VHF Power Transistor

- 150 W
- 100 - 175 MHz
- High Gain
- RF Power Transistor
- Silicon

JØ 500

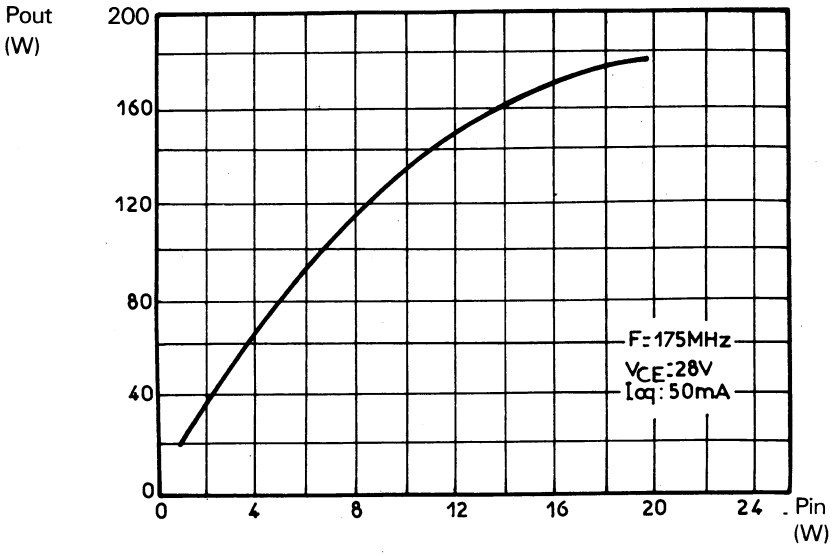
The TP 9386 is designed for use in the new generation of VHF transmitters. It operates in class A, B or C from a 28 V supply.
Its construction, which now incorporates the new standard TRW process of gold metallisation and diffused ballast resistors, ensures a long operational life even when run at its maximum ratings.

Electrical Characteristics (T_{case} = 25 °C)

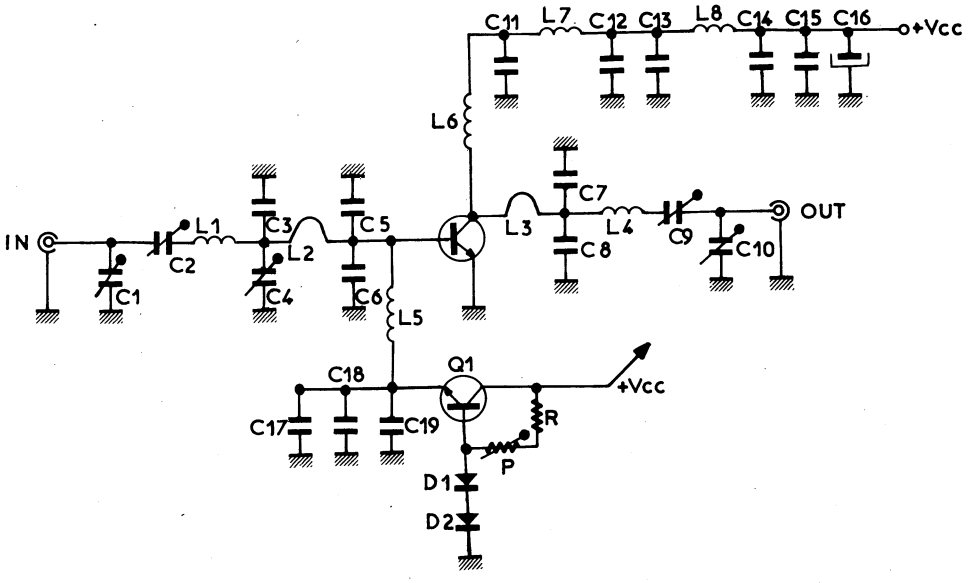
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC Test	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 20 mA	4			V
	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_C = 50 mA	35			V
	BV_{CER}	Collector - Emitter Breakdown Voltage	I_C = 50 mA R_{BE} = 10 Ω	60			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 50 mA	65			V
	h_{FE}	D.C Current Gain	V_{CE} = 5V I_C = 1 A	15		150	—
RF Test	P_{out}	Common Emitter Amplifier output power	V_{CE} = 28 V I_{cq} = 50 mA F = 175 MHz P_{in} = 15 W	150			W
	η_c	Collector Efficiency	V_{CE} = 28 V I_{cq} = 50 mA F = 175 MHz P_{out} = 150 W	60			%
	C_{ob}	Output Capacitance	V_{CB} = 28 V F = 1 MHz			150	pF
Thermal	P_d	Maximum Power dissipation				250	W
	I_c	Maximum Collector Current				15	A
	R_{thjc}	Thermal resistance Junction case				0,7	°C/W

