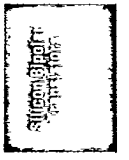
T-31-17
T-31-21

Low Noise Transistors HXTR-7011 Chip

Technical Data

HXTR-7111, TX and TXV
HXTR-3615, TX and TXV
HXTR-3645, TX and TXV
HXTR-3675, TX and TXV
HSMX-3635
HSMX-3655



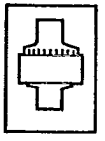
Features

- **High f_T**
  6.0 GHz
- **Low Noise**
  1.2 dB at 1.0 GHz
  2.8 dB at 4.0 GHz
- **HighGain**
  18.5 dB at 1.0 GHz
  8.7 dB at 4.0 GHz
- **High P_{1dB}**
  18.5 dBm at 4.0 GHz
- **Available in Low Cost Hermetic and Surface Mount Packages**

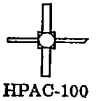
Recommended Die Attach and Bonding Procedures

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.

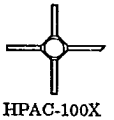
Thermocompression Wire Bond at a stage temperature of 310 ± 10°C, using a tip force of 30 ± 5 grams with 0.7 or 1.0 mil gold wire. A one mil minimum wire clearance at the passivation edge is recommended. (Ultrasonic bonding is not recommended.)



Generic Chip
HXTR-7011



HPAC-100
HXTR-7111

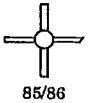


HPAC-100X

Part No.	"X"
HXTR-3615	L
HXTR-3645	N
HXTR-3675	P

T5 23
HSMX-3635

T5 143
HSMX-3655



85/86
HXTR-3685
HXTR-3686

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

Description

The HXTR-7011 is an NPN silicon bipolar transistor chip designed for use in hybrid applications requiring superior noise figure and associated gain performance at VHF, UHF, and microwave frequencies. The chip is protected by silicon nitride passivation, and is provided with gold bonding pads for ease of use in most hybrid applications.

The HXTR-7011 chip is available in several package styles. The HXTR-7111 is supplied in the HPAC-100, and the HXTR-3615, HXTR-3645 and HXTR-3675 are supplied in the lower cost HPAC-100X. These are rugged hermetic metal/ceramic packages, capable of meeting the environmental requirements of MIL-S-19500 and the test requirements of MIL-STD-750/883.

The HSMX-3635 and HSMX-3151 are the low cost plastic package versions supplied in the SOT-23 and SOT-143 surface mount packages respectively.

The HXTR-7011 chip is also offered in an 85-mil microplastic

1000 B-01

Electrical Specifications (HXTR-7011, HXTR-7111, HXTR-3615)

Symbol	Parameters and Test Conditions	Test Method MIL-STD-750	HXTR-7011[1]			HXTR-7111[2]			HXTR-3615[2]		
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.
BV_{CBO}	Collector-Base Breakdown Voltage at I_C = 100 µA	3001*	30			30			25		
BV_{CEO}	Collector-Emitter Breakdown Voltage at I_C = 15 mA	3011*	18			18			16		
I_{CBO}	Collector-Base Cutoff Current at V_{CB} = 15 V	3041**			50			50			100
I_{CEO}	Collector-Emitter Leakage at V_{CE} = 15 V	3036**			50			50			100
h_{FE}	Forward Current Transfer Ratio at V_{CE} = 10 V, I_C = 10 mA	3076*	55		175	55		175	50		180
f_T	Gain Bandwidth Product at V_{CE} = 10 V, I_C = 10 mA										
NF_{MIN}	Minimum Noise Figure V_{CE} = 10 V, I_C = 10 mA — f = 500 MHz	3246		1.2			1.2			1.3	
	f = 1000 MHz			1.7			1.7			1.4	
	f = 2000 MHz			2.8			2.8	3.4		2.1	
	f = 4000 MHz									3.5	
G_A	Associated Gain V_{CE} = 10 V, I_C = 10 mA — f = 500 MHz	3246								21.5	
	f = 1000 MHz			18			18.5			16.6	
	f = 2000 MHz			13			13.8			12.0	
	f = 4000 MHz			8.2		8.1	8.7			7.0	
P_{1dB}	Power Output at 1 dB Gain Compression V_{CE} = 15 V, I_C = 18 mA — f = 1000 MHz			18.0			18.5			19.0	
	f = 4000 MHz										
G_{1dB}	Associated 1 dB Gain V_{CE} = 15 V, I_C = 18 mA — f = 1000 MHz			8.5			9.1			19.0	
	f = 4000 MHz										
C_{cb}	Collector Base Capacitance (Reverse Transfer Capacitance V_{CB} = 10 V, I_C = 0 mA — f = 1 MHz						0.27			0.30	

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

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

package with copper leads as the HXTR-3685 and HXTR-3686 (bent lead version). These devices replace the 100-mil microplastic HXTR-3625 part with alloy 42 leads.

Electrical Specifications (HXTR-3645, HXTR-3675)

Symbol	Parameters and Test Conditions	Test Method MIL-STD-750	HXTR-3645 [1]			HXTR-3675 [1]		
			Min.	Typ.	Max.	Min.	Typ.	Max.
BV_{CBO}	Collector-Base Breakdown Voltage at I_C = 100 µA	3001*	30			30		
BV_{CEO}	Collector-Emitter Breakdown Voltage at I_C = 15 mA	3011*	18			18		
I_{CBO}	Collector-Base Cutoff Current at V_{CB} = 15 V	3041**			50			50
I_{CEO}	Collector-Emitter Leakage at V_{CE} = 15 V	3036**			50			50
h_{FE}	Forward Current Transfer Ratio at V_{CE} = 10 V, I_C = 10 mA	3076*	55		175	55		175
f_T	Gain Bandwidth Product at V_{CE} = 10 V, I_C = 10 mA			6.0			6.0	
NF_{MIN}	Minimum Noise Figure V_{CE} = 10 V, I_C = 10 mA — f = 500 MHz f = 1000 MHz f = 1500 MHz f = 2000 MHz f = 4000 MHz	3246		1.2 1.4 1.4 1.9	 2.3		1.4 1.9 3.0	 3.4
G_A	Associated Gain V_{CE} = 10 V, I_C = 10 mA — f = 500 MHz f = 1000 MHz f = 1500 MHz f = 2000 MHz f = 4000 MHz	3246	 12.2	22.5 17.5 14.6 13.0	 	 7.7	17.7 13.0 8.3	
P_{1dB}	Power Output at 1 dB Gain Compression V_{CE} = 15 V, I_C = 18 mA — f = 1000 MHz f = 4000 MHz			19.0			17.5	
G_{1dB}	Associated 1 dB Gain V_{CE} = 15 V, I_C = 18 mA — f = 1000 MHz f = 4000 MHz			13.5			8.4	
C_{cb}	Collector Base Capacitance (Reverse Transfer Capacitance V_{CB} = 10 V, I_C = 0 mA — f = 1 MHz			0.27			0.29	

