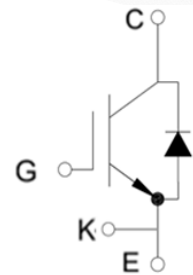
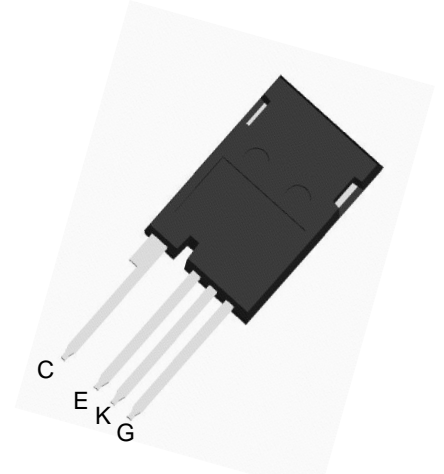


PRODUCT FEATURES

- 1200V IGBT chip in trench FS-technology
- Low switching losses
- $V_{CE(sat)}$ with positive temperature coefficient
- Fast switching and short tail current
- Free wheeling diodes with fast and soft reverse recovery



APPLICATIONS

- Motor control
- UPS/PFC
- General purpose inverters

| Type | V_{CES} | I_C | $V_{CE(sat)}$ $T_J=25^\circ C$ | T_{Jmax} | Marking | Package |
|----------------|-----------|-------|--------------------------------|------------|----------------|---------|
| MM140G7U120BKM | 1200V | 140A | 1.6V | 175°C | MM140G7U120BKM | TO-247 |

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MM140G7U120BKM

ABSOLUTE MAXIMUM RATINGS($T_C=25^{\circ}\text{C}$ unless otherwise specified)

| Symbol | Parameter/Test Conditions | | Values | Unit |
|--------------|---|---------------------------|---------------------------|--------------------|
| V_{CES} | Collector Emitter Voltage | $T_J=25^{\circ}\text{C}$ | 1200 | V |
| V_{GES} | Gate Emitter Voltage | | ± 20 | |
| | Transient Gate Emitter Voltage ($t_p \leq 0.5\mu\text{s}, D < 0.001$) | | ± 25 | |
| I_C | DC Collector Current, limited by T_{Jmax} | limited by bondwire | $T_C=25^{\circ}\text{C}$ | A |
| | | | $T_C=100^{\circ}\text{C}$ | |
| I_{Cpulse} | Pulsed collector current, t_p limited by T_{Jmax} | | 560 | |
| P_{tot} | Power Dissipation Per IGBT | $T_C=25^{\circ}\text{C}$ | 1111 | W |
| | | $T_C=100^{\circ}\text{C}$ | 555 | |
| V_{RRM} | Repetitive Reverse Voltage | $T_J=25^{\circ}\text{C}$ | 1200 | V |
| I_F | Forward Current, limited by T_{Jmax} | $T_C=25^{\circ}\text{C}$ | 209 | A |
| | | $T_C=95^{\circ}\text{C}$ | 140 | |
| I_{Fpulse} | Diode pulsed current, t_p limited by T_{Jmax} | | 560 | |
| T_{Jmax} | Max. Junction Temperature | | 175 | $^{\circ}\text{C}$ |
| T_{Jop} | Operating Temperature | | -40~175 | |
| T_{stg} | Storage Temperature | | -55~150 | |
| T_{SLD} | Wave Soldering 1.6mm (0.063in.) from case for 10s | | 260 | |
| Torque | to heatsink | Recommended (M3) | 1.1 | Nm |
| Weight | | | 8 | g |

THERMAL RESISTANCE($T_C=25^{\circ}\text{C}$ unless otherwise specified)

| Symbol | Parameter/Test Conditions | Min. | Typ. | Max. | Unit |
|------------|---|------|------|-------|------|
| R_{thJC} | Junction to Case Thermal Resistance (IGBT) | | | 0.135 | K /W |
| R_{thJC} | Junction to Case Thermal Resistance (Diode) | | | 0.261 | |
| R_{thJA} | Junction to Ambient Thermal Resistance | | | 40 | |

