

3.2 V OPERATION SILICON RF POWER LD-MOS FET
FOR GSM/DCS DUAL-BAND PHONE TRANSMISSION AMPLIFIERS

DESCRIPTION

The NE5520379A is an N-channel silicon power MOS FET specially designed as the transmission power amplifier for 3.2 V GSM 900 handsets. Dies are manufactured using our NEWMOS technology (our 0.6 μ m WSi gate lateral-diffusion MOS FET) and housed in a surface mount package. This device can deliver 34.6 dBm output power with 68% power efficiency at 915 MHz under the 2.8 V supply voltage.

FEATURES

- High output power : $P_{out} = 35.5$ dBm TYP. ($V_{DS} = 3.2$ V, $V_{GS} = 2.5$ V, $f = 915$ MHz, $P_{in} = 25$ dBm)
: $P_{out} = 33.0$ dBm TYP. ($V_{DS} = 3.2$ V, $V_{GS} = 2.5$ V, $f = 1\ 785$ MHz, $P_{in} = 25$ dBm)
- High power added efficiency : $\eta_{add} = 65\%$ TYP. ($V_{DS} = 3.2$ V, $V_{GS} = 2.5$ V, $f = 915$ MHz, $P_{in} = 25$ dBm)
: $\eta_{add} = 35\%$ TYP. ($V_{DS} = 3.2$ V, $V_{GS} = 2.5$ V, $f = 1\ 785$ MHz, $P_{in} = 25$ dBm)
- High linear gain : $G_L = 16.0$ dB TYP. ($V_{DS} = 3.2$ V, $V_{GS} = 2.5$ V, $f = 915$ MHz, $P_{in} = 10$ dBm)
: $G_L = 8.5$ dB TYP. ($V_{DS} = 3.2$ V, $V_{GS} = 2.5$ V, $f = 1\ 785$ MHz, $P_{in} = 10$ dBm)
- Surface mount package : $5.7 \times 5.7 \times 1.1$ mm MAX.
- Single supply : $V_{DS} = 2.8$ to 3.8 V

APPLICATIONS

- Digital cellular phones : 3.2 V GSM/DCS Dual-Band handsets
- Others : General purpose amplifiers for 1.6 to 2.0 GHz TDMA applications

ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form
NE5520379A-T1	79A	A3	<ul style="list-style-type: none"> • 12 mm wide embossed taping • Gate pin face the perforation side of the tape • Qty 1 kpcs/reel
NE5520379A-T1A			<ul style="list-style-type: none"> • 12 mm wide embossed taping • Gate pin face the perforation side of the tape • Qty 5 kpcs/reel

Remark To order evaluation samples, consult your NEC sales representative.
Part number for sample order: NE5520379A

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°C)

Parameter	Symbol	Ratings	Unit
★ Drain to Source Voltage	V _{DS}	15.0	V
Gate to Source Voltage	V _{GS}	5.0	V
Drain Current	I _{DS}	1.5	A
Drain Current (Pulse Test)	I _{DS} ^{Note}	3.0	A
Total Power Dissipation	P _{tot}	20	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}		2.8	3.2	3.8	V
Gate to Source Voltage	V _{GS}		0	2.5	3.5	V
Drain Current (Pulse Test)	I _{DS}	Duty Cycle ≤ 50%, T _{on} ≤ 1 s	–	1.75	2.0	A
Input Power	P _{in}	f = 1.8 GHz, V _{DS} = 3.6 V	24	25	26	dBm

