

## N-Channel Enhancement Mode Power MOSFET

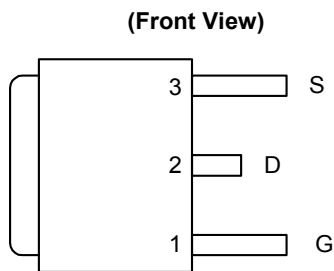
### ■ Features

- Low Gate Charge
- Simple Drive Requirement
- Fast Switching
- RoHS Compliant
- Pb Free Plating Product

### ■ Product Summary

| $BV_{DSS}$ (V) | $R_{DS(ON)}$ (m $\Omega$ ) | $I_D$ (A) |
|----------------|----------------------------|-----------|
| 30             | 9                          | 60        |

### ■ Pin Assignments



### ■ General Description

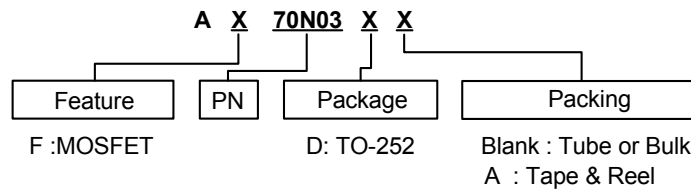
The advanced power MOSFET provides the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The TO-252 package is universally preferred for all commercial-industrial surface mount applications and suited for low voltage applications such as DC/DC converters.

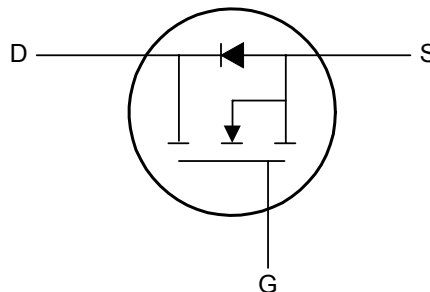
### ■ Pin Descriptions

| Pin Name | Description |
|----------|-------------|
| S        | Source      |
| G        | Gate        |
| D        | Drain       |

### ■ Ordering information



### ■ Block Diagram





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■ Absolute Maximum Ratings

| Symbol    | Parameter                              | Rating            | Units      |
|-----------|--|-------------------|------------|
| $V_{DS}$  | Drain-Source Voltage                   | 30                | V          |
| $V_{GS}$  | Gate-Source Voltage                    | $\pm 20$          | V          |
| $I_D$     | Continuous Drain Current, $V_{GS}=10V$ | $T_A=25^\circ C$  | 60         |
|           |  | $T_A=100^\circ C$ | 43         |
| $I_{DM}$  | Pulsed Drain Current (Note 1)          | 195               | A          |
| $P_D$     | Total Power Dissipation                | $T_A=25^\circ C$  | 53         |
|           | Linear Derating Factor                 |                   | 0.36       |
| $T_{STG}$ | Storage Temperature Range              | -55 to 175        | $^\circ C$ |
| $T_J$     | Operating Junction Temperature Range   | -55 to 175        | $^\circ C$ |

■ Thermal Data

| Symbol          | Parameter                            | Maximum | Units |
|-----------------|--------------------------------------|---------|-------|
| $R_{\theta JC}$ | Thermal Resistance Junction-Case     | Max.    | 2.8   |
| $R_{\theta JA}$ | Thermal Resistance Junction- Ambient | Max.    | 110   |

■ Electrical Characteristics ( $T_J=25^\circ C$  unless otherwise noted)

