TOSHIBA INTEGRATED IGBT MODULE SILICON N CHANNEL IGBT

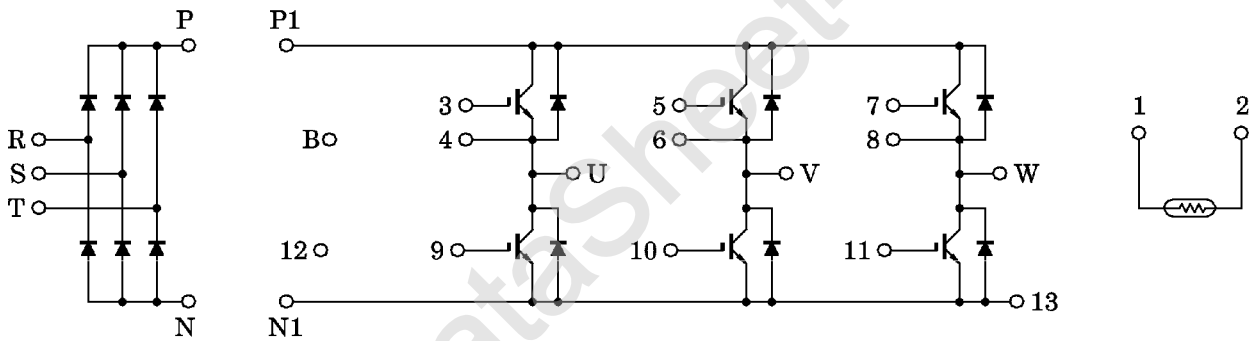
# MIG10Q806H, MIG10Q806HA

HIGH POWER SWITCHING APPLICATIONS

MOTOR CONTROL APPLICATIONS

- Integrates Inverter, Converter Power Circuits and Thermistor in One Package.
- Output (Inverter Stage) : 3$\phi$ 10 A / 1200 V IGBT
- Input (Converter Stage) : 3$\phi$ 15 A / 1600 V Silicon Rectifier
- The Electrodes are Isolated from Case.
- Outline
  MIG10Q806H : 2-108E5A
  MIG10Q806HA : 2-108E6A
- Weight : 190 g

