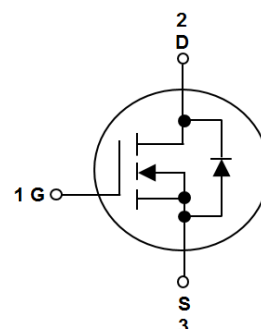


### Features

- Revolutionary semiconductor material silicon carbide
- High blocking voltage with low on-resistance
- High-speed switching with very low switching losses
- High-speed and high robust intrinsic body diode
- RoHS compliant with Halogen-free

**HF**

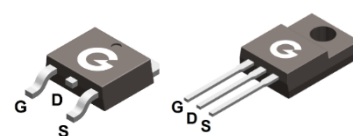


### Applications

- LED driver
- PD charger
- PC adapter
- Air-conditioning
- E-bike charger

### Mechanical Data

- Case: TO-252, TO-220MF
- Molding Compound: UL Flammability Classification Rating 94V-0
- Terminals: Matte tin-plated leads; solderability-per MIL-STD-202, Method 208



TO-252

TO-220MF

### Ordering Information

| Part Number | Package  | Shipping Quantity                       | Marking Code |
|-------------|----------|-----------------------------------------|--------------|
| GSC65R260D  | TO-252   | 80 pcs / Tube or 2500 pcs / Tape & Reel | 65R260       |
| GSC65R260F  | TO-220MF | 50 pcs / Tube                           | 65R260       |

### Maximum Ratings (@ T<sub>C</sub> = 25°C unless otherwise specified)

| Parameter                                                           | Symbol           | Value      | Unit |
|---------------------------------------------------------------------|------------------|------------|------|
| Drain-to-Source Voltage                                             | V <sub>DSS</sub> | 650        | V    |
| Gate-to-Source Voltage (transient)                                  | V <sub>GSS</sub> | -10/+22    | V    |
| Gate-to-Source Voltage (static)                                     |                  | 0/+15      |      |
| Continuous Drain Current (T <sub>C</sub> = 25°C)                    | I <sub>D</sub>   | 14         | A    |
| Continuous Drain Current (T <sub>C</sub> = 100°C)                   |                  | 10         |      |
| Pulsed Drain Current (t <sub>p</sub> = 10μs, T <sub>C</sub> = 25°C) | I <sub>DM</sub>  | 28         | A    |
| Single Pulse Avalanche Energy (L = 1mH) <sup>*2</sup>               | E <sub>AS</sub>  | 20         | mJ   |
| Power Dissipation (T <sub>C</sub> = 25°C, TO-252)                   | P <sub>D</sub>   | 54         | W    |
| Power Dissipation (T <sub>C</sub> = 25°C, TO-220MF)                 |                  | 27         |      |
| Operating Junction Temperature Range                                | T <sub>J</sub>   | -55 ~ +175 | °C   |
| Storage Temperature Range                                           | T <sub>STG</sub> | -55 ~ +175 | °C   |

## Thermal Characteristics

| Parameter                                      | Symbol           | Min. | Typ. | Max. | Unit |
|------------------------------------------------|------------------|------|------|------|------|
| Thermal Resistance Junction-to-Case (TO-252)   | R <sub>θJC</sub> | -    | 2.4  | 2.8  | °C/W |
| Thermal Resistance Junction-to-Case (TO-220MF) |                  | -    | -    | 5.5  |      |
| Thermal Resistance Junction-to-Air (TO-252)    | R <sub>θJA</sub> | -    | -    | 62   | °C/W |
| Thermal Resistance Junction-to- Air (TO-220MF) |                  | -    | -    | 75   |      |

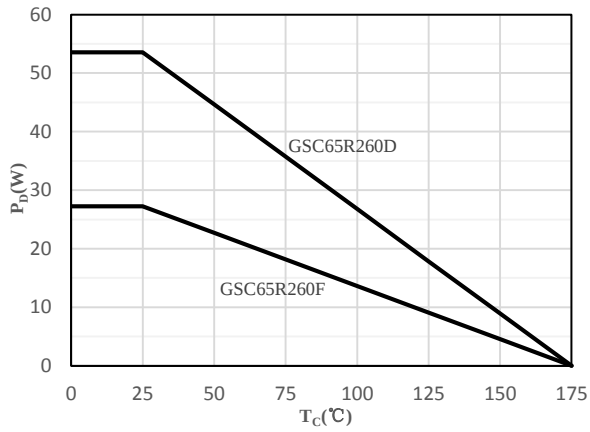
### Electrical Characteristics (@ $T_A = 25^\circ\text{C}$ unless otherwise specified)

