

To our customers,

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## Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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# MOS FIELD EFFECT TRANSISTOR

# QN7002

## 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	PACKAGE
QN7002-T1B-AT	SC-59 (Mini Mold)
QN7002-T2B-AT	

**Remark** "-AT" indicates Pb-free.

This product dose not contain Pb external electrode and other parts.  
8 mm embossed carrier tape, 3,000 pcs/reel.

**Remark for Agent** ORDER NUMBER "2SK4079A(1)" must be used to order, instead of "QN7002".  
For instance, "2SK4079A(1)-T1B-AT".

**Marking: G28**

### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)

Drain to Source Voltage (V <sub>GS</sub> = 0 V)	V <sub>DSS</sub>	60	V
Gate to Source Voltage (V <sub>DS</sub> = 0 V)	V <sub>GSS</sub>	±20	V
Drain Current (DC)	I <sub>D(DC)</sub>	200	mA
Drain Current (pulse) <sup>Note</sup>	I <sub>D(pulse)</sub>	±800	mA
Total Power Dissipation	P <sub>T</sub>	200	mW
Channel Temperature	T <sub>ch</sub>	150	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C

**Note** PW ≤ 10 μs, Duty Cycle ≤ 1%

**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.

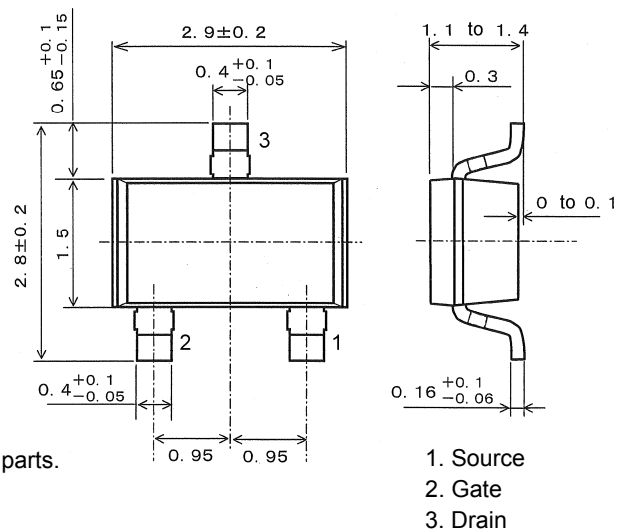
**Caution** This product is electrostatic-sensitive device due to low ESD capability and should be handled with caution for electrostatic discharge.

V<sub>ESD</sub> ±400 V (MIL STD; C = 100 pF, R = 1.5 kΩ, 5 times), as reference value.

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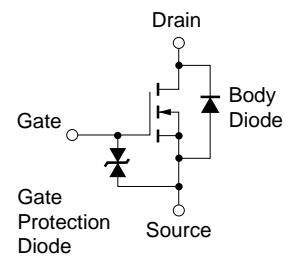
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### PACKAGE DRAWING (Unit: mm)



