TPV5055B

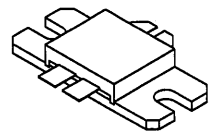
50 V, 470–860 MHz
UHF LINEAR
POWER TRANSISTOR
NPN SILICON

The RF Line
UHF Linear Power Transistor

. . . designed for output stages in Band IV & V TV transmitter amplifiers. Internal matching of both input and output along with use of a push-pull package configuration aids broadband amplifier designs.

Gold metallized dice with diffused emitter ballast resistors enhances reliability, ruggedness and linearity.

- Band IV & V (470–860 MHz)
- 50 W — P_{out}, Class AB
- 28 V — V_{CC}
- Push-Pull Package
- Gold Metallization for Reliability



CASE 398, STYLE 1
(BMA-4)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	30	Vdc
Collector-Base Voltage	V_{CBO}	45	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Operating Junction Temperature	T_J	200	°C
Storage Temperature Range	T_{stg}	−65 to +200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.5	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 60 mA, I_B = 0)	$V_{(BR)CEO}$	28	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 20 mA, I_E = 0)	$V_{(BR)CBO}$	45	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 6.0 mA, I_C = 0)	$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current (V_{CE} = 28 V, V_{BE} = 0)	I_{CES}	—	—	10	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 1.0 A, V_{CE} = 10 V)	h_{FE}	10	—	—	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 28 V, I_E = 0, f = 1.0 MHz)	C_{ob}	—	38	—	pF
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain (V_{CE} = 28 V, P_{out} = 50 W, f = 860 MHz, I_{CQ} = 2.0 x 200 mA)	G_{PE}	7.0	—	—	dB
Collector Efficiency (V_{CE} = 28 V, P_{out} = 50 W, f = 860 MHz, I_{CQ} = 2.0 x 200 mA)	η	45	50	—	%
Output Power, 1.0 dB Compression Point (V_{CE} = 28 V, f = 860 MHz, I_{CQ} = 2.0 x 200 mA, P_{ref} = 12.5 W)	$P_{o1\ dB}$	50	—	—	W

TYPICAL BROADBAND RESULTS
V_{CC} = 28 V I_{CQ} = 2 x 200 mA
f = 470–860 MHz

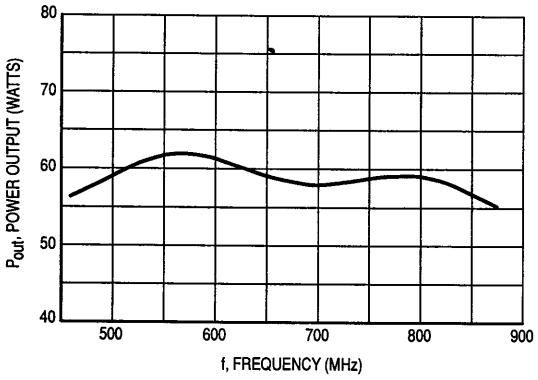


Figure 1. Power Output at 1.0 dB Compression versus Frequency

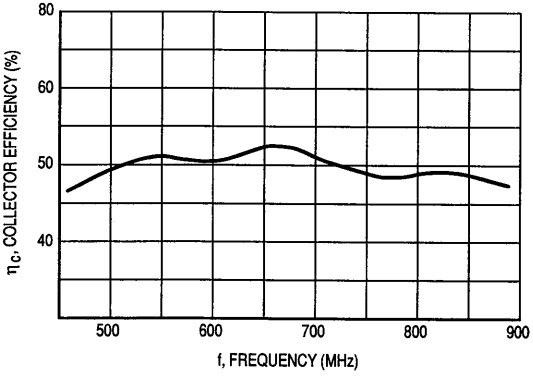


Figure 2. Collector Efficiency versus Frequency

TYPICAL CHARACTERISTICS

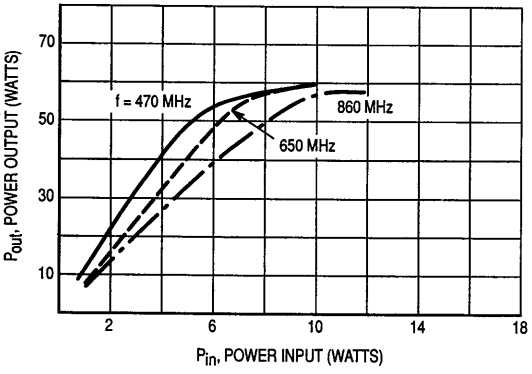
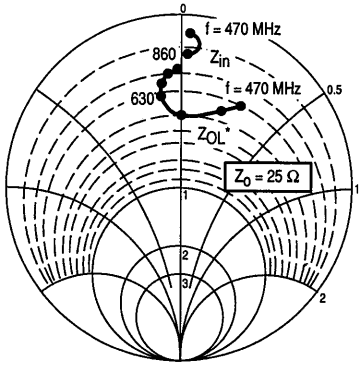


Figure 3. Power Output versus Power Input



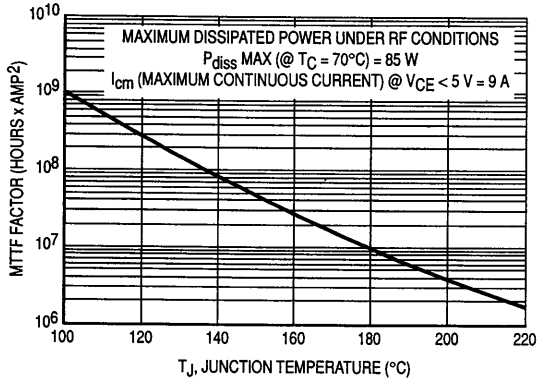


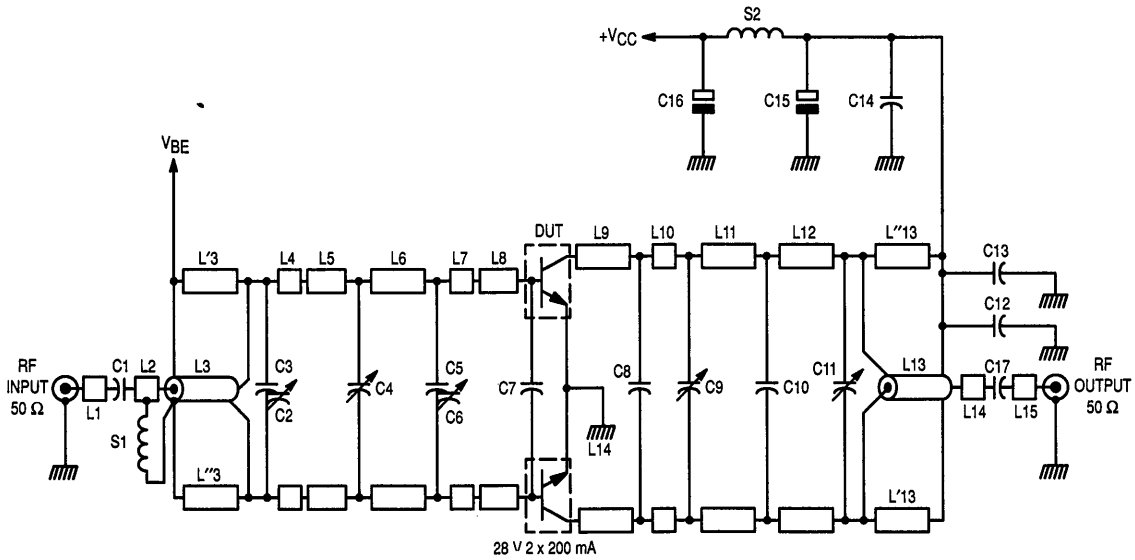
Figure 4. MTTF Factor versus Junction Temperature (MTTF — Hrs. x A^2 — Divide by I_C^2 to obtain MTTF in hours)

f (MHz)	Z_{in} (Ω)	Z_{OL}* (Ω)
470	1.5 + j0.65	7.8 + j5.3
520		9 + j4.5
565	1.9 + j1	10 + j2.5
590		10 + j0
630	2.5 + j1	7.8 – j2
680		6 – j1.7
765	2.9 + j0.8	5 – j1
860	3 + j0.5	4.5 – j0.5

