General Purpose Transistors HXTR-2001 Chip

Technical Data

2N6679, TX and TXV (HXTR-2101, TX and TXV)
HXTR-2102, TX and TXV
HXTR-4101, TX and TXV
HXTR-6105, TX and TXV
HXTR-6106, TX and TXV

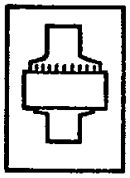
Features

- **High Gain**
  11 dB Typical at 4 GHz
- **Low Noise Figure**
  3.8 dB Typical at 4 GHz
- **High Output Power**
  20 dBm Typical P1dB at 2 GHz
- **Common Emitter and Common-Base Configurations**
- **Hermetic Packaging**

Recommended Die Attach and Bonding Procedures

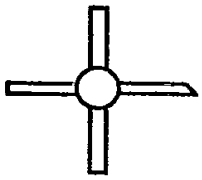
Eutectic Die Attach at a stage temperature of 410 ± 10°C under an N_2 ambient. Chip should be lightly scrubbed using a tweezer or collet and eutectic should flow within five seconds.

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.)



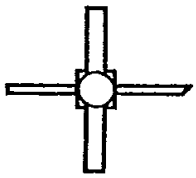
Generic Chip

HXTR-2001



HPAC-70GT

HXTR-2102
HXTR-6106



HPAC-100

2N6679 (HXTR-2101)
HXTR-4101 Common Base
HXTR-6105

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

Description

The HXTR-2001 chip features a metallization system that provides consistent and reliable performance at rated dissipation under high temperature operation. 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-2001 is available in two package styles. The common-emitter transistors 2N6679 (HXTR-2101) and HXTR-6105, and the common-base HXTR-4101 are supplied in the HPAC-100. The common-emitter HXTR-2102 and HXTR-6106 are supplied in the HPAC-70GT.

Both are rugged metal/ceramic hermetic packages, and are capable of meeting the environmental requirements of MIL-S-19500 and the test requirements of MIL-STD-750/883.

Electrical Specifications (HXTR-2001, HXTR-2101, HXTR-2102)

Symbol	Parameters and Test Conditions	Test Method MIL-STD-750	Units	HXTR-2001[1]			HXTR-2101[2]			HXTR-2102[2]		
				Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.
BV_{CES}	Collector-Emitter Breakdown Voltage, I_C = 100 µA	3011*	V	30			30			30		
I_{CEO}	Collector-Emitter Leakage Current at V_{CE} = 15 V	3041**	nA			500			500			500
I_{CBO}	Collector Cutoff Current at V_{CB} = 15 V	3036**	nA			100			100			100
h_{FE}	Forward Current Transfer Ratio V_{CE} = 15 V, I_C = 15 mA	3076*	–	50	100	220	50	100	220	50	100	220
NF_{MIN}	Minimum Noise Figure f = 2 GHz 4 GHz V_{CE} = 15 V, I_C = 15 mA	3246	dB		2.3 4.0							
G_A	Associated Gain V_{CE} = 15 V, I_C = 15 mA f = 2 GHz 4 GHz		dB		13.0 9.0							
G_T	Tuned Gain f = 2 GHz 4 GHz V_{CE} = 15 V, I_C = 25 mA		dB				9.0	10		13.0	15.0 10.5	
MAG	Maximum Available Gain f = 2 GHz 4 GHz V_{CC} = 15V, I_C = 25 mA		dB		17.5 11.5							
P_{1dB}	Power Output at 1 dB Compression f = 2 GHz 4 GHz V_{CE} = 15 V, I_C = 25 mA		dBm		20.0 18.5			18.5			20.0 18.5	
C_{cb}	Reverse Transfer Capacitance I_C = 0 mA; V_{CB} = 10 V; f = 1 MHz		pF					0.27				

*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.

