NEC's 3.0 V, 0.25 W L&S-BAND MEDIUM POWER SILICON LD-MOSFET

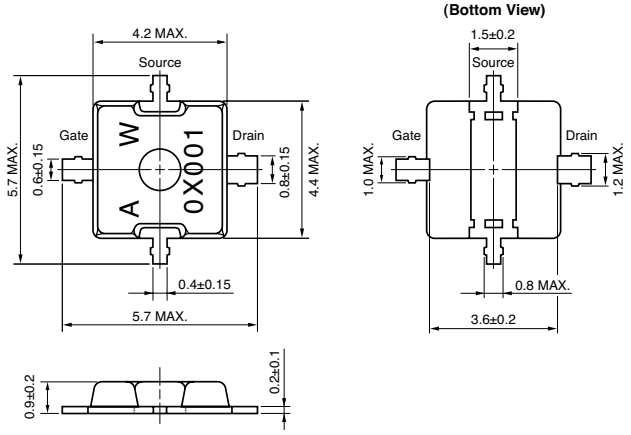
NE552R479A

FEATURES

- **LOW COST PLASTIC SURFACE MOUNT PACKAGE**
- **HIGH OUTPUT POWER:** +26 dBm TYP at V_{DS} = 3.0 V
- **HIGH LINEAR GAIN:** 11 dB TYP @ 2.45 GHz
- **SINGLE SUPPLY:** 2.8 to 6 V
- **SURFACE MOUNT PACKAGE:** 5.7x5.7x1.1 mm MAX

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE 79A



DESCRIPTION

NEC's NE552R479A is an N-Channel silicon power laterally diffused MOSFET specially designed as the transmission power amplifier for mobile and fixed wireless applications. Die are manufactured using NEC's NEWMOS2 technology (NEC's 0.6 μm WSi gate lateral MOSFET) and housed in a surface mount package.

APPLICATIONS

- **DIGITAL CELLULAR PHONES:**
  3.0 V GSM1900 Pre Driver
- **ANALOG CELLULAR PHONES:**
  2.4 V AMPS Handsets
- **OTHERS:**
  W-LAN
  Short Range Wireless
  Retail Business Radio
  Special Mobile Radio

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER / PACKAGE OUTLINE				NE552R479A 79A			
	SYMBOLS	CHARACTERISTICS	UNITS	MIN	TYP	MAX	TEST CONDITIONS
Functional Characteristics	P_{OUT}	Output Power	dBm	24.0	26.0		f = 2.45 GHz, V_{DS} = 3.0 V, I_{DSQ} = 200 mA (RF OFF) P_{in} = 19 dBm, except Pin = 10 dBm for linear gain
	G_L	Linear Gain	dB		11.0		
	η_{ADD}	Power Added Efficiency	%	35	45		
	I_D	Drain Current	A		230		
Electrical DC Characteristics	I_{GSS}	Gate-to-Source Leakage Current	nA			100	V_{GS} = 5.0 V
	I_{DSS}	Saturated Drain Current (Zero Gate Voltage Drain Voltage)	nA			100	V_{DS} = 6.0 V
	V_{TH}	Gate Threshold Voltage	V	1	1.4	1.9	V_{DS} = 3.5 V, I_{DS} = 1 mA
	g_m	Transconductance	S		0.4		V_{DS} = 3.5 V, I_{DS} = 100 mA
	BV_{DSS}	Drain-to-Source Breakdown Voltage	V	15	18		I_{DSS} = 10 μA
	RTH	Thermal Resistance	°C/W			10	Channel-to-Case

Notes:
1. DC performance is tested 100%. Several samples per wafer are tested for RF performance. Wafer rejection criteria for standard devices is 1 reject for several samples.

ABSOLUTE MAXIMUM RATINGS[1] (T_A = 25 °C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{DS}	Drain Supply Voltage	V	15.0
V_{GS}	Gate Supply Voltage	V	5.0
I_{DS}	Drain Current	mA	300
I_{DS}	Drain Current (Pulse Test)[2]	mA	600
P_T	Total Power Dissipation	W	10
T_{CH}	Channel Temperature	°C	125
T_{STG}	Storage Temperature	°C	-55 to +125

Notes:
1. Operation in excess of any one of these parameters may result in permanent damage.
2. Duty cycle 50%, Ton ≤ 1 s.

