STV9302

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

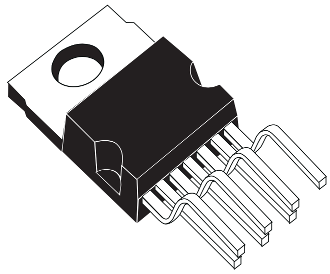
FEATURES
- Power Amplifier
- Flyback Generator
- Output Current up to 2 App
- Thermal Protection

DESCRIPTION

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

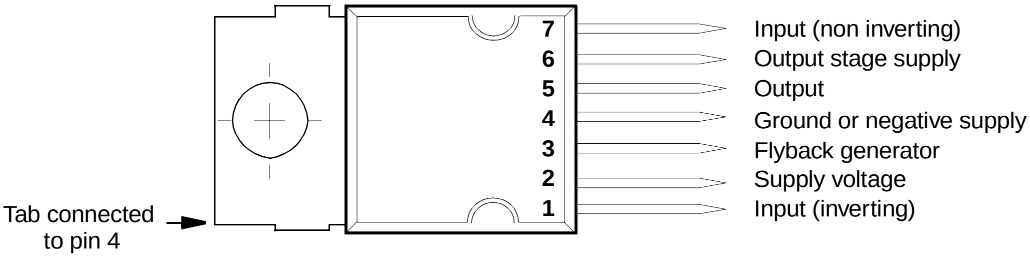
This device, supplied with up to 32 V, provides up to 2 App output current to drive the vertical deflection yoke.

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

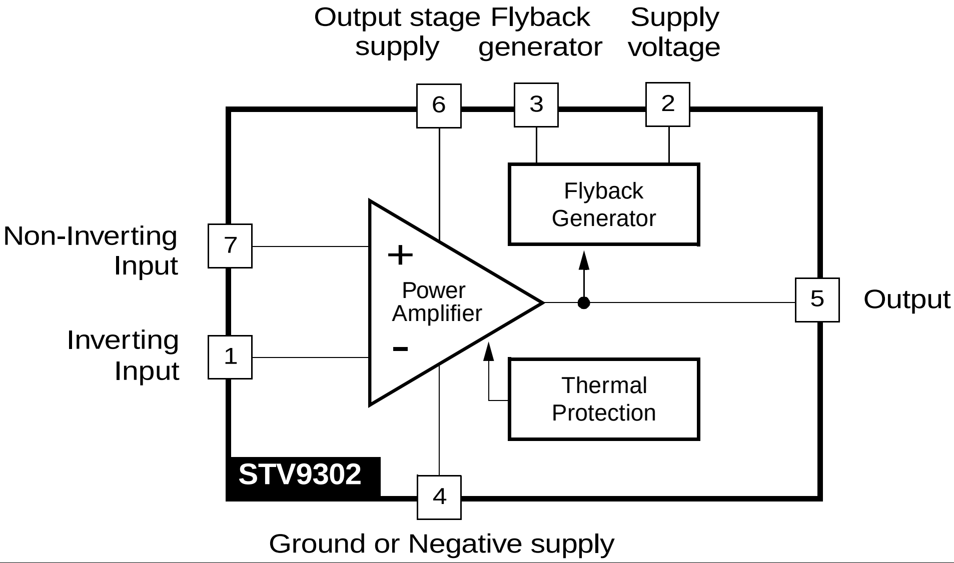


HEPTAWATT
(Plastic Package)
ORDER CODE: STV9302

PIN CONNECTION (top view)



BLOCK DIAGRAM



Version 2.5

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 ≤ 10µs - 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≤10µs - Note 4	±5	A
ESD SUSCEPTIBILITY			
ESD1	Human body model (100pF discharge through 1.5kΩ)	2	kV
ESD2	EIAJ norm (200pF discharge through 0Ω)	300	V
TEMPERATURE			
T_o	Operating ambient temperature	-20 to 75	°C
T_s	Storage Temperature	-40 to 150	°C
T_j	Junction temperature	+150	°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: V3 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	°C/W
T_t	Temperature for thermal shutdown	150	°C
T_{jr}	Recommended Max. junction temperature	120	°C

3 ELECTRICAL CHARACTERISTICS

(V_S = 35V, T_{amb} = 25°C, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	Fig.
SUPPLY							
Vs	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 = 1 V, V_7 = 2.2 V		- 0.6	-1.5	µA	1
I_7	Input bias current	V_1 = 2.2 V, V_7 = 1 V		- 0.6	-1.5	µA	
V_{I0}	Offset voltage			2		mV	
$\Delta V_{I0}/dt$	Offset drift versus temperature			-10		µV/°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 (V2-V4) = 30V, the flyback peak voltage on pin 5 is approximatively equal to 60 V.

