NEC

SILICON POWER MOS FET

NE5520379A

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 NEC's NEWMOS technology (NEC's 0.6 μm 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 : η_{add} = 65% TYP. (V_{DS} = 3.2 V, V_{GS} = 2.5 V, f = 915 MHz, P_{in} = 25 dBm)
  : η_{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 × 5.7 × 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	• 12 mm wide embossed taping • Gate pin face the perforation side of the tape • Qty 1 kpcs/reel
NE5520379A-T1A			• 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 Please handle this device at static-free workstation, because this is an electrostatic sensitive device.

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ABSOLUTE MAXIMUM RATINGS (T_A = +25°C)

Parameter	Symbol	Ratings	Unit
Drain to Source Voltage	V_{DS}	6.0	V
Gate to Source Voltage	V_{GSO}	5.0	V
Drain Current	I_D	1.5	A
Drain Current (Pulse Test)	I_D Note	3.0	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}		2.8	3.2	3.8	V
Gate to Source Voltage	V_{GSO}		0	2.5	3.5	V
Drain Current (Pulse Test)	I_D	Duty Cycle ≤ 50%, T_{on} ≤ 1 ms	–	1.75	2.0	A
Input Power	P_{in}	f = 1.8 GHz, V_{DS} = 3.6 V	24	25	26	dBm

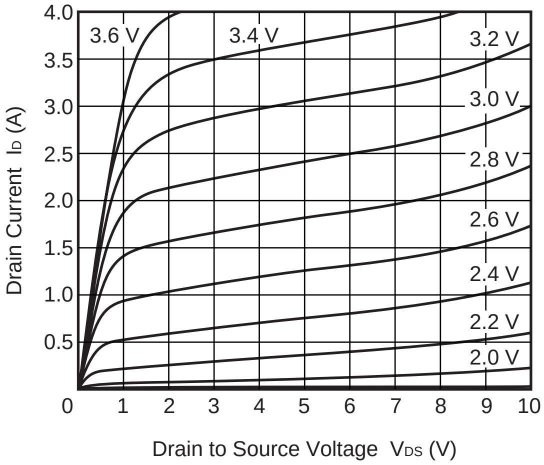
ELECTRICAL CHARACTERISTICS (T_A = +25°C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Gate to Source Leak Current	I_{GSO}	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_{DS}	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	–	%

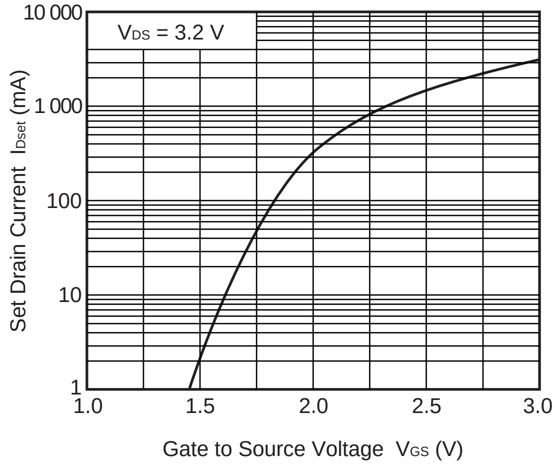
Note DC performance is 100% testing. RF performance is testing several samples per wafer.
Wafer rejection criteria for standard devices is 1 reject for several samples.

TYPICAL CHARACTERISTICS (T_A = +25°C)

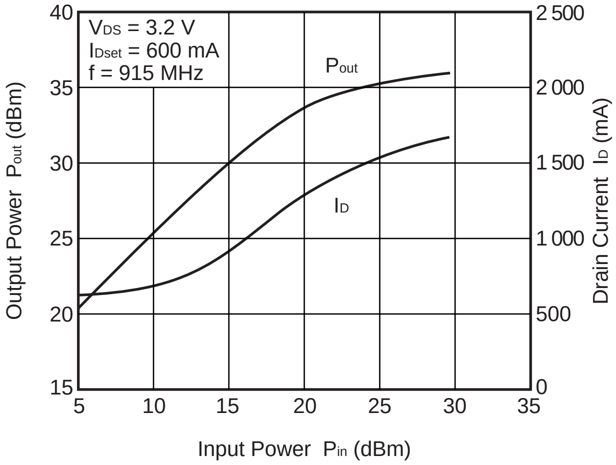
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



