



# *Phase Linear Corporation*

20121-48 Avenue West  
Lynnwood, Washington 98036 USA  
206 774-3571 TWX 9104492851

## SERVICE BULLETIN

1-76  
rev 6-81

SUBJECT: Replacement of Transistor 2N5401

Our statistics and quality control have revealed that in later use of Motorola transistor 2N5401, excessive breakdown occurred with the PL14 series of model 400 and 700B drive PC boards. Therefore, any 2N5401 transistor which has failed should be replaced with Motorola transistor MPS A93 (Phase Linear part no. 126-0028).

In all models of 700B and 400 which contain any of the PL14 series of drive PC boards it is advisable to replace Q3 and Q4 in both channels even though the channel(s) may be operable. If MPS A93 is already used for Q3 and/or Q4, replacement is not necessary unless the device is defective. Q3 alternately used MPS A93 or TIS93 depending on the production run and either is permissible. Q4 should only be replaced with MPS A93 and nothing else.

Q1 and Q2 will accept either TIS97, GES97 or 2N5172 as suitable parts, although both will want to be the same number since the matching of these two differential transistors will determine offset voltage at the output of the amplifier (see OFFSET VOLTAGE under the TROUBLESHOOTING AND ALIGNMENT section of the service manual).

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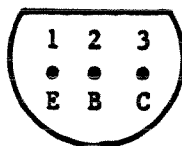
6-76  
rev 6-81

Subject: TO-92/TO-18 Transistor Pin Patterns

All Phase Linear products incorporate one or more type of the small plastic case TO-92 or TO-18 packaged transistors. Unfortunately these do not all have the same pin configuration and since different pin pattern transistors are interchangeable we feel that a few diagrams are in order.

These types of transistors fall into two basic categories: in-line or TO-92 as shown in diagram 1, and triangular(offset) or TO-18 as shown in diagram 2. These pin configurations apply to the transistors listed below each diagram, but not necessarily to any transistor made in that package. BE SURE TO CHECK THE PIN PATTERN WHENEVER REPLACING A TRANSISTOR WITH ONE OF A DIFFERENT NUMBER OR PACKAGE. The most commonly confused are the MPS5172 replaced with GES97 or TIS 97, and GES93 or TIS 93 replaced with a MPS A93. To further complicate matters, a few years ago GE changed the pin pattern on the GES97 and GES93 transistors, two of our most commonly used. Therefore both of these devices were used in both in-line and triangular packages. It is important that these be examined for proper installation if being used as a replacement part.

NOTE: For example, if you've just replaced Q1 and/or Q2 in a PL14 PCB and the amp seems to work okay except for ten or fifteen volts of offset, you've stuffed them in backward.



Bottom View

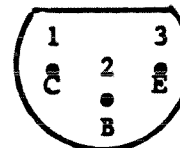


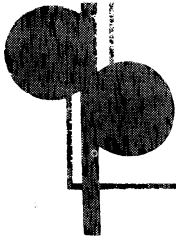
Diagram 1  
TO-92

MPS A93  
MPS A55  
GES97 (later versions)  
GES93 (later versions)  
MPS5172  
MPS A18  
2N5401 (obsolete)  
3569  
4355  
8599

Diagram 2  
TO-18

TIS97  
GES97 (earlier versions)  
TIS93  
GES93 (earlier versions)  
KAL778\*

(\*in-line version of KAL778 but has triangular pin pattern, i.e., pins 1-2-3 are C-B-E, respectively.)



*Phase Linear* CORPORATION

20121 - 48th Avenue West, LYNNWOOD, WASHINGTON 98036 U.S.A. Telephone: (206) 777-1111

SERVICE BULLETIN

SUBJECT: GES 97 pin out change.

GE has recently discontinued the triangular or off-set pin configuration (TO-18) used on their GES 97 transistor and changed it to the in-line pin configuration (TO-92). The GES 93 will also be changed in the future. The two versions look identical except for the pin out so be sure to check the pin configuration before installing a GES 97 or GES 93 in one of our products.

BOTTOM VIEW



TRIANGULAR (TO-18)

GES 97  
TIS 97  
GES 93  
TIS 93  
KA 1778\*



IN-LINE (TO-92)

GES 97  
TIS 97  
2N5401  
MPS A-42  
MPS A-55  
MPS A-93  
MPS 5172  
MPS 8599  
FPN 3569  
FPN 4355  
KA 1778\*

\*The in-line version of the KA 1778 has the same pin out as triangular package.