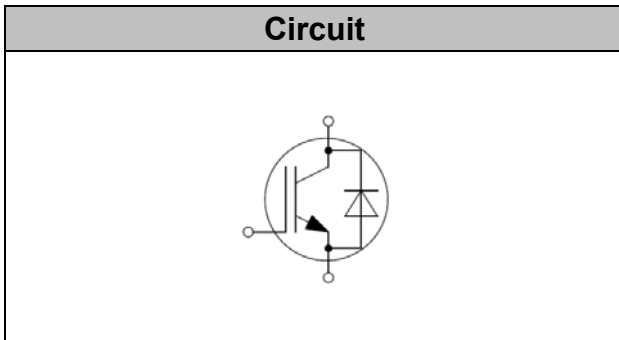




IGBT Modules

| | | |
|-----------------------|------------|----------|
| V_{CE} | 650 | V |
| I_C | 20 | A |
| $V_{CE(SAT)} I_C=20A$ | 1.9 | V |



Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

Features

- High speed smooth switching device for hard & soft switching
- Maximum junction temperature 175°C
- Positive temperature coefficient
- High ruggedness, temperature stable
- Pb-free lead plating; RoHS compliant

Maximum Ratings

| Parameter | Symbol | Value | Unit |
|--|-------------|----------|---------|
| Collector-Emitter Breakdown Voltage | V_{CE} | 650 | V |
| DC Collector Current, limited by T_{jmax} $T_C=25^\circ C$ value limited by bondwire $T_C=100^\circ C$ | I_C | 40 20 | A |
| Diode Forward Current, limited by T_{jmax} $T_C=25^\circ C$ $T_C=100^\circ C$ | I_F | 40 20 | A |
| Continuous Gate-Emitter Voltage | V_{GE} | ± 20 | V |
| Transient Gate-Emitter Voltage | V_{GE} | ± 30 | V |
| Turn off Safe Operating Area $V_{CE} \leq 650V$, $T_j \leq 150^\circ C$ | | 80 | A |
| Pulsed Collector Current, $V_{GE}=15V$, t_p limited by T_{jmax} | I_{CM} | 80 | A |
| Short Circuit Withstand Time, $V_{GE}=15V$, $V_{CE} \leq 400V$ | T_{SC} | 5 | μs |
| Diode Pulsed Current, t_p limited by T_{jmax} | I_{Fpuls} | 80 | A |
| Power Dissipation, $T_j=175^\circ C, T_c=25^\circ C$ | P_{tot} | 166 | W |



| | | | |
|--|-------|------------|----|
| Operating Junction Temperature | T_j | -40...+175 | °C |
| Storage Temperature | T_s | -55...+150 | °C |
| Soldering Temperature, wave soldering 1.6mm (0.063in.) from case for 10s | | 260 | °C |

Electrical Characteristics of the IGBT ($T_j = 25^\circ\text{C}$ unless otherwise specified):

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|--------------------------------------|---------------|---|------|----------------------|-----------|------|
| Static | | | | | | |
| Collector-Emitter Breakdown Voltage | BV_{CES} | $V_{GE}=0V, I_C=1mA$ | 650 | | - | V |
| Gate Threshold Voltage | $V_{GE(th)}$ | $V_{GE}=V_{CE}, I_C=250\mu A$ | 4.1 | 5.0 | 5.7 | V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE}=15V, I_C=20A$ $T_j=25^\circ\text{C}$, $T_j=125^\circ\text{C}$ $T_j=150^\circ\text{C}$ | | 1.90 2.25 2.35 | 2.20 | V |
| Zero Gate Voltage Collector Current | I_{CES} | $V_{CE}=650V, V_{GE}=0V$ $T_j=25^\circ\text{C}$, $T_j=150^\circ\text{C}$ | | | 0.25 | mA |
| Gate-Emitter Leakage Current | I_{GES} | $V_{CE}=0V, V_{GE}=\pm 20V$ | | | ± 200 | nA |
| Transconductance | g_{fs} | $V_{CE}=20V, I_C=20A$ | | 10 | | S |

