Semiconductor Division
TRW Electronic Components Group

TRW

DataBook 1983

RF and Power Semiconductors

CONTENTS

Introduction

This catalog contains the latest TRW Semiconductor devices used by design engineers. In addition to the specifications listed herein, we offer a wide variety of specially screened and tested High Reliability products and custom tested devices to your unique specifications.

Our reputation as the world-wide leader in quality Semiconductor devices is your assurance that TRW is committed to remaining number one – by continually developing new/better devices for your applications and servicing your requirements.

This catalog will be up-dated periodically and therefore we would appreciate your constructive input.

About this Catalog...

The catalog is organized by product segments followed by a preliminary specification section.

Marketing

TRW has Sales Engineering Offices and Distributor warehouses for Semiconductors located worldwide. The following pages show the addresses and pertinent information for them. At both the Lawndale, California, and Bordeaux, France facilities internal sales and marketing personnel are organized on the geographic concept. They welcome the opportunity to discuss your requirements.

Leadership

TRW has pioneered many significant developments in both RF and High Power switching technology.

TRW pioneered the Power SCHOTTKY rectifier and brought it from a laboratory curiosity to a usable, efficient low voltage rectifier.

TRW's switching diodes are among the fastest in the world. At high voltages in particular, the performance is unmatched.

Policy on Customer Drawings and Special Requirements

Often, it is necessary to control specific characteristics or impose screening requirements which are different from or beyond the normal manufacturing processes for products listed herein.

Because of the complexity of administering special parts to customer drawings, the following policy is established:

1. Customer drawings for TRW products must be reviewed by the product producing division and agreed to in writing prior to a purchase order.
2. Authority for approval and agreement to supply items described in customer drawings rests solely with the product producing division. No agent, distributor, field sales representative or other person engaged other than as a direct employee of the product producing division is authorized to approve or agree to supply items described by customer drawings.
3. Orders for TRW standard products will be supplied in accordance with published data only. Advance or verbal orders for standard product confirmed with additional requirements, such as drawings or fixturing, will be rejected unless specific agreement is obtained from the product producing division in advance.
4. Items to customer drawings will (in general) be assigned unique type numbers for control purposes.

A few words about TRW Semiconductors...

Dear Customer:

Your request for this databook indicates an interest in our product that is greatly appreciated by TRW Semiconductors.

Data on the product contained herein speaks for itself. I will confine my comments to issues not contained in the technical data, but which are of equal importance to you, our customer, and to us, the TRW people who want to service your needs. They are:

- CUSTOMER SERVICE
- APPLICATIONS SUPPORT
- PRODUCT QUALITY
- R&D AND PRODUCT ENGINEERING

In 1982, we completed the re-structuring of our organization to strengthen these important areas.

A well staffed CUSTOMER SERVICE organization structured on a geographic and an account basis will assure timely answers regarding your purchase orders.

An APPLICATIONS ENGINEERING staff exists solely to provide technical assistance and advice to you.

I have a personal commitment to the QUALITY of the product supplied by TRW Semiconductors. This is supported by an experienced, well-staffed QUALITY ASSURANCE organization reporting directly to me.

A large portion of our operating budget is dedicated to RESEARCH and PRODUCT DEVELOPMENT. In my opinion, we have assembled some of the most talented Semiconductor physicists and engineers in the world to staff these groups. We also encourage them to have frequent involvement with you our customers. This helps us assure that our development direction is toward your present and future needs.

We enjoy the role of a "leading-edge" technology company and I pledge to continue the investment for innovative product and service for your use.

Thank you for your response to our products in the past years. It is my hope that you will find this databook and our products and people useful for your current and future design needs.

Yours Very Truly,

Kevin M. Finn

Kevin M. Finn, Vice President, General Manager
Semiconductor Division
TRW Electronic Components Group

TRW Electronic Components Group

Printed Circuit Division
200 South Turnbull Canyon Road
City of Industry, California 91749
Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
4243 Campus Point Court
San Diego, California 92121
Phone: 714/457-1000

Products: Data converters, arithmetic products, and special processors.

Optoelectronics Division
1201 Tappan Circle
Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

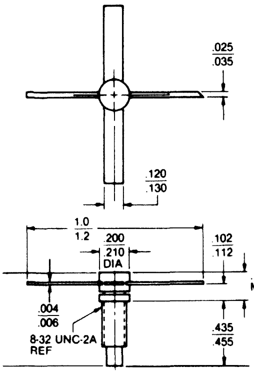
Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

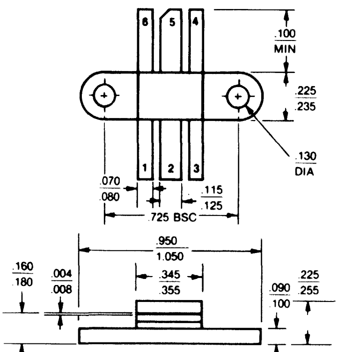
Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

RF Packages

.200 SOE

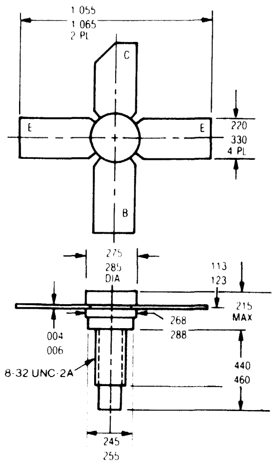


.230 F



STYLE 1:
PIN 1. BASE
2. EMITTER
3. BASE
4. BASE
5. COLLECTOR
6. BASE

.280 SOE



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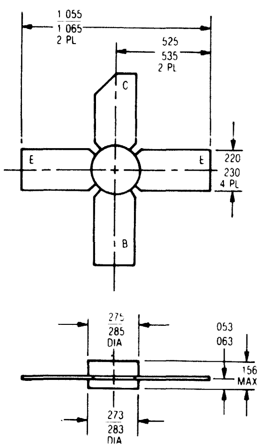

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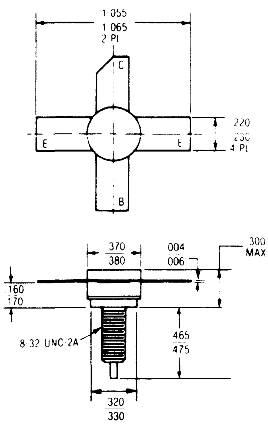

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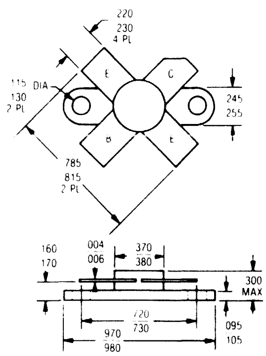

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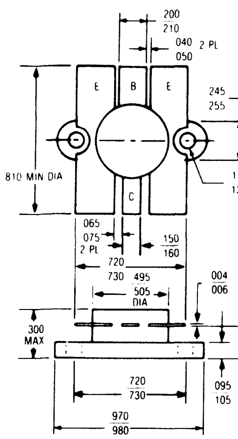

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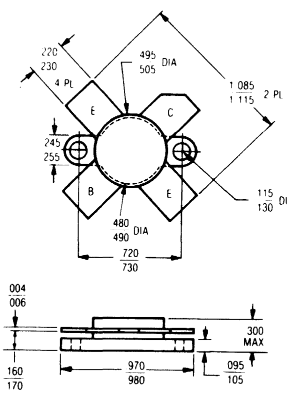

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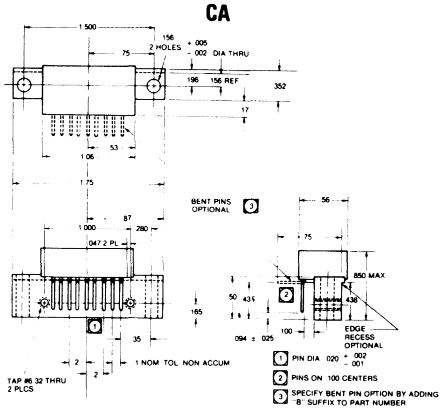
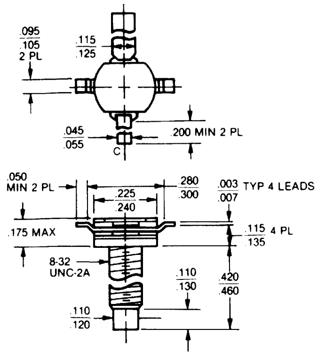
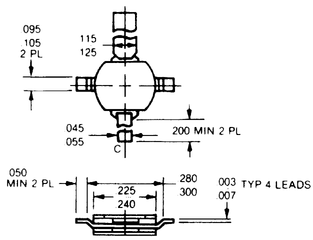


RF Packages

GP-14



GP-14 Studless



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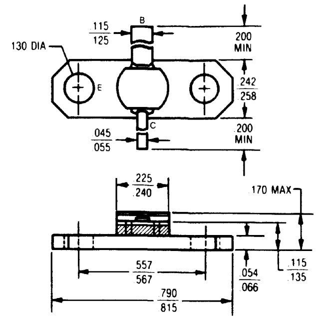

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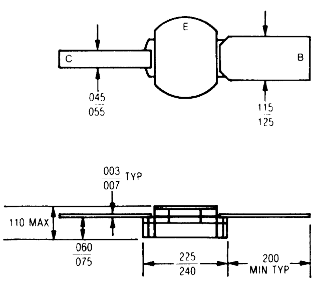

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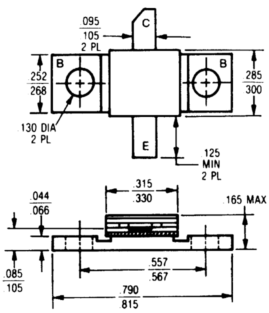

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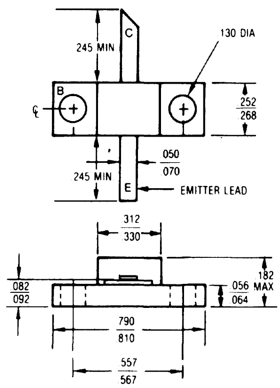

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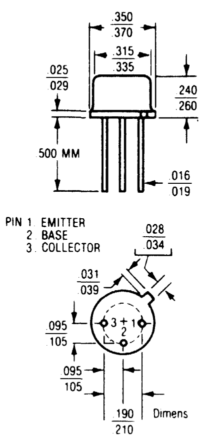

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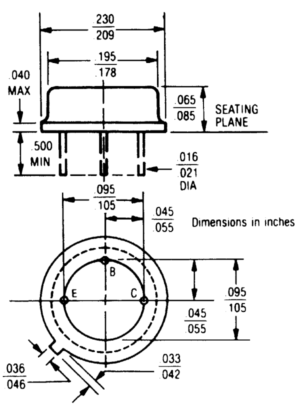

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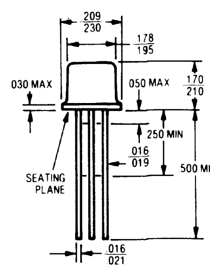
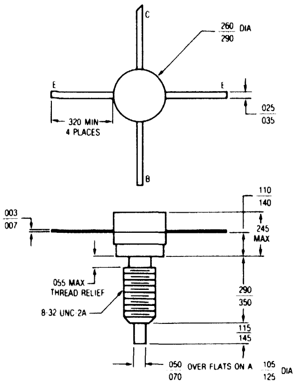
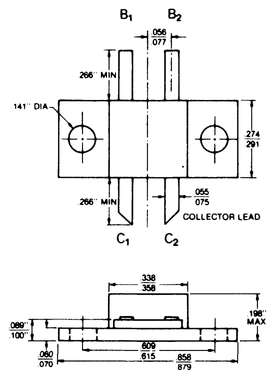


RF Packages

TO-117A



BMA-2



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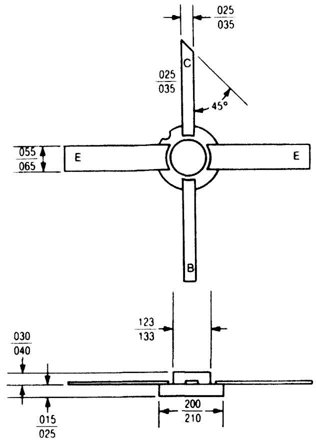
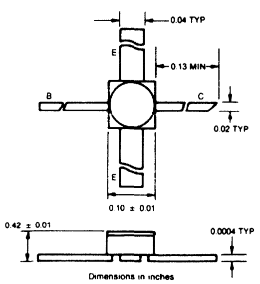


Package 00



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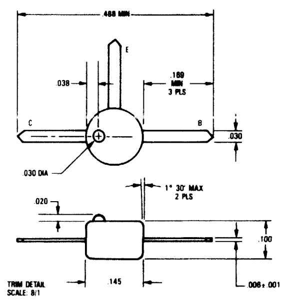

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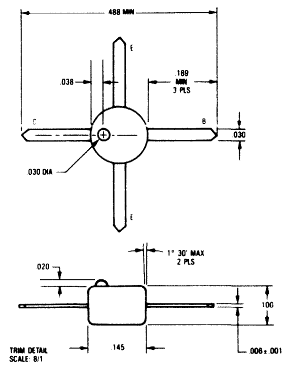

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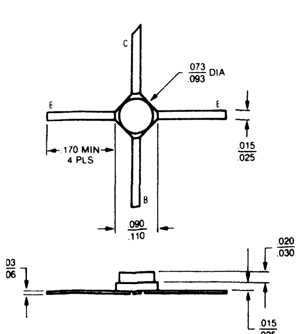
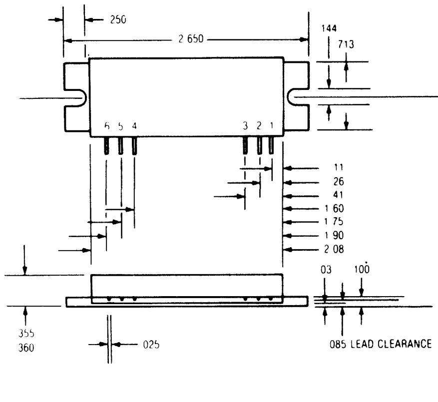
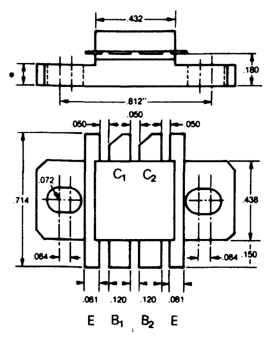


MOBILE MODULE

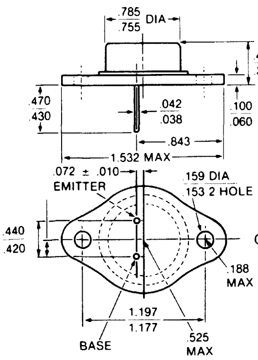


MRP-7



Power Packages

TO-3



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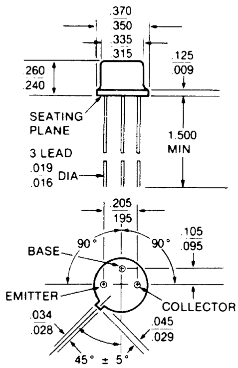
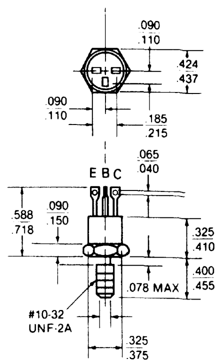
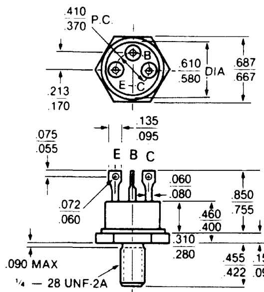


TO-59 Isolated

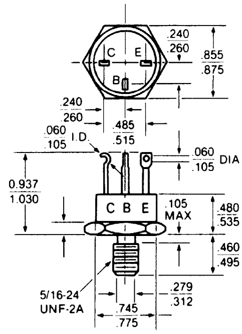


TO-61 Isolated



COLLECTOR ISOLATED FROM CASE

TO-63



COLLECTOR COMMON TO CASE

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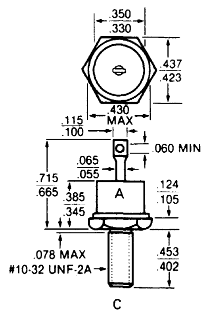

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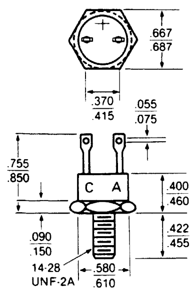

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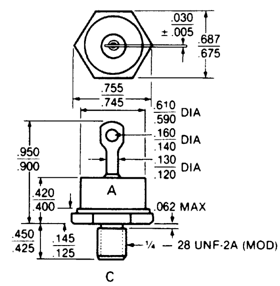

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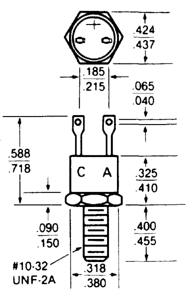

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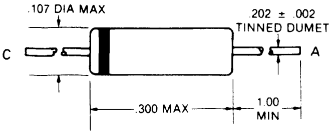
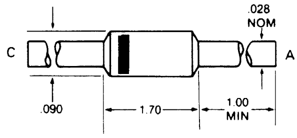
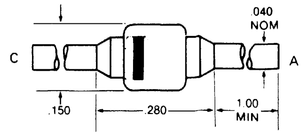


Double Slug "A" Package

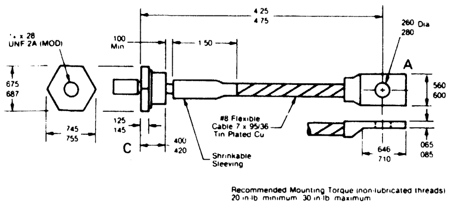


Double Slug "B" Package

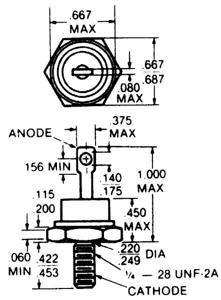


Packages

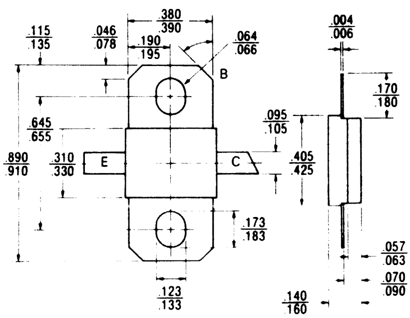
DO-203AB (DO-5) w/Flexible Lead Package Outline Drawing



DO-5 Schottky



HLP-12



ALPHANUMERIC LISTING

ALPHANUMERIC LISTING

ALPHANUMERIC LISTING

12.5 Volt Class "C" Transistors

Primarily intended for Vehicular FM Communications, the following devices cover the U.S. and European mobile bands. All are protected from damage due to arbitrary terminations up to ∞ VSWR.

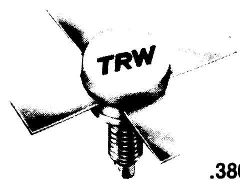
These devices feature TRW's proprietary GOLD metalization and diffused ballasting.

Alternate packages are available on special order (consult factory).

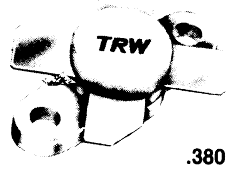
TRW

RF Power Transistor

- 50 MHz
- 5.0 Watts
- 12.5 V
- 13 dB Gain
- Class B or C Operation
- Diffused Ballast Resistors
- Isolated Packages
- Common Emitter
- 20:1 VSWR



.380 SOE

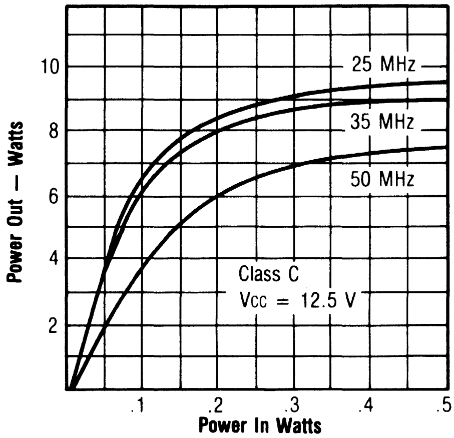


.380 SOE F

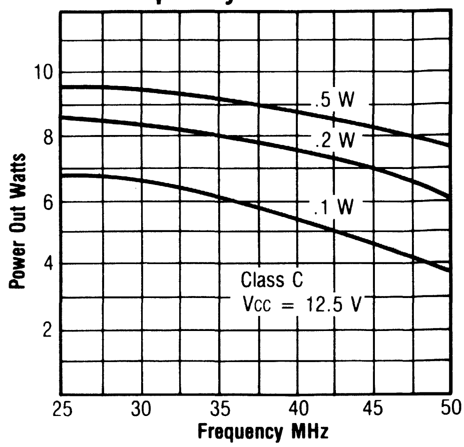
Electrical Characteristics (T_{CASE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CEO}	Collector Emitter Breakdown Voltage	I_C = 50mA I_B = 0	16			V
	BV_{EBO}	Emitter Base Breakdown Voltage	I_E = 1.0mA I_C = 0	4			V
	BV_{CBO}	Collector Base Breakdown Voltage	I_C = 50mA I_E = 0	36			V
	H_{FE}	DC Current Gain	V_{CE} = 5V I_C = 100mA	10		200	
RF TEST	P_G	Power Gain	V_{CE} = 12.5V, f = 50 MHz P_{IN} = 0.25 W	13			dB
	Load VSWR	Mismatch Tolerance	V_{CE} = 15.5V, f = 50 MHz P_{IN} = 0.25 W	20:1			VSWR
	η	Efficiency	V_{CE} = 12.5V, f = 50 MHz P_{IN} = 0.25 W	60			%
THERMAL	I_C	Cont. Coll. Current				2.0	A
	Θ_{JC}	Thermal Resistance	T_C = 25°C			7.0	°C/W
	T_{STG}	Storage Temp.		−65		150	°C
	P_D	Power Dissipation	T_C = 25°C			25	W

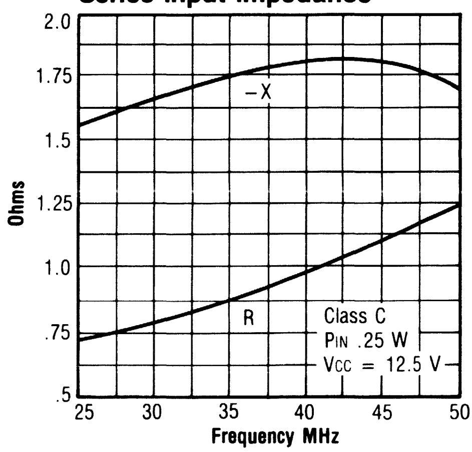
Broadband Power Transfer



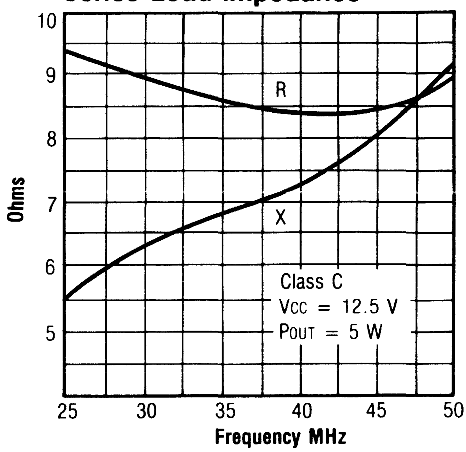
Broadband Power Out vs. Frequency



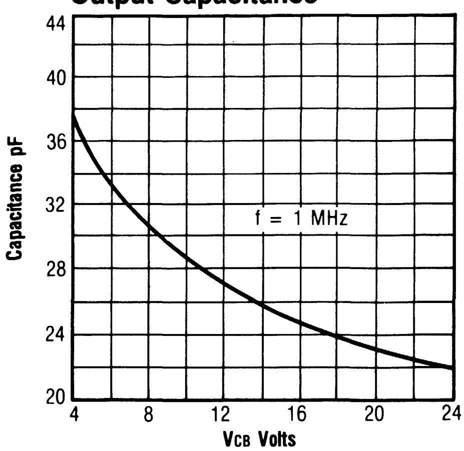
Series Input Impedance

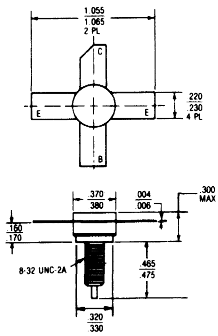


Series Load Impedance

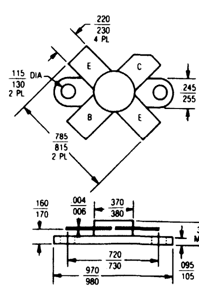


Output Capacitance





.380 SOE
PT88SOA

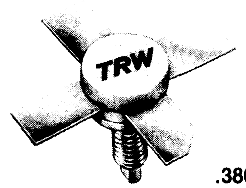


.380 SOE F
PT88SO

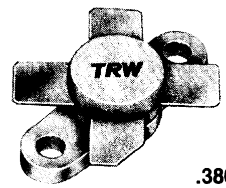
TRW

RF Power Transistor

- 10 Watts
- 12.5 V_{CC}
- 50 MHz
- Class B or C Operation
- Diffused Ballast Resistors
- Common Emitter
- Isolated Packages
- 20:1 VSWR



.380 SOE

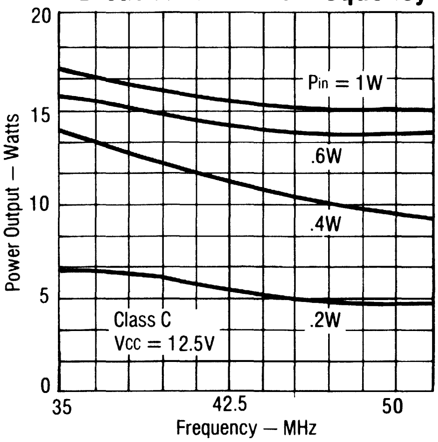


.380 SOE F

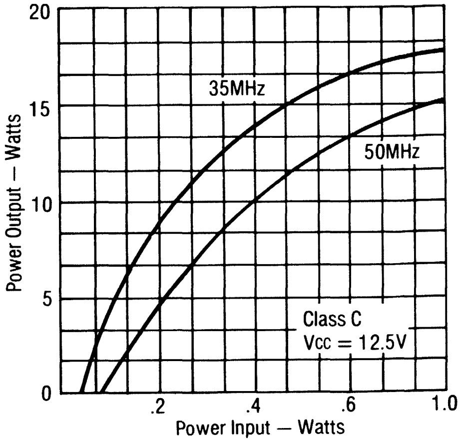
Electrical Characteristics (T_{FLANGE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 1mA, I_C = 0	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 25mA, I_B = 0	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 50mA, I_E = 0	36			V
	h_{FE}	D.C. Current Gain	V_{CE} = 10V, I_C = 500mA	20		150	—
RF TEST	P_{GAIN}	Power Gain	V_{CE} = 12.5V, f = 50MHz P_{IN} = 0.6W	12.2			dB
	η	Efficiency	V_{CE} = 12.5V, f = 50MHz P_{IN} = 0.6W	60			%
	Load VSWR	Mismatch Tolerance	V_{CE} = 15.5V, f = 50MHz P_{IN} = 0.6W	20:1			VSWR
THERMAL	I_C	Continuous Collector Current				2.5	A
	$\theta_{j\text{-}c}$	Thermal Resistance	T_C = 25°C			5.8	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		-65		150	°C
	P_D	Power Dissipation	T_C = 25°C			30	W

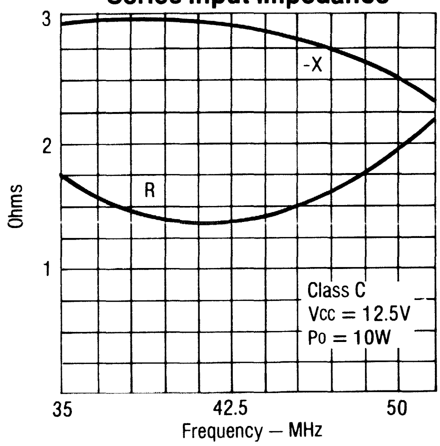
Broadband POUT vs Frequency



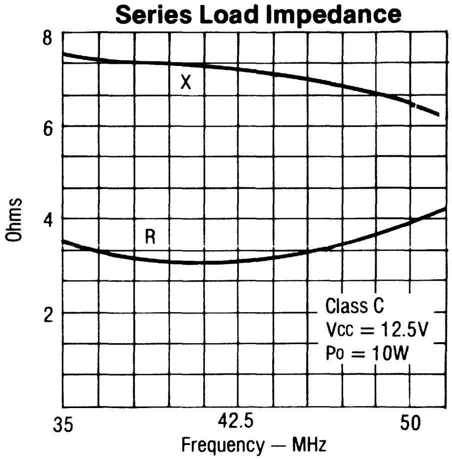
Broadband Power Transfer



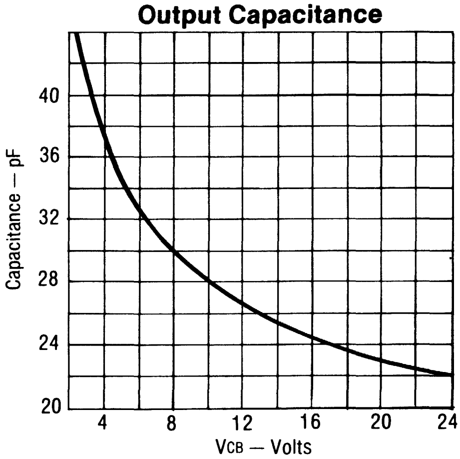
Series Input Impedance



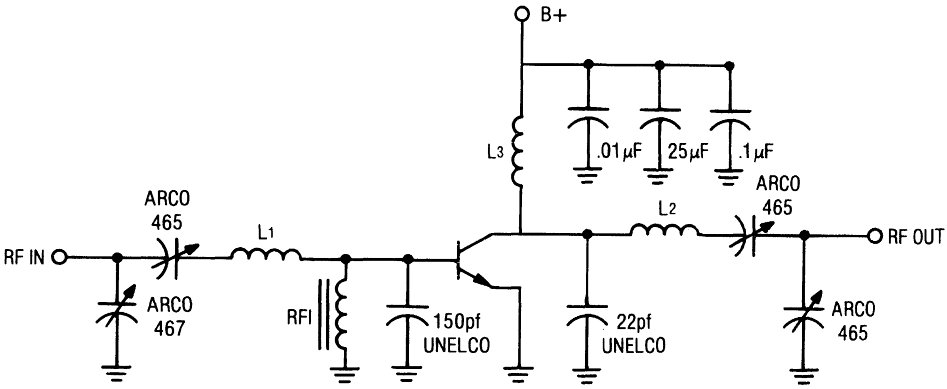
Series Load Impedance



Output Capacitance

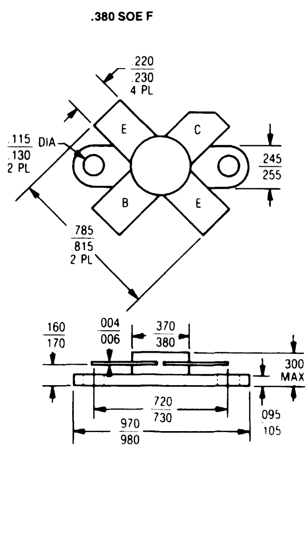


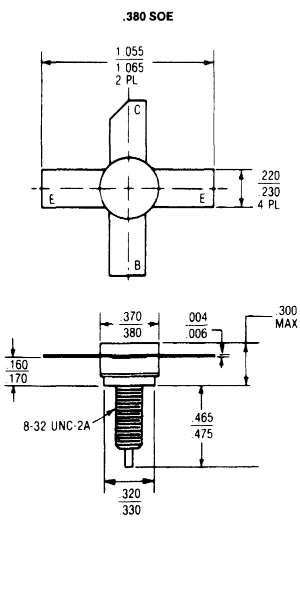
TEST CIRCUIT



L1	4 turns, 16 AWG wire, 0.28" ID, close wound.
L2	6 turns, 16 AWG wire, 0.40" ID, close wound.
L3	12 turns, 16 AWG wire, 0.28" ID, close wound.
RFI	2 turns, 22 AWG wire, wound on Ferroxcube VK211-073B axial core.

PT 8851

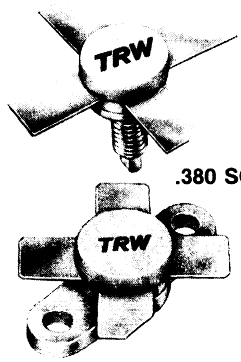




PT 8851A

RF Power Transistors

- 20 Watts
- 12.5 V_{CC}
- 50 MHz
- High Gain
- Diffused Ballast Resistors
- Common Emitter
- Isolated Packages
- 20:1 VSWR
- Class B or C Operation



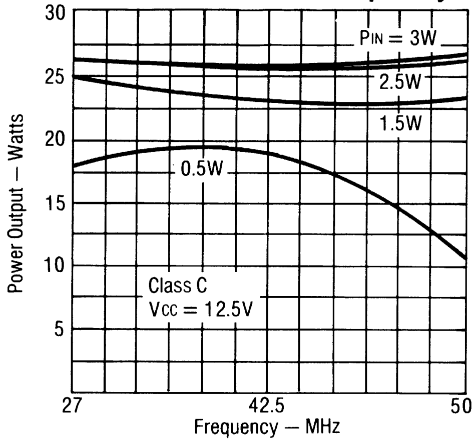
.380 SOE

.380 SOE F

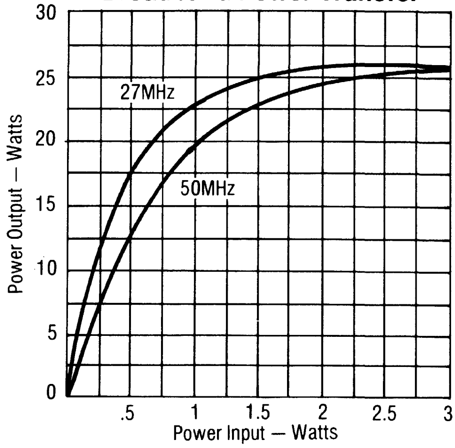
Electrical Characteristics (T_{FLANGE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 10mA, I_C = 0	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 40mA, I_B = 0	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 5mA, I_E = 0	36			V
	h_{FE}	D.C. Current Gain	V_{CE} = 10V, I_C = 100mA	10		200	—
RF TEST	P_{GAIN}	Power Gain	V_{CE} = 12.5V, f = 50MHz P_{IN} = 1.5W	11.2			dB
	η	Efficiency	V_{CE} = 12.5V, f = 50MHz P_{IN} = 1.5W	60			%
	Load VSWR	Mismatch Tolerance	All Phases Angles V_{CE} = 15.5V, f = 50MHz P_{IN} = 1.5W	20:1			VSWR
THERMAL	I_C	Continuous Collector Current				5	A
	θ_{jc}	Thermal Resistance	T_C = 25°C			3.5	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		-65		150	°C
	P_D	Power Dissipation	T_C = 25°C			50	W

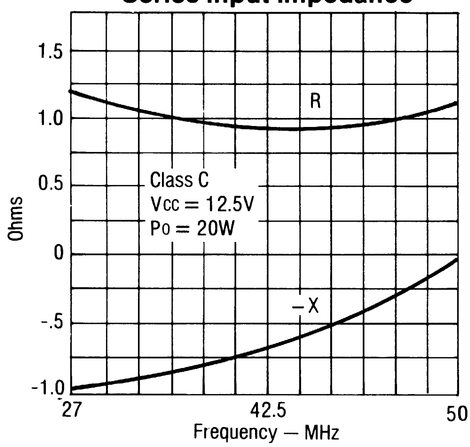
Broadband POUT vs Frequency



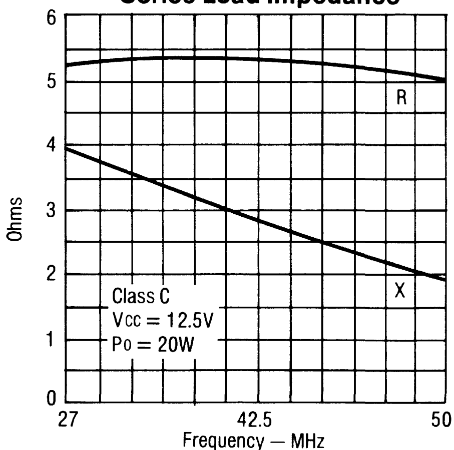
Broadband Power Transfer



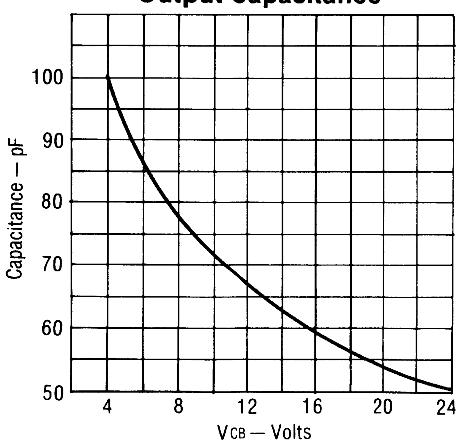
Series Input Impedance



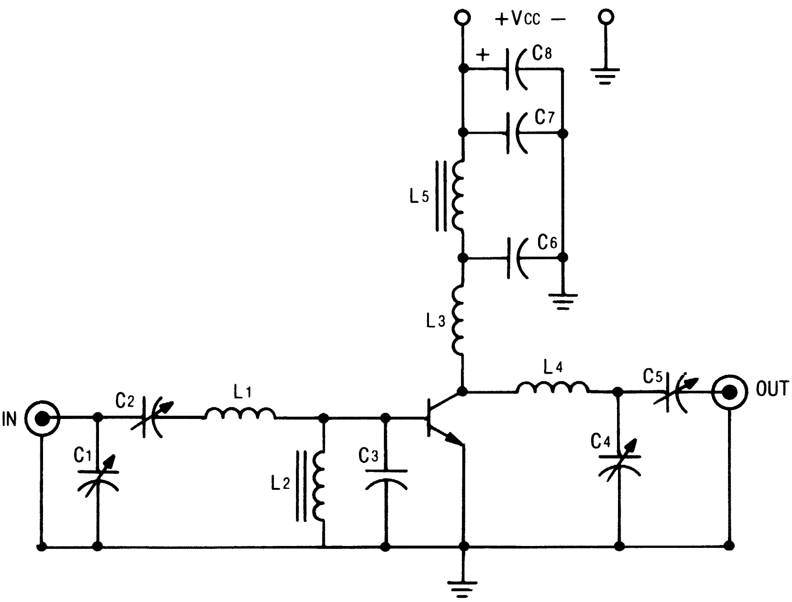
Series Load Impedance



Output Capacitance

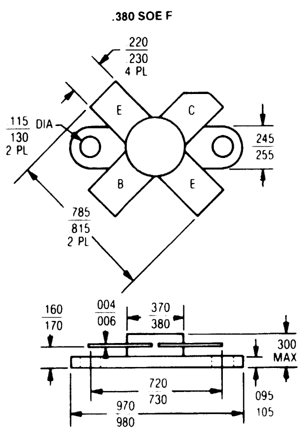


TEST CIRCUIT

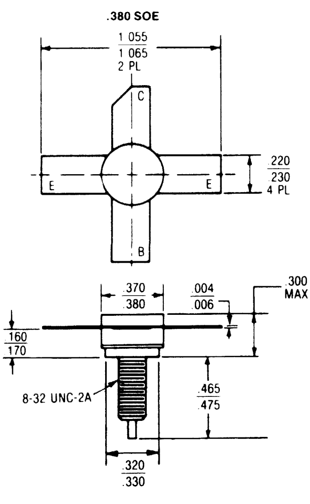


PARTS LIST:

$C_{1,2}$	467 ARCO
$C_{3,6}$	1000pf UNELCO
$C_{4,5}$	466 ARCO
C_7	0.1 MFD
C_8	5 MFD
L_1	2 T. #18 AWG., .35 in. I.D.
L_2	2-1/2 T. #22 AWG. on Ferroxcube VK211-073B axial core.
L_3	3 T. #18 AWG., .35 in. I.D.
L_4	2 T. #14 AWG., .35 in. I.D.
L_5	2-1/2 T. #18 AWG. on stackpole 9500-D0 A7 23-1838 core.



PT 8852

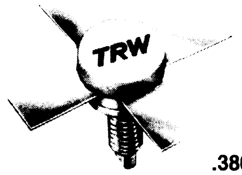


PT 8852A

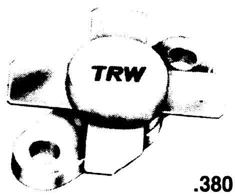
TRW

RF Power Transistor

- 50 MHz
- 35 Watts
- 12.5 V
- 10 dB Gain
- Diffused Ballast Resistors
- Common Emitter
- Isolated Packages
- 20:1 VSWR
- Class B or C Operation



.380 SOE

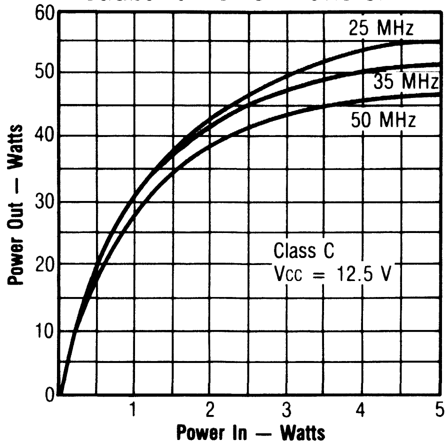


.380 SOE F

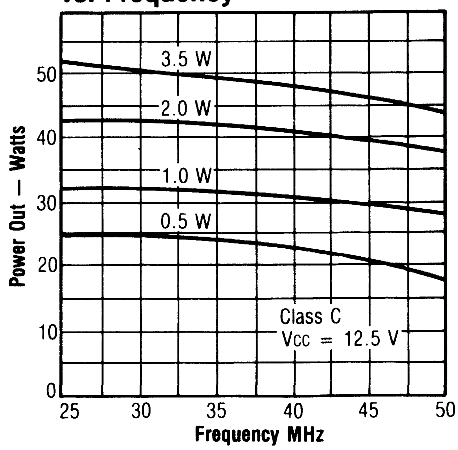
Electrical Characteristics (T_{CASE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter Base Breakdown Voltage	I_E = 5mA, I_C = 0	4.0			V
	BV_{CEO}	Collector Emitter Breakdown Voltage	I_C = 50mA, I_B = 0	16			V
	BV_{CBO}	Collector Base Breakdown Voltage	I_C = 50mA, I_E = 0	36			V
	H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 1.0 A	10		200	
RF TEST	P_G	Power Gain	V_{CE} = 12.5V, f = 50 MHz P_{IN} = 3.5 W	10			dB
	Load VSWR	Mismatch Tolerance	V_{CE} = 15.5V, f = 50 MHz P_{IN} = 3.5 W	20:1			VSWR
	η	Efficiency	V_{CE} = 12.5V, f = 50 MHz P_{IN} = 3.5 W	60			%
THERMAL	I_C	Continuous Coll. Current				6	A
	P_D	Power Dissipation	T_C = 25°C			75	W
	Θ_{JC}	Thermal Resistance				2.3	°C/W
	T_{STG}	Storage Temperature		−65		150	°C

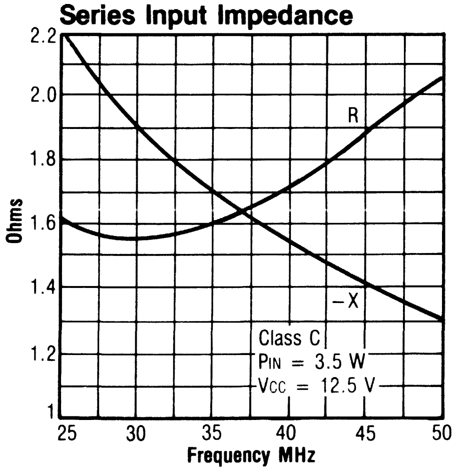
Broadband Power Transfer



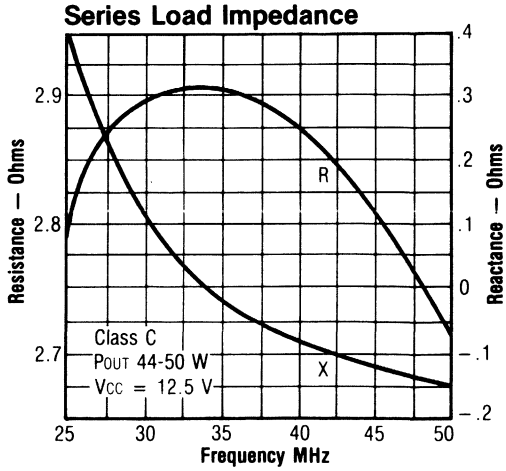
Broadband Power Out vs. Frequency



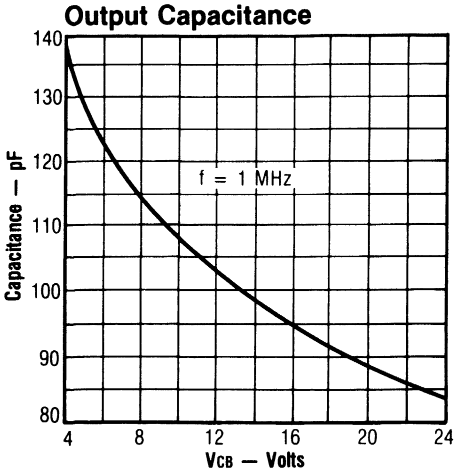
Series Input Impedance

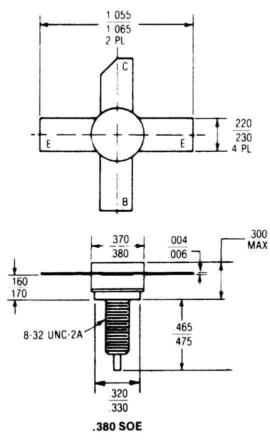


Series Load Impedance

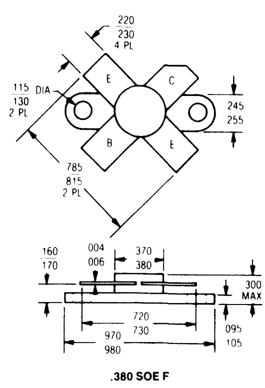


Output Capacitance





PT8853A

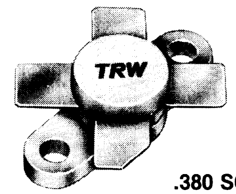


PT8853

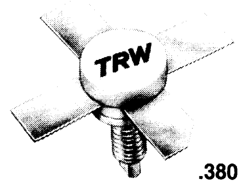
TRW

RF Power Transistors

- 70 Watts
- 12.5 V_{CC}
- 50 MHz
- High Gain
- Diffused Ballast Resistors
- Common Emitter
- Isolated Packages
- 20:1 VSWR
- Class B or C Operation



.380 SOE F

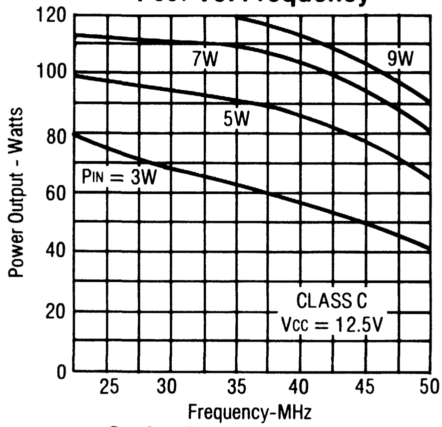


.380 SOE

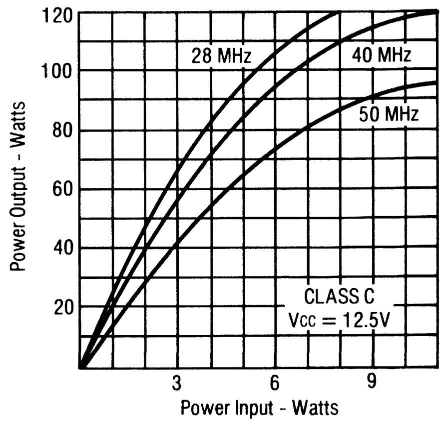
Electrical Characteristics (T_{CASE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CBO}	Collector-Base Breakdown Voltage	$I_E = 0$, $I_C = 50mA$	36V	–	–	Vdc
	BV_{CEO}	Collector-Emitter Breakdown Voltage	$I_B = 0$, $I_C = 50mA$	16		–	Vdc
	BV_{EBO}	Emitter-Base Breakdown Voltage	$I_C = 0$, $I_E = 10mA$	4			Vdc
	h_{FE}	D.C. Current Gain	$V_{CE} = 5V$, $I_C = 1A$	10		200	
	I_{CES}	Collector Cutoff Current	$V_{CE} = 16V$	–	0.1	10	mA
RF TEST	P_G	Power Gain	$V_{CE} = 12.5V$, f = 50MHz $P_{IN} = 8W$	9.4			dB
	Load VSWR	Load Mismatch Tolerance	$V_{CE} = 15.5V$, f = 50MHz $P_{IN} = 8W$	20:1			VSWR
	η	Efficiency	$V_{CE} = 12.5V$, f = 50MHz $P_{IN} = 8W$	60			%
THERMAL	P_D	Maximum Power Dissipation				203	W
	I_C	Maximum Collector Current				24	A
	T_{STG}	Operating & Storage Temperature		–65	–	+150	°C
	θ_{JC}	Thermal Resistance			.86		°C/W

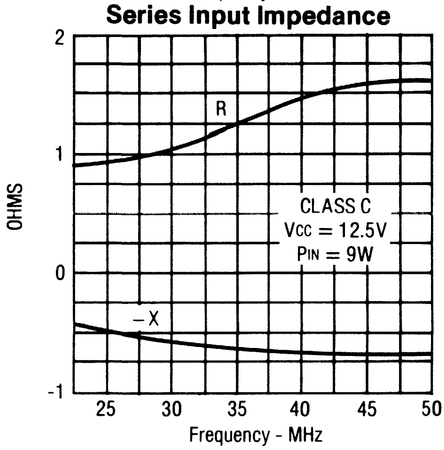
POUT Vs. Frequency



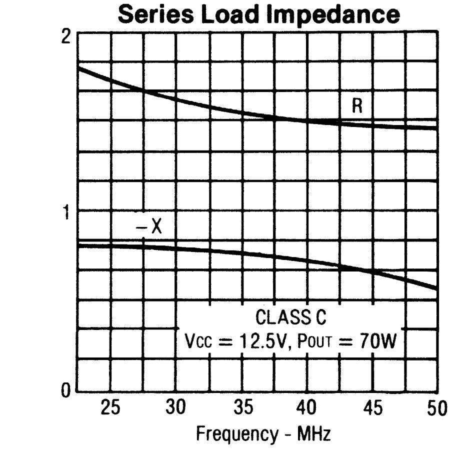
Power Transfer



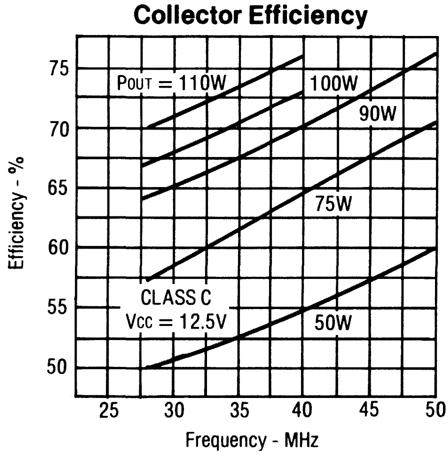
Series Input Impedance



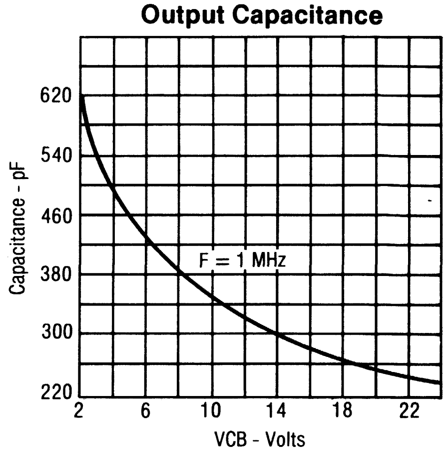
Series Load Impedance



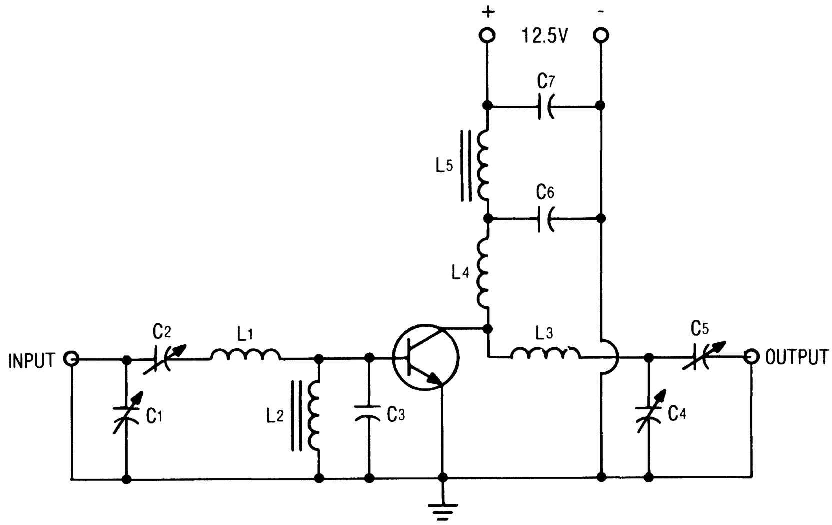
Collector Efficiency



Output Capacitance



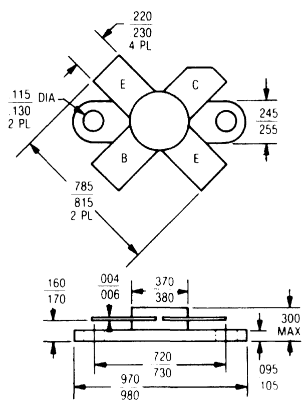
70 WATT 50 MHz
12.5V TEST CIRCUIT



C_1, C_2	ARCO 467
C	1000 pF Underwood Electric
C_4, C_5	ARCO 465
C_6, C_7	.1μf

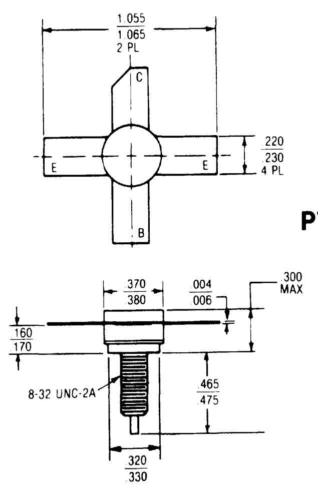
L_1	1 Turn No. 18, 5/16 inch diam.
L_2	2½ Turns No. 24 on Ferroxcube VK211-07-3B Core
L_3	2 Turns No. 16 5/16 inch diam.
L_4	3 Turns No. 16 5/16 inch diam.
L_5	2½ Turns No. 16 on Stackpole Ceramag No. 9500, D0 A7 Core

.380 SOE F



PT 8854

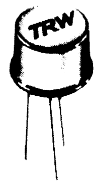
.380 SOE



PT 8854A

RF Power Transistor

- 1.8 Watts
- 88 MHz
- 12.5 V
- 14 dB Gain
- ∞ VSWR

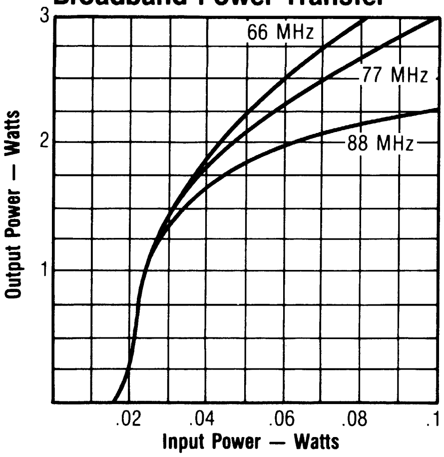


TO-39

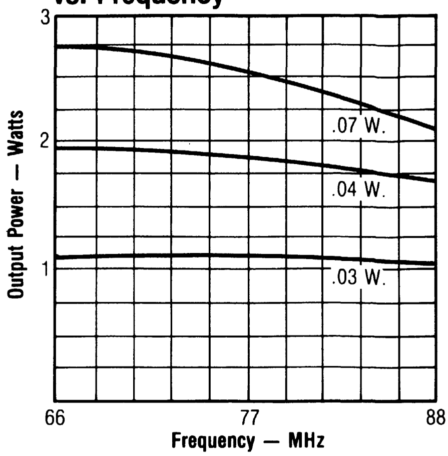
Electrical Characteristics (T_{CASE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CEO}	Collector Emitter Breakdown Voltage	I_C = 20mA, I_B = 0	16			V
	BV_{CBO}	Collector Base Breakdown Voltage	I_C = 2.0mA, I_E = 0	36			V
	BV_{EBO}	Emitter Base Breakdown Voltage	I_E = 1.0mA, I_C = 0	4.0			V
	H_{FE}	DC Current Gain	V_{CE} = 5.0V, I_C = 50mA	10		200	
RF TEST	P_G	Power Gain	V_{CE} = 12.5V, f = 88 MHz P_{IN} = .07 W	14			dB
	η	Efficiency	V_{CE} = 15.5V, f = 88 MHz P_{IN} = .07 W	60			%
THERMAL	I_C	Continuous Collector Current				.75	A
	P_D	Power Dissipation				5	W
	Θ_{JC}	Thermal Resistance				35	°C/W
	T_{STG}	Storage Temp.		−65		150	°C

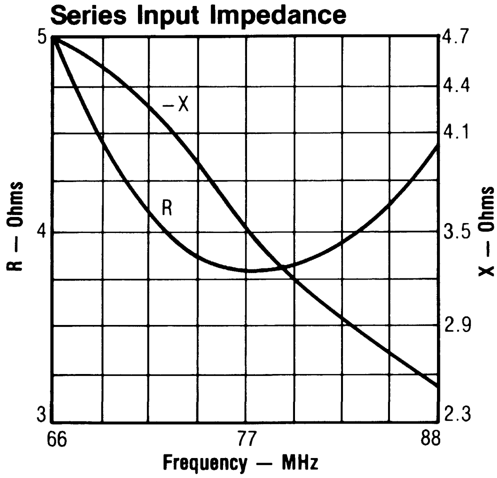
Broadband Power Transfer



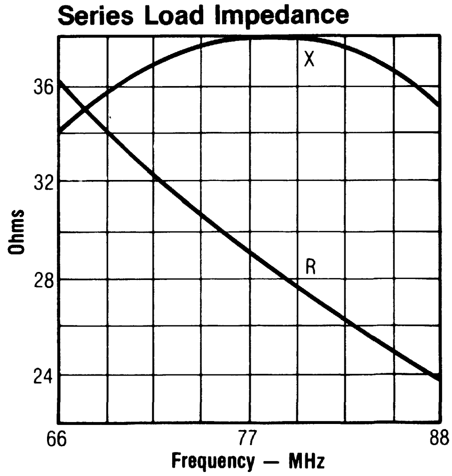
Broadband Power Out vs. Frequency



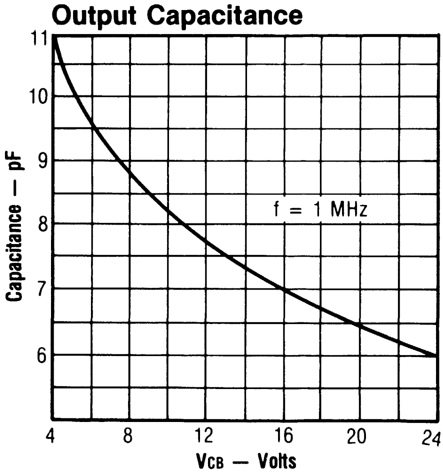
Series Input Impedance



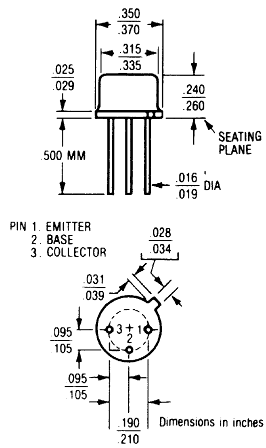
Series Load Impedance



Output Capacitance

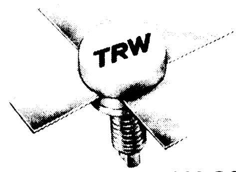


TO-39

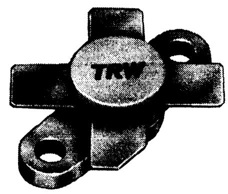


RF Power Transistors

- 5 Watts
- 12.5 V_{CC}
- 88 MHz
- Class B or C Operation
- High Gain
- Diffused Ballast Resistors
- Common Emitter
- Isolated Packages
- 20:1 VSWR



.380 SOE

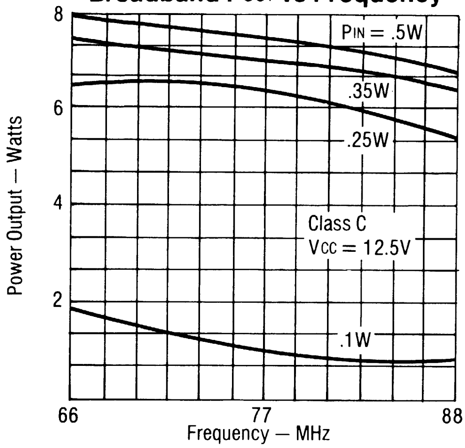


.380 SOE F

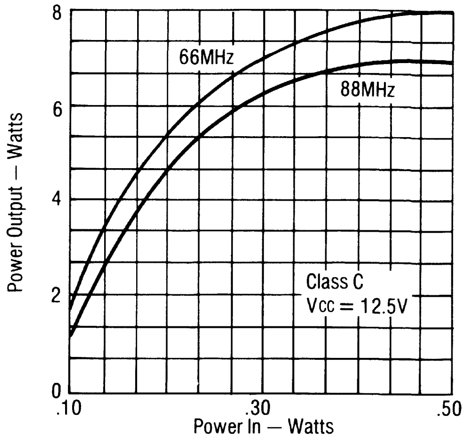
Electrical Characteristics (T_{FLANGE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 1mA, I_C = 0	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA, I_B = 0	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 5mA, I_E = 0	36			V
	I_{CES}	Collector Cutoff Current	V_{CE} = 15V, I_B = 0			10	mA
	h_{FE}	D.C. Current Gain	V_{CE} = 10V, I_C = 100mA	10		200	–
RF TEST	P_{GAIN}	Power Gain	V_{CE} = 12.5V, f = 88MHz P_{IN} = 0.25W	13			dB
	η	Efficiency	V_{CE} = 12.5V, f = 88MHz P_{IN} = 0.25W	60			%
	Load VSWR	Mismatch Tolerance	All Phases Angles V_{CE} = 15.5V, f = 88MHz P_{IN} = 0.25W	20:1			VSWR
THERMAL	I_C	Continuous Collector Current				2	A
	$\theta_{J\text{-}C}$	Thermal Resistance	T_C = 25°C			7	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		-65		150	°C
	P_D	Power Dissipation	T_C = 25°C			25	W

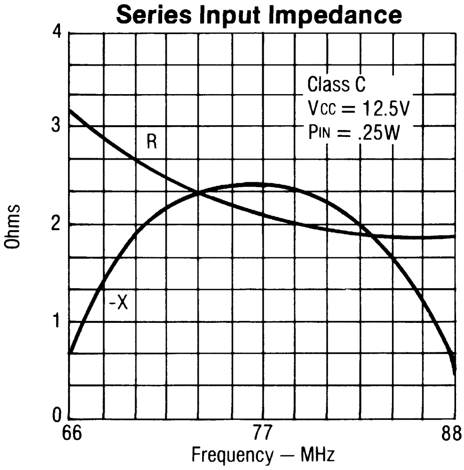
Broadband P_{OUT} vs Frequency



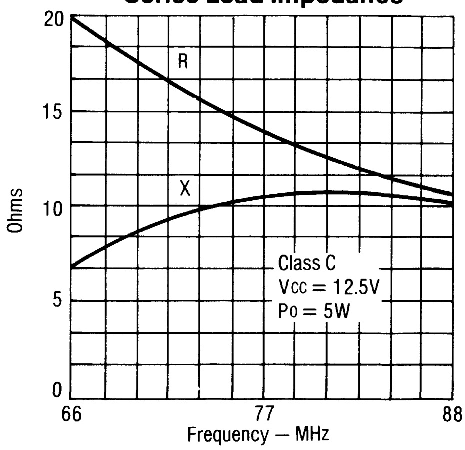
Broadband Power Transfer



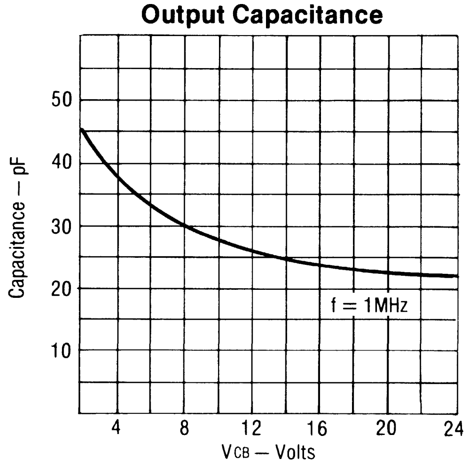
Series Input Impedance



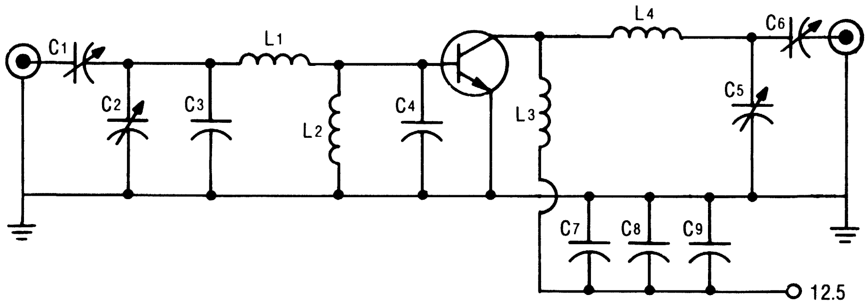
Series Load Impedance



Output Capacitance

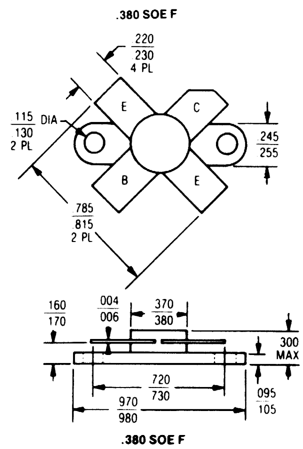


TEST CIRCUIT

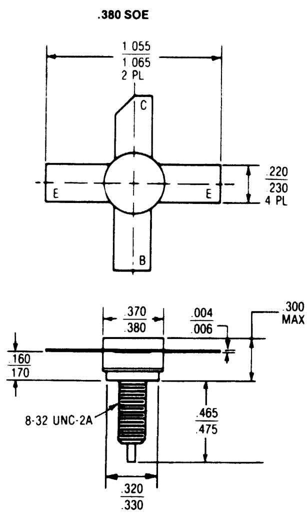


PARTS LIST:

C1	402 ARCO
C2	403 ARCO
C3	22pf UNELCO
C4	300pf UNELCO
C5,6	427 ARCO
C7	.001μF
C8	.01μF
C9	100 MFD
L1	4 T., #16 AWG., 1/4" I.D., 5/16" long.
L2	2-1/2 T., #22 AWG. looped thru VK211-0733 Ferroxcube Core.
L3	8 T., #16 AWG., 5/16" I.D., 1/2" long.
L4	3 T., #16 AWG., 5/16" AWG., 5/16" I.D., 5/16" long.



PT 8861

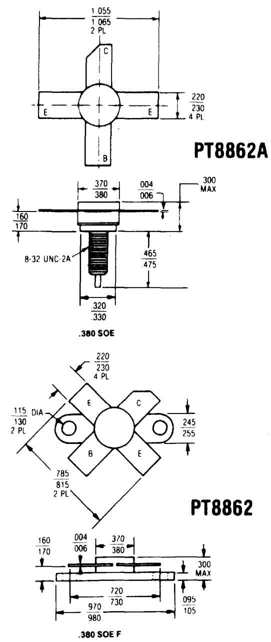


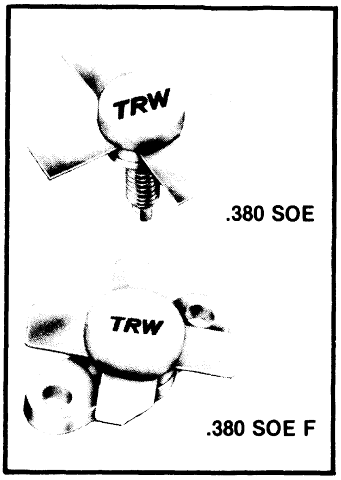
PT 8861A

TRW

RF Power Transistor

- 12 Watts
- 88 MHz
- 8 dB Gain
- 12.5 V
- Class B or C Operation
- Diffused Ballast Resistors
- Common Emitter
- Isolated Packages
- 20:1 VSWR





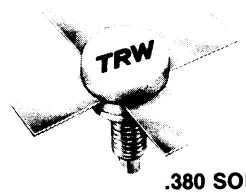
Electrical Characteristics (T_{CASE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 10mA, I_C = 0	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA, I_B = 0	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 50mA, I_E = 0	36			V
	H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 1.0 A	10		200	
RF TEST	P_G	Power Gain	V_{CE} = 12.5V, f = 88 MHz P_{IN} = 1.8 W	8.2			dB
	Load VSWR	Mismatch Tolerance	V_{CE} = 15.5V, f = 88 MHz P_{IN} = 1.8 W	20:1			VSWR
	η	Efficiency	V_{CE} = 12.5V, f = 88 MHz P_{IN} = 1.8 W	60			%
THERMAL	I_C	Continuous Collector Current				5	A
	P_D	Power Dissipation	T_C = 25°C			25	W
	Θ_{JC}	Thermal Resistance				1.2	°C/W
	T_{STG}	Storage Temperature		−65		150	°C

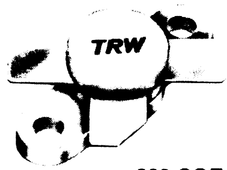
TRW

RF Transistors

- 20 Watts
- 12.5 VCC
- 88 MHz
- Class B or C Operation
- High Gain
- Diffused Ballast Resistors
- Common Emitter
- Isolated Packages
- 20:1 VSWR



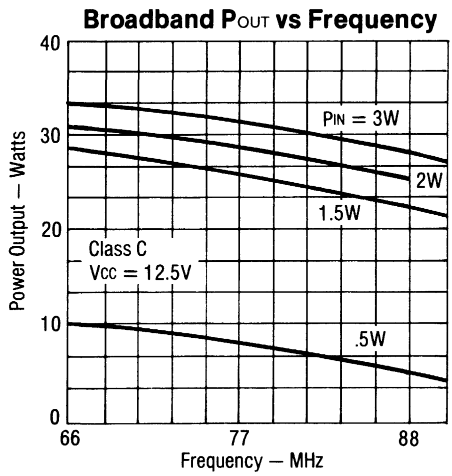
.380 SOE

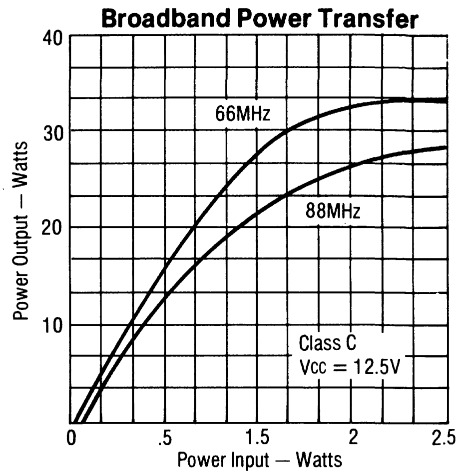


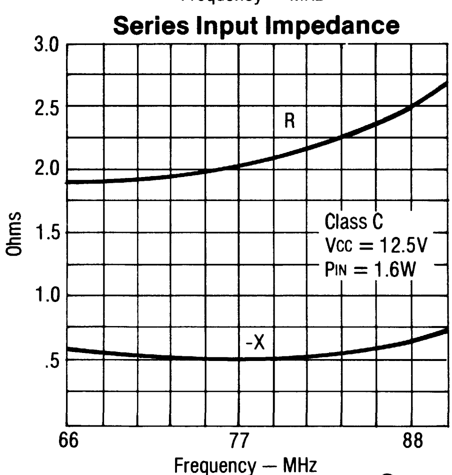
.380 SOE F

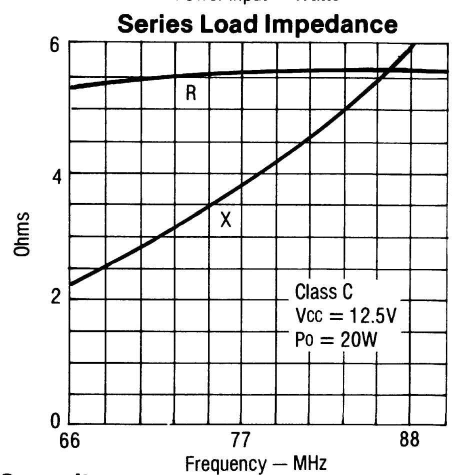
Electrical Characteristics (T_{FLANGE} = 25°C)

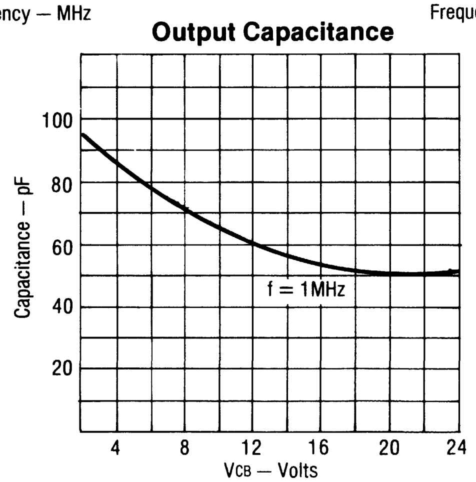
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 5mA, I_C = 0	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA, I_B = 0	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 50mA, I_B = 0	36			V
	I_{CES}	Collector Cutoff Current	V_{CE} = 15V, I_E = 0			10	mA
	h_{FE}	D.C. Current Gain	V_{CE} = 10V, I_C = 100mA	10		200	–
RF TEST	P_{GAIN}	Power Gain	V_{CE} = 12.5V, f = 88MHz P_{IN} = 1.6W	11			dB
	η	Efficiency	V_{CE} = 12.5V, f = 88MHz P_{IN} = 1.6W	60			%
	Load VSWR	Mismatch Tolerance	V_{CE} = 15.5V, f = 88MHz P_{IN} = 1.6W	20:1			VSWR
THERMAL	I_C	Continuous Collector Current				4	A
	$\theta_{J\text{-}C}$	Thermal Resistance	T_C = 25°C			5.8	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		-65		150	°C
	P_D	Power Dissipation	T_C = 25°C			30	W


Broadband POUT vs Frequency
Power Output — Watts
40
30
20
10
0
66
77
88
Frequency — MHz
PIN = 3W
2W
1.5W
.5W
Class C
VCC = 12.5V

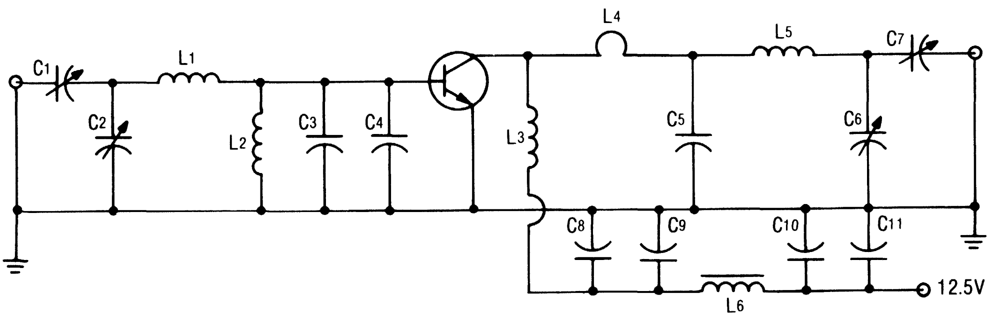

Broadband Power Transfer
Power Output — Watts
40
30
20
10
0
.5
1.5
2
2.5
Power Input — Watts
66MHz
88MHz
Class C
VCC = 12.5V


Series Input Impedance
Ohms
3.0
2.5
2.0
1.5
1.0
.5
66
77
88
Frequency — MHz
R
-X
Class C
VCC = 12.5V
PIN = 1.6W


Series Load Impedance
Ohms
6
4
2
0
66
77
88
Frequency — MHz
R
X
Class C
VCC = 12.5V
PO = 20W


Output Capacitance
Capacitance — pF
100
80
60
40
20
4
8
12
16
20
24
VCB — Volts
f = 1MHz

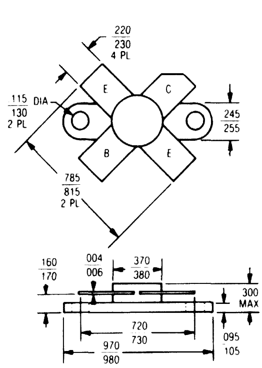
TEST CIRCUIT



PARTS LIST:

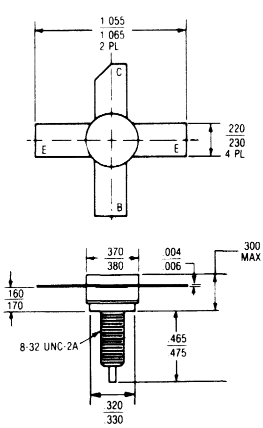
$C_{1,2,6,7}$	423 ARCO
C_3	250pf UNELCO
C_4	300pf UNELCO
C_5	400pf UNELCO
C_8	.001μf
C_9	500pf UNELCO
C_{10}	.1μf
C_{11}	5 MFD
L_1	4 T. #16 AWG., 1/4" ID, 11/16" Long
L_2	1-1/2 T. #22 AWG. looped thru VK211-073B Ferroxcube Core
L_3	4 T. #16 AWG., 3/16" ID., 5/16" Long
L_4	Loop #16 AWG., 1/2" Long
L_5	4 T. #16 AWG., 1/4" ID., 9/16" Long
L_6	1-1/2 T. #18 AWG. looped thru CN20 Core.

.380 SOE F



PT 8863

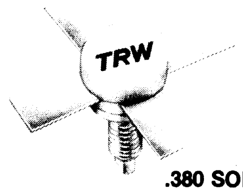
.380 SOE



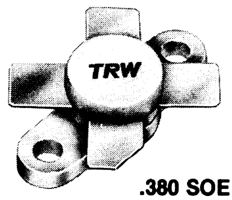
PT 8863A

RF Power Transistor

- 35 Watts
- 12.5 V_{CC}
- 88 MHz
- Class B or C Operation
- High Gain
- Diffused Ballast Resistors
- Common Emitter
- Isolated Packages
- 20:1 VSWR



.380 SOE

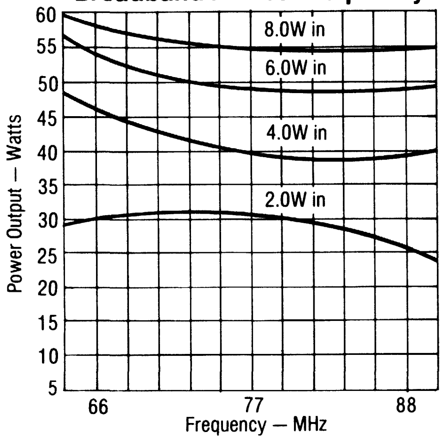


.380 SOE F

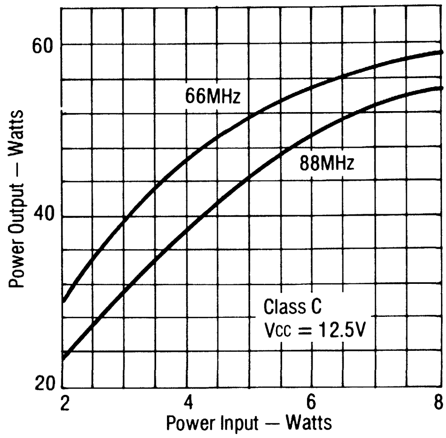
Electrical Characteristics (T_{FLANGE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 5mA, I_C = 0	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA, I_B = 0	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 50mA, I_E = 0	36			V
	I_{CES}	Collector Cutoff Current	V_{CE} = 15V, I_B = 0			10	mA
	h_{FE}	D.C. Current Gain	V_{CE} = 10V, I_C = 100mA	10		200	—
RF TEST	P_{GAIN}	Power Gain	V_{CE} = 12.5V, f = 88MHz P_{IN} = 4.5W	8.9			dB
	η	Efficiency	V_{CE} = 12.5V, f = 88MHz P_{IN} = 4.5W	60			%
	Load VSWR	Mismatch Tolerance	All Phases Angles V_{CE} = 15.5V, f = 88MHz P_{IN} = 4.5W	20:1			VSWR
THERMAL	I_C	Continuous Collector Current				6	A
	$\theta_{j\text{-}C}$	Thermal Resistance	T_C = 25°C			2.3	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		-65		150	°C
	P_D	Power Dissipation	T_C = 25°C			75	W

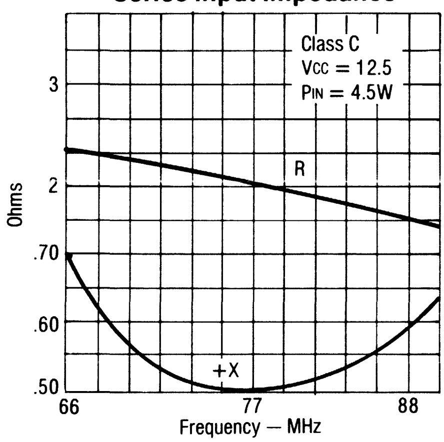
Broadband Pout vs Frequency



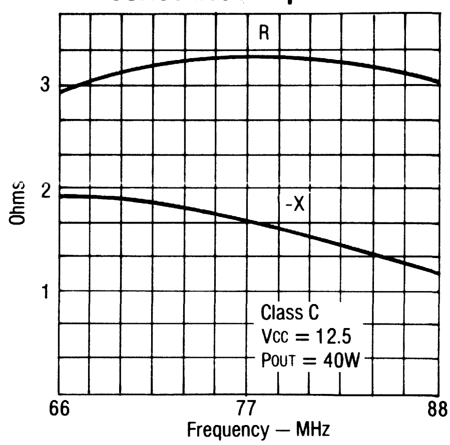
Broadband Power Transfer



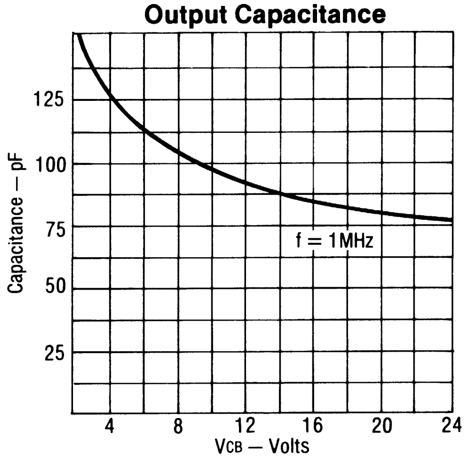
Series Input Impedance



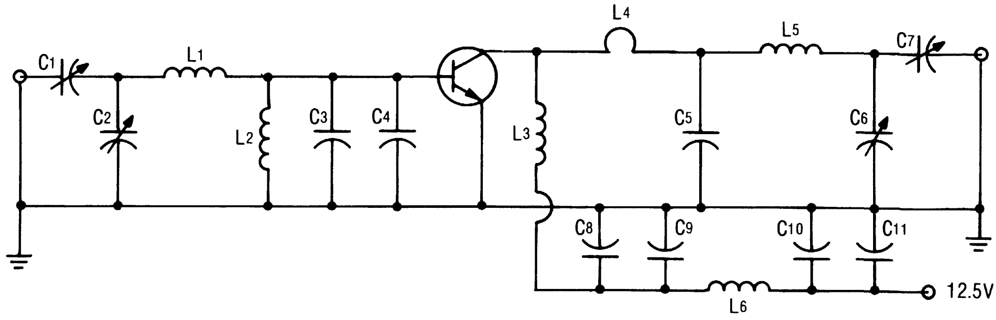
Series Load Impedance



Output Capacitance



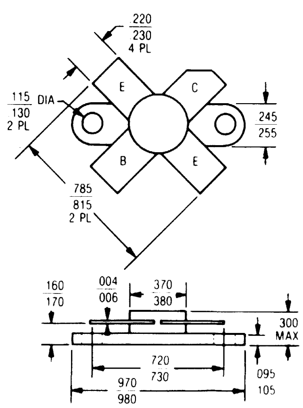
TEST CIRCUIT



PARTS LIST:

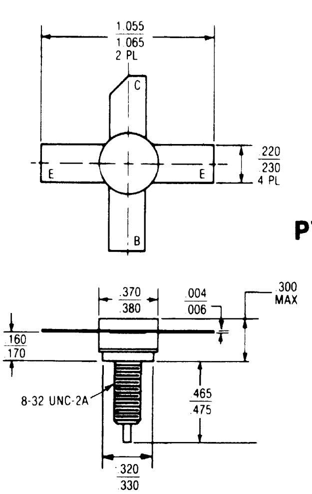
$C_{1,2,6,7}$	423 ARCO
C_3	250pf UNELCO
C_4	300pf UNELCO
C_5	400pf UNELCO
C_8	.001μF
C_9	500pf UNELCO
C_{10}	.1μF
C_{11}	5 MFD
L_1	4 T. #16 AWG., 1/4" ID., 11/16" Long
L_2	1-1/2 T. #22 AWG. looped thru VK211-073B Ferroxcube Core
L_3	4 T. #16 AWG., 3/16" ID., 5/16" Long
L_4	Loop #16 AWG., 1/2" Long
L_5	4 T. #16 AWG., 1/4" ID., 9/16" Long
L_6	1-1/2 T. #18 AWG. looped thru CN20 Core

.380 SOE F



PT 8864

.380 SOE

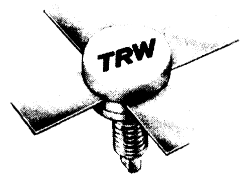


PT 8864A

TRW

RF Power Transistors

- 70 Watts
- 12.5 V_{CC}
- 88 MHz
- High Gain
- Diffused Ballast Resistors
- Class B or C Operation
- Common Emitter
- Isolated Packages
- 20:1 VSWR

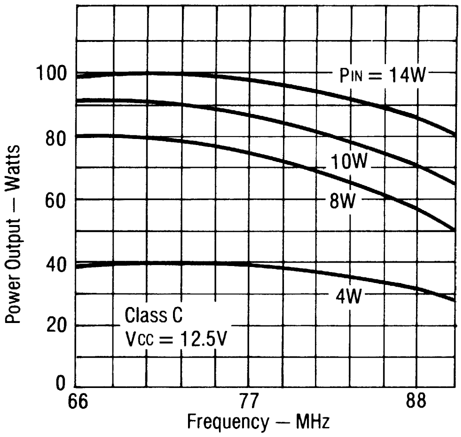


.380 SOE

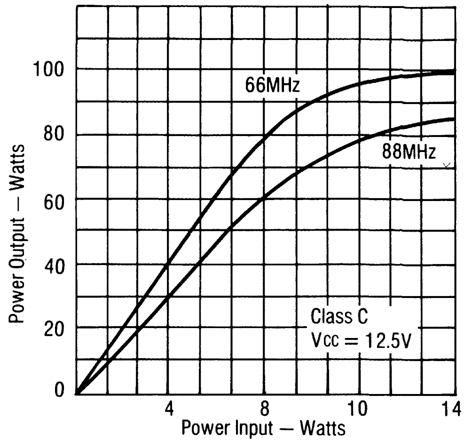
Electrical Characteristics ($T_{FLANGE} = 25°C$)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	$I_E = 5mA, I_C = 0$	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	$I_C = 100mA, I_B = 0$	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	$I_C = 100mA, I_E = 0$	36			V
	I_{CES}	Collector Cutoff Current	$V_{CE} = 15V, I_B = 0$			10	mA
	h_{FE}	D.C. Current Gain	$V_{CE} = 5V, I_C = 1A$	10		200	–
RF TEST	P_{GAIN}	Power Gain	$V_{CE} = 12.5V, f = 88MHz$ $P_{IN} = 11W$	8.4			dB
	η	Efficiency	$V_{CE} = 12.5V, f = 88MHz$ $P_{IN} = 11W$	60			%
	Load VSWR	Mismatch Tolerance	$V_{CE} = 15.5V, f = 88MHz$ $P_{IN} = 11W$	20:1			VSWR
THERMAL	I_C	Continuous Collector Current				24	A
	θ_{JC}	Thermal Resistance	$T_C = 25°C$			.86	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		-65		150	°C
	P_D	Power Dissipation	$T_C = 25°C$			200	W

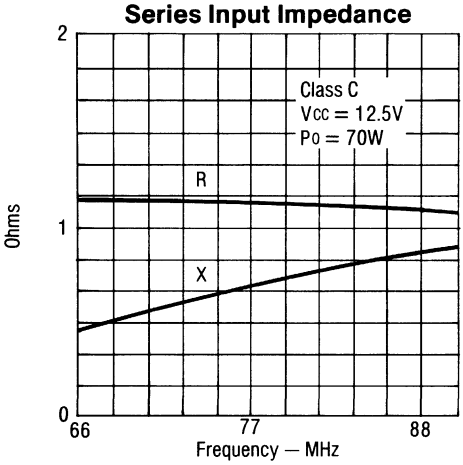
Broadband P_{OUT} vs Frequency



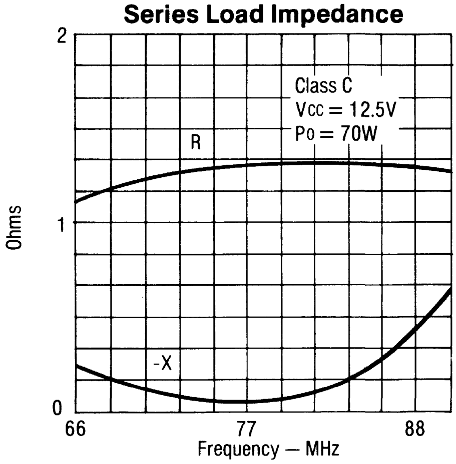
Broadband Power Transfer



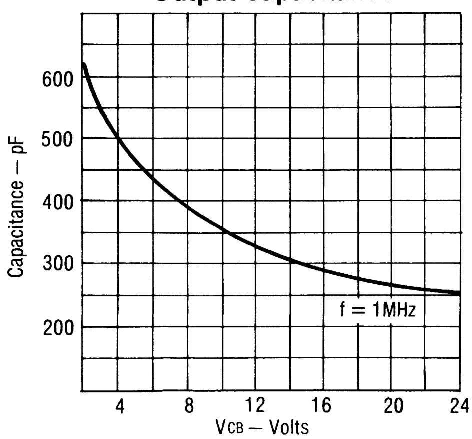
Series Input Impedance



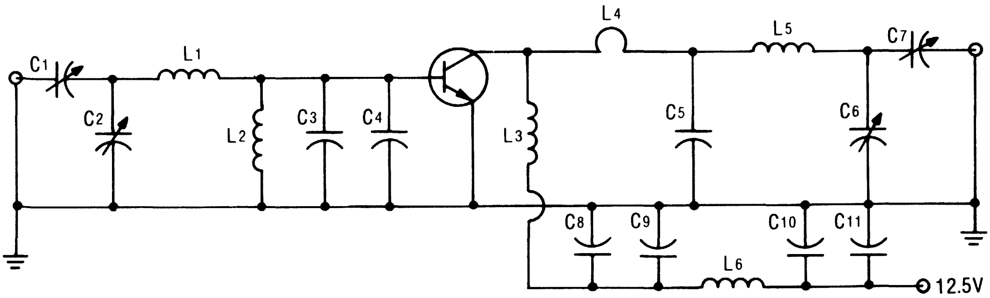
Series Load Impedance



Output Capacitance



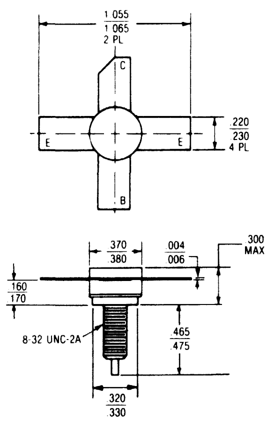
TEST CIRCUIT



PARTS LIST:

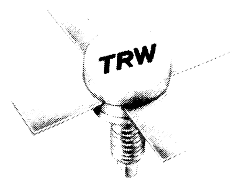
C1,2,6,7	423 ARCO
C3	250pf UNELCO
C4	300pf UNELCO
C5	400pf UNELCO
C8	.001μF
C9	500pf UNELCO
C10	.1μF
C11	5 MFD
L1	4 T., #16 AWG., 1/4" I.D., 11/16" long.
L2	1-1/2 T., #22 AWG. looped thru VK211-073B Ferroxcube Core
L3	4 T., #16 AWG., 3/16" I.D., 5/16" long.
L4	Loop #16 AWG., 1/2" long.
L5	4 T., #16 AWG., 1/4" I.D., 9/16" Long.
L6	1-1/2 T., #18 AWG. looped thru CN20 Core.

.380 SOE



RF Power Transistors

- 4 to 30 Watts
- 12.5 V_{CC}
- 175 MHz
- High Gain
- Rugged
- Low Cost
- Common Emitter
- Isolated Packages



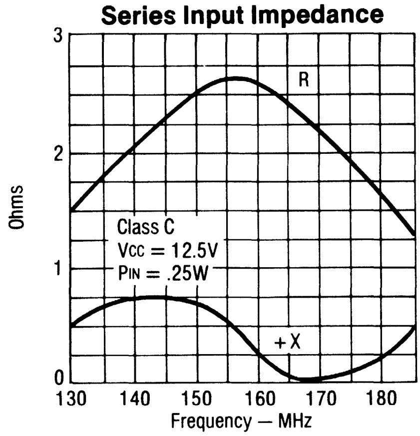
.380 SOE

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	2N 6080	2N 6081	2N 6082	2N 6083	UNIT
DC TEST	BV_{EBO}	Min. Emitter-Base Breakdown Voltage	I_E = 1mA, I_C = 0 I_E = 2mA, I_C = 0 I_E = 5mA, I_C = 0	4	4	4	4	V
	BV_{CEO}	Min. Collector-Emitter Breakdown Voltage	I_C = 10mA, I_B = 0 I_C = 20mA, I_B = 0 I_C = 100mA, I_B = 0	16	16	16	16	V
	BV_{CBO}	Min. Collector-Base Breakdown Voltage	I_C = 5mA, I_E = 0 I_C = 10mA, I_E = 0 I_C = 15mA, I_E = 0	36	36	36	36	V
	I_{CBO}	Max. Collector Cutoff Current	V_{CB} = 15V, I_E = 0	0.25	0.5	1	1	mA
	h_{FE}	Min. D.C. Current Gain	V_{CE} = 5V, I_C = 0.25A V_{CE} = 5V, I_C = 0.5A V_{CE} = 5V, I_C = 1A	5	5	5	5	–
RF TEST	P_{GAIN}	Min. Power Gain	V_{CE} = 12.5V, P_O = 4W P_O = 15W f = 175MHz, P_O = 25W P_O = 30W	12	6.3	6.2	5.7	dB
	η	Min. Efficiency	V_{CE} = 12.5V, P_{IN} = 0.25W P_{IN} = 3.5W P_{IN} = 6W f = 175MHz, P_{IN} = 8W	60	50	50	50	%
	C_{OB}	Max. Collector-Base Capacitance	V_{CB} = 15V, f = 1MHz I_E = 0	20	85	130	130	pF
THERMAL	I_C	Continuous Collector Current		1	2.5	5	7	A
	θ_{JC}	Thermal Resistance	T_C = 25°C	14.5	5.6	3.5	2.5	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		-65°C to +150°C				°C
	P_D	Power Dissipation	T_C = 25°C	12	31	50	70	W

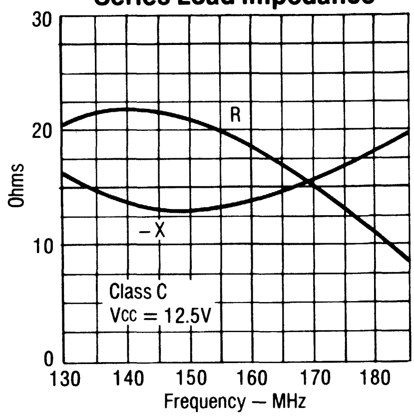
2N6080

2N6080

Series Input Impedance

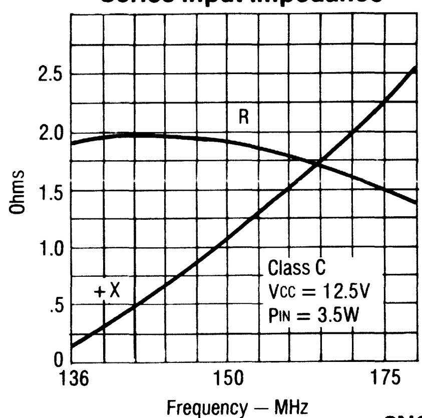


Series Load Impedance

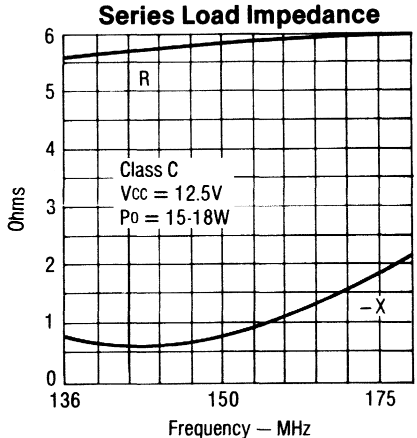


2N6081

Series Input Impedance

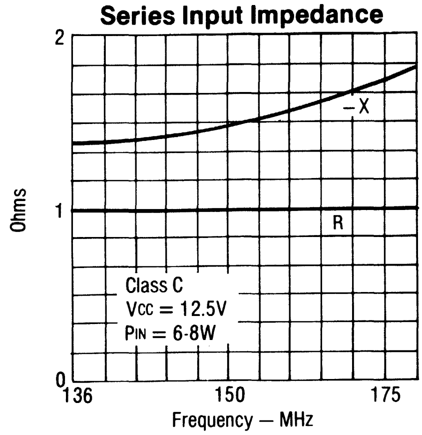


Series Load Impedance

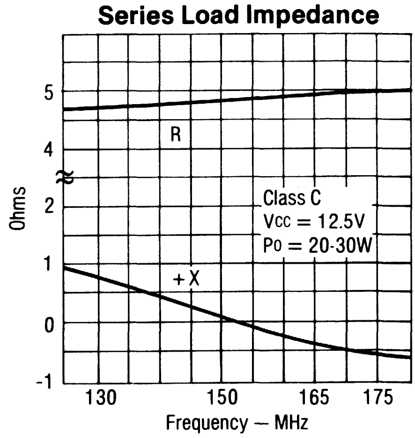


2N6082, 2N6083

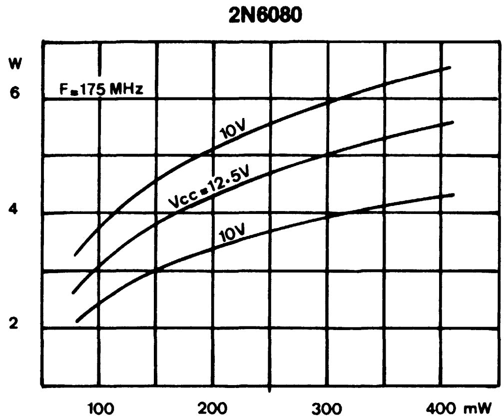
Series Input Impedance

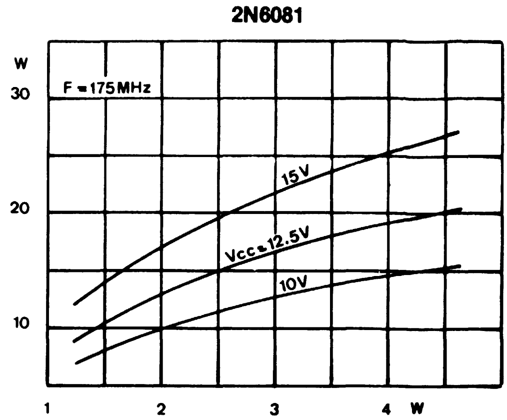


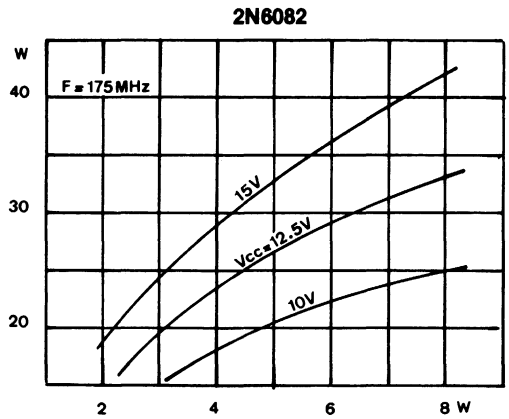
Series Load Impedance

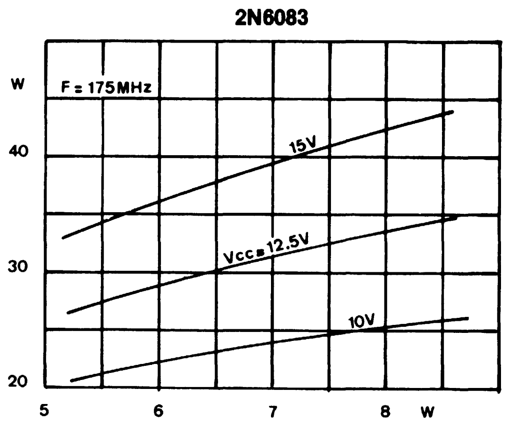


Output Power vs Input Power and Voltage Supply

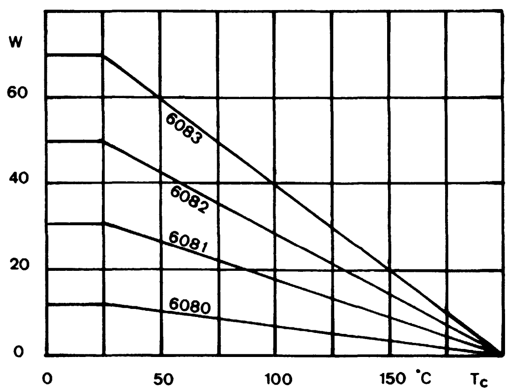




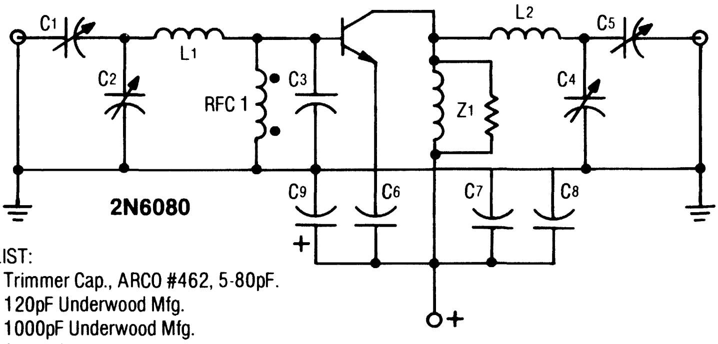




Power - Temperature Derating Curve



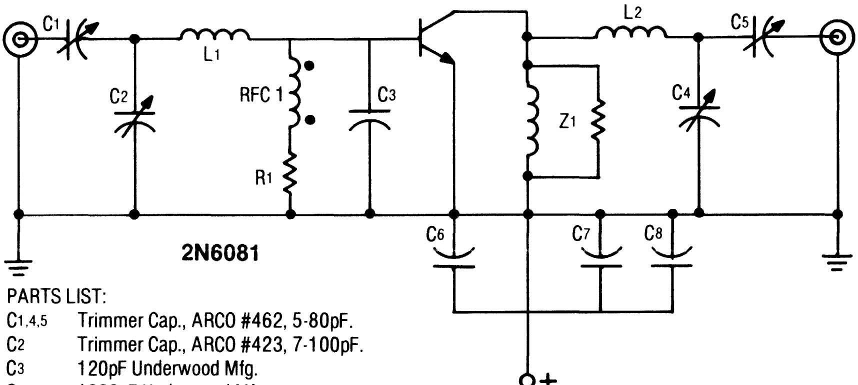
TEST CIRCUITS



2N6080

PARTS LIST:

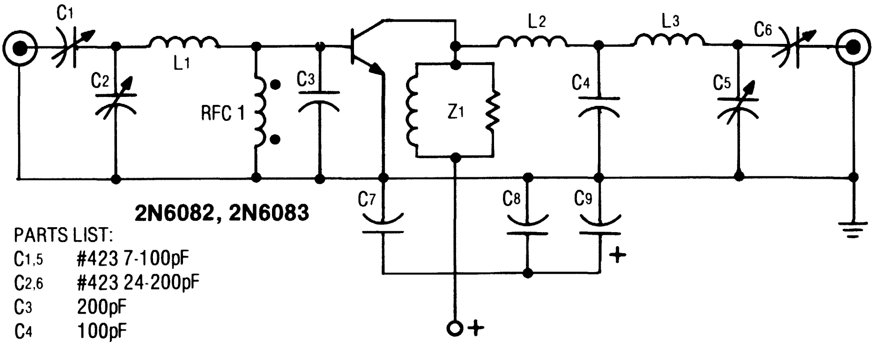
C1,2,4,5	Trimmer Cap., ARCO #462, 5-80pF.
C3	120pF Underwood Mfg.
C6	1000pF Underwood Mfg.
C7	0.1μF disc ceramic.
C8	0.02μF disc ceramic.
C9	25μF, Electrolytic, 35 WVDC.
L1	2 T., #18 AWG., 0.25" I.D.
L2	2T., #18 AWG., 0.25" I.D.
Z1	8 T., #18 AWG., wound on 330 ohms 1/2 W Resistor.
RFC 1	2-1/2 T., #22 AWG. on Ferroxcube VK 211-17/4B Core.'



2N6081

PARTS LIST:

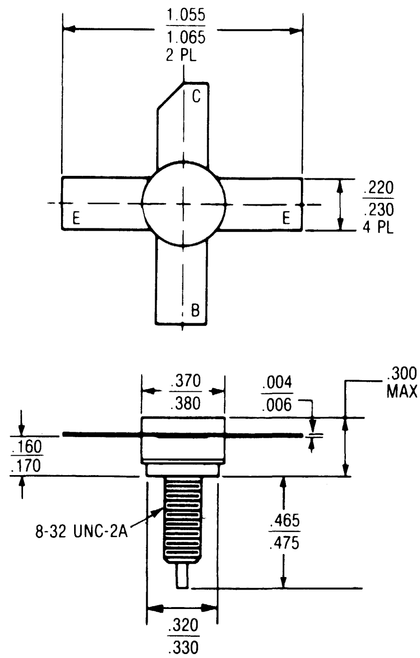
C1,4,5	Trimmer Cap., ARCO #462, 5-80pF.
C2	Trimmer Cap., ARCO #423, 7-100pF.
C3	120pF Underwood Mfg.
C6	1000pF Underwood Mfg.
C7	0.1μF disc ceramic.
C8	0.025μF disc ceramic.
L1	3 mil copper strip, 1/4" W x 1-1/4" L.
L2	1 T., #16 AWG., 0.25" I.D.
Z1	6 T., #16 AWG., wound on 100 ohms 2 watt resistor.
RFC 1	2-1/2 T., #22 AWG. on Ferroxcube VK 211-17/4B Core.
R1	1.5 ohm two-30HM, 1/2 watt in parallel.



2N6082, 2N6083

PARTS LIST:

C1,5	#423 7-100pF
C2,6	#423 24-200pF
C3	200pF
C4	100pF
C7	1000pF
C8	01μF
C9	5μF
L1	1-1/4", #16 AWG.
L2	Collector Pad, 1 mil copper, 9/32" x 5/8" L
L3	1 inch #16 AWG., 1 T., 1/4" I.D.
RFC 1	2-1/2 T., #22 AWG. on Ferroxcube VK 211 07-3B Core.
Z1	5 T., #18 AWG., wound on 390 ohms, 1 watt carbon resistor.

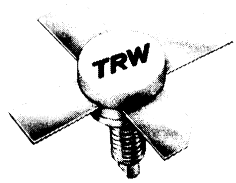


1.055
1.065
2 PL
C
E
E
.220
.230
4 PL
B
.370
.380
.004
.006
.300
MAX
.160
.170
8-32 UNC-2A
.465
.475
.320
.330

.380 SOE

RF Power Transistors

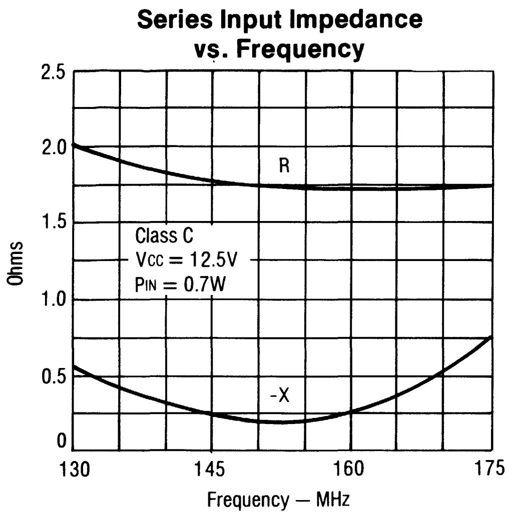
- 10 Watt Typical
- 12.5 Vcc
- 175 MHz
- Class B or C Operation
- Diffused Ballast Resistors
- Common Emitter
- Isolated Packages
- 20:1 VSWR
- High Gain

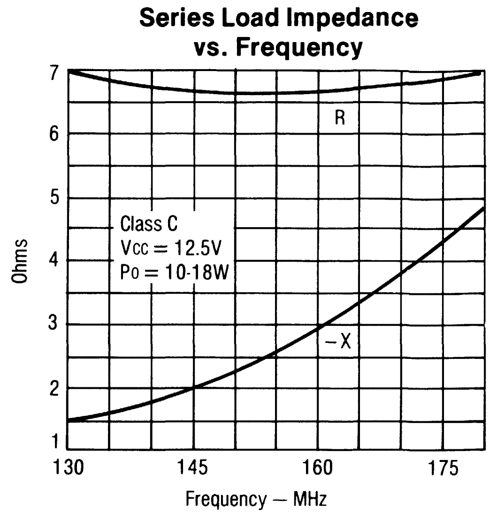


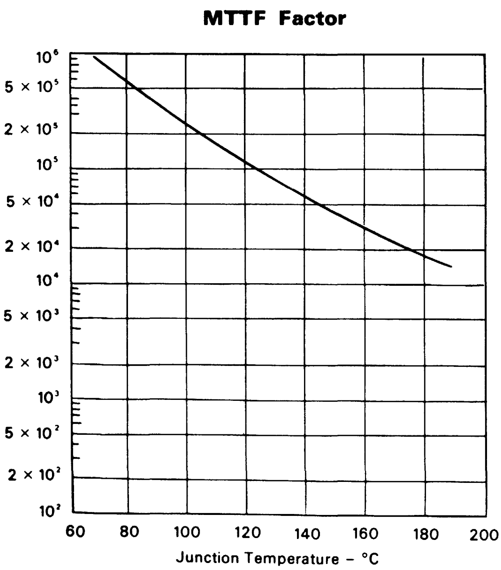
.380 SOE

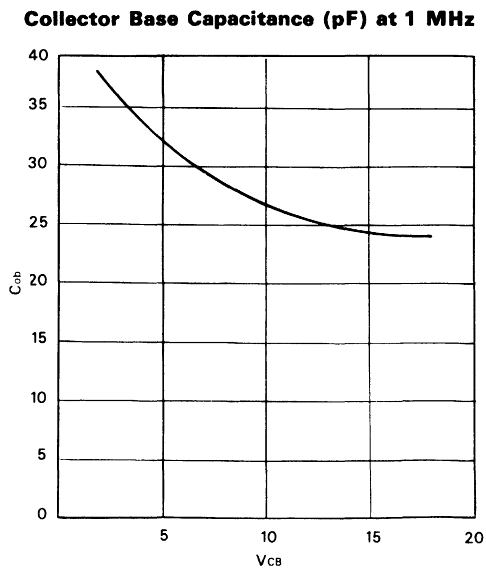
Electrical Characteristics (T_{FLANGE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 5mA, I_C = 0	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA, I_B = 0	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 20mA, I_E = 0	36			V
	I_{CES}	Collector Cutoff Current	V_{CE} = 15V, I_B = 0			5	mA
	h_{FE}	D.C. Current Gain	V_{CE} = 5V, I_C = 500mA	10		200	–
RF TEST	P_{GAIN}	Power Gain	V_{CE} = 12.5V, f = 175MHz P_{IN} = 0.7W	11.0			dB
	η	Efficiency	V_{CE} = 12.5V, f = 175MHz P_{IN} = 0.7W	60			%
	Load VSWR	Mismatch Tolerance	V_{CE} = 15.5V, f = 175MHz P_{IN} = 0.7W	20:1			VSWR
THERMAL	I_C	Continuous Collector Current				3.4	A
	$\theta_{j\text{-}c}$	Thermal Resistance	T_C = 25°C			3.5	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		-65		150	°C
	P_D	Power Dissipation	T_C = 25°C			50	W

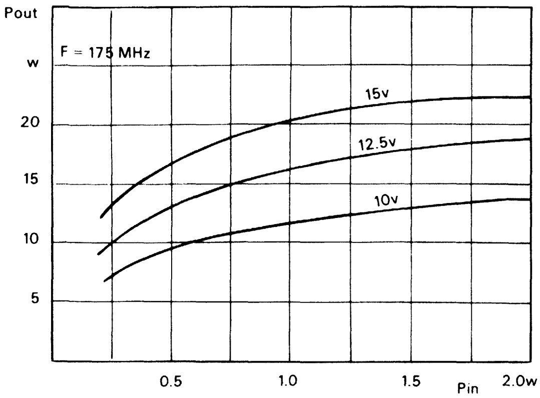

Series Input Impedance
vs. Frequency
2.5
2.0
1.5
1.0
0.5
0
Ohms
R
-X
Class C
Vcc = 12.5V
PIN = 0.7W
130
145
160
175
Frequency — MHz


Series Load Impedance
vs. Frequency
7
6
5
4
3
2
1
Ohms
R
−X
Class C
Vcc = 12.5V
Po = 10-18W
130
145
160
175
Frequency — MHz

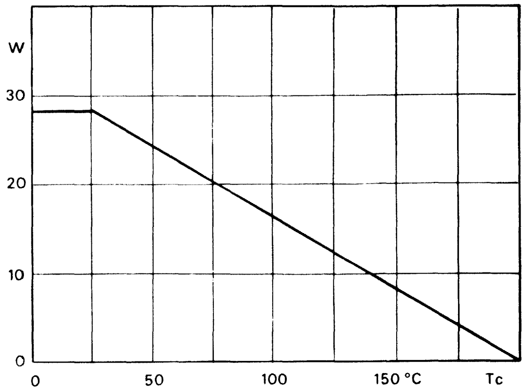

MTTF Factor
10⁶
5 × 10⁵
2 × 10⁵
10⁵
5 × 10⁴
2 × 10⁴
10⁴
5 × 10³
2 × 10³
10³
5 × 10²
2 × 10²
10²
60
80
100
120
140
160
180
200
Junction Temperature - °C


Collector Base Capacitance (pF) at 1 MHz
40
35
30
25
20
15
10
5
0
Cob
5
10
15
20
VCB

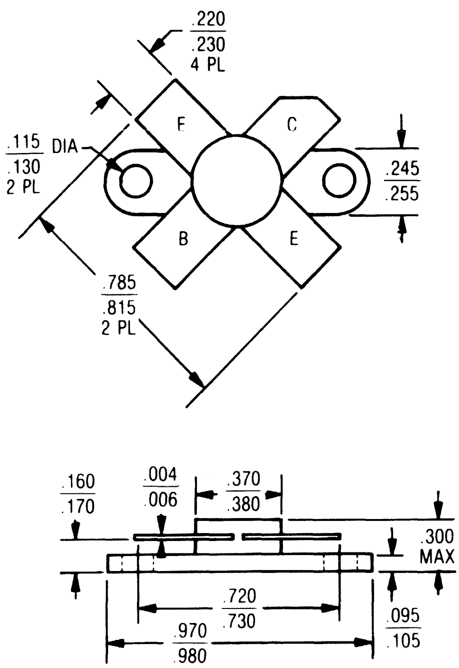
Typical characteristics



Power - Temperature Derating Curve

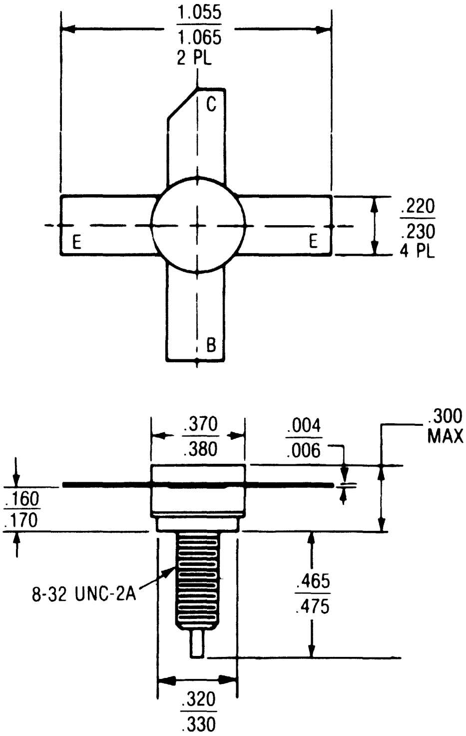


.380 SOE F



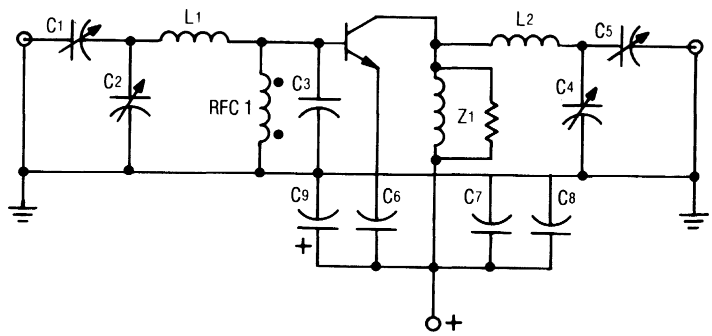
PT 8828A

.380 SOE



PT 8828

TEST CIRCUIT



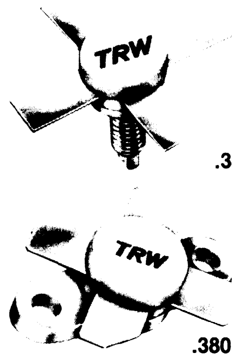
PARTS LIST:

$C_{1,2,4,5}$	Trimmer car, ARCO #462, 5-80pf.
C_3	120pf Underwood Mfg.
C_6	1000pf Underwood Mfg.
C_7	0.01μf disc ceramic.
C_8	0.02μf disc ceramic.
C_9	25μf, electrolytic, 35 WVDC.
L_1	2 T., #18 AWG., 0.25" I.D.
L_2	2 T., #18 AWG., 0.25" I.D.
Z_1	8 T., #18 AWG., wound on 330 ohms 1/2 W. resistor.
RFC 1	2-1/2 T., #22 AWG. on Ferrox cube VK211-17/4B Core.

TRW

RF Power Transistors

- 15 Watts
- 12.5 VCC
- 175 MHz
- Gold Metalized
- Diffused Ballast Resistor
- Class C Operation
- Common Emitter
- Isolated Package
- 20:1 VSWR



.380 SOE

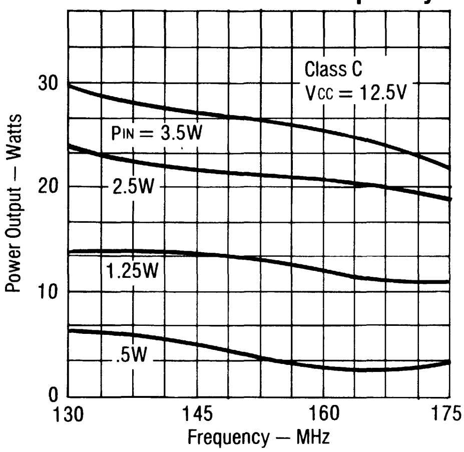
.380 SOE F

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

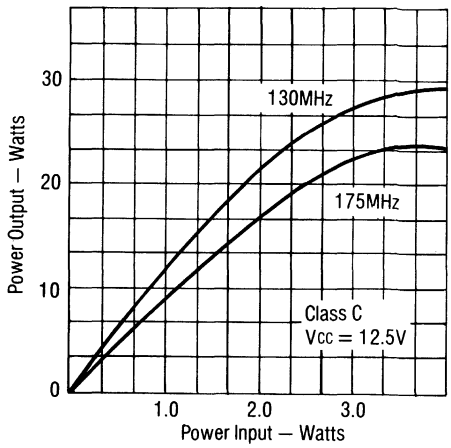
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 5mA, I_C = 0	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA, I_B = 0	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 50mA, I_E = 0	36			V
	I_{CES}	Collector Cutoff Current	V_{CE} = 15V, I_B = 0			10	mA
	h_{FE}	D.C. Current Gain	V_{CE} = 5V, I_C = 500mA	10		200	–
RF TEST	P_{GAIN}	Power Gain	V_{CE} = 12.5V, f = 175MHz P_{IN} = 2.5W	7.8			dB
	η	Efficiency	V_{CE} = 12.5V, f = 175MHz P_{IN} = 2.5W	60			%
	Load VSWR	Mismatch Tolerance	All Phases Angles V_{CE} = 15.5V, f = 175MHz P_{IN} = 2.5W	20:1			VSWR
THERMAL	I_C	Continuous Collector Current				6	A
	$\theta_{j\text{-}C}$	Thermal Resistance	T_C = 25°C			3.5	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		-65		150	°C
	P_D	Power Dissipation	T_C = 25°C			30	W

PT8873

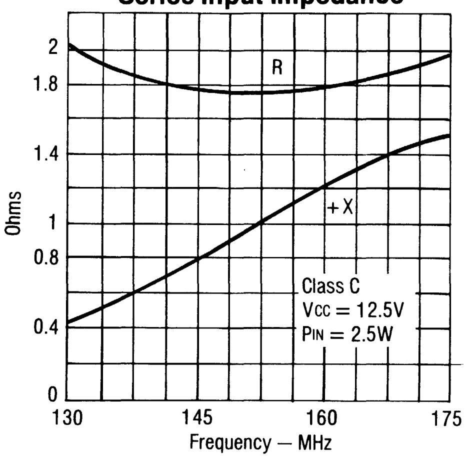
Broadband P_{OUT} vs Frequency



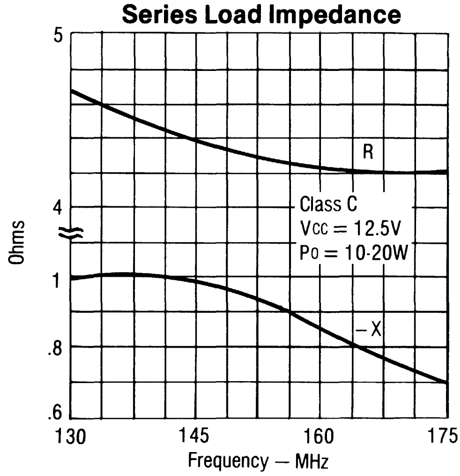
Broadband Power Transfer



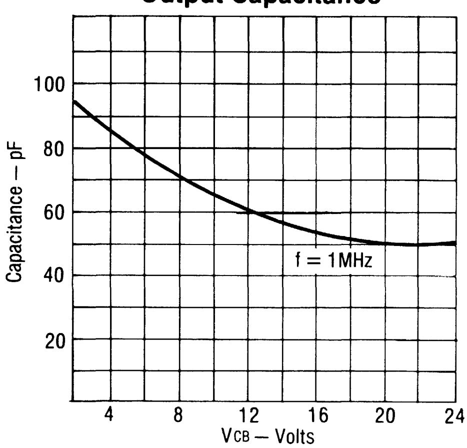
Series Input Impedance



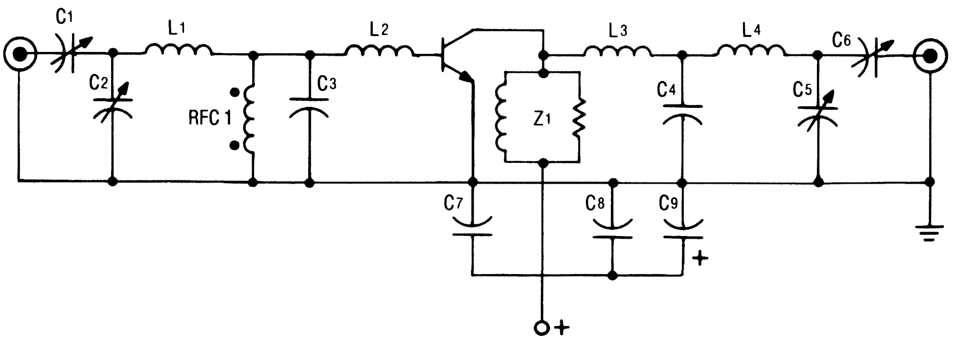
Series Load Impedance



Output Capacitance



TEST CIRCUIT



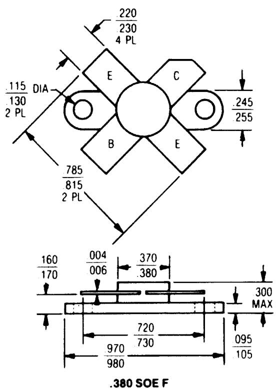
PARTS LIST:

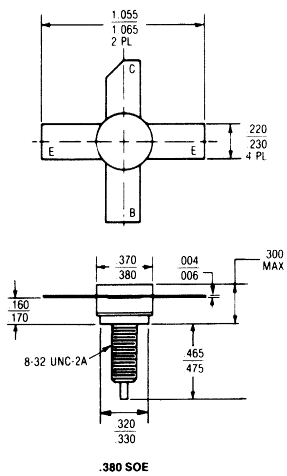
C1,5	#423 (7-100)pf ARCO
C2,6	#403 (3-35)pf ARCO
C3,4	(2) each 51pf
C7	1000pf
C8	.1μf
C9	5μf

All capacitors in pf are underwood capacitors, others are disc ceramic.

L1	1-3/8", #14 AWG. hairpin loop.
L2,3	Collector pad, 1 mil copper, 9/32" x 5/8" L
L4	2-1/8", #14 AWG., 1 T., 5/16" I.D.
Z1	5 T., #18 AWG. wound on 390 ohm, 1 watt carbon resistor.
RFC 1	2-1/2 T., #22 AWG. on Ferrox cube VK211/07-3B.

PT 8873

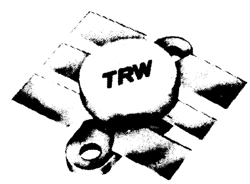




PT 8873A

RF Power Transistors

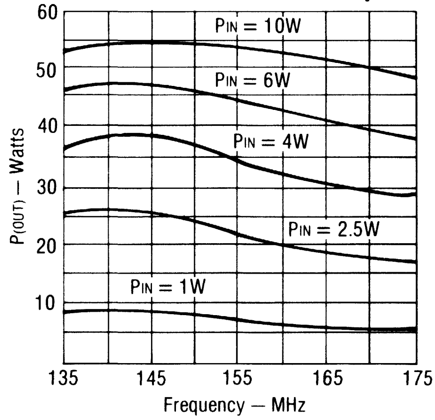
- 36 Watts
- 12.5 V_{CC}
- 175 MHz
- Gold Metalization
- Diffused Ballast Resistors
- Low Thermal Resistance
- Common Emitter
- Isolated Package
- Internally Matched
- 20:1 VSWR
- Class C



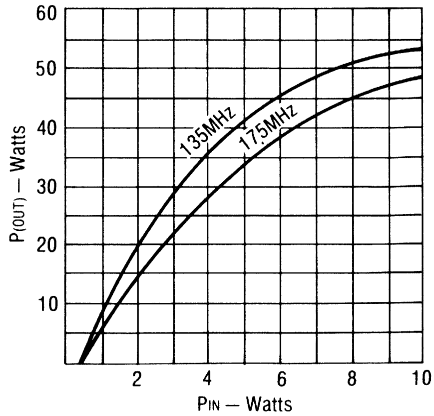
.500 Jo

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 5mA	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 50mA	36			V
	I_{CES}	Collector Cutoff Current	V_{CE} = 15V			10	mA
RF TEST	P_{GAIN}	Power Gain	V_{CE} = 12.5V, f = 175MHz P_{IN} = 6W	7.8			dB
	P_{REF}	Power Reflected	V_{CE} = 12.5V, f = 175MHz P_{IN} = 6W			0.60	W
	Load VSWR	Mismatch Tolerance	V_{CE} = 15.5V, f = 175MHz P_{IN} = 6W	20:1			VSWR
THERMAL	I_C	Continuous Collector Current	T_C = 25°C			6.5	A
	P_T	Total Dissipation	T_C = 25°C			100	W
	θ_{JC}	Thermal Resistance Junction to Flange			1.75		°C/W
	T_{STG}	Storage Temperature		-65		150	°C

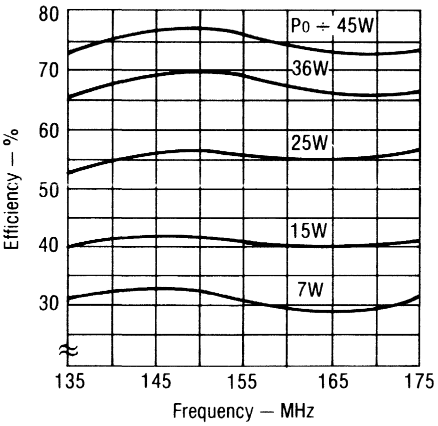
Broadband P(OUT) vs. Frequency



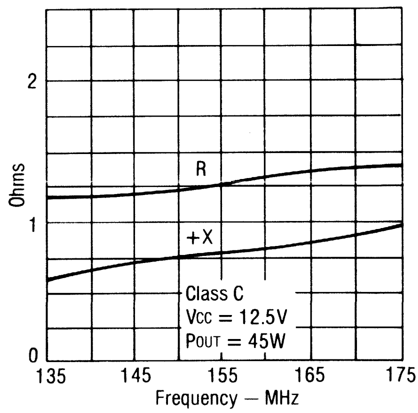
Broadband Power Transfer



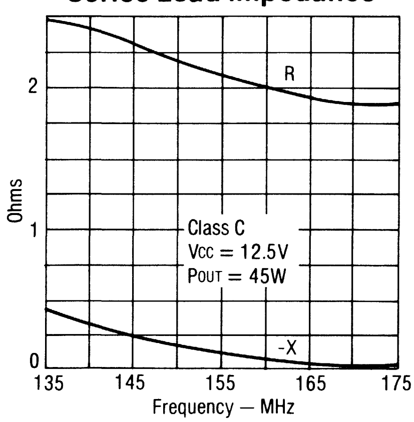
Broadband Collector Efficiency



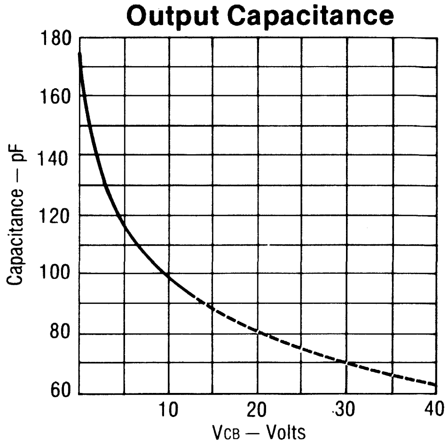
Series Input Impedance



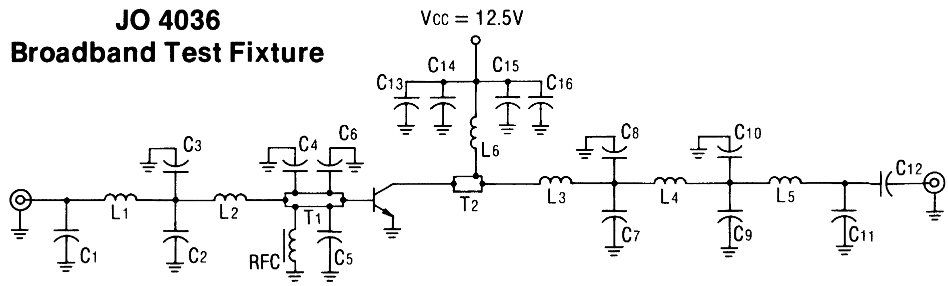
Series Load Impedance



Output Capacitance



JO 4036
Broadband Test Fixture

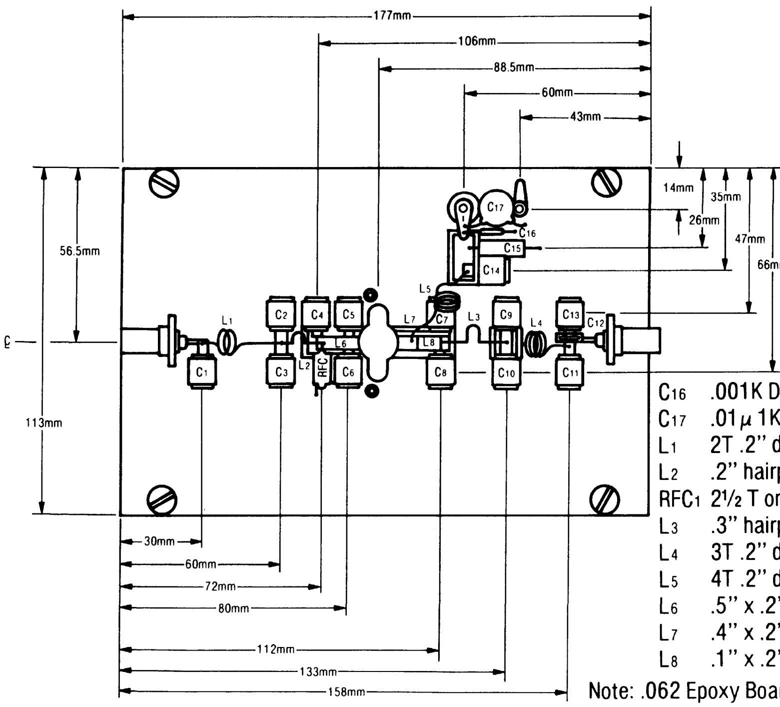


COMPONENTS LIST:

$C_{1,2}$	25pf
$C_{3,4}$	80pf
C_5	250pf
C_6	200pf
C_7	150pf
C_8	100pf
$C_{9,10}$	40pf
C_{11}	25pf
$C_{12,13}$	1000pf
C_{14}	.001μf
C_{15}	.01μf
C_{16}	25μf
L_1	2T 18 AWG .2" dia.
L_2	.2" hairpin .125" wide x .025 thick copper strip
L_3	.1" x .2" wide x .005" thick copper loop
L_4	.3" hairpin 18 AWG.
L_5	3 T. 18 AWG. .2" dia.
L_6	4 T. 18 AWG. .2" dia.
RFC	2½ T. on VK-211-07/38 ferrox cube
T_1	.2" width .5" length from package as ref.
T_2	.2" width .4" length from package as ref.

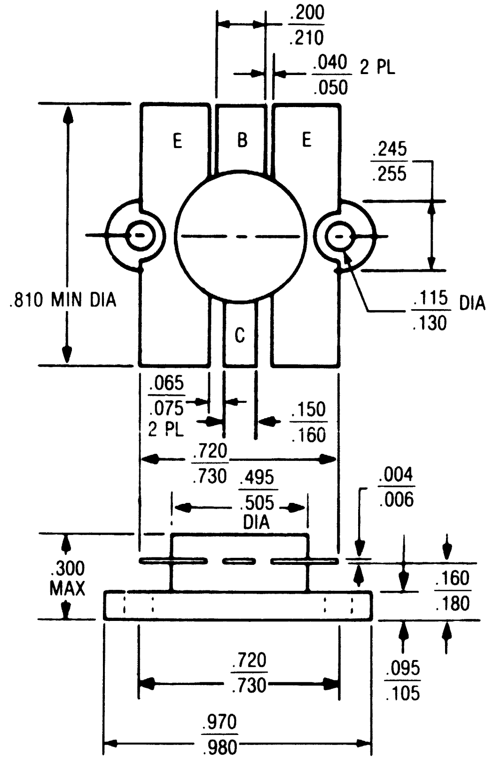
NOTES:

1. All capacitors in signal path are Underwood Electric Corp. Case Type J101.
2. Position C_5 and C_6 as close to pkg. as possible.



C_1	25pf
$C_{2,4}$	80pf
C_3	30pf
C_5	250pf
C_6	200pf
C_7	150pf
C_8	100pf
$C_{9,10}$	40pf
C_{11}	10pf
$C_{12,14}$	1000pf
C_{13}	15pf
C_{15}	5μf 25V
C_{16}	.001K Disc
C_{17}	.01μ 1KV Disc
L_1	2T .2" dia. 18 AWG .250" long
L_2	.2" hairpin .125" wide x .025 thick
RFC_1	2½ T on VK-211-07/3B ferrox cube
L_3	.3" hairpin #18 AWG
L_4	3T .2" dia. #10 AWG .500" long
L_5	4T .2" dia. #18 AWG .400 long
L_6	.5" x .2"
L_7	.4" x .2"
L_8	.1" x .2" wide x .005" thick

Note: .062 Epoxy Board Copper Clad — 2 Sides


.200
.210
.040 2 PL
.050
E
B
E
.245
.255
.810 MIN DIA
.115 DIA
.130
C
.065
.075
2 PL
.150
.160
.720
.730
.495
.505
DIA
.004
.006
.300
MAX
.160
.180
.720
.730
.095
.105
.970
.980

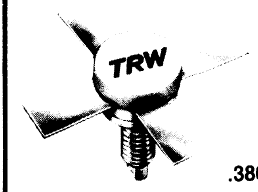
.500 J ZERO:

PT8874/A

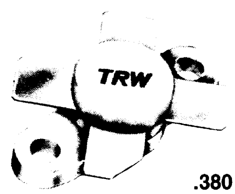
TRW

RF Power Transistors

- **40 Watts**
- **12.5 V_{CC}**
- **175 MHz**
- **High Gain**
- **Class A, B or C Operation**
- **Gold Metalization**
- **Diffused Ballast Resistors**
- **Common Emitter**
- **Isolated Packages**
- **20:1 VSWR**



.380 SOE

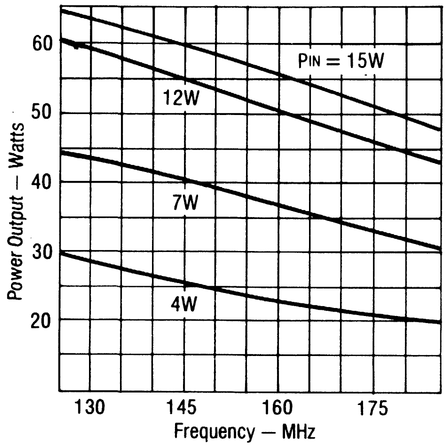


.380 SOE F

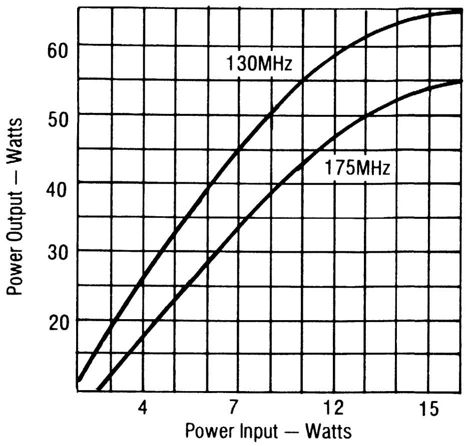
Electrical Characteristics (T_{FLANGE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 5mA, I_C = 0	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA, I_B = 0	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 50mA, I_E = 0	36			V
	I_{CES}	Collector Cutoff Current	V_{CE} = 15V, I_B = 0			10	mA
	h_{FE}	D.C. Current Gain	V_{CE} = 5V, I_C = 1000mA	10		200	—
RF TEST	P_{GAIN}	Power Gain	V_{CE} = 12.5V, f = 175MHz P_{IN} = 12W	5.2			dB
	η	Efficiency	V_{CE} = 12.5V, f = 175MHz P_{IN} = 12W	60			%
	Load VSWR	Mismatch Tolerance	All Phases Angles V_{CE} = 15.5V, f = 175MHz P_{IN} = 12W	20:1			VSWR
THERMAL	I_C	Continuous Collector Current				6	A
	$\theta_{j\text{-}C}$	Thermal Resistance	T_C = 25°C			2.3	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		-65		150	°C
	P_D	Power Dissipation	T_C = 25°C			75	W

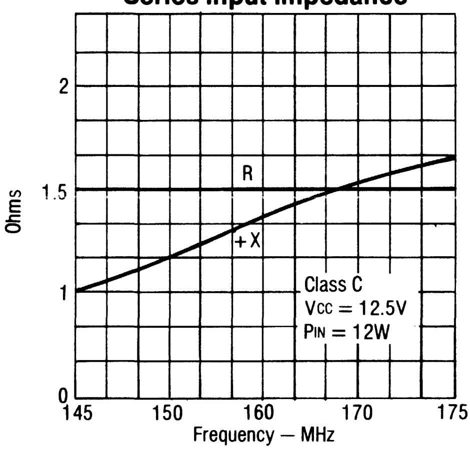
Broadband POUT vs Frequency



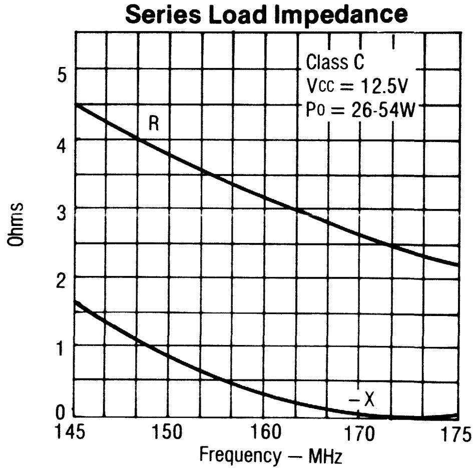
Broadband Power Transfer



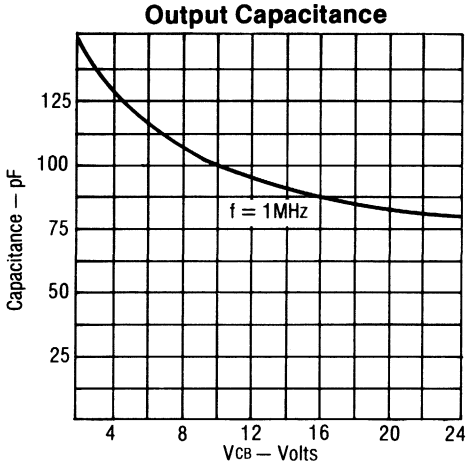
Series Input Impedance



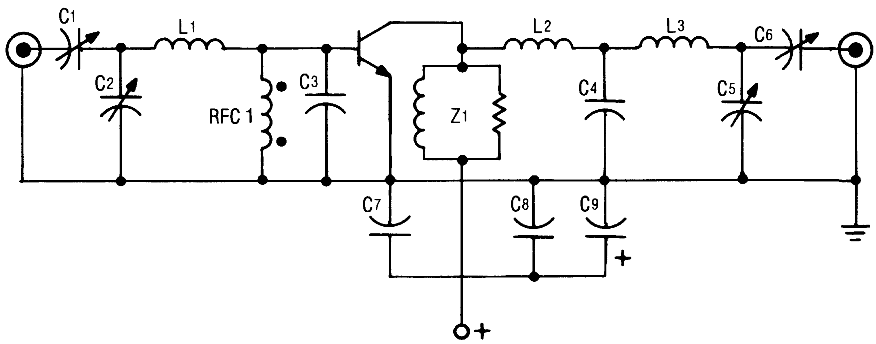
Series Load Impedance



Output Capacitance



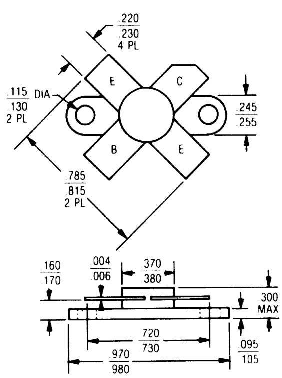
TEST CIRCUIT



PARTS LIST:

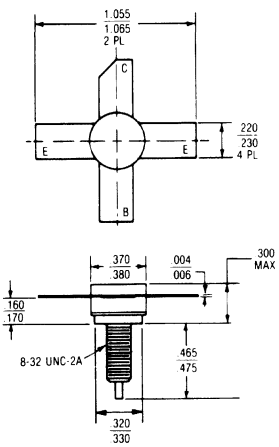
$C_{1,5}$ #423 ARCO
$C_{2,6}$ #425 ARCO
C_3 200pf
C_4 100pf
C_7 1000pf
C_8 01μf
C_9 5μf
L_1 1-1/4" #16 AWG.
L_2 Collector pad, 1 mil copper, 9/32" x 5/8" L
L_3 1 inch #16 AWG., 1 T., 1/4" I.D.
RFC 1 2-1/2 T., #22 AWG. on Ferrox cube VK211 07-3B
Z_1 5 T., #18 AWG., wound on 390 ohms, 1 watt carbon resistor.

PT 8874



.380 SOE F

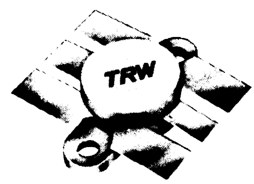
PT 8874A



.380 SOE

RF Power Transistors

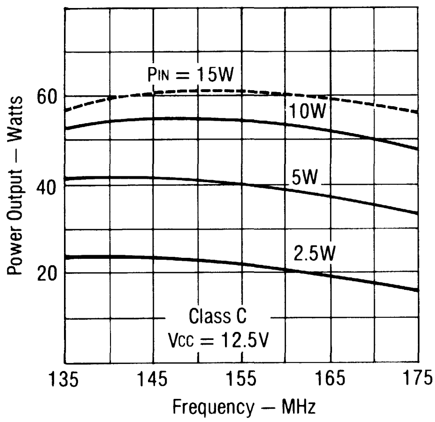
- 45 Watts
- 12.5 V_{CC}
- 175 MHz
- Gold Metalization
- Diffused Ballast Resistors
- Low Thermal Resistance
- Common Emitter
- Isolated Packages
- Class C Operation
- 20:1 VSWR
- Internally Matched



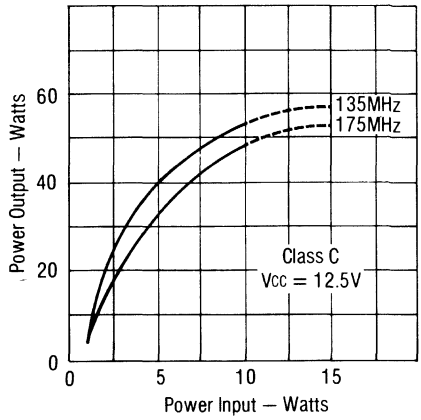
.500 J Zero

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 50mA	36			Vdc
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA	16			Vdc
	I_{CES}	Collector Cutoff Current	V_{CE} = 15V			10	mAdc
	h_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 1A	10		200	–
RF TEST	P_G	Power Gain	V_{CE} = 12.5V, f = 175MHz P_{IN} = 10W	6.5			dB
	P_{REF}	Power Reflected	V_{CE} = 12.5V, f = 175MHz P_{IN} = 10W			1.0	W
	Load VSWR	Load Mismatch Tolerance	V_{CE} = 15.5V, f = 175MHz P_{IN} = 10W	20:1			VSWR
THERMAL	$I_{C(MAX)}$	Collector Current	T_C = 25°C			6.5	A
	$P_{D(MAX)}$	Total Dissipation	T_C = 25°C			100	W
	T_{STG}	Operating and Storage Temperature		-65		150	°C
	θ_{JC}	Thermal Resistance			1.75		°C/W

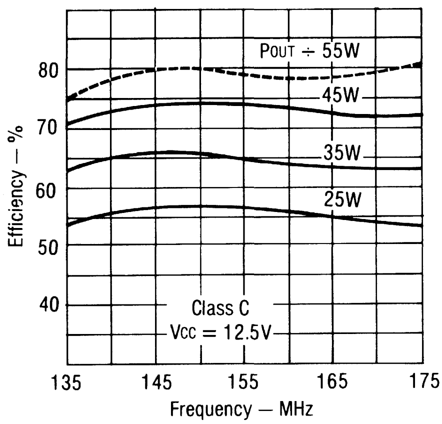
Broadband P(OUT) vs. Frequency



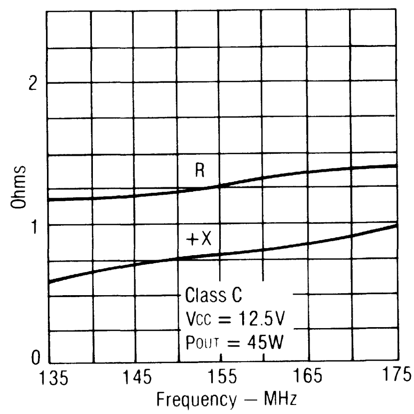
Broadband Power Transfer



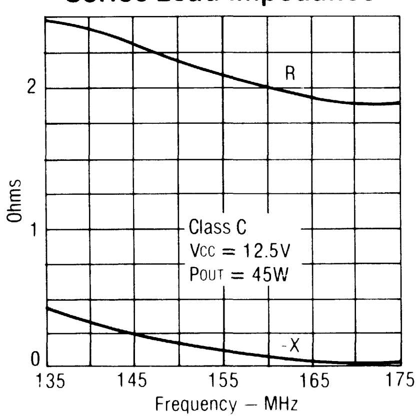
Broadband Collector Efficiency



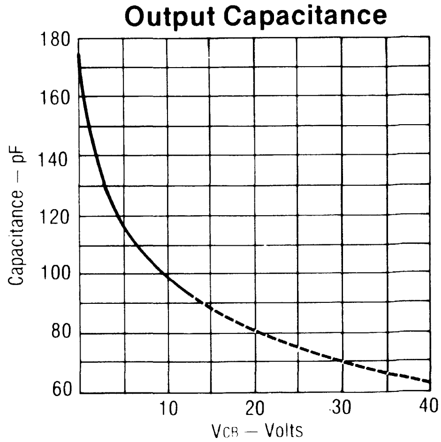
Series Input Impedance



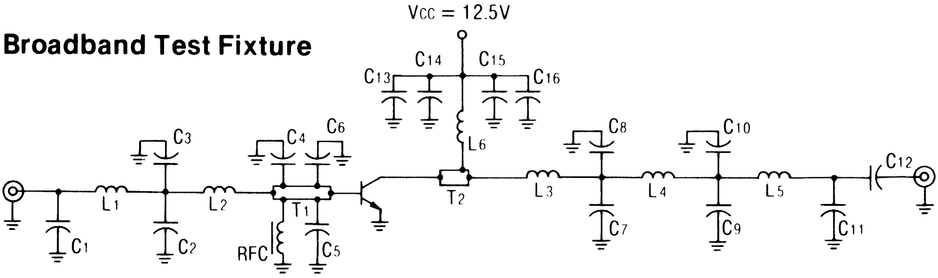
Series Load Impedance



Output Capacitance



Broadband Test Fixture

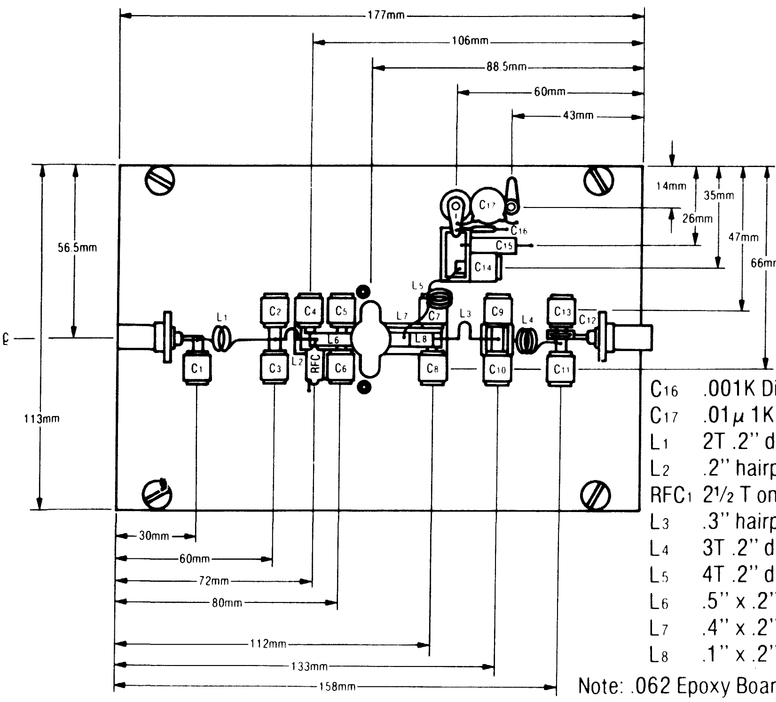


COMPONENTS LIST:

$C_{1,2}$	25pf
$C_{3,4}$	80pf
C_5	250pf
C_6	200pf
C_7	150pf
C_8	100pf
$C_{9,10}$	40pf
C_{11}	25pf
$C_{12,13}$	1000pf
C_{14}	.001μf
C_{15}	.01μf
C_{16}	25μf
L_1	2T 18 AWG .2" dia.
L_2	.2" hairpin .125" wide x .025 thick copper strip
L_3	.1" x .2" wide x .005" thick copper loop
L_4	.3" hairpin 18 AWG.
L_5	3 T. 18 AWG. .2" dia.
L_6	4 T. 18 AWG. .2" dia.
RFC	2½ T. on VK-211-07/38 ferrox cube
T_1	.2" width .5" length from package as ref.
T_2	.2" width .4" length from package as ref.

NOTES:

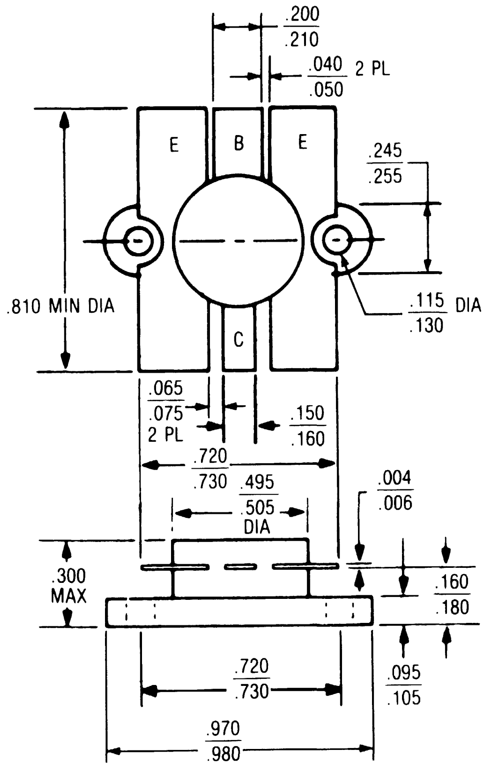
1. All capacitors in signal path are Underwood Electric Corp. Case Type J101.
2. Position C_5 and C_6 as close to pkg. as possible.



C_1	25pf
$C_{2,4}$	80pf
C_3	30pf
C_5	250pf
C_6	200pf
C_7	150pf
C_8	100pf
$C_{9,10}$	40pf
C_{11}	10pf
$C_{12,14}$	1000pf
C_{13}	15pf
C_{15}	5μf 25V
C_{16}	.001K Disc
C_{17}	.01μ 1KV Disc
L_1	2T .2" dia. 18 AWG .250" long
L_2	.2" hairpin .125" wide x .025 thick
RFC_1	2½ T on VK-211-07/3B ferrox cube
L_3	.3" hairpin #18 AWG
L_4	3T .2" dia. #10 AWG .500" long
L_5	4T .2" dia. #18 AWG .400 long
L_6	.5" x .2"
L_7	.4" x .2"
L_8	.1" x .2" wide x .005" thick

Note: .062 Epoxy Board Copper Clad — 2 Sides

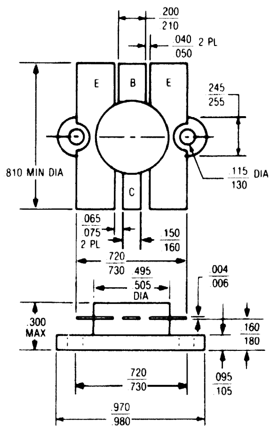
J04045



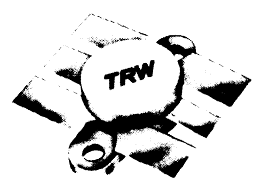
.500 J ZERO:

VHF Power Transistor

- 75 Watts
- 12.5 VCC
- 175 MHz
- High Gain
- Diffused Ballast Resistors
- Gold Metalization
- Common Emitter
- Isolated Packages
- Internally Matched
- Class C Operation



500 J ZERO

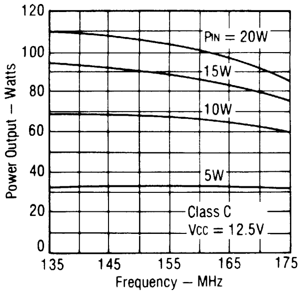


.500 J Zero

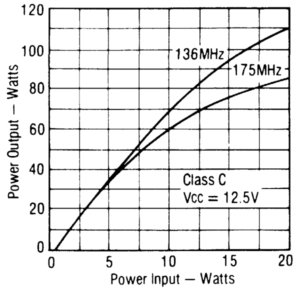
Electrical Characteristics ($T_{FLANGE} = 25°C$)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CBO}	Collector-Base Voltage	$I_C = 50mA$, $I_E = 0$	36			V
	BV_{CEO}	Collector-Emitter Voltage	$I_C = 50mA$, $I_B = 0$	16			V
	BV_{EBO}	Emitter-Base Voltage	$I_E = 10mA$, $I_C = 0$	4			V
	h_{FE}	D.C. Current Gain	$V_{CE} = 5V$, $I_C = 1A$	10		200	
	I_{CES}	Collector-Emitter Leakage	$V_{CE} = 15V$			10	mA
RF TEST	P_{gain}	Power Gain	$V_{CE} = 12.5V$, f = 175MHz, $P_{IN} = 18W$	6.24			dB
	P_{REF}	Power Reflected	$V_{CE} = 12.5V$, f = 175MHz, $P_{IN} = 15W$			1.5	W
	$VSWR_L$	Load Mismatch Tolerance*	$V_{CE} = 15.5V$, f = 175MHz, $P_{IN} = 18W$	20:1			VSWR
THERMAL	$P_{D(MAX)}$	Maximum Total Dissipation				233	W
	$I_{C(MAX)}$	Maximum Collector Current				17.5	A
	T_{STG}	Operating & Storage Temperature Range		-65		+150	°C
	$\theta_{J\text{-}F}$	Thermal Resistance				0.75	°C/W

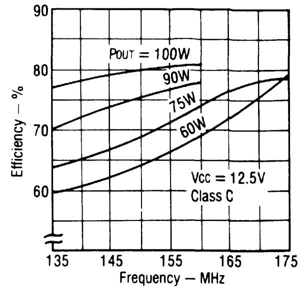
BROADBAND P$_{OUT}$ VS. FREQUENCY



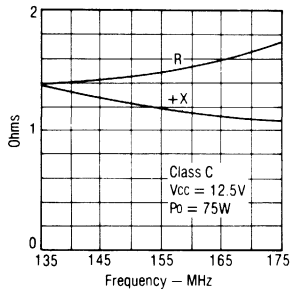
BROADBAND POWER TRANSFER



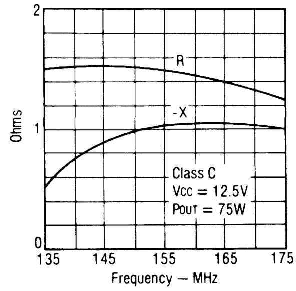
BROADBAND COLLECTOR EFFICIENCY



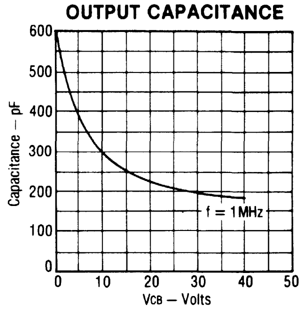
SERIES INPUT IMPEDANCE



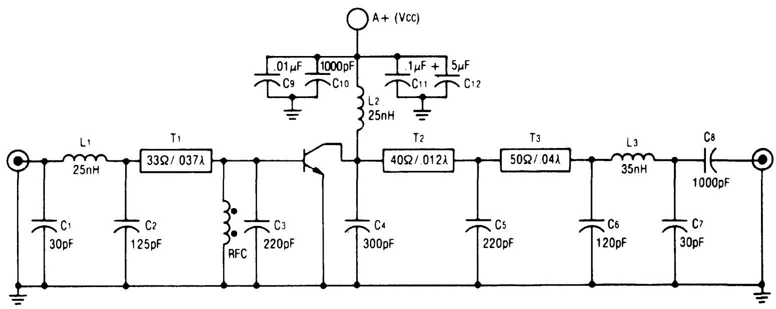
SERIES LOAD IMPEDANCE



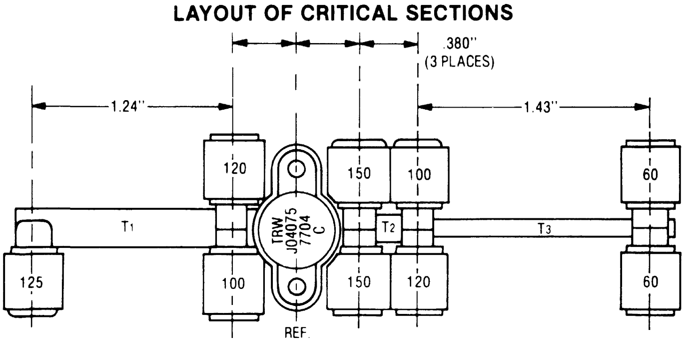
OUTPUT CAPACITANCE



BROADBAND TEST FIXTURE



LAYOUT OF CRITICAL SECTIONS

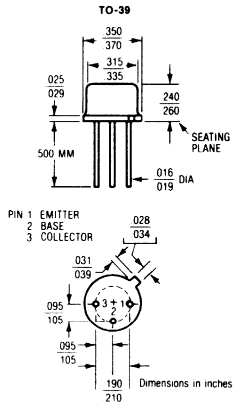


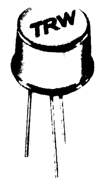
NOTES

1. All capacitors in signal path are Underwood Electric Corp., Case Type J101
2. L1: 3T, #16, 0.16 I.D., 0.25" Spacing
3. L2: 3T, #16, 0.16 I.D., 0.125" Spacing
4. L3: 4T, #16, 0.16 I.D., 0.125" Spacing
5. RFC: 2½T, #22 on Ferroxcube VK211-07/3B Bead
6. G10 P.C. Board, 1/16" Thick. Double Clad with 2 oz. Copper
7. Locate Metalized Thru-holes at all Shunt Capacitors
8. T1: 0.23" W, 1.75" L from REF. (33Ω, .037λ)
9. T2: 0.170" W, 0.85" L from REF. (40Ω, .012λ)
10. T3: 0.115"W, 1.5" L from T2 (50Ω, .04λ)
11. f_{REF} = 155MHz

RF Power Transistor

- 0.2 Watts
- 400-512 MHz
- 9 dB Gain
- 12.5 V
- Diffused Ballast Resistors
- Gold Metalization





TO-39

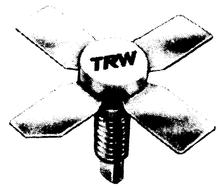
Electrical Characteristics (T_{CASE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 1.0mA, I_C = 0mA	3.5			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 5.0mA, I_B = 0mA	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 1.0mA, I_E = 0mA	36			V
	H_{FE}	DC Current Gain	V_{CE} = 5.0V, I_C = 50mA	10		200	
RF TEST	P_G	Power Gain	V_{CE} = 12.5V, f = 470 MHz P_{IN} = .025 W, P_O = .2W	9.0			dB
	η	Efficiency	V_{CE} = 12.5V, f = 470 MHz P_{IN} = .025 W	60			%
THERMAL	I_C	Continuous Collector Current				0.5	A
	P_D	Power Dissipation	T_C = 25°C			3.5	W
	Θ_{JC}	Thermal Resistance				50	°C/W
	T_{STG}	Storage Temperature		−65		+150	°C

***Discontinued, replacement LT1001A**

RF Power Transistors

- 2 to 10 Watts
- 12.5 V_{CC}
- 470 MHz
- Diffused Ballast Resistors
- Common Emitter
- Isolated Packages
- 20:1 VSWR



.280 SOE

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

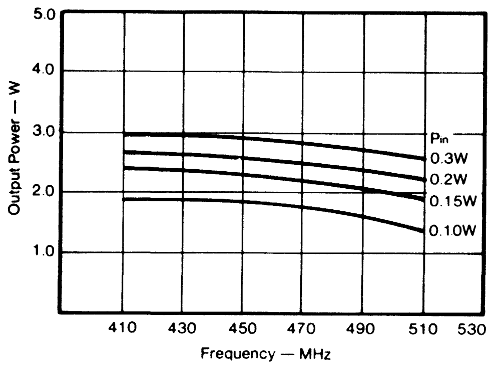
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	PT 8809	PT 8810	PT 8811	UNIT
DC TEST	BV_{EBO}	Min. Emitter-Base Breakdown	I_E = 1mA I_C = 0 I_E = 2mA I_C = 0 I_E = 5mA I_C = 0	4	4	4	V
	BV_{CES}	Min. Collector-Emitter Breakdown	I_C = 5mA V_{BE} = 0 I_C = 10mA V_{BE} = 0 I_C = 20mA V_{BE} = 0	36	36	36	V
	BV_{CEO}	Min. Collector-Emitter Breakdown	I_C = 25mA I_B = 0 I_C = 50mA I_B = 0	16	16	16	V
	H_{FE}	Min. D.C. Current Gain	V_{CE} = 5V I_C = 100mA V_{CE} = 5V I_C = 200mA V_{CE} = 5V I_C = 500mA	20	20	20	—
RF TEST	P_{GAIN}	Power Gain	V_{CE} = 12.5V P_O = 2W P_O = 5W F = 470 MHz P_O = 10W	10	8.5	6.0	dB
	n	Min. Collector Efficiency	V_{CE} = 12.5V P_{OUT} = 2W F = 470 MHz P_{OUT} = 5W P_{OUT} = 10W	60	55	55	%
	VSWR	Mismatch Tolerance	P_{OUT} = 2W V_{CE} = 12.5V P_{OUT} = 5W F = 470 MHz P_{OUT} = 10W	20:1	20:1	20:1	VSWR
	C_{OB}	Max. Collector-Base Capacitance	I_E = 0 V_{CB} = 15V F = 1 MHz	8	17	30	pF
THERMAL	I_C	Continuous Collector Current		0.75	1.7	3.4	A
	θ_{j-c}	Thermal Resistance	T_C = 25°C	10	5	3.5	°C/W
	T_{STG}	Storage Temperature and Junction Temperature		−65°	to	+150°	°C
	P_D	Power Dissipation	T_C = 25°C	17.5	35	50	W

TYPICAL POWER GAIN PERFORMANCE IN BROADBAND CIRCUIT

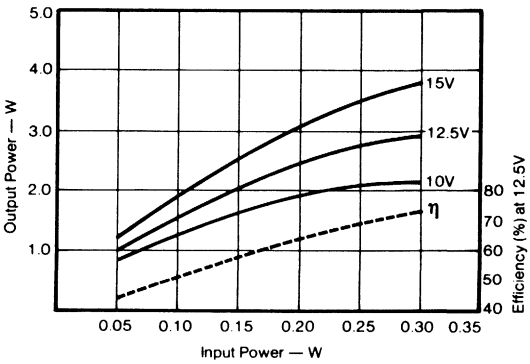
Power Output Frequency
V_{CE} = 12.5 V

Power Output vs Power Input
f = 470 MHz

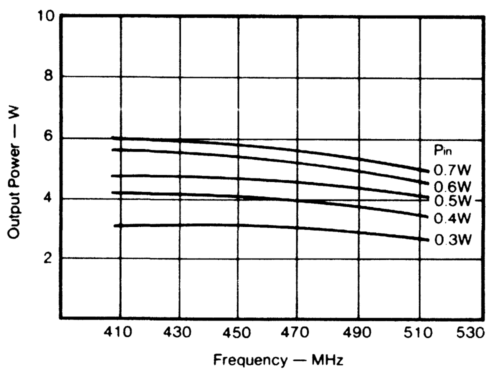
PT 8809



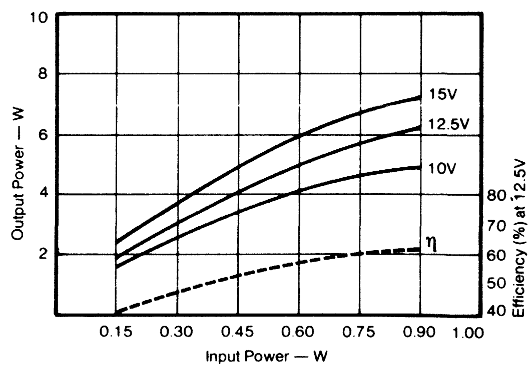
PT 8809



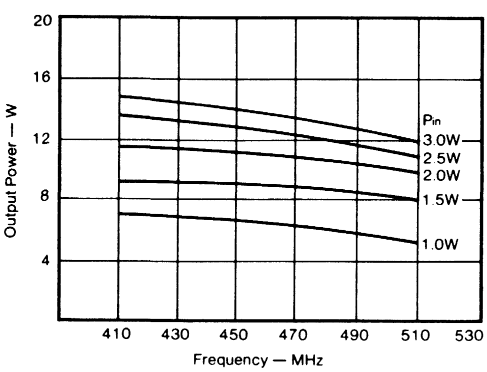
PT 8810



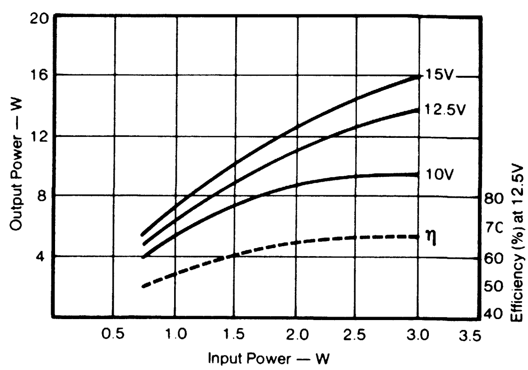
PT 8810



PT 8811



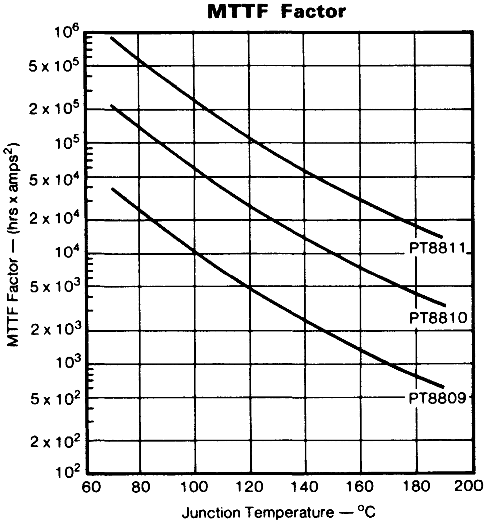
PT 8811



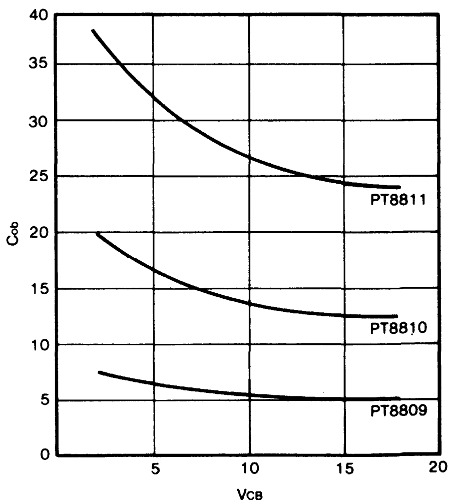
DEVICE IMPEDANCE PARAMETERS AT 12.5 V AND RATED INPUT POWER

DEVICE	FREQUENCY (MHz)	Z_n (Ω)	Z_{out} (Ω)
PT 8809	410	1.70 + j 1.92	15.7 — j 20.4
	430	1.79 + j 2.09	15.5 — j 19.7
	450	1.87 + j 2.26	15.4 — j 18.9
	470	1.96 + j 2.44	15.2 — j 18.2
	490	2.03 + j 2.61	15.1 — j 17.5
	510	2.11 + j 2.77	14.9 — j 16.7
PT 8810	410	1.49 + j 2.60	9.95 — j 6.20
	430	1.52 + j 2.90	9.80 — j 6.05
	450	1.56 + j 3.20	9.65 — j 5.90
	470	1.60 + j 3.50	9.55 — j 5.75
	490	1.63 + j 3.80	9.40 — j 5.60
	510	1.67 + j 4.10	9.30 — j 5.45
PT 8811	410	1.25 + j 2.65	6.00 — j 1.70
	430	1.24 + j 2.77	5.85 — j 1.64
	450	1.23 + j 2.89	5.70 — j 1.58
	470	1.22 + j 3.00	5.55 — j 1.62
	490	1.21 + j 3.12	5.40 — j 1.46
	510	1.20 + j 3.24	5.25 — j 1.40

MTTF Factor



Collector Base Capacitance (pF) at 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 charts shown above. Consider the PT 8810 operating at 470 MHz under normal conditions.

$P_0 = 5$ W
$V_C = 12.5$ V
$P_{in} = 0.6$ W
$\eta = 60$ %

From this we calculate $I_C = 0.67$ A ; therefore, the total power dissipated is 4 watts.

The junction temperature can then be calculated from :

$$T_j = T_{stud} + Pd \times \theta_{jC}$$

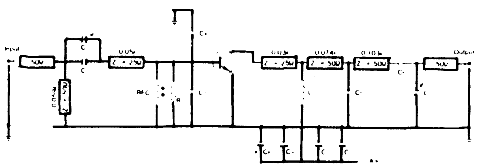
In this example $P_d \times \theta_{jC}$ is 20 °C.

For a stud temperature of 100 °C, T_j is 120 °C. From the chart above, we find the PT 8810 has an MTTF factor of 2.75 × 10^4 hours amps² at 120 °C. We calculate MTTF as follows :

$$MTTF = \frac{2.75 \times 10^4 \text{ hrs.amps}^2}{(0.67 \text{ amps})^2}$$

MTTF = 61,300 hours

PT 8809 TEST CIRCUIT BROADBAND (450-510 MHz)



COMPONENT AND MATERIAL LIST

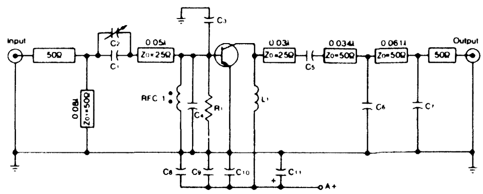
C_1 3.9 pF, ceramic chip
$C_{2,7}$ 0.8-10 pF, Voltronics AP 10, variable
$C_{3,4}$ 27 pF, ceramic chip
C_5 15 pF, ceramic chip
C_6 470 pF, ceramic chip
C_8 5 μF, electrolytic
C_9 1000 pF, Underwood
C_{10} 0.1 μF, disc-ceramic
C_{11} 0.1 μF, disc-ceramic

L_1 2 turns # 22 enameled, 0.1" I.D.

R_1 270 Ω, 1/2 watt, carbon
RFC_1 2 1/2 turns # 22 AWG on Ferroxcube VK 211/17-4 B

All transmission lines reference at 480 MHz

PT 8810 TEST CIRCUIT BROADBAND (450-510 MHz)



COMPONENT AND MATERIAL LIST

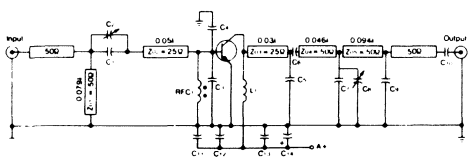
C_1 3.9 pF, ceramic chip
C_2 0.8-10 pF, Voltronics AP 10, variable
$C_{3,4}$ 25 pF, ceramic chip
C_5 1500 pF, ceramic chip
C_6 10 pF, Underwood
C_7 5 pF, Underwood
C_8 0.01 μF, disc-ceramic
C_9 0.10 μF, disc-ceramic
C_{10} 1000 pF, Underwood
C_{11} 5 μF, electrolytic

L_1 4 turns, # 22 enameled, 0.1" I.D.

R_1 750 Ω, 1/2 watt, carbon
RFC_1 2 1/2 turns # 22 AWG on Ferroxcube VK 211/17-4 B

All transmission lines reference at 480 MHz

PT 8811 TEST CIRCUIT BROADBAND (450-510 MHz)



COMPONENT AND MATERIAL LIST

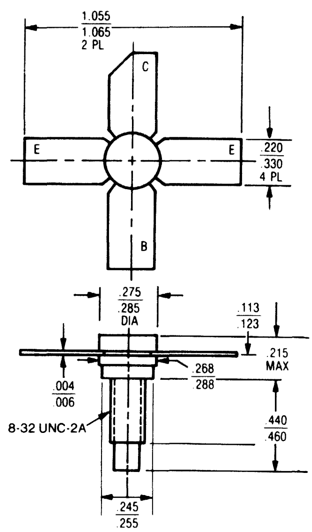
C_1 3.9 pF, ceramic chip
$C_{2,8}$ 0.8-10 pF, Voltronics AP 10, variable
$C_{3,4}$ 27 pF, ceramic chip
C_5 20 pF, Underwood
C_6 81 pF, ceramic chip
C_7 10 pF, Underwood
C_9 5 pF, Underwood
C_{10} 470 pF, ceramic chip
C_{11} 1000 pF, Underwood
C_{12} 0.1 μF, disc-ceramic
C_{13} 0.01 μF, disc-ceramic
C_{14} 5 μF, electrolytic

L_1 4 turns, # 22 enameled, 0.1" I.D.

RFC_1 2 1/2 turns # 22 AWG on Ferroxcube VK 211/17-4 B

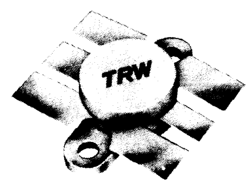
All transmission lines reference at 480 MHz

.280 SOE



UHF RF Power Transistor

- **20 Watt**
- **12.5 V_{CC}**
- **450-512 MHz**
- **Diffused Ballast Resistors**
- **Internally Matched**
- **Common Emitter**
- **Isolated Package**
- **20:1 VSWR**

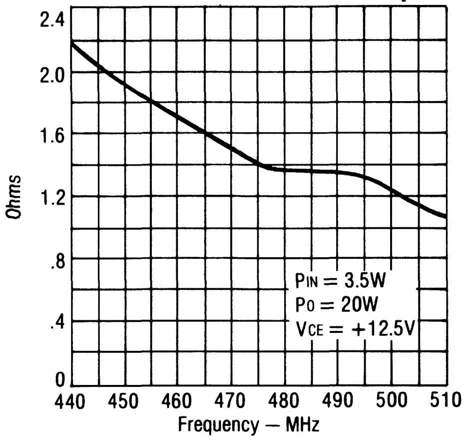


.500 J Zero

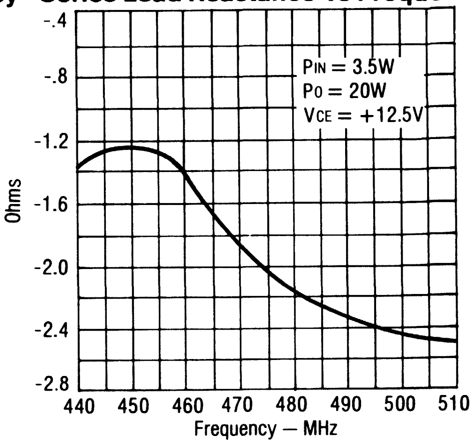
Electrical Characteristics (T_{CASE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CBO}	Collector Base Voltage	I_C = 50mA	36			V
	BV_{CEO}	Collector Emitter Voltage	I_C = 50mA	16			V
	I_{CES}	Collector Emitter Leakage	V_{CE} = 15V			10	mA
	BV_{EBO}	Emitter Base Voltage	I_E = 5mA, I_C = 0	4			V
	h_{FE}	D.C. Current Gain	V_{CE} = 5V, I_C = 1A	20		200	
RF TEST	P_{gain}	Power Gain	V_{CE} = 12.5V, f = 470MHz P_{IN} = 3.5W	7.6			dB
	$VSWR_L$	Collector Load	V_{CE} = 15.5V, f = 470MHz P_{IN} = 3.5W	20:1			VSWR
	η	Collector Efficiency	At P_O = 20W		60		%
THERMAL	θ_{JC}	Thermal Resistance	25°C Case		4.5		°C/W
	T_{STG}	Storage Temperature		−65		150	°C
	$I_{C(MAX)}$	Maximum Collector Current	T_C = 25°C			3	A
	$P_{D(MAX)}$	Total Dissipation	T_C = 25°C			39	W

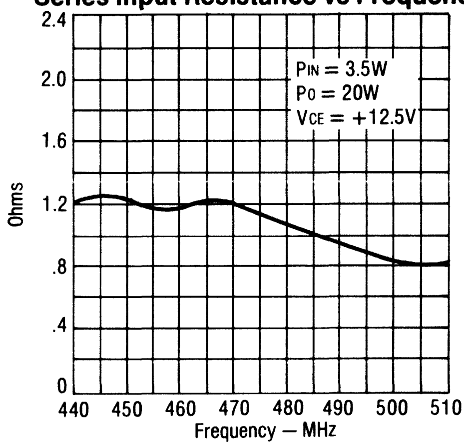
Series Load Resistance vs Frequency



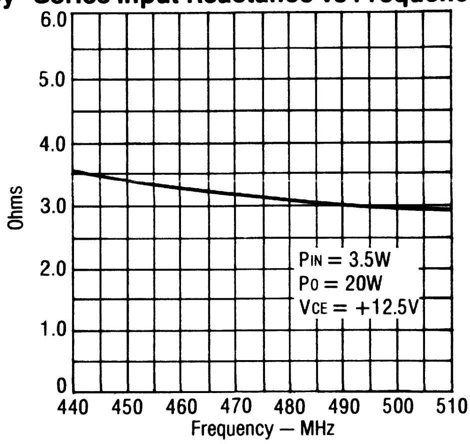
Series Load Reactance vs Frequency



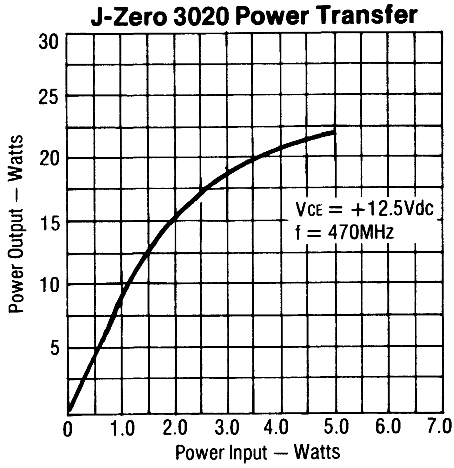
Series Input Resistance vs Frequency

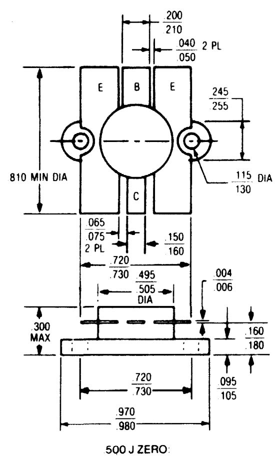


Series Input Reactance vs Frequency



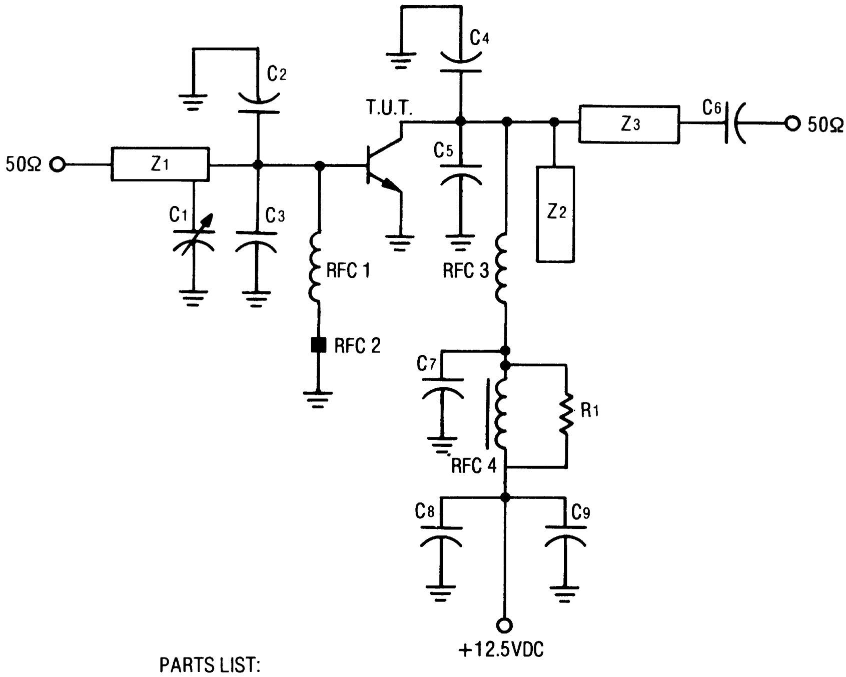
J-Zero 3020 Power Transfer





500 J ZERO

TEST CIRCUIT



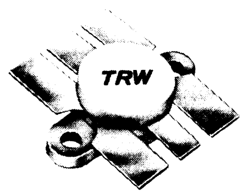
PARTS LIST:

C_1	1-10pf piston trimmer, located 0.4" from device end on Z_1.
$C_{2,4}$	30pf uncased mica capacitor.
C_3	20pf uncased mica capacitor.
C_5	40pf uncased mica capacitor.
C_6	30pf miniature uncased mica capacitor.
C_7	220pf uncased mica capacitor.
C_8	5μf @ 25 volts.
C_9	0.1μfD @ 50 volts disc ceramic.
RFC 1	6 T. #18 AWG., 1/4" dia., 1/2" long.
RFC 2	Ferrite bead.
RFC 3	4 T. #18 AWG., 3/8" dia., 1/2" long.
RFC 4	3 T. #18 AWG. on 1/2" "H" toroid
R_1	10 ohms @ 1/2 watt.
Z_1	Microstripline, Z_O = 30 ohms, W = 0.37", L = 3.02"
Z_2	Microstripline capacitor, Z_O = 24 ohms, W = 0.46", L = 1.62
Z_3	Microstripline, Z_O = 20 ohms, W = 0.56", L = 2.34"

Board material — 1/16" Teflon-glass

UHF RF Power Transistor

- 37 Watts
- 12.5 Vcc
- 450-512 MHz
- High Gain
- 20:1 VSWR
- Common Emitter
- Isolated Package
- Internally Matched



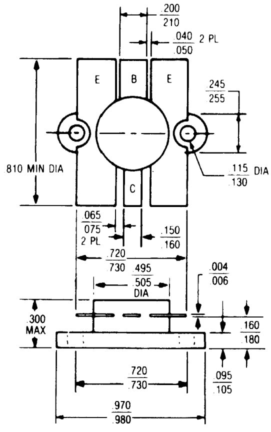
.500 J Zero

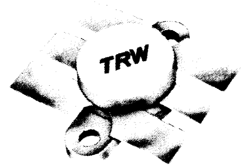
Electrical Characteristics (T_{CASE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CBO}	Collector-Base Voltage	I_C = 50mA	36			V
	BV_{CEO}	Collector-Emitter Voltage	I_C = 50mA	16			V
	BV_{EBO}	Emitter-Base Voltage	I_E = 5mA, I_C = 0	4			V
	I_{CES}	Collector Emitter Leakage	V_{CE} = 15V		10		mA
	h_{FE}	D.C. Current Gain	V_{CE} = 5V, I_C = 1A	10		200	
RF TEST	P_G	Power Gain	V_{CE} = +12.5V, f = 470MHz P_{IN} = 12W	4.9			dB
	$VSWR_L$	Collector Load	V_{CE} = +15.5V, f = 470MHz P_{IN} = 12W	20:1			VSWR
	η	Collector Efficiency	P_O = 37W, f = 470MHz		60		%
THERMAL	θ_{jc}	Thermal Resistance	25 deg C case		2.1		°C/W
	T_{stg}	Storage Temperature		−65		+150	°C
	$I_{C(MAX)}$	Maximum Collector Current	T_C = 25°C			5	A
	$P_{D(MAX)}$	Total Dissipation	T_C = 25°C			83	W

RF Power Transistor

- 50 Watts
- 400-512 MHz
- 5.8 dB Gain
- 12.5 V
- Diffused Ballast Resistors
- Common Emitter
- 20:1 VSWR
- Internally Matched
- Isolated Package
- Low Thermal Resistance





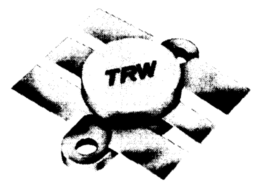
.500 J Zero

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

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 5mA, I_C = 0mA	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA, I_B = 0mA	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 20mA, I_E = 0mA	36			V
	H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 1.0 A	10		200	
RF TEST	P_G	Power Gain	V_{CE} = 12.5V, f = 470 MHz P_{IN} = 13 W	5.9			dB
	Load VSWR	Mismatch Tolerance	V_{CE} = 15.5V, f = 470 MHz P_{IN} = 13 W	20:1			VSWR
	η	Efficiency	V_{CE} = 12.5V, f = 470 MHz P_{IN} = 13 W	55			%
THERMAL	I_C	Continuous Collector Current				8.0	A
	P_D	Power Dissipation	T_C = 25°C			100	W
	Θ_{JC}	Thermal Resistance				1.75	°C/W
	T_{STG}	Storage Temperature		−65		+150	°C

UHF RF Power Transistor

- 55 Watts
- 12.5 V_{CC}
- 450-512 MHz
- High Gain
- Common Emitter
- Isolated Package
- Internally Matched
- 20:1 VSWR
- Low Thermal Resistance

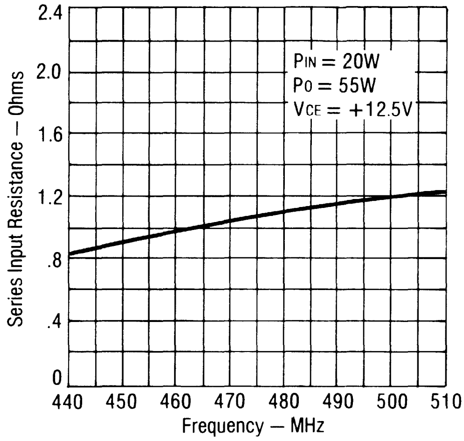


.500 J Zero

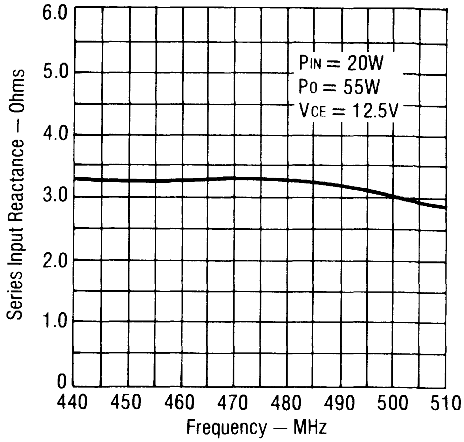
Electrical Characteristics (T_{CASE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CBO}	Collector Base Voltage	I_C = 50mA	36			V
	BV_{CEO}	Collector Emitter Voltage	I_C = 50mA	16			V
	I_{CES}	Collector Emitter Leakage	V_{CE} = 12.5V			20	mA
	BV_{EBO}	Emitter Base Voltage	I_E = 5mA, I_C = 0	4			V
	h_{FE}	D.C. Current Gain	V_{CE} = 5V, I_C = 1A	20		200	
RF TEST	P_{gain}	Power Gain	V_{CE} = 12.5V, f = 470MHz P_{IN} = 20W	4.4			W
	$VSWR_L$	Collector Load	V_{CE} = 15.5V, f = 470MHz P_{IN} = 20W	20:1			VSWR
	η	Collector Efficiency	At P_O = 55W		60		%
THERMAL	$\theta_{j\text{-}c}$	Thermal Resistance	25°C Case		1.75		°C/W
	T_{STG}	Storage Temperature		-65		150	°C
	$I_{C(MAX)}$	Maximum Collector Current	T_C = 25°C			8	A
	$P_{D(MAX)}$	Total Dissipation	T_C = 25°C			100	W

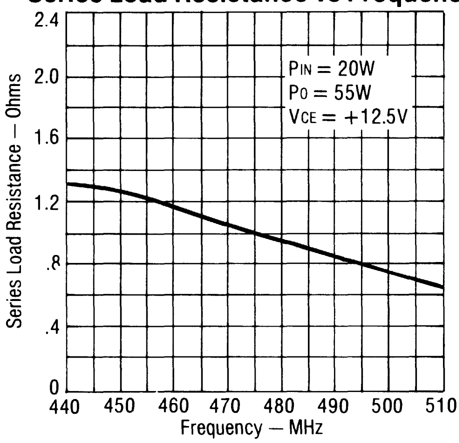
Series Input Resistance vs Frequency



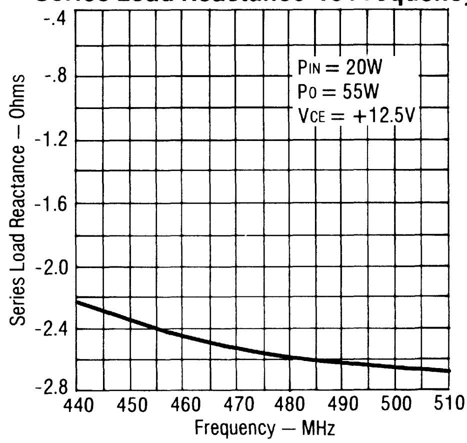
Series Input Reactance vs Frequency



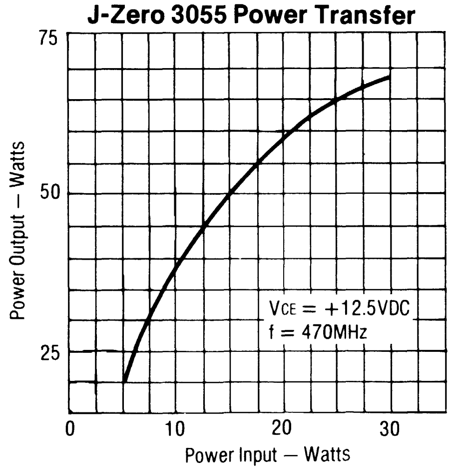
Series Load Resistance vs Frequency

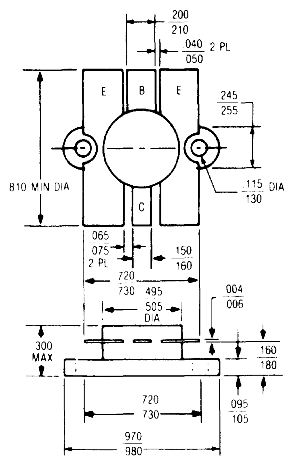


Series Load Reactance vs Frequency

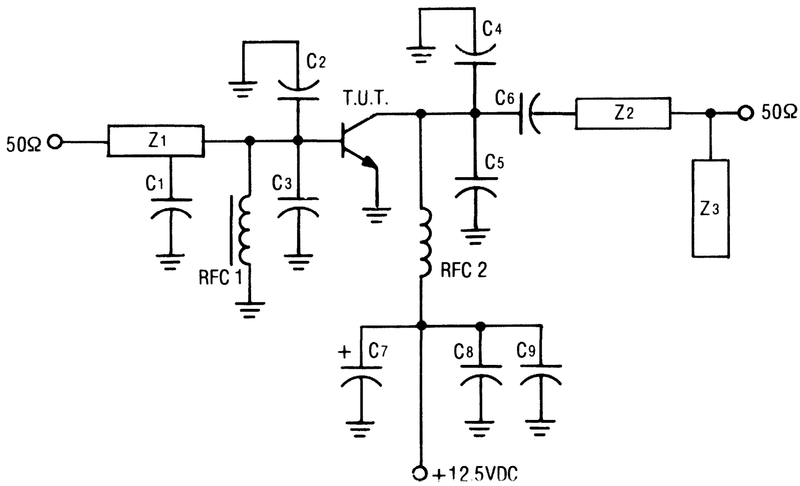


J-Zero 3055 Power Transfer





TEST CIRCUIT



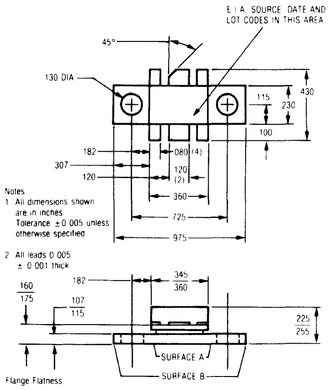
PARTS LIST:

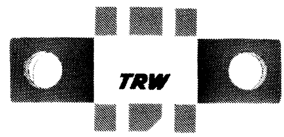
C_1	1-10pf piston trimmer located 1.0" from device end on Z_1.
$C_{2,3,4,5}$	33pf uncased mica capacitor.
C_6	39pf uncased mica capacitor.
C_7	5μf @ 25 volts.
C_8	220pf uncased mica capacitor.
C_9	0.1μfD @ 50 volts disc ceramic.
RFC 1	VK200 choke
RFC 2	5 T. #18 AWG., 1/4" dia., 1/2" long.
Z_1	Microstripline, Z_O = 45 ohms, W = 0.15", L = 2.05".
Z_2	Microstripline, Z_O = 22 ohms, W = 0.425", L = 3.2".
Z_3	Microstripline Capacitor, Z_O = 28 ohms, W = 0.25", L = 0.55".

Board material — 1/16" epoxy-glass.

RF Power Transistor

- 5 Watts
- 806-870 MHz
- 7 dB Gain
- 12.5 V
- Common Base
- Rugged





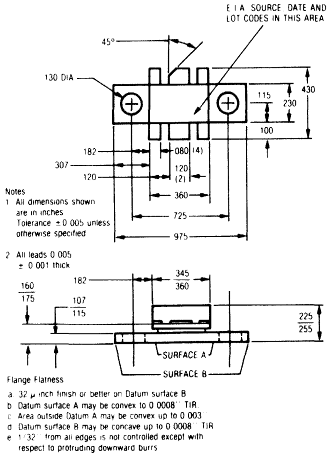
.230 Flange

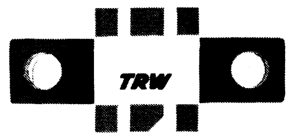
Electrical Characteristics (T_{CASE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 5mA, I_C = 0mA	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA, I_B = 0mA	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 50mA, I_E = 0mA	36			V
	H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 100mA	10		200	
RF TEST	P_G	Power Gain	V_{CE} = 12.5V, f = 870 MHz P_{IN} = 1 W	7.0			dB
	Load VSWR	Mismatch Tolerance	V_{CE} = 15.5V, f = 870 MHz P_{IN} = 1 W	10:1			VSWR
	η	Efficiency	V_{CE} = 12.5V, f = 870 MHz P_{IN} = 1 W	50	55		%
THERMAL	I_C	Continuous Collector Current				1.8	A
	P_D	Power Dissipation	T_C = 25°C			25	W
	Θ_{JC}	Thermal Resistance				4.4	°C/W
	T_{STG}	Storage Temperature		−65		+150	°C

RF Power Transistor

- 18 Watts
- 806-870 MHz
- 6.5 dB Gain
- 12.5 V
- Common Base
- Rugged





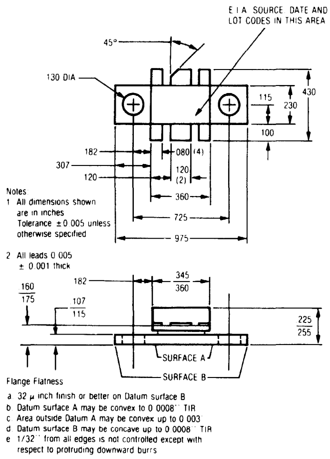
.230 Flange

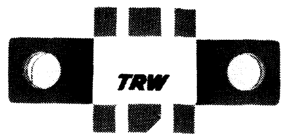
Electrical Characteristics (TCASE = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 5mA, I_C = 0mA	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA, I_B = 0mA	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 50mA, I_E = 0mA	36			V
	H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 1.0mA	10		200	
RF TEST	P_G	Power Gain	V_{CE} = 12.5V, f = 870 MHz P_{IN} = 4 W	6.5			dB
	Load VSWR	Mismatch Tolerance	V_{CE} = 15.5V, f = 870 MHz P_{IN} = 4 W	10:1			VSWR
	η	Efficiency	V_{CE} = 12.5V, f = 870 MHz P_{IN} = 4 W	50	55		%
THERMAL	I_C	Continuous Collector Current				3.5	A
	P_D	Power Dissipation	T_C = 25°C			55	W
	Θ_{JC}	Thermal Resistance				2.2	°C/W
	T_{STG}	Storage Temperature		−65		+150	°C

RF Power Transistor

- 28 Watts
- 806-870 MHz
- 5.5 dB Gain
- 12.5 V
- Common Base
- Rugged





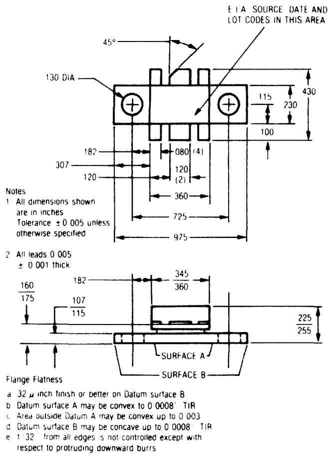
.230 Flange

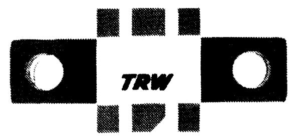
Electrical Characteristics (T_{CASE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 5mA, I_C = 0mA	4			V
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA, I_B = 0mA	16			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 50mA, I_E = 0mA	36			V
	H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 1.0A	10		200	
RF TEST	P_G	Power Gain	V_{CE} = 12.5V, f = 870 MHz P_{IN} = 8 W	5.4			dB
	Load VSWR	Mismatch Tolerance	V_{CE} = 15.5V, f = 870 MHz P_{IN} = 8 W	10:1			VSWR
	η	Efficiency	V_{CE} = 12.5V, f = 870 MHz P_{IN} = 8 W	50	55		%
THERMAL	I_C	Continuous Collector Current				6.5	A
	P_D	Power Dissipation	T_C = 25°C			100	W
	Θ_{JC}	Thermal Resistance				1.5	°C/W
	T_{STG}	Storage Temperature		−65		+150	°C

RF Power Transistor

- 45 Watts
- 806-870 MHz
- 4.8 dB Gain
- 12.5 V
- Common Base
- Rugged





.230 Flange

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

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 5mA, I_C = 0mA	4			V
DC TEST	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA, I_B = 0mA	16			V
DC TEST	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 50mA, I_E = 0mA	36			V
DC TEST	H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 1.0A	10			
RF TEST	P_G	Power Gain	V_{CE} = 12.5V, f = 870 MHz P_{IN} = 15 W	4.8			dB
RF TEST	Load VSWR	Mismatch Tolerance	V_{CE} = 15.5V, f = 870 MHz P_{IN} = 15 W	10:1			VSWR
RF TEST	η	Efficiency	V_{CE} = 12.5V, f = 870 MHz P_{IN} = 15 W	50	55		%
THERMAL	I_C	Continuous Collector Current				9.0	A
THERMAL	P_D	Power Dissipation	T_C = 25°C			150	W
THERMAL	Θ_{JC}	Thermal Resistance				1.2	°C/W
THERMAL	T_{STG}	Storage Temperature		−65		+150	°C

TRW Electronic Components Group

TRW

Printed Circuit Division
200 South Turnbull Canyon Road
City of Industry, California 91749
Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
4243 Campus Point Court
San Diego, California 92121
Phone: 714/457-1000

Products: Data converters, arithmetic products, and special processors.

Optoelectronics Division
1201 Tappan Circle
Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

28 Volt VHF-UHF Transistors

These devices are intended for both Military and Industrial service in the frequency range below 400 MHz with a 28 Volt collector supply.

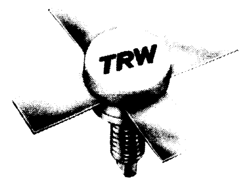
Matched* and unmatched transistors are offered and all feature TRW's proprietary GOLD Metalization and diffused ballast for ruggedness and long life.

Alternate packages (in some cases) are available on special order (consult factory).

TRW

VHF Power Transistors

- 4 to 50 Watts
- 28 V_{CC}
- 175 MHz
- High Gain
- Diffused Ballast Resistors
- Class A, AB or C Operation
- Common Emitter
- Isolated Package
- ∞ VSWR

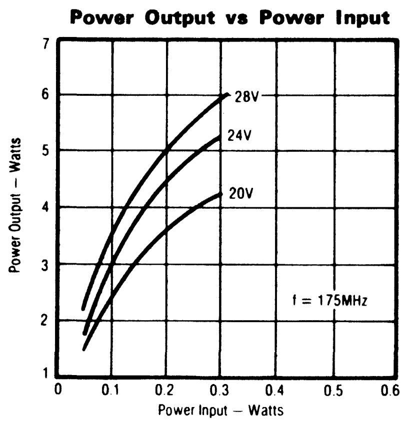


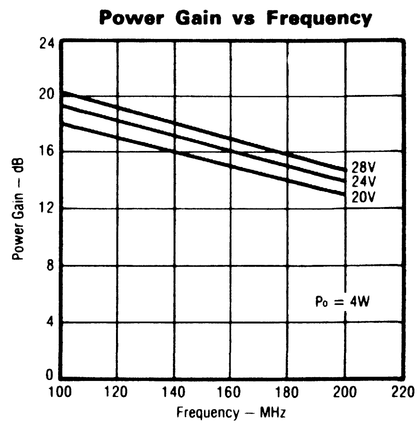
.380 SOE

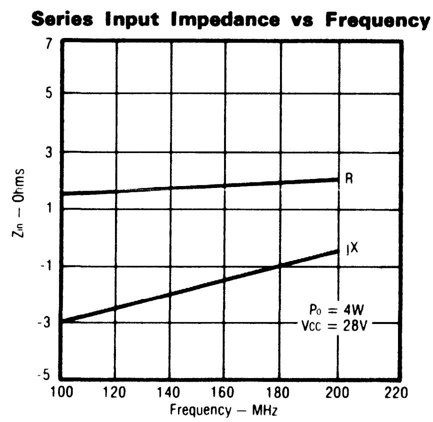
Electrical Characteristics (T_{FLANGE} = 25°C)

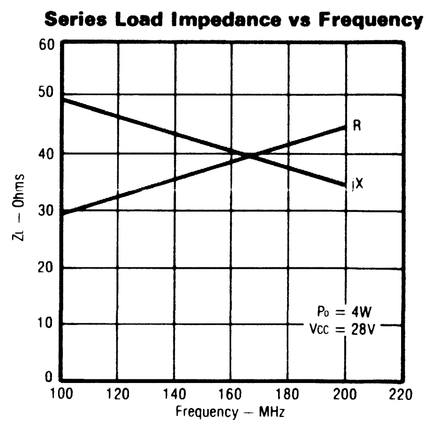
SYMBOL	CHARACTERISTICS	TEST CONDITIONS	PT 9730	PT 9732	PT 9734	PT 9731	PT 9733	UNIT
BV_{EBO}	Min. Emitter-Base Breakdown	I_E = 1mA, I_C = 0	4	4	4	4	4	V
BV_{CES}	Min. Collector-Emitter Breakdown	I_C = 50mA, V_{BE} = 0	60	60	60	60	60	V
BV_{CEO}	Min. Collector-Emitter Breakdown	I_C = 25mA, I_B = 0	35	35	35	35	35	V
I_{CES}	Max. Collector-Emitter Cutoff Current	V_{CE} = 25V	0.5	1.0	1.5	2.0	2.0	mA
H_{FE}	Min. D.C. Current Gain	I_C = 500mA, V_{CE} = 10V	20 to 150	20 to 150	20 to 150	20 to 150	20 to 150	—
P_{GAIN}	Min. Power Gain	V_{CE} = 28V, P_{IN} = 0.2W P_{IN} = 0.5W P_{IN} = 1W f = 175 MHz, P_{IN} = 2.5W P_{IN} = 8W	4	8	15	25	50	W
η	Min. Collector Efficiency	V_{CE} = 28V, f = 175 MHz Rated Output Power	60	60	60	60	60	%
VSWR	Mismatch Tolerance	V_{CE} = 28V, f = 175 MHz Rated Output Power	∞	∞	∞	∞	∞	
P_{SAT}	Min. Saturated Power Output	V_{CE} = 28V, f = 175 MHz	6	10	18	30	60	W
C_{OB}	Max. Collector-Base Capacitance	V_{CB} = 28V, f = 1 MHz I_E = 0	12	18	24	40	90	pF
I_C	Continuous Collector Current (Max. Rating)		1	1.25	2.5	4	8	A
$\Theta_{J\text{-}C}$	Thermal Resistance	T_C = 25°C	17.5	8.8	5.8	3.9	2.1	°C/W
T_{STG}	Storage Temperature			−65 to +150				°C
T_J	Junction Temperature			+200° Maximum				
P_D	Power Dissipation	T_C = 25°C	10	20	30	45	85	W

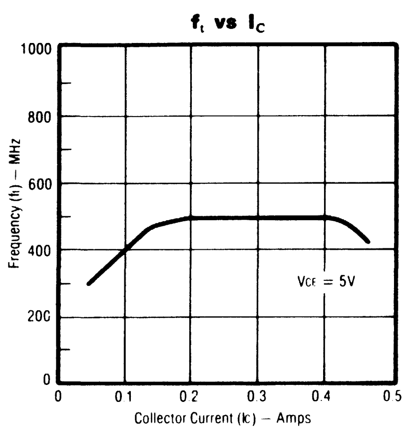
PT 9730 — 4 Watts

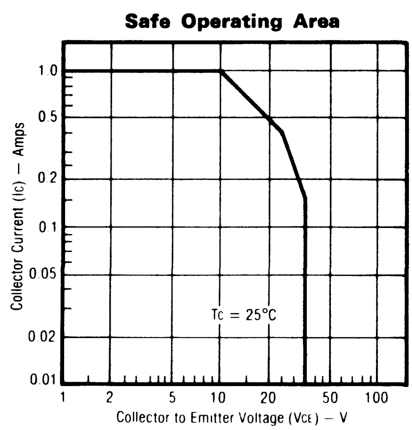






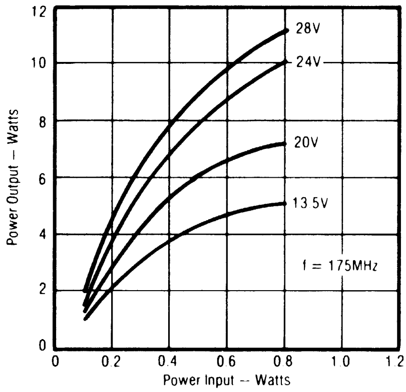




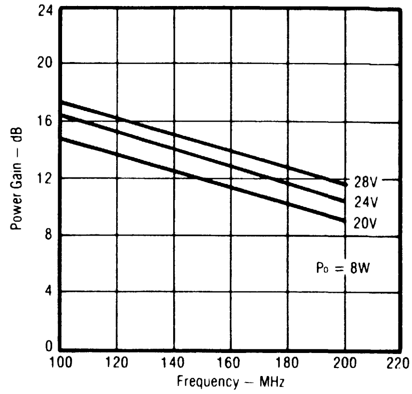


PT 9732 — 8 Watts

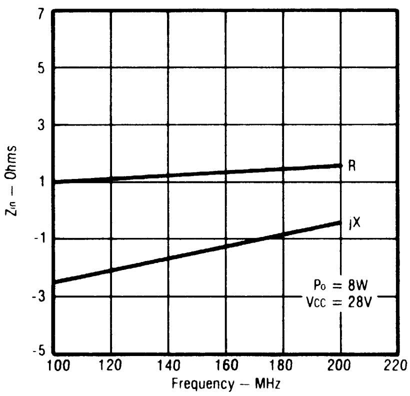
Power Output vs Power Input



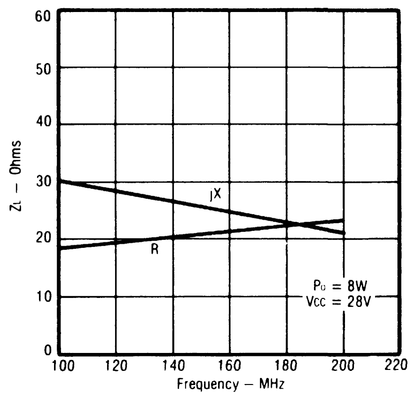
Power Gain vs Frequency



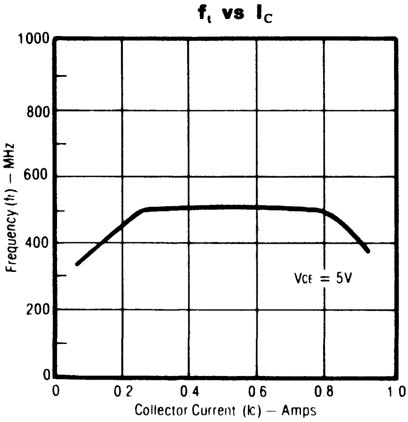
Series Input Impedance vs Frequency



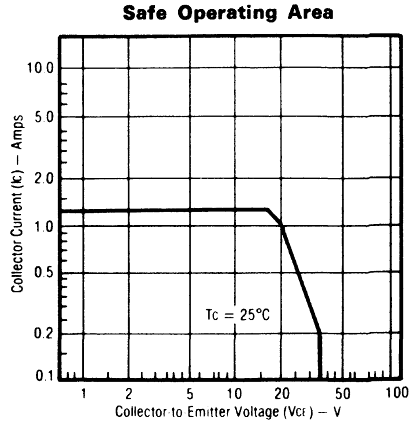
Series Load Impedance vs Frequency



f_t vs I_C

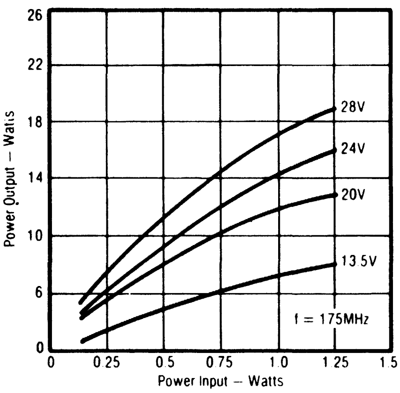


Safe Operating Area

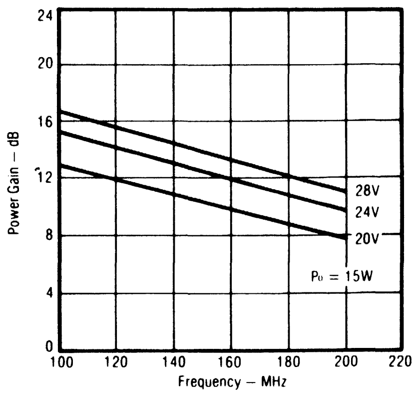


PT 9734 — 15 Watts

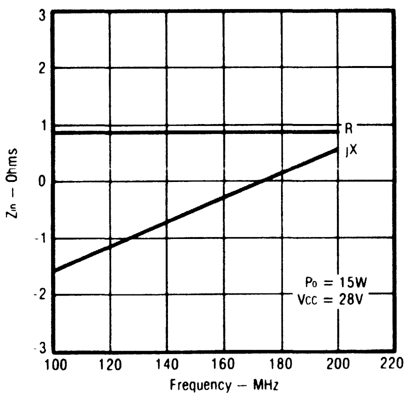
Power Output vs Power Input



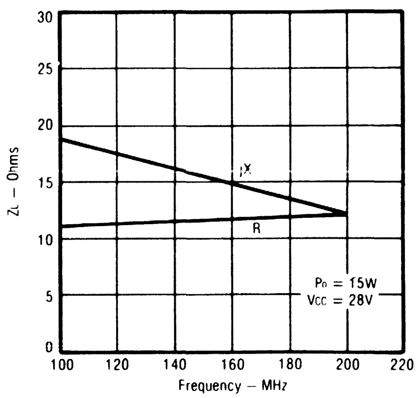
Power Gain vs Frequency



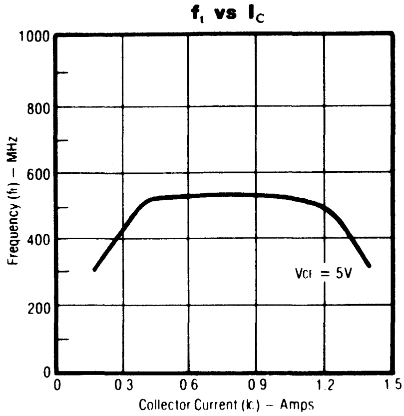
Series Input Impedance vs Frequency



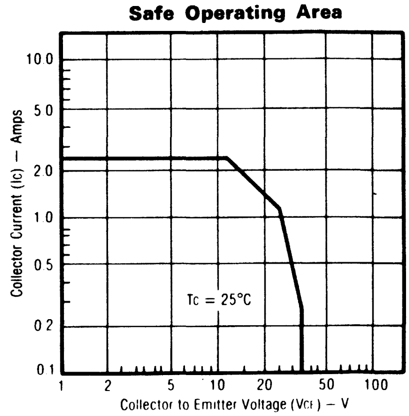
Series Load Impedance vs Frequency



f_t vs I_C

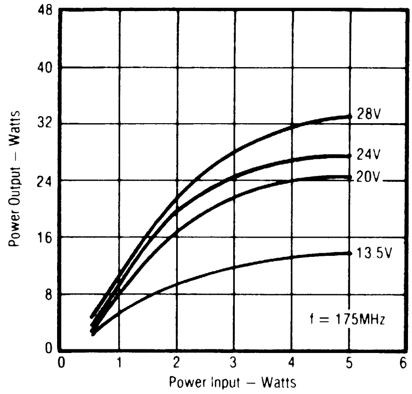


Safe Operating Area

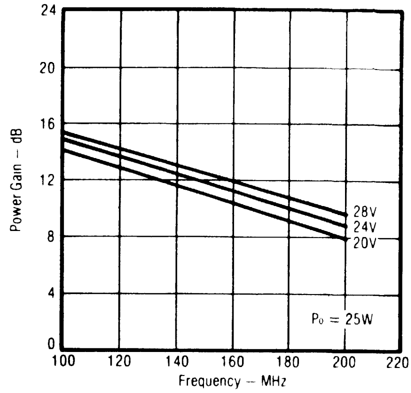


PT 9731 — 25 Watts

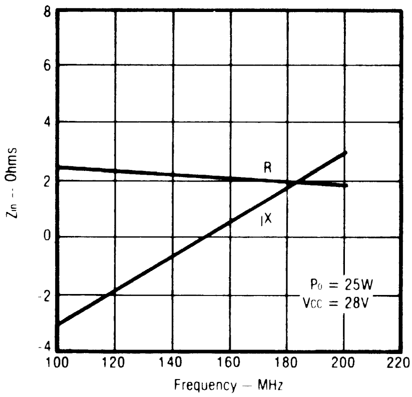
Power Output vs Power Input



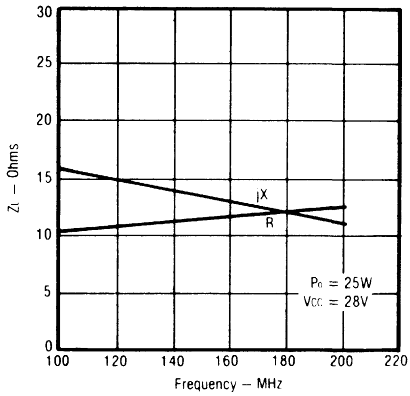
Power Gain vs Frequency



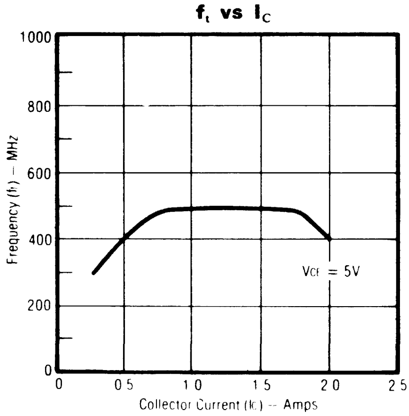
Series Input Impedance vs Frequency



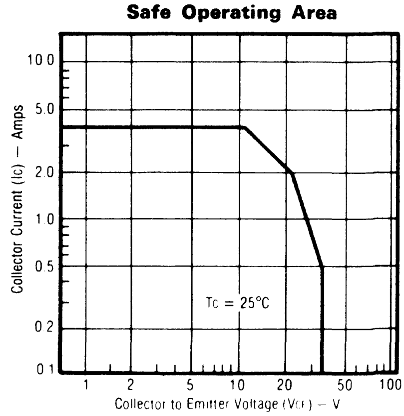
Series Load Impedance vs Frequency



f_t vs I_C

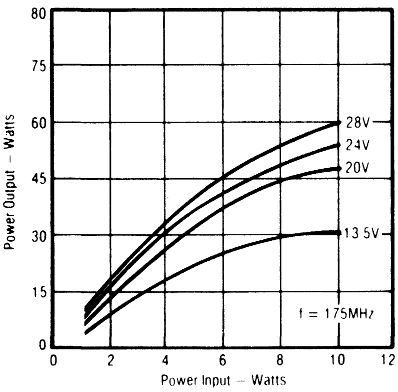


Safe Operating Area

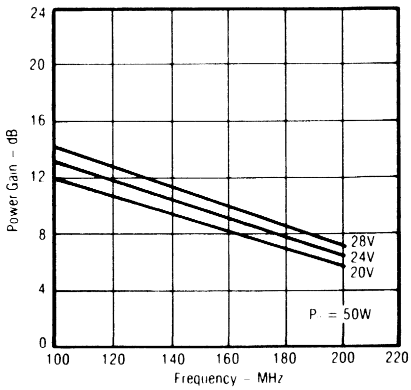


PT 9733 — 50 Watts

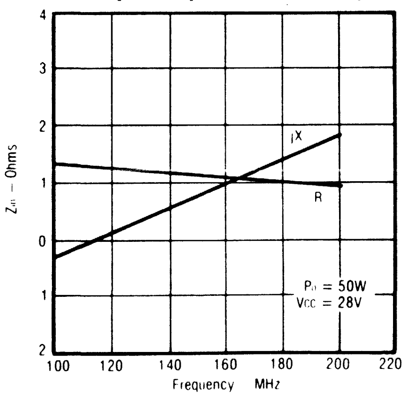
Power Output vs Power Input



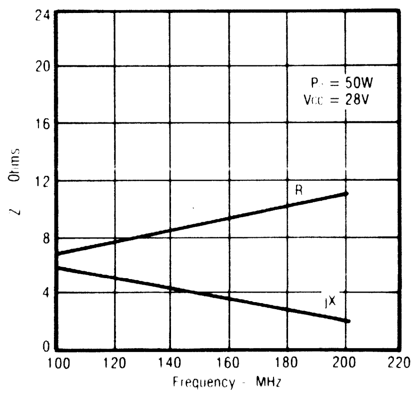
Power Gain vs Frequency



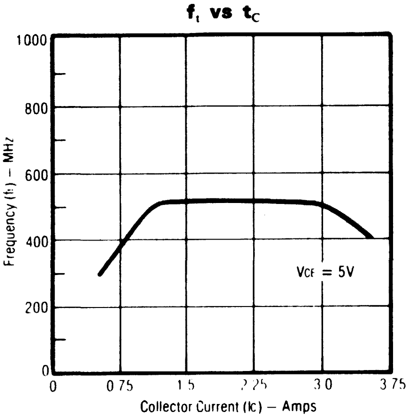
Series Input Impedance vs Frequency



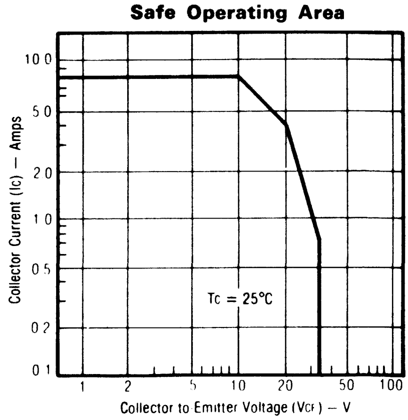
Series Load Impedance vs Frequency



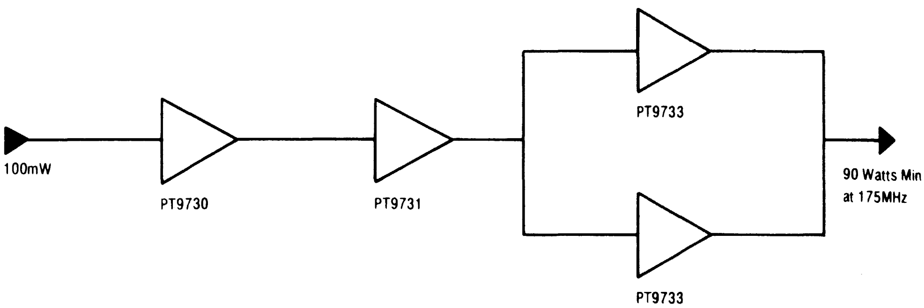
f_t vs t_C



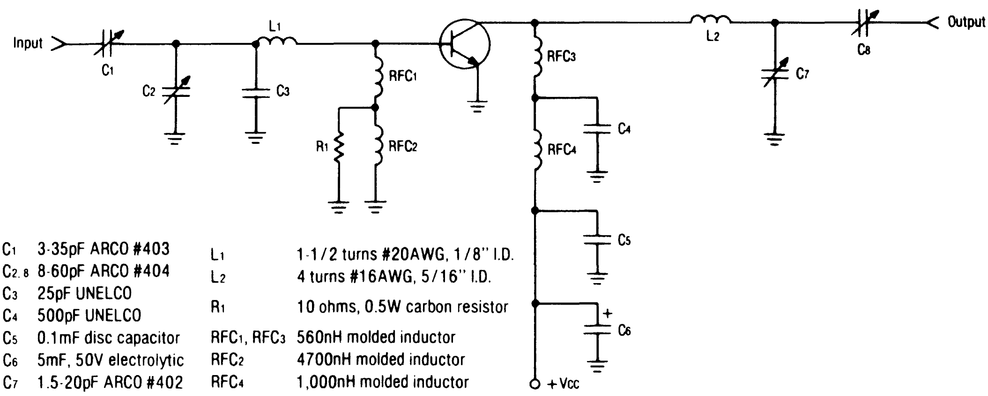
Safe Operating Area



TYPICAL APPLICATION
90 Watt VHF 28 V Power Amplifier

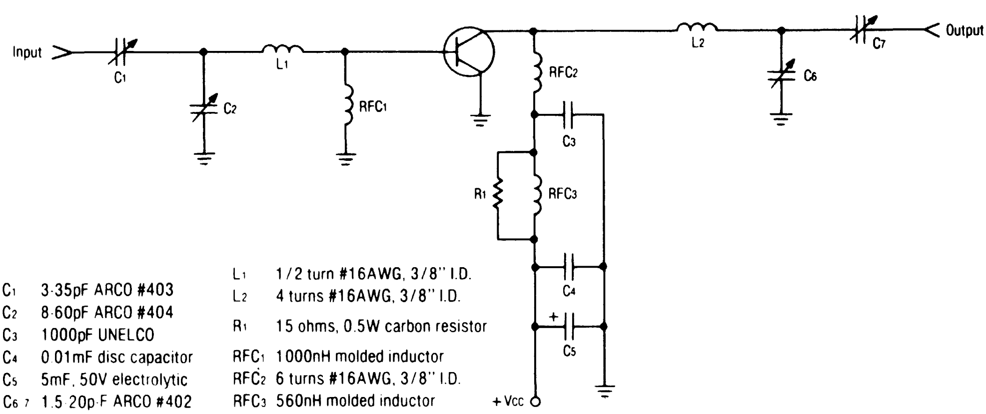


PT 9730 and PT 9732 175 MHz TEST CIRCUIT



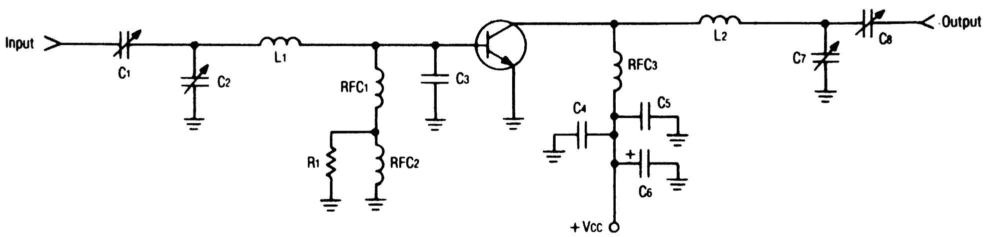
C_1	3-35pF ARCO #403	L_1	1-1/2 turns #20AWG, 1/8" I.D.
$C_{2,8}$	8-60pF ARCO #404	L_2	4 turns #16AWG, 5/16" I.D.
C_3	25pF UNELCO	R_1	10 ohms, 0.5W carbon resistor
C_4	500pF UNELCO	RFC_1, RFC_3	560nH molded inductor
C_5	0.1mF disc capacitor	RFC_2	4700nH molded inductor
C_6	5mF, 50V electrolytic	RFC_4	1,000nH molded inductor
C_7	1.5-20pF ARCO #402		

PT 9734 175 MHz TEST CIRCUIT



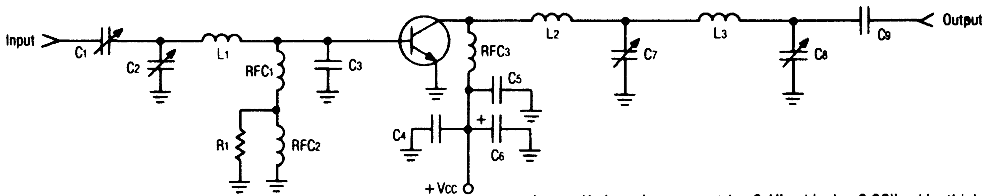
C_1	3-35pF ARCO #403	L_1	1/2 turn #16AWG, 3/8" I.D.
C_2	8-60pF ARCO #404	L_2	4 turns #16AWG, 3/8" I.D.
C_3	1000pF UNELCO	R_1	15 ohms, 0.5W carbon resistor
C_4	0.01mF disc capacitor	RFC_1	1000nH molded inductor
C_5	5mF, 50V electrolytic	RFC_2	6 turns #16AWG, 3/8" I.D.
$C_{6,7}$	1.5-20p-F ARCO #402	RFC_3	560nH molded inductor

PT 9731 175 MHz TEST CIRCUIT

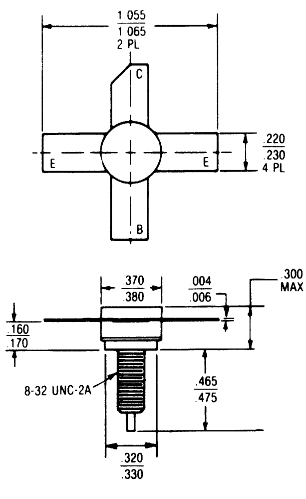


$C_{1,8}$	7-100pF ARCO #423
C_2	8-60pF ARCO #404
C_3	90pF UNELCO
C_4	1000pF UNELCO
C_5	0.1mF disc capacitor
C_6	5mF, 50V electrolytic
C_7	5-80pF ARCO #462
L_1	2 turns, 0.1" wide by 0.02" thick copper strip, 1/4" I.D.
L_2	4 turns, 0.1" wide by 0.02" thick copper strip, 1/4" I.D.
R_1	10 ohms, 0.5W carbon resistor
RFC_1	150nH molded inductor
RFC_2	10,000nH molded inductor
RFC_3	4 turns #16AWG, 5/16" I.D.

