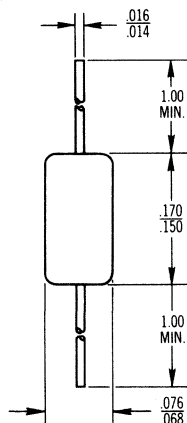
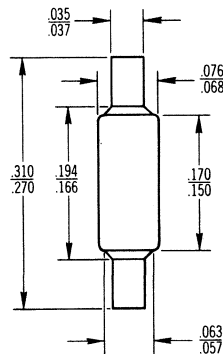


Microwave Mixers and Detectors

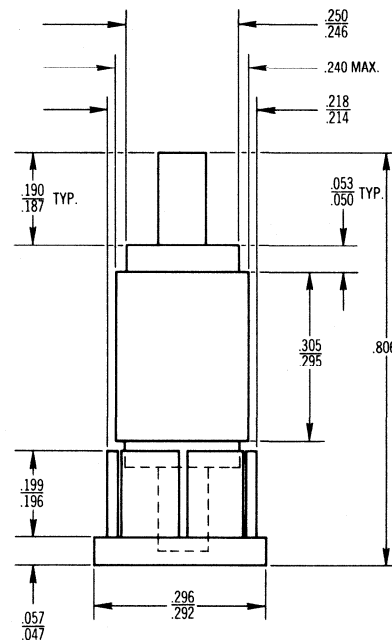
Low and Stable Noise Figure
Uniform and Repeatable RF Characteristics
Microminiature Size
High Burnout Resistance
Large Dynamic Range at High LO Powers
Low IF and Video Impedance
Low 1/f Noise



HP Outline 15



HP Outline 19



HP Outline 20

DESCRIPTION

Hot Carrier Diodes employ a metal-silicon Schottky barrier junction and utilize electrons for majority carrier conduction. The Hot Carrier Diode's performance conforms closely with theory and can be described as closely approximating the ideal diode. HP Application Note 907 contains additional detailed information.

APPLICATIONS

HP's Hot Carrier Mixer and Detector Diodes are intended for use in applications requiring the ultimate in performance and reliability. Extensive testing has shown that these devices exhibit the design capability necessary to meet the general requirements of MIL-S-19500, in addition to the special reliability requirements of man-rated space systems.

As mixers they offer low and stable noise figure as well as high pulse burnout resistance. Their uniform and repeatable RF characteristics allow the designer a great deal of latitude in specifying his RF circuitry.

The diodes are also intended for use as small signal square law detectors, and in large signal power monitor applications.

TEST CONDITIONS

HP HOT CARRIER MIXER DIODE SPECIFICATIONS AT $T_A = 25^\circ\text{C}$

Test Frequency†		2.0 GHz			3.0 GHz			8.0 GHz		
Package Outline		15	19	20	15	19	20	15	19	20
NF _o = 6.0 dB	Single	2400	2406	2403	2565	2561	2563	-	-	-
	Pair*	2401	2407	2404	2566	2562	2564	-	-	-
	Quad*	-	-	-	-	-	-	-	-	-
NF _o = 6.5 dB	Single	2365	2415	2366	2550	2556	2553	2601	2611	2621
	Pair*	2418	2416	2417	2551	2557	2554	2606	2616	2626
	Quad*	-	-	-	2552	2558	2555	-	-	-
NF _o = 7.0 dB	Single	2350	2413	2353	2520	2526	2523	2602	2612	2622
	Pair*	2351	2414	2354	2521	2527	2524	2607	2617	2627
	Quad*	2374	-	-	2522	-	-	-	-	-
NF _o = 7.5 dB	Single	-	-	-	-	-	-	2603	2613	2623
	Pair*	-	-	-	-	-	-	2608	2618	2628
	Quad*	-	-	-	-	-	-	-	-	-
VSWR		1.3			1.5			1.5		
Z _{IF} (ohms)		150-250			100-250			125-250		

* Noise Figure Match ΔNF_o 0.3 dB max.
IF Impedance Match ΔZ_{IF} 25 ohms max.

† Test Conditions: The noise figure is measured at the specified test frequency and is a single sideband receiver noise figure using a 30 MHz, 1.5 dB Noise Figure IF amplifier. L.O. power is 1.0 mW.

