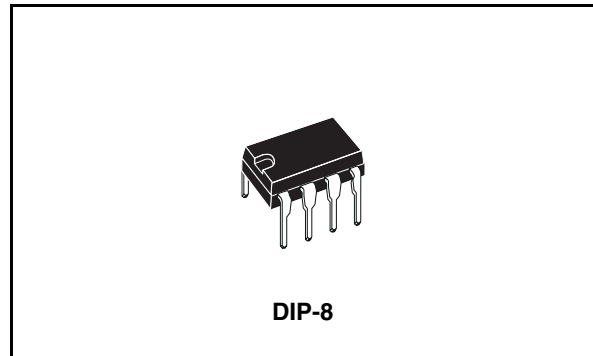


## Interface circuit (relay and Lamp-driver)

### 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

The TDE1767, TDE1767A, TDE1787, TDE1787A are a monolithic amplifiers designed for high current and high voltage applications, specifically to drive lamps, relays, stepping motors.

The devices are essentially blow-out proof. The output is protected from short-circuits with the positive supply or drive. In addition thermal shut down is provided to keep the IC from overheating.

If internal dissipation becomes too high, the driver will shut down to prevent excessive heating. The output stays null after the overheating is off, if the reset input is low. If high the output will alternatively switch-on and off until the overload is removed.

The devices operates over a wide range voltages from standard 15V operational amplifier supplies to the single +6V or +48V used for industrial electric systems. Input voltages can be higher than in the  $V_{CC}$ .

An alarm output suitable for driving a LED is provided. This LED, normally on (if referred to ground), will die out or flash during an overload depending on the state of the reset input.

The output is low in open ground conditions.

**Table 1. Device summary**

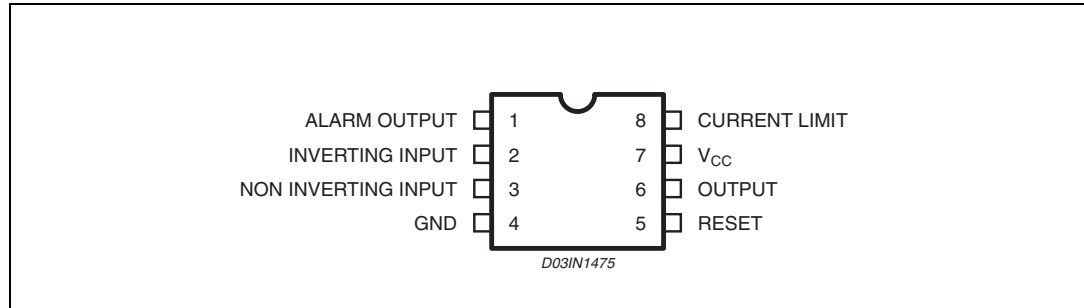
Part number	Package	Packaging
TDE1767DP	DIP8	Tube
TDE1767ADP	DIP8	Tube
TDE1787DP	DIP8	Tube
TDE1787ADP	DIP8	Tube

# Contents

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# 1 Pin connections

Figure 1. Pin connection (top view)



## 2 Maximum ratings

### 2.1 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	TDE1767A TDE1787A	TDE1767 TDE1787	Unit
$V_{CC}$	Supply voltage	60	50	V
$V_{ID}$	Input differential voltage	60	50	V
$V_I$	Input voltage	- 10 to + 60	- 10 to + 50	V
$I_O$	Output current	1.3	1.2	A
$V_{I(reset)}$	Reset input voltage	- 0.5 to + 60	- 0.5 to + 50	V
$I_{OA}$	Alarm output current	- 10 to + 20	- 10 to + 20	mA
$P_{tot}$	Power dissipation	Internally Limited		mW
$T_{oper}$	Operating ambient temperature range	- 25 to + 85	- 25 to + 85	°C
$T_{stg}$	Storage temperature range	- 65 to + 150	- 65 to + 150	°C

### 2.2 Thermal data

Table 3. Thermal data

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

Note: Devices 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

**TDE1767A:**  $-25^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ ,  $6\text{V} \leq V_{\text{CC}} \leq 55\text{V}$ ,  $I_o \leq 500\text{mA}$ ,  $T_J \leq 150^{\circ}\text{C}$

**TDE1767:**  $-25^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ ,  $6\text{V} \leq V_{\text{CC}} \leq 45\text{V}$ ,  $I_o \leq 500\text{mA}$ ,  $T_J \leq 150^{\circ}\text{C}$

**TDE1787A:**  $-25^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ ,  $6\text{V} \leq V_{\text{CC}} \leq 55\text{V}$ ,  $I_o \leq 300\text{mA}$ ,  $T_J \leq 150^{\circ}\text{C}$

**TDE1787:**  $25^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ ,  $6\text{V} \leq V_{\text{CC}} \leq 45\text{V}$ ,  $I_o \leq 300\text{mA}$ ,  $T_J \leq 150^{\circ}\text{C}$

Unless otherwise specified.

