

To our customers,

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## Old Company Name in Catalogs and Other Documents

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On April 1<sup>st</sup>, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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# LDMOS FIELD EFFECT TRANSISTOR

# NE55410GR

## N-CHANNEL SILICON POWER LDMOS FET FOR 2 W + 10 W VHF to L-BAND SINGLE-END POWER AMPLIFIER

### DESCRIPTION

The NE55410GR is an N-channel enhancement-mode LDMOS FET designed for driver 0.1 to 2.6 GHz PA, such as, cellular base station amplifier, analog/digital TV-transmitters, and the other PA's. This product has two different FET's on one die manufactured using our NEWMOS technology (our WSi gate lateral MOS FET), and its nitride surface passivation and quadruple layer aluminum silicon metalization offer a high degree of reliability.

### FEATURES

- Two different FET's (Q1 : P<sub>out</sub> = 2 W, Q2 : P<sub>out</sub> = 10 W) in one package
  - Over 25 dB gain available by connecting two FET's in series
    - : G<sub>L</sub> (Q1) = 13.5 dB TYP. (V<sub>DS</sub> = 28 V, I<sub>Dset</sub> (Q1) = 20 mA, f = 2 140 MHz)
    - : G<sub>L</sub> (Q2) = 11.0 dB TYP. (V<sub>DS</sub> = 28 V, I<sub>Dset</sub> (Q2) = 100 mA, f = 2 140 MHz)
  - High 1 dB compression output power : P<sub>O</sub> (1 dB) (Q1) = 35.4 dBm TYP. (V<sub>DS</sub> = 28 V, I<sub>Dset</sub> (Q1) = 20 mA, f = 2 140 MHz)
    - : P<sub>O</sub> (1 dB) (Q2) = 40.4 dBm TYP. (V<sub>DS</sub> = 28 V, I<sub>Dset</sub> (Q2) = 100 mA, f = 2 140 MHz)
  - High drain efficiency
    - : η<sub>d</sub> (Q1) = 52% TYP. (V<sub>DS</sub> = 28 V, I<sub>Dset</sub> (Q1) = 20 mA, f = 2 140 MHz)
    - : η<sub>d</sub> (Q2) = 46% TYP. (V<sub>DS</sub> = 28 V, I<sub>Dset</sub> (Q2) = 100 mA, f = 2 140 MHz)
  - Low intermodulation distortion : IM<sub>3</sub> (Q1) = -40 dBc TYP. (V<sub>DS</sub> = 28 V, I<sub>Dset</sub> (Q1+Q2) = 120 mA, f = 2 132.5/2 147.5 MHz, P<sub>out</sub> = 33 dBm (2 tones) )
- <R>
- Single Supply (V<sub>DS</sub> : 3 V < V<sub>DS</sub> ≤ 32 V)
  - Excellent Thermal Stability
  - Surface mount type and Super low cost plastic package : 16-pin plastic HTSSOP
  - Integrated ESD protection
  - Excellent stability against HCI (Hot Carrier Injection)

### APPLICATION

- <R>
- Digital cellular base station PA : W-CDMA/GSM/D-AMPS/N-CDMA/PCS etc.
  - UHF-band TV transmitter PA

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

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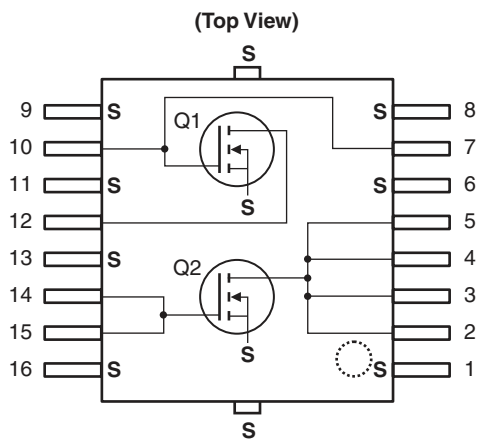
**ORDERING INFORMATION**

Part Number	Order Number	Package	Marking	Supplying Form
NE55410GR	NE55410GR-T3-AZ	16-pin plastic HTSSOP (Pb-Free) <sup>Note</sup>	55410	<ul style="list-style-type: none"> <li>• Embossed tape 12 mm wide</li> <li>• Pin 1 and 8 indicates pull-out direction of tape</li> <li>• Qty 1 kpcs/reel</li> </ul>

**Note** With regards to terminal solder (the solder contains lead) plated products (conventionally plated), contact your nearby sales office.

