DATA SHEET

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_{out} = 2 W, Q2 : P_{out} = 10 W) in one package
- Over 25 dB gain available by connecting two FET’s in series
  : $G_{L\,(Q1)}$ = 13.5 dB TYP. (V_{DS} = 28 V, $I_{Dset\,(Q1)}$ = 20 mA, f = 2 140 MHz)
  : $G_{L\,(Q2)}$ = 11.0 dB TYP. (V_{DS} = 28 V, $I_{Dset\,(Q2)}$ = 100 mA, f = 2 140 MHz)
- High 1 dB compression output power : $P_{O\,(1\,dB)\,(Q1)}$ = 35.4 dBm TYP. (V_{DS} = 28 V, $I_{Dset\,(Q1)}$ = 20 mA, f = 2 140 MHz)
  : $P_{O\,(1\,dB)\,(Q2)}$ = 40.4 dBm TYP. (V_{DS} = 28 V, $I_{Dset\,(Q2)}$ = 100 mA, f = 2 140 MHz)
- High drain efficiency : $\eta_{d\,(Q1)}$ = 52% TYP. (V_{DS} = 28 V, $I_{Dset\,(Q1)}$ = 20 mA, f = 2 140 MHz)
  : $\eta_{d\,(Q2)}$ = 46% TYP. (V_{DS} = 28 V, $I_{Dset\,(Q2)}$ = 100 mA, f = 2 140 MHz)
- Low intermodulation distortion : $IM_{3\,(Q1)}$ = –40 dBc TYP. (V_{DS} = 28 V, $I_{Dset\,(Q1+Q2)}$ = 120 mA, f = 2 132.5/2 147.5 MHz, P_{out} = 33 dBm (2 tones))

<R>
- Single Supply (V_{DS} : 3 V < V_{DS} ≤ 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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The mark <R> shows major revised points.

The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

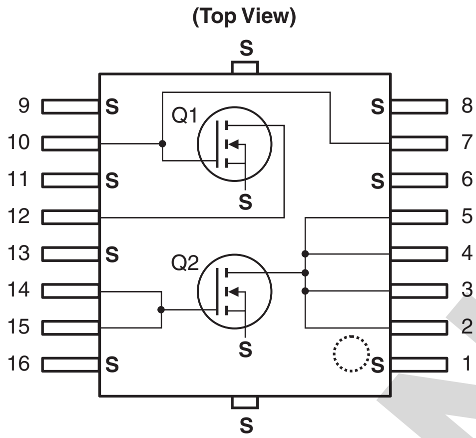
ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
NE55410GR	NE55410GR-T3-AZ	16-pin plastic HTSSOP (Pb-Free) Note	55410	• Embossed tape 12 mm wide • Pin 1 and 8 indicates pull-out direction of tape • Qty 1 kpcs/reel

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_A = +25°C, unless otherwise specified)

Parameter	Symbol	Test Conditions	Ratings	Unit
Drain to Source Voltage	V_{DS}		65	V
Gate to Source Voltage	V_{GS}		±7	V
Drain Current (Q1)	$I_{D\ (Q1)}$		0.25	A
Drain Current (Q2)	$I_{D\ (Q2)}$		1.0	A
Total Device Dissipation (T_{case} = 25°C)	P_{tot}		40	W
Input Power (Q1)	$P_{in\ (Q1)}$	f = 2.14 GHz, V_{DS} = 28 V	0.3	W
Input Power (Q2)	$P_{in\ (Q2)}$	f = 2.14 GHz, V_{DS} = 28 V	1.5	W
Channel Temperature	T_{ch}		150	°C
Storage Temperature	T_{stg}		–65 to +150	°C

THERMAL RESISTANCE (T_A = +25°C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Channel to Case Resistance	$R_{th\ (ch\text{-}c)}$		–	2.5	3.0	°C/W

RECOMMENDED OPERATING CONDITIONS (T_A = +25°C)

