TRW 52601

Microwave Linear Transistors

The TRW linear devices described herein are medium signal (1.5 watt), common emitter, diffused ballasted, **gold metalized** microwave transistors characterized for Class « A » service.

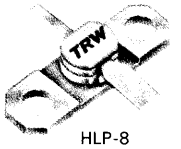
Because of TRW's proprietary ballasting and other protection techniques, no special techniques are required to protect these devices from arbitrary terminations up to infinite VSWR (any phase) so long as the transistors are attached properly to an adequate heat sink.

These transistors are useful for a variety of Military and industrial applications. They are available in TRW's HLP-8 flange package (TRW 52601), the HLP-8 flangeless (TRW 52101) and the new TW-200 symmetrically opposed emitter stripline package (TRW 52001).

Particular attention is directed to the ultralinear properties of these transistors and the guaranteed specification in accordance with DIN-45004.

Complete mechanical and electrical data are contained herein.

1.5 W
2 GHz
CLASS "A"



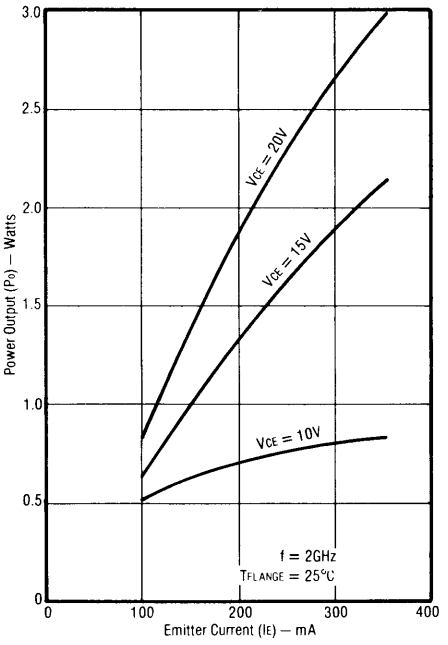
HLP-8

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

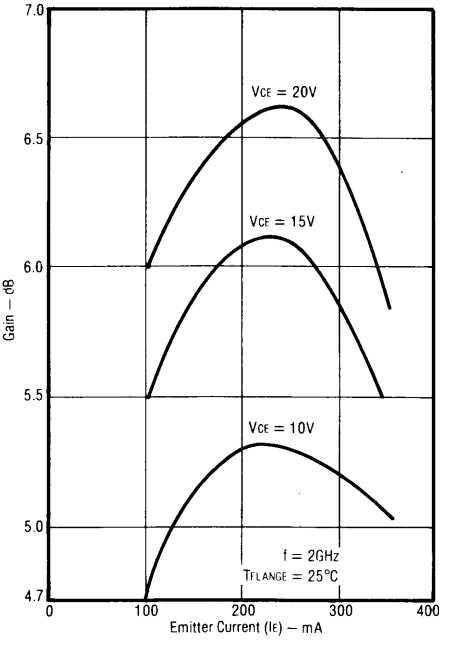
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
D C Tests	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 20 mA	24			V
	BV_{CER}	Collector-Emitter Breakdown Voltage	R_{BE} = 10 Ω, I_C = 20 mA	50			V
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25 mA	3.5			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 1.0 mA	45			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 28 V			0.125	mA
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5.0 V, I_C = 100 mA	20		120	—
R F Tests	C_{ob}	Collector-Base Capacitance	V_{CB} = 28 V, f = 1 MHz			5	pF
	P_o	Power Output	V_{CE} = 20 V, I_E = 220 mA f = 2.0 GHz, P_{in} = 0.375 W	1.5			W
	f_t	Frequency Cutoff	V_{CE} = 20 V, I_E = 220 mA	2.7	3.0		GHz
	VSWR	Mismatch Tolerance	P_o = 1.5 W, I_E = 220 mA, V_{CE} = 20 V	∞			
	IMD	Third Order intermodulation Distortion (Reference to Either Tone)	V_{CE} = 20 V, I_E = 220 mA f = 2.0 GHz, $P_{o(PEP)}$ = 1.5 W Tones at 2.05 GHz and 2.1 GHz			— 30	dB
	$IMD_{(TV)}$	Intermodulation per DIN-45004/K	V_{CE} = 20 V, I_E = 150 mA f = 1.0 GHz, P_{REF} = 0.5 W			-60	dB
Operating	T_j & T_{stg}	Max Junction and Storage Temperature		— 65		+ 200	°C
	θ_{jC}	Thermal Resistance	T_C = 25 °C			15	°C/W

ELECTRICAL CHARACTERISTICS
TRW52001, TRW52101, TRW52601

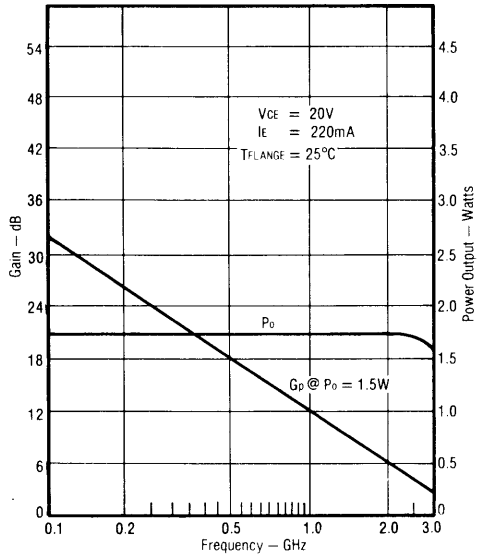
1dB Compression Point vs. Emitter Current



