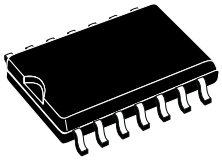
LM2901B

Datasheet

Automotive grade, low-power quad voltage comparator



SO14

TSSOP14

QFN16 3x3
wettable flank

Maturity status link
LM2901B

Features

- AEC-Q100 qualified
- Wide single supply voltage range or dual supplies +2 V to +36 V or ±1 V to ±18 V
- Very low supply current 1 mA (typ., all channels), essentially independent of supply voltage
- Low input bias current: 20 nA typ.
- Low input offset current: ±5 nA typ.
- Input common-mode voltage range includes negative rail
- Low output saturation voltage: 250 mV typ. (I_O = 4 mA)
- Input voltage range can exceed the positive supply voltage
- TTL, DTL, ECL, MOS, CMOS compatible outputs

Applications

- Level shifters
- Sampling circuits
- Peak & zero crossing detectors
- Threshold detectors
- Automotive

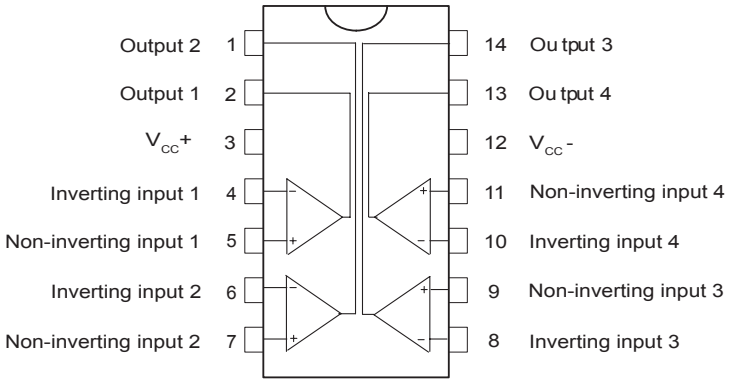
Description

The LM2901B consists of four independent low-power voltage comparators designed specifically to operate from a single supply over a wide range of voltages. It is fully specified at 5 V and 36 V single supply voltage operation, however operation from dual power supplies is also possible.

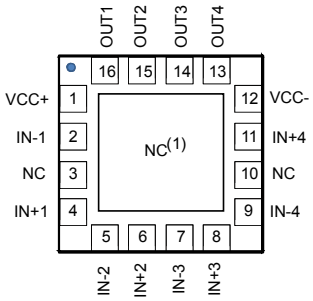
The B-grade version of the LM2901 comparators offers an increased maximum operating voltage of 40 V and improved electrical characteristics.

1 Pin configuration

Figure 1. Pin connections (top view)



SO14 and TSSOP14



QFN16 3 x 3

2 Maximum ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
Vcc	Supply voltage (1)	±20 or 40	V
Vid	Differential input voltage (2)	±40	
Vin	Input voltage	-0.3 to 40	
Iin	Input current (3)	10	mA
	Output sinking current	20	
	Duration of output short circuit to ground(4)	Infinite	s
Tstg	Storage temperature range	-65 to 150	°C
Tj	Maximum junction temperature	150	
Rthja	Thermal resistance junction to ambient (5) SO-14 TSSOP-14 QFN16	 105 100 45	°C/W
Rthjc	Thermal resistance junction to case (5) SO-14 TSSOP-14 QFN16	 31 32 14	
ESD	HBM: human body model (6) MM: machine model (7) CDM: charged device model (8)	500 100 1500	V

1. *All voltage values, except differential voltage, are with respect to network ground terminal.*
2. *Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.*
3. *Input current must be limited by a resistor in series with the inputs to keep Vin in the range of the specified AMR.*
4. *Short-circuits from the output to Vcc+ can cause excessive heating and eventual destruction. Destructive dissipation can result from simultaneous short-circuits on all amplifiers.*
5. *Short-circuits can cause excessive heating and destructive dissipation. Values are typical.*
6. *Human body model: a 100 pF capacitor is charged to the specified voltage, then discharged through a 1.5 kΩ resistor between two pins of the device. This is done for all couples of connected pin combinations while the other pins are floating.*
7. *Machine model: a 200 pF capacitor is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5 Ω). This is done for all couples of connected pin combinations while the other pins are floating.*
8. *Charged device model: all pins and the package are charged together to the specified voltage and then discharged directly to the ground through only one pin. This is done for all pins.*

