



# 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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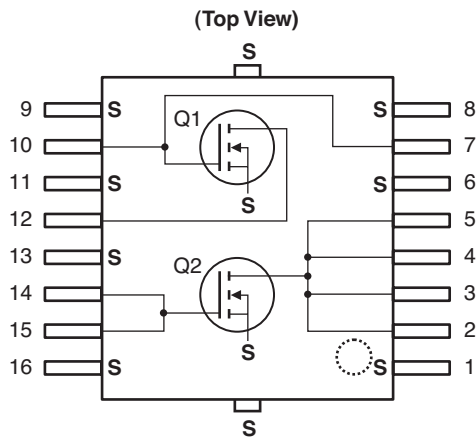
**ORDERING INFORMATION**

| 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)**

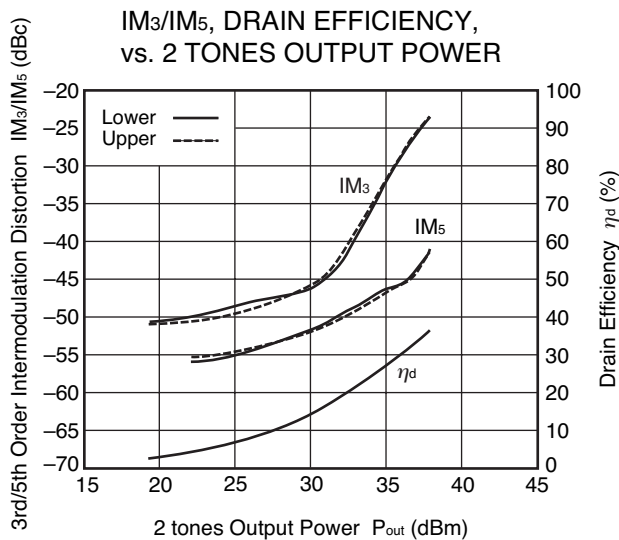
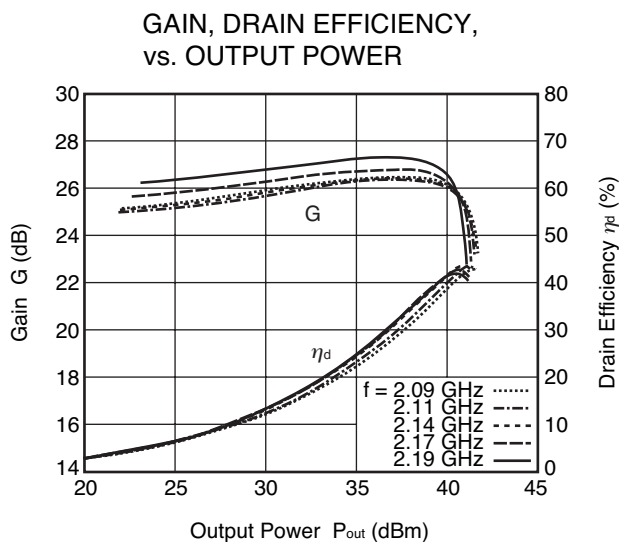
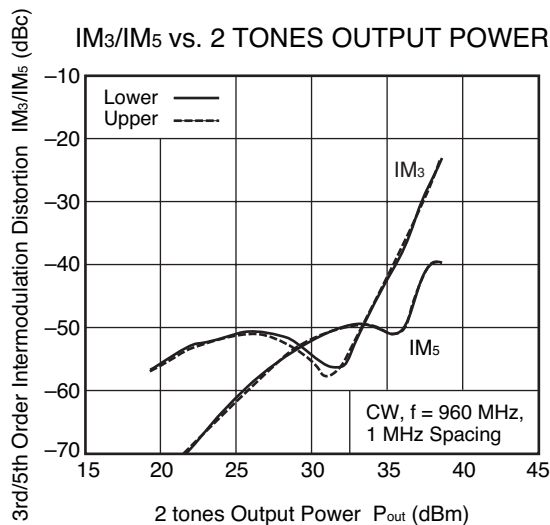
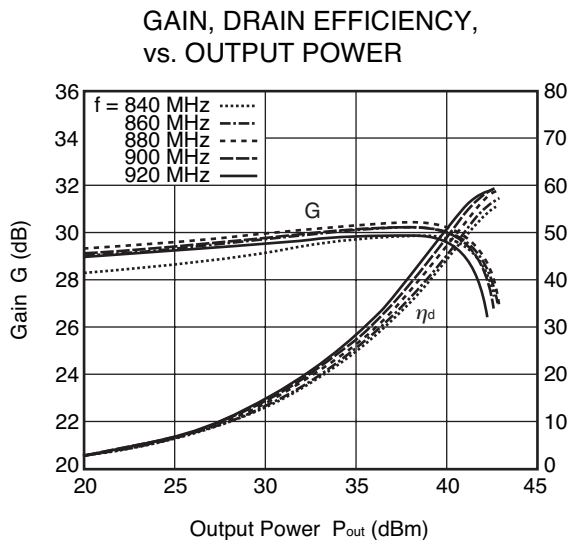
| Parameter                         | Symbol                 | Test Conditions                                  | MIN. | TYP. | MAX. | Unit |
|-----------------------------------|------------------------|--|------|------|------|------|
| <b>Q1</b>                         |                        |  |      |      |      |      |
| 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                     | $\eta_{jd}$                     | 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                     | $\eta_{jd}$                     | 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                     | $\eta_{jd}$                     | 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                     | $\eta_{jd}$                     | 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                     | $\eta_{jd}$                     | 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                     | $\eta_{jd}$                     | 2 carrier W-CDMA 3GPP, Test Model1,<br>64DPCH, 67% Clipping,<br>I <sub>Dset</sub> = 120 mA (Q1 + Q2),<br>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 ( $T_A = +25^\circ\text{C}$ ,  $V_{DS} = 28\text{ V}$ ,  $I_{Dset} = 120\text{ mA}$ , unless otherwise specified)**



