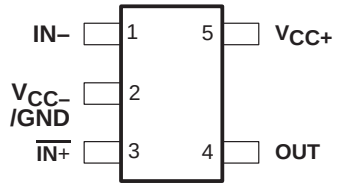
- **Low-Voltage and Single-Supply Operation**
  V_{CC} = 2 V to 7 V
- **Common-Mode Voltage Range Includes Ground**
- **Fast Response Time . . . 0.7 μs Typ**
- **Low Supply Current . . . 80 μA Typ and 150 μA Max**
- **Fully Specified at 3-V and 5-V Supply Voltages**
- **Available in SOT-23 (DBV) Packaging**

DBV PACKAGE
(TOP VIEW)



description

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 of today.

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.

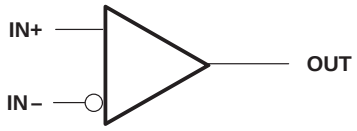
The TLV1391C is characterized for operation from 0°C to 70°C and the TLV1391I is characterized for operation from –40°C to 85°C.

AVAILABLE OPTIONS

T_A	PACKAGED DEVICES	SYMBOL	CHIP FORM (Y)
	SOT-23 (DBV)		
0°C to 70°C	TLV1391CDBV	VABC	TLV1391Y
–40°C to 85°C	TLV1391IDBV	VABI	

† The DBV package is only available taped and reeled. Chip forms are specified for operation at 25°C only.

symbol (each comparator)



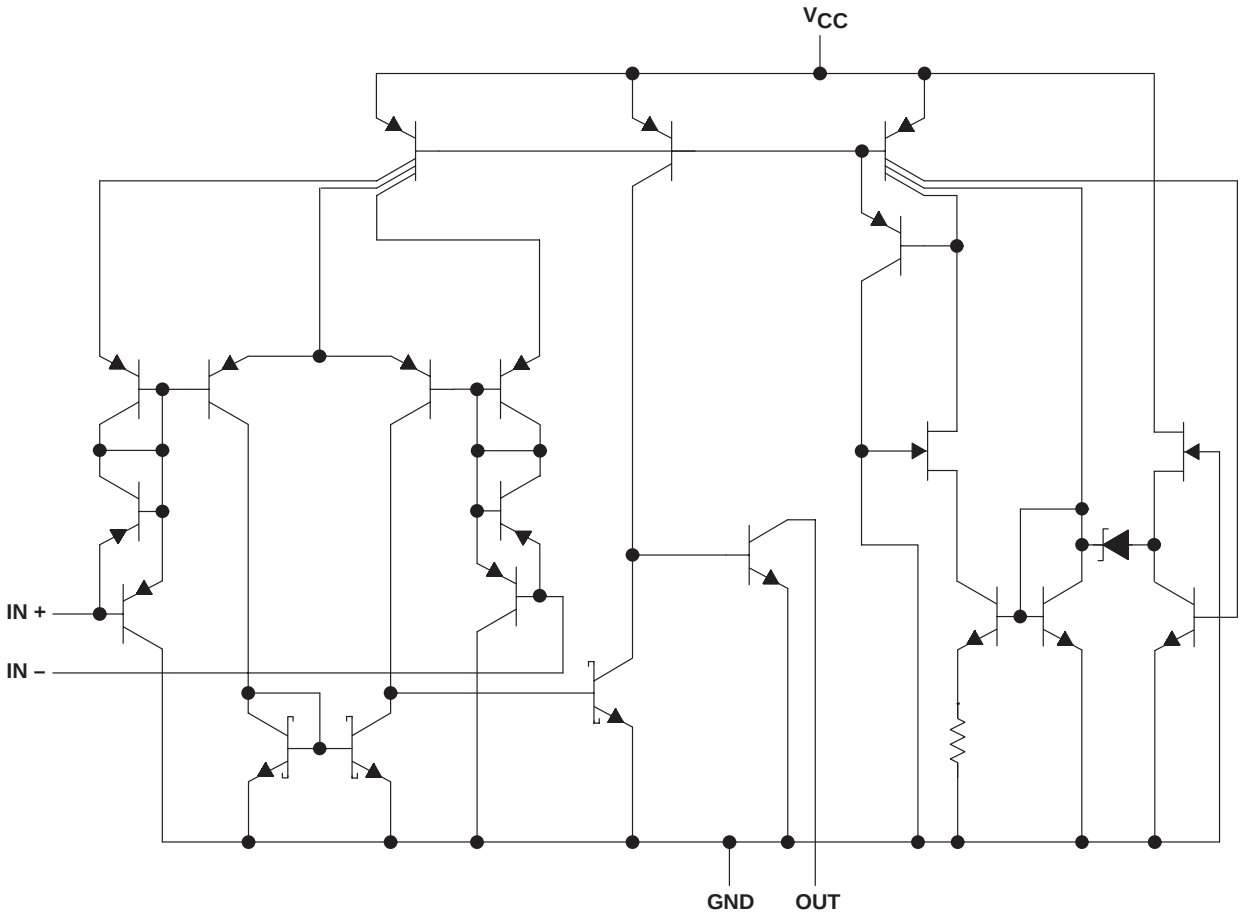


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TLV1391, TLV1391Y equivalent schematic



