

4.8 V OPERATION SILICON RF POWER LD-MOS FET FOR 1.8 GHz 2 W TRANSMISSION AMPLIFIERS

DESCRIPTION

The NE5510279A is an N-channel silicon power MOS FET specially designed as the transmission power amplifier for 4.8 V GSM 1 800 handsets. Dies are manufactured using our NEWMOS technology (our 0.6 μm WSi gate lateral-diffusion MOS FET) and housed in a surface mount package. The device can deliver 33.0 dBm output power with 47% power added efficiency at 1.8 GHz under the 4.8 V supply voltage.

FEATURES

- High output power : $P_{\text{out}} = 35.5 \text{ dBm TYP. (} V_{\text{DS}} = 4.8 \text{ V, } I_{\text{Dset}} = 300 \text{ mA, } f = 900 \text{ MHz, } P_{\text{in}} = 25 \text{ dBm)}$
: $P_{\text{out}} = 33.0 \text{ dBm TYP. (} V_{\text{DS}} = 4.8 \text{ V, } I_{\text{Dset}} = 300 \text{ mA, } f = 1.8 \text{ GHz, } P_{\text{in}} = 25 \text{ dBm)}$
- High power added efficiency : $\eta_{\text{add}} = 65\% \text{ TYP. (} V_{\text{DS}} = 4.8 \text{ V, } I_{\text{Dset}} = 300 \text{ mA, } f = 900 \text{ MHz, } P_{\text{in}} = 25 \text{ dBm)}$
: $\eta_{\text{add}} = 47\% \text{ TYP. (} V_{\text{DS}} = 4.8 \text{ V, } I_{\text{Dset}} = 300 \text{ mA, } f = 1.8 \text{ GHz, } P_{\text{in}} = 25 \text{ dBm)}$
- High linear gain : $G_{\text{L}} = 16.0 \text{ dB TYP. (} V_{\text{DS}} = 4.8 \text{ V, } I_{\text{Dset}} = 300 \text{ mA, } f = 900 \text{ MHz, } P_{\text{in}} = 10 \text{ dBm)}$
: $G_{\text{L}} = 10.0 \text{ dB TYP. (} V_{\text{DS}} = 4.8 \text{ V, } I_{\text{Dset}} = 300 \text{ mA, } f = 1.8 \text{ GHz, } P_{\text{in}} = 10 \text{ dBm)}$
- Surface mount package : $5.7 \times 5.7 \times 1.1 \text{ mm MAX.}$
- Single supply : $V_{\text{DS}} = 3.0 \text{ to } 6.0 \text{ V}$

APPLICATIONS

- Digital cellular phones : 4.8 V GSM 1 800 class 1 handsets
- Others : General purpose amplifiers for 1.6 to 2.0 GHz TDMA applications

ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form
NE5510279A-T1	79A	W2	• 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: NE5510279A

Caution Observe precautions when handling because these devices are sensitive to electrostatic discharge.

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

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Parameter	Symbol	Ratings	Unit
Drain to Source Voltage	V_{DS}	20.0	V
Gate to Source Voltage	V_{GS}	5.0	V
Drain Current	I_{DS}	1.0	A
Drain Current (Pulse Test)	I_{DS}^{Note}	2.0	A
Total Power Dissipation	P_{tot}	20	W
Channel Temperature	T_{ch}	125	$^{\circ}\text{C}$
Storage Temperature	T_{stg}	-65 to +125	$^{\circ}\text{C}$

Note Duty Cycle $\leq 50\%$, $T_{on} \leq 1\text{ s}$ **RECOMMENDED OPERATING CONDITIONS**