**Remark** The graphs indicate nominal characteristics.

**<R> S-PARAMETERS**

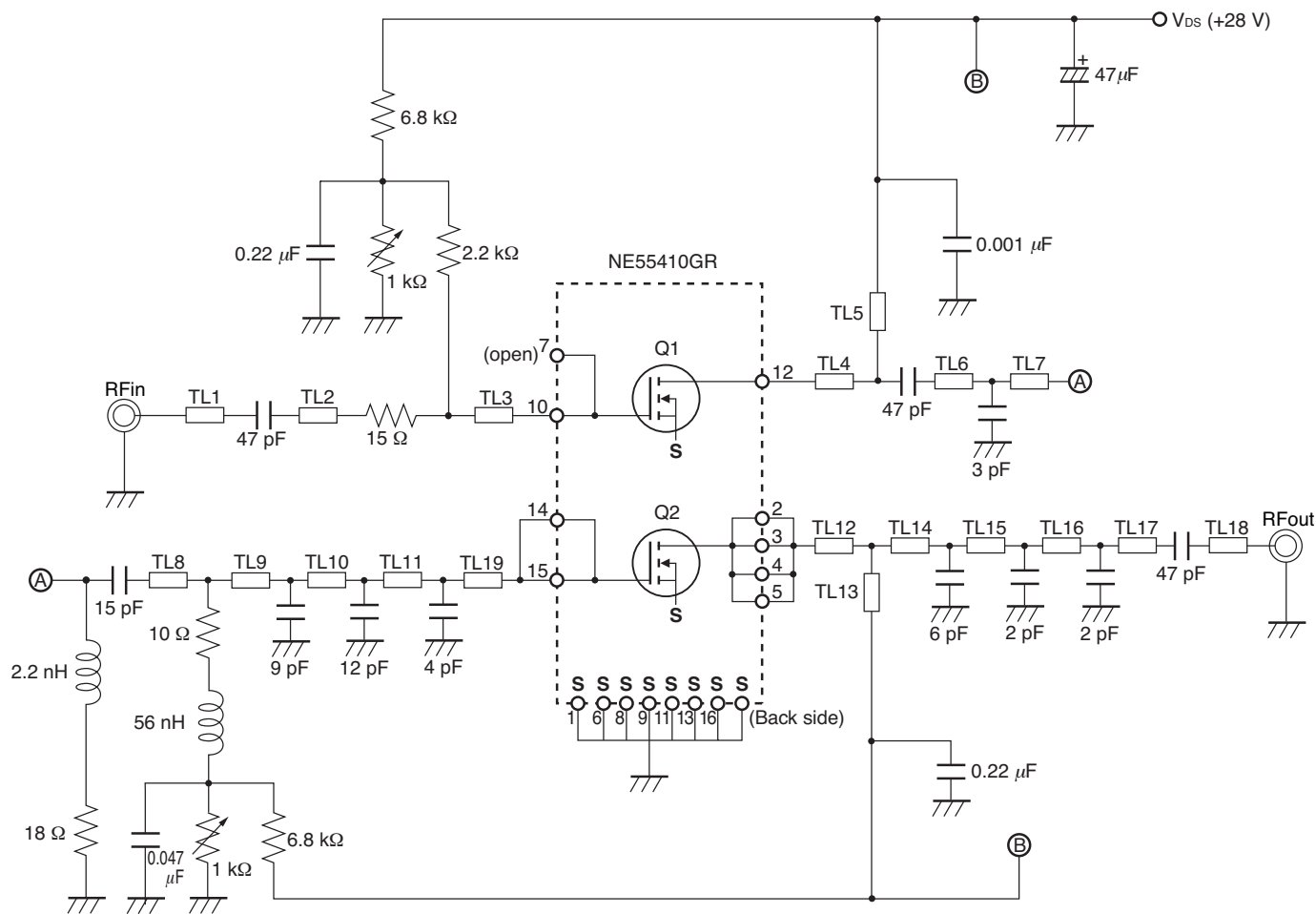
S-parameters/Noise parameters are provided on our web site in a form (S2P) that enables direct import to a microwave circuit simulator without keyboard input.

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)

