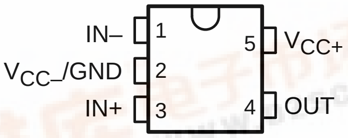
TLV1391
SINGLE DIFFERENTIAL COMPARATORS

SLCS128E – APRIL 1996 – REVISED MAY 2003

- **Low-Voltage and Single-Supply Operation V_{CC} = 2 V to 7 V**
- **Common-Mode Voltage Range Includes Ground**
- **Fast Response Time . . . 0.7 µs Typ**
- **Low Supply Current . . . 80 µA Typ and 150 µA Max**
- **Fully Specified at 3-V and 5-V Supply Voltages**

DBV PACKAGE
(TOP VIEW)



description/ordering informaton

The TLV1391 is a differential comparator built using a Texas Instruments low-voltage, high-speed bipolar process. These devices have been developed specifically for low-voltage, single-supply applications. Their enhanced performance makes them excellent replacements for the LM393 in the improved 3-V and 5-V system designs.

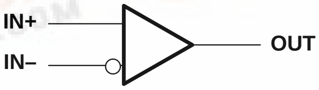
The TLV1391, with its typical supply current of only 80 µA, is ideal for low-power systems. Response time also has been improved to 0.7 µs.

ORDERING INFORMATION

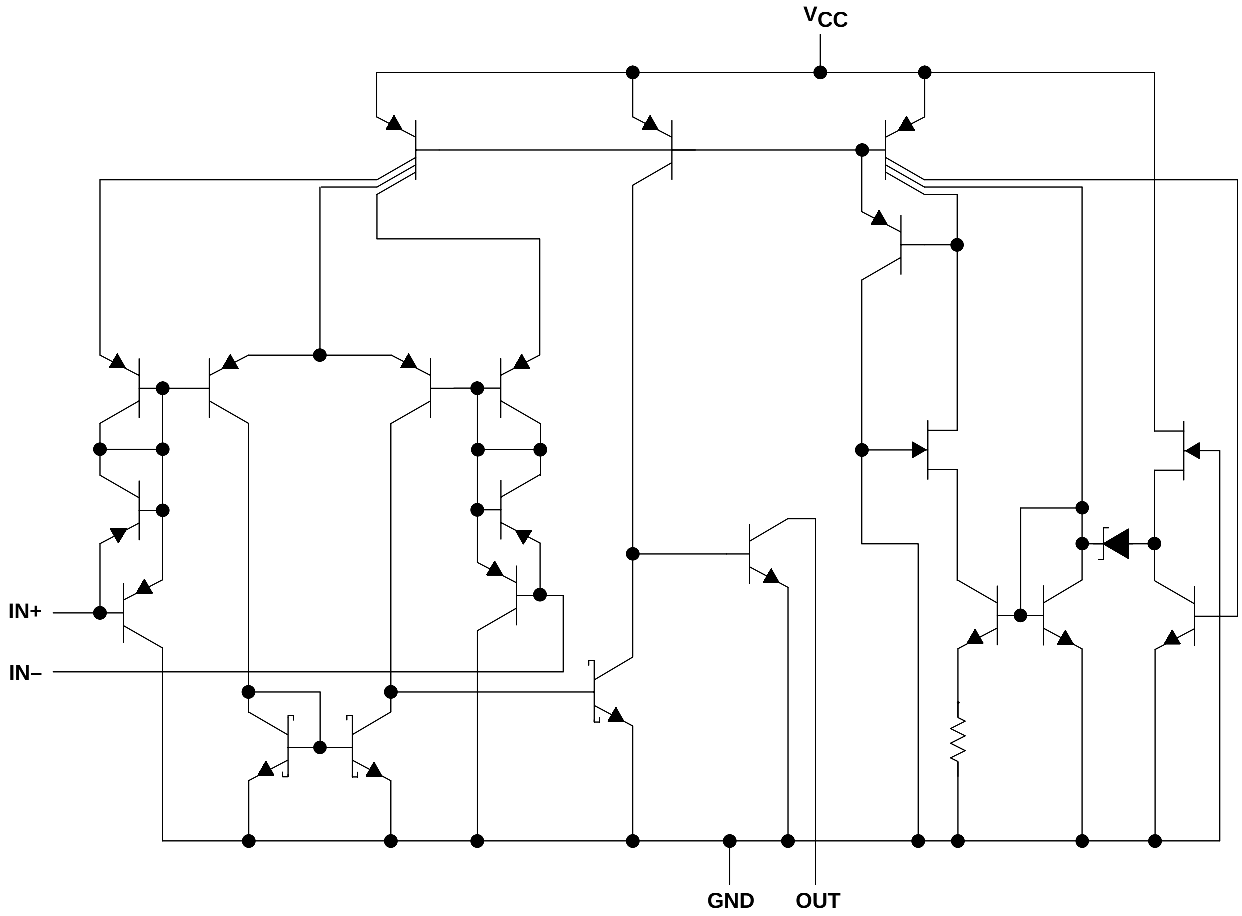
T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–0°C to 70°C	SOT-23-5 (DBV)	Reel of 3000	TLV1391CDBVR	VABC
		Reel of 250	TLV1391CDBVT	
–40°C to 85°C	SOT-23-5 (DBV)	Reel of 3000	TLV1391IDBVR	VABI
		Reel of 250	TLV1391IDBVT	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

