The RF Line

NPN Silicon RF Power Transistor

TPV8200B

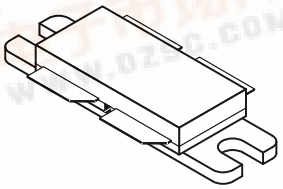
Motorola Preferred Device

190 W, 470–860 MHz
RF POWER TRANSISTOR
NPN SILICON

The TPV8200B is designed for output stages in band IV and V TV transmitter amplifiers. It incorporates high value emitter ballast resistors, gold metallizations and offers a high degree of reliability and ruggedness.

Including input and output matching networks, the TPV8200B features high impedances. It can operate over the 470 MHz to 860 MHz bandwidth using a single fixed tuned circuit.

- To be used class AB for TV band IV and V.
- Specified 28 Volts, 860 MHz Characteristics
  Output Power = 190 Watts (peak sync.)
  Output Power = 150 Watts (CW)
  Gain = 8 dB Min
- Circuit board photomaster available upon request by contacting RF Tactical Marketing in Phoenix, AZ.



CASE 375A–01, STYLE 1

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	30	Vdc
Collector–Base Voltage	V_{CBO}	65	Vdc
Emitter–Base Voltage	V_{EBO}	4	Vdc
Collector–Current — Continuous	I_C	20	Adc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	250 1.43	Watts W/°C
Quiescent Current (without RF drive)	I_{CQ}	2 x 500	mAdc
Storage Temperature Range	T_{stg}	–65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (1)	$R_{\theta JC}$	0.7	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Breakdown Voltage (I_C = 20 mAdc, I_B = 0)	$V_{(BR)CEO}$	30	35	—	Vdc
Collector–Base Breakdown Voltage (I_C = 20 mAdc, I_E = 0)	$V_{(BR)CBO}$	65	80	—	Vdc
Emitter–Base Breakdown Voltage (I_E = 20 mAdc, I_C = 0)	$V_{(BR)EBO}$	4	5	—	Vdc
Collector–Emitter Leakage Current (V_{CE} = 28 Vdc, R_{BE} = 75 Ω)	I_{CER}	—	—	15	mAdc

NOTE:
1. Thermal resistance is determined under specific RF condition.

(continued)

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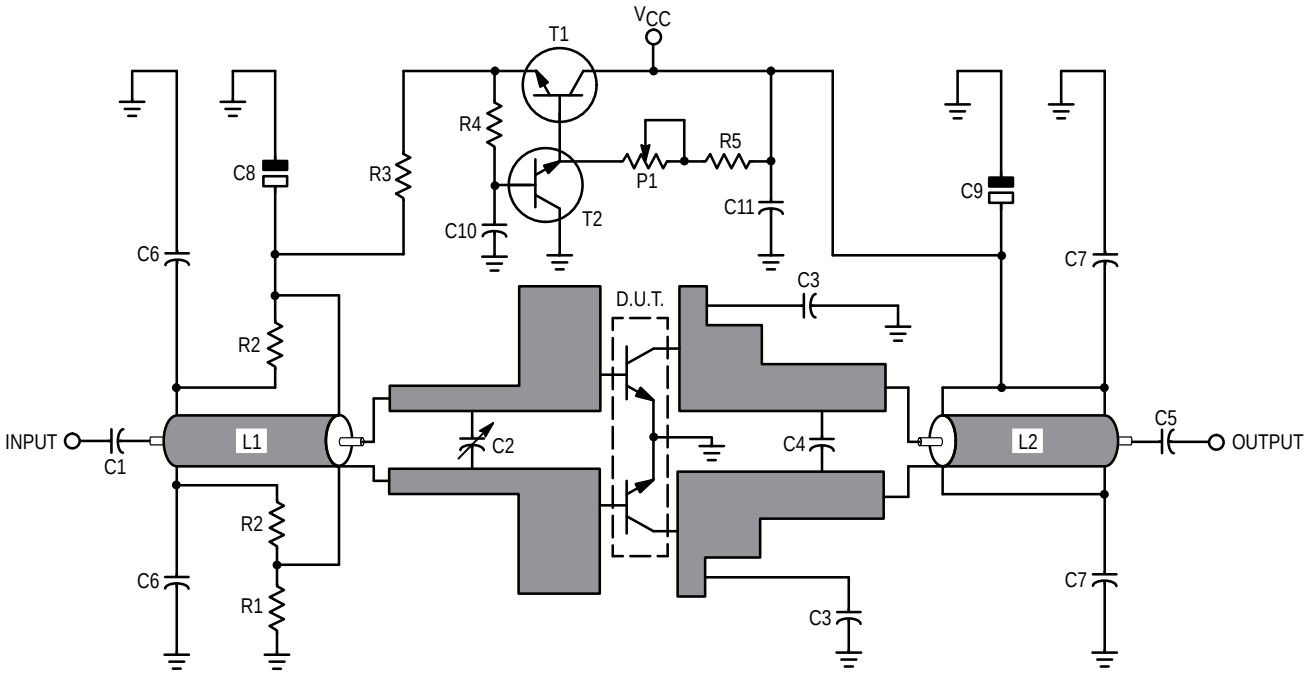
Preferred devices are Motorola recommended choices for future use and best overall value.

