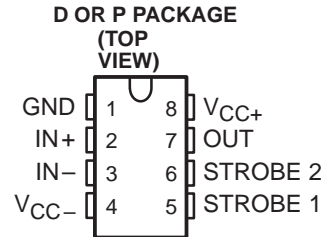


# LM306 DIFFERENTIAL COMPARATOR WITH STROBES

SLCS008A – OCTOBER 1979 – REVISED OCTOBER 1991

- Fast Response Times
- Improved Gain and Accuracy
- Fanout to 10 Series 54/74 TTL Loads
- Strobe Capability
- Short-Circuit and Surge Protection
- Designed to Be Interchangeable With National Semiconductor LM306



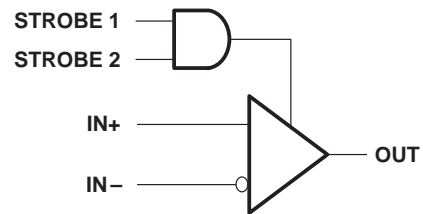
## description

The LM306 is a high-speed voltage comparator with differential inputs, a low-impedance high-sink-current (100 mA) output, and two strobe inputs. This device detects low-level analog or digital signals and can drive digital logic or lamps and relays directly. Short-circuit protection and surge-current limiting is provided.

A low-level input at either strobe causes the output to remain high regardless of the differential input. When both strobe inputs are either open or at a high logic level, the output voltage is controlled by the differential input voltage. The circuit will operate with any negative supply voltage between -3 V and -12 V with little difference in performance.

The LM306 is characterized for operation from 0°C to 70°C.

## functional block diagram



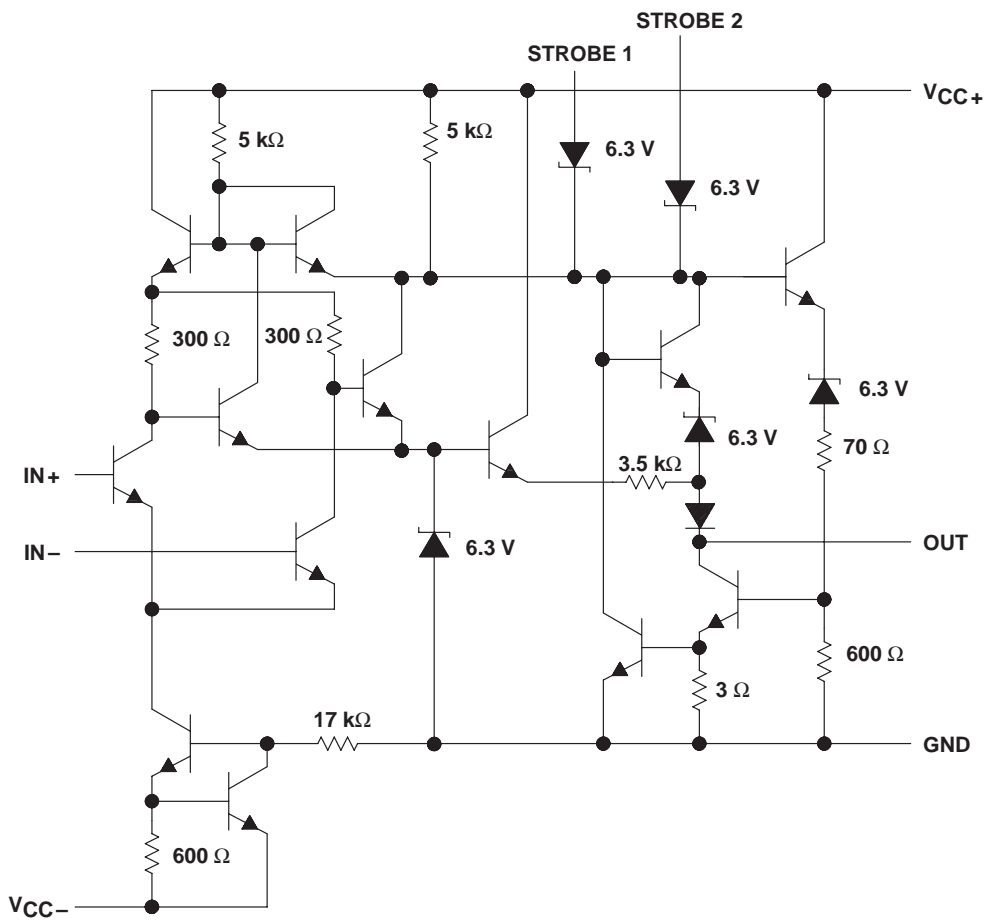
## AVAILABLE OPTIONS

T <sub>A</sub>	V <sub>IO</sub> max at 25°C	PACKAGE	
		SMALL OUTLINE (D)	PLASTIC DIP (P)
0°C to 70°C	5 mV	LM306D	LM306P

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## schematic



Resistor values are nominal.

