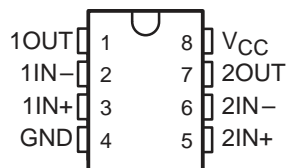


# TLV1393, TLV1393Y, TLV2393, TLV2393Y DUAL DIFFERENTIAL COMPARATORS

SLCS121A – AUGUST 1993 – REVISED APRIL 1994

- **Low-Voltage and Single-Supply Operation**  
 $V_{CC} = 2\text{ V to }7\text{ V}$
- **Common-Mode Voltage Range Includes Ground**
- **Fast Response Time**  
450 ns Typ (TLV2393)
- **Low Supply Current**  
0.16 mA Typ (TLV1393)
- **Fully Specified at 3-V and 5-V Supply Voltages**

D, P, OR PW PACKAGE  
(TOP VIEW)



## description

The TLV1393 and the TLV2393 are dual differential comparators built using a new Texas Instruments low-voltage, high-speed bipolar process. These devices have been specifically developed for low-voltage, single-supply applications. Their enhanced performance makes them excellent replacements for the LM393 in today's improved 3-V and 5-V system designs.

The TLV1393, with its typical supply current of only 0.16 mA, is ideal for low-power systems. Response time has also been improved to 0.7  $\mu\text{s}$ . For higher-speed applications, the TLV2393 features excellent ac performance with a response time of just 0.45  $\mu\text{s}$ , three times that of the LM393.

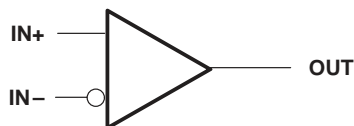
Package availability for these devices includes the TSSOP (thin-shrink small-outline package). With a maximum thickness of 1.1 mm and a package area that is 25% smaller than the standard surface-mount package, the TSSOP is ideal for high-density circuits, particularly in hand-held and portable equipment.

## AVAILABLE OPTIONS

T <sub>A</sub>	PACKAGED DEVICES					CHIP FORM (Y)
	SUPPLY CURRENT (TYP)	RESPONSE TIME (TYP)	SMALL OUTLINE (D)	PLASTIC DIP (P)	TSSOP (PW) <sup>†</sup>	
-40°C to 105°C	0.16 mA	0.7 $\mu\text{s}$	TLV1393ID	TLV1393IP	TLV1393IPWLE	TLV1393Y
	1.1 mA	0.45 $\mu\text{s}$	TLV2393ID	TLV2393IP	TLV2393IPWLE	TLV2393Y

<sup>†</sup> The PW packages are only available left-ended taped and reeled (e.g., TLV1393IPWLE).

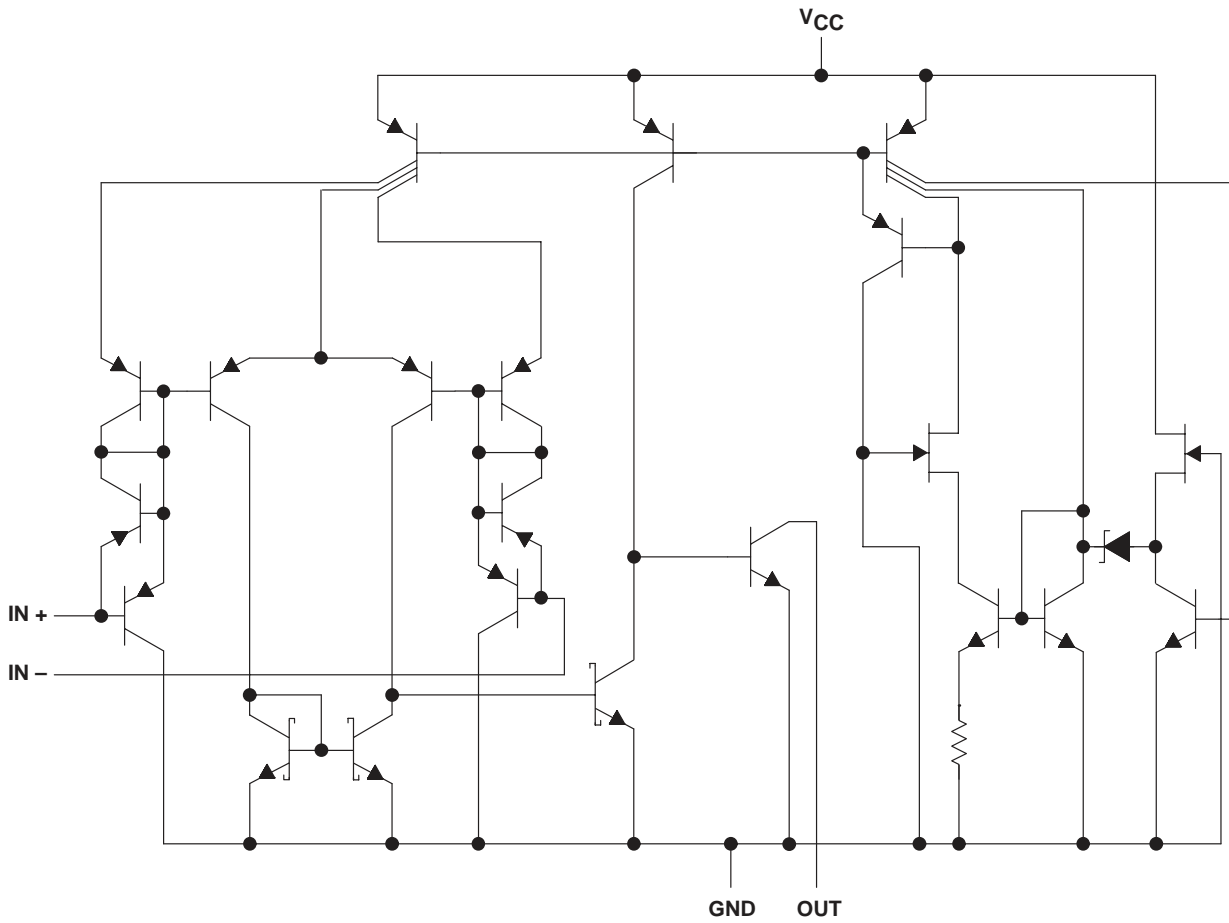
## symbol (each comparator)