MM140G7U120BKM

IGBT

ELECTRICAL CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter/Test Conditions | | Min. | Typ. | Max. | Unit |
|---------------|--------------------------------------|--|-------------------------|------|------|---------------|
| $V_{GE(th)}$ | Gate Emitter Threshold Voltage | $V_{CE}=V_{GE}, I_C=3\text{mA}$ | 4.8 | 5.5 | 6.2 | V |
| $V_{CE(sat)}$ | Collector Emitter Saturation Voltage | $I_C=140\text{A}, V_{GE}=15\text{V}, T_J=25^\circ\text{C}$ | | 1.6 | 2.1 | |
| | | $I_C=140\text{A}, V_{GE}=15\text{V}, T_J=175^\circ\text{C}$ | | 1.95 | | |
| I_{CES} | Collector Leakage Current | $V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$ | | | 100 | μA |
| | | $V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_J=175^\circ\text{C}$ | | 4 | | mA |
| I_{GES} | Gate Leakage Current | $V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}, T_J=25^\circ\text{C}$ | -200 | | 200 | nA |
| g_{fs} | Transconductance | $V_{CE}=20\text{V}, I_C=140\text{A}, T_J=25^\circ\text{C}$ | | 430 | | S |
| Q_G | Gate Charge | $V_{CE}=240\text{V}, I_C=140\text{A}, V_{GE}=15\text{V}$ | | 690 | | nC |
| C_{ies} | Input Capacitance | $V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=100\text{kHz}$ | | 22.6 | | nF |
| C_{oes} | Output Capacitance | | | 345 | | pF |
| C_{res} | Reverse Transfer Capacitance | | | 108 | | |
| $t_{d(on)}$ | Turn on Delay Time | $V_{CC}=600\text{V}, I_C=140\text{A}$ $R_{Gon}=2.9\Omega,$ $R_{Goff}=2.9\Omega,$ $V_{GE}=0\dots 15\text{V}$ | $T_J=25^\circ\text{C}$ | 63 | | ns |
| | | | $T_J=175^\circ\text{C}$ | 57 | | ns |
| t_r | Rise Time | | $T_J=25^\circ\text{C}$ | 30 | | ns |
| | | | $T_J=175^\circ\text{C}$ | 36 | | ns |
| $t_{d(off)}$ | Turn off Delay Time | $V_{CC}=600\text{V}, I_C=140\text{A}$ $R_{Gon}=2.9\Omega,$ $R_{Goff}=2.9\Omega,$ $V_{GE}=0\dots 15\text{V}$ | $T_J=25^\circ\text{C}$ | 380 | | ns |
| | | | $T_J=175^\circ\text{C}$ | 480 | | ns |
| t_f | Fall Time | | $T_J=25^\circ\text{C}$ | 40 | | ns |
| | | | $T_J=175^\circ\text{C}$ | 128 | | ns |
| E_{on} | Turn on Energy | $V_{CC}=600\text{V}, I_C=140\text{A}$ $R_{Gon}=2.9\Omega,$ $R_{Goff}=2.9\Omega,$ $V_{GE}=0\dots 15\text{V}$ | $T_J=25^\circ\text{C}$ | 2.80 | | mJ |
| | | | $T_J=175^\circ\text{C}$ | 4.63 | | mJ |
| E_{off} | Turn off Energy | | $T_J=25^\circ\text{C}$ | 3.99 | | mJ |
| | | | $T_J=175^\circ\text{C}$ | 9.20 | | mJ |

Diode

ELECTRICAL CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter/Test Conditions | | Min. | Typ. | Max. | Unit |
|-----------|-------------------------------|--|------|------|------|---------------|
| V_F | Forward Voltage | $I_F=140\text{A}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$ | | 2.7 | 3.2 | V |
| | | $I_F=140\text{A}, V_{GE}=0\text{V}, T_J=175^\circ\text{C}$ | | 2.1 | | |
| t_{rr} | Reverse Recovery Time | $I_F=140\text{A}, V_R=600\text{V}$ $di_F/dt=-2930\text{A}/\mu\text{s}$ $T_J=175^\circ\text{C}$ | | 200 | | ns |
| Q_{RR} | Reverse Recovery Charge | | | 13.4 | | μC |
| I_{RRM} | Max. Reverse Recovery Current | | | 146 | | A |
| E_{rec} | Reverse Recovery Energy | | | 6.14 | | mJ |

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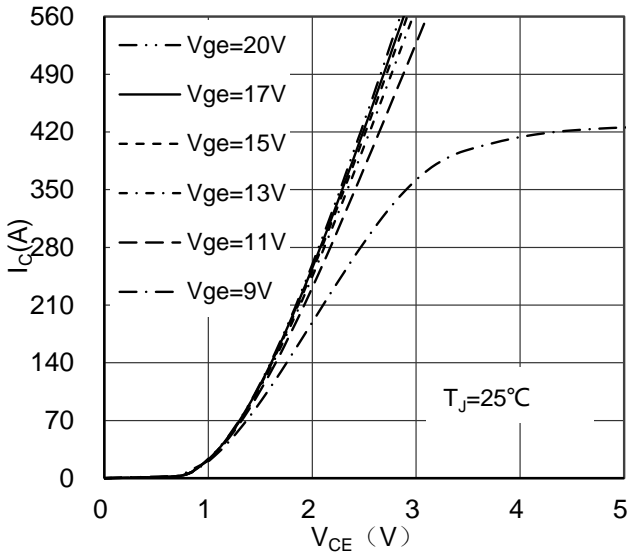