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

Note:
1. T_{CASE} = 25°C

Electrical Specifications (HSMX-3635, HSMX-3655)

Symbol	Parameters and Test Conditions	Test Method MIL-STD-750	HSMX-3635[1]			HSMX-3655[1]		
			Min.	Typ.	Max.	Min.	Typ.	Max.
BV_{CBO}	Collector-Base Breakdown Voltage at I_C = 100 µA	3001*	25			25		
I_{CBO}	Collector-Base Cutoff Current at V_{CE} = 15 V	3041**			500			500
h_{FE}	Forward Current Transfer Ratio HSMX-3635: V_{CE} = 15 V, I_C = 15 mA HSMX-3655: V_{CE} = 10 V, I_C = 10 mA	3076*	40	80	180	40	80	250
f_T	Gain Bandwidth Product at V_{CE} = 10 V, I_C = 10 mA HSMX-3635: V_{CE} = 10 V, I_C = 15 mA HSMX-3655: V_{CE} = 10 V, I_C = 10 mA			5			5	
$\|S_{21E}\|^2$	Transducer Gain at 1000 MHz at V_{CE} = 10 V, I_C = 15 mA			11.5			14.4	
MAG	Maximum Available Gain at 1000 MHz at V_{CE} = 10 V, I_C = 15 mA				15		20 21	
NF_{MIN}	Minimum Noise Figure f = 1000 MHz f = 2000 MHz V_{CE} = 10 V, I_C = 10 mA	3246		1.4			1.5 2.0	
G_A	Associated Gain f = 1000 MHz V_{CE} = 10 V, I_C = 10 mA	3246					15.6	
P_{1dB}	Power Output at 1 dB Gain Compression f = 1000 MHz f = 2000 MHz V_{CE} = 10 V, I_C = 15 mA			15			16.6 16.0	
G_{1dB}	Associated 1 dB Gain at f = 1000 MHz f = 2000 MHz V_{CE} = 10 V, I_C = 15 mA			12			15.9 11.1	
C_{cb}	Collector Base Capacitance (Reverse Transfer Capacitance f = 1 MHz V_{CB} = 10 V, I_C = 0 mA			0.36			0.30	

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

Note:
1. T_{CASE} = 25°C

Absolute Maximum Ratings*

Symbol	Parameter	HXTR-7011[1] (T_A = 25°C)	HXTR-3615[2] (T_{CASE} = 25°C)	HSMX-3635, 55[2] T_{CASE} = 25°C)	HXTR-3645[4] (T_{CASE} = 25°C)	HXTR-3675[2] (T_{CASE} = 25°C)	HXTR-7111[2] (T_{CASE} = 25°C)
V_{CBO}	Collector to Base Voltage	30 V	25 V	25 V	30 V	30 V	30 V
V_{CEO}	Collector to Emitter Voltage	18 V	16 V	15 V	18 V	18 V	18 V
V_{EBO}	Emitter to Base Voltage	1.5 V	1.5 V	1.5 V	1.5 V	1.5 V	1.5 V
I_C	DC Collector Current	65 mA	65 mA	65 mA	65 mA	65 mA	65 mA
P_T	Total Device Dissipation	600 mA	600 mW	250 mW	600 mW	600 mW	600 mW
T_J	Junction Temperature	200°C	200°C	150°C	200°C	200°C	200°C
T_{STG}	Storage Temperature	-65°C to +300°C	-65°C to +150°C	-65°C to +150°C	-65°C to 150°C	-65°C to +150°C	-65°C to +200°C
–	Lead Temperature (Soldering 10 seconds each lead)		+250°C			+250°C	+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 65°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 120°C/W should be used for derating and junction temperature calculations ($T_J = P_D \times \theta_{JC} + T_{CASE}$).
3. A θ_{JA} of 500°C/W should be used for derating and junction temperature calculations: ($T_J = P_D \times \theta_{JA} + T_{CASE}$).
4. A θ_{JA} maximum of 120°C/W should be used for derating and junction temperature calculations: ($T_J = P_D \times \theta_{JC} + T_{CASE}$).

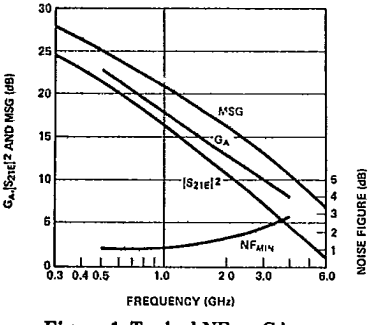


Figure 1. Typical NF_{MIN}, GA, $|S_{21E}|^2$ and MSG vs. Frequency at V_{CE} = 10 V, I_C = 10 mA for the HXTR-7011.

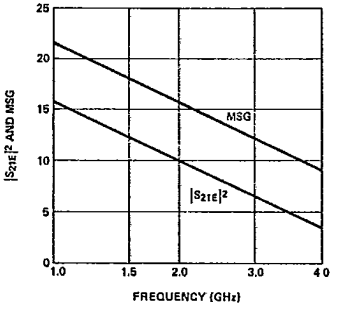


Figure 2. Typical $|S_{21E}|^2$ and Maximum Stable Gain (MSG) vs. Frequency at V_{CE} = 10 V and I_C = 10 mA, for the HXTR-7111.

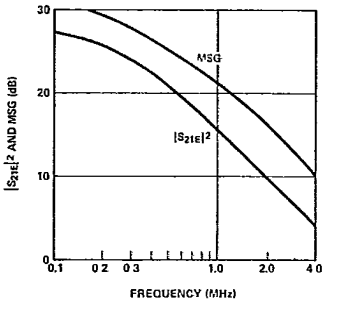


Figure 3. Typical $|S_{21E}|^2$ and Maximum Stable Gain (MSG) vs. Frequency at V_{CE} = 10 V and I_C = 10 mA, for the HXTR-7111.

