

4.8 V OPERATION SILICON RF POWER LD-MOS FET FOR 1.9 GHz 1 W TRANSMISSION AMPLIFIERS

DESCRIPTION

The NE5500179A is an N-channel silicon power MOS FET specially designed as the transmission driver amplifier for 4.8 V GSM 1 800 and GSM 1 900 handsets. Dies are manufactured using NEC's NEWMOS technology (NEC's 0.6 μm WSi gate lateral-diffusion MOS FET) and housed in a surface mount package. The device can deliver 30.0 dBm output power with 55% power added efficiency at 1.9 GHz under the 4.8 V supply voltage, or can deliver 27 dBm output power with 50% power added efficiency at 3.5 V, respectively.

FEATURES

- High output power : $P_{\text{out}} = 30.0$ dBm TYP. ($V_{\text{DS}} = 4.8$ V, $I_{\text{Dset}} = 200$ mA, $f = 1.9$ GHz, $P_{\text{in}} = 20$ dBm)
- High power added efficiency : $\eta_{\text{add}} = 55\%$ TYP. ($V_{\text{DS}} = 4.8$ V, $I_{\text{Dset}} = 200$ mA, $f = 1.9$ GHz, $P_{\text{in}} = 20$ dBm)
- High linear gain : $G_{\text{L}} = 14.0$ dB TYP. ($V_{\text{DS}} = 4.8$ V, $I_{\text{Dset}} = 200$ mA, $f = 1.9$ GHz, $P_{\text{in}} = 10$ dBm)
- Surface mount package : $5.7 \times 5.7 \times 1.1$ mm MAX.
- Single supply : $V_{\text{DS}} = 3.0$ to 6.0 V

APPLICATIONS

- Digital cellular phones : 4.8 V driver amplifier for GSM 1 800/ GSM 1 900 class 1 handsets, or 4.8 V final stage amplifier
- Digital cordless phones : 3.5 V final stage amplifier for DECT
- Others : General purpose amplifiers for 1.6 to 2.5 GHz TDMA applications

ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form
NE5500179A-T1	79A	R1	<ul style="list-style-type: none"> • 12 mm wide embossed taping • Gate pin face the perforation side of the tape • Qty 1 kpcs/reel

Remark To order evaluation samples, consult your NEC sales representative.
Part number for sample order: NE5500179A

Caution Please handle this device at static-free workstation, because this is an electrostatic sensitive device.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C)

Parameter	Symbol	Ratings	Unit
Drain to Source Voltage	V _{DS}	8.5	V
Gate to Source Voltage	V _{GSO}	5.0	V
Drain Current	I _D	0.25	A
Drain Current (Pulse Test)	I _D ^{Note}	0.5	A
Total Power Dissipation	P _{tot}	1.6	W
Channel Temperature	T _{ch}	125	°C
Storage Temperature	T _{stg}	-65 to +125	°C

Note Duty Cycle ≤ 50%, T_{on} ≤ 1 ms

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Drain to Source Voltage	V _{DS}		3.0	4.8	6.0	V
Gate to Source Voltage	V _{GSO}		0	2.0	3.5	V
Drain Current (Pulse Test)	I _D	Duty Cycle ≤ 50%, T _{on} ≤ 1 ms	-	340	-	mA
Input Power	P _{in}	f = 1.9 GHz, V _{DS} = 4.8 V	0	20	22	dBm

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Gate to Source Leak Current	I _{GSO}	V _{GSS} = 5.0 V	-	-	100	nA
Saturated Drain Current (Zero Gate Voltage Drain Current)	I _{DSS}	V _{DSS} = 8.5 V	-	-	100	nA
Gate Threshold Voltage	V _{th}	V _{DS} = 4.8 V, I _{DS} = 1 mA	1.0	1.45	2.0	V
Transconductance	g _m	V _{DS} = 4.8 V, I _{DS} = 250 mA	-	420	-	mS
Drain to Source Breakdown Voltage	BV _{DS}	I _{DSS} = 10 μA	20	24	-	V
Thermal Resistance	R _{th}	Channel to Case	-	10	-	°C/W
Linear Gain	G _L	f = 1.9 GHz, P _{in} = 10 dBm, V _{DS} = 4.8 V, I _{Dset} = 200 mA, Note 1, 2	-	14.0	-	dB
Output Power	P _{out}	f = 1.9 GHz, P _{in} = 20 dBm, V _{DS} = 4.8 V, I _{Dset} = 200 mA, Note 1, 2	28.5	30.0	-	dBm
Operating Current	I _{op}	V _{DS} = 4.8 V, I _{Dset} = 200 mA, Note 1, 2	-	340	-	mA
Power Added Efficiency	η _{add}	V _{DS} = 4.8 V, I _{Dset} = 200 mA, Note 1, 2	48	55	-	%

