Jaycar Electronics **Specialists in electronic kits, components and products.**

KC5443: KIT – IGNITION COIL DRIVER (KC5442)

Silicon Chip Magazine March 2007 (p16 – p27), April 2007 (p66 – p78), May 2007 (p74 – p83)

Batch No: 7W1112

Rev 1.1

Customers please note:
This project is designed to operate in conjunction with the Programmable Ignition System KC5442.
Some case processing and mounting hardware is required.

PLEASE READ BEFORE COMMENCING CONSTRUCTION

The guarantee on this kit is limited to the replacement of faulty parts only, as we cannot guarantee the labour content you provide. Our Service Department does not do general service on simple kits and it is recommended that if a kit builder does not have enough knowledge to diagnose faults, that the project should not be started unless assistance can be obtained. Unfortunately, one small faulty solder joint or wiring mistake can take many hours to locate and at normal service rates the service charge could well be more than the total cost of the kit.
If you believe that you may have difficulty in building this kit (which is simply a complete set of separate parts made up to a list provided by the major electronics magazines) and you cannot get assistance from a friend, we suggest you return the kit to us IN ITS ORIGINAL CONDITION for a refund under our satisfaction guarantee.
Unfortunately, kits cannot be replaced under our satisfaction guarantee once construction has been commenced.

CONTACTS:

For queries with regards to the design aspects of this kit please contact the Project Designer. It is recommended to check the designers/publishers website for further notes and errata since this document was issued.
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For **quality issues** please contact the **Production Manager** at Jaycar Electronics and provide the following information:

- Product Number
- Batch No
- Details of Quality Issue

Notes and Errata (at time of print):
It is recommended to check the designers/publishers website for further notes and errata since this document was issued, before starting construction.
None.

Possible Substitutions			
Original Part	**Original Part Desc**	**Subst Part**	**Subst. Part Desc.**
N/A			

PARTS LIST
Please note that catalogue numbers refer to suitable products from the Jaycar product range. Quantities listed refer to the actual number of items required. When purchasing items separately, take pack quantities into account.
[1] *See section about Substitution* [2] **See section about Notes & Errata** [3] Processed Panel not part of Case listed
Catalogue numbers starting with "E" or listed as "Special Order" (incl. processed panels) are Kit specific and may not be readily available.

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RESISTOR(S)

Cat.#	Qty*	Description	Component Ident And/Or Location
HP1250	4	PIN PCB 0.9MM GLD	
RR0564	1	RES 0.5W MTL 470R 1%	Yellow Purple Black Black Brown
RR0574	1	RES 0.5W MTL 1K2 1%	Brown Red Black Brown Brown
RR3274	1	RES 5W W/W 100R	5W 100R

CAPACITOR(S)

Cat.#	Qty*	Description	Component Ident And/Or Location
RC5336	1	CAP CER NPO 1N 50V 10% P=5MM	1n / 1000p / 102

SEMICONDUCTOR(S)

Cat.#	Qty*	Description	Component Ident And/Or Location	
EZ8870	1	TRAN BU941P DARLINGT NPN 400V 10A TO218	BUP941	Q1
HP1174	1washer & 1bush	MNT KIT RUB TO3P		
ZR1480	4	DIODE ZENER 1N5374 75V 5W	1N5374 (75V)	ZD1-ZD4
ZT2115	2	TRAN BC337/BC877 NPN 50V 800MA TO92	BC337	Q2, Q3

HARDWARE / WIRE(S) / MISCELLANEOUS

Cat.#	Qty*	Description	Component Ident And/Or Location
EB2256	1	PNL ALU (KC5443) 51X91X2MM	
EC8251	1	PCB (KC5443) NTN 05104072 39X40MM 03/07	With overlay
HB5060	1	ENCL BOX DIECAST 51X51X32.0MM	
HP0141	1	SCREW NYLON M3X12MM PHIL R/HD WHT	Cut to size
HP0146	1	NUT NYLON M3 WHT	
HP0403	1	SCREW M3X10MM PHIL R/HD SP	
HP0407	4	SCREW M3X15MM PHIL R/HD SP	
HP0425	5	NUT M3 SP	
HP0433	5	WASHER MTL M3 S/PRF INT/T SLV	
HP0725	2	CABLE GLAND IP68 4-8MM	
HP0921	4	SPACER NYLON TAPPED HEX M3X6.3MM	
HP1350	2	LUG SOLDER TIN ID4.3XID2X17.6MM0	
NS3015	1m	SOLDER 60/40 1MM	
WH3040	2m	CABLE HU RND 24X0.2MM H/D RED	
WH3041	2m	CABLE HU RND 24X0.2MM H/D BLK	
WH3042	2m	CABLE HU RND 24X0.2MM H/D GRN	
WH3050	2m	CABLE HU RND 32X0.2MM H/D BRN	colour may vary
WH5531	10cm	HEATSHRINK 2.5MM X 1.2M BLK	colour may vary
WW4032	6cm	WIRE TIN CU 0.71MM 22AWG	

Programmable Ignition System For Cars:

Coil Driver Module

By John Clarke

The text presented here is extracted from the Programmable Ignition System for Cars published in the Mar - May 2007 issues of the Silicon Chip Magazine.