ELECTRICAL CHARACTERISTICS — continued (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
DC Current Gain (I_{CE} = 2 Adc, V_{CE} = 10 Vdc)	h_{FE}	30	75	120	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (each side) (2) (V_{CB} = 28 Vdc, I_E = 0, f = 1 MHz)	C_{ob}	—	76	—	pF
FUNCTIONAL TESTS IN CW					
Common–Emitter Amplifier Power Gain (V_{CE} = 28 Vdc, P_{out} = 150 W, I_{CQ} = 2 x 75 mA, f = 860 MHz)	G_{pe}	8	9.5	—	dB
Collector Efficiency (V_{CE} = 28 Vdc, P_{out} = 150 W, I_{CQ} = 2 x 75 mA, f = 860 MHz)	η	45	53	—	%
Output Power @ 1 dB Compression (P_{ref} = 40 W) (V_{CE} = 28 Vdc, I_{CQ} = 2 x 75 mA, f = 860 MHz)	P_{out}	150	165	—	W
Input overdrive: no degradation (V_{CE} = 28 Vdc, I_{CQ} = 2 x 75 mA, f = 860 MHz)	P_{in}	30	—	—	W
Output Mismatch Stress: (V_{CE} = 28 Vdc, P_{out} = 120 W, I_{CQ} = 2 x 75 mA, f = 860 MHz, Load VSWR = 3:1, all phase angles at frequency of test)	ψ	No Degradation in Output Power Before or After Test			
FUNCTIONAL TESTS IN VIDEO (Standard Black Level)					
Peak Output Power @ 1 dB Compression (V_{CE} = 28 Vdc, I_{CQ} = 2 x 75 mA, f = 860 MHz)	P_{out}	190	210	—	W

NOTE:

2. Value of "C_{ob}" is that of die only. It is not measurable in TPV8200B because of internal matching network.



C1 — Chip Capacitor 47 pF ATC 100A
C2 — Chip Capacitor 12 pF ATC 100B + Trimmer Capacitor 0.5–4 pF
C3 — Chip Capacitor 8.2 pF ATC 100B
C4 — Chip Capacitor 12 pF ATC 100B
C5 — Chip Capacitor 100 pF ATC 100A
C6 — Chip Capacitor 2 x 1000 pF Vitramon
C7 — Chip Capacitor 2 x 0.1 μF Vitramon
C8 — Capacitor 220 μF/16 V
C9 — Capacitor 100 μF/40 V
C10 — Chip Capacitor 100 pF Vitramon
C11 — Chip Capacitor 15 nF Vitramon
L1 — Coaxial 25 Ω/length = 41 mm
L2 — Coaxial 25 Ω/length = 41 mm
R1 — Chip Resistor 47 Ω
R2 — 2 x 1 Ω (0.5 Ω)
R3 — Resistor 0.8 Ω
R4 — Resistor 47 Ω
R5 — Resistor 1.2 kΩ
P1 — Trimmer Resistor 5 kΩ
T1 — Transistor BD 135
T2 — Transistor BD 135
PC Board: 1/50″ Glass Teflon® ϵ_r = 2.55