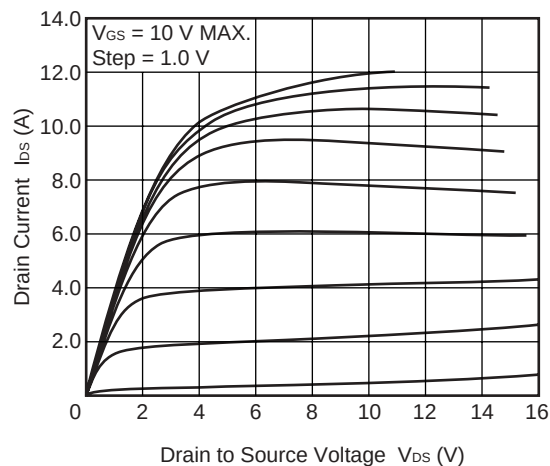
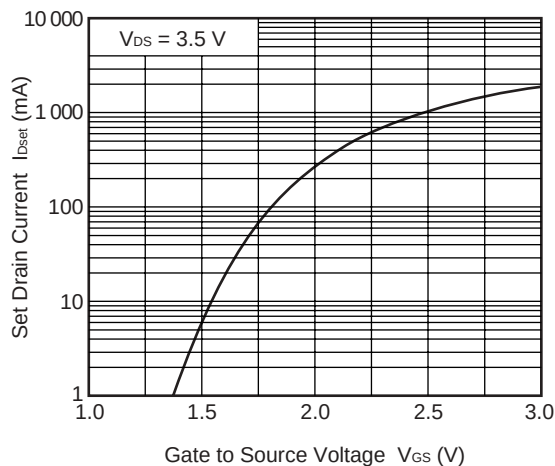
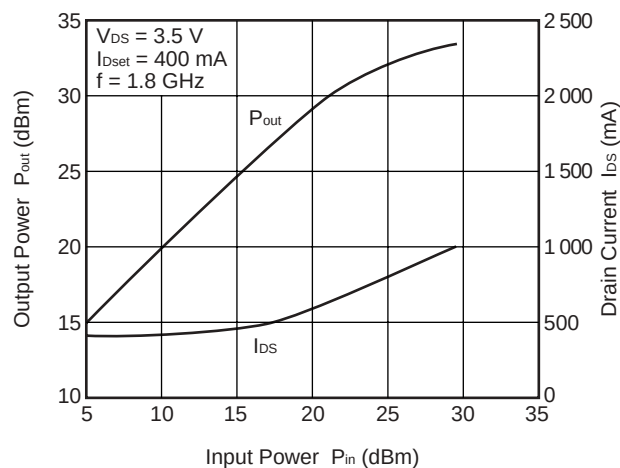
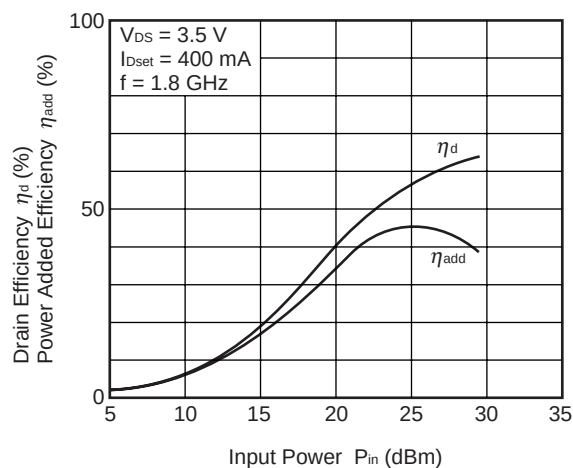
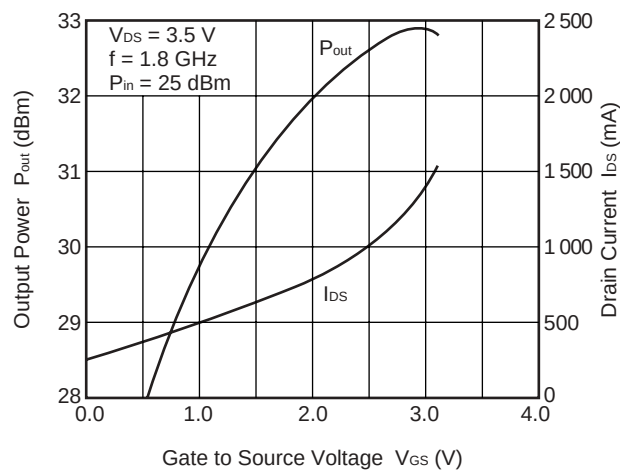
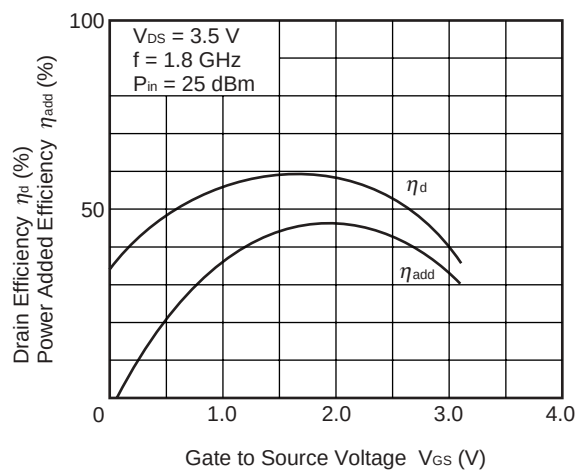
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Drain to Source Voltage	V_{DS}		3.0	4.8	6.0	V
Gate to Source Voltage	V_{GS}		0	2.0	3.5	V
Drain Current (Pulse Test)	I_{DS}	Duty Cycle $\leq 50\%$, $T_{on} \leq 1\text{ s}$	–	1.0	1.5	A
Input Power	P_{in}	$f = 1.8\text{ GHz}$, $V_{DS} = 4.8\text{ V}$	25	–	27	dBm