# TLV1393, TLV1393Y, TLV2393, TLV2393Y DUAL DIFFERENTIAL COMPARATORS

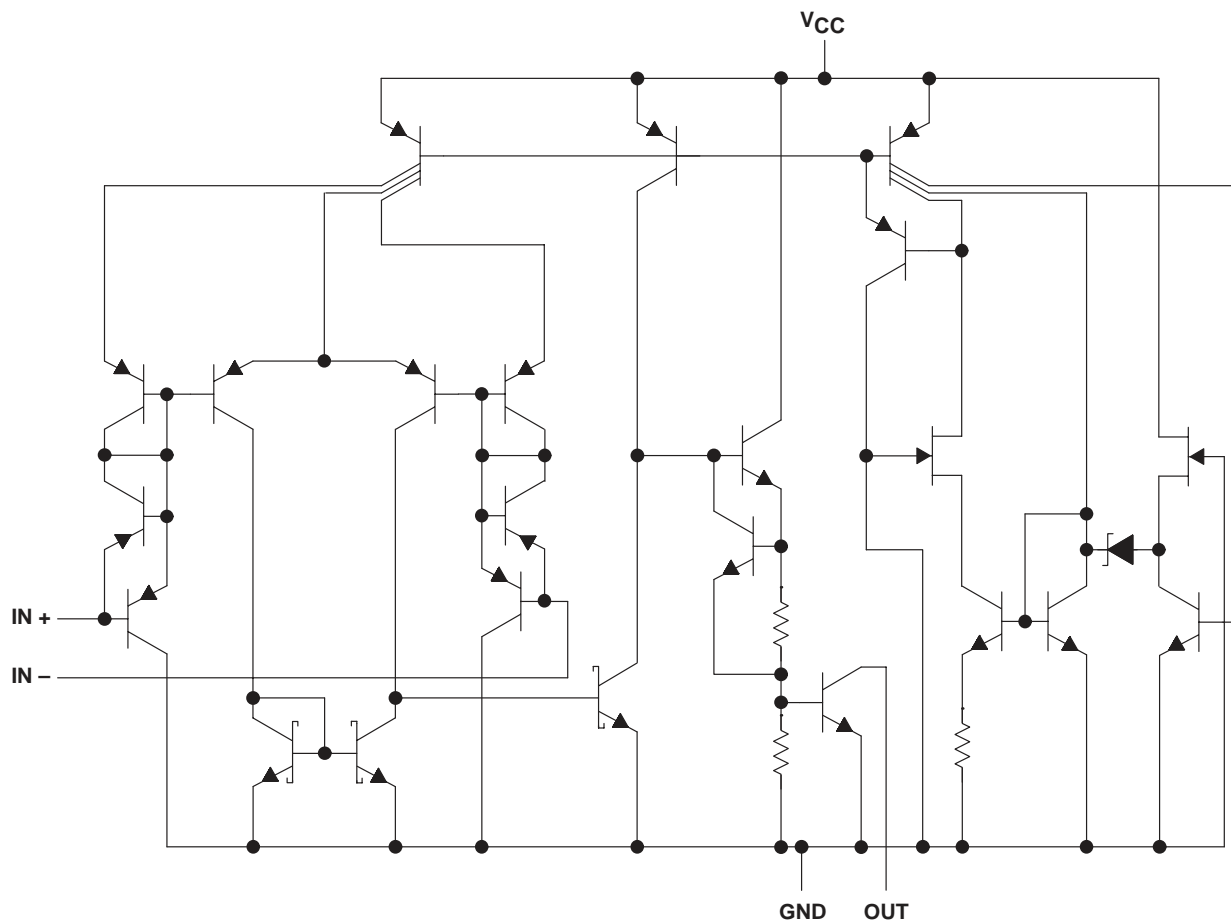
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## TLV1393, TLV1393Y equivalent schematic (each comparator)



COMPONENT COUNT	
Transistors	44
Resistors	1
Diodes	7
Epi-FET	2

TLV2393, TLV2393Y equivalent schematic (each comparator)



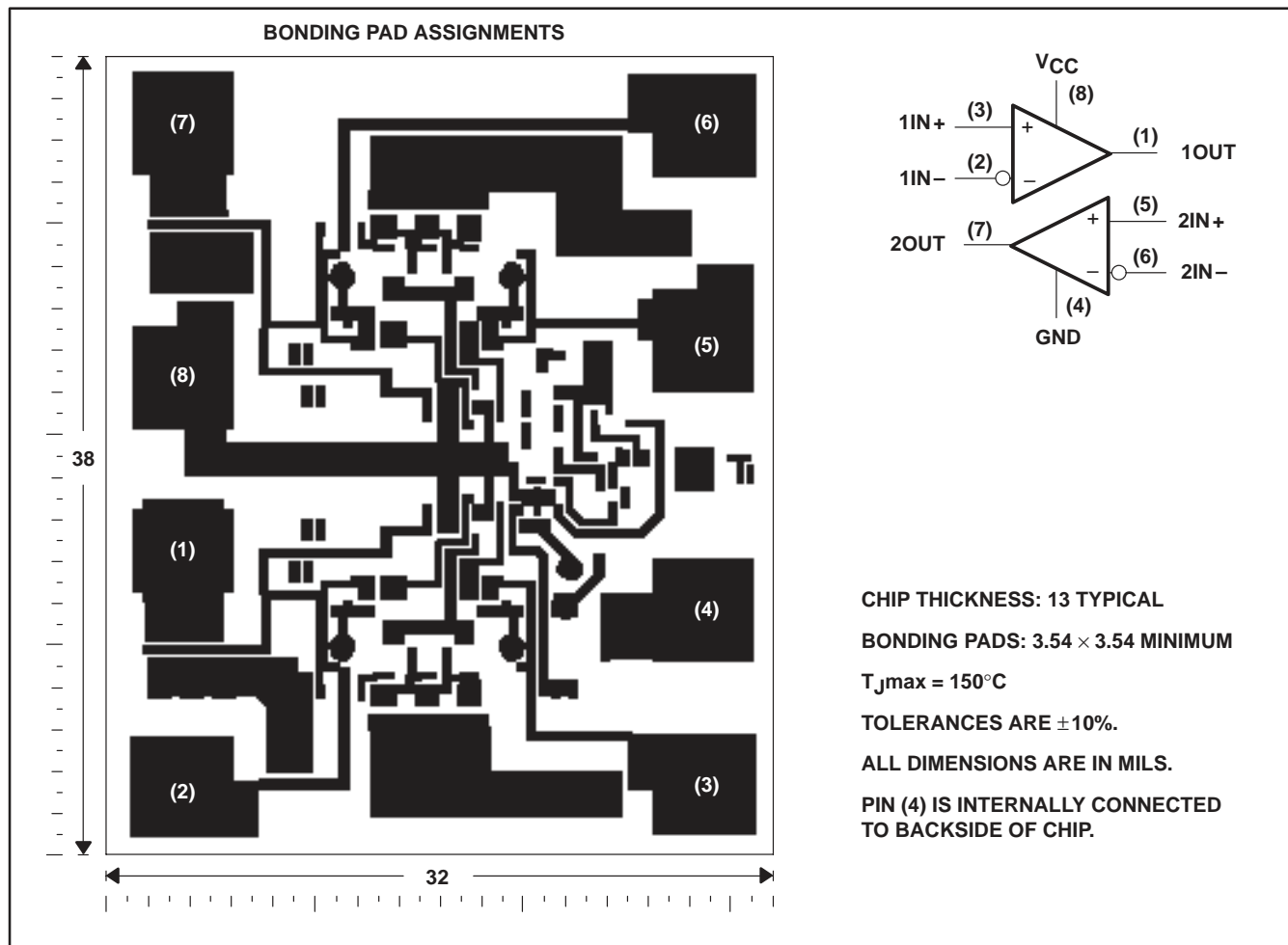
COMPONENT COUNT	
Transistors	44
Resistors	1
Diodes	7
Epi-FET	2

