HEWLETT PACKARD

T-31-23
T-33-05

Linear Power Transistors HXTR-3002 Chip

Technical Data

HXTR-3102, TX and TXV
2N6839 (HXTR-3104, TX and TXV)

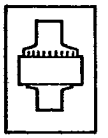
Features

- **High Output Power**
  22 dBm Typical P_{1dB} at 1 GHz
- **High P_{1dB} Gain**
  18 dB Typical G1dB at 1 GHz
- **High f_T**
  5.5 GHz Typical
- **Large Gold Bonding Pads**
- **Low Cost Hermetic Package**

Recommended Die Attach and Bonding Procedures

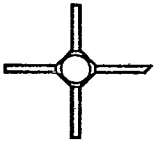
Eutectic Die Attach at a stage temperature of 410 ± 10°C under an N_2 ambient. Chip should be lightly scrubbed using a tweezer or collet and eutectic should flow within five seconds.

Thermocompression Wire Bond at a stage temperature of 310 ± 10°C, using a tip force of 30 ± 5 grams with 0.7 of 1.0 mil gold wire. A one mil minimum wire clearance at the passivation edge is recommended. (Ultrasonic bonding is not recommended.)



Generic Chip

HXTR-3002



HPAC-100X

Part No.	Package Marking "X"
HXTR-3102	B
2N6839 (HXTR-3104)	A

Note: See the Package Outline section, page 16-7, for complete dimensions

Description

The HXTR-3002 is an NPN silicon bipolar transistor chip designed for high output power and gain at VHF, UHF and microwave frequencies. The chip is silicon nitride passivated, and is provided with gold bonding pads for ease of use in most hybrid applications.

The HXTR-3102 and 2N6839 (HXTR-3104) containing the HXTR-3002 chip are supplied in the rugged metal/ceramic HPAC-100X package. These devices are capable of meeting the environmental requirements of MIL-S-19500 and test requirements of MIL-STD-750/883.

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Electrical Specifications

Symbol	Parameters and Test Conditions	Test Method MIL-STD-750	Units	HXTR-3002[1]			HXTR-3102[2]			HXTR-3104[2]		
				Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.
BV_{CBO}	Collector-Base Breakdown Voltage: HXTR-3002: I_C = 3 mA Pkg. Devices: I_C = 100 µA	3001*	V	40			35			35		
BV_{CEO}	Collector-Emitter Breakdown Voltage at I_C = 15 mA	3011*	V	24						24		
BV_{EBO}	Emitter-Base Breakdown Voltage at I_E = 30 µA	3026*	V	3.3						3.3		
I_{EBO}	Emitter-Base Leakage Current at V_{EB} = 2 V	3061	µA			2						
I_{CES}	Collector-Emitter Leakage Current at V_{CE} = 32 V	3041**	nA			200						
I_{CBO}	Collector-Base Leakage Current at V_{CB} = 20 V	3036**	nA			100			200			50
I_{CEO}	Collector-Emitter Leakage Current at V_{CE} = 15 V	3041**	nA									75
h_{FE}	Forward Current Transfer Ratio HXTR-3002: V_{CE} = 18 V, I_C = 30 mA Pkg. Devices: V_{CE} = 15 V, I_C = 30 mA	3076*		15	40	75	15		75	15		75
f_T	Gain Bandwidth Product at V_{CE} = 15 V, I_C = 30 mA		GHz					6		4.0	5.5	
P_{1dB}	Power Output at 1 dB Gain Compression f = 1000 MHz HXTR-3002: V_{CE} = 18 V, I_C = 30 mA Pkg. Devices: V_{CE} = 15 V, I_C = 30 mA		dBm		22.0			21.0		19.0	21.0	
G_{1dB}	Associated 1 dB Compressed Gain f = 1000 MHz HXTR-3002: V_{CE} = 18 V, I_C = 30 mA Pkg. Devices: V_{CE} = 15 V, I_C = 30 mA		dB		18.0			15.0		14.0	16.0	
$\|S_{21E}\|^2$	Transducer Gain f = 500 MHz HXTR-3002: 1000 MHz V_{CE} = 18 V, I_C = 30 mA Pkg. Devices: V_{CE} = 15 V, I_C = 30 mA		dB		16.5 13.6			12.5		10.5	12.5	
C_{cb}	Reverse Transfer Capacitance I_C = 0 mA; V_{CB} = 10 V; f = 1 MHz		pF					0.36			0.36	

