TRW® SEMICONDUCTORS

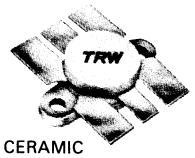
JO VHF

RF Power Transistors

JO 4020 20 Watts
JO 4030 30 Watts
JO 4040 40 Watts

136-175 MHz ∞ VSWR

The JO 4020, 4030 and 4040 offer the greatest combination of gain, bandwidth and power output available in the industry. They are inherently more reliable than conventional transistors. They use internal impedance matching elements to improve performance in the following areas : Broadband performance without tuning ; increased stability ; high input-output isolation ; increased reliability and more cost effective designs.



J zéro CERAMIC

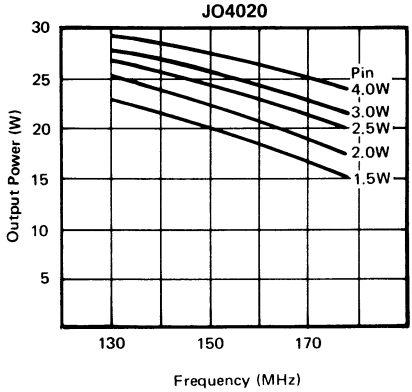
Electrical Characteristics (T_{flange} = 25 °C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS		JO 4020	JO 4030	JO 4040	UNIT
DC Test	BV_{EBO}	Min. Emitter - Base Breakdown Voltage	I_E = 5 mA	I_C = 0	4	4	4	V
	BV_{CEO}	Min. Collector - Emitter Breakdown Voltage	I_C = 50 mA	I_B = 0	18	18	18	V
	BV_{CBO}	Min. Collector - Base Breakdown Voltage	I_C = 50 mA	I_E = 0	40	40	40	V
	I_{CBO}	Max. Collector Cutoff Current	V_{CB} = 15 V	I_E = 0	2	2	2	mA
	H_{FE}	Min. D.C Current Gain	V_{CE} = 5 V	I_C = 500 mA I_C = 1000 mA	25	25	25	—
RF Test	P_{GAIN}	Min. Power Gain	V_{CE} = 12.5 V F = 175 MHz	P_{in} = 2.7 W P_{in} = 5 W P_{in} = 8 W	20	30	40	W
	Load VSWR	Mismatch Tolerance	V_{CE} = 15.5 V F = 175 MHz	Rated Output Power	∞ : 1	∞ : 1	∞ : 1	
	Z_{in}	Common Emitter Amplifier Input Impedance	V_{CE} = 12.5 V F = 175 MHz	Rated Input Power	2.9 + j 1.75	2.5 + j 0.9	1.65 + j 2.7	Ω
	Z_{Load}	Common Emitter Amplifier Load Impedance	V_{CE} = 12.5 V F = 175 MHz	Rated Output Power	4 + j 1.25	2.5 — j 0.1	1.85 — j 0.1	Ω
	C_{OB}	Max. Collector - Base Capacitance	V_{CB} = 15 V	F = 1 MHz	70	100	180	PF
Operating	I_C	Continous Collector Current			4.8	5.6	8	A
	θ_{j-C}	Thermal Resistance	T_C = 25 °C		2.9	2.5	1.75	°C/W
	T_{STG}	Storage Temperature and Junction Temperature			— 65°		200°	°C
	P_D	Power Dissipation	T_C = 25 °C		60	70	100	W

