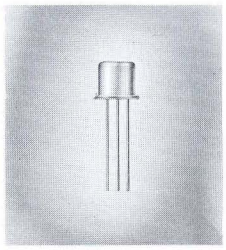
TYPE 2N716

N-P-N DOUBLE-DIFFUSED MESA SILICON TRANSISTOR

VHF Oscillator-Amplifier Transistor

- **Operation to 200 mc**
- **Guaranteed rf power output**
- **High breakdown voltage**



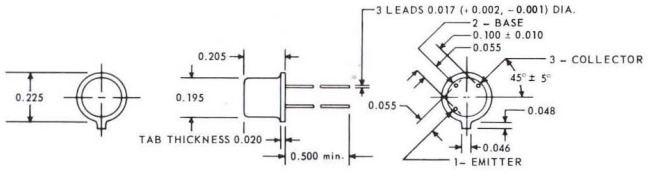
environmental tests

All units are heat cycled from —65°C to +175°C for 10 cycles. The hermetic seal is checked by pressure testing. All units are completely tested for electrical characteristics and undergo a rigorous tumble test to check for mechanical reliability.

mechanical data

Welded case with glass-to-metal hermetic seal between case and leads. Unit weight is approximately 1/3 gram. These units meet JEDEC TO-18 case outline dimensions.

THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE CASE



DIMENSIONS ARE MAXIMUM IN INCHES UNLESS OTHERWISE SPECIFIED

maximum ratings at 25°C ambient (unless otherwise noted)

Collector-Base Voltage	70 v
Collector-Emitter Voltage (See note 1)	40 v
Emitter-Base Voltage	5 v
Total Device Dissipation (See note 2)	0.5 w
Total Device Dissipation at 25°C Case Temperature (See note 3)	1.2 w
Storage Temperature Range	—65°C to +175°C

electrical characteristics at 25°C ambient (unless otherwise noted)

PARAMETER		TEST CONDITIONS	min	typ	max	unit
I_{CBO}	Collector Reverse Current	$V_{CB} = 30$ v $I_E = 0$	—	—	1.0	μa
I_{CBO}	Collector Reverse Current	$V_{CB} = 30$ v $I_E = 0$ $T_A = +150°C$	—	—	100	μa
I_{CBO}	Collector Reverse Current	$V_{CB} = 70$ v $I_E = 0$	—	—	10	μa
I_{EBO}	Emitter Reverse Current	$V_{EB} = 5$ v $I_C = 0$	—	—	100	μa
BV_{CEO}*	Collector-Emitter Breakdown Voltage	$I_{CE} = 20$ ma $I_B = 0$	40	—	—	v
h_{FE}*	D-C Forward-Current Transfer Ratio	$V_{CE} = 10$ v $I_C = 15$ ma	10	—	50	—
$V_{CE(sat)}$*	Collector-Emitter Saturation Voltage	$I_C = 15$ ma $I_B = 3$ ma	—	—	1.2	v
C_{ob}	Output Capacitance	$V_{CB} = 5$ v $I_E = 0$ $f = 1$ mc	—	3	6	μμf
r_{ies}	Short-Circuit Common-Emitter Series Input Resistance	$V_{CE} = 10$ v $I_E = -15$ ma $f = 70$ mc	—	65	—	ohms
r_{oep}	Short-Circuit Common-Emitter Parallel Output Resistance	$V_{CE} = 10$ v $I_E = -15$ ma $f = 70$ mc	—	1.5	—	k ohms
f_T	Frequency at which $\lvert h_{fe} \rvert = 1$	$V_{CE} = 10$ v $I_E = -15$ ma	70	150	—	mc

functional tests at 25°C ambient (see circuits on last page)

OPERATING CHARACTERISTICS	TEST CONDITIONS	min	typ	max	unit
Oscillator Output Power	$V_{CB} = 40$ v $I_C = 30$ ma $f = 70$ mc	400	450	—	mw
Amplifier Power Output	$V_{CB} = 40$ v $I_C = 30$ ma $P_{in}(ac) = 200$ mw $f = 70$ mc	500	600	—	mw
Transducer Gain	$V_{CB} = 40$ v $I_C = 30$ ma $P_o(ac) = 500$ mw $f = 70$ mc	4	7.5	—	db

*Semiautomatic testing is facilitated by using pulse techniques to measure these parameters. A 300-microsecond pulse (approximately 2% duty cycle) is utilized. Thus, the unit can be tested under maximum current conditions without a significant increase in junction temperature. The parameter values obtained in this manner are particularly pertinent for switching circuit design and, in general, indicate the true capabilities of the device.

