PRELIMINARY DATA SHEET

NEC

GaAs HETEROJUNCTION BIPOLAR TRANSISTOR

NE52318

L to S BAND LOW NOISE, HIGH GAIN AMPLIFIER
NPN GaAs HBT

FEATURES

- Ideal for low noise and high gain amplifier
  NF = 1.1 dB TYP., G_a = 16 dB TYP., MSG = 18.0 dB TYP. (@ f = 2 GHz, V_{CE} = 2.0 V, I_C = 3 mA, Z_S = Z_L = 50 Ω)
  OIP_3 = +21 dBm TYP. (@ f = 2 GHz, V_{CE} = 2.5 V, I_C = 5 mA)
- 4-pin super minimold package employed (SOT-343 style)
- Grounded emitter transistor

APPLICATION

- Front-end, LNA for L to S band mobile communications, etc.

ORDERING INFORMATION (PLAN)

Part Number	Package	Marking	Supplying Form
NE52318-T1	4-pin super minimold	V43	• 8 mm wide embossed taping • Pin 3 (Emitter), Pin 4 (Collector) face the perforation side of the tape • Qty 3 kpcs/reel

Remark To order evaluation samples, consult your NEC sales representative.
Part number for sample order: NE52318

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C)

Parameter	Symbol	Ratings	Unit
Collector to Emitter Voltage	V_{CEO}	5.0	V
Collector to Base Voltage	V_{CBO}	3.0	V
Emitter to Base Voltage	V_{EBO}	3.0	V
Collector Current	I_C	7	mA
Base Current	I_B	0.3	mA
Total Power Dissipation	P_{tot}	30	mW
Junction Temperature	T_j	+125	°C
Storage Temperature	T_{stg}	−65 to +125	°C

Because this product uses high-frequency technology, avoid excessive static electricity, etc.

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RECOMMENDED OPERATING RANGE (T_A = +25°C)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Collector to Emitter Voltage	V_{CE}	1.5	2.0	3.0	V
Collector Current	I_C	–	3	6	mA
Input Power	P_{in}	–	–	0	dBm

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Emitter to Base Leak Current	I_{EBO}	V_{EB} = 3.0 V	–	0.2	1.0	μA
Collector to Base Leak Current	I_{CBO}	V_{CB} = 3.0 V	–	0.2	1.0	μA
DC Current Gain	h_{FE}	V_{CE} = 2.0 V, I_C = 3 mA	70	100	140	–
Noise Figure	NF	V_{CE} = 2.0 V, I_C = 3 mA, f = 2 GHz,	–	1.1	1.5	dB
Associated Gain	G_a	$Z_S = Z_L$ = 50 Ω	14	16	–	dB
Insertion Power Gain	$\|S_{21e}\|^2$		14	16	–	dB
3rd-order Inter-modulation Distortion Output Intercept Point	OIP_3	V_{CE} = 2.5 V, I_C = 5 mA, f = 2 GHz, 1 tone, $Z_S = Z_L = Z_{opt}$	–	21	–	dBm

S-PARAMETERS
MAG. AND ANG.

