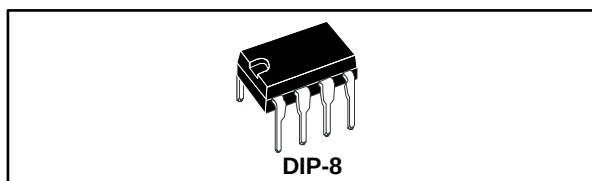


## Interface circuit (relay and lamp driver)

Datasheet - production data



### Features

- Open ground protection
- High output current
- Adjustable short-circuit protection
- Internal thermal protection with external reset
- Large supply voltage range
- Alarm output
- Input voltage can be higher than  $V_{CC}$
- Output voltage can be lower than ground ( $V_{CC} - V_O \leq V_{CC[max.]}$ )

### Description

This device is a monolithic amplifier designed for high current and high voltage applications,

specifically to drive lamps, relays, stepping motors. It is a blow-out proof device whose output is protected against overload and short-circuits. This output is low in open ground conditions and in case of overload and reset for high input, it switches on and off alternately until the overload is removed. The LED, driven by an alarm output, if referred to ground, flashes during an overload depending on the state of the reset input. The thermal shutdown prevents the IC from overheating, so if the internal dissipation becomes too high, the driver shuts down. The device works over a wide range of voltages from standard 15 V operational amplifier to the single +6 V or +48 V used for industrial electric systems.

Table 1: Device summary

| Order code | Package | Packing |
|------------|---------|---------|
| TDE1787ADP | DIP-8   | Tube    |

---

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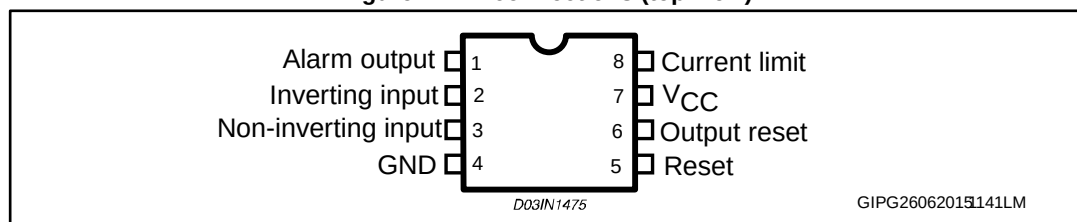
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# 1 Pin connections

**Figure 1: Pin connections (top view)****Table 2: Pin description**

| Pin | Function            |
|-----|---------------------|
| 1   | Alarm output        |
| 2   | Inverting input     |
| 3   | Non-inverting input |
| 4   | GND                 |
| 5   | Reset               |
| 6   | Output reset        |
| 7   | V <sub>CC</sub>     |
| 8   | Current limit       |

## 2 Maximum ratings

Table 3: Absolute maximum ratings

| Symbol                 | Parameter                           | Value              | Unit |
|------------------------|-------------------------------------|--------------------|------|
| $V_{CC}$               | Supply voltage                      | 60                 | V    |
| $V_{ID}$               | Input differential voltage          | 60                 | V    |
| $V_I$                  | Input voltage                       | -10 to +60         | V    |
| $I_O$                  | Output current                      | 1.3                | A    |
| $V_{I\text{ (reset)}}$ | Reset input voltage                 | -0.5 to +60        | V    |
| $I_{OA}$               | Alarm output current                | -10 to 20          | mA   |
| $P_{tot}$              | Power dissipation                   | Internally limited | mW   |
| $T_{oper}$             | Operating ambient temperature range | -25 to +85         | °C   |
| $T_{stg}$              | Storage temperature range           | -65 to +150        | °C   |

Table 4: Thermal data

| Symbol       | Parameter                           | Value   | Unit |
|--------------|-------------------------------------|---------|------|
| $R_{th(JC)}$ | Thermal resistance junction-case    | 30 max. | °C/W |
| $R_{th(JA)}$ | Thermal resistance junction-ambient | 80 max. | °C/W |



The device is bonded on a 40 cm<sup>2</sup> glass-epoxy printed circuit, 0.15 cm thick with 4 cm<sup>2</sup> of copper.

### 3 Electrical characteristics

-25 °C ≤ T<sub>A</sub> ≤ 85 °C, 6 V ≤ V<sub>CC</sub> ≤ 55 V, T<sub>J</sub> ≤ 150 °C, I<sub>O</sub> ≤ 300 mA for R<sub>SC</sub> = 330 mΩ and I<sub>O</sub> ≤ 500 mA for R<sub>SC</sub> = 220 mΩ, unless otherwise specified.

