**TENTATIVE** TOSHIBA INTEGRATED IGBT MODULE SILICON N CHANNEL IGBT

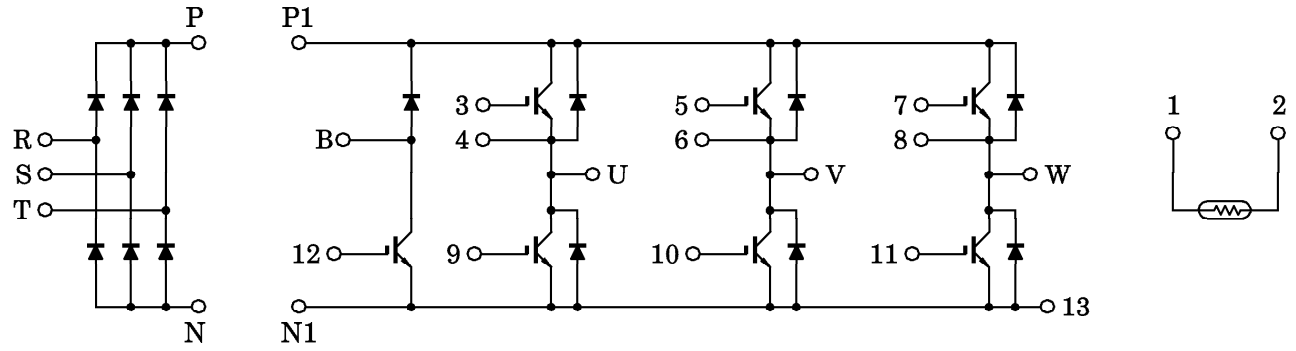
# MIG20J906H, MIG20J906HA

HIGH POWER SWITCHING APPLICATIONS

MOTOR CONTROL APPLICATIONS

- Integrates Inverter, Converter and Brake Power Circuits and Thermistor in One Package.
- Output (Inverter Stage)
  : 3$\phi$ 20A / 600V IGBT
- Input (Converter Stage)
  : 3$\phi$ 30A / 800V Silicon Rectifier
- The Electrodes are Isolated from Case.
- Outline
  MIG20J906H : 2-108E5A
  MIG20J906HA : 2-108E6A
- Weight : 190g