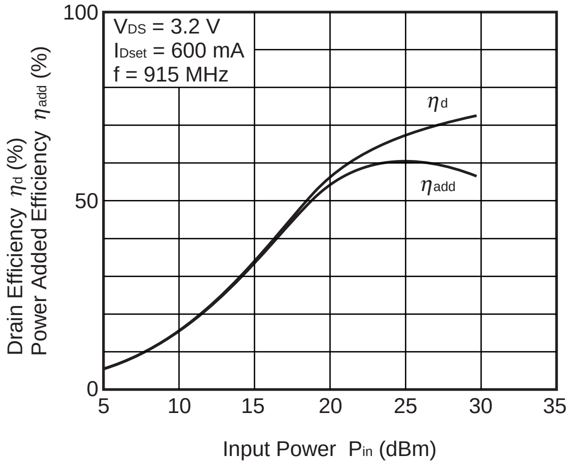
SET DRAIN CURRENT vs.
GATE TO SOURCE VOLTAGE



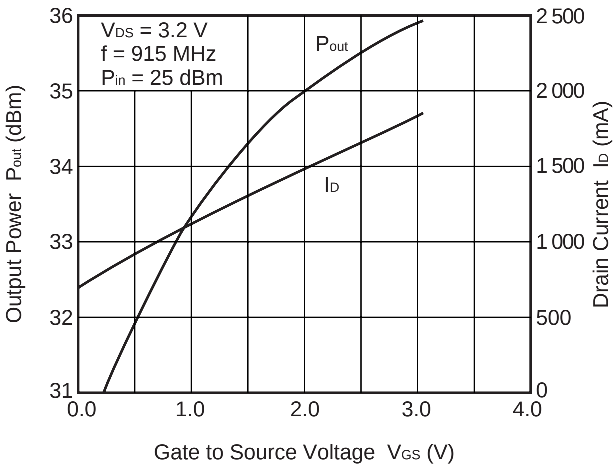
OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER



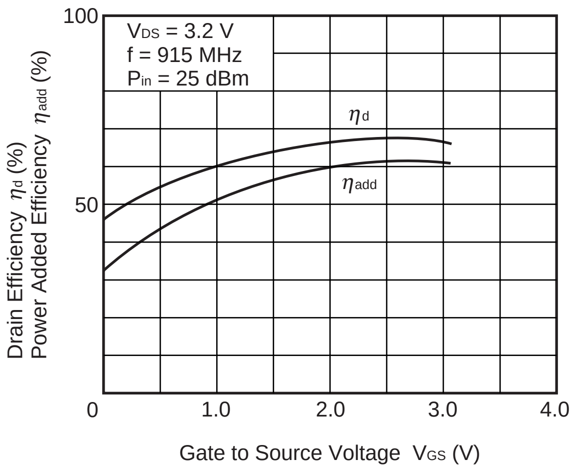
DRAIN EFFICIENCY, POWER ADDED
EFFICIENCY vs. INPUT POWER



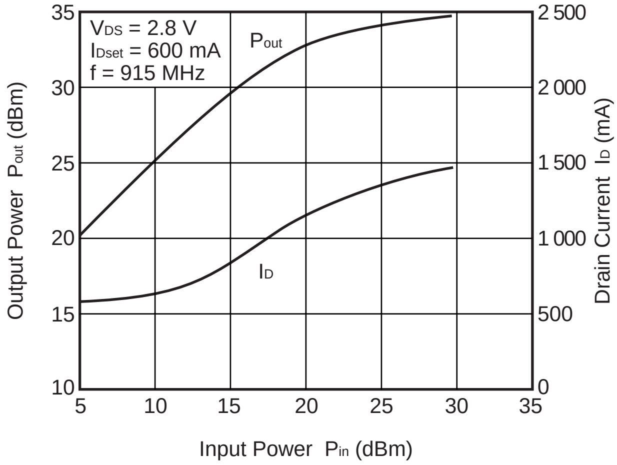
OUTPUT POWER, DRAIN CURRENT
vs. GATE TO SOURCE VOLTAGE