# TLV1393, TLV1393Y, TLV2393, TLV2393Y DUAL DIFFERENTIAL COMPARATORS

SLCS121A – AUGUST 1993 – REVISED APRIL 1994

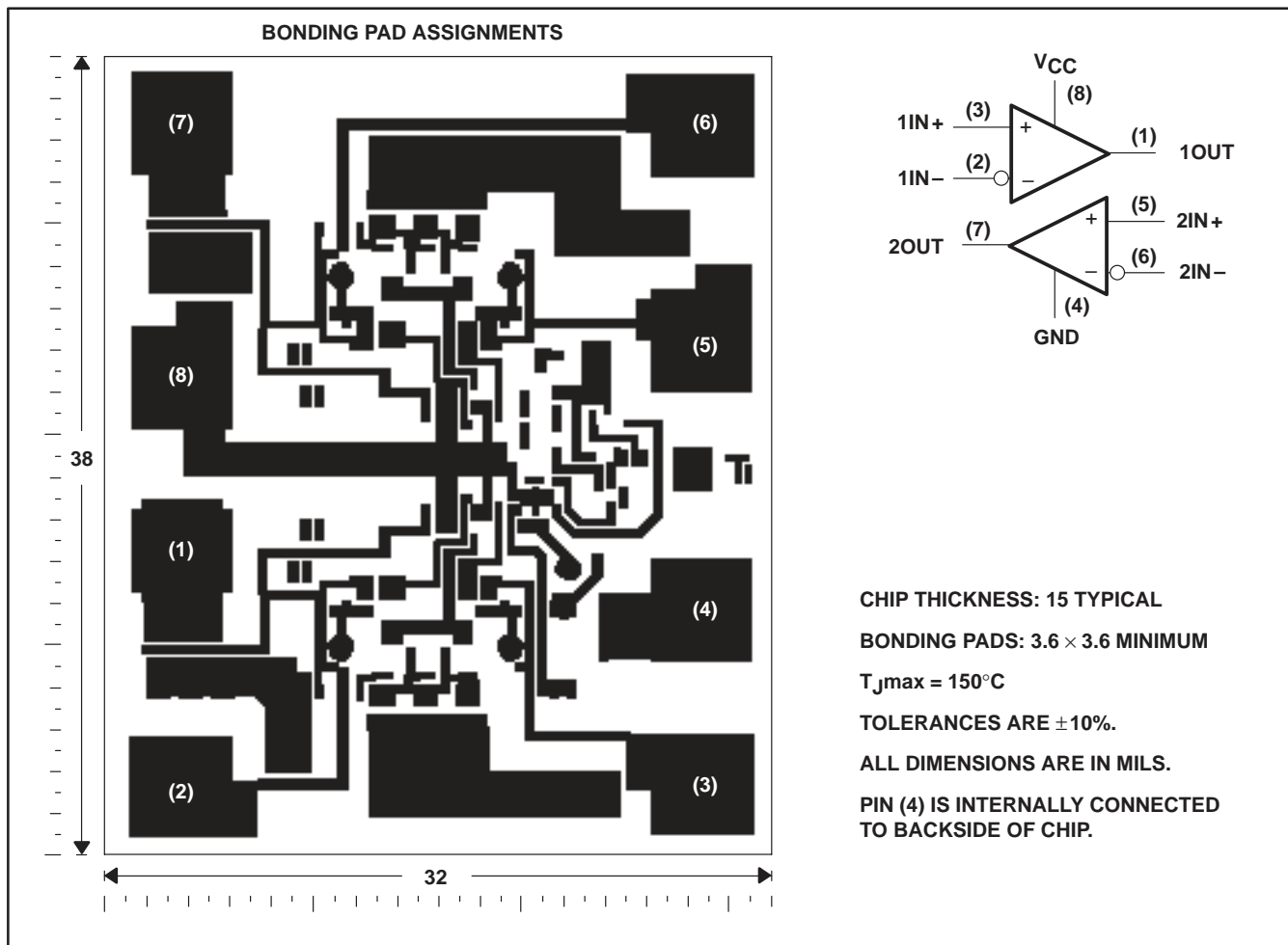
## TLV1393Y chip information

This chip, when properly assembled, displays characteristics similar to the TLV1393. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.



**TLV2393Y chip information**

This chip, when properly assembled, displays characteristics similar to the TLV2393. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.



# TLV1393, TLV1393Y, TLV2393, TLV2393Y DUAL DIFFERENTIAL COMPARATORS

SLCS121A – AUGUST 1993 – REVISED APRIL 1994

## 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)	7 V
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
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range, $T_A$	-40°C to 105°C
Storage temperature range	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°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.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$	DERATING FACTOR	$T_A = 70^\circ\text{C}$	$T_A = 85^\circ\text{C}$
	POWER RATING	ABOVE $T_A = 25^\circ\text{C}$	POWER RATING	POWER RATING
D	725 mW	5.8 mW/°C	464 mW	377 mW
P	1000 mW	8.0 mW/°C	640 mW	520 mW
PW	525 mW	4.2 mW/°C	336 mW	273 mW

## recommended operating conditions

	MIN	MAX	UNIT
Supply voltage, $V_{CC}$	2	7	V
Operating free-air temperature, $T_A$	-40	105	°C



# TLV1393, TLV1393Y, TLV2393, TLV2393Y DUAL DIFFERENTIAL COMPARATORS

SLCS121A – AUGUST 1993 – REVISED APRIL 1994

## electrical characteristics, $V_{CC} = 3\text{ V}$

PARAMETER	TEST CONDITIONS	$T_A$ †	TLV1393			UNIT
			MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_O = 1.4\text{ V}$ , $V_{IC} = V_{ICRmin}$	25°C		1.5	5	mV
		Full range		120	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	$V_{ID} = -1\text{ V}$ , $I_{OL} = 500\text{ }\mu\text{A}$	Full range		120	300	mV
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$	25°C		5	50	nA
		Full range			150	
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$	25°C		-40	-250	nA
		Full range			-400	
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$ , $V_{OH} = 3\text{ V}$	25°C		0.1		nA
	$V_{ID} = 1\text{ V}$ , $V_{OH} = 5\text{ V}$	Full range			100	
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V}$ , $V_{OL} = 1.5\text{ V}$	25°C	500			$\mu\text{A}$
$I_{CCH}$ High-level supply current	$V_O = V_{OH}$	25°C		160	250	$\mu\text{A}$
		Full range			300	
$I_{CCL}$ Low-level supply current	$V_O = V_{OL}$	25°C		160	250	$\mu\text{A}$
		Full range			300	

† Full range is  $-40^\circ\text{C}$  to  $105^\circ\text{C}$ .