V_{CE} = 2.0 V, I_C = 3 mA

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
400	0.877	–21.3	8.533	159.8	0.025	79.1	0.982	–12.9
500	0.871	–25.9	8.281	156.1	0.033	75.0	0.966	–16.3
600	0.851	–31.1	8.184	151.5	0.037	70.9	0.948	–18.8
700	0.832	–35.7	7.979	147.4	0.045	67.8	0.934	–21.6
800	0.812	–40.4	7.823	143.5	0.049	63.4	0.911	–23.9
900	0.791	–44.9	7.636	139.7	0.054	63.1	0.887	–26.0
1000	0.776	–49.1	7.401	135.9	0.057	60.2	0.867	–29.0
1100	0.746	–52.8	7.192	132.7	0.061	58.1	0.843	–30.6
1200	0.738	–56.1	7.036	129.2	0.063	56.0	0.829	–33.2
1300	0.705	–60.6	6.855	126.0	0.068	56.3	0.807	–34.2
1400	0.687	–63.9	6.654	122.7	0.069	51.9	0.788	–35.8
1500	0.671	–67.1	6.437	120.1	0.072	50.8	0.775	–37.2
1600	0.655	–70.7	6.303	117.5	0.077	52.2	0.762	–37.8
1700	0.630	–73.7	6.102	114.6	0.078	50.2	0.742	–39.2
1800	0.611	–76.1	5.920	112.2	0.081	47.6	0.726	–40.4
1900	0.592	–79.3	5.757	109.5	0.082	49.1	0.714	–42.2
2000	0.542	–79.8	5.463	107.0	0.083	48.3	0.670	–39.5
2100	0.524	–82.7	5.291	105.0	0.085	45.7	0.668	–41.0
2200	0.495	–85.8	5.181	102.4	0.085	47.0	0.651	–42.3
2300	0.480	–88.6	5.024	100.3	0.089	45.1	0.629	–42.4
2400	0.461	–92.9	4.914	97.7	0.090	43.6	0.614	–44.3
2500	0.439	–95.7	4.776	95.5	0.089	42.6	0.603	–44.6
2600	0.429	–99.1	4.687	93.3	0.092	43.5	0.586	–45.8
2700	0.417	–101.5	4.579	91.6	0.095	41.6	0.573	–45.4
2800	0.397	–105.2	4.474	89.3	0.096	41.5	0.553	–46.8
2900	0.386	–108.4	4.335	87.4	0.096	39.7	0.547	–48.3
3000	0.375	–112.1	4.267	85.0	0.098	41.0	0.538	–48.6
3500	0.319	–128.8	3.811	76.2	0.106	37.5	0.492	–52.8
4000	0.287	–149.6	3.462	67.1	0.109	37.0	0.442	–57.3
4500	0.273	–167.7	3.175	59.3	0.117	35.9	0.411	–60.9
5000	0.276	175.7	2.916	51.8	0.118	33.2	0.379	–65.9
5500	0.280	160.6	2.707	44.6	0.125	32.8	0.358	–70.9
6000	0.296	148.9	2.517	37.0	0.130	31.5	0.331	–75.7
6500	0.322	137.0	2.365	30.0	0.138	28.9	0.304	–79.0
7000	0.350	126.3	2.237	22.9	0.147	28.3	0.271	–84.5
7500	0.372	116.6	2.100	16.0	0.152	23.5	0.225	–89.7
8000	0.407	108.6	2.000	9.1	0.159	23.6	0.188	–97.0

