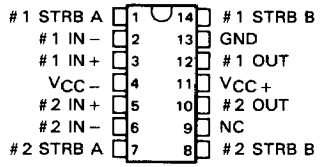
TYPES TL506M, TL506C
DUAL DIFFERENTIAL COMPARATORS WITH STROBES

D1208, MARCH 1971—REVISED AUGUST 1983

- **Each Comparator Identical to LM106 or LM306 with Common $V_{CC}+$, $V_{CC}-$, and Ground Connections**
- **Improved Gain and Accuracy**
- **Fan-Out to 10 Series 54/74 TTL Loads**
- **Strobe Capability**
- **Short-Circuit and Surge Protection**
- **Fast Response Times**

TL506M . . . J OR W PACKAGE
TL506C . . . J OR N PACKAGE
(TOP VIEW)



NC—No internal connection

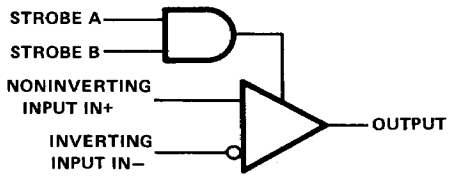
description

The TL506 is a dual high-speed comparator, with each half having differential inputs, a low-impedance output with high-sink-current capability (100 mA), 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.

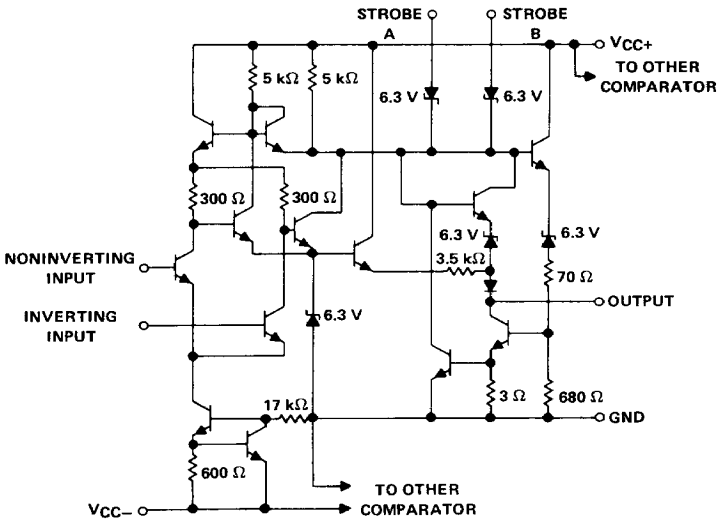
The circuit is similar to a TL810 with gated output. A low-level input at either strobe causes the output to remain high regardless of the differential input. When both strobe inputs are either open or at a high logic level, the output voltage is controlled by the differential input voltage. The circuit will operate with any negative supply voltage between −3 V and −12 V with little difference in performance.

The TL506M is characterized for operation over the full military temperature range of −55 °C to 125 °C; the TL506C is characterized for operation from 0 °C to 70 °C.

functional block diagram (each comparator)



schematic (each comparator)



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 (see Note 2)	±5 V
Input voltage (any input, see Notes 1 and 3)	±7 V
Strobe voltage range (see Note 1)	0 V to V_{CC+}
Output voltage (see Note 1)	24 V
Voltage from output to V_{CC-}	30 V
Duration of output short-circuit (see Note 4)	10 s
Continuous total dissipation at (or below) 25°C free-air temperature (see Note 5):	
J package (TL506MJ)	1375 mW
J package (TL506CJ)	1025 mW
N package	875 mW
W package	1000 mW
Operating free-air temperature range: TL506M	−55°C to 125°C
TL506C	0°C to 70°C
Storage temperature range	−65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J or W package	300°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: N package	260°C

NOTES: 1. All voltage values, except differential voltages and the voltage from the output to V_{CC-}, are with respect to the network ground terminal.
2. Differential voltages are at the noninverting input terminal with respect to the inverting input terminal.
3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 7 V, whichever is less.
4. One output at a time may be shorted to ground or either power supply.
5. For operation above 25°C free-air temperature, refer to Dissipation Derating Curves, Section 2. In the J package, TL506M chips are alloy mounted; TL506C chips are glass mounted.