Figure 1. Measurement of I_1, I_2, I_6

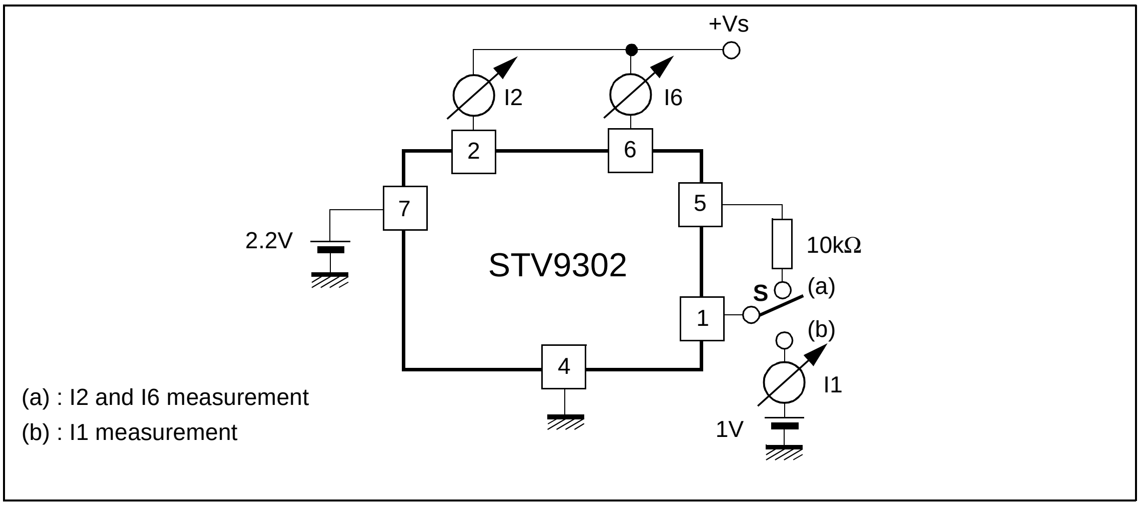


Figure 2. Measurement of V_{5H}

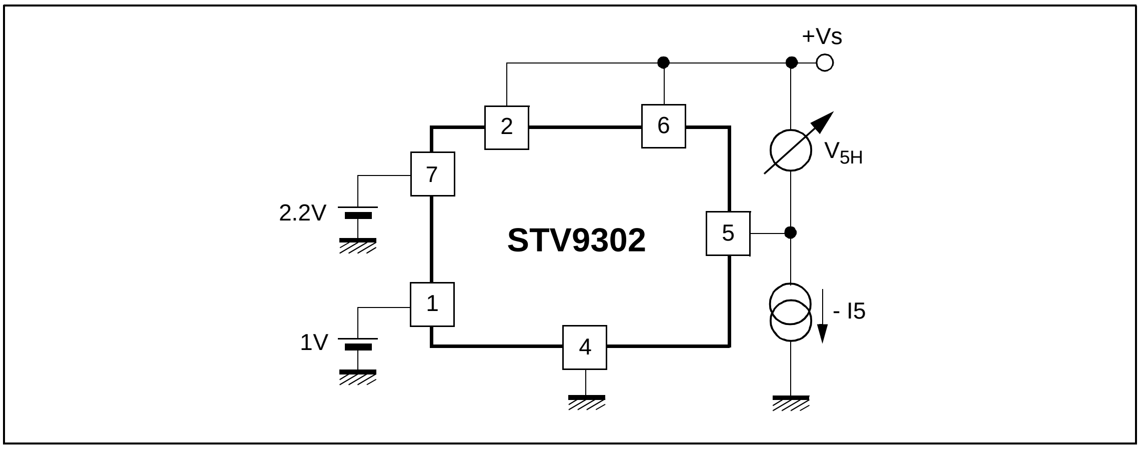
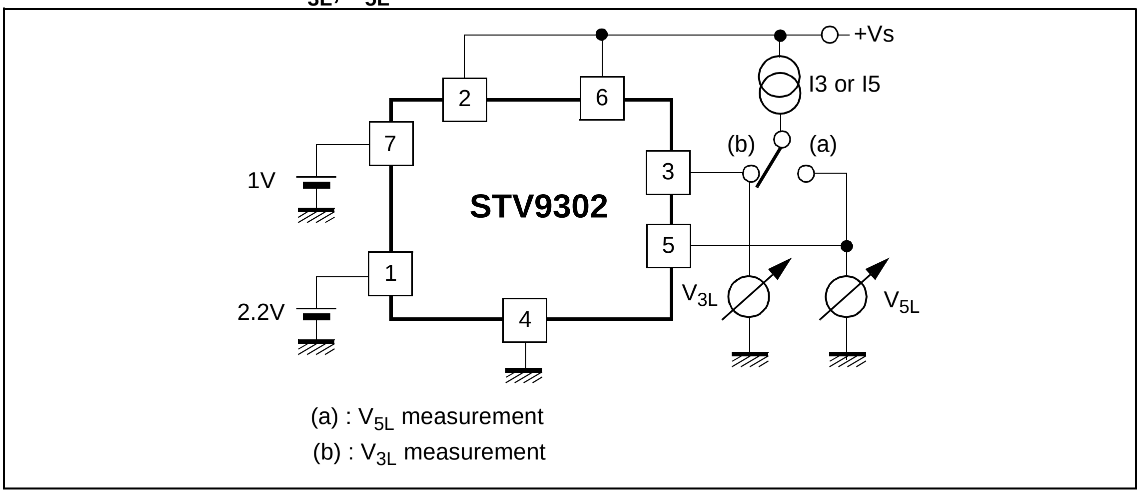


