

To our customers,

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## Old Company Name in Catalogs and Other Documents

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

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# MOS FIELD EFFECT TRANSISTOR $\mu$ PA2709AGR

## SWITCHING N-CHANNEL POWER MOSFET

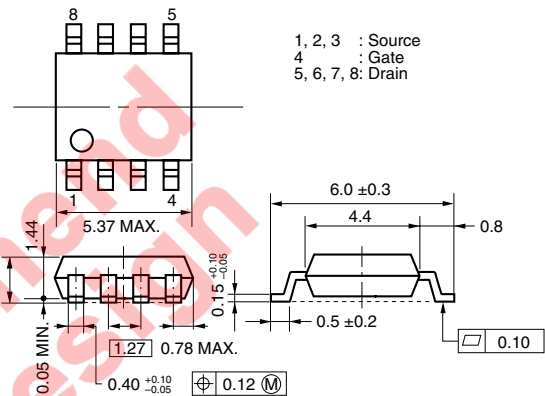
### DESCRIPTION

The  $\mu$ PA2709AGR is N-channel MOS Field Effect Transistor designed for DC/DC converter and power management applications of notebook computer.

### FEATURES

- Low on-state resistance  
 $R_{DS(on)1} = 10.5 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 7.0 \text{ A)}$   
 $R_{DS(on)2} = 15 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_D = 7.0 \text{ A)}$
- Low gate to drain charge  
 $Q_{GD} = 3.3 \text{ nC TYP. (} V_{DD} = 15 \text{ V, } I_D = 13 \text{ A)}$
- Built-in gate protection diode
- Small and surface mount package (Power SOP8)

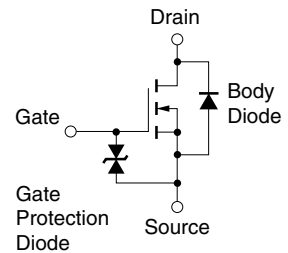
### PACKAGE DRAWING (Unit: mm)



### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C, All terminals are connected.)

|  |                       |             |    |
|--|-----------------------|-------------|----|
| Drain to Source Voltage (V <sub>GS</sub> = 0 V)        | V <sub>DSS</sub>      | 30          | V  |
| Gate to Source Voltage (V <sub>DS</sub> = 0 V)         | V <sub>GSS</sub>      | ±20         | V  |
| Drain Current (DC)                                     | I <sub>D(DC)</sub>    | ±13         | A  |
| Drain Current (pulse) <sup>Note1</sup>                 | I <sub>D(pulse)</sub> | ±52         | A  |
| Total Power Dissipation <sup>Note2</sup>               | P <sub>T1</sub>       | 1.1         | W  |
| Total Power Dissipation (PW = 10 sec) <sup>Note2</sup> | P <sub>T2</sub>       | 2.5         | W  |
| Channel Temperature                                    | T <sub>ch</sub>       | 150         | °C |
| Storage Temperature                                    | T <sub>stg</sub>      | -55 to +150 | °C |
| Single Avalanche Current <sup>Note3</sup>              | I <sub>AS</sub>       | 13          | A  |
| Single Avalanche Energy <sup>Note3</sup>               | E <sub>AS</sub>       | 17          | mJ |

### EQUIVALENT CIRCUIT



**Notes 1.** PW ≤ 10 μs, Duty Cycle ≤ 1%

**2.** Mounted on glass epoxy board of 25.4 mm x 25.4 mm x 0.8 mm

**3.** Starting T<sub>ch</sub> = 25°C, V<sub>DD</sub> = 15 V, R<sub>G</sub> = 25 Ω, V<sub>GS</sub> = 20 → 0 V, L = 100 μH