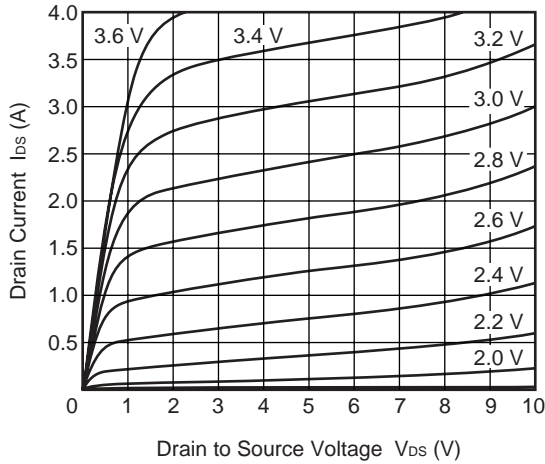
ELECTRICAL CHARACTERISTICS (T_A = +25°C)

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} = 6.0 V	–	–	100	nA
Gate Threshold Voltage	V _{th}	V _{DS} = 3.5 V, I _{DS} = 1 mA	1.0	1.35	2.0	V
Transconductance	g _m	V _{DS} = 3.5 V, I _{DS} = 0.8 to 1.0 A	–	2.5	–	S
Drain to Source Breakdown Voltage	BV _{DSS}	I _{DSS} = 10 μA	15	20	–	V
Thermal Resistance	R _{th}	Channel to Case	–	–	5	°C/W
Linear Gain	G _L	f = 915 MHz, P _{in} = 10 dBm, V _{DS} = 3.2 V, V _{GS} = 2.5 V, Note	–	16.0	–	dB
Output Power	P _{out}	f = 915 MHz, P _{in} = 25 dBm, V _{DS} = 3.2 V, V _{GS} = 2.5 V, Note	–	35.5	–	dBm
Operating Current	I _{op}		–	1 000	–	mA
Drain Efficiency	η _d		–	68	–	%
Power Added Efficiency	η _{add}		–	65	–	%
Linear Gain	G _L	f = 1 785 MHz, P _{in} = 10 dBm, V _{DS} = 3.2 V, V _{GS} = 2.5 V, Note	–	8.5	–	dB
Output Power	P _{out}	f = 1 785 MHz, P _{in} = 25 dBm, V _{DS} = 3.2 V, V _{GS} = 2.5 V, Note	31.0	33.0	–	dBm
Operating Current	I _{op}		–	750	–	mA
Drain Efficiency	η _d		29	38	–	%
Power Added Efficiency	η _{add}		–	35	–	%

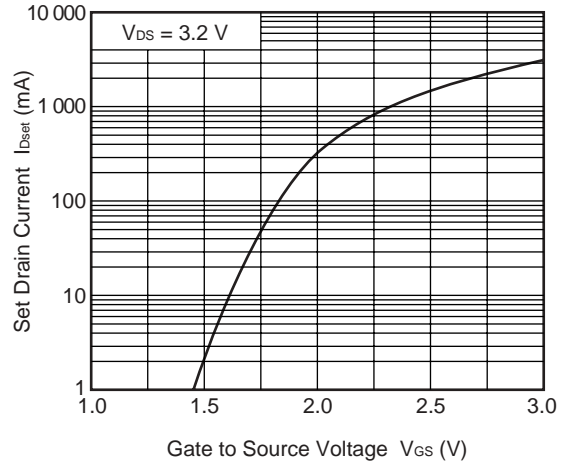
Note DC performance is 100% testing. RF performance is testing several samples per wafer.
Wafer rejection criteria for standard devices is 1 reject for several samples.

TYPICAL CHARACTERISTICS (T_A = +25°C)

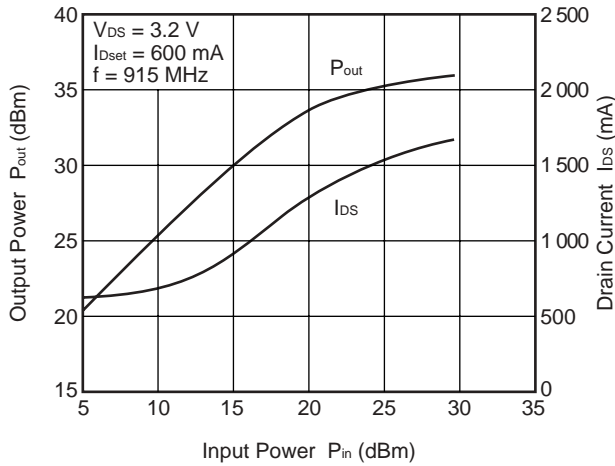
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



