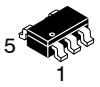
Low Power Single Voltage Comparator

TS391, NCV391



TSOP−5
SN SUFFIX
CASE 483

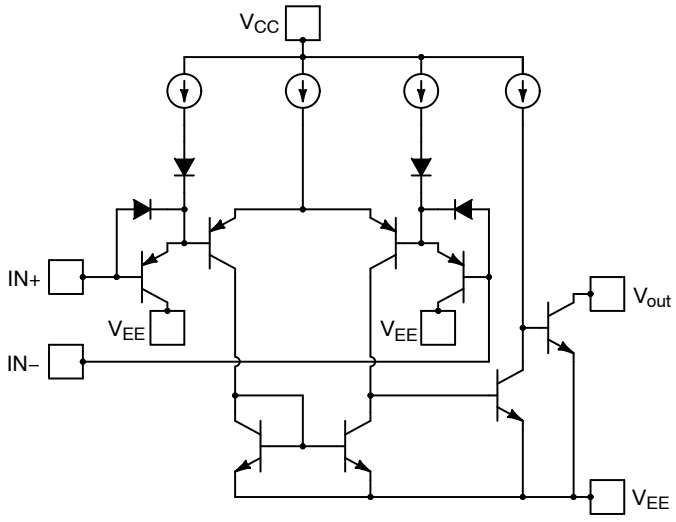
Description

The TS391 is an open collector, low−power voltage comparator designed specifically to operate from a single supply over a wide range of voltages. Operation from split power supplies is also possible.

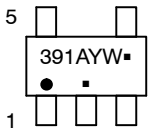
This comparator also has a unique characteristic in that the input common−mode voltage range includes ground, even though operated from a single power supply voltage.

Features

- Wide Single Supply Voltage Range or Dual Supplies
- Low Supply Current (0.5 mA) Independent of Supply Voltage (1 mW/Comparator at +5 V)
- Low Input Bias Current: 25 nA TYP
- Low Input Offset Current: ±5 nA TYP
- Low Input Offset Voltage: ±1 mV TYP
- Input Common Mode Voltage Range includes Ground
- Low Output Saturation Voltage: 250 mV TYP at I_O = 4 mA
- Differential Input Voltage Range Equal to the Supply Voltage
- TTL, DTL, ECL, CMOS Compatible Devices
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable



MARKING DIAGRAM

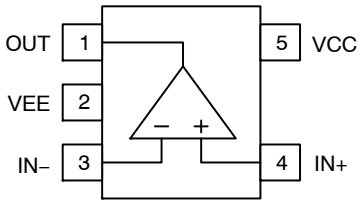


Analog

391 = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

PIN CONNECTIONS



ORDERING INFORMATION

Device	Package	Shipping†
TS391SN2T1G	TSOP−5 (Pb−Free)	3000 / Tape & Reel
NCV391SN2T1G*	TSOP−5 (Pb−Free)	3000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

* NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable

Table 1. ABSOLUTE MAXIMUM RATINGS (Over operating free−air temperature, unless otherwise stated)

Parameter	Symbol	Limit	Unit
Supply Voltage (V_{CC} − V_{EE})	V_S	36	V
INPUT AND OUTPUT PINS			
Input Voltage	V_{IN}	−0.3 to 36	V
Differential Input Voltage	V_{ID}	±36	V
Output Short Circuit Current (Note 1)	I_{SC}	20	mA
TEMPERATURE			
Storage Temperature	T_{STG}	−65 to +150	°C
Junction Temperature	T_J	+150	°C
ESD RATINGS			
Human Body Model	HBM	1500	V
Charged Device Model	CDM	2000	V
Machine Model	MM	200	V

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Short circuits from the output to V_{CC} can cause excessive heating and potential destruction. The maximum short circuit current is independent of the magnitude of V_{CC}.

