

To our customers,

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## Old Company Name in Catalogs and Other Documents

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

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Not recommended  
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## SWITCHING

### N-CHANNEL POWER MOS FET

#### DESCRIPTION

The 2SK4075B is N-channel MOS FET designed for high current switching applications.

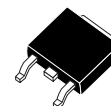
#### ORDERING INFORMATION

| PART NUMBER       | LEAD PLATING  | PACKING     | PACKAGE         |
|-------------------|---------------|-------------|-----------------|
| 2SK4075B-ZK-E1-AY | Pure Sn (Tin) | Tape        | TO-252 (MP-3ZK) |
| 2SK4075B-ZK-E2-AY |               | 2500 p/reel | typ. 0.27 g     |

#### FEATURES

- Low on-state resistance  
 $R_{DS(on)1} = 7.9 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 25 \text{ A)}$   
 $R_{DS(on)2} = 10 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_D = 13 \text{ A)}$
- Low  $C_{iss}$ :  $C_{iss} = 2230 \text{ pF TYP.}$
- Logic level drive type

(TO-252)



#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

|  |                |             |                  |
|--|----------------|-------------|------------------|
| Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )   | $V_{DSS}$      | 40          | V                |
| Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )    | $V_{GSS}$      | $\pm 20$    | V                |
| Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )      | $I_{D(DC)}$    | $\pm 50$    | A                |
| Drain Current (pulse) <sup>Note1</sup>               | $I_{D(pulse)}$ | $\pm 120$   | A                |
| Total Power Dissipation ( $T_C = 25^\circ\text{C}$ ) | $P_{T1}$       | 36          | W                |
| Total Power Dissipation ( $T_A = 25^\circ\text{C}$ ) | $P_{T2}$       | 1.0         | W                |
| Channel Temperature                                  | $T_{ch}$       | 150         | $^\circ\text{C}$ |
| Storage Temperature                                  | $T_{stg}$      | -55 to +150 | $^\circ\text{C}$ |
| Single Avalanche Current <sup>Note2</sup>            | $I_{AS}$       | 20.8        | A                |
| Single Avalanche Energy <sup>Note2</sup>             | $E_{AS}$       | 43          | mJ               |

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

2. Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = 20 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$ ,  $L = 100 \mu\text{H}$

#### THERMAL RESISTANCE

|                                       |                |      |                    |
|---------------------------------------|----------------|------|--------------------|
| Channel to Case Thermal Resistance    | $R_{th(ch-C)}$ | 3.47 | $^\circ\text{C/W}$ |
| Channel to Ambient Thermal Resistance | $R_{th(ch-A)}$ | 125  | $^\circ\text{C/W}$ |

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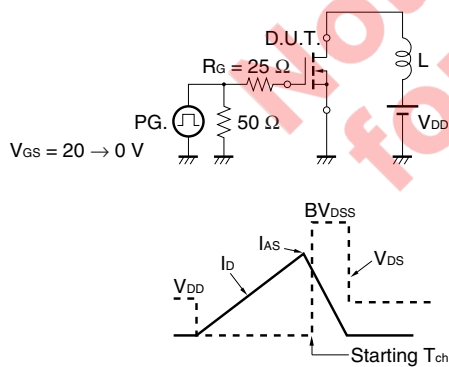
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**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