| Symbol                             | Parameter                       | Test Condition                                                                                    | Min. | Typ. | Max. | Unit |
|------------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------|------|------|------|------|
| Static Characteristics             |                                 |                                                                                                   |      |      |      |      |
| V <sub>DSS</sub>                   | Drain-Source Breakdown Voltage  | V <sub>GS</sub> = 0V, I <sub>D</sub> = 100μA                                                      | 650  | -    | -    | V    |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current | V <sub>DS</sub> = 650V, V <sub>GS</sub> = 0V                                                      | -    | -    | 20   | μA   |
| I <sub>GSS</sub>                   | Gate-Body Leakage Current       | V <sub>GS</sub> = 22V, V <sub>DS</sub> = 0V                                                       | -    | -    | 250  | nA   |
|                                    |                                 | V <sub>GS</sub> = -10V, V <sub>DS</sub> = 0V                                                      | -    | -    | -250 |      |
| On Characteristics                 |                                 |                                                                                                   |      |      |      |      |
| R <sub>DS(ON)</sub>                | Drain-Source On-resistance *1   | V <sub>GS</sub> = 15V, I <sub>D</sub> = 8A, T <sub>J</sub> = 25°C                                 | -    | 250  | 325  | mΩ   |
|                                    |                                 | V <sub>GS</sub> = 15V, I <sub>D</sub> = 8A, T <sub>J</sub> = 175°C                                | -    | 255  | -    |      |
|                                    |                                 | V <sub>GS</sub> = 18V, I <sub>D</sub> = 8A, T <sub>J</sub> = 25°C                                 | -    | 185  | 260  |      |
|                                    |                                 | V <sub>GS</sub> = 18V, I <sub>D</sub> = 8A, T <sub>J</sub> = 175°C                                | -    | 225  | -    |      |
| V <sub>GS(th)</sub>                | Gate Threshold Voltage          | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 3.5mA                                        | 2.5  | 3.3  | 5    | V    |
| R <sub>G</sub>                     | Gate Resistance                 | V <sub>GS</sub> = 0V, f = 1MHz                                                                    | -    | 37   | -    | Ω    |
| Dynamic Characteristics            |                                 |                                                                                                   |      |      |      |      |
| C <sub>ISS</sub>                   | Input Capacitance               | V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 400V<br>f = 1MHz                                        | -    | 270  | -    | pF   |
| C <sub>OSS</sub>                   | Output Capacitance              |                                                                                                   | -    | 21   | -    |      |
| C <sub>RSS</sub>                   | Reverse Transfer Capacitance    |                                                                                                   | -    | 1.2  | -    |      |
| Switching Characteristics          |                                 |                                                                                                   |      |      |      |      |
| t <sub>d(ON)</sub>                 | Turn-on Delay Time *3           | V <sub>DD</sub> = 400V<br>V <sub>GS</sub> = 0/15V<br>I <sub>D</sub> = 8A<br>R <sub>G</sub> = 2.2Ω | -    | 18.3 | -    | ns   |
| t <sub>r</sub>                     | Turn-on Rise Time *3            |                                                                                                   | -    | 11.6 | -    |      |
| t <sub>d(OFF)</sub>                | Turn-Off Delay Time *3          |                                                                                                   | -    | 18.1 | -    |      |
| t <sub>f</sub>                     | Turn-Off Fall Time *3           |                                                                                                   | -    | 12.7 | -    |      |
| E <sub>on</sub>                    | Turn-On Energy *3               |                                                                                                   | -    | 76.8 | -    | μJ   |
| E <sub>off</sub>                   | Turn-Off Energy *3              |                                                                                                   | -    | 14.5 | -    |      |
| Q <sub>G</sub>                     | Total Gate-Charge               | V <sub>DD</sub> = 400V                                                                            | -    | 14.1 | -    | nC   |
| Q <sub>GS</sub>                    | Gate to Source Charge           | V <sub>GS</sub> = 0/15V                                                                           | -    | 7.7  | -    |      |
| Q <sub>GD</sub>                    | Gate to Drain (Miller) Charge   | I <sub>D</sub> = 8A                                                                               | -    | 2.3  | -    |      |
| Source-Drain Diode Characteristics |                                 |                                                                                                   |      |      |      |      |
| V <sub>SD</sub>                    | Diode Forward Voltage *1        | I <sub>SD</sub> = 4A, V <sub>GS</sub> = 0V, T <sub>J</sub> = 25°C                                 | -    | 3.8  | -    | V    |
|                                    |                                 | I <sub>SD</sub> = 4A, V <sub>GS</sub> = 0V, T <sub>J</sub> = 175°C                                | -    | 3.5  | -    |      |
| t <sub>rr</sub>                    | Reverse Recovery Time           | I <sub>F</sub> = 8A, V <sub>R</sub> = 400V<br>dI/dt = 300A/μs                                     | -    | 12   | -    | ns   |
| Q <sub>rr</sub>                    | Reverse Recovery Charge         |                                                                                                   | -    | 10   | -    | nC   |
| I <sub>rr</sub>                    | Peak Reverse Recovery Current   |                                                                                                   | -    | 1.6  | -    | A    |