Figure 1. Typical Output Characteristics

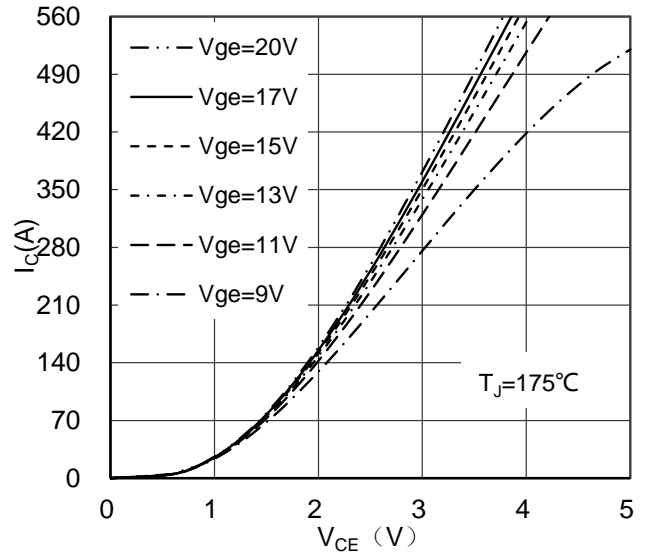


Figure 2. Typical Output Characteristics

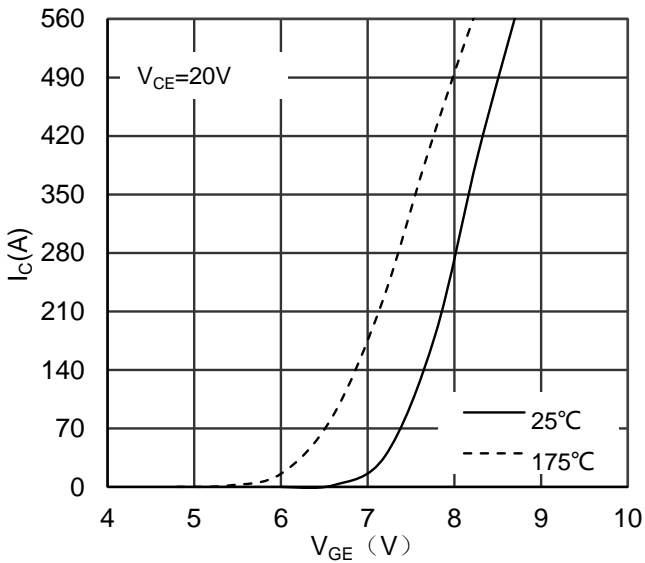


Figure 3. Typical Transfer characteristics

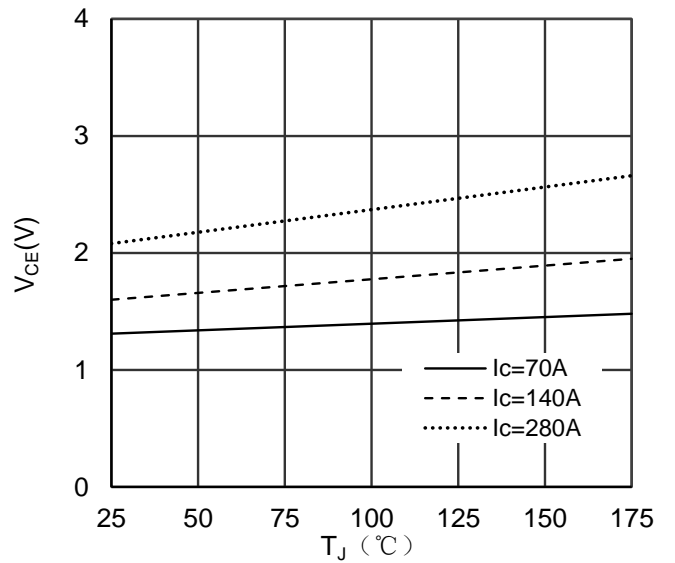


Figure 4. Collector-Emitter Voltage vs Junction temperature

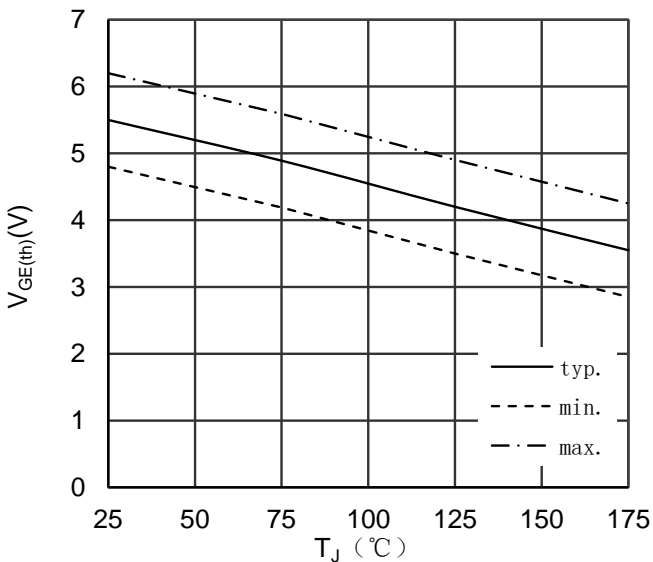