*300 µs wide pulse measurement at ≤ 2% duty cycle
**Measured under low ambient light conditions for chip only.

Notes:
1. T_A = 25°C
2. T_{CASE} = 25°C

Absolute Maximum Ratings*

Symbol	Parameter	HXTR-3002[1] (T_A = 25°C)	HXTR-3102/3104[2] (T_{CASE} = 25°C)
V_{CBO}	Collector to Base Voltage	45 V	35 V
V_{CEO}	Collector to Emitter Voltage	27 V	25 V
V_{EBO}	Emitter to Base Voltage	4.0 V	3.5 V
I_C	DC Collector Current	100 mA	100 mA
P_T	Total Device Dissipation	1.4 W	700 mW
T_J	Junction Temperature	200°C	200°C
T_{STG}	Storage Temperature	-65°C to +300°C	-65°C to +150°C
—	Lead Temperature (Soldering 10 seconds each lead)		+250°C

*Operation in excess of any one of these conditions may result in permanent damage to this device.

Notes:
1. Power dissipation derating should include a θ_{JB} (Junction-to-Back contact thermal resistance) of 70°C/W. Total θ_{JA} (Junction to Ambient) will be dependent upon the heat sinking provided in the individual application.
2. A θ_{JC} maximum of 140°C/W should be used for derating and junction temperature calculations ($T_J = P_D \times \theta_{JC} + T_{CASE}$).

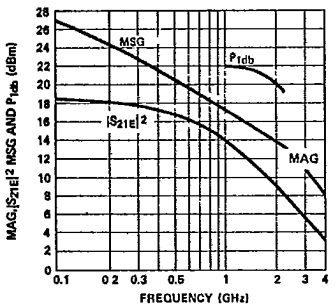

Figure 1. Typical MAG, $|S_{21E}|^2$, Maximum Stable Gain (MSG), and Power Output at 1 dB Gain Compression (P_{1dB}) vs. Frequency (V_{CE} = 18 V, I_C = 30 mA) for the HXTR-3002.

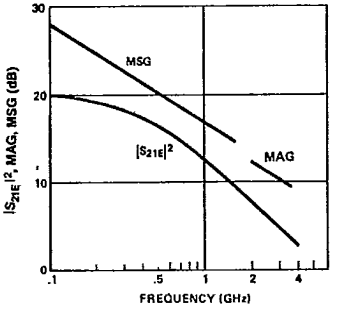

Figure 2. Typical $|S_{21E}|^2$, MAG, Maximum Stable Gain (MSG), vs. Frequency (V_{CE} = 15 V, I_C = 30 mA), for the HXTR-3102 and HXTR-3104.

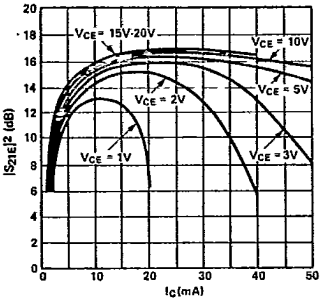

Figure 3. Typical $|S_{21E}|^2$ vs. Collector Current at 500 MHz, for the HXTR-3002.

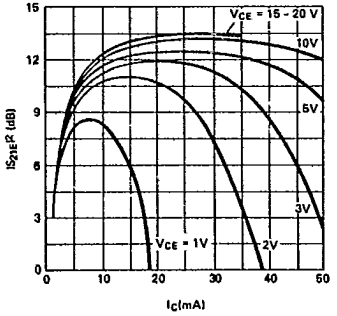

Figure 4. Typical $|S_{21E}|^2$ vs. Collector Current at 1000 MHz, for the HXTR-3102 and HXTR-3104.