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, 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) . . . . . 347°C/W
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 $P_D = (T_J(max) – T_A)/\theta_{JA}$. 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.

recommended operating conditions

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

electrical characteristics, V_{CC} = 3 V

PARAMETER		TEST CONDITIONS	T_A†	TLV1391C			UNIT
				MIN	TYP	MAX	
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	

† Full range is 0°C to 70°C.

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

PARAMETER	TEST CONDITIONS	TLV1391C			UNIT
		MIN	TYP	MAX	
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†	TLV1391C			UNIT
				MIN	TYP	MAX	
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	

† Full range is 0°C to 70°C.

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

PARAMETER	TEST CONDITIONS	TLV1391C			UNIT
		MIN	TYP	MAX	
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.

electrical characteristics, V_{CC} = 3 V

PARAMETER		TEST CONDITIONS	T_A†	TLV1391I			UNIT
				MIN	TYP	MAX	
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	

† Full range is –40°C to 85°C.

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

PARAMETER	TEST CONDITIONS	TLV1391I			UNIT
		MIN	TYP	MAX	
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†	TLV1391I			UNIT
					MIN	TYP	MAX	
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	

† Full range is –40°C to 85°C.

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

PARAMETER	TEST CONDITIONS		TLV1391I			UNIT
			MIN	TYP	MAX	
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.

electrical characteristics, V_{CC} = 3 V, T_A = 25°C

PARAMETER		TEST CONDITIONS	TLV1391Y			UNIT
			MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_O = 1.4 V, V_{IC} = V_{ICR}(min)		1.5	5	mV
V_{ICR}	Common-mode input voltage range		0 to V_{CC} – 1.5	0 to V_{CC} – 1.2		V
I_{IO}	Input offset current	V_O = 1.4 V		5	50	nA
I_{IB}	Input bias current	V_O = 1.4 V		–40	–250	nA
I_{OH}	High-level output current	V_{ID} = 1 V, V_{OH} = 3 V		0.1		nA
I_{OL}	Low-level output current	V_{ID} = –1 V, V_{OL} = 1.5 V	500			µA
$I_{CC(H)}$	High-level supply current	V_O = V_{OH}		80	125	µA
$I_{CC(L)}$	Low-level supply current	V_O = V_{OL}		80	125	µA

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

PARAMETER	TEST CONDITIONS	TLV1391Y			UNIT
		MIN	TYP	MAX	
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, T_A = 25°C

PARAMETER		TEST CONDITIONS	TLV1391Y			UNIT
			MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_O = 1.4 V, V_{IC} = V_{ICR}(min)		1.5	5	mV
V_{ICR}	Common-mode input voltage range		0 to V_{CC} – 1.5	0 to V_{CC} – 1.2		V
I_{IO}	Input offset current	V_O = 1.4 V		5	50	nA
I_{IB}	Input bias current	V_O = 1.4 V		–40	–250	nA
I_{OH}	High-level output current	V_{ID} = 1 V, V_{OH} = 3 V		0.1		nA
I_{OL}	Low-level output current	V_{ID} = –1 V, V_{OL} = 1.5 V	600			µA
$I_{CC(H)}$	High-level supply current	V_O = V_{OH}		100	150	µA
$I_{CC(L)}$	Low-level supply current	V_O = V_{OL}		100	150	µA