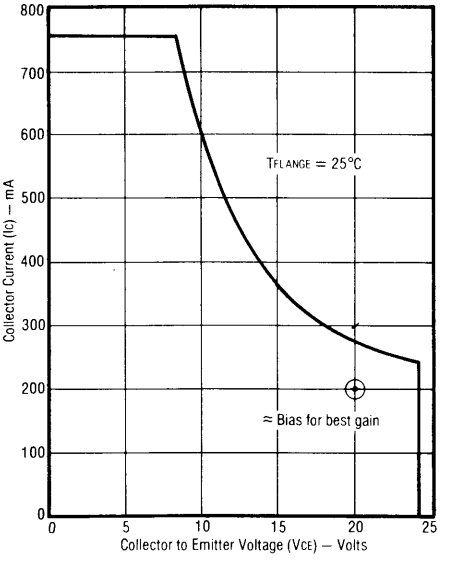
Gain vs. Emitter Current



Gain and 1dB Compressed Power vs. Frequency

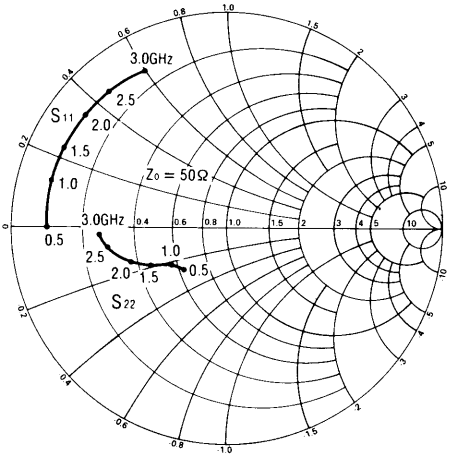


Safe Operating Area

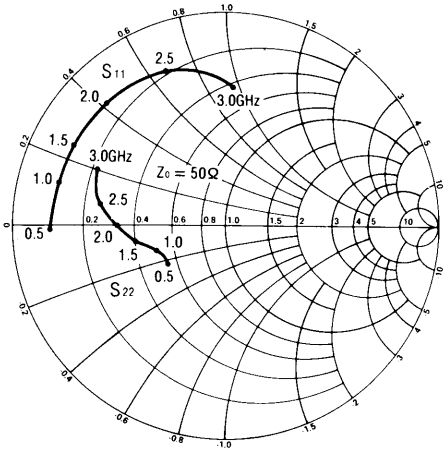


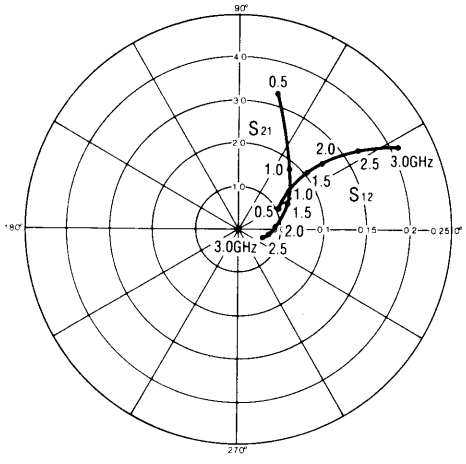
S-PARAMETERS
V_{CE} = 20V, I_E = 220mA, T_{FLANGE} = 25°C

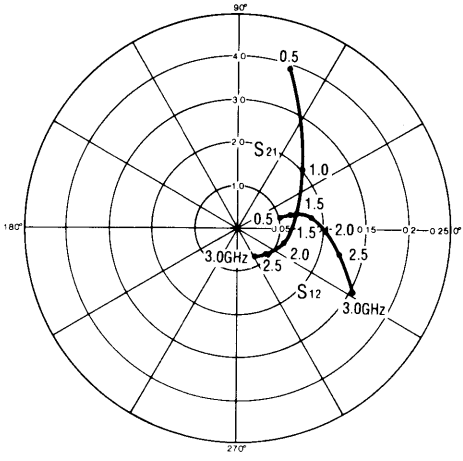
TRW52001



TRW52101, TRW52601

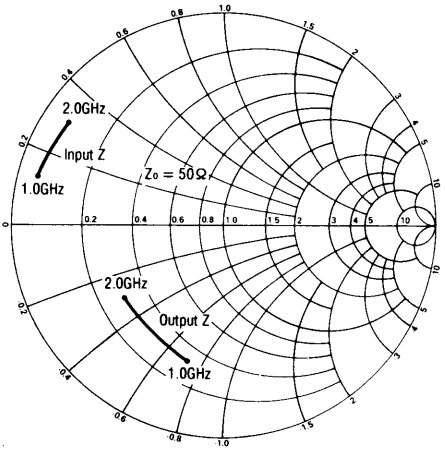




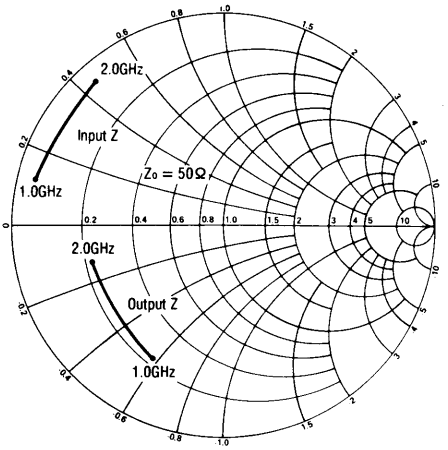


LARGE SIGNAL IMPEDANCE DATA
V_{CE} = 20V, I_E = 220mA, T_{FLANGE} = 25°C

TRW52001

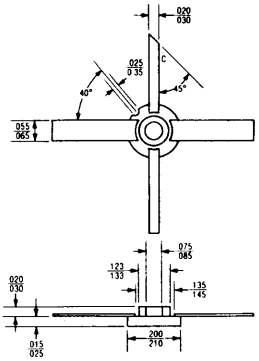


TRW52101, TRW52601

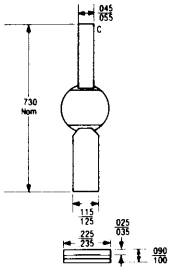


Package Outlines

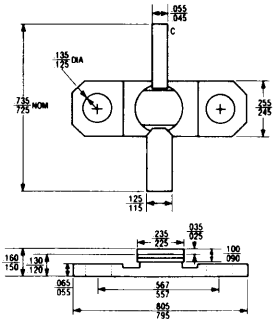
TRW52001



TRW52101



TRW52601



Mechanical Specifications

The following are mechanical 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.

Hermaticity: 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.

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.

Microwave Linear Transistors

The TRW linear devices described herein are medium signal (3.0 watt), common emitter, diffused ballasted **gold metalized** microwave transistors characterized for Class « A » service.

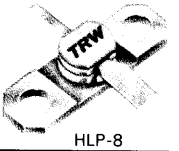
Because of TRW's proprietary ballasting and other protection techniques, no special techniques are required to protect these devices from arbitrary terminations up to infinite VSWR (any phase) so long as the transistors are attached properly to an adequate heat sink.

These transistors are useful for a variety of Military and industrial applications. They are available in TRW's HLP-8 flange package (TRW 52602), the HLP-8 flangeless (TRW 52102).

Particular attention is directed to the ultralinear properties of these transistors and the guaranteed specification in accordance with DIN-45004.

Complete mechanical and electrical data are contained herein.