P_{out} = @ 1.0 dB Compression
V_{CC} = 28 V, I_{CQ} = 2.0 x 200 mA

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

Figure 5. Z_{IN} and Z_{OL}* versus Frequency (Each Side)



C1 — Chip Capacitor 100 pF ATC 100A101JP50
C2 — Trimmer Capacitor 0.5/4.0 pF Ref. 37275 TEKELEC
C3 — Chip Capacitor 1.3 pF ATC 100A1R3BP50
C4 — Trimmer Capacitor 1.0–4.0 pF GKU 4RO
C5 — Chip Capacitor 5.6 pF ATC 100A5R6CP50
C6 — Trimmer Capacitor 0.5/4.0 pF Ref. 37275 TEKELEC
C7 — Chip Capacitor 18 pF ATC 100A180DP50
C8 — Chip Capacitor 6.8 pF ATC 100A6R8CP50
C9 — Trimmer Capacitor 0.5/4.0 pF Ref. 37275 TEKELEC
C10 — 6 mm Coaxial Line 50 Ω Dia.070
C11 — Trimmer Capacitor 0.5/4.0 pF Ref. 37275 TEKELEC
C12 — Chip Capacitor 100 pF ATC 100A101JP50
C13 — Chip Capacitor 100 pF ATC 100A101JP50
C14 — Chip Capacitor 1.0 nF
C15 — Chip Tantalum Capacitor 6.8 µF 35 V
C16 — Capacitor 100 µF 40 V
C17 — Chip Capacitor 100 pF ATC 100A101JP50

L1 — 50 Ω Printed Line
L2 — 50 Ω Printed Line
L3 — Coaxial Cable 50 Ω 85 mils L = 75 mm
L'3 — 70 Ω Printed Line; Length 75 mm
L4 — 25 Ω Printed Line; Length 2 mm
L5 — 35 Ω Printed Line; Length 22 mm
L6 — 35 Ω Printed Line; Length 12 mm
L7 — 35 Ω Printed Line; Length 2 mm
L8 — 25 Ω Printed Line; Length 8 mm
L9 — 25 Ω Printed Line; Length 16 mm
L10 — 25 Ω Printed Line; Length 7 mm
L11 — 35 Ω Printed Line; Length 15 mm
L12 — 35 Ω Printed Line; Length 15 mm
L13 — Coaxial Cable 50 Ω 85 mils L = 75 mm
L'13 — 70 Ω Printed Line; Length 75 mm
L"13 — 70 Ω Printed Line; Length 75 mm
L14 — 40 Ω Printed Line; Length 7 mm
S1 — 4 Turns Wire 0.8 mm ID 3 mm
S2 — 4 Turns Wire 0.8 mm ID 3 mm
RF Substrate, Teflon Glass 1/50 inch 35 µ
Note: L3 & L13 soldered on 70 W printed line L'3/L'13

Figure 6. 470–860 MHz Test Circuit, Class AB

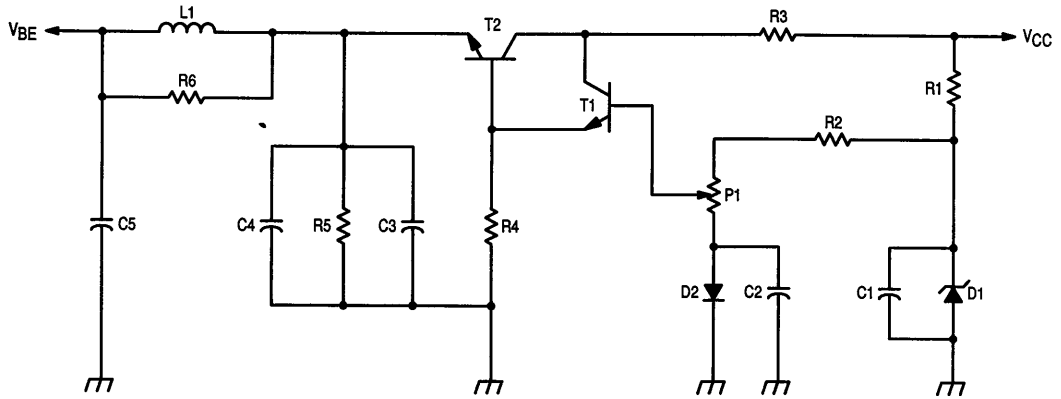
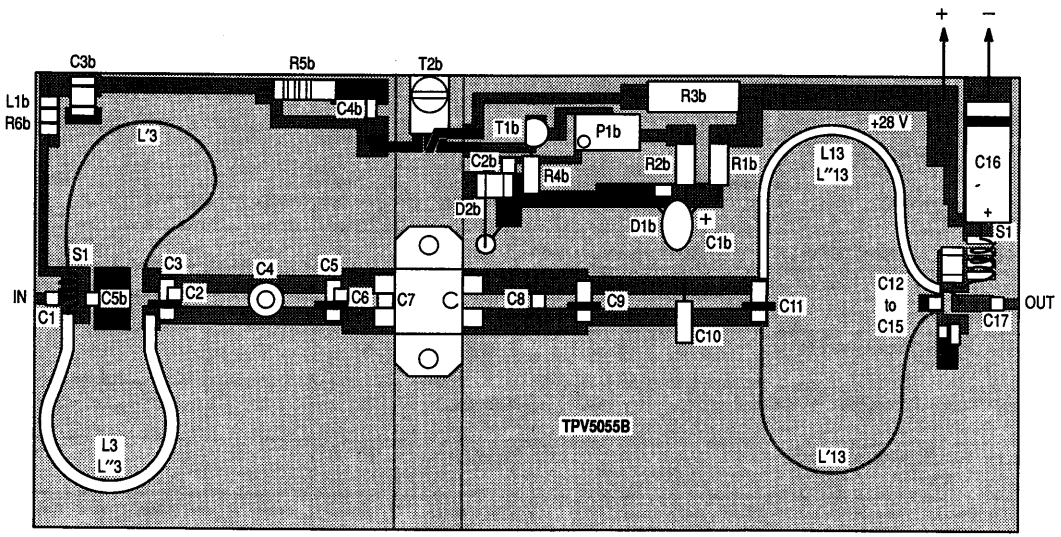


Figure 7. Bias Circuit, Class AB



C1b — 22 µF 35 V Tantalum Capacitor
C2b — 6.8 µF 35 V Tantalum Capacitor + 1.0 nF Chip Capacitor
C3b — 6.8 µF 35 V Tantalum Capacitor
C4b — 1.0 nF Chip Capacitor
C5b — 100 pF ATC 100A101JP50
D1b — Zener Diode 9.1 V
D2b — Diode 1N4007 (fixed in the heatsink next to the RF Transistor Flange)
L1b — 10 Turns Wire Ø 30/100 around R6
P1b — 500 Ω Trimmer
R1b — 2.2 kΩ 1/4 W
R2b — 1.5 kΩ 1/4 W
R3b — 15 Ω 3.0 W SFERNICE
R4b — 1.0 kΩ 1/4 W
R5b — 47 Ω 1/2 W
R6b — 150 Ω 1/4 W
T1b — Transistor BC337
T2b — Transistor BD135 fixed on the heatsink

Figure 8. PC Board Layout

TPV6030

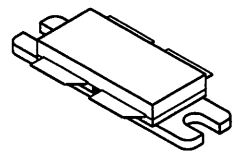
The RF Line
NPN Silicon RF Power Transistor

The TPV6030 is designed for driver 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 double input and output matching networks, the TPV6030 features high impedances. It can easily operate in a full 470 MHz to 860 MHz bandwidth in a single and simple circuit.