Figure 5. Gate-Emitter Threshold Voltage vs Junction temperature

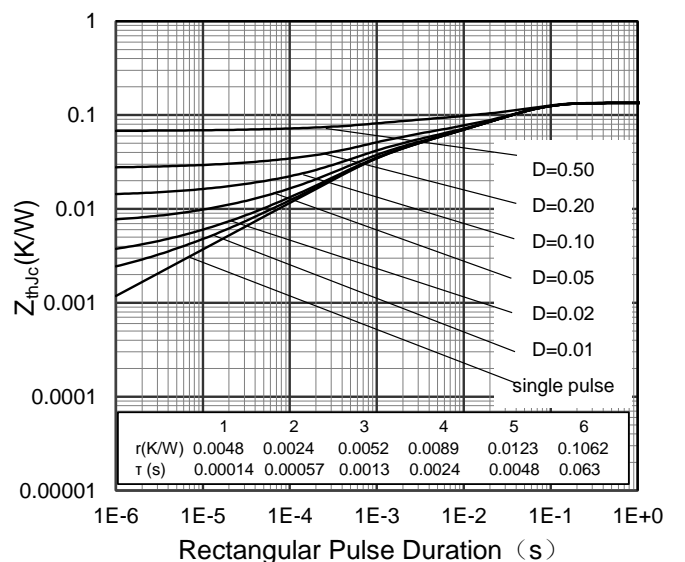


Figure 6. IGBT Transient Thermal Impedance

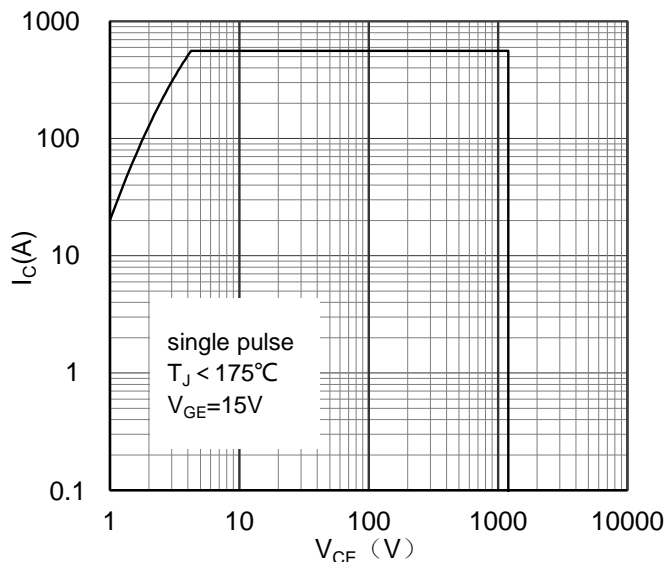


Figure 7. Forward Biased Safe Operating Area

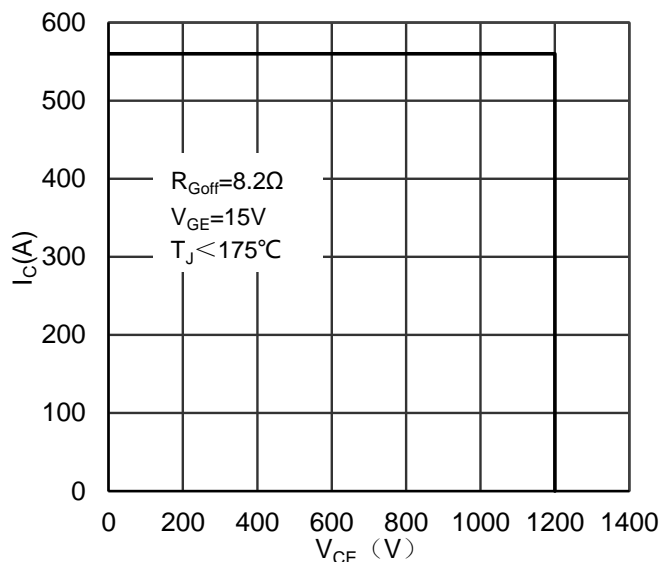


Figure 8. Reverse Biased Safe Operating Area

