

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.

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Not all devices/types available in every country. Please check with local NEC Compound Semiconductor Devices 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}	10	W
Channel Temperature	T _{ch}	125	°C
Storage Temperature	T _{stg}	-65 to +125	°C

★ **Note** Duty Cycle ≤ 50%, T_{on} ≤ 1 s

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 s	–	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)

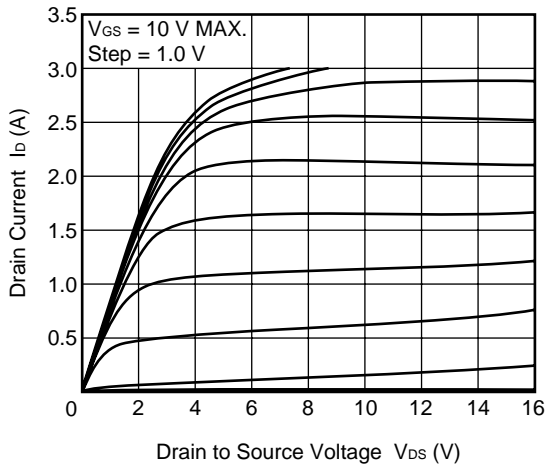
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Gate to Source Leak Current	I _{GSO}	V _{GSS} = 5.0 V	–	–	100	nA
Saturated Drain Current (Zero Gate Voltage Drain Current)	I _{DSS}	V _{DSS} = 8.5 V	–	–	100	nA
Gate Threshold Voltage	V _{th}	V _{DS} = 4.8 V, I _{DS} = 1 mA	1.0	1.45	2.0	V
Transconductance	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,	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}		48	55	–	%

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

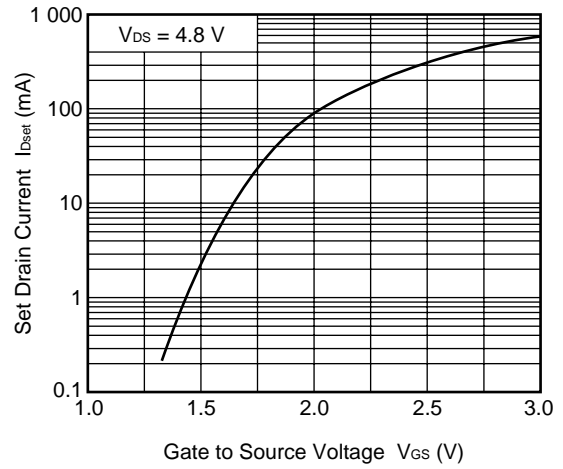
2. DC performance is 100% testing. RF performance is testing several samples per wafer. Wafer rejection criteria for standard devices is 1 reject for several samples.

TYPICAL CHARACTERISTICS (T_A = +25°C)

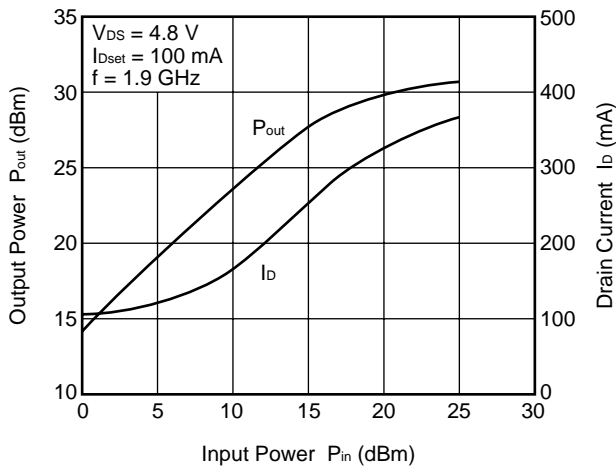
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



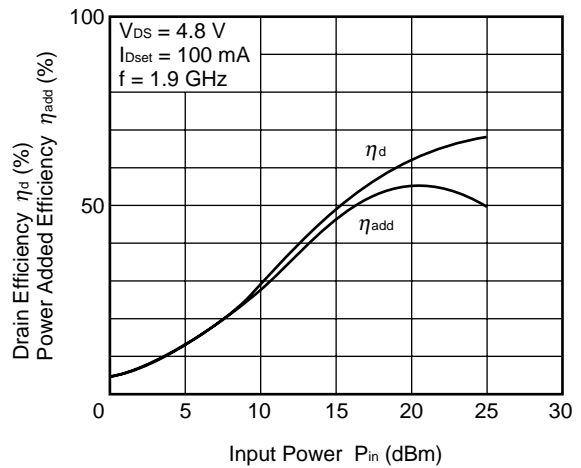
SET DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