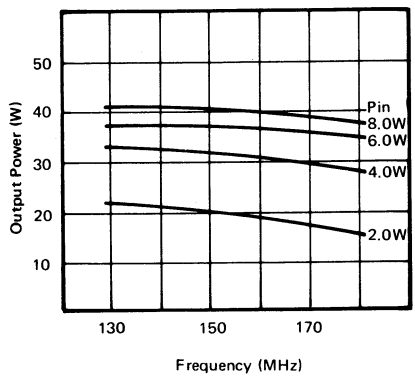
TYPICAL POWER GAIN PERFORMANCE WITH OPTIMUM MATCHING

Power Output vs Frequency
V_{CE} = 12.5V

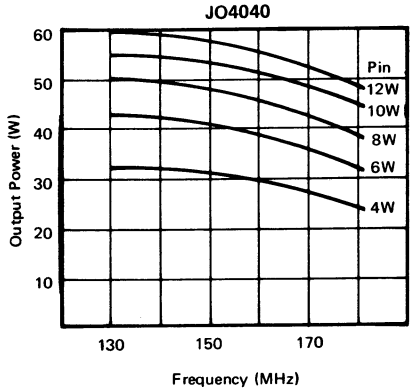
JO4020



JO4030

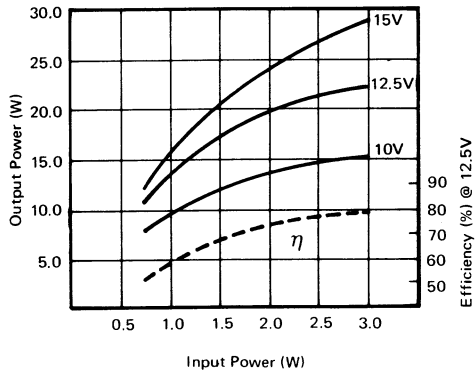


JO4040

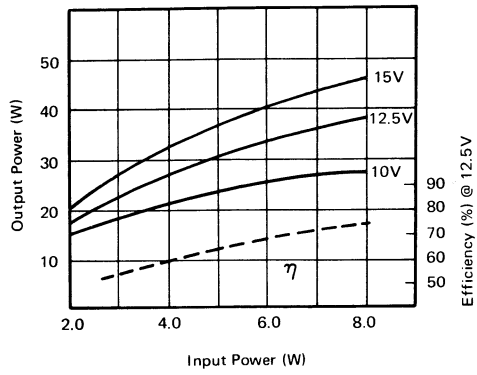


Power Output vs Power Input
f = 175 MHz

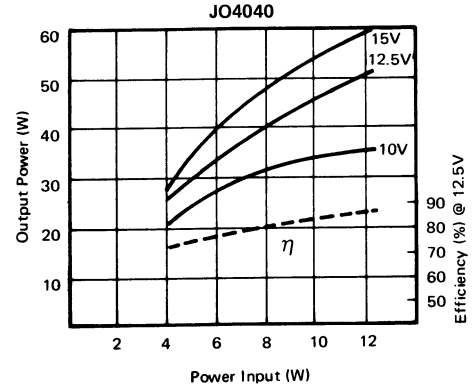
JO4020



JO4030



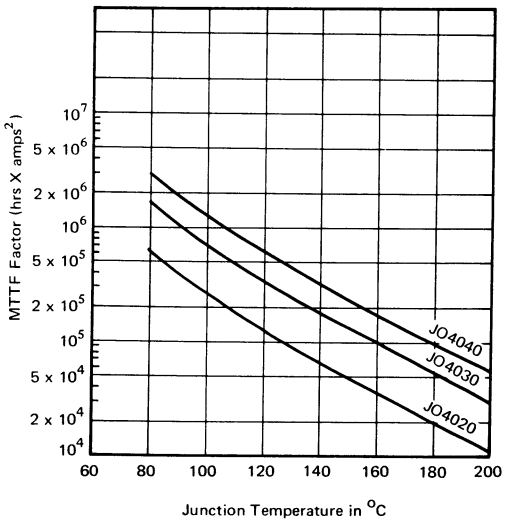
JO4040



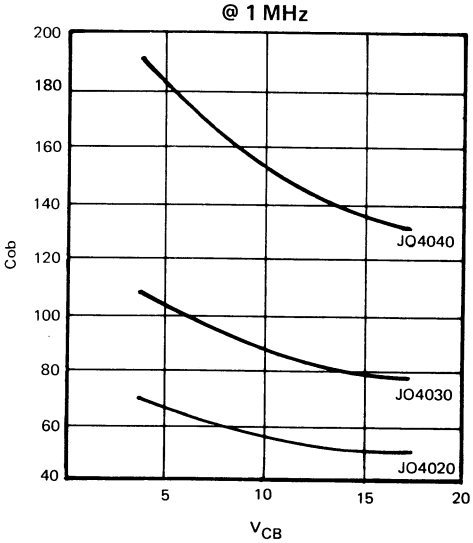
DEVICE IMPEDANCE PARAMETERS AT 12.5V AND RATED INPUT POWER

DEVICE	FREQUENCY (MHz)	Zin (Ω)	Z_{out} (Ω)
JO4020	136	1.60 + j2.25	5.40 – j1.4
	150	2.00 + j2.20	4.65 – j1.7
	165	2.40 + j2.10	4.10 – j1.75
	175	2.90 + j1.75	4.00 – j1.25
JO4030	136	1.40 + j1.50	3.60 + j0.65
	150	1.75 + j1.45	3.30 –j0
	165	2.15 + j1.20	2.75 –j0.25
	175	2.50 + j0.9	2.50 + j0.1
JO4040	136	1.05 + j2.05	2.45 + j0.35
	150	1.25 + j2.20	2.20 + j0.25
	165	1.50 + j2.45	1.93 + j0.15
	175	1.65 + j2.70	1.85 + j0.10

MTTF Factor



Collector Base Capacitance (pf) @ 1 MHz



MTTF factor is derived from calculations based on metal migration theory. The following example will serve to demonstrate the use of the MTTF factor chart shown above. Consider the JO4040 operating at normal conditions.

P_O = 40W
V_C = 12.5V
Pin = 8W
η = 80%

From this we calculate I_C = 4.0A. Therefore, the total power dissipation is 18W.

The junction temperature can then be calculated from

$$T_j = Tstud + P_d X \theta_{jc}.$$

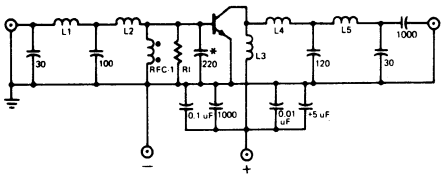
In this example $P_d X \theta_{jc}$ is 32°C.

