



STV9302

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

FEATURES

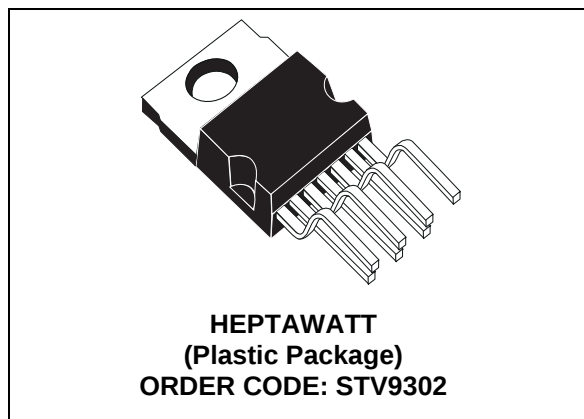
- Power Amplifier
- Flyback Generator
- Output Current up to 2 App
- Thermal Protection

DESCRIPTION

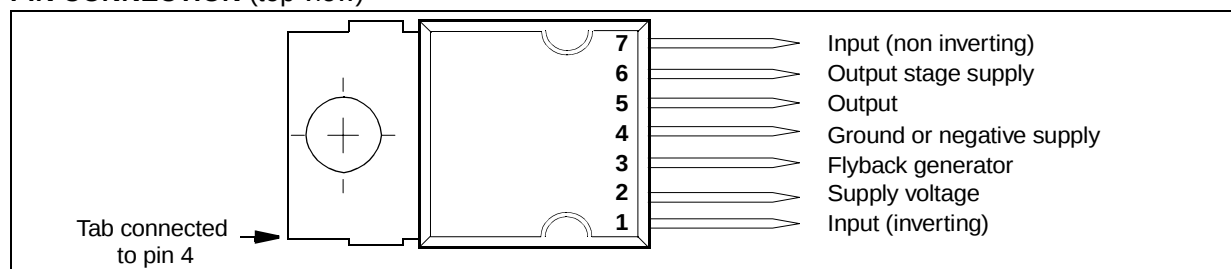
The STV9302 is a vertical deflection booster designed for monitor and TV applications.

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

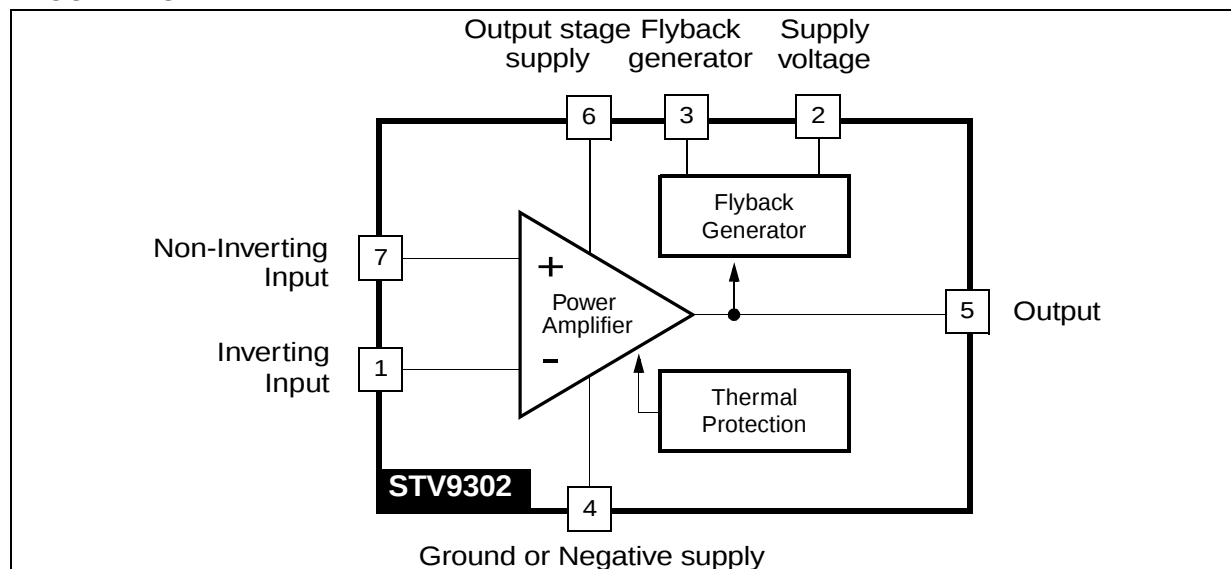
The internal flyback generator delivers flyback voltages up to 60 V.