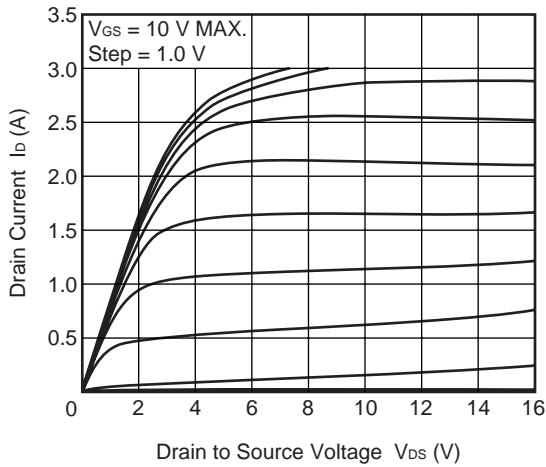
Notes 1. Peak measurement at Duty Cycle ≤ 50%, T_{on} ≤ 1 ms.

2. DC performance is 100% testing. RF performance is testing several samples per wafer.

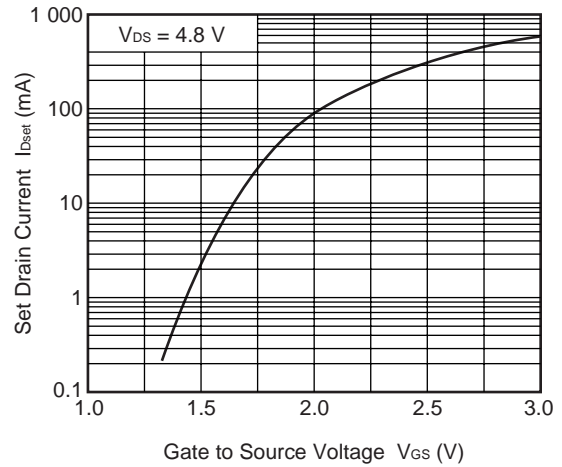
Wafer rejection criteria for standard devices is 1 reject for several samples.

TYPICAL CHARACTERISTICS (T_A = +25°C)

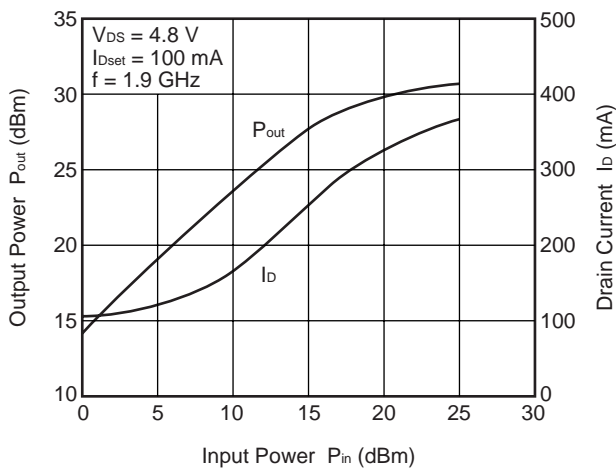
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



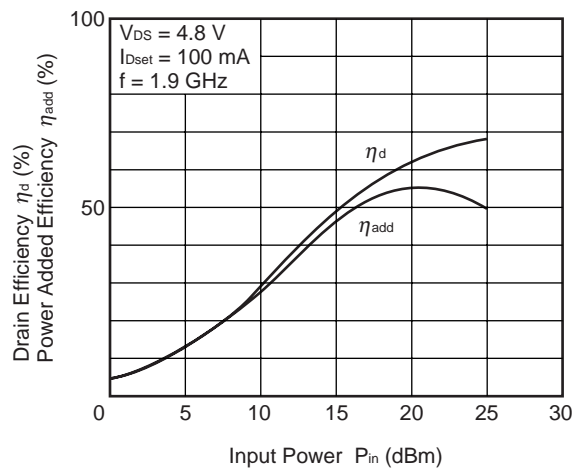
SET DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