Table 5: Electrical characteristics

| Symbol                | Parameter                          | Test conditions                                                                                                                                         | Min. | Typ. | Max. | Unit |
|-----------------------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| V <sub>IO</sub>       | Input offset voltage               | See note <sup>(1)</sup>                                                                                                                                 |      | 2    | 50   | mV   |
| I <sub>CC</sub>       | Power supply current               | Measured on pin 4<br>Output high<br>(T <sub>A</sub> = 25 °C)                                                                                            |      | 5.8  | 8    | mA   |
|                       |                                    | Output high V <sub>CC</sub> =<br>V <sub>CCmax</sub> , (T <sub>J</sub> = 150 °C)                                                                         |      | 5    | 7    | mA   |
|                       |                                    | Output low V <sub>CC</sub> =<br>V <sub>CCmax</sub> , (T <sub>A</sub> = 25 °C)                                                                           |      | 1.5  | 4    | mA   |
| I <sub>IB</sub>       | Input bias current                 |                                                                                                                                                         |      | 15   | 100  | μA   |
| V <sub>CM</sub>       | Common mode input<br>voltage range |                                                                                                                                                         | 1    |      | 60   | V    |
| V <sub>I</sub>        | Input voltage range                | V <sub>ref</sub> ≥ 1 V, see note <sup>(2)</sup><br>and <a href="#">Figure 1: "Pin<br/>connections (top<br/>view)"</a>                                   | 1    |      | 60   | V    |
| I <sub>SC</sub>       | Short-circuit output<br>current    | V <sub>CC</sub> = 35 V, t = 10 ms<br>R <sub>SC</sub> = 0.22 Ω                                                                                           |      | 700  |      | mA   |
|                       |                                    | R <sub>SC</sub> = 0.33 Ω                                                                                                                                |      | 380  |      |      |
| V <sub>sense</sub>    | Output limit sense<br>voltage      | V <sub>O</sub> = V <sub>CC</sub> - 2 V,<br>t = 10 ms                                                                                                    | 130  | 150  | 170  | mV   |
|                       |                                    | V <sub>O</sub> = 0 V, t = 10 ms                                                                                                                         | 120  | 140  | 165  |      |
| V <sub>O(sat)</sub>   | Output saturation<br>voltage       | Output high V <sub>I</sub> <sup>+</sup> - V <sub>I</sub> <sup>-</sup> ≥<br>50 mV; R <sub>SC</sub> = 0;<br>V <sub>CC</sub> = 30 V T <sub>J</sub> = 25 °C |      | 1    | 1.1  | V    |
|                       |                                    | T <sub>J</sub> = 150 °C                                                                                                                                 |      | 1.1  | 1.2  | V    |
| I <sub>OL</sub>       | Output leakage current             | Output low                                                                                                                                              |      |      | 100  | μA   |
| I <sub>A</sub>        | Available alarm output<br>current  | Output source current<br>V <sub>AH</sub> = V <sub>CC</sub> - 2.5 V                                                                                      | -4   | -5   |      | mA   |
|                       |                                    | Output sink current in<br>thermal shutdown<br>V <sub>A</sub> = 1.4 V                                                                                    | 5    | 10   |      | mA   |
| I <sub>reset</sub>    | Reset input current                |                                                                                                                                                         |      | 2    | 40   | μA   |
| V <sub>th_reset</sub> | Reset threshold                    |                                                                                                                                                         |      | 1.4  |      | V    |
| I <sub>LGND</sub>     | Output leakage current             | Open ground                                                                                                                                             |      | 10   |      | μA   |

**Notes:**

<sup>(1)</sup>The offset voltage given is the maximum value of different input voltage required to drive the output voltage within 2 V of ground or the supply voltage.

<sup>(2)</sup>Input voltage range is independent of the supply voltage.