PIN CONNECTION (top view)



BLOCK DIAGRAM



1 ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
VOLTAGE			
V_S	Supply Voltage (pin 2) - Note 1 and Note 2	35	V
V_5, V_6	Flyback Peak Voltage - Note 2	60	V
V_3	Voltage at Pin 3 - Note 2 , Note 3 and Note 6	-0.4 to ($V_S + 3$)	V
V_1, V_7	Amplifier Input Voltage - Note 6	- 0.4 to $+V_S$	V
CURRENT			
I_0 (1)	Output Peak Current at $f = 50$ to 200 Hz, $t \leq 10\mu s$ - Note 4	± 5	A
I_0 (2)	Output Peak Current non-repetitive - Note 5	± 2	A
I_3 sink	Sink Current, $t < 1ms$ - Note 3	1.5	A
I_3 source	Source Current, $t < 1ms$	1.5	A
I_3	Flyback pulse current at $f=50$ to 200 Hz, $t \leq 10\mu s$ - Note 4	± 5	A
ESD SUSCEPTIBILITY			
ESD1	Human body model (100pF discharge through 1.5k Ω)	2	kV
ESD2	EIAJ norm (200pF discharge through 0 Ω)	300	V
TEMPERATURE			
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.
SUPPLY							
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
INPUT							
I_1	Input bias current	$V_1 = 1V$, $V_7 = 2.2V$		-0.6	-1.5	μA	1
I_7	Input bias current	$V_1 = 2.2V$, $V_7 = 1V$		-0.6	-1.5	μA	
V_{I0}	Offset voltage			2		mV	
$\Delta V_{I0}/dt$	Offset drift versus temperature			-10		$\mu V/^\circ C$	
OUTPUT							
I_0	Operating peak output current				± 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
MISCELLANEOUS							
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 approximatively equal to 60 V.

Figure 1. Measurement of I_1 , I_2 , I_6

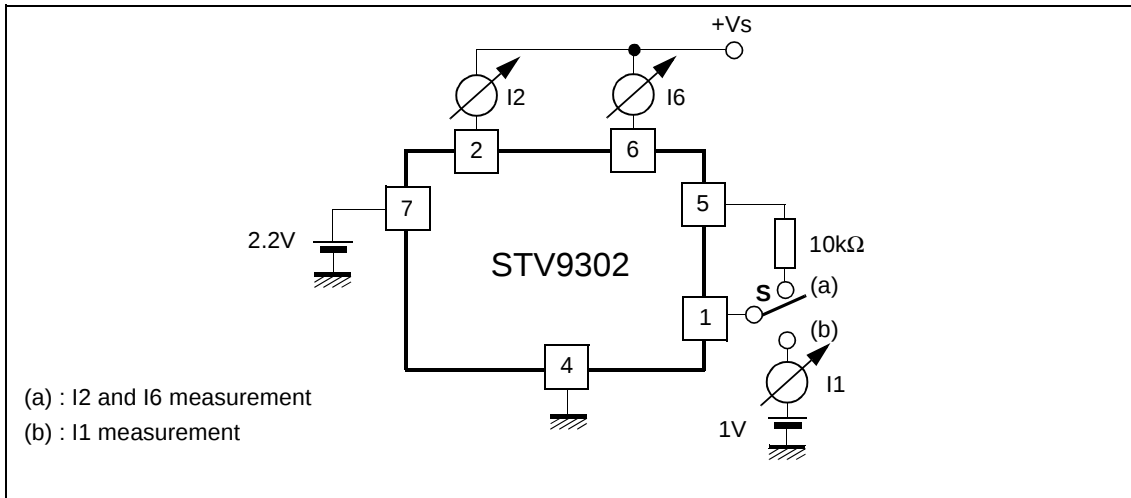


Figure 2. Measurement of V_{5H}

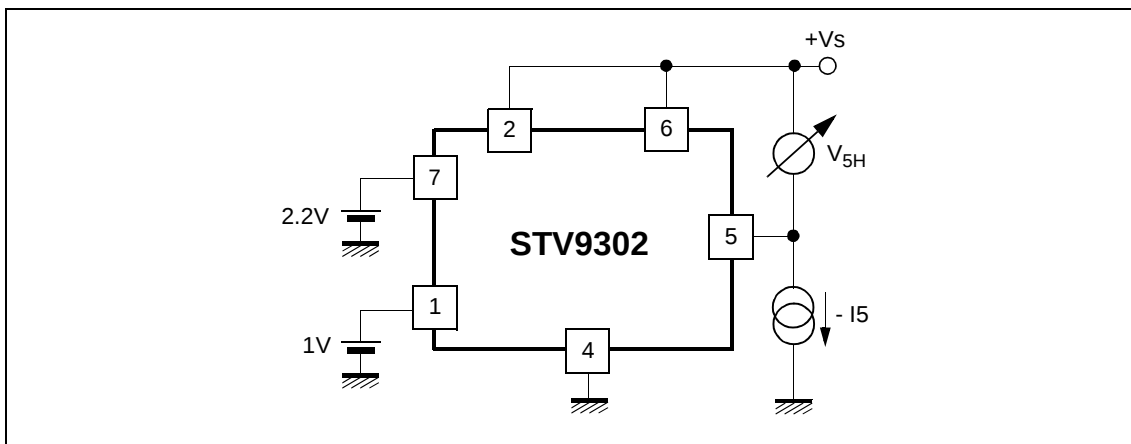
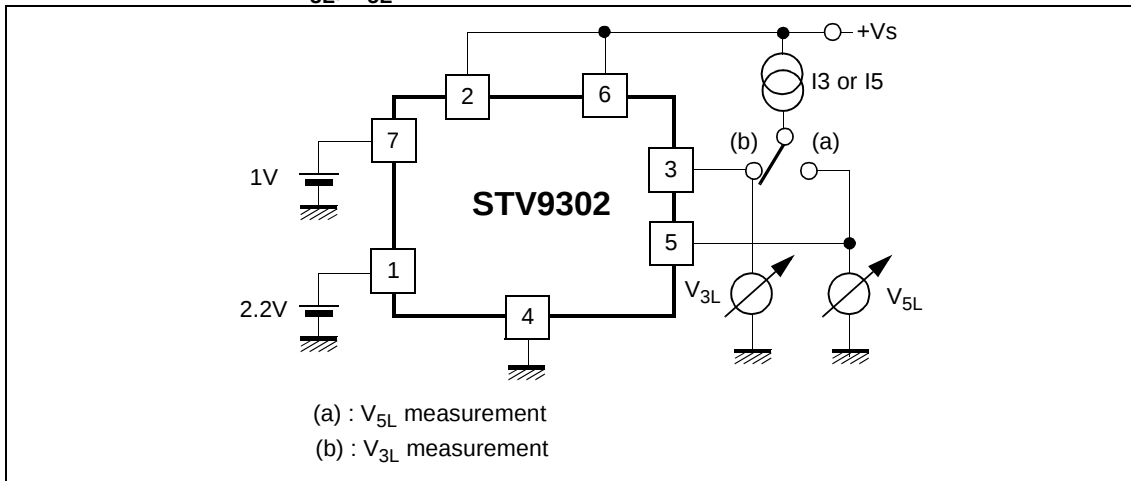