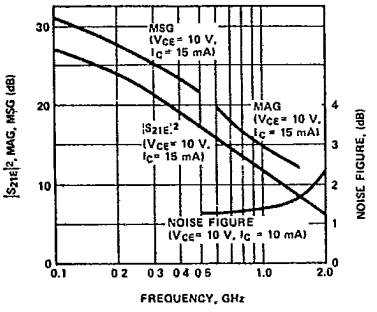


Figure 4. Typical $|S_{21E}|^2$, MAG, MSG, and Noise Figure vs. Frequency, for the HSMX-3635.

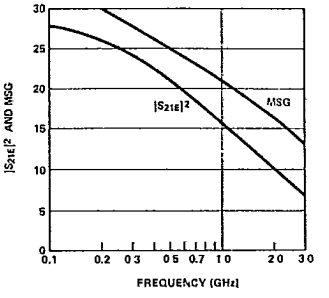


Figure 5. Typical $|S_{21E}|^2$ and Maximum Stable Gain (MSG) vs. Frequency at V_{CE} = 10 V and I_C = 10 mA, for the HXTR-3645.

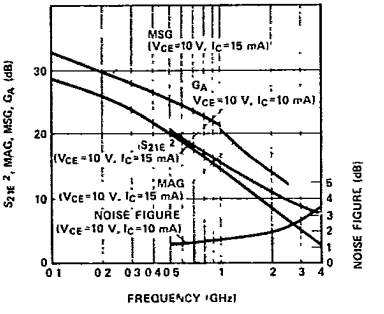


Figure 6. Typical $|S_{21E}|^2$, MAG, MSG, Noise Figure, and G_A vs. Frequency, for the HSMX-3655.

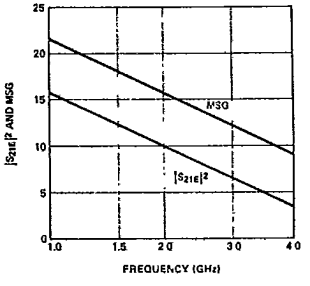


Figure 7. Typical $|S_{21E}|^2$ and Maximum Stable Gain (MSG) vs. Frequency at V_{CE} = 10 V and I_C = 10 mA, for the HXTR-3675.

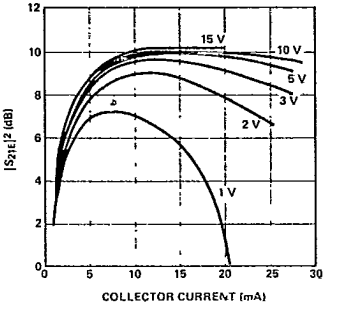


Figure 8. Typical $|S_{21E}|^2$ vs. Collector Current at 2000 GHz, for the HXTR-7011.

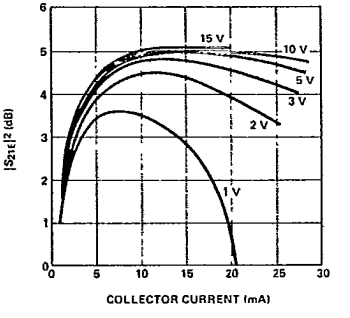


Figure 9. Typical $|S_{21E}|^2$ vs. Collector Current at 4000 MHz, for the HXTR-7111.

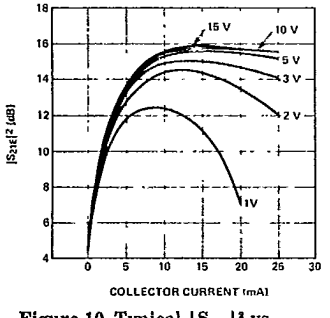


Figure 10. Typical $|S_{21E}|^2$ vs. Collector Current at 1000 MHz, for the HXTR-3615.

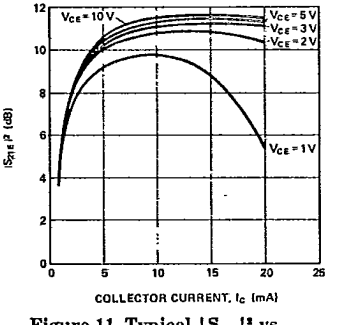


Figure 11. Typical $|S_{21E}|^2$ vs. Collector Current at 1000 MHz, for the HSMX-3635.

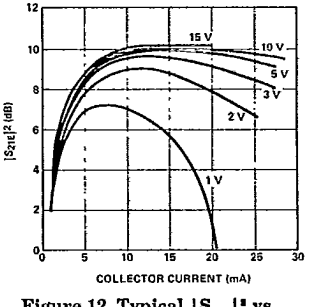


Figure 12. Typical $|S_{21E}|^2$ vs. Current at 2000 MHz, for the HXTR-3645.

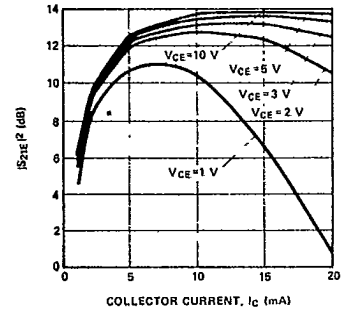


Figure 13. Typical $|S_{21E}|^2$ vs. Collector Current at 1 GHz, for the HSMX-3655.

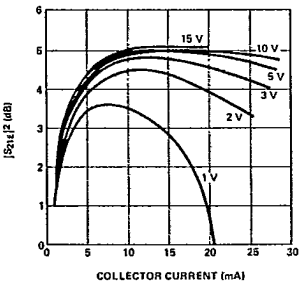


Figure 14. Typical $|S_{21E}|^2$ vs. Collector Current at 4000 MHz, for the HXTR-3675.

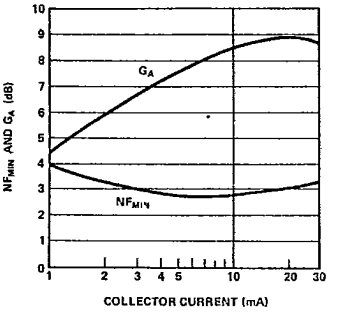


Figure 15. Typical NF_{MIN} and Associated Gain vs. I_C at 4 GHz for V_{CE} = 10 V, for the HXTR-7011.

