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Microsemi
POWER PRODUCTS GROUP
MICROWAVE RF PRODUCTS DIVISION

BYI-1

BYISTOR FOR LINEAR POWER AMPLIFIERS

GENERAL DESCRIPTION

The BYI-1 is a semiconductor device specifically designed for use in linear amplifier bias circuitry. The byistor acts as a low impedance D.C. bias source which has two modes for thermal compensation.

FEATURES

- The package can be physically attached to the same heatsink used for the RF Power Transistors
- Contains a diode fabricated like an RF Power Transistor (same material, geometry and diffusion) which provides one mode of thermal tracking
- Contains a silicon resistor which provides a second mode of thermal tracking
- Fabricated and assembled with the same consistency and precision used in building RF Power Transistors.

BYISTOR SPECIFICATIONS

Maximum Injector Current I_j = 500 mA

V_{ir} = 0.85 +/- 0.03 (I_j = 350 mA, I_s = 0, T_c = 25°C)

Resistor = 0.70 +/- 0.12 Ω, (T_c = 25°C)

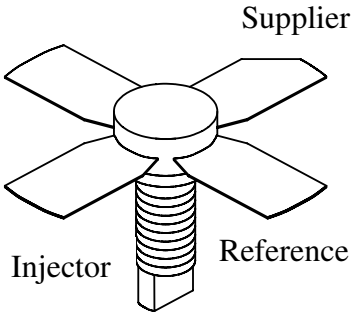
Maximum Temperatures

Storage Temperature	- 65 to +150°C
Operating Junction Temperature	+150°C

CASE OUTLINE

BYI – 1

55FT



BYISTOR – A DEVICE FOR LINEAR AMPLIFIER BIAS NETWORKS

An essential part of any linear solid state amplifier is the D.C. Bias circuitry. The bias circuitry for class AB must meet all of the following basic requirements:

- Provide voltage/current capability compatible with the static (zero RF drive) collector current requirements of the amplifier
- Provide a low impedance voltage source with sufficient current capability to counter the negative rectification effect of the RF drive on the base of the transistor
- Compensate for the drop in the V_{be} of the transistor as a function of increasing temperature (thermal tracking) to eliminate the possibility of D.C. thermal runaway of the amplifier

Microsemi Corp. is delivering a semiconductor device called a BYISTOR, to be used as the key element in a transistor bias network. The advantages of using a BYISTOR are the excellent temperature tracking for D.C. stability and the significantly simplified bias circuit. Furthermore, supplemental emitter resistance is not needed to insure D.C. stability.

Jan 2009

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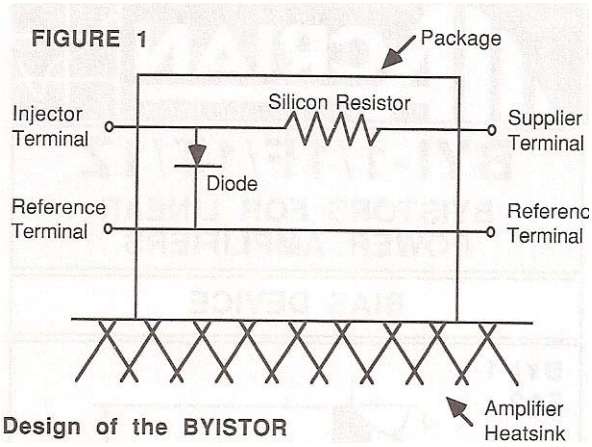
BYI-1

FIGURE 1



Design of the BYISTOR

The key elements of a BYISTOR are:

- A diode fabricated like and RF power transistor (same material, geometry, and diffusion process) for improved temperature tracking;
- An internal silicon resistor to further improve temperature tracking;
- A package that can be physically attached to the same heatsink used for the RF amplifier transistor (available in a variety of stud, flange or flangeless packages)

Fig. 1 shows the basic design of a BYISTOR. By providing a constant current to the injector terminal, the diode acts as a voltage source with approximately 0.3Ω source impedance. The addition of a silicon resistor (approximately 0.7Ω) increases the apparent source impedance of the BYISTOR to approximately 1 Ω.