**Remark** The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

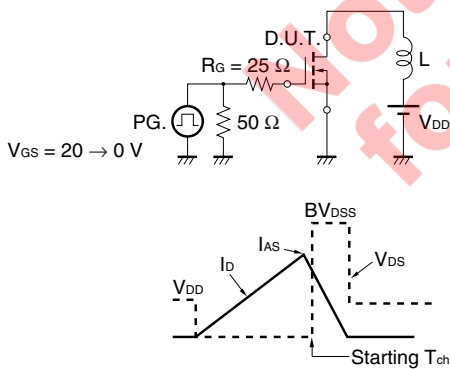
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**ELECTRICAL CHARACTERISTICS (TA = 25°C, All terminals are connected.)**

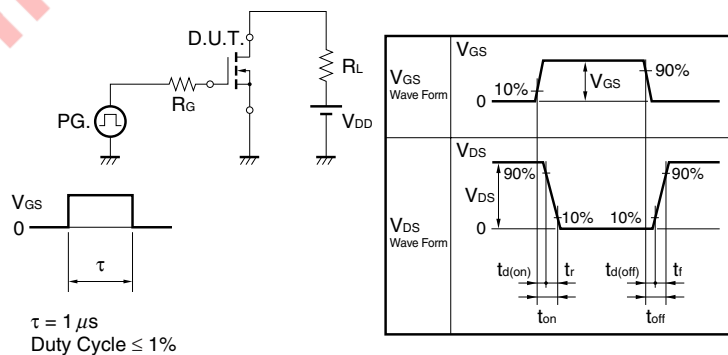
| CHARACTERISTICS                                     | SYMBOL        | TEST CONDITIONS                                 | MIN. | TYP. | MAX. | UNIT |
|---|---------------|---|------|------|------|------|
| Zero Gate Voltage Drain Current                     | $I_{DSS}$     | $V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$     |      |      | 10   | μA   |
| Gate Leakage Current                                | $I_{GSS}$     | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$ |      |      | ±10  | μA   |
| Gate to Source Cut-off Voltage                      | $V_{GS(off)}$ | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$       | 1.5  |      | 2.5  | V    |
| Forward Transfer Admittance <sup>Note</sup>         | $ y_{fs} $    | $V_{DS} = 10\text{ V}, I_D = 7.0\text{ A}$      | 7    |      |      | S    |
| Drain to Source On-state Resistance <sup>Note</sup> | $R_{DS(on)1}$ | $V_{GS} = 10\text{ V}, I_D = 7.0\text{ A}$      |      | 8.3  | 10.5 | mΩ   |
|   | $R_{DS(on)2}$ | $V_{GS} = 4.5\text{ V}, I_D = 7.0\text{ A}$     |      | 10.6 | 15   | mΩ   |
| Input Capacitance                                   | $C_{iss}$     | $V_{DS} = 10\text{ V}$                          |      | 1270 |      | pF   |
| Output Capacitance                                  | $C_{oss}$     | $V_{GS} = 0\text{ V}$                           |      | 320  |      | pF   |
| Reverse Transfer Capacitance                        | $C_{rss}$     | $f = 1\text{ MHz}$                              |      | 110  |      | pF   |
| Turn-on Delay Time                                  | $t_{d(on)}$   | $V_{DD} = 15\text{ V}, I_D = 7.0\text{ A}$      |      | 10   |      | ns   |
| Rise Time   | $t_r$         | $V_{GS} = 10\text{ V}$                          |      | 5.3  |      | ns   |
| Turn-off Delay Time                                 | $t_{d(off)}$  | $R_G = 10\ \Omega$                              |      | 40   |      | ns   |
| Fall Time   | $t_f$         |   |      | 7.8  |      | ns   |
| Total Gate Charge                                   | $Q_G$         | $V_{DD} = 15\text{ V}$                          |      | 11   |      | nC   |
| Gate to Source Charge                               | $Q_{GS}$      | $V_{GS} = 5\text{ V}$                           |      | 3.8  |      | nC   |
| Gate to Drain Charge                                | $Q_{GD}$      | $I_D = 13\text{ A}$                             |      | 3.3  |      | nC   |
| Body Diode Forward Voltage <sup>Note</sup>          | $V_{F(S-D)}$  | $I_F = 13\text{ A}, V_{GS} = 0\text{ V}$        |      | 0.8  |      | V    |
| Reverse Recovery Time                               | $t_{rr}$      | $I_F = 13\text{ A}, V_{GS} = 0\text{ V}$        |      | 25   |      | ns   |
| Reverse Recovery Charge                             | $Q_{rr}$      | $di/dt = 100\text{ A}/\mu\text{s}$              |      | 22   |      | nC   |
| Gate Resistance                                     | $R_G$         | $f = 1\text{ MHz}$                              |      | 1.2  |      | Ω    |