1. Source
2. Gate
3. Drain

### EQUIVALENT CIRCUIT

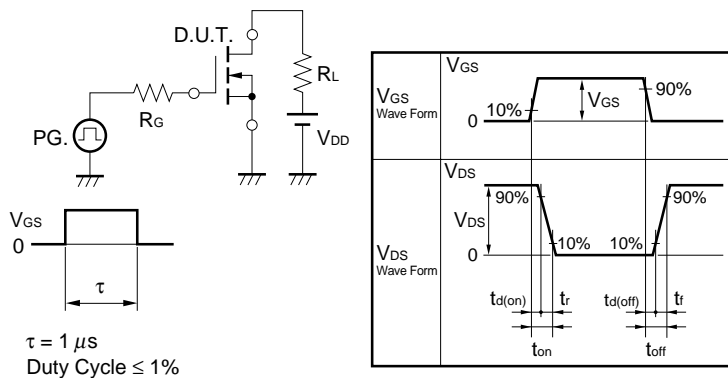


**ELECTRICAL CHARACTERISTICS (TA = 25°C)**

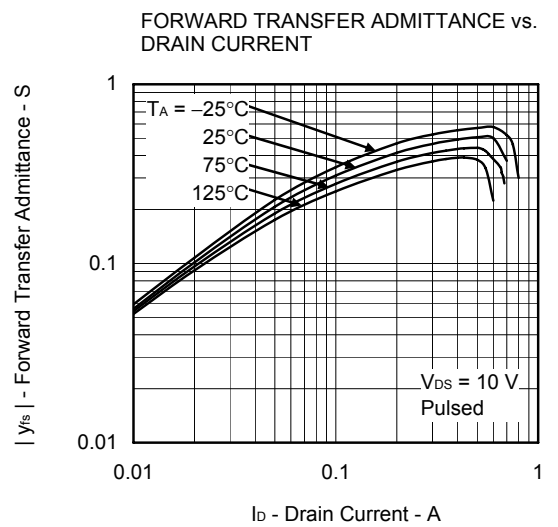
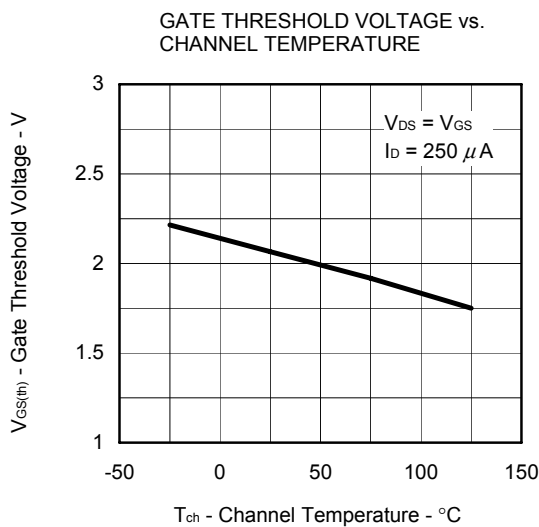
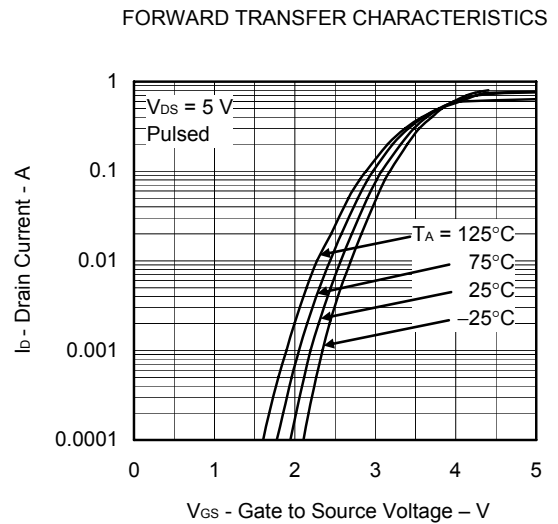
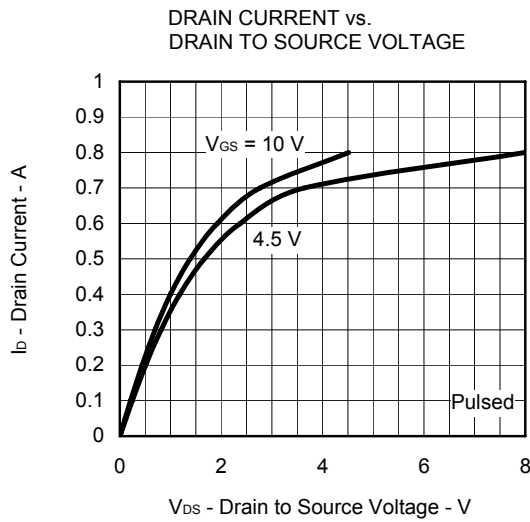
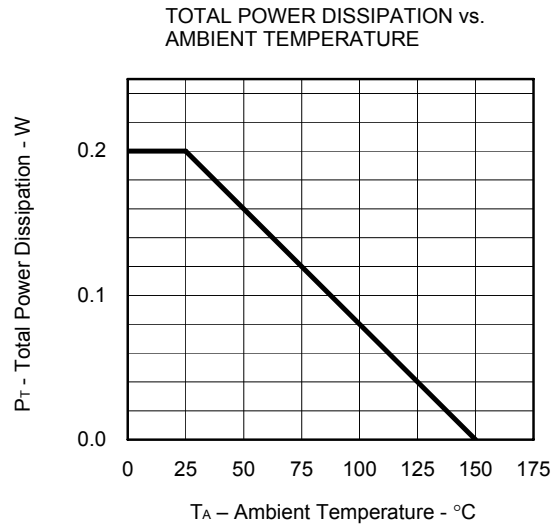
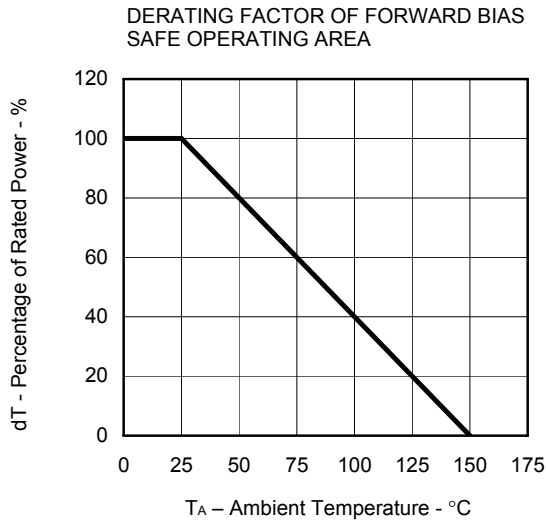
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V			1	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V			±10	μA
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <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