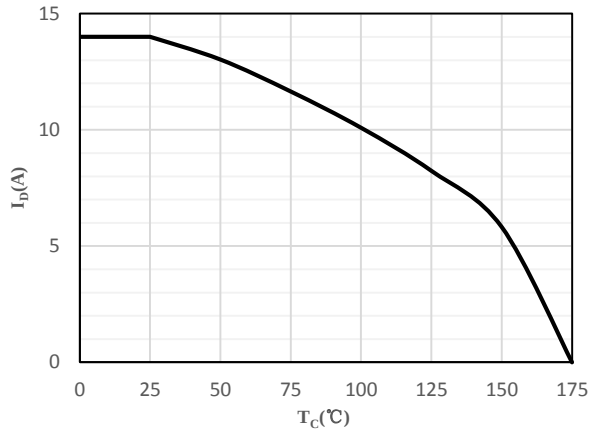
Notes:

1. The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
2. The  $E_{AS}$  data shows Max. rating. The test condition is  $V_{DD} = 120V, V_{GS} = 15V, L = 1mH$
3. Guaranteed by design, not subject to production

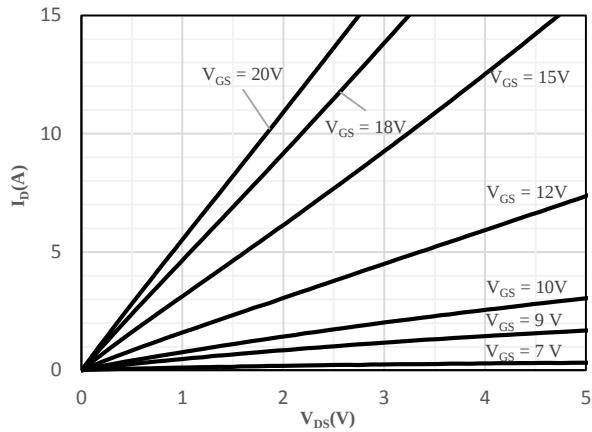
**Ratings and Characteristics Curves** (@  $T_A = 25^\circ\text{C}$  unless otherwise specified)