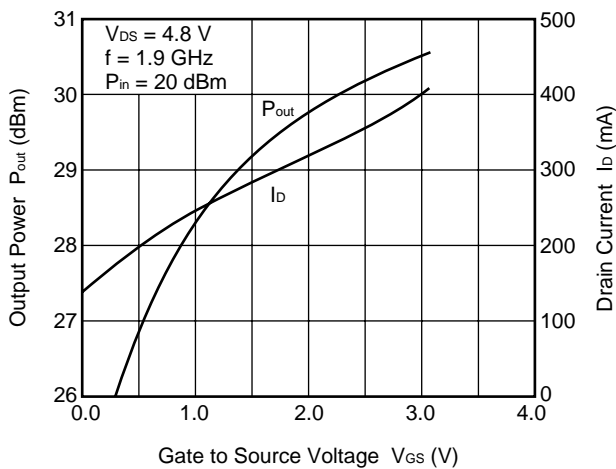
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



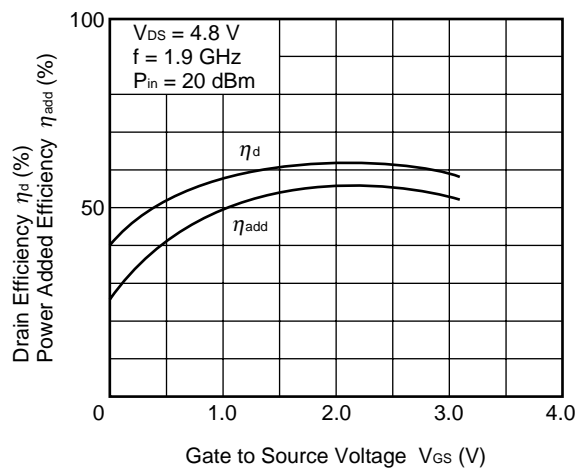
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER



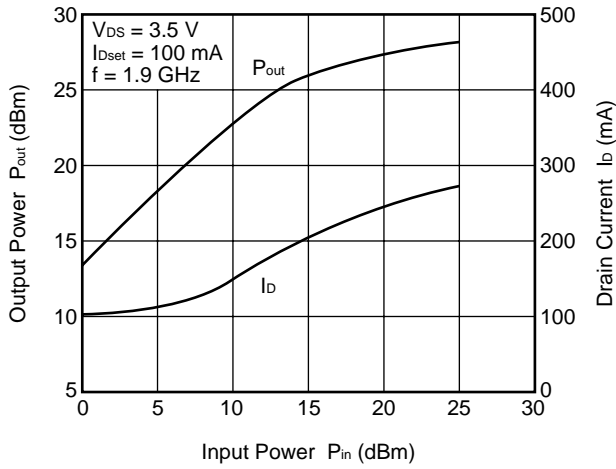
OUTPUT POWER, DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



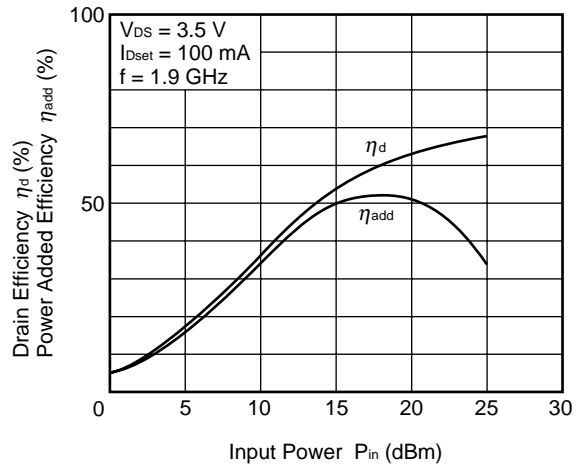
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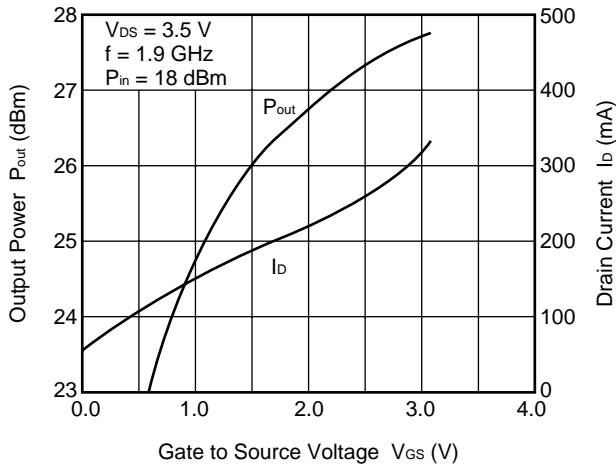
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