## 4 Schematic diagram

Figure 2: Schematic diagram

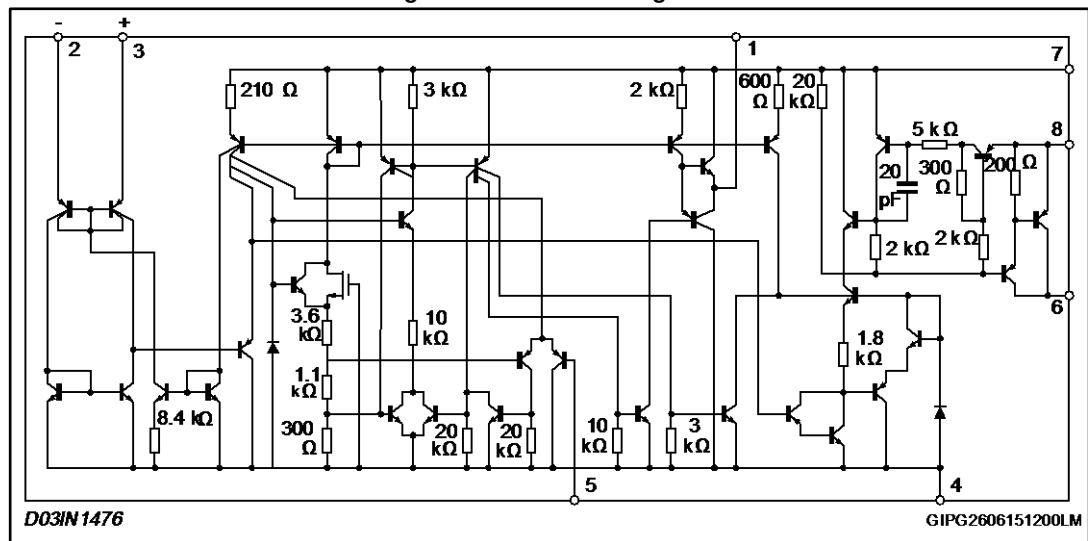
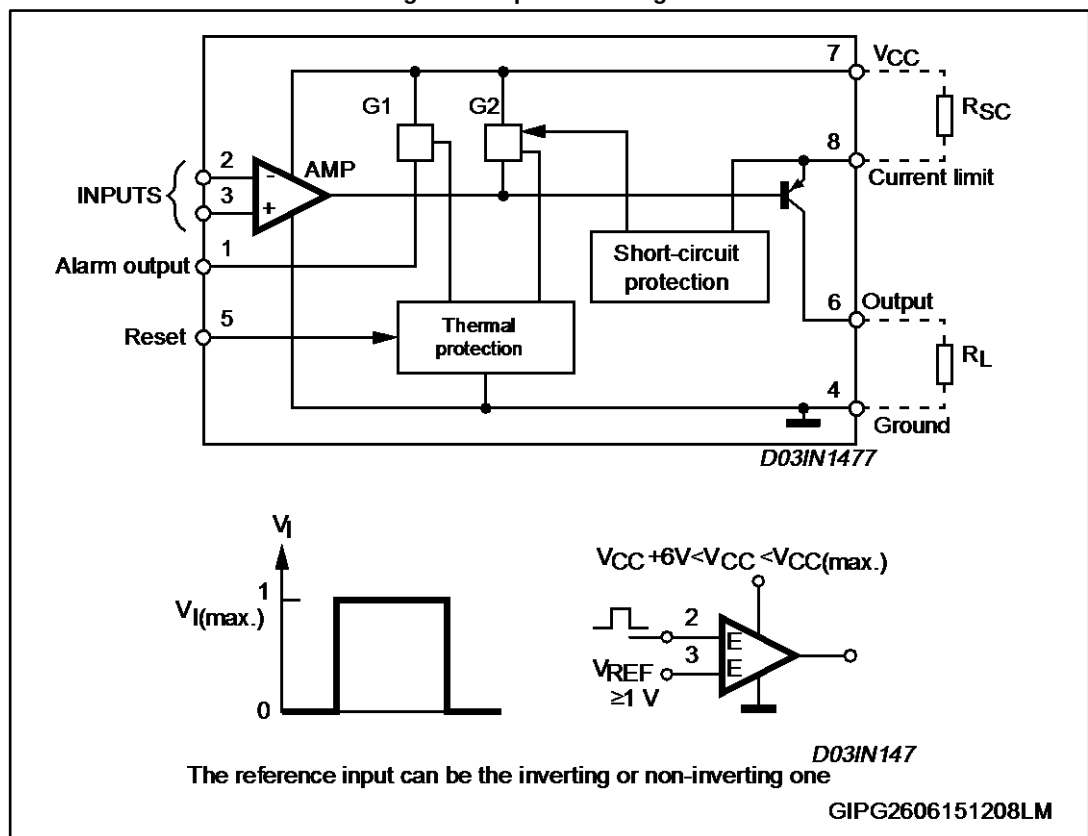


Figure 3: Equivalent diagram





## 5 Typical characteristics

Figure 4: Peak short-circuit vs. limiting resistor

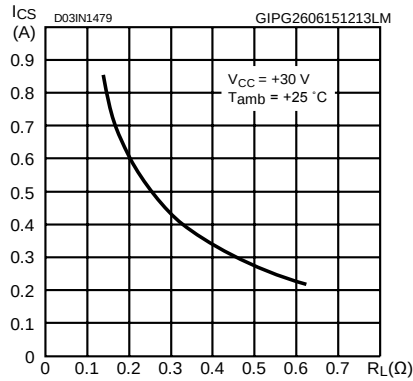


Figure 5: Available output current vs. limiting resistor

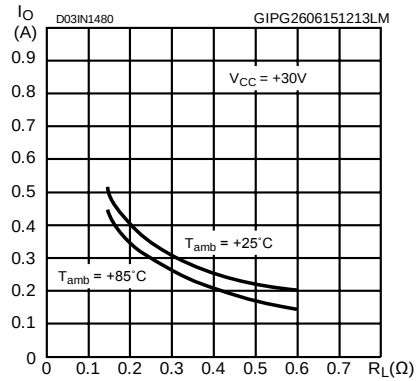


Figure 6: Power supply current (pin 4)