- To be used class A for TV band IV and V.
- Specified 25 Volts, 860 MHz Characteristics
  Output Power = 20 Watts @ −51 dB (3 tones)
  Output Power = 35 Watts @ 1 dB Comp. (CW)

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



CASE 375A, STYLE 1

2

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	28	Vdc
Collector-Base Voltage	V_{CBO}	55	Vdc
Emitter-Base Voltage	V_{EBO}	4	Vdc
Storage Temperature Range	T_{stg}	−65 to +150	°C
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation @ T = 25°C Derate above 25°C	P_D	160 0.9	W W/°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (1)	$R_{\theta JC}$	1.1	°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 = 35 mA, R_{be} = 75 Ω)	$V_{(BR)CER}$	40	—	—	Vdc
Collector-Emitter Breakdown Voltage (I_C = 10 mAdc)	$V_{(BR)EBO}$	4	—	—	Vdc
Collector-Base Breakdown Voltage (I_E = 35 mAdc)	$V_{(BR)CBO}$	55	—	—	Vdc
Collector-Emitter Leakage (V_{CE} = 30 V, R_{be} = 75 Ω)	I_{CER}	—	—	10	mA
ON CHARACTERISTICS					
DC Current Gain (I_C = 2 Adc, V_{CE} = 10 Vdc)	h_{FE}	15	—	100	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (each side) (2) (V_{CB} = 28 V, I_E = 0, f = 1 MHz)	C_{ob}	—	45	—	pF

(continued)

NOTES:
1. Thermal resistance is determined under specified RF operating condition.
2. Value of "C_{ob}" is that of die only. It is not measurable in TPV6030 because of internal matching network.

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

Characteristic	Symbol	Min	Typ	Max	Unit
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain (V_{CE} = 25 V, I_C = 4.5 A, f = 860 MHz)	G_p	9.5	10.5	—	dB
Intermodulation (−8 dB/−7 dB/−16 dB) (3) (V_{CE} = 25 V, P_{out} = 20 W ref, I_C = 4.5 A, f = 860 MHz)	IMD	—	−52	−51	dB
Output Power @ 1 dB Compression (V_{CE} = 25 V, I_C = 4.5 A, f = 860 MHz)	P_{out}	35	40	—	W

NOTE:
3. Vision Carrier, Sound Carrier and Sideband Signal respectively.

2

V_{CE} = 25 V, I_C = 4.5 A

f	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	$\|S_{11}\|$	∠Ø	$\|S_{21}\|$	∠Ø	$\|S_{12}\|$	∠Ø	$\|S_{22}\|$	∠Ø
460	.98	175	1.04	98	.012	50	.73	168
560	.97	172	1.17	83	.015	39	.66	170
660	.94	170	1.46	60	.020	23	.59	176
760	.88	168	1.77	35	.026	−4	.59	−168
860	.81	171	1.70	−7	.027	−42	.77	−163

Table 1. Common Emitter S-Parameters

TPV7025

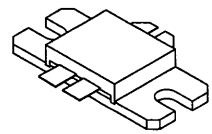
The RF Line
UHF Linear Power Transistor

. . . designed for output stages in Band IV & V TV transmitter amplifiers. Internal matching of both input and output along with use of a push-pull package configuration aids broadband amplifier designs.

Gold metallized dice with diffused emitter ballast resistors enhances reliability, ruggedness and linearity.

- Band IV & V (470–860 MHz)
- 25 W — P_{ref} @ –45 dB IMD
- 25 V — V_{CC}
- Push-Pull Package
- Gold Metallization for Reliability

25 W, 470–860 MHz
UHF LINEAR
POWER TRANSISTOR



CASE 398, STYLE 1
(BMA-4)

2

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	28	Vdc
Collector-Base Voltage	V_{CBO}	45	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Operating Junction Temperature	T_J	200	°C
Storage Temperature Range	T_{stg}	–50 to +200	°C
Operating Case Temperature	T_C	70	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (T_C = 70°C)	$R_{\theta JC}$	1.5	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (1)					
Collector-Emitter Breakdown Voltage (I_C = 120 mA, I_B = 0)	$V_{(BR)CEO}$	28	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 20 mA, I_E = 0)	$V_{(BR)CBO}$	45	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 6.0 mA, I_C = 0)	$V_{(BR)EBO}$	4.0	—	—	Vdc
ON CHARACTERISTICS (1)					
DC Current Gain (I_C = 1.0 A, V_{CE} = 20 V)	h_{FE}	10	—	60	—
DYNAMIC CHARACTERISTICS (1)					
Output Capacitance (V_{CB} = 28 V, I_E = 0, f = 1.0 MHz)	C_{ob}	64	—	80	pF

(continued)

NOTE:
1. Each transistor chip measured separately.

ELECTRICAL CHARACTERISTICS — continued

Characteristic	Symbol	Min	Typ	Max	Unit
FUNCTIONAL TESTS (2)					
Common-Emitter Amplifier Power Gain (V_{CE} = 25 V, P_{out} = 25 W, f = 860 MHz, I_{CQ} = 3.2 A)	G_{PE}	9.0	—	10.5	dB
Load Mismatch (V_{CE} = 25 V, P_{out} = 24 W, f = 860 MHz, Load VSWR = ∞:1, All Phase Angles)	ψ	No Degradation in Output Power			
Overdrive (f = 470 MHz, 2 tones, V_{CE} = 25 V, I_C = 3.2 A) (No Degradation)	$P_{in_{over}}$	24	—	—	W
Intermodulation Distortion, 3 Tone (f = 860 MHz, V_{CE} = 25 V, I_E = 3.2 A, P_{ref} = 25 W, Vision Carrier = −8.0 dB, Sound Carrier = −7.0 dB, Sideband Signal = −16 dB, Specification TV05001)	IMD_1	—	—	−45	dB
Cross Modulation Distortion (P_{ref} = 25 W, f = 860 MHz, Δ% Sound = (−7.0 dB), Vision 0 – Peak)	X_{MOD}	—	—	20	%

NOTE:
2. Both transistor chips operating in push-pull amplifier.

