

# N0600N

R07DS0220EJ0100

Rev.1.00

Jan 25, 2011

## MOS FIELD EFFECT TRANSISTOR

### Description

The N0600N is N-channel MOS Field Effect Transistor designed for high current switching applications.

### Features

- Low on-state resistance
  - $R_{DS(on)1} = 25 \text{ m}\Omega \text{ MAX.}$  ( $V_{GS} = 10 \text{ V}$ ,  $I_D = 15 \text{ A}$ )
  - $R_{DS(on)2} = 36 \text{ m}\Omega \text{ MAX.}$  ( $V_{GS} = 4.5 \text{ V}$ ,  $I_D = 15 \text{ A}$ )
- Low input capacitance
  - $C_{iss} = 1380 \text{ pF TYP.}$  ( $V_{DS} = 10 \text{ V}$ ,  $V_{GS} = 0 \text{ V}$ )

### Ordering Information

| Part No.         | Lead Plating  | Packing          | Package                       |
|------------------|---------------|------------------|-------------------------------|
| N0600N-S17-AY *1 | Pure Sn (Tin) | Tube<br>50p/tube | Isolated TO-220<br>typ. 2.2 g |

Note: \*1. Pb-free (This product does not contain Pb in the external electrode and other parts.)

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

| Item                                                 | Symbol         | Ratings     | Unit             |
|------------------------------------------------------|----------------|-------------|------------------|
| Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )   | $V_{DSS}$      | 60          | V                |
| Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )    | $V_{GSS}$      | $\pm 20$    | V                |
| Drain Current (DC)                                   | $I_{D(DC)}$    | $\pm 30$    | A                |
| Drain Current (pulse) *1                             | $I_{D(pulse)}$ | $\pm 60$    | A                |
| Total Power Dissipation ( $T_C = 25^\circ\text{C}$ ) | $P_{T1}$       | 20          | W                |
| Total Power Dissipation ( $T_A = 25^\circ\text{C}$ ) | $P_{T2}$       | 2.0         | W                |
| Channel Temperature                                  | $T_{ch}$       | 150         | $^\circ\text{C}$ |
| Storage Temperature                                  | $T_{stg}$      | -55 to +150 | $^\circ\text{C}$ |
| Single Avalanche Current *2                          | $I_{AS}$       | 9.2         | A                |
| Single Avalanche Energy *2                           | $E_{AS}$       | 12.5        | mJ               |

### Thermal Resistance

Channel to Case (Drain) Thermal Resistance  $R_{th(ch-C)}$  6.25  $^\circ\text{C/W}$

Channel to Ambient Thermal Resistance \*2  $R_{th(ch-A)}$  62.5  $^\circ\text{C/W}$

Notes: \*1.  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

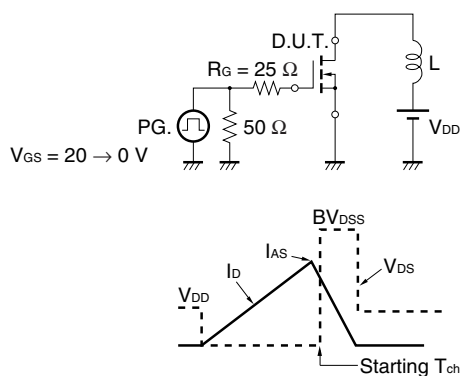
\*2. Starting  $T_{ch} = 25^\circ\text{C}$ ,  $R_G = 25 \Omega$ ,  $V_{DD} = 30 \text{ V}$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$