AMPLIFIER PARAMETERS

V_{CE} = 2.0 V, I_C = 3 mA

Frequency	GUmax	GAmax	$\|S_{21}\|^2$	$\|S_{12}\|^2$	K	Delay	Mason's U	G1	G2
MHz	dB	dB	dB	dB		ns	dB	dB	dB
400	39.58		18.62	–31.90	0.08	0.103		6.36	14.60
500	36.25		18.36	–29.64	0.12	0.103		6.16	11.73
600	33.80		18.26	–28.56	0.17	0.128	46.599	5.59	9.95
700	32.11		18.04	–27.00	0.20	0.113	36.342	5.12	8.94
800	30.25		17.87	–26.22	0.25	0.107	29.994	4.68	7.71
900	28.64		17.66	–25.41	0.26	0.107	34.769	4.27	6.71
1000	27.45		17.39	–24.95	0.28	0.104	33.428	4.01	6.06
1100	26.05		17.14	–24.34	0.32	0.091	30.503	3.53	5.38
1200	25.41		16.95	–23.98	0.33	0.095	30.861	3.42	5.05
1300	24.27		16.72	–23.38	0.35	0.090	41.335	2.98	4.57
1400	23.44		16.46	–23.21	0.41	0.091	27.912	2.77	4.21
1500	22.75		16.17	–22.81	0.42	0.074	28.025	2.60	3.98
1600	22.21		15.99	–22.22	0.42	0.071		2.44	3.78
1700	21.38		15.71	–22.12	0.46	0.082	31.571	2.19	3.48
1800	20.73		15.45	–21.85	0.50	0.066	27.052	2.03	3.25
1900	20.17		15.20	–21.76	0.50	0.075	38.018	1.88	3.09
2000	18.85		14.75	–21.66	0.63	0.069	24.746	1.51	2.59
2100	18.43		14.47	–21.42	0.65	0.057	23.572	1.40	2.56
2200	17.90		14.29	–21.42	0.67	0.073	24.625	1.22	2.39
2300	17.34		14.02	–21.03	0.71	0.058	22.968	1.14	2.18
2400	16.92		13.83	–20.93	0.73	0.071	22.549	1.04	2.05
2500	16.47		13.58	–21.02	0.78	0.061	21.757	0.93	1.96
2600	16.13		13.42	–20.72	0.79	0.063	22.479	0.88	1.83
2700	15.77		13.22	–20.49	0.82	0.047	21.392	0.83	1.73
2800	15.35		13.01	–20.36	0.85	0.062	21.099	0.74	1.59
2900	14.99		12.74	–20.32	0.87	0.054	20.405	0.70	1.55
3000	14.74		12.60	–20.21	0.88	0.066	21.103	0.66	1.48
3500	13.29		11.62	–19.50	0.98	0.049	19.416	0.47	1.20
4000	12.10	13.24	10.79	–19.28	1.09	0.050	18.333	0.37	0.94
4500	11.17	12.12	10.03	–18.67	1.13	0.043	17.684	0.34	0.80
5000	10.31	11.06	9.29	–18.54	1.22	0.042	16.151	0.34	0.67
5500	9.60	10.30	8.65	–18.03	1.25	0.040	15.522	0.35	0.60
6000	8.92	9.55	8.02	–17.73	1.31	0.042	14.460	0.40	0.50
6500	8.37	8.99	7.48	–17.23	1.32	0.039	13.830	0.47	0.42
7000	7.89	8.50	6.99	–16.63	1.30	0.040	13.314	0.57	0.33
7500	7.32	7.83	6.45	–16.38	1.36	0.038	12.088	0.65	0.23
8000	6.96	7.44	6.02	–16.00	1.36	0.038	11.400	0.78	0.16

S-PARAMETERS
MAG. AND ANG.

V_{CE} = 2.0 V, I_C = 5 mA

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
400	0.812	–27.7	12.987	154.7	0.026	74.9	0.952	–17.3
500	0.794	–33.1	12.409	149.4	0.030	66.2	0.924	–20.6
600	0.766	–39.6	12.141	144.2	0.035	65.7	0.893	–23.7
700	0.736	–45.0	11.617	139.3	0.038	65.8	0.871	–26.9
800	0.706	–50.4	11.168	135.0	0.044	61.5	0.835	–29.2
900	0.674	–55.5	10.722	130.9	0.045	58.7	0.795	–30.9
1000	0.647	–60.0	10.255	126.7	0.049	57.4	0.775	–34.2
1100	0.624	–64.2	9.767	123.4	0.053	56.8	0.748	–35.8
1200	0.599	–67.6	9.418	119.3	0.054	58.0	0.726	–38.0
1300	0.568	–71.7	9.009	116.6	0.056	51.9	0.704	–38.4
1400	0.546	–75.6	8.639	113.3	0.060	53.2	0.683	–39.8
1500	0.525	–78.4	8.284	110.6	0.061	53.3	0.661	–40.7
1600	0.505	–82.1	7.996	108.1	0.066	53.5	0.650	–41.4
1700	0.483	–85.4	7.662	105.3	0.066	51.4	0.633	–42.5
1800	0.466	–87.2	7.355	103.0	0.067	51.9	0.612	–42.7
1900	0.445	–90.9	7.072	100.4	0.072	51.3	0.603	–44.4
2000	0.395	–90.4	6.668	98.7	0.073	51.6	0.571	–40.8
2100	0.385	–93.3	6.436	96.6	0.071	49.5	0.562	–41.9
2200	0.354	–96.6	6.227	94.2	0.073	50.3	0.546	–42.4
2300	0.342	–99.2	6.032	92.4	0.076	46.9	0.529	–42.6
2400	0.327	–103.3	5.853	90.3	0.078	49.1	0.516	–43.9
2500	0.305	–107.1	5.676	88.1	0.079	49.7	0.504	–44.1
2600	0.300	–110.9	5.520	86.3	0.084	49.3	0.498	–44.6
2700	0.291	–113.2	5.362	84.9	0.082	46.1	0.482	44.3
2800	0.278	–117.1	5.194	82.8	0.087	48.0	0.468	–45.6
2900	0.268	–120.5	5.030	81.0	0.086	47.9	0.458	–46.6
3000	0.258	–125.4	4.937	79.2	0.089	48.6	0.453	–47.6
3500	0.223	–143.8	4.341	71.3	0.097	47.4	0.411	–50.1
4000	0.217	–166.8	3.917	63.4	0.102	44.6	0.372	–54.0
4500	0.216	174.0	3.546	56.4	0.114	44.0	0.343	–57.6
5000	0.233	159.3	3.239	49.6	0.120	41.4	0.314	–61.4
5500	0.250	145.8	3.008	43.0	0.127	39.5	0.294	–66.5
6000	0.273	136.0	2.792	36.0	0.139	36.8	0.270	–70.8
6500	0.299	127.1	2.608	29.3	0.148	35.1	0.245	–75.5
7000	0.330	118.2	2.455	22.7	0.155	31.7	0.214	–79.9
7500	0.355	109.5	2.309	16.3	0.166	28.8	0.178	–83.2
8000	0.394	103.2	2.198	10.1	0.172	25.7	0.131	–88.5

