TOSHIBA INTEGRATED IGBT MODULE SILICON N CHANNEL IGBT

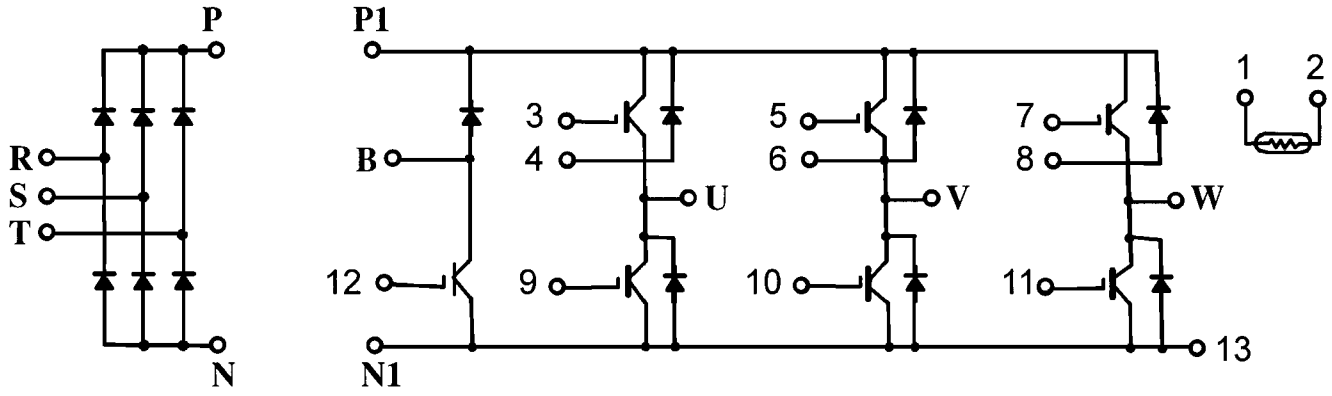
# MIG30J906H, MIG30J906HA

HIGH POWER SWITCHING APPLICATIONS

MOTOR CONTROL APPLICATIONS

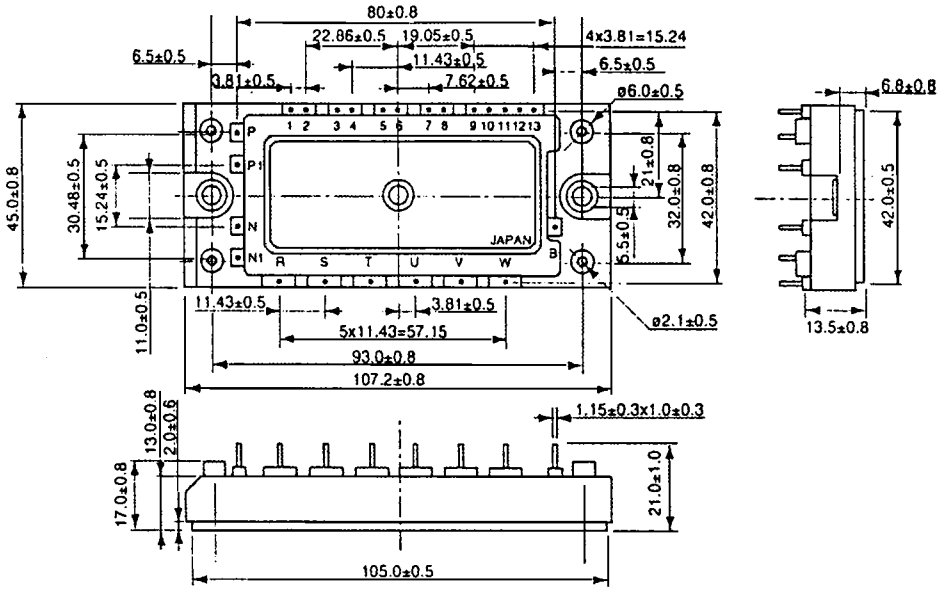
- Integrates Inverter, Converter and Brake Power Circuits and Thermistor in One Package.
- Output (Inverter Stage):
  3ø 30A/600V IGBT
- Input (Converter Stage):
  3ø 30A/800V Silicon Rectifier
- The Electrodes are Isolated from Case.
- Outline:
  MIG30J906H : 2-108E3A
  MIG30J906HA : 2-108E4A
- Weight: 190g