**Table 4. Electrical characteristics**

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$V_{\text{IO}}$	Input offset voltage	(note 1)		2	50	mV
$I_{\text{CC}}$	Power supply current	(measured on pin 4)				
		Output high ( $T_A = 25^{\circ}\text{C}$ )		5.8	8	mA
		Output high ( $V_{\text{CC}} = V_{\text{CCmax}}$ , ( $T_J = 150^{\circ}\text{C}$ ))		5	7	mA
	Output low ( $V_{\text{CC}} = V_{\text{CCmax}}$ , ( $T_A = 25^{\circ}\text{C}$ ))		1.5	4	mA	
$I_{\text{B}}$	Input bias current			15	100	$\mu\text{A}$
$V_{\text{CM}}$	Common-mode input voltage range	TDE1787A, TDE1767A	1		60	V
		TDE1787, TDE1767	1		45	V
$V_{\text{I}}$	Input voltage range	$V_{\text{ref}} \geq 1\text{V}$ (figure1, note2)				
		TDE1787A, TDE1767A TDE1787, TDE1767	1 1		60 45	V V
$I_{\text{SC}}$	Short circuit output current	$V_{\text{CC}} = 35\text{V}$ , $t = 10\text{ms}$				
		<b>TDE1767A:</b> $R_{\text{SC}} = 0.22\Omega$ <b>TDE1787A:</b> $R_{\text{SC}} = 0.33\Omega$		700 380		mA mA
$V_{\text{sense}}$	Output limit sense voltage	$V_{\text{O}} = V_{\text{CC}} - 2\text{V}$ , $t = 10\text{ms}$	130	150	170	mV
$V_{\text{sense}}$	Output limit sense voltage	$V_{\text{O}} = 0\text{V}$ , $t = 10\text{ms}$	120	140	165	mV
$V_{\text{O(sat)}}$	Output saturation voltage	Output high $V_{\text{I}^+} - V_{\text{I}^-} \geq 50\text{mV}$ ; $R_{\text{SC}} = 0$ ; $V_{\text{CC}} = 30\text{V}$ TDE1787A, TDE1767A: $T_J = 25^{\circ}\text{C}$		1	1.1	V
		TDE1787, TDE1767: $T_J = 25^{\circ}\text{C}$		1	1.2	V
		TDE1787A, TDE1767A: $T_J = 150^{\circ}\text{C}$		1.1	1.2	V
		TDE1787, TDE1767: $T_J = 150^{\circ}\text{C}$		1.1	1.3	V
$I_{\text{OL}}$	Output leakage current	Output low			100	$\mu\text{A}$

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$I_A$	Available alarm output current	Output source current $V_{AH} = V_{CC} - 2.5V$	-4	-5		mA
		Output sink current (in thermal shut-down) $V_A = 1.4V$	5	10		mA
$I_{reset}$	Reset input current			2	40	$\mu A$
$V_{th-reset}$	Reset threshold			1.4		A
	Output leakage current	open ground		10		$\mu A$

- Note: 1 The offset voltage given is the maximum value of different input voltage required to drive the output voltage within 2 V of the ground or the supply voltage.
- 2 Input voltage range is independent of the supply voltage.