Figure 1. 860 MHz Test Circuit

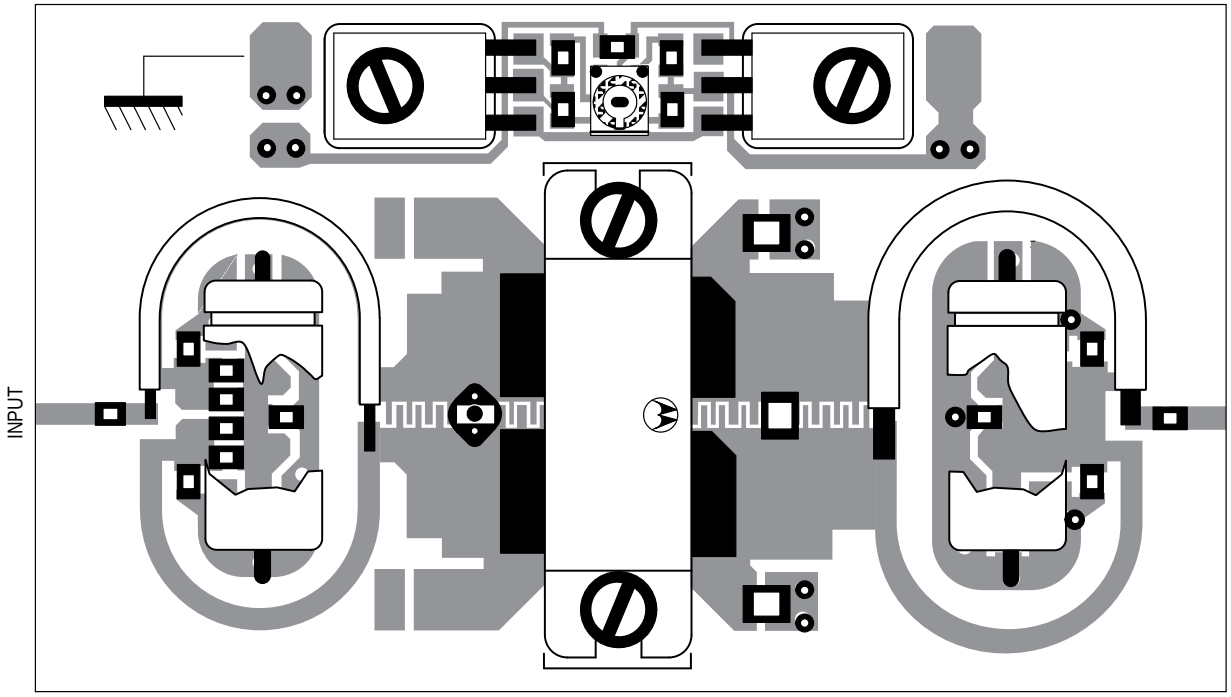


Figure 2. Components View

CAUTION

The TPV8200B is a high power transistor and thermal adaptation is very important for good RF performance (see mechanical drawing for mounting recommendations).

Maximum Ratings are given to avoid destruction of the transistor; another limitation is MMMTBF and the user must first determine the minimum wanted life–time in order to choose the right way of use for the device (see MMMTBF curves), especially in case of CW application.

