



# STV9302

## VERTICAL DEFLECTION OUTPUT FOR MONITOR / TV 2 App / 60 V WITH FLYBACK GENERATOR

### FEATURES

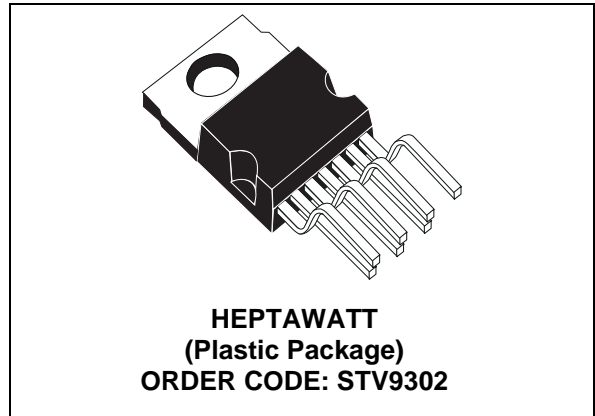
- Power Amplifier
- Flyback Generator
- Output Current up to 2 App
- Thermal Protection

### DESCRIPTION

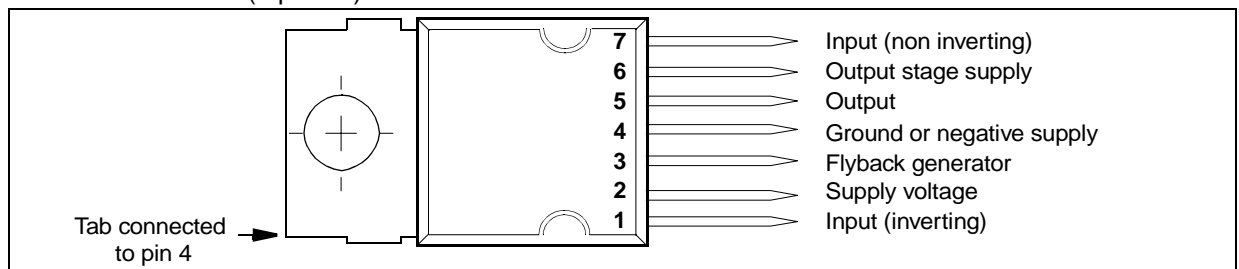
The STV9302 is a vertical deflection booster designed for monitor and TV applications.

This device, supplied with up to 32 V, provides up to 2 App output current to drive the vertical deflection yoke.

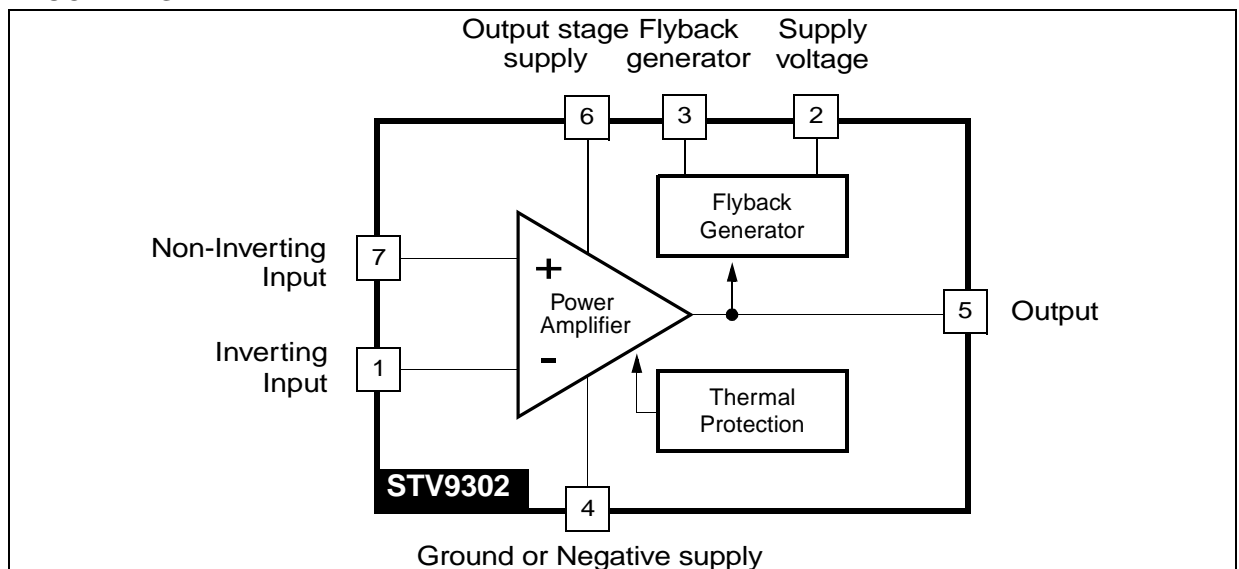
The internal flyback generator delivers flyback voltages up to 60 V.



### PIN CONNECTION (top view)



### BLOCK DIAGRAM



## 1 ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
<b>VOLTAGE</b>			
$V_S$	Supply Voltage (pin 2) - <a href="#">Note 1</a> and <a href="#">Note 2</a>	35	V
$V_5, V_6$	Flyback Peak Voltage - <a href="#">Note 2</a>	60	V
$V_3$	Voltage at Pin 3 - <a href="#">Note 2</a> , <a href="#">Note 3</a> and <a href="#">Note 6</a>	-0.4 to ( $V_S + 3$ )	V
$V_1, V_7$	Amplifier Input Voltage - <a href="#">Note 6</a>	- 0.4 to $+V_S$	V
<b>CURRENT</b>			
$I_0$ (1)	Output Peak Current at $f = 50$ to $200$ Hz, $t \leq 10\mu s$ - <a href="#">Note 4</a>	$\pm 5$	A
$I_0$ (2)	Output Peak Current non-repetitive - <a href="#">Note 5</a>	$\pm 2$	A
$I_3$ sink	Sink Current, $t < 1$ ms - <a href="#">Note 3</a>	1.5	A
$I_3$ source	Source Current, $t < 1$ ms	1.5	A
$I_3$	Flyback pulse current at $f=50$ to $200$ Hz, $t \leq 10\mu s$ - <a href="#">Note 4</a>	$\pm 5$	A
<b>ESD SUSCEPTIBILITY</b>			
ESD1	Human body model (100pF discharge through 1.5k $\Omega$ )	2	kV
ESD2	EIAJ norm (200pF discharge through 0 $\Omega$ )	300	V
<b>TEMPERATURE</b>			
$T_o$	Operating ambient temperature	-20 to 75	$^{\circ}C$
$T_s$	Storage Temperature	-40 to 150	$^{\circ}C$
$T_j$	Junction temperature	+150	$^{\circ}C$

**Note 1:** Usually, the flyback voltage is close to  $2.V_S$   
This must be taken into consideration when setting  $V_S$ .