3 W
2 GHz
CLASS "A"



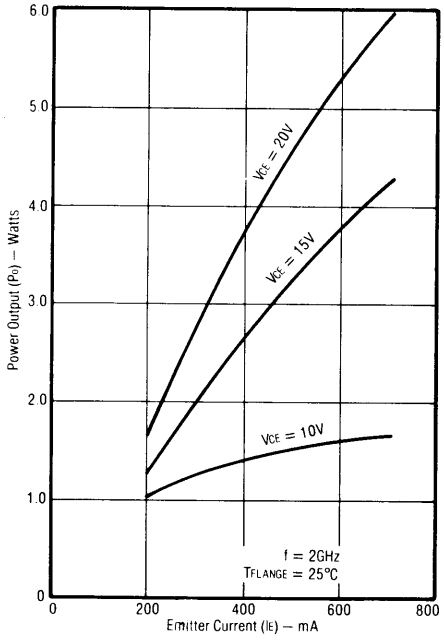
HLP-8

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

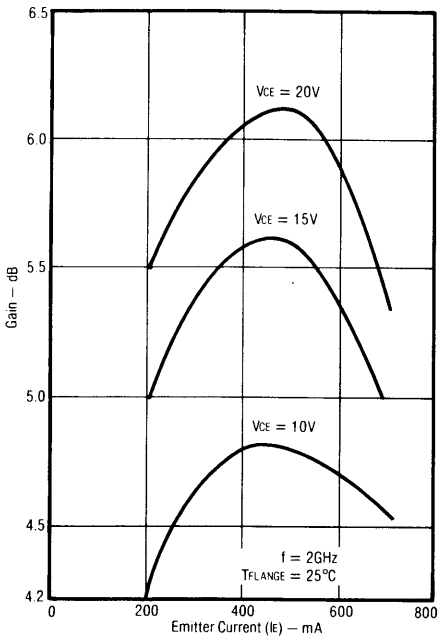
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC Tests	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 40 mA	24			V
	BV_{CER}	Collector-Emitter Breakdown Voltage	R_{BE} = 10 Ω, I_C = 40 mA	50			V
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.50 mA	3.5			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 2.0 mA	45			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 28 V			0.25	mA
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5.0 V, I_C = 200 mA	20		120	—
RF Tests	C_{ob}	Collector-Base Capacitance	V_{CB} = 28 V, f = 1 MHz			7	pF
	P_o	Power Output	V_{CE} = 20 V, I_E = 440 mA f = 2.0 GHz, P_{in} = 0.75 W	3.0			W
	f_t	Frequency Cutoff	V_{CE} = 20 V, I_E = 440 mA	2.7	3.0		GHz
	VSWR	Mismatch Tolerance	P_o = 3.0 W, I_E = 440 mA, V_{CE} = 20 V	∞			
	IMD	Third Order Intermodulation Distortion	V_{CE} = 20 V, I_E = 440 mA $P_{o(PEP)}$ = 3.0 W Tones at 2.000 GHz and 2.005 GHz			— 30	dB
	$IMD_{(TV)}$	Intermodulation per DIN-45004/K	V_{CE} = 20 V, I_E = 300 mA f = 1.0 GHz, P_{REF} = 1.0 W			— 60	dB
Operating	T_j & T_{stg}	Max Junction and Storage Temperature		— 65		+ 200	°C
	θ_{j-c}	Thermal Resistance	25 °C			8.5	°C/W

ELECTRICAL CHARACTERISTICS

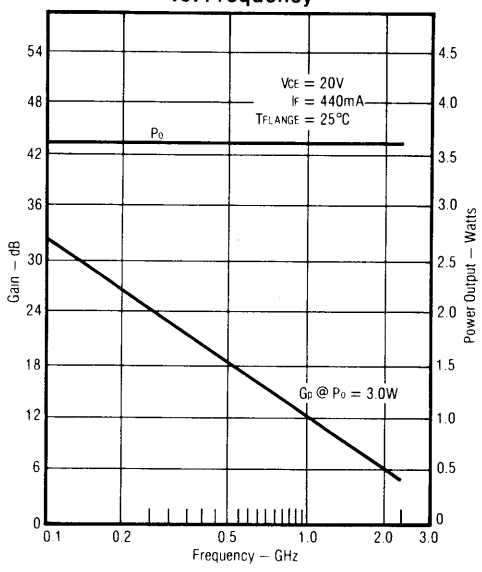
1dB Compression Point vs. Emitter Current



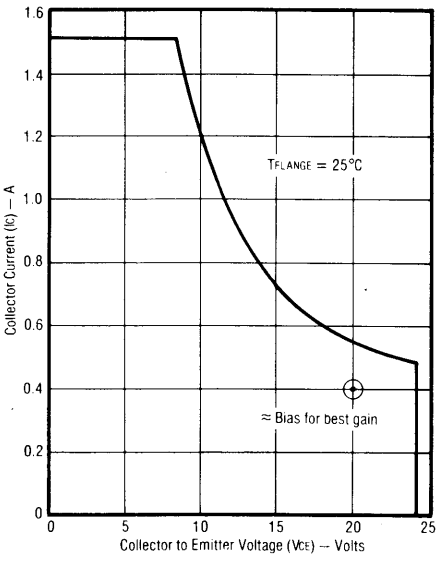
Gain vs. Emitter Current



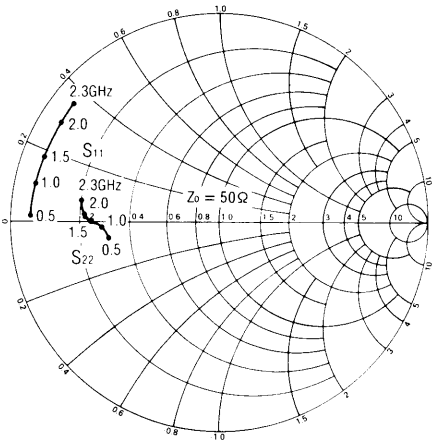
Gain and 1dB Compressed Power vs. Frequency

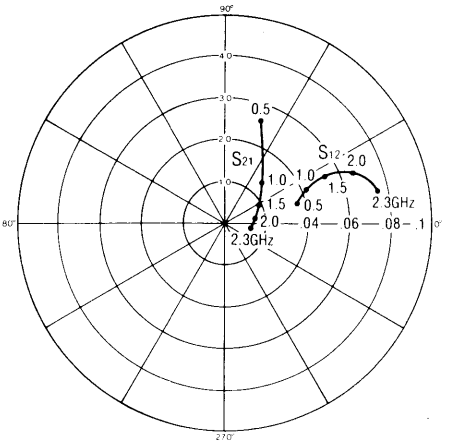


D.C. Safe Operating Area

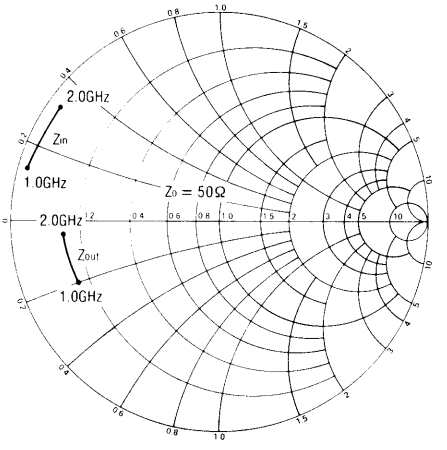


S-PARAMETERS
V_{CE} = 20V, I_E = 440mA, T_{FLANGE} = 25°C

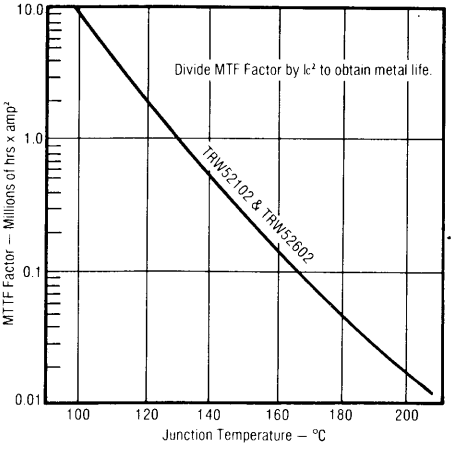




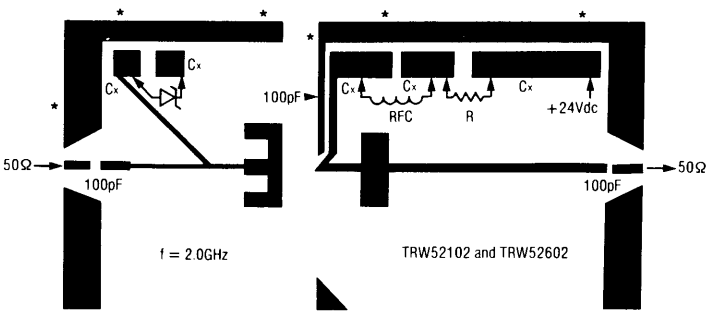
Large Signal Impedance Data



MTTF Factor vs. Junction Temperature



TEST CIRCUIT BOARD FOR TRW52102 AND TRW52602



Parts Details

* = Foil-wrap asterisked edge to ground plane. Board material 0.020 inch glass-teflon $\varepsilon_r = 2.55$.

