TRW® SEMICONDUCTORS

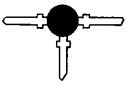
TP 210

7.5 Volts Transistor

88 MHz

19 dB GAIN

Using the most recent TRW technology, this T-Pack transistor has been specifically designed and characterized as a high gain 7.5 V VHF device. It is ideally suited for use in pocketphone applications where low battery voltage is used.

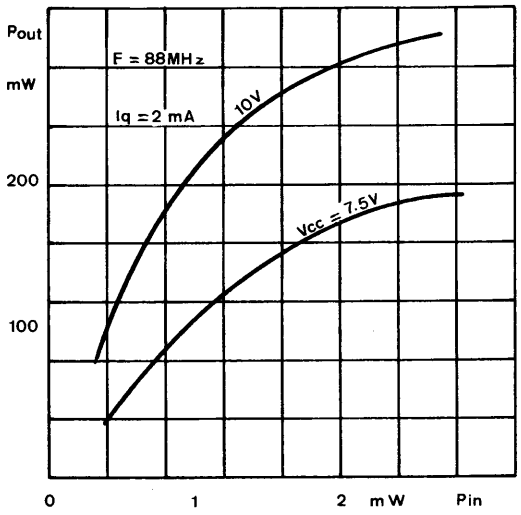


T - PACK

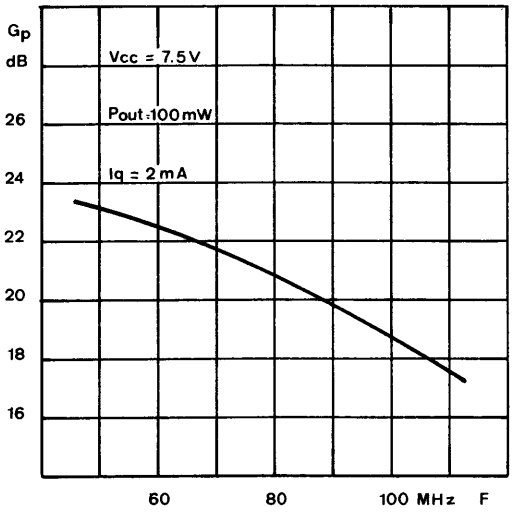
Preliminary

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter Base Breakdown Voltage	I_E = 0.1 mA	I_C = 0	3			V
	BV_{CEO}	Collector Emitter Breakdown Voltage	I_C = 10 mA	I_B = 0	20			V
	BV_{CER}	Collector Emitter Breakdown Voltage	I_C = 10 mA	R_{BE} = 10 Ω	25			V
	BV_{CEO}	Collector Base Breakdown Voltage	I_C = 1 mA	I_E = 0	30			V
	H_{FE}	DC Current Gain	V_{CE} = 10 V	I_C = 40 mA	15			—
RF TEST	P_{GAIN}	Power Gain	V_{CE} = 7.5 V I_C = 2 mA	P_{in} = 1 mW F = 88 MHz	80			mW
	F_T	Cutoff Frequency	V_{CE} = 10 V I_C = 40 mA	F = 100 MHz		2		GHz
	G_{Umax}	Maximum unilaterilized Gain	V_{CE} = 10 V I_C = 40 mA	F = 100 MHz		26		dB
	S_{21}	Forward Gain 50 Ω/50 Ω	V_{CE} = 10 V I_C = 40 mA	F = 100 MHz		24		dB
	C_{ob}	Collector Base Capacitance	V_{CB} = 10 V	F = 1 MHz		2.5		pF
OPERATING THERMAL	I_{Cmax}	Maximum Collector Current					200	mA
	P_T	Dissipated Power	T_{case} = 50 °C				0.6	W
	T_{STG}	Storage Temperature			— 65°		+ 200	°C
	T_J	Junction Temperature						

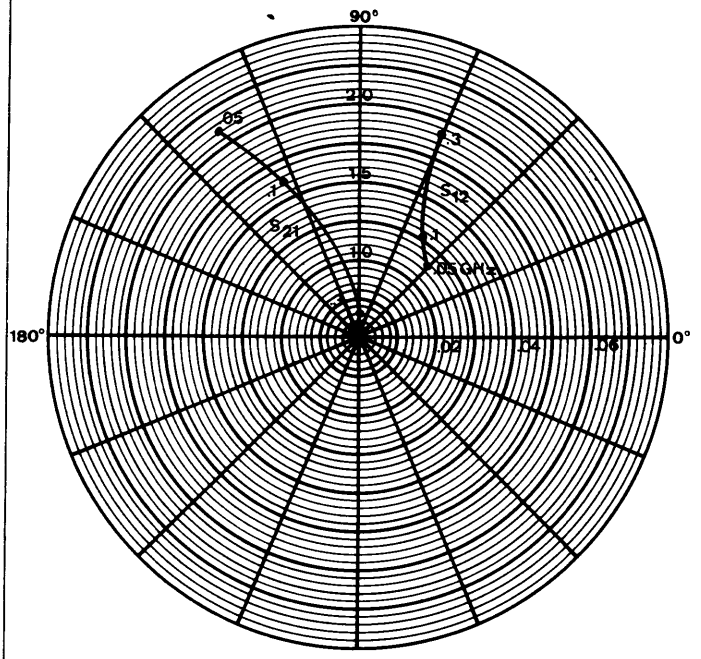
Output Power vs Frequency and Voltage Supply



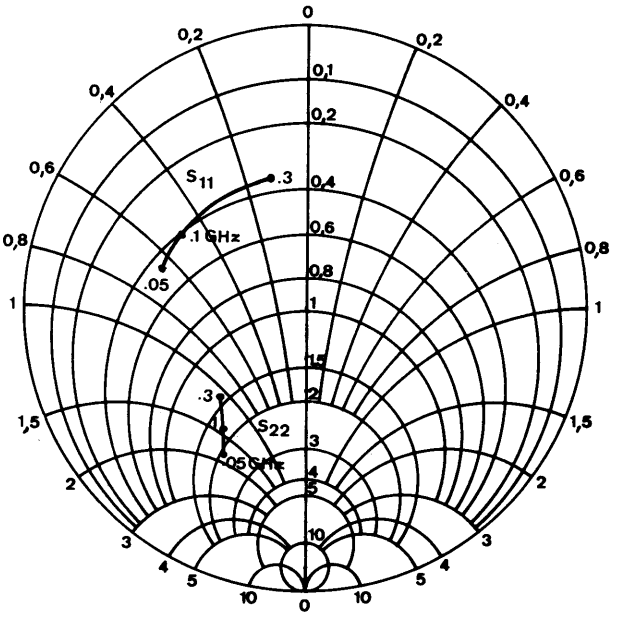
Power Gain vs Frequency



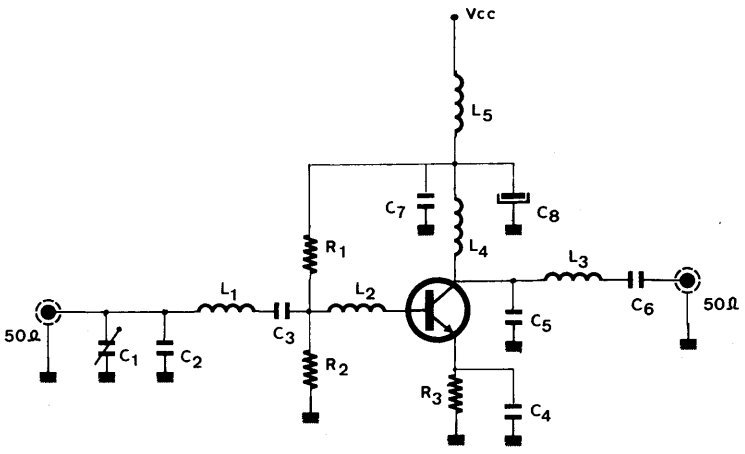
S21 - S12 Parameters vs Frequency
V_{CE} = 10 V - I_C = 40 mA