**Note 2:** Versus pin 4

**Note 3:**  $V_3$  is higher than  $V_S$  during the first half of the flyback pulse

**Note 4:** This repetitive output peak current is usually observed just before and after the flyback pulse.

**Note 5:** This non-repetitive output peak current can be observed, for example, during the switch-On/switch-Off phases.  
This peak current is acceptable providing the SOA is respected ([Figure 8](#) and [Figure](#) )

**Note 6:** All pins have a reverse diode towards pin 4, these diodes should never be forward-biased

## 2 THERMAL DATA

Symbol	Parameter	Value	Unit
$R_{th(j-c)}$	Thermal Resistance Junction-case	3	$^{\circ}C/W$
$T_t$	Temperature for thermal shutdown	150	$^{\circ}C$
$T_{jr}$	Recommended Max. junction temperature	120	$^{\circ}C$

### 3 ELECTRICAL CHARACTERISTICS

( $V_S = 35V$ ,  $T_{amb} = 25^\circ C$ , unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	Fig.
<b>SUPPLY</b>							
$V_S$	Operating supply voltage range ( $V_2$ - $V_4$ )	Note 7	10		30	V	
$I_2$	Pin 2 quiescent current	$I_3 = 0$ , $I_5 = 0$		5	20	mA	1
$I_6$	Pin 6 quiescent current	$I_3 = 0$ , $I_5 = 0$ , $V_6 = 35V$	8	19	50	mA	1
<b>INPUT</b>							
$I_1$	Input bias current	$V_1 = 1V$ , $V_7 = 2.2V$		-0.6	-1.5	$\mu A$	1
$I_7$	Input bias current	$V_1 = 2.2V$ , $V_7 = 1V$		-0.6	-1.5	$\mu A$	
$V_{I0}$	Offset voltage			2		mV	
$\Delta V_{I0}/dt$	Offset drift versus temperature			-10		$\mu V/^\circ C$	
<b>OUTPUT</b>							
$I_0$	Operating peak output current				$\pm 1$	A	
$V_{5L}$	Output saturation voltage to pin 4	$I_5 = 1A$		1	1.4	V	3
$V_{5H}$	Output saturation voltage to pin 6	$I_5 = -1A$		1.6	2.2	V	2
<b>MISCELLANEOUS</b>							
G	Voltage gain		80			dB	
$V_{D5-6}$	Diode forward voltage between pins 5-6	$I_5 = 1A$		1.4	2	V	
$V_{D3-2}$	Diode forward voltage between pins 3-2	$I_3 = 1A$		1.3	2	V	
$V_{3SL}$	Saturation voltage on pin 3	$I_3 = 20mA$		0.4	1	V	3
$V_{3SH}$	Saturation voltage to pin 2 (2nd part of fly-back)	$I_3 = -1A$		2.1		V	