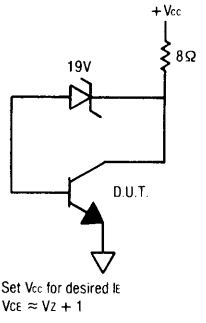
C_x = 100pF and 0.1pF chip

Zener Diode = 19V, 1W

RFC = 8 turns, #28A.W.G., 0.040 diameter

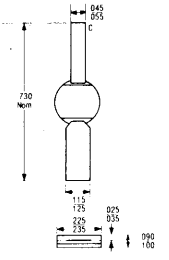
R = 8Ω, 2W

Self-Regulating Bias Circuit

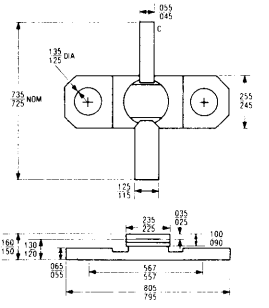


Package Outlines

TRW52102



TRW52602



Mechanical Specifications

The following are mechanical 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.

Hermaticity: 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® SEMICONDUCTORS

TRW 52604

Microwave Linear Transistors

The TRW linear devices described herein are medium signal (6.0 watt), common emitter, diffused ballasted, **gold metalized** microwave transistors characterized for Class « A » service.

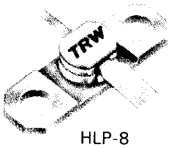
Because of TRW's proprietary ballasting and other protection techniques, no special techniques are required to protect these devices from arbitrary terminations up to infinite VSWR (any phase) so long as the transistors are attached properly to an adequate heat sink.

These transistors are useful for a variety of Military and industrial applications. They are available in TRW's HLP-8 flange package (TRW 52604), the HLP-8 flangeless (TRW 52104).

Particular attention is directed to the ultralinear properties of these transistors and the guaranteed specification in accordance with DIN-45004.

Complete mechanical and electrical data are contained herein.

6 W
2 GHz
CLASS "A"



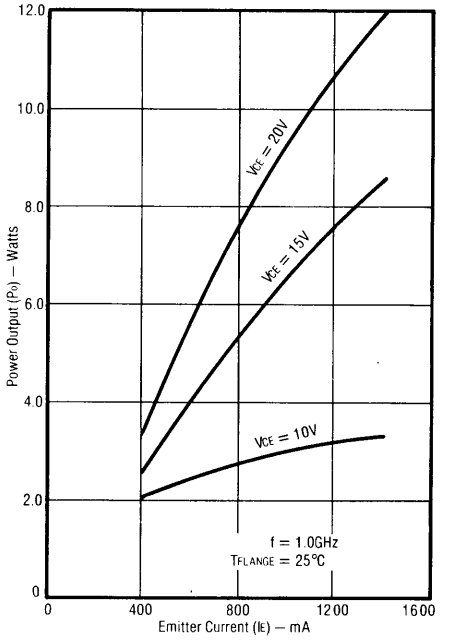
HLP-8

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

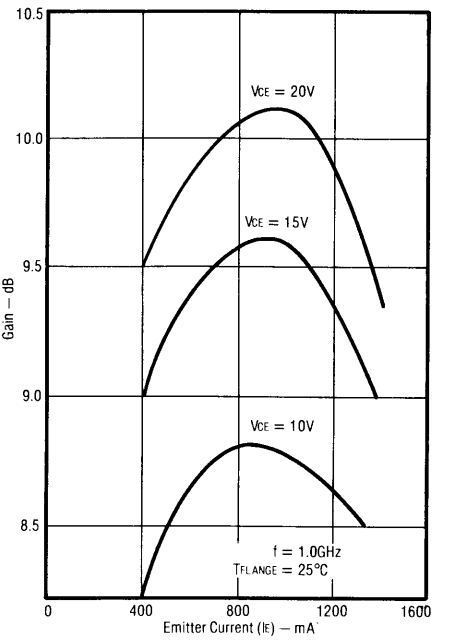
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
D C Tests	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 80 mA	24			V
	BV_{CER}	Collector-Emitter Breakdown Voltage	R_{BE} = 10 Ω, I_C = 80 mA	50			V
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 1.0 mA	3.5			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 4.0 mA	45			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 28 V			0.5	mA
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5.0 V, I_C = 400 mA	20		120	—
R F Tests	C_{ob}	Collector-Base Capacitance	V_{CB} = 28 V, f = 1 MHz			12	pF
	P_o	Power Output	V_{CE} = 20 V, I_E = 880 mA f = 1.0 GHz, P_{in} = 0.600 W	6.0			W
	f_t	Frequency Cutoff	V_{CE} = 20 V, I_E = 880 mA	2.4	2.6		GHz
	VSWR	Mismatch Tolerance	P_o = 5.0 W, I_E = 600 mA, V_{CE} = 20 V	3:1			
	IMD	Third Order Intermodulation Distortion	V_{CE} = 20 V, I_E = 880 mA $P_{o(PEP)}$ = 6.0 W Tones at 1.000 GHz and 1.005 GHz			— 30	dB
	$IMD_{(TV)}$	Intermodulation per DIN-45004/K	V_{CE} = 20 V, I_E = 600 mA f = 1.0 GHz, P_{REF} = 2.0 W			— 60	dB
Operating	T_j & T_{stg}	Max Junction and Storage Temperature		— 65		+ 200	°C
	θ_{j-C}	Thermal Resistance	P_o = 5 W, V_{CE} = 20 V, I_E = 880 mA			6.0	°C/W

ELECTRICAL CHARACTERISTICS

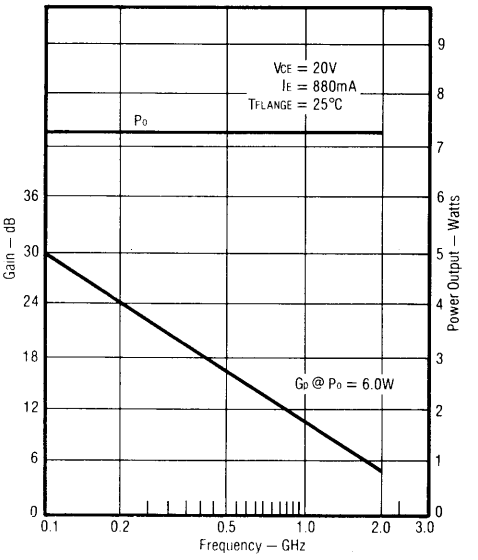
1dB Compression Point vs. Emitter Current



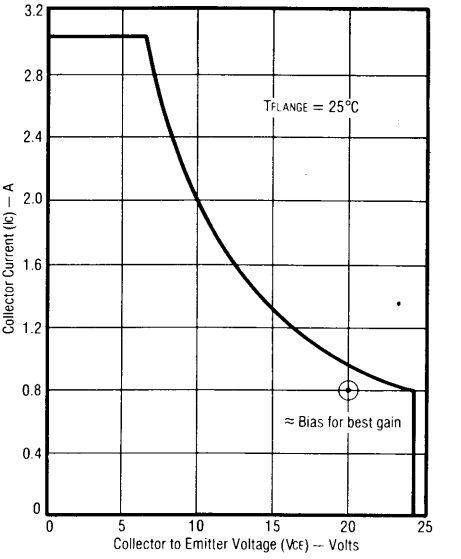
Gain vs. Emitter Current



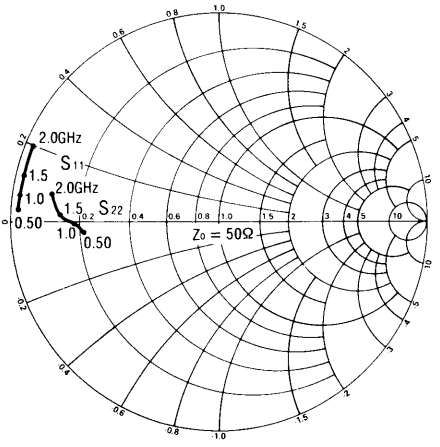
Gain and 1dB Compressed Power vs. Frequency