Table 2. Operating conditions

Symbol	Parameter	Value	Unit
Vcc	Supply voltage	2 to 36	V
Vicm	Common-mode input voltage range (1) Tamb = 25 °C Common-mode input voltage range Tmin ≤ Tamb ≤ Tmax	Vcc- to Vcc+ - 1.5, max. Vcc- + 32 Vcc- to Vcc+ - 2, max. Vcc- + 32	
T	Operating free-air temperature range	-40 to 125	°C

1. *Positive excursions of input voltage may exceed the power supply level. As long as the other voltage remains within thecommon-mode range, the comparator provides a proper output state. The low input voltage state must not be less than –0.3 V (or 0.3 V below the negative power supply, if used).*

3 Electrical characteristics

Vcc+ = 5 V and 36 V, Vcc- = 0 V, Vo = 1.4 V, Rl connected to ground, T = 25 °C (unless otherwise specified).

Table 3. Electrical characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit
Vio	Input offset voltage (1) Tmin < T < Tmax			4 5	mV
Iib	Input bias current (2) Tmin < T < Tmax		20	150 200	nA
Iio	Input offset current Tmin < T < Tmax		5	30 40	nA
Avd	Vcc = 15 V, RL = 15 kΩ, Vo = 1 to 11 V		200		V / mV
Icc	Supply current, all comparators, no load Vcc = 5 V Tmin < T < Tmax Vcc = 36 V Tmin < T < Tmax		 0.8 1.2	 2 2 2.5 2.5	mA
Vol	Low-level output voltage V_{cc} = 5 V, V_{id} = -1 V, I_{sink} = 4 mA T_{min} < T < T_{max} V_{cc} = 36 V, V_{id} = -1 V, I_{sink} = 4 mA T_{min} < T < T_{max}		 250 250	 350 600 350 600	mV
I_{oh}	High-level output current V_{cc} = V_o = 36 V, V_{id} = 1 V T_{min} < T < T_{max}		0.1	1	nA µA
Isink	Output sink current V_{id} = -1 V, V_o = 1.5 V V_{cc} = 5 V T_{min} < T < T_{max} V_{cc} = 36 V T_{min} < T < T_{max}	 8 7 11 10	 17 10 22 13		mA
t_{res}	Small signal response time R_L = 5.1 kΩ to Vcc (3) V_{cc} = 5 V V_{cc} = 36 V		 1.0 0.9		µs
t_{rel}	Large signal response time (4) TTL input (V_{ref} = +1.4 V, R_L = 5.1 kΩ to Vcc) Output signal at 50% of final value Output signal at 95% of final value			 500 1	 ns µs

1. *At output switch point, V_O ≈ 1.4 V, RS = 0 Ω with Vcc from 5 V to 36 V, and over the full input common-mode range (0 V to Vcc+ - 1.5 V, max. Vcc- + 32 V).*
2. *The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output, so no loading charge exists on the reference of input lines.*
3. *The response time specified is for a 100 mV input step with 5 mV overdrive.*

