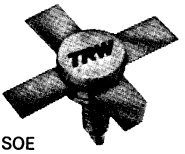
RF Power Transistor

- 40 W
- 12.5 V
- 175 MHz



380 SOE

B

The TP 2304 is designed for use in 12.5 V VHF amplifiers operating under class A, B or C conditions.

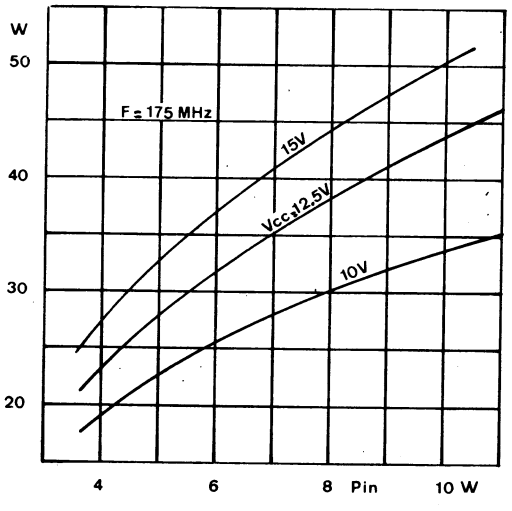
Its construction which incorporates gold metalization and diffused ballast resistors for longer life, enables the part to be used at its maximum ratings and be able to withstand an infinite VSWR at all phase angles.

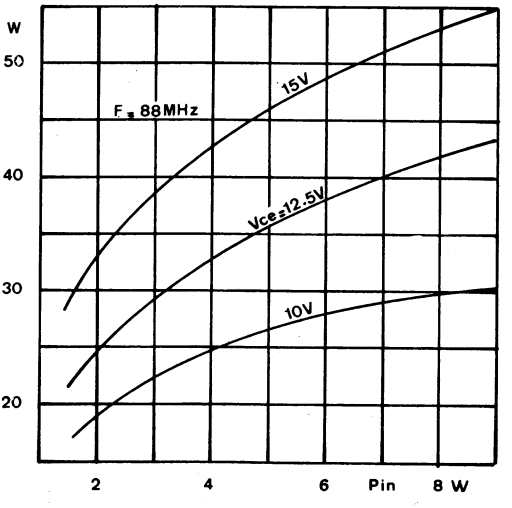
Electrical Characteristics (T_{flange} = 25 °C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC Test	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 5 mA I_C = 0	4			V
	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_C = 50 mA I_B = 0	18			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 50 mA I_E = 0	40			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 15 V I_E = 0			2	mA
	H_{FE}	D.C Current Gain	V_{CE} = 5 V I_C = 1000 mA	10			—
RF Test	P_{GAIN}	Power Gain	V_{CE} = 12.5 V F = 175 MHz P_{in} = 12 W V_{CE} = 12.5 V F = 88 MHz P_{in} = 8 W	40 40			W
	η	Efficiency	V_{CE} = 12.5 V F = 175 MHz P_{out} = 40 W	60			%
	Load VSWR	Mismatch Tolerance	All Phases Angles V_{CE} = 12.5 V F = 175 MHz P_{out} = 40 W		∞ : 1		
	Z_{in}	Common Emitter Amplifier Input Impedance	V_{CE} = 12.5 V F = 175 MHz P_{in} = 10 W		1.5 + j 1.6		Ω
	Z_{Load}	Common Emitter Amplifier Load Impedance	V_{CE} = 12.5 V F = 175 MHz P_{out} = 40 W		2.25+j0.1		Ω
	C_{OB}	Collector - Base Capacitance	V_{CB} = 20 V F = 1 MHz		70	100	pF
Operating	I_C	Continous Collector Current				8	A
	θ_{j-C}	Thermal Resistance	T_C = 25 °C			2.2	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		— 65°		200°	°C
	P_D	Power Dissipation	T_C = 25 °C			80	W