Figure 3. Measurement of V_{3L} , V_{5L}



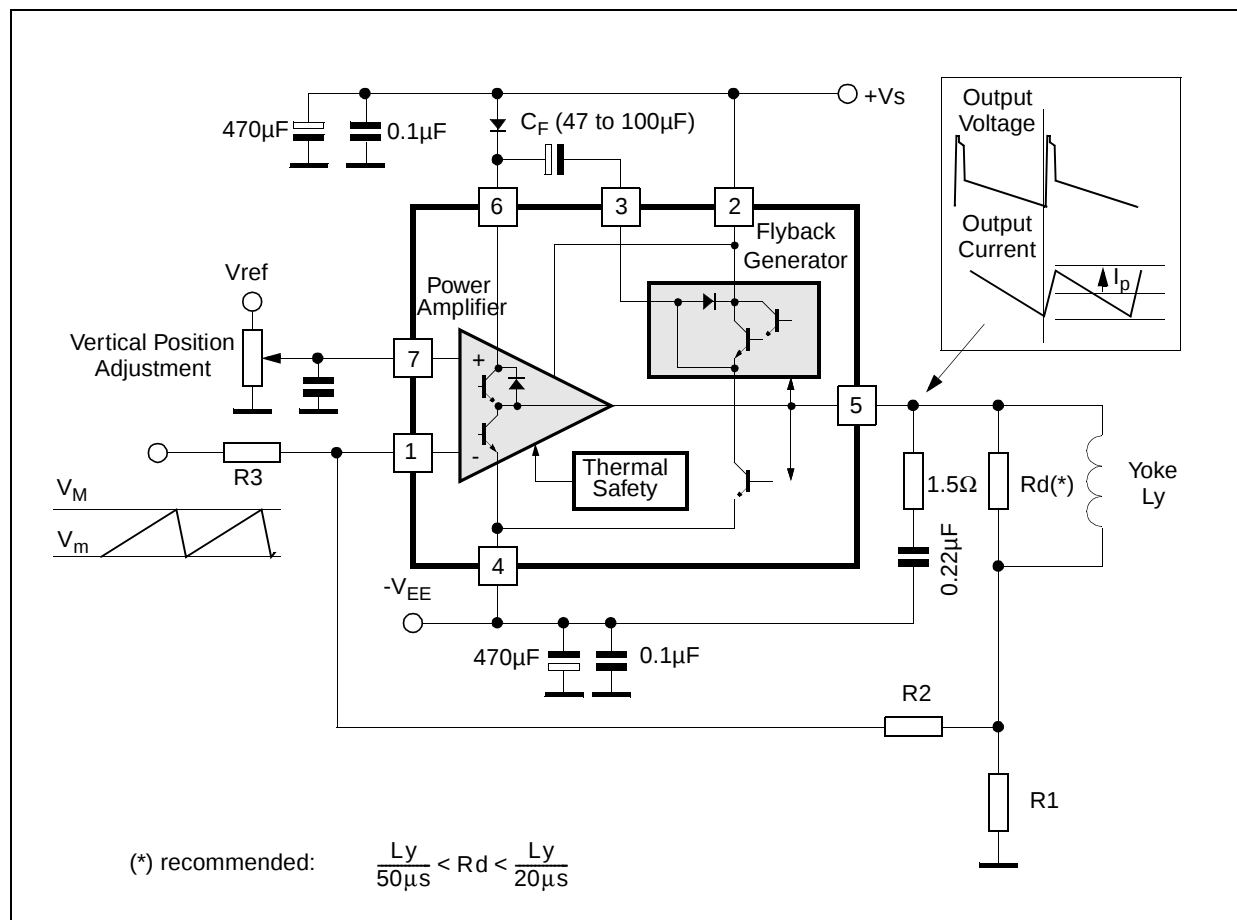
4 APPLICATION HINTS

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 $R_3 = 15 \text{ k}\Omega$

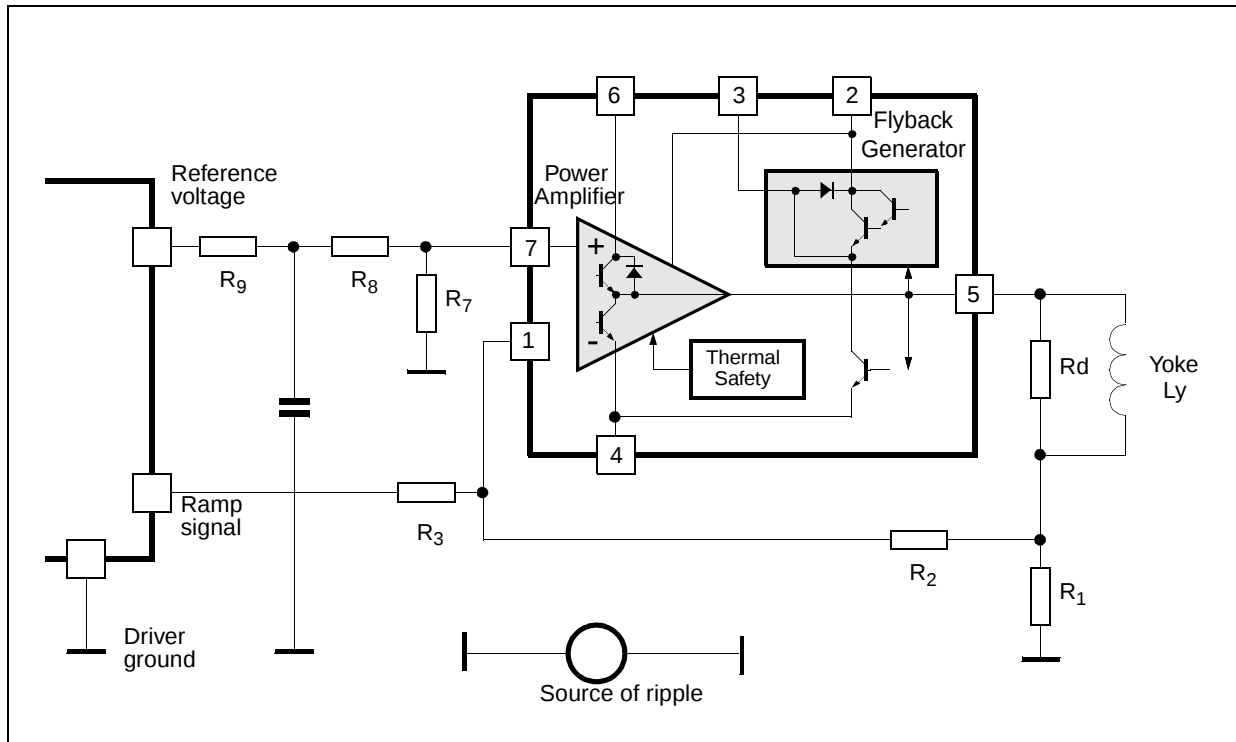
- Finally, bias voltage on pin 7 should be:

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

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 .

