

# QN7002

R07DS0269EJ0100

Rev.1.00

Mar 11, 2011

## N-CHANNEL MOSFET FOR SWITCHING

### Description

The QN7002, N-channel vertical type MOSFET designed for general-purpose switch, is a device which can be driven directly by a 4.5 V power source.

### Features

- Directly driven by a 4.5 V power source.
- Low on-state resistance  
 $R_{DS(on)1} = 2.7 \Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 100 \text{ mA)}$   
 $R_{DS(on)2} = 3.2 \Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_D = 50 \text{ mA)}$

### Ordering Information

| Part Number   | Lead Plating | Packing    | Package           |
|---------------|--------------|------------|-------------------|
| QN7002-T1B-AT | Pure Sn      | 3000p/Reel | SC-59 (Mini Mold) |

**Remark** "-AT" indicates Pb-free. This product does not contain Pb in external electrode and other parts.

### Remark for Agent

ORDER NUMBER "2SK4079(1)" must be used to order, instead of "QN7002". For instance, "2SK4079(1)-T1B-AT"

### Absolute Maximum Ratings (TA = 25°C)

|  |                |             |    |
|--|----------------|-------------|----|
| 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)                                 | $I_{D(DC)}$    | 200         | mA |
| Drain Current (pulse) <sup>Note</sup>              | $I_{D(pulse)}$ | $\pm 800$   | mA |
| Total Power Dissipation                            | $P_T$          | 200         | mW |
| Channel Temperature                                | $T_{ch}$       | 150         | °C |
| Storage Temperature                                | $T_{stg}$      | -55 to +150 | °C |

**Note**  $PW \leq 10 \mu s$ , Duty Cycle  $\leq 1\%$

**Caution** This product is electrostatic-sensitive device due to low ESD capability and should be handled with caution for electrostatic discharge.

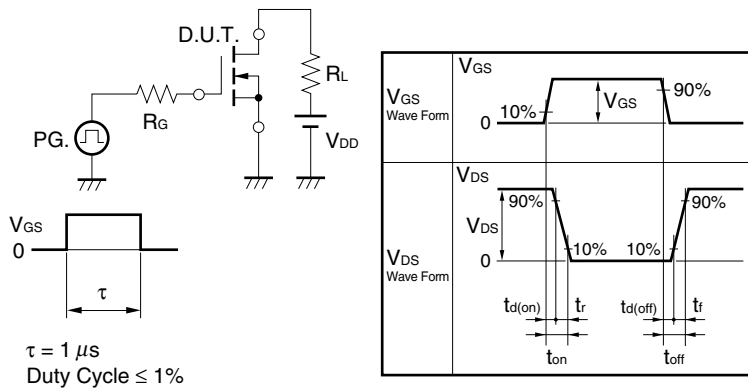
$V_{ESD} \pm 400 \text{ V (MIL STD; } C = 100 \text{ pF, } R = 1.5 \text{ k}\Omega, 5 \text{ times)}$ , as reference value.

Electrical Characteristics (T<sub>A</sub> = 25°C)