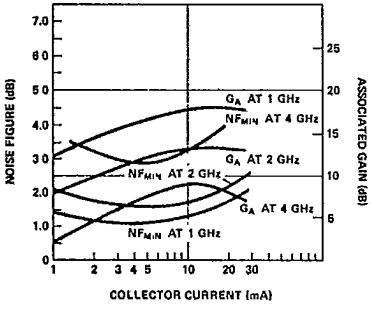


Figure 16. Typical NF_{MIN} and Associated Gain (G_A) vs. Collector Current at V_{CE} = 10 V, for the HXTR-7111.

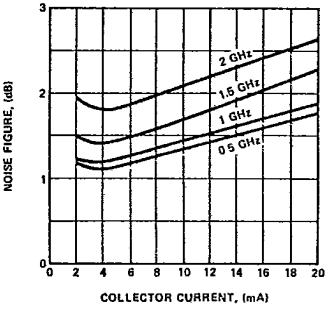


Figure 17. Typical Noise Figure vs. Collector Current, V_{CE} = 10 V, for the HSMX-3635.

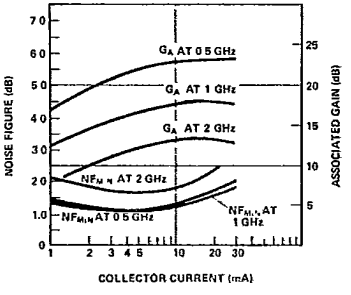


Figure 18. Typical NF_{MIN} and Associated Gain (G_A) vs. Collector Current at V_{CE} = 10 V, for the HXTR-3645.

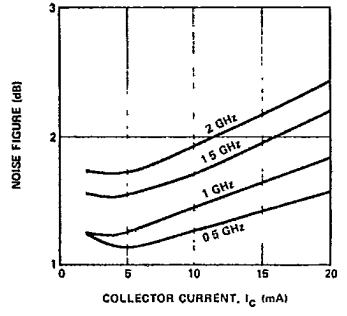


Figure 19. Typical Noise Figure vs. Collector Current, V_{CE} = 10 V, for the HSMX-3655.

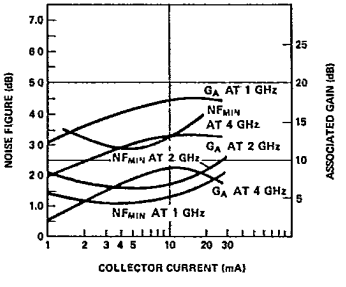


Figure 20. Typical NF_{MIN} and Associated Gain (G_A) vs. Collector Current at V_{CE} = 10 V, for the HXTR-3675.

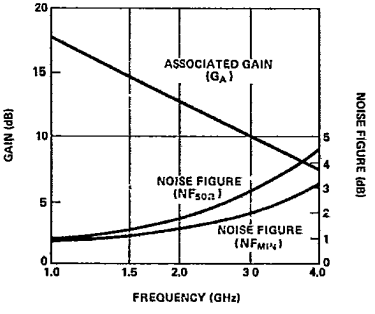


Figure 21. Typical Noise Figure and Associated Gain vs. Frequency at V_{CE} = 10 V, I_C = 10 mA, for the HXTR-7111.

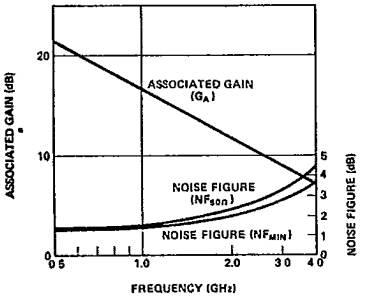


Figure 22. Typical NF_{MIN} and Associated Gain vs. Frequency at V_{CE} = 10 V, I_C = 10 mA, for the HXTR-3615.

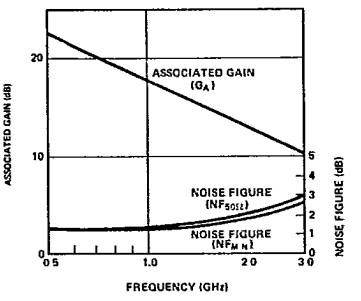


Figure 23. Typical Noise Figure and Associated Gain vs. Frequency at V_{CE} = 10 V, I_C = 10 mA, for the HXTR-3645.

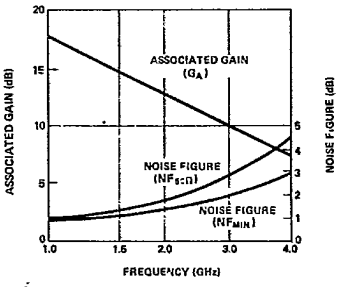


Figure 24. Typical Noise Figure and Associated Gain vs. Frequency at V_{CE} = 10 V, I_C = 10 mA, for the HXTR-3675.

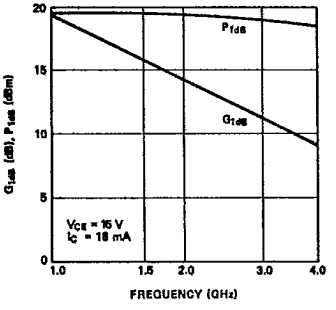


Figure 25. Typical Power Output at 1 dB Compression Gain vs. Frequency, for the HXTR-7111.

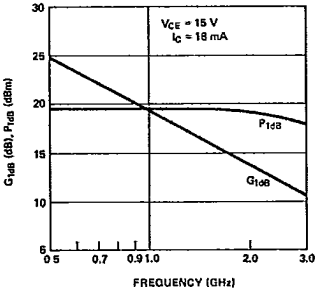


Figure 26. Typical Power Output at 1 dB Compression Gain vs. Frequency, for the HXTR-3645.

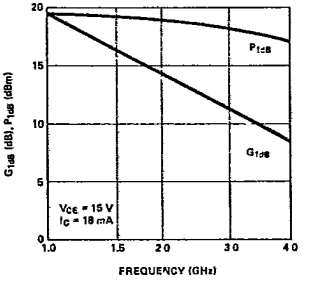


Figure 27. Typical Power Output at 1 dB Compression Gain vs. Frequency, for the HXTR-3675.

