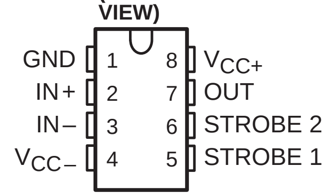
LM306 DIFFERENTIAL COMPARATOR WITH STROBES

- **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**

D OR P PACKAGE (TOP VIEW)



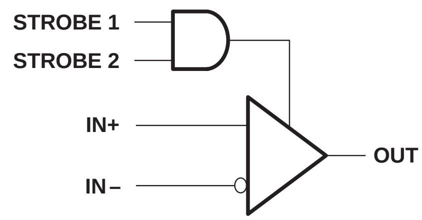
description

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.

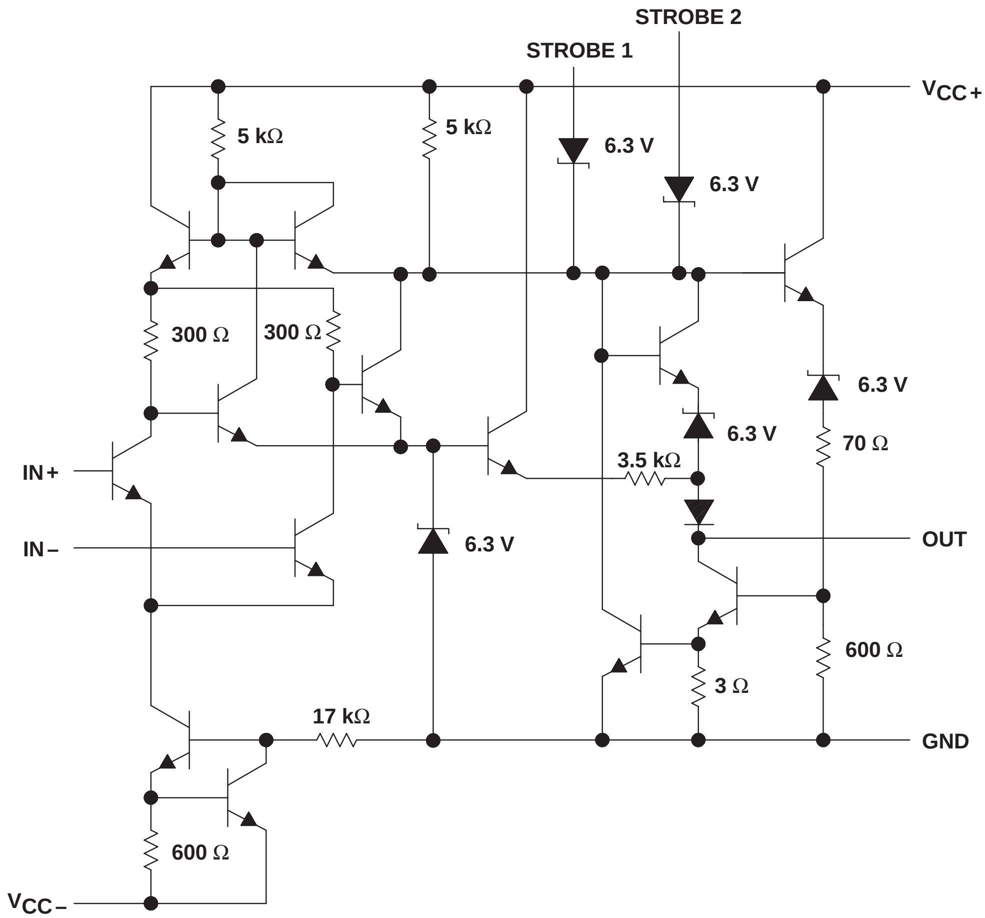
functional block diagram



AVAILABLE OPTIONS

T_A	V_{IO}max at 25°C	PACKAGE	
		SMALL OUTLINE (D)	PLASTIC DIP (P)
0°C to 70°C	5 mV	LM306D	LM306P

schematic



Resistor values are nominal.