4. *Maximum values are guaranteed by design and evaluation.*

4 Typical performance characteristics

Figure 2. Supply current vs. supply voltage

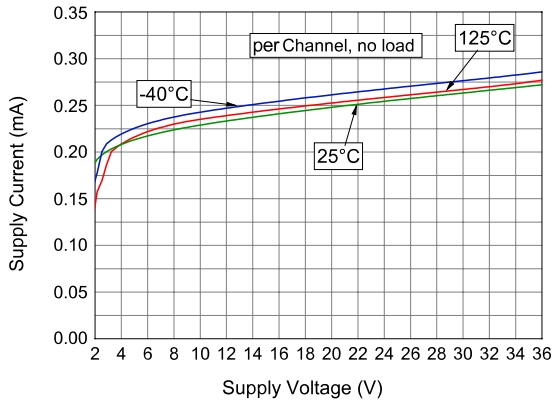


Figure 3. Input offset voltage vs. supply voltage at Vicm = Vcc/2

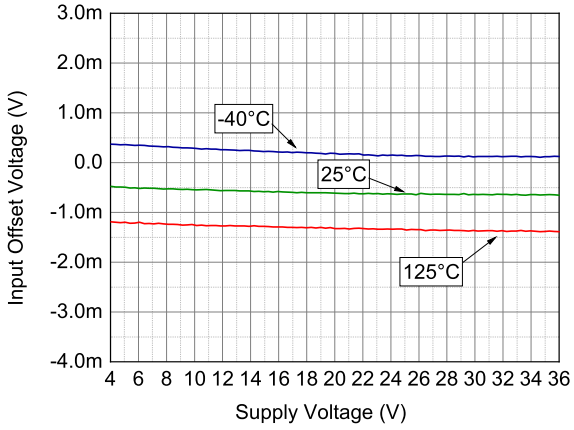


Figure 4. Input offset voltage vs. common-mode voltage at Vcc = 36 V

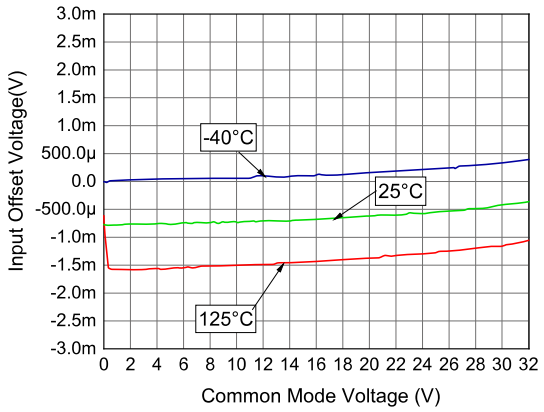


Figure 5. Input bias current vs. supply voltage at Vicm = Vcc/2