**Note** Pulsed

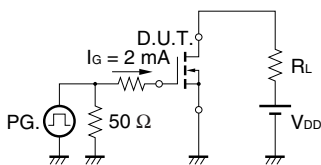
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



**TEST CIRCUIT 2 SWITCHING TIME**

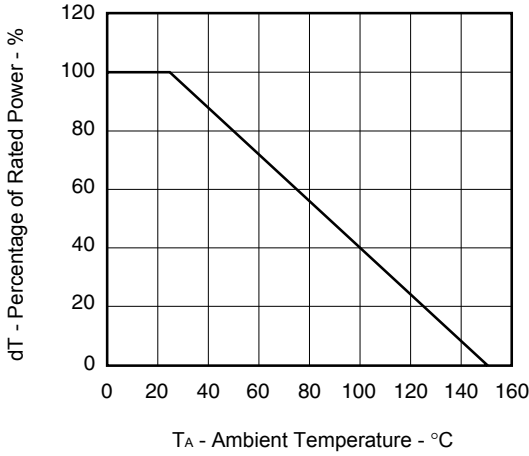


**TEST CIRCUIT 3 GATE CHARGE**

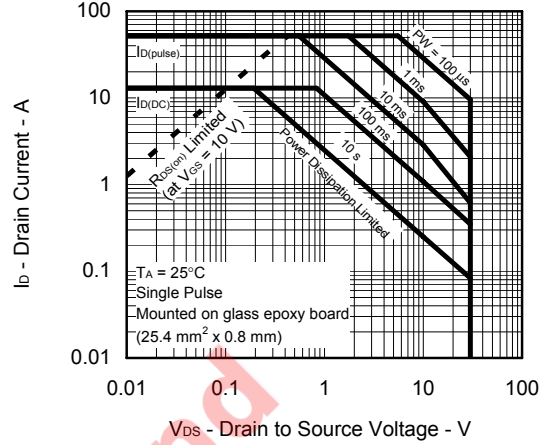


TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

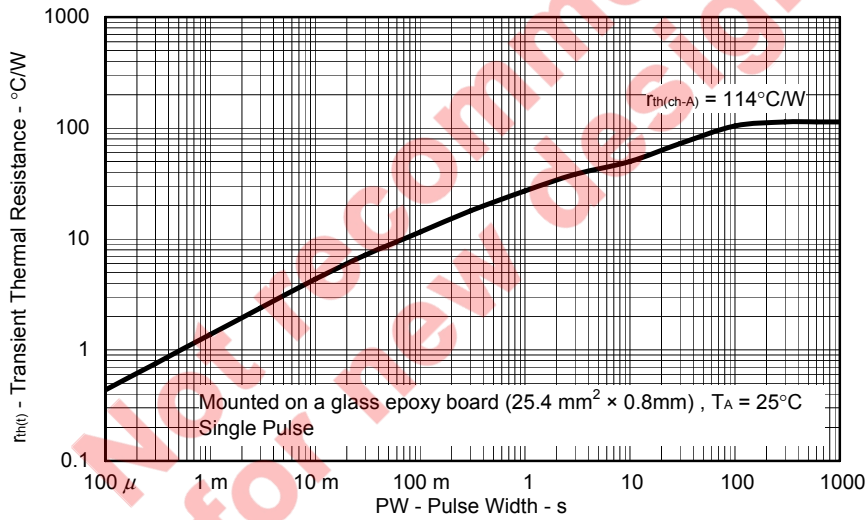
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



