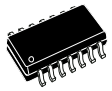
RT2901H

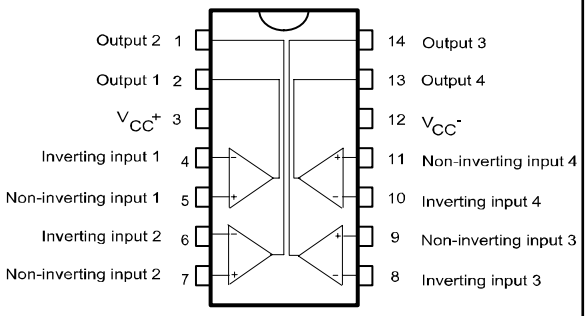
RobuST high-temperature low-power quad voltage comparators

Datasheet - production data



D
SO14
(plastic micropackage)

Pin connections (top view)



Features

- Wide single supply voltage range or dual supplies for all devices: 2 V to 36 V or ±1 V to ±18 V
- Very low supply current (1.1 mA) independent of supply voltage (1.4 mW/comparator at 5 V)
- Low input bias current: 25 nA typ.
- Low input offset current: ±5 nA typ.
- Input common-mode voltage range includes ground
- Low output saturation voltage: 250 mV typ. (I_O = 4 mA)
- Differential input voltage range equal to the supply voltage
- TTL, DTL, ECL, MOS, CMOS compatible outputs
- Intended for use in aerospace and defense applications:
  - Dedicated traceability and part marking
  - Approval documents available for production parts
  - Adapted extended life time and obsolescence management
  - Extended product change notification process
  - Designed and manufactured to meet sub ppm quality goals
  - Advanced mold and frame designs for superior resilience to harsh environments (acceleration, EMI, thermal, humidity)
  - Extended screening capability on request
  - Single fabrication, assembly, and test site
  - Temperature range (-40 °C to 150 °C)

Applications

- Aerospace and defense
- Harsh environments

Description

This device consists of four independent precision voltage comparators. All comparators are designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible.

These comparators also have a unique characteristic in that the input common-mode voltage range includes ground even though operated from a single power supply voltage.

Contents

1 Absolute maximum ratings and operating conditions

Table 1: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	±18 or 36	V
V_{id}	Differential input voltage	±36	
V_{in}	Input voltage	-0.3 to 36	
	Output short-circuit duration(1)	20	mA
R_{thja}	Thermal resistance junction-to-ambient(2)	105	°C/W
R_{thjc}	Thermal resistance junction-to-case (2)	31	
T_j	Maximum junction temperature	160	°C
ESD	HBM: human body model (3)	500	V
	MM: machine model (4)	100	
	CDM: charged device model (5)	1500	
T_{stg}	Storage temperature	-65 to 150	°C

Notes:

(1)Short-circuits from the output to V_{CC}^+ can cause excessive heating and eventual destruction. The maximum output current is approximately 20 mA, independent of the magnitude of V_{CC}^+.

(2)Short-circuits can cause excessive heating and destructive dissipation. Values are typical.

(3)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.

(4)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.