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---------------------------------|-------------|---|-------|-------|------|------|
| Dynamic | | | | | | |
| Input Capacitance | C_{ies} | $V_{CE}=25V, V_{GE}=0V,$ $f=1MHz$ | - | 0.99 | - | nF |
| Output capacitance | C_{oes} | | 0.056 | | | |
| Reverse Transfer Capacitance | C_{res} | | - | 0.03 | - | |
| Gate Charge | Q_G | $V_{CC}=480V, I_C=20A,$ $V_{GE}=15V$ | - | 0.052 | - | uC |
| Short circuit collector current | $I_{C(sc)}$ | $V_{GE}=15V, t_{sc} \leq 5$ us $V_{CC}=400V,$ $T_{j, start}=25^\circ\text{C}$ | - | 98 | - | A |



Electrical Characteristics of the Diode (T_j= 25°C unless otherwise specified):

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|-----------------------|----------------|--|------|----------------------|------|------|
| Static | | | | | | |
| Diode Forward Voltage | V _F | I _F = 20A T _j = 25°C, T _j = 125°C T _j = 150°C | | 1.90 1.85 1.85 | | V |

Switching Characteristic, Inductive Load

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|--|---------------------|--|------|------|------|------|
| Dynamic , at T_j= 25°C | | | | | | |
| Turn-on Delay Time | t _{d(on)} | T _j =25°C V _{CC} = 400V, I _C =20A, V _{GE} =0/15V, R _g =12 Ω | - | 13 | - | ns |
| Rise Time | t _r | | - | 20 | - | ns |
| Turn-on Energy | E _{on} | | - | 1.0 | - | mJ |
| Turn-off Delay Time | t _{d(off)} | | - | 60 | - | ns |
| Fall Time | t _f | | - | 40 | - | ns |
| Turn-off Energy | E _{off} | | - | 0.2 | - | mJ |
| Dynamic , at T_j= 125°C | | | | | | |
| Turn-on Delay Time | t _{d(on)} | T _j =25°C V _{CC} = 400V, I _C =20A, V _{GE} =0/15V, R _g =12 Ω | - | 22 | - | ns |
| Rise Time | t _r | | - | 25 | - | ns |
| Turn-on Energy | E _{on} | | - | 1.44 | - | mJ |
| Turn-off Delay Time | t _{d(off)} | | - | 90 | - | ns |
| Fall Time | t _f | | - | 48 | - | ns |
| Turn-off Energy | E _{off} | | - | 0.25 | - | mJ |
| Dynamic , at T_j= 150°C | | | | | | |
| Turn-on Delay Time | t _{d(on)} | T _j =25°C V _{CC} = 400V, I _C =20A, V _{GE} =0/15V, R _g =12 Ω | - | 24 | - | ns |
| Rise Time | t _r | | - | 28 | - | ns |
| Turn-on Energy | E _{on} | | - | 1.68 | - | mJ |
| Turn-off Delay Time | t _{d(off)} | | - | 95 | - | ns |
| Fall Time | t _f | | - | 53 | - | ns |
| Turn-off Energy | E _{off} | | - | 0.28 | - | mJ |



Electrical Characteristics of the DIODE

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|--|------------------|---|------|------|------|------|
| Dynamic , at T_j= 25°C | | | | | | |
| Reverse Recovery Current | I _{rr} | I _F = 20A V _R = 300V, -di/dt =300A/μs | - | 15 | - | A |
| Reverse Recovery Charge | Q _{rr} | | - | 0.6 | - | uC |
| Reverse Recovery Energy | E _{rec} | | - | 0.72 | | mJ |
| Dynamic , at T_j= 125°C | | | | | | |
| Reverse Recovery Current | I _{rr} | I _F = 20A V _R = 300V, -di/dt =300A/μs | - | 20 | - | A |
| Reverse Recovery Charge | Q _{rr} | | - | 1.1 | - | uC |
| Reverse Recovery Energy | E _{rec} | | - | 1.35 | | mJ |
| Dynamic , at T_j= 150°C | | | | | | |
| Reverse Recovery Current | I _{rr} | I _F = 20A V _R = 300V, -di/dt =300A/μs | - | 22 | - | A |
| Reverse Recovery Charge | Q _{rr} | | - | 1.3 | - | uC |
| Reverse Recovery Energy | E _{rec} | | - | 1.50 | | mJ |