| Characteristics                                     | Symbol               | Test Conditions   | MIN. | TYP. | MAX. | UNIT |
|---|----------------------|---|------|------|------|------|
| Zero Gate Voltage Drain Current                     | I <sub>DSS</sub>     | V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V                           |      |      | 1    | μA   |
| Gate Leakage Current                                | I <sub>GSS</sub>     | V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V                          |      |      | ±10  | μA   |
| Gate Threshold Voltage                              | V <sub>GS(th)</sub>  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA             | 1.0  |      | 2.5  | V    |
| Forward Transfer Admittance <sup>Note</sup>         | y <sub>fs</sub>      | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 100 mA                         | 150  |      |      | mS   |
| Drain to Source On-state Resistance <sup>Note</sup> | R <sub>DS(on)1</sub> | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 100 mA                         |      | 2.1  | 2.7  | Ω    |
|   | R <sub>DS(on)2</sub> | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 50 mA                         |      | 2.4  | 3.2  | Ω    |
| Input Capacitance                                   | C <sub>iss</sub>     | V <sub>DS</sub> = 10 V,   |      | 20   |      | pF   |
| Output Capacitance                                  | C <sub>oss</sub>     | V <sub>GS</sub> = 0 V,  |      | 9    |      | pF   |
| Reverse Transfer Capacitance                        | C <sub>rss</sub>     | f = 1.0 MHz   |      | 2    |      | pF   |
| Turn-on Delay Time                                  | t <sub>d(on)</sub>   | V <sub>DD</sub> = 10 V,   |      | 16   |      | ns   |
| Rise Time   | t <sub>r</sub>       | I <sub>D</sub> = 200 mA,  |      | 6.5  |      | ns   |
| Turn-off Delay Time                                 | t <sub>d(off)</sub>  | V <sub>GS</sub> = 10 V,   |      | 82   |      | ns   |
| Fall Time   | t <sub>f</sub>       | R <sub>G</sub> = 10 Ω   |      | 32   |      | ns   |
| Total Gate Charge                                   | Q <sub>G</sub>       | I <sub>D</sub> = 200 mA, V <sub>DD</sub> = 25 V, V <sub>GS</sub> = 10 V |      | 2    |      | nC   |
| Body Diode Forward Voltage <sup>Note</sup>          | V <sub>F(S-D)</sub>  | I <sub>F</sub> = 200 mA, V <sub>GS</sub> = 0 V                          |      | 0.86 |      | V    |

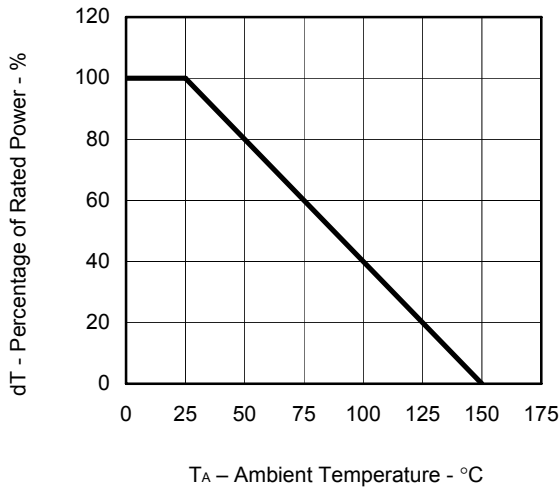
**Note** Pulsed

Test Circuit Switching Time

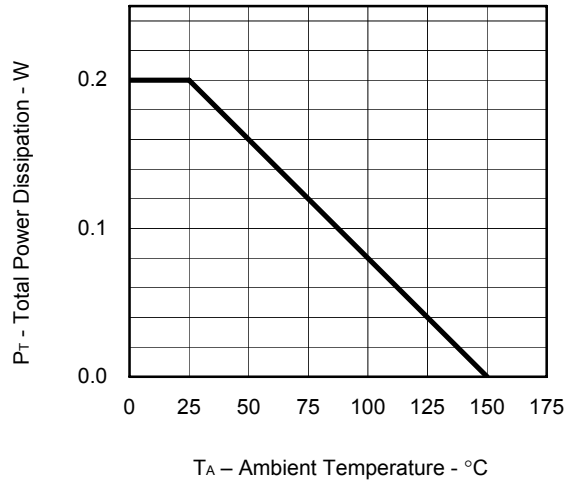


Typical Characteristics (T<sub>A</sub> = 25°C)