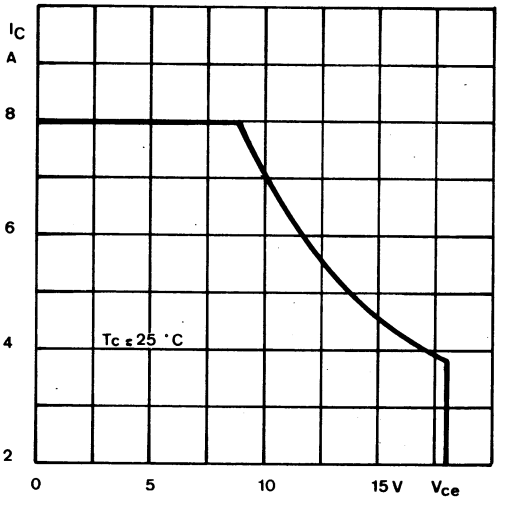
TYPICAL CHARACTERISTICS

Output Power vs Input Power and Voltage Supply

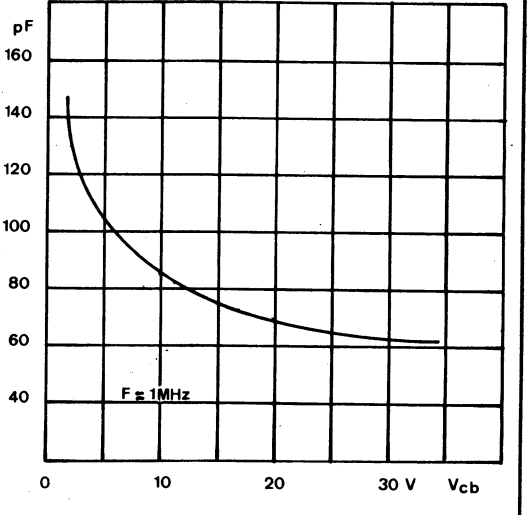




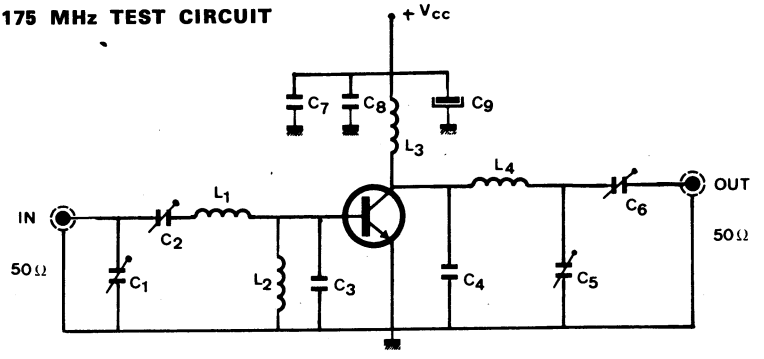
Safe Operating Area



Collector Base Capacitance



175 MHz TEST CIRCUIT



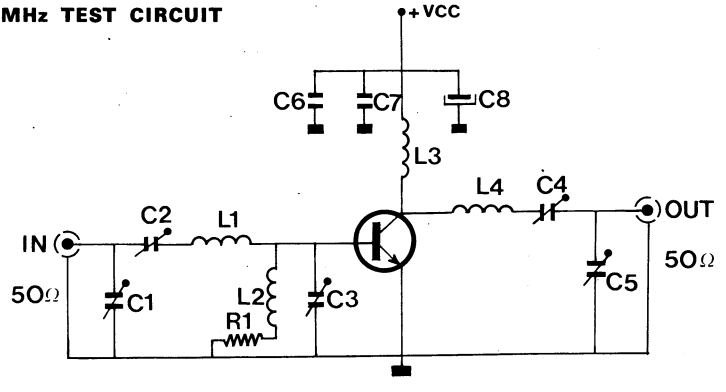
C_1 = ARCO 403 trimmer capacitor
C_2 = C_5 = ARCO 423 trimmer capacitor
C_3 = 200 pF mica capacitor UNELCO
C_4 = 150 pF mica capacitor UNELCO
C_6 = ARCO 425 trimmer capacitor
C_7 = 1000 pF mica capacitor UNELCO
C_8 = 0.1 µF ceramic disc
C_9 = 47 µF/63 V electrolytic

L_1 = 3 turns 15/10 mm silvered wire 6 mm I.D.
L_2 = 0.47 µH molded coil
L_3 = 6 turns 10/10 mm enameled wire wound on R_1

L_4 = 1 turns 15/10 mm silvered wire 6 mm I.D.

R_1 = 380 ohms 2 W carbon composition

88 MHz TEST CIRCUIT

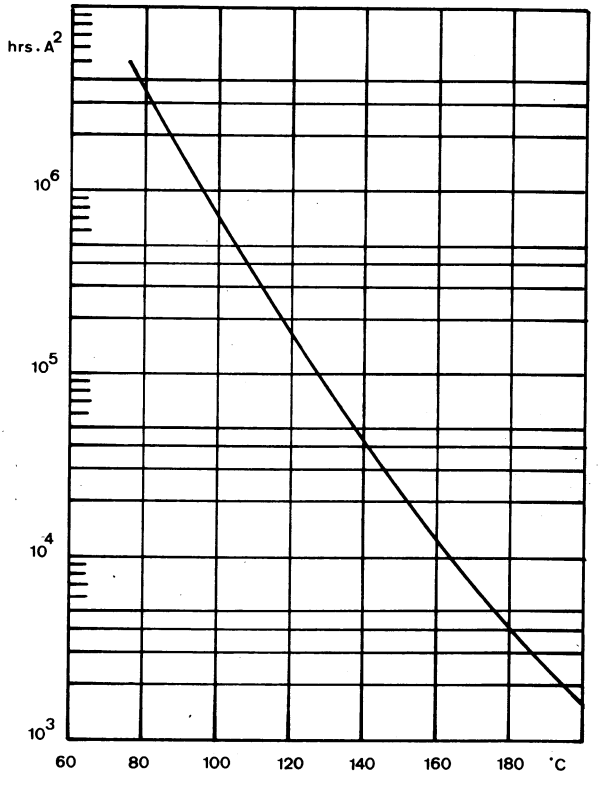


C_1 = C_4 = ARCO 425 24-200 pF trimmer capacitor
C_2 = ARCO 423 7-100 pF trimmer capacitor
C_3 = C_5 = ARCO 427 55-300 pF trimmer capacitor
C_6 = 1000 pF mica capacitor
C_7 = 10 nF ceramic
C_8 = 100 µF/35 V electrolytic

L_1 = 5 turns # 14 AWG 3/8" I.D.
L_2 = 1 µH
L_3 = 9 turns # 16 AWG 5/16" I.D.
L_4 = 4 turns # 14 AWG 3/8" I.D.

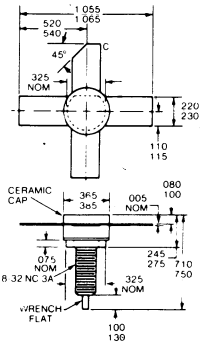
R_1 = 2.4 Ω

MTTF Factor vs Junction Temperature



PACKAGE OUTLINE

.380 SOE



RF Power Transistor

- 3 W
- 12.5 V
- 175 MHz

TO 39 GE

B

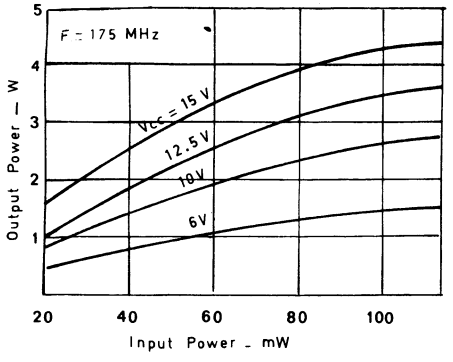
The TP 2312 is designed for 6 V to 12 V VHF applications and is intended for class A, B or C medium power amplifiers, frequency multipliers or oscillator circuits.

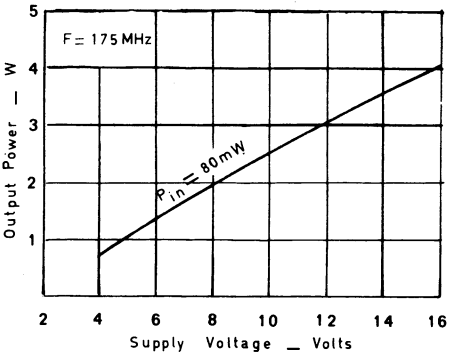
Its grounded emitter construction gives excellent thermal dissipation and the ability of providing further heatsinking where necessary the case also acts as a good RF screen.

