

NP90N04MUK, NP90N04NUK

R07DS0601EJ0100

Rev.1.00

MOS FIELD EFFECT TRANSISTOR

Jan 11, 2012

Description

These products are N-channel MOS Field Effect Transistors designed for high current switching applications.

Features

- Super low on-state resistance
 $R_{DS(on)} = 2.8 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 45 \text{ A)}$
- Low C_{iss} : $C_{iss} = 4700 \text{ pF TYP. (} V_{DS} = 25 \text{ V)}$
- Designed for automotive application and AEC-Q101 qualified

Ordering Information

| Part No. | Lead Plating | Packing | Package |
|----------------------|---------------|----------------|------------------|
| NP90N04MUK-S18-AY *1 | Pure Sn (Tin) | Tube 50 p/tube | TO-220 (MP-25K) |
| NP90N04NUK-S18-AY *1 | | | TO-262 (MP-25SK) |

Note: *1 Pb-free (This product does not contain Pb in the external electrode)

Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$)

| Item | Symbol | Ratings | Unit |
|--|----------------|------------|------------------|
| Drain to Source Voltage ($V_{GS} = 0 \text{ V}$) | V_{DSS} | 40 | V |
| Gate to Source Voltage ($V_{DS} = 0 \text{ V}$) | V_{GSS} | ± 20 | V |
| Drain Current (DC) ($T_C = 25^\circ\text{C}$) | $I_{D(DC)}$ | ± 90 | A |
| Drain Current (pulse) *1 | $I_{D(pulse)}$ | ± 360 | A |
| Total Power Dissipation ($T_C = 25^\circ\text{C}$) | P_{T1} | 176 | W |
| Total Power Dissipation ($T_A = 25^\circ\text{C}$) | P_{T2} | 1.8 | W |
| Channel Temperature | T_{ch} | 175 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | -55 to 175 | $^\circ\text{C}$ |
| Repetitive Avalanche Current *2 | I_{AR} | 43 | A |
| Repetitive Avalanche Energy *2 | E_{AR} | 185 | mJ |

Notes: *1 $T_C = 25^\circ\text{C}$, $P_W \leq 10 \mu\text{s}$, Duty Cycle $\leq 1\%$

*2 $R_G = 25 \Omega$, $V_{GS} = 20 \rightarrow 0 \text{ V}$

Thermal Resistance

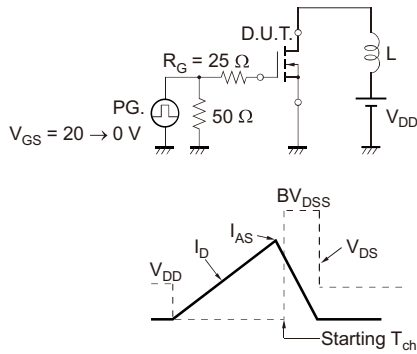
| | | | |
|---------------------------------------|----------------|------|--------------------|
| Channel to Case Thermal Resistance | $R_{th(ch-C)}$ | 0.85 | $^\circ\text{C/W}$ |
| Channel to Ambient Thermal Resistance | $R_{th(ch-A)}$ | 83.3 | $^\circ\text{C/W}$ |

Electrical Characteristics ($T_A = 25^\circ\text{C}$)