2

TYPICAL CHARACTERISTICS

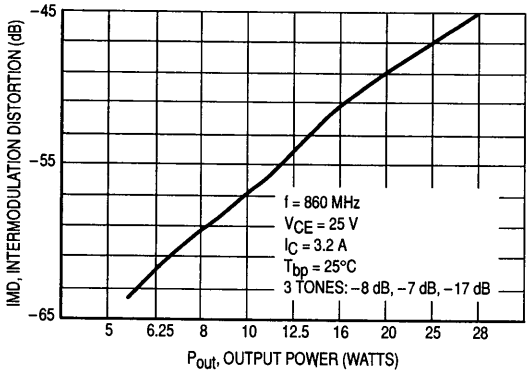


Figure 1. IMD versus Output Power

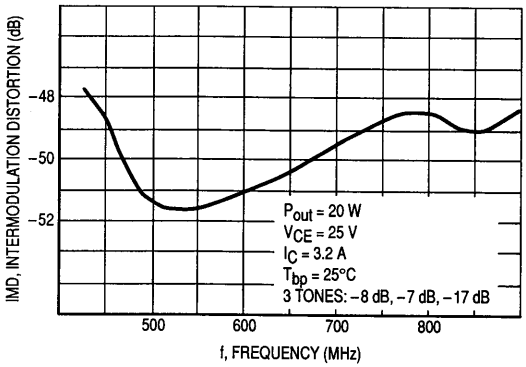
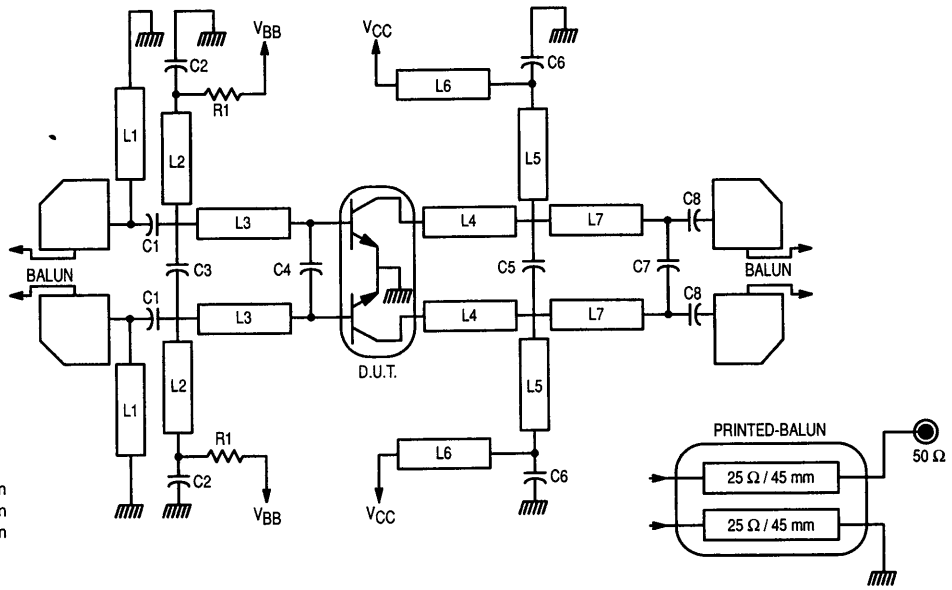


Figure 2. IMD versus Frequency



C1 — 15 pF
C2 — 180 pF
C3 — 10 pF
C4 — 15 pF
C5 — 15 pF
C6 — 180 pF
C7 — 4.7 pF
C8 — 100 pF
L1 — 90 / 16 mm
L2 — 90 / 16 mm
L3 — 35 / 10 mm
L4 — 25 / 7 mm
L5 — 70 / 6 mm
L6 — 70 / 26 mm
L7 — 60 / 16 mm
R1 — 3.3 Ω
Board Material: Teflon Glass Substrate .020 In.

Figure 3. 470–860 MHz Broadband Test Circuit

V_{CE} (Volts)	I_C (A)	f (GHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			Mag	∠ϕ	Mag	∠ϕ	Mag	∠ϕ	Mag	∠ϕ
25	2 x 1.8	0.44	1.0	178	1.25	80	0.02	29	0.89	156
		0.46	1.0	176	1.25	84	0.02	31	0.78	151
		0.48	1.0	174	1.30	81	0.02	30	0.70	148
		0.50	0.99	173	1.39	75	0.02	29	0.65	145
		0.52	0.98	171	1.42	70	0.03	26	0.59	142
		0.54	0.97	173	1.52	65	0.03	17	0.53	140
		0.56	0.97	171	1.67	67	0.03	12	0.46	139
		0.58	0.94	169	1.77	49	0.03	8.0	0.39	138
		0.60	0.92	164	1.93	40	0.04	0	0.31	142
		0.62	0.89	163	2.05	30	0.04	−9.0	0.23	157
		0.64	0.86	163	2.19	18	0.05	−19	0.21	−173
		0.66	0.82	164	2.29	4.0	0.05	−30	0.30	−150
		0.68	0.79	166	2.29	−11	0.05	−42	0.43	−147
		0.70	0.79	169	2.16	−26	0.05	−55	0.57	−150
		0.72	0.79	171	1.99	−40	0.05	−66	0.68	−155
		0.74	0.82	172	1.80	−52	0.05	−76	0.77	−161
		0.76	0.84	172	1.59	−63	0.04	−87	0.83	−168
		0.78	0.86	172	1.38	−74	0.04	−96	0.86	−173
		0.80	0.88	171	1.23	−82	0.03	−102	0.88	−178
		0.82	0.89	170	1.10	−88	0.03	−106	0.88	178
		0.84	0.90	170	0.99	−94	0.03	−110	0.89	175
		0.86	0.90	169	0.89	−100	0.03	−115	0.88	172
		0.88	0.90	168	0.80	−107	0.03	−119	0.87	170

Table 1. Common Emitter S-Parameters

TPV8100B

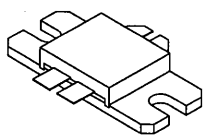
The RF Line
NPN Silicon RF Power Transistor

The TPV8100B 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 double input and output matching networks, the TPV8100B features high impedances. It can easily operate in a full 470 MHz to 860 MHz bandwidth in a single and simple circuit.

- To be used class AB for TV band IV and V.
- Specified 28 Volts, 860 MHz Characteristics
  Output Power = 125 Watts (peak sync.)
  Output Power = 100 Watts (CW)
  Minimum Gain = 8.5 dB
- Specified 32 Volts, 860 MHz Characteristics
  Output Power = 150 Watts (peak sync.)

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



CASE 398, STYLE 1

2

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	65	Vdc
Emitter-Base Voltage	V_{EBO}	4	Vdc
Collector-Current — Continuous	I_C	12	Adc
Total Device Dissipation @ 25°C Case Derate above 25°C	P_D	215 1.25	Watts W/°C
Operating Junction Temperature	T_J	200	°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (1)	$R_{\theta JC}$	0.8	°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 = 10 mA, R_{be} = 75 Ω)	$V_{(BR)CER}$	30	—	—	Vdc
Collector-Emitter Breakdown Voltage (I_C = 10 mAdc)	$V_{(BR)EBO}$	4	—	—	Vdc
Collector-Base Breakdown Voltage (I_E = 20 mAdc)	$V_{(BR)CBO}$	65	—	—	Vdc
Collector-Emitter Leakage (V_{CE} = 28 V, R_{be} = 75 Ω)	I_{CER}	—	—	10	mA

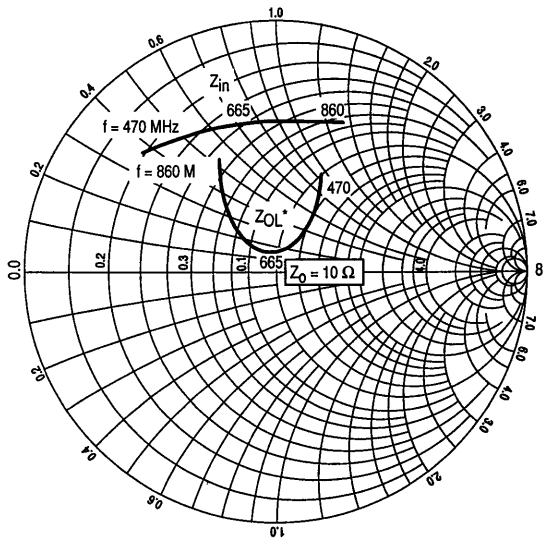
NOTE:
1. Thermal resistance is determined under specified RF operating condition.