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

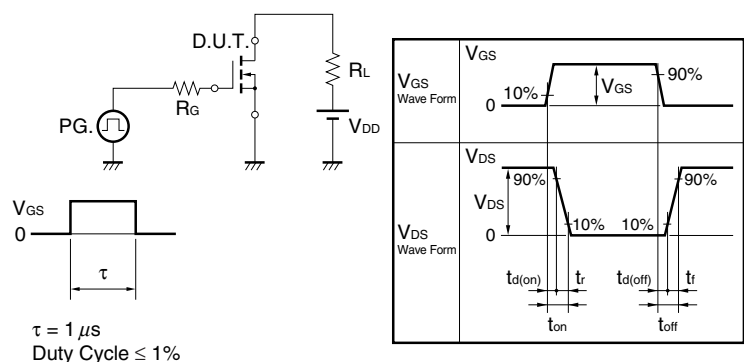
| Item                                              | Symbol        | Min | Typ  | Max       | Unit          | Test Conditions                                     |
|---------------------------------------------------|---------------|-----|------|-----------|---------------|-----------------------------------------------------|
| Zero Gate Voltage Drain Current                   | $I_{DSS}$     |     |      | 1         | $\mu\text{A}$ | $V_{DS} = 60\text{ V}$ , $V_{GS} = 0\text{ V}$      |
| Gate Leakage Current                              | $I_{GSS}$     |     |      | $\pm 100$ | nA            | $V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$  |
| Gate to Source Cut-off Voltage                    | $V_{GS(off)}$ | 1.5 | 2.0  | 2.5       | V             | $V_{DS} = 10\text{ V}$ , $I_D = 1\text{ mA}$        |
| Forward Transfer Admittance <sup>*1</sup>         | $ y_{fs} $    | 4   |      |           | S             | $V_{DS} = 10\text{ V}$ , $I_D = 15\text{ A}$        |
| Drain to Source On-state Resistance <sup>*1</sup> | $R_{DS(on)1}$ |     | 17.5 | 25        | m $\Omega$    | $V_{GS} = 10\text{ V}$ , $I_D = 15\text{ A}$        |
|                                                   | $R_{DS(on)2}$ |     | 22.3 | 36        | m $\Omega$    | $V_{GS} = 4.5\text{ V}$ , $I_D = 15\text{ A}$       |
| Input Capacitance                                 | $C_{iss}$     |     | 1380 |           | pF            | $V_{DS} = 10\text{ V}$ ,<br>$V_{GS} = 0\text{ V}$ , |
| Output Capacitance                                | $C_{oss}$     |     | 186  |           | pF            | $f = 1\text{ MHz}$                                  |
| Reverse Transfer Capacitance                      | $C_{rss}$     |     | 109  |           | pF            |                                                     |
| Turn-on Delay Time                                | $t_{d(on)}$   |     | 5.7  |           | ns            | $V_{DD} = 30\text{ V}$ , $I_D = 15\text{ A}$ ,      |
| Rise Time                                         | $t_r$         |     | 6.3  |           | ns            | $V_{GS} = 10\text{ V}$ ,                            |
| Turn-off Delay Time                               | $t_{d(off)}$  |     | 33.2 |           | ns            | $R_G = 0\text{ }\Omega$                             |
| Fall Time                                         | $t_f$         |     | 3.9  |           | ns            |                                                     |
| Total Gate Charge                                 | $Q_G$         |     | 29.8 |           | nC            | $V_{DD} = 48\text{ V}$ ,                            |
| Gate to Source Charge                             | $Q_{GS}$      |     | 4.2  |           | nC            | $V_{GS} = 10\text{ V}$ ,                            |
| Gate to Drain Charge                              | $Q_{GD}$      |     | 9.0  |           | nC            | $I_D = 30\text{ A}$                                 |
| Body Diode Forward Voltage <sup>*1</sup>          | $V_{F(S-D)}$  |     | 0.92 | 1.5       | V             | $I_F = 30\text{ A}$ , $V_{GS} = 0\text{ V}$         |
| Reverse Recovery Time                             | $t_{rr}$      |     | 30   |           | ns            | $I_F = 30\text{ A}$ , $V_{GS} = 0\text{ V}$ ,       |
| Reverse Recovery Charge                           | $Q_{rr}$      |     | 39.6 |           | nC            | $di/dt = 100\text{ A}/\mu\text{s}$                  |