MECHANICAL SPECIFICATIONS

The HP Outline 15 package has a glass hermetic seal with dumet leads. The leads on the Outline 15 package should be restricted so that the bend starts at least 1/16 inch from the glass body. With this restriction, Outline 15 package will meet MIL-STD-750, Method 2036, Conditions A and E (4 lbs. tension for 30 minutes). The maximum soldering temperature is $230^\circ\text{C} \pm 5^\circ\text{C}$ for 5 seconds. Outline 15 package inductance and capacitance is typically 2 nH and 0.07 pF, respectively.

The HP Outline 19 package is an Outline 15 package which has gold-plated brass ferrules, soft-soldered onto

the ends. This package is intended for replaceable mounting in spring clips or in a conventional miniature connector center conductor such as the OSM 217 adapter or equivalent.

The HP Outline 20 package is the Outline 15 glass package mounted such that it is a direct mechanical replacement for the 1N21WE or 1N23WE-type cartridge case.

Marking on all packages is by digital coding with a cathode band.

TYPICAL PERFORMANCE CHARACTERISTICS

HP Type	Junction Capacitance C_{JO} pF	Series Resistance R_s ohms	NF_o Temperature Coefficient + dB/ $^\circ\text{C}$
2400	0.5 - 0.9	7 - 11	0.004
2565	0.3 - 0.7	3 - 6	0.004
2601	0.2 - 0.6	4 - 7	0.004

ABSOLUTE MAXIMUM RATINGS

	Units	2300 2400	2500	2600
Operating Temperature Range	$^\circ\text{C}$	- 60 to + 125	- 60 to + 125	- 60 to + 125
Storage Temperature Range	$^\circ\text{C}$	- 60 to + 125	- 60 to + 125	- 60 to + 125
CW Power Dissipation at $T_A = 25^\circ\text{C}$	mW	200	200	125
Peak Power Dissipation (1 nsec pulse, 0.001 DF at $T_A = 25^\circ\text{C}$)	Watt	15	4	0.8
Pulse Burnout (3 10-nsec pulses for 1 dB increase in NF_o)	ergs	25	15	5

RELIABILITY

Hewlett-Packard Hot Carrier Diodes are suitable for high reliability space applications where maximum performance stability under the most adverse conditions is required. Maintenance of product reliability during manufacture has resulted in the use of these diodes in major aerospace and national defense programs.

ENVIRONMENTAL CHARACTERISTICS

	MIL-STD-750 Reference	Conditions
Temperature, Storage	1031	See maximum ratings
Temperature, Operating	—	See maximum ratings
Solderability	2026	230°C as applicable
Temperature, Cycling	1051	5 cycles, — 65° to + 125°C
Thermal Shock	1056	5 cycles, 0-100°C
Moisture Resistance	1021	10 days, 90-98% RH
Shock	2016	5 blows, X _i , Y _i , Z _i , at 1500 G
Vibration Fatigue	2046	32 hrs, X, Y, Z at 20 G min.
Vibration Variable Frequency	2056	4, 4-min. cycles, X, Y, Z, at 20 G min., 100 to 2000 Hz
Constant Acceleration	2006	X _i , Y _i , Z _i at 20,000 G
Terminal Strength	2036	Package dependent
Salt Atmosphere	1041	35°C fog for 24 hours

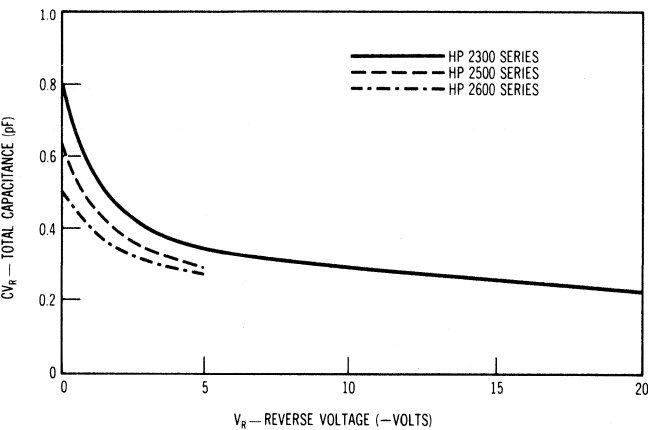


Figure 1. Typical Capacitance vs. Reverse Bias Voltage Characteristics at T_A = 25°C.

