

LM106/LM306

Voltage Comparator

General Description

The LM106 series are high-speed voltage comparators designed to accurately detect low-level analog signals and drive a digital load. They are equivalent to an LM710, combined with a two input NAND gate and an output buffer. The circuits can drive RTL, DTL or TTL integrated circuits directly. Furthermore, their outputs can switch voltages up to 24V at currents as high as 10 mA.

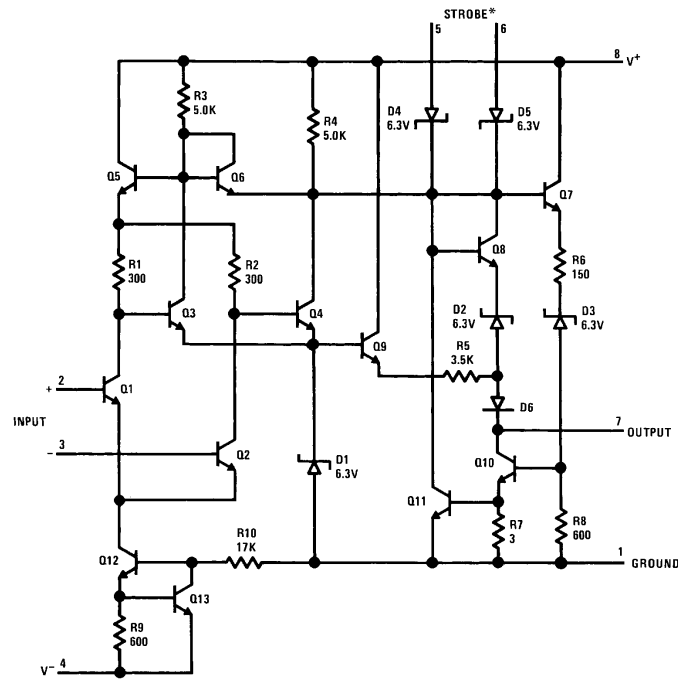
The devices have short-circuit protection which limits the in-rush current when it is used to drive incandescent lamps, in addition to preventing damage from accidental shorts to the positive supply. The speed is equivalent to that of an LM710. However, they are even faster where buffers and additional logic circuitry can be eliminated by the increased flexibility of the LM106 series. They can also be operated from any negative supply voltage between -3V and -12V with little effect on performance.

The LM106 is specified for operation over the -55°C to +125°C military temperature range. The LM306 is specified for operation over 0°C to +70°C temperature range.

Features

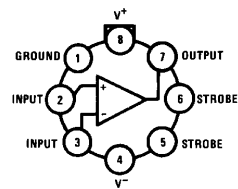
- Improved accuracy
- Fan-out of 10 with DTL or TTL
- Added logic or strobe capability
- Useful as a relay or lamp driver
- Plug-in replacement for the LM710
- 40 ns maximum response time

Schematic and Connection Diagrams



DS007756-1

Metal Can



DS007756-2

Note: Pin 4 connected to case.

†Available per SMD# 8003701

Top View
Order Number LM106H,
LM106H/883† or LM306H
See NS Package Number H08A

Absolute Maximum Ratings (Note *NO TARGET FOR FNxref NS0058*)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

(Note 6)

| | |
|-----------------------------------|------|
| Positive Supply Voltage | 15V |
| Negative Supply Voltage | -15V |
| Output Voltage | 24V |
| Output to Negative Supply Voltage | 30V |
| Differential Input Voltage | ±5V |

| | |
|---------------------------------------|---------------------|
| Input Voltage | ±7V |
| Power Dissipation (Note 1) | 600 mW |
| Output Short Circuit Duration | 10 seconds |
| Operating Temperature Range | T_{MIN} T_{MAX} |
| LM106 | -55°C to +125°C |
| LM306 | 0°C to +70°C |
| Storage Temperature Range | -65°C to +150°C |
| Lead Temperature (Soldering, 10 sec.) | 300°C |
| ESD rating to be determined. | |