Thermal Resistance

| Parameter | Symbol | Max. Value | Unit |
|---|----------------------|------------|------|
| IGBT Thermal Resistance, Junction - Case | R _{th(j-c)} | 0.9 | K/W |
| Diode Thermal Resistance, Junction - Case | R _{th(j-c)} | 1.5 | K/W |
| Thermal Resistance, Junction - Ambient | R _{th(j-a)} | 40 | K/W |

Fig. 1 FBSOA characteristics

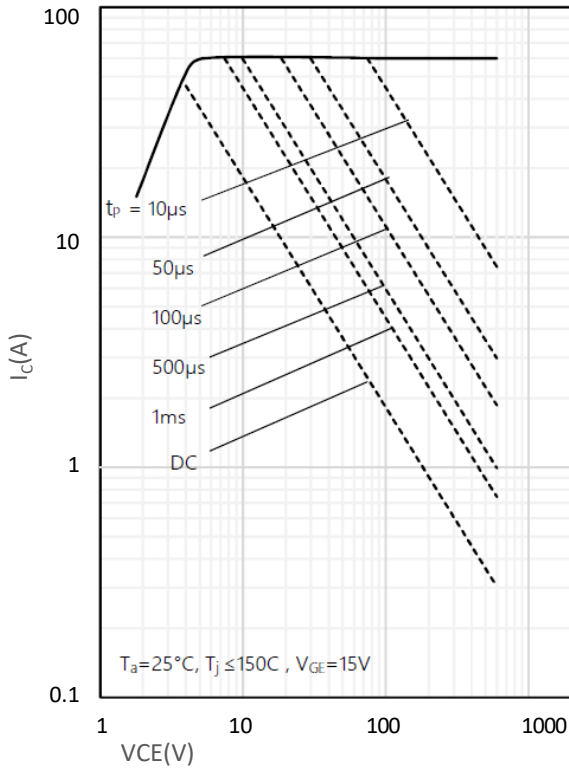


Fig. 2 Load Current vs. Frequency

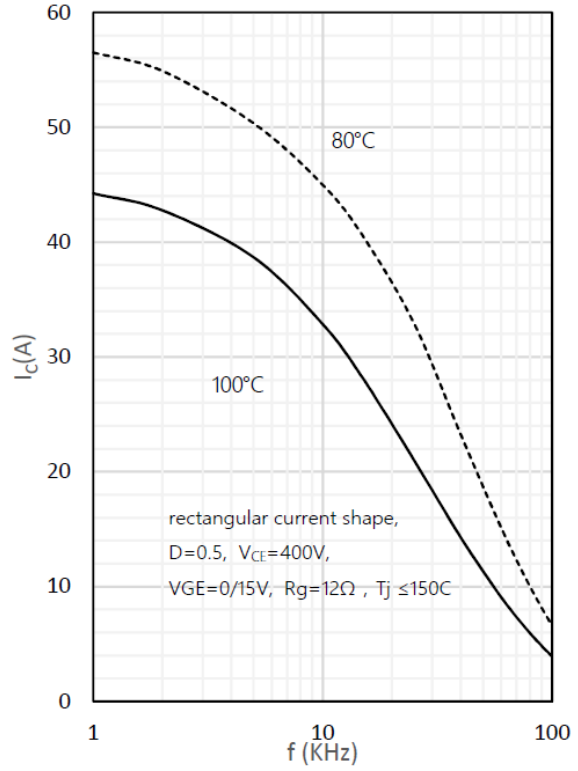


Fig. 3 Output characteristics

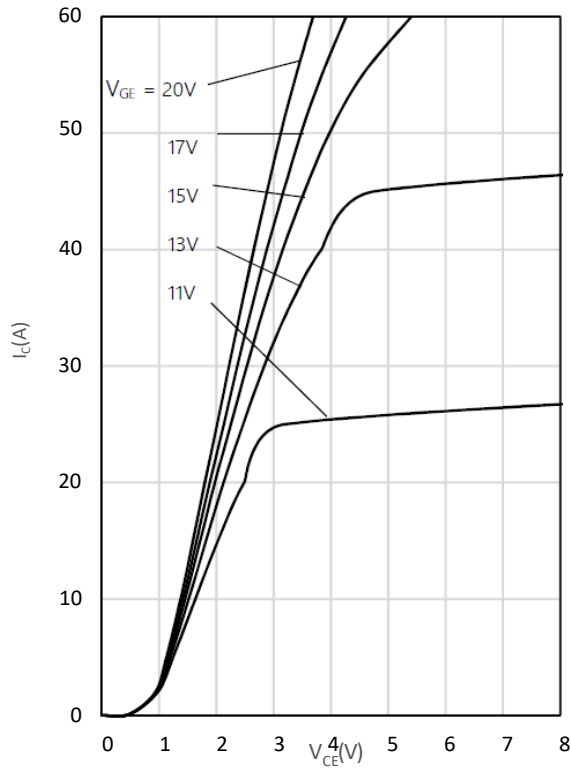


Fig. 4 Saturation voltage characteristics

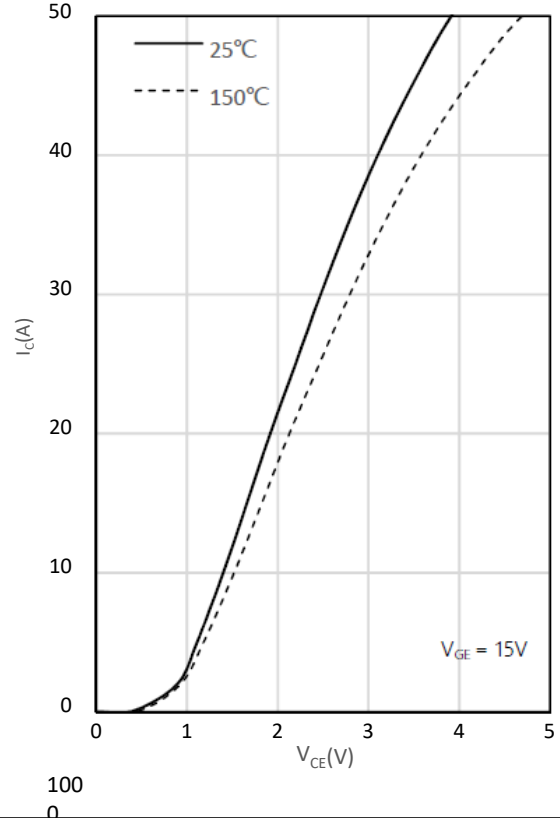