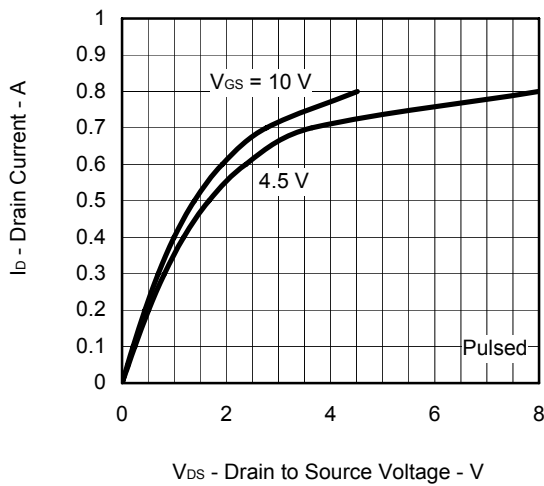
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



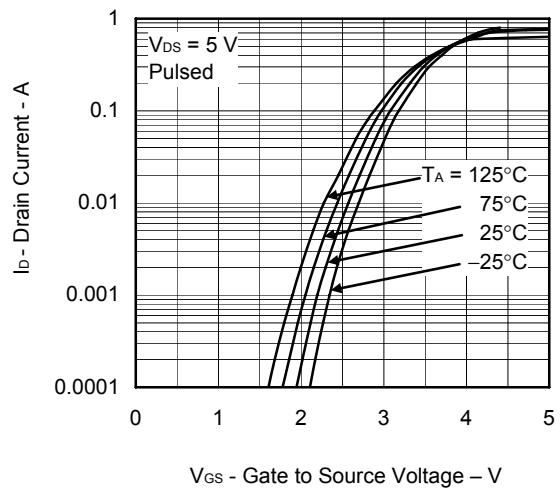
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



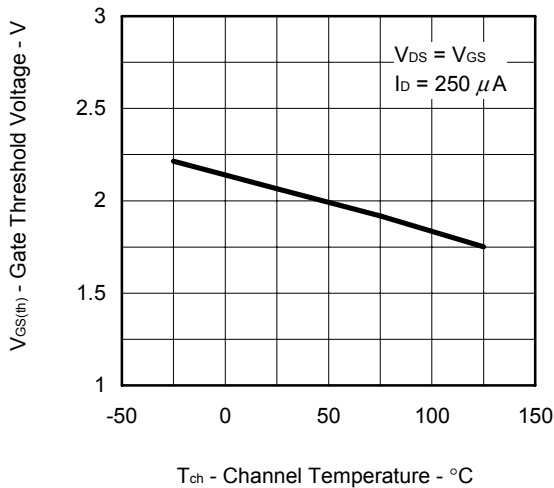
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



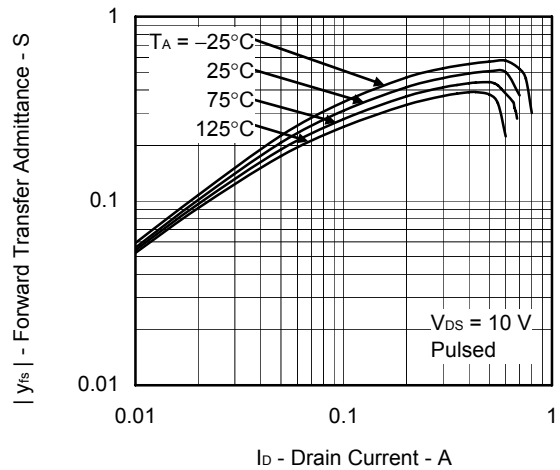
FORWARD TRANSFER CHARACTERISTICS



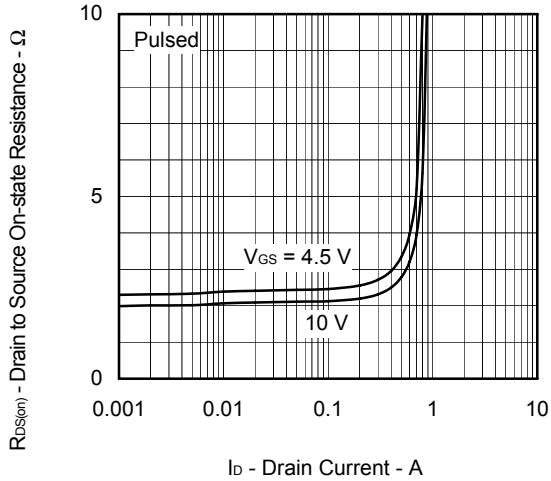
GATE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