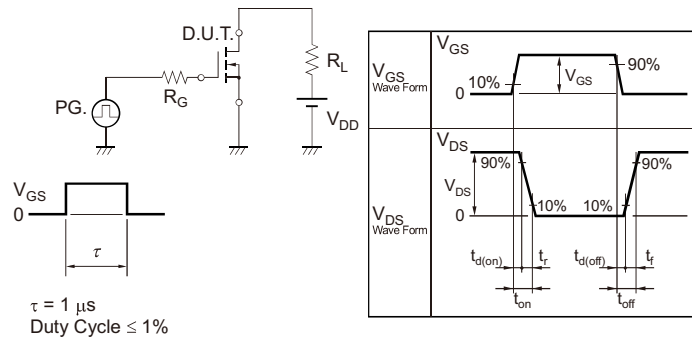
| Item | Symbol | MIN. | TYP. | MAX. | Unit | Test Conditions |
|--|--------------|------|------|-----------|---------------|---|
| Zero Gate Voltage Drain Current | I_{DSS} | — | — | 1 | μA | $V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$ |
| Gate Leakage Current | I_{GSS} | — | — | ± 100 | nA | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$ |
| Gate to Source Threshold Voltage | $V_{GS(th)}$ | 2.0 | 3.0 | 4.0 | V | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$ |
| Forward Transfer Admittance *1 | $ y_{fs} $ | 35 | 70 | — | S | $V_{DS} = 5\text{ V}, I_D = 45\text{ A}$ |
| Drain to Source On-state Resistance *1 | $R_{DS(on)}$ | — | 2.35 | 2.80 | m Ω | $V_{GS} = 10\text{ V}, I_D = 45\text{ A}$ |
| Input Capacitance | C_{iss} | — | 4700 | 7050 | pF | $V_{DS} = 25\text{ V}$ |
| Output Capacitance | C_{oss} | — | 660 | 990 | pF | $V_{GS} = 0\text{ V}$ |
| Reverse Transfer Capacitance | C_{rss} | — | 270 | 490 | pF | $f = 1\text{ MHz}$ |
| Turn-on Delay Time | $t_{d(on)}$ | — | 28 | 70 | ns | $V_{DD} = 20\text{ V}, I_D = 45\text{ A}$ |
| Rise Time | t_r | — | 14 | 40 | ns | $V_{GS} = 10\text{ V}$ |
| Turn-off Delay Time | $t_{d(off)}$ | — | 70 | 140 | ns | $R_G = 0\ \Omega$ |
| Fall Time | t_f | — | 10 | 30 | ns | |
| Total Gate Charge | Q_G | — | 80 | 120 | nC | $V_{DD} = 32\text{ V}$ |
| Gate to Source Charge | Q_{GS} | — | 21 | — | nC | $V_{GS} = 10\text{ V}$ |
| Gate to Drain Charge | Q_{GD} | — | 20 | — | nC | $I_D = 90\text{ A}$ |
| Body Diode Forward Voltage *1 | $V_{F(S-D)}$ | — | 0.9 | 1.5 | V | $I_F = 90\text{ A}, V_{GS} = 0\text{ V}$ |
| Reverse Recovery Time | t_{rr} | — | 52 | — | ns | $I_F = 90\text{ A}, V_{GS} = 0\text{ V}$ |
| Reverse Recovery Charge | Q_{rr} | — | 78 | — | nC | $di/dt = 100\text{ A}/\mu\text{s}$ |