Fig. 5 Switching times vs. gate resistor

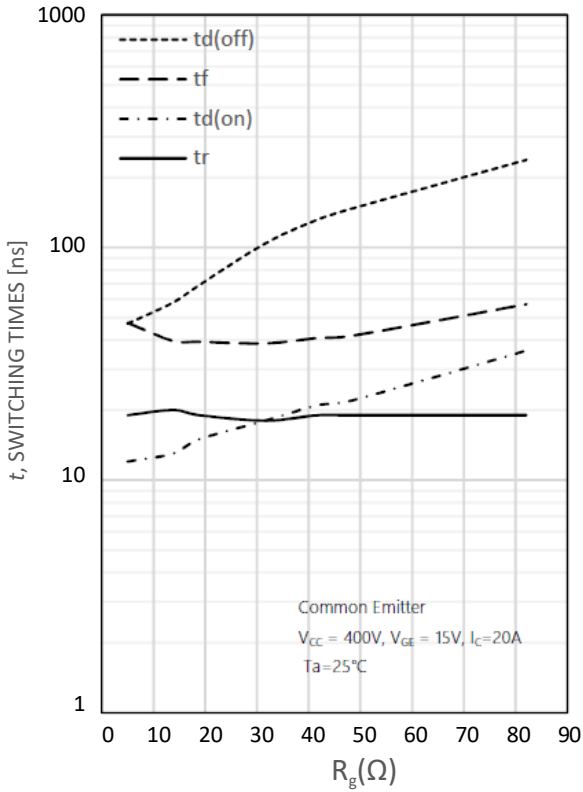


Fig. 6 Switching times vs. collector current

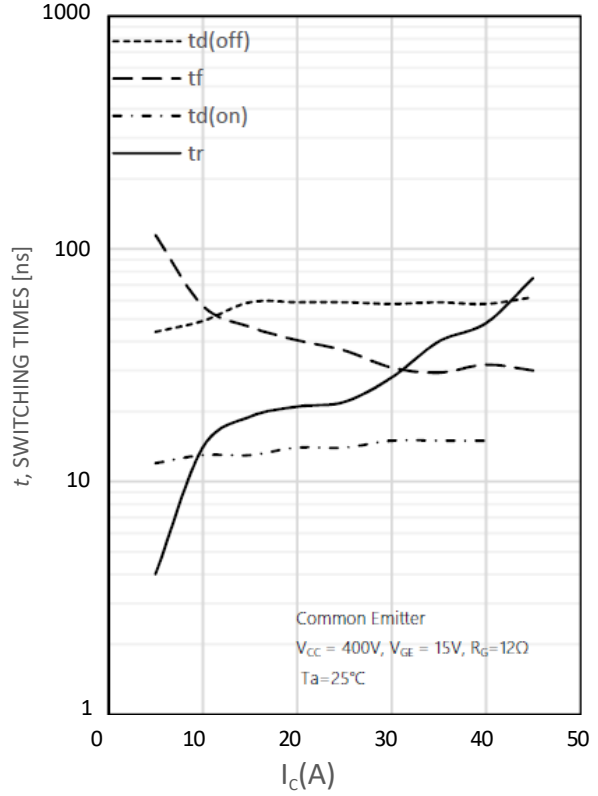


Fig. 7 Switching loss vs. gate resistor

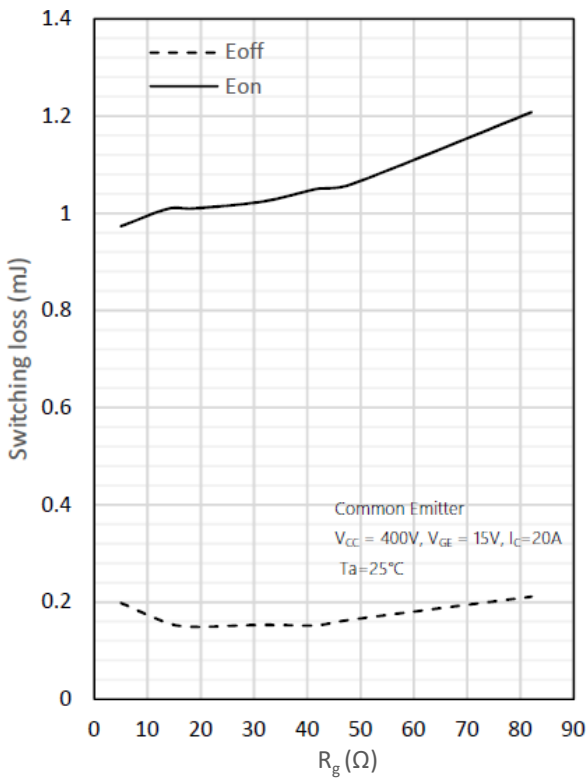


Fig. 8 Switching loss vs. collector current

