# DATA SHEET

NEC

# MOS FIELD EFFECT TRANSISTOR
# 2SK3053

## SWITCHING
## N-CHANNEL POWER MOS FET
## INDUSTRIAL USE

### DESCRIPTION

The 2SK3053 is N-Channel MOS Field Effect Transistor designed for high current switching applications in consumer instruments.

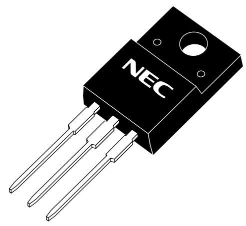
### ORDERING INFORMATION

| PART NUMBER | PACKAGE |
|---|---|
| 2SK3053 | Isolated TO-220 |

### FEATURES

- Low On-State Resistance
  $R_{DS(on)1}$ = 45 mΩ MAX. ($V_{GS}$ = 10 V, $I_D$ = 13 A)
  $R_{DS(on)2}$ = 70 mΩ MAX. ($V_{GS}$ = 4.0 V, $I_D$ = 13 A)
- Low $C_{iss}$ : $C_{iss}$ = 790 pF TYP.
- Built-in Gate Protection Diode
- Isolated TO-220 package

(Isolated TO-220)




### ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25 °C)

| | | | |
|---|---|---|---|
| Drain to Source Voltage | $V_{DSS}$ | 60 | V |
| Gate to Source Voltage | $V_{GSS(AC)}$ | ±20 | V |
| Gate to Source Voltage | $V_{GSS(DC)}$ | +20, –10 | V |
| Drain Current (DC) | $I_{D(DC)}$ | ±25 | A |
| Drain Current (Pulse) Note1 | $I_{D(pulse)}$ | ±75 | A |
| Total Power Dissipation ($T_C$ = 25°C) | $P_T$ | 30 | W |
| Total Power Dissipation ($T_A$ = 25°C) | $P_T$ | 2.0 | W |
| Channel Temperature | $T_{ch}$ | 150 | °C |
| Storage Temperature | $T_{stg}$ | –55 to +150 | °C |
| Single Avalanche Current Note2 | $I_{AS}$ | 12.5 | A |
| Single Avalanche Energy Note2 | $E_{AS}$ | 15.6 | mJ |

**Notes 1.** PW ≤ 10 $\mu$s, Duty cycle ≤ 1 %

★ **2.** Starting $T_{ch}$ = 25 °C, $V_{DD}$ = 30 V, $R_G$ = 25 Ω, $V_{GS}$ = 20 V → 0 V

**The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.**
**Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.**

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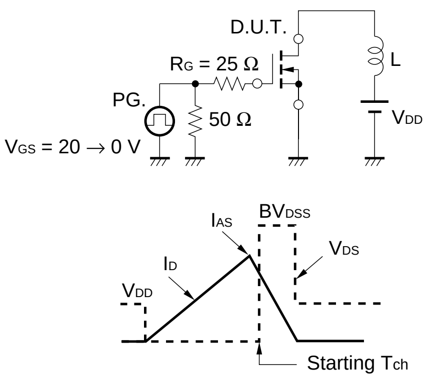
**The mark ★ shows major revised points.**

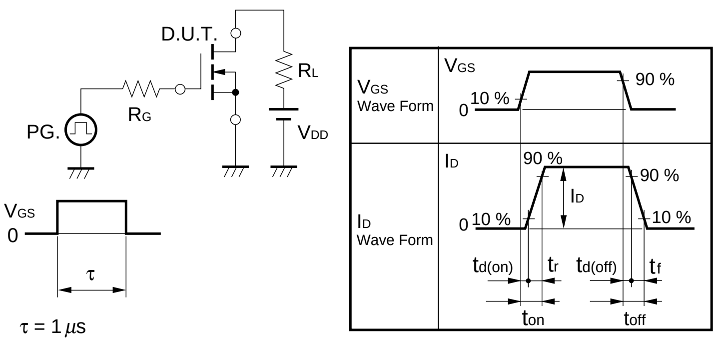
## ELECTRICAL CHARACTERISTICS ($T_A$ = 25 °C)