EQUIVALENT CIRCUIT



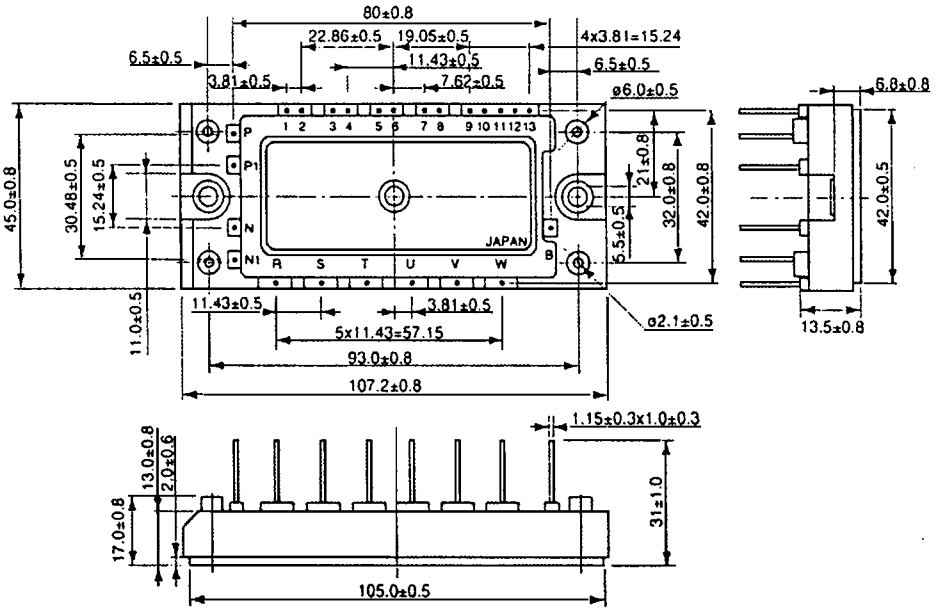

961001EAA2

Package Dimensions Units: mm




2-108E3A

Units: mm




2-108E4A

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 | $I_C$ | 35/30 | A | |
| | | | 1ms | $I_{CP}$ | 70/60 | A | (25°C/40°C) |
| | | Forward Current | DC | $I_F$ | 30 | A | (25°C/40°C) |
| | | | 1ms | $I_{FM}$ | 60 | A | |
| | | Collector Power Dissipation (Tc=25°C) | | $P_C$ | 125 | 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 | $I_C$ | 35/30 | A | (25°C/40°C) |
| | | | 1ms | $I_{CP}$ | 70/60 | A | (25°C/40°C) |
| | | Collector Power Dissipation (Tc=25°C) | | $P_C$ | 125 | W | |
| | FWD | Reverse Voltage | | $V_R$ | 600 | V | |
| | | Forward Current | DC | $I_F$ | 30 | A | |
| | | | 1ms | $I_{FM}$ | 60 | A | |
| Module | | Junction Temperature | | $T_j$ | 150 | °C | |
| | | Storage Temperature Range | | $T_{stg}$ | -40 ~ 125 | °C | |
| | | Isolation Voltage | | $V_{Isol}$ | 2500 (AC 1 min) | 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 | | $I_{GES}$ | $V_{GE}$=±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 | | $V_{GE\ (off)}$ | $I_C$=3mA, $V_{CE}$=5V | | 5.0 | — | 8.0 | V |
| Collector-Emitter Saturation Voltage | | $V_{CE\ (sat)}$ | $I_C$=30A, $V_{GE}$=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 | | — | — | — | pF |
| Switching Time | Rise Time | $t_r$ | $V_{CC}$=300V, $I_C$=30A, $V_{GE}$=±15V, $R_G$=43Ω (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 | | $V_F$ | $I_F$=30A, $V_{GE}$=0 | | — | 2.0 | 2.8 | V |
| Reverse Recovery Time | | $t_{rr}$ | $I_F$=30A, $V_{GE}$=-10V, di/dt=100A/μs | | — | 0.08 | 0.15 | μs |
| Thermal Resistance | | $R_{th(j-c)}$ | Transistor | | — | — | 1.0 | °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 |