C

TYPICAL POWER OUTPUT VERSUS POWER INPUT



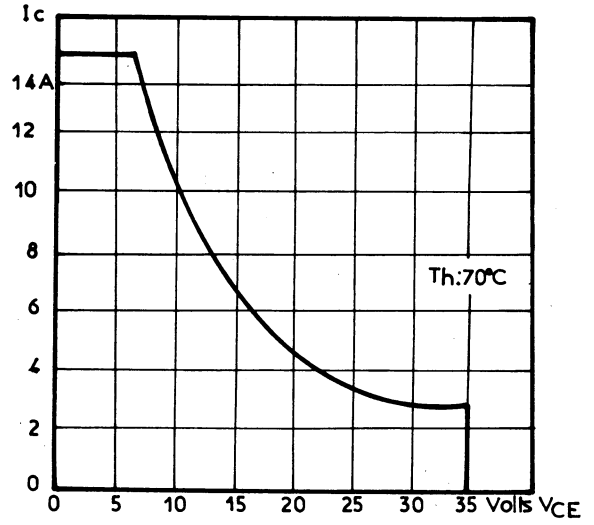
TEST FIXTURE (Narrow band)



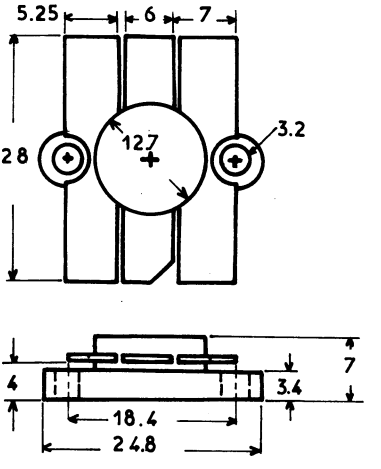
COMPONENTS PART LIST

C_1 C_2	ARCO 403	
C_3	30 pF	
C_4	ARCO 404	
C_5 C_6	80 pF	
C_7 C_8	100 pF	
C_9 C_{10}	ARCO 425	(24-200 pF)
C_{11} C_{12} C_{14} C_{17}	1 000 pF	
C_{13} C_{15} C_{18}	10 nF	
C_{16} C_{19}	47 µF	
L_1	2turns	⌀ 8 mm 1 mm wire
L_2	Hair pin	Copper foil 15 × 3 mm 0,3 mm thick
L_3	Hair pin	Copper foil 12 × 5 mm 0,3 mm thick
L_4	3 turns	⌀ 5 mm 1,5 mm wire
L_5	10 turns	⌀ 5 mm 0,5 mm wire
L_6	3 turns	⌀ 6 mm 1,5 mm wire
L_7	3 turns	⌀ 6 mm 1,5 mm wire
L_8	10 turns	1 mm wire on core (µi = 120)
R	1,5 Ω	1/2 W
P	5 KΩ	
D_1 D_2	IN 4007	
Q_1	BD 135	

