HEWLETT PACKARD

Low Cost General Purpose Transistors

Technical Data

HXTR-3685
HXTR-3686

Features

HXTR-3685

- **Low Noise Figure: 1.8 dB Typical at 1 GHz**
- **High Gain: 16.4 Typical at 1 GHz at Noise Figure Bias**
- **Low Cost Plastic Package**
- **Nitride Passivation for Greater Reliability**

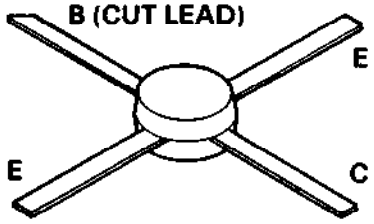
HXTR-3686

- **Low Noise Figure: 1.8 dB Typical at 1 GHz**
- **High Gain: 16.4 Typical at 1 GHz at Noise Figure Bias**
- **Low Cost Surface Mount Plastic Package**
- **Tape and Reel Options Available**
- **Nitride Passivation for Greater Reliability**

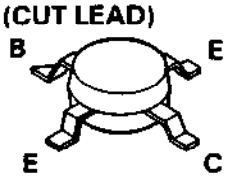
Description

The HXTR-3685/3686 is a low cost NPN bipolar transistor designed for low noise, high gain, and wide dynamic range up to 4,000 MHz. To achieve excellent uniformity and reliability, the manufacturing process utilizes self-alignment and ion implantation techniques. The chip is protected by silicon nitride passivation.

HXTR-3685



HXTR-3686



Absolute Maximum Ratings, T_A = 25°C*

Symbol	Parameter	Value
V_{CBO}	Collector to Base Voltage	25 V
V_{CEO}	Collector to Emitter Voltage	15 V
V_{EBO}	Emitter to Base Voltage	1.5 V
I_C	DC Collector Current	65 mA
P_T	Total Device Dissipation	500 mW
T_J	Junction Temperature	150°C
T_{STG}	Storage Temperature	-65 to +150°C

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

Notes:
1. A θ_{JC} of 110°C/W for HXTR-3685 and 115°C/W for HXTR-3686 should be used for derating and junction temperature calculations: $T_J = (P_D \times \theta_{JC}) + T_C$.
2. Maximum soldering temperature is 260°C for 5 seconds.

The HXTR-3685 is supplied in the HPAC-85, a low cost 85 mil diameter plastic stripline package. The HXTR-3686 has the leads formed suitable for surface mount applications. Tape and reel option is also available for the HXTR-3686.

Electrical Specifications, T_A = 25°C

Symbol	Parameters and Test Conditions	Units	HXTR-3685			HXTR-3686		
			Min.	Typ.	Max.	Min.	Typ.	Max.
BV_{CBO}	Collector to Base Breakdown Voltage at I_C = 100 μA	V	25			25		
I_{CBO}	Collector-Base Cutoff Current at V_{CE} = 15 V	nA			500			500
h_{FE}	Forward Current Transfer Ratio at V_{CE} = 15 V, I_C = 15 mA		40	80	180	40	80	180
f_T	Gain Bandwidth Product at V_{CE} = 10 V, I_C = 15 mA	GHz		5			5	
$\|S_{21E}\|^2$	Transducer Gain at 1,000 MHz at V_{CE} = 10 V, I_C = 15 mA	dB		14.8			14.7	
NF_{MIN}	Minimum Noise Figure at 1,000 MHz at V_{CE} = 10 V, I_C = 10 mA	dB		1.8			1.8	
G_A	Associated Gain at Minimum Noise Figure, 1,000 MHz	dB		16.4			16.4	
C_{cb}	Collector Base Capacitance V_{CB} = 10 V, I_E = 0, f = 1.0 MHz	pF		0.31			0.31	
P_{1dB}	Power Output at 1 dB Compression at 1,000 MHz, V_{CE} = 10 V, I_C = 15 mA	dBm		16.3			16.2	
G_{1dB}	Associated 1 dB Compressed Gain at 1,000 MHz, V_{CE} = 10 V, I_C = 15 mA	dB		13.3			13.3	
MSG	Maximum Stable Gain at 1,000 MHz at V_{CE} = 10 V, I_C = 15 mA	dB		21.4			21.3	