Ignition coil driver

Fig.5 shows the ignition Coil Driver circuit. It's fairly straightforward and is based on transistors Q1-Q3. Q1 is a Darlington transistor specifically made for ignition systems. It's capable of handling currents in excess of 10A and voltages exceeding 400v. As shown, four 75v Zener diodes (ZD1-ZD4) are connected in series between its collector and emitter terminals. These protect the transistor from excess voltages by clamping its collector at 300v, which is well within its rating. The circuit works like this: when the input signal is low (or there is no signal), transistor Q3 is off, Q2 is on (due to base current through the 1.2kOhm resistor) and Q1 is off. Conversely, when the input subsequently switches high, Q3 turns on and switches Q2 off by pulling its base to ground. As a result, Q1 turns on and current flows through the primary winding of the ignition coil. The ignition input signal now subsequently switches low again and so Q3 immediately turns off due to the 470Ohm resistor between its base terminal and ground. And when that happens, Q2 switches on and Q1 switches off, interrupting the current through the ignition coil. As a result, the coil's magnetic flux rapidly collapses and this generates a high voltage in the secondary to fire one of the spark plugs. The 1nF capacitor on Q3's base is there to suppress any RF signals that may otherwise be injected when the current through the ignition coil is interrupted (ie, when Q1 switches off).

Resistor R1 is included to make the module more versatile. in our application, r1 is not used and is replaced with a wire link. For other applications, where a separate ignition coil driver is required, r1 will be required. Typically, a 470Ohm resistor would be used for a 5V drive signal, while a 1.2kOhm resistor would be used for a 12V drive signal. Finally, the module can also be configured to drive transistor Q1 when the input signal switches low. in this case, Q3 is left out of circuit and a link installed between the pads on the PCB for its base and collector leads. The 1.2kW resistor pull-up is also removed from circuit.

Construction

The PCB for the Ignition Coil Driver module (code 05104072, 40 x 39mm) is housed in a diecast case measuring 51 x 51 x 32mm.

Fig.17 shows the assembly details for this small PC board. Begin by installing the wire link, then install the 1.2kOhm and 470Ohm resistors. The 100Ohm 5W resistor can then go in – it should be mounted all the way down onto the PC board, so that it cannot vibrate and break its leads. Zener diodes ZD1-ZD4 are next on the list. Be sure to orient them as shown (two face in one direction and two in the other, so take care here). Follow these with transistors Q2 & Q3 and the 1nF ceramic capacitor. Transistor Q1 is mounted on the underside of the PC board. This device is installed with its leads bent up through 90°, so that they go through matching holes in the PCB from the track side (ie, the metal tab of the device faces away from the board – see photo). Push the leads through their holes until the metal tab is exactly 6mm below the underside of the PCB, then lightly solder one of the leads. This will allow you to make any adjustments as necessary before completing the soldering. Finally, complete the board assembly by installing PC stakes at the four external wiring points. Once completed, the Ignition Coil Driver PC board can be installed in its diecast case – see Fig.18. As shown, the board in mounted on the lid of the case on 6mm tapped spacers and secured using M3 x 15mm screws, nuts and star washers. Transistor Q1 (on the underside of the board) is fastened to the lid for heatsinking. The first step is to mark out all the mounting holes on the lid. Drill these holes to 3mm, then carefully deburr them using an oversize drill. In particular, make sure that Q1's

mounting hole is perfectly smooth and free of any metal swarf that could puncture its insulating washer. Note too that Q1's mounting hole should be chamfered (use an oversize drill bit). this is necessary to avoid sharp edges around the circumference of the hole, to prevent arcing through the insulating washer (due to the high voltages present on the transistor tab).

Next drill pilot holes into the case base for the cable glands. The cable glands must be mounted as close as possible to the bottom of the base. Enlarge the holes to match the mounting diameter of the glands. **Position the internal locking nuts as shown in the photo and remove sufficient material so that the PCB assembly fits into the base.** Finally drill a 3mm hole close to bottom of the base for the earth lug.

Once the holes have been "cleaned up", fit the four tapped spacers to the board mounting positions and secure them using the M3 x 15mm screws. That done, install transistor Q1's nylon mounting screw and insulating washer (see photo), then slip the board into position and secure it using M3 nuts and star washers. Don't leave the star washers out – they are necessary to ensure that the nuts don't shake loose due to vibration. **You may need to trim the PCB corners so that it mounting pillars in the case.** Transistor Q1 can now be secured by installing its nut and tightening the nylon screw (use a pair of needle-nose pliers to hold the nut in position while you "start" the screw). Finally, use your multimeter (set to a low ohms range) to confirm that Q1's metal tab is indeed electrically isolated from the case lid (you should get an open-circuit reading).