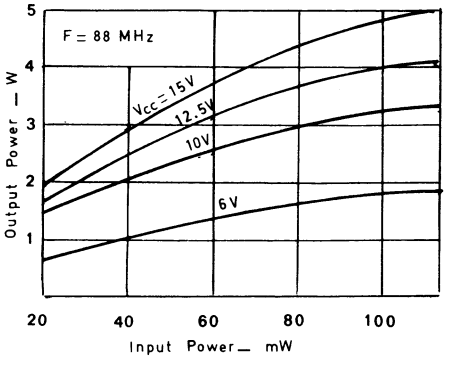
This device features high gain and an infinite VSWR rating at all phase angles at rated power output.

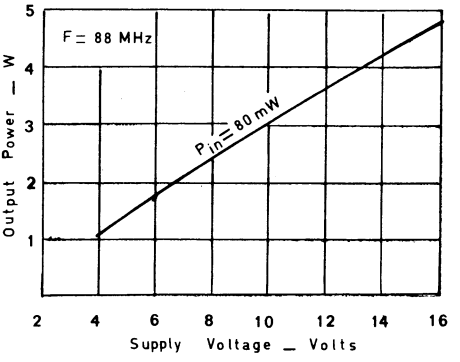
Electrical Characteristics (T_{case} = 25 °C)

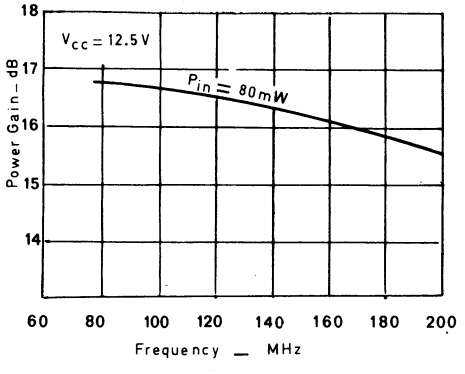
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC Test	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 1 mA I_C = 0	4			V
	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_C = 25 mA I_B = 0	16			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 5 mA I_E = 0	35			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 15 V I_E = 0			1	mA
	H_{FE}	D.C Current Gain	V_{CE} = 5 V I_C = 100 mA	20	70		—
RF Test	P_{GAIN}	Power Gain	V_{CE} = 12.5 V F = 175 MHz P_{in} = 80 mW V_{CE} = 6 V F = 175 MHz P_{in} = 80 mW V_{CE} = 12.5 V F = 88 MHz P_{in} = 80 mW	2.75 1 3	3 1.3 3.5		W
	η	Efficiency	V_{CE} = 12.5 V F = 175 MHz P_{out} = 3 W	60	68		%
	Load VSWR	Mismatch Tolerance	All Phase Angles V_{CE} = 12.5 V F = 175 MHz P_{out} = 2.75 W		∞ : 1		
	Z_{in}	Common Emitter Amplifier Input Impedance	V_{CE} = 12.5 V F = 175 MHz P_{in} = 80 mW F = 88 MHz		2.9 + j 4.36 2.94 — j 7.67		Ω
	Z_{Load}	Common Emitter Amplifier Load Impedance	V_{CE} = 12.5 V F = 175 MHz P_{out} = 3 W F = 88 MHz		25.1 + j 10.2 29 + j 18.4		Ω
	C_{OB}	Collector - Base Capacitance	V_{CB} = 20 V F = 1 MHz		5.5	7	pF
Operating	I_C	Continous Collector Current				0.7	A
	θ_{j-C}	Thermal Resistance	T_C = 25 °C			25	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		— 65°		200°	°C
	P_D	Power Dissipation	T_C = 25 °C			7	W

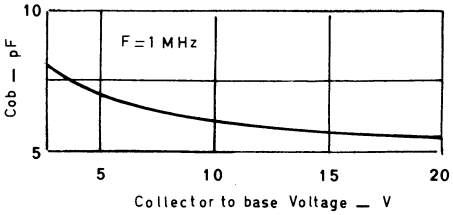


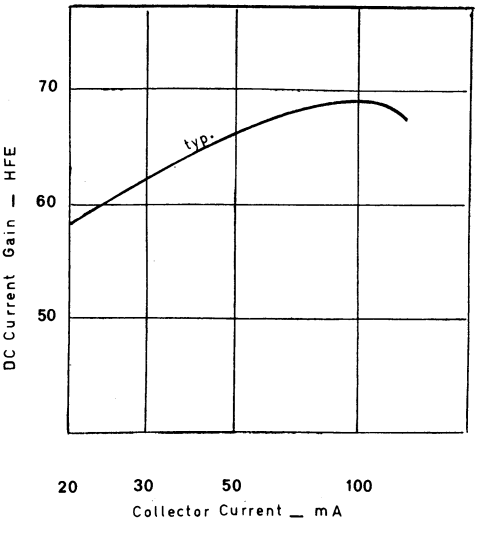






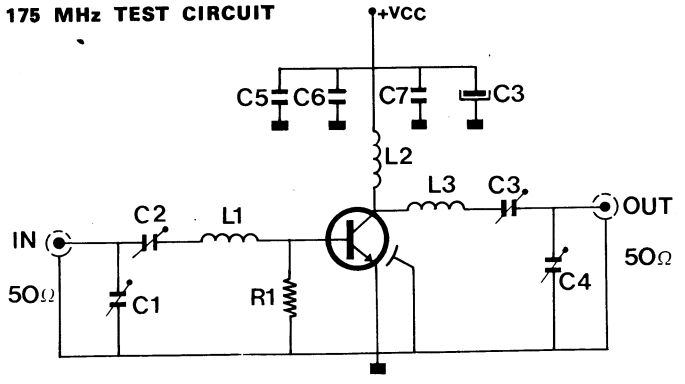






NOTA : TYPICAL CHARACTERISTICS

175 MHz TEST CIRCUIT



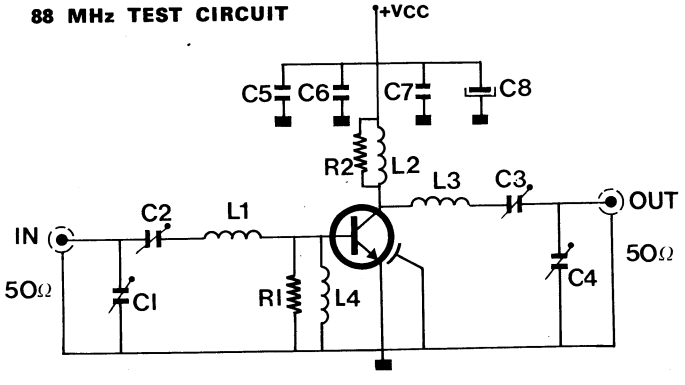
$C_1 = C_2 = C_3 = C_4$ = ARCO 404 7-60 pF trimmer capacitor
C_5 = 1000 pF mica capacitor
C_6 = 10 nF ceramic dlsc
C_7 = 0.1 µF ceramic disc
C_8 = 47 µF electrolytic

$L_1 = L_3$ = 2.5 turns - silvered wire ⌀ 1.5 mm - 10 mm I.D.
L_2 = 3 turns - silvered wire ⌀ 1.5 mm - 10 mm I.D.