Note: *1 Pulsed test

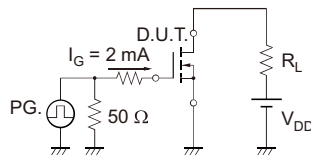
TEST CIRCUIT 1 AVALANCHE CAPABILITY



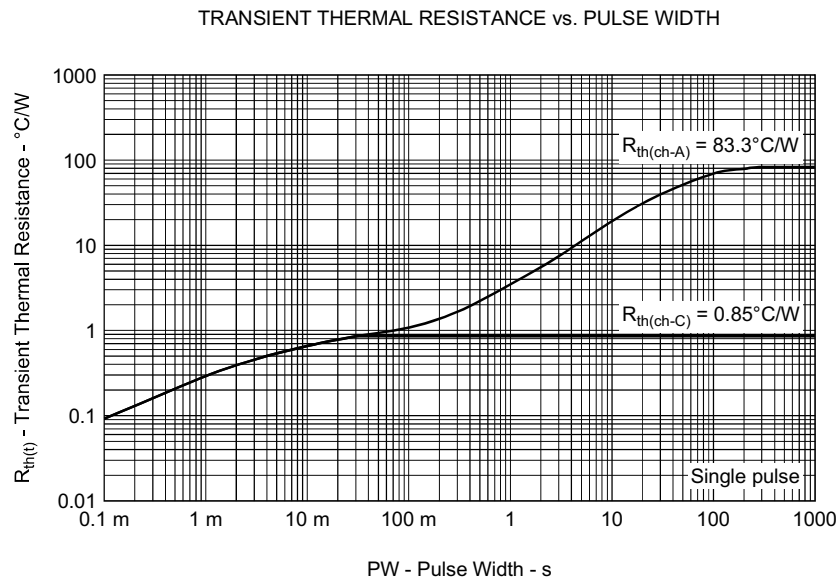
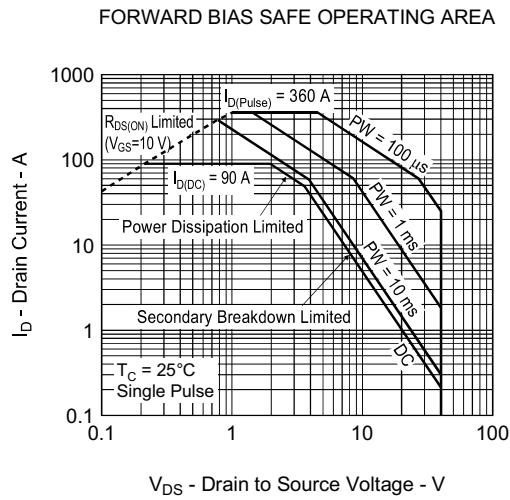
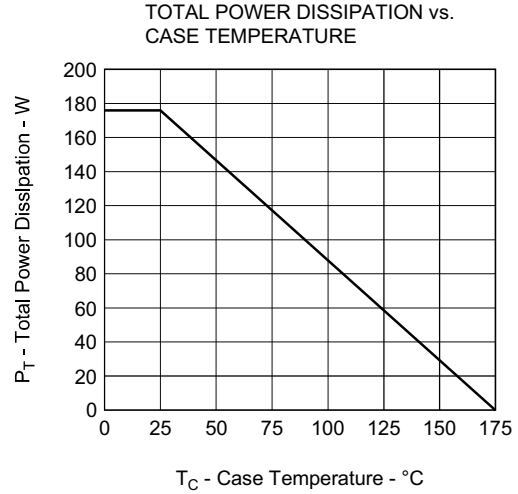
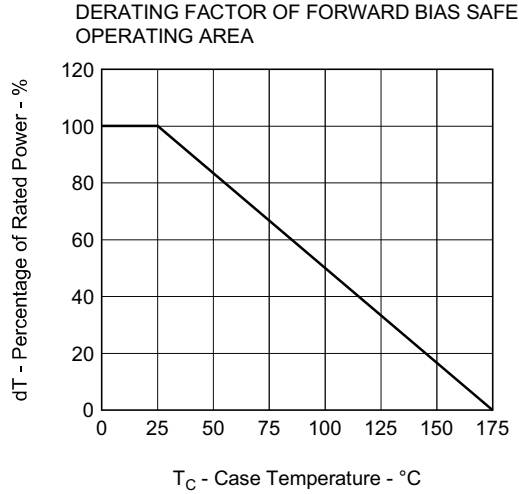
TEST CIRCUIT 2 SWITCHING TIME