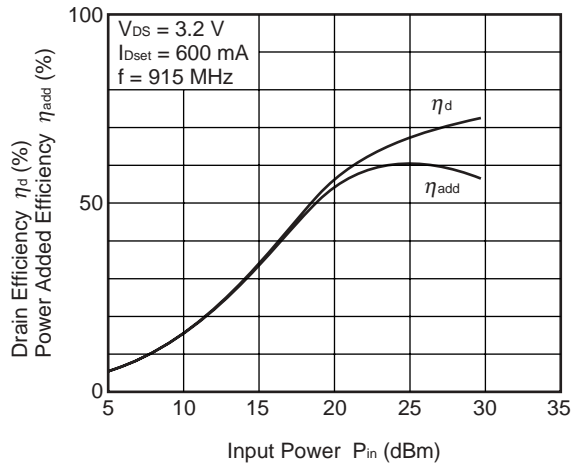
SET DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



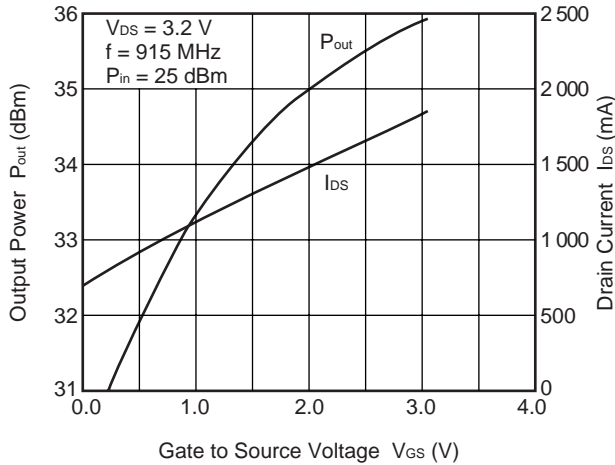
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



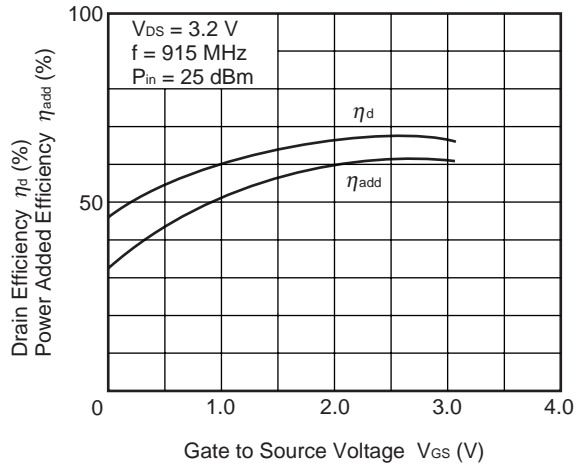
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER



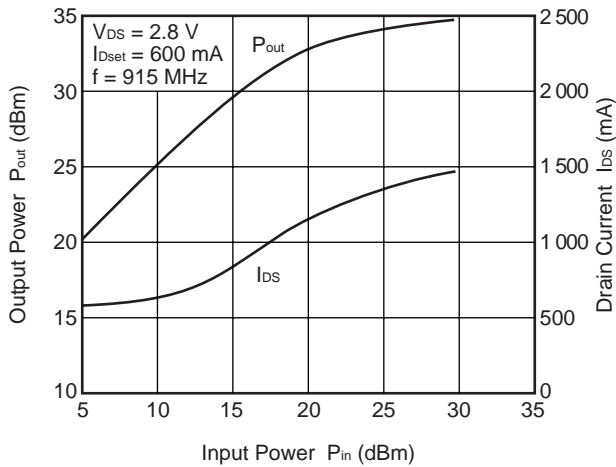
OUTPUT POWER, DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