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

PARAMETER		TEST CONDITIONS†		TL506M			TL506C			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	See Note 6	25°C		0.5‡	2		1.6‡	5	mV
			Full range			3			6.5	
α_{VIO}	Average temperature coefficient of input offset voltage	See Note 6	Full range		3	10		5	20	μV/°C
I_{IO}	Input offset current	See Note 6	25°C		0.7‡	3		1.8‡	5	μA
			MIN		2	7		1	7.5	
			MAX		0.4	3		0.5		
α_{IIO}	Average temperature coefficient of input offset current	See Note 6	MIN to 25°C		15	75		24	100	nA/°C
			25°C to MAX		5	25		15	50	
I_{IB}	Input bias current	V_O = 0.5 V to 5 V	25°C		7‡	20		16‡	25	μA
			Full range			45			40	
$I_{IL(S)}$	Low-level strobe current	$V_{(strobe)}$ = 0.4 V	Full range		−1.7‡	−3.3		−1.7‡	−3.3	mA
$V_{IH(S)}$	High-level strobe voltage		Full range	2.5			2.5			V
$V_{IL(S)}$	Low-level strobe voltage		Full range			0.9			0.9	V
V_{ICR}	Common-mode input voltage range	V_{CC-} = −7 V to −12 V	Full range	±5			±5			V
V_{ID}	Differential input voltage range		Full range	±5			±5			V
A_{VD}	Large-signal differential voltage amplification	No load, V_O = 0.5 V to 5 V	25°C		40 000‡			40 000‡		
V_{OH}	High-level output voltage	V_{ID} = 5 mV, I_{OH} = −400 μA	Full range	2.5		5.5	2.5		5.5	V
V_{OL}	Low-level output voltage	V_{ID} = −5 mV, I_{OL} = 100 mA	25°C		0.8‡	1.5		0.8‡	2	V
		V_{ID} = −5 mV, I_{OL} = 50 mA	Full range			1			1	
		V_{ID} = −5 mV, I_{OL} = 16 mA	Full range			0.4			0.4	
I_{OH}	High-level output current	V_{ID} = 5 mV, V_{OH} = 8 V to 24 V	25°C		0.02‡	1		0.02‡	2	μA
			Full range			100			100	
I_{CC+}	Supply current from V_{CC+}	V_{ID} = −5 mV, See Note 7	Full range		13.9‡	20		13.9‡	20	mA
I_{CC-}	Supply current from V_{CC-}	See Note 7	Full range		3.2‡	7.2		3.2‡	7.2	mA

†Unless otherwise noted, all characteristics are measured with the strobe open. Full range (MIN to MAX) for TL506M is −55°C to 125°C and for the TL506C is 0°C to 70°C.

‡These typical values are at V_{CC+} = 12 V, V_{CC-} = −6 V, T_A = 25°C.

NOTES: 6. 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}). Thus these parameters actually define an error band and take into account the worst-case effects of voltage gain and input impedance.

7. Power supply currents are measured with the respective noninverting inputs and inverting inputs of both comparators connected in parallel. The outputs are open.

switching characteristics, V_{CC+} = 12 V, V_{CC-} = −6 V, T_A = 25°C

PARAMETER	TEST CONDITIONS†	TL506M			TL506C			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
Response time, low-to-high-level output	R_L = 390 Ω to 5 V, C_L = 15 pF, See Note 8		28	40		28		ns