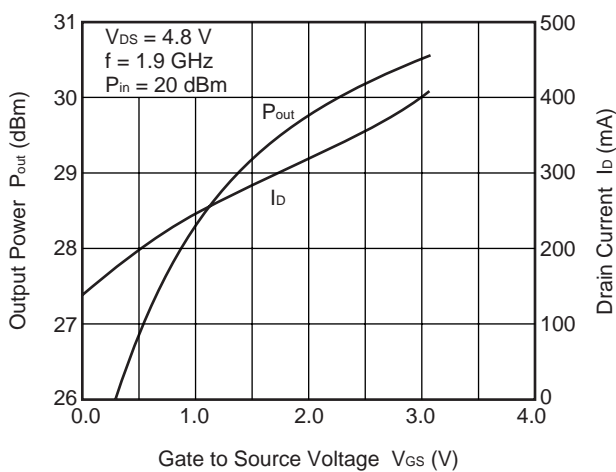
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



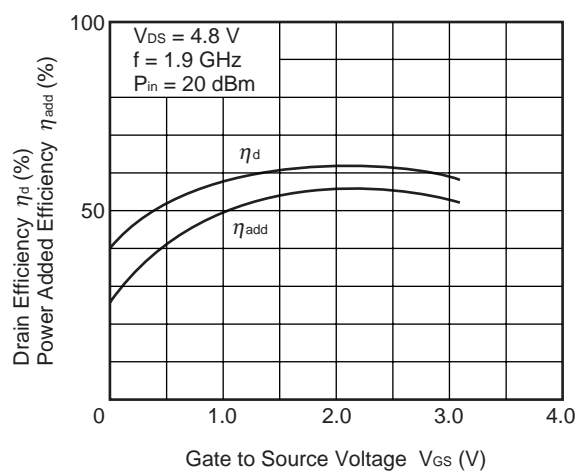
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER



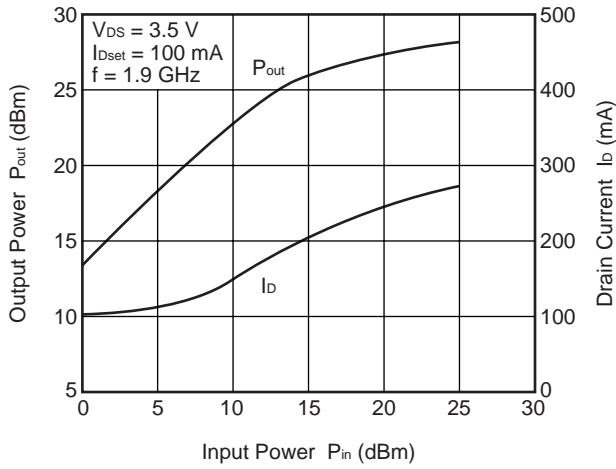
OUTPUT POWER, DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



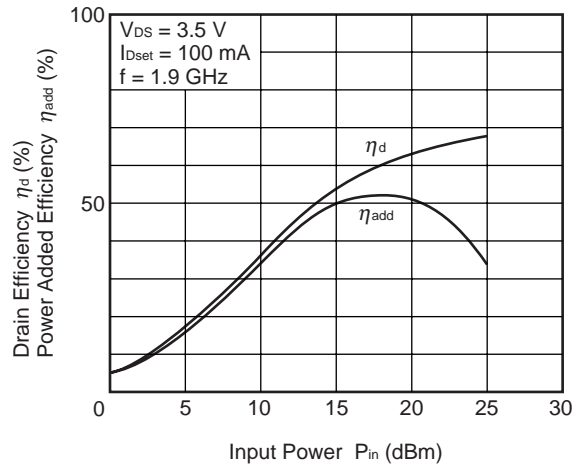
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. GATE TO SOURCE VOLTAGE



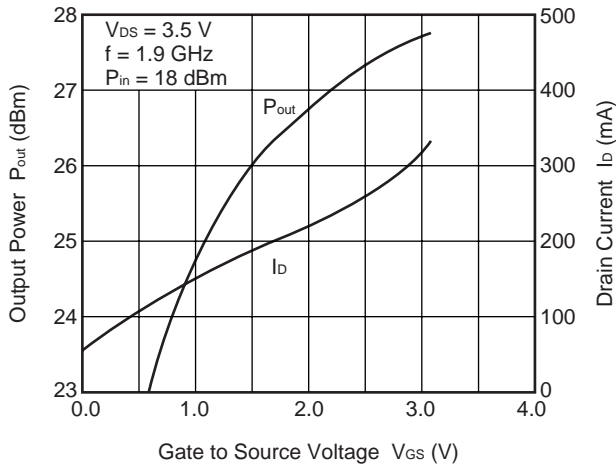
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