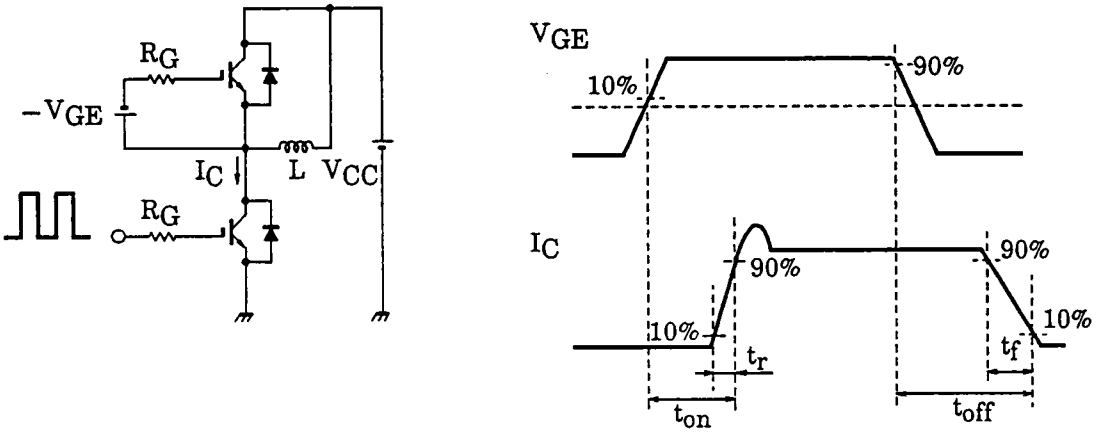
c. Brake stage

| CHARACTERISTIC | | SYMBOL | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|
| Gate Leakage Current | | $I_{GES}$ | $V_{GE}$=±20V, $V_{CE}$=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 | | $V_{GE\ (off)}$ | $I_C$=3mA, $V_{CE}$=5V | | 5.0 | — | 8.0 | V |
| Collector-Emitter Saturation Voltage | | $V_{CE\ (sat)}$ | $I_C$=30A, $V_{GE}$=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 | | — | — | — | pF |
| Switching Time | Rise Time | $t_r$ | $V_{CC}$=300V, $I_C$=30A, $V_{GE}$=±15V, $R_G$=43Ω (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 | | $V_F$ | $I_F$=30A, $V_{GE}$=0 | | — | 2.0 | 2.8 | V |
| Thermal Resistance | | $R_{th(j-c)}$ | Transistor | | — | — | 1.0 | °C/W |
| | | | Diode | | — | — | 2.6 | |

d. Thermistor

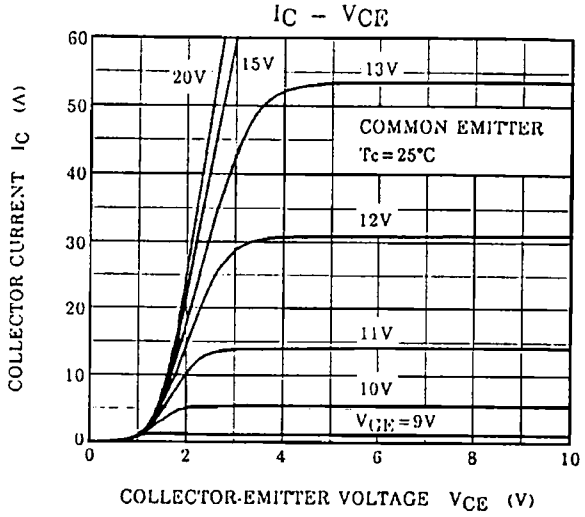
| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Zero-power Resistance | R25 | $I_{TM}$=0.2mA, $T_c$=25°C | 17.31 | 20 | 23.14 | kΩ |
| B Value | B25/85 | Tc=25°C/Tc=85°C | — | 3760 | — | K |