AMPLIFIER PARAMETERS

V_{CE} = 2.0 V, I_C = 5 mA

Frequency	GUmax	GAmax	$\|S_{21}\|^2$	$\|S_{12}\|^2$	K	Delay	Mason's U	G1	G2
MHz	dB	dB	dB	dB		ns	dB	dB	dB
400	37.26		22.27	–31.69	0.15	0.148		4.68	10.31
500	34.53		21.87	–30.40	0.27	0.148	31.367	4.33	8.32
600	32.46		21.69	–29.01	0.27	0.144	33.598	3.83	6.94
700	30.85		21.30	–28.32	0.27	0.137		3.39	6.16
800	29.14		20.96	–27.22	0.34	0.119	33.737	3.00	5.18
900	27.57		20.61	–26.94	0.39	0.113	31.249	2.63	4.34
1000	26.55		20.22	–26.16	0.41	0.116	32.570	2.35	3.98
1100	25.50		19.79	–25.46	0.44	0.092	33.573	2.14	3.56
1200	24.66		19.48	–25.32	0.46	0.115		1.93	3.25
1300	23.76		19.09	–25.02	0.53	0.076	28.849	1.69	2.97
1400	23.00		18.73	–24.42	0.54	0.090	32.117	1.54	2.73
1500	22.26		18.36	–24.34	0.58	0.076	32.456	1.40	2.50
1600	21.72		18.06	–23.62	0.59	0.070	39.590	1.28	2.39
1700	21.06		17.69	–23.65	0.63	0.076	31.321	1.15	2.22
1800	20.44		17.33	–23.44	0.67	0.064	31.244	1.06	2.04
1900	19.91		16.99	–22.86	0.68	0.072	33.322	0.96	1.96
2000	18.93		16.48	–22.74	0.78	0.047	26.364	0.73	1.71
2100	18.51		16.17	–22.99	0.82	0.060	24.945	0.70	1.65
2200	18.01		15.89	–22.75	0.86	0.066	24.853	0.58	1.54
2300	17.58		15.61	–22.38	0.89	0.051	23.208	0.54	1.43
2400	17.18		15.35	–22.12	0.90	0.059	24.081	0.49	1.34
2500	16.78		15.08	–22.07	0.93	0.061	23.847	0.42	1.27
2600	16.48		14.84	–21.55	0.92	0.048	24.271	0.41	1.24
2700	16.12		14.59	–21.70	0.97	0.039	22.164	0.38	1.15
2800	15.73		14.31	–21.19	0.97	0.058	22.895	0.35	1.07
2900	15.38	17.12	14.03	–21.27	1.01	0.050	22.212	0.32	1.02
3000	15.17	17.06	13.87	–21.01	1.00	0.052	22.744	0.30	1.00
3500	13.78	14.72	12.75	–20.24	1.08	0.043	20.996	0.22	0.80
4000	12.71	13.43	11.86	–19.80	1.16	0.044	19.372	0.21	0.65
4500	11.75	12.43	10.99	–18.84	1.17	0.039	18.801	0.21	0.55
5000	10.90	11.49	10.21	–18.44	1.22	0.038	17.351	0.24	0.45
5500	10.24	10.80	9.56	–17.92	1.24	0.037	16.552	0.28	0.39
6000	9.58	10.16	8.92	–17.14	1.23	0.039	16.039	0.34	0.33
6500	9.00	9.57	8.33	–16.57	1.23	0.037	15.255	0.41	0.27
7000	8.51	9.05	7.80	–16.17	1.24	0.036	14.455	0.50	0.20
7500	7.99	8.50	7.27	–15.62	1.24	0.036	13.630	0.59	0.14
8000	7.65	8.12	6.84	–15.29	1.24	0.034	12.960	0.73	0.07