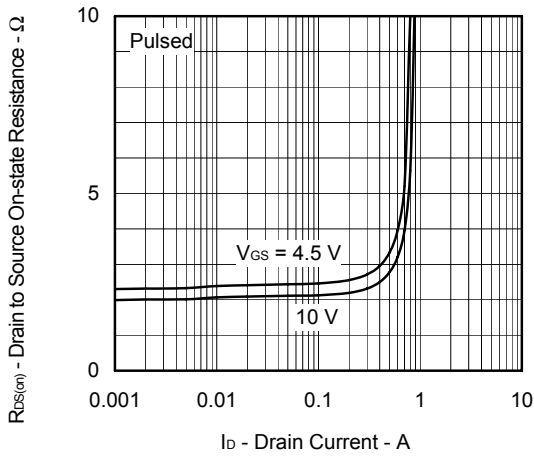
**TEST CIRCUIT SWITCHING TIME**



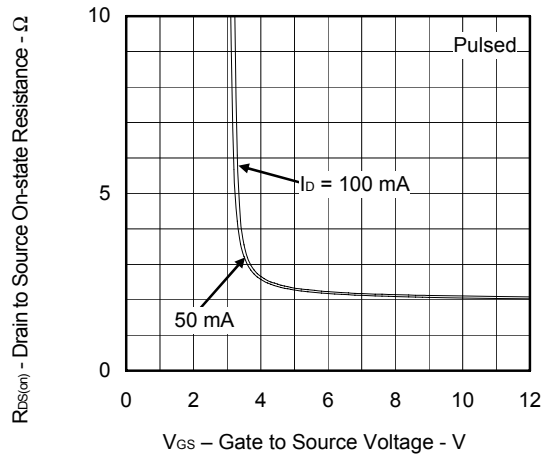
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