(Note 1) Switching Time Test Circuit & Timing Chart

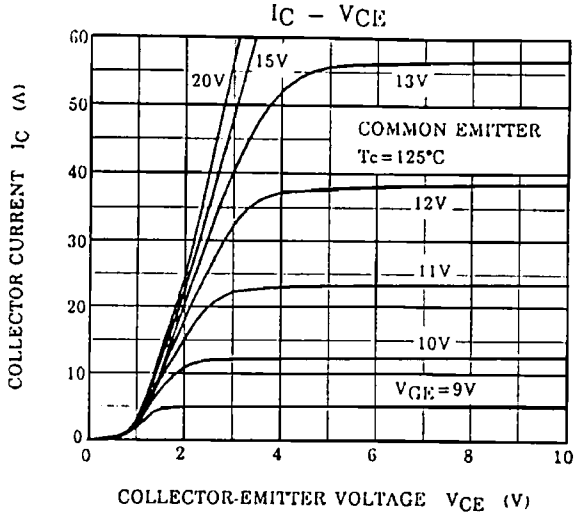


a. Inverter stage / c. Brake stage

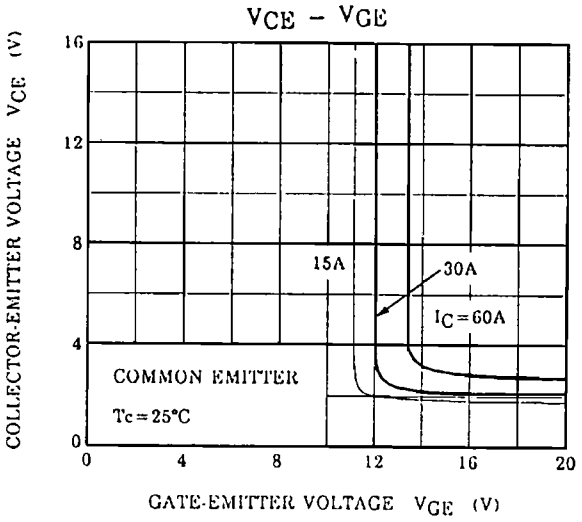
$I_C$ – $V_{CE}$



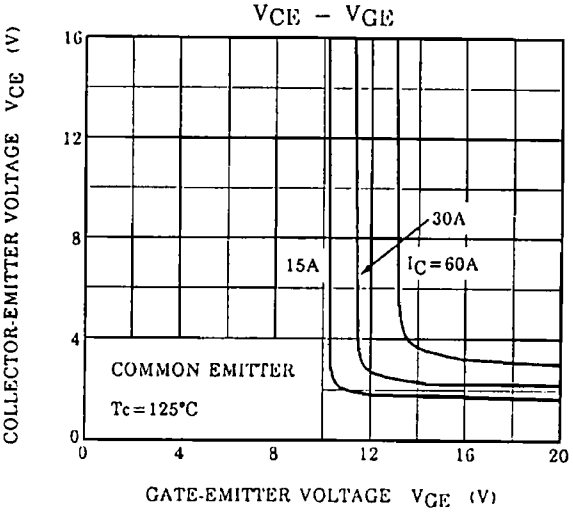

$I_C$ – $V_{CE}$