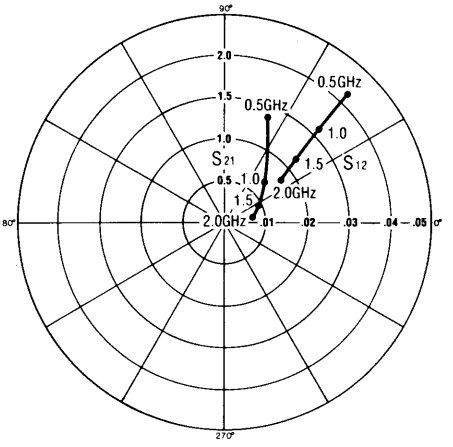


D.C. Safe Operating Area

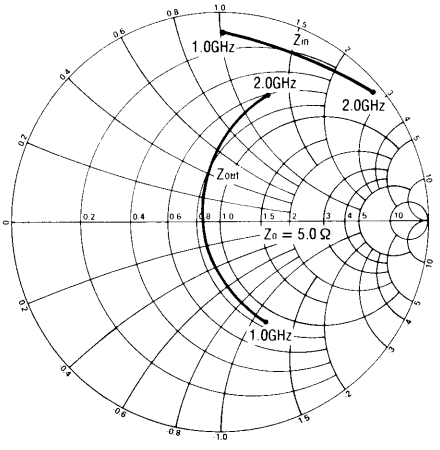


S-Parameters
V_{CE} = 20V, I_E = 880mA, T_{FLANGE} = 25°C

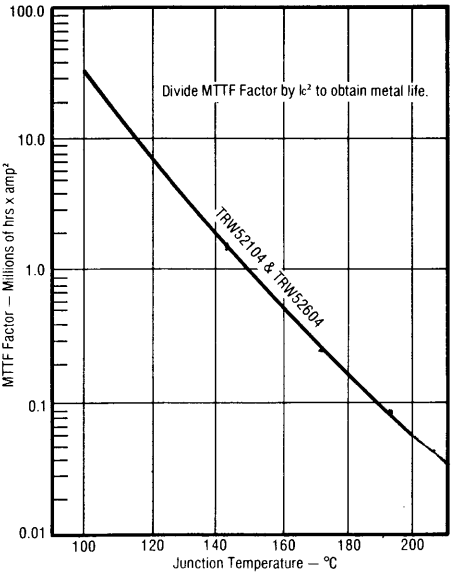




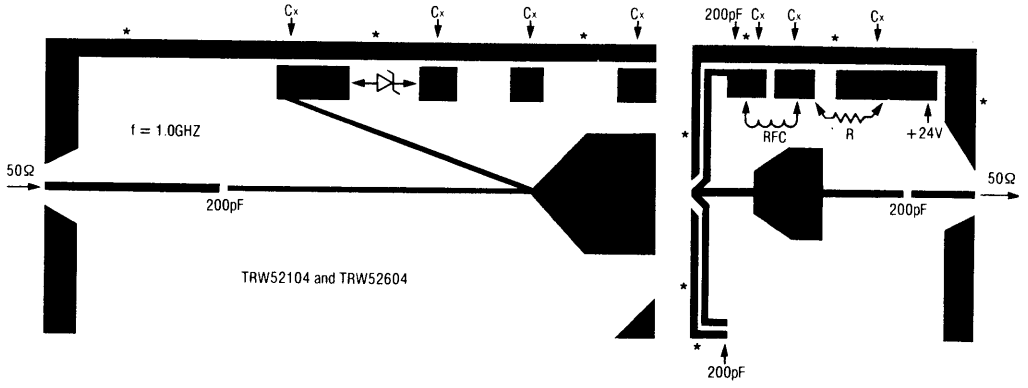
Large Signal Impedance Data



MTTF Factor vs. Junction Temperature



TEST CIRCUIT BOARD FOR TRW52104 AND TRW52604



Parts Details

* = Foil-wrap asterisked edge to ground plane. Board material 0.020 inch glass-teflon $\varepsilon_r = 2.55$.

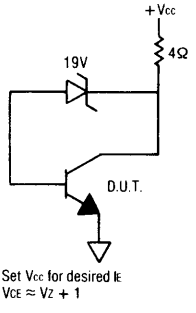
C_x = 100pF and 0.1μF chip

Zener Diode = 19V, 1W

RFC = 8 turns, #28A.W.G., 0.040 diameter

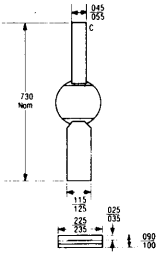
R = 4Ω, 4W

Self-Regulating Bias Circuit

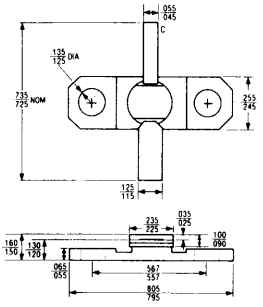


Package Outlines

TRW52104



TRW52604



Mechanical Specifications

The following are mechanical 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.

Hermaticity: 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 Linear Transistors

The TRW linear devices described herein are medium signal (0.8 watt), common emitter, diffused ballasted, **gold metalized** microwave transistors characterized for Class « A » service.

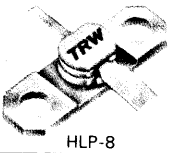
Because of TRW's proprietary ballasting and other protection techniques, no special techniques are required to protect these devices from arbitrary terminations up to infinite VSWR (any phase) so long as the transistors are attached properly to an adequate heat sink.

These transistors are useful for a variety of Military and industrial applications. They are available in TRW's HLP-8 flange package (TRW 53601), the HLP-8 flangeless (TRW 53101) and the new TW-200 symmetrically opposed emitter stripline package (TRW 53001).

Particular attention is directed to the ultralinear properties of these transistors and the guaranteed specification in accordance with DIN-45004.

Complete mechanical and electrical data are contained herein.

