



NEC's L TO S BAND LOW NOISE AMPLIFIER NPN GaAs HBT

NE52418

FEATURES

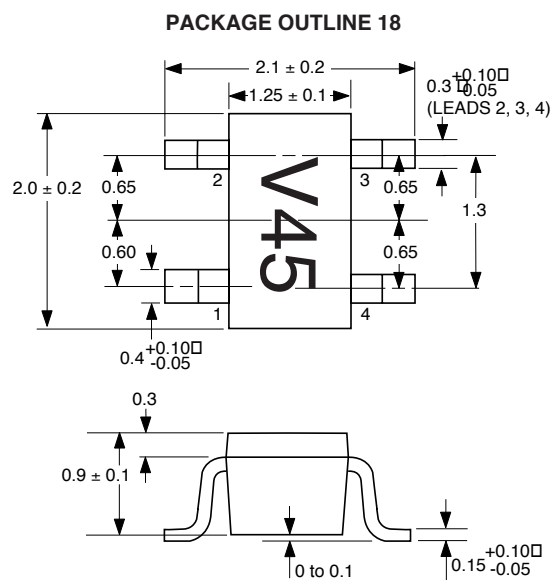
- **HIGH POWER GAIN:**
GA = 16 dB TYP , MSG = 18 dB TYP
at f = 2 GHz, VCE = 2 V, IC = 3 mA, ZS = ZL = 50 Ω
- **LOW NOISE:**
NF = 1.0 dB TYP
at f = 2 GHz, VCE = 2 V, IC = 3 mA, ZS = ZL = 50 Ω
- **OIP3 = +25 dBm TYP**
at f = 2 GHz, VCE = 2 V, IC = 10 mA, ZS = ZOPT , 1TONE
- **4 PIN SUPER MINI MOLD PACKAGE**
- **GROUNDING EMITTER TRANSISTOR**

DESCRIPTION

NEC's NE52418 is a low cost NPN GaAs HBT(InGaP) suitable for front end LNA's in L/S band mobile communications applications. The NE52418 is housed in a 4-pin super mini-mold package, making it ideal for high-density design.

NEC's stringent quality assurance and test procedures ensure the highest reliability performance

PACKAGE DIMENSIONS (Units in mm)



PIN CONNECTIONS

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

ELECTRICAL CHARACTERISTICS (TA = 25°C)

PART NUMBER PACKAGE OUTLINE			NE52418 18		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
IEBO	Emitter to Base Leakage Current at VEB = 3 V	μA	—	0.2	1.0
ICBO	Collector to Base Leakage Current at VCB = 3 V	μA	—	0.2	1.0
hFE	DC Current Gain at VCE = 2 V, IC = 3 mA	—	100	140	180
NF	Noise Figure at VCE = 2 V, IC = 3 mA, f = 2 GHz, ZS = ZL = 50 Ω	dB	—	1.0	1.5
Ga	Associated Gain at VCE = 2 V, IC = 3 mA, f = 2 GHz, ZS = ZL = 50 Ω	dB	14	16	—
IS21d12	Insertion Power Gain at VCE = 2 V, IC = 20 mA, f = 2 GHz	dB	—	20	—
OIP3	Out Third - Order Distortion Intercept Point at VCE = 2 V, f = 2 GHz, ZS = ZL = ZOPT, IC = 10 mA, 1 tone	dBm	—	25	—

ABSOLUTE MAXIMUM RATINGS ($T_A = +25^{\circ}\text{C}$)

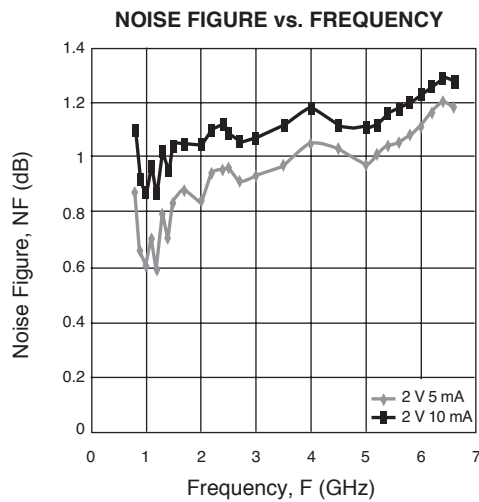
SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CEO}	Collector to Emitter Voltage	V	5.0
V_{CBO}	Collector to Base Voltage	V	3.0
V_{EBO}	Emitter to Base Voltage	V	3.0
I_C	Collector Current	mA	40
I_B	Base Current	mA	0.3
P_T	Total Power Dissipation	mW	150
T_j	Junction Temperature	$^{\circ}\text{C}$	+125
T_{STG}	Storage Temperature	$^{\circ}\text{C}$	-65 to +125

Note:

- Operation in excess of any of these parameters may result in permanent damage.