TYPICAL CHARACTERISTICS

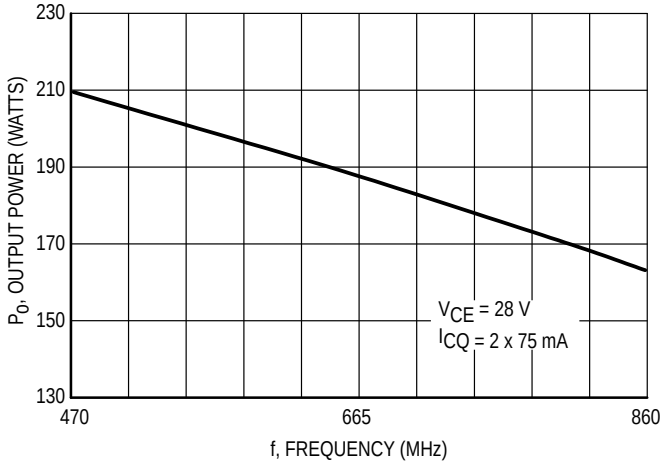


Figure 3. Output Power @ 1 dB Comp. versus Frequency

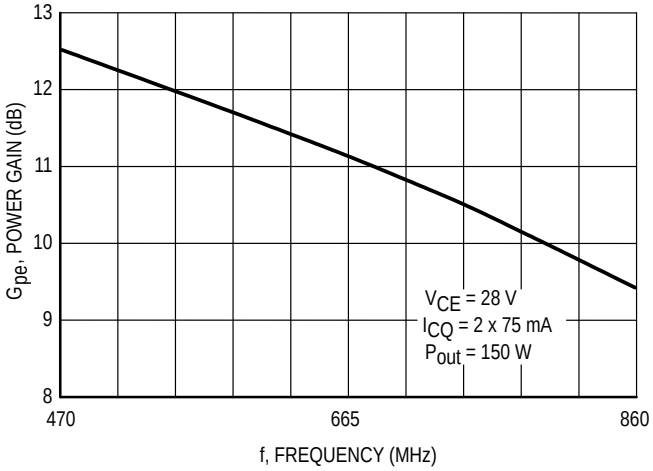


Figure 4. Power Gain versus Frequency

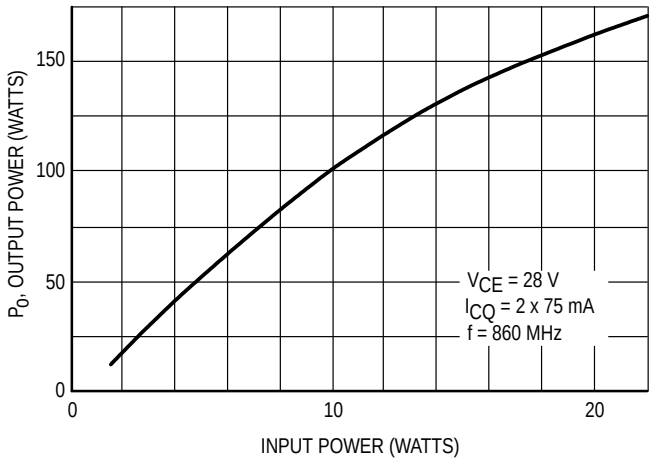


Figure 5. Output Power versus Input Power