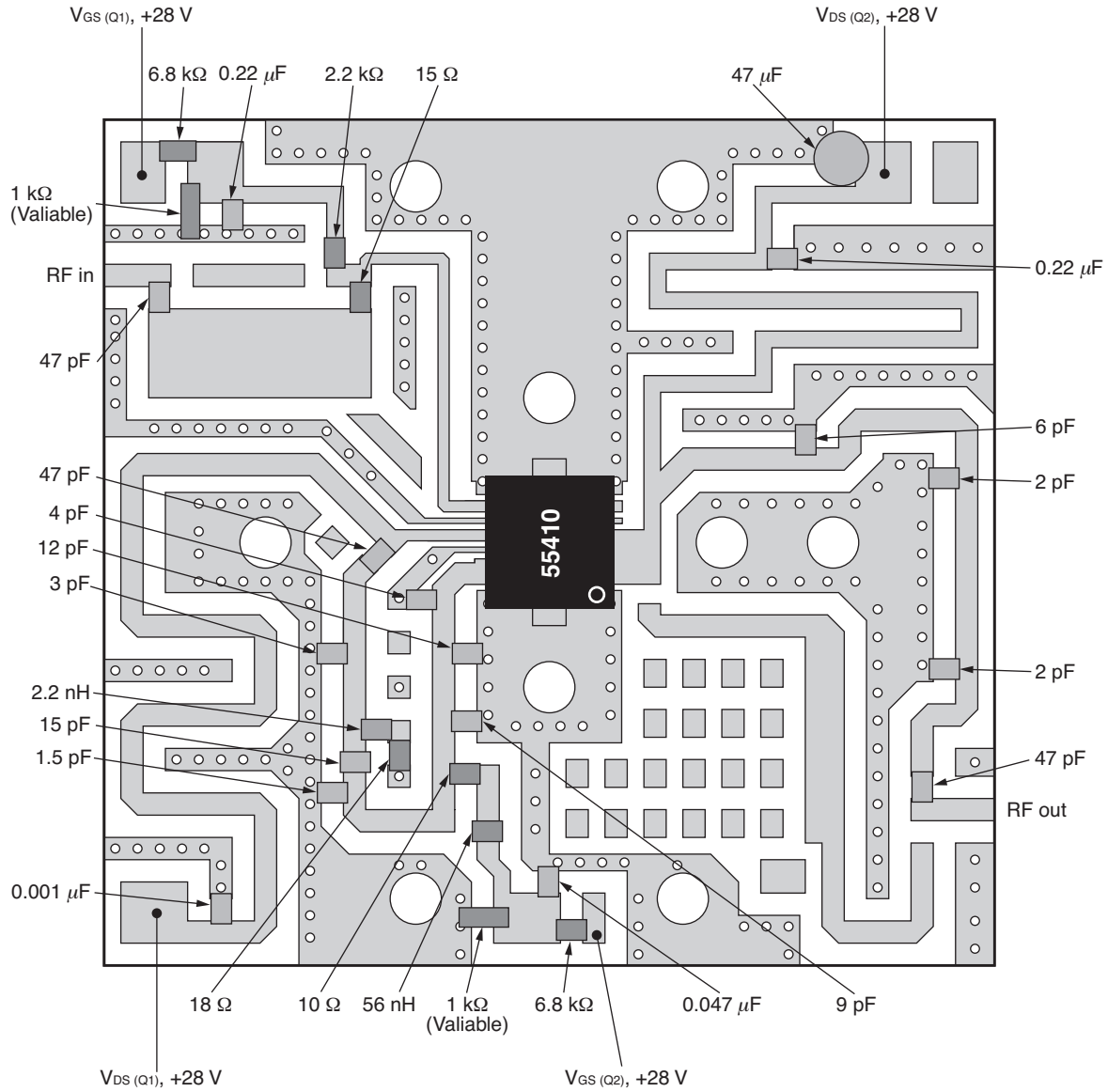


| Symbol | Width (mm) | Length (mm) |
|--------|------------|-------------|
| TL1    | 1.0        | 3.0         |
| TL2    | 4.5        | 10.0        |
| TL3    | 0.5        | 16.0        |
| TL4    | 0.5        | 5.0         |
| TL5    | 1.0        | 48.0        |
| TL6    | 1.0        | 4.0         |
| 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         |