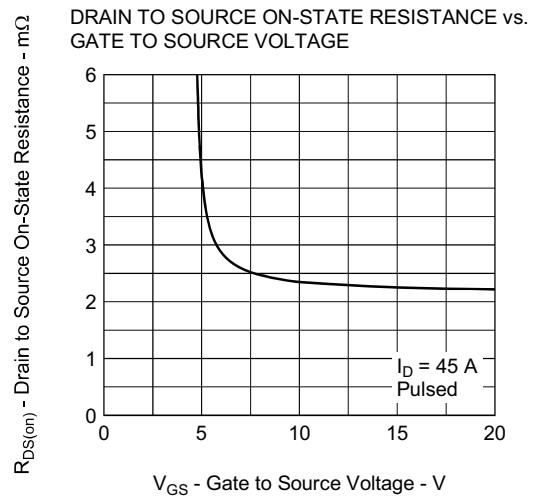
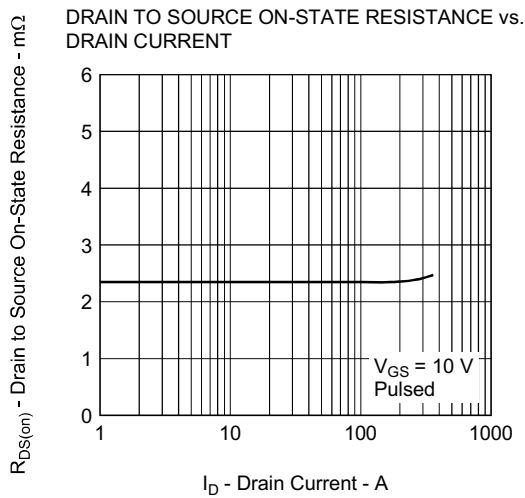
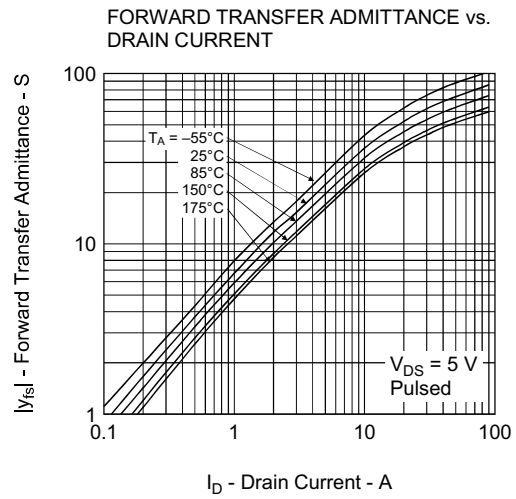
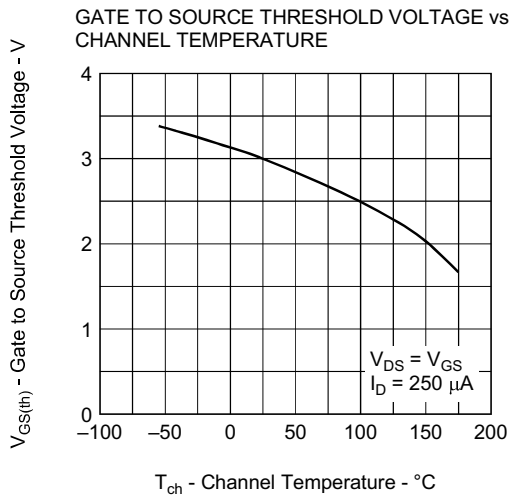
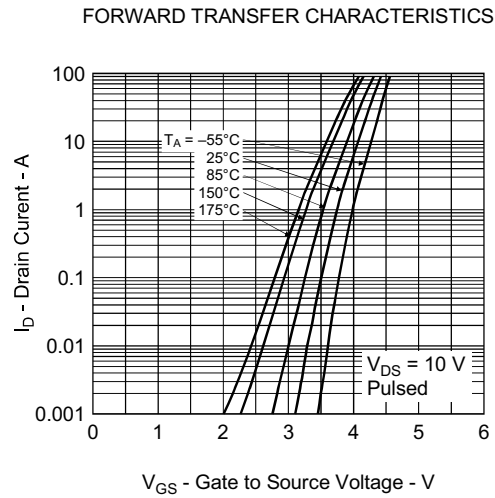
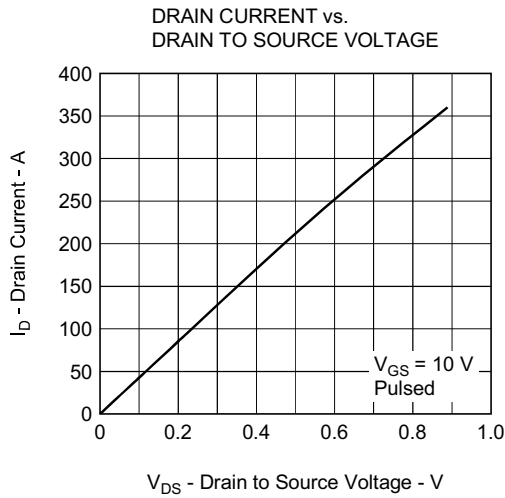