RECOMMENDED OPERATING LIMITS

SYMBOLS	PARAMETERS	UNITS	TYP	MAX
V_{DS}	Drain to Source Voltage	V	3.0	6.0
V_{GS}	Gate Supply Voltage	V	2.0	3.0
I_{DS}	Drain Current[1]	mA	200	500
P_{IN}	Input Power[2]	dBm	19	25

Notes:
1. Duty cycle 50%, Ton ≤ 1 s.
2. f = 2.45 GHz, V_{DS} = 3.0 V.

LARGE SIGNAL IMPEDANCE

(V_{DS} = 3.0 V, I_D = 200 mA, f = 2.45 GHz, P_{out} = 400 mW)

FREQUENCY (GHz)	Z_{in} (Ω)	Z_{OL} (Ω)[1]
2.45	2.96 –j7.78	3.36 –j8.42

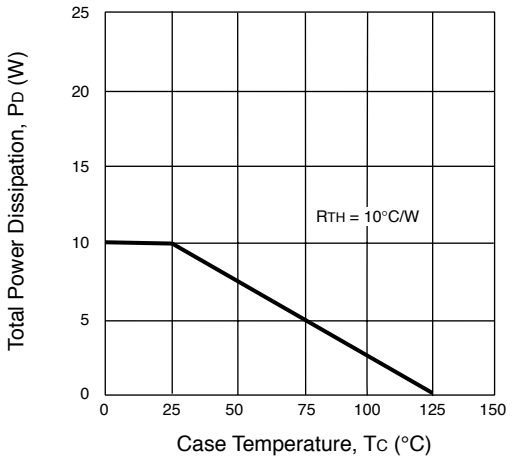
Note:
1. Z_{OL} is the conjugate of optimum load impedance at given voltage, idling current, input power and frequency.

ORDERING INFORMATION

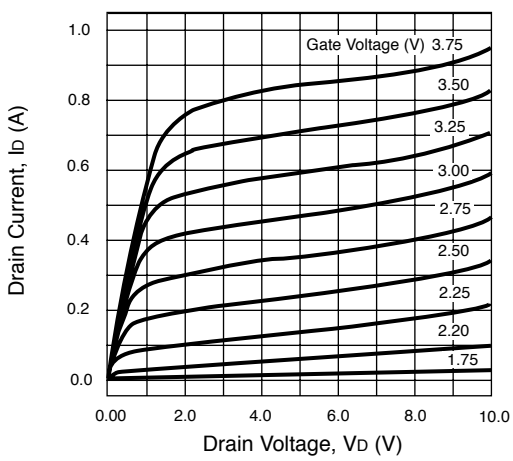
PART NUMBER	QTY
NE552R479A-T1A-A	• 12 mm wide embossed taping. • Gate pin faces the perforation side of the tape. • 5 kpcs/Reel