DC SAFE OPERATING AREA



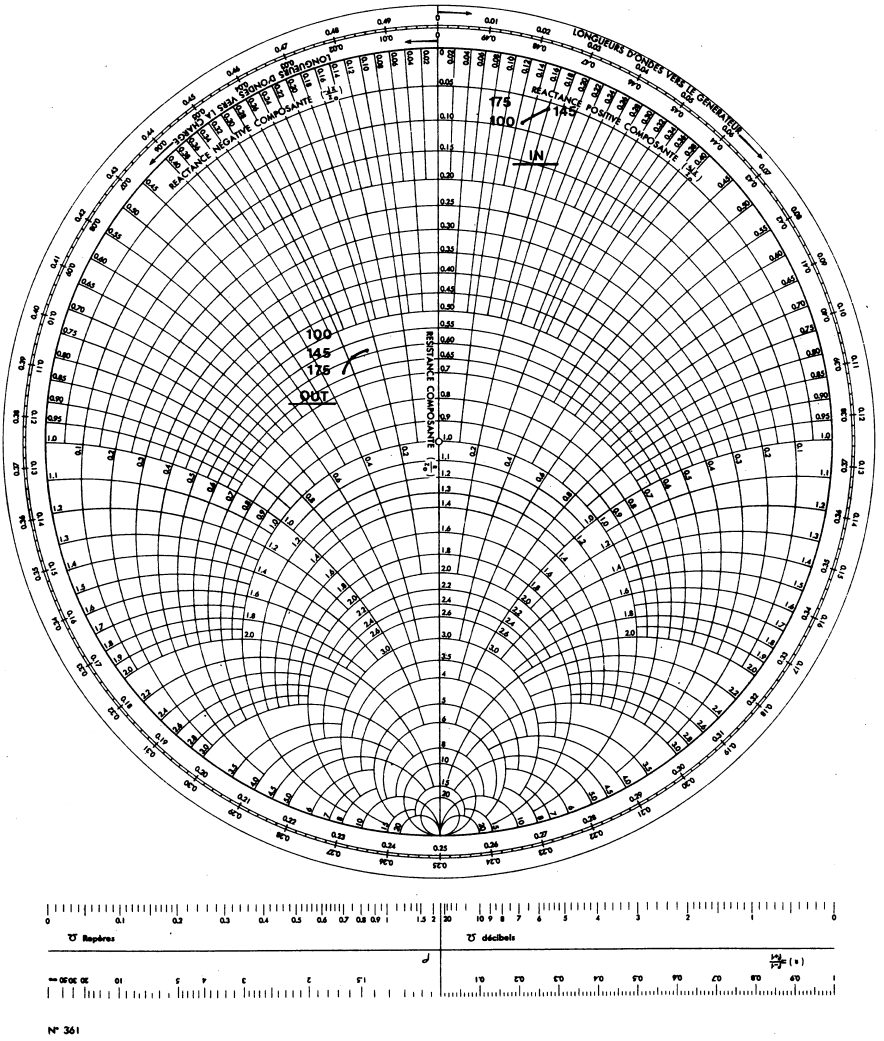
PACKAGE



Dimensions given in mm

C

TYPICAL VALUES

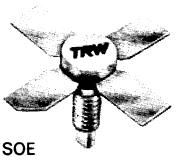


TP 9386 at 28 V Icq = 50 mA Pout = 150 W

	Zin (Ω)	*Zout* (Ω)
100 MHz	0.43 + j0.65	2.88 – j1.13
145 MHz	0.40 + j0.7	2.88 – j1.22
175 MHz	0.29 + j0.87	3.16 – j1.39

UHF Power Transistor

- 1 W
- 20 V
- 100 - 400 MHz
- 16 dB Gain
- Narrow Band
- Gold Reliability



280 SOE

The TM 401 is a NPN gold metallized transistor using diffused emitter ballast resistor design for operation in class A, B or C conditions.

The high gain reduces the need for complex broadband circuits and is ideally suited for 100-400 MHz broadband amplifier applications.

