Techniques

ACTUALLY DOING IT!

by Robert Penfold

AS pointed out at least once previously, letters from readers who are having problems with projects that refuse to work are relatively rare these days. Although the general level of sophistication of published projects has steadily risen over the years, much of this sophistication is handled by complex integrated circuits.

The number of components in the average project has probably changed little over the years. This factor, coupled with increased use of custom printed circuit boards, means that modern projects are generally easier to construct than those of twenty or so years ago.

Beginners Luck

This is good news for beginners at electronic project construction, as they have a relatively good chance of constructing a project that will work first time. Feedback from readers would tend to suggest that the main problem these days is in locating and identifying the right components, and that assembling the components into a finished project is the easy part! In truth there should be no major problems in obtaining and identifying components provided you go about things the right way.

I make no excuse for repeating the much given advice that a couple of the larger component catalogues should be regarded as an essential part of the hobby. They may cost a few pounds to buy, but this is money well spent.

The larger catalogues contain a wealth of useful data and illustrations, and beginners can learn a great deal from them. Obtaining the components you need is always going to be an uphill struggle without the aid of one or two decent component catalogues.

It may be stating the obvious when I suggest reading the articles describing the projects you intend to build, but a certain percentage of queries from readers requests information that is provided in the articles concerned. In the case of projects in *EPE* you should also consult the *ShopTalk* feature, which gives buying advice for any out of the ordinary components used in that month's projects.

With any project it is worthwhile ensuring that you can obtain any unusual components before buying the rest of the parts. With older designs it is essential to do so, as it is quite likely that any components that were out of the ordinary several years ago will be totally unobtainable now.

It may be possible to track down obsolete semiconductors for an old design, and there are one or two companies amongst the advertising pages that specialise in this type of thing. The problem with many of these components is that their current prices are often quite high, and they can be as much as ten times their original price. They are mainly sold as spares for existing equipment, and are not necessarily a realistic prospect for new projects.

Numbers Game

Semiconductor type numbers seem to cause a certain amount of confusion, and not just to beginners! In fact they are probably the main cause of difficulties when trying to identify and buy the correct components.

The problem stems from the fact that many semiconductors are produced by more than one manufacturer. In an ideal world the type number would be exactly the same regardless of the manufacturer, and with most semiconductors this is indeed the case. A BC549 transistor is always a BC549 transistor, no matter which company manufactured it.

Most of the confusion with transistors and diodes occurs because the actual devices are often marked with a few numbers and letters in addition to the type number. These extra characters are usually of no practical importance, and simply indicate the name of the manufacturer, the date of manufacture in some highly cryptic form, a batch number, or something of this nature. Extraneous numbers and letters are to be found on capacitors and many other components, but you soon get used to sorting out the "wheat from the chaff."

Some transistor type numbers carry a suffix letter, and this can sometimes be of importance. This suffix letter is "A", "B", or "C", and indicates the gain group of the device ("A" is the lowest and "C" is the highest). A BC549C for example, is a BC549 transistor in the highest gain group.

If a particular gain group is specified in a components list, then it is important that a device having the appropriate suffix letter is used. In all other cases it is acceptable to use a device having any suffix letter, or no suffix at all.

It used to be quite common for transistors to have a suffix letter which indicated that a different leadout configuration was used for that particular version of the device. This type of thing is less common these days, and it is now the norm for each version of a device to have its own type number. However, some of the older devices having a suffix letter are still available and in use today.

The only common examples are the BC182/3/4, and BC212/3/4 series, which are available with and without an "L" suffix. Fig.1 shows the leadout configurations for the "L" suffix and non-suffix versions of these transistors.

As is the convention for transistors, thyristors, etc., Fig.1 shows base views (i.e. the device viewed with the leads pointing towards you). The only difference between the two types is the leadout configuration, so they are interchangeable, provided you are careful to get them connected correctly.

On the other hand, mistakes are less likely to be made if you obtain the right type. There should be no difficulty here, as the "L" suffix and plain versions are both readily available.

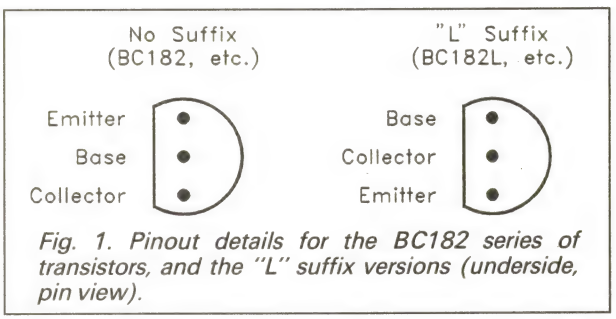

Fig. 1. Pinout details for the BC182 series of transistors, and the "L" suffix versions (underside, pin view).

Some Confusion

From time-to-time, letters are received from readers who are having difficulty in getting J-f.e.t. transistors connected correctly. The main offenders seem to be the 2N3819, and the BF244. The latter is also available with "A" and "B" suffix letters, but these are equivalent to the gain grouping of some bipolar transistors, and do not indicate a different leadout configuration.

The initial cause of confusion over J-f.e.t. leadouts was caused by the drain (d) and source (s) terminals being transposed on the leadout diagrams in the initial 2N3819 data sheets. Apparently some circuits functioned quite well despite the fact that the 2N3819 was connected around the wrong way!