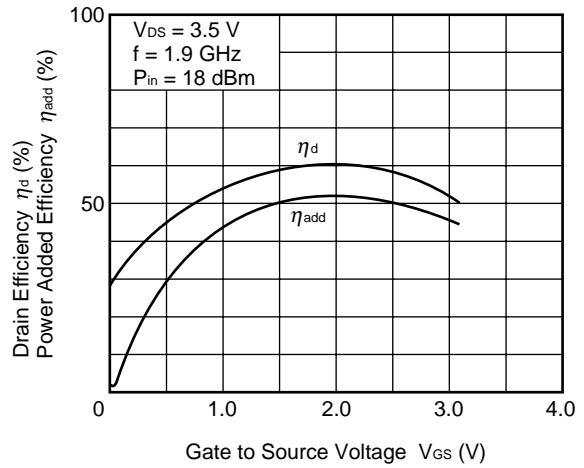
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER



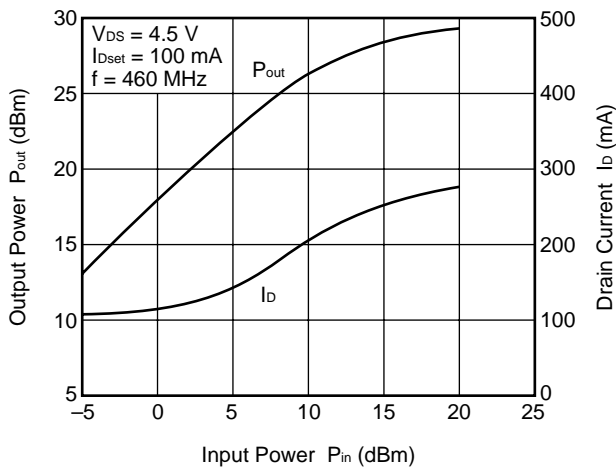
OUTPUT POWER, DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



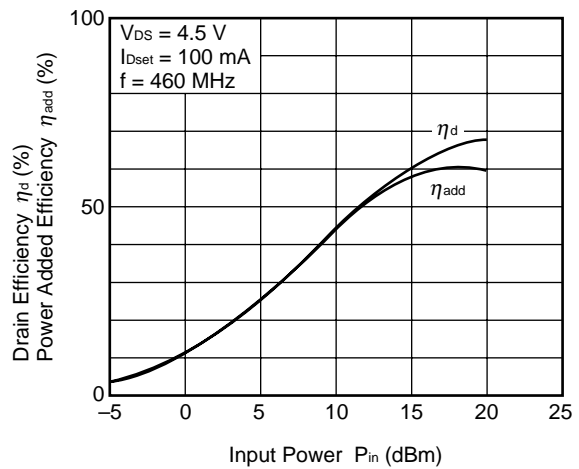
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. GATE TO SOURCE VOLTAGE



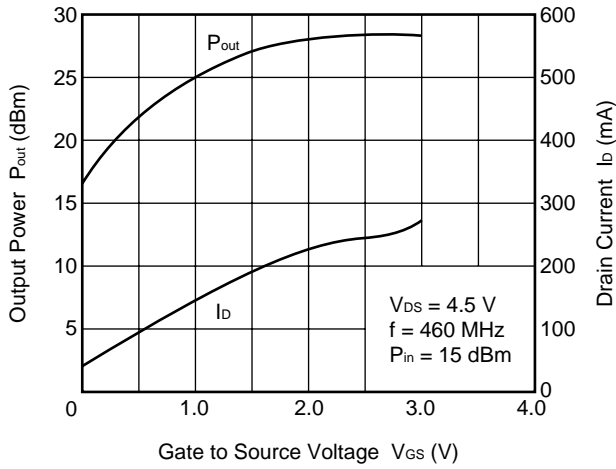
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