R_1 = 47 ohms - 1/2 W - carbon composition

NOTA : CASE MUST BE GROUNDED

88 MHz TEST CIRCUIT



$C_1 = C_2 = C_3 = C_4$ = ARCO 404 7-60 pF trimmer capacitor
C_5 = 1000 pF mica capacitor
C_6 = 10 nF ceramic disc
C_7 = 0.1 µF ceramic disc
C_8 = 47 µF electrolytic

$L_1 = L_3$ = 2.5 turns - silvered wire ⌀ 1.5 mm - 10 mm I.D.
L_2 = 3 turns - silvered wire ⌀ 1.5 mm - 10 mm I.D.
L_4 = 0.45 µH - molded coil
R_1 = 47 ohms - 1/2 W

R_2 = 220 ohms - 1/2 W

NOTA : CASE MUST BE GROUNDED

RF Power Transistor

- 4 W
- 12.5 V
- 175 MHz

TO 39 GE

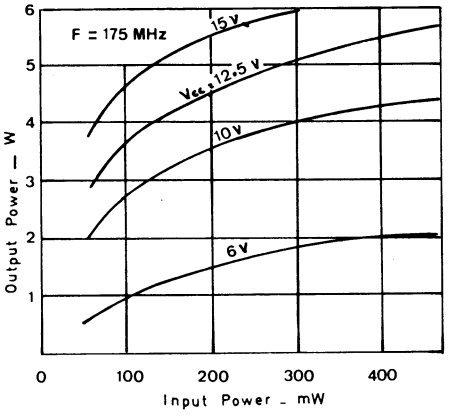
The TP 2314 is designed for 6 V to 12 V VHF applications and is intended for class A, B or C medium power amplifiers, frequency multipliers or oscillator circuits.

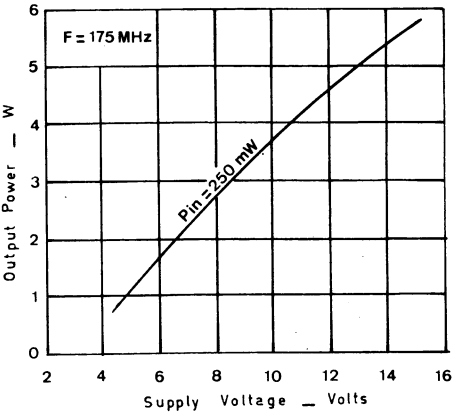
Its grounded emitter constructions gives excellent thermal dissipation and the ability of providing further heatsinking where necessary.

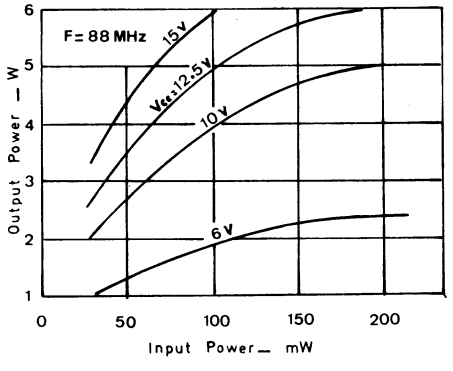
The case also acts as a good RF screen this device features high gain and an infinite VSWR rating at all phase angles at rated power output.

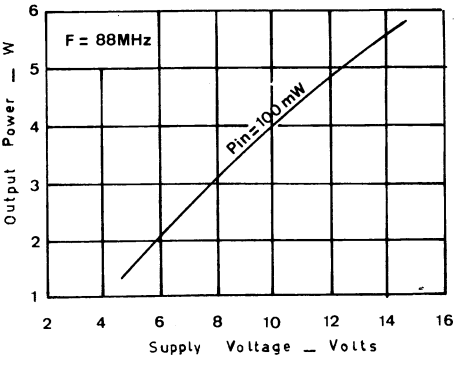
Electrical Characteristics (T_{case} = 25 °C)

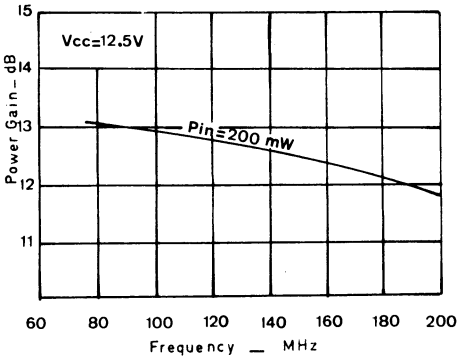
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC Test	BV_{EBO}	Emitter - Base Breakdwon Voltage	I_E = 2 mA I_C = 0	4			V
	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_C = 50 mA I_B = 0	16			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 10 mA I_E = 0	36			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 15 V I_E = 0			1	mA
	H_{FE}	D.C Current Gain	V_{CE} = 5 V I_C = 200 mA	20	40		—
RF Test	P_{GAIN}	Power Gain	V_{CE} = 12.5 V F = 175 MHz P_{in} = 250 mW V_{CE} = 6 V F = 175 MHz P_{in} = 250 mW V_{CE} = 12.5 V F = 88 MHz P_{in} = 250 mW	4 1 4	4.8 1.6 4.8		W
	η	Efficiency	V_{CE} = 12.5 V F = 175 MHz P_{out} = 4 W	55	64		%
	Load VSWR	Mismatch Tolerance	All Phase Angles V_{CE} = 12.5 V F = 175 MHz P_{out} = 4 W		∞ : 1		
	Z_{in}	Common Emitter Amplifier Input Impedance	V_{CE} = 12.5 V F = 175 MHz P_{in} = 250 mW F = 88 MHz		4.33 — j 3.69 4.5 — j 4.8		Ω
	Z_{Load}	Common Emitter Amplifier Load Impedance	V_{CE} = 12.5 V F = 175 MHz P_{out} = 4 W F = 88 MHz		15.96 + j 4.13 18.74 + j 6.44		Ω
	C_{OB}	Collector - Base Capacitance	V_{CB} = 20 V F = 1 MHz		12	15	pF
Operating	I_C	Continous Collector Current				1	A
	θ_{j-c}	Thermal Resistance	T_C = 25 °C			20	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		— 65°		200°	°C
	P_D	Power Dissipation	T_C = 25 °C			8	W