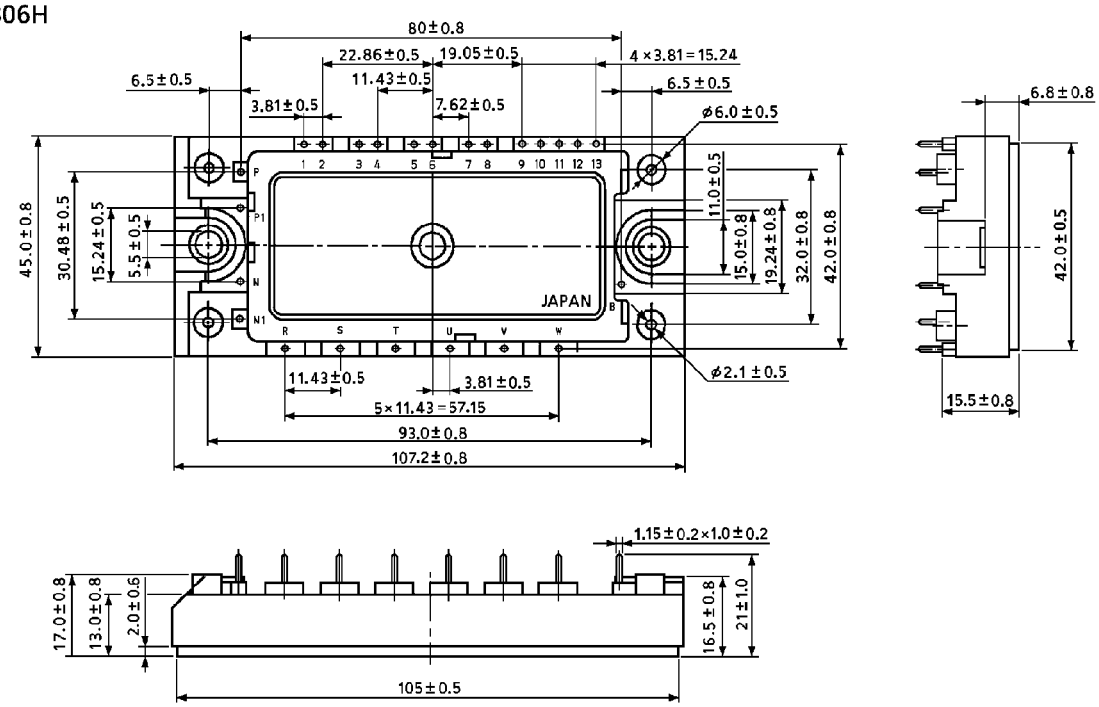
EQUIVALENT CIRCUIT



**Package Dimension**

Unit : mm

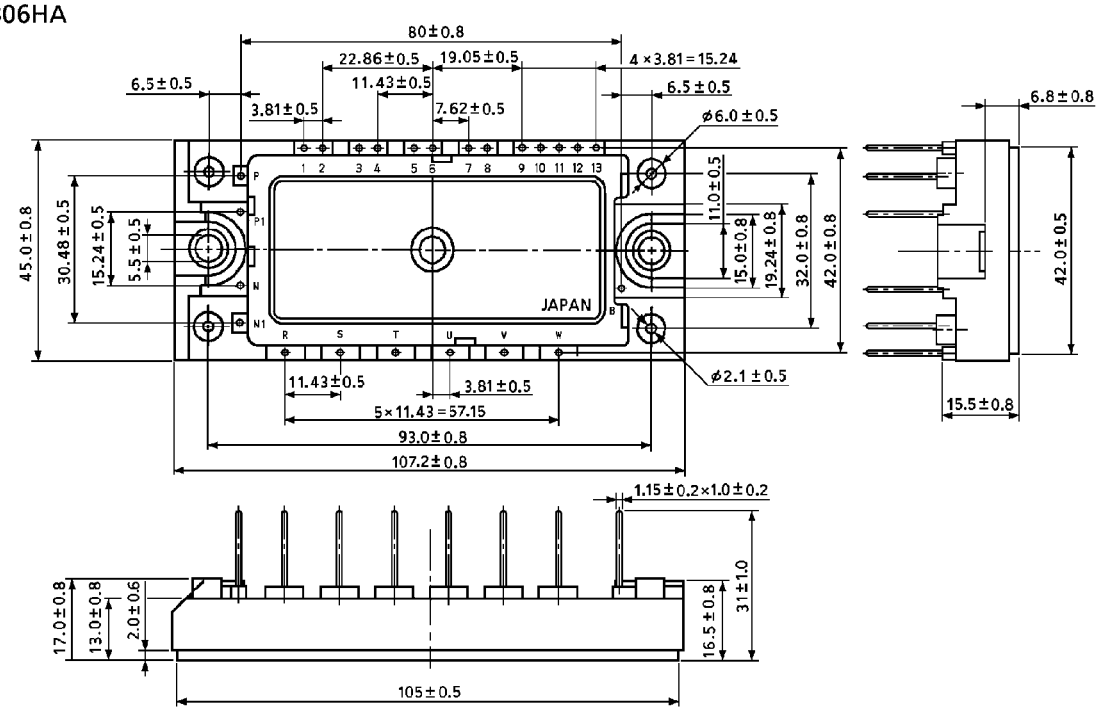
MIG10Q806H




2-108E5A

Unit : mm

MIG10Q806HA




2-108E6A

MAXIMUM RATINGS (Ta = 25°C)