Electrical Characteristics (Note 2)

| Parameter | Conditions | LM106 | | | LM306 | | | Units |
|------------------------|--|-------|------|-----|-------|------|-----|-------|
| | | Min | Typ | Max | Min | Typ | Max | |
| Input Offset Voltage | (Note 3) | | 0.5 | 2.0 | | 1.6 | 5.0 | mV |
| Input Offset Current | (Note 3) | | 0.7 | 3.0 | | 1.8 | 5.0 | μA |
| Input Bias Current | | | 10 | 20 | | 16 | 25 | μA |
| Response Time | $R_L = 390\Omega$ to 5V $C_L = 15$ pF, (Note 4) | | 28 | 40 | | 28 | 40 | ns |
| Saturation Voltage | $V_{IN} \leq -5$ mV, $I_{OUT} = 100$ mA $V_{IN} \leq -7$ mV, $I_{OUT} = 100$ mA | | 1.0 | 1.5 | | 0.8 | 2.0 | V |
| Output Leakage Current | $V_{IN} \geq 5$ mV, $8V \leq V_{OUT} \leq 24V$ $V_{IN} \geq 7$ mV, $8V \leq V_{OUT} \leq 24V$ | | 0.02 | 1.0 | | 0.02 | 2.0 | μA |

THE FOLLOWING SPECIFICATIONS APPLY FOR $T_{MIN} \leq T_A \leq T_{MAX}$ (Note 5)

| | | | | | | | | |
|---|---|------|-------------|------------|------|----------|------------|----------------|
| Input Offset Voltage | (Note 3) | | | 3.0 | | | 6.5 | mV |
| Average Temperature Coefficient of Input Offset Voltage | | | 3.0 | 10 | | 5 | 20 | μV/°C |
| Input Offset Current | $T_L \leq T_A \leq 25^\circ\text{C}$, (Note 3) $25^\circ\text{C} \leq T_A \leq T_H$ | | 1.8 0.25 | 7.0 3.0 | | 2.4 | 7.5 5.0 | μA μA |
| Average Temperature Coefficient of Input Offset Current | $25^\circ\text{C} \leq T_A \leq T_H$ $T_L \leq T_A \leq 25^\circ\text{C}$ | | 5.0 15 | 25 75 | | 15 24 | 50 100 | nA/°C nA/°C |
| Input Bias Current | $T_L \leq T_A \leq 25^\circ\text{C}$ $25^\circ\text{C} \leq T_A \leq T_H$ | | | 45 20 | | 25 | 40 25 | μA μA |
| Input Voltage Range | $-7V \geq V^- \geq -12V$ | ±5.0 | | | ±5.0 | | | V |
| Differential Input Voltage Range | | ±5.0 | | | ±5.0 | | | V |
| Saturation Voltage | $V_{IN} \leq -5$ mV, $I_{OUT} = 50$ mA $V_{IN} \leq -8$ mV For LM306 | | | 1.0 | | | 1.0 | V |
| Saturation Voltage | $V_{IN} \leq -5$ mV, $I_{OUT} = 16$ mA $V_{IN} \leq -8$ mV For LM306 | | | 0.4 | | | 0.4 | V |
| Positive Output Level | $V_{IN} \geq 5$ mV, $I_{OUT} = -400\mu\text{A}$ $V_{IN} \geq 8$ mV For LM306 | 2.5 | | 5.5 | 2.5 | | 5.5 | V |
| Output Leakage Current | $V_{IN} \geq 5$ mV, $8V \leq V_{OUT} \leq 24V$ $V_{IN} \geq 8$ mV For LM306 $T_L \leq T_A \leq 25^\circ\text{C}$ $25^\circ\text{C} < T_A \leq T_H$ | | | 1.0 100 | | | 2.0 100 | μA μA |
| Strobe Current | $V_{STROBE} = 0.4V$ | | -1.7 | -3.2 | | -1.7 | -3.2 | mA |
| Strobe "ON" Voltage | | 0.9 | 1.4 | | 0.9 | 1.4 | | V |
| Strobe "OFF" Voltage | $I_{SINK} \leq 16$ mA | | 1.4 | 2.2 | | 1.4 | 2.2 | V |
| Positive Supply Current | $V_{IN} = -5$ mV $V_{IN} = -8$ mV for LM306 | | 5.5 | 10 | | 5.5 | 10 | mA |
| Negative Supply Current | | | -1.5 | -3.6 | | -1.5 | -3.6 | mA |

Electrical Characteristics (Note 2) (Continued)

Note 1: The maximum junction temperature of LM106 is 150°C, LM306 is 85°C. For operating at elevated temperatures, devices must be derated based on a thermal resistance of 170°C/W, junction to ambient, or 23°C/W, junction to case.

Note 2: These specifications apply for $-3V \geq V^- \geq -12V$, $V^+ = 12V$ and $T_A = 25^\circ\text{C}$ unless otherwise specified. All currents into device pins are considered positive.

