MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

2

The RF Line
UHF Power Transistor

TPM405

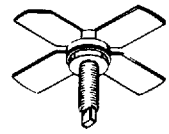
5 W — 400 MHz
UHF POWER TRANSISTOR

. . . designed as an NPN gold metallized transistor using diffused emitter ballast resistors for operation in Class A, AB and C.

High gain reduces the complexity of the broadband stages and make the TPM405 ideal for 100–400 MHz applications.

A 100–400 MHz push-pull amplifier is described in the two last pages of this data sheet.

- 400 MHz
- 5 W — P_{out}
- High Gain — 16 dB Min @ f = 400 MHz
- Diffused Emitter Ballast Resistors for Ruggedness
- Gold Metallization for Reliability



CASE 244C-01, STYLE 1
(.280 SOE)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	24	Vdc
Collector-Base Voltage	V_{CBO}	45	Vdc
Emitter-Base Voltage	V_{EBO}	3.5	Vdc
Collector Current — Continuous	I_C	1.4	Adc
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 (T_{case} = 70°C)	$R_{\theta JC}$	9.5	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Base Breakdown Voltage (I_C = 2 mA, I_E = 0)	$V_{(BR)CBO}$	45	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.5 mA, I_C = 0)	$V_{(BR)EBO}$	3.5	—	—	Vdc
Collector-Emitter Breakdown Voltage (I_C = 40 mA, R_{BE} = 10 Ω)	$V_{(BR)CER}$	50	—	—	Vdc
Collector Cutoff Current (V_{CB} = 28 V, I_E = 0)	I_{CBO}	—	—	0.45	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 200 mA, V_{CE} = 5 V)	h_{FE}	20	—	120	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 24 V, I_E = 0, f = 1 MHz)	C_{ob}	—	—	7	pF

(continued)

ELECTRICAL CHARACTERISTICS — continued

Characteristic	Symbol	Min	Typ	Max	Unit
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain — Class AB (V_{CE} = 24 V, P_{out} = 5 W, f = 400 MHz, I_Q = 50 mA)	G_{PE}	16	—	—	dB
Collector Efficiency (V_{CE} = 24 V, P_{out} = 5 W, f = 400 MHz, I_Q = 50 mA)	η_C	50	—	—	%
Load Mismatch (V_{CE} = 24 V, P_{out} = 3 W, f = 400 MHz, I_Q = 50 mA, Load VSWR = ∞:1, All Phase Angles)	ψ	No Degradation in Output Power			
Saturated Output Power (V_{CE} = 24 V, f = 400 MHz, I_Q = 50 mA)	P_{sat}	7	—	—	W

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CLASS A - V_{CE} = 20 V - I_C = 440 mA - Small Signal

POLAR S-PARAMETERS IN 50 OHM SYSTEM								
F	S 11		S 21		S 12		S 22	
MHz	Magn	Angl°	Magn	Angl°	Magn	Asgl°	Magn	Angl°
100 MHz	0 871	190	6.130	108	0.028	17	0 537	205
200 MHz	0.902	182	4 9	90	03	18	0 562	191
300 MHz	0.907	178	3.35	80	0 033	20	0 562	189
400 MHz	0.902	175	2.66	72	0 035	22	0 562	188
500 MHz	0.905	175	2.21	71	0.034	30	540	192