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

Supply voltage, $V_{CC+}$ (see Note 1)	15 V
Supply voltage, $V_{CC-}$ (see Note 1)	–15 V
Differential input voltage, $V_{ID}$ (see Note 2)	$\pm 5$ V
Input voltage, $V_I$ (either input, see Notes 1 and 3)	$\pm 7$ V
Strobe voltage range (see Note 1)	0 V to $V_{CC+}$
Output voltage, $V_O$ (see Note 1)	24 V
Voltage from output to $V_{CC-}$	30 V
Duration of output short circuit to ground (see Note 4)	10 s
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range, $T_A$	0°C to 70°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 and the voltage from the output to  $V_{CC-}$ , are with respect to the network ground.
  2. Differential voltages are at  $IN+$  with respect to  $IN-$ .
  3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 7 V, whichever is less.
  4. The output may be shorted to ground or either power supply.

**DISSIPATION RATING TABLE**

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR	DERATE ABOVE $T_A$	$T_A = 70^\circ\text{C}$ POWER RATING
D	600 mW	5.8 mW/°C	46°C	464 mW
P	600 mW	8.0 mW/°C	75°C	600 mW

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**electrical characteristics at specified free-air temperature,  $V_{CC+} = 12\text{ V}$ ,  $V_{CC-} = -3\text{ V}$  to  $-12\text{ V}$  (unless otherwise noted)**

PARAMETER	TEST CONDITIONS†	$T_A$ ‡	MIN	TYP	MAX	UNIT
$V_{IO}$ Input offset voltage	$R_S \leq 200\ \Omega$	25°C		1.6§	5	mV
		Full range			6.5	
$\alpha_{VIO}$ Average temperature coefficient of input offset voltage	$R_S = 50\ \Omega$ , See Note 5	Full range		5	20	$\mu\text{V}/^\circ\text{C}$
$I_{IO}$ Input offset current	See Note 5	25°C		1.8	5	$\mu\text{A}$
		MIN		1	7.5	
		MAX		0.5	5	
$\alpha_{IIO}$ Average temperature coefficient of input offset current	See Note 5	MIN to 25°C		24	100	nA/°C
		25°C to MAX		15	50	
$I_{IB}$ Input bias current	$V_O = 0.5\text{ V}$ to $5\text{ V}$	MIN to 25°C			40	$\mu\text{A}$
		25°C to MAX		16	25	
$I_{IL(S)}$ Low-level strobe current	$V_{(\text{strobe})} = 0.4\text{ V}$	Full range		-1.7	-3.2	mA
$V_{IH(S)}$ High-level strobe voltage		Full range	2.2			V
$V_{IL(S)}$ Low-level strobe voltage		Full range			0.9	V
$V_{ICR}$ Common-mode input voltage range	$V_{CC-} = -7\text{ V}$ to $-12\text{ V}$	Full range	$\pm 5$			V
$V_{ID}$ Differential input voltage range		Full range	$\pm 5$			V
$A_{VD}$ Large-signal differential voltage amplification	$V_O = 0.5\text{ V}$ to $5\text{ V}$ , No load	25°C		40		V/mV
$V_{OH}$ High-level output voltage	$I_{OH} = -400\ \mu\text{A}$ $V_{ID} = 8\text{ mV}$	Full range	2.5		5.5	V
$V_{OL}$ Low-level output voltage	$I_{OL} = 100\text{ mA}$ $V_{ID} = -7\text{ mV}$	25°C		0.8	2	V
	$I_{OL} = 50\text{ mA}$ $V_{ID} = -7\text{ mV}$	Full range			1	
	$I_{OL} = 16\text{ mA}$ $V_{ID} = -8\text{ mV}$	Full range			0.4	
$I_{OH}$ High-level output voltage	$V_{OH} = 8\text{ V}$ to $24\text{ V}$	$V_D = 7\text{ mV}$ MIN to 25°C		0.02	2	$\mu\text{A}$
		$V_{ID} = 8\text{ mV}$ 25°C to MAX			100	
$I_{CC+}$ Supply current from $V_{CC+}$	$V_{ID} = -5\text{ mV}$ , No load	Full range		6.6	10	mA
$I_{CC-}$ Supply current from $V_{CC-}$	No load	Full range		-1.9	-3.6	mA

† Unless otherwise noted, all characteristics are measured with both strobes open.