Electrical Characteristics (T_{case} = 25 °C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
DC TEST	BV_{EBO}	Emitter Base Breakdown Voltage	I_E = 0.3 mA	3.5			V
	BV_{CER}	Collector Emitter Breakdown Voltage	R_{BE} = 10 Ω I_C = 20 mA	50			V
	BV_{CEO}	Collector Emitter Breakdown Voltage	I_C = 20 mA	24			V
	BV_{CBO}	Collector Base Breakdown Voltage	I_C = 1 mA	45			V
	I_{CBO}	Collector Base Leakage	V_{CB} = 28 V			0.4	mA
	h_{FE}	DC Current Gain	V_{CE} = 5 V I_C = 100 mA	20		120	
RF TEST	P_G	Power Gain Class A Broad Band	F = 400 MHz V_{CE} = 20 V I_E = 200 mA P_O = .5 W	13			dB
	P_{sat}	Broad Band Min Saturated Output Power Class A	F = 400 MHz V_{CE} = 20 V I_E = 200 mA	1.3			W
	VSWR	Mismatch Tolerance	F_O = 400 MHz V_{CE} = 20 V I_C = 220 mA P_{out} = 1.0 WCW		∞		
	C_{ob}	Collector Base Capacitance	V_{CB} = 24 V F = 1 MHz			5	pF
	F_T	Cutoff Frequency	V_{CE} = 20 V I_E = 200 mA	2.2			GHz
THERMAL	I_C	Maximum Collector Current				0.7	A
	$\theta_{j.C}$	Thermal Resistance Junction Case	T_{case} = 70 °C			20	°C/W
	P_T	Power Dissipation	T_{case} = 25 °C			8.75	W
	T_{STG} T_J	Storage temperature Junction temperature		— 65		+ 200	°C

C

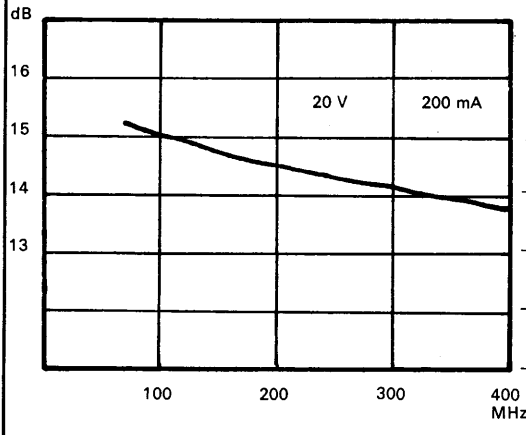
V_{CE} = 20 V - I_C = 200 mA - Class A

POLAR S-PARAMETERS IN 50 OHM SYSTEM								
F	S 11		S 21		S 12		S 22	
MHz	Magn	Angl°	Magn	Angl°	Magn	Angl°	Magn	Angl°
100 MHz	0.67	203°	12.6	112°	0.037	32°	0.41	— 90°
200 MHz	0.78	186°	7.6	93°	0.042	31°	0.33	— 122°
300 MHz	0.79	183°	5.5	82.5°	0.047	30°	0.34	— 135°
400 MHz	0.78	170°	4.21	72°	0.053	30°	0.34	— 137°
500 MHz	0.76	165°	3.39	66°	0.061	35°	0.33	— 138°