Electrical Specifications (HXTR-4101, HXTR-6105, HXTR-6106)

Symbol	Parameters and Test Conditions	Test Method MIL-STD-750	Units	HXTR-4101[1,2]			HXTR-6105[1]			HXTR-6106[1]		
				Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.
BV_{CES}	Collector-Emitter Breakdown Voltage, I_C = 100 µA	3011*	V				30			30		
I_{CEO}	Collector-Emitter Leakage Current at V_{CE} = 15 V	3041**	nA			500			500			500
I_{CBO}	Collector Cutoff Current at V_{CB} = 15 V	3036**	nA			100			100			100
h_{FE}	Forward Current Transfer Ratio V_{CE} = 15 V, I_C = 15 mA	3076*	–	50	120	220	50	100	220	50	100	220
NF_{MIN}	Minimum Noise Figure HXTR-6105: V_{CE} = 15 V, I_C = 15 mA HXTR-6106: V_{CE} = 15 V I_C = 10 mA	3246	dB					2.2 4.0	4.2		2.5 4.0	2.7
	f = 1.5 GHz							2.2				
	2 GHz							4.0			2.5	
	4 GHz								4.2		4.0	2.7
G_A	Associated Gain HXTR-6105: V_{CE} = 15 V, I_C = 15 mA HXTR-6106: V_{CE} = 15 V I_C = 10 mA		dB					15.0			11.5	
	f = 1.5 GHz							15.0				
	2 GHz									10.0		
	4 GHz						8.0	9.0			9.0	
P_{OSC}[3]	Oscillator Output Power V_{CE} = 15 V, I_C = 30 mA		dBm									
	f = 3 GHz					21.5						
	4.3 GHz				19.0	20.5						
	6 GHz					17.0						
	8 GHz					12.0						
N/C	Phase Noise to Carrier Ratio at 1 KHz from the Carrier (SSB) f = 4.3 GHz		dBc/ Hz				-50					
P_{1dB}	Power Output at 1 dB Compression HXTR-6105: V_{CE} = 15 V, I_C = 15 mA HXTR-6106: V_{CE} = 15 V, I_C = 10 mA		dBm									
	f = 2 GHz									15		
	4 GHz							14				

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

Notes:
1. T_{CASE} = 25°C.
2. HXTR-4101 is common base configuration.

Absolute Maximum Ratings*

Symbol	Parameter	HXTR-2001[1] (T_A = 25°C)	HXTR-2101/2, -4101, -6105/6[2] (T_{CASE} = 25°C)
V_{CBO}	Collector to Base Voltage	30 V	30 V
V_{CEO}	Collector to Emitter Voltage	20 V	20 V
V_{EBO}	Emitter to Base Voltage	1.5 V	1.5 V
I_C	DC Collector Current	70 mA	70 mA
P_T	Total Device Dissipation	900 mW	900 mW
T_J	Junction Temperature	200°C	200°C
T_{STG}	Storage Temperature	-65°C to 300°C	-65°C to 200°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 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 130°C/W for the HXTR-2101, HXTR-4101 and HXTR-6105, and a θ_{JC} maximum of 125°C/W for the HXTR-2102 and HXTR-6106 should be used for derating and junction temperature calculations ($T_J = P_D + \theta_{JC} + T_{CASE}$).

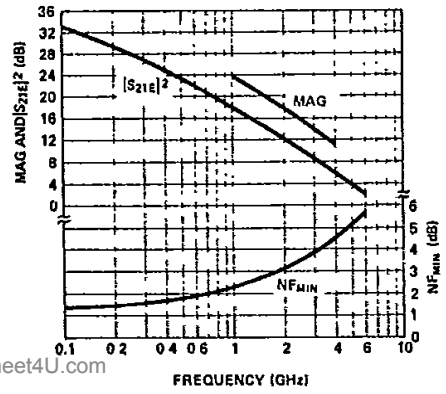


Figure 1. Typical MAG, $|S_{21E}|^2$, and Noise Figure (NF_{MIN}) vs. Frequency (V_{CE} = 15 V, I_C = 25 mA), for the HXTR-2001.