| Symbol                       | Parameter   | Test Conditions  | Limits |       |           | Unit         |
|------------------------------|---|--|--------|-------|-----------|--------------|
|                              |   |  | Min.   | Typ.  | Max.      |              |
| $BV_{DSS}$                   | Drain-Source Breakdown Voltage                    | $V_{GS}=0V, I_D=250\mu A$  | 30     | -     | -         | V            |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temperature Coefficient         | Reference to $25^\circ C, I_D=1mA$                               | -      | 0.032 | -         | $V/^\circ C$ |
| $R_{DS(ON)}$                 | Static Drain-Source On-Resistance                 | $V_{GS}=10V, I_D=33A$  | -      | -     | 9         | m $\Omega$   |
|                              |   | $V_{GS}=4.5V, I_D=20A$   | -      | -     | 18        |              |
| $V_{GS(th)}$                 | Gate Threshold Voltage                            | $V_{DS}=V_{GS}, I_D=250\mu A$                                    | 1      | -     | 3         | V            |
| $g_{fs}$                     | Forward Transconductance                          | $V_{DS}=10V, I_D=33A$  | -      | 35    | -         | S            |
| $I_{DSS}$                    | Drain-Source Leakage Current( $T_J=25^\circ C$ )  | $V_{DS}=30V, V_{GS}=0V$  | -      | -     | 1         | $\mu A$      |
|                              | Drain-Source Leakage Current( $T_J=175^\circ C$ ) | $V_{DS}=24V, V_{GS}=0V$  | -      | -     | 250       |              |
| $I_{GSS}$                    | Gate Source Leakage                               | $V_{GS}=\pm 20V$   | -      | -     | $\pm 100$ | nA           |
| $Q_g$                        | Total Gate Charge (Note 2)                        | $I_D=33A$  | -      | 16.5  | -         | nC           |
| $Q_{gs}$                     | Gate-Source Charge                                | $V_{DS}=20V$   | -      | 5     | -         |              |
| $Q_{gd}$                     | Gate-Drain ("Miller") Charge                      | $V_{GS}=4.5V$  | -      | 10.3  | -         |              |
| $t_{d(on)}$                  | Turn-On Delay Time (Note 2)                       | $V_{DS}=15V, I_D=33A, R_G=3.3\Omega, V_{GS}=10V, R_D=0.45\Omega$ | -      | 8.2   | -         | nS           |
| $t_r$                        | Rise Time   |  | -      | 105   | -         |              |
| $t_{d(off)}$                 | Turn-Off Delay Time                               |  | -      | 21.4  | -         |              |
| $t_f$                        | Fall-Time   |  | -      | 8.5   | -         |              |
| $C_{iss}$                    | Input Capacitance                                 | $V_{GS}=0V$  | -      | 1485  | -         | pF           |
| $C_{oss}$                    | Output Capacitance                                | $V_{DS}=25V, f=1.0MHz$   | -      | 245   | -         |              |
| $C_{rss}$                    | Reverse Transfer Capacitance                      |  | -      | 170   | -         |              |

■ Source-Drain Diode

| Symbol   | Parameter                                   | Test Conditions                      | Min. | Typ. | Max. | Unit |
|----------|---|--------------------------------------|------|------|------|------|
| $I_S$    | Continuous Source Current (Body Diode)      | $V_D=V_G=0V, V_S=1.3V$               | -    | -    | 60   | A    |
| $I_{SM}$ | Pulsed Source Current (Body Diode) (Note 1) |                                      | -    | -    | 195  | A    |
| $V_{SD}$ | Forward On Voltage (Note 2)                 | $T_J=25^\circ C, I_S=60A, V_{GS}=0V$ | -    | -    | 1.3  | V    |

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Note 1: Pulse width limited by safe operating area.  
 Note 2: Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .

### Typical Performance Characteristics

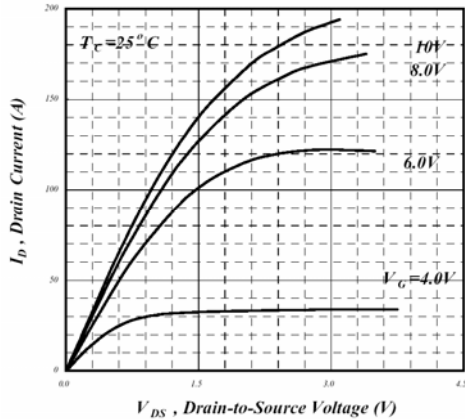


Fig 1. Typical Output Characteristics

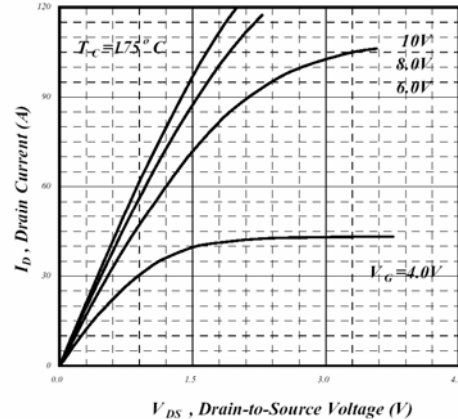


Fig 2. Typical Output Characteristics

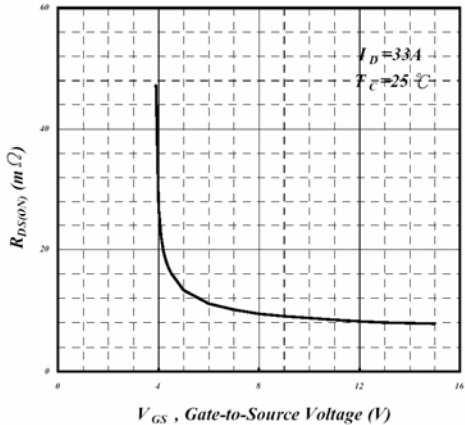


Fig 3. On-Resistance v.s. Gate Voltage

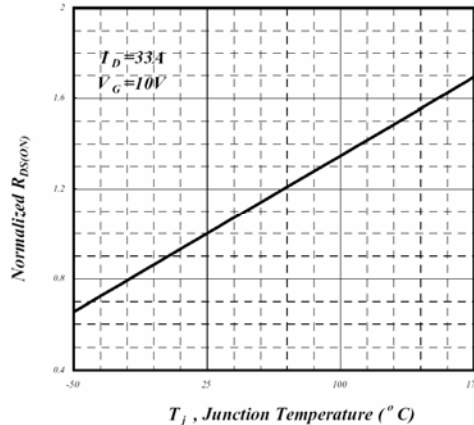


Fig 4. Normalized On-Resistance v.s. Junction Temperature

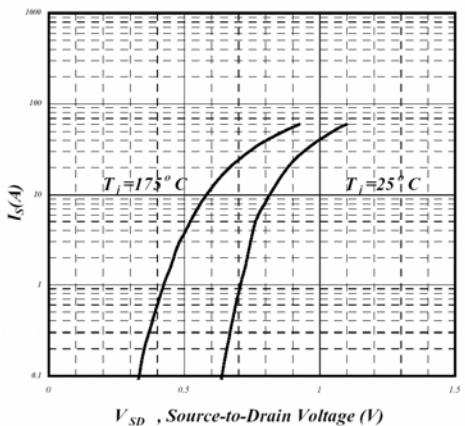


Fig 5. Forward Characteristic of Reverse Diode

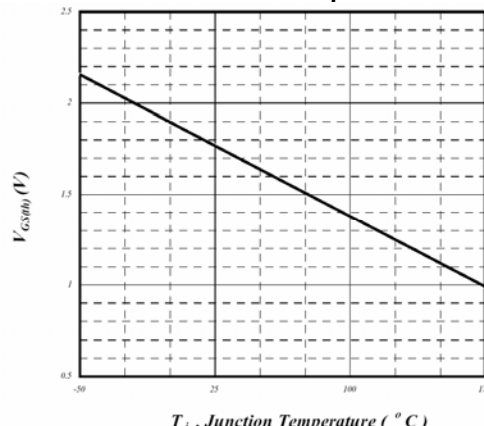


Fig 6. Gate Threshold Voltage v.s. Junction Temperature

## N-Channel Enhancement Mode Power MOSFET

### Typical Performance Characteristics

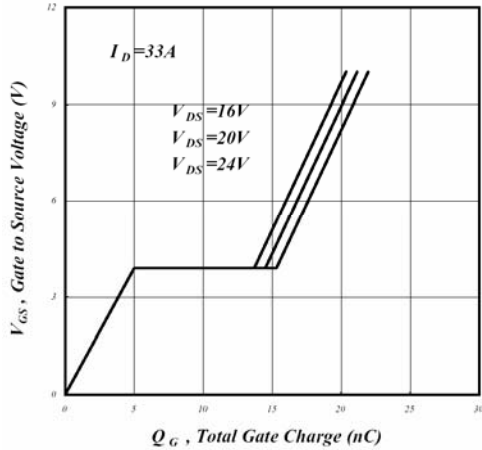


Fig 9. Gate Charge Characteristics

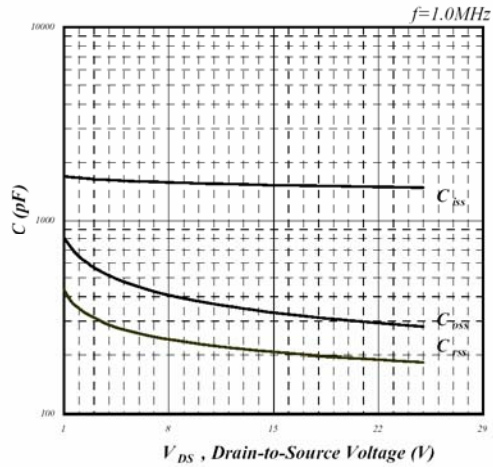


Fig 10. Typical Capacitance Characteristics

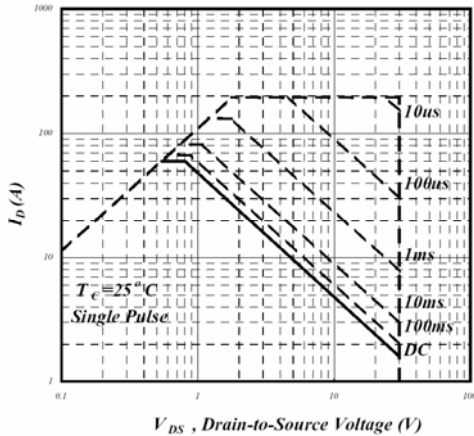


Fig 7. Maximum Safe Operating Area

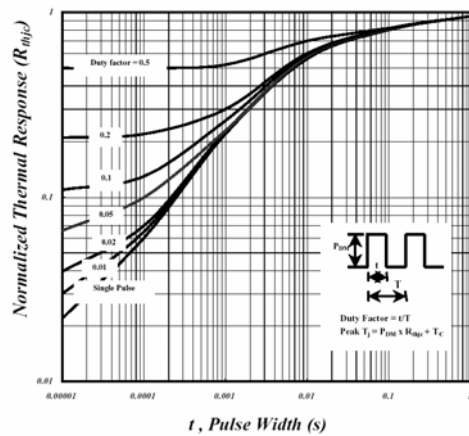


Fig 8. Effective Transient Thermal Impedance

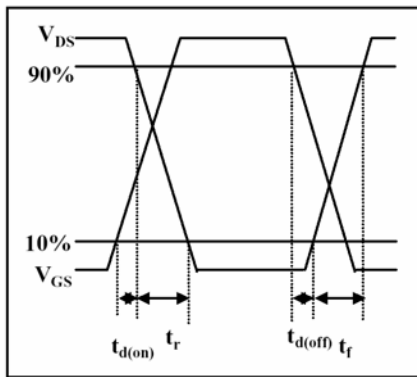


Fig 11. Switching Time Waveform

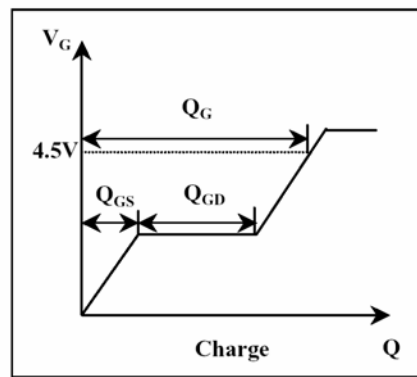