Figure 3. Measurement of V_{3L}, V_{5L}



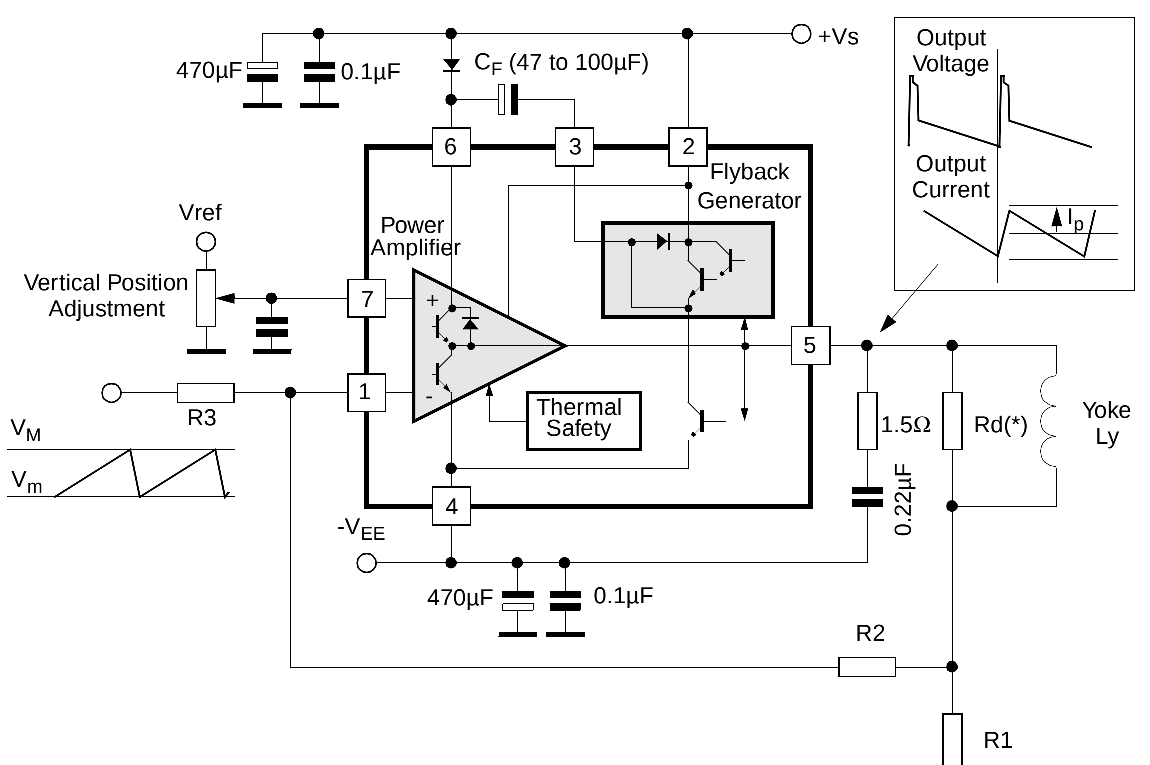
4 APPLICATION HINTS

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



$$\frac{Ly}{50\mu s} < Rd < \frac{Ly}{20\mu s}$$

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:

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

(R_1 is negligible)