# 4 Schematic diagrams

Figure 2. Schematic diagram

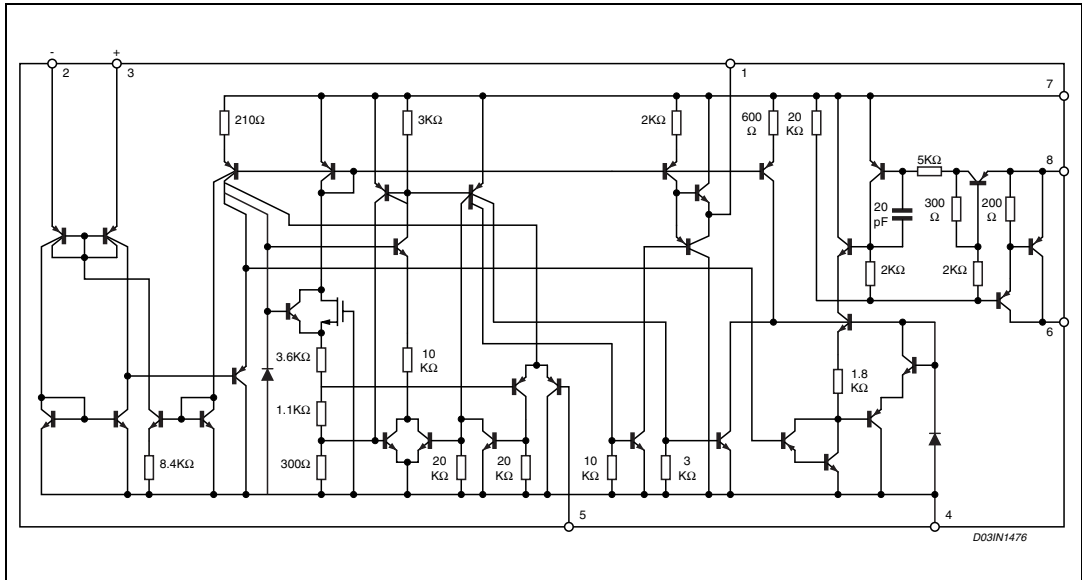
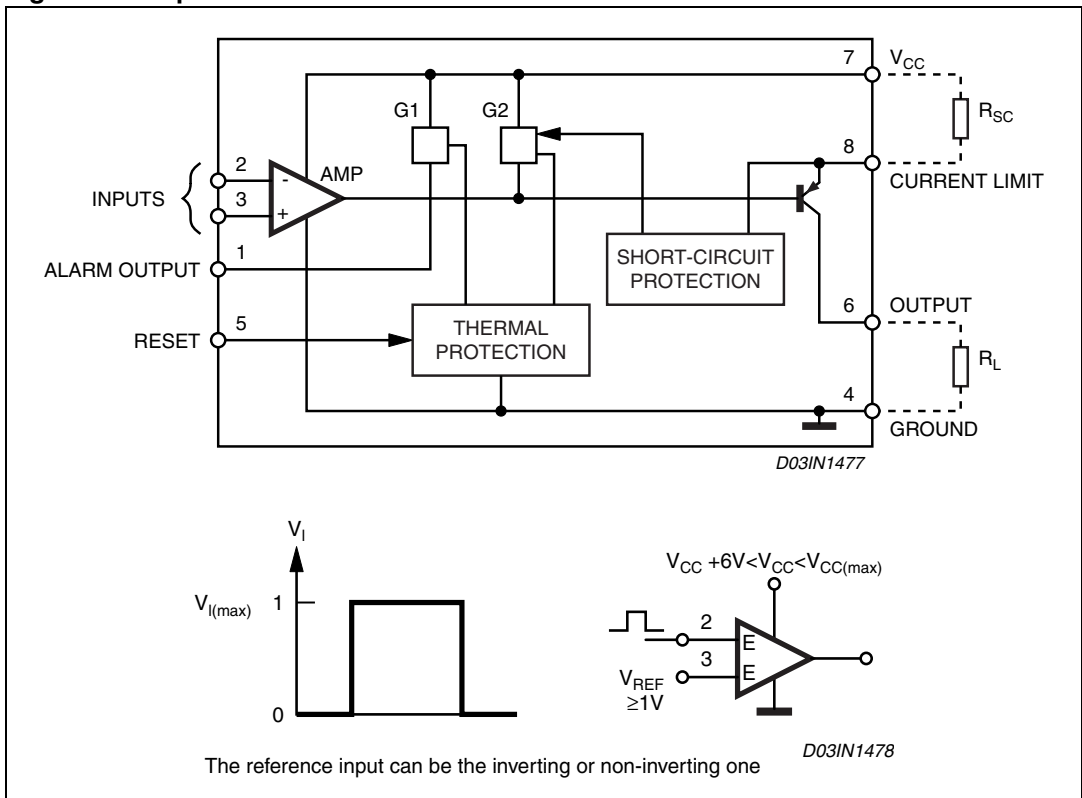
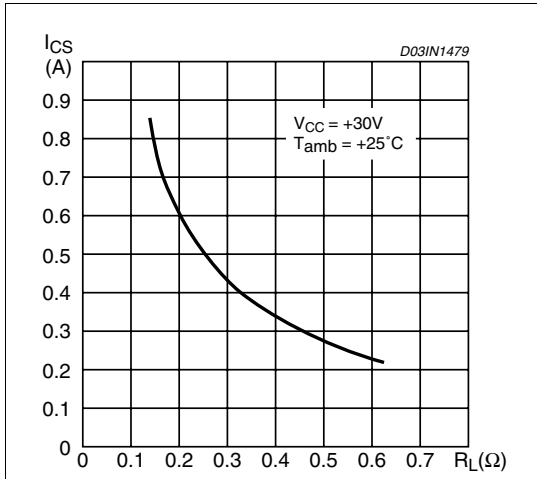