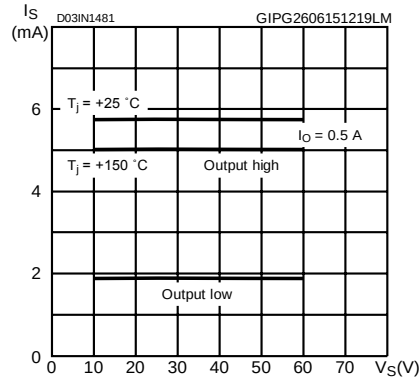


Figure 7: Output saturation voltage vs. output current

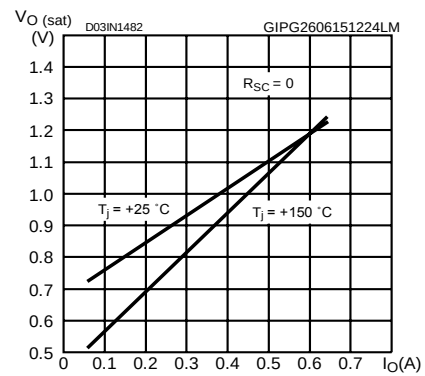


Figure 8: Output transistor safe operating area (pulsed)

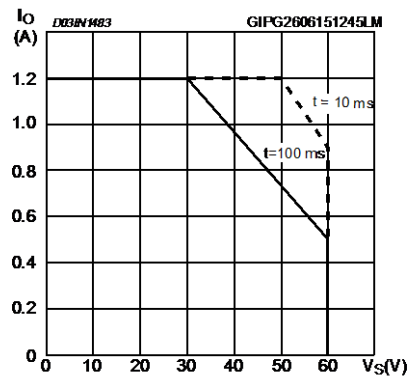


Figure 9: Normal operating area (short-circuit protected)

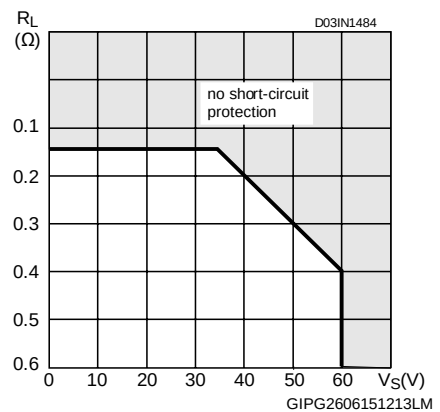


Figure 10: Current sinking

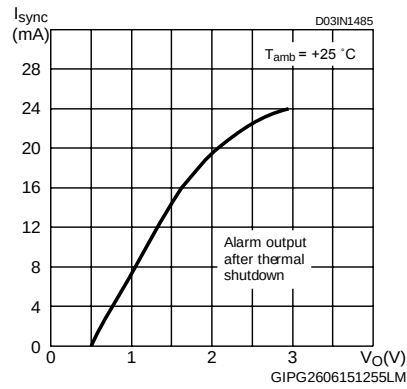


Figure 11: Current sourcing

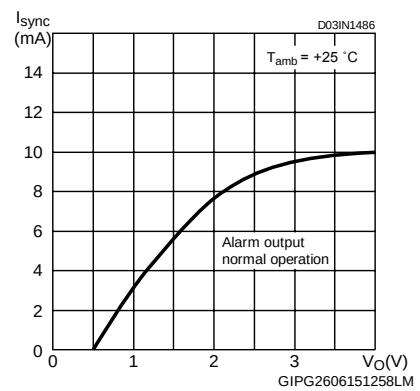


Figure 12: Response time

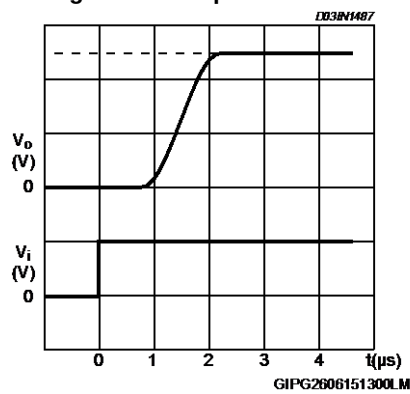
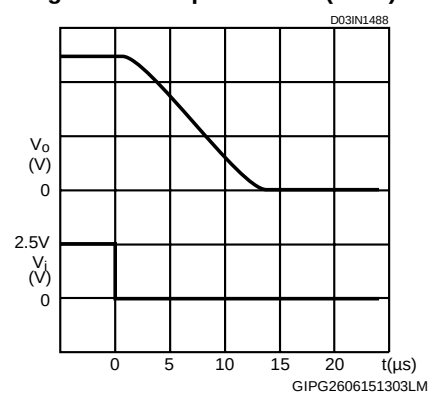


Figure 13: Response time (2.5 V)