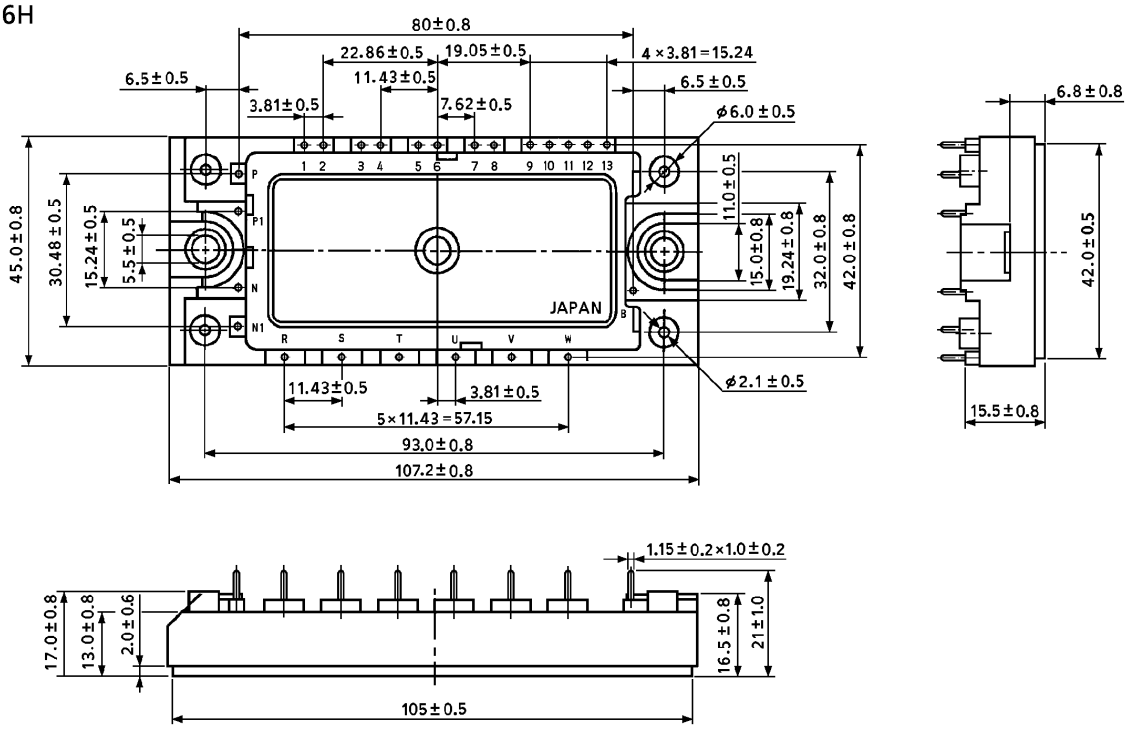
EQUIVALENT CIRCUIT



**Package Dimension**

Unit : mm

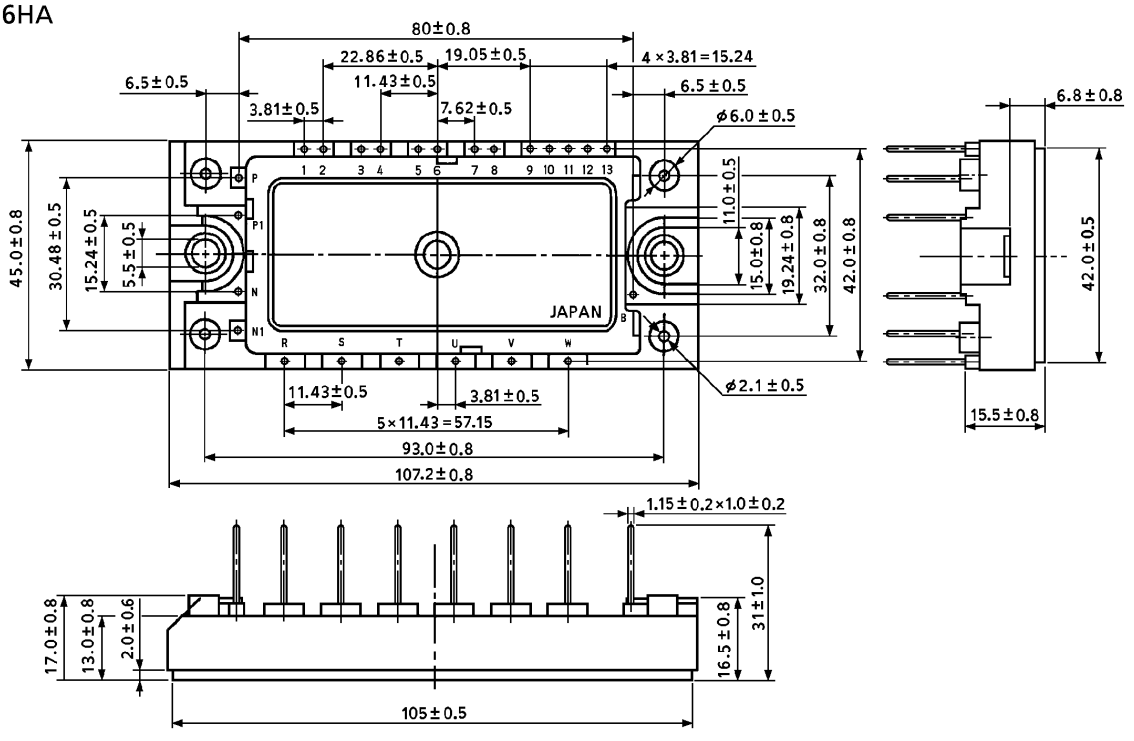
MIG20J906H




2-108E5A

Unit : mm

MIG20J906HA




2-108E6A

MAXIMUM RATINGS (Ta = 25°C)