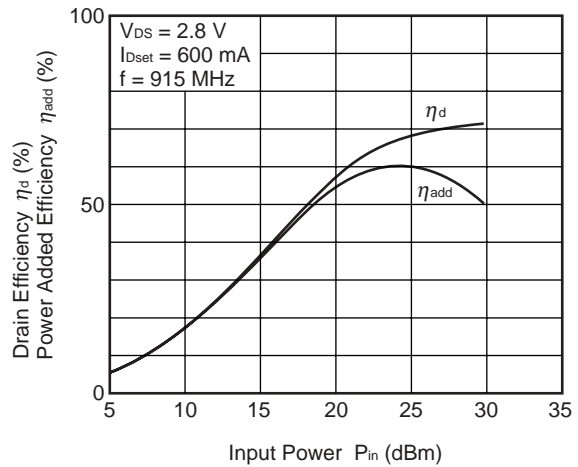
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. GATE TO SOURCE VOLTAGE



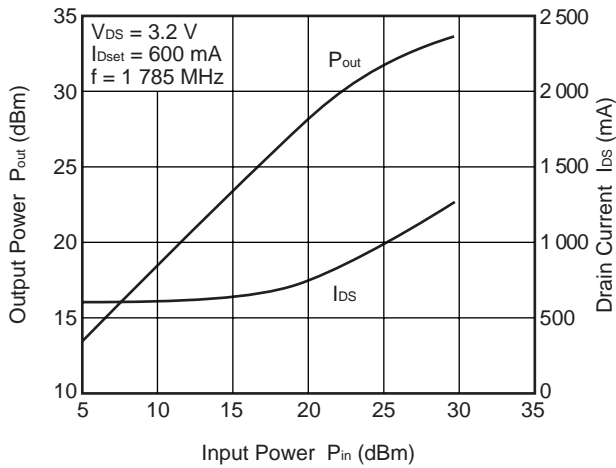
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



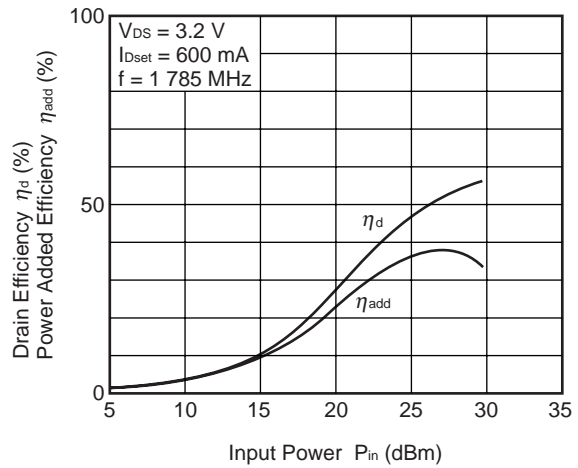
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER



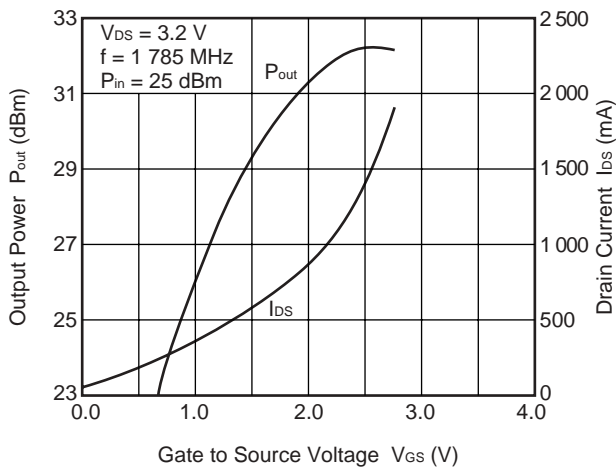
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