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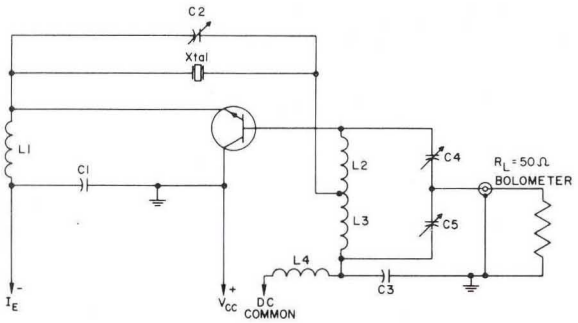
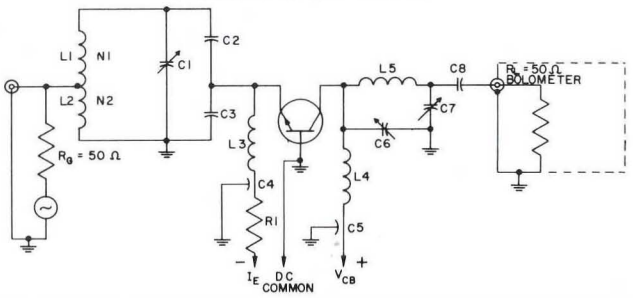
TEST CIRCUITS

OSCILLATOR TEST CIRCUIT



Symbol	Description	Manufacturer	Part No.
C1 & C3	0.01 μfd	Mucon	Type RLA
C2	3-35 μμfd	Arco	403
C4	9-180 μμfd	Arco	463
C5	6-140 μμfd	Hammarlund	HF-140
L1	0.84 μh	Ohmite	Z-235
L2	0.101 μh, 2 turns No. 14 wire, center tapped	Air Dux	1206S
L3	0.107 μh, 2 turns No. 14 wire, center tapped	Air Dux	1206S
L4	1.8 μh	Ohmite	Z-144
Xtal	70 mc Crystal	International	F-605

AMPLIFIER TEST CIRCUIT



Symbol	Description	Manufacturer	Part No.
C1	2.7-30 μμfd	Arco	461
C2	6.8 μμfd	Centralab	TCZ-6.8
C3	15 μμfd	Centralab	TCZ-15
C4 & C5	2300 μμfd	Centralab	FT-2300
C6	9-180 μμfd	Arco	463
C7	65-320 μμfd	Arco	303-M
C8	0.1 μfd	Centralab	
L1	0.25 μh, 4½ turns No. 18 wire random wound	CTC ceramic coil form	LS7
L2	0.08 μh, $\frac{N1}{N2} = 4$	CTC ceramic coil form	LS7
L3 & L4	1.8 μh	Ohmite	Z-144
L5	0.25 μh, 6½ turns No. 18 wire random wound	CTC ceramic coil form	LS5
R1	2000 ohm	IRC	