(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
DC Current Gain (I_C = 2 Adc, V_{CE} = 10 Vdc)	h_{FE}	30	—	120	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (each side) (2) (V_{CB} = 28 V, I_E = 0, f = 1 MHz)	C_{ob}	—	44	—	pF
FUNCTIONAL TESTS IN CW (SOUND)					
Common-Emitter Amplifier Power Gain (V_{CC} = 28 V, P_{out} = 100 W, I_{CQ} = 2 x 50 mA, f = 860 MHz)	G_p	8.5	9.5	—	dB
Collector Efficiency (V_{CC} = 28 V, P_{out} = 100 W, I_Q = 2 x 50 mA, f = 860 MHz)	η	55	58	—	%
Output Power @ 1 dB Compression (P_{ref} = 25 W) (V_{CC} = 28 V, I_{CQ} = 2 x 50 mA, f = 860 MHz)	P_{out}	100	110	—	W
FUNCTIONAL TESTS IN VIDEO (STANDARD BLACK LEVEL)					
Peak Output Power (synch.) (V_{CC} = 28 V, I_{CQ} = 2 x 50 mA, f = 860 MHz)	P_{out}	125	135	—	W
Peak Output Power (synch.) (V_{CC} = 32 V, I_{CQ} = 2 x 25 mA, f = 860 MHz)	P_{out}	150	160	—	W
Recommended Quiescent Current	I_{CQ}	—	—	2 x 0.3	A

NOTE:
2. Value of "C_{ob}" is that of die only. It is not measurable in TPV8100B because of internal matching network.

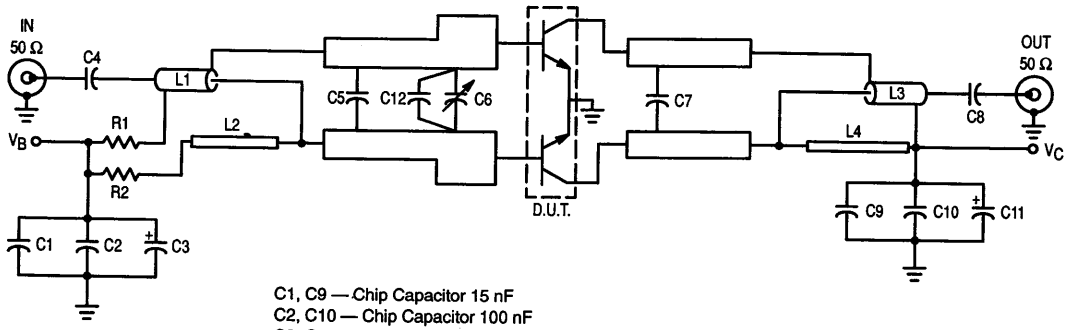


f (MHz)	Z_{in} (Ohms)	Z_{OL}^* (Ohms)
470	1.95 + j3.67	10.0 + j9.50
665	3.65 + j6.82	9.23 + j1.30
860	6.66 + j13.8	4.45 + j5.22

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

Input and Output impedances with circuit tuned for maximum linearity @ V_{CC} = 28 V / I_{CQ} = 2 x 50 mA / P_{out} = 100 W

Figure 1. Series Equivalent Input/Output Impedances



C1, C9 — Chip Capacitor 15 nF
C2, C10 — Chip Capacitor 100 nF
C3, C11 — Chip Capacitor 100 µF/40 V
C4 — Chip Capacitor 15 pF ATC 100A
C5 — Chip Capacitor 5.6 pF ATC 100A
C6 — Trimmer Capacitor 1–4 pF
C7 — Chip Capacitor 12 pF ATC 100B
C8 — Chip Capacitor 15 pF ATC 100A
C12 — Chip Capacitor 12 pF ATC 100A
L1, L3 — Coaxial Wire 25 Ω/85 Mils/40 mm
L2, L4 — Printed Board Inductance
R1, R2 — Chip Resistor 1 Ω 0805 5%

Figure 2. Test Circuit

2

TYPICAL CHARACTERISTICS

CW — WIDEBAND

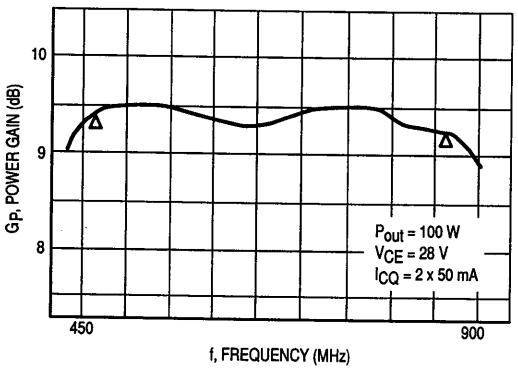


Figure 3. Power Gain versus Frequency

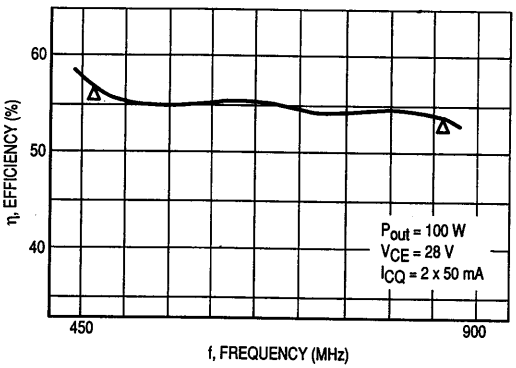
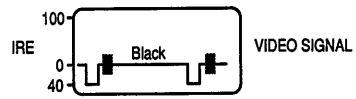


Figure 4. Collector Efficiency versus Frequency

TYPICAL VIDEO CHARACTERISTICS @ f = 800 MHz
V_{CE} = 28 V



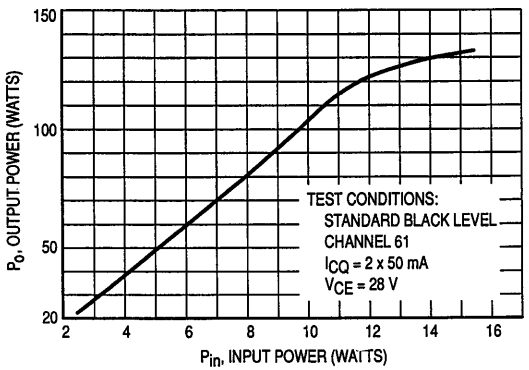


Figure 5. Peak Output Power versus Peak Input Power

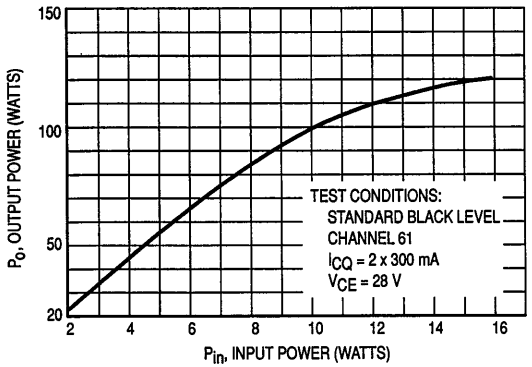
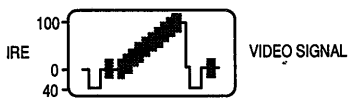