PT 9733 175 MHz TEST CIRCUIT



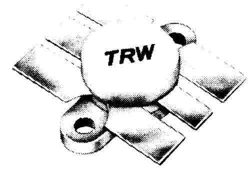
$C_{1,2,8}$	8-60pF ARCO #404
C_3	150pF UNELCO
C_4	500pF UNELCO
C_5	0.1mF disc capacitor
C_6	5mF, 50V electrolytic
C_7	5-80pF ARCO #462
C_9	0.001mF disc capacitor
L_1	1 turn, 0.1" wide by 0.02" thick copper strip, 5/16" I.D.
L_2	U-shaped copper strip, 0.1" wide by 0.02" wide thick, 0.25" high by 0.675" long
L_3	1-1/2 turns, 0.1" wide by 0.02" thick copper strip, 5/16" I.D.
R_1	10 ohms, 0.5W carbon resistor
RFC_1	150nH molded inductor
RFC_2	10,000nH molded inductor
RFC_3	4 turns #16AWG, 5/16" I.D.



.380 SOE

VHF Power Transistors

- **100 Watts**
- **28 Vcc**
- **100-180 MHz**
- **Internally Matched**
- **Gold Metalized**
- **Diffused Ballast Resistors**
- **Common Emitter**
- **Isolated Package**
- **Low Thermal Resistance**
- **Class B or C Operation**

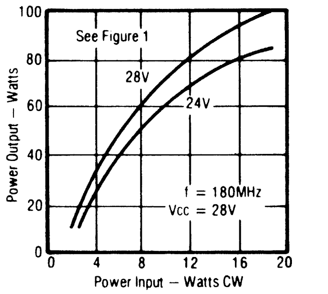


.500 J0

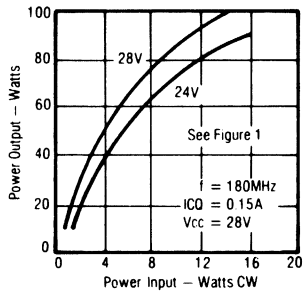
Electrical Characteristics (T_{FLANGE} = 25°C)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 5mA, I_C = 0	4			V
BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 100mA, V_{BE} = 0	60			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA, I_B = 0	35			V
I_{CES}	Collector-Emitter Cutoff Current	V_{CE} = 25V			10	mA
H_{FE}	DC Current Gain	I_C = 1A, V_{CE} = 10V	20		150	—
P_{GAIN}	Power Gain	V_{CE} = 28V, P_{IN} = 20W f = 175 MHz	100			W
η	Collector Efficiency	V_{CE} = 28V, P_{OUT} = 100W f = 175 MHz		60		%
VSWR	Mismatch Tolerance	All Phase Angles V_{CE} = 28V, f = 175 MHz P_{OUT} = 100W	3:1			
P_{SAT}	Saturated Power Output	V_{CE} = 28V, f = 175 MHz	125			W
C_{OB}	Collector-Base Capacitance	V_{CB} = 28V, f = 1 MHz I_E = 0			200	pF
I_C	Continuous Collector Current				12	A
Θ_{J-C}	Thermal Resistance	T_C = 25°C			0.88	°C/W
T_{STG}	Storage Temperature		−65°		150	°C
T_J	Junction Temperature				200	°C
P_D	Power Dissipation	T_C = 25°C	150			W

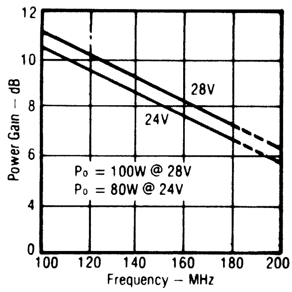
Class C Narrowband Power Input vs Power Output



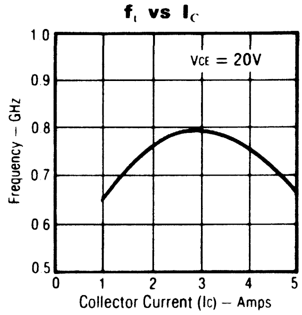
Class B Narrowband Power Input vs Power Output



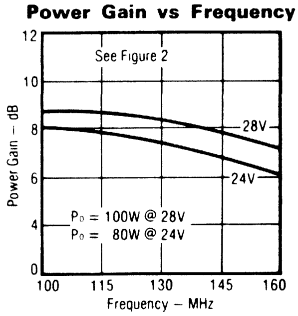
Class C Narrowband Power Gain vs Frequency



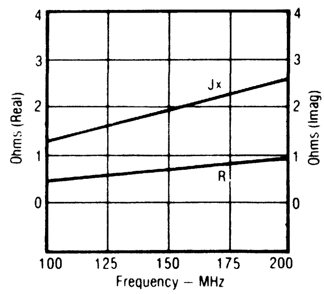
Narrowband f_t vs I_C



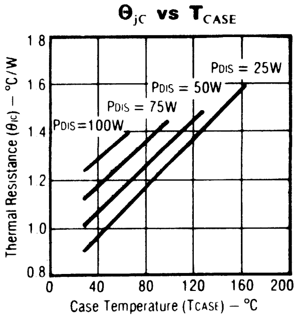
Broadband Power Gain vs Frequency



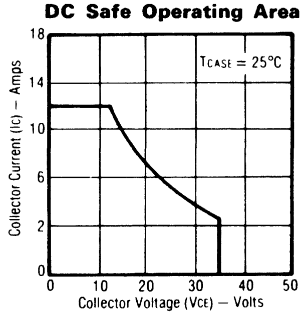
Series Input Impedance vs Frequency

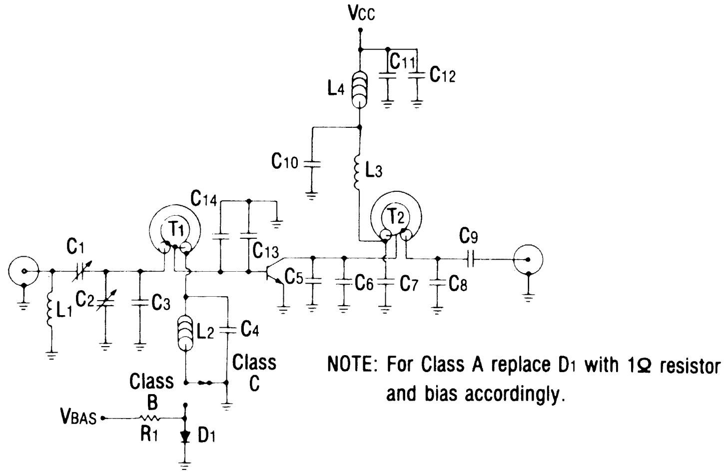


Θ_{jC} vs T_{CASE}



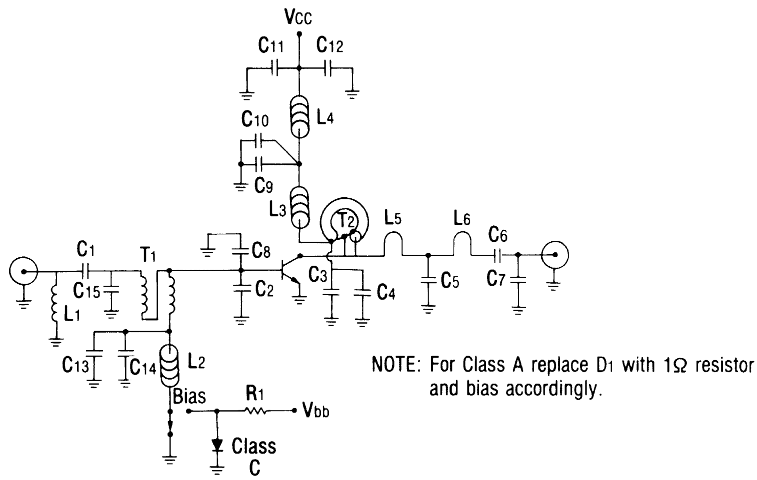
DC Safe Operating Area





C_1	8-60 pF ARCO	C_{13}	350 pF UNELCO
C_2	3-35 pF ARCO	C_{14}	300 pF UNELCO
C_3	30 pF UNELCO	D_1	DSR 5050
$C_{4,7,9,10,11}$	1000 pF UNELCO	L_1	5 turns, 0.125" diameter # 22 AWG
C_5	110 pF UNELCO	$L_{2,4}$	3 Ferrite beads
C_6	120 pF UNELCO	R_1	12 Ω
C_8	40 pF UNELCO	T_1	0.075" diameter semiridged 10 Ω co-ax
C_{12}	25 μF Electrolytic	T_2	0.075" diameter semiridged 25 Ω co-ax

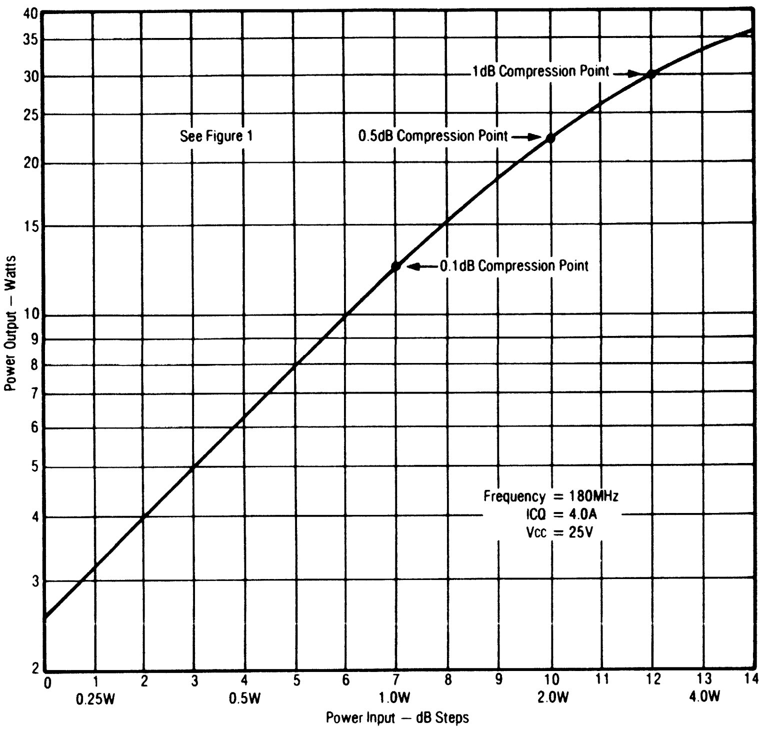
Figure 1. JO 1006 NARROWBAND TEST CIRCUIT (100-180 MHz)



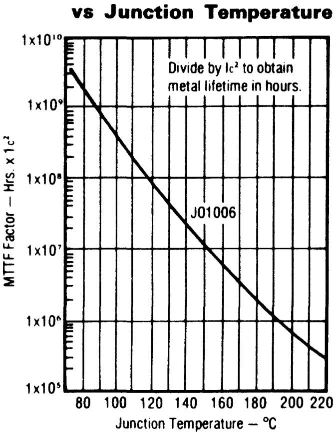
C_1	50 pF UNELCO	L_1	4 turns, 0.125" diameter # 22 AWG
C_2	350 pF UNELCO	$L_{2,3,4}$	3 Ferrite Beads on # 22 AWG
$C_{3,6,9,12,14}$	1000 pF UNELCO	L_5	0.08" wide ribbon, 0.25" long
$C_{4,10,13}$	0.1 μF disc	L_6	0.08" wide ribbon, 0.125" long
$C_{5,15}$	30 pF UNELCO	R_1	50 Ω
C_7	0-18 pF # 402 ARCO	T_1	1" long twisted pair # 22 AWG
C_8	300 pF UNELCO	T_2	0.075" diameter semiridged 25 Ω co-ax, 2" long (Balun transformer)
C_{11}	100 μF Electrolytic		
D_1	DSR 5050		

Figure 2. JO 1006 BROADBAND TEST CIRCUIT (100-160 MHz)

Class A Narrowband Power Input vs Power Output



MTTF Factor vs Junction Temperature



Where :

P_o = 100 W
η_C = 60 %
G_T = 7 dB
T_{CASE} = 45 °C
θ_{jC} = 1.25
V_{CE} = 28 V
P_{DIS} = 87 W
T_j = 150 °C

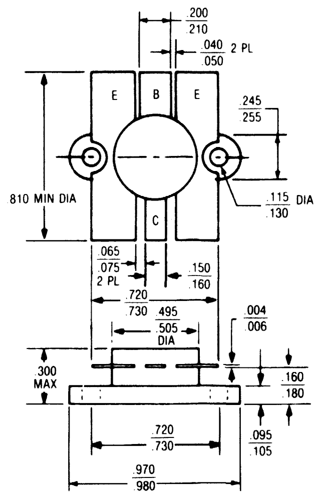
MTTF Factor = $(1 \times 10^7 \text{ hrs})\ (\text{amp}^2)$

$$\text{MTTF (hr)} = \frac{(1 \times 10^7 \text{ hrs})\ (\text{amp}^2)}{(5.95 \text{ amp})^2}$$

$= 2.8 \times 10^5$ hrs

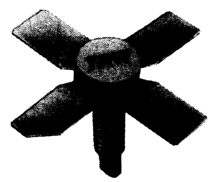
= 32 yrs

.500 J0 Package Outline



UHF Power Transistors

- **1.5 to 30 Watts**
- **28 V_{CC}**
- **400 MHz**
- **Gold Metalized**
- **Diffused Ballast Resistors**
- **Class A, AB or C Operation**
- **Common Emitter**
- **Isolated Package**
- **∞ VSWR**



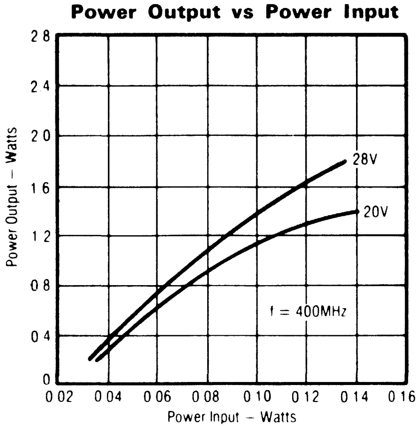
.280 SOE

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

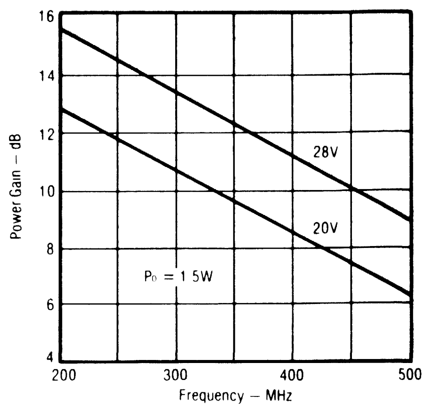
SYMBOL	CHARACTERISTICS	TEST CONDITIONS	PT 9700	PT 9701B	PT 9703B	PT 9702B	PT 9704B	UNIT
BV_{EBO}	Min. Emitter-Base Breakdown	I_E = 0.1mA, I_C = 0 I_E = 0.5mA, I_C = 0 I_E = 1mA, I_C = 0 I_E = 2mA, I_C = 0 I_E = 3mA, I_C = 0	3.5	4	4	4	4	V
BV_{CES}	Min. Collector-Emitter Breakdown	I_C = 1mA, V_{BE} = 0 I_C = 5mA, V_{BE} = 0 I_C = 10mA, V_{BE} = 0 I_C = 20mA, V_{BE} = 0 I_C = 30mA, V_{BE} = 0	55	60	60	60	60	V
BV_{CEO}	Min. Collector-Emitter Breakdown	I_C = 2.0mA, I_B = 0 I_C = 5mA, I_B = 0 I_C = 10mA, I_B = 0 I_C = 20mA, I_B = 0 I_C = 30mA, I_B = 0	35	30	30	30	30	V
I_{CBO}	Max. Collector-Base Leakage Current	V_{CB} = 30V	0.25	0.5	1.0	2.0	3.0	mA
H_{FE}	Min. D.C. Current Gain	I_C = 0.1A, V_{CE} = 5V	20-150	10-150	10-150	10-150	10-150	—
P_{GAIN}	Min. Power Gain	V_{CE} = 28V, P_{IN} = 0.12W P_{IN} = 0.62W P_{IN} = 1.5W f = 400 MHz, P_{IN} = 4W P_{IN} = 6W	1.5	5	10	20	30	W
η	Min. Collector Efficiency	V_{CE} = 28V, f = 400 MHz Rated Output Power	55	55	60	60	60	%
VSWR	Mismatch Tolerance	V_{CE} = 28V, f = 400 MHz 360° Rated Output Power	∞	∞	∞	∞	∞	
P_{SAT}	Min. Saturated Power Output	V_{CE} = 28V, f = 400 MHz	2	6	12	24	36	W
C_{OB}	Max. Collector-Base Capacitance	V_{CB} = 28V, f = 1 MHz I_E = 0	3.5	6	12	24	36	pF
I_C	Continuous Collector Current (Max. Rating)		0.5	0.75	1.25	2	5	A
$\Theta_{J\text{-}C}$	Thermal Resistance	T_C = 25°C	35	17.5	8.8	4.4	2.5	°C/W
T_{STG}	Storage Temperature		−65 to +150					°C
T_J	Junction Temperature		+200° Maximum					°C
P_D	Power Dissipation	T_C = 25°C	5	10	20	40	70	W

PT9700 — 1.5 Watts

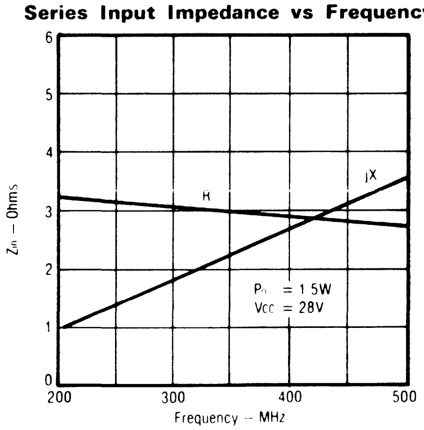
Power Output vs Power Input



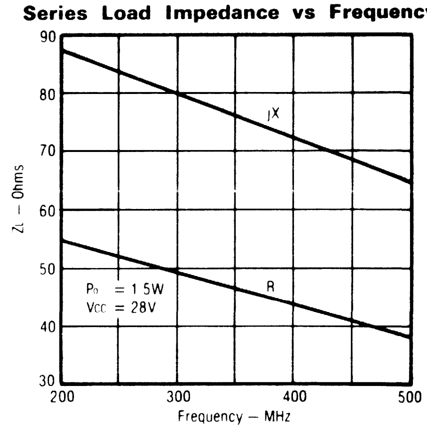
Power Gain vs Frequency



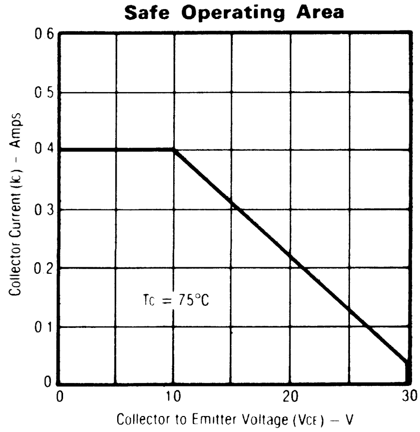
Series Input Impedance vs Frequency



Series Load Impedance vs Frequency

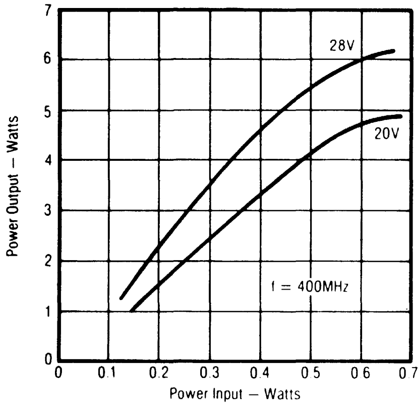


Safe Operating Area

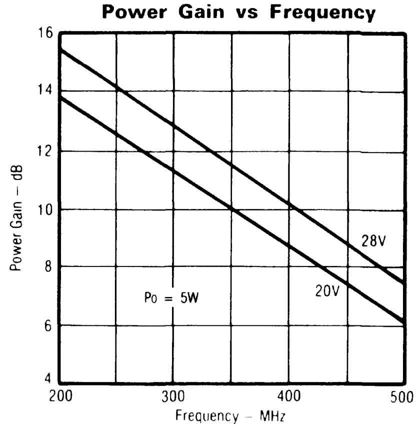


PT9701B — 5 Watts

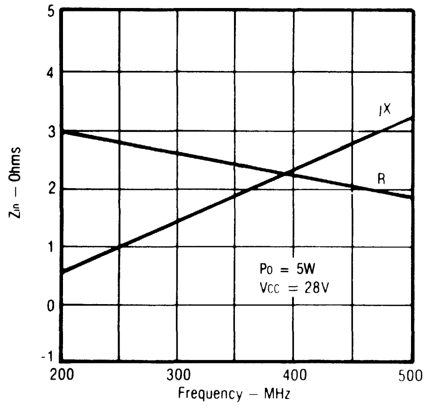
Power Output vs Power Input



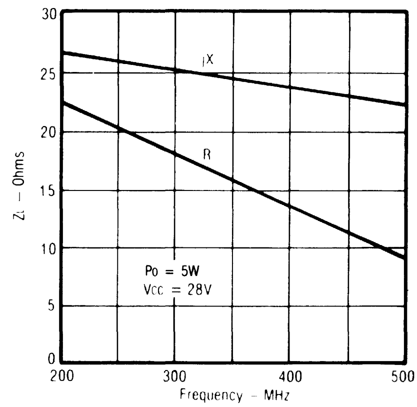
Power Gain vs Frequency



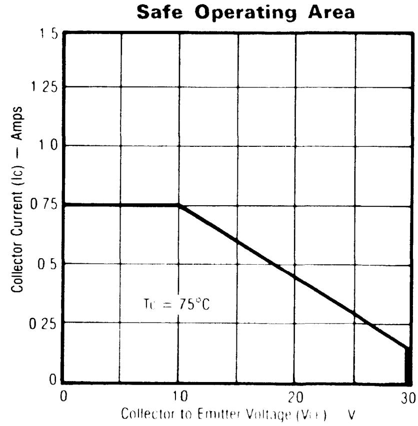
Series Input Impedance vs Frequency



Series Load Impedance vs Frequency

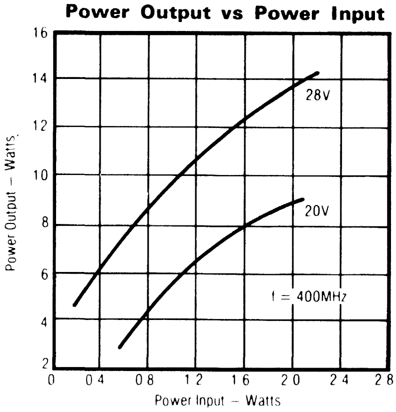


Safe Operating Area

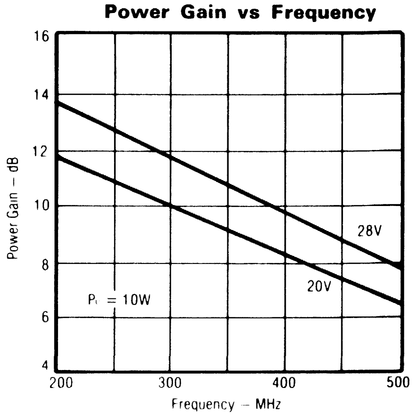


PT9703B — 10 Watts

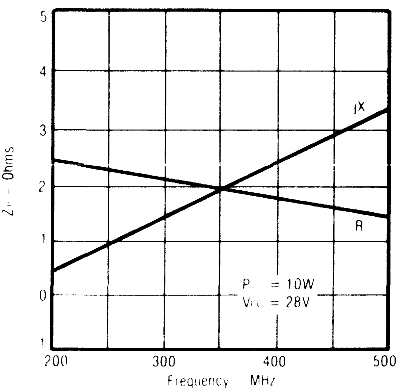
Power Output vs Power Input



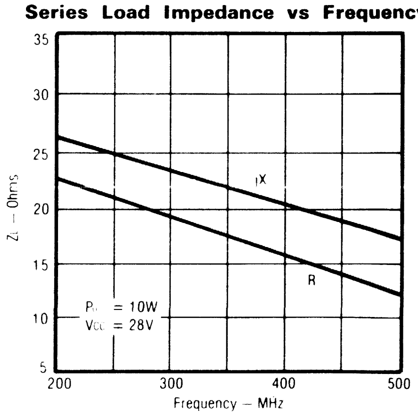
Power Gain vs Frequency



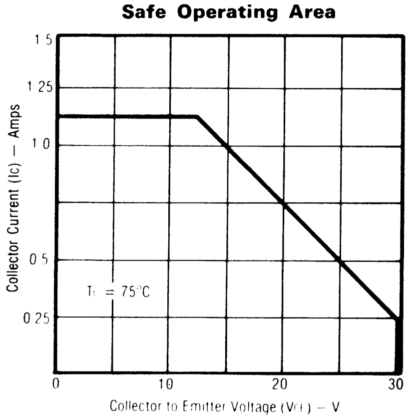
Series Input Impedance vs Frequency



Series Load Impedance vs Frequency

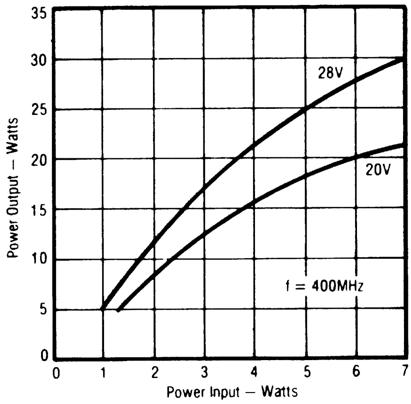


Safe Operating Area

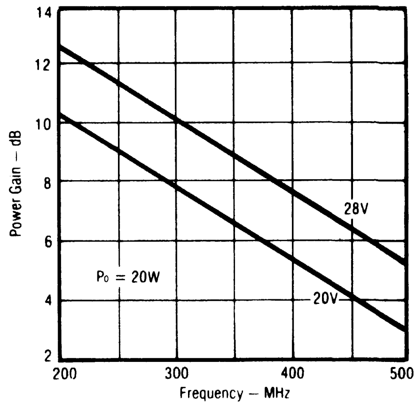


PT9702B — 20 Watts

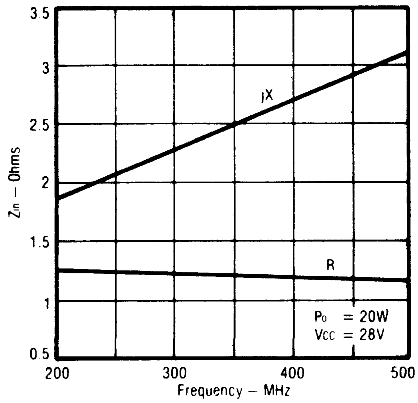
Power Output vs Power Input



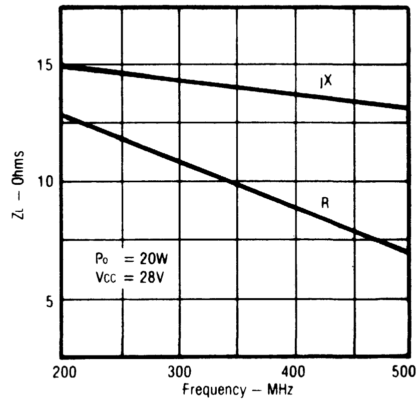
Power Gain vs Frequency



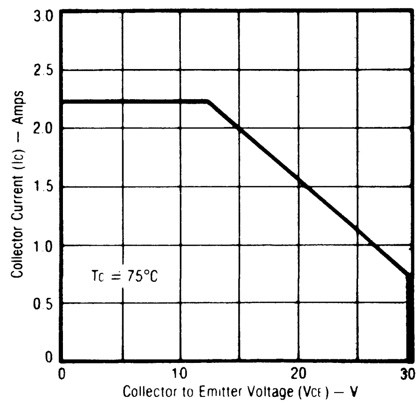
Series Input Impedance vs Frequency



Series Load Impedance vs Frequency

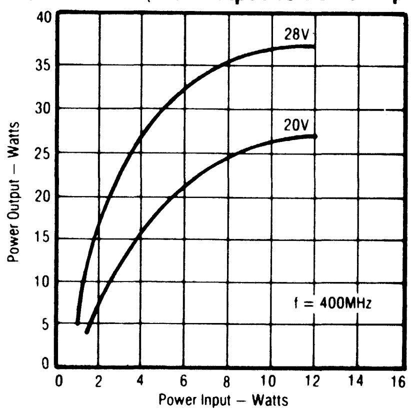


Safe Operating Area

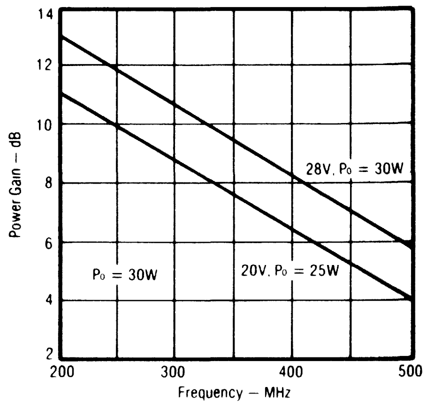


PT9704B — 30 Watts

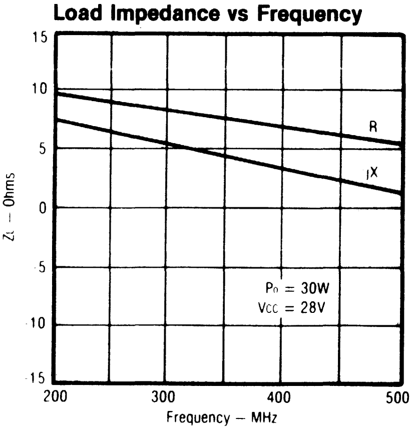
PT9704 B Power Output vs Power Input



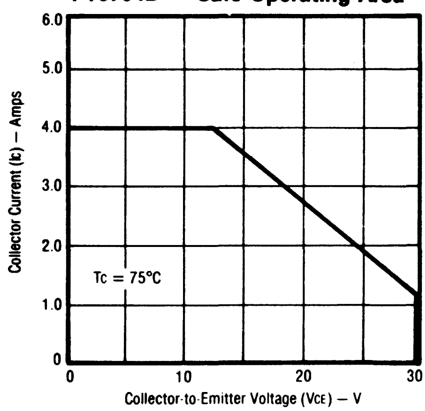
PT9704 B Power Gain vs Frequency



PT9704 B Series
Load Impedance vs Frequency

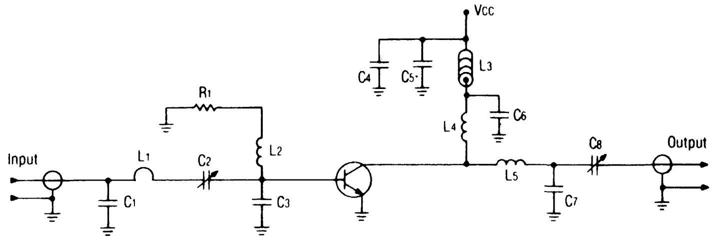


PT9704B — Safe Operating Area



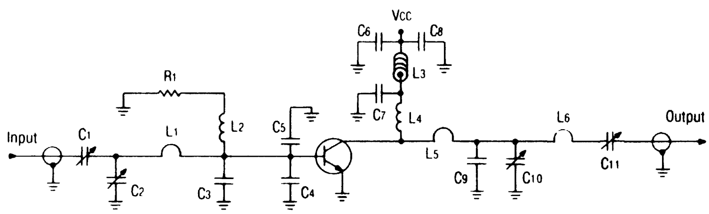
PT9700, 400 MHz TEST CIRCUIT

$C_{1,7,8}$ 0.9-7pF ARCO #400
C_2 3-35pF ARCO #403
C_3 30pF UNELCO
$C_{4,6}$ 1000pF UNELCO
C_5 1000µF electrolytic
L_1 1 loop #22AWG, 3/4"
$L_{2,5}$ 4 turns #22AWG, 0.1" I.D.
L_3 3 Ferrite beads
L_4 6 turns #22AWG, 0.1" I.D.
R_1 1 ohm, 1/4 watt carbon resistor



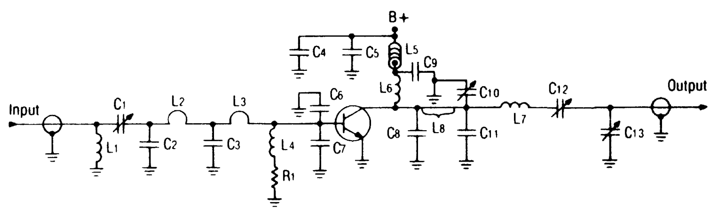
PT9701B and PT9703B, 400 MHz TEST CIRCUIT

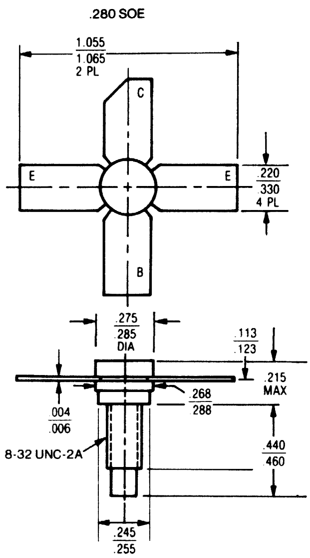
C_1 3-35pF ARCO #403
$C_{2,10}$ 0.9-7pF ARCO #400
$C_{3,9}$ 10pF UNELCO
$C_{4,5}$ 30pF UNELCO
$C_{6,7}$ 1000pF UNELCO
C_8 100µF electrolytic
C_{11} 0-18pF ARCO #402
L_1 #22AWG, 1/2"
L_2 4 turns #22AWG, 0.1" I.D.
L_3 3 Ferrite beads
L_4 2 turns #22AWG, 0.1" I.D.
L_5 #22AWG, 0.5" hairpin
L_6 3 turns #22AWG, 0.1" I.D.
R_1 1 ohm, 1/4 watt carbon resistor



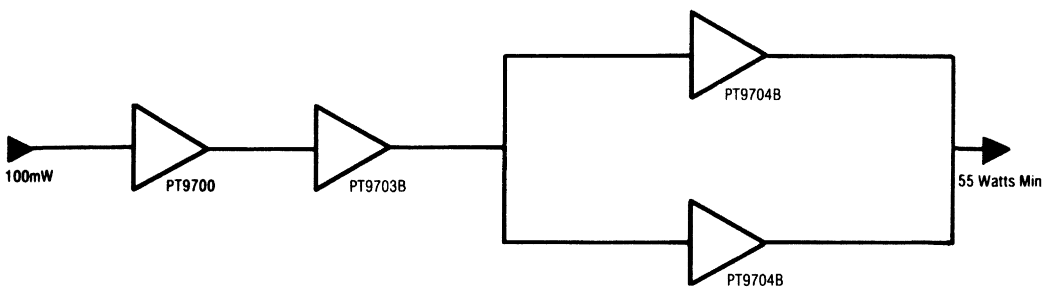
PT9702B and PT9704B, 400 MHz TEST CIRCUIT

$C_{1,12}$ 1.5-20pF ARCO #402
C_2 15pF UNELCO
$C_{3,6,7}$ 30pF UNELCO
$C_{4,9}$ 1000pF UNELCO
C_5 100µF electrolytic
C_8 35pF UNELCO
$C_{10,13}$ 0.9-7pF ARCO #400
C_{11} 10pF UNELCO
L_1 6 turns #22AWG, 1/8" I.D.
L_2 #22AWG, 3/8" hairpin
L_3 1/8" by 1/4" strap
L_4 2 turns on resistor lead
L_5 3 Ferrite beads
$L_{6,7}$ 2 turns #22AWG, 1/8" I.D.
L_8 #22AWG, 0.3"
R_1 1 ohm, 1/2 watt carbon resistor



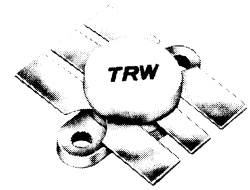


Typical Application
55 Watt UHF 28 V Power Amplifier
225-400 MHz



UHF Power Transistors

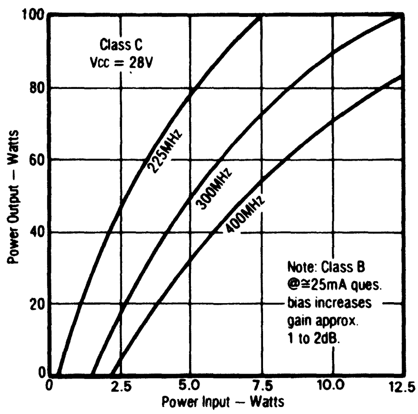
- 70 Watts
- 28 Vcc
- 225-400 MHz
- Internally Matched
- Gold Metalized
- Diffused Ballast Resistors
- Low Thermal Resistance
- Common Emitter
- Isolated Package
- RF Gain Matching



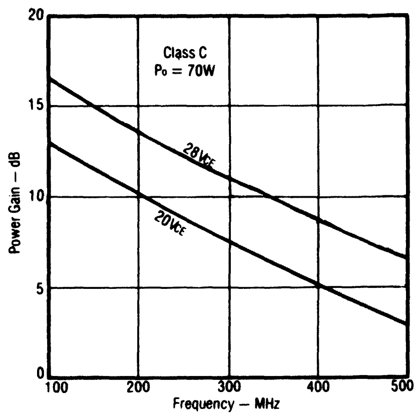
.500 J0

	SYMBOL	CHARACTERISTICS	CONDITION	VALUE
DC TESTS	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 100 mA	65 Vdc Min
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 5.0 mA	3.5 Vdc Min
	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50 mA	30 Vdc Min
	VSWR	Mismatch Tolerance	V_{CE} = 28 V, f = 400 MHz, P_o = 70 W	3:1 (All Angles)
	C_{ob}	Collector-Base Capacitance	V_{CB} = 28 V, f = 1 MHz	80 pF Max
	h_{FE}	DC Current Gain	V_{CE} = 10 V, I_C = 1 A	10-100
RF TESTS	P_{gain}	Power Gain, CW Broadband	V_{CE} = 28 V, P_o = 70 W f = 225-400 MHz	8.4 dB Min
	P_{sat}	Saturated Power Output	V_{CE} = 28 V, f = 400 MHz	85 W Min
	η	Narrowband Collector Efficiency	V_{CE} = 28, f = 400 MHz, P_o = 70 W	55 % Min
OPERATING	T_{stg}	Max Storage Temperature		−65°C to +150°C
	θ_{jC}	Thermal Resistance	25 °C	1.25 °C/W
	I_C	Continuous Collector Current	V_{CE} = 10 V	10 A Max

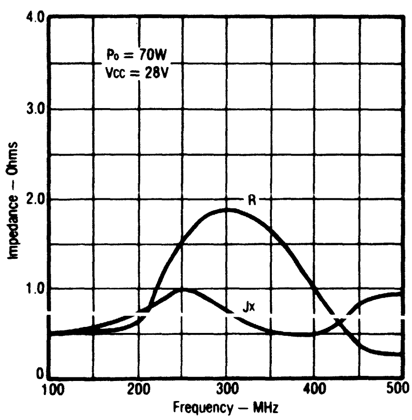
Power Output vs Power Input



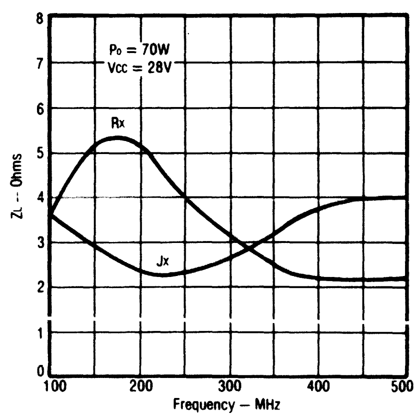
Power Gain vs Frequency



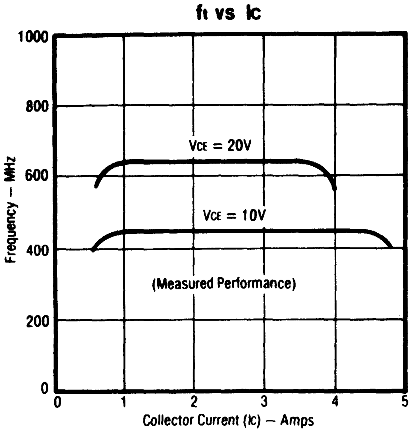
Series Input Impedance vs Frequency



Series Load Impedance vs Frequency



ft vs Ic



Safe Operating Area

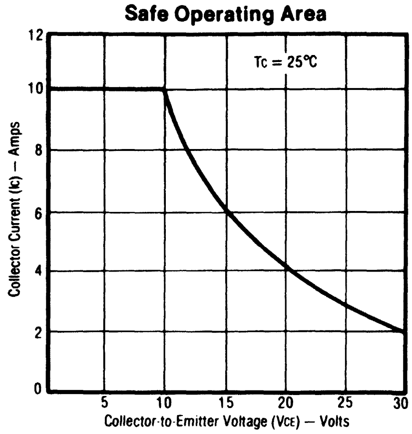
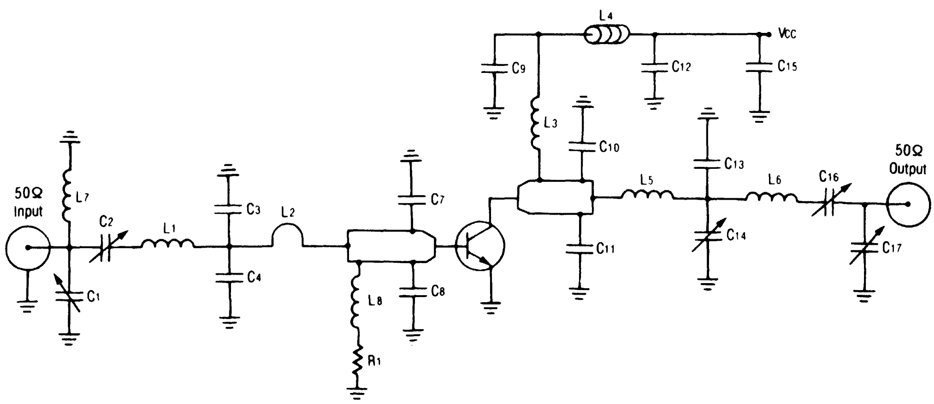


Figure 1. Narrowband Test Circuit



$C_{1,2,14,17}$	1.5-20pF ARCO #402	L_1	2 turns #22AWG, 0.1" form
$C_{3,4}$	10pF UNELCO	L_2	0.2" hairpin, 0.1" wide ribbon
$C_{7,8}$	60pF UNELCO	L_3	#22AWG, 1" diameter
$C_{10,11}$	40pF UNELCO	L_4	3 Ferrite beads on #22AWG
C_{13}	15pF UNELCO	L_5	#22AWG, 0.25" hairpin
$C_{9,12}$	1000pF UNELCO	L_6	1 turn #22AWG, 0.1" form
C_{15}	5μF electrolytic	L_7	6 turns #22AWG, 0.1" form
C_{16}	8-60pF ARCO #404	L_8	8 turns #22AWG, 0.1" form

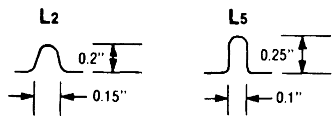
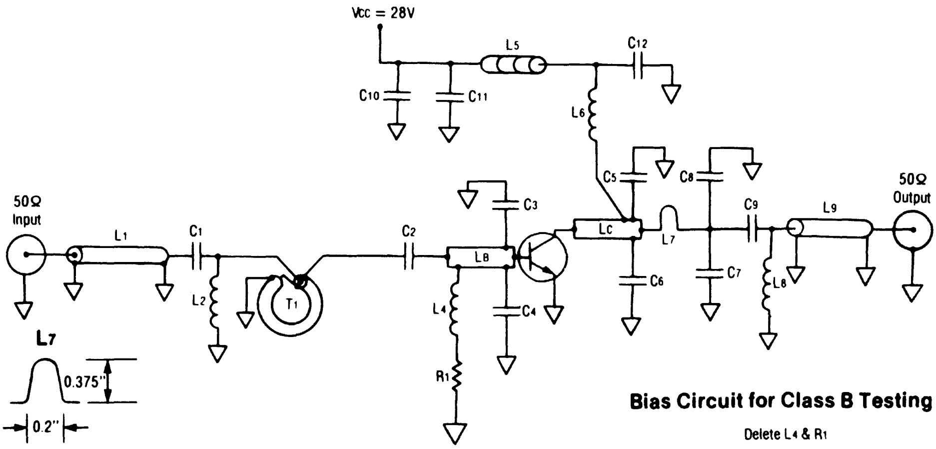
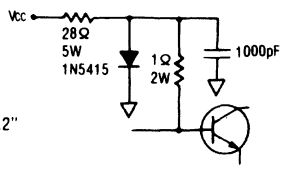


Figure 2. 70 Watt Broadband Test Circuit (225-400MHz)



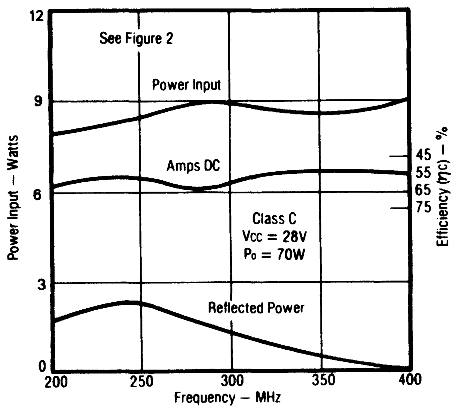
Bias Circuit for Class B Testing

Delete L_4 & R_1

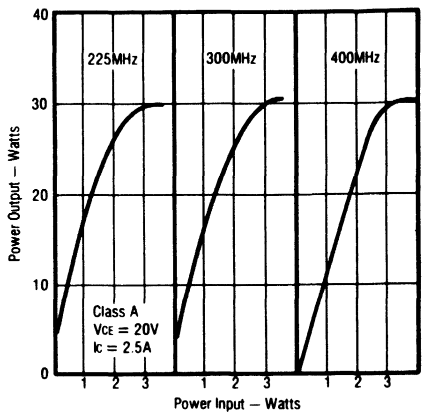


C_1	20pF JFD	$L_{2,4}$	4 turns #20AWG, 0.125" form
C_2	68pF JFD	L_5	3 Ferrite beads
$C_{3,4}$	60pF UNELCO	L_6	#20AWG, 1" diameter.
$C_{5,6}$	40pF UNELCO	L_7	3/8" hairpin
$C_{7,9}$	15pF UNELCO	L_8	3 turns #20AWG, 0.125" form
C_8	10pF UNELCO	L_B	Base Inductance Pad, 0.5" x 0.2"
C_{10}	5μF electrolytic	L_C	Collector Inductance Pad, 0.5" x 0.2"
$C_{11,12}$	1000pF UNELCO	R_1	0.5Ω, 1W
$L_{1,9}$	50Ω semirigid (length to suit circuit)	T_1	1", 25Ω semirigid coax

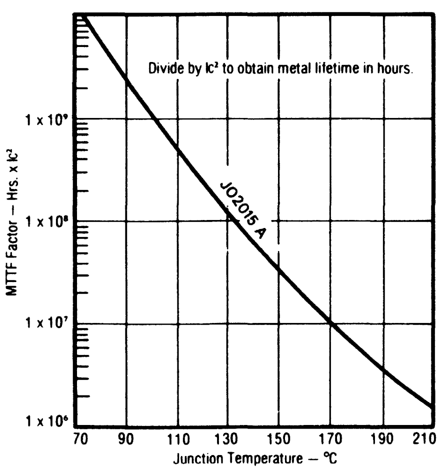
70W Broadband Performance



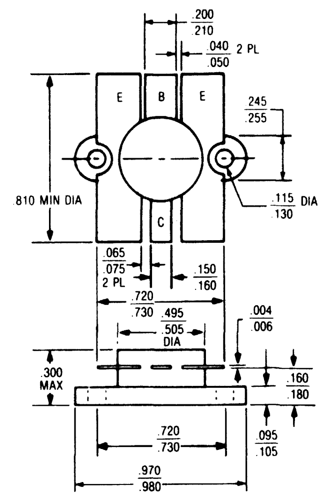
Typical Class A Linear Transfer Characteristics



MTTF Factor vs Tj



.500 JO Package Outline

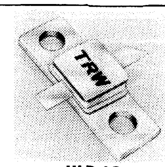


TRW

JO 2058

High Power UHF Pulse Transistor

- **100 Watts (Pulse)**
- **75 Watts (CW)**
- **Low θ_{JC}**
- **.88°C/W**



HLP-12

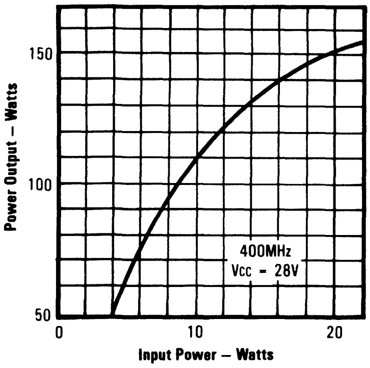
The JO 2058 Transistor is intended for use in military UHF CW and Pulse RF transmitters. The combination of all-gold metallization with state-of-the-art die technology and an inorganic hermetic seal enables reliable operation in hostile environments. Common base mode operation utilizes the multi-octave bandwidth capability of this device.

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

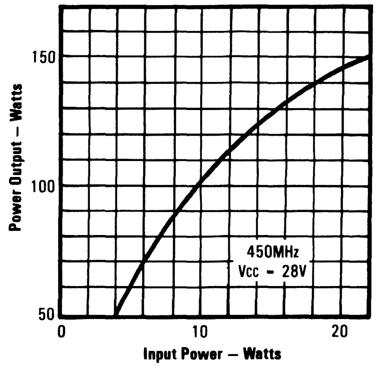
	Symbol	Characteristics	Test Conditions	Min.	Typ.	Max.	Unit
DC TEST	BV_{EBO}	Emitter Base Voltage	I_E = 5mA	3.5			Volts
	BV_{CEO}	Collector Emitter Voltage	I_C = 50mA	30			Volts
	BV_{CES}	Collector Emitter Voltage	I_C = 50mA	60			Volts
	I_{CES}	Collector Emitter Leakage	V_{CE} = 50V			5	mA
RF TEST	P_{OUT}	Power Output (Pulse)	V_{CC} = 28V, f = 450MHz, P_{IN} = 16W, 1msec. 10% Duty Cycle	100			Watts
	η	Efficiency (Pulse)	V_{CC} = 28V, f = 450MHz, P_{OUT} = 100W, 1msec, 10% Duty Cycle	60			%
	$VSWR_L$	Collector Load	V_{CC} = 28V, f = 450HMz, P_{OUT} = 100W, 1msec. 10% Duty Cycle Phase angle varied > 360° during 3-second test.	3:1			–
MAX. RATINGS	θ_{JC}	Thermal Resistance	25°C Flange			0.88	°C/W
	T_J	Junction Temperature				200	°C
	T_{STG}	Storage Temperature		-65		200	°C
	I_C	Collector Current	25°C Flange			14	A
	P_D	Total Dissipation	25°C Flange			200	W

Typical Pulse Characteristics
(1 millisecond pulse-width, 10% duty cycle)

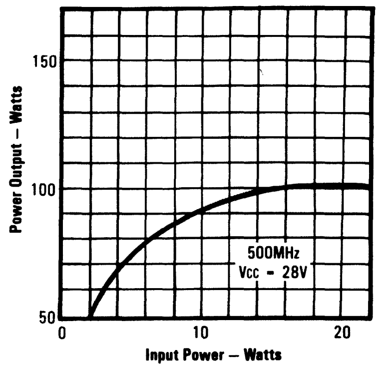
Power Transfer



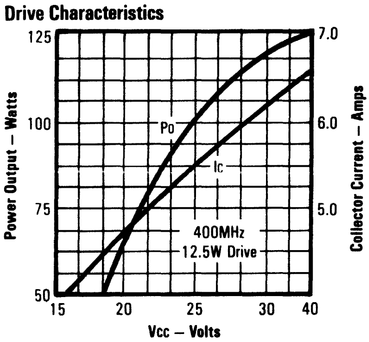
Power Transfer



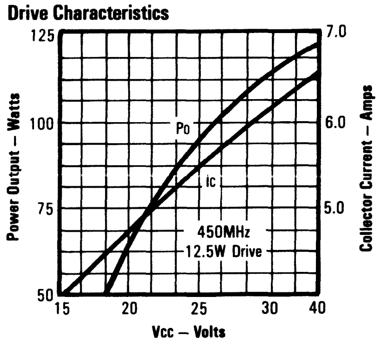
Power Transfer



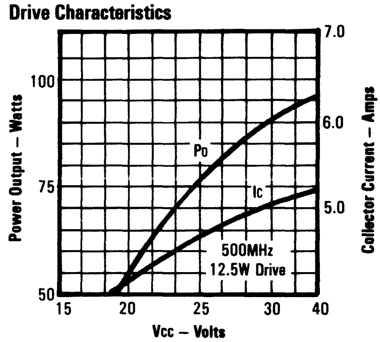
Drive Characteristics



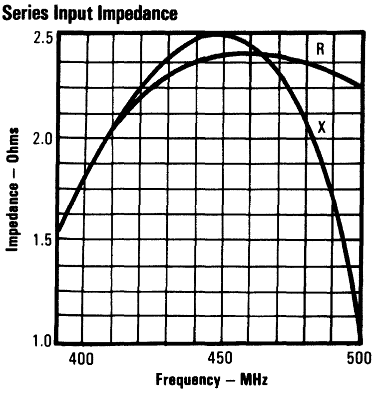
Drive Characteristics



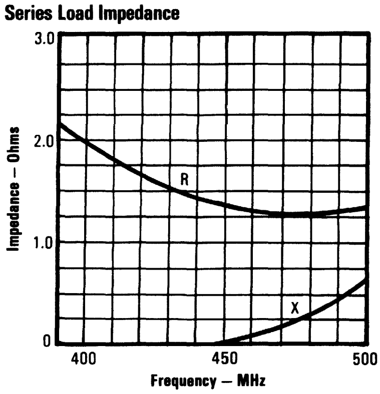
Drive Characteristics



Series Input Impedance

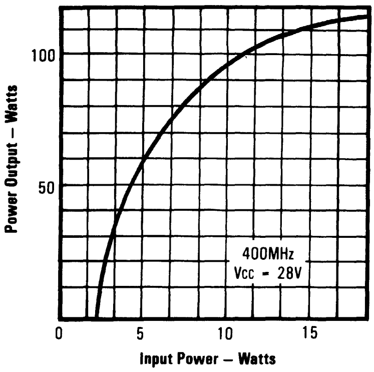


Series Load Impedance

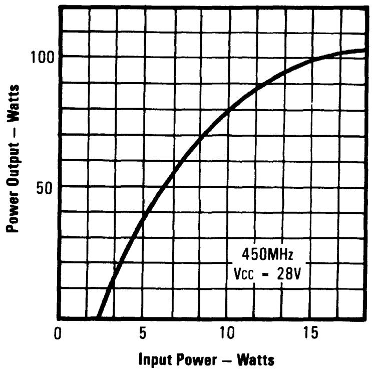


Typical CW (Class C) Characteristics

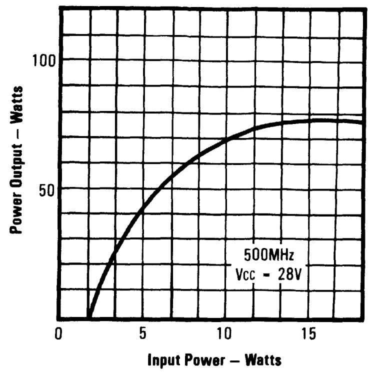
Power Transfer



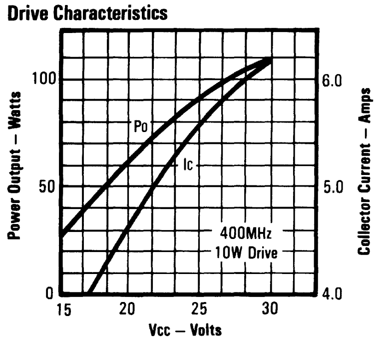
Power Transfer



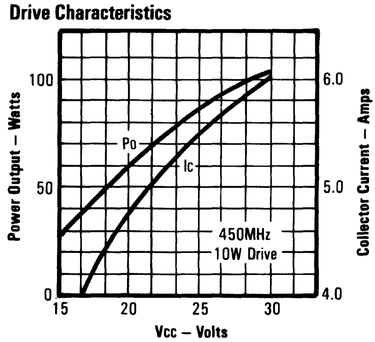
Power Transfer



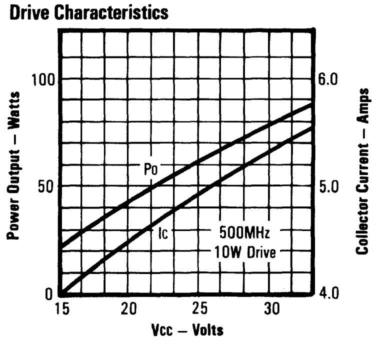
Drive Characteristics



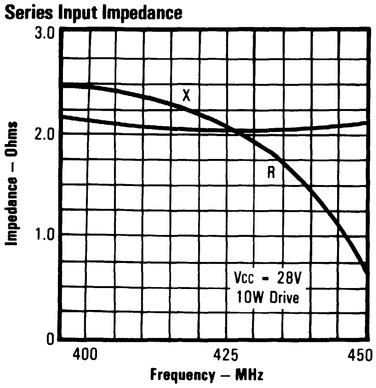
Drive Characteristics



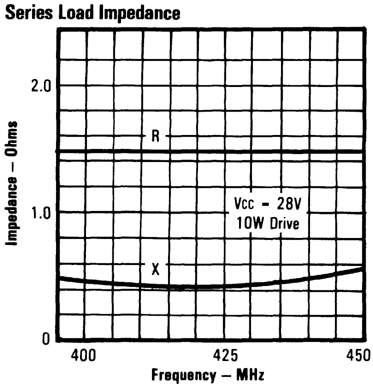
Drive Characteristics



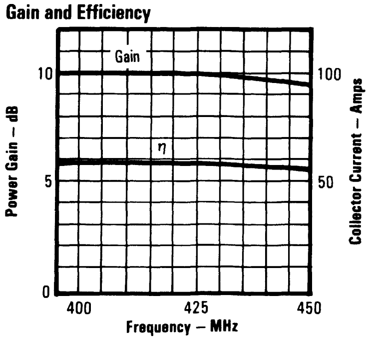
Series Input Impedance



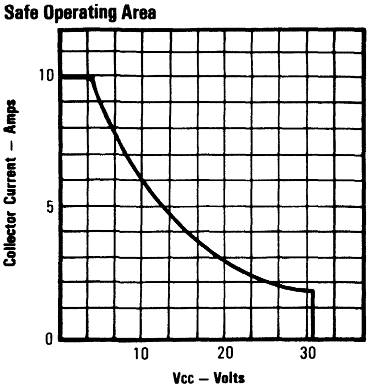
Series Load Impedance



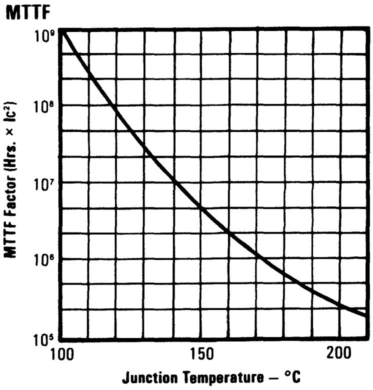
Gain and Efficiency



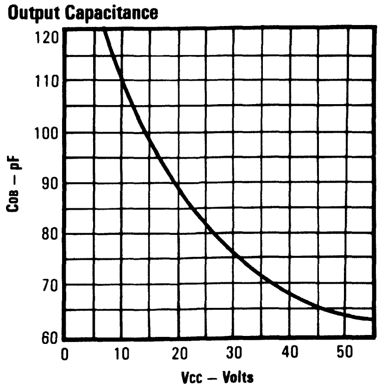
Safe Operating Area



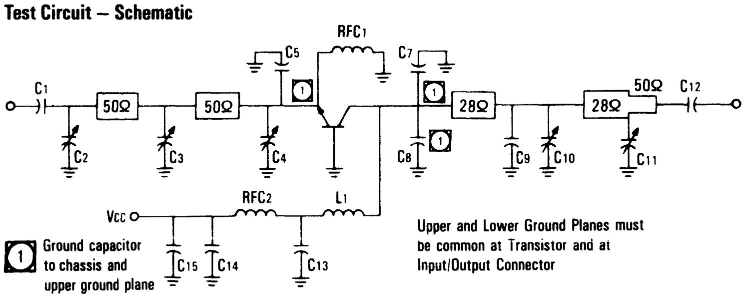
MTTF



Output Capacitance



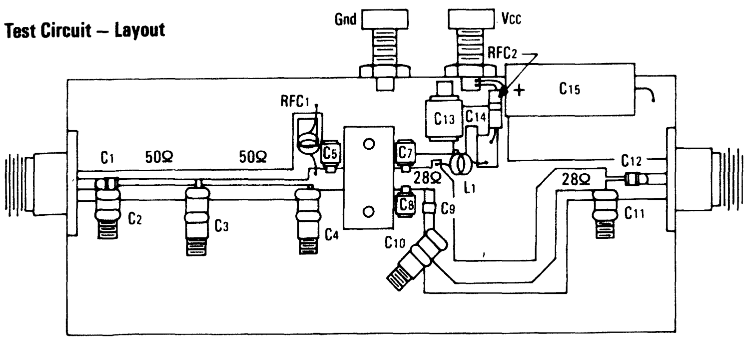
Test Circuit – Schematic



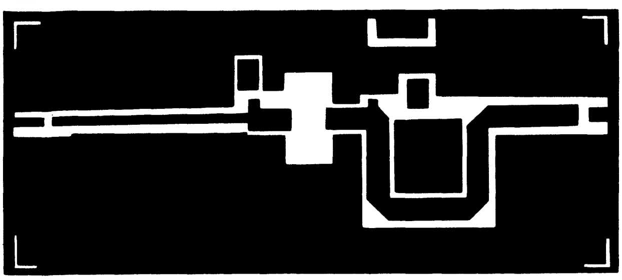
COMPONENTS LIST:

C1, 12	420pF	C14	470pF
C2, 11	0-10pF	C15	100μF 50VDC
C3, 4, 10	0-20pF	RFC1	13T, AWG. 20, 1/4" dia.
C5, 9	33pF	RFC2	3 ferrite beads on AWG. 20 wire.
C7, 8	35pF	L1	3T, #20 AWG., .125 dia.
C13	1000pF	CKT	Brd. Matl. 0.032 Teflon-Glass

Test Circuit – Layout



Test Circuit – Artwork



Circuit is reduced. Contact factory for actual size.

TRW Electronic Components Group

Printed Circuit Division
200 South Turnbull Canyon Road
City of Industry, California 91749
Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
4243 Campus Point Court
San Diego, California 92121
Phone: 714/457-1000

Products: Data converters, arithmetic products, and special processors.

Optoelectronics Division
1201 Tappan Circle
Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

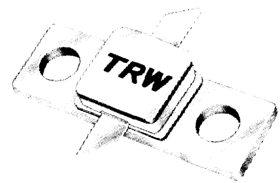
Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

Discrete Microwave Transistors, Common Base

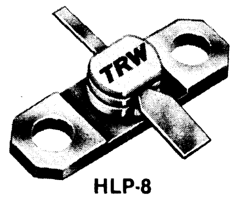
TRW developed the industry's first 100% VSWR tolerant 2 and 3 GHz devices. The units feature gold metalization, diffused ballast resistors and a full MIL hermetic package. Gain and power output margin well above ratings are design features. The units are common base configured and rated for either 28 volt or 20 volt operation depending on part number.

Microwave Power Transistors

- 1 W to 20 W
- ∞ VSWR
- Common Base
- Gold Metalized
- Hermetic
- Characterized to 2.3 GHz
- MTTF Data
- Diffused Ballast Resistors



HLP-11



HLP-8

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

Mechanical Design Specifications

The following are design specifications for this transistor.

Dimensions : Per outline drawing.

Solderability : Per MIL-STD-750.

Marking : Per MIL-S-19500, « TRW », 4-digit date code, type number.

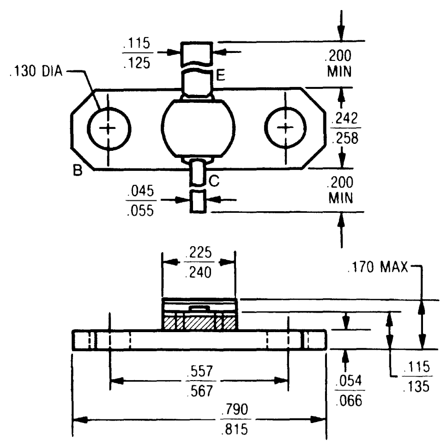
Hermeticity : Per MIL-STD-750, 10^{-7} atmospheres gross and fine leak. (Available on special order screened to 10^{-8} atmospheres.)

Acceleration: Per MIL-STD-750, 20,000 G in any plane.

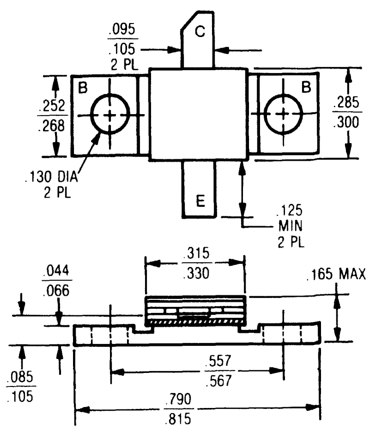
Bond Pull : Per MIL-STD-750, 3 grams min.

Package HLP-11 HLP-8 : A glass-free, brazed ceramic package assuring long-term integrity of hermetic seals. Leads of KOVAR base material with minimum 60 micro-inches of gold plating.

HLP-8, TRW 2001, 2003, 2005 & 2010



HLP-11, TRW 2015 & 2020

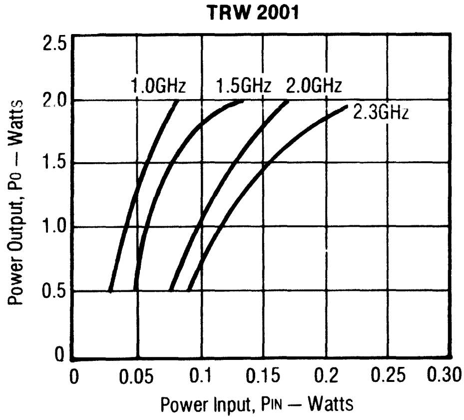


TRW 2001

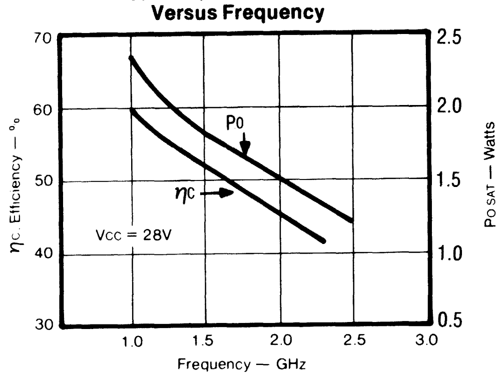
Electrical Characteristics (T_{flange} = 25°C)

Symbol	Characteristic	Conditon	Value
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 10mA	50V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = .2mA	3.5 Min
I_{CBO}	Collector Cutoff Current	V_{CB} = 28V V_{CB} = 45V	500μA 1mA
I_C	Continuous Collector Current (Max)	V_{CE} = 4V	0.250A
h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5V I_C = 100mA	10-120
θ_{JF}	Thermal Resistance (Junction to Flange)	—	28°C/W
C_{OB}	Collector-Base Capacitance (Max)	V_{CB} = 28V	4.0pF
P_O	Power Output @ 2000MHz	P_{in} = 0.125W	1W Min
$P_{O(sat)}$	Power Output @ 2300MHz	V_{CE} = 28Vdc	1.0W (Typ)
	Power Output @ 1500MHz		1.2W (Typ)
	Power Output @ 1000MHz		1.3W (Typ)
P_{gain}	Power Gain (dB) @ 2000MHz	P_O = 1.0W	9dB Min
VSWR	Mismatch Tolerance @ V_{CC} = 28V	P_O = 1.0W f = 2.0GHz	∞
η_C	Collector Efficiency (Min)	P_O = 1.0W f = 2.0GHz	40%
T_J & T_{stg}	Max Junction and Storage Temperatures	-65 to 200°C	

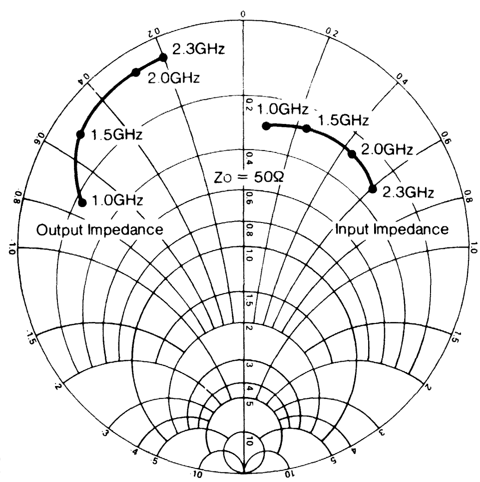
TRW 2001



Typical η_C, Power Output Versus Frequency



Impedance Data
Vcc = 28V



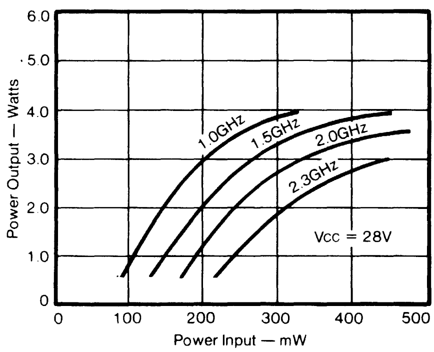
Note: Test circuit details available from TRW Semiconductors.

TRW 2003

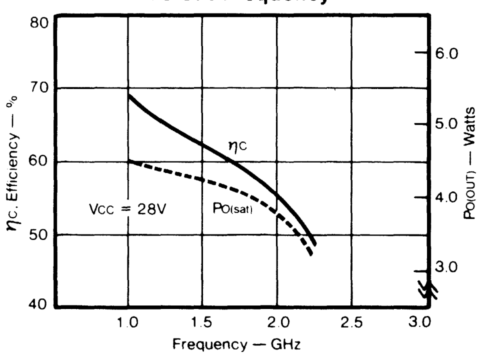
Electrical Characteristics (T_{flange} = 25°C)

Symbol	Characteristic	Conditon	Value
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 20mA	50V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25mA	3.5V Min
I_{CBO}	Collector Cutoff Current	V_{CB} = 28V V_{CB} = 45V	500μA 1mA
I_C	Continuous Collector Current (Max)	V_{CE} = 4V	0.50A
h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5V I_C = 100mA	10-100
θ_{JF}	Thermal Resistance (Junction to Flange)	—	15°C/W
C_{OB}	Collector-Base Capacitance (Max)	V_{CB} = 28V	5.0pF
P_O	Power Output @ 2000MHz	P_{in} = 0.47W	3.0W Min
$P_{O(sat)}$	Power Output @ 2300MHz	V_{CE} = 28Vdc	3.0W (Typ)
	Power Output @ 1500MHz		3.7W (Typ)
	Power Output @ 1000MHz		4.0W (Typ)
P_{gain}	Power Gain (dB) @ 2000MHz	P_O = 3.0W	8dB Min
VSWR	Mismatch Tolerance @ V_{CC} = 28V	P_O = 3.0W f = 2.0GHz	∞
η_C	Collector Efficiency (Min)	P_O = 3.0W f = 2.0GHz	40%
T_J & T_{stg}	Max Junction and Storage Temperatures	-65 to 200°C	

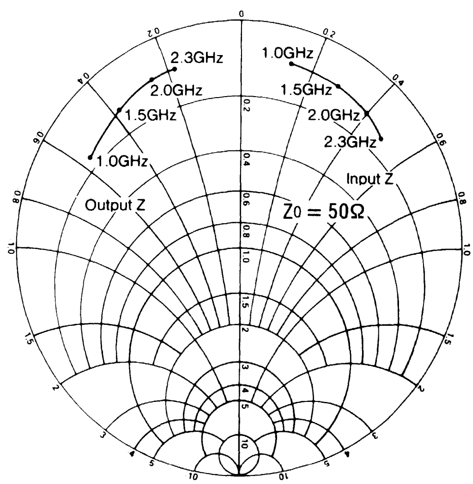
Typical Transfer Characterics Versus Frequency



Typical η_C, Power Output Versus Frequency



Impedance Data Vcc = 28V



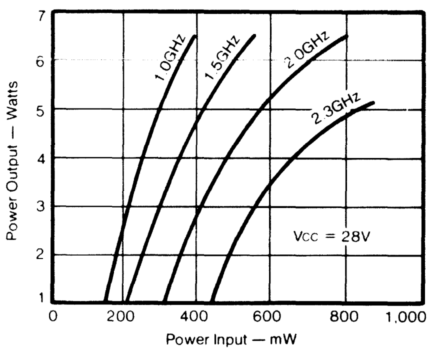
Note: Test circuit details available from TRW Semiconductors.

TRW 2005

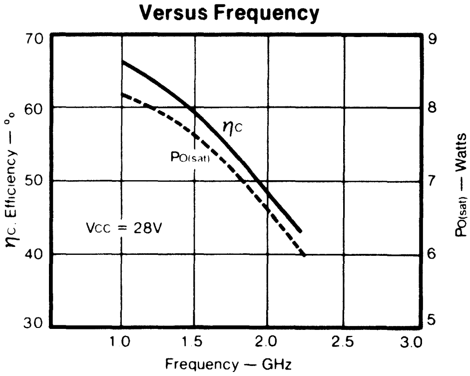
Electrical Characteristics (T_{flange} = 25°C)

Symbol	Characteristic	Conditon	Value
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 40mA	50V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.5mA	3.5V Min
I_{CBO}	Collector Cutoff Current	V_{CB} = 28V V_{CB} = 45V	500μA 2mA
I_C	Continuous Collector Current (Max)	V_{CE} = 4V	1.0A
h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5V I_C = 200mA	10-100
θ_{JF}	Thermal Resistance (Junction to Flange)	—	8.5°C/W
C_{OB}	Collector-Base Capacitance (Max)	V_{CB} = 28V	7.0pF
P_O	Power Output @ 2000MHz	P_{in} = 0.80W	5W Min
$P_{O(sat)}$	Power Output @ 2300MHz	V_{CE} = 28Vdc	5.0W (Typ)
	Power Output @ 1500MHz		6.5W (Typ)
	Power Output @ 1000MHz		7.5W (Typ)
P_{gain}	Power Gain (dB) @ 2000MHz	P_O = 5.0W	8dB Min
VSWR	Mismatch Tolerance @ V_{CC} = 28V	P_O = 5.0W f = 2.0GHz	∞
η_C	Collector Efficiency (Min)	P_O = 5.0W f = 2.0GHz	40%
T_J & T_{stg}	Max Junction and Storage Temperatures	-65 to 200°C	

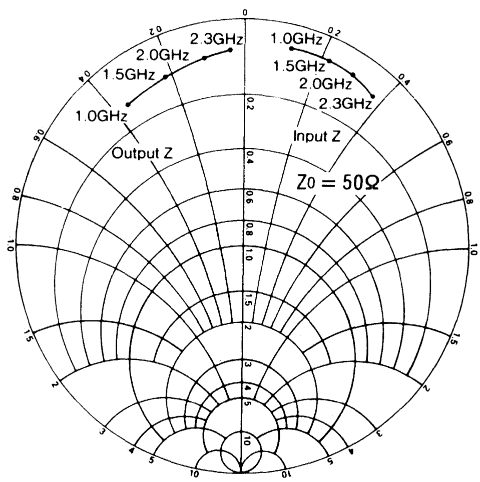
Typical Transfer Characteristics Versus Frequency



Typical ηc, Power Output Versus Frequency



Impedance Data
Vcc = 28V



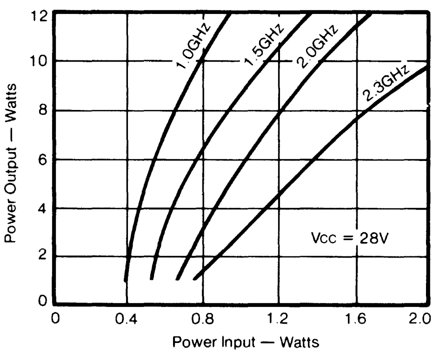
Note: Test circuit details available from TRW Semiconductors.

TRW 2010

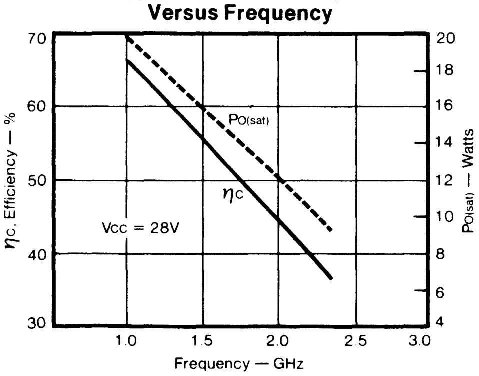
Electrical Characteristics (T_{flange} = 25°C)

Symbol	Characteristic	Conditon	Value
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 80mA	50V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 1.0mA	3.5V Min
I_{CBO}	Collector Cutoff Current	V_{CB} = 28V V_{CB} = 45V	500μA 4mA
I_C	Continuous Collector Current (Max)	V_{CE} = 4V	2.0A
h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5V I_C = 400mA	10-100
θ_{JF}	Thermal Resistance (Junction to Flange)	—	6°C/W
C_{OB}	Collector-Base Capacitance (Max)	V_{CB} = 28V	12.0pF
P_o	Power Output @ 2000MHz	P_{in} = 2.0W	10.0W Min
$P_{o(sat)}$	Power Output @ 2300MHz	V_{CE} = 28Vdc	10.0W (Typ)
	Power Output @ 1500MHz		13.0W (Typ)
	Power Output @ 1000MHz		15.0W (Typ)
P_{gain}	Power Gain (dB) @ 2000MHz	P_o = 10W	7dB Min
VSWR	Mismatch Tolerance @ Vcc = 28V	P_o = 10.0W f = 2.0GHz	∞
η_C	Collector Efficiency (Min)	P_o =10.0W f = 2.0GHz	40%
T_J & T_{stg}	Max Junction and Storage Temperatures	-65 to 200°C	

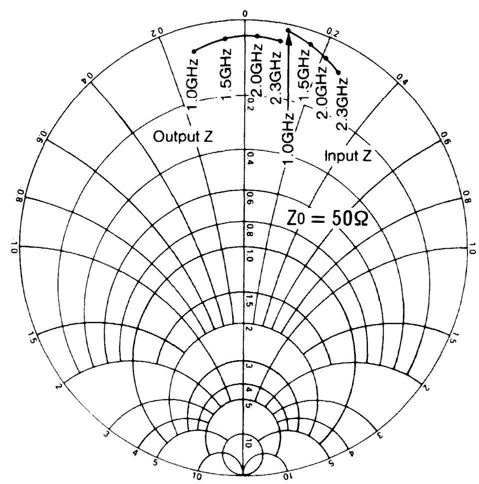
Typical Transfer Characteristics Versus Frequency



Typical η_C, Power Output Versus Frequency



Impedance Data Vcc = 28V



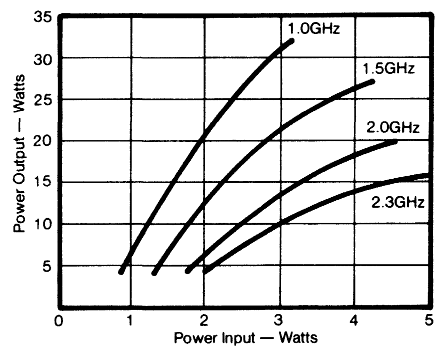
Note: Test circuit details available from TRW Semiconductors.

TRW 2015

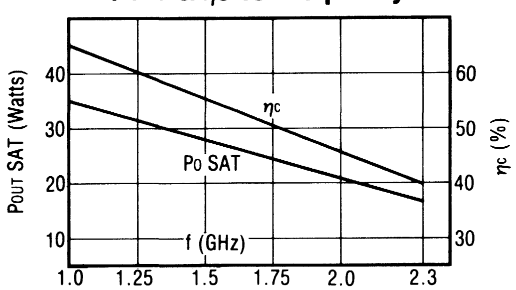
Electrical Characteristics (T_{FLANGE} = 25°C)

Symbol	Characteristic	Condition	Value
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 120mA	50V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 1.5mA	3.5V Min
I_{CBO}	Collector Cutoff Current	V_{CB} = 28V V_{CB} = 45V	1.5mA Max 6.0mA Max
I_C	Continuous Collector Current (Max)	V_{CE} = 4V	3.0A
h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5V I_C = 600mA	10-100
θ_{JF}	Thermal Resistance (Junction to Flange)	—	3.5°C/W
C_{OB}	Collector-Base Capacitance (Max)	V_{CB} = 28V	21pF
P_O	Power Output 2000MHz	P_{in} = 3.75W	15.0W Min
$P_{O(SAT)}$	Power Output 1500MHz	V_{CE} = 28V	22W Typ
	Power Output 1000MHz		30W Typ
P_{gain}	Power Gain (dB) 2000MHz	P_O = 15W	6dB Min
VSWR	Mismatch Tolerance V_{CC} = 28V	P_O = 15W f = 2GHz	∞
η_C	Collector Efficiency (Min)	P_O = 15W f = 2GHz	40%
T_j & T_{stg}	Max Junction and Storage Temperature	-65°C to +200°C	

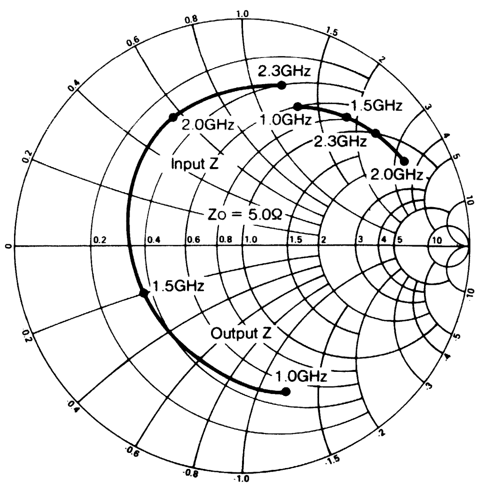
Typical Transfer Characteristics Versus Frequency



PSAT & η_C vs Frequency



Impedance Data
V_{CC} = 28V



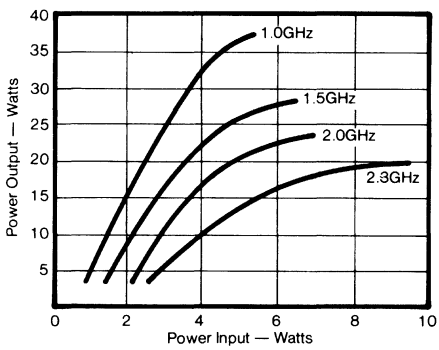
Note: Test circuit details are available from TRW Semiconductors.

TRW 2020

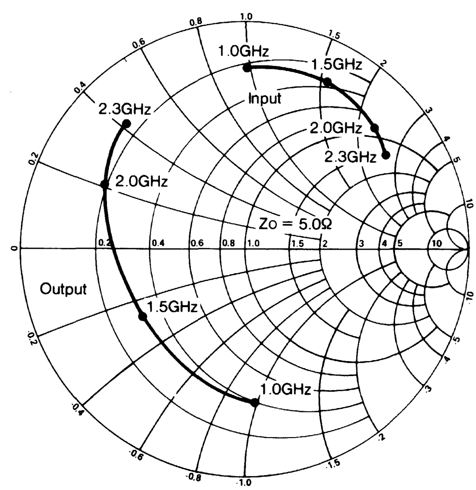
Electrical Characteristics (T_{FLANGE} = 25°C)

Symbol	Characteristic	Condition	Value
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 160mA	50V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 2.0mA	3.5V Min
I_{CBO}	Collector Cutoff Current	V_{CB} = 28V V_{CB} = 45V	2.0mA 8mA Max
I_C	Continuous Collector Current (Max)	V_{CE} = 4V	4.0A
h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5V I_C = 800mA	10-100
θ_{jF}	Thermal Resistance (Junction to Flange)	—	3°C/W
C_{OB}	Collector-Base Capacitance (Max)	V_{CB} = 28V	24.0pF
P_O	Power Output @ 2000MHz	P_{in} = 6.0W	20.0W Min
$P_{O(SAT)}$	Power Output @ 1500MHz	V_{CE} = 28Vdc	30W (Typ)
	Power Output @ 1000MHz		40W (Typ)
P_{gain}	Power Gain (dB) @ 2000MHz	P_O = 20W	5.2dB Min
VSWR	Mismatch Tolerance @ V_{CC} = 28V	P_O = 20.0W f = 2.0GHz	∞
η_C	Collector Efficiency (Min)	P_O = 20.0W f = 2.0GHz	40%
T_j & T_{stg}	Max Junction and Storage Temperature	-65 to 200°C	

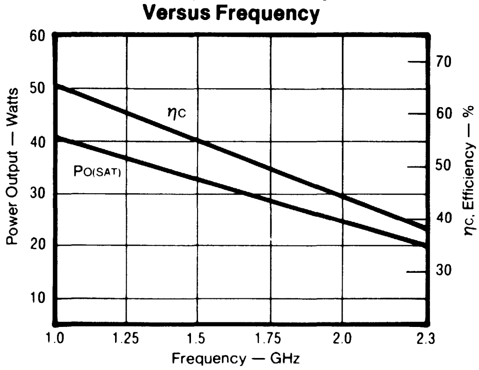
Typical Transfer Characteristics Versus Frequency



Impedance Data
V_{CC} = 28V



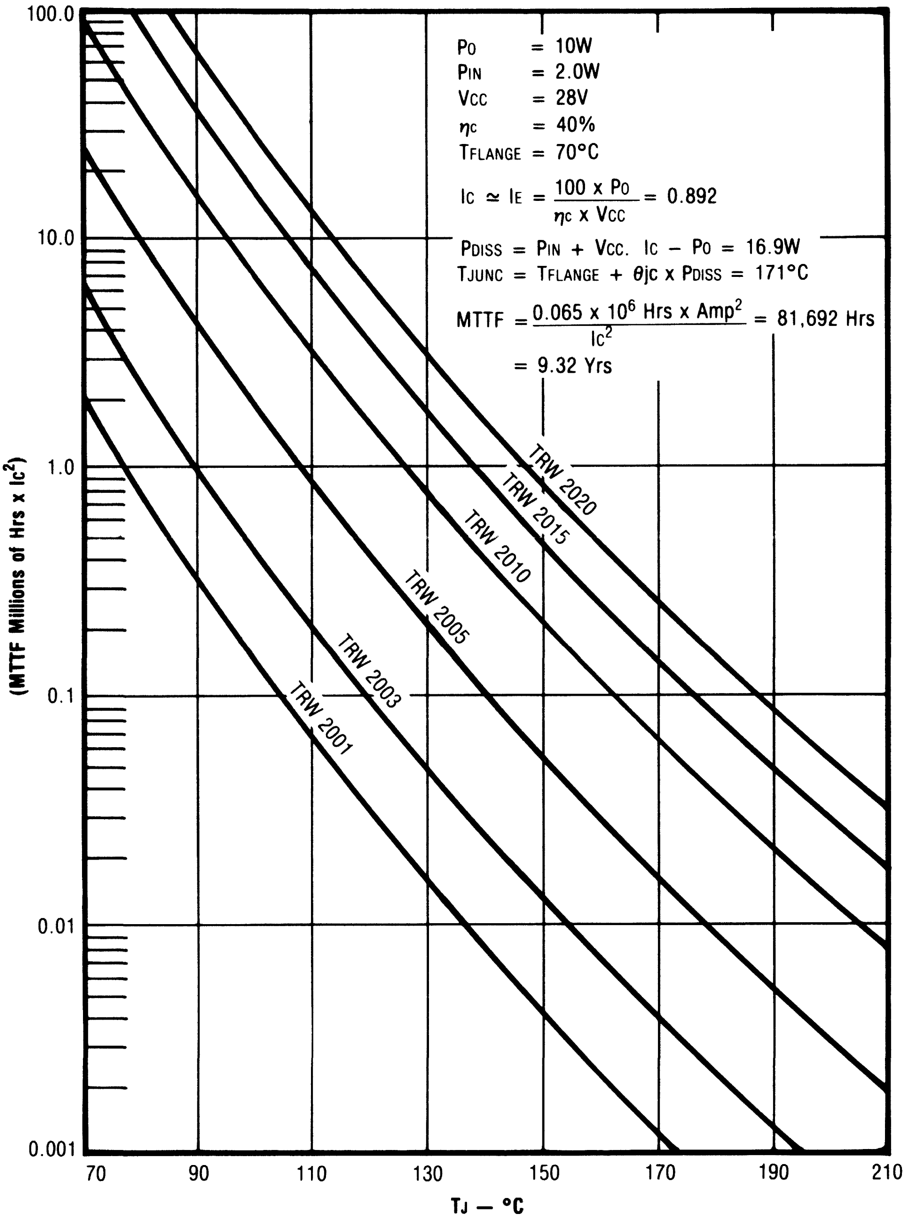
Typical η_C, Power Output Versus Frequency



Note: Test circuit details available from TRW Semiconductors.

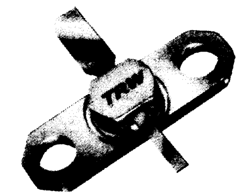
MTTF FACTOR (Normalized to 1 ampere² Continuous Duty)

The graph shown below displays MTTF in hours x ampere² emitter current for each of the "Super 2GHz" devices. Life tests at elevated temperatures have correlated to better than ± 10% to the theoretical prediction for metal failure. Sample MTTF calculations based on operating conditions are included on the graph.



Microwave Power Transistor

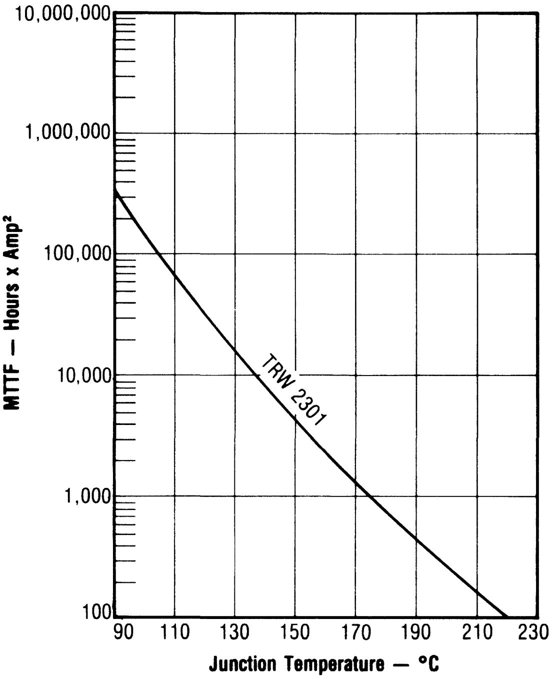
- Common Base
- Gold Metalized
- Hermetic
- Diffused Ballast Resistors
- 2.3 GHz
- 1.5 W — 20 V
- ∞ VSWR

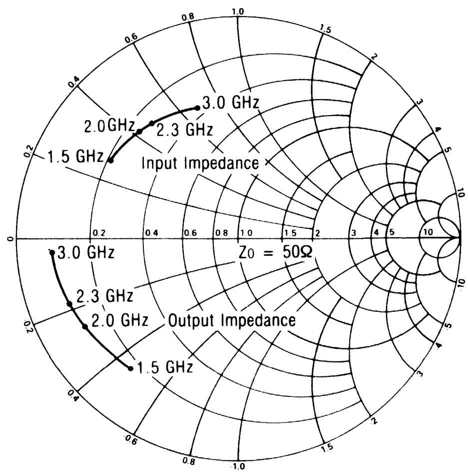


HLP-8

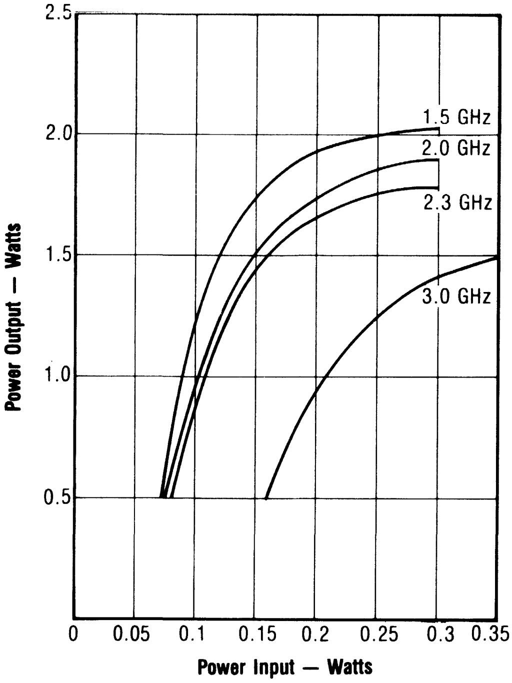
Electrical Characteristics (T_{flange} = 25 °C)

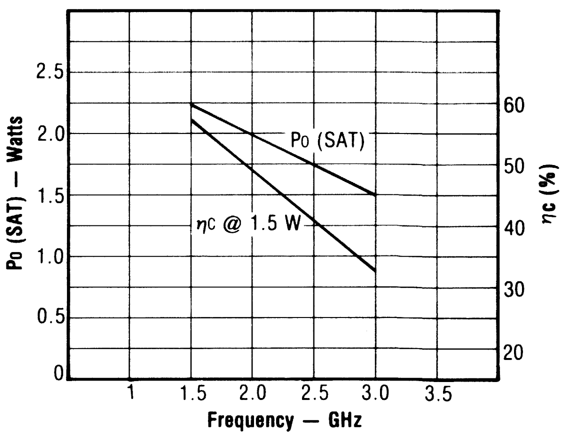
	Symbol	Characteristics	Condition	Value
DC Tests	BV_{CES}	Collector-Base Breakdown Voltage	Ic = 10 mA	42 V Min
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 1.0 mA	3.5 V Min
	I_{CBO}	Collector Cutoff Current	V_{CB} = 22 V VCB = 38 V	0.5 mA Max 1.0 mA Max
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5 V I_C = 100 mA	10-120
RF Tests	C_{OB}	Collector-Base Capacitance (Max)	VCB = 22 V, f = 1 MHz	3.5pF
	P_o	Power Output	f = 2.3 GHz V_{CE} = 20 V	1.5 W Min
	P_{gain}	Power Gain (dB)	f = 2.3 GHz P_o = 1.5 W V_{CE} = 20 V	8.0 dB Min
	VSWR	Mismatch Tolerance	P_o = 1.5 W f = 2.3 GHz V_{CE} = 20 V	∞
	η_C	Collector Efficiency	P_o = 1.5 W f = 2.3 GHz V_{CE} = 20 V	40 % Min
Operating	T_j & T_{stg}	Max Junction and Storage Temperature	— 65 to + 200 °C	
	θ_{jF}	Thermal Resistance		35 °C/W
	I_C	Continuous Collector Current	V_{CE} = 5 V	0.5 A Max





Note: Test circuit details are available from TRW Semiconductors.

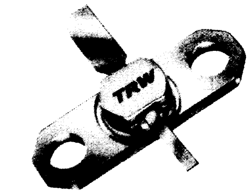




TRW

Microwave Power Transistor

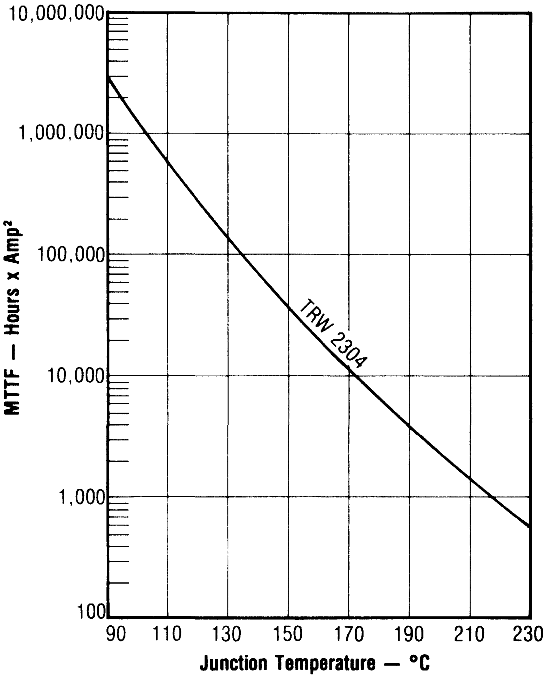
- Common Base
- Gold Metalized
- Hermetic
- Diffused Ballast Resistors
- 2.3 GHz
- 4 W — 20 V
- ∞ VSWR

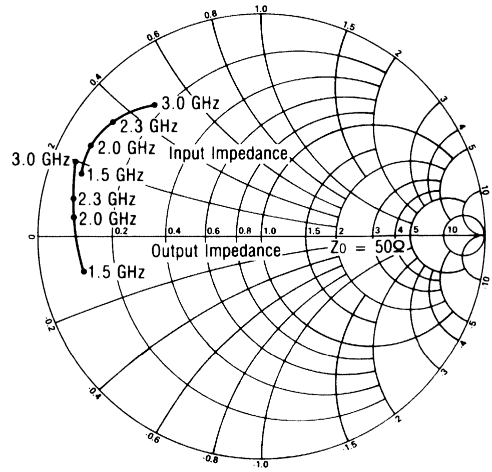


HLP-8

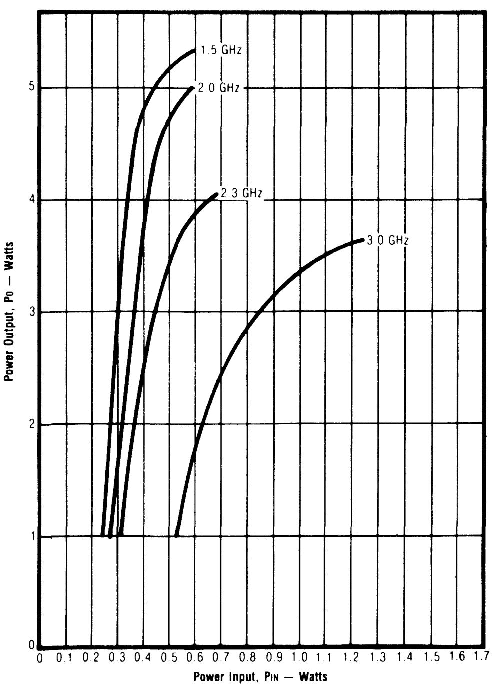
Electrical Characteristics (T_{flange} = 25 °C)

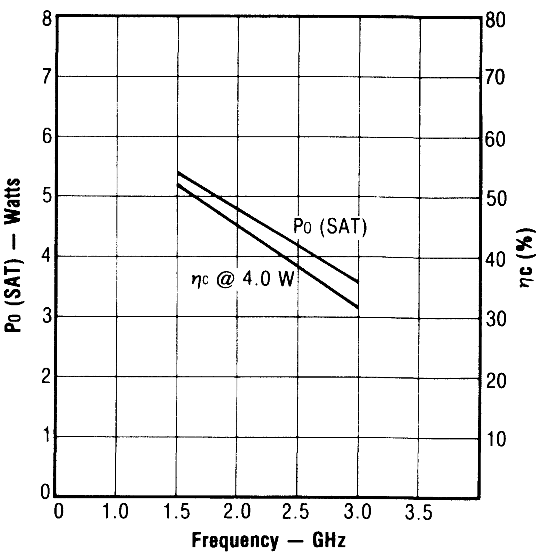
	Symbol	Characteristics	Condition	Value
DC Tests	BVCES	Collector-Base Breakdown Voltage	IC = 30 mA	42 V Min
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 1.0 mA	3.5 V Min
	I_{CBO}	Collector Cutoff Current	V_{CB} = 22 V VCB = 38 V	0.75 mA Max 3.0 mA Max
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5 V IC = 300 mA	10-120
RF Tests	C_{OB}	Collector-Base Capacitance (Max)	VCB = 22 V, f = 1 MHz	7 pF
	P_o	Power Output	f = 2.3 GHz V_{CE} = 20 V	4 W Min
	P_{gain}	Power Gain (dB)	f = 2.3 GHz P_o = 4 W V_{CE} = 20 V	8.0 dB Min
	VSWR	Mismatch Tolerance	P_o = 4 W f = 2.3 GHz V_{CE} = 20 V	∞
	η_C	Collector Efficiency	P_o = 4 W f = 2.3 GHz V_{CE} = 20 V	40 % Min
Operating	T_j & T_{stg}	Max Junction and Storage Temperature	— 65 to + 200 °C	
	θ_{jF}	Thermal Resistance		17 °C/W
	I_C	Continuous Collector Current	V_{CE} = 5 V	1.5 A Max





Note: Test circuit details are available from TRW Semiconductors.

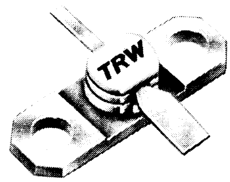




TRW

Microwave Power Transistor

- Common Base
- Gold Metalized
- Hermetic
- 1 to 3 GHz
- Diffused Ballast Resistors
- 2.3 GHz
- 7 W — 20 V
- ∞ VSWR

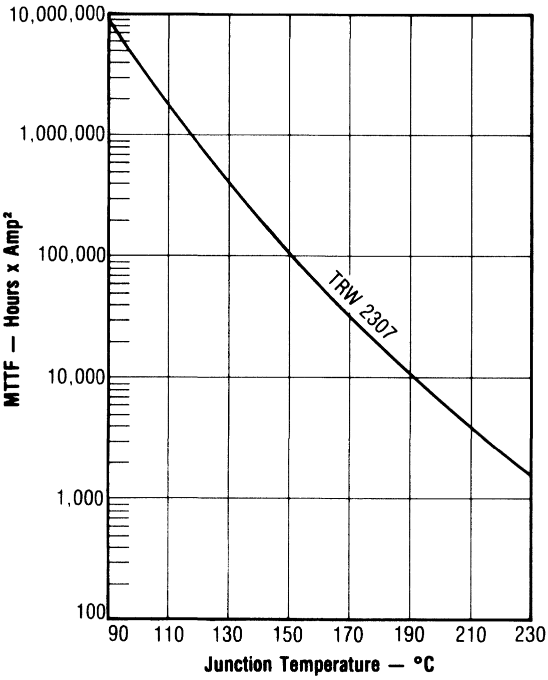


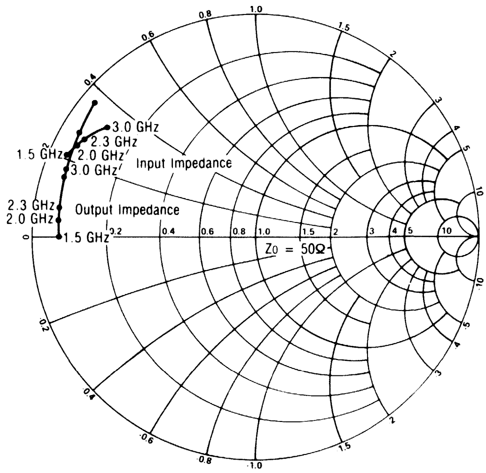
HLP-8

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

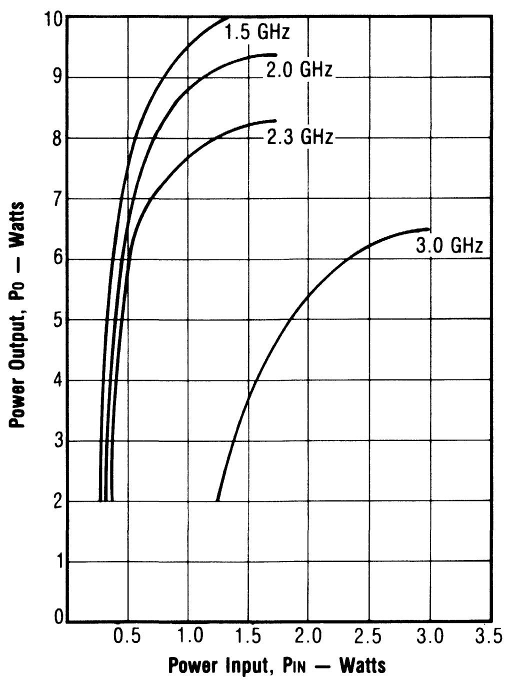
	Symbol	Characteristics	Condition	Value
DC Tests	BV_{CES}	Collector-Base Breakdown Voltage	I_C = 50 mA	42 V Min
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 1.0 mA	3.5 V Min
	I_{CBO}	Collector Cutoff Current	V_{CB} = 22 V V_{CB} = 38 V	1.25 mA 5 mA
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5 V I_C = 500 mA	10-120
RF Tests	C_{OB}	Collector-Base Capacitance (Max)	V_{CB} = 22 V, f = 1 MHz	10 pF
	P_o	Power Output	f = 2.3 GHz V_{CE} = 20 V	7.0 W Min
	P_{gain}	Power Gain (dB)	f = 2.3 GHz P_o = 7.0 W V_{CE} = 20 V	8.0 dB Min
	VSWR	Mismatch Tolerance	P_o = 7.0 W f = 2.3 GHz V_{CE} = 20 V	∞
	η_C	Collector Efficiency	P_o = 7.0 W f = 2.3 GHz V_{CE} = 20 V	40 % Min
Operating	T & T_{stg}	Max Junction and Storage Temperature	−65 to + 200 °C	
	θ_{JF}	Thermal Resistance		8.5 °C/W
	I_C	Continuous Collector Current	V_{CE} = 5 V	2.5 A Max

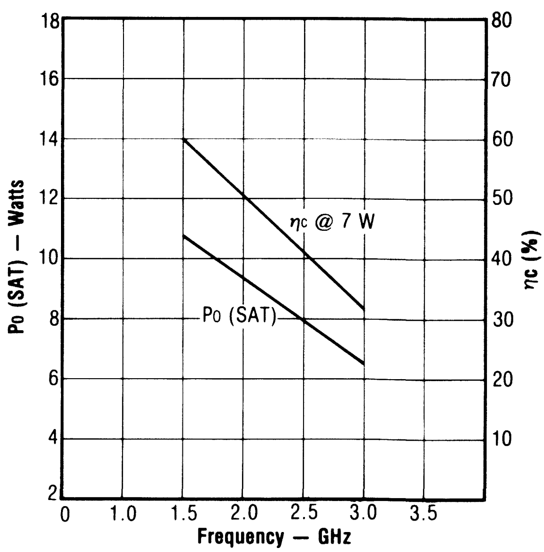
TRW 2307



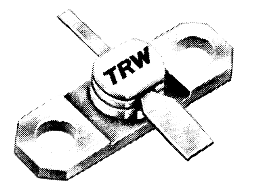


Note: Test circuit details are available from TRW Semiconductors.





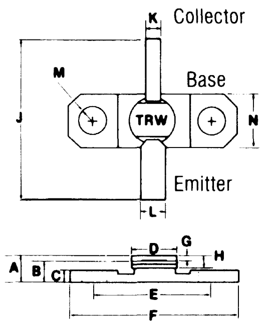
• Common Base • Diffused Ballast Resistors • Avalanche Protection • Gold Metalized • Hermetic	• Characterized to 3 GHz • MTTF Data • 1 to 5 W • ∞ VSWR



HLP-8

Mechanical Dimensions

HLP-8 Normal Package



Dimension	U.S. (Inches ± 0.005)	Metric (Centimeters ± 0.0127)
A	0.155	0.3937
B	0.125	0.3175
C	0.060	0.1524
D	0.230	0.5842
E	0.562	1.4270
F	0.800	2.030
G	0.030	0.0762
H	0.095	0.2413
J	0.730 nom	1.85 nom
K	0.050	0.127
L	0.120	0.3048
M	0.130 dia	0.3302 dia
N	0.250	0.6350

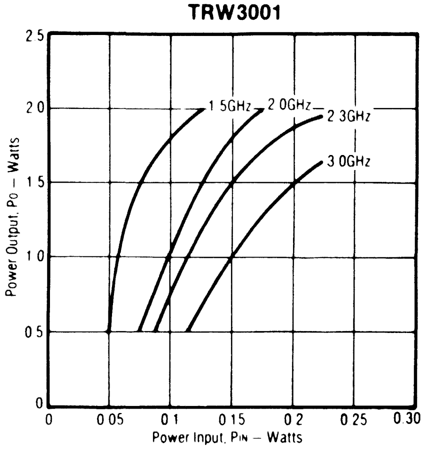
TRW 3000 Series

Electrical Characteristics (T_{case} = 25 °C) **TRW 3001 — 1 WATT**

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 1.0 mA I_C = 0	3.5			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 1.0 mA b	45			V
	BV_{CES}	Collector - Emitter Breakdown Voltage (EB Shorted)	I_C = 10 mA	50			V
	I_{CBO}	Collector - Base Leakage	V_{CB} = 28 V			0.5	mA
	H_{FE}	DC Current Gain	V_{CE} = 5.0 V I_C = 100 mA	10		120	
RF TEST	P_{gain}	Power Gain	F_O = 3 GHz P_O = 1.0 W V_{CC} = 28 V	7.0			dB
	η_C	Collector Efficiency	F_O = 3 GHz P_O = 1.0 W V_{CC} = 28 V	30			%
	VSWR	Mismatch Tolerance (Without Damage)	F_O = 3 GHz P_O = 1.0 W V_{CC} = 28 V	∞			
	C_{OB}	Collector - Base Capacitance	V_{CB} = 28 V F_O = 1 MHz		3.5	4.0	pF
THERMAL	θ_{JC}	Thermal Impedance Junction to Case	—			35	°C/W
	T_{STG} & T_J	Junction & Storage Temperature Range	—	— 65		+ 200	°C

TYPICAL CHARACTERISTICS

TRW3001



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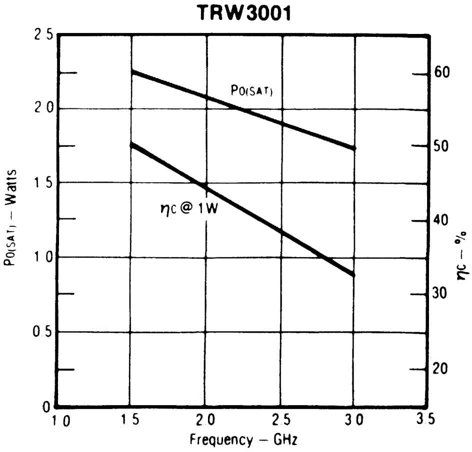
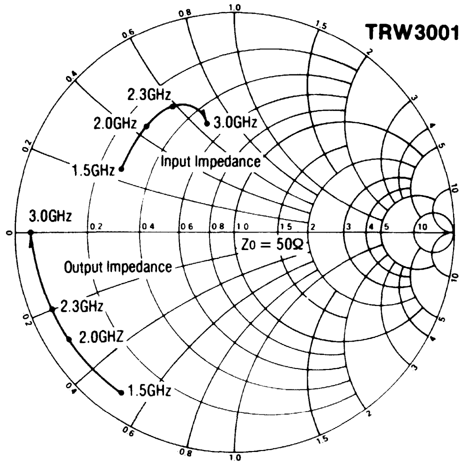
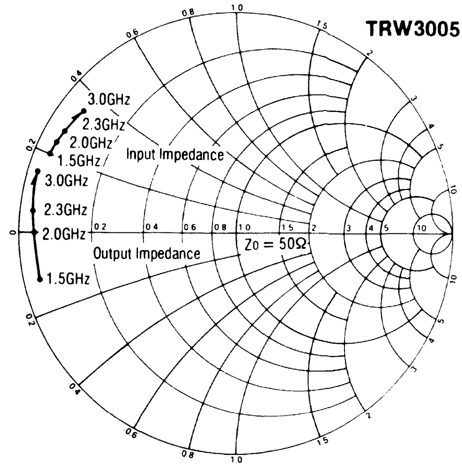
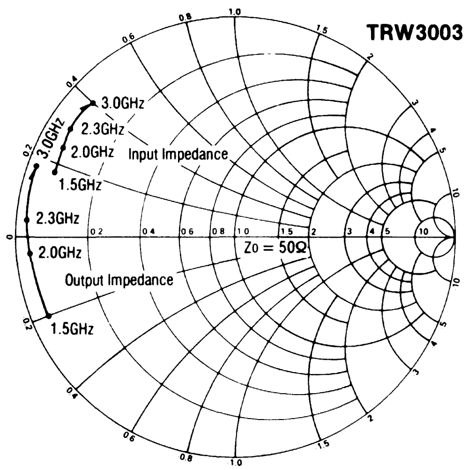


TYPICAL CHARACTERISTICS







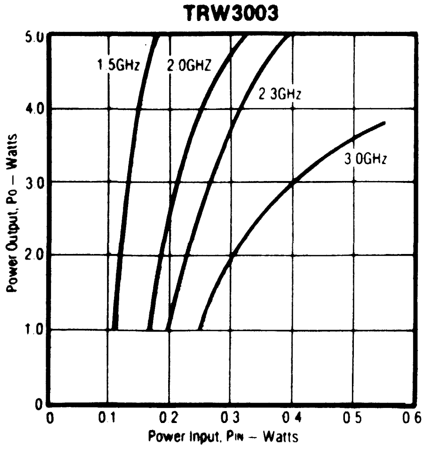
Note: Test circuit details are available from TRW Semiconductors.

Electrical Characteristics (T_{case} = 25 °C) **TRW 3003 — 3 WATTS**

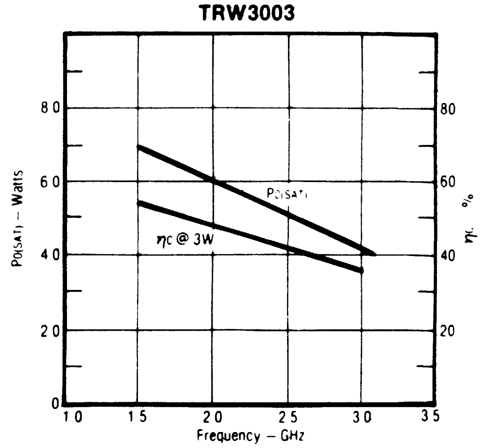
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 1.0 mA I_C = 0	3.5			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 3.0 mA	45			V
	BV_{CES}	Collector - Emitter Breakdown Voltage (EB Shorted)	I_C = 30.0 mA	50			V
	I_{CBO}	Collector - Base Leakage	V_{CB} = 28 V			0.75	mA
RF TEST	H_{FE}	DC Current Gain	V_{CE} = 5.0 V I_C = 300 mA	10		120	
	P_{Gain}	Power Gain	F_O = 3 GHz P_O = 3.0 W V_{CC} = 28 V	6.0			dB
	η_C	Collector Efficiency	F_O = 3 GHz P_O = 3.0 W V_{CC} = 28 V	30			%
	VSWR	Mismatch Tolerance (Without Damage)	F_O = 3 GHz P_O = 3.0 W V_{CC} = 28 V	∞			
	C_{OB}	Collector - Base Capacitance	V_{CB} = 28 V F_O = 1 MHz		5.7	7.0	pF
THERMAL	θ_{JC}	Thermal Impedance Junction to Case	—			17	°C/W
	T_{STG} & T_J	Junction & Storage Temperature Range	—	— 65		+ 200	°C

TYPICAL CHARACTERISTICS

TRW3003



TRW3003

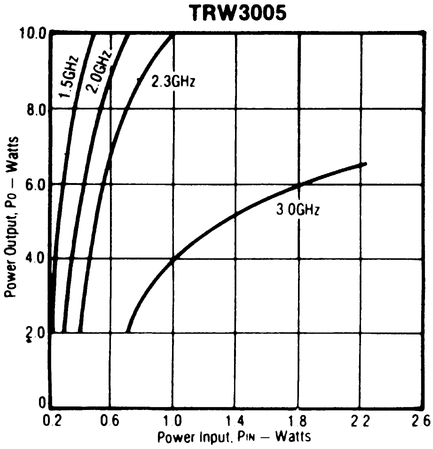


Electrical Characteristics (T_{CASE} = 25°C)

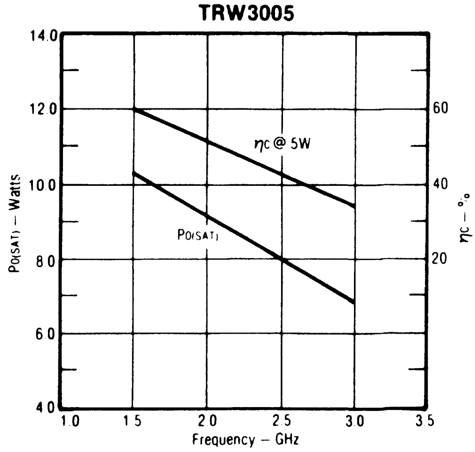
SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 1.0mA I_C = 0	3.5			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 5.0mA	45			V
BV_{CES}	Collector-Emitter Breakdown Voltage (EB Shorted)	I_C = 50.0mA	50			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 28V			1.25	mA
H_{FE}	DG Current Gain	V_{CE} = 5.0V I_C = 500mA	10		120	
P_{GAIN}	Power Gain	F_O = 3GHz P_O = 5W V_{CC} = 28V	5.0			dB
n_C	Collector Efficiency	F_O = 3GHz P_O = 5W V_{CC} = 28V	30			%
VSWR	Mismatch Tolerance (Without Damage)	F_O = 3GHz P_O = 5W V_{CC} = 28V				
C_{OB}	Collector-Base Capacitance	V_{CB} = 28V F_O = 1MHz		8.4	10	pF
O_{JC}	Thermal Impedance Junction to Case	—			8.5	°C/W
T_{STG} & T_J	Junction & Storage Temperature Range	—	−65		+200	°C

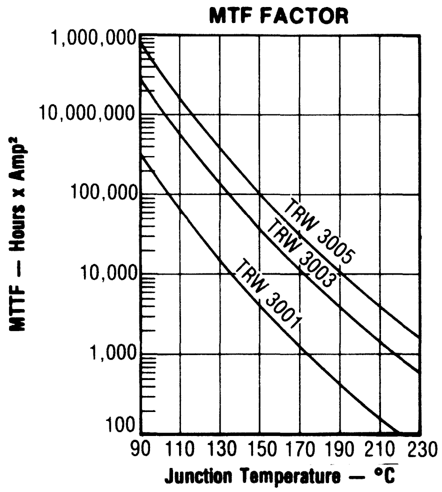
TYPICAL CHARACTERISTICS

TRW3005



TRW3005





MTTF FACTOR

(Normalized to 1 ampere² Continuous Duty)

The graph shown displays MTTF in hours x ampere² emitter current for each of the 3 GHz devices. Life tests at elevated temperatures have correlated to better than ± 10 % to the theoretical prediction for metal failure. **CAUTION** — A calculation is required to obtain actual metal life. Sample MTTF calculations based on operating conditions are shown below.

Junction Temperature — °C

To calculate metal lifetime under any set of conditions, obtain actual data or estimate from typical performance curves. Solve for T_J (°C):

(1) $$T_J = \theta_F \left(\frac{P_{OUT} \times 100}{\eta_C \%} + P_{IN} - P_{OUT} \right) + T_{FLANGE}$$

Enter graph of MTF factor vs. T_J. Obtain MTF factor. Calculate metal life by:

(2) $$\text{Metal Life in Hours} = \frac{\text{MTF Factor}}{I_C^2\ (\text{Amps})}$$

TRW Electronic Components Group

Printed Circuit Division
200 South Turnbull Canyon Road
City of Industry, California 91749
Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
4243 Campus Point Court
San Diego, California 92121
Phone: 714/457-1000

Products: Data converters, arithmetic products, and special processors.

Optoelectronics Division
1201 Tappan Circle
Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

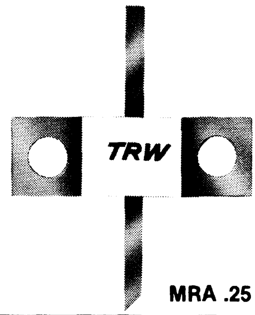
Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

Broadband Microwave Transistors, Common Base

The MICROAMP transistor employs low-loss MOS capacitors and other internal elements to transform input Z to a manageable value prior to the point where package parasitic reactances inhibit the bandwidth capability of the device. All MICROAMP transistors are assembled in common base configuration and gold metalized for long life. The units are rated for either 22 or 28 volts as indicated.

MICROAMP®

- 3 to 40 Watts
- Broadband 600-1000 MHz
- Internally Compensated*
- Gold Metalized
- Diffused Ballast Resistors
- MTTF Data
- Common Base
- ∞ VSWR



MRA .25

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

Symbol	Characteristic	MRA0610-3	MRA0610-9	MRA0610-18	MRA0610-40
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 20 mA 50 V Min	I_C = 60 mA 50 V Min	I_C = 100 mA 50 V Min	I_C = 200 mA 50 V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25 mA 3.5 V Min	I_B = 0.75 mA 3.5 V Min	I_B = 1.25 mA 3.5 V Min	I_E = 2.5 mA 3.5 V Min
I_{CBO}	Collector Cutoff Current I_E = 0	V_{CB} = 28 V 0.5 mA V_{CB} = 45 V 1.0 mA	V_{CB} = 28 V 1.5 mA V_{CB} = 45 V 3.0 mA	V_{CB} = 28 V 2.5 mA V_{CB} = 45 V 5.0 mA	V_{CB} = 28 V 5.0 mA V_{CB} = 45 V 10.0 mA
I_C	Max Continuous Collector Current V_{CE} = 4 V	0.5 A	1.5 A	5.0 A	10.0 A
h_{FE}	Forward Current Transfer Ratio V_{CE} = 5 V	I_C = 0.1 A 10-100	I_C = 0.3 A 10-100	I_C = 0.5 A 10-100	I_C = 1.0 A 10-100
θ_{jF}	Thermal Resistance Junction to Flange	15 °C/W	6 °C/W	4 °C/W	2.5 °C/W
P_o	Min Broadband Power Output	3.0 W	9.0 W	18.0 W	40.0 W
C_{ob}	Max Collector-Base Capacitance V_{CB} = 28 V, f = 1 MHz	4.5 pF	10 pF	14 pF	28 pF
$P_{G(dB)}$	Min Power Gain in dB V_{CB} = 28 V	P_o = 3.0 W 7.8 dB	P_o = 9.0 W 7.8 dB	P_o = 18.0 W 7.8 dB	P_o = 40.0 W 7.0 dB
L_R	Input Return Loss in Recommended Circuit	-10dB Max	-10dB Max	-10dB Max	-10dB Max
η_c	Min Broadband Collector Efficiency	P_o = 3.0 W 50 %	P_o = 9.0 W 55 %	P_o = 18.0 W 55 %	P_o = 40.0 W 55 %
T_J	-65 to +200°C				
T_{STG}	-65 to +150°C				

* The concept of input and/or output matching using MOS capacitors, wire bonds and other techniques is patented by TRW, inc. (US # 3,713,006).

MRA 0610 Series *Also applies to series: MRA 1014, MRA 1417, MRAL 1417, MRA 1720, MRAL 1720, MRAL 2023, MRAL 2327

The TRW MRA0610 series offers a complete family of broad-band, high-gain transistors for applications in the 600-1000MHz band.

Using internal compensation (a patented* technique developed and first offered for sale by TRW), the MRA0610 series is intended for use in a variety of military and industrial applications including ECM, radio relay and the "960" mobile band for fixed station use.

The smooth, broadband transfer characteristics of the MRA0610 series makes it attractive for semi-linear applications without the need for bias. Power leveling within a broad range can be accomplished simply through control of low-level drive, thus eliminating brute force control of collector voltage.

Device output power levels of 3, 9, 18 and 40 watts allow a wide choice of lineup configurations. Excellent device-to-device phase tracking characteristics permit hybrid combination for higher powers with negligible combining loss.

Test circuit details are available from TRW Semiconductors.

DIFFUSED BALLASTING AND RELIABILITY

Microwave transistor devices are universally constructed using multiple cell combinations for higher power. A number of advantages are obtained using the cellular concept including better thermal balance and the ability to adjust power output capability using more or less cells to construct a device. Unless proper ballasting techniques are employed, some difficulty can be encountered in the act of combining cells. Ballasting makes cell combining practical. The alternative to ballasted cells is an operator-dependent assembly technique called "contour-bonding." Herein, bond wires of varying lengths are employed to adjust inductance and thereby achieve the expected balance. TRW has decided in favor of ballasting rather than contour-bonding because it is a controlled, repeatable and totally reliable technique.

While ballasting is desirable, certain techniques for creating ballast resistors in fine geometry microwave transistors have proven unreliable. Such an example is "metal" ballast resistors. Such resistors are incorporated by introducing an exposed section of barrier metal between the emitter finger and feeder bar. This type of resistor, of necessity, lies on top of an oxide layer. Because the metal resistor is required to dissipate as much as $10KW/CM^2$, extreme temperatures are generated in the resistor material. With this construction there is no adequate means of removing heat from the metal resistor. Therefore, the ballast resistor undergoes radical changes in physical dimension during its operating profile. This results in separation from the oxide layer or micro-cracking, or both.

Given that ballasting is desirable, a better solution, **diffused ballast resistors**, is incorporated in the MRA0610 series. Several advantages accrue from this approach. It is integral in the silicon carrier, has the same coefficient of expansion and is heat sinked. Experience has shown that the diffused ballast resistor has none of the metal resistor disadvantages, yet offers an additional advantage. In the MRA0610 series, the diffused resistor is designed to current limit (because of limited carriers) before destructive current levels at the junction occur. Diffused ballast resistors are definitely superior in performance and reliability. Test data is available to verify this fact.

METALIZATION AND RELIABILITY

Metal migration is the main concern when considering a metal system. In fine geometry devices such as microwave transistors, the use of aluminum having sufficiently large grain size to provide an activation energy equal to that of gold is not possible since geometrical definition would be impossible. In order to adequately define small geometries, one must use aluminum with a grain size (1 micron or less) which has a very unattractive activation energy. Activation energy has an exponential relationship to metal migration.

A fair comparison of two metal systems (aluminum versus gold) would be to construct the same transistor using both metal systems and calculate the anticipated metal failure point using Black's equation. The following example is based upon the same transistor cell as is used in the TRW MRA0610 series.

Junction Temperature	Times Improvement of MTTF with Gold vs Aluminum
100°C	691
125°C	370
150°C	168
175°C	56
200°C	30

For this reason, TRW RF Semiconductors uses a gold metalization system on all microwave transistors including the MRA0610 series.

TRW'S PATENTED* MICroAMP

Since power microwave transistors became feasible, the bandwidth limiting problem of excessively high input "Q's" has vexed the solid state microwave amplifier designer.

Parasitic reactances (primarily due to the package) become increasingly more significant past 200MHz and impose severe limitations on band width past 1GHz. Additionally, the real component of input $Z(R_{bb})$ becomes smaller as higher drive power and higher power outputs are achieved.

Microwave power transistors generally employ several emitter ballasted cells in parallel to obtain power outputs required with the small cell geometry necessary to realize a microwave transistor. Figure 1 shows the schematic representation of such a device.

Note that all components of the input impedance are in parallel, which compounds the "Q" and bandwidth problem as more cells are used to achieve power, or the operating frequency is raised (or both). Figure 2 illustrates a more acceptable solution which combines inputs after an impedance transformation at the input of each device cell. It is convenient to do this all or partially within the package.

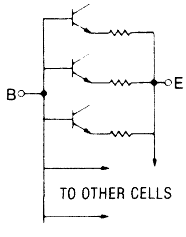


Figure 1. Elementary Method of Cell Combining

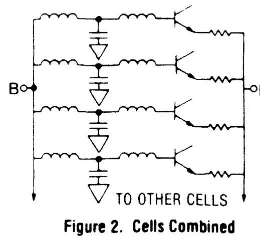


Figure 2. Cells Combined with Transformers

Correct input circuitry design can yield a device which is broadbandable over a broad range of frequencies (40 percent or more).

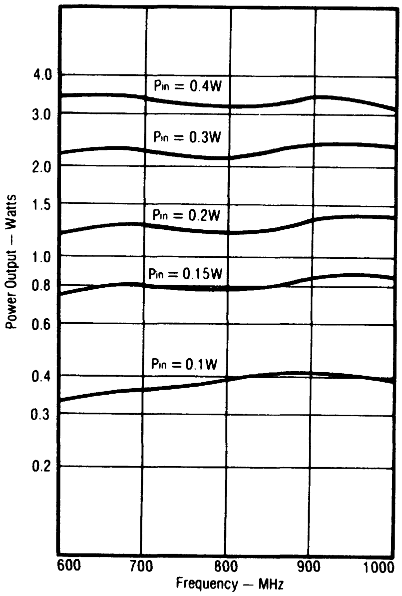
Because of the nature of source impedance driving the transistor cell (essentially a voltage source), as much as 10dB additional usable dynamic range without noticeably altering bandwidth or tuning is possible with the MICroAMP.

Additional gain and bandwidth advantage can be obtained by operation of the MICroAMP device cells in a common base configuration. The devices described therein are so configured.

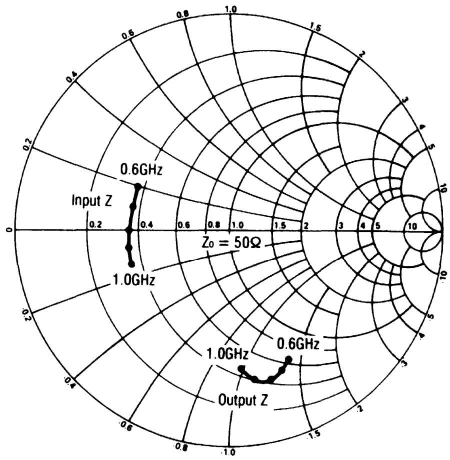
*TRW U.S. Patent #3 713 006

MRA0610-3 — 3 WATTS BROADBAND

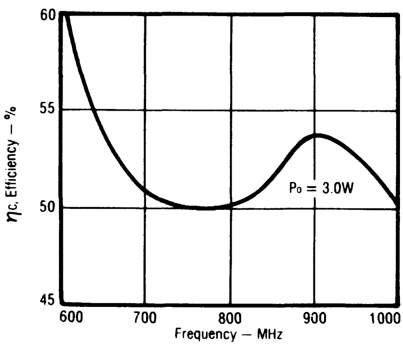
Typical Power Output vs Frequency



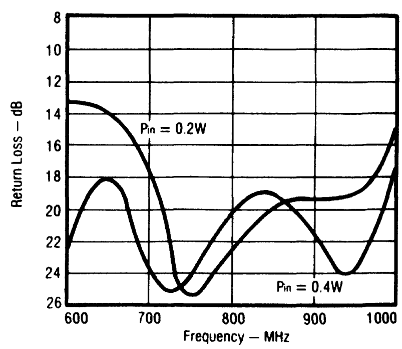
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

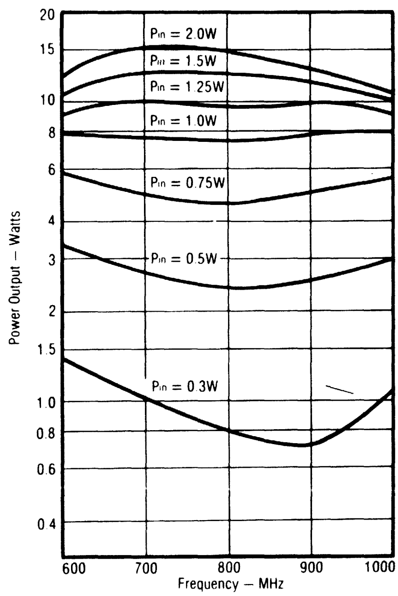


Typical Return Loss vs Frequency

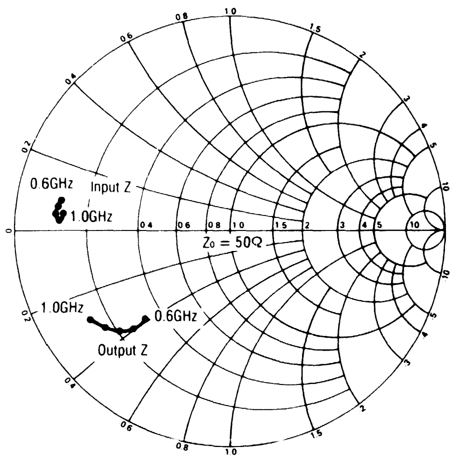


MRA0610-9 — 9 WATTS BROADBAND

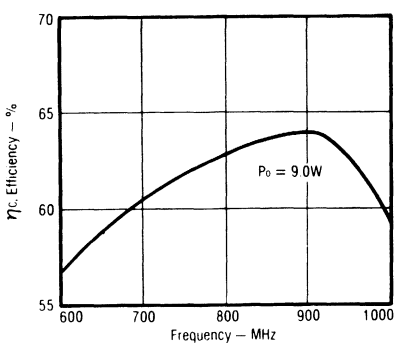
Typical Power Output vs Frequency



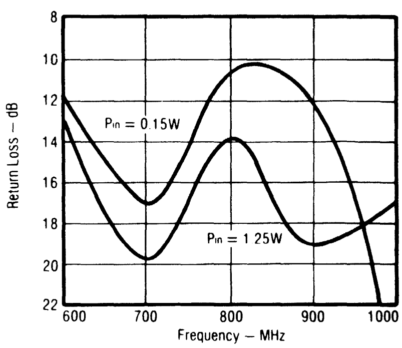
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

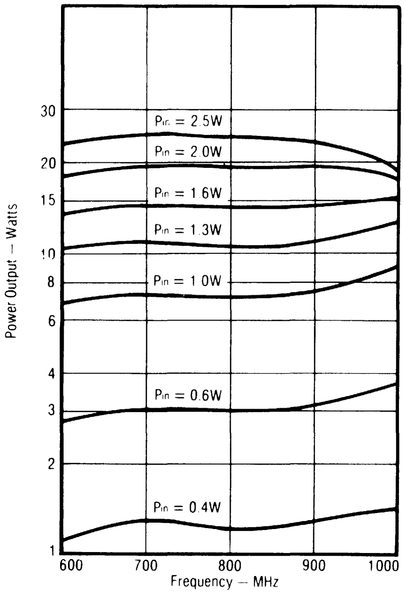


Typical Return Loss vs Frequency

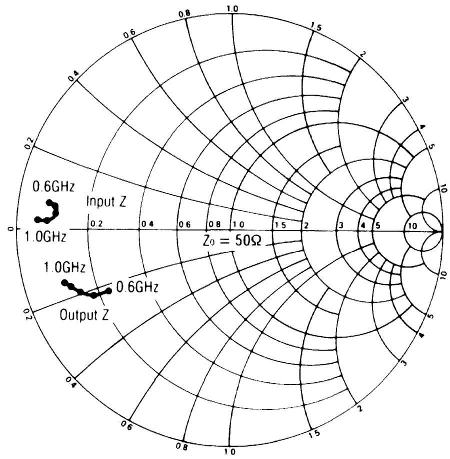


MRA0610-18 — 18 WATTS BROADBAND

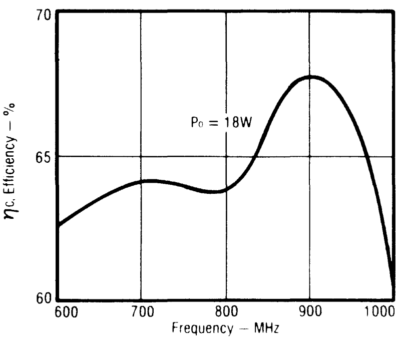
Typical Power Output vs Frequency



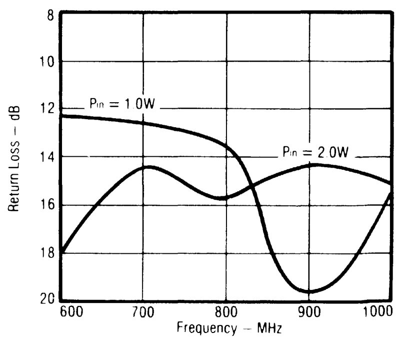
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

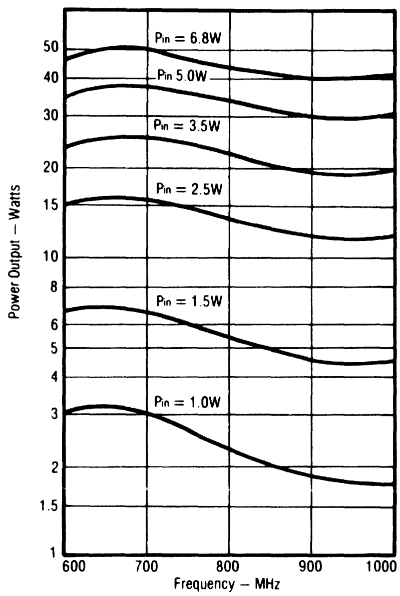


Typical Return Loss vs Frequency

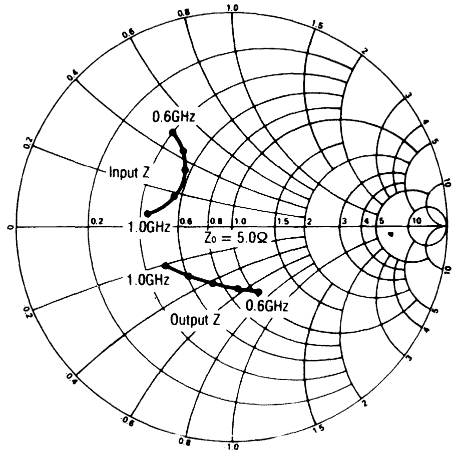


MRA0610-40 — 40 WATTS BROADBAND

Typical Power Output vs Frequency

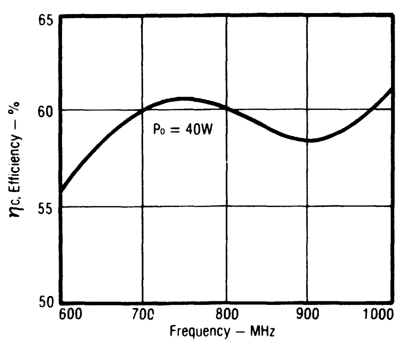


Impedance Data
Vcc = 28V

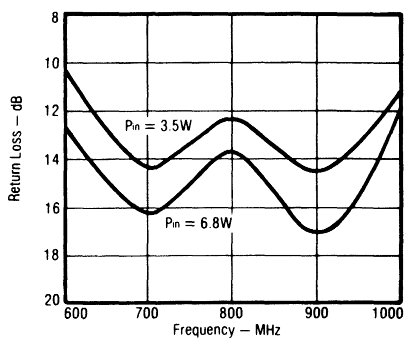


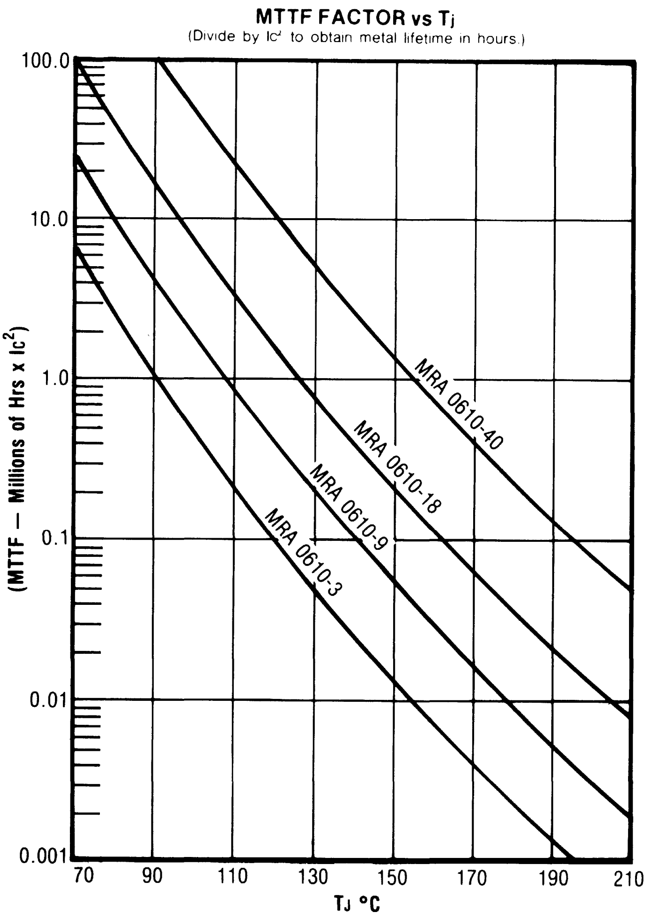
Test Circuit Details available from TRW Semiconductors.

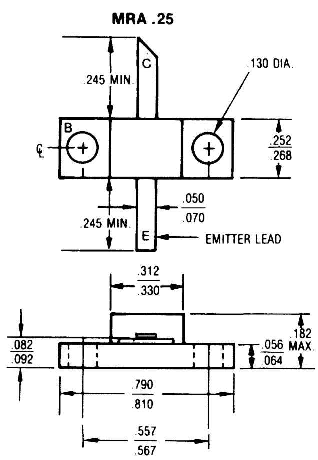
Typical Efficiency vs Frequency



Typical Return Loss vs Frequency




MTTF FACTOR vs Tj
(Divide by Ic² to obtain metal lifetime in hours.)
(MTTF — Millions of Hrs x Ic²)
100.0
10.0
1.0
0.1
0.01
0.001
70
90
110
130
150
170
190
210
TJ °C
MRA 0610-40
MRA 0610-18
MRA 0610-9
MRA 0610-3


MRA .25
.245 MIN.
C
.130 DIA.
B
.252
.268
.050
.070
.245 MIN.
E
EMITTER LEAD
.312
.330
.082
.092
.056
.064
.182
MAX.
.790
.810
.557
.567

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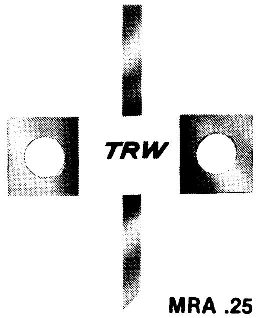


MRA .25

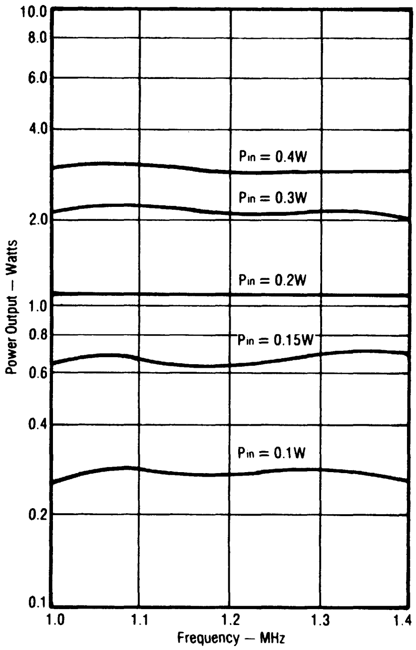
Electrical Characteristics (T_{flange} = 25 °C)

Symbol	Characteristic	MRA1014-2	MRA1014-6	MRA1014-12	MRA1014-35
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 20 mA 50 V Min	I_C = 40 mA 50 V Min	I_C = 80 mA 50 V Min	I_C = 200 mA 50 V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25 mA 3.5 V Min	I_E = 0.5 mA 3.5 V Min	I_E = 1.0 mA 3.5 V Min	I_E = 2.5 mA 3.5 V Min
I_{CBO}	Collector Cutoff Current I_E = 0	V_{CB} = 28 V 0.5 mA V_{CB} = 45 V 1.0 mA	V_{CB} = 28 V 1.0 mA V_{CB} = 45 V 2.0 mA	V_{CB} = 28 V 2.0 mA V_{CB} = 45 V 4.0 mA	V_{CB} = 28 V 5.0 mA V_{CB} = 45 V 10.0 mA
I_C	Max Continuous Collector Current V_{CE} = 4 V	0.5 A	1.5 A	5.0 A	10.0 A
h_{FE}	Forward Current Transfer Ratio V_{CE} = 5 V	I_C = 0.1 A 10-100	I_C = 0.2 A 10-100	I_C = 0.4 A 10-100	I_C = 1.0 A 10-100
θ_{jF}	Thermal Resistance Junction to Flange	15 °C/W	8 °C/W	4.5 °C/W	2.5°C/W
P_o	Min Broadband Power Output	2.0 W	6.0 W	12.0 W	35.0 W
C_{ob}	Max Collector-Base Capacitance V_{CB} = 28 V, f = 1 MHz	4.5 pF	8 pF	12 pF	Internal Shunt L
$P_{G(dB)}$	Min Power Gain in dB V_{CB} = 28 V	P_o = 2.0 W 8.2 dB	P_o = 6.0 W 7.4 dB	P_o = 12.0 W 7.8 dB	P_o = 35.0 W 7.0 dB
η_c	Min Broadband Collector Efficiency	P_o = 2.0 W 45 %	P_o = 6.0 W 50 %	P_o = 12.0 W 50 %	P_o = 35.0 W 50 %
T_j	-65 to +200°C				
T_{STG}	-65 to +150°C				
L_R	Input Return Loss in Recommended Circuit	-10dB Max	-10dB Max	-10dB Max	-10dB Max

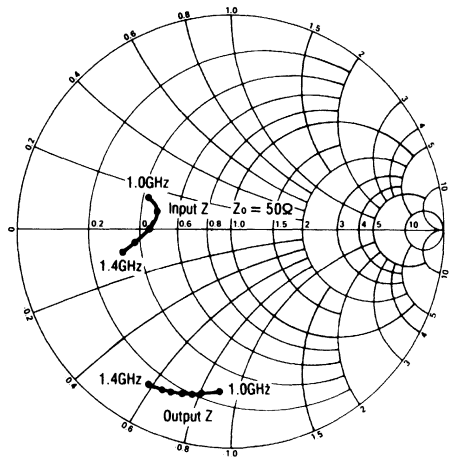
*The concept of input and/or output matching using MOS capacitors, wire bonds and other techniques is patented by TRW, Inc. (US #3,713,006).

MRA1014-2 — 2 WATTS BROADBAND

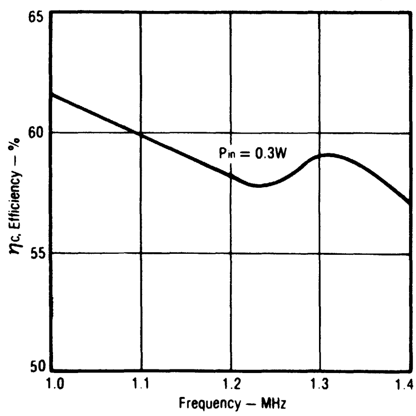
Typical Power Output vs Frequency



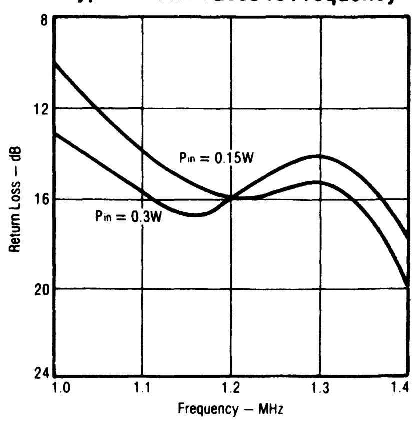
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

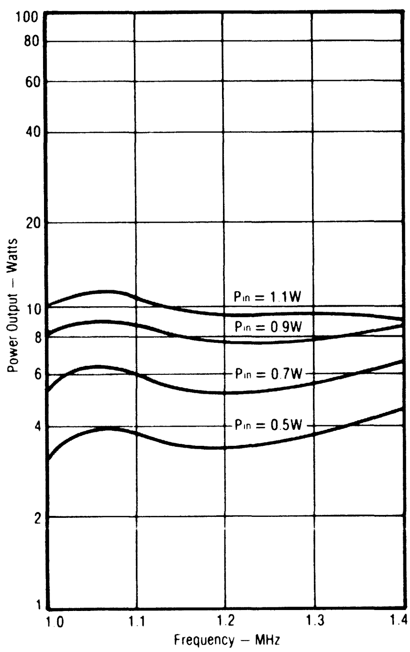


Typical Return Loss vs Frequency

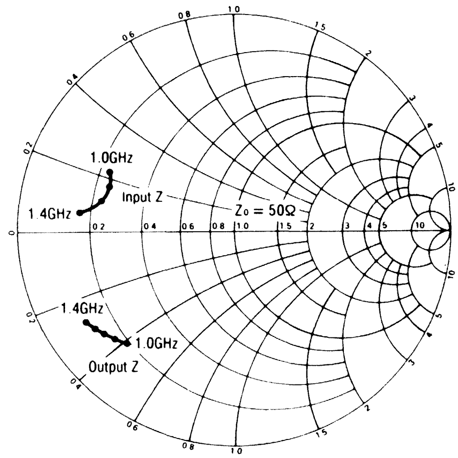


MRA1014-6 — 6 WATTS BROADBAND

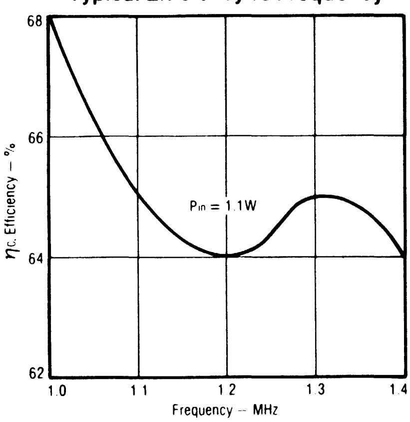
Typical Power Output vs Frequency



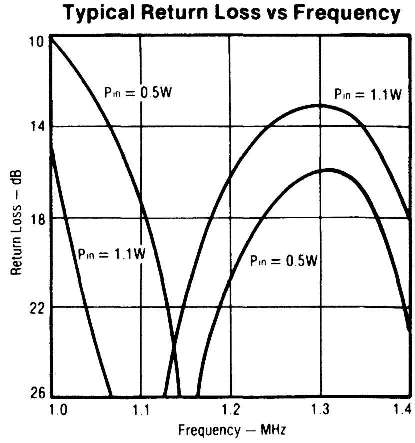
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

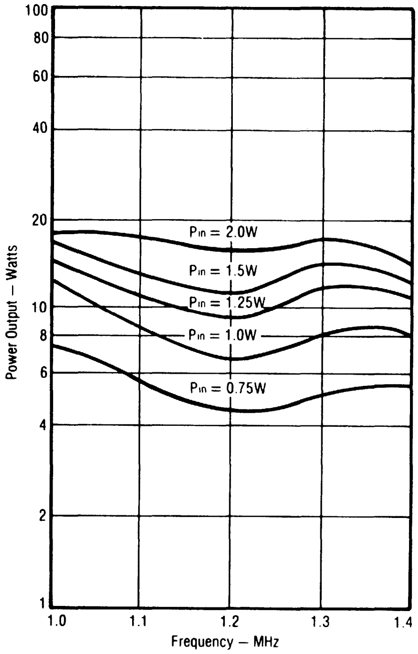


Typical Return Loss vs Frequency

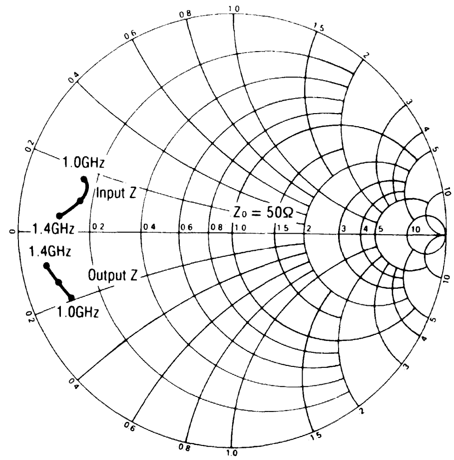


MRA1014-12 — 12 WATTS BROADBAND

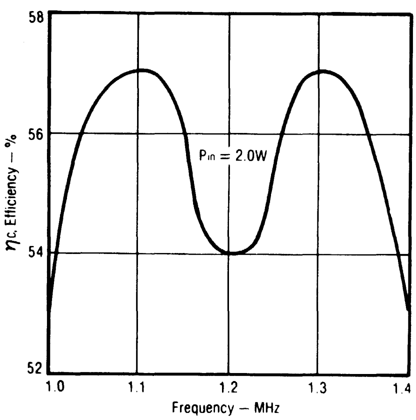
Typical Power Output vs Frequency



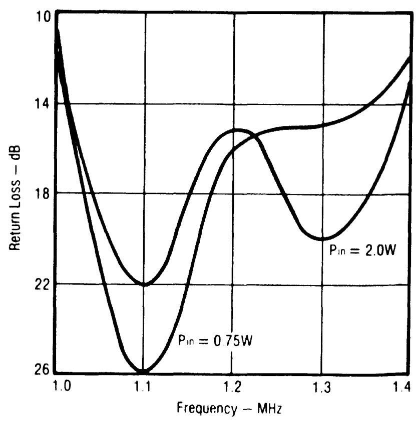
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

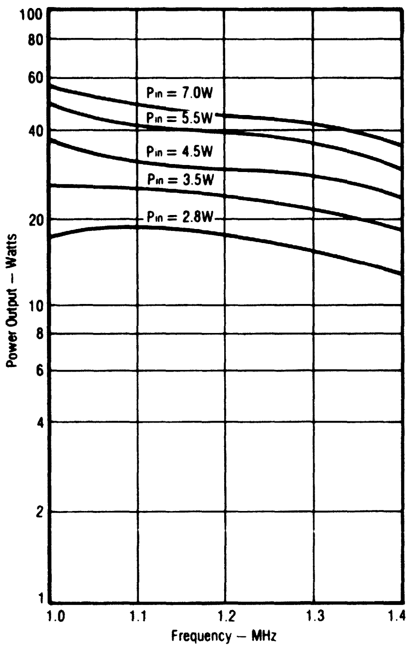


Typical Return Loss vs Frequency

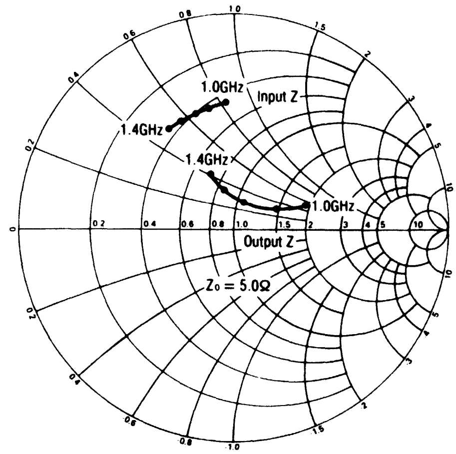


MRA1014-35 — 35 WATTS BROADBAND

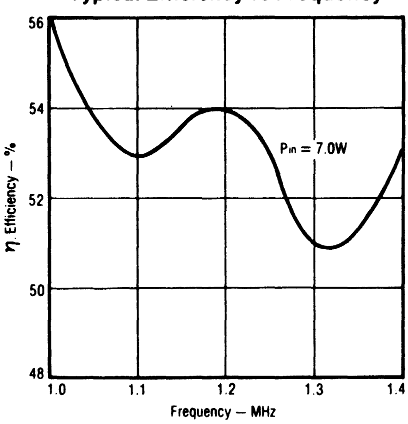
Typical Power Output vs Frequency



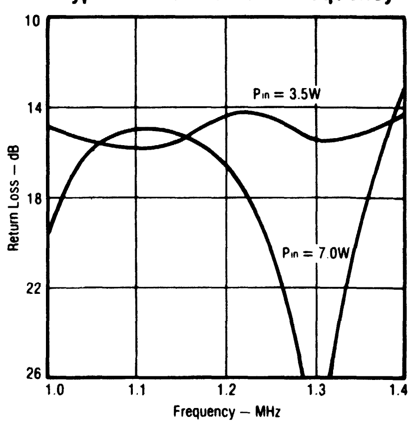
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

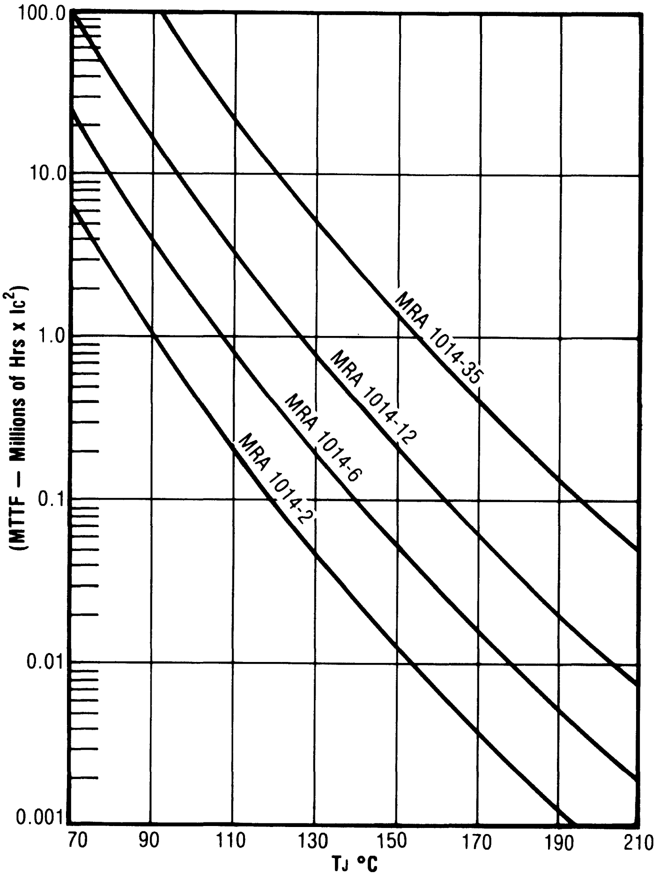


Typical Return Loss vs Frequency



MTTF FACTOR (Normalized to 1 Ampere^2 Continuous Duty)

The graph shown below displays MTTF in hours x ampere^2 emitter current for each of the devices. Life tests at elevated temperatures have correlated to better than ±10% to the theoretical prediction for metal failure. Sample MTTF calculations based on operating conditions are included below.



Example of MTTF for MRA1014-12 Conditions

$P_O = 12W$

$P_{IN} = 2.0W$

$V_{CC} = 28V$

$\eta\% = 50$

$T_{FLANGE} = 70°C$

$$I_C \simeq I_E = \frac{100 \times P_O}{\eta_C \times V_{CC}} = 0.857 \text{ A}$$

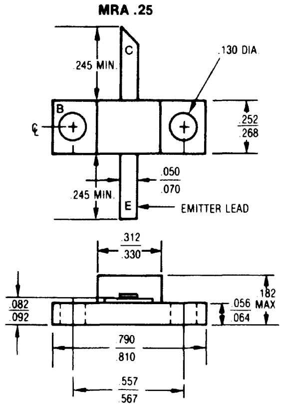
$$P_{DISS} = P_{IN} + V_{CC} \cdot I_C - P_O = 13.99W$$

$$T_{JUNC} = T_{FLANGE} + \theta JF \times P_{DISS} = 132.9\ °C$$

$$MTTF = \frac{0.7 \times 10^6 \text{ Hrs Amp}^2}{I_C^2} = 953{,}095 \text{ Hrs}$$

$$MTTF = 108.8 \text{ Yrs}$$

MRA .25



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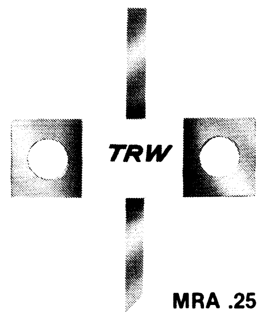


MRA .25

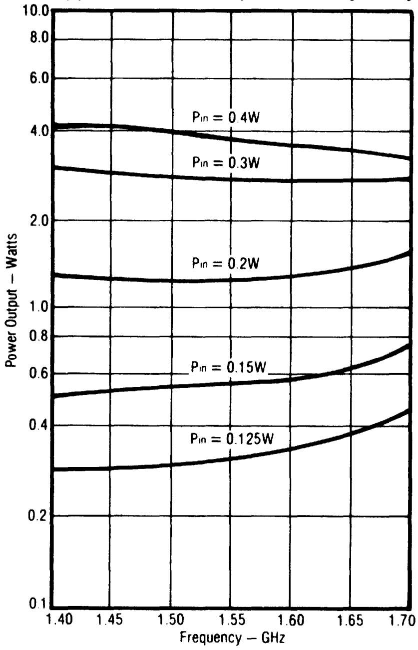
Electrical Characteristics at T_{flange} = 25 °C

Symbol	Characteristic	MRA1417-2	MRA1417-6	MRA1417-11	MRA1417-25
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 20 mA 50 V Min	I_C = 40 mA 50 V Min	I_C = 80 mA 50 V Min	I_C = 160 mA 50 V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25 mA 3.5 V Min	I_E = 0.5 mA 3.5 V Min	I_E = 1.0 mA 3.5 V Min	I_E = 2.0 mA 3.5 V Min
I_{CBO}	Collector Cutoff Current I_E = 0	V_{CB} = 28 V 0.5 mA	V_{CB} = 28 V 1.0 mA	V_{CB} = 28 V 2.0 mA	V_{CB} = 28 V 4.0 mA
		V_{CB} = 45 V 1.0 mA	V_{CB} = 45 V 2.0 mA	V_{CB} = 45 V 4.0 mA	V_{CB} = 45 V 8.0 mA
I_C	Max Continuous Collector Current V_{CE} = 4 V	0.5 A	1.0 A	4.0 A	8.0 A
h_{FE}	Forward Current Transfer Ratio V_{CE} = 5 V	I_C = 0.1 A 10-100	I_C = 0.2 A 10-100	I_C = 0.4 A 10-100	I_C = 0.8 A 10-100
θ_{jF}	Thermal Resistance Junction to Flange	15 °C/W	8 °C/W	4.5 °C/W	2.5 °C/W
P_o	Min Broadband Power Output	2.0 W	6.0 W	11.0 W	25.0 W
C_{ob}	Max Collector-Base Capacitance V_{CB} = 28 V, f = 1 MHz	4.5 pF	8 pF	12 pF	Internal Shunt L
$P_{G(dB)}$	Min Power Gain in dB V_{CB} = 28 V	P_o = 2.0 W 8.0 dB	P_o = 6.0 W 7.4 dB	P_o = 11.0 W 7.4 dB	P_o = 25.0 W 7.0 dB
η_c	Min Broadband Collector Efficiency	P_o = 2.0 W 40 %	P_o = 6.0 W 45 %	P_o = 11.0 W 45 %	P_o = 25.0 W 45 %
T_j	-65 to +200°C				
T_{STG}	-65 to +150°C				
L_R	Input Return Loss in Recommended Circuit	-10dB Max	-10dB Max	-10dB Max	-10dB Max

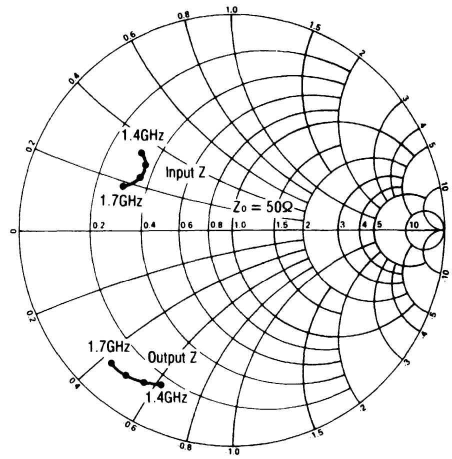
* The concept of input and/or output matching using MOS capacitors, wire bonds and other techniques is patented by TRW, Inc. (US # 3,713,006).

MRA1417-2 — 2 WATTS BROADBAND

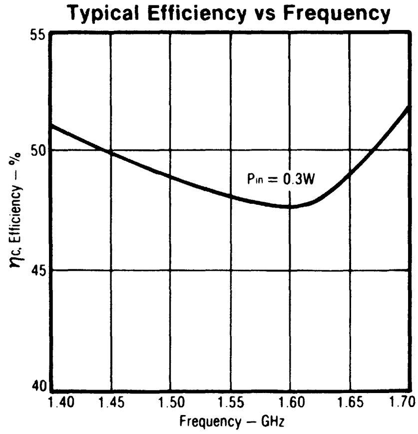
Typical Power Output vs Frequency



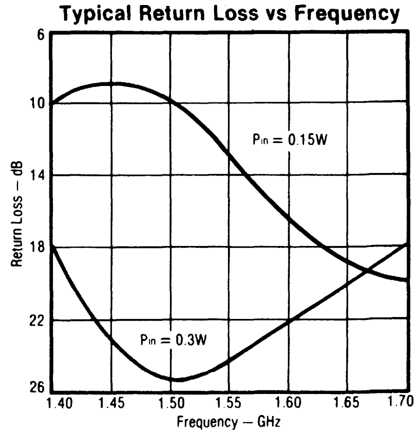
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

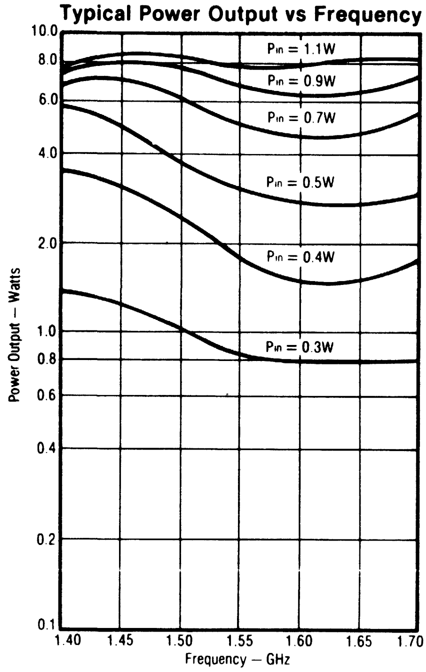


Typical Return Loss vs Frequency

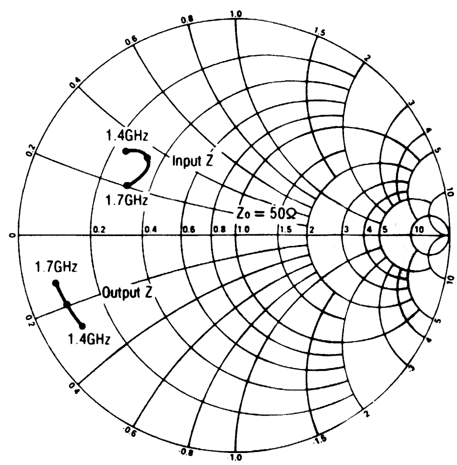


MRA1417-6 — 6 WATTS BROADBAND

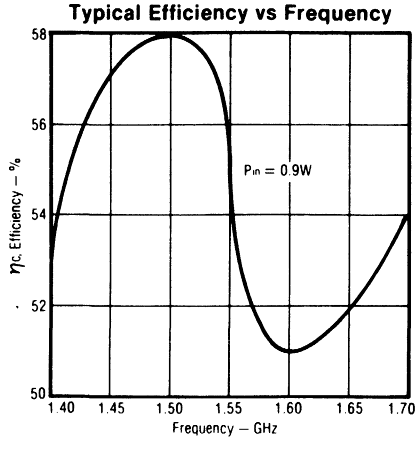
Typical Power Output vs Frequency



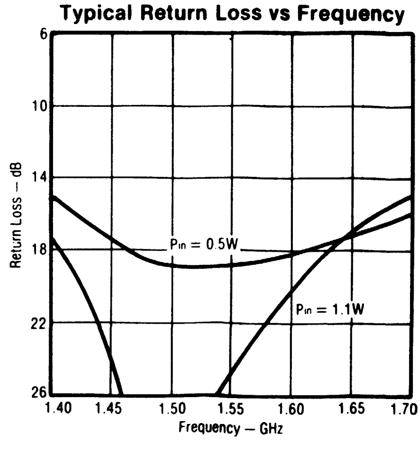
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

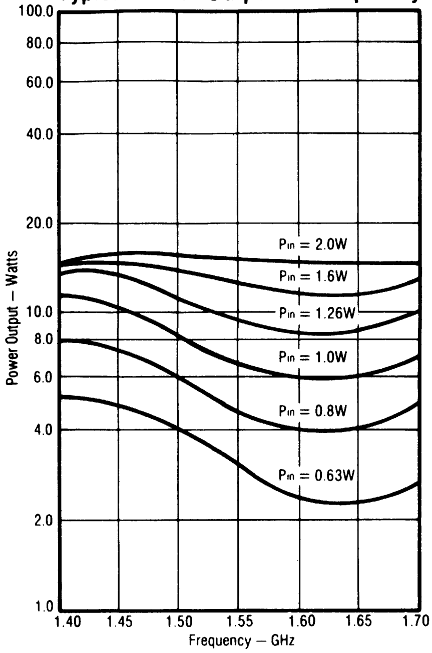


Typical Return Loss vs Frequency

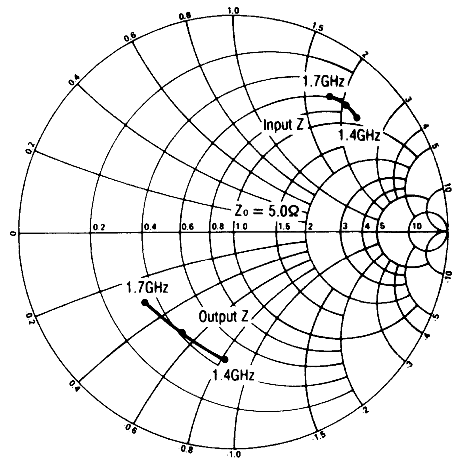


MRA1417-11 — 11 WATTS BROADBAND

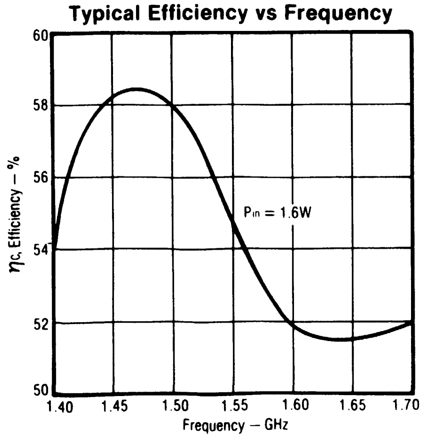
Typical Power Output vs Frequency



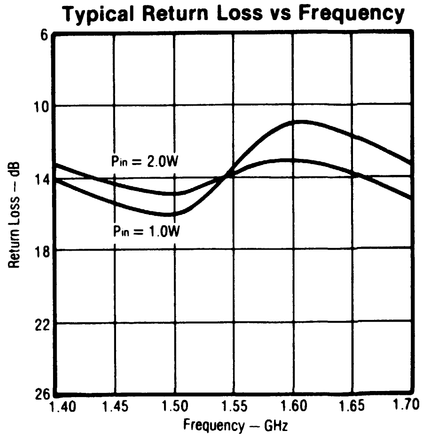
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

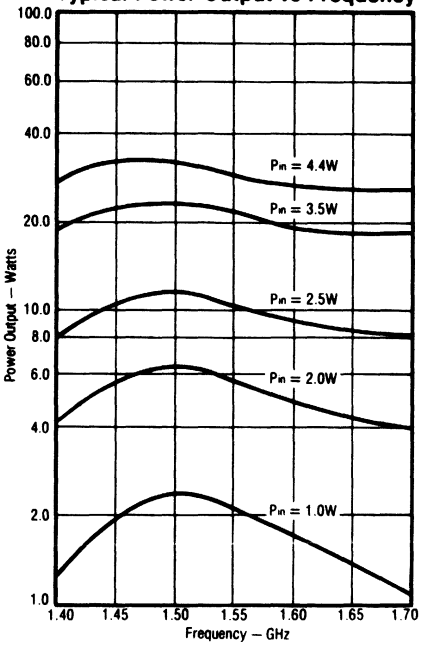


Typical Return Loss vs Frequency

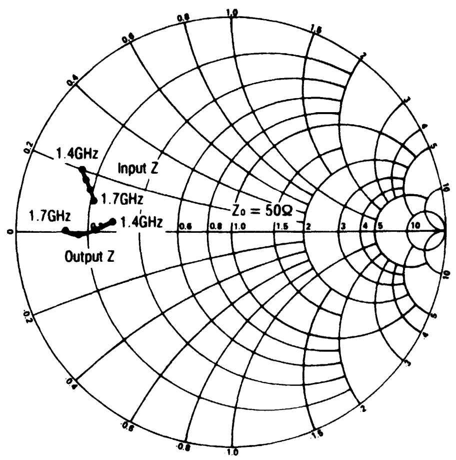


MRA1417-25 — 25 WATTS BROADBAND

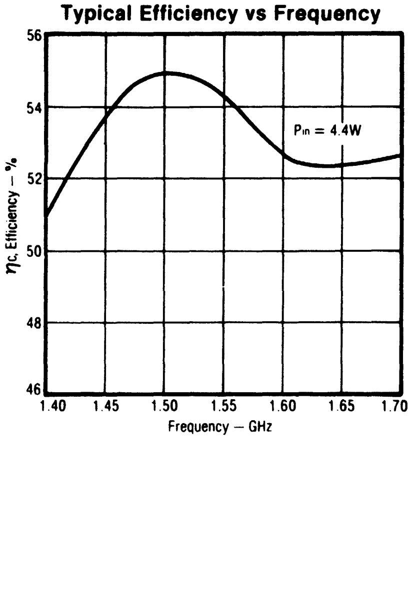
Typical Power Output vs Frequency



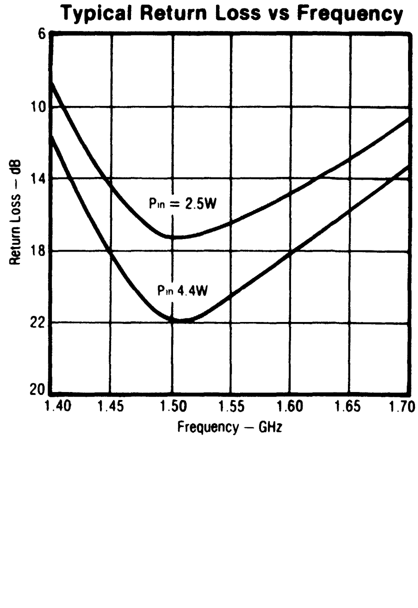
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

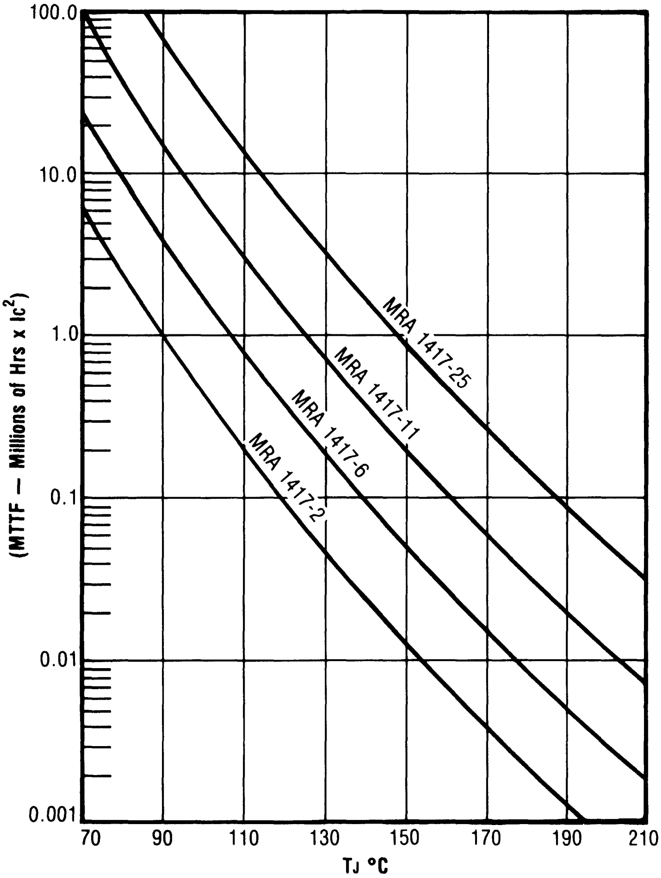


Typical Return Loss vs Frequency



MTTF FACTOR (Normalized to 1 Ampere² Continuous Duty)

The graph shown below displays MTTF in hours x ampere² emitter current for each of the devices. Life tests at elevated temperatures have correlated to better than ±10% to the theoretical prediction for metal failure. Sample MTTF calculations based on operating conditions are included below.



Example of MTTF for MRA1417-11 Conditions

$P_O = 11.0W$

$P_{IN} = 2.0W$

$V_{CC} = 28V$

$\eta = 45\%$

$T_{FLANGE} = 70°C$

$$I_C = I_E = \frac{100 \times P_O}{\eta_C \times V_{CC}} = 0.873A$$

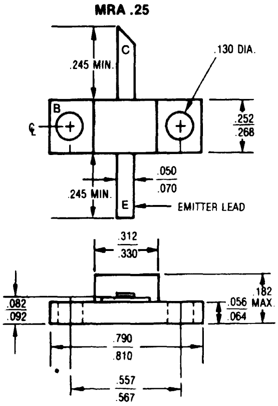
$$P_{DISS} = P_{IN} + V_{CC}.\ I_C - P_O = 15.44W$$

$$T_{JUNC} = T_{FLANGE} + \theta JF \times P_{DISS} = 139.4\ °C$$

$$MTTF = \frac{0.36 \times 10^6 \text{ Hrs Amp}^2}{I_C^2} = 472{,}360 \text{ Hrs}$$

$$MTTF = 53.9 \text{ Yrs}$$

MRA .25



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- Common Base
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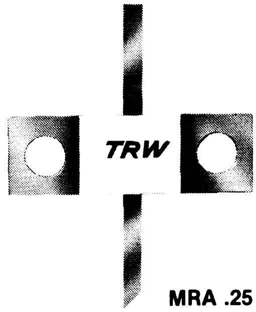


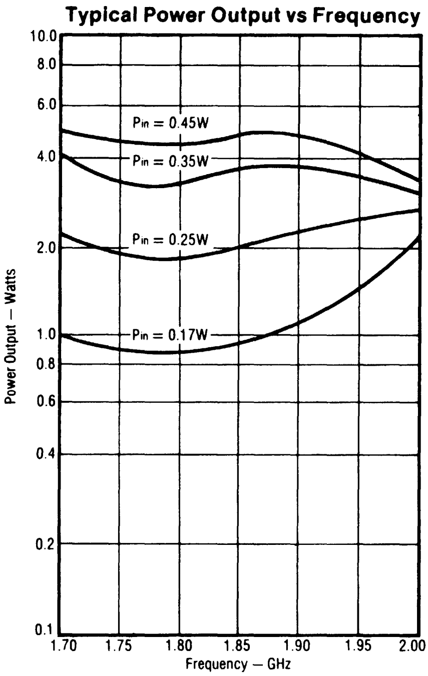
MRA .25

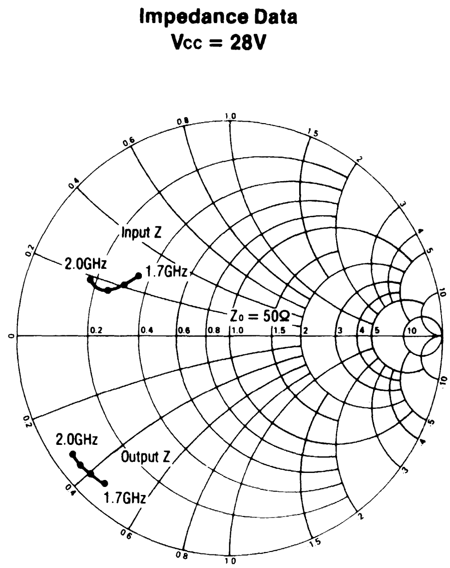
Electrical Characteristics at T_{flange} = 25 °C

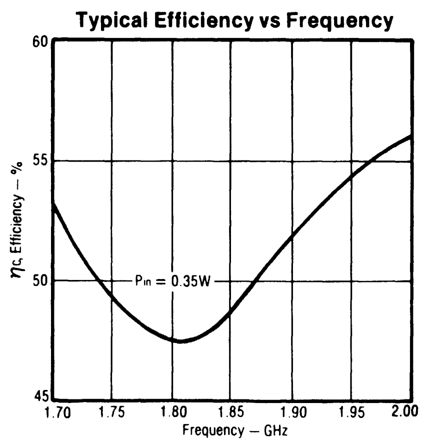
Symbol	Characteristic	MRA1720-2	MRA1720-5	MRA1720-9	MRA1720-20
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 20 mA 50 V Min	I_C = 40 mA 50 V Min	I_C = 80 mA 50 V Min	I_C = 160 mA 50 V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25 mA 3.5 V Min	I_E = 0.5 mA 3.5 V Min	I_E = 1.0 mA 3.5 V Min	I_E = 2.0 mA 3.5 V Min
I_{CBO}	Collector Cutoff Current I_E = 0	V_{CB} = 28 V 0.5 mA	V_{CB} = 28 V 1.0 mA	V_{CB} = 28 V 2.0 mA	V_{CB} = 28 V 4.0 mA
		V_{CB} = 45 V 1.0 mA	V_{CB} = 45 V 2.0 mA	V_{CB} = 45 V 4.0 mA	V_{CB} = 45 V 8.0 mA
I_C	Max Continuous Collector Current V_{CE} = 4 V	0.5 A	1.0 A	4.0 A	8.0 A
h_{FE}	Forward Current Transfer Ratio V_{CE} = 5 V	I_C = 0.1 A 10-100	I_C = 0.2 A 10-100	I_C = 0.4 A 10-100	I_C = 0.8 A 10-100
θ_{jF}	Thermal Resistance Junction to Flange	15 °C/W	8 °C/W	4.5 °C/W	2.5 °C/W
P_o	Min Broadband Power Output	2.0 W	5.0 W	9.0 W	20.0 W
C_{ob}	Max Collector-Base Capacitance V_{CB} = 28 V, f = 1 MHz	4.5 pF	8 pF	12 pF	Internal Shunt L
$P_{G(dB)}$	Min Power Gain in dB V_{CB} = 28 V	P_o = 2.0 W 7.5 dB	P_o = 5.0 W 6.5 dB	P_o = 9.0 W 6.5 dB	P_o = 20.0 W 6.0 dB
η_c	Min Broadband Collector Efficiency	P_o = 2.0 W 35 %	P_o = 5.0 W 40 %	P_o = 9.0 W 40 %	P_o = 20.0 W 40 %
T_j	-65 to +200°C				
T_{STG}	-65 to +150°C				
L_R	Input Return Loss in Recommended Circuit	-10dB Max	-10dB Max	-10dB Max	-10dB Max

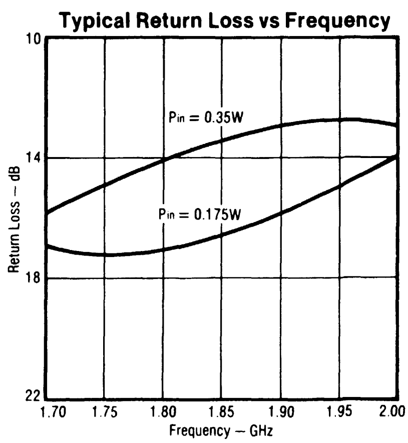
*The concept of input and/or output matching using MOS capacitors, wire bonds and other techniques is patented by TRW, Inc. (US # 3,713,006).

MRA 1720-2 WATTS BROADBAND



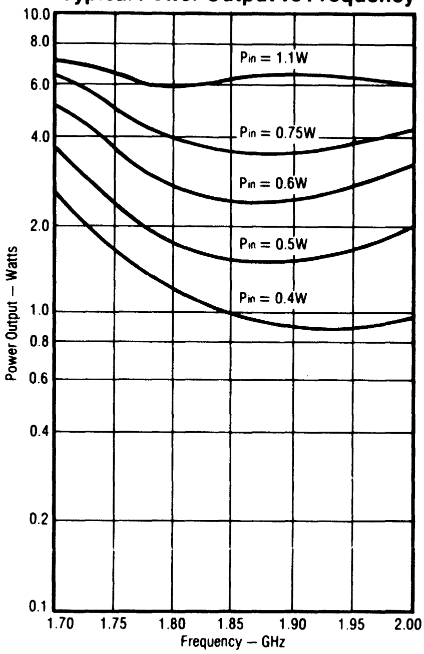




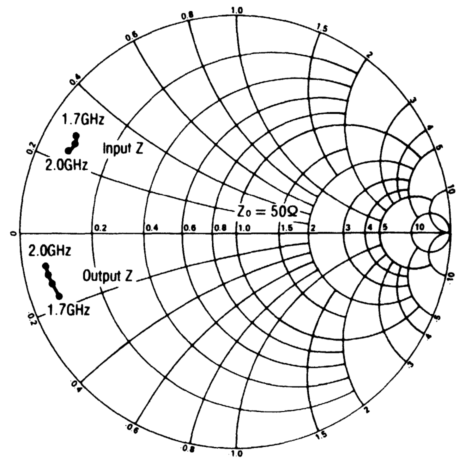


MRA 1720-5 — 5 WATTS BROADBAND

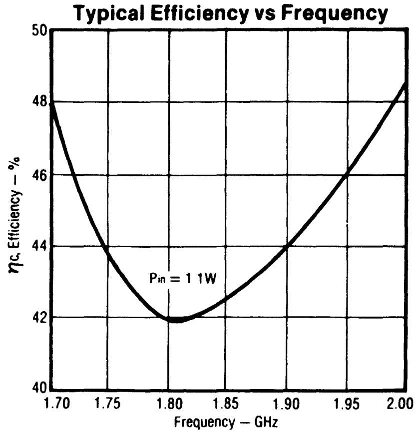
Typical Power Output vs Frequency



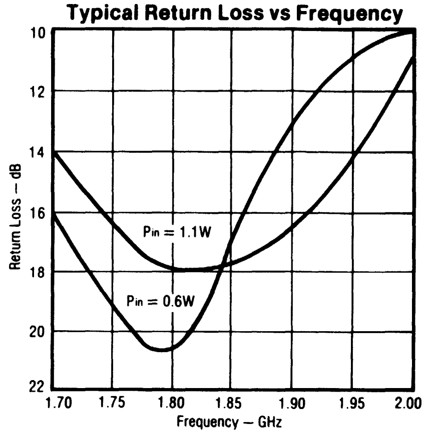
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

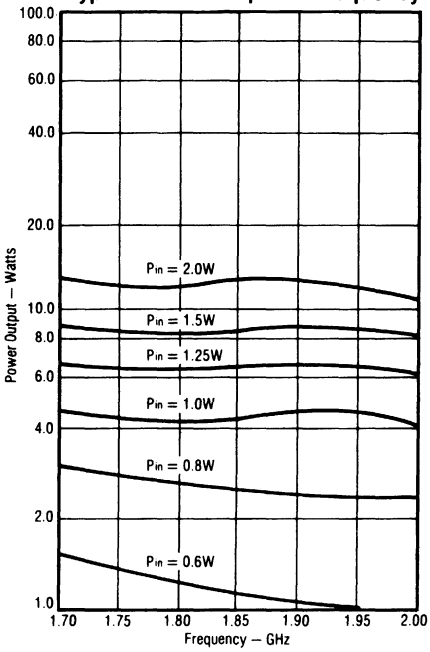


Typical Return Loss vs Frequency

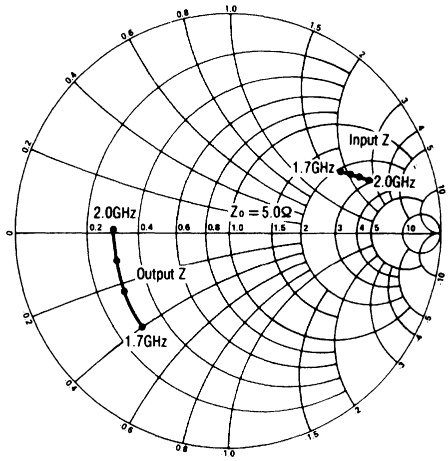


MRA 1720-9 — 9 WATTS BROADBAND

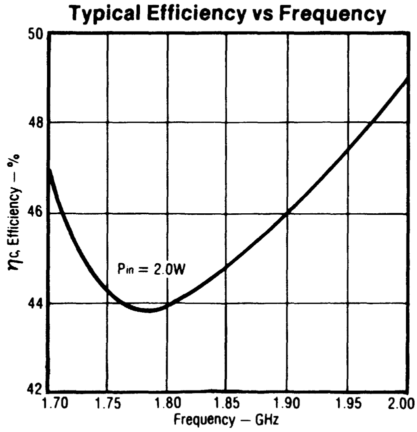
Typical Power Output vs Frequency



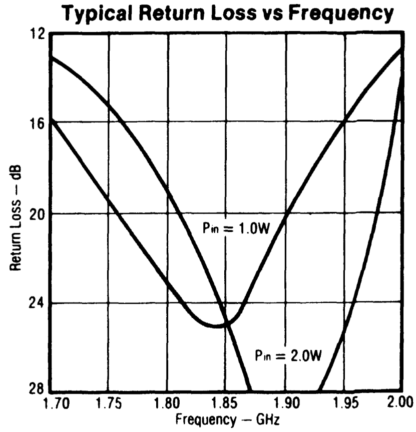
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

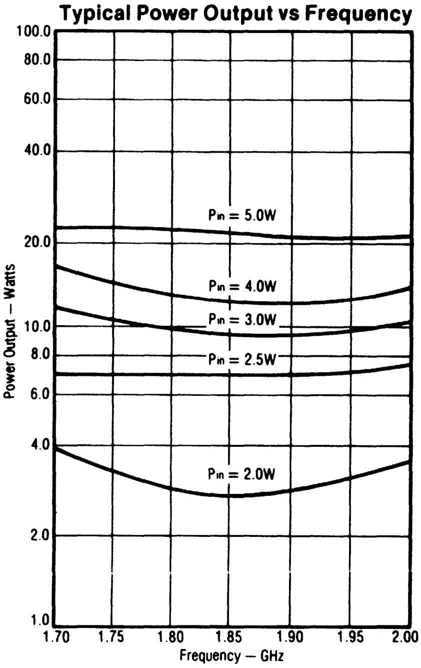


Typical Return Loss vs Frequency

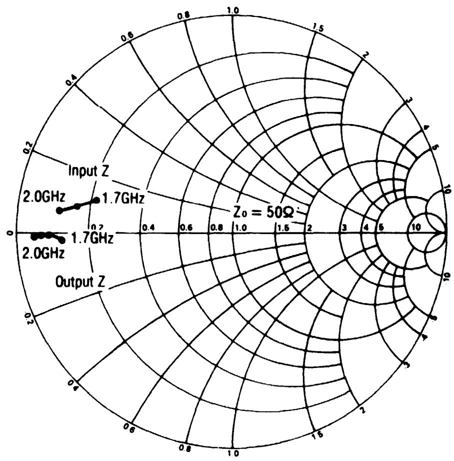


MRA 1720-20 — 20 WATTS BROADBAND

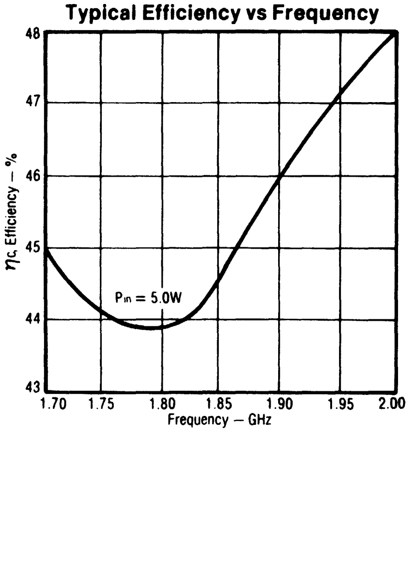
Typical Power Output vs Frequency



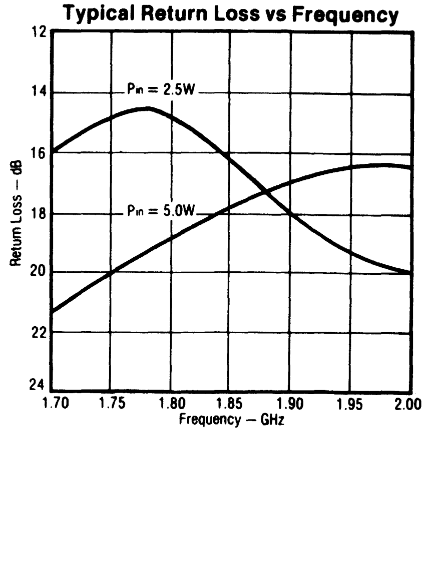
Impedance Data
Vcc = 28V



Typical Efficiency vs Frequency

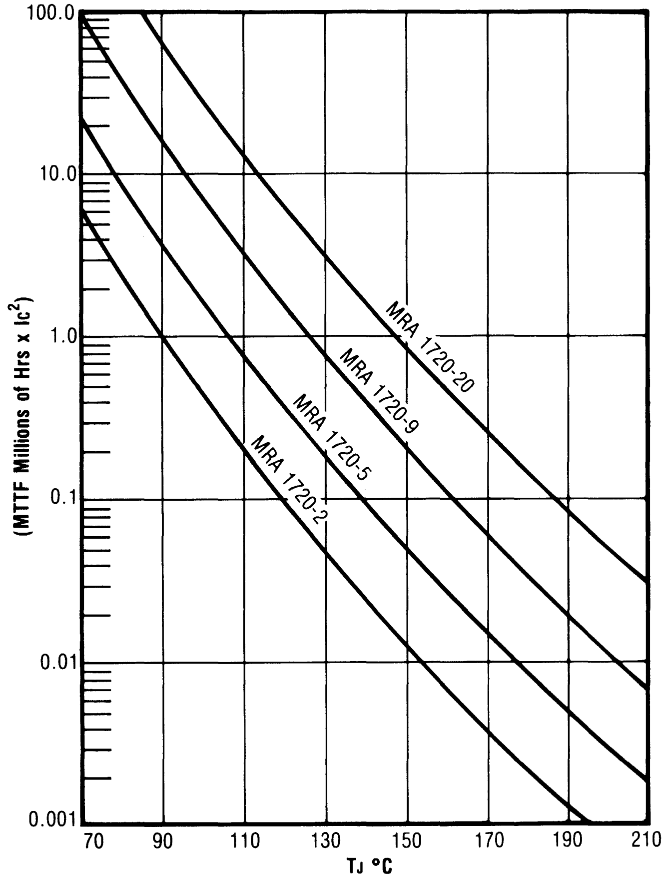


Typical Return Loss vs Frequency



MTTF FACTOR (Normalized to 1 Ampere² Continuous Duty)

The graph shown below displays MTTF in hours x ampere² emitter current for each of the devices. Life tests at elevated temperatures have correlated to better than ±10% to the theoretical prediction for metal failure. Sample MTTF calculations based on operating conditions are included below.



Example of MTTF for MRA1720-9 Conditions

$P_O = 9.0W$

$P_{IN} = 2.0W$

$V_{CC} = 28V$

$\eta_C = 40\%$

$T_{FLANGE} = 70°C$

$$I_C = I_C = \frac{100\ P_O}{\eta_C \times V_{CC}} = 0.803A$$

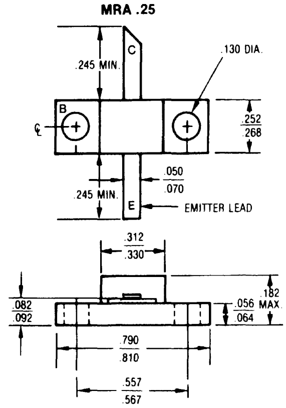
$P_{DISS} = P_{IN} + V_{CC} \cdot I_C - P_O = 15.48W$

$T_{JUNC} = T_{FLANGE} + \theta_{JF} \times 15.48 = 139.6\ °C$

$$MTTF = \frac{0.4 \times 10^6\ \text{Hrs Amp}^2}{I_C^2} = 620,338\ \text{Hrs}$$

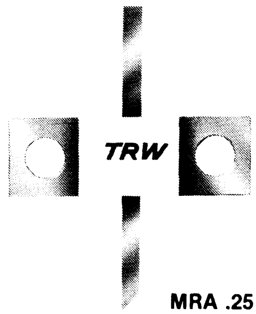
$MTTF = 70.8\ \text{Yrs}$

MRA .25



MICROAMP®

- Full "MRA" performance at 22 volts V_{CC}
- Gold metalization
- Diffused ballast resistors
- Common Base
- ∞ VSWR
- 1400-1700 MHz
- 2 to 25 Watts



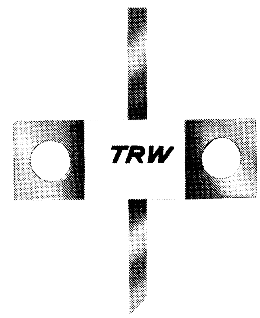
Electrical Characteristics at T_{FLANGE} = 25°C

SYMBOL	CHARACTERISTICS	MRAL1417-2	MRAL1417-6	MRAL1417-11	MRAL1417-25
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 20mA 42V Min	I_C = 40mA 42V Min	I_C = 80mA 42V Min	I_C = 160mA 42V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25mA 3.5V Min	I_E = 0.5mA 3.5V Min	I_E = 1.0mA 3.5V Min	I_E = 2.0mA 3.5V Min
I_{CBO}	Collector Cutoff Current I_E = 0	V_{CB} = 22V 0.5mA	V_{CB} = 22V 1.0mA	V_{CB} = 22V 2.0mA	V_{CB} = 22V 4.0mA
		V_{CB} = 38V 1.0mA	V_{CB} = 38V 2.0mA	V_{CB} = 38V 4.0mA	V_{CB} = 38V 8.0mA
I_C	Max. Continuous Collector Current V_{CE} = 4V	0.5A	1.0A	4.0A	8.0A
h_{FE}	Forward Current Transfer Ratio V_{CE} = 5V	I_C = 0.1A 10-100	I_C = 0.2A 10-100	I_C = 0.4A 10-100	I_C = 0.8A 10-100
P_O	Min. Broadband Power Output	2.0W	6.0W	11.0W	25.0W
$P_{G(dB)}$	Min. Power Gain in dB V_{CB} = 22V	P_O = 2.0W 8.0dB	P_O = 6.0W 7.4dB	P_O = 11.0W 7.4dB	P_O = 25.0W 7.0dB
η_C	Min. Broadband Collector Efficiency	P_O = 2.0W 40%	P_O = 6.0W 45%	P_O = 11.0W 45%	P_O = 25.0W 45%
T_j	−65 to +200°C				
T_{STG}	−65 to +150°C				

*The concept of input and/or output matching using MOS capacitors, wire bonds and other techniques is patented by TRW, Inc. (US # 3,713,006).

MICROAMP® MRAL 1720 Series

- Internally Compensated*
- Gold Metalized
- Diffused Ballast Resistors
- MTTF Data
- 22 Volt Operation
- 1700-2000 MHz
- 2 to 20 Watts
- ∞ VSWR
- Common Base



MRA .25

Electrical Characteristics at T_{FLANGE} = 25°C

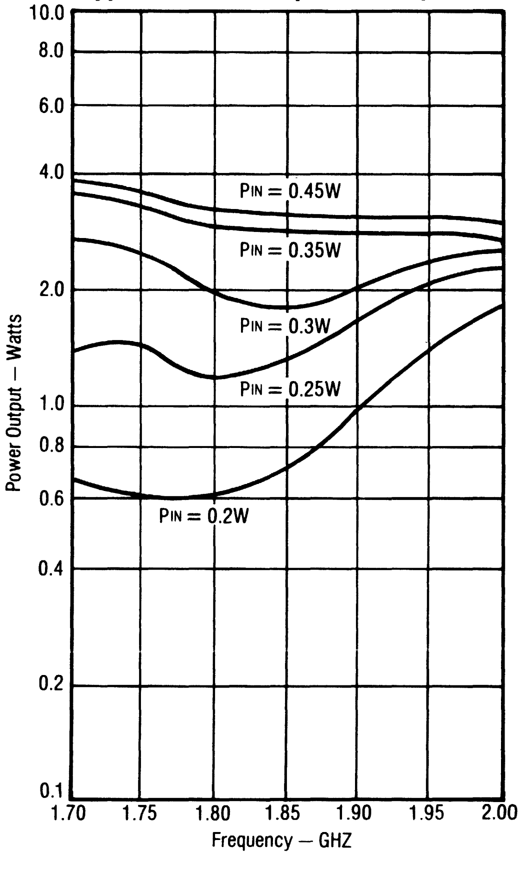
SYMBOL	CHARACTERISTICS	MRAL1720-2	MRAL1720-5	MRAL1720-9	MRAL1720-20
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 20mA 42V Min	I_C = 40mA 42V Min	I_C = 80mA 42V Min	I_C = 160mA 42V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25mA 3.5V Min	I_E = 0.5mA 3.5V Min	I_E = 1.0mA 3.5V Min	I_E = 2.0mA 3.5V Min
I_{CBO}	Collector Cutoff Current I_E = 0	V_{CB} = 22V 0.5mA	V_{CB} = 22V 1.0mA	V_{CB} = 22V 2.0mA	V_{CB} = 22V 4.0mA
		V_{CB} = 38V 1.0mA	V_{CB} = 38V 2.0mA	V_{CB} = 38V 4.0mA	V_{CB} = 38V 8.0mA
I_C	Max. Continuous Collector Current V_{CE} = 4V	0.5A	1.0A	4.0A	8.0A
h_{FE}	Forward Current Transfer Ratio V_{CE} = 5V	I_C = 0.1A 10-100	I_C = 0.2A 10-100	I_C = 0.4A 10-100	I_C = 0.8A 10-100
θ_{jF}	Thermal Resistance Junction to Flange	15°C/W	8°C/W	4.5°C/W	2.5°C/W
P_O	Min. Broadband Power Output	2.0W	5.0W	9.0W	20.0W
C_{OB}	Max. Collector-Base Capacitance V_{CB} = 28V; f = 1MHz	4.5pF	8pF	12pF	24pF(1)
$P_{G(dB)}$	Min. Power Gain in dB V_{CB} = 22V	P_O = 2.0W 7.5dB	P_O = 5.0W 6.5dB	P_O = 9.0W 6.5dB	P_O = 20.0W 6.0dB
η_C	Min. Broadband Collector Efficiency	P_O = 2.0W 35%	P_O = 5.0W 40%	P_O = 9.0W 40%	P_O = 20.0W 40%
T_{STG}	Maximum Storage Temperature: -65 to +150°C				
T_j	Maximum Junction Temperature: -65 to +200°C				

*The concept of input and/or output matching using MOS capacitors, wire bonds and other techniques is patented by TRW, Inc. (US #3,713,006).

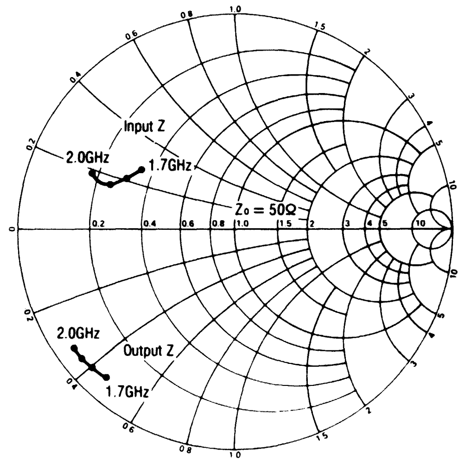
(1)Nominal value, not measurable due to shunt inductor bypass.