  Peak current

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

- Example: for V_m= 2 V, V_M= 5 V and I_P= 1 A

  Choose R_1 in the1 Ω range, for instance R_1=1 Ω

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

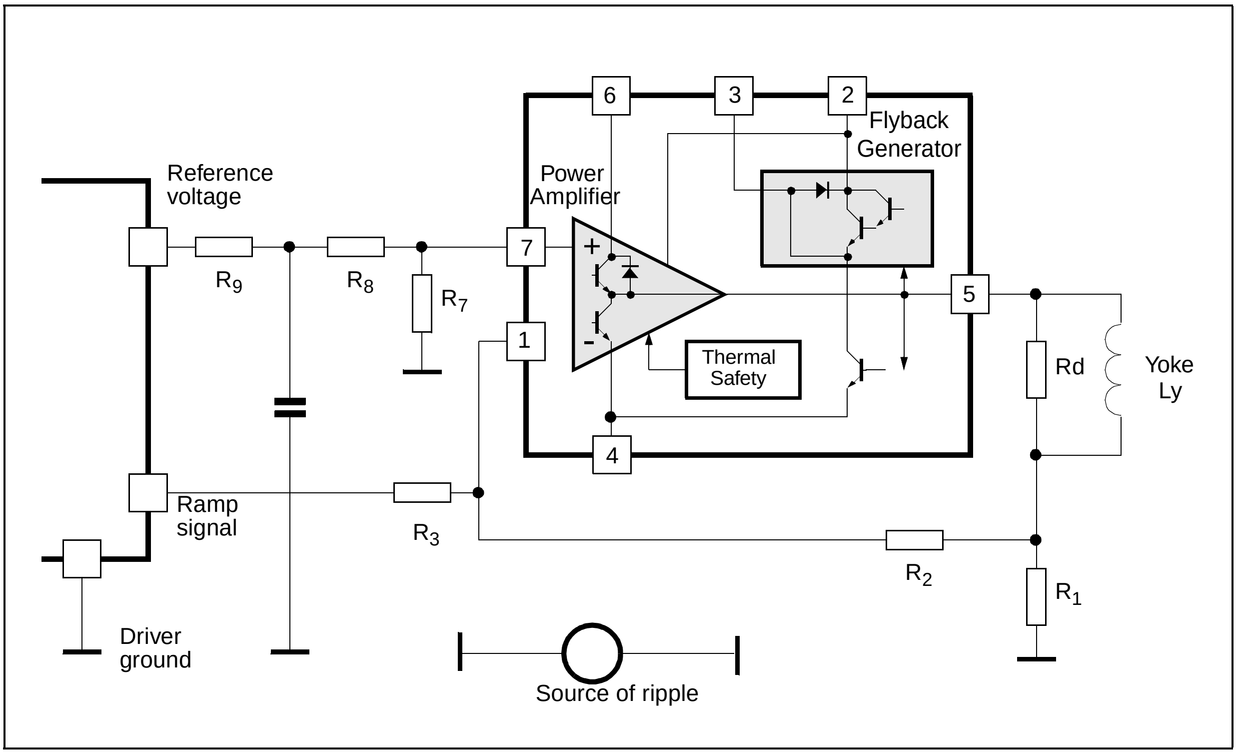
  Then choose R_2 or R_3. For instance if R_2 = 10 kΩ then R_3=15 kΩ
- Finally, bias voltage on pin 7 should be:

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

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.

