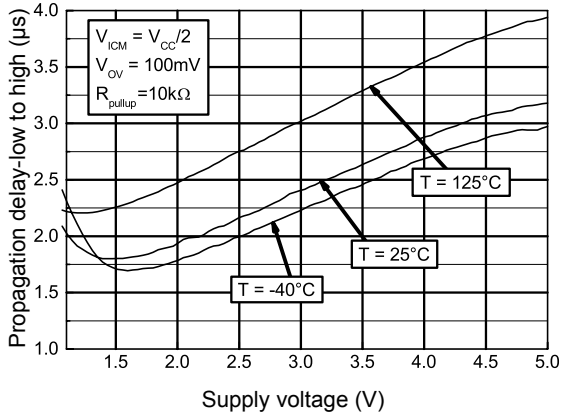
**Figure 35. Current consumption Vs. input common mode voltage,  $V_{CC}=0.9V$ , output low**



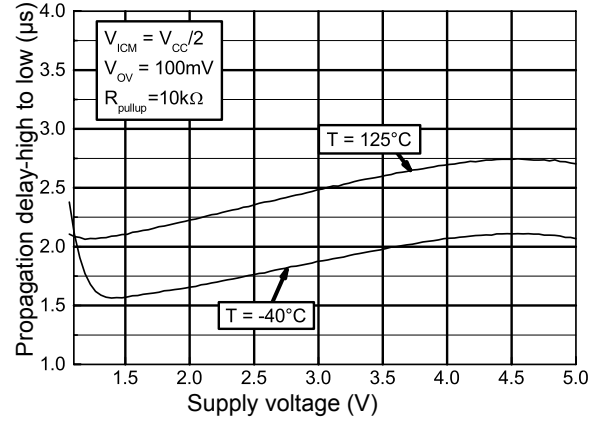
**Figure 36. Current consumption Vs. input common mode voltage,  $V_{CC}=0.9V$ , output high**



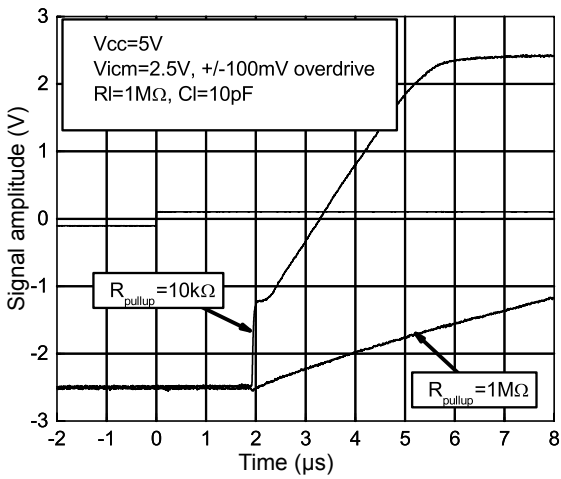
**Figure 37. Propagation delay  $T_{PLH}$  vs. input signal overdrive,  $V_{CC}=5\text{ V}$**



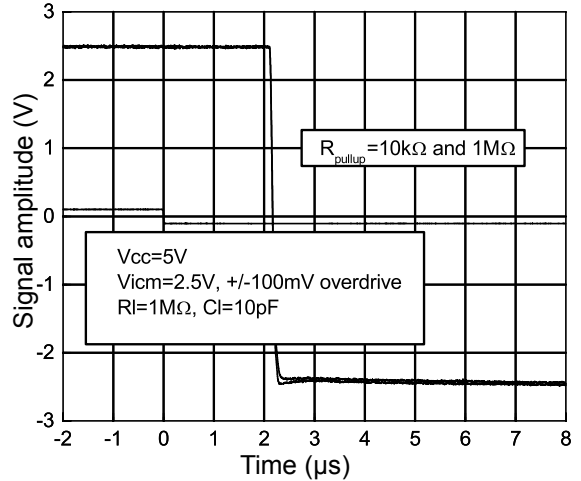
**Figure 38. Propagation delay  $T_{PHL}$  vs. input signal overdrive,  $V_{CC}=5\text{ V}$**