Note: \*1. Pulsed

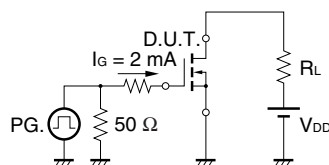
## TEST CIRCUIT 1 AVALANCHE CAPABILITY



## TEST CIRCUIT 2 SWITCHING TIME

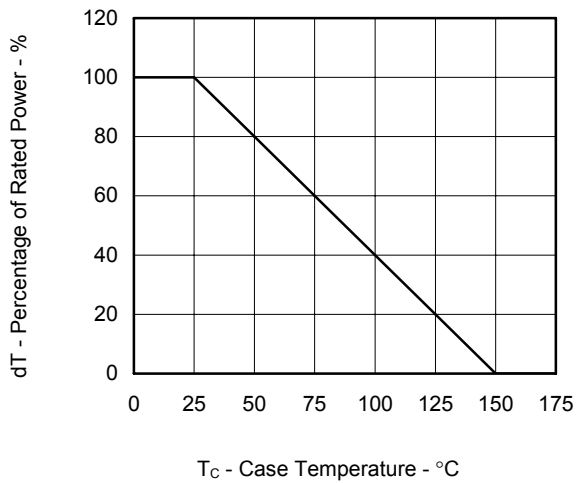


## TEST CIRCUIT 3 GATE CHARGE

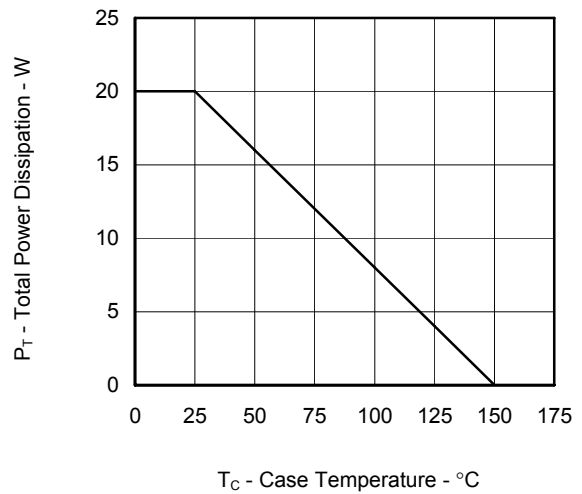


## Typical Characteristics ( $T_A = 25^\circ\text{C}$ )

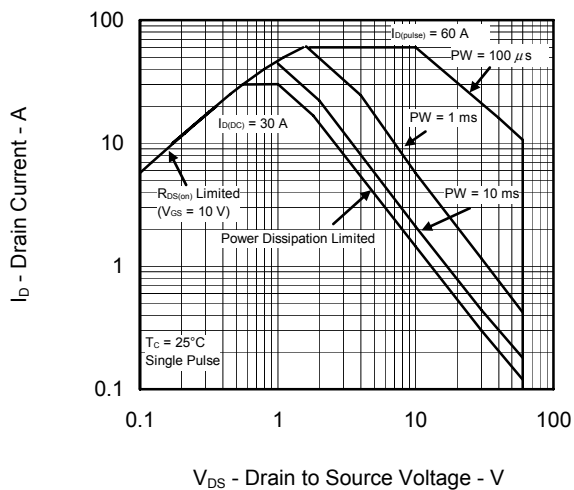
DERATING FACTOR OF FORWARD BIAS SAFE  
OPERATING AREA



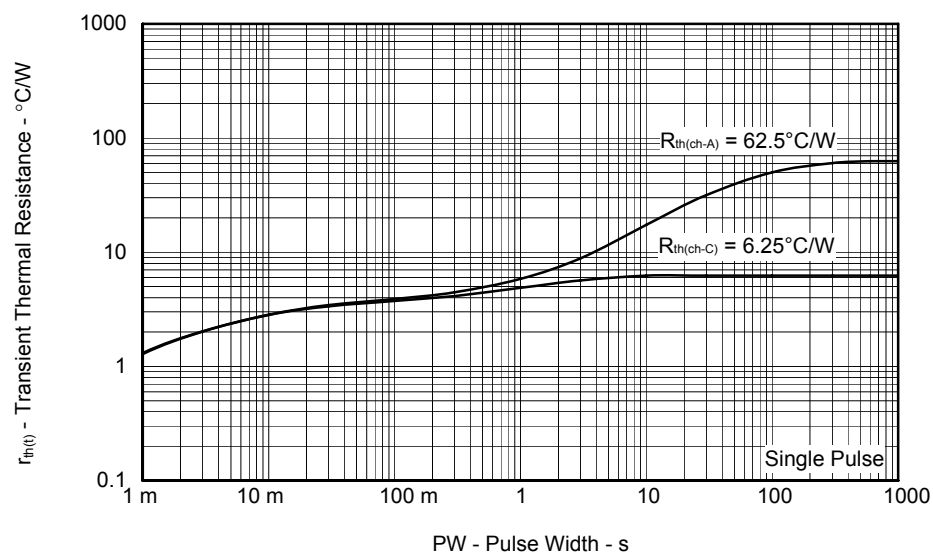
TOTAL POWER DISSIPATION vs.  
CASE TEMPERATURE