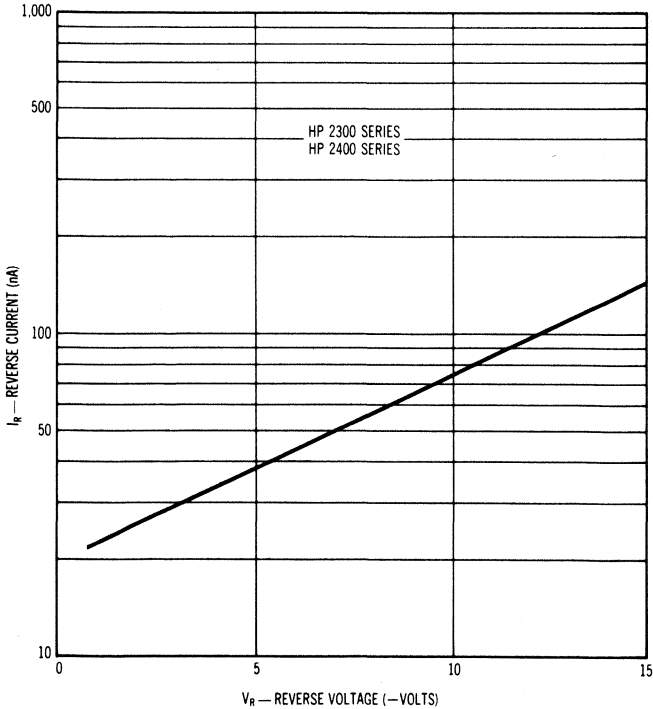


Figure 2. Typical HP 2300 and HP 2400 Series Reverse Current vs. Reverse Voltage Characteristics at T_A = 25°C.

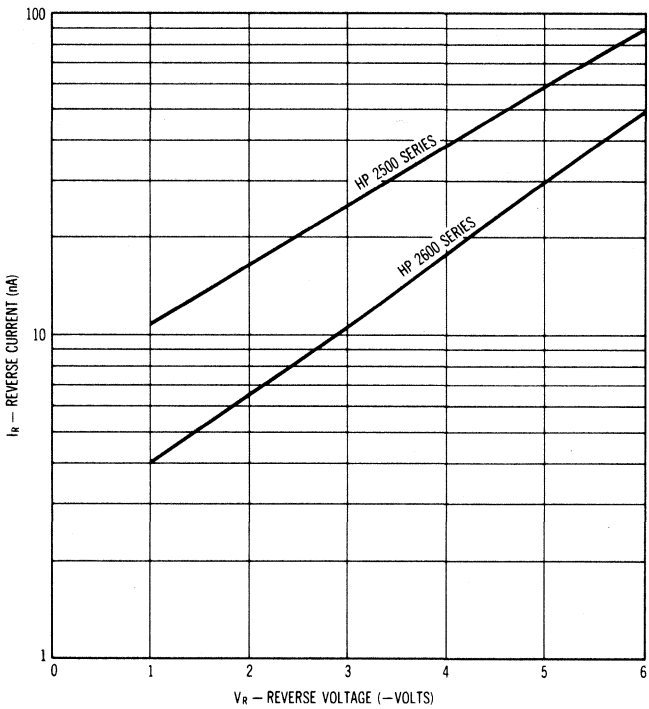


Figure 3. Typical HP 2500 and HP 2600 Series Reverse Current vs. Reverse Voltage Characteristics at T_A = 25°C.