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

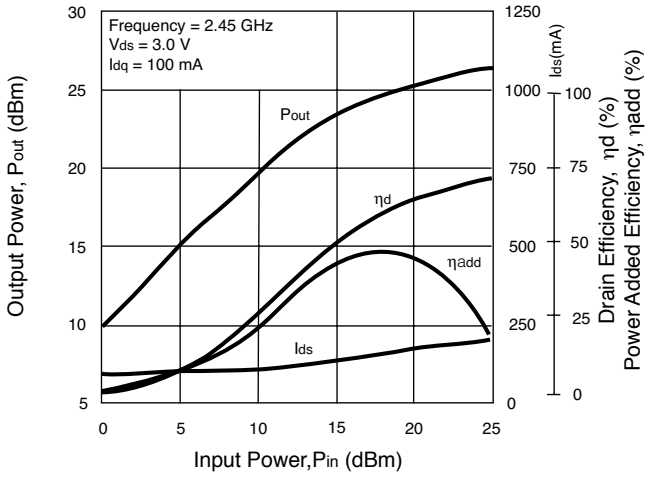


DRAIN CURRENT vs. DRAIN VOLTAGE

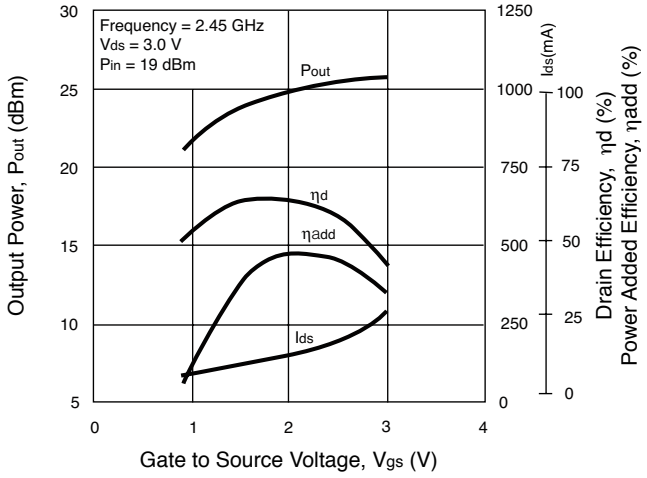


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

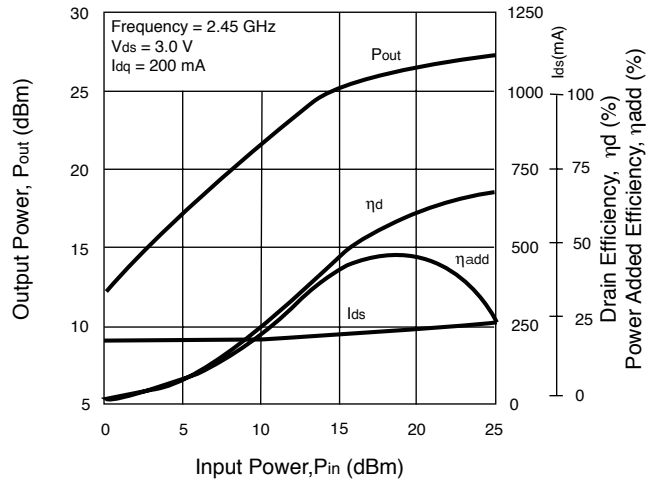
OUTPUT POWER, DRAIN CURRENT EFFICIENCY vs. INPUT POWER



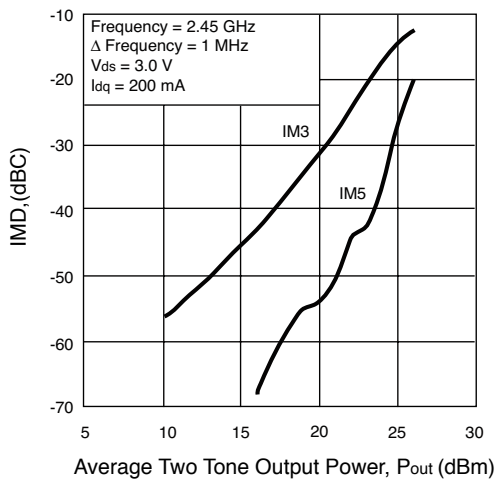
OUTPUT POWER, DRAIN CURRENT EFFICIENCY vs. GATE TO SOURCE VOLTAGE



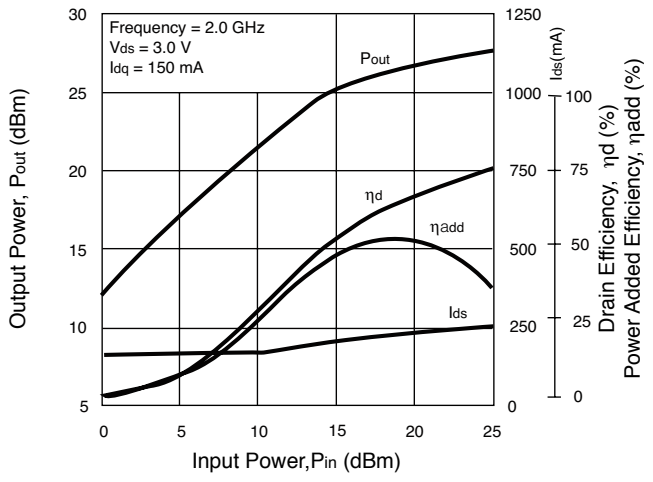
OUTPUT POWER, DRAIN CURRENT EFFICIENCY vs. INPUT POWER