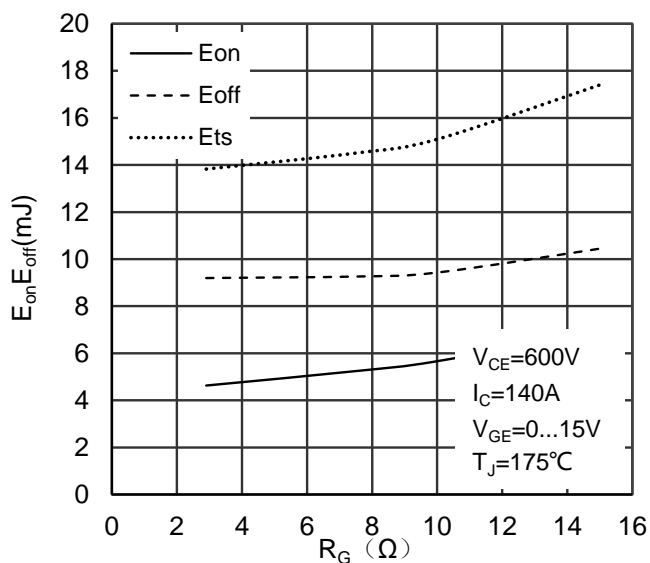


Figure 9. Switching Energy vs Gate Resistor Diode

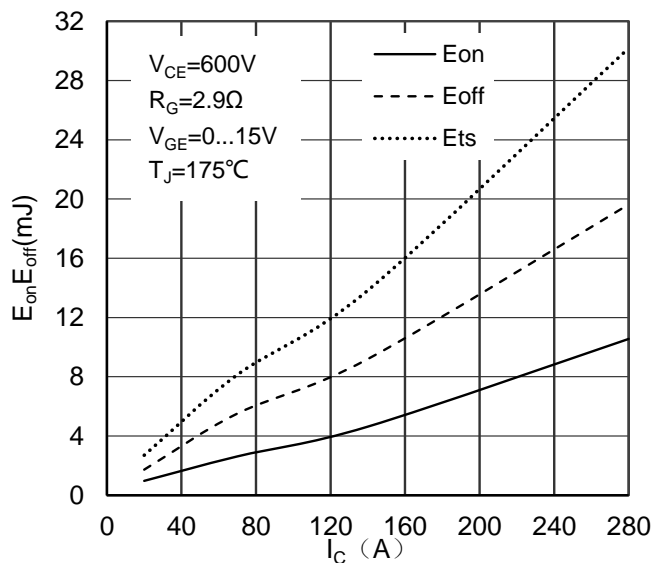


Figure 10. Switching Energy vs Collector Current

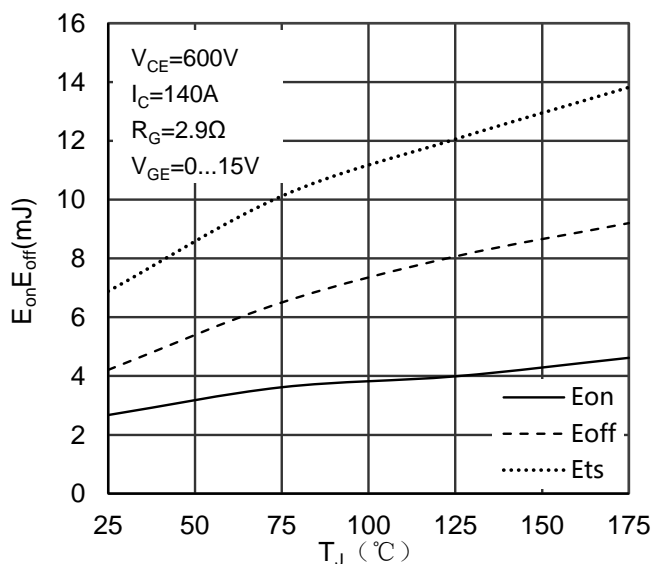


Figure 11. Switching Energy vs Junction temperature

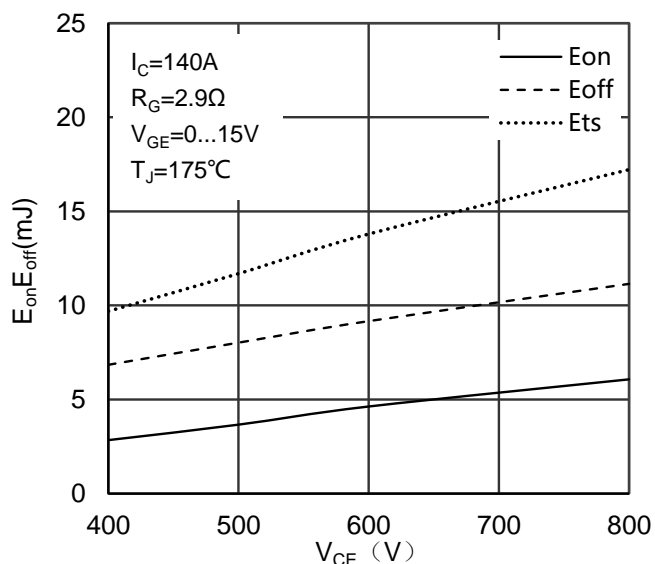