## 6 Typical application

Figure 14: Test circuit

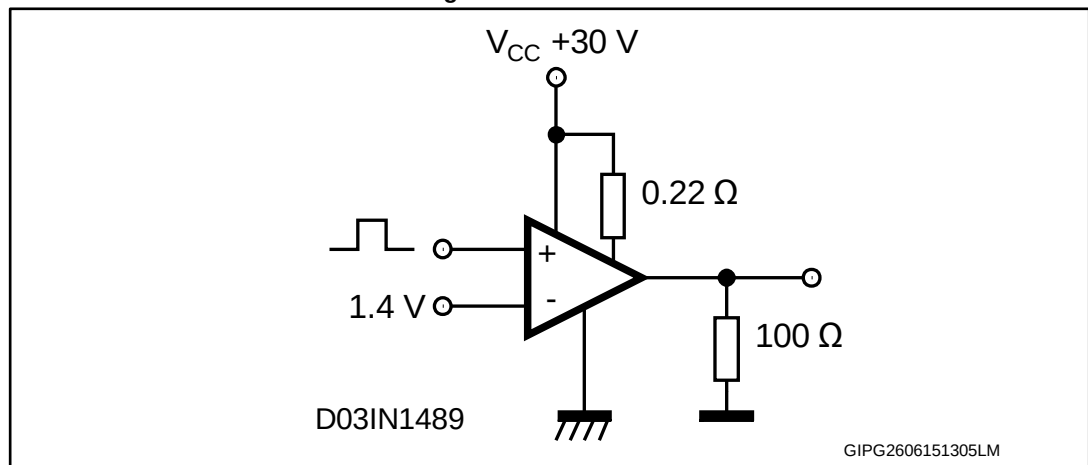


Figure 15: Open load detection 4

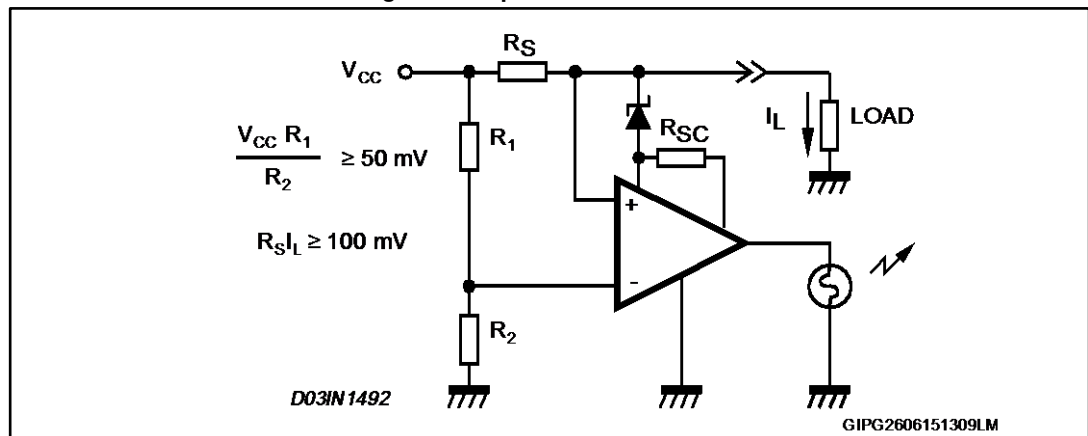


Figure 16: Driving lamps, relays

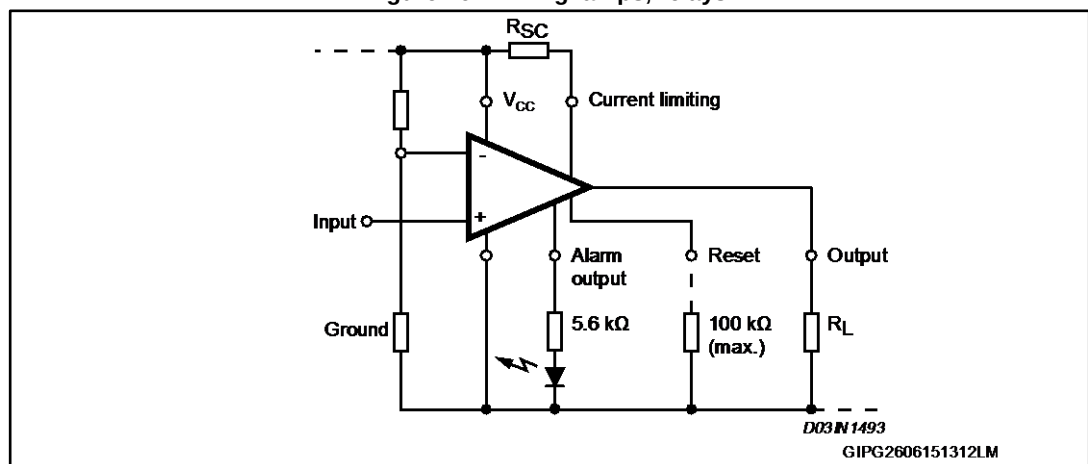


Figure 17: Common reset