MRAL 1720-2, 2 WATTS BROADBAND

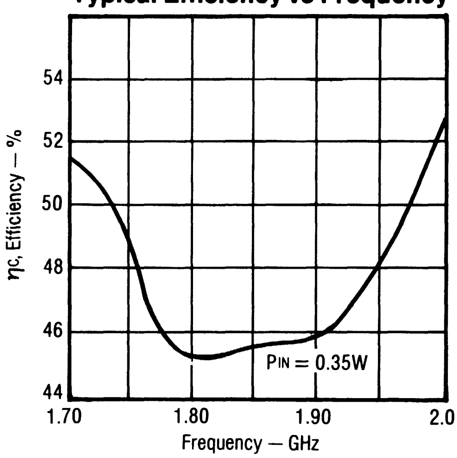
Typical Power Output vs Frequency



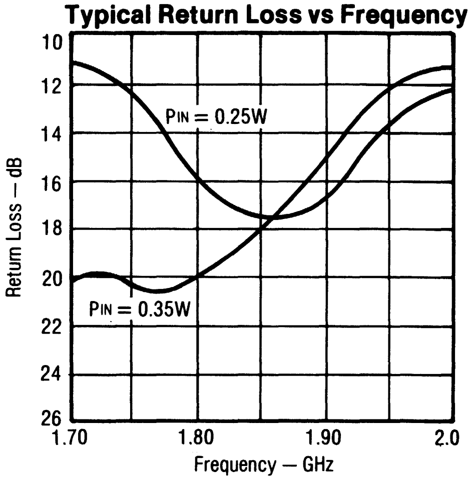
Impedance Data
Vcc = 22V



Typical Efficiency vs Frequency

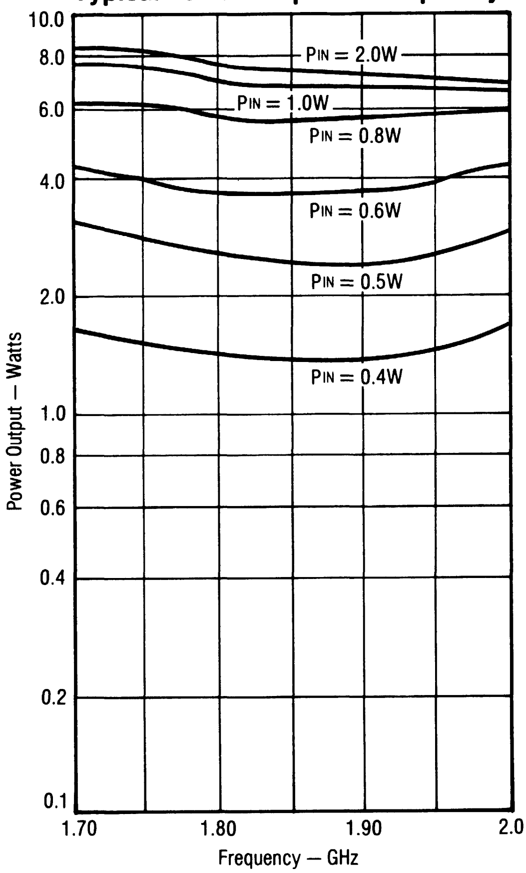


Typical Return Loss vs Frequency

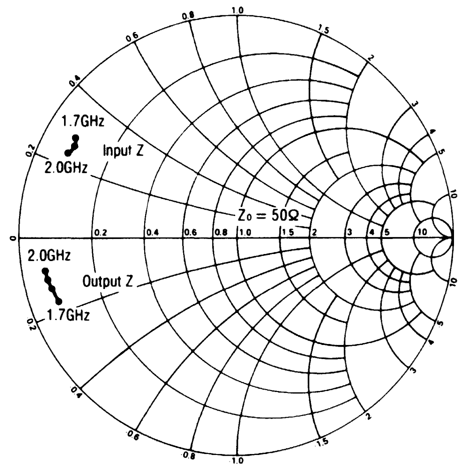


MRAL 1720-5, 5 WATTS BROADBAND

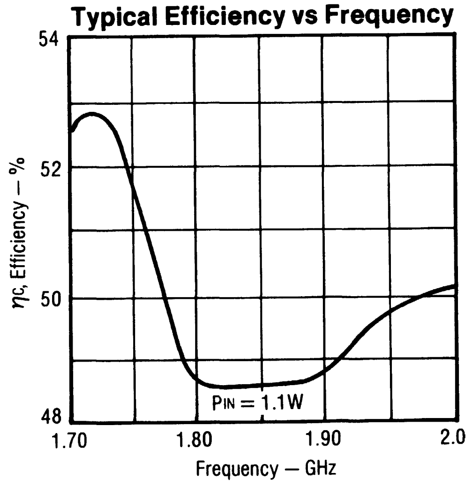
Typical Power Output vs Frequency



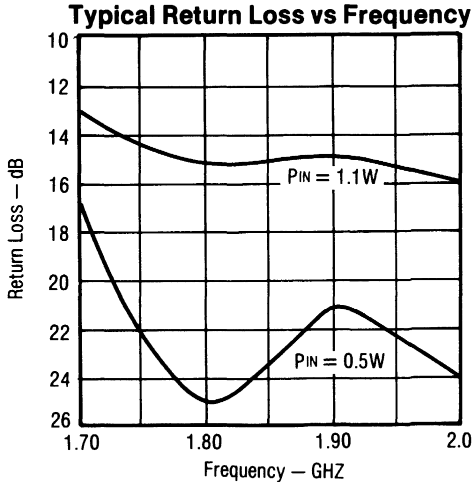
Impedance Data
Vcc = 22V



Typical Efficiency vs Frequency

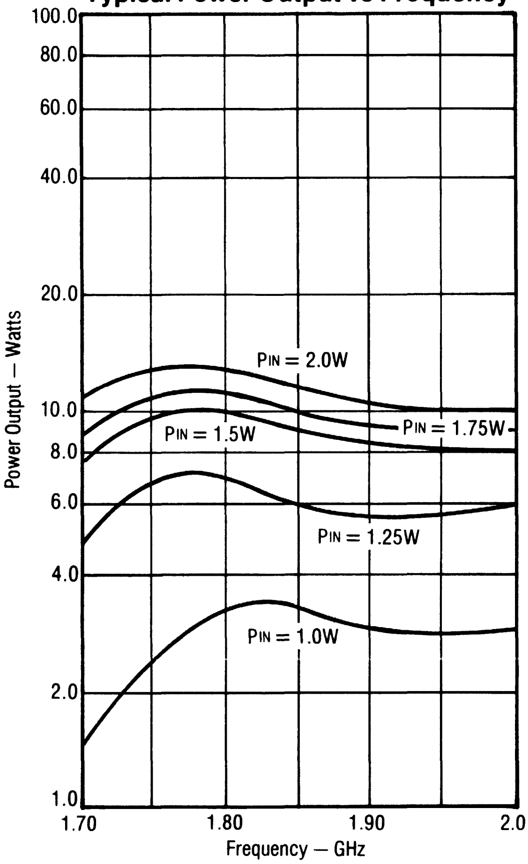


Typical Return Loss vs Frequency

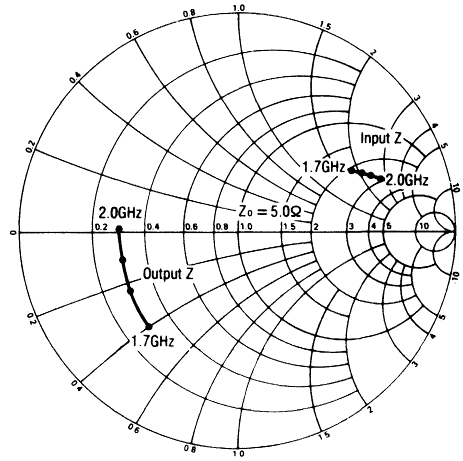


MRAL 1720-9, 9 WATTS BROADBAND

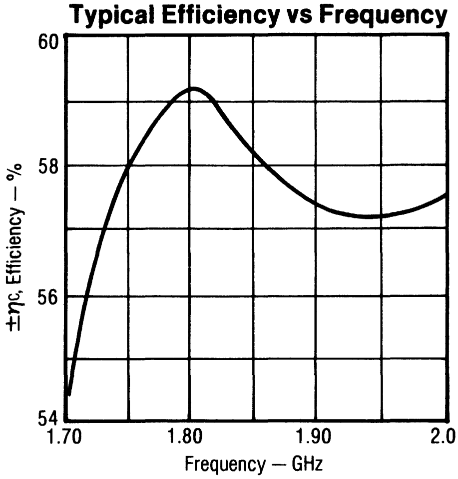
Typical Power Output vs Frequency



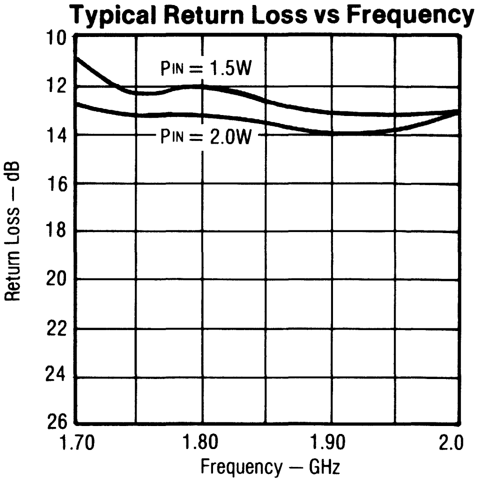
Impedance Data
Vcc = 22V



Typical Efficiency vs Frequency

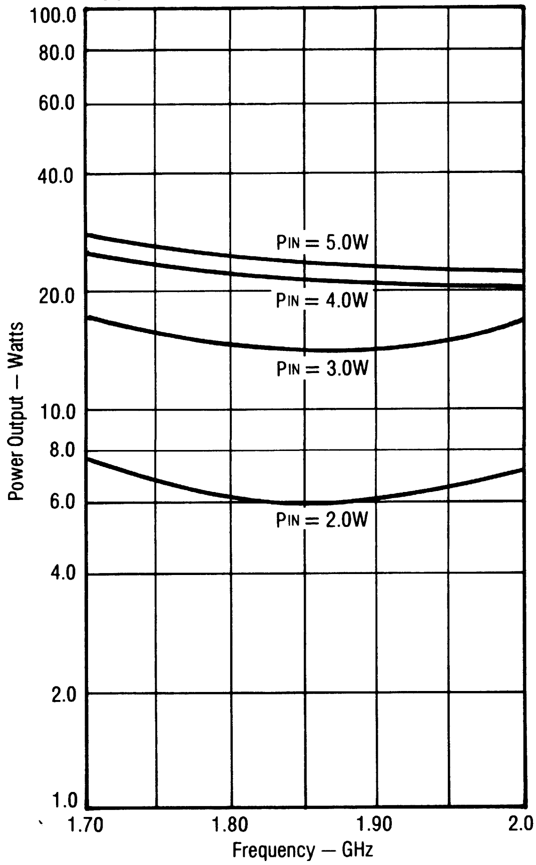


Typical Return Loss vs Frequency

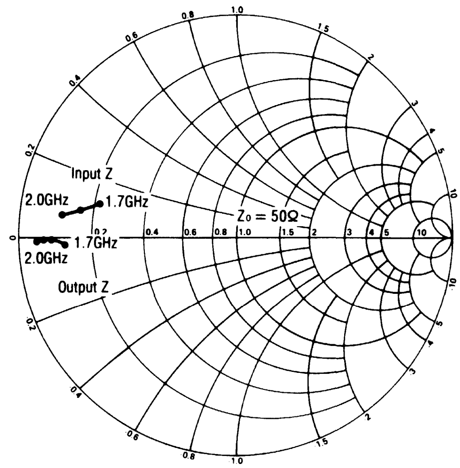


MRAL 1720-20, 20 WATTS BROADBAND

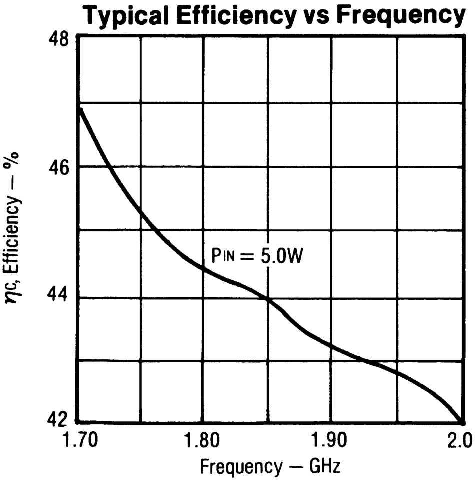
Typical Power Output vs Frequency



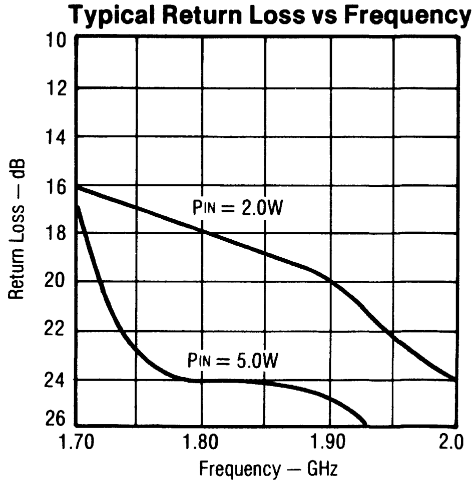
Impedance Data
Vcc = 22V



Typical Efficiency vs Frequency



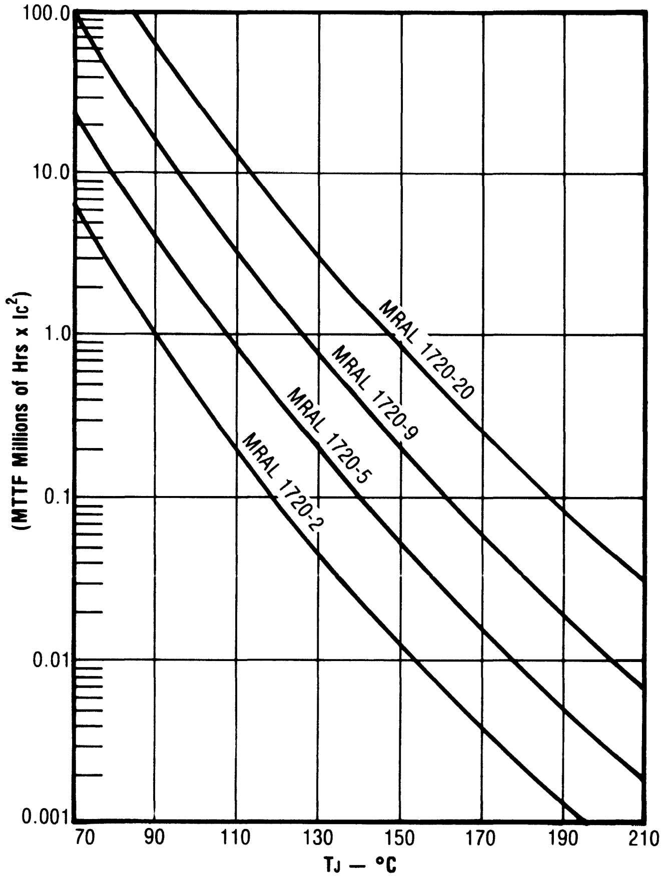
Typical Return Loss vs Frequency



Note: Test circuit details are available from TRW Semiconductors.

MTTF FACTOR (Normalized to 1 Ampere² Continuous Duty)

The graph shown below displays MTTF in hours x ampere² emitter current for each of the devices. Life tests at elevated temperatures have correlated to better than ±10% to the theoretical prediction for metal failure. Sample MTTF calculations based on operating conditions are included below.



Example of MTTF for MRA1720-9 Conditions

$P_O = 9.0W$

$P_{IN} = 2.0W$

$V_{CC} = 28V$

$\eta_C = 40\%$

$T_{FLANGE} = 70°C$

$$I_C \simeq I_E = \frac{100\ P_O}{\eta_C \times V_{CC}} = 0.803A$$

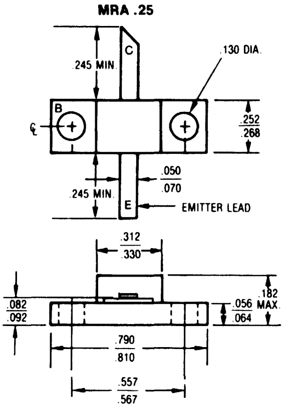
$P_{DISS} = P_{IN} + V_{CC}.\ I_C - B = 15.48W$

$T_{JUNC} = T_{FLANGE} + \theta JF \times 15.48 = 139.6\ °C$

$$MTTF = \frac{0.4 \times 10^6\ \text{Hrs Amp}^2}{I_C^2} = 620{,}338\ \text{Hrs}$$

$MTTF = 70.8$ Yrs

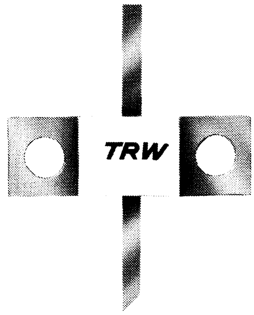
MRA .25



TRW

MICroAMP®

- 1.5 to 12 Watts
- ∞ VSWR
- Broadband 2000-2300 MHz
- Internally Compensated*
- Gold Metalized
- Diffused Ballast Resistors
- MTTF Data
- Full "MRA" Performance at 22 V
- Common Base



MRA .25

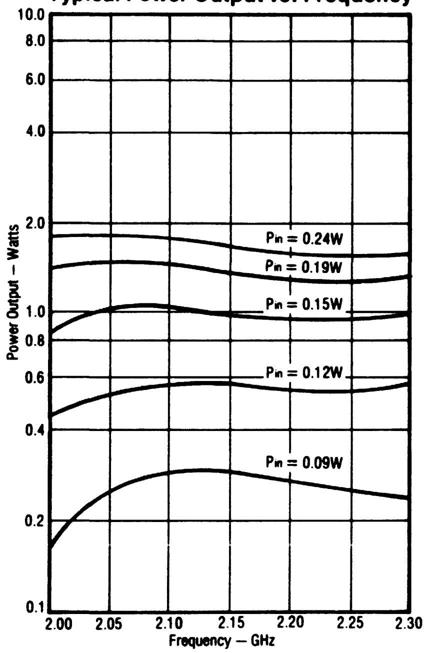
Electrical Characteristics at T_{flange} = 25 °C

Symbol	Characteristic	MRAL2023-1.5	MRAL2023-3	MRAL2023-6	MRAL2023-12
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 10 mA 42 V Min	I_C = 20 mA 42 V Min	I_C = 50 mA 42 V Min	I_C = 100 mA 42 V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.2 mA 3.5 V Min	I_E = 0.4 mA 3.5 V Min	I_E = 1.0 mA 3.5 V Min	I_E = 2.0 mA 3.5 V Min
I_{CBO}	Collector Cutoff Current I_E = 0	V_{CB} = 22 V 0.25 mA	V_{CB} = 22 V 0.5 mA	V_{CB} = 22 V 1.25 mA	V_{CB} = 22 V 2.5 mA
		V_{CB} = 38 V 0.5 mA	V_{CB} = 38 V 1.0 mA	V_{CB} = 38 V 2.5 mA	V_{CB} = 38 V 5.0 mA
I_C	Max Continuous Collector Current V_{CE} = 4 V	0.25 A	0.5 A	1.25 A	2.5 A
h_{FE}	Forward Current Transfer Ratio V_{CE} = 5 V	I_C = 0.1 A 10-90	I_C = 0.2 A 10-90	I_C = 0.5 A 10-90	I_C = 1.0 A 10-90
θ_{jF}	Thermal Resistance Junction to Flange	30 °C/W	16 °C/W	8 °C/W	4.5 °C/W
P_o	Min Broadband Power Output	1.5 W	3.0 W	6.0 W	12.0 W
C_{ob}	Max Collector-Base Capacitance V_{CB} = 22 V, f = 1 MHz	3.5 pF	5 pF	10 pF	Internal Shunt L
$P_{G(dB)}$	Min Power Gain in dB V_{CB} = 22 V	P_o = 1.5 W 8.0 dB	P_o = 3.0 W 8.0 dB	P_o = 6.0 W 6.8 dB	P_o = 12.0 W 6.8 dB
η_c	Min Broadband Collector Efficiency	P_o = 1.5 W 35 %	P_o = 3.0 W 40 %	P_o = 6.0 W 40 %	P_o = 12.0 W 40 %
T_j	-65 + 200 °C				
T_{STG}	-65 to +150°C				
L_R	Input Return Loss in Recommended Circuit	-10dB Max	-10dB Max	-10dB Max	-10dB Max

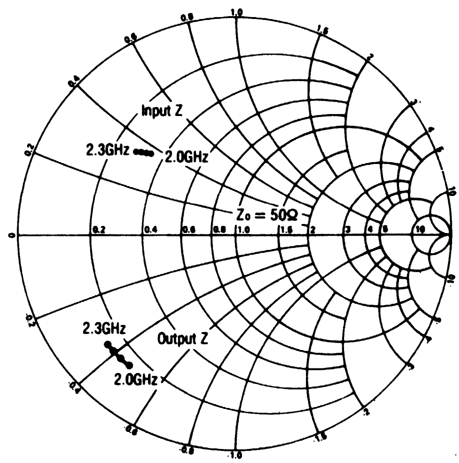
* The concept of input and/or output matching using MOS capacitors, wire bonds and other techniques is patented by TRW, Inc. (US # 3,713,006).

MRAL2023-1.5 WATTS BROADBAND

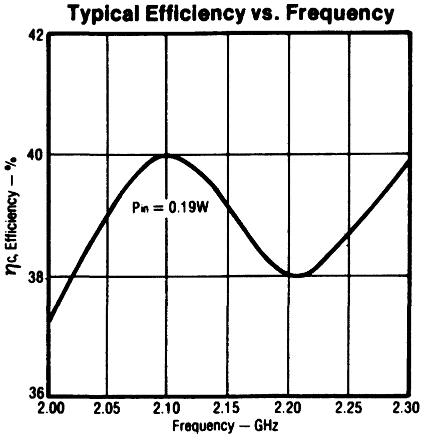
Typical Power Output vs. Frequency



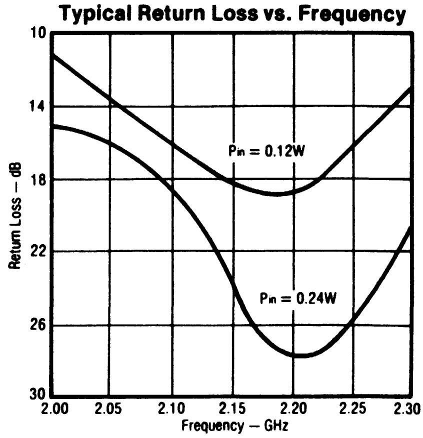
Impedance Data
Vcc = 22V



Typical Efficiency vs. Frequency

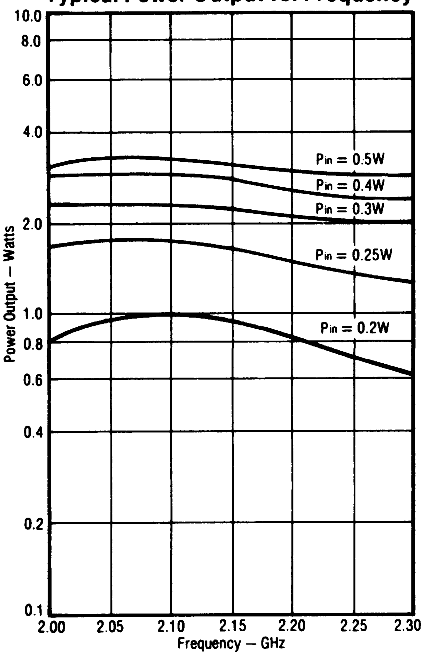


Typical Return Loss vs. Frequency

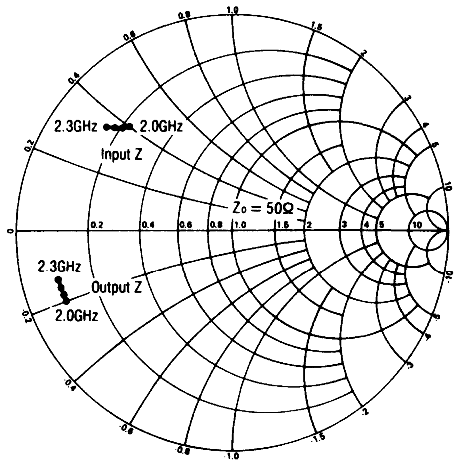


MRAL2023-3 — 3 WATTS BROADBAND

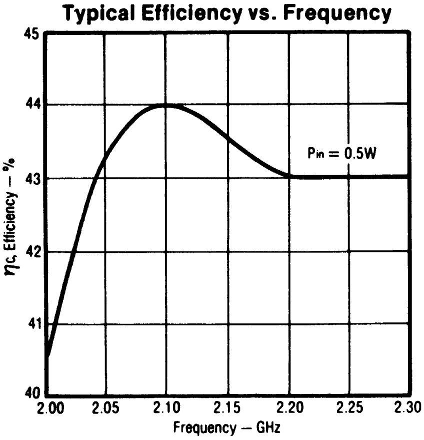
Typical Power Output vs. Frequency



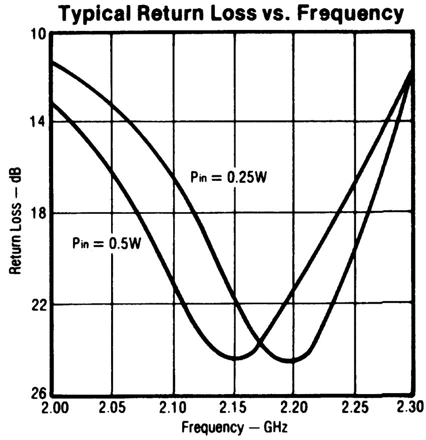
Impedance Data
Vcc = 22V



Typical Efficiency vs. Frequency

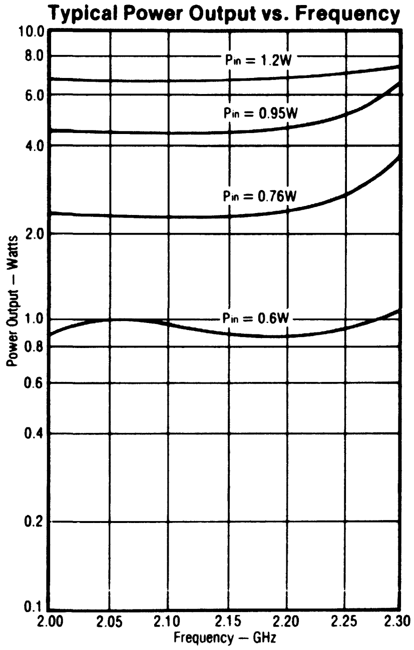


Typical Return Loss vs. Frequency

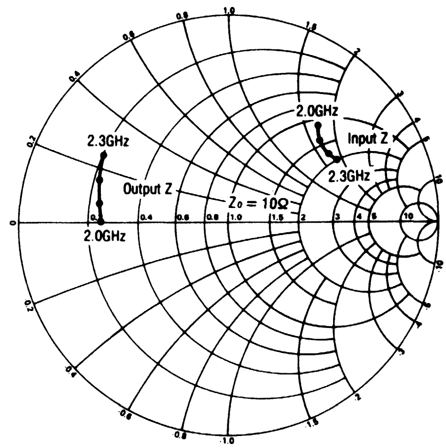


MRAL2023-6 — 6 WATTS BROADBAND

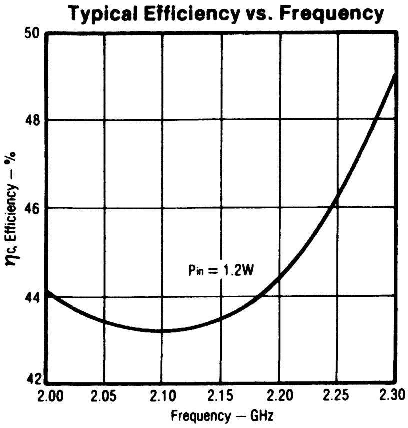
Typical Power Output vs. Frequency



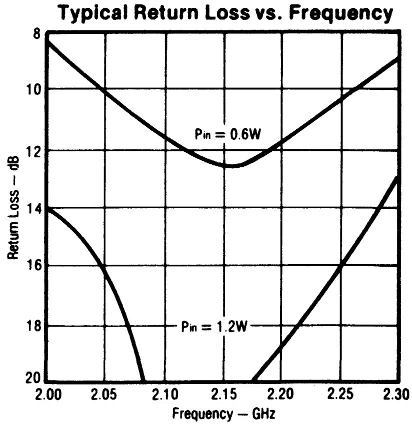
Impedance Data
Vcc = 22V



Typical Efficiency vs. Frequency

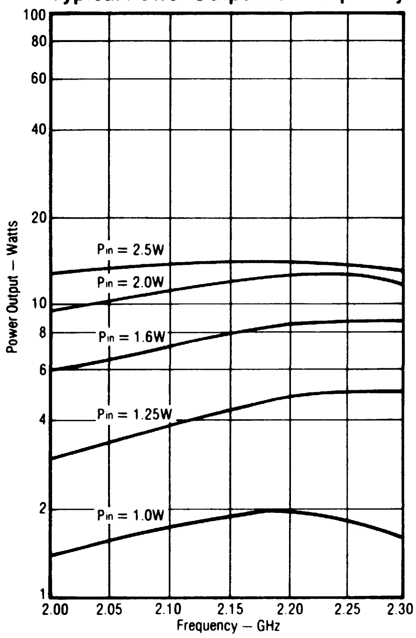


Typical Return Loss vs. Frequency

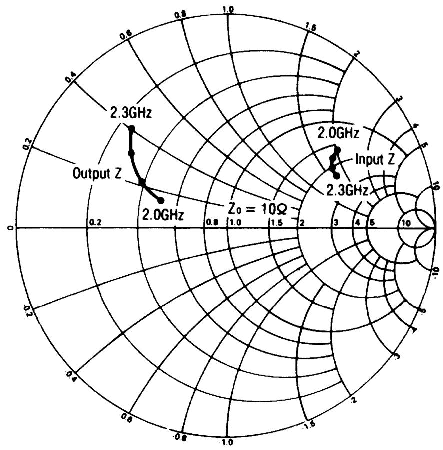


MRAL2023-12 — 12 WATTS BROADBAND

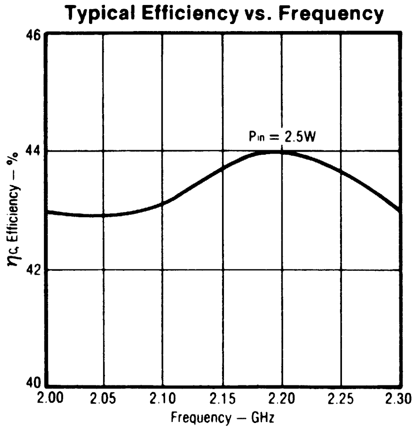
Typical Power Output vs. Frequency



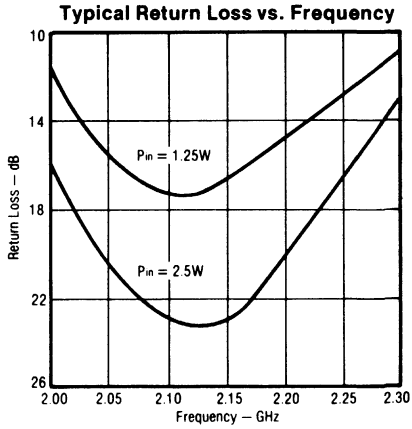
Impedance Data
Vcc = 22V



Typical Efficiency vs. Frequency

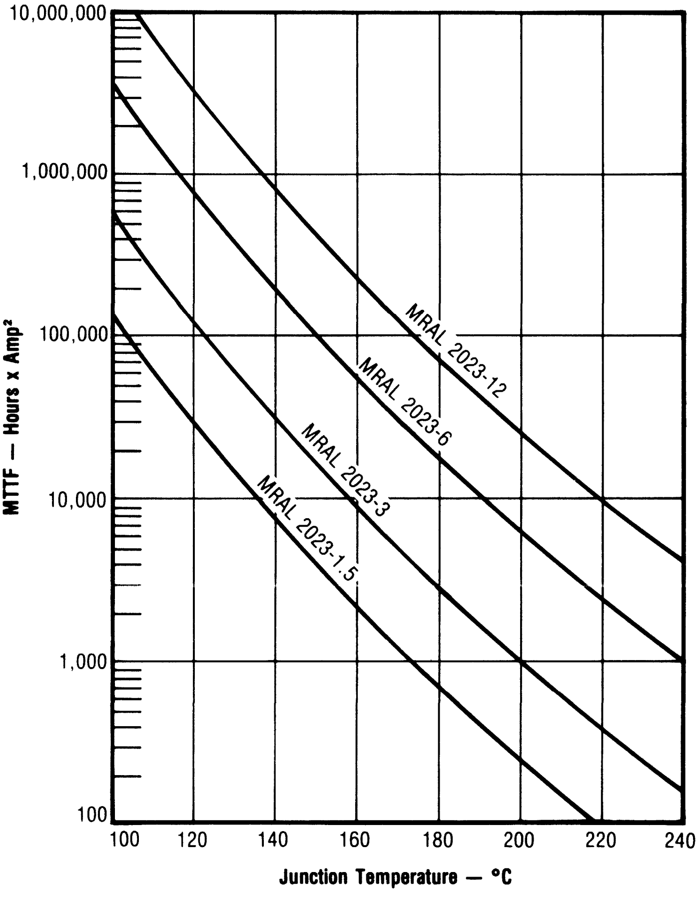


Typical Return Loss vs. Frequency



MTTF FACTOR (Normalized to 1 Ampere² Continuous Duty)

The graph shown below displays MTTF in hours x ampere² emitter current for each of the devices. Life tests at elevated temperatures have correlated to better than ±10% to the theoretical prediction for metal failure. Sample MTTF calculations based on operating conditions are included below.



MRAL 2023-12 (H)

WHERE:

$P_O = 12W$

$P_{IN} = 2.5W$

$V_{CC} = 22V$

$\eta_C = 40\%$

$T_{FLANGE} = 70°C$

$$I_C \simeq I_E = \frac{100\ P_O}{\eta_C \times V_{CC}} = 1.36A$$

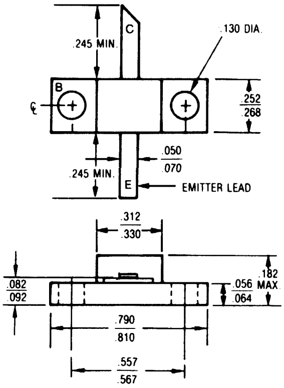
$P_{DISS} = P_{IN} + V_{CC}.\ I_C - P_O = 20.42W$

$T_{JUNC} = T_{FLANGE} + (\theta JF \times P_{DISS}) = 161.89\ °C$

$$MTTF = \frac{2.05 \times 10^5 \text{ Hrs Amp}^2}{I_C^2} = 110{,}834 \text{ Hrs}$$

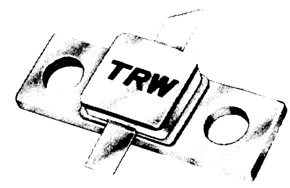
$= 12.65$ Yrs

MRA .25



MICroAMP®

- 1.5-3-6-12 Watts, 22V Operation
- Broadband 2000-2300 MHz
- Internally Compensated*
- Gold Metalized
- Diffused Ballast Resistors
- MTTF Data



HLP-11

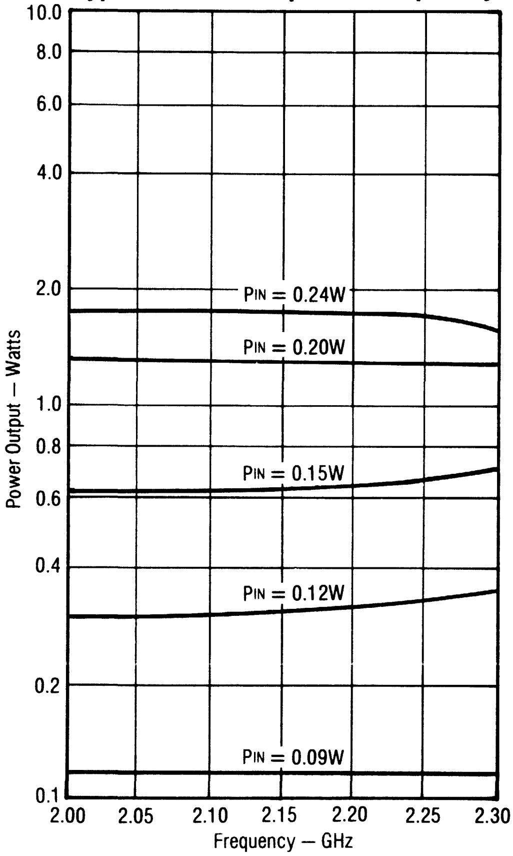
Electrical Characteristics at T_{FLANGE} = 25°C

SYMBOL	CHARACTERISTICS	MRAL2023-1.5H	MRAL2023-3H	MRAL2023-6H	MRAL2023-12H
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 10mA 42V Min	I_C = 20mA 42V Min	I_C = 50mA 42V Min	I_C = 100mA 42V Min
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.2mA 3.5V Min	I_E = 0.4mA 3.5V Min	I_E = 1.0mA 3.5V Min	I_E = 2.0mA 3.5V Min
I_{CBO}	Collector Cutoff Current I_E = 0	V_{CB} = 22V 0.25mA	V_{CB} = 22V 0.5mA	V_{CB} = 22V 1.25mA	V_{CB} = 22V 2.5mA
		V_{CB} = 38V 0.5mA	V_{CB} = 38V 1.0mA	V_{CB} = 38V 2.5mA	V_{CB} = 38V 5.0mA
I_C	Max. Continuous Collector Current V_{CE} = 4V	0.25A	0.5A	1.25A	2.5A
h_{FE}	Forward Current Transfer Ratio V_{CE} = 5V	I_C = 0.1A 10-90	I_C = 0.2A 10-90	I_C = 0.5A 10-90	I_C = 1.0A 10-90
θ_{jF}	Thermal Resistance Junction to Flange	30°C/W	16°C/W	8°C/W	4.5°C/W
P_O	Min. Broadband Power Output	1.5W	3.0W	6.0W	12.0W
C_{OB}	Max. Collector-Base Capacitance V_{CB} = 22V; f = 1MHz	3.5pF	5pF	Internal Shunt L	Internal Shunt L
$P_{G(dB)}$	Min. Power Gain in dB V_{CB} = 22V	P_O = 1.5W 8.0dB	P_O = 3.0W 8.0dB	P_O = 6.0W 7.0dB	P_O = 12.0W 7.0dB
η_C	Min. Broadband Collector Efficiency	P_O = 1.5W 35%	P_O = 3.0W 40%	P_O = 6.0W 40%	P_O = 12.0W 40%
T_j & T_{STG}	Maximum Junction and Storage Temperatures: -65 to +200°C				
Based on Black's Equation and using ϕ = .96EV, β = 1.07 x 10^{-12} for unpassivated Au. Empirical data indicates a 3-10 times improvement for glass passivated units. These units are glass passivated.					

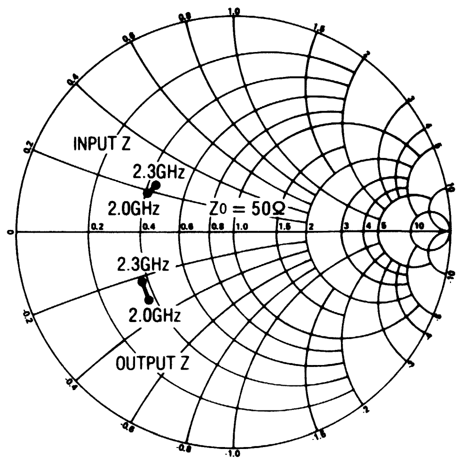
*The concept of input and/or matching using MOS capacitors, wire bonds and other techniques is patented by TRW, Inc. (US #3,713,006).

MRAL 2023-1.5H, 1.5 Watts Broadband Hermetic

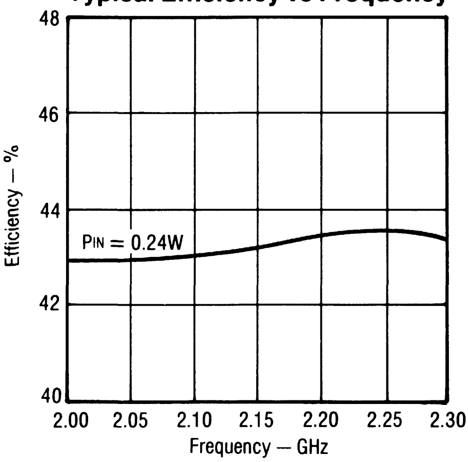
Typical Power Output vs Frequency



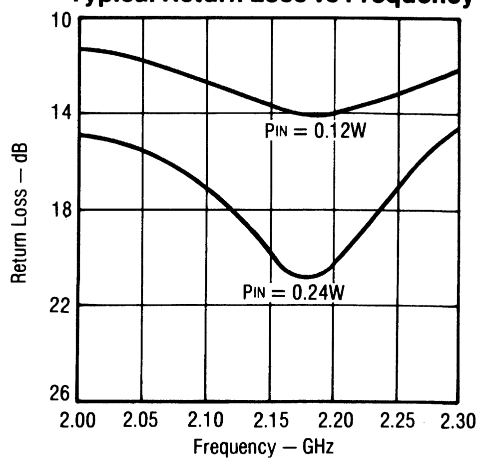
Impedance Data



Typical Efficiency vs Frequency

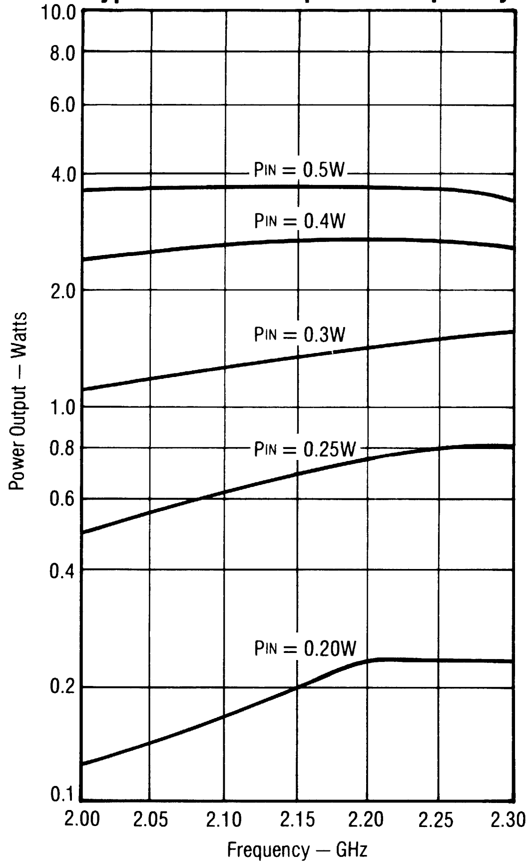


Typical Return Loss vs Frequency

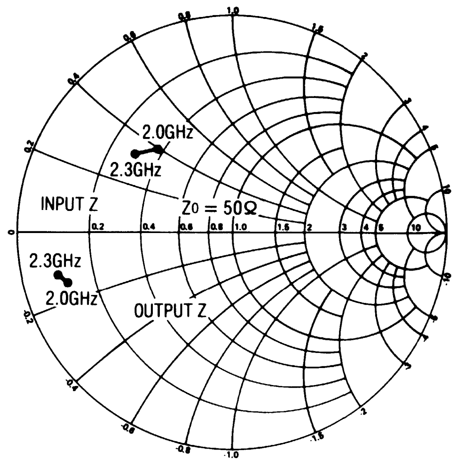


MRAL 2023-3H, 3 Watts Broadband Hermetic

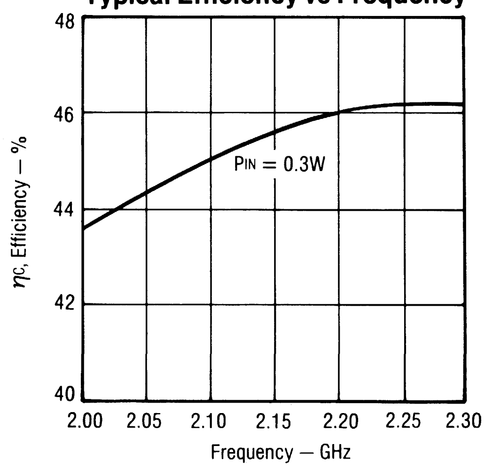
Typical Power Output vs Frequency



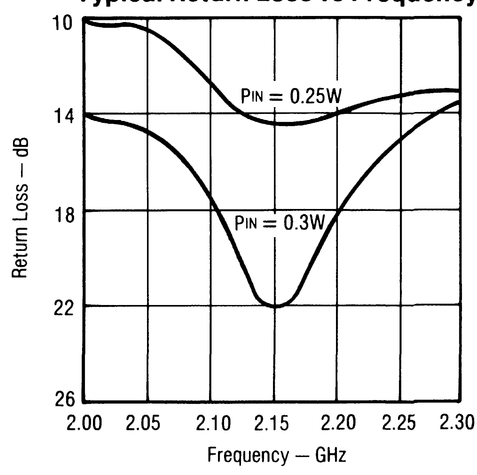
Impedance Data



Typical Efficiency vs Frequency

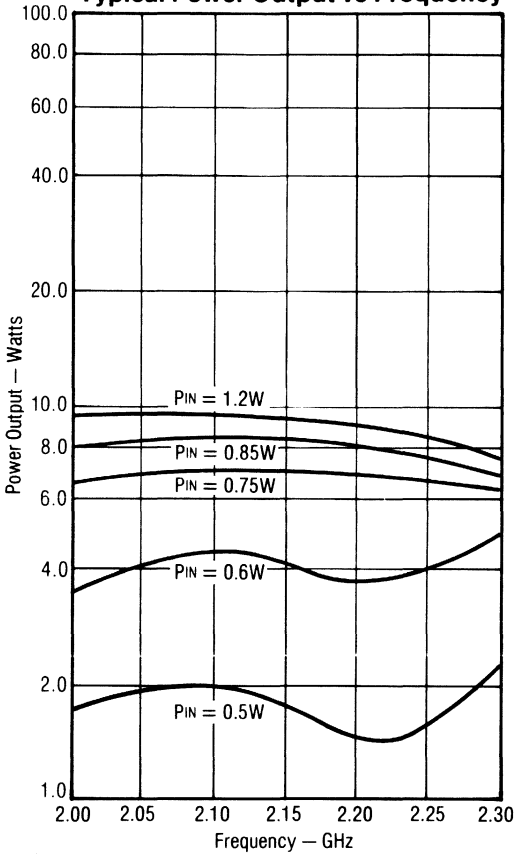


Typical Return Loss vs Frequency

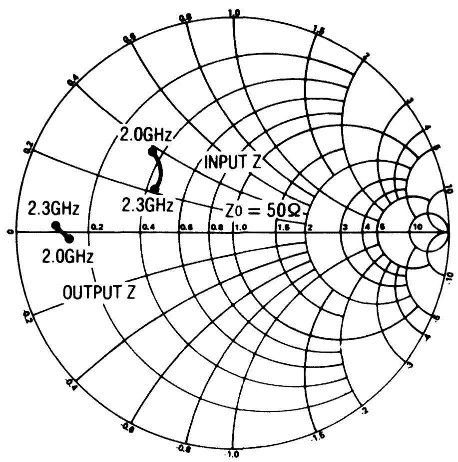


MRAL 2023-6H, 6 Watts Broadband Hermetic

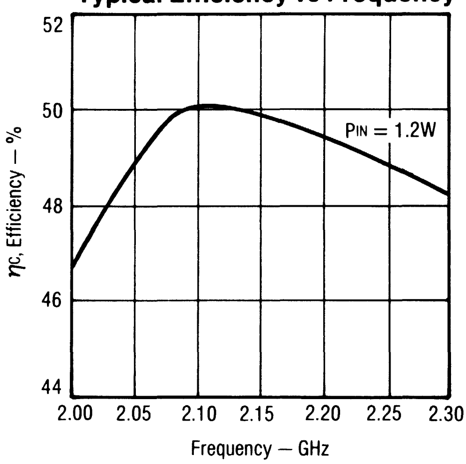
Typical Power Output vs Frequency



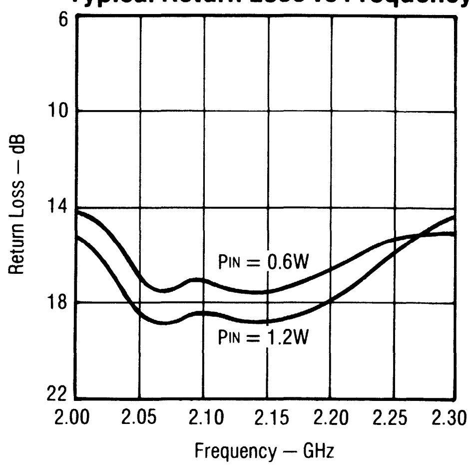
Impedance Data



Typical Efficiency vs Frequency

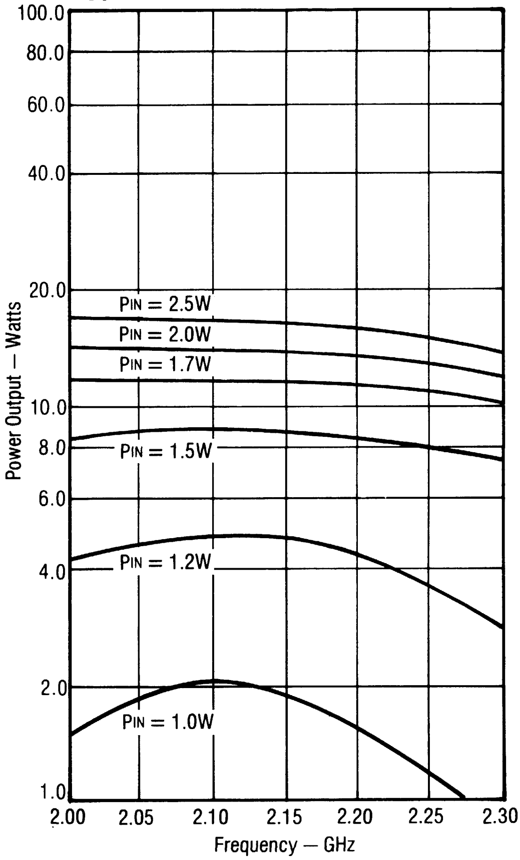


Typical Return Loss vs Frequency

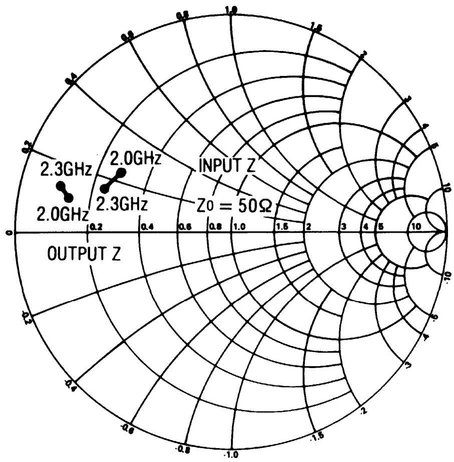


MRAL 2023-12H, 12 Watts Broadband Hermetic

Typical Power Output vs Frequency

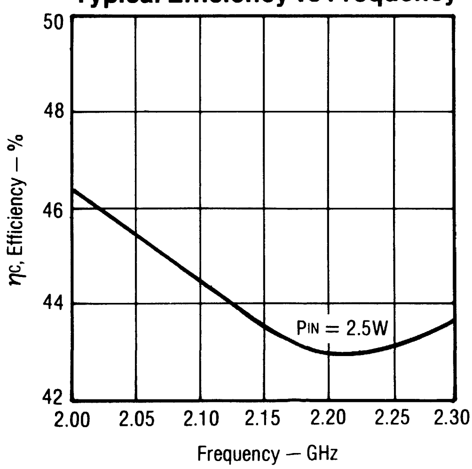


Impedance Data

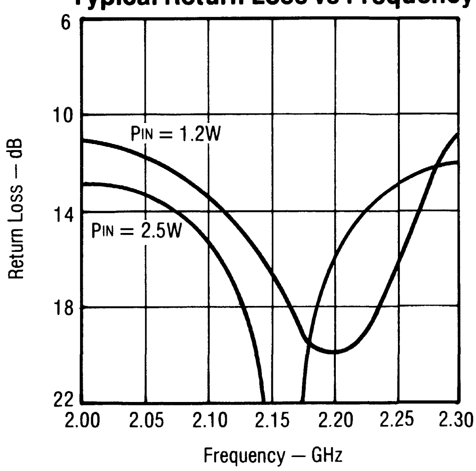


Test circuit details available from TRW Semiconductors.

Typical Efficiency vs Frequency

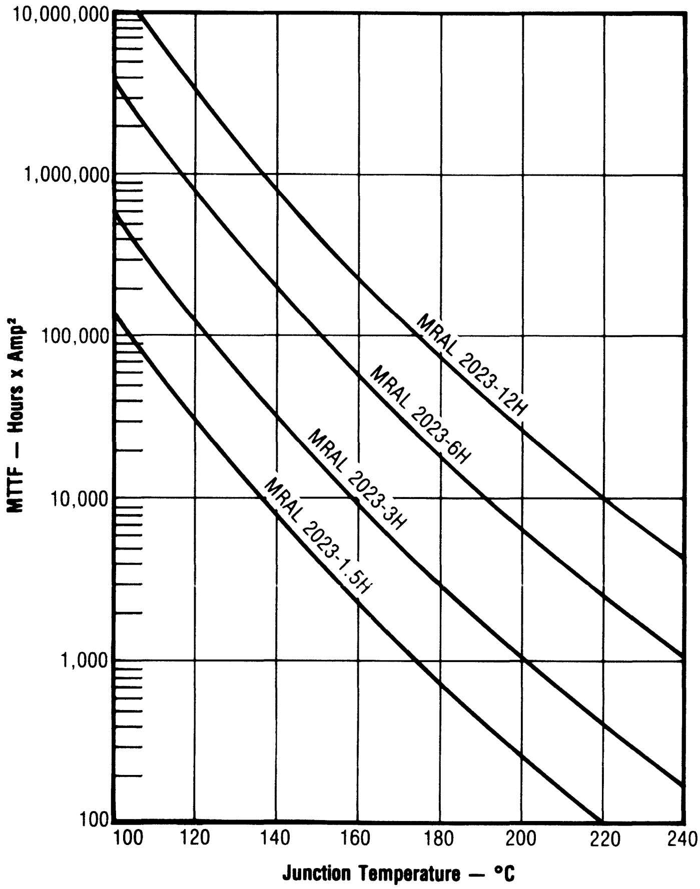


Typical Return Loss vs Frequency

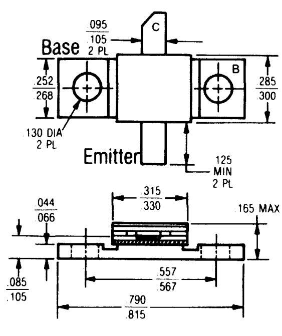


MTTF FACTOR (Normalized to 1 Ampere^2 Continuous Duty)

The graph shown below displays MTTF in hours x ampere^2 emitter current for each of the devices. Life tests at elevated temperatures have correlated to better than ±10% to the theoretical prediction for metal failure. Sample MTTF calculations based on operating conditions are included below.



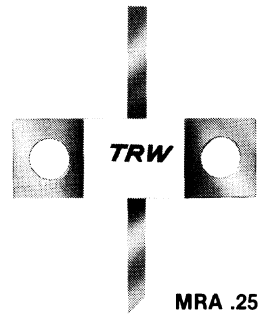
HLP-11 Series Package



TRW

MICroAMP®

- **2.3-2.7 GHz**
- **3 to 6 Watts**
- **Internally Compensated***
- **Gold Metalized**
- **Diffused Ballast Resistors**
- **Common Base**
- **∞ VSWR**



MRA .25

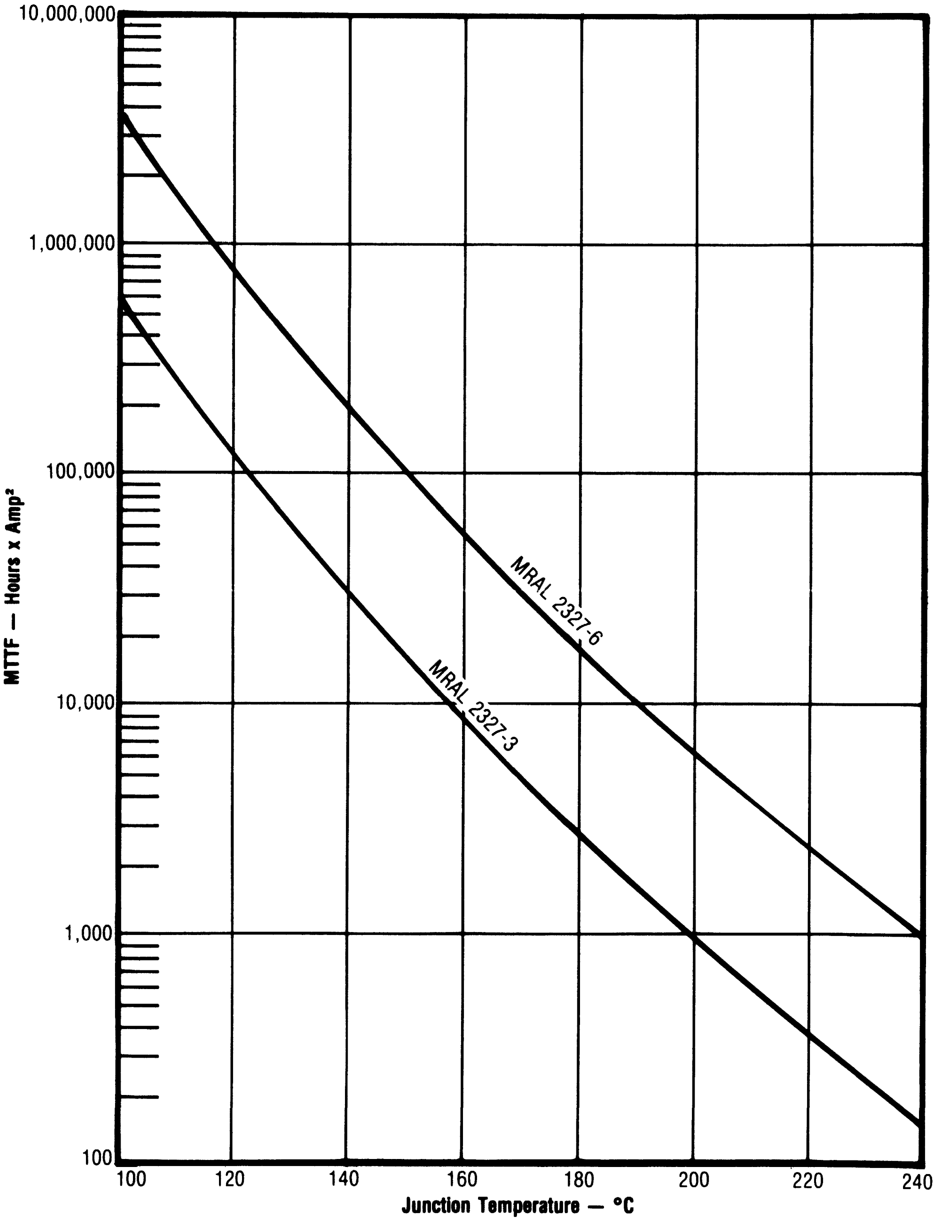
Electrical Characteristics at T_{FLANGE} = 25°C.

SYMBOL	CHARACTERISTICS	MRAL2327-3	MRAL2327-6
BV_{CES}	Collector-Base Breakdown Voltage	I_C = 20mA 42V Min.	I_C = 50mA 42V Min.
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.4mA 3.5V Min.	I_E = 1.0mA 3.5V Min.
h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5V I_C = 200mA 10-90	V_{CE} = 5V I_C = 500 mA 10-90
θ_{JF}	Thermal Resistance Junction to Flange	16°C/W	8°C/W
P_O	Minimum Broadband Power Output V_{CC} = 22V	3.0W	6.0W
P_G	Minimum Power Gain V_{CC} = 22V	P_O = 3.0W 6.5 dB	P_O = 6W 6.5 dB
η_C	Minimum Broadband Collector Efficiency	P_O = 3.0W 35%	P_O = 6W 35%
T_j	−65 to +200°C		
T_{STG}	−65 to +150°C		

*The concept of input and/or matching using MOS capacitors, wire bonds and other techniques is patented by TRW, Inc. (US #3,713,006).

MTTF FACTOR (Normalized to 1 Ampere² Continuous Duty)

The graph shown below displays MTTF in hours x ampere² emitter current for each of the devices. Life tests at elevated temperatures have correlated to better than ±10% to the theoretical prediction for metal failure.

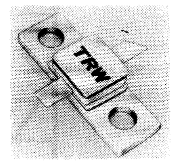


TRW

MRAL2023-18H

RF Power Transistor

- **Internally Compensated***
- **Gold Metallized**
- **Diffused Ballast Resistors**
- **MIL Package**
- **18 Watts**
- **2.0-2.3GHz @ 22V**
- **35% Minimum Collector Efficiency**
- **7.0dB Gain**



GP-20

The MRAL2023-18H is suitable for military and industrial service where a full 18 Watts is required over the 2.0-2.3GHz band. High reliability is assured by TRW's etchless gold metal system, diffused ballast and patented* internal compensation.

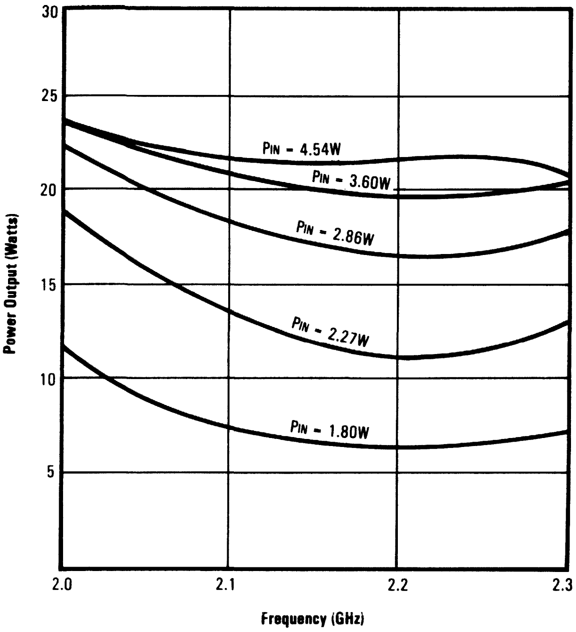
The unit is supplied in TRW's GP-20 package which is already proven in space and military service.

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

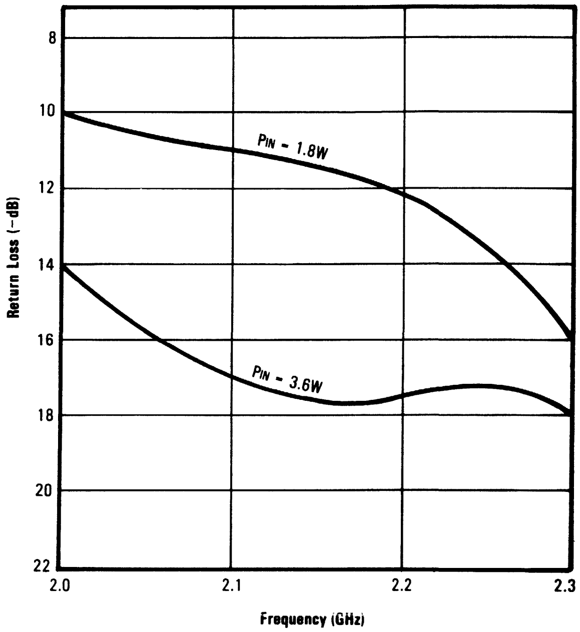
	Symbol	Characteristics	Test Conditions	Min.	Typ.	Max.	Unit
DC TEST	BV_{CES}	Collector-Emitter Breakdown Voltage, V_{BE} = 0	I_C = 160mA	42			Vdc
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 2mA	3.5			Vdc
	I_{CBO}	Collector Cutoff Current I_E = 0	V_{CB} = 22V V_{CB} = 38V			4.0 8.0	mA mA
	I_C	Maximum Continuous Collector Current	V_{CE} = 4V	8			A
	h_{FE}	Forward Current Transfer Ratio	I_C = 0.8A V_{CE} = 5.0V	10		100	
RF TEST	P_O	Minimum Broadband Power Output	V_{CB} = 22V	18			Watts
	$P_{G(dB)}$	Minimum Power Gain in dB	V_{CB} = 22V	7.0			dB
	η_C	Minimum Broadband Collector Efficiency	P_O = 18 Watts	35			%
	L_R	Input Return Loss in Recommended Circuit	P_O = 18 Watts			-10	dB
THERMAL	θ_{JF}	Thermal Resistance Junction to Flange	T_A = 25°C			3.0	°C/W
	T_J	Maximum Junction Temperature				200	°C
	T_{STG}	Maximum Storage Temperature		-65		150	°C

*U.S. Patent #3713006

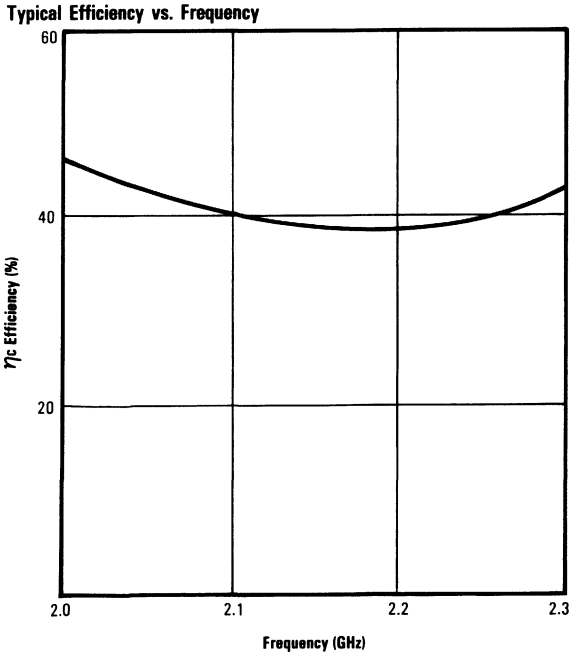
Typical Power vs. Frequency



Typical Return Loss vs. Frequency



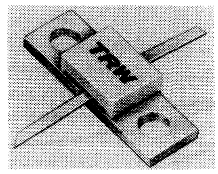
Typical Efficiency vs. Frequency



MRAL2327-1.3, 2327-3, 2327-6, 2327-12

RF Power Transistor

- **MICROAMP**
- **2.3 - 2.7 GHz**
- **RF Power Transistors**



MRA .25

MRA .325

The MRAL2327 series is constructed using TRW's patented* MICROAMP concept.

These devices are intended for broadband military and industrial service in the 2.3-2.7 GHz band.

TRW's etchless gold metal system, gold bond wires, diffused ballast resistors and other exclusive construction techniques are employed throughout the series.

The units are characterized for 22 Volt collector potentials making them compatible with telemetry, radio relay and other services where full performance is required at 22 Volts.

*U.S. Patent 3.713.006

Electrical Characteristics at T_{flange} = 25°C.

Symbol	Characteristics	MRAL2327-1.3	MRAL2327-3	MRAL2327-6	MRAL2327-12
BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 10mA 42V Min.	I_C = 20mA 42V Min.	I_C = 50mA 42V Min.	I_C = 100mA 42V Min.
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.2mA 3.5V Min.	I_E = 0.4mA 3.5V Min.	I_E 1.0mA 3.5V Min.	I_E 2.0mA 3.5V Min.
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 0.5mA 38V Min.	I_C = 1.0mA 38V Min.	I_C = 2.5mA 38V Min.	I_C = 5.0mA 38V Min.
I_{CBO}	Collector Cutoff Current I_E = 0	0.25mA Max.	0.5mA Max.	1.0mA Max.	2.5mA Max.
h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5V I_C = 100mA 10-90	V_{CE} = 5V I_C = 200mA 10-90	V_{CE} = 5V I_C = 500mA 10-90	V_{CE} = 5V I_C = 1.0mA 10-90
P_O	Minimum Broadband Power Output V_{CC} = 22V	1.3W	3.0W	6.0W	12.0W
P_G	Minimum Power Gain V_{CC} = 22V	P_O = 1.3W 5.4dB	P_O = 3.0W 6.5dB	P_O = 6W 6.5dB	P_O = 12W 6.5dB
η_C	Minimum Broadband Collector Efficiency	P_O = 1.3W 30%	P_O = 3.0W 35%	P_O = 6W 35%	P_O = 12W 35%
θ_{JF}	Thermal Resistance Junction to Flange	32°C/W	16°C/W	8°C/W	4.5°C/W
	Package Type	MRA .25	MRA .25	MRA .25	MRA .325

RF Small Signal, Low-Noise Linear Transistors

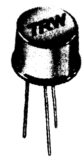
TRW's RF small signal transistor series features high gain, low noise and high reliability.

Available in a variety of popular packages, all are constructed with TRW's long life GOLD metal system.

Units are available for both military and industrial applications. Typical uses are MATV, CATV, RECEIVER FRONT-END, I.F. and OSCILLATOR applications.

RF Transistor

- **High f_T — 3.0 GHz**
- **Low Distortion**
- **Low Noise Figure, 2.5 dB @ 300 MHz**



TO-39

The LT1001 is a high-output NPN silicon TO-39-mounted transistor designed for ultra-linear communications or instrumentation applications. Low noise figure combined with high-output capability gives this device an exceptional dynamic range. Gold metallization and diffused emitter ballasting are combined to achieve the high reliability demanded by the most severe communications requirements. High gain makes this transistor ideal for broadband applications.

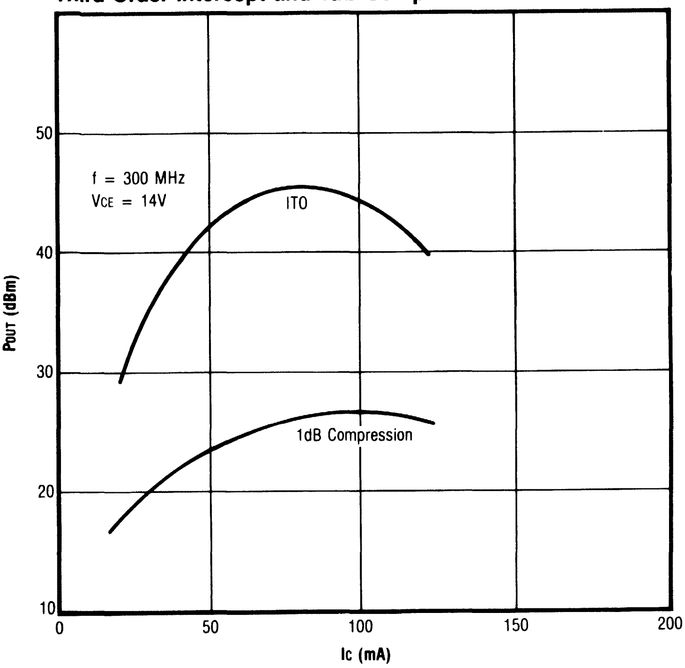
Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = 0.1mA	3.5			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 5.0mA	20			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1.0mA	40			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V		50		μA
$V_{CE\ (SAT)}$	Collector-Emitter Saturation Voltage	I_C = 50mA I_C/I_B = 10		500		mV
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 50mA	70	100	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1 MHz		1.6		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V I_C = 50mA f = 300 MHz		2.5		dB
G_{Umax}	Maximum Unilateral Gain	V_{CE} = 14V I_C = 90mA f = 300 MHz		15		dB
$[S_{21}]_E^2$	Common Emitter Insertion Gain	V_{CE} = 14V I_C = 90mA f = 300 MHz		13.5		dB
F_T	Gain Bandwidth Product	V_{CE} = 14V I_C = 90mA		3.0		GHz
P_{OUT}	Power out @ 1dB Compression	V_{CE} = 14V I_C = 90mA f = 300 MHz		26		dBm
ITO	Third Order Intercept	V_{CE} = 14V I_C = 90mA f = 300 MHz		45		dBm

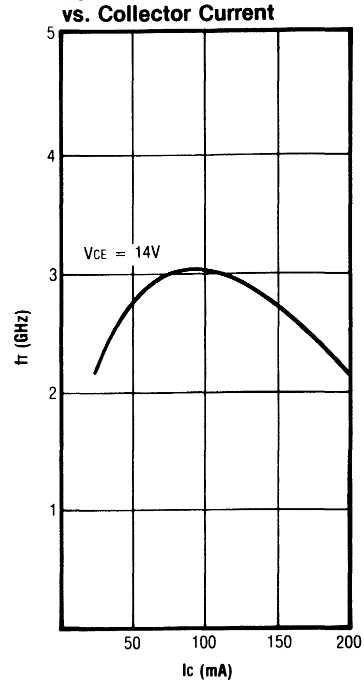
Absolute Maximum Ratings @ 25°C Case

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_j)	Storage Temperature (T_{STG})
200mA	40V	200°C	−65°C to 200°C

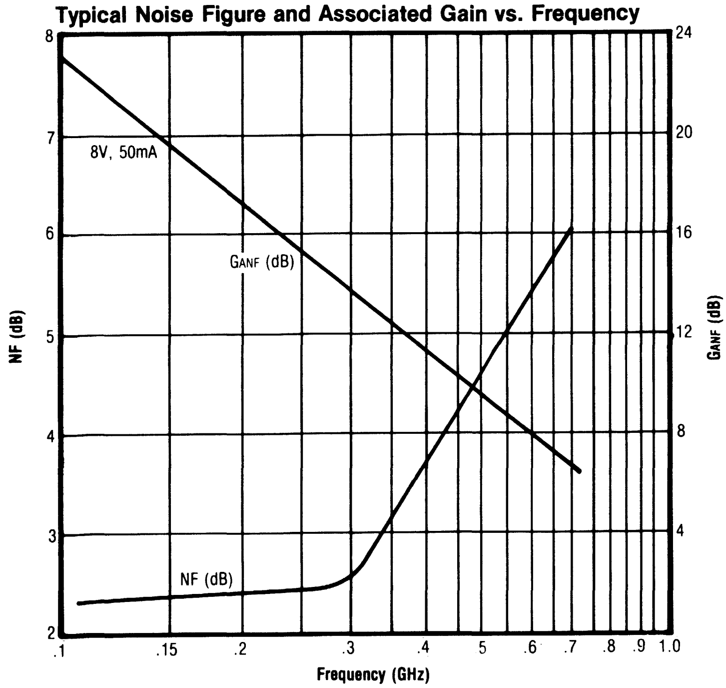
Third Order Intercept and 1dB Compression



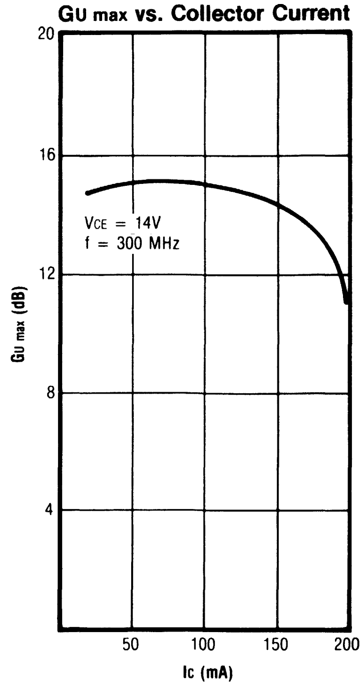
Gain-Bandwidth Product vs. Collector Current



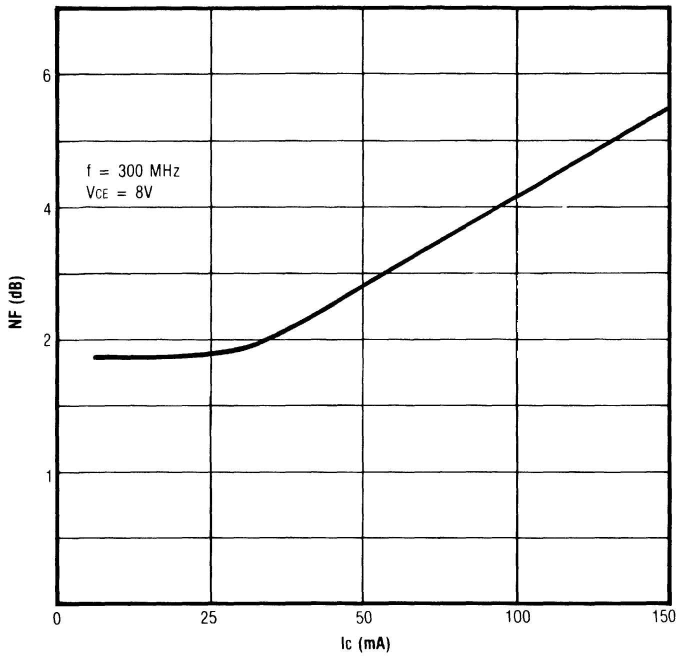
Typical Noise Figure and Associated Gain vs. Frequency



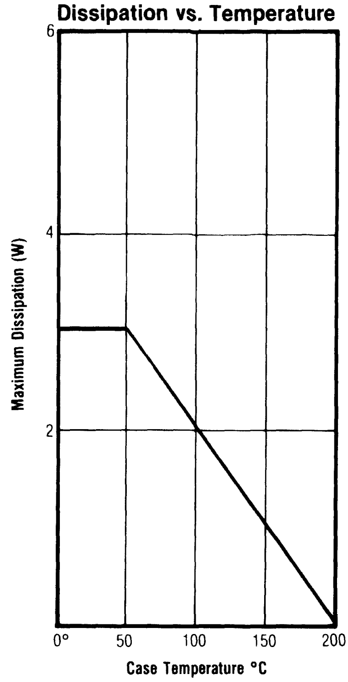
GU max vs. Collector Current



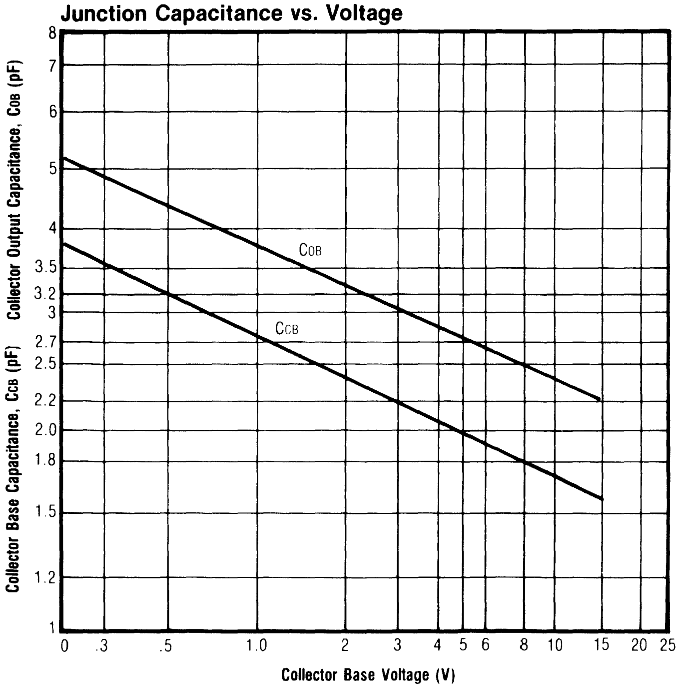
NF vs. Collector Current



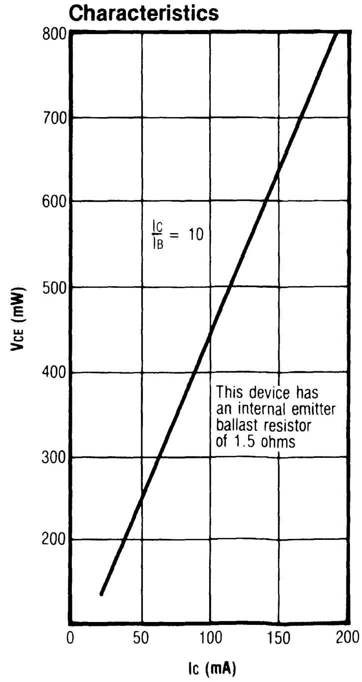
Dissipation vs. Temperature



Junction Capacitance vs. Voltage

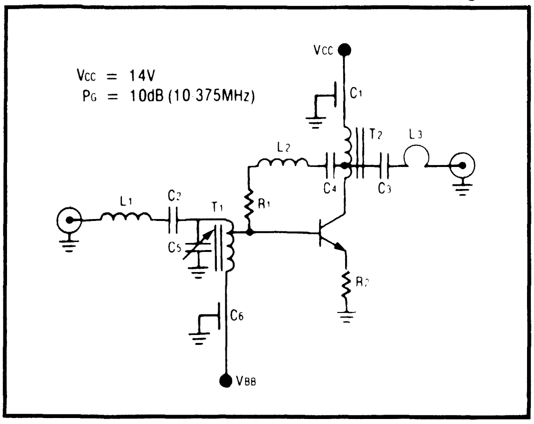


Collector Saturation Characteristics



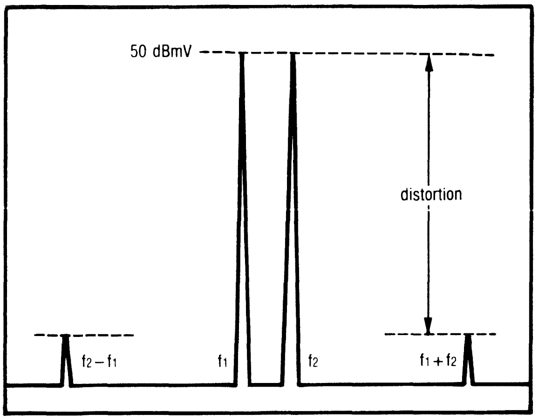
CATV/MATV Characterization

Broadband Test Circuit — Figure 1

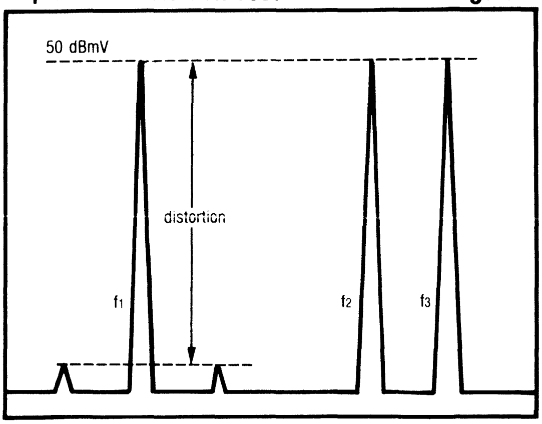


$C_{1,2,3,4}$	0.001μF
C_5	5-10pF
C_6	0.01μF
L_1	2 turns 1/8" I.D. #20AWG
L_2	3 turns 3/16" I.D. #20AWG
L_3	1 turn 1/8" I.D. #20AWG
T_{12}	2x8 #30AWG, Q_1 Core
R_1	24Ω, 1/8W
R_2	13Ω, 1/2W

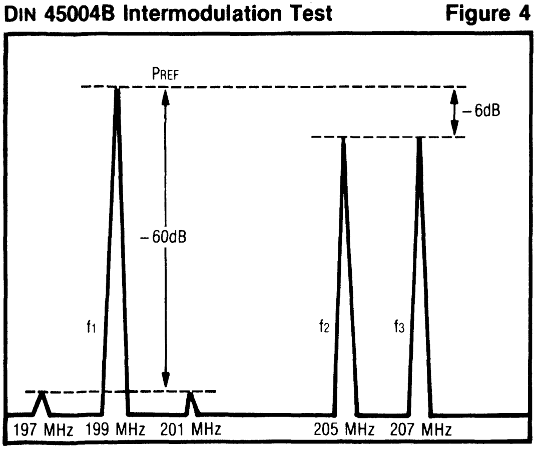
Second Order Distortion Test — Figure 2



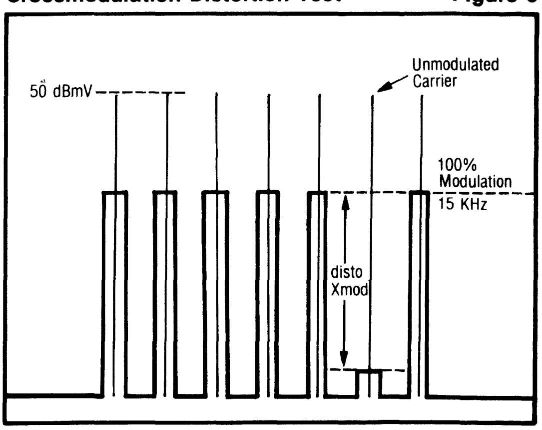
Triple Beat Distortion Test — Figure 3



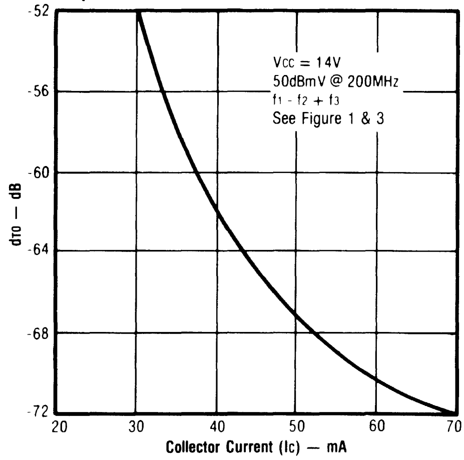
DIN 45004B Intermodulation Test — Figure 4



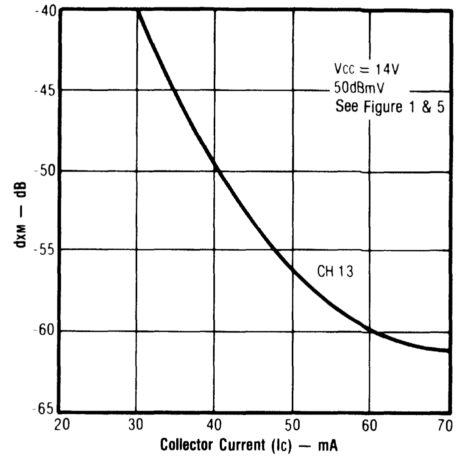
Crossmodulation Distortion Test — Figure 5



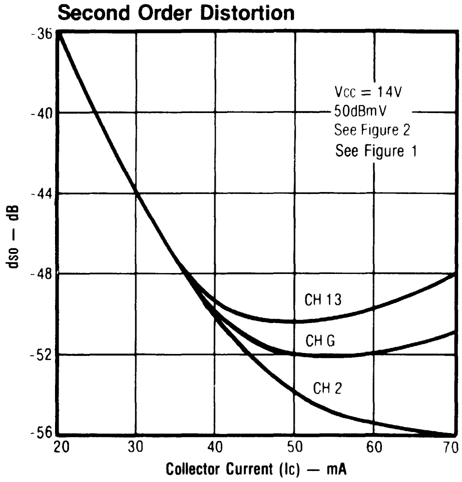
Triple Beat Distortion Test



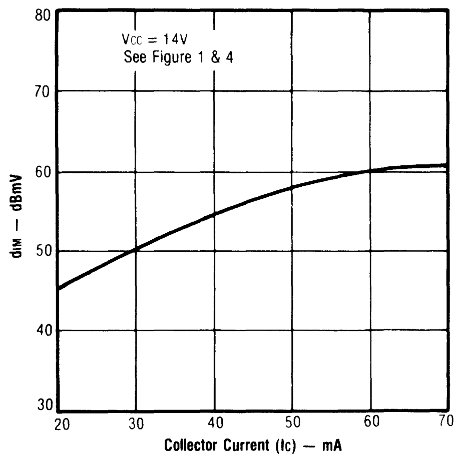
7 Channel X-Modulation Distortion



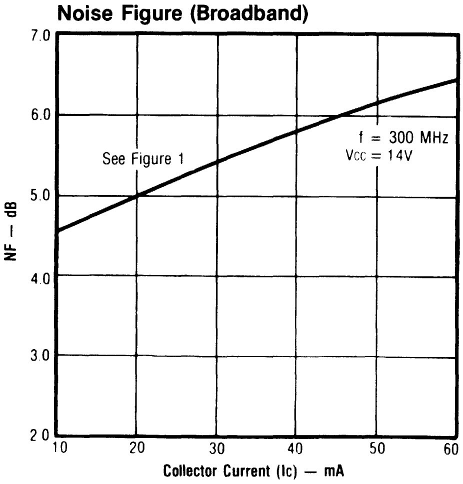
Second Order Distortion



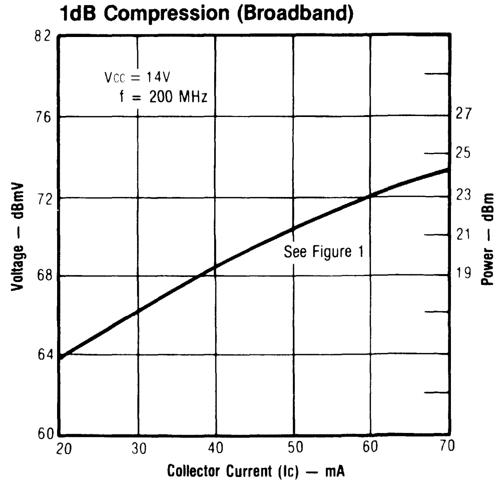
DIN 45004B



Noise Figure (Broadband)



1dB Compression (Broadband)



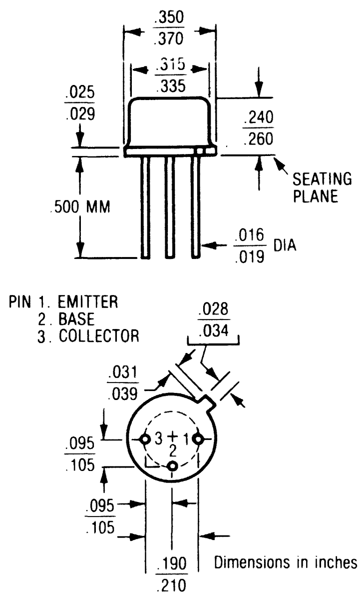
LT1001A S PARAMETERS

S-dB and Angles:
VCE = 8V, IC = 50mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−7.23	−131.8	21.95	101.3	−25.33	58.8	− 7.08	− 78.4	0.631
200	−9.06	−167.6	16.02	85.4	−21.46	65.6	−11.85	− 86.2	0.969
300	−9.06	175.3	12.69	75.7	−18.49	68.9	−12.58	− 93.5	1.025
400	−8.90	160.9	10.33	67.5	−16.21	69.7	−12.74	−102.7	1.049
500	−8.87	145.8	8.53	60.8	−14.42	69.7	−12.55	−110.4	1.071
600	−8.67	136.0	7.14	54.8	−12.90	69.3	−11.66	−119.7	1.068
700	−8.70	124.0	6.12	49.6	−11.50	68.3	−10.72	−126.6	1.059
800	−8.94	114.2	5.13	43.7	−10.37	66.4	− 9.85	−136.3	1.065
900	−8.91	105.3	4.28	39.1	− 9.34	65.0	− 9.39	−143.9	1.066
1000	−9.16	93.6	3.63	34.6	− 8.42	62.8	− 3.70	−152.1	1.064

VCE = 14V, IC = 90mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−7.74	−126.6	22.66	103.0	−28.85	57.6	−6.82	− 47.5	0.748
200	−8.33	−157.8	17.08	86.3	−25.01	62.6	−8.40	− 56.7	0.965
300	−8.28	−172.6	13.71	75.6	−22.37	65.8	−8.25	− 66.4	1.026
400	−8.31	−177.5	11.25	66.7	−20.31	66.9	−7.58	− 75.0	1.037
500	−8.18	173.9	9.61	61.2	−17.69	70.4	−7.33	− 78.9	0.938
600	−8.12	167.5	8.08	55.5	−16.35	71.2	−6.81	− 85.1	0.932
700	−8.19	161.2	6.83	48.9	−15.21	70.2	−6.22	− 91.6	0.913
800	−8.16	−155.6	5.60	43.6	−14.22	70.9	−5.44	− 96.4	0.883
900	−8.07	149.9	4.58	38.0	−13.28	70.0	−4.84	−102.4	0.844
1000	−7.86	143.8	3.70	34.4	−12.40	70.2	−4.54	−105.1	0.824

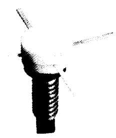


TO-39

TRW

RF Transistor

- **High f_T — 3.0 GHz**
- **Low Distortion**
- **Low Noise Figure, 2.5 dB @ 300 MHz**



TO-117A

The LT2001 is a high-output NPN silicon stud-mounted transistor designed for ultra-linear communications or instrumentation applications.

Low noise figure combined with high-output capability gives this device an exceptional dynamic range.

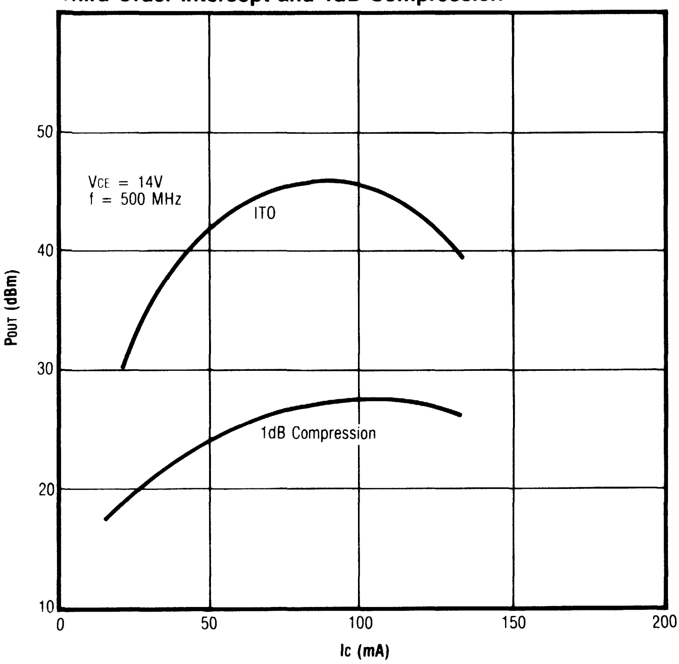
Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = 0.1mA	3.5			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 5.0mA	20			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1.0mA	40			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V		50		μA
$V_{CE\ (SAT)}$	Collector-Emitter Saturation Voltage	I_C = 50mA I_C/I_B = 10		500		mV
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 50mA	70	100	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V fo = 1 MHz		1.2		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V I_C = 50mA f = 300 MHz		2.5		dB
GU_{max}	Maximum Unilateral Gain	V_{CE} = 14V I_C = 90mA f = 500 MHz		14		dB
$[S_{21}]^2_E$	Common Emitter Insertion Gain	V_{CE} = 14V I_C = 90mA f = 500 MHz		11.5		dB
F_T	Gain Bandwidth Product	V_{CE} = 14V I_C = 90mA		3.0		GHz
P_{OUT}	Power out @ 1dB Compression	V_{CE} = 14V I_C = 90mA f = 500 MHz		26		dBm
ITO	Third Order Intercept	V_{CE} = 14V I_C = 90mA f = 500 MHz		46		dBm

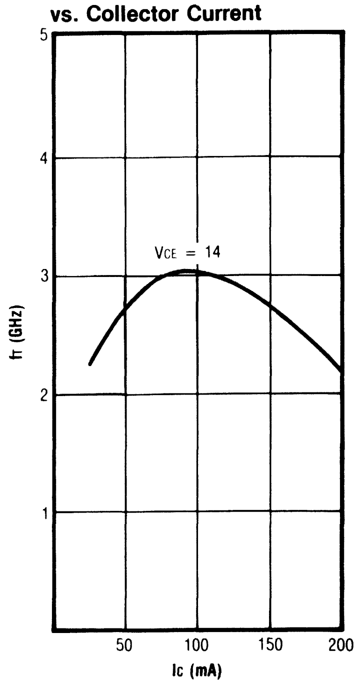
Absolute Maximum Ratings @ 25°C Case

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_j)	Storage Temperature (T_{STG})
200mA	40V	+200°C	−65°C to 200°C

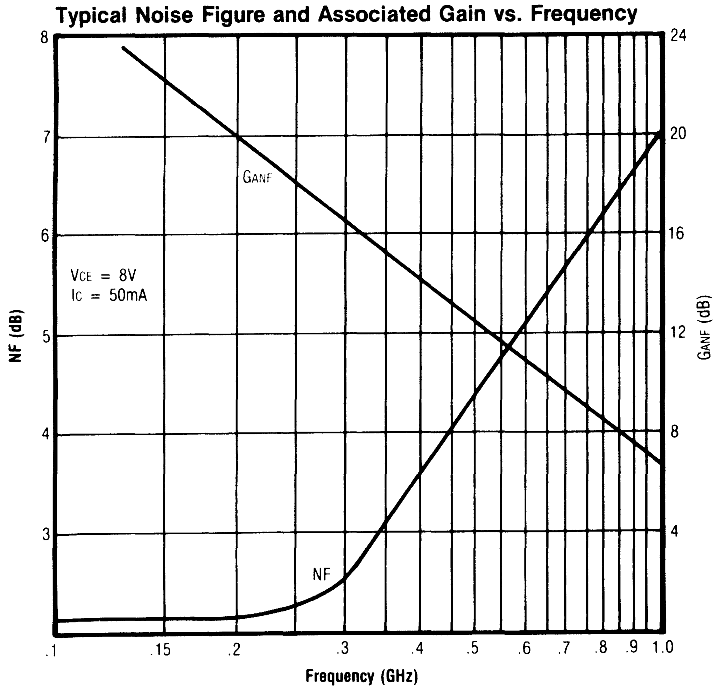
Third Order Intercept and 1dB Compression



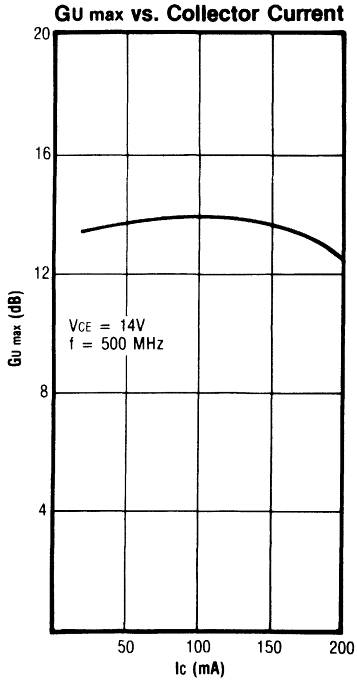
Gain-Bandwidth Product vs. Collector Current



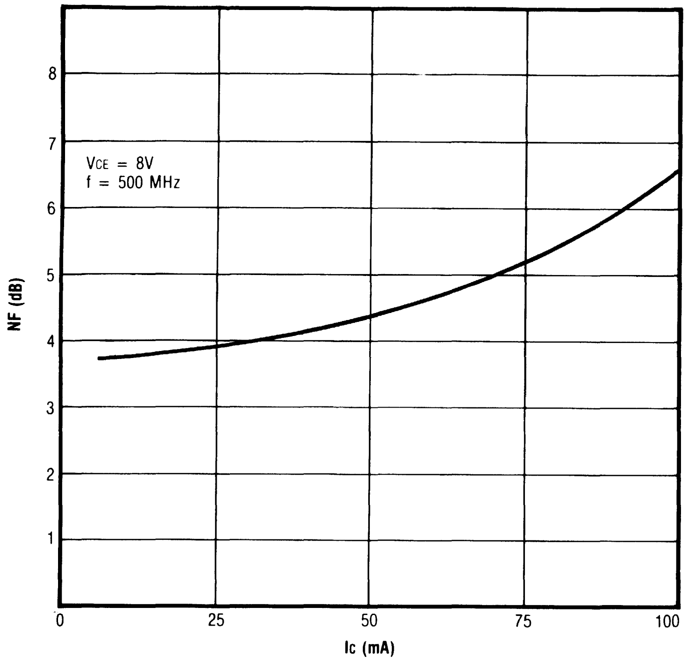
Typical Noise Figure and Associated Gain vs. Frequency



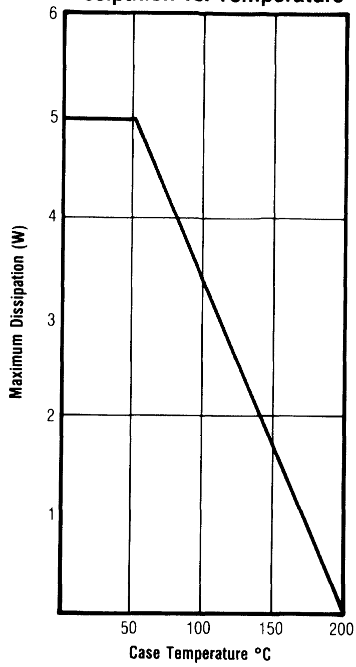
GU max vs. Collector Current



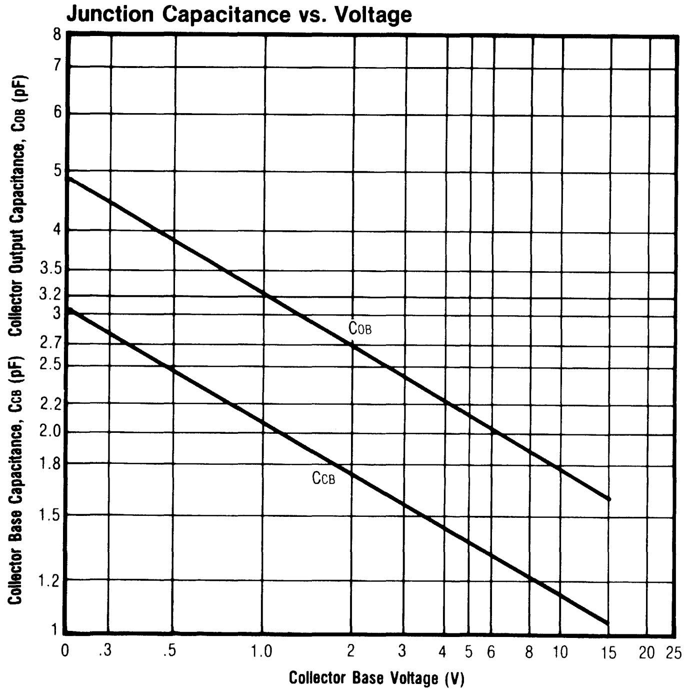
NF vs. Collector Current



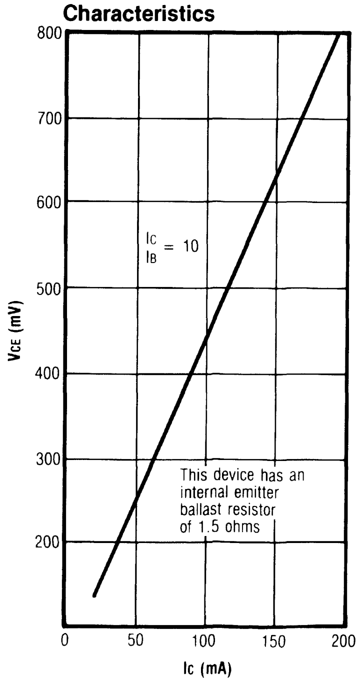
Dissipation vs. Temperature



Junction Capacitance vs. Voltage

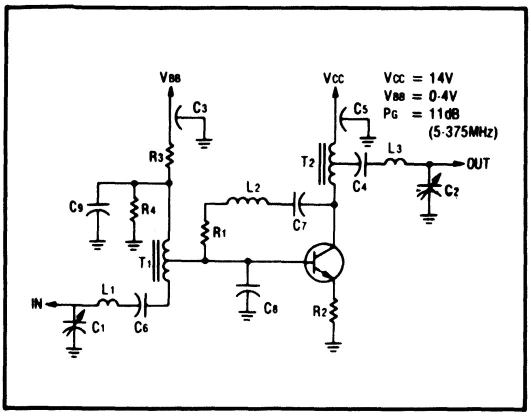


Collector Saturation Characteristics



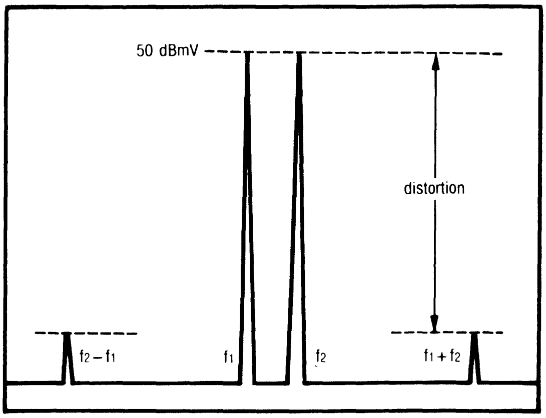
CATV/MATV Characterization LT2001

Broadband Test Circuit — Figure 1

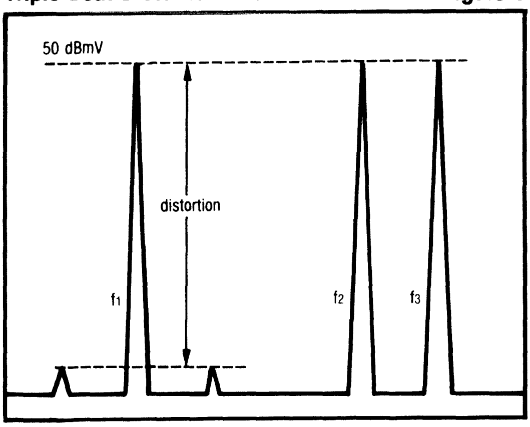


$C_{1,2}$	0.5-10pF	L_1	1 turn, .012 dia., #22AWG
$C_{3,5}$	0.01μF feed thru	L_2	4 turn, .225 dia., #20AWG
$C_{7,9}$	0.01μF Chip Caps	L_3	3 turn, .012 dia., #20AWG
$C_{4,6}$	0.1μF Chip Caps	$T_{1,2}$	5 turns taped at 2 turns, Ferronics 12-340-K Core
C_8	2pF Mica		
R_1	360Ω 1/8W		
R_2	12Ω 1W (2-24Ω 1/2W on each emitter port)		
R_3	1.8K 1/8W		
R_4	2.2K 1/8W		

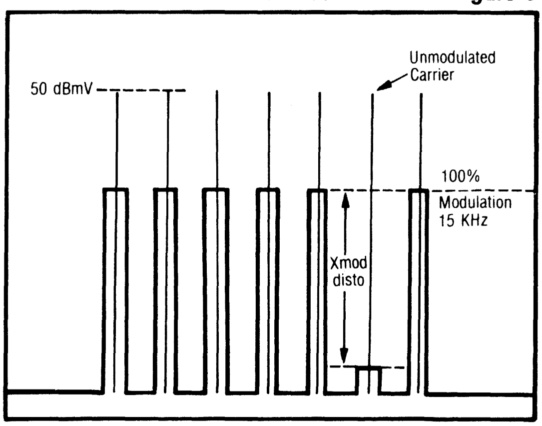
Second Order Distortion Test — Figure 2



Triple Beat Distortion Test — Figure 3

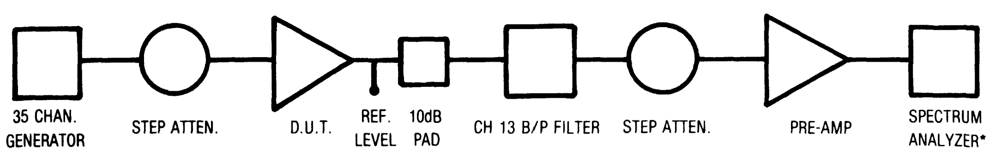


Crossmodulation Distortion Test — Figure 5

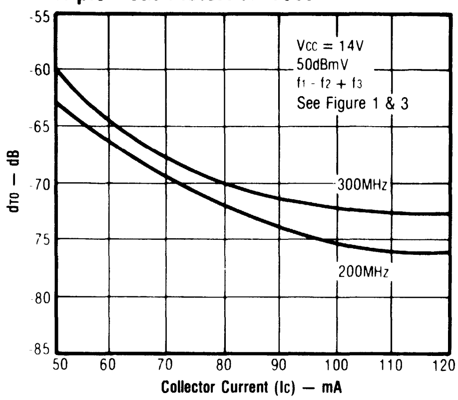


Signal to Third Order Noise Test Setup — Figure 4

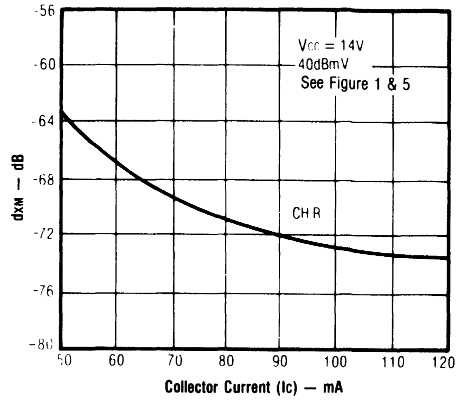
*Spectrum Analyzer — 100 KHz I.F. B.W., 10 Hz video filter, zero dispersion, 10 log display — Add 2.5dB to noise level for RMS level.



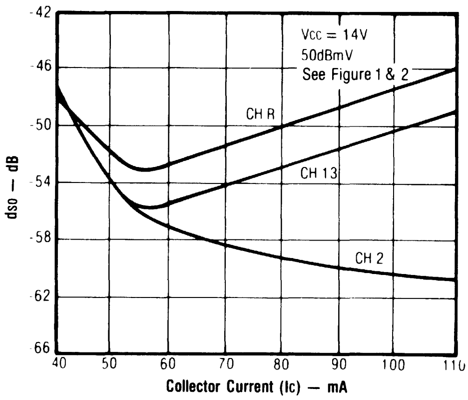
Triple Beat Distortion Test



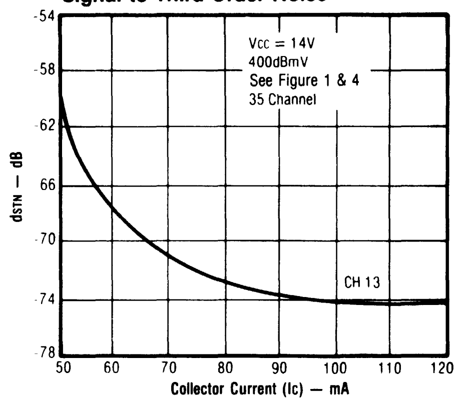
35 Channel X-Modulation Distortion



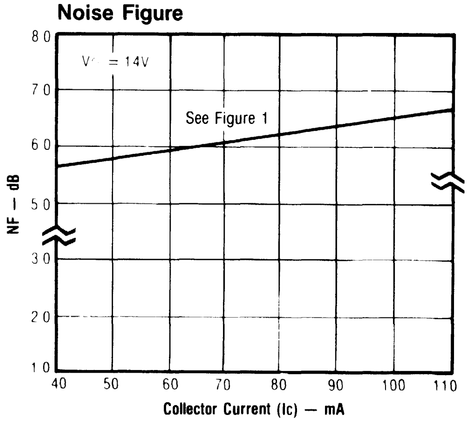
Second Order Distortion



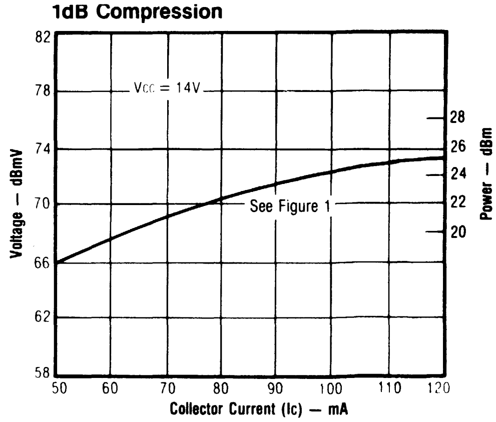
Signal to Third Order Noise



Noise Figure



1dB Compression



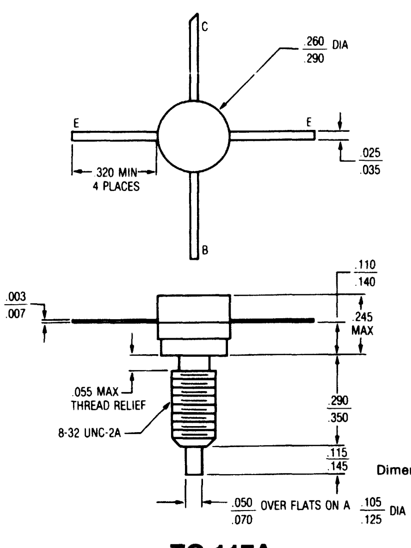
LT2001 S PARAMETERS

S-dB and Angles:
VCE = 8V, IC = 50mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−6.12	−118.9	23.57	114.3	−29.61	52.8	− 6.47	− 57.0	0.611
200	−7.31	−159.1	19.20	95.9	−26.38	58.5	− 9.68	− 58.3	0.910
300	−7.46	177.3	16.11	82.7	−23.77	62.1	−10.29	− 70.7	1.003
400	−7.48	164.7	13.77	73.2	−21.67	64.7	−10.21	− 75.8	1.038
500	−7.47	151.5	11.84	64.7	−20.05	65.4	− 9.57	− 86.8	1.075
600	−6.93	141.2	10.35	56.8	−18.43	65.3	− 9.85	− 98.4	1.076
700	−7.07	134.5	9.04	50.9	−17.10	65.2	− 9.23	−105.6	1.085
800	−6.69	126.1	7.96	42.8	−15.98	63.3	− 8.34	−126.4	1.093
900	−6.33	118.3	6.88	36.4	−14.92	61.6	− 8.17	−136.4	1.101
1000	−6.32	113.6	5.93	30.6	−13.96	60.3	− 7.96	−145.1	1.114

VCE = 14V, IC = 90mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−5.91	−131.6	24.75	110.5	−32.25	55.4	−5.79	− 36.7	0.626
200	−6.13	−162.8	19.32	95.5	−28.89	65.0	−7.94	− 39.1	0.918
300	−5.90	−176.7	16.04	88.0	−26.35	73.3	−8.65	− 43.2	1.030
400	−5.66	173.8	13.56	82.7	−24.29	79.2	−8.88	− 50.2	1.089
500	−6.19	170.6	11.80	60.4	−21.99	66.6	−8.11	− 60.9	1.008
600	−5.91	165.5	10.29	51.3	−20.30	64.8	−7.84	− 69.2	0.947
700	−5.72	161.2	8.87	43.9	−19.06	64.1	−7.60	− 78.8	0.938
800	−5.57	157.8	7.75	36.3	−17.97	62.2	−7.34	− 87.1	0.909
900	−5.41	154.5	6.79	29.5	−16.52	60.1	−6.63	− 94.4	0.800
1000	−5.38	150.9	5.82	22.0	−15.71	57.7	−6.58	−103.5	0.811

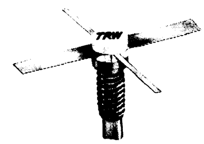


Dimensions in inches

TO-117A

RF Transistor

- **High Frequency Microwave Package S_{21} = 14dB @ 500 MHz**
- **Low Distortion: I_{TO} = +46dBm**
- **Low Noise Figure: @ 300 MHz**



.200 SOE

The LT3005 is a high-output NPN silicon stud-mounted transistor designed for ultra-linear communications or instrumentation applications. Low noise figure combined with high-output capability gives this device an exceptional dynamic range. Gold metallization and diffused emitter ballasting are combined to achieve the high reliability demanded by the most severe communications requirements. High gain makes this transistor ideal for broadband applications.

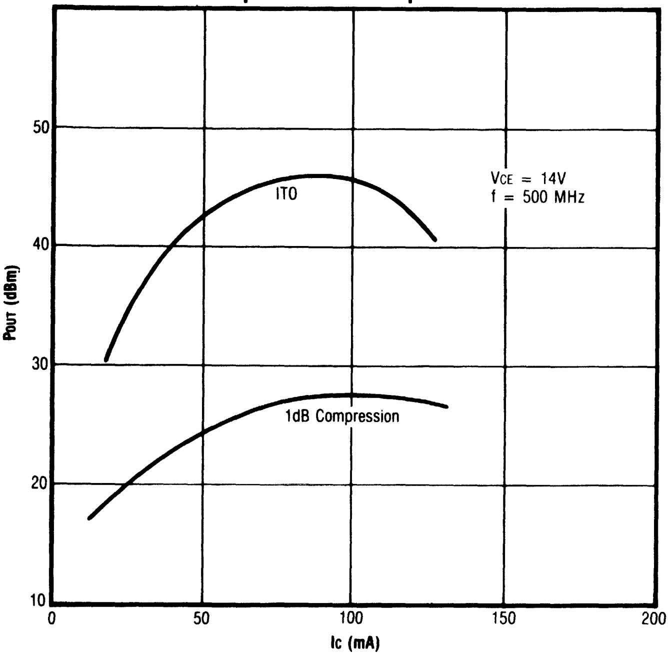
Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = 0.1mA	3.5			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 5.0mA	20			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1.0mA	40			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V		50		μA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	I_C = 100mA, I_C/I_B = 10		500		mV
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 50mA	70	100	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f_o = 1.0 MHz		1.0		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V I_C = 50mA, f = 300 MHz		2.5		dB
GU_{max}	Maximum Unilateral Gain	V_{CE} = 14V I_C = 90mA, f = 500 MHz		18		dB
$[S_{21}]^2_E$	Common Emitter Insertion Gain	V_{CE} = 14V I_C = 90mA, f = 500 MHz		14		dB
F_T	Gain Bandwidth Product	V_{CE} = 14V I_C = 90mA		3.0		GHz
F_{max}	Maximum Oscillation Frequency	V_{CE} = 14V I_C = 90mA		4		GHz
P_{OUT}	Power out @ 1dB Compression	V_{CE} = 14V, I_C = 90mA f = 500 MHz		26		dBm
ITO	Third Order Intercept	V_{CE} = 14V, I_C = 90mA f = 500 MHz		46		dBm

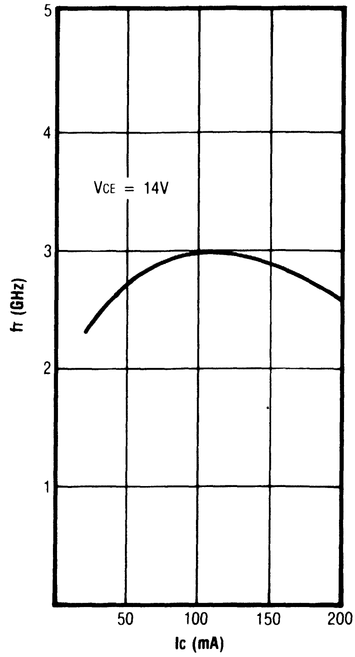
Absolute Maximum Ratings @ 25°C Case

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_j)	Storage Temperature (T_{STG})
200mA	40V	+200°C	−65°C to +200°C

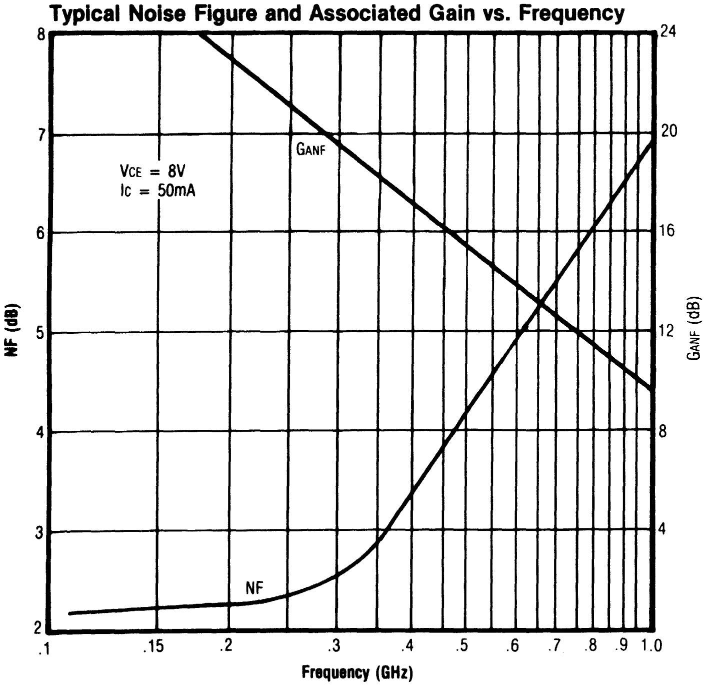
Third Order Intercept and 1dB Compression



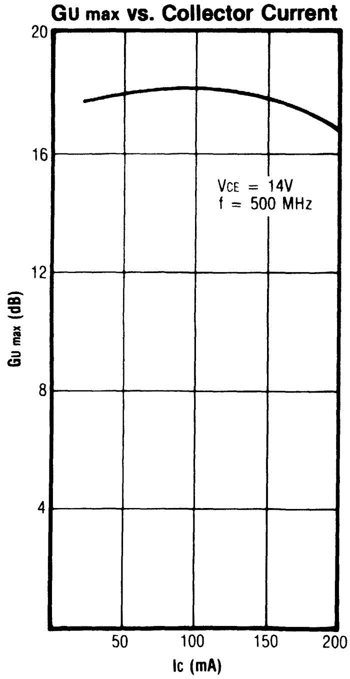
Gain-Bandwidth Product vs. Collector Current



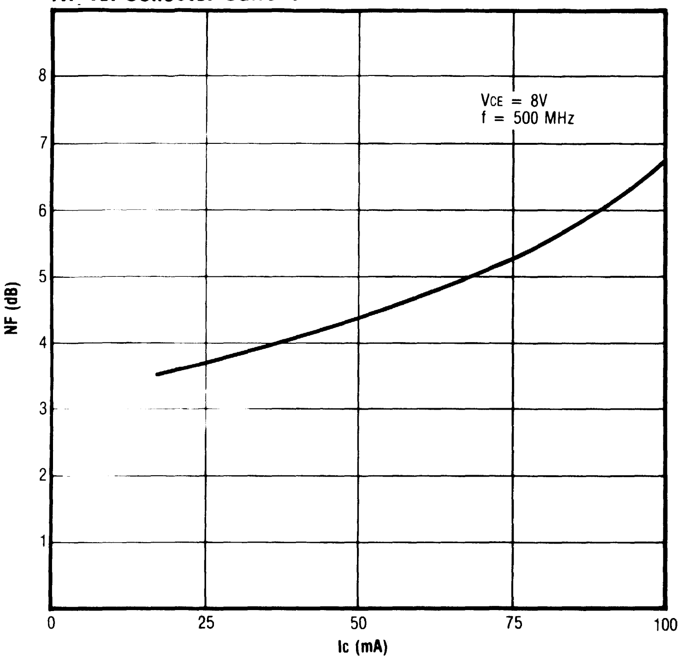
Typical Noise Figure and Associated Gain vs. Frequency



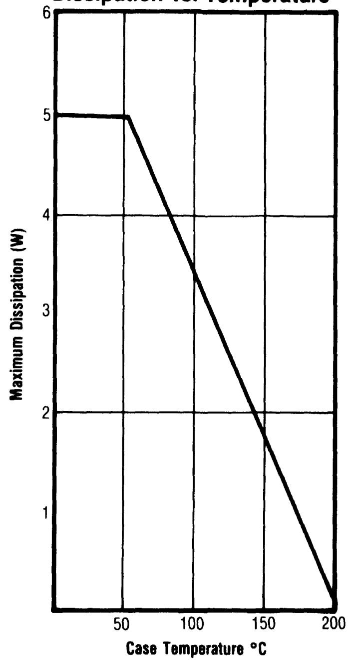
GU max vs. Collector Current



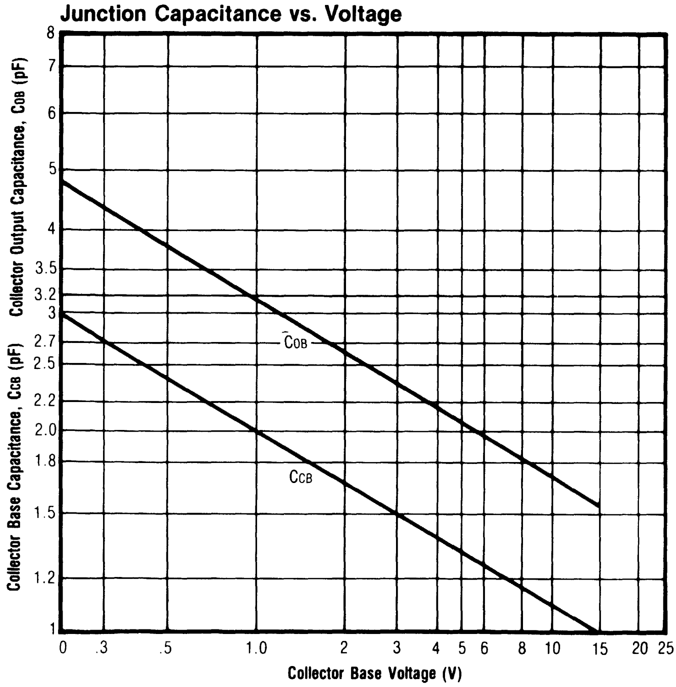
NF vs. Collector Current



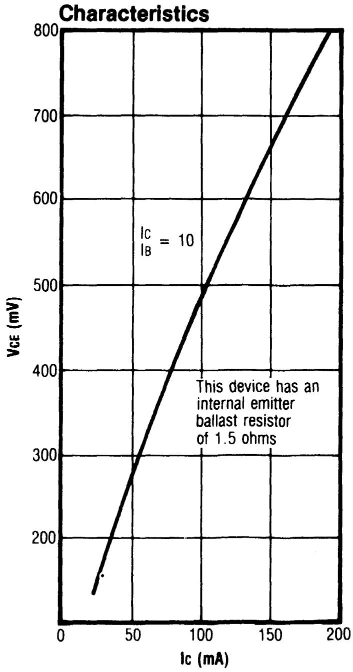
Dissipation vs. Temperature



Junction Capacitance vs. Voltage



Collector Saturation Characteristics



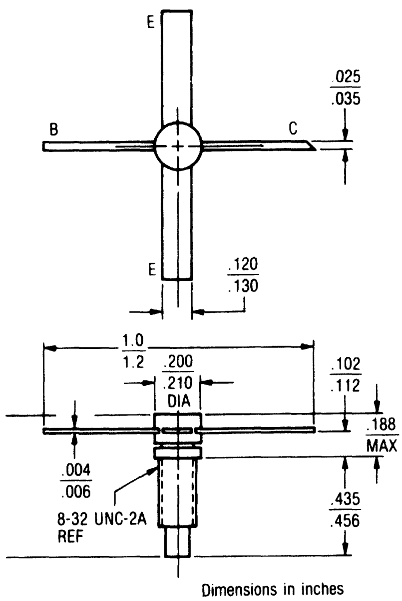
LT3005 S PARAMETERS

S-dB and Angles:
VCE = 8V, IC = 50mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−2.55	−135.6	26.02	111.8	−30.66	35.7	− 4.21	− 68.0	0.074
200	−2.60	−166.7	20.40	92.8	−29.88	32.0	− 9.79	− 73.6	0.530
300	−2.33	176.6	17.09	81.6	−28.99	34.9	−11.06	− 85.0	0.687
400	−2.14	165.1	14.64	73.1	−28.20	38.9	−11.63	− 89.4	0.803
500	−2.11	155.3	12.43	65.9	−27.56	43.0	−11.35	− 99.8	0.981
600	−1.90	146.6	10.93	59.2	−26.65	46.8	−11.93	−110.3	1.025
700	−1.88	139.4	9.61	53.6	−25.76	50.4	−11.22	−115.1	1.084
800	−1.88	132.1	8.23	46.1	−24.96	51.9	−10.54	−137.0	1.226
900	−1.90	125.9	7.01	40.5	−24.13	54.3	−10.35	−147.2	1.334
1000	−2.04	120.6	5.92	35.2	−23.33	56.0	− 9.99	−153.2	1.458

VCE = 14V, IC = 90mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−2.91	−129.1	26.43	114.8	−32.67	38.8	− 5.54	− 44.8	0.285
200	−1.22	−156.9	21.28	96.8	−31.41	36.0	− 8.76	− 50.4	0.199
300	−2.47	−168.8	17.98	87.3	−30.50	39.4	− 9.99	− 53.6	0.709
400	−2.40	−176.2	15.59	80.4	−29.68	45.2	−10.23	− 58.3	0.839
500	−2.38	178.9	13.93	69.0	−28.74	44.7	− 9.83	− 62.3	0.885
600	−2.30	174.5	12.30	61.4	−27.93	46.6	− 9.54	− 67.5	0.930
700	−2.18	170.6	10.83	55.8	−27.06	51.1	− 9.22	− 73.4	0.938
800	−2.10	167.2	9.65	49.8	−26.21	53.6	− 8.91	− 78.5	0.928
900	−2.01	163.3	8.56	41.7	−25.22	54.9	− 8.23	− 84.6	0.852
1000	−1.93	159.9	7.52	36.6	−24.45	56.4	− 8.08	− 90.4	0.847

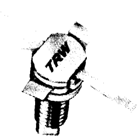


.200 SOE

TRW

RF Transistor

- **High Gain at UHF Frequencies**
  S_{21} = 14dB @ 500 MHz
- **Low Distortion: I_{TO} = +46dBm**
- **Low Noise Figure: 3.1 dB @ 300 MHz**



GP-14 STUD

The LT3014 is a high-output NPN silicon stud-mounted transistor designed for ultra-linear communications or instrumentation applications. Low noise figure combined with high-output capability gives this device an exceptional dynamic range. Gold metallization and diffused emitter ballasting are combined to achieve the high reliability demanded by the most severe communications requirements. High gain makes this transistor ideal for broadband applications. In addition, the LT3014 is hermetic, making it suitable for high reliability applications.

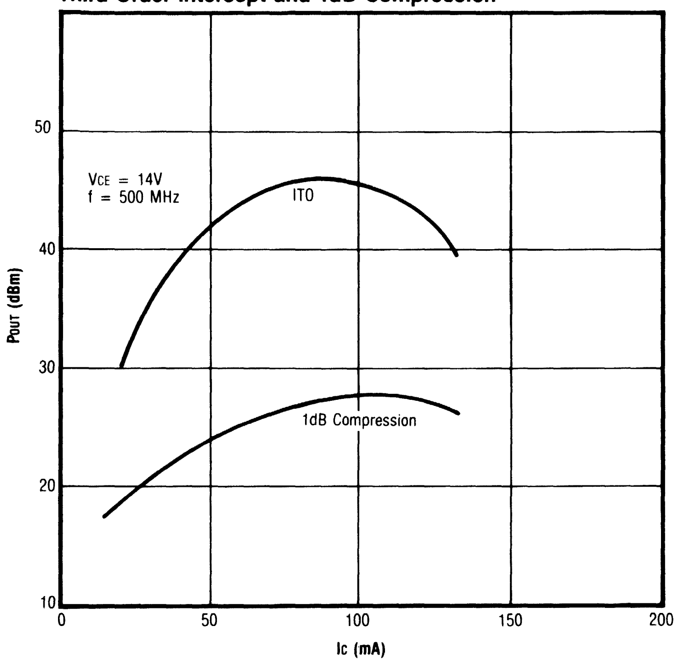
Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = 0.1mA	3.5			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 5.0mA	20			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1.0mA	40			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V		50		μA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	I_C = 50mA, I_C/I_B = 10		500		mV
h_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 50mA	70	100	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V, f = 1 MHz		1.0		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 50mA, f = 300 MHz		3.1		dB
G_{Umax}	Maximum Unilateral Gain	V_{CE} = 14V, I_C = 90mA, f = 500 MHz		19		dB
$[S_{21}]^2_E$	Common Emitter Insertion Gain	V_{CE} = 14V, I_C = 90mA, f = 500 MHz		14		dB
F_T	Gain Bandwidth Product	V_{CE} = 14V, I_C = 90mA		3.0		GHz
F_{max}	Maximum Oscillation Frequency	V_{CE} = 14V, I_C = 90mA		4.5		GHz
P_{OUT}	Power out @ 1dB Compression	V_{CE} = 14V, I_C = 90mA, f = 500 MHz		26		dBm
ITO	Third Order Intercept	V_{CE} = 14V, I_C = 90mA, f = 500 MHz		46		dBm

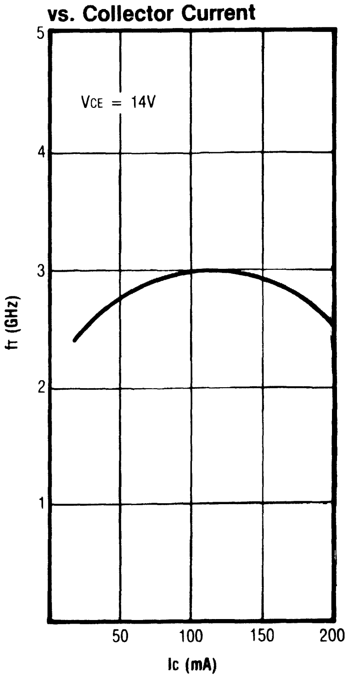
Absolute Maximum Ratings @ 25°C Case

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_j)	Storage Temperature (T_{STG})
200mA	40V	+200°C	−65°C to +200°C

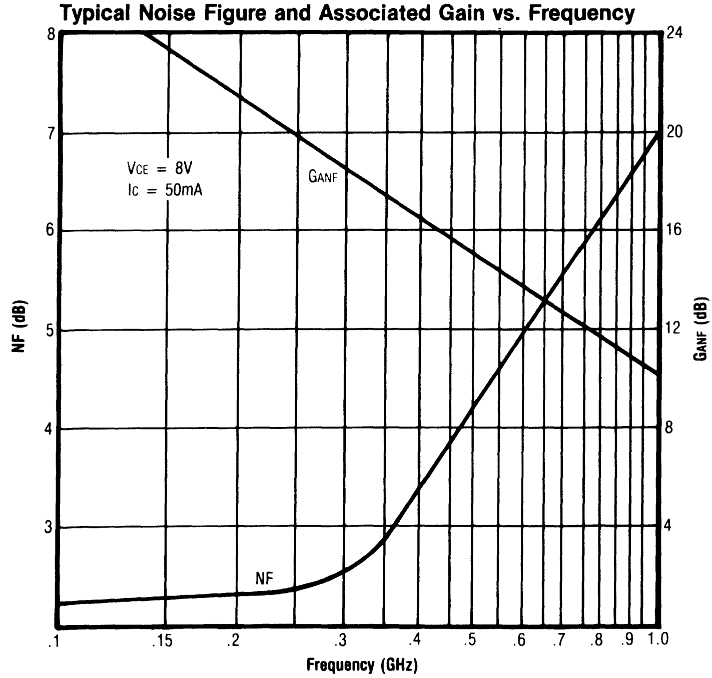
Third Order Intercept and 1dB Compression



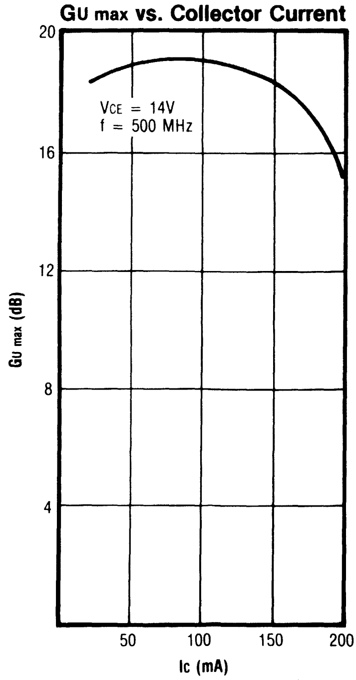
Gain-Bandwidth Product vs. Collector Current



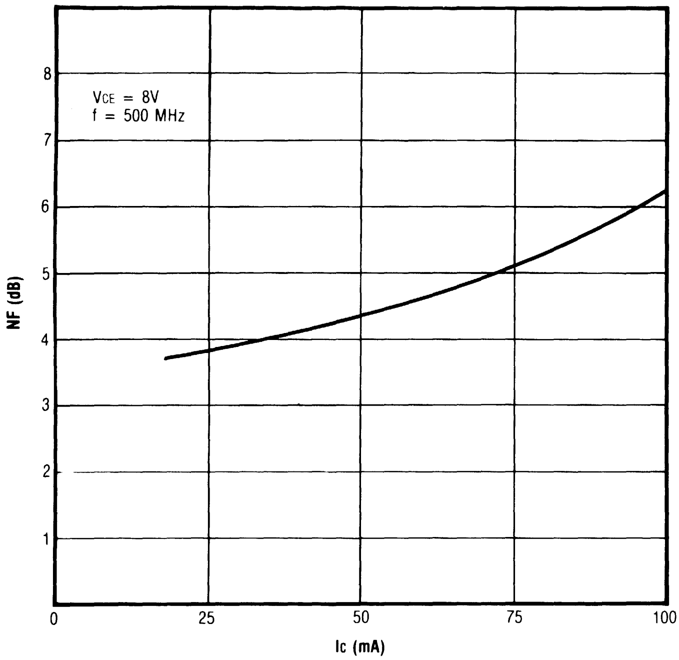
Typical Noise Figure and Associated Gain vs. Frequency



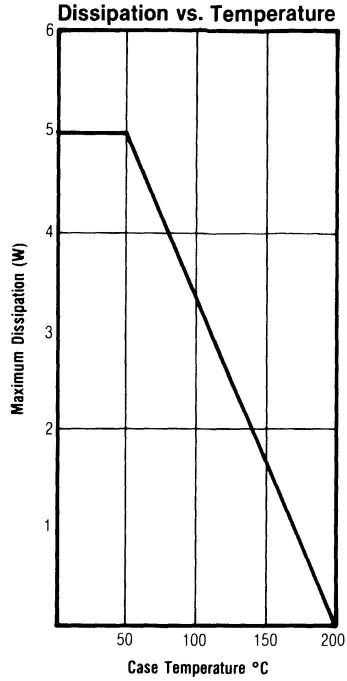
GU max vs. Collector Current



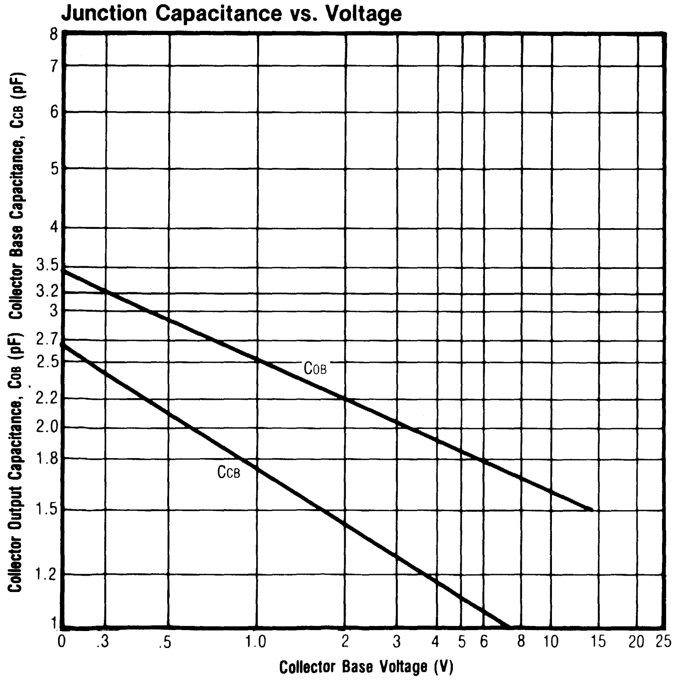
NF vs. Collector Current



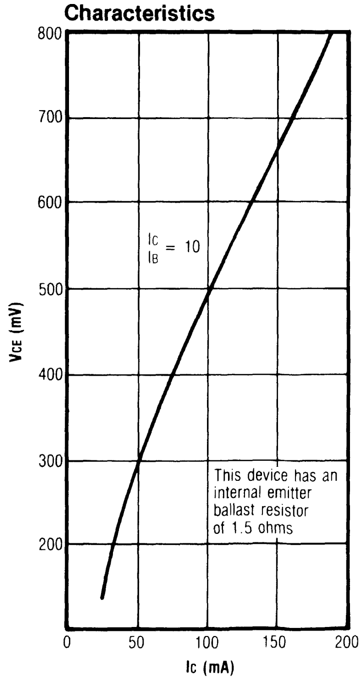
Dissipation vs. Temperature



Junction Capacitance vs. Voltage



Collector Saturation Characteristics



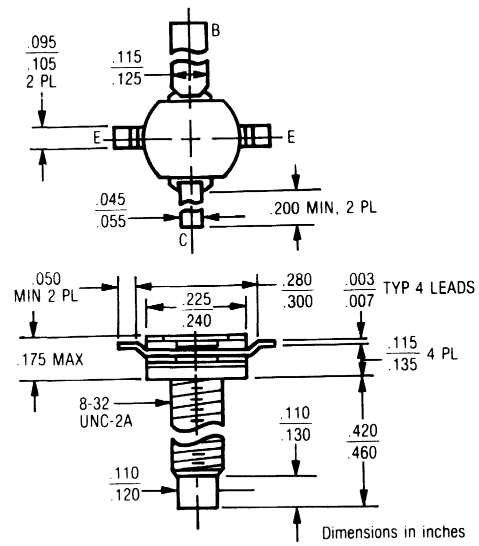
LT3014 S PARAMETERS

S-dB and Angles:
VCE = 8V, IC = 50mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-2.21	-123.8	26.31	115.5	-30.27	33.9	-3.67	-71.1	0.007
200	-2.40	-158.3	21.07	96.0	-29.41	24.6	-8.66	-81.7	0.391
300	-2.27	-176.3	17.87	83.7	-29.01	22.5	-9.18	-94.9	0.528
400	-2.09	172.2	15.45	74.7	-28.59	24.1	-9.22	-101.2	0.633
500	-2.08	162.5	13.38	67.0	-28.41	26.0	-8.55	-110.7	0.791
600	-1.92	153.9	11.87	59.3	-28.01	27.7	-8.49	-120.6	0.884
700	-1.88	147.1	10.51	53.7	-27.56	30.3	-7.62	-124.4	0.942
800	-1.91	139.9	9.08	45.3	-27.32	31.5	-6.86	-141.5	1.144
900	-1.99	133.8	7.91	39.2	-26.89	33.6	-6.54	-149.5	1.319
1000	-2.14	128.7	6.81	33.4	-26.45	36.6	-6.06	-154.1	1.491

VCE = 14V, IC = 90mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-2.41	-121.2	26.83	116.3	-32.67	35.5	-4.80	-45.9	0.205
200	-2.24	-151.3	21.78	96.3	-31.51	26.3	-7.58	-55.8	0.395
300	-2.16	-163.9	18.46	85.3	-31.02	26.0	-8.45	-62.4	0.557
400	-2.09	-171.3	15.99	77.2	-30.78	27.6	-8.36	-69.6	0.697
500	-2.12	-173.4	14.00	67.8	-29.97	21.4	-7.13	-74.8	0.739
600	-2.10	-177.5	12.33	59.6	-29.70	21.4	-6.64	-80.6	0.838
700	-2.07	178.9	10.81	53.2	-29.48	23.3	-6.26	-87.1	0.928
800	-2.04	176.0	9.59	46.6	-29.22	24.8	-5.87	-92.4	0.992
900	-1.97	170.5	8.45	36.9	-28.75	25.5	-5.29	-98.7	0.949
1000	-1.98	167.5	7.35	31.2	-28.55	26.2	-5.11	-103.8	1.058



GP-14

TRW

RF Transistor

- **High Gain: S_{21} = 15dB @ 300 MHz**
- **Low Distortion: I_{TO} = +45dBm**
- **Low Noise Figure: 2.5dB @ 200 MHz**

TO-46

The LT3046 is a NPN, silicon, TO-46, mounted transistor designed for ultra-linear communications or instrumentation applications.

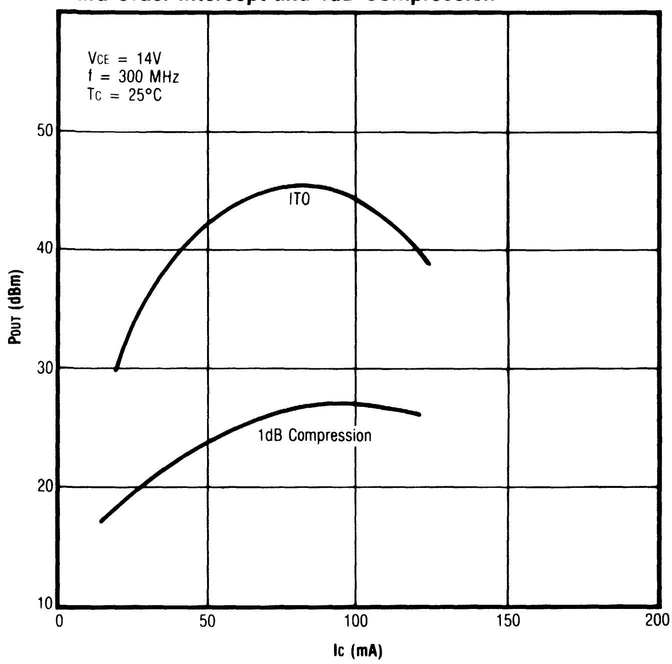
Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = 0.1mA	3.5			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 5.0mA	20			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1.0mA	40			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V		50		μA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	I_C = 50mA, I_C/I_B = 10		300		mV
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 50mA	70	100	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f_o = 1 MHz		1.5		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V I_C = 25mA, f = 300 MHz		2.5		dB
G_{Umax}	Maximum Unilateral Gain	V_{CE} = 14V I_C = 40mA, f = 300 MHz		17.5		dB
$[S_{21}]^2_E$	Common Emitter Insertion Gain	V_{CE} = 14V I_C = 40mA, f = 300 MHz		15.5		dB
F_T	Gain Bandwidth Product	V_{CE} = 14V I_C = 40mA		3.0		GHz
P_{OUT}	Power out @ 1dB Compression	V_{CE} = 14V I_C = 40mA, f = 300 MHz		22		dBm
ITO	Third Order Intercept	V_{CE} = 14V I_C = 40mA, f = 300 MHz		40		dBm

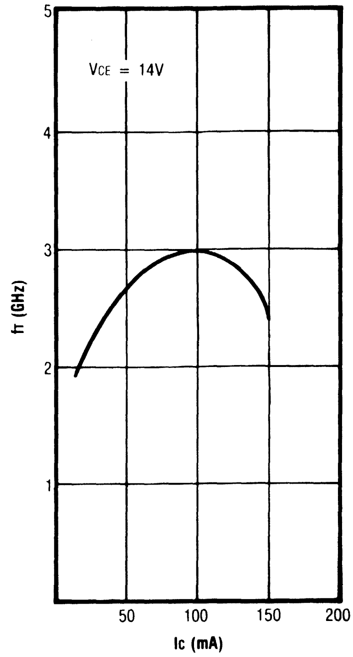
Absolute Maximum Ratings @ 25°C Case

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_j)	Storage Temperature (T_{STG})
150mA	40V	200°C	−65°C to +200°C

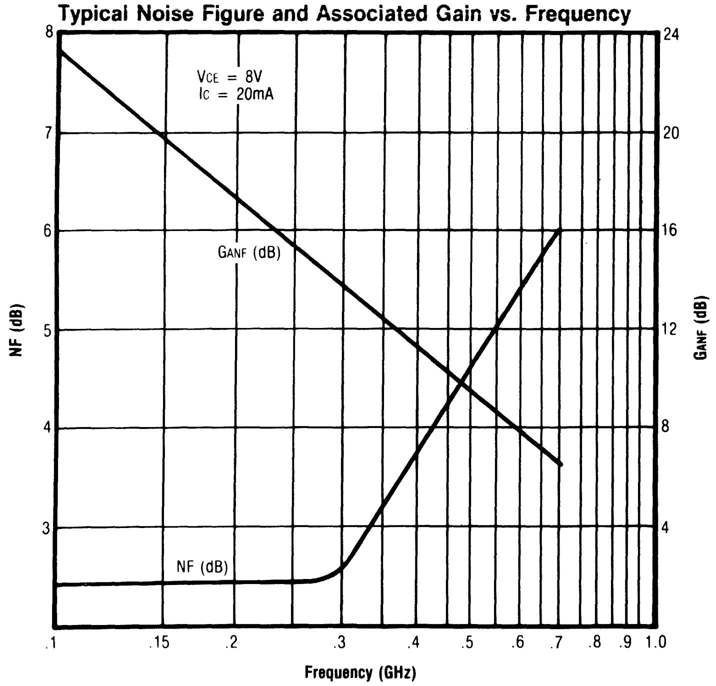
Third Order Intercept and 1dB Compression



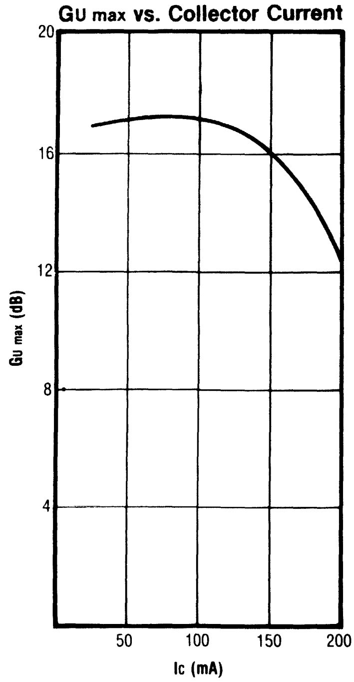
Gain-Bandwidth Product vs. Collector Current



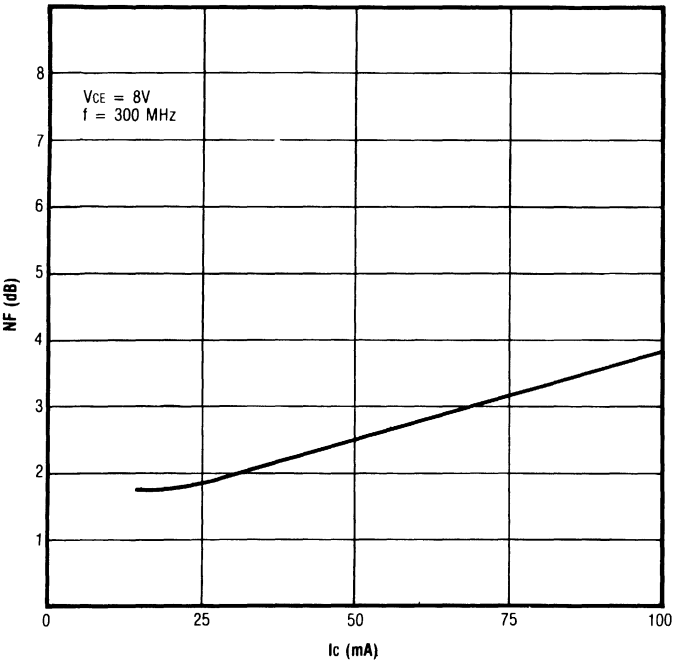
Typical Noise Figure and Associated Gain vs. Frequency



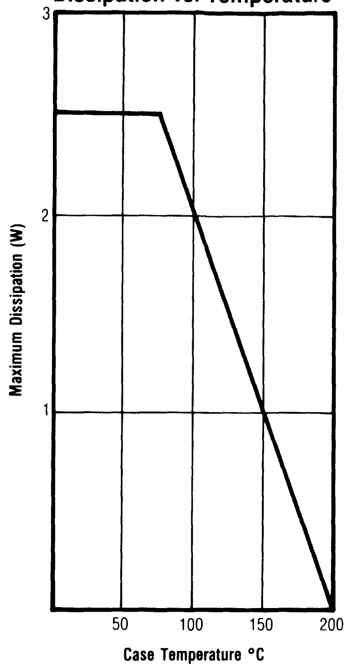
GU max vs. Collector Current



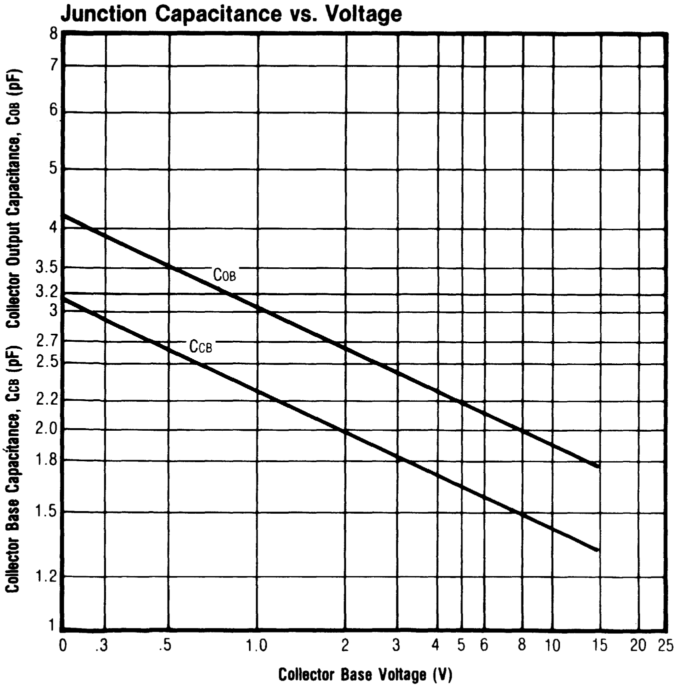
NF vs. Collector Current



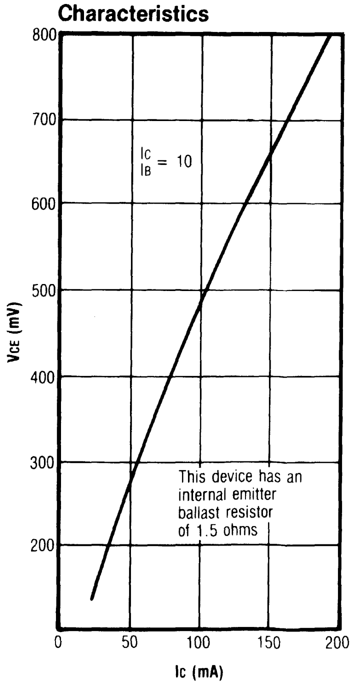
Dissipation vs. Temperature



Junction Capacitance vs. Voltage



Collector Saturation Characteristics



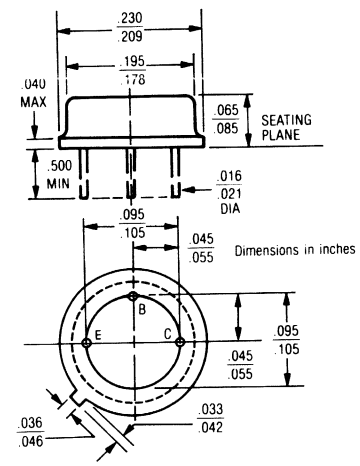
LT3046 S PARAMETERS

S-dB and Angles:
VCE = 8V, IC = 20mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−6.58	−117.7	21.66	108.6	−25.92	57.2	− 4.36	− 60.6	0.437
200	−8.53	−155.2	15.98	90.3	−22.80	63.9	− 8.88	− 61.1	0.915
300	−8.45	−175.7	12.75	80.0	−20.03	70.0	−10.29	− 70.6	1.020
400	−8.45	171.1	10.41	72.2	−17.73	73.8	−10.50	− 76.1	1.050
500	−8.27	155.2	8.56	65.0	−15.95	75.6	−10.69	− 89.3	1.095
600	−7.81	147.3	7.22	59.6	−14.20	77.2	−11.13	− 96.4	1.076
700	−7.96	135.9	6.11	55.4	−12.73	78.1	− 9.84	−105.7	1.069
800	−7.46	127.7	5.24	48.6	−11.24	76.2	−10.27	−126.1	1.064
900	−7.18	119.6	4.35	43.9	−10.00	75.2	−10.02	−136.2	1.057
1000	−7.49	109.8	3.60	40.2	− 8.94	73.9	− 8.06	−146.6	1.058

VCE = 14V, IC = 40mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−4.36	−113.9	23.66	115.4	−28.54	47.9	− 5.28	− 46.6	0.410
200	−4.72	−145.8	18.57	97.2	−26.42	48.2	− 8.32	− 54.8	0.684
300	−4.58	−159.9	15.39	59.0	−24.90	53.2	− 9.31	− 64.7	0.842
400	−4.66	−168.3	12.97	80.8	−23.69	58.4	− 9.66	− 65.9	0.967
500	−4.58	−174.3	11.04	74.9	−22.47	63.9	− 9.65	− 72.2	1.041
600	−3.77	−179.2	9.47	70.3	−21.39	68.8	− 9.31	− 77.0	0.956
700	−4.57	177.1	8.32	64.7	−20.12	71.6	− 8.64	− 81.9	1.057
800	−4.55	172.5	7.16	60.7	−19.06	75.4	− 8.25	− 86.9	1.067
900	−4.47	168.7	6.21	56.9	−17.99	78.0	− 7.69	− 91.2	1.030
1000	−4.29	164.4	5.27	53.6	−17.01	80.5	− 7.38	− 96.4	1.015

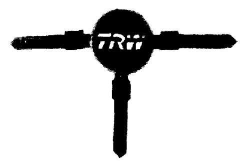


TO-46

LT3203*

UHF Linear Transistor

- **High Output**
- **Low Cost**
- **Gold Reliability**
- **2.5 GHz F_T**



T-PAK

The LT3203 is a NPN transistor, gold metalized for reliability, using diffused ballast resistors for super linearity at currents compatible with the power dissipation capability of a T-Pack. LT3203 is the ideal candidate for up to **0.8 V MATV** amplifiers from **40** to **860 MHz**. The LT3203 has applications in driver stages of 12 volts VHF/UHF transmitters and broadband instrumentation equipment.

Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = 0.1mA	3.5			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 5.0mA	20			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1.0mA	40			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V		50		μA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	I_C = 50mA, I_C/I_B = 10		300		mV
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 50mA	70	100	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f_o = 1.0 MHz		1.2		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V I_C = 40mA, f = 300 MHz		2.5		dB
GU_{max}	Maximum Unilateral Gain	V_{CE} = 14V I_C = 40mA, f = 500 MHz		15		dB
$[S_{21}]_E^2$	Common Emitter Insertion Gain	V_{CE} = 14V I_C = 40mA, f = 500 MHz		13		dB
F_T	Gain Bandwidth Product	V_{CE} = 14V I_C = 40mA		3.0		GHz
P_{out}	Power out @ 1dB Compression	V_{CE} = 14V I_C = 40mA		23		dBm
ITO	Third Order Intercept	V_{CE} = 14V I_{CE} = 40mA		45		dBm

Absolute Maximum Ratings @ 25°C Case

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_j)	Storage Temperature (T_{STG})
150mA	40V	+150°C	-65°C to +150°C

***Replaces TP394**

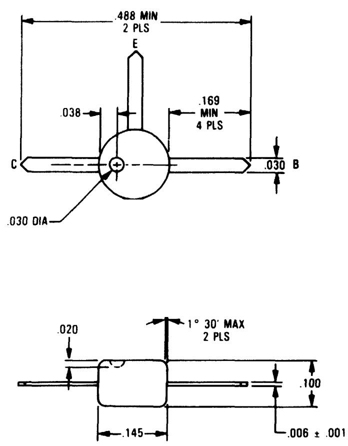
LT3203 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 20mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-3.04	-114.1	24.22	116.2	-29.57	42.2	-4.81	- 42.1	0.298
200	-3.39	-148.3	19.22	95.8	-27.76	39.6	-7.87	- 47.6	0.554
300	-3.53	-162.8	15.87	83.9	-26.71	45.0	-9.06	- 50.9	0.768
400	-3.56	-171.6	13.51	76.1	-25.55	49.9	-9.50	- 55.2	0.897
500	-3.57	-177.7	11.60	68.9	-24.39	55.7	-9.53	- 60.5	0.981
600	-3.57	177.7	10.01	62.5	-23.14	59.9	-9.38	- 65.7	1.012
700	-3.51	173.7	8.78	56.3	-21.94	63.1	-9.24	- 72.4	1.003
800	-3.42	169.4	7.61	50.9	-20.87	66.6	-8.89	- 77.9	0.984
900	-3.38	166.9	6.64	45.3	-19.61	68.6	-8.59	- 84.2	0.932
1000	-3.27	162.9	5.79	39.9	-18.47	69.2	-8.23	- 90.3	0.870
1100	-3.15	159.7	4.96	34.7	-17.44	69.9	-7.89	- 96.5	0.817
1200	-3.05	155.8	4.19	29.6	-16.33	70.6	-7.52	-103.4	0.764
1300	-3.00	153.3	3.52	24.9	-15.24	69.2	-7.15	-108.7	0.704

V_{CE} = 14V, I_C = 40mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-3.49	-115.7	25.61	114.0	-31.18	44.2	-5.31	-39.2	0.385
200	-3.98	-149.1	20.41	94.8	-29.27	45.4	-8.17	-41.2	0.670
300	-4.11	-163.0	17.08	83.5	-27.50	51.2	-9.19	-42.2	0.842
400	-4.14	-171.4	14.72	76.4	-26.04	55.0	-9.59	-45.2	0.943
500	-4.13	-177.2	12.82	69.4	-24.67	59.2	-9.68	-49.2	0.996
600	-4.14	178.5	11.21	63.3	-23.44	62.3	-9.57	-53.3	1.033
700	-4.06	174.7	9.96	57.4	-22.26	64.5	-9.41	-59.1	1.018
800	-3.95	170.7	8.83	51.9	-21.05	66.8	-9.15	-64.0	0.979
900	-3.88	168.1	7.83	46.6	-20.12	68.8	-8.84	-69.5	0.958
1000	-3.78	164.4	6.96	41.4	-18.97	69.7	-8.50	-75.0	0.894
1100	-3.64	161.4	6.16	36.2	-18.04	69.9	-8.15	-81.0	0.837
1200	-3.50	157.7	5.38	31.0	-16.97	70.5	-7.88	-87.4	0.780
1300	-3.42	155.2	4.72	26.4	-16.00	70.0	-7.57	-92.7	0.727



T-PAK

TRW

LT3204

UHF Linear Transistor

- **High Output**
- **Low Cost**
- **Gold Reliability**
- **2.5 GHz F_T**

X-PAK

The LT3204 is a NPN transistor, gold metalized for reliability, using diffused ballast resistors for super linearity at currents compatible with the power dissipation capability of a X-Pack. LT3204 is the ideal candidate for up to **0.8 V MATV** amplifiers from **40** to **860 MHz**. The LT3204 has applications in driver stages of 12 volts VHF/UHF transmitters and broadband instrumentation equipment.

Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base-Breakdown-Voltage	I_E = 0.1mA	3.5			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 5.0mA	20			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1.0mA	40			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V		50		μA
$V_{CE\,(SAT)}$	Collector-Emitter Saturation Voltage	I_C = 50mA, I_C/I_B = 10		300		mV
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 50mA	70	100	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f_o = 1.0 MHz		1.2		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V I_C = 40mA, f = 300 MHz		2.5		dB
G_{Umax}	Maximum Unilateral Gain	V_{CE} = 14V I_C = 40mA, f = 500 MHz		15		dB
$[S_{21}]^2_E$	Common Emitter Insertion Gain	V_{CE} = 14V I_C = 40mA, f = 500 MHz		13		dB
F_T	Gain Bandwidth Product	V_{CE} = 14V I_C = 40mA		3.0		GHz
P_{out}	Power out @ 1dB Compression	V_{CE} = 14V I_C = 40mA		23		dBm
ITO	Third Order Intercept	V_{CE} = 14V I_{CE} = 40mA		45		dBm

Absolute Maximum Ratings @ 25°C Case

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_j)	Storage Temperature (T_{STG})
150mA	40V	+150°C	-65°C to +150°C

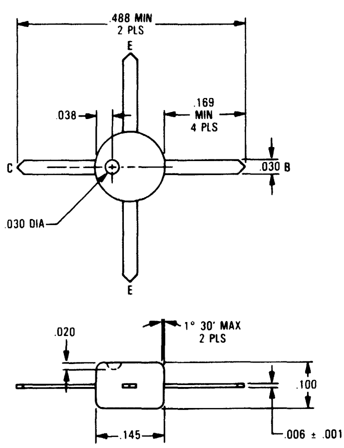
LT3204 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 20mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-1.79	-115.0	24.95	118.3	-29.54	36.2	-4.64	- 47.1	0.136
200	-1.82	-148.6	20.04	97.1	-28.24	25.7	-8.03	- 57.1	0.291
300	-1.89	-162.6	16.76	85.1	-27.92	24.8	-9.45	- 61.9	0.459
400	-1.96	-170.6	14.31	77.5	-27.55	26.3	-9.91	- 66.7	0.615
500	-2.00	-176.3	12.37	70.2	-27.22	29.0	-9.83	- 71.9	0.756
600	-2.04	179.5	10.73	63.8	-26.92	32.8	-9.62	- 76.8	0.895
700	-2.03	176.1	9.32	57.9	-26.50	36.8	-9.28	- 83.0	0.985
800	-1.98	172.6	8.18	52.4	-25.90	41.0	-8.78	- 87.7	0.999
900	-1.98	170.5	7.07	47.0	-25.28	43.9	-8.36	- 92.8	1.037
1000	-1.94	167.3	6.15	41.6	-24.67	47.3	-7.85	- 97.8	1.023
1100	-1.92	165.0	5.27	36.4	-23.94	50.7	-7.43	-103.0	1.008
1200	-1.84	161.9	4.41	31.3	-23.29	52.2	-6.94	-108.2	0.953
1300	-1.83	160.4	3.68	26.6	-22.46	54.9	-6.57	-112.5	0.904

V_{CE} = 14V, I_C = 40mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-1.97	-116.8	26.55	117.0	-31.34	35.9	- 5.09	-45.9	0.190
200	-2.07	-149.1	21.54	96.5	-29.94	29.4	- 8.55	-52.5	0.370
300	-2.16	-163.3	18.17	85.1	-29.31	29.5	- 9.99	-55.3	0.553
400	-2.21	-171.1	15.72	77.7	-28.84	32.5	-10.43	-58.2	0.713
500	-2.24	-176.3	13.79	70.8	-28.20	35.2	-10.55	-62.4	0.839
600	-2.29	179.7	12.22	64.6	-27.53	38.8	-10.30	-66.1	0.935
700	-2.27	176.2	10.81	58.9	-26.91	41.8	-10.08	-71.3	1.008
800	-2.21	173.1	9.60	53.6	-26.38	45.6	- 9.62	-75.7	1.042
900	-2.22	171.1	8.56	48.3	-25.59	48.5	- 9.18	-80.3	1.051
1000	-2.17	167.8	7.64	43.1	-25.06	50.3	- 8.70	-85.1	1.049
1100	-2.12	165.6	6.76	38.0	-24.44	53.2	- 8.31	-89.9	1.034
1200	-2.03	162.5	5.92	32.9	-23.62	54.1	- 7.87	-95.1	0.961
1300	-2.00	160.9	5.18	28.2	-22.92	55.8	- 7.44	-99.6	0.921

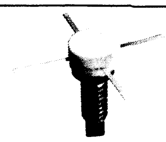


X-PAK

TRW

Broadband Class A Linear Applications

- **High Output**
- **Low Noise**
- **Low Distortion**



TO-117A

These rugged NPN silicon transistors are specifically designed for broadband Class A applications requiring low distortion and low noise figure. Ceramic capped and stud mounted, these high power devices are ideally suited for CATV and MATV amplifiers. The PT4572A is used as an intermediate or output stage transistor.

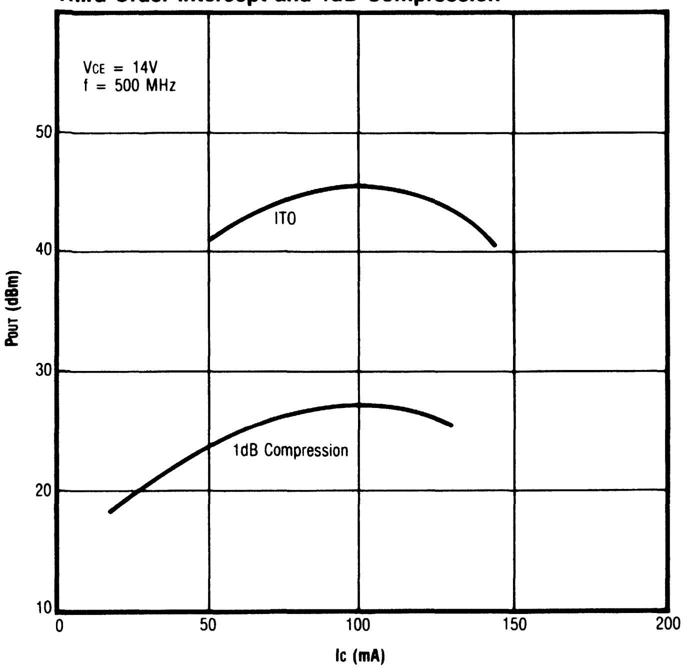
Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = 0.1mA	3.0			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 5.0mA	25			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1.0mA	40			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			200	μA
$V_{CE\,(SAT)}$	Collector-Emitter Saturation Voltage	I_C = 100mA, I_C/I_B = 2		400		mV
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 50mA	20	100	150	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1 MHz		2.2		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V I_C = 50mA, f = 300 MHz		2.3		dB
G_{Umax}	Maximum Unilateral Gain	V_{CE} = 14V I_C = 90mA, f = 300 MHz		16		dB
$[S_{21}]_E^2$	Common Emitter Insertion Gain	V_{CE} = 14V I_C = 90mA, f = 300 MHz		14		dB
F_T	Gain Bandwidth Product	V_{CE} = 14V I_C = 90mA		2.5		GHz
P_{OUT}	Power out @ 1dB Compression	V_{CE} = 14V I_C = 90mA, f = 500 MHz		27		dBm
ITO	Third Order Intercept	V_{CE} = 14V I_C = 90mA, f = 500 MHz		45		dBm

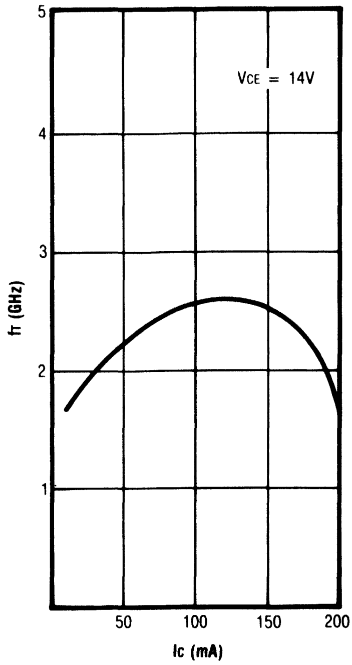
Absolute Maximum Ratings @ 25°C Case

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_j)	Storage Temperature (T_{STG})
200mA	40V	200°C	−65°C to +200°C

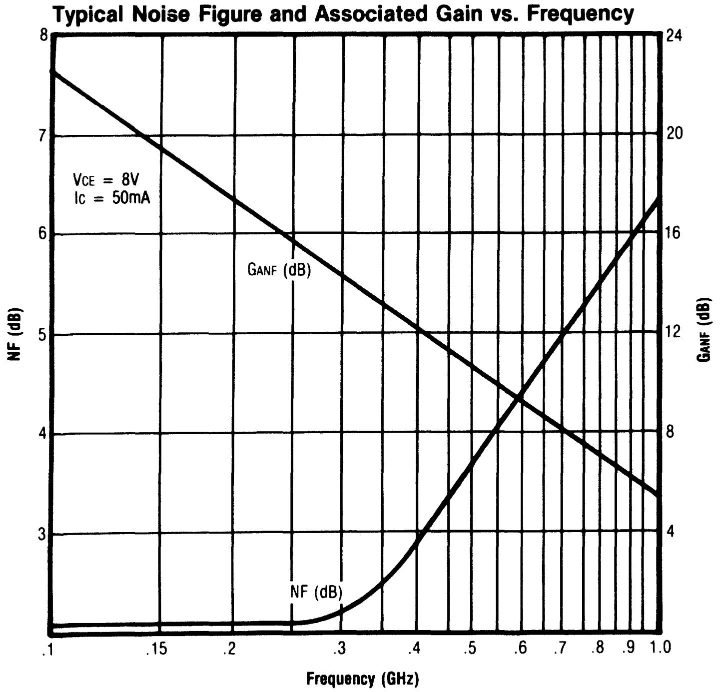
Third Order Intercept and 1dB Compression



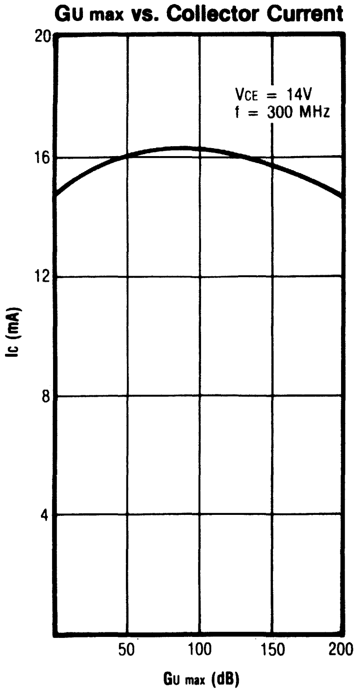
Gain-Bandwidth Product vs. Collector Current



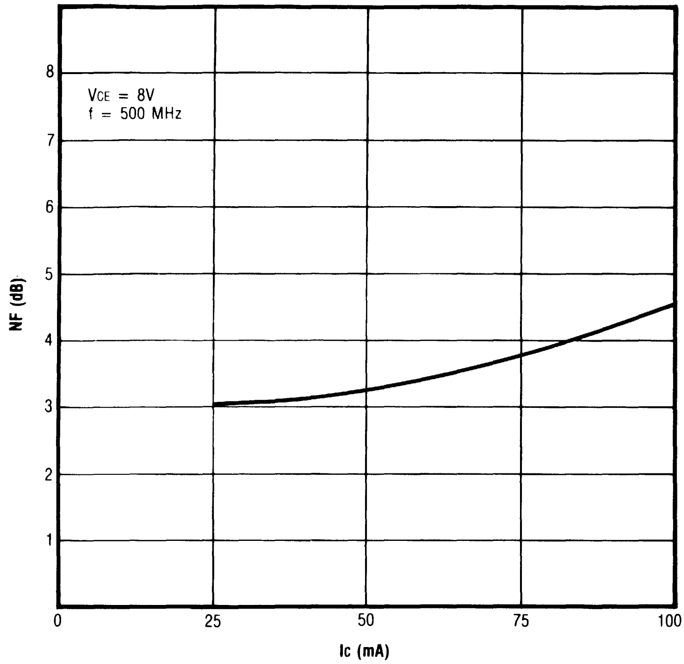
Typical Noise Figure and Associated Gain vs. Frequency



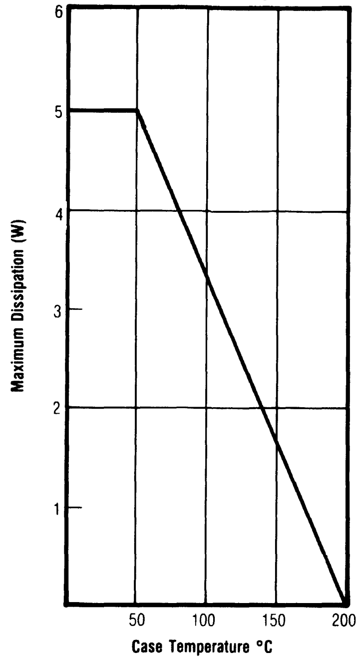
GU max vs. Collector Current



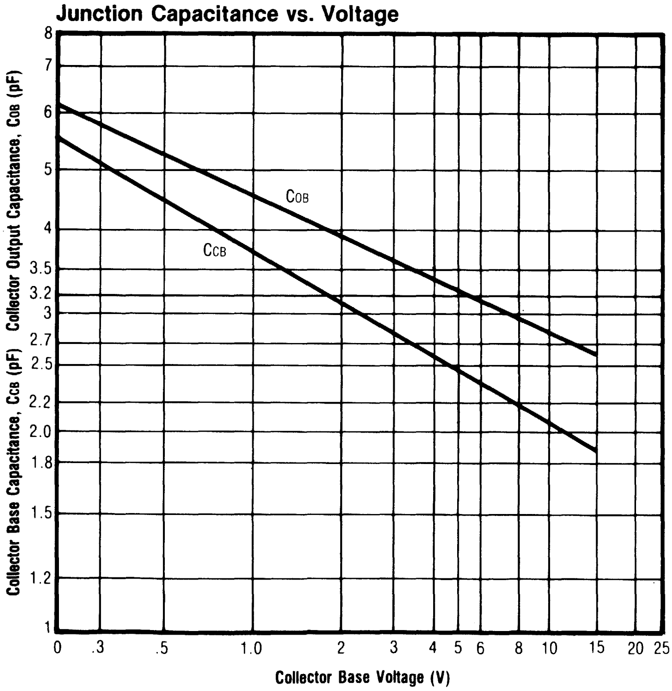
NF vs. Collector Current



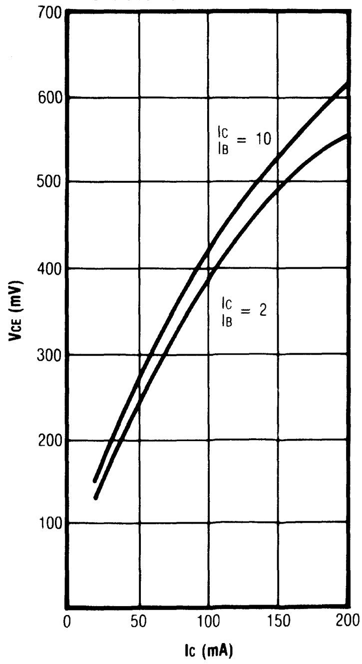
Dissipation vs. Temperature



Junction Capacitance vs. Voltage



Collector Saturation Characteristics



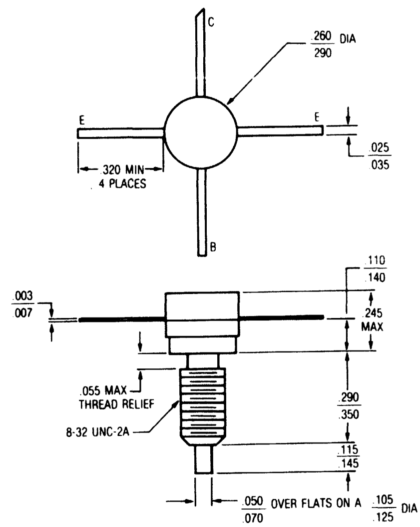
PT4572A S PARAMETERS

S-dB and Angles:
VCE = 8V, IC = 50mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−4.58	−172.6	22.07	96.2	−31.41	60.7	−16.48	−108.4	1.085
200	−4.47	169.5	17.14	84.5	−26.24	67.2	−20.29	−124.3	1.101
300	−4.29	156.2	13.79	74.2	−22.99	67.3	−18.02	−132.3	1.100
400	−4.32	146.8	11.42	65.4	−20.62	65.6	−18.23	−128.8	1.098
500	−4.30	136.9	9.43	57.6	−18.96	63.5	−16.01	−129.2	1.123
600	−4.04	128.1	7.90	49.7	−17.55	60.3	−15.84	−143.4	1.119
700	−4.20	121.3	6.47	43.5	−16.45	58.1	−14.73	−141.8	1.164
800	−4.10	113.1	5.23	36.5	−15.67	55.5	−12.53	−158.0	1.216
900	−4.00	105.5	4.08	30.9	−14.82	53.2	−12.23	−166.1	1.245
1000	−4.11	99.9	3.07	25.6	−14.12	51.4	−12.14	−170.1	1.295

VCE = 14V, IC = 90mA

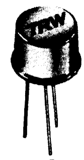
Frequency (MHz)	S11		S21		S12		S22		k
100	−4.49	−177.2	24.66	83.6	−32.32	66.1	−16.41	− 86.9	0.914
200	−4.61	167.1	17.94	75.5	−26.89	70.9	−19.88	− 92.7	1.066
300	−4.49	157.1	14.31	69.1	−23.68	71.1	−19.75	− 99.9	1.100
400	−4.25	147.5	11.78	62.7	−21.31	69.7	−18.35	−110.1	1.094
500	−4.16	138.0	9.76	56.5	−19.44	67.5	−17.36	−117.7	1.105
600	−4.01	130.3	8.14	50.2	−18.02	65.6	−15.80	−127.3	1.115
700	−3.97	123.5	6.80	44.7	−16.86	63.0	−14.36	−137.5	1.139
800	−4.07	115.2	5.43	38.9	−15.97	60.8	−13.31	−146.4	1.214
900	−3.99	107.8	4.23	34.1	−15.12	58.6	−12.54	−153.3	1.248
1000	−4.12	101.5	3.19	30.5	−14.40	57.2	−11.78	−161.1	1.312



TO-117A

RF Transistor

- **High f_T — 2.0 GHz**
- **Low Distortion**
- **Low Noise Figure: 2.3 dB @ 200 MHz**



TO-39

The PT4579 is a high-output NPN silicon TO-39-mounted transistor designed for ultra-linear communications or instrumentation applications. Low noise figure combined with high-output capability gives this device an exceptional dynamic range. Gold metalization is used to achieve the high reliability demanded by the most severe communications requirements. High gain makes this transistor ideal for broadband applications.

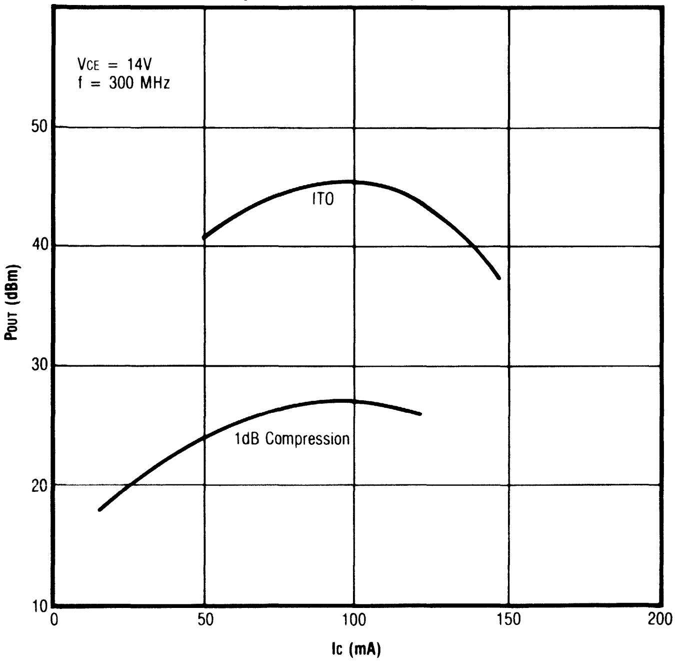
Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = 0.1mA	3.0			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 25mA	25			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1.0mA	40			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 13V		100		μA
$V_{CE (SAT)}$	Collector-Emitter Saturation Voltage	I_C = 100mA I_C/I_B = 2		400		mV
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 50mA	50	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1 MHz		2.5		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V I_C = 50mA f = 300 MHz		2.3		dB
G_{Umax}	Maximum Unilateral Gain	V_{CE} = 14V I_C = 90mA f = 300 MHz		13.5		dB
$[S_{21}]_E^2$	Common Emitter Insertion Gain	V_{CE} = 14V I_C = 90mA f = 300 MHz		12.0		dB
F_T	Gain Bandwidth Product	V_{CE} = 14V I_C = 90mA		2.5		GHz
P_{OUT}	Power out @ 1dB Compression	V_{CE} = 14V I_C = 90mA f = 300 MHz		26		dBm
ITO	Third Order Intercept	V_{CE} = 14V I_C = 90mA f = 300 MHz		46		dBm

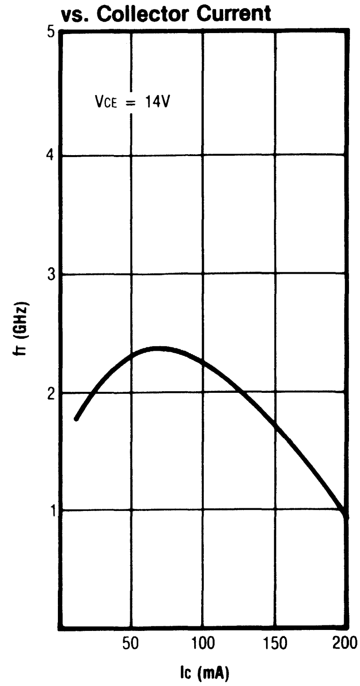
Absolute Maximum Ratings @ 25°C Case

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_j)	Storage Temperature (T_{STG})
200mA	40V	+200°C	−65°C to +200°C

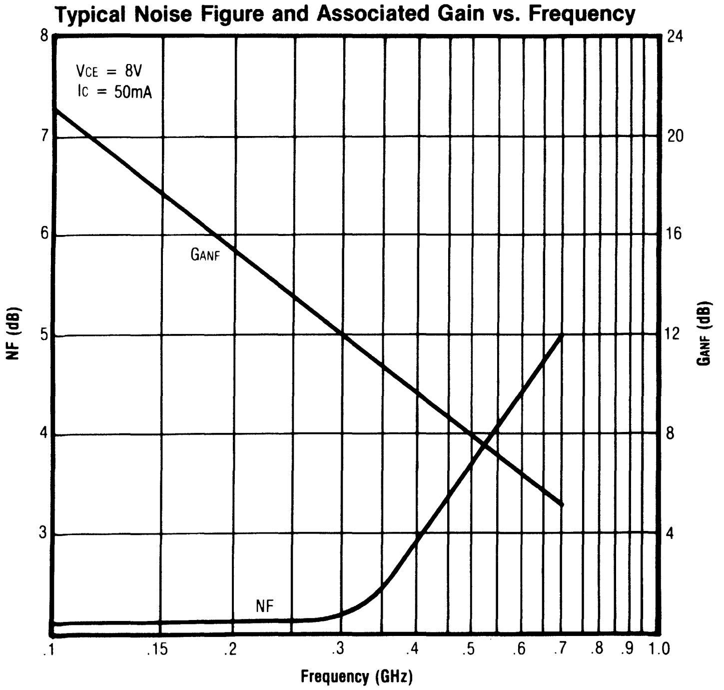
Third Order Intercept and 1dB Compression



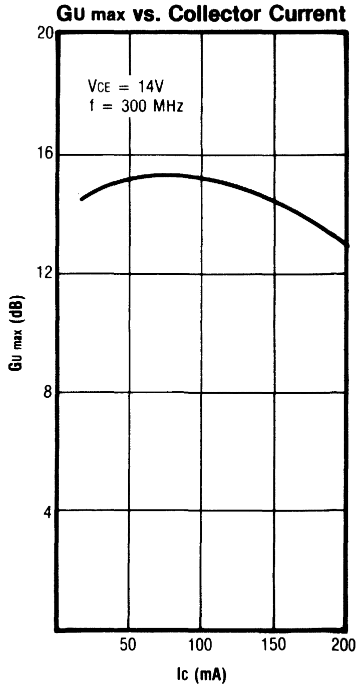
Gain-Bandwidth Product vs. Collector Current



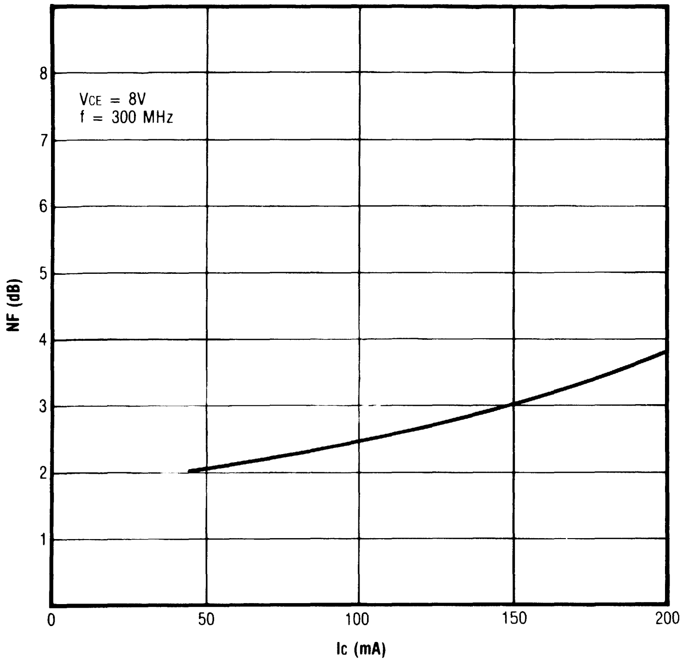
Typical Noise Figure and Associated Gain vs. Frequency



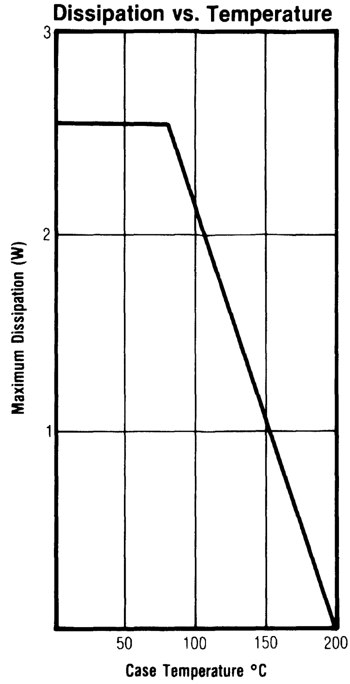
GU max vs. Collector Current



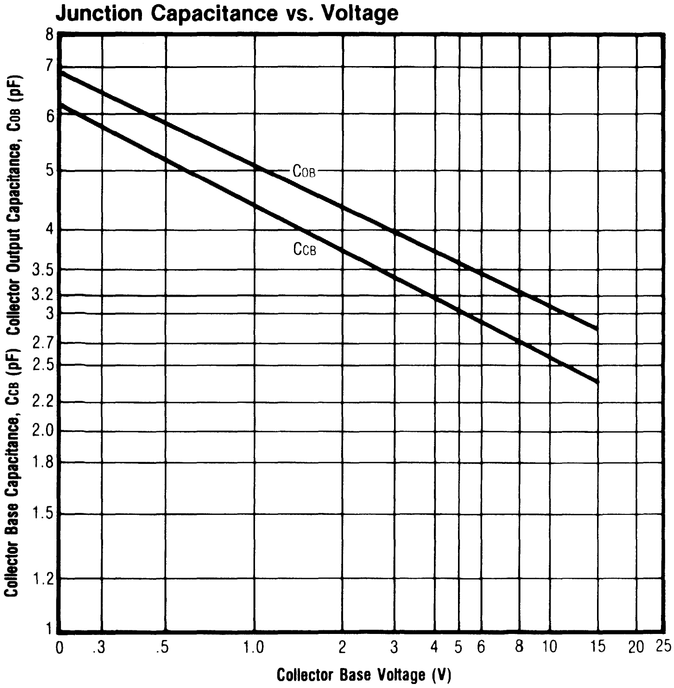
NF vs. Collector Current



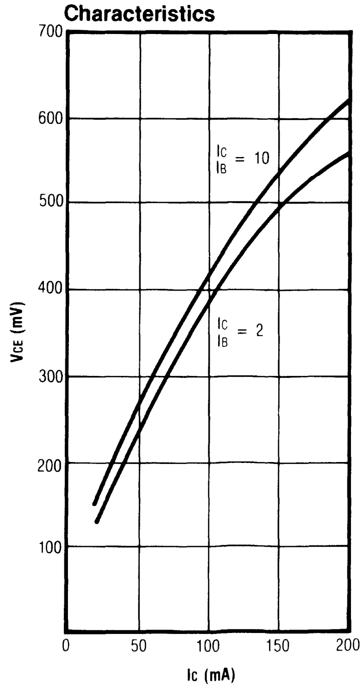
Dissipation vs. Temperature



Junction Capacitance vs. Voltage



Collector Saturation Characteristics



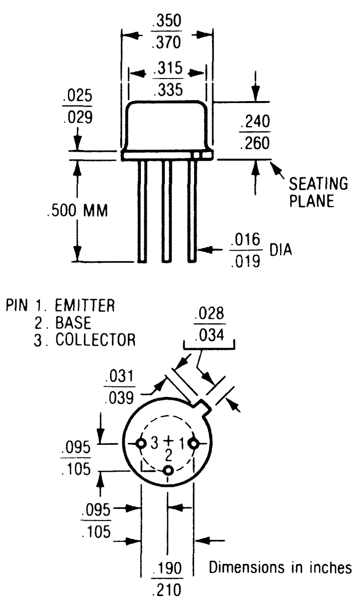
PT4579 S PARAMETERS

S-dB and Angles:
VCE = 8V, IC = 50mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−5.90	−170.7	19.47	96.2	−26.71	66.7	−15.48	−113.1	1.043
200	−5.73	170.6	14.39	83.4	−21.49	71.2	−17.43	−129.8	1.064
300	−5.60	158.7	11.21	73.6	−18.27	71.4	−16.90	−134.9	1.061
400	−5.65	148.4	8.97	65.5	−15.95	70.4	−15.46	−140.3	1.067
500	−5.53	137.7	7.21	58.2	−14.17	68.9	−15.41	−144.0	1.065
600	−5.33	128.4	5.85	51.4	−12.75	67.2	−14.00	−148.0	1.057
700	−5.38	117.8	4.69	46.2	−11.49	65.3	−12.82	−149.6	1.064
800	−5.59	109.5	3.83	39.8	−10.50	62.9	−11.50	−156.7	1.078
900	−5.49	101.0	2.99	34.6	− 9.56	60.8	−10.80	−162.2	1.076
1000	−5.69	90.5	2.27	29.5	− 8.76	58.5	−10.01	−169.2	1.091

VCE = 14V, IC = 90mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−6.12	−164.8	21.44	92.0	−28.07	64.6	−14.71	− 99.9	0.972
200	−5.94	−179.1	15.65	82.1	c23.14	69.6	−15.64	−112.7	1.060
300	−5.83	173.2	12.20	74.6	−20.09	70.3	−14.63	−116.3	1.082
400	−5.88	167.3	9.81	67.8	−17.96	69.6	−13.38	−115.2	1.091
500	−5.91	161.9	8.05	62.0	−16.34	69.2	−12.22	−114.4	1.086
600	−6.03	156.8	6.55	56.1	−14.99	68.5	−11.15	−113.1	1.082
700	−6.15	151.4	5.33	51.1	−13.89	67.1	−10.21	−113.6	1.078
800	−6.26	146.4	4.23	46.3	−12.96	67.0	− 9.44	−115.0	1.084
900	−6.33	140.6	3.33	41.9	−12.18	66.2	− 8.60	−115.9	1.076
1000	−6.24	134.0	2.45	37.9	−11.42	65.7	− 8.00	−118.6	1.073



TO-39

Small Signal Low Noise Transistor for Receiver Applications

- **Front End Amplifier**
- **Low Noise Oscillator**
- **High Frequency Multiplier**
- **Isolation Buffer**
- **High Output IF Amplifier**
- **Low Noise**
- **High Gain**
- **Wide Dynamic Range**
- **High Output Capability**
- **Hermetic Package**

100 MIL Package

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. Processes in wafer fabrication make this transistor effective in applications up to 3.5 GHz, with a very wide dynamic range.

The LT3700 sets new standards for low noise figure, high gain, and dynamic range. Gold metallization insures high reliability for low noise amplifier applications.

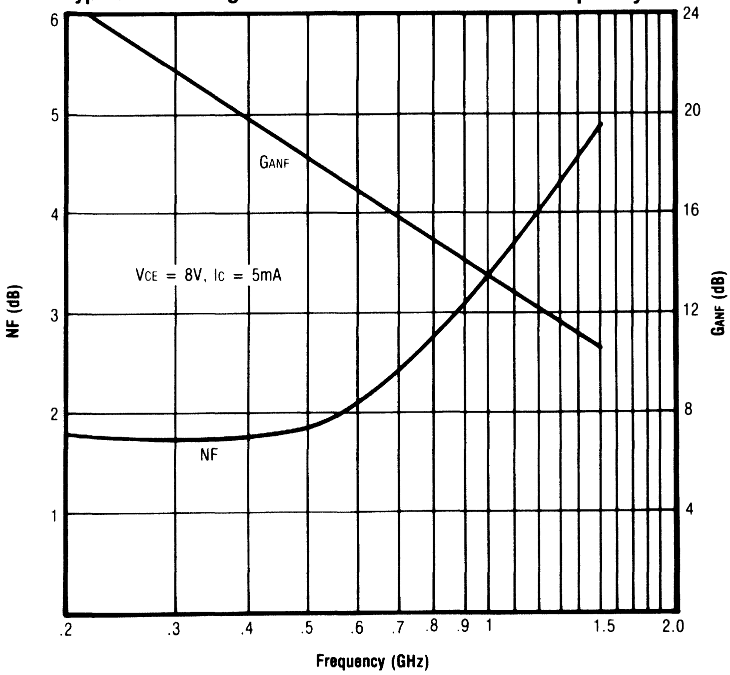
Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_C = .1mA	3			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	14			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 25mA	50	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1.0 MHz			.6	pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 5mA f = .3 GHz f = .5 GHz f = 1.0 GHz		1.8 1.8 3.4	 4.0	dB dB dB
G_{ANF}	Gain @ Associated Noise Figure	V_{CE} = 8V, I_C = 5mA f = .3 GHz f = .5 GHz f = 1.0 GHz		22.0 18.0 13.5		dB dB dB
$[S_{21}]^2_E$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 25mA f = .3 GHz f = .5 GHz f = 1.0 GHz	 10	22 18 12		dB dB dB
$G_{U(max)}$	Maximum Unilateral Gain	V_{CE} = 8V, I_C = 25mA f = .3 GHz f = .5 GHz f = 1.0 GHz		28.0 24.5 17.0		dB dB dB
F_t	Gain Bandwidth Product	V_{CE} = 8V I_C = 25mA		3.5		GHz
F_{max}	Maximum Oscillation Frequency	V_{CE} = 8V I_C = 25mA		6		GHz

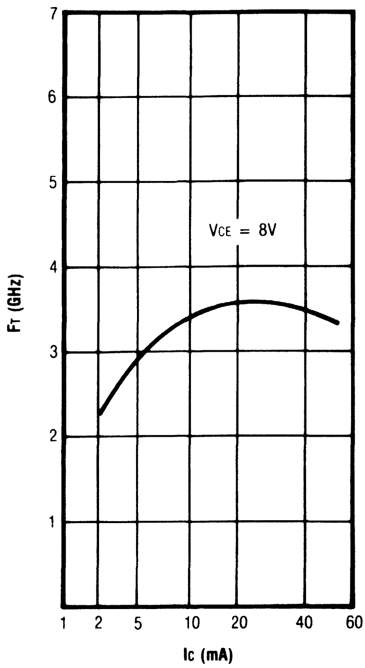
Absolute Maximum Ratings

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_S)
50mA	25V	200 °C	– 65 °C to 200 °C

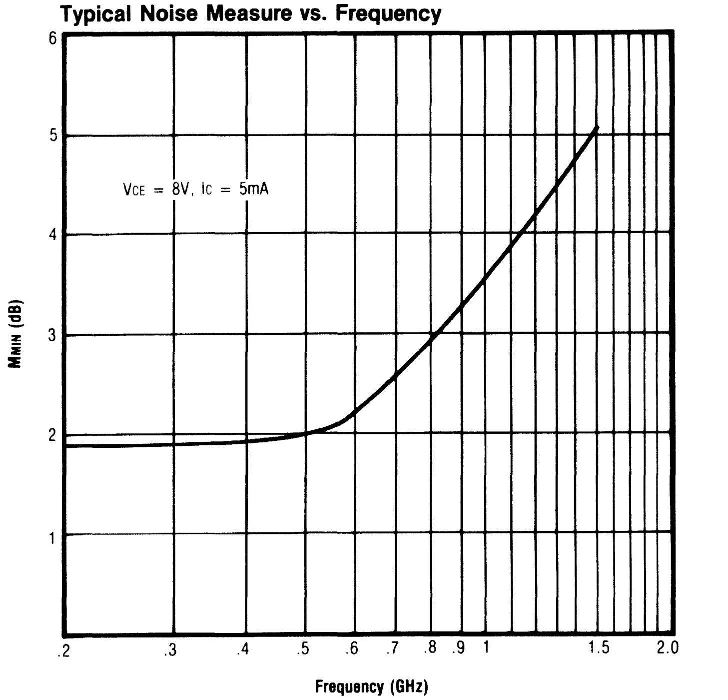
Typical Noise Figure and Associated Gain vs. Frequency



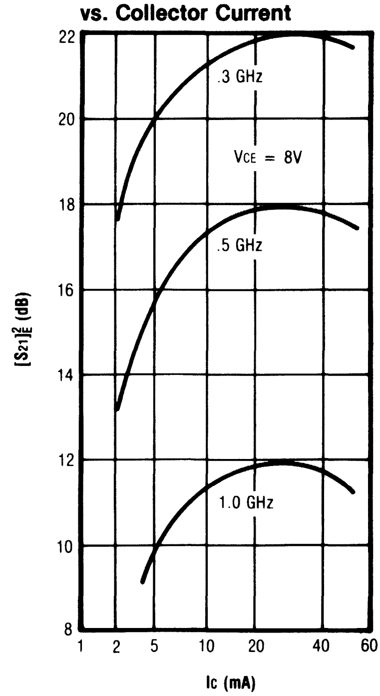
Typical Gain Bandwidth Product vs. Collector Current



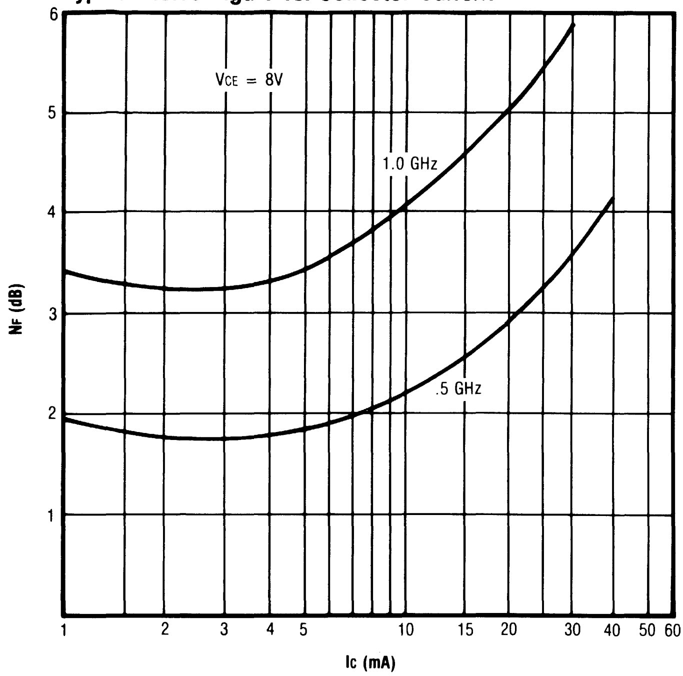
Typical Noise Measure vs. Frequency



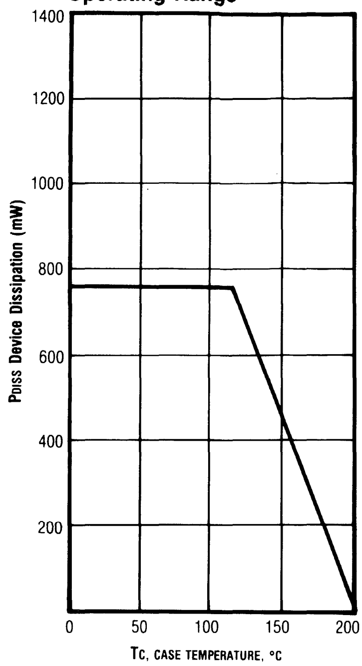
Typical Insertion Gain vs. Collector Current



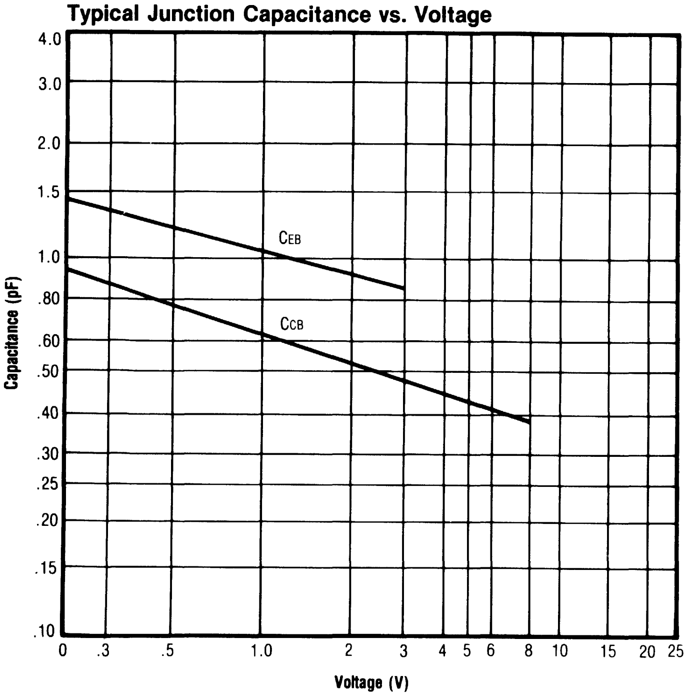
Typical Noise Figure vs. Collector Current



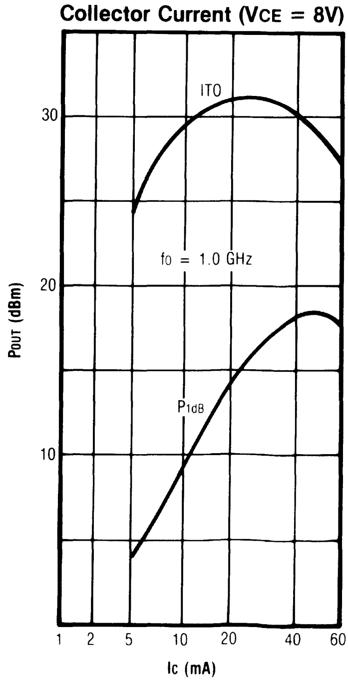
Device Dissipation Operating Range



Typical Junction Capacitance vs. Voltage



Third Order Intercept vs. Collector Current (VCE = 8V)



LT3700 S PARAMETERS

S-dB and Angles:
VCE = 8V, IC = 5mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−1.81	−48.7	22.43	149.6	−33.53	68.8	−0.73	−12.2	0.11333
150	−2.11	−65.3	21.60	140.7	−31.14	56.5	−1.16	−17.0	0.18984
200	−2.35	−79.9	20.61	132.4	−29.65	50.4	−1.72	−19.8	0.23355
250	−2.54	−92.2	19.71	125.4	−28.78	45.3	−2.11	−21.6	0.27096
300	−2.69	−103.8	18.76	119.0	−27.99	42.8	−2.43	−21.7	0.29494
350	−2.81	−112.6	17.93	112.7	−27.69	37.3	−2.95	−23.2	0.38410
400	−2.89	−120.2	17.16	108.2	−27.33	35.4	−3.23	−24.4	0.41191
450	−2.96	−126.8	16.45	104.9	−27.06	33.5	−3.48	−24.6	0.44890
500	−3.01	−133.0	15.61	101.9	−26.83	32.5	−3.60	−23.8	0.48081
600	−3.09	−142.1	14.33	95.4	−26.53	29.6	−3.94	−25.2	0.57104
700	−3.14	−149.8	13.13	89.3	−26.33	28.8	−4.21	−25.8	0.66558
800	−3.16	−156.0	12.06	85.1	−26.06	27.7	−4.32	−27.9	0.72726
900	−3.21	−161.4	11.05	80.4	−25.96	27.3	−4.50	−29.1	0.83249
1000	−3.22	−165.8	10.15	76.4	−25.68	27.3	−4.40	−30.5	0.87155
1100	−3.20	−171.0	9.26	71.8	−25.86	27.0	−4.54	−32.9	0.99611
1200	−3.21	−174.6	8.54	68.2	−25.55	27.0	−4.52	−33.8	1.03973
1300	−3.19	−177.9	7.89	64.9	−25.38	27.1	−4.58	−36.6	1.09188
1400	−3.20	−179.0	7.21	62.0	−25.36	27.7	−4.66	−37.6	1.19821
1500	−3.18	176.1	6.62	58.1	−25.15	26.4	−4.53	−39.9	1.28717
1600	−3.15	173.8	6.02	55.0	−25.02	27.4	−4.57	−41.9	1.28717
1700	−3.14	172.7	5.48	53.9	−24.93	28.4	−4.52	−43.4	1.33209
1800	−3.19	168.7	4.88	49.9	−24.86	27.8	−4.55	−46.0	1.44548
1900	−3.07	167.0	4.59	46.7	−24.66	27.8	−4.59	−47.7	1.42425
2000	−3.07	165.2	4.28	43.1	−24.48	29.1	−4.43	−51.1	1.39454

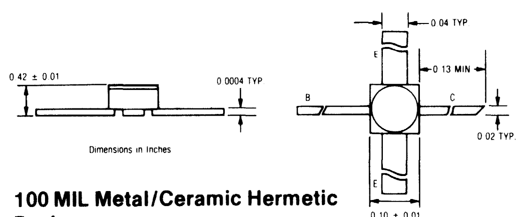
VCE = 8V, IC = 25mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−4.36	−107.1	28.78	127.4	−38.42	56.2	−2.68	−21.2	0.31065
150	−3.99	−125.8	26.78	117.5	−36.42	44.2	−3.70	−23.1	0.41882
200	−3.69	−137.7	24.92	109.8	−35.83	41.4	−4.48	−23.1	0.52782
250	−3.53	−145.8	23.46	104.2	−35.38	40.9	−4.91	−22.2	0.61024
300	−3.47	−152.9	21.97	99.4	−35.03	42.6	−5.22	−20.7	0.71356
350	−3.40	−157.4	20.84	94.5	−34.52	40.3	−5.57	−20.6	0.80758
400	−3.33	−160.9	19.81	91.9	−34.05	42.8	−5.73	−20.8	0.85282
450	−3.31	−164.0	18.90	89.5	−33.56	42.6	−5.87	−20.4	0.90744
500	−3.27	−167.2	17.91	87.7	−33.33	44.9	−5.87	−19.2	0.97851
600	−3.23	−171.5	16.42	83.0	−32.50	45.9	−6.00	−20.2	1.06296
700	−3.19	−175.3	15.07	78.4	−31.90	47.7	−6.09	−20.2	1.16326
800	−3.16	−178.3	13.87	74.7	−31.10	48.9	−6.11	−22.2	1.20862
900	−3.15	178.8	12.81	71.2	−30.58	50.0	−6.17	−23.3	1.29513
1000	−3.10	176.3	11.86	67.7	−29.95	50.6	−5.99	−25.0	1.29980
1100	−3.03	173.0	10.90	63.9	−29.63	51.1	−6.06	−27.2	1.38869
1200	−2.99	171.0	10.14	60.8	−29.00	51.4	−5.98	−28.2	1.38574
1300	−2.94	168.8	9.42	57.8	−28.58	51.4	−5.97	−31.3	1.40842
1400	−2.93	166.9	8.69	55.3	−28.22	52.3	−5.95	−32.5	1.46353
1500	−2.87	165.0	8.07	51.8	−27.81	51.3	−5.81	−35.1	1.45500
1600	−2.82	163.3	7.40	49.1	−27.48	51.8	−5.77	−36.9	1.48563
1700	−2.79	163.1	6.84	48.2	−27.13	52.8	−5.68	−38.9	1.49039
1800	−2.83	159.6	6.23	44.6	−26.88	52.6	−5.69	−41.3	1.58113
1900	−2.73	158.4	5.86	41.7	−26.46	52.4	−5.65	−43.2	1.50892
2000	−2.70	157.0	5.51	38.3	−26.10	53.0	−5.52	−46.8	1.46444

NOISE PARAMETERS

Freq.	N.F. OPT	Γs OPT	Rn
0.5 GHz	1.8 dB	.184 /150°	.57Ω
1.0 GHz	3.4 dB	.339 /175°	.30Ω

Reflection coefficient of source and the noise resistance at optimum noise figure for VCE = 8V, IC = 5mA

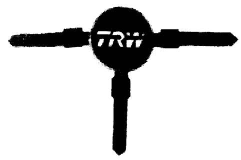


100 MIL Metal/Ceramic Hermetic Package

LT3703*

Small Signal Low Noise Transistor for Receiver Applications

- **Front End Amplifier**
- **Low Noise Oscillator**
- **High Frequency Multiplier**
- **Low Noise**
- **High Gain**
- **Wide Dynamic Range**
- **Plastic Package**



T-PAK

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. Processes in wafer fabrication make this transistor effective in applications up to 3.5 GHz, with a very wide dynamic range.

The LT3703 sets new standards for low noise figure, high gain, and dynamic range. Gold metallization insures high reliability for low noise amplifier applications.

Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_C = .1mA	3.0			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	14			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
h_{FE}	DC Current Gain	V_{CE} = 5V I_E = 25mA	50	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1.0 MHz		.6		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 5mA f = .3 GHz f = .5 GHz f = 1.0 GHz		1.5 1.8 3.4	2.8	dB dB dB
G_{ANF}	Gain @ Associated Noise Figure	V_{CE} = 8V, I_C = 5mA f = .3 GHz f = .5 GHz f = 1.0 GHz		21 16.0 11.0		dB dB dB
$\|S_{21}\|^2_E$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 25mA f = .3 GHz f = .5 GHz f = 1.0 GHz	13	20 15.5 9.5		dB dB dB
G_{Umax}	Maximum Unilateral Gain	V_{CE} = 8V, I_C = 25mA f = .3 GHz f = .5 GHz f = 1.0 GHz		24 19.5 13.5		dB dB dB
F_T	Gain Bandwidth Product	V_{CE} = 8V I_C = 25mA		3.5		GHz

Absolute Maximum Ratings

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_S)
50mA	25V	150°C	−65°C to +150°C

***Replaces TP491**

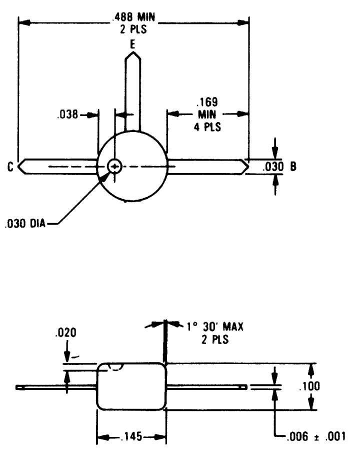
LT3703 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 5mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-2.41	- 52.7	22.86	144.3	-33.03	62.4	-1.04	-15.7	0.242
200	-4.10	- 89.9	20.15	120.8	-29.13	51.6	-2.48	-21.7	0.439
300	-5.31	-114.5	17.71	105.8	-27.67	47.3	-3.45	-23.9	0.634
400	-6.02	-131.9	15.66	96.7	-26.60	47.2	-4.02	-25.1	0.778
500	-6.49	-144.5	13.96	89.0	-25.83	48.1	-4.36	-26.1	0.916
600	-6.78	-153.9	12.44	83.0	-25.11	49.9	-4.54	-27.7	1.029
700	-6.92	-161.9	11.19	77.5	-24.23	51.3	-4.72	-29.0	1.097
800	-7.03	-168.9	10.17	72.5	-23.61	52.6	-4.72	-30.6	1.143
900	-7.12	-173.7	9.16	67.9	-22.79	54.7	-4.74	-32.4	1.172
1000	-7.11	-179.4	8.31	63.8	-21.99	55.0	-4.74	-35.0	1.167
1100	-7.10	175.9	7.67	59.7	-21.55	56.0	-4.74	-37.1	1.189
1200	-7.09	170.9	6.91	55.2	-20.87	57.4	-4.78	-39.8	1.196
1300	-7.11	166.8	6.30	51.6	-20.19	57.9	-4.69	-42.0	1.169

V_{CE} = 8V, I_C = 25mA

100	-6.83	- 99.5	27.84	121.8	-36.55	56.4	-3.27	-22.0	0.600
200	-7.78	-136.8	23.07	102.1	-33.01	58.2	-5.03	-21.3	0.886
300	-8.07	-153.6	19.80	91.5	-30.48	63.0	-5.68	-20.3	1.024
400	-8.07	-163.5	17.53	85.5	-28.43	63.8	-5.97	-20.7	1.070
500	-8.06	-170.2	15.59	79.8	-26.90	64.7	-6.12	-21.7	1.128
600	-8.07	-175.4	14.00	75.0	-25.55	65.5	-6.15	-23.1	1.158
700	-7.91	-179.7	12.77	70.8	-24.45	65.8	-6.24	-24.5	1.172
800	-7.85	175.8	11.60	66.4	-23.38	65.6	-6.16	-26.5	1.169
900	-7.77	173.0	10.56	62.3	-22.39	65.7	-6.10	-28.4	1.161
1000	-7.63	169.2	9.73	58.8	-21.57	65.6	-6.05	-31.2	1.143
1100	-7.50	166.0	8.90	55.1	-20.84	64.7	-6.03	-33.1	1.141
1200	-7.42	162.0	8.18	51.1	-20.14	65.3	-5.99	-35.8	1.131
1300	-7.36	159.7	7.57	47.7	-19.38	64.4	-5.83	-38.0	1.086



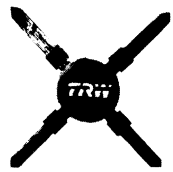
T-PAK

TRW

LT3704

Small Signal Low Noise Transistor for Receiver Applications

- **Front End Amplifier**
- **Low Noise Oscillator**
- **High Frequency Multiplier**
- **Low Noise**
- **High Gain**
- **Wide Dynamic Range**
- **Plastic Package**



X-PAK

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. Processes in wafer fabrication make this transistor effective in applications up to 3.5 GHz, with a very wide dynamic range.

The LT3704 sets new standards for low noise figure, high gain, and dynamic range. Gold metallization insures high reliability for low noise amplifier applications.

Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_C = .1mA	3.0			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	14			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
h_{FE}	DC Current Gain	V_{CE} = 5V I_E = 25mA	50	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1.0 MHz		.6		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 5mA f = .3 GHz f = .5 GHz f = 1.0 GHz		1.5 1.8 3.4	2.8	dB dB dB
G_{ANF}	Gain @ Associated Noise Figure	V_{CE} = 8V, I_C = 5mA f = .3 GHz f = .5 GHz f = 1.0 GHz		22.0 17.0 12.0		dB dB dB
$\|S_{21}\|_E^2$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 25mA f = .3 GHz f = .5 GHz f = 1.0 GHz	15	21 17 11		dB dB dB
G_{Umax}	Maximum Unilateral Gain	V_{CE} = 8V, I_C = 25mA f = .3 GHz f = .5 GHz f = 1.0 GHz		24 19.5 13.5		dB dB dB
F_T	Gain Bandwidth Product	V_{CE} = 8V I_C = 25mA		3.5		GHz

Absolute Maximum Ratings

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_S)
50mA	25V	150°C	−65°C to +150°C

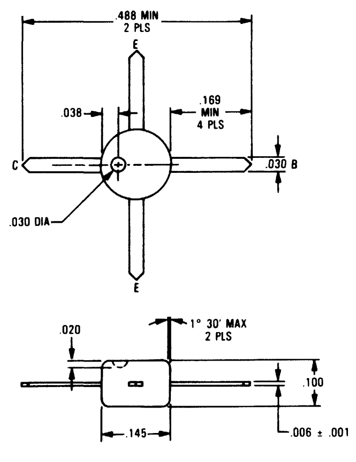
LT3704 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 5mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-1.87	- 52.4	22.86	148.6	-32.73	61.1	-0.86	-16.1	0.155
200	-2.67	- 90.6	20.66	125.6	-28.82	45.6	-2.28	-24.4	0.277
300	-3.28	-115.9	18.30	110.0	-27.38	37.9	-3.42	-28.3	0.413
400	-3.64	-133.0	16.37	100.0	-26.79	34.0	-4.14	-30.2	0.541
500	-3.90	-145.1	14.72	91.8	-26.27	31.8	-4.61	-31.8	0.674
600	-4.07	-154.0	13.26	85.3	-25.99	30.8	-4.86	-33.6	0.804
700	-4.16	-161.3	12.04	79.7	-25.58	31.2	-5.08	-35.0	0.907
800	-4.22	-167.6	10.94	74.5	-25.34	32.4	-5.13	-36.8	1.000
900	-4.26	-171.6	9.89	69.9	-25.06	32.0	-5.19	-38.9	1.111
1000	-4.28	-176.9	9.12	65.6	-24.58	32.1	-5.20	-41.6	1.140
1100	-4.27	179.2	8.29	61.2	-24.25	33.7	-5.20	-43.7	1.195
1200	-4.27	175.0	7.62	56.8	-24.10	33.5	-5.22	-46.6	1.271
1300	-4.28	172.3	6.96	53.1	-23.61	34.8	-5.15	-49.0	1.277

V_{CE} = 8V, I_C = 25mA

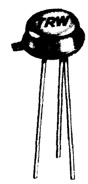
Frequency (MHz)	S11		S21		S12		S22		k
100	-4.67	-106.6	28.68	125.8	-36.81	48.0	-3.22	-26.4	0.394
200	-4.44	-142.4	24.21	104.7	-34.17	43.8	-5.57	-27.9	0.650
300	-4.43	-157.8	21.00	93.2	-32.78	44.8	-6.59	-26.8	0.874
400	-4.41	-166.7	18.63	86.6	-31.33	46.0	-7.05	-26.7	0.998
500	-4.40	-172.7	16.76	80.7	-30.23	49.8	-7.27	-27.3	1.099
600	-4.41	-177.3	15.22	75.7	-29.43	50.4	-7.34	-28.9	1.203
700	-4.34	179.0	13.83	71.3	-28.39	50.9	-7.40	-30.2	1.246
800	-4.30	175.3	12.67	67.1	-27.51	53.2	-7.33	-31.9	1.264
900	-4.29	173.2	11.60	62.9	-26.75	53.3	-7.23	-34.1	1.298
1000	-4.23	169.6	10.65	59.3	-26.05	53.4	-7.16	-37.2	1.311
1100	-4.17	167.2	9.90	55.6	-25.54	53.2	-7.06	-39.2	1.324
1200	-4.08	164.0	9.16	51.6	-24.76	53.1	-7.00	-42.3	1.285
1300	-4.06	162.3	8.46	48.2	-24.29	52.6	-6.83	-44.9	1.296



X-PAK

Small Signal Low Noise Transistor for Receiver Applications

- **Front End Amplifier**
- **Low Noise Oscillator**
- **High Frequency Multiplier**
- **Low Noise**
- **High Gain**
- **Wide Dynamic Range**



TO-46 Package

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. Processes in wafer fabrication make this transistor effective in applications up to 3.5 GHz, with a very wide dynamic range.

The LT3746 sets new standards for low noise figure, high gain, and dynamic range. Gold metallization insures high reliability for low noise amplifier applications.

