

NP20N10YDF

R07DS0705EJ0100

Rev.1.00

MOS FIELD EFFECT TRANSISTOR

Apr 17, 2012

Description

The NP20N10YDF is N-channel MOS Field Effect Transistor designed for high current switching applications.

Features

- Low on-state resistance
 $R_{DS(on)} = 55 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 10 \text{ A)}$
 $R_{DS(on)} = 68 \text{ m}\Omega \text{ MAX. (} V_{GS} = 5 \text{ V, } I_D = 10 \text{ A)}$
 $R_{DS(on)} = 74 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_D = 10 \text{ A)}$
- Low C_{iss} : $C_{iss} = 1000 \text{ pF TYP. (} V_{DS} = 25 \text{ V, } V_{GS} = 0 \text{ V)}$
- Logic level drive type
- Designed for automotive application and AEC-Q101 qualified

Ordering Information

| Part No. | Lead Plating | Packing | | Package |
|---------------------|---------------|------------------|------------------|------------|
| NP20N10YDF-E1-AY *1 | Pure Sn (Tin) | Tape 2500 p/reel | Taping (E1 type) | 8-pin HSON |
| NP20N10YDF-E2-AY *1 | | | Taping (E2 type) | |

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} | 100 | V |
| Gate to Source Voltage ($V_{DS} = 0 \text{ V}$) | V_{GSS} | ± 20 | V |
| Drain Current (DC) ($T_C = 25^\circ\text{C}$) | $I_{D(DC)}$ | ± 20 | A |
| Drain Current (pulse) *1 | $I_{D(pulse)}$ | ± 40 | A |
| Total Power Dissipation ($T_C = 25^\circ\text{C}$) | P_{T1} | 61 | W |
| Total Power Dissipation ($T_A = 25^\circ\text{C}$) *2 | P_{T2} | 1.0 | W |
| Channel Temperature | T_{ch} | 175 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | -55 to +175 | $^\circ\text{C}$ |
| Single Avalanche Current *3 | I_{AS} | 16 | A |
| Single Avalanche Energy *3 | E_{AS} | 26 | mJ |

Thermal Resistance

Channel to Case Thermal Resistance $R_{th(ch-C)}$ 2.46 $^\circ\text{C/W}$

Channel to Ambient Thermal Resistance *2 $R_{th(ch-A)}$ 150 $^\circ\text{C/W}$

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

*2 Mounted on glass epoxy substrate of 40 mm \times 40 mm \times 1.6 mm with 4% copper area (35 μm)

*3 $T_{ch(start)} = 25^\circ\text{C}$, $V_{DD} = 50 \text{ V}$, $R_G = 25 \Omega$, $L = 100 \mu\text{H}$, $V_{GS} = 20 \text{ V} \rightarrow 0 \text{ V}$

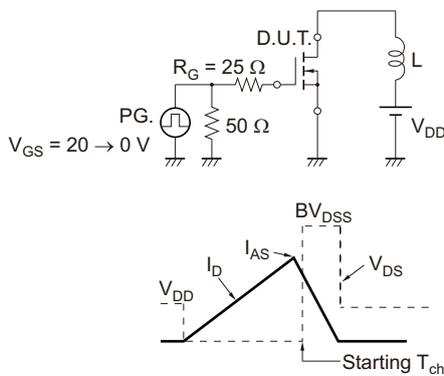
Caution: This product is an electrostatic-sensitive device due to low ESD capability and should be handled with caution for electrostatic discharge. HBM (C = 100 pF, R = 1.5 k Ω) $\pm 700 \text{ V}$.