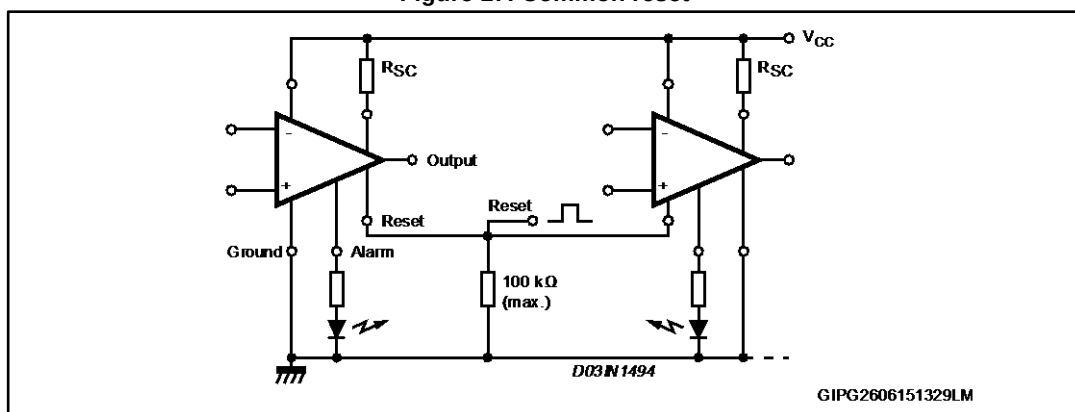
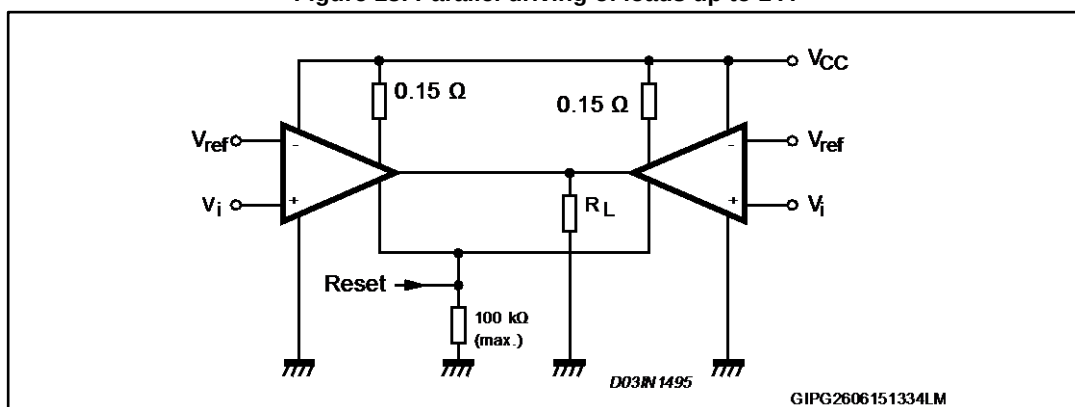


Figure 18: Parallel driving of loads up to 1 A



## 7 Using alarm output

Figure 19: Parallel output alarm

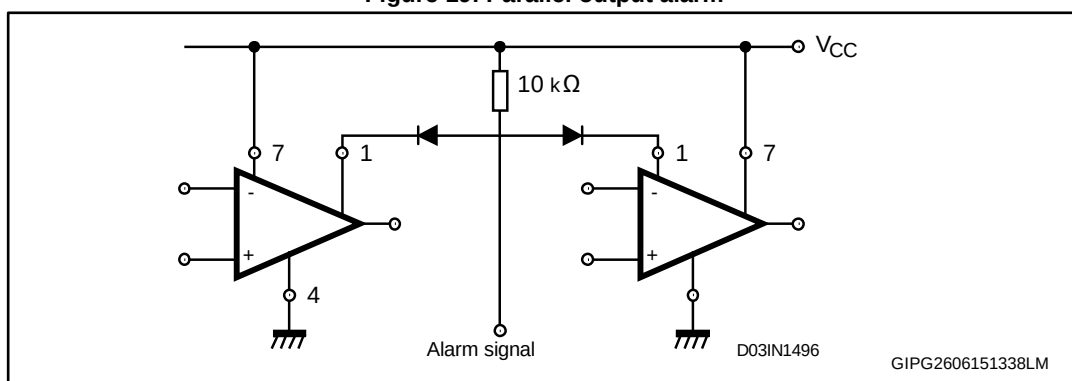
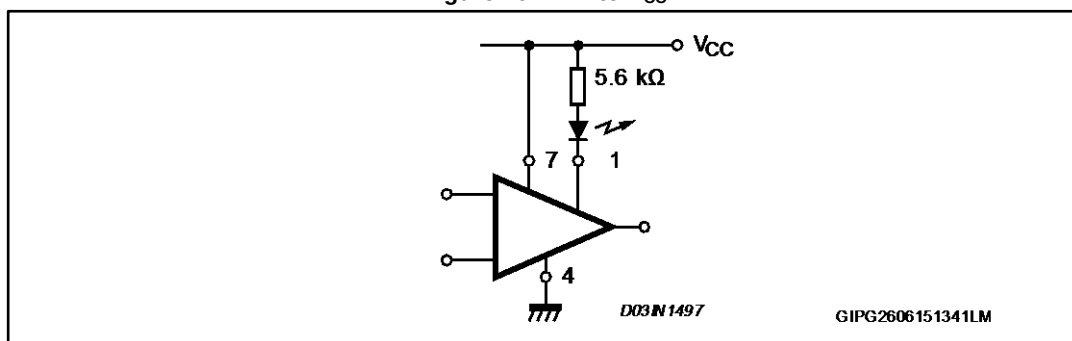
Figure 20: LED to V<sub>CC</sub>