## switching characteristics, $V_{CC} = 3\text{ V}$ , $C_L = 15\text{ pF}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLV1393			UNIT
		MIN	TYP	MAX	
Response time	100-mV input step with 5-mV overdrive, $R_L$ connected to 5 V through 5.1 k $\Omega$		0.7		$\mu\text{s}$



# TLV1393, TLV1393Y, TLV2393, TLV2393Y DUAL DIFFERENTIAL COMPARATORS

SLCS121A – AUGUST 1993 – REVISED APRIL 1994

## electrical characteristics, $V_{CC} = 5\text{ V}$

PARAMETER	TEST CONDITIONS	$T_A$ †	TLV1393			UNIT
			MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_O = 1.4\text{ V}$ , $V_{IC} = V_{ICRmin}$	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	$V_{ID} = -1\text{ V}$ , $I_{OL} = 500\text{ }\mu\text{A}$	Full range		120	300	mV
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$	25°C		5	50	nA
		Full range			150	
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$	25°C		-40	-250	nA
		Full range			-400	
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$ , $V_{OH} = 3\text{ V}$	25°C		0.1		nA
	$V_{ID} = 1\text{ V}$ , $V_{OH} = 5\text{ V}$	Full range			100	
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V}$ , $V_{OL} = 1.5\text{ V}$	25°C	600			$\mu\text{A}$
$I_{CCH}$ High-level supply current	$V_O = V_{OH}$	25°C		200	300	$\mu\text{A}$
		Full range			350	
$I_{CCL}$ Low-level supply current	$V_O = V_{OL}$	25°C		200	300	$\mu\text{A}$
		Full range			350	

† Full range is  $-40^\circ\text{C}$  to  $105^\circ\text{C}$ .

## switching characteristics, $V_{CC} = 5\text{ V}$ , $C_L = 15\text{ pF}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLV1393			UNIT
		MIN	TYP	MAX	
Response time	100-mV input step with 5-mV overdrive, $R_L$ connected to 5 V through 5.1 k $\Omega$		0.65		$\mu\text{s}$
	TTL-level input step, $R_L$ connected to 5 V through 5.1 k $\Omega$		0.18		

## electrical characteristics, $V_{CC} = 3\text{ V}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLV1393Y			UNIT
		MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_O = 1.4\text{ V}$ , $V_{IC} = V_{ICRmin}$		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	$V_O = 1.4\text{ V}$		5	50	nA
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$		-40	-250	nA
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$ , $V_{OH} = 3\text{ V}$		0.1		nA
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V}$ , $V_{OL} = 1.5\text{ V}$	500			$\mu\text{A}$
$I_{CCH}$ High-level supply current	$V_O = V_{OH}$		160	250	$\mu\text{A}$
$I_{CCL}$ Low-level supply current	$V_O = V_{OL}$		160	250	

## switching characteristics, $V_{CC} = 3\text{ V}$ , $C_L = 15\text{ pF}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLV1393Y			UNIT
		MIN	TYP	MAX	
Response time	100-mV input step with 5-mV overdrive, $R_L$ connected to 5 V through 5.1 k $\Omega$		0.7		$\mu\text{s}$





# TLV1393, TLV1393Y, TLV2393, TLV2393Y DUAL DIFFERENTIAL COMPARATORS

SLCS121A – AUGUST 1993 – REVISED APRIL 1994

## electrical characteristics, $V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLV1393Y			UNIT
		MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_O = 1.4\text{ V}$ , $V_{IC} = V_{ICRmin}$		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	$V_O = 1.4\text{ V}$		5	50	nA
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$		-40	-250	nA
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$ , $V_{OH} = 3\text{ V}$		0.1		nA
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V}$ , $V_{OL} = 1.5\text{ V}$	600			$\mu\text{A}$
$I_{CCH}$ High-level supply current	$V_O = V_{OH}$		200	300	$\mu\text{A}$
$I_{CCL}$ Low-level supply current	$V_O = V_{OL}$		200	300	

## switching characteristics, $V_{CC} = 5\text{ V}$ , $C_L = 15\text{ pF}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLV1393Y			UNIT
		MIN	TYP	MAX	
Response time	100-mV input step with 5-mV overdrive, $R_L$ connected to 5 V through 5.1 k $\Omega$		0.65		$\mu\text{s}$
	TTL-level input step, $R_L$ connected to 5 V through 5.1 k $\Omega$		0.18		

# TLV1393, TLV1393Y, TLV2393, TLV2393Y DUAL DIFFERENTIAL COMPARATORS

SLCS121A – AUGUST 1993 – REVISED APRIL 1994

## electrical characteristics, $V_{CC} = 3\text{ V}$

PARAMETER	TEST CONDITIONS	$T_A$ †	TLV2393			UNIT
			MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_O = 1.4\text{ V}$ , $V_{IC} = V_{ICRmin}$	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	$V_{ID} = -1\text{ V}$ , $I_{OL} = 1\text{ mA}$	25°C		80	300	mV
	$V_{ID} = -1\text{ V}$ , $I_{OL} = 4\text{ mA}$	Full range		250	700	
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$	25°C		5	50	nA
		Full range			150	
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$	25°C		-100	-250	nA
		Full range			-400	
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$ , $V_{OH} = 3\text{ V}$	25°C		0.1		nA
	$V_{ID} = 1\text{ V}$ , $V_{OH} = 5\text{ V}$	Full range			100	
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V}$ , $V_{OL} = 1.5\text{ V}$	25°C	4			mA
$I_{CCH}$ High-level supply current	$V_O = V_{OH}$	25°C		450	600	$\mu\text{A}$
		Full range			700	
$I_{CCL}$ Low-level supply current	$V_O = V_{OL}$	25°C		1.1	1.3	mA
		Full range			1.4	

† Full range is  $-40^\circ\text{C}$  to  $105^\circ\text{C}$ .

## switching characteristics, $V_{CC} = 3\text{ V}$ , $C_L = 15\text{ pF}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLV2393			UNIT
		MIN	TYP	MAX	
Response time	100-mV input step with 5-mV overdrive, $R_L$ connected to 5 V through 5.1 k $\Omega$		0.45	1	$\mu\text{s}$



# TLV1393, TLV1393Y, TLV2393, TLV2393Y DUAL DIFFERENTIAL COMPARATORS

SLCS121A – AUGUST 1993 – REVISED APRIL 1994

## electrical characteristics, $V_{CC} = 5\text{ V}$

PARAMETER	TEST CONDITIONS	$T_A$ †	TLV2393			UNIT
			MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_O = 1.4\text{ V}$ , $V_{IC} = V_{ICRmin}$	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	$V_{ID} = -1\text{ V}$ , $I_{OL} = 1\text{ mA}$	25°C		70	300	mV
	$V_{ID} = -1\text{ V}$ , $I_{OL} = 4\text{ mA}$	Full range		200	700	
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$	25°C		5	50	nA
		Full range			150	
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$	25°C		-100	-250	nA
		Full range			-400	
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$ , $V_{OH} = 3\text{ V}$	25°C		0.1		nA
	$V_{ID} = 1\text{ V}$ , $V_{OH} = 5\text{ V}$	Full range			100	
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V}$ , $V_{OL} = 1.5\text{ V}$	25°C	6			mA
$I_{CCH}$ High-level supply current	$V_O = V_{OH}$	25°C		550	700	$\mu\text{A}$
		Full range			800	
$I_{CCL}$ Low-level supply current	$V_O = V_{OL}$	25°C		1.2	1.5	mA
		Full range			1.6	

† Full range is  $-40^\circ\text{C}$  to  $105^\circ\text{C}$ .