Large Signal Impedances

Class AB I_Q = 50 mA F_O = 400 MHz

P_{out} = 5 W V_{CE} = 20 V

Z_{in}	Z_{OL}^*
(1,5— J 1) ohm	(15,5 — J 21,4) ohm

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

PUSH-PULL PERFORMANCE

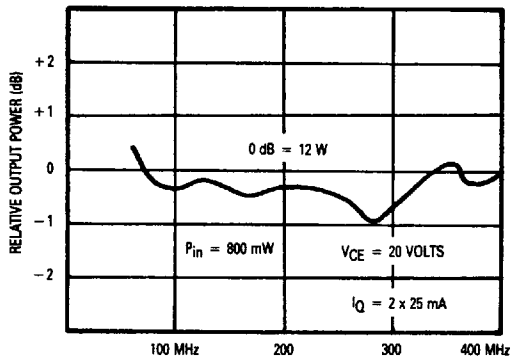


Figure 1. Output Power versus Frequency

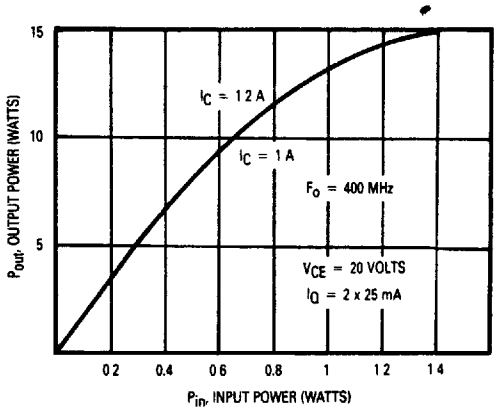


Figure 2. Output Power versus Input Power

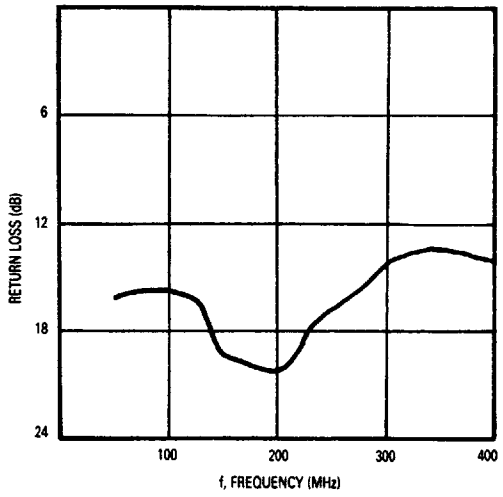
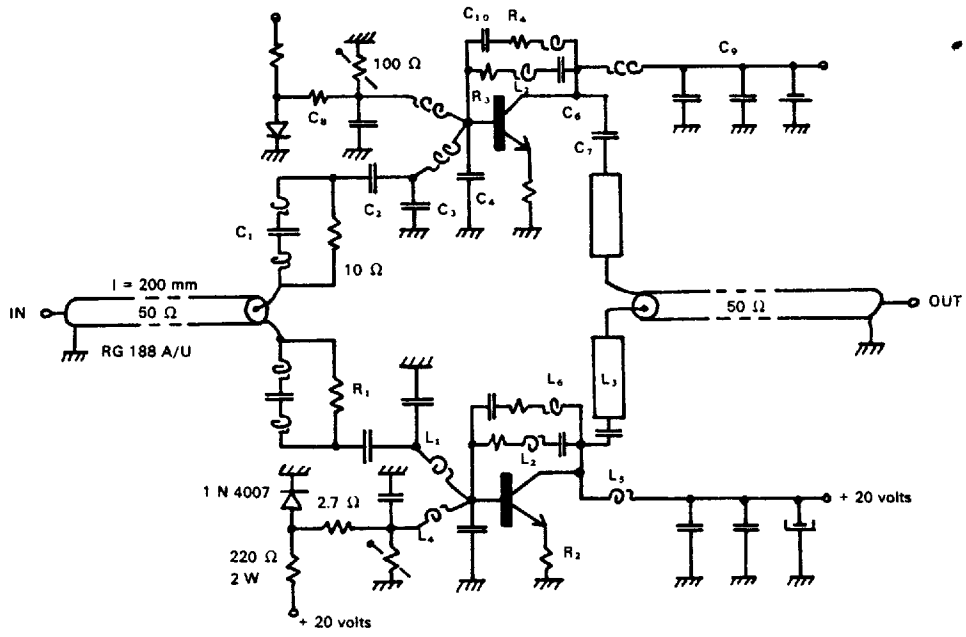


Figure 3. Input Return Loss



L1 — 1/2 turn 5 mm 5/10 mm
5 mm
L2 — 6 turns Ø 3 mm 5/10 mm
L3 — 25 Ω line 2% Ag at 400 MHz
L4 — Molled coil 0.47 μF
L5 — Molled coil 4.7 μH
L6 — 17 turns Ø 3 mm 5/10 mm

C1 — 27 pF C 300 RTC with 12 mm leads
C2, C7 — 10 nF chip
C3 — 27 pF ATC 100 A
C4 — 2 x 1.3 pF ATC 100 A
C6, C10 — 10 nF RTC C 331
C8, C9 — 1 nF + 10 nF + 0.1 μF + 10 μF decoupling

R1 — 10 Ω 1/4 W carbon
R2 — 4 x 1 Ω 1/4 W carbon
R3, R4 — 300 Ω 1/4 W carbon

Figure 4. Push-Pull Amplifier 100–400 MHz