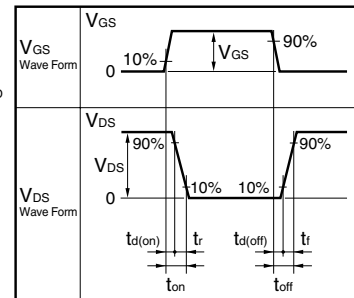
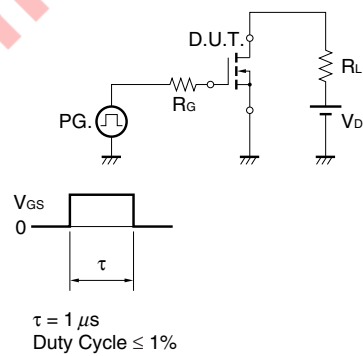
| CHARACTERISTICS                                     | SYMBOL               | TEST CONDITIONS                                | MIN. | TYP. | MAX. | UNIT |
|---|----------------------|--|------|------|------|------|
| Zero Gate Voltage Drain Current                     | I <sub>DSS</sub>     | V <sub>DS</sub> = 40 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 |      |      | ±100 | nA   |
| Gate Cut-off Voltage                                | V <sub>GS(off)</sub> | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA  | 1.5  | 2.0  | 2.5  | V    |
| Forward Transfer Admittance <sup>Note</sup>         | y <sub>fs</sub>      | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 13 A  | 7.0  |      |      | S    |
| 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> = 25 A  |      | 5.9  | 7.9  | mΩ   |
|   | R <sub>DS(on)2</sub> | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 13 A |      | 7.5  | 10   | mΩ   |
| Input Capacitance                                   | C <sub>iss</sub>     | V <sub>DS</sub> = 10 V                         |      | 2230 |      | pF   |
| Output Capacitance                                  | C <sub>oss</sub>     | V <sub>GS</sub> = 0 V                          |      | 319  |      | pF   |
| Reverse Transfer Capacitance                        | C <sub>rss</sub>     | f = 1 MHz                                      |      | 171  |      | pF   |
| Turn-on Delay Time                                  | t <sub>d(on)</sub>   | V <sub>DD</sub> = 20 V                         |      | 15   |      | ns   |
| Rise Time   | t <sub>r</sub>       | I <sub>D</sub> = 25 A                          |      | 17   |      | ns   |
| Turn-off Delay Time                                 | t <sub>d(off)</sub>  | V <sub>GS</sub> = 10 V                         |      | 51   |      | ns   |
| Fall Time   | t <sub>f</sub>       | R <sub>G</sub> = 0 Ω                           |      | 5    |      | ns   |
| Total Gate Charge                                   | Q <sub>G</sub>       | V <sub>DD</sub> = 32 V                         |      | 44   |      | nC   |
| Gate to Source Charge                               | Q <sub>GS</sub>      | V <sub>GS</sub> = 10 V                         |      | 8    |      | nC   |
| Gate to Drain Charge                                | Q <sub>GD</sub>      | I <sub>D</sub> = 50 A                          |      | 12   |      | nC   |
| Body Diode Forward Voltage <sup>Note</sup>          | V <sub>F(S-D)</sub>  | I <sub>F</sub> = 50 A, V <sub>GS</sub> = 0 V   |      | 0.9  | 1.5  | V    |
| Reverse Recovery Time                               | t <sub>rr</sub>      | I <sub>F</sub> = 50 A, V <sub>GS</sub> = 0 V   |      | 30   |      | ns   |
| Reverse Recovery Charge                             | Q <sub>rr</sub>      | di/dt = 100 A/μs                               |      | 25   |      | nC   |

**Note** Pulsed

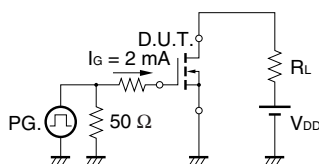
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