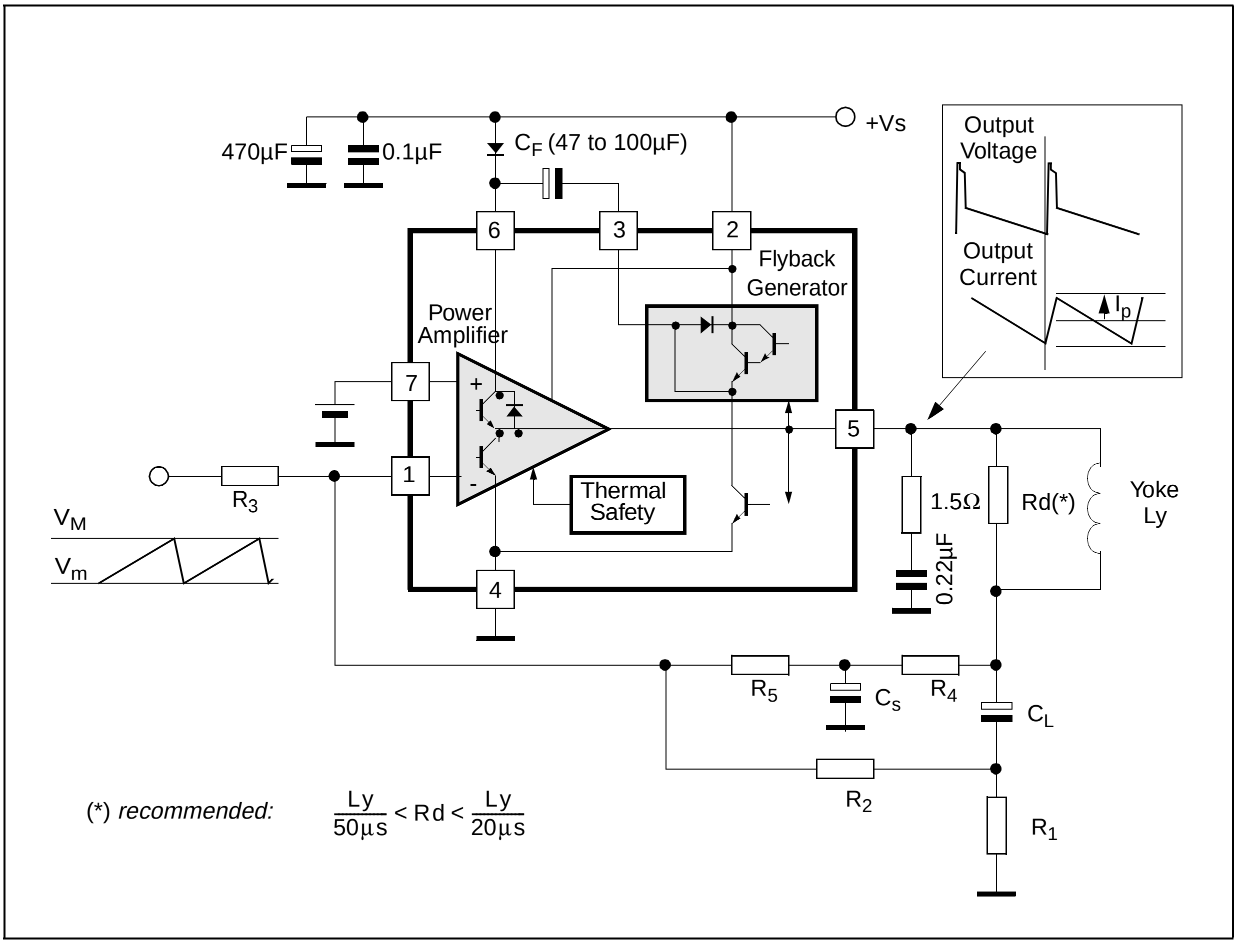
Figure 5. Ripple rejection



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

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

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:

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

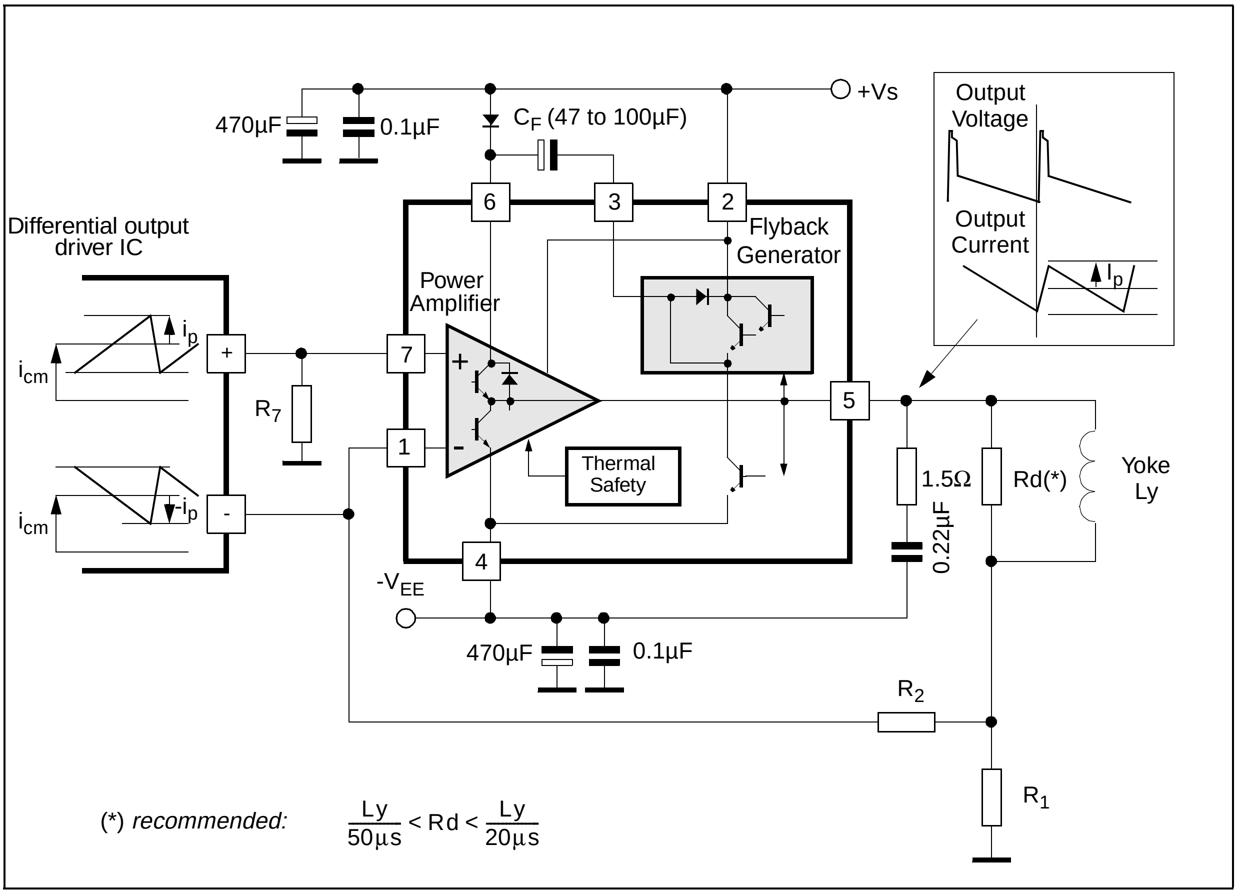
Peak current

Scanning current should be Ip when positive and negative driver outputs provide respectively $i_{cm} - i_p$ and $i_{cm} + i_p$, therefore

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

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



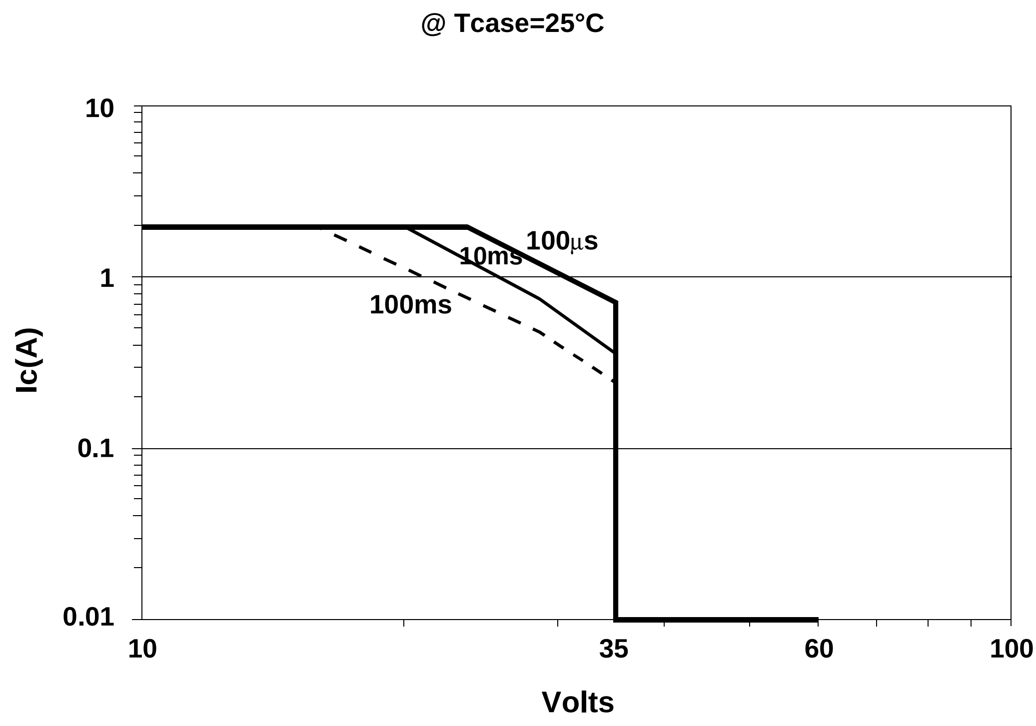
- Example : for i_{cm} = 0.4mA, i = 0.2mA (corresponding to 0.8mA of peak-peak differential current), I_p = 1A

  Choose R_1 = 0.75Ω, it follows R_2 = R_7 = 1.875kΩ.