Figure 3. Equivalent schematic

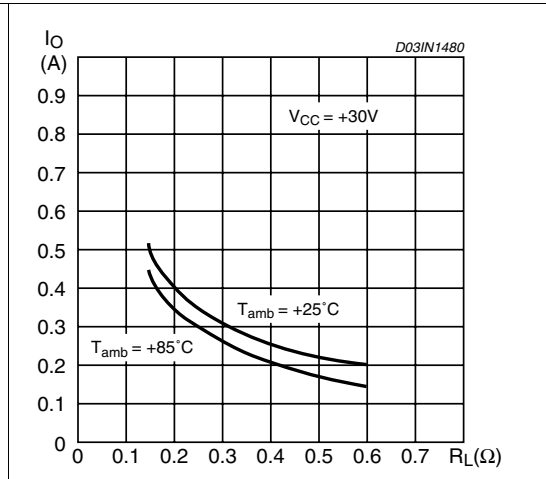


# 5 Typical characteristics

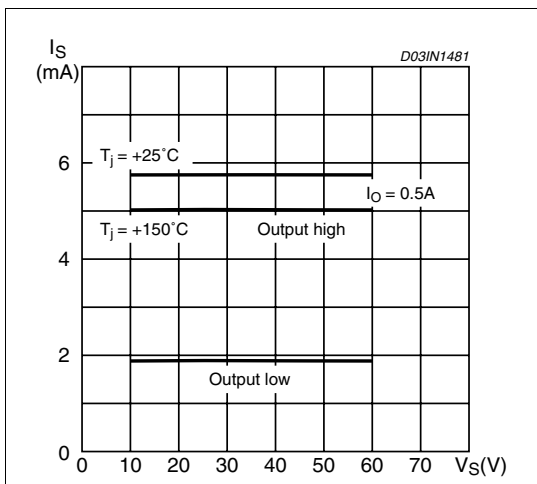
**Figure 4. Peak short-circuit vs limiting resistor**



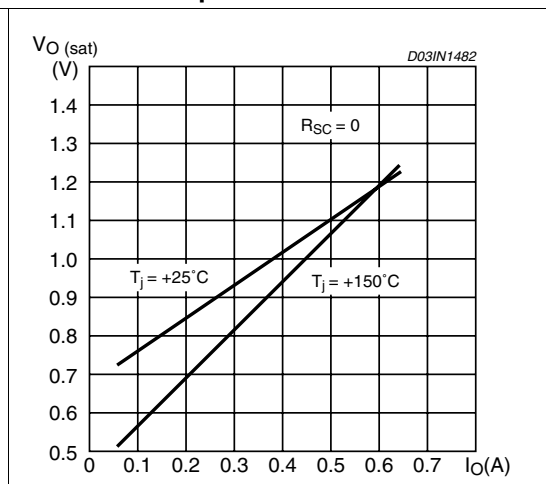
**Figure 5. Available output current vs limiting resistor**



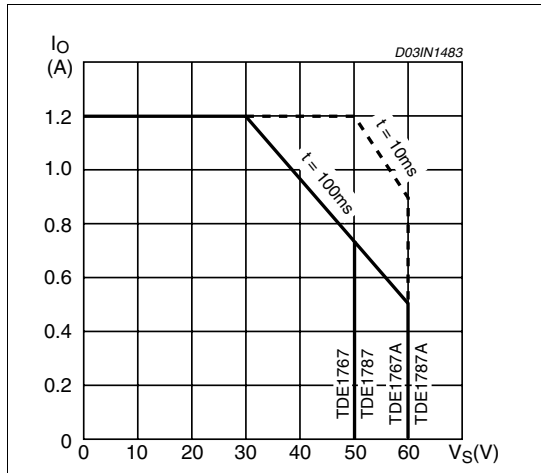
**Figure 6. Power supply current (pin 4)**



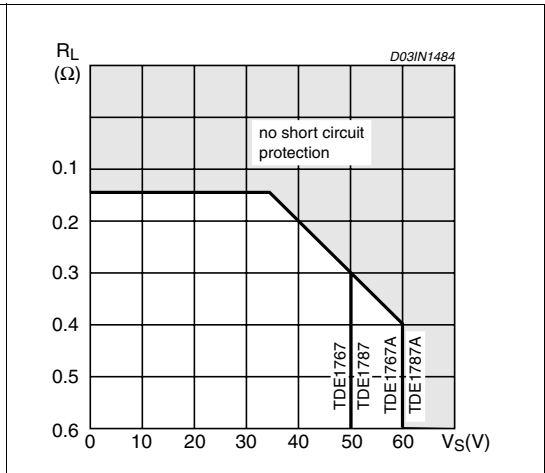
**Figure 7. Output saturation voltage vs output current**



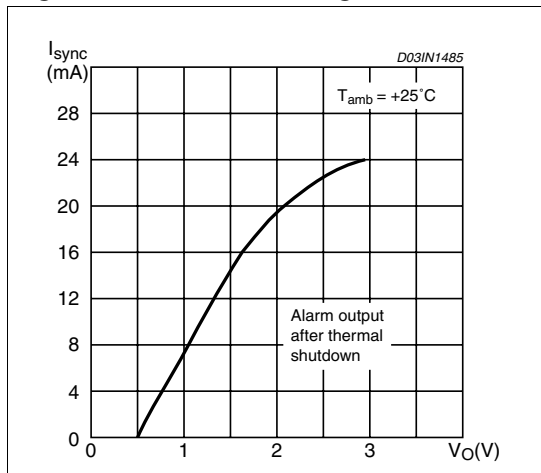
**Figure 8. Output transistor safe operating area (pulsed)**



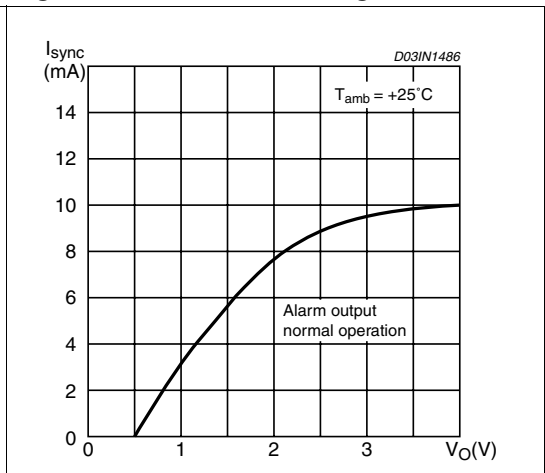
**Figure 9. Normal operating area (short circuit protected)**