**TEST CIRCUIT 2 SWITCHING TIME**

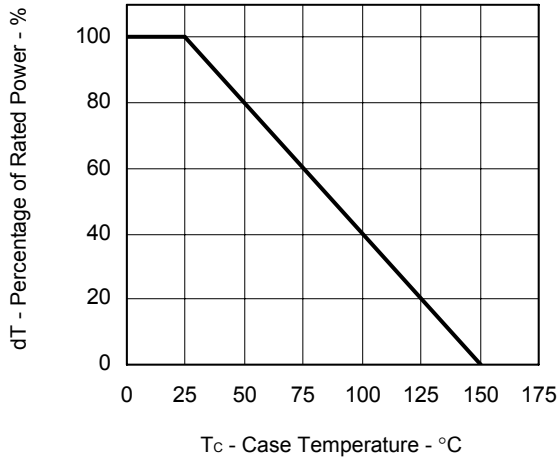


**TEST CIRCUIT 3 GATE CHARGE**

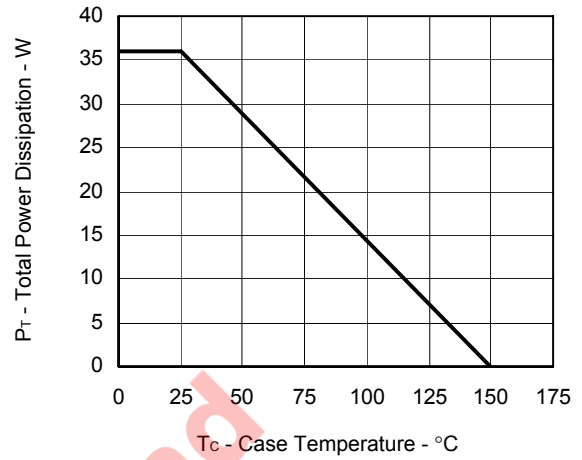


TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

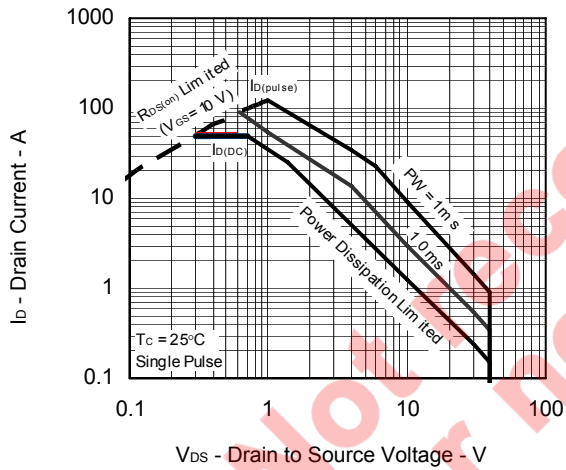
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



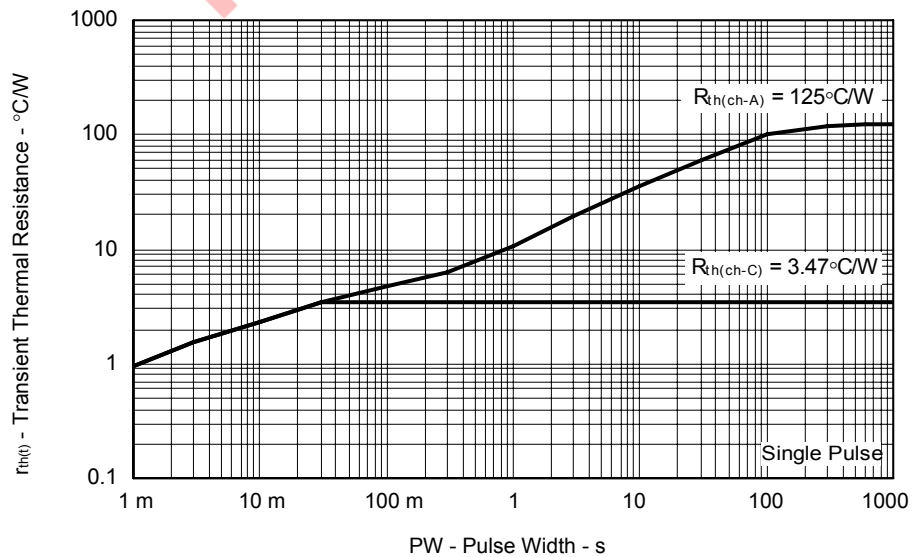
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