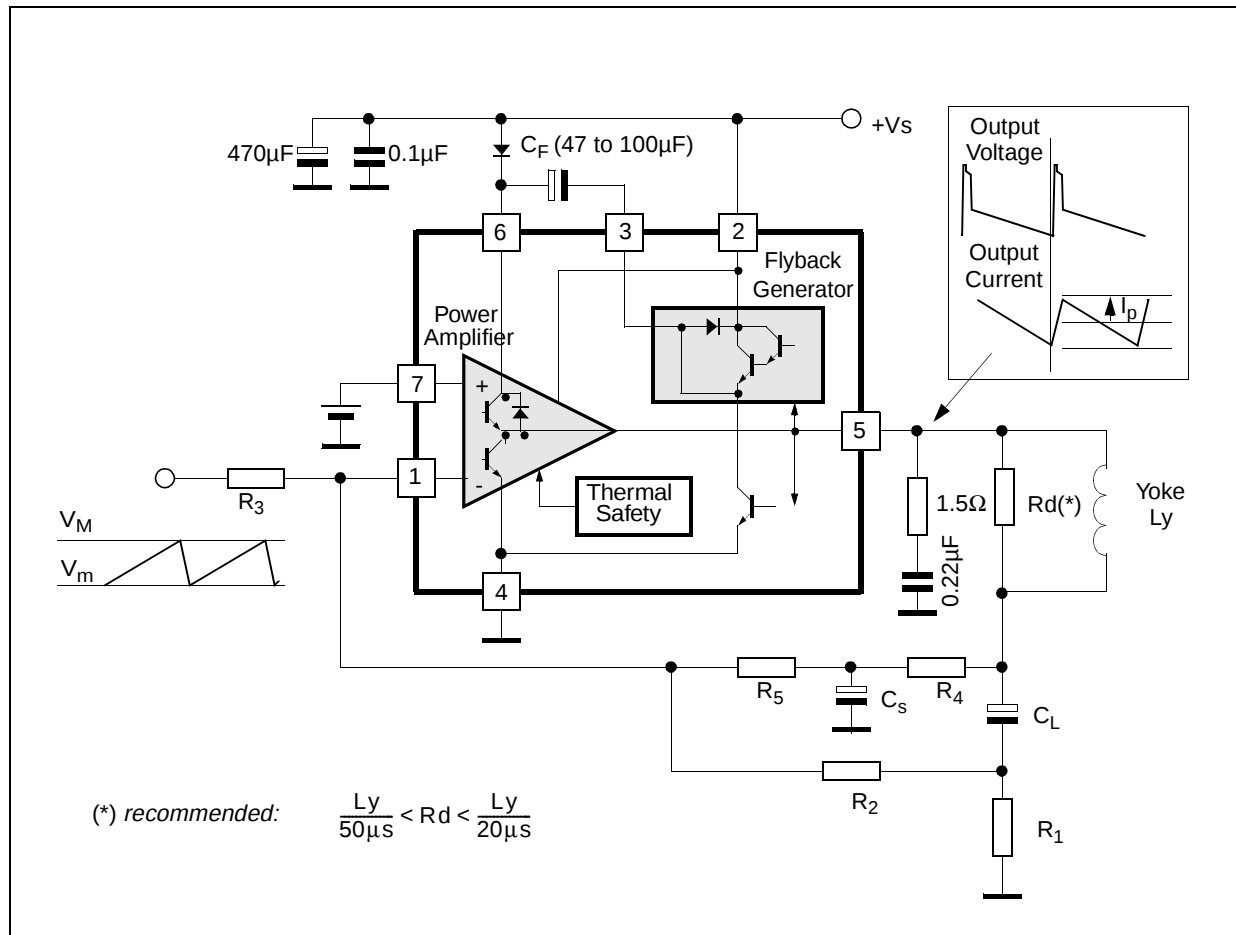
Figure 5. Ripple rejection



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