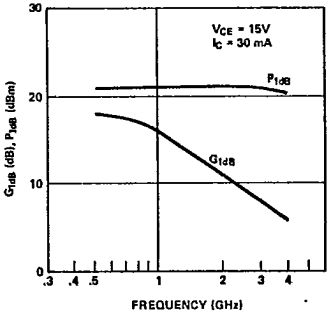

Figure 5. Typical Power Output at 1 dB Gain Compression vs. Frequency for the HXTR-3102 and HXTR-3104.

HXTR-3002 Typical Common-Emitter S-Parameters (V_{CE} = 18 V, I_C = 30 mA)*

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.658	-17	18.5	8.44	170	-35.9	0.016	82	0.991	-7
200	0.656	-32	18.3	8.18	161	-30.1	0.031	75	0.965	-14
300	0.652	-47	17.8	7.79	153	-27.0	0.045	68	0.926	-20
400	0.648	-60	17.3	7.33	145	-25.0	0.056	62	0.881	-25
500	0.644	-72	16.7	6.85	138	-23.7	0.066	56	0.833	-29
600	0.641	-82	16.1	6.37	132	-22.7	0.073	52	0.787	-33
700	0.637	-91	15.4	5.91	126	-22.0	0.080	48	0.744	-36
800	0.634	-99	14.8	5.49	121	-21.5	0.085	45	0.706	-39
900	0.632	-105	14.2	5.11	117	-21.0	0.089	42	0.671	-41
1000	0.629	-111	13.6	4.76	113	-20.7	0.092	39	0.641	-43
1500	0.623	-131	10.9	3.50	98	-19.7	0.103	32	0.541	-50
2000	0.618	-143	8.8	2.74	88	-19.2	0.110	29	0.492	-54
2500	0.614	-151	7.0	2.24	79	-18.8	0.115	28	0.469	-58
3000	0.611	-156	5.6	1.90	72	-18.4	0.120	27	0.461	-62
3500	0.608	-160	4.3	1.65	65	-18.1	0.125	27	0.460	-66
4000	0.604	-163	3.3	1.46	59	-17.7	0.130	27	0.465	-70

*Values do not include any parasitic bonding inductances and were generated by use of a computer model

RF Equivalent Circuit See page 3-7.

HXTR-3102 and HXTR-3104 Typical Common-Emitter S-Parameters (V_{CE} = 15 V, I_C = 20 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.767	-19	18.9	8.810	165	-36.0	0.016	72	0.985	-10
300	0.699	-52	17.7	7.674	143	-27.0	0.045	60	0.892	-25
500	0.620	-79	16.1	6.383	126	-24.0	0.063	50	0.783	-35
800	0.556	-110	13.8	4.898	109	-22.2	0.078	41	0.654	-40
1000	0.548	-126	12.7	4.317	95	-21.0	0.089	34	0.598	-45
1500	0.523	-155	9.9	3.143	74	-20.2	0.098	30	0.525	-55
2000	0.513	-177	7.9	2.475	57	-19.7	0.103	29	0.489	-63
3000	0.534	156	5.1	1.792	30	-17.8	0.129	31	0.495	-85
4000	0.546	132	3.0	1.412	4	-15.6	0.166	29	0.522	-109

HXTR-3102 and HXTR-3104 Typical Common-Emitter S-Parameters (V_{CE} = 15 V, I_C = 30 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.777	-21	19.7	9.661	164	-35.9	0.016	71	0.985	-10
300	0.694	-57	18.3	8.222	139	-27.1	0.044	58	0.874	-27
500	0.606	-85	16.4	6.607	122	-24.4	0.060	48	0.757	-36
800	0.538	-116	13.9	4.955	105	-22.7	0.073	40	0.630	-40
1000	0.535	-131	12.7	4.296	92	-21.4	0.085	34	0.580	-44
1500	0.513	-159	9.8	3.086	72	-20.4	0.095	32	0.518	-53
2000	0.508	-180	7.7	2.415	55	-19.8	0.102	31	0.488	-62
3000	0.532	153	4.8	1.740	28	-17.8	0.129	33	0.500	-84
4000	0.546	130	2.7	1.362	3	-15.5	0.167	29	0.527	-108

High Reliability Testing*

Two basic levels of High-Reliability testing are offered.