| CHARACTERISTICS | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Drain to Source On-state Resistance | $R_{DS(on)1}$ | $V_{GS}$ = 10 V, $I_D$ = 13 A | | 28 | 45 | mΩ |
| | $R_{DS(on)2}$ | $V_{GS}$ = 4.0 V, $I_D$ = 13 A | | 46 | 70 | mΩ |
| Gate to Source Cut-off Voltage | $V_{GS(off)}$ | $V_{DS}$ = 10 V, $I_D$ = 1 mA | 1.0 | 1.6 | 2.0 | V |
| Forward Transfer Admittance | $\| y_{fs} \|$ | $V_{DS}$ = 10 V, $I_D$ = 13 A | 8.0 | 16 | | S |
| Drain Leakage Current | $I_{DSS}$ | $V_{DS}$ = 60 V, $V_{GS}$ = 0 V | | | 10 | μA |
| Gate to Source Leakage Current | $I_{GSS}$ | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | | | ±10 | μA |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = 10 V | | 790 | | pF |
| Output Capacitance | $C_{oss}$ | $V_{GS}$ = 0 V | | 240 | | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | f = 1 MHz | | 100 | | pF |
| Turn-on Delay Time | $t_{d(on)}$ | $I_D$ = 13 A | | 20 | | ns |
| ★ Rise Time | $t_r$ | $V_{GS}$ = 10 V | | 200 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | $V_{DD}$ = 30 V | | 65 | | ns |
| Fall Time | $t_f$ | $R_G$ = 10 Ω | | 95 | | ns |
| Total Gate Charge | $Q_G$ | $I_D$ = 25 A | | 20 | | nC |
| Gate to Source Charge | $Q_{GS}$ | $V_{DD}$ = 48 V | | 3.0 | | nC |
| ★ Gate to Drain Charge | $Q_{GD}$ | $V_{GS}$ = 10 V | | 6.5 | | nC |
| Body Diode Forward Voltage | $V_{F(S-D)}$ | $I_F$ = 25 A, $V_{GS}$ = 0 V | | 1.0 | | V |
| Reverse Recovery Time | $t_{rr}$ | $I_F$ = 25 A, $V_{GS}$ = 0 V | | 40 | | ns |
| Reverse Recovery Charge | $Q_{rr}$ | di/dt = 100 A/μs | | 45 | | nC |