**Figure 39. Propagation delay  $T_{PLH}$  vs. supply voltage**



**Figure 40. Propagation delay  $T_{PHL}$  vs. supply voltage**



## 5 Ordering information

**Table 7. Order code**

Order code	Temp. range	Package	Packing	Marking
TS880ICT	-40 to +125 °C	SC70-5	Tape and reel	K5P
TS880ILT		SOT23-5		K534
TS883IST		MiniSO8		K5Q
TS883IQ2T		DFN8 2x2 mm		

## 6 Package information

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In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

## 6.1 SC70-5 (or SOT323-5) package information

Figure 41. SC70-5 (or SOT323-5) package outline

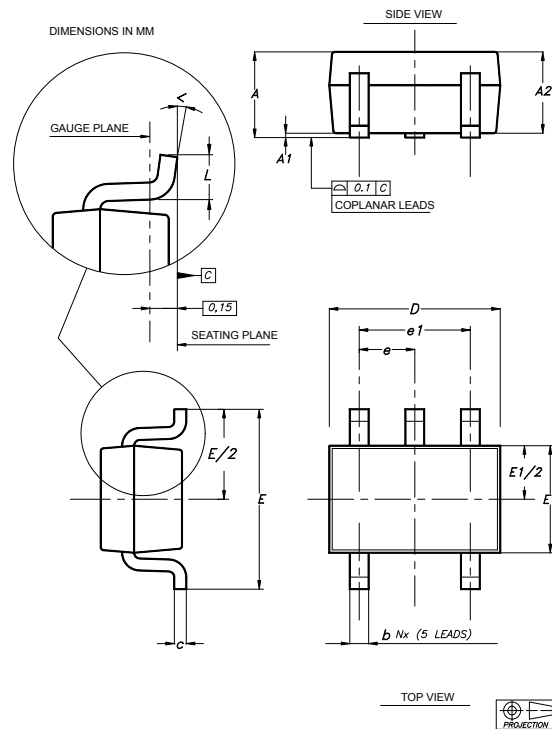
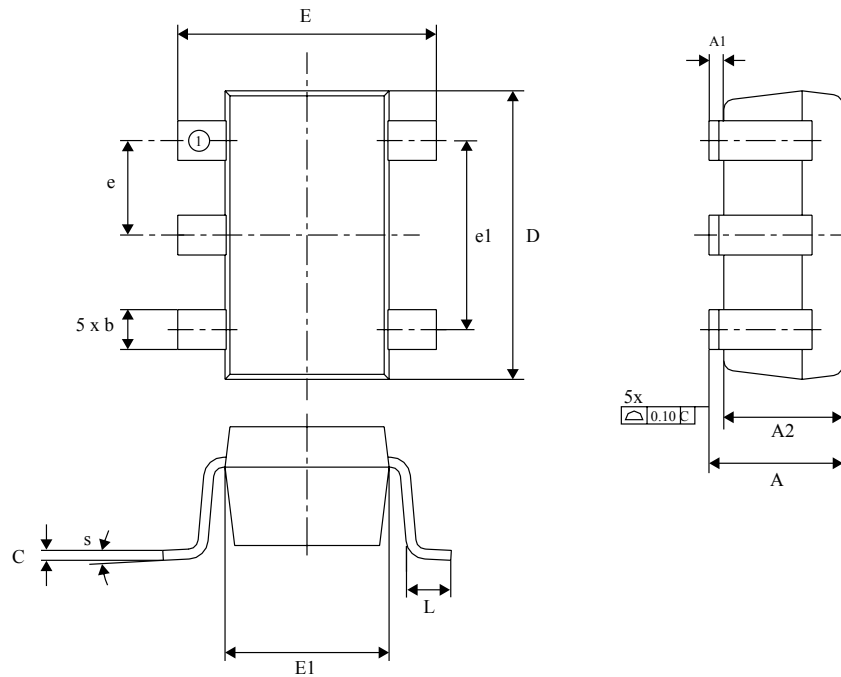


Table 8. SC70-5 (or SOT323-5) package mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.80		1.10	0.032		0.043
A1			0.10			0.004
A2	0.80	0.90	1.00	0.032	0.035	0.039
b	0.15		0.30	0.006		0.012
c	0.10		0.22	0.004		0.009
D	1.80	2.00	2.20	0.071	0.079	0.087
E	1.80	2.10	2.40	0.071	0.083	0.094
E1	1.15	1.25	1.35	0.045	0.049	0.053
e		0.65			0.025	
e1		1.30			0.051	
L	0.26	0.36	0.46	0.010	0.014	0.018
<	0°		8°	0°		8°