**Note 7:** When  $(V_2-V_4) = 30V$ , the flyback peak voltage on pin 5 is approximately equal to 60 V.

Figure 1. Measurement of  $I_1, I_2, I_6$

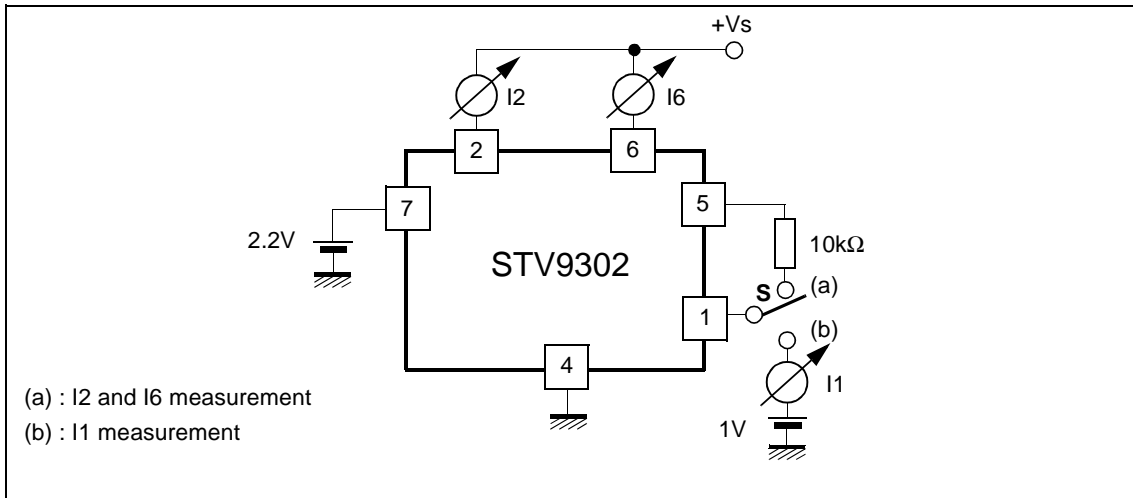


Figure 2. Measurement of  $V_{5H}$

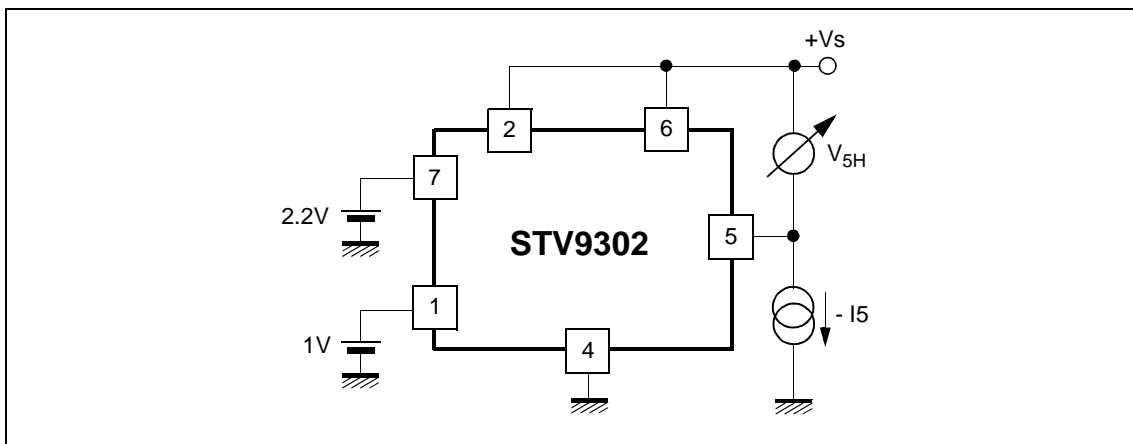
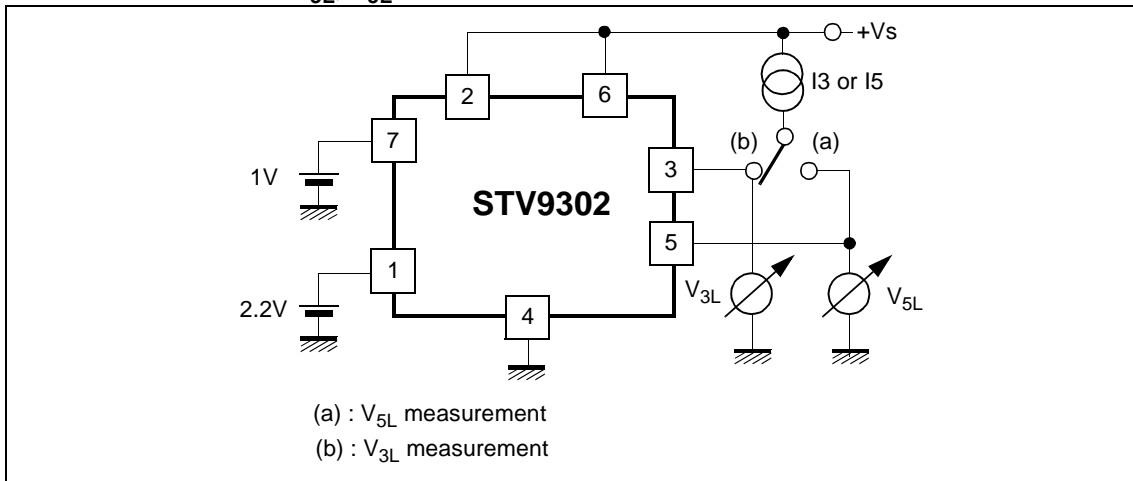


Figure 3. Measurement of  $V_{3L}, V_{5L}$



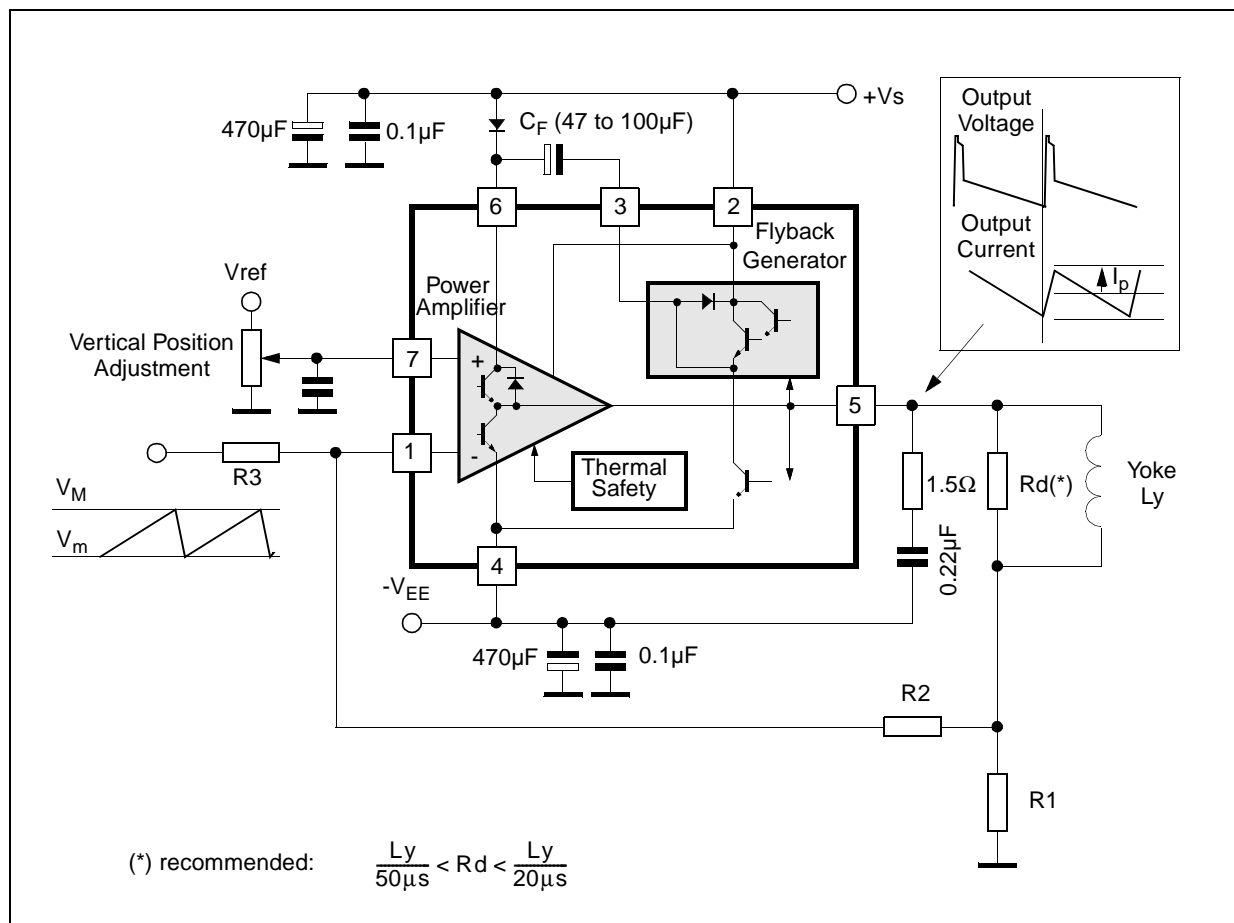
## 4 APPLICATION HINTS

The yoke can be coupled either in AC or DC.

### 4.1 DC-coupled application

When DC coupled (see [Figure 4](#)), the display vertical position can be adjusted with input bias. On the other hand, 2 supply sources ( $V_S$  and  $-V_{EE}$ ) are required.