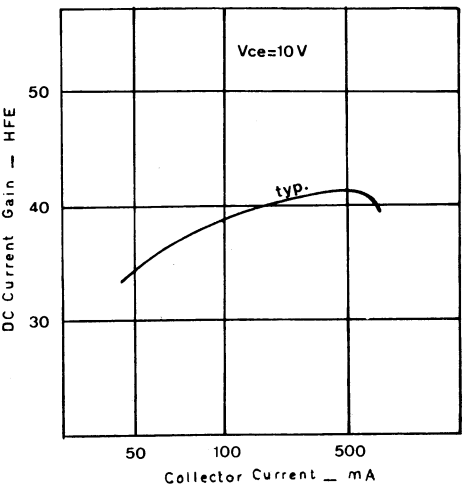


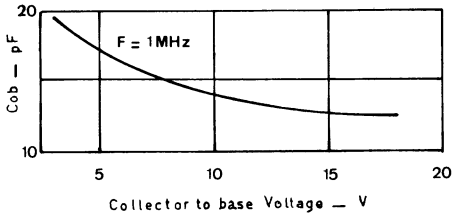






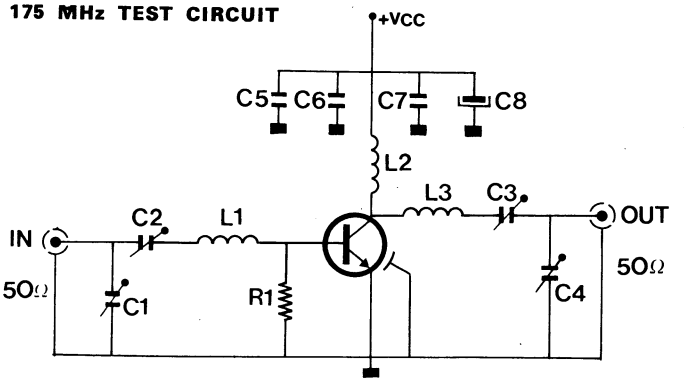






NOTA : TYPICAL CHARACTERISTICS

175 MHz TEST CIRCUIT



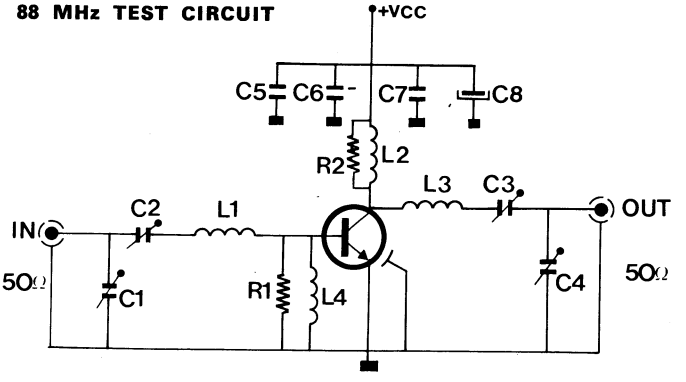
$C_1 = C_2 = C_3 = C_4$ = ARCO 404 7-60 pF trimmer capacitor
C_5 = 1000 pF mica capacitor
C_6 = 10 nF ceramic disc
C_7 = 0.1 µF ceramic disc
C_8 = 47 µF electrolytic

$L_1 = L_3$ = 2.5 turns - silvered wire ⌀ 1.5 mm - 10 mm I.D.
L_2 = 3 turns - silvered wire ⌀ 1.5 mm - 10 mm I.D.

R_1 = 47 ohms - 1/2 W - carbon composition

NOTA : CASE MUST BE GROUNDED

88 MHz TEST CIRCUIT



$C_1 = C_2 = C_3 = C_4$ = ARCO 404 7-60 pF trimmer capacitor
C_5 = 1000 pF mica capacitor
C_6 = 10 nF ceramic disc
C_7 = 0.1 µF ceramic disc
C_8 = 47 µF electrolytic
$L_1 = L_3$ = 2.5 turns - silvered wire ⌀ 1.5 mm - 10 mm I.D.
L_2 = 3 turns - silvered wire ⌀ 1.5 mm - 10 mm I.D.
L_4 = 0.47 µF - molded coil
R_1 = 47 ohms - 1/2 W
R_2 = 220 ohms - 1/2 W

NOTA : CASE MUST BE GROUNDED

RF Power Transistor

- 20 W
- 12.5 V
- 175 MHz

380 SOE

B

The TP 2320 is designed for use in 12.5 V VHF amplifiers operating under class A, B or C conditions.

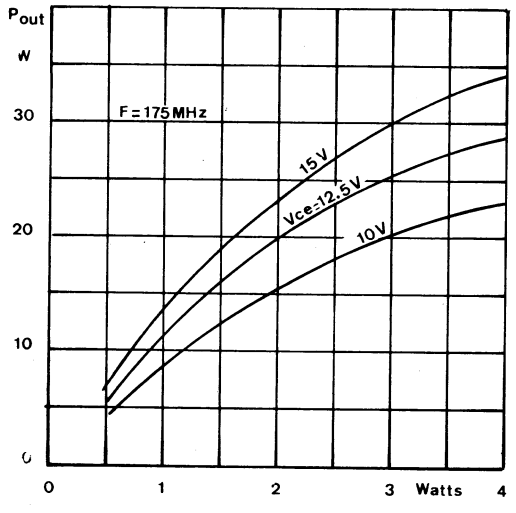
Its construction which incorporates gold metalization and diffused ballast resistors for longer life, enables the part to be used at its maximum ratings and be able to withstand an infinite VSWR at all phase angles.