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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)	±5 V
Input voltage, V_I (either input, see Notes 1 and 3)	±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	$T_A \le 25°C$ POWER RATING	DERATING FACTOR	DERATE ABOVE T_A	$T_A = 70°C$ POWER RATING
D	600 mW	5.8 mW/°C	46°C	464 mW
P	600 mW	8.0 mW/°C	75°C	600 mW

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

PARAMETER		TEST CONDITIONS†		T_A‡	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	$R_S \le 200\ \Omega$		25°C		1.6§	5	mV
				Full range			6.5	
α_{VIO}	Average temperature coefficient of input offset voltage	$R_S = 50\ \Omega$,	See Note 5	Full range		5	20	µV/°C
I_{IO}	Input offset current	See Note 5		25°C		1.8	5	µA
				MIN		1	7.5	
				MAX		0.5	5	
α_{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 V to 5 V		MIN to 25°C			40	µA
				25°C to MAX		16	25	
$I_{IL(S)}$	Low-level strobe current	$V_{(strobe)}$ = 0.4 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 V to –12 V		Full range	±5			V
V_{ID}	Differential input voltage range			Full range	±5			V
A_{VD}	Large-signal differential voltage amplification	V_O = 0.5 V to 5 V,	No load	25°C		40		V/mV
V_{OH}	High-level output voltage	I_{OH} = –400 µA	V_{ID} = 8 mV	Full range	2.5		5.5	V
V_{OL}	Low-level output voltage	I_{OL} = 100 mA	V_{ID} = –7 mV	25°C		0.8	2	V
		I_{OL} = 50 mA	V_{ID} = –7 mV	Full range			1	
		I_{OL} = 16 mA	V_{ID} = –8 mV	Full range			0.4	
I_{OH}	High-level output voltage	V_{OH} = 8 V to 24 V	V_D = 7 mV	MIN to 25°C		0.02	2	µA
			V_{ID} = 8 mV	25°C to MAX			100	
I_{CC+}	Supply current from V_{CC+}	V_{ID} = –5 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 V, V_{CC-} = –6 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 V, V_{CC-} = –6 V, T_A = 25°C

PARAMETER	TEST CONDITIONS†	MIN	TYP	MAX	UNIT
Response time, low-to-high-level output	R_L = 390 Ω to 5 V, C_L = 15 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