**Figure 4. DC coupled application**



**Application hints**

- For calculations, treat the IC as an op-amp, where the feedback loop maintains  $V_1 = V_7$  :

**Centring**

Display will be centred (null mean current in yoke) when voltage on pin 7 is:

$$V_7 = \frac{V_M + V_m}{2} \times \frac{R_2}{R_2 + R_3} \quad (R_1 \text{ is negligible})$$

**Peak current**

$$I_P = \frac{(V_M - V_m)}{2} \times \frac{R_2}{R_1 \times R_3}$$

- Example: for  $V_m = 2 \text{ V}$ ,  $V_M = 5 \text{ V}$  and  $I_P = 1 \text{ A}$

Choose  $R_1$  in the  $1 \text{ } \Omega$  range, for instance  $R_1 = 1 \text{ } \Omega$

From equation of peak current: 
$$\frac{R_2}{R_3} = \frac{2 \times I_P \times R_1}{V_M - V_m} = \frac{2}{3}$$

Then choose  $R_2$  or  $R_3$ . For instance if  $R_2 = 10 \text{ k}\Omega$  then  $R_3 = 15 \text{ k}\Omega$

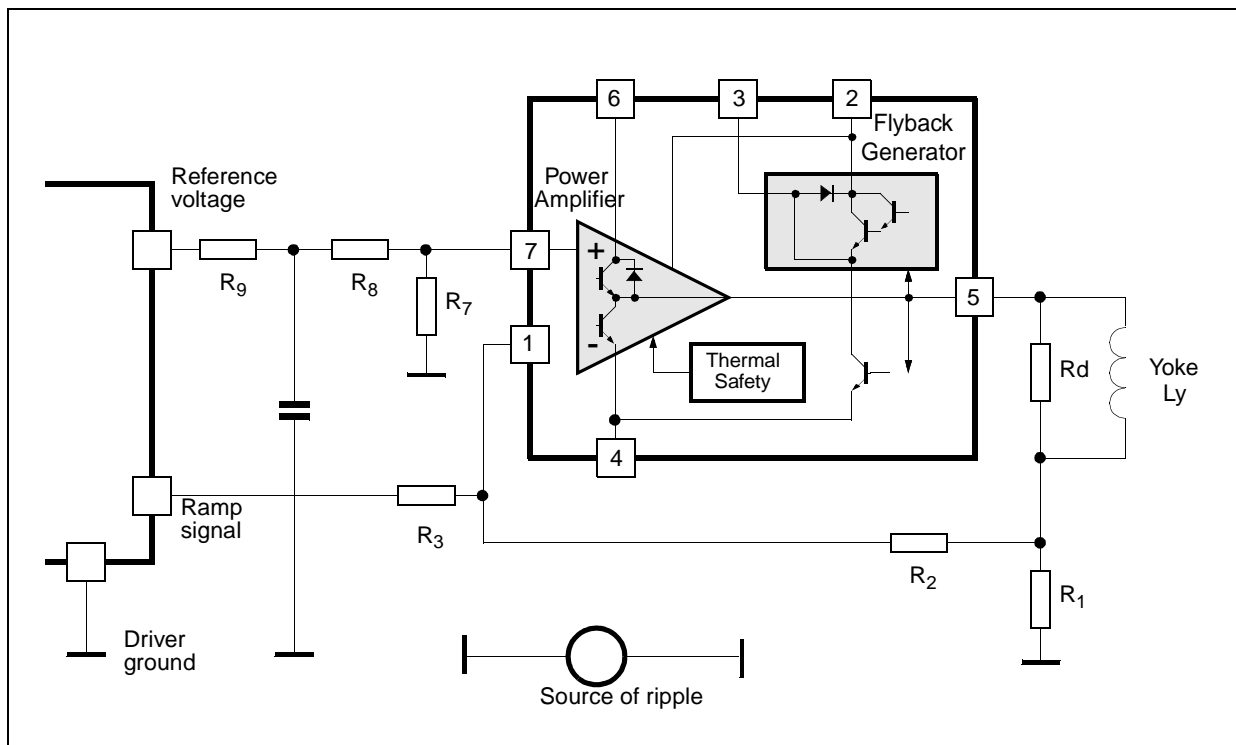
- Finally, bias voltage on pin 7 should be:

$$V_7 = \frac{V_M + V_m}{2} \times \frac{1}{1 + \frac{R_3}{R_2}} = \frac{3.5}{2} \times \frac{1}{2.5} = 0.7 \text{ V}$$

### Ripple rejection

When both ramp signal and bias are provided by the same driver IC, you can gain natural rejection of any ripple caused by a voltage drop in the ground (see Figure 5), if you manage to apply the same fraction of ripple voltage to both booster inputs. For that purpose, arrange an intermediate point in the bias resistor bridge, such that  $(R_8 / R_7) = (R_3 / R_2)$ , and connect the bias filtering capacitor between the intermediate point and the local driver ground. Of course,  $R_7$  should be connected to the booster reference point, which is the ground side of  $R_1$ .