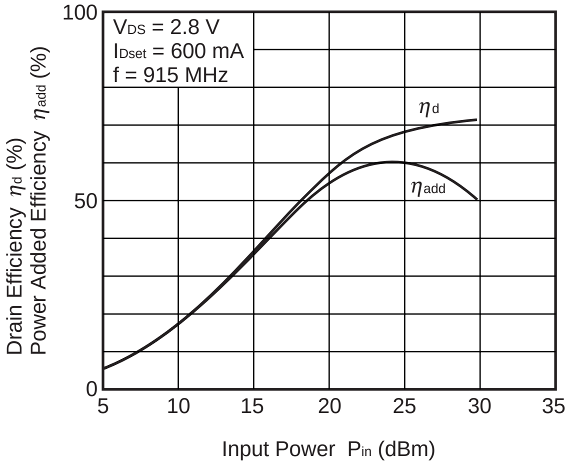
DRAIN EFFICIENCY, POWER ADDED
EFFICIENCY vs. GATE TO SOURCE VOLTAGE



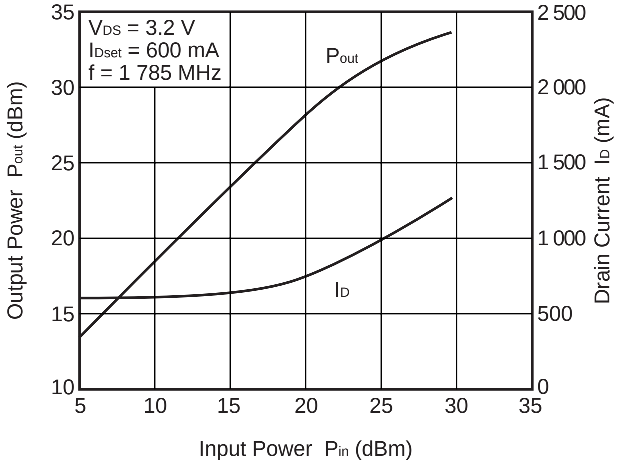
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



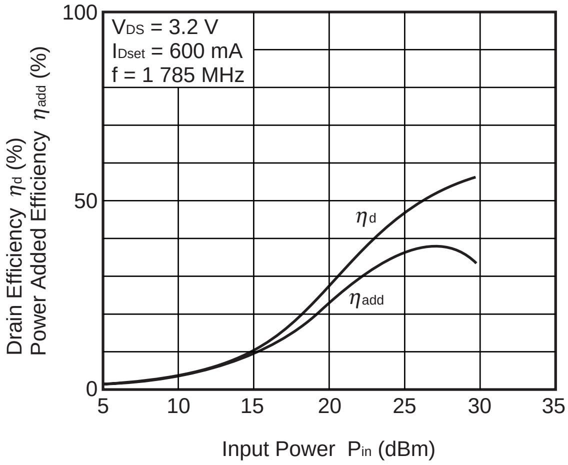
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER



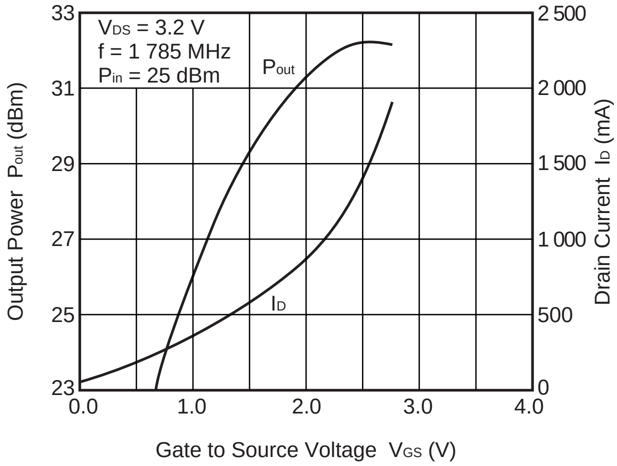
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER



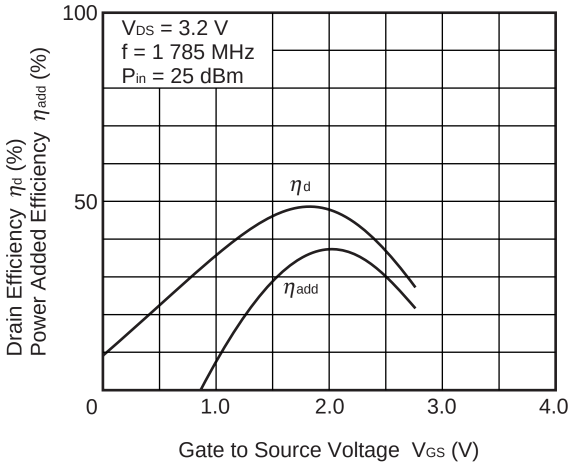
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. INPUT POWER



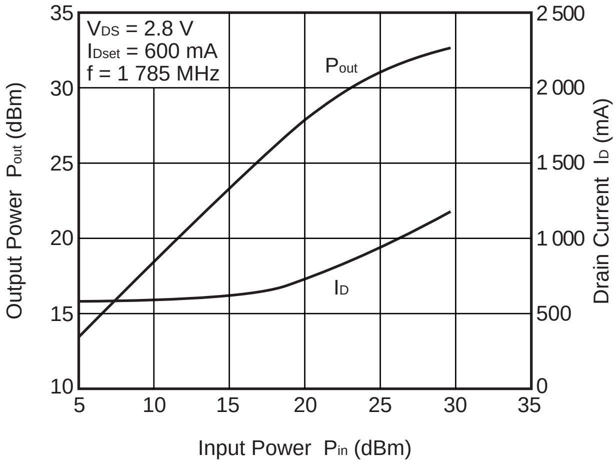
OUTPUT POWER, DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