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

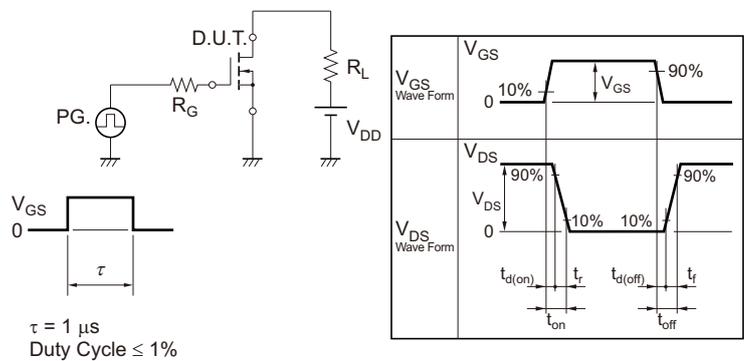
| Item | Symbol | MIN. | TYP. | MAX. | Unit | Test Conditions |
|--|---------------|------|------|-----------|---------------|--|
| Zero Gate Voltage Drain Current | I_{DSS} | — | — | 1 | μA | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$ |
| Gate Leakage Current | I_{GSS} | — | — | ± 100 | nA | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$ |
| Gate to Source Threshold Voltage | $V_{GS(th)}$ | 1.5 | 2.0 | 2.5 | V | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$ |
| Forward Transfer Admittance *1 | $ y_{fs} $ | 8 | 17 | — | S | $V_{DS} = 5\text{ V}, I_D = 10\text{ A}$ |
| Drain to Source On-state Resistance *1 | $R_{DS(on)1}$ | — | 45 | 55 | m Ω | $V_{GS} = 10\text{ V}, I_D = 10\text{ A}$ |
| | $R_{DS(on)2}$ | — | 50 | 68 | m Ω | $V_{GS} = 5\text{ V}, I_D = 10\text{ A}$ |
| | $R_{DS(on)3}$ | — | 53 | 74 | m Ω | $V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$ |
| Input Capacitance | C_{iss} | — | 1000 | 1500 | pF | $V_{DS} = 25\text{ V}$ $V_{GS} = 0\text{ V}$ $f = 1\text{ MHz}$ |
| Output Capacitance | C_{oss} | — | 100 | 150 | pF | |
| Reverse Transfer Capacitance | C_{rss} | — | 50 | 90 | pF | |
| Turn-on Delay Time | $t_{d(on)}$ | — | 13 | 26 | ns | $V_{DD} = 50\text{ V}, I_D = 10\text{ A}$ $V_{GS} = 10\text{ V}$ $R_G = 0\ \Omega$ |
| Rise Time | t_r | — | 10 | 25 | ns | |
| Turn-off Delay Time | $t_{d(off)}$ | — | 40 | 80 | ns | |
| Fall Time | t_f | — | 4 | 10 | ns | |
| Total Gate Charge | Q_G | — | 24 | 36 | nC | $V_{DD} = 80\text{ V}$ $V_{GS} = 10\text{ V}$ $I_D = 20\text{ A}$ |
| Gate to Source Charge | Q_{GS} | — | 4 | — | nC | |
| Gate to Drain Charge | Q_{GD} | — | 7 | — | nC | |
| Body Diode Forward Voltage *1 | $V_{F(S-D)}$ | — | 0.92 | 1.5 | V | $I_F = 20\text{ A}, V_{GS} = 0\text{ V}$ |
| Reverse Recovery Time | t_{rr} | — | 56 | — | ns | $I_F = 20\text{ A}, V_{GS} = 0\text{ V}$ |
| Reverse Recovery Charge | Q_{rr} | — | 128 | — | nC | $di/dt = 100\text{ A}/\mu\text{s}$ |