### TEST CIRCUIT 1 AVALANCHE CAPABILITY

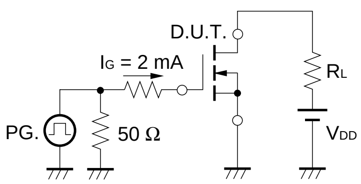



### ★ TEST CIRCUIT 2 SWITCHING TIME



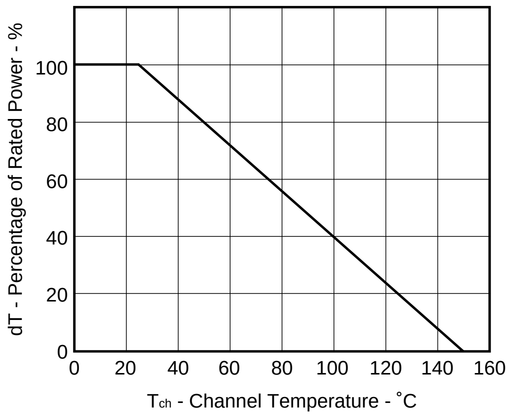

τ = 1 μs
Duty Cycle ≤ 1 %

### TEST CIRCUIT 3 GATE CHARGE

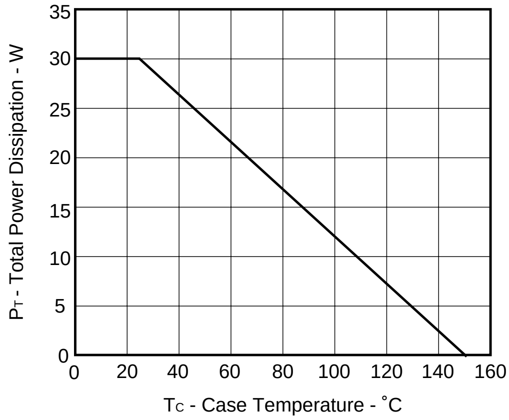


## TYPICAL CHARACTERISTICS ($T_A$ = 25 °C )

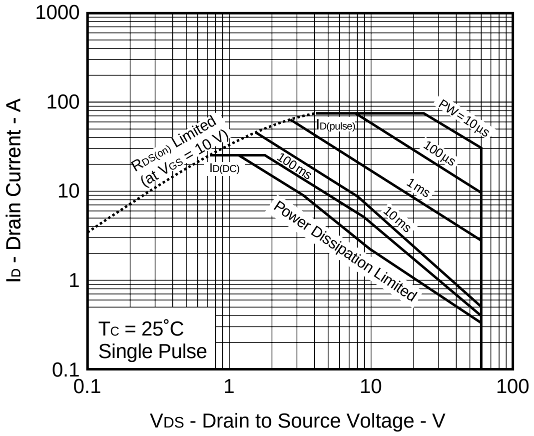
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