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

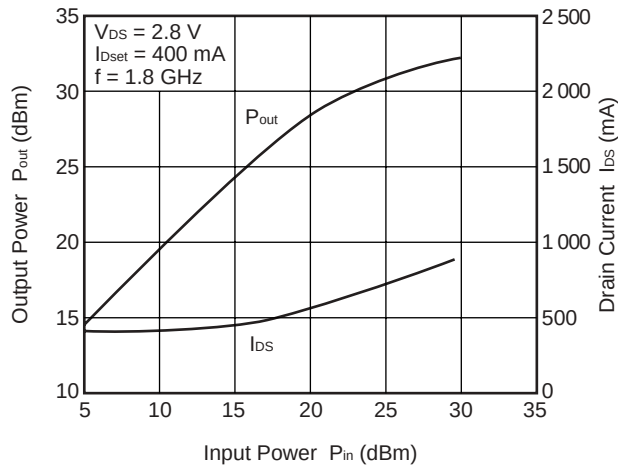
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Gate to Source Leak Current	I _{GSS}	V _{GSS} = 5.0 V	–	–	100	nA
Saturated Drain Current (Zero Gate Voltage Drain Current)	I _{DSS}	V _{DSS} = 8.5 V	–	–	100	nA
Gate Threshold Voltage	V _{th}	V _{DS} = 4.8 V, I _{DS} = 1 mA	1.0	1.35	2.0	V
Transconductance	g _m	V _{DS} = 4.8 V, I _{DS} = 600 mA	–	1.50	–	S
Drain to Source Breakdown Voltage	BV _{DSS}	I _{DSS} = 10 μ A	20	24	–	V
Thermal Resistance	R _{th}	Channel to Case	–	5	–	°C/W
Linear Gain	G _L	f = 900 MHz, P _{in} = 10 dBm, V _{DS} = 4.8 V, I _{Dset} = 300 mA, Note 1, 2	–	16.0	–	dB
Output Power	P _{out}	f = 900 MHz, P _{in} = 25 dBm,	–	35.5	–	dBm
Operating Current	I _{op}	V _{DS} = 4.8 V, I _{Dset} = 300 mA, Note 1, 2	–	1 000	–	mA
Power Added Efficiency	η_{add}		–	65	–	%
Linear Gain	G _L	f = 1.8 GHz, P _{in} = 10 dBm, V _{DS} = 4.8 V, I _{Dset} = 300 mA, Note 1, 2	–	10.0	–	dB
Output Power	P _{out}	f = 1.8 GHz, P _{in} = 25 dBm,	32.0	33.0	–	dBm
Operating Current	I _{op}	V _{DS} = 4.8 V, I _{Dset} = 300 mA, Note 1, 2	–	750	–	mA
Power Added Efficiency	η_{add}		38	47	–	%

Notes 1. Peak measurement at Duty Cycle $\leq$ 50%, T_{on} $\leq$ 1 s.