Note: *1 Pulsed test

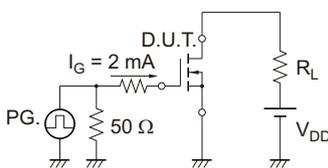
TEST CIRCUIT 1 AVALANCHE CAPABILITY



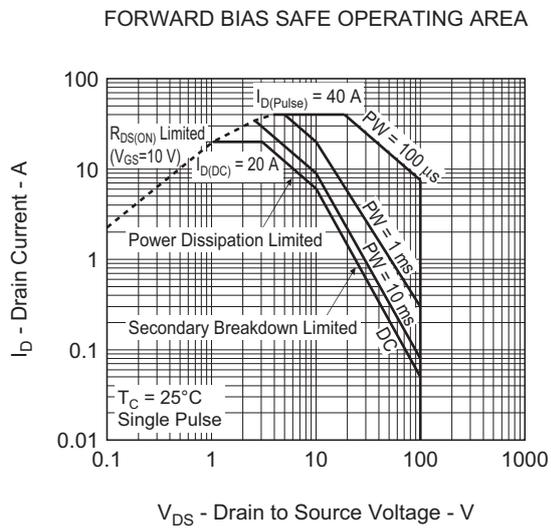
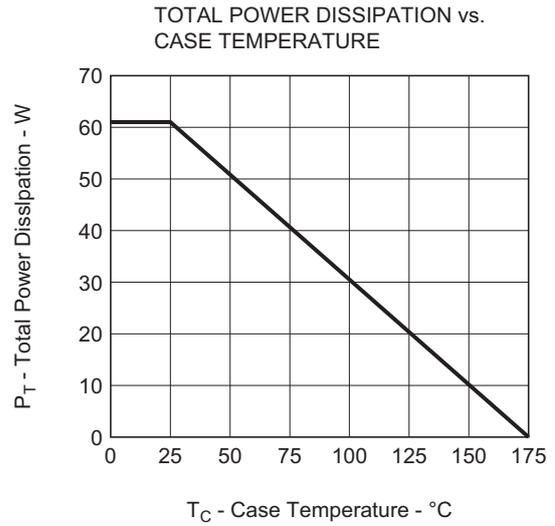
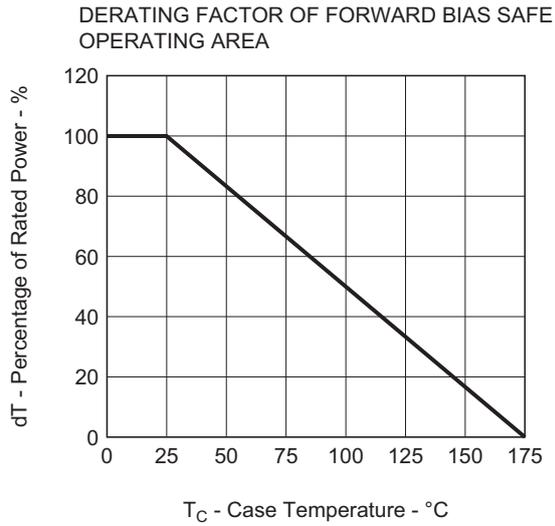
TEST CIRCUIT 2 SWITCHING TIME