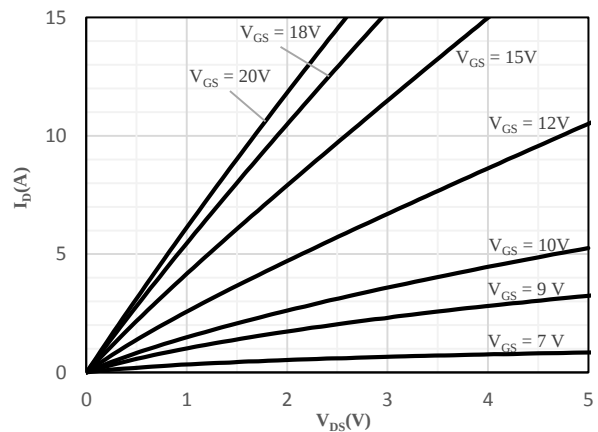
**Fig 1 Power Dissipation**



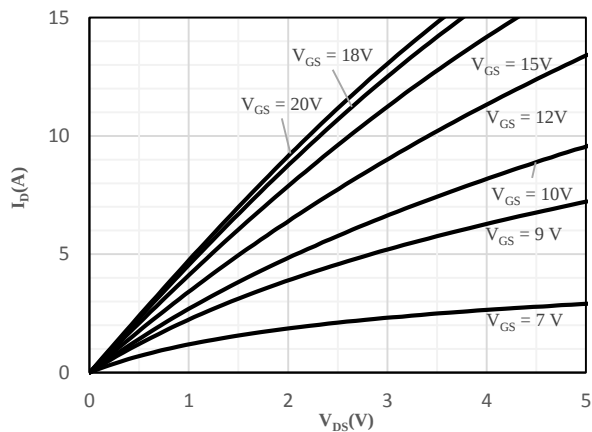
**Fig 2 Drain Current**



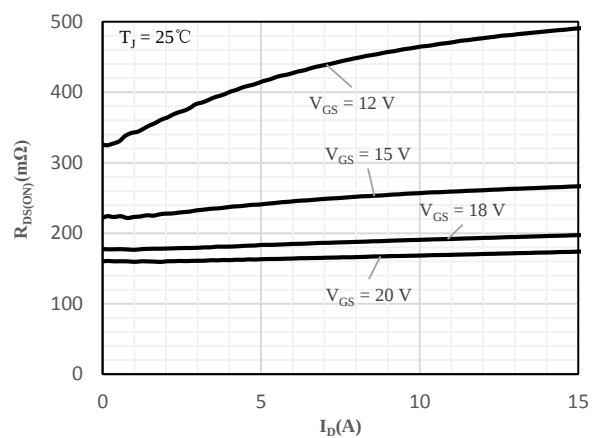
**Fig 3 Typical Output Characteristics ( $T_j = -55^\circ\text{C}$ )**



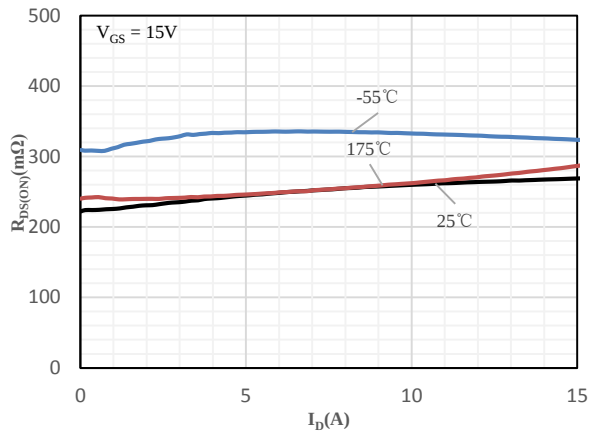
**Fig 4 Typical Output Characteristics ( $T_j = 25^\circ\text{C}$ )**



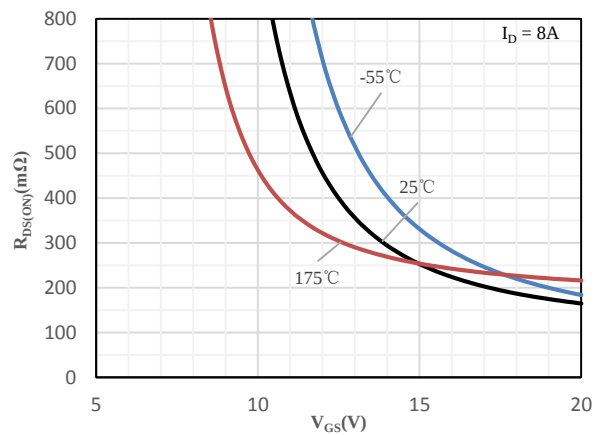
**Fig 5 Typical Output Characteristics ( $T_j = 175^\circ\text{C}$ )**



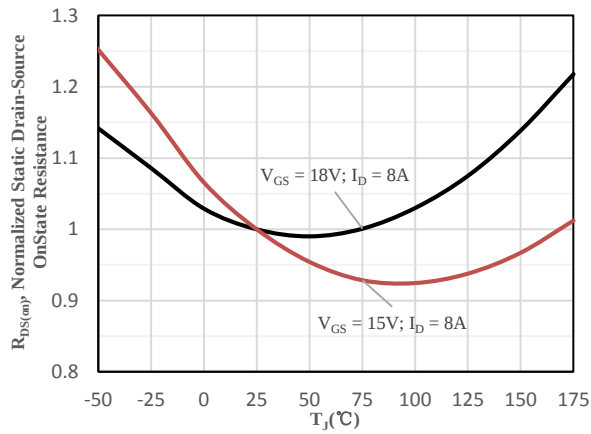
**Fig 6 On-Resistance vs. Drain Current**



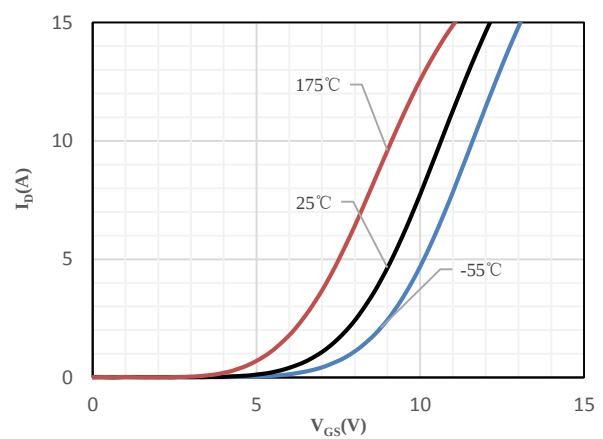
**Fig 7 On-Resistance vs. Drain Current**  
for Various Junction Temperatures