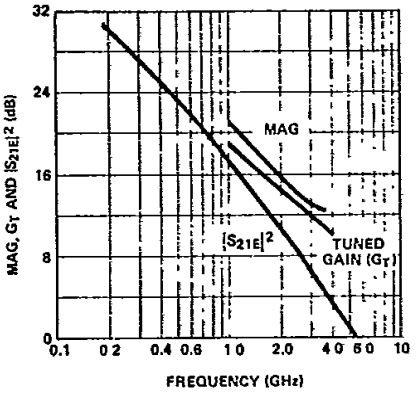


Figure 2. Typical MAG, $|S_{21E}|^2$, and Tuned Gain vs. Frequency (V_{CE} = 15 V, I_C = 25 mA), for the HXTR-2101.

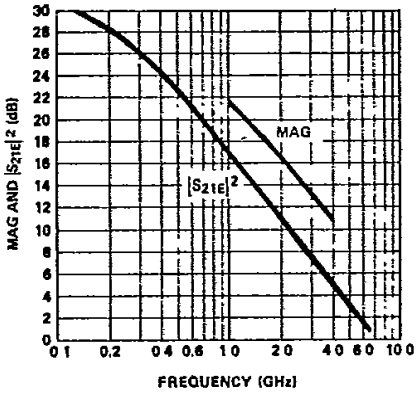


Figure 3. Typical MAG, and $|S_{21E}|^2$ vs. Frequency (V_{CE} = 15 V, I_C = 25 mA), for the HXTR-2102.

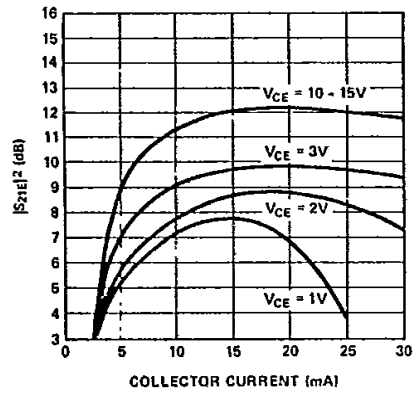


Figure 4. Typical $|S_{21E}|^2$ vs. Current at 2 GHz, for the HXTR-2001.

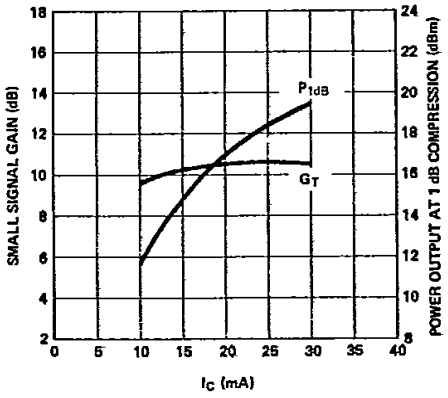


Figure 5. Typical $|S_{21E}|^2$ vs. Collector Current at 4 GHz, for the HXTR-2101.

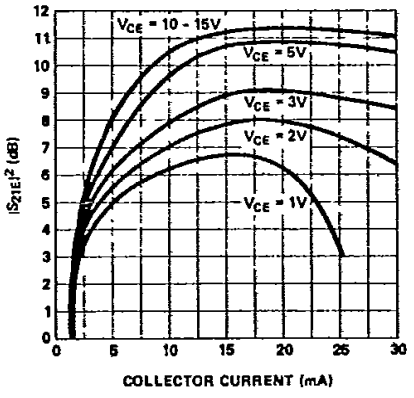


Figure 6. Typical $|S_{21E}|^2$ vs. Collector Current at 2 GHz, for the HXTR-2102.

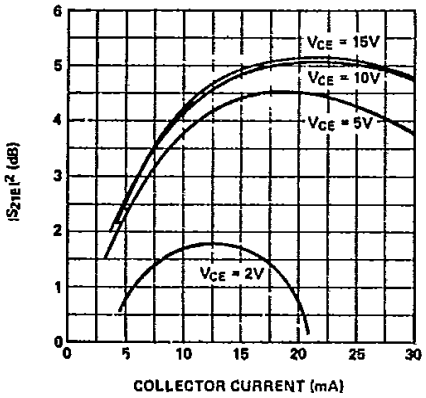


Figure 7. Typical $|S_{21E}|^2$ vs. Collector Current at 4 GHz, for the HXTR-6105.