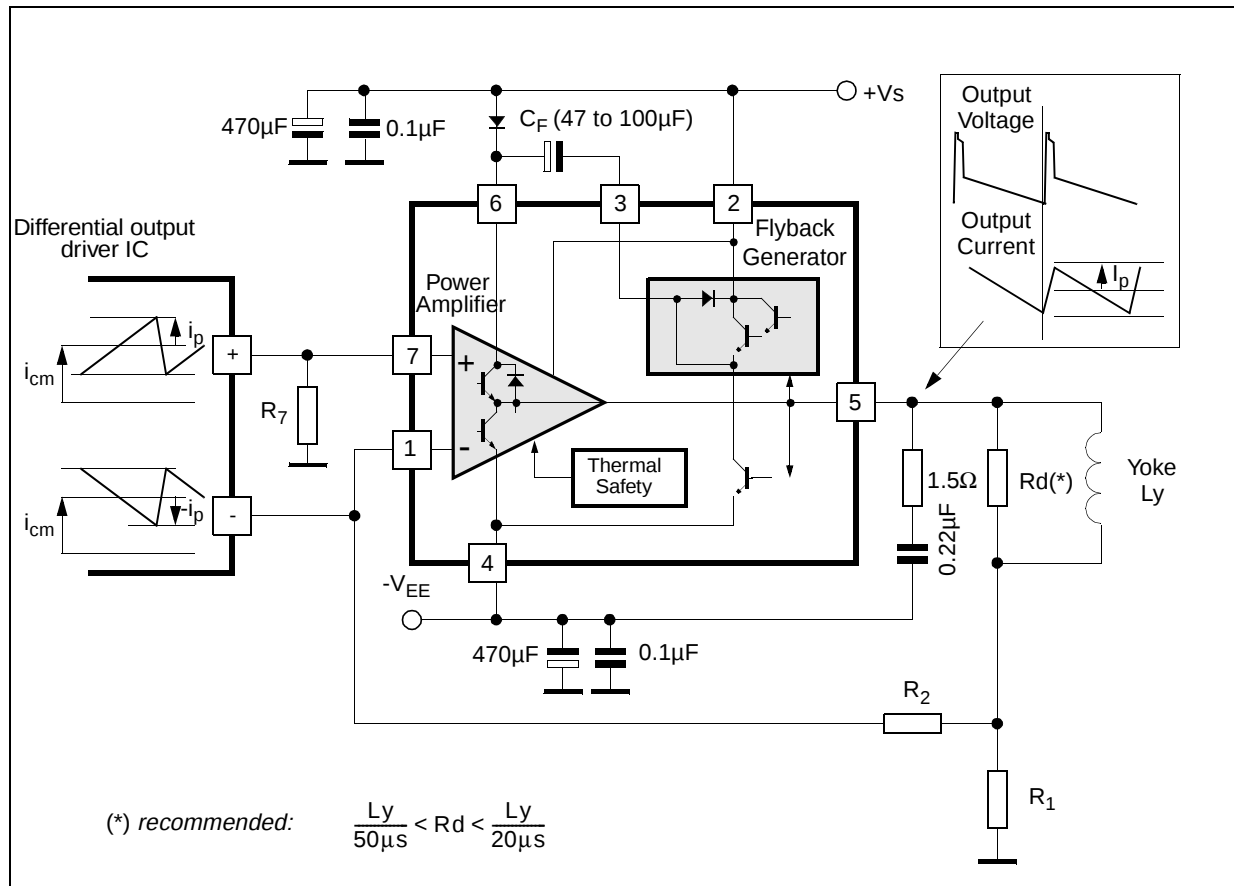
Scanning current should be I_p when positive and negative driver outputs provide respectively