symbol (each comparator)



equivalent schematic



COMPONENT COUNT	
Transistors	26
Resistors	1
Diodes	4
Epi-FET	1

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V_{CC} (see Note 1)	7 V
Differential input voltage, V_{ID} (see Note 2)	±7 V
Input voltage range, V_I (any input)	–0.3 V to V_{CC}
Output voltage, V_O	7 V
Output current, I_O (each output)	20 mA
Duration of short-circuit current to GND (see Note 3)	Unlimited
Package thermal impedance, θ_{JA} (see Note 4 and 5)	206°C/W
Operating virtual junction temperature, T_J	150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C
Storage temperature range, T_{stg}	–65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES:
1. All voltage values, except differential voltages, are with respect to the network GND.
2. Differential voltages are at the noninverting input with respect to the inverting input.
3. Short circuits from the outputs to V_{CC} can cause excessive heating and eventual destruction of the chip.
4. Maximum power dissipation is a function of T_J(max), θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(\text{max}) – T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can impact reliability.
5. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

			MIN	MAX	UNIT
V_{CC}	Supply voltage		2	7	V
T_A	Operating free-air temperature	TLV1391C	0	70	°C
		TLV1391I	–40	85	

electrical characteristics, V_{CC} = 3 V

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	V_O = 1.4 V, $V_{IC} = V_{ICR}$(min)	25°C		1.5	5	mV
			Full range			9	
V_{ICR}	Common-mode input voltage range		25°C	0 to V_{CC}–1.5	0 to V_{CC}–1.2		V
			Full range	0 to V_{CC}–2			
V_{OL}	Low-level output voltage	V_{ID} = –1 V, I_{OL} = 500 μA	Full range		120	300	mV
I_{IO}	Input offset current	V_O = 1.4 V	25°C		5	50	nA
			Full range			150	
I_{IB}	Input bias current	V_O = 1.4 V	25°C		–40	–250	nA
			Full range			–400	
I_{OH}	High-level output current	V_{ID} = 1 V, V_{OH} = 3 V	25°C		0.1		nA
		V_{ID} = 1 V, V_{OH} = 5 V	Full range			100	
I_{OL}	Low-level output current	V_{ID} = –1 V, V_{OL} = 1.5 V	25°C	500			μA
$I_{CC(H)}$	High-level supply current	$V_O = V_{OH}$	25°C		80	125	μA
			Full range			150	
$I_{CC(L)}$	Low-level supply current	$V_O = V_{OL}$	25°C		80	125	μA
			Full range			150	

switching characteristics, V_{CC} = 3 V, C_L = 15 pF[†], T_A = 25°C

PARAMETER	TEST CONDITIONS		TYP	UNIT
Response time	100-mV input step with 5-mV overdrive,	R_L = 5.1 kΩ	0.7	μs