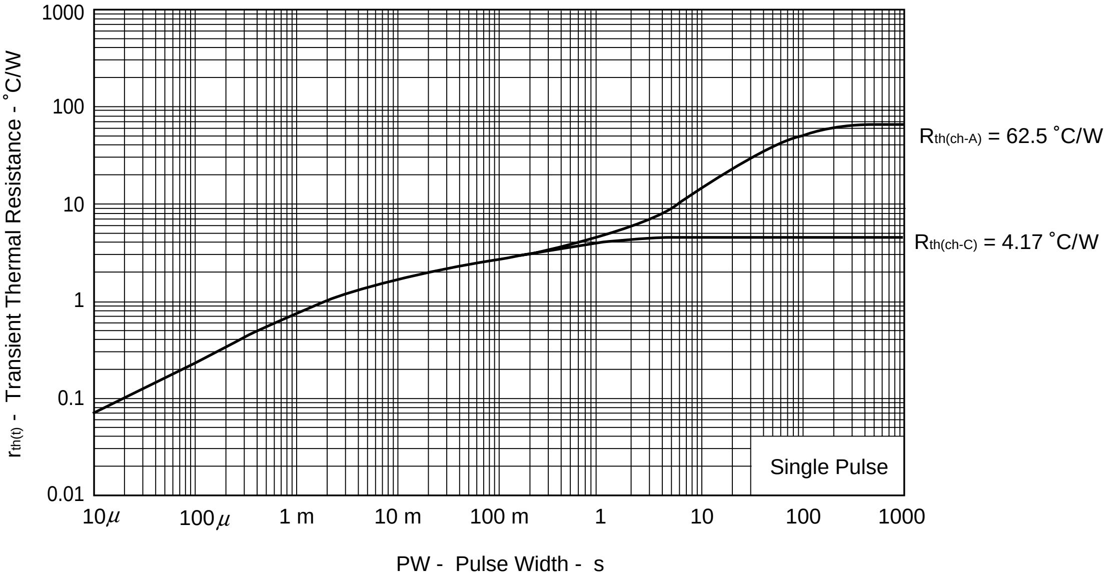

TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



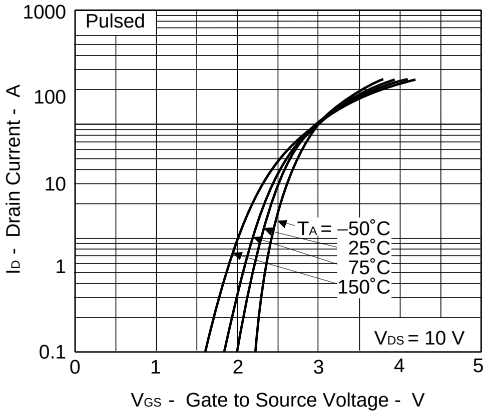

★ FORWARD BIAS SAFE OPERATING AREA



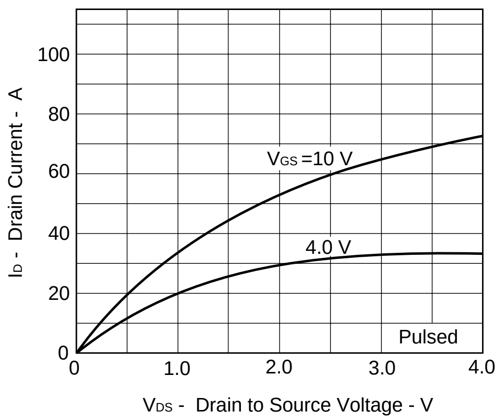

TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



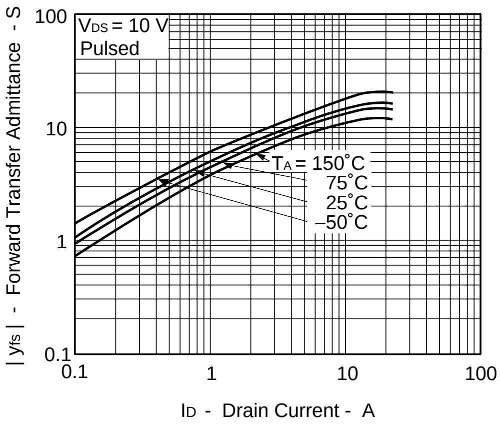
FORWARD TRANSFER CHARACTERISTICS



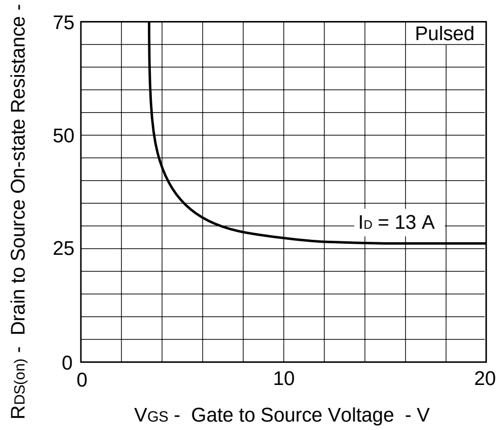

DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



