NEC

L TO S BAND LOW NOISE AMPLIFIER NPN GaAs HBT

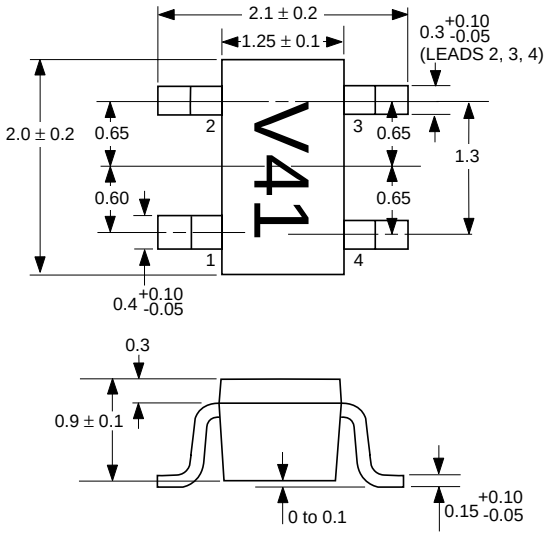
NE52118

FEATURES

- **HIGH POWER GAIN:**
  G_A = 15 dB TYP
  at f = 2 GHz, V_{CE} = 2 V, I_C = 3 mA, Z_S = Z_L = 50 Ω
- **LOW NOISE:**
  NF = 1.0 dB TYP
  at f = 2 GHz, V_{CE} = 2 V, I_C = 3 mA, Z_S = Z_L = 50 Ω
- **OIP_3 = 15 dBm TYP**
  at f = 2 GHz, V_{CE} = 2 V, I_C = 3 mA, Z_S = Z_L = 50 Ω
- **4 PIN SUPER MINI MOLD PACKAGE**
- **GROUNDED EMITTER TRANSISTOR**

PACKAGE DIMENSIONS (Units in mm)

PACKAGE OUTLINE 18



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

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER PACKAGE OUTLINE			NE52118 18		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
NF	Noise Figure at V_{CE} = 2 V, f = 2 Ghz, Z_S = Z_L = 50 Ω I_C = 3 mA I_C = 5 mA	dB	 — —	 1.0 1.0	 1.5 —
G_a	Associated Gain at V_{CE} = 2 V, f = 2 Ghz, Z_S = Z_L = 50 Ω I_C = 3 mA I_C = 5 mA	dB	— 13.5 —	— 15 16.3	— — —
OIP_3	Out Third - Order Distortion Intercept Point at V_{CE} = 2 V, f = 2 Ghz, Z_S = Z_L = 50 Ω, I_C = 3 mA	dBm	—	15	—
I_{EBO}	Emitter to Base Leakage Current at V_{EBO} = 3 V	μA	—	0.2	1.0
I_{CBO}	Collector to Base Leakage Current at V_{CBO} = 3 V	μA	—	0.2	1.0
I_{CEO}	Collector to Emitter Leakage Current, V_{CEO} = 5 V	μA	—	0.5	2.0
h_{FE}	DC Current Gain at V_{CE} = 2 V, I_C = 3 mA	—	50	90	140
V_{FBE}	Base to Emitter Forward Voltage at I_{BE} = 100 μA	V	1.0	1.2	1.4
V_{FBC}	Base to Collector Forward Voltage at I_{BE} = 100 μA	V	0.7	1.0	1.3

ABSOLUTE MAXIMUM RATINGS (T_A = +25°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	7
I_B	Base Current	mA	0.3
P_T	Total Power Dissipation	mW	30
T_j	Junction Temperature	°C	+125
T_{STG}	Storage Temperature	°C	-65 to +125

Note:
1. Operation in excess of any of these parameters may result in permanent damage.