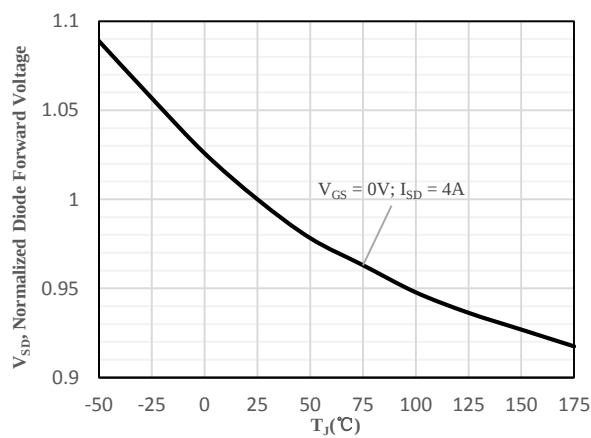
**Fig 8 On-Resistance vs. Gate-Source Voltage**  
for Various Junction Temperatures



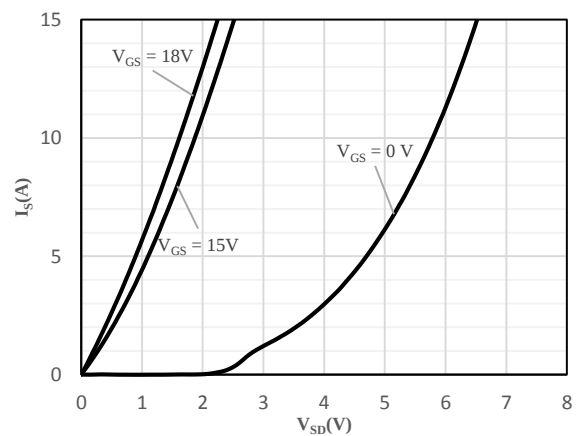
**Fig 9 Normalized On-Resistance vs.**  
Junction Temperature



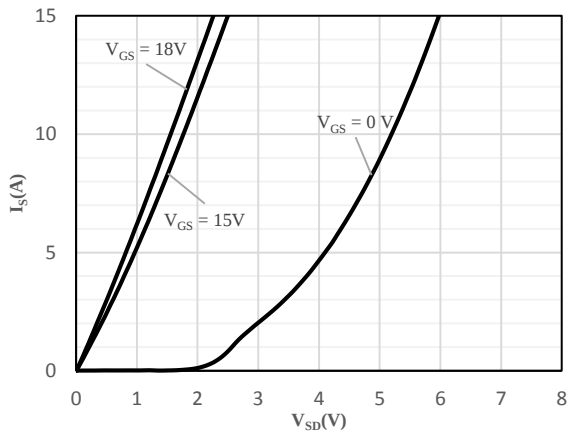
**Fig 10 Transfer Characteristics**  
for Various Junction Temperatures



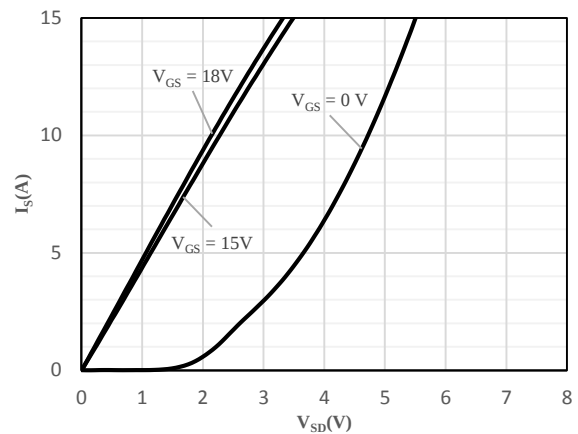
**Fig 11 Normalized Diode Forward Voltage vs.**  
Junction Temperature