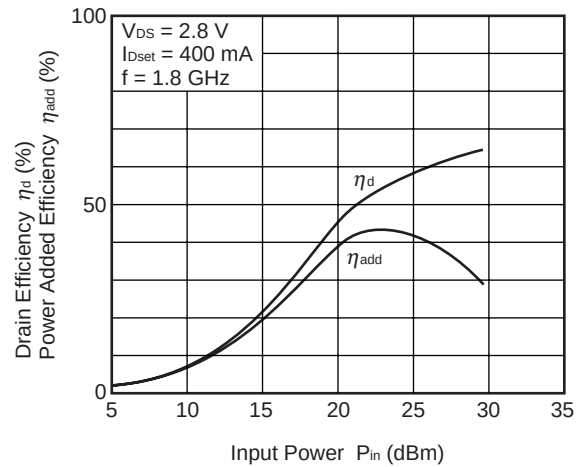
2. DC performance is 100% testing. RF performance is testing several samples per wafer.
Wafer rejection criteria for standard devices is 1 reject for several samples.

TYPICAL CHARACTERISTICS ($T_A = +25^\circ\text{C}$)DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGESET DRAIN CURRENT vs.
GATE TO SOURCE VOLTAGEOUTPUT POWER, DRAIN CURRENT
vs. INPUT POWERDRAIN EFFICIENCY, POWER ADDED
EFFICIENCY vs. INPUT POWEROUTPUT POWER, DRAIN CURRENT
vs. GATE TO SOURCE VOLTAGEDRAIN EFFICIENCY, POWER ADDED
EFFICIENCY vs. GATE TO SOURCE VOLTAGE

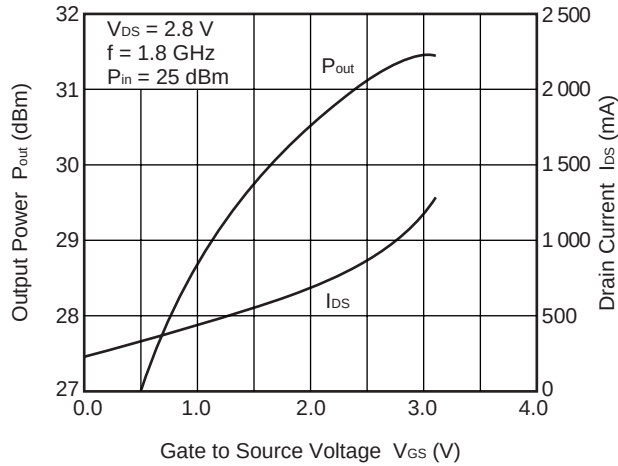
OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER



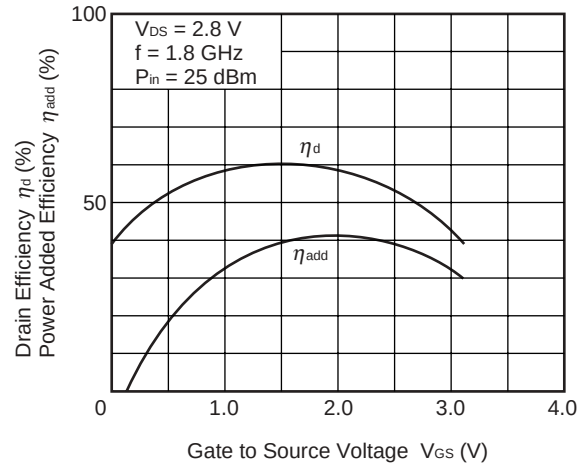
DRAIN EFFICIENCY, POWER ADDED
EFFICIENCY vs. INPUT POWER



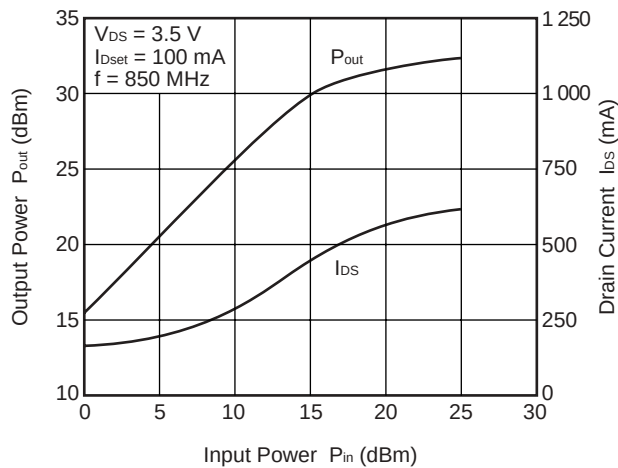
OUTPUT POWER, DRAIN CURRENT
vs. GATE TO SOURCE VOLTAGE



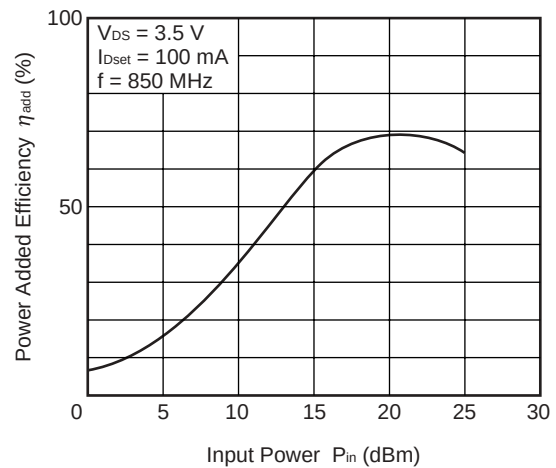
DRAIN EFFICIENCY, POWER ADDED
EFFICIENCY vs. GATE TO SOURCE VOLTAGE



OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER



POWER ADDED EFFICIENCY
vs. INPUT POWER



Remark The graphs indicate nominal characteristics.