RECOMMENDED OPERATING CONDITIONS (T_A = +25°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	-	3	6

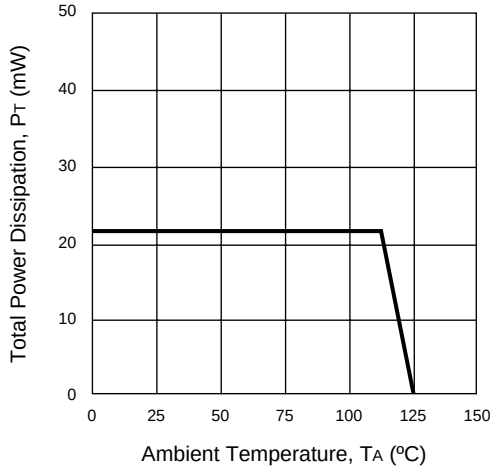
ORDERING INFORMATION

PART NUMBER	QUANTITY
NE52118-T1	3 K pcs/Reel

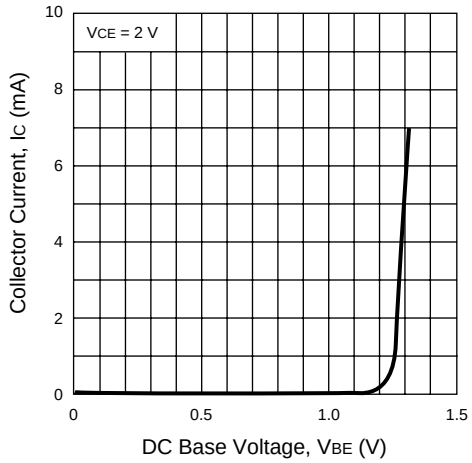
Note: 8-mm wide embossed tape, pin 3 (Emitter), pin 4 (Collector) face perforated side of tape.