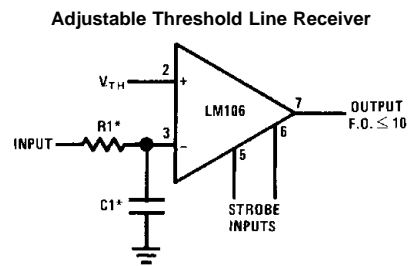
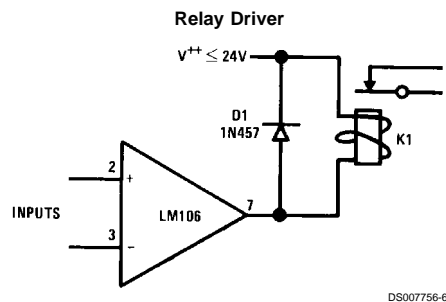
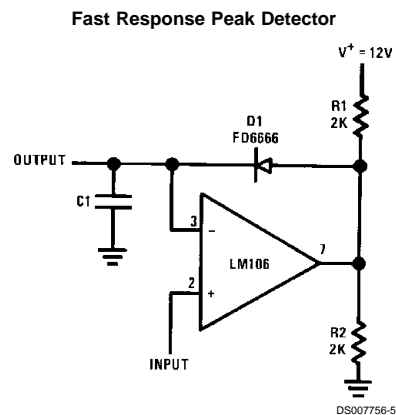
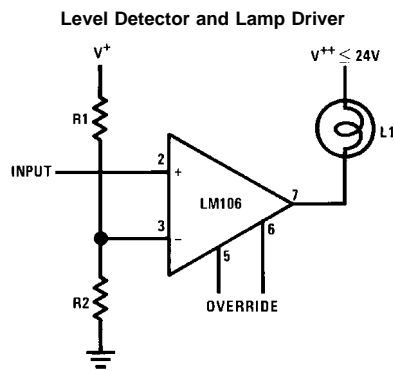
Note 3: The offset voltages and offset currents given are the maximum values required to drive the output down to 0.5V or up to 4.4V (0.5V or up to 4.8V for the LM306). Thus, these parameters actually define an error band and take into account the worst-case effects of voltage gain, specified supply voltage variations, and common mode voltage variations.

Note 4: The response time specified (see definitions) is for a 100 mV input step with 5 mV overdrive.

Note 5: All currents into device pins are considered positive.

Note 6: Refer to RETS106X for LM106 military specifications.

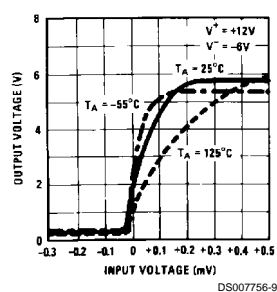
Typical Applications



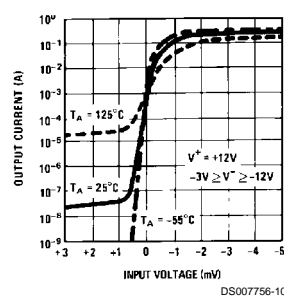
*Optional for response time control.

Typical Performance Characteristics

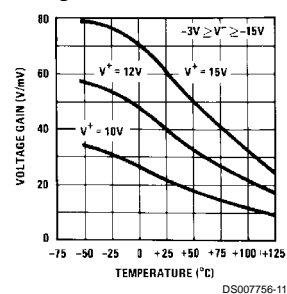
Transfer Function



Transconductance

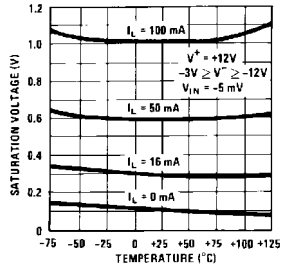


Voltage Gain



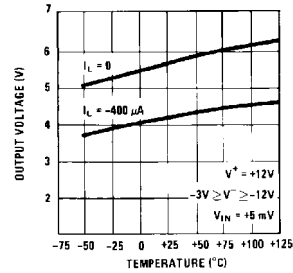
Typical Performance Characteristics (Continued)

Saturation Voltage



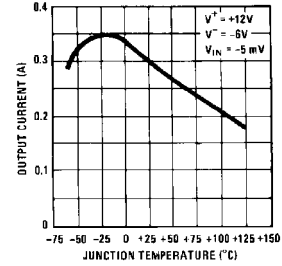
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Positive Output Level