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

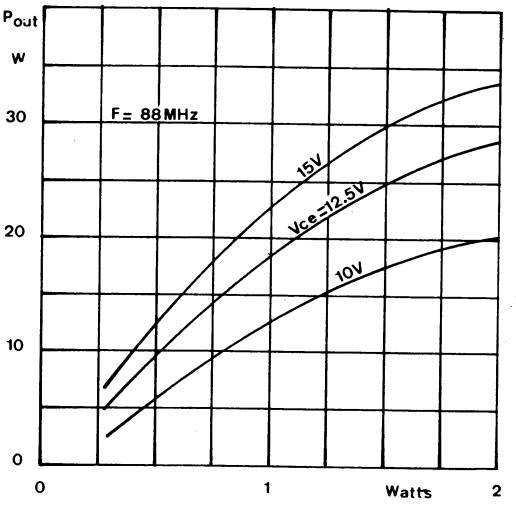
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC Test	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 5 mA I_C = 0	4			V
	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_C = 50 mA I_B = 0	18			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_c = 50 mA I_E = 0	40			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 15 V I_E = 0			2	mA
	H_{FE}	D.C Current Gain	V_{CE} = 5 V I_C = 500 mA	20			—
RF Test	P_{GAIN}	Power Gain	V_{CE} = 12.5 V F = 175 MHz P_{in} = 3 W V_{CE} = 12.5 V F = 88 MHz P_{in} = 1.5 W	17 17	20 20		W
	η	Efficiency	V_{CE} = 12.5 V F = 175 MHz P_{out} = 20 W	50			%
	Load VSWR	Mismatch Tolerance	All Phases Angles V_{CE} = 12.5 V F = 175 MHz P_{out} = 17 W		∞ : 1		
	Z_{in}	Common Emitter Amplifier Input Impedance	V_{CE} = 12.5 V F = 175 MHz P_{in} = 3 W		2 + j 1.5		Ω
	Z_{Load}	Common Emitter Amplifier Load Impedance	V_{CE} = 12.5 V F = 175 MHz P_{out} = 20 W		4.2 + j 0.7		Ω
	C_{OB}	Collector - Base Capacitance	V_{CE} = 20 V F = 1 MHz I_E = 0		55	70	pF
Operating	I_C	Continous Collector Current				6	A
	θ_{j-C}	Thermal Resistance	T_C = 25 °C			3.5	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		— 65°		+200°	°C
	P_D	Power Dissipation	T_C = 25 °C			50	W

TYPICAL CHARACTERISTICS

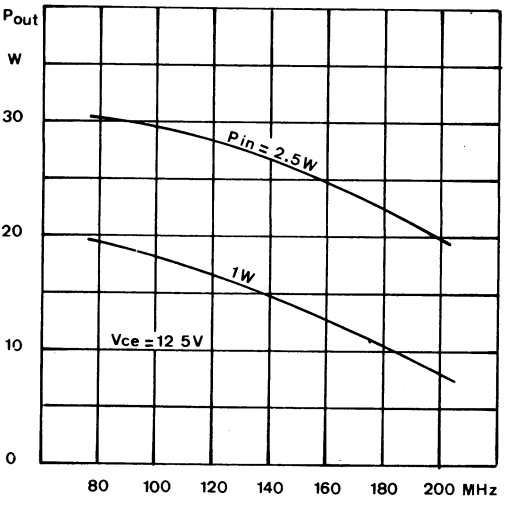
Output power vs input power and voltage supply



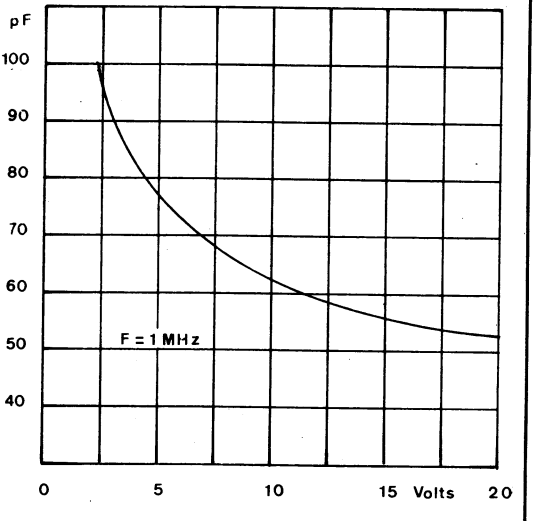
Output power vs input power and voltage supply



Output power vs frequency and input power

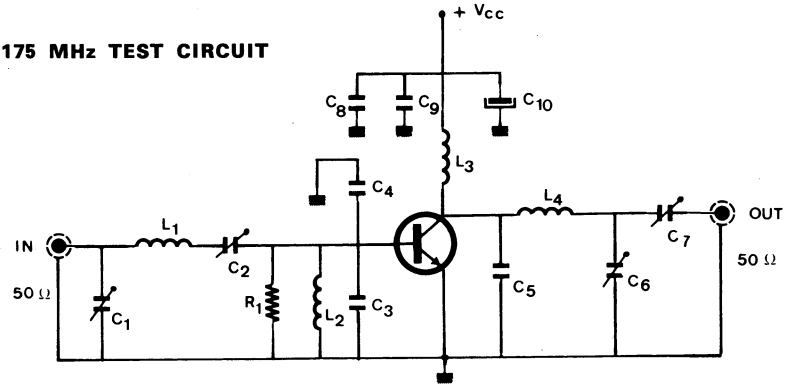


Coll. base capacitance



B

175 MHz TEST CIRCUIT



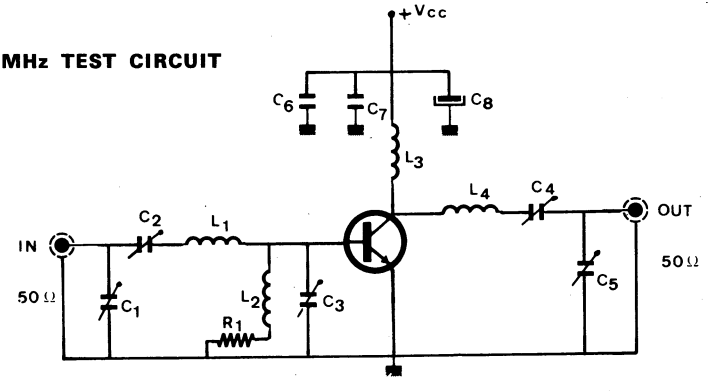
C_1 = ARCO 423 - 7-100 pF trimmer capacitor
C_2 = ARCO 423
C_3 = C_4 = 80 pF mica capacitor UNELCO
C_5 = 100 pF mica capacitor UNELCO
C_6 = C_7 = ARCO 423
C_8 = 1000 pF mica capacitor UNELCO
C_9 = 1000 pF ceramic disc
C_{10} = 47 µF electrolytic

L_1 = 3 turns 12/10 mm silvered wire - 6 mm I.D.