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

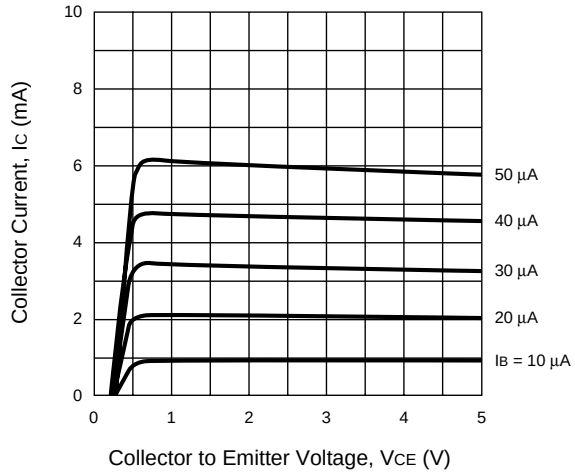
TOTAL POWER DISSIPATION VS. AMBIENT TEMPERATURE



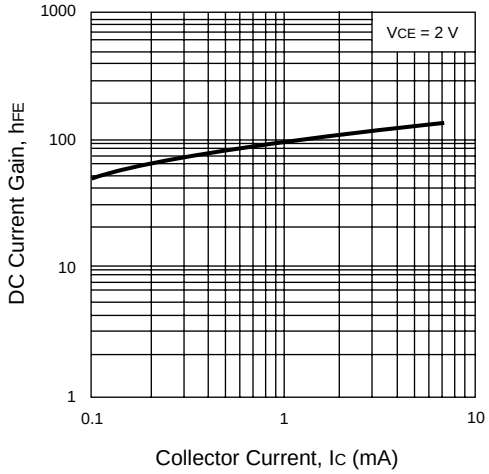
COLLECTOR CURRENT VS. DC BASE VOLTAGE



COLLECTOR CURRENT VS. COLLECTOR TO EMITTER VOLTAGE

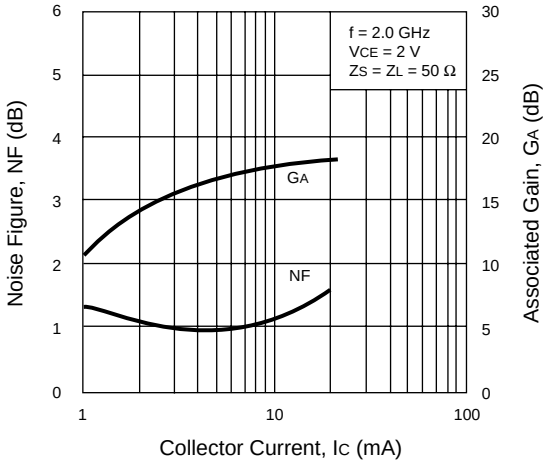


DC CURRENT GAIN VS. COLLECTOR CURRENT

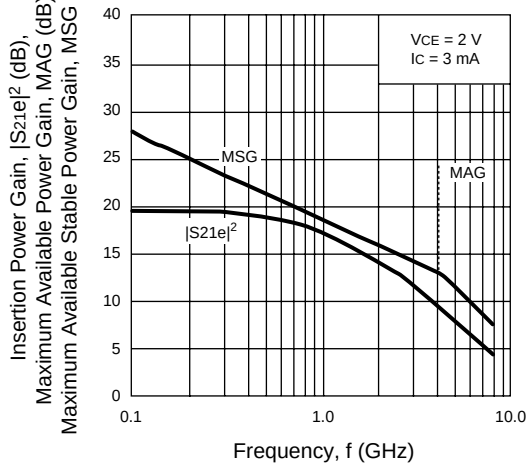


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

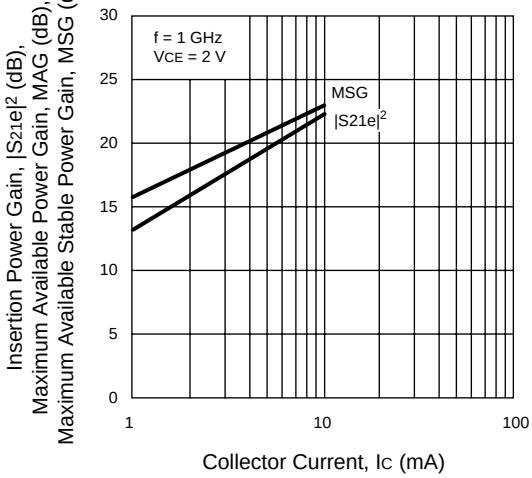
NOISE FIGURE, ASSOCIATED GAIN VS. COLLECTOR CURRENT



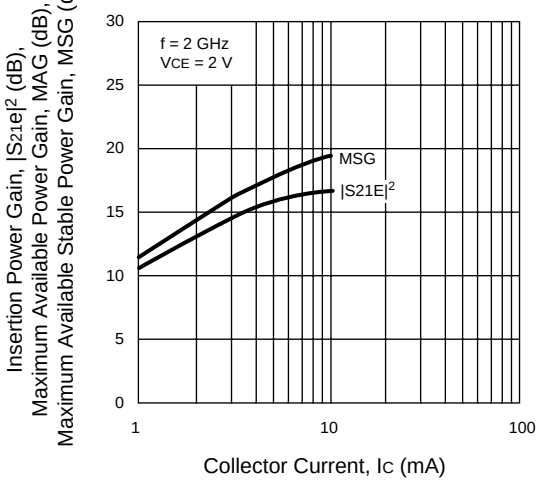
INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN VS. FRQUENCY



INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN VS. COLLECTOR CURRENT

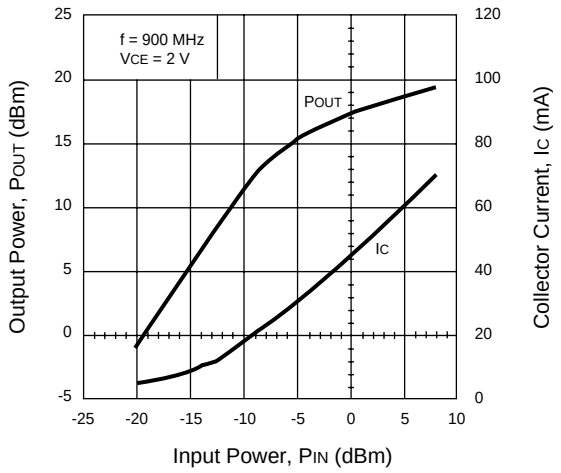


INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN VS. COLLECTOR CURRENT

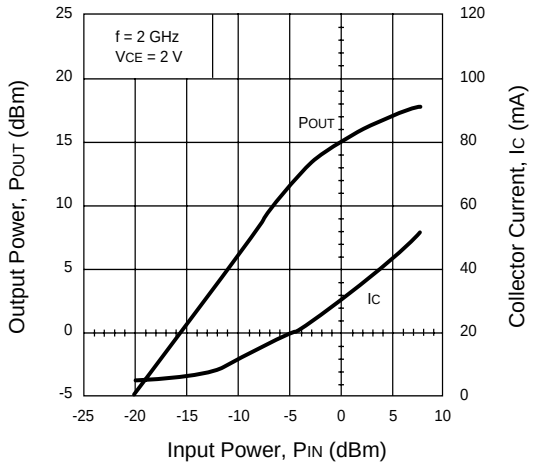


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

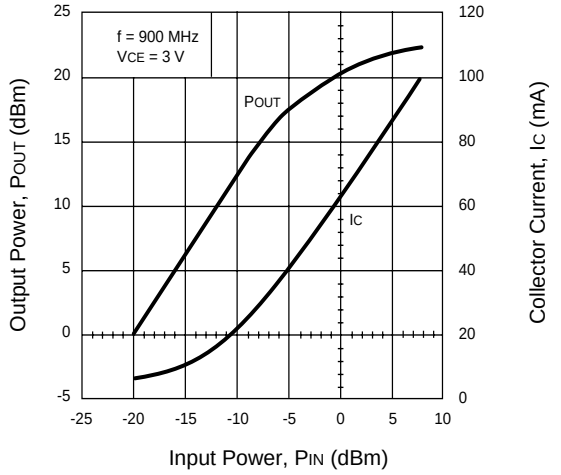
OUTPUT POWER AND COLLECTOR CURRENT VS. INPUT POWER



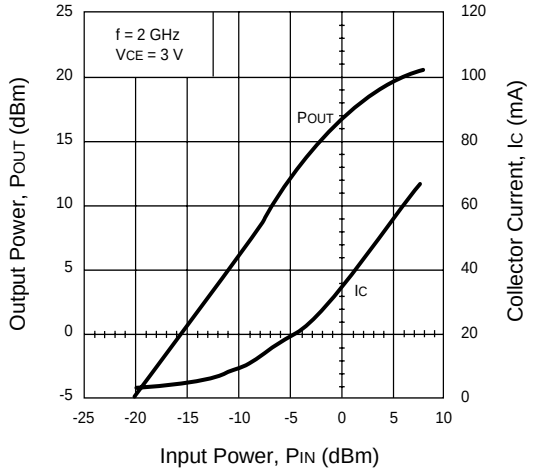
OUTPUT POWER AND COLLECTOR CURRENT VS. INPUT POWER



OUTPUT POWER AND COLLECTOR CURRENT VS. INPUT POWER



OUTPUT POWER AND COLLECTOR CURRENT VS. INPUT POWER



TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

NE52118
V_{CE} = 2.0 V, I_C = 3 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
400	0.878	-27.70	8.567	154.40	0.048	68.10	0.965	-23.20	0.18	36.72
500	0.868	-34.80	8.361	148.60	0.057	65.30	0.952	-27.60	0.17	34.77
600	0.849	-41.60	8.204	142.80	0.069	61.00	0.916	-32.60	0.22	31.75
700	0.836	-47.40	7.969	137.80	0.078	57.20	0.890	-37.10	0.24	30.07
800	0.806	-53.30	7.758	132.60	0.084	54.40	0.866	-41.50	0.25	28.39
900	0.790	-59.50	7.584	127.90	0.090	47.00	0.839	-45.20	0.31	27.14
1000	0.764	-64.60	7.242	123.10	0.096	45.90	0.819	-49.50	0.31	25.84
1100	0.740	-70.30	7.089	118.30	0.102	41.80	0.792	-53.80	0.33	24.75
1200	0.726	-75.40	6.860	114.20	0.108	39.30	0.752	-56.90	0.36	23.60
1300	0.715	-80.20	6.588	109.90	0.114	35.90	0.733	-60.00	0.38	22.83
1400	0.690	-84.30	6.397	105.30	0.115	33.20	0.713	-63.80	0.40	22.00
1500	0.679	-89.30	6.155	101.80	0.119	29.10	0.687	-66.00	0.43	21.25
1600	0.656	-93.30	5.968	98.20	0.124	27.90	0.660	-69.20	0.45	20.45
1700	0.640	-97.60	5.785	95.00	0.126	25.90	0.603	-71.60	0.46	19.80
1800	0.631	-101.40	5.559	91.10	0.129	23.90	0.617	-74.00	0.48	19.19