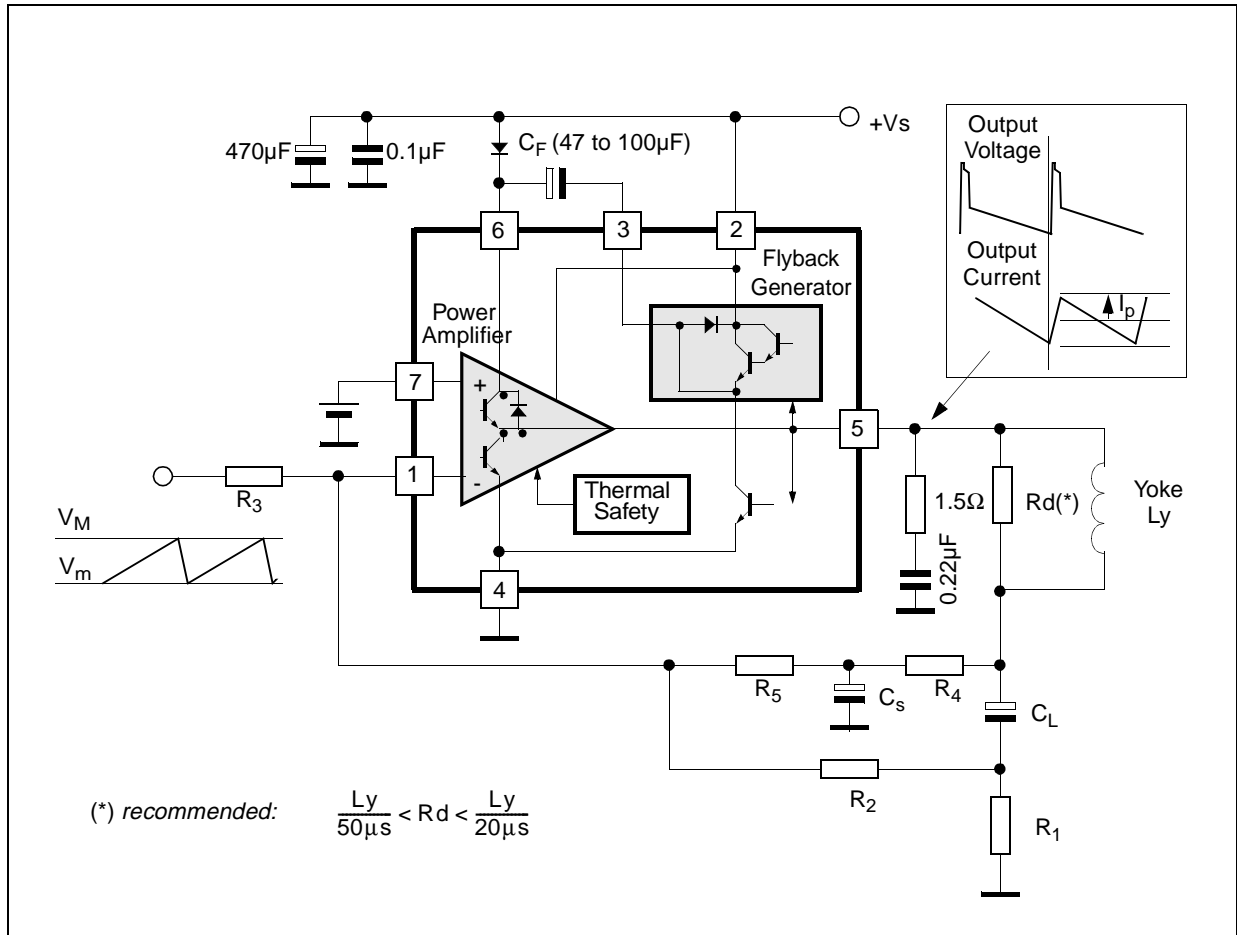
Figure 5. Ripple rejection



4.2 AC-Coupled applications (See Figure 6)

In AC-coupled application, only one supply ( $V_S$ ) is needed. The vertical position of the scanning cannot be adjusted with input bias (for that purpose, usually some current is injected or sunk with a resistor in the low side of the yoke).

Figure 6. AC-coupled application





### Application hints

- Gain is defined as in the previous case:

$$I_p = \frac{V_M - V_m}{2} \times \frac{R_2}{R_1 \times R_3}$$

- Choose  $R_1$  then either  $R_2$  or  $R_3$
- For good output centering,  $V_7$  must fulfill the following equation:

$$\frac{\frac{V_S}{2} - V_7}{R_4 + R_5} = \frac{V_7 - \frac{V_M + V_m}{2}}{R_3} + \frac{V_7}{R_2}$$

or

$$V_7 \times \left( \frac{1}{R_3} + \frac{1}{R_2} + \frac{1}{R_4 + R_5} \right) = \frac{V_S}{2(R_4 + R_5)} + \frac{V_M + V_m}{2 \times R_3}$$

$C_S$  performs an integration of the parabolic signal on  $C_L$ , therefore the amount of S correction is set by the combination of  $C_L$  and  $C_S$ .

### 4.3 Application with differential-output drivers

Some driver ICs provide the ramp signal in differential form, as two current sources  $i_+$  and  $i_-$  with opposite variations.

Let us set some definitions :

- $i_{cm}$  is the common-mode current :  $i_{cm} = \frac{1}{2}(i_+ + i_-)$
- at peak of signal,  $i_+ = i_{cm} + i_p$  and  $i_- = i_{cm} - i_p$ , therefore the peak differential signal is  $i_p - (-i_p) = 2 i_p$ , and the peak-peak differential signal,  $4i_p$ .

The application is described in [Figure 7](#) with DC yoke coupling.

The calculations still rely on the fact that  $V_1$  remains equal to  $V_7$ .

#### Centring

When idle, both driver outputs provide  $i_{cm}$  and the yoke current should be null, hence:

$$i_{cm} \cdot R_7 = i_{cm} \cdot R_2 \quad \text{therefore} \quad R_7 = R_2 \quad (R_1 \text{ is negligible})$$

#### Peak current

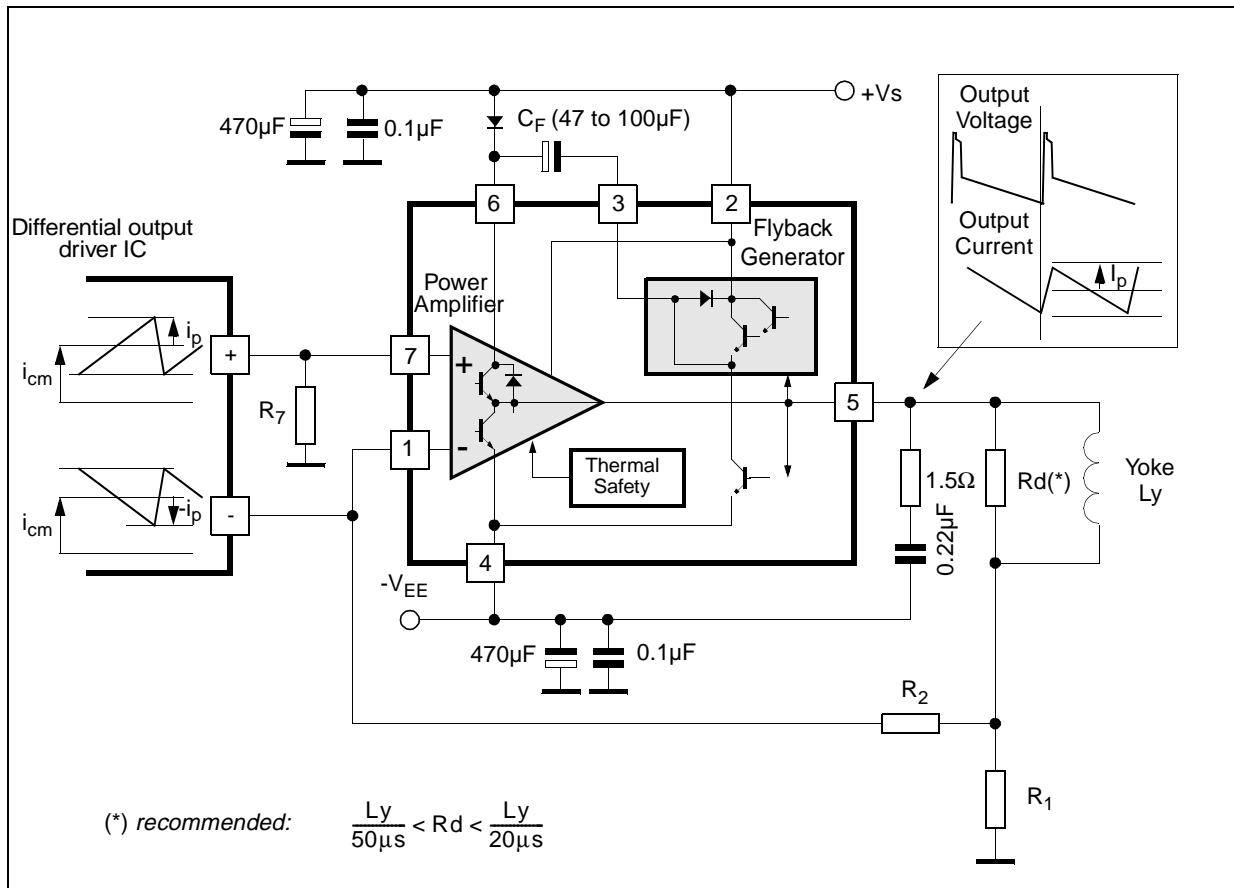
Scanning current should be  $I_p$  when positive and negative driver outputs provide respectively