S-PARAMETERS

Test Conditions: $V_{DS} = 3.5 \text{ V}$, $I_{Dset} = 400 \text{ mA}$

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	0.889	-149.7	18.8	8.66	99.8	-34.4	0.019	14.6	0.854	-173.8		26.6	
0.2	0.872	-165.4	12.9	4.41	87.5	-34.0	0.020	3.4	0.861	-177.7		23.4	
0.3	0.871	-170.9	9.3	2.91	82.0	-34.0	0.020	-1.8	0.875	-178.6		21.6	
0.4	0.871	-173.7	6.6	2.13	76.1	-34.4	0.019	-4.1	0.869	-179.6		20.5	
0.5	0.873	-175.6	4.6	1.69	71.5	-34.4	0.019	-9.5	0.886	179.7		19.5	0.04
0.6	0.880	-176.9	2.7	1.37	67.7	-34.9	0.018	-11.8	0.886	179.2		18.8	0.22
0.7	0.884	-177.9	1.4	1.17	63.9	-35.9	0.016	-10.6	0.893	178.9		18.6	0.40
0.8	0.897	-179.1	-0.1	0.99	60.5	-35.9	0.016	-10.2	0.898	178.0		17.9	0.40
0.9	0.905	-179.9	-1.2	0.87	56.3	-37.1	0.014	-15.0	0.914	177.6		17.9	0.41
1.0	0.919	178.1	-2.3	0.77	53.8	-37.1	0.014	-7.8	0.928	176.0		17.4	0.16
1.1	0.930	175.9	-3.2	0.69	48.8	-38.4	0.012	-13.7	0.938	174.8		17.6	0.11
1.2	0.923	174.2	-4.4	0.60	46.9	-38.4	0.012	-11.0	0.927	172.9		17.0	0.59
1.3	0.919	172.9	-5.4	0.54	42.6	-40.0	0.010	-10.5	0.923	171.8	14.1		1.29
1.4	0.918	171.8	-6.4	0.48	41.0	-40.0	0.010	-4.7	0.922	170.6	12.2		1.62
1.5	0.918	170.6	-7.1	0.44	37.6	-39.2	0.011	-8.0	0.924	170.1	11.7		1.53
1.6	0.920	168.9	-7.7	0.41	36.7	-41.9	0.008	-5.5	0.927	168.7	10.4		2.46
1.7	0.918	167.5	-8.9	0.36	33.6	-41.9	0.008	4.3	0.922	167.9	8.5		3.27
1.8	0.927	166.2	-9.1	0.35	30.9	-40.9	0.009	12.5	0.935	165.9	10.3		1.95
1.9	0.922	164.1	-10.2	0.31	28.2	-43.1	0.007	20.9	0.932	164.9	7.9		3.67
2.0	0.923	162.6	-10.5	0.30	27.8	-43.1	0.007	32.4	0.942	163.0	8.6		3.08
2.1	0.928	159.9	-11.7	0.26	25.2	-43.1	0.007	48.5	0.928	161.8	6.2		4.46
2.2	0.926	158.6	-12.0	0.25	23.2	-44.4	0.006	36.8	0.938	160.0	6.3		4.89
2.3	0.929	156.6	-13.2	0.22	20.0	-41.9	0.008	50.0	0.935	157.6	5.4		4.01
2.4	0.925	154.5	-13.2	0.22	18.0	-40.9	0.009	45.1	0.945	156.2	6.2		3.01
2.5	0.928	152.2	-14.0	0.20	18.1	-43.1	0.007	61.4	0.941	154.5	4.8		4.77
2.6	0.933	150.4	-14.0	0.20	17.2	-40.9	0.009	56.3	0.938	152.5	5.2		3.43
2.7	0.930	148.4	-15.9	0.16	15.0	-39.2	0.011	70.0	0.933	150.3	2.5		4.13
2.8	0.929	146.2	-15.4	0.17	11.1	-37.7	0.013	59.4	0.952	148.1	5.4		2.01
2.9	0.931	144.4	-15.9	0.16	11.6	-37.7	0.013	74.0	0.937	146.9	3.2		3.01
3.0	0.933	142.6	-16.5	0.15	10.0	-37.1	0.014	67.5	0.950	145.0	4.3		2.10

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

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

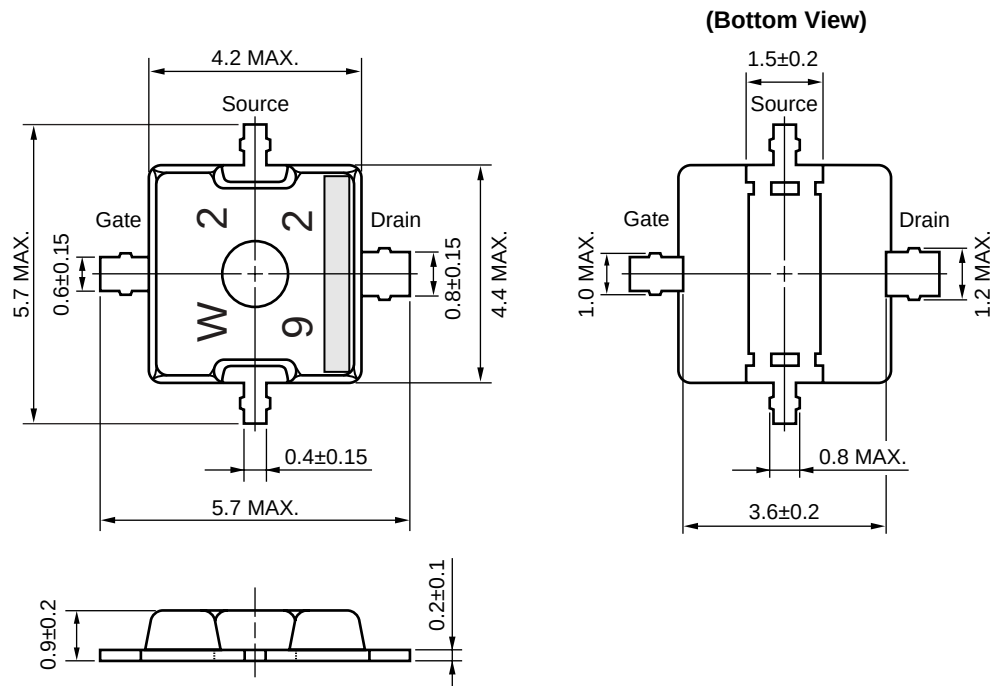
LARGE SIGNAL IMPEDANCE ($V_{DS} = 3.5 \text{ V}$, $I_{Dset} = 400 \text{ mA}$, $P_{in} = 25 \text{ dBm}$)