L_2 = 1 µH molded coil
L_3 = 3 turns 12/10 mm silvered wire - 6 mm I.D.
L_4 = 2 turns 12/10 mm silvered wire - 6 mm I.D.

R_1 = 150 ohms

88 MHz TEST CIRCUIT

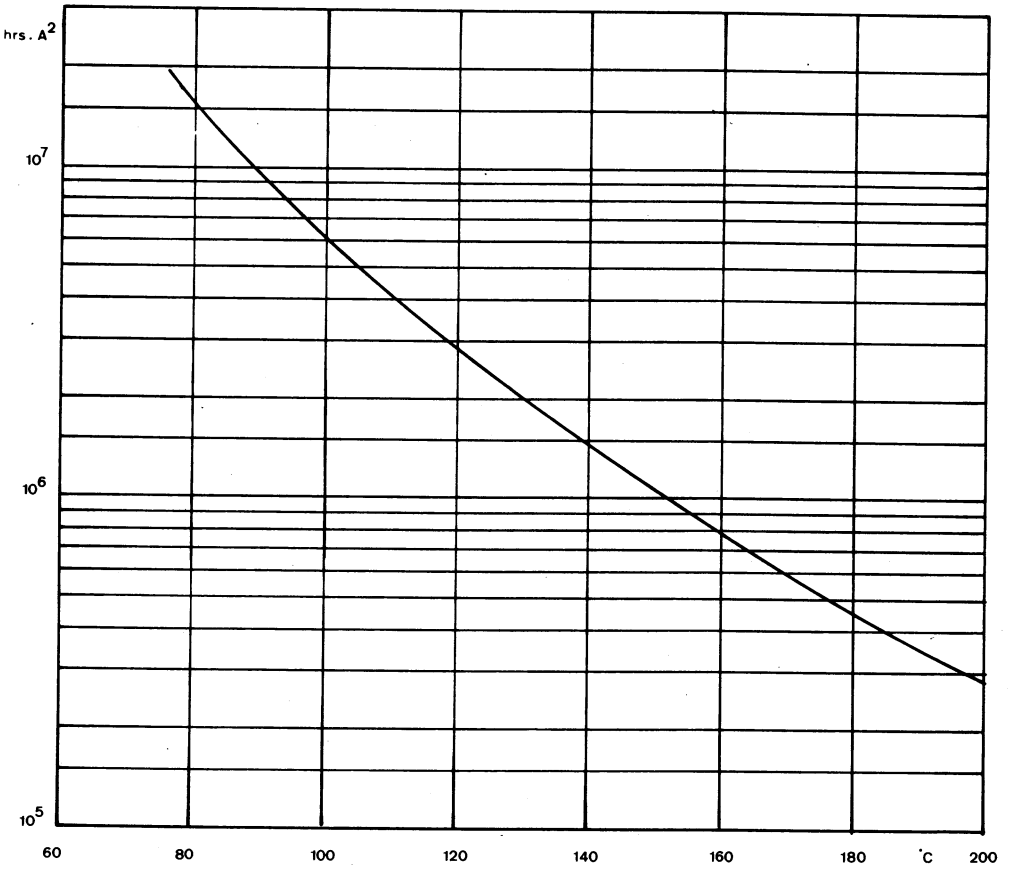


C_1 = C_4 = ARCO 425 24-200 pF trimmer capacitor
C_2 = ARCO 423 7-100 pF trimmer capacitor
C_3 = C_5 = ARCO 427 55-300 pF trimmer capacitor
C_6 = 1000 pF mica capacitor
C_7 = 10 nF ceramic
C_8 = 100 µF/35 V electrolytic

L_1 5 turns ≠ 14 AWG 3/8" ID
L_2 1 µH
L_3 9 turns ≠ 16 AWG 5/16" ID
L_4 4 turns ≠ 14 AWG 3/8" ID

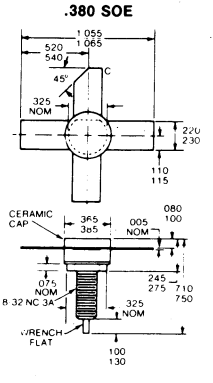
R_1 2.4 Ω

MTTF factor vs junction temperature



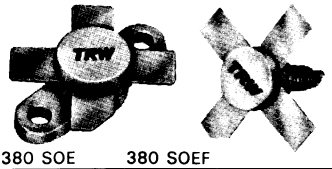
PACKAGE OUTLINE

.380 SOE



RF Power Transistor

- 30 W
- 12.5 V
- 175 MHz
- 10 dB



380 SOE 380 SOEF

B

The TP 2330 is device intended for use in VHF transmitter output stages where a high gain is necessary.

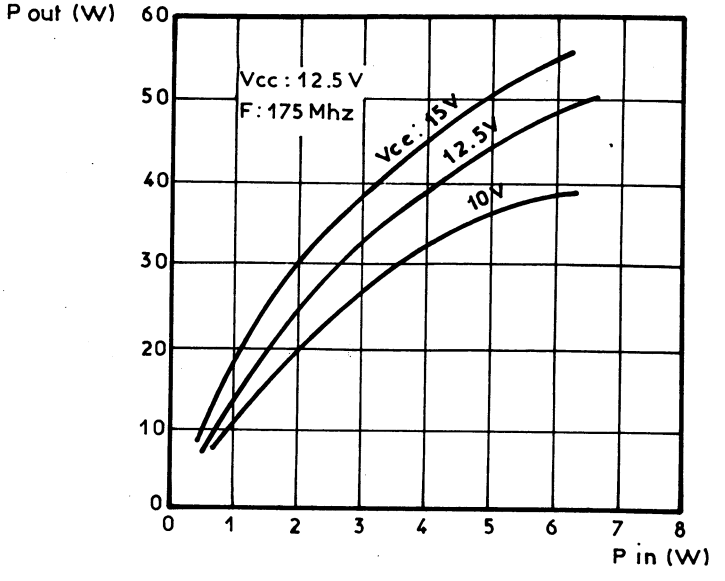
Using the latest in technology and manufacturing processes from TRW, excellent gain and high saturated output power has been achieved enabling a 30 W transmitter to be designed using only a TO 39 as driver.