S11 - S22 Parameters vs Frequency
V_{CE} = 10 V - I_C = 40 mA



88 MHz Test Circuit

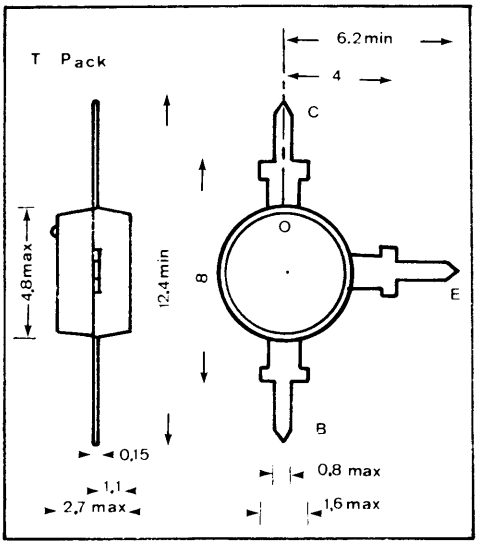


C_1 = 6-60 pF Trimmer Capacitor
C_2 = 22 pF Ceramic
C_3 = 180 pF Ceramic
C_4 = C_7 = 1 nF Ceramic
C_5 = 18 pF
C_6 = 220 pF
C_8 = 1 µF Electrolytic

L_1 = L_2 = 0.1 µH Molded Coil
L_3 = 0.18 µH Molded Coil
L_4 = 0.22 µH Molded Coil
L_5 = 1.2 µH Molded Coil

R_1 = 680 Ω Carbon composition
R_2 = 56 Ω Carbon composition
R_3 = 4.7 Ω Carbon composition

Package Outline



TRW® SEMICONDUCTORS

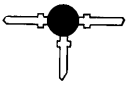
TP 250

7.5 Volts Transistor

400 - 512 MHz

12 dB GAIN

Using the most recent TRW technology, this T-Pack transistor has been specifically designed and characterized as a high gain 7.5 V VHF device. It is ideally suited for use in pocketphone applications where low battery voltage is used.

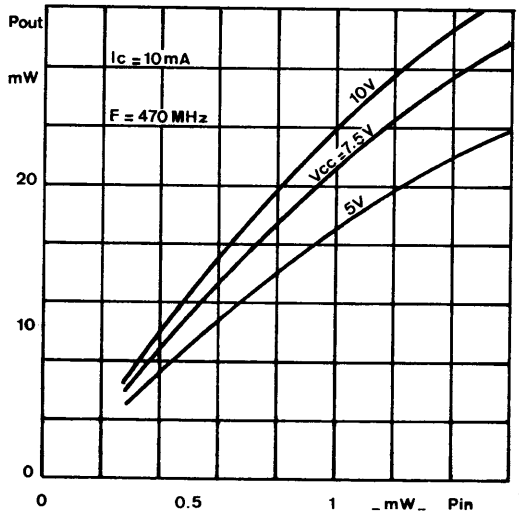


T - PACK

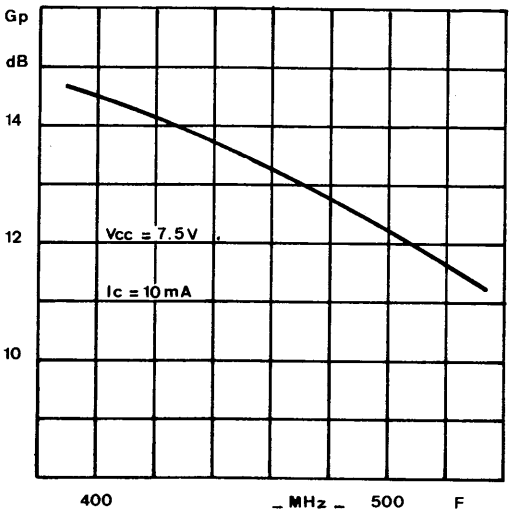
Preliminary

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter Base Breakdown Voltage	I_E = 0.1 mA I_C = 0	3			V
	BV_{CEO}	Collector Emitter Breakdown Voltage	I_C = 10 mA I_B = 0	18			V
	BV_{CER}	Collector Emitter Breakdown Voltage	I_C = 10 mA R_{BE} = 10 Ω	30			V
	BV_{CBO}	Collector Base Breakdown Voltage	I_C = 1 mA I_E = 0	35			V
	H_{FE}	DC Current Gain	V_{CE} = 10 V I_C = 40 mA	15			—
RF TEST	P_{GAIN}	Power Gain	V_{CE} = 7.5 V I_C = 10 mA P_{in} = 1 mW F = 470 MHz	15			mW
	F_T	Cut-off Frequency	V_{CE} = 10 V I_C = 40 mA F = 500 MHz		2.5		GHz
	$G_{U\ max}$	Maximum Unilaterilized Gain	V_{CE} = 10 V I_C = 40 mA F = 500 MHz		14		dB
	S_{21}	Forward Gain 50 Ω/50 Ω	V_{CE} = 10 V I_C = 40 mA F = 500 MHz		12.5		dB
	C_{ob}	Collector Base Capacitance	V_{CB} = 10 V F = 1 MHz		2.5		pF
OPERATING	$I_{C\ max}$	Maximum Collector Current				200	mA
	P_T	Dissipated Power	T_{case} = 50 °C			0.6	W
	T_{STG}	Storage Temperature		— 65		+ 200	°C
	T_J	Junction Temperature					

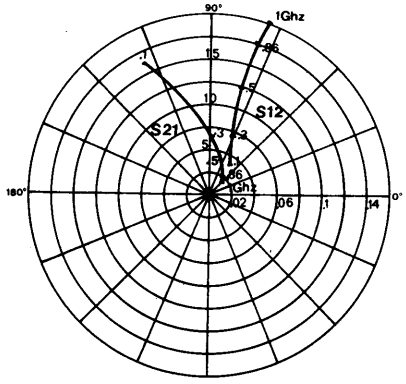
Output Power vs Input Power and Voltage Supply