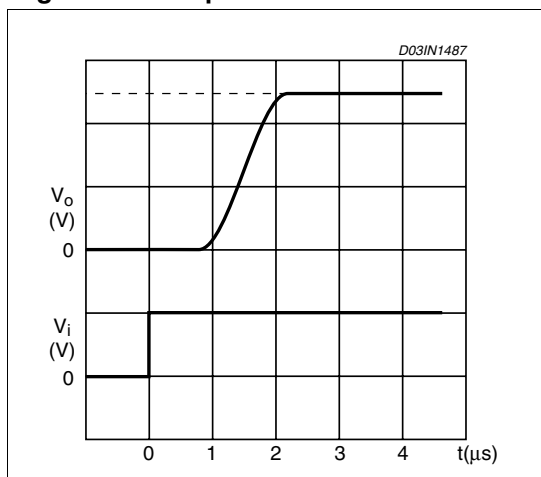
**Figure 10. Current sinking**



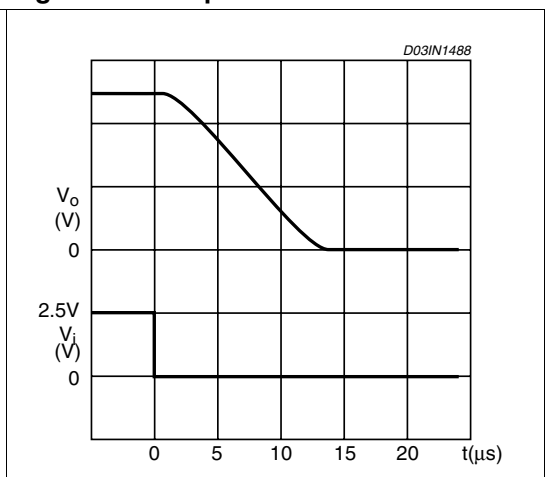
**Figure 11. Current sourcing**



**Figure 12. Response time**



**Figure 13. Response time**





## 6 Typical application

Figure 14. Test circuit

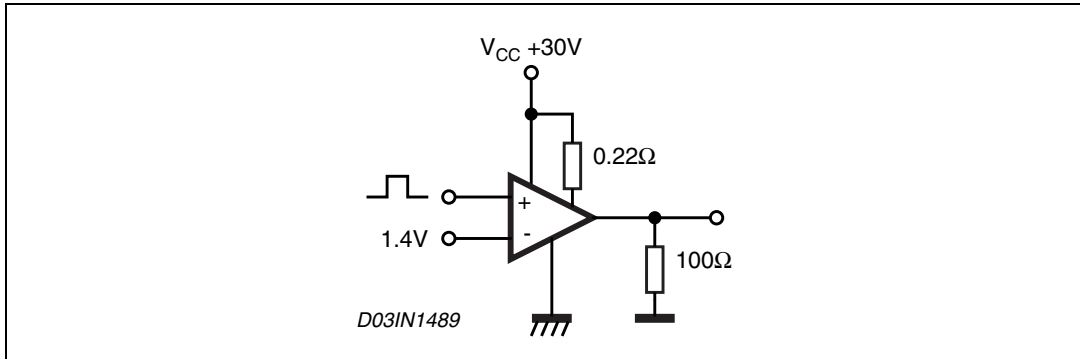


Figure 15. Open load detection.4

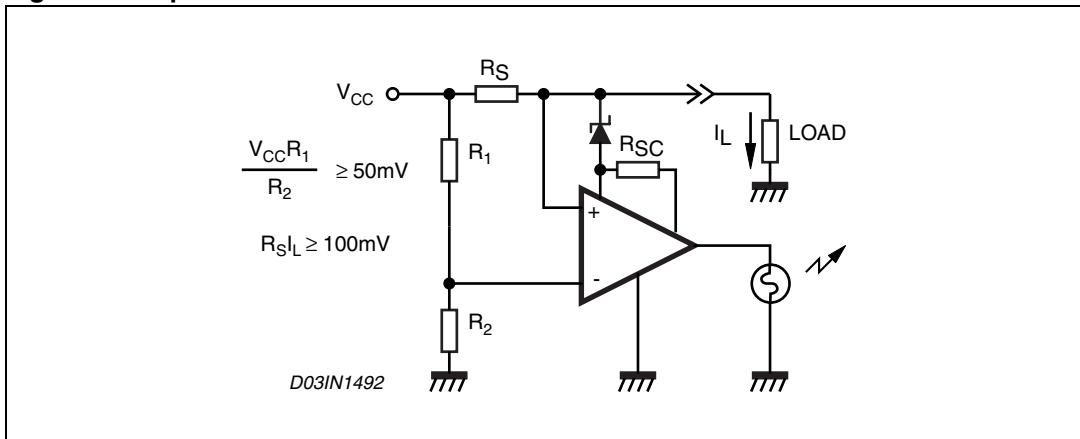


Figure 16. Driving lamps, relays, etc...