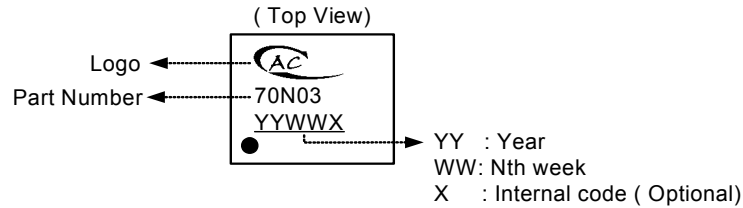


Fig 12. Gate Charge Waveform

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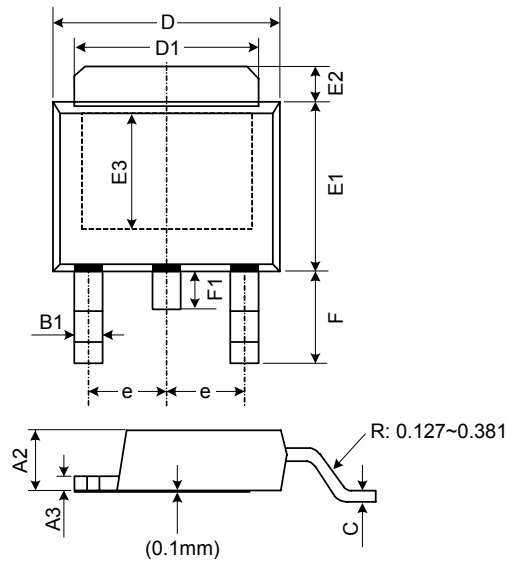
### ■ Marking Information

TO-252



### ■ Package Information

Package Type: TO-252



1. All Dimensions Are in Millimeters.
2. Dimension Does Not Include Mold Protrusions.

| Symbol | Dimensions In Millimeters |      |      |
|--------|---------------------------|------|------|
|        | Min.                      | Nom. | Max. |
| A2     | 1.80                      | 2.30 | 2.80 |
| A3     | 0.40                      | 0.50 | 0.60 |
| B1     | 0.40                      | 0.70 | 1.00 |
| D      | 6.00                      | 6.50 | 7.00 |
| D1     | 4.80                      | 5.35 | 5.90 |
| F      | 2.20                      | 2.63 | 3.05 |
| F1     | 0.50                      | 0.85 | 1.20 |
| E1     | 5.10                      | 5.70 | 6.30 |
| E2     | 0.50                      | 1.10 | 1.70 |
| E3     | 3.50                      | 4.00 | 4.50 |
| e      | -                         | 2.30 | -    |
| C      | 0.35                      | 0.50 | 0.65 |