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

PARAMETER	TEST CONDITIONS	TLV1391Y			UNIT
		MIN	TYP	MAX	
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

LOW-TO HIGH-LEVEL OUTPUT
RESPONSE FOR VARIOUS INPUT OVERDRIVES

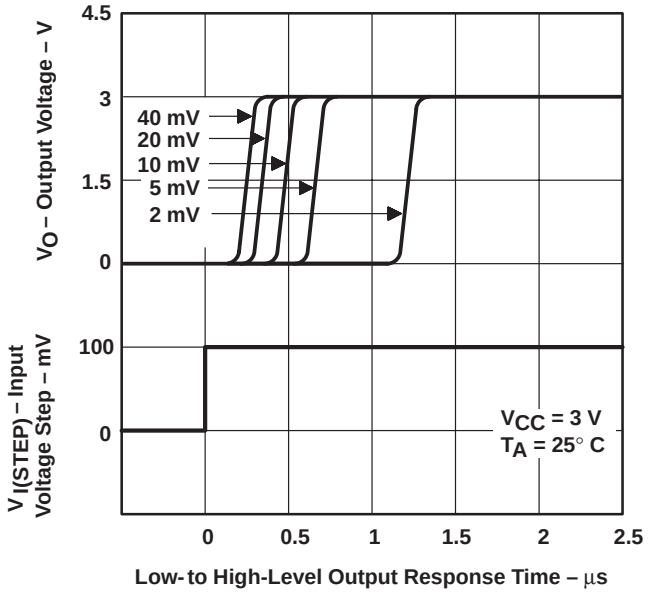


Figure 1

HIGH-TO LOW-LEVEL OUTPUT
RESPONSE FOR VARIOUS INPUT OVERDRIVES

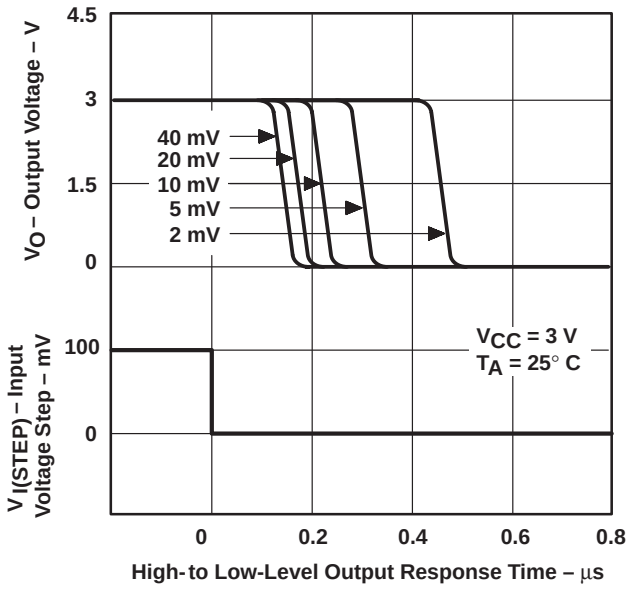


Figure 2

LOW-TO HIGH-LEVEL OUTPUT
RESPONSE FOR VARIOUS INPUT OVERDRIVES

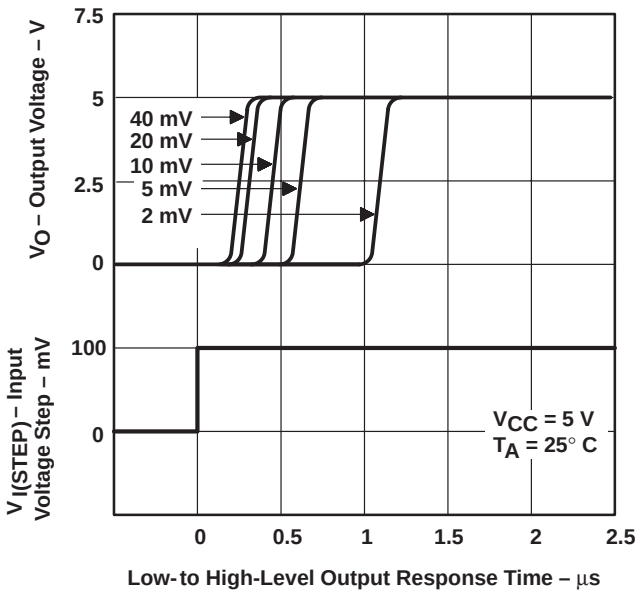


Figure 3

HIGH-TO LOW-LEVEL OUTPUT
RESPONSE FOR VARIOUS INPUT OVERDRIVES

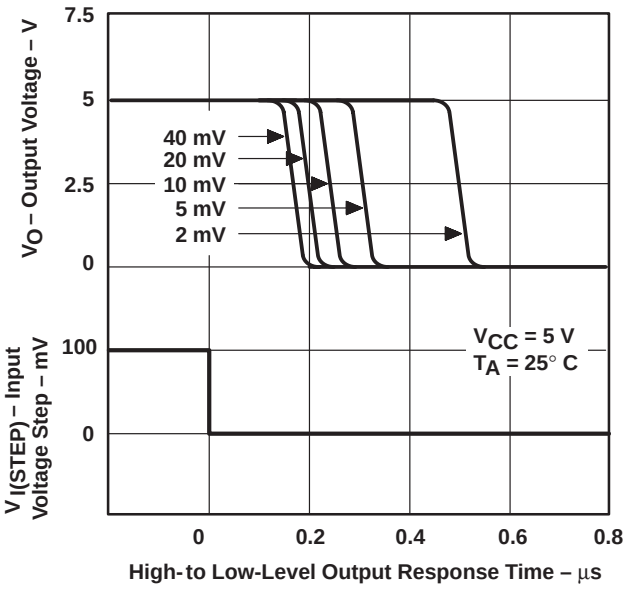


Figure 4

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