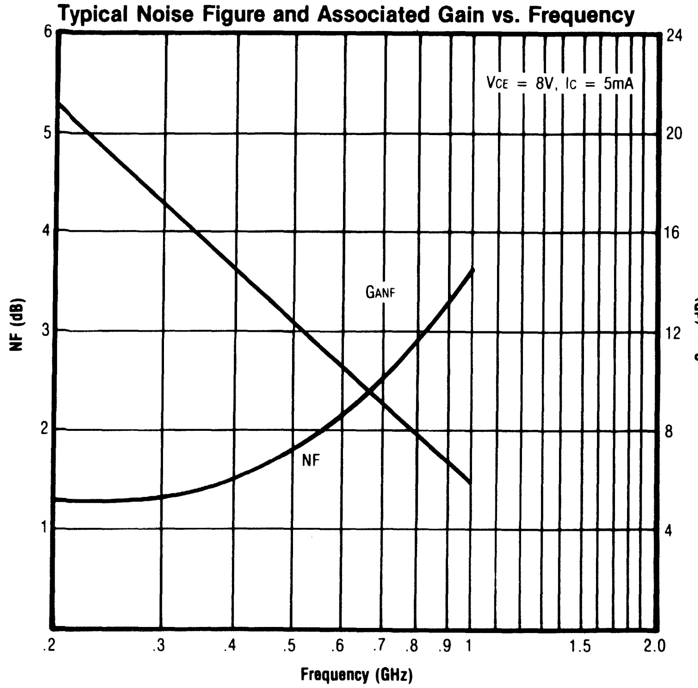
Electrical Characteristics (T_{CASE} = 25°C)

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_C = .1mA	3.0			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	14			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
h_{FE}	DC Current Gain	V_{CE} = 5V I_E = 25mA	50	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1.0 MHz		1.0		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 5mA f = .300 GHz f = .500 GHz f = 1.000 GHz		1.3 1.8 3.6		dB dB dB
G_{ANF}	Gain @ Associated Noise Figure	V_{CE} = 8V, I_C = 5mA f = .300 GHz f = .500 GHz f = 1.000 GHz		17.5 6.0 11.0		dB dB dB
$[S_{21}]^2_E$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 25mA f = .300 GHz f = .500 GHz f = 1.000 GHz		15.5 11.5 6.0		dB dB dB
$G_{U(max)}$	Maximum Unilateral Gain	V_{CE} = 8V, I_C = 25mA f = .300 GHz f = .500 GHz f = 1.000 GHz		17.0 12.5 7.5		dB dB dB
F_t	Gain Bandwidth Product	V_{CE} = 8V I_C = 25mA		3.5		GHz

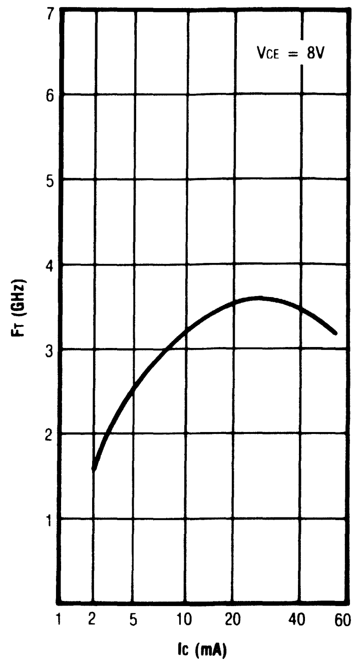
Absolute Maximum Ratings

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_S)
50mA	25V	200°C	−65°C to 200°C

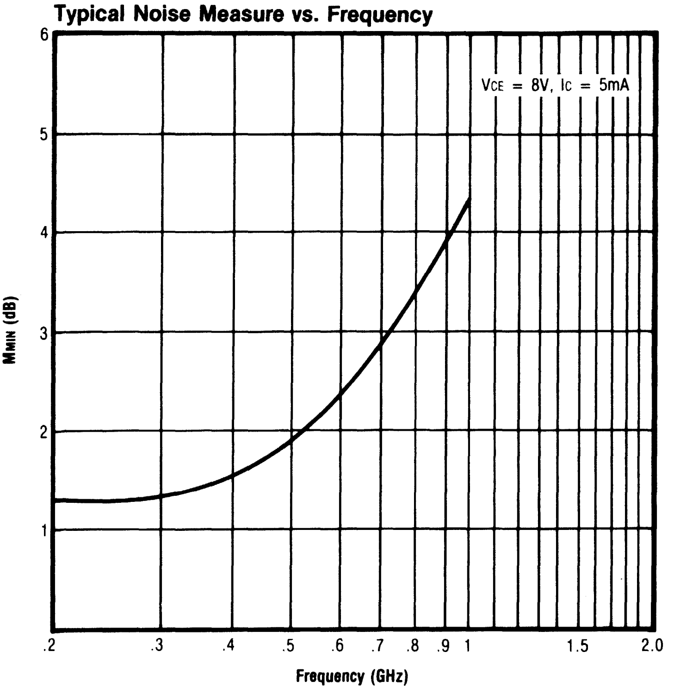
Typical Noise Figure and Associated Gain vs. Frequency



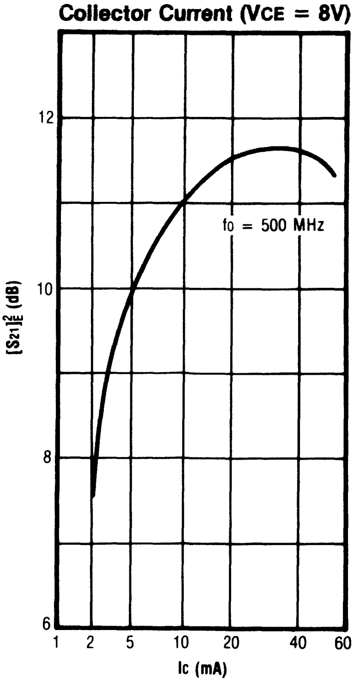
Typical Gain Bandwidth Product vs. Collector Current

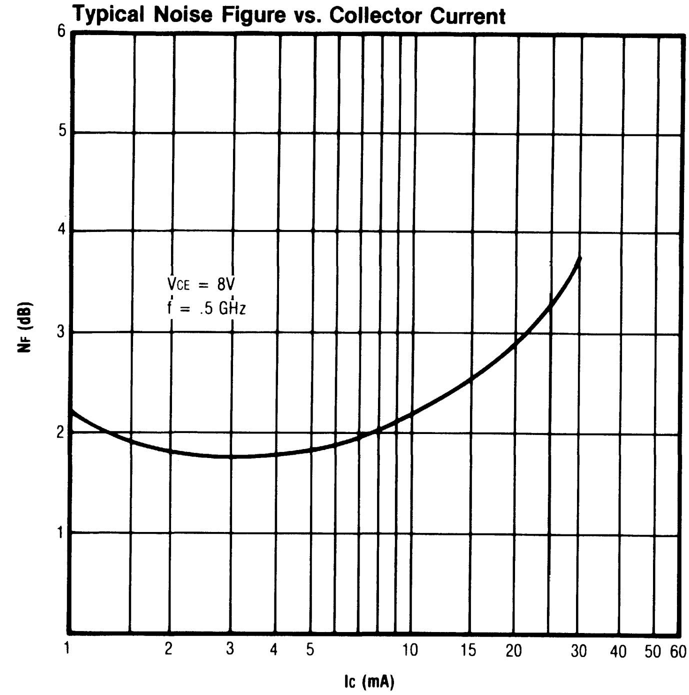


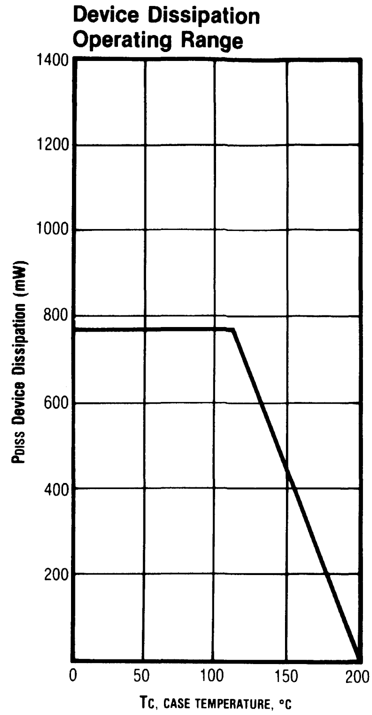
Typical Noise Measure vs. Frequency

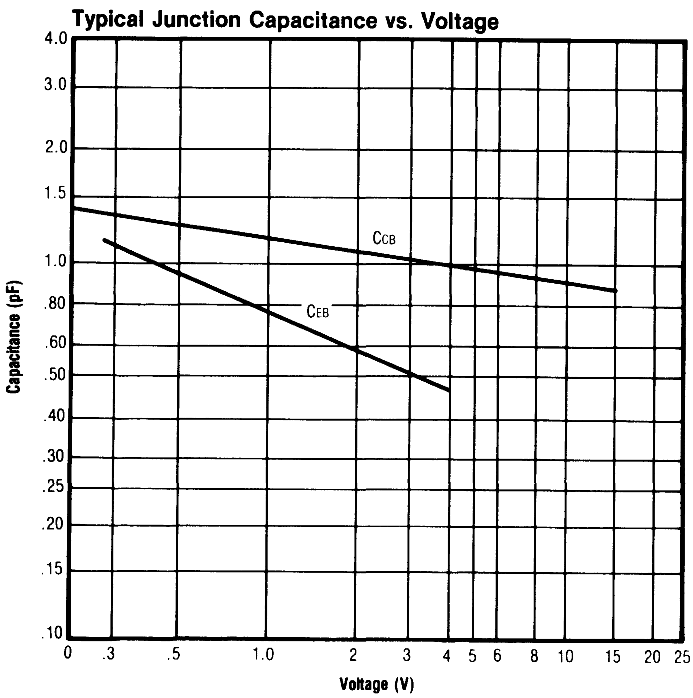


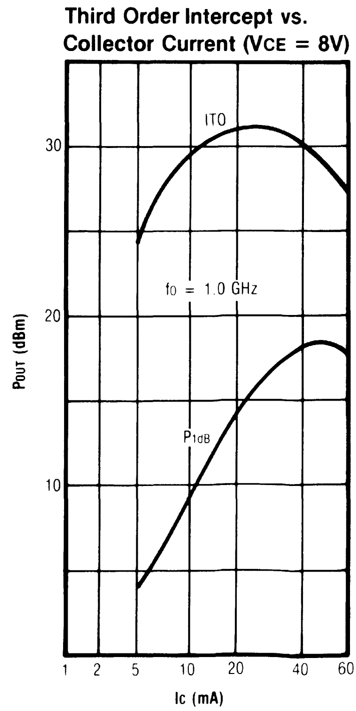
Typical Insertion Gain vs. Collector Current (VCE = 8V)




Typical Noise Figure vs. Collector Current
VCE = 8V
f = .5 GHz
NF (dB)
6
5
4
3
2
1
1 2 3 4 5 10 15 20 30 40 50 60
IC (mA)


Device Dissipation Operating Range
PDISS Device Dissipation (mW)
1400
1200
1000
800
600
400
200
0 50 100 150 200
TC, CASE TEMPERATURE, °C


Typical Junction Capacitance vs. Voltage
CCB
CEB
Capacitance (pF)
4.0
3.0
2.0
1.5
1.0
.80
.60
.50
.40
.30
.25
.20
.15
.10
0 .3 .5 1.0 2 3 4 5 6 8 10 15 20 25
Voltage (V)


Third Order Intercept vs. Collector Current (VCE = 8V)
ITO
f0 = 1.0 GHz
P1dB
POUT (dBm)
30
20
10
1 2 5 10 20 40 60
IC (mA)

LT3746 S PARAMETERS

S-dB and Angles:
VCE = 8V, IC = 5mA

Frequency (MHz)	S11		S21		S12		S22		k
100	− 3.62	− 52.6	19.97	134.2	−25.94	63.7	−2.55	−28.6	0.424
200	− 7.34	− 84.9	16.54	112.5	−22.76	60.8	−5.24	−35.0	0.737
300	− 9.89	−107.1	13.73	101.5	−20.87	64.6	−6.77	−35.2	0.935
400	−11.56	−123.2	11.59	94.3	−19.39	69.3	−7.59	−35.1	1.059
500	−12.64	−137.7	9.84	89.5	−18.08	74.1	−8.12	−34.9	1.142
600	−13.14	−149.7	8.48	84.9	−16.90	77.6	−8.41	−35.2	1.181
700	−13.54	−160.7	7.33	81.8	−15.80	81.1	−8.65	−36.5	1.205
800	−13.50	−170.3	6.39	79.1	−14.75	84.1	−8.78	−37.9	1.200
900	−13.30	−179.6	5.50	76.7	−13.85	87.1	−8.88	−39.6	1.204
1000	−13.24	172.3	4.77	75.2	−12.92	90.2	−9.09	−41.2	1.199
1100	−12.59	166.8	4.14	74.2	−12.20	93.0	−9.33	−42.6	1.194
1200	−11.93	159.4	3.48	73.6	−11.52	95.7	−9.50	−46.3	1.200

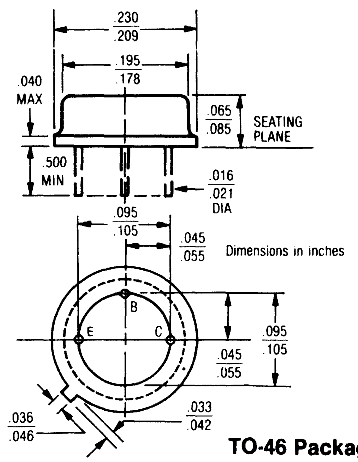
VCE = 8V, IC = 25mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−10.47	− 94.7	23.67	111.7	−29.04	70.3	− 6.29	−33.6	0.821
200	−13.61	−129.8	18.71	98.2	−24.39	76.0	− 8.87	−29.7	0.993
300	−14.40	−149.3	15.43	91.8	−21.37	79.7	− 9.80	−26.2	1.046
400	−14.70	−162.9	13.08	87.3	−19.10	82.0	−10.12	−24.7	1.065
500	−14.65	−173.8	11.27	84.0	−17.35	84.2	−10.32	−23.8	1.074
600	−14.44	178.9	9.80	80.8	−15.98	85.3	−10.37	−24.3	1.081
700	−14.32	171.3	8.67	78.3	−14.78	86.7	−10.45	−25.2	1.078
800	−13.94	165.6	7.69	76.3	−13.64	88.1	−10.41	−26.5	1.063
900	−13.39	159.8	6.78	74.3	−12.74	89.5	−10.41	−27.9	1.058
1000	−13.16	154.8	6.02	73.1	−12.02	91.4	−10.49	−29.5	1.064
1100	−12.54	152.4	5.37	72.4	−11.20	93.3	−10.69	−30.1	1.051
1200	−11.73	146.9	4.69	71.8	−10.61	95.2	−10.84	−33.7	1.054

NOISE PARAMETERS

Freq.	N.F. OPT	Γs OPT	Rn
0.5 GHz	1.8 dB	.339 /115°	.192Ω
1.0 GHz	3.6 dB	.375 /168°	.159Ω

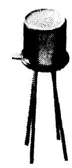
Reflection coefficient of source and the noise resistance at optimum noise figure for VCE = 8V, IC = 5mA



TO-46 Package

Small Signal Low Noise Transistor for Receiver Applications

- **Front End Amplifier**
- **Low Noise Oscillator**
- **High Frequency Multiplier**
- **Low Noise**
- **High Gain**
- **Wide Dynamic Range**



TO-72 Package

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. Processes in wafer fabrication make this transistor effective in applications up to 3.5 GHz, with a very wide dynamic range.

The LT3772 sets new standards for low noise figure, high gain, and dynamic range. Gold metallization insures high reliability for low noise amplifier applications.

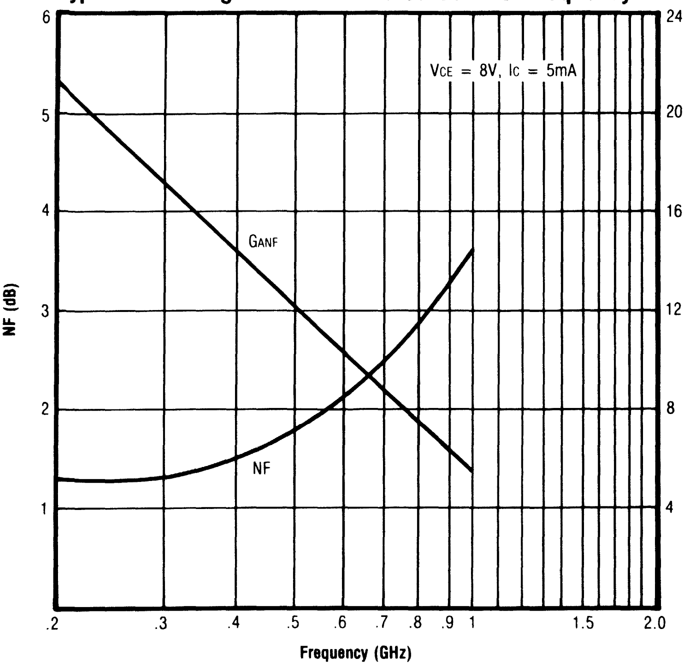
Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_C = .1mA	3.0			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	14			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
h_{FE}	DC Current Gain	V_{CE} = 5V I_E = 25mA	50	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1.0 MHz			.5	pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 5mA f = .300 GHz f = .500 GHz f = 1.000 GHz		1.3 2.0 3.6		dB dB dB
G_{ANF}	Gain @ Associated Noise Figure	V_{CE} = 8V, I_C = 5mA f = .300 GHz f = .500 GHz f = 1.000 GHz		17.5 11.5 6.5		dB dB dB
$[S_{21}]^2_E$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 25mA f = .300 GHz f = .500 GHz f = 1.000 GHz		16.0 11.0 6.0		dB dB dB
$G_{U(max)}$	Maximum Unilateral Gain	V_{CE} = 8V, I_C = 25mA f = .300 GHz f = .500 GHz f = 1.000 GHz		18.5 14.0 8.5		dB dB dB
F_t	Gain Bandwidth Product	V_{CE} = 8V I_C = 25mA		3.0		GHz

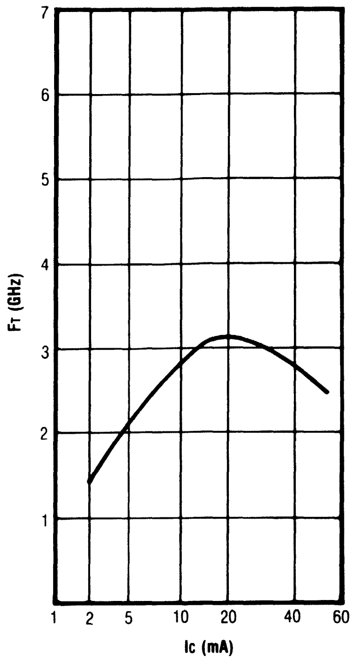
Absolute Maximum Ratings

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_S)
50mA	25V	200°C	−65°C to 200°C

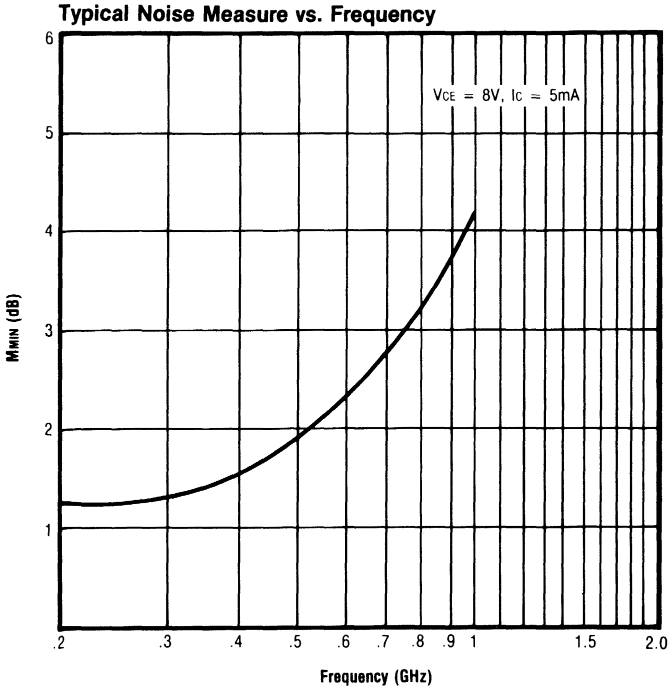
Typical Noise Figure and Associated Gain vs. Frequency



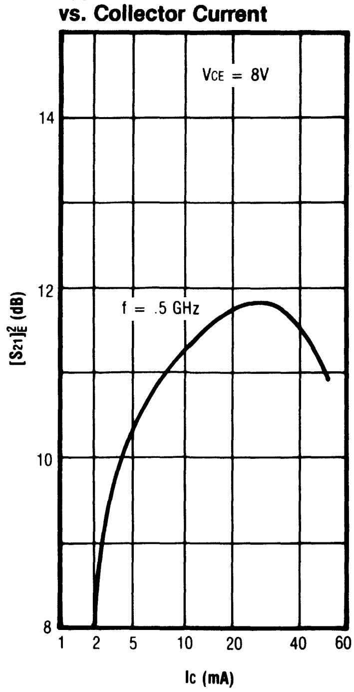
Typical Gain Bandwidth Product vs. Collector Current



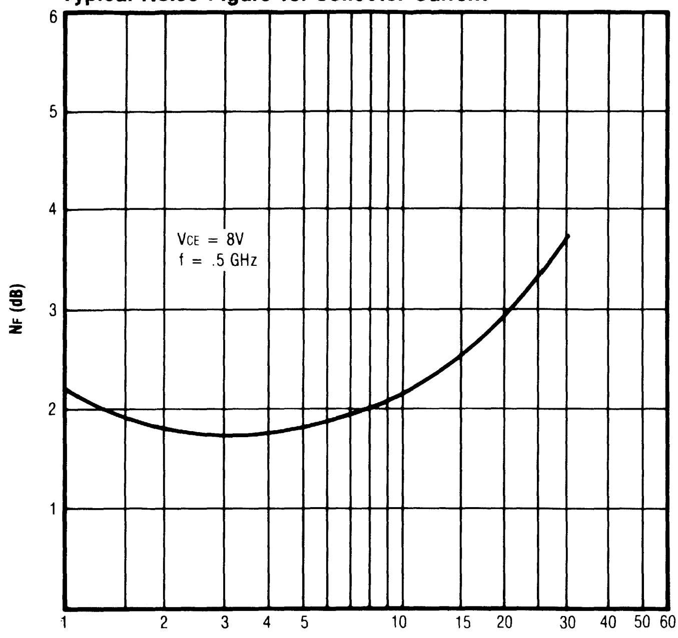
Typical Noise Measure vs. Frequency



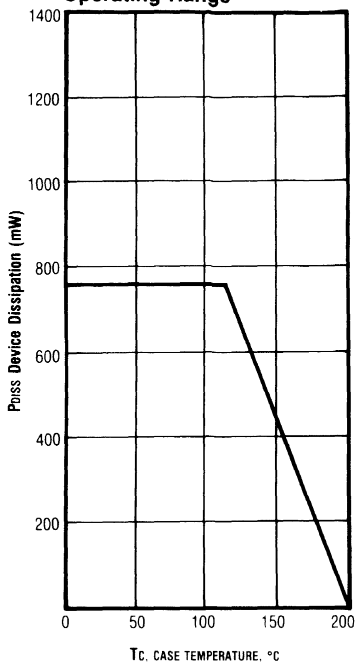
Typical Insertion Gain vs. Collector Current



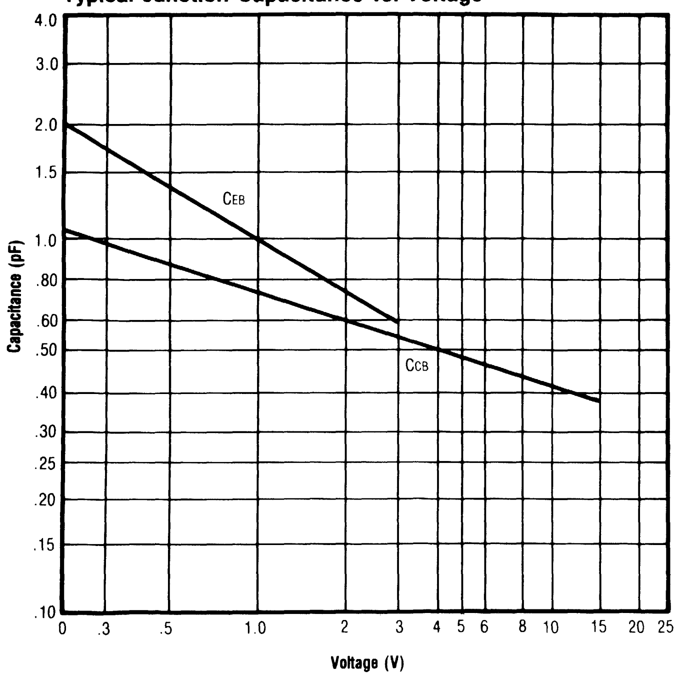
Typical Noise Figure vs. Collector Current



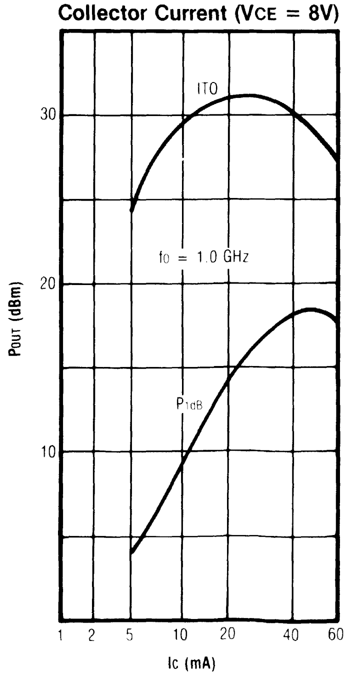
Device Dissipation Operating Range



Typical Junction Capacitance vs. Voltage



Third Order Intercept vs. Collector Current (VCE = 8V)



LT3772 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 5mA

Frequency (MHz)	S11		S21		S12		S22		k
100	− 3.62	− 46.1	19.84	136.0	−29.67	67.7	−1.54	−16.6	0.457
200	− 7.15	− 74.4	16.67	113.9	−26.03	64.8	−3.05	−20.0	0.752
300	− 9.92	− 93.7	13.99	101.7	−23.91	67.3	−3.82	−20.4	0.936
400	−12.03	−107.7	11.90	93.5	−22.28	71.1	−4.17	−21.0	1.046
500	−13.69	−120.4	10.22	87.6	−20.90	74.8	−4.38	−21.5	1.115
600	−14.92	−131.7	8.74	81.7	−19.74	77.4	−4.46	−23.1	1.167
700	−16.14	−142.3	7.55	77.4	−18.61	80.1	−4.51	−24.8	1.190
800	−17.01	−152.7	6.56	73.5	−17.70	82.3	−4.51	−26.9	1.203
900	−17.81	−163.4	5.61	69.4	−16.82	84.2	−4.47	−29.1	1.212
1000	−18.86	−172.4	4.76	66.5	−16.10	86.2	−4.46	−31.6	1.236
1100	−19.24	−179.7	4.02	63.6	−15.41	87.8	−4.42	−33.6	1.240
1200	−20.27	168.4	3.19	60.5	−14.90	88.8	−4.37	−37.5	1.284

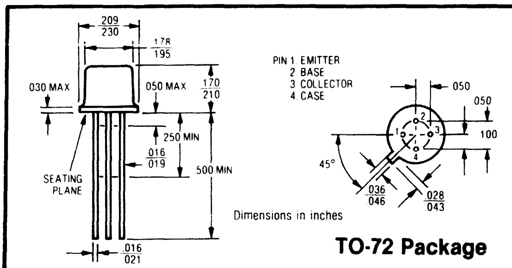
V_{CE} = 8V, I_C = 25mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−10.62	− 64.5	23.66	114.1	−31.85	74.2	−3.55	−17.5	0.849
200	−15.40	− 86.8	19.01	99.0	−26.89	76.8	−4.75	−15.8	0.988
300	−18.21	−103.4	15.75	91.3	−23.95	78.9	−5.13	−15.1	1.051
400	−20.34	−116.2	13.45	85.3	−21.63	80.3	−5.23	−15.3	1.060
500	−22.17	−129.6	11.59	81.2	−20.03	81.5	−5.29	−16.1	1.088
600	−23.12	−141.2	10.09	76.5	−18.69	81.7	−5.24	−17.5	1.096
700	−24.75	−151.4	8.80	72.8	−17.55	82.2	−5.20	−19.3	1.109
800	−25.73	−161.8	7.83	69.4	−16.57	82.5	−5.11	−21.4	1.100
900	−26.44	−173.9	6.84	65.8	−15.82	82.9	−4.98	−23.9	1.108
1000	−28.63	178.2	5.96	63.0	−15.11	83.6	−4.89	−26.1	1.122
1100	−29.07	178.1	5.18	60.2	−14.56	84.0	−4.77	−28.2	1.131
1200	−31.48	161.3	4.31	57.1	−14.26	84.3	−4.66	−32.5	1.177

NOISE PARAMETERS

Freq.	N.F. OPT	Γs OPT	Rn
0.5 GHz	1.8 dB	.221 / + 126°	.71Ω
1.0 GHz	3.6 dB	.133 / + 000°	.95Ω

Reflection coefficient of source and the noise resistance at optimum noise figure for V_{CE} = 8V, I_C = 5mA



TO-72 Package

Small Signal Low Noise Transistor for Receiver Applications

- **Front End Amplifier**
- **Low Noise Oscillator**
- **High Frequency Multiplier**
- **Low Noise**
- **High Gain**
- **Wide Dynamic Range**
- **Low Cost Package**

85 MIL Package

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. Processes in wafer fabrication make this transistor effective in applications up to 3.5 GHz, with a very wide dynamic range.

The LT3785 sets new standards for low noise figure, high gain, and wide dynamic range. Gold metallization insures high reliability for low noise amplifier applications.

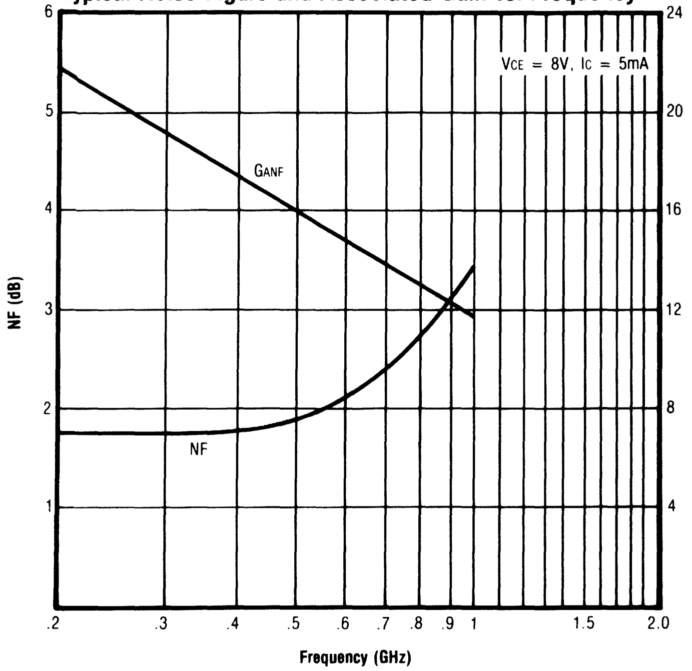
Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_C = .1mA	3			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	14			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
h_{FE}	DC Current Gain	V_{CE} = 5V I_E = 25mA	50	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1.0 MHz			.6	pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 5mA f = .3 GHz f = .5 GHz f = 1.0 GHz		1.9 1.9 3.5	 4.3	dB dB dB
G_{ANF}	Gain @ Associated Noise Figure	V_{CE} = 8V, I_C = 5mA f = .3 GHz f = .5 GHz f = 1.0 GHz		19 16 12		dB dB dB
$[S_{21}]_E^2$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 25mA f = .3 GHz f = .5 GHz f = 1.0 GHz	 9	20 17 11		dB dB dB
$G_{U(max)}$	Maximum Unilateral Gain	V_{CE} = 8V, I_C = 25mA f = .3 GHz f = .5 GHz f = 1.0 GHz		26 23 16		dB dB dB
F_t	Gain Bandwidth Product	V_{CE} = 8V I_C = 25mA		3.5		GHz
F_{max}	Maximum Oscillation Frequency	V_{CE} = 8V I_C = 25mA		6.0		GHz

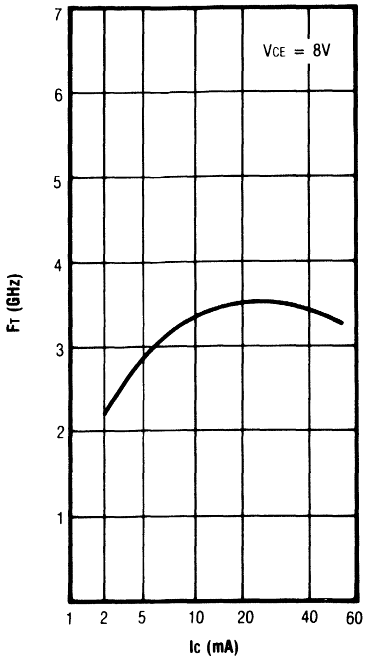
Absolute Maximum Ratings

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_S)
50mA	25V	200 °C	− 65 °C to 200 °C

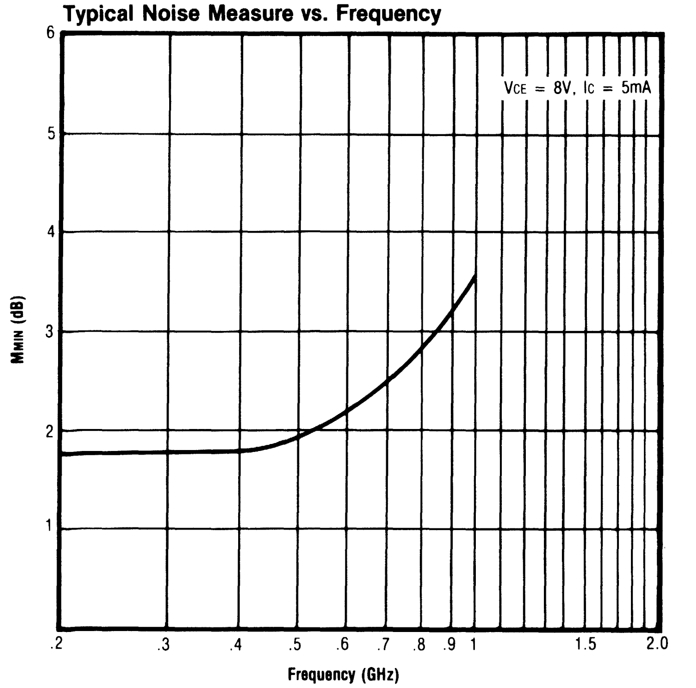
Typical Noise Figure and Associated Gain vs. Frequency



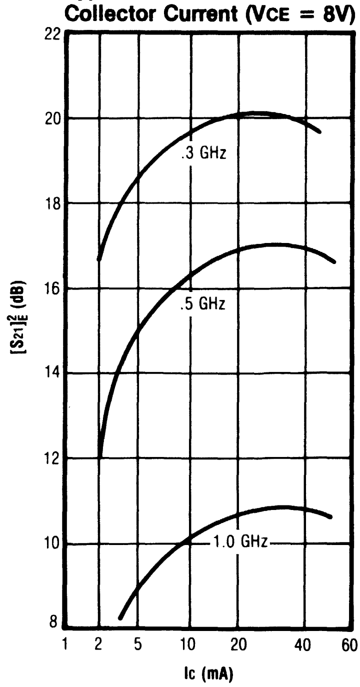
Typical Gain Bandwidth Product vs. Collector Current



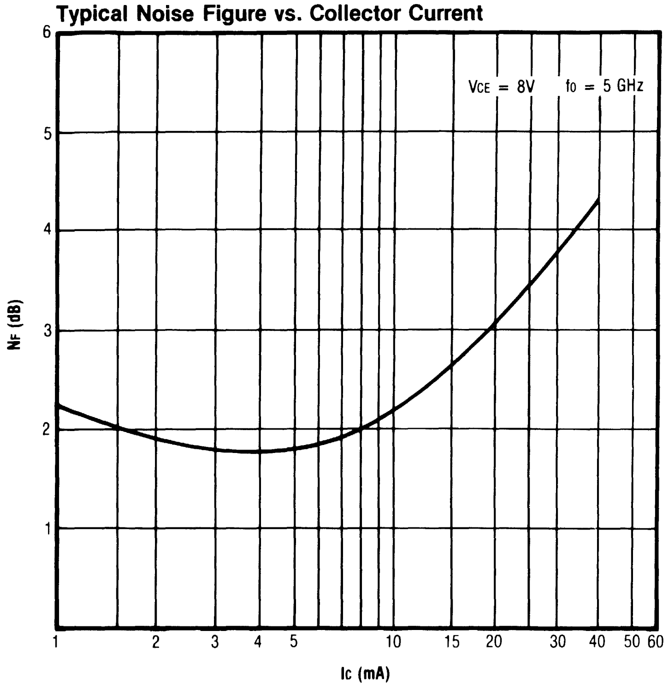
Typical Noise Measure vs. Frequency



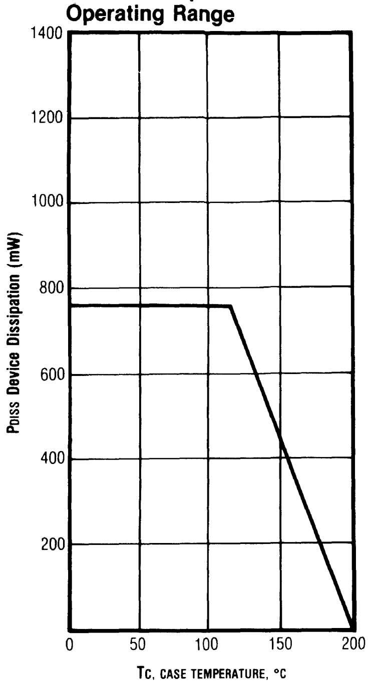
Typical Insertion Gain vs. Collector Current (VCE = 8V)



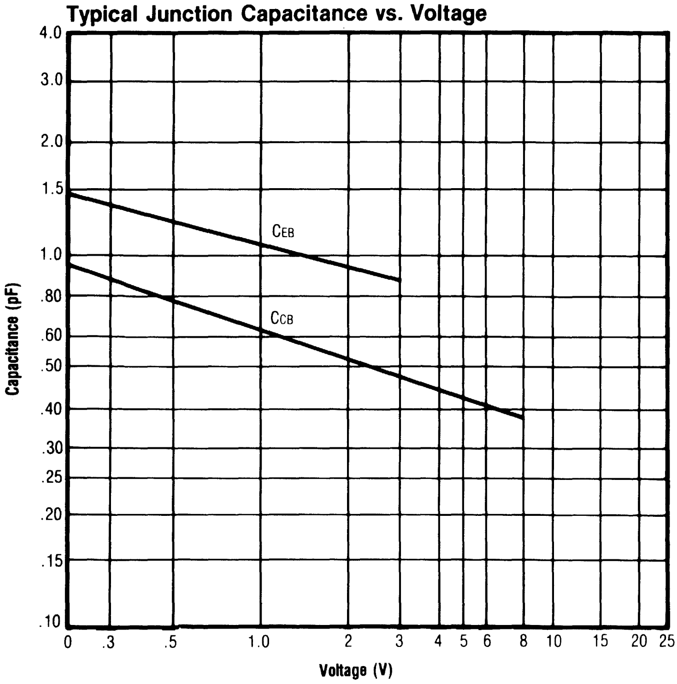
Typical Noise Figure vs. Collector Current



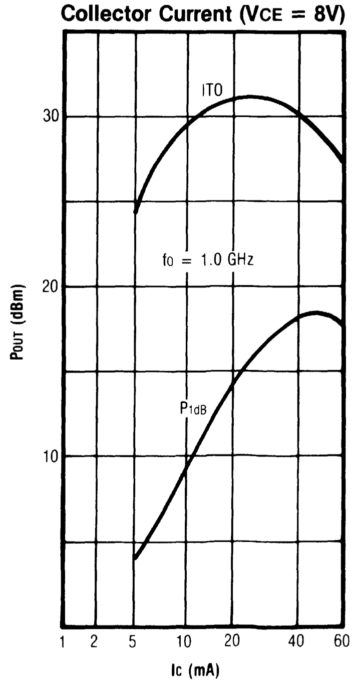
Device Dissipation Operating Range



Typical Junction Capacitance vs. Voltage



Third Order Intercept vs. Collector Current (VCE = 8V)



LT3785 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 5mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-1.89	-46.0	22.57	149.4	-34.23	65.9	-0.71	-12.4	0.18468
150	-2.35	-64.6	21.63	139.0	-31.15	58.2	-1.23	-16.1	0.23032
200	-2.81	-80.6	20.48	129.7	-29.90	51.4	-1.86	-18.6	0.30970
250	-3.18	-93.9	19.45	121.9	-28.75	47.5	-2.33	-20.5	0.36060
400	-3.14	-124.0	16.99	104.5	-27.28	33.7	-3.43	-22.8	0.49101
500	-3.41	-136.6	15.40	99.3	-26.69	32.4	-3.79	-24.0	0.54999
600	-3.48	-146.5	13.94	91.7	-26.38	30.1	-4.19	-26.1	0.66410
700	-3.51	-154.4	12.75	85.6	-26.06	29.8	-4.41	-25.3	0.75497
800	-3.53	-160.7	11.71	81.4	-25.74	28.8	-4.53	-27.9	0.81622
900	-3.58	-169.1	10.66	75.6	-25.67	28.1	-4.66	-29.7	0.92249
1000	-3.60	-174.3	9.74	71.6	-25.38	27.6	-4.70	-31.6	0.98886
1100	-3.60	-178.9	8.95	67.4	-25.31	28.2	-4.80	-32.8	1.08413
1200	-3.59	176.9	8.19	63.5	-25.02	27.2	-4.78	-34.0	1.14146
1300	-3.57	173.1	7.46	60.0	-24.86	27.5	-4.92	-35.5	1.23356
1400	-3.55	169.4	6.83	56.7	-24.66	28.6	-4.87	-37.3	1.27208
1500	-3.52	165.9	6.20	53.0	-24.49	27.3	-4.91	-39.9	1.34082
1600	-3.56	163.4	5.58	50.8	-24.29	28.8	-4.94	-41.9	1.41591
1700	-3.41	159.7	5.17	46.9	-24.11	28.3	-4.93	-44.1	1.39775
1800	-3.34	156.9	4.55	44.0	-24.02	28.8	-4.90	-46.0	1.45654
1900	-3.26	154.1	4.08	40.0	-23.83	28.2	-4.89	-48.5	1.47381
2000	-3.18	151.6	3.60	36.5	-23.73	28.8	-4.89	-51.3	1.50751

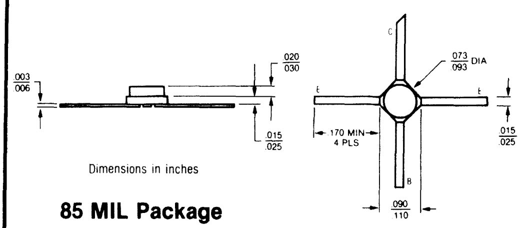
V_{CE} = 8V, I_C = 25mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-3.15	-97.2	28.93	127.4	-37.96	56.9	-2.70	-20.8	0.41476
150	-3.31	-118.8	26.73	116.3	-35.76	52.5	-3.82	-21.7	0.53925
200	-3.33	-133.1	34.72	108.1	-35.17	50.0	-4.63	-21.2	0.70809
250	-3.31	-142.7	23.01	102.0	-34.13	51.3	-5.07	-20.6	0.79410
400	-3.74	-161.2	19.75	89.3	-33.06	43.5	-6.29	-19.4	0.91437
500	-3.74	-168.2	17.88	85.5	-32.15	46.6	-6.50	-19.9	1.01871
600	-3.68	-173.1	16.31	80.1	-31.33	47.5	-6.68	-21.0	1.11524
700	-3.60	-177.1	15.00	75.7	-30.63	48.4	-6.73	-20.4	1.18583
800	-3.55	179.5	13.79	72.3	-29.78	49.3	-6.83	-22.4	1.22521
900	-3.53	173.4	12.61	67.0	-29.27	49.2	-6.82	-23.9	1.32065
1000	-3.49	170.2	11.63	63.6	-28.61	49.3	-6.69	-26.7	1.33733
1100	-3.44	167.3	10.77	60.2	-28.16	49.8	-6.78	-27.8	1.39949
1200	-3.38	164.5	9.96	56.8	-27.63	49.3	-6.68	-29.0	1.41563
1300	-3.32	161.7	9.16	53.6	-27.26	48.9	-6.78	-31.0	1.48227
1400	-3.26	159.1	8.49	51.1	-26.83	49.6	-6.68	-32.3	1.48916
1500	-3.19	156.4	7.82	47.6	-26.45	49.0	-6.65	-35.9	1.50488
1600	-3.19	154.7	7.17	46.0	-26.02	49.5	-6.69	-37.4	1.55021
1700	-3.02	151.7	6.72	42.3	-25.61	49.0	-6.60	-39.8	1.47235
1800	-2.94	149.4	6.05	39.8	-25.42	50.0	-6.57	-42.3	1.51788
1900	-2.85	147.2	5.63	36.3	-25.13	48.0	-6.51	-44.1	1.49452
2000	-2.75	145.0	5.11	33.4	-24.78	49.1	-6.52	-47.9	1.47709

NOISE PARAMETERS

Freq.	N.F. OPT	Γs OPT	Rn
.5 GHz	1.9 dB	.201 /140°	.55Ω
1.0 GHz	3.5 dB	.345 /178°	.28Ω

Reflection coefficient of source and the noise resistance at optimum noise figure for V_{CE} = 8V, I_C = 5mA



Dimensions in inches

85 MIL Package

TRW

Small Signal Transistor for High Performance Receiver Applications

- **High Output IF Amplifier**
- **High Gain**
- **Wide Dynamic Range**
- **Hermetic Package**

100 MIL Package

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. A new process in wafer fabrication helps make this new transistor effective in applications up to 5 GHz, with a very wide dynamic range.

Utilizing ion implantation techniques coupled with arsenic emitters and diffused ballast resistors, the LT4400 sets new standards for high output capability, high gain, and wide dynamic range. Gold metallization insures high reliability for high performance receiver applications.

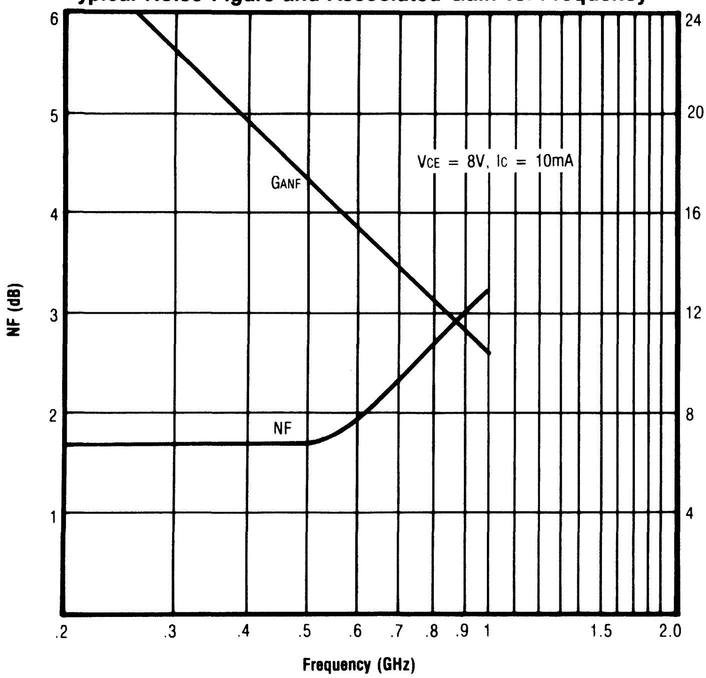
Electrical Characteristics @ 25°C Case

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = .1mA	3			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	15			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1mA	30			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	I_C = 40mA I_C/I_B = 10		500		mV
h_{FE}	DC Current Gain	V_{CE} = 8V I_C = 25mA	50	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1.0 MHz			1.5	pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 10mA, f = 1.0 GHz		3.2		dB
GU_{max}	Maximum Unilateral Gain	V_{CE} = 8V I_C = 40mA, f = 1.0 GHz		15		dB
$[S_{21}]^2_E$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 40mA f = .3 GHz f = .5 GHz f = 1.0 GHz	15	21 17 11		dB dB dB
F_T	Gain Bandwidth Product	V_{CE} = 8V I_C = 40mA		5.0		GHz
F_{max}	Maximum Oscillation Frequency	V_{CE} = 8V I_C = 40mA		6.0		GHz
P_{OUT}	Power out @ 1 dB Compression	V_{CE} = 80 I_C = 40mA	16	18		dBm
ITO	Third Order Intercept	V_{CE} = 8V I_C = 40mA		38		dBm

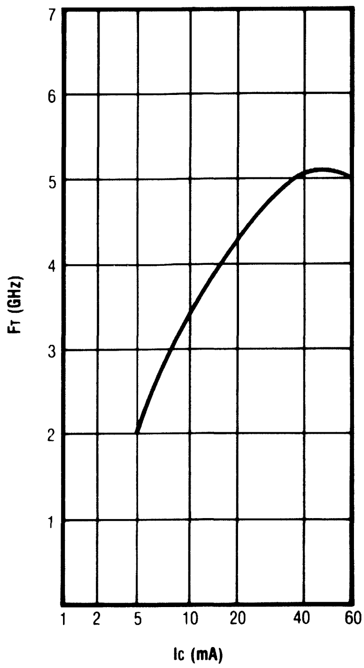
Absolute Maximum Ratings

Collector Current (Ic)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_{STG})
70mA	30V	200°C	−65°C to 200°C

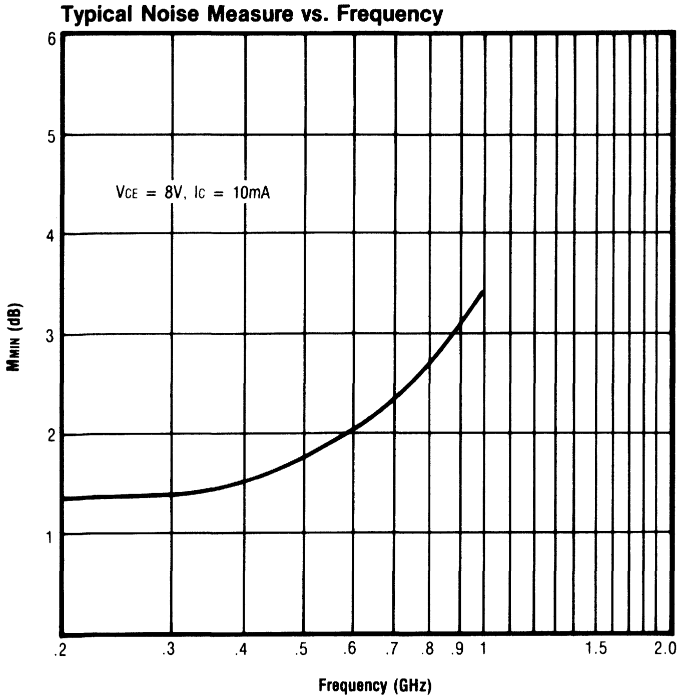
Typical Noise Figure and Associated Gain vs. Frequency



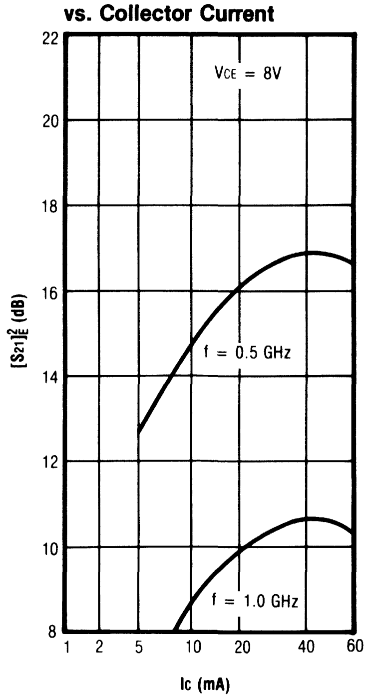
Typical Gain Bandwidth Product vs. Collector Current



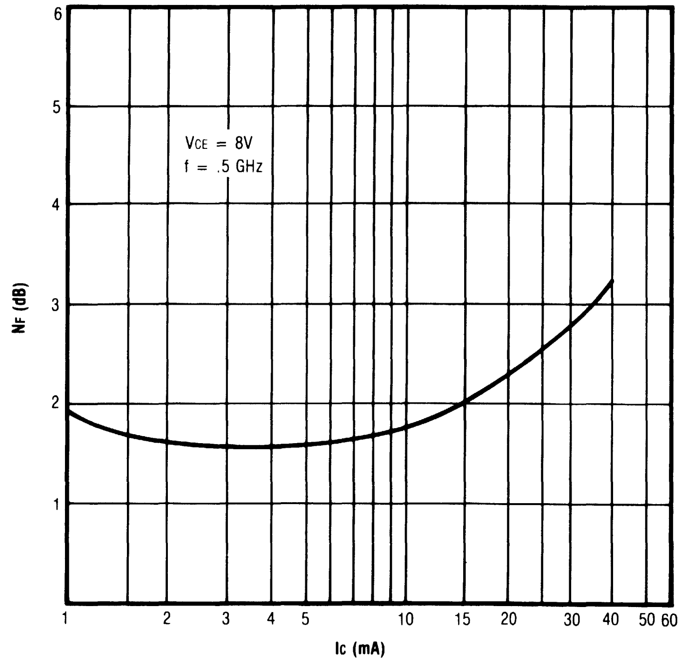
Typical Noise Measure vs. Frequency



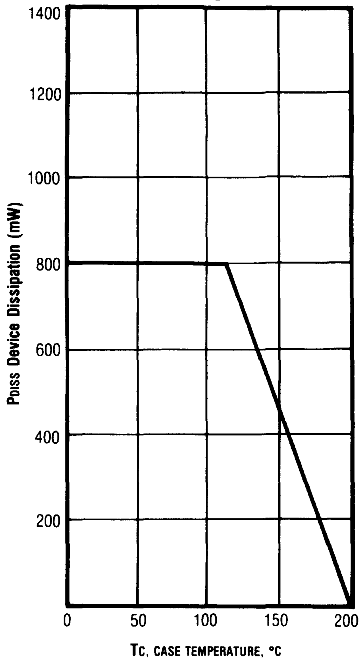
Typical Insertion Gain vs. Collector Current



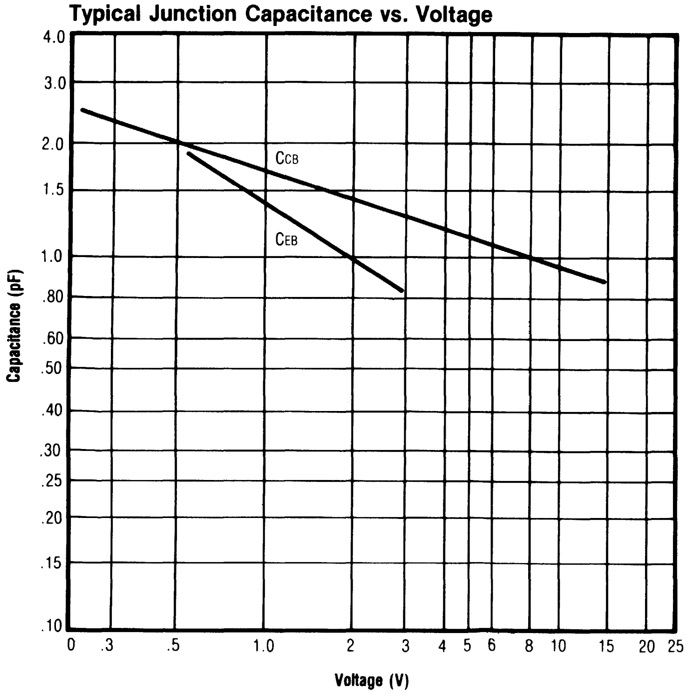
Typical Noise Figure vs. Collector Current



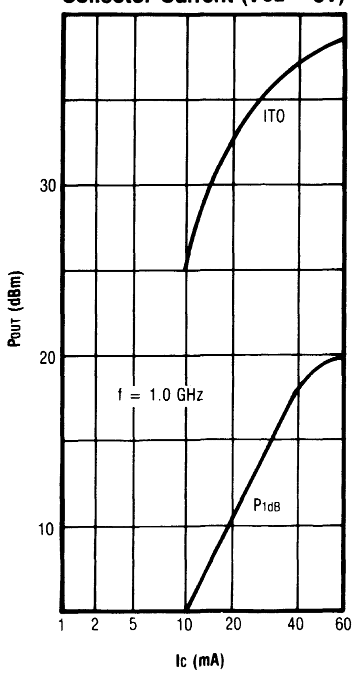
Device Dissipation Operating Range



Typical Junction Capacitance vs. Voltage



Third Order Intercept vs. Collector Current (VCE = 8V)



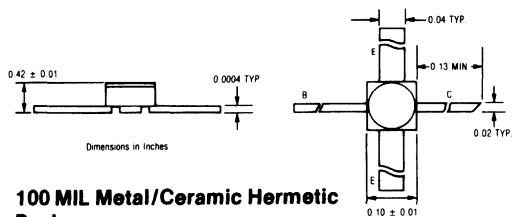
LT4400 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 10mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−2.67	− 94.8	25.18	129.0	−28.34	43.4	−2.97	− 47.3	0.14542
150	−2.58	−115.3	23.36	117.4	−27.08	35.5	−4.56	− 57.9	0.18456
200	−2.49	−129.4	21.53	108.8	−26.40	29.3	−5.99	− 65.1	0.23740
250	−2.45	−139.6	20.10	102.1	−26.10	25.1	−7.04	− 70.7	0.28575
300	−2.40	−147.0	18.60	97.4	−26.11	22.1	−7.73	− 74.9	0.33480
350	−2.38	−152.7	17.45	91.6	−25.88	20.6	−8.43	− 77.4	0.39214
400	−2.36	−156.2	16.48	89.1	−25.80	20.7	−8.90	− 79.2	0.43987
500	−2.30	−162.9	14.61	83.9	−25.62	19.8	−9.30	− 83.7	0.52480
600	−2.27	−167.9	13.10	77.8	−25.65	20.2	−9.52	− 89.3	0.62939
700	−2.26	−172.0	11.76	72.2	−25.59	21.0	−9.42	− 92.9	0.72373
800	−2.25	−175.3	10.56	67.7	−25.57	21.0	−9.12	− 97.7	0.81524
900	−2.22	−178.4	9.49	63.1	−25.54	23.2	−8.81	−101.8	0.90382
1000	−2.21	−178.8	8.54	58.7	−25.44	25.0	−8.42	−105.5	0.97629
1100	−2.21	−175.6	7.51	53.9	−25.50	27.1	−8.07	−109.3	1.10445
1200	−2.18	173.3	6.76	50.0	−25.29	28.7	−7.75	−112.7	1.14416
1300	−2.16	171.2	6.03	46.3	−25.11	31.0	−7.30	−115.8	1.17618
1400	−2.14	169.2	5.21	42.8	−24.99	33.4	−6.96	−119.8	1.25138
1500	−2.08	167.3	4.62	38.2	−24.74	34.5	−6.64	−122.4	1.23857
1600	−2.09	167.0	3.83	35.6	−24.48	37.0	−6.21	−127.1	1.29105
1700	−2.15	163.6	3.27	33.4	−24.24	39.9	−5.98	−129.8	1.37376
1800	−1.99	162.2	2.66	28.2	−23.88	40.6	−5.48	−133.1	1.23516
1900	−1.96	160.7	2.18	24.9	−23.56	42.3	−5.34	−136.4	1.23372
2000	−1.94	159.1	1.78	21.8	−23.04	44.2	−4.98	−139.2	1.15105

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

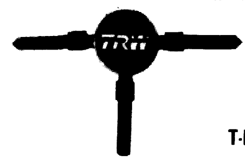
Frequency (MHz)	S11		S21		S12		S22		k
100	−3.16	−131.6	29.02	116.2	−32.83	35.5	− 5.68	− 74.8	0.25353
150	−2.73	−146.0	26.54	106.6	−31.78	31.9	− 7.67	− 88.4	0.33258
200	−2.54	−154.7	24.37	100.0	−31.28	31.3	− 9.19	− 98.6	0.42224
250	−2.45	−161.0	22.77	94.8	−31.05	31.5	−10.29	−106.2	0.50789
300	−2.39	−165.3	21.30	91.3	−30.77	31.4	−10.90	−111.7	0.57899
350	−2.36	−168.7	20.00	86.7	−30.43	32.6	−11.46	−115.6	0.64966
400	−2.33	−170.3	18.89	85.4	−30.07	36.0	−11.85	−117.8	0.71431
500	−2.27	−174.4	17.00	81.7	−29.43	38.4	−12.11	−122.7	0.81558
600	−2.25	−177.6	15.44	76.9	−28.82	41.4	−12.14	−126.7	0.90439
700	−2.25	−179.5	14.09	72.3	−28.16	43.5	−11.99	−129.1	0.97511
800	−2.23	177.2	12.92	68.7	−27.50	45.4	−11.72	−131.0	1.02220
900	−2.21	174.9	11.86	64.8	−26.84	47.3	−11.39	−132.8	1.05523
1000	−2.20	172.7	10.92	61.0	−26.28	48.5	−11.02	−134.2	1.08718
1100	−2.21	170.0	9.94	57.2	−25.88	50.0	−10.57	−135.3	1.14982
1200	−2.19	168.1	9.20	53.6	−25.29	50.4	−10.26	−137.0	1.15238
1300	−2.16	166.4	8.51	50.3	−24.77	51.2	− 9.82	−137.6	1.14227
1400	−2.15	164.8	7.74	47.4	−24.33	51.8	− 9.47	−139.8	1.17100
1500	−2.11	163.2	7.17	43.2	−23.89	51.3	− 9.12	−140.6	1.14571
1600	−2.12	163.2	6.42	40.9	−23.46	51.9	− 8.62	−143.8	1.17011
1700	−2.18	160.0	5.90	38.9	−23.05	52.8	− 8.40	−144.7	1.21496
1800	−2.04	158.8	5.34	33.9	−22.63	52.1	− 7.86	−146.2	1.12300
1900	−2.02	157.6	4.92	31.0	−22.26	52.1	− 7.64	−148.4	1.10898
2000	−1.99	156.2	4.54	27.9	−21.74	52.4	− 7.26	−149.5	1.05212



100 MIL Metal/Ceramic Hermetic Package

Small Signal Transistor for High Performance Receiver Applications

- **High Output IF Amplifier**
- **High Gain**
- **Wide Dynamic Range**
- **Plastic Package**



T-PAK

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. A new process in wafer fabrication helps make this new transistor effective in applications up to 5 GHz, with a very wide dynamic range.

Utilizing ion implantation techniques coupled with arsenic emitters and diffused ballast resistors, the LT4403 sets new standards for high output capability, high gain, and wide dynamic range. Gold metallization insures high reliability for high performance receiver applications.

Electrical Characteristics @ 25°C Case

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = .1mA	3			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	15			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1mA	30			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
$V_{CE\ (SAT)}$	Collector-Emitter Saturation Voltage	I_C = 40mA I_C/I_B = 10		500		mV
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 25mA	50	150	300	
C_{CB}	Collector-Base Capacitance	V_{CE} = 8V f = 1.0 MHz		1.5		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V I_C = 10mA, f = .5 GHz		1.7		dB
G_{Umax}	Maximum Unilateral Gain	V_{CE} = 8V I_C = 40mA, f = .5 GHz		17		dB
$[S_{21}]_E^2$	Common Emitter Insertion Gain	f = .3 GHz V_{CE} = 8V, f = .5 GHz I_C = 40mA		18 14		dB dB
F_T	Gain Bandwidth Product	V_{CE} = 8V I_C = 40mA		5.0		GHz
P_{out}	Power out @ 1dB Compression	V_{CE} = 8V I_C = 40mA, f = .5 GHz	16	18		dBm
ITO	Third Order Intercept	V_{CE} = 8V I_C = 40mA, f = .5 GHz		38		dBm

Absolute Maximum Ratings @ 25°C Case

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_j)	Storage Temperature (T_{STG})
70mA	30V	150°C	-65°C to +150°C

***Replaces BFR96**

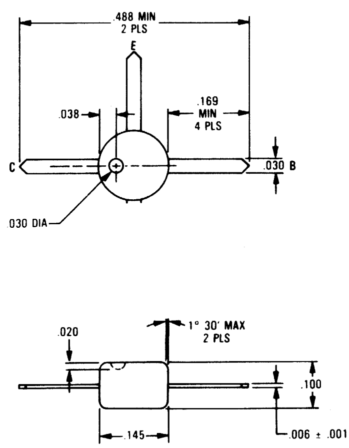
LT4403 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 40mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-6.53	-127.0	26.71	114.7	-30.73	52.9	- 6.44	- 68.4	0.568
200	-6.33	-155.3	21.54	97.0	-27.48	56.1	-10.71	- 89.3	0.837
300	-6.31	-167.6	18.28	88.1	-25.05	60.6	-13.11	-100.4	0.965
400	-6.21	-175.5	15.84	81.3	-23.05	62.4	-14.02	-107.8	1.018
500	-6.17	179.3	14.05	75.5	-21.39	64.0	-14.59	-115.6	1.044
600	-6.11	174.4	12.51	69.7	-20.07	62.8	-14.59	-118.8	1.058
700	-6.09	170.5	11.20	65.4	-18.75	63.6	-14.32	-124.0	1.062
800	-6.08	166.1	10.17	60.9	-17.65	63.2	-14.24	-126.4	1.059
900	-6.07	162.6	9.24	56.7	-16.67	62.5	-14.08	-130.3	1.057
1000	-5.94	159.9	8.39	52.5	-15.76	61.6	-13.55	-134.1	1.043
1100	-5.87	156.0	7.65	48.2	-14.92	60.5	-13.20	-135.1	1.027
1200	-5.91	152.3	7.00	44.5	-14.15	59.3	-12.90	-138.2	1.023
1300	-5.98	149.9	6.37	40.6	-13.55	58.3	-12.48	-141.7	1.026

V_{CE} = 8V, I_C = 10mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-4.52	- 91.3	23.82	127.3	-27.62	49.8	- 3.43	- 46.4	0.314
200	-5.19	-130.1	19.64	104.8	-25.18	44.0	- 6.94	- 63.8	0.555
300	-5.46	-149.2	16.57	92.8	-23.96	44.5	- 9.12	- 71.9	0.763
400	-5.50	-161.2	14.25	84.1	-22.84	47.2	-10.18	- 77.9	0.897
500	-5.50	-169.3	12.41	76.1	-21.93	50.3	-10.76	- 83.9	1.006
600	-5.45	-175.8	11.02	70.2	-20.86	53.7	-10.94	- 88.4	1.047
700	-5.44	178.8	9.72	65.0	-19.73	55.4	-10.97	- 94.4	1.075
800	-5.42	173.6	8.58	59.7	-18.84	57.9	-10.75	- 98.6	1.103
900	-5.39	169.1	7.63	55.0	-17.98	59.5	-10.63	-103.4	1.116
1000	-5.27	165.8	6.87	50.1	-17.08	59.7	-10.25	-108.9	1.085
1100	-5.21	161.3	6.13	45.5	-16.11	60.1	- 9.88	-112.7	1.051
1200	-5.18	157.2	5.43	41.4	-15.28	60.2	- 9.62	-117.9	1.041
1300	-5.24	154.1	4.77	37.2	-14.47	60.2	- 9.24	-122.5	1.029



T-PAK

LT4404

Small Signal Transistor for High Performance Receiver Applications

- **High Output IF Amplifier**
- **High Gain**
- **Wide Dynamic Range**
- **Plastic Package**

X-PAK

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. A new process in wafer fabrication helps make this newtransistor effective in applications up to 5 GHz, with a very wide dynamic range.

Utilizing ion implantation techniques coupled with arsenic emitters and diffused ballast resistors, the LT4404 sets new standards for high output capability, high gain, and wide dynamic range. Gold metallization insures high reliability for high performance receiver applications.

Electrical Characteristics @ 25°C Case

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = .1mA	3			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	15			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1mA	30			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
$V_{CE\,(SAT)}$	Collector-Emitter Saturation Voltage	I_C = 40mA I_C/I_B = 10		500		mV
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 25mA	50	150	300	
C_{CB}	Collector-Base Capacitance	V_{CE} = 8V f = 1.0 MHz		1.5		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 10mA, f = .5 GHz		1.7		dB
GU_{max}	Maximum Unilateral Gain	V_{CE} = 8V I_C = 40mA f = .5 GHz		17		dB
$[S_{21}]^2_E$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 40mA f = .3 GHz f = .5 GHz		19 15		dB dB
F_T	Gain Bandwidth Product	V_{CE} = 8V I_C = 40mA		5.0		GHz
P_{out}	Power out @ 1dB Compression	V_{CE} = 8V I_C = 40mA f = .5 GHz	16	18		dBm
ITO	Third Order Intercept	V_{CE} = 8V I_C = 40mA f = .5 GHz		38		dBm

Absolute Maximum Ratings @ 25°C Case

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_j)	Storage Temperature (T_{STG})
70mA	30V	150°C	-65°C to +150°C

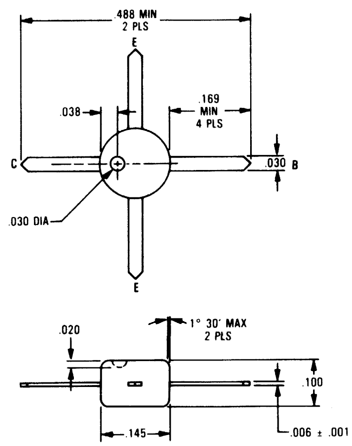
LT4404 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 40mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-3.85	-127.6	27.70	118.6	-31.04	39.5	- 5.21	- 76.3	0.290
200	-3.27	-154.9	22.72	99.7	-29.40	34.0	- 8.72	-106.2	0.519
300	-3.16	-166.4	19.46	90.5	-28.27	36.1	-10.42	-121.7	0.709
400	-3.09	-173.6	17.14	83.6	-27.45	38.7	-10.99	-131.3	0.844
500	-3.06	-178.5	15.23	77.7	-26.51	42.4	-11.31	-138.5	0.953
600	-3.03	177.2	13.69	72.1	-25.69	43.4	-11.40	-142.8	1.025
700	-3.04	174.0	12.36	68.0	-24.69	45.9	-11.35	-146.2	1.073
800	-3.05	170.5	11.17	63.7	-23.95	47.5	-11.18	-148.9	1.129
900	-3.05	167.6	10.25	59.6	-23.26	48.4	-11.08	-151.2	1.157
1000	-3.01	165.4	9.28	55.4	-22.47	48.3	-10.74	-153.1	1.159
1100	-3.01	162.4	8.42	51.5	-21.75	49.2	-10.55	-153.7	1.173
1200	-3.01	159.5	7.72	47.8	-21.11	49.4	-10.24	-156.2	1.180
1300	-3.09	157.7	7.06	44.1	-20.49	49.2	-10.00	-157.7	1.195

V_{CE} = 8V, I_C = 10mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-3.15	- 92.8	24.41	130.9	-27.43	45.9	- 2.89	- 48.7	0.158
200	-3.06	-131.1	20.53	17.7	-25.49	30.7	- 6.21	- 71.3	0.298
300	-3.07	-149.3	17.45	95.5	-24.78	25.3	- 8.33	- 83.4	0.450
400	-3.05	-160.4	15.15	86.6	-24.44	23.8	- 9.39	- 91.8	0.583
500	-3.02	-167.7	13.38	78.5	-24.26	24.0	- 9.94	- 98.9	0.709
600	-2.99	-173.6	11.80	72.6	-23.98	24.8	-10.06	-103.5	0.819
700	-3.02	-178.0	10.47	67.5	-23.88	27.8	-10.03	-109.2	0.958
800	-3.04	177.9	9.28	62.2	-23.74	28.6	- 9.88	-113.3	1.085
900	-2.99	174.2	8.33	57.6	-23.28	30.8	- 9.60	-117.0	1.126
1000	-2.96	171.2	7.36	52.8	-22.99	32.7	- 9.26	-121.3	1.200
1100	-2.96	168.0	6.53	48.2	-22.54	34.9	- 8.85	-124.1	1.235
1200	-2.92	164.8	5.83	44.0	-22.15	35.7	- 8.55	-128.4	1.261
1300	-2.99	162.5	5.07	39.8	-21.71	38.7	- 8.13	-131.6	1.317

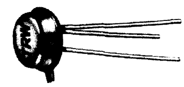


X-PAK

TRW

Small Signal Transistor for High Performance Receiver Applications

- **High Output IF Amplifier**
- **High Gain**
- **Wide Dynamic Range**



TO-46 Package

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. A new process in wafer fabrication helps make this new transistor effective in applications up to 5 GHz, with a very wide dynamic range.

Utilizing ion implantation techniques coupled with arsenic emitters and diffused ballast resistors, the LT4446 sets new standards for high output capability, high gain, and wide dynamic range. Gold metallization insures high reliability for high performance receiver applications.

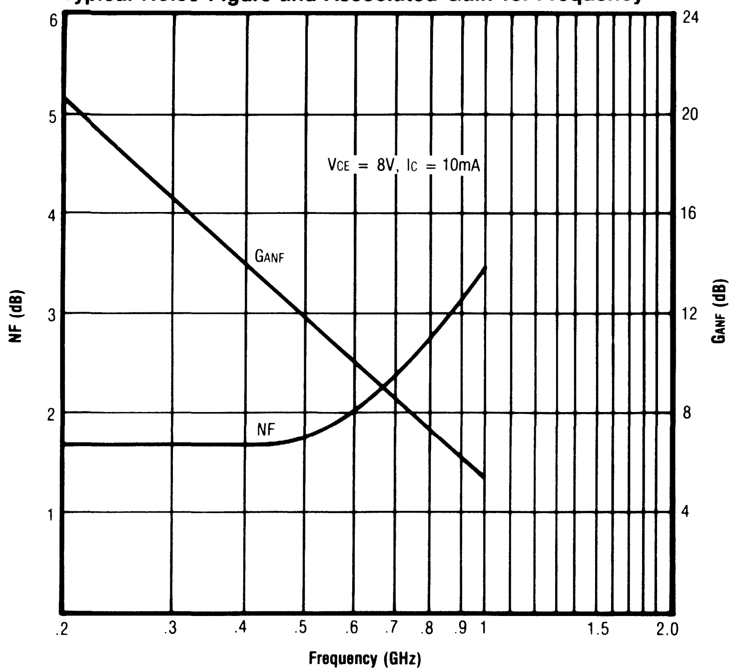
Electrical Characteristics @ 25°C Case

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = .1mA	3			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	15			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1mA	30			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	mA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	I_C = 40mA I_C/I_B = 10		500		mV
h_{FE}	DC Current Gain	V_{CE} = 8V I_C = 25mA	50	150	300	
C_{CB}	Collector-Base Capacitance	V_{CE} = 8V f = 1.0 MHz			1.6	pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V I_C = 10mA f = .5 GHz		2.0		dB
GU_{max}	Maximum Unilateral Gain	V_{CE} = 8V I_C = 40mA f = .5 GHz		11.0		dB
$[S_{21}]^2_E$	Common Emitter Insertion Gain	f = .3 GHz V_{CE} = 8V f = .5 GHz I_C = 40mA	9	14.5 10.5		dB dB
F_T	Gain Bandwidth Product	V_{CE} = 8V I_C = 40mA		5.0		GHz
P_{OUT}	Power out @ 1 dB Compression	V_{CE} = 8V I_C = 40mA	16	18		dBm
ITO	Third Order Intercept	V_{CE} = 8V I_C = 40mA		38		dBm

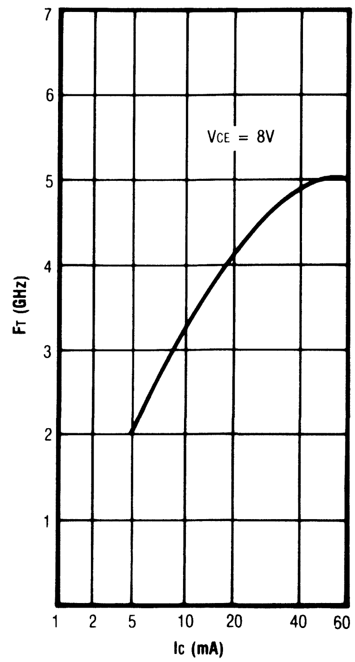
Absolute Maximum Ratings @ 25°C Case

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_{STG})
70mA	30V	200°C	−65°C to 200°C

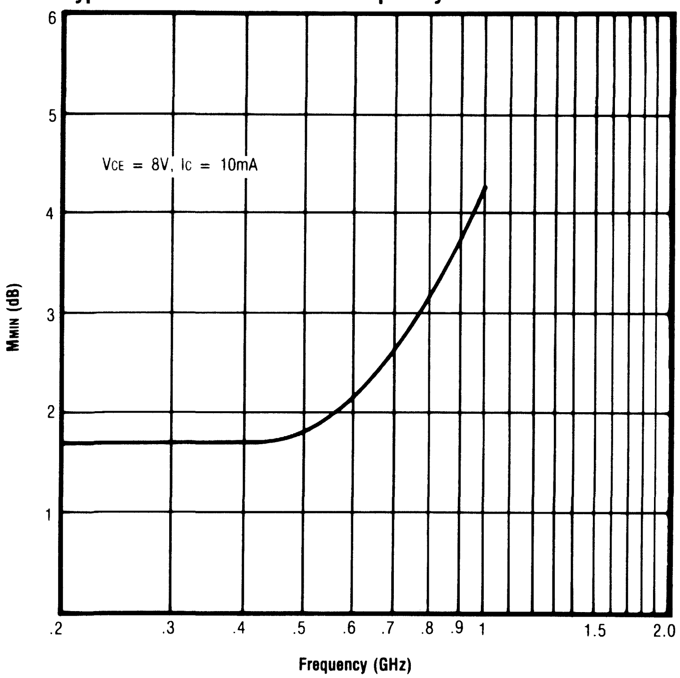
Typical Noise Figure and Associated Gain vs. Frequency



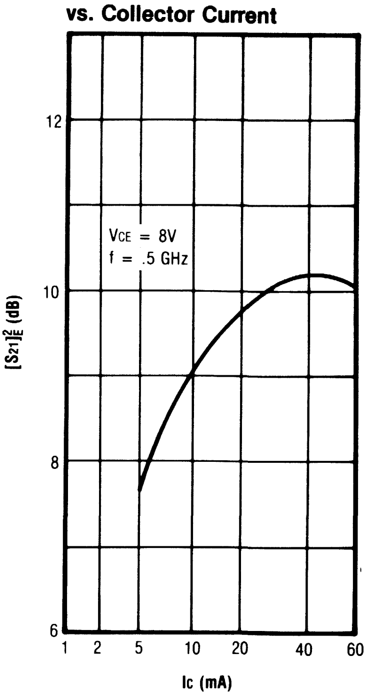
Typical Gain Bandwidth Product vs. Collector Current



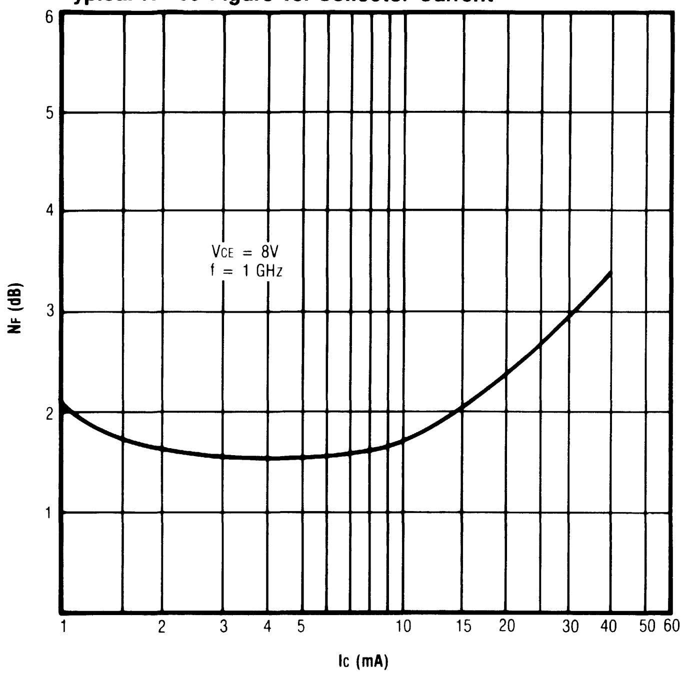
Typical Noise Measure vs. Frequency



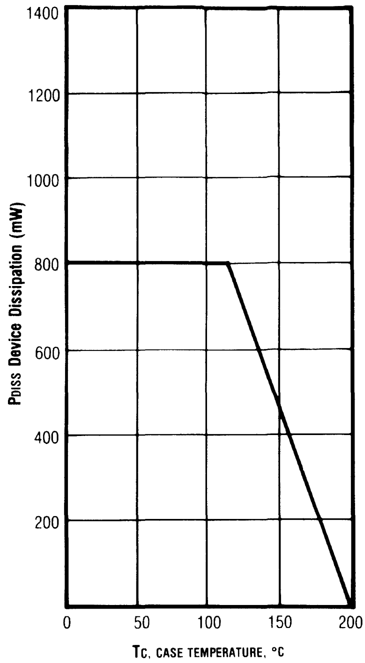
Typical Insertion Gain vs. Collector Current



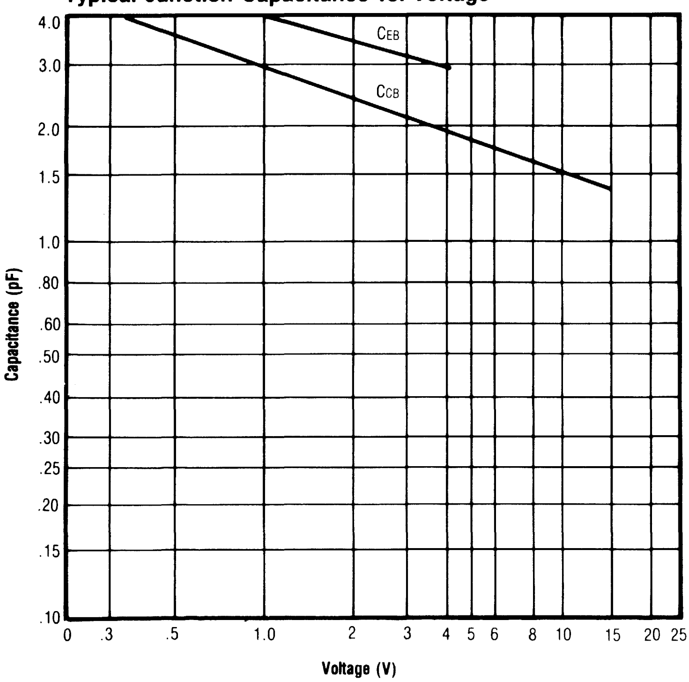
Typical Noise Figure vs. Collector Current



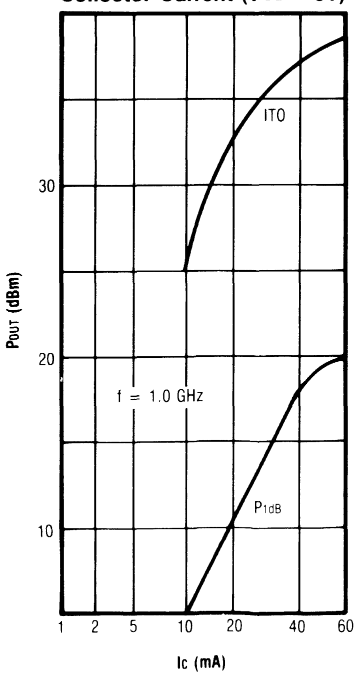
Device Dissipation Operating Range



Typical Junction Capacitance vs. Voltage



Third Order Intercept vs. Collector Current (VCE = 8V)



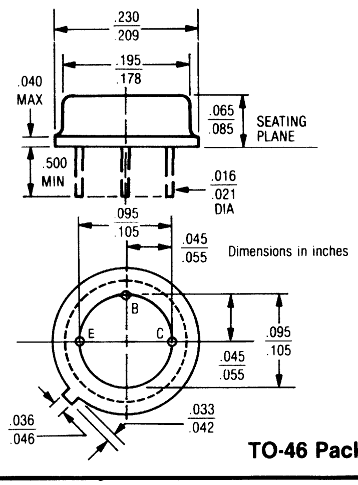
LT4446 S PARAMETERS

S-dB and Angles:
VCE = 8V, IC = 10mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−6.38	− 95.3	21.36	118.6	−24.35	57.5	− 5.47	− 59.9	0.519
200	−8.15	−131.2	16.49	101.5	−21.41	60.7	− 9.43	− 77.2	0.815
300	−8.53	−148.4	13.26	93.1	−19.34	66.7	−11.43	− 86.1	0.968
400	−8.70	−158.8	11.06	87.8	−17.62	72.3	−12.37	− 91.6	1.045
500	−8.75	−166.3	9.30	83.8	−16.12	77.1	−12.94	− 96.6	1.093
600	−8.63	−171.7	7.87	80.0	−14.79	80.3	−13.11	−100.6	1.111
700	−8.69	−176.6	6.74	77.4	−13.54	83.6	−12.99	−104.3	1.115
800	−8.56	179.3	5.80	75.2	−12.46	86.1	−12.89	−108.1	1.111
900	−8.39	174.8	4.92	73.3	−11.46	88.6	−12.66	−111.2	1.108
1000	−8.41	171.0	4.24	72.4	−10.54	91.4	−12.64	−115.2	1.105
1100	−8.08	168.2	3.64	71.7	− 9.74	93.6	−12.53	−120.6	1.096
1200	−7.76	163.1	3.01	71.9	− 9.05	95.8	−12.09	−125.1	1.097

VCE = 8V, IC = 40mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−9.10	−126.7	23.17	108.3	−26.24	66.2	− 8.77	− 79.4	0.773
200	−9.49	−154.5	17.90	96.7	−21.90	72.6	−12.79	−101.7	0.950
300	−9.44	−166.3	14.59	91.0	−19.01	76.6	−14.58	−113.9	1.010
400	−9.49	−174.1	12.29	87.0	−16.79	79.3	−15.49	−121.2	1.033
500	−9.39	180.0	10.48	84.3	−15.14	81.7	−15.99	−127.1	1.051
600	−9.32	175.5	9.07	81.4	−13.71	82.9	−16.20	−130.5	1.054
700	−9.42	170.7	7.98	79.3	−12.53	84.3	−16.33	−133.3	1.057
800	−9.36	167.1	7.06	77.6	−11.45	85.6	−16.21	−135.7	1.052
900	−9.20	163.0	6.19	76.0	−10.55	86.8	−16.30	−137.1	1.051
1000	−9.25	159.0	5.56	75.2	− 9.71	88.4	−16.33	−140.8	1.048
1100	−8.94	157.4	4.97	74.7	− 9.02	90.0	−16.38	−146.8	1.042
1200	−8.57	152.5	4.38	74.8	− 8.50	91.5	−15.69	−148.6	1.043



TO-46 Package

Small Signal Transistor for High Performance Receiver Applications

- **High Output IF Amplifier**
- **High Gain**
- **Wide Dynamic Range**
- **Hermetic Package**

85 MIL Package

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. A new process in wafer fabrication helps make this new transistor effective in applications up to 5 GHz, with a very wide dynamic range.

Utilizing ion implantation techniques coupled with arsenic emitters and diffused ballast resistors, the LT4485 sets new standards for high output capability, high gain, and wide dynamic range. Gold metallization insures high reliability for high performance receiver applications.

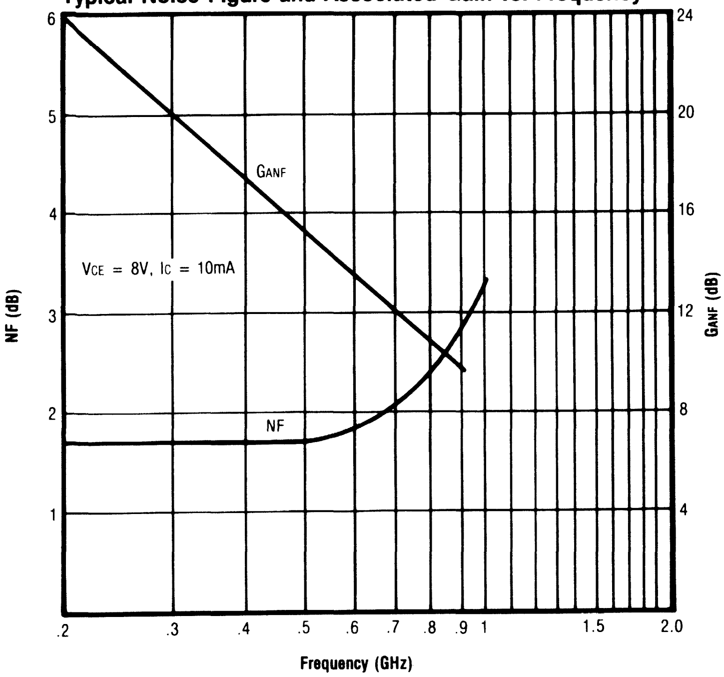
Electrical Characteristics @ 25°C Case

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = .1mA	3			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	15			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 1mA	30			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	mA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	I_C = 40mA I_C/I_B = 10		500		mV
h_{FE}	DC Current Gain	V_{CE} = 8V I_C = 25mA	50	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1.0 MHz			1.0	pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 10mA, f = 1.0 GHz		3.4		GHz
G_{Umax}	Maximum Unilateral Gain	V_{CE} = 8V I_C = 40mA f = 1.0 GHz		14		dB
$[S_{21}]^2_E$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 40mA f = .3 GHz f = .5 GHz f = 1.0 GHz	14	20 16 10		dB dB dB
F_T	Gain Bandwidth Product	V_{CE} = 8V I_C = 40mA		5.0		GHz
F_{max}	Maximum Oscillation Frequency	V_{CE} = 8V I_C = 40mA		6.0		GHz
P_{OUT}	Power out @ 1 dB Compression	V_{CE} = 8V I_C = 40mA	16	18		dBm
ITO	Third Order Intercept	V_{CE} = 8V I_C = 40mA		38		dBm

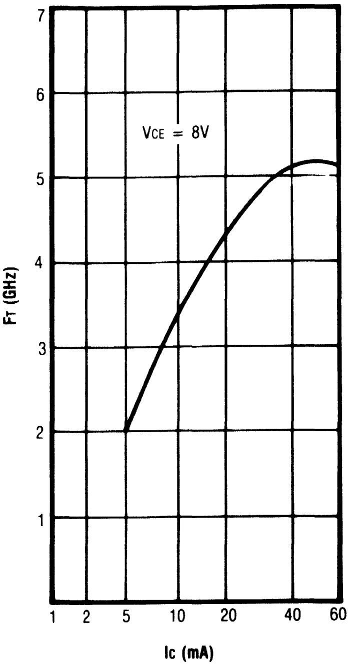
Absolute Maximum Ratings @ 25°C Case

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_{STG})
70mA	30V	200°C	−65°C to 200°C

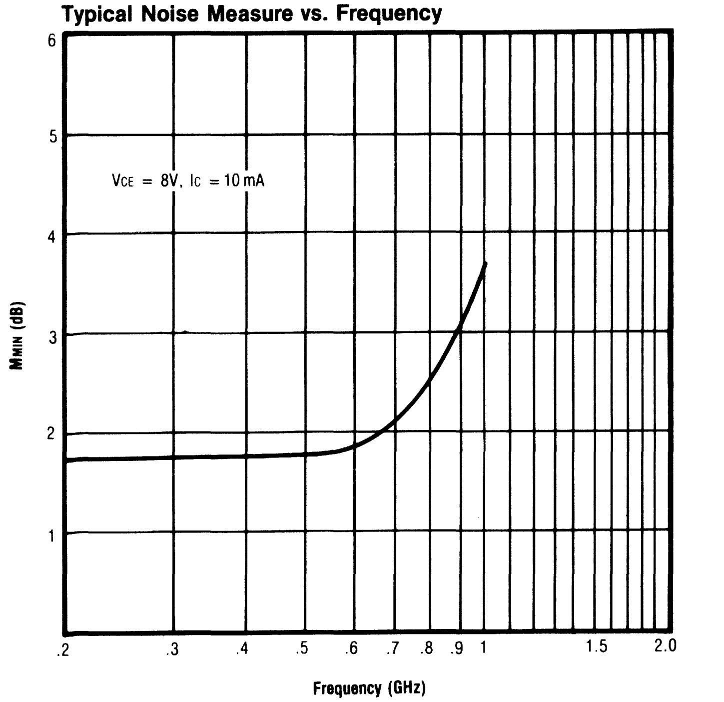
Typical Noise Figure and Associated Gain vs. Frequency



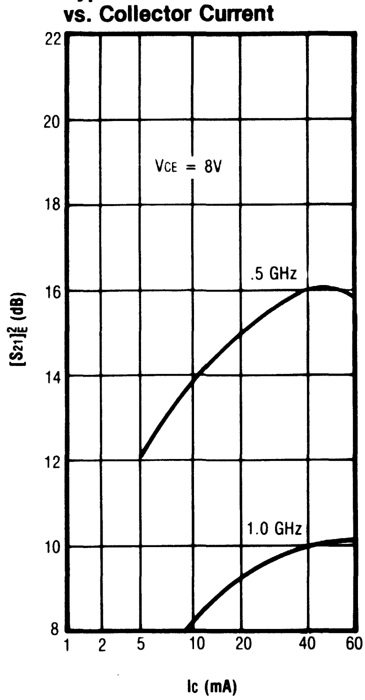
Typical Gain Bandwidth Product vs. Collector Current



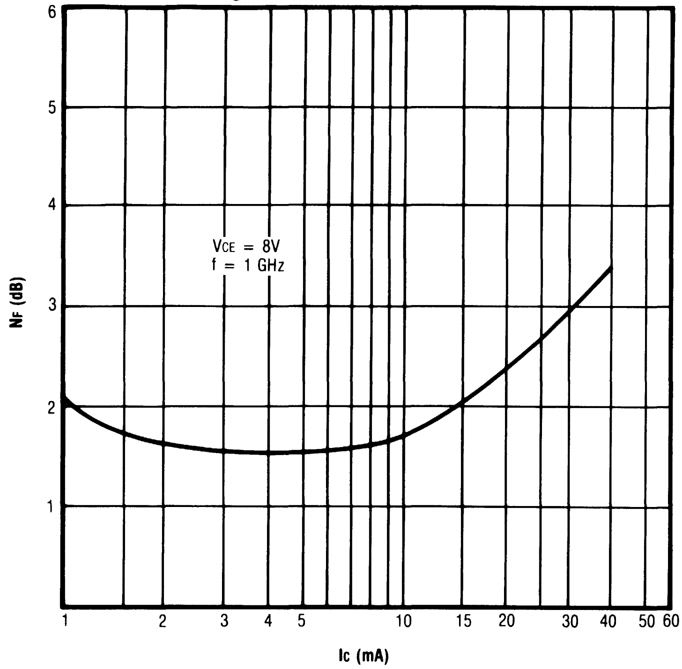
Typical Noise Measure vs. Frequency



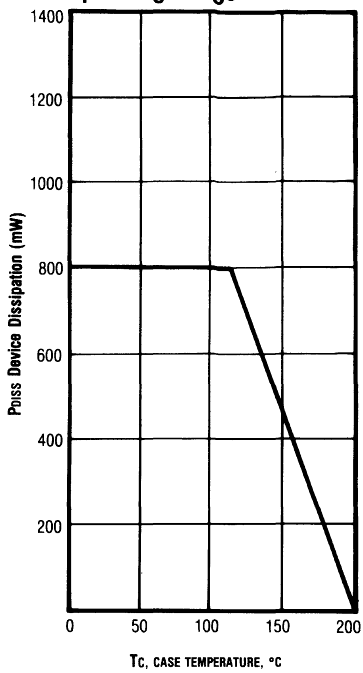
Typical Insertion Gain vs. Collector Current



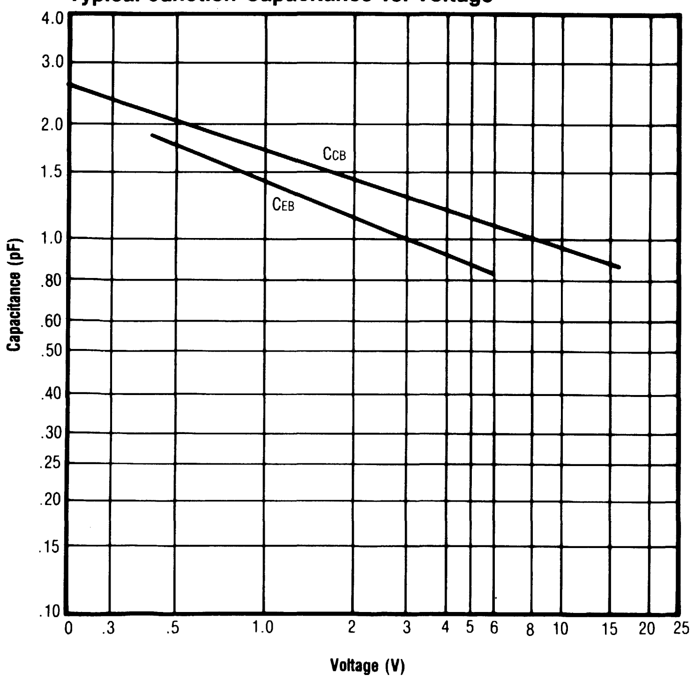
Typical Noise Figure vs. Collector Current



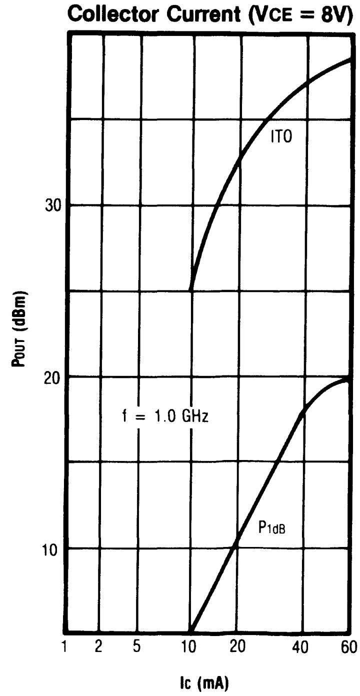
Device Dissipation Operating Range



Typical Junction Capacitance vs. Voltage



Third Order Intercept vs. Collector Current (V_{CE} = 8V)



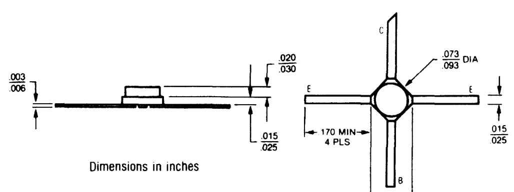
LT4485 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 10mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−2.72	−85.0	25.43	132.4	−28.51	48.0	−2.70	−48.4	0.13293
150	−2.76	−109.0	23.58	120.3	−26.19	39.0	−4.41	−60.5	0.19757
200	−2.83	−125.0	21.60	110.7	−25.54	32.0	−6.05	−70.5	0.26691
250	−2.84	−136.1	20.10	103.4	−25.17	28.5	−7.22	−77.6	0.32371
400	−2.77	−157.2	16.39	87.1	−24.93	23.3	−9.36	−90.7	0.49674
500	−2.79	−165.3	14.55	81.9	−24.69	23.1	−9.83	−97.2	0.60691
600	−2.75	−171.0	12.92	75.3	−24.61	24.0	−10.07	−104.0	0.72132
700	−2.71	−175.5	11.62	69.4	−24.45	25.3	−10.08	−107.9	0.81477
800	−2.69	−179.4	10.46	64.9	−24.28	26.0	−9.84	−112.6	0.89979
900	−2.65	177.0	9.39	59.3	−24.14	28.0	−9.60	−117.5	0.98761
1000	−2.62	173.9	8.47	55.1	−23.85	30.1	−9.24	−121.3	1.04401
1100	−2.60	171.0	7.58	50.9	−23.69	32.1	−8.86	−126.0	1.11949
1200	−2.57	168.3	6.75	45.9	−23.41	32.7	−8.53	−128.8	1.16569
1300	−2.54	165.7	6.04	41.6	−23.09	35.0	−8.03	−132.6	1.18452
1400	−2.51	163.2	5.30	38.8	−22.76	37.2	−7.69	−136.7	1.22688
1500	−2.46	160.9	4.51	33.8	−22.50	37.7	−7.32	−139.4	1.25369
1600	−2.49	159.2	3.83	30.9	−22.02	39.7	−6.97	−144.2	1.28626
1700	−2.36	156.4	3.40	26.9	−21.59	40.9	−6.65	−147.0	1.20923
1800	−2.29	154.4	2.65	23.5	−21.32	41.9	−6.15	−151.4	1.21613
1900	−2.23	152.4	2.21	18.9	−20.91	41.7	−5.95	−154.5	1.16966
2000	−2.15	150.5	1.60	16.6	−20.43	42.1	−5.62	−156.3	1.12113

V_{CE} = 8V, I_C = 40mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−3.54	−123.6	29.11	117.8	−33.53	36.9	−5.15	−81.3	0.25534
150	−3.10	−142.4	26.46	108.0	−30.48	37.4	−7.36	−96.0	0.37120
200	−2.96	−152.8	24.10	100.7	−30.19	34.3	−8.76	−109.4	0.47343
250	−2.87	−159.6	22.40	95.2	−29.70	35.1	−9.65	−118.7	0.55888
400	−2.71	−170.5	18.48	83.4	−28.43	37.1	−10.80	−135.6	0.74429
500	−2.71	−176.3	16.60	79.7	−27.56	40.6	−11.06	−141.8	0.85660
600	−2.68	−179.8	14.94	74.5	−26.89	43.3	−11.02	−146.8	0.94599
700	−2.65	−176.6	13.63	69.6	−26.13	45.0	−11.01	−150.0	0.99859
800	−2.63	173.8	12.47	66.2	−25.32	46.4	−10.84	−152.0	1.03264
900	−2.61	170.5	11.37	61.4	−24.64	47.9	−10.65	−155.1	1.07476
1000	−2.60	167.9	10.45	57.7	−23.99	48.0	−10.38	−156.8	1.09578
1100	−2.59	165.6	9.59	54.1	−23.38	48.6	−10.02	−159.2	1.11900
1200	−2.57	163.3	8.80	50.1	−22.89	47.8	−9.84	−160.3	1.13247
1300	−2.55	161.1	8.06	46.3	−22.37	48.1	−9.45	−161.5	1.13948
1400	−2.52	159.0	7.38	43.6	−21.84	48.3	−9.19	−163.6	1.14859
1500	−2.48	156.9	6.74	39.3	−21.43	47.3	−8.90	−164.6	1.14214
1600	−2.51	155.7	6.10	37.2	−20.91	47.5	−8.55	−167.7	1.16468
1700	−2.40	153.2	5.68	33.1	−20.50	47.0	−8.30	−168.9	1.11532
1800	−2.34	151.3	5.02	29.9	−20.19	46.5	−7.86	−171.3	1.12189
1900	−2.29	149.5	4.51	25.8	−19.82	45.2	−7.61	−172.8	1.09542
2000	−2.22	147.8	3.95	23.5	−19.44	44.3	−7.34	−173.3	1.07419



85 MIL Package

TRW

Small Signal Low Noise Transistor for High Performance Receiver Applications

- **Front End Amplifier**
- **Low Noise Oscillator**
- **High Frequency Multiplier**
- **Low Noise**
- **High Gain**
- **Wide Dynamic Range**
- **Hermetic Package**

100 MIL Package

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. A new process in wafer fabrication helps make this new transistor effective in applications up to as high as 6 GHz, with a very wide dynamic range.

Utilizing ion implantation techniques coupled with arsenic emitters, the LT4700 sets new standards for low noise figure, high gain, and wide dynamic range. Gold metallization insures high reliability for low noise amplifier applications.

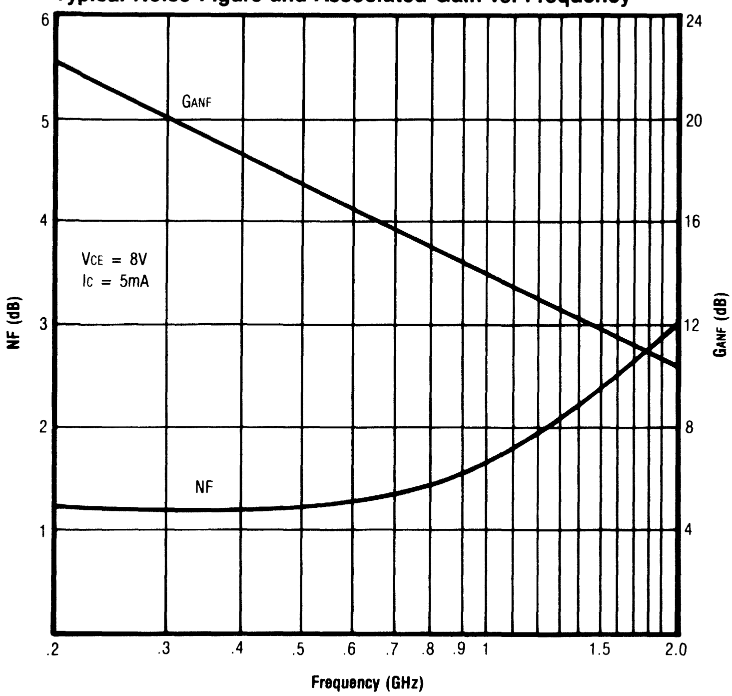
Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = .1mA	3			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	12			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 25mA	70	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1 MHz			.6	pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 5mA f = 0.5 GHz f = 1.0 GHz f = 2.0 GHz		1.2 1.6 3.0	2.5	dB dB dB
G_{ANF}	Gain @ Associated Noise Figure	V_{CE} = 8V, I_C = 5mA f = 0.5 GHz f = 1.0 GHz f = 2.0 GHz		18.0 14.0 11.0		dB dB dB
$[S_{21}]_E^2$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 25mA f = 0.5 GHz f = 1.0 GHz f = 2.0 GHz	13.0	21.0 15.0 10.0		dB dB dB
$G_{U(max)}$	Maximum Unilateral Gain	V_{CE} = 8V, I_C = 25mA f = 0.5 GHz f = 1.0 GHz f = 2.0 GHz		26.0 21.0 16.0		dB dB dB
F_t	Gain Bandwidth Product	V_{CE} = 8V I_C = 25mA		6.0		GHz
F_{max}	Maximum Oscillation Frequency	V_{CE} = 8V I_C = 25mA		7.0		GHz

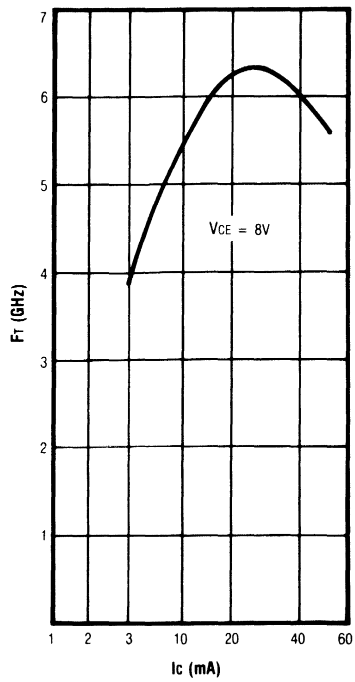
Absolute Maximum Ratings

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_S)
50mA	20V	200 °C	− 65 °C to 200 °C

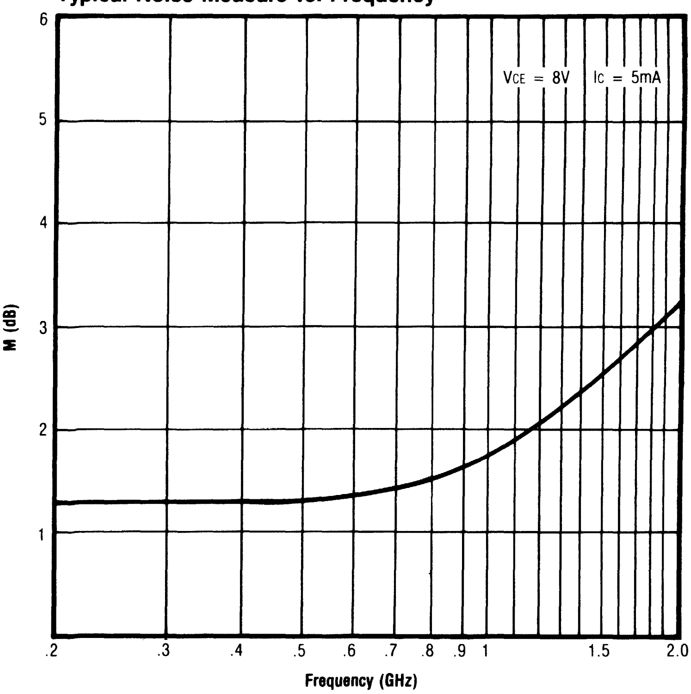
Typical Noise Figure and Associated Gain vs. Frequency



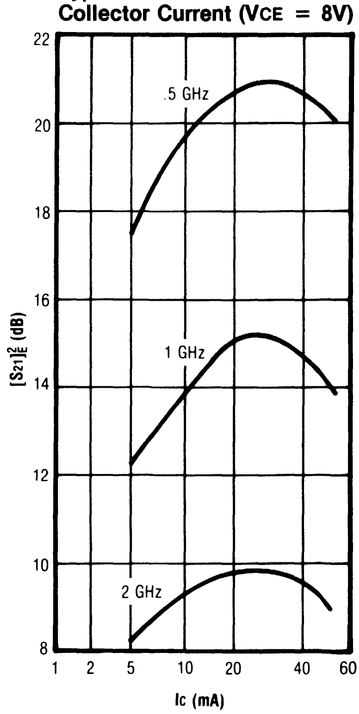
Typical Gain Bandwidth Product vs. Collector Current



Typical Noise Measure vs. Frequency



Typical Insertion Gain vs. Collector Current (VCE = 8V)



LT4700 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 5mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−2.09	−35.4	24.61	149.8	−33.54	71.3	−0.28	−18.5	0.14632
150	−2.70	−48.2	23.37	153.7	−32.03	66.7	−0.42	−14.5	0.08388
200	−3.17	−61.0	21.27	143.5	−30.61	56.5	−2.11	−17.4	0.38362
250	−3.62	−73.5	19.86	133.3	−29.07	51.8	−2.20	−28.6	0.34603
400	−3.66	−106.1	18.67	113.0	−26.98	40.3	−3.23	−29.9	0.43098
500	−3.91	−119.4	17.34	107.3	−26.32	37.3	−3.69	−30.4	0.48277
600	−4.00	−130.2	16.13	100.2	−25.82	34.5	−4.15	−32.8	0.54641
700	−4.07	−139.1	15.05	94.4	−25.56	32.7	−4.56	−33.2	0.62994
800	−4.11	−146.6	14.04	89.9	−25.20	31.1	−4.75	−35.7	0.67527
900	−4.14	−152.9	13.06	85.1	−25.04	30.8	−5.10	−37.1	0.76699
1000	−4.76	−161.3	12.15	79.1	−25.02	34.9	−5.10	−36.8	0.91025
1100	−4.79	−166.5	11.41	75.5	−24.88	35.2	−5.33	−37.9	0.99839
1200	−4.81	−171.3	10.70	71.9	−24.55	35.8	−5.34	−39.0	1.03922
1300	−4.81	−175.7	10.03	68.3	−24.34	36.4	−5.42	−41.8	1.09306
1400	−4.80	−179.6	9.41	65.1	−24.19	37.7	−5.55	−43.1	1.16138
1500	−4.77	176.8	8.82	61.6	−23.92	36.9	−5.50	−45.4	1.19230
1600	−4.77	173.2	8.24	58.6	−23.73	38.9	−5.53	−47.3	1.24361
1700	−4.82	171.1	7.70	57.1	−23.50	40.0	−5.54	−49.1	1.29489
1800	−4.72	167.4	7.25	52.6	−23.31	40.4	−5.54	−51.3	1.31465
1900	−4.70	164.6	6.92	50.1	−22.96	41.3	−5.57	−54.0	1.30445
2000	−4.68	161.8	6.48	47.3	−22.74	42.8	−5.55	−56.0	1.32750

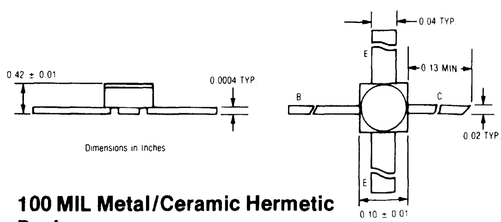
V_{CE} = 8V, I_C = 25mA

Frequency (MHz)	S11		S21		S12		S22		k
100	−5.83	−88.2	30.87	131.0	−37.23	55.3	−2.18	−27.5	0.33256
150	−5.77	−107.6	29.28	125.3	−35.66	56.8	−3.33	−28.6	0.38799
200	−5.54	−121.6	27.32	119.5	−34.93	52.9	−4.67	−30.6	0.52604
250	−5.43	−132.5	25.47	112.9	−34.55	53.8	−5.39	−32.4	0.64475
400	−4.86	−152.7	22.60	96.7	−32.75	45.9	−7.29	−34.6	0.82367
500	−4.77	−160.5	20.82	92.8	−31.90	47.6	−7.79	−33.2	0.92234
600	−4.72	−166.2	19.35	87.7	−31.00	49.6	−8.18	−33.6	0.99615
700	−4.66	−170.7	18.07	83.4	−30.21	50.8	−8.47	−32.9	1.06180
800	−4.63	−174.6	16.93	80.0	−29.45	51.7	−8.64	−34.9	1.10767
900	−4.58	−177.9	15.94	76.7	−29.79	52.7	−8.84	−35.3	1.15458
1000	−5.29	176.5	14.85	72.4	−27.18	59.5	−8.36	−34.0	1.16067
1100	−5.27	−173.3	14.02	69.5	−26.60	59.4	−8.50	−35.3	1.19985
1200	−5.22	−170.4	13.20	66.3	−25.95	59.5	−8.48	−36.3	1.21402
1300	−5.17	167.7	12.50	63.2	−25.28	59.8	−8.55	−39.2	1.21229
1400	−5.13	−165.3	11.84	61.0	−24.82	60.2	−8.61	−40.4	1.24004
1500	−5.08	163.0	11.23	57.8	−24.24	58.8	−8.54	−42.8	1.23090
1600	−5.05	160.8	10.65	55.2	−23.81	59.7	−8.52	−44.9	1.24442
1700	−5.10	159.4	10.07	54.4	−23.36	59.6	−8.53	−46.5	1.27095
1800	−4.97	156.4	9.62	50.1	−22.93	58.9	−8.52	−49.1	1.25286
1900	−4.97	154.5	9.22	48.1	−22.44	58.9	−8.57	−51.2	1.24397
2000	−4.96	152.6	8.78	45.0	−22.10	59.2	−8.47	−54.0	1.24979

NOISE PARAMETERS

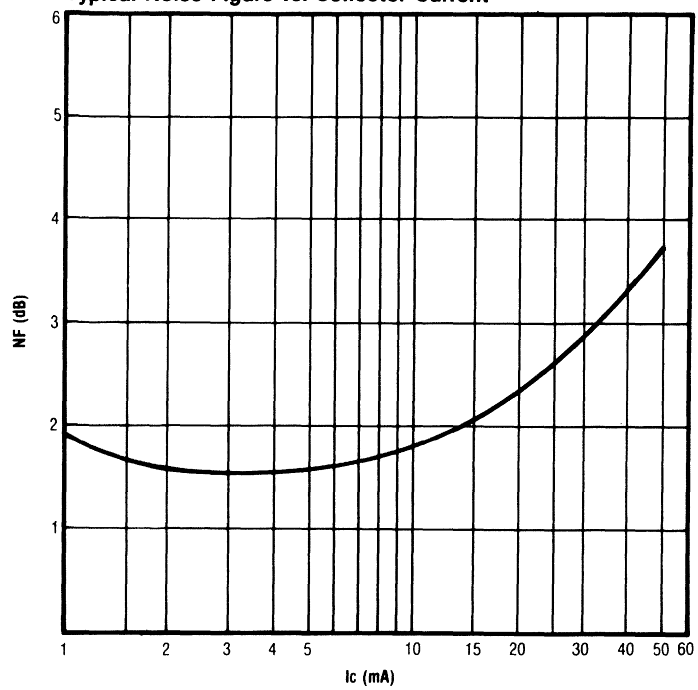
Freq.	N.F. OPT	Γs OPT	Rn
0.5 GHz	1.2 dB	.244 /80°	.72Ω
1.0 GHz	1.6 dB	.337 / −97°	.63Ω
1.5 GHz	2.3 dB	.353 / −158°	.31Ω
2.0 GHz	3.0 dB	.345 / −146°	1.15Ω

Reflection coefficient of source and the noise resistance at optimum noise figure for V_{CE} = 8V, I_C = 5mA

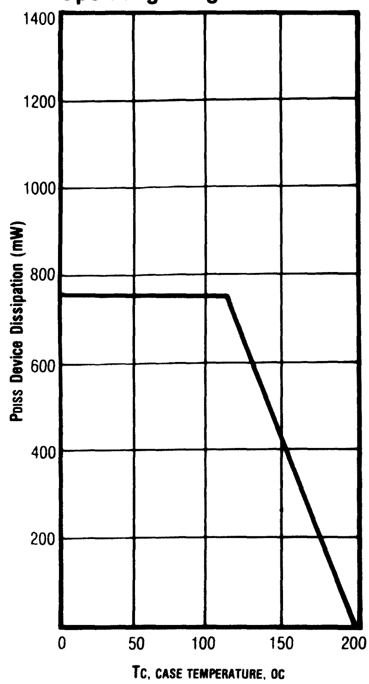


100 MIL Metal/Ceramic Hermetic Package

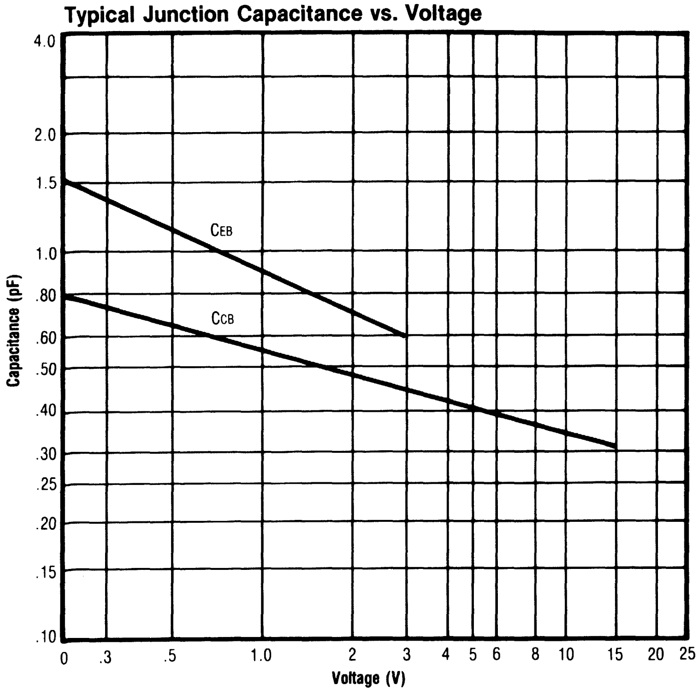
Typical Noise Figure vs. Collector Current



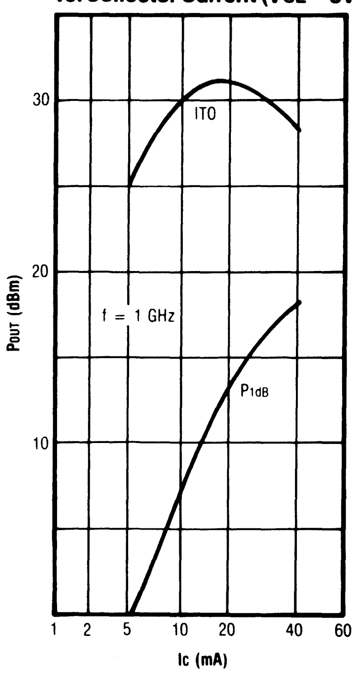
Device Dissipation Operating Range



Typical Junction Capacitance vs. Voltage



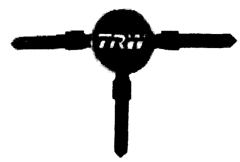
Typical Third Order Intercept vs. Collector Current (VCE = 8V)



LT4703*

Small Signal Low Noise Transistor for High Performance Receiver Applications

- **Front End Amplifier**
- **Low Noise Oscillator**
- **High Frequency Multiplier**
- **Low Noise**
- **High Gain**
- **Wide Dynamic Range**
- **Plastic Package**



T-PAK

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. A new process in wafer fabrication helps make this new transistor effective in applications up to 5.5 GHz, with a very wide dynamic range.

Utilizing ion implantation techniques coupled with arsenic emitters, the LT4703 sets new standards for low noise figure, high gain, and dynamic range. Gold metallization insures high reliability for low noise amplifier applications.

Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_C = .1mA	3			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	12			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
h_{FE}	DC Current Gain	V_{CE} = 5V I_E = 25mA	70	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1.0 MHz		.75		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 5mA f = .3 GHz f = .5 GHz f = 1.0 GHz		1.4 1.5 2.0	2.5	dB dB dB
G_{ANF}	Gain @ Associated Noise Figure	V_{CE} = 8V, I_C = 5mA f = .3 GHz f = .5 GHz f = 1.0 GHz	15	22.0 18.0 12.0		dB dB dB
$[S_{21}]_E^2$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 25mA f = .3 GHz f = .5 GHz f = 1.0 GHz		22.0 18.0 12.0		dB dB dB
G_{Umax}	Maximum Unilateral Gain	V_{CE} = 8V, I_C = 25mA f = .3 GHz f = .5 GHz f = 1.0 GHz		26.0 21.0 15.0		dB dB dB
F_T	Gain Bandwidth Product	V_{CE} = 8V I_C = 25mA		5.5		GHz

Absolute Maximum Ratings

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_S)
50mA	20V	150°C	−65°C to 150°C

***Replaces BFR91**

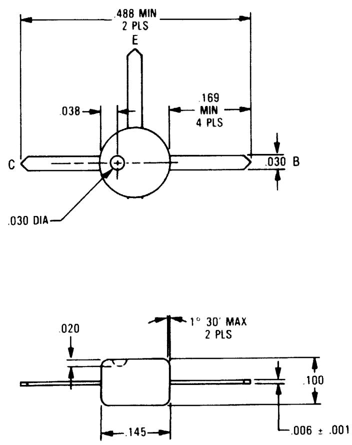
LT4703 S PARAMETERS

S-dB and Angles:
VCE = 8V, Ic = 5mA

Frequency (MHz)	S11		S21		S12		S22		k
100	- 1.56	- 35.0	23.60	152.4	-32.59	69.3	-0.79	-16.3	0.209
200	- 3.22	- 62.9	21.79	131.1	-28.19	57.9	-2.18	-26.1	0.381
300	- 4.92	- 84.1	19.78	115.8	-26.30	52.6	-3.50	-31.3	0.542
400	- 6.31	-100.9	18.07	105.9	-24.89	51.1	-4.52	-34.0	0.665
500	- 7.43	-114.8	16.42	97.8	-23.97	49.5	-5.27	-35.3	0.790
600	- 8.26	-124.7	15.13	91.4	-23.12	49.4	-5.75	-36.6	0.876
700	- 8.87	-134.5	13.88	85.9	-22.44	49.3	-6.21	-37.4	0.966
800	- 9.41	-143.3	12.85	80.8	-21.63	50.5	-6.39	-38.0	1.009
900	- 9.79	-150.1	11.94	76.3	-21.01	50.5	-6.56	-38.9	1.057
1000	- 9.96	-156.6	11.07	72.4	-20.33	50.4	-6.66	-40.9	1.081
1100	-10.17	-163.1	10.38	68.2	-19.76	50.1	-6.78	-42.1	1.107
1200	-10.33	-169.2	9.66	64.2	-19.16	50.0	-6.89	-43.8	1.128
1300	-10.63	-173.7	9.11	60.6	-18.54	50.0	-6.83	-45.3	1.125

VCE = 8V, Ic = 25mA

Frequency (MHz)	S11		S21		S12		S22		k
100	- 6.21	- 71.5	30.00	127.2	-35.49	61.9	-3.58	-29.3	0.557
200	- 9.30	-107.0	25.64	107.1	-31.94	61.8	-6.26	-32.0	0.836
300	-10.94	-127.5	22.47	96.4	-29.11	64.5	-7.59	-30.9	0.958
400	-11.59	-142.1	20.23	90.5	-27.23	65.1	-8.33	-30.4	1.027
500	-11.95	-152.5	18.36	85.1	-25.53	65.1	-8.77	-30.4	1.063
600	-12.23	-159.5	16.78	80.8	-24.17	65.2	-8.97	-31.0	1.094
700	-12.29	-166.0	15.56	76.9	-22.96	65.0	-9.25	-31.8	1.107
800	-12.29	-172.7	14.48	73.1	-21.90	64.1	-9.16	-32.3	1.104
900	-12.43	-175.8	13.45	69.6	-21.00	64.1	-9.20	-33.1	1.119
1000	-12.28	179.5	12.60	66.5	-20.10	62.4	-9.18	-35.7	1.111
1100	-12.13	175.1	11.78	63.1	-19.36	61.5	-9.22	-37.1	1.114
1200	-12.24	170.7	11.09	59.6	-18.63	60.2	-9.29	-39.1	1.116
1300	-12.32	168.1	10.42	56.7	-17.93	59.0	-9.08	-40.7	1.106

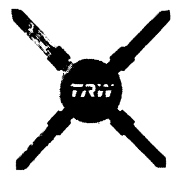


T-PAK

LT4704

Small Signal Low Noise Transistor for High Performance Receiver Applications

- Front End Amplifier
- Low Noise Oscillator
- High Frequency Multiplier
- Low Noise
- High Gain
- Wide Dynamic Range
- Plastic Package



X-PAK

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. A new process in wafer fabrication helps make this new transistor effective in applications up to 5.5 GHz, with a very wide dynamic range.

Utilizing ion implantation techniques coupled with arsenic emitters, the LT4704 sets new standards for low noise figure, high gain, and dynamic range. Gold metallization insures high reliability for low noise amplifier applications.

Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_C = .1mA	3			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	12			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
h_{FE}	DC Current Gain	V_{CE} = 5V I_E = 25mA	70	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1.0 MHz		.75		pF
NF_{min}	Minimum Noise Figure	f = .3 GHz V_{CE} = 8V f = .5 GHz I_C = 5mA f = 1.0 GHz		1.4 1.5 2.0	2.5	dB dB dB
G_{ANF}	Gain @ Associated Noise Figure	f = .3 GHz V_{CE} = 8V f = .5 GHz I_C = 5mA f = 1.0 GHz	15	23.0 19.0 13.0		dB dB dB
$[S_{21}]^2{}_E$	Common Emitter Insertion Gain	f = .3 GHz V_{CE} = 8V f = .5 GHz I_C = 25mA f = 1.0 GHz		24.0 20.0 14.0		dB dB dB
G_{Umax}	Maximum Unilateral Gain	f = .3 GHz V_{CE} = 8V f = .5 GHz I_C = 25mA f = 1.0 GHz		26.0 21.0 15.0		dB dB dB
F_T	Gain Bandwidth Product	V_{CE} = 8V I_C = 25mA		5.5		GHz

Absolute Maximum Ratings

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_S)
50mA	20V	150°C	-65°C to 150°C

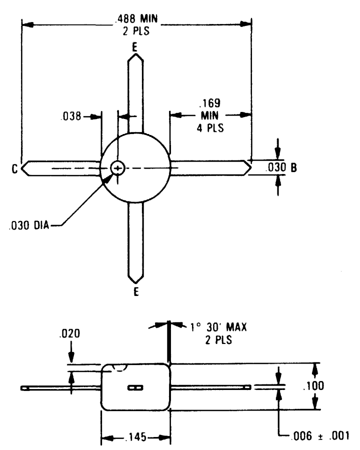
LT4704 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 5mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-1.35	- 38.0	24.61	154.8	-32.98	65.8	-0.74	-18.3	0.150
200	-2.31	- 69.4	23.00	134.1	-28.28	52.6	-2.11	-31.0	0.240
300	-3.28	- 93.4	21.17	118.7	-26.51	44.3	-3.59	-38.9	0.353
400	-4.01	-111.8	19.47	108.4	-25.49	39.0	-4.84	-43.7	0.459
500	-4.55	-125.3	17.96	99.9	-24.73	35.7	-5.82	-46.3	0.568
600	-4.94	-135.6	16.66	93.3	-24.49	34.8	-6.52	-47.9	0.676
700	-5.19	-144.6	15.46	87.5	-24.06	33.4	-7.13	-50.0	0.770
800	-5.43	-151.9	14.40	82.5	-23.68	32.7	-7.47	-50.8	0.856
900	-5.55	-156.9	13.39	77.8	-23.26	32.5	-7.73	-52.1	0.931
1000	-5.63	-162.8	12.58	73.8	-22.82	32.4	-7.93	-54.5	0.975
1100	-5.70	-167.6	11.88	69.5	-22.66	31.9	-8.08	-55.7	1.046
1200	-5.77	-172.3	11.16	65.5	-22.26	32.0	-8.19	-57.8	1.090
1300	-5.87	-175.8	10.48	62.1	-21.87	32.3	-8.16	-59.2	1.129

V_{CE} = 8V, I_C = 25mA

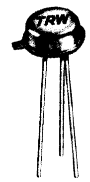
Frequency (MHz)	S11		S21		S12		S22		k
100	-4.26	- 81.3	31.15	132.8	-36.04	51.7	- 3.15	-35.7	0.345
200	-5.18	-121.6	27.18	111.2	-33.20	45.6	- 6.55	-46.4	0.581
300	-5.63	-141.7	24.26	99.3	-31.42	45.8	- 8.75	-48.9	0.763
400	-5.76	-154.0	21.93	92.5	-30.13	47.7	-10.16	-49.5	0.894
500	-5.84	-162.1	20.12	86.9	-28.97	49.9	-11.08	-49.2	0.986
600	-5.94	-167.9	18.51	82.1	-28.04	49.3	-11.59	-49.0	1.077
700	-5.93	-172.8	17.25	78.1	-27.07	50.9	-12.05	-50.4	1.118
800	-5.97	-177.1	16.14	74.2	-26.34	51.0	-12.16	-50.1	1.167
900	-5.97	-179.7	15.11	70.7	-25.44	51.9	-12.25	-50.7	1.185
1000	-5.94	176.7	14.22	67.4	-24.68	50.2	-12.32	-52.9	1.197
1100	-5.90	173.9	13.39	63.9	-24.05	50.2	-12.28	-54.4	1.217
1200	-5.88	170.5	12.71	60.6	-23.71	49.6	-12.30	-56.0	1.256
1300	-5.92	169.1	12.10	57.5	-22.75	49.6	-12.04	-57.2	1.210



X-PAK

Small Signal Low Noise Transistor for High Performance Receiver Applications

- Front End Amplifier
- Low Noise Oscillator
- High Frequency Multiplier
- Low Noise
- High Gain
- Wide Dynamic Range



TO-46 Package

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers.

A new process in wafer fabrication helps make this new transistor effective in applications up to 6 GHz, with a very wide dynamic range.

Utilizing ion implantation techniques coupled with arsenic emitters, the LT4746 sets new standards for low noise figure, high gain, and wide dynamic range. Gold metallization insures high reliability for low noise amplifier applications.

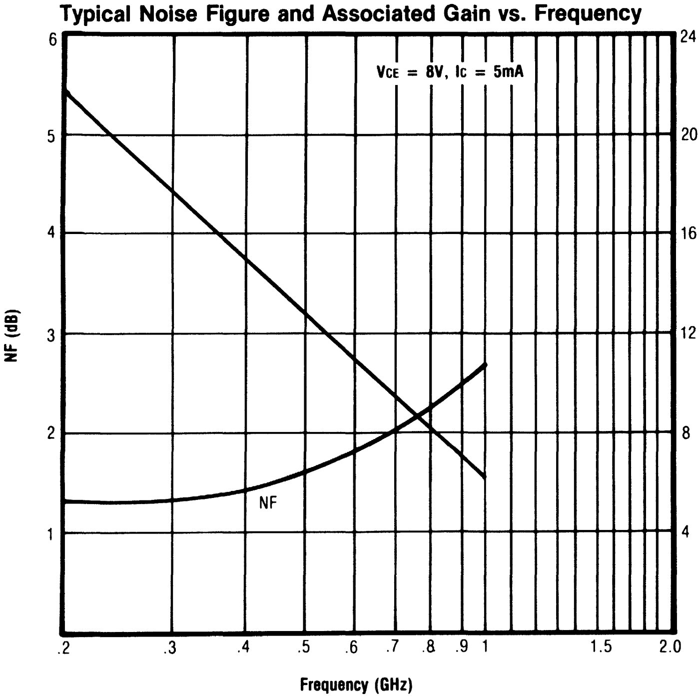
Electrical Characteristics (T_{CASE} = 25°C)

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_C = .1mA	3			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	12			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 25mA	70	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1.0 MHz		1.0		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 5mA f = 300 MHz f = 500 MHz f = 1000 MHz		1.3 1.6 2.7		dB dB dB
G_{ANF}	Gain @ Associated Noise Figure	V_{CE} = 8V, I_C = 5mA f = 300 MHz f = 500 MHz f = 1000 MHz		18.0 11.5 6.5		dB dB dB
$[S_{21}]_E^2$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 25mA f = 300 MHz f = 500 MHz f = 1000 MHz		16.5 12.5 7.0		dB dB dB
$G_{U(max)}$	Maximum Unilateral Gain	V_{CE} = 8V, I_C = 25mA f = 300 MHz f = 500 MHz f = 1000 MHz		17.0 13.0 7.5		dB dB dB
F_t	Gain Bandwidth Product	V_{CE} = 8V I_C = 25mA		6.0		GHz

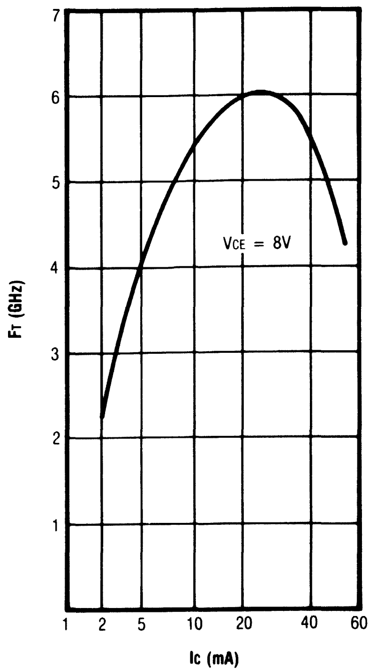
Absolute Maximum Ratings

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_S)
50mA	20V	200°C	−65°C to 200°C

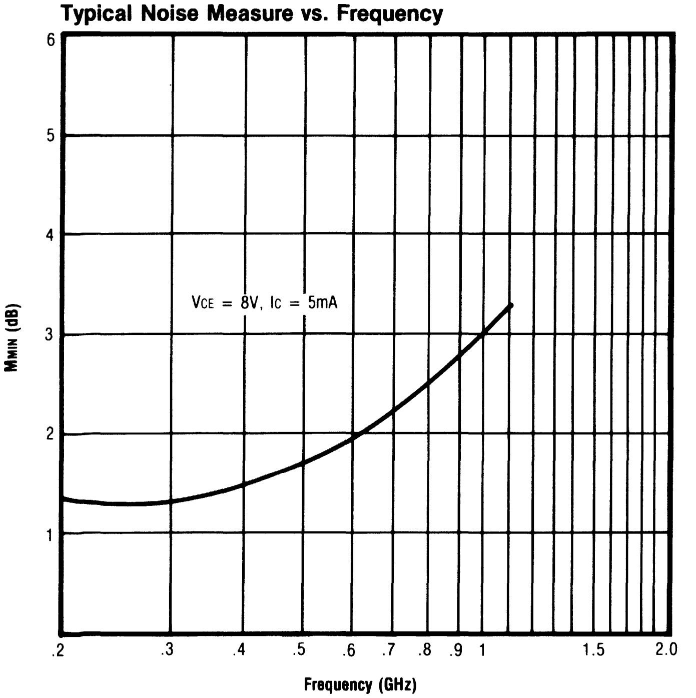
Typical Noise Figure and Associated Gain vs. Frequency



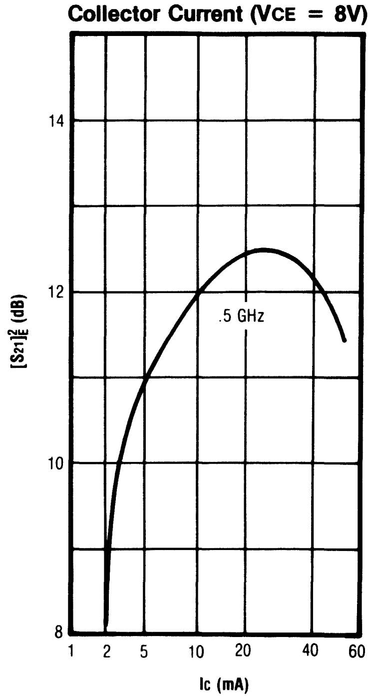
Gain Bandwidth Product vs. Collector Current



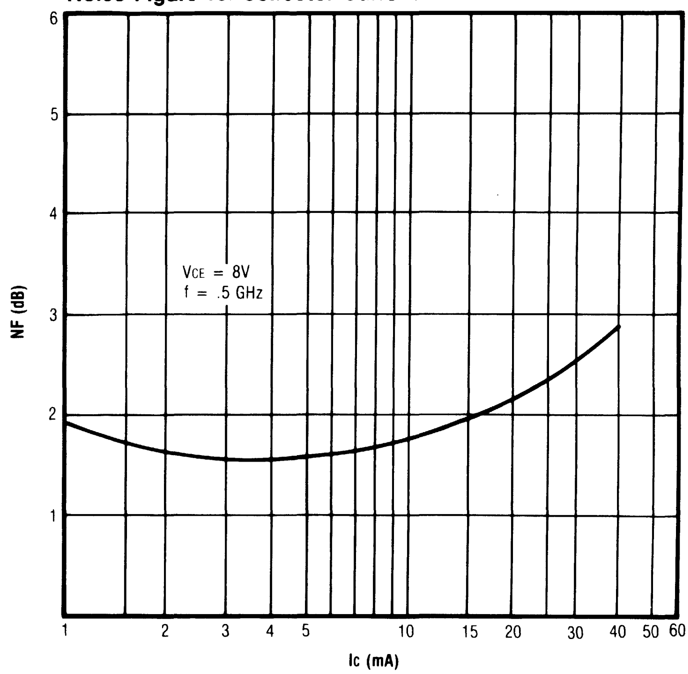
Typical Noise Measure vs. Frequency



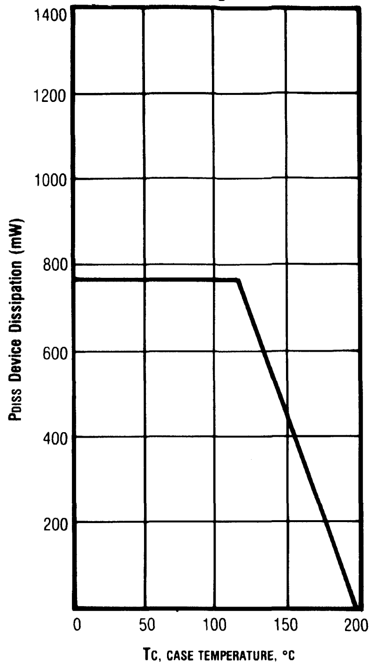
Insertion Gain vs. Collector Current (VCE = 8V)



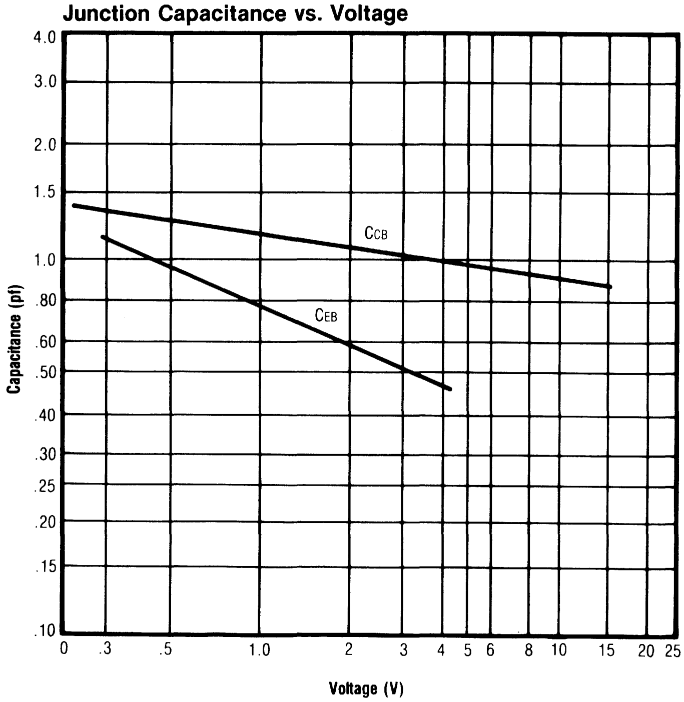
Noise Figure vs. Collector Current



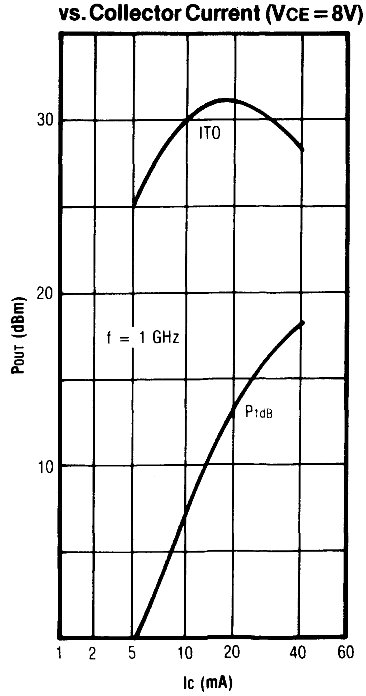
Device Dissipation Operating Range



Junction Capacitance vs. Voltage



Typical Third Order Intercept vs. Collector Current (VCE = 8V)



LT4746 S PARAMETERS

S-dB and Angles:
VCE = 8V, IC = 5mA

Frequency (MHz)	S11		S21		S12		S22		k
100	− 2.59	−40.1	20.17	139.2	−24.64	66.8	− 2.27	−33.3	0.358
200	− 6.05	−64.3	17.28	118.1	−21.02	61.7	− 5.20	−47.8	0.627
300	− 8.99	−80.1	14.68	106.5	−19.12	62.7	− 7.36	−53.2	0.813
400	−11.50	−90.4	12.60	99.0	−17.68	65.4	− 8.84	−55.8	0.941
500	−13.74	−99.7	10.95	94.0	−16.47	68.4	− 9.84	−56.6	1.025
600	−15.60	−108.9	9.53	89.4	−15.45	70.5	−10.61	−57.4	1.090
700	−17.56	−116.6	8.38	86.2	−14.47	72.8	−11.10	−58.7	1.128
800	−19.19	−126.7	7.50	83.5	−13.63	74.8	−11.41	−59.5	1.146
900	−20.86	−140.4	6.62	81.0	−12.88	76.7	−11.61	−60.1	1.169
1000	−22.84	−153.2	5.89	79.5	−12.22	79.0	−12.03	−61.4	1.190
1100	−22.60	−165.0	5.25	78.2	−11.70	81.1	−12.38	−62.2	1.207
1200	−22.39	170.8	4.59	77.6	−11.19	83.4	−12.48	−65.4	1.227

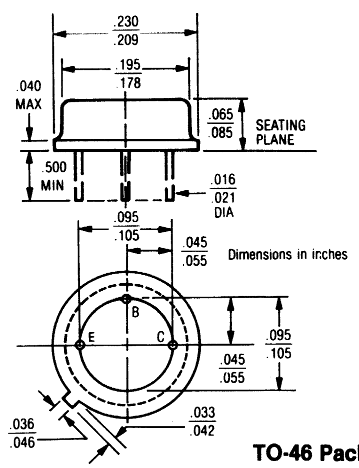
VCE = 8V, IC = 25mA

Frequency (MHz)	S11		S21		S12		S22		k
100	− 8.38	−70.8	23.92	115.8	−27.49	68.7	− 6.46	−47.0	0.733
200	−13.65	−96.8	19.76	101.8	−23.04	72.8	−10.39	−51.1	0.927
300	−16.74	−117.5	16.53	95.3	−20.17	75.9	−12.39	−50.3	0.997
400	−19.03	−135.2	14.22	91.0	−18.06	77.7	−13.58	−48.9	1.032
500	−20.61	−155.5	12.35	88.0	−16.37	79.3	−14.31	−47.5	1.055
600	−21.01	−173.0	10.92	85.0	−15.06	79.8	−14.72	−47.0	1.067
700	−21.62	168.6	9.77	82.9	−13.88	80.7	−15.04	−47.2	1.073
800	−21.18	154.5	8.78	81.2	−12.85	81.5	−15.13	−47.8	1.073
900	−20.13	142.6	7.85	79.4	−12.09	82.2	−15.11	−48.1	1.082
1000	−19.75	130.3	7.11	78.5	−11.32	83.6	−15.50	−48.6	1.086
1100	−18.95	129.5	6.44	77.7	−10.79	84.8	−15.94	−49.2	1.094
1200	−17.19	121.8	5.77	77.6	−10.25	86.3	−16.12	−52.6	1.101

NOISE PARAMETERS

Freq.	N.F. OPT	Γs OPT	Rn
0.3 GHz	1.3 dB	.452 / +39°	.81Ω
0.5 GHz	1.6 dB	.385 / +36°	.32Ω
0.7 GHz	2.0 dB	.153 / +94°	.38Ω
1.0 GHz	2.7 dB	.186 / +97°	.88Ω

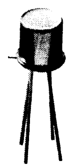
Reflection coefficient of source and the noise resistance at optimum noise figure for VCE = 8V, IC = 5mA



TO-46 Package

Small Signal Low Noise Transistor for High Performance Receiver Applications

- **Front End Amplifier**
- **Low Noise Oscillator**
- **High Frequency Multiplier**
- **Low Noise**
- **High Gain**
- **Wide Dynamic Range**



TO-72 Package

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers.

A new process in wafer fabrication helps make this new transistor effective in applications up to 6 GHz, with a very wide dynamic range.

Utilizing ion implantation techniques coupled with arsenic emitters, the LT4772 sets new standards for low noise figure, high gain, and wide dynamic range. Gold metallization insures high reliability for low noise amplifier applications.

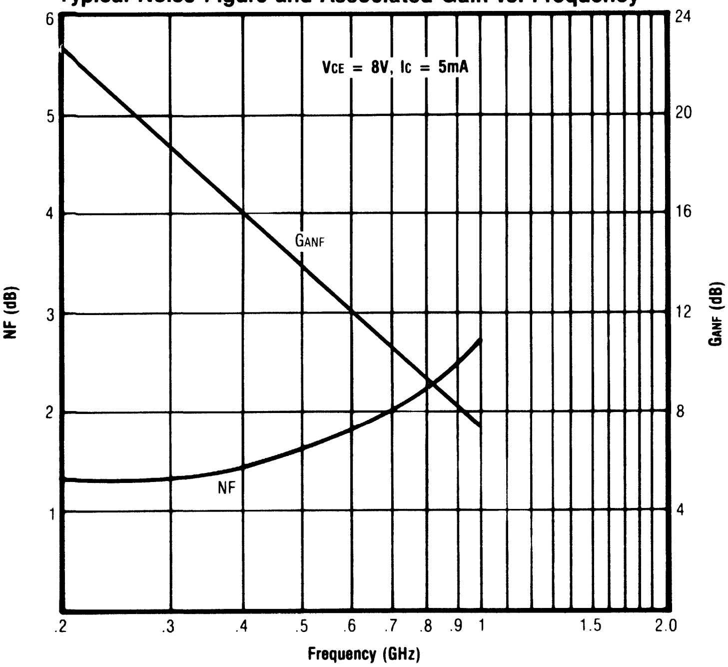
Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = .1mA	3			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	12			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 25mA	70	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1.0 MHz		.5		pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 5mA; f = 300 MHz f = 500 MHz f = 1000 MHz		1.3 1.6 2.7		dB dB dB
G_{ANF}	Gain @ Associated Noise Figure	V_{CE} = 8V, I_C = 5mA; f = 300 MHz f = 500 MHz f = 1000 MHz		19.0 13.0 7.5		dB dB dB
$[S_{21}]_E^2$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 25mA; f = 300 MHz f = 500 MHz f = 1000 MHz		17.0 13.0 7.0		dB dB dB
$G_{U(max)}$	Maximum Unilateral Gain	V_{CE} = 8V, I_C = 25mA; f = 300 MHz f = 500 MHz f = 1000 MHz		19.0 14.5 8.5		dB dB dB
F_t	Gain Bandwidth Product	V_{CE} = 8V I_C = 25mA		6.0		GHz

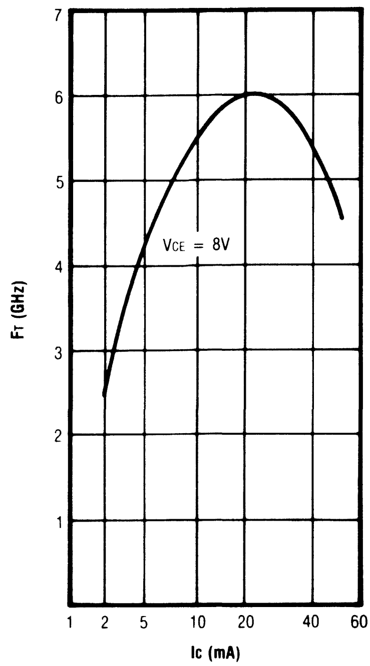
Absolute Maximum Ratings

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_S)
50mA	20V	200 °C	− 65 °C to 200 °C

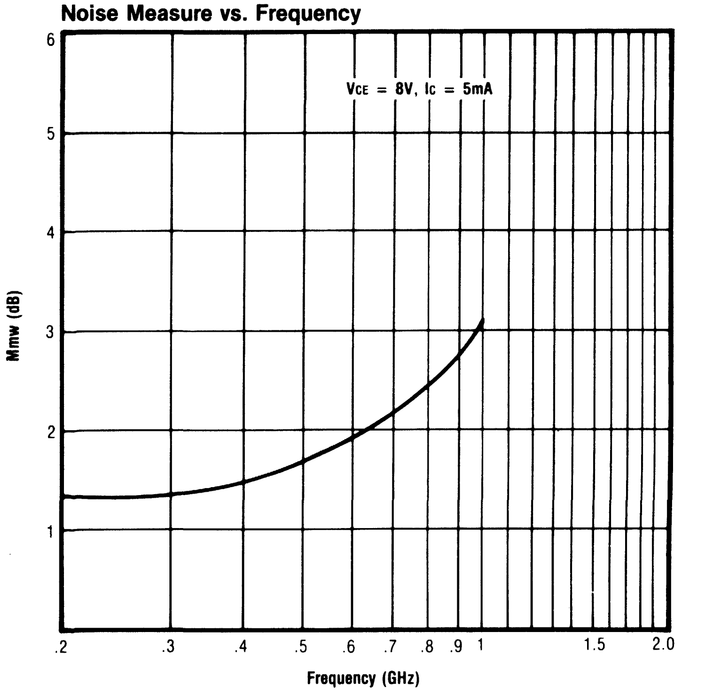
Typical Noise Figure and Associated Gain vs. Frequency



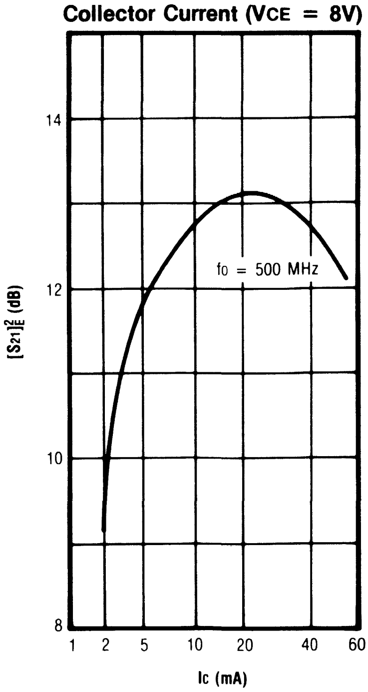
Gain Bandwidth Product vs. Collector Current



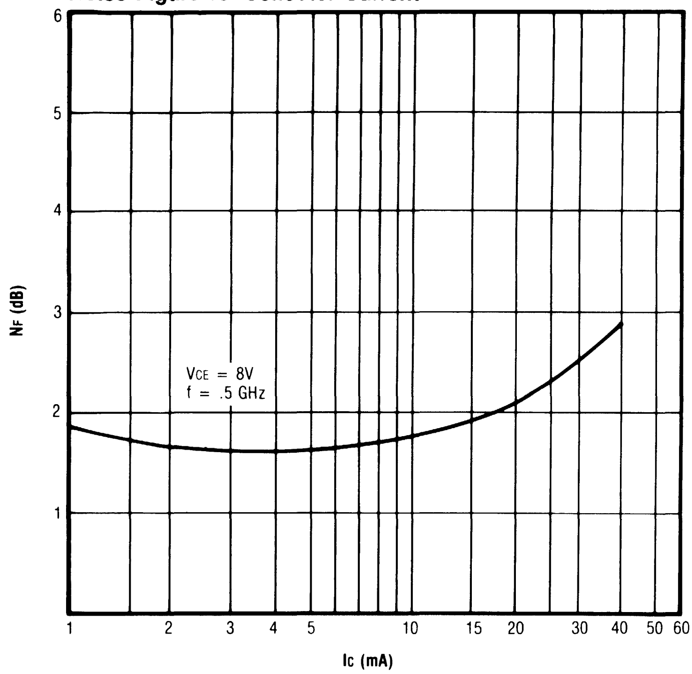
Noise Measure vs. Frequency



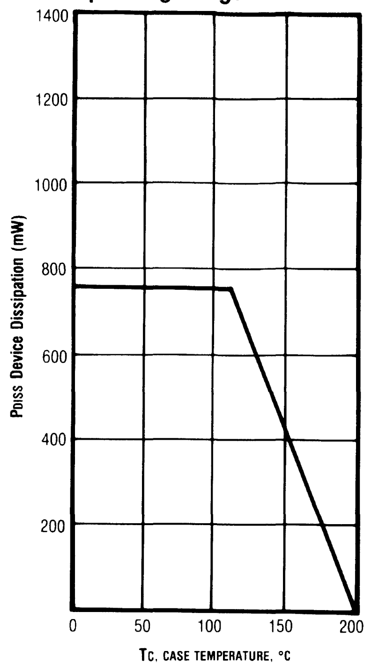
Insertion Gain vs. Collector Current (VCE = 8V)



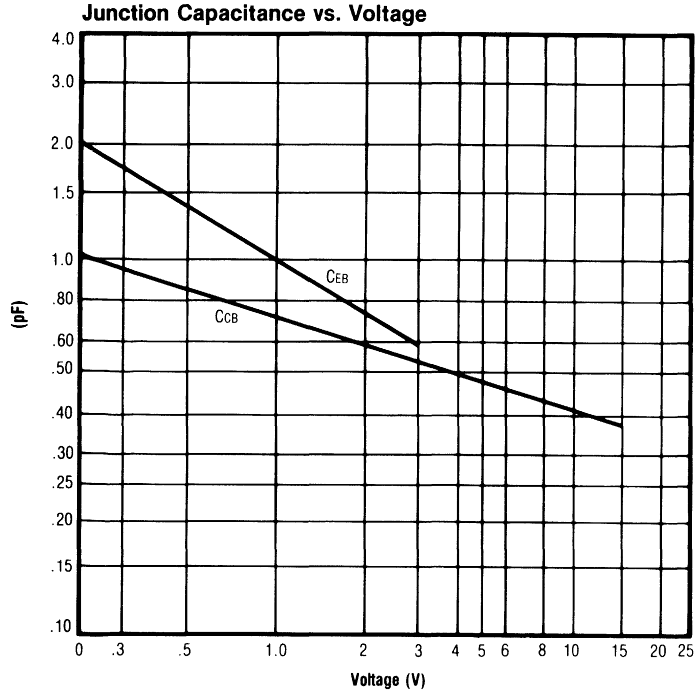
Noise Figure vs. Collector Current



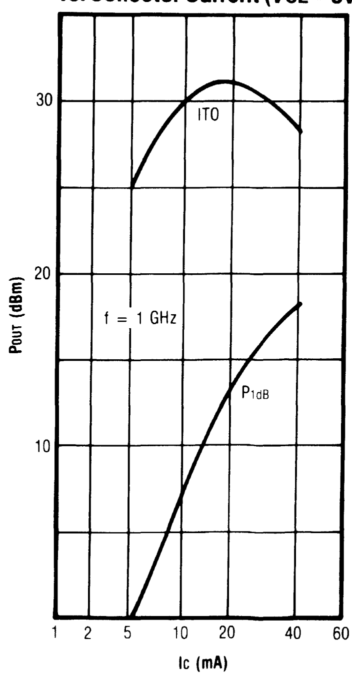
Device Dissipation Operating Range



Junction Capacitance vs. Voltage



Typical Third Order Intercept vs. Collector Current (VCE = 8V)



LT4772 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 25mA

Frequency (MHz)	S11		S21		S12		S22		k
100	− 6.45	−35.8	24.14	116.4	−30.87	75.8	−3.93	−19.3	0.847
200	− 9.83	−36.1	20.29	101.4	−25.81	77.1	−5.42	−17.4	0.974
300	−11.46	−34.1	17.08	93.8	−22.72	77.7	−5.93	−15.8	1.025
400	−12.26	−30.9	14.70	88.3	−20.48	77.6	−6.08	−15.0	1.049
500	−12.82	−27.8	12.89	84.2	−18.83	77.5	−6.15	−14.8	1.066
600	−13.02	−26.9	11.38	79.9	−17.50	76.4	−6.10	−15.6	1.077
700	−12.88	−25.3	10.15	76.4	−16.50	75.6	−6.02	−16.8	1.089
800	−12.73	−25.7	9.06	73.2	−15.57	74.6	−5.89	−18.2	1.094
900	−12.60	−26.6	7.99	69.9	−15.00	73.9	−5.71	−20.3	1.117
1000	−12.07	−27.8	7.15	67.3	−14.52	73.2	−5.54	−22.1	1.134
1100	−11.76	−32.0	6.32	64.4	−14.11	72.4	−5.35	−23.7	1.151
1200	−11.37	−33.6	5.42	61.5	−14.02	71.6	−5.17	−27.9	1.199

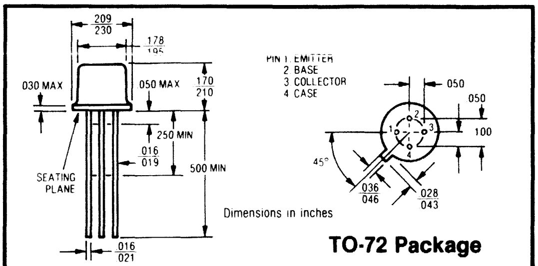
V_{CE} = 8V, I_C = 5mA

Frequency (MHz)	S11		S21		S12		S22		k
100	− 2.29	−29.5	20.86	139.7	−29.35	73.0	−1.64	−18.0	0.468
200	− 5.22	−44.0	18.07	118.2	−24.93	69.4	−3.40	−23.1	0.742
300	− 7.65	−50.4	15.51	105.9	−22.49	69.8	−4.47	−23.2	0.905
400	− 9.52	−51.5	13.56	97.4	−20.62	70.8	−5.02	−22.7	0.995
500	−10.84	−50.4	11.81	91.4	−19.21	71.9	−5.35	−22.1	1.062
600	−11.82	−49.8	10.41	85.3	−18.07	71.9	−5.48	−22.3	1.104
700	−12.46	−46.7	9.19	81.3	−17.06	72.2	−5.53	−23.0	1.135
800	−12.81	−45.8	8.12	77.3	−16.31	72.3	−5.50	−24.2	1.162
900	−13.00	−44.5	7.21	73.4	−15.63	72.3	−5.38	−25.5	1.177
1000	−12.78	−43.2	6.33	70.3	−15.15	72.4	−5.28	−27.1	1.205
1100	−12.53	−45.4	5.54	67.0	−14.82	72.4	−5.15	−28.5	1.235
1200	−12.27	−45.4	4.66	63.9	−14.73	72.2	−4.99	−32.2	1.295

NOISE PARAMETERS

Freq.	N.F. OPT	Γs OPT	Rn
0.3 GHz	1.3 dB	.468 / +36°	.78Ω
0.5 GHz	1.6 dB	.412 / +66°	.130Ω
0.7 GHz	2.0 dB	.120 / +51°	.720Ω
1.0 GHz	2.7 dB	.237 / +58°	.8Ω

Reflection coefficient of source and the noise resistance at optimum noise figure for V_{CE} = 8V, I_C = 5mA

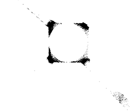


TO-72 Package

TRW

Small Signal Low Noise Transistor for High Performance Receiver Applications

- Front End Amplifier
- Low Noise Oscillator
- High Frequency Multiplier
- Low Noise
- High Gain
- Wide Dynamic Range
- Low Cost Package



85 MIL Package

The prime applications of this Silicon NPN transistor include satellite down conversion links, microwave radio relay communication links, ECM receivers, oscillators, mixers, and multipliers. A new process in wafer fabrication helps make this new transistor effective in applications up to 6 GHz, with a very wide dynamic range.

Utilizing ion implantation techniques coupled with arsenic emitters, the LT4785 sets new standards for low noise figure, high gain, and wide dynamic range. Gold metallization insures high reliability for low noise amplifier applications.

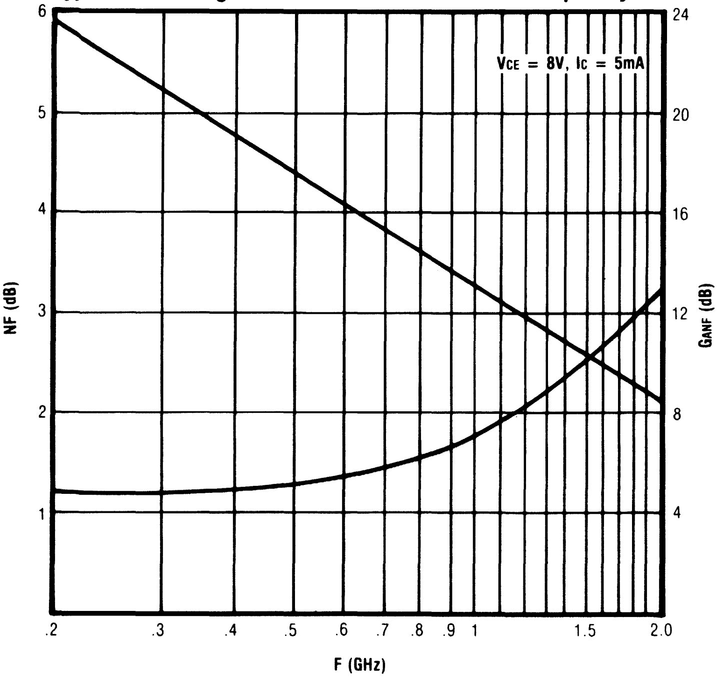
Electrical Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = .1mA	3			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 1mA	12			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 10V			1	μA
h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 25mA	70	150	300	
C_{CB}	Collector-Base Capacitance	V_{CB} = 8V f = 1 MHz			.6	pF
NF_{min}	Minimum Noise Figure	V_{CE} = 8V, I_C = 5mA f = .5 GHz f = 1.0 GHz f = 2.0 GHz		1.4 1.8 3.2	 2.7 	dB dB dB
G_{ANF}	Gain @ Associated Noise Figure	V_{CE} = 8V, I_C = 5mA f = .5 GHz f = 1.0 GHz f = 2.0 GHz		18 13 9		dB dB dB
$[S_{21}]_E^2$	Common Emitter Insertion Gain	V_{CE} = 8V, I_C = 25mA f = .5 GHz f = 1.0 GHz f = 2.0 GHz	12	21 14 9		dB dB dB
$G_{U(max)}$	Maximum Unilateral Gain	V_{CE} = 8V, I_C = 25mA f = .5 GHz f = 1.0 GHz f = 2.0 GHz		23 18 12		dB dB dB
F_t	Gain Bandwidth Product	V_{CE} = 8V I_C = 25mA		6.0		GHz
F_{max}	Maximum Oscillation Frequency	V_{CE} = 8V I_C = 25mA		7.0		GHz

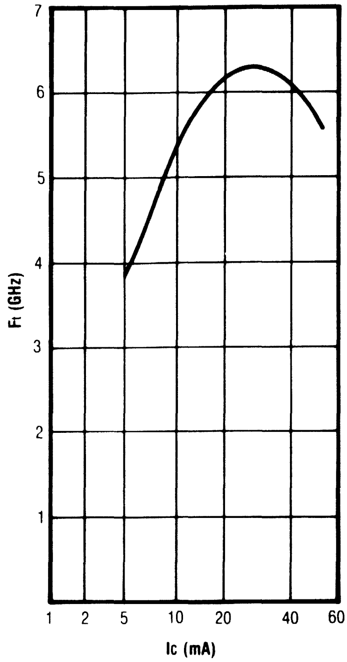
Absolute Maximum Ratings

Collector Current (I_C)	Collector Base Voltage (V_{CBO})	Junction Temperature (T_J)	Storage Temperature (T_S)
50mA	20V	200°C	−65°C to 200°C

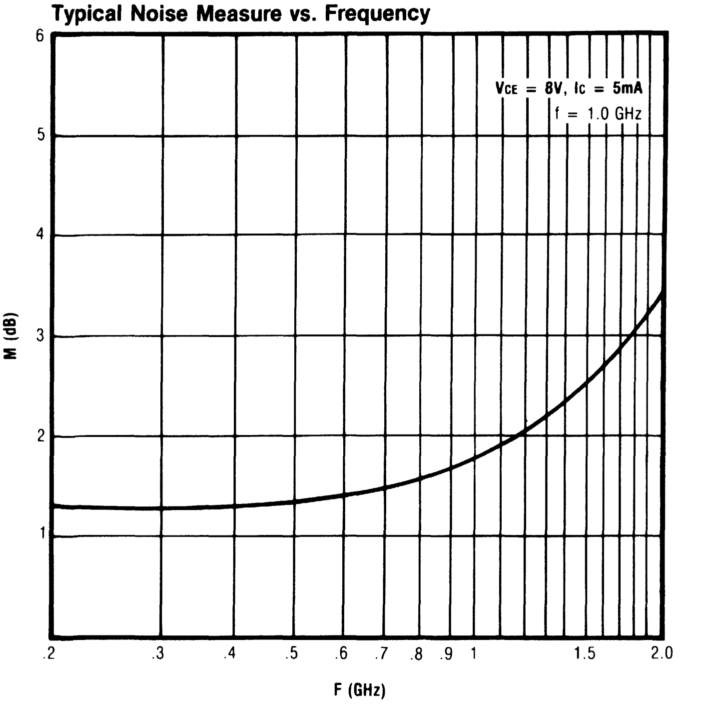
Typical Noise Figure and Associated Gain vs. Frequency



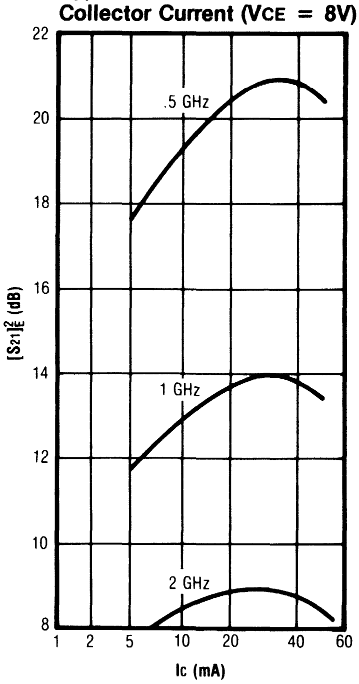
Typical Gain Bandwidth Product vs. Collector Current



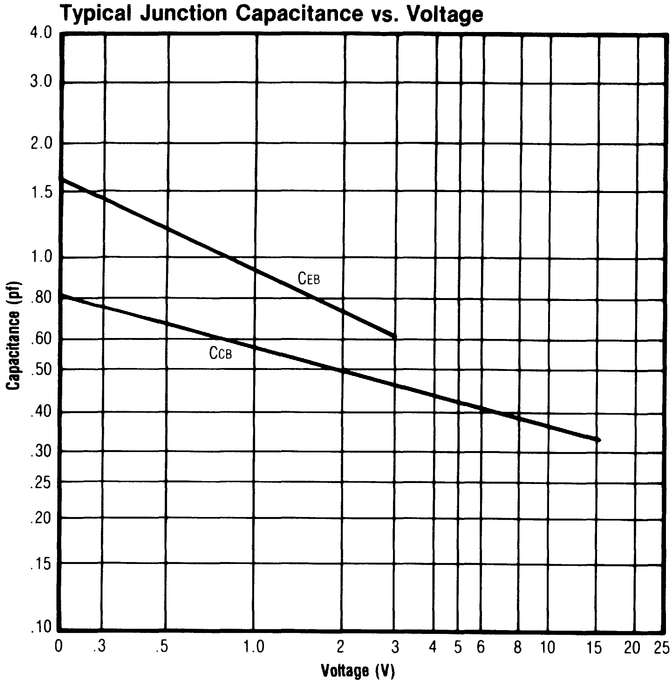
Typical Noise Measure vs. Frequency



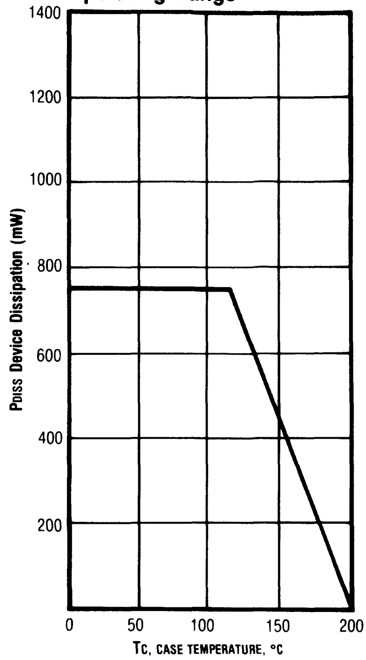
Typical Insertion Gain vs. Collector Current (VCE = 8V)



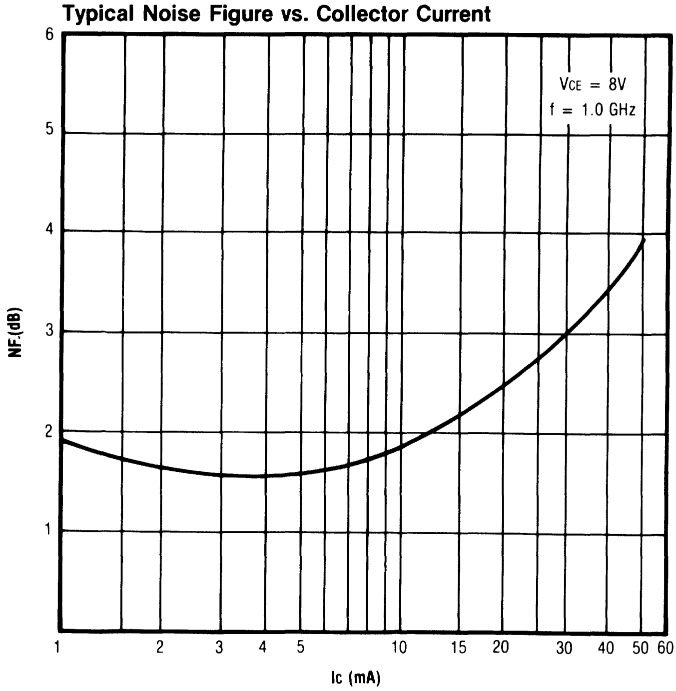
Typical Junction Capacitance vs. Voltage



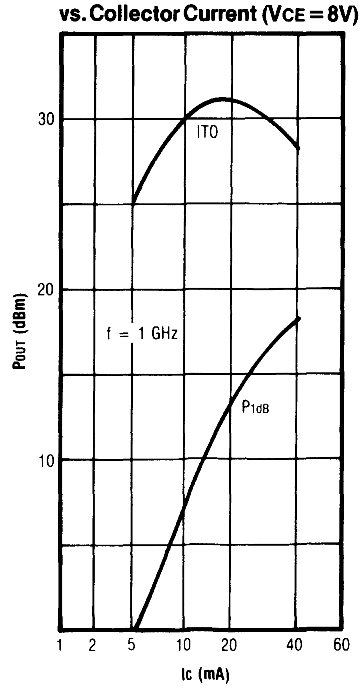
Device Dissipation Operating Range



Typical Noise Figure vs. Collector Current



Typical Third Order Intercept vs. Collector Current (VCE = 8V)



LT4785 S PARAMETERS

S-dB and Angles:
V_{CE} = 8V, I_C = 5mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-1.66	- 30.8	23.09	158.3	-35.29	73.6	-0.40	-11.4	0.12296
150	-1.93	- 44.8	22.59	150.5	-31.51	66.7	-0.80	-15.9	0.16351
200	-2.27	- 57.8	21.92	142.5	-29.98	59.9	-1.31	-20.0	0.21372
250	-2.59	- 69.5	21.27	135.2	-28.51	54.9	-1.74	-23.5	0.25036
400	-3.78	- 94.9	19.31	117.3	-25.39	44.6	-3.35	-32.6	0.41710
500	-4.29	-108.7	18.05	111.9	-24.54	41.0	-4.07	-35.5	0.46678
600	-4.64	-120.9	16.85	103.7	-24.03	37.6	-4.86	-38.6	0.55285
700	-4.88	-131.3	15.87	97.5	-23.66	35.8	-5.47	-38.3	0.63119
800	-5.03	-140.0	14.93	92.9	-23.25	33.8	-5.87	-40.8	0.68006
900	-5.18	-148.8	13.94	87.1	-23.01	32.6	-6.56	-42.2	0.77854
1000	-5.27	-155.6	13.13	82.8	-22.66	31.8	-6.76	-44.0	0.82379
1100	-5.33	-161.3	12.41	78.7	-22.54	31.2	-7.13	-45.0	0.89734
1200	-5.38	-166.7	11.69	75.0	-22.15	29.5	-7.33	-45.5	0.94707
1300	-5.40	-171.6	11.04	71.4	-22.01	29.1	-7.69	-47.3	1.01646
1400	-5.43	-176.1	10.44	68.3	-21.78	29.6	-7.84	-47.8	1.06567
1500	-5.45	179.6	9.82	64.7	-21.61	27.8	-7.99	-50.3	1.12571
1600	-5.52	176.2	9.27	62.1	-21.31	28.2	-8.24	-51.6	1.17890
1700	-5.40	172.1	8.91	58.7	-21.07	27.7	-8.36	-53.0	1.18306
1800	-5.35	168.6	8.29	56.3	-20.99	27.5	-8.50	-55.0	1.25181
1900	-5.17	165.9	7.92	52.2	-20.72	25.8	-8.63	-56.2	1.25083
2000	-5.11	162.8	7.48	49.4	-20.54	25.8	-8.73	-59.2	1.27915

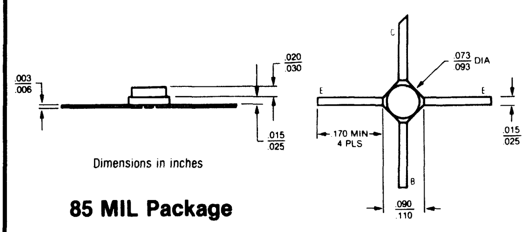
V_{CE} = 8V, I_C = 25mA

Frequency (MHz)	S11		S21		S12		S22		k
100	-4.97	- 73.4	30.95	138.8	-37.97	61.8	-2.08	-24.3	0.30224
150	-5.10	- 97.1	29.36	127.4	-35.47	55.3	-3.36	-29.5	0.38452
200	-5.32	-113.8	27.72	118.3	-34.70	50.5	-4.56	-32.3	0.51063
250	-5.39	-126.3	26.31	111.6	-33.75	49.4	-5.53	-33.3	0.59464
400	-5.69	-146.0	23.09	97.8	-30.80	46.5	-8.58	-42.2	0.79839
500	-5.77	-156.0	21.30	94.2	-29.85	48.7	-9.56	-42.2	0.89948
600	-5.75	-163.2	19.77	88.6	-29.08	49.6	-10.38	-42.2	0.99471
700	-5.72	-169.0	18.52	84.1	-28.31	50.1	-10.92	-40.6	1.06017
800	-5.70	-173.8	17.42	81.0	-27.46	50.6	-11.37	-41.4	1.09704
900	-5.62	-178.7	16.38	76.4	-26.91	50.9	-11.84	-41.8	1.15753
1000	-5.60	177.4	15.50	74.0	-26.20	50.8	-12.05	-43.1	1.18020
1100	-5.56	174.0	14.67	70.8	-25.60	50.9	-12.31	-43.3	1.21201
1200	-5.54	170.8	13.82	67.6	-25.06	50.3	-12.49	-43.6	1.25336
1300	-5.49	167.7	13.10	64.8	-24.52	49.6	-12.79	-45.0	1.27884
1400	-5.45	164.8	12.47	62.5	-24.02	49.7	-12.94	-45.8	1.29471
1500	-5.38	162.1	11.84	59.5	-23.56	48.2	-13.11	-48.0	1.31434
1600	-5.28	160.6	11.27	57.8	-23.07	48.5	-13.34	-49.5	1.31675
1700	-5.13	157.6	10.84	54.6	-22.67	47.3	-13.48	-50.9	1.30258
1800	-5.04	155.4	10.22	52.6	-22.37	46.9	-13.65	-53.0	1.33810
1900	-4.96	153.0	9.83	49.1	-21.98	44.8	-13.81	-54.4	1.32968
2000	-4.87	150.9	9.32	46.8	-21.69	44.4	-13.95	-57.2	1.34888

NOISE PARAMETERS

Freq.	N.F. OPT	Γs OPT	Rn
0.5 GHz	1.4 dB	.230 /85°	.70Ω
1.0 GHz	1.8 dB	.345 /92°	.59Ω
1.5 GHz	2.5 dB	.341 / -165°	.37Ω
2.0 GHz	3.2 dB	.335 / -140°	1.08Ω

Reflection coefficient of source and the noise resistance at optimum noise figure for V_{CE} = 8V, I_C = 5mA



85 MIL Package

TRW Electronic Components Group

TRW

Printed Circuit Division
200 South Turnbull Canyon Road
City of Industry, California 91749
Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
4243 Campus Point Court
San Diego, California 92121
Phone: 714/457-1000

Products: Data converters, arithmetic products, and special processors.

Optoelectronics Division
1201 Tappan Circle
Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

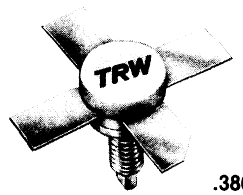
Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

Linear SSB RF Transistors

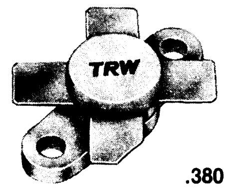
These transistors are designed for linear Single Sideband service in the 1.5-30MHz frequency range (broad band). All are rated CW or P.E.P. with guaranteed −32dB intermodulation distortion. Three series are offered for operation at V_{CC}'s of 12.5, 28 and 50V. All are offered in the popular "SOE" flange package. Alternate packages available on special order (consult factory). All are designed to tolerate ∞ VSWR without damage.

SSB Power Transistors

- 15 to 100 Watts (PEP)
- 13.5 V_{CC}
- 2 to 30 MHz
- Class A, AB & C Operation
- Diffused Ballast Resistors
- High Gain
- Common Emitter
- Isolated Packages
- ∞ VSWR
- Linear Capability



.380 SOE



.380 SOE F

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

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	PT 9795/A	PT 9796/A	PT 9797/A	PT 9784/A	PT 9785	PT 9847	UNIT
DC TEST	BV_{CBO}	Collector-Base Breakdown	I_C = 50mA I_C = 100mA I_C = 200mA	50	50	50	40	40	45	V Min
	BV_{EBO}	Emitter-Base Breakdown	I_E = 2mA I_E = 4mA I_E = 5mA I_E = 6mA I_E = 10mA	4.0	4.0	4.0	4.0	4.0	4.0	V Min
	I_{CES}	Collector-Emitter Cutoff Current	V_{CE} = 13.5V	4	10	10	10	20	10	mA Max
	h_{FE}	DC Current Gain	V_{CE} = 5V 500mA, 1A, 2A	25-150	25-150	25-150	25-150	20-100	40-120	–
	Δh_{FE}	Matched Pairs	I_C = 1A, 500mA, 2A	Δ 10	Δ 10	Δ 10	Δ 5	Δ 5	–	–
RF TEST	P_{OUT}	Output Power PEP	V_{CE} = 13.5V f = 28MHz	15	30	50	75	100	100	W PEP
	P_G	Power Gain	V_{CE} = 13.5V f = 28MHz P_{OUT} = Rated PEP	15	15	14.5	15	13	13	dB Min
	IMD	Typical Intermodulation Distortion	V_{CE} = 13.5V f = 28MHz P_{OUT} = Rated PEP	-32	-32	-32	-32	-32	-32	dB Typ
	VSWR	Mismatch Tolerance	V_{CE} = 13.5V f = 28MHz P_{OUT} = Rated PEP	∞	∞	∞	∞	∞	∞	–

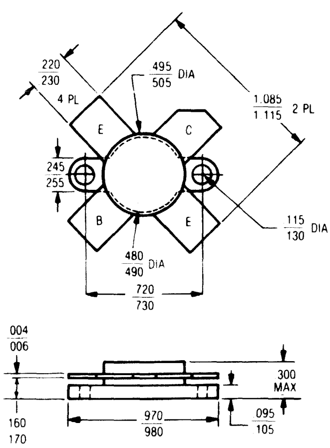
13.5V SERIES

Absolute Maximum Ratings (T_{CASE} = 25°C)

PART NUMBER	V_{CBO} VOLTS	V_{CEO} VOLTS	V_{EBO} VOLTS	I_C MAX AMPS	P_T W	θ_{JC} °C/W	$T_{STORAGE}$ °C
PT9795	50	20.0	4.0	4.0	35	5.0	-65 to 150
PT9795A	50	20.0	4.0	4.0	35	5.0	-65 to 150
PT9796	50	20.0	4.0	8.0	70	2.5	-65 to 150
PT9796/A	50	20.0	4.0	8.0	63	2.8	-65 to 150
PT9797	50	20.0	4.0	12.0	117	1.5	-65 to 150
PT9797/A	50	20.0	4.0	12.0	76	2.3	-65 to 150
PT9784	40	20.0	4.0	15.0	200	0.87	-65 to 150
PT9784/A	40	20.0	4.0	15.0	175	1.75	-65 to 150
PT9785	40	20.0	4.0	25.0	350	0.5	-65 to 150
PT9847	45	18.0	4.0	20.0	200	0.87	-65 to 150
The "A" suffix on part number denotes stud package.							

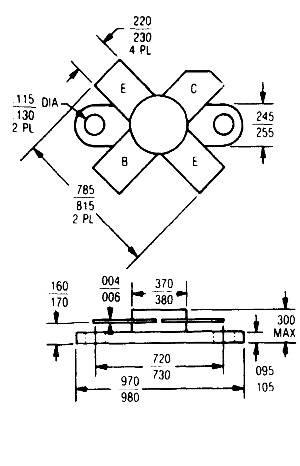
PT 9785

.500 SOE F



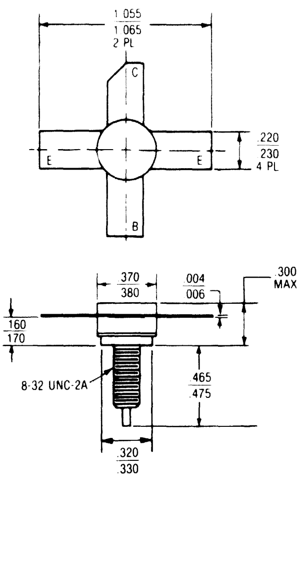
PT 9795
PT 9796
PT 9797
PT 9784
PT 9847

.380 SOE F



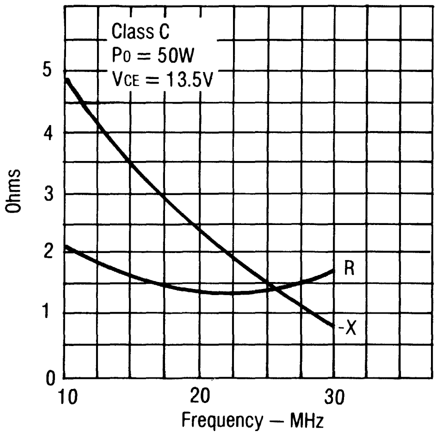
PT 9795A
PT 9796A
PT 9797A
PT 9784A

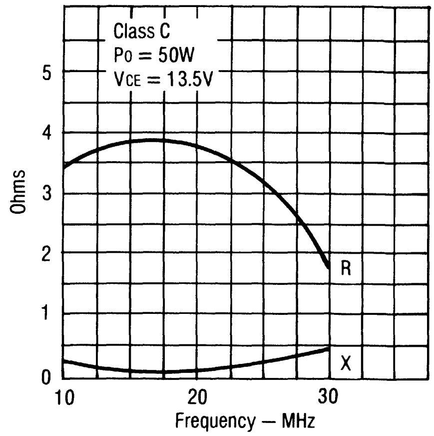
.380 SOE



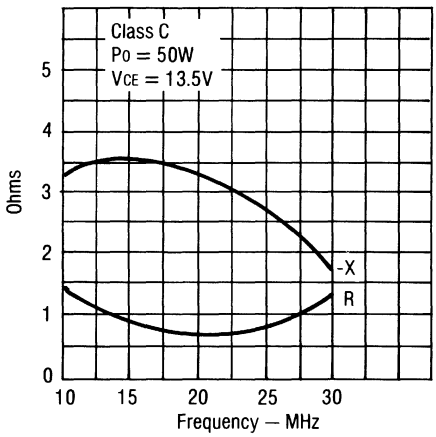
13.5V SERIES

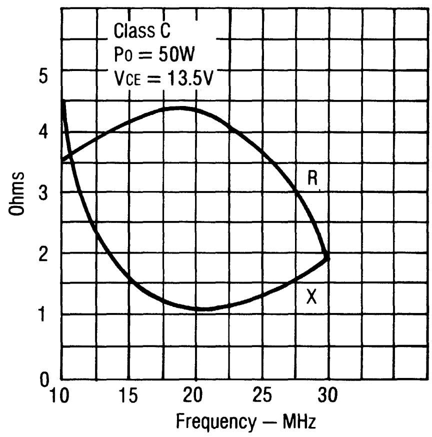
Series Input Impedance PT9797/A Series Load Impedance



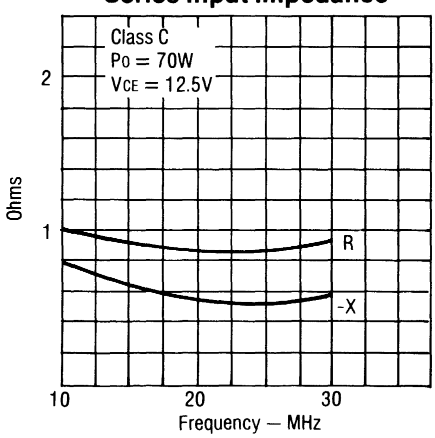


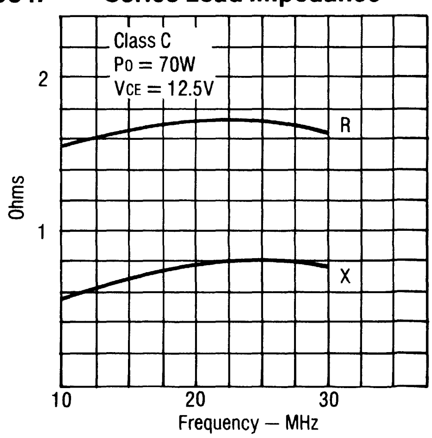
Series Input Impedance PT9784/A Series Load Impedance



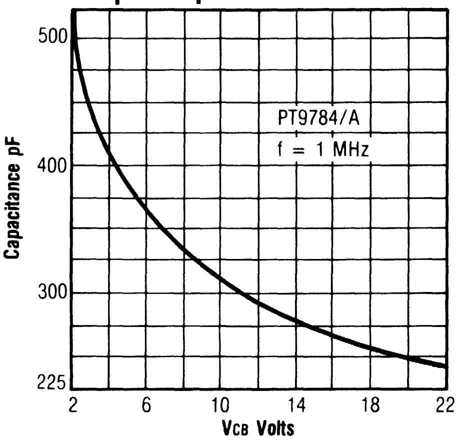


Series Input Impedance PT9847 Series Load Impedance

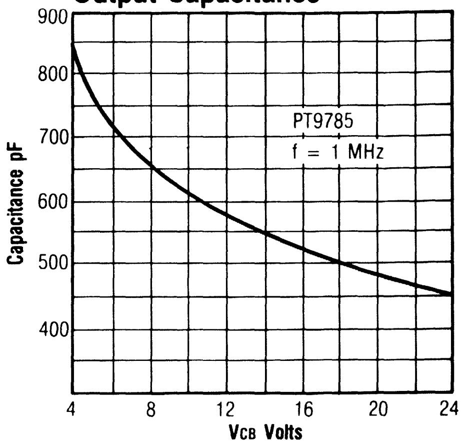




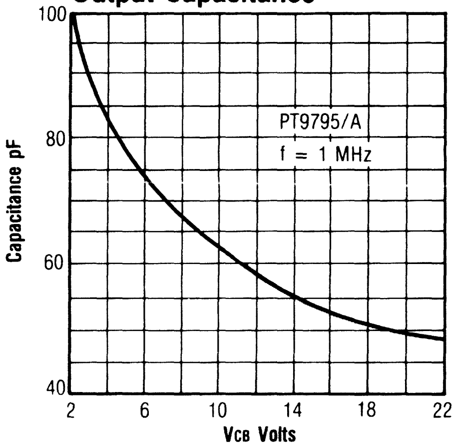
Output Capacitance



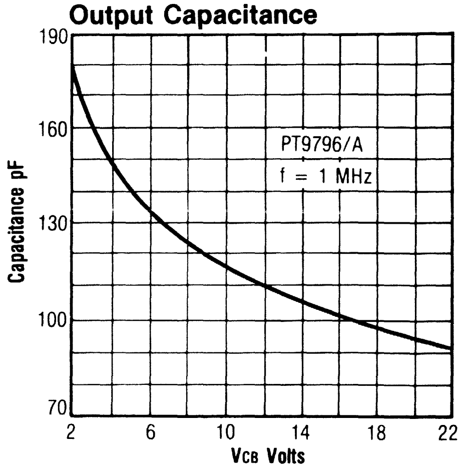
Output Capacitance



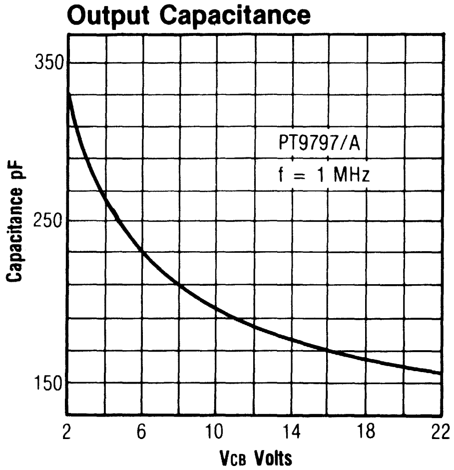
Output Capacitance



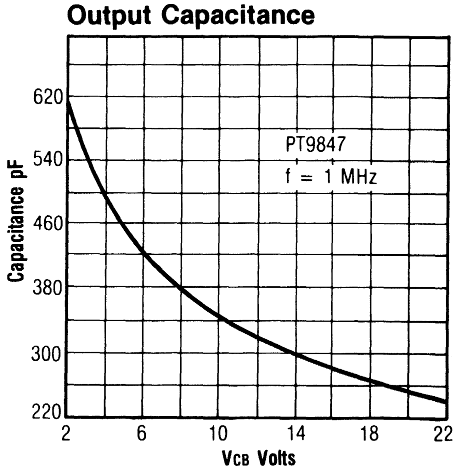
Output Capacitance



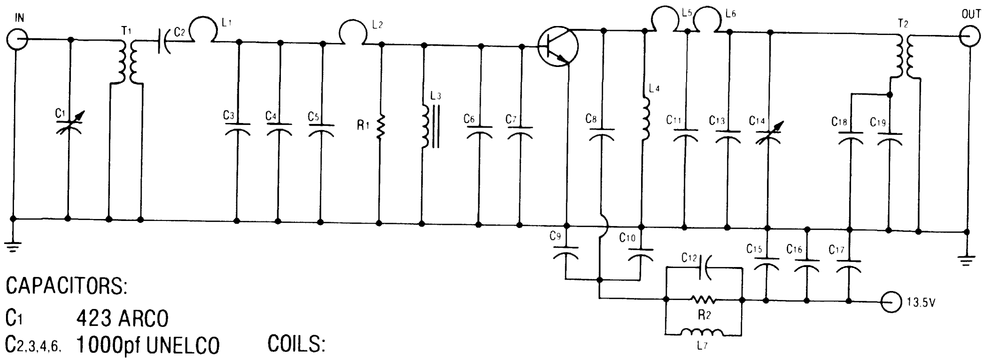
Output Capacitance



Output Capacitance



PT9784 HF 28MHz 13.5 Volts TF 206



CAPACITORS:

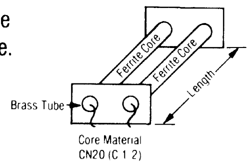
C_1	423 ARCO
$C_{2,3,4,6,7,9,10,13,18,19}$	1000pf UNELCO
C_5	500pf UNELCO
C_8	400pf UNELCO
C_{11}	250pf UNELCO
$C_{12,15}$	.1 Disc.
C_{14}	469 ARCO
C_{16}	.01 Disc.
C_{17}	25 MFD, 35 Volts

RESISTORS:

R_1	51 Ohms
R_2	16 Ohms 2W

COILS:

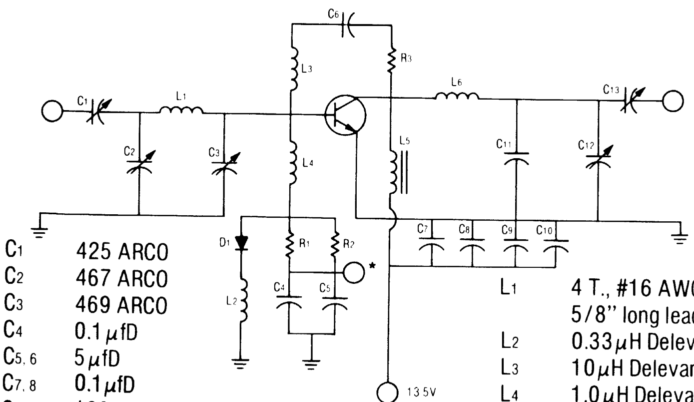
L_1	#18 AWG., 1-3/8" Long, Looped 3/8" Curve
L_2	#18 AWG., 1-1/8" Long, Looped 1/4" Curve.
L_3	2-1/2 T., #24 AWG., Looped thru Ferrox Cube VK21107-3B
L_4	8 T., #18 AWG., .2 I.D., 5/8" Long
L_5	#18 AWG., 1/4" Long, straight
L_6	#18 AWG., 1/2" Long, Looped 3/8" Curve.
L_7	10 T., #20 AWG., Enamel, Wrapped around 16 Ohm, 2 Watt resistor.



TRANSFORMERS:

T_1	Primary — 4 T., #22 AWG. Teflon insulated. Secondary — Brass Tube. Length — 11/16".
T_2	Primary — Brass Tube. Secondary — 3 T., #22 AWG. Teflon insulated. Length — 1-1/4".

PT9785 28MHz 13.5 Volts TF 210



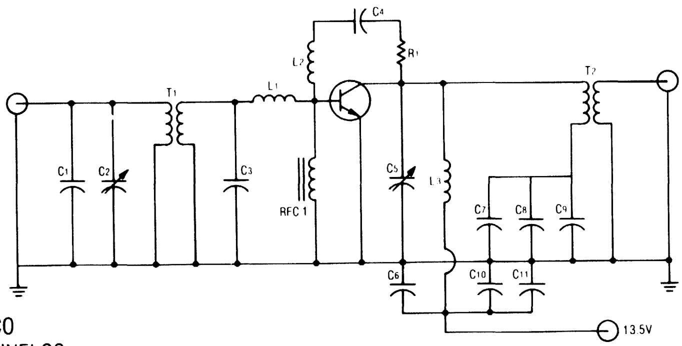
C_1	425 ARCO
C_2	467 ARCO
C_3	469 ARCO
C_4	0.1μfD
$C_{5,6}$	5μfD
$C_{7,8}$	0.1μfD
C_9	100μfD
C_{10}	1000pf UNELCO
C_{11}	100pf UNELCO
C_{12}	466 ARCO
C_{13}	427 ARCO

*Note: Set voltage for 100ma idle collector current.

L_1	4 T., #16 AWG., 7/16" I.D., 3/4" Long with 5/8" long lead on base side.
L_2	0.33μH Delevan
L_3	10μH Delevan
L_4	1.0μH Delevan
L_5	4 T., #20 wire wound on 2 Stackpole Carbon Co. Ferrite #9500 DO A723-1838.
L_6	4 T., #10 AWG., 1/2" I.D., 1" long.
D_1	Power diode
$R_{1,2}$	2.7 Ohms
R_3	51 Ohms 2W

PT9795 PT9796

PT9795 HF 28MHz 13.5 Volts TF 217

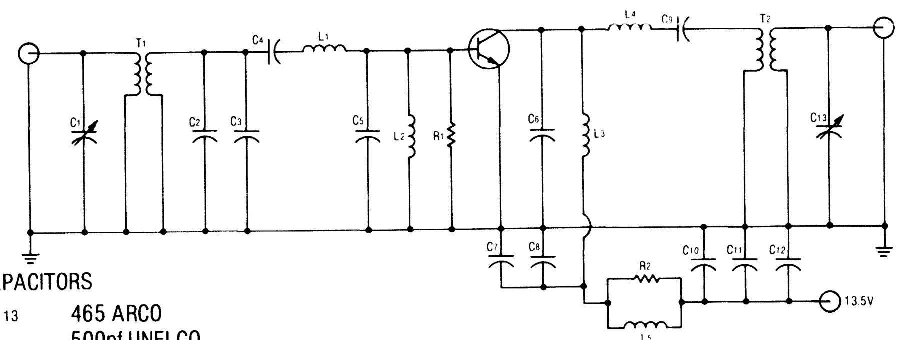


C_1	220pf
C_2	427 ARCO
$C_{3,6}$	1000pf UNELCO
C_4	5 MfD
C_5	425 ARCO
$C_{7,8,9}$	.005 MfD
C_{10}	.1 MfD
C_{11}	25 MfD
L_1	2 T., #20 AWG, 5/16" I.D., 1/4" Long
L_2	10μH
L_3	2 T., #18 AWG., wound thru Ceramag 9500 DO A7 23-1838

R_1	51 Ohms, 2 Watts
RFC 1	2-1/2 T., #22 AWG. on Ferroxcube VK 211-07-3B
T_1	Primary — 2 T., #22 AWG. Teflon insulated. Secondary — Brass Tube Length — .750 inches
T_2	Primary — Brass Tube Length — .750 inches Secondary — 3 T., #22 AWG. Teflon insulated.

Core material CN20 (C-1-2) slipped over brass tube.

PT9796 HF 28MHz 13.5 Volts TF 207



CAPACITORS

$C_{1,13}$	465 ARCO
C_2	500pf UNELCO
C_3	300pf UNELCO
$C_{4,5,7,8,9}$	1000pf UNELCO
C_6	400pf UNELCO
$C_{10,11}$	.1 MFD Disc.
C_{12}	25 MFD

COILS:

L_1	2-1/2 T., #18 AWG., .2" I.D., 3/8" Long
L_2	2-1/2 T., #24 AWG., looped thru Ferrox Cube VK 21107-3B
L_3	4 T., #18 AWG., .2" I.D., 1/2" Long
L_4	3 T., #18 AWG., .2" I.D., 3/8" Long
L_5	7 T., #18 AWg. enamel, wrapped around 150 Ohms 1 Watt resistor

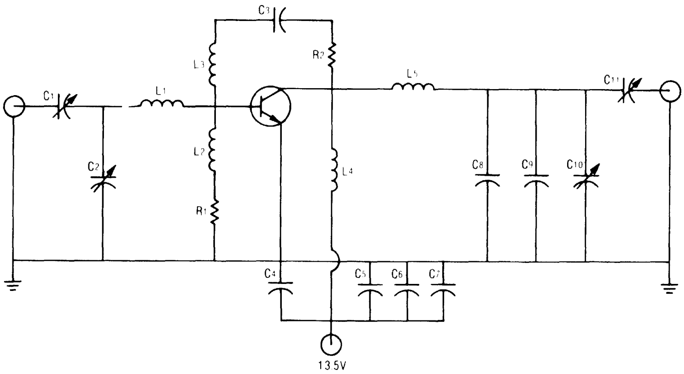
RESISTORS:

R_1	20 Ohms 1/2 Watt
R_2	150 Ohms 1 Watt

TRANSFORMERS:

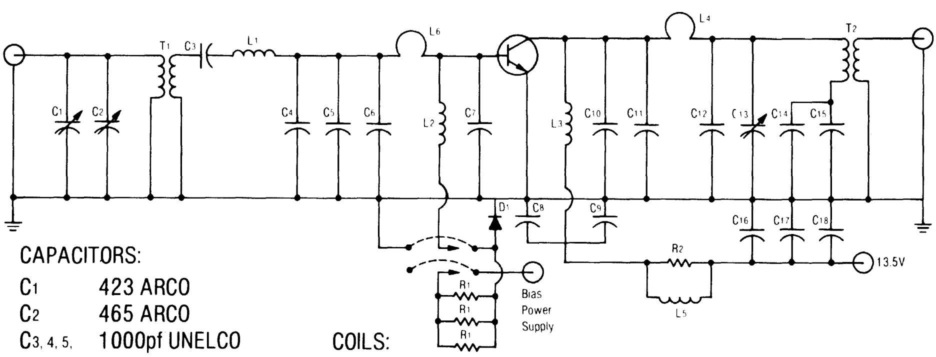
T_1	Primary — 4 T., #20 AWG. Teflon Secondary — Brass Tube Length — 11/16"
T_2	Primary — Brass Tube Secondary — 2 T., #20 AWG. Teflon Length — 1-1/4"

PT9797 HF 28MHz 13.5 Volts TF 211



C1, 10	466 ARCO	L1	4 Turns, #18 AWG, 5/8" Long, 7/16" I.D.
C2	467 ARCO	L2	1 μh
C3	5 MFD	L3	10μh
C4	25 MFD 35 Volts	L4	4 Turns, #18 AWG, Wound thru Cerimag 9500 DO A7 23-1838
C5, 6	.1 μfD		
C7	1000 MFD	L5	4 Turns, #10 AWG, 7/8" Long, 1/2" I.D.
C8, 9	90pf UNELCO	R1	1 Ohm, 1/2 Watt
C11	427 ARCO	R2	51 Ohms, 2 Watt

PT9847 HF 28MHz 13.5 Volts TF 212



CAPACITORS:

C1	423 ARCO
C2	465 ARCO
C3, 4, 5, 7, 8, 9, 12, 14, 15	1000pf UNELCO
C6	500pf UNELCO
C10	400pf UNELCO
C11	250pf UNELCO
C13	469pf ARCO
C16	.1 μfD
C17	.01 μfD
C18	5μfD
D1	5 Amp Power Diode Mounted on Heatsink near Transistor
R1	8.2 Ohms
R2	16 Ohms, 2 W

COILS:

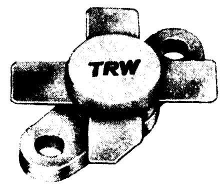
L1	#18 AWG., 3/8" Long, 1/4" I.D. 2 T.
L2	#24 AWG., Looped thru Ferrox Cube VK 21107-3B
L3	#18 AWG., Looped thru two Stackpole Carbon Co. Ferrite #9500 DO A723-1838
L4	#14 AWG., straight piece 1/2" Long
L5	#20 AWG., wrapped around 16 Ohm resistor
L6	#14 AWG., 1/2" Long, Loop

TRANSFORMERS:

T1	Primary — 4 T. #22 AWG. Teflon insulated Secondary — Brass Tube Length — 11/16"
T2	Primary — Brass Tube Secondary — 3 Turns #20 AWG. Teflon insulated. Length— 1-1/4"

SSB Power Transistors

- 8 to 100 Watts (PEP)
- 28 Vcc
- 2 to 30 MHz
- Gold Metallized
- Diffused Ballast Resistors
- Class A, AB and C Operation
- High Gain
- Common Emitter
- Isolated Packages
- ∞ VSWR



.380 SOE F

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

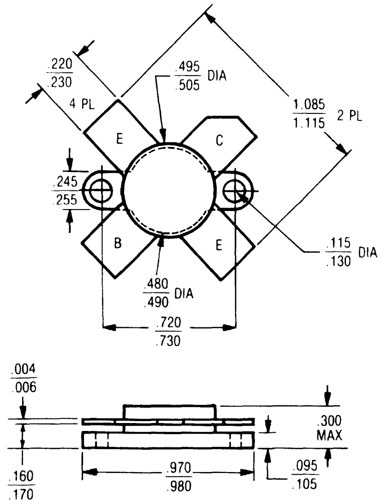
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	PT9787/A	PT9788/A	PT9783/A	PT9780	UNIT
DC TEST	BV_{CBO}	Collector to Base Breakdown Voltage	I_C = 5 mA I_C = 100mA	60	70	70	70	V Min
DC TEST	BV_{CEO}	Collector to Emitter Breakdown Voltage	I_C = 50mA	40	40	40	40	V Min
DC TEST	I_{CES}	Collector-Emitter Cutoff Current	V_{CE} = 28V			25	25	mA Max
DC TEST	V_{EBO}	Emitter-Base Breakdown Voltage	I_E = 1mA I_E = 2.5mA I_E = 5mA	4.0	4.0	4.0	4.0	V Max
DC TEST	h_{FE}	D.C. Current Gain	V_{CE} = 5V I_C = 200mA I_C = 1A	10-100	10-100	10-100	10-100	
RF TEST	P_{OUT}	Output Power PEP	V_{CE} = 28V f = 28MHz	8	20	50	100	W Min
RF TEST	G_P	Power Gain	V_{CE} = 28V f = 28MHz Rated P_{OUT} I_{CQ} = 10mA I_{CQ} = 20mA I_{CQ} = 60mA I_{CQ} = 100mA	14	14	14	14	dB Min
RF TEST	IMD	Intermodulation Distortion	V_{CE} = 28V f = 28MHz P_{OUT} = Rated PEP	-30	-32	-32	-32	dB Max
RF TEST	VSWR	Mismatch Tolerance	V_{CE} = 28V f = 28MHz P_{OUT} = Rated PEP	∞	∞	∞	∞	–
RF TEST	C_{OB}	Output Capacitance	V_{CB} = 28Vdc f = 1.0MHz	20	50	150	290	pF Typ

Absolute Maximum Ratings (T_{CASE} = 25°C)

PART NUMBER*	V_{CBO} VOLTS	V_{CEO} VOLTS	V_{EBO} VOLTS	I_C MAX AMPS	P_T @ 25°C WATTS	θ_{JC} °C/W	$T_{STORAGE}$ °C
PT9780	70	40	4.0	20.0	350	0.50	-65 to 150
PT9783/A	70	40	4.0	10.0	175	1.0	-65 to 150
PT9788/A	70	40	4.0	4.0	70	2.5	-65 to 150
PT9787/A	60	40	4.0	2.0	25	7.0	-65 to 150

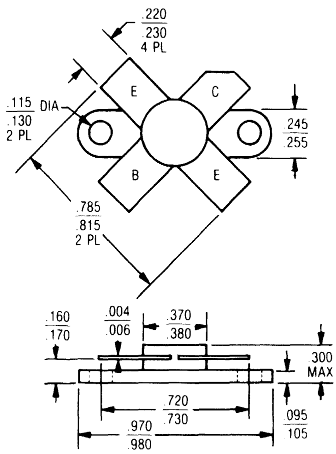
*The "A" suffix on part number denotes stud package.