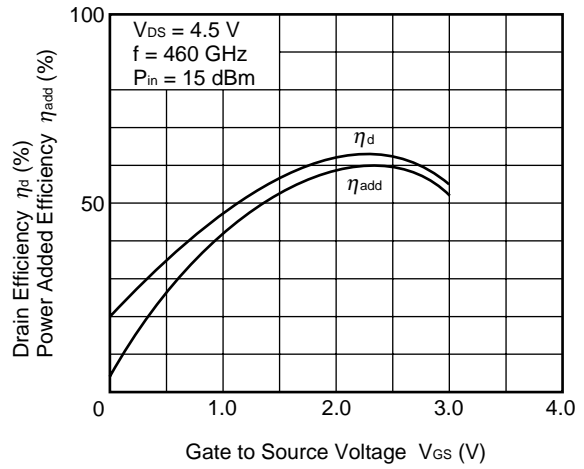
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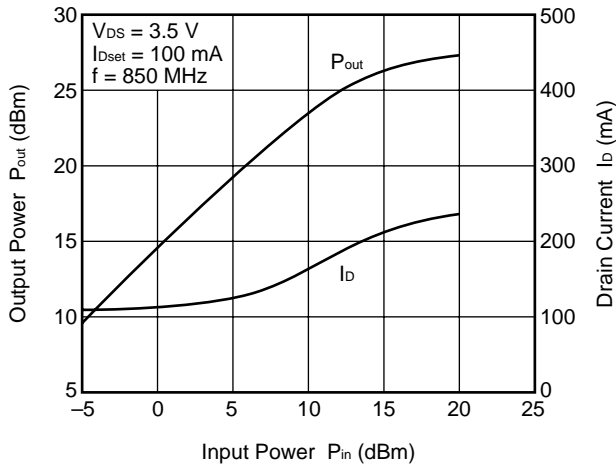
OUTPUT POWER, DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



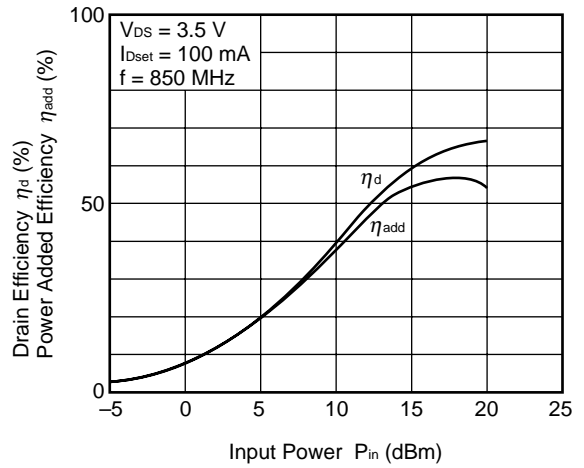
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. GATE TO SOURCE VOLTAGE



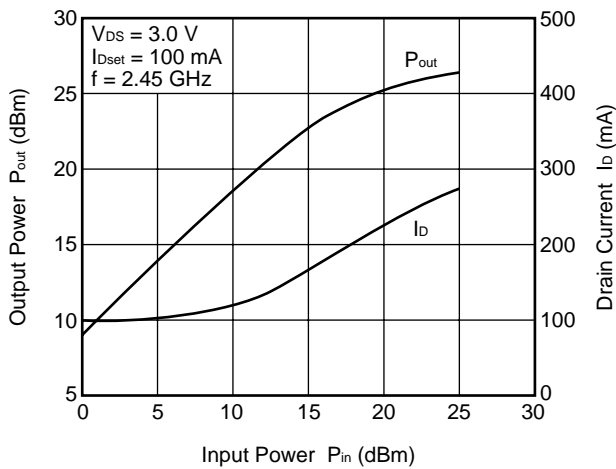
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



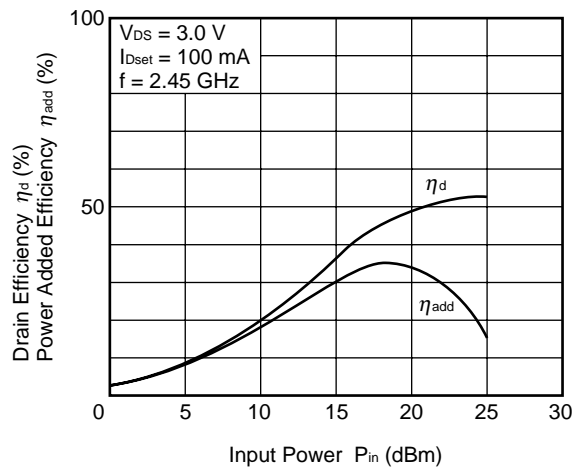
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER

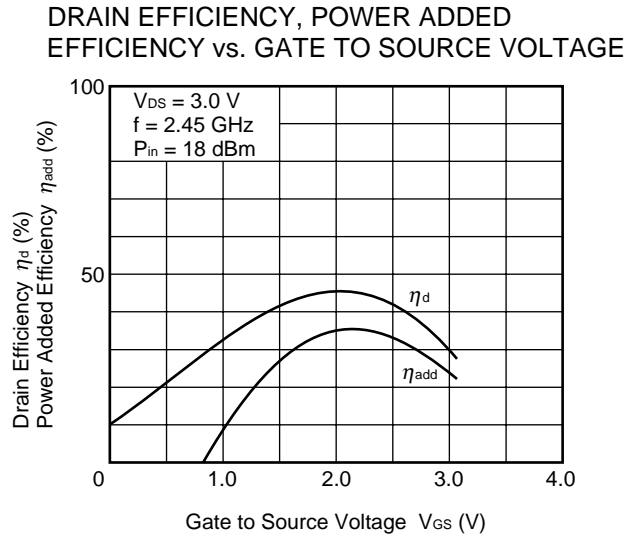
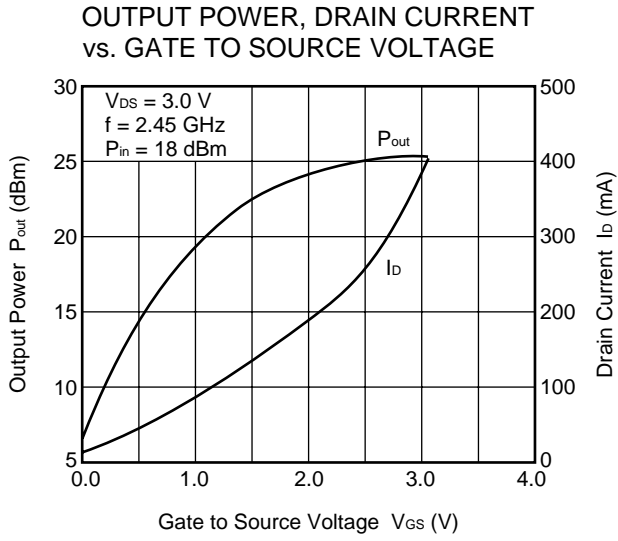


OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



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}	MSG ^{Note}	K
	MAG.	ANG.	dB	MAG.	ANG.	dB	MAG.	ANG.	MAG.	ANG.	dB	dB	
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. $MSG = \left| \frac{S_{21}}{S_{12}} \right|, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 \cdot |S_{12}| \cdot |S_{21}|}$,

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

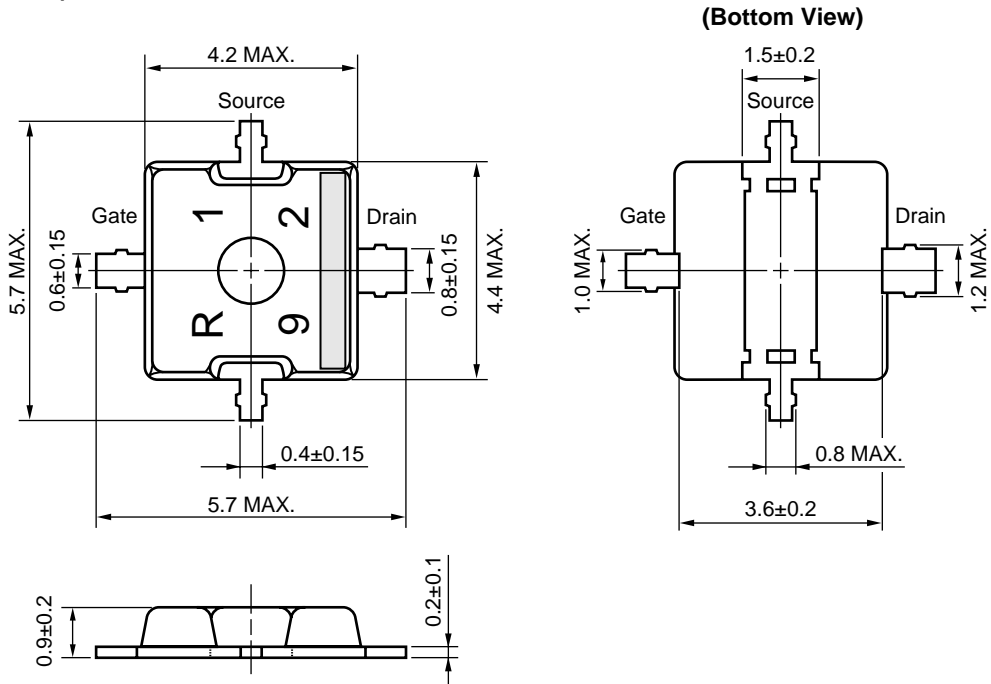
LARGE SIGNAL IMPEDANCE ($V_{DS} = 4.8\text{ V}$, $I_{Dset} = 100\text{ mA}$, $P_{in} = 20\text{ dBm}$)