NOTE 8: 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§

INPUT OFFSET CURRENT
vs
FREE-AIR TEMPERATURE

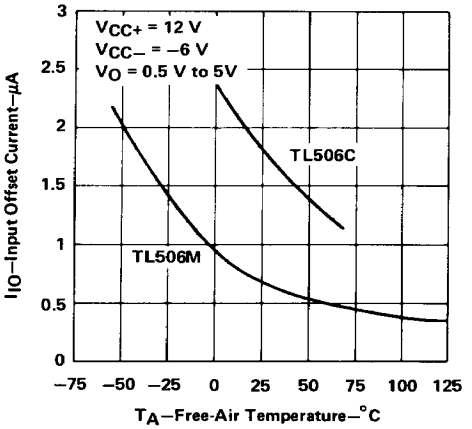

FIGURE 1

INPUT BIAS CURRENT
vs
FREE-AIR TEMPERATURE

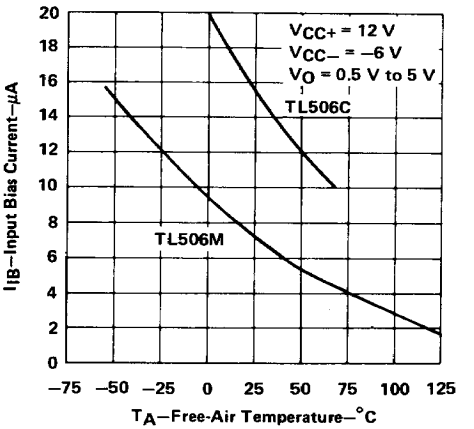

FIGURE 2

HIGH-LEVEL OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

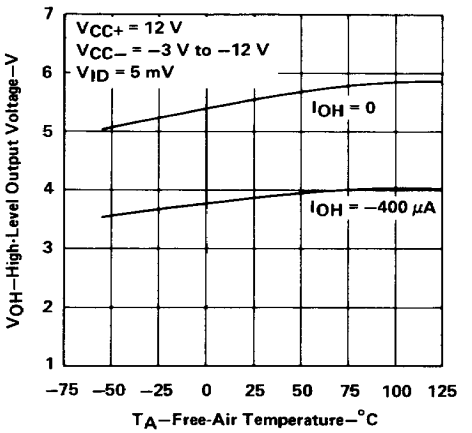

FIGURE 3

LOW-LEVEL OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

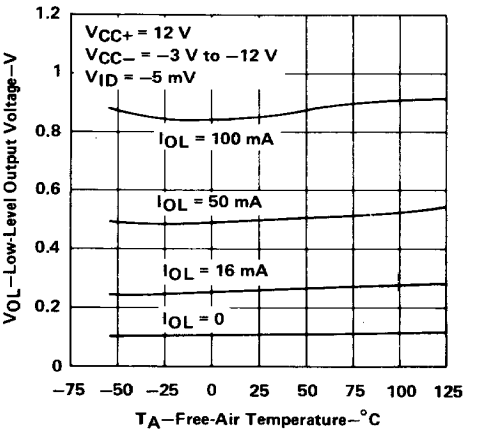

FIGURE 4

§Data for temperatures below 0°C and above 70°C is applicable to TL506M circuits only.