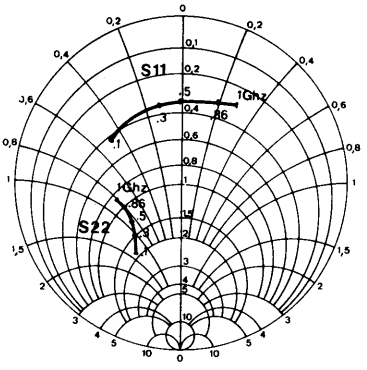
Power Gain vs Frequency



S21 - S12 Parameters vs Frequency
V_{CE} = 10 V - I_C = 40 mA

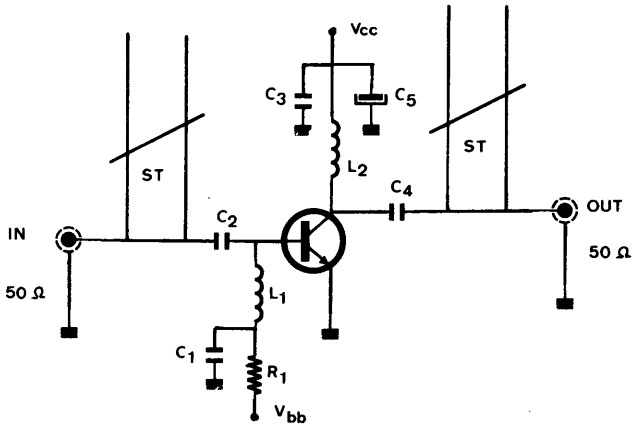


S11 - S22 Parameters vs Frequency
V_{CE} = 10 V - I_C = 40 mA



TYPICAL VALUE

Test Circuit 400-512 MHz



$L_1 = L_2 = 0.33\ \mu H$ Molded coil
$C_1 = C_2 = C_3 = C_4 = 1000$ pF Ceramic chip
$C_5 = 10\ \mu F/25$ V Electrolytic
$R_1 = 10\ k\Omega$ 1/2 W Carbon composition
ST = Stub tuner

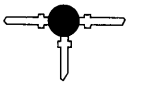
TRW SEMICONDUCTORS

TP 312

UHF LINEAR TRANSISTOR

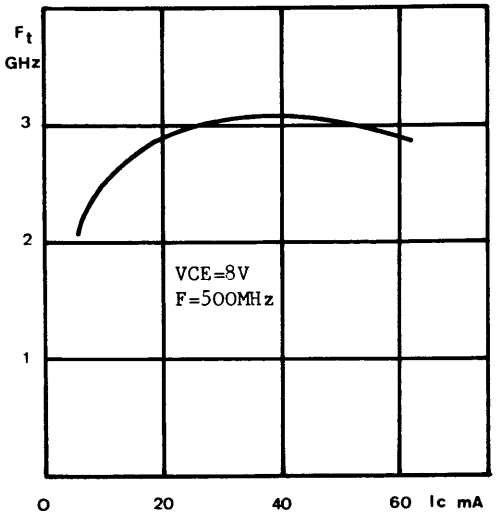
HIGH OUTPUT AT LOW COST
0.7 V AT - 60 DB IMD
GOLD RELIABILITY
3 GHz FT

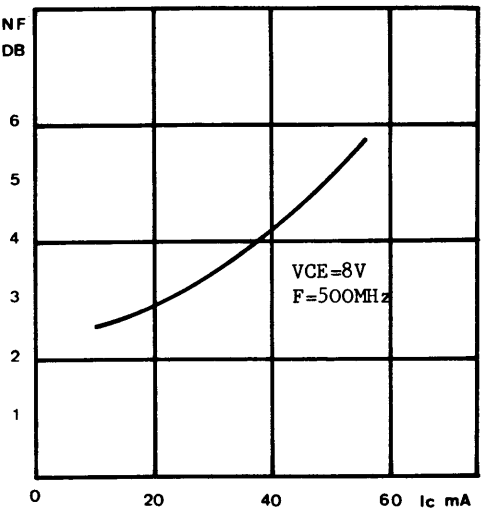
The TP 312 is a NPN transistor, gold metallized for reliability, using diffused ballast resistors for super linearity at low currents compatible with the power dissipation capability of a T-pack. TP 312 is the ideal candidate for up to **0.7 V** (DIN 45004/B) **MATV** amplifiers from **40 to 860 MHz.** The TP 312 has applications in driver stages of 12 volts VHF/UHF transmitters and broadband instrumentation equipment.

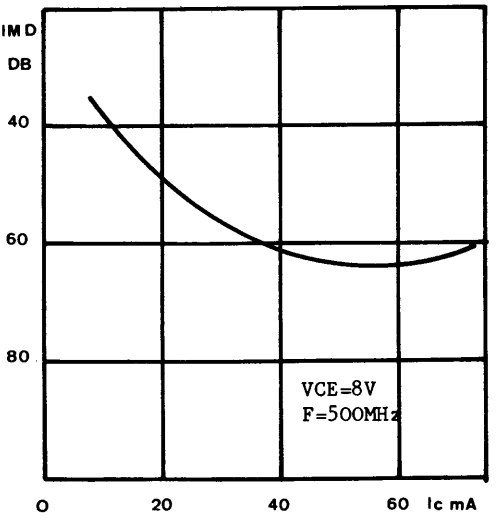


Electrical Characteristics (T_{flange} = 25 °C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC Test	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 0.1 mA	3.5			V
	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_C = 10 mA	14			V
	BV_{CER}	Collector - Emitter Breakdown Voltage	I_C = 10 mA R_{BE} = 10 ohms	20			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 0.1 mA	20			V
	h_{FE}	D.C. Current Gain	V_{CE} = 8 V I_C = 40 mA	15			
RF Test	NF	Noise Figure	V_{CE} = 8 V I_C = 40 mA F = 500 MHz		4.5		dB
	f_T	Cutoff Frequency	V_{CE} = 8 V I_C = 40 mA F = 500 MHz		3		GHz
	G_{Umax}	Maximum Unilaterilized Gain	V_{CE} = 8 V I_C = 40 mA F = 500 MHz		13.5		dB
	$\|S_{21}\|$	Forward Gain 50 Ω/50 Ω	V_{CE} = 10 V I_C = 40 mA F = 500 MHz		12		dB
	IMD	Intermodulation Distortion 3 Tone - Din 45004/B F = 500 MHz R_{LOAD} = 75 ohms	V_{CE} = 8 V V_{out} = 700 mV I_C = 40 mA		— 60		dB
	C_{OB}	Collector - Base Capacitance	V_{CB} = 8 V f = 1 MHz		1.7		pF
Thermal	I_{Cmax}	Maximum Collector Current				300	mA
	P_T	Dissipated Power				0.7	W
	T_{STG}	Storage Temperature		— 65		+ 200	°C
	T_J	Junction Temperature					