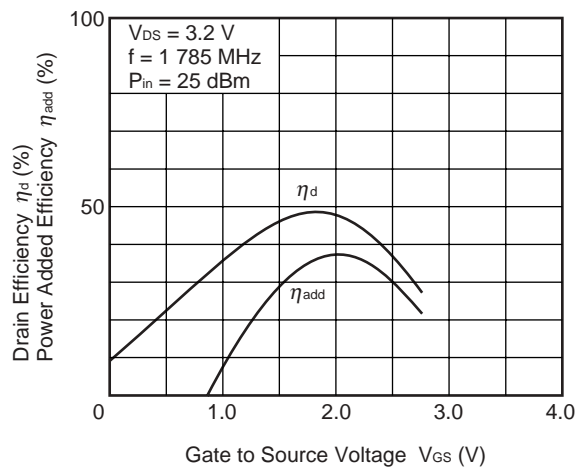
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER



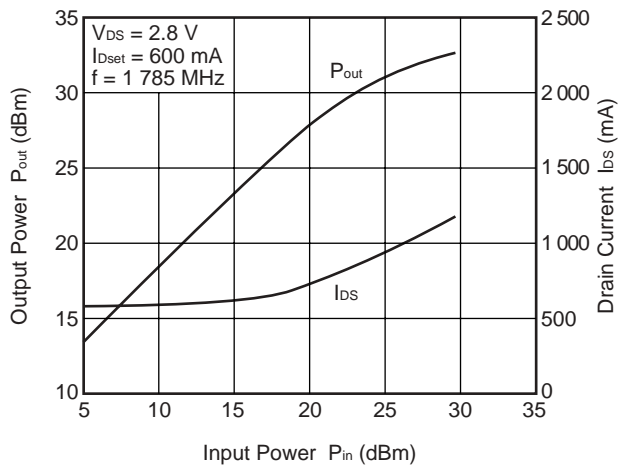
OUTPUT POWER, DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



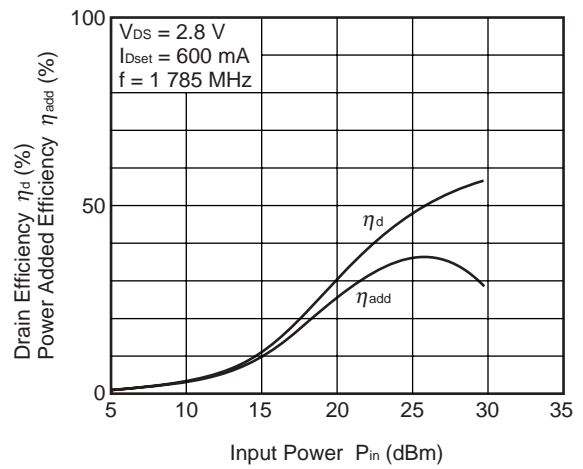
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. GATE TO SOURCE VOLTAGE



OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER



Remark The graphs indicate nominal characteristics.