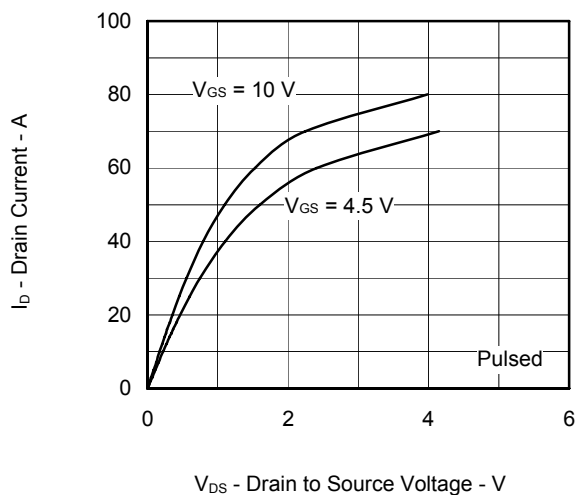
FORWARD BIAS SAFE OPERATING AREA



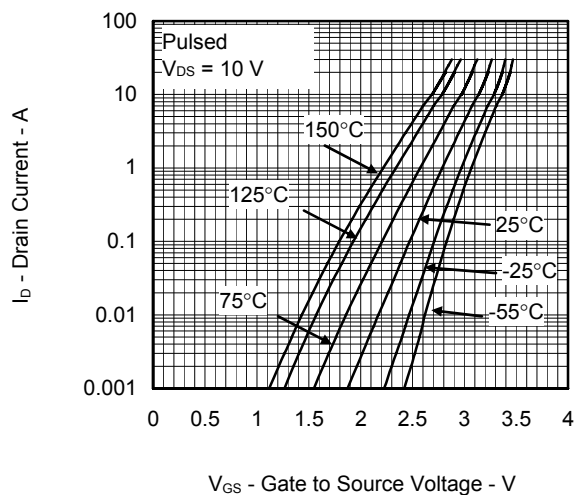
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



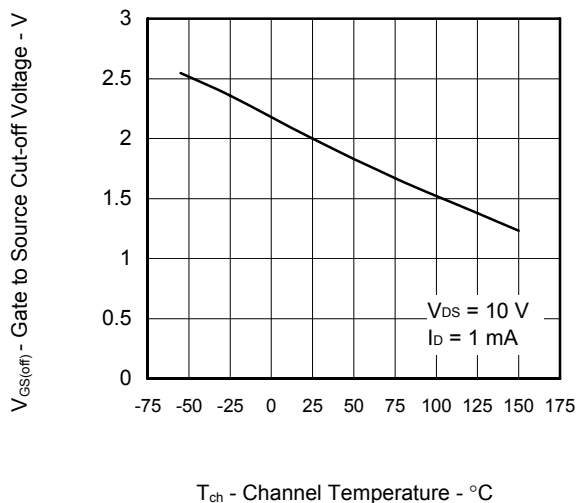
DRAIN CURRENT vs.  
DRAIN TO SOURCE VOLTAGE