(5)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

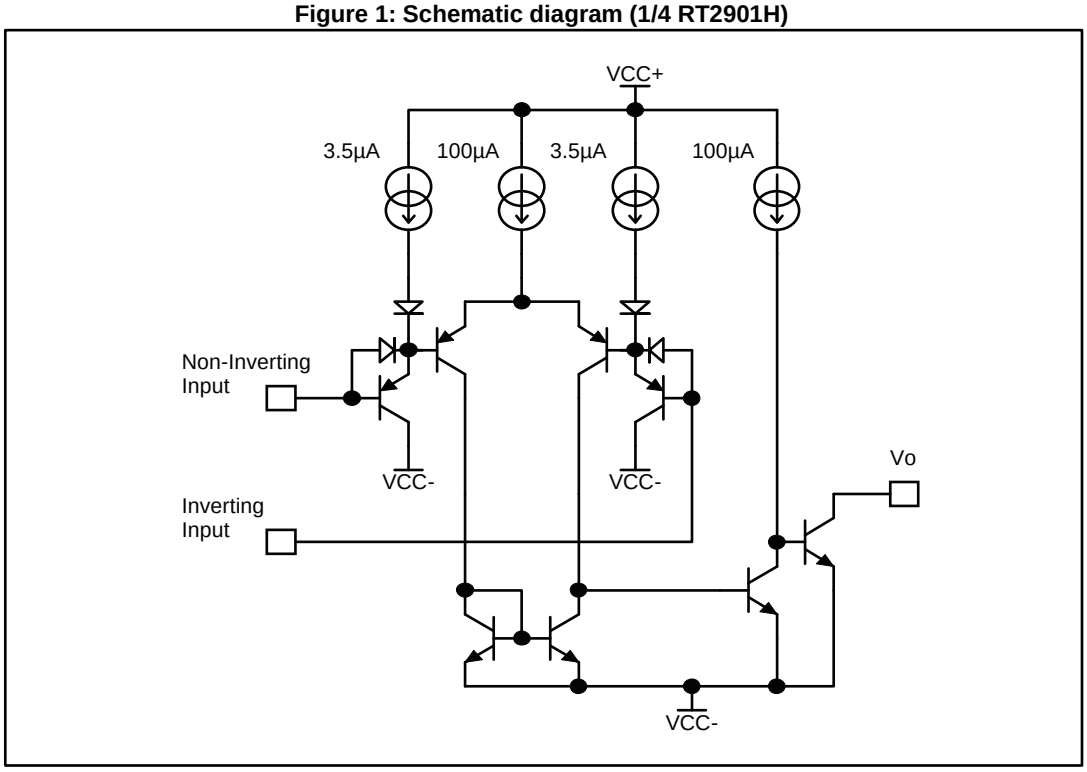
Symbol	Parameter		Value	Unit
V_{CC}^+	Supply voltage		2.5 to 6	V
T_{oper}	Operating free air temperature range		-40 to 150	°C
V_{icm}	Input common mode voltage range (V_{CC} = 30 V)(1)	T_{amb} = 25 °C	0 to (V_{CC}^+) - 1.5	V
		$T_{min} \le T_{amb} \le T_{max}$	0 to (V_{CC}^+) - 2	

Notes:

(1)The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3 V. The upper end of the common-mode voltage range is (V_{CC}^+) - 1.5 V, but either or both inputs can go to 30 V without damage.

2 Schematic diagram

Figure 1: Schematic diagram (1/4 RT2901H)



3 Electrical characteristics

Table 3: V_{CC}^+ = 5 V, V_{CC}^- = ground, T_{amb} = 25 °C (unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage(1)			1	7	mV
		$T_{min} \le T_{amb} \le T_{max}$			15	
I_{io}	Input offset current			5	50	nA
		$T_{min} \le T_{amb} \le T_{max}$			150	
I_{ib}	Input bias current (I_I^+ or I_I^-)(2)			25	250	
		$T_{min} \le T_{amb} \le T_{max}$			400	
A_{vd}	Large signal voltage gain, V_{CC} = 15 V, R = 15 kΩ, V_o = 1 to 11 V		25	200		V/mV
I_{CC}	Supply current (all comparators)	V_{CC} = 5 V, no load		1.1	2	mA
		V_{CC} = 30 V, no load		1.3	2.5	
V_{ID}	Differential input voltage(3)				V_{CC}^+	V
V_{OL}	Low level output voltage	V_{id} = -1 V, I_{sink} = 4 mA		250	400	mV
		$T_{min} \le T_{amb} \le T_{max}$			700	
I_{OH}	High level output current	V_{CC} = V_o = 30 V, V_{id} = 1 V		0.1		nA
		$T_{min} \le T_{amb} \le T_{max}$			1	µA
I_{sink}	Output sink current	V_{id} = -1 V, V_o = 1.5 V	6	16		mA
		$T_{min} \le T_{amb} \le T_{max}$	2			
t_{re}	Small signal response time, R_L = 5.1 kΩ connected to V_{CC}^+(4)			1.3		µs
t_{rel}	Large signal response time, TTL input, V_{ref} = 1.4 V, R_L = 5.1 kΩ to V_{CC}^+(5)	Output signal at 50 % of final value			500	ns
		Output signal at 95 % of final value			1	µs

Notes:

(1)At output switch point, $V_O \approx$ 1.4 V, R_S = 0 with V_{CC}^+ from 5 V to 30 V, and over the full input common-mode range (0 V to (V_{CC}^+) – 1.5 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 there is no load on the reference of input lines.