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TYPICAL CHARACTERISTICS§

VOLTAGE TRANSFER CHARACTERISTICS

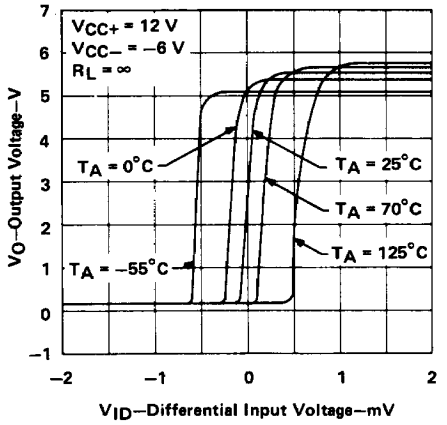

FIGURE 5

OUTPUT CURRENT
vs
DIFFERENTIAL INPUT VOLTAGE

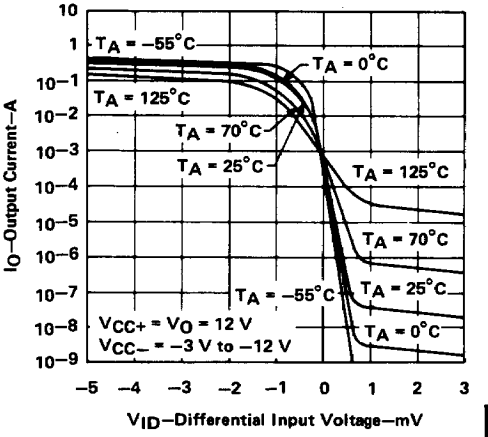

FIGURE 6

LARGE-SIGNAL DIFFERENTIAL
VOLTAGE AMPLIFICATION
vs
FREE-AIR TEMPERATURE

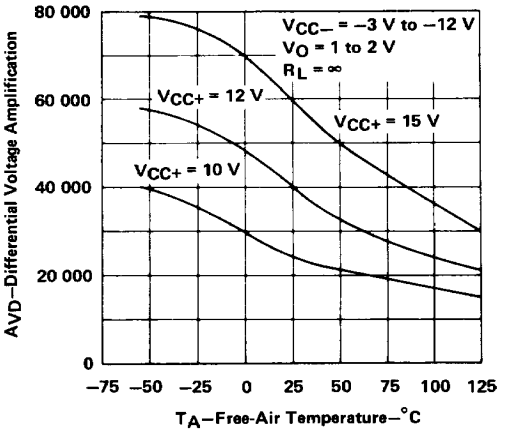

FIGURE 7

SHORT-CIRCUIT OUTPUT CURRENT
vs
FREE-AIR TEMPERATURE

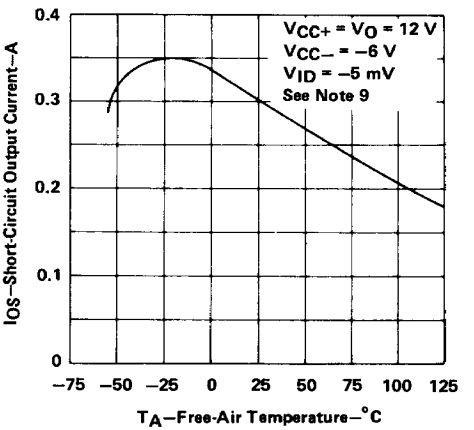

FIGURE 8

§Data for temperatures below 0°C and above 70°C is applicable to TL506M circuits only.
NOTE 9: This parameter was measured using a single 5-ms pulse.

TYPICAL CHARACTERISTICS§

OUTPUT RESPONSE FOR
VARIOUS INPUT OVERDRIVES

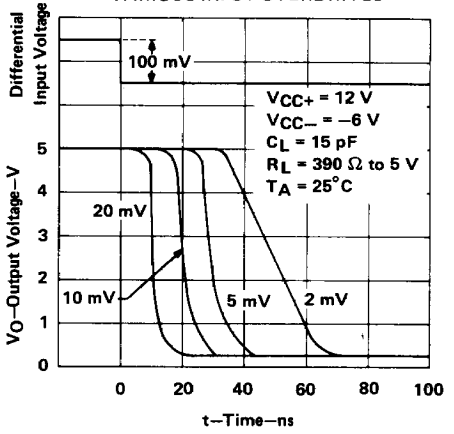

FIGURE 9

OUTPUT RESPONSE FOR
VARIOUS INPUT OVERDRIVES

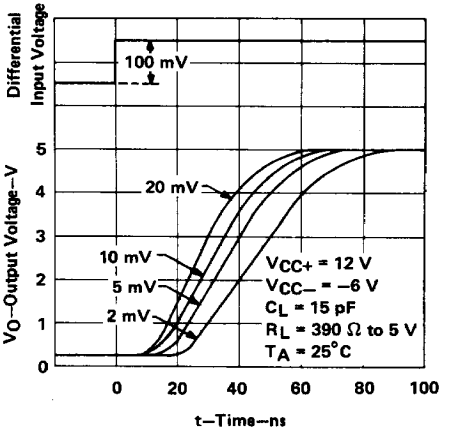

FIGURE 10

SUPPLY CURRENT FROM V_{CC+}
vs
SUPPLY VOLTAGE V_{CC+}

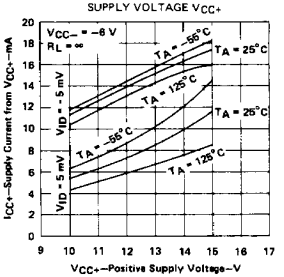

FIGURE 11

SUPPLY CURRENT FROM V_{CC-}
vs
SUPPLY VOLTAGE V_{CC-}

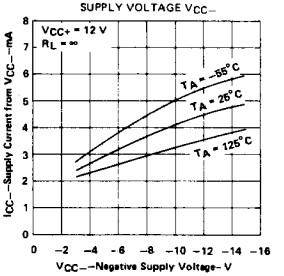

FIGURE 12

TOTAL POWER DISSIPATION
vs
FREE-AIR TEMPERATURE

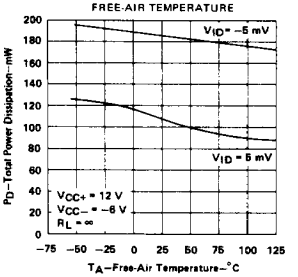

FIGURE 13

§Data for temperatures below 0°C and above 70°C is applicable to TL506M circuits only.

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