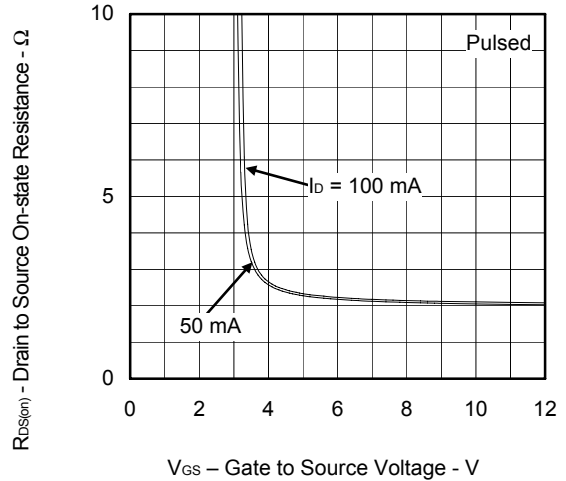
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



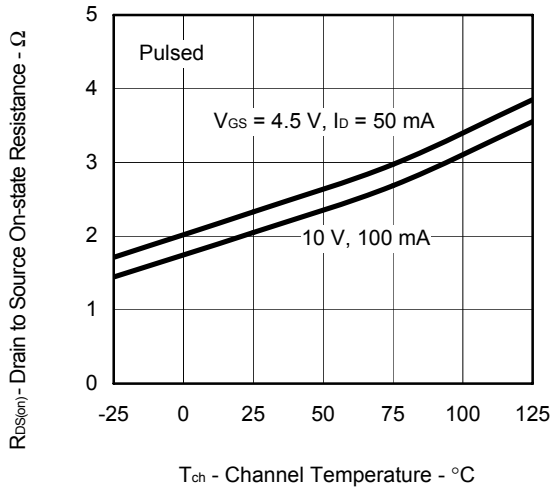
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



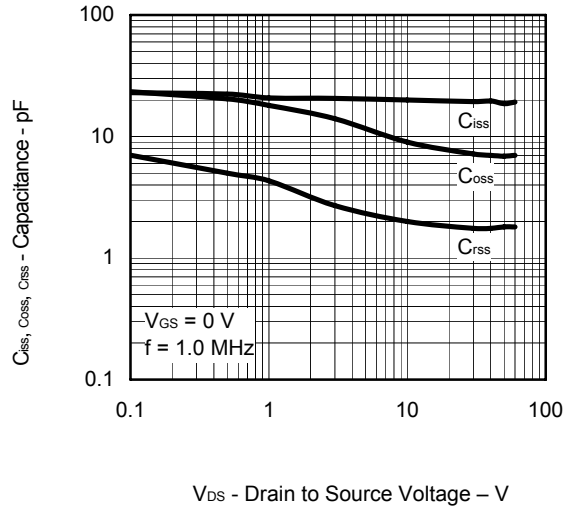
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



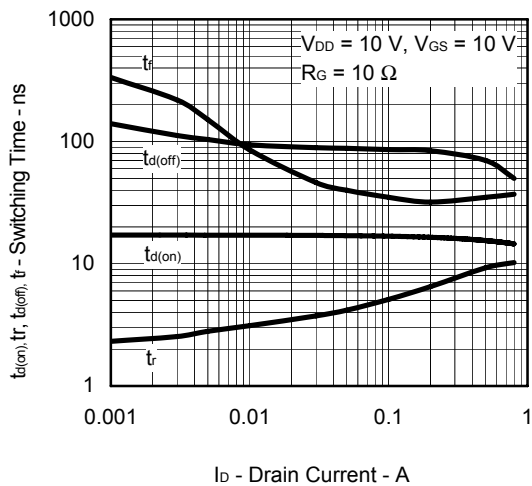
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