‡ Full range is 0°C to 70°C. MIN is 0°C. MAX is 70°C.

§ This typical value is at  $V_{CC+} = 12\text{ V}$ ,  $V_{CC-} = -6\text{ V}$ .

NOTE 5: The offset voltages and offset currents given are the maximum values required to drive the output down to the low range ( $V_{OL}$ ) or up to the high range ( $V_{OH}$ ). These parameters actually define an error band and take into account the worst-case effects of voltage gain and input impedance.

### switching characteristics, $V_{CC+} = 12\text{ V}$ , $V_{CC-} = -6\text{ V}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS†	MIN	TYP	MAX	UNIT
Response time, low-to-high-level output	$R_L = 390\ \Omega$ to $5\text{ V}$ , $C_L = 15\text{ pF}$ , See Note 6		28	40	ns

† All characteristics are measured with both strobes open.

NOTE 6: The response time specified is for a 100-mV input step with 5-mV overdrive and is the interval between the input step function and the instant when the output crosses 1.4 V.

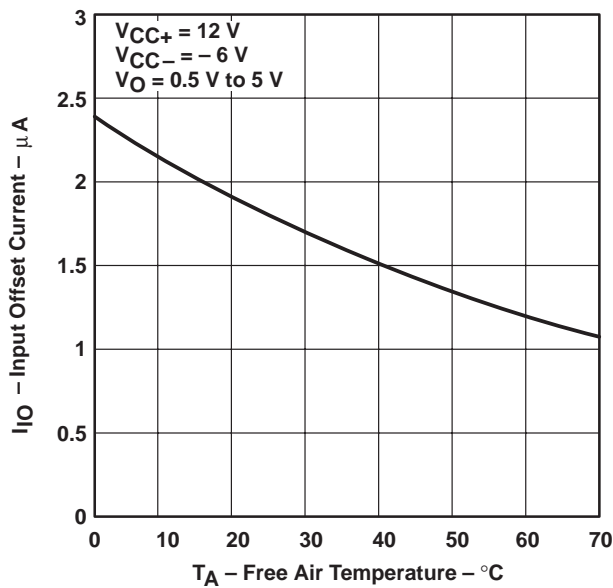


## TYPICAL CHARACTERISTICS

**Table of Graphs**

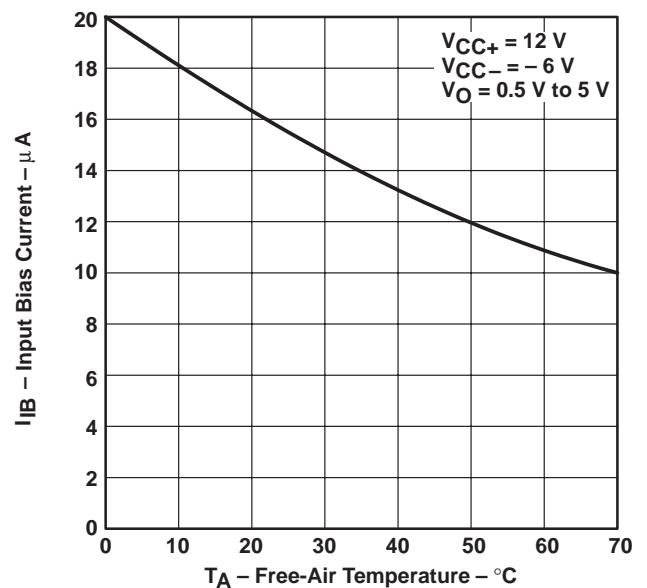
			FIGURE
$I_{IB}$	Input bias current	vs Free-air temperature	1
$I_{IO}$	Input offset current	vs Free-air temperature	2
$V_{OH}$	High-level output voltage	vs Free-air temperature	3
$V_{OL}$	Low-level output voltage	vs Free-air temperature	4
$V_O$	Output voltage	vs Differential input voltage	5
$I_O$	Output current	vs Differential input voltage	6
$A_{VD}$	Large-signal differential voltage amplification	vs Free-air temperature	7
$I_{OS}$	Short-circuit output current	vs Free-air temperature	8
	Output response	vs Time	9, 10
$I_{CC+}$	Positive supply current	vs Positive supply voltage	11
$I_{CC-}$	Negative supply current	vs Negative supply voltage	12
$P_D$	Total power dissipation	vs Free-air temperature	13