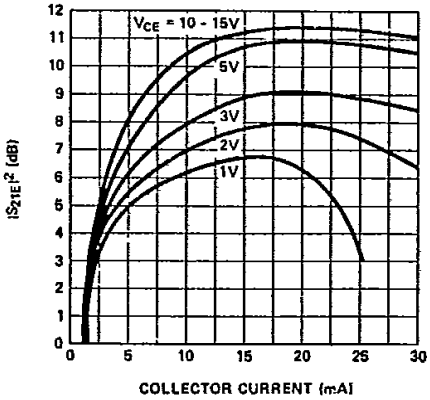


Figure 8. Typical $|S_{21E}|^2$ vs. Collector Current at 2 GHz, for the HXTR-6106.

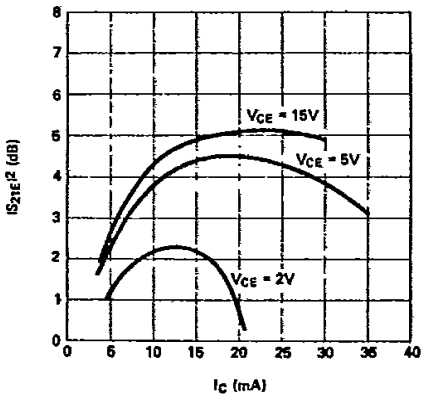


Figure 9. Typical Power Output at 1 dB Compression and Small Signal Gain vs. Collector Current at 4 GHz for V_{CE} = 15 V, for the HXTR-2101.

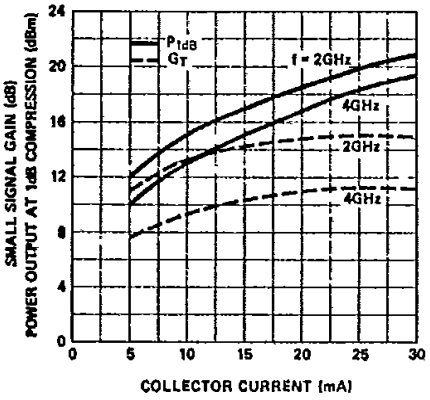


Figure 10. Typical Power Output at 1 dB Compression and Small Signal Gain vs. Collector Current for V_{CE} = 15 V, for the HXTR-2102.

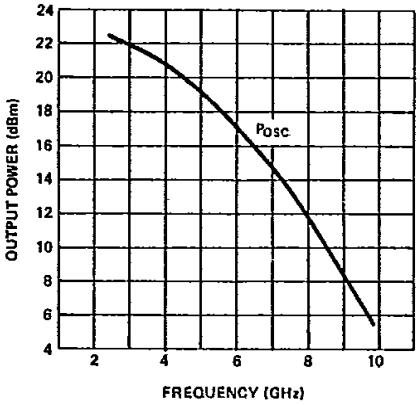


Figure 11. Typical Tuned Power Output vs. Frequency (V_{CB} = 15 V, I_C = 30 mA) for the HXTR-4101.

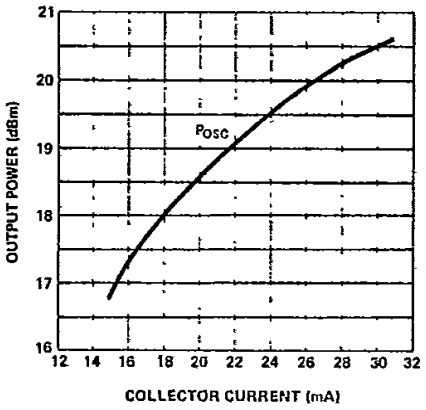


Figure 12. Typical Oscillator Power vs. Collector Current for V_{CB} = 15 V at 4.3 GHz, for the HXTR-4101.

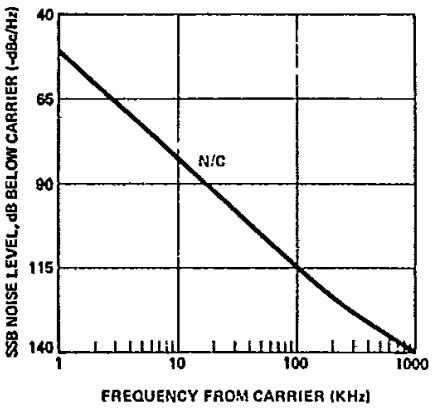


Figure 13. Typical Phase Noise to Carrier Ratio (N/C) vs. Frequency from Carrier at 4.3 GHz (V_{CB} = 15 V, I_C = 30 mA), for the HXTR-4101.

