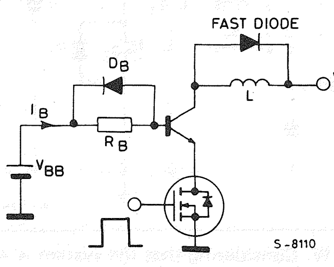
HIGH DEFINITION MONITOR DEFLECTION

A very useful technique to overcome the switching speed limitations of very high voltage bipolar power transistors is to use a low voltage Power MOS device to switch the emitter current of the high voltage transistor. The basic circuit is shown in figure 2.

Fig. 1 - The basic circuit used for the evaluation of the emitter switching system.

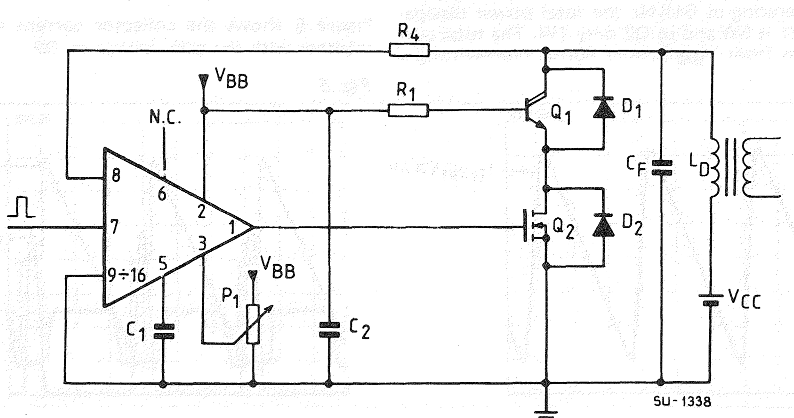


This type of circuit can be cost effective for high performance professional systems.

The base of the high voltage bipolar is fed from a voltage source so that when the emitter becomes open circuit the forward base current ceases and the collector current being forced by the load must flow out of the base. Hence a very high reverse base current is achieved which minimises both storage and fall times.

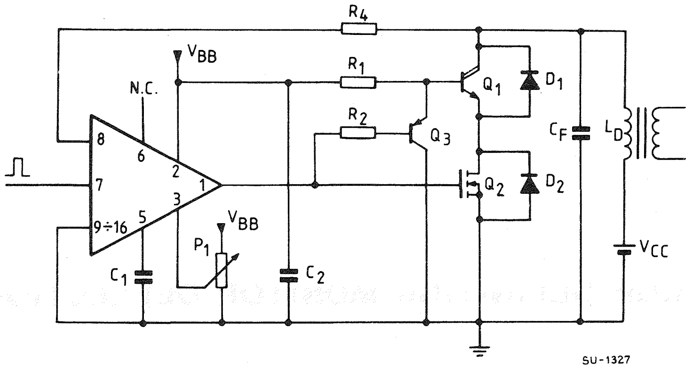
The following circuit has been built where, for convenience, the TDA8140 is used as the control circuit, although many of its features are not exploited. The TDA8140 drives the gate of Q2, an SGSP381, which is a 60V device with an $R_{ds\,(on)}$ of 0.06Ω in a TO-220 package. Q2 switches the emitter current of Q1 which is a 1200V fast switching monolithic darlington, SGSD00052. Using a darlington minimises the required base current and power consumption of the driver stage. D1 and D2 are the internal parasitic diodes of Q1 and Q2 respectively.

Fig. 2



The performance achieved is suitable for a line scan frequency of 64KHz with a deflection current of 6A peak to peak and a 950V flyback voltage. With this circuit one limitation was a nonlinearity of the collector current during the storage time, between when the Power MOS turned off and the current starts to fall. This is due to the 12V V_{BB} being significant compared with the 120V V_{CC}. This was overcome by adding Q3, a PNP fast switching device from Q1 base to ground which holds that point at ground during the storage time.

Fig. 2



However as can be seen in the following waveform this was not entirely successful as Q2 switches off much faster than Q3 can turn on and a 'glitch' still occurs. Adding R3, a 180Ω resistor slows Q2 turn off due to its time constant with the input capacitance of Q2 and a clean switching is achieved.

Fig. 3

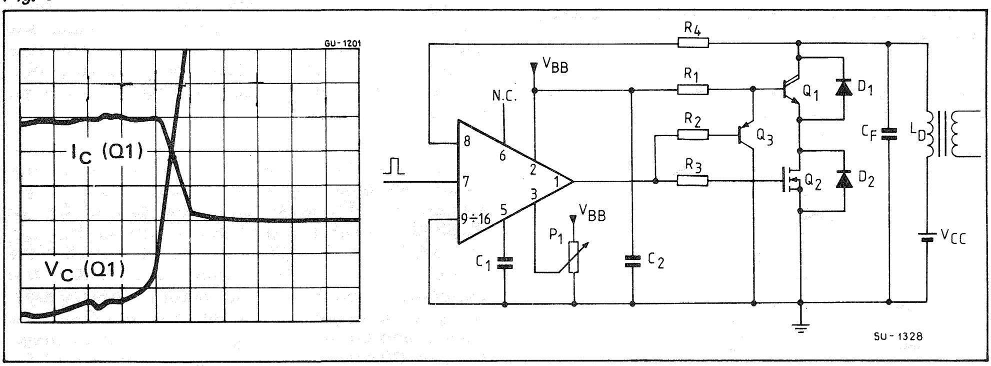


Figure 4 shows the deflection current Q1's storage time CS 1.1µs and the fall time is below 200ns. When operating at 64KHz the total power dissipation in Q1 is 5W and in Q2 only 1W. The total current taken from V_{BB} is only 80mA representing a further 1W. Considering that the system is working at 64KHz this is quite efficient.

Figure 5 shows the collector current and voltage together with the gate voltage on Q2.

Fig. 4

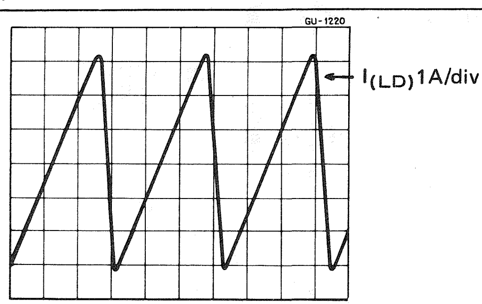
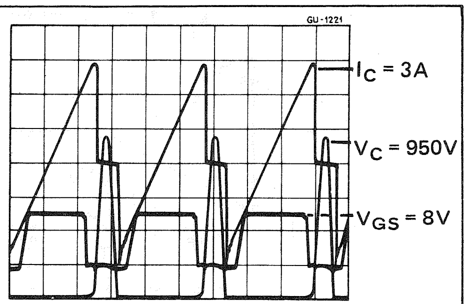


Fig. 5



The parts list is:

C1	15pF	
C2	470μF	40V
IC1	TDA8140	
Q1	SGSD00052	
Q2	SGSP381	
Q3	D45H	
R1	180	1W
R2	3.3	1/4W
R3	180	1/4W
R4	680K	1/2W
P1	500K	
Ld	250μH	
Cf	3.3nF	

CONCLUSION

For many applications transistors with 1200V rating can be used with adequate safety margin. The SGSF444 is ideal for small screen 90° deflection, working with I_C around 3A. The SGSF464 is a larger device for operation at currents around 5A, a lower current device SGSF424 will also be available. The availability of these fast switching devices in the easy to mount ISOWATT218 package, for example SGSIF444, offers further improvements in overall cost and reliability.

For very high performance applications in professional systems the use of more sophisticated circuits with emitter switching merit investigation.