## switching characteristics, $V_{CC} = 5\text{ V}$ , $C_L = 15\text{ pF}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLV2393			UNIT
		MIN	TYP	MAX	
Response time	100-mV input step with 5-mV overdrive, $R_L$ connected to 5 V through 5.1 k $\Omega$		0.4	0.8	$\mu\text{s}$
	TTL-level input step, $R_L$ connected to 5 V through 5.1 k $\Omega$		0.15	0.3	

# TLV1393, TLV1393Y, TLV2393, TLV2393Y DUAL DIFFERENTIAL COMPARATORS

SLCS121A – AUGUST 1993 – REVISED APRIL 1994

## electrical characteristics, $V_{CC} = 3\text{ V}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLV2393Y			UNIT
		MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_O = 1.4\text{ V}$ , $V_{IC} = V_{ICRmin}$		1.5	5	mV
$V_{ICR}$ Common-mode input voltage range		0 to $V_{CC} - 1.5$	0 to $V_{CC} - 1.2$		V
$V_{OL}$ Low-level output voltage	$V_{ID} = -1\text{ V}$ , $I_{OL} = 1\text{ mA}$		80	300	mV
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$		5	50	nA
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$		-100	-250	nA
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$ , $V_{OH} = 3\text{ V}$		0.1		nA
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V}$ , $V_{OL} = 1.5\text{ V}$	4			mA
$I_{CCH}$ High-level supply current	$V_O = V_{OH}$		450	600	$\mu\text{A}$
$I_{CCL}$ Low-level supply current	$V_O = V_{OL}$		1.1	1.3	mA

## switching characteristics, $V_{CC} = 3\text{ V}$ , $C_L = 15\text{ pF}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLV2393Y			UNIT
		MIN	TYP	MAX	
Response time	100-mV input step with 5-mV overdrive, $R_L$ connected to 5 V through 5.1 k $\Omega$		0.45	1	$\mu\text{s}$

## electrical characteristics, $V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLV2393Y			UNIT
		MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_O = 1.4\text{ V}$ , $V_{IC} = V_{ICRmin}$		1.5	5	mV
$V_{ICR}$ Common-mode input voltage range		0 to $V_{CC} - 1.5$	0 to $V_{CC} - 1.2$		V
$V_{OL}$ Low-level output voltage	$V_{ID} = -1\text{ V}$ , $I_{OL} = 1\text{ mA}$		70	300	mV
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$		5	50	nA
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$		-100	-250	nA
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$ , $V_{OH} = 3\text{ V}$		0.1		nA
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V}$ , $V_{OL} = 1.5\text{ V}$	6			mA
$I_{CCH}$ High-level supply current	$V_O = V_{OH}$		550	700	$\mu\text{A}$
$I_{CCL}$ Low-level supply current	$V_O = V_{OL}$		1.2	1.5	mA

## switching characteristics, $V_{CC} = 5\text{ V}$ , $C_L = 15\text{ pF}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLV2393Y			UNIT
		MIN	TYP	MAX	
Response time	100-mV input step with 5-mV overdrive, $R_L$ connected to 5 V through 5.1 k $\Omega$		0.4	0.8	$\mu\text{s}$
	TTL-level input step, $R_L$ connected to 5 V through 5.1 k $\Omega$		0.15	0.3	



TYPICAL CHARACTERISTICS

Table of Graphs

		FIGURE
Input overdrives for TLV1393	vs Low-to-high-level output response time	1, 3
	vs High-to-low-level output response time	2, 4
Input overdrives for TLV2393	vs Low-to-high-level output response time	5, 7
	vs High-to-low-level output response time	6, 8