1900	0.612	-105.20	5.362	87.50	0.134	22.80	0.603	-76.50	0.50	18.58
2000	0.553	-109.5	5.094	84.90	0.131	19.50	0.529	-77.90	0.60	17.15
2100	0.541	-114.00	4.900	81.30	0.134	16.70	0.523	-81.20	0.61	16.70
2200	0.516	-117.60	4.774	78.20	0.132	16.00	0.495	-83.60	0.64	16.14
2300	0.501	-121.90	4.601	75.10	0.136	11.40	0.483	-85.90	0.67	15.67
2400	0.504	-125.00	4.499	72.30	0.137	11.20	0.471	-87.60	0.68	15.42
2500	0.503	-128.10	4.350	69.10	0.139	10.20	0.455	-90.30	0.69	15.04
2600	0.480	-132.70	4.229	66.30	0.138	9.20	0.428	-92.90	0.72	14.54
2700	0.476	-136.00	4.119	63.50	0.143	5.40	0.419	-93.50	0.74	14.25
2800	0.464	-140.50	4.007	60.30	0.138	6.50	0.399	-98.20	0.77	13.86
2900	0.453	-143.90	3.894	57.90	0.142	4.30	0.396	-99.30	0.78	13.55
3000	0.447	-147.90	3.778	54.90	0.140	4.00	0.377	-102.40	0.81	13.18
3500	0.433	-163.00	3.377	42.50	0.149	-5.10	0.324	-114.30	0.88	
4000	0.434	-179.90	3.000	30.10	0.149	-10.70	0.289	-127.60	0.95	
4500	0.433	166.00	2.730	18.30	0.152	-16.90	0.259	-141.00	1.02	11.68
5000	0.448	153.30	2.490	7.10	0.155	-23.00	0.250	-154.20	1.06	10.60
5500	0.467	141.70	2.291	-4.60	0.154	-27.50	0.240	-168.80	1.11	9.72
6000	0.484	131.90	2.104	-15.70	0.156	-33.60	0.247	176.70	1.14	9.03
6500	0.509	122.20	1.949	-26.90	0.161	-39.90	0.255	163.50	1.13	8.61
7000	0.540	113.40	1.809	-38.20	0.160	-45.20	0.269	147.10	1.14	8.26
7500	0.562	105.70	1.668	-49.00	0.161	-51.30	0.292	133.90	1.15	7.82
8000	0.595	97.90	1.543	-59.7	0.157	-56.00	0.329	122.10	1.13	7.72

Note:
1. Gain Calculation:

MAG = $\frac{|S_{21}|}{|S_{12}|}\left(K - \sqrt{K^2 - 1}\right)$. When K ≤ 1, MAG is undefined and MSG values are used. MSG = $\frac{|S_{21}|}{|S_{12}|}$, K = $\frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}\,S_{21}|}$, $\Delta = S_{11}\,S_{22} - S_{21}\,S_{12}$