More recently, confusion has arisen due to the introduction of a different case style having a totally different leadout configuration. Leadout diagrams for both types are shown in Fig. 2.

As the encapsulations are different for the two types, it should be obvious which particular version you have,

even though the type numbers would seem to be exactly the same for both versions.

Integrated Numbers

Probably most of the confusion over type numbers occurs with integrated circuits (i.c.s). Many integrated circuit type numbers are devised by individual manufacturers, and are not standardised in the same way as most transistor and diode type numbers.

This is fine for integrated circuits that are only produced by a single manufacturer, but most devices are produced by two or more manufacturers. This often leads to an i.c. being produced under several similar type numbers.

Many integrated circuit type numbers break down into *three* sections. First there are one, two, or three letters which identify the manufacturer.

For example, devices produced by RCA usually have the letters "CA" at the start of the type number. Table 1 gives details of some of the prefixes used by some of the larger semiconductor manufacturers.

Next there is a three or four digit number, and this is the actual type number.

Finally, there is usually a one or two letter suffix which indicates the type of encapsulation. Devices used by the home constructor are generally in a d.i.l. (dual-in-line) plastic encapsulation, and have either a "C", "N", "E", or "P" suffix.

A "Components List" might just give the basic type number, or it could give a full type number. For example, the popular 741 operational amplifier (op.amp) might be specified as a "741", or as something like a μA741C.

Table 1:

PREFIX	*MANUFACTURER*
AD, OP	Analogue Devices
CA, CD	RCA
HA	Harris Semiconductors
ICL, ICM	Intersil
LM, LF, LH	National Semiconductors
LT	Linear Technology
MAX	Maxim
MC	Motorola
NE, SE	Signetics
SN,TL	Texas
SP,SL	Plessey
TS	Teledyne Components
μA	Fairchild
Z	Ferranti

Similarly, in component catalogues a 741 might be listed as such, or under a specific type number, or both. This could obviously lead to confusion, with the same basic type number being used for totally different devices.

In practice this is rarely a problem, but it is a potential pitfall. The components lists in *Everyday Practical Electronics* specify the basic function of each semiconductor (Bifet op.amp, quad 2-input NAND gate, etc.).

This should avoid any problems with the wrong device being ordered. If a component in a catalogue has the right basic type number and function, then you can be fairly certain that it is the device you require.

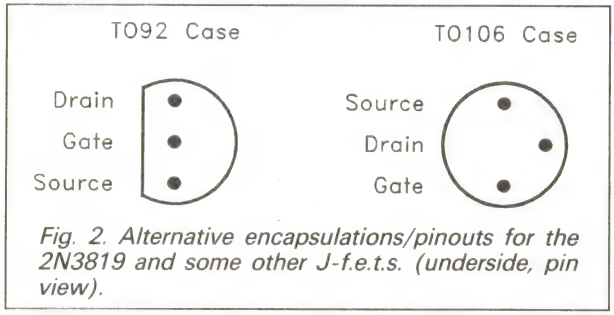

Fig. 2. Alternative encapsulations/pinouts for the 2N3819 and some other J-f.e.t.s. (underside, pin view).

Logical Numbers

TTL logic devices differ slightly from the standard scheme of things. The original series of TTL chips conform to the standard setup, and have the 74** number sandwiched between the manufacturer's prefix and what is usually an "N" suffix to denote a plastic d.i.l. encapsulation.

As various series of improved TTL chips were introduced, they had two or three letters added into the middle of the type numbers. These extra letters indicate the logic family of each chip.

For example, the 7408 is the original TTL quad 2-input AND gate, the 74LS08 is the low power Schottky version, and the 74HC08 is the high speed CMOS version.

The compatibility (or lack of it) between TTL logic families is a complex matter, and is something that beginners should not become embroiled with. Only use the exact type specified in a components list, and do not be tempted to a type from the wrong logic family.

Genuine "Duds"

Some readers worry about the type numbers on i.c.s differing slightly from what they ordered. I suppose that strictly speaking if you order (say) an LF351N op.amp, then you should be supplied with a genuine LF351N, and not an exact equivalent such as a KF351N.

Not unreasonably, retailers tend to buy semiconductors from the firm offering the best price, and this can lead to alternatives being supplied. This is of no practical consequence to the consumer. You are getting exactly the same device, but from a different manufacturer and under a slightly different type number.

Where an alternative device is supplied, the retailer should make this clear on the invoice, or in a simple explanatory note supplied with the order. If in doubt, an enquiry to the retailer should soon ascertain whether the devices supplied are proper alternatives to the devices you ordered, or the wrong goods have been supplied in error.

About 25 to 30 years ago there were problems with sub-standard or even totally non-functioning devices being relabelled to look like the "real thing", and sold as such. At one time there was quite a major problem with these so-called "genuine duds."

It would seem that this practice has returned recently, but it only seems to be the more expensive chips, particularly some microprocessors and memory chips, that are the subject of this scam. Most of the semiconductors used in electronic projects cost a few pence when bought in bulk, and there is presumably no point in counterfeiting such low cost items. Any semiconductors you buy will be of good quality and the "genuine article."