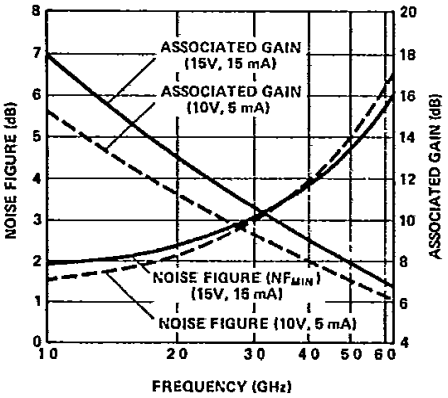


Figure 14. Typical NF_{MIN} and Associated Gain vs. Frequency, for the HXTR-6105.

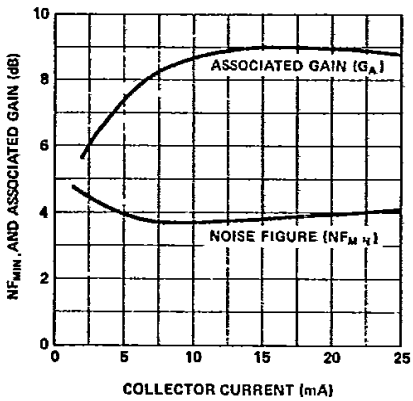


Figure 15. Typical NF_{MIN} and Associated Gain vs. Collector Current at 4 GHz for V_{CE} = 15 V (Tuned for NF_{MIN}) for the HXTR-6105.

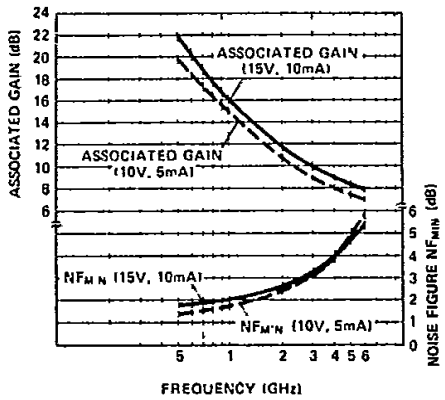


Figure 16. Typical Noise Figure (NF_{MIN}) and Associated Gain vs. Frequency, for the HXTR-6106.

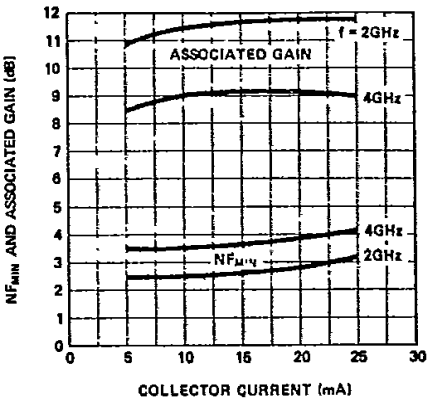


Figure 17. Typical Noise Figure (NF_{MIN}) and Associated Gain vs. Collector Current at 2 GHz and 4 GHz at V_{CE} = 15V, for the HXTR-6106.

Typical Noise Parameters

HXTR-6105 (V_{CE} = 15 V, I_C = 15 mA)

Freq. (MHz)	Γ_O (Mag./Ang.)	R_N (Ohms)	NF_{MIN} (dB)
1000	0.238/123°	6.81	1.80
1500	0.385/142°	5.33	2.15
2000	0.429/173°	5.04	2.25
3000	0.541/-158°	6.54	3.01
4000	0.628/-135°	15.54	3.81
5000	0.624/-107°	60.14	4.75

HXTR-6105 (V_{CE} = 15 V, I_C = 15 mA)