| STAGE | CHARACTERISTIC | | SYMBOL | RATING | UNIT | |
|---|---|---|---|---|---|---|
| Inverter | Collector-Emitter Voltage | | $V_{CES}$ | 1200 | V | |
| | Gate-Emitter Voltage | | $V_{GES}$ | ±20 | V | |
| | Collector Current | DC | $I_C$ | 15 / 10 | A | (25°C / 80°C) |
| | | 1 ms | $I_{CP}$ | 30 / 20 | A | (25°C / 80°C) |
| | Forward Current | DC | $I_F$ | 10 | A | |
| | | 1 ms | $I_{FM}$ | 20 | A | |
| | Collector Power Dissipation (Tc = 25°C) | | $P_C$ | 82 | W | |
| Converter | Repetitive Peak Reverse Voltage | | $V_{RRM}$ | 1600 | V | |
| | Average Output Rectified Current | | $I_O$ | 15 | A | |
| | Peak One Cycle Surge Forward Current (50 Hz, Non-Repetitive) | | $I_{FSM}$ | 250 | A | |
| Module | Junction Temperature | | $T_j$ | 150 | °C | |
| | Storage Temperature Range | | $T_{stg}$ | −40~125 | °C | |
| | Isolation Voltage | | $V_{Isol}$ | 2500 (AC 1 minute) | V | |
| | Screw Torque | | — | 6 | N·m | |

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

a. Inverter stage

| CHARACTERISTIC | | SYMBOL | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|
| Gate Leakage Current | | $I_{GES}$ | $V_{GE}$ = ±20 V, $V_{CE}$ = 0 | | — | — | ±500 | nA |
| Collector Cut-Off Current | | $I_{CES}$ | $V_{CE}$ = 1200 V, $V_{GE}$ = 0 | | — | — | 0.5 | mA |
| Gate-Emitter Cut-Off Voltage | | $V_{GE\ (off)}$ | $I_C$ = 10 mA, $V_{CE}$ = 5 V | | — | 6.0 | — | V |
| Collector-Emitter Saturation Voltage | | $V_{CE\ (sat)}$ | $I_C$ = 10 A, $V_{GE}$ = 15 V | $T_j$ = 25°C | — | 2.8 | 3.2 | V |
| | | | | $T_j$ = 125°C | — | 3.1 | 3.7 | |
| Input Capacitance | | $C_{ies}$ | $V_{CE}$ = 10 V, $V_{GE}$ = 0, f = 1 MHz | | — | 1200 | — | pF |
| Switching Time | Rise Time | $t_r$ | $V_{CC}$ = 600 V, $I_C$ = 10 A, $V_{GE}$ = ±15 V, $R_G$ = 120 Ω, $T_j$ = 125°C (Note 1) | | — | 0.07 | 0.15 | μs |
| | Turn-On Time | $t_{on}$ | | | — | 0.15 | 0.30 | |
| | Fall Time | $t_f$ | | | — | 0.07 | 0.10 | |
| | Turn-Off Time | $t_{off}$ | | | — | 0.60 | 0.90 | |
| Forward Voltage | | $V_F$ | $I_F$ = 10 A, $V_{GE}$ = 0 | | — | 2.0 | 2.8 | V |
| Reverse Recovery Time | | $t_{rr}$ | $I_F$ = 10 A, $V_{GE}$ = −10 V, di / dt = 200 A / μs | | — | 0.10 | 0.25 | μs |
| Thermal Resistance | | $R_{th\ (j-c)}$ | Transistor | | — | — | 1.52 | °C / W |
| | | | Diode | | — | — | 1.5 | |