PT 9780



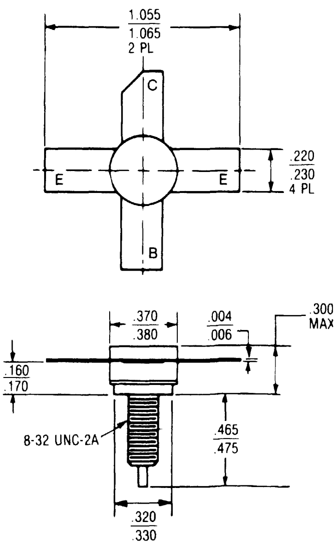
.500 SOE F

PT 9783
PT 9788
PT 9787



.380 SOE F

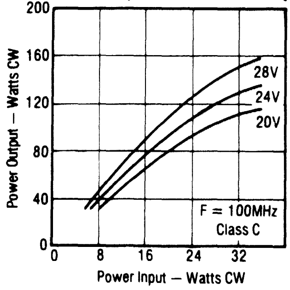
PT 9783A
PT 9788A
PT 9787A



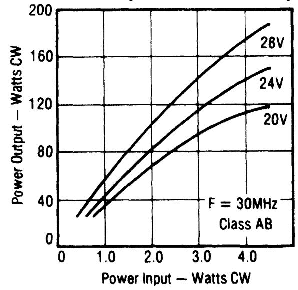
.380 SOE

Dimensions in inches

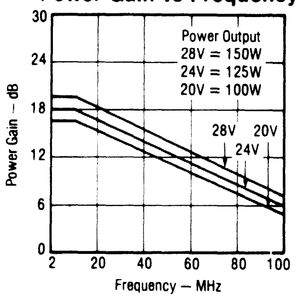
Power Output vs Power Input



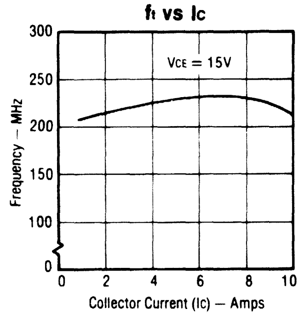
Power Output vs Power Input



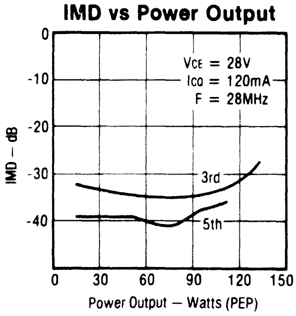
Power Gain vs Frequency



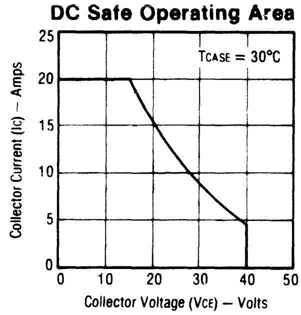
fₜ vs Ic



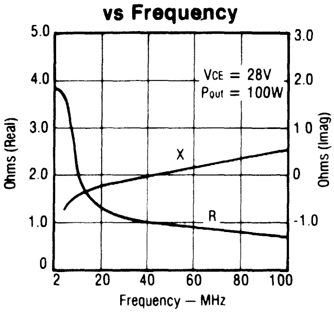
IMD vs Power Output



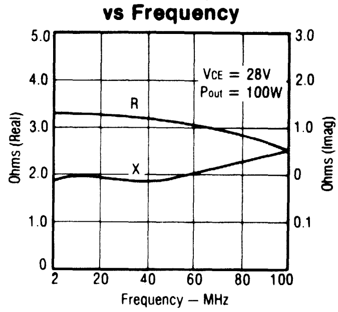
DC Safe Operating Area



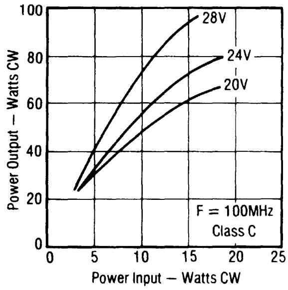
Series Input Impedance vs Frequency



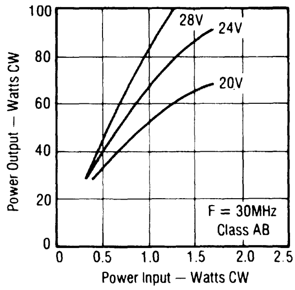
Series Load Impedance vs Frequency



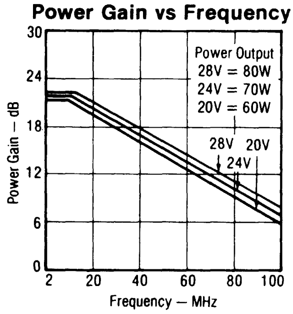
Power Output vs Power Input



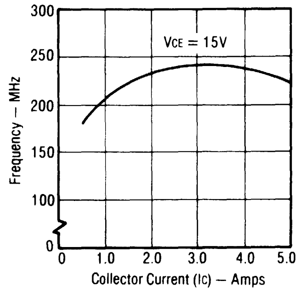
Power Output vs Power Input



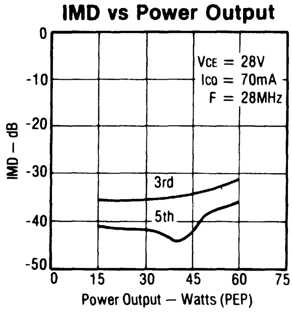
Power Gain vs Frequency



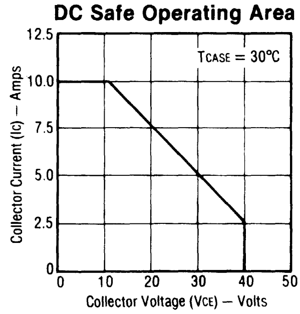
fₜ vs Ic



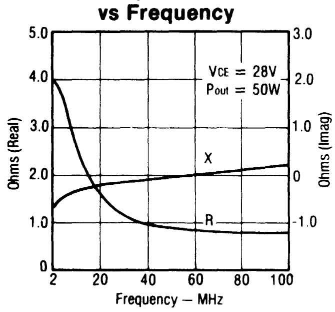
IMD vs Power Output



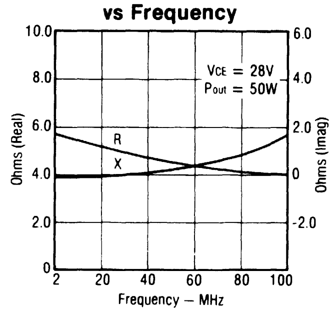
DC Safe Operating Area



Series Input Impedance vs Frequency

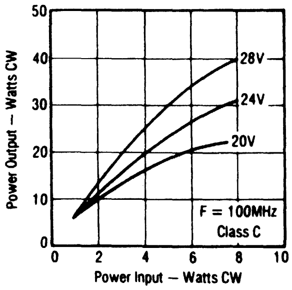


Series Load Impedance vs Frequency

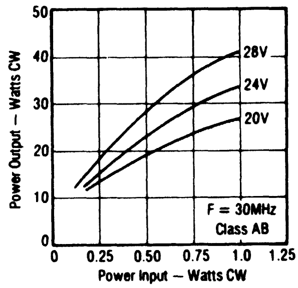


PT9788/PT9788A

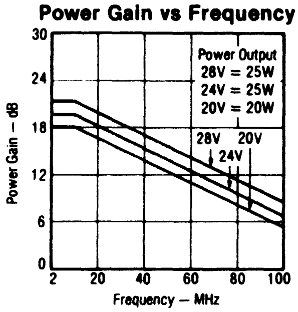
Power Output vs Power Input



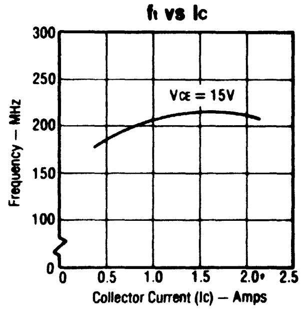
Power Output vs Power Input



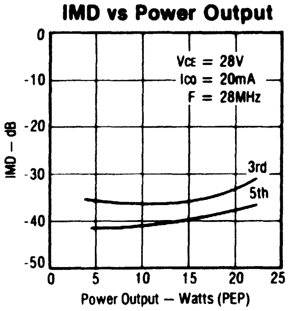
Power Gain vs Frequency



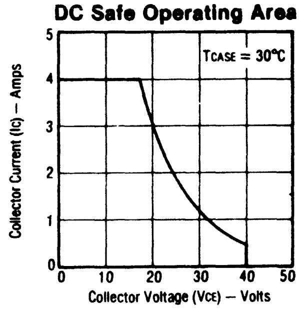
fₜ vs Ic



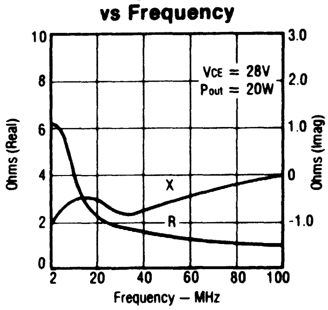
IMD vs Power Output



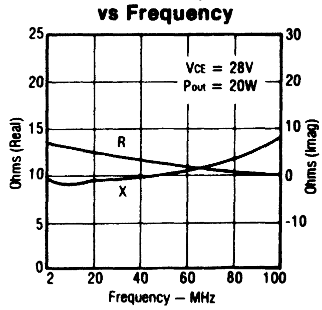
DC Safe Operating Area

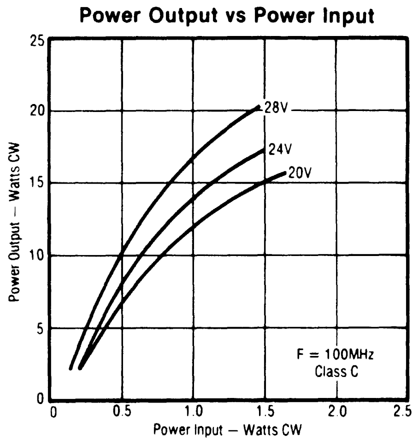


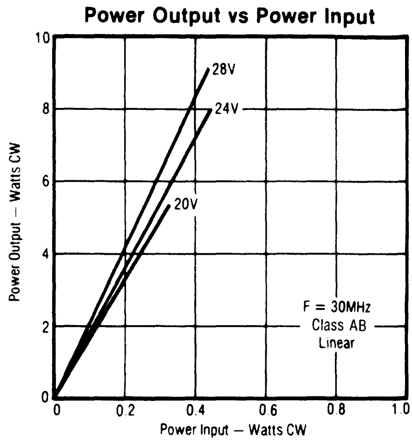
Series Input Impedance vs Frequency

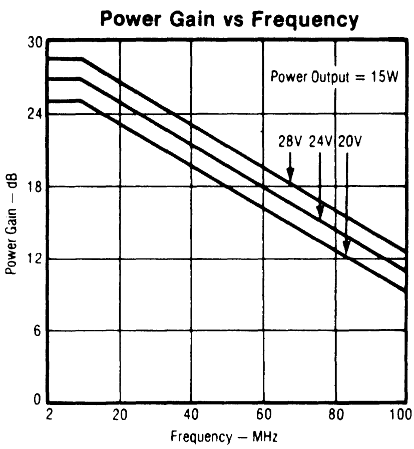


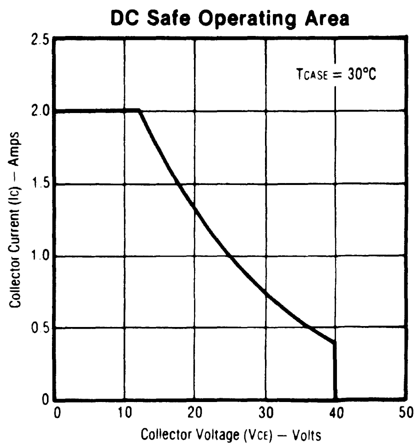
Series Load Impedance vs Frequency



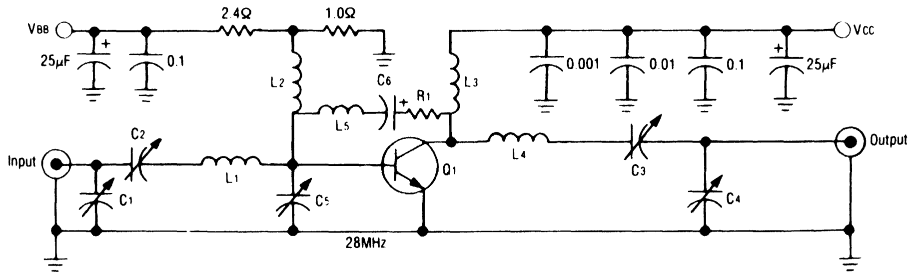

Power Output vs Power Input
Power Output — Watts CW
25
20
15
10
5
0
0.5
1.0
1.5
2.0
2.5
Power Input — Watts CW
28V
24V
20V
F = 100MHz
Class C


Power Output vs Power Input
Power Output — Watts CW
10
8
6
4
2
0
0.2
0.4
0.6
0.8
1.0
Power Input — Watts CW
28V
24V
20V
F = 30MHz
Class AB
Linear


Power Gain vs Frequency
Power Gain — dB
30
24
18
12
6
0
2
20
40
60
80
100
Frequency — MHz
Power Output = 15W
28V 24V 20V

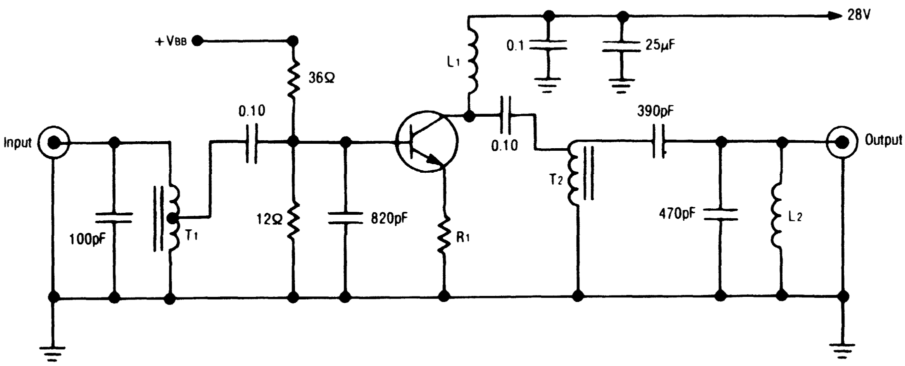

DC Safe Operating Area
Collector Current (Ic) — Amps
2.5
2.0
1.5
1.0
0.5
0
10
20
30
40
50
Collector Voltage (VCE) — Volts
TCASE = 30°C

28MHz Test Circuit



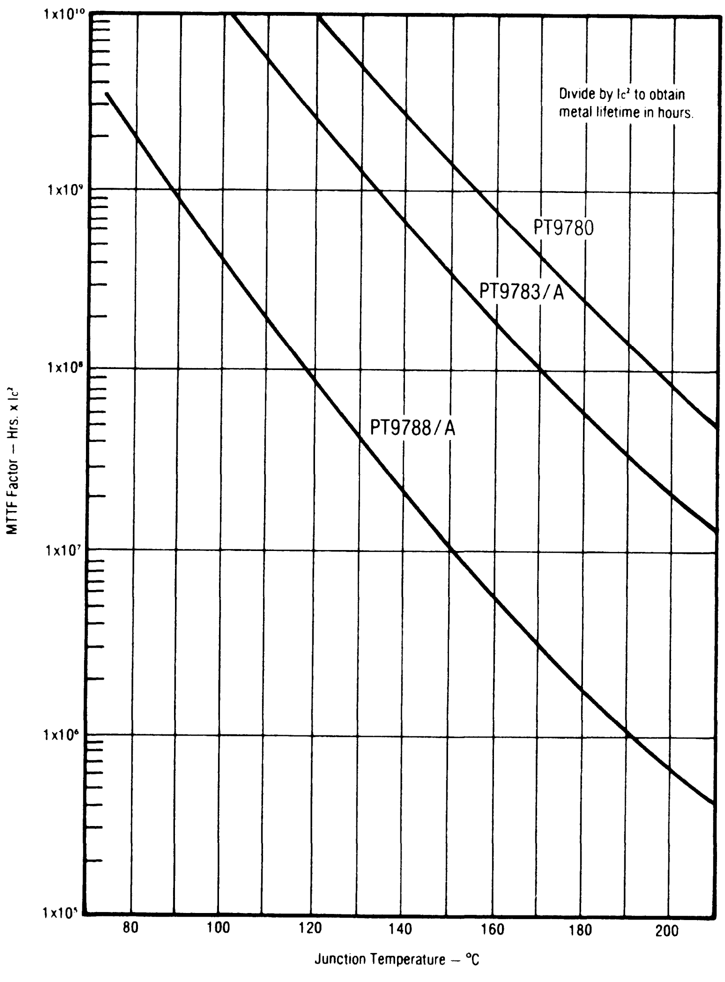
C_1 ARCO #467, 110-580pF
$C_{2,3,4}$ ARCO #466, 80-480pF
C_5 ARCO #469, 170-780pF
C_6 5μF, 50V ELE
R_1 50Ω, 2W
$L_{1,4}$ 5 turns #14 tinned copper, 0.5" mean diameter, 1 equals 1.0"
L_2 10 turns #18AWG, 0.5" mean diameter
L_3 4 turns #20AWG through two Stackpole #23-1838 cores
L_5 6.8μH molded
V_{CC} 28V
V_{BB} 1.6 volts (Ic[Quies] = 100mA)

28MHz Test Circuit



R_1 1.0Ω on each emitter (0.5Ω)
T_1 6 turns, #22 wire tapped 2 turns from ground, on Fairrite Products #43 bead.
T_2 4 turns, #20 wire tapped 3½ turns from ground, on Fairrite Products #43 bead.
L_1 1.0μH
L_2 0.05μH

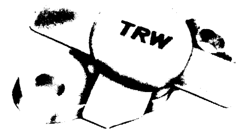
MTTF Factor
vs Junction Temperature



PT 9798

SSB Power Transistors

- **All Gold (Monometallic) Metallization System for Highest Reliability**
- **Diffused Emitter Ballast Resistors for Ruggedness**
- **Suitable for Class A, AB and C Operation**
- **50 Volt Operation**
- **75 Watts**
- **15dB Gain**
- **∞ VSWR**



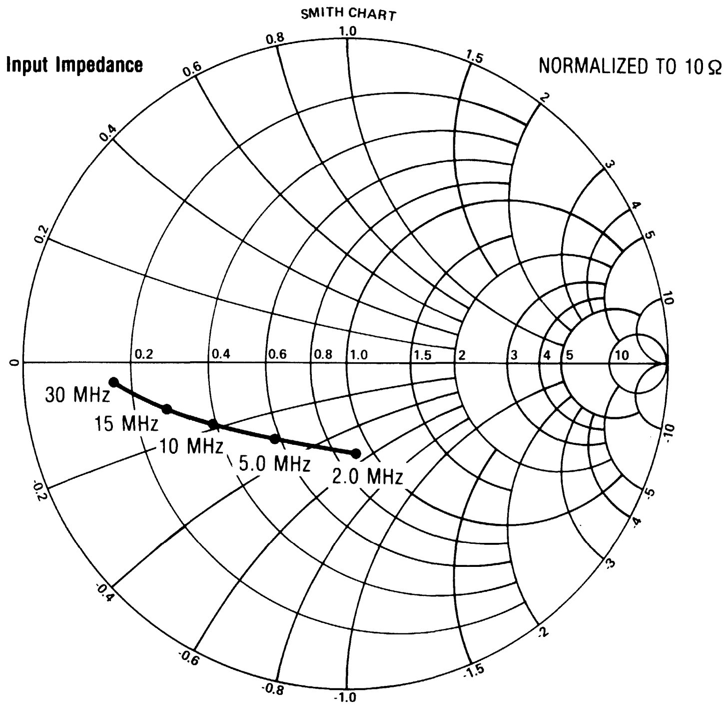
.380 SOE F

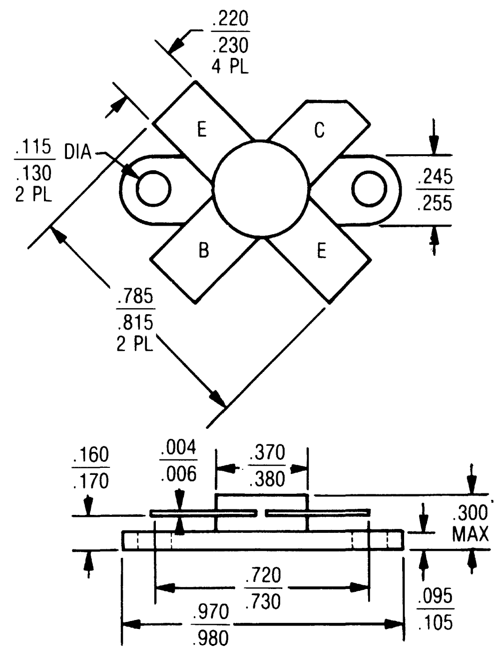
Electrical Characteristics (T_{FLANGE} = 25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	MAX.	UNITS
DC TEST	BV_{EBO}	Emitter to Base Breakdown Voltage	I_B = 5.0mA	4.0		VDC
	BV_{CBO}	Collector to Base Breakdown Voltage	I_C = 100mA	110		VDC
	BV_{CEO}	Collector to Emitter Breakdown Voltage	I_C = 50mA	55		VDC
	h_{FE}	DC Current Gain	V_{CE} = 5V I_C = 1.0A	10	70	
RF TEST	P_{OUT}	Power Output	V_{CE} = 50V P_{IN} = 2.35W f_1 = 28 MHz	75		Watts
	IMD	Intermodulation Distortion	V_{CE} = 50V P_{OUT} = 75W f_1 = 28 MHz		−32	dB
	VSWR	Mismatch Tolerance	V_{CE} = 50V P_{OUT} = 75W f_1 = 28 MHz	∞:1		VSWR
MAX. RATINGS	θ_{JF}	Thermal Resistance Junction to Flange			1.0	°C/W
	$I_{C(MAX)}$	Collector Current	T_F = 25°C		15	A
	P_T	Total Dissipation	T_F = 25°C		150	Watts
	T_{STG}	Storage Temperature		−65	150	°C
	$T_{J(MAX)}$	Junction Temperature			200	°C

PT 9798

Vcc = 50V
Ico = 60mA
Pout = 75 Watts





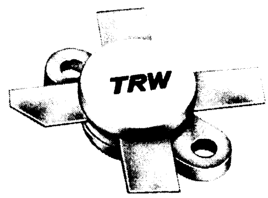
.380 SOE F

PT9790

TRW

SSB Power Transistor

- 150 Watts (PEP)
- 50 V_{CC}
- 2 to 30 MHz
- Gold Metallized
- Diffused Ballast Resistors
- Class A, AB and C Operation
- High Gain
- Common Emitter
- Isolated Packages
- ∞ VSWR

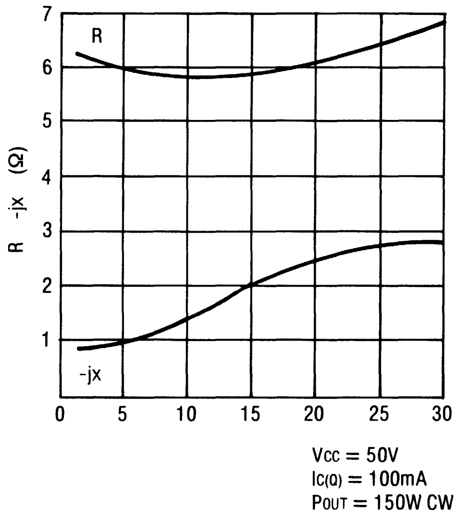


.500 SOE F

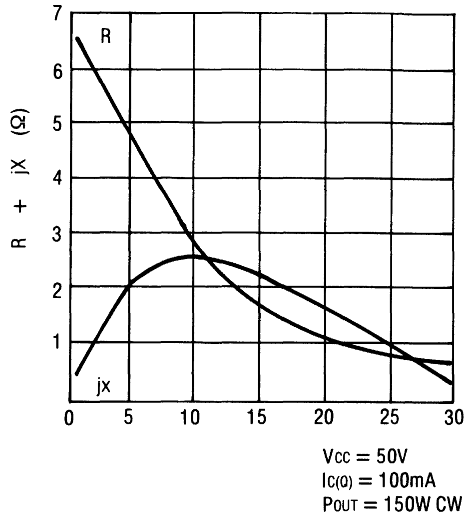
Electrical Characteristics (25°C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CBO}	Collector-Base Breakdown	I_C = 100mA	110			V
	BV_{CEO}	Collector-Emitter Breakdown	I_C = 50mA	55			V
	BV_{EBO}	Emitter-Base Breakdown	I_E = 5mA	4.0			V
	h_{FE}	D.C. Current Gain	V_{CE} = 5V, I_C = 1A	10		60	
	Δh_{FE}	Matched Pairs	V_{CE} = 5V, I_C = 1A			Δ 5	
RF TEST	P_O	Power Gain	V_{CE} = 50V, I_{CQ} = 50mA f = 28MHz, P_{OUT} = 150W	15			dB
	IMD	Intermodulation Distortion	V_{CE} = 50V, f = 28MHz P_{OUT} = 150W PEP, I_{CQ} = 50mA			-32	dB
	VSWR	Mismatch Tolerance	V_{CE} = 50V, f = 28MHz P_{OUT} = 150W PEP, I_{CQ} = 50mA	∞			
	C_{OB}	Output Capacitance	V_{CB} = 28Vdc, f = 1.0MHz		200		pF
MAX. RATINGS	$I_{C\,MAX}$	Collector Current	T_C = 25°C			15	A
	$\theta_{j\text{-}c}$	Thermal Resistance Junction - Case				0.5	°C/W
	$T_{J\,MAX}$	Junction Temperature				200	°C
	T_{STG}	Storage Temperature		-65		+150	°C
	$P_{D\,MAX}$	Total Dissipation	T_C = 25°C			300	W

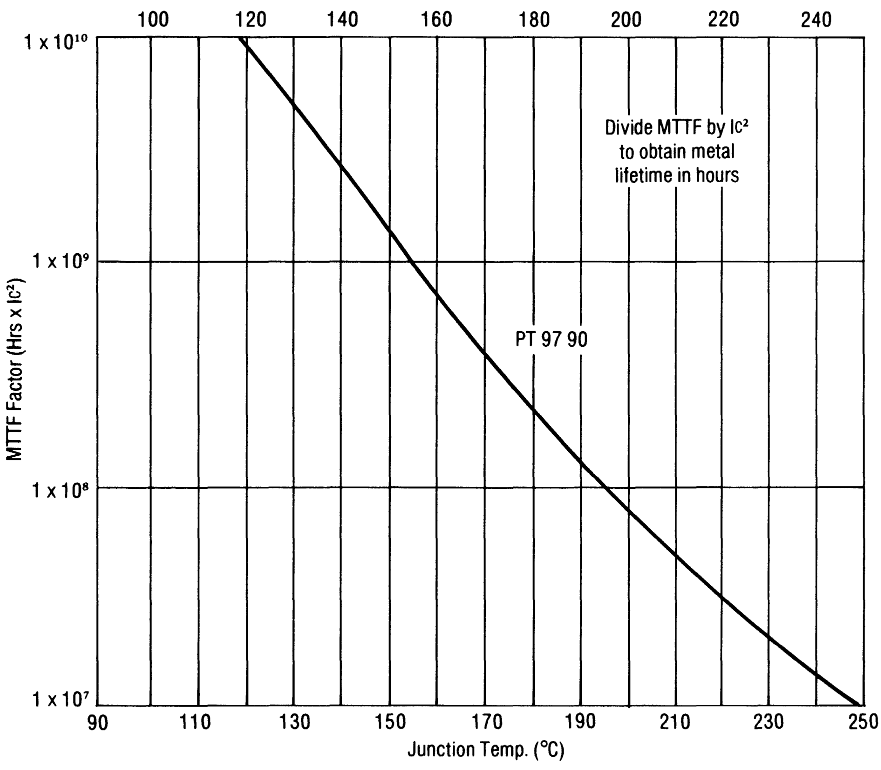
Series Load Impedance Vs. Frequency



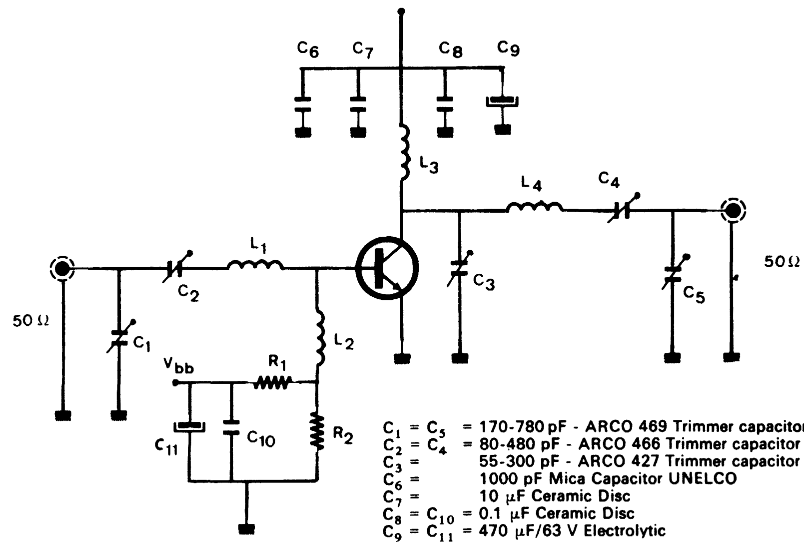
Series Input Impedance Vs. Frequency



MTTF Factor vs. Junction Temperature



28 MHz TEST CIRCUIT

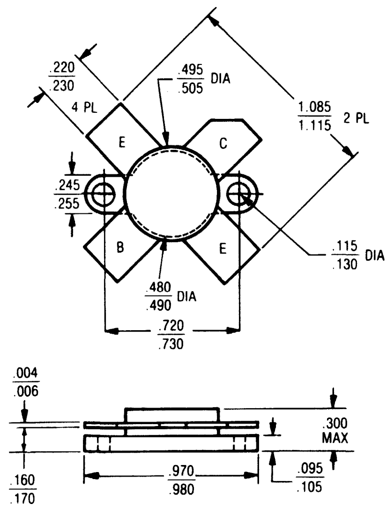


$C_1 = C_5$ = 170-780 pF - ARCO 469 Trimmer capacitor
$C_2 = C_4$ = 80-480 pF - ARCO 466 Trimmer capacitor
C_3 = 55-300 pF - ARCO 427 Trimmer capacitor
C_6 = 1000 pF Mica Capacitor UNELCO
C_7 = 10 μF Ceramic Disc
$C_8 = C_{10}$ = 0.1 μF Ceramic Disc
$C_9 = C_{11}$ = 470 μF/63 V Electrolytic

L_1 = 5 turns 15/10 mm Silvered wire - 10 mm I.D. - 25 mm length
L_2 = 10 turns 8/10 mm Enamelled wire - 10 mm I.D.
L_3 = 4 turns 12/10 mm Enamelled wire - 10 mm I.D. - 10 mm length
L_4 = 7 turns 15/10 mm Enamelled wire - 10 mm I.D. - 20 mm length

R_1 = 1 Ω - 2 W
R_2 = 2.7 Ω - 2 W

.500 SOE F



TRW Electronic Components Group

Printed Circuit Division
200 South Turnbull Canyon Road
City of Industry, California 91749
Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
4243 Campus Point Court
San Diego, California 92121
Phone: 714/457-1000

Products: Data converters, arithmetic products, and special processors.

Optoelectronics Division
1201 Tappan Circle
Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

Balanced, High Power VHF-UHF Broadband Linear Transistors

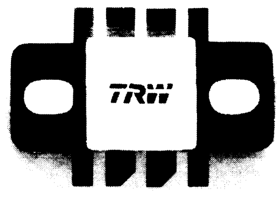
These internally matched transistors in a push-pull package are specially designed for multi octave bandwidth, high gain and class AB power applications. Internal matching and common emitter configuration lead to high input and output impedances.

Multicell die design and ultra thin beryllium oxide header allow optimum heat dissipation and operating efficiency.

Long term reliability and ruggedness are guaranteed by diffused silicon ballast resistors and the TRW gold metalization process.

Push-Pull Transistor

- **40 W**
- **30-400 MHz**
- **28V**
- **RF Power**
- **Push-Pull Transistor**
- **NPN Silicon**



MRP7 Push-Pull Package

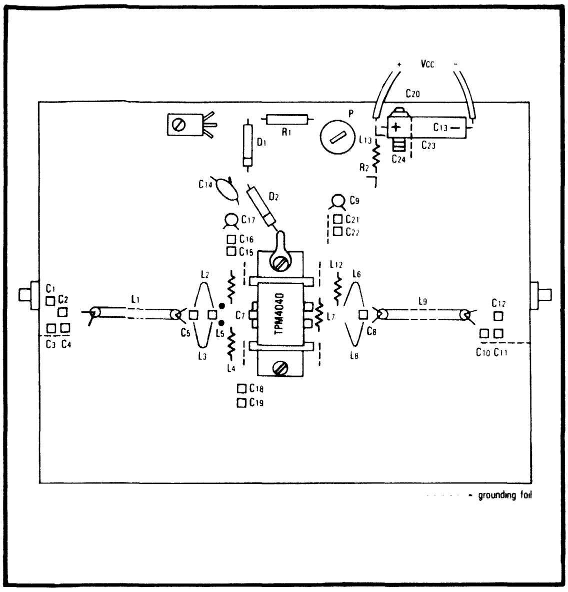
The TPM 4040 is an internally matched transistor on a push-pull package specially designed for multioctave bandwidth high gain and power applications. Its internal matching and package configuration lead to high input and output impedances.

Multicell die design and ultra thin beryllium oxide header allow optimum heat dissipation and operating efficiency. Long term reliability and ruggedness are guaranteed by diffused silicon ballast resistors and the TRW gold metallization process.

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

Symbol	Characteristics	Test Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = 6mA	4			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 40mA	30			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 20mA	45			V
h_{FE}	DC Current Gain	V_{CE} = 20V I_C = 500mA	10			–
P_G	RF Power Gain	V_{CE} = 28V	10			dB
η_C	Collector Efficiency	F = 400 MHz	50			%
VSWR	Mismatch Tolerance	P_{out} = 40 W I_{cq} = 2 × 50 mA	∞			–
C_{OB}	Collector-Base Capacitance (Each Side)	V_{CB} = 28V F = 1 MHz			20	pF
θ_{JC}	Thermal Resistance Junction Case	T°$_{case}$ = 70°C			2	°C/W
P_D	Power Dissipated	T°$_{case}$ = 70°C			65	W

Components Layout

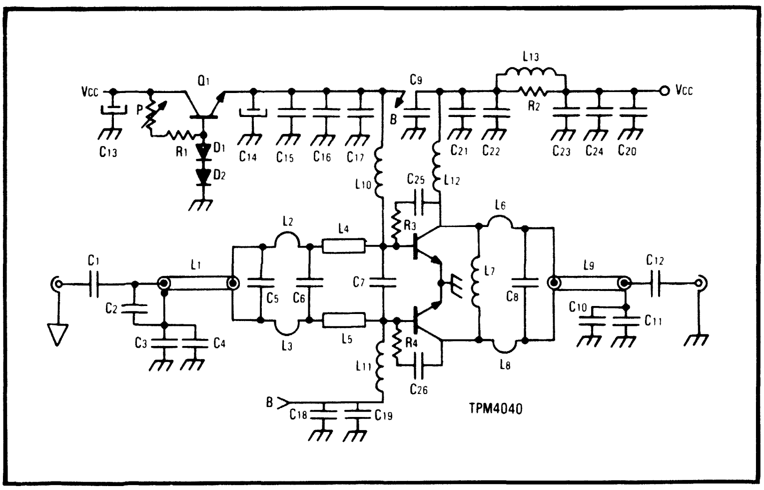


Components Part List

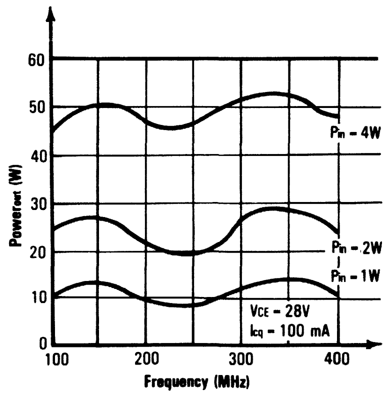
C1, C6, C12	- 39 pF chip capacitor
C2	- 3.9 pF chip capacitor
C3, C10, C15, C18, C21, C23	- 1000 pF chip capacitor
C4, C11, C16, C19, C22, C24	- 15 nF chip capacitor
C5	- 22 pF chip capacitor
C7	- 68 pF chip capacitor
C8	- 15 pF chip capacitor
C25, C26	- 10 nF ceramic disc capacitor
C14	- 10 μF/ 5V Electrolytic capacitor
C13	- 100 μF/40V Electrolytic capacitor
C9, C13, C17, C20	- 0.1 μF Tantal
L1, L9	- 100 mm, 50 ohms teflon coaxial cable
L2, L3	- hair pin L = 17 mm, 0.8 mm wire
L4, L5	- 6 mm × 3 mm line on substrate
L6, L8	- hair pin L = 12 mm, 0.8 mm wire
L7	- 3 turns Ø 5 mm, 0.8 mm wire
L10, L11, L12	- 15 turns Ø 3 mm 0.5 mm craneled wire
L13	- 6 turns Ø 5 mm 1.2 mm wire
R1	- 1.2 K ohms 1/2 W
R2	- 15 ohms 1/2 W
R3, R4	- 1 K ohms 1/4 W
D1, D2	- 1 N 4007 or equivalent
Q1	- BD 135 or equivalent

Substrate: teflon glass 1/50"

100-MHz 40 W Amplifier (Class AB)



Typical Pout vs. Pin, F

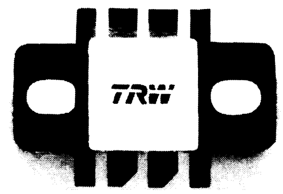


TRW

TPM4100

Push-Pull Transistor

- 100 W
- 100-400 MHz
- 28V
- RF Power
- Push-Pull Transistor
- NPN Silicon



MRP7 Push-Pull Package

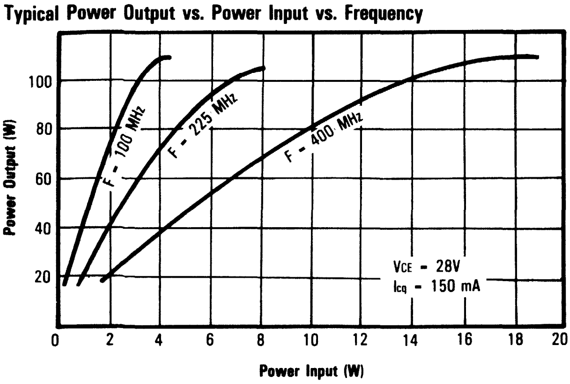
The TPM 4100 is an internally matched transistor on a push-pull package specially designed for multioctave bandwidth high power applications. Its internal matching and package configuration lead to high input and output impedances.

Multicell die design and ultra thin beryllium oxide header allow optimum heat dissipation and operating efficiency. Long term reliability and ruggedness are guaranteed by diffused silicon ballast resistors and the TRW gold metallization process.

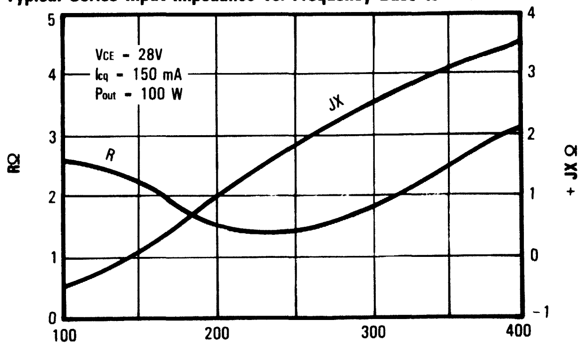
Electrical Characteristics (T_{case} = 25°C)

Symbol	Characteristics	Test Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = 5mA	3.5			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 50mA	30			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 100mA	65			V
H_{FE}	DC Current Gain	V_{CE} = 5V I_C = 1A	20		150	–
P_G	Power Gain	V_{CE} = 28V P_{out} = 100 W F = 400 MHz I_{CQ} = 150mA	7.5			dB
η_C	Collector Efficiency	V_{CE} = 28V P_{out} = 100 W F = 400 MHz I_{CQ} = 150mA	50			%
C_{OB}	Collector-Base Capacitance (each side)	V_{CB} = 28V F = 1 MHz		60	70	pF
P_D	Maximal Total Dissipation	t_C = 25°C			175	W
I_C	Maximal Collector Current (each side)				10	A
R_{TH}	Thermal Resistance Junction Heatsink	$T_{heatsink}$ = 60°C P_D = 100 W Including contact			1	°C/W

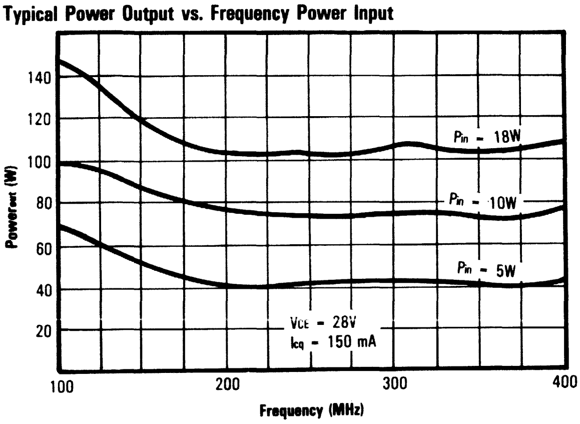
Typical Power Output vs. Power Input vs. Frequency



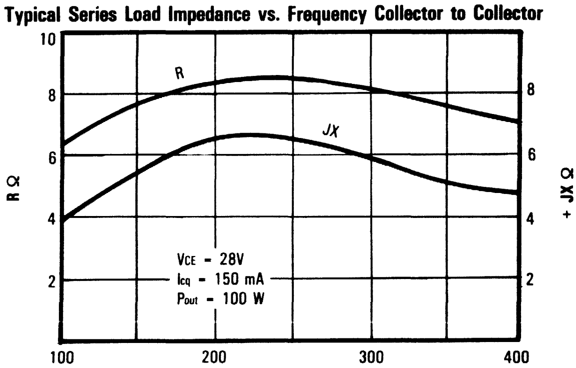
Typical Series Input Impedance vs. Frequency Base to Base



Typical Power Output vs. Frequency Power Input

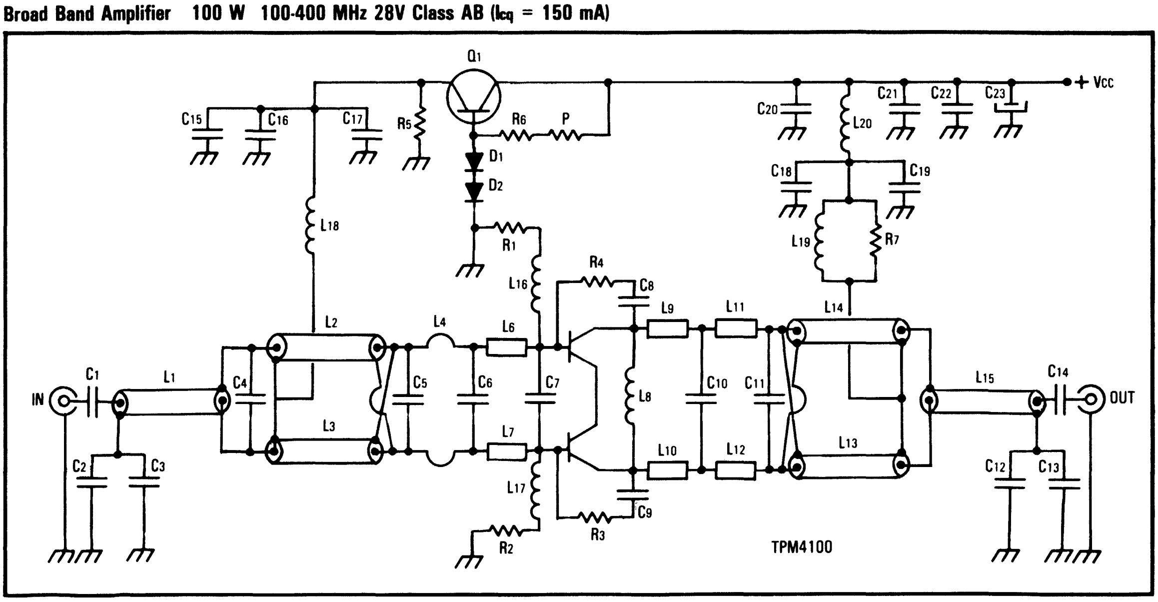


Typical Series Load Impedance vs. Frequency Collector to Collector

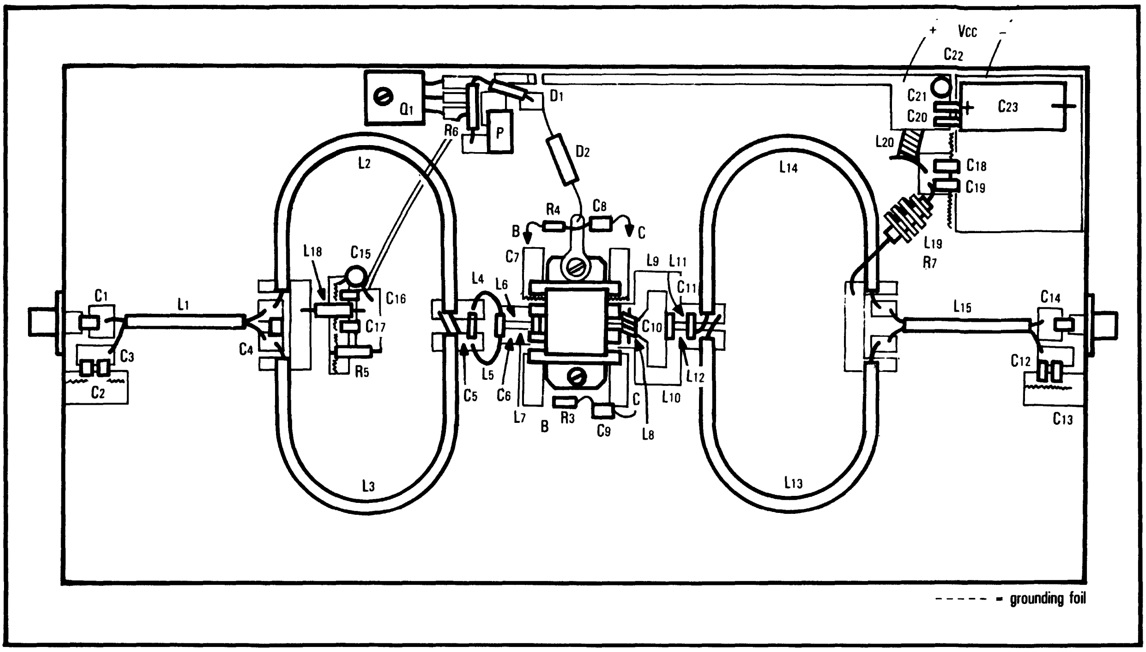


– Icq = 150 mA is total quiescent current.
– All these values are given in push-pull configuration

Broad Band Amplifier 100 W 100-400 MHz 28V Class AB (Icq = 150 mA)



Components Layout



Components Part List

C1, C14	39 pF chip
C2, C12, C15, C18, C20	1000 pF chip
C3, C13, C16, C19, C21	15 nF chip
C4	3.6 pF chip
C5	27 + 22 pF chip
C6	47 pF chip
C7	47 + 22 pF chip
C8, C9	10 nF ceramic disc
C10	15 pF chip
C11	22 pF chip
C17, C22	0.1 μF Tantal
C23	100 μF/40V
L1, L15	75 mm, 50 Ω coaxial cable (Teflon)
L2, L3, L14, L13	65 mm, 25 Ω coaxial cable (Teflon)
L4, L5	Hair pin, L = 4 mm, 0.8 mm wire
L6, L7	L = 6 mm × 2.5 mm on substrate
L8	4 turns Ø 4 mm, L = 5 mm, 0.8 mm wire

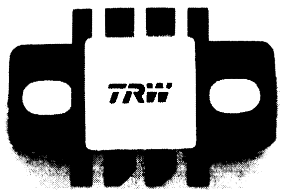
L9, L10	L = 20 mm × 2.5 mm on substrate
L11, L12	L = 5 mm × 3 mm on substrate
L16, L17	0.1 μH molded inductor
L18	0.47 μH molded inductor
L19	6 turns, Ø 6 mm, 1 mm wire
R1, R2	10 Ω 1/2 W
R3, R4	330 Ω 1/2 W
R5	33 Ω 1/4 W
R6	1.5 KΩ 1/2 W
R7	15 Ω 1/2 W
Q1	BD 135
Q2	TPM 4100
D1, D2	IN 4007

Substrate: teflon glass 1/50"

TRW

Push-Pull Transistor

- 130 W
- 225-400 MHz
- 28V
- RF Power
- Push-Pull Transistor
- NPN Silicon



MRP7 Push-Pull Package

The TPM4130 is an internally matched transistor on a push-pull package specially designed for multioctave bandwidth high power applications.

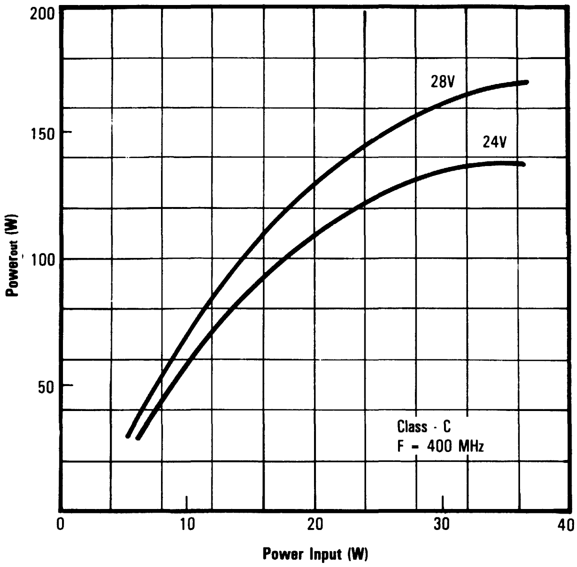
Its internal matching and package configuration lead to high input and output impedances.

Multicell die design and ultra thin beryllium oxide header allow optimum heat dissipation and operating efficiency. Long term reliability and ruggedness are guaranteed by diffused silicon ballast resistors and the TRW gold metallization process.

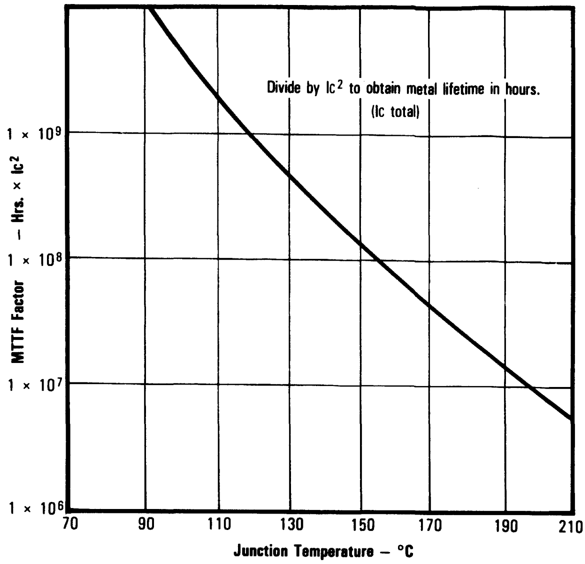
Electrical Characteristics (T_{case} = 25°C)

Symbol	Characteristics	Test Conditions	Min.	Typ.	Max.	Units
BV_{EBO}	Emitter-Base Breakdown-Voltage	I_E = 5mA	3.5			V
BV_{CEO}	Collector-Emitter Breakdown-Voltage	I_C = 50mA	30			V
BV_{CBO}	Collector-Base Breakdown-Voltage	I_C = 100mA	65			V
H_{FE}	DC Current Gain	V_{CE} = 5V I_C = 1A	20		150	–
P_G	Power Gain	V_{CE} = 28V P_{out} = 130 W F = 400 MHz	7.2			dB
η_C	Collector Efficiency	V_{CE} = 28V P_{out} = 130 W F = 400 MHz	60			%
C_{OB}	Collector-Base Capacitance (each side)	V_{CB} = 28V F = 1 MHz		60	70	pF
P_D	Maximal Total Dissipation	t_C = 25°C			210	W
I_C	Maximal Collector Current (each side)				10	A
R_{TH}	Thermal Resistance Junction-Case	T_{case} = 60°C			0.85	°C/W

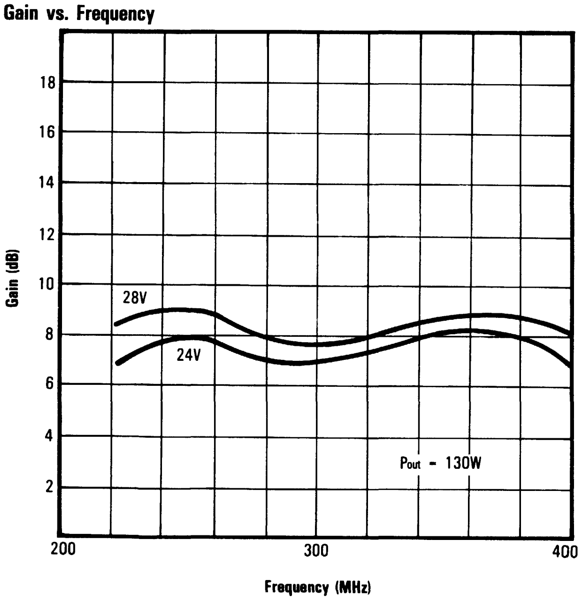
Typical Power Output vs. Frequency Power Input



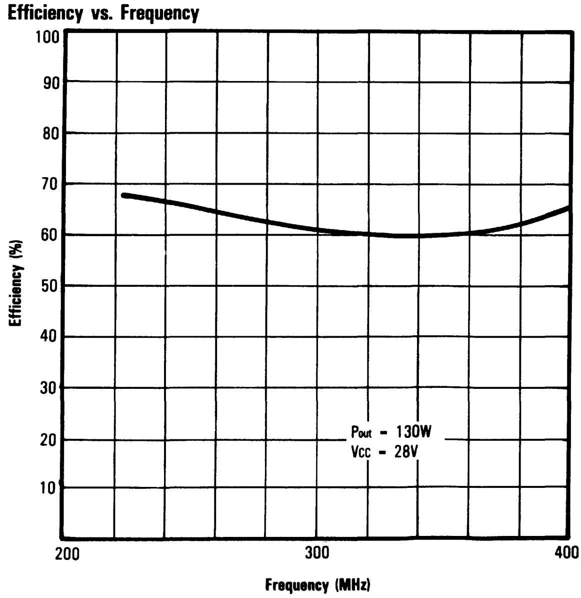
MTTF Factor vs. Tj



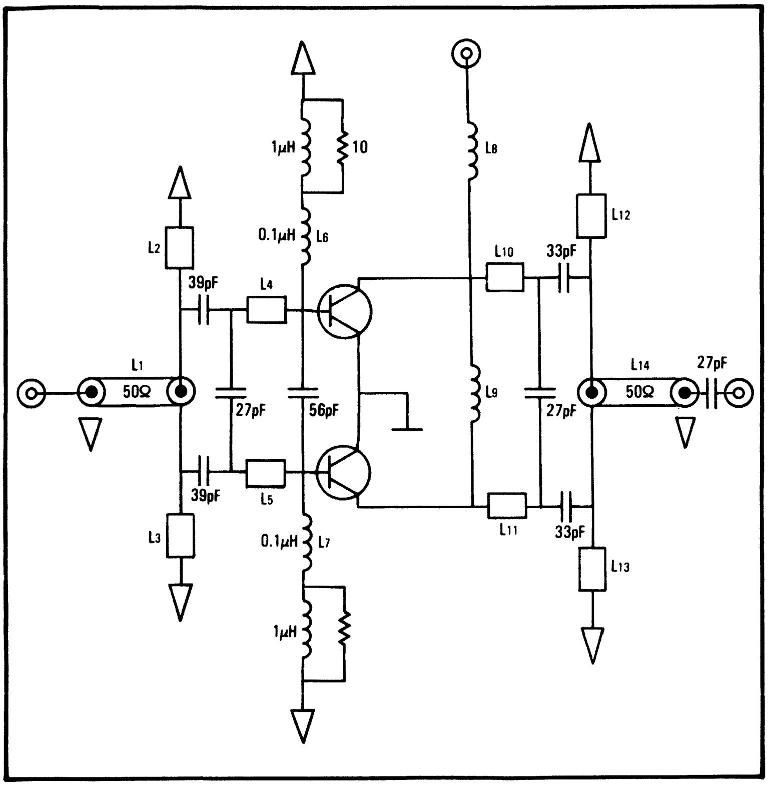
Gain vs. Frequency



Efficiency vs. Frequency



Schematic TPM4130



Components Part List

L1, L4	- 30 mm 50Ω teflon coaxial cable soldered on L2 and L12
L2, L3	- 24 mm × 1.5 mm on substrate
L4, L5	- 6 × 2.5 mm on substrate
L9	- hair pin made with 24 mm of 5 mm wire (as close to the collectors as possible)
L8	- 0.1 μH
L10, L11	- 8 × 1.5 mm on substrate
L12, L13	- 30 mm × 2.5 mm on substrate

Substrate: Teflon-glass 1/16" (ε_r = 2.55) (ε_r = 2.55)

TRW Electronic Components Group

Printed Circuit Division
200 South Turnbull Canyon Road
City of Industry, California 91749
Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
4243 Campus Point Court
San Diego, California 92121
Phone: 714/457-1000

Products: Data converters, arithmetic products, and special processors.

Optoelectronics Division
1201 Tappan Circle
Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

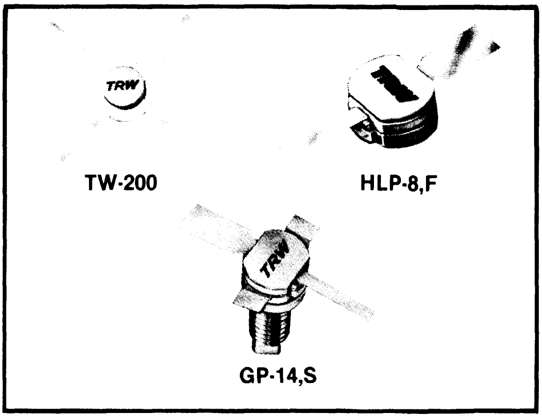
Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

Linear Microwave Transistors

TRW's series of common emitter microwave devices find numerous uses in small and medium signal applications to 4GHz. Through TRW's diffused ballast resistors and other proprietary protection mechanisms, these fully hermetic, gold metalized transistors can withstand a full infinite VSWR mismatch, any phase without damage. All units are rated for 20 volt operation.

Microwave Linear Transistors

- Gold Metalized
- Diffused Ballast Resistors
- Linear per DIN-45004K
- Common Emitter
- 5 Package Options
- 2 GHz
- 1.5 W
- ∞ VSWR

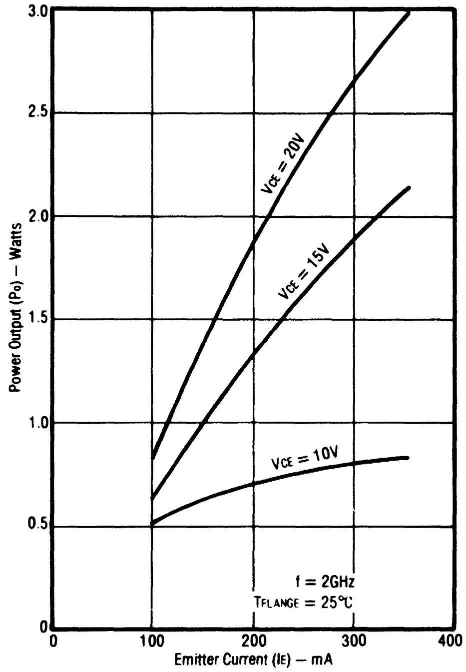


Electrical Characteristics (T_{CASE} = 25°C)

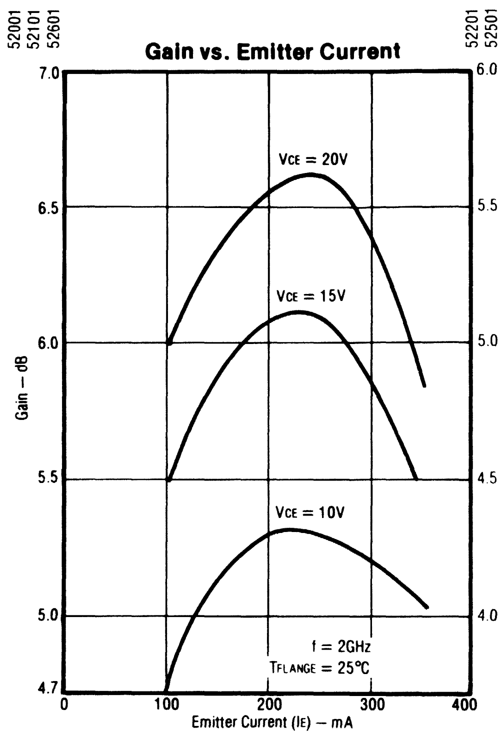
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 20mA	24			V
DC TEST	BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 20mA	50			V
DC TEST	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25mA	3.5			V
DC TEST	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 1.0mA	45			V
DC TEST	I_{CBO}	Collector Cutoff Current	V_{CB} = 28V			0.125	mA
DC TEST	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5.0V, I_C = 100mA	20		120	—
RF TEST	C_{ob}	Collector-Base Capacitance	V_{CB} = 28V, f = 1MHz			5	pF
RF TEST	P_O	Power Output	V_{CE} = 20V, I_E = 220mA f = 2.0GHz, P_{in} = 0.375W *P_{in} = 0.474W f/52201 & 52501	1.5			W
RF TEST	f_t	Frequency Cutoff	V_{CE} = 20V, I_E = 220mA	2.7	3.0		GHz
RF TEST	VSWR	Mismatch Tolerance	P_O = 1.5W, I_E = 220mA, V_{CE} = 20V	∞			
RF TEST	IMD	Third Order Intermodulation Distortion	V_{CE} = 20V, I_E = 220mA f = 2.0GHz, $P_{O(PEP)}$ = 1.5W Tones at 2.05GHz and 2.1GHz		-30		dB
RF TEST	$IMD_{(TV)}$	Intermodulation per DIN-45004/K	V_{CE} = 20V, I_E = 150mA, f = 1.0GHz, P_{REF} = 0.5W		-60		dB
RF TEST	L_G	Gain Linearity	V_{CE} = 20V, I_E = 220mA f = 2.0GHz, P_{O1} = 1.5W, P_{O2} = 1.5mW			-0.2 +1.0	dB
OPER.	T_j & T_{stg}	Max. Junction & Storage Temperature		-65		+200	°C
OPER.	θ_{jC}	Thermal Resistance	T_C = 25°C			16	°C/W

ELECTRICAL CHARACTERISTICS
TRW52001, TRW52101, TRW52201, TRW52501, TRW52601

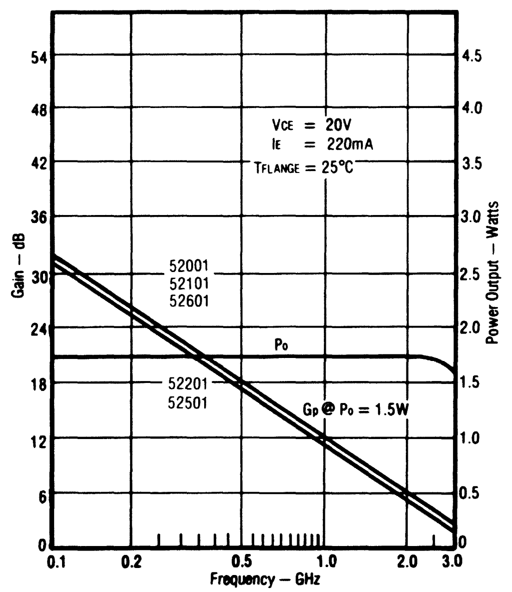
1dB Compression Point vs. Emitter Current



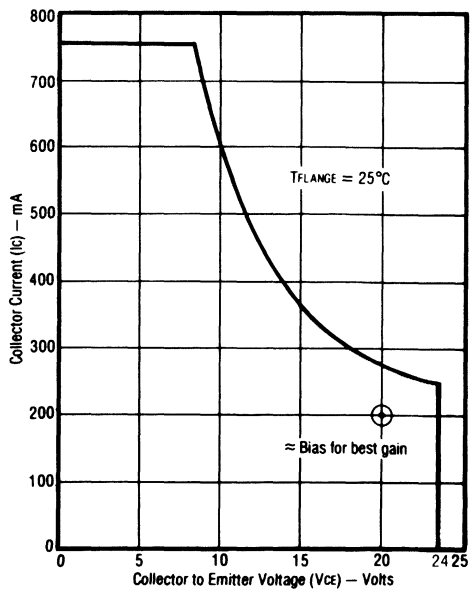
Gain vs. Emitter Current



Gain and 1dB Compressed Power vs. Frequency

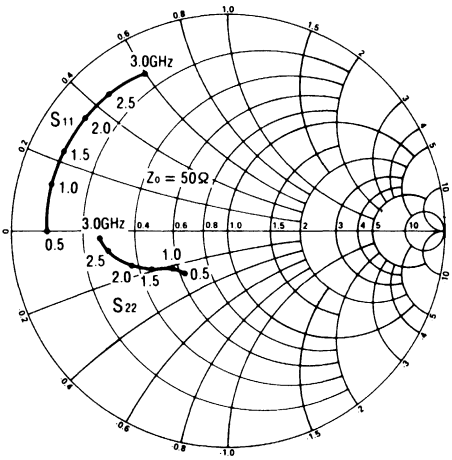


Safe Operating Area

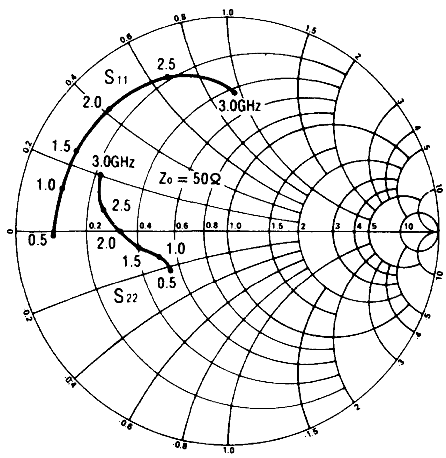


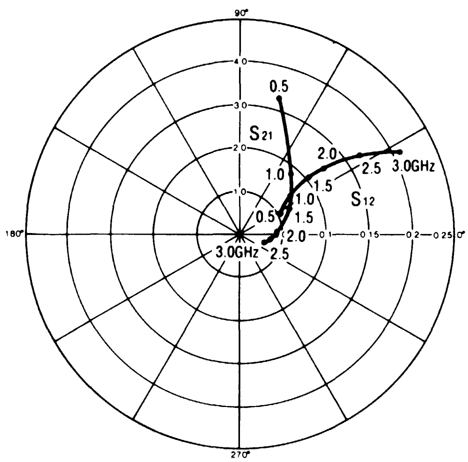
S-PARAMETERS
V_{CE} = 20V, I_E = 220mA, T_{FLANGE} = 25°C

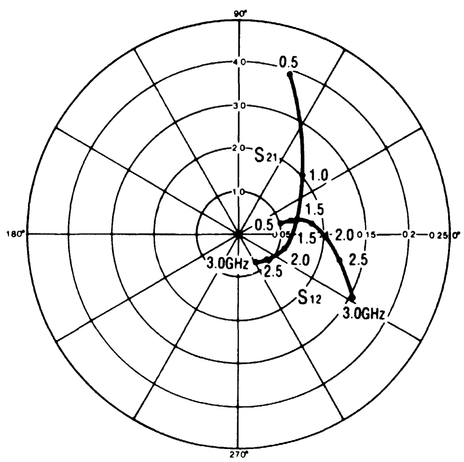
TRW52001



TRW52101, TRW52601



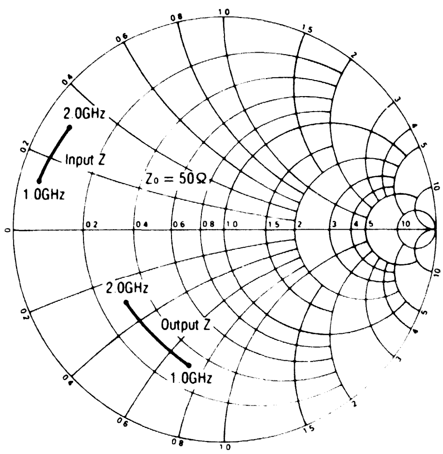




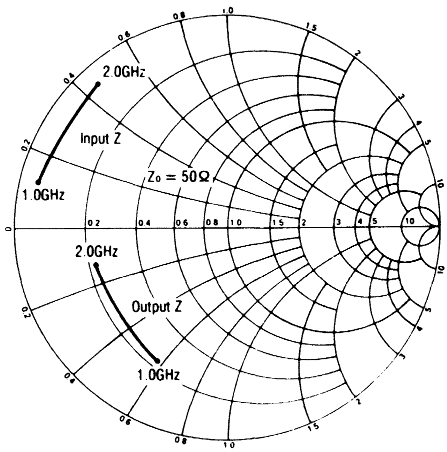
TRW 52001 Series

LARGE SIGNAL IMPEDANCE DATA
V_{CE} = 20V, I_E = 220mA, T_{FLANGE} = 25°C

TRW52001

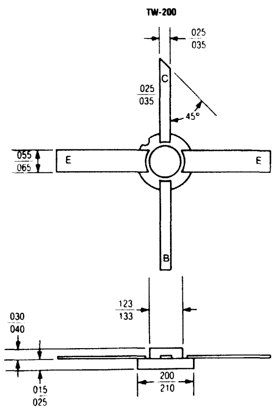


TRW52101, TRW52601

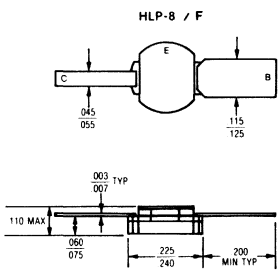


Package Outlines

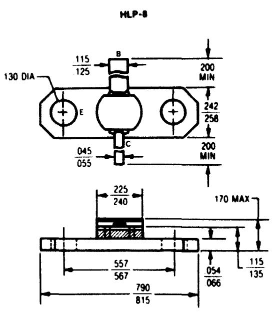
TRW52001



TRW52101



TRW52601



Mechanical Design Specifications

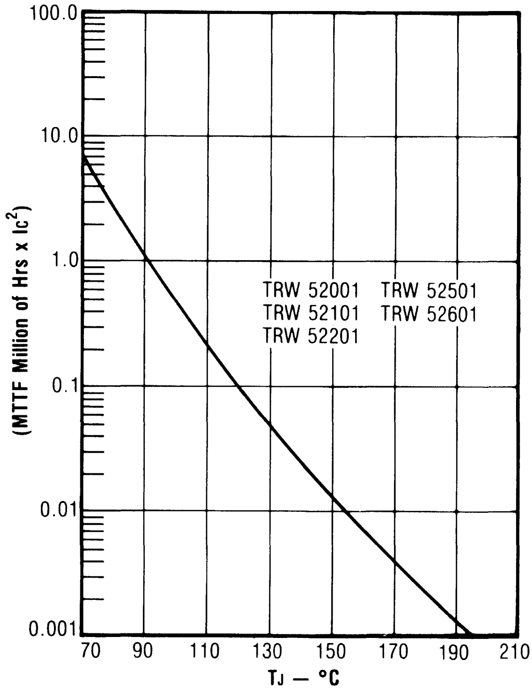
The following are design specifications for this transistor series:

Dimensions: Per outline drawing.
Solderability: Per MIL STD 750.
Marking: Per MIL S 19500, "TRW," 4 digit date code, type number.
Hermeticity: Per MIL STD 750, 10⁻⁷ atmospheres gross and fine leak. (Available on special order screened to 10⁻⁸ atmospheres.)

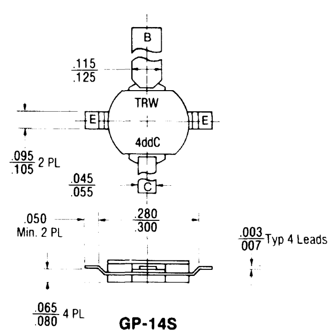
Acceleration: Per MIL STD 750, 20,000 G in any plane.
Lead Pull: Per MIL STD 750, 3 grams min.
Package: A brazed ceramic package assuring long term integrity of hermetic seals. Leads of KOVAR base material with minimum 60 microinches of gold plating.

MTTF FACTOR (Normalized to 1 Ampere² Continuous Duty)

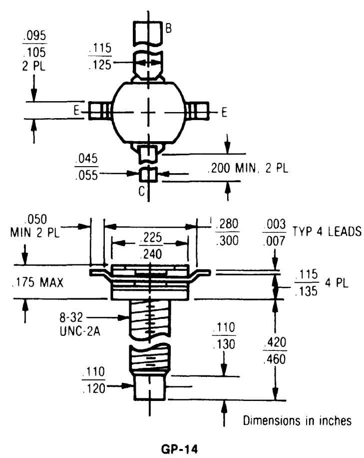
The graph shown below displays MTTF in hours x ampere² emitter current for each of the devices. Life tests at elevated temperatures have correlated to better than ±10% to the theoretical prediction for metal failure. Sample MTTF calculations based on operating conditions are included below.



TRW52201



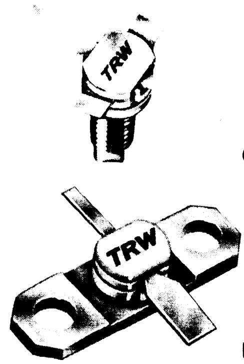
TRW52501



TRW 52002 Series

Microwave Linear Transistors

- Gold Metalized
- Diffused Ballast Resistors
- Linear per DIN 45004K
- Common Emitter
- Package Options
- 3 Watts
- 2 GHz
- Hermetic
- ∞ VSWR



GP-14

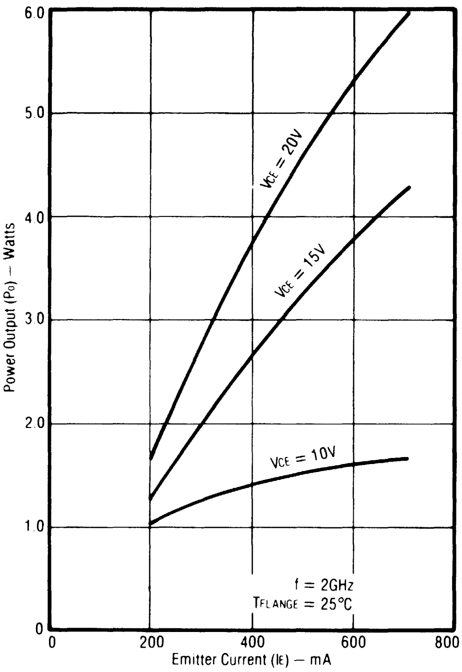
HLP-8

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

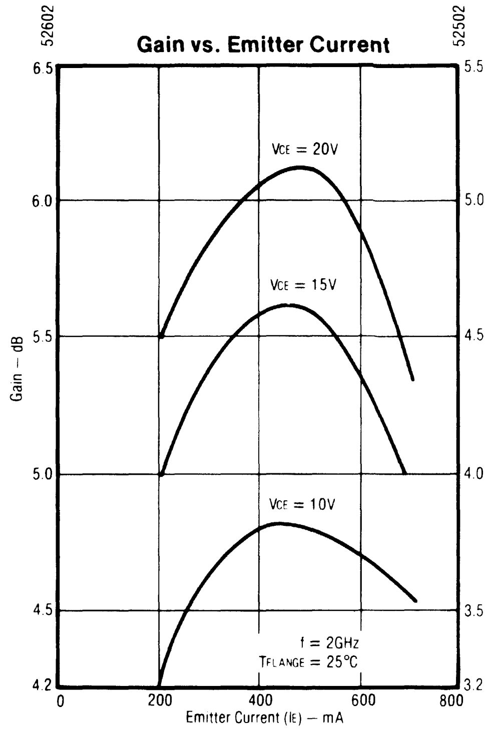
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 40mA	24			V
	BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 40mA	50			V
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.50mA	3.5			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 2.0mA	45			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 28V			0.25	mA
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5.0V, I_C = 200mA	20		120	–
RF TEST	C_{ob}	Collector-Base Capacitance	V_{CB} = 28V, f = 1MHz			7	pF
	P_O	Power Output	V_{CE} = 20V, I_E = 440mA f = 2.0GHz, P_{in} = 0.75W(52602) P_{in} = .95W f/(52502)	3.0			W
	f_t	Frequency Cutoff	V_{CE} = 20V, I_E = 440mA	2.7	3.0		GHz
	VSWR	Mismatch Tolerance	P_O = 3.0W, I_E = 440mA, V_{CE} = 20V	∞			
	IMD	Third Order Intermodulation Distortion	V_{CE} = 20V, I_E = 440mA $P_{O(PEP)}$ = 3.0W Tones at 2.000GHz and 2.005GHz		-30		dB
	$IMD_{(TV)}$	Intermodulation per DIN-45004/K	V_{CE} = 20V, I_E = 300mA, f = 1.0GHz, P_{REF} = 1.0W		-60		dB
	L_G	Gain Linearity	V_{CE} = 20V, I_E = 440mA f = 2.0GHz, P_{O1} = 3.0W, P_{O2} = 3.0mW			-0.2 +1.0	dB
OPER.	T_j & T_{stg}	Max. Junction & Storage Temperature		-65		+200	°C
	θ_{jC}	Thermal Resistance	T_C = 25°C			8.5	°C/W

ELECTRICAL CHARACTERISTICS
TRW52502, TRW52602

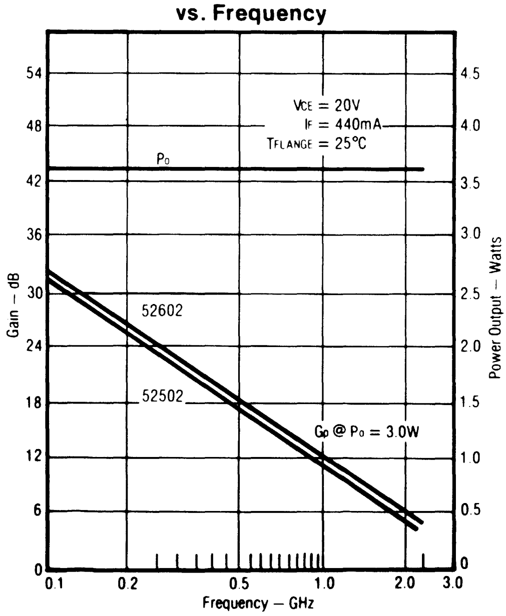
1dB Compression Point vs. Emitter Current



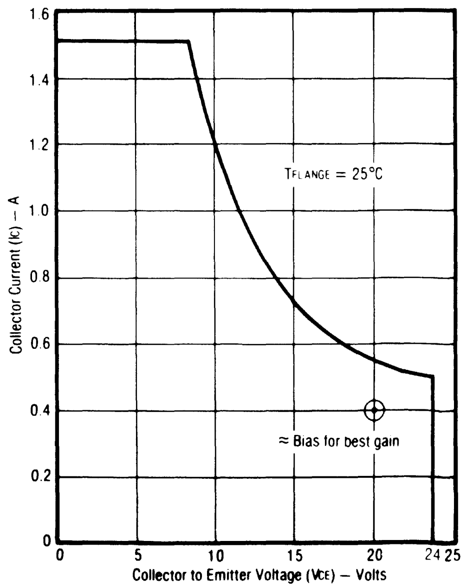
Gain vs. Emitter Current



Gain and 1dB Compressed Power vs. Frequency

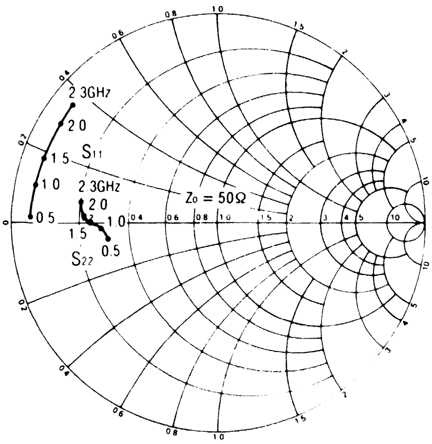


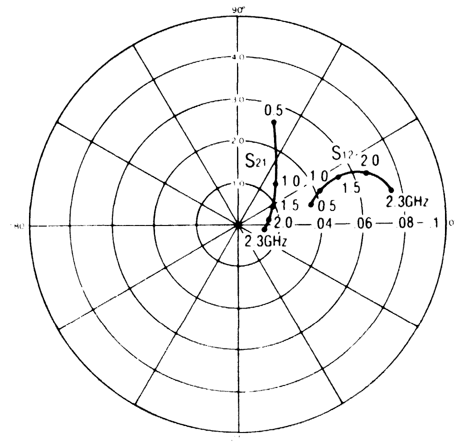
D.C. Safe Operating Area



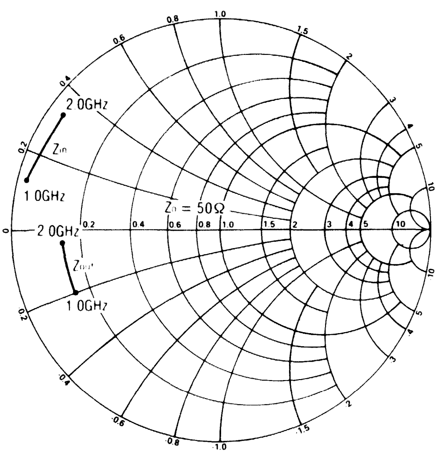
S-PARAMETERS

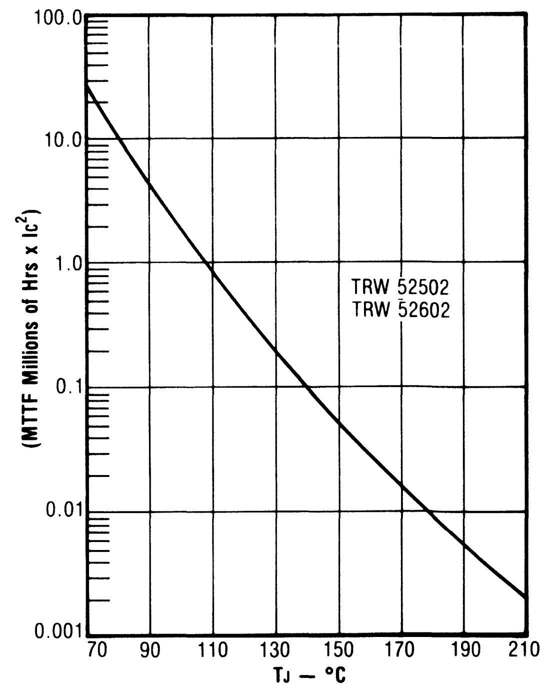
$V_{CE} = 20V$, $I_E = 440mA$, $T_{FLANGE} = 25°C$





Large Signal Impedance Data





Mechanical Design Specifications

The following are design specifications for this transistor series.

Dimensions: Per outline drawing.

Solderability: Per MIL-STD-750.

Marking: Per MIL-S-19500, "TRW," 4-digit date code, type number.

Hermeticity: Per MIL-STD-750, 10^{-7} atmospheres gross and fine leak. (Available on special order screened to 10^{-8} atmospheres.)

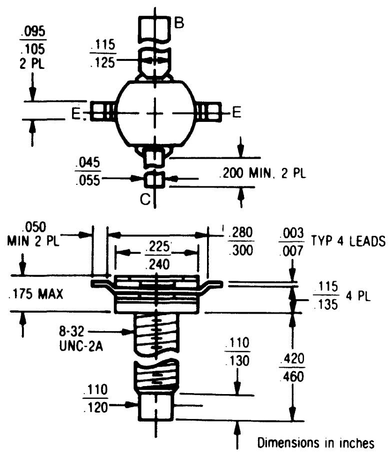
Acceleration: Per MIL-STD-750, 20,000G in any plane.

Bond Pull: Per MIL-STD-750, 3 grams min.

Package: A brazed ceramic package assuring long-term integrity of hermetic seals. Leads of NICKEL base material with minimum 60 microinches of gold plating.

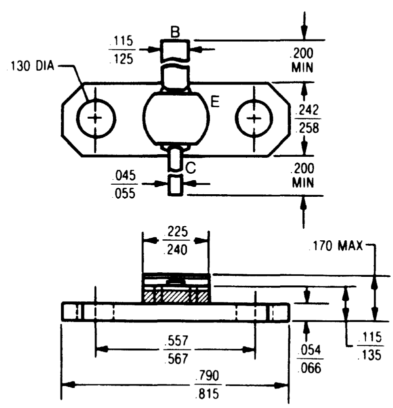
TRW52502

GP-14



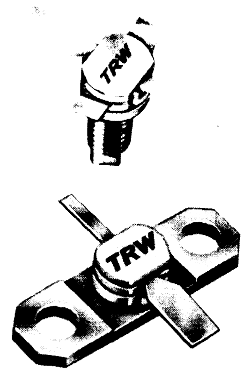
TRW52602

HLP-8



Microwave Linear Transistors

- **Gold Metalized**
- **Diffused Ballast Resistors**
- **Linear per DIN 45004K**
- **Common Emitter**
- **Package Options**
- **6 Watts**
- **2 GHz**
- **∞ VSWR**
- **Hermetic**



GP-14

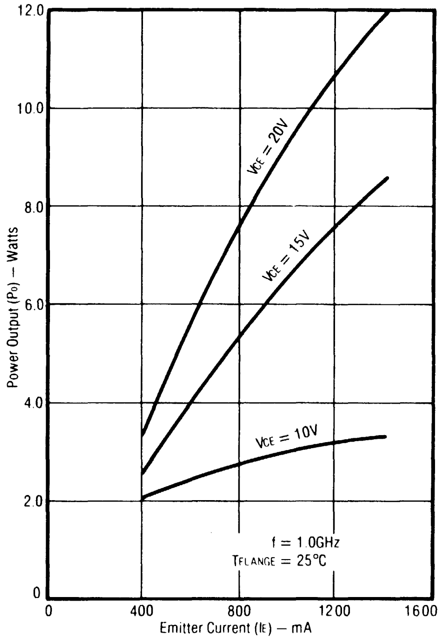
HLP-8

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

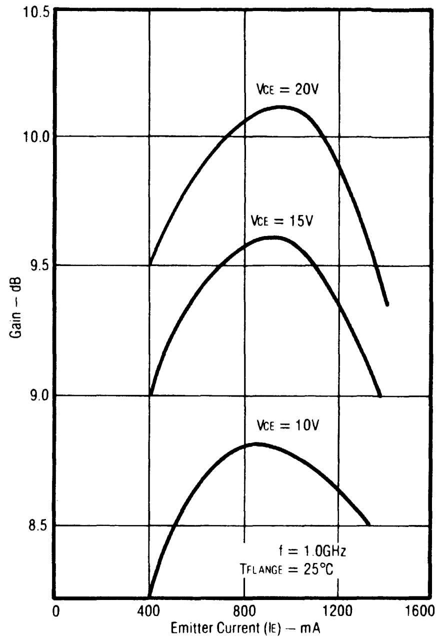
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 80mA	24			V
	BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 80mA	50			V
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 1.0mA	3.5			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 4.0mA	45			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 28V			0.5	mA
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5.0V, I_C = 400mA	20		120	—
RF TEST	C_{ob}	Collector-Base Capacitance	V_{CB} = 28V, f = 1MHz			12	pF
	P_O	Power Output	V_{CE} = 20V, I_E = 880mA f = 2.0GHz, P_{in} = 2.0W	6.0			W
	f_t	Frequency Cutoff	V_{CE} = 20V, I_E = 880mA	2.4	2.6		GHz
	VSWR	Mismatch Tolerance	P_O = 6.0W, I_E = 880mA, V_{CE} = 20V	3:1			
	IMD	Third Order Intermodulation Distortion	V_{CE} = 20V, I_E = 880mA $P_{O(PEP)}$ = 6.0W Tones at 1.000GHz and 1.005GHz		-30		dB
	$IMD_{(TV)}$	Intermodulation per DIN-45004/K	V_{CE} = 20V, I_E = 600mA, f = 1.0GHz, P_{REF} = 2.0W		-60		dB
	L_G	Gain Linearity	V_{CE} = 20V, I_E = 880mA f = 2.0GHz, P_{O1} = 6W, P_{O2} = 6mW			-0.2 +1.0	dB
OPER.	T_j & T_{stg}	Max. Junction & Storage Temperature		-65		+200	°C
	θ_{jC}	Thermal Resistance	P_O = 5W, V_{CE} = 20V, I_E = 880mA			6.0	°C/W

ELECTRICAL CHARACTERISTICS

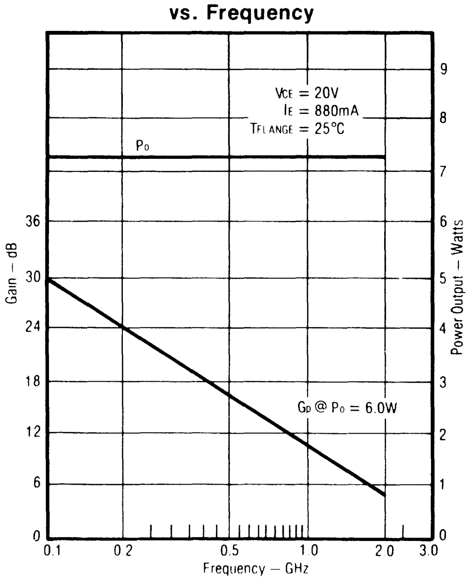
1dB Compression Point vs. Emitter Current



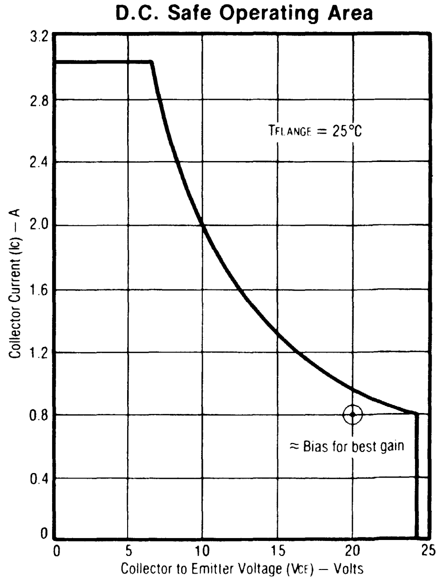
Gain vs. Emitter Current



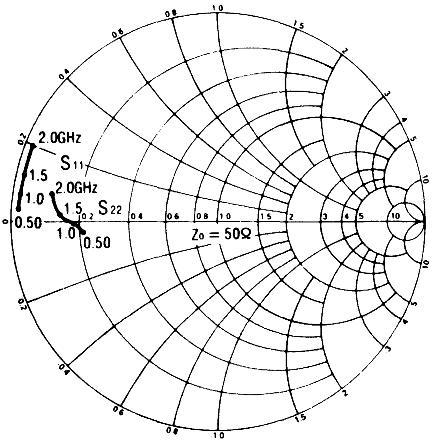
Gain and 1dB Compressed Power vs. Frequency

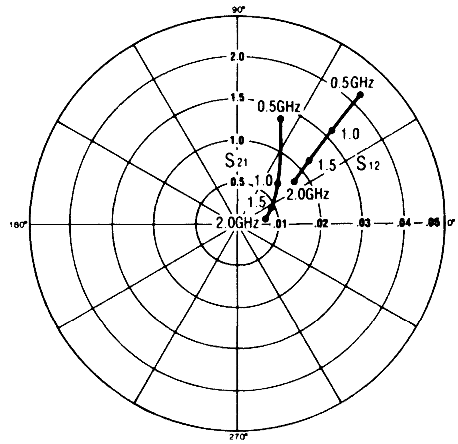


D.C. Safe Operating Area

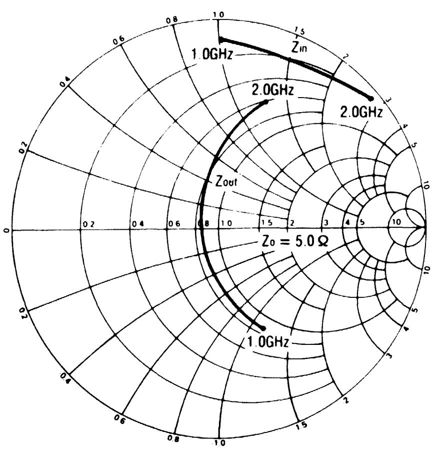


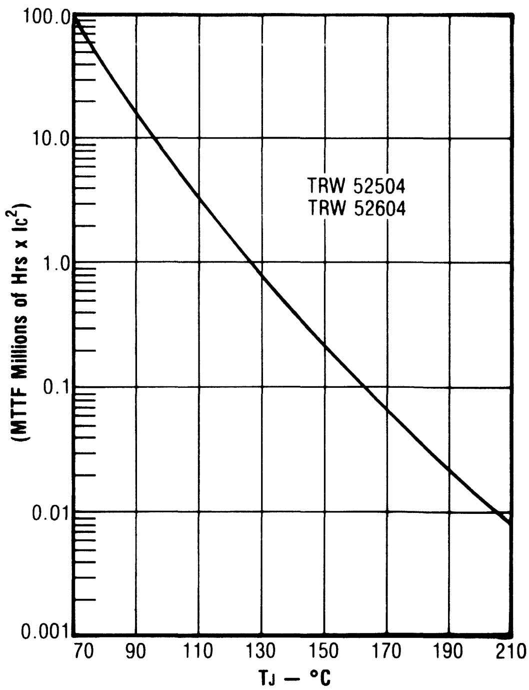
S-Parameters
V_{CE} = 20V, I_E = 880mA, T_{FLANGE} = 25°C





Large Signal Impedance Data





Mechanical Design Specifications

The following are design specifications for this transistor series.

Dimensions: Per outline drawing.

Solderability: Per MIL-STD-750.

Marking: Per MIL-S-19500, "TRW," 4-digit date code, type number.

Hermeticity: Per MIL-STD-750, 10^{-7} atmospheres gross and fine leak. (Available on special order screened to 10^{-8} atmospheres.)

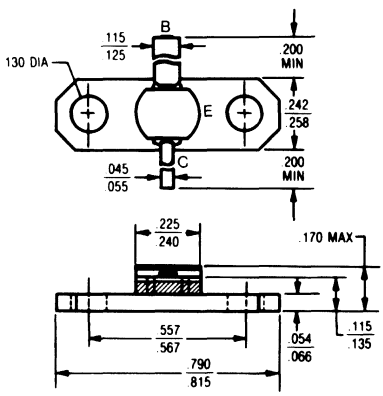
Acceleration: Per MIL-STD-750, 20,000G in any plane.

Bond Pull: Per MIL-STD-750, 3 grams min.

Package: A brazed ceramic package assuring long-term integrity of hermetic seals. Leads of NICKEL base material with minimum 60 microinches of gold plating.

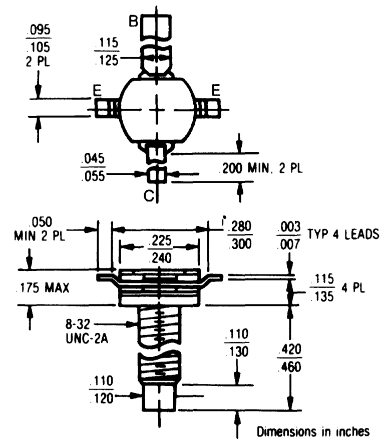
Package Outlines

TRW52604



HLP-8

TRW52504

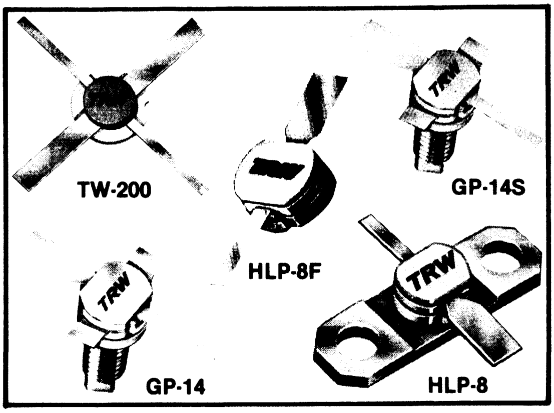


GP-14

TRW

Microwave Linear Transistors

- 0.8 Watts
- 3 GHz
- Gold Metalized
- Diffused Ballast Resistors
- Linear per DIN 45004K
- Common Emitter
- Package Options
- Hermetic
- ∞VSWR

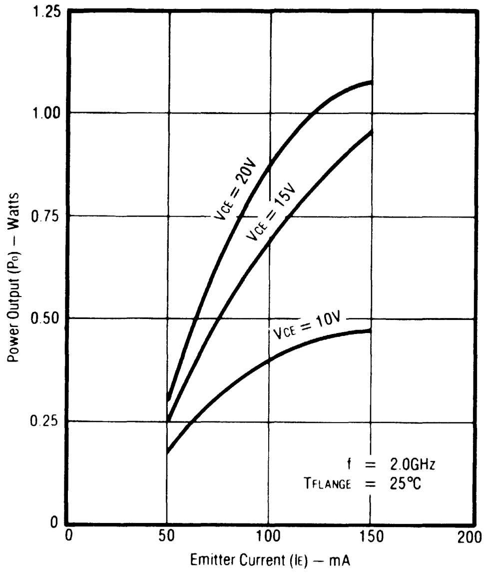


Electrical Characteristics (T_{CASE} = 25°C)

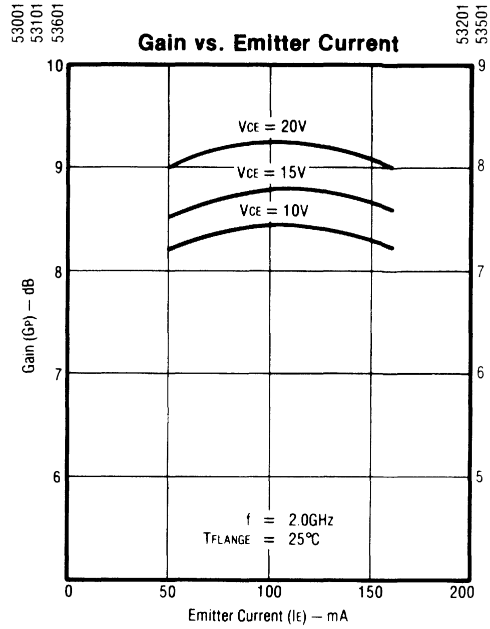
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 10mA	22			V
	BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 10mA	50			V
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25mA	3.5			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 1.0mA	45			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 28V			0.25	mA
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5.0V, I_C = 100mA	20		120	–
RF TEST	C_{ob}	Collector-Base Capacitance	V_{CB} = 28V, f = 1MHz			3.5	pF
	P_O	Power Output	V_{CE} = 20V, I_E = 120mA, f = 2.0GHz *P_{in} = .100W f/53101 & 53601 P_{in} = 0.142W f/53201 & 53501 P_{in} = .142WF/53001	.8			W
	f_t	Frequency Cutoff	V_{CE} = 20V, I_E = 120mA	3.0	3.3		GHz
	VSWR	Mismatch Tolerance	P_O = 0.8W, I_E = 120mA, V_{CE} = 20V	∞			
	IMD	Third Order Intermodulation Distortion	V_{CE} = 20V, I_E = 120mA f = 2.0GHz, $P_{O(PEP)}$ = 0.8W Tones at 2.000GHz and 2.005GHz		-30		dB
	$IMD_{(TV)}$	Intermodulation per DIN-45004/K	V_{CE} = 20V, I_E = 75mA, f = 1.0GHz, P_{REF} = 0.25W		-60		dB
	L_G	Gain Linearity	V_{CE} = 20V, I_E = 120mA f = 2.0GHz, P_{O1} = .8W, P_{O2} = .8mW			-0.2 +1.0	dB
OPER.	T_j & T_{stg}	Max. Junction & Storage Temperature		-65		+200	°C
	θ_{jC}	Thermal Resistance	T_C = 25°C			31	°C/W

ELECTRICAL CHARACTERISTICS
TRW53001, TRW53101, TRW53201, TRW53501, TRW53601

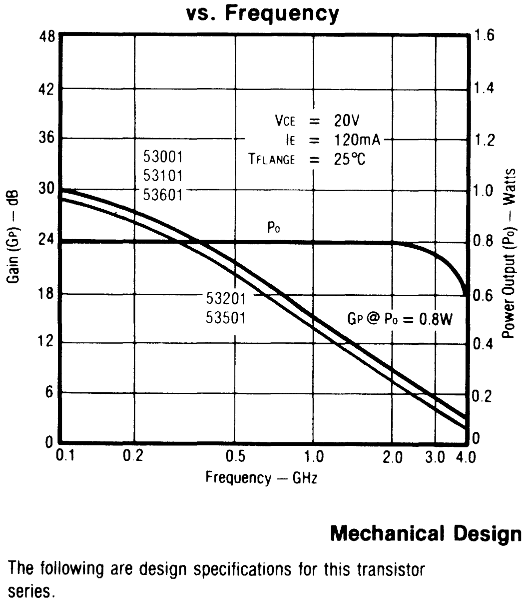
1dB Compression Point vs. Emitter Current



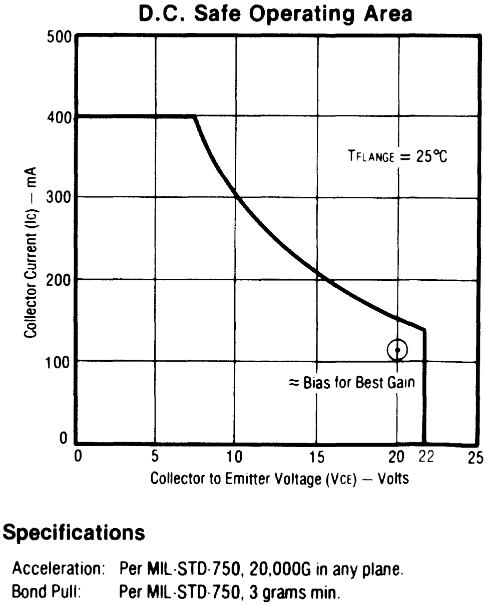
Gain vs. Emitter Current



Gain and 1dB Compressed Power vs. Frequency



D.C. Safe Operating Area



Mechanical Design Specifications

The following are design specifications for this transistor series.

Dimensions: Per outline drawing.

Solderability: Per MIL-STD-750.

Marking: Per MIL-S-19500, "TRW," 4-digit date code, type number.

Hermeticity: Per MIL-STD-750, 10^{-7} atmospheres gross and fine leak. (Available on special order screened to 10^{-8} atmospheres.)

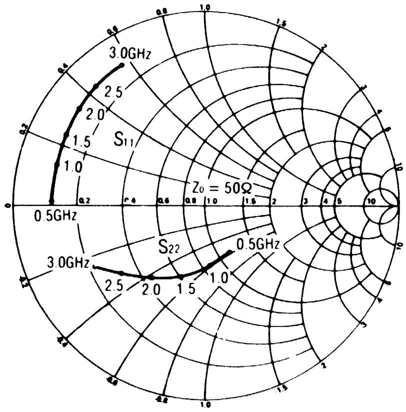
Acceleration: Per MIL-STD-750, 20,000G in any plane.

Bond Pull: Per MIL-STD-750, 3 grams min.

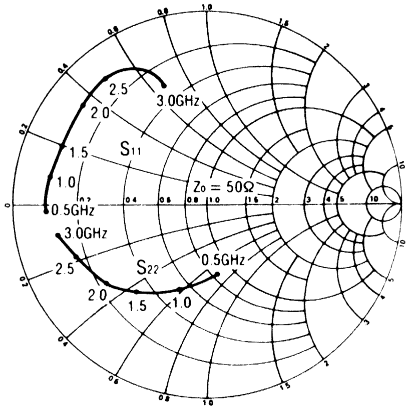
Package: A brazed ceramic package assuring long-term integrity of hermetic seals. Leads of KOVAR base material with minimum 60 microinches of gold plating.

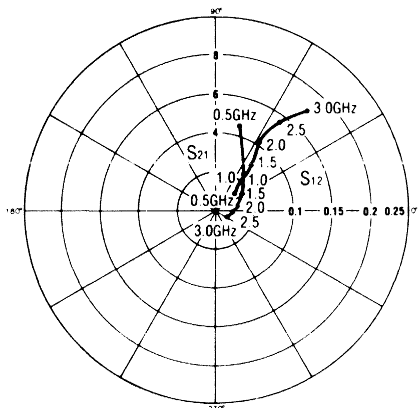
S-Parameters
VCE = 20V, IE = 120mA, TFLANGE = 25°C

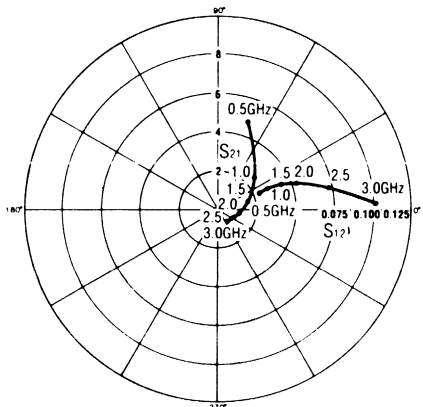
TRW53001



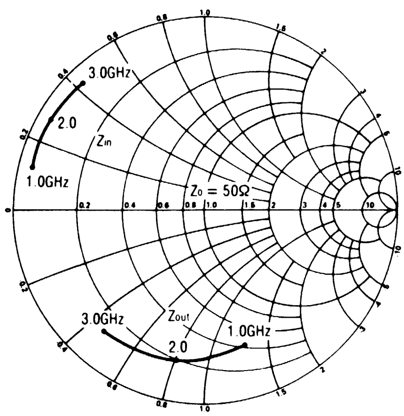
TRW53101, TRW53601

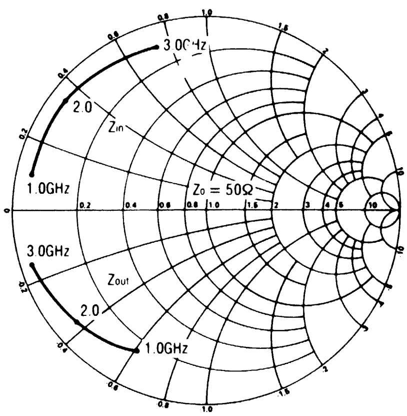






Large Signal Impedance Data
VCE = 20V, IE = 120mA, TFLANGE = 25°C

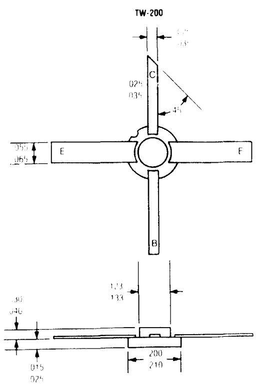




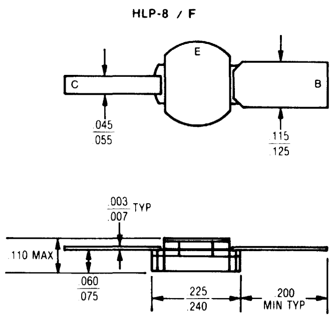
TRW 53001 Series

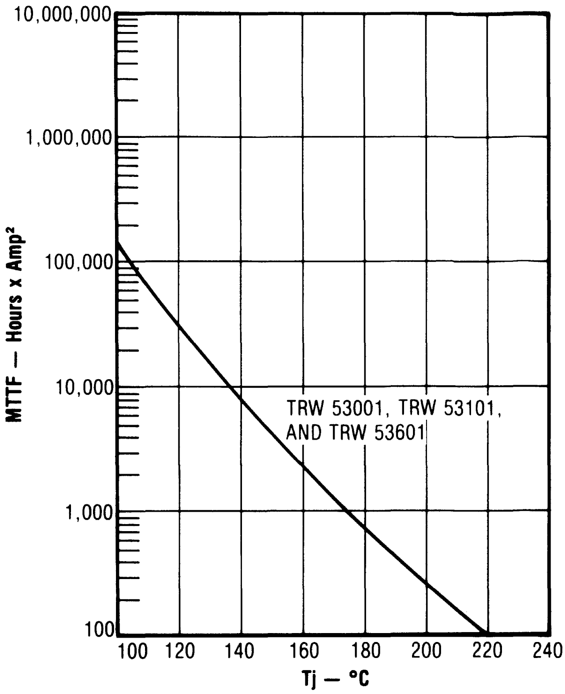
Note: Test circuit details are available from TRW Semiconductors.

TRW53001

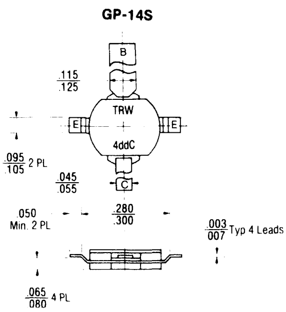


TRW53101

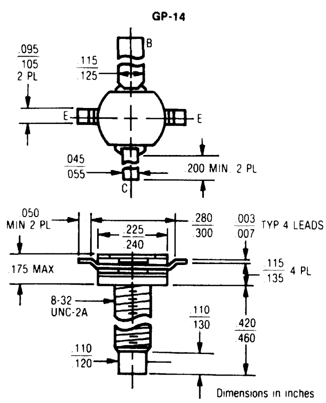




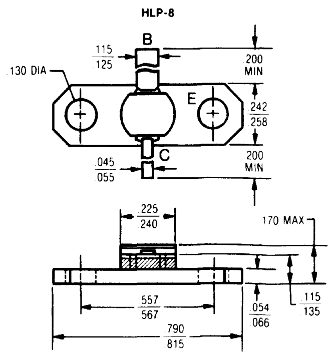
TRW53201



TRW53501



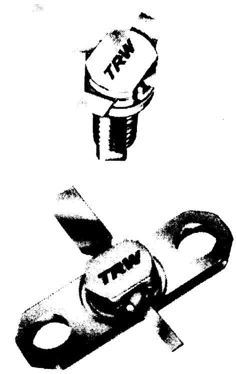
TRW53601



TRW 53002 Series

Microwave Linear Transistors

- 1.6 Watts
- 3 GHz
- Gold Metalized
- Diffused Ballast Resistors
- Linear per DIN 45004K
- Common Emitter
- Package Options
- Hermetic
- ∞ VSWR



GP-14

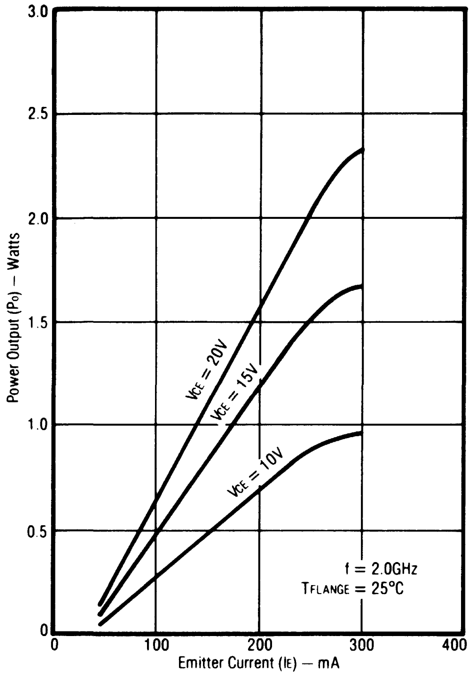
HLP-8

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

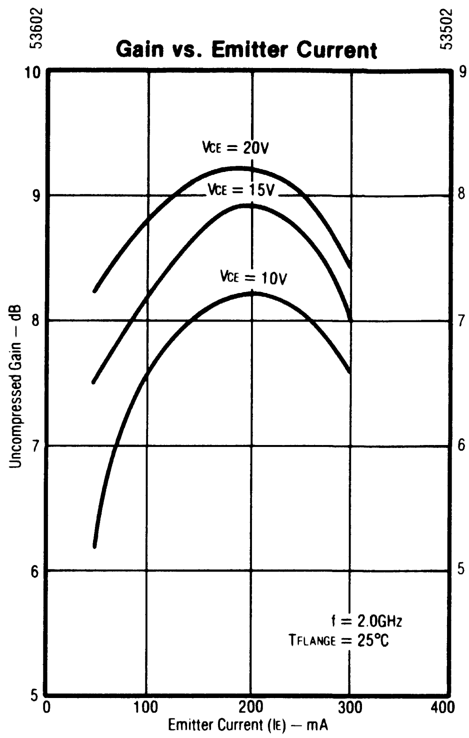
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 20mA	22			V
	BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 20mA	50			V
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.50mA	3.5			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 2.0mA	45			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 28V			0.5	mA
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5.0V, I_C = 200mA	20		120	—
RF TEST	C_{ob}	Collector-Base Capacitance	V_{CB} = 28V, f = 1MHz			5.5	pF
	P_O	Power Output	V_{CE} = 20V, I_E = 230mA, f = 2.0GHz P_{in} = 0.253W f/53602 P_{in} = .319W f/53502	1.6			W
	f_t	Frequency Cutoff	V_{CE} = 20V, I_E = 230mA	3.0	3.3		GHz
	VSWR	Mismatch Tolerance	P_O = 1.6W, I_E = 230mA, V_{CE} = 20V	∞			
	IMD	Third Order Intermodulation Distortion	V_{CE} = 20V, I_E = 230mA $P_{O(PEP)}$ = 1.6W Tones at 2.000GHz and 2.005GHz		-30		dB
	$IMD_{(TV)}$	Intermodulation per DIN-45004/K	V_{CE} = 20V, I_E = 150mA, f = 1.0GHz, P_{REF} = 0.5W		-60		dB
	L_G	Gain Linearity	V_{CE} = 20V, I_E = 230mA f = 2.0GHz, P_{O1} = 1.6W, P_{O2} = 1.6mW			-0.2 +1.0	dB
OPER.	T_j & T_{stg}	Max. Junction & Storage Temperature		-65		+200	°C
	θ_{jC}	Thermal Resistance	T_C = 25°C			17	°C/W

ELECTRICAL CHARACTERISTICS
TRW53502, TRW53602

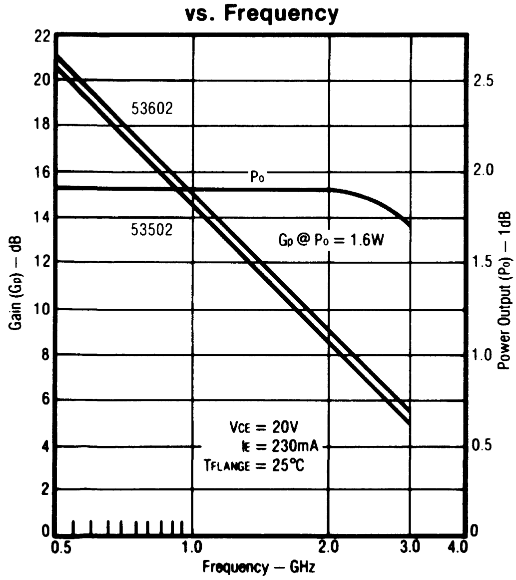
1dB Compression Point vs. Emitter Current



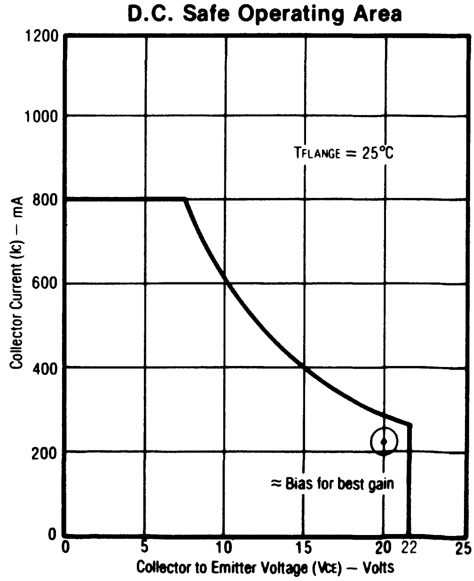
Gain vs. Emitter Current



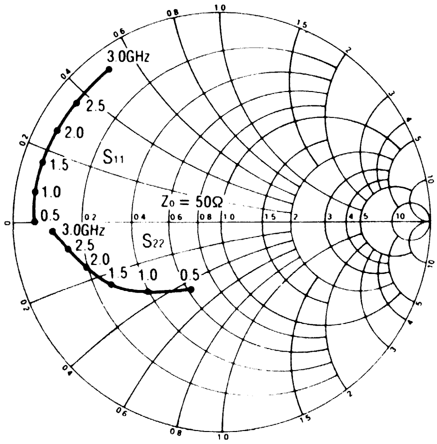
Gain and 1dB Compressed Power vs. Frequency

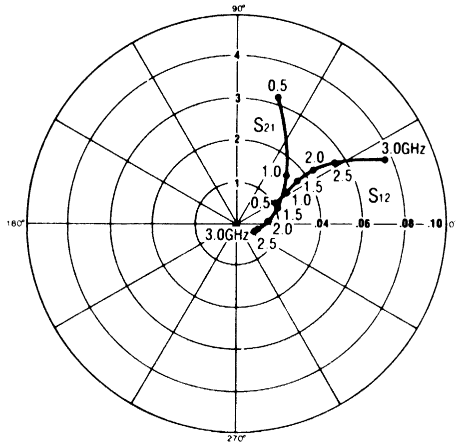


D.C. Safe Operating Area

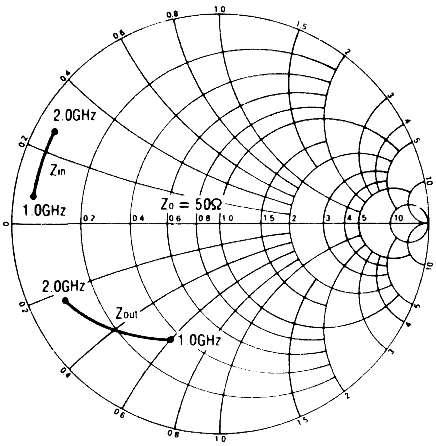


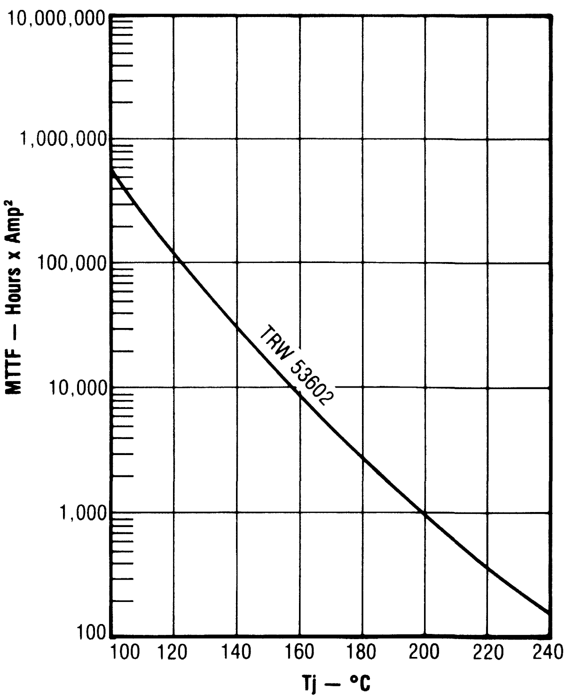
S-PARAMETERS
V_{CE} = 20V, I_E = 230mA, T_{FLANGE} = 25°C





Large Signal Impedance Data





Mechanical Design Specifications

The following are design specifications for this transistor series.

Dimensions: Per outline drawing.

Solderability: Per MIL STD-750.

Marking: Per MIL-S-19500, "TRW," 4-digit date code, type number.

Hermeticity: Per MIL-STD-750, 10^{-7} atmospheres gross and fine leak. (Available on special order screened to 10^{-8} atmospheres.)

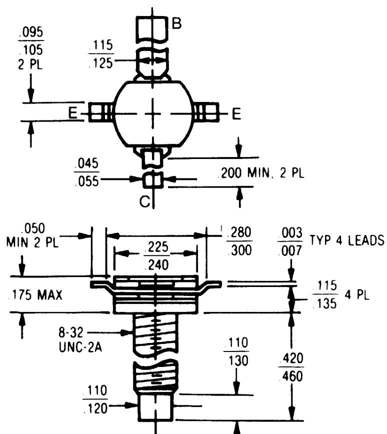
Acceleration: Per MIL-STD-750, 20,000G in any plane.

Bond Pull: Per MIL-STD-750, 3 grams min.

Package: A brazed ceramic package assuring long-term integrity of hermetic seals. Leads of NICKEL base material with minimum 60 microinches of gold plating.

TRW53502

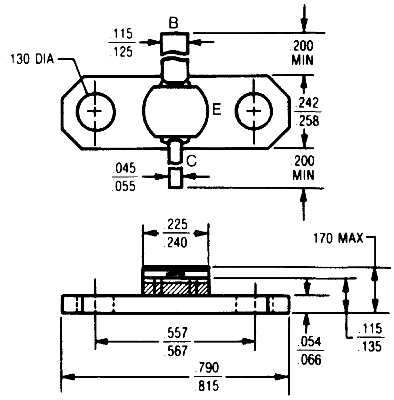
GP-14



Dimensions in inches

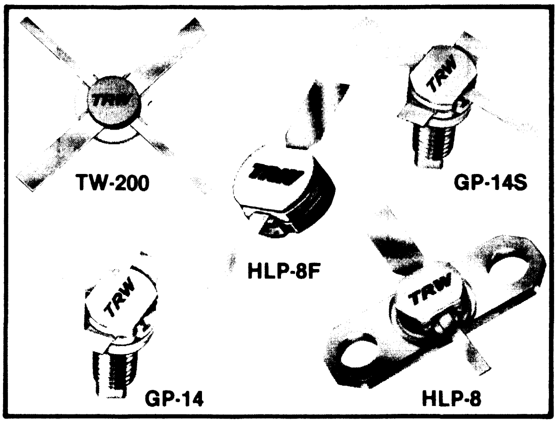
TRW53602

HLP-8



Microwave Linear Transistors

- 0.5 Watts
- 4 GHz
- Gold Metalized
- Diffused Ballast Resistors
- Linear per DIN 45004K
- Common Emitter
- Package Options
- Hermetic
- ∞ VSWR

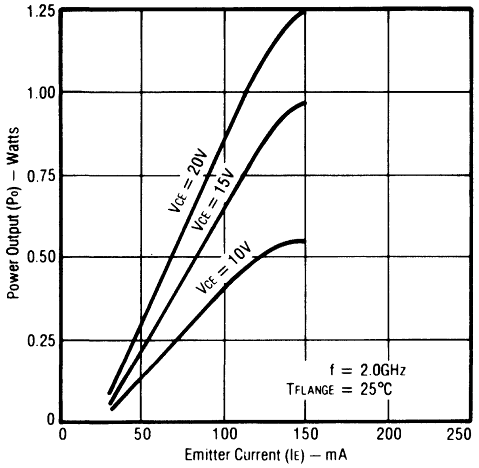


Electrical Characteristics (T_{CASE} = 25°C)

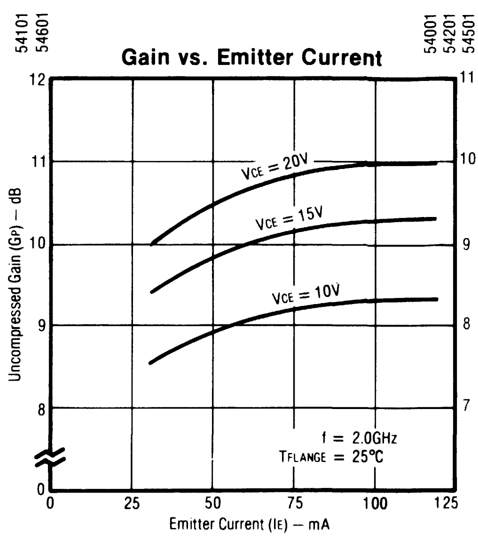
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 10mA	22			V
	BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 10mA	50			V
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25mA	3.5			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 1.0mA	45			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 28V			0.25	mA
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5.0V, I_C = 100mA	20		120	–
RF TEST	C_{ob}	Collector-Base Capacitance	V_{CB} = 28V, f = 1MHz			3.5	pF
	P_O	Power Output	V_{CE} = 20V, I_E = 120mA, f = 2.0GHz P_{in} = .05W f/54001 & 54201 & 54501 *P_{in} = .04W all others	.5			W
	f_t	Frequency Cutoff	V_{CE} = 20V, I_E = 120mA	4.0	4.5		GHz
	VSWR	Mismatch Tolerance	P_O = 0.5W, I_E = 120mA, V_{CE} = 20V	∞			
	IMD	Third Order Intermodulation Distortion	V_{CE} = 20V, I_E = 120mA $P_{O(PEP)}$ = 0.5W Tones at 2.000GHz and 2.005GHz		-30		dB
	$IMD_{(TV)}$	Intermodulation per DIN-45004/K	V_{CE} = 20V, I_E = 75mA, f = 1.0GHz, P_{REF} = 0.15W		-60		dB
	L_G	Gain Linearity	V_{CE} = 20V, I_E = 120mA f = 2.0GHz, P_{O1} = 0.5W, P_{O2} = 0.5mW			-0.2 +1.0	dB
OPER.	T_j & T_{stg}	Max. Junction & Storage Temperature		-65		+200	°C
	θ_{jC}	Thermal Resistance	T_C = 25°C			40	°C/W

ELECTRICAL CHARACTERISTICS
TRW54001, TRW54101, TRW54201, TRW54501, TRW54601

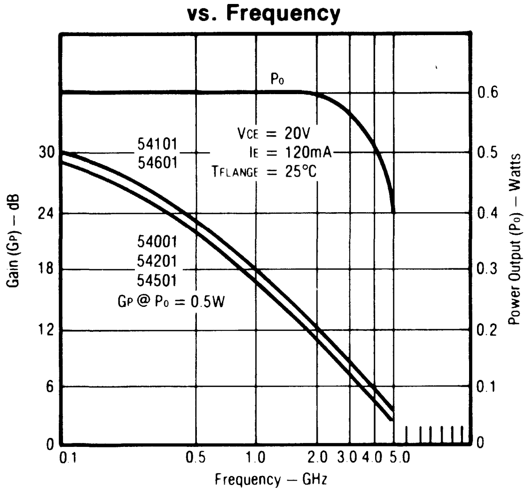
1dB Compression Point vs. Emitter Current



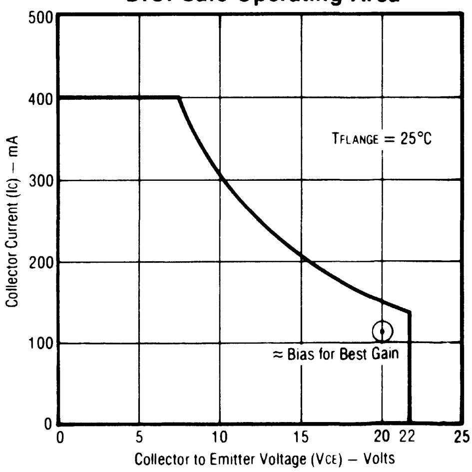
Gain vs. Emitter Current



Gain and 1dB Compressed Power vs. Frequency



D.C. Safe Operating Area



Mechanical Design Specifications

The following are design specifications for this transistor series.

Dimensions: Per outline drawing.

Solderability: Per MIL-STD 750.

Marking: Per MIL-S-19500, "TRW," 4 digit date code, type number.

Hermeticity: Per MIL-STD-750, 10^{-7} atmospheres gross and fine leak. (Available on special order screened to 10^{-8} atmospheres.)

Acceleration: Per MIL-STD-750, 20,000G in any plane.

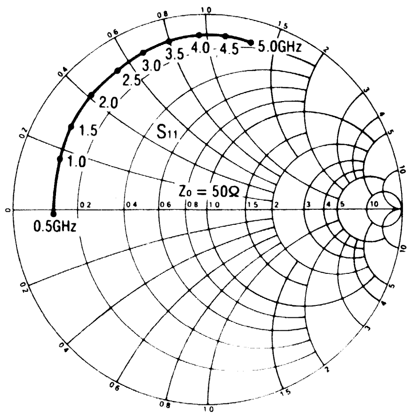
Bond Pull: Per MIL-STD-750, 3 grams min.

Package: A brazed ceramic package assuring long-term integrity of hermetic seals. Leads of KOVAR base material with minimum 60 microinches of gold plating.

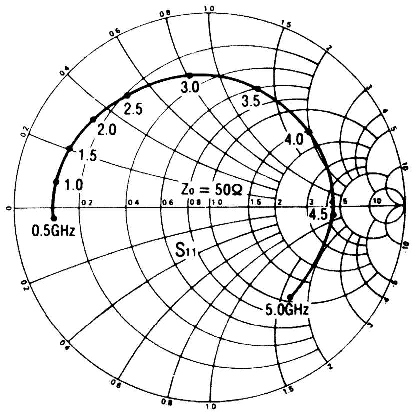
S-Parameters

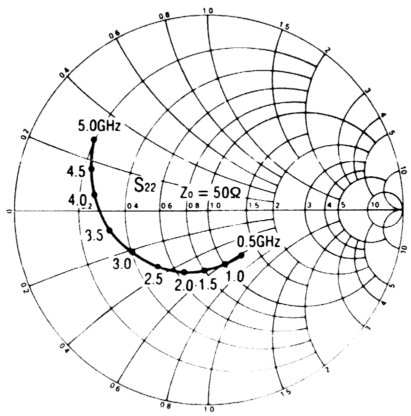
V_{CE} = 20V, I_E = 120mA, T_{FLANGE} = 25°C

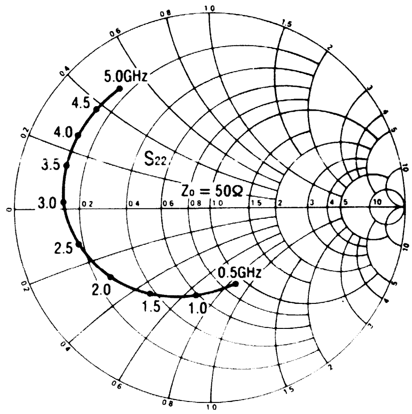
TRW54001

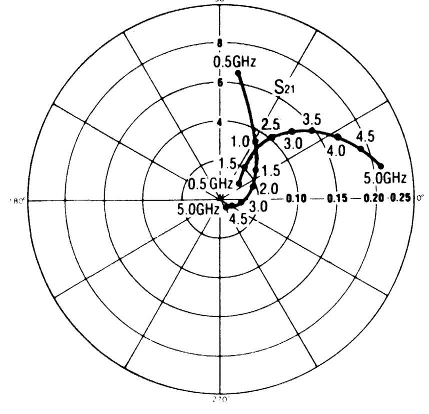


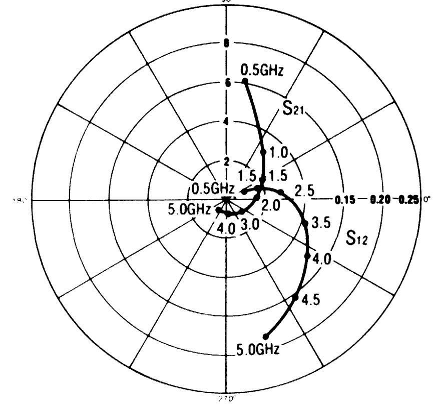
TRW54101, TRW54601







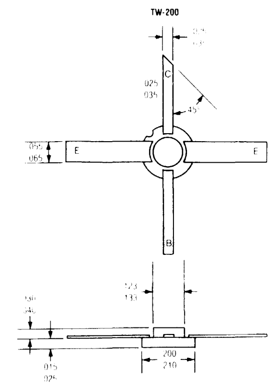




TRW 54001 Series

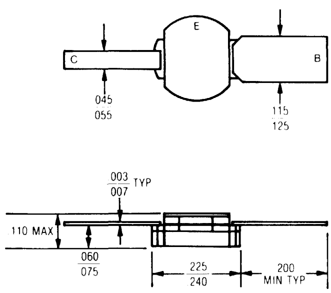
Note: Test circuit details are available from TRW Semiconductors.

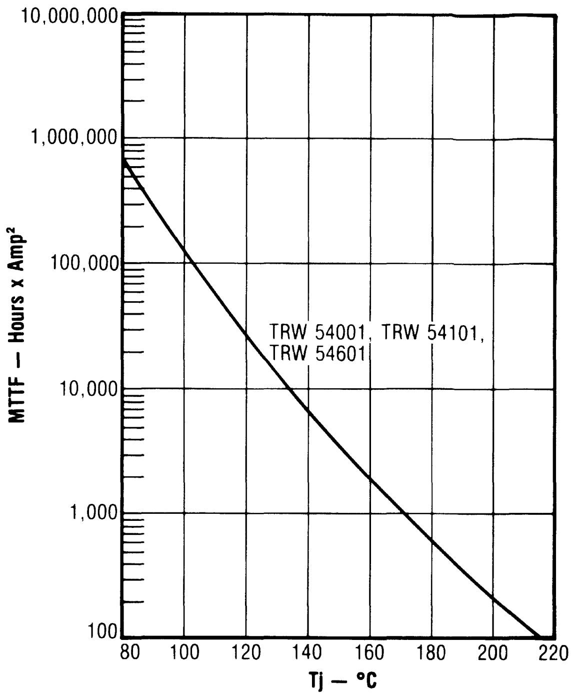
TRW54001



TRW54101

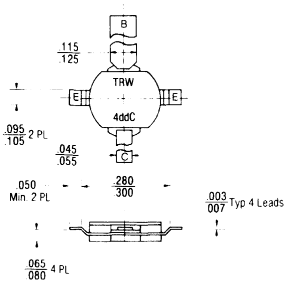
HLP-8 / F





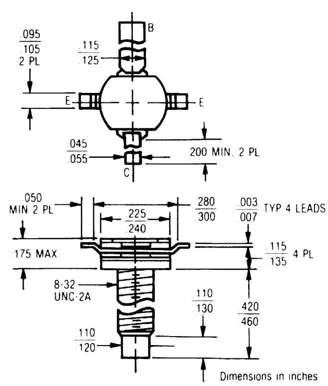
TRW54201

GP-14S



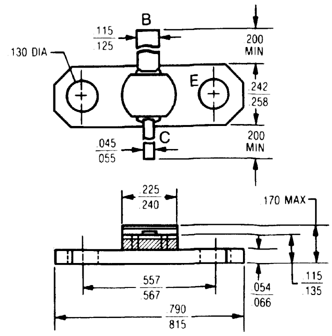
TRW54501

GP-14



TRW54601

HLP-8

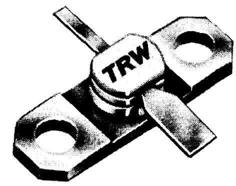


Microwave Power Oscillator Transistors

TRW oscillator devices are common collector, diffused ballasted, gold metalized microwave transistors in fully hermetic HLP 8 packages, characterized for power oscillator applications

Microwave Power Oscillator Transistor

- Common Collector
- Diffused Ballast Resistors
- Gold Metalized
- Hermetic
- Up to 3 GHz
- 1.2 W at 2.5 GHz
- ∞ VSWR

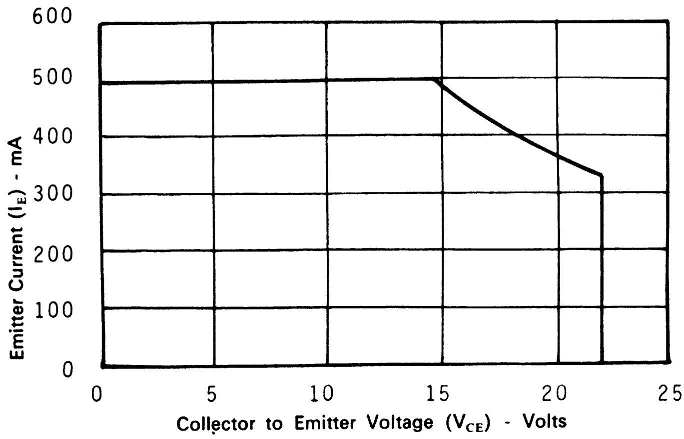


HLP-8

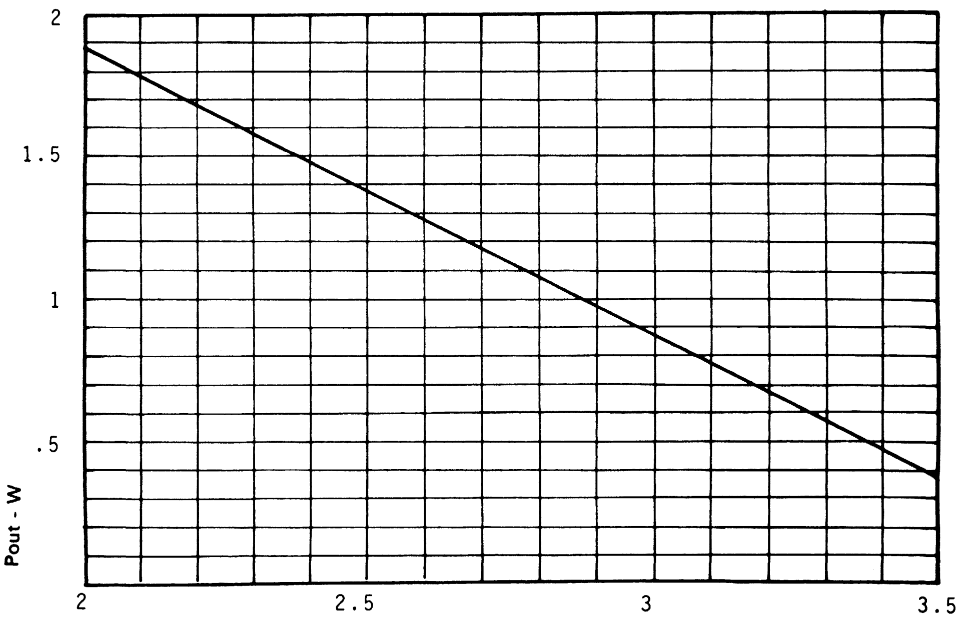
Electrical Characteristics (T_{FLANGE} = 25°C)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 20mA	22			V
BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 20mA	50			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25mA	3.5			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 1.0mA	45			V
I_{CBO}	Collector Cutoff Current	V_{CB} = 28V			0.125	mA
H_{FE}	Fwd. Current Transfer Ratio	V_{CE} = 5.0V, I_C = 100mA	20		120	
C_{OB}	Collector Base Capacitance	V_{CB} = 28V, f = 1 MHz			5.0	pF
F_T	Frequency Cutoff	V_{CE} = 20V, I_E = 220mA	2.7	3.0		GHz
P_O	Power Output	f = 2.0 GHz V_{CE} = 20V, I_E = 220mA	1.25			W
VSWR	Mismatch Tolerance	P_O = 1.25W V_{CE} = 20V, I_E = 220mA		∞:1		
Θ_{JF}	Thermal Resistance (Junction to Flange)				15	°C/W
T_{STG}	Maximum Junction and Storage Temperature		−65		200	°C

D.C. Safe Operating Area



Output Power vs. Frequency
(V_{CE} = 20 V, I_E = 220 mA)



C₁: 220 pF (chip)

C_2: 220 pF (chip) + 10 nF

C_3: 220 pF (chip) + 10 nF + 10 μF

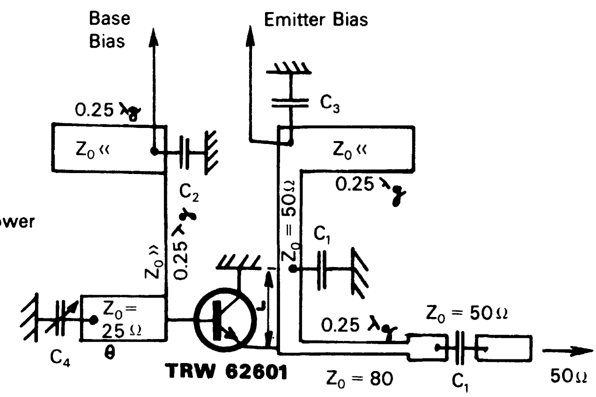
C_4: 0.6-4.5 pF (Frequency tuning)

L : adjust to obtain the maximum output power

θ = 0.115 λg for Fo = 2.3 GHz

θ = 0.06 λg for Fo = 3 GHz

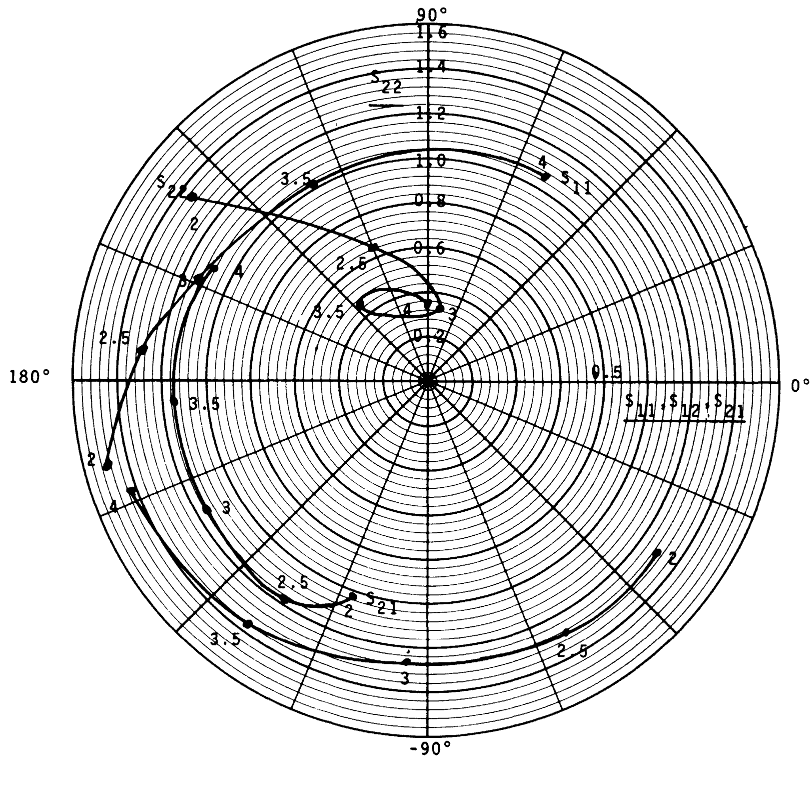
TEST CIRCUIT



Note: PC board artwork is available from TRW Semiconductors.

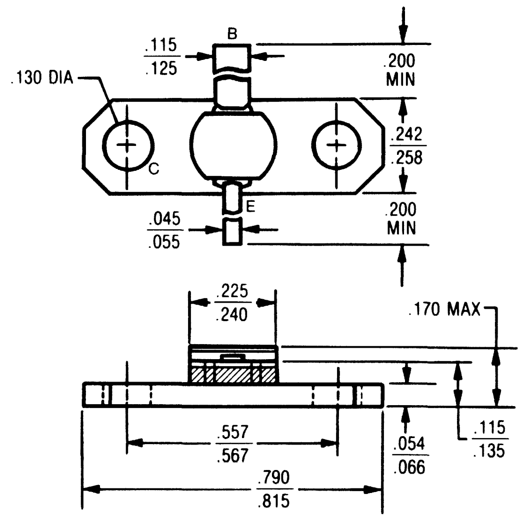
Small Signal S-Parameters

(V_{CE} = 20 V, I_E = 220 mA)



Package Outline

HLP-8



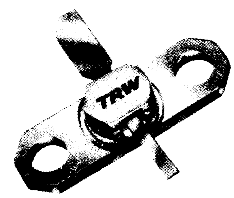
Mechanical Design Specifications

The following are design specifications for this transistor series.

Dimensions:	Per outline drawing.
Solderability:	Per MIL-STD-750.
Marking:	Per MIL-S-19500, "TRW," 4-digit date code, type number.
Hermeticity:	Per MIL-STD-750, 10^{-7} atmospheres gross and fine leak. (Available on special order screened to 10^{-8} atmospheres.)
Acceleration:	Per MIL-STD-750, 20,000G in any plane.
Bond Pull:	Per MIL-STD-750, 3 grams min.
Package:	A brazed ceramic package assuring long-term integrity of hermetic seals. Leads of KOVAR base material with minimum 60 microinches of gold plating.

Microwave Power Oscillator Transistor

- Common Collector
- Diffused Ballast Resistors
- Gold Metalized
- Hermetic
- Up to 3 GHz
- 2 W at 2.5 GHz
- ∞ VSWR

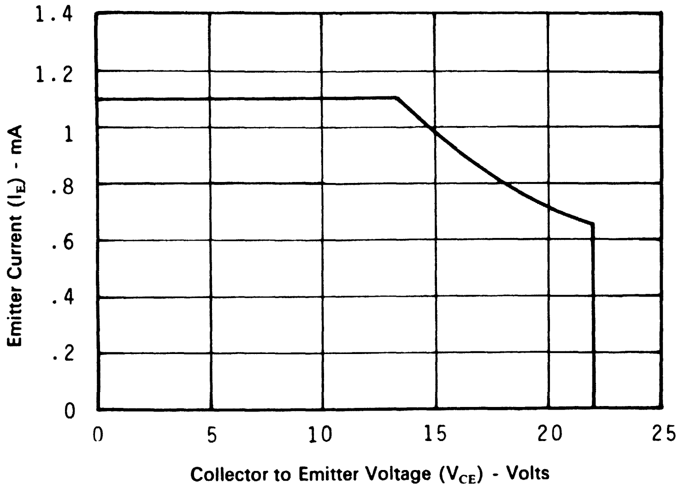


HLP-8

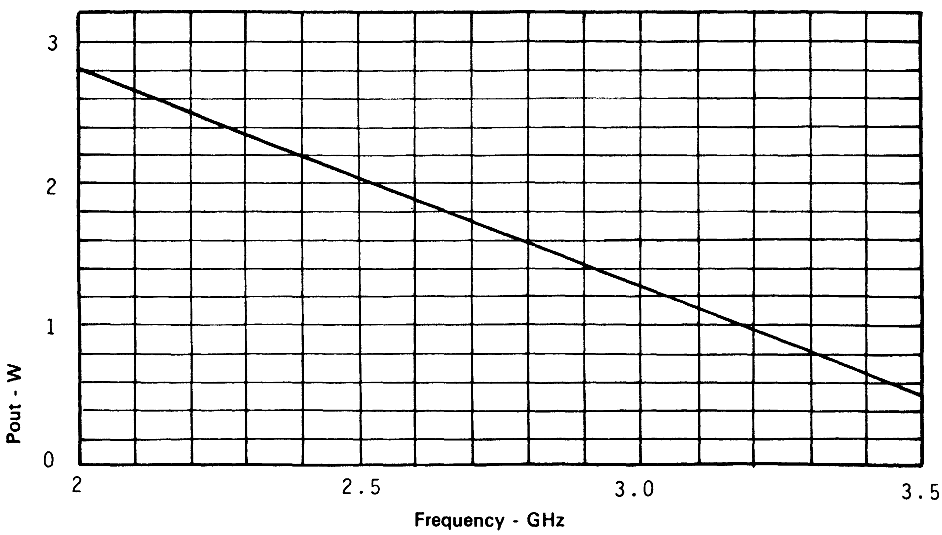
Electrical Characteristics (T_{CASE} = 25°C)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 40mA	22			V
BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 40mA	50			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.5mA	3.5			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 2.0mA	45			V
I_{CBO}	Collector Cutoff Current	V_{CB} = 28V			0.25	mA
H_{FE}	Fwd. Current Transfer Ratio	V_{CE} = 5.0V, I_C = 200mA	20		120	
C_{OB}	Collector Base Capacitance	V_{CB} = 28V, f = 1 MHz			7.0	pF
F_T	Frequency Cutoff	V_{CE} = 2.0 GHz, I_E = 440mA	2.7	3.0		GHz
P_O	Power Output	f = 2.00 GHz V_{CE} = 20V, I_E = 440mA	2.5			W
VSWR	Mismatch Tolerance	P_O = 2.5W V_{CE} = 20V, I_E = 440mA		∞:1		
O_{JF}	Thermal Resistance (Junction to Flange)				8.5	°C/W
T_{STG}	Maximum Junction and Storage Temperature		−65		200	°C

D.C. Safe Operating Area

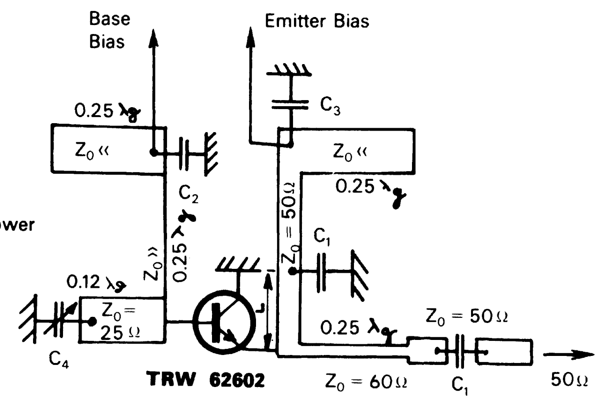


Output Power vs. Frequency
(V_{CE} = 20 V, I_E = 440 mA)



TEST CIRCUIT

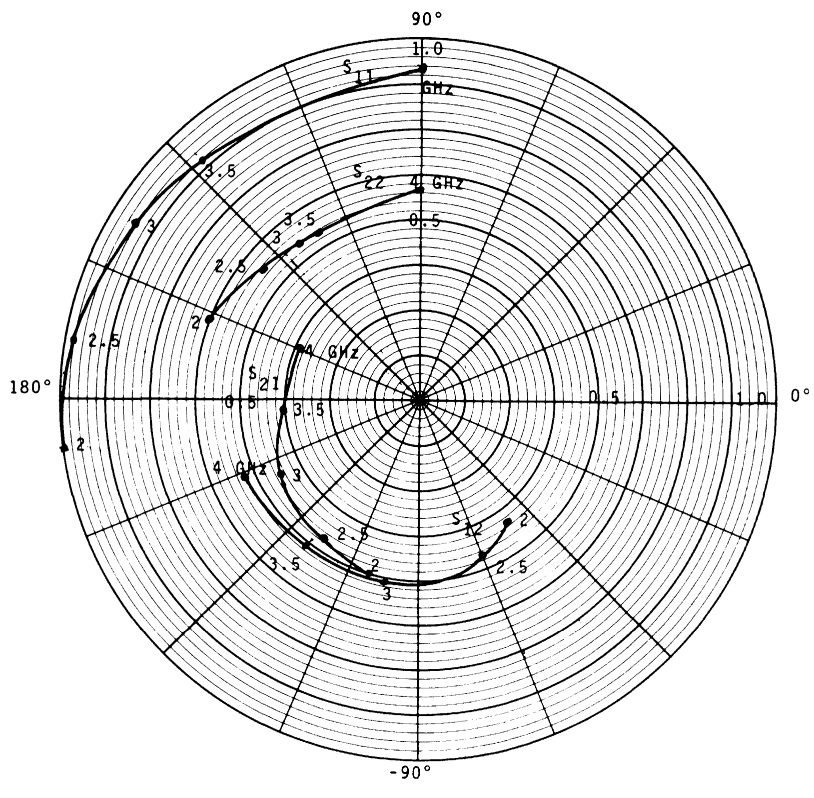
C₁: 220 pF (chip)
C₂: 220 pF (chip) + 10 nF
C₃: 220 pF (chip) + 10 nF + 10 μF
C₄: 0.6-4.5 pF (Frequency tuning)
L : adjust to obtain the maximum output power



Note: PC board artwork is available from TRW Semiconductors.

Small Signal S-Parameters

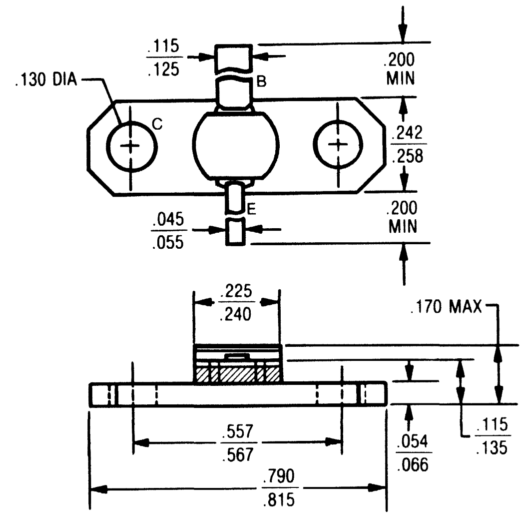
(V_{CE} = 20 V, I_E = 440 mA)



TRW 62602

PACKAGE OUTLINE

HLP-8



Mechanical Design Specifications

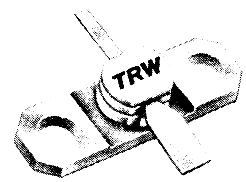
The following are design specifications for this transistor series.

Dimensions:	Per outline drawing.
Solderability:	Per MIL-STD-750.
Marking:	Per MIL-S-19500, "TRW," 4-digit date code, type number.
Hermeticity:	Per MIL-STD-750, 10^{-7} atmospheres gross and fine leak. (Available on special order screened to 10^{-8} atmospheres.)
Acceleration:	Per MIL-STD-750, 20,000G in any plane.
Bond Pull:	Per MIL-STD-750, 3 grams min.
Package:	A brazed ceramic package assuring long-term integrity of hermetic seals. Leads of KOVAR base material with minimum 60 microinches of gold plating.

TRW

Microwave Power Oscillator Transistor

- Common Collector
- Diffused Ballast Resistors
- Gold Metalized
- Hermetic
- Up to 3.5 GHz
- 430 mW at 3 GHz
- ∞ VSWR



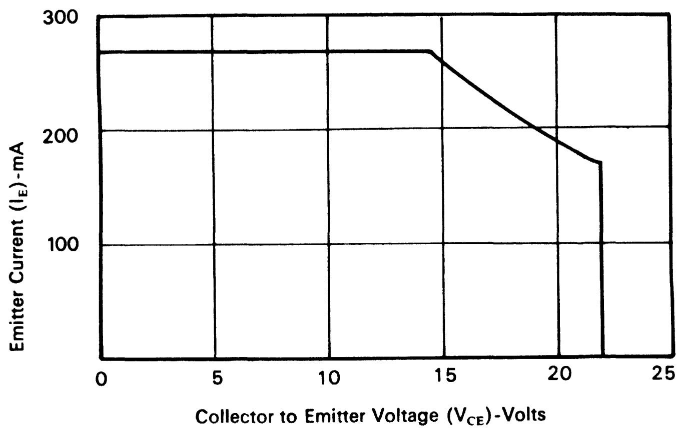
HLP-8

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

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 10mA	22			V
BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 10mA	50			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25mA	3.5			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 1.0mA	45			V
I_{CBO}	Collector Cutoff Current	V_{CB} = 28V			0.250	mA
H_{FE}	Fwd. Current Transfer Ratio	V_{CE} = 5.0V, I_C = 100mA	20		120	
C_{OB}	Collector Base Capacitance	V_{CB} = 28V, f = 1 MHz			3.5	pF
F_T	Frequency Cutoff	V_{CE} = 20V, I_E = 120mA	3.0	3.3		GHz
P_O	Power Output	f = 2.3 GHz V_{CE} = 20V, I_E = 120mA	0.6			W
VSWR	Mismatch Tolerance	P_O = 0.6W V_{CE} = 20V, I_E = 120mA		∞:1		
θ_{JF}	Thermal Resistance (Junction to Flange)				32	°C/W
T_{STG}	Maximum Junction and Storage Temperature		−65		200	°C

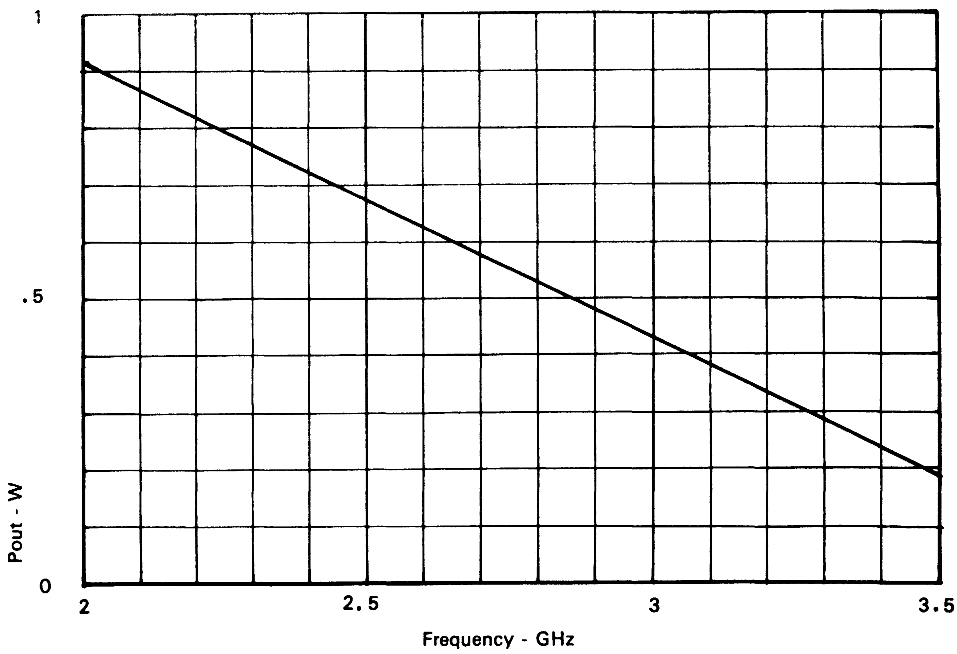
D.C. Safe Operating Area

T_{flange} = 75 °C



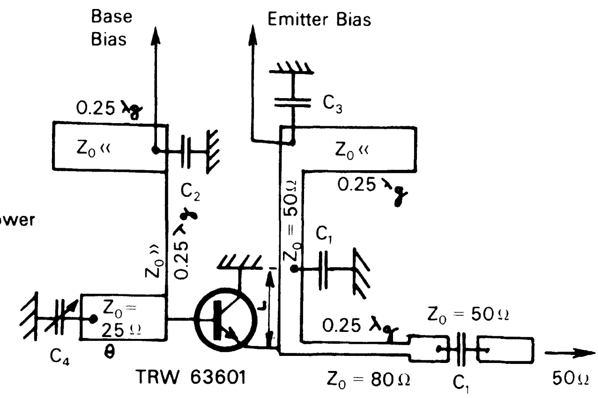
Output Power vs. Frequency

(V_{CE} = 20 V, I_E = 120 mA)



TEST CIRCUIT

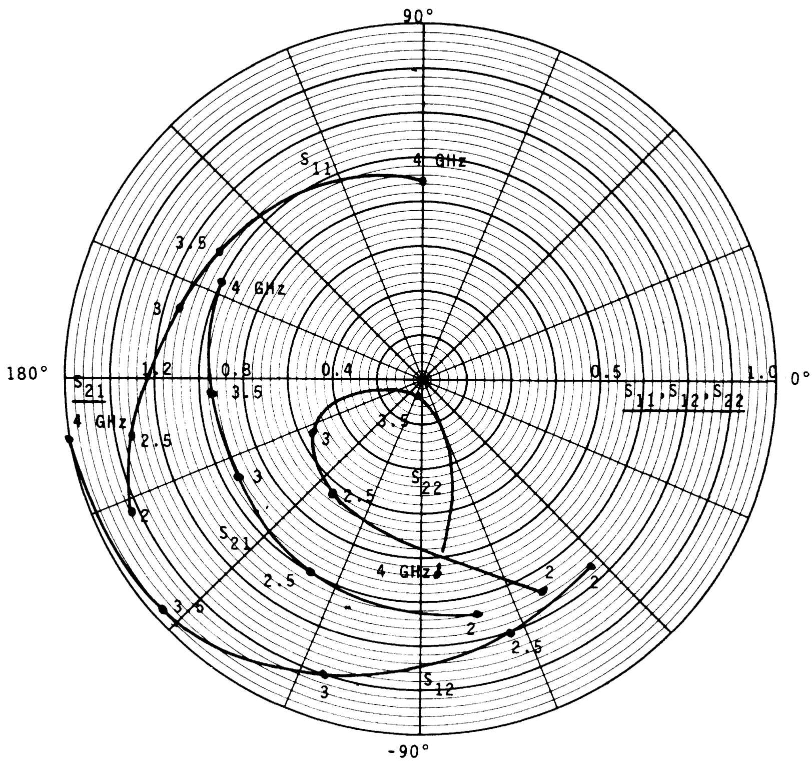
C_1: 220 pF (chip)
C_2: 220 pF (chip) + 10 nF
C_3: 220 pF (chip) + 10 nF + 10 μF
C_4: 0.6-4.5 pF (Frequency tuning)
L : adjust to obtain the maximum output power
$\theta = 0.115\ \lambda g$ for Fo = 2.3 GHz
$\theta = 0.06\ \lambda g$ for Fo = 3 GHz



Note: PC board artwork is available from TRW Semiconductors.

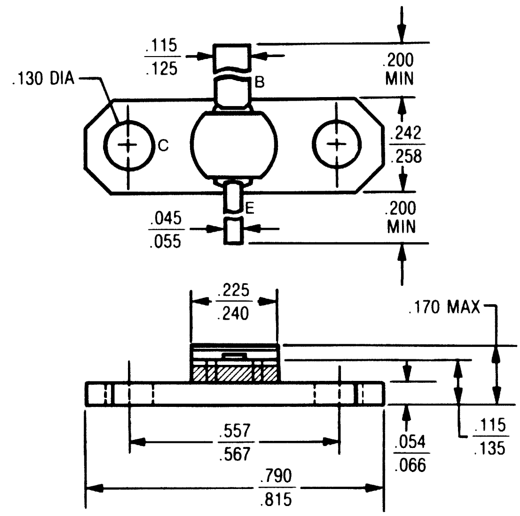
Small Signal S-Parameters

(V_{CE} = 20 V, I_E = 120 mA)



Package Outline

HLP-8



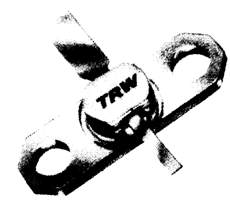
Mechanical Design Specifications

The following are design specifications for this transistor series.

Dimensions:	Per outline drawing.
Solderability:	Per MIL-STD-750.
Marking:	Per MIL-S-19500, "TRW," 4-digit date code, type number.
Hermeticity:	Per MIL-STD-750, 10^{-7} atmospheres gross and fine leak. (Available on special order screened to 10^{-8} atmospheres.)
Acceleration:	Per MIL-STD-750, 20,000G in any plane.
Bond Pull:	Per MIL-STD-750, 3 grams min.
Package:	A brazed ceramic package assuring long-term integrity of hermetic seals. Leads of KOVAR base material with minimum 60 microinches of gold plating.

Microwave Power Oscillator Transistor

- Common Collector
- Diffused Ballast Resistors
- Gold Metalized
- Hermetic
- Up to 3.5 GHz
- 850 mW at 3 GHz
- ∞ VSWR

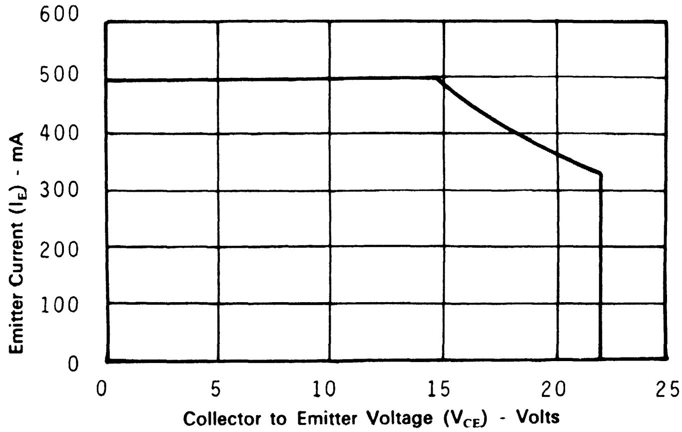


HLP-8

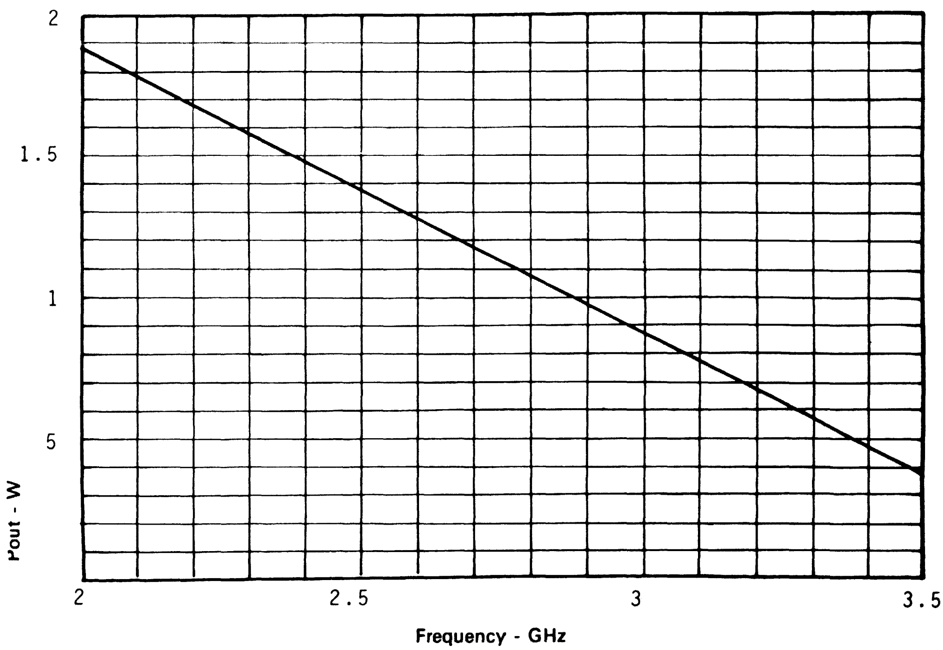
Electrical Characteristics (T_{FLANGE} = 25°C)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 20mA	22			V
BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 20mA	50			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.5mA	3.5			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 2.0mA	45			V
I_{CBO}	Collector Cutoff Current	V_{CB} = 28V			0.5	mA
H_{FE}	Fwd. Current Transfer Ratio	V_{CE} = 5.0V, I_C = 200mA	20		120	
C_{OB}	Collector Base Capacitance	V_{CB} = 28V, f = 1 MHz			5.5	pF
F_T	Frequency Cutoff	V_{CE} = 20V, I_E = 230mA	3	3.3		GHz
P_O	Power Output	f = 2.3 GHz V_{CE} = 20V, I_E = 230mA	1.2			W
VSWR	Mismatch Tolerance	P_O = 1.2W V_{CE} = 20V, I_E = 230mA		∞:1		
Θ_{JF}	Thermal Resistance (Junction to Flange)				17	°C/W
T_{STG}	Maximum Junction and Storage Temperature		−65		200	°C

D.C. Safe Operating Area

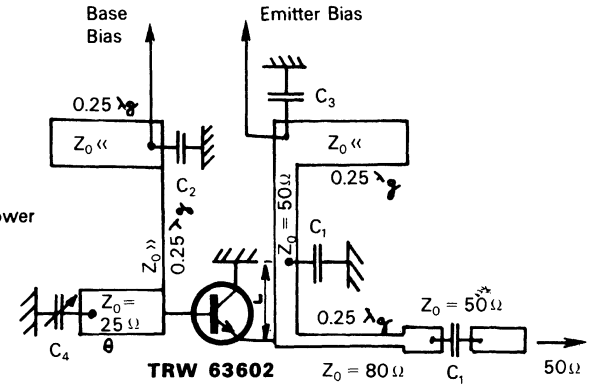


Output Power vs. Frequency
(V_{CE} = 20 V, I_E = 230 mA)



C_1: 220 pF (chip)
C_2: 220 pF (chip) + 10 nF
C_3: 220 pF (chip) + 10 nF + 10 μF
C_4: 0.6-4.5 pF (Frequency tuning)
L : adjust to obtain the maximum output power
$\theta = 0.115\ \lambda g$ for Fo = 2.3 GHz
$\theta = 0.06\ \lambda g$ for Fo = 3 GHz

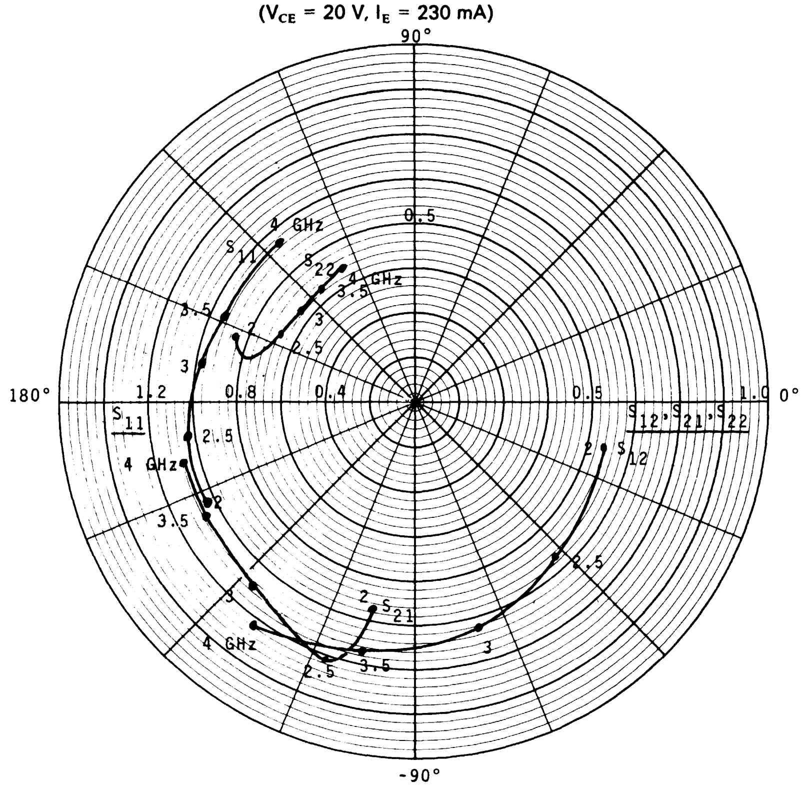
TEST CIRCUIT



Note: PC board artwork is available from TRW Semiconductors.

Small Signal S-Parameters

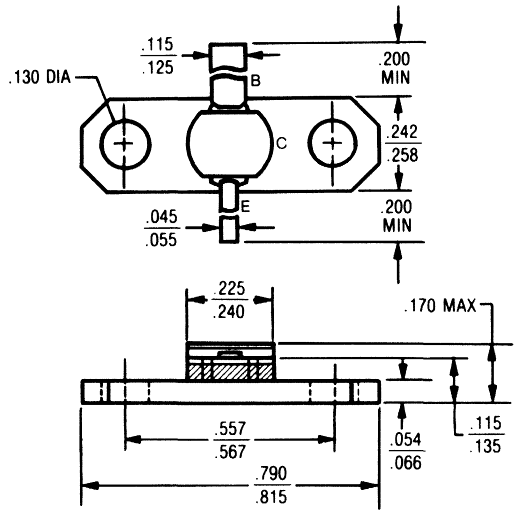
(V_{CE} = 20 V, I_E = 230 mA)



TRW 63602

Package Outline

HLP-8



Mechanical Design Specifications

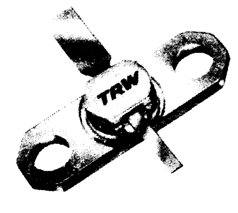
The following are design specifications for this transistor series.

Dimensions:	Per outline drawing.
Solderability:	Per MIL-STD-750.
Marking:	Per MIL-S-19500, "TRW," 4-digit date code, type number.
Hermeticity:	Per MIL-STD-750, 10^{-7} atmospheres gross and fine leak. (Available on special order screened to 10^{-8} atmospheres.)
Acceleration:	Per MIL-STD-750, 20,000G in any plane.
Bond Pull:	Per MIL-STD-750, 3 grams min.
Package:	A brazed ceramic package assuring long-term integrity of hermetic seals. Leads of KOVAR base material with minimum 60 microinches of gold plating.

TRW

Microwave Power Oscillator Transistor

- **Common Collector**
- **Diffused Ballast Resistors**
- **Gold Metalization**
- **Hermetic**
- **Up to 5 GHz**
- **350 mW at 4 GHz**
- **∞ VSWR**



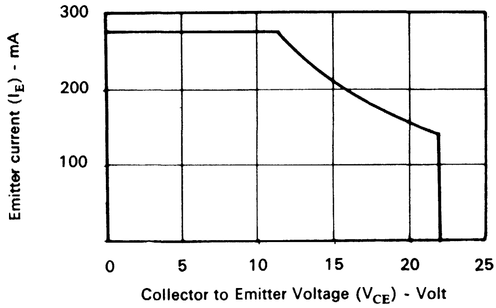
HLP-8

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

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC Test	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_C = 10 mA	22			V
	BV_{CES}	Collector - Emitter Breakdown Voltage	I_C = 10 mA	50			V
	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 0.25 mA	3.5			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 1.0 mA	45			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 28			0.25	mA
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5.0 V, I_C = 100 mA	20		120	
RF Test	C_{ob}	Collector Base Capacitance	V_{CB} = 28 V, F = 1 MHz			3.5	pF
	F_T	Frequency Cutoff	V_{CE} = 20 V, I_E = 120 mA	4.0	4.5		GHz
	P_o	Power output	F = 4 GHz, V_{CE} = 20 V, I_E = 120 mA	0.300	0.350		W
	VSWR	Mismatch Tolerance	P_o = 0.300 W, V_{CE} = 20 V, I_E = 120 mA		∞ : 1		
Operating	θ_{JF}	Thermal Resistance (junction to Flange)				40	°C/W
	T_{STG}	Max Junction and Storage Temperature		— 65		200	°C

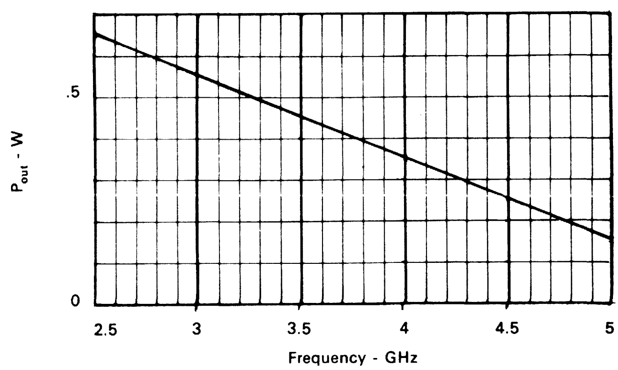
DC Safe Operating Area

T_{Flange} = 75 °C



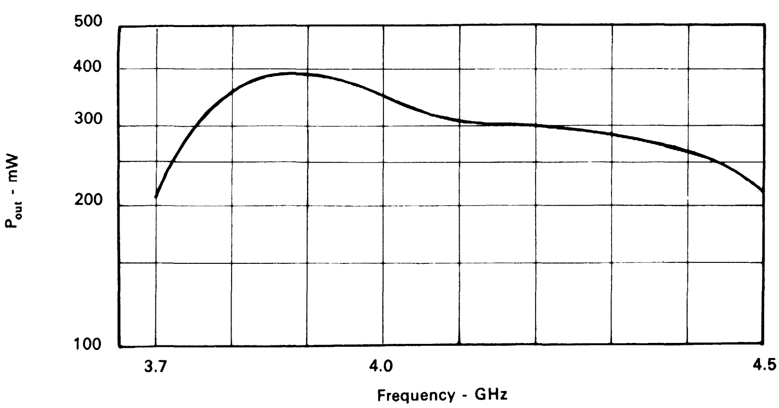
Output Power V_S Frequency

(V_{CE} = 20 V, I_E = 120 mA)



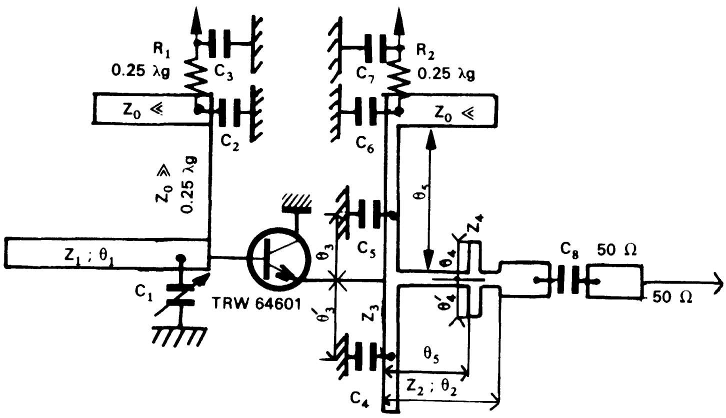
P_{out} V_S Frequency with a Fixed tuned output circuit

Oscillator circuit : TF; V_{CE} = 20 V; I_E = 120 mA



Test circuit

F_0 = 4 GHz

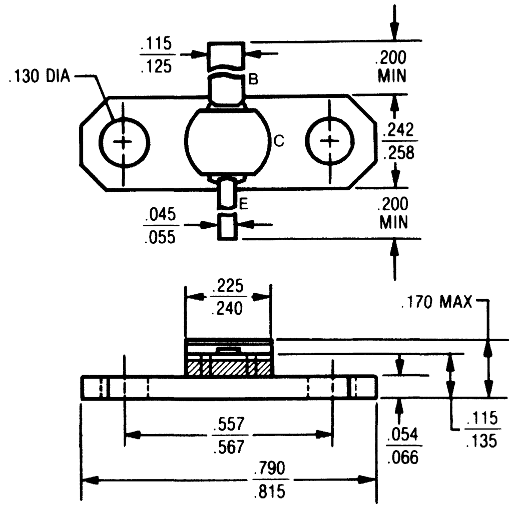


Z_1 = 23.5 Ω θ_1 = 0.52 λg
Z_2 = 80/67 Ω θ_2 = 0.25 λg
Z_3 = 50 Ω   { θ_3 = 0.095 λg; θ'_3 = 0.140 λg
Adjust θ_3 and θ_3 to obtain the maximum output power }
Z_4 = 62 Ω θ_4 = 0.05 λg
θ_5 = 0.18 λg
R_1 = 160 Ω
R_2 = 1 Ω
C_1 = 0.4 - 2.5 pF
C_2 = C_6 = 100 pF (chip) + 10 nF
C_3 = C_7 = 10 nF
C_4 = C_5 = C_8 = 33 pF (chip)

Note: PC board artwork is available from TRW Semiconductors.

Package Outline

HLP-8



Mechanical Design Specifications

The following are design specifications for this transistor series.

Dimensions: Per outline drawing.

Solderability: Per MIL-STD-750.

Marking: Per MIL-S-19500, "TRW," 4-digit date code, type number.

Hermeticity: Per MIL-STD-750, 10^{-7} atmospheres gross and fine leak. (Available on special order screened to 10^{-8} atmospheres.)

Acceleration: Per MIL-STD-750, 20,000G in any plane.

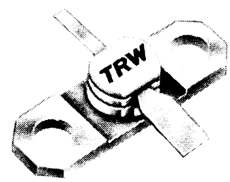
Bond Pull: Per MIL-STD-750, 3 grams min.

Package: A brazed ceramic package assuring long-term integrity of hermetic seals. Leads of KOVAR base material with minimum 60 microinches of gold plating.

TRW

Microwave Power Oscillator Transistor

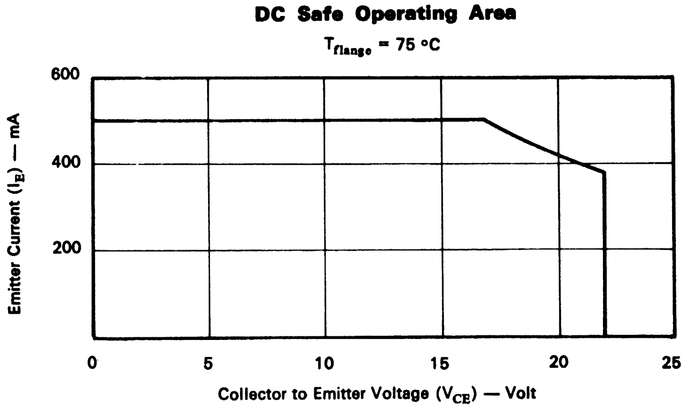
- Common Collector
- Diffused Ballast Resistors
- Gold Metalized
- Hermetic
- Up to 5 GHz
- 650 mW at 4 GHz
- ∞ VSWR

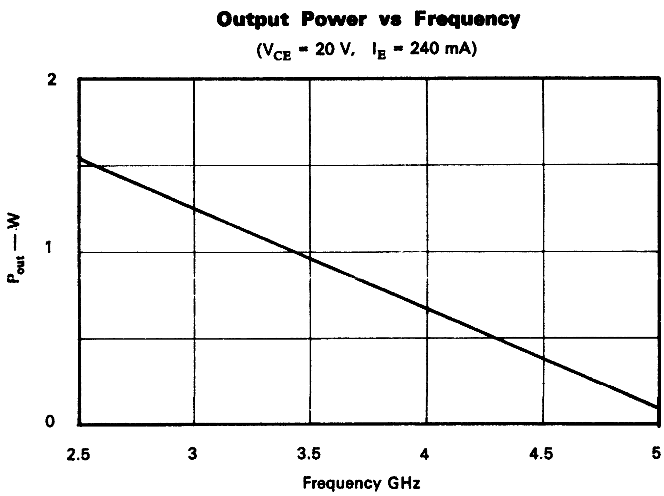


HLP-8

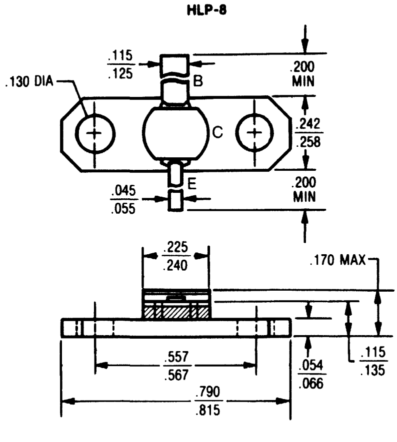
Electrical Characteristics (T_{CASE} = 25°C)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 20mA	22			V
BV_{CES}	Collector-Emitter Breakdown Voltage	I_C = 20mA	50			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.5V	3.5			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 2mA	45			V
I_{CBO}	Collector Cutoff Current	V_{CE} = 28V			0.5	mA
H_{FE}	Fwd. Current Transfer Ratio	V_{CE} = 5V I_C = 200mA	20		120	
C_{OB}	Collector Base Capacitance	V_{CB} = 28V f = 1 MHz			5.5	pF
P_O	Power Output	V_{CE} = 20V I_C = 240mA f = 4 GHz	550	650		mW
VSWR	Mismatch Tolerance	V_{CE} = 20V I_C = 240mA f = 4 GHz		∞:1		
θJF	Thermal Resistance Junction to Flange				20	°C/W
T_{STG} & T_J	Max. Junction & Storage Temperature		−65		+200	°C





HLP-8



Mechanical Design Specifications

The following are design specifications for this transistor series.

Dimensions:	Per outline drawing.
Solderability:	Per MIL-STD-750.
Marking:	Per MIL-S-19500, "TRW," 4-digit date code, type number.
Hermeticity:	Per MIL-STD-750, 10^{-7} atmospheres gross and fine leak. (Available on special order screened to 10^{-8} atmospheres.)
Acceleration:	Per MIL-STD-750, 20,000G in any plane.
Bond Pull:	Per MIL-STD-750, 3 grams min.
Package:	A brazed ceramic package assuring long-term integrity of hermetic seals. Leads of KOVAR base material with minimum 60 microinches of gold plating.

TRW Electronic Components Group

Printed Circuit Division
200 South Turnbull Canyon Road
City of Industry, California 91749
Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
4243 Campus Point Court
San Diego, California 92121
Phone: 714/457-1000

Products: Data converters, arithmetic products, and special processors.

Optoelectronics Division
1201 Tappan Circle
Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

Linear Power Transistors for TV Transmitters and Transposers

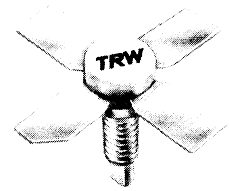
TRW's "TPV" series of linear power RF devices are specially designed for service in VHF and UHF TELEVISION TRANSMITTERS.

Long life is assured by GOLD metalization and reliable DIFFUSED BALLASTING, both of which were pioneered by TRW.

Although designed for TV transmitter service, these devices are useful in many applications requiring high power, excellent linearity and broadband operation in the VHF UHF regions.

VHF Linear Transistor

- TV Transposer and Transmitter Band 3
- 5 W at −58 dB IMD
- 16 dB Gain
- Isolated Package
- Common Emitter
- Gold Metalized
- Diffused Ballast Resistors
- ∞ VSWR

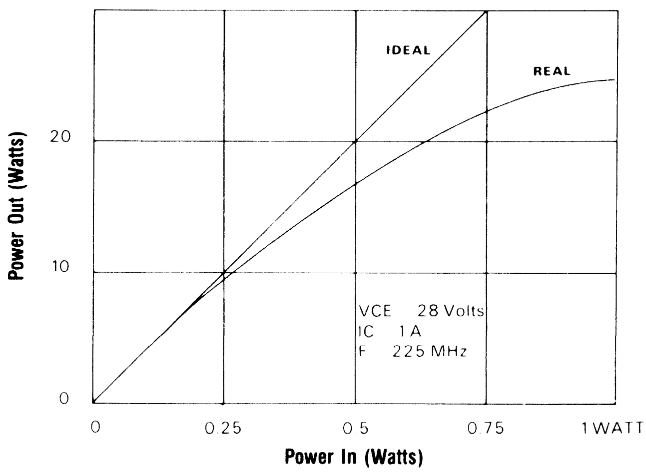


.280 SOE

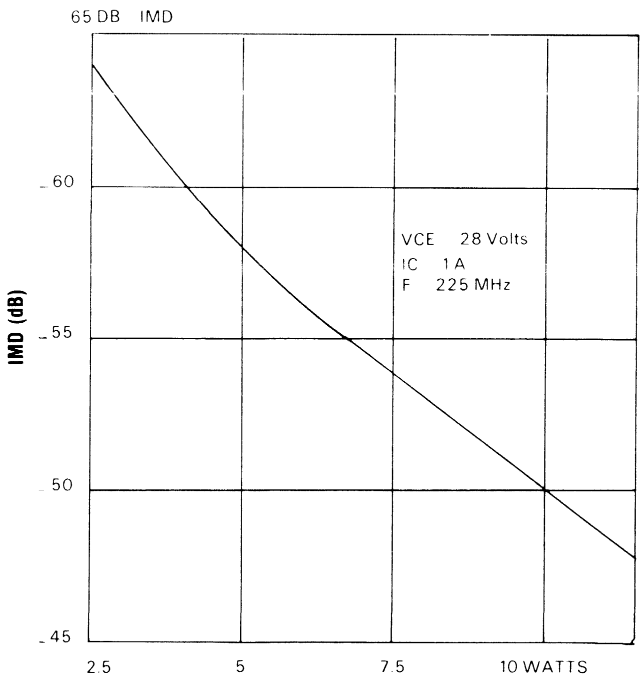
SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 2mA	4			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA	30			V
BV_{CER}	Collector-Emitter Breakdown Voltage	I_C = 50mA, R_{BE} = 10 ohms	55			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 20mA	55			V
H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 100mA	10		150	
IMD 1	Intermodulation Distortion — 3 Tone Vision Carrier = Reference — 8dB Sound Carrier = Reference — 7dB Sideband Carrier = Reference — 16dB	f = 225 MHz, P_{REF} = 5W V_{CE} = 28V, I_E = 1A			−58	dB
IMD 2	Idem	f = 225 MHz, V_{CE} = 28V I_E = 1A, P_{REF} = 10W			−50	dB
P_G	Power Gain	f = 225 MHz, V_{CE} = 28V I_E = 1A, P_{REF} = 5W	15	16		dB
VSWR	Mismatch Tolerance	f = 225 MHz, V_{CE} = 28V I_E = 1A, P_{REF} = 5W		8		
C_{OB}	Collector-Base Capacitance	V_{CB} = 28V, f = 1 MHz			35	pF
I_C	Maximum Collector Current				4	A
Θ_{JC}	Thermal Resistance Junction-Case	T_{CASE} = 70°C			2.5	°C/W
Θ_{CH}	Thermal Resistance Case-Heatsink				1.0	°C/W
P_T	Dissipated Power	$T_{HEATSINK}$ = 25°C			50	W
T_{STG}	Storage Temperature		−65		+150	°C
T_J	Junction Temperature		−65		+200	°C

TPV 394

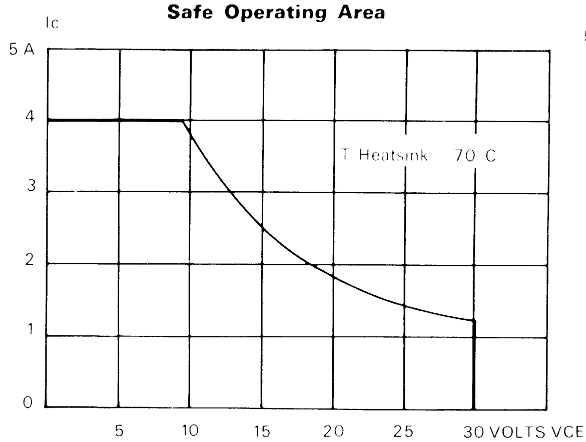
Power Out vs Power In



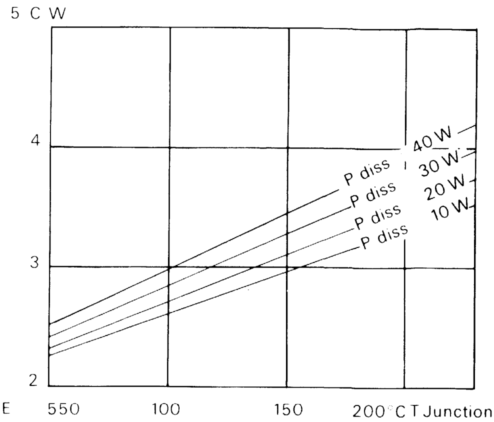
Intermodulation Distortion vs Power Out



Safe Operating Area

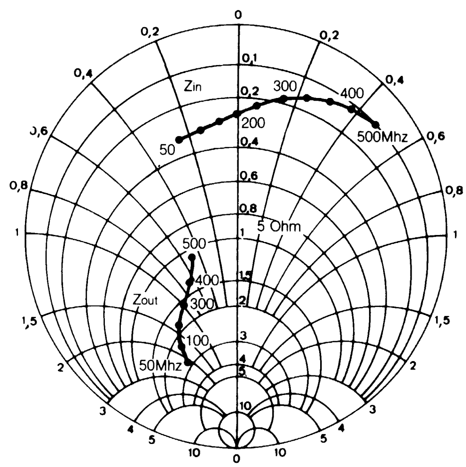


Thermal Resistance Junction Heatsink vs Temperature of Junction for Various Power's Dissipated

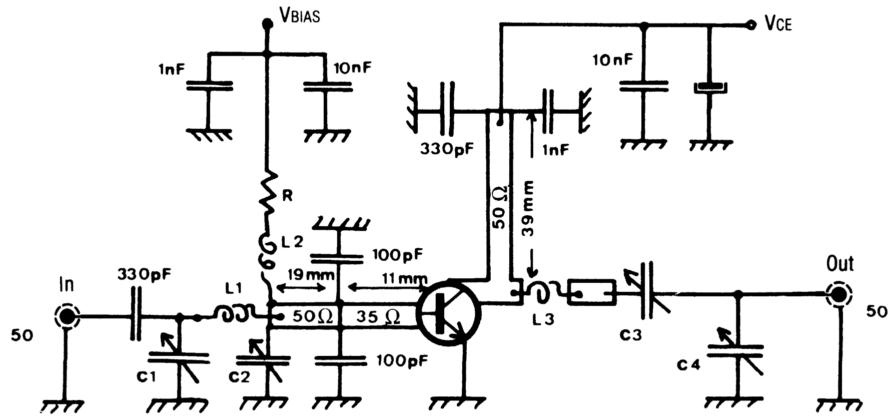


Large Signal Impedances vs Frequency

V_{CE} = 28 V = Ic = 1A



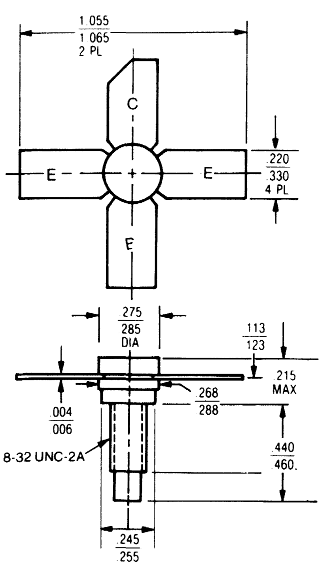
TEST CIRCUIT AT F = 225 MHz



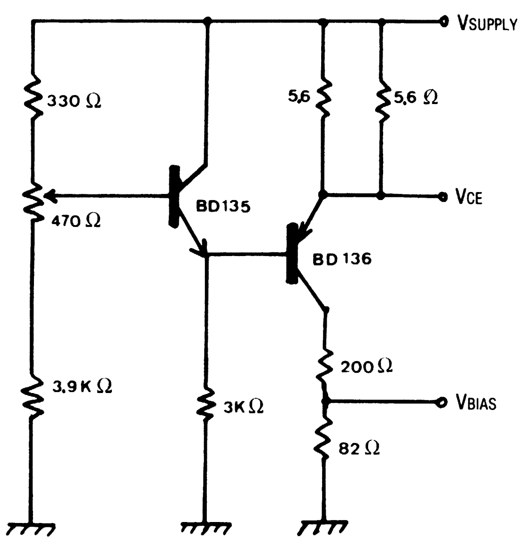
Lines are printed on G 10 epoxy glass material

$C_{1,4}$ ARCO 403
C_2 ARCO 404
C_3 ARCO 423
L_1 1 turn 1/2 I.D. = 5 mm
L_2 RFC 10 turns I.D. = 5 mm
L_3 1.5 mm shaped :

280 SOE



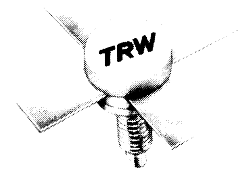
CLASS A BIAS CIRCUIT



TRW

VHF Linear Transistor

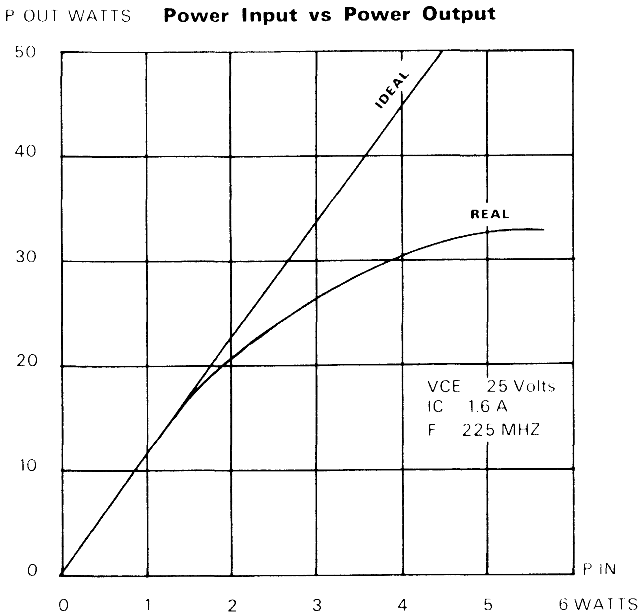
- TV Transposer and Transmitter Band 3
- 10 W at −55 dB IMD
- 10 dB Gain
- All Gold Metalization
- ∞ VSWR
- Common Emitter
- Isolated Package



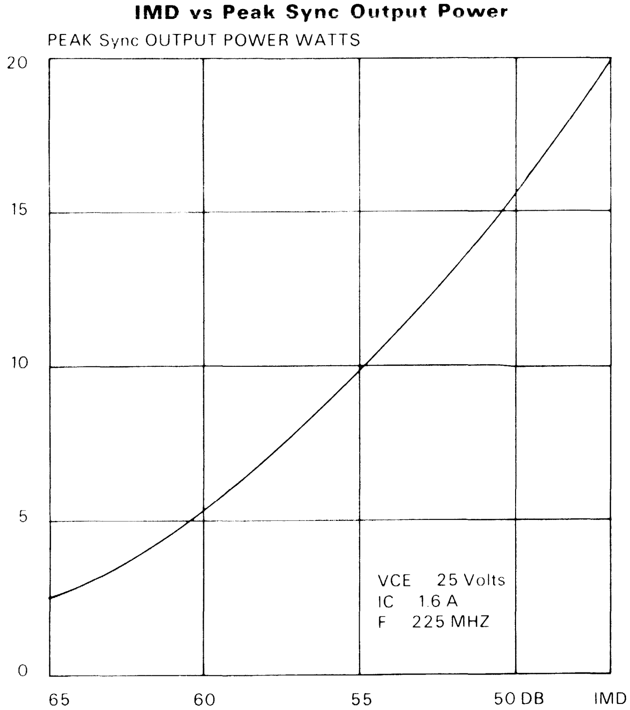
.380 SOE

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 10mA	4			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA	35			V
BV_{CER}	Collector-Emitter Breakdown Voltage	I_C = 50mA, R_{BE} = 10 ohms	65			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 50mA	65			V
H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 1000mA	20		120	
IMD 1	Intermodulation Distortion — 3 Tone Vision Carrier = Reference — 8dB Sound Carrier = Reference — 7dB Sideband Carrier = Reference — 16dB	f = 225 MHz, P_{REF} = 10W V_{CE} = 25V, I_E = 1.6A			−54	dB
IMD 2	Idem	f = 225 MHz, V_{CE} = 25V I_E = 1.6A, P_{REF} = 15W			−52	dB
P_G	Power Gain	f = 225 MHz, V_{CE} = 25V I_E = 1.6A	10			dB
VSWR	Mismatch Tolerance	P_{REF} = 20W, f = 225 MHz V_{CE} = 25V, I_E = 1.6A P_{REF} = 15W		∞		
C_{OB}	Collector-Base Capacitance	V_{CB} = 30V, f = 1 MHz		58	85	pF
I_C	Maximum Collector Current				9	A
Θ_{JC}	Thermal Resistance Junction-Case	T_{CASE} = 70°C			2.0	°C/W
Θ_{CH}	Thermal Resistance Case-Heatsink				0.5	°C/W
P_T	Dissipated Power	$T_{HEATSINK}$ = 25°C			70	W
T_{STG}	Storage Temperature		−65		+150	°C
T_J	Junction Temperature		−65		+200	°C

Power Input vs Power Output

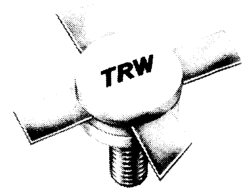


IMD vs Peak Sync Output Power



VHF Linear Transistor

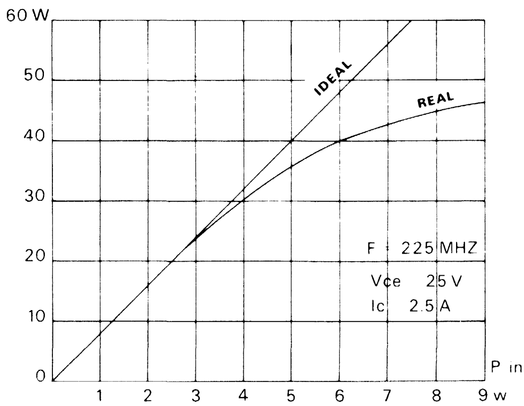
- TV Transposer and Transmitter Band 3
- 20 W at −51 dB IMD
- 14 W at −55 dB IMD
- High Saturation Power (More than 70 Watts)
- All Gold Metalization
- ∞ VSWR
- Common Emitter
- Isolated Package



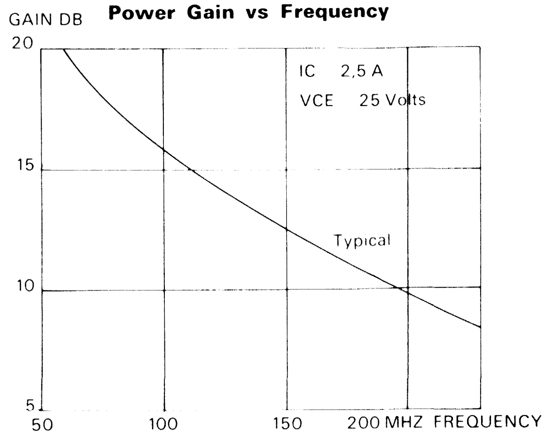
.500 SOE

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 10mA	4			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 50mA	35			V
BV_{CER}	Collector-Emitter Breakdown Voltage	I_C = 50mA, R_{BE} = 10 ohms	60			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 50mA	65			V
H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 1000mA	20		120	
IMD 1	Intermodulation Distortion — 3 Tone Vision Carrier = Reference — 8dB Sound Carrier = Reference — 7dB Sideband Carrier = Reference — 16dB	f = 225 MHz, P_{REF} = 14W V_{CE} = 25V, I_E = 2.5A			−55	dB
IMD 2	Idem	f = 225 MHz, V_{CE} = 25V I_E = 2.5A, P_{REF} = 20W			−51	dB
P_G	Power Gain	f = 225 MHz, V_{CE} = 25V I_E = 2.5A, P_{REF} = 20W	8	9		dB
VSWR	Mismatch Tolerance	f = 225 MHz, V_{CE} = 25V I_E = 2.5A, P_{REF} = 20A		∞		
C_{OB}	Collector-Base Capacitance	V_{CB} = 30V, f = 1 MHz		58	85	pF
I_C	Maximum Collector Current				10	A
Θ_{JC}	Thermal Resistance Junction-Case	T_{CASE} = 70°C			1.5	°C/W
Θ_{CH}	Thermal Resistance Case-Heatsink				0.25	°C/W
P_T	Dissipated Power	$T_{HEATSINK}$ = 25°C			100	W
T_{STG}	Storage Temperature		−65		+150	°C
T_J	Junction Temperature		−65		+200	°C

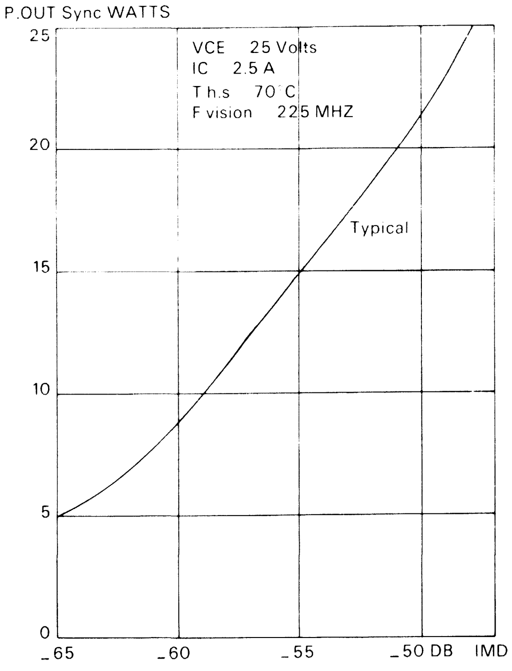
Power Output vs Power Input



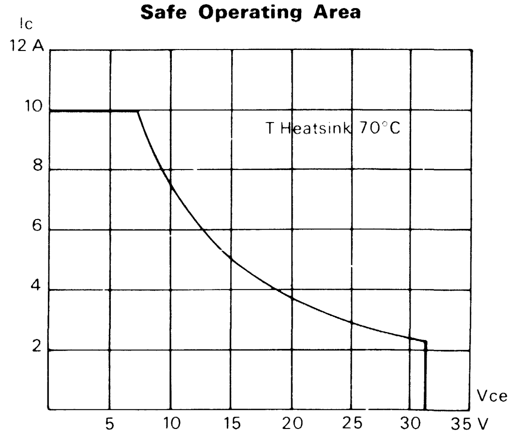
Power Gain vs Frequency



Intermodulation Distortion vs Peak Sync Power

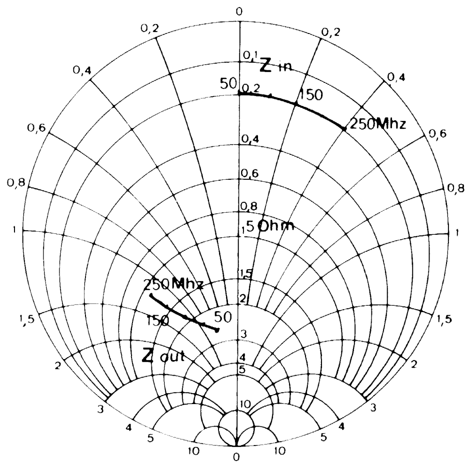


Safe Operating Area

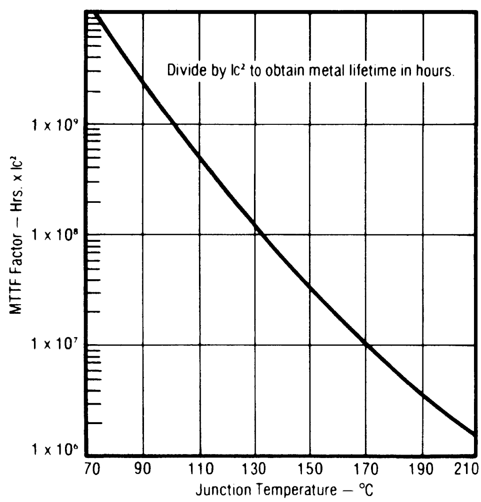


Large signal Impedances vs Frequency

V_{CE} = **25 V** - I_C = **2.5 A**

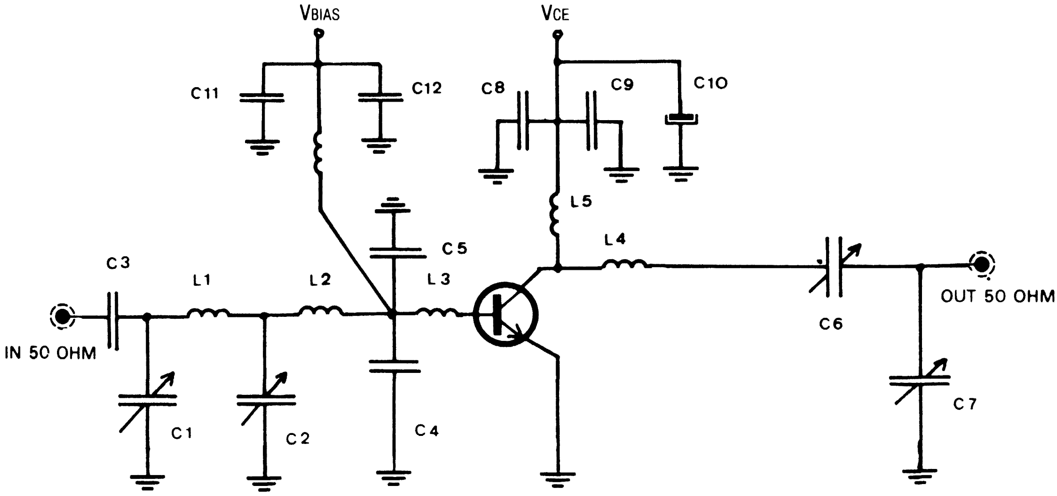


MTTF Factor vs Tj



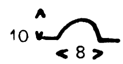
TPV 375

TEST CIRCUIT FOR F = 225 MHz

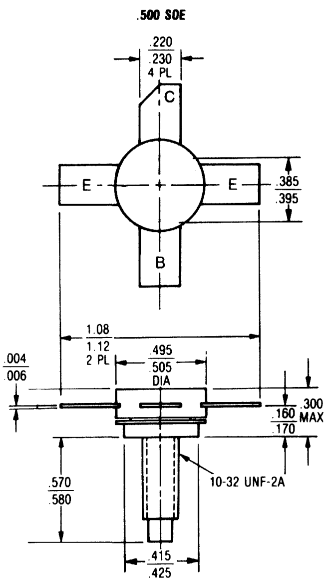


$C_{1,7}$	ARCO 403
C_2	ARCO 404
$C_{3,8}$	chip capacitor 470 pF
$C_{4,5}$	UNELCO 80 pF
C_6	ARCO 423
$C_{9,11}$	UNELCO 1000 pF
C_{10}	470 μF electrolytic
C_{12}	10 nF

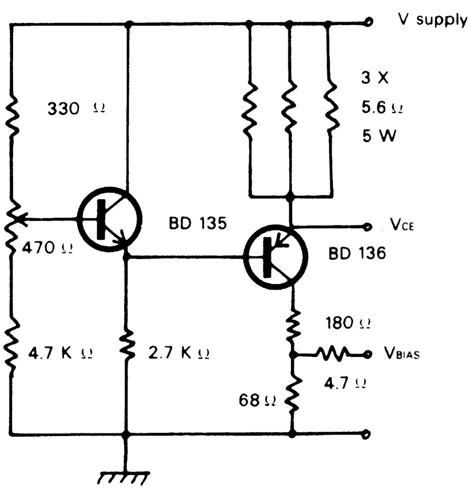
L_1 1.5 turns closely wound. Cu wire 0.7 mm I.D. 4.5 mm
L_2 2.1 cm - 50 ohms - line
L_3 length of the base lead
L_4 Cu wire 1.6 mm



L_5 3.5 cm - 50 ohms line
L_6 4 turns closely wound Cu wire 0.8 mm I.D. 4.5 mm

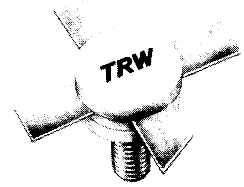


BIAS CIRCUIT



UHF Linear Transistor

- Band 3
- 30 W at −53 dB IMD
- 8 dB Gain
- Class A or AB Operation
- All Gold Metalization
- ∞ VSWR
- Common Emitter
- Isolated Package

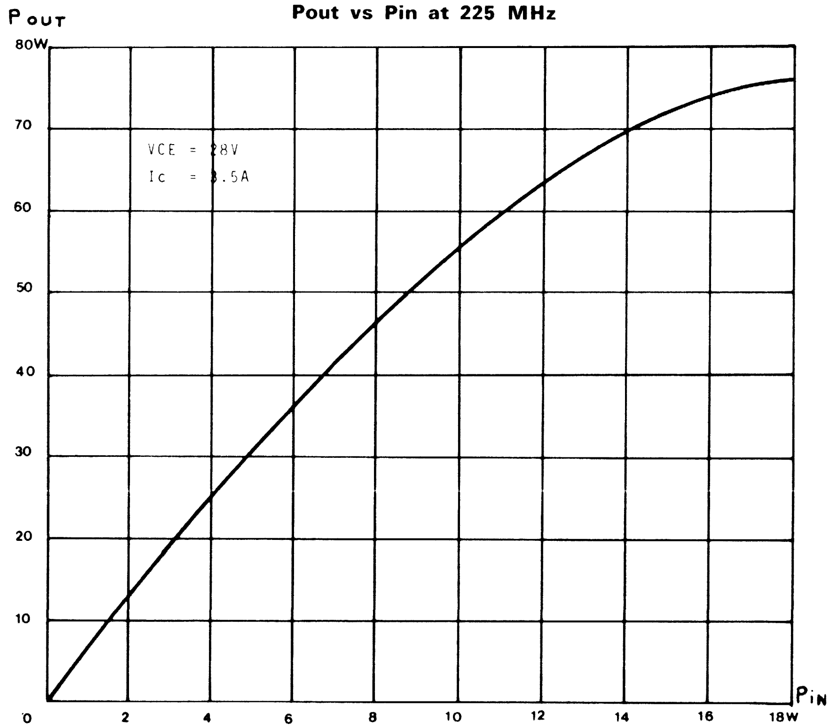


.500 SOE ¼ STUD

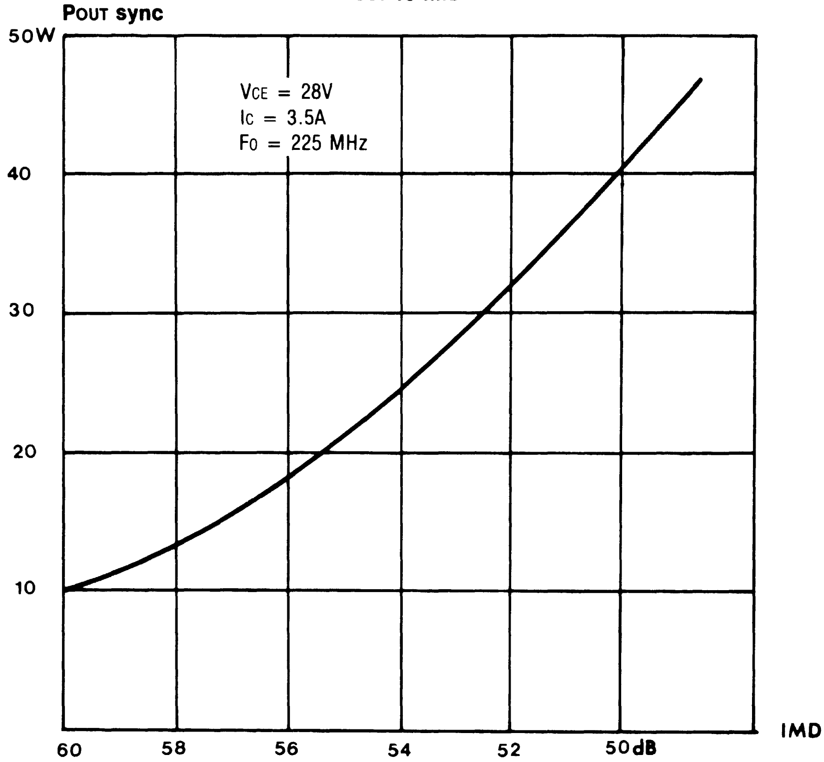
SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 20mA	4			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 100mA	35			V
BV_{CER}	Collector-Emitter Breakdown Voltage	I_C = 100mA, R_{BE} = 10 ohms	60			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 100mA	65			V
H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 1000mA	20		120	
IMD 1	Intermodulation Distortion — 3 Tone Vision Carrier = Reference — 8dB Sound Carrier = Reference — 7dB Sideband Carrier = Reference — 16dB	f = 225 MHz, P_{REF} = 30W V_{CE} = 28V, I_E = 3.5A			−53	dB
P_G	Power Gain	f = 225 MHz, V_{CE} = 28V I_E = 3.5A, P_{REF} = 20W	7.5		8	dB
VSWR	Mismatch Tolerance	f = 225 MHz, V_{CE} = 28V I_E = 3.5A, P_{REF} = 20W	∞			
C_{OB}	Collector-Base Capacitance	V_{CB} = 30V, f = 1 MHz		100	150	pF
I_C	Maximum Collector Current			16		A
Θ_{JC}	Thermal Resistance Junction-Case	T_{CASE} = 70°C		0.9	1	°C/W
Θ_{CH}	Thermal Resistance Case-Heatsink			0.15		°C/W
P_T	Dissipated Power	$T_{HEATSINK}$ = 25°C		150		W
T_{STG}	Storage Temperature		−65		+150	°C
T_J	Junction Temperature		−65		+200	°C

TPV 376

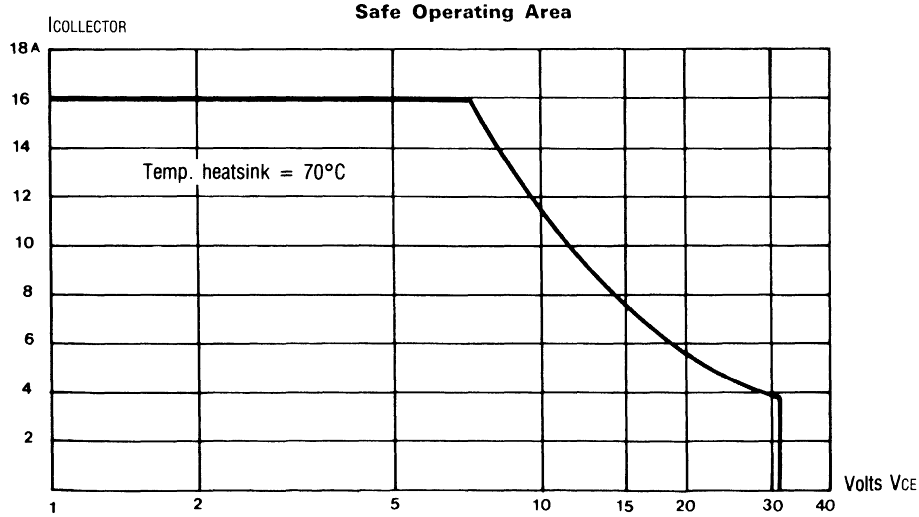
Pout vs Pin at 225 MHz



POUT vs IMD

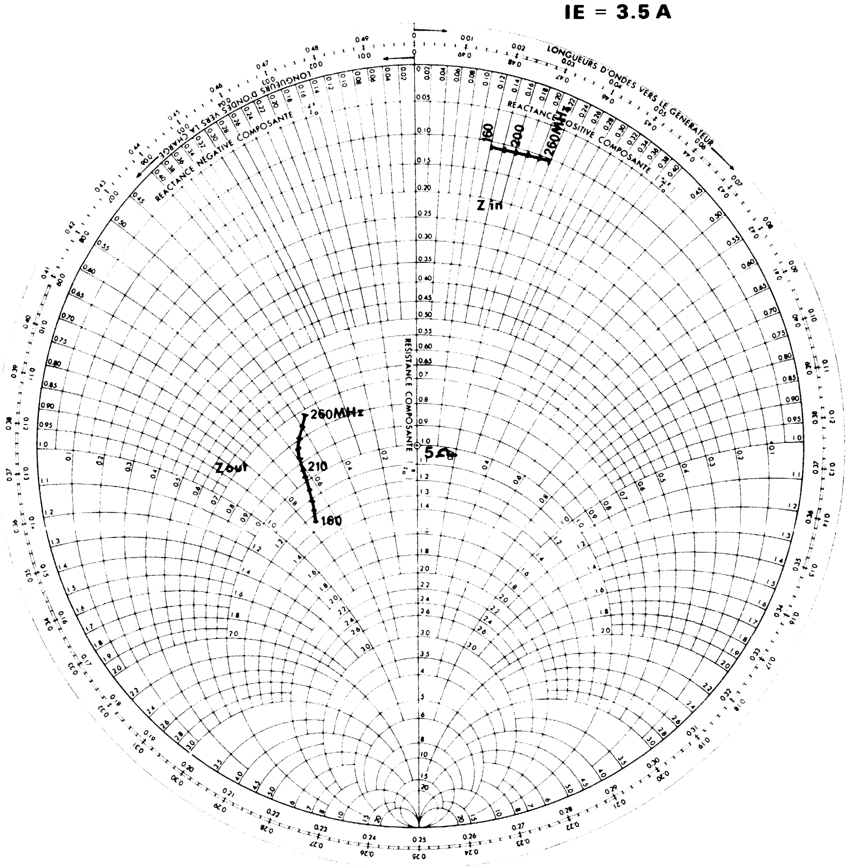


Safe Operating Area



Large Signal Zout Zin

VCE = 28 V
IE = 3.5 A



UHF Linear Transistor

- Class A
- TV Transposer and Transmitter
- Band 3
- 14 dB Gain
- 14 W at −53 dB
- Internally Matched
- Common Emitter
- Isolated Package
- Diffused Ballast Resistors
- All Gold Metalization

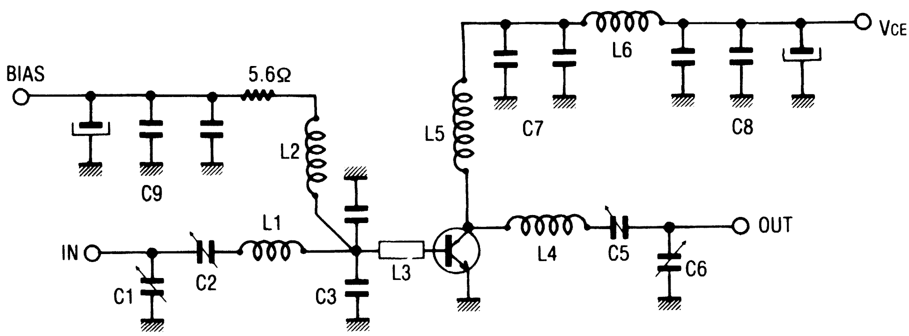
J0500

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

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC Test	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 10 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	60			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 50 mA	65			V
	H_{FE}	D.C Current Gain	V_{CE} = 5 V I_C = 1 A	20		100	
RF Test	IMD	Intermodulation Distortion 3 tone vision = — 8 dB sound = — 7 dB sideband = — 16 dB	F_O = 225 MHz V_{CE} = 28 V I_E = 2.5 A			— 53	dB
	P_G	Power Gain	P_{REF} = 14 W	14	15		dB
	VSWR	Mismatch Tolerance			∞		
	C_{OB}	Collector - Base Capacitance	V_{CB} = 30 V F = 1 MHz		65	85	pF
Thermal	I_C	Maximum Collector Current				10	A
	θ_{JC}	Thermal Resistance Junction Case	T_{case} = 70 °C			1.5	°C/W
	T_{STG}	Storage Temperature		— 65		+ 150	°C
	Tj	Junction Temperature		- 65		+ 200	°C

TPV 385

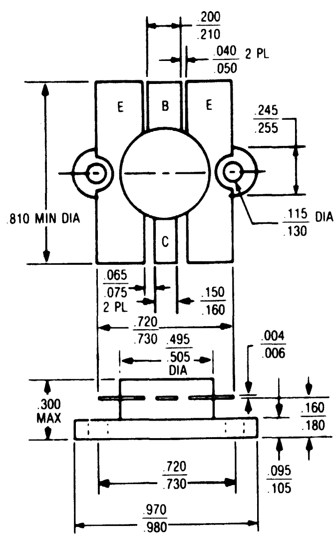
TEST CIRCUIT a 225 MHz CLASS A

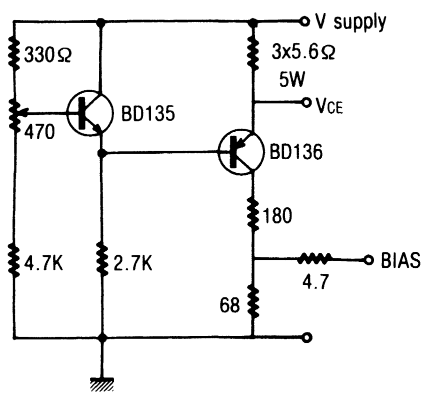


$C_1 = C_6$ = ARCO 404
$C_2 = C_5$ = ARCO 423
$C_3 = C_4$ = UNELCO 80 pF
C_7 = 1 nF + 47 nF
$C_8 = C_9$ = 1 nF + 0.1 μF + 47 μF

L_1 = 2 turns - ID 6 mm - wire 1 mm
L_1 = 1 turn - ID 10 mm - wire 1 mm
L_2 = 6 turns - ID 6 mm - wire .6 mm
L_3 = base inductance PAD - L = 10 mm W = 5 mm
L_5 = 1 turn - ID 6 mm - wire 1.5 mm
L_6 = 2 turns on ferrite core - wire 1.5 mm

J-Zero-C
Package Outline

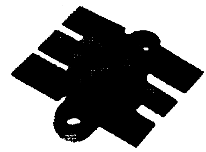




TRW

UHF Linear Transistor

- Internally Matched
- TV Transposer & Transmitter
- Band 3
- Class A or AB Operation
- 12 dB Gain
- All Gold Metalization
- Diffused Ballast Resistors
- Common Emitter
- Isolated Package
- Low Thermal Resistance

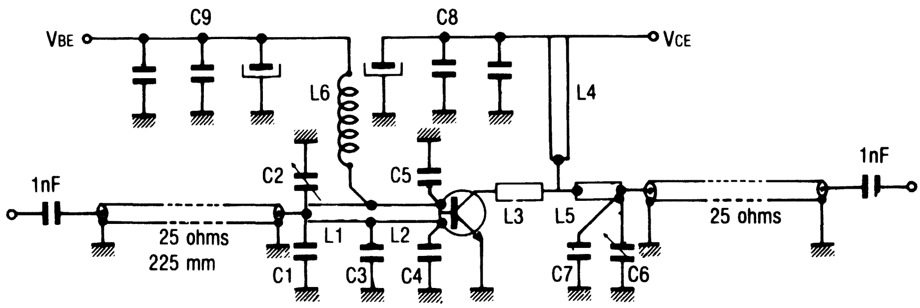


J0500 S

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 = 100 mA	35			V
	BV_{CER}	Collector - Emitter Breakdown Voltage	I_C = 100 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} = 5 V I_C = 1 A	20		100	
RF Test	Class A	Intermodulation Distortion 3 tone vision = — 8 dB sound = — 7 dB sideband = — 16 dB	F = 225 MHz V_{CE} = 28 V I_E = 3.5 A P_{REF} = 30 W		— 53	— 51	dB
		Power Gain		11	12		dB
		Mismatch Tolerance			∞		
	Class AB	1 dB Compression Point CW	V_{CE} = 28 V I_Q = 200 mA F = 225 MHz	90			W
	C_{OB}	Collector - Base Capacitance	V_{CB} = 30 V F = 1 MHz		130	150	pF
Thermal	I_C	Maximum Collector Current				16	A
	θ_{JC}	Thermal Resistance Junction Base	T_{case} = 70 °C		0.7	1	°C/W
	T_{STG}	Storage Temperature		— 65		+ 150	°C
	Tj	Junction Temperature		- 65		+ 200	°C

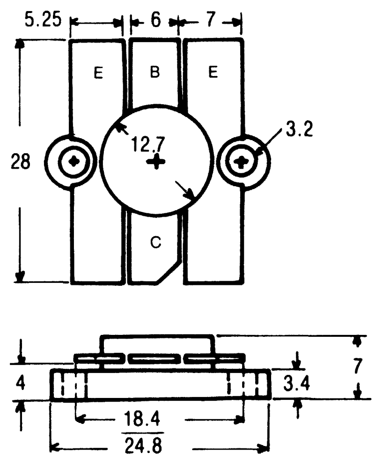
TEST CIRCUIT DIAGRAM



C_1 = 2 X 47 pF ATC 100 A
C_2 = 22 pF ATC 100 A
C_3 = 2 X 33 pF ATC 100 A
$C_4 = C_5$ = 220 pF ATC 100 B
C_6 = 7-60 pF ARCO 404
C_7 = 100 pF ATC 100 A
$C_8 = C_9$ = 220 pF ATC 100 B + 1 nF + 10 nF + 2 x .1 μF + 100 μF

L_1 = 30 Ω Line (W = 7 mm ; L = 10 mm) époxy ε_r = 4.1
L_2 = 30 Ω Line (W = 7 mm ; L = 11 mm) époxy ε_r = 4.1
L_3 = 35 Ω Line (W = 6 mm ; L = 5 mm) époxy ε_r = 4.1
L_4 = 8 X 3 mm COPPER STRIP .3 mm THICKNESS
L_5 = 6 X 3 mm COPPER STRIP .3 mm THICKNESS
L_6 = 3 turns closely wound - copper wire .6 mm ID 3 mm

PACKAGE

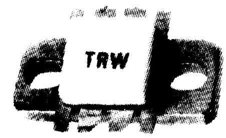


Dimensions given in mm

TRW

VHF Linear Power Transistor

- Band 3
- TV Transmitter
- High Gain
- Class AB Operation
- Push-Pull Transistor
- Low Thermal Resistance
- All Gold Metalization
- Diffused Ballast Resistors



MRP 7

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

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
EACH SIDE DC TEST	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 5 mA	3.5			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} = 15 Ω	60			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 50 mA	65			V
	H_{FE}	D.C. Current Gain	V_{CE} = 28 V I_C = 0.5 A	20	150		
RF TEST	P_G	Power Gain	V_{CE} = 28 V	11			dB
	G_C	Gain Compression	P_{out} = 100 W			1	dB
	η_C	Collector Efficiency	IQ = 2 × 100 mA F_o = 225 MHz	70			%
	C_{OB}	Collector Base Capacitance each side	V_{CB} = 28 V F = 1 MHz		60		pF
THERMAL	I_C	Maximum Collector Current each side				8	A
	θ_{j-c}	D.C. Thermal Resistance Junction Case	T_{case} 70 °C			1.2	°C/W
	T_{STG}	Storage Température		– 65		+ 200	°C
	Tj	Junction Temperature		– 65		+ 200	°C

TPV3100

LARGE SIGNAL IMPEDANCES

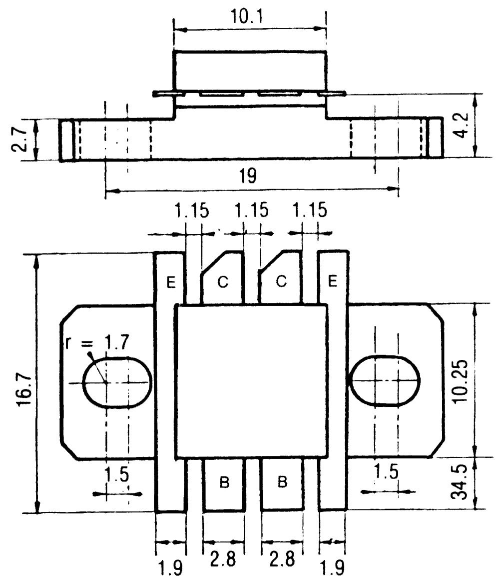
FREQUENCY (MHz)	Z_{in} (Ω)	Z_{Load} (Ω)
170	1.25 + j 0.5	10 + j 10
200	0.9 + j 0.9	9.5 + j 7
230	1 + j 2	6.5 + j 6.5

NOTES : V_{CE} = 28 Volts I_q = 2 × 100 mA P_{out} = 100 W

— Z_{in} values to get optimum input return loss

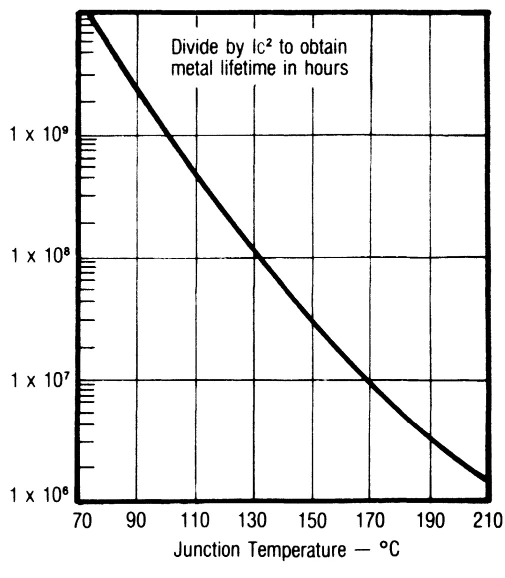
— Z_{Load} values to get optimum output power and efficiency

Package Outline

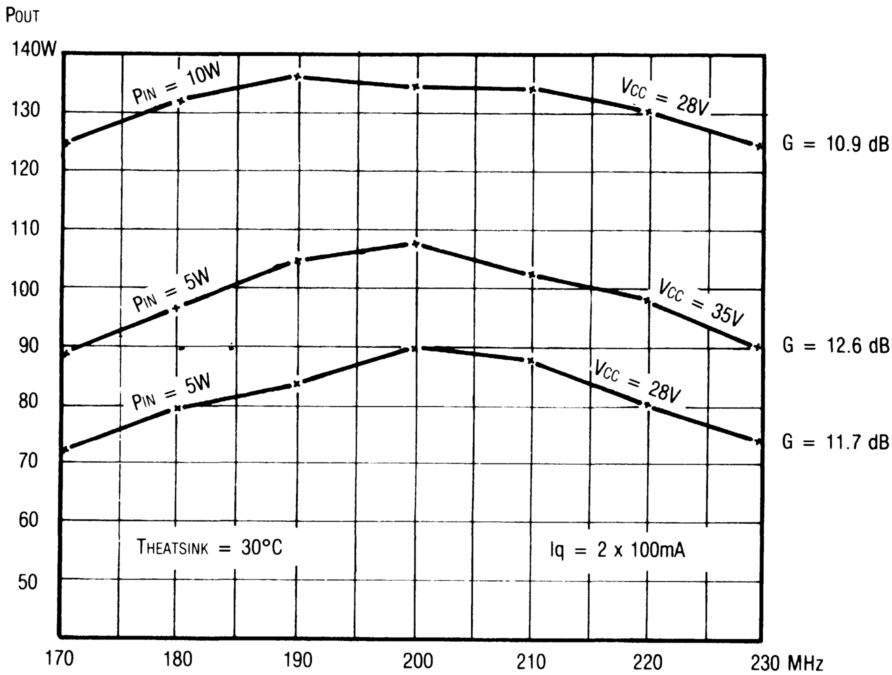


Dimensions given in millimeters.