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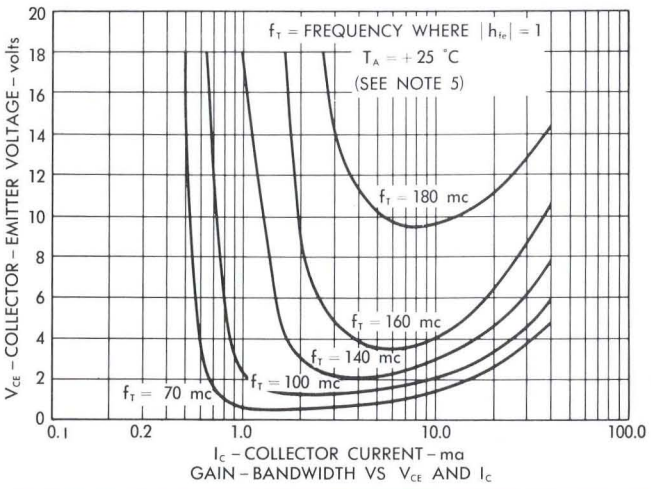
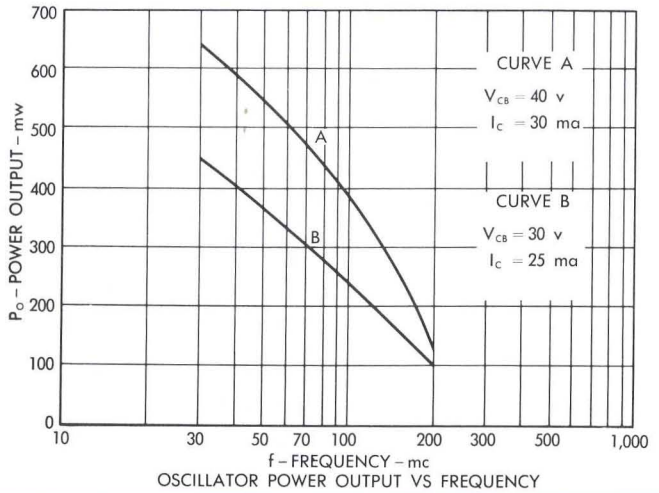
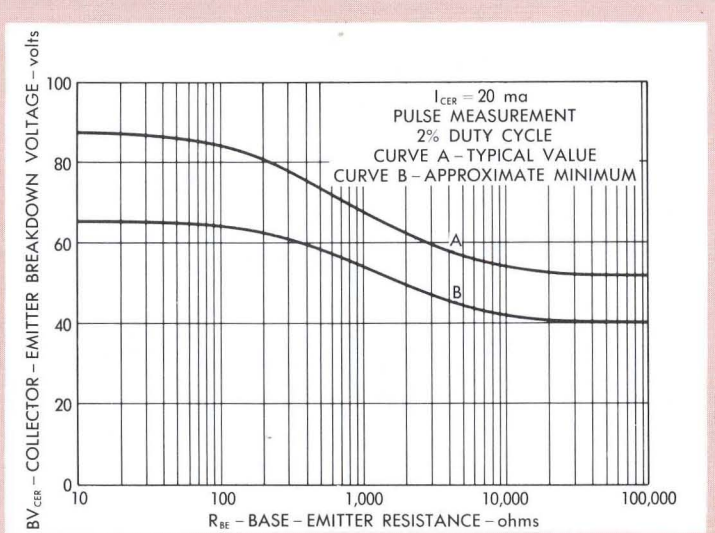
TYPICAL CHARACTERISTICS