Figure 6. Peak Output Power versus Peak Input Power

2

TEST CONDITIONS:
DIFF. Gain, 10 Steps
Channel 61
V_{CE} = 28 V



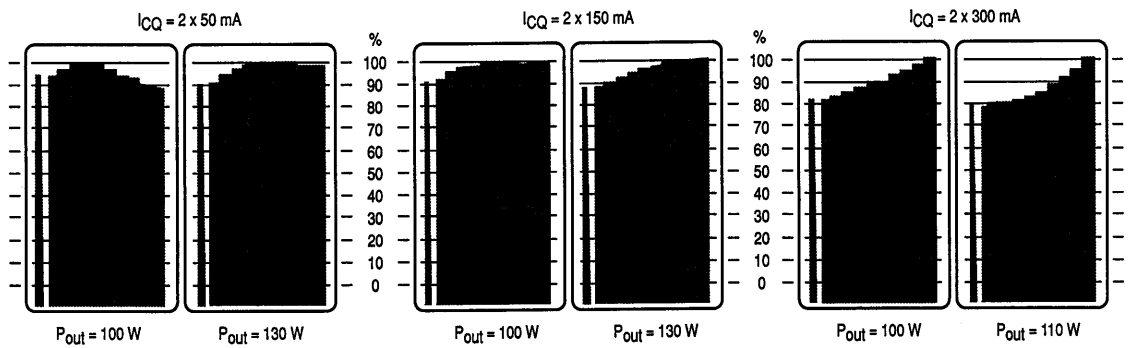
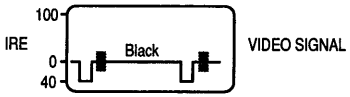


Figure 7. Gain versus Output Power

TYPICAL VIDEO CHARACTERISTICS @ f = 800 MHz
V_{CE} = 32 V



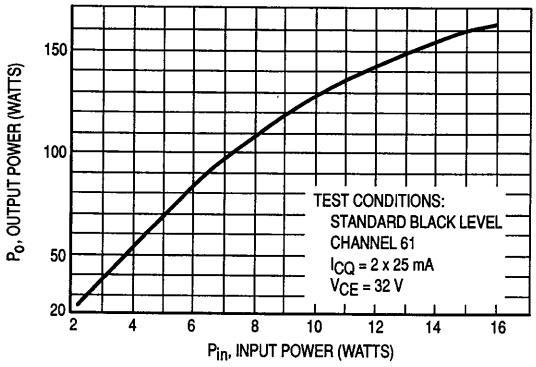


Figure 8. Peak Output Power versus Peak Input Power

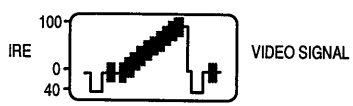
V_{CE} = 32 V, I_{CQ} = 2 x 25 mA

P_{out}	Gain
25 W	10.6 dB
50 W	11.1 dB
100 W	11.3 dB
120 W	11.1 dB
130 W	11.0 dB
140 W	10.7 dB
150 W	10.5 dB
160 W	10.2 dB

(see curve on left)

2

TEST CONDITIONS:
DIFF. Gain, 10 Steps
Channel 61
V_{CE} = 32 V
I_{CQ} = 2 x 25 mA



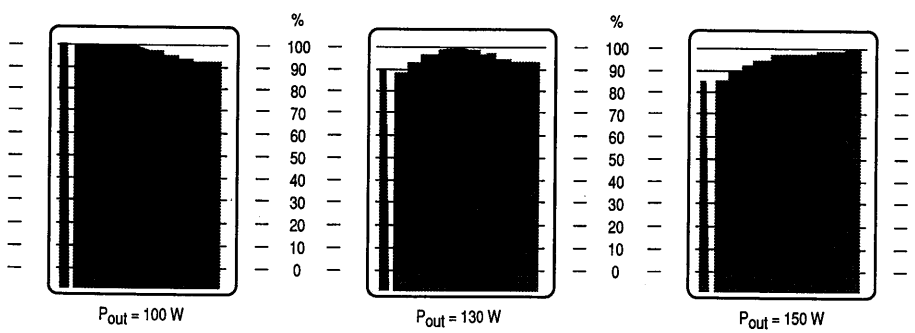


Figure 9. Differential Gain

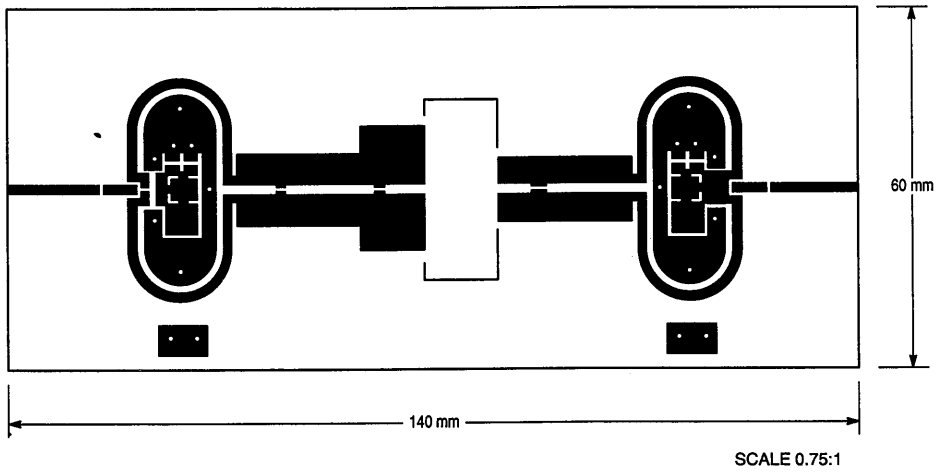


Figure 10. Photomaster
(Teflon® Glass 1/50 in., ϵ_r = 2.43)

2

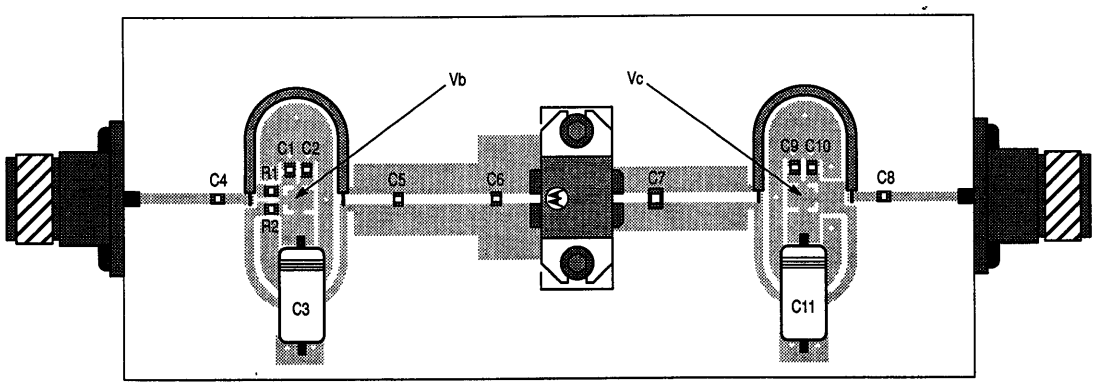


Figure 11. Components View

TPV8200B

Motorola Preferred Device

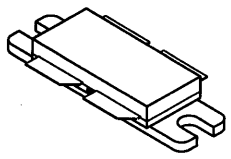
The RF Line
NPN Silicon RF Power Transistor

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

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



CASE 375A, STYLE 1

2

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)