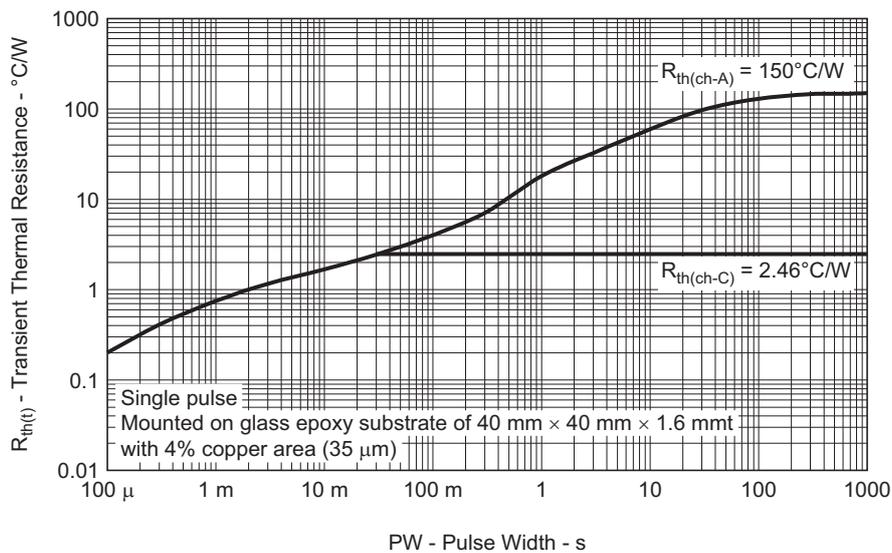
TEST CIRCUIT 3 GATE CHARGE



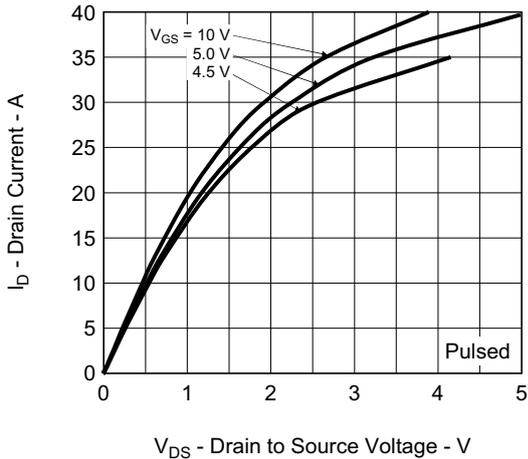
Typical Characteristics ($T_A = 25^\circ\text{C}$)



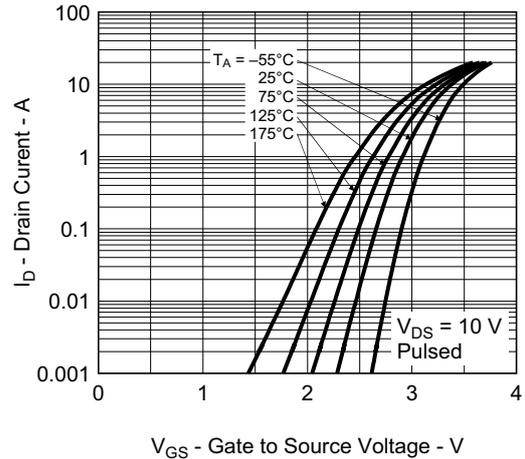
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



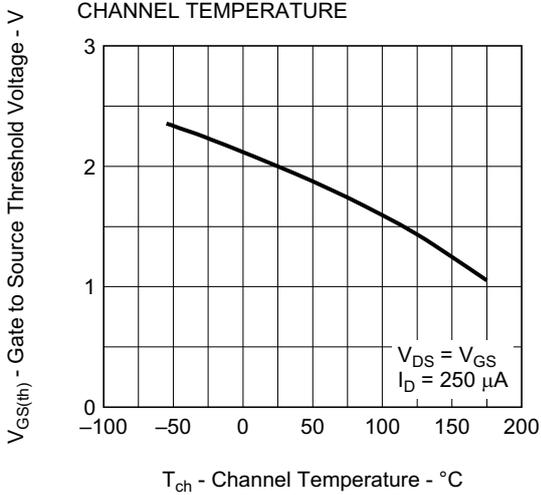
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



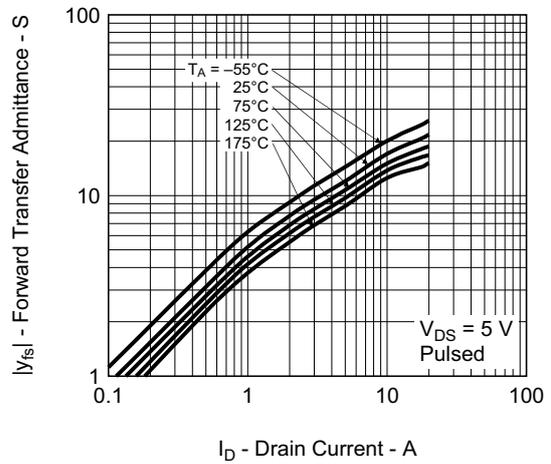
FORWARD TRANSFER CHARACTERISTICS



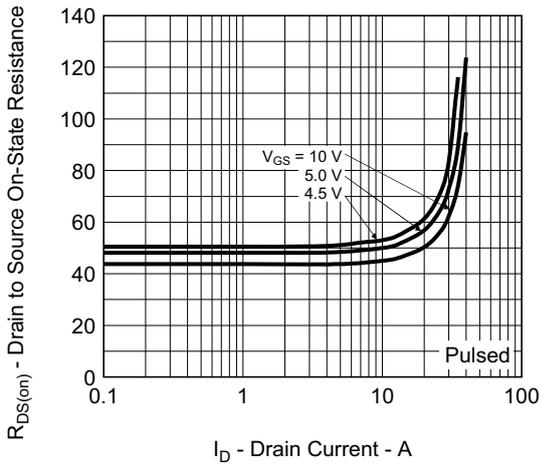
GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