S-PARAMETERS

Test Conditions: $V_{DS} = 3.5\text{ V}$, $I_{DS} = 300\text{ mA}$

Frequency GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂		MAG ^{Note}	MSG ^{Note}	K
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	dB	dB	
0.1	0.91	-166.0	4.96	91.5	0.02	2.8	0.87	-177.5		24.8	0.12
0.2	0.91	-174.2	2.48	82.3	0.02	-4.8	0.87	-179.7		21.7	0.24
0.3	0.92	-177.5	1.63	75.6	0.02	-9.0	0.87	-179.1		19.8	0.37
0.4	0.92	-179.6	1.20	69.7	0.02	-14.4	0.88	-178.3		18.7	0.50
0.5	0.92	178.8	0.94	64.1	0.02	-18.7	0.88	177.4		17.8	0.63
0.6	0.92	177.4	0.77	58.9	0.01	-19.7	0.88	176.6		17.3	0.87
0.7	0.93	176.1	0.64	53.8	0.01	-24.7	0.89	175.6		16.4	0.93
0.8	0.93	174.9	0.54	49.3	0.01	-27.0	0.89	174.8	14.0		1.12
0.9	0.93	173.6	0.47	44.9	0.01	-29.5	0.90	173.9	12.2		1.33
1.0	0.94	172.4	0.41	40.7	0.01	-31.7	0.90	173.0	10.8		1.61
1.1	0.95	171.2	0.37	36.9	0.01	-33.5	0.91	172.1	9.9		1.85
1.2	0.95	170.0	0.32	33.1	0.01	-35.3	0.91	171.1	9.0		2.08
1.3	0.95	168.9	0.28	29.6	0.01	-38.7	0.91	170.2	8.1		2.43
1.4	0.95	167.7	0.25	26.3	0.01	-40.1	0.91	169.1	7.2		2.88
1.5	0.95	166.6	0.23	23.2	0.01	-40.3	0.92	168.1	6.6		3.31
1.6	0.95	165.5	0.21	20.2	0.01	-42.1	0.92	167.2	5.9		4.05
1.7	0.95	164.3	0.19	17.6	0.01	-41.5	0.92	166.4	5.1		4.91
1.8	0.96	163.3	0.17	15.0	0.00	-41.4	0.92	165.4	4.4		5.68
1.9	0.96	162.2	0.16	12.6	0.00	-40.2	0.93	164.4	3.8		7.09
2.0	0.96	161.2	0.14	10.4	0.00	-35.5	0.93	163.6	3.5		8.29
2.1	0.96	160.1	0.13	8.4	0.00	-30.1	0.93	162.8	2.9		11.07
2.2	0.96	159.2	0.12	6.5	0.00	-21.3	0.93	161.9	2.2		14.89
2.3	0.96	158.3	0.11	4.6	0.00	-15.3	0.94	161.0	1.7		16.85
2.4	0.96	157.4	0.11	3.1	0.00	-2.0	0.94	160.2	1.6		18.02
2.5	0.96	156.5	0.10	1.9	0.00	9.5	0.95	159.6	1.5		16.22
2.6	0.97	155.7	0.09	0.7	0.00	17.4	0.95	158.9	1.0		18.87
2.7	0.97	154.9	0.09	-0.8	0.00	49.6	0.95	158.0	0.6		17.17
2.8	0.97	154.2	0.08	-2.1	0.00	54.6	0.95	157.2	0.8		17.91
2.9	0.97	153.4	0.08	-3.3	0.00	75.7	0.96	156.6	0.9		11.30
3.0	0.97	152.7	0.07	-4.0	0.00	84.8	0.96	155.9	0.7		12.00