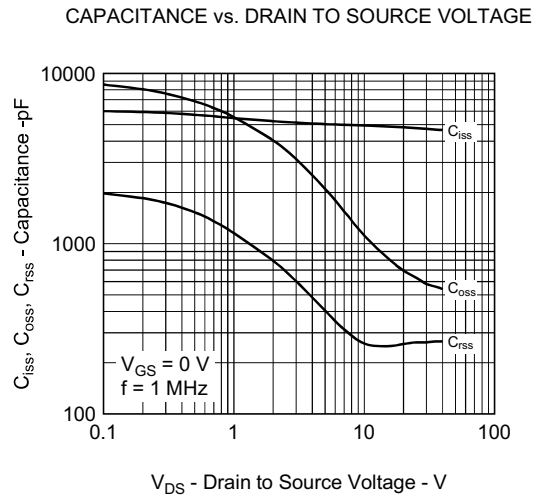
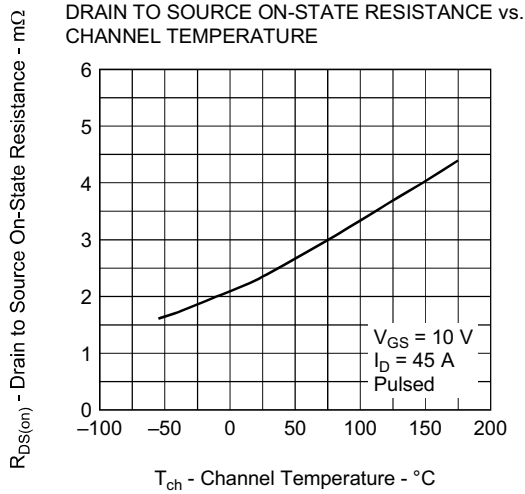
TEST CIRCUIT 3 GATE CHARGE



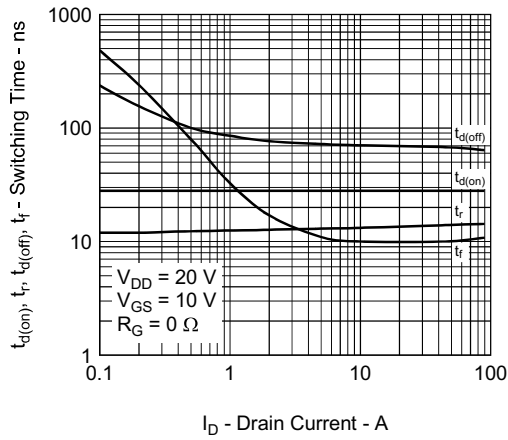
Typical Characteristics ($T_A = 25^\circ\text{C}$)