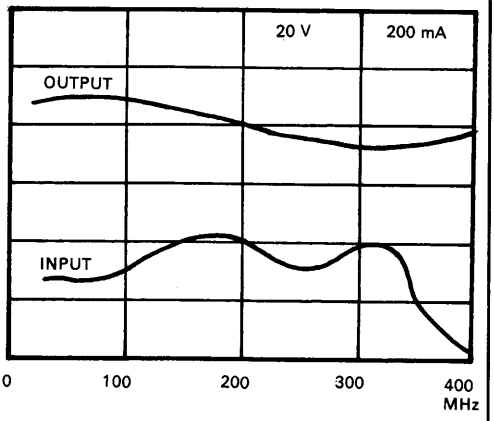
100-400 MHz AMPLIFIER PERFORMANCES

Class A **20 V** **200 mA**

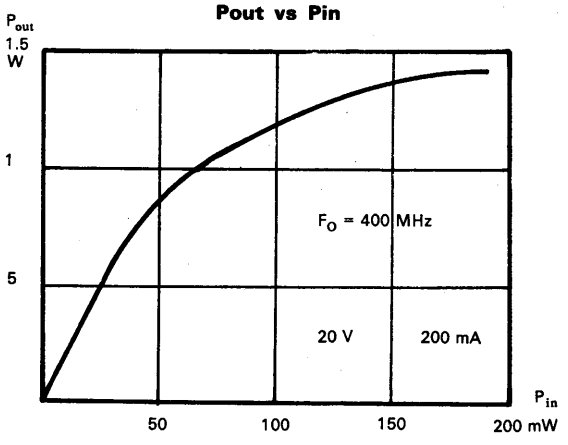
Small Signal Gain Variation



Input and Output VSWR

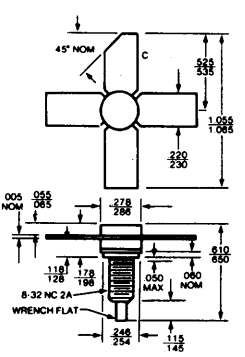


Pout vs Pin

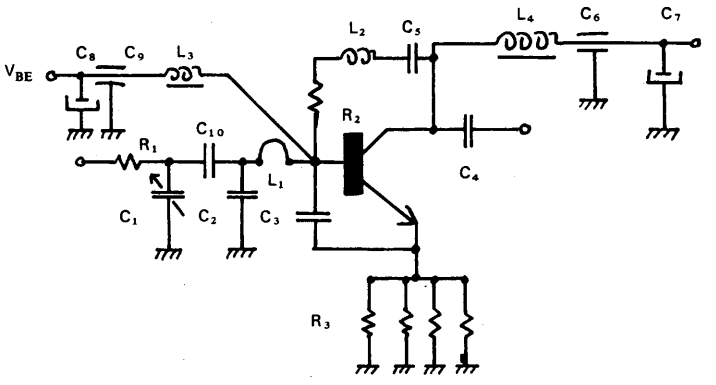


Package

.280 SOE



1 W - 100-400 MHz Class A AMPLIFIER



C_1 = 1-9 pF variable RTC
C_2 = 8.2 pF RTC C 330
C_3 = 2 × 2.2 pF RTC C 632
C_4 = 10 nF RTC C 331
C_5 = C_{10} = 1 nF C 331
C_6 = C_9 = 1 nF by-pass
C_7 = C_8 = 10 µF 25 V

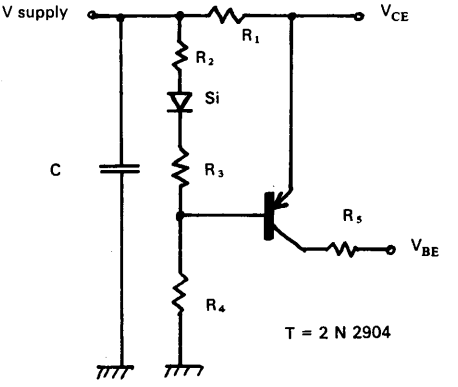
R_1 = 15 Ω carbon composition
R_2 = 300 Ω carbon composition
R_3 = 4 × 3.9 Ω 1/4 W
Carbon composition

L_1 =  5 mm wire 5/10 mm

L_2 = 4 turns ID 4 mm wire 5/10 mm

L_3 = L_4 = choke

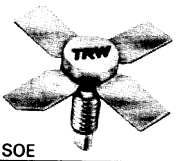
Bias Circuit



R_1 = 11 Ω 1/2 W
R_2 = 500 Ω
R_3 = 220 Ω
R_4 = 4.7 kΩ
R_5 = 22 Ω

UHF Power Transistor

- 5 W
- 400 MHz
- 16 dB Gain
- Gold Reliability



280 SOE

The TPM 405 is a NPN gold metallized transistor using diffused emitter ballast resistors for operation at class A, AB and C.

Its high gain reduces the complexity of the broadband stages and make the TPM 405 ideal for 100-400 MHz applications.