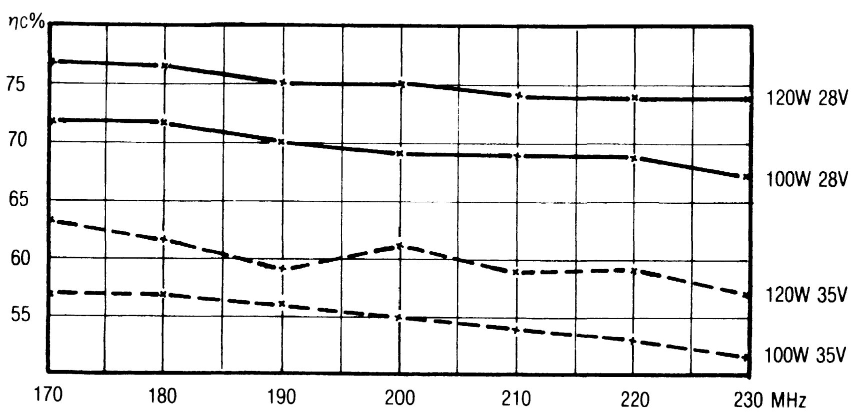
MTTF vs Junction Temperature



Typical Performances Class AB

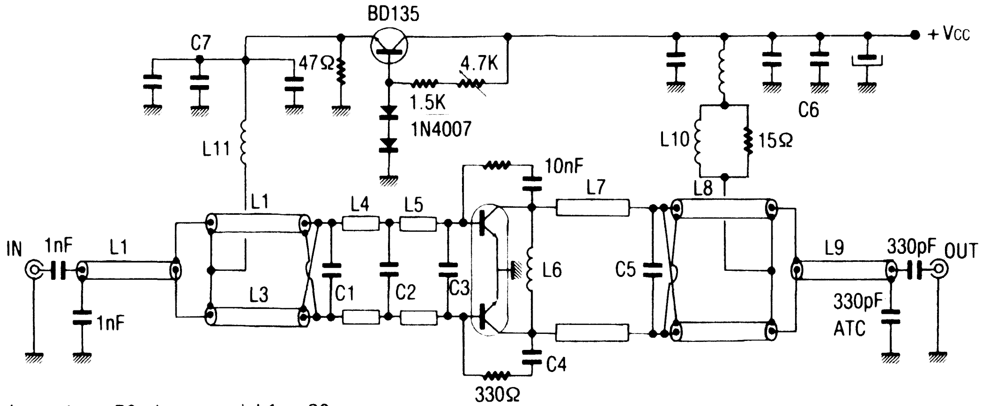


Collector Efficiency vs Frequency



TPV 3100

170-230 MHz BROADBAND AMPLIFIER CLASS AB

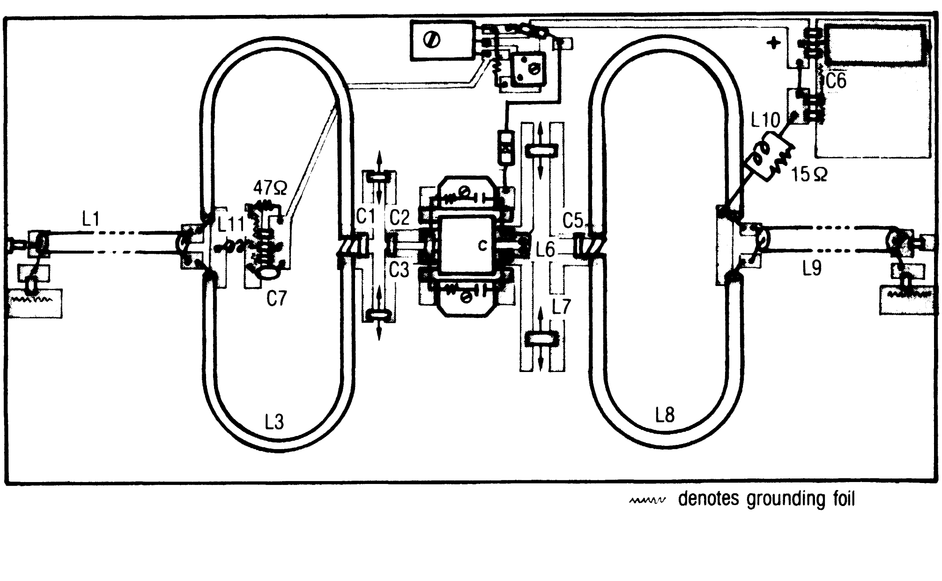


L_1 = L_9 = 50 ohms coaxial 1 = 80 mm
L_2 = L_3 = L_8 = 25 ohms coaxial cable or semi-rigid 1 = 80 mm
L_4 = 40 ohms line 2.5 % of λg 225 MHz or 1 = 23 mm sub 1/50 inch teflon glass
L_5 = 40 ohms line 65 % λg 225 MHz or 1 ≃ 6 mm
L_6 = 3 turns ID 4 mm wire 1 mm ∅ leads 5 mm long
L_7 = 40 line 3.5 % λg 225 MHz or 1 = 32 mm 1/50 teflon glass
L_{10} = 11 turns ID 4 mm wire 1 mm ∅
L_{11} = .22 μH molded inductor

C_1 = 68 pF ATC 100B
C_2 = 100 pF ATC 100B
C_3 = 220 pF ATC 100B
C_5 = 27 pF + 33 pF ATC 100A
C_6 = C_7 = 1 nF + 10 nF + .1 μF + ELECTROLYTIC

L_4 has to be adjusted for Gain
L_6 and L_7 have to be adjusted for the best lead

Components Layout

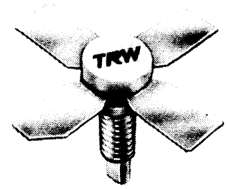


denotes grounding foil

TRW

UHF Linear Transistor

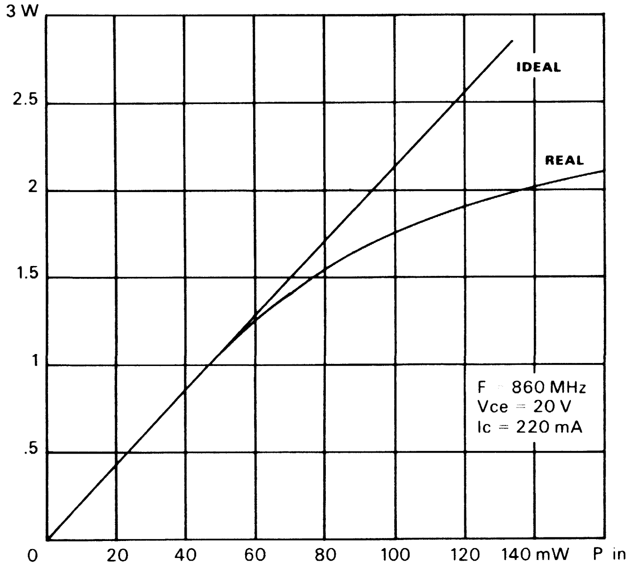
- TV Transposer 0.5 W Band 5
- MATV 1.5 V −860 MHz
- 12 dB Gain
- Gold Reliability
- ∞ VSWR
- Common Emitter
- Isolated Package



.280 SOE

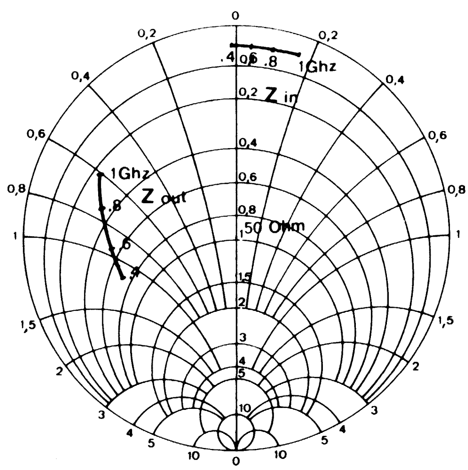
SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25mA	3.5			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 20mA	24			V
BV_{CER}	Collector-Emitter Breakdown Voltage	I_C = 20mA, R_{BE} = 10 ohms	50			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 1mA	45			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 28V			450	μA
H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 100mA	20		120	
IMD 1	Intermodulation Distortion — 3 Tone Vision Carrier = Reference — 8dB Sound Carrier = Reference — 7dB Sideband Carrier = Reference — 16dB	f = 860 MHz, V_{CE} = 20V I_E = 0.22A, P_{REF} = 1W			−50	dB
IMD 2	Idem	f = 860 MHz, V_{CE} = 20V I_E = 0.22A, P_{REF} = 0.5W		−60	−58	dB
P_G	Power Gain	f = 860 MHz, V_{CE} = 20V I_E = 0.22A, P_{REF} = 1W	11.5	12		dB
VSWR	Mismatch Tolerance	f = 860 MHz, V_{CE} = 20V I_E = 0.22A, P_{REF} = 1W		∞		
C_{OB}	Collector-Base Capacitance	V_{CB} = 28V, f = 1 MHz			5	pF
F_T	Cutoff Frequency	V_{CE} = 20V, I_E = 220mA	2.2	2.5		GHz
I_C	Maximum Collector Current				0.7	A
Θ_{JC}	Thermal Resistance Junction-Case	T_{CASE} = 70°C			20	°C/W
P_T	Dissipated Power	$T_{HEATSINK}$ = 25°C			8.75	W
T_{STG}	Storage Temperature		−65		+150	°C
T_J	Junction Temperature		−65		+200	°C

Power Output vs Power Input

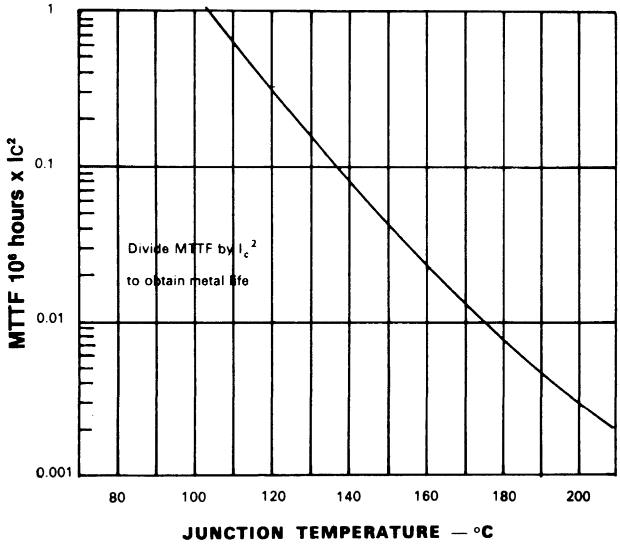


LARGE SIGNAL IMPEDANCES

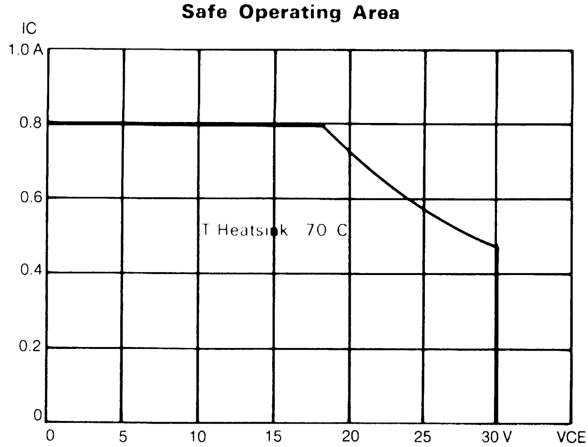
Vce = 20 v
Ic = 22 mA



MTTF FACTOR vs JUNCTION TEMPERATURE

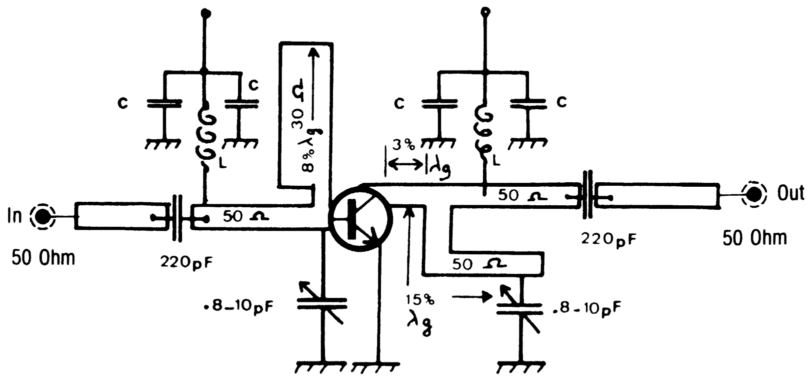


Safe Operating Area



TPV 596

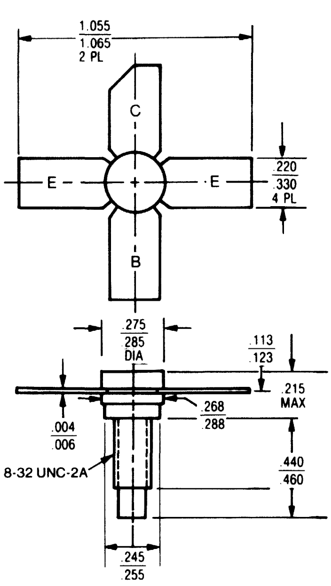
TEST CIRCUIT AT 860 MHz



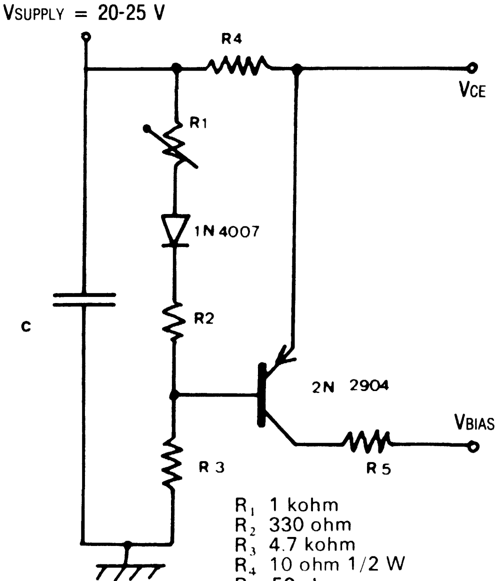
L = 6 turns   ID = 1 mm   Wire diameter = 0.6 mm

The lengths are given for F = 860 MHz

.280 SOE



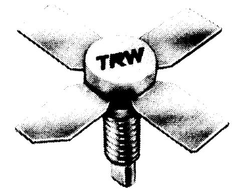
CLASS A BIAS CIRCUIT



R_1 1 kohm
R_2 330 ohm
R_3 4.7 kohm
R_4 10 ohm 1/2 W
R_5 50 ohm
C 100 F + 10 nF + 1 nF

UHF Linear Transistor

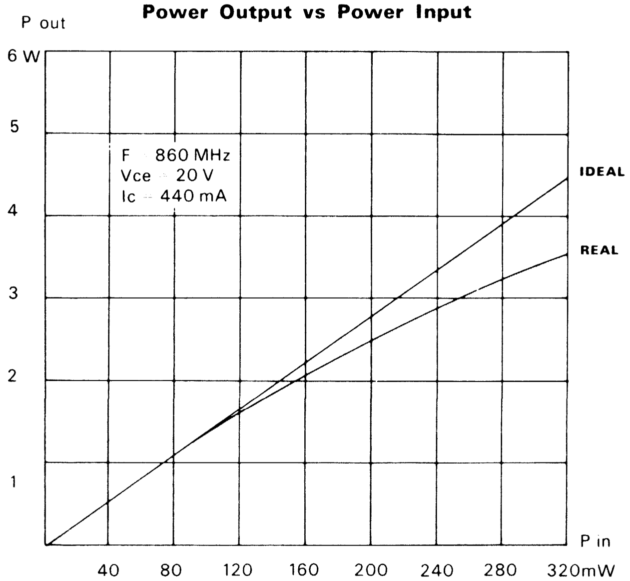
- TV Transposer Band 5
- 1 W
- 11 dB Gain
- Gold Reliability
- ∞ VSWR
- Common Emitter
- Isolated Package



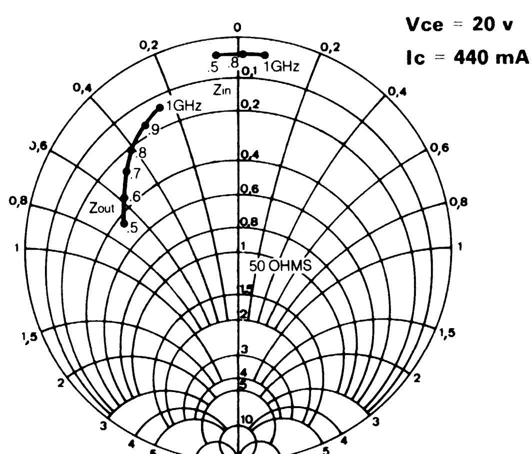
.280 SOE

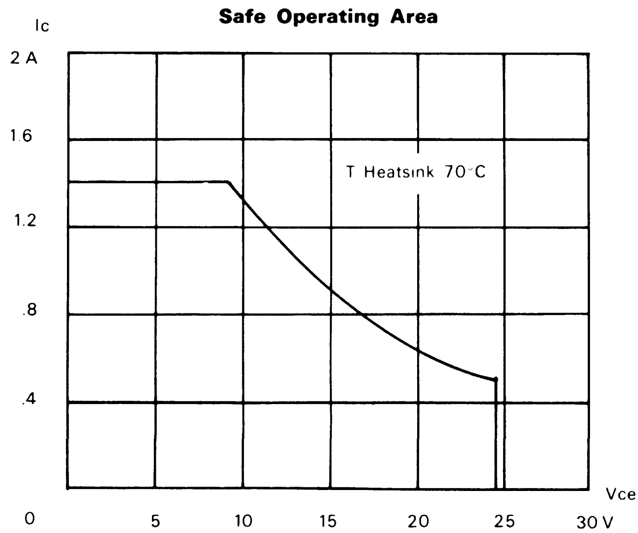
SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.5mA	3.5			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 40mA	24			V
BV_{CER}	Collector-Emitter Breakdown Voltage	I_C = 40mA, R_{BE} = 10 ohms	50			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 2mA	45			V
I_{CBO}	Collector-Base Leakage	V_{CB} = 28V			450	μA
H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 200mA	20		120	
IMD 1	Intermodulation Distortion — 3 Tone Vision Carrier = Reference — 8dB Sound Carrier = Reference — 7dB Sideband Carrier = Reference — 16dB	f = 860 MHz, V_{CE} = 20V I_E = 0.44A, P_{REF} = 1W		−60	−58	dB
IMD 2	Idem	f = 860 MHz, V_{CE} = 20V I_E = 0.44A, P_{REF} = 2W			−51	dB
P_G	Power Gain	f = 860 MHz, V_{CE} = 20V I_E = 0.44A, P_{REF} = 1W	10.5	11		dB
VSWR	Mismatch Tolerance	f = 860 MHz, V_{CE} = 20V I_E = 0.44A, P_{REF} = 2W		∞		
C_{OB}	Collector-Base Capacitance	V_{CB} = 28V, f = 1 MHz			7	pF
F_T	Cutoff Frequency	V_{CE} = 20V, I_E = 440mA	2.2	2.5		GHz
I_C	Maximum Collector Current				1.4	A
Θ_{JC}	Thermal Resistance Junction-Case	T_{CASE} = 70°C			9	°C/W
P_T	Dissipated Power	$T_{HEATSINK}$ = 25°C			19	W
T_{STG}	Storage Temperature		−65		+150	°C
T_J	Junction Temperature		−65		+200	°C

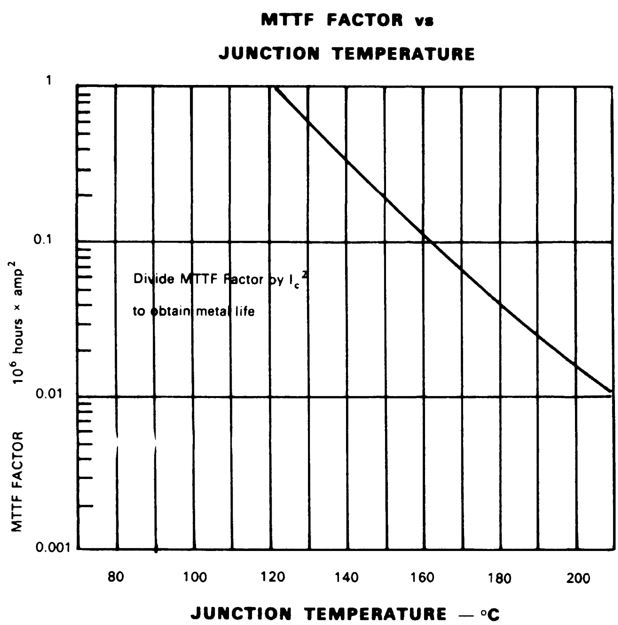
Power Output vs Power Input



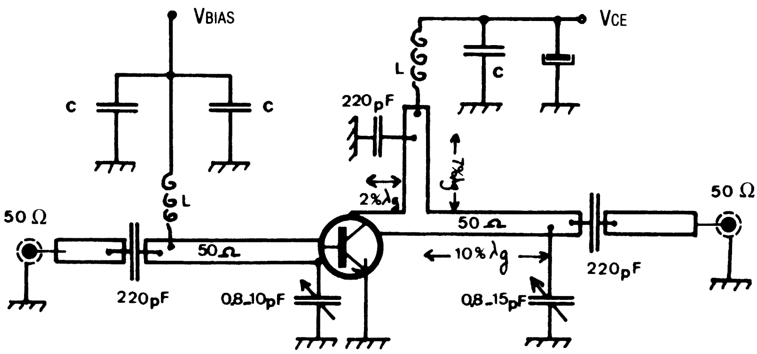
LARGE SIGNAL IMPEDANCES



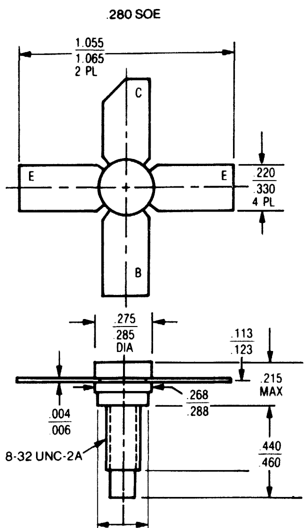

Safe Operating Area
Ic
2 A
1.6
1.2
.8
.4
0
T Heatsink 70°C
5
10
15
20
25
30 V
Vce


MTTF FACTOR vs
JUNCTION TEMPERATURE
1
0.1
0.01
0.001
MTTF FACTOR 10^6 hours × amp^2
Divide MTTF Factor by Ic^2
to obtain metal life
80
100
120
140
160
180
200
JUNCTION TEMPERATURE — °C

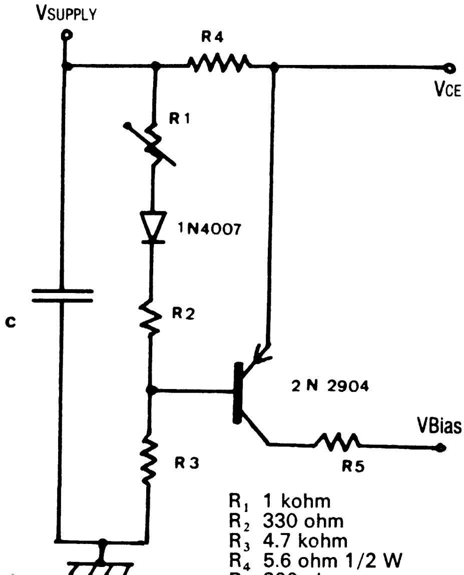
TEST CIRCUIT AT 860 MHz



L = 6 turns ID = 1 mm Wire diameter = 0.6 mm
The lengths are given for F = 860 MHz



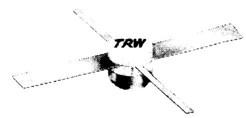
CLASS A BIAS CIRCUIT



R_1 1 kohm
R_2 330 ohm
R_3 4.7 kohm
R_4 5.6 ohm 1/2 W
R_5 390 ohm
C 100 µF + 10 nF + 1 nF

UHF Linear Transistor

- Class A Operation
- TV Transposer
- 0.25 W — Band 5
- 14 dB Gain at 860 MHz
- Gold Reliability
- Common Emitter
- Diffused Ballast Resistors



.200 SOE

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

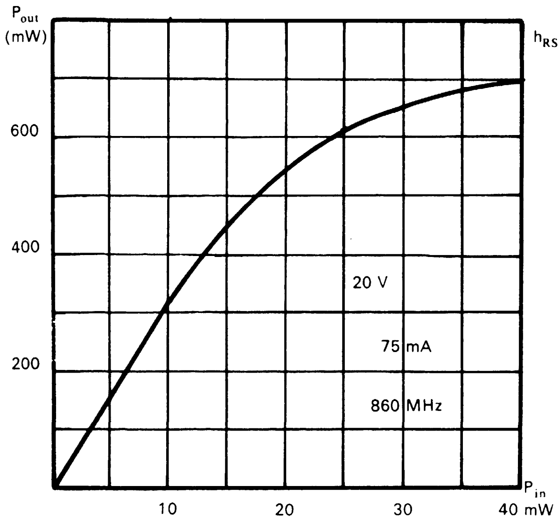
SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25mA	3.5			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 10mA	24			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 1mA	45			V
BV_{CER}	Collector Emitter Breakdown Voltage	R_{BE} = 10, I_C = 10mA	50			V
I_{CBO}	Collector Cutoff Current	V_{CB} = 28V			0.25	mA
H_{FE}	DC Current Gain	V_{CE} = 5V, I_C = 100mA	20		120	
I_{MD}	Intermodulation Distortion −8dB −16dB −7dB	f = 860 MHz, V_{CE} = 20V		−60	−58	dB
P_G	Power Gain	I_E = 75mA	14	14.5		dB
VSWR	Mismatch Tolerance	P_{REF} = 0.25W		∞		
C_{OB}	Collector Base Capacitance	V_{CB} = 20V, f = 1 MHz			3	pF
F_T	Cutoff Frequency	V_{CE} = 20V, I_E = 75mA	3			GHz
I_C	Maximum Collector Current				.4	A
O_{JF}	Thermal Resistance Junction Heatsink	$T_{HEATSINK}$ = 70°C			30	°C/W
T_J	Maximum Junction Temperature		−65		+200	°C
T_{STG}	Storage Temperature		−65		+150	°C

TPV 590

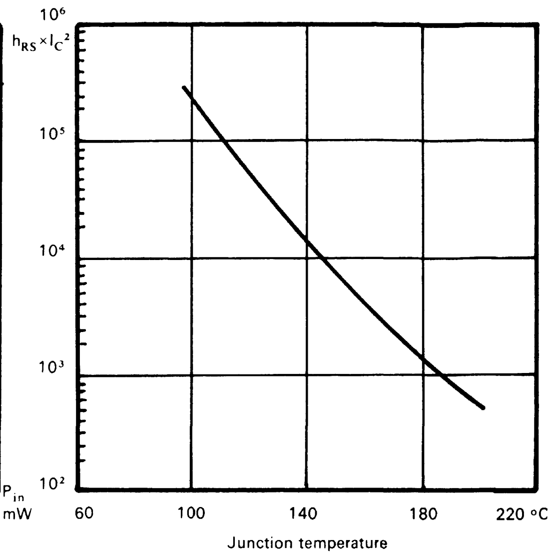
V_{CE} = 20 V I_C = 100 mA

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	0.613	226°	17.78	126°	0.0199	35°	0.530	320°
200 MHz	0.732	203°	12.88	103°	0.028	33°	0.316	305°
300 MHz	0.767	192.5°	9.22	93°	0.029	33°	0.266	297°
400 MHz	0.767	185°	6.91	84°	0.033	33°	0.266	295°
500 MHz	0.754	179.5°	5.16	79°	0.033	38°	0.266	300°
600 MHz	0.776	174°	4.67	72°	0.035	42°	0.237	300°
700 MHz	0.776	170°	4.02	66°	0.039	43°	0.237	290°
800 MHz	0.767	167°	3.34	61°	0.044	44°	0.266	285°
900 MHz	0.767	163°	3.16	56°	0.047	44°	0.237	290°
1 GHz	0.776	160°	2.786	52°	0.053	45°	0.266	280°

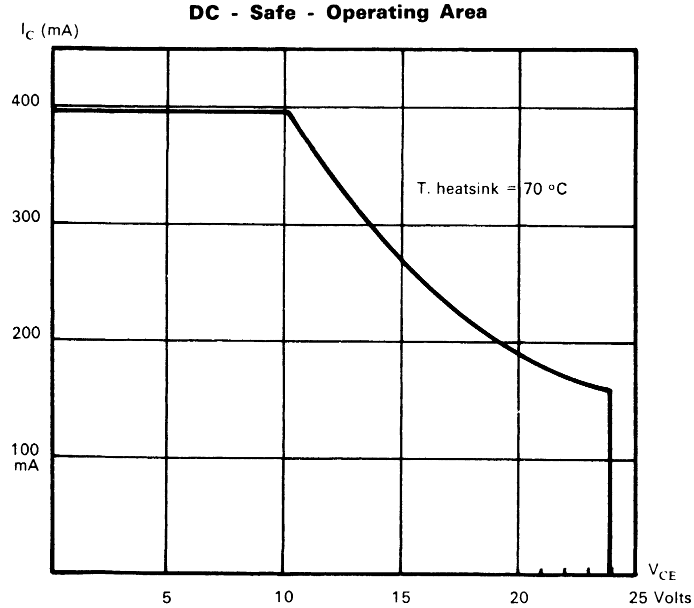
Power Output vs Power Input



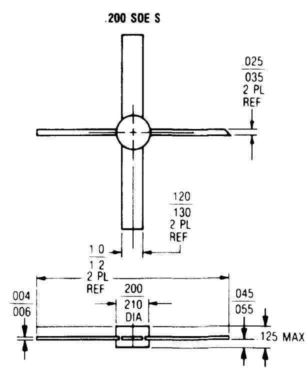
MTTF Factor vs Junction Temperature



DC - Safe - Operating Area

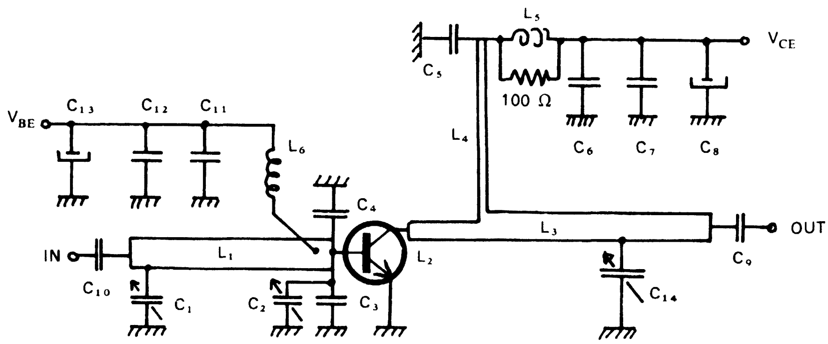


Package



TPV 590

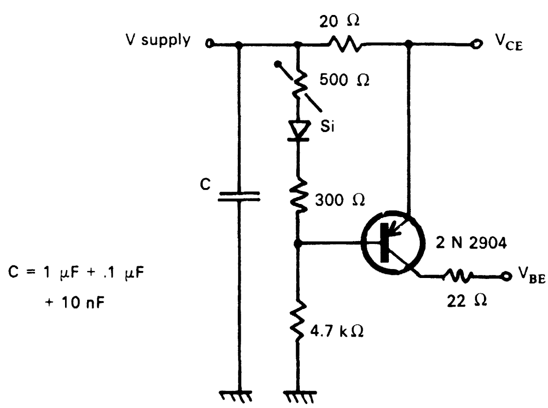
V_{CE} = 20 V **I_C = 75 mA** **F_O = 860 MHz**



TEST CIRCUIT

L_1 : 50 Ω line l = 10 % λg at 860 MHz
L_2 : 100 Ω line l = 12 % λg at 860 MHz
L_3 : 50 Ω 'ine l = 7 % λg at 860 MHz
L_4 : 120 Ω line l = 10 % λg at 860 MHz
L_5 : 6 turns ID 3 mm wire .5 mm
L_6 : 6 turns ID 3 mm wire .5 mm

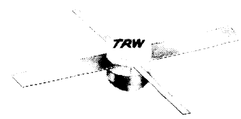
C_1 = C_2 = C_{14} = variable AIRTRONIC C max 4.7 pF AT 7275
C_3 = C_4 = ATC chip 10 pF
C_5 = 680 pF ATC chip
C_6 = C_{11} = 1 nF
C_7 = C_{12} = 10 nF
C_8 = 10 µF 63 V
C_{13} = 10 µF 25 V
C_9 = C_{10} = 1 nF chip



Bias Circuit

UHF Linear Transistor

- **Class A Operation**
- **TV Transposer**
- **0.5 W Band 5**
- **14 dB Gain at 860 MHz**
- **High Efficiency**
- **Gold Reliability**
- **Common Emitter**
- **Diffused Ballast Resistors**



.200 SOE

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

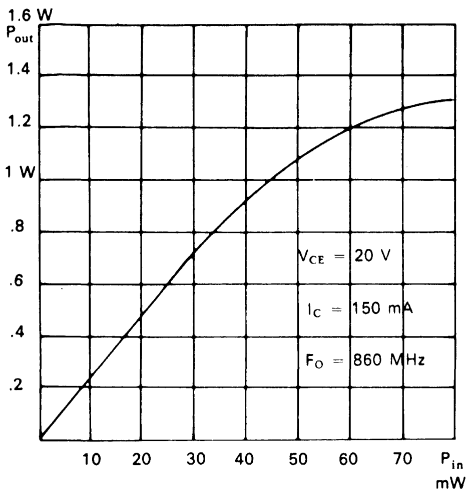
SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 20mA	24			V
BV_{CER}	Collector-Emitter Breakdown Voltage	R_{BE} = 10 , I_C = 20mA	50			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.5mA	3.5			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 2mA	45			V
I_{CBO}	Collector Cutoff Current	V_{CB} = 28V			0.5	mA
H_{FE}	Fwd. Current Transfer Ratio	V_{CE} = 5V, I_C = 200mA	20		120	
IMD	Intermodulation Distortion −8dB −16dB −7dB	F_O = 860 MHz		−60	−58	dB
P_G	Power Gain	V_{CE} = 20V, I_C = 150mA	13	14		dB
VSWR	Mismatch Tolerance	P_{REF} = 0.5W		∞		
F_T	Cutoff Frequency	V_{CE} = 20V, I_E = 75mA	3			GHz
C_{OB}	Collector-Base Capacitance	V_{CB} = 20V, f = 1 MHz			5.5	pF
I_C	Maximum Collector Current				.8	A
Θ_{JF}	Thermal Resistance Junction-Heatsink	$T_{HEATSINK}$ = 70°C			16	°C/W
T_J	Maximum Junction Temperature		−65		+200	°C
T_{STG}	Storage Temperature		−65		+150	°C

TPV 591

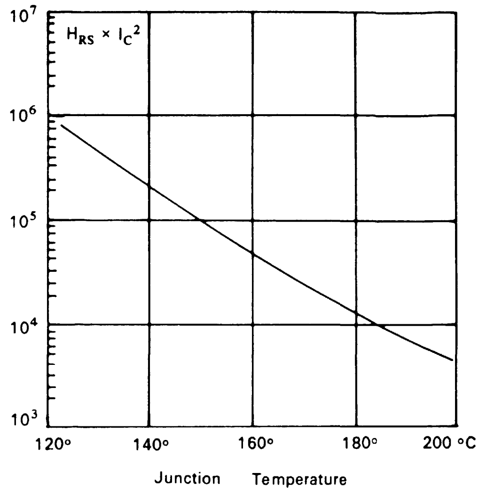
V_{CE} = 20 V I_C = 150 mA

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	0.733	190	13.8	117	0.025	27	0.365	280
200	0.841	187	8.13	100	0.028	27	0.266	241
300	0.861	181	5.62	88	0.033	27	0.266	241
400	0.861	177	4.27	79	0.035	30	0.282	225
500	0.861	173	3.47	72	0.040	36	0.282	225
600	0.865	169	2.82	68	0.045	36	0.282	218
700	0.865	167	2.44	61	0.045	37	0.316	214
800	0.866	163	2.15	54	0.050	40	0.316	216
860	0.866	162	2.03	54	0.050	43	0.331	218
900	0.866	160	1.94	52	0.053	44	0.331	217
1 000	0.876	158	1.66	46	0.056	44	0.376	214

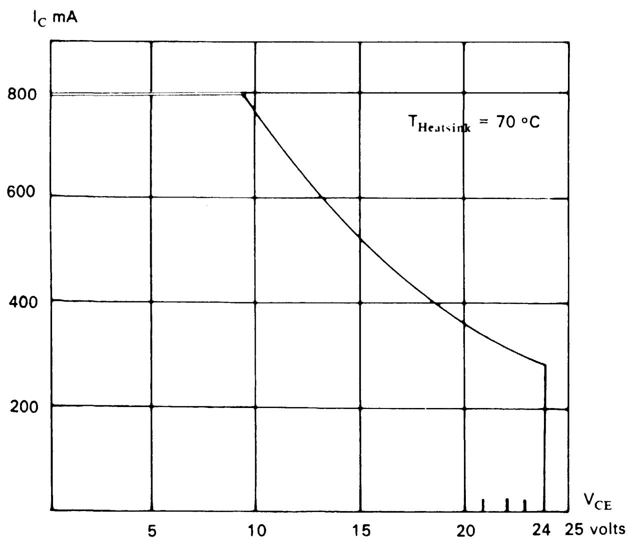
Power Output vs Power Input



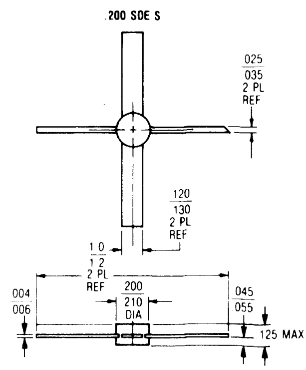
MTTF Factor vs Junction Temperature



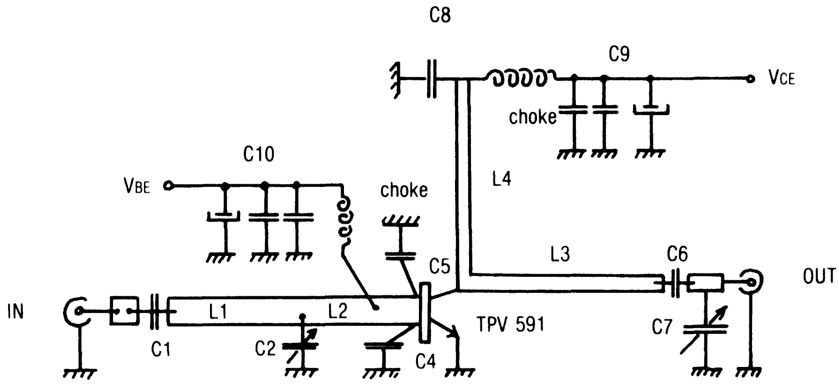
D.C Safe Operating Area



Package



F_O = 860 MHz — V_{CE} = 20 V — I_C = 150 mA



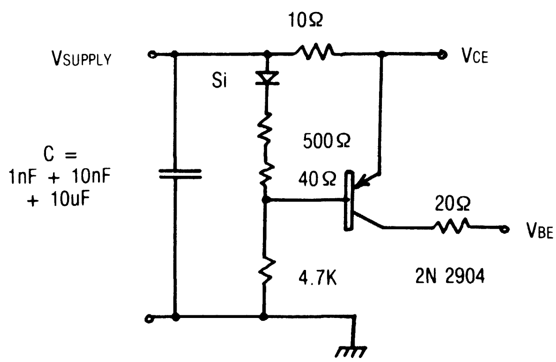
TEST CIRCUIT

C_1 = C_6 = 1 nF
C_2 = C_7 = Variable Airtronic AT 7285 - max. 2.5 pF
C_4 = ATC 100 A 10 pF
C_5 = ATC 100 A 6.8 pF + 4.7 pF
C_8 = 1 nF
C_9 = C_{10} = 1 nF + 10 nF + 10 μF

Choke : 8 turns — ID 6 mm — wire .5 mm

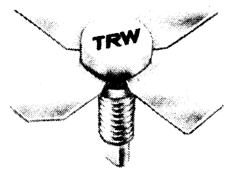
L_1 = 50 line — ℓ = 10 % λg at 860 MHz
L_2 = 50 line — ℓ = 5 % λg at 860 MHz
L_3 = 80 line — ℓ = 13 % λg at 860 MHz
L_4 = 100 line — ℓ = 8 % λg at 860 MHz

BIAS CIRCUIT



UHF Linear Transistor

- Class A Operation
- TV Transposer
- Band 4 & 5
- 9 dB Gain
- 2 Watts
- Diffused Ballast Resistors
- Common Emitter
- Isolated Packages



.280 SOE

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

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_C = 80 mA	25			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 10 mA	45			V
	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 1 mA	4			V
	H_{FE}	D.C. Current Gain	V_{CE} = 20 V I_C = 250 mA	10			—
RF TEST	IMD	Intermodulation distortion vision = — 8 dB sound = — 7 dB Sideband = — 16 dB	F = 860 MHz P_{REF} = 2 W V_{CE} = 25 V I_C = 450 mA			— 60	dB
	P_G	Power Gain		8.5	9		dB
	C_{OB}	Collector Base Capacitance	V_{CB} = 25 V F = 1 MHz			10	pF
THERMAL	θ_{j-c}	Thermal Resistance Junction Case	T_{case} 70 °C			11	°C/W
	T_{STG}	Storage Temperature		— 65		+ 150	°C
	T_J	Junction Temperature		— 65		+ 200	°C

TPV 593

POLAR « S » PARAMETERS IN 50 OHMS SYSTEM

F	S11		S21		S12		S22		S21	K
MHz	MAGN	ANGL	MAGN	ANGL	MAGN	ANGL	MAGN	ANGL	dB	FACTOR
470	0.93	170°	1.5	63	0.04	50°	0.55	— 166°	3.52	1.01
650	0.93	165°	1.06	50	0.05	54°	0.60	— 169°	0.51	1.04
860	0.92	162°	0.79	38	0.06	54°	0.65	— 169°	— 2	1.15

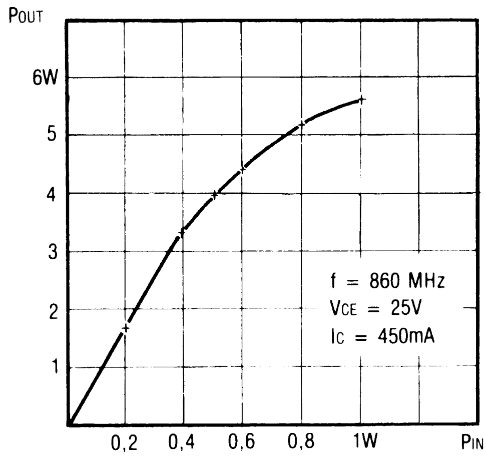
NOTE : V_{CE} = 25 Volts — I_C = 450 mA — Class A

POLAR COORDINATES OF SIMULTANEOUS CONJUGATE MATCH IN 50 OHMS SYSTEM

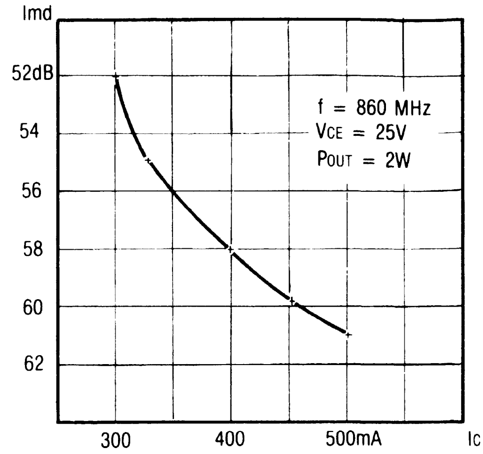
F	SOURCE REFL. COEFF.		LOAD REFL. COEFF.		G MAX
MHz	MAGN	ANGLE	MAGN	ANGLE	dB
470	0.99	— 173°	0.91	124°	15.2
650	0.99	— 168°	0.83	134°	12.0
860	0.95	— 165°	0.79	146°	9.2

NOTE : V_{CE} = 25 Volts — I_C = 450 mA — Class A

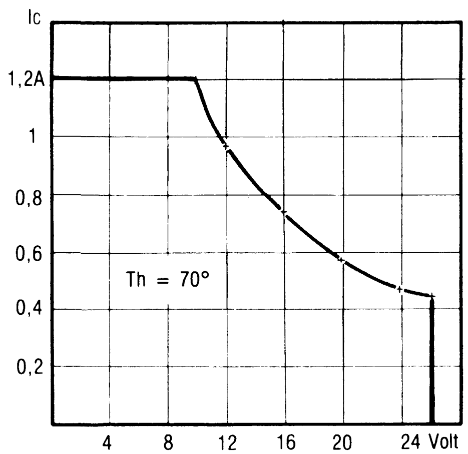
Output Power vs Input Power



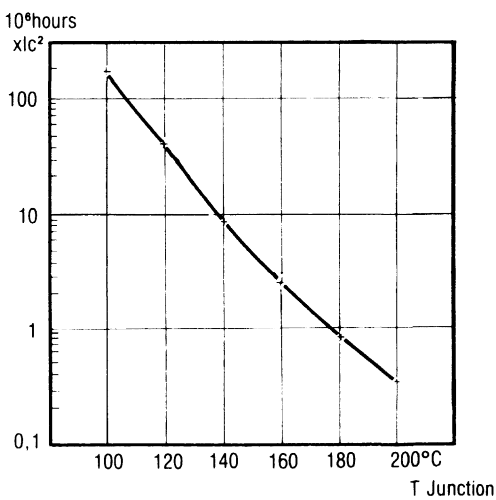
IMD vs Collector Current



DC Safe Operating Area

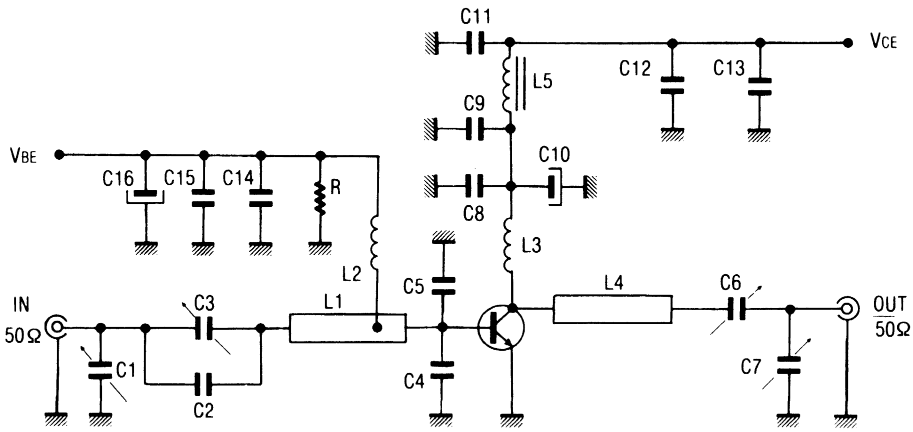


MTTF vs Junction Temperature



TPV 593

TEST CIRCUIT AT 860 MHz

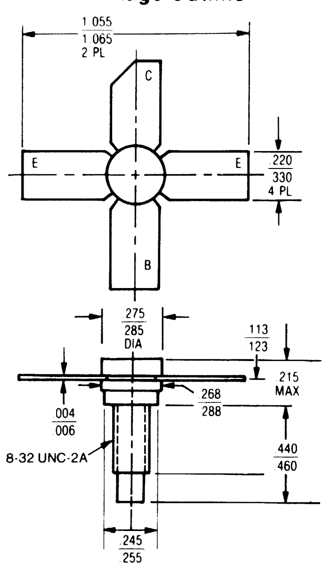


Components Part List

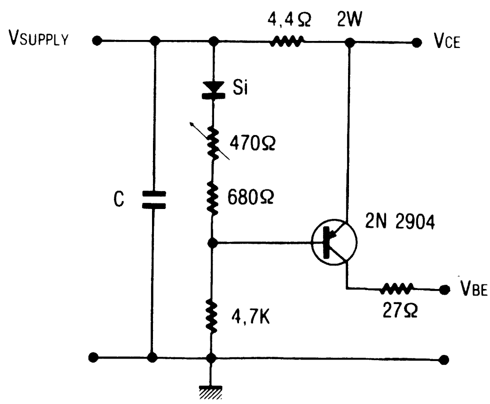
C_1 = AIR TRIMMER AT 5201 0.8 - 10 pF TEKELEC
C_2 = CHIP ATC 4.7 pF
C_3 = AIR TRIMMER AT 5751 0.6 - 6 pF TEKELEC
C_4 = C_5 = CHIP ATC 3.3 pF
C_6 = C_7 = AIR TRIMMER AT 5501 1 - 20 pF TEKELEC
C_8 = C_{13} = C_{14} = 1 nF CHIP CAPACITOR
C_9 = C_{11} = C_{15} = 10 nF RTC
C_{12} = 0.1 μF RTC
C_{10} = C_{16} = 10 μF 63 V electrolytic

L_1 = 30 Ω line 1 = 6.5 % λg
L_2 = choke 0.47 μH
L_3 = 1 turn - ID 6 mm - wire 10/10
L_4 = 30 Ω line 1 = 19 % λg
L_5 = 8 turns on a CN 20 FERRITE BEAD - CERAMICL - MAGNETICS
R = 43 Ω 1/4 Watt

Package Outline

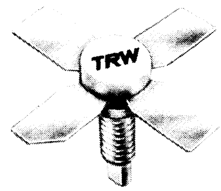


Class a Bias Circuit



UHF Linear Transistor

- TV Transposer Band 4-5
- 4 W
- 7 dB Gain
- All-Gold Metalization
- Common Emitter
- Isolated Package



.280 SOE

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 1mA	4			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 20mA	25			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 10mA	45			V
H_{FE}	DC Current Gain	V_{CE} = 20V	10			
IMD	Intermodulation Distortion — 3 Tone Vision Carrier = Reference — 8dB Sound Carrier = Reference — 7dB Sideband Carrier = Reference — 16dB	f = 860 MHz, V_{CE} = 20V I_E = 1A, P_{REF} = 4W			−60	dB
P_G	Power Gain	f = 860 MHz, V_{CE} = 20V I_E = 1A, P_{REF} = 4W	7			dB
C_{OB}	Collector-Base Capacitance	V_{CB} = 20V, f = 0.1 MHz			20	pF
F_T	Cutoff Frequency	V_{CE} = 20V, I_E = 1A		2		GHz
Θ_{JC}	Thermal Resistance Junction-Case	T_{CASE} = 40°C			5	°C/W
T_{STG}	Storage Temperature		−65		+150	°C
T_J	Junction Temperature		−65		+200	°C

TPV 598

POLAR S PARAMETERS IN 50 OHMS SYSTEM

F	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	1.065	68	0.032	50	0.749	184
500	0.957	173	0.86	63	0.035	57	0.746	183
600	0.959	171	0.692	56	0.040	59	0.759	182
700	0.957	170	0.596	49	0.045	59	0.767	182
800	0.955	168	0.537	45	0.050	63	0.785	181
900	0.955	166	0.501	45	0.056	63	0.776	180
1000	0.955	164	0.409	36	0.063	61	0.813	180

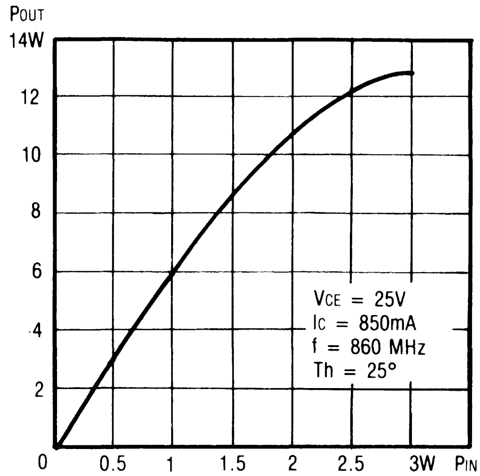
NOTE : V_{CE} = 25 Volts I_C = 850 mA

LARGE SIGNAL IMPEDANCES

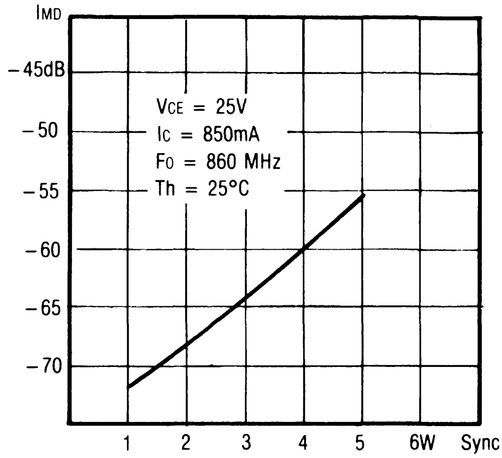
FREQUENCY (MHz)	Z_{in} (Ohms)	Z_{Load} (Ohms)
470	.63 + j .9	11.25 + j 11
550	.63 + j 1.2	8.75 + j 10.5
650	.6 + j 1.5	7 + j 10
750	.5 + j 1.75	6 + j 9.5
860	.45 + j 2.15	3.5 + j 7.5

NOTES : — Z_{in} = Values to get optimum input return loss and gain.
— Z_{Load} = Values to get optimum IMD at 5 W Sync.

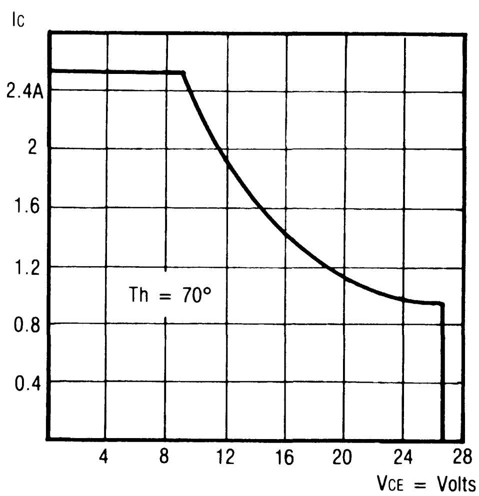
Output Power vs Input Power



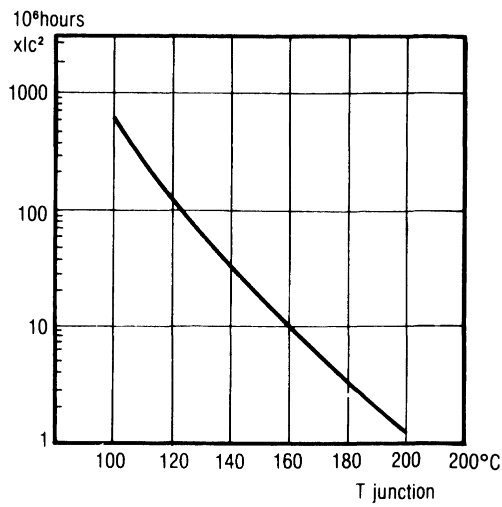
IMD vs Collector Current



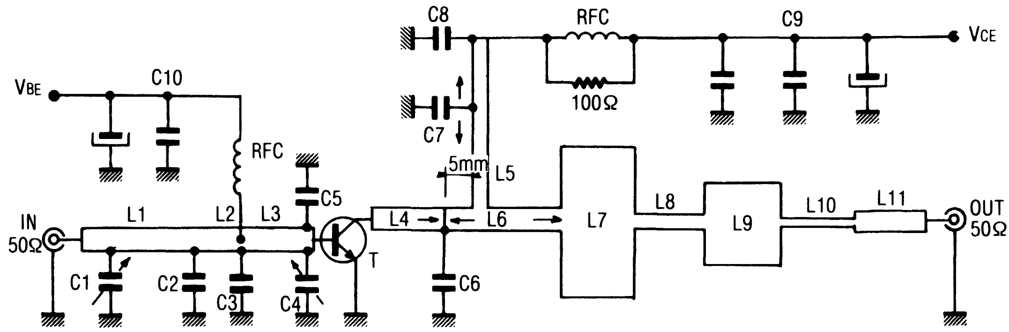
DC Safe Operating Area



MTTF vs Junction Temperature



BROADBAND TEST CIRCUIT

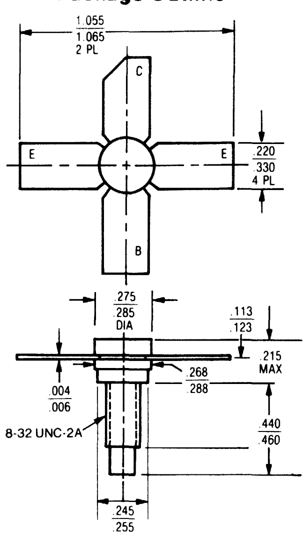


C_1 = VARIABLE .5 - 4.7 pF AIRTRONIC
C_2 = C_3 = ATC 4.7 pF
C_4 = ATC 10 pF + VARIABLE .5 - 4.7 pF AIRTRONIC
C_5 = ATC 10 pF + ATC 5.6 pF
C_6 = ATC 18 pF + .5 - 4.7 pF VARIABLE AIRTRONIC
C_7 = 470 pF CHIP CAPACITOR
C_8 = 1 nF + 10 nF DECOUPLING
C_9 = 1 nF + 10 nF + .1 μF + 10 μF
C_{10} = 10 nF + 1 μF + 10 μF

RFC = 8 turns ID 2.5 mm Wire = .5 mm

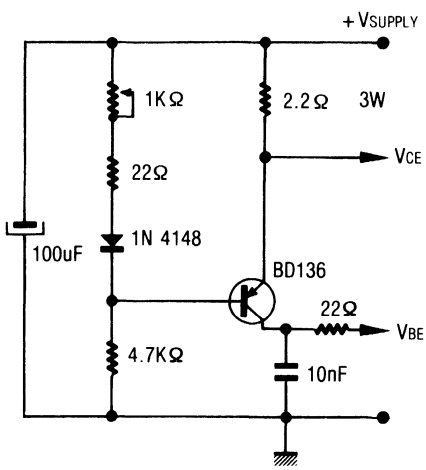
L_1 = 50 Ω line 6.2 % λg at 860 MHz
L_2 = 50 Ω line 4.2 % λg at 760 MHz
L_3 = 50 Ω line 4.9 % λg at 860 MHz
L_4 = 20 Ω line 6.5 % λg at 860 MHz
L_5 = 50 Ω line 5 % λg at 860 MHz
L_6 = 20 Ω line 9.5 % λg at 860 MHz
L_7 = 4 Ω line 8 % λg at 860 MHz
L_8 = 55 Ω line 7.5 % λg at 860 MHz
L_9 = 7.5 Ω line 8 % λg at 860 MHz
L_{10} = 100 Ω line 8 % λg at 860 MHz
L_{11} = 20 Ω line 8 % λg at 860 MHz

Package Outline



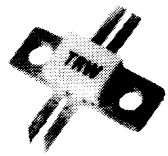
280 SOE

Class a Bias Circuit



UHF Linear Transistor

- Push Pull Transistors
- TV Transposers
- Band 4 & 5
- 8 W
- 7.5 dB Gain
- Gold Reliability
- Diffused Ballast Resistors
- Class A Operation



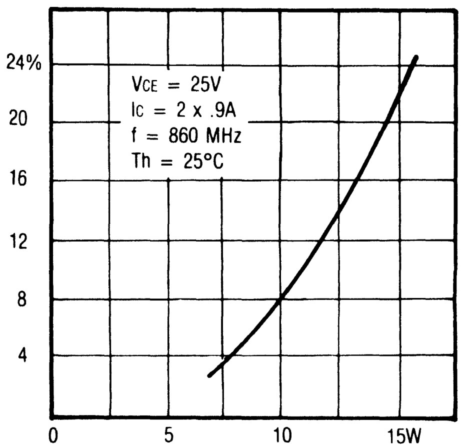
BMA-2

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

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST EACH SIDE	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 3 mA	4			V
	BV_{CEO}	Collector - Emitter Breakdown Voltage	I_C = 40 mA	28			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 20 mA	45			V
	H_{FE}	D.C Current Gain	V_{CE} = 20 V I_C = 500 mA	10			
RF TEST	I_{MD}	Intermodulation distortion 3 tones (-8-7-16)	F = 860 MHz V_{CE} = 25 V I_C = 2 X .9 A Pref. = 8 W			− 58	dB
	P_G	Power Gain		7.5	8		dB
	C_{OB}	Collector - Base Capacitance each side			17.5	20	pF
THERMAL	θ_{JC}	Thermal Resistance Junction Case	high resolution T_{case} = 70 °C D.C dissipation			2.5	°C/W
	θ_{CH}	Thermal Resistance Case heatsink			0.2		°C/W
	T_{STG}	Storage Temperature		− 65		+ 150	°C
	Tj	Junction Temperature		−65		+200	°C

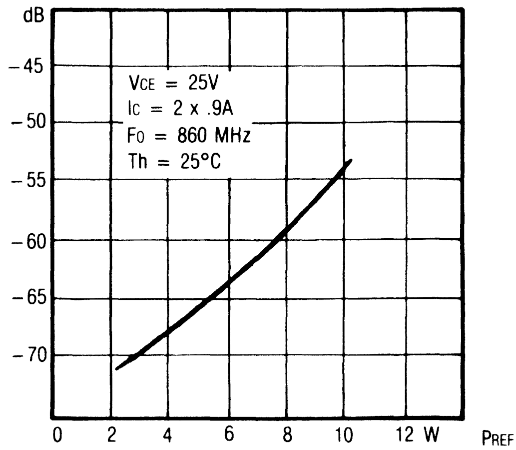
TPV 508

Cross-mod* vs Output Power



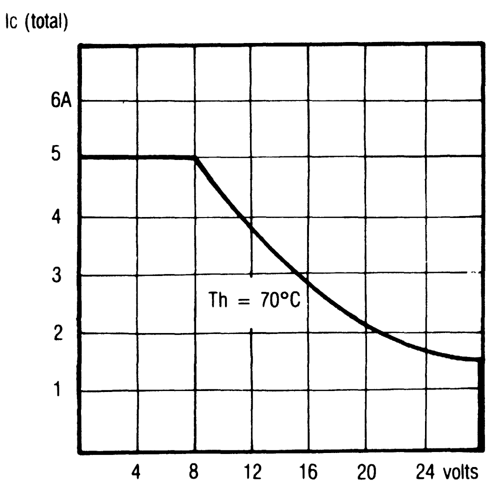
*Cross-mod: % sound (— 7dB)
— vision 0 ——→ PEAK

IMD* vs Output Power

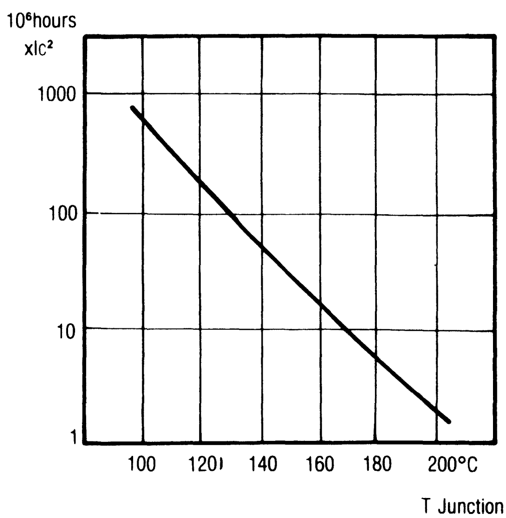


*IMD: 3 tones — 7dB, — 8dB, — 16dB

DC Safe Operating Area

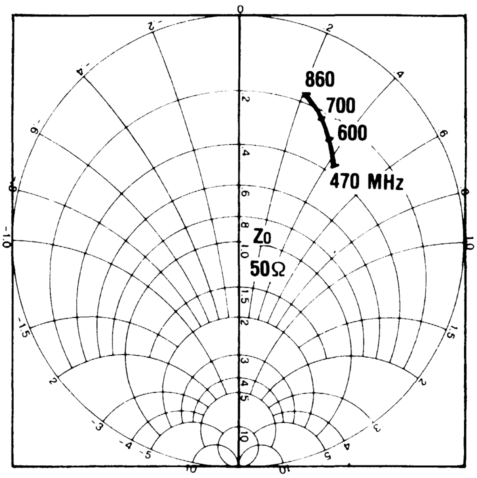


MTTF vs Junction Temperature



Z LOAD FOR BEST IMD (8 W) and CROSS-MODULATION (12 W)

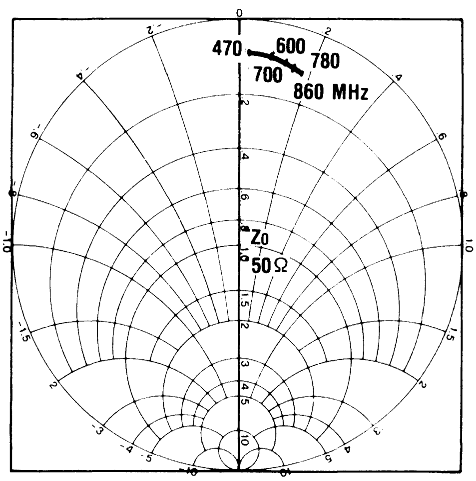
Collector to collector



$V_{CE} = 25$ V
$I_C = 2 \times 0.9$A9 A

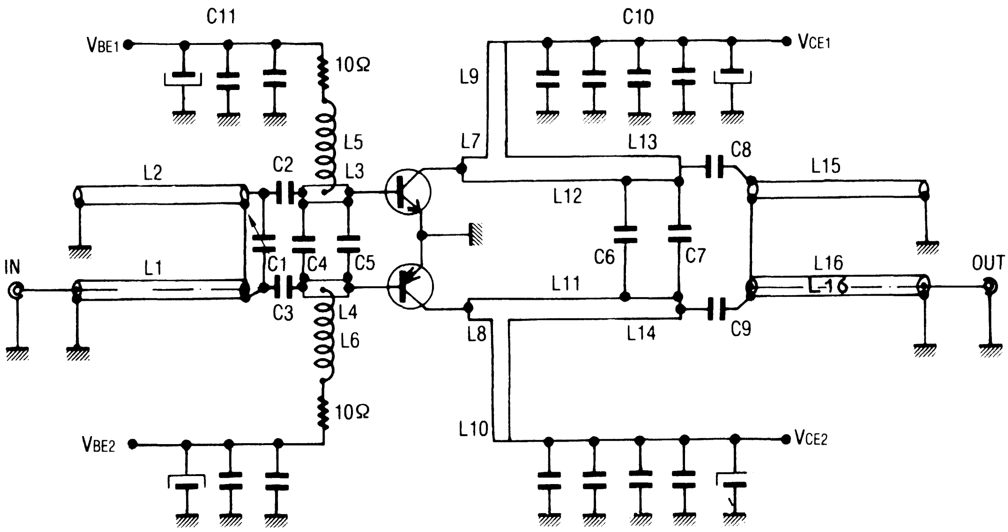
ZIN FOR BEST INPUT VSWR

Base to base



$V_{CE} = 25$ V
$I_C = 2 \times 0.9$ A

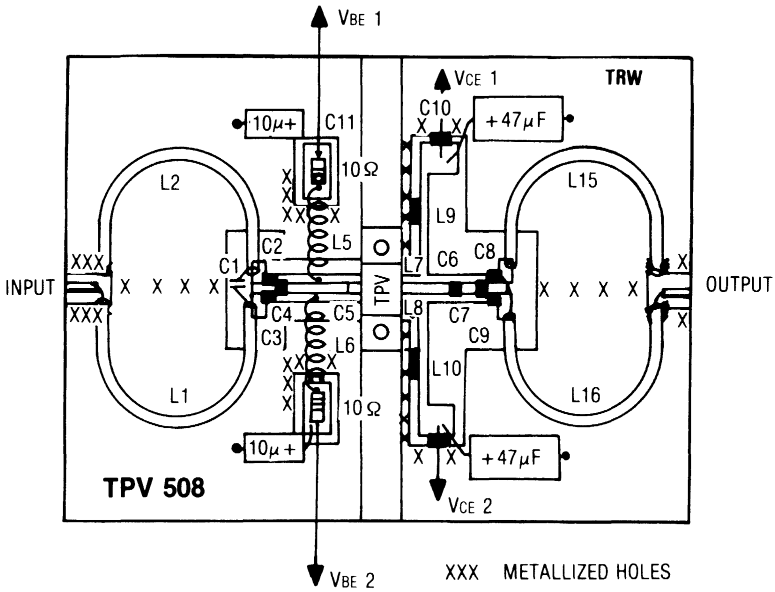
TPV 508 BROADBAND AMPLIFIER 470-860 MHz
Class A

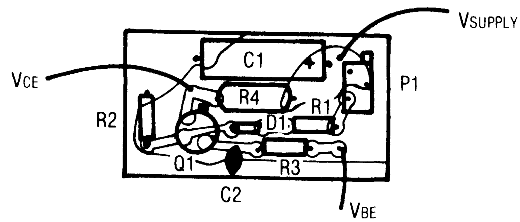


$L_1 = L_2 = L_{15} = L_{16}$	= 60 mm of 50 Ω - 2.2 mm semi rigid coax
$L_3 = L_4$	= 50 Ω line - 5.5 % λ g at 860 MHz
$L_5 = L_6$	= 3 turns ID 2 mm
$L_7 = L_8$	= 50 Ω line - 1.5 % λ g at 860 MHz
$L_9 = L_{10}$	= 50 Ω line - 4.9 % λ g at 860 MHz
$L_{11} = L_{12}$	= 50 Ω line - 2 % λ g at 860 MHz
$L_{13} = L_{14}$	= 50 Ω line - 1.5 % λ g at 860 MHz
C_1	= .5 — 4.5 pF GIGATRIM TRIMMER
$C_2 = C_3$	= 27 pF ATC 100 A
C_4	= 6.8 pF ATC 100 A
C_5	= 18 pF ATC 100 A
C_6	= 3.3 pF ATC 100 A
C_7	= 4.7 pF ATC 100 A
$C_8 = C_9$	= 27 pF ATC 100 A
C_{10}	= + 330 pF ATC 100 B + 1 nF + 10 nF + 47 µF
C_{11}	= 1 nF + 10 nF + 10 µF

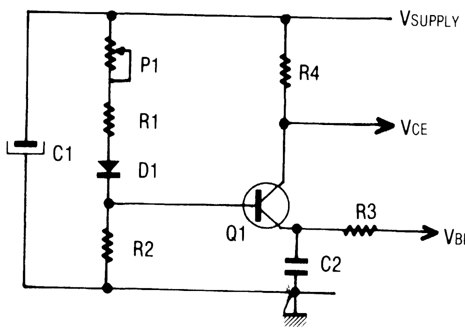
470-860 MHz BROADBAND AMPLIFIER

Class A





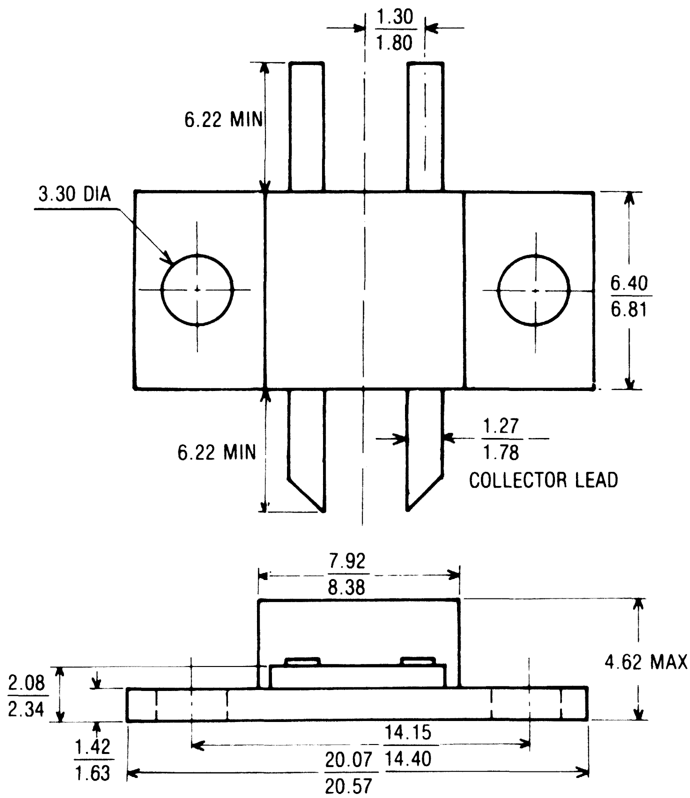
BIAS



PART LIST

C_1 = 100 MF	R_2 = 5.6 KΩ	D_1 = 1 N 4148
C_2 = 10 nF	R_3 = 100 Ω	Q_1 = 2 N 2904
R_1 = 150 Ω	R_4 = 2.7 Ω 2 W.	P_1 = 1 K Ω

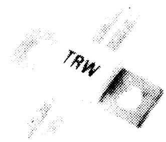
PACKAGE OUTLINE



Dimensions given in mm

UHF Linear Transistor

- TV Transmitter
- Band 4 & 5 (Vision only)
- 50 Watts
- Class AB Operation
- Push-Pull
- Gold Reliability
- Diffused Ballast Resistors



BMA-2

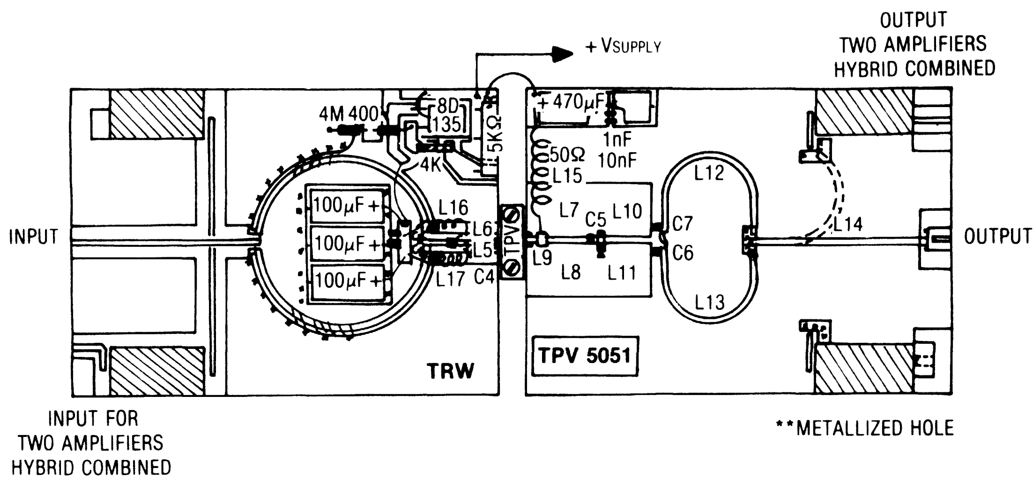
Electrical Characteristics (T_{case} = 25 °C)

	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC TEST EACH SIDE	BV_{EBO}	Emitter - Base Breakdown Voltage	I_E = 6 mA	4			V
	BV_{ECO}	Collector Emitter Breakdown Voltage	I_C = 40 mA	30			V
	BV_{CBO}	Collector - Base Breakdown Voltage	I_C = 20 mA	45			V
	H_{FE}	D.C Current Gain	V_{CE} = 20 V I_C = 800 mA	10			
RF TEST	P_G	Power Gain	V_{CE} = 28 V I_q = 2 X 100 mA F = 860 MHz P_{out} = 50 W	6.5	7		dB
	η_C	Collector Efficiency		45	50		%
THERMAL	Cob/Side	Collector - Base Capitance	V_{CB} = 28 V F = 1 MHz			40	pF
	θ_{JC}	Thermal Resistance Junction - Case	— High resolution — T_{case} = 70 °C — Rated output power			1.8	°C/W
	θ_{CH}	Thermal Resistance Case Heatsink			0.2		°C/W
	T_{STG}	Storage Temperature		— 65		+ 150	°C
	Tj	Junction Temperature		– 65		+ 200	°C

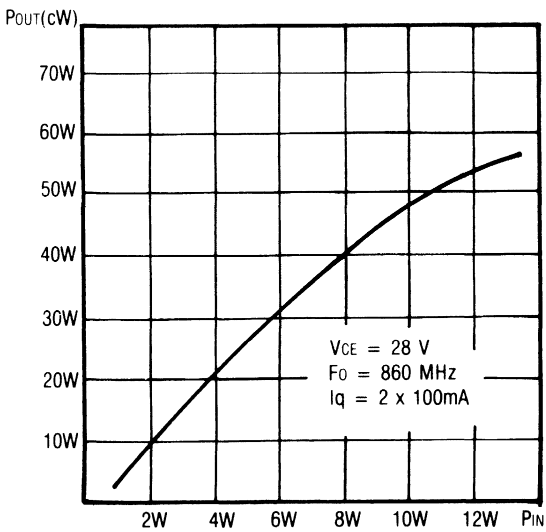
TYPICAL APPLICATION

600-860 MHz BROADBAND AMPLIFIER CLASS A-B

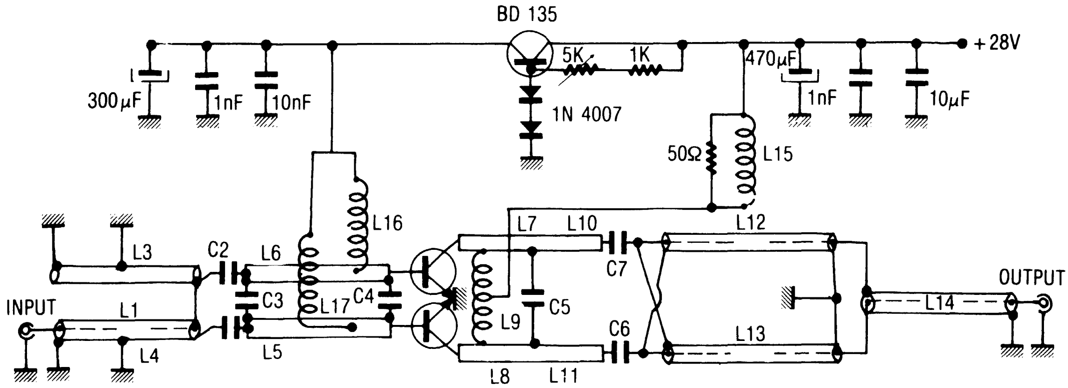
CIRCUIT LAYOUT

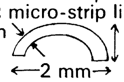


TYPICAL OUTPUT POWER US INPUT POWER



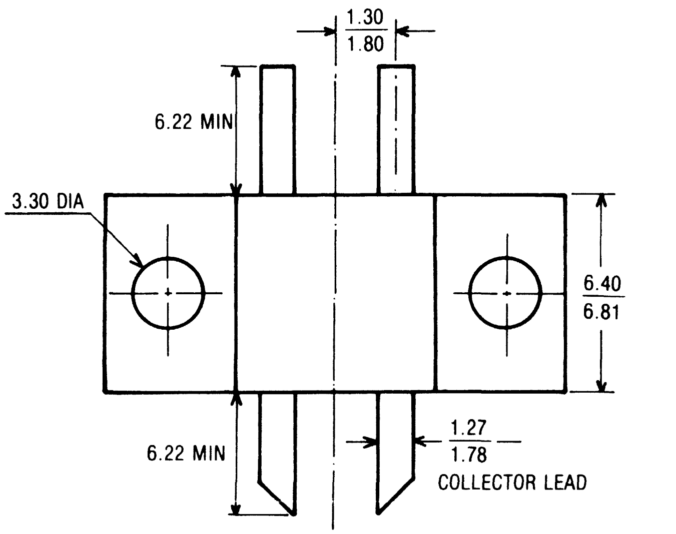
600-860 MHz CIRCUIT DIAGRAM

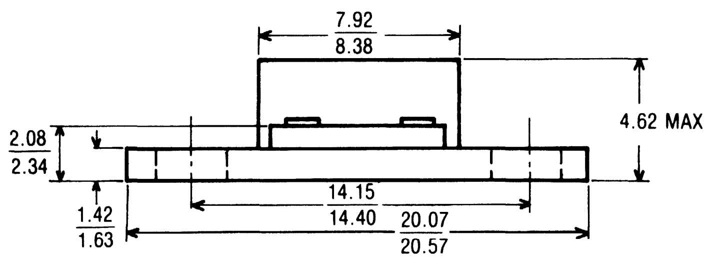


L_1 = L_2 = 70 mm of 50 Ω semi rigid coax — ∅ 2.2 mm
L_3 = L_4 = 50 Ω micro-strip line — 17 % λ g at 860 MHz
L_5 = L_6 = 40 Ω micro-strip line — 6 % λ g at 860 MHz
L_7 = L_8 = 10 Ω micro-strip line — 6 % λ g at 860 MHz
L_9 = 2 mm ↘  ↑6 mm ←2 mm→ cooper ribbon
L_{10} = L_{11} = 12 Ω micro-strip line — 6 % λ g at 860 MHz
L_{12} = L_{13} = 25 Ω semi-rigid — 50 mm long
L_{14} = 50 Ω semi-rigid — 47 mm long

C_1 = C_2 = 8.2 pF ATC 100 A
C_3 = 2.2 pF ATC 100 A + .5 — 4.5 pF GIGATRIM TRIMMER
C_4 = 12 pF + 4.7 pF ATC 100 A
C_5 = 10 pF ATC 100 A + .5 — 4.5 pF GIGATRIM TRIMMER
C_6 = C_7 = 100 pF ATC 100 A
L_{15} = 3 turns — wire 1 mm — ID 5 mm
L_{16} = L_{17} = 6 turns — wire .5 mm — ID 2 mm

PACKAGE OUTLINE

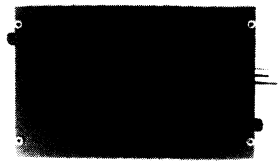




Dimensions given in mm

TV Transmitter Amplifier

- TV Transmitters
- Band 4-5
- Class A Operation
- 7.5 dB Power Gain
- 20 Watt Linear Power Output
- Solid State Reliability
- Built-In Test Points
- Linear Push-Pull Transistors

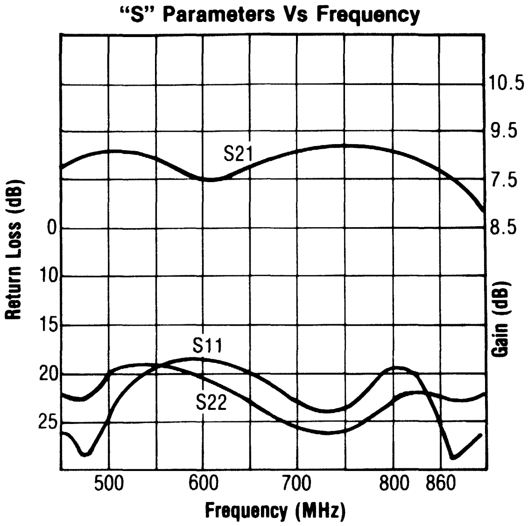


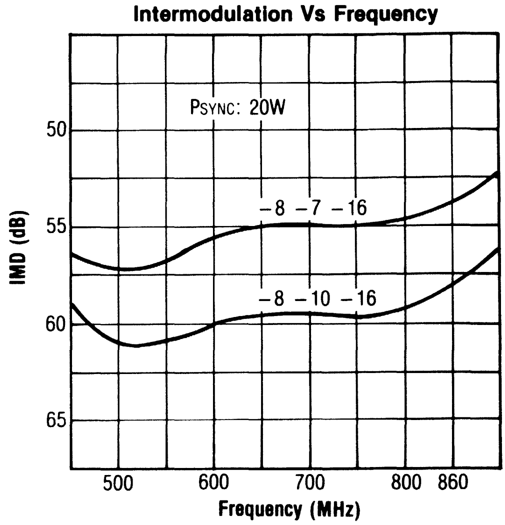
ATV 5030

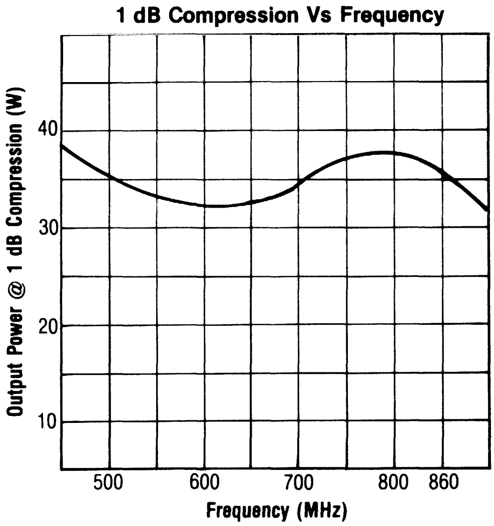
Electrical Characteristics (T_{CASE} = 50°C)

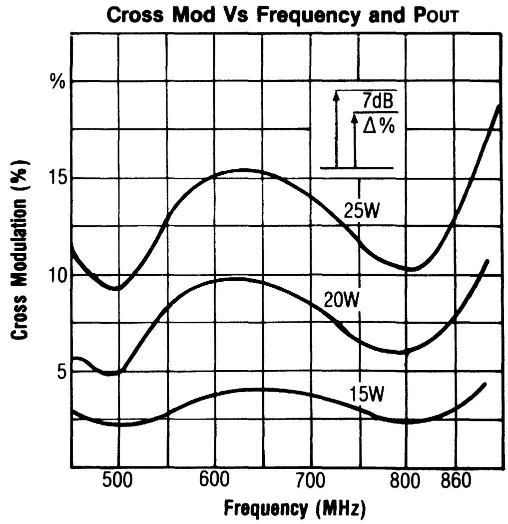
SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Z_L	In/Out Load	50 Ohms Reference			−20	dB
$Z_{IN/OUT}$	Input/Output Return Loss	50 Ohms Reference			−15	dB
F	Frequency Range		470		860	MHz
G_P	Power Gain	V_{CC} = 26.5V P_{sync} = 20W	7.5			dB
G_R	Gain Ripple	V_{CC} = 26.5V P_{sync} = 20W			1	dB
IMD	Intermodulation 3 Tones	V_{CC} = 26.5V −8, −7, 16 P_{sync} = 20W −8, −10, 16			−51 −54	dB dB
P_{OUT}	Output Power	1dB Compression V_{CC} = 26.5V	25			W
V_{CC}	Supply Voltage		26	26.5	27	V
T_{OP}	Operating Temp. Range	Base Plate	−20		+80	°C
T_{STG}	Storage Temp. Range	Base Plate	−40		+100	°C
I	Maximum Current	V_{CC} = 26.5V P_{sync} = 20W		3.8	4	A

TYPICAL CHARACTERISTICS

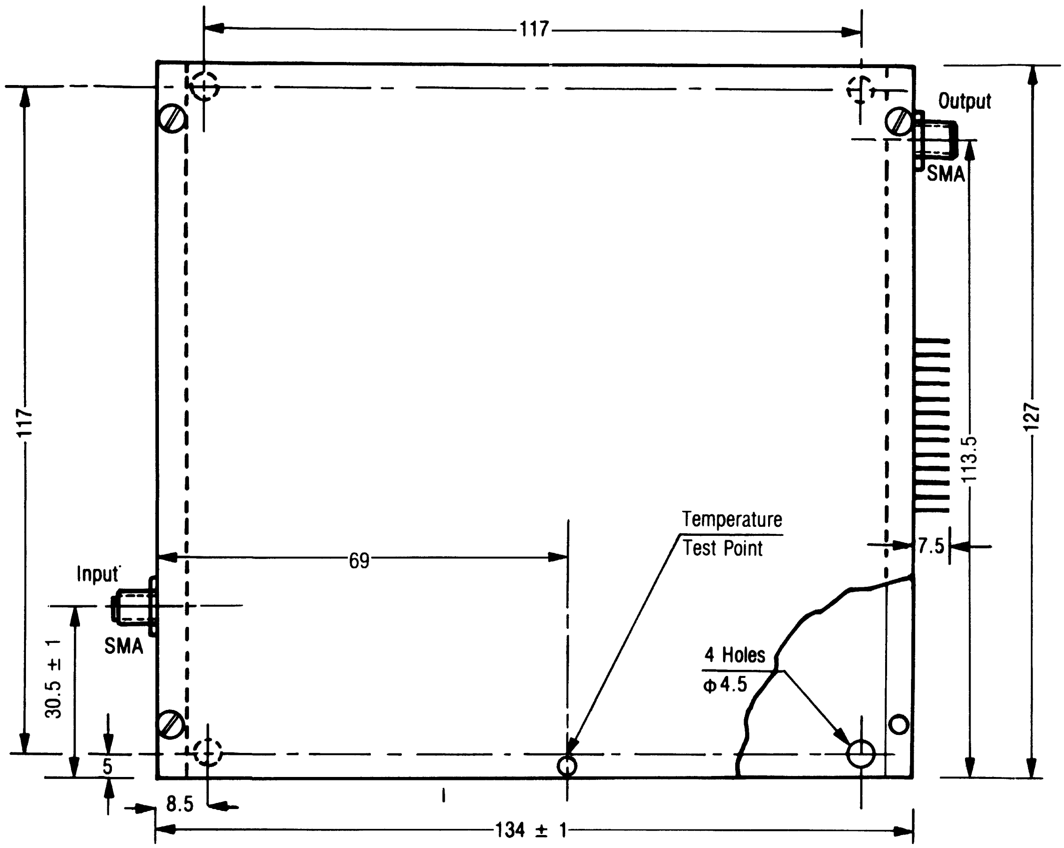


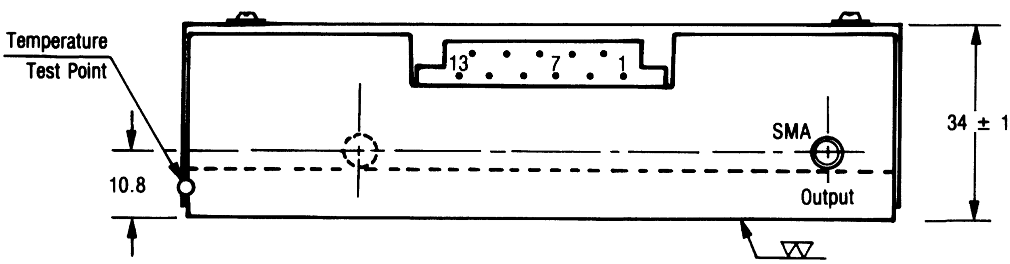






ATV 5020





3 Test Point Transistor No. 2
5 Test Point Transistor No. 1
6,7,8 V_{CC} +
9 Test Point Transistor No. 4
11 Test Point Transistor No. 3
10,12,13 Ground

Plug-In Layout

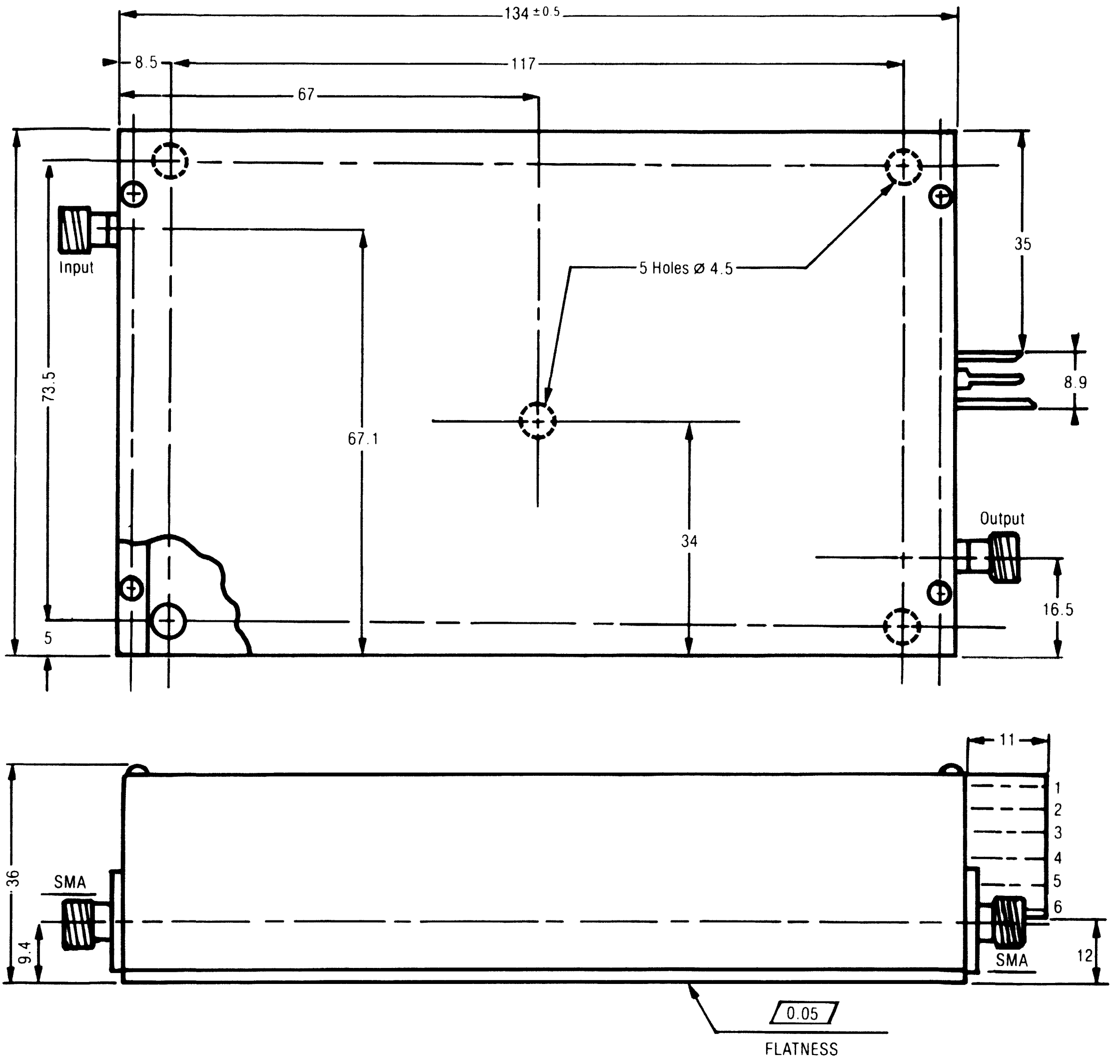
Current and Voltage Measurements on Test Points

1 — $\frac{\text{Collector Current}}{\text{Referenced to } P_{IN4}}$ $I_A = 1 \times V_{VOLT}$

2 — $\frac{\text{Collector Voltage}}{\text{Referenced to Ground}}$

All dimensions are in millimeters.

RF Amplifier ATV 5030



Plug-In Layout

Pin 1 +V supply 26.5 Volts
Pin 2 Do not use
Pin 3 Ground
Pin 4-5 Collector current test point
Pin 6 Optional

Voltage Measurement

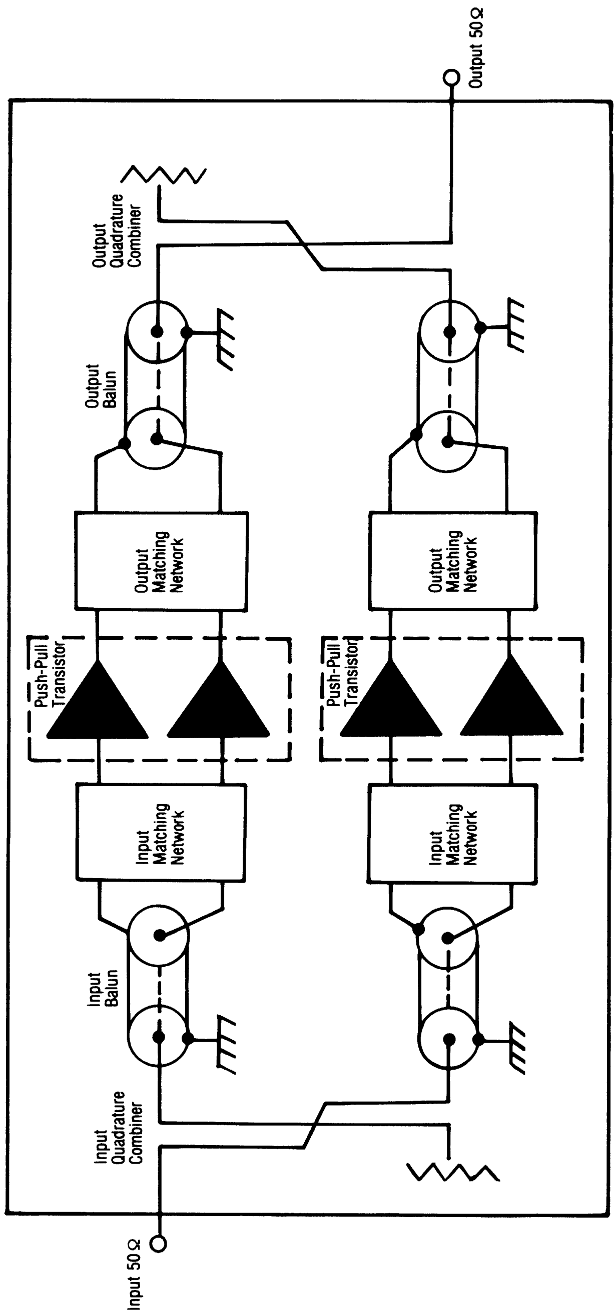
V supply (between Pin 1 and 3)

Collector Current Measurement

Voltmeter must have an input impedance greater than 10 K Ω

- Transistor No. 1
  $I_{1\,AMP} = \frac{1}{0.47} \times V_{(Volts)}$ between Pin 1-5
- Transistor No. 2
  $I_{2\,AMP} = \frac{1}{0.47} \times V_{(Volts)}$ between Pin 1-4

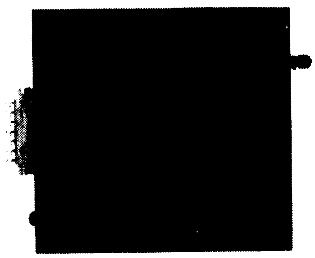
ATV 5030 CIRCUIT



TRW

TV Transposer Amplifier

- TV Transposers & Transmitters
- Band 4-5
- Class AB Operation
- 6 dB Power Gain
- 80 W Power Output (−1dB Compression)
- Solid State Reliability
- Built-In Test Points
- Linear Push-Pull Transistors

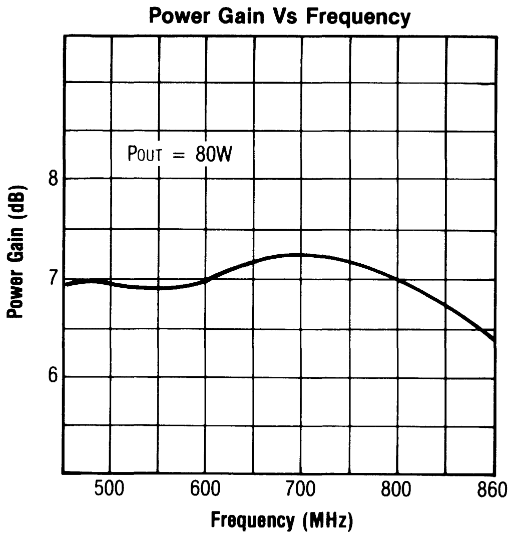


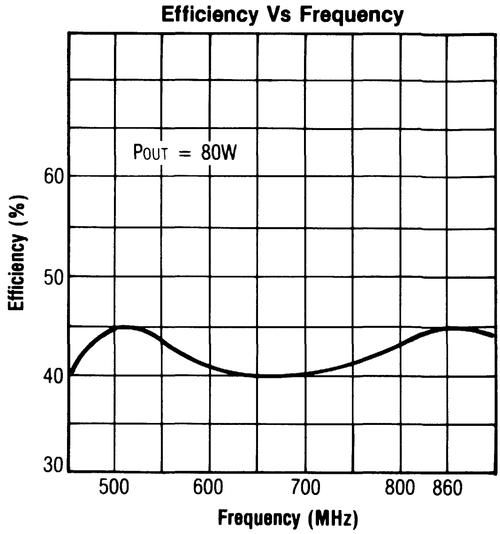
ATV 5080

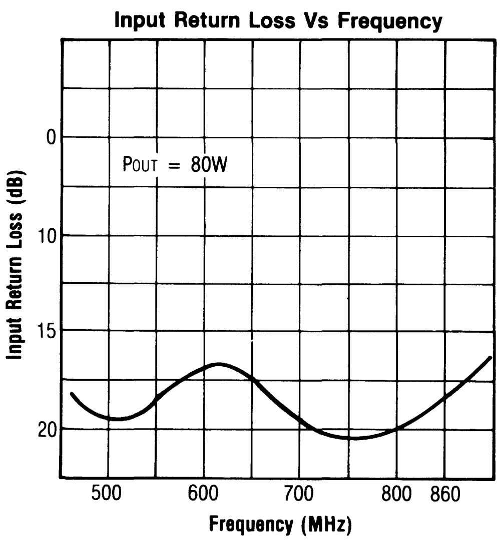
Electrical Characteristics (T_{CASE} = 50°C)

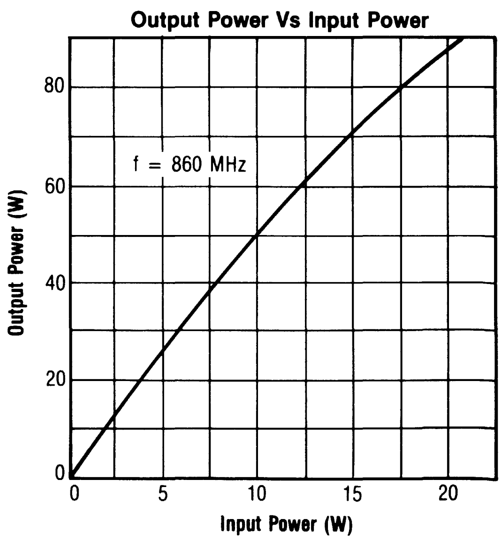
SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Z_L	In/Out Load	50 Ohms Reference			−20	dB
Z_{IN}	Input Return Loss	50 Ohms Reference			−25	dB
HR	Harmonics Rejection	P_{OUT} = 80W, CW	30	35		dB
F	Frequency Range		470		860	MHz
V_{CC}	Supply Voltage		27.5	28	28.5	V
GP	Power Gain	V_{CC} = 28V P_{OUT} = 80W, CW	6			dB
GR	Gain Ripple	V_{CC} = 28V P_{OUT} = 80W, CW			1.5	dB
P_{OUT}	Output Power	V_{CC} = 28V Continuous Wave 1dB Compression	80			W
I	DC Current	V_{CC} = 28V P_{OUT} = 80W, CW			7.5	A
VSWR	Mismatch Tolerance	V_{CC} = 28V, t ◄ 1 S P_{OUT} = 80W		3:1		
I_{MAX}	Max DC Current	V_{CC} = 28V			9	A
T_{OP}	Operating Temperature	Base Plate	−20		+70	°C
T_{STG}	Storage Temperature	Base Plate	−40		+100	°C

TYPICAL CHARACTERISTICS

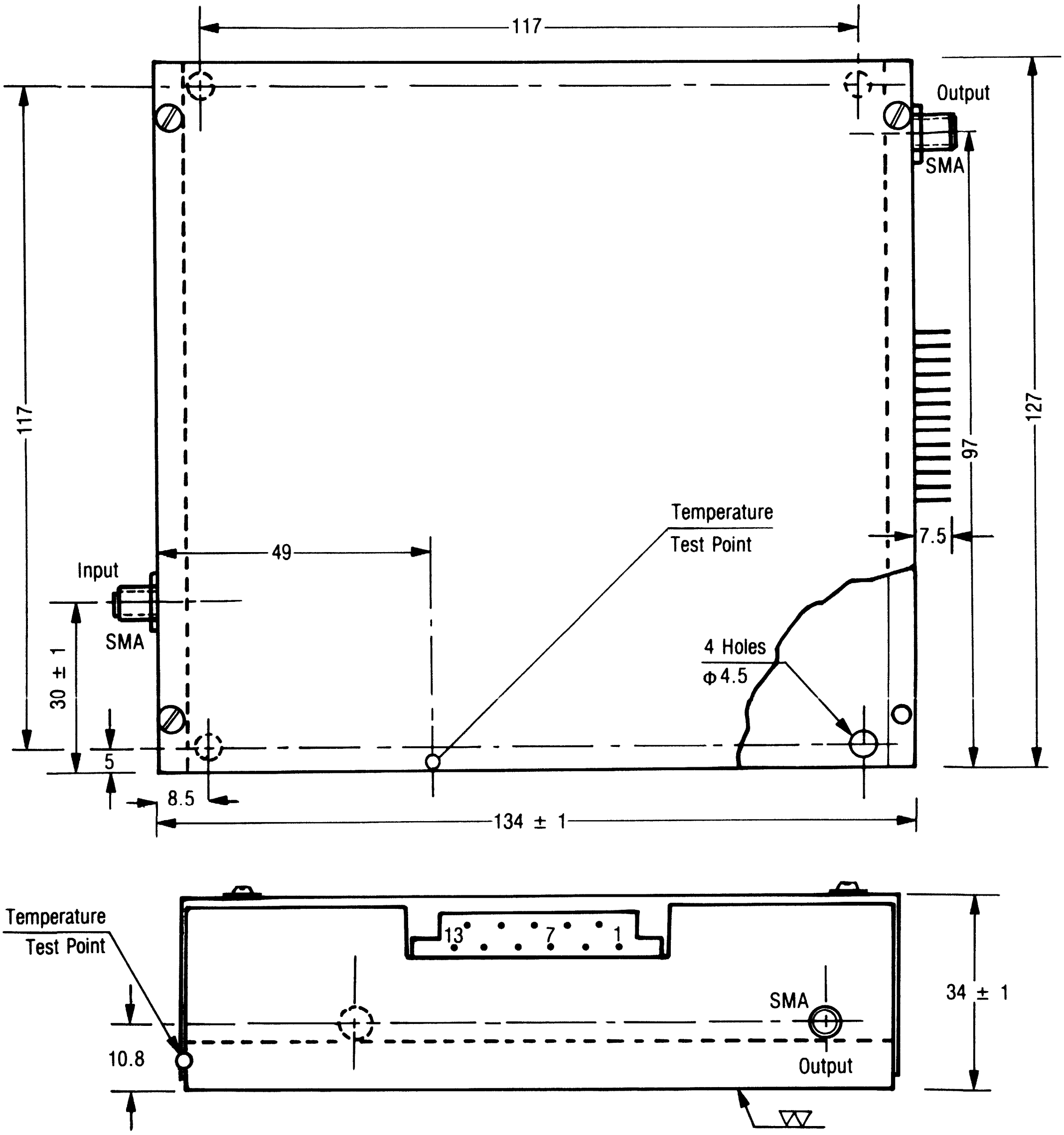








ATV 5080



5.6.7.8.9 V_{CC} +
3 Test Point Transistor No. 1
11 Test Point Transistor No. 2
1.2.12.13 Ground

Plug-In Layout

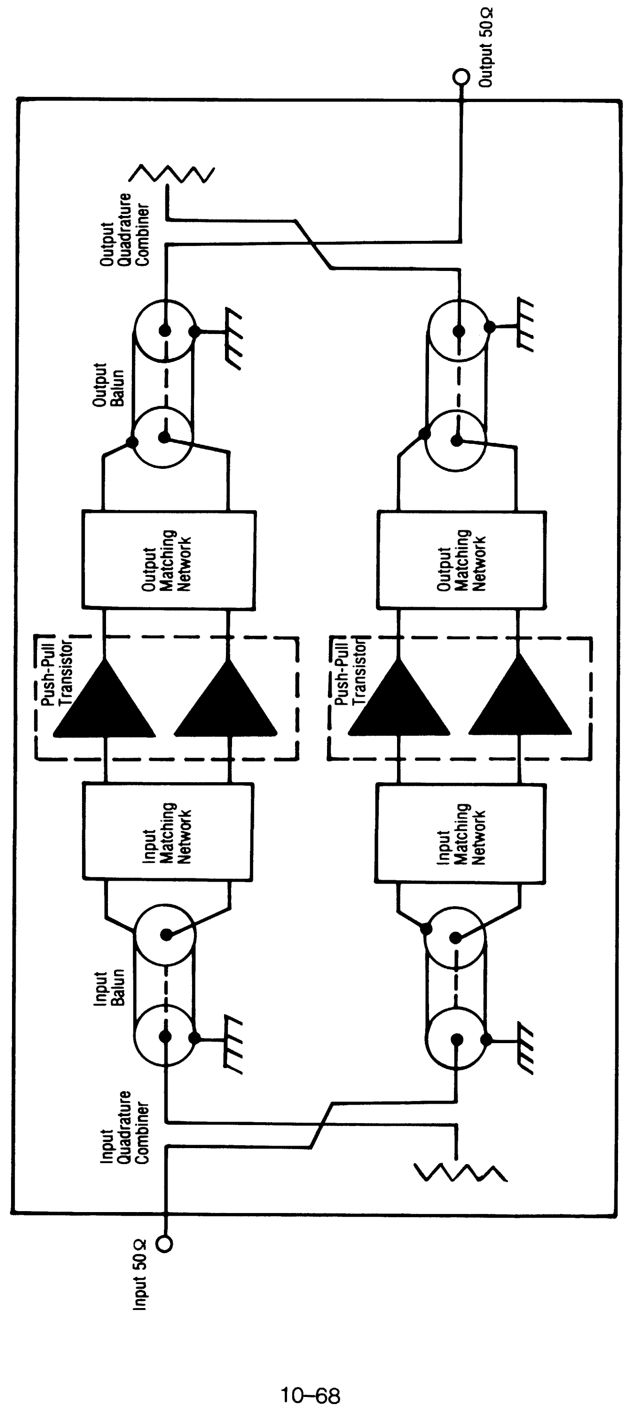
Current and Voltage Measurements on Test Points

1 — Collector Current / Referenced to V_{CC} — $I_A = 13.3 \times V_{VOLT}$

2 — Collector Voltage / Referenced to Ground

Note: All dimensions are in millimeters.

ATV 5080 CIRCUIT



TRW Power Switching Transistors

TRW's high speed switching transistors feature MIL-quality construction, including gold-silicon eutectic die attached and gold plated package headers.

Both discrete and monolithic, high gain Darlington configurations are offered.

MIL screening to "S" levels are available (consult factory).

2N4305
2N4307
2N4309
2N4311

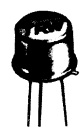
TRW

High Speed Switching Transistor

100-120 Volts
5 Amperes
100 nsec

MAXIMUM RATINGS (T_C = 25°C)

Symbol	Characteristics	2N4305 2N4309	2N4307 2N4311
V_{CEO}	Collector to Emitter Voltage	80V	60V
V_{CBO}	Collector to Base Voltage	120V	100V
V_{EBO}	Emitter to Base Voltage	6V	6V
I_C	Continuous Collector Current	5A	5A
I_B	Continuous Base Current	2.5A	2.5A
P_T	Total Dissipation Case Temp. 25°C	11W	11W
P_T	Case Temp. 125°C	5W	5W
P_T	Free Air Temp. 25°C	1.0W	1.0W
θ_{JC}	Thermal Resistance (Junction to Case)	15°C/W	15°C/W
T_{STG}	Storage Temp.	-65 to 200°C	-65 to 200°C
T_J	Junction Temp.	200°C	200°C



TO-5

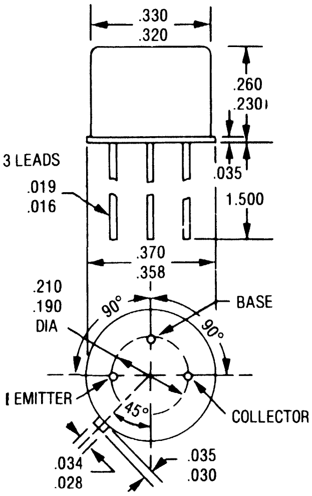
- **Low Voltage Inverters**
- **Pulse Amplifiers**
- **Base Drive Circuits**

ELECTRICAL CHARACTERISTICS (T_C = 25°C)

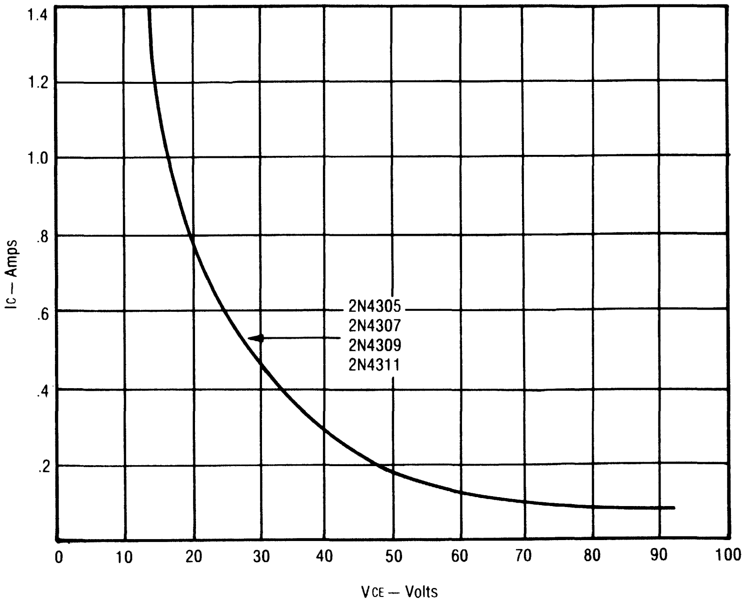
Symbol	Characteristics	Test Conditions	2N4305		2N4307		2N4309		2N4311		Units
			Min	Max	Min	Max	Min	Max	Min	Max	
		V_{CB} = 100V		200				200			nA
I_{CBO}	Collector Cutoff Current	V_{CB} = 80V		150		500		150		500	nA
		V_{CB} = 60V		100		200		100		200	nA
I_{CES}	Collector to Emitter Current	V_{CE} = 60V		100		200		100		200	nA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 3V		100		100		100		100	nA
BV_{CBO}	Collector to Base Voltage	I_C = 100μA	120		100		120		100		V
BV_{CEO}	Collector to Emitter Voltage	I_C = 50μA	80		60		80		60		V
BV_{EBO}	Emitter to Base Voltage	I_E = 10μA	6		6		6		6		V
		I_C = 1A V_{CE} = 2V Pulsed	50	150	50	150	40	120	40	120	
h_{FE}*	D.C. Current Gain	I_C = 3A V_{CE} = 2V Pulsed					10		10		
		I_C = 5A V_{CE} = 2V Pulsed	10		10						
$V_{BE(sat)}$*	Base Saturation Voltage	I_C = 5A I_B = 500mA		1.5		1.5					V
		I_C = 3A I_B = 300mA						1.5		1.5	V
$V_{CE(sat)}$	Collector Saturation Voltage	I_C = 5A I_B = 500mA		1		1					V
		I_C = 3A I_B = 300mA						1		1	V
$t_d + t_r$	Turn On	I_C = 1A		140		140		140		140	ns
t_s**	Storage Time	I_{B1} = I_{B2} = Defined by circuit		300		300		300		300	ns
t_f**	Fall Time	V_{CC} = 30V		100		100		100		100	ns
C_{OB}	Output Capacitance	V_{CB} = 10V		100		100		100		100	pF
f_t	Gain Bandwidth Product	I_C = 500mA V_{CE} = 5V	80		80		80		80		MHz

* Pulse width ≤ 300μsec 2% duty cycle   ** Switching Time Circuit — Last Page

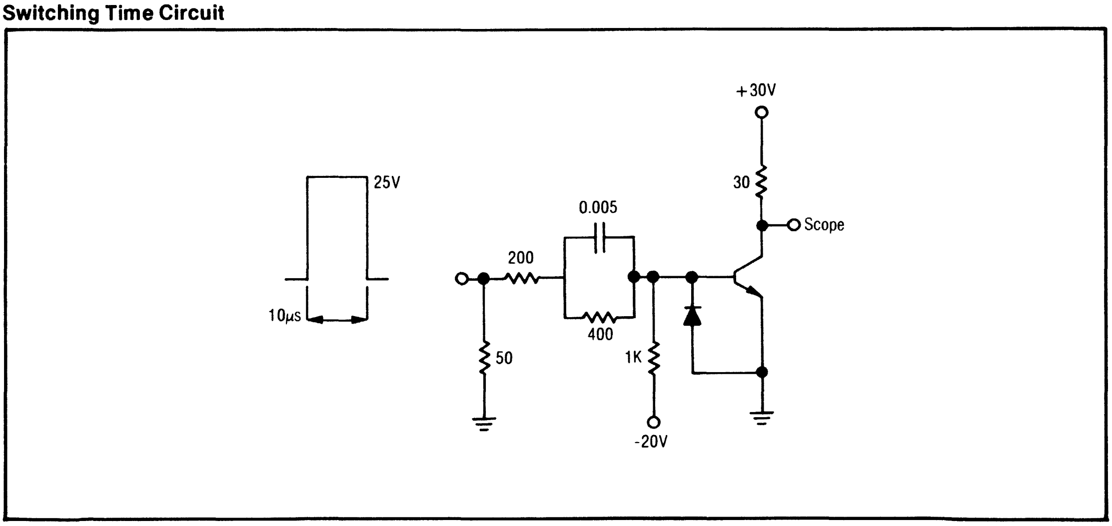
TO-5 Case Outline



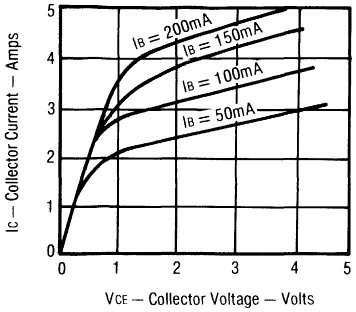
DC Second Breakdown Loci (Free Air)

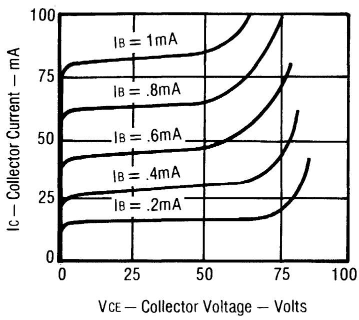


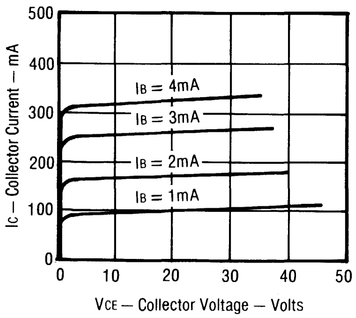
Switching Time Circuit

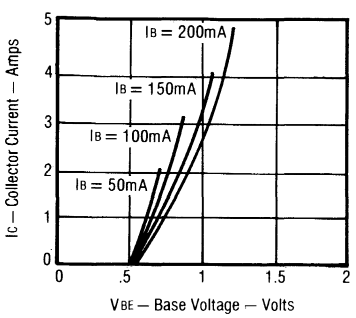


COMMON EMITTER CHARACTERISTICS @ 100°C

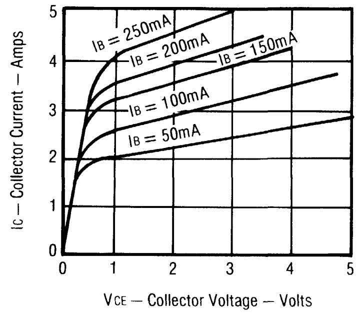


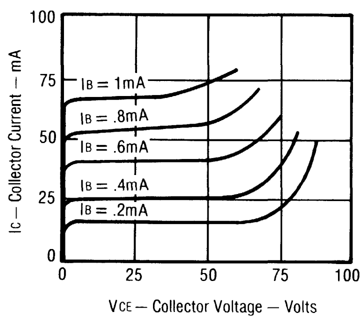


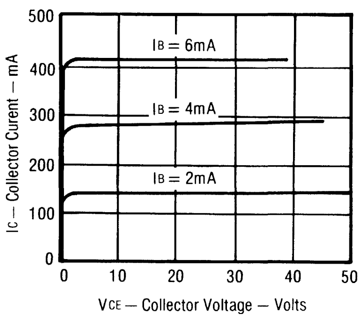


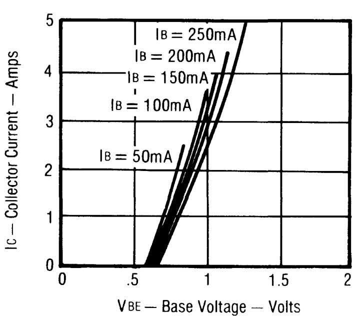


COMMON EMITTER CHARACTERISTICS @ 25°C

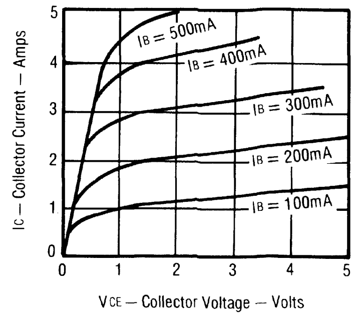


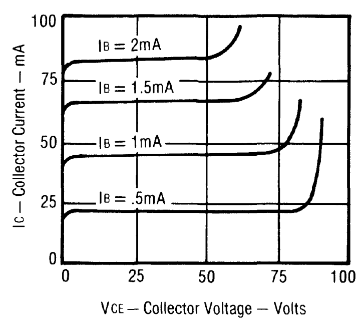


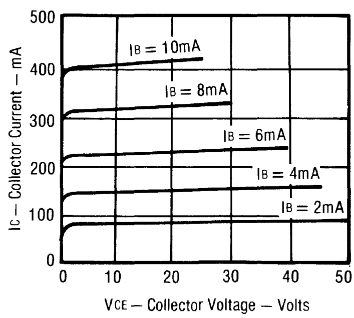


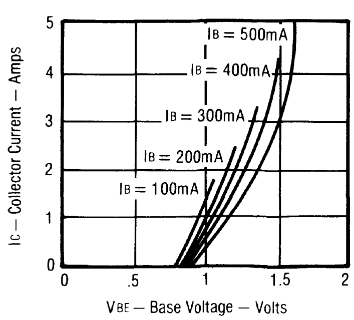


COMMON EMITTER CHARACTERISTICS @ -55°C

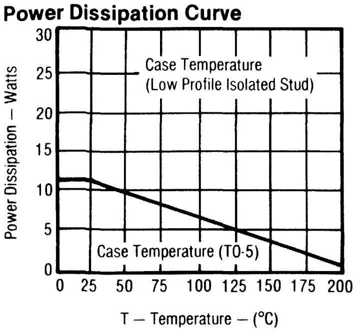




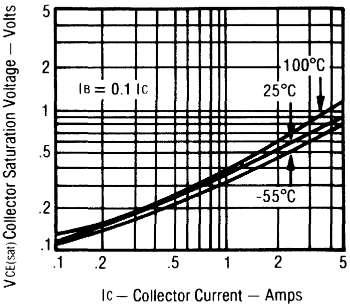




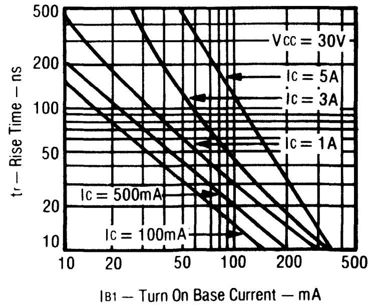
Power Dissipation Curve



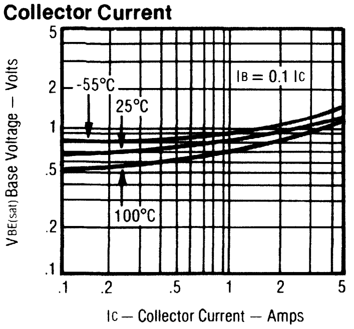
Collector Saturation Voltage Vs. Collector Current



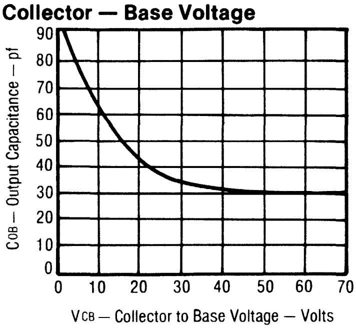
Rise Time Vs. Turn On Base Current



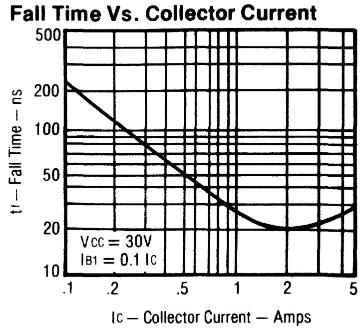
Base Saturation Voltage Vs. Collector Current



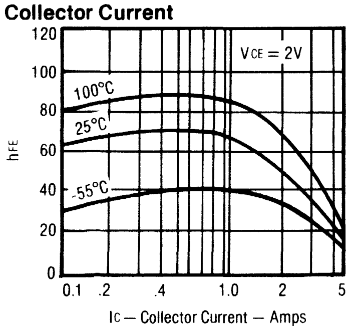
Output Capacitance Vs. Collector — Base Voltage



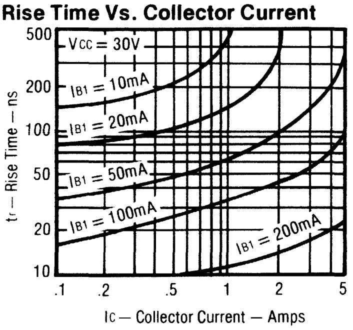
Fall Time Vs. Collector Current



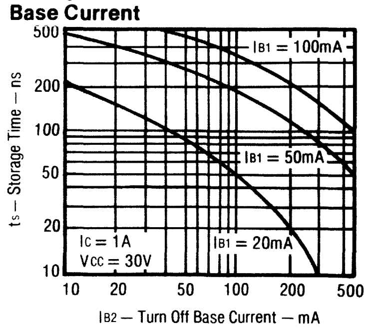
DC Current Gain Vs. Collector Current



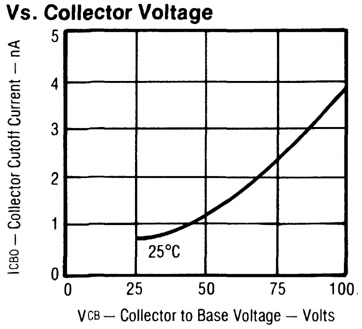
Rise Time Vs. Collector Current



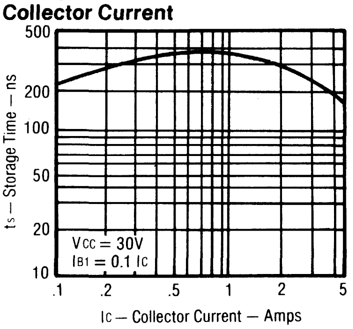
Storage Time Vs. Turn Off Base Current



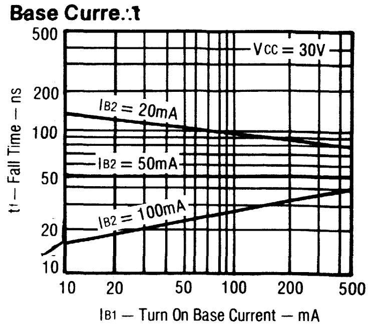
Collector Cutoff Current Vs. Collector Voltage



Storage Time Vs. Collector Current



Fall Time Vs. Turn On Base Current



2N5326

Power Switching Transistor

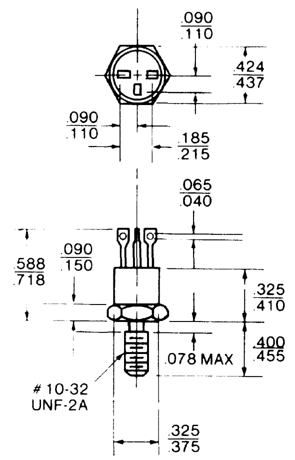
Typical applications are: Gyro motor driver — Inverters and switching regulator through 50kc — High frequency linear amplifiers for deflections systems and SSB equipment — Radiation resistant

80 Volts
5 Amperes
400 nsec

MAXIMUM RATINGS (T_{CASE} = 25°C)

Symbol	Characteristics	
V_{CBO}	Collector-Base Voltage	100V
V_{CEO}	Collector-Emitter Voltage	80V
$I_{C(CONT)}$	Collector Current	5A
$I_{C(PEAK)}$	Collector Current	10A
$I_{B(CONT)}$	Base Current	1A
$I_{B(PEAK)}$	Base Current	2A
$I_{E(CONT)}$	Emitter Current	6A
$I_{E(PEAK)}$	Emitter Current	12A
P_T	Power Dissipation	30 Watts

TO-59



COLLECTOR ISOLATED FROM CASE

THERMAL CHARACTERISTICS

Characteristic	
Thermal Resistance Junction to Case	5.88°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	275°C
Operating and Storage Junction Temperature Range	-65, +200°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C)

Symbol	Characteristic	Test Conditions	Min	Max	
I_{CES}	Collector Emitter Cutoff Current	V_{CE} = 60V		100	nA
I_{CES}	Collector Emitter Cutoff Current	V_{CE} = 60V, t_c = 150°C		10	μA
I_{EBO}	Emitter Base Cutoff Current	V_{EB} = 3V		100	nA
BV_{CBO}	Collector Base Voltage	I_C = 100μA	120		vdc
* BV_{CEO}	Collector Emitter Voltage	I_C = 10mA	80		vdc
BV_{EBO}	Emitter Base Voltage	I_E = 100μA	6		vdc
* h_{FE}	DC Forward Current Transfer Ratio	I_C = 1A, V_{CE} = 2V	50	150	
* h_{FE}	DC Forward Current Transfer Ratio	I_C = 5A, V_{CE} = 3V	10		
* $V_{BE(SAT)}$	Base Emitter Saturation Voltage	I_C = 5A, I_B = .5A		1.5	vdc
* $V_{CE(SAT)}$	Collector Emitter Saturation Voltage	I_C = 5A, I_B = .5A		1.0	vdc
T_{ON}	td + tr	V_C = 30V, I_C = 1A, I_{B1} = I_{B2} = .05A		150	nsec
T_{OFF}	ts + tf	V_C = 30V, I_C = 1A, I_{B1} = I_{B2} = .05A		400	nsec
C_{OB}	Output Capacitance	V_{CE} = 10V, f = 1MHz		100	pF
f_t	Small Signal Current Gain	V_{CE} = 500mA, V_{CE} = 5V, f = 10MHz	8		

*Pulse Width 300μsec 2% duty cycle

2N5154

Medium Power Switching Transistor

MAXIMUM RATINGS (T_{CASE} = 25°C)

Symbol	Characteristics	Max.
V_{CBO}	Collector-Base Voltage	100Vdc
V_{CEO}	Collector-Emitter Voltage	80Vdc
$I_{C(CONT)}$	Collector Current	2.0A*
$I_{C(PEAK)}$	Collector Current	10A
$I_{B(CONT)}$	Base Current	1.0A*
$I_{B(PEAK)}$	Base Current	5.0A
$I_{E(CONT)}$	Emitter Current	3.0A*
$I_{E(PEAK)}$	Emitter Current	15A
P_T	Power Dissipation	11.6W

* Power Dissipation Limited

h_{FE} > 40 @ 5 Amperes
f_t > 70 MHz
$V_{CEO(SUS)}$ > 80 Volts

THERMAL CHARACTERISTICS

Symbol	Characteristics	Max.
$R_{\theta JC}$	Thermal Resistance Junction to Case	16°C/W
T_L	Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 60 Seconds	300°C
T_J, T_{STG}	Operating and Storage Junction Temperature Range	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

OFF CHARACTERISTICS

Symbol	Characteristics	Test Conditions	Min.	Max.
$V_{CEO(sus)}$	Collector-Emitter Sustaining Voltage	I_C = .1A I_{B1} = .01A I_{B2} = 0 L = 1mH	80V	
I_{CEO}	Collector Cutoff Current	V_{CE} = 40V I_B = 0		50μA
I_{CEV}	Collector Cutoff Current	V_{CE} = 60 $V_{BE(off)}$ = -2.0V T_C = 150°C		500μA
I_{EBO}	Emitter Cutoff Current	V_{EB} = -5V I_C = 0		1.0μA

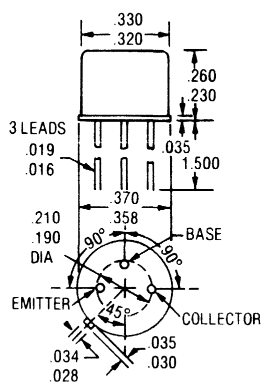
ON CHARACTERISTICS (1)

Symbol	Characteristics	Test Conditions	Min.	Max.
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 5A I_B = .5A I_C = 2.5A I_B = .25A		1.5V .75V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 5A I_B = .5A		2.2V
h_{FE}	DC Current Gain	I_C = 2.5A V_{CE} = 5V I_C = 5A V_{CE} = 5V	70 40	200

(1) Pulse Test: Pulse Width = 300μs, Duty Cycle ≤ 2%, measured 1/8" from case

DYNAMIC CHARACTERISTICS

Symbol	Characteristics	Test Conditions	Min.	Max.
h_{fe}	Small Signal Current Gain	I_C = .5A, V_{CE} = 5V f_{test} = 20MHz	3.5	
C_{OB}	Output Capacitance	V_{CB} = 10V I_E = 0, f_{test} = 1.0MHz		250



TO-5 Case Outline

The 2N5154 is a 5 Ampere, NPN Triple diffused switching device intended for both Military and Industrial service. High switching speed and low $V_{CE(SAT)}$ voltage makes the TRW 2N5154 an ideal low power inverter, base driver or pulse amplifier device.

The TRW 2N5154 is useful in power switching applications at rates in excess of 50KHz.

2N5328

Power Switching Transistor

Typical applications are: Inverters and switching regulator through 50kc — Squib driver applications — Medium current motor driver — Linear amplifier for deflections systems — Radiation resistant.

80 Volts
10 Amperes
900 nsec

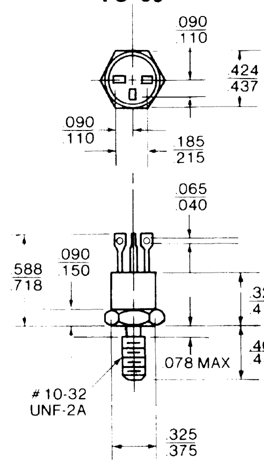
MAXIMUM RATINGS (T_{CASE} = 25°C)

Symbol	Characteristics	
V_{CBO}	Collector-Base Voltage	100V
V_{CEO}	Collector-Emitter Voltage	80V
$I_{C(CONT)}$	Collector Current	10A
$I_{C(PEAK)}$	Collector Current	15A
$I_{B(CONT)}$	Base Current	2A
$I_{B(PEAK)}$	Base Current	4A
$I_{E(CONT)}$	Emitter Current	12A
$I_{E(PEAK)}$	Emitter Current	19A
P_T	Power Dissipation	30 Watts

THERMAL CHARACTERISTICS

Characteristic	
Thermal Resistance Junction to Case	3.3°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	275°C
Operating and Storage Junction Temperature Range	-65, +200°C

TO-59



COLLECTOR ISOLATED FROM CASE

ELECTRICAL CHARACTERISTICS (T_C = 25°C)

Symbol	Characteristic	Test Conditions	Min	Max	
I_{CEX}	Collector Emitter Cutoff Current	V_{CE} = 90V, V_{BE} = -.5V		.1	mA
I_{CEX}	Collector Emitter Cutoff Current	V_{CE} = 90V, V_{BE} = -.5V, T_j = 150°C		10	mA
I_{EBO}	Emitter Base Cutoff Current	V_{EB} = 5V		10	μA
BV_{CBO}	Collector Base Voltage	I_C = 100μA	100		vdc
* BV_{CEO}	Collector Emitter Voltage	I_C = 100mA	70		vdc
* h_{FE}	DC Forward Current Transfer Ratio	V_{CE} = 5V, I_C = 1A	100	300	
* h_{FE}	DC Forward Current Transfer Ratio	V_{CE} = 5V, I_C = 5A	50	150	
* $V_{BE(SAT)}$	Base Emitter Saturation Voltage	I_C = 3A, I_B = .15A		1.5	vdc
* $V_{CE(SAT)}$	Collector Emitter Saturation Voltage	I_C = 3A, I_B = .15A		.3	vdc
T_{ON}	td + tr	V_C = 30V, I_C = 1A, I_{B1} = I_{B2} = .05A		200	nsec
T_{OFF}	ts + tf	V_C = 30V, I_C = 1A, I_{B1} = I_{B2} = .05A		900	nsec
C_{OB}	Output Capacitance	V_{CB} = 10V, f = 1MHz		300	pF
f_t	Small Signal Current Gain	I_C = 500mA, V_{CE} = 5V, f = 10MHz	10		

* Pulse width 300μsec 2% duty cycle

2N5329

Power Switching Transistor

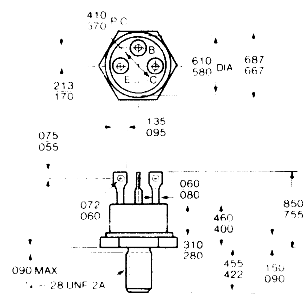
Typical applications are: High inductance loads as used for solenoids — Power inverters and switching regular through 50kc — Squib driver applications — Radiation resistant — Linear amplifier for deflections systems.

100 Volts
20 Amperes
1150 nsec

MAXIMUM RATINGS (CASE = 25°C)

Symbol	Characteristics	
V_{CBO}	Collector-Base Voltage	150V
V_{CEO}	Collector-Emitter Voltage	100V
$I_{C(CONT)}$	Collector Current	20A
$I_{C(PEAK)}$	Collector Current	25A
$I_{B(CONT)}$	Base Current	5A
$I_{B(PEAK)}$	Base Current	8A
$I_{E(CONT)}$	Emitter Current	25A
$I_{E(PEAK)}$	Emitter Current	33A
P_T	Power Dissipation	100 Watts

TO-61



COLLECTOR ISOLATED FROM CASE

THERMAL CHARACTERISTICS

Characteristic	
Thermal Resistance Junction to Case	1.5°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	275°C
Operating and Storage Junction Temperature Range	-65, +200°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C)

Symbol	Characteristic	Test Conditions	Min	Max	
I_{CEX}	Collector Emitter Cutoff Current	V_{CE} = 150V, V_{BE} = -.5V		5	mA
I_{CEX}	Collector Emitter Cutoff Current	V_{CE} = 150V, V_{BE} = -.5V, t_c = 150°C		50	mA
I_{EBO}	Emitter Base Cutoff Current	V_{EB} = 8V		1.0	mA
BV_{CBO}	Collector Base Voltage	I_C = 10mA	150		vdc
* BV_{CEO}	Collector Emitter Voltage	I_C = 100mA	90		vdc
* h_{FE}	DC Forward Current Transfer Ratio	V_{CE} = 2V, I_C = 10A	40	120	
* h_{FE}	DC Forward Current Transfer Ratio	V_{CE} = 3V, I_C = 20A	10		
* $V_{BE(SAT)}$	Base Emitter Saturation Voltage	I_C = 20A, I_B = 2A		1.7	vdc
* $V_{CE(SAT)}$	Collector Emitter Saturation Voltage	I_C = 20A, I_B = 2A		1.8	vdc
T_{ON}	td + tr	V_C = 20V, I_C = 10A, I_{B1} = I_{B2} = .5A		.350	μsec
T_{OFF}	ts + tf	V_C = 20V, I_C = 10A, I_{B1} = I_{B2} = .5A		1.10	μsec
C_{OB}	Output Capacitance	V_{CB} = 10V, f = 1MHz		500	pF
f_t	Small Signal Current Gain	V_{CE} = 10V, I_C = 3A, f = 10MHz	8		

* Pulse width 300μsec 2% duty cycle

2N5330

Power Switching Transistor

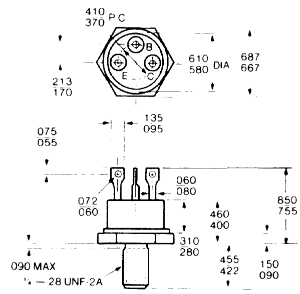
Typical applications are: High power inverter and switching regulator through 50kc — Power amplifier for sonar and VLF transmitters — Squib driver applications — Radiation resistant

100 Volts
30 Amperes
1.25 μsec

MAXIMUM RATINGS (T_{CASE} = 25°C)

Symbol	Characteristics	
V_{CBO}	Collector-Base Voltage	150V
V_{CEO}	Collector-Emitter Voltage	100V
$I_{C(CONT)}$	Collector Current	30A
$I_{C(PEAK)}$	Collector Current	35A
$I_{B(CONT)}$	Base Current	5A
$I_{B(PEAK)}$	Base Current	10A
$I_{E(CONT)}$	Emitter Current	35A
$I_{E(PEAK)}$	Emitter Current	45A
P_T	Power Dissipation	125 Watts

TO-61



COLLECTOR ISOLATED FROM CASE

THERMAL CHARACTERISTICS

Characteristic	
Thermal Resistance Junction to Case	1.25°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	275°C
Operating and Storage Junction Temperature Range	-65, +200°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C)

Symbol	Characteristic	Test Conditions	Min	Max	
I_{CEX}	Collector Emitter Cutoff Current	V_{CE} = 150V, V_{BE} = -.5V		10	mA
I_{CEX}	Collector Emitter Cutoff Current	V_{CE} = 150V, V_{BE} = -.5V, t_c = 150°C		50	mA
I_{EBO}	Emitter Base Cutoff Current	V_{EB} = 8V		1.0	mA
BV_{CBO}	Collector Base Voltage	I_C = 10mA	150		vdc
*BV_{CEO}	Collector Emitter Voltage	I_C = 100mA	90		vdc
*h_{FE}	DC Forward Current Transfer Ratio	I_C = 10A, V_{CE} = 2V	50	150	
*h_{FE}	DC Forward Current Transfer Ratio	I_C = 30A, V_{CE} = 3V	10		
*$V_{BE(SAT)}$	Base Emitter Saturation Voltage	I_C = 10A, I_B = .5A		1.3	vdc
*$V_{BE(SAT)}$	Base Emitter Saturation Voltage	I_C = 30A, I_B = 3A		1.8	vdc
*$V_{CE(SAT)}$	Collector Emitter Saturation Voltage	I_C = 10A, I_B = .5A		.6	vdc
*$V_{CE(SAT)}$	Collector Emitter Saturation Voltage	I_C = 30A, I_B = 3A		1.8	vdc
T_{ON}	td + tr	V_C = 20V, I_C = 10A, I_{B1} = I_{B2} = .5A		.350	μsec
T_{OFF}	ts + tf	V_C = 20V, I_C = 10A, I_{B1} = I_{B2} = .5A		1.250	μsec
C_{OB}	Output Capacitance	V_{CB} = 10V, f = 1MHz		750	pF
ft	Small Signal Current Gain	I_C = 3A, V_{CE} = 10V, f = 10MHz	8		

*Pulse width 300μsec 2% duty cycle

2N5331

Power Switching Transistor

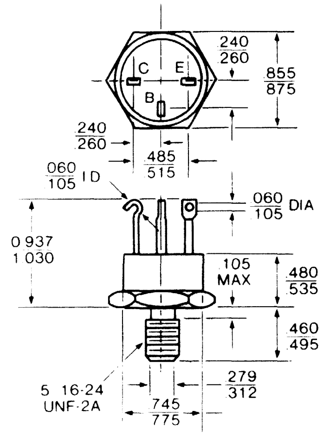
Typical applications are: High power inverter and switching regulator through 50kc — Power amplifier for sonar and VLF transmitters — Squib driver applications — Radiation resistant.

100 Volts
30 Amperes
1.25 μsec

MAXIMUM RATINGS (T_{CASE} = 25°C)

Symbol	Characteristics	
V_{CBO}	Collector-Base Voltage	150V
V_{CEO}	Collector-Emitter Voltage	100V
$I_{C(CONT)}$	Collector Current	30A
$I_{C(PEAK)}$	Collector Current	35A
$I_{B(CONT)}$	Base Current	5A
$I_{B(PEAK)}$	Base Current	10A
$I_{E(CONT)}$	Emitter Current	35A
$I_{E(PEAK)}$	Emitter Current	45A
P_T	Power Dissipation	175 Watts

TO-63



COLLECTOR COMMON TO CASE

THERMAL CHARACTERISTICS

Characteristic	
Thermal Resistance Junction to Case	1.0°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	275°C
Operating and Storage Junction Temperature Range	-65 + 200°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C)

Symbol	Characteristic	Test Conditions	Min	Max	
I_{CEX}	Collector Emitter Cutoff Current	V_{CE} = 150V, V_{BE} = -.5V		10	mA
I_{CEX}	Collector Emitter Cutoff Current	V_{CE} = 150V, V_{BE} = -.5V, t_c = 150°C		50	mA
I_{EBO}	Emitter Base Cutoff Current	V_{EB} = 8V		1.0	mA
BV_{CBO}	Collector Base Voltage	I_C = 10mA	150		vdc
*BV_{CEO}	Collector Emitter Voltage	I_C = 100mA	90		vdc
*h_{FE}	DC Forward Current Transfer Ratio	I_C = 10A, V_{CB} = 2V	50	150	
*h_{FE}	DC Forward Current Transfer Ratio	I_C = 30A, V_{CE} = 3V	10		
*$V_{BE(SAT)}$	Base Emitter Saturation Voltage	I_C = 10A, I_B = .5A		1.3	vdc
*$V_{BE(SAT)}$	Base Emitter Saturation Voltage	I_C = 30A, I_B = 3A		1.8	vdc
*$V_{CE(SAT)}$	Collector Emitter Saturation Voltage	I_C = 10A, I_B = .5A		.6	vdc
*$V_{CE(SAT)}$	Collector Emitter Saturation Voltage	I_C = 30A, I_B = 3A		1.8	vdc
T_{ON}	td + tr	V_C = 20V, I_C = 10A, I_{B1} = I_{B2} = .5A		.350	μsec
T_{OFF}	ts + tf	V_C = 20V, I_C = 10A, I_{B1} = I_{B2} = .5A		1.250	μsec
C_{OB}	Output Capacitance	V_{CB} = 10V, f = 1MHz		750	pF
ft	Small Signal Current Gain	I_C = 3A, V_{CE} = 10V, f = 10MHz	8		

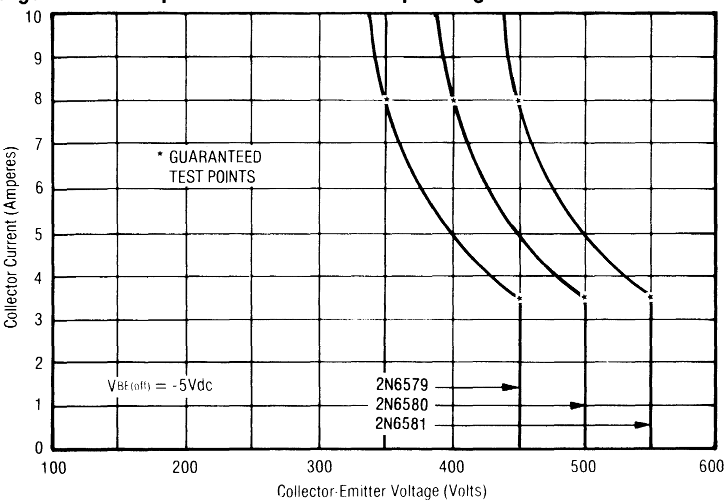
*Pulse width 300μsec 2% duty cycle

2N6579
2N6580
2N6581

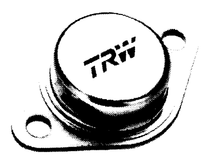
TRW

Power Switching Transistor

Figure 1 — Clamped Reverse Bias Safe Operating Area



450 Volts
5 Amperes
.5 μsec



TO-204MA (TO-3)

The 2N6579 thru 2N6581 Series are NPN, high-voltage, high-gain, power switching transistors for use in high-speed power circuits at switching frequencies to 40KHz and higher.

The silicon die is metallurgically bonded to a molybdenum tab which in turn is bonded to the header. This mounting system provides superior resistance to thermal fatigue.

They are particularly suited for offline applications from 115V to 230VAC sources.

- **Switching Regulators**
- **PWM Inverters**
- **Motor Controls**
- **Solenoid Drivers**
- **Deflection Circuits**

* **MAXIMUM RATINGS (T_{CASE} = 25°C)**

Symbol	Characteristics	2N6579	2N6580	2N6581
V_{CBO}	Collector-BaseVoltage	450V	500V	550V
V_{CEO}	Collector-Emitter Voltage	350V	400V	450V
$I_{C(CONT)}$	Collector Current	10A	10A	10A
$I_{C(PEAK)}$	Collector Current	16A	16A	16A
$I_{B(CONT)}$	Base Current	5A	5A	5A
$I_{B(PEAK)}$	Base Current	16A	16A	16A
$I_{E(CONT)}$	Emitter Current	15A	15A	15A
$I_{E(PEAK)}$	Emitter Current	32A	32A	32A
P_T	Power Dissipation	125W	125W	125W

***THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max.	Unit
Thermal Resistance Junction to Case	$R_{\theta JC}$	1.4	°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	T_L	275	°C
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-65 to +200	°C

* Indicates JEDEC Registered Data

ELECTRICAL CHARACTERISTICS(T_C = 25°C unless otherwise noted)

OFF CHARACTERISTICS (1)

	Symbol	Characteristic	Test Conditions	2N6579		2N6580		2N6581		Unit
				Min	Max	Min	Max	Min	Max	
*	$V_{CEO(SUS)}$	Collector-Emitter Sustaining Voltage	I_C = 200mA I_{B1} = .05A L = 2mH	350		400		450		V
	$V_{CEX(SUS)}$	Collector-Emitter Sustaining Voltage	I_C = 8A I_{B1} = 1.6A $V_{BE(off)}$ = -5V	350		400		450		V
			I_C = 3.5A I_{B1} = 0.7A $V_{BE(off)}$ = -5V	450		500		550		V
*	V_{CBO}	Collector-Base Voltage	I_C = .5mA	450		500		550		V
*	I_{CEV}	Collector Cutoff Current	V_{CE} = Rated V_{CBO} $V_{BE(off)}$ = -1.5V		0.5		0.5		0.5	mA
			V_{CE} = Rated V_{CBO} $V_{BE(off)}$ = -1.5V T_C = +100°C		2.0		2.0		2.0	mA
*	I_{EBO}	Emitter Cutoff Current	V_{EB} = 9V I_C = 0		0.1		0.1		0.1	mA

SECOND BREAKDOWN

*	$I_{s/b}$	Second Breakdown Collector Current	V_{CE} = 200V Non Rep. t_p = 1S	.09		.09		.09		A

ON CHARACTERISTICS (2)

*	$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 5A I_B = 1.0A		1.5		1.5		1.5	V
			I_C = 10A I_B = 5A		3.0		3.0		3.0	
*	$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 5A I_B = 1.0A		1.5		1.5		1.5	V
*	h_{FE}	DC Current Gain	I_C = 5A V_{CE} = 3V	7	35	7	35	7	35	

DYNAMIC CHARACTERISTICS

	f_T	Gain-Bandwidth Product	I_C = 1A V_{CE} = 10V f_{test} = 10MHz	12.5	50	12.5	50	12.5	50	MHz
*	C_{OB}	Output Capacitance	V_{CB} = 10V I_E = 0 f_{test} = 1.0MHz	75	250	75	250	75	250	pF

SWITCHING CHARACTERISTICS (1)

	Resistive Load			Typ	Max	Typ	Max	Typ	Max	
*	t_d	Delay Time	V_{CC} = 150V I_C = 5A		.05		.05		.05	μs
*	t_r	Rise Time	I_{B1} = I_{B2} = 1.0A		0.5		0.5		0.5	μs
*	t_s	Storage Time	$V_{BE(off)}$ = -5V t_p = 100μs		2.0		2.0		2.0	μs
*	t_f	Fall Time	(I_{B2} = 0 for t_d, t_r)		0.5		0.5		0.5	μs
	Inductive Load, Clamped									
	t_s	Storage Time	V_{clamp} = 300V I_C = 5A	1.8		1.8		1.8		μs
	t_f	Fall Time	I_{B1} = I_{B2} = 1.0A	0.1		0.1		0.1		μs
	t_c	Commutation Time	$V_{BE(off)}$ = -5V L = 200μH	0.2		0.2		0.2		μs
	t_s	Storage Time	V_{clamp} = 300V I_C = 5A	2.6		2.6		2.6		μs
	t_f	Fall Time	I_{B1} = I_{B2} = 1.0A T_C = 100°C	.15		.15		.15		μs
	t_c	Commutation Time	$V_{BE(off)}$ = -5V L = 200μH	.35		.35		.35		μs

(1) See Figure 8
(2) Pulse Test: Pulse Width = 300μs, Duty Cycle ≤ 2%.
* Indicates JEDEC Registered Data

Figure 2 — SOA Curve Forward Bias

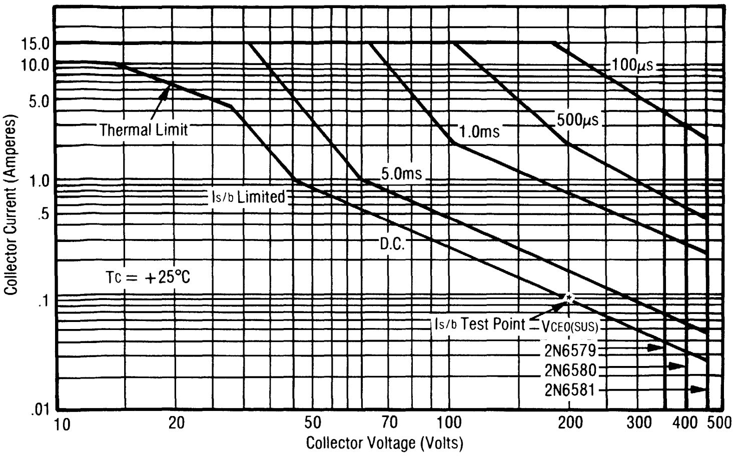


Figure 3 — Power Derating

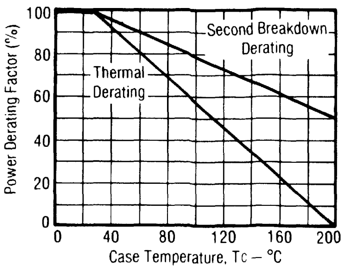


Figure 4 — Thermal Response

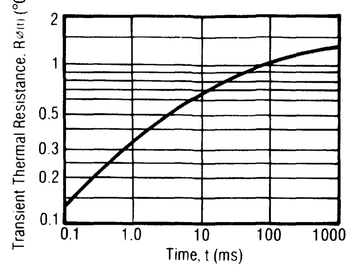


Figure 5 — Inductive Turn Off Waveform

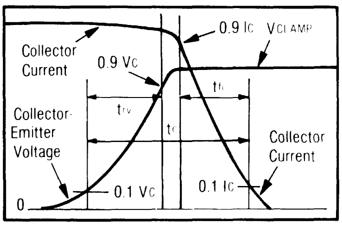


Figure 6 — Inductive Switching Performance

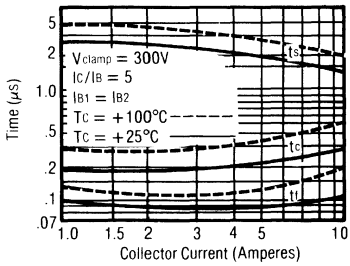


Figure 7 — Resistive Switching Performance

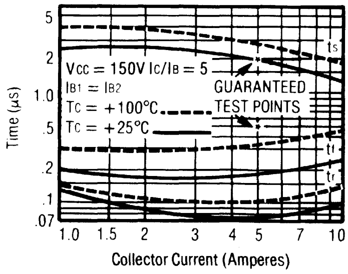


Figure 8 — Switch Time Test Circuit

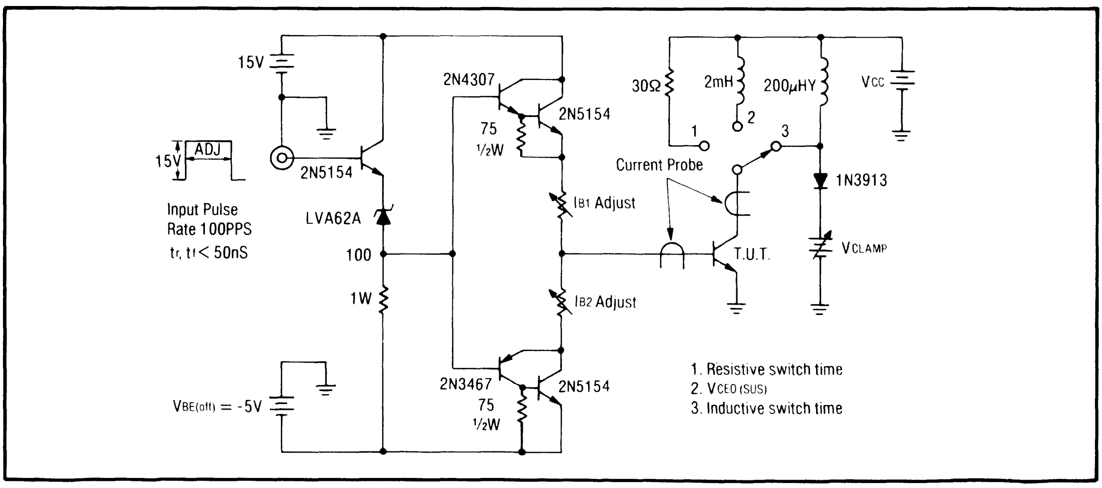


Figure 9 — Typical DC Current Gain

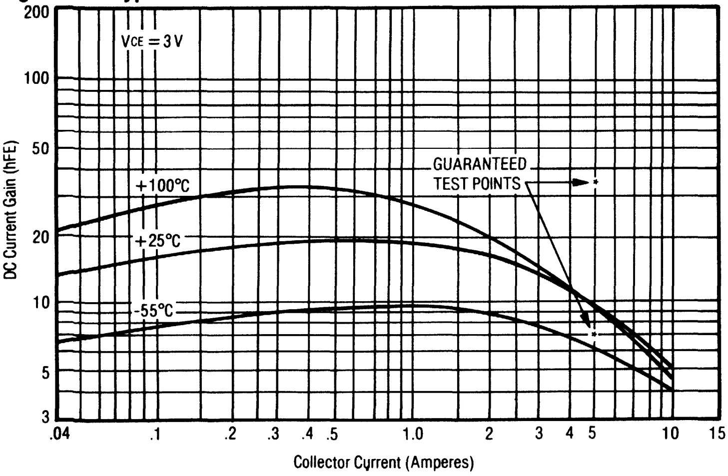


Figure 10 — Collector-Emitter Saturation Voltage

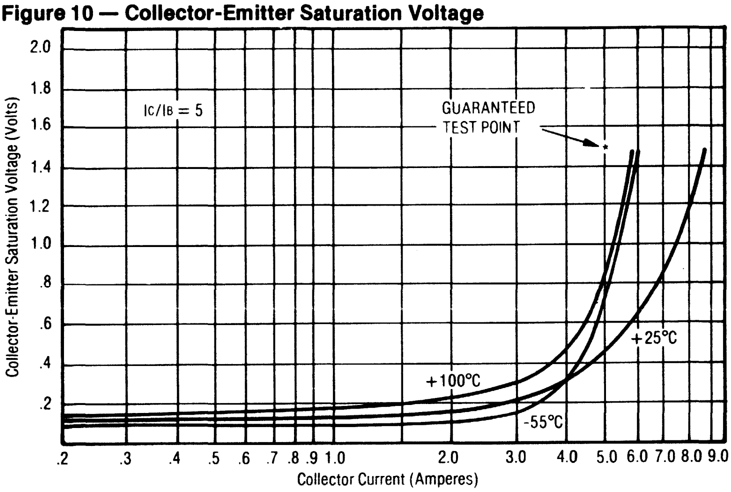


Figure 11 — Base-Emitter Voltage

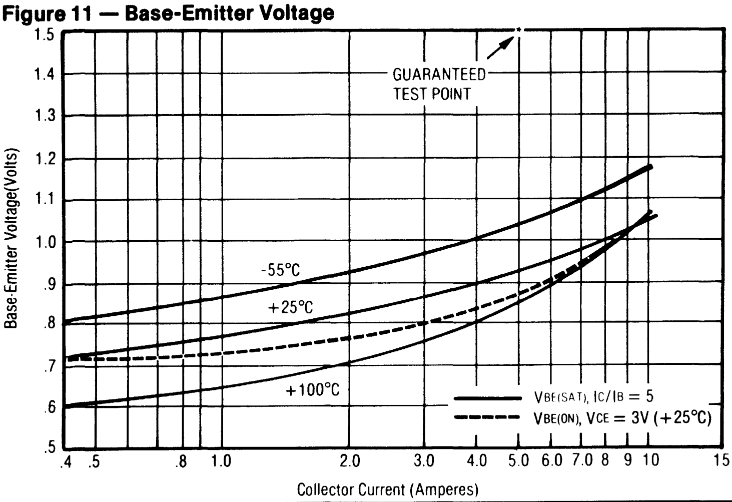


Figure 12 — Collector Saturation Region

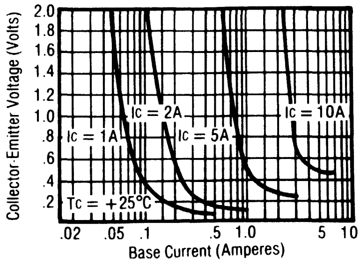
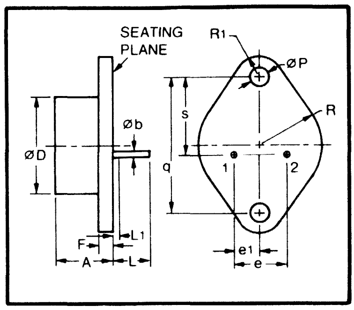


Figure 13 — DIMENSIONAL OUTLINE JEDEC TO-204MA (Formerly JEDEC TO-3)



Symbol	Inches	Millimeters	Notes
A	0.250 / 0.450	6.35 / 11.35	3
Øb	0.038 / 0.043	0.96 / 1.092	1
ØD	— / 0.875	— / 22.22	
e	0.420 / 0.440	10.67 / 11.17	2
e1	0.205 / 0.225	5.21 / 5.71	2
F	0.060 / 0.135	1.53 / 3.42	
L	0.312 / 0.500	7.93 / 12.70	
L1	— / 0.050	— / 1.27	1
ØP	0.151 / 0.161	3.836 / 4.089	
q	1.177 / 1.197	29.90 / 30.40	
R	0.495 / 0.525	12.58 / 13.33	
R1	0.131 / 0.188	3.33 / 4.77	
s	0.655 / 0.675	16.64 / 17.14	

Notes:

1. Øb applies between L1 and L. Diameter is uncontrolled in L1.
2. These dimensions shou'd be measured at points 0.050 in. (1.270mm) to 0.055 in. (1.397mm) below seating plane. When gage is not used, measurement will be made at seating plane.
3. min. / max.

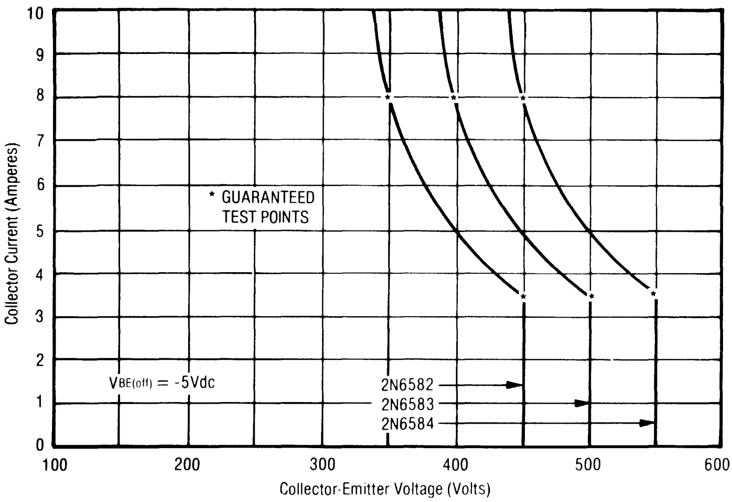
Terminal Connections

Pin 1 — Emitter
Pin 2 — Base
Case — Collector
Mounting Flange — Collector

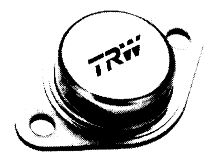
2N6582
2N6583
2N6584

Power Switching Transistor

Figure 1 — Clamped Reverse Bias Safe Operating Area



450 Volts
7 Amperes
.5 μsec



TO-204MA (TO-3)

The 2N6582 thru 2N6584 Series are NPN, high-voltage, high-gain, power switching transistors for use in high-speed power circuits at switching frequencies to 40KHz and higher.

The silicon die is metallurgically bonded to a molybdenum tab which in turn is bonded to the header. This mounting system provides superior resistance to thermal fatigue.

They are particularly suited for offline applications from 115V to 230VAC sources.

- **Switching Regulators**
- **PWM Inverters**
- **Motor Controls**
- **Solenoid Drivers**
- **Deflection Circuits**

*** MAXIMUM RATINGS (T_{CASE} = 25°C)**

Symbol	Characteristics	2N6582	2N6583	2N6584
V_{CBO}	Collector-BaseVoltage	450V	500V	550V
V_{CEO}	Collector-Emitter Voltage	350V	400V	450V
$I_{C(CONT)}$	Collector Current	10A	10A	10A
$I_{C(PEAK)}$	Collector Current	16A	16A	16A
$I_{B(CONT)}$	Base Current	5A	5A	5A
$I_{B(PEAK)}$	Base Current	16A	16A	16A
$I_{E(CONT)}$	Emitter Current	15A	15A	15A
$I_{E(PEAK)}$	Emitter Current	32A	.32A	32A
P_T	Power Dissipation	125W	125W	125W

*** THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max.	Unit
Thermal Resistance Junction to Case	$R_{\theta JC}$	1.4	°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	T_L	275	°C
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-65 to +200	°C

* Indicates JEDEC Registered Data

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

OFF CHARACTERISTICS (1)

Symbol	Characteristic	Test Conditions	2N6582 Min	2N6582 Max	2N6583 Min	2N6583 Max	2N6584 Min	2N6584 Max	Unit
* $V_{CEO(SUS)}$	Collector-Emitter Sustaining Voltage	I_C = 200mA I_{B1} = .05A L = 2mH	350		400		450		V
$V_{CEX(SUS)}$	Collector-Emitter Sustaining Voltage	I_C = 8A I_{B1} = 1.6A $V_{BE(off)}$ = -5V	350		400		450		V
		I_C = 3.5A I_{B1} = 0.7A $V_{BE(off)}$ = -5V	450		500		550		V
* V_{CBO}	Collector-Base Voltage	I_C = .5mA	450		500		550		V
* I_{CEV}	Collector Cutoff Current	V_{CE} = Rated V_{CBO} $V_{BE(off)}$ = -1.5V		0.5		0.5		0.5	mA
		V_{CE} = Rated V_{CBO} $V_{BE(off)}$ = -1.5V T_C = +100°C		2.0		2.0		2.0	mA
* I_{EBO}	Emitter Cutoff Current	V_{EB} = 9V I_C = 0		0.1		0.1		0.1	mA

SECOND BREAKDOWN

Symbol	Characteristic	Test Conditions	2N6582 Min	2N6582 Max	2N6583 Min	2N6583 Max	2N6584 Min	2N6584 Max	Unit
* $I_{S/b}$	Second Breakdown Collector Current	V_{CE} = 200V Non Rep. t_p = 1S	.09		.09		.09		A

ON CHARACTERISTICS (2)

Symbol	Characteristic	Test Conditions	2N6582 Min	2N6582 Max	2N6583 Min	2N6583 Max	2N6584 Min	2N6584 Max	Unit
* $V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 7A I_B = 1.4A		1.5		1.5		1.5	V
		I_C = 10A I_B = 5A		3.0		3.0		3.0	V
* $V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 7A I_B = 1.4A		1.5		1.5		1.5	V
* h_{FE}	DC Current Gain	I_C = 7A V_{CE} = 3V	7	35	7	35	7	35	

DYNAMIC CHARACTERISTICS

Symbol	Characteristic	Test Conditions	2N6582 Min	2N6582 Max	2N6583 Min	2N6583 Max	2N6584 Min	2N6584 Max	Unit
f_T	Gain-Bandwidth Product	I_C = 1A V_{CE} = 10V f_{test} = 10MHz	12.5	50	12.5	50	12.5	50	MHz
* C_{OB}	Output Capacitance	V_{CB} = 10V I_E = 0 f_{test} = 1.0MHz	75	250	75	250	75	250	pF

SWITCHING CHARACTERISTICS (1)

Resistive Load			Typ	Max	Typ	Max	Typ	Max	
* t_d	Delay Time	V_{CC} = 150V I_C = 7.0A		.05		.05		.05	μs
* t_r	Rise Time	I_{B1} = I_{B2} = 1.4A		0.5		0.5		0.5	μs
* t_s	Storage Time	$V_{BE(off)}$ = -5V t_p = 100μs		2.0		2.0		2.0	μs
* t_f	Fall Time	(I_{B2} = 0 for t_d, t_r)		0.5		0.5		0.5	μs
Inductive Load, Clamped									
t_s	Storage Time	V_{clamp} = 300V I_C = 7.0A	1.5		1.5		1.5		μs
t_f	Fall Time	I_{B1} = I_{B2} = 1.4A	0.1		0.1		0.1		μs
t_c	Commutation Time	$V_{BE(off)}$ = -5V L = 200μH	.25		.25		.25		μs
t_s	Storage Time	V_{clamp} = 300V I_C = 7.0A	2.0		2.0		2.0		μs
t_f	Fall Time	I_{B1} = I_{B2} = 1.4A T_C = 100°C	.15		.15		.155		μs
t_c	Commutation Time	$V_{BE(off)}$ = -5V L = 200μH	0.4		0.4		0.4		μs

(1) See Figure 8
(2) Pulse Test: Pulse Width = 300μs, Duty Cycle ≤ 2%.
* Indicates JEDEC Registered Data

Figure 2 — SOA Curve Forward Bias

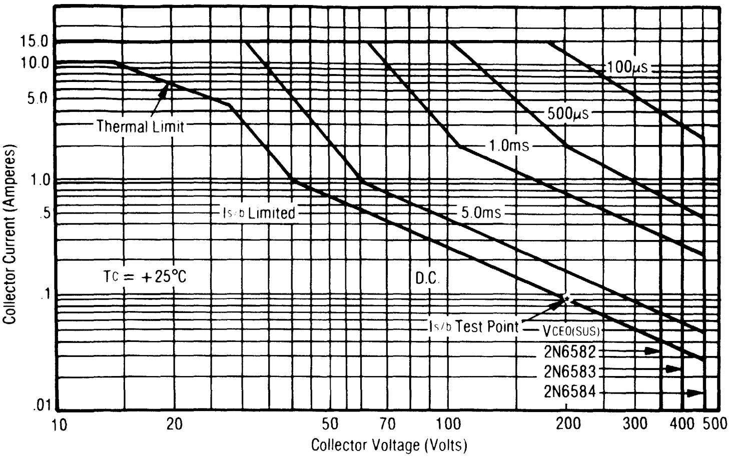


Figure 3 — Power Derating

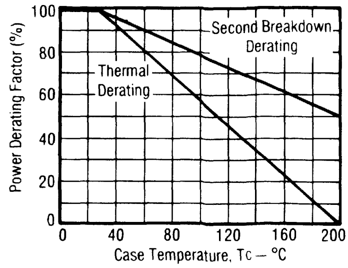


Figure 4 — Thermal Response

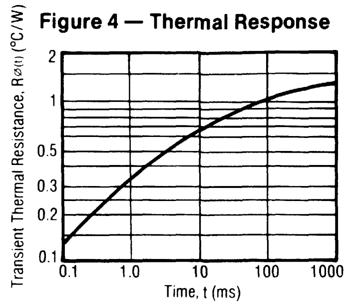


Figure 5 — Inductive Turn Off Waveform

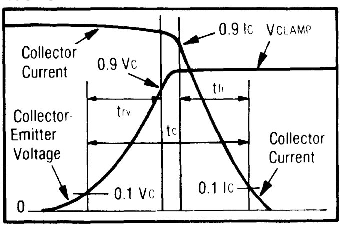


Figure 6 — Inductive Switching Performance

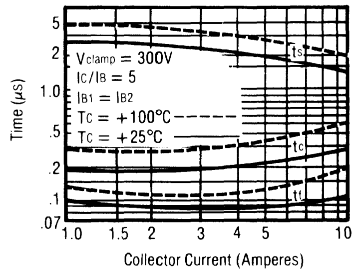


Figure 7 — Resistive Switching Performance

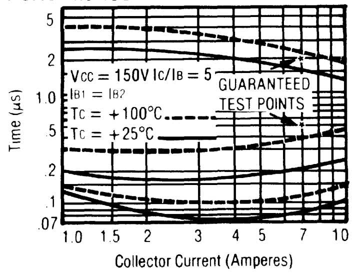


Figure 8 — Switch Time Test Circuit

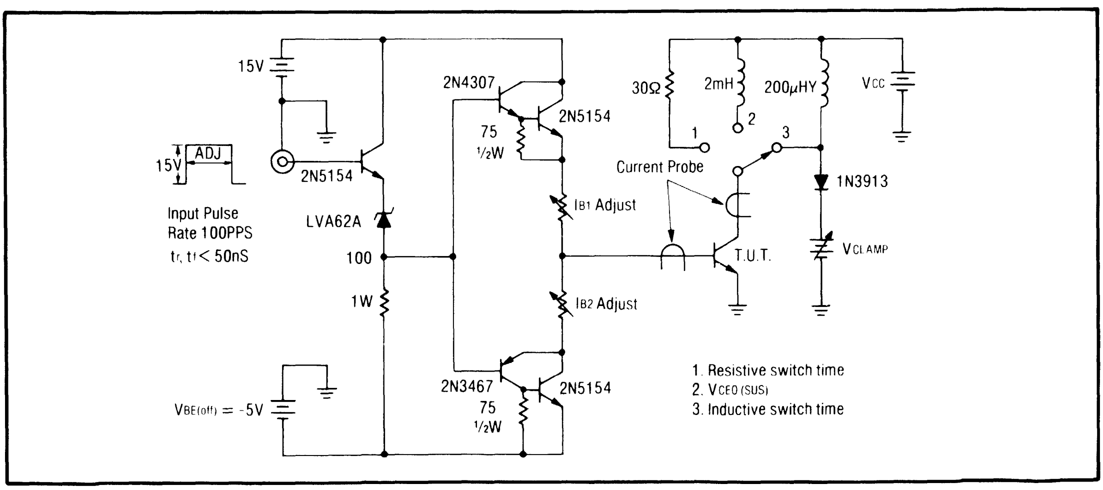


Figure 9 — Typical DC Current Gain

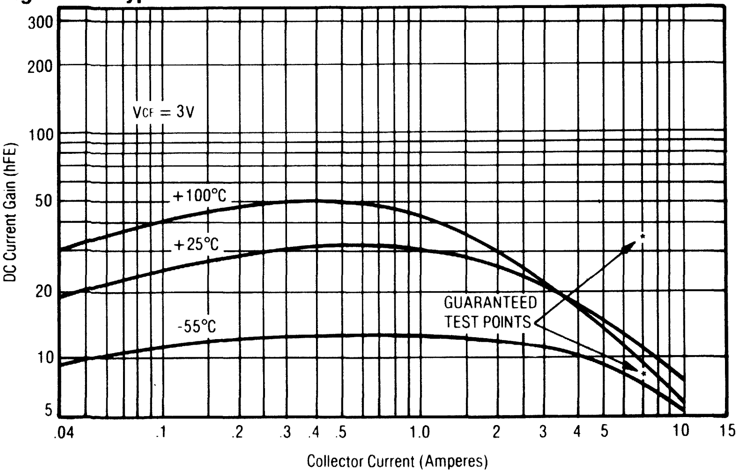


Figure 10 — Collector-Emitter Saturation Voltage

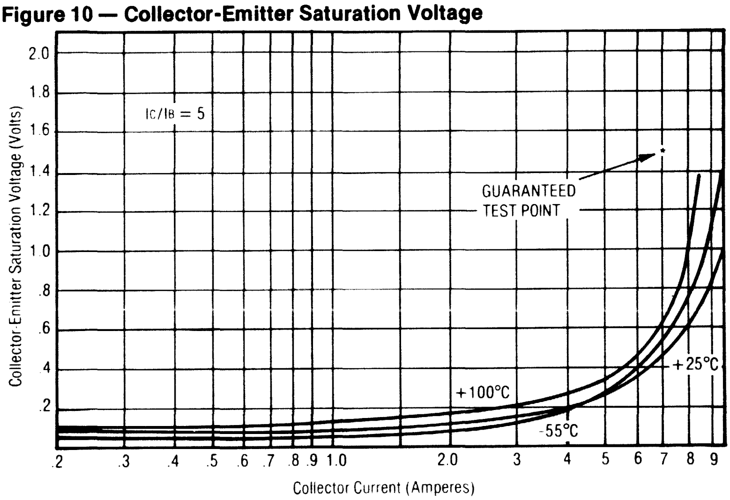


Figure 11 — Base-Emitter Voltage

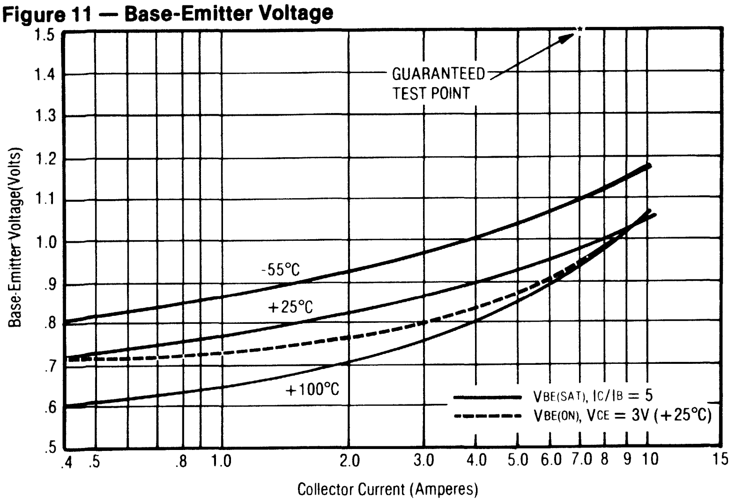


Figure 12 — Collector Saturation Region

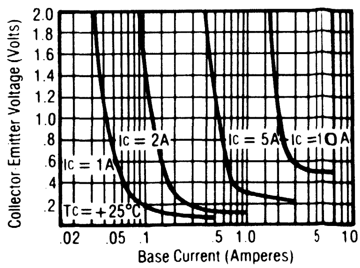
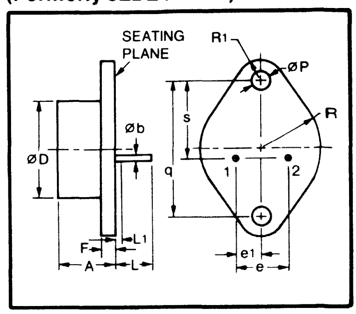


Figure 13 — DIMENSIONAL OUTLINE JEDEC TO-204MA (Formerly JEDEC TO-3)



Symbol	Inches	Millimeters	Notes
A	0.250 / 0.450	6.35 / 11.35	3
Øb	0.038 / 0.043	0.96 / 1.092	1
ØD	— / 0.875	— / 22.22	
e	0.420 / 0.440	10.67 / 11.17	2
e1	0.205 / 0.225	5.21 / 5.71	2
F	0.060 / 0.135	1.53 / 3.42	
L	0.312 / 0.500	7.93 / 12.70	
L1	— / 0.050	— / 1.27	1
ØP	0.151 / 0.161	3.836 / 4.089	
q	1.177 / 1.197	29.90 / 30.40	
R	0.495 / 0.525	12.58 / 13.33	
R1	0.131 / 0.188	3.33 / 4.77	
s	0.655 / 0.675	16.64 / 17.14	

Notes:

1. Øb applies between L1 and L. Diameter is uncontrolled in L1.
2. These dimensions shou'd be measured at points 0.050 in. (1.270mm) to 0.055 in. (1.397mm) below seating plane. When gage is not used, measurement will be made at seating plane.
3. min. / max.

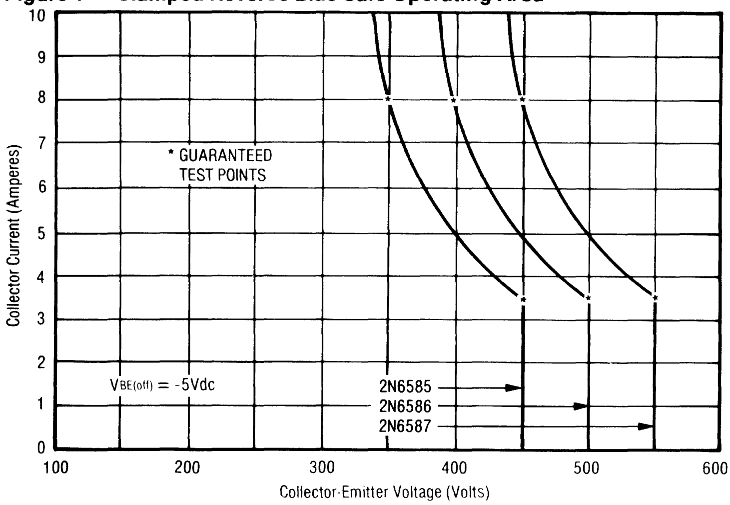
Terminal Connections

Pin 1 — Emitter — Case — Collector
Pin 2 — Base — Mounting Flange — Collector

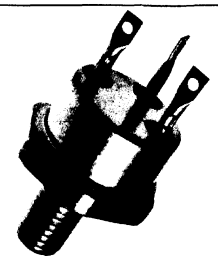
2N6585
2N6586
2N6587

Power Switching Transistor

Figure 1 — Clamped Reverse Bias Safe Operating Area



450 Volts
5 Amperes
.5 μsec



TO-61 Isolated

TRW's 2N6585 thru 2N6587 series of Power Switching Transistors provide a unique combination of speed, voltage, and current capability which makes them ideally suited for high frequency off-line switching regulators, Class "D" audio amplifiers and other similar applications requiring a fast high voltage device. The very fast switching times achievable with these devices result in ultra low switching losses in high frequency power switching applications. These planar, triple diffused transistors display excellent parameter stability at high temperature.

- **Switching Regulators**
- **PWM Inverters**
- **Motor Controls**
- **Solenoid Drivers**
- **Deflection Circuits**

***MAXIMUM RATINGS (T_{CASE} = 25°C)**

Symbol	Characteristics	2N6585	2N6586	2N6587
V_{CBO}	Collector-BaseVoltage	450V	500V	550V
V_{CEO}	Collector-Emitter Voltage	350V	400V	450V
$I_{C(CONT)}$	Collector Current	10A	10A	10A
$I_{C(PEAK)}$	Collector Current	16A	16A	16A
$I_{B(CONT)}$	Base Current	5A	5A	5A
$I_{B(PEAK)}$	Base Current	16A	16A	16A
$I_{E(CONT)}$	Emitter Current	15A	15A	15A
$I_{E(PEAK)}$	Emitter Current	32A	32A	32A
P_T	Power Dissipation	125W	125W	125W

***THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max.	Unit
Thermal Resistance Junction to Case	$R_{\theta JC}$	1.4	°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	T_L	275	°C
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-65 to +200	°C

* Indicates JEDEC Registered Data

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

OFF CHARACTERISTICS (1)

Symbol	Characteristic	Test Conditions	2N6585 Min	2N6585 Max	2N6586 Min	2N6586 Max	2N6587 Min	2N6587 Max	Unit
* $V_{CEO(SUS)}$	Collector-Emitter Sustaining Voltage	I_C = 200mA I_{B1} = .05A L = 2mH	350		400		450		V
$V_{CEX(SUS)}$	Collector-Emitter Sustaining Voltage	I_C = 8A I_{B1} = 1.6A $V_{BE(off)}$ = -5V	350		400		450		V
		I_C = 3.5A I_{B1} = 0.7A $V_{BE(off)}$ = -5V	450		500		550		V
* V_{CBO}	Collector-Base Voltage	I_C = .5mA	450		500		550		V
* I_{CEV}	Collector Cutoff Current	V_{CE} = Rated V_{CBO} $V_{BE(off)}$ = -1.5V		0.5		0.5		0.5	mA
		V_{CE} = Rated V_{CBO} $V_{BE(off)}$ = -1.5V T_C = +100°C		2.0		2.0		2.0	mA
* I_{EBO}	Emitter Cutoff Current	V_{EB} = 9V I_C = 0		0.1		0.1		0.1	mA

SECOND BREAKDOWN

Symbol	Characteristic	Test Conditions	2N6585 Min	2N6585 Max	2N6586 Min	2N6586 Max	2N6587 Min	2N6587 Max	Unit
* $I_{s/b}$	Second Breakdown Collector Current	V_{CE} = 200V Non Rep. t_p = 1S	.09		.09		.09		A

ON CHARACTERISTICS (2)

Symbol	Characteristic	Test Conditions	2N6585 Min	2N6585 Max	2N6586 Min	2N6586 Max	2N6587 Min	2N6587 Max	Unit
* $V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 5A I_B = 1.0A		1.5		1.5		1.5	V
		I_C = 10A I_B = 5A		3.0		3.0		3.0	V
* $V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 5A I_B = 1.0A		1.5		1.5		1.5	V
* h_{FE}	DC Current Gain	I_C = 5A V_{CE} = 3V	7	35	7	35	7	35	

DYNAMIC CHARACTERISTICS

Symbol	Characteristic	Test Conditions	2N6585 Min	2N6585 Max	2N6586 Min	2N6586 Max	2N6587 Min	2N6587 Max	Unit
f_T	Gain-Bandwidth Product	I_C = 1A V_{CE} = 10V f_{test} = 10MHz	12.5	50	12.5	50	12.5	50	MHz
* C_{OB}	Output Capacitance	V_{CB} = 10V I_E = 0 f_{test} = 1.0MHz	75	250	75	250	75	250	pF

SWITCHING CHARACTERISTICS (1)

Resistive Load			Typ	Max	Typ	Max	Typ	Max	
* t_d	Delay Time	V_{CC} = 150V I_C = 5A		.05		.05		.05	μs
* t_r	Rise Time	I_{B1} = I_{B2} = 1.0A		0.5		0.5		0.5	μs
* t_s	Storage Time	$V_{BE(off)}$ = -5V t_p = 100μs		2.0		2.0		2.0	μs
* t_f	Fall Time	(I_{B2} = 0 for t_d, t_r)		0.5		0.5		0.5	μs
Inductive Load, Clamped									
t_s	Storage Time	V_{clamp} = 300V I_C = 5A	1.8		1.8		1.8		μs
t_f	Fall Time	I_{B1} = I_{B2} = 1.0A	0.1		0.1		0.1		μs
t_c	Commutation Time	$V_{BE(off)}$ = -5V L = 200μH	0.2		0.2		0.2		μs
t_s	Storage Time	V_{clamp} = 300V I_C = 5A	2.6		2.6		2.6		μs
t_f	Fall Time	I_{B1} = I_{B2} = 1.0A T_C = 100°C	.15		.15		.15		μs
t_c	Commutation Time	$V_{BE(off)}$ = -5V L = 200μH	.35		.35		.35		μs

(1) See Figure 8
(2) Pulse Test: Pulse Width = 300μs, Duty Cycle ≤ 2%.
* Indicates JEDEC Registered Data

Figure 2 — SOA Curve Forward Bias

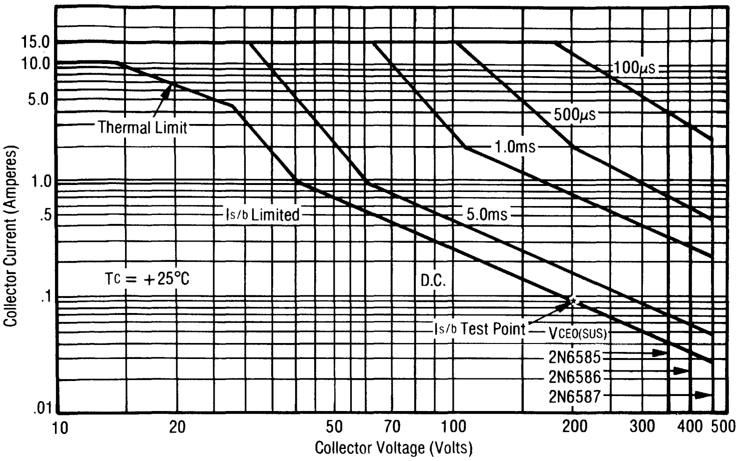


Figure 3 — Power Derating

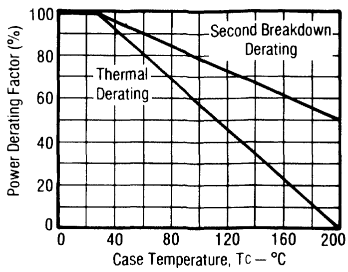


Figure 4 — Thermal Response

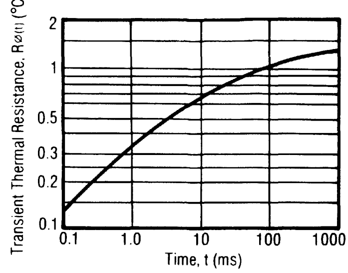


Figure 5 — Inductive Turn Off Waveform

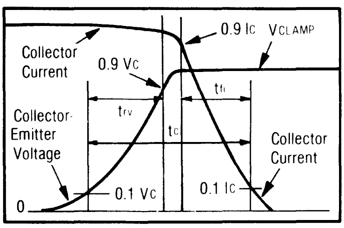


Figure 6 — Inductive Switching Performance

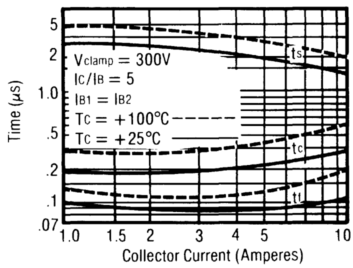


Figure 7 — Resistive Switching Performance

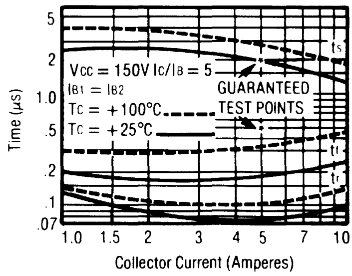


Figure 8 — Switch Time Test Circuit

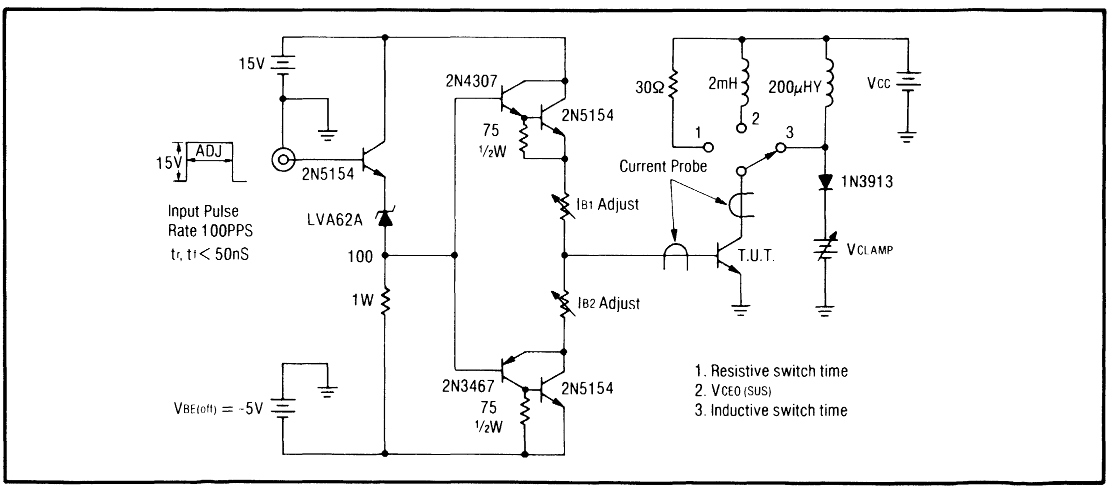


Figure 9 — Typical DC Current Gain

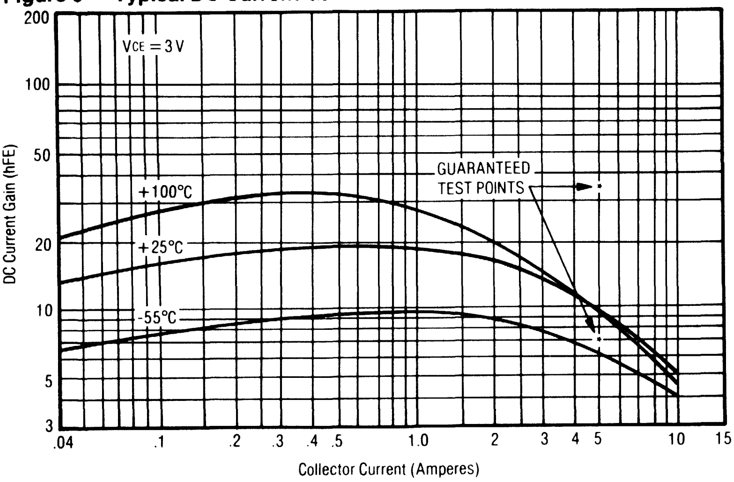


Figure 10 — Collector-Emitter Saturation Voltage

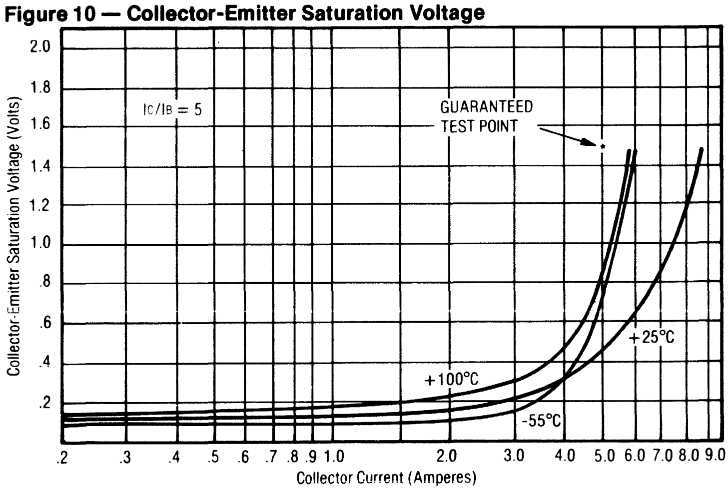


Figure 11 — Base-Emitter Voltage

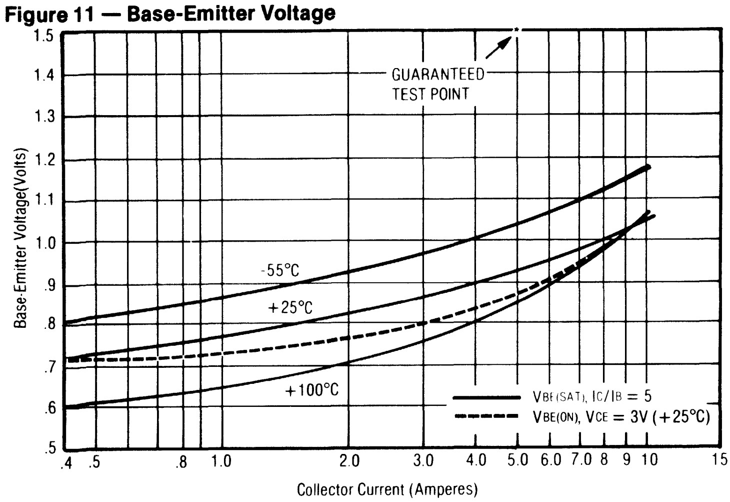


Figure 12 — Collector Saturation Region

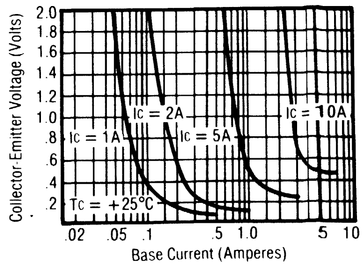
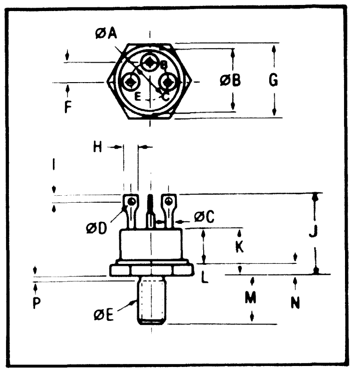


Figure 13 — Dimensional Outline JEDEC TO-61, Isolated Collector Package



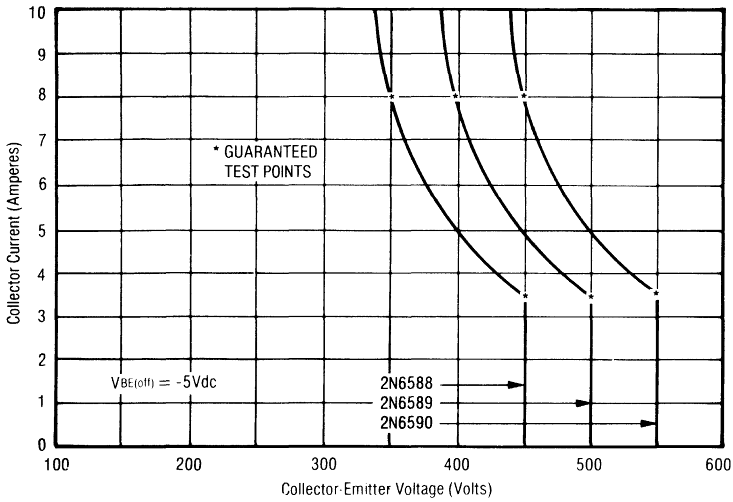
Symbol	Inches	Millimeters
ØA	370 410	9.38 10.42
ØB	580 610	14.73 15.50
ØC	060 080	1.52 2.04
ØD	060 072	1.52 1.83
ØE		¼-28UNF-2A
F	170 213	4.31 5.42
G	667 687	16.94 17.45
H	095 .135	2.41 3.43
I	.055 075	1.39 1.91
J	.755 .850	19.17 21.59
K	400 460	10.16 11.80
L	.280 .310	7.12 7.88
M	.422 .455	10.72 11.56
N	.090 .150	2.29 3.81
P	.090 max	2.29 max

Notes:
1. Case Electrically Isolated from Transistor.
2. All Dimensions Min./Max.

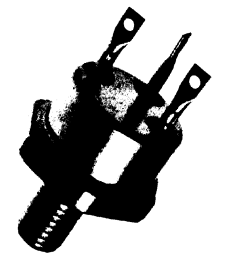
2N6588
2N6589
2N6590

Power Switching Transistor

Figure 1 — Clamped Reverse Bias Safe Operating Area



450 Volts
7 Amperes
.5 μsec



TO-61 Isolated

TRW's 2N6588 thru 2N6590 series of Power Switching Transistors provide a unique combination of speed, voltage, and current capability which makes them ideally suited for high frequency off-line switching regulators, Class "D" audio amplifiers and other similar applications requiring a fast high voltage device. The very fast switching time achievable with these devices result in ultra low switching losses in high frequency power switching applications. These planar, triple diffused transistors display excellent parameter stability at high temperature.

- **Switching Regulators**
- **PWM Inverters**
- **Motor Controls**
- **Solenoid Drivers**
- **Deflection Circuits**

*** MAXIMUM RATINGS (T_{CASE} = 25°C)**

Symbol	Characteristics	2N6588	2N6589	2N6590
V_{CBO}	Collector-BaseVoltage	450V	500V	550V
V_{CEO}	Collector-Emitter Voltage	350V	400V	450V
$I_{C(CONT)}$	Collector Current	10A	10A	10A
$I_{C(PEAK)}$	Collector Current	16A	16A	16A
$I_{B(CONT)}$	Base Current	5A	5A	5A
$I_{B(PEAK)}$	Base Current	16A	16A	16A
$I_{E(CONT)}$	Emitter Current	15A	15A	15A
$I_{E(PEAK)}$	Emitter Current	32A	32A	32A
P_T	Power Dissipation	125W	125W	125W

*** THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max.	Unit
Thermal Resistance Junction to Case	$R_{\theta JC}$	1.4	°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	T_L	275	°C
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-65 to +200	°C

* Indicates JEDEC Registered Data

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

OFF CHARACTERISTICS (1)

Symbol	Characteristic	Test Conditions	2N6588 Min	2N6588 Max	2N6589 Min	2N6589 Max	2N6590 Min	2N6590 Max	Unit
* $V_{CEO(SUS)}$	Collector-Emitter Sustaining Voltage	I_C = 200mA I_{B1} = .05A, L = 2mH	350		400		450		V
$V_{CEX(SUS)}$	Collector-Emitter Sustaining Voltage	I_C = 8A I_{B1} = 1.6A, $V_{BE(off)}$ = -5V	350		400		450		V
		I_C = 3.5A I_{B1} = 0.7A, $V_{BE(off)}$ = -5V	450		500		550		V
* V_{CBO}	Collector-Base Voltage	I_C = .5mA	450		500		550		V
* I_{CEV}	Collector Cutoff Current	V_{CE} = Rated V_{CBO}, $V_{BE(off)}$ = -1.5V		0.5		0.5		0.5	mA
		V_{CE} = Rated V_{CBO}, $V_{BE(off)}$ = -1.5V T_C = +100°C		2.0		2.0		2.0	mA
* I_{EBO}	Emitter Cutoff Current	V_{EB} = 9V I_C = 0		0.1		0.1		0.1	mA

SECOND BREAKDOWN

Symbol	Characteristic	Test Conditions	2N6588 Min	2N6588 Max	2N6589 Min	2N6589 Max	2N6590 Min	2N6590 Max	Unit
* $I_{s/b}$	Second Breakdown Collector Current	V_{CE} = 200V, Non Rep. t_p = 1S	.09		.09		.09		A

ON CHARACTERISTICS (2)

Symbol	Characteristic	Test Conditions	2N6588 Min	2N6588 Max	2N6589 Min	2N6589 Max	2N6590 Min	2N6590 Max	Unit
* $V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 7A I_B = 1.4A		1.5		1.5		1.5	V
		I_C = 10A I_B = 5A		3.0		3.0		3.0	V
* $V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 7A I_B = 1.4A		1.5		1.5		1.5	V
* h_{FE}	DC Current Gain	I_C = 7A V_{CE} = 3V	7	35	7	35	7	35	

DYNAMIC CHARACTERISTICS

Symbol	Characteristic	Test Conditions	2N6588 Min	2N6588 Max	2N6589 Min	2N6589 Max	2N6590 Min	2N6590 Max	Unit
f_T	Gain-Bandwidth Product	I_C = 1A V_{CE} = 10V, f_{test} = 10MHz	12.5	50	12.5	50	12.5	50	MHz
* C_{OB}	Output Capacitance	V_{CB} = 10V, I_E = 0 f_{test} = 1.0MHz	75	250	75	250	75	250	pF

SWITCHING CHARACTERISTICS (1)

Resistive Load			Typ	Max	Typ	Max	Typ	Max	
* t_d	Delay Time	V_{CC} = 150V I_C = 7.0A		.05		.05		.05	μs
* t_r	Rise Time	I_{B1} = I_{B2} = 1.4A		0.5		0.5		0.5	μs
* t_s	Storage Time	$V_{BE(off)}$ = -5V t_p = 100μs		2.0		2.0		2.0	μs
* t_f	Fall Time	(I_{B2} = 0 for t_d, t_r)		0.5		0.5		0.5	μs

Inductive Load, Clamped

t_s	Storage Time	V_{clamp} = 300V I_C = 7.0A	1.5		1.6		1.5		μs
t_f	Fall Time	I_{B1} = I_{B2} = 1.4A	0.1		0.1		0.1		μs
t_c	Commutation Time	$V_{BE(off)}$ = -5V L = 200μH	.25		.25		.25		μs
t_s	Storage Time	V_{clamp} = 300V I_C = 7.0A	2.0		2.0		2.0		μs
t_f	Fall Time	I_{B1} = I_{B2} = 1.4A T_C = 100°C	.15		.15		.15		μs
t_c	Commutation Time	$V_{BE(off)}$ = -5V L = 200μH	0.4		0.4		0.4		μs

(1) See Figure 8
(2) Pulse Test: Pulse Width = 300μs, Duty Cycle ≤ 2%.
* Indicates JEDEC Registered Data

Figure 2 — SOA Curve Forward Bias

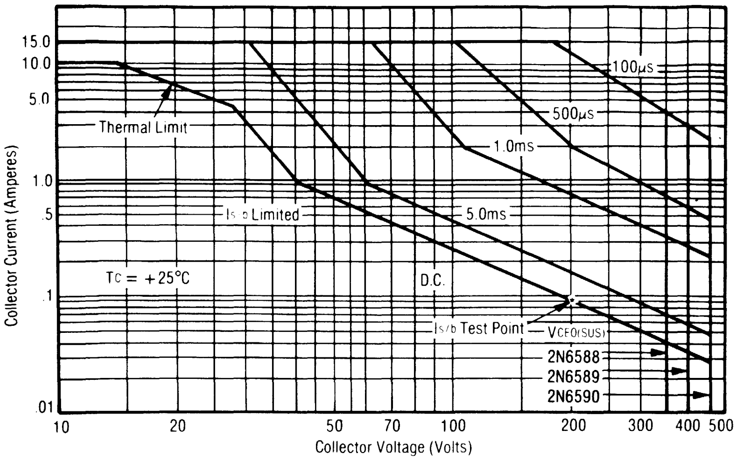


Figure 3 — Power Derating

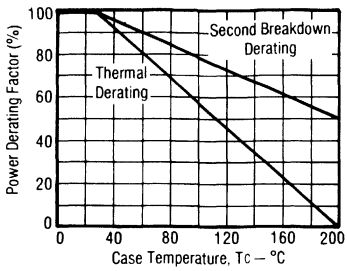


Figure 4 — Thermal Response

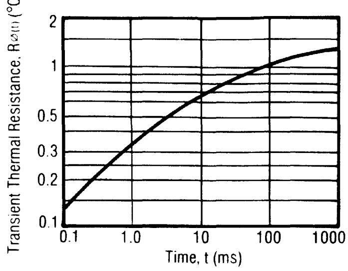


Figure 5 — Inductive Turn Off Waveform

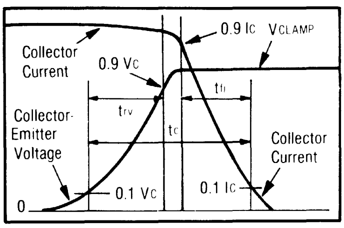


Figure 6 — Inductive Switching Performance

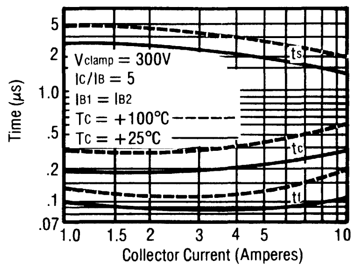


Figure 7 — Resistive Switching Performance

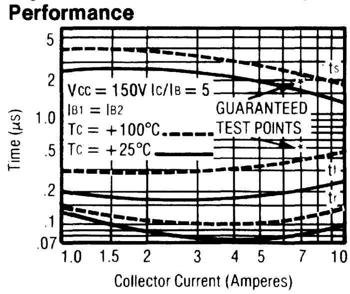


Figure 8 — Switch Time Test Circuit

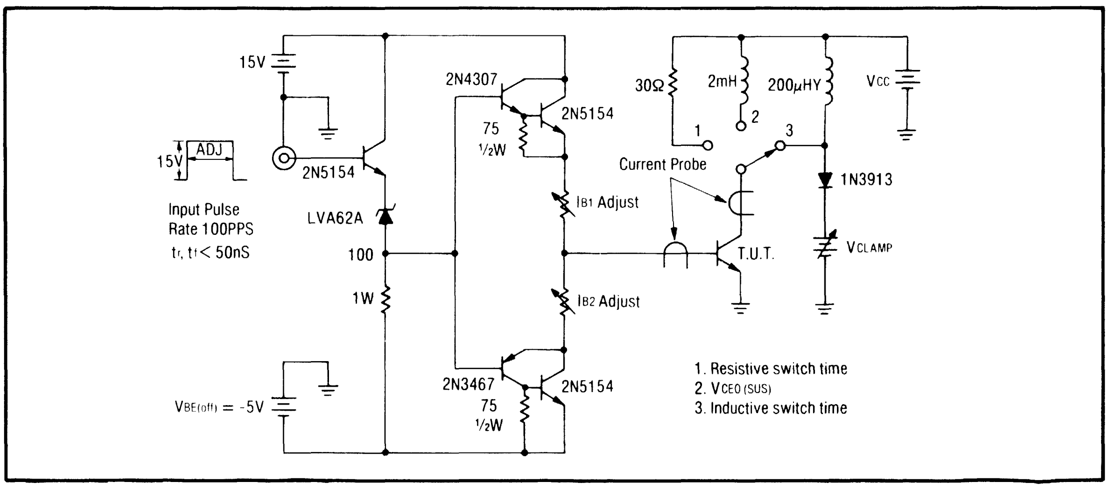


Figure 9 — Typical DC Current Gain

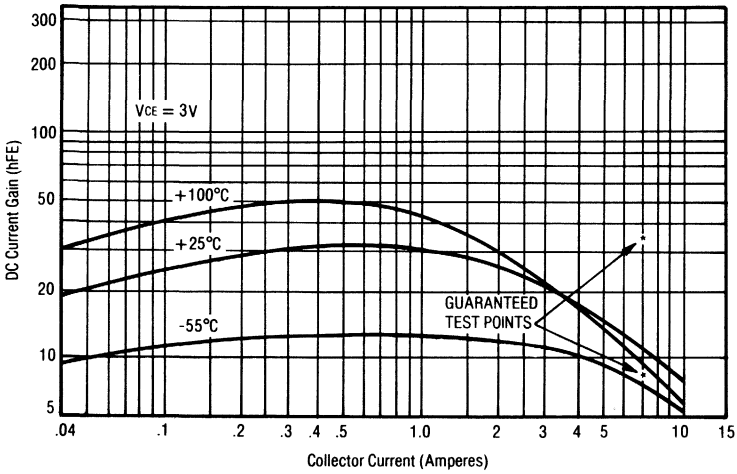


Figure 10 — Collector-Emitter Saturation Voltage

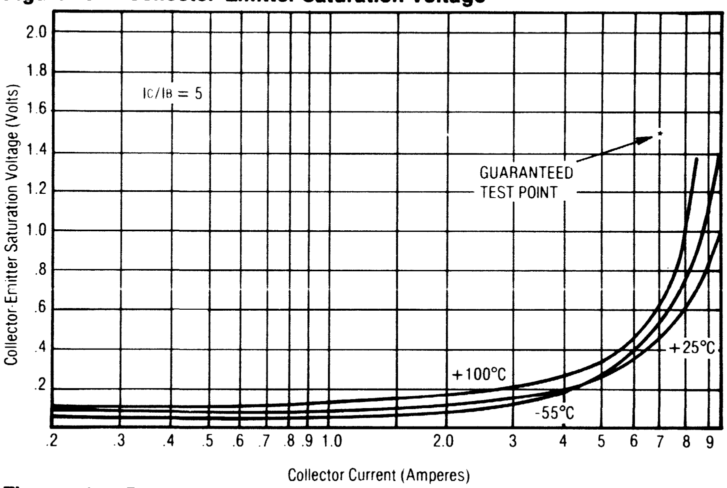


Figure 11 — Base-Emitter Voltage

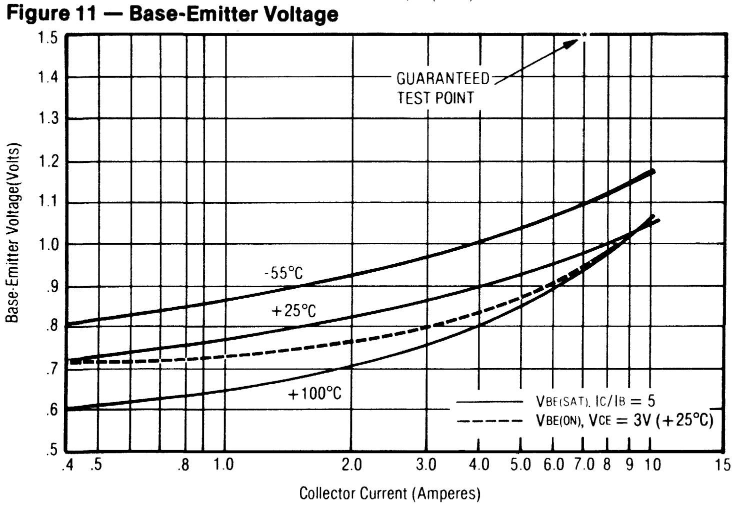


Figure 12 — Collector Saturation Region

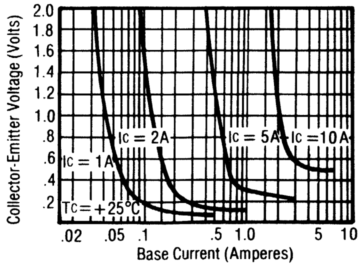
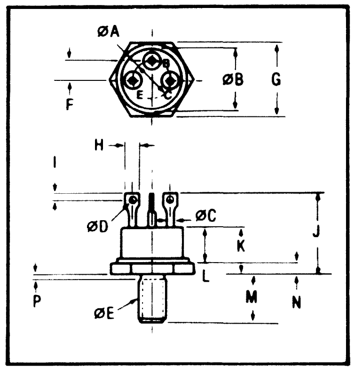


Figure 13 — Dimensional Outline JEDEC TO-61, Isolated Collector Package



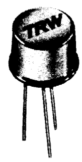
Symbol	Inches	Millimeters
ØA	.370 .410	9.38 10.42
ØB	.580 .610	14.73 15.50
ØC	.060 .080	1.52 2.04
ØD	.060 .072	1.52 1.83
ØE		¼-28UNF-2A
F	.170 .213	4.31 5.42
G	.667 .687	16.94 17.45
H	.095 .135	2.41 3.43
I	.055 .075	1.39 1.91
J	.755 .850	19.17 21.59
K	.400 .460	10.16 11.80
L	.280 .310	7.12 7.88
M	.422 .455	10.72 11.56
N	.090 .150	2.29 3.81
P	.090 max	2.29 max

Notes:
1. Case Electrically Isolated from Transistor.
2. All Dimensions Min./Max.

SVT60-5
SVT80-5

Medium Power Switching Transistors

- **Medium Power Switching**
- **Base Drive Circuits For High Speed Inverters**



TO-39

60-80 Volts
5 Amperes
100 nsec

MAXIMUM RATINGS (T_{CASE} = 25°C)

Symbol	Characteristics	SVT60-5	SVT80-5
V_{CEO}	Collector-to-Emitter Voltage	60Vdc	80Vdc
V_{CBO}	Collector-to-Base Voltage	60Vdc	80Vdc
V_{EBO}	Emitter to Base	6.0Vdc	
I_C	Continuous Collector Current	5.0Adc	
I_B	Continuous Base Current	2.5Adc	
P_T	Case Temperature @ 25°C	11.0W	
	Free Air Temperature 5°C	1.0W	
$\theta_{j\text{-}c}$	Thermal Resistance (Junction to Case)	15°C/W	
T_{op}	Operating Temperature	-65°C to +200°C	

ELECTRICAL CHARACTERISTICS (T_{CASE} = 25°C)

Symbol	Characteristics	Test Conditions	Unit
I_{CBO}	Collector Cutoff Current	V_{CB} = Rated V_{CBO}	100μA max
I_{EBO}	Emitter-to-Base Current	V_{EB} = 3V	100μA max
BV_{CBO}	Collector-to-Base Voltage	I_C = 100μA	†60V min
BV_{CEO}	Collector-to-Emitter Voltage	i_C = 50μA	†60V min
h_{FE}*	D.C. Current Gain	V_{CE} = 2V, I_C = 1A V_{CE} = 2V, I_C = 5A	40 min 10 min
$V_{CE(sat)}$*	Collector Saturation Voltage	I_C = 5A, I_B = 500mA	1V max
$V_{BE(sat)}$*	Base Saturation Voltage	I_C = 5A, I_B = 500mA	1.5V max
C_{ob}	Collector-Base Capacitance	V_{CB} = 10V, f = 1 MHz	100pF typ
f_t	Gain Bandwidth Product	V_{CE} = 5V, I_C = 500mA, f = 10MHz	50MHz typ
t_s	Storage Time	See Switching Test Circuit	300nsec typ
t_f	Fall Time		100nsec typ
t_r	Rise Time		140nsec typ
*Pulse Width: 300μsec, 2% duty cycle, measured 1/8" from case. †SVT60-5			

SVT300-5 through SVT450-5

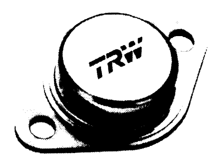
5 Ampere High Speed Switching Transistors

This series of NPN, planar devices is intended for MILITARY and high quality industrial service.

Because of their switching speeds and rugged construction, they are ideal for use in high frequency switching regulators and class "D" amplifiers and converters.

The construction features a silicon die euctectically mounted to a moly tab which is brazed to the TO-3 headers. This type of construction is fully consistant with military equipment needs.

MIL-processing to "S" levels is available (contact factory).