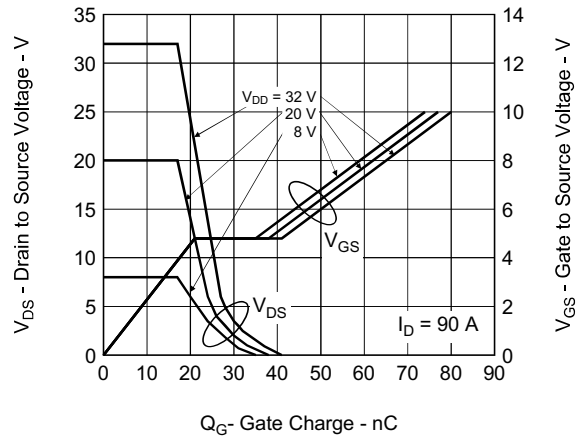




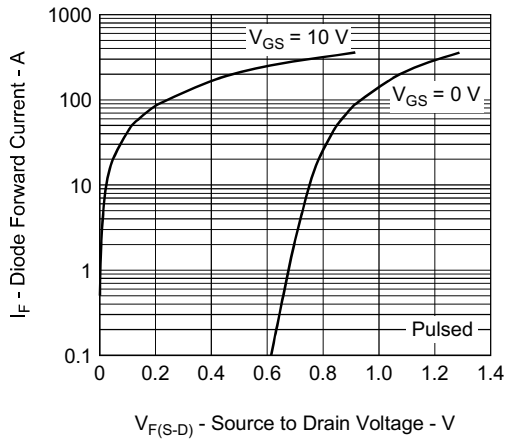
SWITCHING CHARACTERISTICS



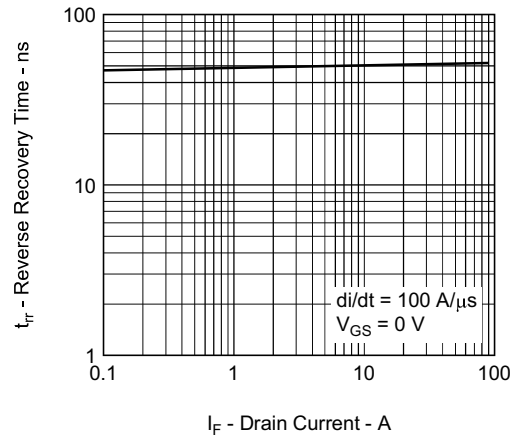
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