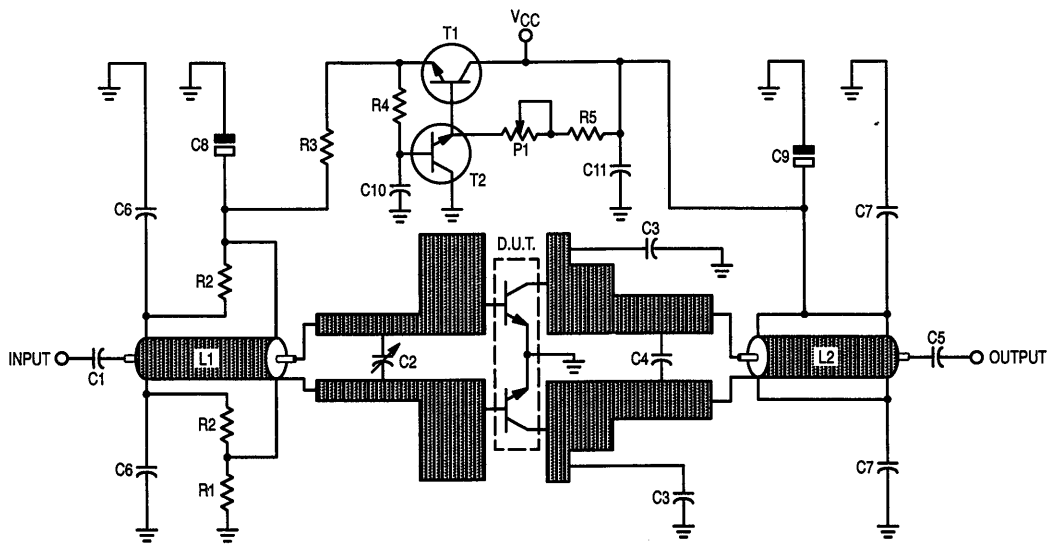
Teflon is a registered trademark of du Pont de Nemours & Co., Inc.

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

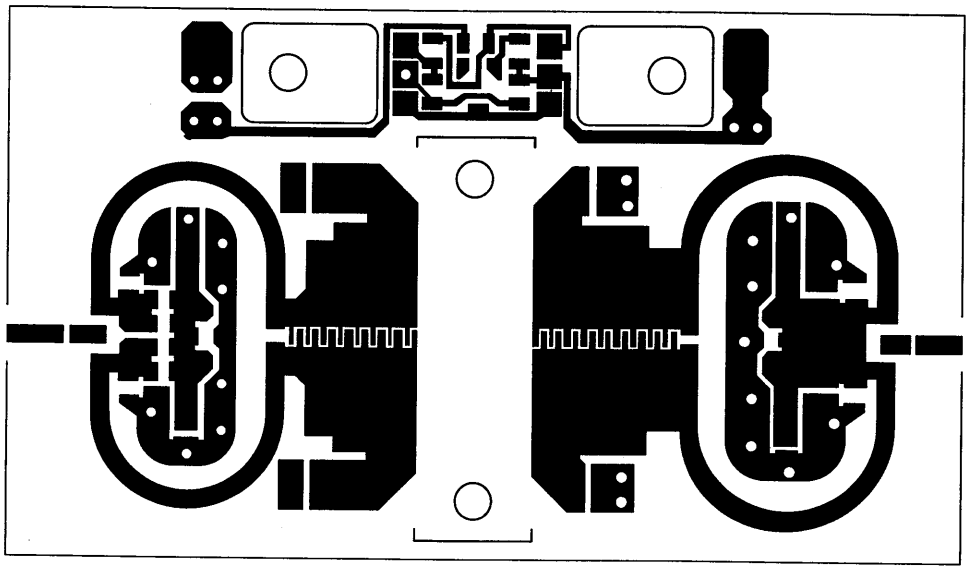


Figure 2. Photomaster

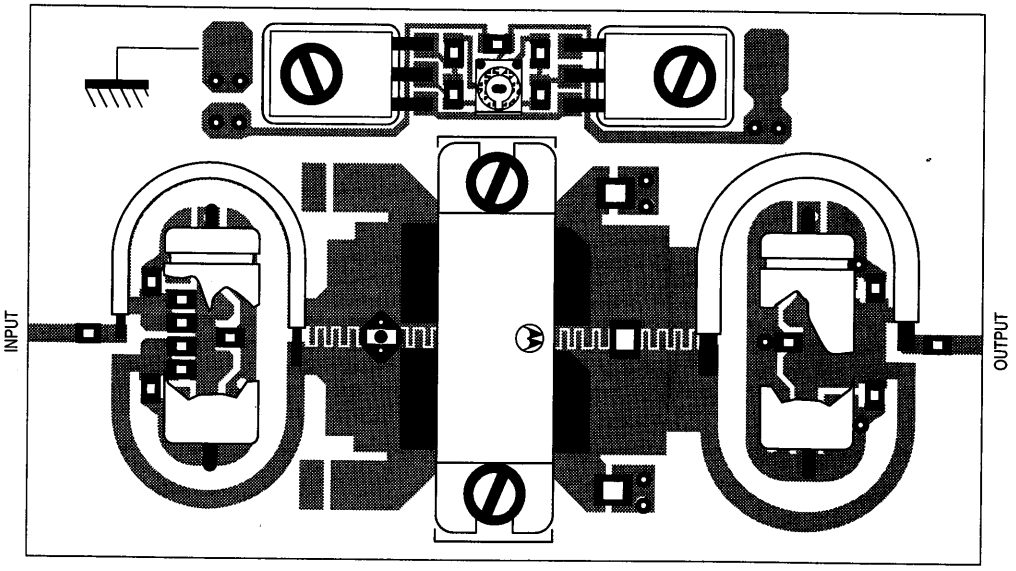


Figure 3. Components View

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 (see page 2-841) 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

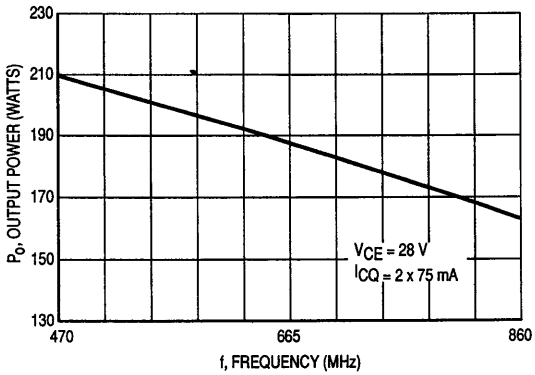


Figure 4. Output Power @ 1 dB Comp. versus Frequency

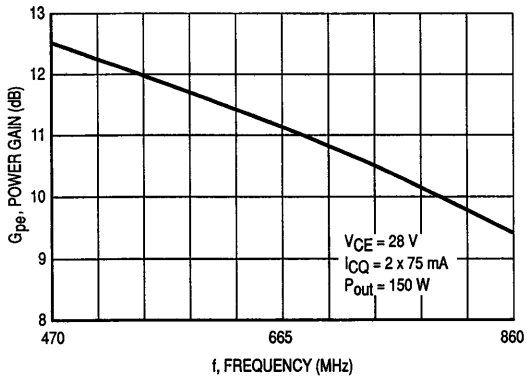


Figure 5. Power Gain versus Frequency

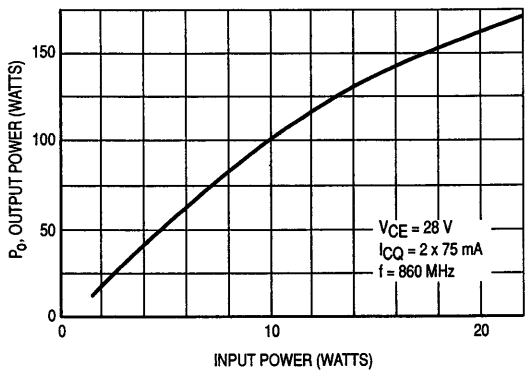


Figure 6. Output Power versus Input Power

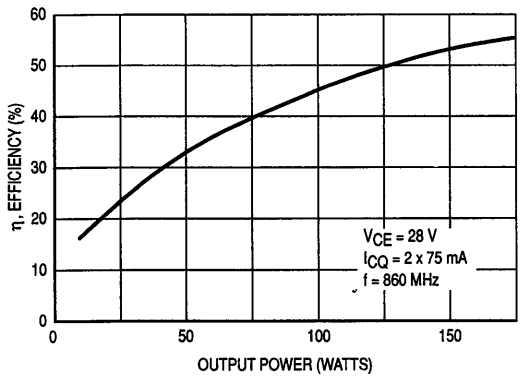


Figure 7. Collector Efficiency versus Output Power

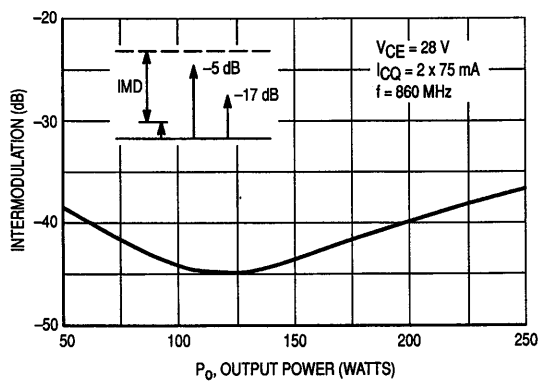


Figure 8. Intermodulation versus Peak Power (Side Band)