$i_{cm} - i_p$  and  $i_{cm} + i_p$ , therefore

$$(i_{cm} - i) \cdot R_7 = I_p \cdot R_1 + (i_{cm} + i) \cdot R_2 \quad \text{and since } R_7 = R_2 : \quad \frac{I_p}{i} = -\frac{2R_7}{R_1}$$

Choose  $R_1$  in the  $1\Omega$  range, the value of  $R_2 = R_7$  follows. Remember that  $i$  is one-quarter of driver peak-peak differential signal ! Also check that the voltages on the driver outputs remain inside allowed range.

Figure 7. Using a differential-output driver



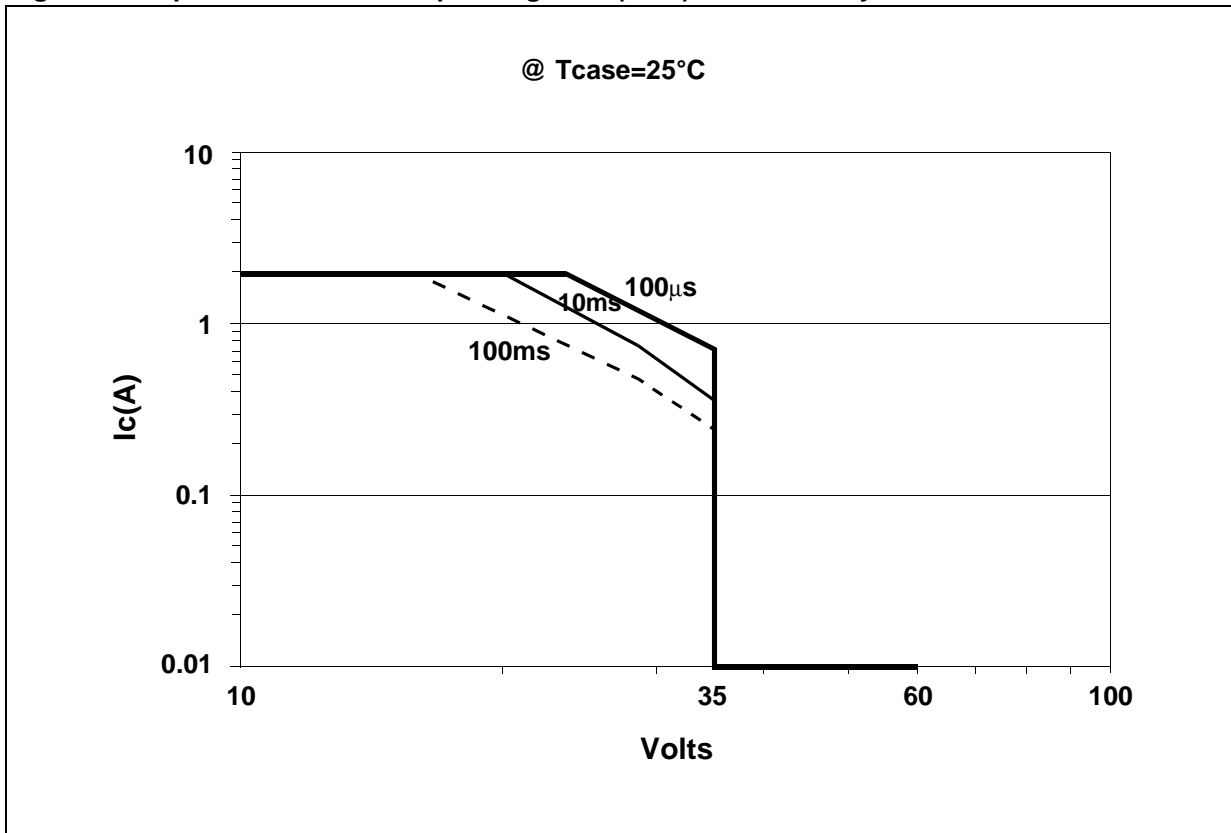
- Example : for  $i_{cm} = 0.4\text{mA}$ ,  $i = 0.2\text{mA}$  (corresponding to  $0.8\text{mA}$  of peak-peak differential current),  $I_p = 1\text{A}$

Choose  $R_1 = 0.75\Omega$ , it follows  $R_2 = R_7 = 1.875\text{k}\Omega$ .