**Remark** To order evaluation samples, contact your nearby sales office.  
Part number for sample order: NE55410GR

**PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM**



Pin No.	Pin Name	Pin No.	Pin Name
1	Source	9	Source
2	Drain (Q2)	10	Gate (Q1)
3	Drain (Q2)	11	Source
4	Drain (Q2)	12	Drain (Q1)
5	Drain (Q2)	13	Source
6	Source	14	Gate (Q2)
7	Gate (Q1)	15	Gate (Q2)
8	Source	16	Source

**Remark** All the terminals of a Q2 connected to a circuit. Backside : Source (S)

**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = +25°C, unless otherwise specified)**

Parameter	Symbol	Test Conditions	Ratings	Unit
Drain to Source Voltage	V <sub>DS</sub>		65	V
Gate to Source Voltage	V <sub>GS</sub>		±7	V
Drain Current (Q1)	I <sub>D (Q1)</sub>		0.25	A
Drain Current (Q2)	I <sub>D (Q2)</sub>		1.0	A
Total Device Dissipation (T <sub>case</sub> = 25°C)	P <sub>tot</sub>		40	W
Input Power (Q1)	P <sub>in (Q1)</sub>	f = 2.14 GHz, V <sub>DS</sub> = 28 V	0.3	W
Input Power (Q2)	P <sub>in (Q2)</sub>	f = 2.14 GHz, V <sub>DS</sub> = 28 V	1.5	W
Channel Temperature	T <sub>ch</sub>		150	°C
Storage Temperature	T <sub>stg</sub>		-65 to +150	°C

**THERMAL RESISTANCE (T<sub>A</sub> = +25°C)**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Channel to Case Resistance	R <sub>th (ch-c)</sub>		–	2.5	3.0	°C/W

**RECOMMENDED OPERATING CONDITIONS (T<sub>A</sub> = +25°C)**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
<R> Drain to Source Voltage	V <sub>DS</sub>	–	28	32	V
Gate to Source Voltage	V <sub>GS</sub>	2.7	3.3	3.7	V
Input Power (Q1), CW	P <sub>in (Q1)</sub>	–	15	23	dBm
Input Power (Q2), CW	P <sub>in (Q2)</sub>	–	20	30	dBm
<R> Average Output Power (Q1), CW <sup>Note</sup>	P <sub>O (ave.) (Q1)</sub>	–	–	24	dBm
<R> Average Output Power (Q2), CW <sup>Note</sup>	P <sub>O (ave.) (Q2)</sub>	–	–	30	dBm

<R> **Note** When mounting on the PWB that our company recommends.