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

Electrical Characteristics (T_{case} = 25 °C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter Base Breakdown Voltage	I_E = 0.5 mA	3.5			V
	BV_{CER}	Collector Emitter Breakdown Voltage	I_C = 40 mA R_{BE} = 10 Ω	50			V
	BV_{CBO}	Collector Base Breakdown Voltage	I_C = 2 mA	45			V
	I_{CBO}	Collector Base Leakage	V_{CB} = 28 V			0.450	mA
	h_{FE}	DC Current Gain	V_{CE} = 5 V I_C = 200 mA	20		120	
RF TEST	P_{GAIN}	Power Gain Class AB	V_{CE} = 24 V P_{out} = 5 W F_O = 400 MHz I_Q = 50 mA	16			dB
	η	Min Collector Efficiency	V_{CE} = 24 V P_{out} = 5 W F_O = 400 MHz I_Q = 50 mA	50			%
	VSWR	Mismatch Tolerance	V_{CE} = 24 V P_{out} = 3 W F_O = 400 MHz I_Q = 50 mA		∞		
	P_{SAT}	Min Saturated Power output	V_{CE} = 24 V F_O = 400 MHz I_Q = 50 mA	7			W
	C_{ob}	Collector Base Capacitance	V_{CB} = 24 V F = 1 MHz			7	pF
THERMAL	I_C	Maximum Collector Current				1.4	A
	$\theta_{J.C}$	Thermal Resistance Junction Case	T_{case} = 70 °C			9.5	°C/W
	T_{STG} T_j	Storage and Junction Temperature		— 65 °C		+ 200	°C

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

C

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

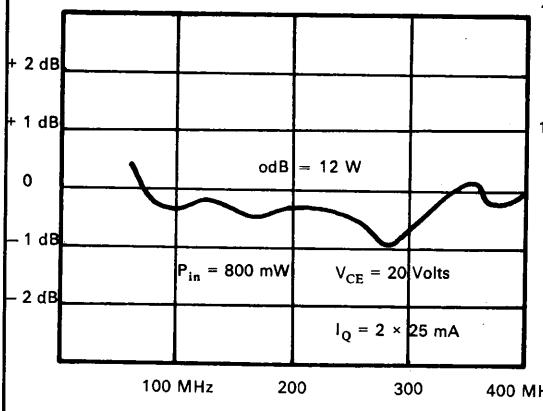
Class AB I_Q = 50 mA F_O = 400 MHz

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

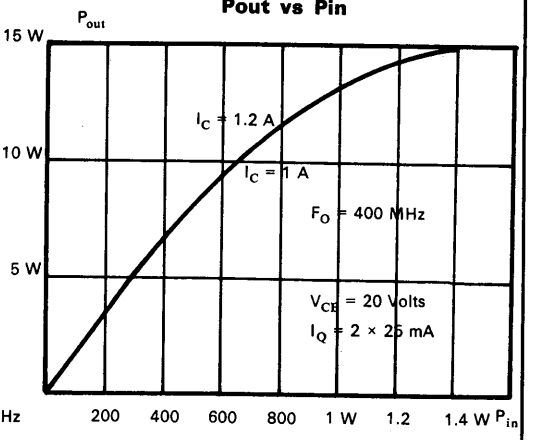
Z_{in}	Z_{out}
(1,5 — J 1) ohm	(15,5 — J 21,4) ohm