Typical Noise Parameters

(V_{CE} = 10 V, I_C = 10 mA)

HXTR-7111

Frequency (MHz)	NF_{MIN} (dB)	G_A (dB)	Γ_o		R_N (Ohms)
			Mag.	Ang.	
1000	1.2	18.5	0.22	141	2.6
2000	1.7	13.8	0.43	174	3.3
4000	2.8	8.7	0.57	-138	11.6

HXTR-3615

Frequency (MHz)	NF_{MIN} (dB)	$NF_{50\Omega}$ (dB)	Γ_o		R_N (Ohms)
			Mag.	Ang.	
500	1.3	1.3	(50 Ω)		–
1000	1.4	1.6	0.20	135	15.4
2000	2.0	2.4	0.39	-177	4.7
4000	3.5	4.4	0.54	-116	18.1

Typical Noise Parameters (Continued)
(V_{CE} = 10 V, I_C = 10 mA)

HSMX-3635

Frequency (MHz)	NF_{MIN} (dB)	G_A (dB)	Γ_o Source		Γ_L Load		R_N (Ohms)
			Mag.	Ang.	Mag.	Ang.	
500	1.3	18.8	0.04	-29	0.36	-25	53
1000	1.4	13.7	0.18	-65	0.77	89	16
1500	1.7	10.6	0.81	-14	0.52	-76	3
2000	2.3	6.8	0.57	-173	0.94	79	4

HXTR-3645

Frequency (MHz)	NF_{MIN} (dB)	$NF_{50\Omega}$ (dB)	Γ_o		R_N (Ohms)
			Mag.	Ang.	
500	1.2	1.2	(50 Ω)	–	0
1000	1.2	1.3	0.20	135	7.3
2000	1.9	2.2	0.39	-177	2.2

HSMX-3655

Frequency (MHz)	NF_{MIN} (dB)	G_A (dB)	Γ_L Source		Γ_L Load		R_N (Ohms)
			Mag.	Ang.	Mag.	Ang.	
500	1.4	20.3	0.10	69	0.60	14	13
1000	1.5	15.6	0.20	118	0.53	27	1
1500	1.8	12.8	0.41	148	0.66	43	3
2000	2.0	11.5	0.35	178	0.54	48	9

HXTR-3675

Frequency (MHz)	NF_{MIN} (dB)	$NF_{50\Omega}$ (dB)	G_A (dB)	Γ_o		R_N (Ohms)
				Mag.	Ang.	
1000	1.2	1.3	17.7	0.2	135	6.5
1000	1.8	2.0	13.0	0.4	-177	2.9
2000	2.8	4.1	8.3	0.6	-117	21.5

HXTR-7011 Typical S-Parameters (V_{CE} = 10 V, I_C = 10 mA)*

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang..
100	0.76	-44	27.1	22.72	158	-36.8	0.02	70	0.94	-13
200	0.77	-78	25.7	19.20	140	-32.2	0.03	54	0.83	-22
300	0.78	-101	24.0	15.80	128	-30.3	0.03	44	0.72	-27
400	0.79	-117	22.4	13.11	119	-29.4	0.03	37	0.64	-28
500	0.79	-128	20.9	11.08	113	-28.9	0.04	33	0.59	-29
600	0.79	-135	19.6	9.54	108	-28.6	0.04	30	0.55	-29
700	0.80	-141	18.4	8.35	104	-28.4	0.04	29	0.52	-28
800	0.80	-146	17.4	7.41	101	-28.2	0.04	27	0.50	-28
900	0.80	-150	16.5	6.65	98	-28.1	0.04	27	0.49	-28
1000	0.80	-153	15.6	6.03	96	-28.0	0.04	26	0.48	-28
1200	0.80	-157	14.1	5.08	92	-27.7	0.04	26	0.46	-28
1400	0.80	-160	12.8	4.38	88	-27.5	0.04	27	0.45	-28
1600	0.80	-163	11.7	3.85	86	-27.3	0.04	27	0.45	-29
1800	0.80	-165	10.7	3.43	83	-27.1	0.04	28	0.45	-29
2000	0.80	-167	9.8	3.10	80	-26.9	0.05	29	0.45	-31
2200	0.80	-168	9.0	2.82	78	-26.7	0.05	30	0.45	-32
2400	0.80	-169	8.3	2.59	76	-26.5	0.05	31	0.45	-33
2600	0.80	-170	7.6	2.39	74	-26.2	0.05	32	0.45	-34
2800	0.80	-171	7.0	2.23	72	-26.0	0.05	33	0.45	-36
3000	0.80	-172	6.4	2.08	70	-25.8	0.05	34	0.45	-37
3200	0.80	-172	5.8	1.95	68	-25.5	0.05	34	0.45	-39
3400	0.80	-173	5.3	1.84	66	-25.3	0.05	35	0.45	-40
3600	0.80	-173	4.8	1.74	64	-25.1	0.06	36	0.46	-42
3800	0.79	-174	4.4	1.65	62	-24.8	0.06	36	0.46	-43
4000	0.79	-174	3.9	1.57	60	-24.6	0.06	37	0.46	-45
4200	0.79	-175	3.5	1.50	59	-24.4	0.06	37	0.47	-47
4400	0.79	-175	3.1	1.43	57	-24.1	0.06	38	0.47	-48
4600	0.79	-175	2.8	1.37	55	-23.9	0.06	38	0.48	-50
4800	0.79	-176	2.4	1.32	53	-24.7	0.07	38	0.48	-51
5000	0.79	-176	2.0	1.27	52	-23.5	0.07	38	0.48	-53
5200	0.79	-176	1.7	1.22	50	-23.3	0.07	39	0.49	-54
5400	0.79	-176	1.4	1.18	48	-23.1	0.07	39	0.49	-56
5600	0.79	-177	1.1	1.14	47	-22.9	0.07	39	0.50	-57
5800	0.79	-177	0.8	1.10	45	-22.7	0.07	39	0.50	-59
6000	0.79	-177	0.5	1.06	44	-22.5	0.08	39	0.51	-60