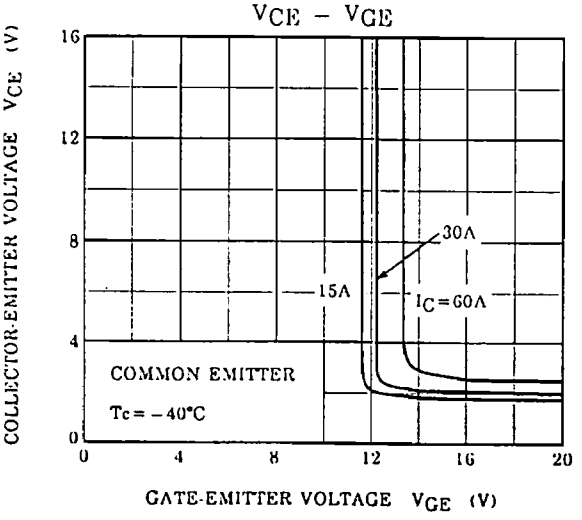

$V_{CE}$ – $V_{GE}$



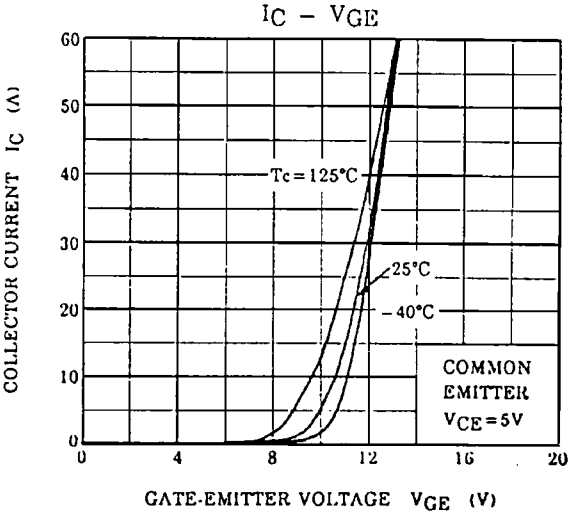

$V_{CE}$ – $V_{GE}$



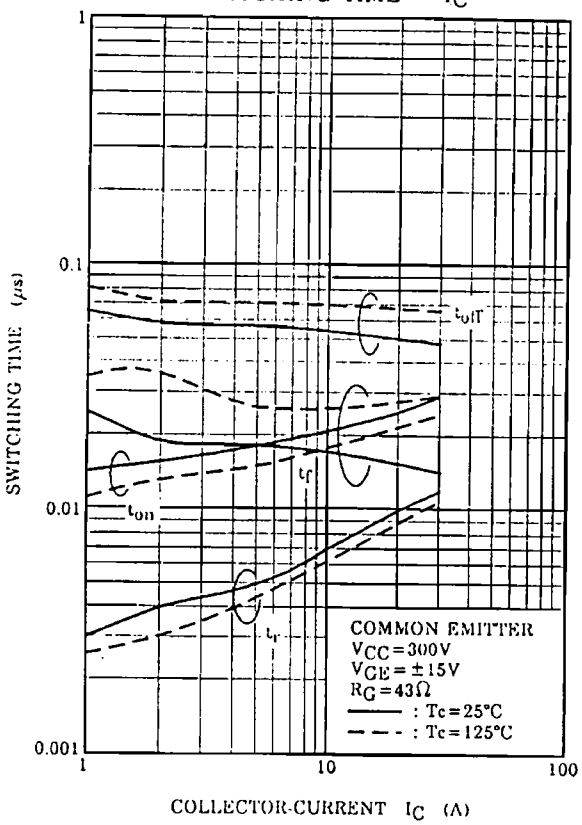

$V_{CE}$ – $V_{GE}$



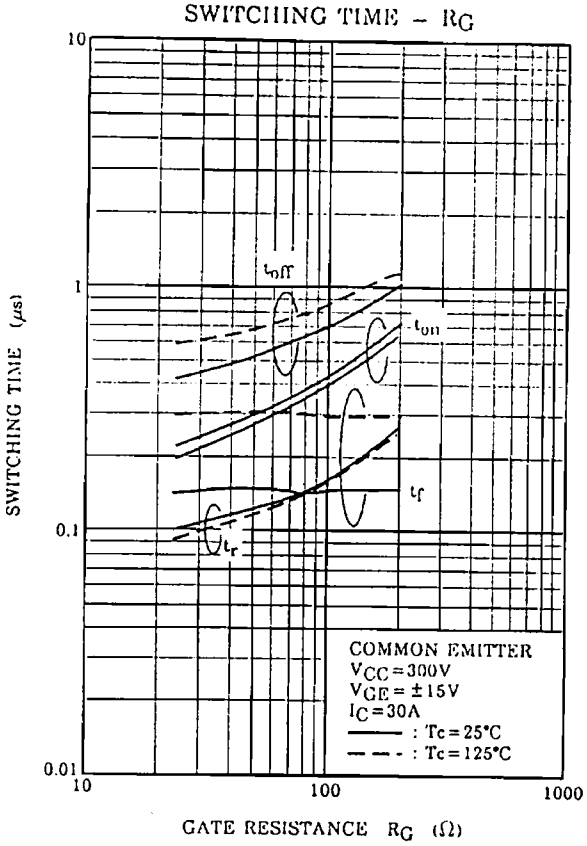

$I_C$ – $V_{GE}$