HXTR-3685 Typical Parameters

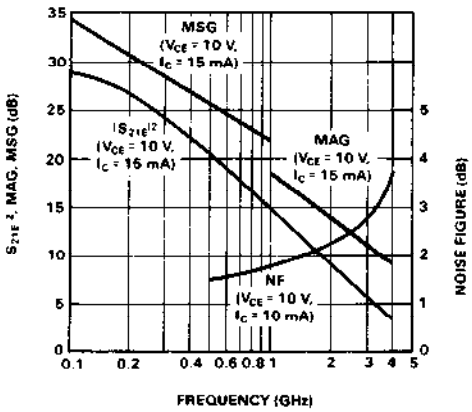


Figure 1. Typical $|S_{21E}|^2$, MAG, MSG, and Noise Figure vs Frequency.

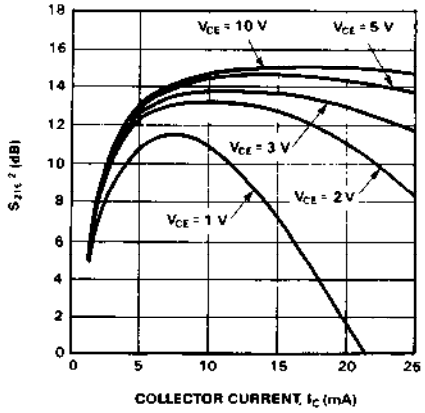


Figure 2. Typical $|S_{21E}|^2$ vs Collector Current at 1000 MHz.

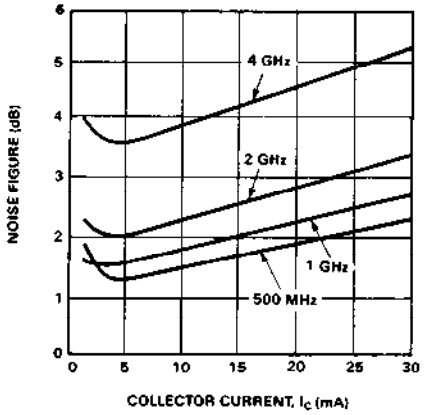


Figure 3. Noise Figure vs. Collector Current (V_{CE} = 10 V).

HXTR-3686 Typical Parameters

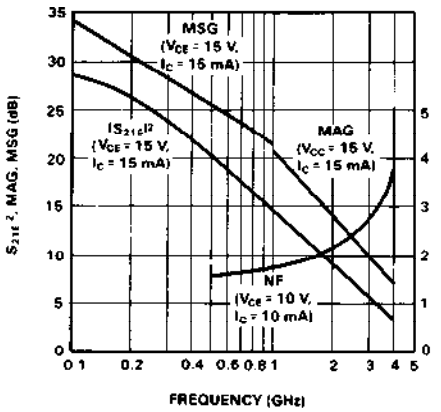


Figure 4. Typical $|S_{21E}|^2$, MAG, MSG, and Noise Figure vs Frequency.

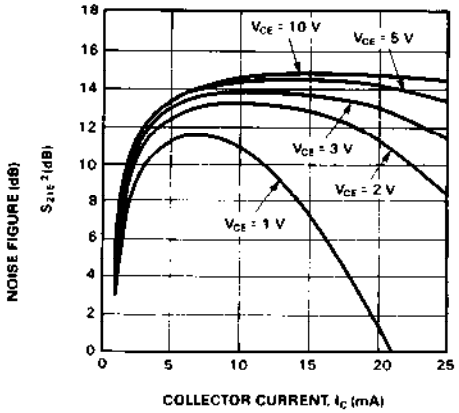


Figure 5. Typical $|S_{21E}|^2$ vs Collector Current at 1000 MHz.