$i_{cm} - i_p$ 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 1Ω 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



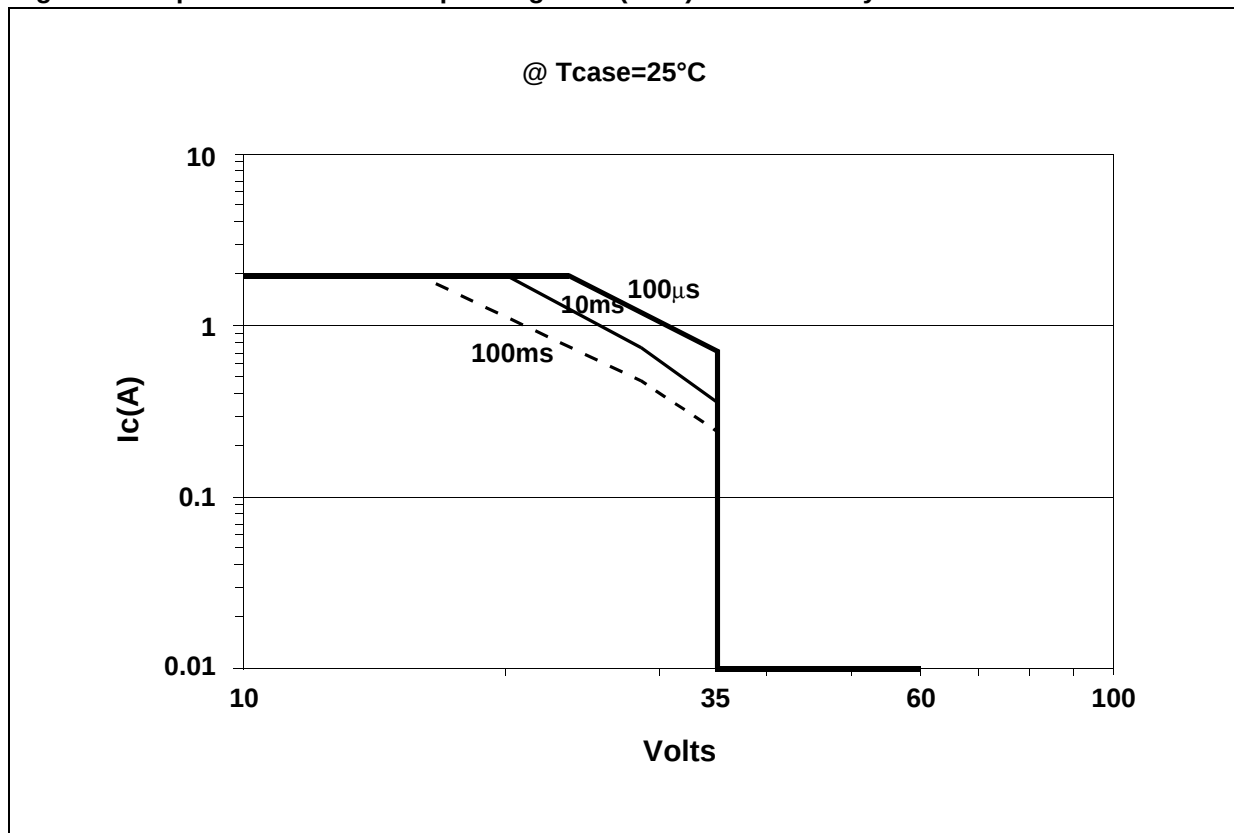
- Example : for $i_{cm} = 0.4\text{mA}$, $i = 0.2\text{mA}$ (corresponding to 0.8mA of peak-peak differential current), $i_p = 1\text{A}$

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

Ripple rejection

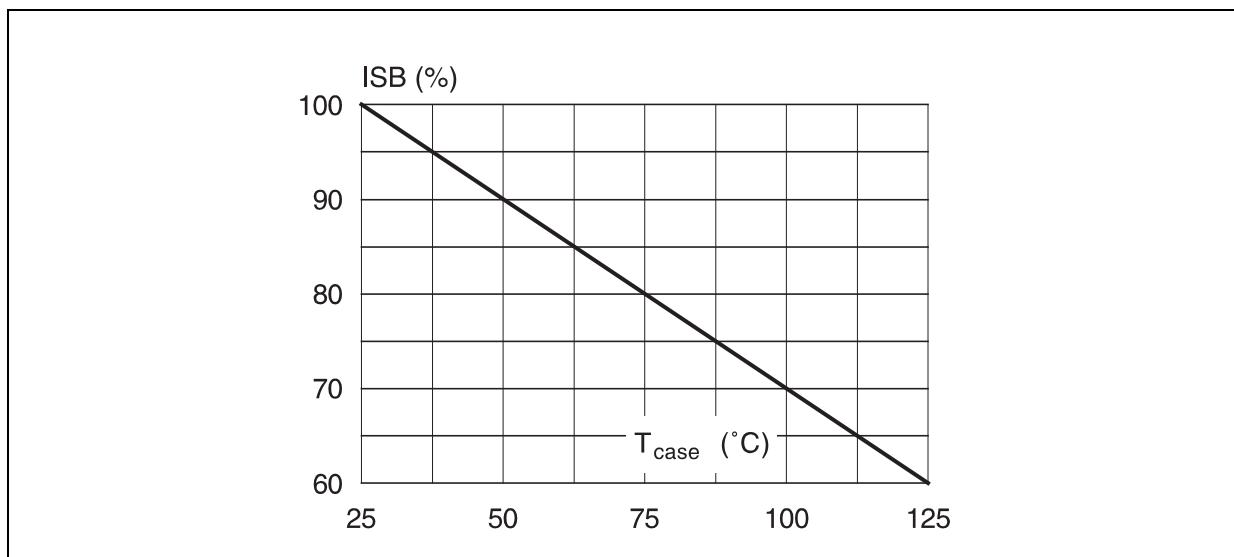
Make sure to connect R_7 directly to the ground side of R_1 .