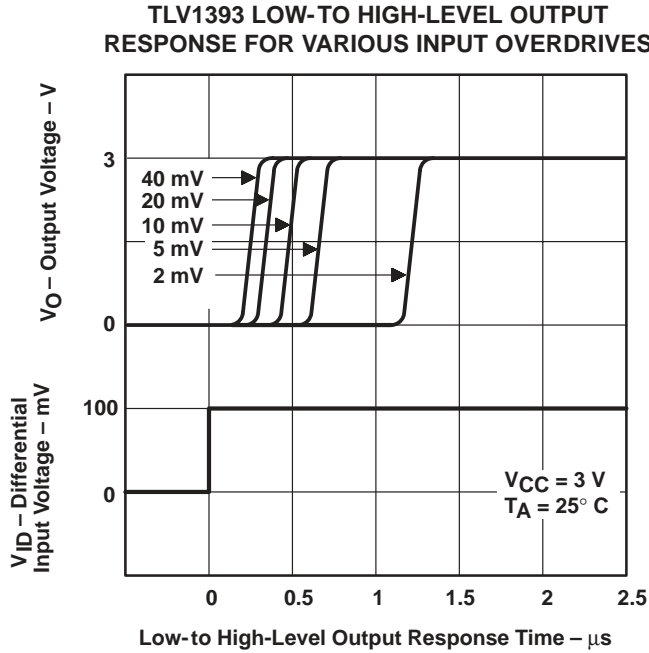


Figure 1

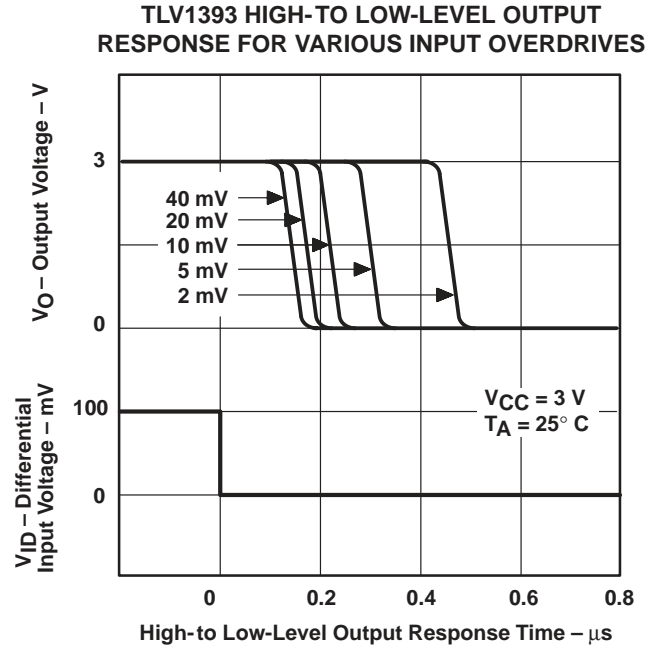


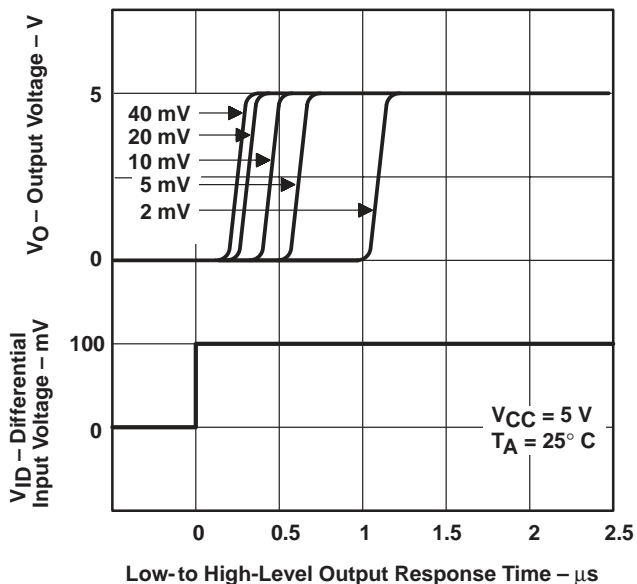
Figure 2

# TLV1393, TLV1393Y, TLV2393, TLV2393Y DUAL DIFFERENTIAL COMPARATORS

SLCS121A – AUGUST 1993 – REVISED APRIL 1994

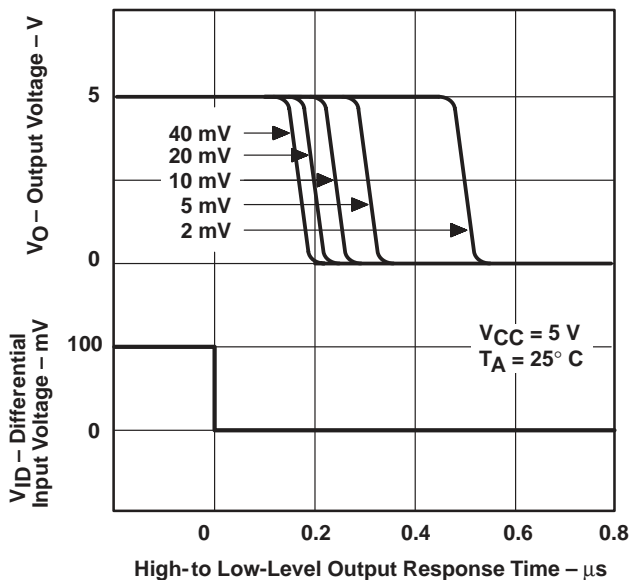
## TYPICAL CHARACTERISTICS

**TLV1393 LOW-TO-HIGH-LEVEL OUTPUT  
RESPONSE FOR VARIOUS INPUT OVERDRIVES**



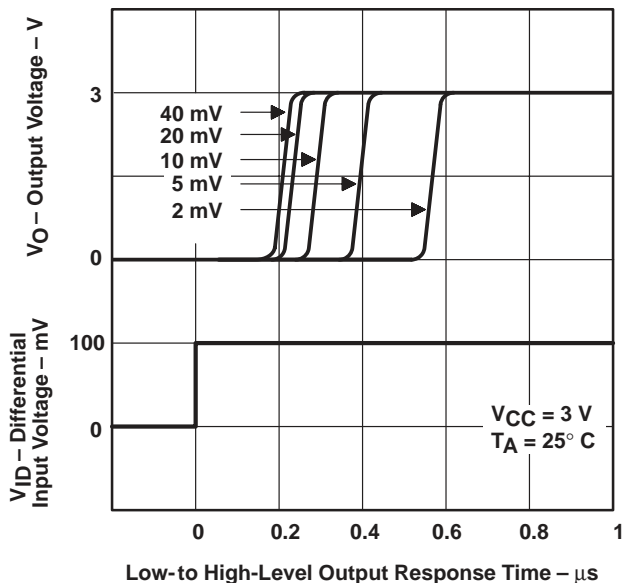
**Figure 3**

**TLV1393 HIGH-TO-LOW-LEVEL OUTPUT  
RESPONSE FOR VARIOUS INPUT OVERDRIVES**



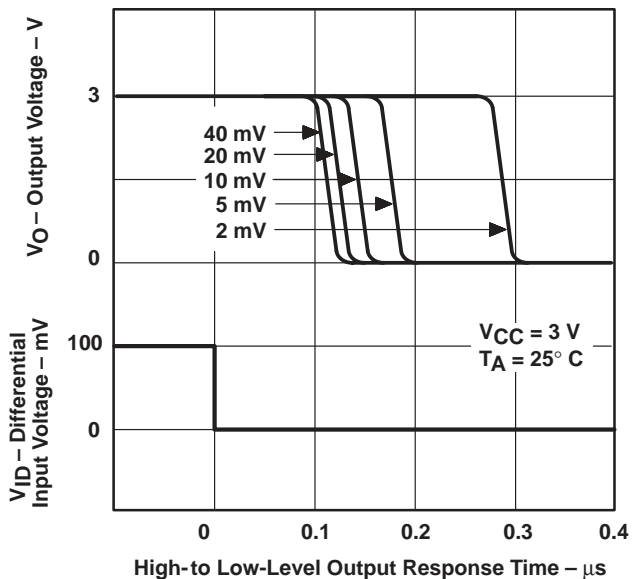
**Figure 4**

**TLV2393 LOW-TO-HIGH-LEVEL OUTPUT  
RESPONSE FOR VARIOUS INPUT OVERDRIVES**



**Figure 5**

**TLV2393 HIGH-TO-LOW-LEVEL OUTPUT  
RESPONSE FOR VARIOUS INPUT OVERDRIVES**



**Figure 6**



TYPICAL CHARACTERISTICS

TLV2393 LOW-TO-HIGH-LEVEL OUTPUT  
 RESPONSE FOR VARIOUS INPUT OVERDRIVES

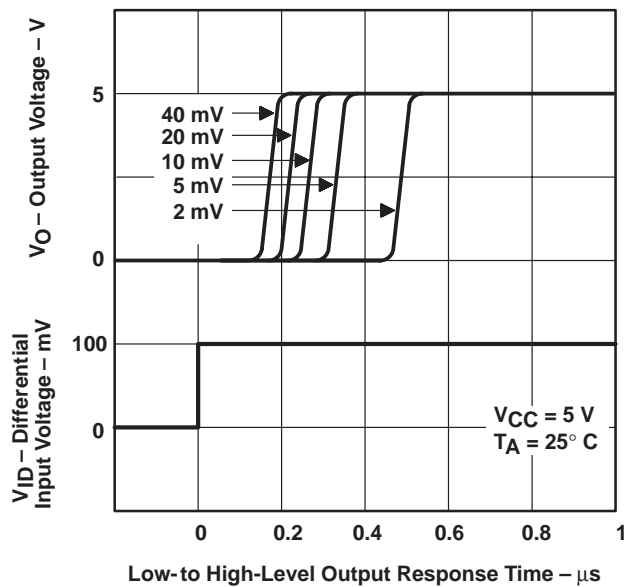


Figure 7

TLV2393 HIGH-TO-LOW-LEVEL OUTPUT  
 RESPONSE FOR VARIOUS INPUT OVERDRIVES

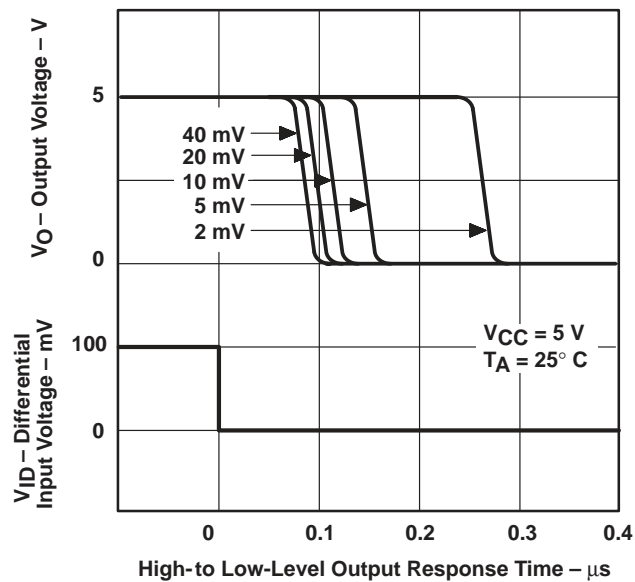


Figure 8