Figure 21: LED to ground

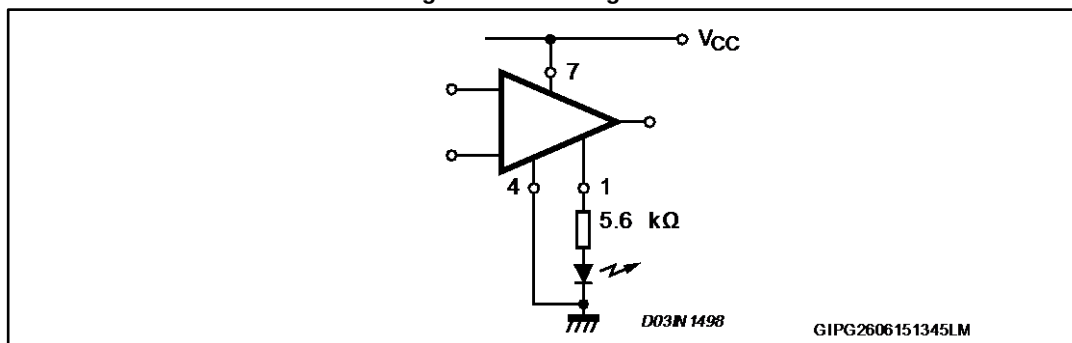


Figure 22: Interface between high voltage and low voltage system

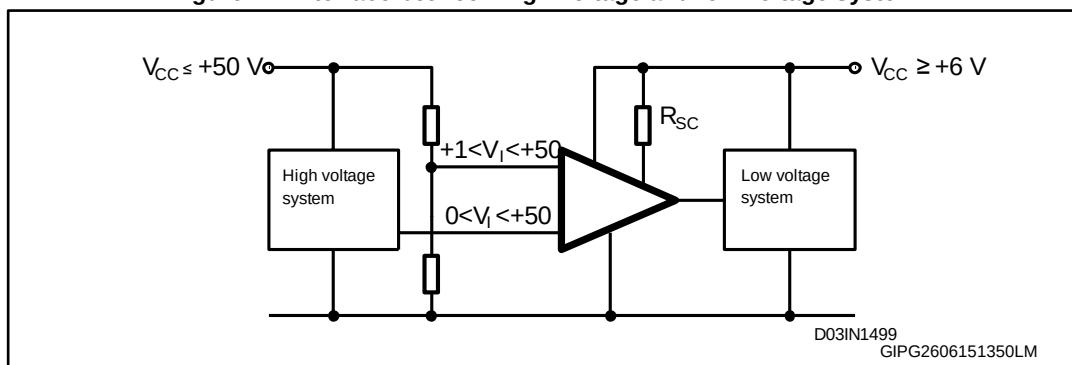
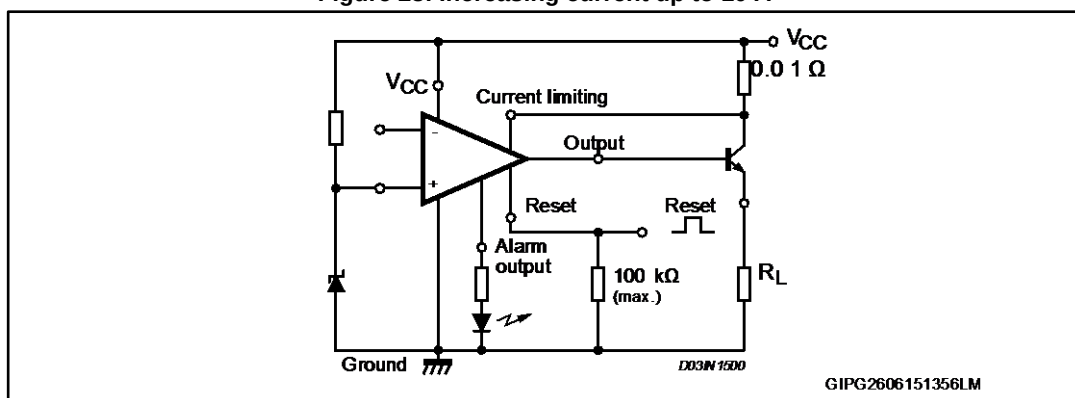