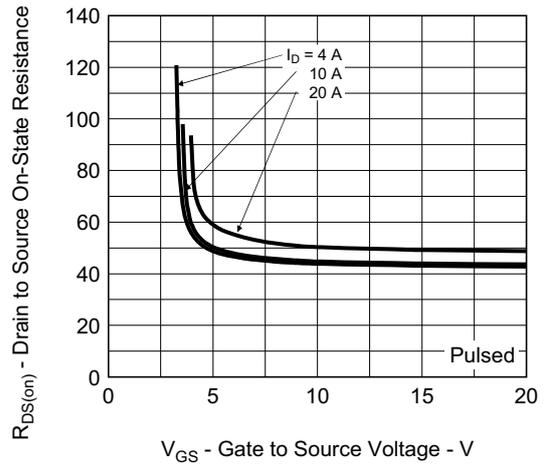
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



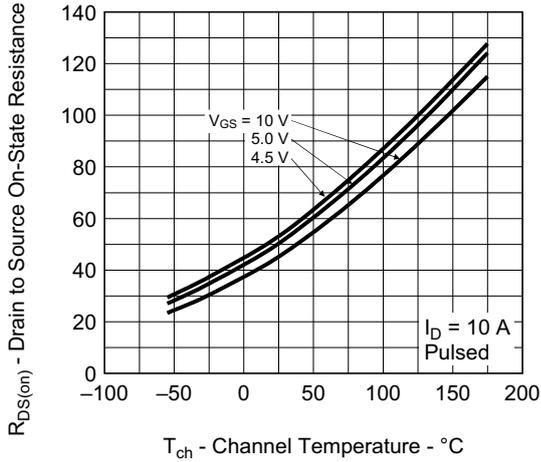
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



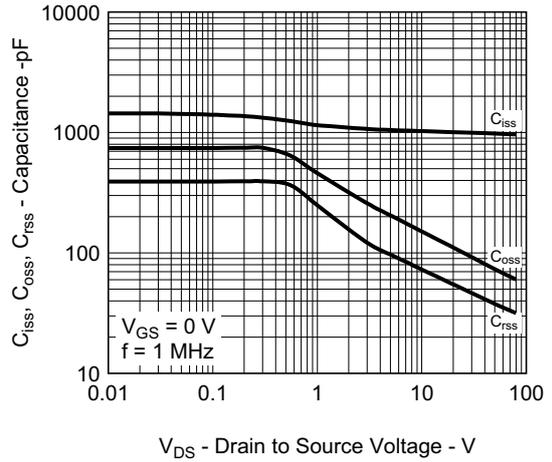
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



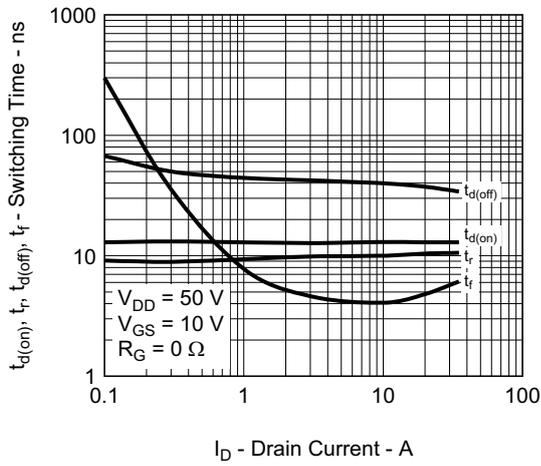
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



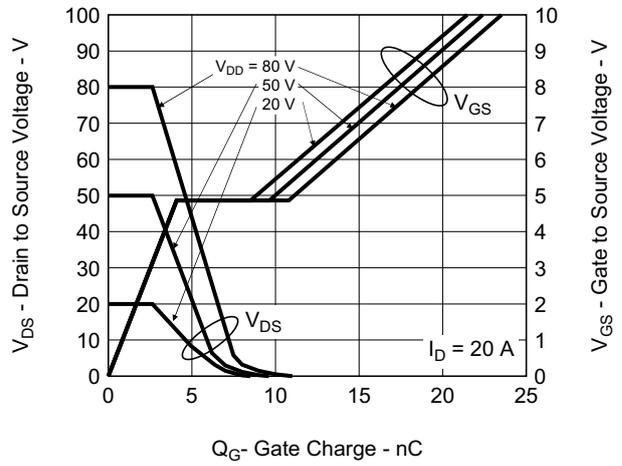
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