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

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

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Q1						
Gate to Source Leak Current	$I_{GSS\ (Q1)}$	V_{GSS} = 5V	–	–	1	μA
Drain to Source Leakage Current	$I_{DSS\ (Q1)}$	V_{DSS} = 65 V	–	–	1	mA
Gate Threshold Voltage	$V_{th\ (Q1)}$	V_{DS} = 10 V, I_{DS} = 1 mA	2.2	2.8	3.4	V
Transconductance	$g_{m\ (Q1)}$	V_{DS} = 28 V, I_{DS} = 20 mA	–	0.09	–	S
Drain to Source Breakdown Voltage	$BV_{DSS\ (Q1)}$	I_{DSS} = 10 μA	65	75	–	V
Q2						
Gate to Source Leak Current	$I_{GSS\ (Q2)}$	V_{GSS} = 5V	–	–	1	μA
Drain to Source Leakage Current	$I_{DSS\ (Q2)}$	V_{DSS} = 65 V	–	–	1	mA
Gate Threshold Voltage	$V_{th\ (Q2)}$	V_{DS} = 10 V, I_{DS} = 1 mA	2.0	2.6	3.2	V
Transconductance	$g_{m\ (Q2)}$	V_{DS} = 28 V, I_{DS} = 100 mA	–	0.45	–	S
Drain to Source Breakdown Voltage	$BV_{DSS\ (Q2)}$	I_{DSS} = 10 μA	65	75	–	V

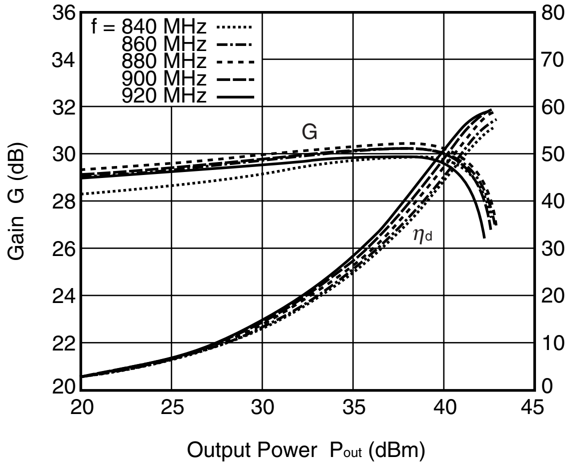
<R> RF CHARACTERISTICS (T_A = +25°C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Q1						
Gain 1 dB Compression Output Power	$P_{O\,(1\,dB)}$	f = 2 140 MHz, V_{DS} = 28 V, I_{Dset} = 20 mA	–	35.4	–	dBm
Drain Efficiency	η_d		–	52	–	%
Linear Gain	G_L Note1		12	13.5	–	dB
Q2						
Gain 1 dB Compression Output Power	$P_{O\,(1\,dB)}$	f = 2 140 MHz, V_{DS} = 28 V, I_{Dset} = 100 mA	–	40.4	–	dBm
Drain Efficiency	η_d		–	46	–	%
Linear Gain	G_L Note2		9.5	11	–	dB
Gain 1 dB Compression Output Power	$P_{O\,(1\,dB)}$	f = 1 840 MHz, V_{DS} = 28 V, I_{Dset} = 100 mA	–	40.5	–	dBm
Drain Efficiency	η_d		–	49	–	%
Linear Gain	G_L Note2		–	14	–	dB
Q1 + Q2						
Gain 1 dB Compression Output Power	$P_{O\,(1\,dB)}$	f = 880 MHz, V_{DS} = 28 V, I_{Dset} = 120 mA (Q1 + Q2)	–	41.5	–	dBm
Drain Efficiency	η_d		–	55	–	%
Linear Gain	G_L Note3		–	30	–	dB
Gain 1 dB Compression Output Power	$P_{O\,(1\,dB)}$	f = 2 140 MHz, V_{DS} = 28 V, I_{Dset} = 120 mA (Q1 + Q2)	–	40.0	–	dBm
Drain Efficiency	η_d		34	42	–	%
Output Power	P_{out}		39	40	–	dB
Linear Gain	G_L Note4		24	25	–	dB
3rd Order Intermodulation Distortion	IM_3	f = 2 132.5/2 147.5 MHz, V_{DS} = 28 V, 2 carrier W-CDMA 3GPP, Test Model1, 64DPCH, 67% Clipping, I_{Dset} = 120 mA (Q1 + Q2), Ave P_{out} = 33 dBm	–	–40	–	dBc
Drain Efficiency	η_d		–	21	–	%