RECOMMENDED OPERATING CONDITIONS ($T_A = +25^{\circ}\text{C}$)

SYMBOLS	PARAMETERS	UNITS	MIN.	TYP.	MAX.
V_{CE}	Collector to Emitter Voltage	V	1.5	2.0	3.0
I_C	Collector Current	mA	–	–	30
P_{IN}	Input Power	dBm	–	–	0

TYPICAL PERFORMANCE CURVE ($T_A = 25^{\circ}\text{C}$)**TYPICAL SCATTERING PARAMETERS** ($T_A = 25^{\circ}\text{C}$)

NE52418

 $V_{CE} = 2.0\text{ V}$, $I_C = 3\text{ mA}$

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz		MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2.0		0.601	-82.0	5.571	107.2	0.064	47.4	0.733	-38.7
2.5		0.505	-98.5	4.898	94.9	0.067	41.0	0.669	-43.7
3.0		0.438	-115.1	4.405	83.4	0.073	38.5	0.619	-48.5
3.5		0.384	-132.3	4.008	73.6	0.077	38.5	0.583	-53.5
4.0		0.346	-148.8	3.645	64.2	0.078	39.2	0.550	-58.7
4.5		0.328	-166.8	3.333	54.9	0.083	38.7	0.525	-64.5
5.0		0.327	178.2	3.100	46.7	0.085	41.0	0.509	-70.7
5.5		0.326	164.7	2.894	38.3	0.094	41.7	0.502	-76.9
6.0		0.344	152.8	2.708	30.2	0.099	41.6	0.485	-84.4
6.5		0.366	140.7	2.573	22.1	0.108	41.6	0.474	-90.1
7.0		0.382	130.2	2.445	14.2	0.121	40.7	0.457	-97.9
7.5		0.402	120.3	2.320	6.2	0.128	37.2	0.428	-107.0
8.0		0.431	110.9	2.209	-2.5	0.146	35.6	0.410	-117.1
8.5		0.46	102.2	2.124	-11.7	0.161	32.0	0.398	-132.9
9.0		0.516	94.2	2.023	-21.2	0.175	26.1	0.395	-151.4
9.5		0.572	87.1	1.912	-31.0	0.191	19.7	0.436	-170.0
10.0		0.617	78.8	1.782	-41.3	0.201	13.7	0.475	172.1
10.5		0.664	73.4	1.663	-51.2	0.211	6.4	0.541	156.3
11.0		0.699	66.5	1.513	-61.8	0.210	-0.7	0.594	140.7
11.5		0.720	61.6	1.373	-72.1	0.211	-9.0	0.636	127.1
12.0		0.728	55.5	1.228	-83.1	0.207	-17.2	0.695	113.6
12.5		0.720	49.1	1.073	-34.6	0.196	-26.2	0.747	99.9
13.0		0.701	43.4	0.910	-107.7	0.172	-33.0	0.789	86.8
13.5		0.643	38.2	0.737	-121.2	0.150	-39.8	0.864	75.9
14.0		0.587	36.7	0.523	-137.3	0.119	-39.1	0.893	65.4

TYPICAL SCATTERING PARAMETERS, cont. ($T_A = 25^\circ\text{C}$)