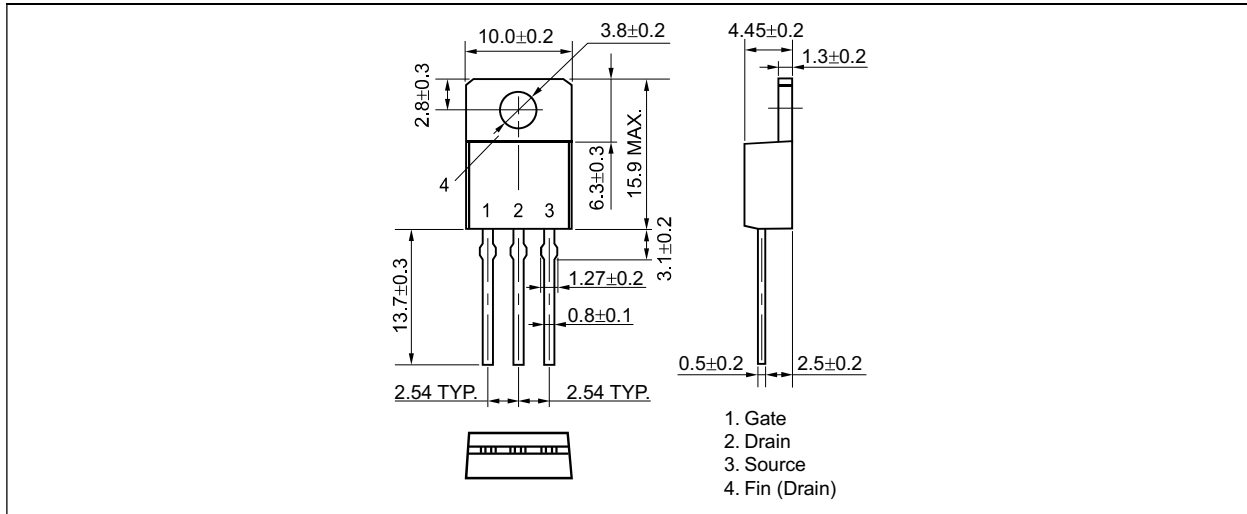


REVERSE RECOVERY TIME vs. DRAIN CURRENT

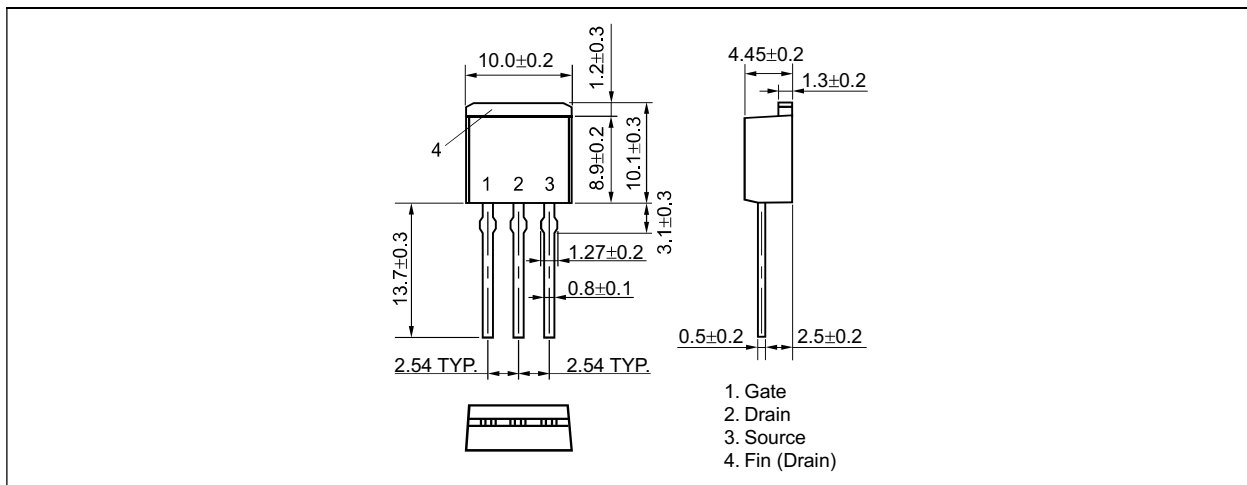


Package Drawing (Unit: mm)

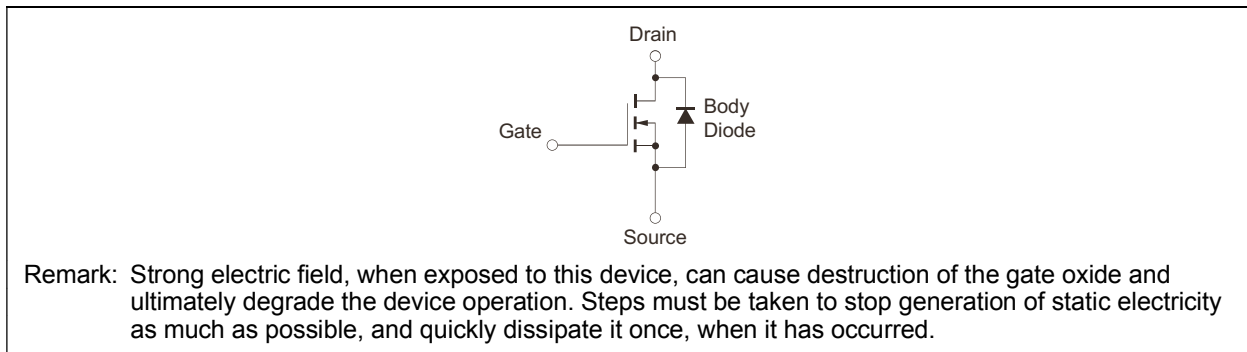
TO-220 (MP-25K) (Mass: 1.9 g TYP.)



TO-262 (MP-25SK) (Mass: 1.8 g TYP.)



Equivalent Circuit



| | |
|-------------------------|--|
| Revision History | NP90N04MUK, NP90N04NUK Data Sheet |
|-------------------------|--|

| Rev. | Date | Description | |
|-------------|--------------|--------------------|----------------------|
| | | Page | Summary |
| 1.00 | Jan 11, 2012 | — | First Edition Issued |

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Renesas Electronics America Inc.

2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited

1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220

Renesas Electronics Europe Limited

Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH

Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.

7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.

Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898

Renesas Electronics Hong Kong Limited

Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852-2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.

13F., No. 363, Fu Shing North Road, Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886-2-8175-9670

Renesas Electronics Singapore Pte. Ltd.

1 HarbourFront Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: +65-6213-0200, Fax: +65-6278-8001

Renesas Electronics Malaysia Sdn.Bhd.

Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
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Renesas Electronics Korea Co., Ltd.

11F., Samik Laved' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141