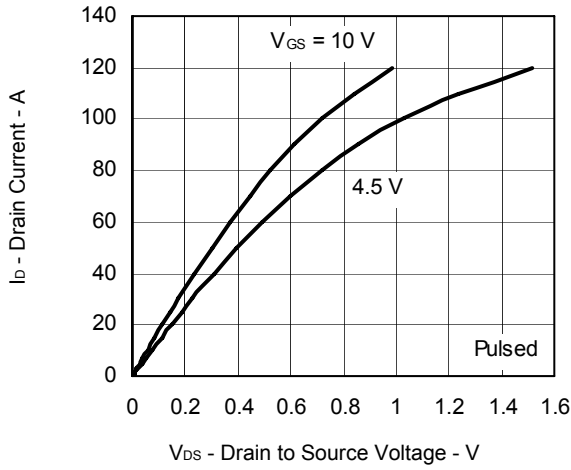
FORWARD BIAS SAFE OPERATING AREA



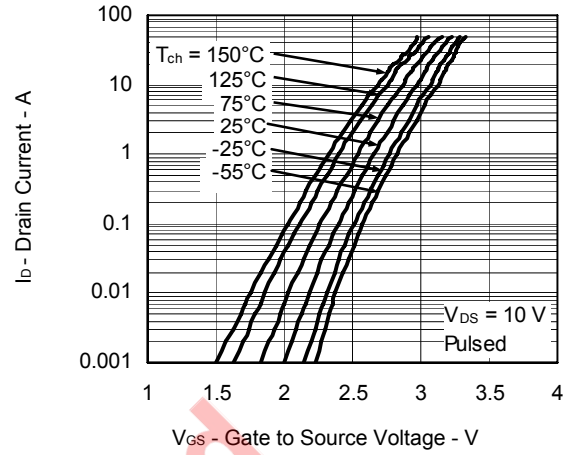
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



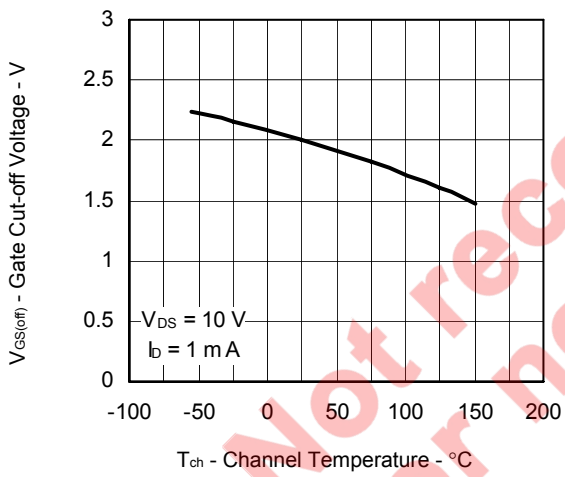
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