| STAGE | | CHARACTERISTIC | | SYMBOL | RATING | UNIT | |
|---|---|---|---|---|---|---|---|
| Inverter | | Collector-Emitter Voltage | | $V_{CES}$ | 600 | V | |
| | | Gate-Emitter Voltage | | $V_{GES}$ | ±20 | V | |
| | | Collector Current | DC | $I_C$ | 25 / 20 | A | (25°C / 40°C) |
| | | | 1ms | $I_{CP}$ | 50 / 40 | A | (25°C / 40°C) |
| | | Forward Current | DC | $I_F$ | 20 | A | |
| | | | 1ms | $I_{FM}$ | 40 | A | |
| | | Collector Power Dissipation (Tc = 25°C) | | $P_C$ | 90 | W | |
| Converter | | Repetitive Peak Reverse Voltage | | $V_{RRM}$ | 800 | V | |
| | | Average Output Rectified Current | | $I_O$ | 30 | A | |
| | | Peak One Cycle Surge Forward Current (50Hz, Non-Repetitive) | | $I_{FSM}$ | 400 | A | |
| Brake | IGBT | Collector-Emitter Voltage | | $V_{CES}$ | 600 | V | |
| | | Gate-Emitter Voltage | | $V_{GES}$ | ±20 | V | |
| | | Collector Current | DC | $I_C$ | 25 / 20 | A | (25°C / 40°C) |
| | | | 1ms | $I_{CP}$ | 50 / 40 | A | (25°C / 40°C) |
| | | Collector Power Dissipation (Tc = 25°C) | | $P_C$ | 90 | W | |
| | FWD | Reverse Voltage | | $V_R$ | 600 | V | |
| | | Forward Current | DC | $I_F$ | 20 | A | |
| | | | 1ms | $I_{FM}$ | 40 | 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 | | $I_{GES}$ | $V_{GE} = \pm 20V$, $V_{CE} = 0$ | | — | — | ±500 | nA |
| Collector Cut-Off Current | | $I_{CES}$ | $V_{CE} = 600V$, $V_{GE} = 0$ | | — | — | 1.0 | mA |
| Gate-Emitter Cut-Off Voltage | | $V_{GE\ (off)}$ | $I_C = 2mA$, $V_{CE} = 5V$ | | 5.0 | — | 8.0 | V |
| Collector-Emitter Saturation Voltage | | $V_{CE\ (sat)}$ | $I_C = 20A$, $V_{GE} = 15V$ | $T_j = 25°C$ | — | 2.1 | 2.7 | V |
| | | | | $T_j = 125°C$ | — | 2.2 | 2.8 | |
| Input Capacitance | | $C_{ies}$ | $V_{CE} = 10V$, $V_{GE} = 0$, f = 1MHz | | — | 1850 | — | pF |
| Switching Time | Rise Time | $t_r$ | $V_{CC} = 300V$, $I_C = 20A$, $V_{GE} = \pm 15V$, $R_G = 62\Omega$ (Note 1) | | — | 0.10 | 0.20 | μs |
| | Turn-On Time | $t_{on}$ | | | — | 0.25 | 0.50 | |
| | Fall Time | $t_f$ | | | — | 0.15 | 0.30 | |
| | Turn-Off Time | $t_{off}$ | | | — | 0.50 | 0.80 | |
| Forward Voltage | | $V_F$ | $I_F = 20A$, $V_{GE} = 0$ | | — | 2.0 | 2.8 | V |
| Reverse Recovery Time | | $t_{rr}$ | $I_F = 20A$, $V_{GE} = -10V$, $di/dt = 100A/\mu s$ | | — | 0.08 | 0.15 | μs |
| Thermal Resistance | | $R_{th\ (j-c)}$ | Transistor | | — | — | 1.39 | °C / W |
| | | | Diode | | — | — | 2.6 | |

b. Converter stage

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Repetitive Peak Reverse Current | $I_{RRM}$ | $V_{RRM} = 800V$ | — | — | 50 | μA |
| Peak Forward Voltage | $V_{FM}$ | $I_{FM} = 30A$ | — | 1.05 | 1.20 | V |
| Peak One Cycle Surge Forward Current | $I_{FSM}$ | 50Hz sine-half-wave | 400 | — | — | A |
| Thermal Resistance | $R_{th\ (j-c)}$ | — | — | — | 1.56 | °C / W |