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
TLV1393CD	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI
TLV1393ID	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI
TLV1393IDR	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI
TLV1393IP	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI
TLV1393IPWLE	OBSOLETE	TSSOP	PW	8		TBD	Call TI	Call TI
TLV1393IPWR	OBSOLETE	TSSOP	PW	8		TBD	Call TI	Call TI
TLV2393ID	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI
TLV2393IDR	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI
TLV2393IP	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI
TLV2393IPWLE	OBSOLETE	TSSOP	PW	8		TBD	Call TI	Call TI
TLV2393IPWR	OBSOLETE	TSSOP	PW	8		TBD	Call TI	Call TI

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) 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.

**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)

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

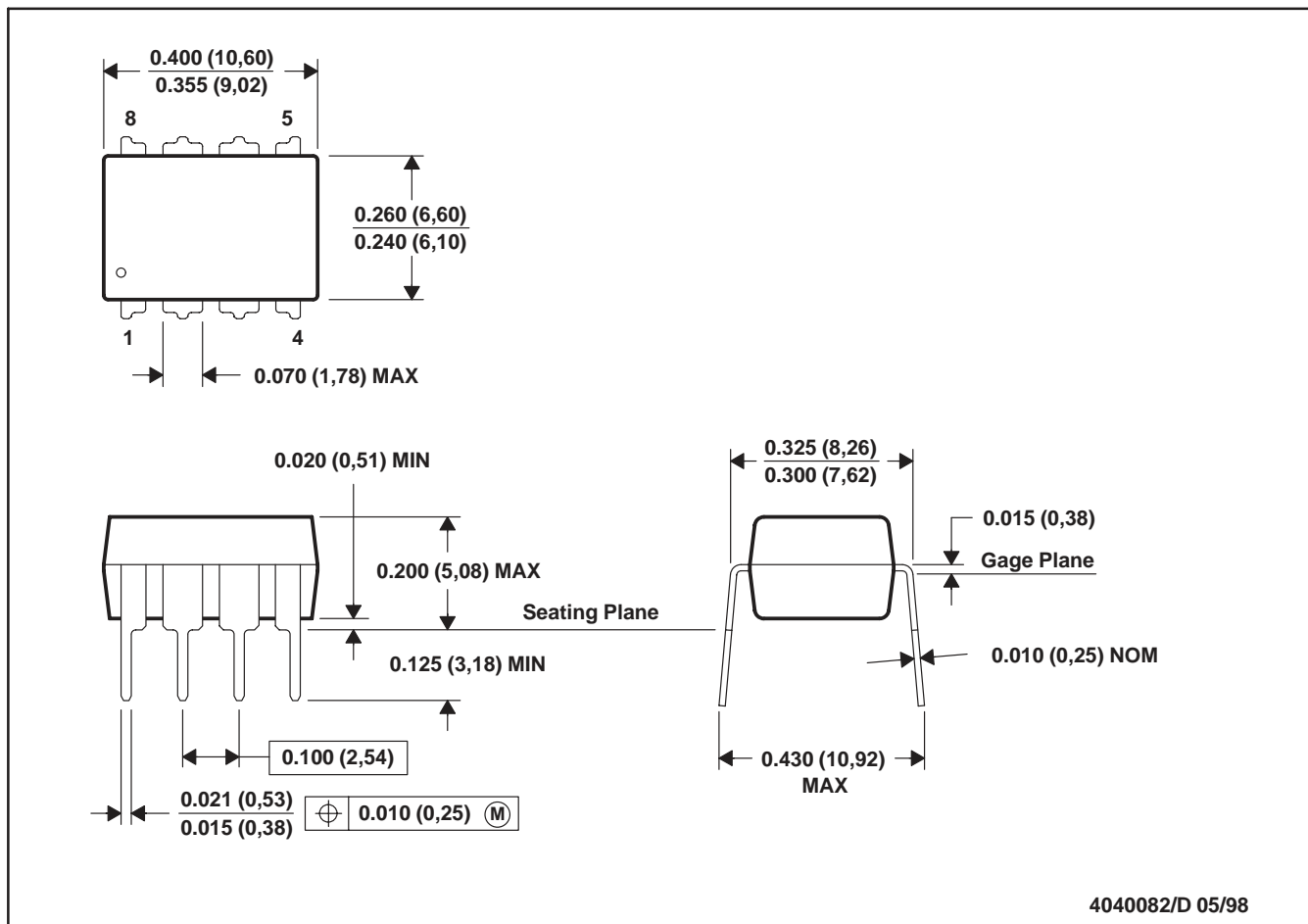
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P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE