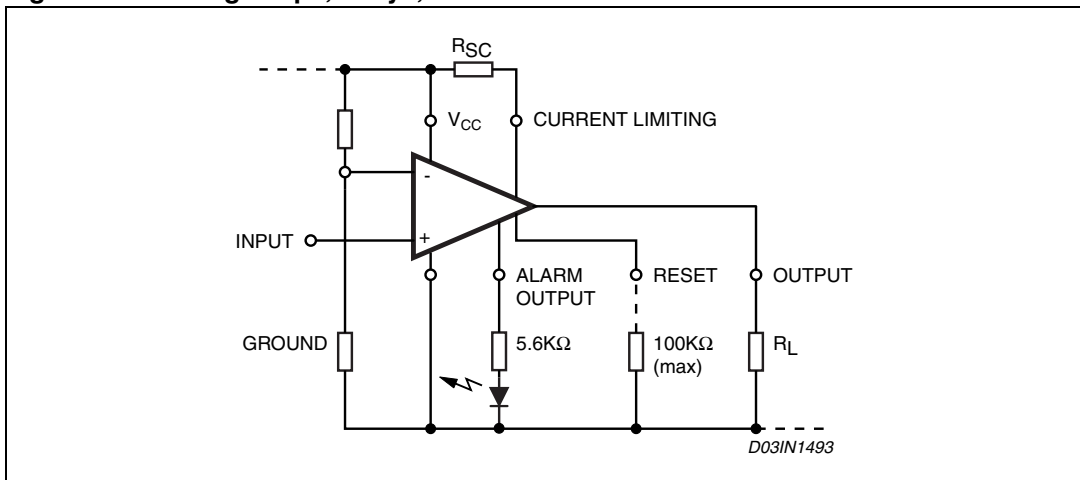


Figure 17. Common reset.

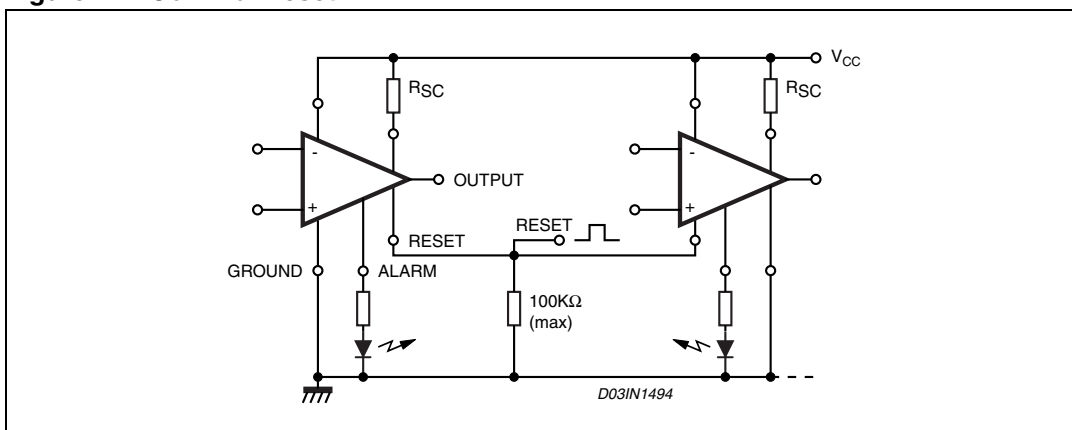
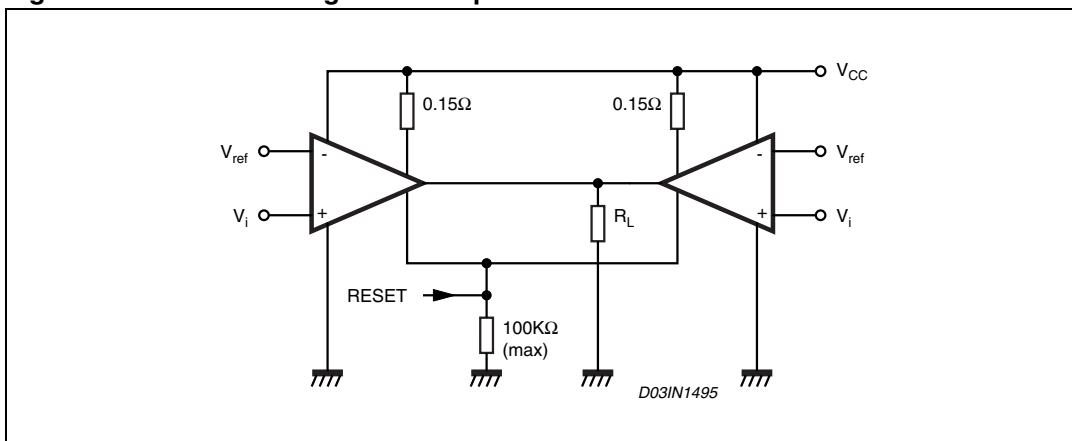


Figure 18. Parallel driving of loads up to 1 A.