0.8 W
3 GHz
CLASS "A"



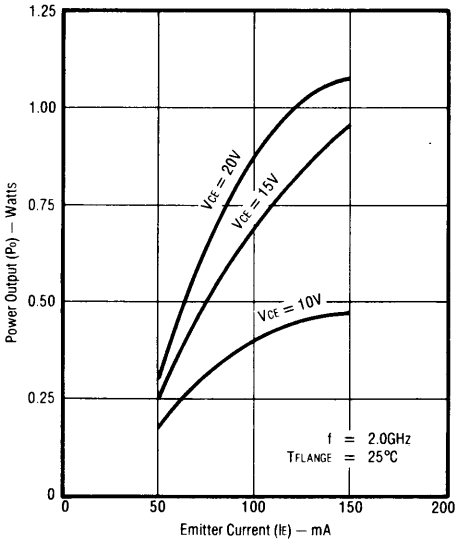
HLP-8

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

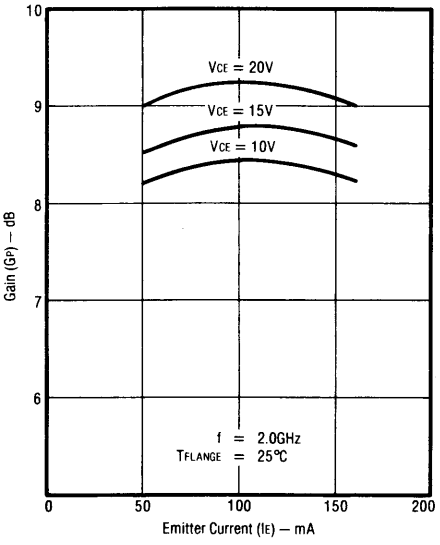
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
D C Tests	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 10 mA	24			V
	BV_{CER}	Collector-Emitter Breakdown Voltage	R_{BE} = 10 Ω, I_C = 10 mA	50			V
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.25 mA	3.5			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 1.0 mA	45			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 28 V			0.25	mA
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5.0 V, I_C = 100 mA	20		120	—
R F Tests	C_{ob}	Collector-Base Capacitance	V_{CB} = 28 V, f = 1 MHz			3.5	pF
	P_o	Power Output	V_{CE} = 20 V, I_E = 120 mA f = 2.0 GHz, P_{in} = 0.113 W	0.8			W
	f_t	Frequency Cutoff	V_{CE} = 20 V, I_E = 120 mA	3.0	3.3		GHz
	VSWR	Mismatch Tolerance	P_o = 0.8 W, I_E = 120 mA, V_{CE} = 20 V	∞			
	IMD	Third Order Intermodulation Distortion (Reference to Either Tone)	V_{CE} = 20 V, I_E = 120 mA $P_{o(PEP)}$ = 0.8 W Tones at 2.000 GHz and 2.005 GHz			— 30	dB
	$IMD_{(TV)}$	Intermodulation per DIN-45004/K	V_{CE} = 20 V, I_E = 75 mA f = 1.0 GHz, P_{REF} = 0.25 W			— 60	dB
Operating	T_j & T_{stg}	Max Junction and Storage Temperature		— 65		+ 200	°C
	θ_{jF}	Thermal Resistance	T_C = 25 °C			31	°C/W

Electrical Characteristics
TRW53001, TRW53101, TRW53601

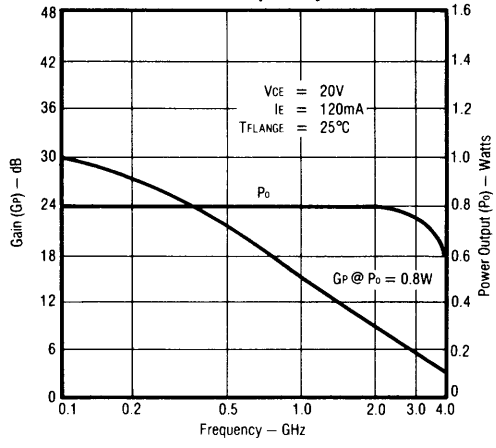
1dB Compression Point vs. Emitter Current



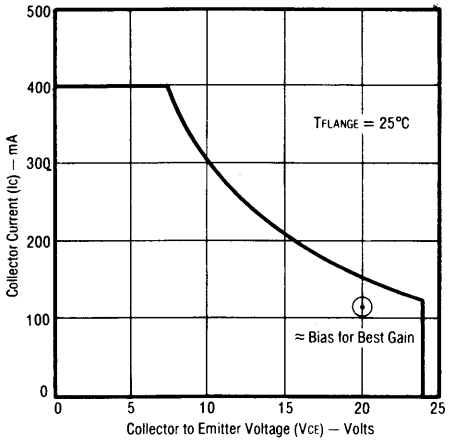
Gain vs. Emitter Current



Gain and 1dB Compressed Power vs. Frequency



D.C. Safe Operating Area



Mechanical Specifications

The following are mechanical 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.

Hermaticity: 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.

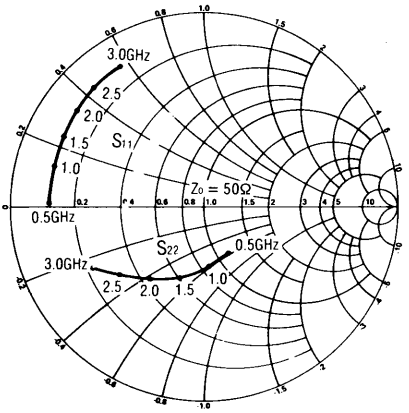
Bond Pull: Per MIL-STD-750, 3 grams min.

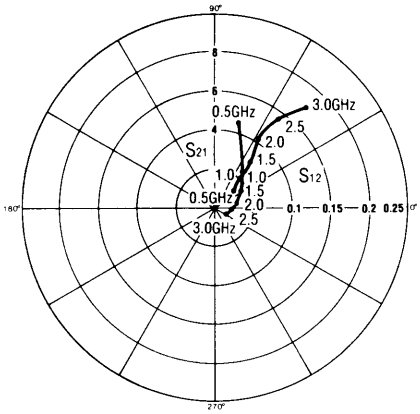
Package: A brazed ceramic package assuring long-term integrity of hermetic seals. Leads of KOVAR base material with minimum 60 microinches of gold plating.

S-Parameters

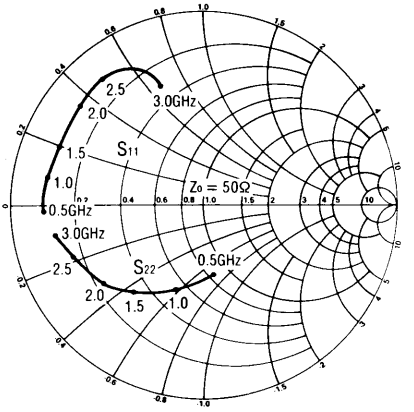
V_{CE} = 20V, I_E = 120mA, T_{FLANGE} = 25°C

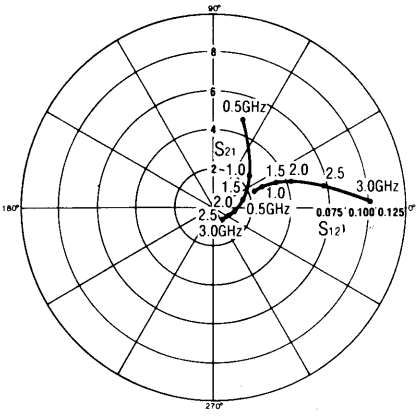
TRW53001





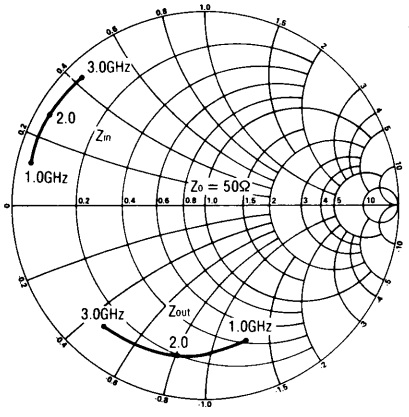
TRW53101, TRW53601

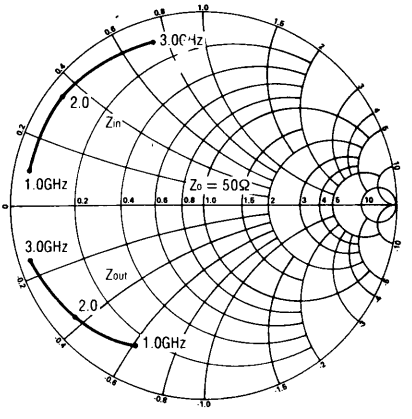




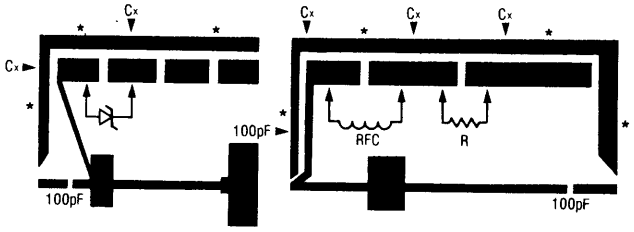
Large Signal Impedance Data

V_{CE} = 20V, I_E = 120mA, T_{FLANGE} = 25°C





Test Circuit Board For TRW53001, TRW53101 AND TRW53601



f = 2GHz

TRW53001, TRW53101 and TRW53601

Parts Details

* = Foil-wrap asterisked edge to ground plane. Board material 0.020 inch glass-teflon $\varepsilon_r = 2.55$.