**Ripple rejection**

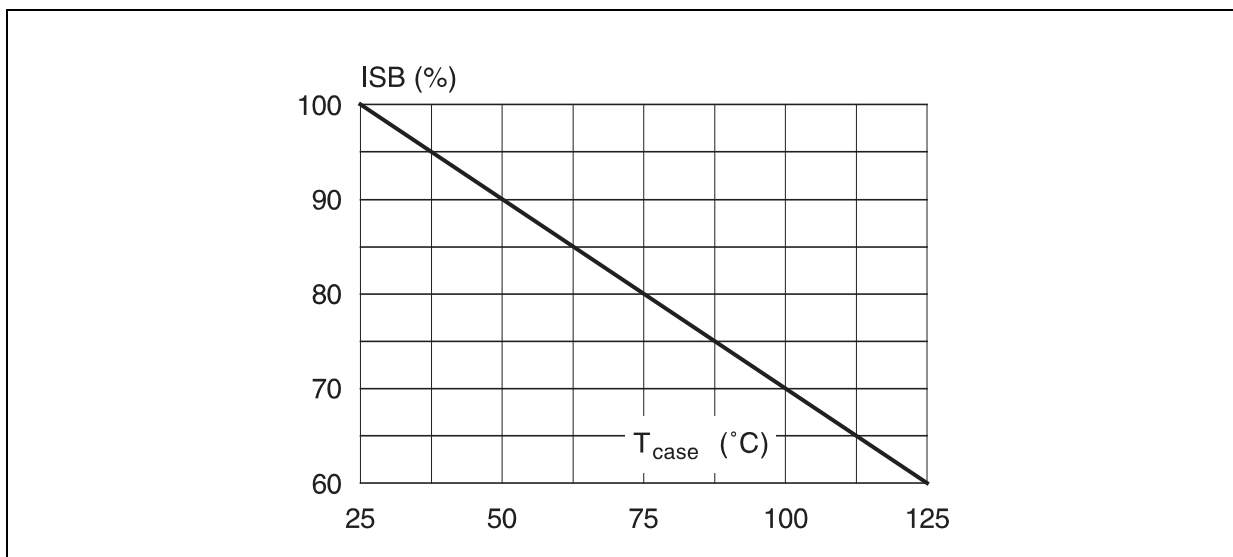
Make sure to connect  $R_7$  directly to the ground side of  $R_1$ .

Figure 8. Output transistor Safe Operating Area (SOA) for secondary breakdown



The diagram has been arbitrarily limited to max  $V_S$  (35 V) and max  $I_0$  (2 A)

Figure 9. Secondary breakdown temperature derating curve (ISB = secondary breakdown current)

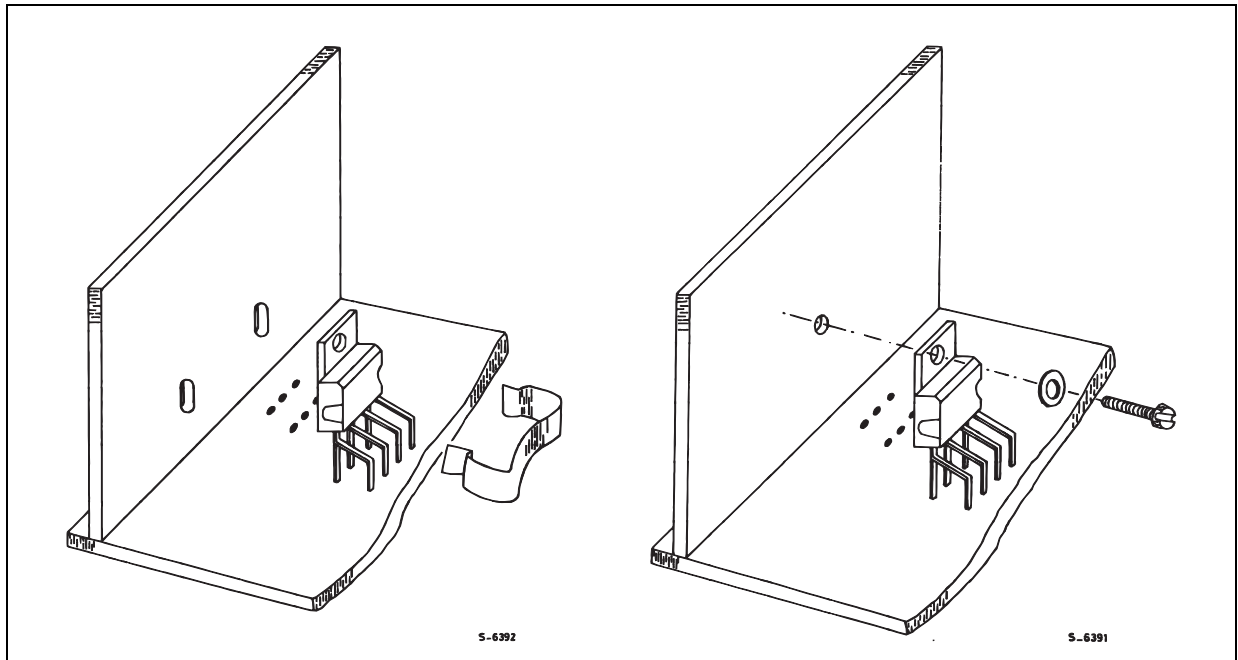


## 5 MOUNTING INSTRUCTIONS

The power dissipated in the circuit is removed by adding an external heatsink. With the HEPTAWATT™ package, the heatsink is simply attached with a screw or a compression spring (clip).

A layer of silicon grease inserted between heatsink and package optimizes thermal contact. In DC-coupled applications we recommend to use a silicon tape between the device tab and the heatsink to isolate electrically the heatsink.