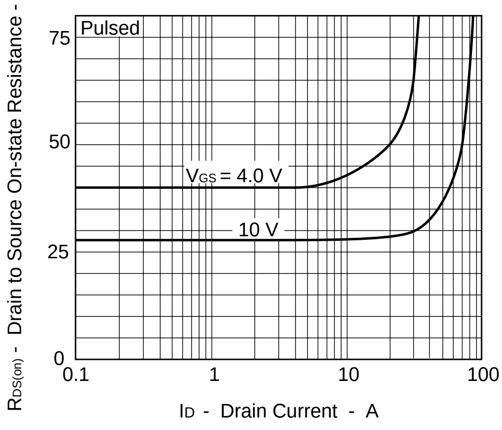

FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



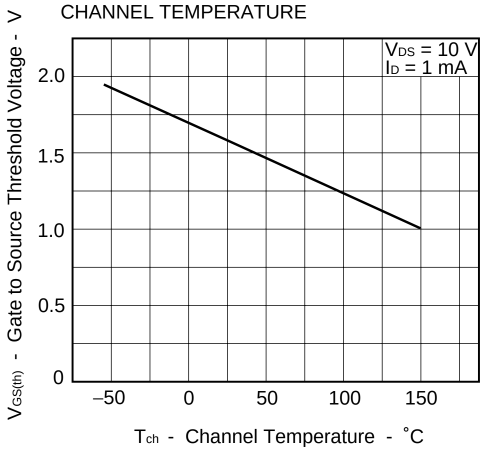

DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



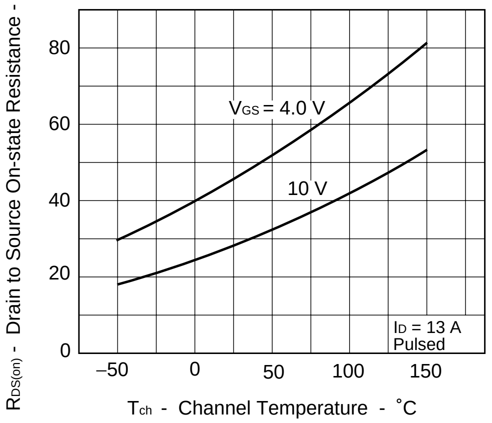

DRAIN TO SOURCE ON-STATE
RESISTANCE vs. DRAIN CURRENT



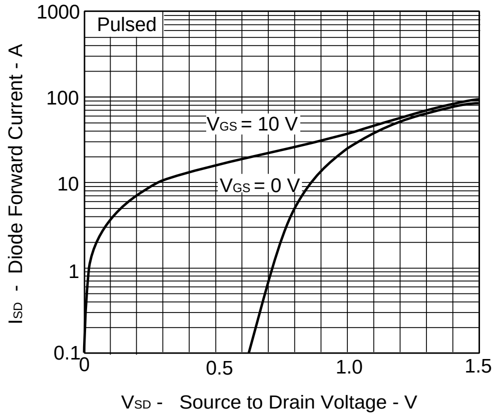

GATE TO SOURCE THRESHOLD VOLTAGE vs.
CHANNEL TEMPERATURE



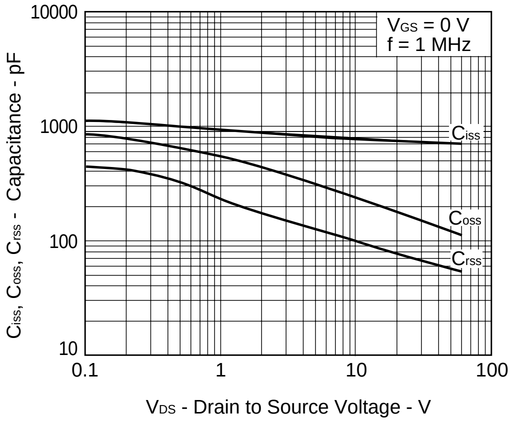
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