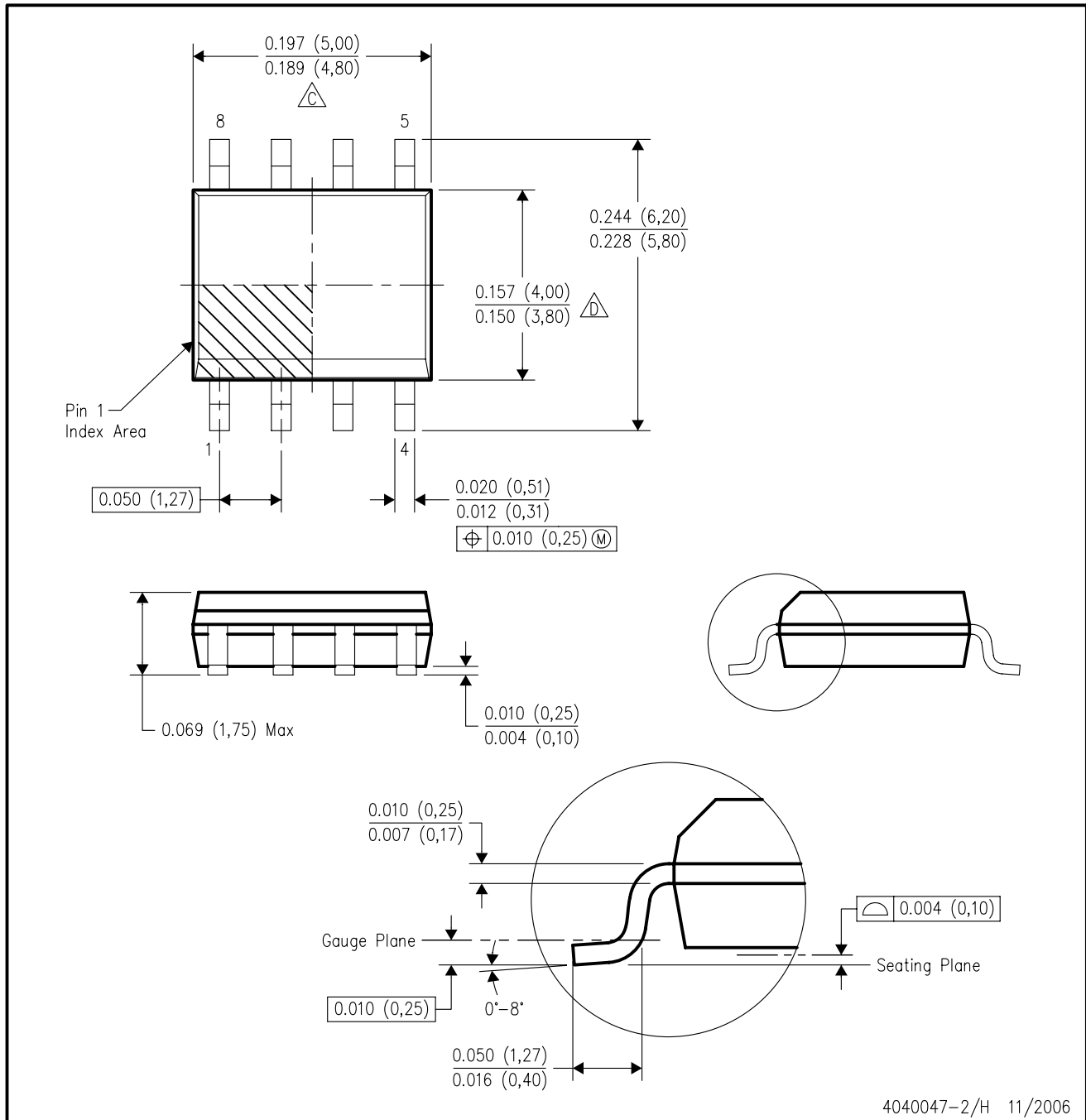


- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-001

For the latest package information, go to [http://www.ti.com/sc/docs/package/pkg\\_info.htm](http://www.ti.com/sc/docs/package/pkg_info.htm)

D (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE

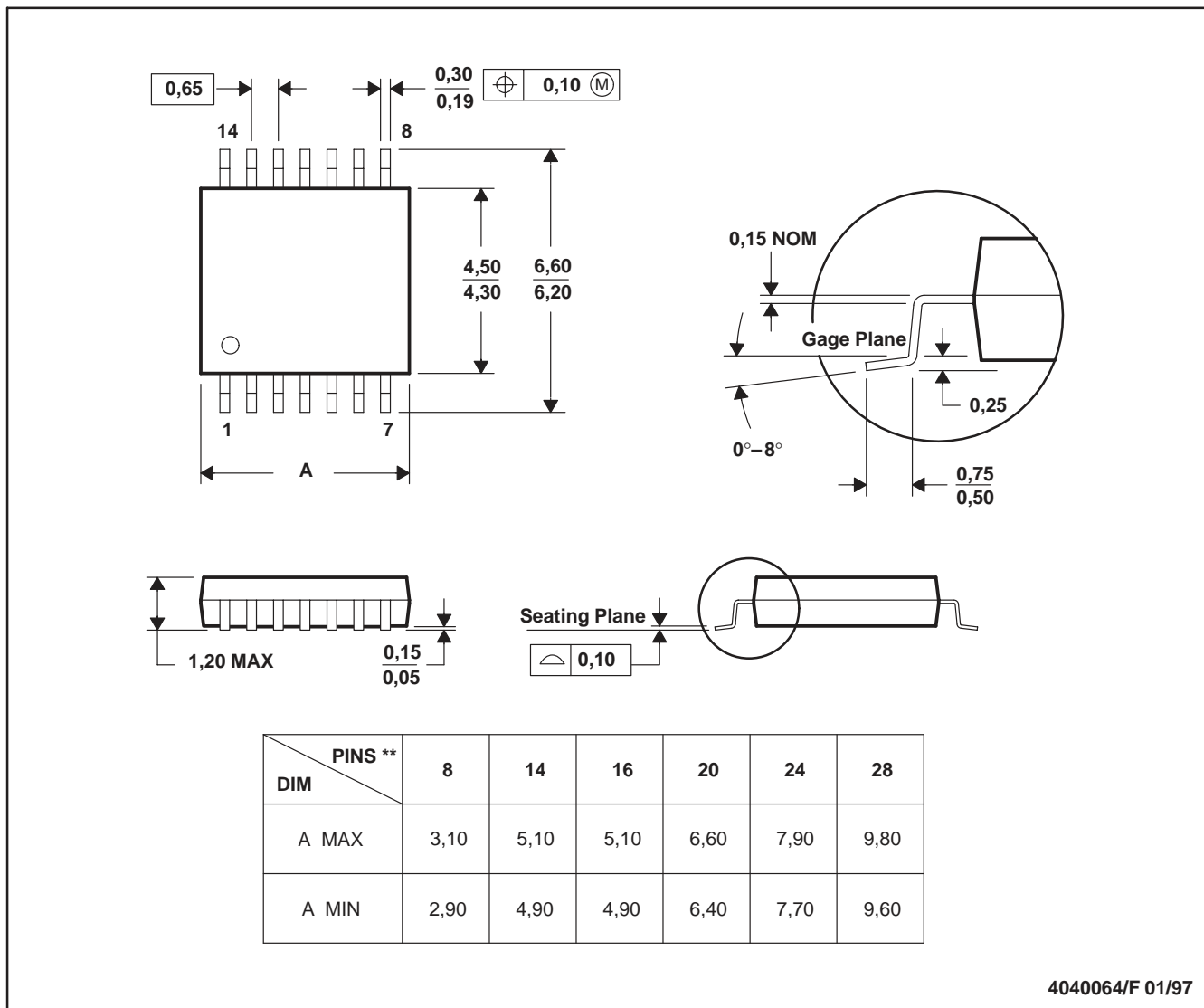


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AA.

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- 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 not to exceed 0,15.  
 D. Falls within JEDEC MO-153

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Low Power Wireless	<a href="http://www.ti.com/lpw">www.ti.com/lpw</a>	Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
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