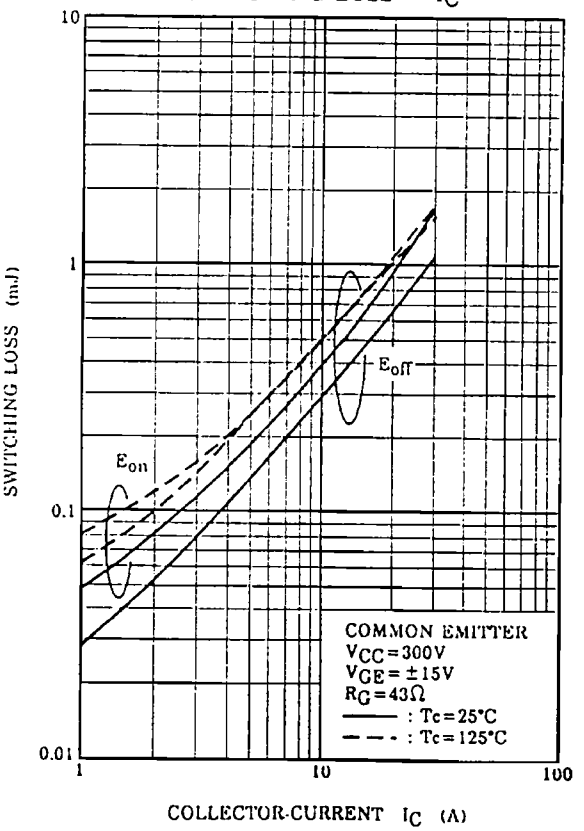
SWITCHING TIME – $I_C$



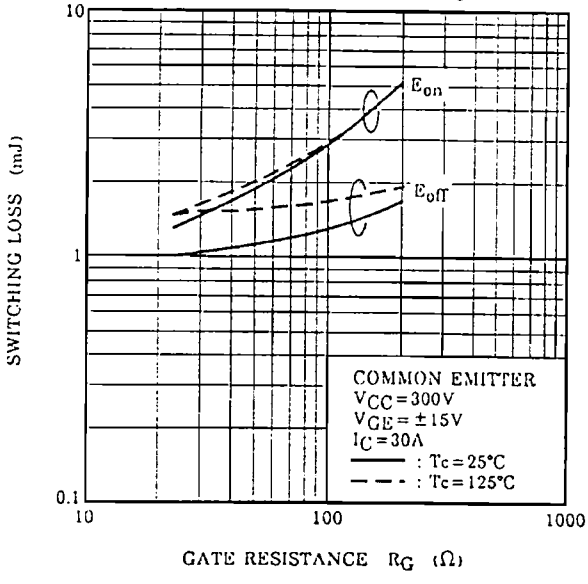

SWITCHING TIME – $R_G$



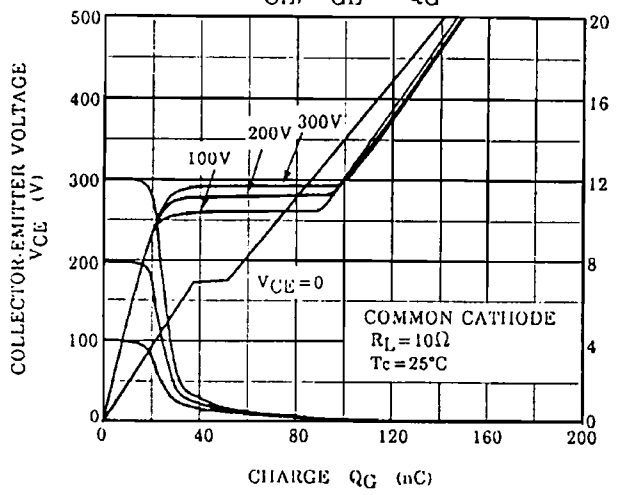

SWITCHING LOSS – $I_C$



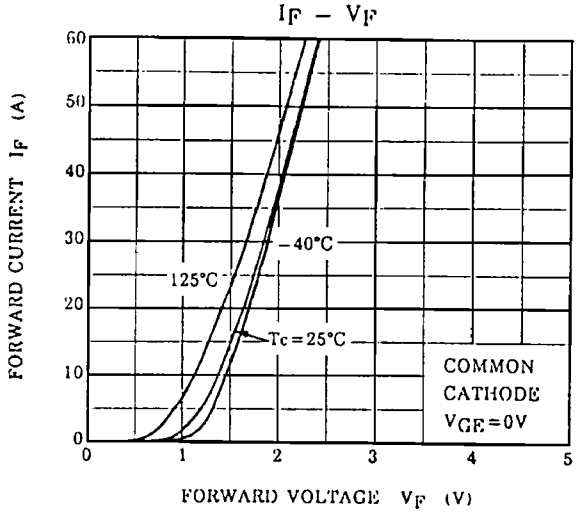

SWITCHING LOSS – $I_C$