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = +25°C)**

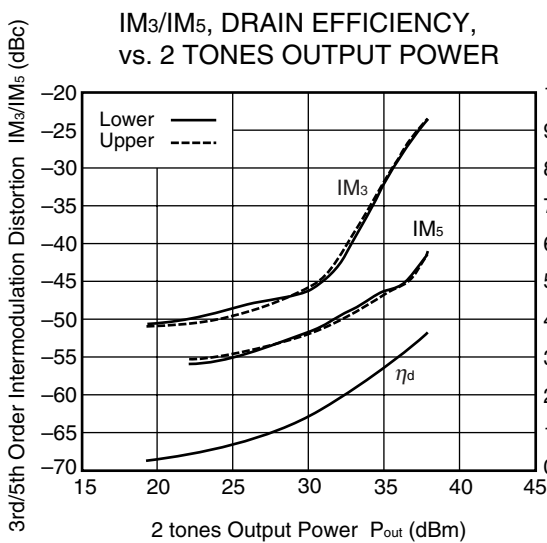
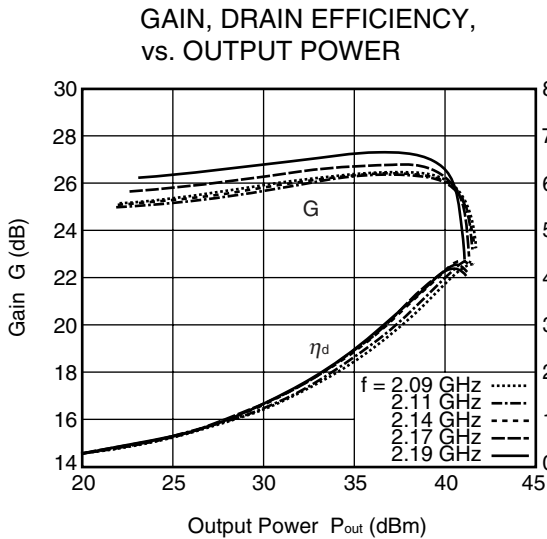
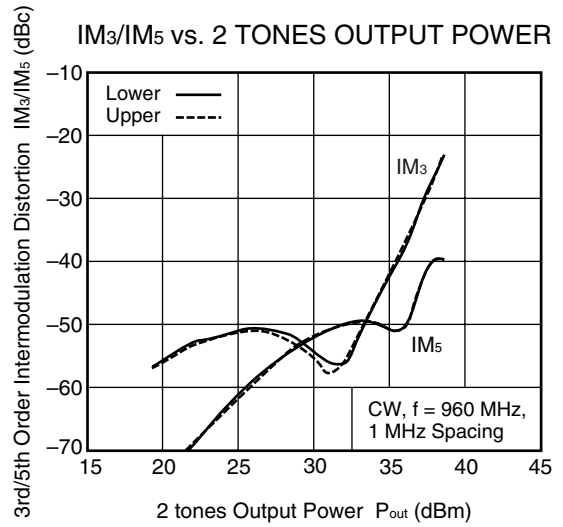
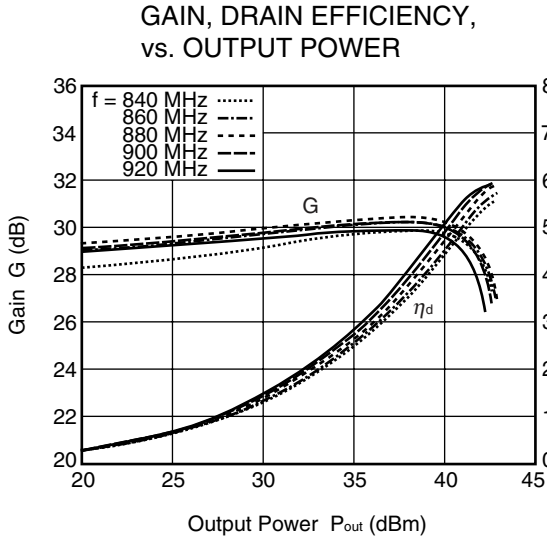
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
<b>Q1</b>						
Gate to Source Leak Current	I <sub>GSS (Q1)</sub>	V <sub>GSS</sub> = 5V	–	–	1	μA
Drain to Source Leakage Current	I <sub>DSS (Q1)</sub>	V <sub>DSS</sub> = 65 V	–	–	1	mA
Gate Threshold Voltage	V <sub>th (Q1)</sub>	V <sub>DS</sub> = 10 V, I <sub>DS</sub> = 1 mA	2.2	2.8	3.4	V
Transconductance	g <sub>m (Q1)</sub>	V <sub>DS</sub> = 28 V, I <sub>DS</sub> = 20 mA	–	0.09	–	S
Drain to Source Breakdown Voltage	BV <sub>DSS (Q1)</sub>	I <sub>DSS</sub> = 10 μA	65	75	–	V
<b>Q2</b>						
Gate to Source Leak Current	I <sub>GSS (Q2)</sub>	V <sub>GSS</sub> = 5V	–	–	1	μA
Drain to Source Leakage Current	I <sub>DSS (Q2)</sub>	V <sub>DSS</sub> = 65 V	–	–	1	mA
Gate Threshold Voltage	V <sub>th (Q2)</sub>	V <sub>DS</sub> = 10 V, I <sub>DS</sub> = 1 mA	2.0	2.6	3.2	V
Transconductance	g <sub>m (Q2)</sub>	V <sub>DS</sub> = 28 V, I <sub>DS</sub> = 100 mA	–	0.45	–	S
Drain to Source Breakdown Voltage	BV <sub>DSS (Q2)</sub>	I <sub>DSS</sub> = 10 μA	65	75	–	V

<R> RF CHARACTERISTICS (T<sub>A</sub> = +25°C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
<b>Q1</b>						
Gain 1 dB Compression Output Power	P <sub>O (1 dB)</sub>	f = 2 140 MHz, V <sub>DS</sub> = 28 V,	–	35.4	–	dBm
Drain Efficiency	$\eta_d$	I <sub>Dset</sub> = 20 mA	–	52	–	%
Linear Gain	G <sub>L</sub> <sup>Note1</sup>		12	13.5	–	dB
<b>Q2</b>						
Gain 1 dB Compression Output Power	P <sub>O (1 dB)</sub>	f = 2 140 MHz, V <sub>DS</sub> = 28 V,	–	40.4	–	dBm
Drain Efficiency	$\eta_d$	I <sub>Dset</sub> = 100 mA	–	46	–	%
Linear Gain	G <sub>L</sub> <sup>Note2</sup>		9.5	11	–	dB
Gain 1 dB Compression Output Power	P <sub>O (1 dB)</sub>	f = 1 840 MHz, V <sub>DS</sub> = 28 V,	–	40.5	–	dBm
Drain Efficiency	$\eta_d$	I <sub>Dset</sub> = 100 mA	–	49	–	%
Linear Gain	G <sub>L</sub> <sup>Note2</sup>		–	14	–	dB
<b>Q1 + Q2</b>						
Gain 1 dB Compression Output Power	P <sub>O (1 dB)</sub>	f = 880 MHz, V <sub>DS</sub> = 28 V,	–	41.5	–	dBm
Drain Efficiency	$\eta_d$	I <sub>Dset</sub> = 120 mA (Q1 + Q2)	–	55	–	%
Linear Gain	G <sub>L</sub> <sup>Note3</sup>		–	30	–	dB
Gain 1 dB Compression Output Power	P <sub>O (1 dB)</sub>	f = 2 140 MHz, V <sub>DS</sub> = 28 V,	–	40.0	–	dBm
Drain Efficiency	$\eta_d$	I <sub>Dset</sub> = 120 mA (Q1 + Q2)	34	42	–	%
Output Power	P <sub>out</sub>		39	40	–	dB
Linear Gain	G <sub>L</sub> <sup>Note4</sup>		24	25	–	dB
3rd Order Intermodulation Distortion	IM <sub>3</sub>	f = 2 132.5/2 147.5 MHz, V <sub>DS</sub> = 28 V,	–	–40	–	dBc
Drain Efficiency	$\eta_d$	2 carrier W-CDMA 3GPP, Test Model1, 64DPCH, 67% Clipping, I <sub>Dset</sub> = 120 mA (Q1 + Q2), Ave P <sub>out</sub> = 33 dBm	–	21	–	%