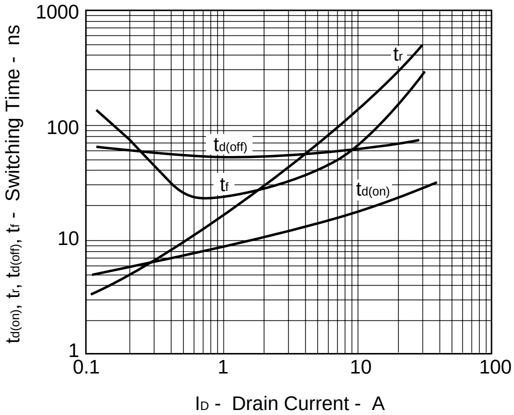

SOURCE TO DRAIN DIODE FORWARD VOLTAGE



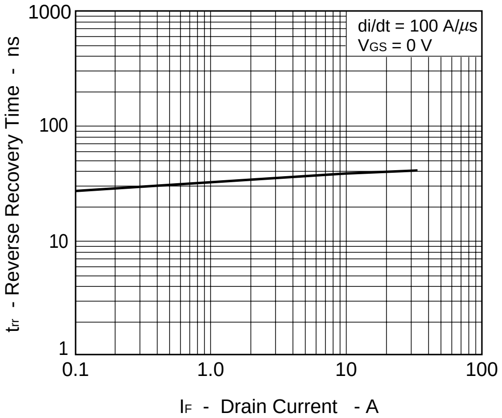

CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



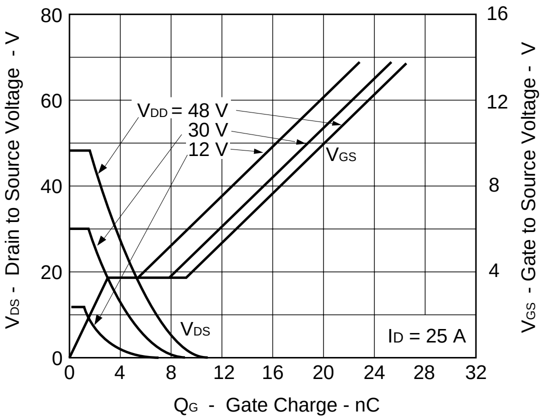

SWITCHING CHARACTERISTICS




REVERSE RECOVERY TIME vs. DRAIN CURRENT

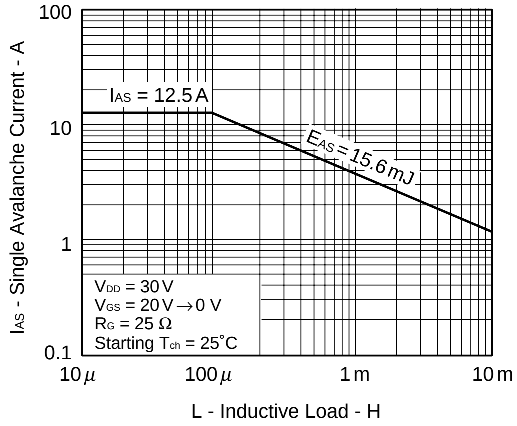



DYNAMIC INPUT/OUTPUT CHARACTERISTICS

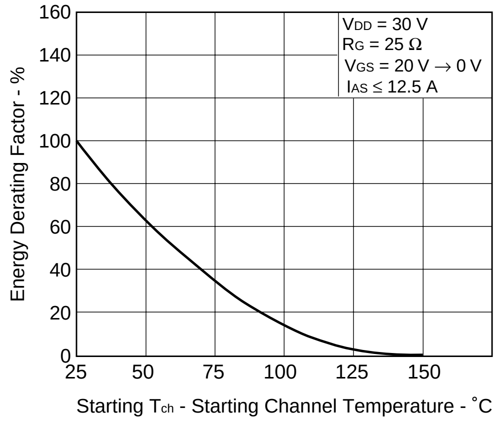


★

SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD

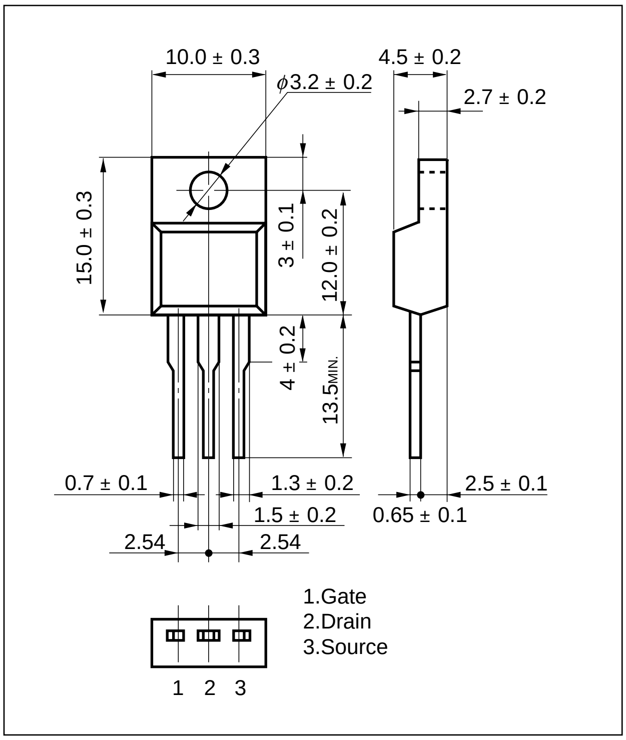



SINGLE AVALANCHE ENERGY DERATING FACTOR

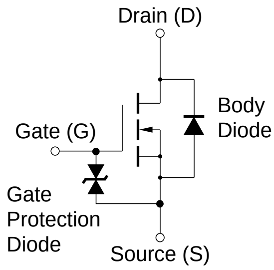


## PACKAGE DRAWING

Isolated TO-220 (MP-45F)




## EQUIVALENT CIRCUIT




**Remark 1.** This product is designed for consumer application and isn't suitable for automotive application.

**2.** 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.