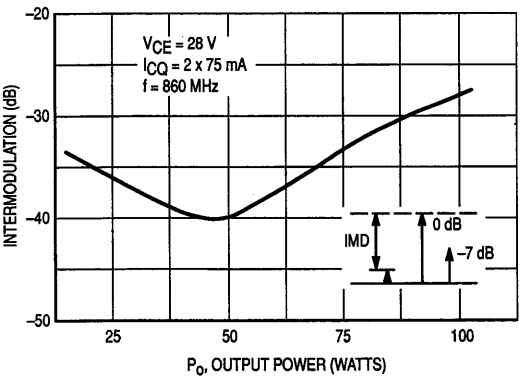


Figure 9. Intermodulation versus Peak Power (Dual Sound)

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

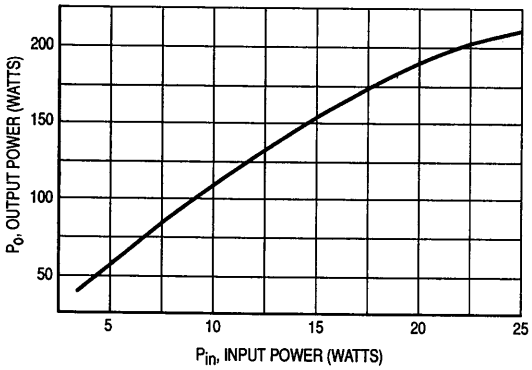


Figure 10. Peak Output Power versus Peak Input Power

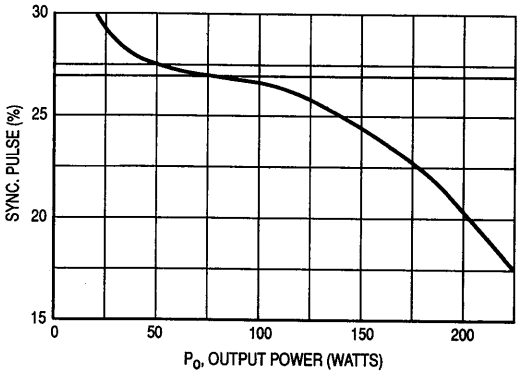


Figure 11. Sync. Pulse versus Peak Output Power

2

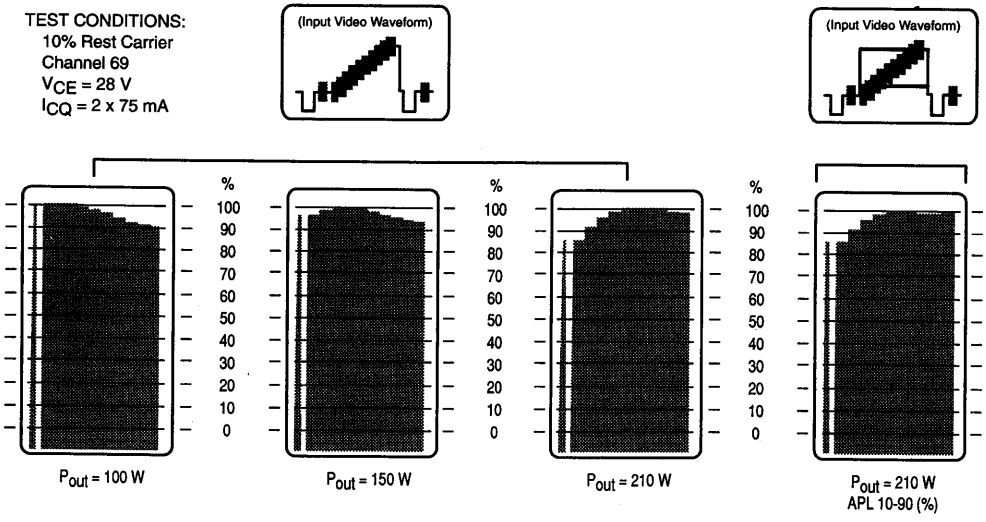
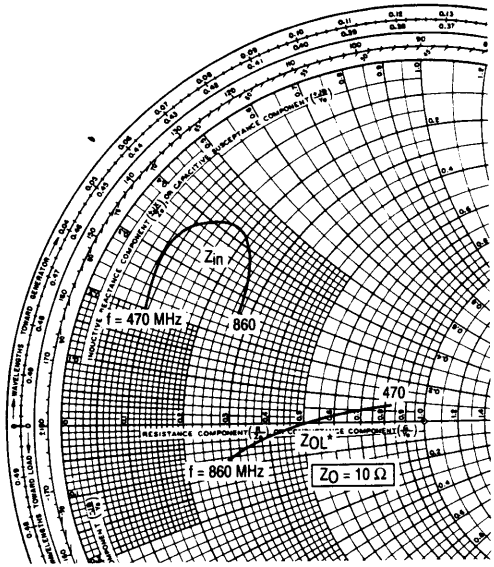


Figure 12. Gain versus Output Power



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 13. Series Equivalent Input/Output Impedances

2

RELIABILITY DEPENDENCE ON THERMAL CONSIDERATIONS

MMMTBF: Metal Migration Mean Time Before Failure.

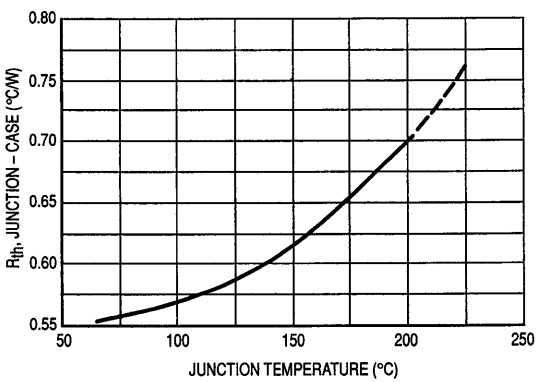


Figure 14. Thermal Resistance versus Junction Temperature

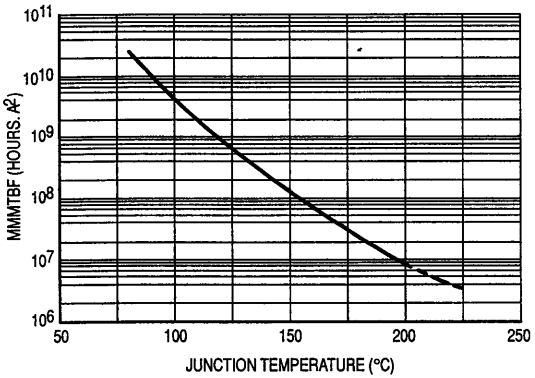


Figure 15. MMMTBF versus Junction Temperature

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**