# 7 Using alarm output

Figure 19. Parallel alarm output

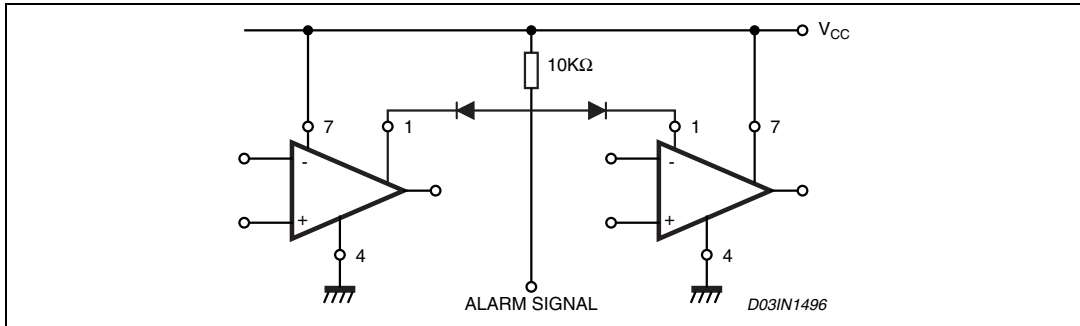


Figure 20. LED to VCC

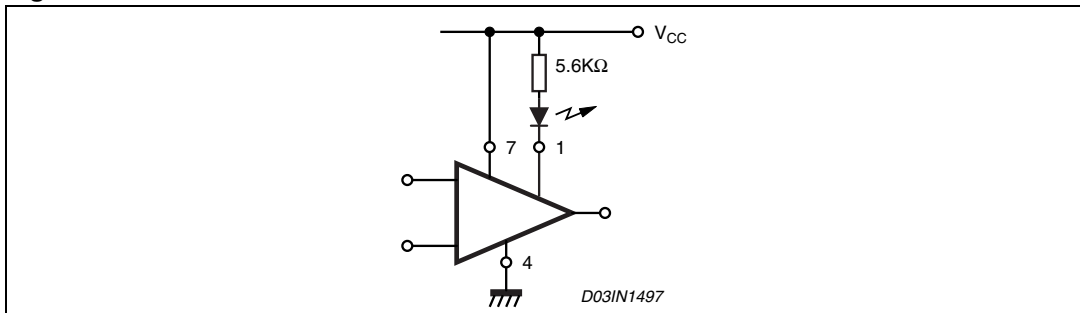
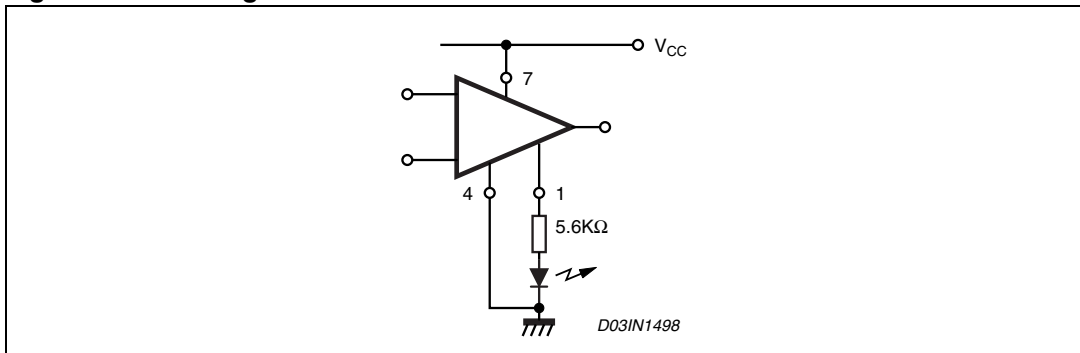
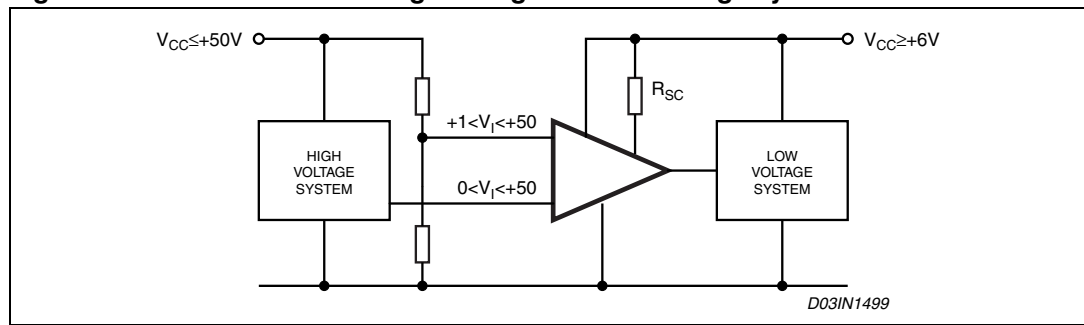