- Notes 1. P<sub>in</sub> = 15 dBm
- 2. P<sub>in</sub> = 20 dBm
- 3. P<sub>in</sub> = 5 dBm
- 4. P<sub>in</sub> = 10 dBm

**TYPICAL CHARACTERISTICS (TA = +25°C, VDS = 28 V, Idset = 120 mA, unless otherwise specified)**



**Remark** The graphs indicate nominal characteristics.

**<R> S-PARAMETERS**

S-parameters/Noise parameters are provided on our web site in a form (S2P) that enables direct import to a microwave circuit simulator without keyboard input.

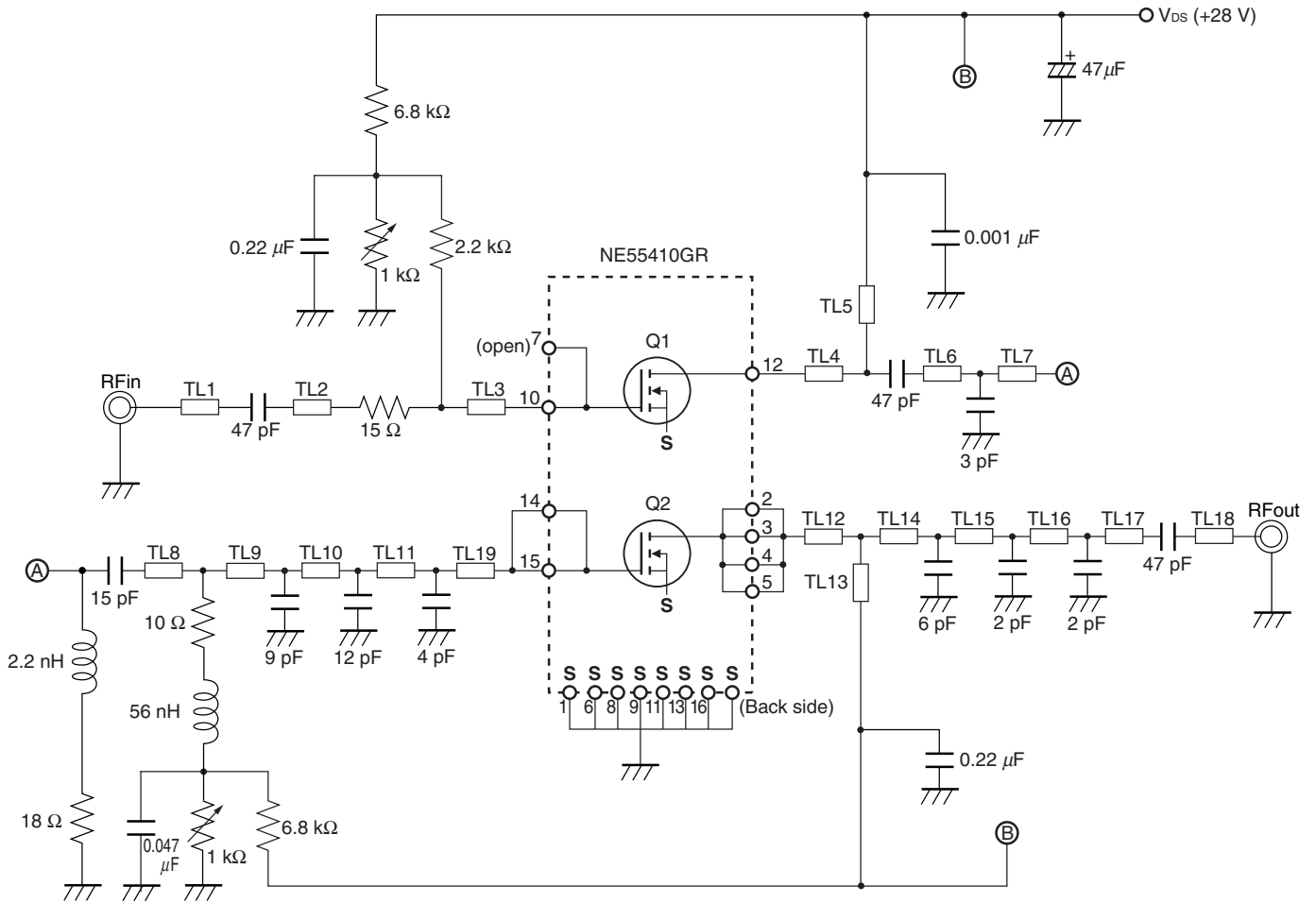
Click here to download S-parameters.