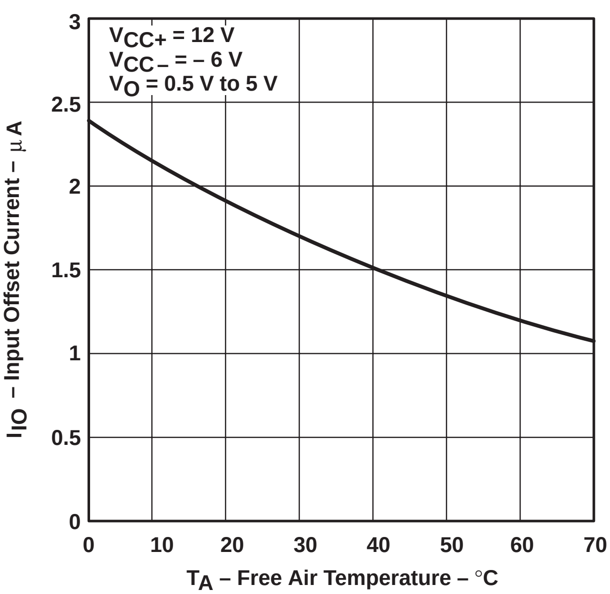


Figure 1

INPUT BIAS CURRENT
vs
FREE-AIR TEMPERATURE

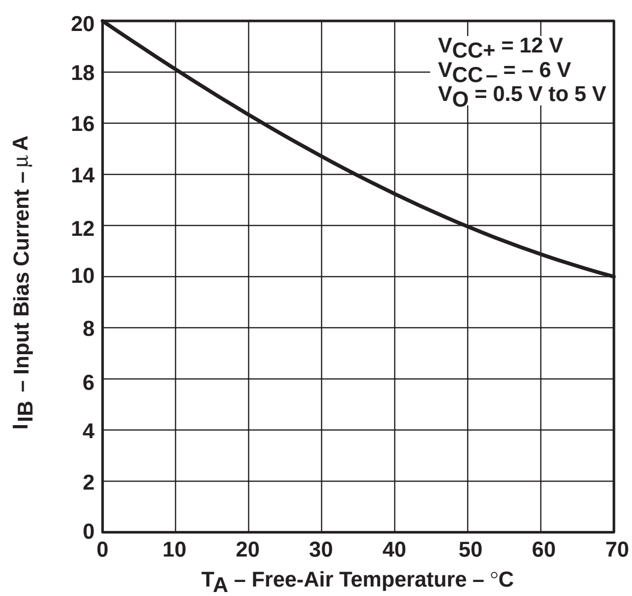


Figure 2

TYPICAL CHARACTERISTICS

HIGH-LEVEL OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE

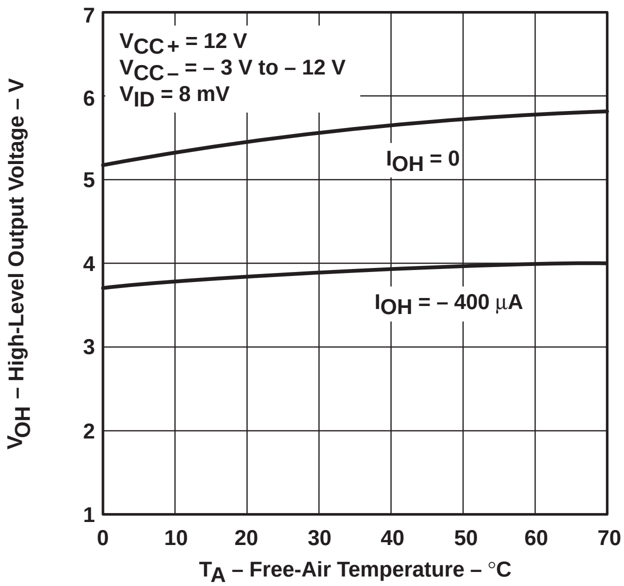


Figure 3

LOW-LEVEL OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE

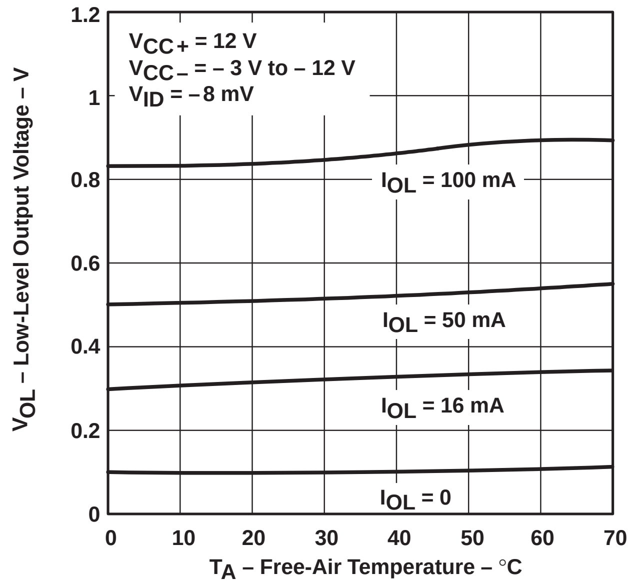