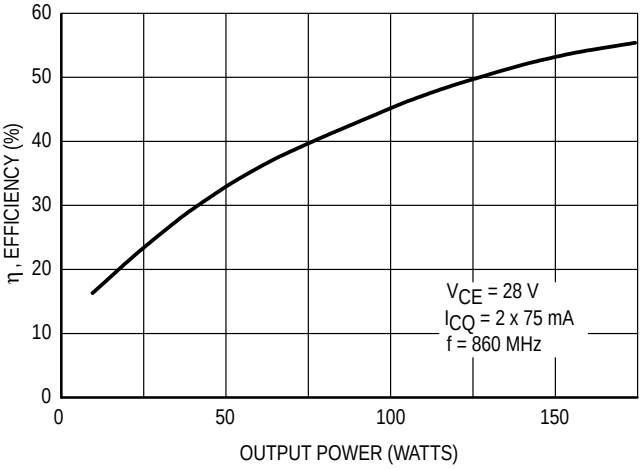


Figure 6. Collector Efficiency versus Output Power

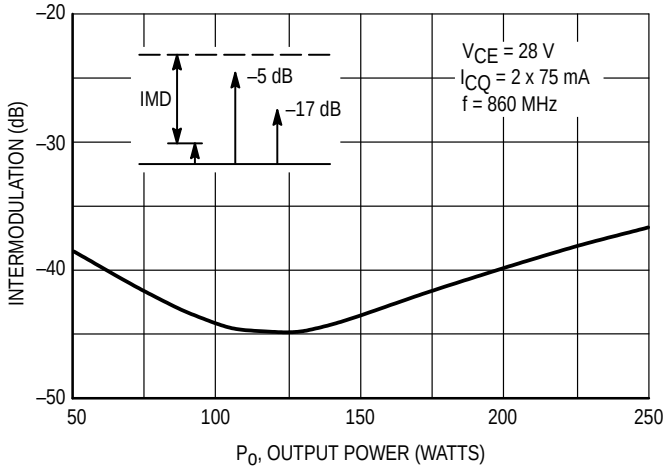


Figure 7. Intermodulation versus Peak Power (Side Band)

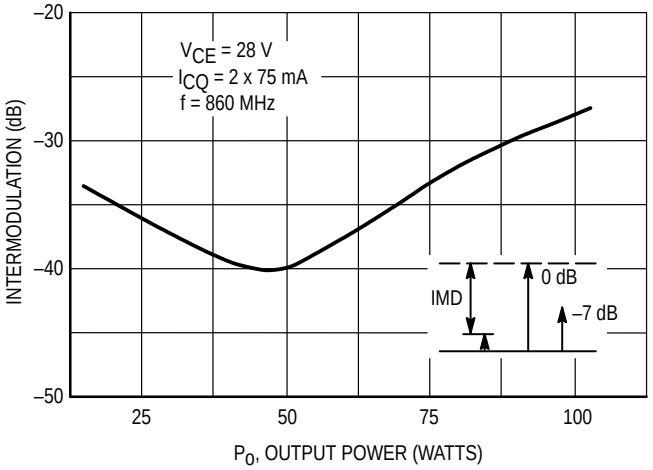


Figure 8. Intermodulation versus Peak Power (Dual Sound)