f (GHz)	$Z_{in} (\Omega)$	$Z_{OL} (\Omega)$ ^{Note}
1.8	TBD	TBD

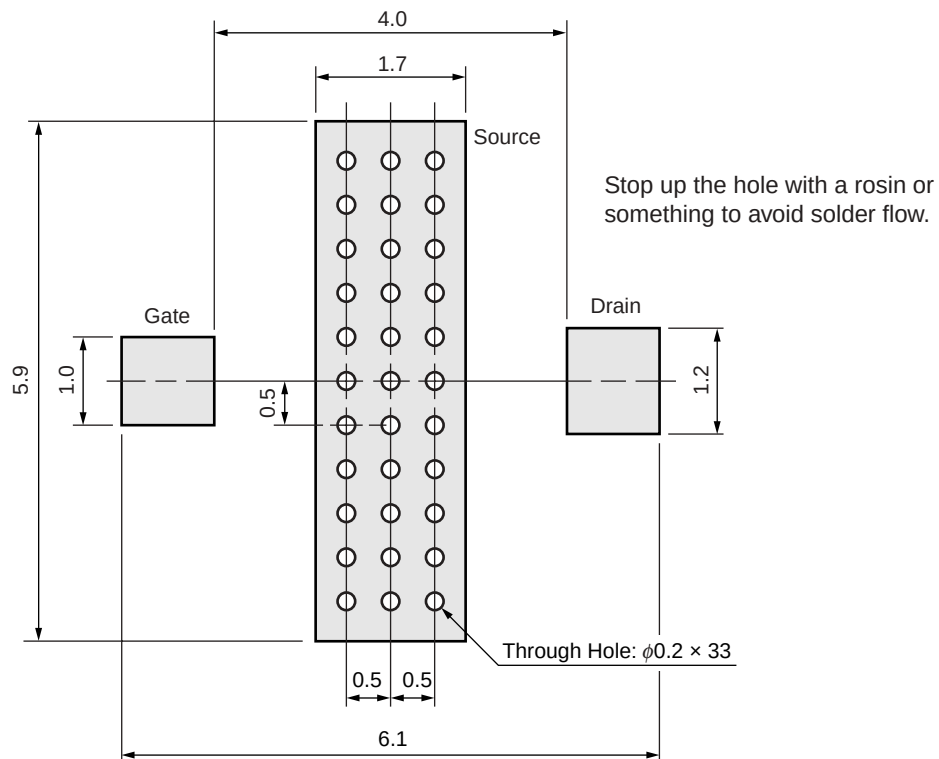
Note Z_{OL} is the conjugate of optimum load impedance at given voltage, idling current, input power and frequency.

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).

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M8E 00.4-0110

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►Technical issue**NEC Compound Semiconductor Devices, Ltd. <http://www.csd-nec.com/>**

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