For a stud temperature of 80°C, T_j is 112°C. From the chart above, we find the JO4040 has an MTTF factor of 1.0 X 10^6 hours amps^2 at 112°C. We calculate MTTF as follows:

$$MTTF = \frac{1.0 \times 10^6 \text{ hrs. amp}^2}{(4.0 \text{ amp})^2}$$

$$= 62{,}500 \text{ hrs.}$$

JO4020 TEST CIRCUIT BROADBAND (136-175 MHz)



PARTS LIST

All capacitors in pF unless otherwise indicated.

All capacitors in pF are Underwood capacitors; others are disc-ceramic.

L1 2 turns #18AWG, 0.16" I.D., 1/4" spacing

L2 5/8" length #18AWG, shaped:

L3 1-1/2" length #16AWG, straight wire

L4 1/2" length #18AWG, shaped:

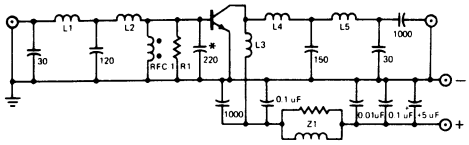
L5 3 turns #18AWG, 0.16" I.D., 1/8" spacing

R1 470Ω, 1/2 watt, carbon

RFC-1 2-1/2 turns #22AWG on Ferroxcube VK211/07-3B

*220pF consists of one 100pF and one 120pF. They are soldered as close as possible to the transistor, symmetrically, one on each side of the base lead.

JO4030 TEST CIRCUIT BROADBAND (136-175 MHz)



PARTS LIST

All capacitors in pF unless otherwise indicated.

All capacitors in pF are Underwood capacitors; others are disc-ceramic.

L1, L3 2 turns #18AWG, 0.16" I.D., 1/8" spacing

L2 1/2" length #18AWG, shaped:

L4 3 mil. copper strap, 1/2"L x 5/32"W shaped:

L5 3 turns #18AWG, 0.16" I.D., 1/8" spacing

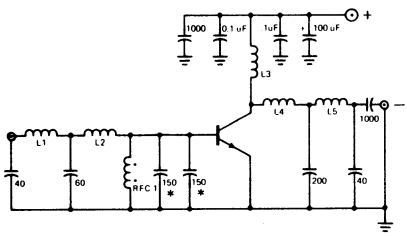
R1 51Ω, 1/2 watt, carbon

RFC-1 2-1/2 turns #22AWG on Ferroxcube VK211/07-3B

Z1 11 turns #24AWG enameled, wound on 10Ω, 1/2 watt, carbon resistor

*220pF consists of one 100pF and one 120pF. They are soldered as close as possible to the transistor, symmetrically, one on each side of the base lead.