[†] C_L includes the probe and jig capacitance.

electrical characteristics, V_{CC} = 5 V

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	V_O = 1.4 V, $V_{IC} = V_{ICR}$(min)	25°C		1.5	5	mV
			Full range			9	
V_{ICR}	Common-mode input voltage range		25°C	0 to V_{CC}–1.5	0 to V_{CC}–1.2		V
			Full range	0 to V_{CC}–2			
V_{OL}	Low-level output voltage	V_{ID} = –1 V, I_{OL} = 500 µA	Full range		120	300	mV
I_{IO}	Input offset current	V_O = 1.4 V	25°C		5	50	nA
			Full range			150	
I_{IB}	Input bias current	V_O = 1.4 V	25°C		–40	–250	nA
			Full range			–400	
I_{OH}	High-level output current	V_{ID} = 1 V, V_{OH} = 3 V	25°C		0.1		nA
		V_{ID} = 1 V, V_{OH} = 5 V	Full range			100	
I_{OL}	Low-level output current	V_{ID} = –1 V, V_{OL} = 1.5 V	25°C	600			µA
$I_{CC(H)}$	High-level supply current	$V_O = V_{OH}$	25°C		100	150	µA
			Full range			175	
$I_{CC(L)}$	Low-level supply current	$V_O = V_{OL}$	25°C		100	150	µA
			Full range			175	

switching characteristics, V_{CC} = 5 V, C_L = 15 pF†, T_A = 25°C

PARAMETER	TEST CONDITIONS		TYP	UNIT
Response time	100-mV input step with 5-mV overdrive,	R_L = 5.1 kΩ	0.65	µs
	TTL-level input step,	R_L = 5.1 kΩ	0.18	

† C_L includes the probe and jig capacitance.