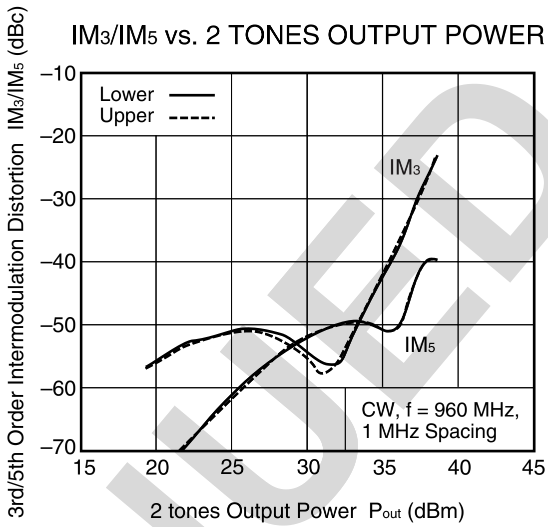
Notes 1. P_{in} = 15 dBm
2. P_{in} = 20 dBm
3. P_{in} = 5 dBm
4. P_{in} = 10 dBm

TYPICAL CHARACTERISTICS (T_A = +25°C, V_{DS} = 28 V, I_{Dset} = 120 mA, unless otherwise specified)

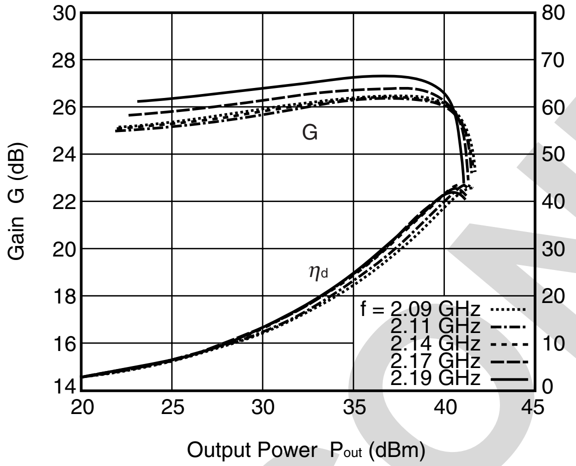
GAIN, DRAIN EFFICIENCY, vs. OUTPUT POWER



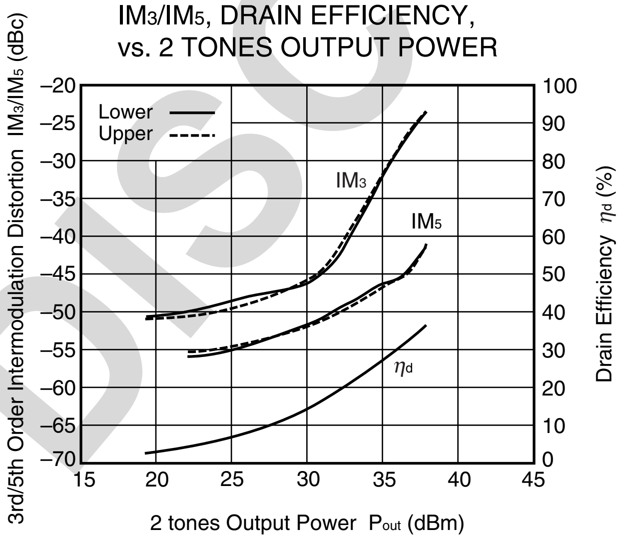
IM3/IM5 vs. 2 TONES OUTPUT POWER



GAIN, DRAIN EFFICIENCY, vs. OUTPUT POWER



IM3/IM5, DRAIN EFFICIENCY, vs. 2 TONES OUTPUT POWER



W-CDMA 3GPP, Test Model 1,
64 DPCH, 67% Clipping,
Center Frequency 2.14GHz,
15 MHz spacing

Remark The graphs indicate nominal characteristics.