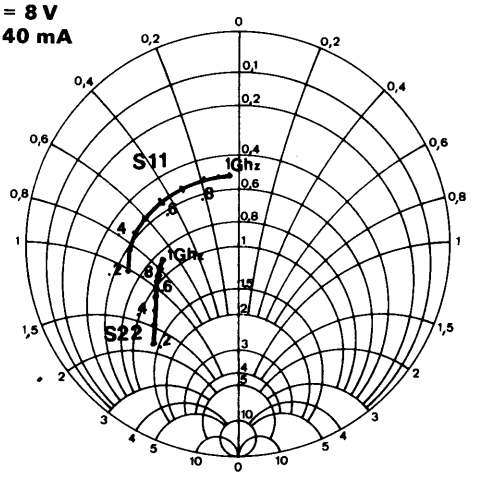

Ft
GHz
3
2
1
VCE=8V
F=500MHz
0
20
40
60 Ic mA


NF
DB
6
5
4
3
2
1
VCE=8V
F=500MHz
0
20
40
60 Ic mA


IMD
DB
40
60
80
VCE=8V
F=500MHz
0
20
40
60 Ic mA

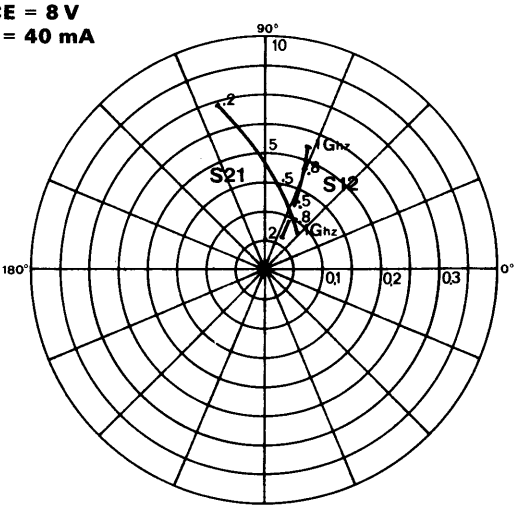
S11-S22 VS FREQUENCY

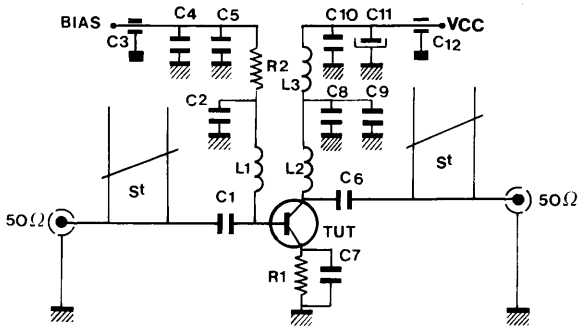
VCE = 8 V
IC = 40 mA



S12-S21 VS FREQUENCY

VCE = 8 V
IC = 40 mA

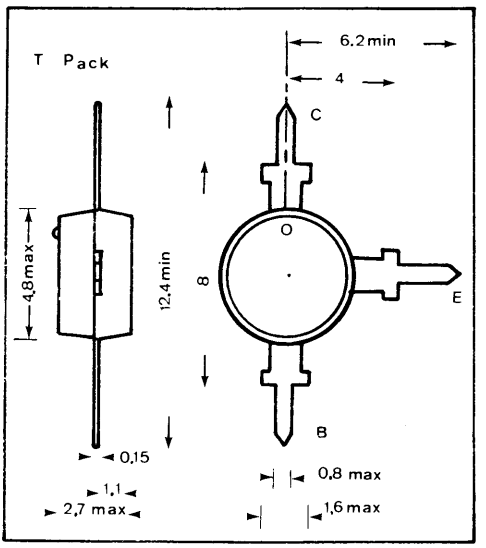




NF AND GAIN TEST CIRCUIT SHEMATIC

$L_{1,2}$	0.02 μH
L_3	0.1 μH - molded coil
$C_{1,6}$	220 pF ceramic chip
$C_{2,4,8}$	470 pF ceramic disc
$C_{3,12}$	1000 pF by pass
$C_{5,9}$	1000 pF ceramic disc
C_7	470 pF ceramic chip
C_{11}	100 μF/25 V - electrolytic
R_1	100 ohms 1/4 W carbon composition
R_2	1.5 K 1/4 W carbon composition
St	Stub tuner

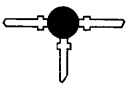
PACKAGE OUTLINE



UHF LINEAR TRANSISTOR

3 DB NOISE FIGURE
AT 500 MHz
3 GHz F_T
LOW COST

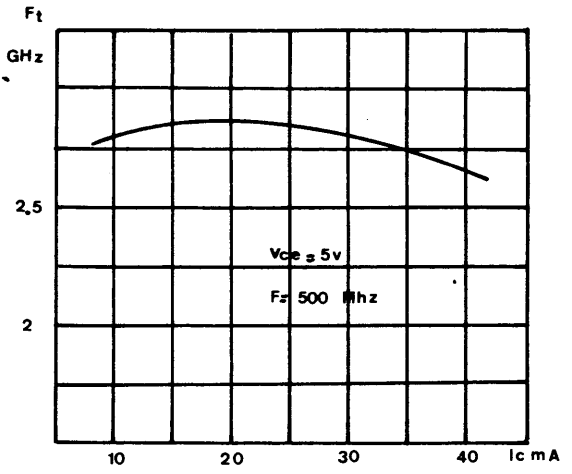
The TP 390 is a low level NPN silicon transistor mounted in T.pack for low cost. Its 3 GHz transition frequency makes it an ideal candidate for broadband UHF linear applications such as in small signal MATV amplifiers from 40 to 860 MHz TP 390 has applications in most VHF/UHF amplifiers such as instrumentation and communications equipments.

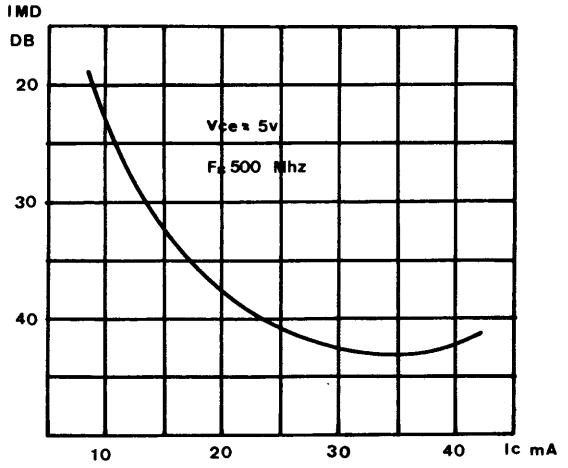


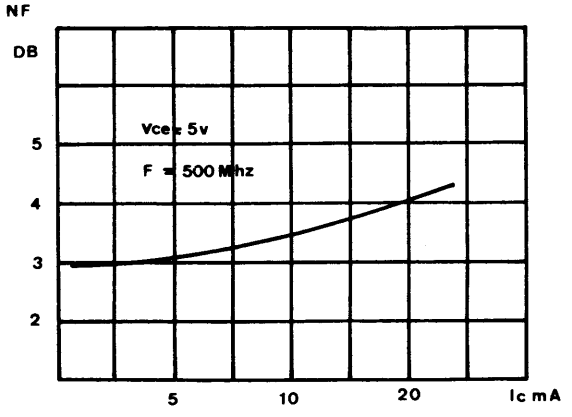
T PACK

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

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC Test	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 0.1 mA	2.5			V
	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_C = 10 mA	15			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 0.1 mA	25			V
	I_{CBO}	Collector - Base Leakage	V_{CB} = 10 V			0.05	µA
	h_{FE}	D.C. Current Gain	V_{CE} = 1 V I_C = 25 mA	20			
RF Test	NF	Noise Figure	V_{CE} = 5 V I_C = 2 mA F = 500 MHz		3		dB
	f_T	Cutoff Frequency	V_{CE} = 5 V I_C = 25 mA F = 500 MHz		2.8		GHz
	G_{Umax}	Maximum Unilaterilized Gain	V_{CE} = 10 V I_C = 25 mA F = 500 MHz		13.5		dB
	$\|S_{21}\|$	Forward Gain 50 Ω/50 Ω	V_{CE} = 10 V I_C = 25 mA F = 500 MHz		11.5		dB
	IMD	Intermodulation Distortion 3 Tone - Din 45004/B F = 500 MHz R_{LOAD} = 75 ohms	V_{CE} = 5 V V_{out} = 700 mV I_C = 30 mA		— 40		dB
	C_{OB}	Collector - Base Capacitance	V_{CB} = 10 V f = 1 MHz		0.7		pF
Thermal	I_{Cmax}	Maximum Collector Current				50	mA
	P_T	Dissipated Power				180	mW
	T_{STG}	Storage Temperature		— 65		+ 200	°C
	T_j	Junction Temperature					