1. The TX suffix indicates a part that is preconditioned and screened to the program shown in Table II and III, and is marked with an orange dot.
2. The TXV suffix indicates that an internal visual inspection per MIL-STD-750 Method 2072 is included as part of the preconditioning screening and is marked with a green dot.

Group B quality conformance inspections are performed on each inspection lot in accordance with Table IVb. Group C quality conformance inspections are performed periodically at six month intervals in accordance with Table V.

*Please refer to MIL-S-19500 for Tables II, III, IVb, and V. High power visual performed on die prior to assembly.

Part Number System for Order and RFQ Information

Part Number Prefix	Screening Level
HXTR-3102 2N6839 (HXTR-3104)	Commercial
HXTR-3102TX 2N6839TX (HXTR-3104TX)	100% Screen (per Tables II and III)
HXTR-3102TXV 2N6839TXV (HXTR-3104TXV)	100% Screen and Internal Visual

100% Screen	Screened per MIL-S-19500, Table II, TX or TXV, with the following specified tests and conditions:		
	HTRB Test (Screen 10)*	Delete HTRB	
	Pre Burn In Tests (Screen 11)*	HXTR-3102	All DC parameters; BV_{CBO}, I_{CBO}, and h_{FE} at 25°C, per data sheet Electrical Specifications table
		HXTR-3104	All DC parameters; BV_{CBO}, BV_{CEO}, BV_{EBO}, I_{CBO}, I_{CEO} and h_{FE} at 25°C, per data sheet Electrical Specifications table
	Burn In Conditions (Screen 12)*	400 mW, T_A = 25°C	
	Post Burn In (Screen 13)*	HXTR-3102	All DC parameters; BV_{CBO}, I_{CBO}, and h_{FE} at 25°C, per data sheet Electrical Specifications table
		HXTR-3104	All DC parameters; BV_{CBO}, BV_{CEO}, BV_{EBO}, I_{CBO}, I_{CEO} and h_{FE} at 25°C, per data sheet Electrical Specifications table
Group A	Per MIL-S-19500, Table III, and the following:		
	Subgroup 2	HXTR-3102	BV_{CBO}, I_{CBO} and h_{FE} per data sheet Electrical Specifications table
		HXTR-3104	BV_{CBO}, BV_{CEO}, BV_{EBO}, I_{CBO}, I_{CEO} and h_{FE} per data sheet Electrical Specifications table
	Subgroup 3	T_A = +150°C, I_{CBO} = 50 µA at V_{CB} = 20 V T_A = -55°C, h_{FE} = 5 minimum at I_C = 30 mA, V_{CE} = 15 V	
	Subgroup 4	f_T, $\|S_{21E}\|^2$, P_{1dB} and G_{1dB}, per data sheet Electrical Specifications table	
	Subgroups 5, 6, and 7 are not applicable.		
Group B	Per MIL-S-19500, Table IVb. End point tests per Group A Subgroup 2, and with the following conditions and exceptions:		
	Subgroup 3	Operating Life conditions same as 100% burn-in.	
	except Subgroup 4	SEM, done prior to assembly	
	except Subgroup 5	Thermal resistance, per MIL-STD-750 Method 3151	
Group C	Per MIL-S-19500, Table V. No exceptions. End point tests per Group A Subgroup 2, and with the following conditions:		
	Subgroup 6	Operating Life conditions same as 100% burn-in.	

*Refer to MIL-S-19500 screen numbers.