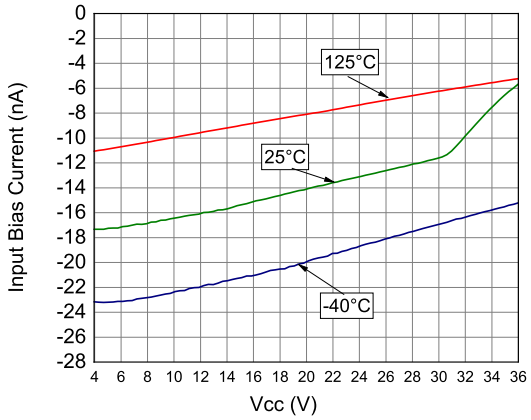


Figure 6. Input bias current vs. common-mode voltage at Vcc = 36 V

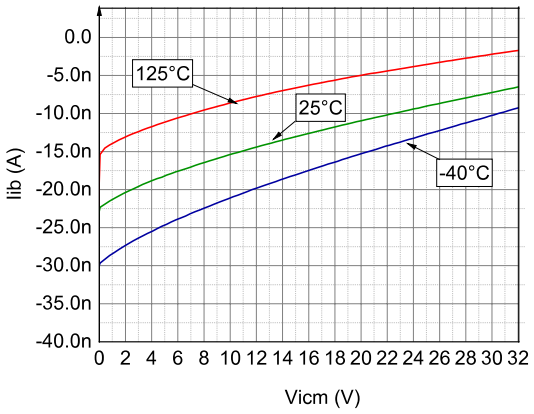


Figure 7. Output saturation voltage vs. output current

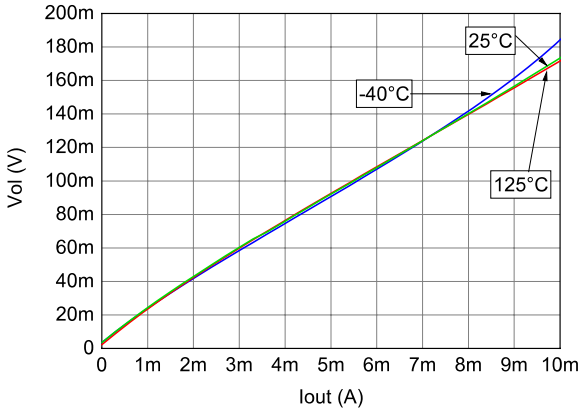


Figure 8. Output saturation current vs. output voltage at Vcc = 36 V

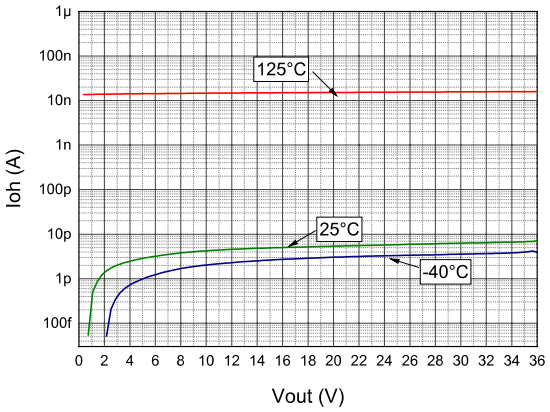


Figure 9. Positive step response

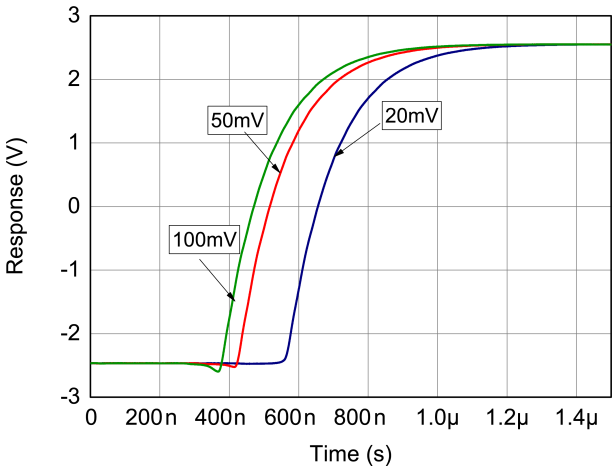


Figure 10. Negative step response

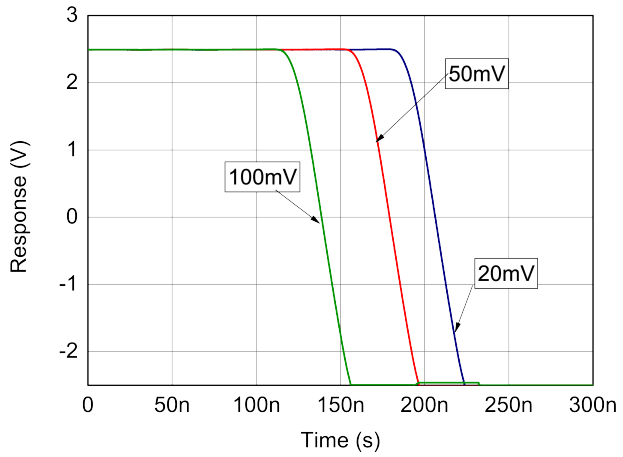