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

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

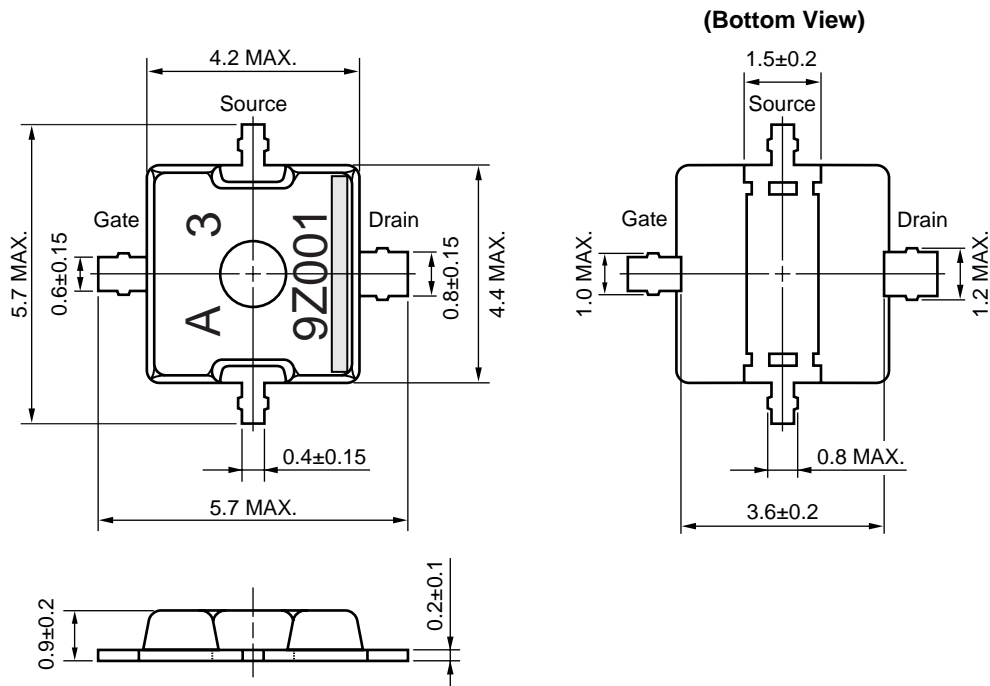
LARGE SIGNAL IMPEDANCE ($V_{DS} = 3.2\text{ V}$, $I_{Dset} = 600\text{ mA}$, $P_{in} = 25\text{ dBm}$)

f (MHz)	Z _{in} (Ω)	Z _{OL} (Ω) ^{Note}
1 785	TBD	TBD

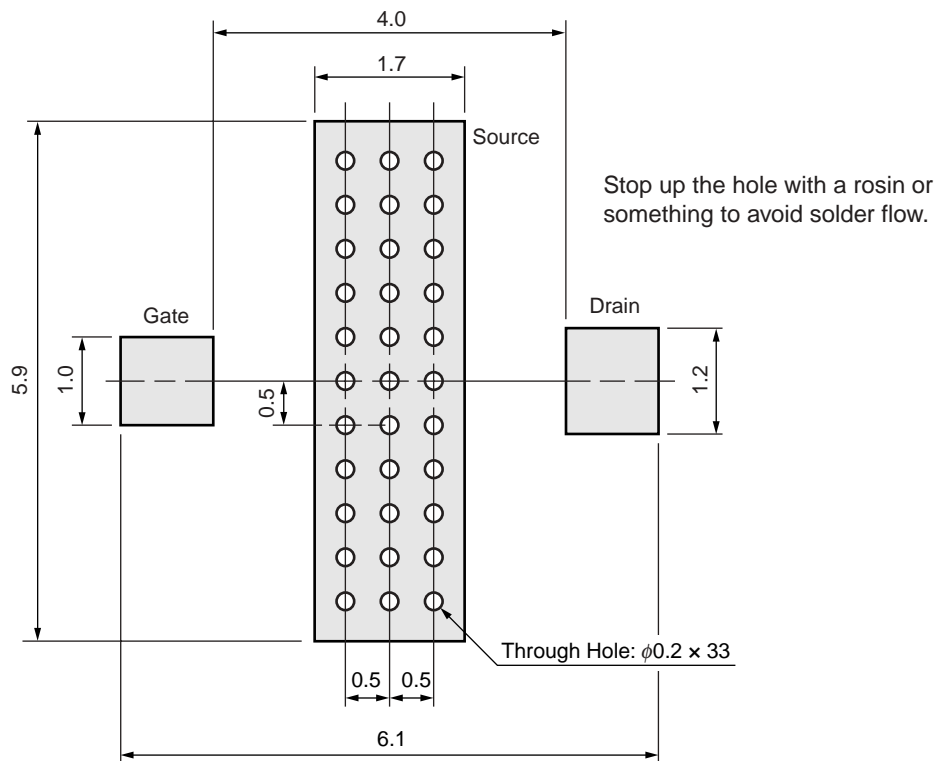
Note Z_{OL} is the conjugate of optimum load impedance at given voltage, idling current, input power and frequency.

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

► **Business issue**

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► **Technical issue**

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