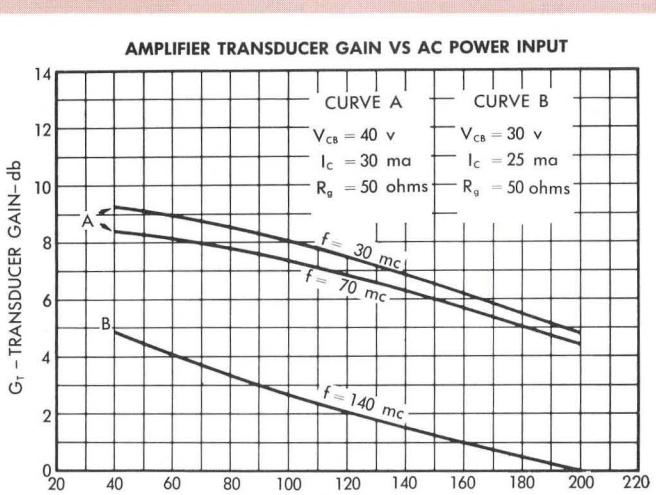


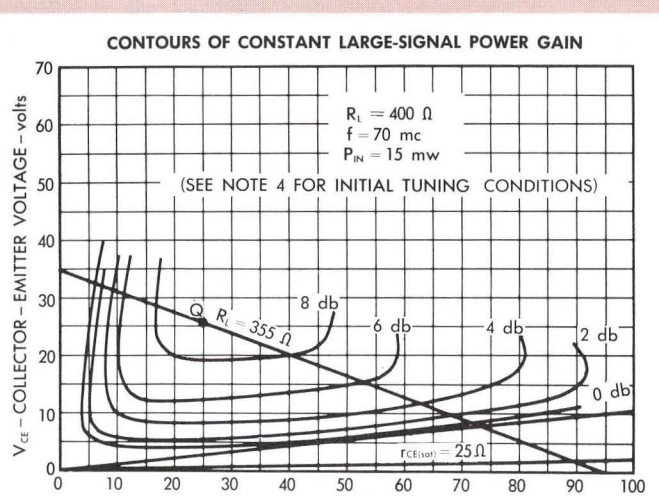
GAIN – BANDWIDTH VS V_{CE} AND I_C



OSCILLATOR POWER OUTPUT VS FREQUENCY







Note 3 Derate linearly to +175°C case temperature at the rate of 8 mw/°C.

Note 4 Each power gain contour is obtained at P_{IN} = 15 mw from an amplifier circuit tuned at V_{CB} = 25 v, I_C = 25 ma, P_{IN} = 60 mw (Point Q). These contours define all instantaneous collector voltages and corresponding collector currents for the specified constant power gain.

Note 5 To obtain f_T, the $|h_{fe}|$ response with frequency is extrapolated at 6db/octave to $|h_{fe}| = 1$ from a measurement of the frequency at which $|h_{fe}| = 2$. The product of $f_T \times 1$ has been referred to as the gain-bandwidth.