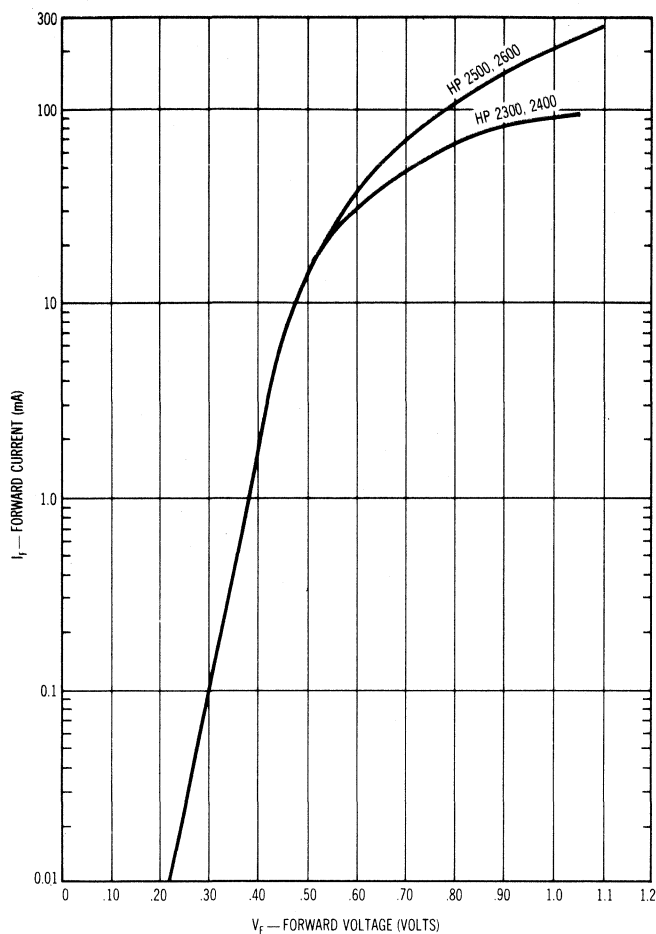


Figure 4. Typical Forward Current vs. Forward Voltage Characteristics at $T_A = 25^\circ\text{C}$.

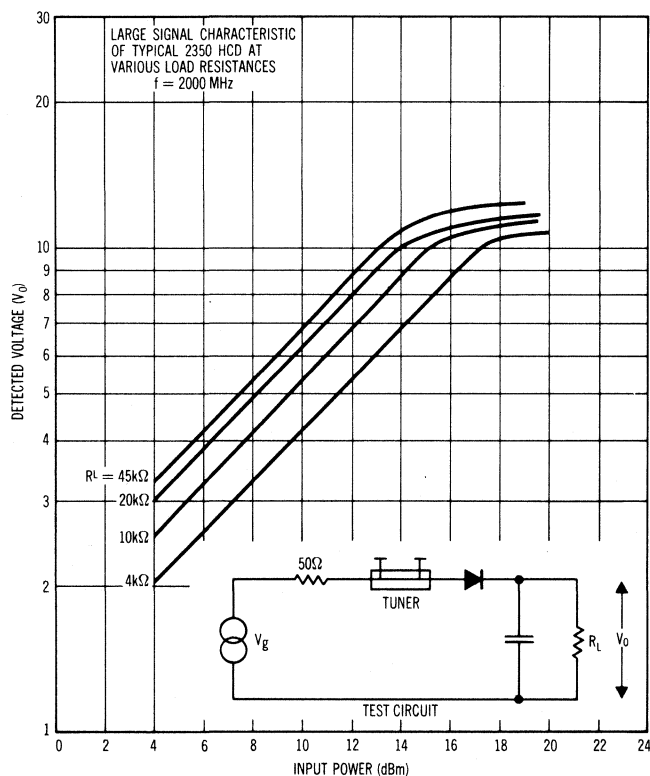


Figure 5. Typical HP 2350 Large Signal Detector Characteristics at $T_A = 25^\circ\text{C}$.

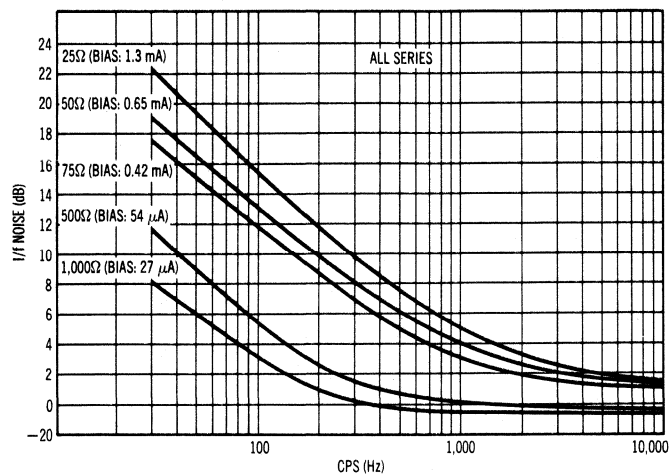


Figure 6. Typical Hot Carrier Diode Flicker ($1/f$) Noise Characteristics at $T_A = 25^\circ\text{C}$.

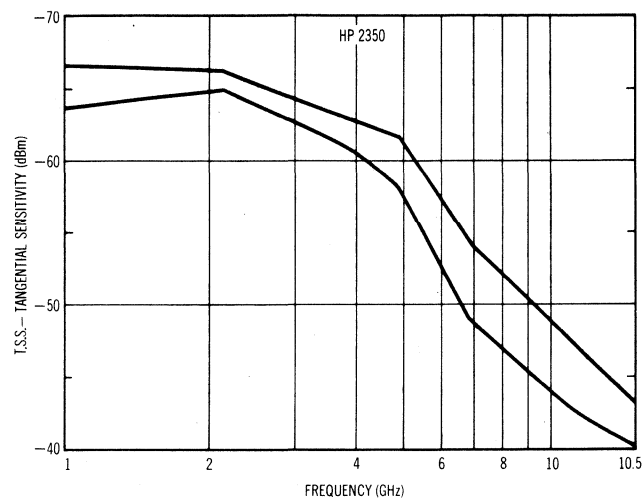


Figure 7. Minimum and Maximum Tangential Sensitivity of 50 Typical HP 2350 Hot Carrier Diodes.