[RF and Microwave] → [Device Parameters]

URL <http://www.ncsd.necel.com/microwave/index.html>



EVALUATION CIRCUIT (f = 840 to 960 MHz, V<sub>DS</sub> = 28 V, I<sub>Dset</sub> = 120 mA)

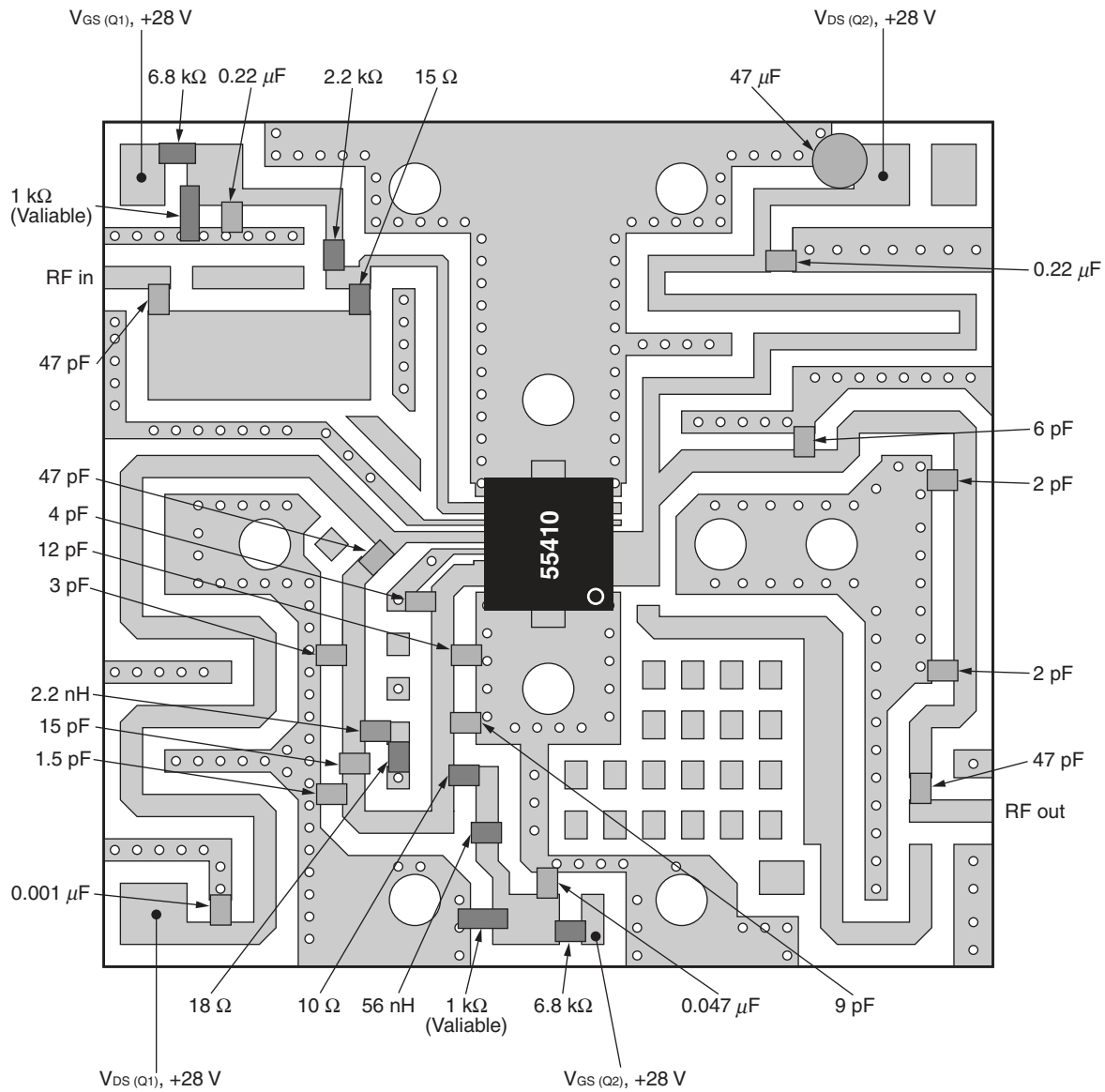


Symbol	Width (mm)	Length (mm)
TL1	1.0	3.0
TL2	4.5	10.0