  Ripple rejection

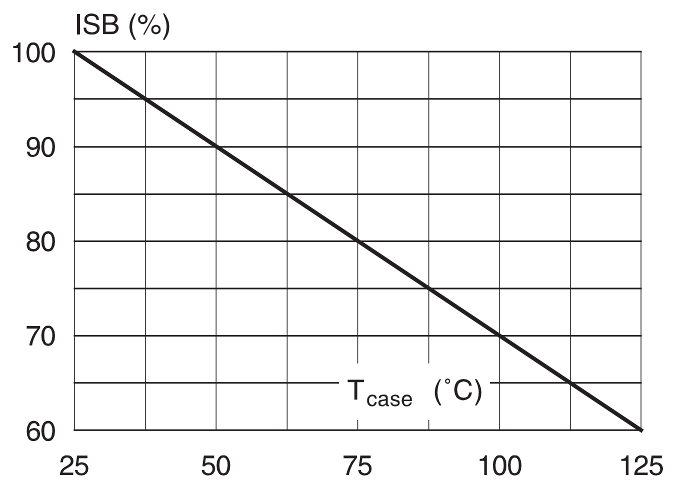
Make sure to connect R_7 directly to the ground side of R_1.

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)

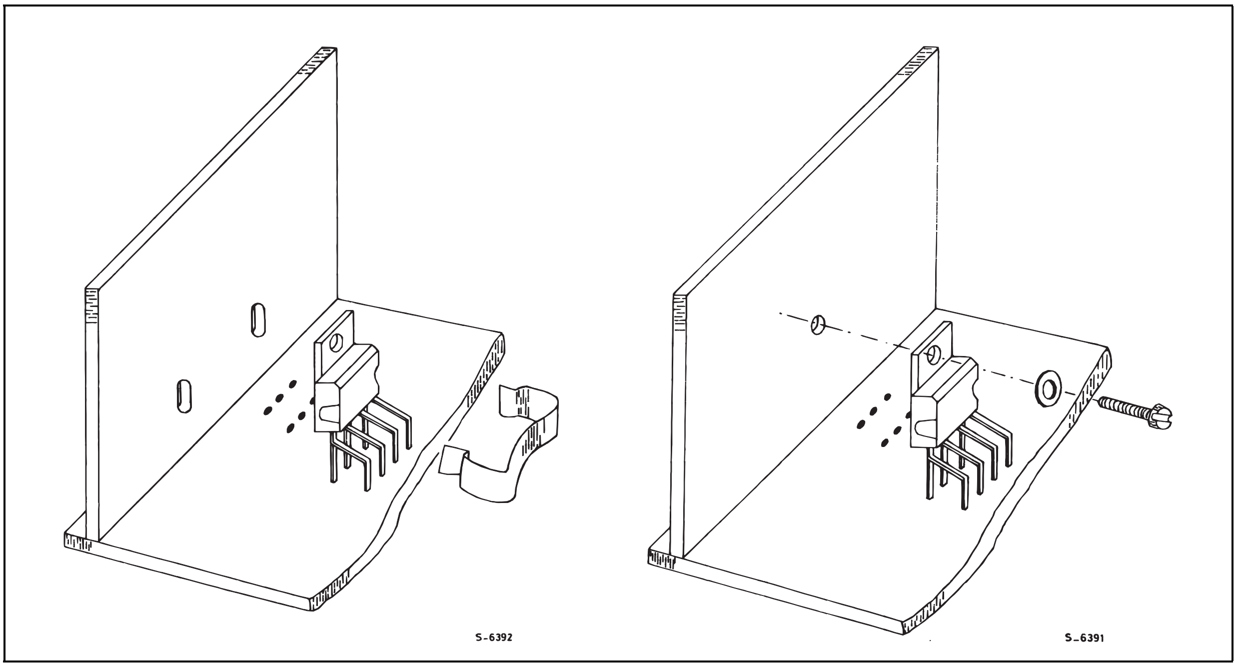


5 MOUNTING INSTRUCTIONS

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