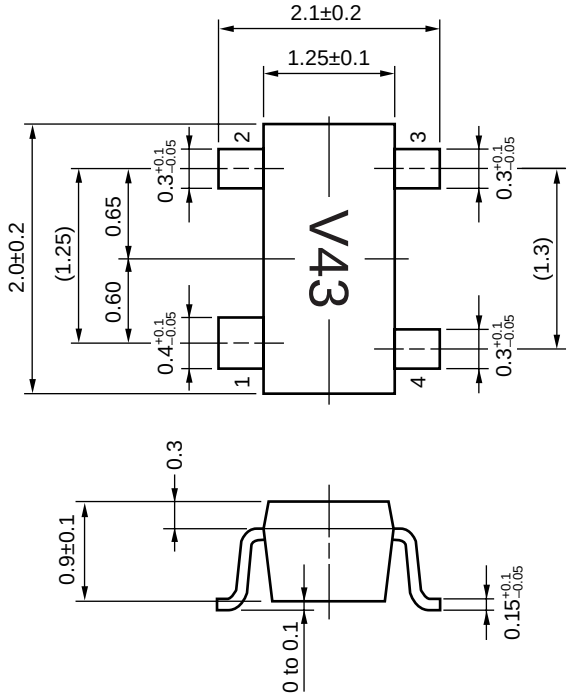
NOISE PARAMETERS

V_{CE} = 2.0 V, I_C = 3 mA

Frequency (GHz)	$NF_{min.}$ (dB)	G_a (dB)	Γopt		Rn/50
			MAG.	ANG. (deg.)	
0.8	0.71	24.1	0.40	11.4	0.21
1.0	0.77	21.8	0.41	12.7	0.23
1.2	0.83	20.1	0.42	15.2	0.23
1.4	0.89	18.8	0.41	18.8	0.23
1.6	0.95	17.8	0.40	23.4	0.23
1.8	1.01	17.0	0.38	29.0	0.22
2.0	1.07	16.2	0.37	35.6	0.22

PACKAGE DIMENSIONS

4-PIN SUPER MINIMOLD (UNIT: mm)



PIN CONNECTIONS

1. Emitter
2. Base
3. Emitter
4. Collector

PRECAUTION

Because this product uses high-frequency technology, sufficient care must be taken regarding static electricity and strong electric fields.

Take measures against static electricity and make sure the body is earthed when mounting the device.

RECOMMENDED SOLDERING CONDITIONS

This product should be soldered and mounted under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your NEC sales representative.

Soldering Method	Soldering Conditions	Recommended Condition Symbol
Infrared Reflow	Package peak temperature: 240°C or below, Time: 30 seconds or less (at 210°C), Count: 3 times or less, Exposure limit: None[Note]	IR40-00-3
Partial Heating	Pin temperature: 300°C or below, Time: 3 seconds or less (per side of device), Exposure limit: None[Note]	–

Note After opening the dry pack, store it at 25°C or less and 65% RH or less for the allowable storage period.

Caution Do not use different soldering methods together (except for partial heating).

For the details the recommended soldering conditions, refer to the document **SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535E)**.

[MEMO]

[MEMO]

CAUTION

The great care must be taken in dealing with the devices in this guide.
The reason is that the material of the devices is GaAs (Gallium Arsenide), which is designated as harmful substance according to the law concerned.
Keep the law concerned and so on, especially in case of removal.