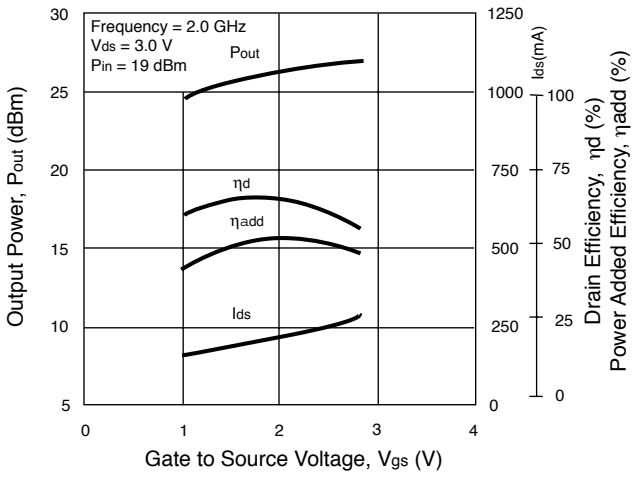
IMD vs. TWO TONE OUTPUT POWER



OUTPUT POWER, DRAIN CURRENT EFFICIENCY vs. INPUT POWER

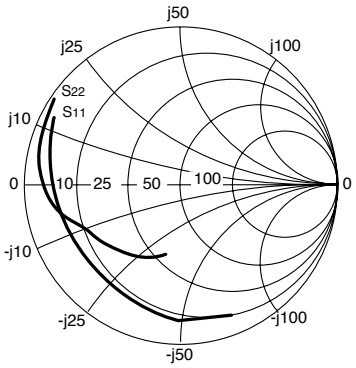


OUTPUT POWER, DRAIN CURRENT EFFICIENCY vs. GATE TO SOURCE VOLTAGE

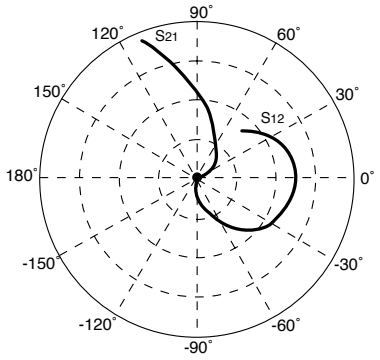


TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

Note: This file and many other s-parameter files can be downloaded from www.cel.com



Coordinates in Ohms
Frequency in GHz
V_D = 2.4 V, I_D = 50 mA



NE552R479A
V_D = 2.4 V, I_D = 50 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.10	0.877	- 70.3	13.863	135.4	0.042	46.6	0.452	-104.4	0.05	25.15
0.20	0.806	-108.8	9.339	111.6	0.057	23.4	0.569	-132.8	0.05	22.13
0.30	0.775	-129.7	6.708	97.4	0.061	9.6	0.614	-145.1	0.07	20.43
0.40	0.764	-142.5	5.130	87.2	0.062	0.6	0.641	-151.6	0.09	19.17
0.50	0.760	-151.0	4.102	79.2	0.061	- 7.0	0.663	-155.4	0.12	18.24
0.60	0.765	-157.3	3.378	72.3	0.060	- 13.0	0.681	-158.2	0.14	17.49
0.70	0.771	-162.3	2.846	66.1	0.059	- 18.2	0.699	-160.3	0.17	16.85
0.80	0.781	-166.4	2.437	60.6	0.057	- 23.0	0.717	-161.9	0.20	16.32
0.90	0.792	-170.0	2.113	55.5	0.055	- 27.3	0.734	-163.4	0.22	15.86
1.00	0.805	-173.2	1.854	50.6	0.053	- 31.4	0.751	-164.8	0.23	15.46
1.10	0.816	-176.0	1.644	46.2	0.051	- 34.8	0.770	-166.0	0.23	15.11
1.20	0.829	-178.7	1.458	41.7	0.048	- 38.5	0.781	-167.7	0.27	14.80
1.30	0.838	178.6	1.304	37.5	0.046	- 41.8	0.793	-169.1	0.31	14.53
1.40	0.848	176.4	1.172	33.7	0.044	- 44.9	0.806	-170.4	0.33	14.29
1.50	0.855	174.2	1.057	30.0	0.041	- 47.6	0.818	-171.7	0.38	14.07
1.60	0.861	172.2	0.958	26.5	0.039	- 50.3	0.830	-173.1	0.43	13.89
1.70	0.866	170.3	0.871	23.3	0.037	- 52.4	0.841	-174.5	0.49	13.72
1.80	0.872	168.5	0.795	20.3	0.035	- 54.4	0.851	-175.9	0.56	13.61
1.90	0.877	166.8	0.729	17.3	0.033	- 56.7	0.861	-177.4	0.61	13.49
2.00	0.883	165.2	0.671	14.6	0.031	- 58.7	0.870	-178.8	0.65	13.39
2.10	0.889	163.8	0.619	11.9	0.029	- 60.2	0.878	179.7	0.68	13.29
2.20	0.895	162.3	0.572	9.3	0.027	- 62.1	0.885	178.2	0.74	13.22
2.30	0.901	161.1	0.531	6.9	0.026	- 63.8	0.892	176.8	0.76	13.14
2.40	0.905	159.8	0.493	4.5	0.024	- 65.6	0.898	175.2	0.82	13.07
2.50	0.909	158.8	0.459	2.2	0.023	- 67.3	0.903	173.8	0.89	13.05
2.60	0.909	157.8	0.427	0.1	0.021	- 68.8	0.909	172.3	1.02	12.11
2.70	0.911	157.0	0.399	- 1.9	0.019	- 71.4	0.914	170.8	1.19	10.52
2.80	0.910	156.3	0.373	- 3.8	0.018	- 74.0	0.919	169.1	1.41	9.38
2.90	0.912	155.7	0.350	- 5.5	0.016	- 74.2	0.924	167.5	1.55	8.93
3.00	0.912	155.1	0.329	- 7.2	0.015	- 74.8	0.927	166.0	1.82	8.26
3.10	0.915	154.8	0.311	- 8.8	0.014	- 75.5	0.932	164.4	1.90	8.13
3.20	0.916	154.2	0.294	- 10.4	0.012	- 77.4	0.935	162.9	2.19	7.63
3.30	0.919	153.8	0.278	- 11.9	0.011	- 77.8	0.939	161.3	2.41	7.39
3.40	0.920	153.4	0.263	- 13.4	0.010	- 79.9	0.943	159.6	2.77	7.11
3.50	0.922	153.1	0.251	- 14.8	0.008	- 80.8	0.948	157.9	3.15	6.98
3.60	0.923	153.0	0.239	- 16.1	0.007	- 78.5	0.951	156.1	3.72	6.76
3.70	0.924	153.0	0.228	- 17.4	0.006	- 75.4	0.953	154.1	4.29	6.58
3.80	0.924	153.1	0.217	- 18.7	0.005	- 73.6	0.957	152.1	4.86	6.47
3.90	0.925	153.5	0.208	- 19.9	0.004	- 70.4	0.960	149.6	6.62	6.36
4.00	0.925	154.1	0.200	- 21.2	0.003	- 50.4	0.961	146.8	9.58	5.98