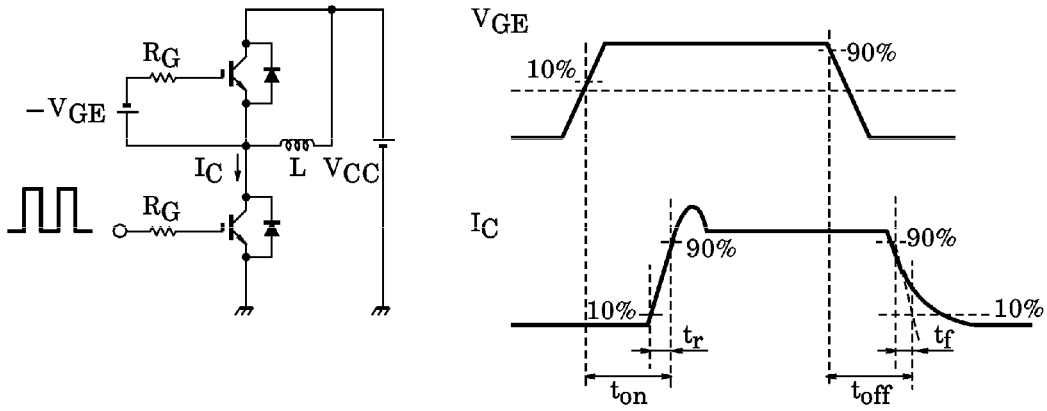
b. Converter stage

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Repetitive Peak Reverse Current | $I_{RRM}$ | $V_{RRM}$ = 1600 V | — | — | 50 | μA |
| Peak Forward Voltage | $V_{FM}$ | $I_{FM}$ = 15 A | — | 1.05 | 1.20 | V |
| Peak One Cycle Surge Forward Current | $I_{FSM}$ | 50 Hz sine-half-wave | 250 | — | — | A |
| Thermal Resistance | $R_{th\ (j-c)}$ | — | — | — | 1.90 | °C / W |

c. Thermistor

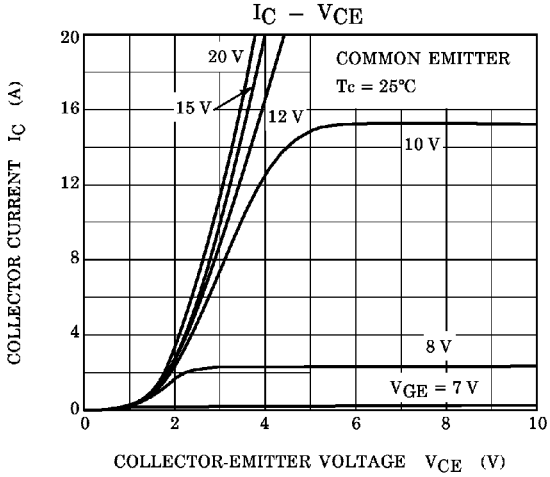
| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Zero-power Resistance | $R_{25}$ | $I_{TM}$ = 0.2 mA, Tc = 25°C | 17.31 | 20 | 23.14 | kΩ |
| B Value | $B_{25\ /\ 85}$ | Tc = 25°C / Tc = 85°C | — | 3760 | — | K |