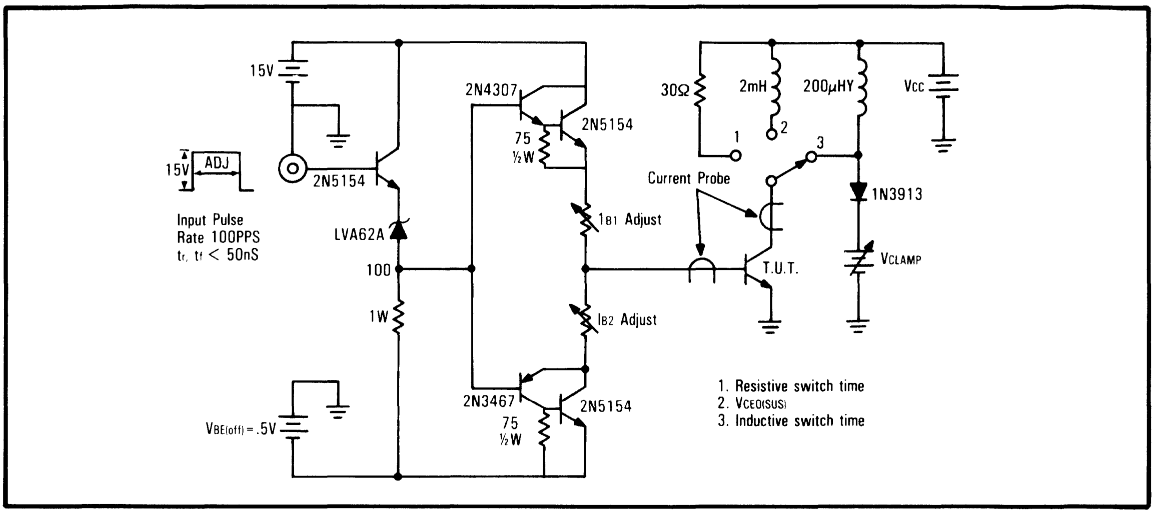
TO-3*

Electrical Characteristics

Symbol	Characteristics	Test Conditions	SVT450-5		SVT400-5		SVT350-5		SVT300-5	
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
$V_{CEO(SUS)}$	Collector-Emitter Voltage	I_C = 50mA	450V		400V		350V		300V	
V_{CBO}	Collector-Base Voltage	I_C = 2.0mA	500V		450V		400V		350V	
V_{EBO}	Emitter-Base Voltage	I_E = 1.0mA	7V		7V		7V		7V	
$V_{CE(SAT)}$	Collector Saturation Voltage	I_C = 5.0A I_B = 1.0A		1.2V		1.2V		1.2V		1.2V
$V_{BE(SAT)}$	Base Saturation Voltage	I_C = 5.0A I_B = 1.0A		1.5V		1.5V		1.5V		1.5V
H_{FE}	D.C. Current Gain	I_C = 5.0A V_{CE} = 5.0V	15		15		15		15	
T_r	Rise Time	I_C = 5A, V_{CC} = 150V I_{B1} = 1.0A, I_{B2} = 2A		.4μs		.4μs		.4μs		.4μs
T_f	Fall Time	I_C = 5A, V_{CC} = 150V I_{B1} = 1.0A, I_{B2} = 2A		.5μs		.5μs		.5μs		.5μs
T_s	Storage Time	I_C 5A, V_{CC} = 150V I_{B1} = 1.0A, I_{B2} = 2A		2.5μs		2.5μs		2.5μs		2.5μs
S.O.A.	Forward Bias S.O.A.	V_{CC} = 10V T = 1.0 Sec.	8A		8A		8A		8A	
CoB	Output Capacitance	V_{CC} = 10V		500Pf		500Pf		500Pf		500Pf
Pk Power	R.B.S.O.A.	V_{CLAMP} = .8$V_{CEO(SUS)}$ L = 200 μH I_{B1} = 1.0A, I_{B2} = 2A	5A		5A		5A		5A	

*Units are available in TO-61 isolated configuration on special order.

Figure 8 – Switch Time Test Circuit



SVT300-3 through SVT450-3

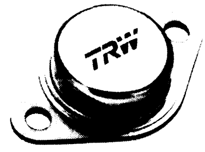
3 Ampere High Speed Switching Transistors

This series of NPN, planar devices is intended for MILITARY and high quality industrial service.

Because of their switching speeds and rugged construction, they are ideal for use in high frequency switching regulators and class "D" amplifiers and converters.

The construction features a silicon die eutectically mounted to a moly tab which is brazed to the TO-3 headers. This type of construction is fully consistant with military equipment needs.

MIL-processing to "S" levels is available (contact factory).



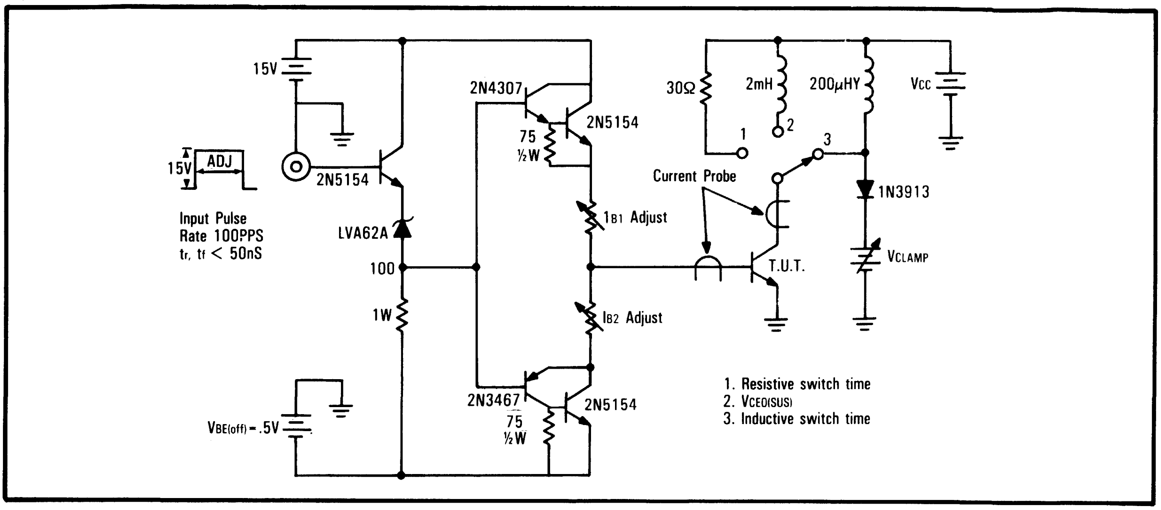
TO-3*

Electrical Characteristics

Symbol	Characteristics	Test Conditions	SVT450-3 Min.	SVT450-3 Max.	SVT400-3 Min.	SVT400-3 Max.	SVT350-3 Min.	SVT350-3 Max.	SVT300-3 Min.	SVT300-3 Max.
$V_{CEO(SUS)}$	Collector-Emitter Voltage	I_C = 50mA	450V		400V		350V		300V	
V_{CBO}	Collector-Base Voltage	I_C = 1.0mA	500V		450V		400V		350V	
V_{EBO}	Emitter-Base Voltage	I_E = 1.0mA	7V		7V		7V		7V	
$V_{CE(SAT)}$	Collector Saturation Voltage	I_C = 3.0A I_B = .6A		1.2V		1.2V		1.2V		1.2V
$V_{BE(SAT)}$	Base Saturation Voltage	I_C = 3.0A I_B = .6A		1.5V		1.5V		1.5V		1.5V
H_{FE}	D.C. Current Gain	I_C = 3.0A V_{CE} = 5.0V	15		15		15		15	
H_{FE}	D.C. Current Gain	I_C = 6.0A V_{CE} = 5.0V	5		5		5		5	
T_r	Rise Time	I_C = 3A, V_{CC} = 150V I_{B1} = .6A, I_{B2} = 1.2A		.4μs		.4μs		.4μs		.4μs
T_f	Fall Time	I_C = 3A, V_{CC} = 150V I_{B1} = .6A, I_{B2} = 1.2A		.5μs		.5μs		.5μs		.5μs
T_s	Storage Time	I_C 3A, V_{CC} = 150V I_{B1} = .6A, I_{B2} = 1.2A		2.5μs		2.5μs		2.5μs		2.5μs
C_{OB}	Output Capacitance	V_{CC} = 10V		500Pf		500Pf		500Pf		500Pf
S.O.A.	Forward Bias S.O.A.	V_{CC} = 10V T = 1.0 Sec.	5A		5A		5A		5A	
R.B. S.O.A.	Reverse Bias S.O.A.	L = 200μH V_C = .8 $V_{CEO(SUS)}$ I_{B1} = .6A, I_{B2} = 1.2A	3A		3A		3A		3A	

*Units are available in TO-61 isolated configuration on special order.

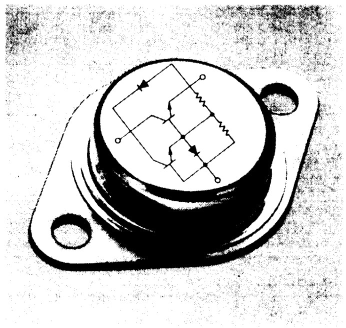
Figure 8 – Switch Time Test Circuit



Monolithic Darlington

350 to 450 Volts $V_{CEX(SUS)}$ 15 Amperes 200 nsec

SVT6000
SVT6001
SVT6002

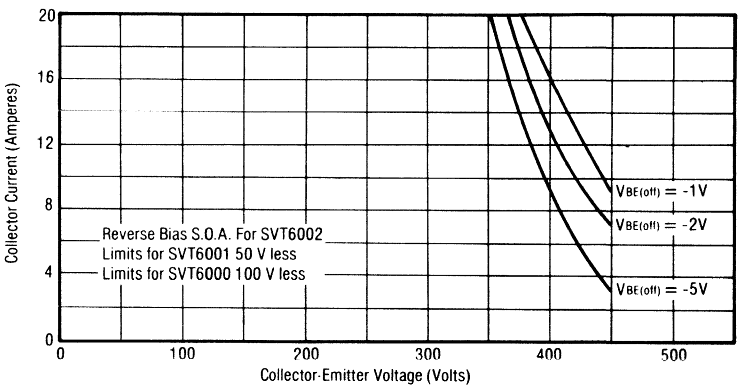


The SVT6000 Series are NPN, high-voltage, high-gain, Monolithic Darlington amplifiers for use in high-speed power circuits at switching frequencies to 40KHz and higher. The units are mounted in the E.I.A. standard TO-3 package. An internal diode provides rapid device turnoff. The silicon die is metallugically bonded to a molybdenum tab which in turn is bonded to the header. This mounting system provides superior resistance to thermal fatigue.

They are particularly suited for off-line applications from 115V to 230VAC sources such as:

- Switching Regulators
- PWM Inverters and Motor Controls
- Solenoid and Relay Drivers
- Deflection Circuits

Figure 1 — Clamped Reverse Bias Safe Operating Area



Maximum Ratings (T_{CASE} = 25°C)

Symbol	Characteristics	SVT6000	SVT6001	SVT6002
V_{CBO}	Collector-Base Voltage	400Vdc	450Vdc	500Vdc
V_{CEO}	Collector-Emitter Voltage	400Vdc	450Vdc	500Vdc
$I_{C(CONT)}$	Collector Current	15A	15A	15A
$I_{C(PEAK)}$	Collector Current	20A	20A	20A
$I_{B(CONT)}$	Base Current	5A	5A	5A
$I_{B(PEAK)}$	Base Current	10A	10A	10A
$I_{E(CONT)}$	Emitter Current	20A	20A	20A
$I_{E(PEAK)}$	Emitter Current	30A	30A	30A
P_T	Power Dissipation	135W	135W	135W

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max.	Unit
Thermal Resistance Junction to Case	$R_{\theta JC}$	1.3	°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	T_L	275	°C
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-65 to +200	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

OFF CHARACTERISTICS (1)

Symbol	Characteristic	Test Conditions	SVT6000		SVT6001		SVT6002		
			Min	Max	Min	Max	Min	Max	Unit
$V_{CEO(sus)}$	Collector-Emitter Sustaining Voltage	I_C = 2A I_{B1} = .1A I_{B2} = 0 L = 1mH	300		350		400		V
$V_{CEX(sus)}$	Collector-Emitter Sustaining Voltage	I_C = 9A I_{B1} = .5A $V_{BE(off)}$ = 1V	350		400		450		V
$V_{CEX(sus)}$	Collector-Emitter Sustaining Voltage	I_C = 20A I_{B1} = 2A $V_{BE(off)}$ = 1V	275		325		375		V
I_{CEO}	Collector Cutoff Current	V_{CE} = Rated V_{CEO}		1		1		1	mA
I_{CEV}	Collector Cutoff Current	V_{CE} = Rated V_{CBO} $V_{BE(off)}$ = -1.5V T_C = 150°C		.5		.5		.5	mA
I_{CER}	Collector Cutoff Current	V_{CE} = Rated V_{CBO} R_{BE} = 50Ω, T_C = 100°C		.5		.5		.5	mA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 2V I_C = 0		150		150		150	mA

SECOND BREAKDOWN

$I_{S/b}$	Second Breakdown Collector Current	V_{CE} = 200V Non Rep. t_p = 1mS	1.4		1.4		1.4		A

ON CHARACTERISTICS (2)

$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 15A I_B = 1.5A I_C = 10A I_B = .5A		2 1.6		2 1.6		2 1.6	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10A I_B = .5A T_C = 100°C		2.0		2.0		2.0	V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10A I_B = .5A		2.5		2.5		2.5	V
h_{FE}	DC Current Gain	I_C = 10A V_{CE} = 5V I_C = 15A V_{CE} = 5V	60 20		60 20		60 20		
V_F	Collector-Emitter Diode Forward Voltage	I_F = 10A		1.9		1.9		1.9	V

(1) See Figure 8
(2) Pulse Test: Pulse Width = 300μs, Duty Cycle ≤ 2%.

Figure 2 — SOA Curve Forward Bias

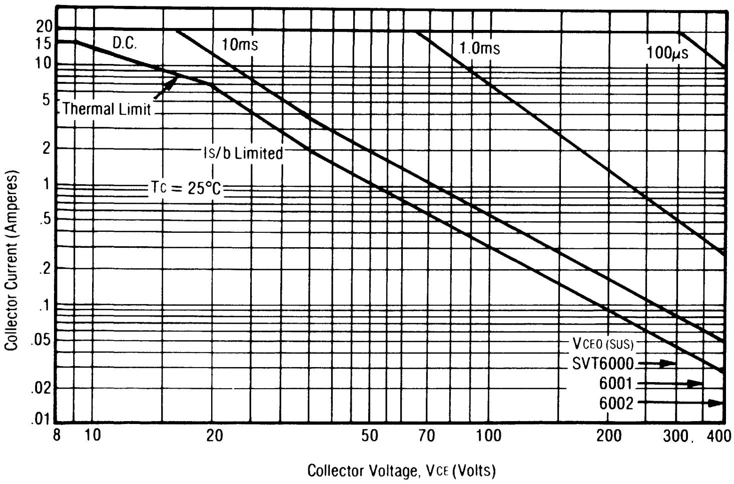


Figure 3 — Power Derating

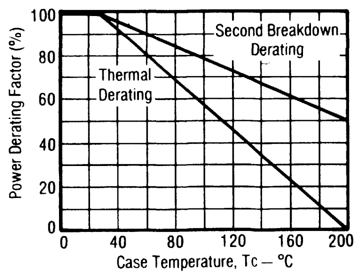
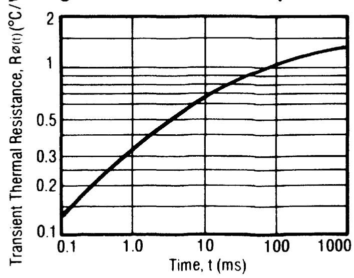


Figure 4 — Thermal Response



ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

DYNAMIC CHARACTERISTICS

Symbol	Characteristic	Test Conditions	SVT6000 Min	SVT6000 Max	SVT6001 Min	SVT6001 Max	SVT6002 Min	SVT6002 Max	Unit
h_{fe}	Small Signal Current Gain	I_C = 1A, V_{CE} = 10V, f_{test} = 1MHz	100		100		100		
C_{OB}	Output Capacitance	V_{CB} = 10V, I_E = 0, f_{test} = 1.0MHz	150	350	150	350	150	350	pF

SWITCHING CHARACTERISTICS (1)

Resistive Load			SVT6000 Typ	SVT6000 Max	SVT6001 Typ	SVT6001 Max	SVT6002 Typ	SVT6002 Max	Unit
t_d	Delay Time	V_{CC} = 300V I_C = 10A		.06		.06		.06	μs
t_r	Rise Time	I_{B1} = .5A		.3		.3		.3	μs
t_s	Storage Time	$V_{BE(off)}$ = -5V		1.0		1.0		1.0	μs
t_f	Fall Time	t_p = 50μsec		.2		.2		.2	μs
Inductive Load, Clamped									
t_s	Storage Time	V_{clamp} = 250V I_C = 10A, I_{B1} = .5A	.9		.9		.9		μs
t_f	Fall Time	$V_{BE(off)}$ = -5V	.07		.07		.07		μs
t_s	Storage Time	V_{clamp} = 250V I_C = 10A, I_{B1} = .5A T_C = 100° C	1.2		1.2		1.2		μs
t_f	Fall Time	$V_{BE(off)}$ = -5V	.10		.10		.10		μs

(1) See Figure 8

Figure 5 — Inductive Turn Off Waveform

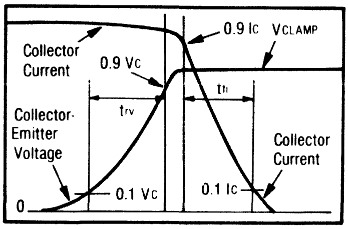


Figure 6 — Inductive Switching Performance

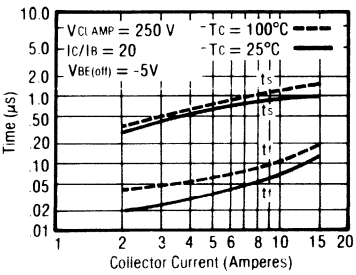


Figure 7 — Resistive Switching Performance

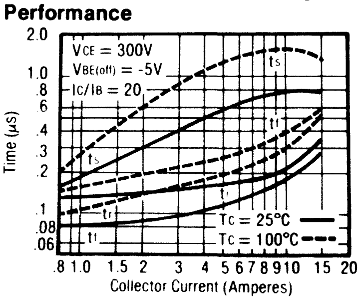


Figure 8 — Switch Time Test Circuit

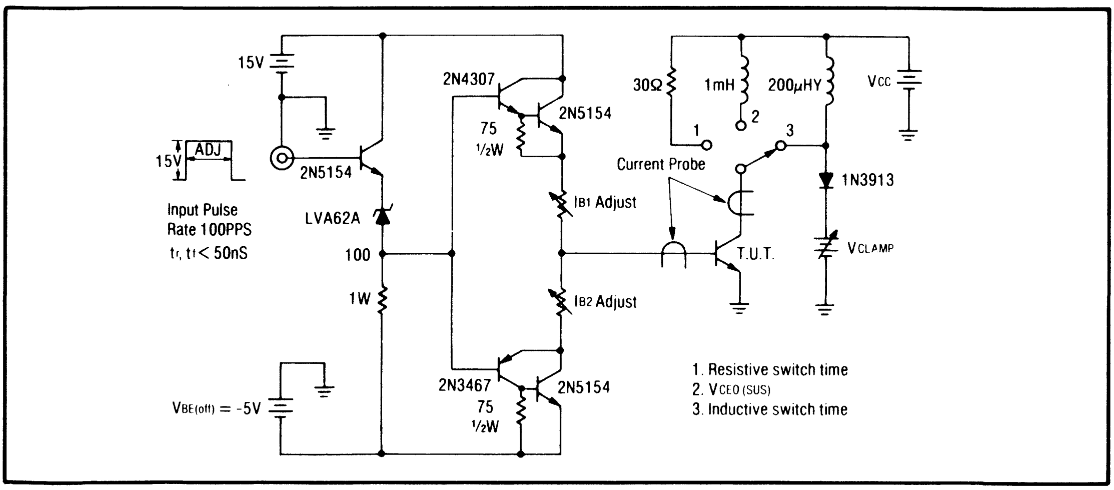


Figure 9 — Typical D.C. Current Gain

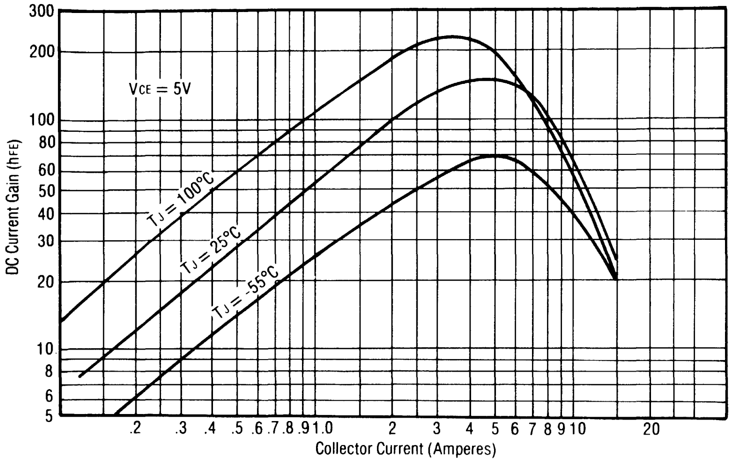


Figure 10 — Collector-Emitter Saturation Voltage

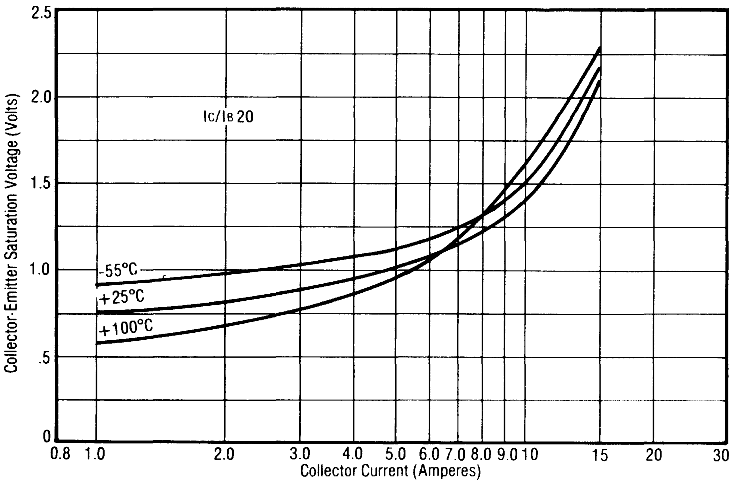


Figure 11 — Base-Emitter Voltage

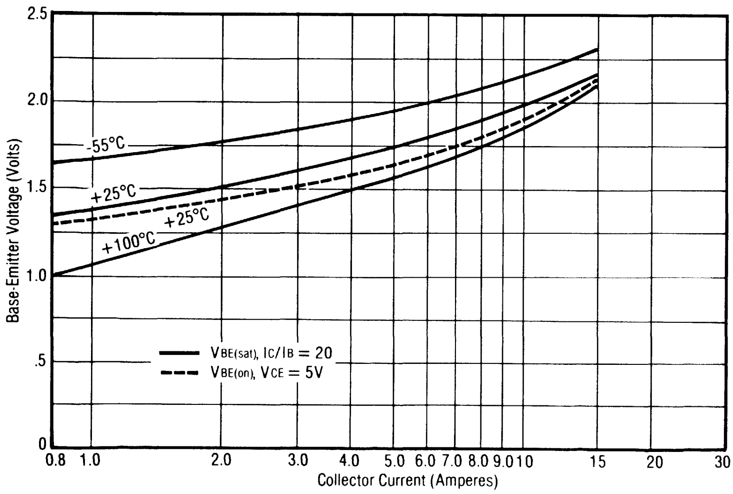


Figure 12 — Collector Saturation Region

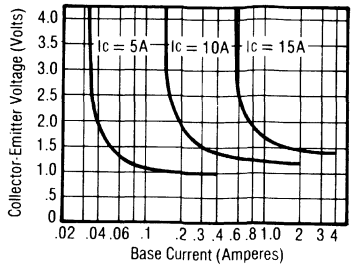
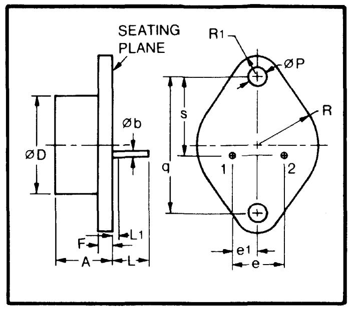


Figure 13 — DIMENSIONAL OUTLINE JEDEC TO-204MA (Formerly JEDEC TO-3)



Symbol	Inches	Millimeters	Notes
A	0.250 / 0.450	6.35 / 11.35	3
Øb	0.038 / 0.043	0.96 / 1.092	1
ØD	— / 0.875	— / 22.22	
e	0.420 / 0.440	10.67 / 11.17	2
e1	0.205 / 0.225	5.21 / 5.71	2
F	0.060 / 0.135	1.53 / 3.42	
L	0.312 / 0.500	7.93 / 12.70	
L1	— / 0.050	— / 1.27	1
ØP	0.151 / 0.161	3.836 / 4.089	
q	1.177 / 1.197	29.90 / 30.40	
R	0.495 / 0.525	12.58 / 13.33	
R1	0.131 / 0.188	3.33 / 4.77	
s	0.655 / 0.675	16.64 / 17.14	

Notes:

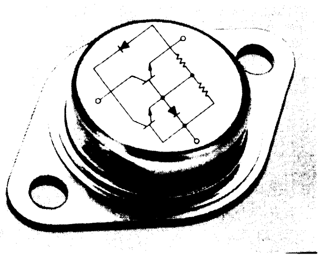
1. Øb applies between L1 and L. Diameter is uncontrolled in L1.
2. These dimensions shou'd be measured at points 0.050 in. (1.270mm) to 0.055 in. (1.397mm) below seating plane. When gage is not used, measurement will be made at seating plane.
3. min. / max.

Terminal Connections

Pin 1 — Base Case — Collector
Pin 2 — Emitter Mounting Flange — Collector

Monolithic Darlington

350 to 450 Volts $V_{CEX(SUS)}$
20 Amperes 200 nsec



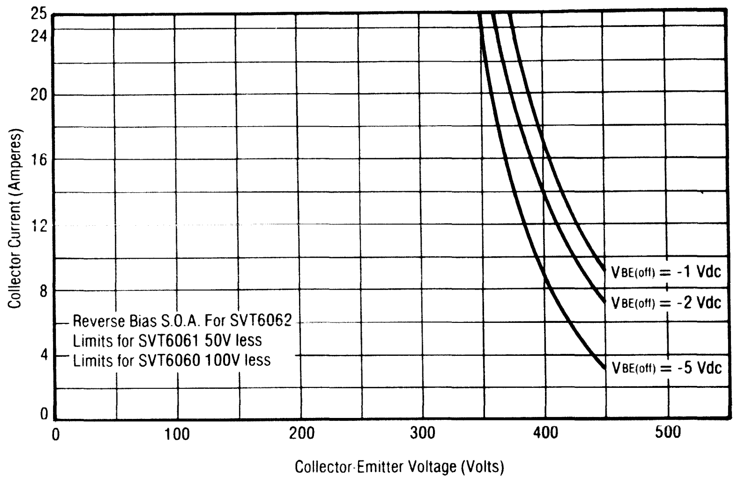
SVT6060
SVT6061
SVT6062

The SVT6060 Series are NPN, high-voltage, high-gain, Monolithic Darlington amplifiers for use in high-speed power circuits at switching frequencies to 40KHz and higher. The units are mounted in the E.I.A. standard TO-3 package. An internal diode provides rapid device turnoff. The silicon die is metallugically bonded to a molybdenum tab which in turn is bonded to the header. This mounting system provides superior resistance to thermal fatigue.

They are particularly suited for off-line applications from 115V to 230VAC sources such as:

- Switching Regulators
- PWM Inverters and Motor Controls
- Solenoid and Relay Drivers
- Deflection Circuits

Figure 1 — Clamped Reverse Bias Safe Operating Area



Maximum Ratings (T_{CASE} = 25° C)

Symbol	Characteristics	SVT6060	SVT6061	SVT6062
V_{CBO}	Collector-Base Voltage	400Vdc	450Vdc	500Vdc
V_{CEO}	Collector-Emitter Voltage	400Vdc	450Vdc	500Vdc
$I_{C(CONT)}$	Collector Current	20A	20A	20A
$I_{C(PEAK)}$	Collector Current	25A	25A	25A
$I_{B(CONT)}$	Base Current	5A	5A	5A
$I_{B(PEAK)}$	Base Current	10A	10A	10A
$I_{E(CONT)}$	Emitter Current	25A	25A	25A
$I_{E(PEAK)}$	Emitter Current	35A	35A	35A
P_T	Power Dissipation	135W	135W	135W

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max.	Unit
Thermal Resistance Junction to Case	$R_{\theta JC}$	1.3	° C/W
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	T_L	275	° C
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-65 to +200	° C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

OFF CHARACTERISTICS (1)

Symbol	Characteristic	Test Conditions	SVT6060		SVT6061		SVT6062		
			Min	Max	Min	Max	Min	Max	Unit
$V_{CEO(sus)}$	Collector-Emitter Sustaining Voltage	I_C = 2A I_{B1} = .1A I_{B2} = 0 L = 1mH	300		350		400		V
$V_{CEX(sus)}$	Collector-Emitter Sustaining Voltage	I_C = 9A I_{B1} = .5A $V_{BE(off)}$ = -1V	350		400		450		V
$V_{CEX(sus)}$	Collector-Emitter Sustaining Voltage	I_C = 25A I_{B1} = 2.5A $V_{BE(off)}$ = -1V	275		325		375		V
I_{CEO}	Collector Cutoff Current	V_{CE} = Rated V_{CEO}		1		1		1	mA
I_{CEV}	Collector Cutoff Current	V_{CE} = Rated V_{CBO} $V_{BE(off)}$ = -1.5V T_C = 150°C		.5		.5		.5	mA
I_{CER}	Collector Cutoff Current	V_{CE} = Rated V_{CBO} R_{BE} = 50Ω, T_C = 100°C		.5		.5		.5	mA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 2V I_C = 0		150		150		150	mA

SECOND BREAKDOWN

$I_{S/b}$	Second Breakdown Collector Current	V_{CE} = 200V Non Rep. t_p = 1mS	1.4		1.4		1.4		A

ON CHARACTERISTICS (2)

$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 20A I_B = 1A I_C = 10A I_B = .5A		3 1.5		3 1.5		3 1.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10A I_B = .5A T_C = 100°C		1.8		1.8		1.8	V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10A I_B = .5A		2.5		2.5		2.5	V
h_{FE}	DC Current Gain	I_C = 10A V_{CE} = 5V I_C = 20A V_{CE} = 5V	100 25		100 25		100 25		
V_F	Collector-Emitter Diode Forward Voltage	I_F = 10A		1.9		1.9		1.9	V

(1) See Figure 8
(2) Pulse Test: Pulse Width = 300μs, Duty Cycle ≤ 2%.

Figure 2 — SOA Curve Forward Bias

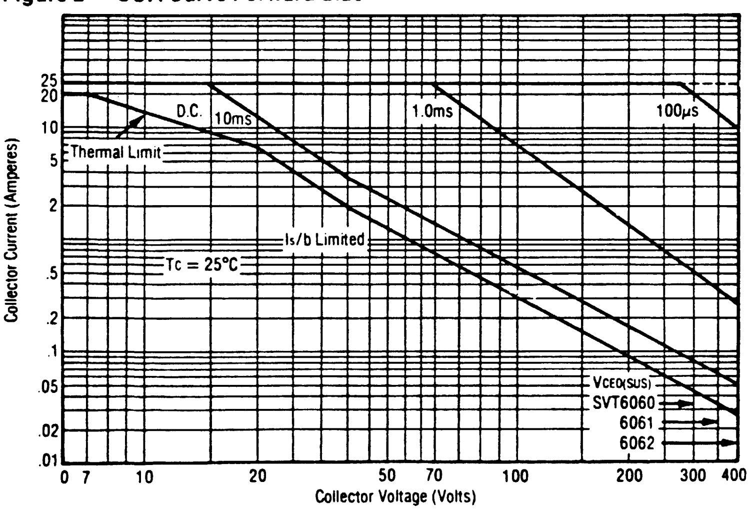


Figure 3 — Power Derating

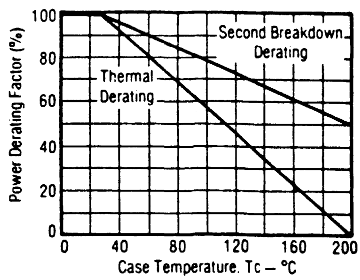
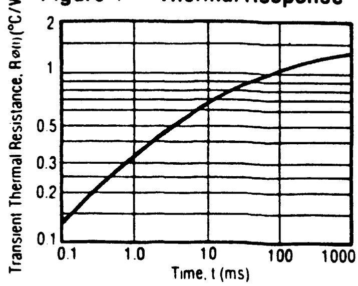


Figure 4 — Thermal Response



ELECTRICAL CHARACTERISTICS (Tc = 25°C unless otherwise noted)

DYNAMIC CHARACTERISTICS

Symbol	Characteristic	Test Conditions	SVT6060		SVT6061		SVT6062		
			Min	Max	Min	Max	Min	Max	Unit
h_{fe}	Small Signal Current Gain	I_C = 1A, V_{CE} = 10V f_{test} = 1.0MHz	100		100		100		
C_{OB}	Output Capacitance	V_{CB} = 10V I_E = 0, f_{test} = 1.0MHz	150	350	150	350	150	350	pF

SWITCHING CHARACTERISTICS (1)

Resistive Load			Typ	Max	Typ	Max	Typ	Max	
t_d	Delay Time	V_{CC} = 300V I_C = 10A		06		06		.06	μs
t_r	Rise Time	I_{B1} = .5A		.3		.3		.3	μs
t_s	Storage Time	$V_{BE(off)}$ = -5V t_p = 50μs		1 0		1.0		1.0	μs
t_f	Fall Time	t_p = 50μs		.2		.2		.2	μs

Inductive Load, Clamped									
t_s	Storage Time	V_{clamp} = 250V I_C = 10A I_{B1} = .5A	.9		.9		.9		μs
t_f	Fall Time	$V_{BE(off)}$ = -5V	.07		.07		.07		μs
t_s	Storage Time	V_{clamp} = 250V I_C = 10A I_{B1} = .5A T_C = 100°C	1.2		1.2		1.2		μs
t_f	Fall Time	$V_{BE(off)}$ = -5V T_C = 100°C	10		.10		.10		μs

(1) See Figure 8

Figure 5 — Inductive Turn Off Waveform

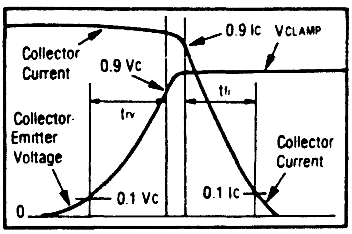


Figure 6 — Inductive Switching Performance

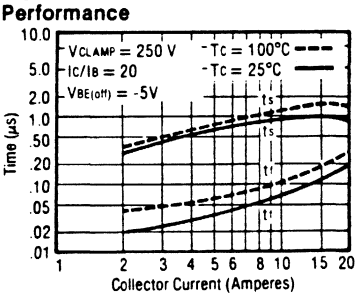


Figure 7 — Resistive Switching Performance

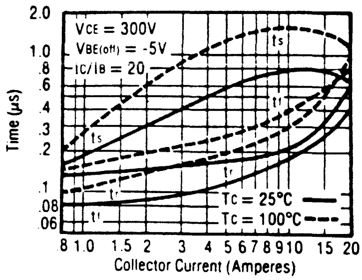


Figure 8 — Switch Time Test Circuit

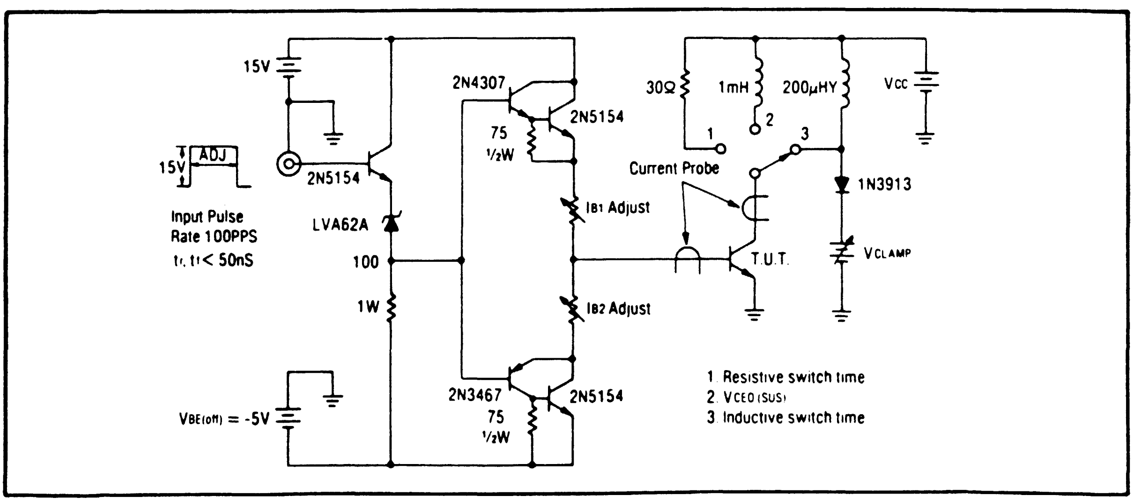


Figure 9 — Typical DC Current Gain

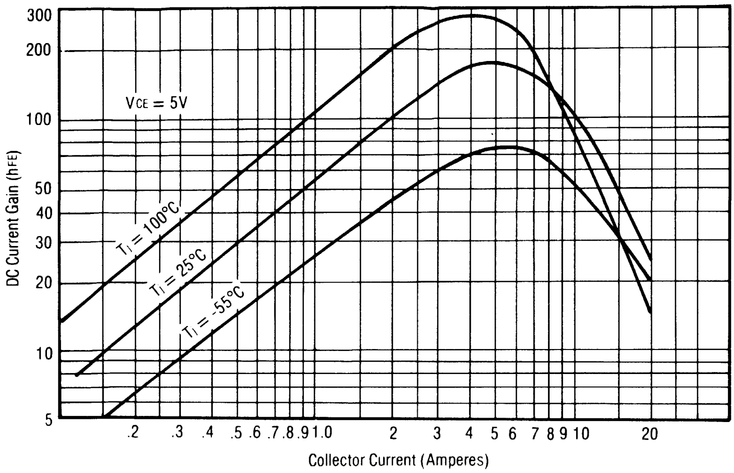


Figure 10 — Collector-Emitter Saturation Voltage

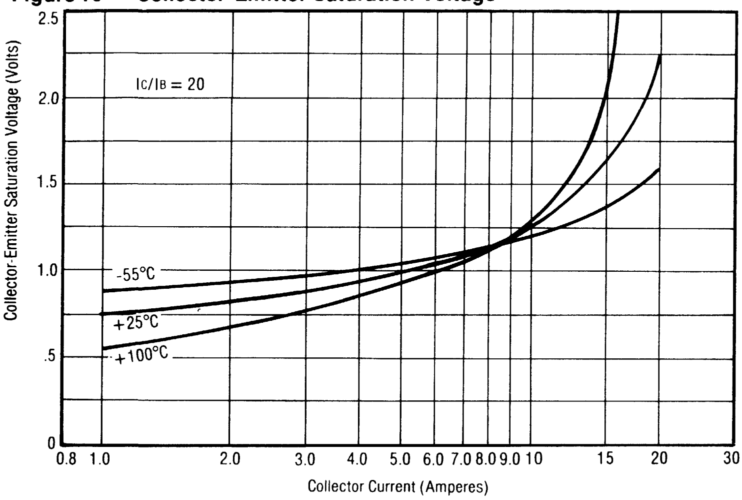


Figure 11 — Base-Emitter Voltage

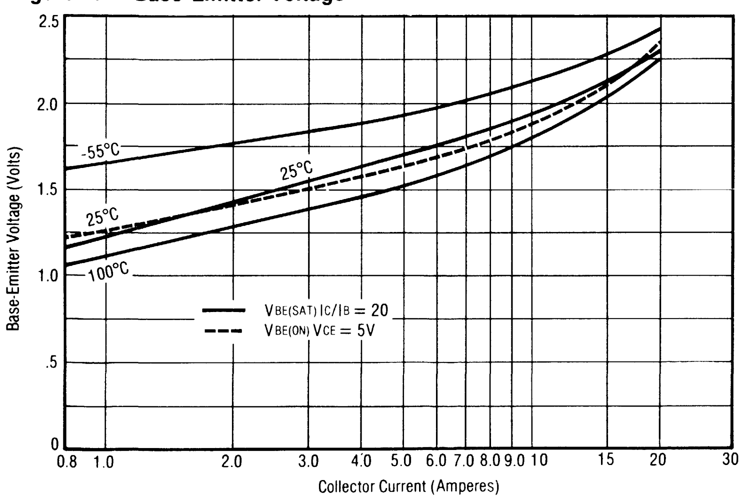


Figure 12 — Collector Saturation Region

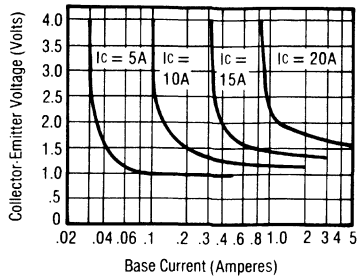
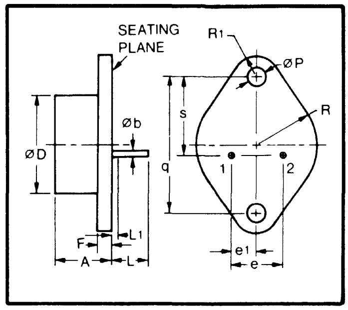


Figure 13 — DIMENSIONAL OUTLINE JEDEC TO-204MA (Formerly JEDEC TO-3)



Symbol	Inches	Millimeters	Notes
A	0.250 / 0.450	6.35 / 11.35	3
Øb	0.038 / 0.043	0.96 / 1.092	1
ØD	— / 0.875	— / 22.22	
e	0.420 / 0.440	10.67 / 11.17	2
e1	0.205 / 0.225	5.21 / 5.71	2
F	0.060 / 0.135	1.53 / 3.42	
L	0.312 / 0.500	7.93 / 12.70	
L1	— / 0.050	— / 1.27	1
ØP	0.151 / 0.161	3.836 / 4.089	
q	1.177 / 1.197	29.90 / 30.40	
R	0.495 / 0.525	12.58 / 13.33	
R1	0.131 / 0.188	3.33 / 4.77	
s	0.655 / 0.675	16.64 / 17.14	

Notes:

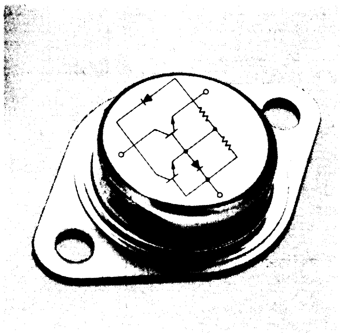
1. Øb applies between L1 and L. Diameter is uncontrolled in L1.
2. These dimensions shou'd be measured at points 0.050 in. (1.270mm) to 0.055 in. (1.397mm) below seating plane. When gage is not used, measurement will be made at seating plane.
3. min / max.

Terminal Connections

Pin 1 — Base Case — Collector
Pin 2 — Emitter Mounting Flange — Collector

Monolithic Darlington

400 to 500 Volts $V_{CEX(SUS)}$
10 Amperes 300 nsec



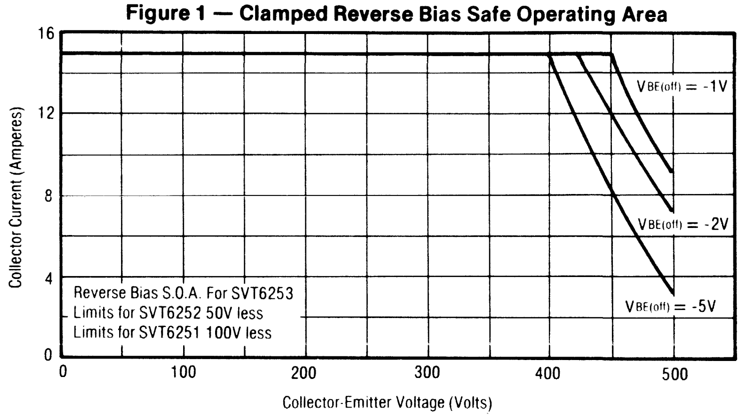
SVT6251
SVT6252
SVT6253

The SVT6250 Series are NPN, high-voltage, high-gain, Monolithic Darlington amplifiers for use in high-speed power circuits at switching frequencies to 40KHz and higher. The units are mounted in the E.I.A. standard TO-3 package. An internal diode provides rapid device turnoff. The silicon die is metallugically bonded to a molybdenum tab which in turn is bonded to the header. This mounting system provides superior resistance to thermal fatigue.

They are particularly suited for off-line applications from 115V to 230VAC sources such as:

- Switching Regulators
- PWM Inverters and Motor Controls
- Solenoid and Relay Drivers
- Deflection Circuits

Figure 1 — Clamped Reverse Bias Safe Operating Area



Maximum Ratings (T_{CASE} = 25°C)

Symbol	Characteristics	SVT6251	SVT6252	SVT6253
V_{CBO}	Collector-Base Voltage	400Vdc	450Vdc	500Vdc
V_{CEO}	Collector-Emitter Voltage	400Vdc	450Vdc	500Vdc
$I_{C(CONT)}$	Collector Current	10A	10A	10A
$I_{C(PEAK)}$	Collector Current	15A	15A	15A
$I_{B(CONT)}$	Base Current	5A	5A	5A
$I_{B(PEAK)}$	Base Current	10A	10A	10A
$I_{E(CONT)}$	Emitter Current	15A	15A	15A
$I_{E(PEAK)}$	Emitter Current	25A	25A	25A
P_T	Power Dissipation	135W	135W	135W

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max.	Unit
Thermal Resistance Junction to Case	$R_{\theta JC}$	1.3	°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	T_L	275	°C
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-65 to +200	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

OFF CHARACTERISTICS (1)

Symbol	Characteristic	Test Conditions	SVT6251		SVT6252		SVT6253		Unit
			Min	Max	Min	Max	Min	Max	
$V_{CEO(sus)}$	Collector-Emitter Sustaining Voltage	I_C = 2A I_{B1} = .1A I_{B2} = 0 L = 1mH	350		400		450		V
$V_{CEX(sus)}$	Collector-Emitter Sustaining Voltage	I_C = 9A I_{B1} = .5A $V_{BE(off)}$ = −1V	400		450		500		V
$V_{CEX(sus)}$	Collector-Emitter Sustaining Voltage	I_C = 15A I_{B1} = 1.5A $V_{BE(off)}$ = −1V	350		400		450		V
I_{CEO}	Collector Cutoff Current	V_{CE} = Rated V_{CEO}		1		1		1	mA
I_{CEV}	Collector Cutoff Current	V_{CE} = Rated V_{CBO} $V_{BE(off)}$ = −1.5V T_C = 150°C		.5		.5		.5	mA
I_{CER}	Collector Cutoff Current	V_{CE} = Rated V_{CBO} R_{BE} = 50Ω, T_C = 100°C		.5		.5		.5	mA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 2V I_C = 0		150		150		150	mA

SECOND BREAKDOWN

Symbol	Characteristic	Test Conditions	SVT6251 Min	SVT6251 Max	SVT6252 Min	SVT6252 Max	SVT6253 Min	SVT6253 Max	Unit
$I_{S/b}$	Second Breakdown Collector Current	V_{CE} = 200V Non Rep. t_p = 1mS	1.4		1.4		1.4		A

ON CHARACTERISTICS (2)

Symbol	Characteristic	Test Conditions	SVT6251 Min	SVT6251 Max	SVT6252 Min	SVT6252 Max	SVT6253 Min	SVT6253 Max	Unit
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 5A I_B = .25A I_C = 10A I_B = .5A		1.5 2.5		1.5 2.5		1.5 2.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10A I_B = .5A T_C = 100°C		3.0		3.0		3.0	V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10A I_B = .5A		2.5		2.5		2.5	V
h_{FE}	DC Current Gain	I_C = 10A V_{CE} = 5V I_C = 5A V_{CE} = 5V		40 100		40 100		40 100	
V_F	Collector-Emitter Diode Forward Voltage	I_F = 10A		1.9		1.9		1.9	V

(1) See Figure 8

(2) Pulse Test: Pulse Width = 300μs, Duty Cycle ≤ 2%.

Figure 2 — SOA Curve Forward Bias

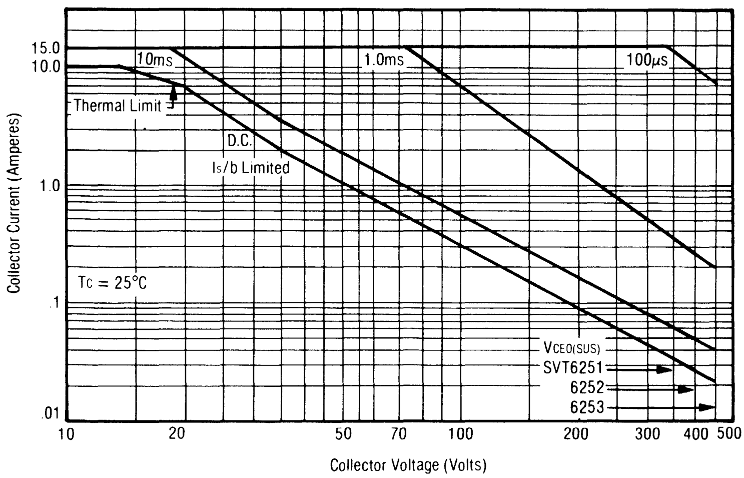


Figure 3 — Power Derating

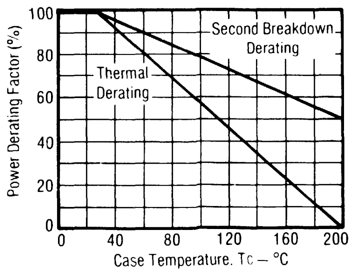
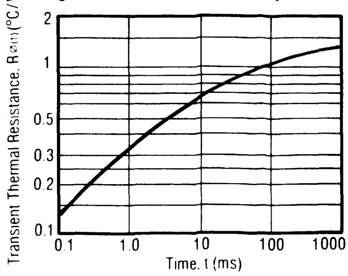


Figure 4 — Thermal Response



ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

DYNAMIC CHARACTERISTICS

Symbol	Characteristic	Test Conditions	SVT6251		SVT6252		SVT6253		
			Min	Max	Min	Max	Min	Max	Unit
h_{fe}	Small Signal Current Gain	I_C = 1A, V_{CE} = 10V f_{test} = 1.0MHz	100		100		100		
C_{OB}	Output Capacitance	V_{CB} = 10V I_E = 0, f_{test} = 1.0MHz	150	350	150	350	150	350	pF

SWITCHING CHARACTERISTICS (1)

Resistive Load			Typ	Max	Typ	Max	Typ	Max	
t_d	Delay Time	V_{CC} = 300V I_C = 10A		.06		.06		.06	μs
t_r	Rise Time	I_{B1} = .5A		.5		.5		.5	μs
t_s	Storage Time	$V_{BE(off)}$ = -5V		1.2		1.2		1.2	μs
t_f	Fall Time	t_p = 50μs		.3		.3		.3	μs

Inductive Load, Clamped									
t_s	Storage Time	V_{clamp} = 250V I_C = 10A I_{B1} = .5A	.9		.9		.9		μs
t_f	Fall Time	$V_{BE(off)}$ = -5V	.07		.07		.07		μs
t_s	Storage Time	V_{clamp} = 250V I_C = 10A I_{B1} = .5A T_C = 100°C	1.2		1.2		1.2		μs
t_f	Fall Time	$V_{BE(off)}$ = -5V	.10		.10		.10		μs

(1) See Figure 8

Figure 5 — Inductive Turn Off Waveform

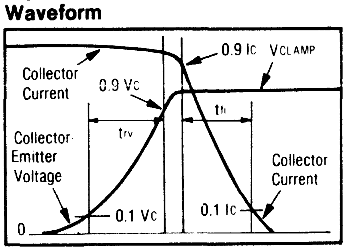


Figure 6 — Inductive Switching Performance

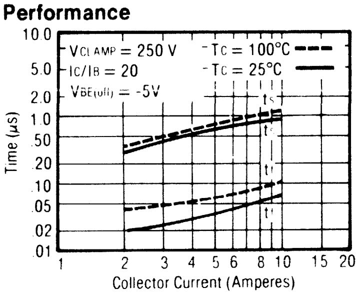


Figure 7 — Resistive Switching Performance

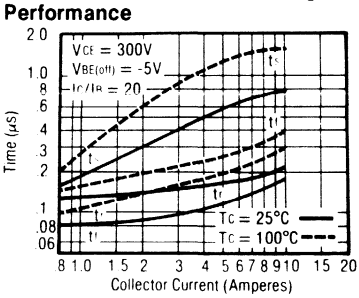


Figure 8 — Switch Time Test Circuit

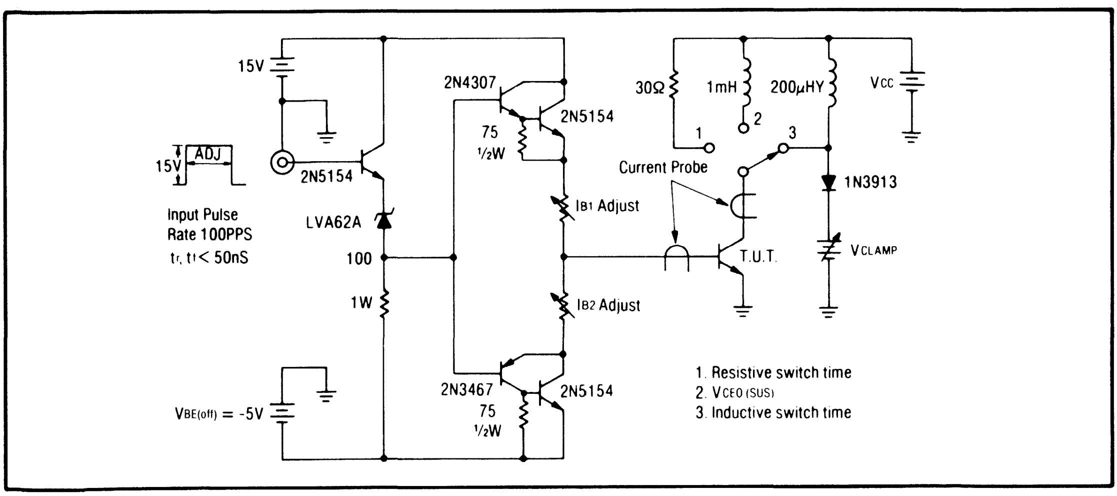


Figure 9 — Typical DC Current Gain

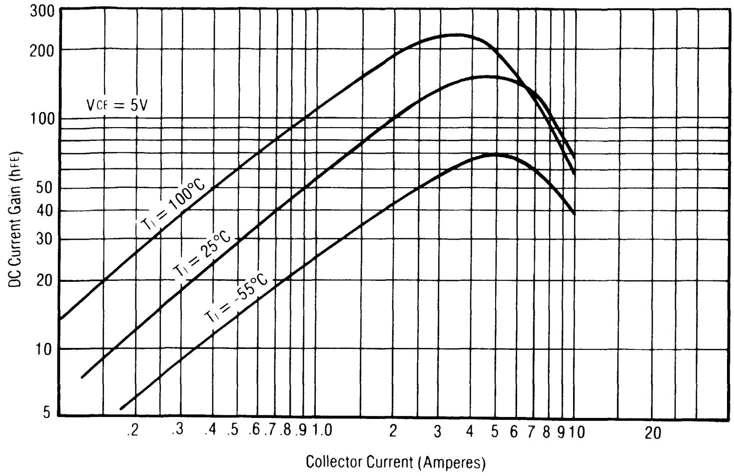


Figure 10 — Collector-Emitter Saturation Voltage

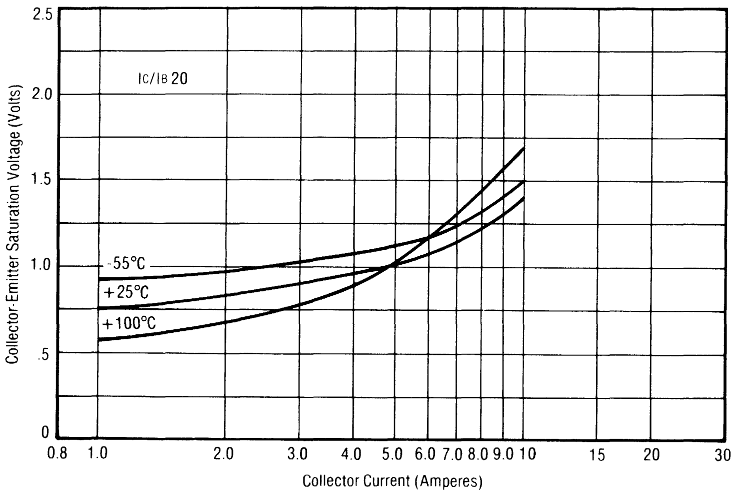


Figure 11 — Base-Emitter Voltage

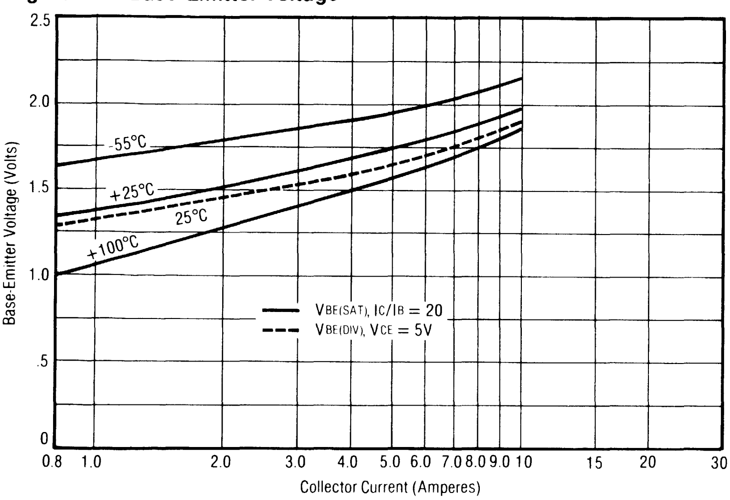


Figure 12 — Collector Saturation Region

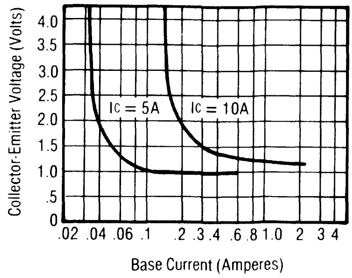
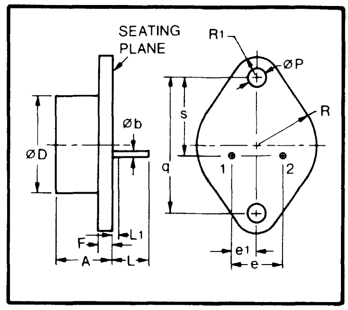


Figure 13 — DIMENSIONAL OUTLINE JEDEC TO-204MA (Formerly JEDEC TO-3)



Symbol	Inches	Millimeters	Notes
A	0.250 / 0.450	6.35 / 11.35	3
Øb	0.038 / 0.043	0.96 / 1.092	1
ØD	— / 0.875	— / 22.22	
e	0.420 / 0.440	10.67 / 11.17	2
e1	0.205 / 0.225	5.21 / 5.71	2
F	0.060 / 0.135	1.53 / 3.42	
L	0.312 / 0.500	7.93 / 12.70	
L1	— / 0.050	— / 1.27	1
ØP	0.151 / 0.161	3.836 / 4.089	
q	1.177 / 1.197	29.90 / 30.40	
R	0.495 / 0.525	12.58 / 13.33	
R1	0.131 / 0.188	3.33 / 4.77	
s	0.655 / 0.675	16.64 / 17.14	

Notes:

1. Øb applies between L1 and L. Diameter is uncontrolled in L1.
2. These dimensions should be measured at points 0.050 in. (1.270mm) to 0.055 in. (1.397mm) below seating plane. When gage is not used, measurement will be made at seating plane.
3. min / max

Terminal Connections

Pin 1 — Base   Case — Collector
Pin 2 — Emitter   Mounting Flange — Collector

TRW

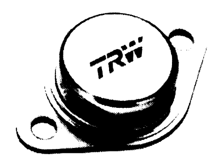
SVT7600 Series

300 Volt – 30 Amps Fast Switching Low $V_{CE(SAT)}$ Power Transistors

- **350 Volts**
- **30 Amps**
- **50 MHz**

These devices are most reliable for high frequency switching regulators, class "D" amplifiers and converters.

The silicon die is mounted to a molybdenum tab using gold eutectic, which is brazed to TO-3 header. This mounting system provides superior resistance to thermal fatigue. Ideally suited for high reliability military applications.



TO-3*

Electrical Characteristics

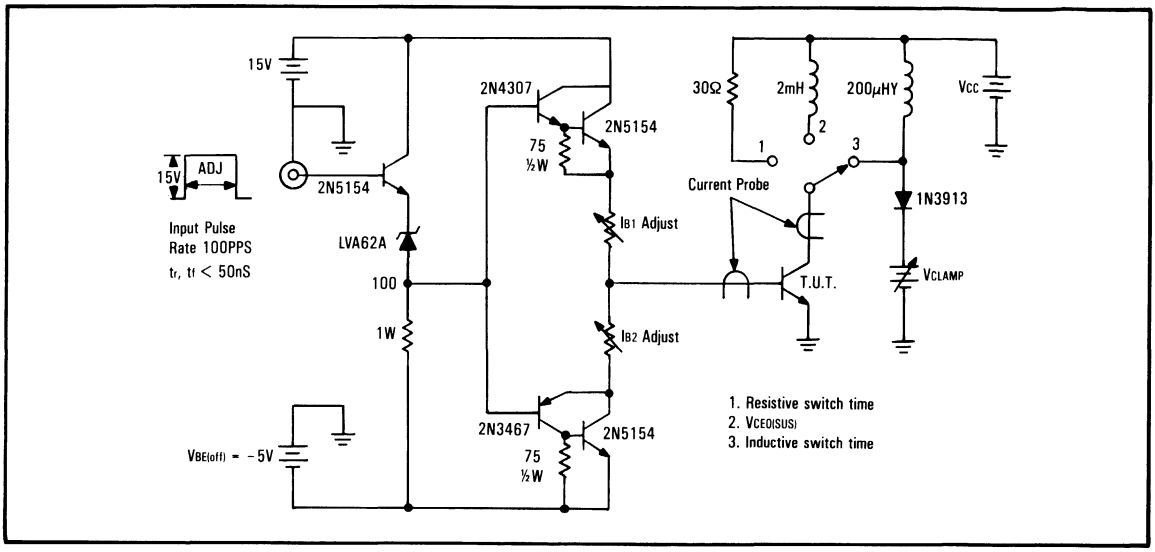
Symbol	Characteristics	Test Conditions	SVT7602 (SVT300-10) Min.	SVT7602 Max.	SVT7601 (SVT250-10) Min.	SVT7601 Max.	SVT7600 (SVT200-10) Min.	SVT7600 Max.
$V_{CEO(SUS)}$	Collector-Emitter Sustaining Voltage	I_C = 50mA	300V		250V		200V	
V_{CBO}	Collector-Base Voltage	I_C = 1.0mA	400V		350V		300V	
V_{EBO}	Emitter-Base Voltage	I_E = .100mA	7V		7.0V		7.0V	
$V_{CE(SAT)}$	Collector Saturation Voltage	I_C = 10.0A, I_B = 1.0A		.8V		.8V		.8V
$V_{BE(SAT)}$	Base Saturation Voltage	I_C = 10.0A, I_B = 1.0A		1.2V		1.2V		1.2V
H_{FE}	D.C. Current Gain	I_C = 10.0A, V_{CE} = 5.0V	20		20		20	
H_{FE}	D.C. Current Gain	I_C = 30.0A, V_{CE} = 5.0V	5		5		5	
T_r	Rise Time	I_C = 10A, V_{CC} = 150V, I_{B1} = I_{B2} = 1.0A		200Ns		200Ns		200Ns
T_s	Storage Time	I_C = 10A, V_{CC} = 150V, I_{B1} = I_{B2} = 1.0A		1.7μs		1.7μs		1.7μs
T_f	Fall Time	I_C = 10A, V_{CC} = 150V, I_{B1} = I_{B2} = 1.0A		400Ns		400Ns		400Ns
F_f	Gain Bandwidth Product	I_C = .5A, V_{CE} = 10V	50MHz		50MHz		50MHz	

Absolute Maximum Ratings

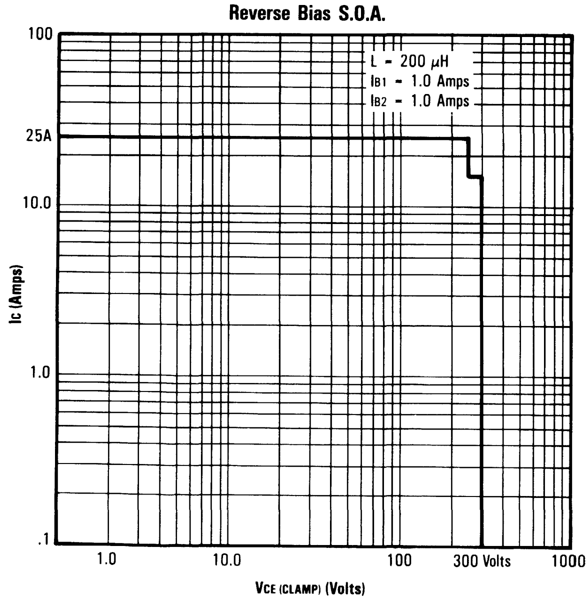
Symbol	Characteristics	SVT7602	SVT7601	SVT7600
V_{CBO}	Collector-Base Voltage	400V	350V	300V
V_{CEO}	Collector-Emitter Voltage	300V	250V	200V
V_{EBO}	Base-Emitter Voltage	7.0V	7.0V	7.0V
I_C-P_K	Collector-Current P_K	30A	30A	30A
P_T	Power Dissipation	150W	150W	150W
θ_{jc}	Thermal Resistance	1.0°C/W	1.0°C/W	1.0°C/W
T_{OP}	Operating Temp.	-65°C–187±12°C	-65°C–187±12°C	-65°C–187±12°C
$T_{storage}$	Storage Temp.	-65°C–200°C	-65°C–200°C	-65°C–200°C

***TO-61 package also available.**

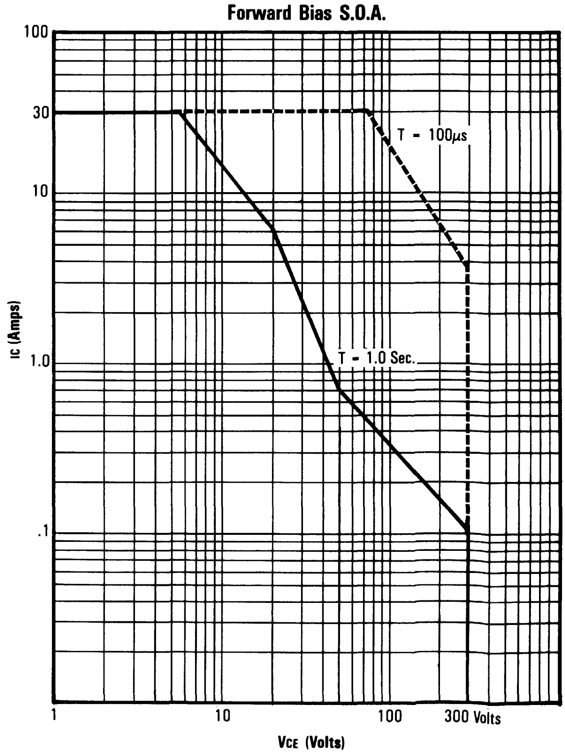
Figure 8 – Switch Time Test Circuit



Reverse Bias S.O.A.



Forward Bias S.O.A.

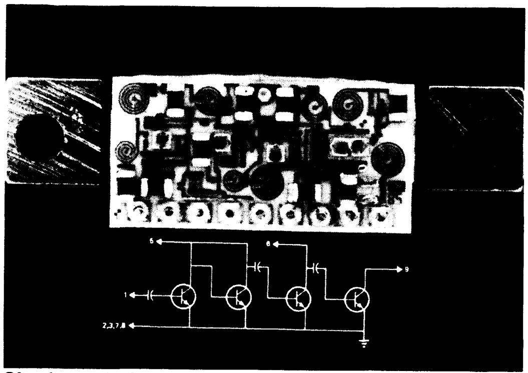


General Purpose Linear Hybrid RF Amplifiers

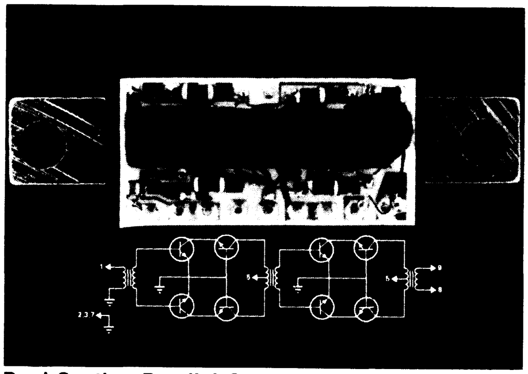
These linear RF amplifiers provide a single solution for small to medium signal RF amplification in numerous applications.

Featuring bandwidths up to 1 GHz, high gain, high ITO and low noise, these 17 products find wide applications in CATV, MATV, communications, instrumentation, TV and other service.

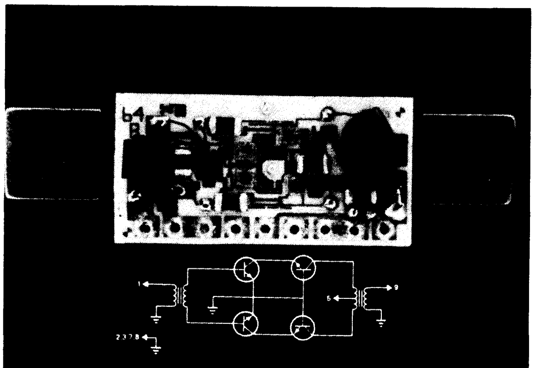
Hermetic package option is available for military applications.



Single-ended Amplifier
(30 dB gain)

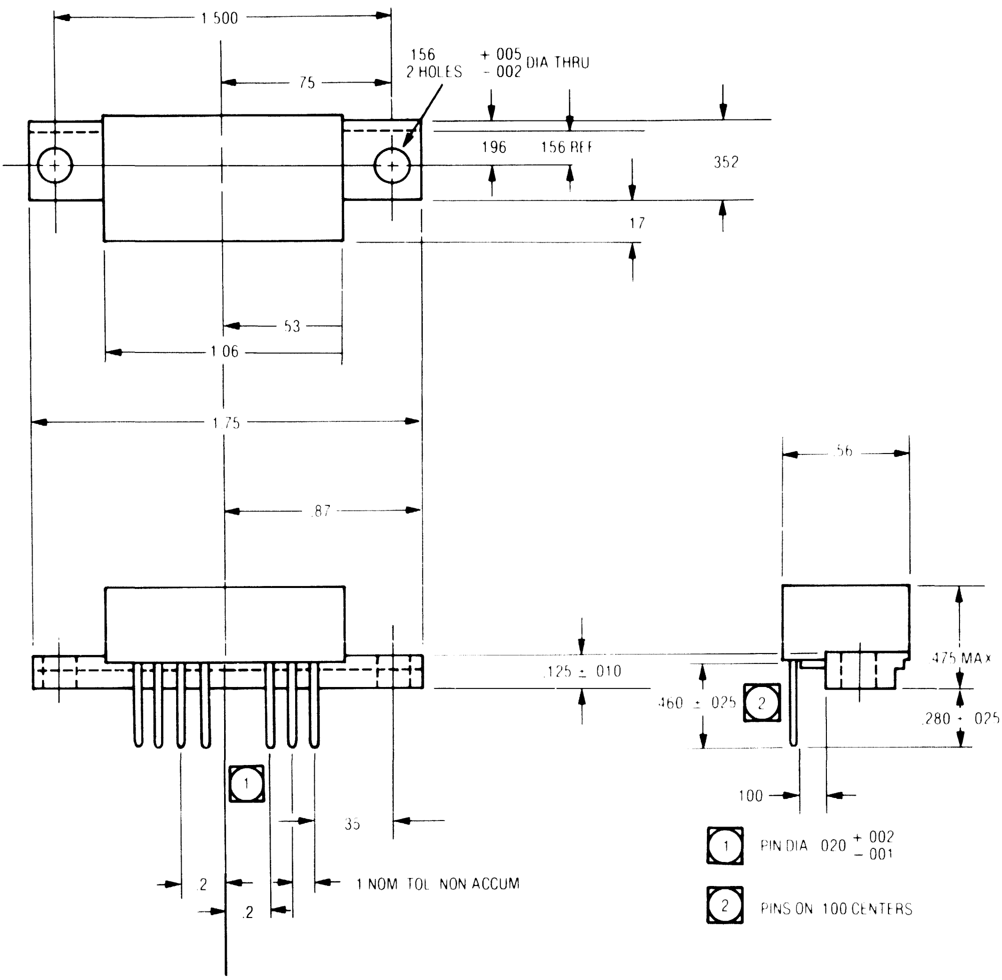


Dual Section Parallel Cascode
(33-36 dB gain)



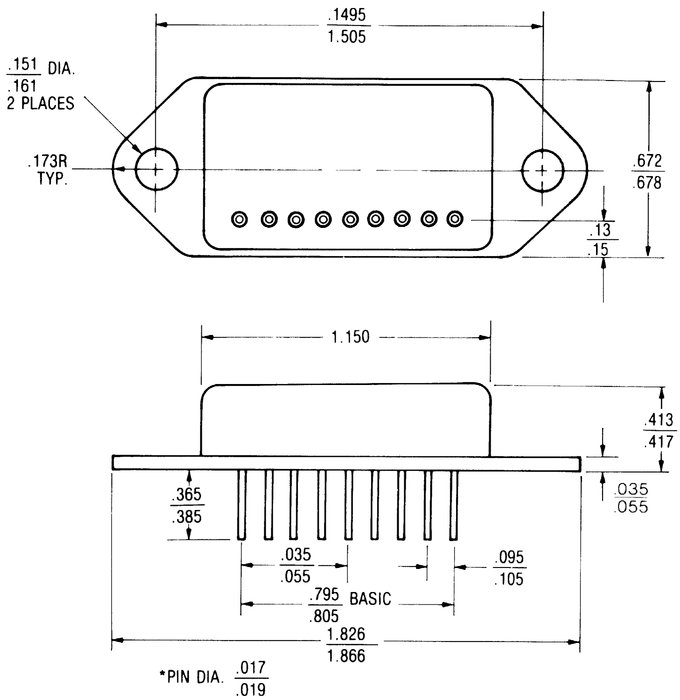
Single Section Parallel Cascode
(17-22 dB gain)

Low Profile Package Option

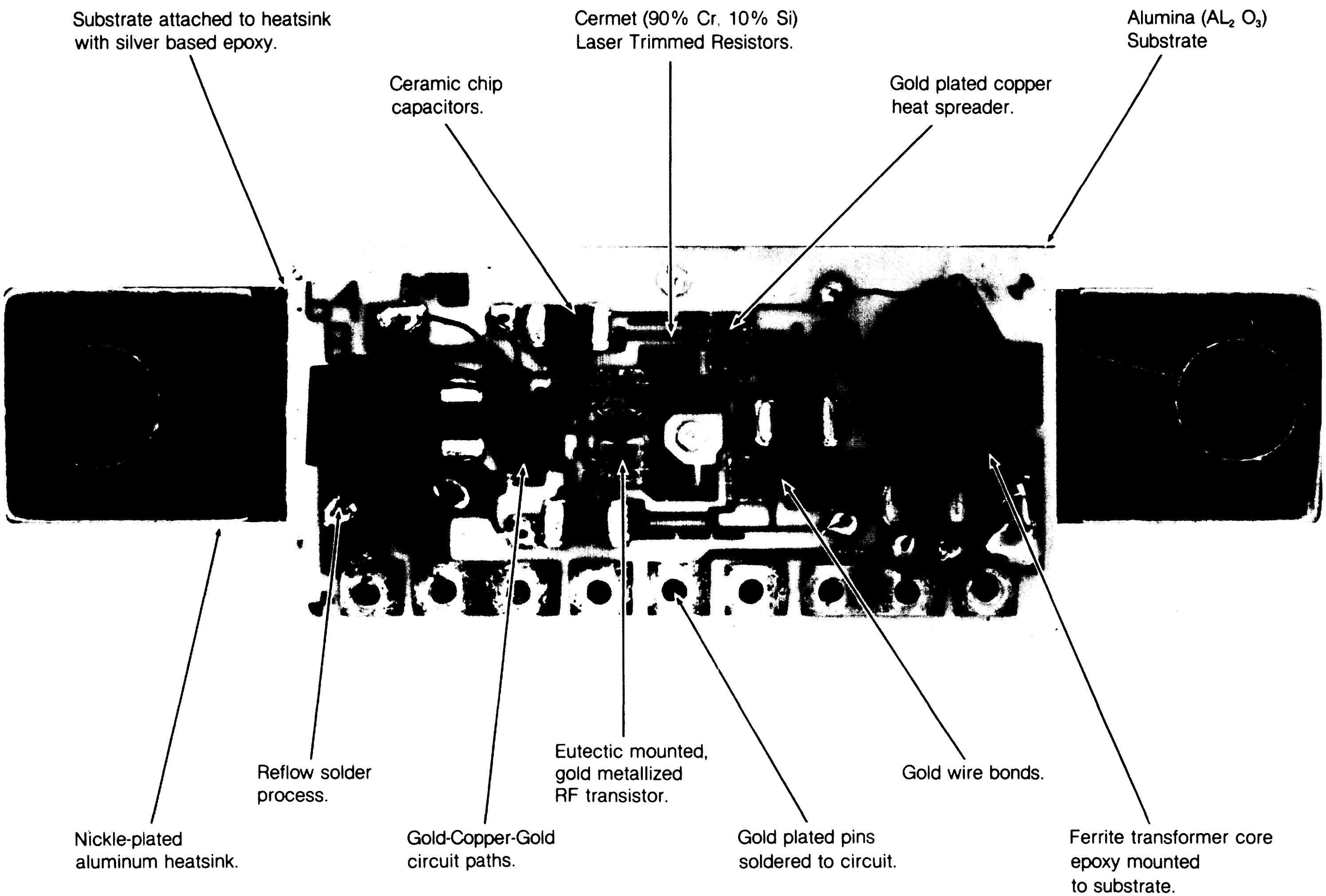


This option is available on the following parts:
CA2830, order part # CA2833
CA2842, order part # CA2846
CA2850R, order part # CA2851R
CA2876R, order part # CA2880R

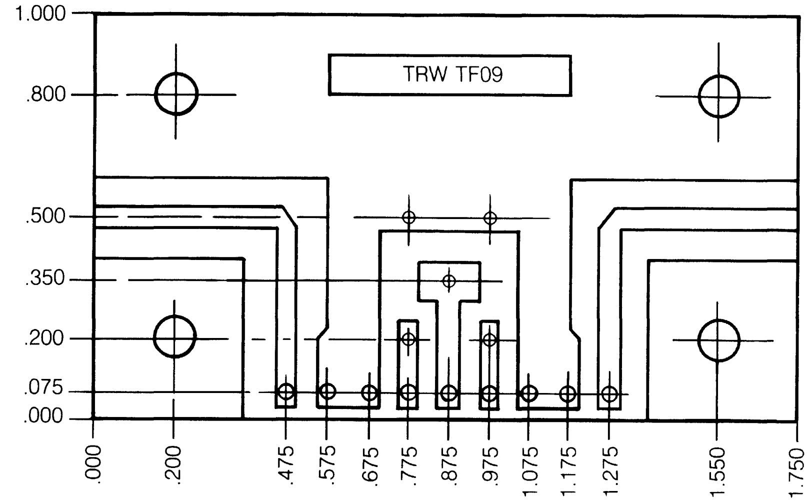
Hermetic Package Option



- All units 100% tested for hermeticity.
- Now available for all TRW RF linear hybrid amplifiers!
- Electrical performance remains unchanged!
- Specify hermetic package option by adding "H" suffix to part number.



22 dB Gain Block



LEGEND: 1. HOLE DIA .037 PLATED THRU FINISHED DIA .033 TYP OF 4

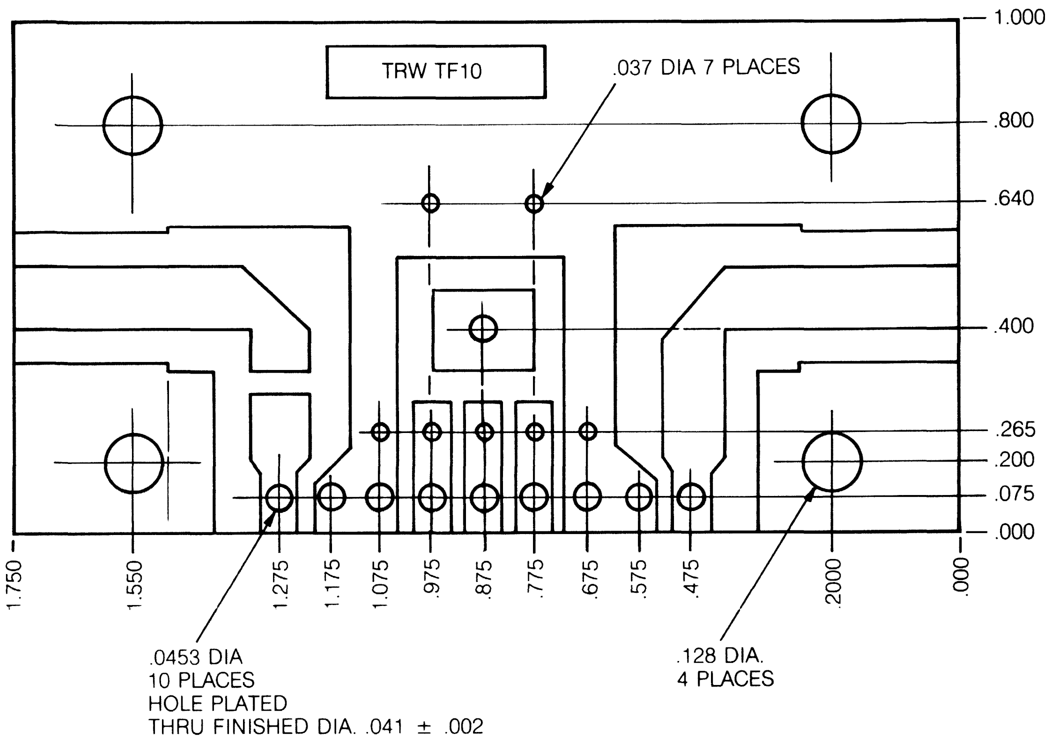
2. HOLE DIA .0453 PLATED THRU FINISHED DIA .041 TYP OF 10

3. HOLE DIA .128 PLATED THRU FINISHED DIA .124 TYP OF 4

NOTES:
1. MATERIAL: DOUBLE SIDED GLASS EPOXY G10
   THICKNESS .062 ± .005 1 OZ.
   MICAPLY EG-758-T OR EQUIVALENT
2. STRIPLINE WIDTH .055 ± .002
3. SOLDER PLATED THRU HOLES AND SURFACES.

Figure 1

P.C. Board for Hybrid Amplifier Test Fixture

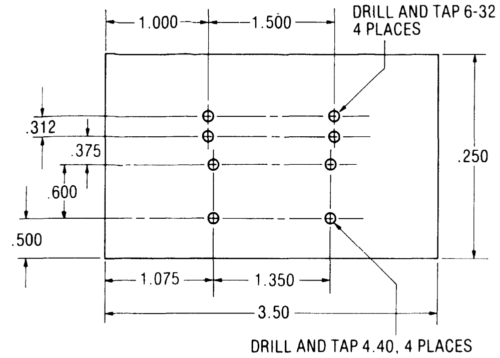


NOTES:
1. MATERIAL, DOUBLE SIDED GLASS EPOXY, G10. MICAPLY EG-758-T OR EQUIVALENT
2. THICKNESS .062 ± .005
3. STRIPLINE WIDTH .120 ± .004
4. SOLDER PLATE SURFACES AND HOLES

Figure 2

P.C. Board for Hybrid Amplifier Test Fixture

NOTE: TF08 is used for models CA2812 and CA2820 only.
All other models use TF09 (Figure 1).



NOTES:
1. All dimensions in inches, tolerance ± .005.
2. Material is 3/8 aluminum.

FIGURE 3: HEATSINK BASE PLATE CONSTRUCTION FOR HYBRID AMPLIFIER TEST FIXTURE

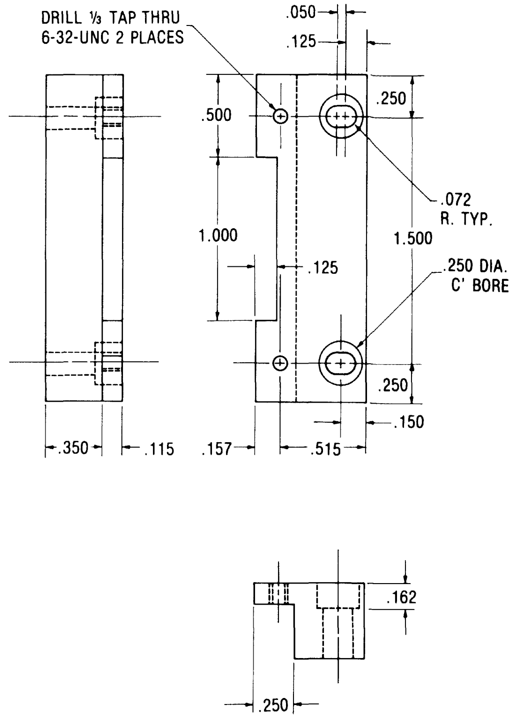


FIGURE 4: ADAPTER FOR HERMETIC PACKAGE TO STANDARD HYBRID AMPLIFIER TEST FIXTURES

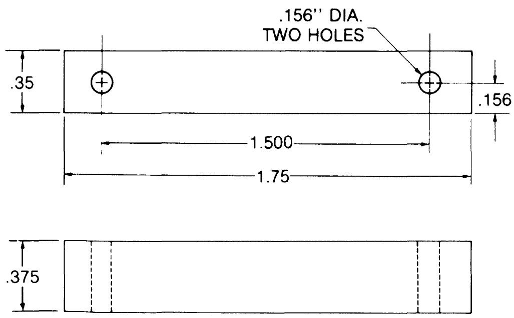
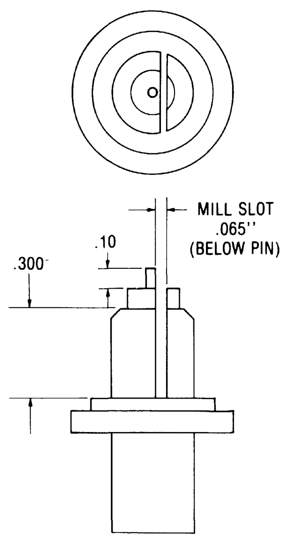


FIGURE 5: ADAPTER FOR LOW PROFILE PACKAGE TO STANDARD HYBRID AMPLIFIER TEST FIXTURES



AMPHENOL P/N US-625/U (50Ω)
TROPOMETER P/N UBJ-20 (75Ω)

FIGURE 6: MODIFICATIONS TO BNC CONNECTOR

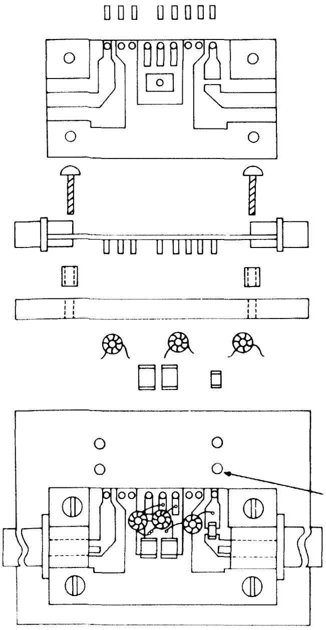


FIGURE 7: CA2820 AND CA2812 TEST FIXTURE ASSEMBLY

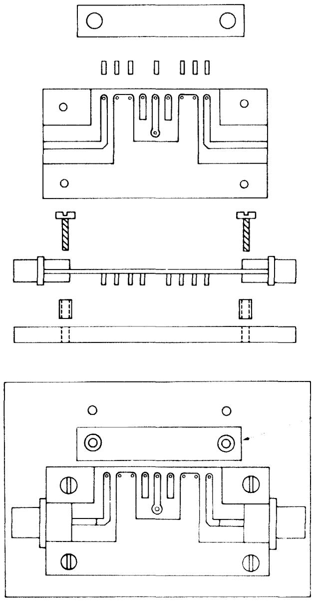


FIGURE 8: TEST FIXTURE ASSEMBLY FOR TRW HYBRID AMPLIFIERS IN LOW PROFILE PACKAGE

NOTE: SOCKETS ARE MOUNTED INTO PLATED-THROUGH HOLES WITH INSERTION TOOL: AUGUT P/N 398-HK-001.

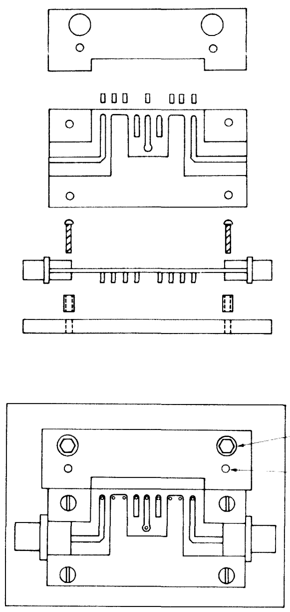
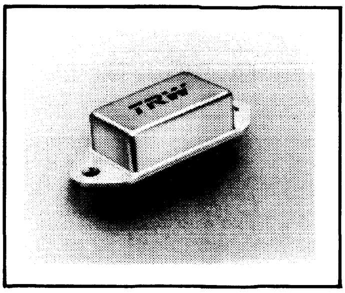


FIGURE 9: TEST FIXTURE ASSEMBLY FOR TRW HYBRID AMPLIFIERS IN HERMETIC PACKAGE

TRW

CA2800H Wide Bandwidth Linear Hybrid Amplifier

- **Power Output, 800mW**
- **17dB Gain**
- **400mW PEP @ −32dB IMD**
- **Instantaneous Bandwidth, 10-400MHz**
- **Low Noise Figure, 5dB**



The CA2800H is a high-reliability thin-film hybrid amplifier utilizing an all gold metalization system. Units are designed for wide bandwidth linear operation in 50 to 100 ohm systems. This hybrid provides excellent gain stability with temperature and very low distortion due to push-pull amplifier circuitry. This module is recommended for wide bandwidth, low noise and linear applications.

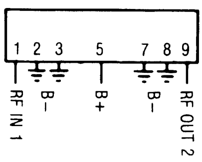
Absolute Maximum Ratings

V_{CC}	RF Power Input	Storage Temperature	Operating Temperature
28 Volts	+16dBm	−40 °C to +100 °C	−20 °C to +90 °C

Electrical Characteristics for 50Ω Systems (T_{CASE} = 25 °C and 24V)

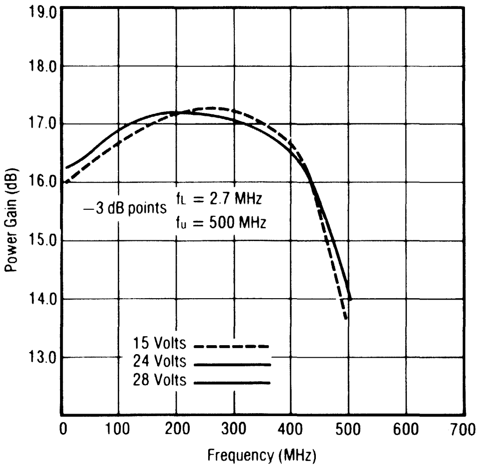
Symbol	Characteristic	Conditions	Value
P_G	Power Gain	f = 50MHz	17 ±0.75dB
NF	Noise Figure, Broadband	f = 60MHz f = 300MHz	5.0dB Typ 8.5dB Typ
I_{TO}	Third Order Intercept, See Figure 1	f_1 = 300MHz	+44dBm Typ
VSWR	Input/Output VSWR for 50Ω Systems	f = 10-400MHz	2:1 Typ
I_{CC}	Supply Current	24V	220mA Max
P_O	Power Output — 1dB Compression	f = 200MHz	800mW
P_{RI}	Reverse Isolation	f = 10-400MHz	25dB Typ
F_R	Frequency Response	f = 30-300MHz f = 10-400MHz	±0.5dB Max ±1dB Max
dso	Second Harmonic Distortion	Tone at 10mW f_{2H} = 10-300MHz	−66dB Typ
PEP	Peak Envelope Power for Two Tone Distortion Test, See Figure 1	f = 10-300MHz at −32dB	400mW Typ

PIN CONFIGURATION

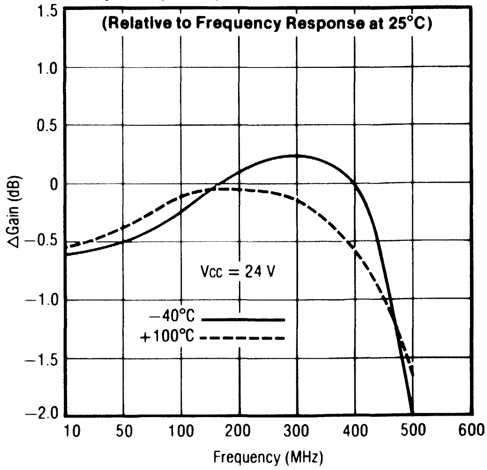


CA2800H

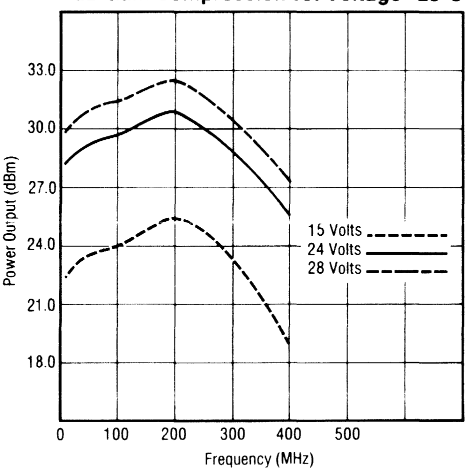
Frequency Response 25°C



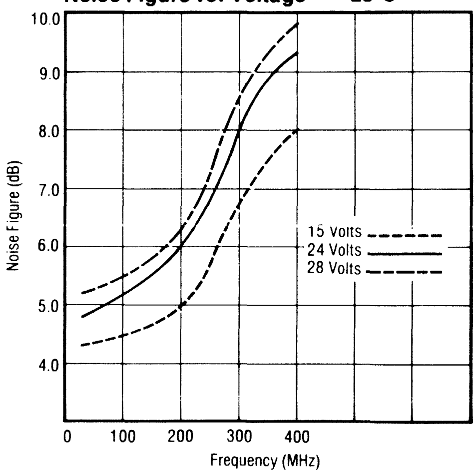
Frequency Response vs. Temperature



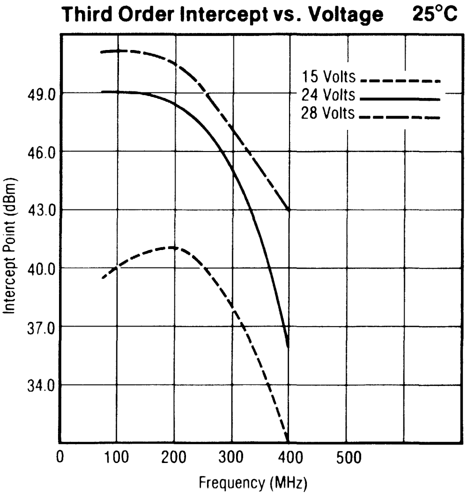
1 dB Gain Compression vs. Voltage 25°C



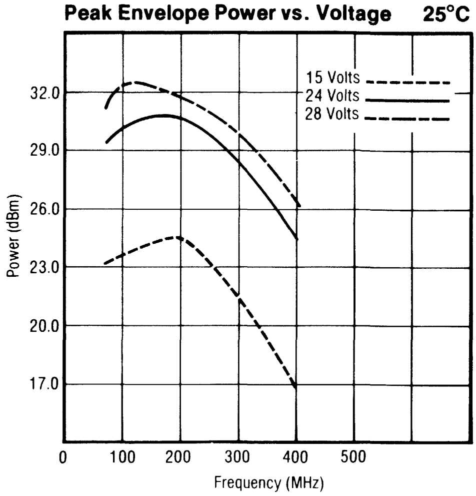
Noise Figure vs. Voltage 25°C



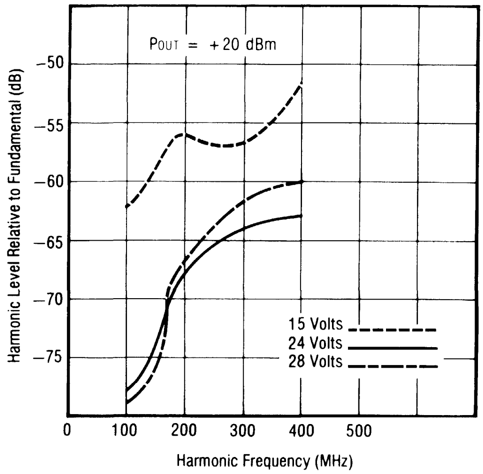
Third Order Intercept vs. Voltage 25°C



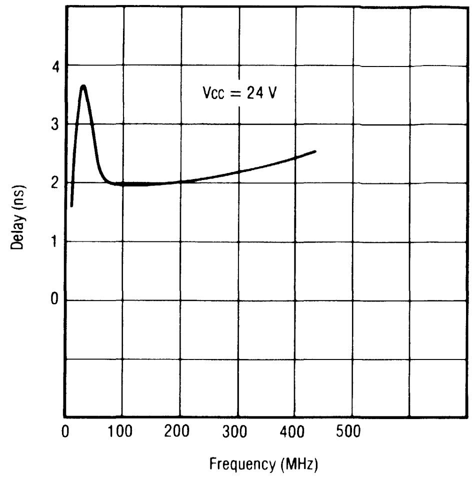
Peak Envelope Power vs. Voltage 25°C



Second Harmonic Distortion vs.Voltage 25°C



Group Delay vs. Frequency 25°C



S-Parameters

Biased at 24 Volts

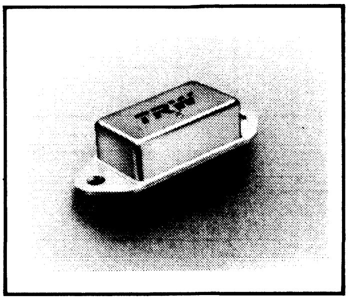
T = 25°C Zo = 50Ω

Frequency (MHz)	S11		S21		S12		S22	
	Mag	**Ang**	**Mag**	**Ang**	**Mag**	**Ang**	**Mag**	**Ang**
10	-8.3	19.3	16.3	14.5	-24.2	-165	-9.7	36.5
100	-12.2	-21.0	16.8	-64.5	-23.8	135	-13.1	-29.3
200	-22.1	28.8	17.2	-136	-23.6	83	-22.0	30.0
300	-12.4	39.4	17.0	145	-24.6	27	-12.1	41.7
400	-11.0	17.6	16.2	63.1	-27.0	-34	-8.3	7.5

Magnitude in dB, Phase Angle in degrees.

CA2810H Wide Bandwidth Linear Hybrid Amplifier

- **Power Output, 800mW**
- **33dB Gain**
- **400mW PEP @ −32dB IMD**
- **Instantaneous Bandwidth, 10-350MHz**
- **Low Noise Figure, 4.5dB**



The CA2810H is a high-reliability thin-film amplifier utilizing an all gold metalization system. Units are designed for wide bandwidth linear operation in 50 to 100 ohm systems. This hybrid provides excellent gain stability with temperature and very low distortion due to push-pull amplifier circuitry. This module is recommended for wide bandwidth, low noise and linear applications.

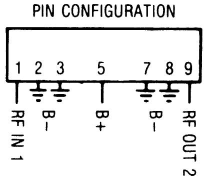
Absolute Maximum Ratings

V_{CC}	RF Power Input	Storage Temperature	Operating Temperature
28 Volts	+5dBm	−40°C to +100°C	−20°C to +90°C

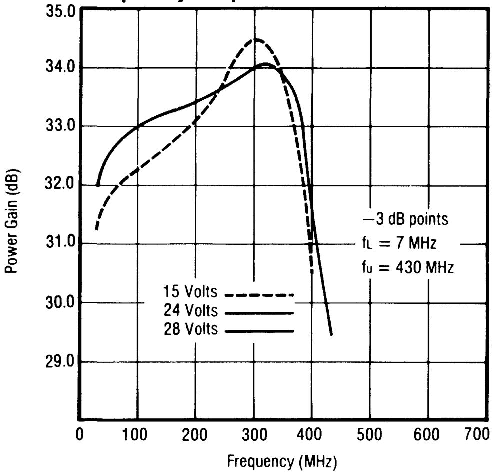
Electrical Characteristics for 50Ω Systems (T_{CASE} = 25°C and 24V)

Symbol	Characteristic	Conditions	Value
P_G	Power Gain	f = 50MHz	33 ± 1dB
NF	Noise Figure, Broadband	f = 60MHz f = 300MHz	4.5dB Typ 8.0dB Max
I_{TO}	Third Order Intercept, See Figure 1	f_1 = 300MHz	+43dBm Typ
VSWR	Input/Output VSWR for 50Ω Systems	f = 10-350MHz	2:1 Typ
I_{CC}	Supply Current	24V	330mA Max
P_O	Power Output — 1dB Compression	f = 200MHz	800mW
P_{RI}	Reverse Isolation	f = 10-350MHz	40dB Typ
F_R	Frequency Response	f = 30-300MHz f = 10-350MHz	± 1.0dB Max ± 1.5dB Max
dso	Second Harmonic Distortion	Tone at 10mW f_{2H} = 10-300MHz	−66dB Typ
PEP	Peak Envelope Power for Two Tone Distortion Test, See Figure 1	f = 10-300MHz at −32dB	400mW Typ

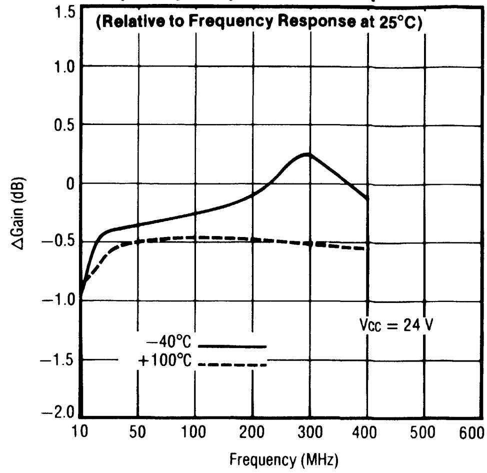
PIN CONFIGURATION



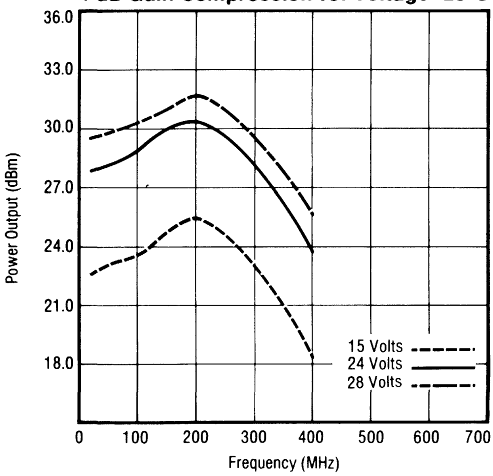
Frequency Response 25°C



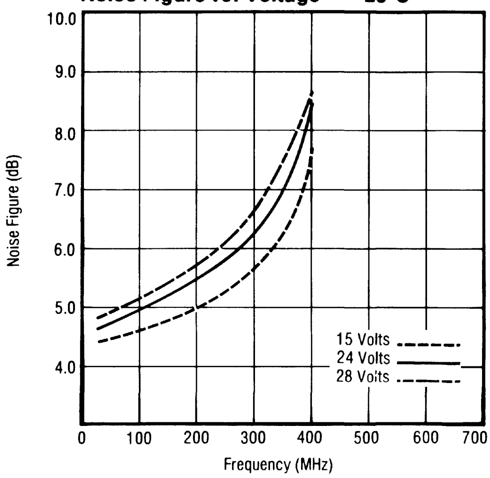
Frequency Response vs. Temperature



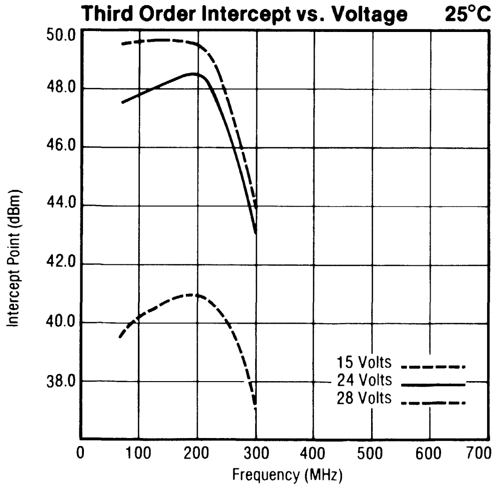
1 dB Gain Compression vs. Voltage 25°C



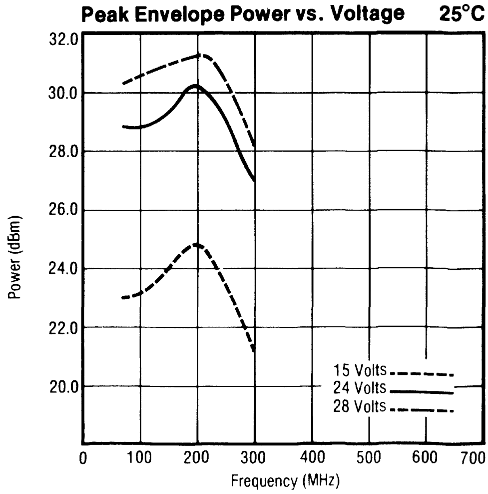
Noise Figure vs. Voltage 25°C



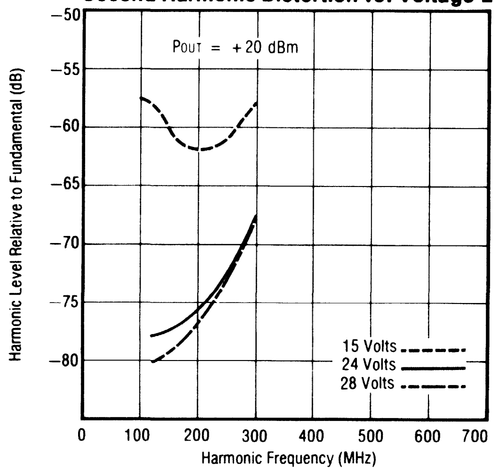
Third Order Intercept vs. Voltage 25°C



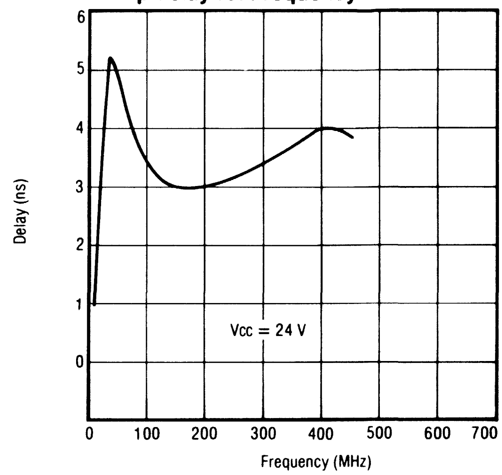
Peak Envelope Power vs. Voltage 25°C



Second Harmonic Distortion vs. Voltage 25°C



Group Delay vs. Frequency 25°C



S-Parameters

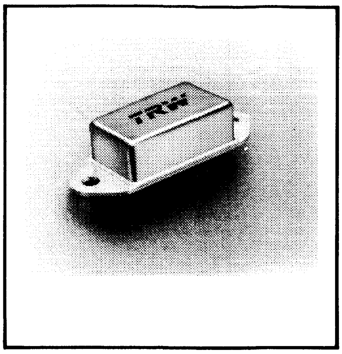
Biased at 24 Volts T = 25°C Zo = 50Ω

Frequency (MHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
30	-13.7	-1.5	31.9	-10.5	-49.0	2.7	-14.2	10.5
50	-14.0	3.6	32.4	-39.9	-48.6	-16.6	-13.9	19.0
100	-13.3	5.8	32.9	-100	-48.4	-53.7	-11.8	11.3
200	-18.7	-3.7	33.4	147	-48.2	-123	-14.1	-1.7
300	-15.2	39.4	34.0	20.9	-47.7	154	-13.2	65.3

Magnitude in dB, Phase Angle in degrees.

CA2812H Wide Bandwidth Linear Hybrid Amplifier

- **Optimized For 12 Volt Operation**
- **Instantaneous Bandwidth, 1-520MHz**
- **30dB Gain**
- **Power Output, 250mW Minimum**
- **Low Cost Single Ended Design**
- **Unconditional Stability Under All Mismatch Conditions**



The CA2812H is a high-reliability thin-film hybrid amplifier utilizing an all gold metallization system. Units are designed for widest bandwidth linear operation in 50 ohm systems. The linear class A bias enables the CA2812 to drive highly reactive loads at large signal levels over its frequency range. Low end frequency response can be extended to 500KHz by increasing the value of the external RF chokes. This module is recommended for wide bandwidth, low cost and linear applications in 25 to 75 ohm systems over a wide range of supply voltages.

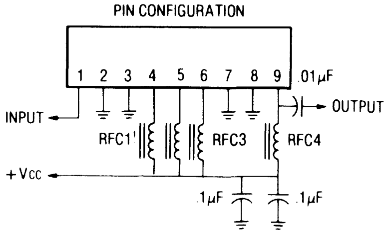
Absolute Maximum Ratings

Vcc	RF Power Input	Storage Temperature	Operating Temperature (Case)
18 Volts	+ 10dBm	− 55°C to + 125°C	− 40°C to + 100°C

Electrical Characteristics for 50Ω Systems (T_{CASE} = 25°C and 12V)

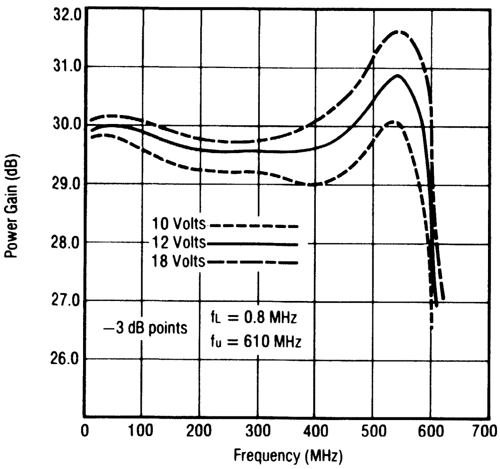
Symbol	Characteristic	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100MHz	29	30	31	dB
NF	Noise Figure, Broadband	f = 30MHz f = 500MHz	— —	5.5 8	7 10	dB
I_{TO}	Third Order Intercept, See Figure 1	f = 520MHz	+ 32	+ 34	—	dBm
VSWR	Input VSWR for 50 Ohm Systems Output VSWR for 50 Ohm Systems	f = 1-520MHz	—	1.5:1 1.8:1	2.0:1 2.0:1	N/A
I_{CC}	Supply Current	12V	300	330	360	mA
P_O	Power Output — 1dB Compression	f = 1-520MHz	250	300	—	mW
P_{RI}	Reverse Isolation	f = 1-520MHz	49	52	—	dB
F_R	Frequency Response	f = 1-520MHz	—	±0.8	±1.5	dB
d_{SO}	Second Harmonic Distortion	P_O = 10mW f_{2H} = 1-520MHz	− 40	− 50	—	dB

PIN CONFIGURATION

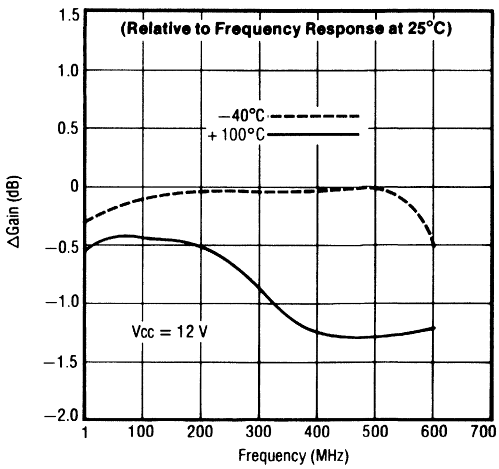


RFC1-4: 30μH CHOKE

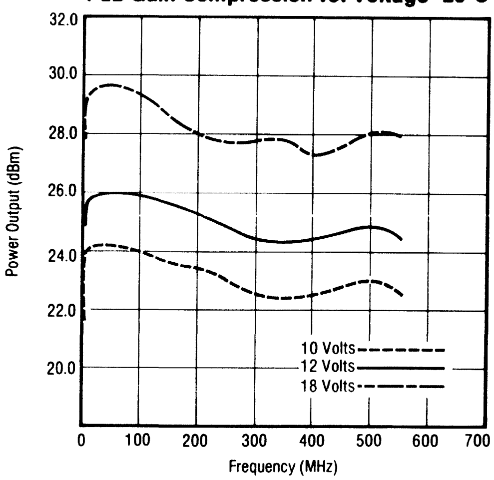
Frequency Response 25°C



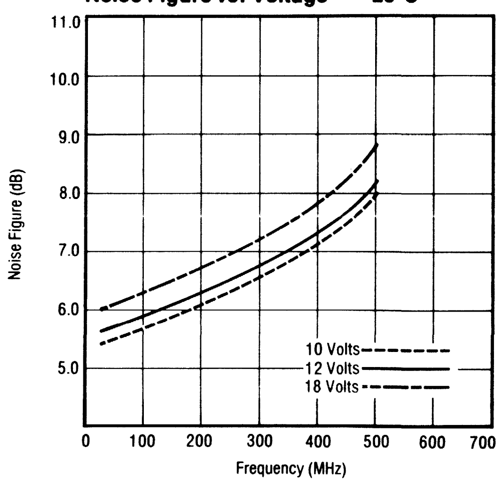
Frequency Response vs. Temperature



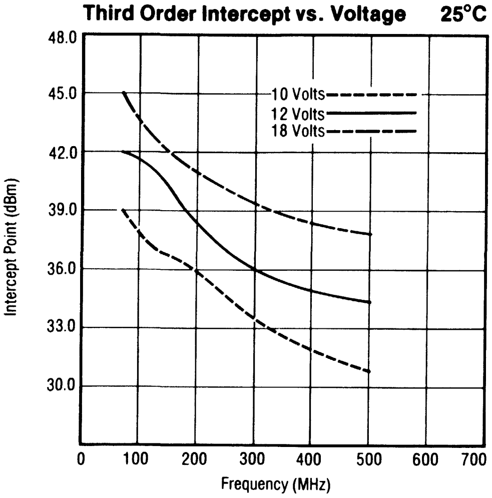
1 dB Gain Compression vs. Voltage 25°C



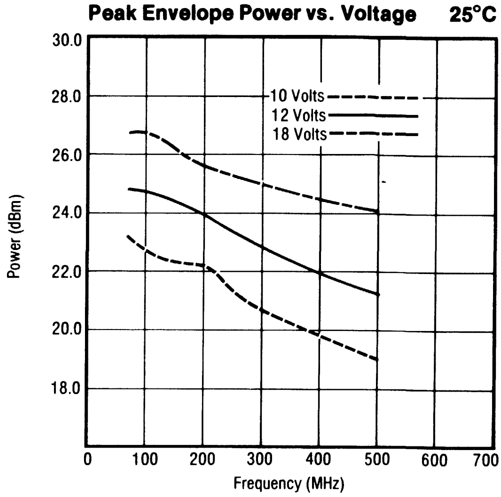
Noise Figure vs. Voltage 25°C



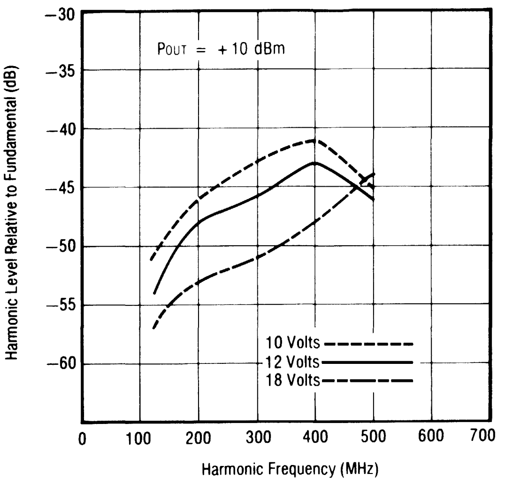
Third Order Intercept vs. Voltage 25°C



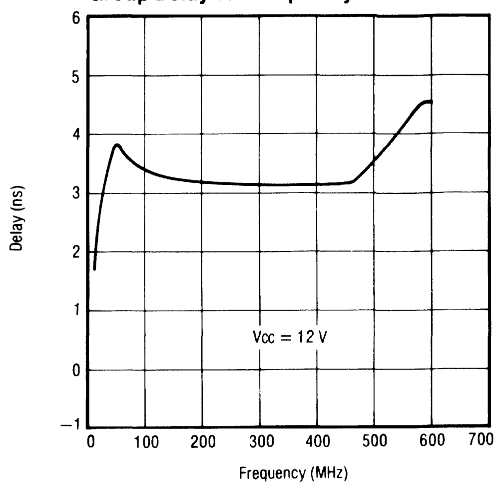
Peak Envelope Power vs. Voltage 25°C



Second Harmonic Distortion vs. Voltage 25°C



Group Delay vs. Frequency 25°C



S-Parameters

Biased at 12 Volts

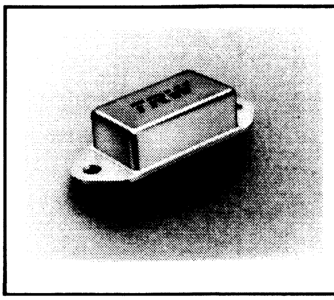
T = 25°C Zo = 50Ω

Frequency (MHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
1	-9.0	-52.7	29.7	170	-50.2	167	-4.0	145
10	-25.0	-26.0	29.9	3.7	-54.5	8.6	-25.5	54.0
100	-20.8	-12.0	29.9	-122	-55.5	-36.8	-22.2	59.0
200	-17.0	-53.7	29.5	117	-58.0	-77.8	-14.8	37.0
300	-14.7	-99	29.5	-6.4	-60.4	-140	-16.8	26.0
400	-14.5	-159	29.5	-131	-56.9	151	-13.1	2.8
500	-17.6	111	30.1	98.2	-51.7	93	-19.9	-135
600	-17.5	-83	27.5	-79.9	-56.2	17.9	-3.1	82

Magnitude in dB, Phase Angle in degrees.

CA2813H Wide Band RF Linear Hybrid Amplifier

- **34 dB gain.**
- **15 volt operation, low power consumption.**
- **Instantaneous Bandwidth, 40-300 MHz.**
- **Low VSWR for 75Ω system.**
- **Low noise figure, 3.5 dB.**



The CA2813H is a high reliability thin-film hybrid amplifier utilizing an all gold metallization system. This hybrid provides excellent gain stability and very low distortion due to push-pull amplifier circuitry. The CA2813 is recommended for driver applications requiring good linearity and noise performance. Excellent performance can be obtained with a supply voltage from 12 to 28 volts.

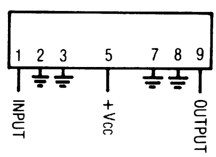
Absolute Maximum Ratings

Supply Voltage	RF Power Input	Storage Temperature	Case Operating Temperature
+28 Volts	+5 dBm	−40 °C to +100 °C	−20 °C to +90 °C

Electrical Characteristics for 75Ω Systems (T_{CASE} = +25°C and +15V Supply Voltage)

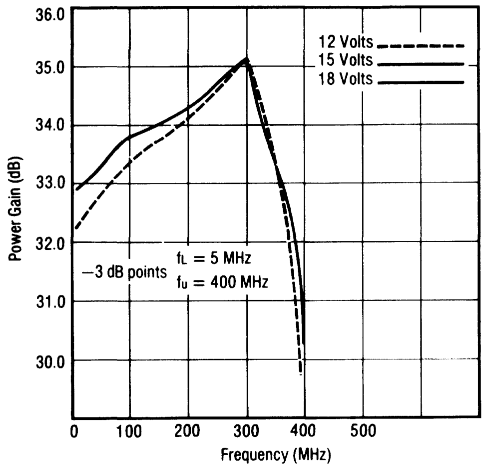
Symbol	Characteristics	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 50 MHz	33.0	34.0	35.0	dB
F_R	Frequency Response	f = 40-300 MHz		±0.75	±1.25	dB
P_O	Power Output, 1dB Compression	f = 300 MHz		+22		dBm
P_{ri}	Reverse Isolation	f = 40-300 MHz		40		dB
PEP	Peak Envelope Power for Two Tone Distortion Test, See Figure 1	f = 40-300 MHz @ −32dB IMD	125	150		mW
I_{TO}	Third Order Intercept, See Figure 1	f = 300 MHz	+38	+40		dBm
dso	Second Harmonic Suppression	P_O = 100mW f_{2h} = 300 MHz	−47	−50		dB
NF	Noise Figure, Broadband	f = 50 MHz f = 300 MHz		3.5 5.0	4.5 6.0	dB
VSWR	Input/Output VSWR (75Ω)	f = 40-300 MHz		1.2:1	1.3:1	N/A
I_{CC}	Supply Current	15V	150	170	190	mA

PIN CONFIGURATION

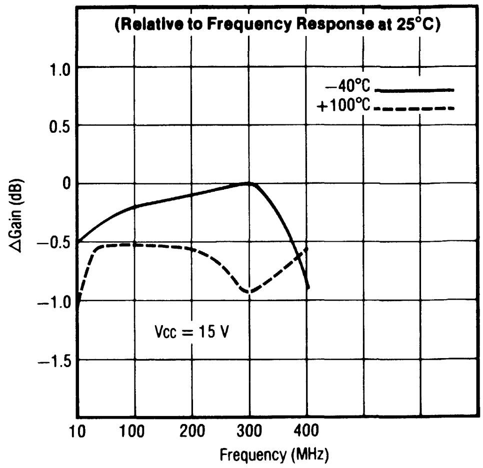


CA2813H

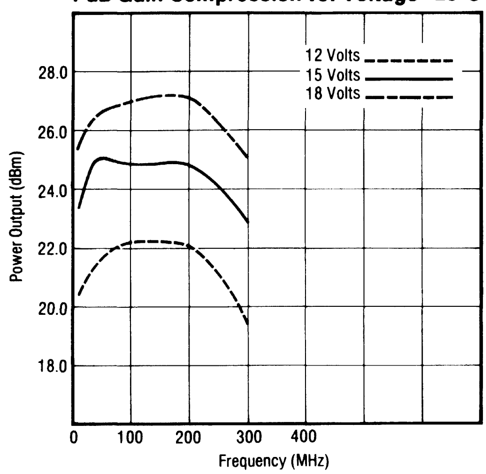
Frequency Response 25°C



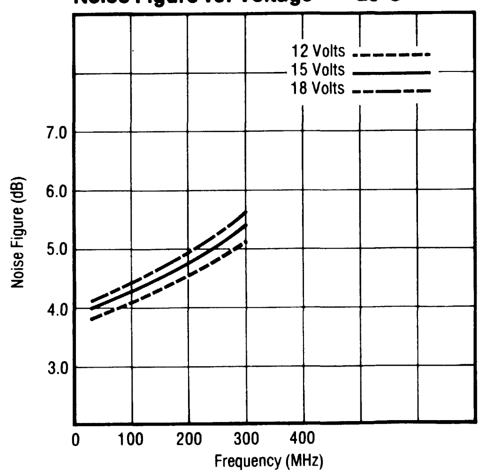
Frequency Response vs. Temperature



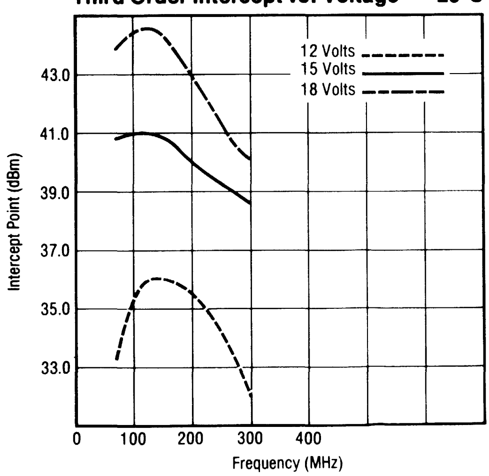
1 dB Gain Compression vs. Voltage 25°C



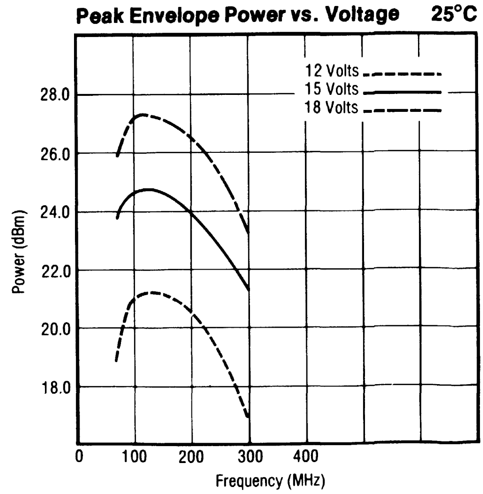
Noise Figure vs. Voltage 25°C



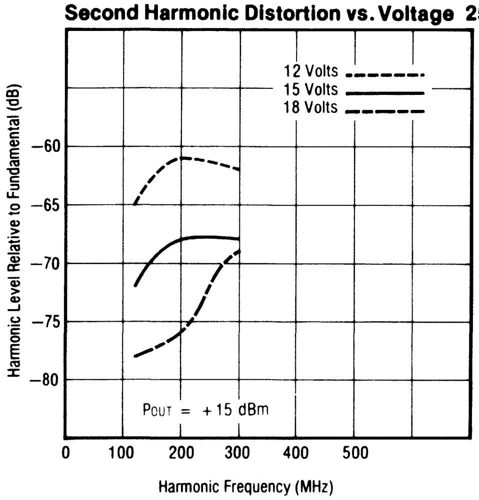
Third Order Intercept vs. Voltage 25°C



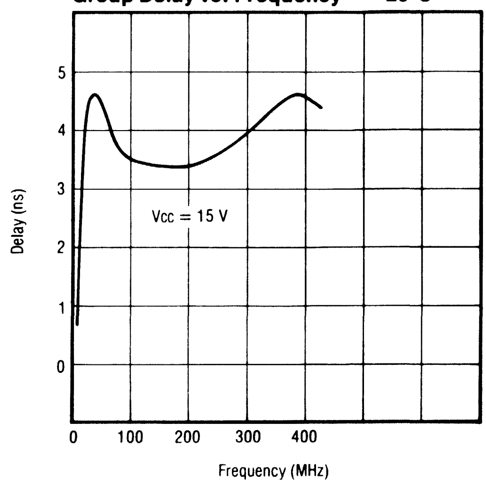
Peak Envelope Power vs. Voltage 25°C



Second Harmonic Distortion vs. Voltage 25°C



Group Delay vs. Frequency 25°C



S-Parameters

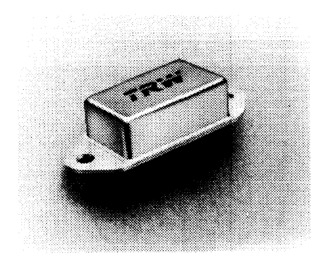
Biased at 15 Volts T = 25°C Zo = 75Ω

Frequency (MHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
10	-16.6	53.0	33.1	35.0	-48.1	39.1	-21.2	48.7
50	-32.3	-2.0	33.6	-44.9	-47.8	-21.0	-30.9	65.0
100	-41.4	119	34.2	-107	-47.7	-58.0	-30.3	22.6
200	-27.8	62.0	34.5	130	-48.6	-140	-38.5	-105
300	-26.1	-177	35.3	-10.2	-47.1	126	-23.3	84.5

Magnitude in dB, Phase Angle in degrees.

CA2818H Wide Bandwidth Linear Hybrid Amplifier

- **Power Output, 800mW**
- **+47dBm Third Order Intercept**
- **18.5dB Gain**
- **Instantaneous Bandwidth, 1-200MHz**
- **Low Noise Figure, 4.5dB**



The CA2818H is a high-reliability thin-film hybrid amplifier utilizing an all gold metallization system. This hybrid provides excellent gain stability and very low distortion due to push-pull amplifier circuitry. The CA2818 is recommended for driver applications requiring high power capability and for "gain blocks" that demand maximum linearity.

Excellent performance can be obtained with a supply voltage from 12 to 28 volts. For 75 ohm performance, refer to CATV equivalent model CA2418.

Absolute Maximum Ratings

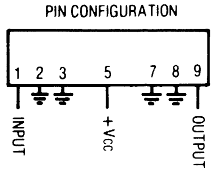
Vcc	RF Power Input	Storage Temperature	Operating Temperature (Case)
28 Volts	+14dBm	−55°C to +125°C	−40°C to +100°C

Electrical Characteristics for 50Ω Systems (T_{CASE} = 25°C and 24V)

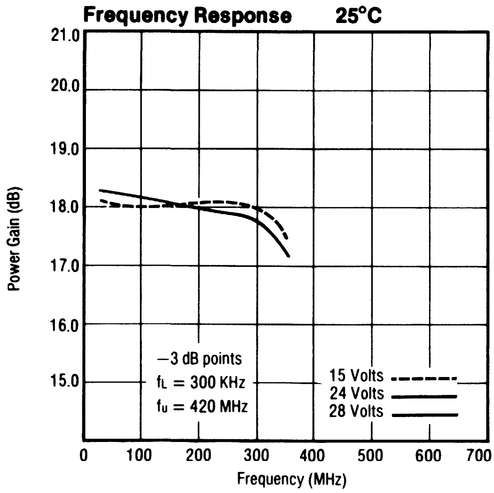
Symbol	Characteristic	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 50MHz	17.75	18.5	19.25	dB
NF	Noise Figure, Broadband	f = 30MHz f = 150MHz	— —	4.5 5.5	6.0 7.0	dB
I_{TO}	Third Order Intercept, See Figure 1	f = 150MHz	+44	+47	—	dBm
VSWR	Input/Output VSWR for 50Ω Systems Input/Output VSWR for 75Ω Systems	f = 1-200MHz	— —	1.7:1 1.2:1	2.0:1 1.3:1	N/A
I_{CC}	Supply Current	24V	190	205	220	mA
P_O	Power Output — 1dB Compression	f = 150MHz	800	900*	—	mW
P_{RI}	Reverse Isolation	f = 1-200MHz	—	25	—	dB
F_R	Frequency Response	f = 5-150MHz f = 1-200MHz	— —	±0.2 ±0.5	±0.5 ±1.0	dB
d_{SO}	Second Harmonic Distortion	P_O = 100mW f_{2H} = 1-200MHz	−55	−60	—	dB
PEP	Peak Envelope Power for Two Tone Distortion Test, See Figure 1	f = 1-200MHz at −32dB	600	800	—	mW

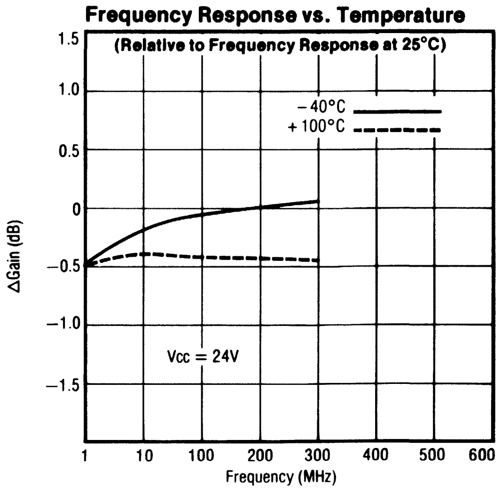
*Except for VSWR as noted.

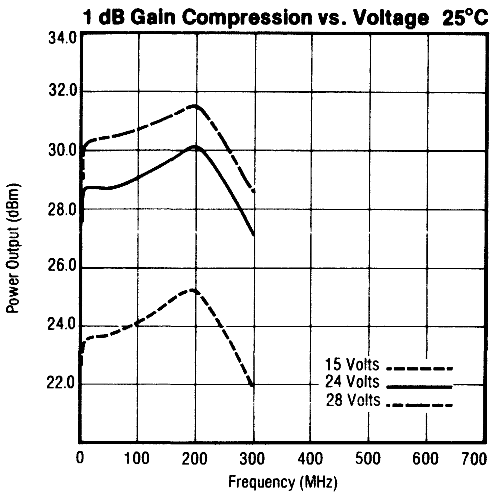
PIN CONFIGURATION

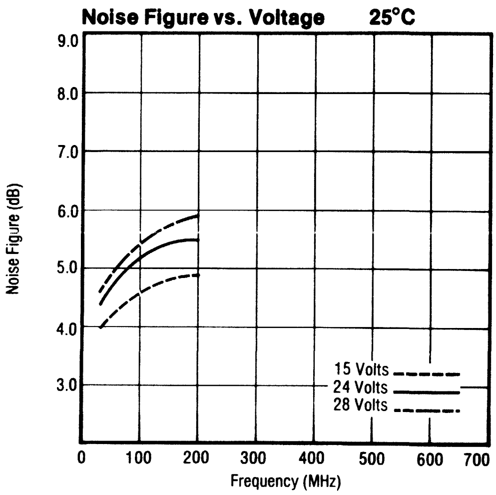


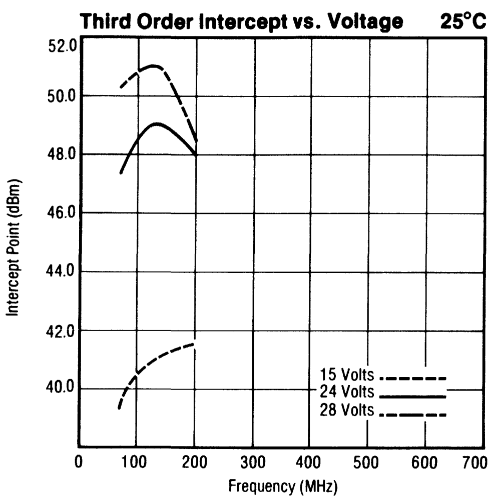
CA2818H

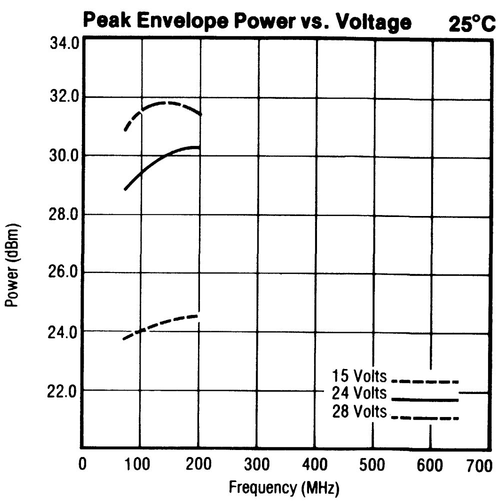

Frequency Response 25°C
21.0
20.0
19.0
18.0
17.0
16.0
15.0
Power Gain (dB)
−3 dB points
fL = 300 KHz
fu = 420 MHz
15 Volts
24 Volts
28 Volts
0 100 200 300 400 500 600 700
Frequency (MHz)

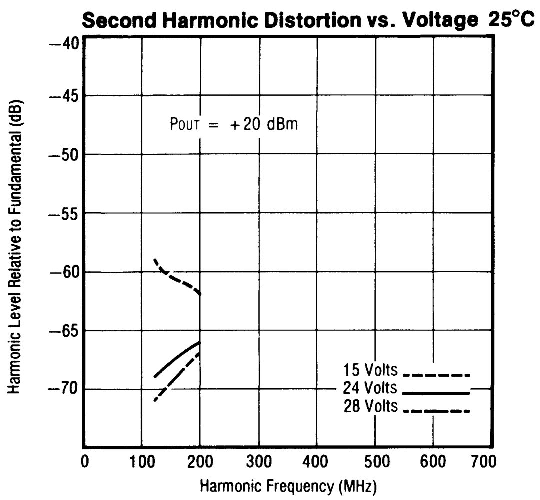

Frequency Response vs. Temperature
(Relative to Frequency Response at 25°C)
1.5
1.0
0.5
0
−0.5
−1.0
−1.5
ΔGain (dB)
−40°C
+100°C
Vcc = 24V
1 10 100 200 300 400 500 600
Frequency (MHz)

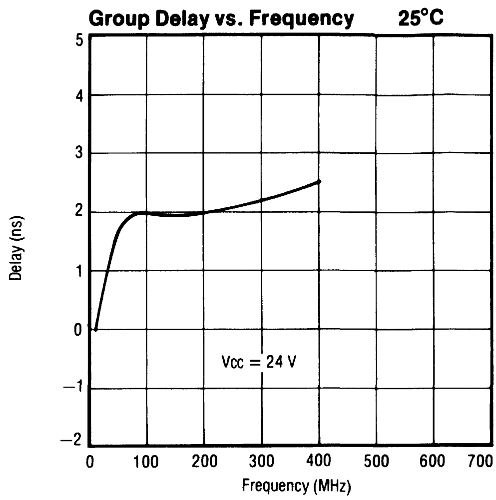

1 dB Gain Compression vs. Voltage 25°C
34.0
32.0
30.0
28.0
26.0
24.0
22.0
Power Output (dBm)
15 Volts
24 Volts
28 Volts
0 100 200 300 400 500 600 700
Frequency (MHz)


Noise Figure vs. Voltage 25°C
9.0
8.0
7.0
6.0
5.0
4.0
3.0
Noise Figure (dB)
15 Volts
24 Volts
28 Volts
0 100 200 300 400 500 600 700
Frequency (MHz)


Third Order Intercept vs. Voltage 25°C
52.0
50.0
48.0
46.0
44.0
42.0
40.0
Intercept Point (dBm)
15 Volts
24 Volts
28 Volts
0 100 200 300 400 500 600 700
Frequency (MHz)


Peak Envelope Power vs. Voltage 25°C
34.0
32.0
30.0
28.0
26.0
24.0
22.0
Power (dBm)
15 Volts
24 Volts
28 Volts
0 100 200 300 400 500 600 700
Frequency (MHz)





S-Parameters

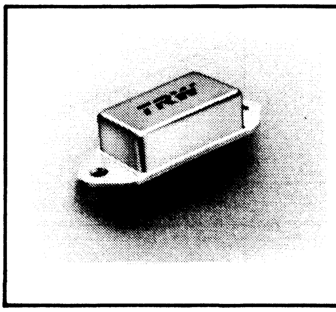
Biased at 24 Volts T = 25°C Zo = 50Ω

Frequency (MHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
1	-11.6	23.5	17.8	9.7	-25.4	-167	-10.9	8.4
10	-11.1	0	18.2	-4.6	-24.9	-183	-11.0	0.4
50	-12.5	-14.2	18.2	-37.1	-25.0	154	-12.7	-9.6
100	-14.8	-18.0	18.2	-74.3	-24.9	128	-15.3	-24.0
200	-13.6	21.5	18.1	-147	-24.9	76.4	-22.7	43.0

Magnitude in dB, Phase Angle in degrees.

CA2820H Wide Bandwidth Linear Hybrid Amplifier

- Instantaneous Bandwidth, 1-520MHz
- 30dB Gain
- Power Output, 400mW Minimum
- Low Cost Single Ended Design
- Unconditional Stability Under All Mismatch Conditions



The CA2820H is a high-reliability thin-film hybrid amplifier utilizing an all gold metallization system. Units are designed for widest bandwidth linear operation in 50 ohm systems. The linear class A bias enables the CA2820 to drive highly reactive loads at large signal levels over its frequency range. Low end frequency response can be extended to 500KHz by increasing the value of the external RF chokes. This module is recommended for wide bandwidth, low cost and linear applications in 25 to 75 ohm systems over a wide range of supply voltages.

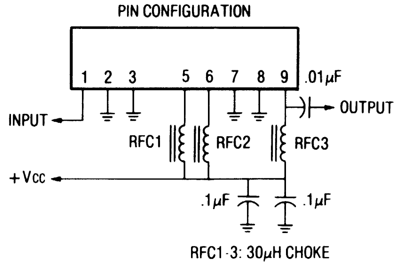
Absolute Maximum Ratings

V_{CC}	RF Power Input	Storage Temperature	Operating Temperature (Case)
28 Volts	+10dBm	−55°C to +125°C	−40°C to +100°C

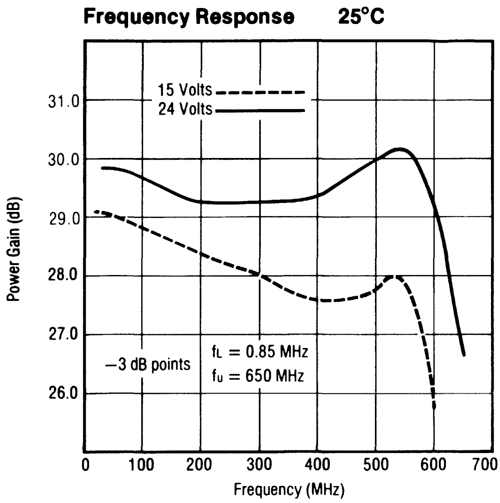
Electrical Characteristics for 50Ω Systems (T_{CASE} = 25°C and 24V)

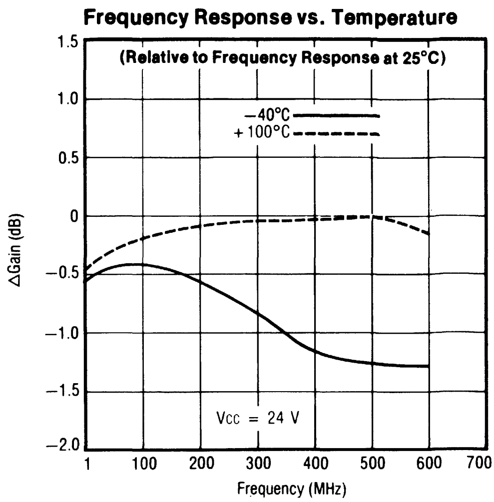
Symbol	Characteristic	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100MHz	29	30	31	dB
NF	Noise Figure, Broadband	f = 30MHz f = 500MHz	— —	6.0 8.3	8 10	dB
I_{TO}	Third Order Intercept, See Figure 1	f = 520MHz	+35	+37	—	dBm
VSWR	Input VSWR for 50 Ohm Systems Output VSWR for 50 Ohm Systems	f = 1-520MHz	—	1.5:1 1.8:1	2.0:1 2.0:1	N/A
I_{CC}	Supply Current	24V	300	330	360	mA
P_O	Power Output — 1dB Compression	f = 1-520MHz	400	440	—	mW
P_{RI}	Reverse Isolation	f = 1-520MHz	49	52	—	dB
F_R	Frequency Response	f = 1-520MHz	—	±0.8	±1.5	dB
d_{SO}	Second Harmonic Distortion	P_O = 10mW f_{2H} = 1-520MHz	−45	−55	—	dB
PEP	Peak Envelope Power for Two Tone Distortion Test, See Figure 1	f = 1-520MHz at −32dB	300	400	—	mW

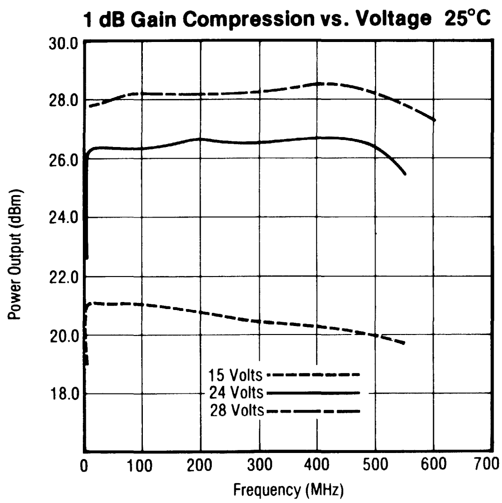
PIN CONFIGURATION

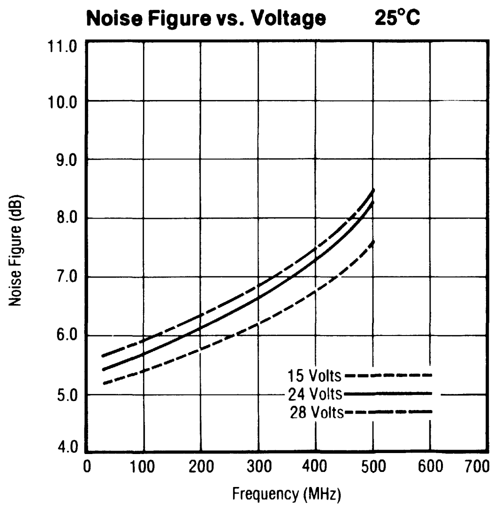


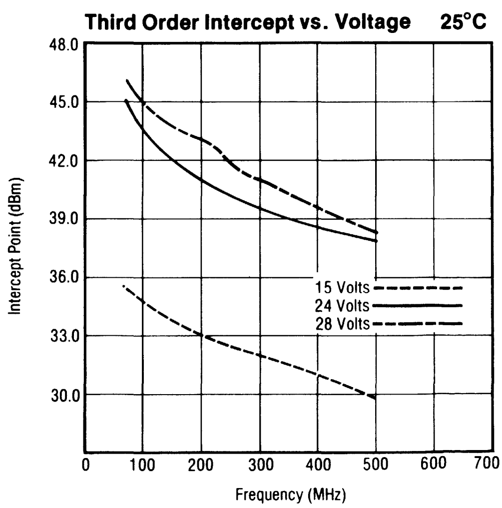
RFC1-3: 30μH CHOKE

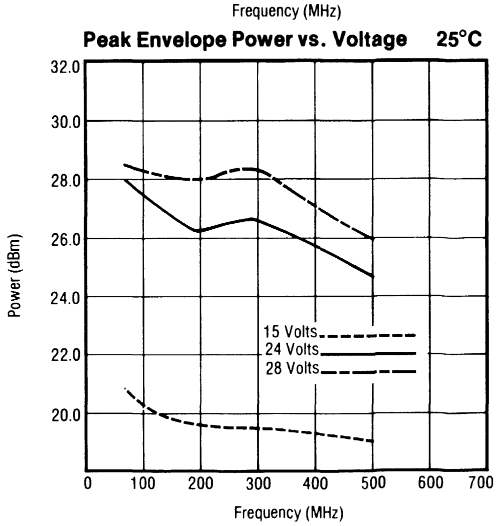

Frequency Response 25°C
15 Volts
24 Volts
−3 dB points
fL = 0.85 MHz
fu = 650 MHz
Power Gain (dB)
Frequency (MHz)

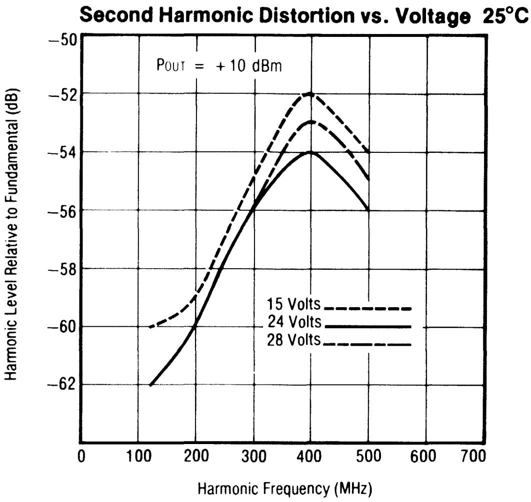

Frequency Response vs. Temperature
(Relative to Frequency Response at 25°C)
−40°C
+100°C
Vcc = 24 V
ΔGain (dB)
Frequency (MHz)

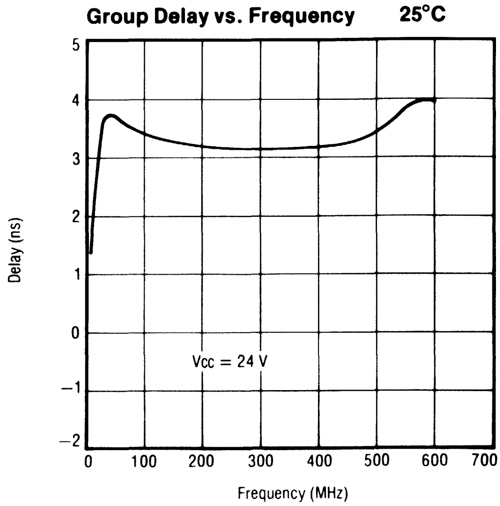

1 dB Gain Compression vs. Voltage 25°C
15 Volts
24 Volts
28 Volts
Power Output (dBm)
Frequency (MHz)


Noise Figure vs. Voltage 25°C
15 Volts
24 Volts
28 Volts
Noise Figure (dB)
Frequency (MHz)


Third Order Intercept vs. Voltage 25°C
15 Volts
24 Volts
28 Volts
Intercept Point (dBm)
Frequency (MHz)


Peak Envelope Power vs. Voltage 25°C
15 Volts
24 Volts
28 Volts
Power (dBm)
Frequency (MHz)





S-Parameters

Biased at 24 Volts T = 25°C Zo = 50Ω

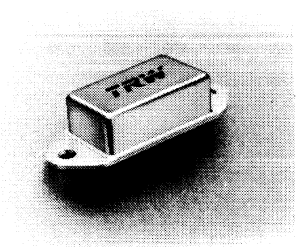
Frequency (MHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
1	-12.5	-41.4	30.1	169	-52.8	150	-6.3	138
10	-25.4	-24.0	29.6	5.0	-53.8	5.0	-24.1	78
100	-27.5	5.6	29.6	-120	-55.3	-51.0	-39.3	-126
200	-21.4	3.6	29.3	120	-59.0	-118	-21.3	15.7
300	-17.1	-43	29.1	-1.6	-58.2	145	-16.0	-30
400	-15.5	-106	29.1	-123	-53.2	89.8	-10.4	-56.6
500	-16.5	-181	29.5	109	-50.3	36.0	-37.7	150
600	-17.3	129	28.7	-41.2	-55.4	14.8	-2.5	-14.2

Magnitude in dB, Phase Angle in degrees.

CA2830H Thin Film RF Linear Hybrid Amplifier

- High Gain (34.5dB), Low Distortion (Push-pull Circuitry)
- 1W Output Power at 28V
- Wide Dynamic Range: +46dBm Third Order Intercept
- Unconditional Stability Under All Load Conditions
- All Gold (Monometallic) Metallization System Featuring Gold Transistor Die with Diffused Emitter Ballast Resistors for the Ultimate in Reliability

Applications
- Transmitter Driver for HF, VHF Communications Radios
- Fiber Optic Driver for Laser/ L.E.D. Diodes
- Driver for Acousto-Optic Modulators
- High Performance Linear Amplifier for all Types of Analog/Digital Waveforms



Absolute Maximum Ratings

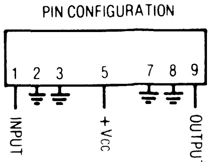
Supply Voltage	RF Power Input	Storage Temperature	Case Operating Temperature
+28 Volts	+5dBm	−55°C to +125°C	−40°C to +100°C

Electrical Characteristics for 50Ω Systems (T_{CASE} = +25°C and +24V*)

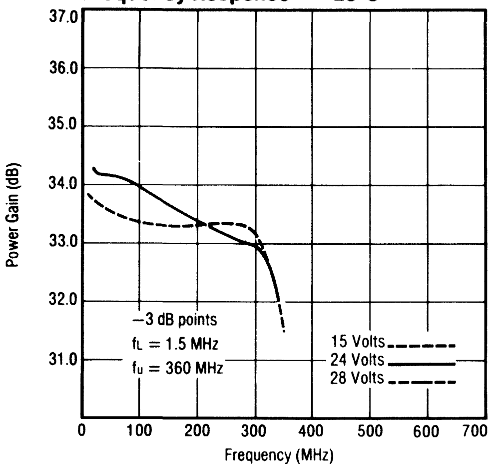
Symbol	Characteristic	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100MHz	33.5	34.5	35.5	dB
F_R	Frequency Response	f = 5-200MHz	—	±0.5	±1.0	dB
P_O	Power Output, 1dB Compression	f = 5-200MHz	+28	+29	—	dBm
P_O	Power Output, 1dB Compression, V_{CC} = 28V	f = 5-200MHz	+30	+31	—	dBm
PEP	Peak Envelope Power for Two Tone Distortion Test, See Figure 1	f = 5-200MHz @ −32dB IMD	600	800	—	mW
I_{TO}	Third Order Intercept, See Figure 1	f = 200MHz	+44	+46	—	dBm
d_{SO}	Second Harmonic Suppression	P_O = 100mW f_{2H} = 150MHz	−50	−60	—	dB
NF	Noise Figure, Broadband	f = 200MHz	—	4.7	5.5	dB
VSWR	Input/Output VSWR (50Ω)	f = 5-200MHz	—	1.5:1	2.0:1	N/A
I_{CC}	Supply Current	24V	270	300	330	mA

*Except for power output as noted.

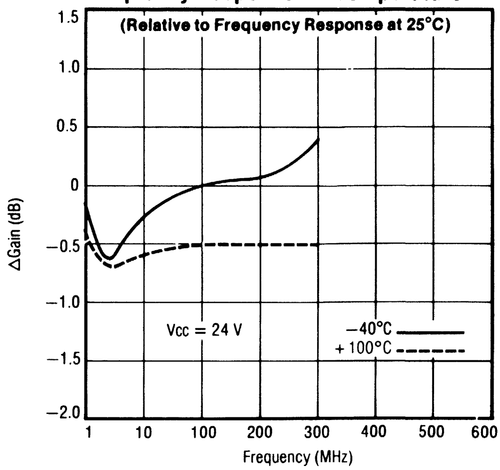
PIN CONFIGURATION



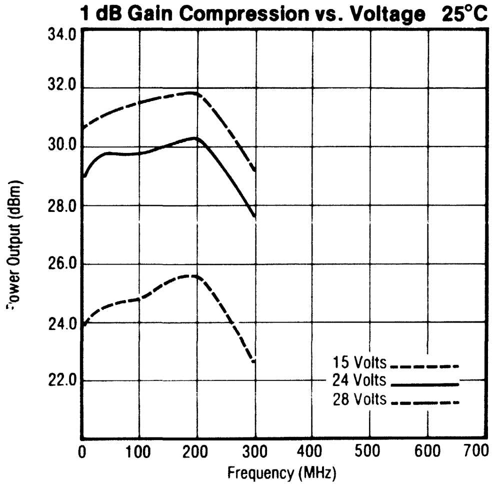
Frequency Response 25°C



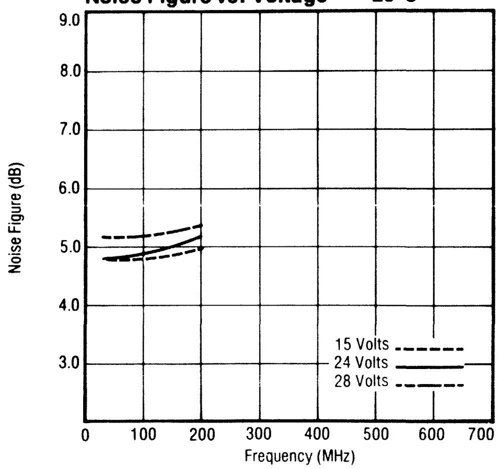
Frequency Response vs. Temperature



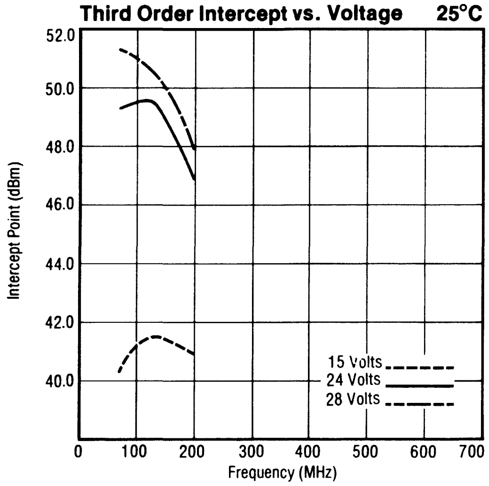
1 dB Gain Compression vs. Voltage 25°C



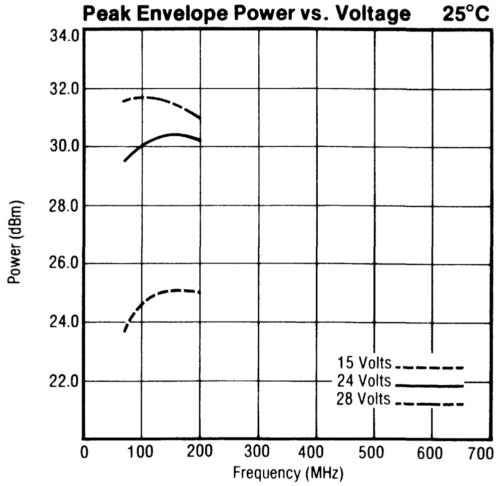
Noise Figure vs. Voltage 25°C



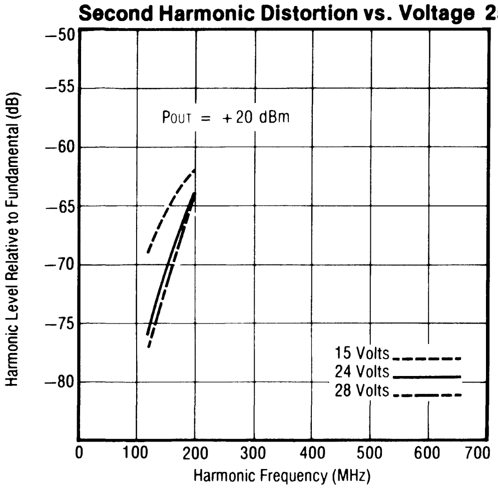
Third Order Intercept vs. Voltage 25°C



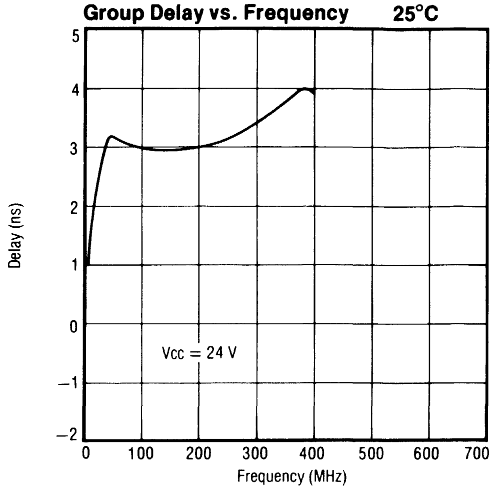
Peak Envelope Power vs. Voltage 25°C



Second Harmonic Distortion vs. Voltage 25°C



Group Delay vs. Frequency 25°C



S-Parameters

Biased at 24 Volts T = 25°C Zo = 50Ω

Frequency (MHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
5	-18.3	66.2	34.6	15.2	-47.0	17.7	-9.8	87.4
10	-19.3	45.5	34.6	-0.6	-47.0	2.3	-14.5	76.8
50	-15.6	35.0	34.2	-56.7	-47.5	-30.3	-12.6	45.0
100	-13.2	34.4	33.9	-114	-47.9	-62.9	-10.8	10.7
200	-11.1	30.1	33.5	134	-48.3	-128	-14.9	-42.6

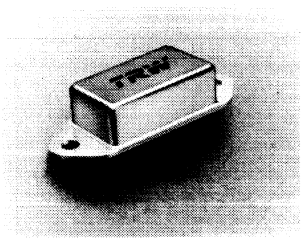
Magnitude in dB, Phase Angle in degrees.

CA2832H Thin Film RF Linear Hybrid Amplifier

- High Gain (35.5dB), Low Distortion (Push-pull Circuitry)
- 2W Output Power at 28V
- Wide Dynamic Range: +47dBm Third Order Intercept
- Unconditional Stability Under All Load Conditions
- All Gold (Monometallic) Metallization System Featuring Gold Transistor Die with Diffused Emitter Ballast Resistors for the Ultimate in Reliability

Applications

- Transmitter Driver for HF, VHF Communications Radios
- Fiber Optic Driver for Laser/L.E.D. Diodes
- Driver for Acousto-Optic Modulators
- High Performance Linear Amplifier for all Types of Analog/Digital Waveforms



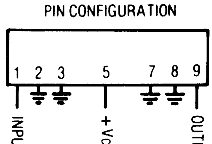
Absolute Maximum Ratings

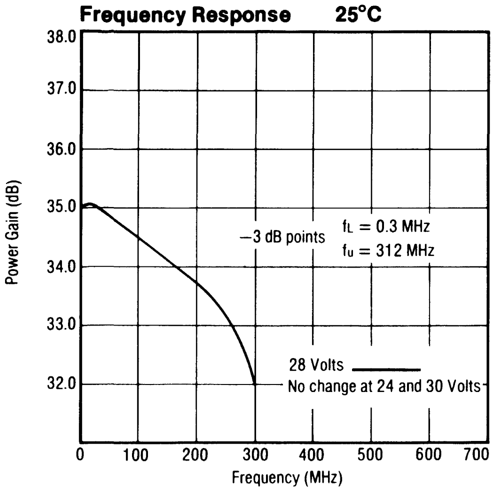
Supply Voltage	RF Power Input	Storage Temperature	Case Operating Temperature
+30 Volts	+5dBm	−55°C to +125°C	−40°C to +90°C

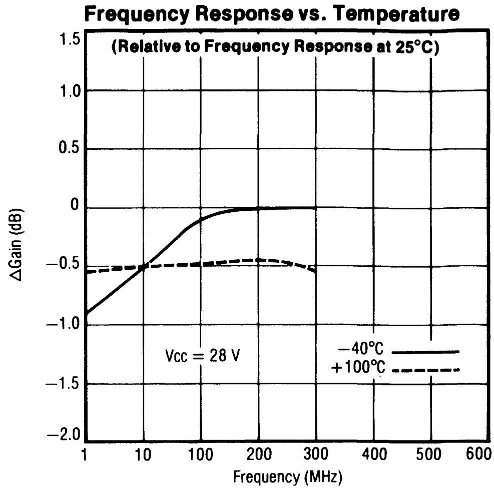
Electrical Characteristics for 50Ω Systems (T_{CASE} = +25°C and +28V)

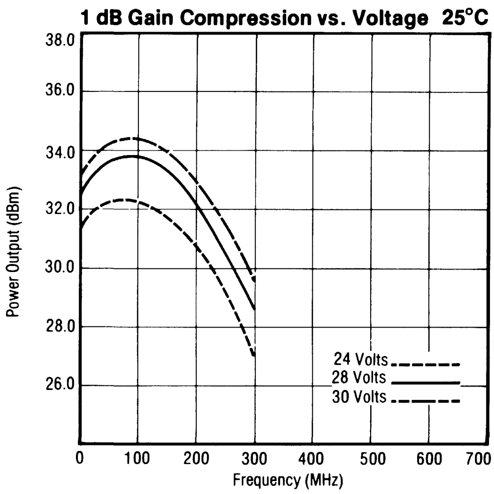
Symbol	Characteristic	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100MHz	34.0	35.5	37.0	dB
F_R	Frequency Response	f = 1-200MHz	—	±0.5	±1.0	dB
P_O	Power Output, 1dB Compression	f = 1-200MHz	+31	+32	—	dBm
P_O	Power Output, 1dB Compression	f = 150MHz	—	+33	—	dBm
PEP	Peak Envelope Power for Two Tone Distortion Test, See Figure 1	f = 1-200MHz @ −32dB IMD	—	900	—	mW
I_{TO}	Third Order Intercept, See Figure 1	f = 200MHz	+45	+47	—	dBm
d_{SO}	Second Harmonic Suppression	P_O = 100mW f_{2H} = 150MHz	−60	−70	—	dB
NF	Noise Figure, Broadband	f = 200MHz	—	6	7	dB
VSWR	Input/Output VSWR (50Ω)	f = 1-200MHz	—	1.5:1	2.0:1	N/A
I_{CC}	Supply Current	28V	400	435	470	mA

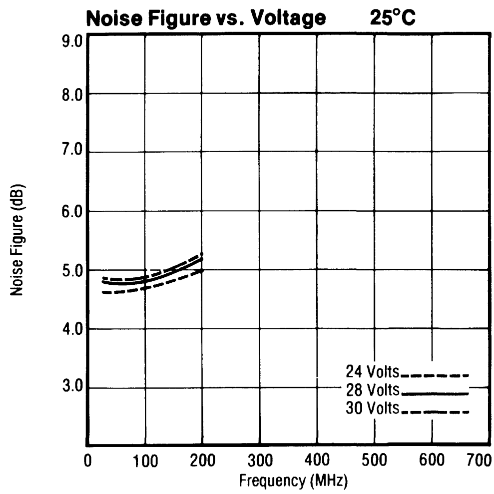
PIN CONFIGURATION

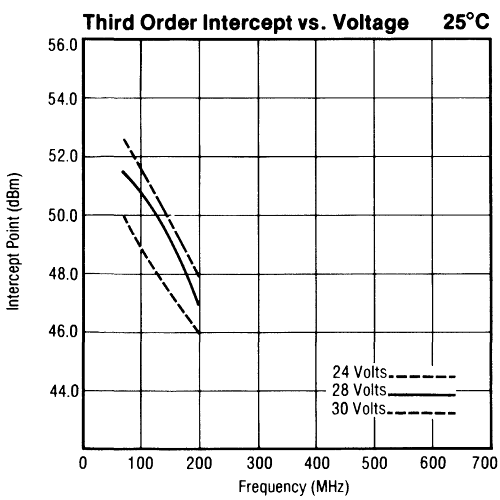


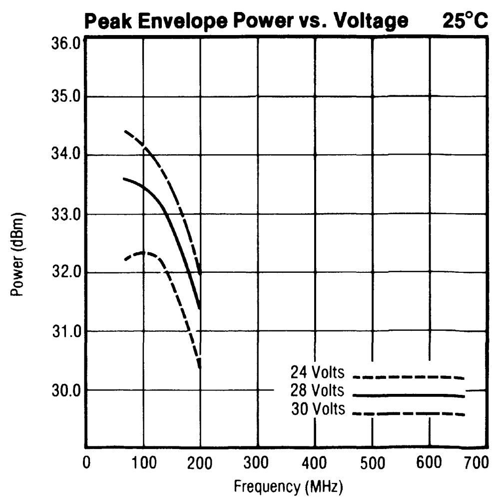

Frequency Response 25°C
Power Gain (dB)
38.0
37.0
36.0
35.0
34.0
33.0
32.0
−3 dB points
fL = 0.3 MHz
fu = 312 MHz
28 Volts
No change at 24 and 30 Volts
0
100
200
300
400
500
600
700
Frequency (MHz)


Frequency Response vs. Temperature
(Relative to Frequency Response at 25°C)
ΔGain (dB)
1.5
1.0
0.5
0
−0.5
−1.0
−1.5
−2.0
Vcc = 28 V
−40°C
+100°C
1
10
100
200
300
400
500
600
Frequency (MHz)

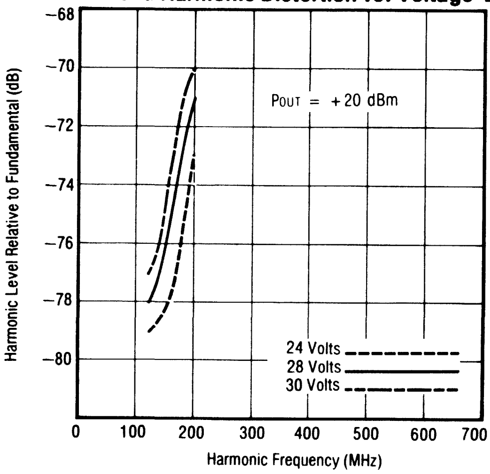

1 dB Gain Compression vs. Voltage 25°C
Power Output (dBm)
38.0
36.0
34.0
32.0
30.0
28.0
26.0
24 Volts
28 Volts
30 Volts
0
100
200
300
400
500
600
700
Frequency (MHz)


Noise Figure vs. Voltage 25°C
Noise Figure (dB)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
24 Volts
28 Volts
30 Volts
0
100
200
300
400
500
600
700
Frequency (MHz)

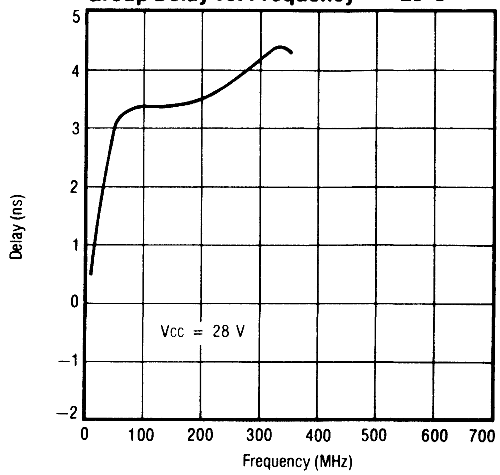

Third Order Intercept vs. Voltage 25°C
Intercept Point (dBm)
56.0
54.0
52.0
50.0
48.0
46.0
44.0
24 Volts
28 Volts
30 Volts
0
100
200
300
400
500
600
700
Frequency (MHz)


Peak Envelope Power vs. Voltage 25°C
Power (dBm)
36.0
35.0
34.0
33.0
32.0
31.0
30.0
24 Volts
28 Volts
30 Volts
0
100
200
300
400
500
600
700
Frequency (MHz)

Second Harmonic Distortion vs. Voltage 25°C



Group Delay vs. Frequency 25°C



S-Parameters

Biased at 28 Volts T = 25°C Zo = 50Ω

Frequency (MHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
1	-17.6	79.3	35.2	23.5	-48.0	28.1	-12.6	60.5
10	-19.7	31.2	35.7	-9.1	-47.3	-4.9	-16.4	25.0
50	-16.0	30.6	35.5	-63.6	-48.0	-37.7	-11.8	9.8
100	-13.3	37.4	35.0	-126	-48.7	-75.0	-10.7	-34.2
200	-10.0	27.6	34.3	110	-50.5	-154	-9.8	-136

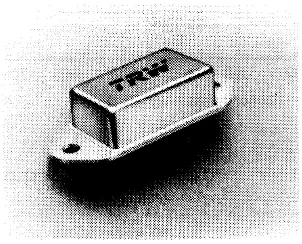
Magnitude in dB, Phase Angle in degrees.

TRW

CA2840H Thin Film RF Linear Hybrid Amplifier

- **22dB Gain, Low Distortion (Push-pull Circuitry)**
- **1W Output Power at 28V**
- **Matched for 75Ω Applications (Refer to CATV equivalent model CA2301 for additional data)**
- **Unconditional Stability Under all Load Conditions**
- **All Gold (Monometallic) Metallization System Featuring Gold Transistor Die with Diffused Ballast Resistors for the Ultimate in Reliability**

Applications (30-300MHz)
- Local Oscillator Buffer Amp for High Level Mixer
- 75 Ohm IF Post Amplifier
- High Performance Linear Amplifier for all Types of Analog/Digital Waveforms



Absolute Maximum Ratings

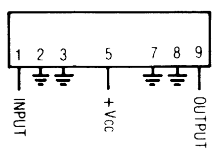
Supply Voltage	RF Power Input	Storage Temperature	Case Operating Temperature
+28 Volts	+14dBm	−55°C to +125°C	−40°C to +100°C

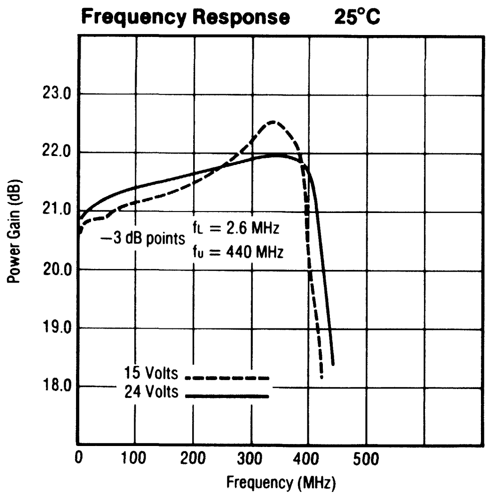
Electrical Characteristics for 50Ω Systems (T_{CASE} = +25°C and +24V*)

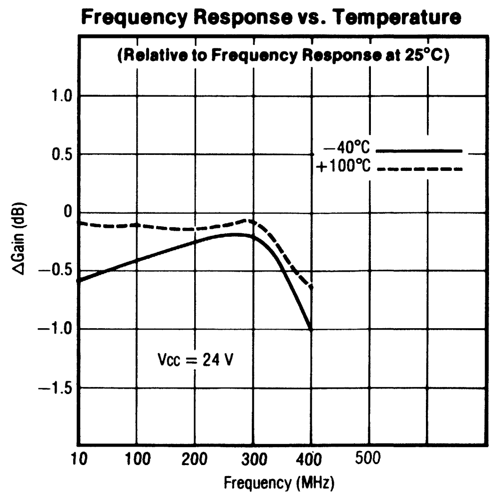
Symbol	Characteristics	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100MHz	21	22	23	dB
F_R	Frequency Response	f = 30-300MHz	—	±0.5	±1.0	dB
P_O	Power Output, 1dB Compression	f = 30-200MHz	+29	+30	—	dBm
P_O	Power Output, 1dB Compression, V_{CC} = 28V	f = 30-200MHz	+30	+31	—	dBm
PEP	Peak Envelope Power for Two Tone Distortion Test, See Figure 1	f = 200MHz @ −32dB IMD	550	650	—	mW
I_{TO}	Third Order Intercept, See Figure 1	f = 30-300MHz	+43	+46	—	dBm
d_{SO}	Second Harmonic Suppression	P_O = 100mW f_{2H} = 300MHz	−50	—	—	dB
NF	Noise Figure, Broadband	f = 100MHz	—	5	6	dB
VSWR	Input/Output VSWR (75Ω)	f = 30-300MHz	—	1.2:1	1.3:1	N/A
I_{CC}	Supply Current	24V	210	230	250	mA

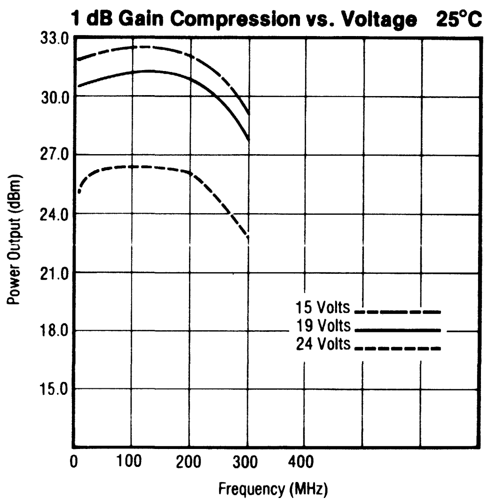
*Except for power output as noted.

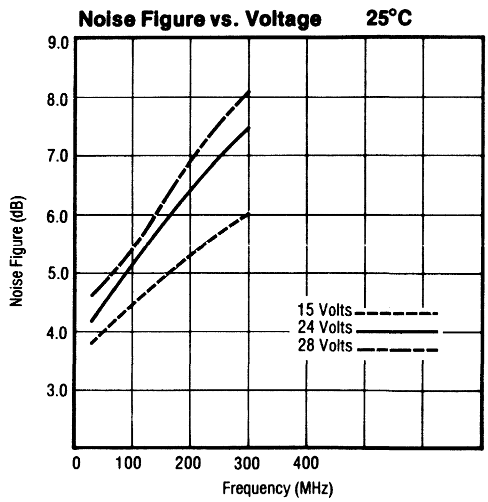
PIN CONFIGURATION

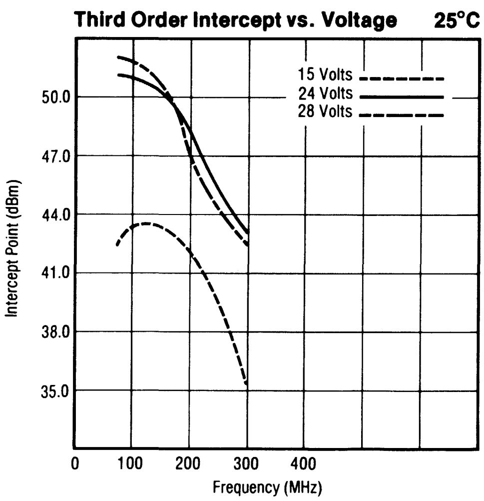


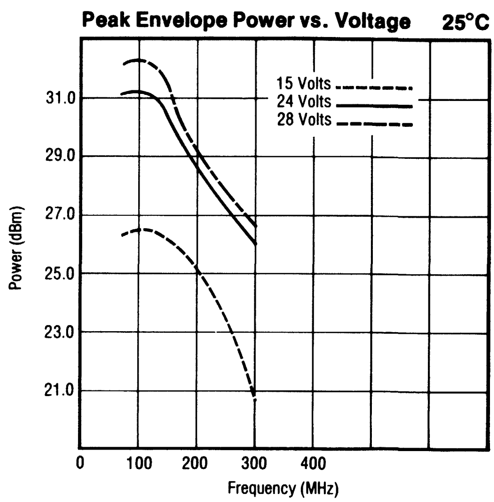

Frequency Response 25°C
Power Gain (dB)
23.0
22.0
21.0
20.0
19.0
18.0
−3 dB points
fL = 2.6 MHz
fu = 440 MHz
15 Volts
24 Volts
0 100 200 300 400 500
Frequency (MHz)


Frequency Response vs. Temperature
(Relative to Frequency Response at 25°C)
ΔGain (dB)
1.0
0.5
0
−0.5
−1.0
−1.5
−40°C
+100°C
Vcc = 24 V
10 100 200 300 400 500
Frequency (MHz)

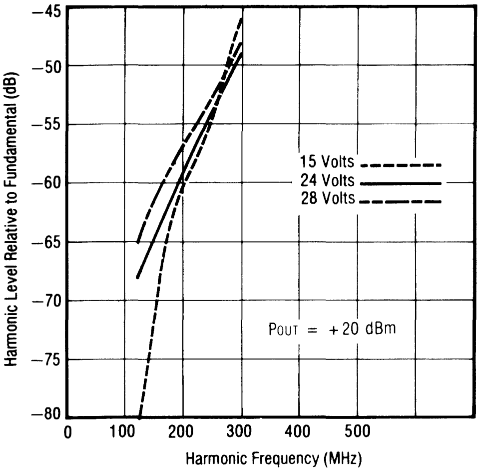

1 dB Gain Compression vs. Voltage 25°C
Power Output (dBm)
33.0
30.0
27.0
24.0
21.0
18.0
15.0
15 Volts
19 Volts
24 Volts
0 100 200 300 400
Frequency (MHz)


Noise Figure vs. Voltage 25°C
Noise Figure (dB)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
15 Volts
24 Volts
28 Volts
0 100 200 300 400
Frequency (MHz)

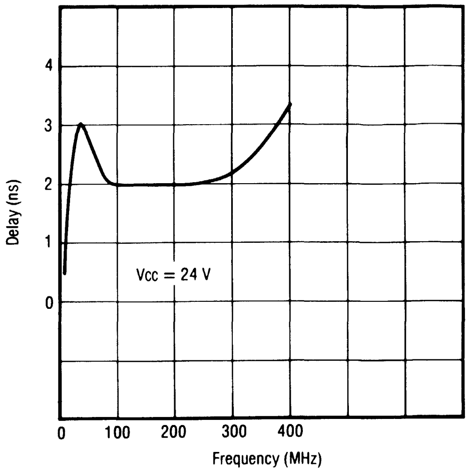

Third Order Intercept vs. Voltage 25°C
Intercept Point (dBm)
50.0
47.0
44.0
41.0
38.0
35.0
15 Volts
24 Volts
28 Volts
0 100 200 300 400
Frequency (MHz)


Peak Envelope Power vs. Voltage 25°C
Power (dBm)
31.0
29.0
27.0
25.0
23.0
21.0
15 Volts
24 Volts
28 Volts
0 100 200 300 400
Frequency (MHz)

Second Harmonic Distortion vs. Voltage 25°C



Group Delay vs. Frequency 25°C



S-Parameters

Biased at 24 Volts T = 25°C Zo = 50Ω

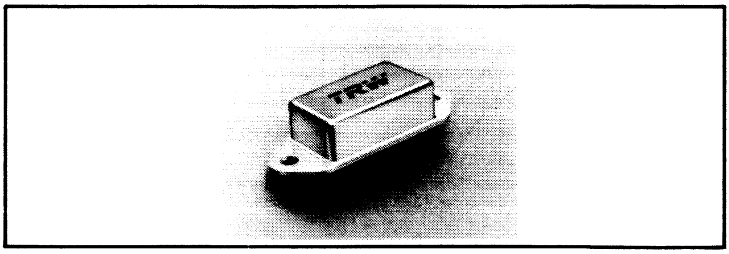
Frequency (MHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
10	-8.21	21.5	20.9	11.4	-27.1	-168	-9.34	21.5
50	-10.8	-8.5	21.1	-33.1	-27.1	156	-11.3	-9.0
100	-13.5	-12.2	21.4	-73.3	-26.9	125	-14.7	-35.8
200	-12.6	40.9	21.5	-152	-27.5	65.5	-15.4	47.9
300	-10.6	10.7	21.9	123	-29.1	-0.2	-12.4	20.6

Magnitude in dB, Phase Angle in degrees.

CA2842H Thin Film RF Linear Hybrid Amplifier

- 1.2W Output Power at 28V from 30-200MHz
- 22dB Gain, 30-300MHz
- Matched for 50Ω Applications
- Insensitive to Load Variations: Unconditionally Stable
- Wide Dynamic Range: +46dBm Third Order Intercept
- Low Distortion (Push-pull Circuitry)
- All Gold (Monometallic) Metallization System Featuring Gold Transistor Die with Diffused Emitter Ballast Resistors for the Ultimate in Reliability

Applications
- Transmitter Driver for VHF Radios (AM/FM)
- Fiber Optic Driver for Laser/ L.E.D. Diodes
- Driver for Acousto-Optic Modulators
- High Performance Linear Amplifier for all Types of Analog/Digital Waveforms



Absolute Maximum Ratings

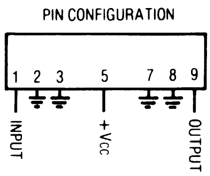
Supply Voltage	RF Power Input	Storage Temperature	Case Operating Temperature
+28 Volts	+14dBm	−55°C to +125°C	−40°C to +100°C

Electrical Characteristics for 50Ω Systems (T_{CASE} = +25°C and +24V*)

Symbol	Characteristics	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100MHz	21	22	23	dB
F_R	Frequency Response	f = 30-300MHz	—	±0.5	±1.0	dB
P_O	Power Output, 1dB Compression, V_{CC} = 28V	f = 30-200MHz f = 200-300MHz	+31 +28	+32 +29	— —	dBm
PEP	Peak Envelope Power for Two Tone Distortion Test, See Figure 1	f = 200MHz @ −32dB IMD	550	650	—	mW
I_{TO}	Third Order Intercept, See Figure 1	f = 30-300MHz	+43	+46	—	dBm
d_{SO}	Second Harmonic Suppression	P_O = 100mW f_{2H} = 300MHz	−50	—	—	dB
NF	Noise Figure, Broadband	f = 100MHz	—	5	6	dB
VSWR	Input/Output VSWR (50Ω)	f = 30-200MHz f = 200-300MHz	— —	— —	1.3:1 1.5:1	N/A
I_{CC}	Supply Current	24V	210	230	250	mA

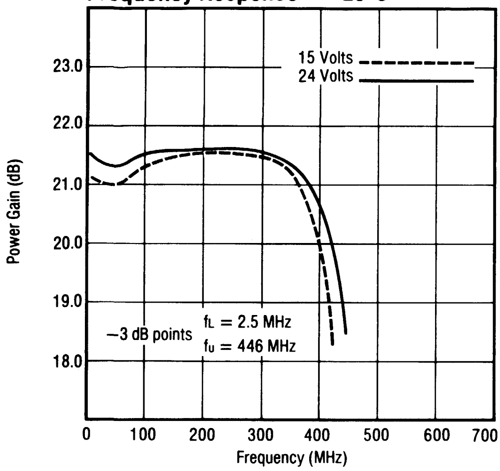
*Except for power output as noted.

PIN CONFIGURATION



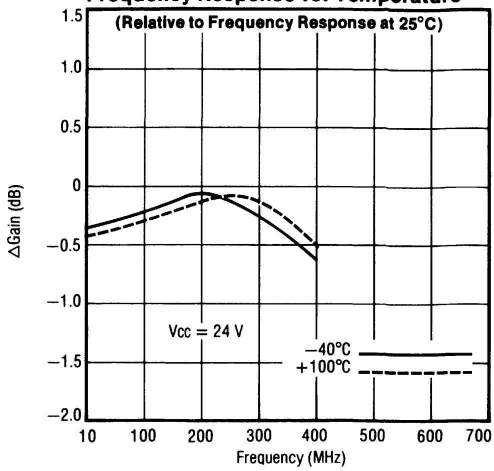
CA2842H

Frequency Response 25°C

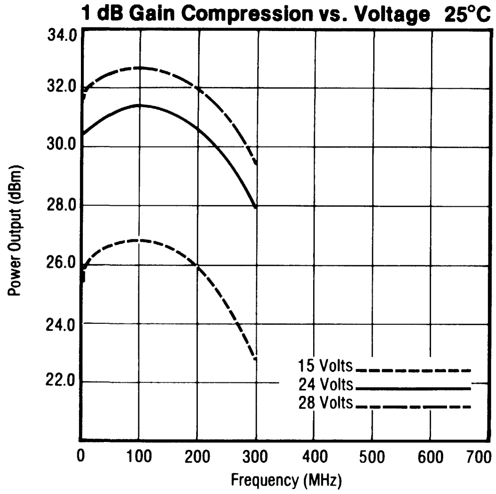


Frequency Response vs. Temperature

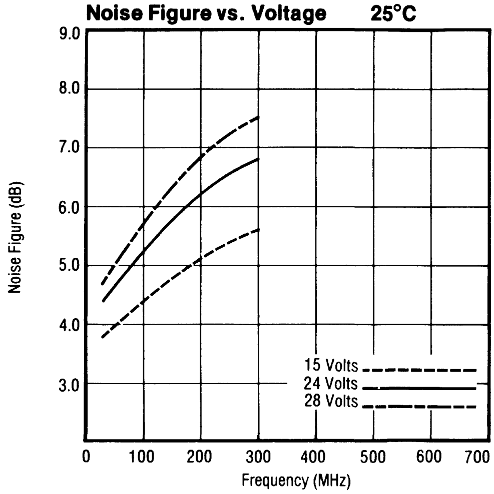
(Relative to Frequency Response at 25°C)



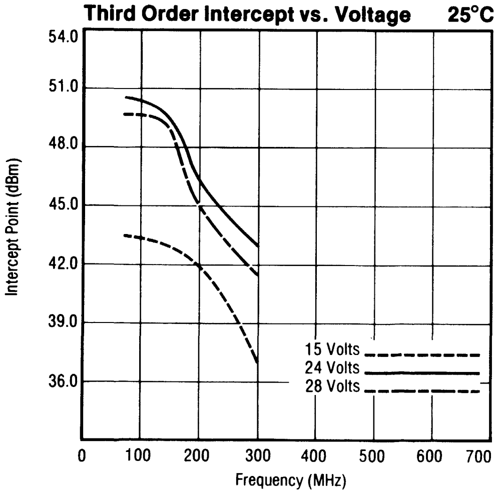
1 dB Gain Compression vs. Voltage 25°C



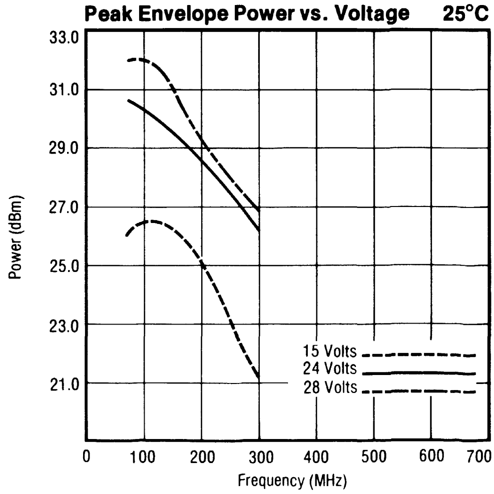
Noise Figure vs. Voltage 25°C



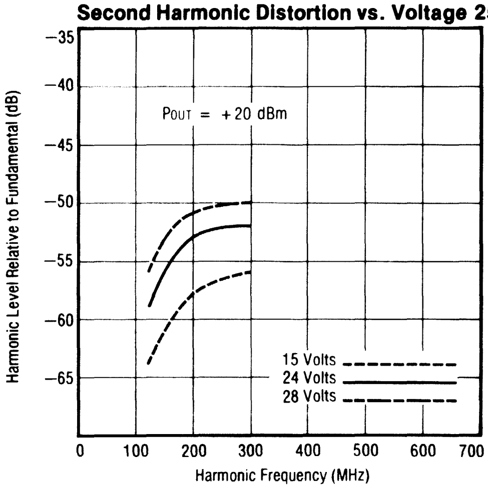
Third Order Intercept vs. Voltage 25°C



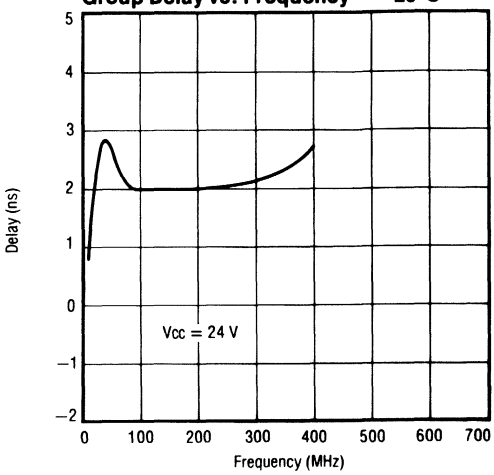
Peak Envelope Power vs. Voltage 25°C



Second Harmonic Distortion vs. Voltage 25°C



Group Delay vs. Frequency 25°C



S-Parameters

Biased at 24 Volts T = 25°C Zo = 50Ω

Frequency (MHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
10	-15.9	34.4	21.0	10.9	-26.3	-168	-18.9	39.0
50	-25.4	-11.8	21.2	-33.1	-26.5	157	-24.2	13.4
100	-32.8	7.6	21.4	-72.7	-26.5	128	-34.7	-63.0
200	-19.7	97.7	21.4	-148	-27.0	73.4	-19.4	85.0
300	-21.8	100	21.4	128	-28.7	12.5	-18.4	100

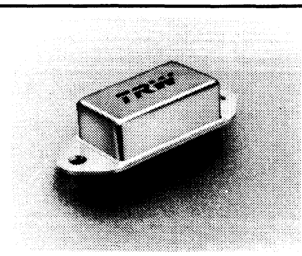
Magnitude in dB, Phase Angle in degrees.

TRW

CA2850RH Thin Film RF Linear Hybrid Amplifier

- **Low Power Consumption**
- **Wide Dynamic Range: +40dBm Third Order Intercept**
- **Low VSWR for 50Ω Systems**
- **Low Noise Figure (Push-pull Cascode Circuit)**
- **All Gold (Monometallic) Metallization System Featuring Gold Transistor Die with Diffused Emitter Ballast Resistors for the Ultimate in Reliability**

Applications
- High Performance 50 Ohm IF Amplifier
- Local Oscillator Buffer Amp for High Level Mixer
- Linear Driver/Repeater Amplifier for 50 Ohm Cable Communications Systems
- −15V to −24V Supply



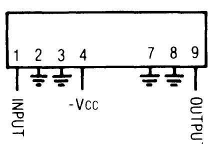
Absolute Maximum Ratings

Supply Voltage	RF Power Input	Storage Temperature	Case Operating Temperature
−28 Volts	+14dBm	−55°C to +125°C	−40°C to +100°C

Electrical Characteristics for 50Ω Systems (T_{CASE} = +25°C and −19V)

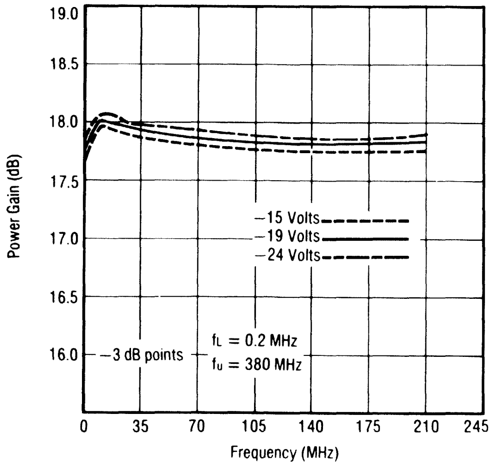
Symbol	Characteristics	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100MHz	17.0	17.5	18.0	dB
F_R	Frequency Response	f = 40-100MHz	—	±0.1	±0.2	dB
P_O	Power Output, 1dB Compression	f = 40-100MHz	+24	+25	—	dBm
PEP	Peak Envelope Power for Two Tone Distortion Test, See Figure 1	f = 40-100MHz @ −32dB IMD	250	300	—	mW
I_{TO}	Third Order Intercept, See Figure 1	f = 70MHz	+37	+40	—	dBm
d_{SO}	Second Harmonic Suppression	P_O = +24dBm f_{2H} = 100MHz	—	−40	—	dB
NF	Noise Figure, Broadband	f = 70MHz	—	4.5	5.0	dB
VSWR	Input/Output VSWR (50Ω)	f = 40-100MHz	—	1.2:1	1.3:1	N/A
I_{CC}	Supply Current	−19V	110	125	140	mA

PIN CONFIGURATION

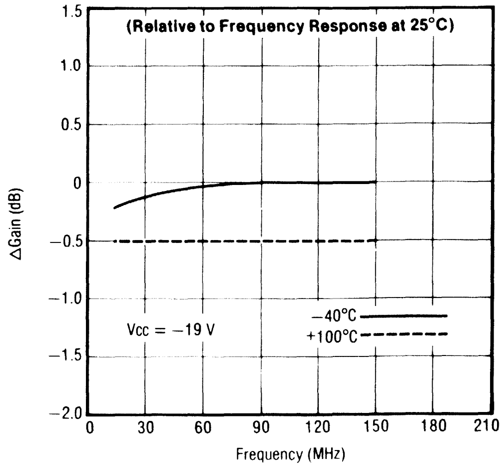


CA2850RH

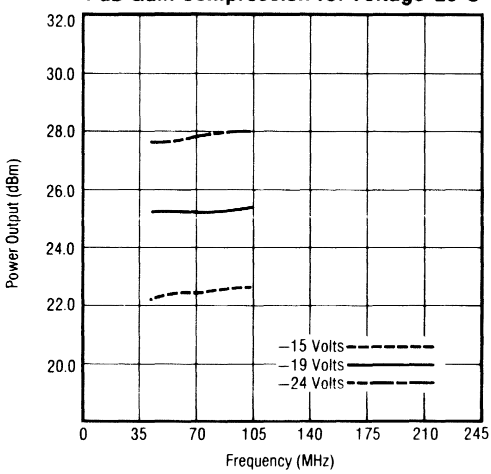
Frequency Response 25°C



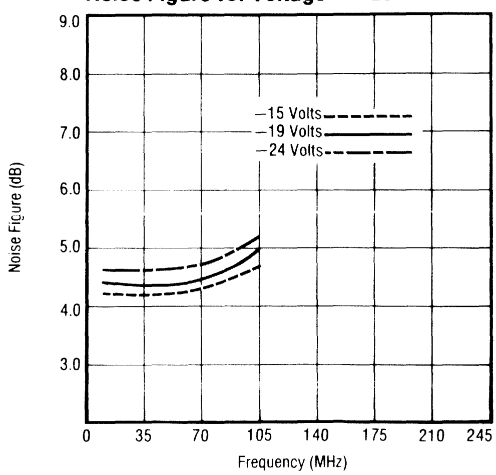
Frequency Response vs. Temperature



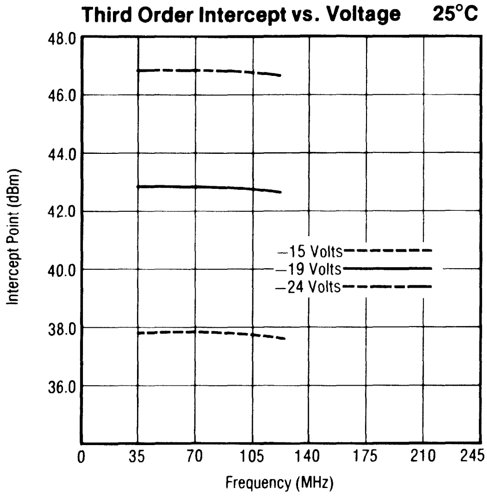
1 dB Gain Compression vs. Voltage 25°C



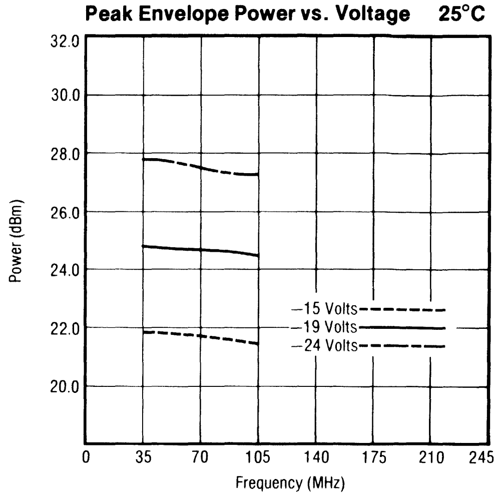
Noise Figure vs. Voltage 25°C



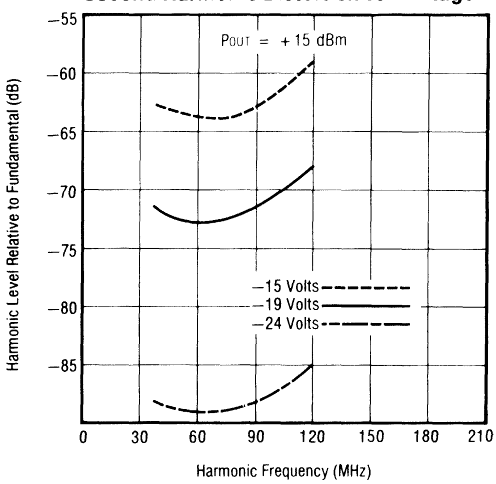
Third Order Intercept vs. Voltage 25°C



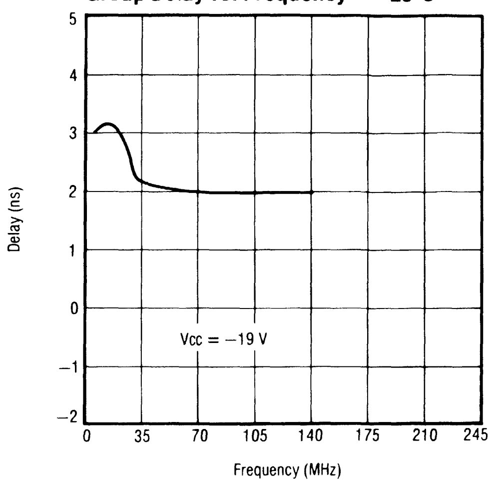
Peak Envelope Power vs. Voltage 25°C



Second Harmonic Distortion vs. Voltage 25°C



Group Delay vs. Frequency 25°C



S-Parameters

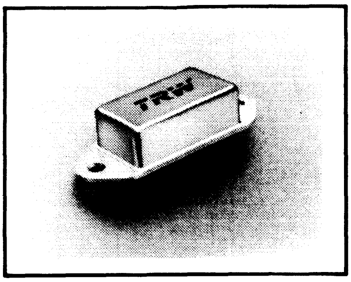
Biased at -19 Volts T = 25°C Zo = 50Ω

Frequency (MHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
40	-33.7	-16.0	17.6	-28.2	-23.7	161	-23.6	4.2
50	-35.8	-8.8	17.6	-35.0	-23.8	158	-24.1	3.2
70	-38.9	+16.8	17.6	-49.1	-23.8	149	-25.5	-7.5
90	-38.0	53.2	17.6	-63.3	-23.8	141	-27.0	-24.8
100	-36.9	63.5	17.6	-70.2	-23.9	136	-27.4	-31.5

Magnitude in dB, Phase Angle in degrees.

CA2870H Wide Bandwidth Linear Hybrid Amplifier

- **Amplitude Leveling Provision**
- **Instantaneous Bandwidth, 20-400MHz**
- **34dB Gain**
- **Power Output, 400mW Minimum**
- **Low Noise Figure, 4.5dB**



The CA2870H is a high-reliability thin-film hybrid amplifier utilizing an all gold metallization system with built-in provisions for amplitude leveling. The circuit covers the 20-400MHz frequency range. Two B+ inputs, one for the preamplifier and one for the final stage, provide a convenient means of RF leveling by variation of the final stage B+ voltage. Load variations on the preceding stage are kept to a minimum by this provision. Although the uncorrected flatness of this module is superb (±0.5dB typical), the leveling provisions provide convenient means of correcting for the frequency response of succeeding stages and injection of AM modulation. This module finds wide application in military and industrial service as gain blocks in RF amplifiers for VHF and UHF transmitters.

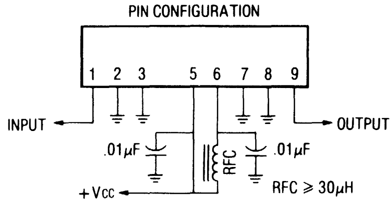
Absolute Maximum Ratings

Vcc	RF Power Input	Storage Temperature	Operating Temperature (Case)
28 Volts	+5dBm	−55°C to +125°C	−40°C to +100°C

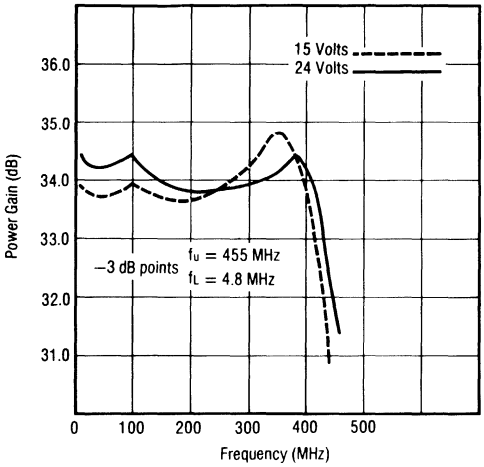
Electrical Characteristics for 50Ω Systems (T_{CASE} = 25°C and 24V)

Symbol	Characteristic	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100MHz	32.5	34	35.5	dB
NF	Noise Figure, Broadband	f = 30MHz f = 400MHz	— —	4.5 7.5	6.0 8.5	dB
I_{TO}	Third Order Intercept, See Figure 1	f = 300MHz	+42	+45	—	dBm
VSWR	Input VSWR for 50 Ohm Systems Output VSWR for 50 Ohm Systems	f = 20-400MHz	— —	1.5:1 1.8:1	2.0:1 2.0:1	N/A
I_{CC}	Supply Current	24V	270	300	330	mA
P_O	Power Output — 1dB Compression	f = 225MHz f = 400MHz	800 400	850 500	— —	mW
P_{RI}	Reverse Isolation	f = 20-400MHz	45	48	—	dB
F_R	Frequency Response	f = 20-400MHz	—	±0.5	±1.0	dB
d_{SO}	Second Harmonic Distortion	P_O = 100mW f_{2H} = 20-400MHz	−45	−52	—	dB
PEP	Peak Envelope Power for Two Tone Distortion Test, See Figure 1	f = 20-400MHz @ −32dB	400	500	—	mW

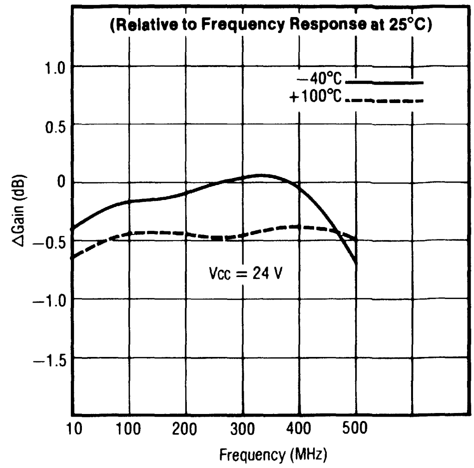
PIN CONFIGURATION



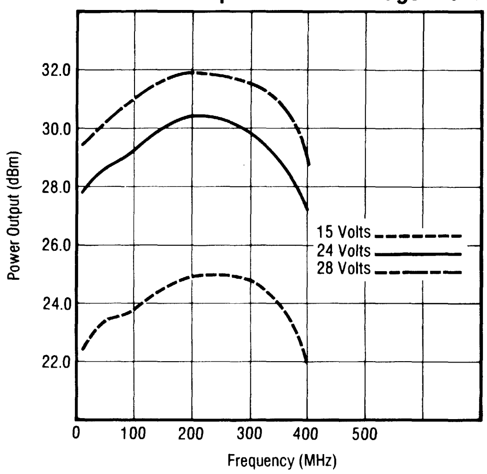
Frequency Response 25°C



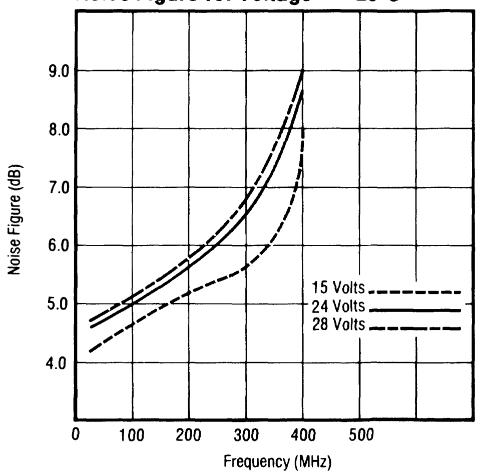
Frequency Response vs. Temperature



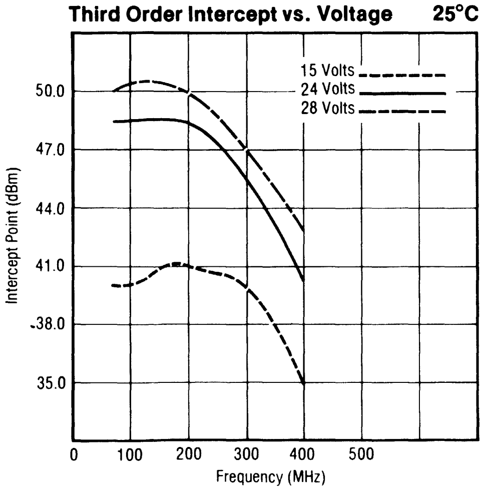
1 dB Gain Compression vs. Voltage 25°C



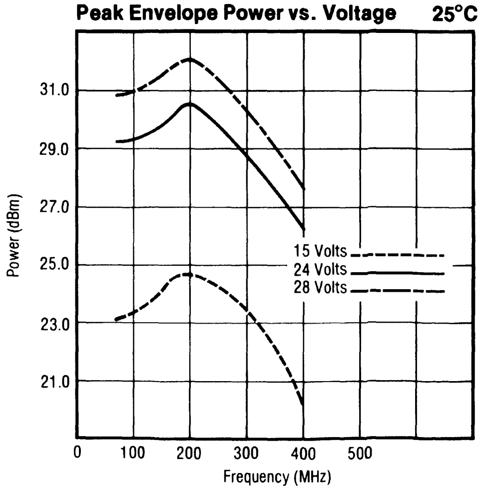
Noise Figure vs. Voltage 25°C

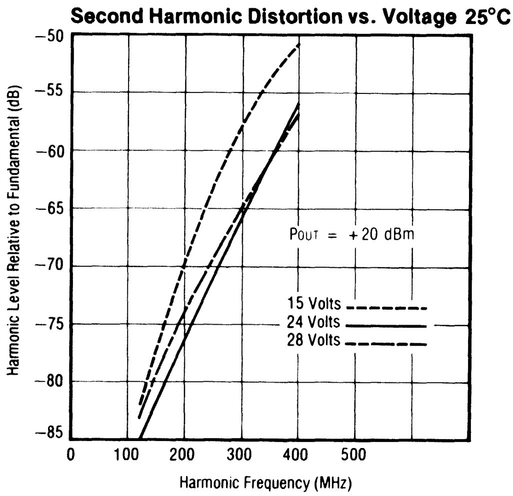


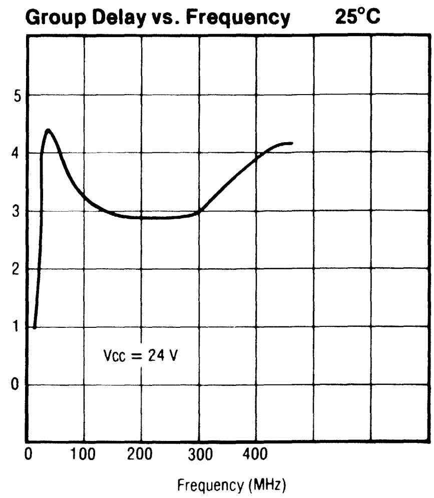
Third Order Intercept vs. Voltage 25°C



Peak Envelope Power vs. Voltage 25°C







S-Parameters

Biased at 24 Volts T = 25°C Zo = 50Ω

Frequency (MHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
20	-29.0	99.8	34.0	-4.3	-47.9	6.0	-14.6	21.3
100	-18.0	76.2	34.3	-107	-47.6	-53.5	-12.3	-5.9
200	-16.1	61.8	33.8	143	-47.9	-115	-11.6	-35.3
300	-13.9	52.3	33.7	27.9	-47.9	172	-13.5	-89.0
400	-20.9	44.6	33.9	-110	-47.2	94.8	-18.5	95.2

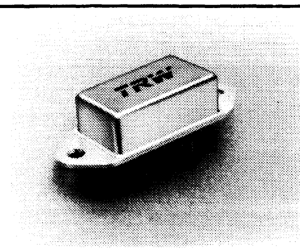
Magnitude in dB, Phase Angle in degrees.

TRW

CA2875RH Thin Film RF Linear Hybrid Amplifier

- **Wide Dynamic Range: +43dBm Third Order Intercept**
- **Excellent Match at Input/Output: Lowest VSWR**
- **Low Noise Figure (Push-pull Cascode Circuit)**
- **All Gold (Monometallic) Metallization System Featuring Gold Transistor Die with Diffused Emitter Ballast Resistors for the Ultimate in Reliability**

Applications
- High Performance 75 Ohm IF Amplifier
- Local Oscillator Buffer Amp for High Level Mixer
- Linear Driver/Repeater Amplifier for 75 Ohm Cable Communications Systems
- −15V to −24V Supply



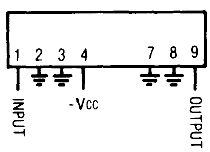
Absolute Maximum Ratings

Supply Voltage	RF Power Input	Storage Temperature	Case Operating Temperature
−28 Volts	+14dBm	−55°C to +125°C	−40°C to +100°C

Electrical Characteristics for 75Ω Systems (T_{CASE} = +25°C and −19V)

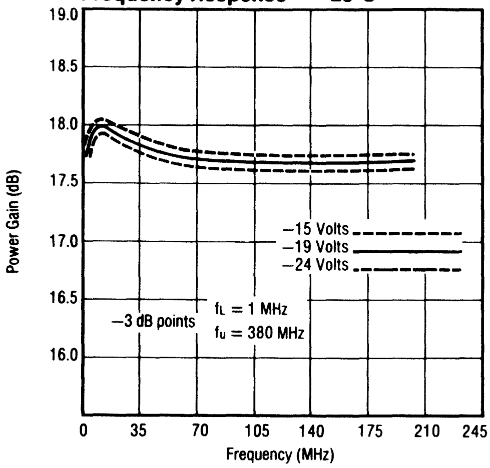
Symbol	Characteristics	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100MHz	17.0	17.5	18.0	dB
F_R	Frequency Response	f = 40-100MHz	—	±0.1	±0.2	dB
P_O	Power Output, 1dB Compression	f = 40-100MHz	+25	+26	—	dBm
PEP	Peak Envelope Power for Two Tone Distortion Test, See Figure 1	f = 40-100MHz @ −32dB IMD	250	300	—	mW
I_{TO}	Third Order Intercept, See Figure 1	f = 70MHz	+42	+43	—	dBm
d_{SO}	Second Harmonic Suppression	P_O = +24dBm f_{2H} = 100MHz	—	−40	—	dB
NF	Noise Figure, Broadband	f = 70MHz	—	4.5	5.0	dB
RL	Input/Output Return Loss (75Ω)	f = 40-100MHz	30	—	—	dB
I_{CC}	Supply Current	−19V	140	155	170	mA

PIN CONFIGURATION

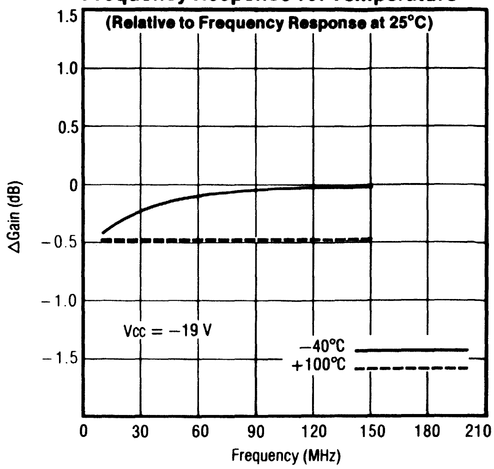


CA2875RH

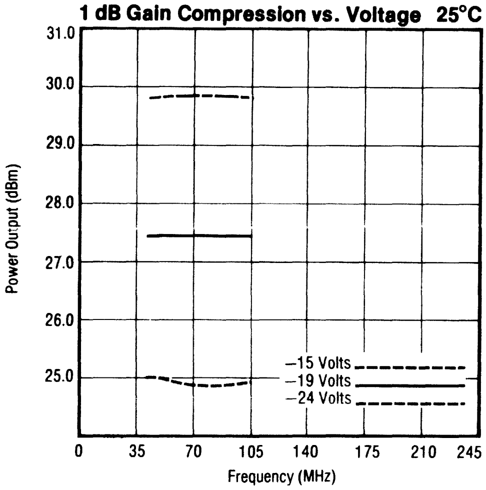
Frequency Response 25°C



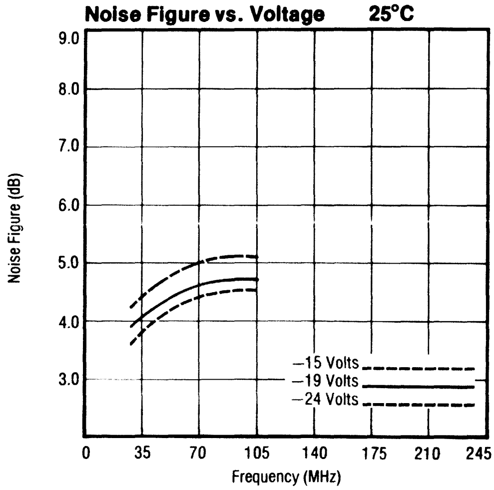
Frequency Response vs. Temperature



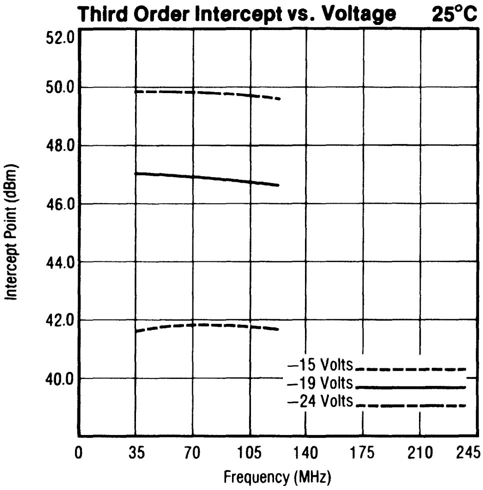
1 dB Gain Compression vs. Voltage 25°C



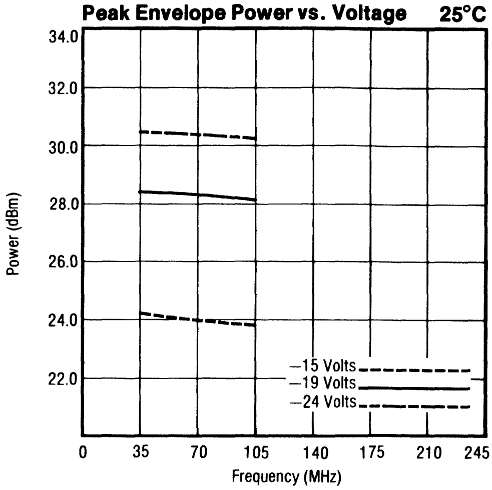
Noise Figure vs. Voltage 25°C

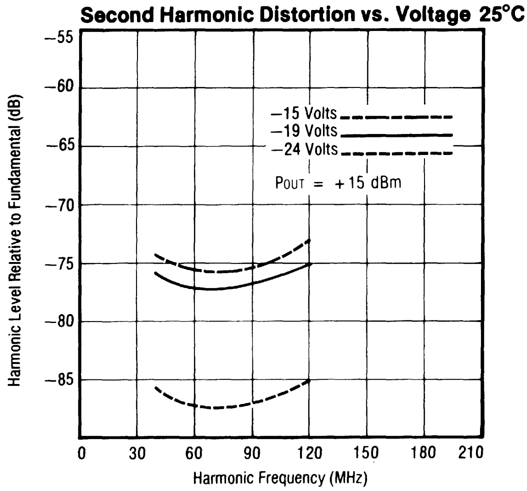


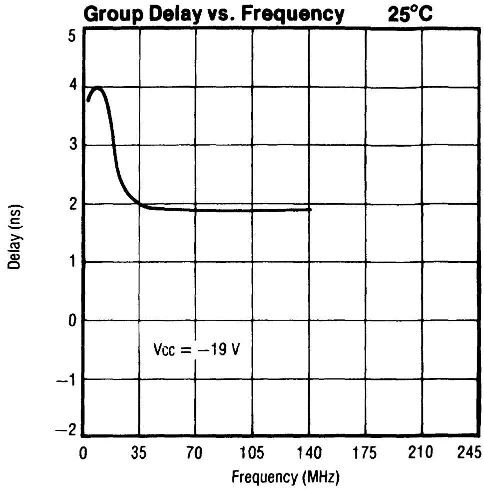
Third Order Intercept vs. Voltage 25°C



Peak Envelope Power vs. Voltage 25°C







S-Parameters

Biased at -19 Volts T = 25°C Zo = 75Ω

Frequency (MHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
40	-32.1	14.8	17.6	-27.4	-24.2	161	-40.5	-31.1
50	-32.7	2.0	17.6	-34.3	-24.3	156	-39.4	-38.1
70	-33.4	-16.0	17.6	-48.1	-24.3	147	-36.0	-57.2
90	-32.8	-27.0	17.5	-60.9	-24.4	138	-32.4	-76.7
100	-32.6	-34.0	17.5	-68.0	-24.5	133	-30.3	-87.7

Magnitude in dB, Phase Angle in degrees.