<R> **S-PARAMETERS**

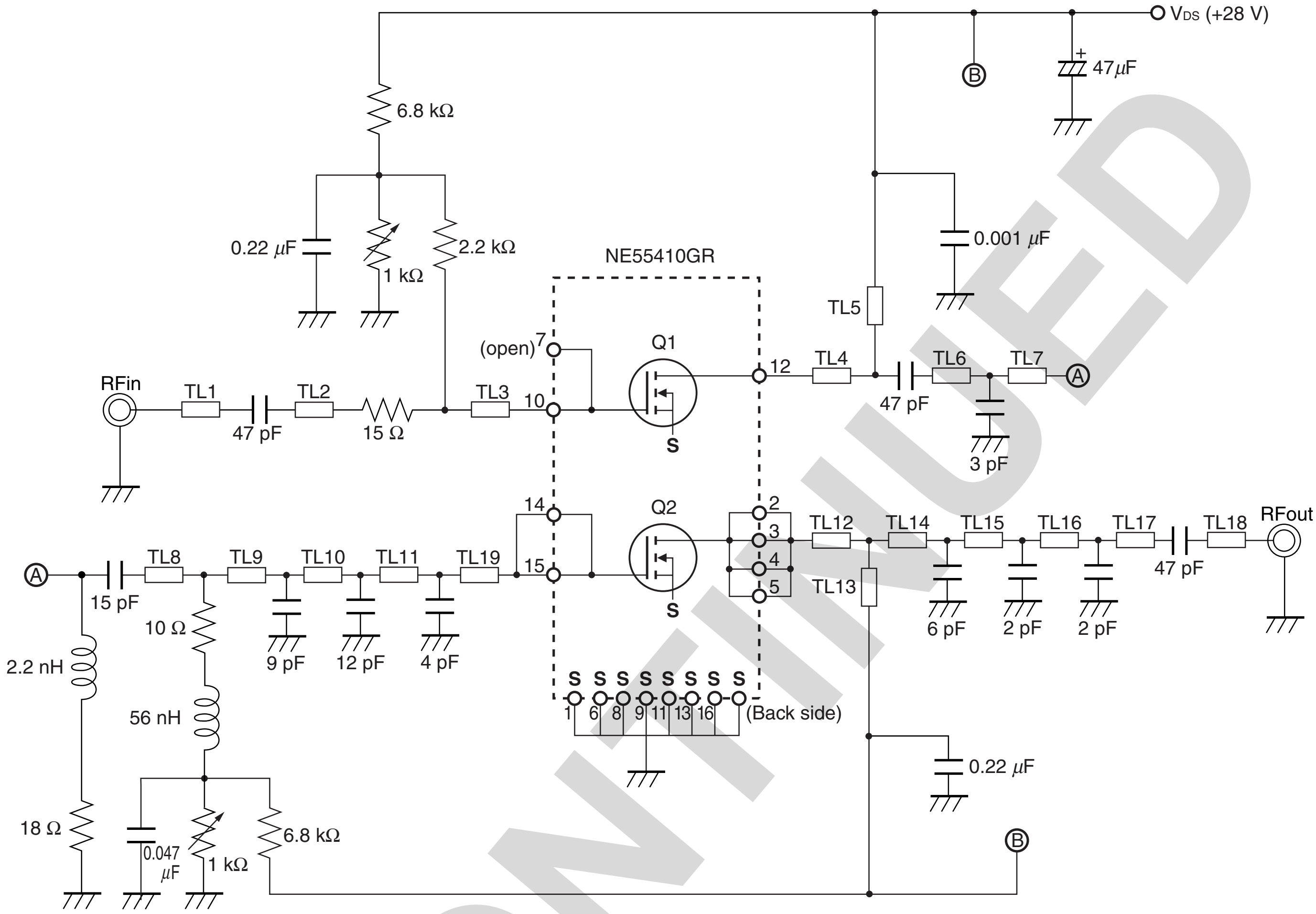
S-parameters/Noise parameters are provided on our web site in a form (S2P) that enables direct import to a microwave circuit simulator without keyboard input.