(Note 1) Switching Time Test Circuit & Timing Chart

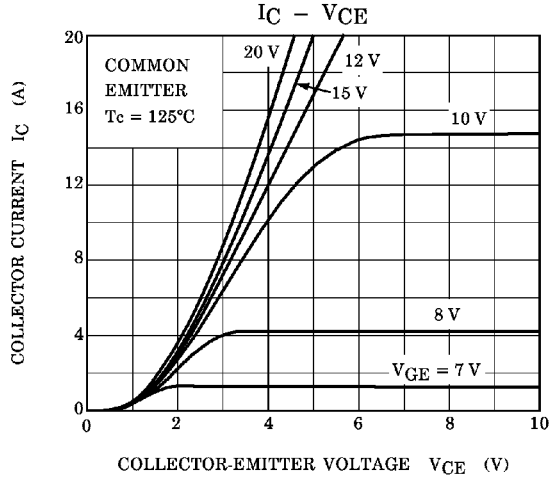


a. Inverter stage

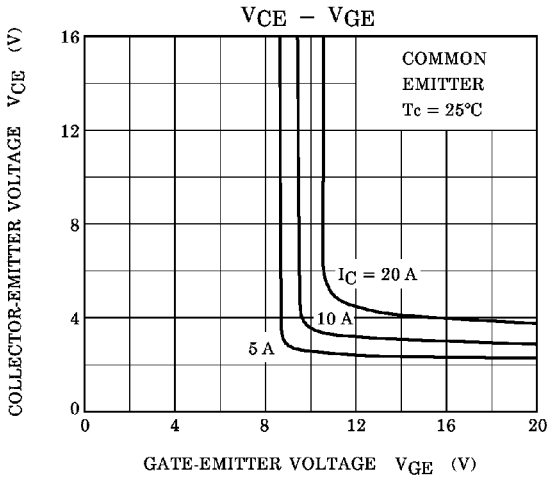
$I_C$ – $V_{CE}$



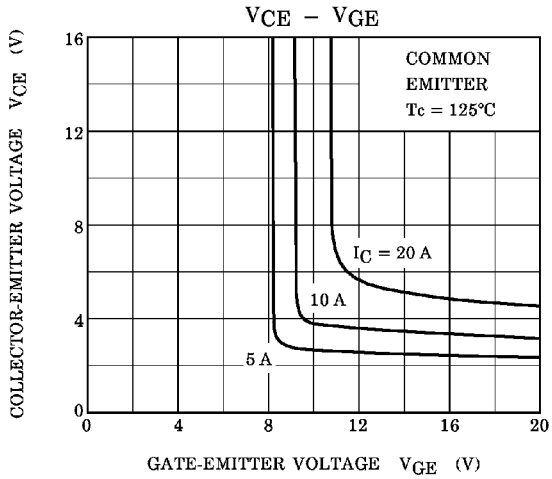

$I_C$ – $V_{CE}$



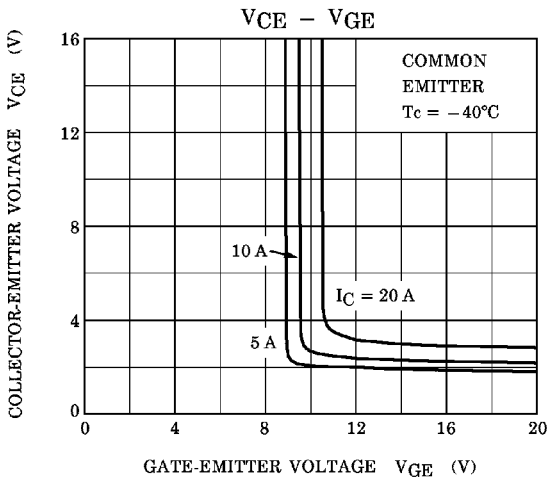

$V_{CE}$ – $V_{GE}$