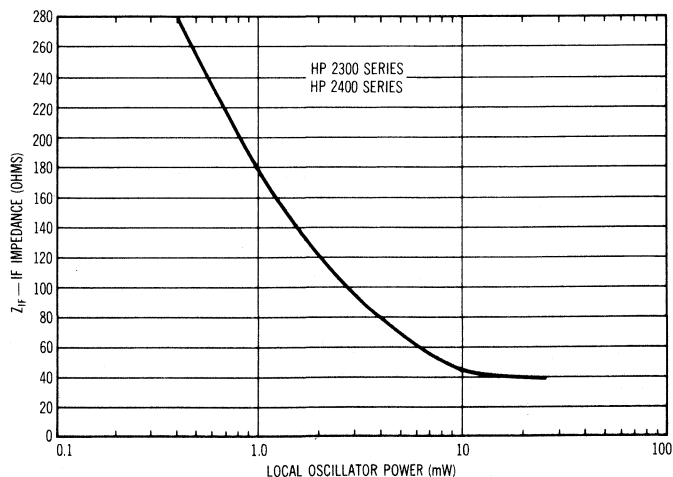


Figure 8. Typical HP 2300 and HP 2400 Series IF Impedance vs. Local Oscillator Power with $f_{LO} = 2.0\text{ GHz}$ and $f_{IF} = 30\text{ MHz}$.

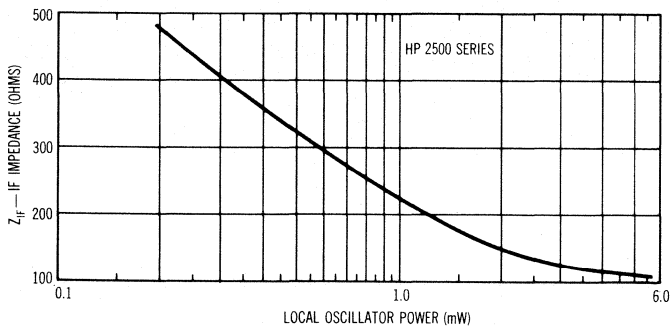


Figure 9. Typical HP 2500 Series IF Impedance vs. Local Oscillator Power at $f_{LO} = 3.0$ GHz and $f_{IF} = 30$ MHz.

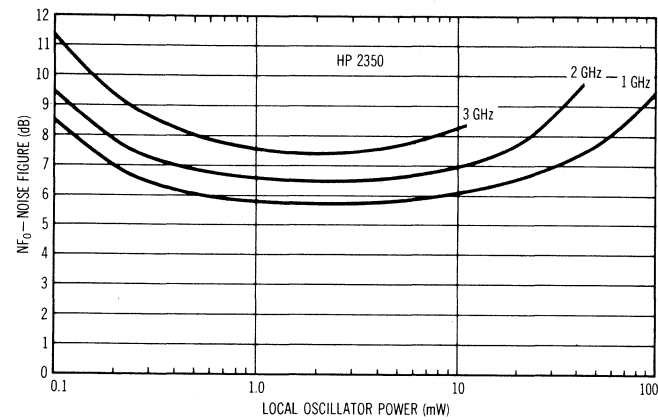


Figure 10. Typical HP 2350 Noise Figure vs. Local Oscillator Power at 1.0, 2.0, and 3.0 GHz with $f_{IF} = 30$ MHz and $NF_{IF} = 1.5$ dB.

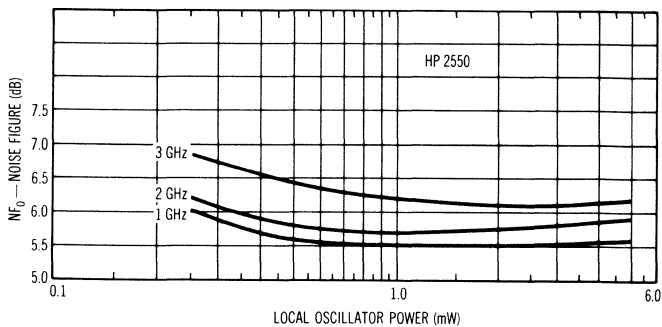


Figure 11. Typical HP 2550 Noise Figure vs. Local Oscillator Power at 1.0, 2.0, and 3.0 GHz with $f_{IF} = 30$ MHz and $NF_{IF} = 1.5$ dB.