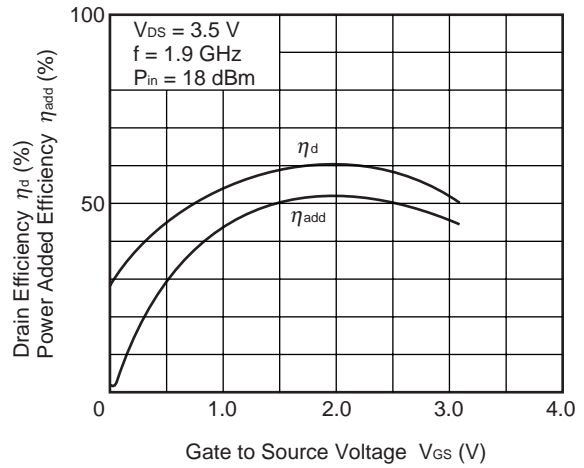
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER



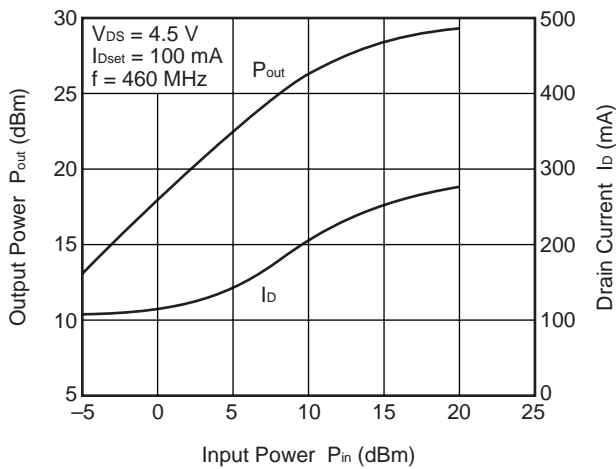
OUTPUT POWER, DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



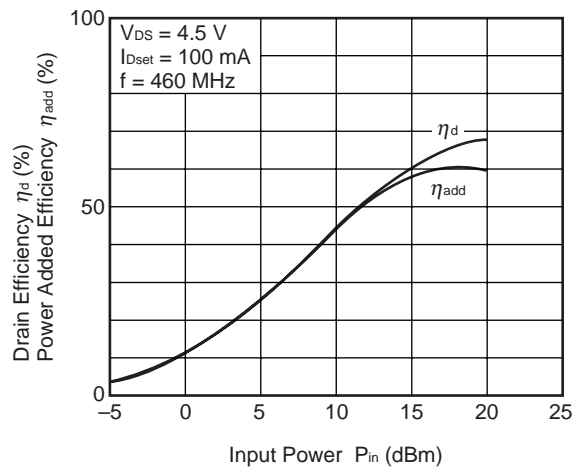
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. GATE TO SOURCE VOLTAGE



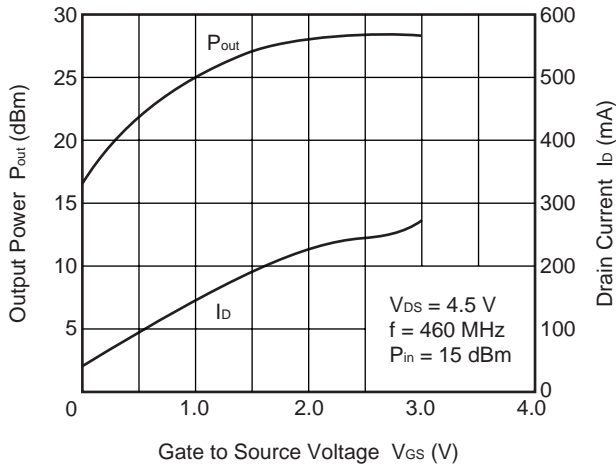
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



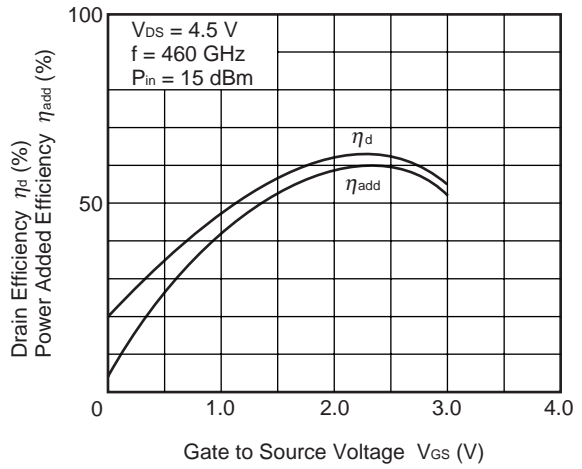
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER



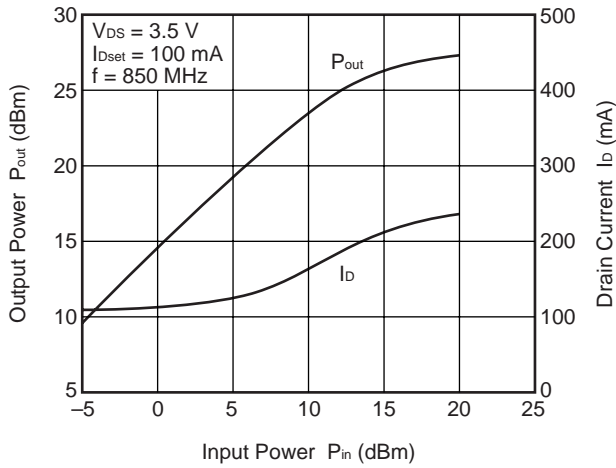
OUTPUT POWER, DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



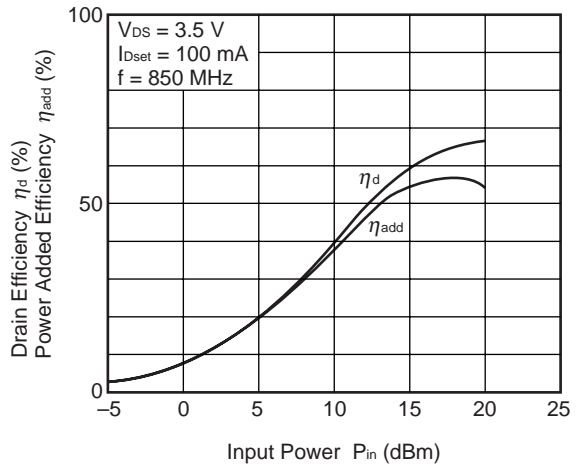
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. GATE TO SOURCE VOLTAGE



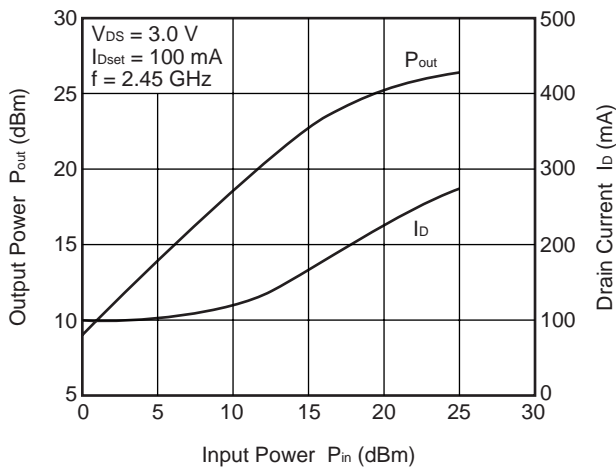
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



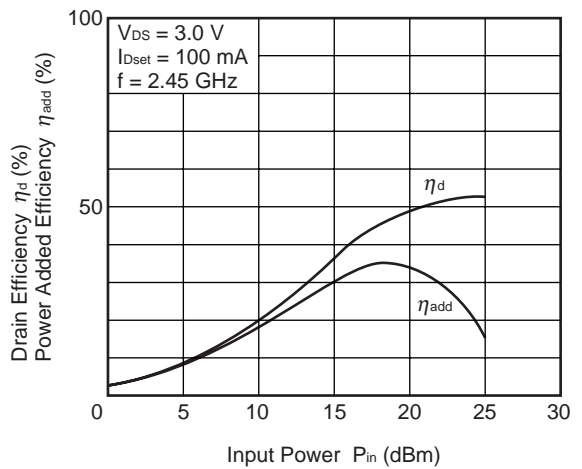
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER

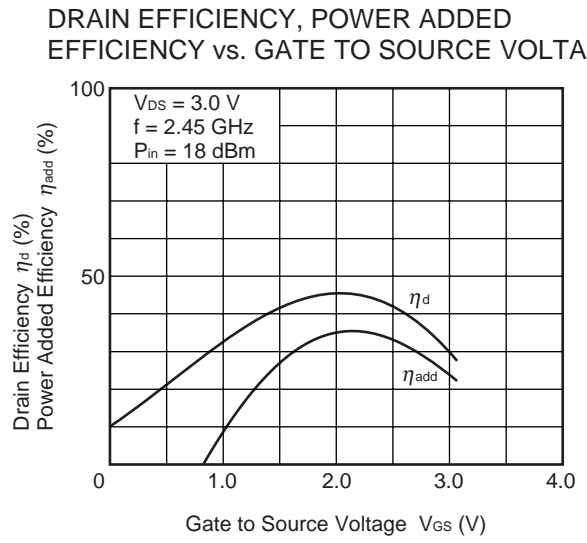
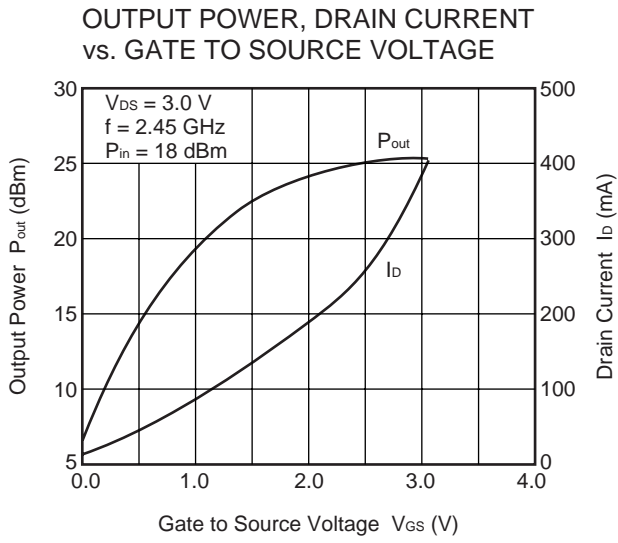


OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER





Remark The graphs indicate nominal characteristics.

S-PARAMETERS

Test Conditions: $V_{DS} = 4.8\text{ V}$, $I_{Dset} = 100\text{ mA}$

Frequency GHz	S ₁₁			S ₂₁			S ₁₂		S ₂₂		MAG ^{Note} dB	MSG ^{Note} dB	K
	MAG.	ANG.	dB	MAG.	ANG.	dB	MAG.	ANG.	MAG.	ANG.			
0.1	0.844	-69.6	25.2	18.11	135.5	-28.5	0.037	48.2	0.517	-85.0		26.8	0.00
0.2	0.792	-107.8	21.7	12.12	112.3	-26.1	0.049	23.2	0.569	-120.7		23.9	0.06
0.3	0.757	-127.4	18.7	8.58	98.8	-25.5	0.052	10.8	0.598	-136.5		22.1	0.08
0.4	0.747	-138.7	16.4	6.58	89.4	-25.7	0.052	3.3	0.618	-144.8		21.0	0.11
0.5	0.746	-146.2	14.5	5.28	82.1	-25.7	0.052	-4.1	0.641	-149.5		20.1	0.13
0.6	0.751	-151.8	12.7	4.32	76.2	-26.0	0.050	-8.9	0.660	-153.4		19.3	0.18
0.7	0.756	-155.6	11.3	3.68	70.9	-26.3	0.048	-12.6	0.681	-156.2		18.8	0.22
0.8	0.772	-159.5	9.9	3.12	65.9	-26.4	0.048	-17.0	0.696	-158.9		18.1	0.23
0.9	0.777	-162.3	8.8	2.75	61.3	-26.9	0.045	-22.1	0.715	-161.0		17.9	0.28
1.0	0.785	-165.0	7.6	2.40	58.2	-27.2	0.043	-21.9	0.732	-162.9		17.4	0.33
1.1	0.796	-167.7	6.7	2.17	53.7	-27.8	0.040	-26.9	0.749	-164.9		17.2	0.35
1.2	0.804	-169.9	5.7	1.91	51.4	-28.3	0.038	-29.2	0.763	-166.9		17.0	0.42
1.3	0.814	-172.4	4.8	1.74	46.4	-28.7	0.036	-30.5	0.776	-169.1		16.8	0.45
1.4	0.820	-174.6	4.0	1.58	44.3	-29.0	0.035	-31.4	0.789	-171.0		16.5	0.48
1.5	0.827	-176.8	3.2	1.45	39.7	-28.9	0.035	-36.6	0.803	-172.7		16.1	0.44
1.6	0.832	-179.6	2.5	1.33	38.4	-30.0	0.031	-38.5	0.808	-175.0		16.3	0.62
1.7	0.833	177.9	1.5	1.19	34.6	-30.5	0.030	-38.3	0.814	-176.7		16.0	0.78
1.8	0.846	175.6	1.1	1.13	31.6	-31.0	0.028	-38.7	0.829	-179.2		16.1	0.70
1.9	0.843	172.9	0.2	1.02	28.3	-31.8	0.025	-38.1	0.834	178.7		16.0	0.98
2.0	0.850	170.3	0.0	0.99	27.1	-32.2	0.024	-40.9	0.840	176.5		16.1	0.97
2.1	0.851	167.1	-1.0	0.89	23.3	-33.5	0.021	-42.9	0.842	174.4	12.4		1.42
2.2	0.854	165.1	-1.6	0.83	21.4	-34.1	0.019	-48.0	0.847	172.1	11.7		1.62
2.3	0.861	162.3	-2.4	0.75	16.9	-35.1	0.017	-43.6	0.856	169.1	10.9		1.88
2.4	0.857	159.5	-2.3	0.76	15.5	-34.9	0.017	-40.8	0.866	167.0	11.5		1.68
2.5	0.870	156.6	-3.4	0.67	13.8	-36.1	0.015	-49.0	0.862	164.7	10.2		2.20
2.6	0.870	153.9	-3.6	0.65	12.0	-35.8	0.016	-36.8	0.865	162.0	10.1		2.13
2.7	0.867	151.6	-5.0	0.56	9.0	-39.4	0.010	-33.0	0.866	159.1	7.8		4.44
2.8	0.870	148.9	-4.8	0.57	3.9	-39.9	0.010	-43.4	0.879	156.7	8.6		3.96
2.9	0.873	146.5	-5.6	0.52	4.7	-42.4	0.007	-18.3	0.879	154.5	7.6		6.01
3.0	0.882	143.9	-5.7	0.51	2.7	-41.3	0.008	-15.0	0.885	152.0	8.2		4.60