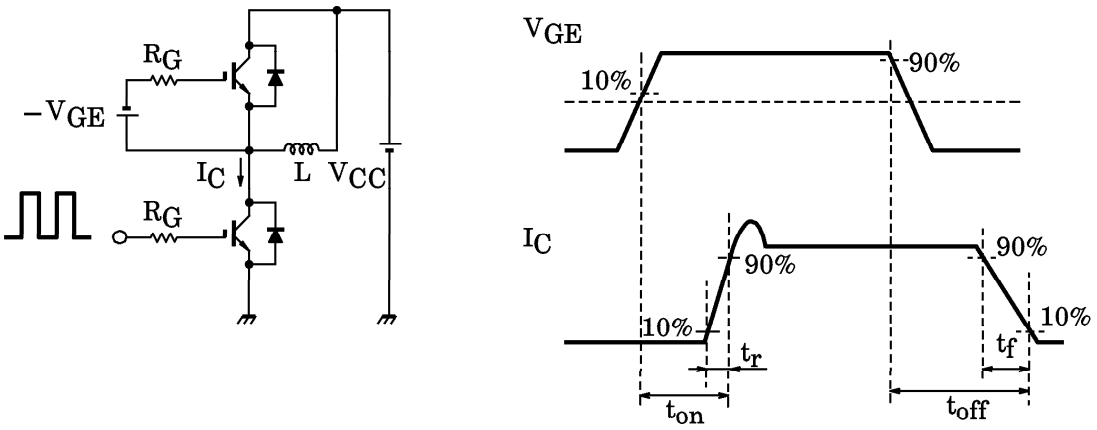
c. Brake stage

| CHARACTERISTIC | | SYMBOL | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|
| Gate Leakage Current | | $I_{GES}$ | $V_{GE}=\pm20V$, $V_{CE}=0$ | | — | — | ±500 | nA |
| Collector Cut-Off Current | | $I_{CES}$ | $V_{CE}=600V$, $V_{GE}=0$ | | — | — | 1.0 | mA |
| Reverse Current | | $I_R$ | $V_R=600V$ | | — | — | 1.0 | mA |
| Gate-Emitter Cut-Off Voltage | | $V_{GE\ (off)}$ | $I_C=2mA$, $V_{CE}=5V$ | | 5.0 | — | 8.0 | V |
| Collector-Emitter Saturation Voltage | | $V_{CE\ (sat)}$ | $I_C=20A$, $V_{GE}=15V$ | $T_j=25°C$ | — | 2.1 | 2.7 | V |
| | | | | $T_j=125°C$ | — | 2.2 | 2.8 | |
| Input Capacitance | | $C_{ies}$ | $V_{CE}=10V$, $V_{GE}=0$, f=1MHz | | — | 1850 | — | pF |
| Switching Time | Rise Time | $t_r$ | $V_{CC}=600V$, $I_C=20A$, $V_{GE}=\pm15V$, $R_G=62\Omega$ (Note 1) | | — | 0.10 | 0.20 | μs |
| | Turn-On Time | $t_{on}$ | | | — | 0.25 | 0.50 | |
| | Fall Time | $t_f$ | | | — | 0.15 | 0.30 | |
| | Turn-Off Time | $t_{off}$ | | | — | 0.50 | 0.80 | |
| Forward Voltage | | $V_F$ | $I_F=20A$, $V_{GE}=0$ | | — | 2.0 | 2.8 | V |
| Thermal Resistance | | $R_{th\ (j-c)}$ | Transistor | | — | — | 1.39 | °C / W |
| | | | Diode | | — | — | 2.6 | |

d. Thermistor

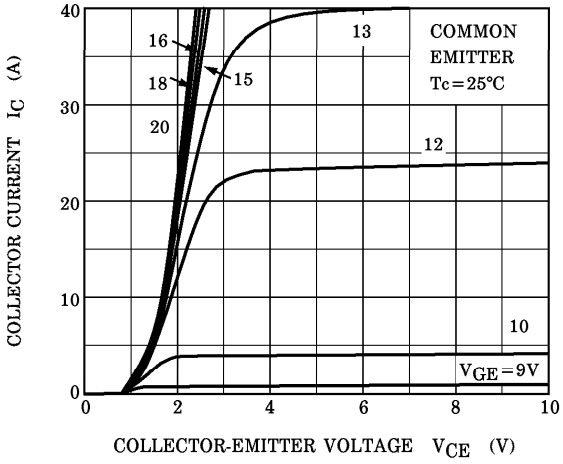
| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Zero-power Resistance | $R_{25}$ | $I_{TM}=0.2mA$, Tc=25°C | 17.31 | 20 | 23.14 | kΩ |
| B Value | $B_{25/85}$ | Tc=25°C / Tc=85°C | — | 3760 | — | K |