Figure 4

OUTPUT VOLTAGE vs DIFFERENTIAL INPUT VOLTAGE

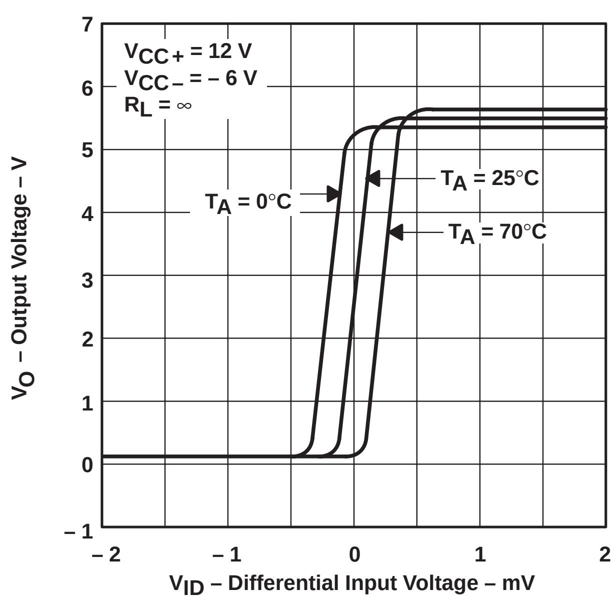


Figure 5

OUTPUT CURRENT vs DIFFERENTIAL INPUT VOLTAGE

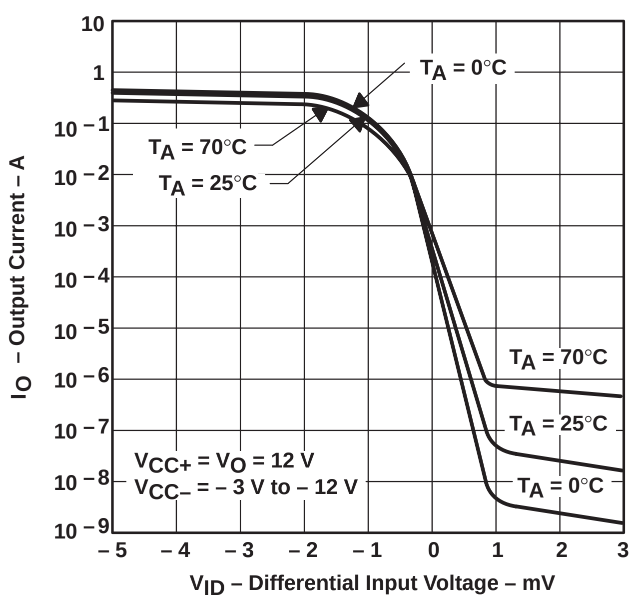


Figure 6

TYPICAL CHARACTERISTICS

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION vs FREE-AIR TEMPERATURE

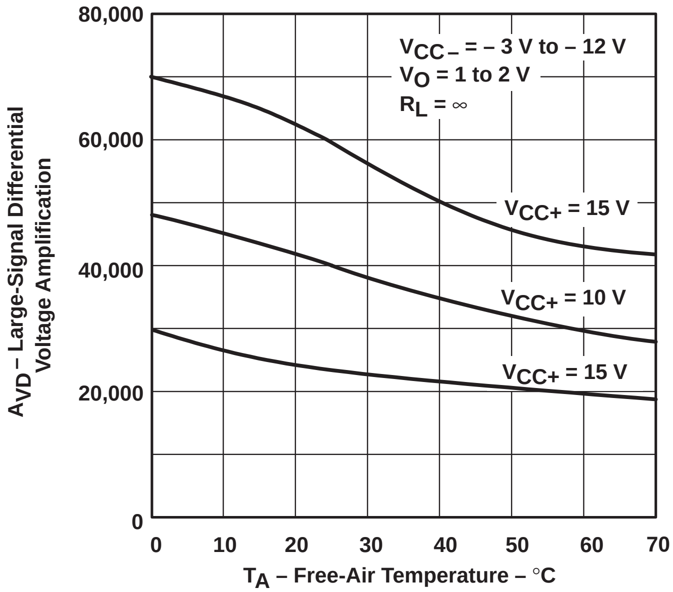
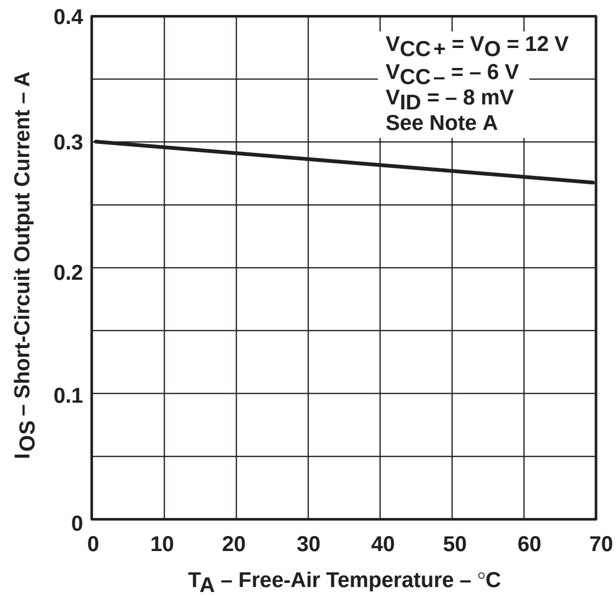