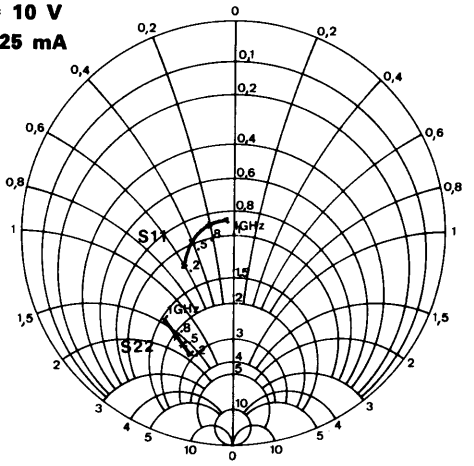

Ft
GHz
2,5
2
Vce = 5v
F= 500 Mhz
10
20
30
40
Ic mA


IMD
DB
20
30
40
Vce = 5v
F = 500 Mhz
10
20
30
40
Ic mA


NF
DB
5
4
3
2
Vce = 5v
F = 500 Mhz
5
10
20
Ic mA

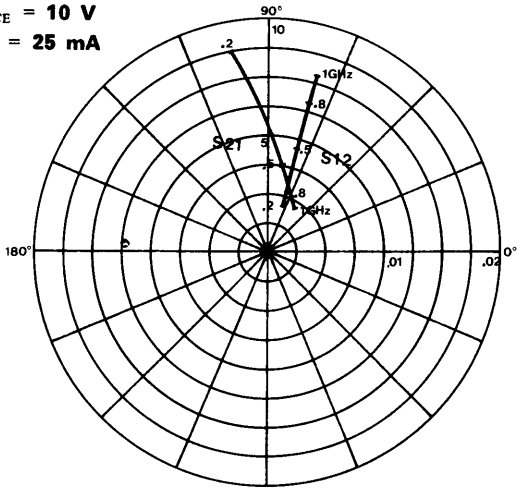
S 11 - S 22 PARAMETERS VS FREQUENCY

V_{CE} = 10 V
I_C = 25 mA

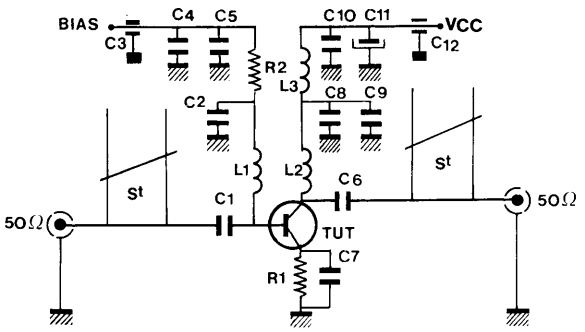


S 21 - S 12 PARAMETERS VS FREQUENCY

V_{CE} = 10 V
I_C = 25 mA



NF AND GAIN TEST CIRCUIT SHEMATIC



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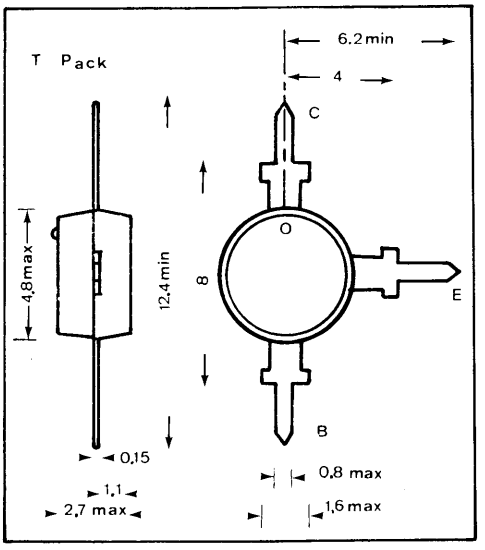
C_7	470 pF ceramic chip
C_{11}	100 µF/25 V - electrolytic
R_1	100 ohms 1/4 W carbon composition
R_2	1.5 K 1/4 W carbon composition
St	Stub tuner

PACKAGE OUTLINE



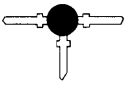
TRW® SEMICONDUCTORS

TP 393

UHF LINEAR TRANSISTOR

The TP 393 is a gold metallized NPN silicon transistor specifically designed for low noise, high frequency broadband operation. It is mounted in T-pack for high volume low cost applications. These characteristics make it an ideal choice for low noise, intermediate level **MATV/CATV** amplifiers from **40 to 860 MHz** TP 393 has applications in low noise **receivers** and **mixers** up to **2.5 GHz** in radio or cable communication, doppler radars and instrumentation equipment.

2 DB NOISE FIGURE
AT 500 MHz
3 GHz FT
HIGH OUTPUT



T - PACK

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

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC Test	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 0.1 mA	2.5			V
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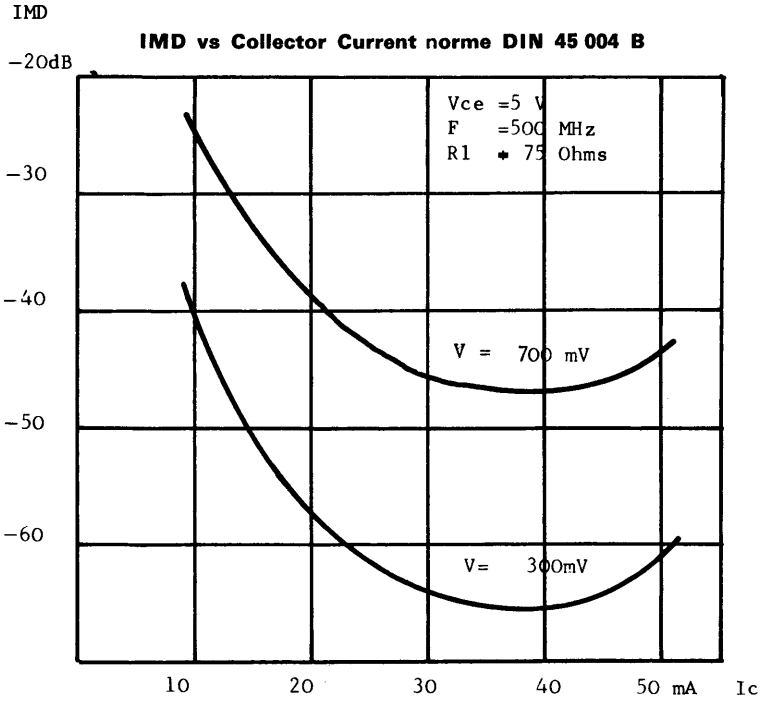
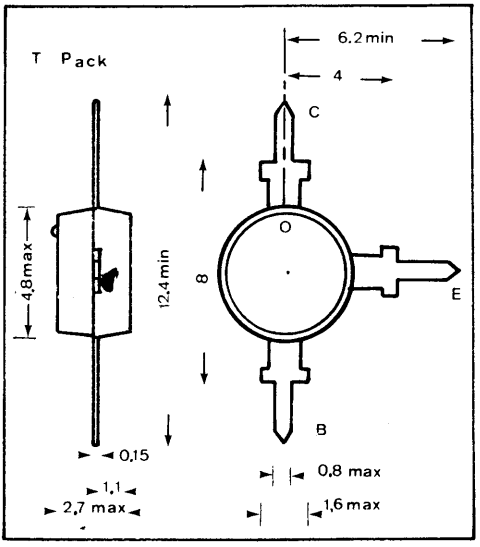
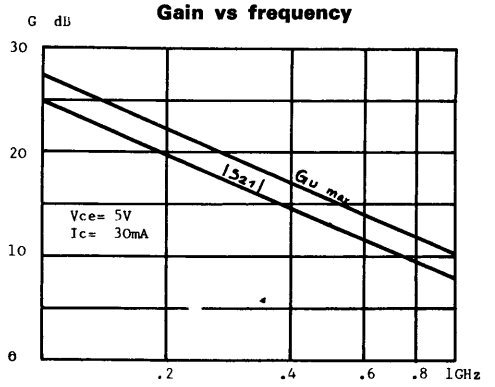
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 0.1 mA	25			V
	h_{FE}	D.C Current Gain	V_{CE} = 5 V I_C = 30 mA	25			
RF Test	NF	Noise Figure	V_{CE} = 5 V I_C = 2 mA F = 500 MHz		2	2.5	dB
	f_T	Cutoff Frequency	V_{CE} = 5 V I_C = 30 mA F = 500 MHz	2.8	3.0		GHz
	G_{Umax}	Maximum Unilaterilized Gain	V_{CE} = 5 V I_C = 30 mA F = 500 MHz	15	15.5		dB
	S_{21}	Forward Gain 50Ω/50 Ω	V_{CE} = 5 V I_C = 30 mA F = 500 MHz		14		dB
	IMD	Intermodulation Distortion 3 Tone - Din 45004/B F = 500 MHz R_{LOAD} = 75 ohms	V_{CE} = 5 V V_{out} = 300 mV I_C = 30 mA V_{out} = 700 mV		— 60 — 45		dB dB
	C_{OB}	Collector - Base Capacitance	V_{CB} = 5 V f = 1 MHz		0.7		pF
Operating Thermal	I_{Cmax}	Maximum Collector Current				50	mA
	P_T	Dissipated Power				250	mW
	T_{STG}	Storage Temperature		— 65		+ 200	°C
	T_j	Junction Temperature				150	°C