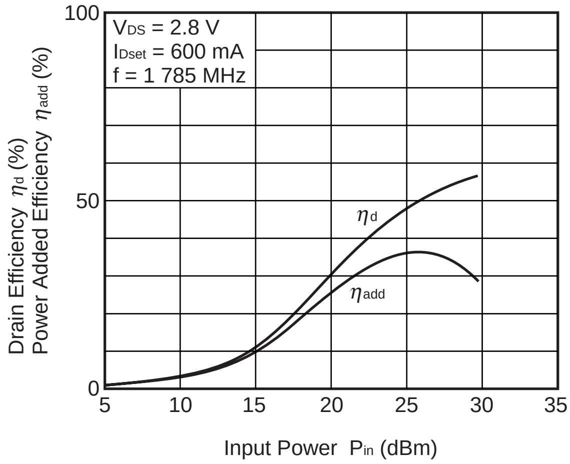
DRAIN EFFICIENCY, POWER ADDED EFFICIENCY vs. GATE TO SOURCE VOLTAGE



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 V, I_{DS} = 300 mA

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

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

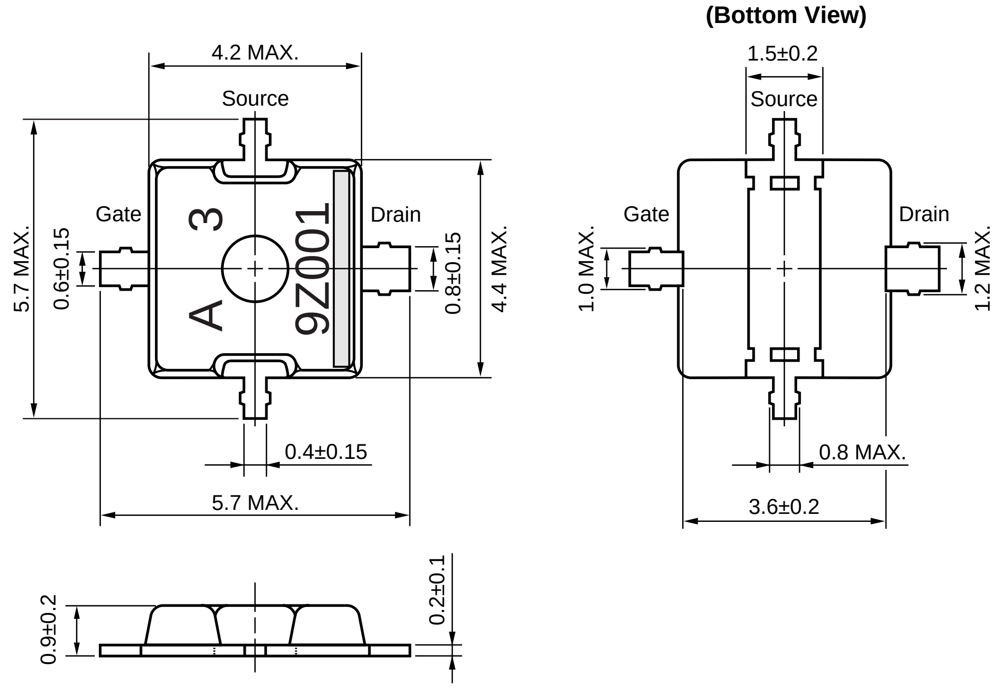
LARGE SIGNAL IMPEDANCE (V_{DS} = 3.2 V, I_{Dset} = 600 mA, P_{in} = 25 dBm)

f (MHz)	Z_{in} (Ω)	Z_{OL} (Ω) Note
1 785	TBD	TBD

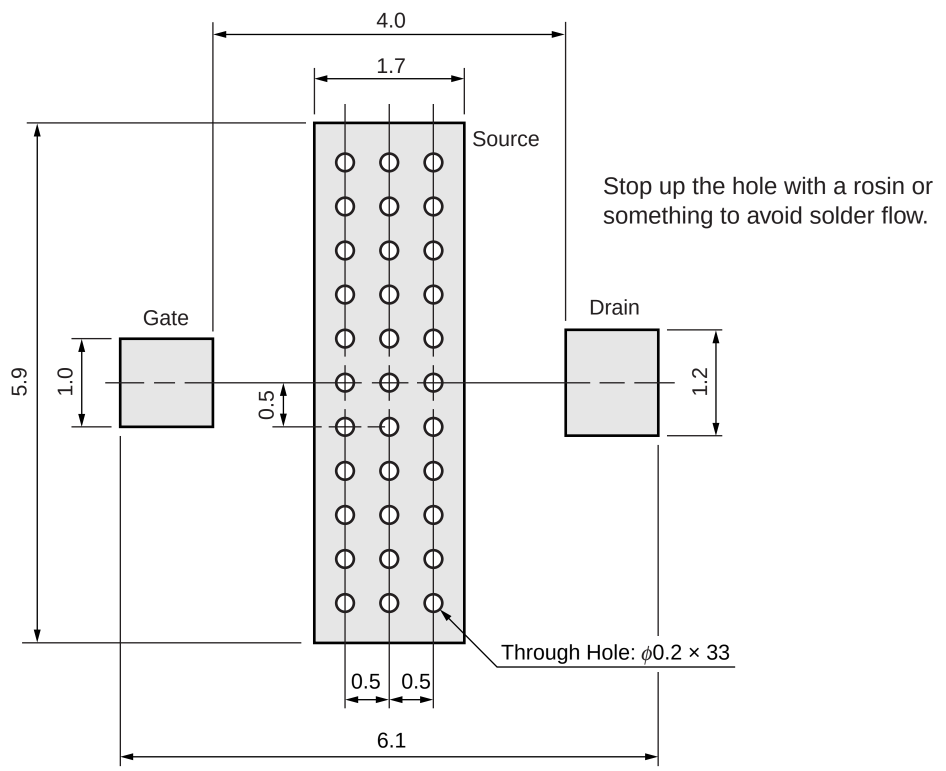
Note Z_{OL} is the conjugate of optimum load impedance at given voltage, idling current, input power and frequency.

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 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]