Figure 11. Propagation delay vs. overdrive for positive steps at Vcc = 36 V

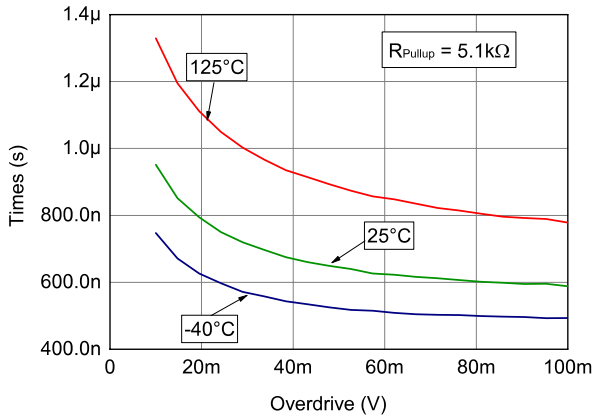
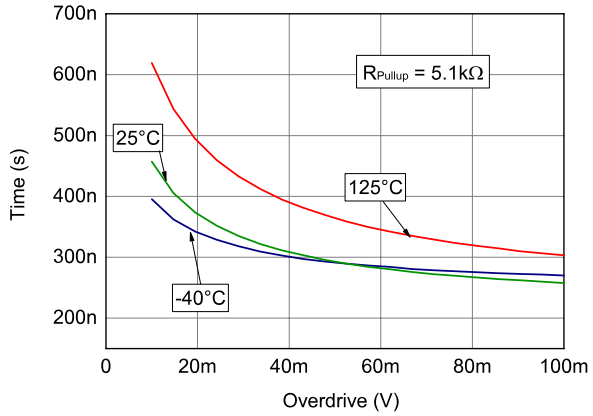


Figure 12. Propagation delay vs. overdrive for negative steps at Vcc = 36 V



5 Package information

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. ECOPACK is an ST trademark.

5.1 SO-14 package information

Figure 13. SO-14 package outline

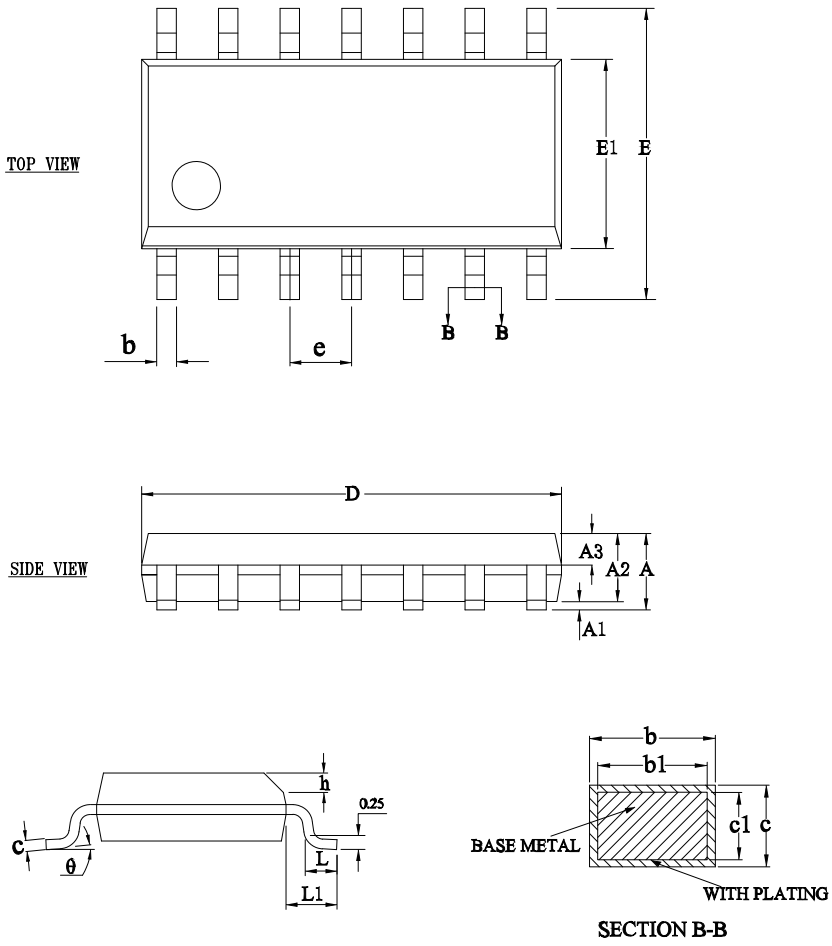
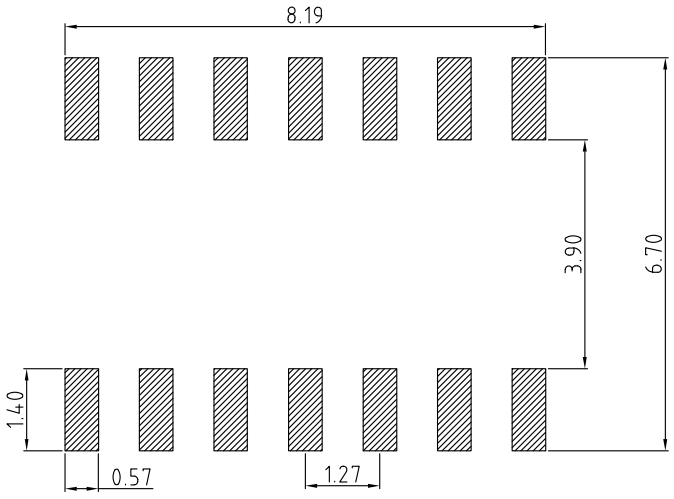