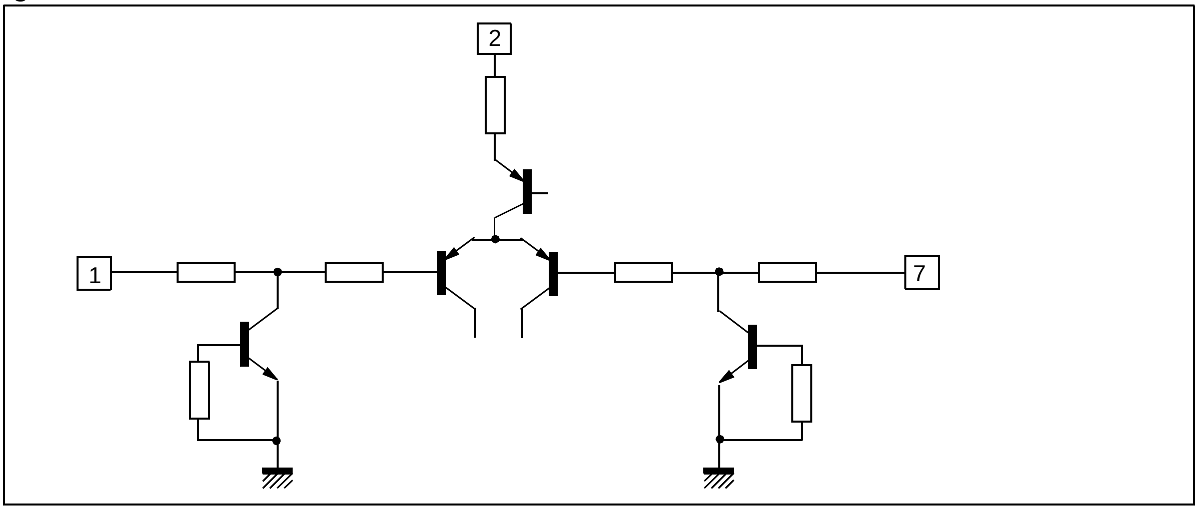


Figure 12. Pin 3

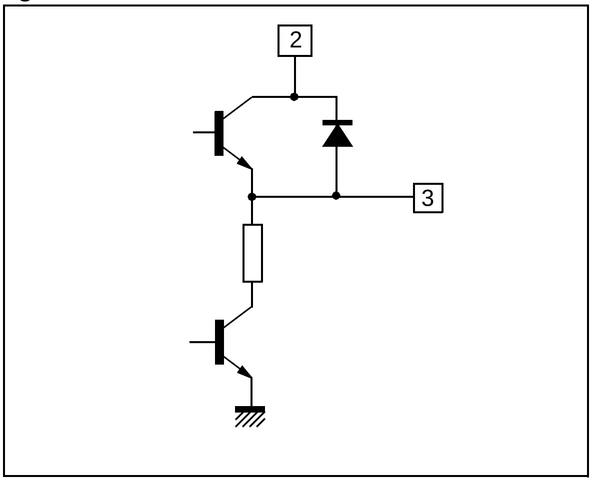
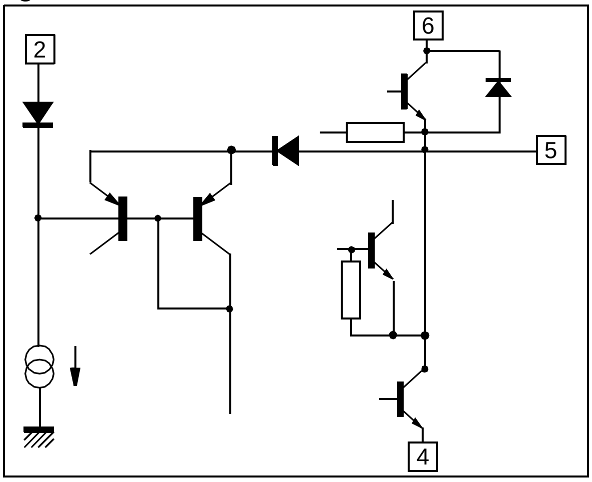
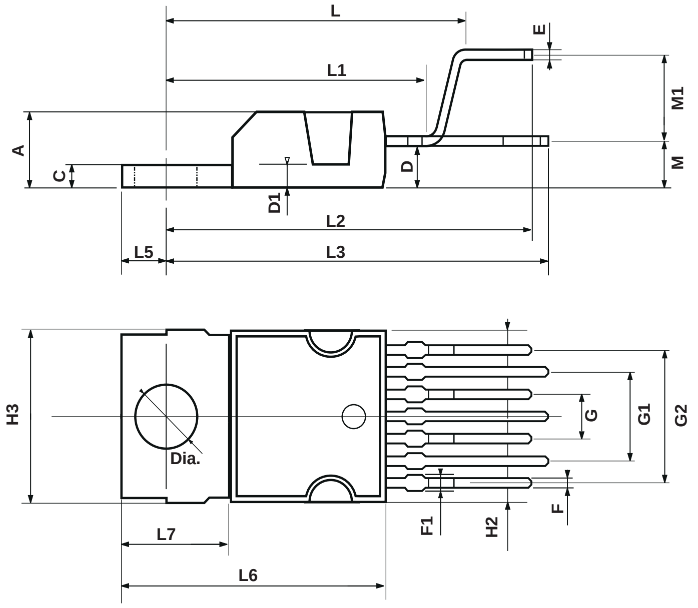


Figure 13. Pins 5 and 6



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