TYPICAL VIDEO CHARACTERISTICS @ f = 860 MHz
V_{CE} = 28 V

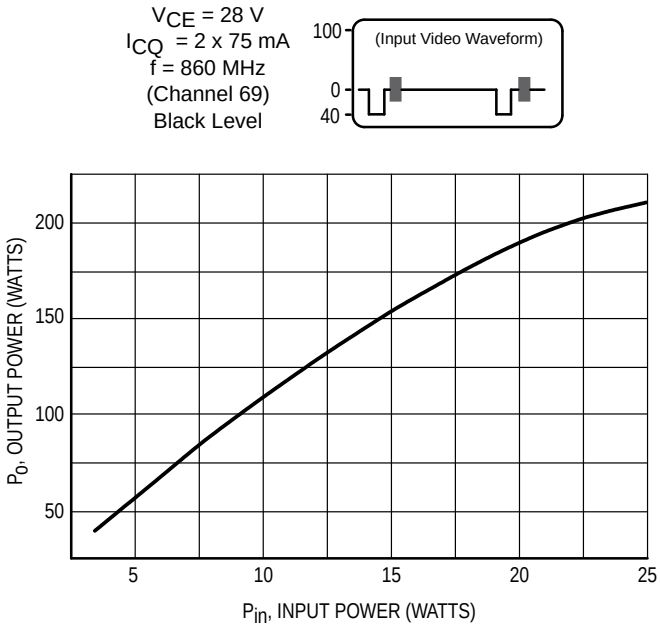


Figure 9. Peak Output Power versus Peak Input Power