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_O (2 A)

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

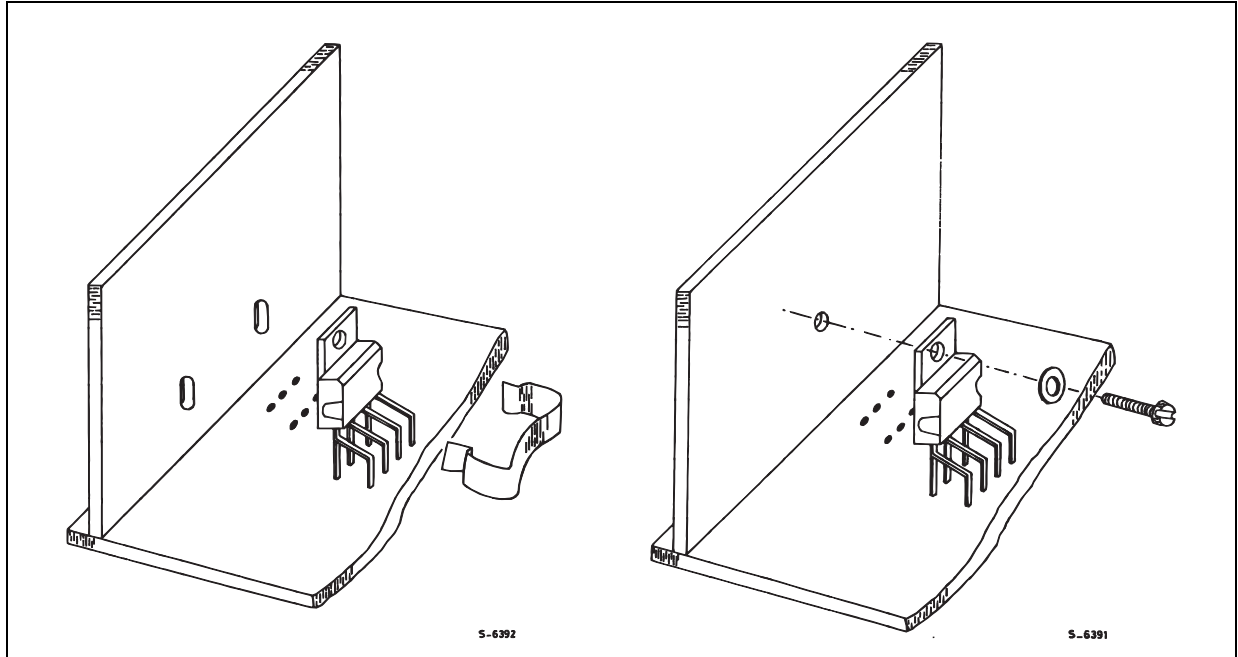


5 MOUNTING INSTRUCTIONS

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

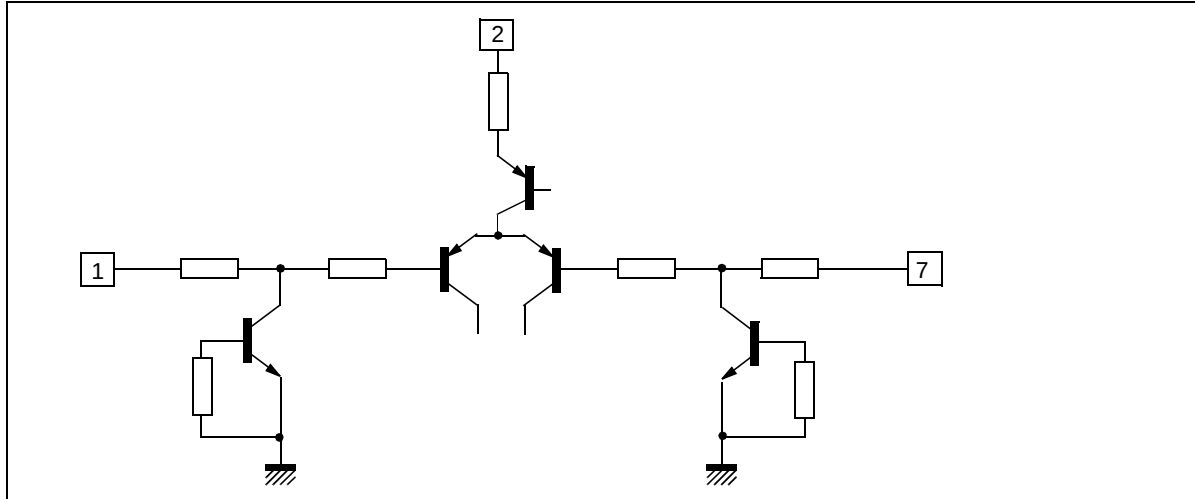