(Note 1) Switching Time Test Circuit & Timing Chart

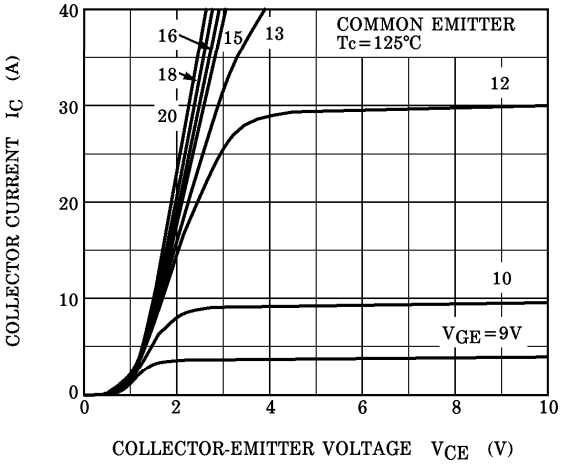


a. Inverter stage / c. Brake stage

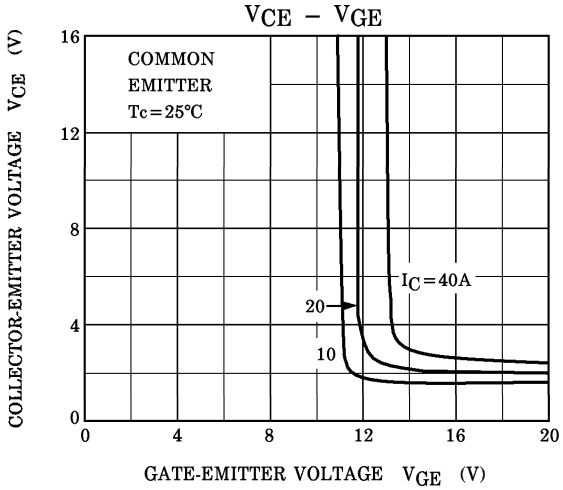
$I_C$ – $V_{CE}$



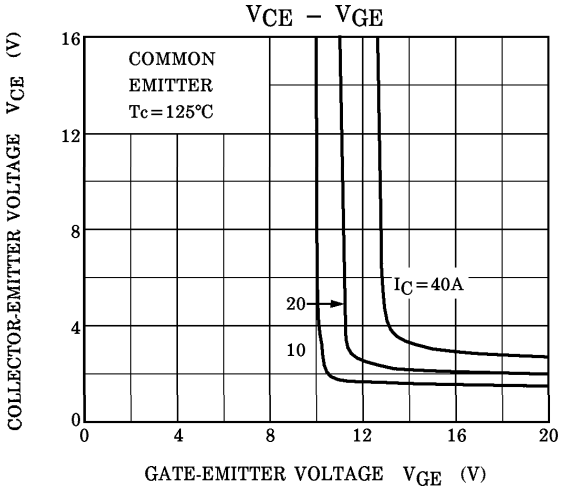

$I_C$ – $V_{CE}$



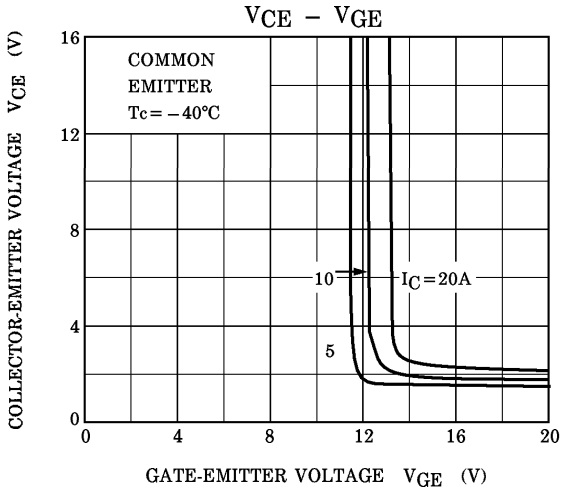