Figure 12. Switching Energy vs Collector-Emitter Voltage

MM140G7U120BKM

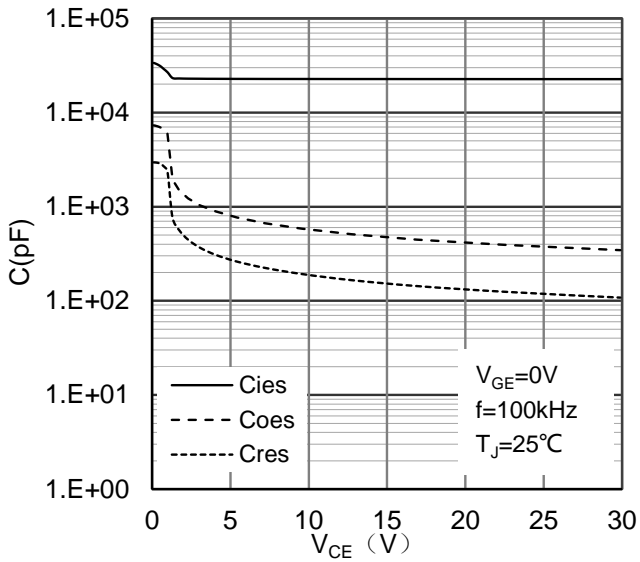


Figure 13. Typical capacitance

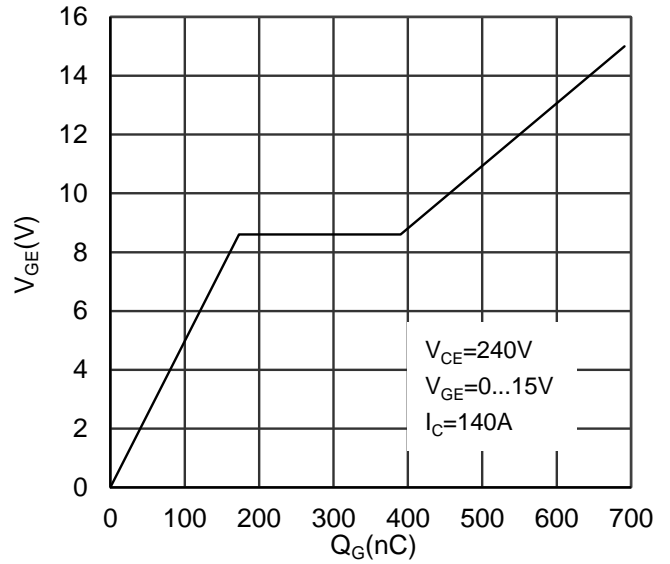


Figure 14. Typical Gate Charge

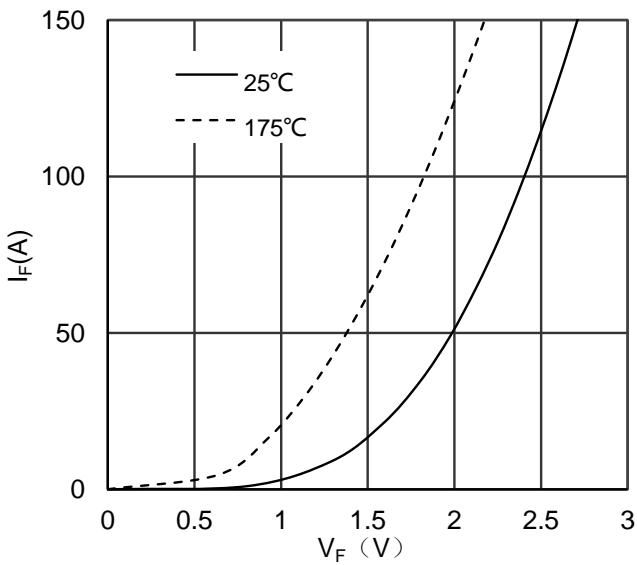


Figure 15. Diode Forward Characteristics

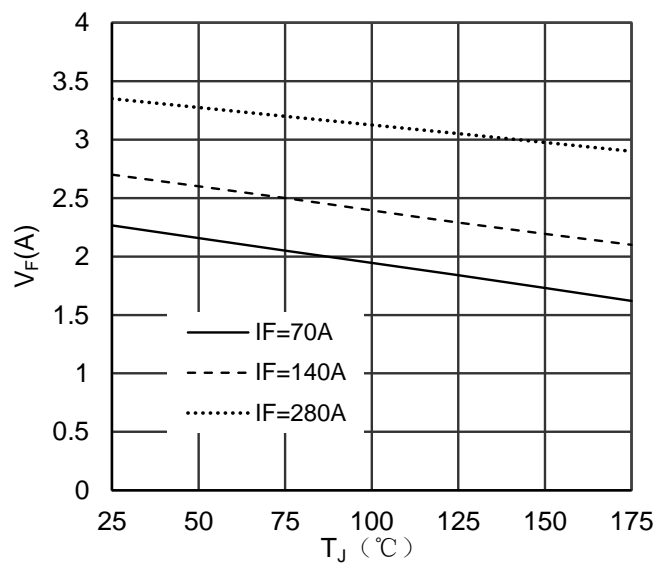