**INPUT OFFSET CURRENT  
vs  
FREE-AIR TEMPERATURE**



**Figure 1**

**INPUT BIAS CURRENT  
vs  
FREE-AIR TEMPERATURE**



**Figure 2**

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TYPICAL CHARACTERISTICS

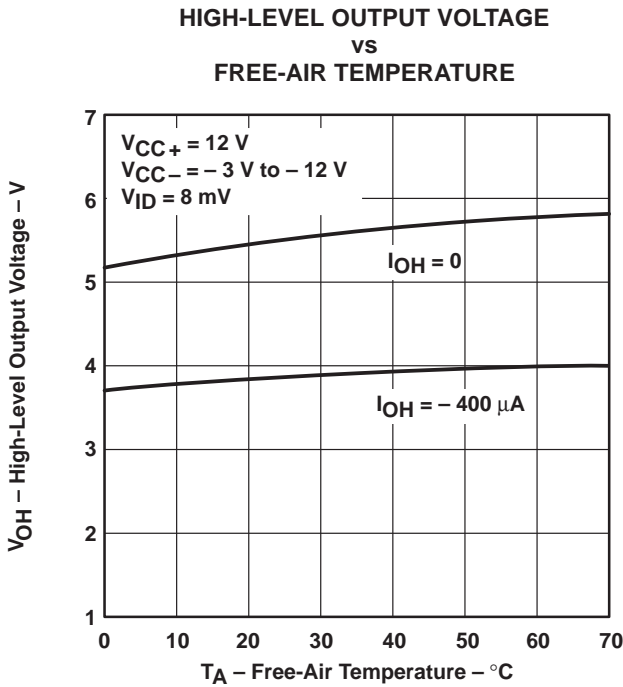


Figure 3