Figure 7

SHORT-CIRCUIT OUTPUT CURRENT vs FREE-AIR TEMPERATURE



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

Figure 8

OUTPUT RESPONSE FOR VARIOUS INPUT OVERDRIVES

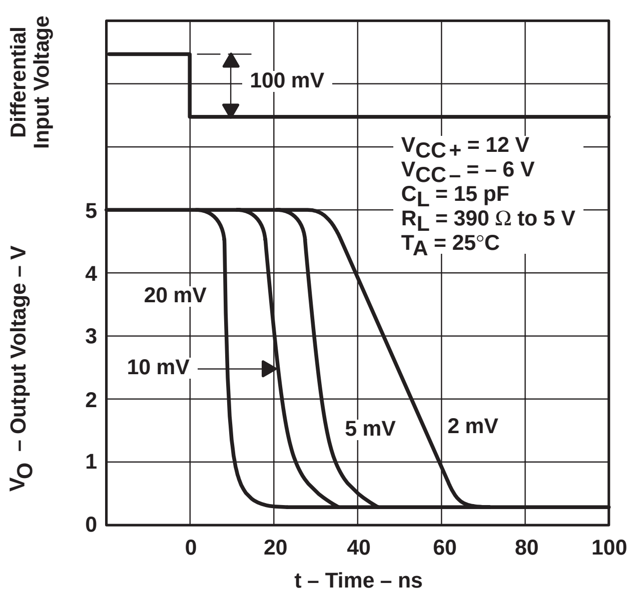


Figure 9

OUTPUT RESPONSE FOR VARIOUS INPUT OVERDRIVES

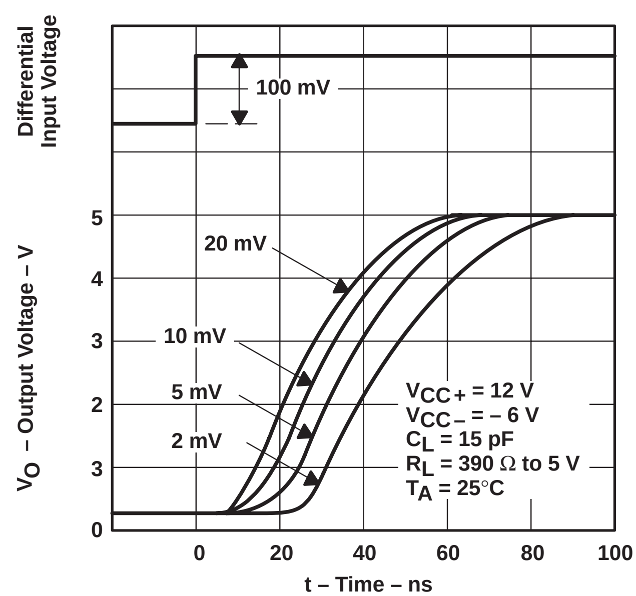


Figure 10

TYPICAL CHARACTERISTICS