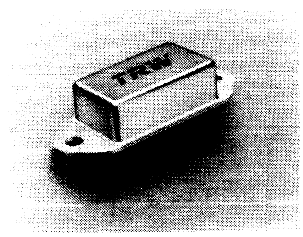
TRW

CA2876RH Thin Film RF Linear Hybrid Amplifier

- 1.5W DC Power Consumption
- 3dB Noise Figure
- 22dB Gain, Low Distortion
- +36dBm Third Order Intercept
- Low VSWR for 75Ω Systems
- Push-pull Cascode Circuit
- All Gold (Monometallic) Metallization System Featuring Gold Transistor Die with Diffused Emitter Ballast Resistors for the Ultimate in Reliability

Applications

- Low Noise 75Ω IF Amplifier
- High Performance Linear Amplifier for Signal Levels Below 100mW
- Linear Amplifier Applications Requiring Low Current Consumption
- −15V to −24V Supply



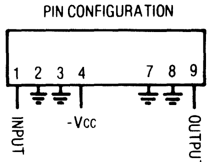
Absolute Maximum Ratings

Supply Voltage	RF Power Input	Storage Temperature	Case Operating Temperature
−28 Volts	+14dBm	−55°C to +125°C	−40°C to +100°C

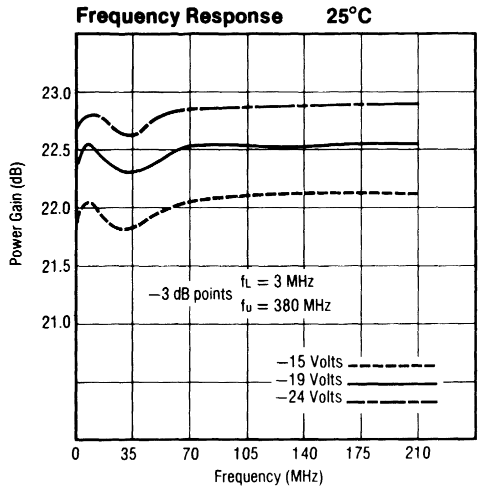
Electrical Characteristics for 75Ω Systems (T_{CASE} = +25°C and −19V)

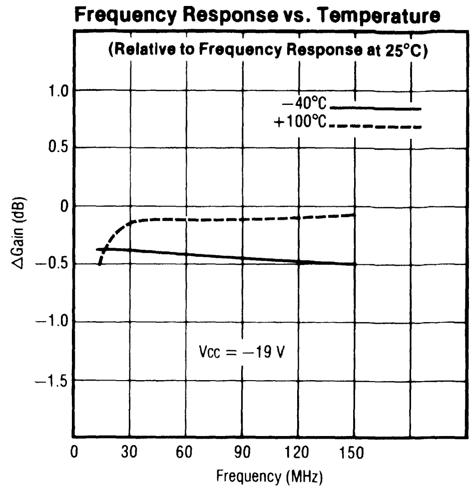
Symbol	Characteristics	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100MHz	21.25	22	22.75	dB
F_R	Frequency Response	f = 40-100MHz	—	±0.1	±0.3	dB
P_O	Power Output, 1dB Compression	f = 40-100MHz	+20	+22	—	dBm
PEP	Peak Envelope Power for Two Tone Distortion Test, See Figure 1	f = 40-100MHz @ −32dB IMD	100	175	—	mW
I_{TO}	Third Order Intercept, See Figure 1	f = 70MHz	+33	+36	—	dBm
d_{SO}	Second Harmonic Suppression	P_O = 100mW f_{2H} = 100MHz	−45	−50	—	dB
NF	Noise Figure, Broadband	f = 70MHz	—	3.0	3.5	dB
VSWR	Input/Output VSWR (75Ω)	f = 40-100MHz	—	1.1:1	1.2:1	N/A
I_{CC}	Supply Current	−19V	65	73	80	mA

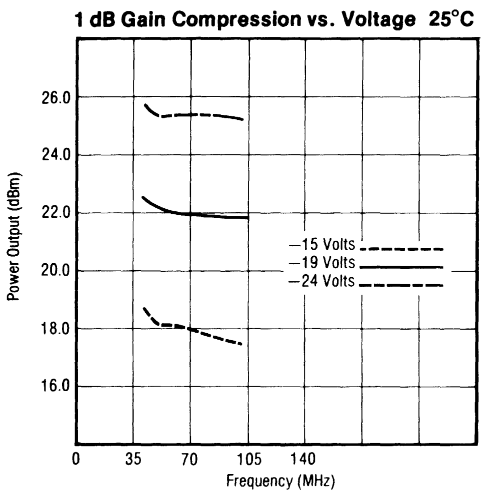
PIN CONFIGURATION

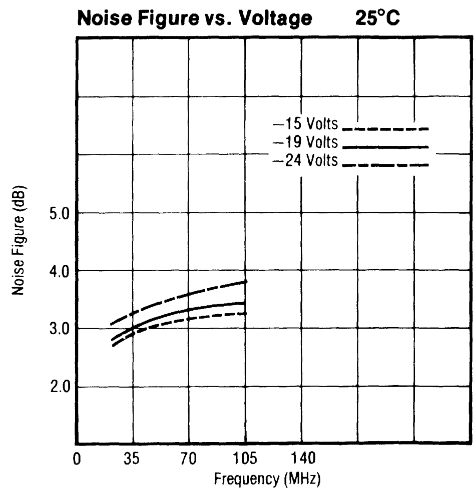


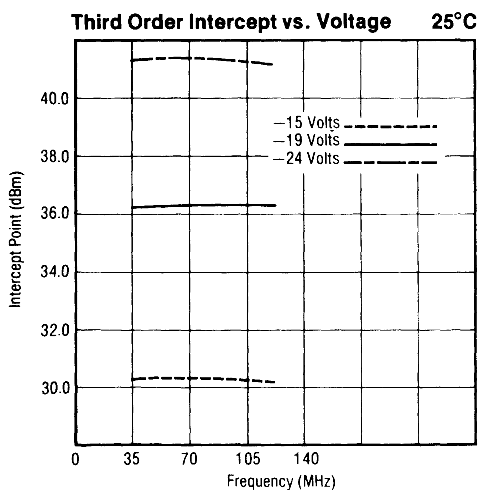
CA2876RH

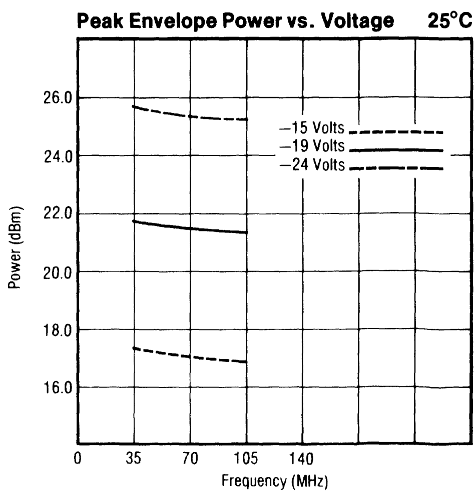

Frequency Response 25°C
23.0
22.5
22.0
21.5
21.0
Power Gain (dB)
−3 dB points
fL = 3 MHz
fu = 380 MHz
−15 Volts
−19 Volts
−24 Volts
0
35
70
105
140
175
210
Frequency (MHz)


Frequency Response vs. Temperature
(Relative to Frequency Response at 25°C)
1.0
0.5
0
−0.5
−1.0
−1.5
ΔGain (dB)
−40°C
+100°C
Vcc = −19 V
0
30
60
90
120
150
Frequency (MHz)

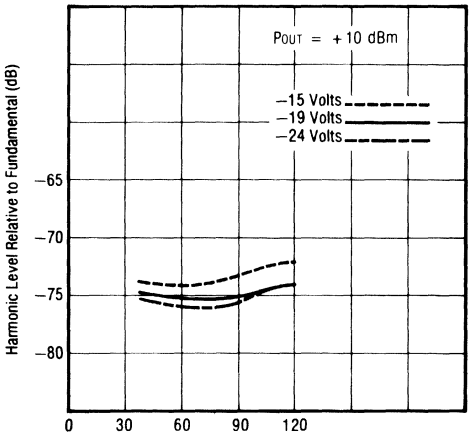

1 dB Gain Compression vs. Voltage 25°C
26.0
24.0
22.0
20.0
18.0
16.0
Power Output (dBm)
−15 Volts
−19 Volts
−24 Volts
0
35
70
105
140
Frequency (MHz)


Noise Figure vs. Voltage 25°C
5.0
4.0
3.0
2.0
Noise Figure (dB)
−15 Volts
−19 Volts
−24 Volts
0
35
70
105
140
Frequency (MHz)

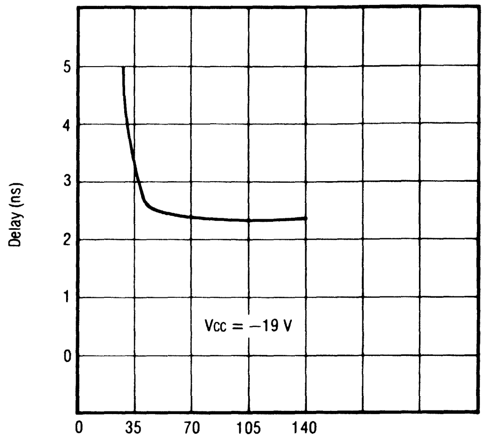

Third Order Intercept vs. Voltage 25°C
40.0
38.0
36.0
34.0
32.0
30.0
Intercept Point (dBm)
−15 Volts
−19 Volts
−24 Volts
0
35
70
105
140
Frequency (MHz)


Peak Envelope Power vs. Voltage 25°C
26.0
24.0
22.0
20.0
18.0
16.0
Power (dBm)
−15 Volts
−19 Volts
−24 Volts
0
35
70
105
140
Frequency (MHz)

Second Harmonic Distortion vs. Voltage 25°C



Group Delay vs. Frequency 25°C



S-Parameters

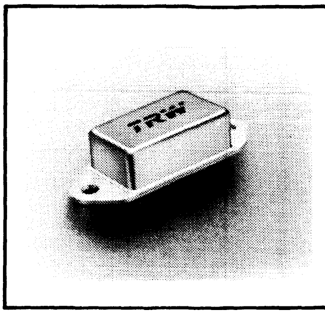
Biased at -19 Volts T = 25°C Zo = 75Ω

Frequency (MHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
40	-28.8	101	21.9	-26.1	-28.0	163	-39.3	108
50	-29.2	108	21.9	-35.0	-27.9	156	-43.4	123
70	-27.7	113	22.0	-52.5	-27.8	143	-43.0	-140
90	-26.6	106	22.1	-68.8	-27.9	132	-36.0	-129
100	-26.1	106	22.1	-77.8	-27.9	125	-33.3	-130

Magnitude in dB, Phase Angle in degrees.

VHF-UHF Linear Amplifier

- Wide Bandwidth: 10 MHz-1000 MHz
- 17dB Gain
- Wide Dynamic Range: 7dB Noise Figure, +38dBm Third Order Intercept
- Low Second Order Distortion: Push Pull Circuitry



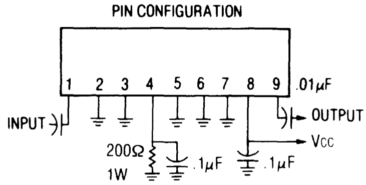
Electrical Characteristics for 50Ω Systems (T_{CASE} = 25°C and 24V)

Symbol	Characteristics	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100 MHz	16	17	18	dB
F_R	Frequency Response	10-1000 MHz			±1	dB
VSWR	50Ω Input & Output	10 MHz-860 MHz 10 MHz-1000 MHz			2:1 2.5:1	
P_{RI}	Reverse Isolation	500 MHz 1000 MHz		38 30		dB dB
I_{CC}	Supply Current	24V	200	220	240	mA
NF	Noise Figure	500 MHz 1000 MHz		6.5 7.5	8 9	dB dB
P_O	Power Output — 1dB Compression	f = 500 MHz	300	400		mW
I_{TO}	Third Order Intercept	10-1000 MHz	38	40		dBm
d_{SO}	Second Harmonic Distortion	P_{OUT} = 100mW f_{2H} = 1000 MHz		−50	−40	dB

Absolute Maximum Ratings

Vcc	RF Power Input	Storage Temperature	Operating Temperature (Case)
26V	+14dBm	−55°C to +125°C	−40°C to +100°C

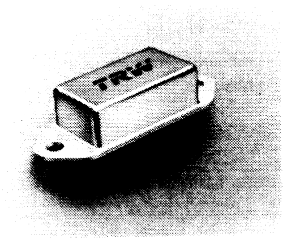
PIN CONFIGURATION



TRW

VHF-UHF Linear Amplifier

- **Wide Bandwidth: 10 MHz-1000 MHz**
- **17dB Gain**
- **Wide Dynamic Range: 7dB Noise Figure, +38dBm Third Order Intercept**
- **Low Second Order Distortion: Push Pull Circuitry**



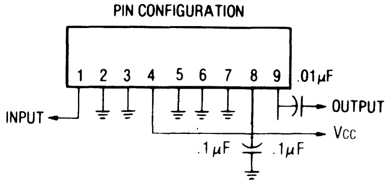
Electrical Characteristics for 50Ω Systems (T_{CASE} = 25°C and 12V)

Symbol	Characteristics	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100 MHz	16	17	18	dB
F_R	Frequency Response	10-1000 MHz			±1	dB
VSWR	50Ω Input & Output	10 MHz-860 MHz 10 MHz-1000 MHz			2:1 2.5:1	
P_{RI}	Reverse Isolation	500 MHz 1000 MHz		38 30		dB dB
I_{CC}	Supply Current	12V	360	380	400	mA
NF	Noise Figure	500 MHz 1000 MHz		6.5 7.5	8 9	dB dB
P_O	Power Output — 1dB Compression	f = 500 MHz	300	400		mW
I_{TO}	Third Order Intercept	10-1000 MHz	38	40		dBm
d_{SO}	Second Harmonic Distortion	P_{OUT} = 100mW f_{2H} = 1000 MHz		−50	−40	dB

Absolute Maximum Ratings

V_{CC}	RF Power Input	Storage Temperature	Operating Temperature (Case)
13V	+14dBm	−55°C to +125°C	−40°C to +100°C

PIN CONFIGURATION



TRW Electronic Components Group

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200 South Turnbull Canyon Road
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Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
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Phone: 714/457-1000

Products: Data converters, arithmetic products, and special processors.

Optoelectronics Division
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Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

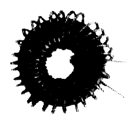
Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

CA2899 Broadband RF Choke

TRW Model CA2899 is a broadband, high impedance choke (RFC) required as an external component for models CA2812 (4 each), CA2820 (3 each), and CA2870 (1 each) RF Linear Hybrid Amplifiers (not sold as a separate item). For construction details refer to Application Note "Mechanical and Thermal Considerations in Using TRW RF Linear Hybrid Amplifiers"

- **Low Cost**
- **30μH RFC**
- **0.5 Amp Capacity**

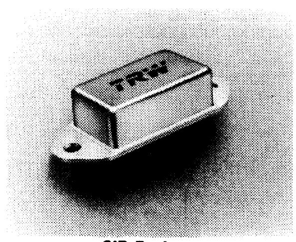


Electrical Characteristics (T_{CASE} = +25°C)

Symbol	Characteristics	Conditions	Min.	Typ.	Max.	Units
R	DC Resistance	I = 100mA	—	.001	—	Ω
L	Inductance	f = 1MHz	—	30	—	μH

VHF-UHF Linear Amplifier
10-1000 MHz, 400 mW Output Power

- **Wide Bandwidth: 10MHz-1000MHz**
- **17dB Gain**
- **Wide Dynamic Range: 7.5dB Noise Figure**
- **40dBm Third Order Intercept**
- **Low Second Order Distortion: Push Pull Circuitry**
- **Optimized for 15V Power Supply**



SIP Package

Electrical Characteristics For 50Ω Systems (T_{case} = 25°C and 15V Supply)

Symbol	Characteristics	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100MHz	16	17	18	dB
F_R	Frequency Response	10-1000MHz		±0.5	±1	dB
P_O	Power Output, 1dB Compression	f = 500MHz	300	400		mW
I_{TO}	Third Order Intercept see Figure 1	10-1000MHz	38	40		dBm
dso	Second Harmonic Suppression	P_O = 100mW f_{2h} = 1000MHz	−40	−50		dB
NF	Noise Figure	f = 500MHz f = 1000MHz		6.5 7.5	8 9	dB
VSWR	Input/Output (50Ω)	40-860MHz 10-1000MHz			2:1 2.5:1	N/A
I_{CC}	Supply Current	+15V	360	380	400	mA
PEP	Peak Envelope Power — For 2 Tone Distortion Test, see Fig. 1	f = 500MHz		25		dBm
IMD	Intermodulation Distortion TV Test (−8 −17 −10) See Fig. 2	f = 860MHz P_{sync} = 200mW		−60		dB

Absolute Maximum Ratings

Supply Voltage	RF Power Input	Storage Temperature	Case Operating Temp.
+18 Volts	+14dBm	−55°C to +125°C	−40°C to +100°C

Pin Configuration

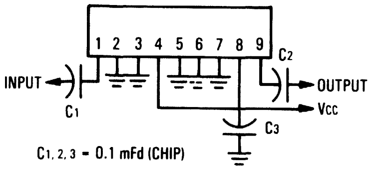
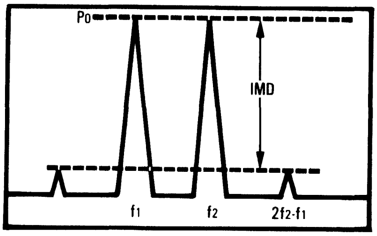


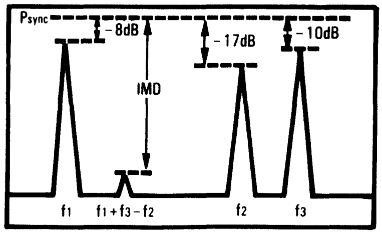
Figure 1: 2 Tone Intermodulation Test



$I_{TO} = P_O + \frac{IMD}{2}$ @ IMD>60dB

PEP = 4X Po @ IMD = −32dB

Figure 2: 3 Tone TV Intermodulation Test

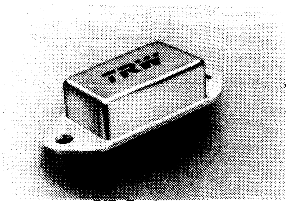


f1: video
f2: sideband
f3: sound

CA5800H

VHF-UHF Linear Amplifier

- 16dB Gain
- 10-1000MHz
- 1W, 1dB Compression
- +43dBm Third Order Intercept



SIP Package

Electrical Characteristics For 50Ω Systems (T_{case} = 25°C and 28V Supply)

Symbol	Characteristics	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100MHz	15	16	17	dB
F_R	Frequency Response	10-1000MHz			±1.5	dB
P_O	Power Output, 1dB Compression	f = 500MHz	0.6	1		W
I_{TO}	Third Order Intercept see Figure 1	10-1000MHz	40	43		dBm
dso	Second Harmonic Suppression	P_O = 100mW f_{2h} = 1000MHz	-46	-56		dB
NF	Noise Figure	f = 500MHz f = 1000MHz		7 8	8.5 9.5	dB
VSWR	Input/Output (50Ω)	10-1000MHz	–	–	2:1	N/A
I_{CC}	Supply Current	+28V	370	400	430	mA

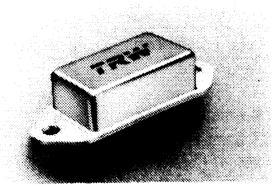
Absolute Maximum Ratings

Supply Voltage	RF Power Input	Storage Temperature	Case Operating Temp.
+30 Volts	+18dBm	-55°C to +125°C	-40°C to +100°C

CA5815H

VHF-UHF Linear Amplifier

- 16dB Gain
- 10-1000MHz
- 1W, 1dB Compression
- +43dBm Third Order Intercept



SIP Package

Electrical Characteristics For 50Ω Systems (T_{case} = 25°C and 15V Supply)

Symbol	Characteristics	Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 100MHz	15	16	17	dB
F_R	Frequency Response	10-1000MHz			±1.5	dB
P_O	Power Output, 1dB Compression	f = 500MHz	0.6	1		W
I_{TO}	Third Order Intercept see Figure 1	10-1000MHz	40	43		dBm
d_{SO}	Second Harmonic Suppression	P_O = 100mW f_{2h} = 1000MHz	-46	-56		dB
NF	Noise Figure	f = 500MHz f = 1000MHz		7 8	8.5 9.5	dB
VSWR	Input/Output (50Ω)	10-1000MHz	–	–	2:1	N/A
I_{CC}	Supply Current	+15V	650	700	750	mA

Absolute Maximum Ratings

Supply Voltage	RF Power Input	Storage Temperature	Case Operating Temp.
+17 Volts	+18dBm	-55°C to +125°C	-40°C to +100°C

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Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

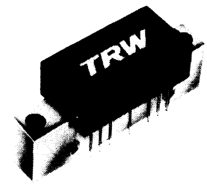
CATV Hybrid Amplifiers

These amplifiers are specifically designed for CATV and MATV applications. Having low distortion and low noise, these high reliability units can be used in mainline, bridger, line extender, reverse, or apartment house amplifier applications. All units feature GOLD die Metalization. Construction techniques have been proven over billions of operating hours in CATV Systems.

TRW

CATV Amplifier Pair

- 17 dB Gain
- 40-300 MHz (±0.1 dB)
- 7/7.5 dB Noise Figure
- −18 dB Return Loss (75 Ohms)
- Low Distortion
- All Gold Metalization
- High Output Capability



CA2101
CA2201

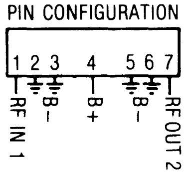
Absolute Maximum Ratings

SYMBOL	CHARACTERISTICS	CA2101	CA2201
V_{CC}	Supply Voltage	28V	28V
P_{IN}	RF Power Input	+65dBmV	+65dBmV
T_{ST}	Storage Temperature	−40°C to +100°C	−40°C to +100°C
T_{OP}	Operating Temperature	−20°C to +100°C	−20°C to +100°C

Electrical Characteristics for 75Ω Systems (T_{CASE} = 25°C, V_{CC} = 24V)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	CA2101	CA2201
Gain	Gain	50 MHz	17.1±0.5 dB	17.1±0.5 dB
B.W.	Frequency Response	±0.1 dB	40-300 MHz	40-300 MHz
S.C.E.	Slope Cable Equivalent	40-300 MHz	0 to +1.0 dB	0 to +1.0 dB
X-Mod	Output Capability @ −57dB NCTA	35 CH Flat	48.0 dBmV	50.5 dBmV
S.O.	Second Order Beat @ 50dBmV	CH 2, 13, R	−69 dB	−71 dB
T.B.	Triple Beat @ 50dBmV	$F_1 \pm F_2 \pm F_3$ on W	−74 dB	−79 dB
C.T.B. *See back for test procedure	Composite Triple Beat, 35 Channels Flat @ 46 dBmV	CH W	−61 dB	−66 dB
N.F.	Noise Figure	CH W	7.0 dB	7.5 dB
R.L.	Return Loss Input/Output	40-300 MHz	18 dB	18 dB
P. Req.	Power Requirement	24V	165mA (Typ)	200mA (Typ)

PIN CONFIGURATION

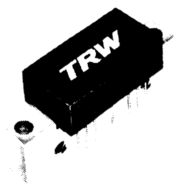


CA2101
CA2201

TRW

CATV Amplifier Pair

- 22 dB Gain
- 40-300 MHz (±0.2 dB)
- 6/7 dB Noise Figure
- 18 dB Return Loss (75 Ohms)
- Low Distortion
- All Gold Metalization
- High Output Capability



CA2301
CA2300

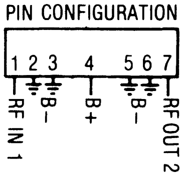
Absolute Maximum Ratings

SYMBOL	CHARACTERISTICS	CA2300	CA2301
V_{CC}	Supply Voltage	28V	28V
P_{IN}	RF Power Input	+60dBmV	+60dBmV
T_{ST}	Storage Temperature	−40°C to +100°C	−40°C to +100°C
T_{OP}	Operating Temperature	−20°C to +100°C	−20°C to +100°C

Electrical Characteristics for 75Ω Systems (T_{CASE} = 25°C, V_{CC} = 24V)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	CA2300	CA2301
Gain	Gain	50 MHz	22.0±0.6 dB	22.0±0.6 dB
B.W.	Frequency Response	±0.2 dB	40-300 MHz	40-300 MHz
S.C.E.	Slope Cable Equivalent	40-300 MHz	0 to +1.0 dB	0 to +1.0 dB
X-Mod	Output Capability @ −57dB NCTA	12 CH Flat 20 CH Flat 35 CH Flat	52.0 dBmV 49.5 dBmV 47.0 dBmV	54.5 dBmV 52.0 dBmV 49.5 dBmV
S.O.	Second Order Beat @ 50dBmV	CH 2, 13, R	−64 dB	−66 dB
T.B.	Triple Beat @ 50dBmV	$F_1 \pm F_2 \pm F_3$ on W $F_1 \pm F_2 \pm F_3$ on 13	−73 dB −77 dB	−78 dB −82 dB
C.T.B. *See back for test procedure	Composite Triple Beat, 35 Channels Flat @ 46 dBmV	CH 13 CH W	−62 dB −59 dB	−67 dB −64 dB
N.F.	Noise Figure	CH W	6.0 dB	7.0 dB
R.L.	Return Loss Input/Output	40-300 MHz	18 dB	18 dB
P. Req.	Power Requirement	24V	180mA (Typ)	220mA (Typ)

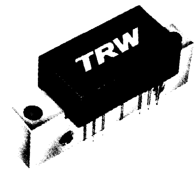
PIN CONFIGURATION



CA2300
CA2301

CATV Reverse Amplifier

- Reverse Amplifier
- 18.5 dB Gain
- Low Distortion
- 6.5 dB Noise Figure
- All Gold Metalization
- 5-120 MHz



CA2418

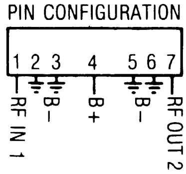
Absolute Maximum Ratings

SYMBOL	CHARACTERISTICS	CA2418
V_{CC}	Supply Voltage	28V
P_{IN}	RF Power Input	+65 dBmV
T_{ST}	Storage Temperature	−40°C to +100°C
T_{OP}	Operating Temperature (Sink)	−20°C to +100°C

Electrical Characteristics for 75Ω Systems (T_{CASE} = 25°C, V_{CC} = 24V)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	CA2418
Gain	Gain	100 MHz	18.5±0.5 dB
B.W.	Frequency Response	±0.25 dB	5-120 MHz
S.C.E.	Slope Cable Equivalent	5-120 MHz	+0.2 to −0.5 dB
X-Mod	Output Capability @ −57 dB NCTA	12 CH Flat	+54.5 dBmV
S.O.	Second Order Beat	50 dBmV	−72 dB
T.B.	Triple Beat	50 dBmV	−84 dB
N.F.	Noise Figure	100 MHz	6.5 dB
R.L.	Return Loss Input/Output	5-120 MHz	20 dB
P. Req.	Power Requirement	24V	200mA (Typ.)

PIN CONFIGURATION

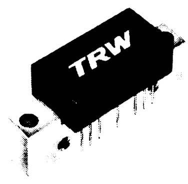


CA2418

TRW

CATV Reverse Amplifier

- Reverse Amplifier
- 22 dB Gain
- Low Distortion
- 6.0 dB Noise Figure
- All Gold Metalization
- 5-120 MHz



CA2422

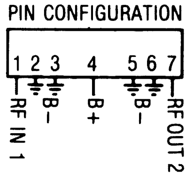
Absolute Maximum Ratings

SYMBOL	CHARACTERISTICS	CA2422
V_{CC}	Supply Voltage	28V
P_{IN}	RF Power Input	+65 dBmV
T_{ST}	Storage Temperature	−40°C to +100°C
T_{OP}	Operating Temperature (Sink)	−20°C to +100°C

Electrical Characteristics for 75Ω Systems (T_{CASE} = 25°C, V_{CC} = 24V)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	CA2422
Gain	Gain	100 MHz	22.0±0.6 dB
B.W.	Frequency Response	±0.25 dB	5-120 MHz
S.C.E.	Slope Cable Equivalent	5-120 MHz	+0.5 to −0.5 dB
X-Mod	Output Capability @ −57 dB NCTA	12 CH Flat	+55.0 dBmV
S.O.	Second Order Beat @ 55 dBmV	25 MHz 120 MHz	−70 dB −65 dB
T.B.	Triple Beat	50 dBmV	−84 dB
N.F.	Noise Figure	30 MHz 100 MHz	5.0 dB 6.0 dB
R.L.	Return Loss Input/Output	5-120 MHz	20 dB
P. Req.	Power Requirement	24V	230mA (Typ.)

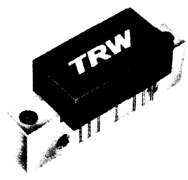
PIN CONFIGURATION



CA2422

CATV Amplifier

- 33 dB Gain
- 40-300 MHz (±0.3 dB)
- 7 dB Noise Figure
- −18 dB Return Loss (75 Ohms)
- Low Distortion
- All Gold Metalization
- High Output Capability



CA2600

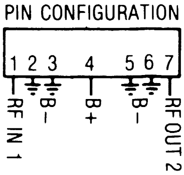
Absolute Maximum Ratings

SYMBOL	CHARACTERISTICS	CA2600
V_{CC}	Supply Voltage	28V
P_{IN}	RF Power Input	+50 dBmV
T_{ST}	Storage Temperature	−40°C to +100°C
T_{OP}	Operating Temperature (Sink)	−20°C to +100°C

Electrical Characteristics for 75Ω Systems (T_{CASE} = 25°C, V_{CC} = 24V)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	CA2600
Gain	Gain	50 MHz	33.5±1.0 dB
B.W.	Frequency Response	±.3 dB	40-300 MHz
S.C.E.	Slope Cable Equivalent	40-300 MHz	+0.5 to +1.5 dB
X-Mod	Output Capability @ −57 dB NCTA	12 CH Flat 20 CH Flat 35 CH Flat	53.5 dBmV 51.0 dBmV 48.5 dBmV
S.O.	Second Order Beat @ 50 dBmV	CH 2, 13, R	−68 dB
T.B.	Triple Beat @ 50 dBmV	$F_1 \pm F_2 \pm F_3$ on 13 $F_1 \pm F_2 \pm F_3$ on W	−80 dB −76 dB
C.T.B. *See back for test procedure	Composite Triple Beat, 35 Channels Flat @ 46 dBmV	CH 13 CH W	−65 −62
N.F.	Noise Figure	CH W	7.0 dB
R.L.	Return Loss Input/Output	40-300 MHz	18 dB
P. Req.	Power Requirement	24V	290mA (Typ.)

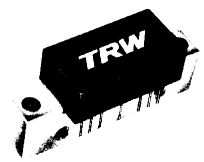
PIN CONFIGURATION



CA3100
CA3200

CATV Amplifiers

- 330 MHz
- 40 Channels
- 5.0/5.5 dB Noise Figure
- Low Distortion
- All Gold Metalization
- 17 dB Gain



CA3100
CA3200

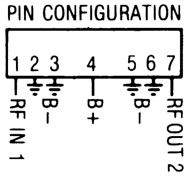
Absolute Maximum Ratings

SYMBOL	CHARACTERISTICS	CA3100	CA3200
V_{CC}	Supply Voltage	28V	28V
P_{IN}	RF Power Input	+65 dBmV	+65 dBmV
T_{ST}	Storage Temperature	−40°C to +100°C	−40°C to +100°C
T_{OP}	Operating Temperature	−20°C to +100°C	−20°C to +100°C

Electrical Characteristics for 75Ω Systems (T_{CASE} = 25°C, V_{CC} = 24V)

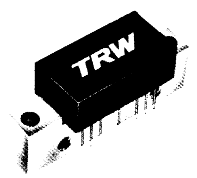
SYMBOL	CHARACTERISTICS	TEST CONDITIONS	CA3100	CA3200
Gain	Gain	50 MHz	17.1±0.5 dB	17.1±0.5 dB
B.W.	Frequency Response	±0.1 dB	40-330 MHz	40-330 MHz
S.C.E.	Slope Cable Equivalent	40-330 MHz	0.0 to +1.0 dB	0.0 to +1.0 dB
X-Mod	Output Capability @ −57dB NCTA	40 CH Flat	47.0 dBmV	49.5 dBmV
S.O.	Second Order Beat	50 dBmV	−68 dB	−70 dB
T.B.	Triple Beat @ 50dBmV	CH W	−74 dB	−79 dB
C.T.B. * See back for test procedure.	Composite Triple Beat, 40 CH Flat @ +46 dBmV	CH W	−58 dB	−63 dB
N.F.	Noise Figure	330 MHz	5.0 dB	5.5 dB
R.L.	Return Loss Input/Output	40-330 MHz	18 dB	18 dB
P. Req.	Power Requirement	24V	175mA (Typ)	210mA (Typ)

PIN CONFIGURATION



CATV Amplifier Pair

- **400 MHz**
- **52 Channels**
- **17 dB Gain**
- **Low Distortion**
- **All Gold Metalization**



CA4101
CA4201

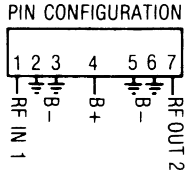
Absolute Maximum Ratings

SYMBOL	CHARACTERISTICS	CA4100	CA4200
V_{CC}	Supply Voltage	28V	28V
P_{IN}	RF Power Input	+65 dBmV	+65 dBmV
T_{ST}	Storage Temperature	−40°C to +100°C	−40°C to +100°C
T_{OP}	Operating Temperature	−20°C to +100°C	−20°C to +100°C

Electrical Characteristics for 75Ω Systems (T_{CASE} = 25°C, V_{CC} = 24V)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	CA4100	CA4200
Gain	Gain	50 MHz 400 MHz	17.2±0.5 dB 18.0±0.6 dB	17.2±0.5 dB 18.0±0.6 dB
B.W.	Frequency Response	±0.1 dB	40-400 MHz	40-400 MHz
X-Mod	Output Capability @ −57dB NCTA	52 CH Flat	+47 dBmV	+49 dBmV
S.O.	Second Order Beat	50 dBmV, CH 2, 13, R 50 dBmV, CH G, N, H 14	−69 dB −66 dB (Typ.)	−71 dB −68 dB (Typ.)
T.B.	Triple Beat @ 50dBmV	CH H 14	−68 dB	−72 dB
C.T.B.	Composite Triple Beat 52 CH Flat @ +46 dBmV	CH H 14	−54 dB	−58 dB
N.F.	Noise Figure	CH H 14	7.5 dB (Typ.) 8.0 dB Max.	8.0 dB (Typ.) 9.0 dB Max.
R.L.	Return Loss Input/Output	40-400 MHz	18 dB	18 dB
P. Req.	Power Requirement	24V	170mA (Typ)	210mA (Typ)

PIN CONFIGURATION

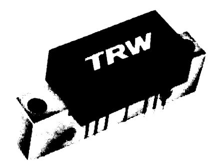


CA4101
CA4201

CA4411
CA4412

CATV Return Amplifiers

- Return Amplifier
- 13 dB Gain
- 5-200 MHz
- 5.5/6.0 dB Noise Figure
- Low Distortion
- All Gold Metalization



CA4411
CA4412

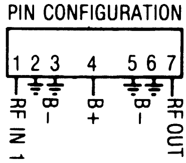
Absolute Maximum Ratings

SYMBOL	CHARACTERISTICS	CA4411	CA4412
V_{CC}	Supply Voltage	28V	28V
P_{IN}	RF Power Input	+65 dBmV	+65 dBmV
T_{ST}	Storage Temperature	−40°C to +100°C	−40°C to +100°C
T_{OP}	Operating Temperature	−20°C to +100°C	−20°C to +100°C

Electrical Characteristics for 75Ω Systems (T_{CASE} = 25°C, V_{CC} = 24V)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	CA4411	CA4412
Gain	Gain	10 MHz	13.0±0.5 dB	13.0±0.5 dB
B.W.	Frequency Response	±0.25 dB	5-200 MHz	5-200 MHz
S.C.E.	Slope Cable Equivalent	5-200 MHz	+0.2 to −0.5 dB	+0.2 to −0.5 dB
X-Mod	Cross Modulation @ 50 dBmV	26 CH Flat	−59 dB	−64 dB
S.O.	Second Order	50 dBmV	−70 dB	−72 dB
T.B.	Triple Beat	50dBmV, 120MHz 50dBmV, 200MHz	−79 dB −77 dB	−84 dB −82 dB
C.T.B.	Composite Triple Beat 26 CH Flat @ +50 dBmV		−60 dB	−65 dB
N.F.	Noise Figure	200 MHz	5.5 dB	6.0 dB
R.L.	Return Loss Input/Output	5-150 MHz 150-200 MHz	20 dB 18 dB	20 dB 18 dB
P. Req.	Power Requirement	24V	200mA (Typ.) 220mA (Max.)	200mA (Typ.) 220mA (Max.)

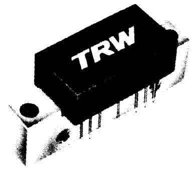
PIN CONFIGURATION



CA4411
CA4412

CATV Return Amplifiers

- Return Amplifiers
- 18.5/22.0 dB Gain
- 5-200 MHz
- 4.5/5.0 dB Noise Figure
- Low Distortion
- All Gold Metalization



CA4418
CA4422

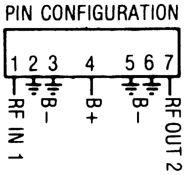
Absolute Maximum Ratings

SYMBOL	CHARACTERISTICS	CA4418	CA4422
V_{CC}	Supply Voltage	28V	28V
P_{IN}	RF Power Input	+65 dBmV	+60 dBmV
T_{ST}	Storage Temperature	−40°C to +100°C	−40°C to +100°C
T_{OP}	Operating Temperature	−20°C to +100°C	−20°C to +100°C

Electrical Characteristics for 75Ω Systems (T_{CASE} = 25°C, V_{CC} = 24V)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	CA4418	CA4422
Gain	Gain	10 MHz	18.5±0.5 dB	22.0±0.6 dB
B.W.	Frequency Response	±0.25 dB	5-200 MHz	5-200 MHz
S.C.E.	Slope Cable Equivalent	5-200 MHz	+0.2 to −0.5 dB	+0.2 to −0.5 dB
X-Mod	Cross Modulation @ 50 dBmV	26 CH Flat	−64 dB	−64 dB
S.O.	Second Order	50 dBmV	−72 dB	−72 dB
T.B.	Triple Beat	50dBmV, 120MHz 50dBmV, 200MHz	−84 dB −82 dB	−84 dB −82 dB
C.T.B.	Composite Triple Beat 26 CH Flat @ 50 dBmV		−65 dB	−65 dB
N.F.	Noise Figure	200 MHz	5.0 dB	4.5 dB
R.L.	Return Loss Input/Output	5-150 MHz 150-200 MHz	20 dB 18 dB	20 dB 18 dB
P. Req.	Power Requirement	24V	160mA (Typ.) 180mA (Max.)	200mA (Typ.) 220mA (Max.)

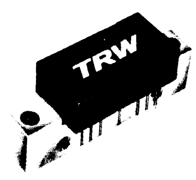
PIN CONFIGURATION



CA4600

CATV Amplifier

- 400 MHz
- 52 Channels
- 34 dB Gain
- 7.5 dB Noise Figure
- Low Distortion
- All Gold Metalization



CA4600

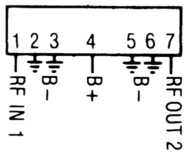
Absolute Maximum Ratings

SYMBOL	CHARACTERISTICS	CA4600
V_{CC}	Supply Voltage	28V
P_{IN}	RF Power Input	+50 dBmV
T_{ST}	Storage Temperature	−40°C to +100°C
T_{OP}	Operating Temperature (Sink)	−20°C to +100°C

Electrical Characteristics for 75Ω Systems (T_{CASE} = 25°C, V_{CC} = 24V)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	CA4600
Gain	Gain	50 MHz	34.0±1.0 dB
B.W.	Frequency Response	±0.4 dB	40-400 MHz
S.C.E.	Slope Cable Equivalent	50-400 MHz	+0.6 to 2.0 dB
X-Mod	Output Capability @ −57 dB Xmod	52 CH Flat	+48.5 dBmV
S.O.	Second Order	50dBmV, CH 2, 13, R 50dBmV, CH G, N, H14	−66 dB −62 dB
T.B.	Triple Beat	50dBmV, CH H14	−71 dB
C.T.B.	Composite Triple Beat 52 Channel	+46dBmV, CH H14	−57 dB
N.F.	Noise Figure	CH H14	7.5 dB (Max.)
R.L.	Return Loss Input/Output	40-400 MHz	18 dB (Min.)
P. Req.	Power Requirement	24V	320mA (Typ.)

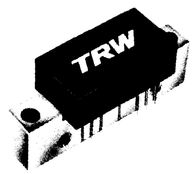
PIN CONFIGURATION



CA5101
CA5201

TRW

- **450 MHz**
- **18 dB Gain**
- **Low Noise Figure**
- **Low Distortion**
- **All Gold Metalization**



CA5101
CA5201

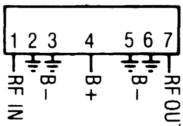
Absolute Maximum Ratings

SYMBOL	CHARACTERISTICS	CA5101	CA5201
V_{CC}	Supply Voltage	28V	28V
P_{IN}	RF Power Input	+65 dBmV	+65 dBmV
T_{ST}	Storage Temperature	−40°C to +100°C	−40°C to +100°C
T_{OP}	Operating Temperature	−20°C to +100°C	−20°C to +100°C

Electrical Characteristics for 75Ω Systems (T_{CASE} = 25°C, V_{CC} = 24V)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	CA5101	CA5201
Gain	Gain	450 MHz	19.1±0.6 dB	19.1±0.6 dB
B.W.	Frequency Response	±0.1 dB	40-450 MHz	40-450 MHz
S.C.E.	Slope Cable Equivalent	50-450 MHz	+0.3 to −1.4 dB	+0.3 to −1.4 dB
X-Mod	Cross Modulation @ +46 dBmV	52 CH	−59 dB	−63 dB
S.O.	Second Order	50dBmV, CH 2, 13, R 50dBmV, CH 2, H5, H14	−71 dB −68 dB	−73 dB −70 dB
T.B.	Triple Beat	50dBmV, CH H14	−74 dB	−78 dB
C.T.B.	Composite Triple Beat 52 Channel @ +46dBmV	CH H14	−58 dB	−62 dB
N.F.	Noise Figure	50 MHz 400 MHz 450 MHz	4.5 dB 6.0 dB 6.5 dB	5.0 dB 6.5 dB 7.0 dB
R.L.	Return Loss Input/Output	40-450 MHz	18 dB	18 dB
P. Req.	Power Requirement	24V	180mA (Typ.)	215mA (Typ.)

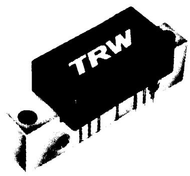
PIN CONFIGURATION



CA5101
CA5201

CA5600

- **450 MHz**
- **34 dB Gain**
- **Low Noise Figure**
- **Low Distortion**
- **All Gold Metalization**



CA5600

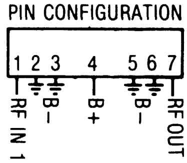
Absolute Maximum Ratings

SYMBOL	CHARACTERISTICS	CA5600
V_{CC}	Supply Voltage	28V
P_{IN}	RF Power Input	+50 dBmV
T_{ST}	Storage Temperature	−40°C to +100°C
T_{OP}	Operating Temperature (Sink)	−20°C to +100°C

Electrical Characteristics for 75Ω Systems (T_{CASE} = 25°C, V_{CC} = 24V)

SYMBOL	CHARACTERISTICS	TEST CONDITIONS	CA5600
Gain	Gain	50 MHz	34.0±1.0 dB
B.W.	Frequency Response	±0.4 dB	40-450 MHz
S.C.E.	Slope Cable Equivalent	50-450 MHz	+0.8 to +2.5 dB
X-Mod	Cross Modulation @ +46 dBmV	52 CH	−61.0 dB
S.O.	Second Order	50dBmV, CH 2, 13, R 50dBmV, CH 2, H5, H14	−68 dB −64 dB
T.B.	Triple Beat	50dBmV, CH H14	−77 dB
C.T.B.	Composite Triple Beat 52 Channel	+46dBmV, CH H14	−61 dB
N.F.	Noise Figure	50 MHz 400 MHz 450 MHz	4.5 dB 5.5 dB 6.0 dB
R.L.	Return Loss Input/Output	40-450 MHz	18 dB
P. Req.	Power Requirement	24V	320mA (Typ.)

PIN CONFIGURATION



TRW Electronic Components Group

Printed Circuit Division
200 South Turnbull Canyon Road
City of Industry, California 91749
Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
4243 Campus Point Court
San Diego, California 92121
Phone: 714/457-1000

Products: Data converters, arithmetic products, and special processors.

Optoelectronics Division
1201 Tappan Circle
Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

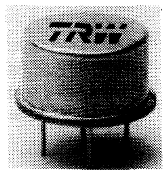
Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

TO-8 Hybrid RF Gain Blocks

These 50 ohm in/out TO-8 gain blocks provide a quick solution to many amplifiers design problems. They feature the same die technology and hybrid processes proven by billions of operating hours in TRW's CATV amplifiers.

GPA500 Series General Purpose Amplifiers

- **Wide Bandwidth**
- **Completely self-contained**
- **Internally matched to 50Ω**
- **Space saving, hermetic TO-8 package**



TO-8 Package

The GPA500 Series is a family of self-contained, high performance amplifiers utilizing a time tested thin film hybrid process to provide a high performance, high reliability product. Eliminating external bias and coupling components saves printed circuit board space and assembly time.

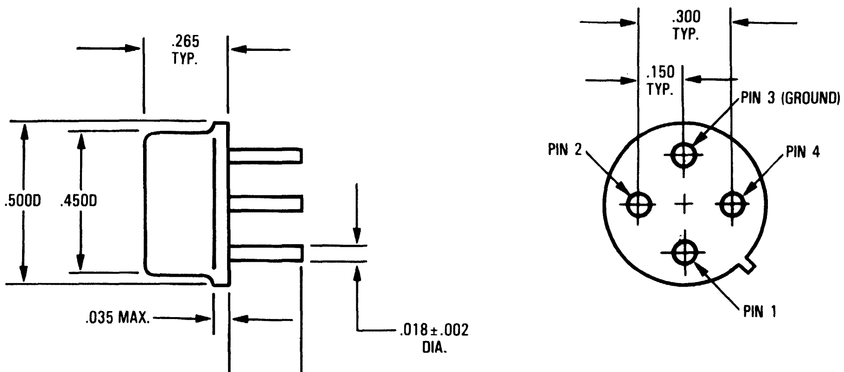
Applications include: low noise receiver front ends, high performance I.F. strips, L.O. buffer amplifiers and transmitter pre-drivers.

Electrical Characteristics (T_{case} = 25°C and ZO = 50Ω)

Characteristics	GPA501			GPA502			GPA503		
	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
Small Signal Gain (dB)	14	15	16	14	15	16	11	12	13
Gain Flatness (±dB)		0.5	0.8		0.5	0.8		0.5	0.8
Power Output At 1 dB Compression (dBm)	3.0	4.0		13.0	14.0		18.0	19.0	
Third Order Intercept (dBm)	16.0	18.0		26.0	28.0		32.0	35.0	
Noise Figure (dB)		4.0	4.5		4.5	5.0		5.0	5.5
Supply Current (mA) Vcc = +15 Volts		15	18		35	40		65	70
Frequency Range (MHz)	5		600	5		600	5		500
VSWR In		1.5	2.0		1.5	2.0		1.5	2.0
VSWR Out		1.5	2.0		1.5	2.0		1.5	2.0

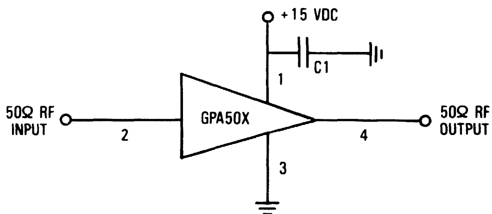
Absolute Maximum Ratings	GPA501			GPA502			GPA503		
	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
Supply Voltage (Volts)			18			18			24
RF Power Input (dBm)			10			10			16
Storage Temp (°C)	-65		125	-65		125	-65		125
Case Operating Temp (°C)	-55		100	-55		100	-55		100

TO-8 Package Outline



NOTE: I. CASE IS RF GROUND CONNECTION

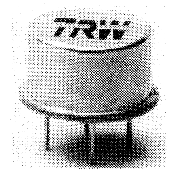
GPA501, 502, 503 Pin Configuration



C1 - 0.01 UF CHIP CAPACITOR

GPA510 Series General Purpose Amplifiers

- **Wide Bandwidth**
- **Space saving, hermetic TO-8 package**
- **Internally matched to 50Ω**
- **Low Cost**



TO-8 Package

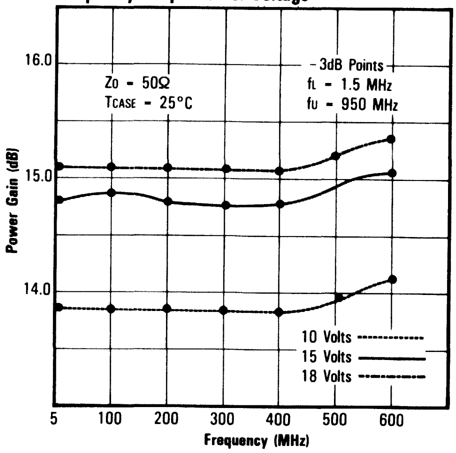
The GPA510 Series is a family of low cost, high performance RF amplifiers utilizing a thin film hybrid process for high performance and reliability. Applications for these compact amplifiers include: low noise receiver front ends, high performance I.F. strips, L.O. buffer amplifiers and transmitter pre-driver stages.

Electrical Characteristics (T_{case} = 25°C and ZO = 50Ω)

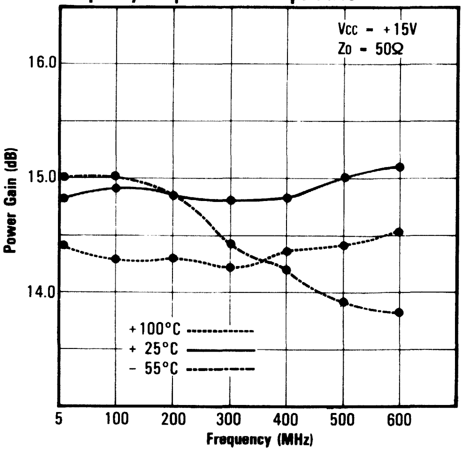
Characteristics		GPA510			GPA511			GPA512	
	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
Small Signal Gain (dB)	14	15	16	14	15	16	11	12	13
Gain Flatness (±dB)		0.5	0.8		0.5	0.8		0.5	0.8
Power Output At 1 dB Compression (dBm)	3.0	4.0		13.0	14.0		18.0	19.0	
Third Order Intercept (dBm)	16.0	18.0		26.0	28.0		32.0	35.0	
Noise Figure (dB)		4.0	4.5		4.5	5.0		5.0	5.5
Supply Current (mA) Vcc = +15 Volts		15	18		35	40		65	70
Frequency Range (MHz)	5		600	5		600		5	500
VSWR In		1.5	2.0		1.5	2.0		1.5	2.0
VSWR Out		1.5	2.0		1.5	2.0		1.5	2.0

Absolute Maximum Ratings		GPA510			GPA511			GPA512	
	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
Supply Voltage (Volts)			18			18			24
RF Power Input (dBm)			10			10			16
Storage Temp (°C)	-65		125	-65		125	-65		125
Case Operating Temp (°C)	-55		100	-55		100	-55		100

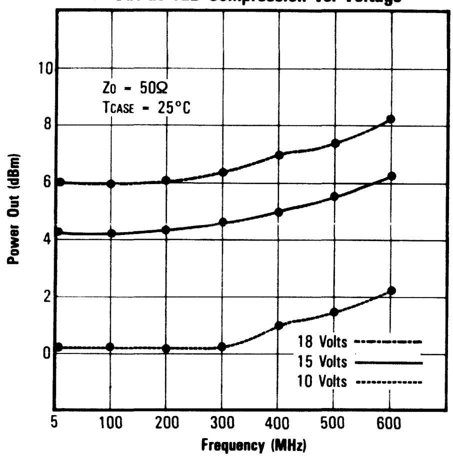
Frequency Response vs. Voltage



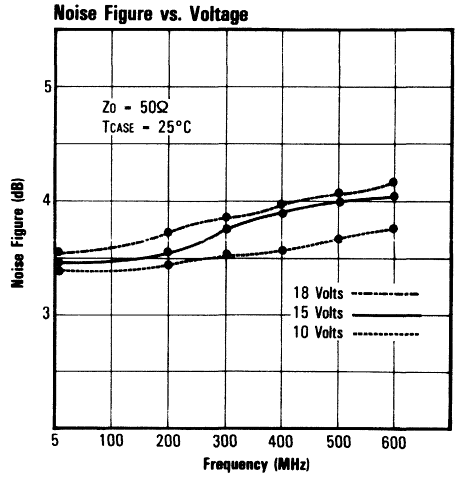
Frequency Response vs. Temperature



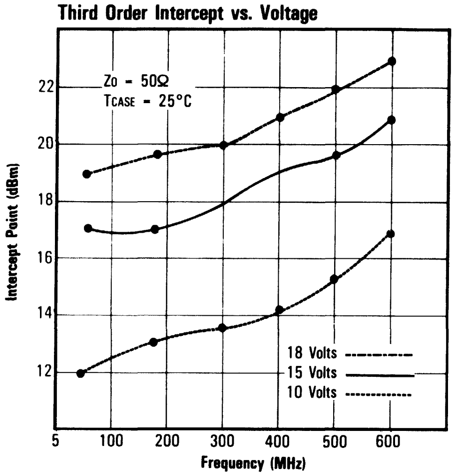
Power Out at 1dB Compression vs. Voltage



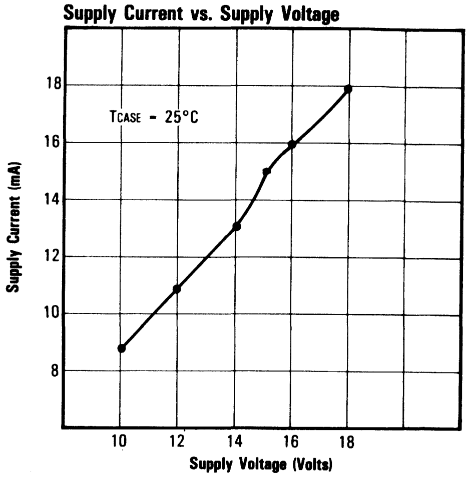
Noise Figure vs. Voltage



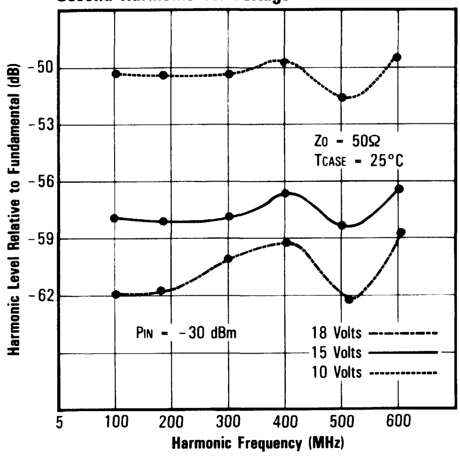
Third Order Intercept vs. Voltage



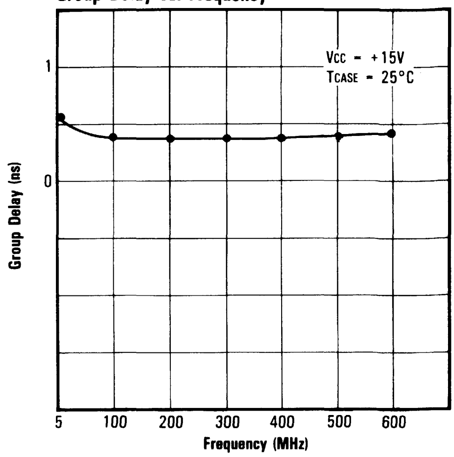
Supply Current vs. Supply Voltage



Second Harmonic vs. Voltage



Group Delay vs. Frequency

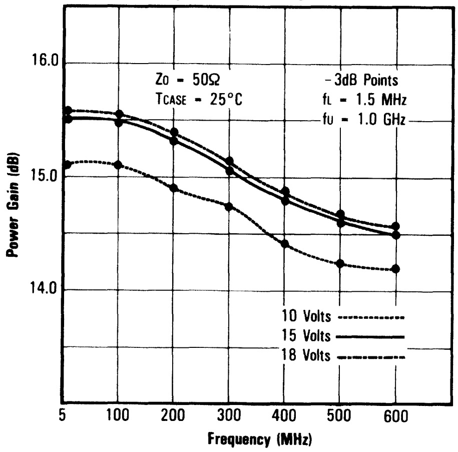


GPA510 S PARAMETERS

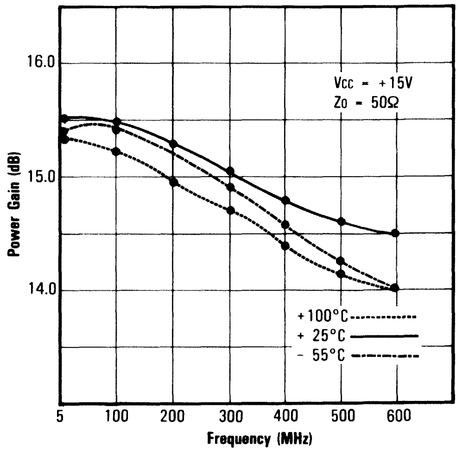
S-dB and Angles:
Biased at 15V, 15mA, T = 25°C

Frequency (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
5	-10.8	- 55.7	14.2	-162.0	-17.8	- 8.4	-12.3	-32.2
100	-23.0	- 46.1	14.9	148.3	-18.5	- 19.0	-19.5	-11.3
200	-23.3	- 67.1	14.8	114.3	-18.1	- 35.1	-18.1	-15.2
300	-23.5	- 99.3	14.8	80.7	-18.0	- 53.0	-17.1	-29.9
400	-24.3	-151.5	14.8	46.3	-17.7	- 71.9	-17.1	-45.1
500	-20.4	178.7	15.0	13.2	-17.4	- 89.0	-16.8	-68.2
600	-18.4	134.8	15.1	- 22.0	-16.8	-107.0	-17.7	-77.3

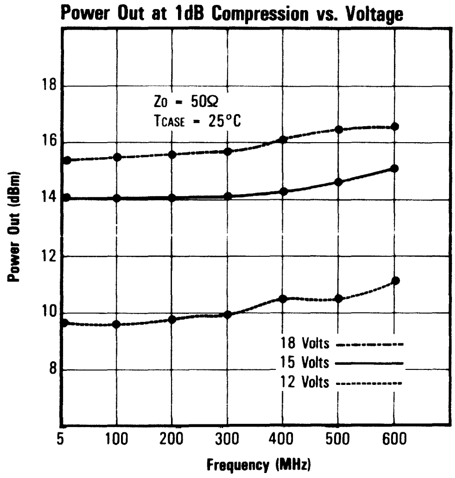
Frequency Response vs. Voltage



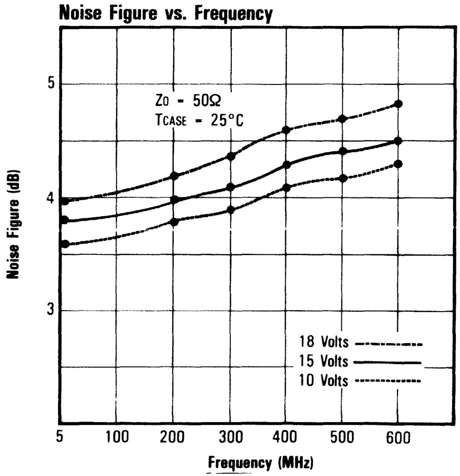
Frequency Response vs. Temperature



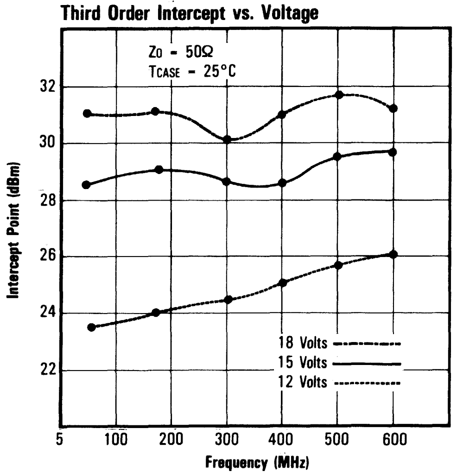
Power Out at 1dB Compression vs. Voltage



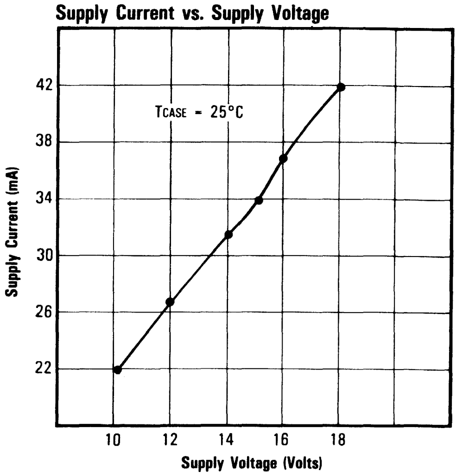
Noise Figure vs. Frequency

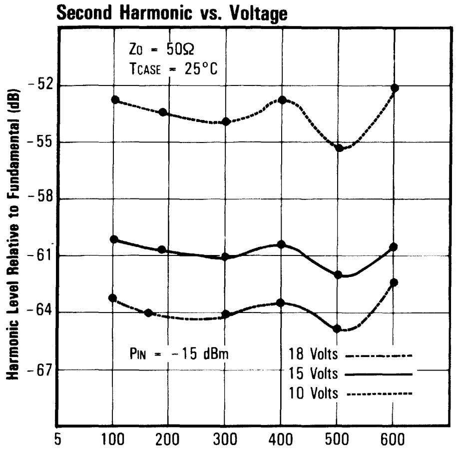


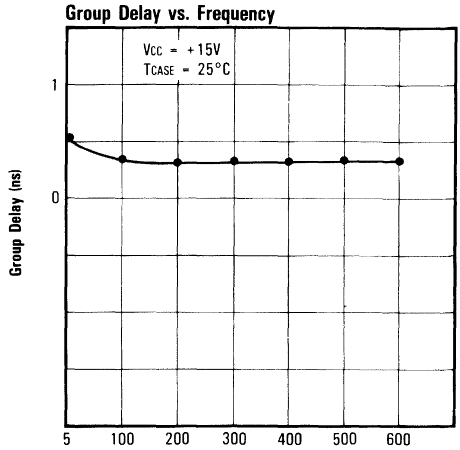
Third Order Intercept vs. Voltage



Supply Current vs. Supply Voltage





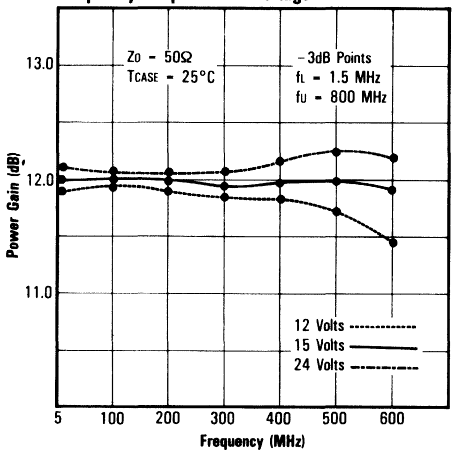


GPA511 S PARAMETERS

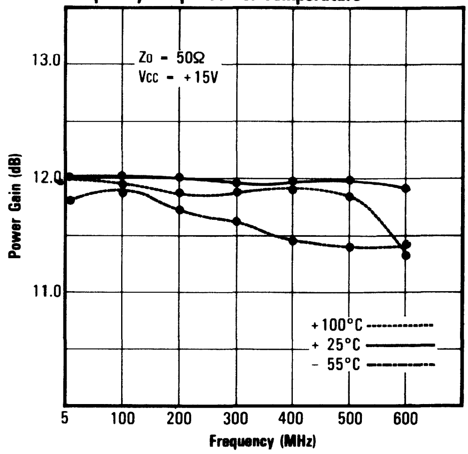
S-dB and Angles:
Biased at 15V, 35mA, T = 25°C

Frequency (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
5	-11.6	-78.1	14.8	-160.1	-17.7	- 11.6	-14.3	-57.2
100	-26.8	154.6	15.5	148.6	-18.7	- 19.1	-26.1	73.4
200	-25.7	94.1	15.3	114.8	-18.4	- 33.9	-19.5	33.3
300	-24.7	58.5	15.1	82.4	-18.1	- 50.3	-16.8	1.4
400	-26.8	25.6	14.8	51.2	-18.1	- 66.8	-14.8	-31.5
500	-26.9	9.3	14.6	19.3	-17.5	- 85.0	-14.7	-62.9
600	-27.0	-10.4	14.5	-12.4	-16.9	-103.3	-15.3	-96.0

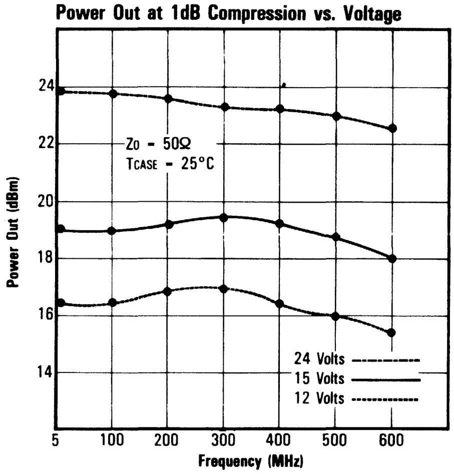
Frequency Response vs. Voltage



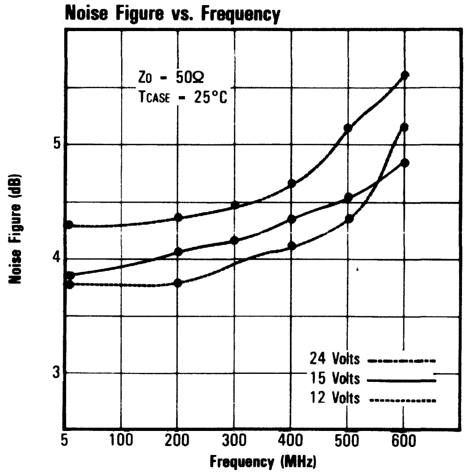
Frequency Response vs. Temperature



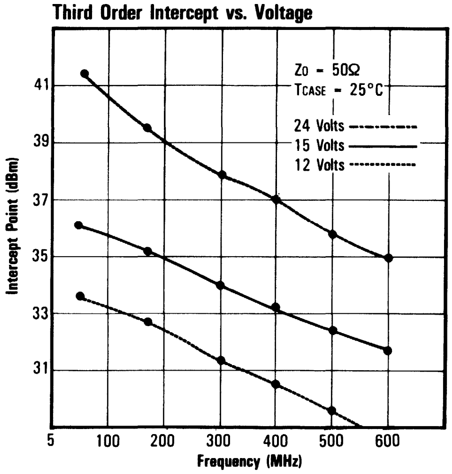
Power Out at 1dB Compression vs. Voltage



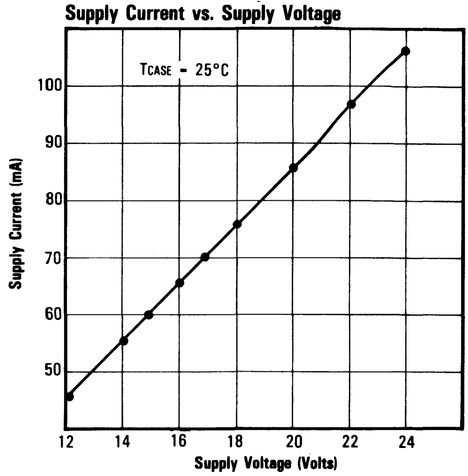
Noise Figure vs. Frequency



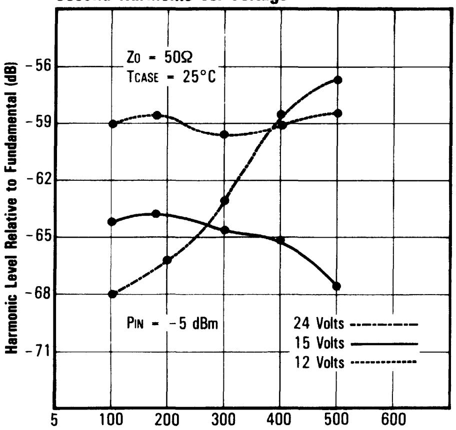
Third Order Intercept vs. Voltage



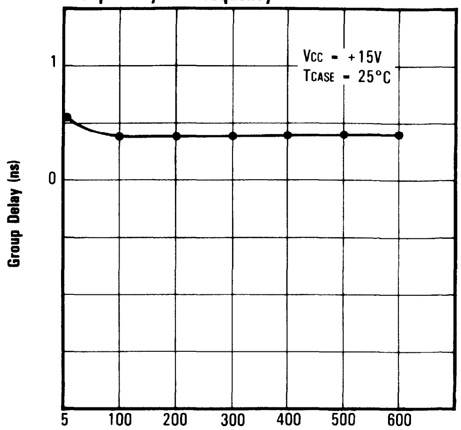
Supply Current vs. Supply Voltage



Second Harmonic vs. Voltage



Group Delay vs. Frequency

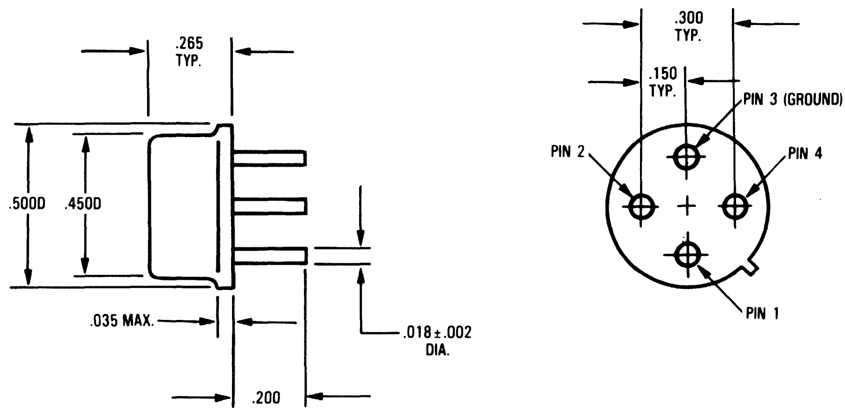


GPA512 S PARAMETERS

S-dB and Angles:
Biased at 15V, 65mA, T = 25°C

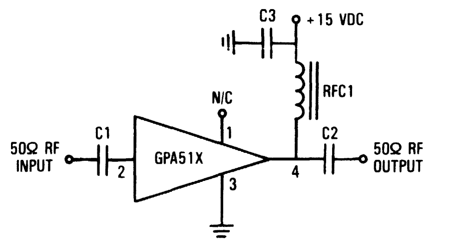
Frequency (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
5	-13.7	-95:3	11.4	-164.2	-15.7	- 6.5	-19.6	-80.7
100	-20.2	166.2	12.0	148.3	-16.5	-20.3	-24.8	99.2
200	-20.2	137.9	12.0	115.5	-16.5	-37.9	-19.8	37.3
300	-19.9	114.7	12.0	82.6	-16.6	-57.8	-16.3	- 9.1
400	-20.9	103.6	12.0	50.4	-16.9	-76.0	-12.9	-53.3
500	-20.8	98.5	12.0	15.8	-17.4	-95.0	-10.0	-96.2

TO-8 Package Outline



NOTE: I. CASE IS RF GROUND CONNECTION

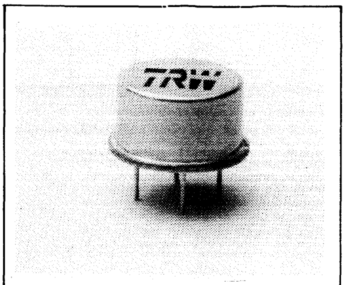
GPA510, 511, 512 Pin Configuration



C1, C2, C3 = 0.01 μF CHIP CAPACITOR
RFC1 = 30 μHy (See CA2899)

Low Noise Wide Band Amplifier Preliminary Data

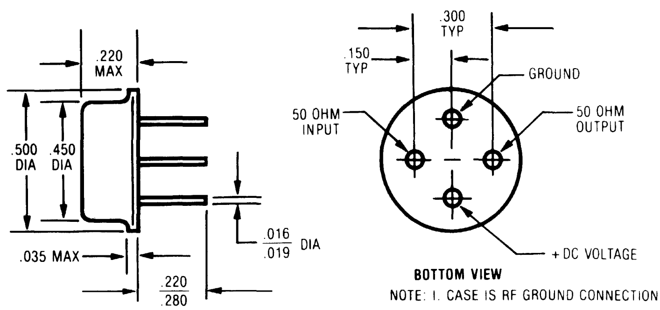
- 13 dB Gain 1-1000 MHz
- Low Noise and Wide Dynamic Range
- 3 dB Noise Figure with 6 dBm Output Power
- 12 Volts Operation



LNA1001

The LNA1001 is a 50 ohm low noise amplifier intended for use in a broadband application.

All bias, matching and decoupling components are housed in a small TO-8 package.



TO-8 Case

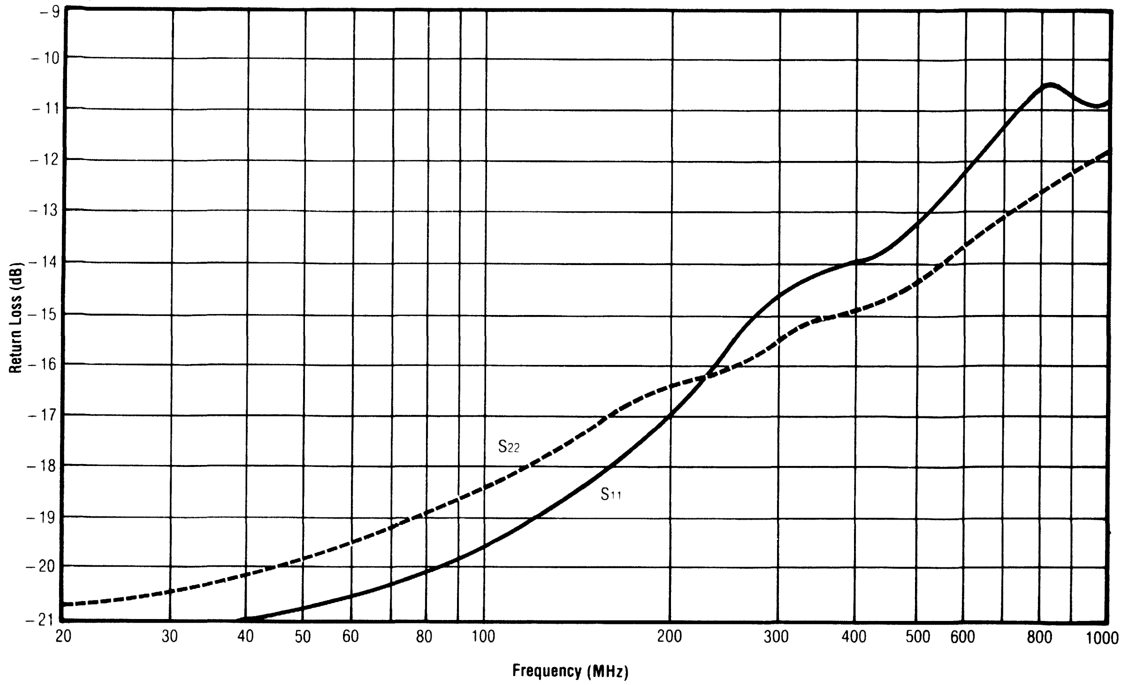
Electrical Characteristics For 50Ω System (T_{case} = 25°C and 12V Supply Voltage)

Symbol	Characteristics	Test Conditions	Min.	Typ.	Max.	Units
P_G	Power Gain	f = 20-900MHz	12	13		dB
F_R	Frequency Response	f = 20-900MHz		±0.5	±1	dB
P_o	Power Output, 1dB Compression	f = 20-900MHz	5	6		dBm
I_{TO}	Third Order Intercept see Figure 1	f = 20-900MHz		20		dBm
N_F	Noise Figure	f = 20-900MHz		3	3.8	dB
VSWR	Input/Output	f = 20-900MHz			2:1	N/A
I_{CC}	Supply Current	12V	13	15	17	mA

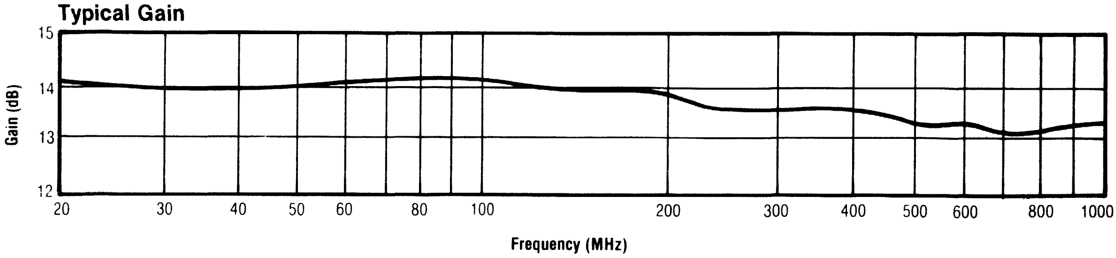
Absolute Maximum Ratings

Vcc	RF Power Input	Storage Temperature	Operating Temperature
17 V	+10dBm	−55°C to +125°C	−55°C to +100°C

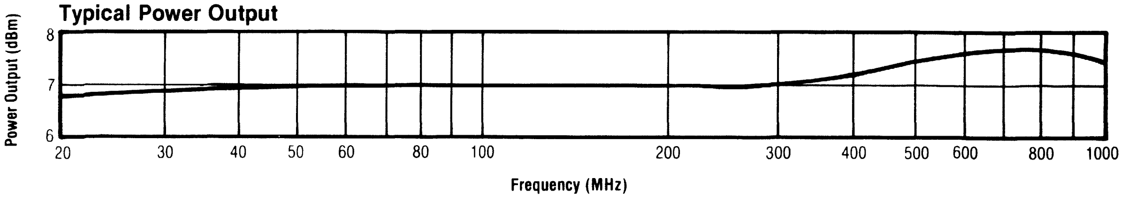
Typical Return Loss



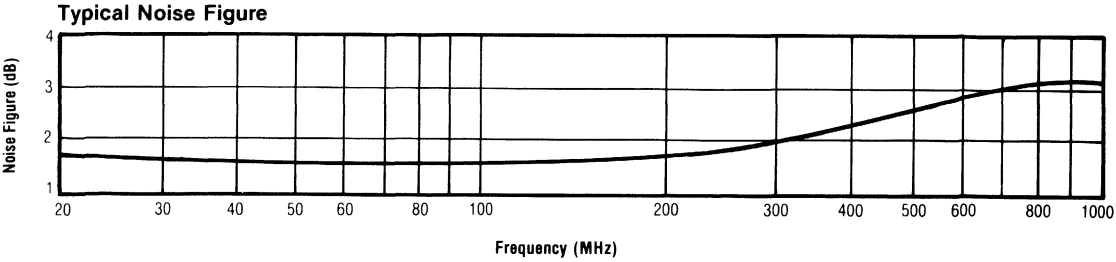
Typical Gain



Typical Power Output

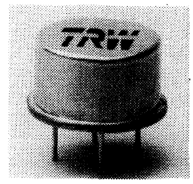


Typical Noise Figure



GPA504 and 505 General Purpose Amplifiers

- **Wide Bandwidth:**
- **Space Saving, Hermetic TO-8 Package**
- **Internally Matched to 50Ω**
- **Low Cost**
- **High Gain**



TO-8 Package

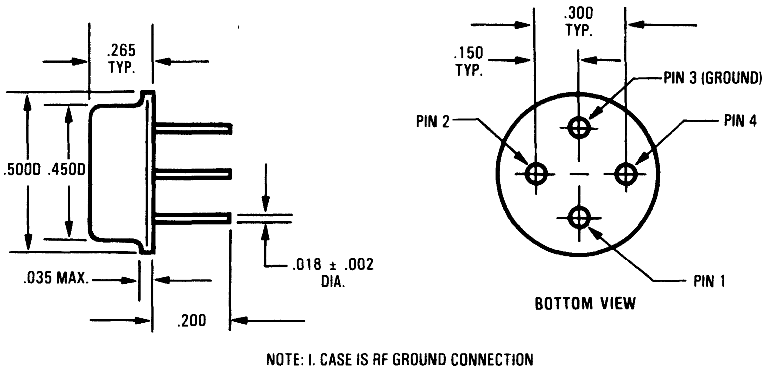
The GPA504 and 505 are low cost, high performance RF amplifiers utilizing a thin film hybrid process for high performance and reliability. Applications for these compact amplifiers include low noise receiver front ends, high performance I.F. strips, L.O. buffer amplifiers and transmitter pre-driver stages.

Electrical Characteristics (T_{case} = 25°C and ZO = 50Ω)

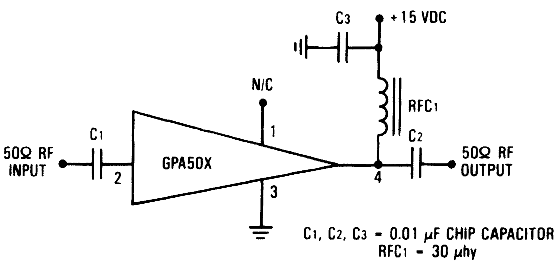
Characteristics	GPA504			GPA505			Units
	Min.	Nom.	Max.	Min.	Nom.	Max.	
Small Signal Gain		25			23		dB
Gain Flatness		1.0			1.0		±dB
Power Output At 1 dB Compression	11.0	13.0			20		dBm
Third Order Intercept		27			35		dBm
Noise Figure		4.5	5.5		5.5		dB
Supply Current Vcc = +15 Volts		60	70		120	140	mA
Frequency Range	5		500	5		500	MHz
VSWR In Out			2 : 1 2 : 1			2 : 1 2 : 1	

Absolute Maximum Ratings	GPA504			GPA505			Units
	Min.	Nom.	Max.	Min.	Nom.	Max.	
Supply Voltage			18			18	Volts
RF Power Input			0			5	dBm
Storage Temp.	-65		125	-65		125	°C
Case Operating Temp.	-55		100	-55		100	°C

TO-8 Package Outline

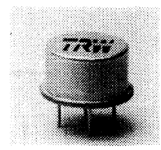


GPA504, 505 Pin Configuration



GPA1000 Series General Purpose Amplifiers

- **Wide Bandwidth:**
- **Completely self-contained**
- **Internally Matched to 50Ω**
- **Space Saving, Hermetic TO-8 Package**



TO-8 Package

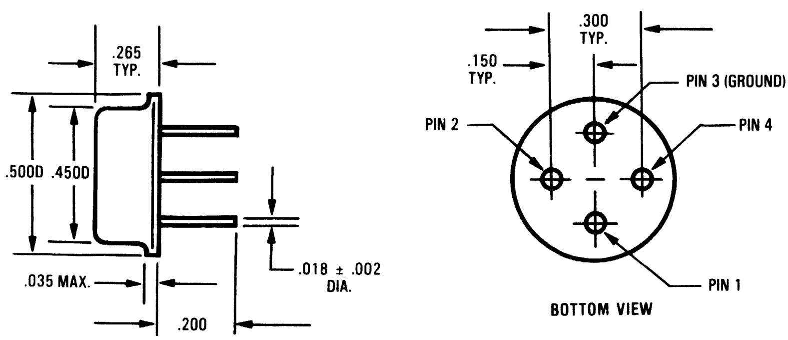
The GPA1000 Series is a family of self-contained, high performance amplifiers utilizing a time tested thin film hybrid process to provide a high performance , high reliability product. Eliminating external bias and coupling components saves printed circuit board space and assembly time. Applications include: low noise receiver front ends, high performance I.F. strips, L.O. buffer amplifiers and transmitter pre-drivers.

Electrical Characteristics (T_{case} = 25°C and Z0 = 50Ω)

Characteristics	GPA1001			GPA1002			GPA1003			Units
	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	
Small Signal Gain	14	15	16	11	12	13	9	10	11	dB
Gain Flatness			1			1			1	±dB
Power Output At 1 dB Compression	1.0	3.0		11	13		18	20		dBm
Third Order Intercept		16			26			34		dBm
Noise Figure		3.0	4.0		5.0	6.0		6.0	7.0	dB
Supply Current Vcc = +15 Volts		10	15		35	40		75	85	mA
Frequency Range	5		1000	5		1000	5		1000	MHz
VSWR In / Out			2 : 1 / 2 : 1			2 : 1 / 2 : 1			2 : 1 / 2 : 1	

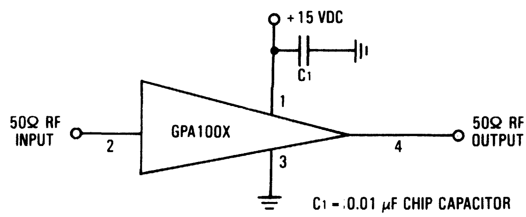
Absolute Maximum Ratings	GPA1001			GPA1002			GPA1003			Units
	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	
Supply Voltage			18			18			18	Volts
RF Power Input			10			10			16	dBm
Storage Temp.	-65		125	-65		125	-65		125	°C
Case Operating Temp.	-55		100	-55		100	-55		100	°C

TO-8 Package Outline



NOTE: I. CASE IS RF GROUND CONNECTION

GPA1001 Through 1003 Pin Configuration

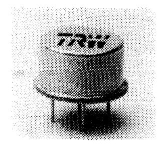


TRW

GPA1004, 1005, 1006, 1007

GPA Series General Purpose Amplifiers

- **Wide Bandwidth:**
- **Space Saving, Hermetic TO-8 Package**
- **Internally Matched to 50Ω**
- **Low Cost**



TO-8 Package

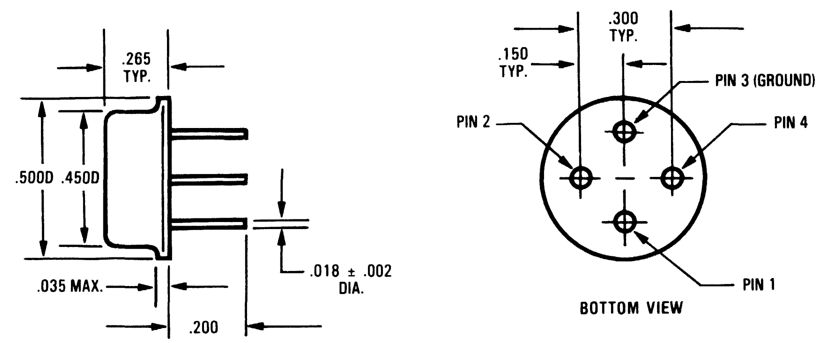
The GPA1004 through 1007 Series is a family of low cost, high performance RF amplifiers utilizing a thin film hybrid process for high performance and reliability. Applications for these compact amplifiers include low noise receiver front ends, high performance I.F. strips, L.O. buffer amplifiers and transmitter pre-driver stages.

Electrical Characteristics (T_{case} = 25°C and Z0 = 50Ω)

Characteristics	GPA1004			GPA1005			GPA1006			GPA1007			Units
	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	
Small Signal Gain	17	18	19	17	18	19	18	19	20	15	16	17	dB
Gain Flatness			1			1			1			1	±dB
Power Output At 1 dB Compression	0	2.0		6.0	8.0		11.0	13		18	20		dBm
Third Order Intercept		16			16			26			34		dBm
Noise Figure		4.5	5.5		5.0	6.0		5.5	6.5		6.5	7.5	dB
Supply Current Vcc = +15 Volts		25	30		35	45		60	70		120	140	mA
Frequency Range	5		1000	5		1000	5		1000	5		1000	MHz
VSWR In Out			2 : 1 2 : 1			2 : 1 2 : 1			2 : 1 2 : 1			2 : 1 2 : 1	

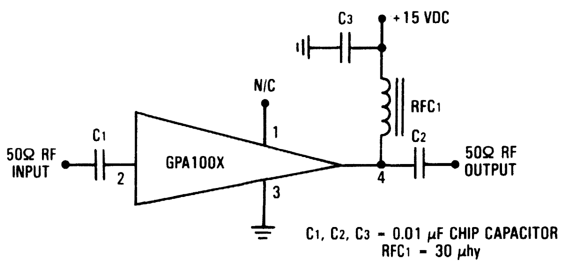
Absolute Maximum Ratings	GPA1004			GPA1005			GPA1006			GPA1007			Units
	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	
Supply Voltage			18			18			18			18	Volts
RF Power Input			0			0			0			5	dBm
Storage Temp.	-85		125	-65		125	-65		125	-65		125	°C
Case Operating Temp.	-55		100	-55		100	-55		100	-55		100	°C

TO-8 Package Outline



NOTE: I. CASE IS RF GROUND CONNECTION

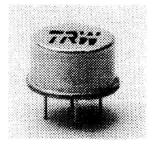
GPA1004 Through 1007 Pin Configuration



C1, C2, C3 = 0.01 μF CHIP CAPACITOR
RFC1 = 30 μhy

GPA1501 General Purpose Amplifiers

- **Wide Bandwidth:**
- **Space Saving, Hermetic TO-8 Package**
- **Internally Matched to 50Ω**



TO-8 Package

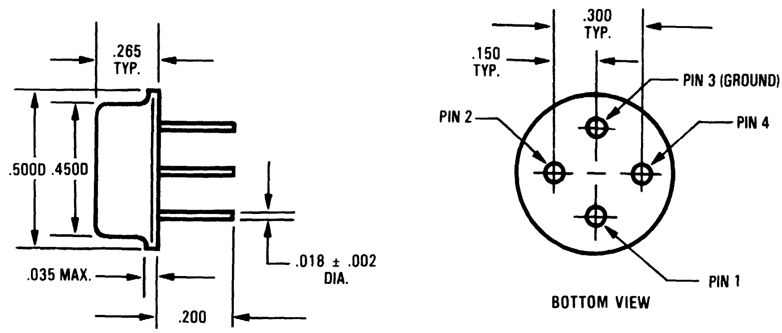
The GPA1501 is a high performance RF amplifier utilizing a thin film hybrid process for high performance and reliability. Applications for these compact amplifiers include low noise receiver front ends, high performance I.F. strips, L.O. buffer amplifiers and transmitter pre-driver stages.

Electrical Characteristics (T_{case} = 25°C and Z0 = 50Ω)

Characteristics	Min.	Nom.	Max.	Units
Small Signal Gain	16	17	18	dB
Gain Flatness			1.0	± dB
Power Output At 1 dB Compression	8.0	10.0		dBm
Third Order Intercept		21.0		dBm
Noise Figure		7.0	8.0	dB
Supply Current V_{CC} = +15 Volts		40	50	mA
Frequency Range	5		1500	MHz
VSWR In Out			2 : 1 2 : 1	

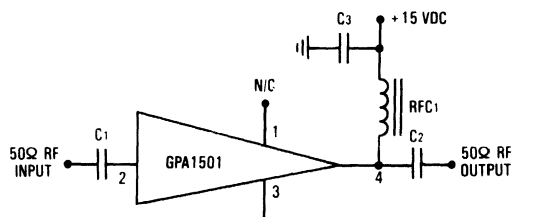
Absolute Maximum Ratings	Min.	Nom.	Max.	Units
Supply Voltage			18	Volts
RF Power Input			0	dBm
Storage Temp.	-65		125	°C
Case Operating Temp.	-55		100	°C

TO-8 Package Outline



NOTE: I. CASE IS RF GROUND CONNECTION

GPA1501 Pin Configuration



C1, C2, C3 = 0.01 μF CHIP CAPACITOR
RFC1 = 30 μhy

TRW Electronic Components Group

Printed Circuit Division
200 South Turnbull Canyon Road
City of Industry, California 91749
Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
4243 Campus Point Court
San Diego, California 92121
Phone: 714/457-1000

Products: Data converters, arithmetic products, and special processors.

Optoelectronics Division
1201 Tappan Circle
Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

12.5 Volt Hybrid Power Modules for Mobile, Marine and Amateur Service

The ML-MX-MV series of hybrid power RF modules can replace the entire RF section of a medium power transmitter or serve as a compact driver for a higher power transmitter.

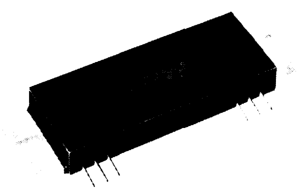
Available for U.S. and European mobile bands from 66-512 MHz, these compact modules feature low harmonic output, high gain and resistance to damage resulting from arbitrary output termination.

Maximum input VSWR is 2:1. A number of units are available in each band offering power outputs from 7.5 to 30.0 watts.

TRW

RF Power Module

- 20 Watts
- 12.5 Volts
- 68-88 MHz
- Class C Operation
- 50 Ohm Input/Output
- ∞ VSWR at 16Vcc
- High Gain
- Cost Effective
- Convenient
- Compact



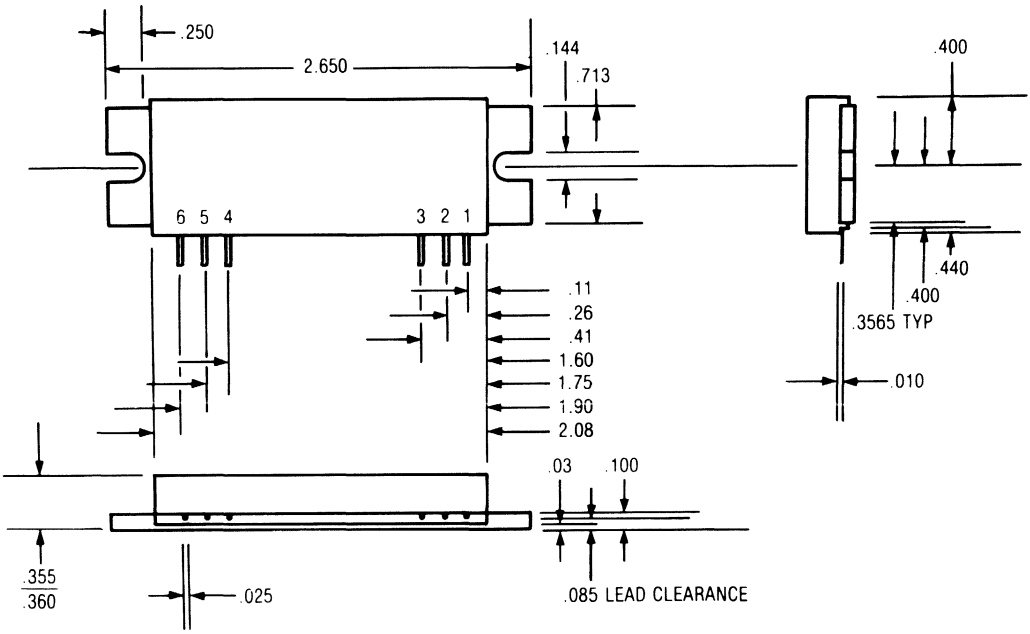
MVM

SPECIFICATIONS (T_{flange} = 25 °C, unless otherwise noted)

CHARACTERISTIC	TEST CONDITIONS	ML 20	UNITS/LIMIT
Frequency Range		68-88	MHz
Supply Voltage, V_{CC}		12.5	Vdc, Nom.
Power Output	Rated V_{CC} Any In-Band Frequency $P_{in} \leqslant 0.15$ watts	20	W, Min.
Efficiency	Rated P_o, V_{CC}	40	%, Min.
Harmonic Outputs	Rated P_o, V_{CC}	— 30	dB, Max.
Input Return Loss	$Z_o = 50\ \Omega$	— 10	dB, Max.
Output Impedance		50	Ω, Nom.
Quiescent Current	$V_{CC} = 16$ V, $P_{in} = 0$ W	0.1	Adc, Max.
Power Slump	Rated P_o, V_{CC} 25 °C — 30 °C to + 80 °C	1	dB, Max.
Load VSWR, 0-360° (Degradation)	$V_{CC} = 16$ V, $P_{in} = 0.3$ W Lowest Frequency	50 : 1	No Degradation
Load VSWR, 0-360° (Stability)	$10\ V \leqslant V_{CC} \leqslant 16$ V $0 < P_{in} \leqslant 0.3$ W Any In-Band Frequency	3 : 1	Min. Typ.
Temperature Range	Operating, T_{FLANGE}	— 30 + 100	°C Min. °C Max.

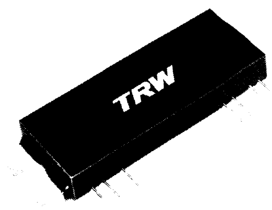
PACKAGE OUTLINE

MVM



RF Power Modules

- 20 to 30 Watts
- 12.5/13.5 V_{CC}
- 140-175 MHz
- Class C Operation
- 50 Ohm Input/Output
- ∞ VSWR at 16 V_{CC}
- High Gain
- Cost Effective
- Convenient
- Compact

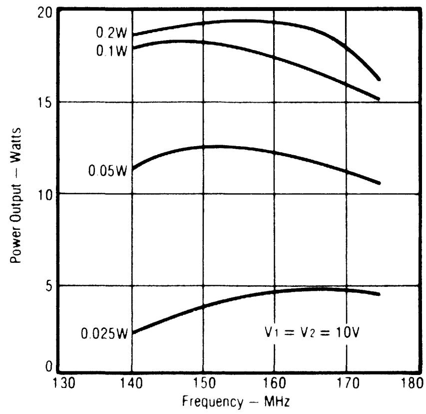


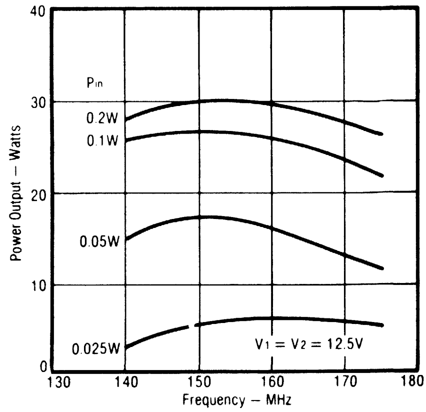
MVM

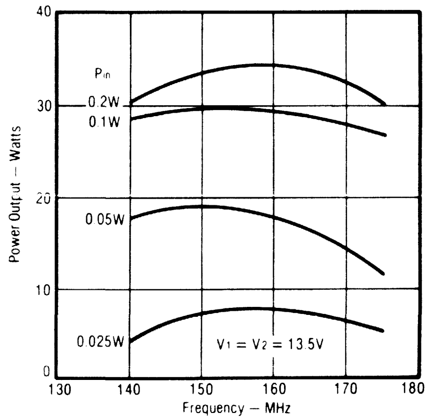
Electrical Characteristics (T_{FLANGE} = 25°C)

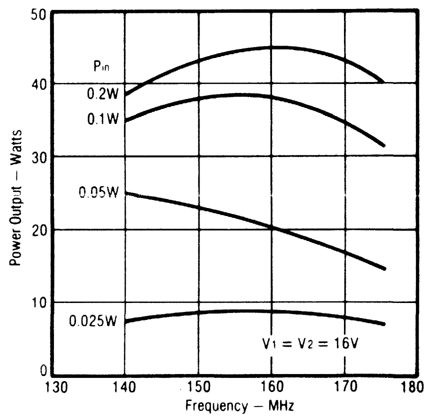
CHARACTERISTICS	TEST CONDITIONS	MV20	MV30	UNITS/LIMIT
Frequency Range		140-175	150-160	MHz
Supply Voltage, V_{CC}		12.5	13.5	Vdc, Nom.
Power Output	Rated V_{CC} Any In-Band Frequency $P_{IN} \leq 0.2$ Watts	20	30	W, Min.
Efficiency	Rated P_O, V_{CC}	40	50	%, Min.
Harmonic Outputs	Rated P_O, V_{CC}	−35	−40	dB, Max.
Input Return Loss	$Z_O = 50\Omega$	−10	−10	dB, Max.
Output Impedance		50	50	Ω, Nom.
Quiescent Current	V_{CC} = 16V, P_{IN} = 0 W	0.1	0.1	Adc, Max.
Power Slump	Rated P_O, V_{CC} 25°C −30°C to +80°C	1.0	1.0	dB, Max.
Load VSWR, 0-360° (Degradation)	V_{CC} = 16V, P_{IN} = 0.3 W Lowest Frequency	20:1	20:1	No Degradation
Load VSWR, 0-360° (Stability)	10V ≤ V_{CC} ≤ 16V 0 < P_{IN} ≤ 0.3 W Any In-Band Frequency	3:1 5:1	3:1 5:1	Min. Typ.
Temperature Range	Operating, T_{FLANGE}	−30 +100	−30 +100	°C Min. °C Max.

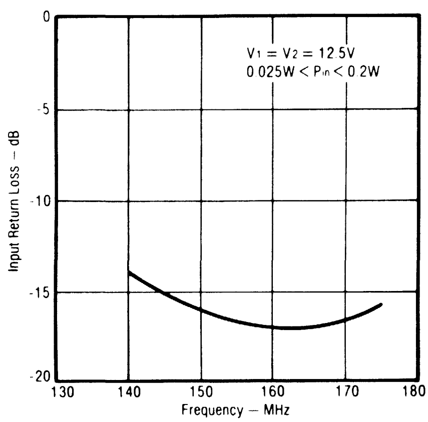
TYPICAL CHARACTERISTICS

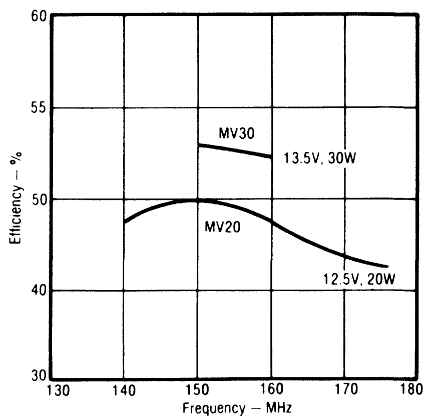


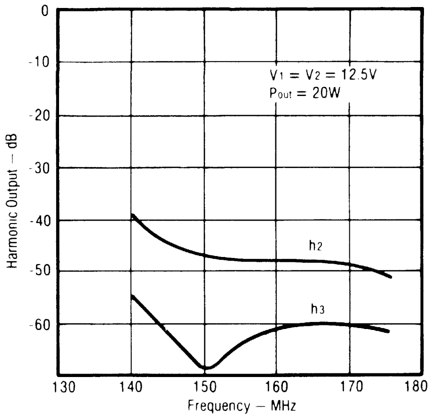


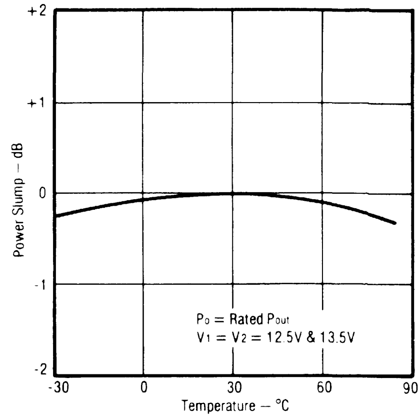


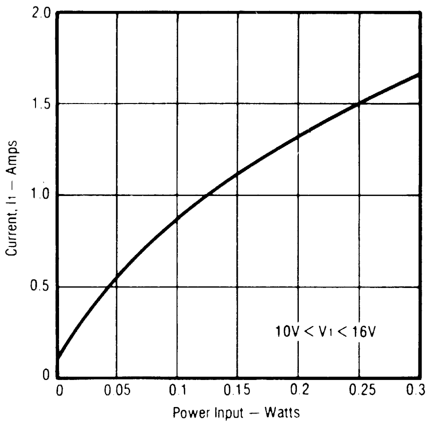


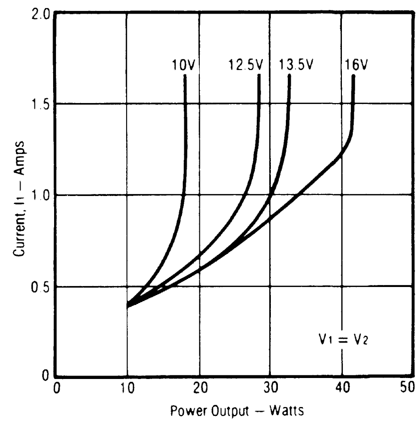


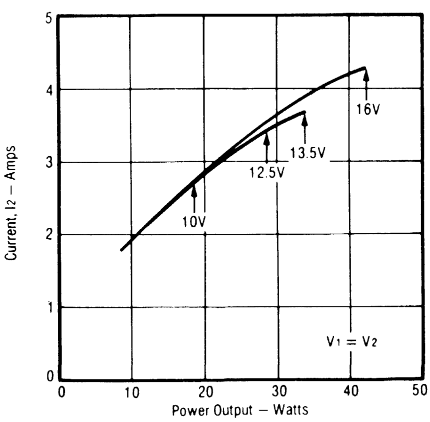


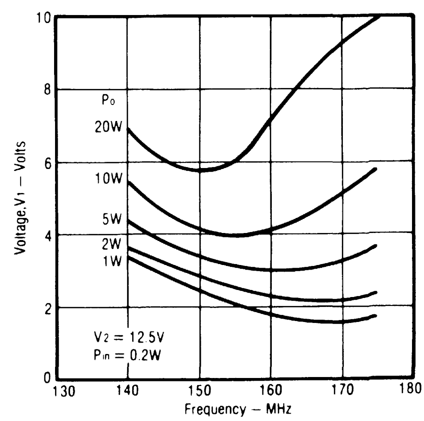

Harmonic Output – dB
Frequency – MHz
V1 = V2 = 12.5V
Pout = 20W
h2
h3


Power Slump – dB
Temperature – °C
Po = Rated Pout
V1 = V2 = 12.5V & 13.5V

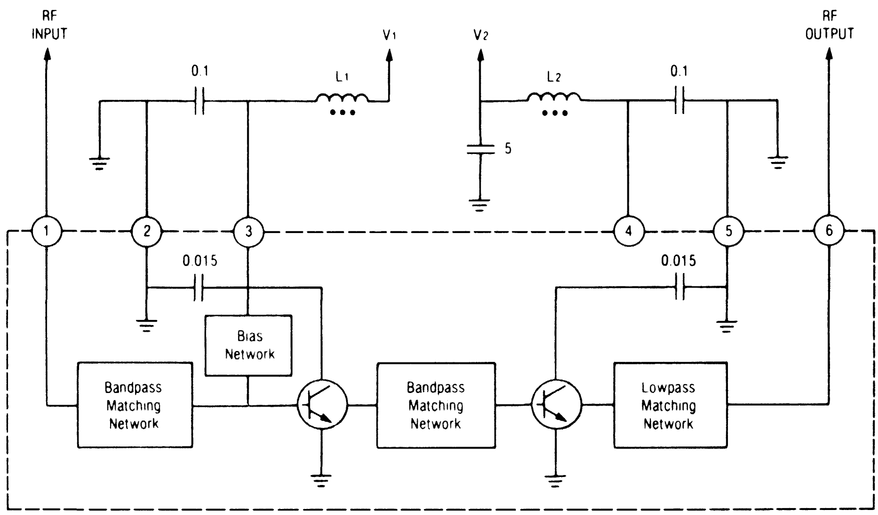

Current, I1 – Amps
Power Input – Watts
10V < V1 < 16V


Current, I1 – Amps
Power Output – Watts
10V
12.5V
13.5V
16V
V1 = V2


Current, I2 – Amps
Power Output – Watts
10V
12.5V
13.5V
16V
V1 = V2

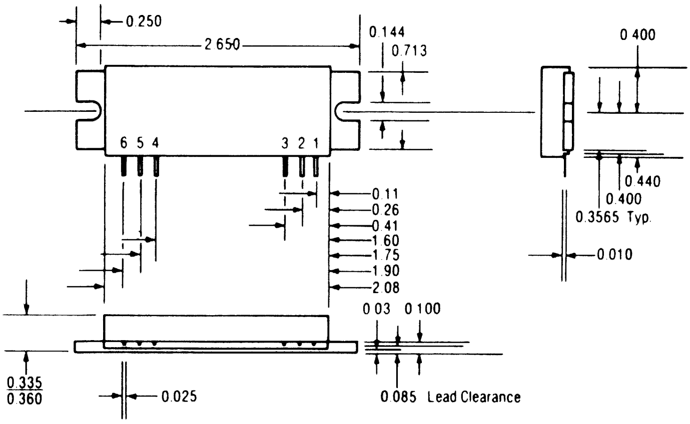

Voltage, V1 – Volts
Frequency – MHz
Po
20W
10W
5W
2W
1W
V2 = 12.5V
Pin = 0.2W

CIRCUIT DIAGRAM FOR MV 20 AND MV 30



L1, L2 Ferroxcube VK211173B, 2½ turns
All capacitor values in μF

MVM PACKAGE OUTLINE



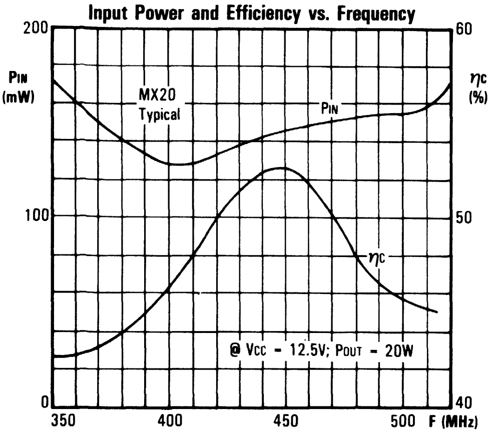
MX 20 TYPICAL PERFORMANCE

Electrical Characteristics (T_{flange} = 25°C, V_{CC} = 12.5V)

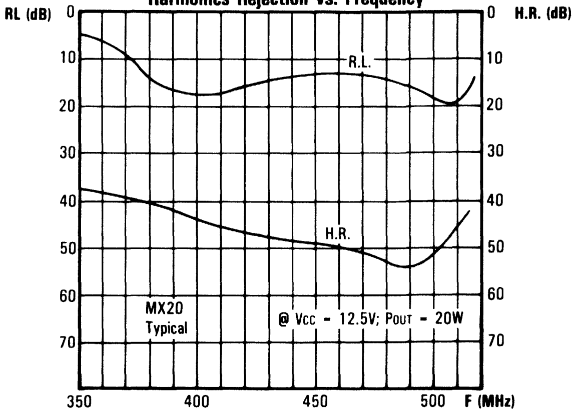
Characteristics	Test Conditions		Unit
Frequency Range		400 - 512	MHz
Supply Voltage		12.5	Vdc nominal
Power Gain	Pin ≤ 200mW	20	W
Efficiency	Rated Po	45	% typ.
Harmonic Content	Rated Po	-40	dB min.
Load VSWR	14V, 20W, low frequency	∞:1	
Power Derating	-30°C to +80°C	1	dB max.
Stability	Any frequency VSWR 2:1	0 - 15.5 0 - 250 20	Vdc mW W max.
Input Impedance Return Loss		50 -10	Ω nominal dB max.
Output Impedance		50	Ω nominal
ϕJF		4	°C/W Typical
Temperature Range	Operating	-30 +100	°C min. °C max.
Gain Control Range	Operating	20	dB min.

MX20 Typical Performance

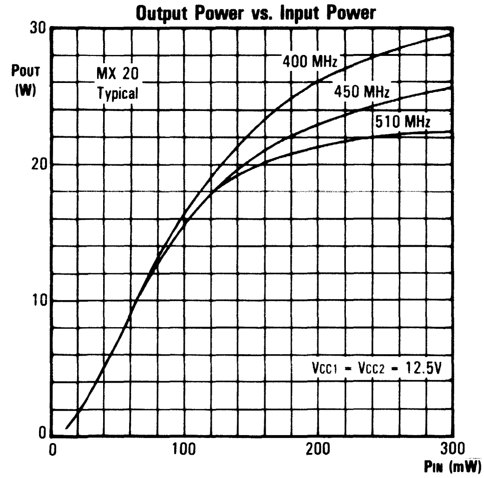
Input Power and Efficiency vs. Frequency



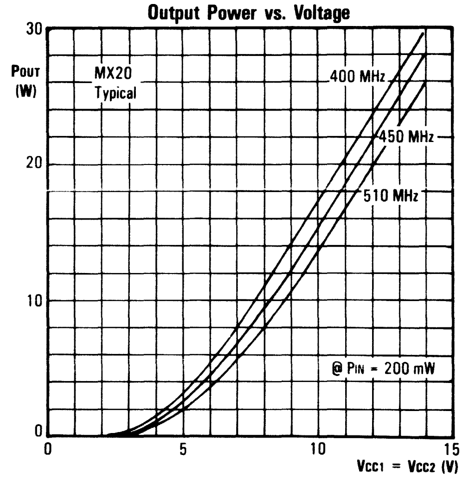
Input Return Loss and Harmonics Rejection vs. Frequency



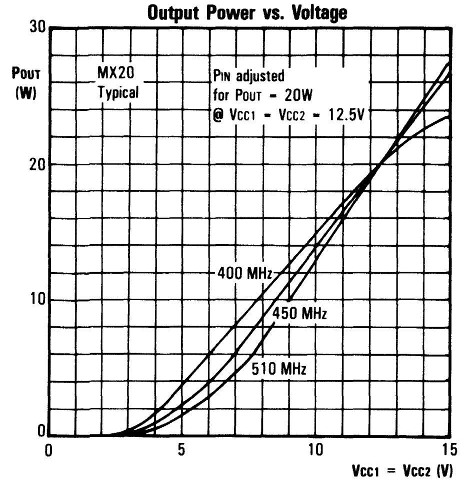
Output Power vs. Input Power



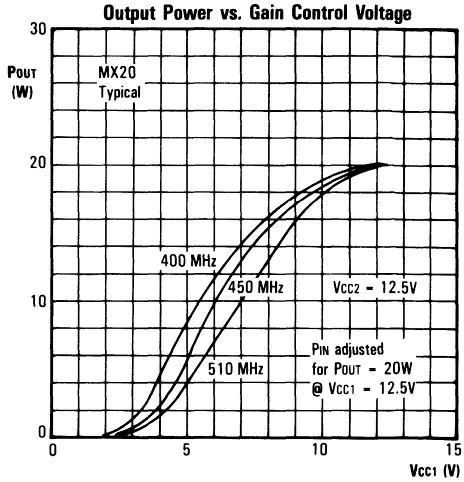
Output Power vs. Voltage



Output Power vs. Voltage



Output Power vs. Gain Control Voltage



TRW Electronic Components Group

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Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
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San Diego, California 92121
Phone: 714/457-1000

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Optoelectronics Division
1201 Tappan Circle
Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

Fast Recovery Diodes

TRW's platinum doped process yields some of the fastest high voltage diodes available.

Available in the voidless "double-slug" A and B packages, DO-4, DO-4 Isolated, DO-5 and DO-5 Isolated packages, they find wide usage in both military and industrial service.

Typical uses are as commutating and clamp diodes in switching power supplies and modulators.

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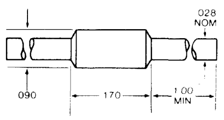
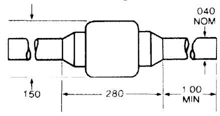
Package A



Package B



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

TRW Part Number	I_F Forward Current (Adc)	PIV Peak Inverse Voltage (Vdc)	V_F Maximum Forward Voltage @ I_F (Vdc)	I_R Maximum Reverse Current @ PIV @ T_A = 25°C (µA)	I_R Maximum Reverse Current @ PIV (mA)	@ T_A (°C)	t_{rr} Maximum Reverse Recovery Time (nsec)	Capacitance (pF)	@ V_R (Vdc)	I Surge (5) Maximum Surge Current (A)	Θ_{JC} (6) Thermal Resistance Junction to Case (°C/W)	Package
1N5802	1.0	50	0.875	1.0	5.0	100	25 (1)	15	10		38.0	A
DSR3050	1.0	50	1.0	5.0			25 (2)			20	38.0	A
DSR3051	1.0	50	1.1	5.0			50 (2)			20	38.0	A
1N5803	1.0	75	0.875	1.0	5.0	100	25 (1)	15	10		38.0	A
1N5804	1.0	100	0.875	1.0	5.0	100	25 (1)	15	10		38.0	A
DSR3100	1.0	100	1.0	5.0			25 (2)			20	38.0	A
DSR3101	1.0	100	1.1	5.0			50 (2)			20	38.0	A
1N5805	1.0	125	0.875	1.0	5.0	100	25 (1)	15	10		38.0	A
1N5806	1.0	150	0.875	1.0	5.0	100	25 (1)	15	10		38.0	A
DSR3150	1.0	150	1.0	5.0			25 (2)			20	38.0	A
DSR3151	1.0	150	1.1	5.0			50 (2)			20	38.0	A
DSR3200	1.0	200	1.1	5.0			25 (2)			20	38.0	A
DSR3201	1.0	200	1.2	5.0			50 (2)			20	38.0	A
1N5615	1.0	200	1.2	0.5	1.5	100	150 (3)	45	6		38.0	A
1N5617	1.0	400	1.2	0.5	1.5	100	150 (3)	35	6		38.0	A
DSR3400X	1.0	400	1.5	10.0	0.16	100	30 (3)	50	0		38.0	A
DSR3500X	1.0	500	1.8	10.0	0.16		30 (3)	50	0		38.0	A
1N5619	1.0	600	1.2	0.5	1.5	100	250 (3)	25	6		38.0	A
DSR3600X	1.0	600	1.8	10.0	0.16	100	50 (3)	40	0		38.0	A
SVD50-2	2.0	50	1.1	5.0			25 (2)			20	38.0	A
SVD100-2	2.0	100	1.1	5.0			25 (2)			20	38.0	A
SVD150-2	2.0	150	1.1	5.0			25 (2)			20	38.0	A
SVD200-2	2.0	200	1.2	5.0			25 (2)			20	38.0	A
SVD50-3	3.0	50	1.0	10.0			25 (2)			80	19.0	B
1N5415	3.0	50	1.1	1.0	1.0	175	150 (3)	200	0		19.0	B
1N5416	3.0	100	1.1	1.0	2.0	175	150 (3)	175	0		19.0	B
SVD100-3	3.0	100	1.0	10.0			25 (2)			80	19.0	B
SVD150-3	3.0	150	1.0	10.0			25 (2)			80	19.0	B
SVD200-3	3.0	200	1.1	10.0			25 (2)			80	19.0	B
1N5417	3.0	200	1.1	1.0	2.0	175	150 (3)	150	0		19.0	B
1N5418	3.0	400	1.1	1.0	2.0	175	150 (3)	120	0		19.0	B
1N5419	3.0	500	1.1	1.0	2.0	175	250 (3)	110	0		19.0	B
1N5420	3.0	600	1.1	1.0	2.0	175	400 (3)	100	0		19.0	B
1N5807	4.0	50	0.875	5.0	15.0	100	30 (4)	45	10		19.0	B
DSR5050	4.0	50	1.0	10.0			25 (2)			80	19.0	B
DSR5051	4.0	50	1.1	10.0			50 (2)			80	19.0	B
1N5808	4.0	75	0.875	5.0	15.0	100	30 (4)	45	10		19.0	B
1N5809	4.0	100	0.875	5.0	15.0	100	30 (4)	45	10		19.0	B
DSR5100	4.0	100	1.0	10.0			25 (2)			80	19.0	B
DSR5101	4.0	100	1.1	10.0			50 (2)			80	19.0	B
1N5810	4.0	125	0.875	5.0	15.0	100	30 (4)	45	10		19.0	B
1N5811	4.0	150	0.875	5.0	15.0	100	30 (4)	45	10		19.0	B
DSR5150	4.0	150	1.0	10.0			25 (2)			80	19.0	B
DSR5151	4.0	150	1.1	10.0			50 (2)			80	19.0	B

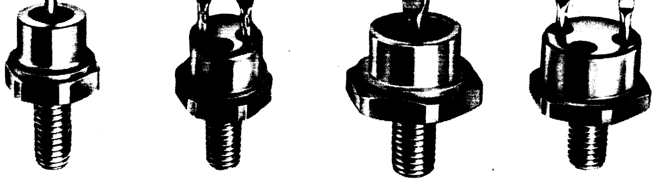
TRW

TRW Part Number	I_F Forward Current (Adc)	PIV Peak Inverse Voltage (Vdc)	V_F Maximum Forward Voltage @ I_F (Vdc)	I_R Maximum Reverse Current @ PIV @ T_A = 25°C (μA)	I_R Maximum Reverse Current @ PIV (mA)	@ T_A (°C)	t_{rr} Maximum Reverse Recovery Time (nsec)	Capacitance (pF)	@ V_R (Vdc)	I Surge (5) Maximum Surge Current (A)	Θ_{JC} (6) Thermal Resistance Junction to Case (°C/W)	Package
DSR5200	4.0	200	1.1	10.0			25 (2)			80	19.0	B
DSR5201	4.0	200	1.2	10.0			50 (2)			80	19.0	B
DSR5400X	4.0	400	1.5	20.0	0.7	100	30 (3)	250	0		19.0	B
DSR5500X	4.0	500	1.8	20.0	0.7	100	30 (3)	225	0		19.0	B
DSR5600X	4.0	600	1.8	20.0	0.7	100	50 (3)	200	0		19.0	B
SVD50-6	6.0	50	1.2	10.0			50 (2)			60	2.5	DO-4
SVD50-6I	6.0	50	1.2	10.0			50 (2)			60	2.5	DO-4I*
SVD100-6	6.0	100	1.2	10.0			50 (2)			60	2.5	DO-4
SVD100-6I	6.0	100	1.2	10.0			50 (2)			60	2.5	DO-4I*
SVD50-12	12.0	50	1.2	10.0			50 (2)			120	2.5	DO-4
SVD50-12I	12.0	50	1.2	10.0			50 (2)			120	2.5	DO-4I*
SVD100-12	12.0	100	1.2	10.0			50 (2)			120	2.5	DO-4
SVD100-12I	12.0	100	1.2	10.0			50 (2)			120	2.5	DO-4I*
1N5410	12.0	150	1.0	10.0			70 (2)			200	2.0	DO-4
SVD200-12	12.0	200	1.2	10.0			50 (2)			120	2.5	DO-4
SVD200-12I	12.0	200	1.2	10.0			50 (2)			120	2.5	DO-4I*
SVD300-12	12.0	300	1.5	10.0			70 (2)			120	2.5	DO-4
SVD300-12I	12.0	300	1.5	10.0			70 (2)			120	2.5	DO-4I*
SVD350-12	12.0	350	1.5	10.0			70 (2)			120	2.5	DO-4
SVD350-12I	12.0	350	1.5	10.0			70 (2)			120	2.5	DO-4I*
SVD400-12	12.0	400	1.5	10.0			70 (2)			120	2.5	DO-4
SVD400-12I	12.0	400	1.5	10.0			70 (2)			120	2.5	DO-4I*
SVD450-12	12.0	450	1.5	10.0			70 (2)			120	2.5	DO-4
SVD450-12I	12.0	450	1.5	10.0			70 (2)			120	2.5	DO-4I*
SVD50-30	30.0	50	1.2	10.0			70 (2)			200	1.5	DO-5
SVD50-30I	30.0	50	1.2	10.0			70 (2)			200	1.5	DO-5I*
SVD100-30	30.0	100	1.2	10.0			70 (2)			200	1.5	DO-5
SVD100-30I	30.0	100	1.2	10.0			70 (2)			200	1.5	DO-5I*
1N5409	30.0	150	1.2	10.0			70 (2)			200	1.5	DO-5
SVD200-30	30.0	200	1.2	10.0			70 (2)			200	1.5	DO-5
SVD200-30I	30.0	200	1.2	10.0			70 (2)			200	1.5	DO-5I*

Notes: (1) 0.5A to 0.5A to 0.05A
(2) 1.0A to 1.0A to 0.5A
(3) 0.5A to 1.0A to 0.25A
(4) 1.0A to 1.0A to 0.1A
(5) 1 msec operating surge, T_{case} = 100°C, duty cycle < 1%
(6) For A and B packages this is a nominal rating with 3/8" lead length

Operating Temperature Range −65°C to +175°C
Storage Temperature Range −65°C to +175°C

*I = Isolated



DO-4 DO-4I DO-5 DO-5I

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Phone: 213/333-1201

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Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

Schottky Diodes

Low Vf at high current allowed by Schottky barrier principle makes these Schottky diodes ideally suitable for low voltage rectification and commutation functions.

TRW

Power Schottky Diode

Low V_F at high current in conjunction with high operating temperature makes the SD-41 ideally suitable for rectification and commutation functions of 5-volt output power supplies. The SD-41 is a schottky-barrier (metal-silicon) power diode. The schottky-barrier principle eliminates stored charge and allows extremely low V_F at high current. Improved barrier formation techniques allow operation at 150°C junction temperature.

- **45 Volts**
- **30 Amperes**
- **150°C (Junction)**

Absolute Maximum Ratings (T_{CASE}=25°C)

Symbol	Characteristics	Unit
$V_{R(max)}$ PRV	D.C. Blocking Voltage Peak Reverse Voltage	45Vdc*
I_F	Average Forward Current	30 Amp
I_{surge}	Surge Current 8.3ms nonrepetitive	600Amp
T_{stg}	Storage Temperature	-55 to +165°C
T_{op}	Operating Temperature (Junction)	-55 to +150°C
θ_{JC}	Thermal Resistance (Junction-to-Case)	2.0°C/W
*See related curve: $V_{R(max)}$ Rating vs Junction Temperature.		

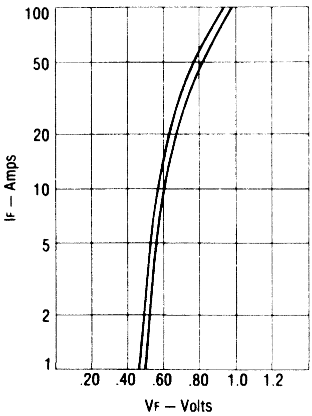
Electrical Characteristics

Symbol	Characteristics	Test Conditions	Max Limits
I_R	Reverse Leakage Current	V_R=35V, T_{CASE}=125°C*	125mA
V_F	Forward Voltage	I_F=30A, T_{CASE}=125°C**	0.55V
C_j	Junction Capacitance	V_R=5.0	2000pF
dv/dt	Rate of Change (PIV vs Time)	V_R=35V max	700V/μsec
T_{rr}	Reverse Recovery Time	Described in detail on page 4 of this data sheet	

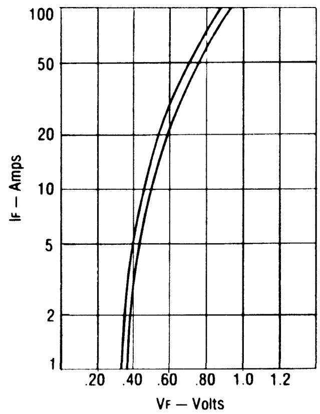
*Voltage Pulse Width — 400μsec Duty Cycle 1%. T_{CASE} = 25°C
**Current Pulse Width — 300μsec Duty Cycle 1%. Device tested in free air.

Typical Range of Forward Characteristics

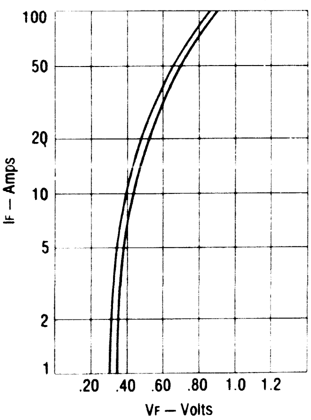
TJUNCTION = -55°C



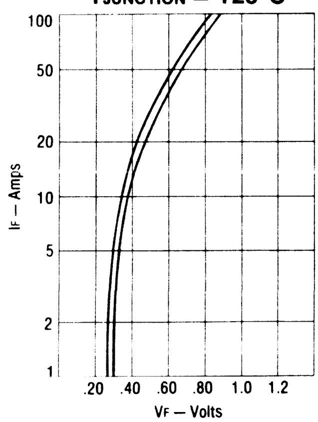
TJUNCTION = 25°C



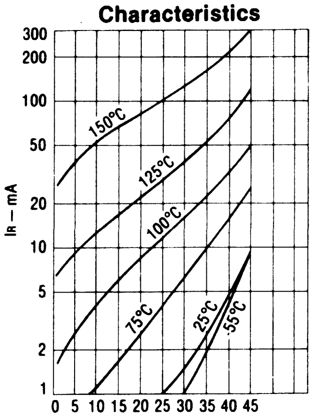
TJUNCTION = 75°C



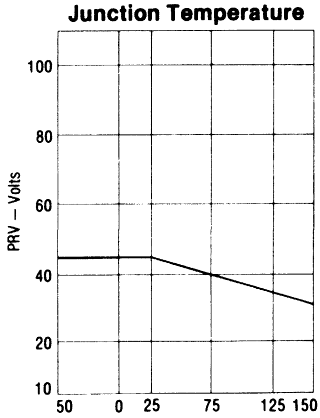
TJUNCTION = 125°C



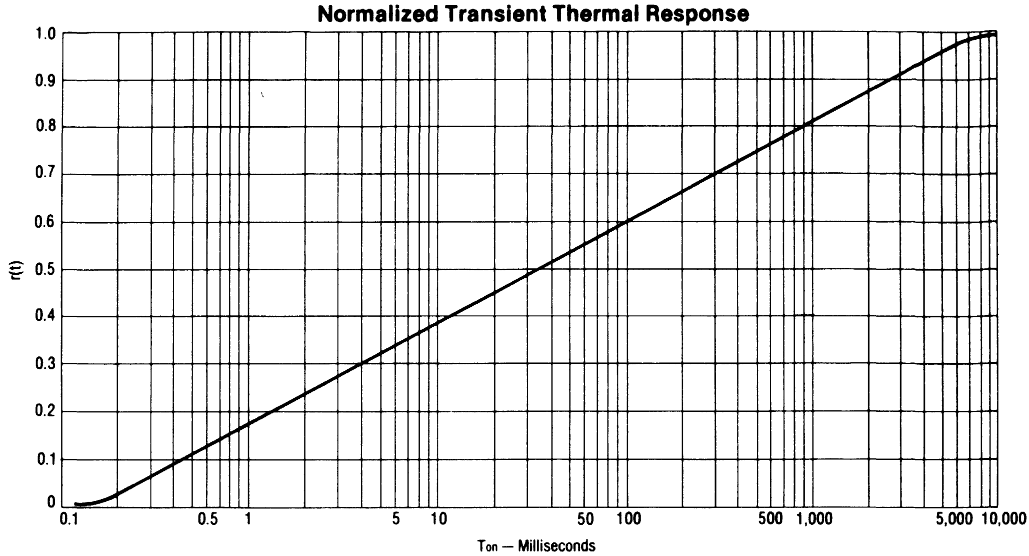
Typical Reverse Characteristics



VR(max) Rating vs Junction Temperature



Normalized Transient Thermal Response



To determine peak junction temperature for a single forward pulse:

$$T_j = P_D \bullet r(t) \bullet \theta_{jc} + T_{CASE}$$

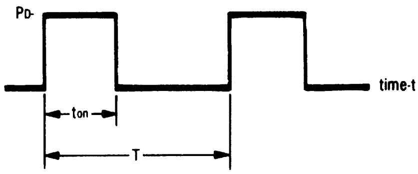
To determine peak junction temperature for repetitive forward rectangular pulses:

$$T_j = \left[\frac{t_{on}}{T}\theta_{jc} + \left(1 - \frac{t_{on}}{T}\right) r(t)\right] P_D + T_{CASE}$$

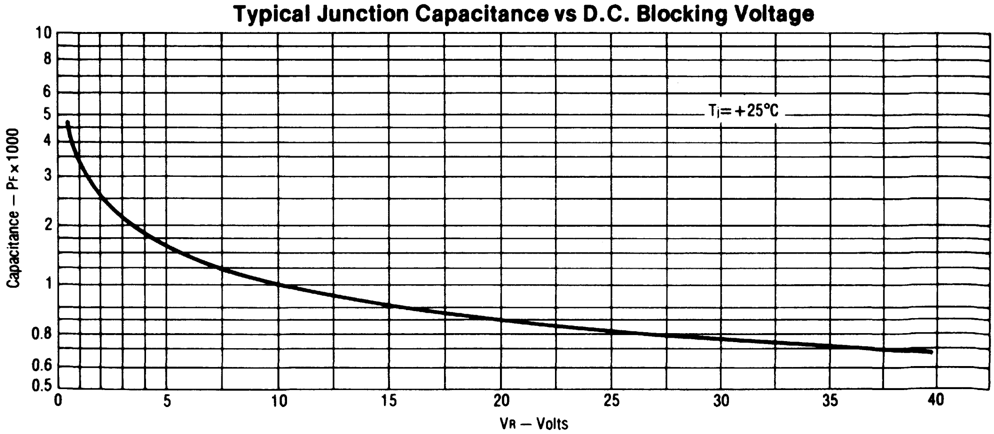
To determine peak junction temperature for repetitive reverse rectangular pulses:

$$T_j = P_R \left(\frac{T - t_{on}}{T}\right) \theta_{jc}$$

where:
P_D = Peak Forward Power
P_R = Peak Reverse Power
t_{on} = Forward Conduction Time
T = 1 ÷ Rep Rate
$r(t)$ = Transient Thermal Impedance at time t, from transient thermal response curve
θ_{jc} = Thermal Impedance



Typical Junction Capacitance vs D.C. Blocking Voltage



What is a Schottky Diode?

The schottky diode is simply a metal in contact with a semiconductor material with rectification taking place at the junction of the two materials. This is fundamentally different from the P-N junction where the junction is buried in the semiconductor material and the surface contacts are only electrical and mechanical attachment points.

Due to lower barrier height, schottky diodes have greater forward **and** reverse conductivity than the P-N junction diode. This translates into a lower forward voltage drop and higher reverse leakage. It should be stressed that the higher reverse leakage is a normal characteristic of the schottky diode and is not symptomatic of surface defects.

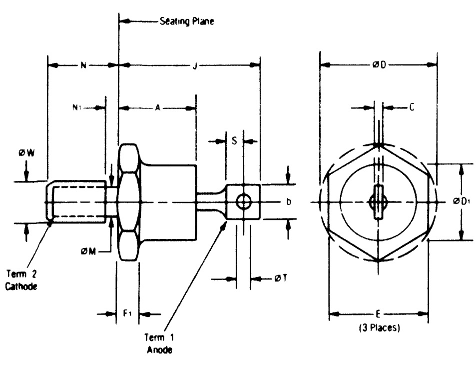
Current transport is mainly due to majority carriers and is not subject to P-N junction diode forward and reverse recovery transients due to minority carrier injection and storage. The absence of these minority carriers results in reverse recovery times that are essentially zero. For purposes of circuit analysis, the schottky diode may be considered an ideal diode shunted by a capacitor equal in value to the junction capacitance.

How to Use Devices In Parallel

Due to the small production variation in V_F (only 60mv), the SD-41 may be paralleled when additional current capability is necessary.

A preferred method is to feed each diode with a separate transformer secondary winding so that the additional winding impedance in series with each diode allows even closer current sharing. This method has the added advantage that the skin effect in the transformer winding is minimized due to the smaller wire size.

Package Outline



Symbol	DO-203AA (formerly DO-4)				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
A	–	0.405	–	10.28	
b	–	0.250	–	6.35	3
C	–	–	–	–	
ØD	–	0.505	–	12.82	
ØD1	0.265	0.424	6.74	10.76	
E	0.423	0.438	10.75	11.12	
F1	0.075	0.175	1.91	4.44	2
J	0.600	0.800	15.24	20.32	
ØM	0.163	0.189	4.15	4.80	
N	0.422	0.453	10.72	11.50	
N1	–	0.078	–	1.98	
S	–	–	–	–	
ØT	0.060	0.095	1.53	2.41	
ØW	10-32	UNF-2A	10-32	UNF-2A	4

NOTES:

1. Refer to applicable symbol list.
2. Chamfer or undercut on one or both ends of hexagonal base is optional.
3. Angular orientation and contour of terminal one is optional.
4. ØW is pitch diameter of coated threads. Ref: Unified screw threads, ANS B1.1-1960
5. Min. Flat.

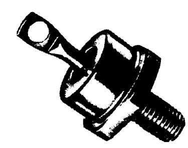
SD-51 TRW

Power Schottky Diodes

Low V_F at high current in conjunction with high operating temperature makes the SD-51 ideally suitable for rectification and commutation functions of 5-volt output power supplies. The SD-51 is a Schottky-barrier (metal-silicon) power diode. The Schottky-barrier principle eliminates stored charge and allows extremely low V_F at high current. Improved barrier formation techniques allow operation at 150°C junction temperature.

Features
- **150°C**
- **Low Power Loss**
- **Fast Recovery**
- **Reverse Polarity Version Available**

45V
60 Amp
150°C



DO-203AB Package (DO-5)

Maximum Ratings

SYMBOL	RATING	LIMIT	UNITS
V_{RMM}	Repetitive Peak Reverse Voltage	45	Volts
V_{RWM}	Repetitive Peak Reverse Working Voltage	35	Volts
I_{FM}	Repetitive Peak Forward Current (50% duty cycle) (See figure 1 for temperature derating.)	120	Ampere
I_{FSM}	Non-repetitive Peak one-cycle surge current. 8.35 msec half sine wave	800	Ampere

Electrical Specifications (25°C unless specified)

SYMBOL	SPECIFICATION/CONDITIONS	LIMIT	UNITS
I_{RM}	Maximum Reverse Leakage Current $V_R = 35V$	50	mA
I_{RM}	Maximum Reverse Leakage Current $V_R = 35V$, $T_j = 125°C$	200	mA
V_{FM}	Maximum Forward Voltage (300μsec,<1% Duty Cycle) $I_F = 60A$ $I_F = 60A$, $T_j = 125°C$ $I_F = 120A$ $I_F = 120A$, $T_j = 125°C$	 0.70 0.60 0.87 0.84	 V V V V
C_J	Typical Junction Capacitance $V_R = 5V$	4000	pf
t_{rr}	Typical Reverse Recovery Time $I_f = I_R = 1A$, $T_C = 125°C$	50	n-sec
dV/dt	Maximum Rate of Change of Reverse Voltage	700	V/μsec

Thermal Specifications

SYMBOL	SPECIFICATION	LIMIT	UNITS
T_j	Operating Temperature Range	-55 to +150	°C
T_{stg}	Storage Temperature Range	-55 to +165	°C
$R_{\theta JC}$	Thermal Resistance Junction to Case	1.0	°C/W

Figure 1. — Average Forward Current vs. Maximum Allowable Case Temperature

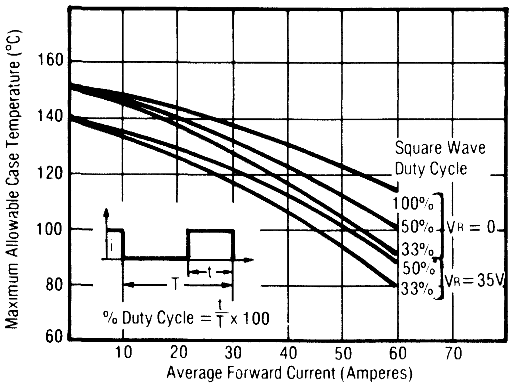


Figure 2. — Maximum Forward Power Dissipation vs. Forward Current

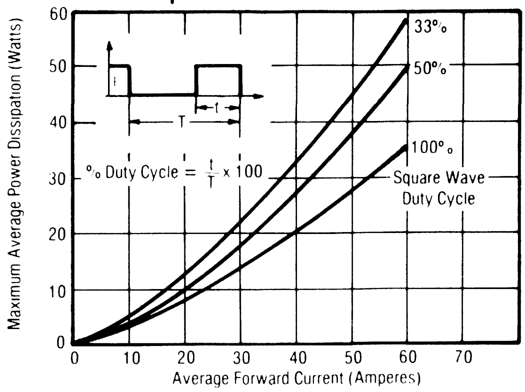


Figure 3. Typical Reverse Characteristics

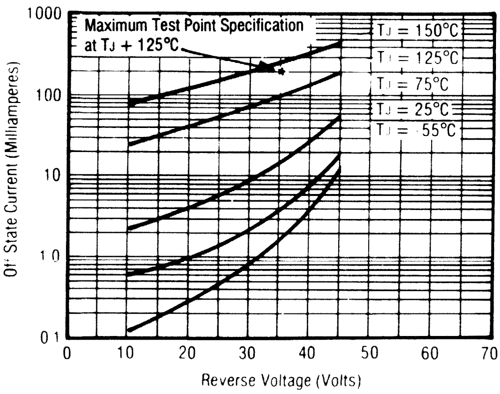


Figure 4. — Typical Junction Capacitance Variation with Reverse Bias

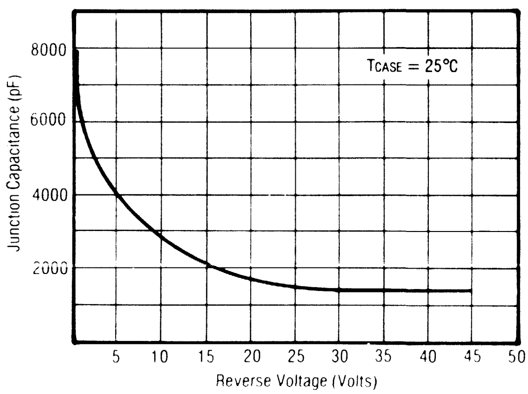


Figure 5. — Transient Thermal Response

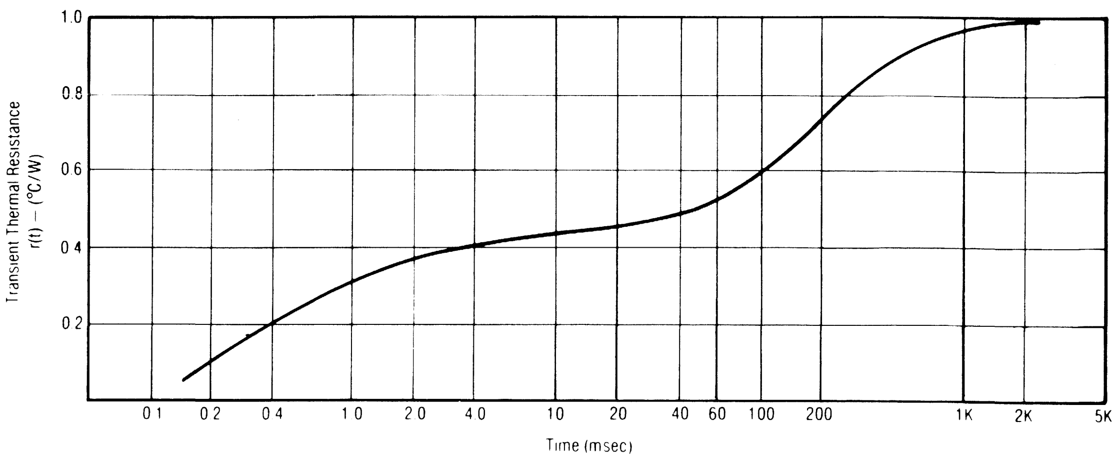


Figure 6. — Forward Characteristics for TJ = -55°C**

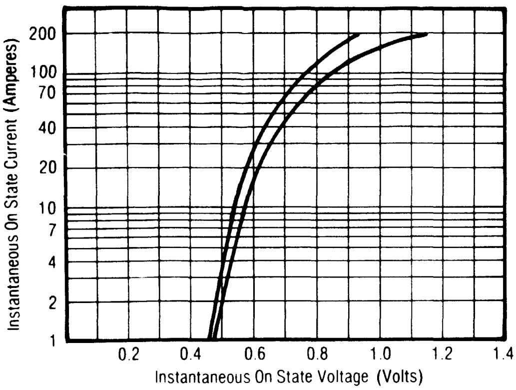


Figure 7. — Forward Characteristics for TJ = +25°C**

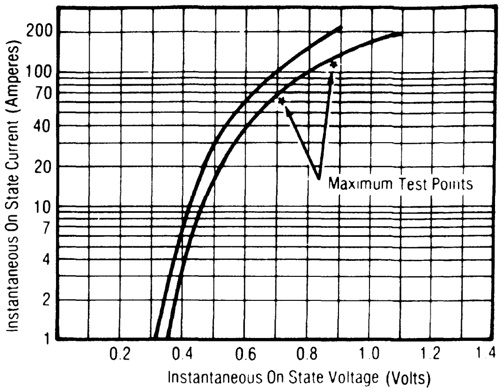


Figure 8. — Forward Characteristics for TJ = +75°C**

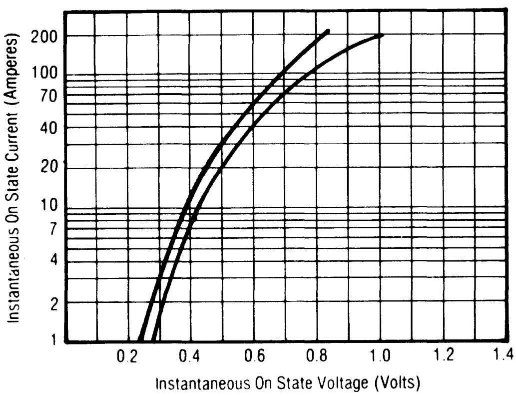


Figure 9. — Forward Characteristics for TJ = +125°C**

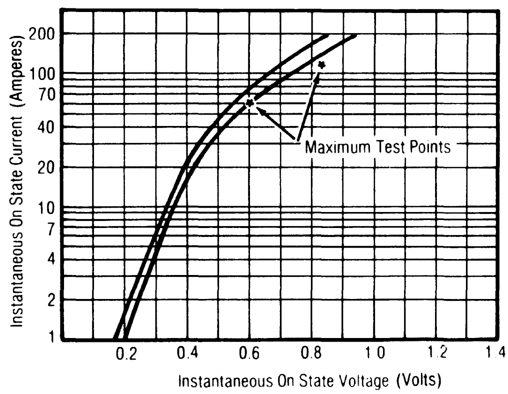
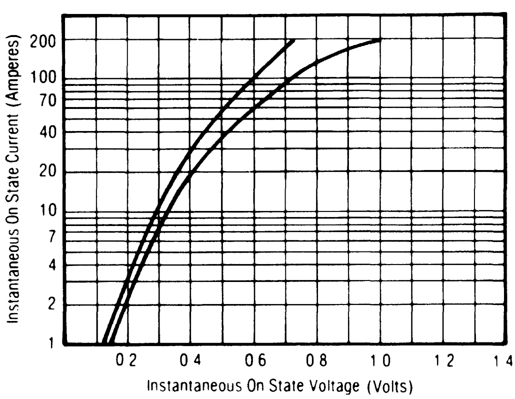


Figure 10. — Forward Characteristics for TJ = +150°C**



**NOTE 90% of distribution will typically fall between curves shown

What is a Schottky Diode?

The Schottky diode is simply a metal in contact with a semiconductor material with rectification taking place at the junction of the two materials. This is fundamentally different from the P-N junction where the junction is buried in the semiconductor material and the surface contacts are only electrical and mechanical attachment points.

Due to lower barrier height, Schottky diodes have greater forward and reverse conductivity than the P-N junction diode. This translates into a lower forward voltage drop and higher reverse leakage. It should be stressed that the higher reverse leakage is a normal characteristic of the Schottky diode and is not symptomatic of surface defects.

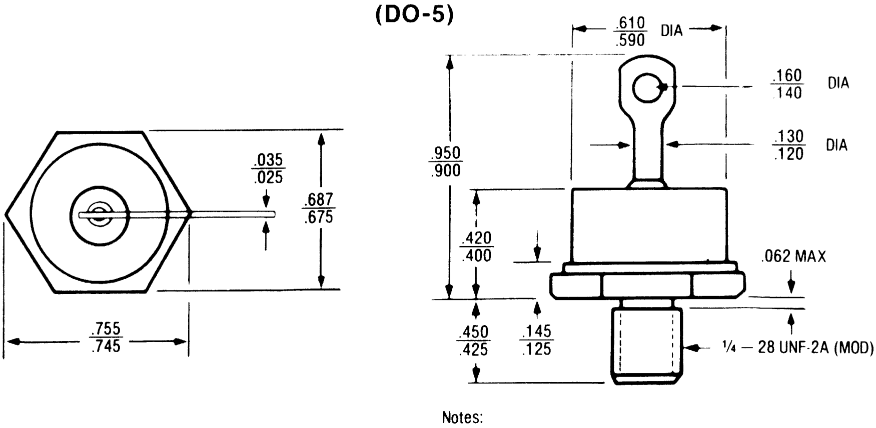
Current transport is mainly due to majority carriers and is not subject to P-N junction diode forward and reverse recovery transients due to minority carrier injection and storage. The absence of these minority carriers results in reverse recovery times that are essentially zero. For purposes of circuit analysis, the Schottky diode may be considered an ideal diode shunted by a capacitor equal in value to the junction capacitance.

How to Use Devices in Parallel

Due to the small production variation in V_F (only 80mv), these devices may be paralleled when additional current capability is necessary.

A preferred method is to feed each diode with a separate transformer secondary winding so that the additional winding impedance in series with each diode allows even closer current sharing. This method has the added advantage that the skin effect in the transformer winding is minimized due to the smaller wire size.

Figure 11. — Package Outline Drawing
JEDEC DO-203AB
(DO-5)

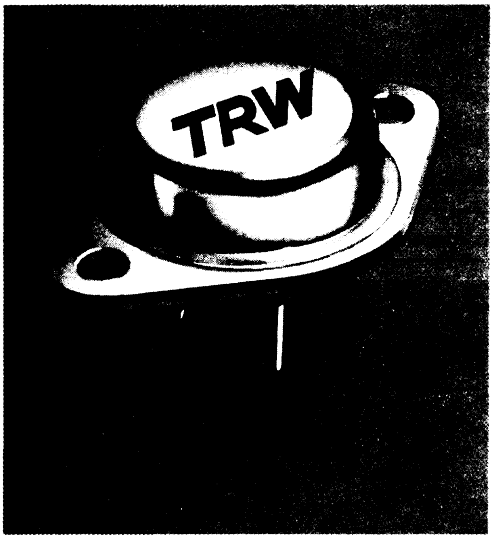


Notes:
1. Recommended Mounting Torque (non-lubricated threads)
   20 in-lb. minimum   30 in-lb. maximum

2. Standard polarity — stud is cathode (SD-51)
   Reverse polarity — stud is anode (SD-51R)

TRW

SD-241 — Dual Schottky Power Diode



Designed for center-tap rectification and commutation applications.

- **45 Volt**
- **30 Amperes**
- **150°C (Junction)**

The SD-241 is a common cathode dual Schottky diode mounted in a TO-3 package. Each diode has a current rating of 30A (60A when used in parallel).

Due to the lower height (compared with stud mount devices) the SD-241 is also suited to low voltage rectification and commutation applications in card mounted switching power supplies and converters.

Absolute Maximum Ratings Per Diode

Symbol	Characteristics	Unit
V_{RM} V_{RRM}	D.C. Blocking Voltage Peak Reverse Voltage	45Vdc
$I_{F(AV)}$	Average Forward Current	30 Amp
I_{FSM}	Surge Current 8.3ms nonrepetitive	400 Amp
T_{stg}	Storage Temperature	-55 to +175°C
T_{op}	Operating Temperature (Junction)	-55 to +150°C
θ_{jc}	Thermal Resistance (Junction-to-Case)	1.4°C/Watt

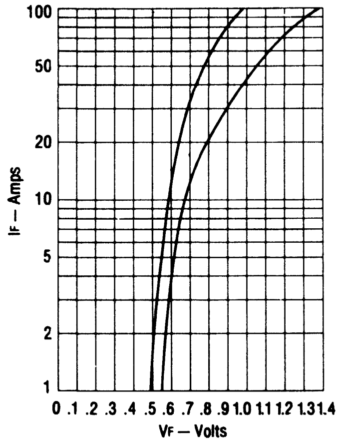
Electrical Characteristics (T_{CASE} = 25°C)

Symbol	Characteristics	Test Conditions	Max Limits
I_R	Reverse Leakage Current	V_R = 35V, T_{CASE} = 125°C*	100mA
V_F	Forward Voltage	I_F = 10.0A, T_{CASE} = 125°C** I_F = 20.0A, T_{CASE} = 125°C**	0.47V 0.60V
C_j	Junction Capacitance	V_R = 5.0	2000pF
dv/dt	Rate of Change of V_R	V_R = 35V max	1000V / μsec
t_{rr}	Reverse Recovery Time	Described in detail on page 4 of this data sheet.	

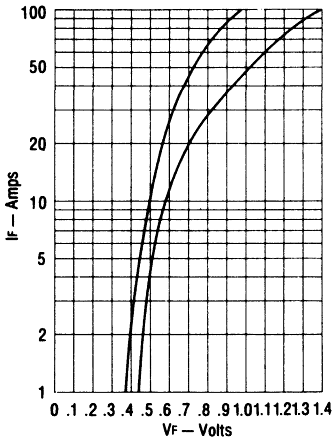
*Voltage Pulse Width — 400μsec Duty Cycle 1%.
**Current Pulse Width — 300μsec Duty Cycle 1%. Device Tested in free air.

Typical Range of Forward Characteristics

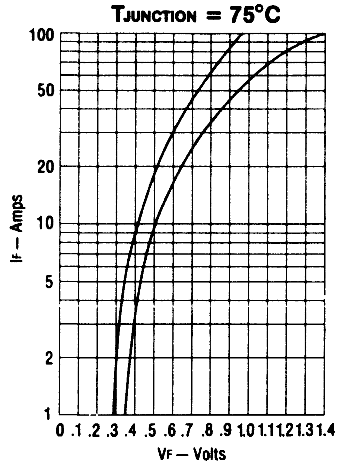
TJUNCTION = -55°C



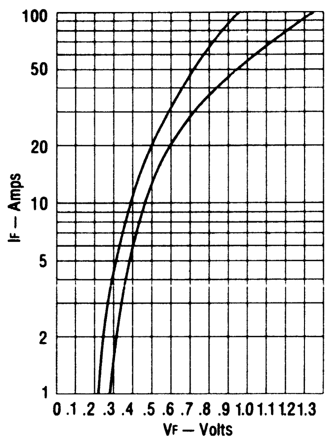
TJUNCTION = 25°C



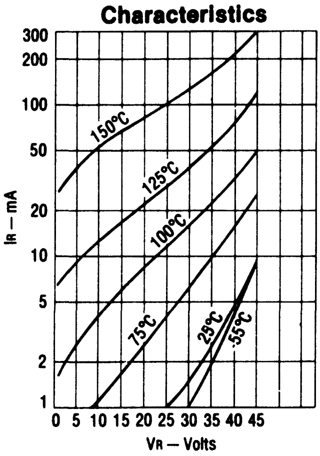
TJUNCTION = 75°C



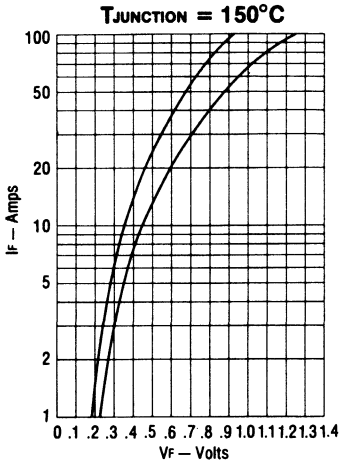
TJUNCTION = 125°C



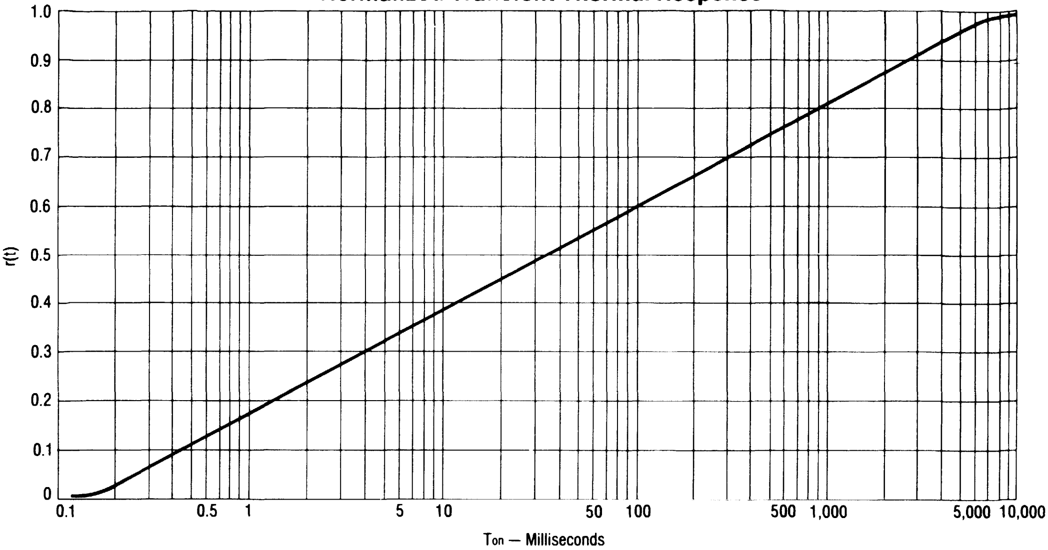
Typical Reverse Characteristics



TJUNCTION = 150°C



Normalized Transient Thermal Response



To determine peak junction temperature for a single forward pulse:

$$T_j = P_D \bullet r(t) \bullet \theta_{jc} + T_{CASE}$$

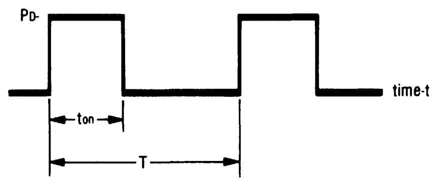
To determine peak junction temperature for repetitive forward rectangular pulses:

$$T_j = \left[\frac{t_{on}}{T}\theta_{jc} + \left(1 - \frac{t_{on}}{T}\right) r(t)\right] P_D + T_{CASE}$$

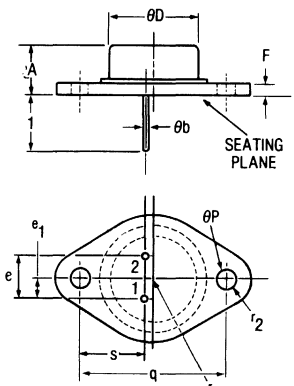
To determine peak junction temperature for repetitive reverse rectangular pulses:

$$T_j = P_R \left(\frac{T - t_{on}}{T}\right) \theta_{jc}$$

where:
P_D = Peak Forward Power
P_R = Peak Reverse Power
t_{on} = Forward Conduction Time
T = 1 ÷ Rep Rate
r(t) = Transient Thermal Impedance at time t, from transient thermal response curve
θ_{jc} = Thermal Impedance



Package Outline
JEDEC TO-204MA (TO-3)



TERMINAL CONNECTIONS
Pin 1 — anode #1
Pin 2 — anode #2
Case — cathode

Symbol	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	0.250	0.450	6.35	11.43
θb	0.038	0.043	0.97	1.09
θD		0.875		22.23
e	0.420	0.440	10.67	11.18
e_1	0.205	0.225	5.21	5.72
F		0.135		3.43
1	0.312		7.92	
θP	0.151	0.161	3.84	4.09
q	1.177	1.197	29.90	30.40
r_1		0.525		13.34
r_2		0.188		4.78
s	0.655	0.675	16.64	17.15

What is a Schottky Diode?

The schottky diode is simply a metal in contact with a semiconductor material with rectification taking place at the junction of the two materials. This is fundamentally different from the P-N junction where the junction is buried in the semiconductor material and the surface contacts are only electrical and mechanical attachment points.

Due to lower barrier height, schottky diodes have greater forward and reverse conductivity than the P-N junction diode. This translates into a lower forward voltage drop and higher reverse leakage. It should be stressed that the higher reverse leakage is a normal characteristic of the schottky diode and is not symptomatic of surface defects.

Current transport is mainly due to majority carriers and is not subject to P-N junction diode forward and reverse recovery transients due to minority carrier injection and storage. The absence of these minority carriers results in reverse recovery time that is negligible. For purposes of circuit analysis, the schottky diode may be considered an ideal diode shunted by a capacitor equal in value to the junction capacitance.

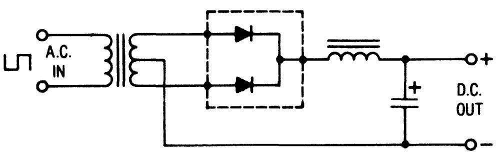
How To Use Devices In Parallel (see below)

Due to the small production variation in V_F (only 60mv), the SD-241 may be paralleled when additional current capability is necessary.

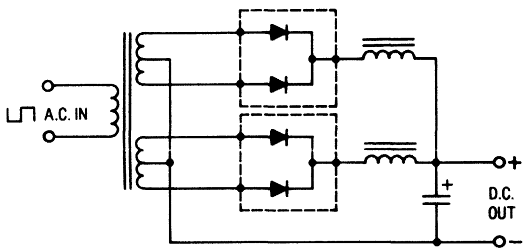
A preferred method is to feed each diode with a separate transformer secondary winding so that the additional winding and choke impedances in series with each diode allows even closer current sharing. This method has the added advantage that the skin effect in the transformer winding is minimized due to the smaller secondary wire size.

TYPICAL APPLICATIONS

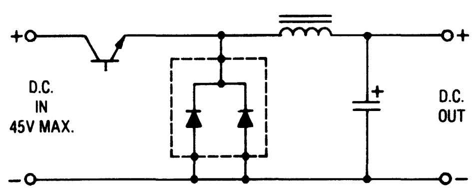
Rectification



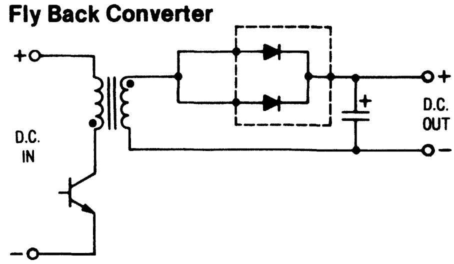
High Current Rectification



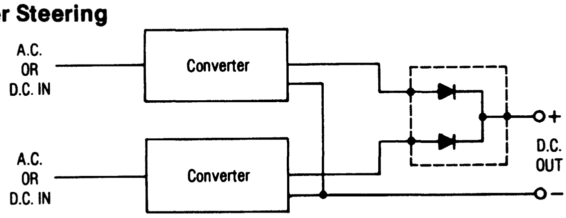
Commutation



Fly Back Converter



Redundant Converter Steering

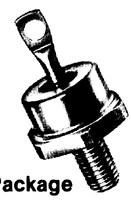


Power Schottky Diode SD-75

45V, 75 Amp, 150 °C (Junction)

Features

- **Guaranteed Reverse Over Current**
- **150°C**
- **Low Power Loss**
- **Fast Recovery**



DO-5 Package

Low V_F at high current in conjunction with high operating temperature makes the SD-75 ideally suitable for rectification and commutation functions of 5-volt output power supplies. The SD-75 is a Schottky-barrier (metal-silicon) power diode. The Schottky-barrier principle eliminates stored charge and allows extremely low V_F at high current. Improved barrier formation techniques allow operation at 150°C junction temperature.

Maximum Ratings

SYMBOL	RATING	LIMIT	UNITS
V_{RMM}	Repetitive Peak Reverse Voltage	45	Volts
V_{RWM}	Repetitive Peak Reverse Working Voltage	35	Volts
I_{FM}	Repetitive Peak Forward Current (50% duty cycle) (See figure — for temperature derating.)	150	Ampere
I_{FSM}	Non-repetitive Peak one-cycle surge current. 8.35 msec half sine wave	800	Ampere

Electrical Specifications (25°C unless specified)

SYMBOL	SPECIFICATION/CONDITIONS	LIMIT	UNITS
$I_{R\,(ov)}$	Maximum Repetitive Peak Reverse Current L = 20μH, f = 1KHz (see Figure 5, Page 4)	2	Amp
I_{RM}	Maximum Reverse Leakage Current V_R = 35V, T_j = 125°C	150	mA
V_{FM}	Maximum Forward Voltage (300μsec, <1% Duty Cycle) I_F = 75A, T_j = 25°C I_F = 75A, T_J = 150°C I_F = 150A, T_j = 25°C I_F = 150A, T_j = 150°C	 0.74 0.66 0.95 0.90	 V V V V
C_J	Typical Junction Capacitance V_R = 5V	4000	pf
t_{rr}	Typical Reverse Recovery Time I_f = I_R = 1A, T_C = 125°C	50	n-sec
dV/dt	Maximum Rate of Change of Reverse Voltage	700	V/μsec

Thermal Specifications

SYMBOL	SPECIFICATION	LIMIT	UNITS
T_j	Operating Temperature Range	-55 to +150	°C
T_{sto}	Storage Temperature Range	-55 to +150	°C
$R_{\theta JG}$	Thermal Resistance Junction to Case	0.8	°C/W

TRW

Figure 1. — Average Forward Current vs. Maximum Allowable Case Temperature

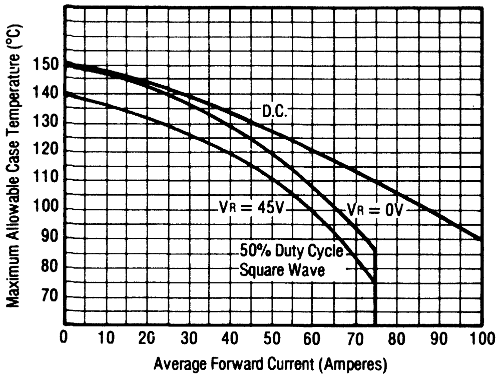


Figure 2. — Maximum Forward Power Dissipation vs. Forward Current

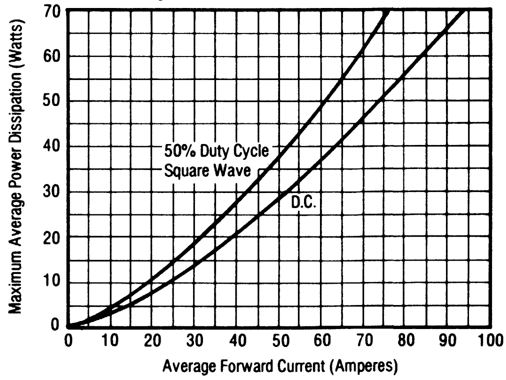


Figure 3.
Typical Reverse Characteristics

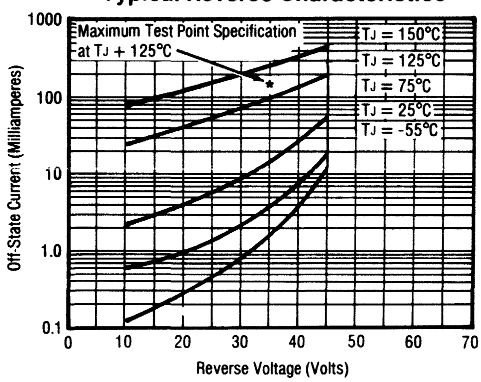


Figure 4. — Typical Junction Capacitance Variation with Reverse Bias

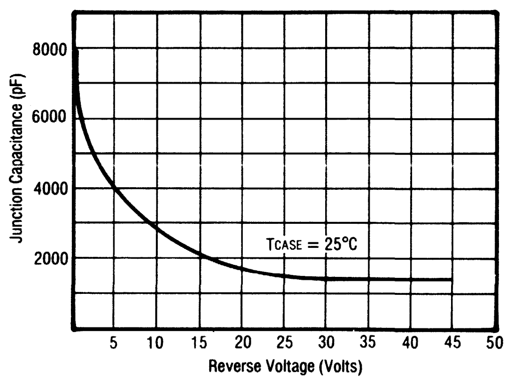


Figure 5. — Reverse Energy Test Circuit

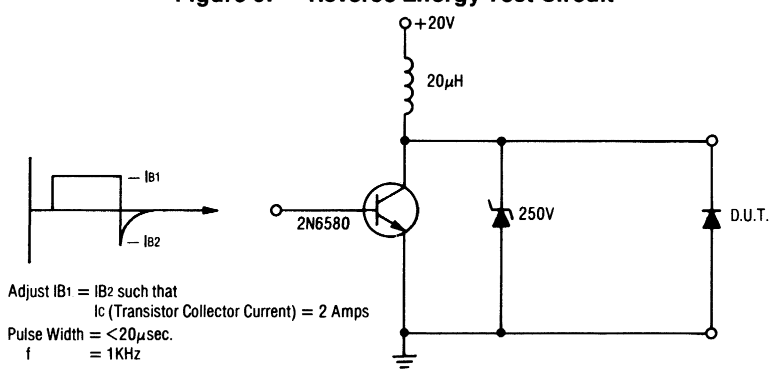


Figure 6. — Forward Characteristics for T_J = -55°C**

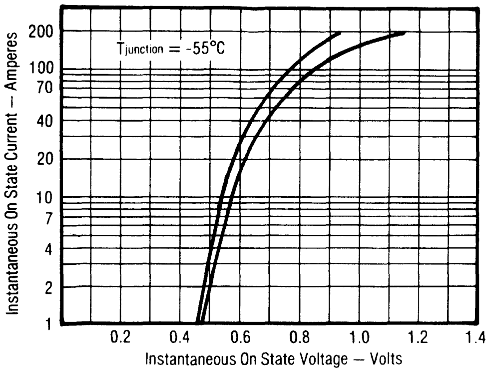


Figure 7. — Forward Characteristics for T_J = +25°C**

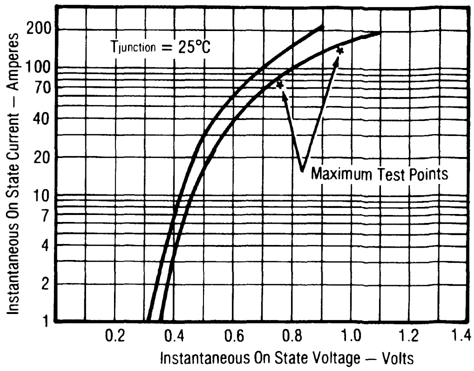


Figure 8. — Forward Characteristics for T_J = +75°C**

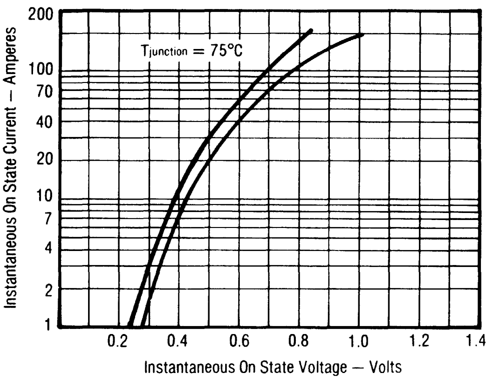


Figure 9. — Forward Characteristics for T_J = +125°C**

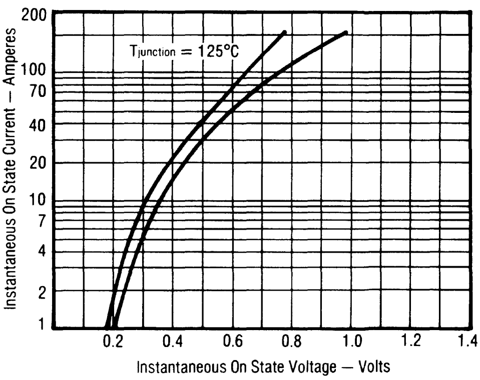
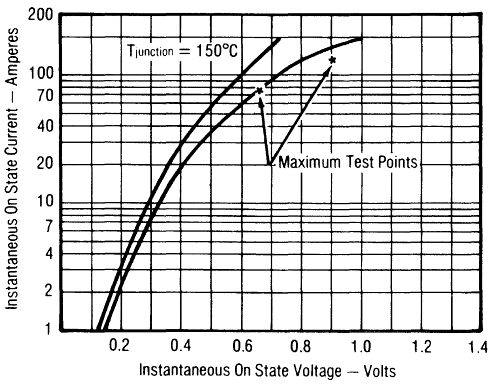


Figure 10. — Forward Characteristics for T_J = +150°C**



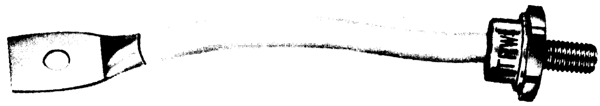
**NOTE: 90% of distribution will typically fall between curves shown.

TRW

Power Schottky Diode SD-5171

45V, 60 Amp, 150 °C (Junction)

Features
- Flexible Anode Lead
- 150°C
- Low Power Loss
- Fast Recovery



DO-203AB (DO-5) with flexible lead

Low V_F at high current in conjunction with high operating temperature makes the SD-5171 ideally suitable for rectification and commutation functions of 5-volt output power supplies. The SD-5171 is a Schottky-barrier (metal-silicon) power diode. The Schottky-barrier principle eliminates stored charge and allows extremely low V_F at high current. Improved barrier formation techniques allow operation at 150°C junction temperature.

Maximum Ratings

SYMBOL	RATING	LIMIT	UNITS
V_{RMM}	Repetitive Peak Reverse Voltage	45	Volts
V_{RWM}	Repetitive Peak Reverse Working Voltage	35	Volts
I_{FM}	Repetitive Peak Forward Current (50% duty cycle) (See figure 1 for temperature derating.)	120	Ampere
I_{FSM}	Non-repetitive Peak one-cycle surge current. 8.35 msec half sine wave	800	Ampere

Electrical Specifications (25°C unless specified)

SYMBOL	SPECIFICATION/CONDITIONS	LIMIT	UNITS
I_{RM}	Maximum Reverse Leakage Current $V_R = 35V$	50	mA
I_{RM}	Maximum Reverse Leakage Current $V_R = 35V$, $T_J = 125°C$	200	mA
V_{FM}	Maximum Forward Voltage (300μsec,<1% Duty Cycle) $I_F = 60A$ $I_F = 60A$, $T_J = 125°C$ $I_F = 120A$ $I_F = 120A$, $T_J = 125°C$	 0.75 0.65 0.92 0.89	 V V V V
C_J	Typical Junction Capacitance $V_R = 5V$	4000	pf
t_{rr}	Typical Reverse Recovery Time $I_f = I_R = 1A$, $T_C = 125°C$	50	n-sec
dV/dt	Maximum Rate of Change of Reverse Voltage	700	V/μsec

Thermal Specifications

SYMBOL	SPECIFICATION	LIMIT	UNITS
T_J	Operating Temperature Range	-55 to +150	°C
T_{stg}	Storage Temperature Range	-55 to +165	°C
$R_{\theta JC}$	Thermal Resistance Junction to Case	1.0	°C/W

Figure 1. — Average Forward Current vs. Maximum Allowable Case Temperature

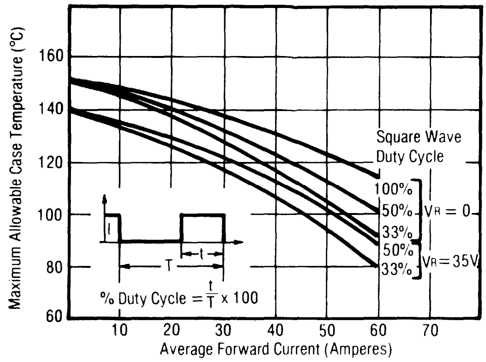


Figure 2. — Maximum Forward Power Dissipation vs. Forward Current

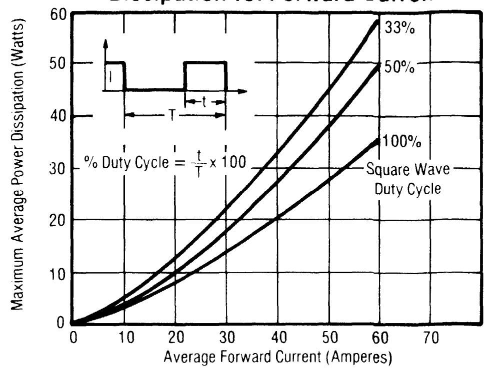


Figure 3. Typical Reverse Characteristics

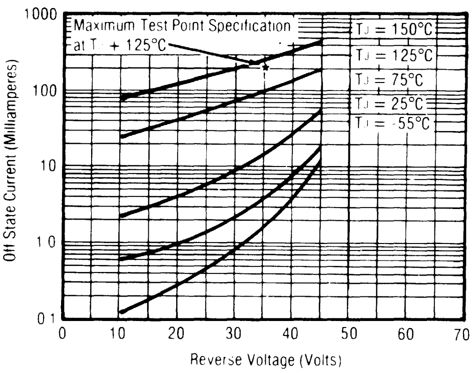


Figure 4. — Typical Junction Capacitance Variation with Reverse Bias

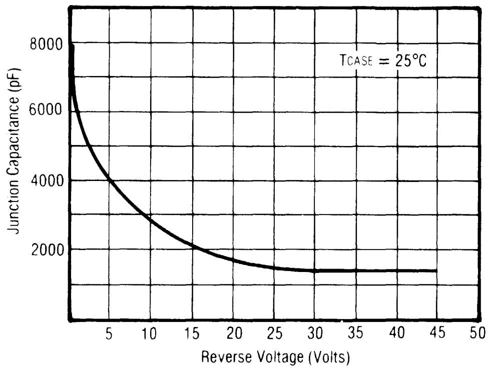


Figure 5. — Transient Thermal Response

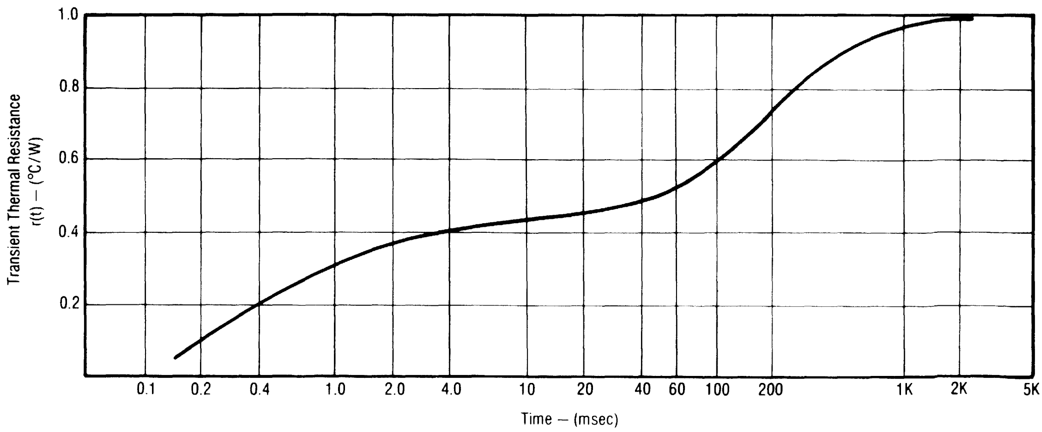


Figure 6. — Forward Characteristics for T_J = -55°C**

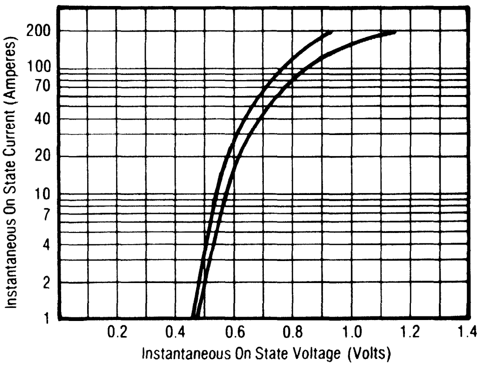


Figure 7. — Forward Characteristics for T_J = +25°C**

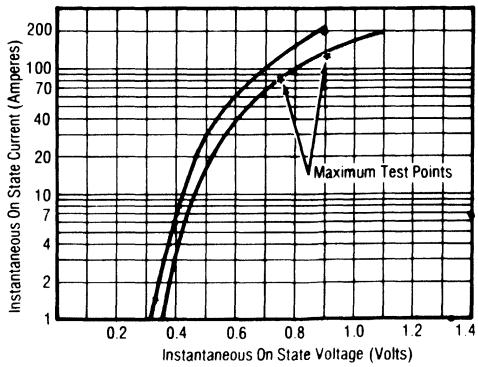


Figure 8. — Forward Characteristics for T_J = +75°C**

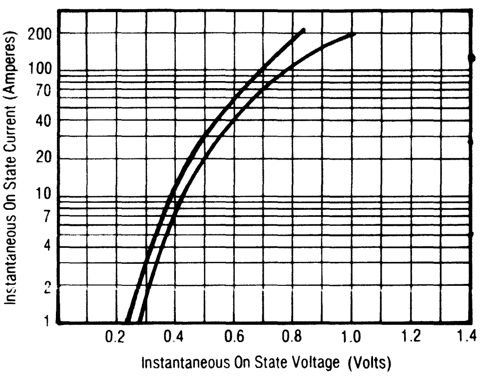


Figure 9. — Forward Characteristics for T_J = +125°C**

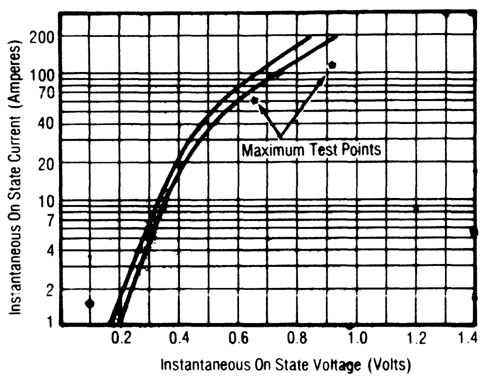
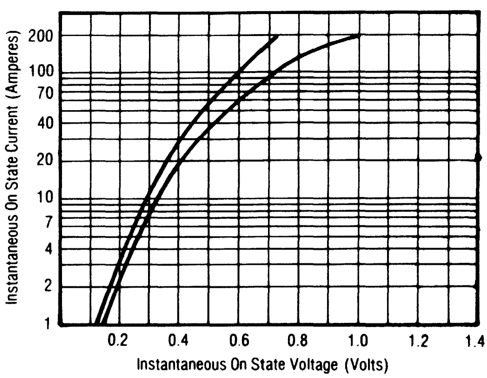
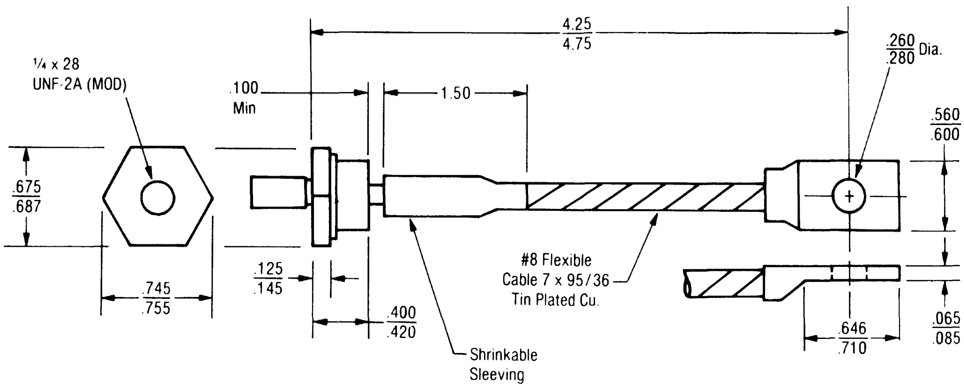


Figure 10. — Forward Characteristics for T_J = +150°C**



**NOTE: 90% of distribution will typically fall between curves shown.

Figure 11. — DO-203AB (DO-5) w/ Flexible Lead Package Outline Drawing

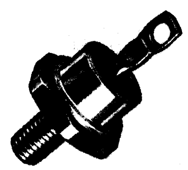


Recommended Mounting Torque (non-lubricated threads)
20 in-lb. minimum 30 in-lb. maximum

TRW

Power Schottky Diodes

- **30 and 40 Volt, 25 and 50 Amp**
- **+150°C (Peak Junction)**
- **Ideally Suited for Rectification and Commutation Functions in Low Voltage Power Supplies**



1N6095 1N6096 1N6097 1N6098

These Schottky diodes combine low voltage drop, absence of stored change and high temperature stability for high efficiency and reliability.

This diode is a metal in contact with a semiconductor material with rectification taking place at the junction of the two. This is fundamentally different from P-N junctions where the junction is buried in the semiconductor material and the surface contacts are only electrical and mechanical attachment points.

Due to lower barrier height, Schottky diodes have greater forward **and** reverse conductivity than the P-N junction diode. This translates into a lower forward voltage drop and higher reverse leakage. It should be stressed that the higher reverse leakage is a normal characteristic of the Schottky diode and is not symptomatic of surface defects.

Current transport is mainly due to majority carriers and is not subject to recovery transients due to minority carrier injection and storage. The absence of minority carriers results in reverse recovery times that are essentially negligible. For circuit analysis, the Schottky diode may be considered an ideal diode shunted by a voltage-variable capacitor equal to the junction capacitance.

Maximum Ratings — JEDEC Registered

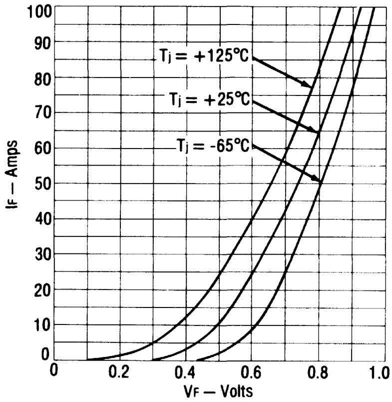
Symbol	Characteristics	1N6095	1N6096	1N6097	1N6098
V_R	D.C. Blocking Voltage	30V	40V	30V	40V
V_{RWM}	Peak Reverse Working Voltage	30V	40V	30V	40V
V_{RSM}	Non-Rep. Peak Reverse Voltage	36V	48V	36V	48V
I_o	Average Constant Forward Current	25A	25A	50A	50A
I_S	Peak Forward Surge Current	400A	400A	800A	800A
T_{OP}	Operating Temperature — No Derating (T_{CASE})	-65°C to +70°C			
T_{STG}	Storage Temperature	-65°C to +125°C			
T_j	Peak Junction Temperature	+150°C			
θ_{jc}	Thermal Impedance	2°C/W	2°C/W	1°C/W	1°C/W

Maximum Electrical Characteristics — JEDEC Registered

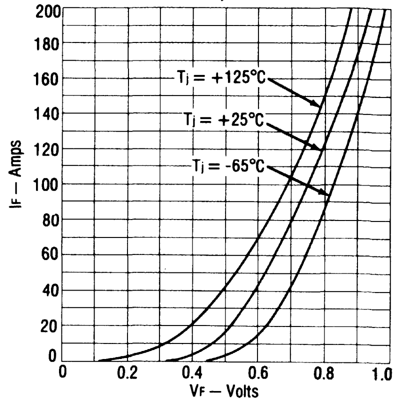
Symbol	Characteristics	Test Conditions	1N6095 1N6096	1N6097 1N6098
V_{RWM}	Peak Reverse Current	V_{RWM}, $T_j = +125°C$ Pulsed Test, P.W. $\leq 300\mu s$, D.C. $\leq 2\%$	250mA	250mA
I_R	D.C. Reverse Current	V_R, $T_j = +125°C$	250mA	250mA
V_{FM}	Peak Forward Voltage	I_o, $T_{CASE} = +70°C$	0.86V	0.86V
C_T	Junction Capacitance	$V_R = 1.0V$, $T_{CASE} = +25°C$ $100KHz \leq f \leq 1MHz$	6000pF	7000pF

Packages (Stud is Cathode)
1N6095, 1N6096 — DO-203AA (formerly DO-4)
1N6097, 1N6098 — DO-203AB (formerly DO-5)

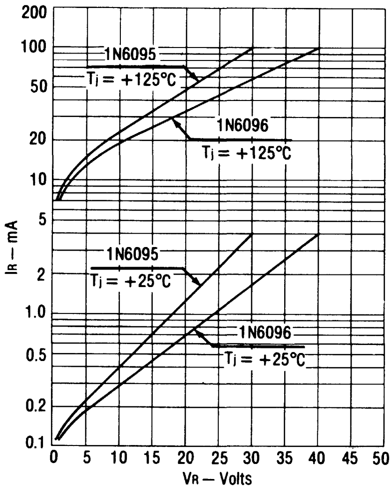
Typical Instantaneous I_F vs V_F 1N6095, 1N6096



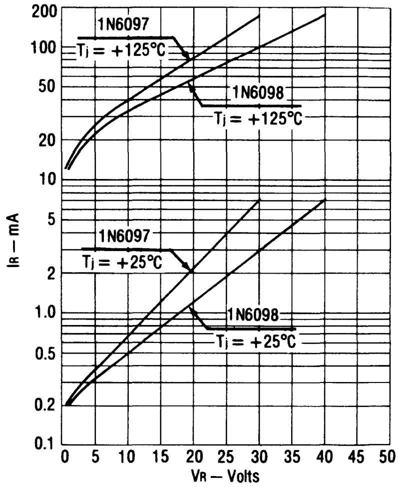
Typical Instantaneous I_F vs V_F 1N6097, 1N6098



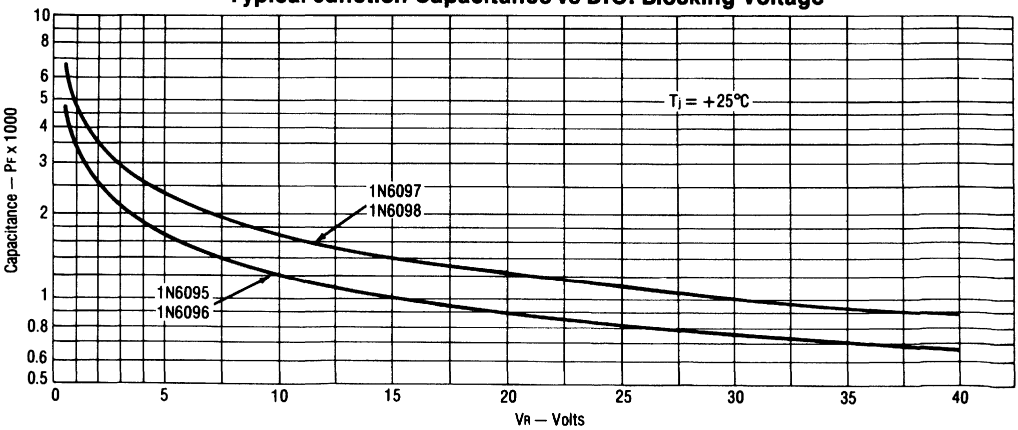
Typical Instantaneous I_R vs V_R 1N6095, 1N6096



Typical Instantaneous I_R vs V_R 1N6097, 1N6098

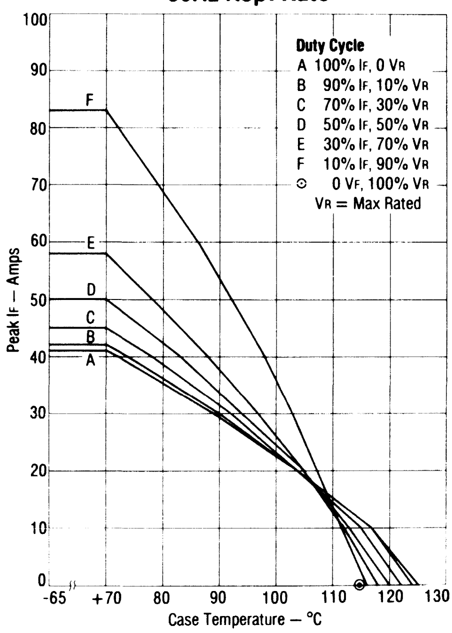


Typical Junction Capacitance vs D.C. Blocking Voltage

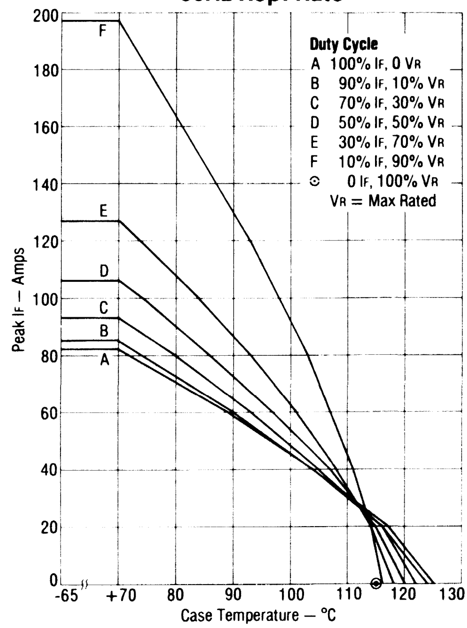


Maximum Peak IF vs Case Temperature — Rectangular Pulses

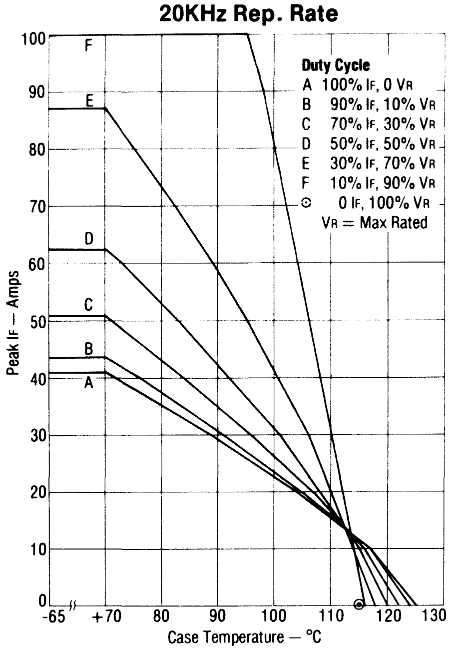
1N6095, 1N6096 60Hz Rep. Rate



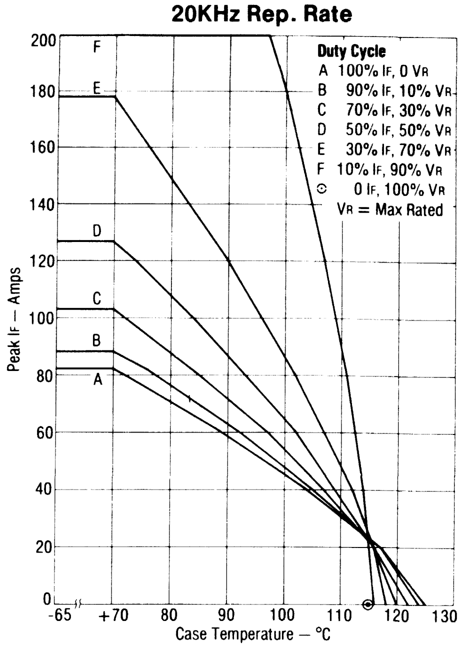
1N6097, 1N6098 60Hz Rep. Rate



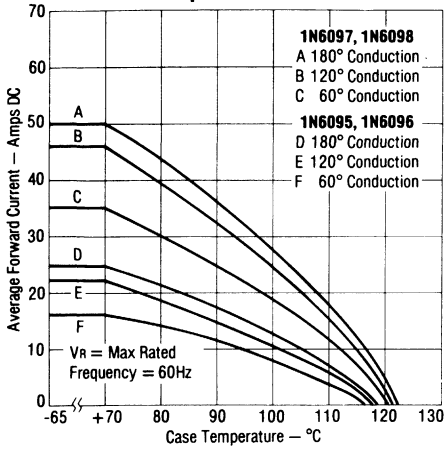
1N6095, 1N6096 20KHz Rep. Rate



1N6097, 1N6098 20KHz Rep. Rate



Maximum Average Forward Current vs Case Temperature — Sine Wave



Transient Thermal Response

To determine peak junction temperature for a single forward pulse:

$$T_j = P_D \times r(t) \times \theta_{jc} + T_{CASE}$$

To determine peak junction temperature for repetitive forward rectangular pulses:

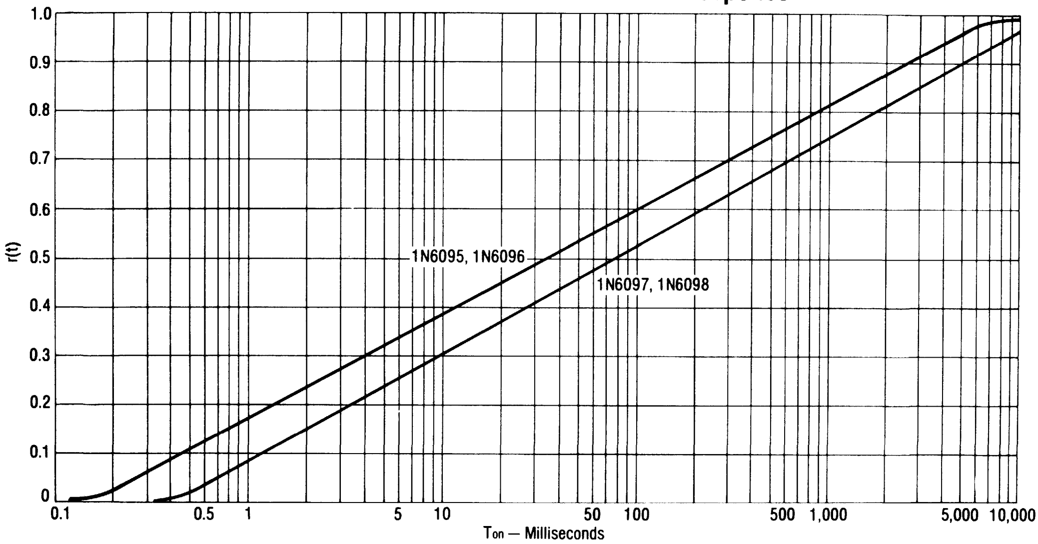
$$T_j = \left[\frac{t_{on}}{T}\theta_{jc} + \left(1 - \frac{t_{on}}{T}\right)r(t)\right]P_D + T_{CASE}$$

To determine peak junction temperature for repetitive reverse rectangular pulses:

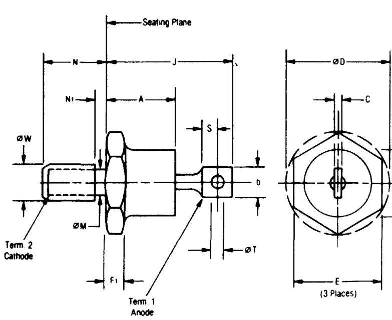
$$T_j = P_R\left(\frac{T - t_{on}}{T}\right)\theta_{jc}$$

where:
- P_D = Peak Forward Power
- P_R = Peak Reverse Power
- t_{on} = Forward Conduction Time
- T = Period (1 ÷ Rep Rate)
- $r(t)$ = Transient Thermal Impedance (appropriate curve)
- θ_{jc} = Thermal Impedance
  0.7°C/W Typical, 1.0°C/W Max for 1N6097, 1N6098
  1.4°C/W Typical, 2.0°C/W Max for 1N6095, 1N6096

Normalized Transient Thermal Response



Package Outline



Symbol	DO-203AA (formerly DO-4) Inches Min	Max	Millimeters Min	Max	Note	DO-203AB (formerly DO-5) Inches Min	Max	Millimeters Min	Max	Note
A	—	0.405	—	10.28		—	0.450	—	11.43	
b	—	0.250	—	6.35	3	—	0.375	—	9.52	3
c	—	—	—	—		—	—	—	—	
øD	—	0.505	—	12.82		—	0.794	—	20.16	
øD1	0.265	0.424	6.74	10.76		—	0.667	—	16.94	
E	0.423	0.438	10.75	11.12		0.669	0.688	17.00	17.47	
F1	0.075	0.175	1.91	4.44	2	0.115	0.200	2.93	5.08	2
J	0.600	0.800	15.24	20.32		0.750	1.000	19.05	25.40	
øM	0.163	0.189	4.15	4.80		0.220	0.249	5.59	6.32	
N	0.422	0.453	10.72	11.50		0.422	0.453	10.72	11.50	
N1	—	0.078	—	1.98		—	0.089	—	2.26	
S	—	—	—	—		0.156	—	3.97	—	5
øT	0.060	0.095	1.53	2.41		0.140	0.175	3.56	4.44	
øW	10-32	UNF-2A	10-32	UNF-2A	4	1/4-28	UNF-2A	1/4-28	UNF-2A	4

Notes:
1. Refer to applicable symbol list.
2. Chamber or undercut on one or both ends of hexagonal base is optional.
3. Angular orientation and contour of terminal one is optional.
4. ϕW is pitch diameter of coated threads. Ref: Unified screw threads, ANS B1.1-1960
5. Min. Flat.

LVA® Zener Diodes

Sharpest breakdown below 10 volts

The LVA device exhibits considerably sharper breakdown characteristics than zeners, in the 4-10 volt range. Above 10 volts, the breakdown mechanism of zener regulators is avalanche, which produces a very sharp knee and provides good voltage regulation. Below 10 volts, the field emission phenomenon starts, and as the operating voltage decreases, field emission accounts for an increasingly higher percentage of the device breakdown mechanism.

The performance of the LVA is displayed in the photograph above; an unretouched scope comparison of 1N752 standard zener (upper), and LVA356A (Tektonix Type 576, 1V/div. horizontal 1mA div. vertical).

Maximum Ratings (Common to all Types)

- DC Power Dissipation Ta = 25°C 400 mW
- Operating Temperature Range -65 to +175°C
- Storage Temperature Range -65 to +200°C

TRW

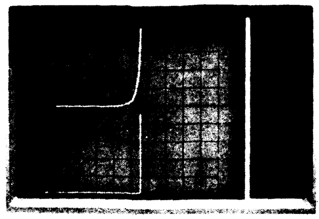
LVA® Zener Diodes

Sharpest breakdown below 10 volts

The LVA device exhibits considerably sharper breakdown characteristics than zeners, in the 4-10 volt range. Above 10 volts, the breakdown mechanism of zener regulators is avalanche, which produces a very sharp knee and provides good voltage regulation. Below 10 volts, the field emission phenomenon starts, and as the operating voltage decreases, field emission accounts for an increasingly higher percentage of the device breakdown mechanism.

Maximum Ratings (Common to all Types)

- DC Power Dissipation Ta = 25°C 400 mW
- Operating Temperature Range -65 to +175°C
- Storage Temperature Range -65 to +200°C
- DO-7 Package



Electrical Characteristics (T_{CASE} = 25°C unless noted) Table 1

Type Part No.	Vz Nominal Zener Voltage @ Iz (VDC)	Iz (mAdc)	Zz (2) Maximum Dynamic Impedance @ Iz (ohms)	Maximum (3) Noise Density @ 250μA ($\mu V/\sqrt{Hz}$)	IR Maximum Reverse Leakage @ VR (μAdc)	VR (Vdc)	VF Maximum Forward Voltage @ 200mA (Vdc)	Maximum Regulation Iz to Iz Low Δ Vz	Iz Low mAdc
LVA43A	4.3	20	18	4	4.0	1.5	1.5		
LVA47A	4.7	10	15	4	4.0	2.0	1.5		
LVA51A	5.1	5	15	4	0.1	2.0	1.5		
LVA56A	5.6	1	40	4	0.05	3.0	1.5		

Type No. (1)	Vz Nominal Zener Voltage @ Iz (VDC)	Iz (mAdc)	Zz (2) Maximum Dynamic Impedance @ Iz (ohms)	Maximum (3) Noise Density @ 250μA ($\mu V/\sqrt{Hz}$)	IR Maximum Reverse Leakage @ VR (μAdc)	VR (Vdc)	VF Maximum Forward Voltage @ 200mA (Vdc)	Maximum Regulation Iz to Iz Low Δ (Vz)	Iz Low (mAdc)
LVA62A	6.2	1	50	4	0.05	4.0	1.5		
LVA68A	6.8	1	50	4	0.05	5.0	1.5		
LVA75A	7.5	1	100	4	0.01	6.0	1.5		
LVA82A	8.2	1	100	4	0.01	6.5	1.5		
LVA91A	9.1	1	100	4	0.01	8.0	1.5		
LVA100A	10.0	1	100	4	0.01	9.0	1.5		
LVA343A	4.3	20	18	1	2.0	1.5	1.2	0.75	2.0
LVA347A	4.7	10	10	1	2.0	2.0	1.2	0.50	1.0
LVA351A	5.1	5	10	1	2.0	3.0	1.2	0.30	0.25
LVA356A	5.6	1	40	1	2.0	4.5	1.2	0.10	0.05
LVA362A	6.2	1	45	1	0.5	5.6	1.2	0.10	0.01
LVA368A	6.8	1	50	1	0.05	6.2	1.2	0.10	0.01
LVA375A	7.5	1	50	1	0.01	6.8	1.2	0.10	0.01
LVA382A	8.2	1	60	1	0.01	7.5	1.2	0.10	0.01
LVA391A	9.1	1	60	2	0.01	8.2	1.2	0.10	0.01
LVA3100A	10.0	1	60	2	0.01	9.1	1.2	0.10	0.01

Notes: (1) Suffix denotes zener voltage tolerance = ± 5%, other tolerances available on special order (consult factory).
(2) Measured @ DC test current with 10% AC superimposed (60 Hz rms)
(3) Measured from 1,000 Hz to 3,000 Hz

TRW

LVA Zener Diodes Table II Electrical Characteristics (T_{CASE} = 25°C unless noted)

DO-7 Package

TRW Part No. (1)	V_Z Nominal Zener Voltage @250μA (Vdc)	Z_Z (2) Maximum Dynamic Impedance @250μA (ohms)	(3) Maximum Noise Density @250μA ($\mu V/\sqrt{Hz}$)	I_R Maximum Reverse Leakage @ 80% V_Z (μAdc)	Maximum Regulation I_{ZHI} to $I_{Z\,Low}$ Δ (V_Z)	I_{ZHI} (mAdc)	I_Z Low (μAdc)	(4) Nominal TC @250μA (mV/°C)	Typical Parameters: Zener Voltage @10μA (Vdc)	Typical Parameters: Reverse Current @ 50% Zener Voltage (nAdc)	Typical Parameters: Reverse Current @ 90% Zener Voltage (μAdc)
LVA450A	5.0	700	1	10.0	0.40	1.0	100	+0.75	4.15	70	15
LVA453A	5.3	250	1	5.0	0.20	1.0	100	1.33	4.9	35	7
LVA456A	5.6	100	1	1.0	0.10	1.0	50	1.96	5.45	15	3
LVA459A	5.9	100	1	0.5	0.10	1.0	10	2.30	5.85	2.5	1
LVA462A	6.2	100	1	0.1	0.10	1.0	10	2.67	6.2	0.8	0.13
LVA465A	6.5	100	1	0.05	0.10	1.0	10	3.06	6.5	0.15	2.5
LVA468A	6.8	100	1	0.01	0.10	1.0	10	3.40	6.8	0.10	9.0
LVA471A	7.1	175	1	0.01	0.10	1.0	10	3.76	7.1	<0.10	5.5
LVA474A	7.4	175	1	0.01	0.10	1.0	10	4.07	7.4	<0.10	3.0
LVA477A	7.7	175	1	0.01	0.10	1.0	10	4.47	7.7	<0.10	2.5
LVA480A	8.0	175	1	0.01	0.10	1.0	10	4.80	8.0	<0.10	1.8
LVA483A	8.3	175	1	0.01	0.10	1.0	10	5.15	8.3	<0.10	1.2
LVA486A	8.6	175	1	0.01	0.10	1.0	10	5.50	8.6	<0.10	0.9
LVA489A	8.9	175	2	0.01	0.10	1.0	10	5.87	8.9	<0.10	0.6
LVA492A	9.2	175	2	0.01	0.10	1.0	10	6.16	9.2	<0.10	0.5
LVA495A	9.5	175	2	0.01	0.10	1.0	10	6.46	9.5	<0.10	0.5
LVA498A	9.8	175	2	0.01	0.10	1.0	10	6.86	9.8	<0.10	0.4

Notes: (1) Suffix denotes zener voltage tolerance = ± 0.200Vdc, other tolerances available on special order (consult factory).
(2) Measured at DC Test current with 10% AC superimposed (60 Hz rms)
(3) Measured, from 1,000 Hz to 3,000 Hz
(4) ± 0.5mV/°C, 0-100°C, ± V_Z nominal only

TRW Electronic Components Group

Printed Circuit Division
200 South Turnbull Canyon Road
City of Industry, California 91749
Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
4243 Campus Point Court
San Diego, California 92121
Phone: 714/457-1000

Products: Data converters, arithmetic products, and special processors.

Optoelectronics Division
1201 Tappan Circle
Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

Field Sales Offices

ALABAMA

TRW Electronic Components
2707 Artie Street, Ste. 12 — (205) 533-7600
Huntsville, AL 35805 — TWX: 810-726-2190

ARIZONA

TRW Electronic Components
6728 E. Avalon Drive, Suite A — (602) 994-0441
Scottsdale, AZ 85251 — TWX: 910-950-1181

CALIFORNIA

Q.T. Wiles & Associates
11340 W. Olympic, Suite 355 — (213) 478-0183
Los Angeles, CA 90064 — TWX: 910-342-6997

Q.T. Wiles & Associates
2101 E. 4th Street
Suite 125, Building A — (714) 973-2162
Santa Ana, CA 92705 — TWX: 910-595-2684

Q.T. Wiles & Associates
7894 Dagget Street, Suite 103
San Diego, CA 92111 — (714) 571-1544

Q.T. Wiles & Associates
22900 Ventura Blvd., Suite 260 — (213) 883-7130
Woodland Hills, CA 91364 — TWX: 910-494-1220

Straube Associates, Inc.
2551 Casey Avenue — (415) 969-6060
Mountain View, CA 94043 — TWX: 910-379-6556

TRW Electronic Components
5959 Century Boulevard, Suite 900 — (213) 535-6175
Los Angeles, Ca 90045 — TWX: 910-328-6124

COLORADO

Straube Associates, Inc.
3699 West 73rd Avenue — (303) 426-0890
Westminster, CO 80030 — TWX: 910-938-0390

CONNECTICUT

TRW Electronic Components
137 Rowayton Avenue — (203) 853-4466
Rowayton, CT 06853 — TWX: 710-468-3058

FLORIDA

TRW Electronic Components
1001 N.W. 62nd Street, Suite 306F — (305) 772-3000
Ft. Lauderdale, FL 33309 — TWX: 510-955-9756

TRW Electronic Components
6220 S. Orange Blossom Trail
Suite 151, Building 1 — (305) 857-3650
Orlando, FL 32809 — TWX: 810-850-4113

GEORGIA

TRW Electronic Components
3300 Holcomb Bridge Road
Suite 249 — (404) 447-6154
Norcross, CA 30092 — TWX: 810-766-0443

IDAHO

N. R. Schultz Co.
1074B N. Cole Road
P.O. Box 4545
Boise, ID 83704 — (208) 377-8686

ILLINOIS

TRW Electronic Components
5725 East River Road
Suite 635 — (312) 693-7730
Chicago, IL 60631 — TWX: 910-253-4081

INDIANA

Robert O. Whitesell & Associates
3426 Taylor Street — (219) 432-5591
Fort Wayne, IN 46804 — TWX: 810-332-1416

Robert O. Whitesell & Associates
6691 E. Washington Street — (317) 359-9283
Indianapolis, IN 46219 — Telex: 2-7440
TWX: 810-341-3320

Robert O. Whitesell & Associates
1825 S. Plate Street, Suite A — (317) 457-9127
Kokomo, IN 46901 — TWX: 810-269-1917

IOWA

C. H. Horn & Associates
4403 First Avenue S.E. — (319) 393-8703
Cedar Rapids, IA 52402 — TWX: 910-525-1331

KANSAS

Midtec Associates, Inc.
7702 Mize Road
DeSoto, KS 66018 — (913) 441-6565

KENTUCKY

Robert O. Whitesell & Associates
110 Daventry Lane
Suite 210 — (502) 426-7696
Louisville, KY 40223 — TWX: 810-535-3105

MASSACHUSETTS

TRW Electronic Components
Five Speen Street — (617) 620-0625
Framingham, MA 01701 — TWX: 710-380-7634

MICHIGAN

Robert O. Whitesell & Associates
688 Cascade W. Parkway Street — (616) 942-5420
Grand Rapids, MI 49506 — TWX: 810-273-6933

Robert O. Whitesell & Associates
18444 West Ten Mile Road — (313) 559-5454
Southfield, MI 48075 — TWX: 810-224-4939

Robert O. Whitesell & Associates
1822 Hilltop Road — (616) 983-7337
St. Joseph, MI 49085 — TWX: 810-270-3180

MINNESOTA

TRW Electronic Components
3050 Metro Drive, Suite 301 — (612) 854-6616
Minneapolis, MN 55420 — TWX: 910-576-2472

MISSOURI

John G. Macke Company
11710 Administration Drive — (314) 432-2830
St. Louis, MO 63141 — TWX: 910-764-0823

NEW YORK (Metropolitan)

TRW Electronic Components
137 Rowayton Avenue — (203) 853-4466
Rowayton, CT 06853 — TWX: 710-468-3058

NEW YORK (Upstate)

TRW Electronic Components
130 Metro Park, Suite 10 — (716) 424-2830
Rochester, NY 14623 — TWX: 510-253-1594

NORTH CAROLINA

TRW Electronic Components
One Woodlawn Green, Suite 156 — (704) 527-1344
Charlotte, NC 28210 — TWX: 810-621-0457

OHIO

Robert O. Whitesell & Associates
1172 W. Galbraith Road — (513) 521-2290
Cincinnati, OH 45231 — TWX: 810-465-8330

Robert O. Whitesell & Associates
6000 West Creek Road, Suite 21 — (216) 447-9020
Cleveland, OH 44131 — TWX: 810-427-2211

Robert O. Whitesell & Associates
6161 Busch Blvd., Suite 108 — (614) 888-9396
Columbus, OH 43229 — TWX: 810-337-2076

Robert O. Whitesell & Associates
4133 S. Dixie Avenue — (513) 298-9546
Dayton, OH 45439 — TWX: 810-459-1827

OREGON

N. R. Schultz Company
P.O. Box 156 — (503) 643-1644
Beaverton, OR 97005 — TWX: 910-467-8707
(mailing address)

13095 S. W. Henry Avenue
Beaverton, OR 97005
(office)

Don Smith Sales
4095 SW 144th Street
Beaverton, OR 97005 — (503) 643-8020

PENNSYLVANIA

TRW Electronic Components
#2 Bala Cynwyd Plaza, Suite 909 — (215) 667-3400
Bala Cynwyd, PA 19004 — TWX: 510-662-4780

Robert O. Whitesell & Associates
1360 Old Freeport Road, Suite 1B — (412) 963-6161
Pittsburgh, PA 15238 — TWX: 710-795-3144

TENNESSEE

Robert O. Whitesell & Associates
942 Snapp Ferry Road — (615) 639-6154
Greeneville, TN 37743 — TWX: 810-576-4594

TEXAS

TRW Electronic Components
3409 Executive Center Drive
Suite 139 — (512) 345-2331
Austin, TX 78731 — TWX: 910-874-1315

TRW Electronic Components
17000 Dallas Parkway
P.O. Box 400827 — (214) 248-8000
Dallas, TX 75240 — TWX: 910-860-5009

TRW Electronic Components
2267 Trawood, Bldg. #3 — (915) 594-8259
El Paso, TX 79935 — TWX: 910-964-1394

TRW Electronic Components
9000 Southwest Fwy., Suite 116 — (713) 772-5541
Houston, TX 77074 — TWX: 910-881-2698

UTAH

Straube Associates
3509 S. Main Street — (801) 263-2640
Salt Lake City, UT 84115 — TWX: 910-925-4026

VIRGINIA

TRW Electronic Components
8000 Franklin Farms Drive
Suite 217 — (804) 288-8334
Richmond, VA 23229 — TWX: 710-956-0078

WASHINGTON

N. R. Schultz Company
300 120th Avenue N.E.
P.O. Box 159 Ste. 210, Bldg. 4 — (206) 454-0300
Bellevue, WA 98009 — TWX: 910-443-2329

Don Smith Sales
711 N. Northlake Way
P.O. 30099 — (206) 633-3160
Seattle, WA 98103 — TWX: 910-444-2005

WISCONSIN

TRW Electronic Components
16535 W. Blue Mound Road, Suite 208 — (414) 784-7773
Brookfield, WI 53005 — TWX: 910-262-3189

International Sales Offices

Argentina, Buenos Aires . . . . . . Thiko S.A.
Australia, Moorabbin, Victoria . . . STC-Cannon Components Pty., Ltd.
Belgium, Brussels . . . . . . REA S.A. Belgium
Brazil, Sao Paulo . . . . . . TRW Do Brasil S/A
Canada, Toronto, Ontario . . . . . . Renmark Electronics Ltd.
Canada, Chateauguay, Quebec . . . . . . Renmark Electronics Ltd.
China — Peoples Republic of,
Palos Verdes, California . . . . . . GTI Global Technology Inc.
Denmark, Herlev . . . . . . A/S Nordisk Elektronik
Finland, Helsinki . . . . . . Oy Fintronic AB
France, Leballois-Perret, France . . . . . . Radio Equipment-Antares S.A.
Germany, Munchen . . . . . . TRW Elektronische GMBH
Hong Kong, Kowloon . . . . . . Tektron
India, Bombay . . . . . . Motwane Private Limited
Italy, Monza . . . . . . Exhibo S.P.A.
Japan, Tokyo . . . . . . Nihon Teksel Company, Ltd.
Korea, Seoul . . . . . . Dongyoung Trading Company
Netherlands, Den Haag . . . . . . Koning En Hartmann
New Zealand, Porirua . . . . . . AWA New Zealand
Norway, Hvalstad . . . . . . Nordisk Elektronik (Norge) A/S
South Africa, Capetown . . . . . . Eletrolink (Pty.) Ltd.
Spain, Madrid . . . . . . Unitronics, S.A.
Sweden, Stockholm . . . . . . Nordisk Electronik AB
Switzerland, Zurich . . . . . . Baerlocher AG
Taiwan, Taipei . . . . . . Sea Union Engineering
United Kingdom, Middlesex, England . . . . . . M.C.P. Electronics Ltd.
Other Countries, San Diego, California . . . . . . Total Electronics

TRW Electronic Components Group

Printed Circuit Division
200 South Turnbull Canyon Road
City of Industry, California 91749
Phone: 213/333-1201

Products: Printed circuit boards, multilayer and doublesided.

LSI Products Division
4243 Campus Point Court
San Diego, California 92121
Phone: 714/457-1000

Products: Data converters, arithmetic products, and special processors.

Optoelectronics Division
1201 Tappan Circle
Carrollton, Texas 75006
Phone: 214/323-2200

Products: Light-emitting diodes, photo sensors, optical integrated circuits, optocouplers, and assemblies.

Semiconductor Division
14520 Aviation Boulevard
Lawndale, California 90260
Phone: 213/679-4561

Products: VHF and UHF microwave power transistors; linear amplifiers; low-noise transistors; power switching transistors; power amplifiers and darlingtons; double-slug, avalanche, Schottky, and zener diodes.

TRW Composants Electroniques, S.A.
(Subsidiary)
Avenue de La Jalle Re
33300 Bordeaux-Lac, France
Phone: (56) 39 . 58 . 26
J.P. Laussade, General Manager

Products: RF power transistors.

Connector Division
1501 Morse Avenue
Elk Grove Village, Illinois 60007
Phone: 312/981-6000

Products: Connectors, interconnection systems, IC sockets, relay sockets, tube sockets, terminal strips, barrier blocks and crimp terminals.

Cylindrical Connector Division
8821 Science Center Drive
New Hope, Minnesota 55428
Phone: 612/537-1010

Products: Aircraft and military cylindrical connectors.

Capacitor Division
301 West O Street
Ogallala, Nebraska 69153
Phone: 308/284-3611

Products: Film capacitors (metallized and film foil); ceramic capacitors.

Motor Division
2275 Stanley Avenue
Dayton, Ohio 45404
Phone: 513/228-3171

Products: DC permanent magnet and wound-field hysteresis and induction-type motors and other motorized devices, including actuators, pumps, blowers, and integral gear trains.

Inductive Products Division
380 West Palatine Road
Wheeling, Illinois 60090
Phone: 312/541-0300

Products: Audio and high frequency transformers and inductors, pulse transformers, power transformers and inductors, magnetic amplifiers, electric wave filters, and High Q coils; assemblies (RF modulators, power adapters, power supplies, telecommunications, video games, analog/digital), RF (chokes) insert molded.

Resistive Products Division
401 North Broad Street
Philadelphia, Pennsylvania 19108
Phone: 215/922-8900

Products: Resistors (thick film, flameproof, power wirewound, high voltage, high frequency, printed and general purpose metal film); networks (thick film, precision metal film, carbon alloy, tantalum, and thin film).

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