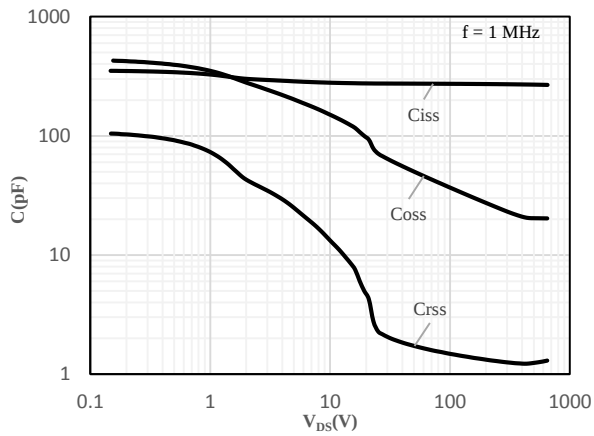
**Fig 12 Body-Diode Characteristics ( $T_J = -55^\circ\text{C}$ )**



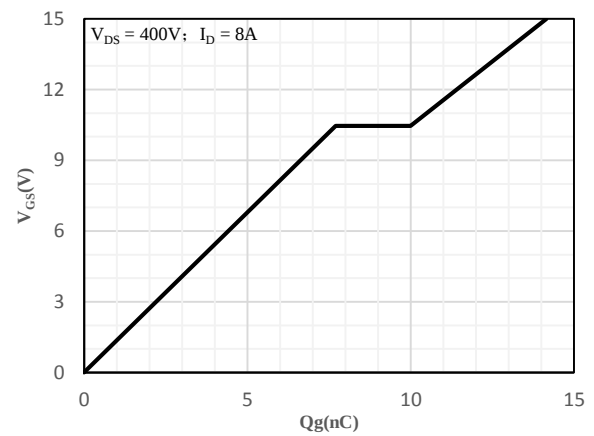
**Fig 13 Body-Diode Characteristics ( $T_j = 25^\circ\text{C}$ )**



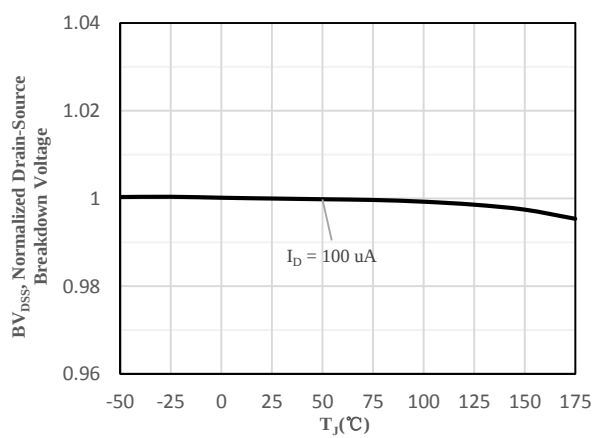
**Fig 14 Body-Diode Characteristics ( $T_j = 175^\circ\text{C}$ )**