POSITIVE SUPPLY CURRENT vs POSITIVE SUPPLY VOLTAGE

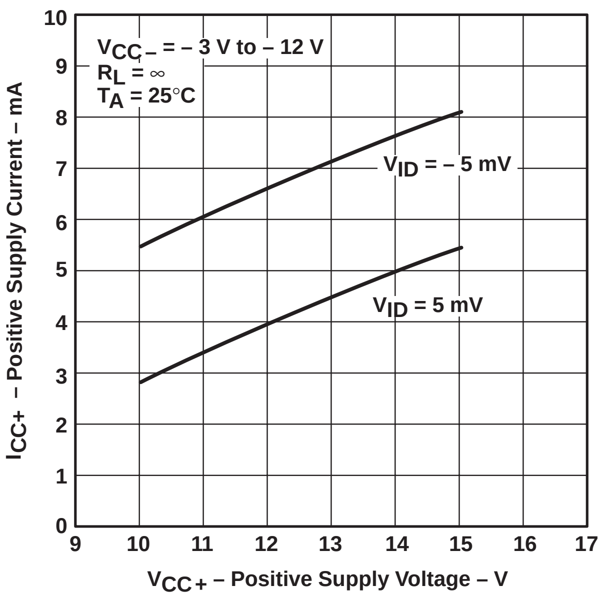


Figure 11

NEGATIVE SUPPLY CURRENT vs NEGATIVE SUPPLY VOLTAGE

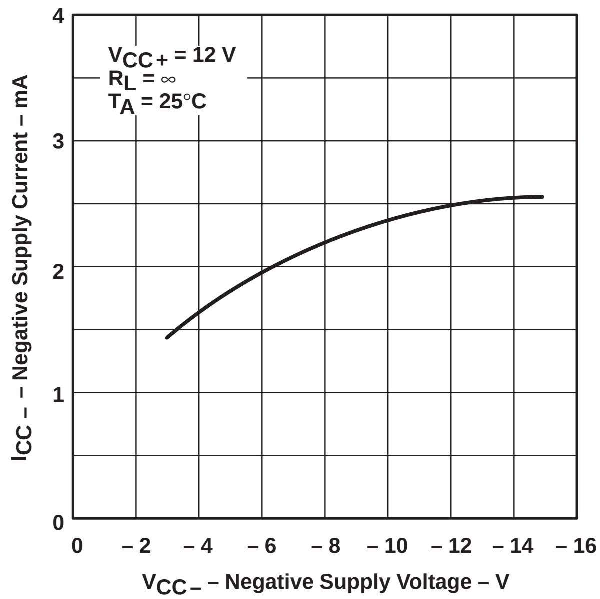


Figure 12

TOTAL POWER DISSIPATION vs FREE-AIR TEMPERATURE

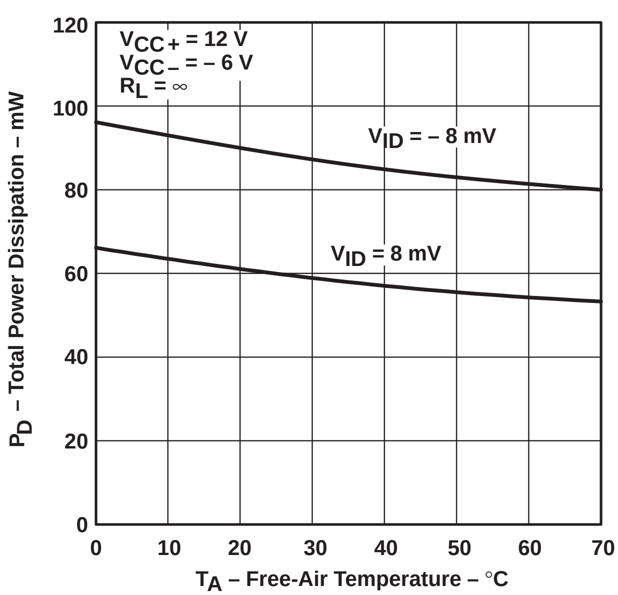


Figure 13

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