TYPICAL CHARACTERISTICS

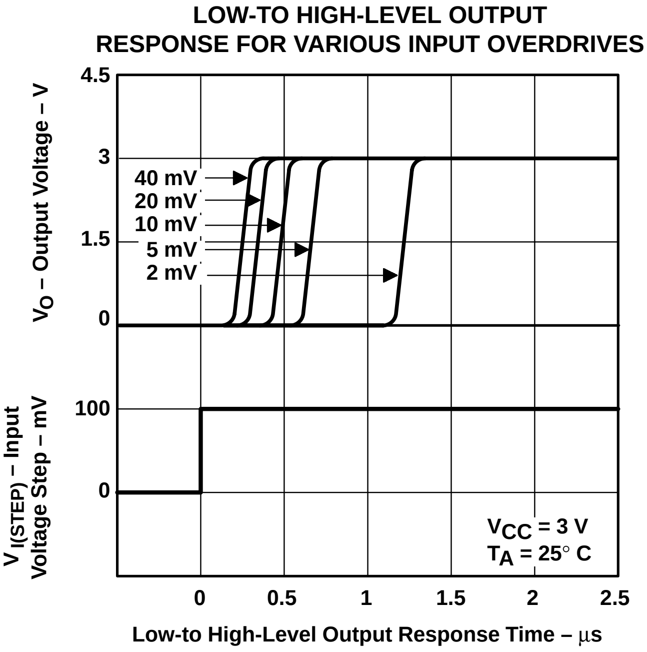


Figure 1

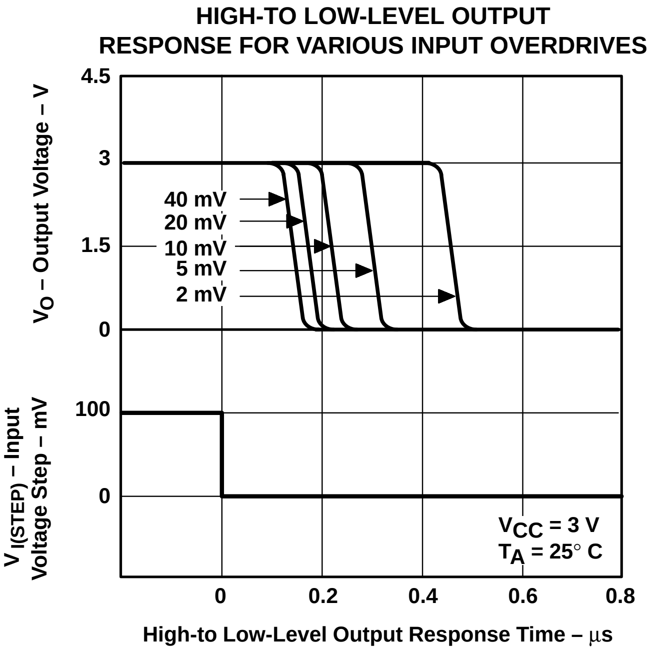


Figure 2

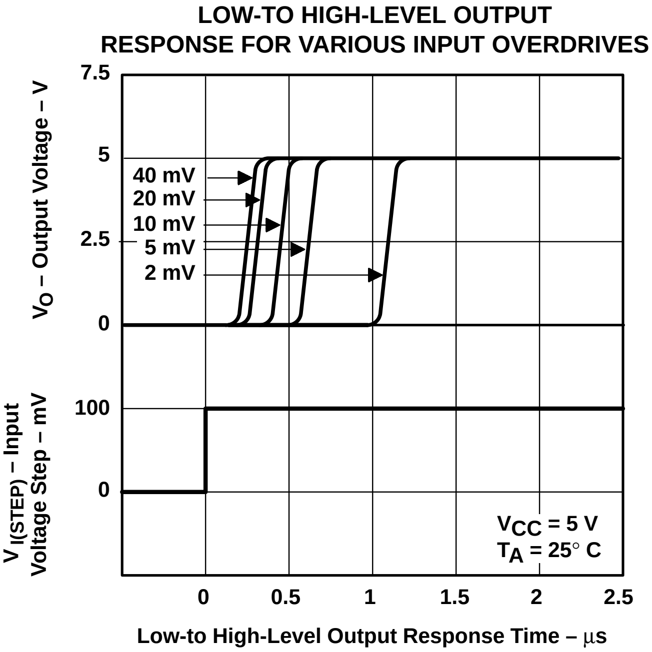


Figure 3

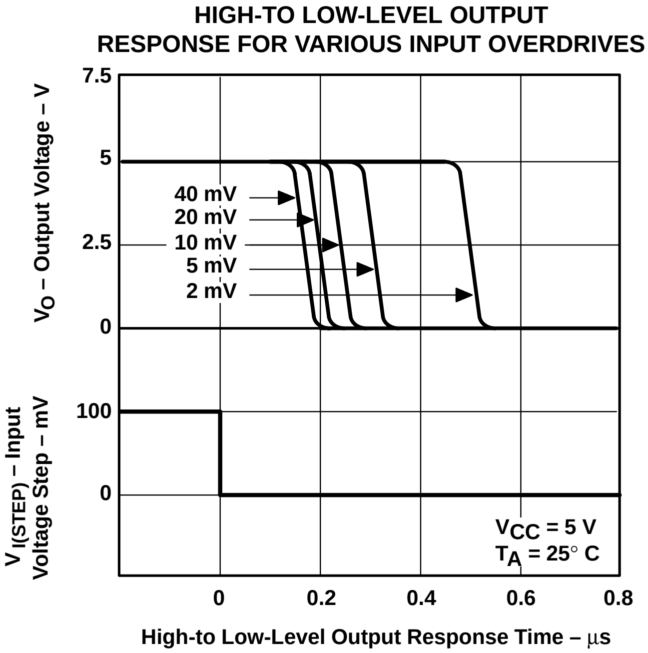


Figure 4

PACKAGE OPTION ADDENDUM

18-Jul-2006

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
TLV1391CDBV	OBSOLETE	SOT-23	DBV	5		TBD	Call TI	Call TI
TLV1391CDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV1391CDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV1391CDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV1391CDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV1391IDBV	OBSOLETE	SOT-23	DBV	5		TBD	Call TI	Call TI