Note When $K \geq 1$, the MAG (Maximum Available Gain) is used. $MAG = \left| \frac{S_{21}}{S_{12}} \right| (K - \sqrt{K^2 - 1})$

When $K < 1$, the MSG (Maximum Stable Gain) is used. $MSG = \left| \frac{S_{21}}{S_{12}} \right|, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 \cdot |S_{12}| \cdot |S_{21}|}$,

$$\Delta = S_{11} \cdot S_{22} - S_{21} \cdot S_{12}$$

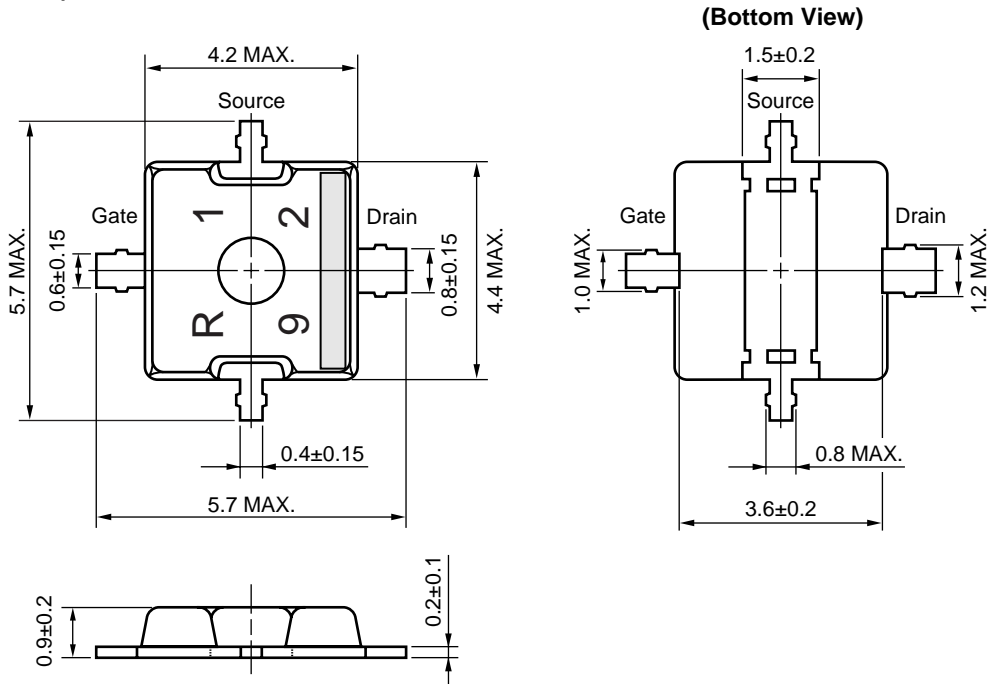
LARGE SIGNAL IMPEDANCE ($V_{DS} = 4.8\text{ V}$, $I_{Dset} = 100\text{ mA}$, $P_{in} = 20\text{ dBm}$)