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

NE52118
V_{CE} = 2.0 V, I_C = 5 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
400	0.816	-37.60	13.111	147.80	0.044	62.40	0.921	-30.60	0.22	35.28
500	0.793	-46.00	12.508	141.60	0.052	59.80	0.894	-36.20	0.22	33.23
600	0.767	-54.80	12.024	134.90	0.062	56.70	0.844	-42.50	0.24	30.85
700	0.738	-62.30	11.440	129.00	0.067	50.80	0.800	-47.70	0.29	29.02
800	0.705	-68.80	10.904	123.40	0.072	48.10	0.764	-52.60	0.31	27.55
900	0.679	-76.10	10.463	118.10	0.078	43.70	0.730	-56.90	0.35	26.37
1000	0.654	-81.50	9.832	113.70	0.082	40.50	0.692	-60.90	0.39	25.11
1100	0.631	-88.00	9.389	108.40	0.085	38.40	0.665	-65.80	0.40	24.19
1200	0.607	-93.60	8.911	104.80	0.089	36.00	0.624	-68.70	0.43	23.14
1300	0.595	-98.80	8.461	100.40	0.092	34.70	0.595	-72.00	0.45	22.35
1400	0.573	-103.30	8.137	96.40	0.097	31.40	0.579	-75.70	0.48	21.71
1500	0.562	-108.00	7.761	92.90	0.097	30.90	0.550	-77.70	0.50	21.01
1600	0.545	-112.10	7.415	89.30	0.101	28.00	0.527	-80.80	0.53	20.35
1700	0.528	-116.40	7.119	86.30	0.103	27.40	0.503	-82.70	0.55	19.74
1800	0.522	-120.00	6.783	83.10	0.105	25.00	0.481	-85.30	0.58	19.15
1900	0.507	-123.70	6.491	79.80	0.109	24.10	0.467	-87.60	0.60	18.60
2000	0.459	-129.10	6.123	77.50	0.106	22.50	0.401	-89.30	0.70	17.53
2100	0.450	-133.60	5.908	74.00	0.108	20.80	0.394	-92.10	0.71	17.14
2200	0.435	-137.70	5.663	71.40	0.107	20.00	0.375	-95.10	0.75	16.63
2300	0.423	-141.90	5.454	68.70	0.110	17.70	0.364	-98.00	0.76	16.21
2400	0.428	-144.70	5.287	66.10	0.113	18.10	0.348	-99.50	0.77	15.90
2500	0.426	-147.00	5.111	63.50	0.115	17.10	0.338	-102.30	0.79	15.57
2600	0.416	-152.50	4.940	60.80	0.116	14.90	0.317	-104.70	0.82	15.16
2700	0.412	-155.70	4.788	58.40	0.120	14.10	0.308	-105.90	0.83	14.84
2800	0.404	-159.30	4.634	55.50	0.120	13.50	0.295	-110.30	0.85	14.49
2900	0.401	-162.40	4.491	53.20	0.120	10.50	0.292	-112.10	0.87	14.20
3000	0.394	-166.00	4.360	50.50	0.122	9.60	0.276	-115.90	0.90	13.87
3500	0.398	179.50	3.831	39.20	0.126	3.80	0.243	-129.10	0.97	
4000	0.416	164.90	3.362	27.70	0.139	-0.60	0.219	-144.80	0.99	
4500	0.422	152.30	3.050	16.50	0.142	-6.90	0.208	-160.30	1.04	12.07
5000	0.444	141.70	2.779	5.90	0.149	-12.70	0.211	-174.90	1.05	11.35
5500	0.469	131.70	2.540	-5.1	0.153	-17.70	0.216	170.70	1.07	10.60
6000	0.487	123.50	2.333	-15.60	0.160	-24.20	0.234	156.90	1.06	8.78
6500	0.514	115.10	2.149	-26.10	0.162	-30.50	0.246	144.70	1.07	9.56
7000	0.551	107.50	1.988	-36.90	0.168	-37.70	0.273	130.70	1.03	9.69
7500	0.572	100.50	1.826	-47.10	0.170	-44.90	0.300	119.30	1.03	9.30
8000	0.605	93.50	1.695	-57.60	0.175	-51.70	0.344	109.30	0.95	

Note:
1. Gain Calculation:

MAG = $\frac{|S_{21}|}{|S_{12}|}\left(K - \sqrt{K^2 - 1}\right)$. When K ≤ 1, MAG is undefined and MSG values are used. MSG = $\frac{|S_{21}|}{|S_{12}|}$, K = $\frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}\,S_{21}|}$, $\Delta = S_{11}\,S_{22} - S_{21}\,S_{12}$

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

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.