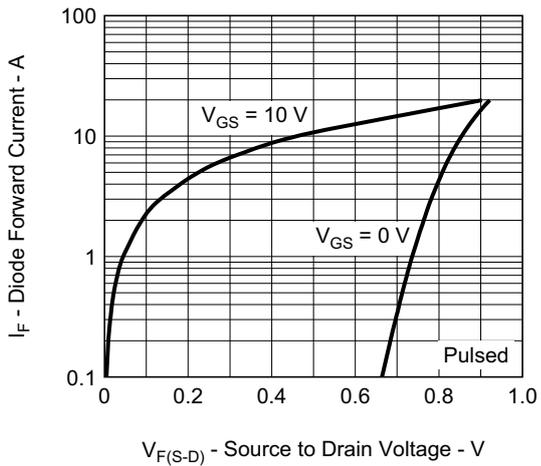
SWITCHING CHARACTERISTICS



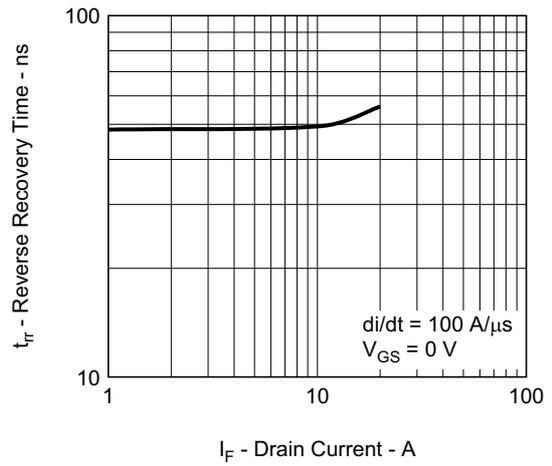
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