Table 2. THERMAL INFORMATION (Note 2)

Thermal Metric	Symbol	Limit	Unit
Junction to Ambient − SOIC8	θ_{JA}	238	°C/W

2. Short−circuits can cause excessive heating and destructive dissipation. These values are typical.

Table 3. OPERATING CONDITIONS

Parameter	Symbol	Limit	Unit
Operating Supply Voltage	V_S	2 to 36	V
Specified Operating Range	T_A	−40 to +125	°C

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

Table 4. ELECTRICAL CHARACTERISTICS (Vs=+5.0 V, At T_A = +25°C)
Boldface limits apply over the specified temperature range, T_A = −40°C to +125°C.

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
INPUT CHARACTERISTICS							
Offset Voltage	V_{OS}	Vo = 1.4 V, R_S = 0 Ω, V_S = 5 V to 30 V	V_{CM} = 0 to V_{CC} −1.5 V		1	5	mV
			V_{CM} = 0 to V_{CC} −2 V			**9**	**mV**
Input Bias Current	I_{IB}				25	250	nA
						400	**nA**
Input Offset Current	I_{OS}				5	50	nA
						150	**nA**
Input Common Mode Range (Note 3)	V_{ICR}			0		V_{CC} − 1.5	V
				0		**V_{CC} − 2**	**V**
Differential Input Voltage (Note 4)	V_{ID}					V_{CC}	V
OUTPUT CHARACTERISTICS							
Output Voltage Low	V_{OL}	V_{ID} = 1 V, I_O = 4 mA			250	400	mV
						700	**mV**
Output Sink Current	I_O	V_{ID} = −1, V_O = 1.5 V		6	16		mA
Output Leakage Current	I_{OH}	V_{ID} = 1 V, V_{CC} = V_O = 5 V			0.1		nA
		V_{ID} = 1 V, V_{CC} = V_O = 30 V				**1**	**μA**
DYNAMIC PERFORMANCE							
Open Loop Voltage Gain	A_{VOL}	V_{CC} = 15 V, R_{PU} = 15 kΩ		94	106		dB
Propagation Delay L−H	t_{PLH}	5 mV overdrive, R_{PU} = 5.1 kΩ			850		ns
		20 mV overdrive, R_{PU} = 5.1 kΩ			490		ns
		100 mV overdrive, R_{PU} = 5.1 kΩ			300		ns
		TTL Input, Vref = +1.4 V, R_{PU} = 5.1 kΩ			220		ns
Propagation Delay H−L	t_{PHL}	5 mV overdrive, R_{PU} = 5.1 kΩ			620		ns
		20 mV overdrive, R_{PU} = 5.1 kΩ			400		ns
		100 mV overdrive, R_{PU} = 5.1 kΩ			250		ns
		TTL Input, Vref = +1.4 V, R_{PU} = 5.1 kΩ			350		ns
POWER SUPPLY							
Quiescent Current	I_{CC}	V_{CC} = 5 V			0.5	–	mA
		V_{CC} = 30 V			0.5	1.25	mA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. The input common mode voltage of either input signal should not be allowed to go negative by more than 0.3 V. The upper end of the common mode voltage range is VCC − 1.5 V, but either or both inputs can go to +30 V without damage.
4. Positive excursions of the 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 stage. The low input voltage state must not be less than 0.3 V below the negative supply rail.