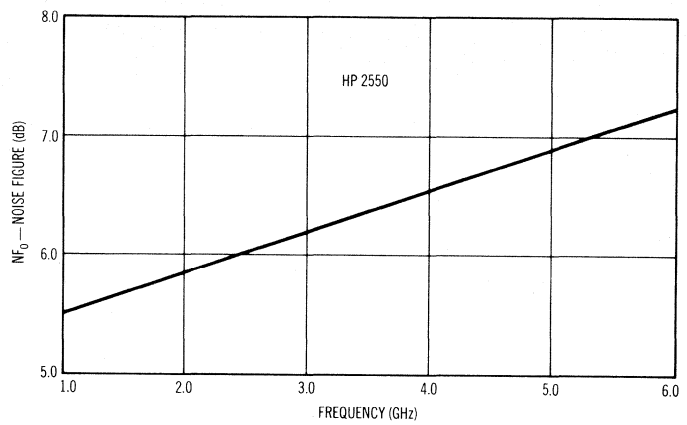


Figure 12. Typical HP 2550 Noise Figure vs. Frequency with $P_{LO} = 1.0$ mW, $f_{IF} = 30$ MHz, and $NF_{IF} = 1.5$ dB.

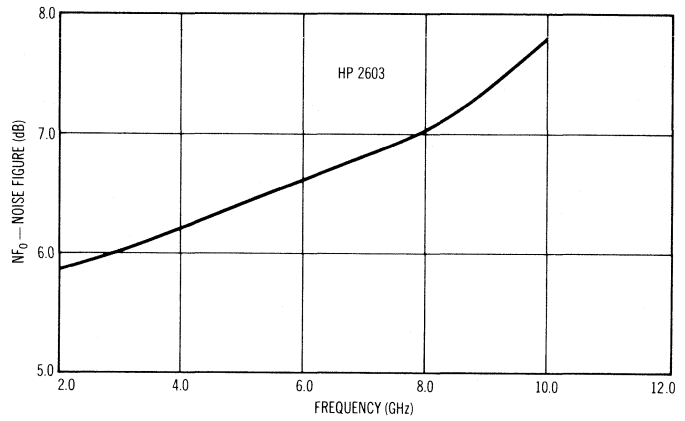


Figure 13. Typical HP 2603 Noise Figure vs. Frequency with $P_{LO} = 1.0$ mW, $f_{IF} = 30$ MHz, and $NF_{IF} = 1.5$ dB.

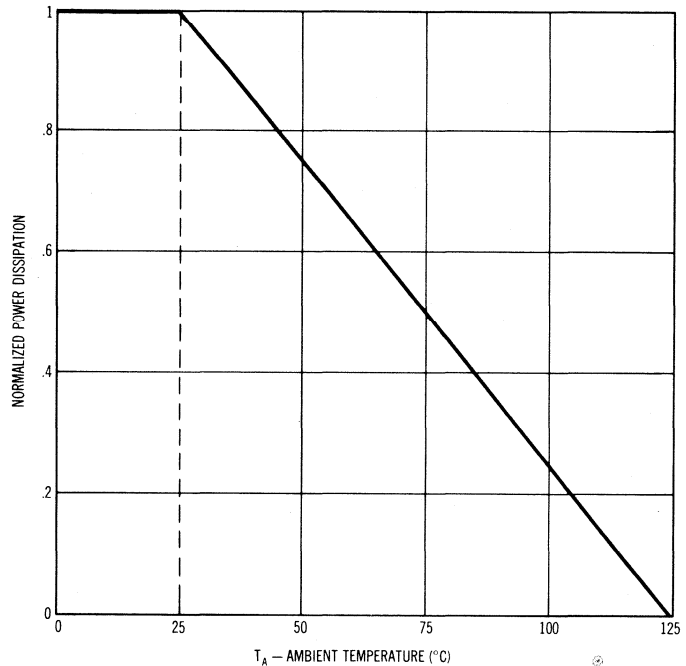


Figure 14. Power Derating Characteristics.