Note:
1. Gain Calculation:

$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right)$. When $K \le 1$, 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)

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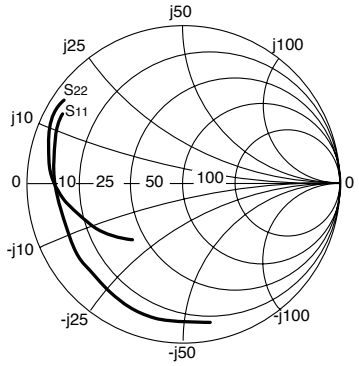
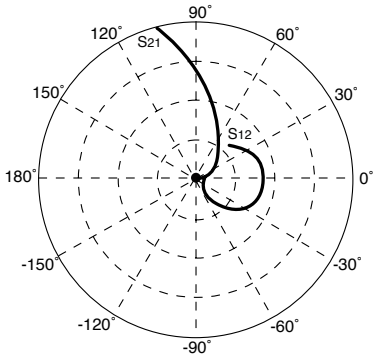


Coordinates in Ohms
Frequency in GHz
V_D = 3.5 V, I_D = 200 mA



NE552R479A
V_D = 3.5 V, I_D = 200 mA

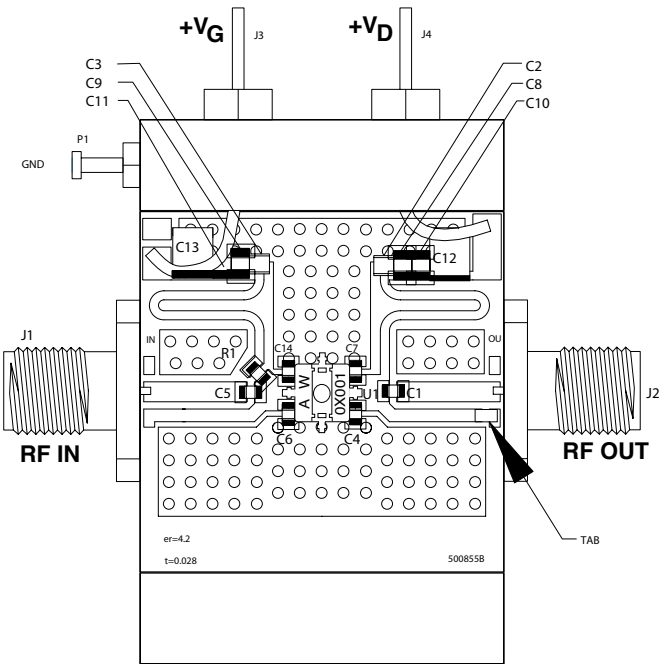
FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.10	0.881	- 80.4	17.975	132.9	0.030	44.0	0.490	-134.7	0.06	27.71
0.20	0.833	-119.4	11.643	110.6	0.039	22.1	0.623	-151.5	0.06	24.72
0.30	0.813	-139.1	8.264	98.2	0.042	10.8	0.666	-159.4	0.08	22.98
0.40	0.805	-151.0	6.317	89.6	0.042	3.3	0.689	-163.6	0.11	21.78
0.50	0.800	-158.9	5.073	82.9	0.042	- 1.9	0.704	-166.2	0.14	20.83
0.60	0.801	-164.7	4.206	77.2	0.042	- 6.9	0.714	-168.1	0.17	20.04
0.70	0.802	-169.3	3.577	72.1	0.041	- 10.8	0.725	-169.4	0.21	19.42
0.80	0.807	-173.1	3.093	67.4	0.040	- 14.2	0.735	-170.5	0.24	18.89
0.90	0.812	-176.3	2.711	63.1	0.039	- 17.7	0.744	-171.5	0.26	18.42
1.00	0.820	-179.2	2.405	58.9	0.038	- 20.7	0.754	-172.3	0.28	18.03
1.10	0.827	178.4	2.158	55.1	0.037	- 23.6	0.767	-173.0	0.29	17.66
1.20	0.836	175.9	1.936	51.1	0.036	- 26.4	0.773	-174.2	0.32	17.37
1.30	0.840	173.6	1.752	47.4	0.034	- 28.9	0.781	-175.1	0.37	17.06
1.40	0.847	171.8	1.592	43.9	0.033	- 30.9	0.790	-176.0	0.41	16.86
1.50	0.851	169.8	1.452	40.4	0.032	- 33.7	0.799	-176.9	0.45	16.63
1.60	0.854	168.1	1.331	37.3	0.030	- 35.5	0.808	-177.8	0.51	16.44