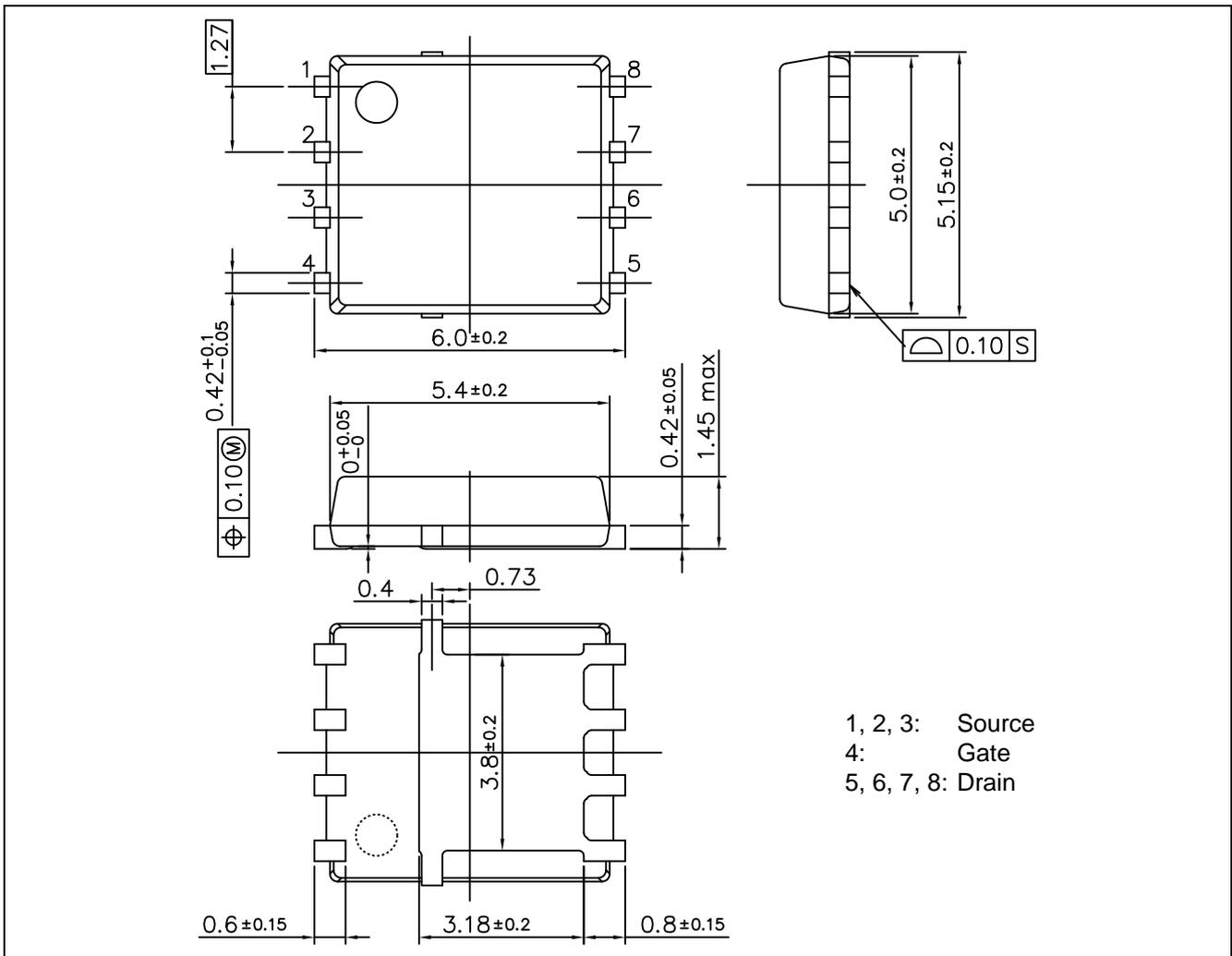


REVERSE RECOVERY TIME vs. DRAIN CURRENT

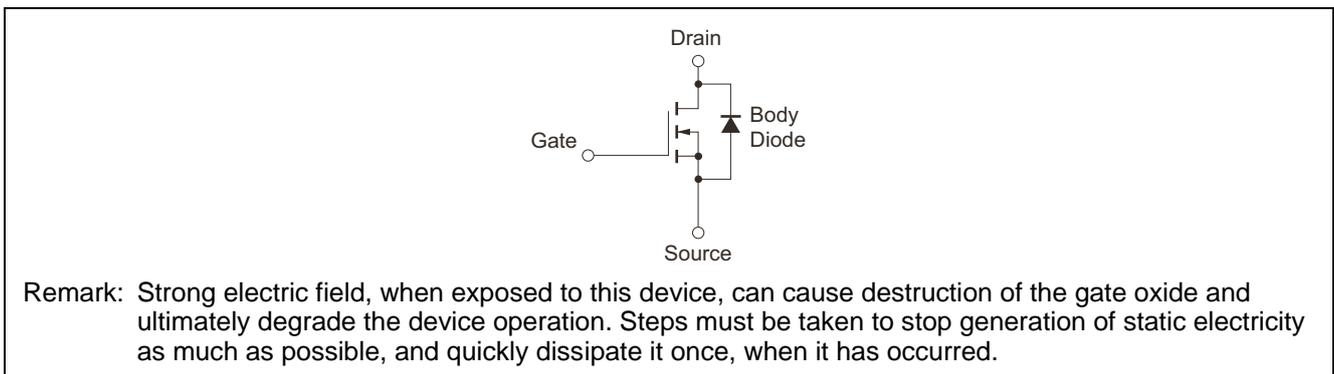


Package Drawings (Unit: mm)

8-pin HSON (Mass: 0.13 g TYP.)



Equivalent Circuit



| | |
|-------------------------|------------------------------|
| Revision History | NP20N10YDF Data Sheet |
|-------------------------|------------------------------|

| Rev. | Date | Description | |
|------|--------------|-------------|----------------------|
| | | Page | Summary |
| 1.00 | Apr 17, 2012 | — | First Edition Issued |

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