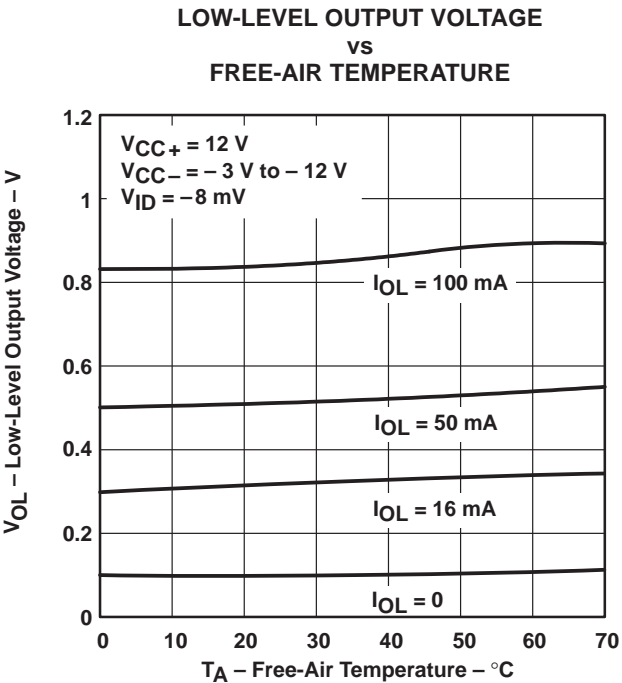


Figure 4

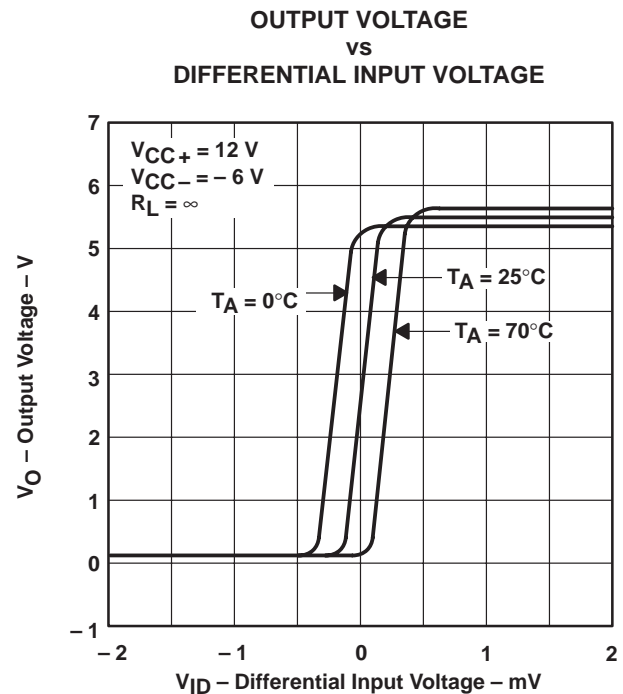


Figure 5

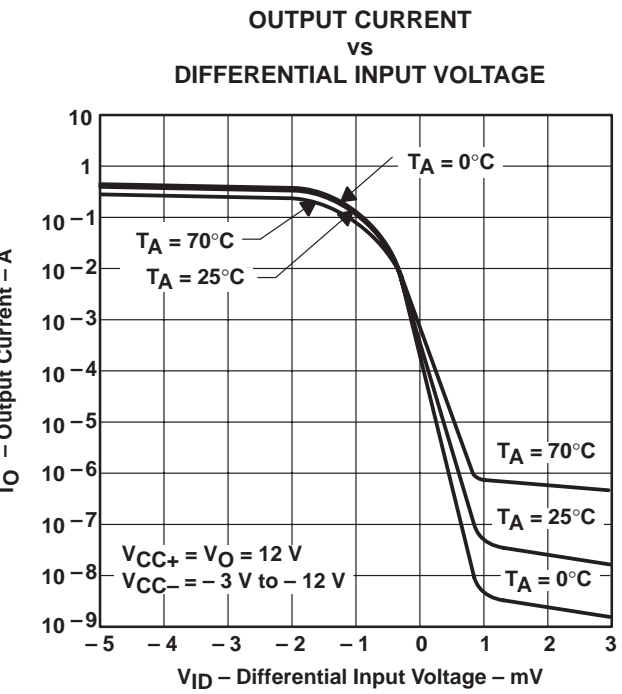


Figure 6

## TYPICAL CHARACTERISTICS

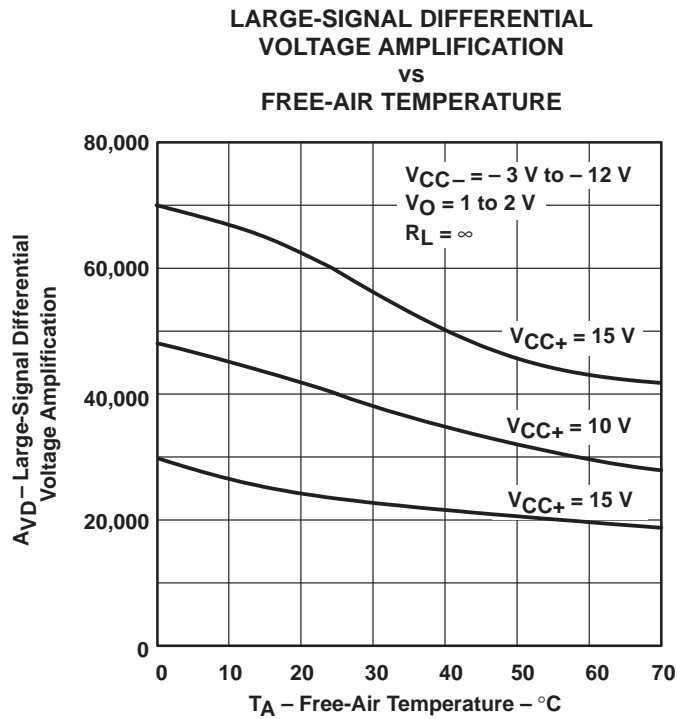
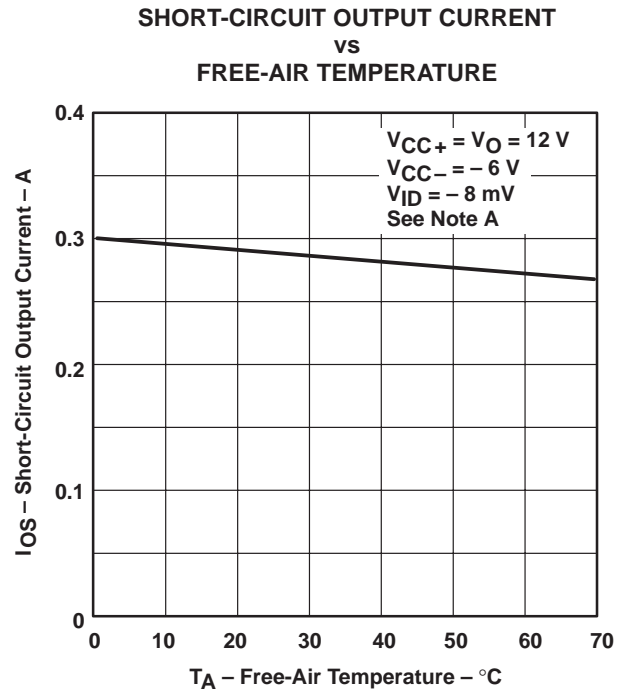