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_{DS} = 28 V, I_{Dset} = 120 mA)

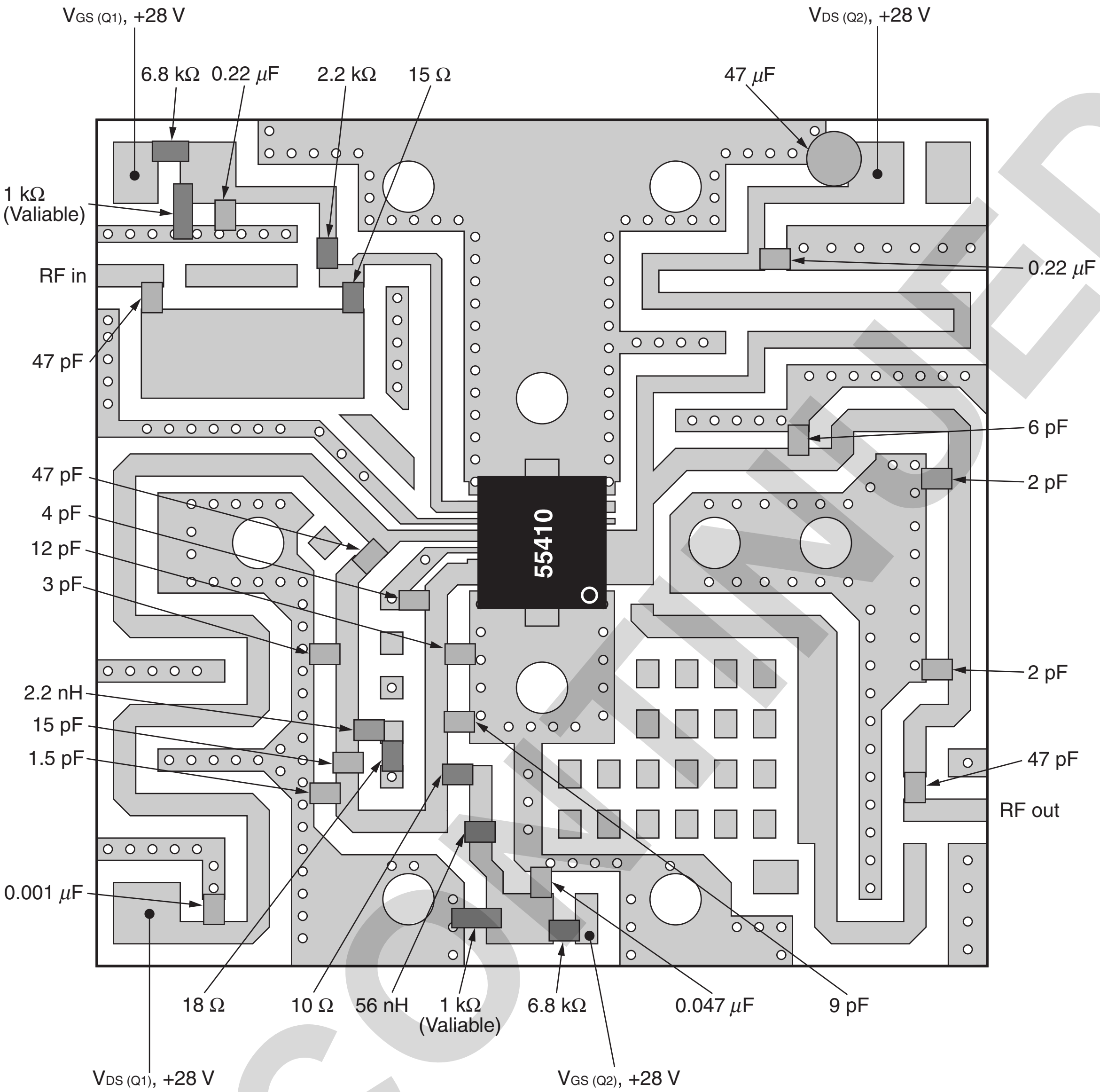


Symbol	Width (mm)	Length (mm)
TL1	1.0	3.0
TL2	4.5	10.0
TL3	0.5	16.0
TL4	0.5	5.0
TL5	1.0	48.0
TL6	1.0	4.0
TL7	1.0	3.0
TL8	1.0	6.0
TL9	1.0	3.0
TL10	1.0	4.0

