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April 1st, 2010 Renesas Electronics Corporation

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MOS FIELD EFFECT TRANSISTOR NP60N055KUG

SWITCHING N-CHANNEL POWER MOS FET

DESCRIPTION

The NP60N055KUG is N-channel MOS Field Effect
Transistor designed for high current switching applications.

ORDERING INFORMATION

| PART NUMBER | PACKAGE |
|-------------|------------------|
| NP60N055KUG | TO-263 (MP-25ZK) |

FEATURES

- Channel temperature 175 degree rating
- Super low on-state resistance
 R_{DS(on)} = 9.4 mΩ MAX. (V_{GS} = 10 V, I_D = 30 A)
- Low Ciss: Ciss = 3700 pF TYP.

(TO-263)



ABSOLUTE MAXIMUM RATINGS (TA = 25°C)

| Drain to Source Voltage (Vgs = 0 V) | VDSS | 55 | V |
|---|--------------------|-------------|----|
| Gate to Source Voltage (V _{DS} = 0 V) | Vgss | ±20 | V |
| Drain Current (DC) (Tc = 25°C) | I _{D(DC)} | ±60 | Α |
| Drain Current (pulse) Note1 | D(pulse) | ±240 | Α |
| Total Power Dissipation (T _A = 25°C) | P _{T1} | 1.8 | W |
| Total Power Dissipation (Tc = 25°C) | P _{T2} | 88 | W |
| Channel Temperature | Tch | 175 | °C |
| Storage Temperature | Tstg | -55 to +175 | °C |
| Repetitive Avalanche Current Note2 | lar | 27 | Α |
| Repetitive Avalanche Energy Note2 | Ear | 73 | mJ |

Notes 1. PW \leq 10 μ s, Duty Cycle \leq 1%

2. Tch < 150°C, VdD = 28 V, Rg = 25 Ω , Vgs = 20 \rightarrow 0 V

THERMAL RESISTANCE

| Channel to Case Thermal Resistance | Rth(ch-C) | 1.70 | °C/W |
|---------------------------------------|-----------|------|------|
| Channel to Ambient Thermal Resistance | Rth(ch A) | 83.3 | °C/W |

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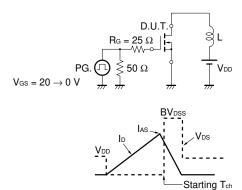


ELECTRICAL CHARACTERISTICS (TA = 25°C)

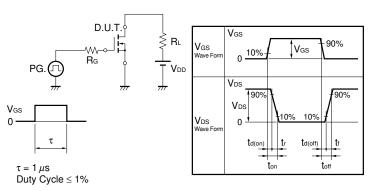
| CHARACTERISTICS | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--|---------------------|---|------|------|------|------|
| Zero Gate Voltage Drain Current | IDSS | V _{DS} = 55 V, V _{GS} = 0 V | | | 1 | μΑ |
| Gate Leakage Current | Igss | V _{GS} = ±20 V, V _{DS} = 0 V | | | ±100 | nA |
| Gate to Source Threshold Voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = 250 μA | 2.0 | 3.0 | 4.0 | V |
| Forward Transfer Admittance Note | y _{fs} | V _{DS} = 10 V, I _D = 30 A | 11 | 22 | | S |
| Drain to Source On-state Resistance Note | R _{DS(on)} | V _{GS} = 10 V, I _D = 30 A | | 7.4 | 9.4 | mΩ |
| Input Capacitance | Ciss | V _{DS} = 25 V | | 3700 | 5600 | pF |
| Output Capacitance | Coss | V _{GS} = 0 V | | 270 | 410 | pF |
| Reverse Transfer Capacitance | Crss | f = 1 MHz | | 160 | 290 | pF |
| Turn-on Delay Time | t _{d(on)} | V _{DD} = 28 V, I _D = 30 A | | 30 | 66 | ns |
| Rise Time | tr | V _{GS} = 10 V | | 44 | 110 | ns |
| Turn-off Delay Time | t d(off) | R _G = 0 Ω | | 79 | 160 | ns |
| Fall Time | tr | | | 8 | 20 | ns |
| Total Gate Charge | Q _G | V _{DD} = 44 V | | 61 | 92 | nC |
| Gate to Source Charge | Qgs | V _{GS} = 10 V | | 14 | | nC |
| Gate to Drain Charge | Q _{GD} | I _D = 60 A | | 20 | | nC |
| Body Diode Forward Voltage Note | V _{F(S-D)} | I _F = 60 A, V _{GS} = 0 V | | 0.94 | 1.5 | ٧ |
| Reverse Recovery Time | trr | I _F = 60 A, V _{GS} = 0 V | | 38 | | ns |
| Reverse Recovery Charge | Qrr | di/dt = 100 A/μs | | 41 | | nC |

Note Pulsed

TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

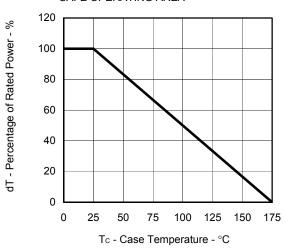


TEST CIRCUIT 3 GATE CHARGE

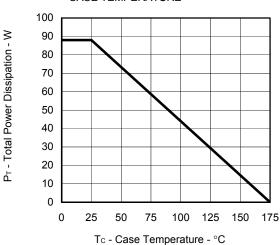
PG.
$$\bigcirc$$
 \$50 Ω

TYPICAL CHARACTERISTICS (TA = 25°C)