TL3	0.5	16.0
TL4	0.5	5.0
TL5	1.0	48.0
TL6	1.0	4.0
TL7	1.0	3.0
TL8	1.0	6.0
TL9	1.0	3.0
TL10	1.0	4.0

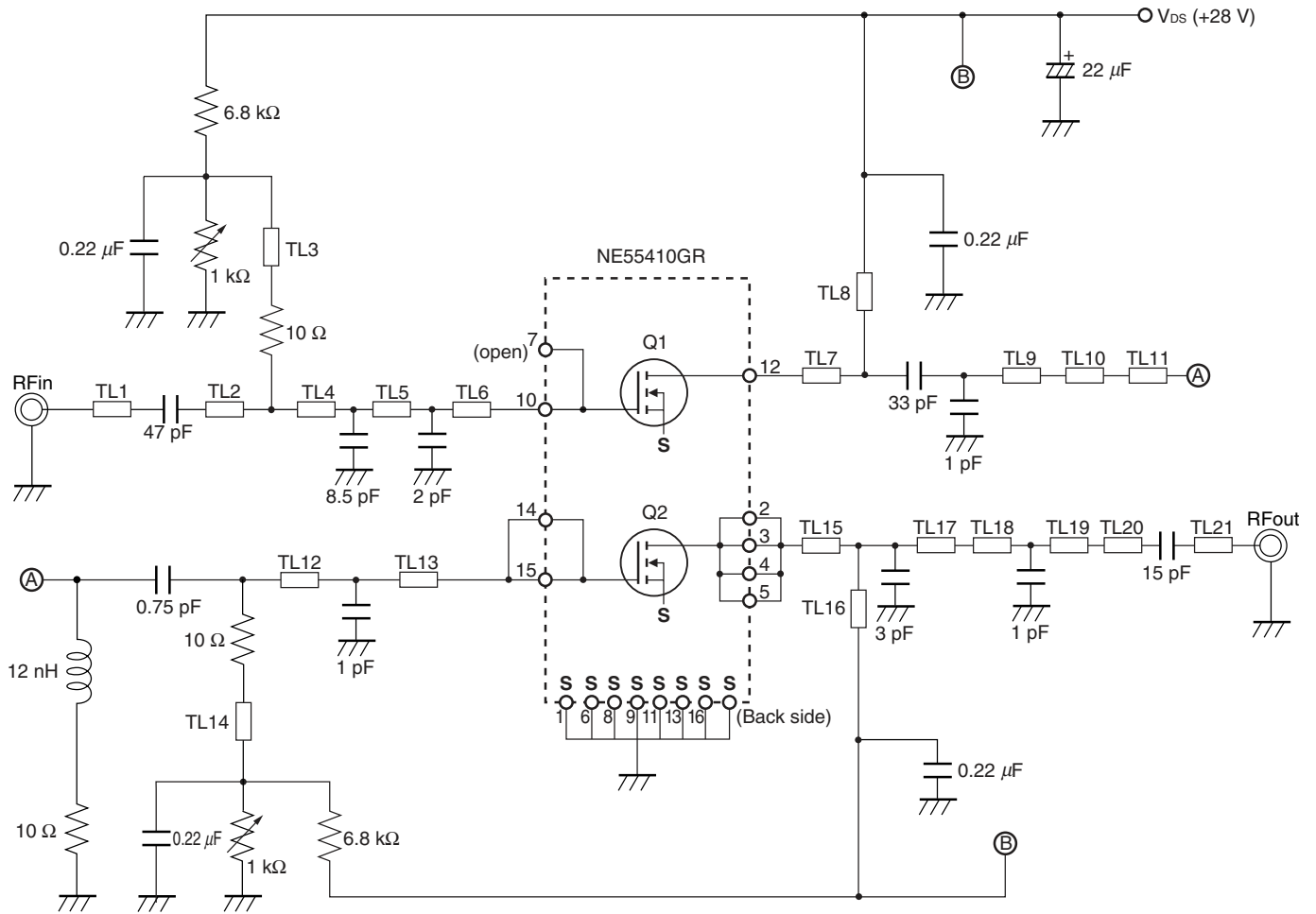
Symbol	Width (mm)	Length (mm)
TL11	1.0	3.0
TL12	1.0	5.0
TL13	0.8	48.0
TL14	1.0	6.5
TL15	1.0	10.5
TL16	1.0	9.5
TL17	1.0	10.0
TL18	1.0	6.0
TL19	1.0	3.0