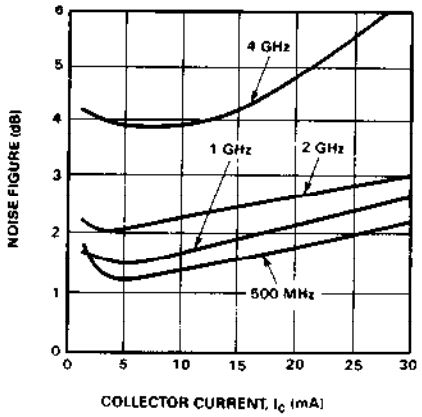


Figure 6. Noise Figure vs. Collector Current (V_{CE} = 10 V).

HXTR-3685 Typical Noise Parameters V_{CE} = 10 V, I_C = 10 mA

Freq. GHz	NF_{MIN} dB	G_A dB	Γ_o Source		Γ_L Load		R_N Ohms
			Mag.	Ang.	Mag.	Ang.	
0.5[1]	1.5	21.8					
1.0	1.8	16.4	.26	135	.58	33	6
1.5	2.0	13.9	.32	158	.51	42	3
2.0	2.2	11.5	.22	-168	.52	49	23
2.5	2.6	10.2	.42	-139	.60	54	8
3.0	3.1	9.0	.34	-141	.56	52	21
3.5	3.4	8.3	.46	-168	.60	67	15
4.0	3.9	7.4	.44	-129	.58	79	38

Notes: 1. NF, G_A at 50 Ohms.

HXTR-3686 Typical Noise Parameters V_{CE} = 10 V, I_C = 10 mA

Freq. GHz	NF_{MIN} dB	G_A dB	Γ_o Source		Γ_L Load		R_N Ohms
			Mag.	Ang.	Mag.	Ang.	
0.5[1]	1.5	21.7					
1.0	1.8	16.4	.34	146	.67	27	1
1.5	2.0	13.9	.32	-162	.52	38	2
2.0	2.2	11.2	.22	-143	.48	40	26
2.5	2.7	8.5	.44	-139	.61	42	16
3.0	3.1	7.9	.46	-126	.56	41	40
3.5	3.4	8.0	.58	-122	.49	85	20
4.0	3.8	7.2	.46	-120	.62	70	84

Notes: 1. NF, G_A at 50 Ohms.

HXTR-3685 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	0.66	-47	26.7	21.7	153	-37	0.01	68	0.92	-16
200	0.62	-83	25.0	17.8	134	-33	0.02	54	0.81	-25
300	0.62	-108	23.2	14.5	120	-31	0.03	47	0.70	-30
400	0.61	-124	21.4	11.7	111	-30	0.03	43	0.63	-29
500	0.65	-136	20.1	10.1	104	-29	0.03	43	0.62	-31
600	0.60	-144	18.6	8.5	99	-29	0.03	42	0.58	-31
700	0.60	-151	17.4	7.4	94	-29	0.04	42	0.55	-31
800	0.60	-157	16.3	6.5	89	-28	0.04	42	0.54	-33
900	0.60	-162	15.3	5.8	87	-28	0.04	44	0.54	-33
1000	0.60	-166	14.5	5.3	82	-28	0.04	44	0.54	-35
1100	0.60	-170	13.7	4.8	78	-27	0.04	46	0.53	-36
1200	0.60	-173	13.1	4.5	75	-27	0.04	46	0.53	-39
1300	0.60	-176	12.3	4.1	73	-27	0.05	48	0.52	-39
1400	0.60	-179	11.7	3.9	70	-26	0.05	49	0.52	-41
1500	0.59	177	11.2	3.6	68	-26	0.05	50	0.51	-43
2000	0.60	166	8.7	2.7	56	-24	0.06	54	0.53	-49
2500	0.60	155	7.0	2.2	45	-23	0.07	57	0.54	-56
3000	0.59	142	5.5	1.9	35	-21	0.09	58	0.56	-62
3500	0.62	131	4.3	1.6	24	-20	0.11	58	0.55	-68
4000	0.63	120	3.2	1.4	15	-18	0.12	56	0.56	-77