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

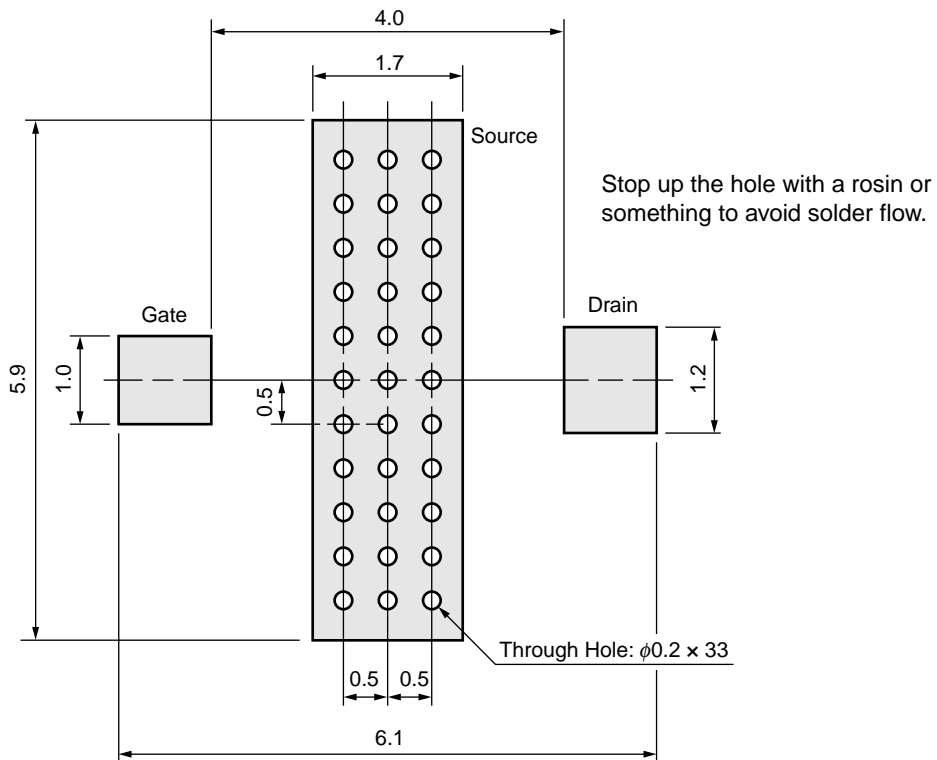
Note Z_{OL} is the conjugate of optimum load impedance at given voltage, idling current, input power and frequency.

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 nearby sales office.

Soldering Method	Soldering Conditions	Condition Symbol
Infrared Reflow	Peak temperature (package surface temperature) : 260°C or below 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	IR260
VPS	Peak temperature (package surface temperature) : 215°C or below 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	VP215
Wave Soldering	Peak temperature (molten solder temperature) : 260°C or below 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	WS260
Partial Heating	Peak temperature (pin temperature) : 350°C or below Soldering time (per pin of device) : 3 seconds or less Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	HS350-P3

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

- **The information in this document is current as of March, 2002. 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.**
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 (2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).

M8E 00.4-0110

► **Business issue**

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► **Technical issue**

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