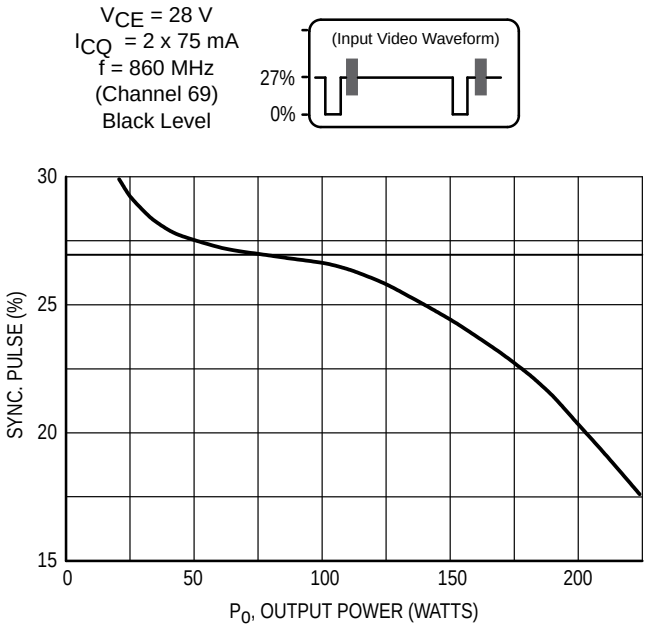


Figure 10. Sync. Pulse versus Peak Output Power

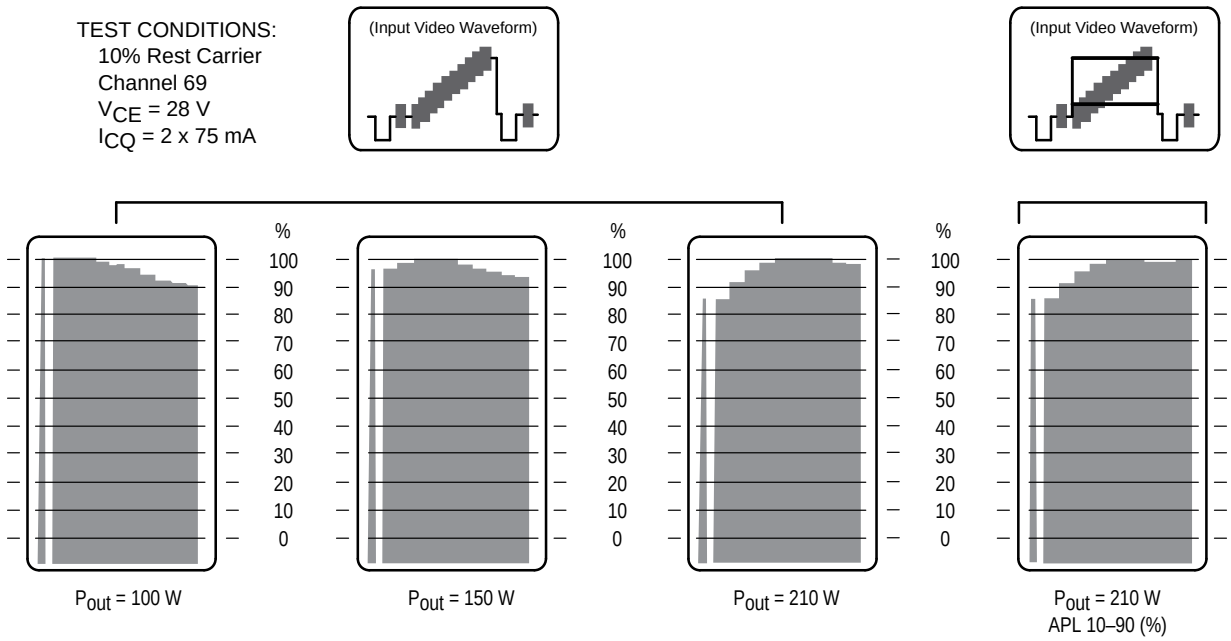
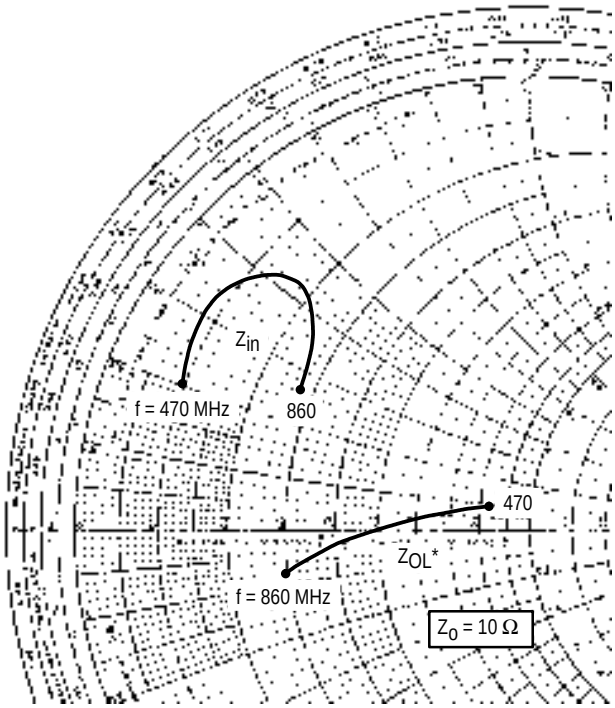