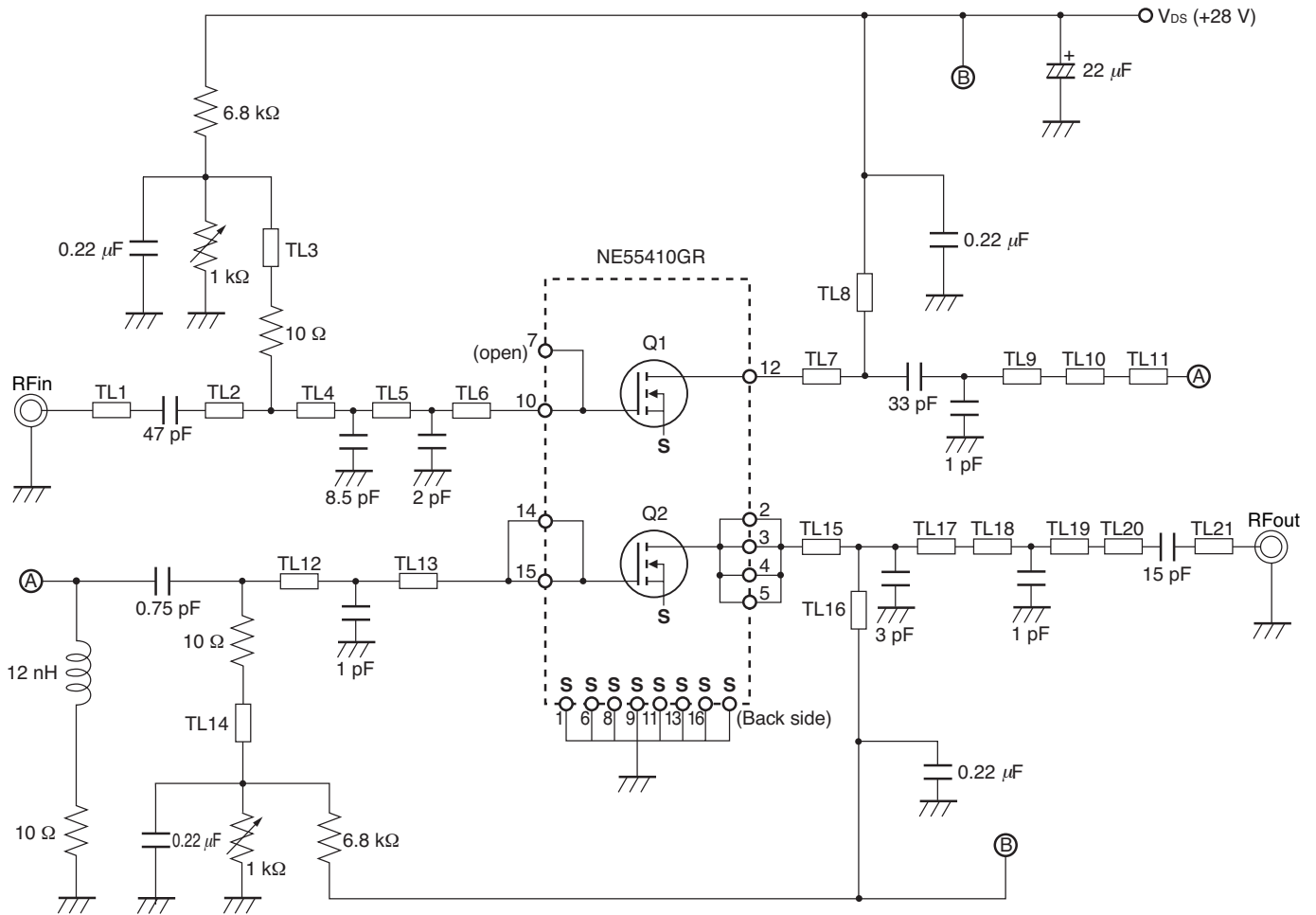
The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