## 6.2 SOT23-5 package information

Figure 42. SOT23-5 package outline



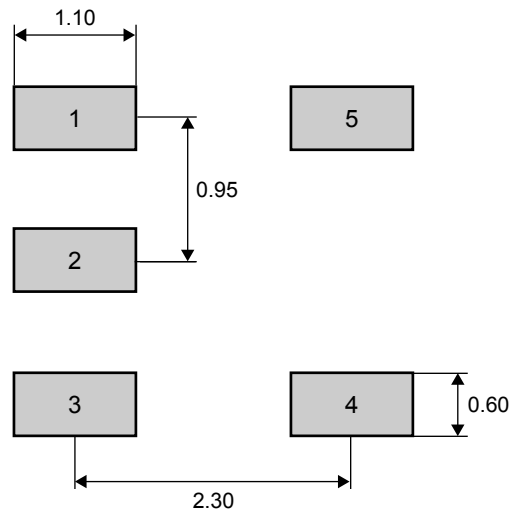
SOT23-5

Table 9. SOT23-5 mechanical data

Symbol	Millimeters			Inches <sup>(1)</sup>		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.45			0.057
A1	0.00		0.15	0.000		0.006
A2	0.90	1.15	1.30	0.035	0.045	0.051
b	0.30		0.50	0.012		0.020
c	0.08		0.22	0.003		0.009
D		2.90			0.114	
E		2.80			0.110	
E1		1.60			0.063	
e		0.95			0.037	
e1		1.90			0.075	
L	0.30	0.45	0.60	0.012	0.018	0.024
θ	0	4	8	0	4	8

1. Values in inches are converted from mm and rounded to 4 decimal digits.

Figure 43. SOT23-5 recommended footprint



### 6.3 DFN8 2x2 package information

Figure 44. DFN8 2x2 package outline

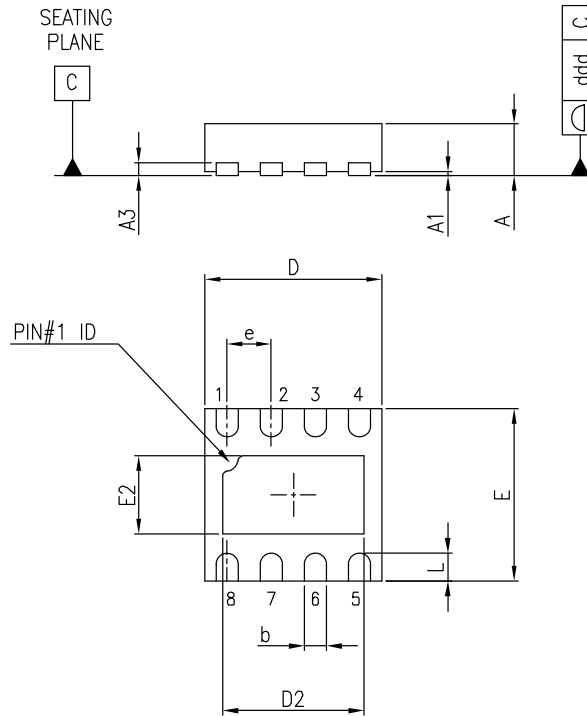
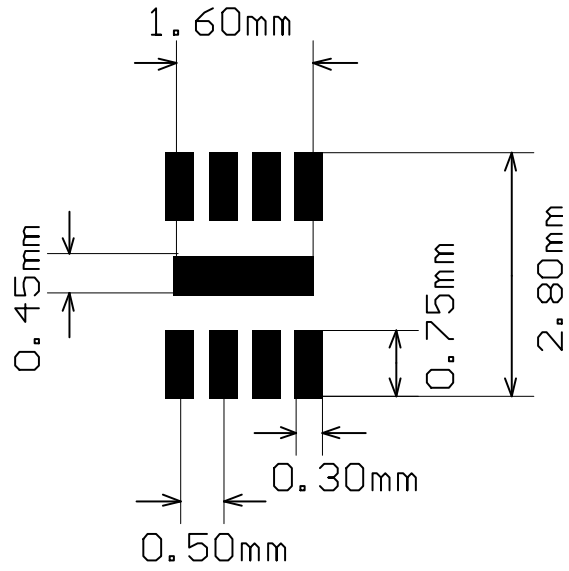