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

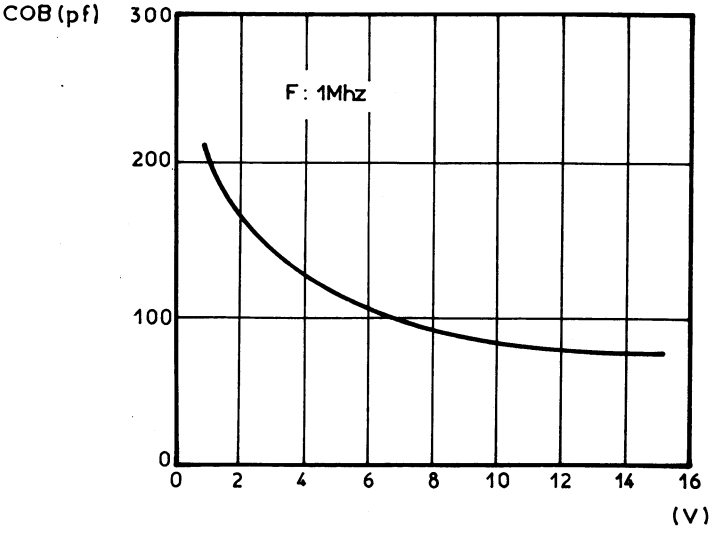
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC Test	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 5 mA I_c = 0	4			V
	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_c = 50 mA I_B = 0	16			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_c = 50 mA I_E = 0	36			V
	I_{CES}	Collector - Emitter Cutoff - Current	V_{CE} = 15 V			10	mA
	H_{FE}	DC Current Gain	V_{CE} = 5 V I_c = 1 A	20		150	
RF Test	P_{GAIN}	Power Gain	V_{CE} = 12.5 V P_{in} = 3 W F = 175 MHz P_{in} = 3.8 W (F)	30 30			W
	η	Efficiency	V_{CE} = 12.5 V F = 175 MHz P_{out} = 30 W	60			%
	Load VSWR	Mismatch Tolerance	All Phases Angles V_{CE} = 12.5 V F = 175 MHz P_{out} = 30 W		∞ : 1		
	Z_{in}	Common Emitter Amplifier Input Impedance	V_{CE} = 12.5 V F = 175 MHz P_{out} = 30 W		1.05 + j 0.5		
	Z_{LOAD}	Common Emitter Amplifier Load Impedance	V_{CE} = 12.5 V F = 175 MHz P_{out} = 30 W		2.7 + j 0.2		
	C_{OB}	Collector - Base Capacitance	V_{CB} = 15 V F = 1 MHz		70	100	pF
	I_c	Continuous Collector Current				8	A
Thermal	θ_{j-c}	Thermal Resistance	T_c = 25 °C			2.2	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		— 65		+ 200	°C
	P_D	Power Dissipation	T_C = 25 °C			80	W

TYPICAL CHARACTERISTICS

TP 2330 Output Power vs Frequency

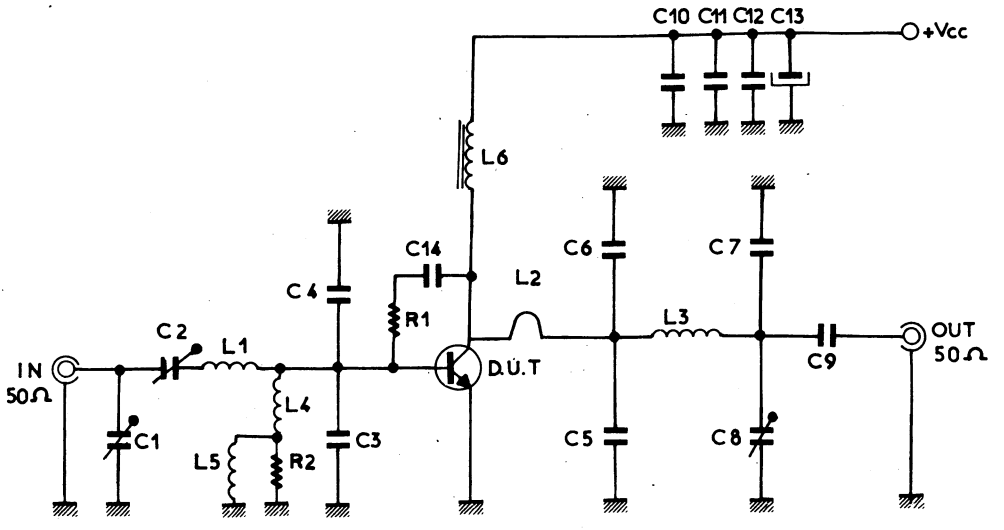


Collector base capacitance vs voltage



B

TP 2330 (F) 175 MHz test circuit



Components List

$C_1 = C_2$	=	100 pF ARCO 423 trimmer capacitor
C_3	=	200 pF UNELCO mica capacitor
C_4	=	150 pF UNELCO mica capacitor
C_5	=	120 pF UNELCO mica capacitor
C_6	=	100 pF UNELCO mica capacitor
C_7	=	25 pF UNELCO mica capacitor
C_8	=	40 pF ARCO 403 trimmer capacitor
C_9	=	1 000 pF ceramic disc capacitor
C_{10}	=	1 000 pF UNELCO mica capacitor
$C_{11} = C_{14}$	=	100 nF ceramic capacitor
C_{12}	=	10 nF ceramic capacitor
C_{13}	=	47 µF 25 V electrolytic capacitor
L_1	=	3 turns — 1 mm enameled wire. ID = 6 mm
L_2	=	Copper lead 8 × 6 mm
L_3	=	1.5 mm wire — 30 mm length
L_4	=	6 turns — 1 mm enameled wire. ID = 6 mm
L_5	=	10 uH molded coil
L_6	=	8 turns enameled wire wound on ferrite core 4C6 9 × 15 mm. ur = 120
R_1	=	100 Ω 1 W Carbon composition resistor.
R_2	=	10 Ω 1/2 W Carbon composition resistor