The earth supply lead goes to a crimp eyelet and this is secured to the inside of the case using an M3 x 10mm screw, star washers and nut. This screw secures a similar eyelet and earth wire arrangement on the outside of the case (this wire goes to the vehicle chassis). As shown in Fig.18, the remaining wires exit via the cable glands. Cover these leads with heatshrink tubing at the exit points and note that the signal lead must pass through its own separate gland, while the ignition coil (-) lead and the +12V lead pass through a second gland. Note that, in addition to the heat-shrink, these leads may require packing out with tubing so that they are tightly clamped by the glands. **The signal lead must at all times be kept clear of the ignition coil (-) wire to prevent retriggering as the coil fires. Be sure to take it out through its own cable gland and route it well away from the ignition coil wire – see Fig.18.**

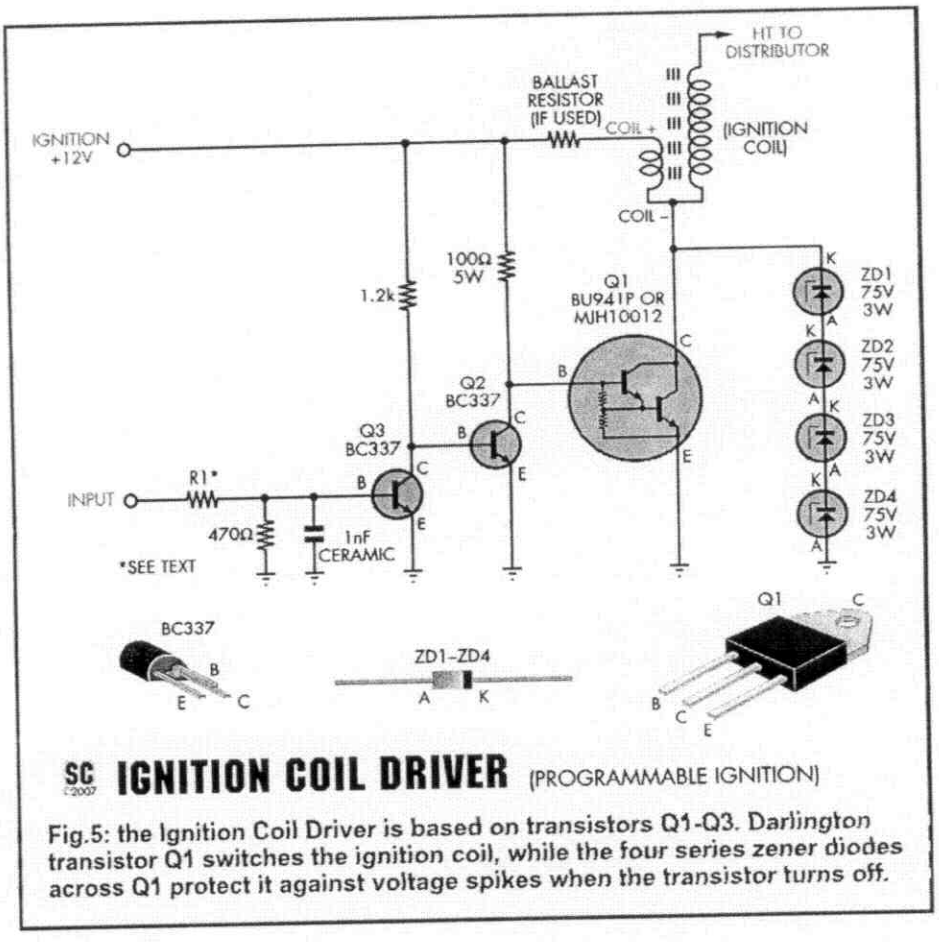
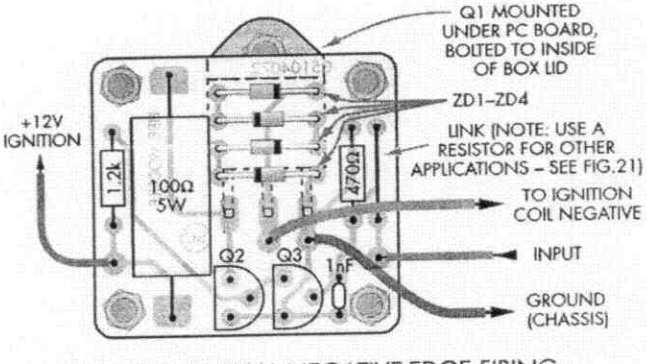


Fig.5: the Ignition Coil Driver is based on transistors Q1-Q3. Darlington transistor Q1 switches the ignition coil, while the four series zener diodes across Q1 protect it against voltage spikes when the transistor turns off.



WIRING FOR NORMAL NEGATIVE-EDGE FIRING

Fig.17: this is the parts layout for the Ignition Trigger Module. Note the different orientations for ZD1-ZD4.

***The metal tab of the Darlington transistor (Q1)* must be insulated from the case using a TO-218 insulating washer and a Nylon screw and nut.**