**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)

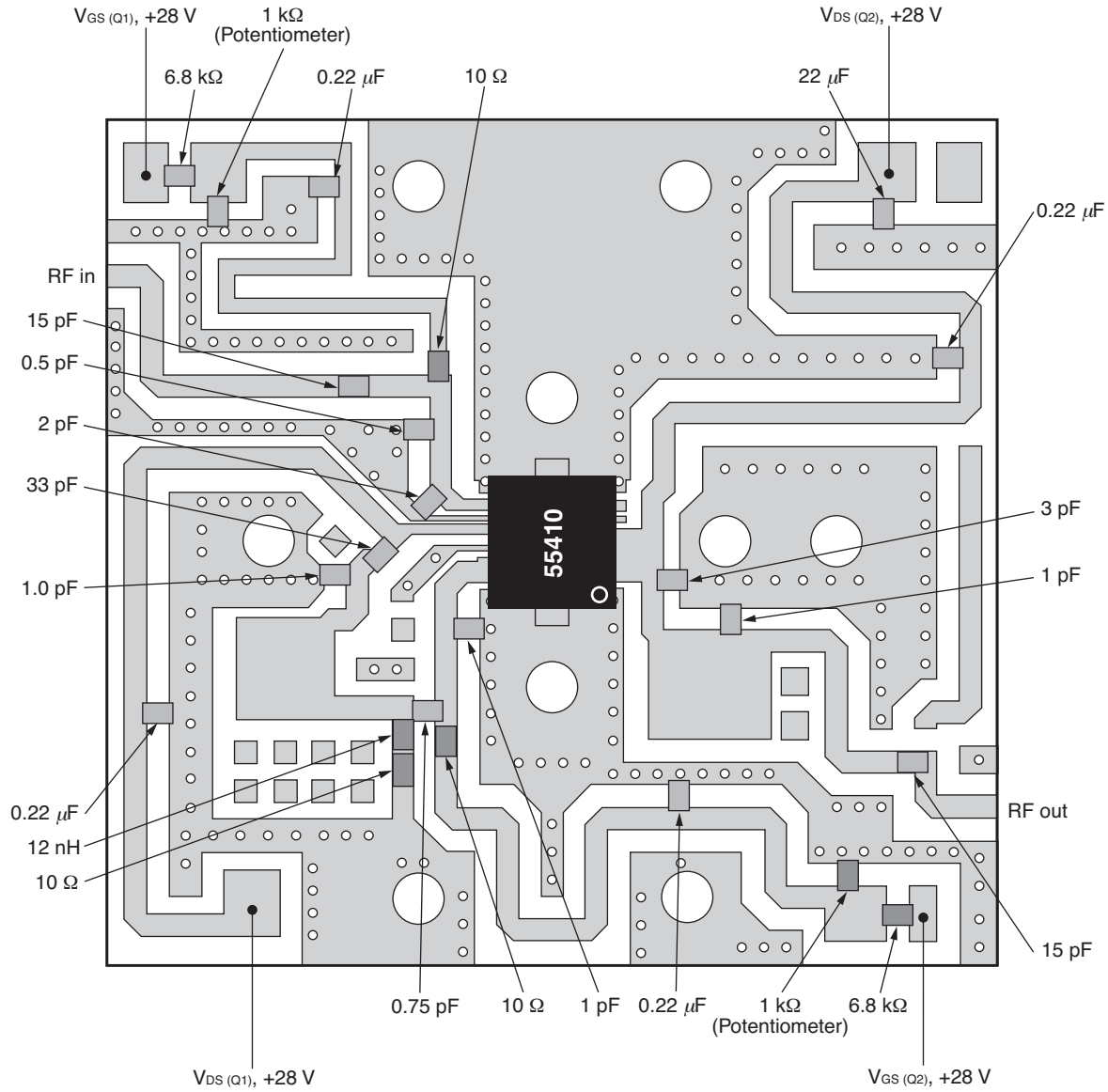


| Symbol | Width (mm) | Length (mm) |
|--------|------------|-------------|
| TL1    | 1.0        | 17.0        |
| TL2    | 1.0        | 4.0         |
| TL3    | 1.0        | 24.5        |
| TL4    | 1.0        | 2.5         |
| TL5    | 1.0        | 3.0         |
| TL6    | 0.5        | 2.5         |
| 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<sub>DS</sub> = 28 V, I<sub>Dset</sub> = 120 mA)





**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<br>Time at peak temperature : 10 seconds or less<br>Time at temperature of 220°C or higher : 60 seconds or less<br>Preheating time at 120 to 180°C : 120±30 seconds<br>Maximum number of reflow processes : 3 times<br>Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below | IR260            |
| Wave Soldering   | Peak temperature (molten solder temperature) : 260°C or below<br>Time at peak temperature : 10 seconds or less<br>Preheating temperature (package surface temperature) : 120°C or below<br>Maximum number of flow processes : 1 time<br>Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below  | WS260            |
| Partial Heating  | Peak temperature (terminal temperature) : 350°C or below<br>Soldering time (per side of device) : 3 seconds or less<br>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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CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (\*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

| Restricted Substance per RoHS | Concentration Limit per RoHS (values are not yet fixed) | Concentration contained in CEL devices |     |
|-------------------------------|---|--|-----|
|                               |   | -A                                     | -AZ |
| Lead (Pb)                     | < 1000 PPM  | Not Detected                           | (*) |
| Mercury                       | < 1000 PPM  | Not Detected                           |     |
| Cadmium                       | < 100 PPM   | Not Detected                           |     |
| Hexavalent Chromium           | < 1000 PPM  | Not Detected                           |     |
| PBB                           | < 1000 PPM  | Not Detected                           |     |
| PBDE                          | < 1000 PPM  | Not Detected                           |     |

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