Figure 10. Mounting examples



## 6 PIN CONFIGURATION

Figure 11. Pins 1 and 7

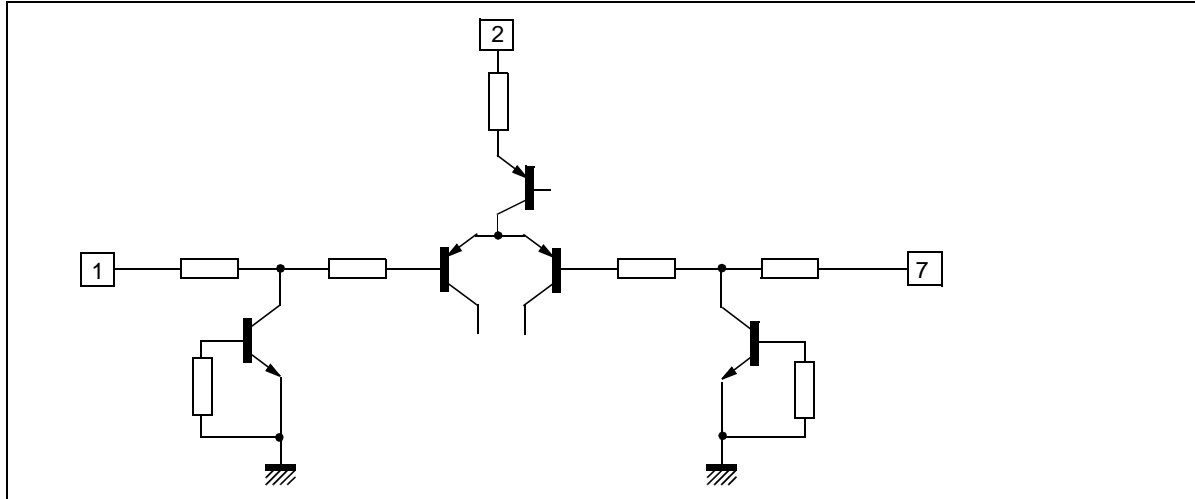


Figure 12. Pin 3

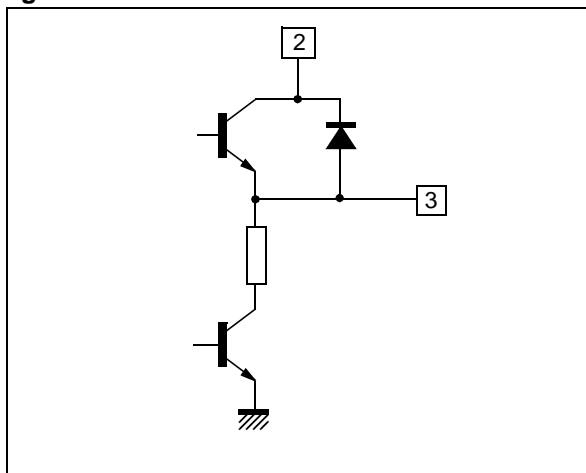
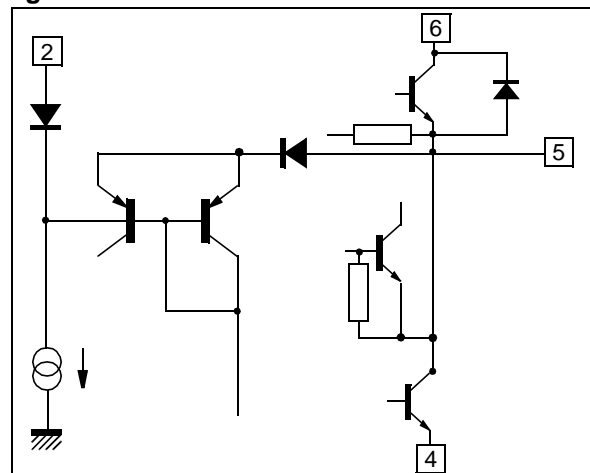
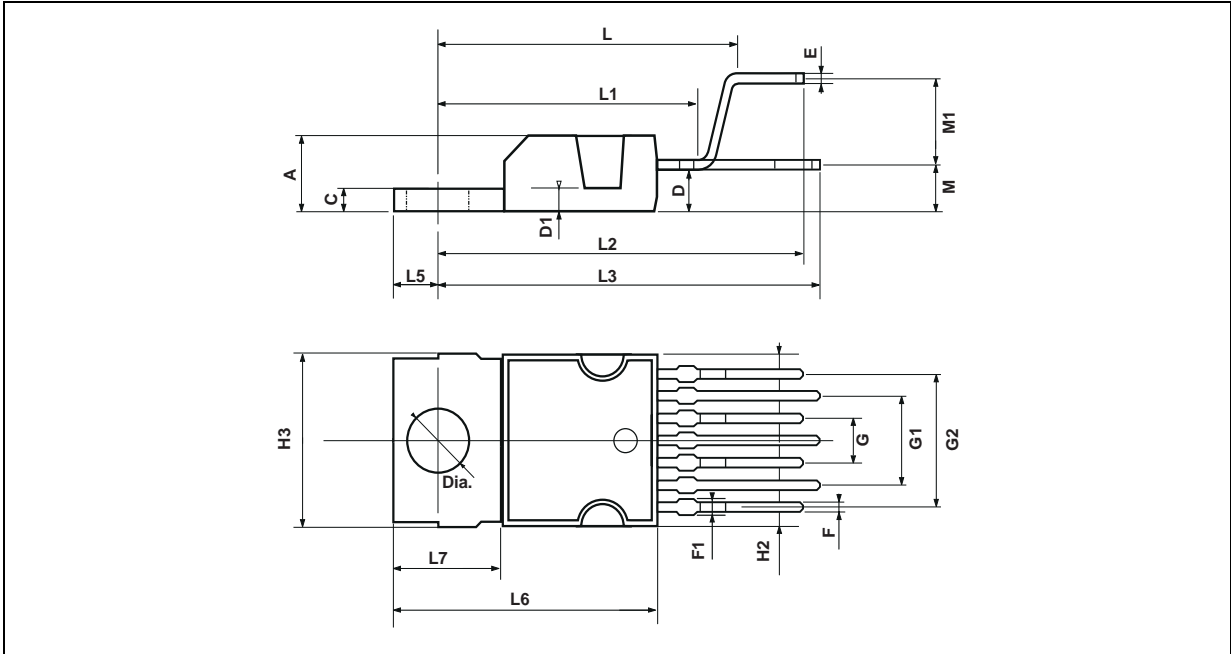


Figure 13. Pins 5 and 6



## 7 PACKAGE MECHANICAL DATA

9 PINS - plastic heptawatt



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			4.8			0.189
C			1.37			0.054
D	2.4		2.8	0.094		0.110
D1	1.2		1.35	0.047		0.053
E	0.35		0.55	0.014		0.022
F	0.6		0.8	0.024		0.031
F1			0.9			0.035
G	2.41	2.54	2.67	0.095	0.100	0.105
G1	4.91	5.08	5.21	0.193	0.200	0.205
G2	7.49	7.62	7.8	0.295	0.300	0.307
H2			10.4			0.409
H3	10.05		10.4	0.396		0.409
L		16.97			0.668	
L1		14.92			0.587	
L2		21.54			0.848	
L3		22.62			0.891	
L5	2.6		3	0.102		0.118
L6	15.1		15.8	0.594		0.622
L7	6		6.6	0.236		0.260
M		2.8			0.110	
M1		5.08			0.200	
Dia.	3.65		3.85	0.144		0.152

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