Freq. (MHz)	Γ_O (Mag./Ang.)	R_N (Ohms)	NF_{MIN} (dB)	G_A (dB)
1000	0.10/60	48.9	1.8	14.3
1500	0.27/132	19.1	2.1	13.3
2000	0.46/156	9.9	2.4	11.6
3000	0.53/167	8.4	3.4	8.9
4000	0.61/174	6.4	4.3	6.9

HXTR-2001 Typical Common-Emitter S-Parameters (V_{CE} = 15 V, I_C = 25 mA)*

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang..
100	0.57	-88	33.3	46.2	144	-42	0.008	58	0.85	-20
200	0.68	-124	30.2	32.5	123	-39	0.011	43	0.67	-26
300	0.72	-141	27.6	23.9	113	-38	0.013	37	0.56	-26
400	0.74	-150	25.4	18.7	106	-37	0.014	35	0.51	-24
500	0.75	-156	23.7	15.3	102	-37	0.014	35	0.48	-22
600	0.76	-160	22.2	12.9	99	-36	0.015	36	0.46	-21
700	0.76	-163	20.8	11.0	97	-36	0.015	37	0.45	-20
800	0.76	-165	19.9	9.8	95	-36	0.016	38	0.44	-19
900	0.76	-167	18.8	8.7	93	-36	0.016	40	0.44	-18
1000	0.76	-168	18.0	7.9	91	-35	0.017	42	0.44	-18
1500	0.77	-172	14.5	5.3	85	-34	0.021	49	0.43	-18
2000	0.77	-175	12.0	4.0	81	-32	0.025	54	0.43	-20
2500	0.77	-176	10.1	3.2	77	-31	0.029	58	0.43	-23
3000	0.77	-177	8.6	2.7	73	-29	0.034	60	0.43	-26
3500	0.77	-178	7.2	2.3	69	-28	0.038	61	0.44	-29
4000	0.76	-179	6.0	2.0	66	-27	0.043	62	0.44	-32
4500	0.76	-179	5.1	1.8	63	-26	0.048	62	0.45	-35
5000	0.76	-179	4.1	1.6	59	-26	0.052	62	0.45	-38
5500	0.76	-180	3.5	1.5	56	-25	0.057	62	0.46	-41
6000	0.76	-180	2.9	1.4	53	-24	0.062	61	0.47	-44

*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-2101 Typical Common-Emitter S-Parameters (V_{CE} = 15 V, I_C = 25 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.59	-66	30.8	34.6	146	-40.0	0.01	69	0.86	-18
500	0.58	-150	22.1	12.7	96	-33.2	0.02	44	0.51	-27
1000	0.59	-175	16.7	6.86	78	-30.5	0.03	51	0.44	-32
1500	0.59	173	13.3	4.61	64	-28.0	0.04	55	0.45	-39
2000	0.60	162	11.0	3.53	53	-25.7	0.05	55	0.44	-49
2500	0.61	156	8.9	2.79	43	-24.2	0.06	55	0.47	-60
3000	0.62	146	7.3	2.32	33	-22.6	0.07	56	0.48	-67
3500	0.63	139	5.9	1.96	22	-21.2	0.09	53	0.52	-79
4000	0.62	131	4.8	1.73	11	-19.7	0.10	50	0.55	-84
4500	0.61	123	3.5	1.50	1	-18.8	0.12	48	0.59	-93
5000	0.60	116	2.6	1.35	-9	-17.0	0.14	44	0.65	-102
5500	0.62	109	1.8	1.23	-19	-15.9	0.16	36	0.66	-113
6000	0.62	103	0.9	1.11	-28	-15.6	0.17	32	0.66	-123
6500	0.62	93	0.0	1.02	-37	-13.7	0.20	28	0.67	-131

HXTR-2102 Typical Common-Emitter S-Parameters (V_{CE} = 15 V, I_C = 25 mA)