Figure 7



NOTE A: This parameter was measured using a single 5-ms pulse.

Figure 8

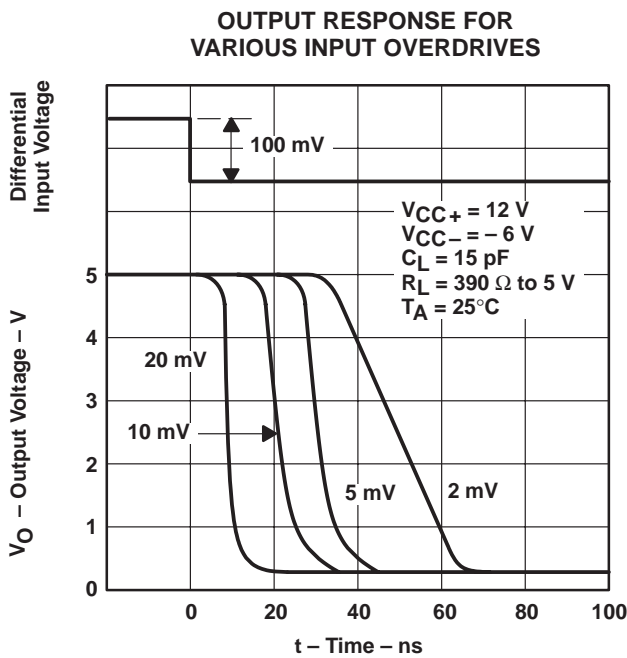


Figure 9

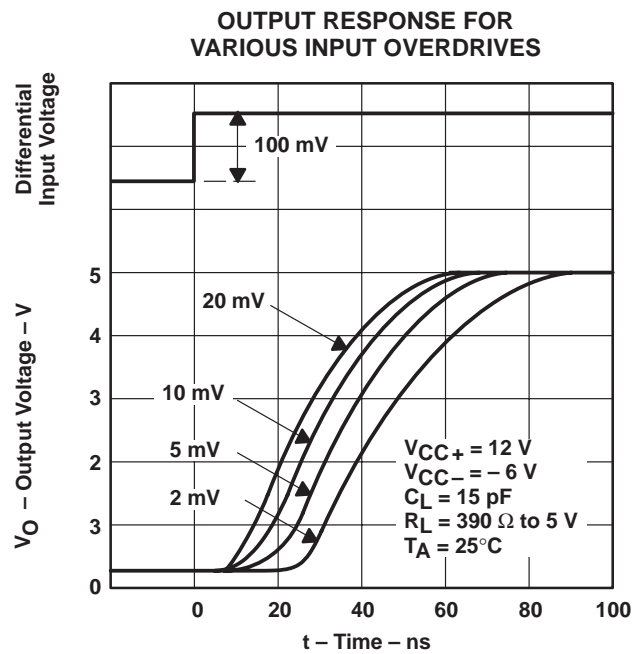


Figure 10

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TYPICAL CHARACTERISTICS