(3)The response time specified is for a 100 mV input step with 5 mV overdrive.

(4)Positive excursions of input voltage may exceed the power supply level. As long as the other voltage remains within the common-mode range, the comparator will provide 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).

(5)Maximum values are guaranteed by design

Figure 2: Supply current vs. supply voltage

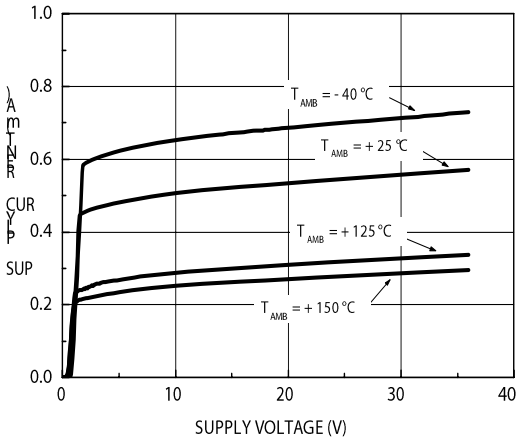


Figure 3: Input current vs. supply voltage

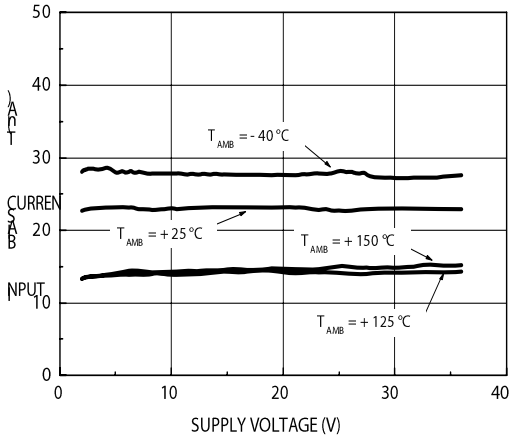


Figure 4: Output saturation voltage vs. output current (VCC = 5 V)

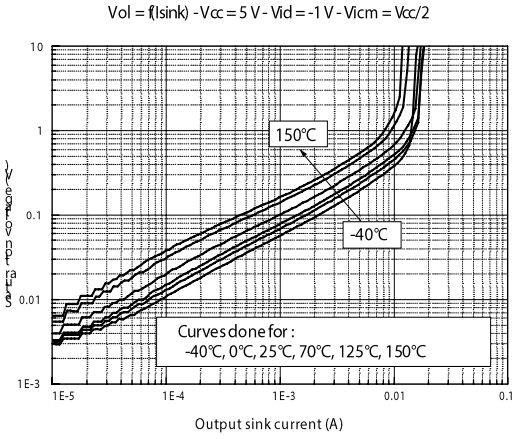


Figure 5: Output saturation voltage vs. output current (VCC = 30 V)