TLV1391IDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV1391IDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV1391IDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV1391IDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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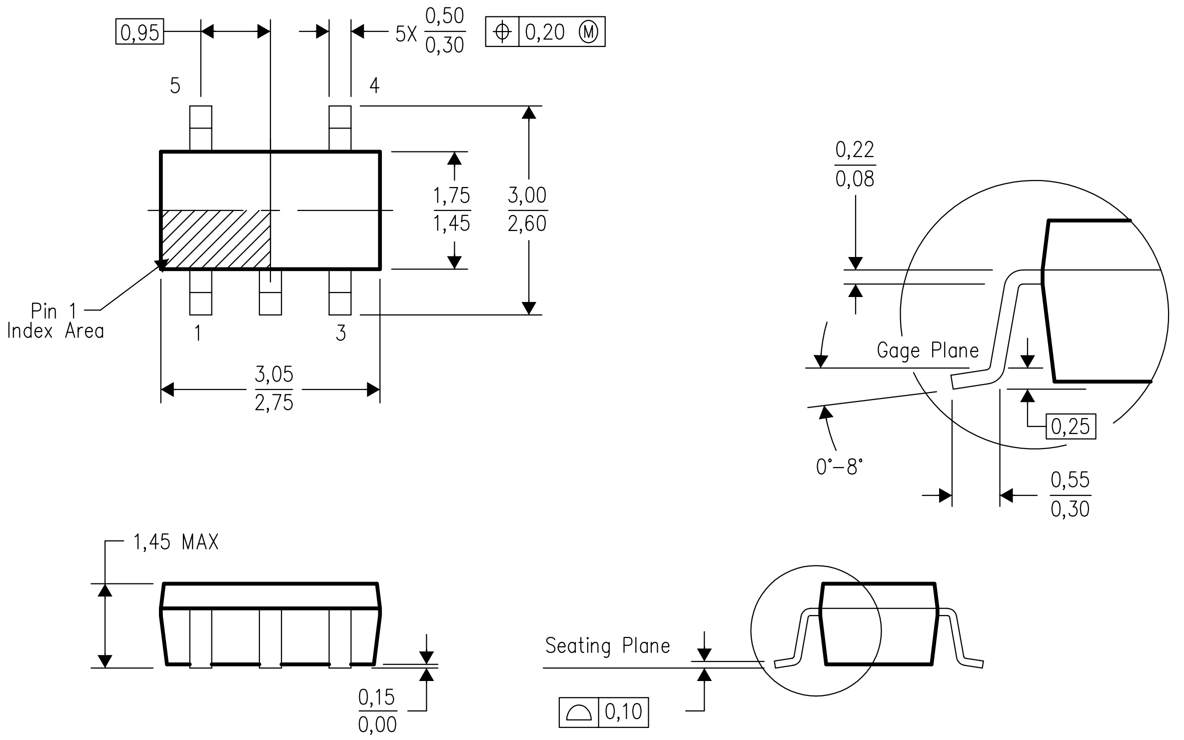
DBV (R–PDSO–G5) PLASTIC SMALL–OUTLINE PACKAGE



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NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. Falls within JEDEC MO–178 Variation AA.

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