1.70	0.857	166.4	1.223	34.2	0.029	- 37.3	0.817	-178.8	0.58	16.28
1.80	0.861	164.9	1.127	31.3	0.027	- 39.0	0.824	-179.9	0.66	16.15
1.90	0.865	163.5	1.044	28.4	0.026	- 40.7	0.833	178.9	0.69	15.97
2.00	0.870	162.1	0.969	25.8	0.025	- 41.6	0.841	177.8	0.76	15.91
2.10	0.875	160.9	0.902	23.1	0.024	- 43.3	0.849	176.7	0.81	15.82
2.20	0.880	159.6	0.841	20.5	0.023	- 44.3	0.855	175.5	0.85	15.69
2.30	0.885	158.5	0.786	18.0	0.022	- 45.3	0.862	174.2	0.88	15.62
2.40	0.889	157.5	0.736	15.6	0.020	- 46.9	0.869	172.9	0.96	15.60
2.50	0.892	156.6	0.689	13.3	0.019	- 48.5	0.875	171.6	1.03	14.40
2.60	0.893	155.7	0.646	11.0	0.018	- 49.6	0.881	170.3	1.17	13.05
2.70	0.895	155.0	0.607	9.0	0.017	- 50.5	0.886	169.0	1.32	12.20
2.80	0.894	154.5	0.571	6.9	0.015	- 53.1	0.891	167.5	1.61	11.19
2.90	0.895	153.9	0.540	5.0	0.014	- 52.4	0.897	166.1	1.81	10.71
3.00	0.896	153.5	0.511	3.2	0.013	- 50.3	0.902	164.7	2.08	10.17
3.10	0.899	153.2	0.485	1.5	0.012	- 50.7	0.907	163.2	2.11	10.09
3.20	0.900	152.8	0.460	- 0.3	0.011	- 51.9	0.911	161.7	2.44	9.58
3.30	0.903	152.4	0.438	- 1.9	0.010	- 49.9	0.915	160.3	2.77	9.33
3.40	0.904	152.0	0.417	- 3.6	0.009	- 47.2	0.920	158.7	3.09	9.09
3.50	0.906	151.9	0.398	- 5.1	0.008	- 44.6	0.925	157.0	3.35	8.98
3.60	0.907	151.8	0.381	- 6.7	0.007	- 38.1	0.928	155.3	3.93	8.65
3.70	0.909	151.8	0.365	- 8.3	0.006	- 33.2	0.932	153.4	4.17	8.53
3.80	0.908	152.1	0.350	- 9.7	0.005	- 26.9	0.936	151.5	4.98	8.21
3.90	0.910	152.5	0.337	- 11.2	0.005	- 15.3	0.940	149.0	4.88	8.20
4.00	0.910	153.1	0.325	- 12.8	0.005	- 4.5	0.941	146.3	4.94	7.84