PUSH-PULL PERFORMANCE

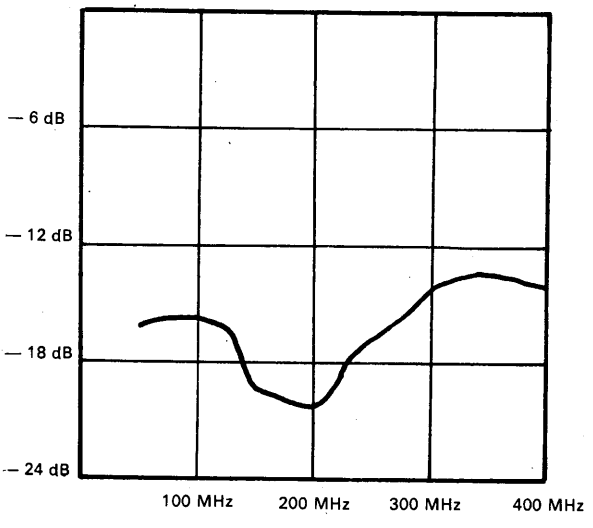
Pout vs Frequency



Pout vs Pin

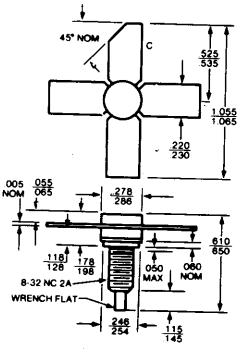


Input Return Loss

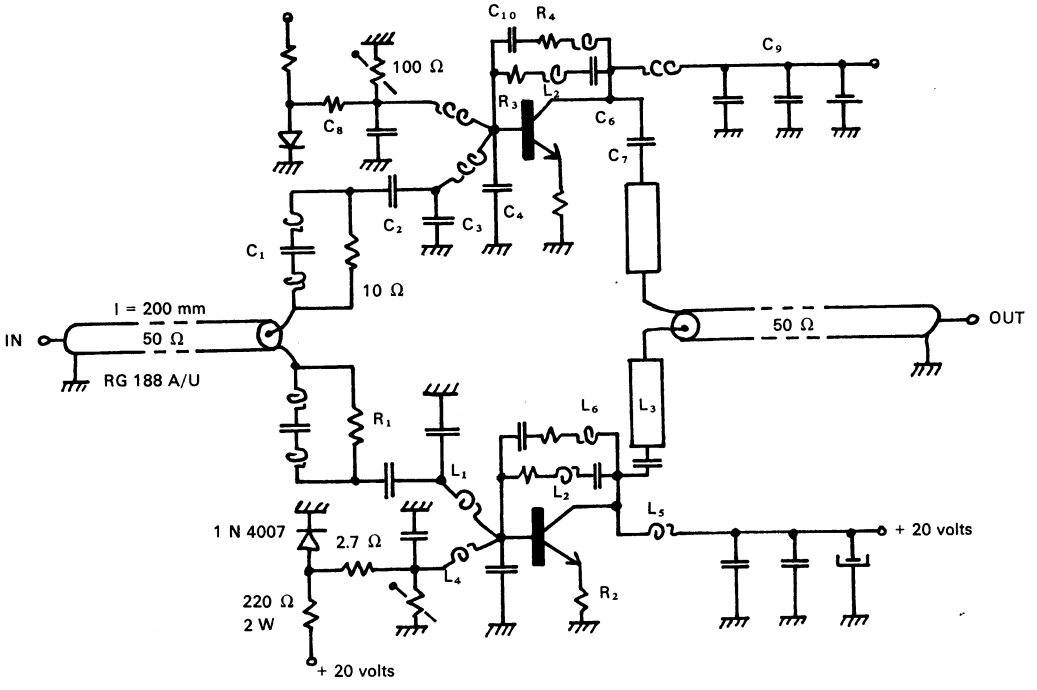


PACKAGE

.280 SOE



PUSH-PULL AMPLIFIER 100-400 MHz



L_1 : 1/2 turn ⌒ ↕ 5 mm 5/10 mm
5 mm

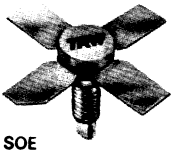
L_2 : 6 turns ⌀ 3 mm 5/10 mm
L_3 : 25 Ω line 2 % λg at 400 MHz
L_4 : Moiled coil .47 μF
L_5 : Moiled coil 4.7 μH
L_6 : 17 turns ⌀ 3 mm 5/10 mm

C_1 : 27 pF C 300 RTC with 12 mm leads
C_2 : C_7 = 10 nF chip
C_3 : 27 pF ATC 100 A
C_4 : 2 × 1.3 pF ATC 100 A
C_6 : C_{10} = 10 nF RTC C 331
C_8 : C_9 = 1 nF + 10 nF + 0.1 μF + 10 μF decoupling