NE52418

 $V_{CE} = 2.0\text{ V}$, $I_C = 10\text{ mA}$

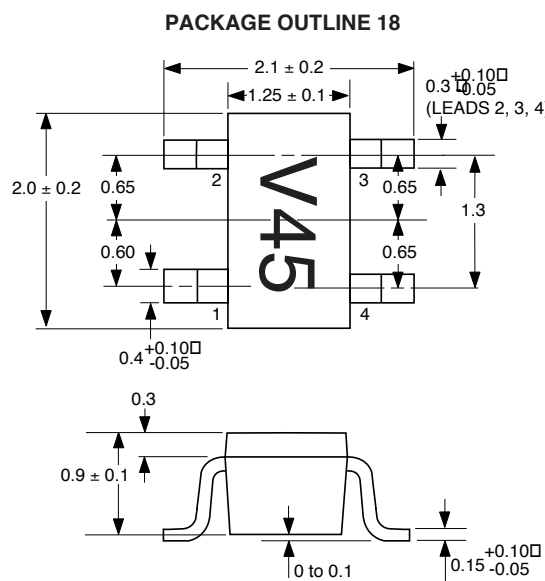
FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz		MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2.0		0.306	-95.3	8.717	91.6	0.051	59.1	0.556	-37.9
2.5		0.237	-111.7	7.212	82.2	0.060	60.0	0.512	-40.1
3.0		0.191	-128.4	6.201	73.3	0.067	55.4	0.478	-43.7
3.5		0.170	-148.2	5.469	65.9	0.077	55.5	0.451	-47.6
4.0		0.160	-168.5	4.904	58.7	0.086	54.3	0.430	-52.8
4.5		0.167	171.7	4.433	51.4	0.094	53.1	0.412	-57.5
5.0		0.181	156.2	4.093	44.6	0.106	51.6	0.398	-63.5
5.5		0.195	144.5	3.813	37.7	0.115	48.5	0.389	-69.9
6.0		0.216	134.5	3.553	30.7	0.126	45.8	0.376	-77.3
6.5		0.245	127.0	3.372	23.7	0.133	42.2	0.363	-82.9
7.0		0.266	117.7	3.192	16.8	0.143	38.0	0.343	-90.1
7.5		0.295	109.6	3.023	9.8	0.152	35.1	0.311	-97.6
8.0		0.325	103.3	2.897	2.0	0.165	30.8	0.293	-106.7
8.5		0.370	96.3	2.793	-6.0	0.179	27.3	0.271	-123.9
9.0		0.423	89.5	2.587	-14.5	0.188	21.0	0.260	-145.1
9.5		0.476	83.4	2.579	-23.3	0.201	15.5	0.292	-166.3
10.0		0.528	76.3	2.456	-33.0	0.208	8.6	0.337	172.9
10.5		0.580	71.2	2.317	-42.3	0.210	2.4	0.403	156.1
11.0		0.620	64.7	2.180	-52.8	0.213	-5.5	0.461	141.9
11.5		0.640	60.7	2.022	-63.2	0.212	-12.6	0.522	128.6
12.0		0.651	54.1	1.875	-74.8	0.205	-20.4	0.588	115.5
12.5		0.636	47.4	1.685	-88.3	0.191	-29.2	0.660	103.2
13.0		0.600	42.2	1.466	-103.2	0.173	-37.2	0.731	90.1
13.5		0.516	39.5	1.172	-120.4	0.145	-42.4	0.834	78.2
14.0		0.482	47.1	0.802	-139.8	0.112	-39.1	0.891	56.2

NE52418

 $V_{CE} = 2.0\text{ V}$, $I_C = 20\text{ mA}$

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz		MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2.0		0.188	-105.5	9.306	85.1	0.049	63.2	0.489	-35.0
2.5		0.140	-124.6	7.618	76.9	0.061	63.4	0.453	-37.3
3.0		0.117	-147.2	6.514	69.1	0.070	63.2	0.429	-40.1
3.5		0.116	-170.3	5.708	62.5	0.081	61.0	0.415	-44.6
4.0		0.124	169.2	5.092	56.0	0.091	58.6	0.390	-49.2
4.5		0.146	150.9	4.595	49.1	0.102	56.2	0.349	-55.5
5.0		0.164	138.1	4.239	42.8	0.112	52.0	0.361	-51.5
5.5		0.184	129.5	3.929	36.2	0.121	49.2	0.350	-67.5
6.0		0.207	124.1	3.675	29.6	0.131	45.9	0.336	-75.1
6.5		0.238	116.7	3.470	22.8	0.145	42.3	0.323	-81.2
7.0		0.262	110.1	3.278	16.1	0.154	37.9	0.299	-88.5
7.5		0.292	102.7	3.108	9.5	0.165	33.5	0.267	-96.6
8.0		0.322	97.6	2.971	2.1	0.174	27.1	0.246	-105.1
8.5		0.362	91.4	2.857	-5.7	0.183	24.6	0.221	-124.7
9.0		0.412	85.1	2.753	-13.8	0.196	19.0	0.210	-147.6
9.5		0.471	79.6	2.641	-22.4	0.203	13.6	0.243	-171.7
10.0		0.517	72.9	2.513	-31.4	0.209	6.2	0.292	167.0
10.5		0.565	68.3	2.387	-40.7	0.219	-0.8	0.359	151.4
11.0		0.607	62.5	2.264	-50.8	0.213	-7.8	0.424	137.4
11.5		0.630	58.3	2.091	-60.7	0.212	-14.5	0.476	124.7
12.0		0.635	51.3	1.960	-72.2	0.206	-22.0	0.548	113.2
12.5		0.616	44.7	1.783	-85.7	0.196	-31.7	0.619	101.4
13.0		0.574	39.1	1.571	-101.2	0.173	-40.0	0.700	89.7
13.5		0.476	37.7	1.265	-119.6	0.143	-45.5	0.815	78.0
14.0		0.442	48.7	0.859	-139.7	0.107	-43.6	0.887	66.5