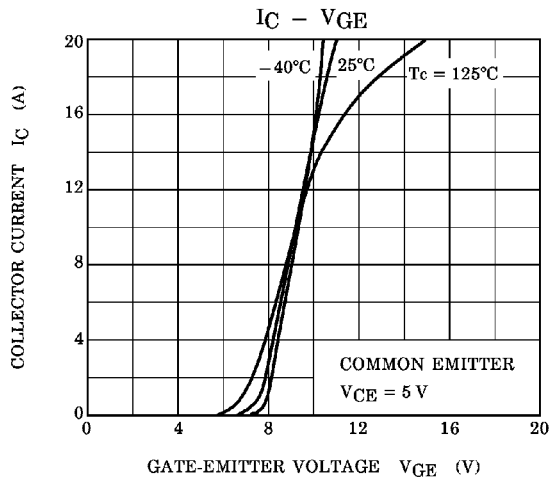

$V_{CE}$ – $V_{GE}$



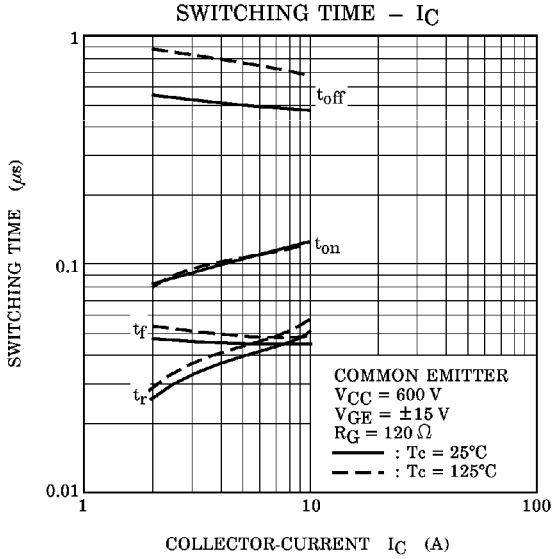

$V_{CE}$ – $V_{GE}$



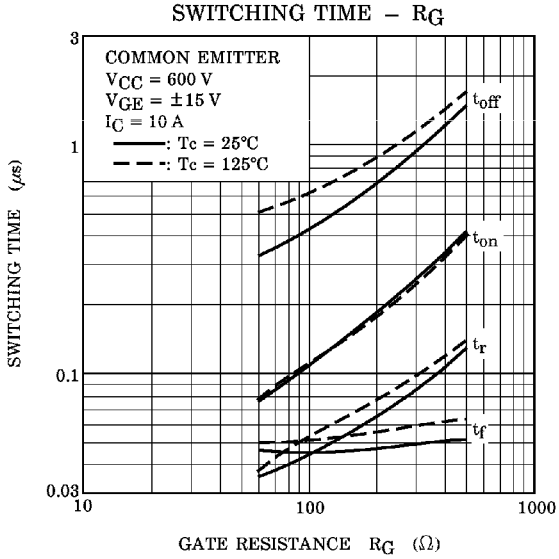

$I_C$ – $V_{GE}$



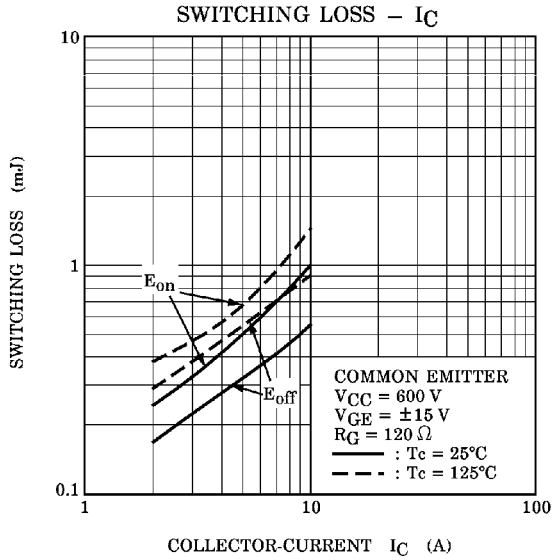
SWITCHING TIME – $I_C$



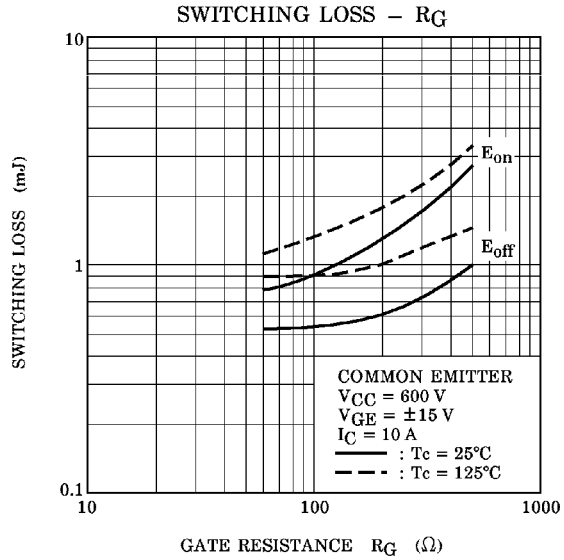

SWITCHING TIME – $R_G$