Figure 16. Forward Voltage vs Junction temperature Diode

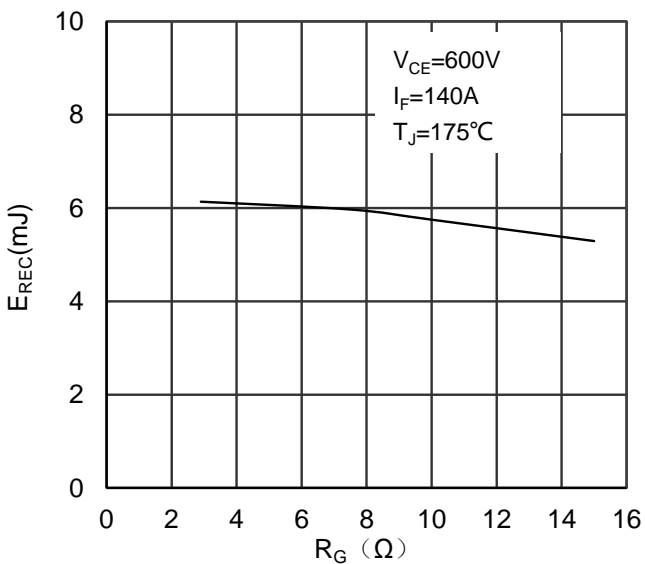


Figure 17. Switching Energy vs Gate Resistor Diode

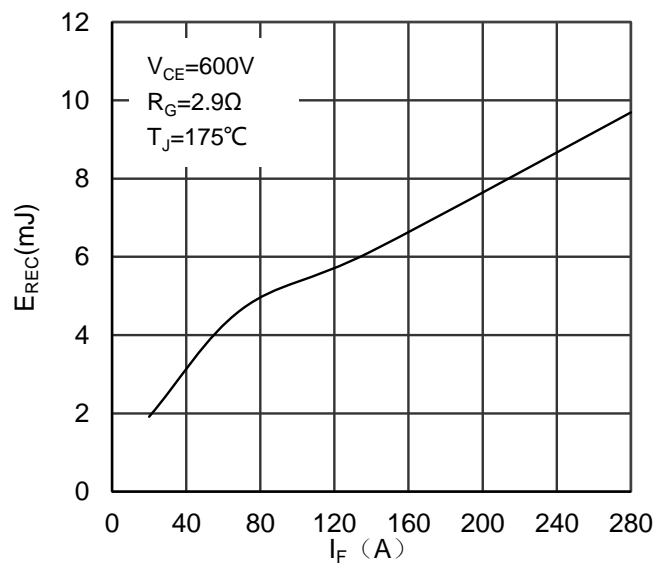


Figure 18. Switching Energy vs Forward Current Diode

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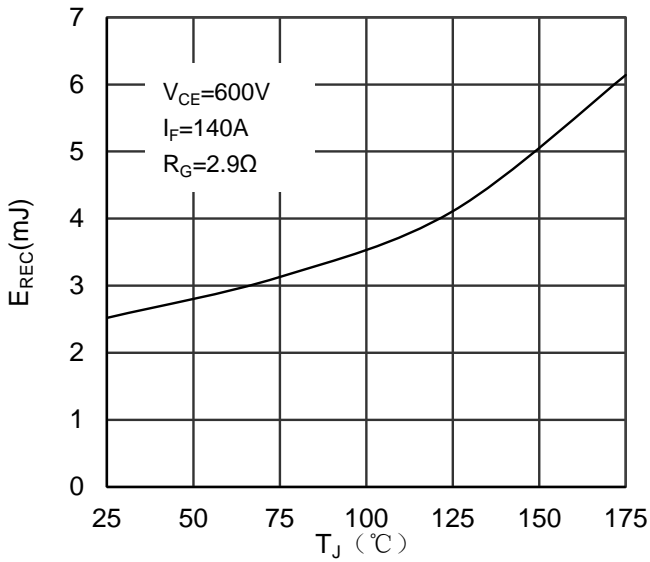