Freq. (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.63	-58	30.5	33.4	149	-39.2	0.011	62	0.88	-16
200	0.63	-99	28.4	26.2	128	-35.9	0.016	49	0.72	-25
300	0.64	-122	26.1	20.3	115	-34.9	0.018	45	0.61	-28
400	0.64	-136	24.2	16.2	107	-33.6	0.021	42	0.54	-29
500	0.64	-146	22.6	13.4	101	-32.8	0.023	42	0.50	-31
600	0.64	-153	21.2	11.5	96	-32.4	0.024	43	0.48	-32
700	0.64	-158	19.9	9.9	92	-32.0	0.025	43	0.47	-33
800	0.64	-162	18.8	8.8	88	-31.7	0.026	45	0.47	-34
900	0.64	-166	17.8	7.8	85	-31.4	0.027	44	0.48	-34
1000	0.64	-170	16.9	7.0	83	-30.8	0.029	46	0.47	-35
1500	0.66	179	13.5	4.7	70	-29.1	0.035	49	0.44	-40
2000	0.65	172	11.1	3.6	60	-27.1	0.044	53	0.48	-50
2500	0.67	165	9.1	2.9	50	-25.7	0.052	55	0.47	-59
3000	0.64	161	7.6	2.4	40	-24.3	0.061	57	0.25	-66
3500	0.72	156	6.4	2.1	32	-23.3	0.068	53	0.51	-79
4000	0.69	149	5.3	1.8	22	-22.8	0.074	48	0.56	-85
4500	0.70	141	4.4	1.7	14	-21.8	0.081	44	0.55	-92
5000	0.72	136	3.3	1.6	6	-21.3	0.086	39	0.58	-101
5500	0.70	128	2.5	1.3	-3	-20.7	0.092	34	0.62	-109
6000	0.75	122	1.7	1.2	-11	-20.1	0.098	30	0.63	-118
6500	0.70	119	0.8	1.1	-20	-19.5	0.105	26	0.70	-127

HXTR-4101 Typical Common-Base S-Parameters (V_{CE} = 15 V, I_C = 30 mA)

Freq. (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1000	0.93	161	1.93	-29	0.011	127	1.01	-15
1500	0.94	153	1.92	-44	0.023	126	1.04	-31
2000	0.96	144	1.95	-59	0.039	120	1.06	-45
2500	0.98	134	1.97	-76	0.061	113	1.10	-59
3000	0.99	123	1.96	-94	0.086	105	1.12	-74
3500	1.01	115	1.95	-114	0.117	93	1.16	-91
4000	1.02	106	1.87	-133	0.154	84	1.19	-108
4500	1.01	96	1.79	-155	0.186	70	1.20	-127
5000	0.98	88	1.65	-174	0.217	58	1.21	-143
6000	0.91	74	1.32	144	0.245	35	1.10	-176
7000	0.85	61	1.06	109	0.267	17	0.99	157
8000	0.78	49	0.87	74	0.298	1	0.89	135
9000	0.76	44	0.76	60	0.238	-10	0.93	131
10000	0.72	27	0.72	29	0.288	-24	0.89	113
11000	0.70	6	0.68	5	0.302	-38	0.84	102
12000	0.64	-24	0.67	-25	0.320	-58	0.82	92

HXTR-6105 Typical Common-Emitter S-Parameters (V_{CE} = 15 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	0.66	-52	29.0	28.3	152	-39.2	0.01	69	0.90	-16
500	0.59	-139	22.0	12.5	101	-37.7	0.03	41	0.55	-33
1000	0.59	-169	16.5	6.71	80	-29.6	0.03	45	0.47	-37
1500	0.59	177	13.1	4.54	65	-27.5	0.04	49	0.47	-41
2000	0.61	165	10.8	3.48	53	-25.5	0.05	50	0.47	-50
2500	0.60	159	8.8	2.75	43	-24.0	0.06	51	0.49	-61
3000	0.62	148	7.2	2.28	32	-22.7	0.07	52	0.50	-68
3500	0.62	141	5.7	1.93	21	-21.4	0.09	49	0.54	-80
4000	0.62	132	4.6	1.70	10	-20.0	0.10	47	0.57	-85
4500	0.60	126	3.5	1.50	0.0	-19.0	0.11	45	0.60	-94
5000	0.60	118	2.6	1.35	-9	-17.2	0.14	42	0.65	-102
5500	0.61	112	1.8	1.23	-20	-16.8	0.14	35	0.66	-112
6000	0.62	104	0.9	1.11	-29	-16.1	0.16	31	0.67	-122