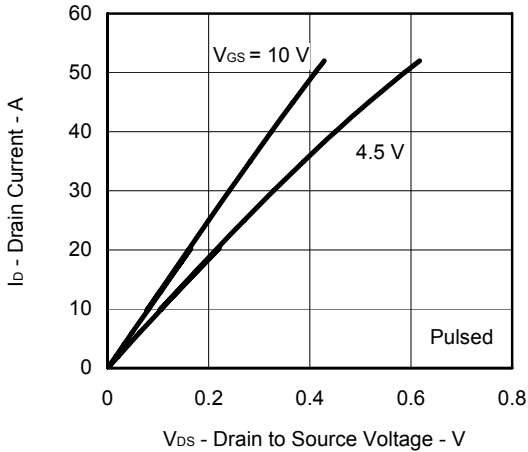
FORWARD BIAS SAFE OPERATING AREA



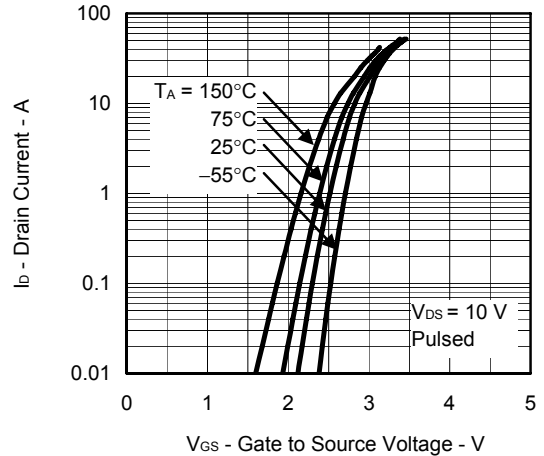
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