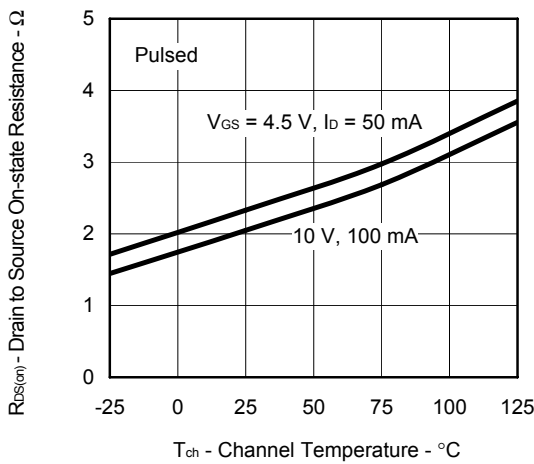
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



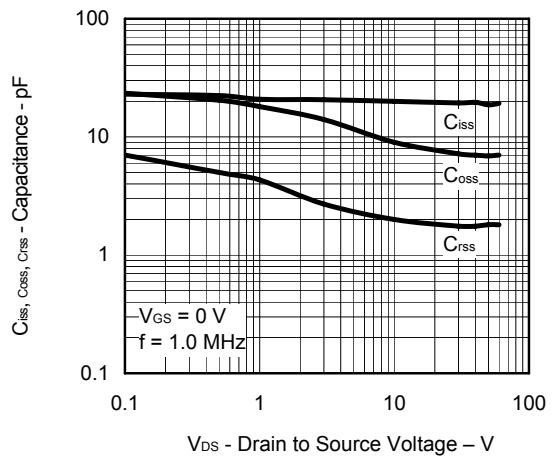
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



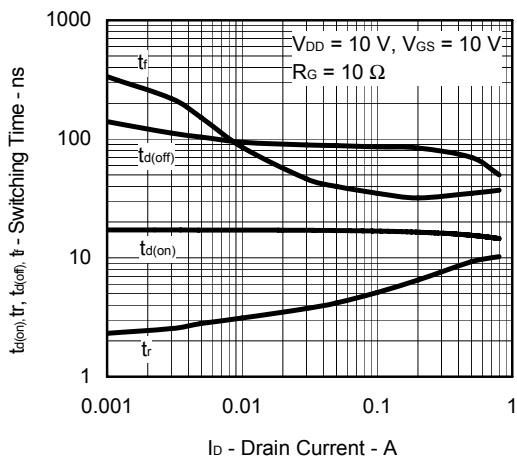
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



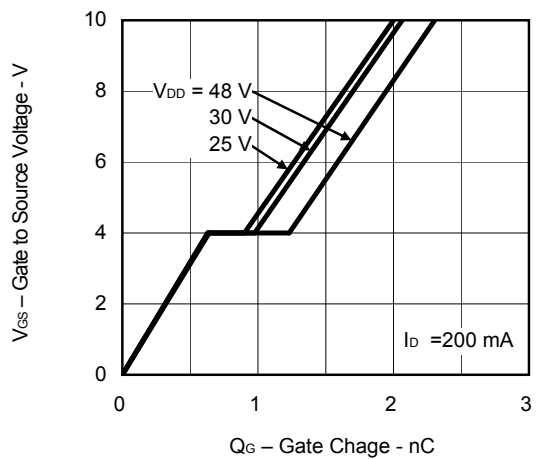
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



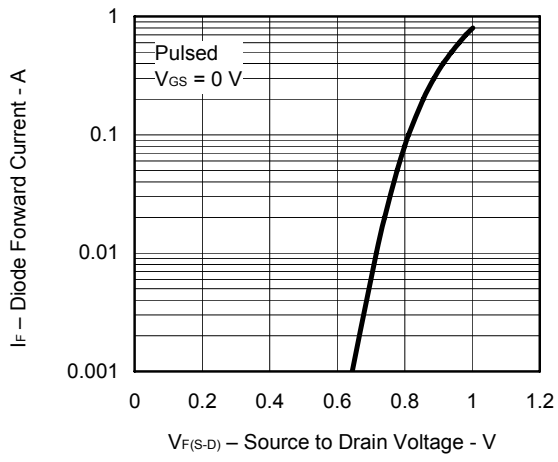
SWITCHING CHARACTERISTICS



DYNAMIC INPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



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