TYPICAL CHARACTERISTICS

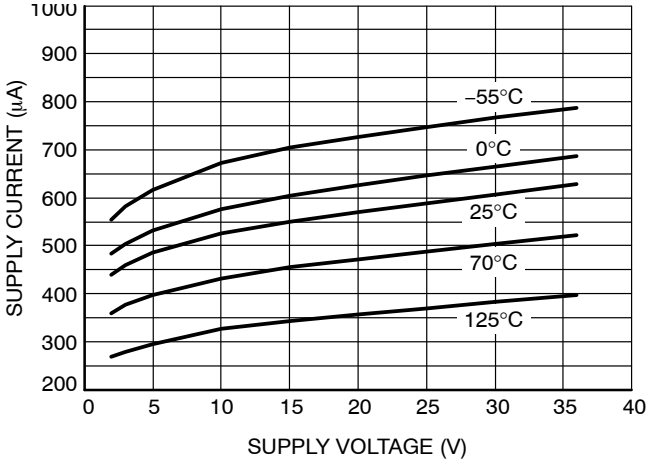


Figure 1. Supply Current vs. Supply Voltage

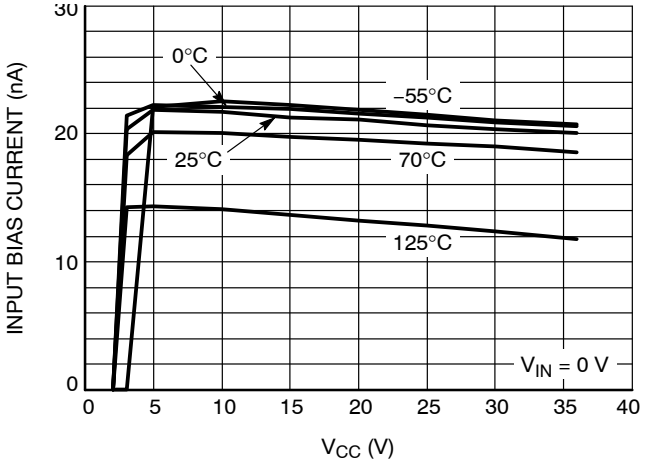


Figure 2. Input Bias Current vs. V_{CC}

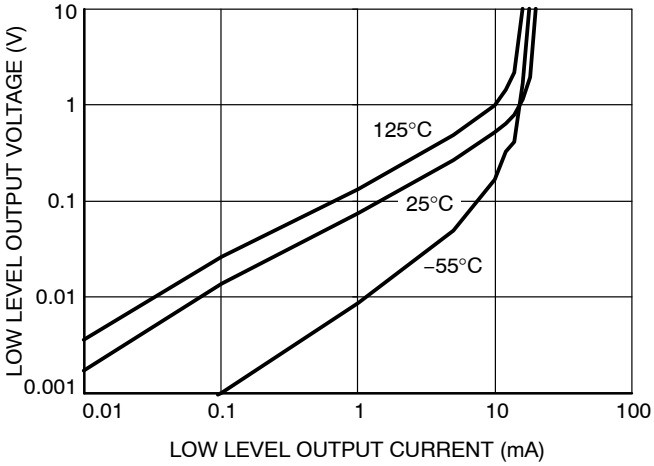


Figure 3. Low Level Output Voltage vs. Output Current

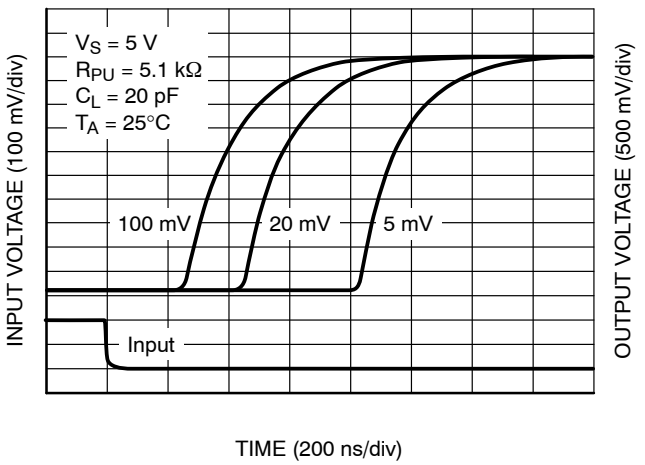


Figure 4. Propagation Delay L−H vs. Overdrive

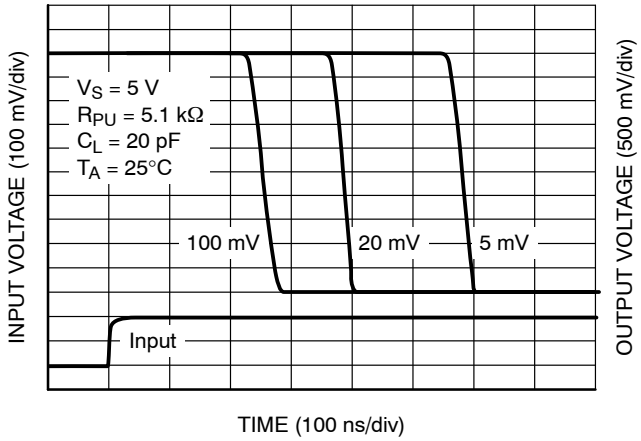
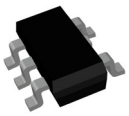
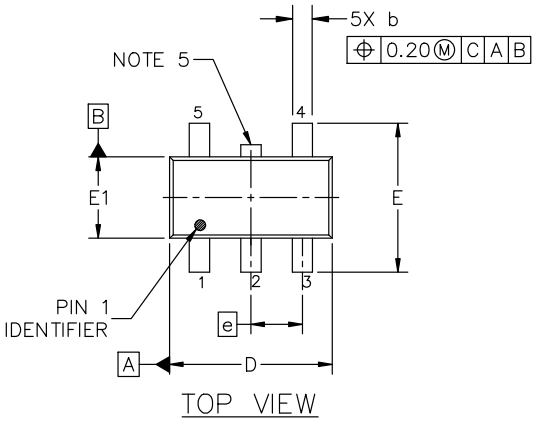


Figure 5. Propagation Delay H−L vs. Overdrive

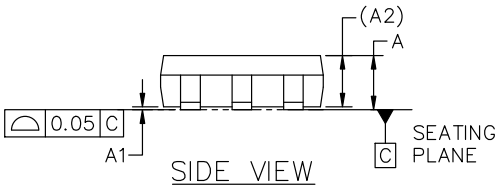


TSOP−5 3.00x1.50x0.95, 0.95P
CASE 483
ISSUE P

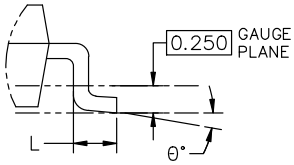
DATE 01 APR 2024



TOP VIEW



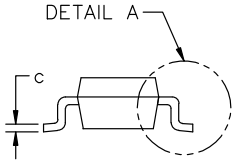
SIDE VIEW



DETAIL "A"
SCALE 2:1

NOTES:

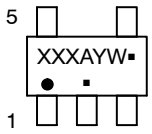
1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5−2018.
2. ALL DIMENSION ARE IN MILLIMETERS (ANGLES IN DEGREES).