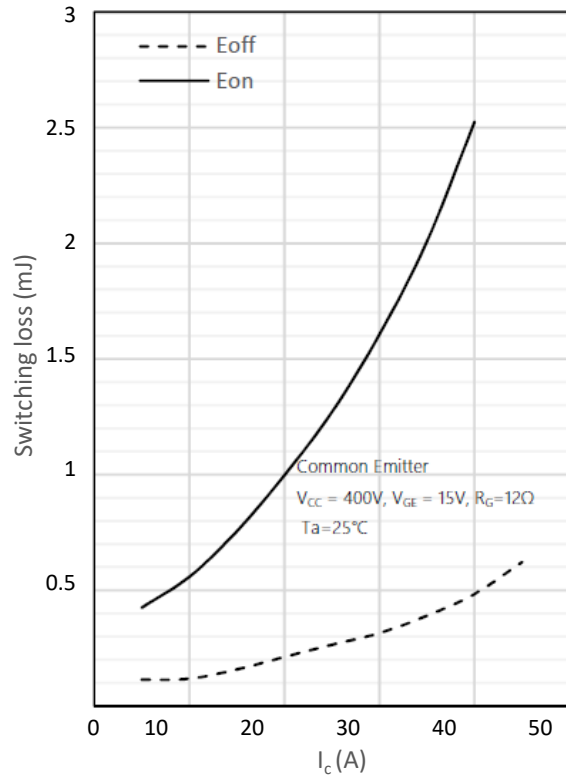




Fig. 9 Gate charge characteristics

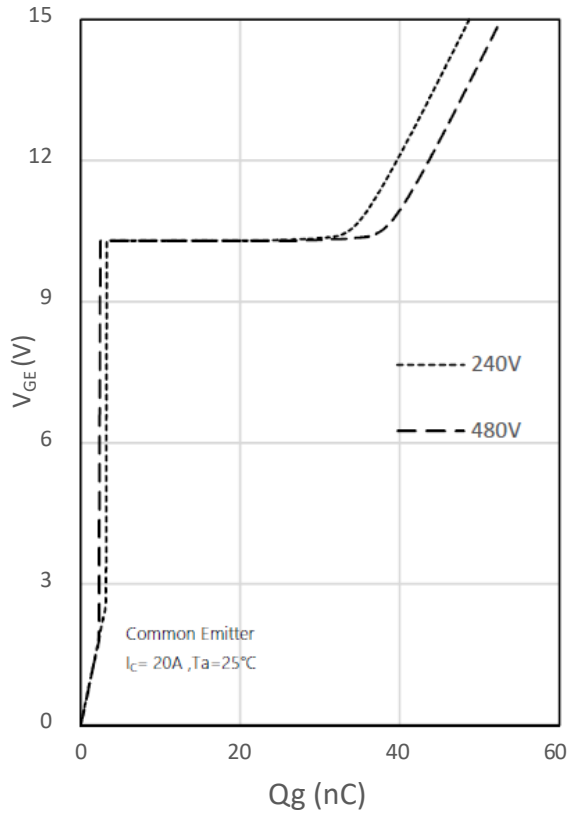
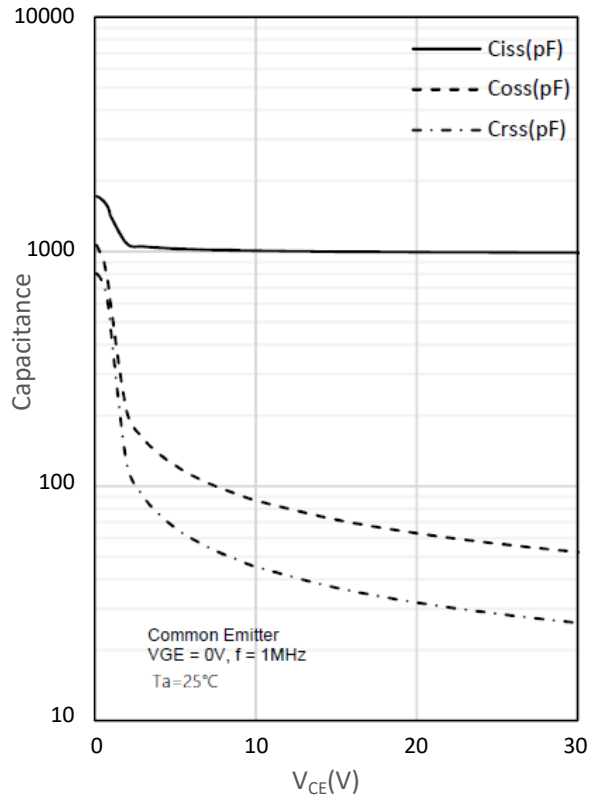
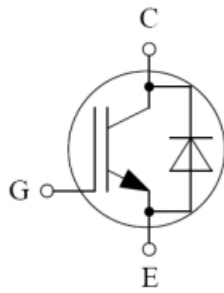


Fig. 10 Capacitance characteristics



- Circuit Diagram



- Package Outline Information

CASE: TO 247