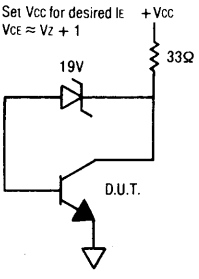
Cx = 100pF and 0.1μF chip

Zener Diode = 19V, 1W

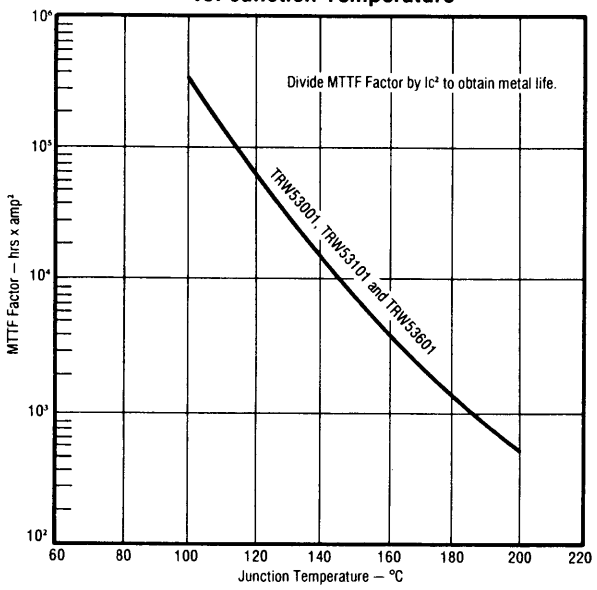
RFC = 8 turns, #28A.W.G., 0.040 diameter

R = 33Ω, 1W

Self-Regulating Bias Circuit

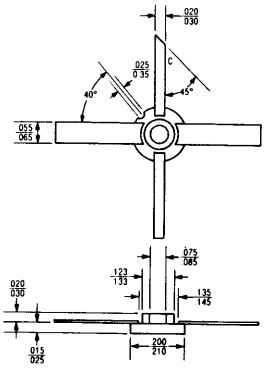


MTTF Factor vs. Junction Temperature

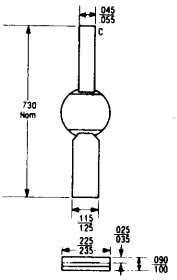


Package Outlines

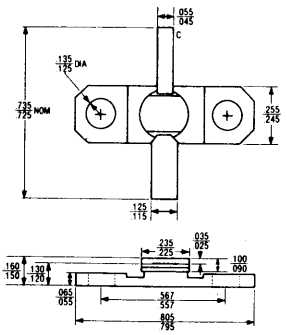
TRW53001



TRW53101



TRW53601



TRW® SEMICONDUCTORS

TRW 53602

Microwave Linear Transistors

The TRW linear devices described herein are medium signal (1.6 watt), common emitter, diffused ballasted, **gold metalized** microwave transistors characterized for Class « A » service.

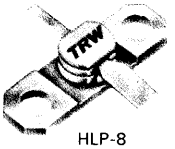
Because of TRW's proprietary ballasting and other protection techniques, no special techniques are required to protect these devices from arbitrary terminations up to infinite VSWR (any phase) so long as the transistors are attached properly to an adequate heat sink.

These transistors are useful for a variety of Military and industrial applications. They are available in TRW's HLP-8 flange package (TRW 53602), the HLP-8 flangeless (TRW 53102).

Particular attention is directed to the ultralinear properties of these transistors and the guaranteed specification in accordance with DIN-45004.

Complete mechanical and electrical data are contained herein.

1.6 W
3 GHz
CLASS "A"



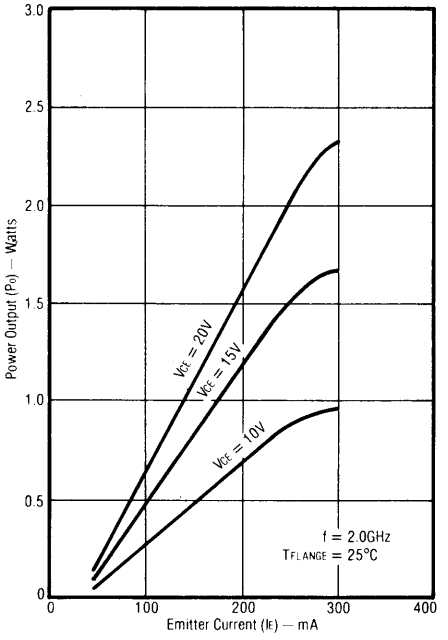
HLP-8

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

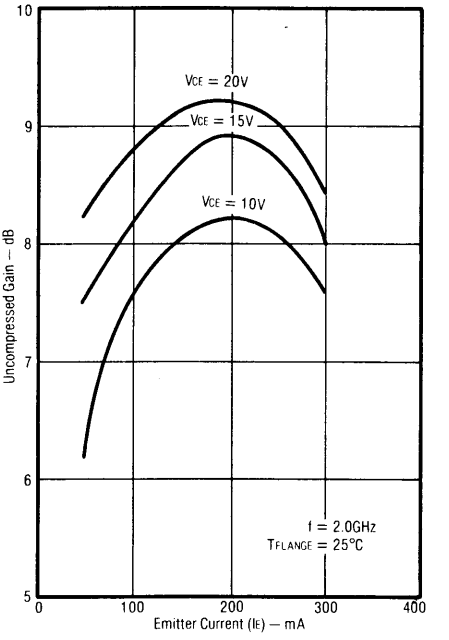
	SYMBOL	CHARACTERISTICS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
D C Tests	BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 20 mA	24			V
	BV_{CER}	Collector-Emitter Breakdown Voltage	R_{BE} = 10 Ω, I_C = 20 mA	50			V
	BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 0.50 mA	3.5			V
	BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 2.0 mA	45			V
	I_{CBO}	Collector Cutoff Current	V_{CB} = 28 V			0.5	mA
	h_{FE}	Forward Current Transfer Ratio	V_{CE} = 5.0 V, I_C = 200 mA	20		120	—
R F Tests	C_{ob}	Collector-Base Capacitance	V_{CB} = 28 V, f = 1 MHz			5.5	pF
	P_o	Power Output	V_{CE} = 20 V, I_E = 230 mA f = 2.0 GHz, P_{in} = 0.253 W	1.6			W
	f_t	Frequency Cutoff	V_{CE} = 20 V, I_E = 230 mA	3.0	3.3		GHz
	VSWR	Mismatch Tolerance	P_o = 1.6 W, I_E = 230 mA, V_{CE} = 20 V	∞			
	IMD	Third Order Intermodulation Distortion (Reference to Either Tone)	V_{CE} = 20 V, I_E = 230 mA $P_{o(PEP)}$ = 1.6 W Tones at 2.000 GHz and 2.005 GHz			— 30	dB
	$IMD_{(TV)}$	Intermodulation per DIN-45004/K	V_{CE} = 20 V, I_E = 150 mA f = 1.0 GHz, P_{REF} = 0.5 W			— 60	dB
Operating	T_j & T_{stg}	Max Junction and Storage Temperature		— 65		+ 200	°C
	θ_{j-C}	Thermal Resistance	T_C = 25 °C			17	°C/W