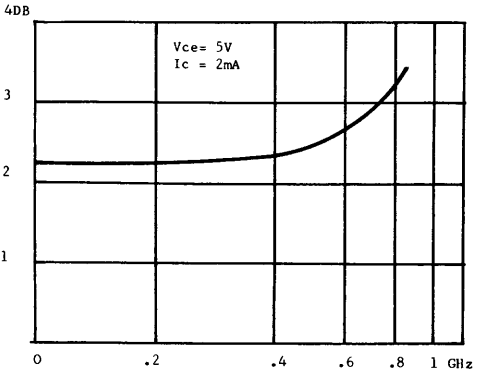

IMD
IMD vs Collector Current norme DIN 45 004 B
-20dB
-30
-40
-50
-60
Vce =5 V
F =500 MHz
R1 = 75 Ohms
V = 700 mV
V= 300mV
10
20
30
40
50 mA
Ic


T Pack
6.2 min
4
C
O
E
B
4,8 max
12,4 min
8
0,15
1,1
2,7 max
0,8 max
1,6 max

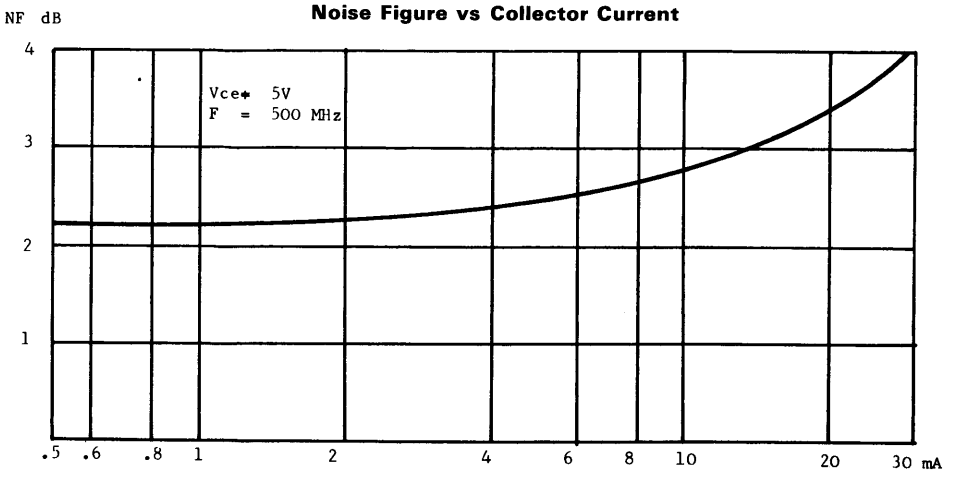
Gain vs frequency



Noise Figure vs Frequency



Noise Figure vs Collector Current



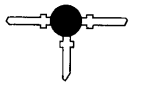
TRW SEMICONDUCTORS

TP 394

UHF LINEAR TRANSISTOR

HIGH OUTPUT
AT LOW COST
0,7 V AT - 62 DB IMD
GOLD RELIABILITY
2,5 GHZ FT

The TP 394 is a NPN transistor, gold metallized for reliability, using diffused ballast resistors for super linearity at currents compatible with the power dissipation capability of a T-Pack. TP 394 is the ideal candidate for up to **0.8 V** (DIN 45004/B) **MATV** amplifiers from **40 to 860 MHz.** The TP 394 has applications in driver stages of 12 volts VHF/UHF transmitters and broadband instrumentation equipment.