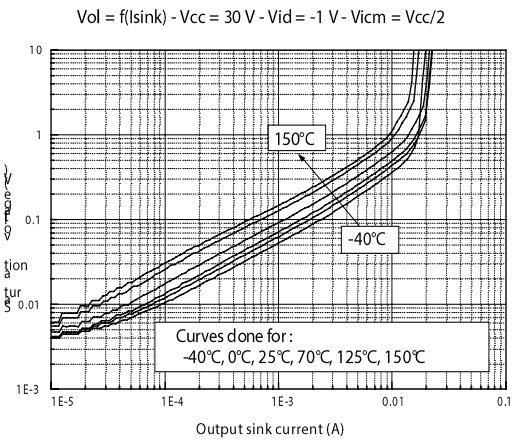


Figure 6: Response time for various input overdrives - positive transition

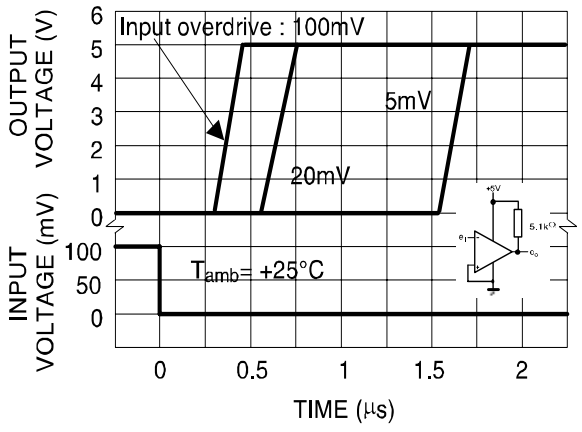
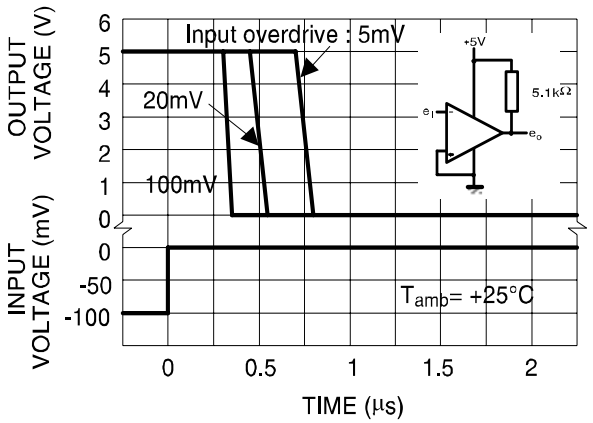


Figure 7: Response time for various input overdrives - negative transition



4 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.

4.1 SO14 package information

Figure 8: SO14 package mechanical drawing

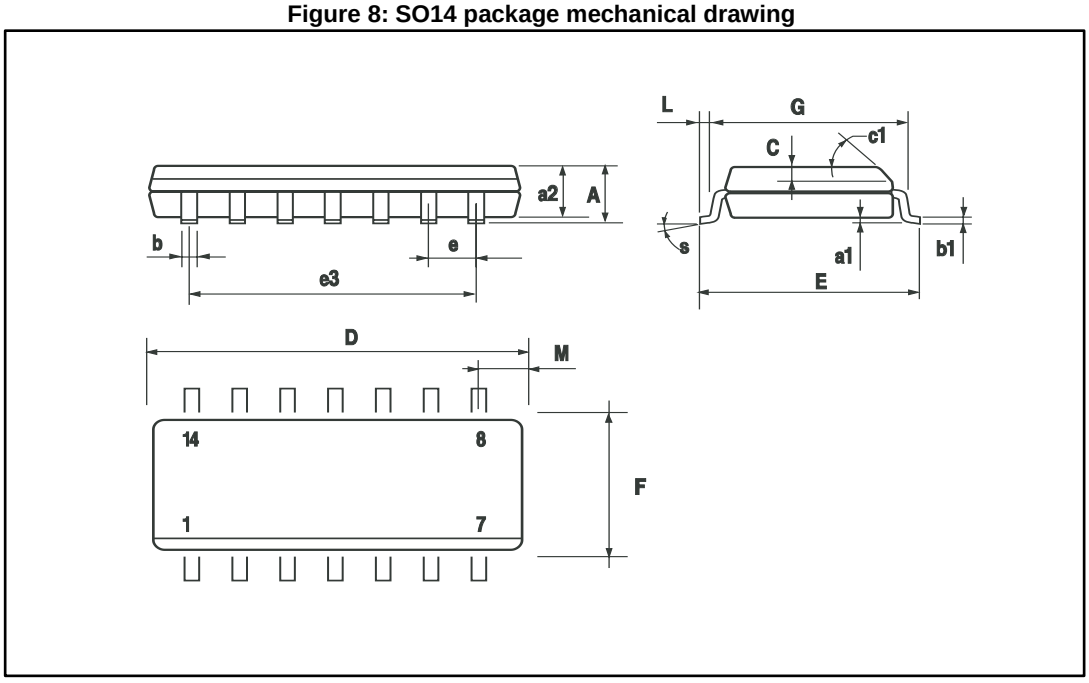


Table 4: SO14 package mechanical data

Ref	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.68			0.026
S	8° (max.)					

5 Ordering information

Table 5: Order codes

Order code	Temperature range	Package	Packaging	Marking
RT2901HYDT	-40 °C to 150 °C	SO14	Tape and reel	R2901HY

6 Revision history

Table 6: Document revision history

Date	Revision	Changes
08-Oct-2014	1	Initial release

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