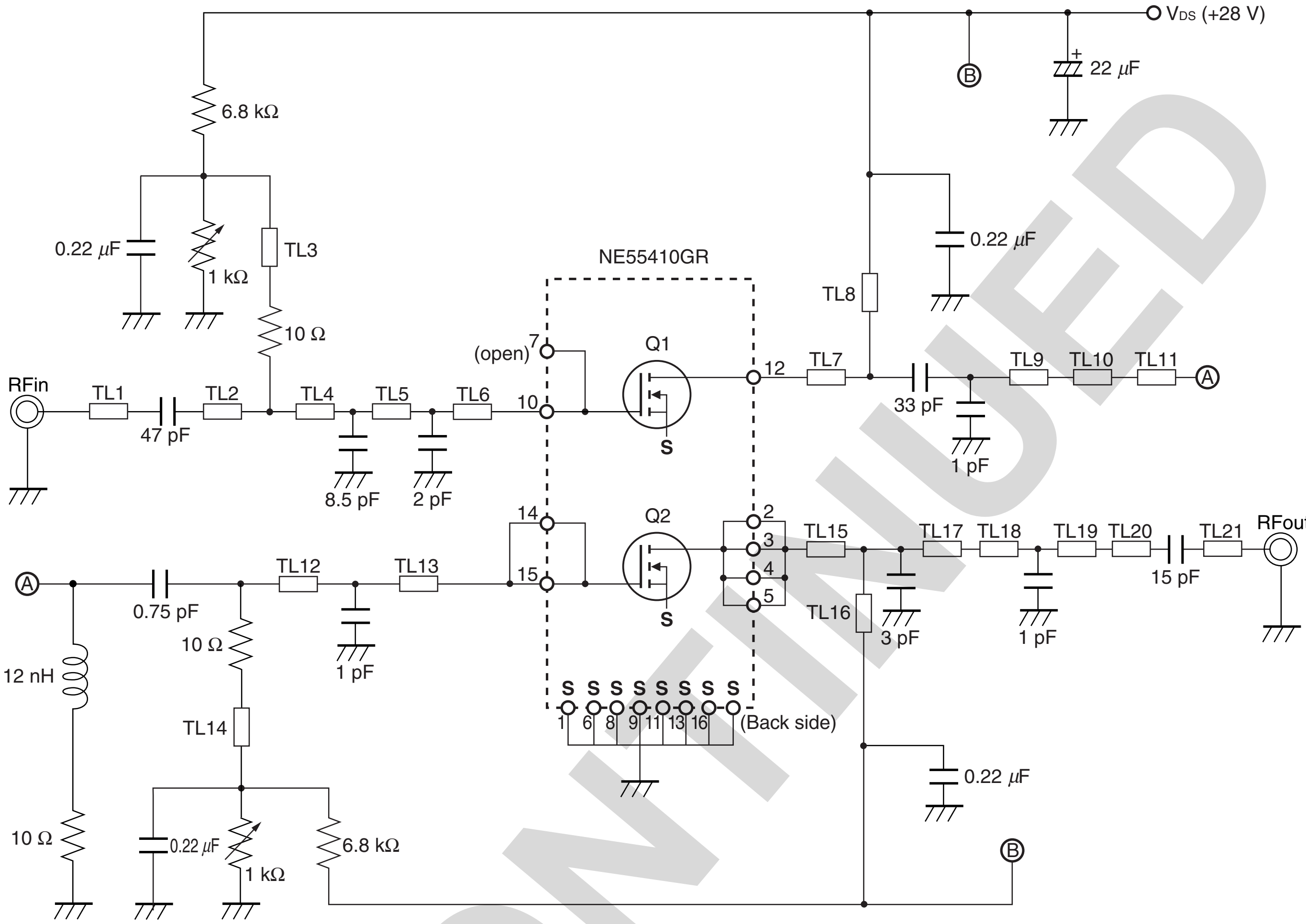
Symbol	Width (mm)	Length (mm)
TL11	1.0	3.0
TL12	1.0	5.0
TL13	0.8	48.0
TL14	1.0	6.5
TL15	1.0	10.5
TL16	1.0	9.5
TL17	1.0	10.0
TL18	1.0	6.0
TL19	1.0	3.0

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_{DS} = 28 V, I_{Dset} = 120 mA)