$V_{CE}$ – $V_{GE}$



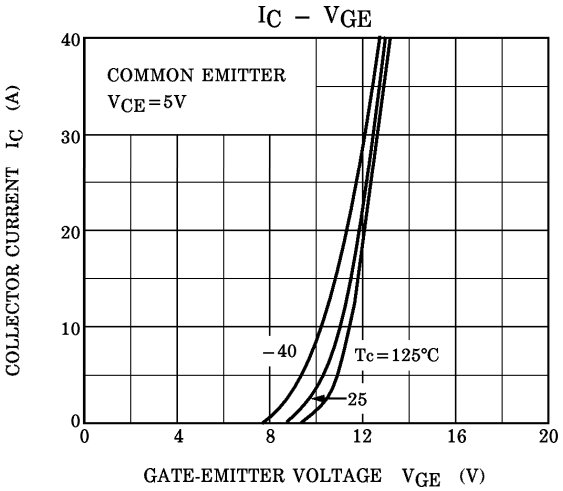

$V_{CE}$ – $V_{GE}$



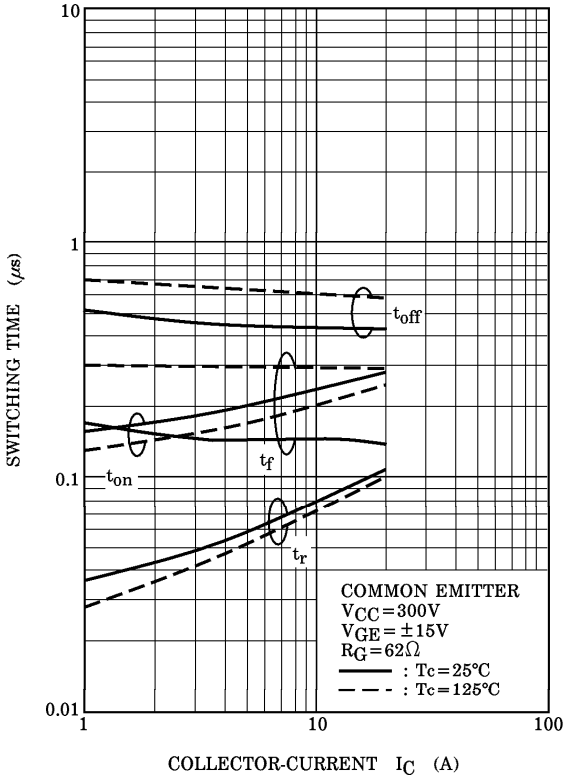

$V_{CE}$ – $V_{GE}$



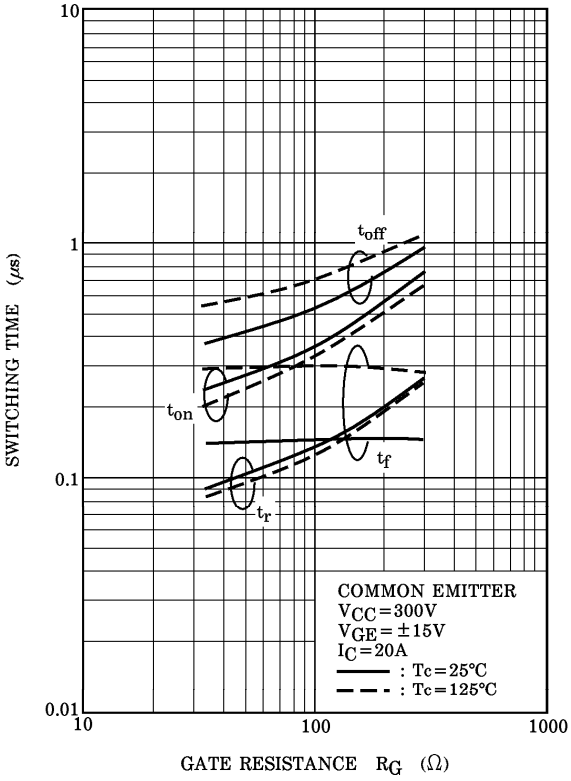

$I_C$ – $V_{GE}$



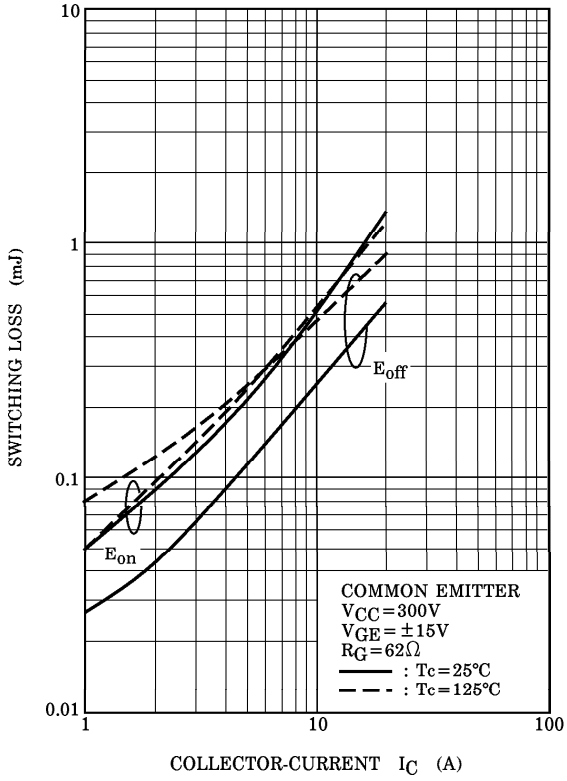