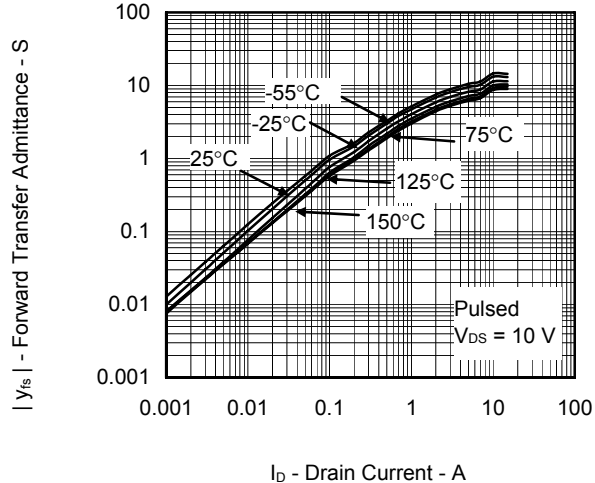
FORWARD TRANSFER CHARACTERISTICS



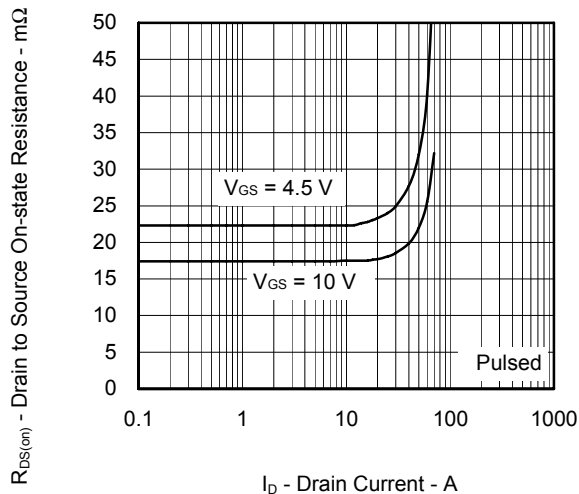
GATE TO SOURCE CUT-OFF VOLTAGE vs.  
CHANNEL TEMPERATURE



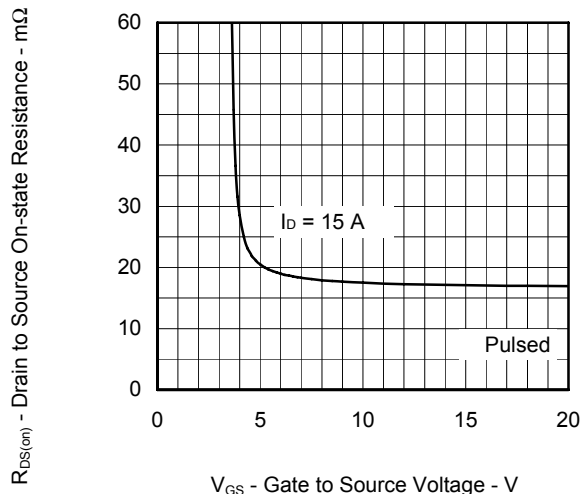
FORWARD TRANSFER ADMITTANCE vs. DRAIN  
CURRENT