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

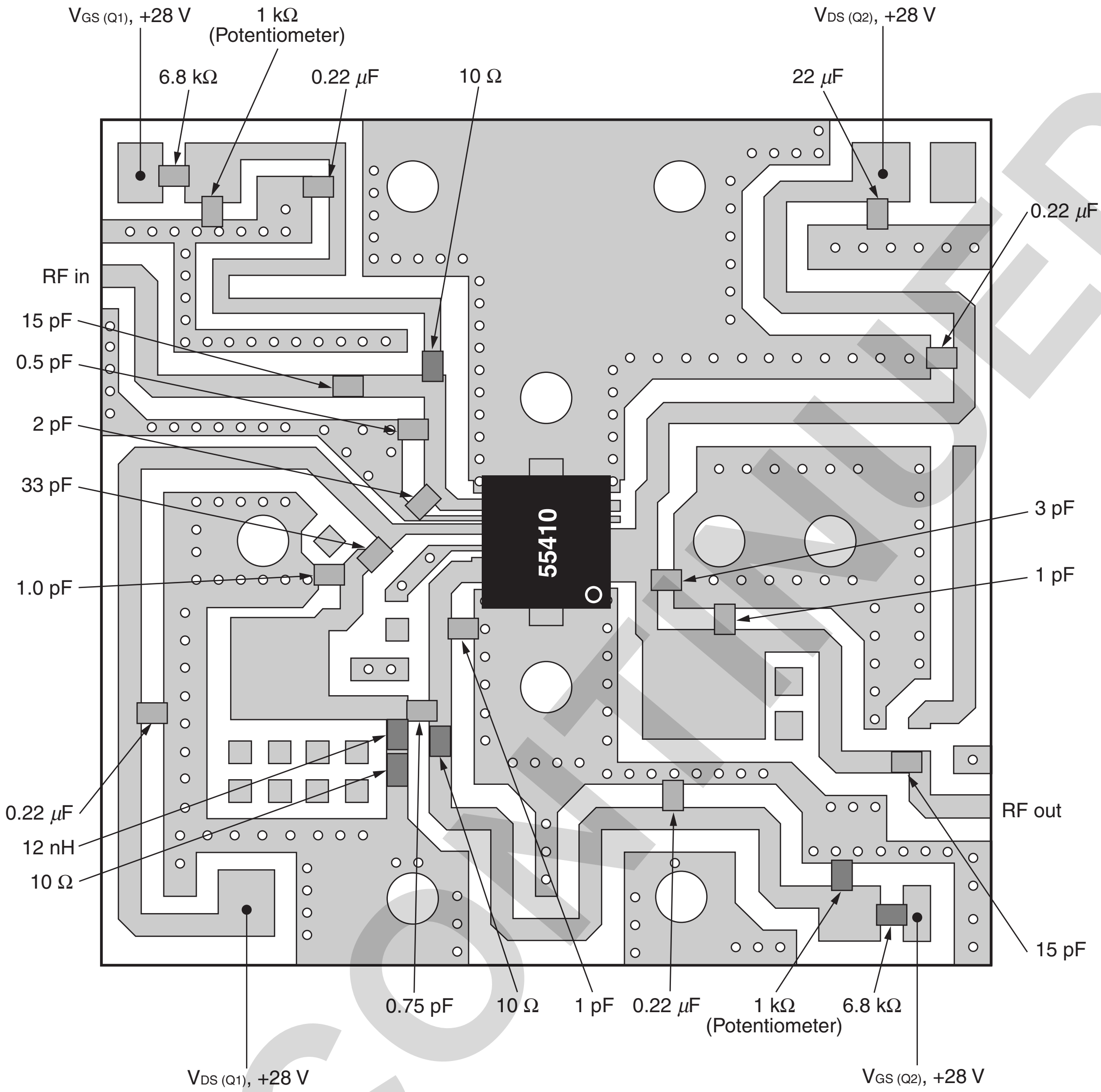


Symbol	Width (mm)	Length (mm)
TL1	1.0	17.0
TL2	1.0	4.0
TL3	1.0	24.5
TL4	1.0	2.5
TL5	1.0	3.0
TL6	0.5	2.5
TL7	0.5	4.5
TL8	1.0	25.5
TL9	1.0	2.5
TL10	4.5	4.5
TL11	1.0	3.5