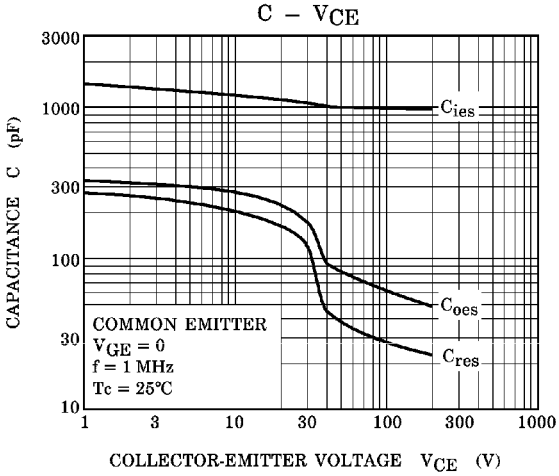

SWITCHING LOSS – $I_C$



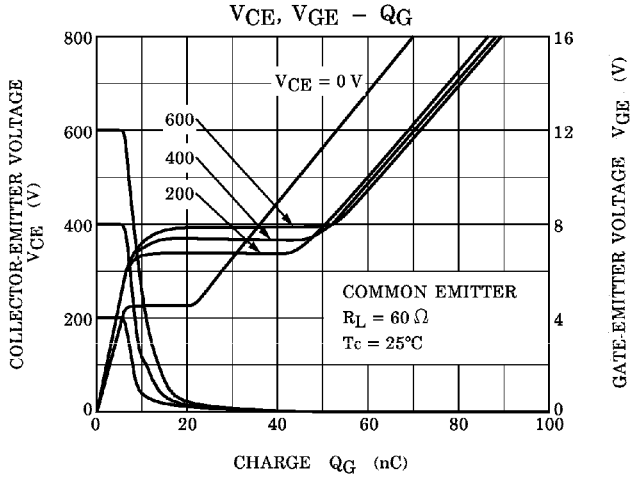

SWITCHING LOSS – $R_G$



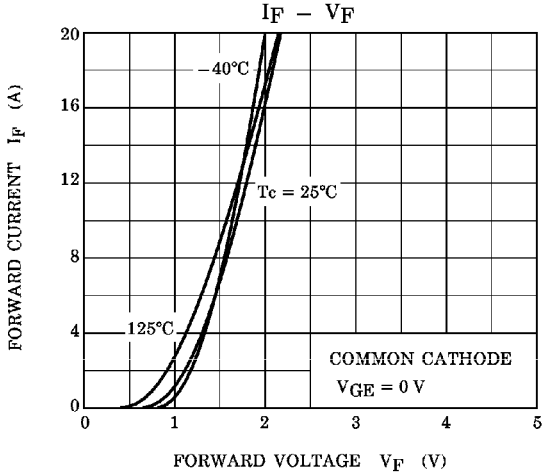
C – $V_{CE}$



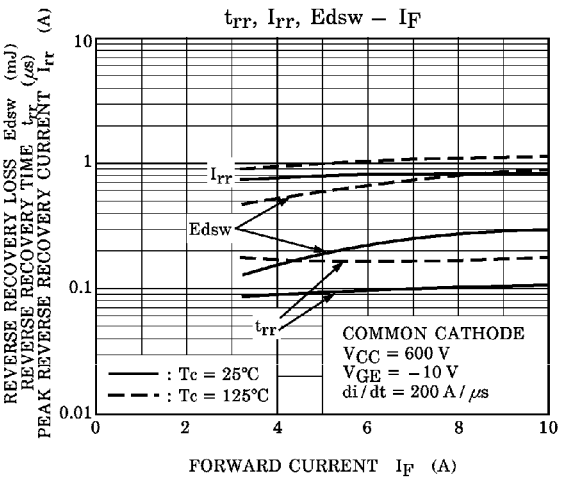

$V_{CE}$, $V_{GE}$ – $Q_G$



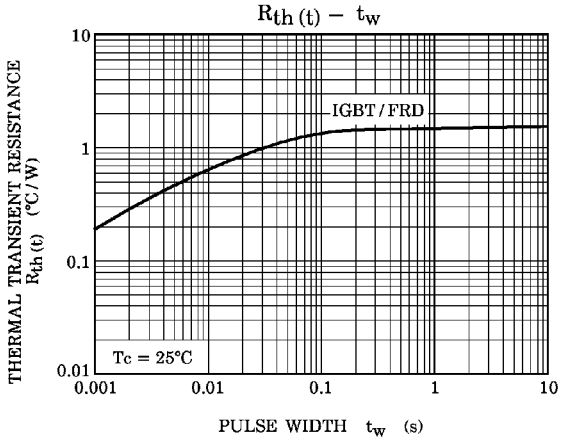