Figure 11. Gain versus Output Power



f MHz	Z_{in} Ohms	Z_{OL*} Ohms
470	0.80 + j2.11	7.93 + j0.94
567	0.85 + j3.15	5.94 + j0.30
665	1.56 + j4.20	4.55 – j0.02
762	2.64 + j3.36	3.70 – j0.52
860	2.72 + j2.24	2.91 – j0.92

Z_{OL*} = Conjugate of optimum load impedance into which the device operates at a given output power, voltage, current, and frequency.

Base–base & collector–collector Impedances with
Circuit Tuned for Maximum Gain @ V_{CE} = 28 V / I_{CQ} = 2 x 75 mA / P_{out} = 150 W

Figure 12. Series Equivalent Input/Output Impedances

RELIABILITY DEPENDENCE ON THERMAL CONSIDERATIONS

MMMTBF: Metal Migration Mean Time Before Failure.

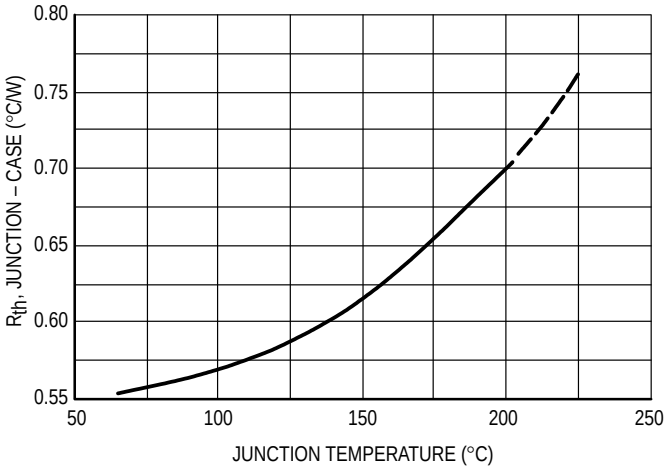


Figure 13. Thermal Resistance versus Junction Temperature

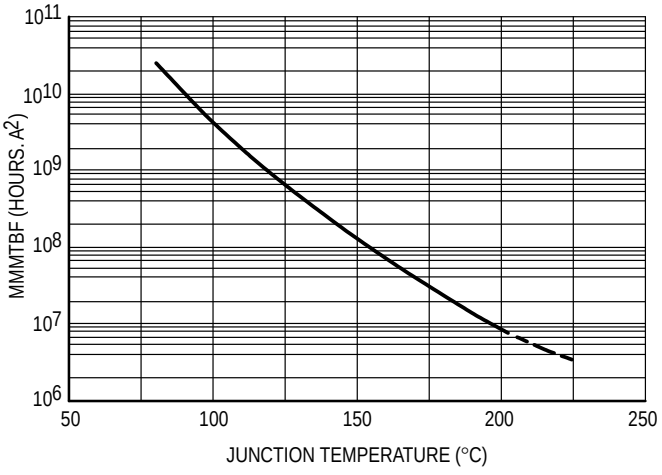


Figure 14. MMMTBF versus Junction Temperature

TYPICAL CONDITIONS (120 W CW):

P_{out} = 120 W
P_{in} = 15 W
V_{CE} = 28 V
η = 45%
I_{CQ} = 9.5 A
R_{TH} = 0.7°C/W
T_{max} = 70°C

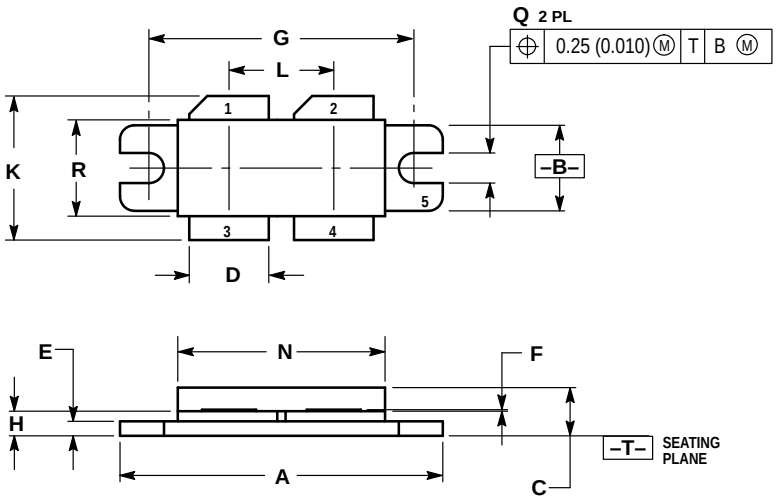
→ P_{diss} = 161 W, T_{jct} = 183°C, J = (5.64) 10^4 A/cm^2 → **MTBF = 26 YEARS**

TYPICAL CONDITIONS (210 W VIDEO):

P_{out} = 70 W
P_{in} = 7.8 W
V_{CE} = 28 V
η = 38%
I_{CQ} = 6.6 A
R_{TH} = 0.7°C/W
T_{max} = 70°C

→ P_{diss} = 123 W, T_{jct} = 156°C, J = (3.92) 10^4 A/cm^2 → **MTBF = 252 YEARS**

PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.330	1.350	33.79	34.29
B	0.375	0.395	9.52	10.03
C	0.180	0.205	4.57	5.21
D	0.320	0.340	8.13	8.64
E	0.060	0.070	1.52	1.77
F	0.004	0.006	0.11	0.15
G	1.100 BSC		27.94 BSC	
H	0.082	0.097	2.08	2.46
K	0.580	0.620	14.73	15.75
L	0.435 BSC		11.05 BSC	
N	0.845	0.875	21.46	22.23
Q	0.118	0.130	3.00	3.30
R	0.390	0.410	9.91	10.41

STYLE 1:
PIN 1. COLLECTOR
2. COLLECTOR
3. BASE
4. BASE
5. EMITTER

CASE 375A–01
ISSUE O

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