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

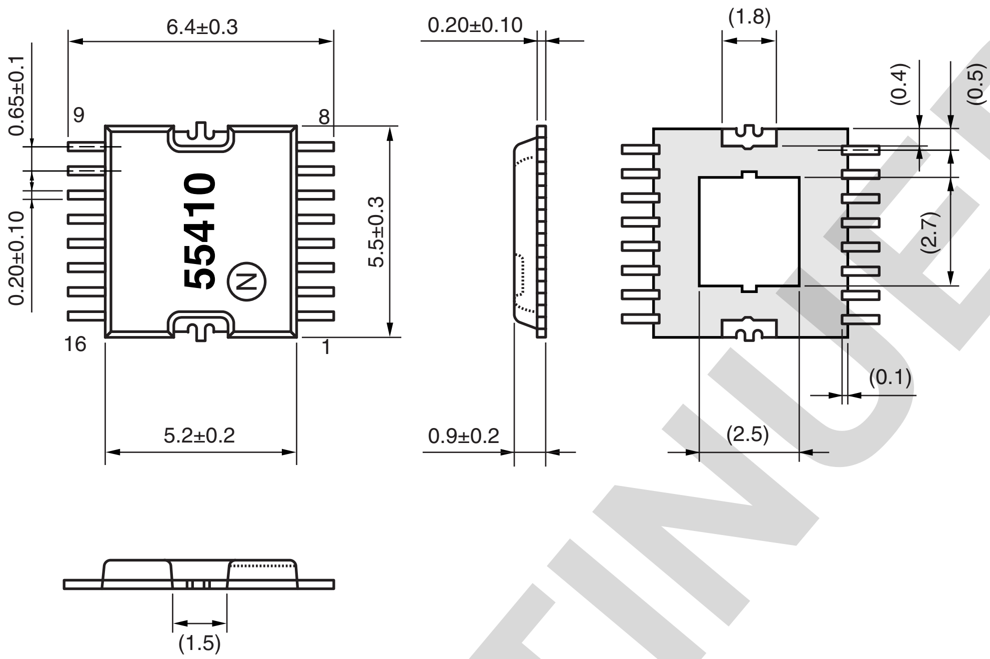
The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

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



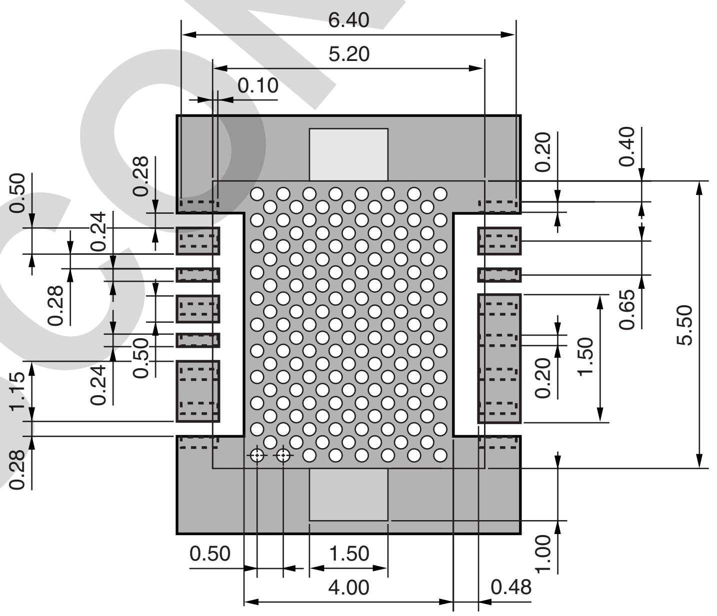
PACKAGE DIMENSIONS

16-PIN PLASTIC HTSSOP (UNIT: mm)



Remark ( ): Reference value

LAND PATTERN (UNIT: mm)



Remarks1. Via holes : 158 holes

<R> **2.** Hole size : ϕ0.15 mm

3. Min. spacing : 0.354 mm

4. ▭ : Solder resist or etching

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) Time at peak temperature Time at temperature of 220°C or higher Preheating time at 120 to 180°C Maximum number of reflow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 60 seconds or less : 120±30 seconds : 3 times : 0.2%(Wt.) or below	IR260
Wave Soldering	Peak temperature (molten solder temperature) Time at peak temperature Preheating temperature (package surface temperature) Maximum number of flow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 120°C or below : 1 time : 0.2%(Wt.) or below	WS260
Partial Heating	Peak temperature (terminal temperature) Soldering time (per side of device) Maximum chlorine content of rosin flux (% mass)	: 350°C or below : 3 seconds or less : 0.2%(Wt.) or below	HS350

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

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