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OF GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSION D.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.



END VIEW

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.900	1.000	1.100
A1	0.010	0.055	0.100
A2		0.950 REF.	
b	0.250	0.375	0.500
c	0.100	0.180	0.260
D	2.850	3.000	3.150
E	2.500	2.750	3.000
E1	1.350	1.500	1.650
e		0.950 BSC	
L	0.200	0.400	0.600
θ	0°	5°	10°

GENERIC
MARKING DIAGRAM*



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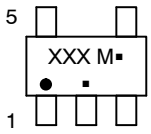
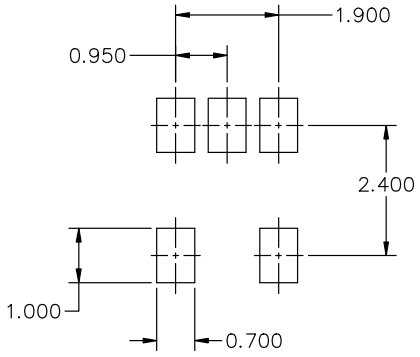


Discrete/Logic

XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



RECOMMENDED MOUNTING FOOTPRINT*

* FOR ADDITIONAL INFORMATION ON OUR Pb−FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

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DESCRIPTION:	**TSOP−5 3.00x1.50x0.95, 0.95P**	**PAGE 1 OF 1**

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