Table 4. **SO-14 package mechanical data**

Dim.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
A1	0.10		0.225	0.004		0.009
A2	1.30	1.40	1.50	0.051	0.055	0.059
A3	0.60	0.65	0.70	0.024	0.026	0.028
b	0.39		0.47	0.015		0.019
b1	0.38	0.41	0.44	0.015	0.016	0.017
c	0.20		0.24	0.008		0.009
c1	0.19	0.20	0.21	0.0075	0.0079	0.0083
D	8.55	8.65	8.75	0.337	0.341	0.344
E	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.154	0.157
e	1.27 BSC			0.050 BSC		
h	0.25		0.50	0.010		0.020
L	0.50		0.80	0.020		0.031
L1	1.05 REF			0.041 REF		
θ	8° (max)					

Figure 14. **SO-14 recommended footprint**



5.2 TSSOP-14 package information

Figure 15. **TSSOP-14 package outline**

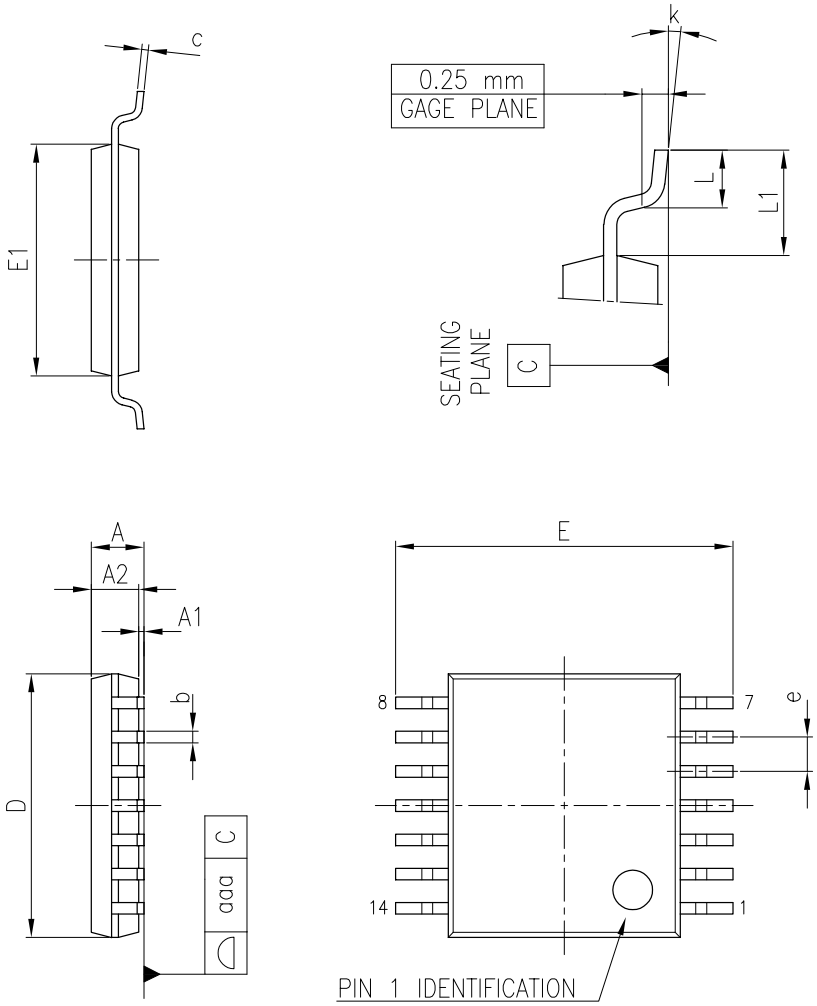
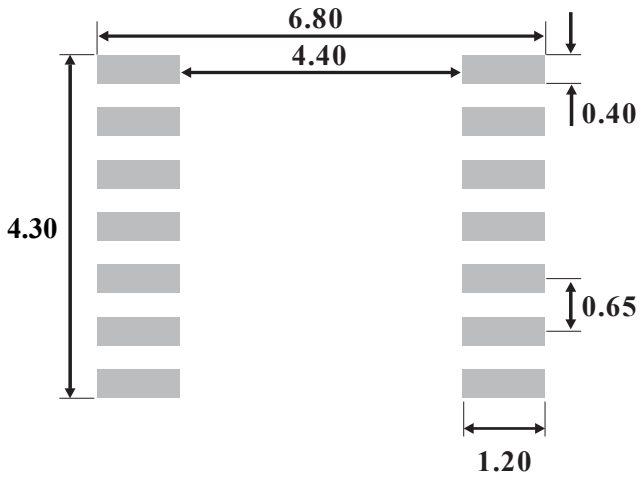