HXTR-3685 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	-63	28.7	27.2	147	-38	0.01	65	0.89	-19
200	0.57	-102	26.4	20.8	127	-34	0.02	52	0.75	-27
300	0.59	-126	24.1	16.1	114	-33	0.02	46	0.64	-30
400	0.59	-140	22.1	12.7	106	-32	0.02	45	0.58	-28
500	0.64	-148	20.6	10.7	99	-31	0.03	46	0.57	-30
600	0.60	-156	19.0	9.0	95	-31	0.03	47	0.55	-29
700	0.60	-162	17.8	7.7	90	-30	0.03	48	0.52	-29
800	0.60	-167	16.6	6.8	86	-30	0.03	49	0.52	-30
900	0.60	-170	15.6	6.1	84	-29	0.03	51	0.52	-30
1000	0.60	-174	14.8	5.5	80	-29	0.04	53	0.51	-33
1100	0.60	-177	14.0	5.0	77	-28	0.04	54	0.51	-34
1200	0.61	180	13.4	4.7	73	-28	0.04	55	0.51	-37
1300	0.60	178	12.5	4.2	71	-27	0.04	56	0.50	-37
1400	0.60	175	11.9	4.0	68	-27	0.04	57	0.51	-39
1500	0.60	171	11.4	3.7	66	-27	0.05	58	0.50	-40
2000	0.60	162	9.0	2.8	55	-24	0.06	61	0.52	-48
2500	0.60	152	7.2	2.3	44	-23	0.07	62	0.53	-54
3000	0.59	140	5.7	1.9	34	-21	0.09	62	0.56	-61
3500	0.62	128	4.5	1.7	24	-19	0.11	61	0.55	-67
4000	0.64	118	3.4	1.5	14	-18	0.13	58	0.55	-77

HXTR-3686 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	0.66	-46	26.7	21.6	152	-37	0.01	68	0.93	-16
200	0.61	-83	24.9	17.6	132	-33	0.02	55	0.81	-25
300	0.59	-108	23.1	14.2	118	-31	0.03	48	0.69	-29
400	0.57	-125	21.2	11.5	109	-30	0.03	45	0.63	-28
500	0.58	-140	19.9	9.9	102	-29	0.03	43	0.61	-29
600	0.55	-148	18.4	8.4	96	-29	0.04	44	0.58	-30
700	0.55	-156	17.2	7.3	90	-28	0.04	44	0.54	-29
800	0.55	-164	16.1	6.4	85	-28	0.04	45	0.53	-31
900	0.55	-169	15.2	5.8	82	-27	0.04	46	0.23	-31
1000	0.55	-175	14.4	5.2	77	-27	0.05	47	0.52	-33
1100	0.55	180	13.6	4.8	73	-26	0.05	48	0.51	-34
1200	0.55	175	13.0	4.4	69	-26	0.05	48	0.51	-37
1300	0.54	171	12.2	4.1	66	-26	0.05	49	0.50	-37
1400	0.55	167	11.6	3.8	63	-25	0.06	50	0.49	-39
1500	0.55	161	11.1	3.6	59	-25	0.06	51	0.48	-40
2000	0.57	145	8.6	2.7	45	-23	0.07	52	0.48	-49
2500	0.59	130	6.8	2.2	31	-21	0.09	51	0.47	-58
3000	0.62	115	5.4	1.9	18	-19	0.11	49	0.45	-69
3500	0.67	103	4.0	1.6	5	-17	0.14	44	0.41	-81
4000	0.70	93	2.8	1.4	-8	-15	0.18	37	0.38	-100

HXTR-3686 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	-62	28.7	27.1	147	-38	0.01	65	0.89	-18
200	0.56	-102	26.3	20.6	126	-34	0.02	53	0.74	-27
300	0.56	-126	24.0	15.9	112	-33	0.02	48	0.63	-29
400	0.56	-141	22.0	12.5	103	-32	0.03	46	0.57	-27
500	0.59	-153	20.4	10.5	97	-31	0.03	46	0.56	-28
600	0.56	-160	18.9	8.8	92	-30	0.03	47	0.54	-28
700	0.56	-167	17.6	7.6	87	-30	0.03	49	0.51	-27
800	0.56	-173	16.5	6.7	82	-29	0.04	50	0.50	-29
900	0.57	-178	15.6	6.0	79	-29	0.04	52	0.50	-29
1000	0.57	177	14.7	5.4	74	-28	0.04	53	0.50	-31
1100	0.57	173	13.9	5.0	71	-27	0.04	53	0.49	-33
1200	0.57	169	13.3	4.6	67	-27	0.05	54	0.49	-35
1300	0.56	166	12.5	4.2	64	-26	0.05	55	0.47	-36
1400	0.57	162	11.9	3.9	61	-26	0.05	55	0.48	-37
1500	0.57	156	11.4	3.7	58	-25	0.05	55	0.47	-39
2000	0.59	142	8.9	2.8	44	-23	0.07	55	0.46	-48
2500	0.62	128	7.0	2.3	30	-21	0.09	54	0.45	-57
3000	0.64	114	5.6	1.9	17	-19	0.11	50	0.44	-68
3500	0.70	102	4.2	1.6	4	-18	0.13	45	0.39	-79
4000	0.73	92	3.0	1.4	-8	-16	0.15	40	0.36	-98