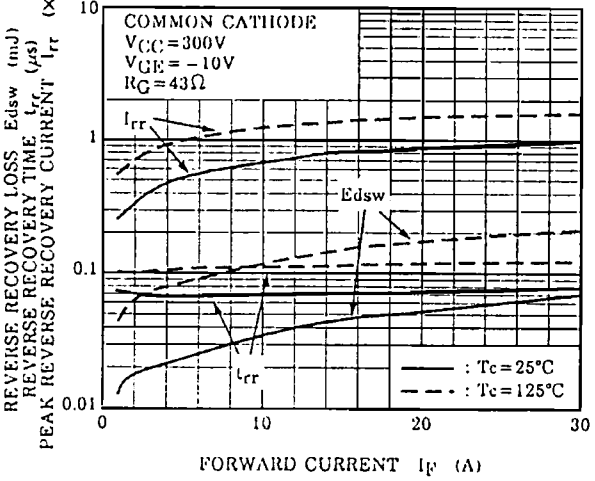
$V_{CE}$, $V_{GE}$ – $Q_G$



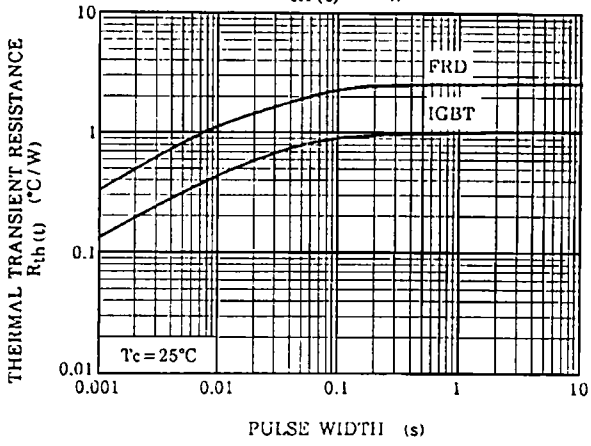

$I_F$ – $V_F$



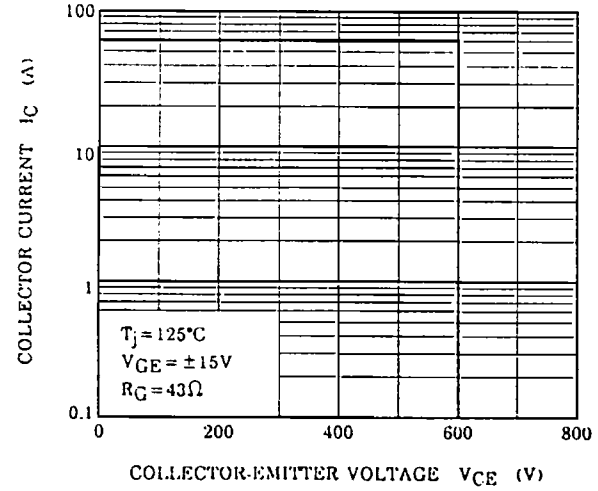

$t_{rr}$, $I_{rr}$, Edsw – $I_F$




$R_{th}$ (t) – $t_w$




REVERSE BIAS



b. Converter stage