The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

**EVALUATION CIRCUIT (f = 840 to 960 MHz, V<sub>DS</sub> = 28 V, I<sub>Dset</sub> = 120 mA)**



EVALUATION CIRCUIT (f = 2 090 to 2 190 MHz, V<sub>DS</sub> = 28 V, I<sub>Dset</sub> = 120 mA)

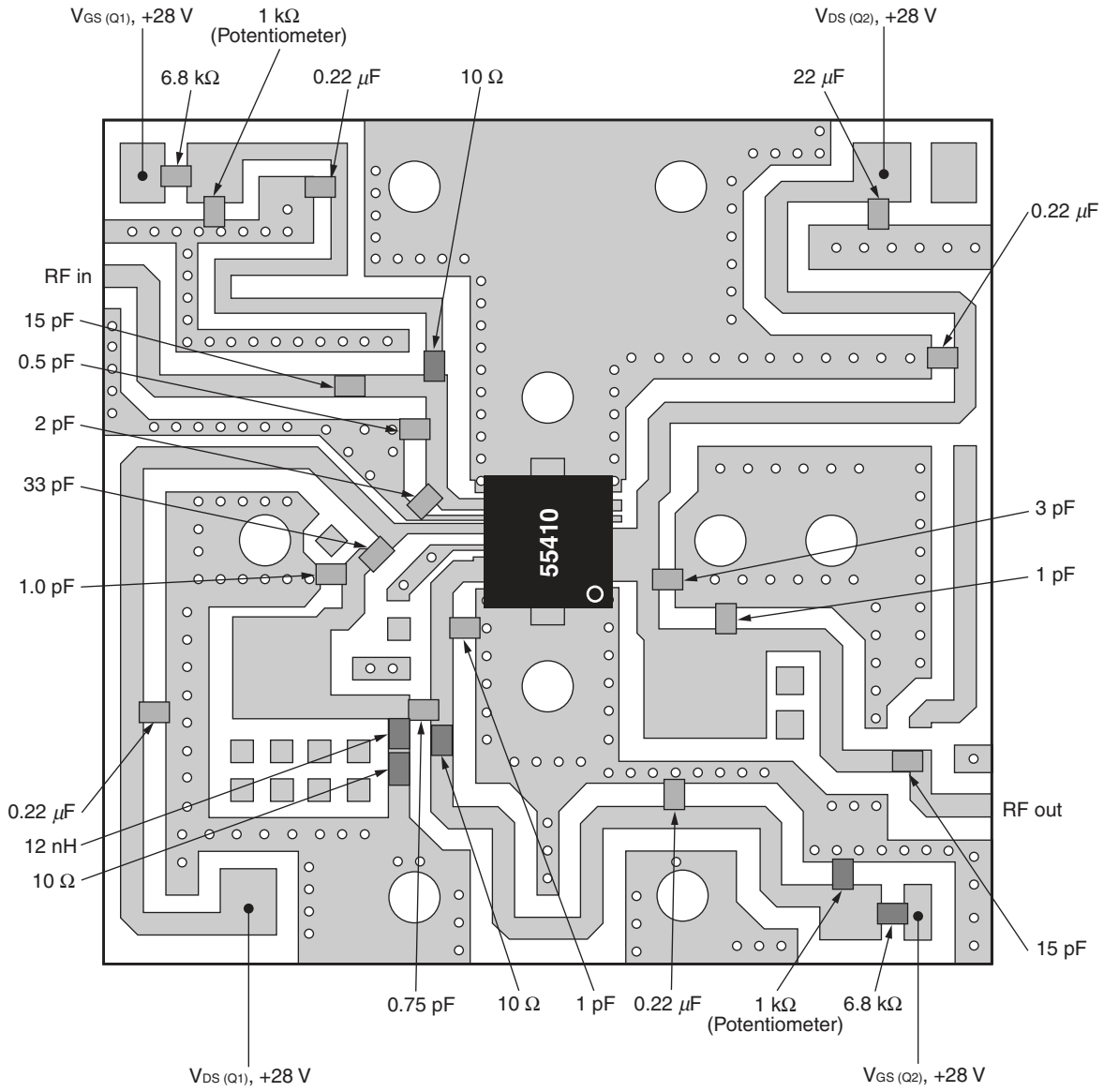


Symbol	Width (mm)	Length (mm)
TL1	1.0	17.0
TL2	1.0	4.0
TL3	1.0	24.5
TL4	1.0	2.5
TL5	1.0	3.0
TL6	0.5	2.5
TL7	0.5	4.5
TL8	1.0	25.5
TL9	1.0	2.5
TL10	4.5	4.5
TL11	1.0	3.5