Table 10. DFN8 2x2 package mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.51	0.55	0.60	0.020	0.022	0.024
A1			0.05			0.002
A3		0.15			0.006	
b	0.18	0.25	0.30	0.007	0.010	0.012
D	1.85	2.00	2.15	0.073	0.079	0.085
D2	1.45	1.60	1.70	0.057	0.063	0.067
E	1.85	2.00	2.15	0.073	0.079	0.085
E2	0.75	0.90	1.00	0.030	0.035	0.039
e		0.50			0.020	
L	0.225	0.325	0.425	0.009	0.013	0.017
ddd			0.08			0.003



Figure 45. DFN8 2x2 recommended footprint



*Note:* The exposed pad of the DFN8 2x2 can be connected to VCC- or left floating.

## 6.4 MiniSO8 package information

Figure 46. MiniSO8 package outline

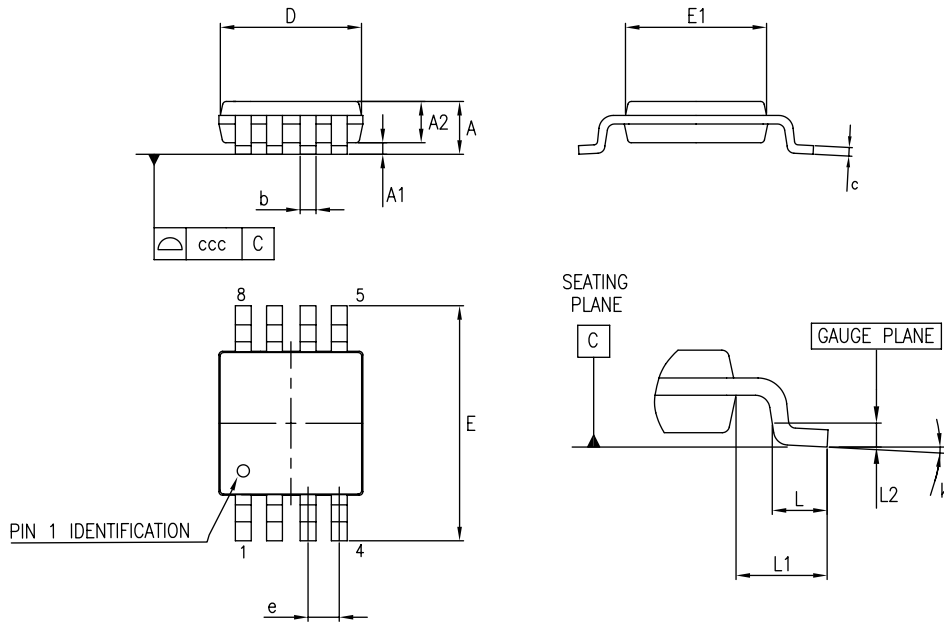


Table 11. MiniSO8 mechanical data

Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.1			0.043
A1	0		0.15	0		0.006
A2	0.75	0.85	0.95	0.03	0.033	0.037
b	0.22		0.4	0.009		0.016
c	0.08		0.23	0.003		0.009
D	2.8	3	3.2	0.11	0.118	0.126
E	4.65	4.9	5.15	0.183	0.193	0.203
E1	2.8	3	3.1	0.11	0.118	0.122
e		0.65			0.026	
L	0.4	0.6	0.8	0.016	0.024	0.031
L1		0.95			0.037	
L2		0.25			0.01	
k	0°		8°	0°		8°
ccc			0.1			0.004

## Revision history

**Table 12. Document revision history**

Date	Version	Changes
16-Apr-2019	1	Initial release.
24-May-2019	2	Updated Table 4. Electrical characteristics $V_{CC} = +1.2\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{ICM} = V_{CC}/2$ (unless otherwise specified), Table 5. Electrical characteristics $V_{CC} = +2.7\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{ICM} = V_{CC}/2$ (unless otherwise specified) and Table 6. Electrical characteristics $V_{CC} = +5\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{ICM} = V_{CC}/2$ (unless otherwise specified).

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