Figure 23: Increasing current up to 10 A



## 8 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

### 8.1 DIP-8 package information

Figure 24: DIP-8 package outline

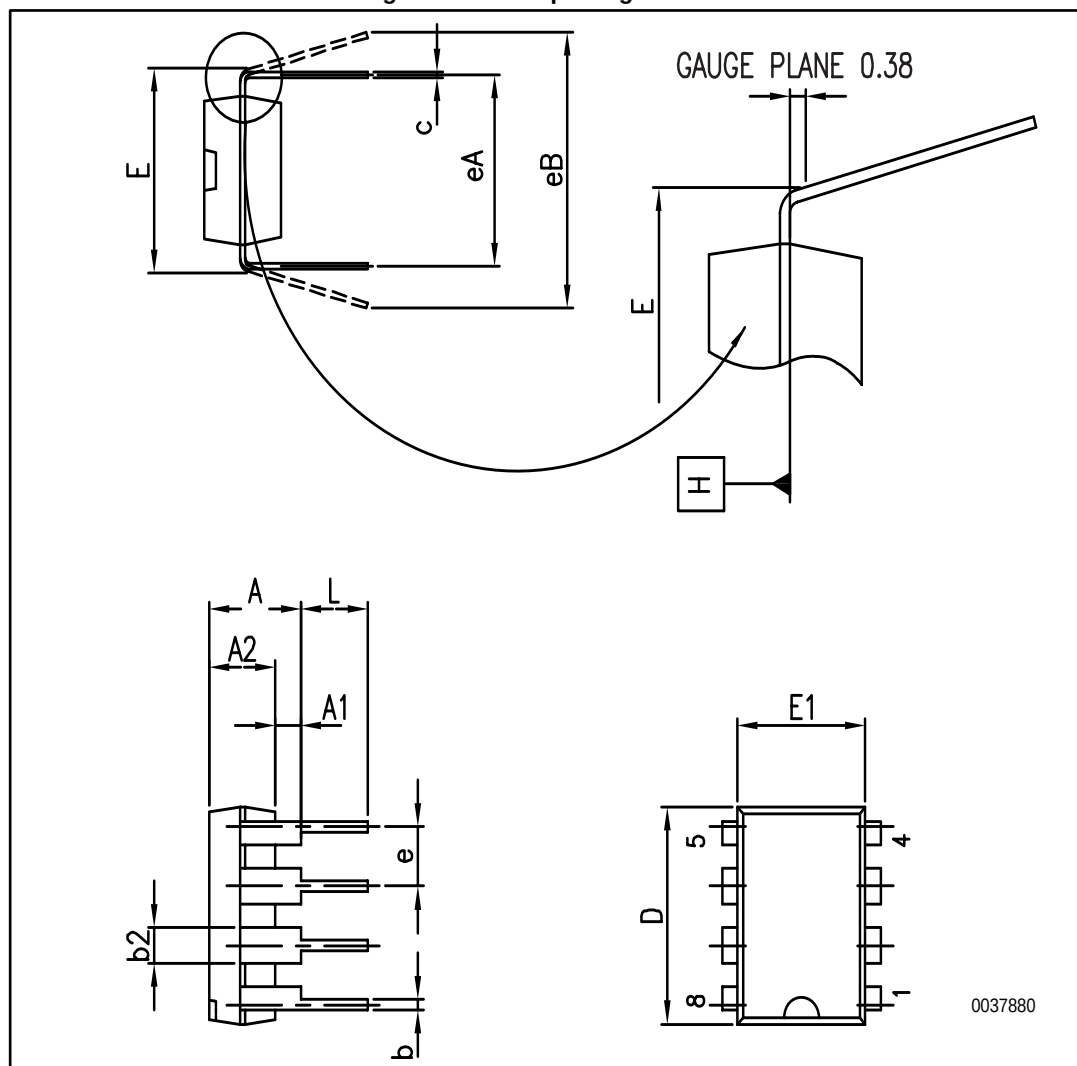


Table 6: DIP-8 package mechanical data

| Dim. | mm   |      |       |
|------|------|------|-------|
|      | Min. | Typ. | Max.  |
| A    |      |      | 5.33  |
| A1   | 0.38 |      |       |
| A2   | 2.92 | 3.30 | 4.95  |
| b    | 0.36 | 0.46 | 0.56  |
| b2   | 1.14 | 1.52 | 1.78  |
| c    | 0.20 | 0.25 | 0.36  |
| D    | 9.02 | 9.27 | 10.16 |
| E    | 7.62 |      | 15.75 |
| E1   | 6.10 | 6.35 | 7.11  |
| e    |      | 2.54 |       |
| eA   |      | 7.62 |       |
| eB   |      |      | 10.92 |
| L    | 2.92 | 3.30 | 3.81  |



## 9 Revision history

**Table 7: Document revision history**

| Date        | Revision | Changes                                                                                     |
|-------------|----------|---------------------------------------------------------------------------------------------|
| 20-Sep-2003 | 1        | Initial release.                                                                            |
| 03-Mar-2007 | 2        | Document reformatted, typo figure 1.                                                        |
| 13-Jul-2015 | 3        | The part numbers: TDE1767DP, TDE1767ADP, TDE1787DP have been moved to a separate datasheet. |

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