R_1 = 10 Ω 1/4 W carbon
R_2 = 4 × 1 Ω 1/4 W carbon
R_3 = R_4 = 300 Ω 1/4 W carbon

UHF Power Transistor

- 25 W
- 400 MHz
- 9 dB Gain
- Gold Reliability

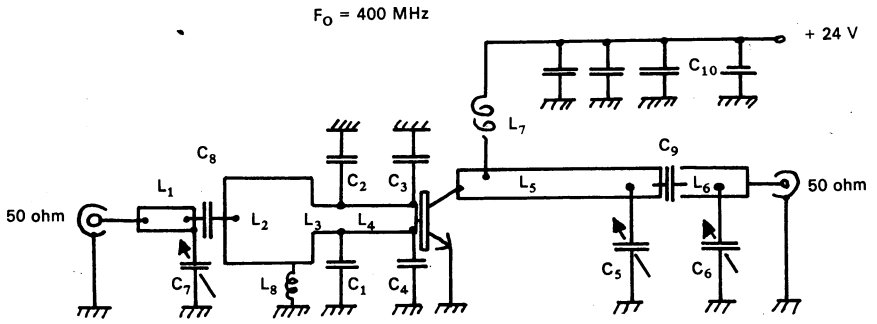


280 SOE

The TPM 425 is a high gain UHF transistor which has been specially designed for use in 100-400 MHz broadband amplifiers.
Its construction utilizes the new standard, gold metallization and diffused emitter ballast resistors, allowing class A, B or C operation and a high degree of ruggedability.

Electrical Characteristics (T_{case} = 25 °C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 3 mA	4			V
	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_E = 20 mA	25			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 10 mA	45			V
	H_{FE}	D.C Current Gain	V_{CE} = 20 V I_C = 500 mA	10			
RF TEST	P_{out}	Power Output	V_{CE} = 24 V F_O = 400 MHz P_{in} = 3 W	25			W
	η_C	Collector Efficiency	V_{CE} = 24 V F_O = 400 MHz P_{out} = 25 W	60	70		%
	C_{OB}	Collector - Base Capacitance	V_{CE} = 24 V F = 1 MHz			20	pF
	I_C	Maximum Collector Current				2	A
THERMAL	θ_{J-C}	Thermal Resistance Junction - Case	T_{case} = 25 °C			5	°C/W
	T_{STG} T_J	Storage Temperature Junction Temperature		— 65		+ 200	°C



L_1 = 50 ohm line
L_2 = 22 ohm line 3 % λg at 400 MHz
L_3 = 30 ohm line 0.5 % λg at 400 MHz
L_4 = 30 ohm line 1 % λg at 400 MHz
L_5 = 50 ohm line 5.5 % λg at 400 MHz
L_6 = 50 ohm line 3.5 % λg at 400 MHz

L_7 = 2 turns — ID 7 mm — wire 1 mm
L_8 = 0.68 μH - Molded — RFC

C_1 = C_2 = 18 pF — ATC — 100 A
C_3 = C_4 = 10 pF — ATC — 100 A
C_5 = AT 5501 — 1-20 pF — Tekelec
C_6 = C_7 = AT 5601 — 1-30 pF — Tekelec
C_8 = C_9 = 1 nF
C_{10} = 1 nF + 10 nF + .1 μF + 10 μF Decoupling.

POLAR S-PARAMETERS 50 OHM SYSTEM

FREQ. MHz	S 11		S 21		S 12		S 22	
	Magn	Angl°	Magn	Angl°	Magn	Angl°	Magn	Angl
100	0.957	181	3.89	99	0.019	35	0.707	190
200	0.957	178	1.97	95	0.019	45	0.724	186
300	0.957	176	1.29	75	0.025	45	0.741	184
400	0.957	174	1.06	68	0.032	50	0.749	184
500	0.957	172	0.86	63	0.035	57	0.746	183

V_{CE} = 25 V I_C = 850 mA