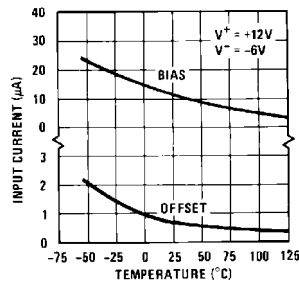
DS007756-13

Short Circuit Output Current



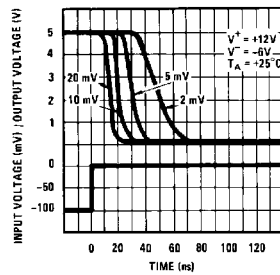
DS007756-14

Input Current



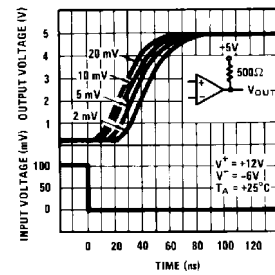
DS007756-15

Response Time for Various Input Overdrives



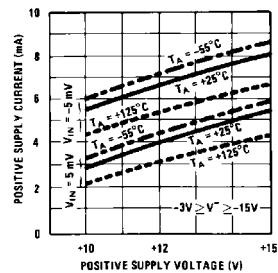
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Response Time for Various Input Overdrives



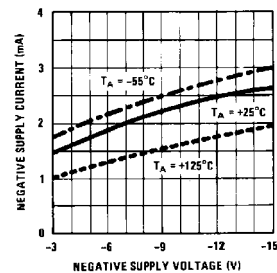
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Positive Supply Current



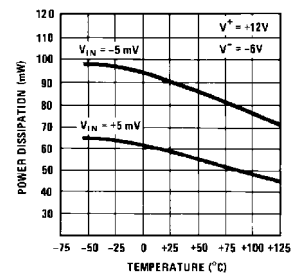
DS007756-18

Negative Supply Current

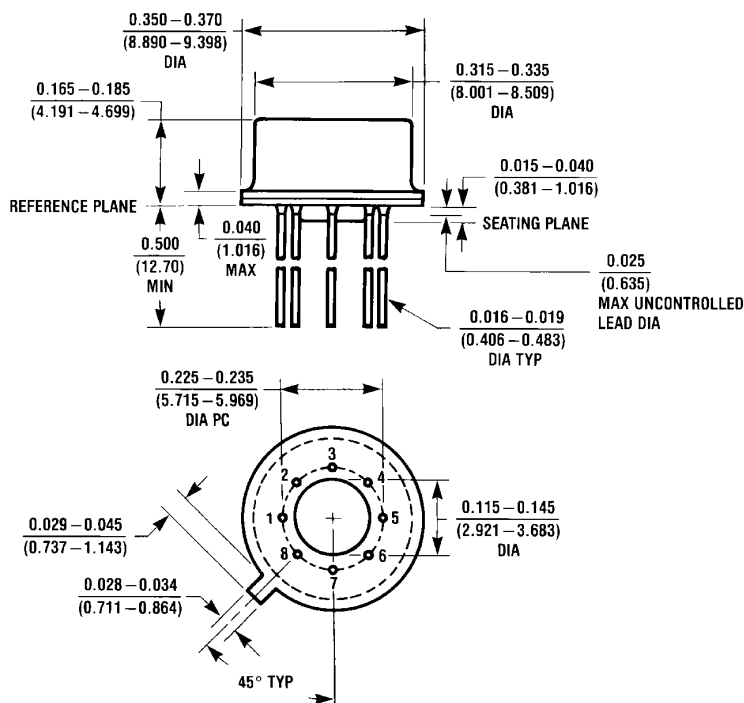


DS007756-19

Power Consumption



DS007756-20

Physical Dimensions inches (millimeters)

H08A (REV C)

Metal Can Package (H)
Order Number LM106H, LM106H/883 or LM306H
NS Package Number H08A

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National Semiconductor Corporation
 1111 West Bardin Road
 Arlington, TX 76017
 Tel: 1(800) 272-9959
 Fax: 1(800) 737-7018

www.national.com

National Semiconductor Europe

Fax: (+49) 0-180-530 85 86
 Email: cnjwge@tevm2.nsc.com
 Deutsch Tel: (+49) 0-180-530 85 85
 English Tel: (+49) 0-180-532 78 32
 Français Tel: (+49) 0-180-532 93 58
 Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.

13th Floor, Straight Block,
 Ocean Centre, 5 Canton Rd.
 Tsimshatsui, Kowloon
 Hong Kong
 Tel: (852) 2737-1600
 Fax: (852) 2736-9960

National Semiconductor Japan Ltd.

Tel: 81-043-299-2308
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