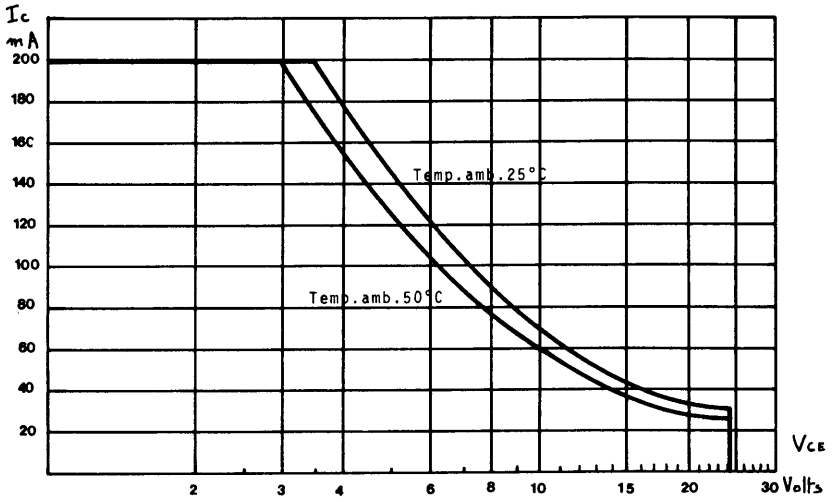


T - PACK

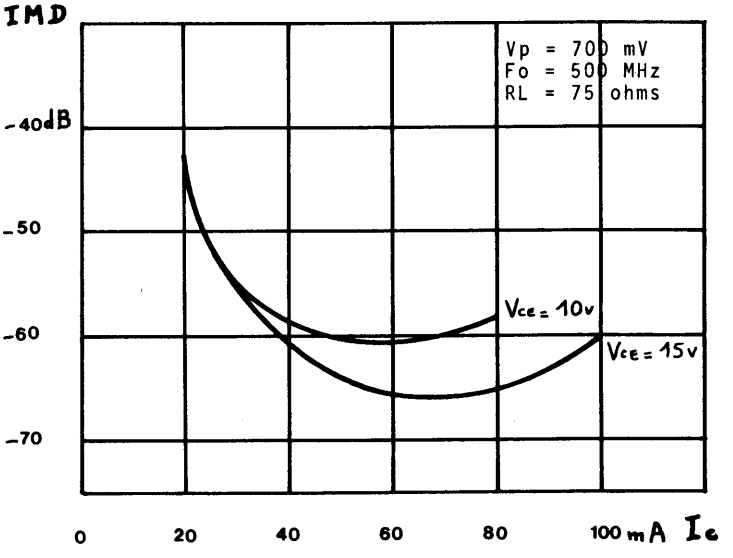
Electrical Characteristics (T_{CASE} = 25 °C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
D C Test	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 0.1 mA	3			V
	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_C = 10 mA	25			V
	BV_{CER}	Collector - Emitter Breakdown Voltage	I_C = 10 mA R_{BE} = 10 ohms	30			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 1 mA	35			V
	h_{FE}	D.C Current Gain	V_{CE} = 10 V I_C = 40 mA	15			
R F Test	NF	Noise Figure	V_{CE} = 10 V I_C = 20 mA F = 500 MHz		3.5		dB
	f_T	Cutoff Frequency	V_{CE} = 10 V I_C = 40 mA F = 500 MHz		2.5		GHz
	G_{Umax}	Maximum Unilaterilized Gain	V_{CE} = 10 V I_C = 40 mA F = 500 MHz		14		dB
	[S 21]	Forward Gain 50 Ω/50 Ω	V_{CE} = 10 V I_C = 40 mA F = 500 MHz		12.5		dB
	IMD	Intermodulation Distortion 3 Tone - DIN 45004/B F = 500 MHz R_{Load} = 75 ohms	V_{CE} = 10 V V_{out} = 700 mV I_C = 60 mA		— 62		dB
	C_{OB}	Collector - Base Capacitance	V_{CB} = 10 V f = 1 MHz		2.5		pF
Thermal	I_{Cmax}	Maximum Collector Current				200	mA
	P_T	Dissipated Power	T_{CASE} = 50 °C			0.6	W
	T_{STG}	Storage Temperature		— 65		+ 200	°C
	T_J	Junction Temperature					

Safe Operating Area

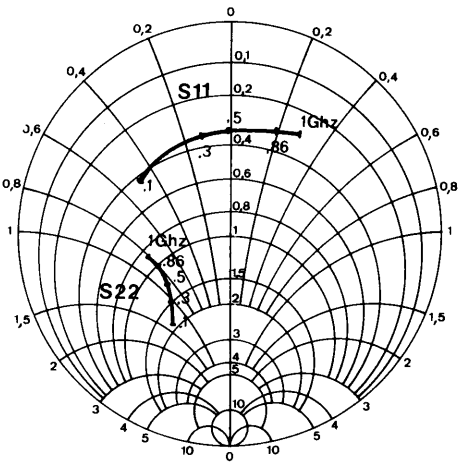


IMD vs Ic Collector Current



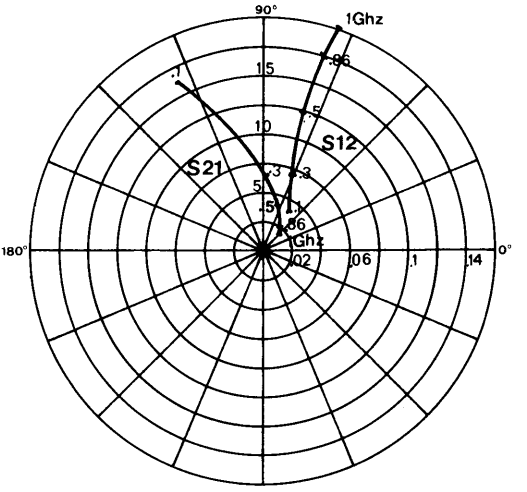
S11 - S22 Parameters vs Frequency

V_{CE} = 10 V - I_C = 40 mA



S21 - S12 Parameters vs Frequency

V_{CE} = 10 V - I_C = 40 mA

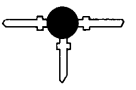


UHF LINEAR TRANSISTOR

1.6 DB NOISE FIGURE
AT 500 MHz
3.5 GHz FT
HIGH OUTPUT

The TP 491 is a gold metallized NPN silicon transistor specifically designed for low noise, high frequency broadband operation, which is mounted in T-pack for high volume low cost applications. These characteristics make it an ideal for low noise, intermediate level **MATV/ CATV** amplifiers from **40 to 860 MHz.**

TP 491 has applications in low noise **receivers** and **mixers** up to **2.5 GHz** in radio or cable communication, doppler radars and instrumentation equipments.

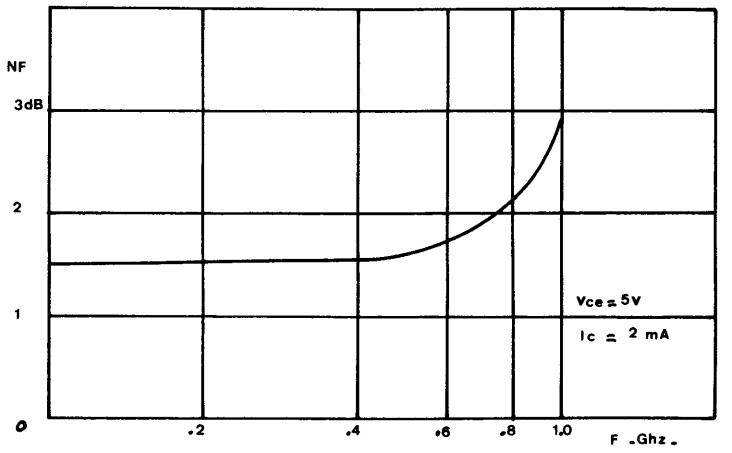


T - PACK

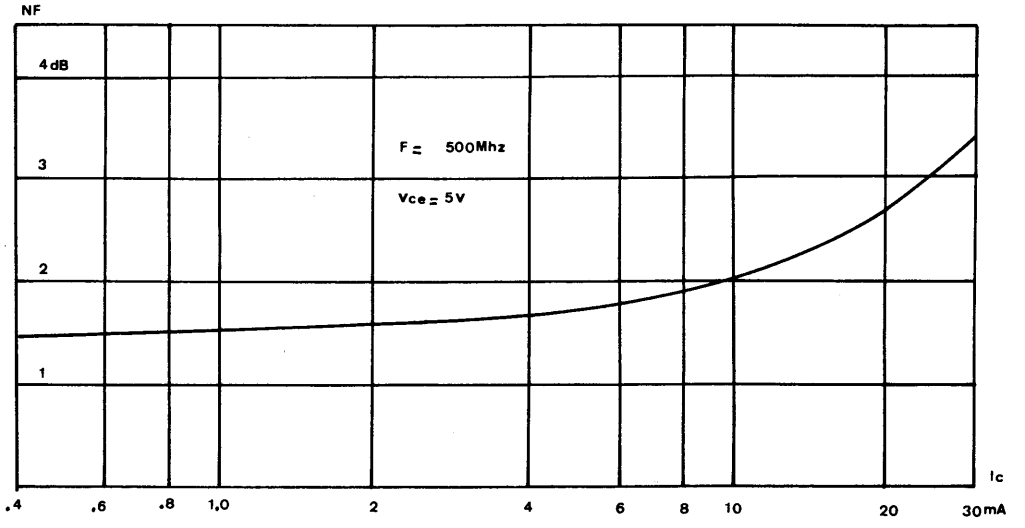
Electrical Characteristics (T_{flange} = 25 °C)