Note:
1. Gain Calculation:

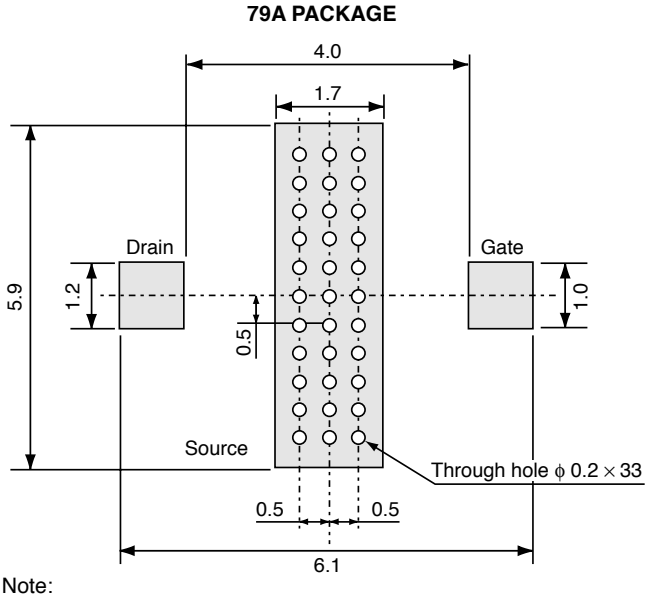
$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right)$. When $K \le 1$, MAG is undefined and MSG values are used. $MSG = \frac{|S_{21}|}{|S_{12}|}$, $K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}\,S_{21}|}$, $\Delta = S_{11}\,S_{22} - S_{21}\,S_{12}$

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

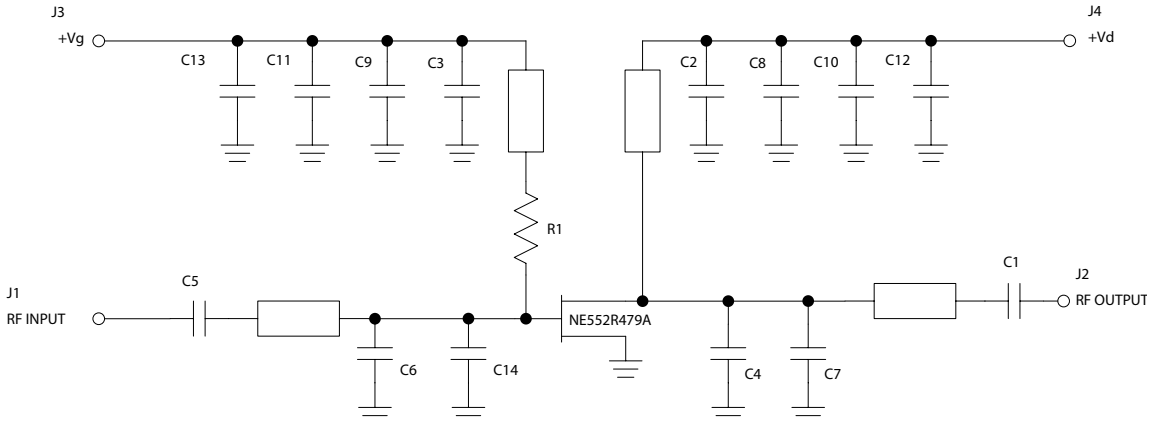
APPLICATION CIRCUIT (2.40-2.48 GHz)



P.C.B. LAYOUT (Units in mm)



Note:
Use rosin or other material to prevent solder from penetrating through-holes.