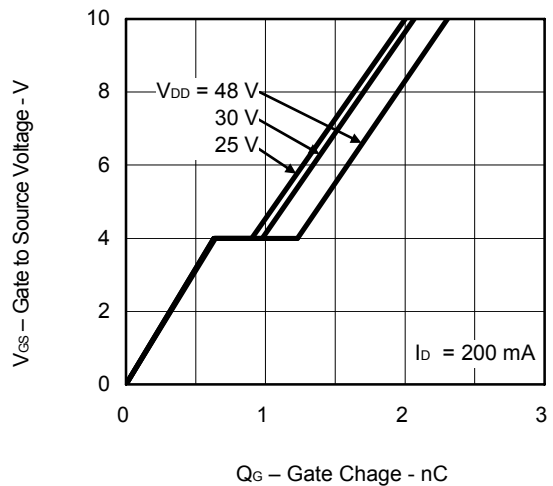
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



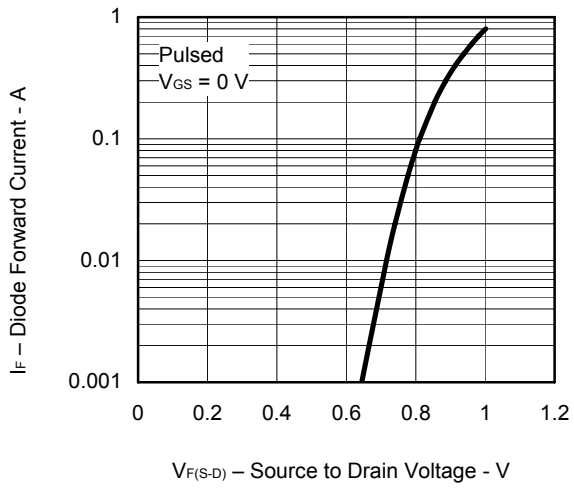
SWITCHING CHARACTERISTICS



DYNAMIC INPUT CHARACTERISTICS

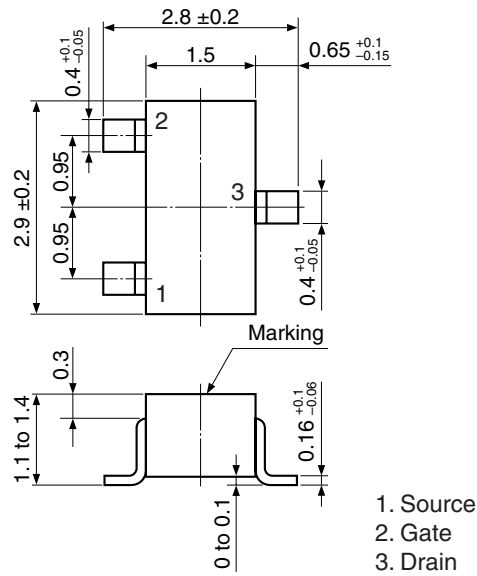


SOURCE TO DRAIN DIODE FORWARD VOLTAGE

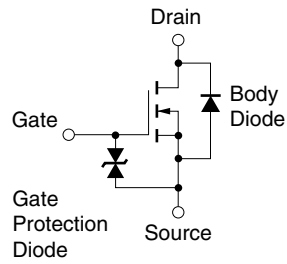


Package Drawings (Unit: mm)

SC-59 (Mini Mold)



Equivalent Circuit



**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.

|                         |                          |
|-------------------------|--------------------------|
| <b>Revision History</b> | <b>QN7002 Data Sheet</b> |
|-------------------------|--------------------------|

| <b>Rev.</b> | <b>Date</b>  | <b>Description</b> |                      |
|-------------|--------------|--------------------|----------------------|
|             |              | <b>Page</b>        | <b>Summary</b>       |
| 1.00        | Mar 11, 2011 | -                  | First Edition Issued |

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