f (GHz)	Z _{in} (Ω)	Z _{OL} (Ω) ^{Note}
1.9	TBD	TBD

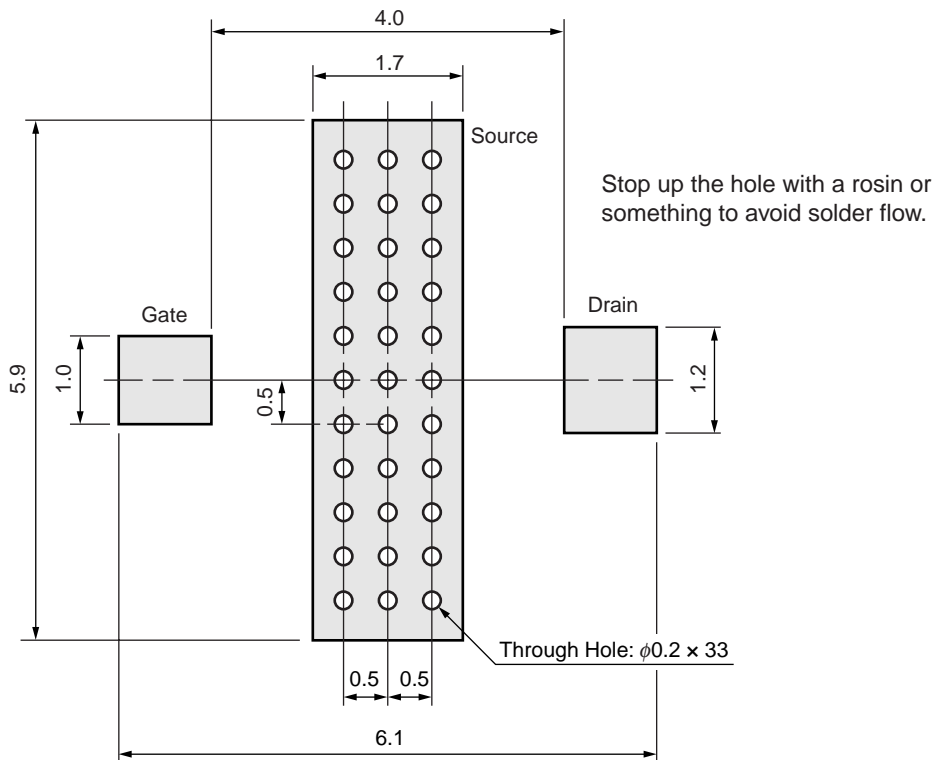
Note Z_{OL} is the conjugate of optimum load impedance at given voltage, idling current, input power and frequency.

PACKAGE DIMENSIONS

79A (UNIT: mm)



79A PACKAGE RECOMMENDED P.C.B. LAYOUT (UNIT: mm)



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: 235°C or below, Time: 30 seconds or less (at 210°C or higher), Count: 2 times or less, Exposure: limit: None ^{Note}	IR35-00-2
Partial Heating	Pin temperature: 260°C or below, Time: 5 seconds or less (per pin row) 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).

[MEMO]

[MEMO]

- **The information in this document is current as of February, 2001. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**
 - No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC. NEC assumes no responsibility for any errors that may appear in this document.
 - NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC semiconductor products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC or others.
 - Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of customer's equipment shall be done under the full responsibility of customer. NEC assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
 - While NEC endeavours to enhance the quality, reliability and safety of NEC semiconductor products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC semiconductor products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment, and anti-failure features.
 - NEC semiconductor products are classified into the following three quality grades:
 "Standard", "Special" and "Specific". The "Specific" quality grade applies only to semiconductor products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of a semiconductor product depend on its quality grade, as indicated below. Customers must check the quality grade of each semiconductor product before using it in a particular application.
 "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
 "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
 "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.
- The quality grade of NEC semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.
- (Note)
- (1) "NEC" as used in this statement means NEC Corporation and also includes its majority-owned subsidiaries.
 - (2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).