

May 1964

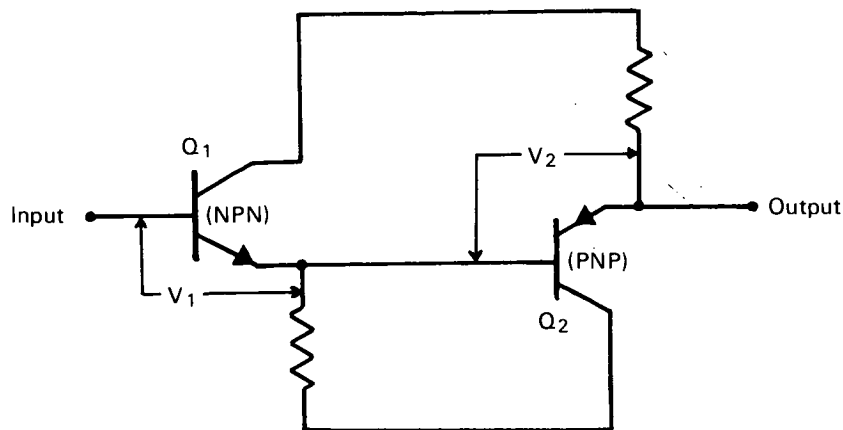
Brief 63-10493

# NASA TECH BRIEF



This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the NASA space program.

## Two-Stage Emitter Follower Is Temperature Stabilized



**The problem:** To design a temperature-stabilized emitter-follower circuit. The output voltage of a transistor used in the conventional emitter-follower circuit varies with environmental temperature changes.

**The solution:** A two-stage circuit employing one NPN and one PNP transistor. Voltage variations due to temperature changes in the first stage are canceled by variations of equal magnitude and opposite polarity in the second stage.

**How it's done:** The two transistors are connected as shown in the circuit diagram. An increase in temperature will cause the base-to-emitter voltage  $V_1$  of NPN transistor  $Q_1$  to become less positive. The base-to-emitter voltage  $V_2$  of PNP transistor  $Q_2$ , on the other hand, will become less negative to a nearly equal degree, so that the temperature-induced variations in  $V_1$  and  $V_2$  will tend to cancel. As a result, the output voltage will remain essentially unaffected by temperature within a prescribed range.

### Notes:

1. In tests employing a 2N780 transistor ( $Q_1$ ) for the first stage and a 2N869 transistor ( $Q_2$ ) for the second stage, the maximum output voltage variation was 30 mv, with an average variation of approximately 25 mv, over the temperature range of  $-20^\circ\text{F}$ . to  $+200^\circ\text{F}$ . No attempt was made to match the characteristics of the transistors used in the tests.
2. For further information about this innovation inquiries may be directed to:  
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Reference: B63-10493

**Patent status:** NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: McDonnell Aircraft Corporation under contract to Manned Spacecraft Center (MSC-20)