Figure 12. Pin 3

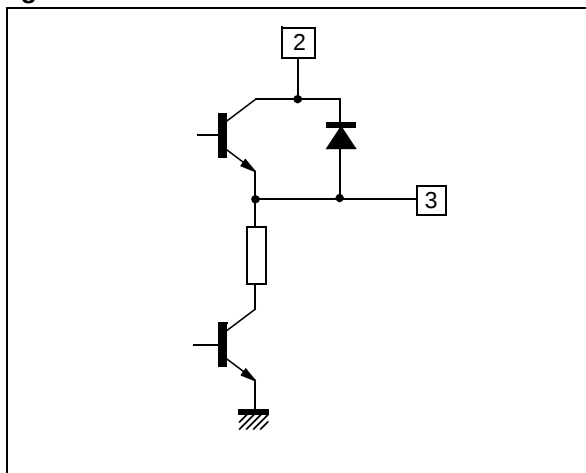
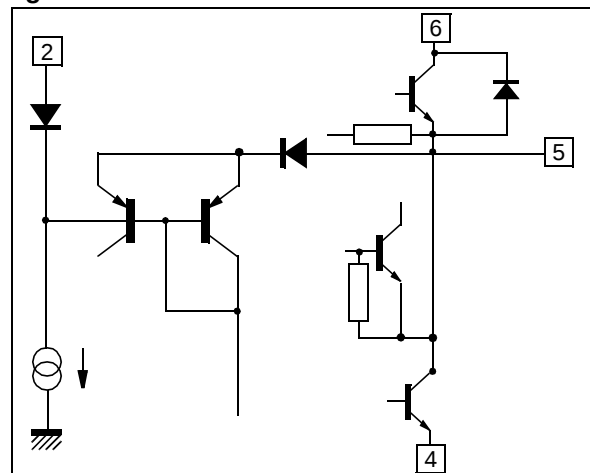
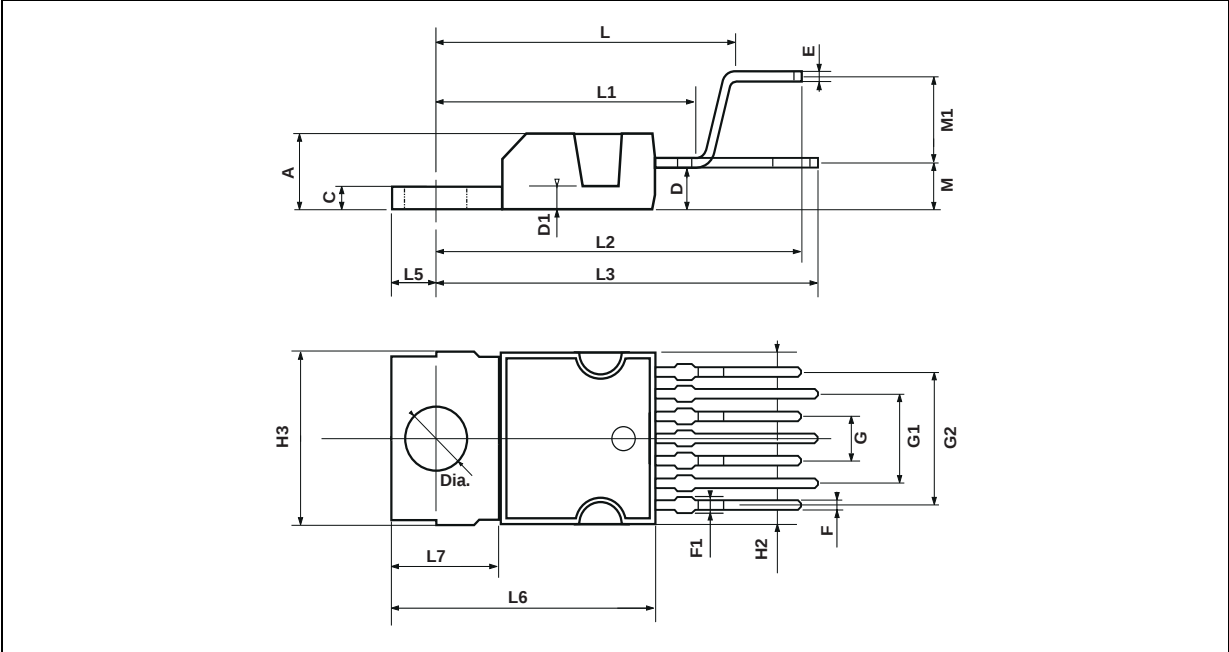


Figure 13. Pins 5 and 6



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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