JO4040 TEST CIRCUIT BROADBAND (136-175 MHz)



PARTS LIST

All capacitors in pF unless otherwise indicated.

All capacitors in pF are Underwood capacitors; others are disc-ceramic.

L1 1 turn #18AWG, 0.16" I.D.

L2 5/8" length #18AWG, shape:

L3 1-1/2" length #18AWG

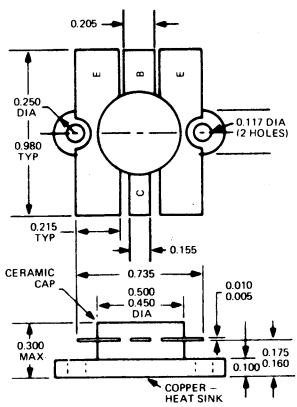
L4 3 mil. copper strap, 9/16"L x 5/32"W, shape:

L5 2 turns #18AWG, 0.19" I.D., 0.15" spacing

RFC-1 2-1/2 turns #22AWG on Ferroxcube VK211/07-3B

*150pF capacitors are soldered as close as possible to the transistor, symmetrically, one on each side of the base lead.

CASE OUTLINE – JO PACKAGE



RF Power Transistors

JO 4045 45 WATTS
JO 4070 70 WATTS

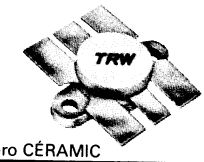
175 MHz - 12,5 V

The JO 4045 and JO 4070 use internal impedance matching elements to improve performance in the following areas :

Broadband performance without tuning increased stability.

High input output isolation.

Increased reliability and more cost effective designs.



J zéro CÉRAMIC

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

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	JO 4045	JO 4070	UNIT
D C Test	BV_{EBO}	Min Emitter - Base Breakdown Voltage	I_E = 5 mA I_C = 0	4	4	V
	BV_{CEO}	Min Collector - Emitter Breakdown Voltage	I_C = 50 mA I_B = 0	18	18	V
	BV_{CBO}	Min Collector - Base Breakdown Voltage	I_C = 50 mA I_E = 0	40	40	V
	I_{CBO}	Max Collector Cutoff Current	V_{CB} = 15 V I_E = 0	2	5	mA
	H_{FE}	Min D.C Current Gain	V_{CE} = 5 V I_C = 1000 mA	10	10	—
R F Test	P_{GAIN}	Min Power Gain	V_{CE} = 12.5 V F = 175 MHz P_{in} = 9 W P_{in} = 18 W	45	70	W
	η	Min Efficiency	V_{CE} = 12.5 V F = 175 MHz Rated Output Power	60	60	%
	Load VSWR	Mismatch Tolerance	V_{CE} = 12.5 V F = 175 MHz Rated Output Power	∞ : 1	∞ : 1	
	Z_{in}	Typ Common Emitter Amplifier Input Impedance	V_{CE} = 12.5 V F = 175 MHz Rated Input Power	1.4 + j 0.9	1.8 + j 1.25	Ω
	Z_{Load}	Typ Common Emitter Amplifier Load Impedance	V_{CE} = 12.5 V F = 175 MHz Rated Output Power	1.9 + j 0	1.25 — j 0.6	Ω
	C_{OB}	Max Collector - Base Capacitance	V_{CB} = 20 V F = 1 MHz	100	180	pF
Operating	I_C	Continous Collector Current		8	12	A
	θ_{j-C}	Thermal Resistance	T_C = 25 °C	2.2	1.25	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		— 65 °C to + 200 °C	— 65 °C to + 200 °C	°C
	P_D	Power Dissipation	T_C = 25 °C	80	140	W

PACKAGE OUTLINE

J-Zero-C