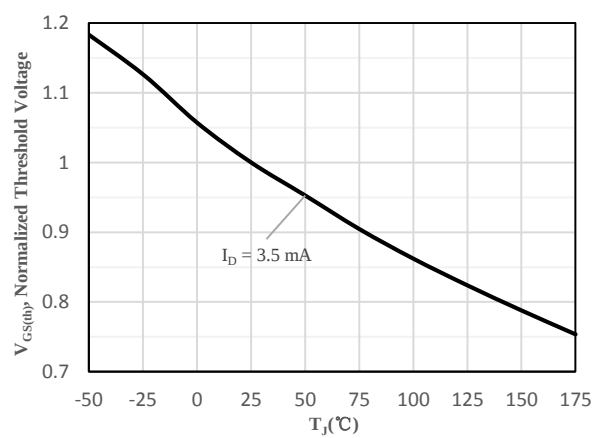
**Fig 15 Capacitance Characteristics**



**Fig 16 Gate-Charge Characteristics**



**Fig 17 Normalized Breakdown Voltage vs. Junction Temperature**



**Fig 18 Normalized  $V_{GS(th)}$  vs. Junction Temperature**

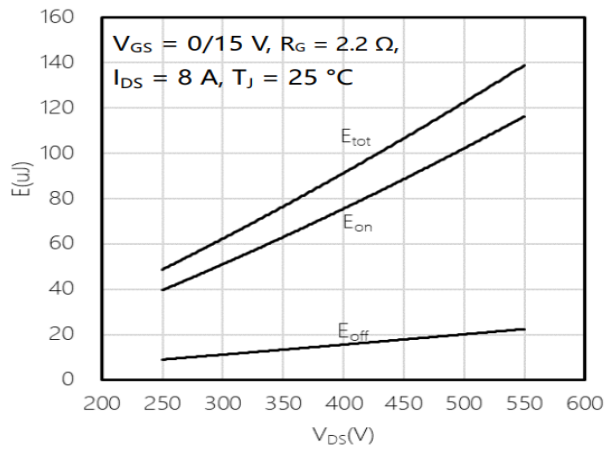


Fig 19 Clamped Inductive Switching Energy vs.  $V_{DS}$

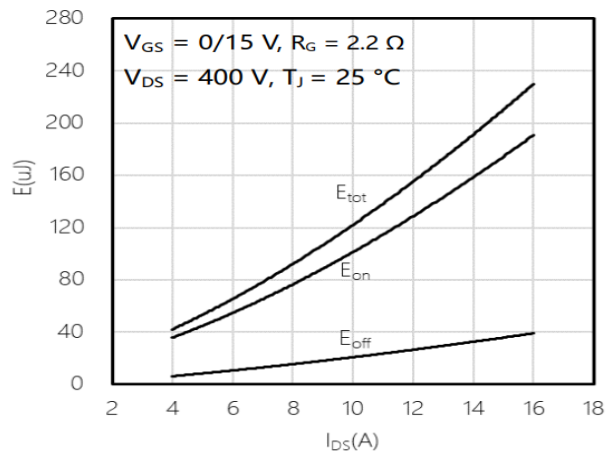


Fig 20 Clamped Inductive Switching Energy vs. Drain Current

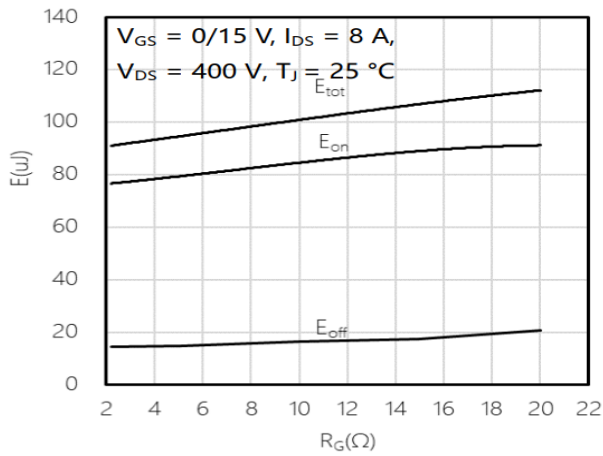


Fig 21 Clamped Inductive Switching Energy vs.  $R_G$

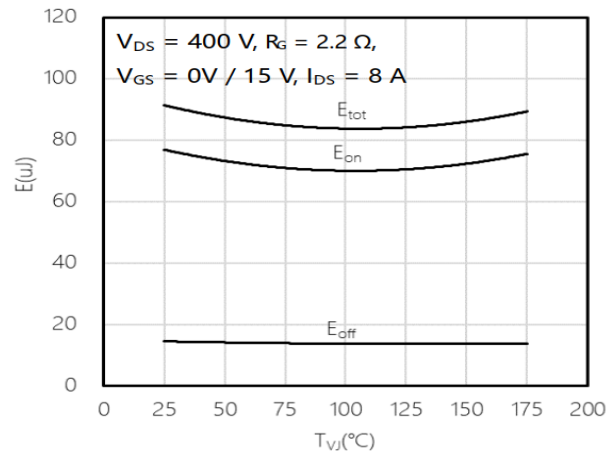


Fig 22 Clamped Inductive Switching Energy vs. Junction Temperature

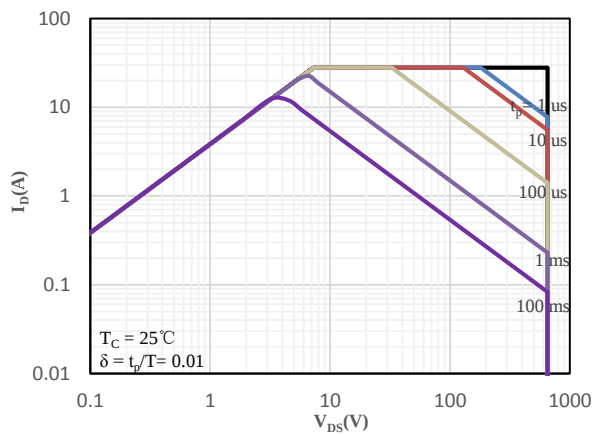


Fig 23 Safe Operating Area (TO-252)