$I_F$ – $V_F$



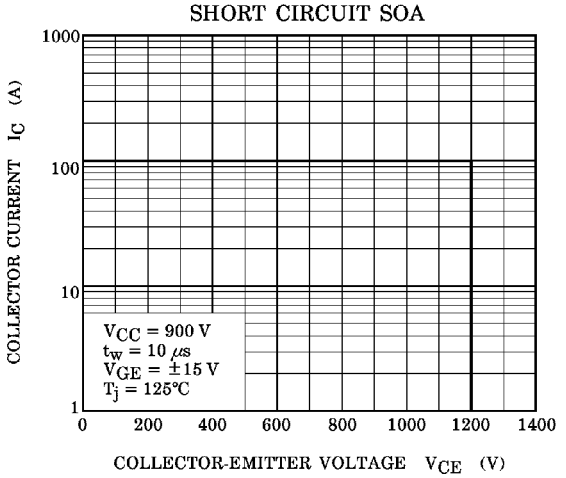

$t_{rr}$, $I_{rr}$, Edsw – $I_F$



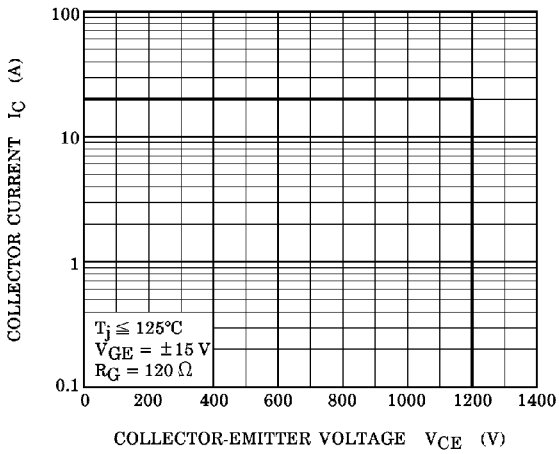

$R_{th\,(t)}$ – $t_w$




SHORT CIRCUIT SOA

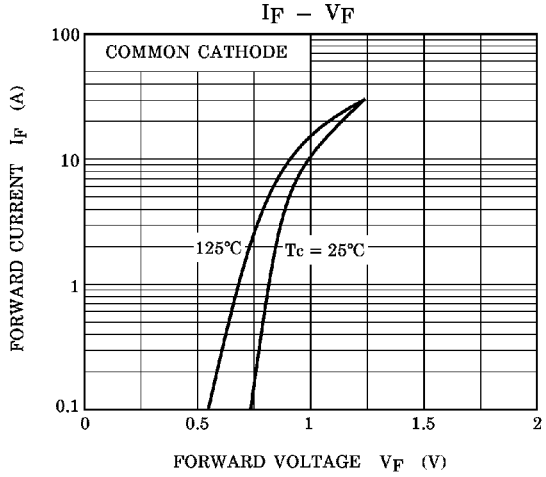


REVERSE BIAS SOA




b. Converter stage

$I_F - V_F$




$R_{th}(t) - t_w$