HXTR-6106 Typical Common-Emitter S-Parameters (V_{CE} = 15 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	0.77	-36	26.4	20.8	157	-38.4	0.012	67	0.93	-12
200	0.72	-70	25.6	19.0	139	-34.0	0.020	65	0.82	-21
300	0.70	-95	24.1	16.0	125	-32.0	0.025	46	0.71	-26
400	0.70	-113	22.7	13.6	115	-31.0	0.028	41	0.64	-29
500	0.69	-126	21.3	11.6	108	-30.5	0.030	37	0.59	-31
600	0.68	-136	20.1	10.1	102	-29.9	0.032	36	0.56	-33
700	0.67	-143	19.0	8.9	97	-29.6	0.033	35	0.54	-34
800	0.66	-149	18.0	7.9	93	-29.4	0.034	35	0.54	-35
900	0.66	-154	17.0	7.0	91	-29.1	0.035	34	0.53	-36
1000	0.66	-159	16.1	6.4	86	-28.9	0.036	35	0.53	-36
1500	0.68	-174	12.8	4.3	72	-27.0	0.040	36	0.48	-41
2000	0.66	177	10.5	3.3	61	-27.1	0.044	40	0.50	-51
2500	0.68	189	8.5	2.6	50	-26.2	0.049	42	0.50	-60
3000	0.67	163	7.0	2.2	39	-25.0	0.056	44	0.54	-87
3500	0.69	156	5.6	1.9	31	-24.1	0.062	46	0.54	-77
4000	0.68	152	4.5	1.7	21	-23.1	0.070	46	0.60	-85
4500	0.69	142	3.6	1.5	12	-22.2	0.078	47	0.60	-92
5000	0.71	138	2.5	1.3	4	-21.2	0.087	46	0.62	-102
5500	0.70	130	1.8	1.2	-5	-20.5	0.094	42	0.66	-111
6000	0.76	124	0.9	1.1	-13	-19.7	0.103	42	0.67	-120
6500	0.71	121	0.0	1.0	-23	-19.1	0.111	38	0.75	-129

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
2N6679 (HXTR-2101) HXTR-2102 HXTR-4101 HXTR-6105 HXTR-6106	Commercial
2N6679TX (HXTR-2101TX) HXTR-2102TX HXTR-4101TX HXTR-6105TX HXTR-6106TX	100% Screen (per Tables II and III)
2N6679TXV (HXTR-2101TXV) HXTR-2102TXV HXTR-4101TXV HXTR-6105TXV HXTR-6106TXV	100% Screen Internal Visual

100% Screen	Screened per MIL-S-19500, Table II, TX or TXV with the following specified tests and conditions:	
	Pre Burn In Tests (Screen 11)*	All DC parameters; BV_{CES}, I_{CEO}, I_{CBO} and h_{FE} at 25°C, per data sheet Electrical Specifications table
	Burn In Conditions (Screen 12)*	HXTR-2101 HXTR-4101 P_T = 450 mW, T_A = 25°C HXTR-6105
		HXTR-2102 P_T = 375 mW, T_A = 25°C HXTR-6106
	Post Burn In and Deltas (Screen 13)*	All DC parameters; BV_{CES}, I_{CEO}, I_{CBO}, h_{FE} at 25°C, per data sheet Electrical Specifications table Delta Limits: Δh_{FE} = ±25% ΔI_{CBO} = ±15 nA or 100%, whichever is greater

*Refer to MIL-S-19500 screen numbers.

Group A	Per MIL-S-19500, Table III, and the following:	
	Subgroup 2	BV_{CES}, I_{CEO}, I_{CBO} and h_{FE} per data sheet Electrical Specifications table
	Subgroup 3	T_A = +150°C, I_{CBO} = 10 µA at V_{CB} = 15 V T_A = -55°C, h_{FE} = 20 minimum at I_C = 15 mA, V_{CE} = 15 V
	Subgroup 4	HXTR-2101, HXTR-2102 G_T per data sheet Electrical Specifications table
		HXTR-4101 P_{OSC}, per data sheet Electrical Specifications table
		HXTR-6105, HXTR-6106 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.