SWITCHING TIME – $I_C$



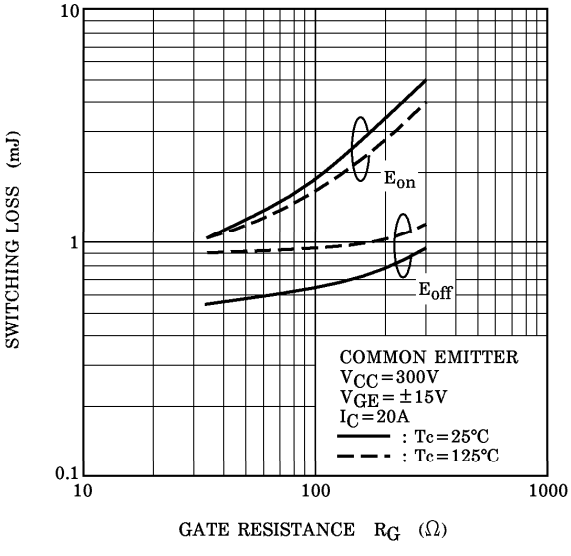

SWITCHING TIME – $R_G$



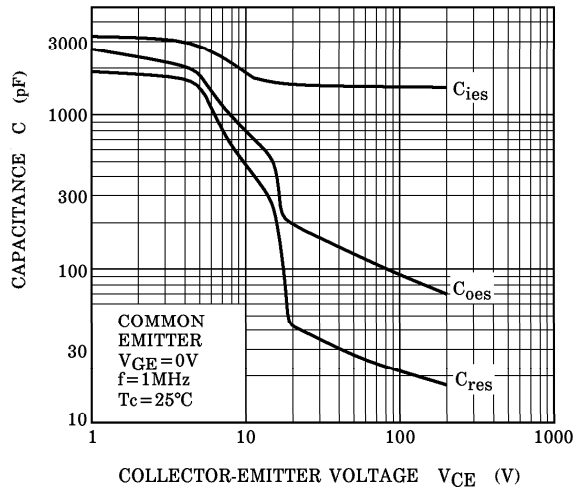

SWITCHING LOSS – $I_C$



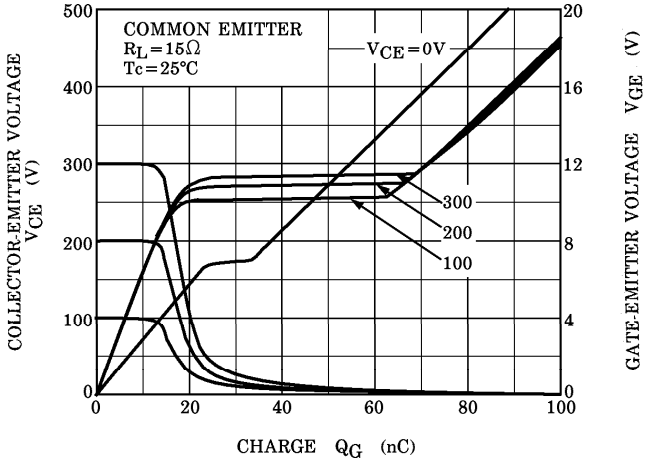

SWITCHING LOSS – $I_C$



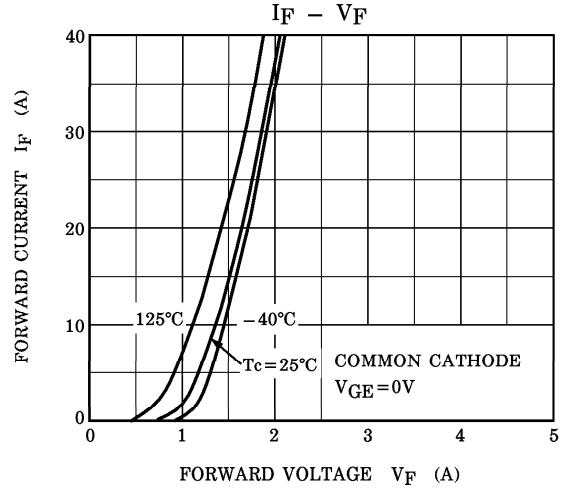
C – $V_{CE}$