The silicon resistor increases in resistance, and the diode voltage decreases with increasing temperature. As a result, the source impedance of the BYISTOR increases, and the bias voltage decreases with increasing temperature (see Fig 2 & 3). By mounting the package on the same heatsink as the RF transistor, the BYISTOR will thermally track the transistor and compensate for the reduction in V_{be}. The result is improved D.C. stability of the amplifier and elimination of D.C. thermal runaway of the RF transistor..

Circuit Applications

To effectively use a BYISTOR , it should be mounted on the same heastink and as physically close to the RF power transistor as possible. Connect the bias circuit as shown in Fig. 4 for class AB operation. Provide approximately 350 mA form any convenient voltage into the injector terminal. Then, adjist R2 until the desired static collector current is achieved (increasing R2 increases the V_{be} and increases the static collector current). No further effort is required. The bias circuit using the BYISTOR will now:

*Provide the appropriate static collector current;
*Provide a low impedance D.C. voltage source
*Thermally track the RF transistor and compensate for increasing temperatures, eliminating D.C. thermal runaway problems.

FIGURE 2

Characteristic Performance of a BYISTOR

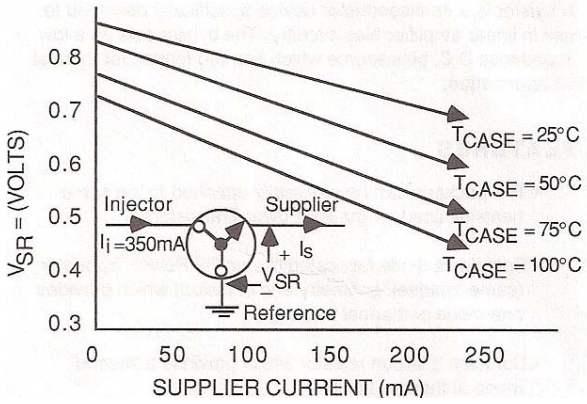


FIGURE 3

Equivalent Output Circuit of a BYISTOR as a Function of Temperature

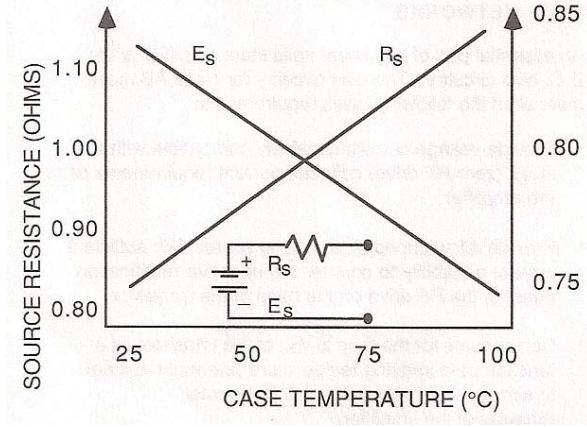
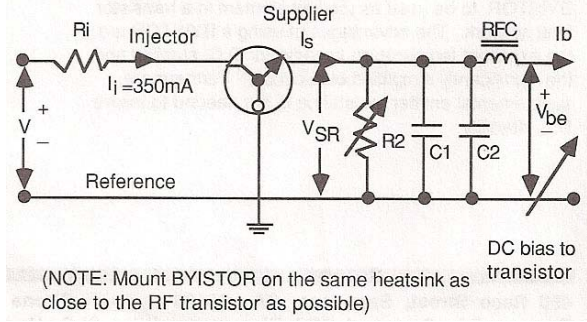


FIGURE 4

Class AB BYISTOR Circuit Application



(NOTE: Mount BYISTOR on the same heatsink as close to the RF transistor as possible)