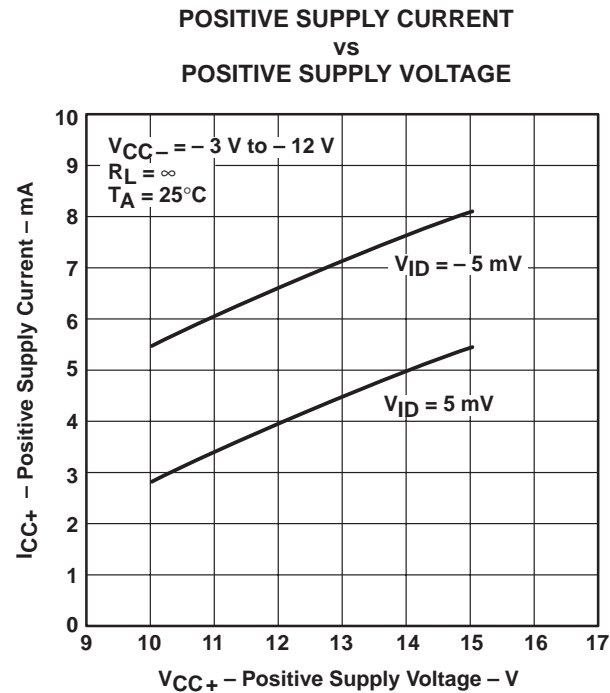


Figure 11

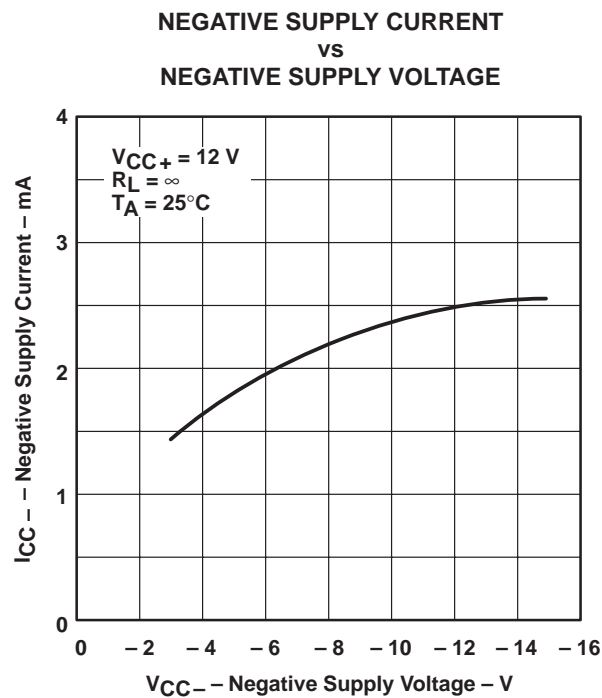


Figure 12

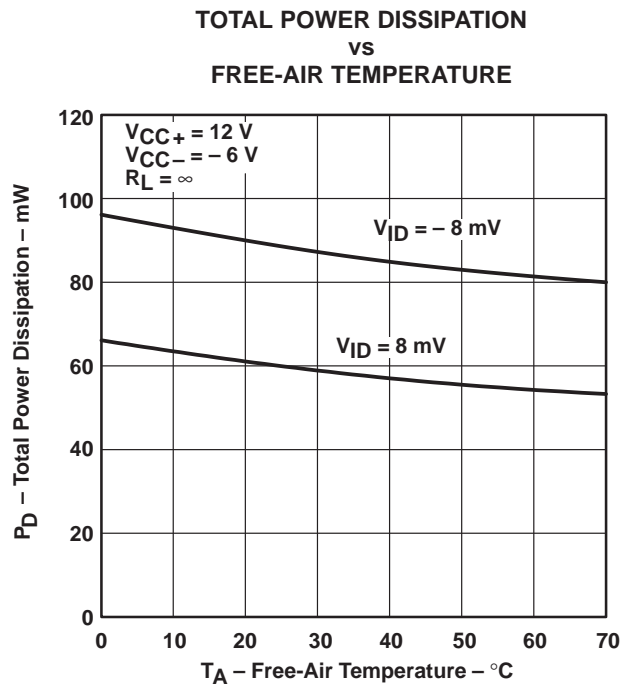


Figure 13



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