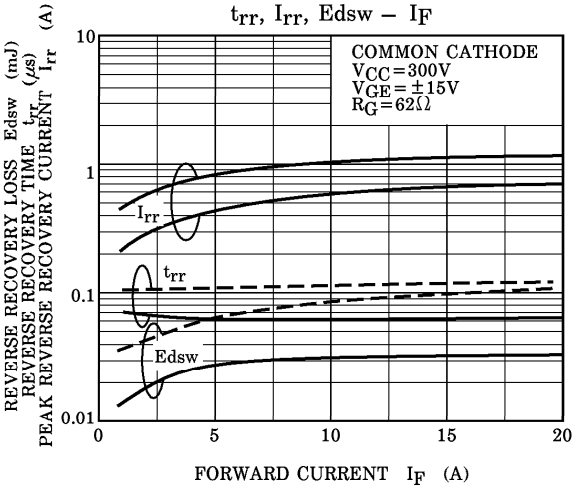

$V_{CE}$, $V_{GE}$ – $Q_G$



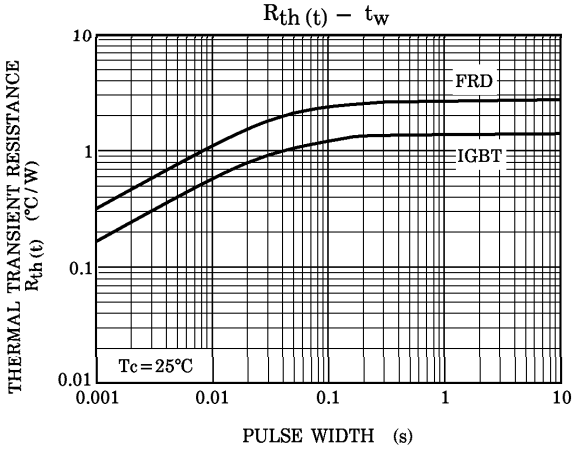

$I_F$ – $V_F$



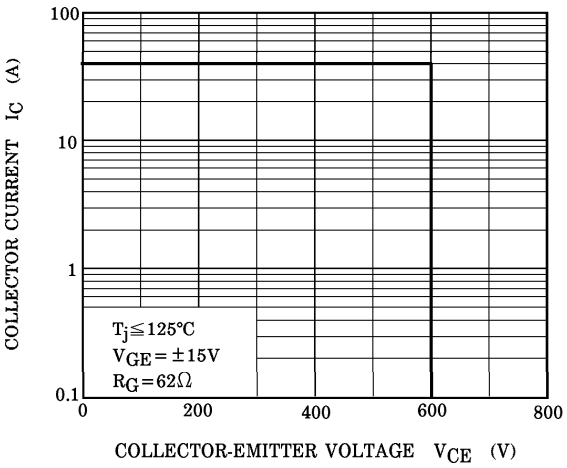

$t_{rr}$, $I_{rr}$, Edsw – $I_F$




$R_{th\,(t)}$ – $t_w$




REVERSE BIAS SOA



b. Converter stage