Figure 19. Switching Energy vs Junction temperature

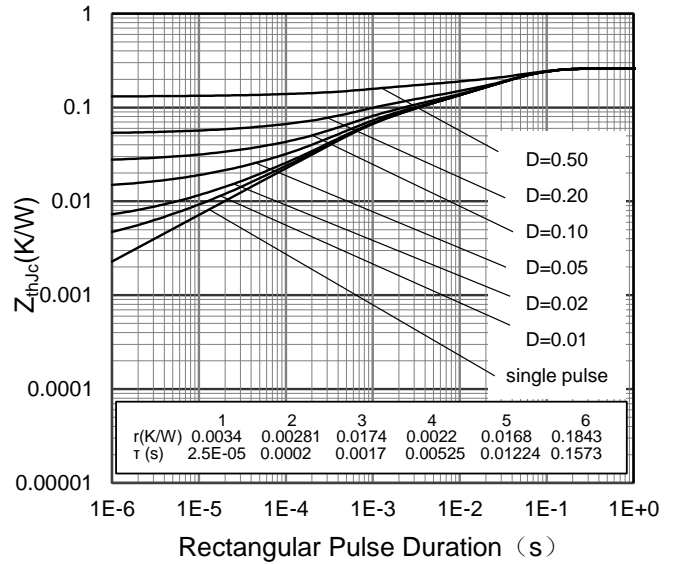
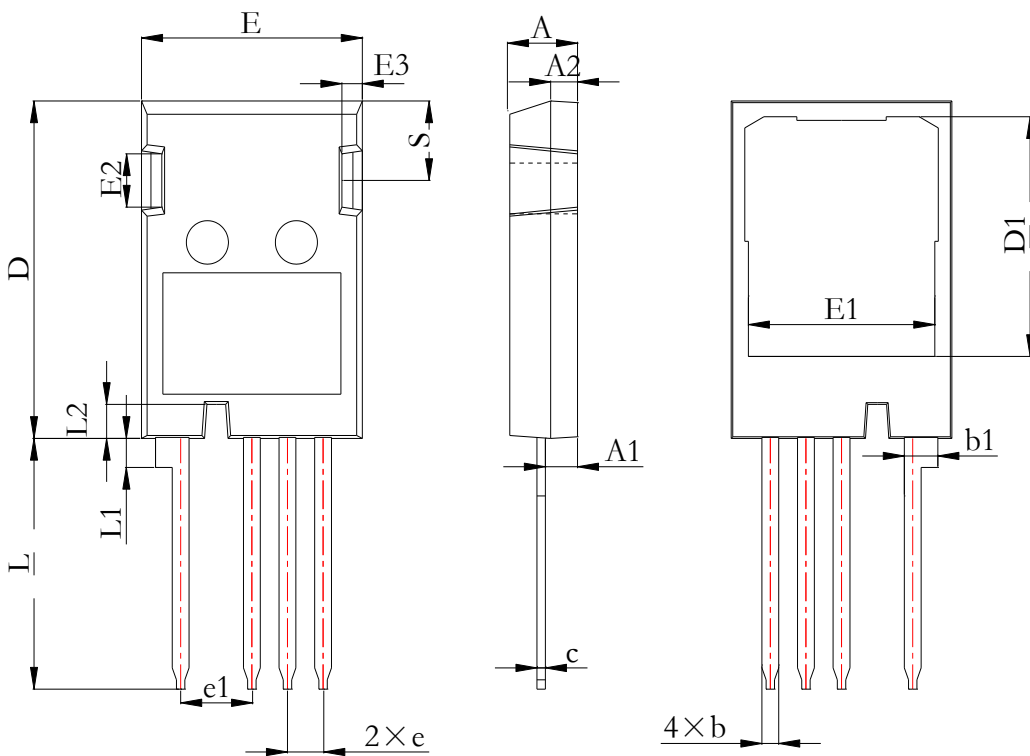


Figure 20. Diode Transient Thermal Impedance Diode



| Symbol | Min | Nom | Max |
|--------|---------|-------|-------|
| A | 4.83 | 5.02 | 5.21 |
| A1 | 2.29 | 2.42 | 2.54 |
| A2 | 1.91 | 2.04 | 2.16 |
| b | 1.07 | 1.20 | 1.33 |
| b1 | 2.39 | 2.54 | 2.69 |
| c | 0.55 | 0.62 | 0.68 |
| e | 2.54BSC | | |
| e1 | 5.08BSC | | |
| E | 15.75 | 15.94 | 16.13 |
| E1 | 12.38 | 12.91 | 13.43 |
| E2 | 3.68 | 4.39 | 5.10 |
| E3 | 1.00 | 1.14 | 1.90 |
| D | 23.30 | 23.45 | 23.60 |
| D1 | 16.25 | 17.10 | 17.65 |
| L | 17.31 | 17.57 | 17.82 |
| *L1 | 1.80 | 2.00 | 2.20 |
| L2 | 2.35 | 2.50 | 2.65 |
| S | 5.49 | 5.75 | 6.00 |

Dimensions in (mm)

Figure 21. Package Outline