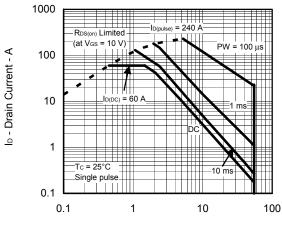
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

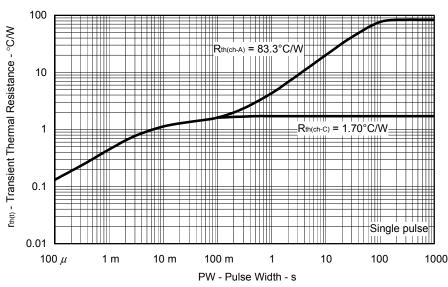


FORWARD BIAS SAFE OPERATING AREA



V_{DS} - Drain to Source Voltage - V

TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

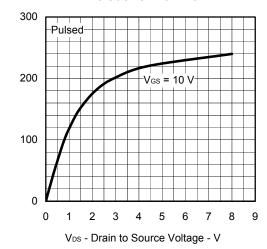


3

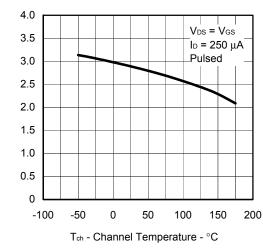
lo - Drain Current - A

Ves(th) - Gate to Source Threshold Voltage - V

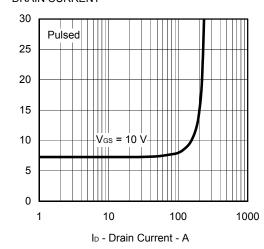
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



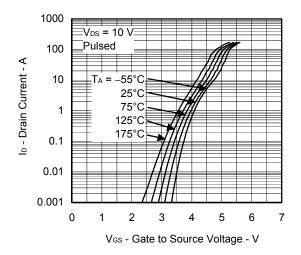
GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



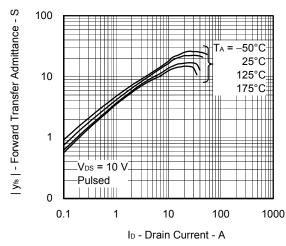
DRAIN TO SOURCE ON-STATE RESISTANCE vs. **DRAIN CURRENT**



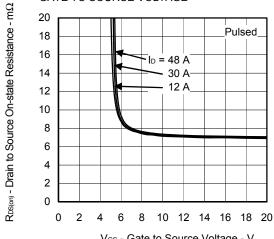
FORWARD TRANSFER CHARACTERISTICS



FORWARD TRANSFER ADMITTANCE vs. **DRAIN CURRENT**

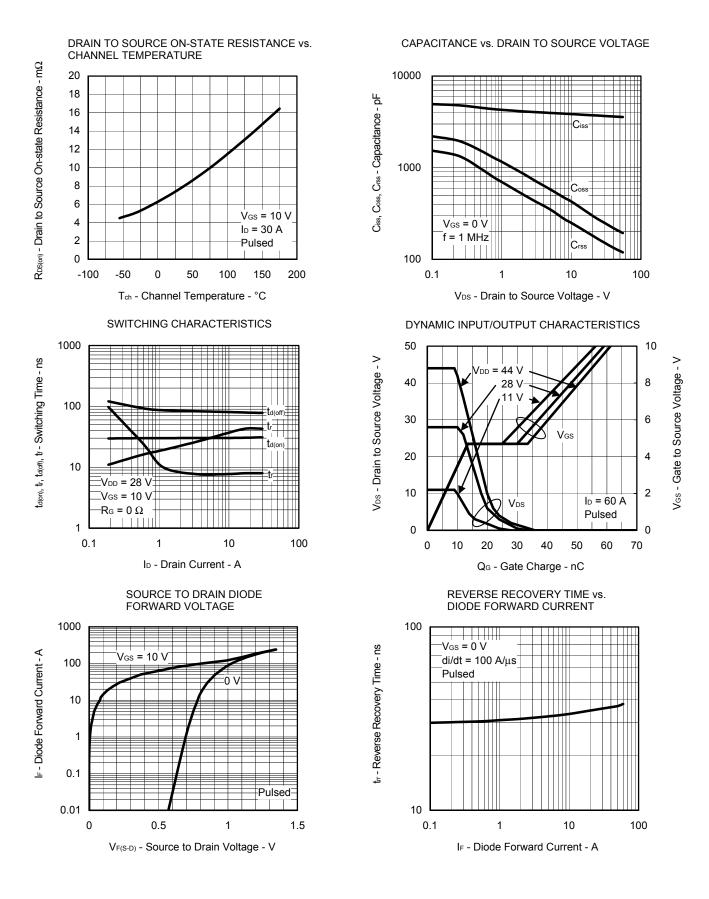


DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



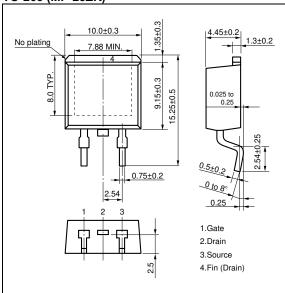
V_{GS} - Gate to Source Voltage - V

 $\mathsf{R}_{\mathsf{DS}(\mathsf{on})}$ - Drain to Source On-state Resistance - $m\Omega$

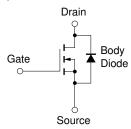


PACKAGE DRAWING (Unit: mm)

TO-263 (MP-25ZK)



EQUIVALENT CIRCUIT



Remark Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.

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