*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-3615, -3645, -3675 Typical S-Parameters (V_{CE} = 10 V, I_C = 10 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.67	-43	27.6	23.92	155	-35.9	0.02	66	0.92	-14
200	0.63	-78	25.9	19.63	136	-33.2	0.02	70	0.81	-23
300	0.59	-103	24.1	15.94	121	-31.4	0.03	53	0.70	-28
400	0.57	-119	22.4	13.22	112	-30.2	0.03	52	0.64	-30
500	0.57	-132	20.9	11.11	105	-28.6	0.04	46	0.59	-32
600	0.55	-141	19.6	9.52	99	-28.4	0.04	49	0.58	-32
700	0.54	-149	18.4	8.30	94	-28.4	0.04	50	0.55	-32
800	0.53	-156	17.4	7.37	89	-28.0	0.04	49	0.53	-32
900	0.53	-162	16.4	6.61	88	-27.3	0.04	51	0.52	-32
1000	0.52	-168	15.6	6.00	83	-26.4	0.05	50	0.50	-34
1500	0.53	172	12.2	4.09	67	-24.7	0.06	55	0.47	-41
2000	0.50	155	9.8	3.11	54	-22.7	0.07	58	0.50	-45
2500	0.54	142	8.1	2.53	43	-20.8	0.09	59	0.47	-55
3000	0.55	130	6.6	2.14	32	-19.0	0.11	58	0.49	-64
3500	0.60	117	5.4	1.87	20	-17.4	0.14	56	0.47	-71
4000	0.61	108	4.3	1.63	10	-16.0	0.16	52	0.49	-83
5000	0.72	90	2.6	1.35	-10	-13.4	0.21	43	0.44	-105
6000	0.81	76	1.2	1.15	-29	-11.2	0.27	32	0.44	-134

HSMX-3615, -3645, -3675 Typical S-Parameters (V_{CE} = 15 V, I_C = 18 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.62	-56	29.3	29 17	148	-40.0	0.01	69	0.90	-16
200	0.59	-93	27.1	22.60	129	-35.4	0.02	66	0.77	-23
300	0.57	-118	24.9	17.68	115	-34.0	0.02	50	0.67	-26
400	0.55	-131	23.0	14.14	107	-31.7	0.03	55	0.62	-26
500	0.54	-143	21.3	11.65	100	-32.0	0.03	47	0.58	-28
600	0.54	-152	20.0	9.96	95	-30.8	0.03	48	0.58	-27
700	0.53	-158	18.7	8.57	91	-30.0	0.03	51	0.55	-28
800	0.53	-165	17.6	7.57	86	-29.1	0.04	52	0.54	-29
900	0.52	-170	16.6	6.78	83	-28.6	0.04	57	0.53	-28
1000	0.52	-175	15.8	6.16	79	-27.7	0.04	57	0.52	-29
1500	0.52	167	12.4	4.16	65	-25.5	0.05	59	0.50	-37
2000	0.51	152	10.0	3.16	53	-23.2	0.07	63	0.52	-42
2500	0.54	139	8.2	2.57	42	-21.3	0.09	64	0.50	-51
3000	0.66	127	6.7	2.17	30	-19.3	0.11	62	0.52	-61
3500	0.61	115	5.6	1.89	19	-17.8	0.13	59	0.50	-68
4000	0.62	106	4.4	1.66	8	-16.3	0.15	55	0.52	-80
5000	0.74	89	2.7	1.36	-12	-13.6	0.21	45	0.47	-102
6000	0.83	75	1.3	1.16	-31	-11.4	0.27	34	0.48	-130

HSMX-3635 Typical S-Parameters (V_{CE} = 10 V, I_C = 5 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.79	-29	21.6	12.06	156	-33.6	0.021	75	0.94	-12
200	0.68	-51	20.3	10.32	138	-29.1	0.035	66	0.85	-19
300	0.57	-71	18.7	8.62	124	-26.8	0.046	61	0.76	-23
400	0.48	-87	17.2	7.22	113	-25.5	0.053	59	0.70	-25
500	0.41	-100	15.8	6.13	105	-24.5	0.059	59	0.66	-26
600	0.37	-111	14.5	5.29	99	-23.7	0.065	59	0.63	-26
700	0.33	-121	13.4	4.66	93	-22.9	0.071	61	0.61	-27
800	0.30	-131	12.4	4.14	88	-22.2	0.077	62	0.60	-28
900	0.28	-140	11.4	3.73	84	-21.5	0.084	63	0.59	-29
1000	0.27	-148	10.6	3.39	80	-20.9	0.091	64	0.59	-30
1100	0.26	-155	9.9	3.13	76	-20.2	0.098	66	0.58	-31
1200	0.25	-162	9.2	2.89	73	-19.6	0.105	67	0.58	-32
1300	0.24	-169	8.6	2.69	70	-19.0	0.112	68	0.58	-33
1400	0.24	-176	8.1	2.53	67	-18.4	0.120	68	0.58	-34
1500	0.23	178	7.5	2.37	64	-17.9	0.128	69	0.58	-35
2000	0.23	149	5.4	1.85	51	-15.2	0.174	70	0.59	-42

HSMX-3635 Typical S-Parameters (V_{CE} = 10 V, I_C = 10 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.65	-41	25.6	18.97	146	-34.6	0.019	72	0.88	-18
200	0.50	-68	23.2	14.40	126	-30.6	0.030	65	0.74	-22
300	0.39	-89	20.8	10.92	112	-28.4	0.038	64	0.66	-24
400	0.32	-105	18.7	8.65	103	-26.8	0.046	65	0.61	-24
500	0.27	-118	17.1	7.12	97	-25.5	0.053	67	0.58	-24
600	0.25	-129	15.6	6.03	92	-24.3	0.061	68	0.57	-24
700	0.23	-139	14.4	5.24	87	-23.2	0.069	69	0.56	-24
800	0.21	-148	13.3	4.63	83	-22.3	0.077	70	0.55	-25
900	0.20	-157	12.3	4.14	79	-21.4	0.085	71	0.55	-26
1000	0.19	-164	11.5	3.26	76	-20.5	0.094	71	0.55	-27
1100	0.19	-171	10.7	3.44	73	-19.8	0.103	72	0.54	-28
1200	0.19	-178	10.0	3.18	70	-19.1	0.111	72	0.54	-30
1300	0.18	-176	9.4	2.95	67	-18.4	0.120	72	0.54	-31
1400	0.18	-169	8.8	2.76	65	-17.8	0.129	72	0.55	-32
1500	0.18	-164	8.3	2.59	62	-17.2	0.139	72	0.55	-33
2000	0.19	-137	6.1	2.01	50	-14.6	0.187	71	0.56	-40