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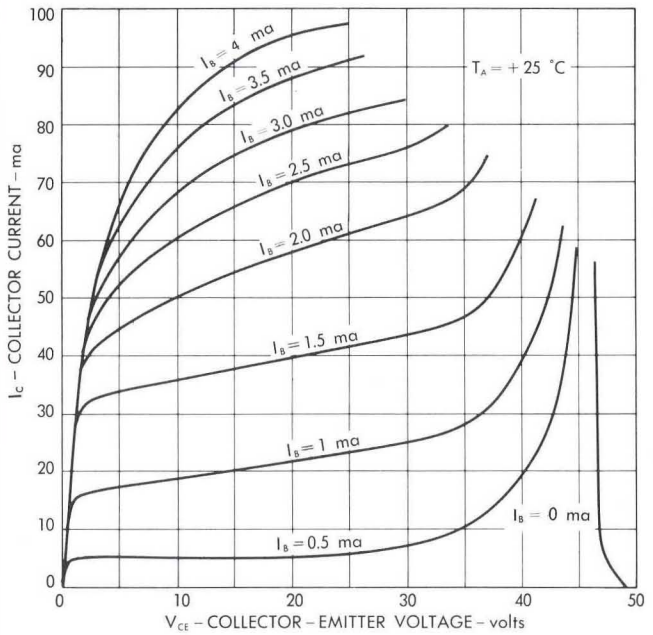
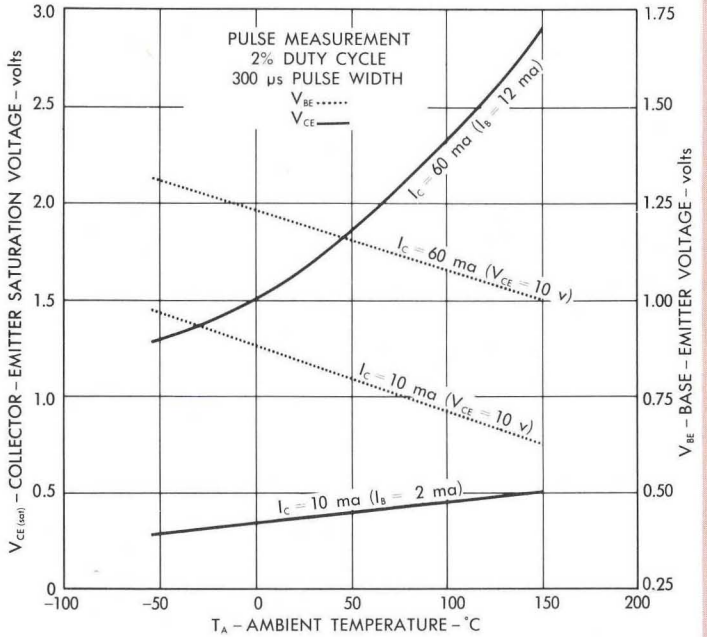
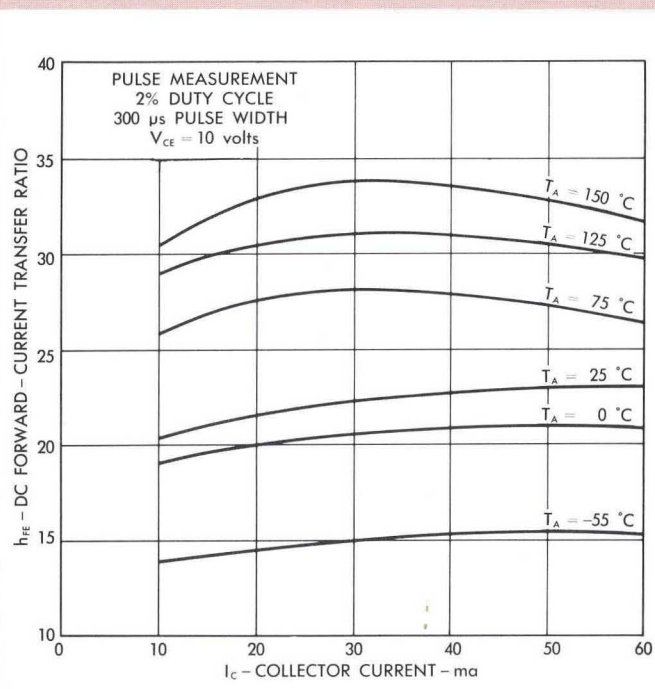
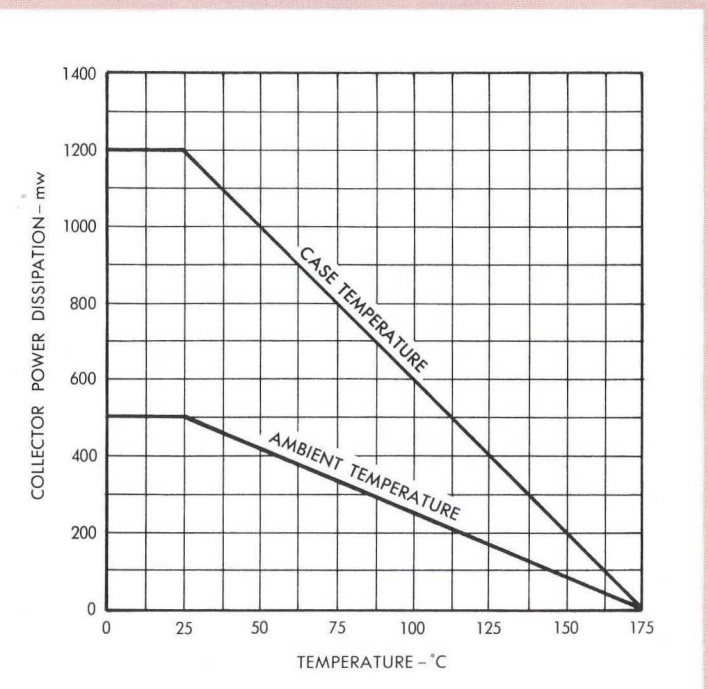
TYPICAL CHARACTERISTICS









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Note 1 The voltage at which h_{FB} approaches one when the emitter-base diode is open circuited. This value can be exceeded in applications where the dc circuit resistance (R_{BE}) between base and emitter is a finite value. When a reverse voltage is applied to the emitter-base diode, a peak collector-emitter voltage equal to BV_{CBO} minus V_{EB} can be allowed. Such conditions may be encountered in class B or C amplifiers and oscillators.

Note 2 Derate linearly to +175°C ambient at the rate of 3-1/3 mw/°C.