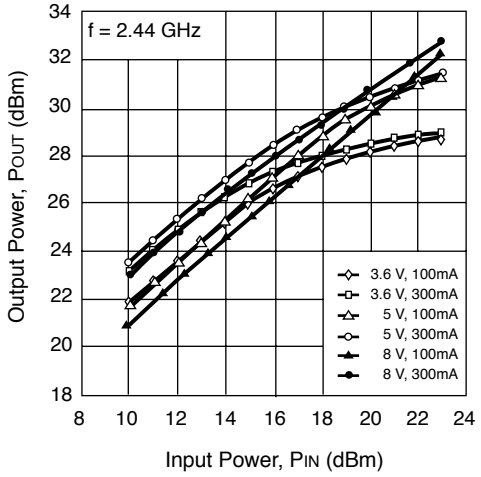


NE552R479A PARTS LIST

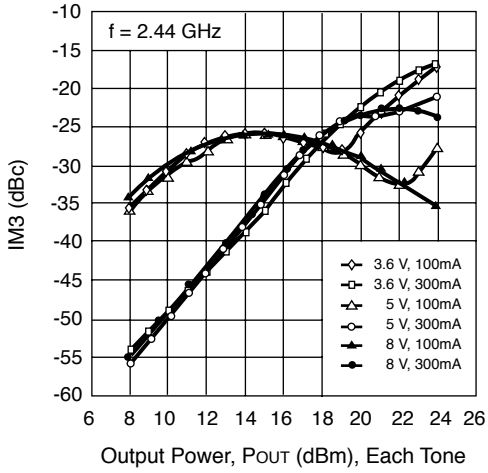
1	600S3R3CW	C14	0603 3.3 pF CAP ATC	17
1	TF-100637		TEST CIRCUIT BLK	15
4			2-56 x 3/16 PHILLIPS PAN HEAD	14
2	MCH185A101JK	C2,C3	0603 100pF CAP ROHM	13
1	MCR03J200	R1	0603 20 OHM RESISTOR ROHM	12
2	600S2R7BW	C4,C7	0603 2.7pF CAP ATC	11
2	600S5R6CW	C1,C5	0603 5.6pF CAP ATC	10
1	600S1R5CW	C6	0805 1.5pF CAP ATC	9
2	TAJB475K010R	C12, C13	CASE B 4.7 uF CAP AVX	8
2	MCH215F104ZP	C10, C11	0805 .1uF CAP ROHM	7
2	0805CG102J9BB04	C8, C9	0805 1000 pF CAP PHIL6	
1	NE552R479A	U1	IC NEC	5
1	703401	P1	GROUND LUG CONCORD	4
1	1250-003	J3, J4	FEEDTHRU MURATA	3
2	2052-5636-02	J1, J2	FLANGE MOUNT JACK RECEPTACLE	2
1	FD-500855B	PCB	S-BAND MODULE FABRICATION DRAWING	1

TYPICAL APPLICATION CIRCUIT PERFORMANCE (T_A = 25°C)

OUTPUT POWER vs. INPUT POWER



IM3 vs. OUTPUT POWER



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 nearby sales office.

Soldering Method	Soldering Conditions		Condition Symbol
Infrared Reflow	Peak temperature (package surface temperature)	: 260°C or below	IR260
	Time at peak temperature	: 10 seconds or less	
	Time at temperature of 220°C or higher	: 60 seconds or less	
	Preheating time at 120 to 180°C	: 120±30 seconds	
	Maximum number of reflow processes	: 3 times	
	Maximum chlorine content of rosin flux (% mass)	: 0.2%(Wt.) or below	
VPS	Peak temperature (package surface temperature)	: 215°C or below	VP215
	Time at temperature of 200°C or higher	: 25 to 40 seconds	
	Preheating time at 120 to 150°C	: 30 to 60 seconds	
	Maximum number of reflow processes	: 3 times	
	Maximum chlorine content of rosin flux (% mass)	: 0.2%(Wt.) or below	
Wave Soldering	Peak temperature (molten solder temperature)	: 260°C or below	WS260
	Time at peak temperature	: 10 seconds or less	
	Preheating temperature (package surface temperature)	: 120°C or below	
	Maximum number of flow processes	: 1 time	
	Maximum chlorine content of rosin flux (% mass)	: 0.2%(Wt.) or below	
Partial Heating	Peak temperature (pin temperature)	: 350°C or below	HS350-P3
	Soldering time (per pin of device)	: 3 seconds or less	
	Maximum chlorine content of rosin flux (% mass)	: 0.2%(Wt.) or below	

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

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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	
Lead (Pb)	< 1000 PPM	-A	-AZ
		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.