Ordering Information for HXTR-3686 Only*

Option T00 = Bulk
Option T15 = Tape and Reel, See Figure 7

Conforms to Electronic Industries Standard RS-481 "Taping of Surface Mounted Components for Automated Placement". Standard Quantity is 1,500 Devices/Reel.

*Note: Tape and Reel options are not available for the HXTR-3685.

Specify Part Number followed by Option Number

Example:

HXTR-3686 TXX

- Bulk or Tape and Reel Option
- Part Number
- Transistor
- HP

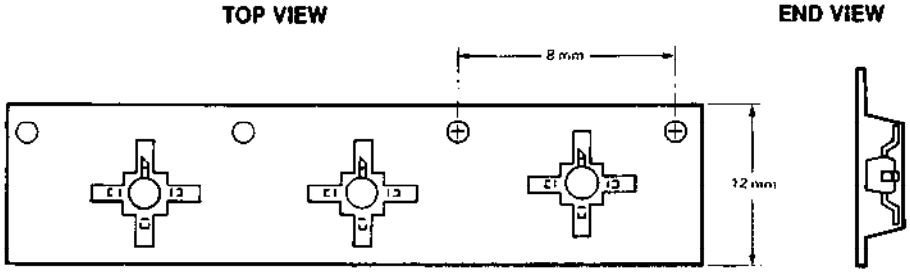
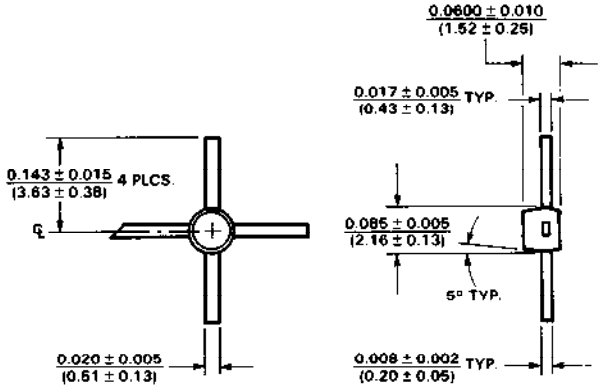
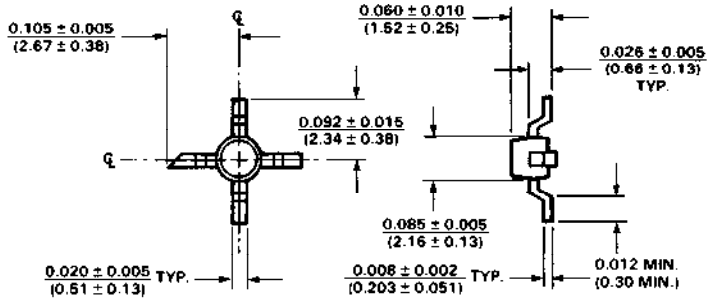


Figure 7. Option T15



DIMENSIONS ARE IN INCHES (MILLIMETERS)

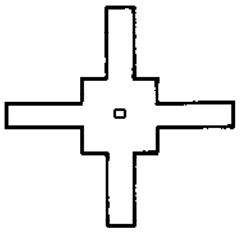
HPAC-85



DIMENSIONS ARE IN INCHES (MILLIMETERS)

HPAC-86

TOP VIEW OF CAVITY



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