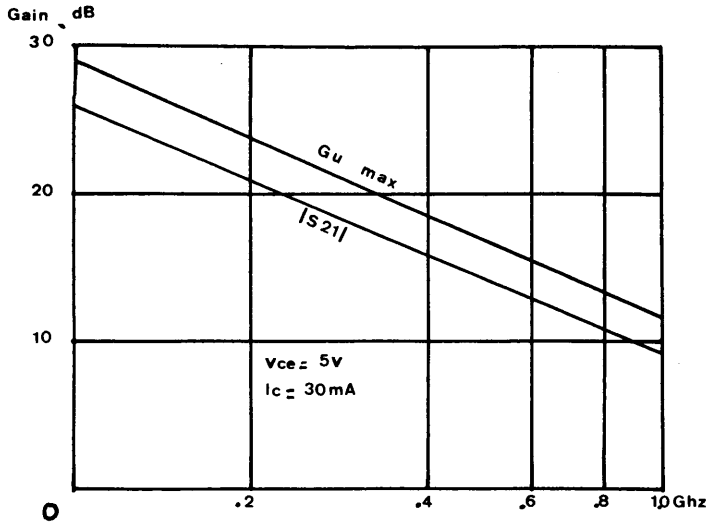
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC Test	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 0.1 mA	2.5			V
	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_C = 10 mA	14			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 0.1 mA	25			V
	I_{CBO}	Collector - Base Leakage	V_{CB} = 20 V			10	µA
	h_{FE}	D.C. Current Gain	V_{CE} = 1 V I_C = 2 mA	25			
RF Test	NF	Noise Figure	V_{CE} = 5 V I_C = 2 mA F = 500 MHz		1.6	2.0	dB
	f_T	Cutoff Frequency	V_{CE} = 5 V I_C = 30 mA F = 500 MHz		3.2		GHz
	G_{Umax}	Maximum Unilaterilized Gain	V_{CE} = 5 V I_C = 30 mA F = 500 MHz		16.4		dB
	$\|S_{21}\|$	Forward Gain 50 Ω/50 Ω	V_{CE} = 5 V I_C = 30 mA F = 500 MHz		14.8		dB
	IMD	Intermodulation Distortion 3 Tone - Din 45004/B F = 500 MHz R_{LOAD} = 75 ohms	V_{CE} = 5 V I_C = 30 mA, V_{out} = 300 mV			— 60	dB
			V_{CE} = 5 V I_C = 30 mA, V_{out} = 700 mV			— 45	dB
	C_{OB}	Collector - Base Capacitance	V_{CB} = 5 V f = 1 MHz		0.8		pF
Thermal	I_{Cmax}	Maximum Collector Current				50	mA
	P_T	Dissipated Power				300	mW
	T_{STG}	Storage Temperature		— 65		+ 200	°C
	T_J	Junction Temperature					

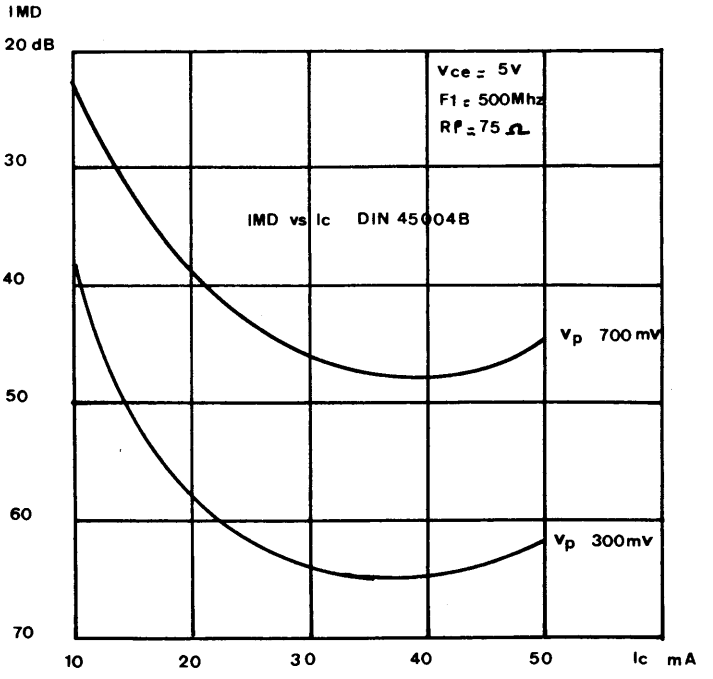
Noise Figure vs Frequency



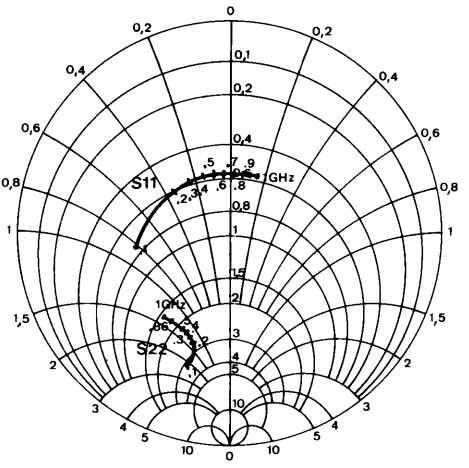
Noise Figure vs Collector Current



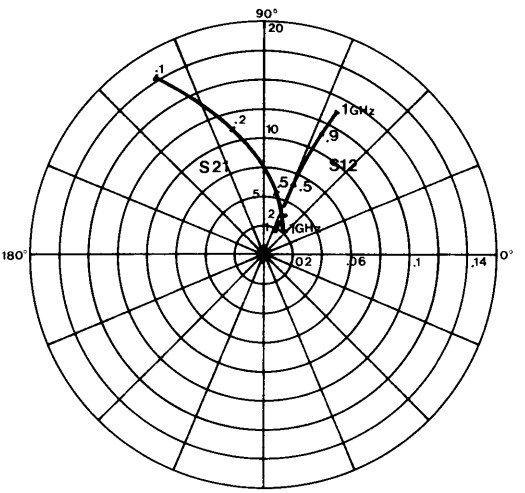

Gain dB
30
20
10
0
Gu max
|S21|
Vce = 5V
Ic = 30mA
.2
.4
.6
.8
1,0 Ghz


IMD
20 dB
30
40
50
60
70
Vce = 5V
F1 = 500Mhz
Rf = 75 Ω
IMD vs Ic DIN 45004B
Vp 700 mV
Vp 300mV
10
20
30
40
50
Ic mA

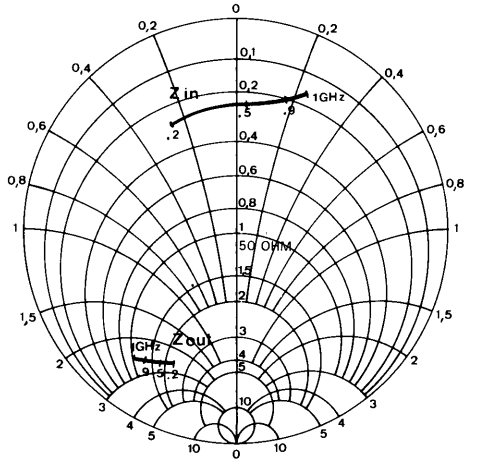
S11 - S22 Parameters vs Frequency
V_{CE} = 5 V - I_C ≙ 30 mA



S21 - S12 Parameters vs Frequency
V_{CE} = 5 V - I_C = 30 mA



Z_{in} Z_{out} from « S » Parameters
V_{CE} = 5 V - I_C = 30 mA



PACKAGE OUTLINE