HSMX-3635 Typical S-Parameters (V_{CE} = 10 V, I_C = 15 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.57	-49	27.0	22.46	140	-35.3	0.017	70	0.84	-18
200	0.41	-79	24.0	15.78	120	-31.5	0.027	66	0.69	-22
300	0.32	-100	21.2	11.50	107	-29.1	0.035	67	0.62	-22
400	0.26	-117	19.0	8.95	99	-27.3	0.043	69	0.58	-22
500	0.23	-129	17.3	7.30	94	-25.8	0.061	70	0.56	-22
600	0.21	-140	15.8	6.15	89	-24.5	0.059	72	0.55	-22
700	0.20	-150	14.5	5.32	85	-23.4	0.068	73	0.54	-22
800	0.19	-159	13.4	4.69	81	-22.3	0.077	74	0.54	-23
900	0.19	-167	12.5	4.19	78	-21.4	0.085	74	0.54	-25
1000	0.18	-174	11.6	3.80	74	-20.5	0.094	74	0.54	-26
1100	0.18	179	10.8	3.48	72	-19.7	0.103	74	0.54	-27
1200	0.18	173	10.1	3.20	69	-19.0	0.113	74	0.54	-28
1300	0.18	167	9.5	2.98	66	-18.3	0.122	74	0.54	-30
1400	0.18	162	8.9	2.79	63	-17.6	0.131	74	0.54	-31
1500	0.18	156	8.4	2.61	61	-17.0	0.141	73	0.54	-32
2000	0.19	132	6.2	2.03	49	-14.4	0.190	71	0.56	-39

HSMX-3655 Typical S-Parameters (V_{CE} = 10 V, I_C = 5 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.85	-28	22.2	12.83	161	-35.8	0.016	71	0.97	-10
200	0.79	-53	21.2	11.47	146	-30.5	0.030	63	0.89	-17
300	0.74	-75	20.1	10.16	133	-28.3	0.039	53	0.82	-23
400	0.70	-94	19.0	8.93	122	-26.9	0.045	46	0.75	-26
500	0.67	-109	17.9	7.82	113	-26.4	0.048	41	0.70	-28
600	0.65	-121	16.7	6.87	106	-25.9	0.051	39	0.67	-29
700	0.63	-131	15.7	6.10	101	-25.6	0.052	37	0.64	-31
800	0.62	-140	14.7	5.45	95	-25.4	0.054	37	0.62	-32
900	0.61	-147	13.8	4.92	91	-25.3	0.054	35	0.60	-33
1000	0.60	-154	13.0	4.47	87	-25.0	0.056	35	0.60	-33
1100	0.60	-159	12.3	4.11	83	-25.0	0.057	35	0.59	-34
1200	0.60	-165	11.6	3.82	80	-24.8	0.058	36	0.58	-35
1300	0.60	-169	10.9	3.53	76	-24.9	0.057	36	0.58	-36
1400	0.60	-174	10.3	3.29	73	-24.8	0.058	37	0.57	-37
1500	0.60	-178	9.8	3.10	70	-24.8	0.058	38	0.57	-38
2000	0.60	166	7.4	2.34	57	-23.8	0.065	46	0.57	-44
2500	0.61	153	5.5	1.88	46	-22.7	0.074	53	0.58	-50
3000	0.61	141	4.0	1.58	35	-21.0	0.089	57	0.59	-56
3500	0.61	130	2.8	1.38	26	-19.3	0.108	61	0.60	-62
4000	0.63	118	1.7	1.22	16	-17.6	0.132	60	0.60	-69

HSMX-3655 Typical S-Parameters (V_{CE} = 10 V, I_C = 10 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.74	-44	26.6	21.39	153	-36.5	0.015	65	0.93	-15
200	0.67	-78	24.8	17.29	134	-32.3	0.024	55	0.80	-22
300	0.63	-104	22.9	14.04	120	-30.6	0.030	48	0.70	-26
400	0.61	-122	21.2	11.49	110	-29.8	0.032	44	0.64	-27
500	0.60	-135	19.6	9.60	103	-29.4	0.034	43	0.60	-28
600	0.59	-145	18.3	8.23	97	-28.8	0.036	42	0.57	-29
700	0.58	-153	17.1	7.16	92	-28.4	0.038	43	0.55	-29
800	0.58	-160	16.0	6.34	88	-28.1	0.039	45	0.54	-30
900	0.58	-166	15.1	5.66	85	-28.0	0.040	45	0.53	-31
1000	0.58	-170	14.2	5.15	81	-27.2	0.044	47	0.53	-31
1100	0.58	-175	13.4	4.67	78	-27.0	0.045	45	0.53	-32
1200	0.58	-179	12.7	4.33	75	-26.9	0.045	50	0.52	-33
1300	0.58	178	12.0	3.97	72	-26.2	0.049	51	0.52	-34
1400	0.58	174	11.4	3.71	69	-25.9	0.051	52	0.52	-36
1500	0.59	171	10.9	3.49	66	-25.8	0.051	55	0.52	-37
2000	0.59	157	8.4	2.62	55	-23.8	0.065	60	0.53	-42
2500	0.59	145	6.5	2.11	44	-22.0	0.080	64	0.54	-49
3000	0.60	134	4.9	1.77	34	-20.0	0.100	63	0.55	-54
3500	0.61	123	3.7	1.53	24	-18.5	0.119	64	0.56	-61
4000	0.62	111	2.6	1.35	15	-16.8	0.144	62	0.57	-67

HSMX-3655 Typical S-Parameters (V_{CE} = 10 V, I_C = 15 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.67	-57	28.5	26.50	147	-37.4	0.014	62	0.89	-17
200	0.62	-95	26.0	19.92	127	-33.7	0.021	51	0.74	-23
300	0.60	-121	23.7	15.35	114	-32.2	0.025	47	0.65	-26
400	0.59	-137	21.7	21.17	105	-31.3	0.027	46	0.59	-26
500	0.59	-148	20.0	10.00	98	-31.0	0.028	46	0.56	-26
600	0.58	-156	18.6	8.50	93	-30.2	0.031	47	0.54	-26
700	0.58	-163	17.3	7.35	89	-29.8	0.032	49	0.53	-27
800	0.58	-169	16.2	6.48	85	-29.4	0.034	52	0.52	-27
900	0.58	-174	15.2	5.78	82	-28.9	0.036	52	0.52	-28
1000	0.58	-178	14.4	5.25	79	-28.1	0.039	54	0.52	-29
1100	0.58	179	13.5	4.74	76	-27.9	0.040	53	0.52	-30
1200	0.59	175	12.8	4.38	73	-27.6	0.042	57	0.51	-31
1300	0.58	172	12.1	4.03	70	-26.8	0.046	58	0.51	-33
1400	0.59	169	11.5	3.76	67	-26.3	0.048	59	0.51	-34
1500	0.59	166	10.9	3.52	65	-25.9	0.051	62	0.52	-35
2000	0.59	154	8.5	2.65	53	-23.7	0.065	66	0.53	-41
2500	0.60	142	6.5	2.13	43	-21.7	0.083	68	0.54	-48
3000	0.60	131	5.0	1.78	33	-19.7	0.103	66	0.55	-54
3500	0.61	120	3.7	1.54	24	-18.2	0.122	66	0.56	-60
4000	0.63	109	2.6	1.35	15	-16.5	0.149	64	0.57	-67