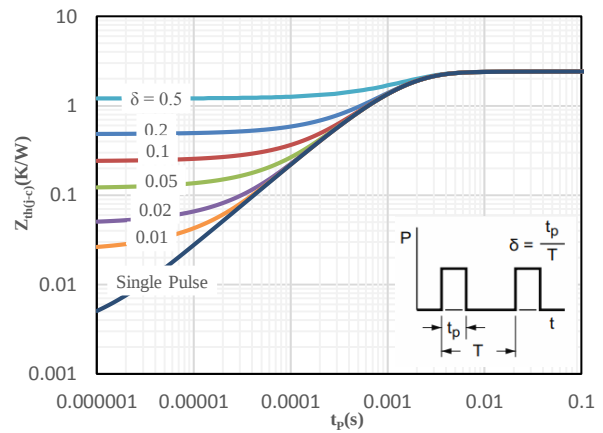
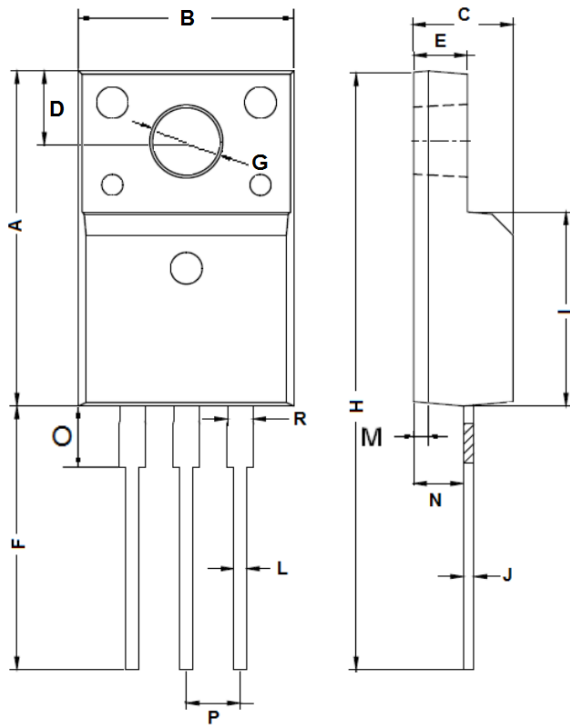
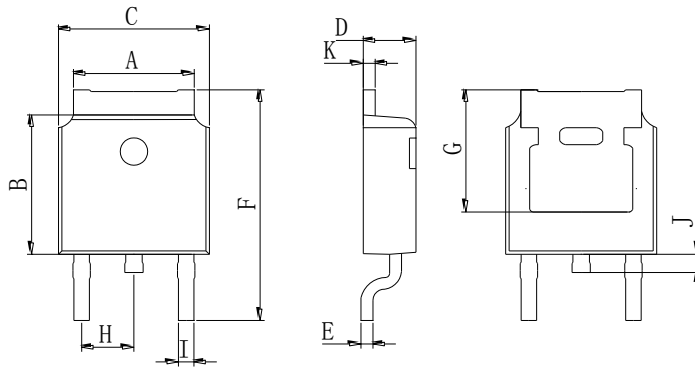


Fig 24 Maximum transient thermal impedance (TO-252)

**Package Outline Dimensions** (Unit: mm)



| TO-220MF  |       |       |
|-----------|-------|-------|
| Dimension | Min.  | Max.  |
| A         | 15.60 | 16.00 |
| B         | 9.90  | 10.30 |
| C         | 4.50  | 4.90  |
| D         | 3.00  | 3.60  |
| E         | 2.44  | 2.64  |
| F         | 12.20 | 12.60 |
| G         | 3.00  | 3.30  |
| H         | 27.80 | 28.60 |
| I         | 8.70  | 9.70  |
| J         | 0.40  | 0.60  |
| L         | 0.70  | 0.90  |
| M         | 0.55  | 0.75  |
| N         | 2.50  | 2.70  |
| O         | 2.70  | 3.10  |
| P         | 2.45  | 2.65  |
| R         | 1.10  | 1.30  |



| TO-252    |      |       |
|-----------|------|-------|
| Dimension | Min. | Max.  |
| A         | 5.05 | 5.65  |
| B         | 5.80 | 6.40  |
| C         | 6.25 | 6.85  |
| D         | 2.20 | 2.40  |
| E         | 0.40 | 0.60  |
| F         | 9.71 | 10.31 |
| G         | 5.05 | 5.65  |
| H         | 2.10 | 2.50  |
| I         | 0.70 | 0.90  |
| J         | 0.50 | 0.70  |
| K         | 0.40 | 0.60  |

**Mounting Pad Layout** (Unit: mm)

**TO-252**