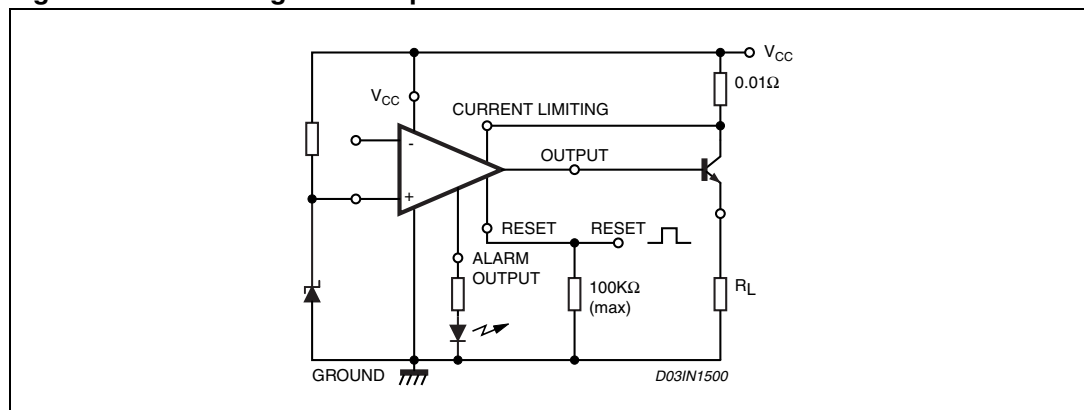
Figure 21. LED to ground



**Figure 22. Interface between high voltage and low voltage system.**



**Figure 23. Increasing current up to 10A.**



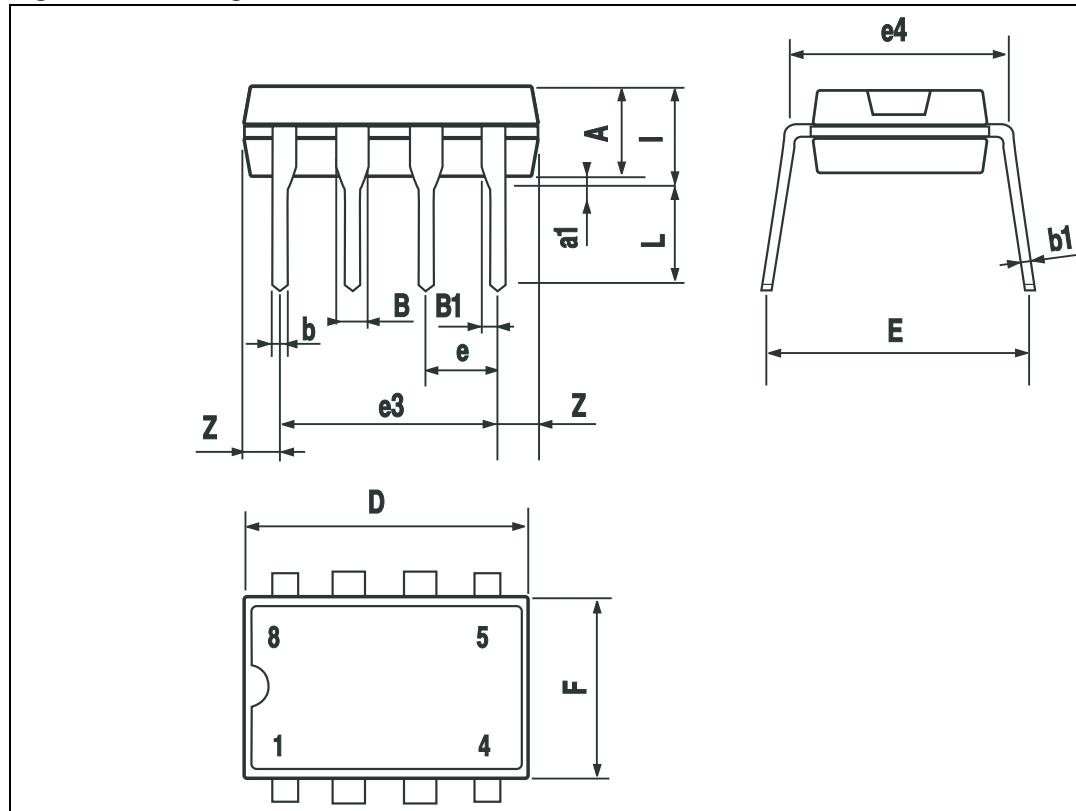
## 8 Mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK<sup>®</sup> packages. These packages have a Lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com).

Table 5. DIP-8 Mechanical data

Dim.	mm			Inch		
	Min	Typ	Max	Min	Typ	Max
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0.260
I			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060

Figure 24. Package dimensions



## 9 Revision history

**Table 6. Revision history**

Date	Revision	Changes
20-Sep-2003	1	Initial release.
3-Mar-2007	2	Document reformatted, typo <i>Figure 1 on page 3</i>

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