HXTR-7111 Typical S-Parameters (V_{CE} = 10 V, I_C = 10 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}		S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
100	0.68	-46	27.8	24.6	154	0.02	63	0.93	-15
200	0.64	-78	26.1	20.2	135	0.02	56	0.80	-26
300	0.85	-105	24.4	16.5	121	0.03	47	0.70	-32
400	0.83	-120	22.7	13.6	113	0.03	43	0.83	-34
500	0.62	-131	21.1	11.4	106	0.03	39	0.58	-35
600	0.61	-140	19.7	9.7	100	0.03	43	0.54	-36
700	0.61	-148	18.6	8.5	95	0.04	43	0.52	-38
800	0.60	-154	17.5	7.5	90	0.04	43	0.50	-37
900	0.61	-160	16.6	6.8	86	0.04	43	0.48	-40
1000	0.61	-164	15.7	6.1	83	0.04	43	0.47	-41
1500	0.61	-178	12.4	4.2	68	0.05	49	0.48	-50
2000	0.61	171	10.1	3.2	57	0.06	58	0.47	-57
2500	0.62	164	8.2	2.6	45	0.07	60	0.49	-68
3000	0.63	156	6.8	2.2	34	0.09	61	0.52	-75
3500	0.63	149	5.5	1.9	24	0.11	61	0.54	-85
4000	0.62	141	4.5	1.7	14	0.13	59	0.57	-93
4500	0.61	132	3.5	1.5	5	0.15	57	0.57	-102
5000	0.60	123	2.7	1.4	-4	0.18	53	0.62	-110
5500	0.61	112	2.0	1.3	-14	0.21	48	0.63	-118
6000	0.62	103	1.2	1.2	-22	0.23	43	0.67	-131
6500	0.62	93	0.5	1.1	-31	0.26	36	0.71	-140

HXTR-7111 Typical S-Parameters (V_{CE} = 15 V, I_C = 18 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}		S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
100	0.63	-59	29.7	30.6	149	0.01	64	0.90	-18
200	0.61	-95	27.4	23.5	129	0.02	46	0.75	-26
300	0.62	-119	25.3	18.3	115	0.02	48	0.85	-30
400	0.62	-133	23.4	14.7	107	0.02	43	0.60	-31
500	0.61	-143	21.7	12.1	101	0.03	48	0.56	-31
600	0.60	-151	20.2	10.2	95	0.03	44	0.53	-32
700	0.60	-157	19.0	8.9	91	0.03	49	0.52	-32
800	0.60	-162	17.8	7.8	87	0.03	49	0.50	-32
900	0.60	-167	16.9	7.0	83	0.03	51	0.49	-35
1000	0.60	-170	16.0	6.3	81	0.03	51	0.48	-35
1500	0.61	177	12.7	4.3	67	0.04	60	0.48	-46
2000	0.61	168	10.4	3.3	55	0.06	65	0.50	-53
2500	0.62	161	8.3	2.6	44	0.07	67	0.52	-64
3000	0.63	153	6.9	2.2	33	0.09	68	0.54	-72
3500	0.63	147	5.6	1.9	23	0.11	66	0.56	-83
4000	0.62	139	4.8	1.7	13	0.13	64	0.60	-89
4500	0.62	130	3.5	1.5	4	0.15	60	0.60	-100
5000	0.60	121	2.9	1.4	-5	0.18	56	0.65	-106
5500	0.62	110	2.3	1.3	-16	0.21	52	0.65	-116
6000	0.63	102	1.6	1.2	-24	0.23	46	0.70	-128
6500	0.63	91	0.8	1.1	-33	0.26	40	0.74	-137

Ordering Information

See page 16-2 for information on ordering surface mount devices.

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.

Part Number System for Order and RFQ Information

Part Number Prefix	Screening Level
HXTR-3615 HXTR-3645 HXTR-3675 HXTR-7111	Commercial
HXTR-3615TX HXTR-3645TX HXTR-3675TX HXTR-7111TX	100% Screen (per Tables II and III)
HXTR-3615TXV HXTR-3645TXV HXTR-3675TXV HXTR-7111TXV	100% Screen Internal Visual

100% Screen	Screened per MIL-S-19500, Table II, TX or TXV, with the following specified tests and conditions:		
	HTRB Test[1] (Screen 10)*	Delete HTRB	
	Pre Burn In Tests (Screen 11)*	All DC parameters; BV_{CBO}, BV_{CEO}, I_{CBO}, I_{CEO} and h_{FE} at 25°C, per data sheet Electrical Specifications table	
	Burn In Conditions (Screen 12)*	HXTR-3615 HXTR-3645 HXTR-3675	350 mW, T_A = 25°C
		HXTR-6106	400 mW, T_A = 25°C
	Post Burn In Tests and Deltas (Screen 13)*	All DC parameters; BV_{CBO}, BV_{CEO}, I_{CBO}, I_{CEO}, h_{FE} at 25°C, per data sheet Electrical Specifications table	
		Delta Limits: HXTR-7111	ΔI_{CBO} = ±15 nA or 100%, whichever is greater Δh_{FE} = ±25%
Group A	Per MIL-S-19500, Table III, and the following:		
	Subgroup 2	BV_{CBO}, BV_{CEO}, I_{CBO}, I_{CEO} and h_{FE} per data sheet Electrical Specifications table	
	Subgroup 3	HXTR-3615 HXTR-3645	T_A = +150°C, I_{CBO} = 10 µA at V_{CB} = 15 V
		HXTR-3675 HXTR-7111	T_A = +150°C, I_{CBO} = 5 µA at V_{CB} = 15 V Electrical Specifications table
		T_A = -55°C, h_{FE} = 20 minimum at I_C = 10 mA, V_{CE} = 10 V	
	Subgroup 4	HXTR-3615	Not applicable
		HXTR-3645 HXTR-3675 HXTR-7111	NF_{MIN} and G_A 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.

Note: 1. Applies to HXTR-3615, HXTR-3645 AND HXTR-3675 only.