ELECTRICAL CHARACTERISTICS

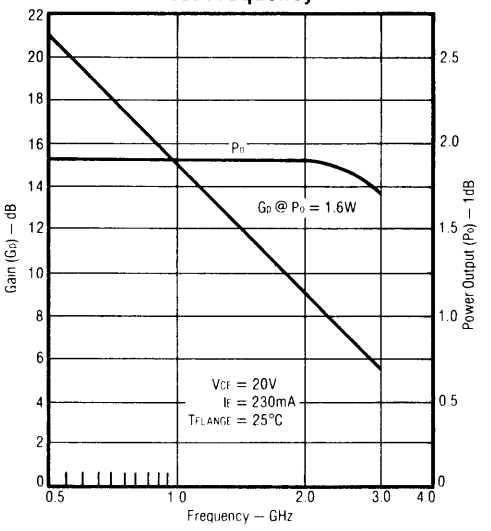
1dB Compression Point vs. Emitter Current



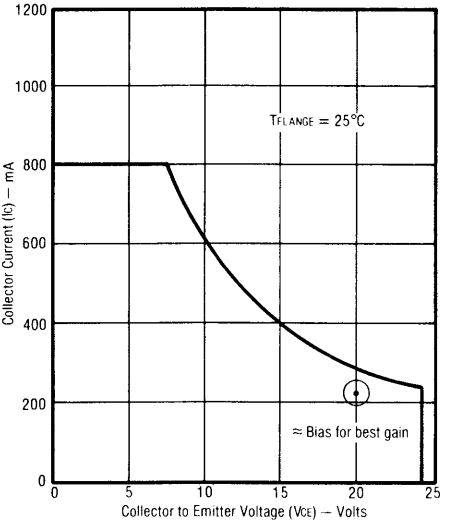
Gain vs. Emitter Current



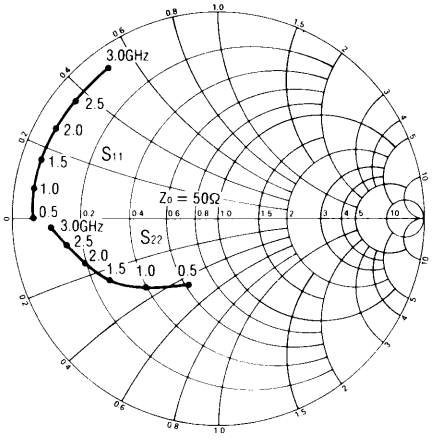
Gain and 1dB Compressed Power vs. Frequency

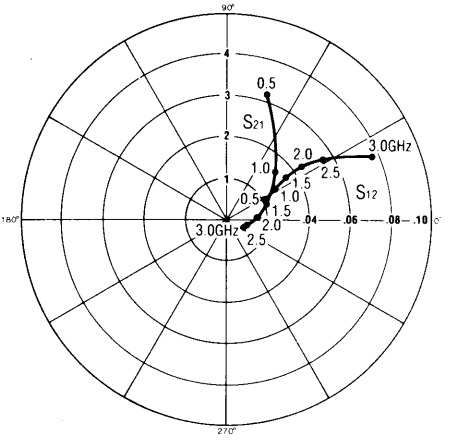


D.C. Safe Operating Area

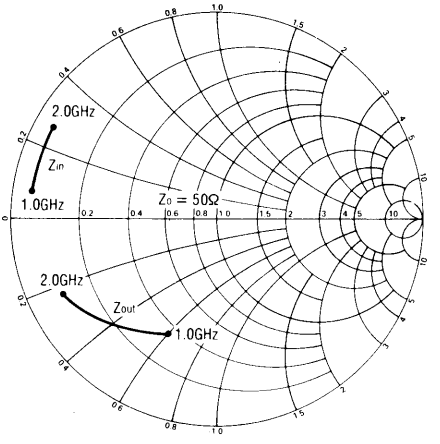


S-PARAMETERS
V_{CE} = 20V, I_E = 230mA, T_{FLANGE} = 25°C

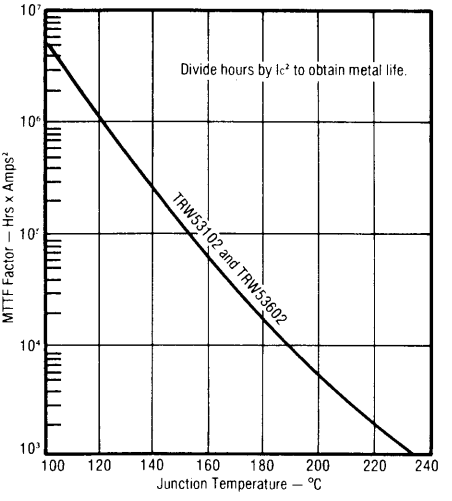




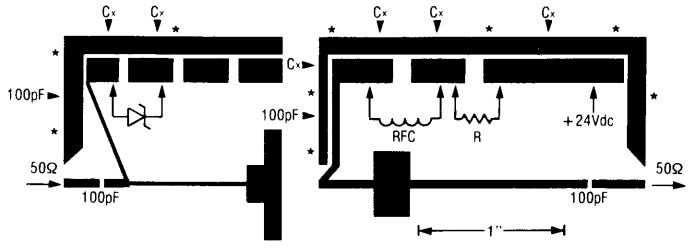
Large Signal Impedance Data



MTTF Factor vs. Junction Temperature



TEST CIRCUIT BOARD FOR TRW53102 AND TRW53602



TRW53102 and TRW53602 · f = 2.0GHz

Parts Details

* = Foil-wrap asterisked edge to ground plane. Board material 0.020 inch glass-teflon $\varepsilon_r = 2.55$.

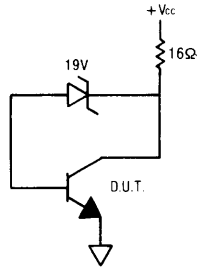
C_x = 100pF and 0.1μF chip

Zener Diode = 19V, 1W

RFC = 8 turns, #28A.W.G., 0.040 diameter

R = 16Ω, 2W

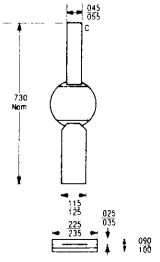
Self-Regulating Bias Circuit



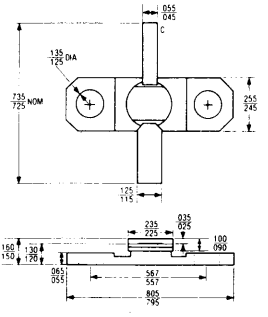
Set V_{CC} for desired I_E
$V_{CE} \approx V_Z + 1$

Package Outlines

TRW53102



TRW53602



Mechanical Specifications

The following are mechanical 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.

Hermaticity: 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.