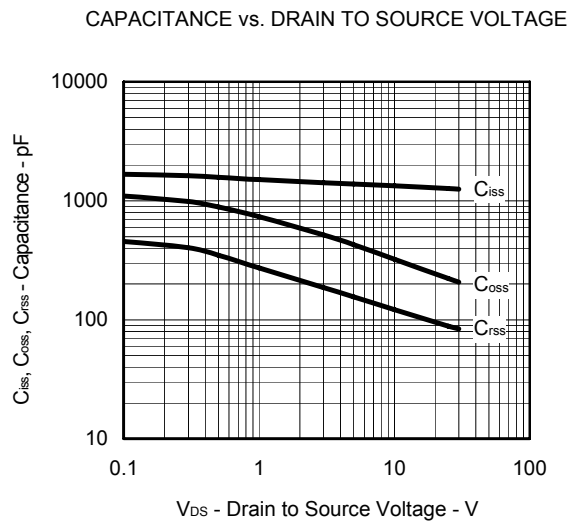
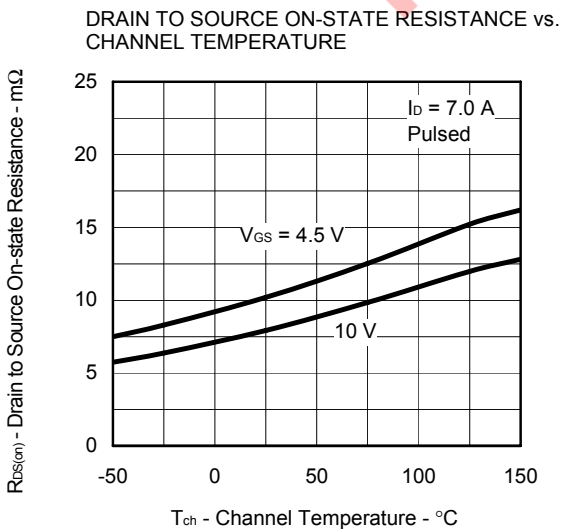
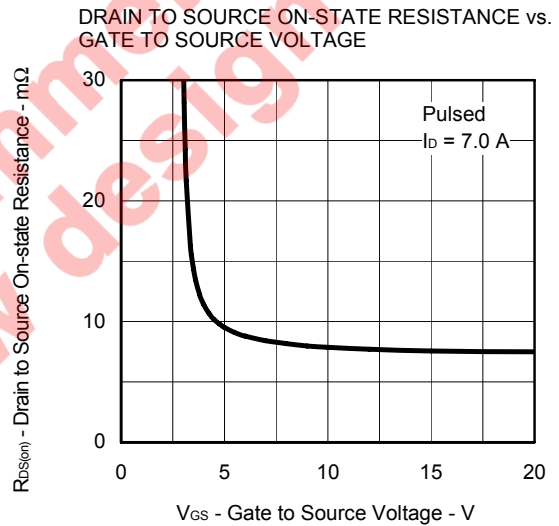
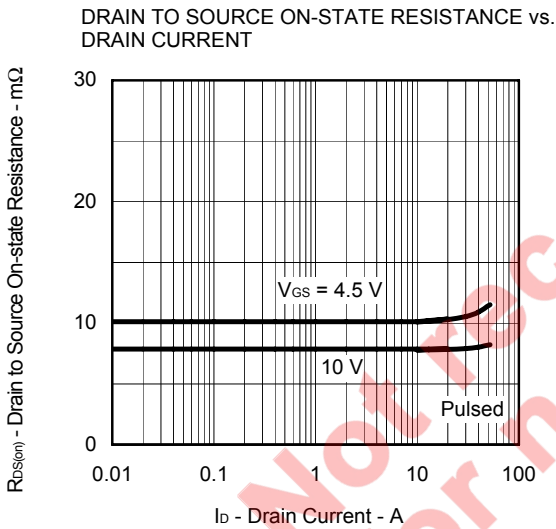
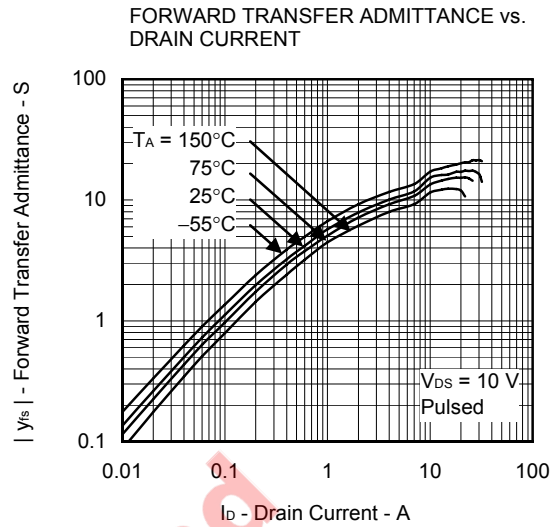
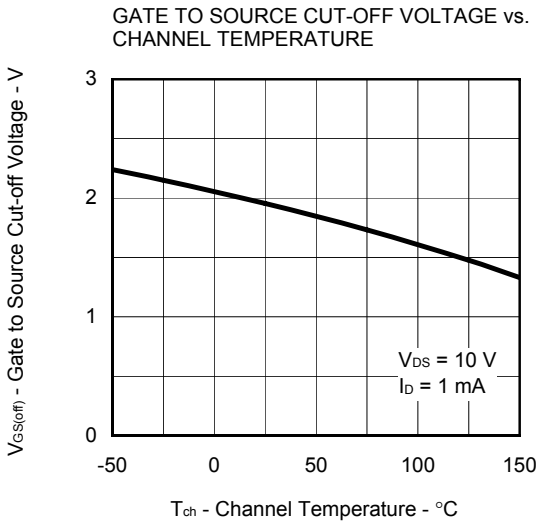


DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE

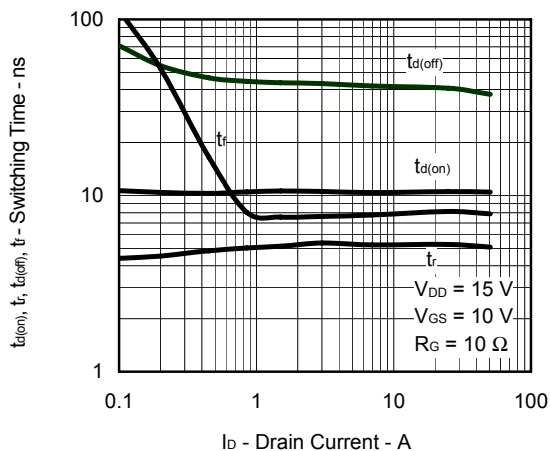


FORWARD TRANSFER CHARACTERISTICS

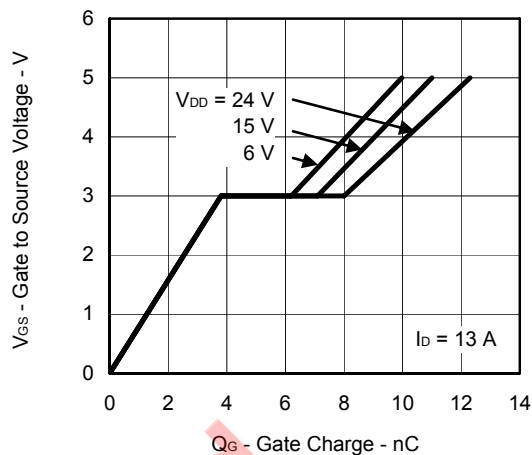




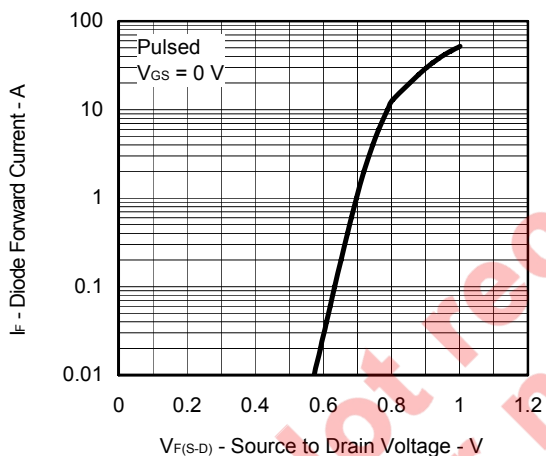
SWITCHING CHARACTERISTICS



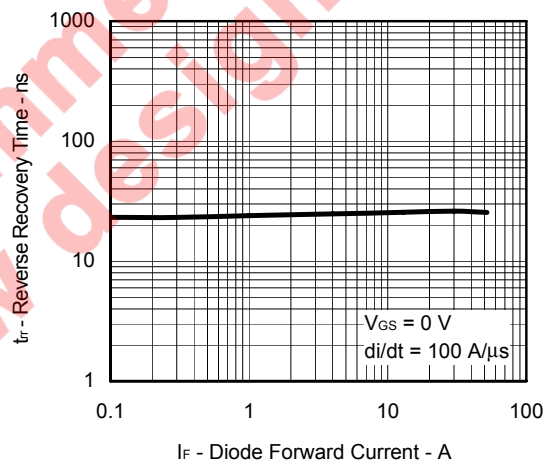
DYNAMIC INPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



ORDERING INFORMATION

| PART NUMBER                           | LEAD PLATING  | PACKING          | PACKAGE     |
|---------------------------------------|---------------|------------------|-------------|
| $\mu$ PA2709AGR-E1-AT <sup>Note</sup> | Pure Sn (Tin) | Tape 2500 p/reel | Power SOP8  |
| $\mu$ PA2709AGR-E2-AT <sup>Note</sup> |               |                  | 0.08 g TYP. |

**Note** Pb-free (This product does not contain Pb in external electrode and other parts.)

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