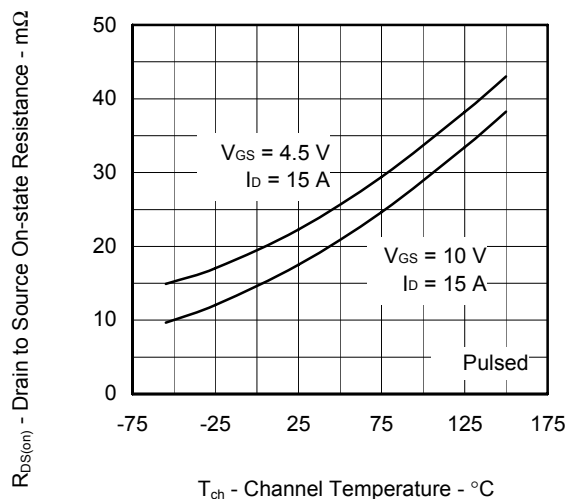


DRAIN TO SOURCE ON-STATE RESISTANCE vs.  
DRAIN CURRENT

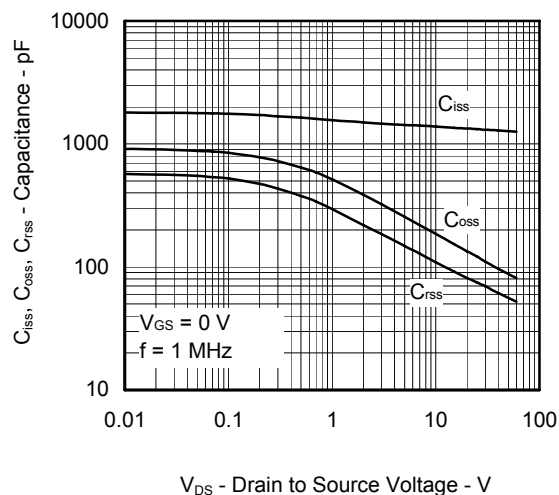


DRAIN TO SOURCE ON-STATE RESISTANCE vs.  
GATE TO SOURCE VOLTAGE

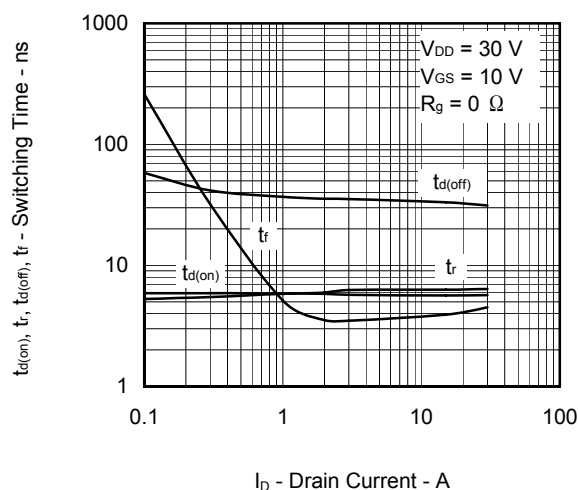


DRAIN TO SOURCE ON-STATE RESISTANCE  
vs. CHANNEL TEMPERATURE

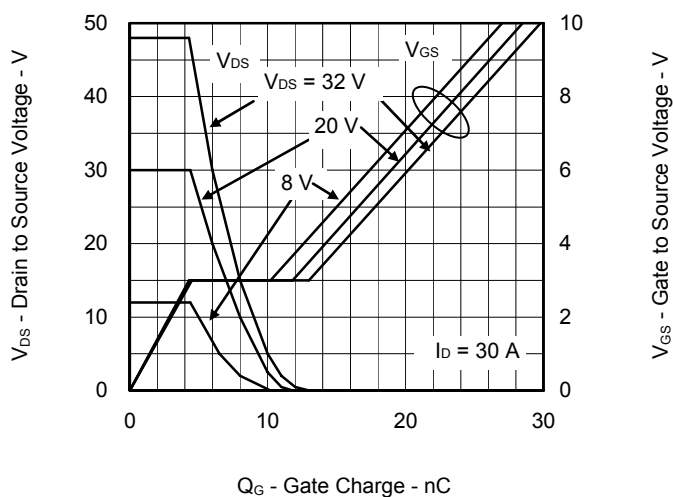
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



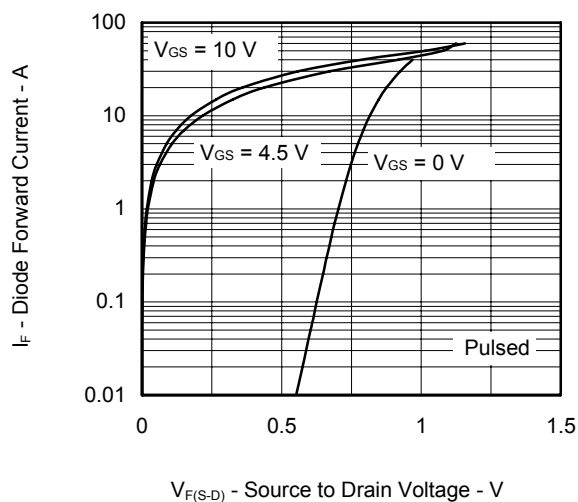
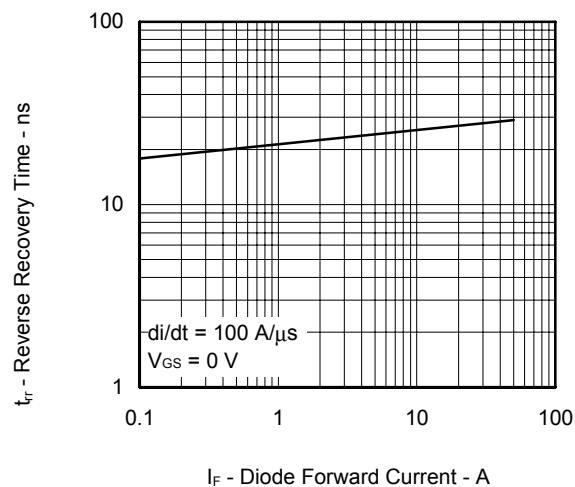
SWITCHING CHARACTERISTICS



DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

REVERSE RECOVERY TIME vs.  
DIODE FORWARD CURRENT



|                         |                          |
|-------------------------|--------------------------|
| <b>Revision History</b> | <b>N0600N Data Sheet</b> |
|-------------------------|--------------------------|

| <b>Rev.</b> | <b>Date</b>  | <b>Description</b> |                      |
|-------------|--------------|--------------------|----------------------|
|             |              | <b>Page</b>        | <b>Summary</b>       |
| 1.00        | Jan 25, 2011 | –                  | First Edition Issued |

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