Table 5. **TSSOP-14 package mechanical data**

Dim.	Dimension					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.20			0.047
A1	0.05		0.15	0.002		0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.008
D	4.90	5.00	5.10	0.193	0.197	0.201
E	6.20	6.40	6.60	0.244	0.252	0.260
E1	4.30	4.40	4.50	0.169	0.173	0.177
e	0.65 BSC			0.25 BSC		
L	0.45	0.60	0.75	0.018	0.024	0.030
L1		1.00			0.039	
k	8° (max)					
aaa			0.10			0.004

Figure 16. **TSSOP-14 recommended footprint**



5.3 QFN16 3x3 wettable flank package information

Figure 17. **QFN16 3x3 mm wettable flank drawing outline**

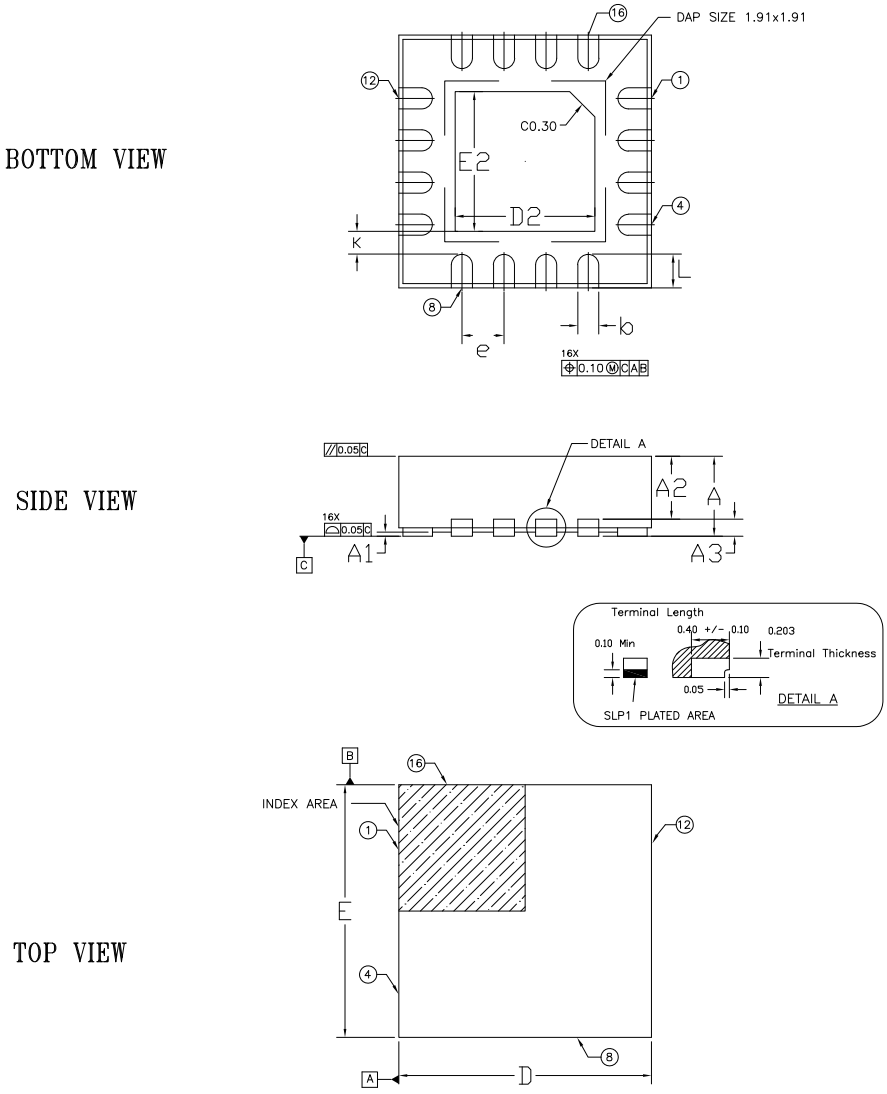
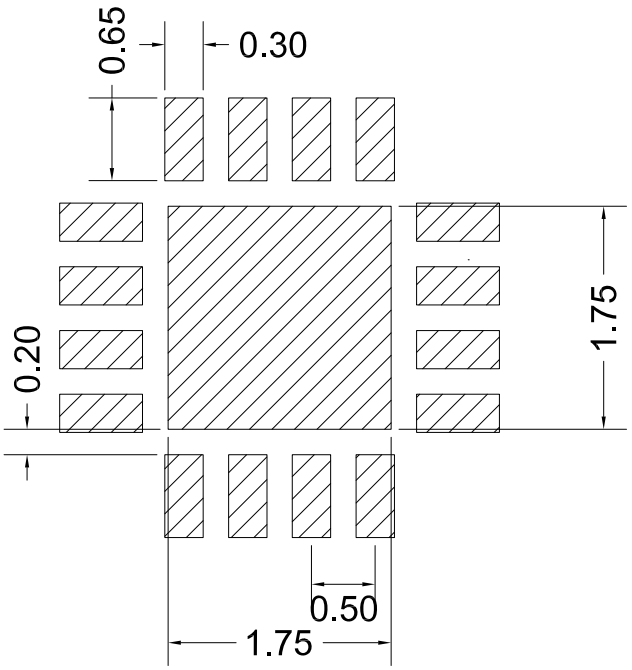


Table 6. **QFN16 3x3 wettable flank mechanical data**

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0,90	0,95	1,00	0,035	0,037	0,039
A1	0,00		0,05	0,000		0,002
A2		0,75			0,030	
A3		0,20			0,008	
b	0,20	0,25	0,30	0,008	0,010	0,012
D		3,00			0,118	
E		3,00			0,118	
e		0,50			0,020	
D2	1,56	1,66	1,76	0,061	0,065	0,069
E2	1,56	1,66	1,76	0,061	0,065	0,069
K		0,27			0,011	
L	0,30	0,40	0,50	0,012	0,016	0,020

Figure 18. **QFN16 3x3 wettable flank recommended footprint**



6 Ordering information

Table 7. Order code

Order code	Temperature range	Package	Packaging	Marking
LM2901BYDT [1]	-40 to +125 °C	SO-14	Tape & reel	LM2901BY
LM2901BYPT [1]		TSSOP-14		LM2901BY
LM2901BYQ5T [1]		QFN16 wf		K432

1. *Qualified and characterized according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 & Q 002 or equivalent.*

Revision history

Table 8. **Document revision history**

Date	Revision	Changes
21-Jul-2023	1	Initial release.

Contents

List of tables

List of figures