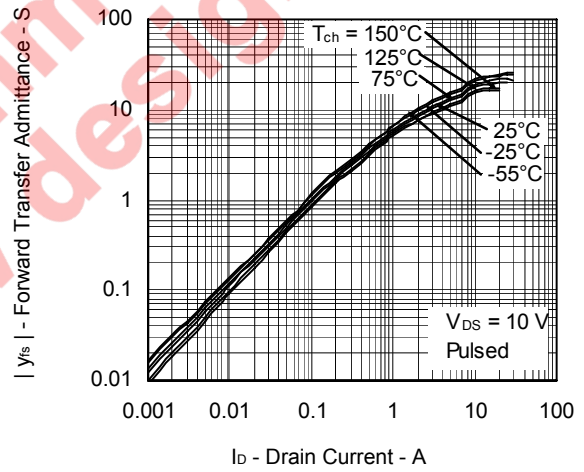
FORWARD TRANSFER CHARACTERISTICS



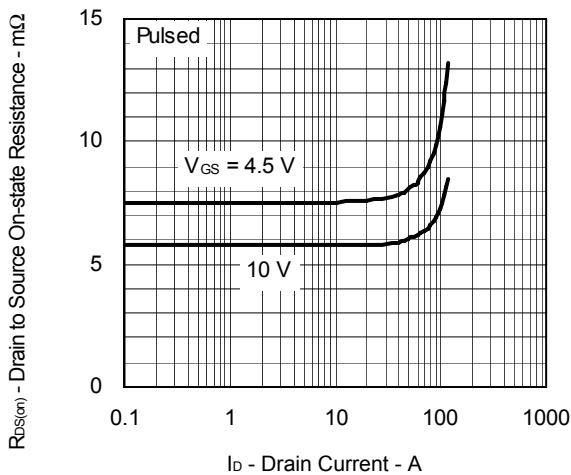
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



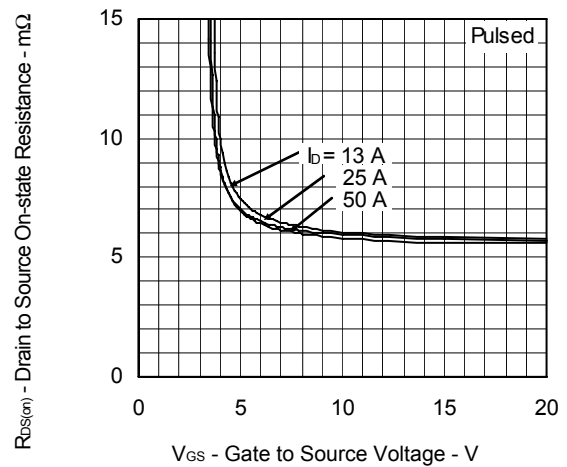
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT

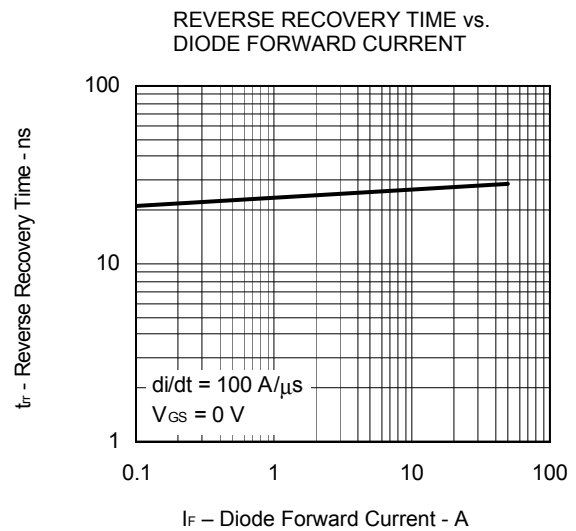
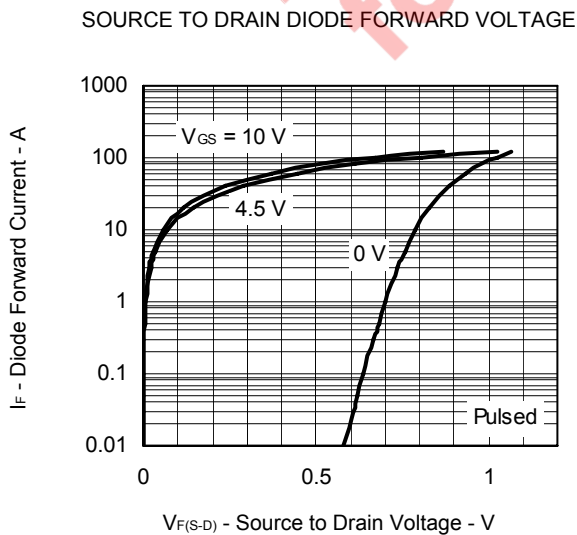
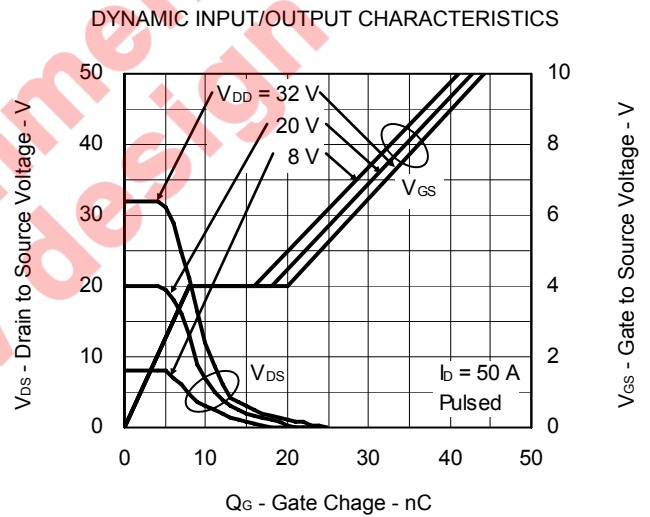
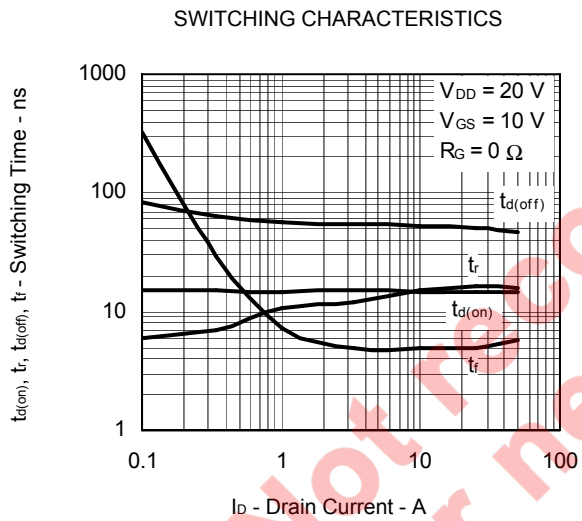
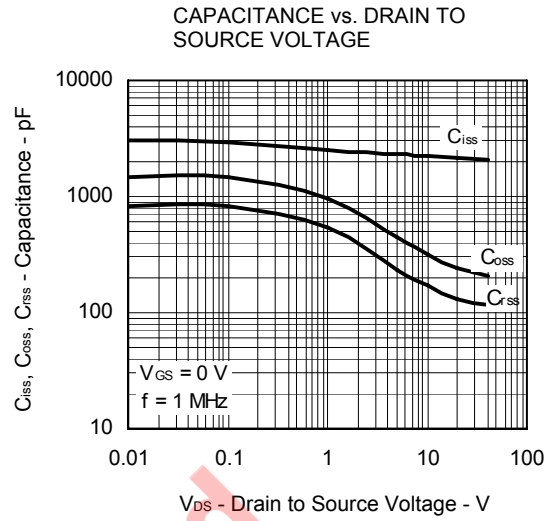
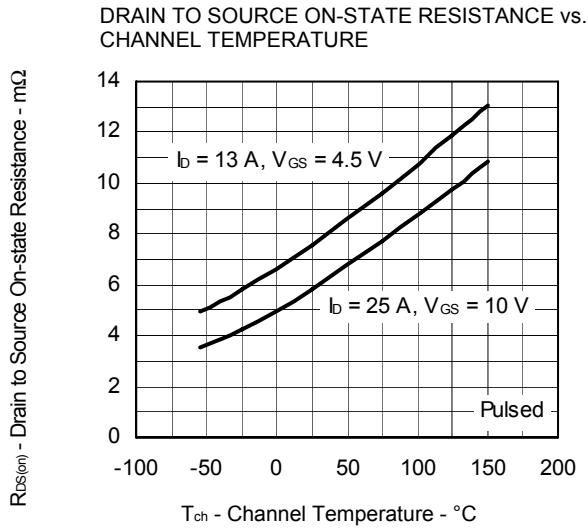


DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



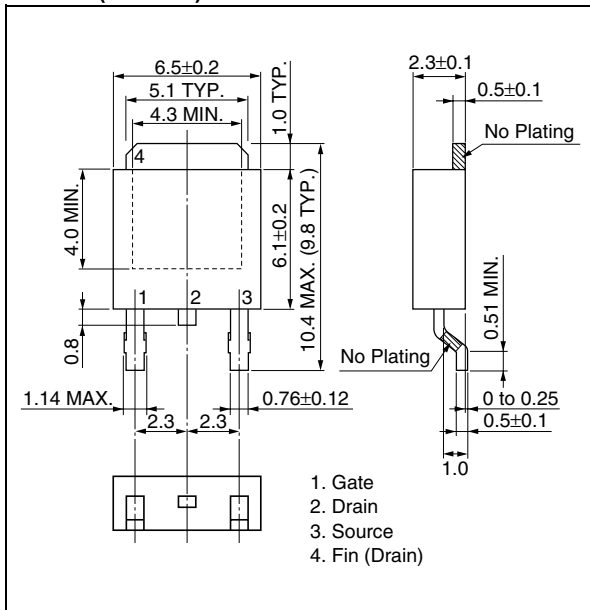
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



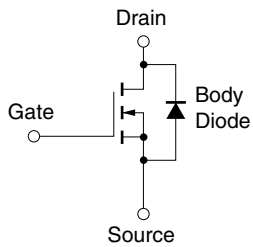


PACKAGE DRAWING (Unit: mm)

TO-252 (MP-3ZK)



EQUIVALENT CIRCUIT

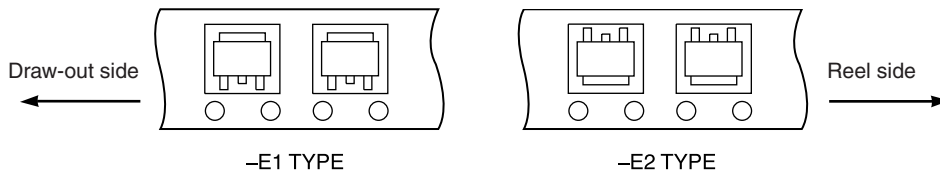


**Remark** The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

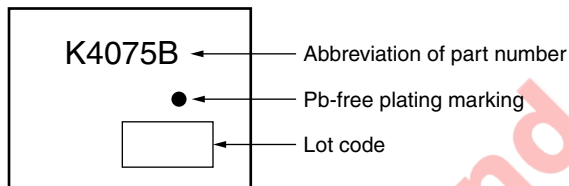


**TAPE INFORMATION**

There are two types (-E1, -E2) of taping depending on the direction of the device.



**MARKING INFORMATION**



**RECOMMENDED SOLDERING CONDITIONS**

The 2SK4075B should be soldered and mounted under the following recommended conditions.

For soldering methods and conditions other than those recommended below, please contact an NEC Electronics sales representative.

For technical information, see the following website.

Semiconductor Device Mount Manual (<http://www.necel.com/pkg/en/mount/index.html>)

| Soldering Method | Soldering Conditions   | Recommended Condition Symbol |
|------------------|--|------------------------------|
| Infrared reflow  | Maximum temperature (Package's surface temperature): 260°C or below<br>Time at maximum temperature: 10 seconds or less<br>Time of temperature higher than 220°C: 60 seconds or less<br>Preheating time at 160 to 180°C: 60 to 120 seconds<br>Maximum number of reflow processes: 3 times<br>Maximum chlorine content of rosin flux (percentage mass): 0.2% or less | IR60-00-3                    |
| Partial heating  | Maximum temperature (Pin temperature): 350°C or below<br>Time (per side of the device): 3 seconds or less<br>Maximum chlorine content of rosin flux: 0.2% (wt.) or less  | P350                         |

**Caution Do not use different soldering methods together (except for partial heating).**

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