Symbol	Width (mm)	Length (mm)
TL12	1.0	4.0
TL13	1.0	4.5
TL14	1.0	25.0
TL15	2.5	2.5
TL16	1.0	27.0
TL17	1.0	2.0
TL18	5.0	4.0
TL19	5.0	2.0
TL20	1.0	12.5
TL21	1.0	5.5

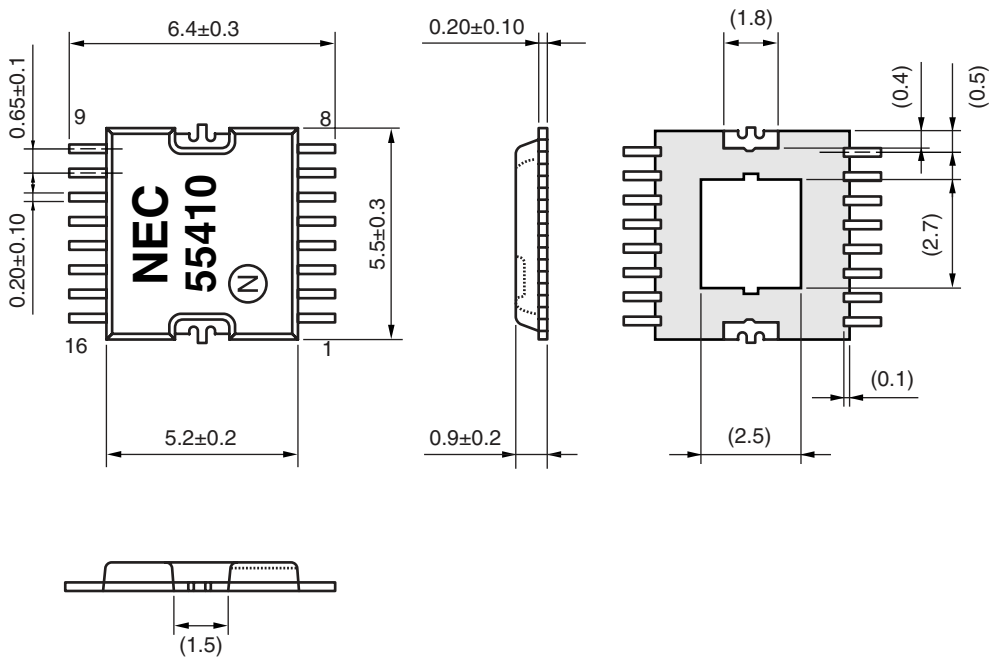
The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

<R> EVALUATION CIRCUIT ( $f = 2\ 090$  to  $2\ 190$  MHz,  $V_{DS} = 28$  V,  $I_{Dset} = 120$  mA)



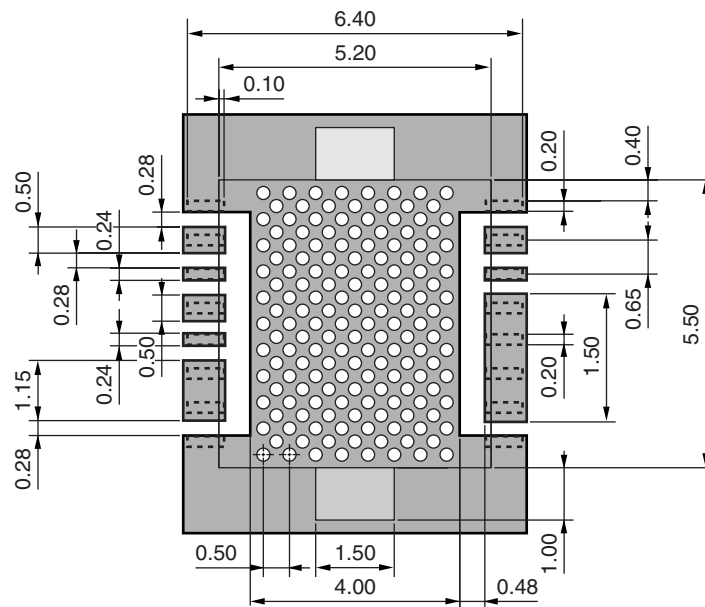
PACKAGE DIMENSIONS


16-PIN PLASTIC HTSSOP (UNIT: mm)



Remark ( ): Reference value

LAND PATTERN (UNIT: mm)



- Remarks**
1. Via holes : 158 holes
  2. Hole size :  $\phi 0.15$  mm
  3. Min. spacing :  $0.354$  mm
  4.  : Solder resist or etching

<R>

**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
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 (terminal temperature) : 350°C or below Soldering time (per side of device) : 3 seconds or less Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	HS350

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

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