PACKAGE DIMENSIONS (Units in mm)



ORDERING INFORMATION

PART NUMBER	QUANTITY
NE52418-T1-A	3 K pcs/Reel

Note: 8-mm wide embossed tape, pin 3 (Emitter), pin 4 (Collector) face perforated side of tape.

RECOMMENDED SOLDERING CONDITIONS

This product should be soldered under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your CEL Sales Representative.

SOLDERING METHOD	SOLDERING CONDITIONS	RECOMMENDED CONDITION SYMBOL
Infrared Reflow	Package Peak Temperature: 230 °C or below Time: 30 seconds or less (at 210 °C) Count: 3, Exposure limit: None ¹	IR30-00-3
VPS	Package Peak Temperature: 215 °C or below Time: 40 seconds or less (at 200 °C) Count: 2, Exposure limit: None ¹	VP15-00-2
WAVE SOLDERING	Soldering Bath Temperature: 260 °C or below Time: 10 seconds or less (at 200 °C) Count: 1, Exposure limit: None ¹	WS60-00-1
PARTIAL HEATING	Pin Temperature: 300 °C or below Time: 3 seconds or less (per side of device) Exposure limit: None ¹	—

Note:

1. After opening the dry pack, keep it in a place below 25 °C and 65% RH for the allowable storage period.

CAUTION:

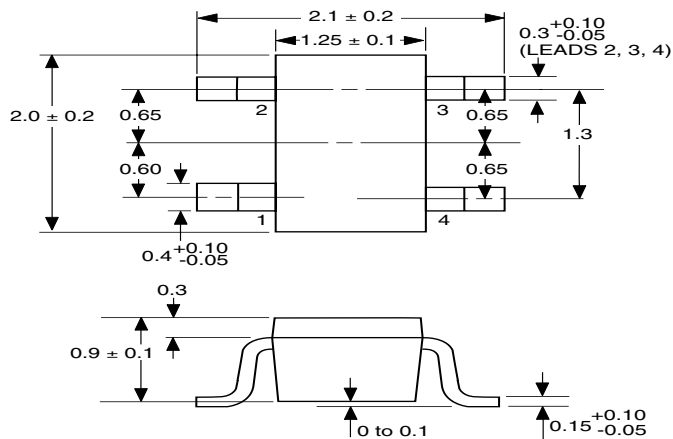
Do not use different soldering methods together (except for partial heating).

PRECAUTION:

Avoid high static voltage and electric fields.

NONLINEAR MODEL

SCHEMATIC



BJT NONLINEAR MODEL PARAMETERS ⁽¹⁾

Parameters	Q1	Parameters	Q1
IS	7.8e-25	MJC	0.07
BF	158	XCJC	0.2
NF	1.006	CJS	0
VAF	1000	VJS	0.75
IKF	1.95	MJS	0
ISE	6.36e-18	FC	0.5
NE	1.92	TF	2e-12
BR	1	XTF	3
NR	1	VTF	1
VAR	1000	ITF	0.05
IKR	1000	PTF	0
ISC	0	TR	50e-12
NC	2.0	EG	1.51
RE	1.5	XTB	0
RB	7	XTI	3
RBM	1	KF	0
IRB	1000	AF	1
RC	1.2		
CJE	0.27		
VJE	0.99		
MJE	0.21		
CJC	0.065e-12		
VJC	0.73		

ADDITIONAL PARAMETERS

Parameters	NE52418
CCB	0.02e-12
CCE	0.19e-12
LB	0.83e-9
Lc	0.8e-9
LE	0.2e-9
CCBPKG	0.002e-12
CCEPKG	0.05e-12
CBEPK	0.15e-12
LBX	0.55e-9
LCX	0.1e-9
LEX	0.05e-9

MODEL RANGE

Frequency: 0.3 to 10 GHz
 Bias: $V_{CE} = 0.7 \text{ V}$ to 2 V , $I_C = 1 \text{ mA}$ to 10 mA
 Date: 02/2002

(1) Gummel-Poon Model

Life Support Applications

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.

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04/22/03

NEC

A Business Partner of NEC Compound Semiconductor Devices, Ltd.

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL's understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

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