TOSHIBA POWER MODULE

# MP7002

1. MAXIMUM RATINGS (Ta = 25°C)

DIODE

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Repetitive Peak Reverse Voltage | $V_{RRM}$ | 600 | V |
| Peak One Cycle Surge Forward Current (D1, D2, D3, D4) (50 Hz, Non-Repetitive) | $I_{FSM}$ | 220 | A |
| Forward Current | $I_F$ | 25 | A |
| Junction Temperature | $T_j$ | 150 | °C |
| Storage Temperature Range | $T_{stg}$ | −40~125 | °C |

IGBT

| CHARACTERISTIC | | SYMBOL | RATING | UNIT |
|---|---|---|---|---|
| Collector-Emitter Voltage | | $V_{CES}$ | 600 | V |
| Gate-Emitter Voltage | | $V_{GES}$ | ±20 | V |
| Collector Current | DC | $I_C$ | 40 | A |
| | 1 ms | $I_{CP}$ | 80 | A |
| Collector Power Dissipation (Tc = 25°C) | | $P_C$ | 37 | W |
| Junction Temperature | | $T_j$ | 150 | °C |
| Storage Temperature Range | | $T_{stg}$ | −40~125 | °C |

ALL SYSTEM

| CHARACTERISTIC | SYMBOL | CONDITION | RATING | UNIT |
|---|---|---|---|---|
| Isolation Voltage | $V_{ISO}$ | AC 1 minute | 2500 | V |

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2. ELECTRICAL CHARACTERISTICS (Ta = 25°C)

DIODE

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Peak Forward Voltage (1) | $V_{FM}$ (1) | $I_F$ = 12.5 A | — | 1.0 | 1.2 | V |
| Peak Forward Voltage (2) | $V_{FM}$ (2) | $I_F$ = 30 A | — | 1.20 | 1.55 | V |
| Repetitive Peak Reverse Current | $I_{RRM}$ | $V_{RRM}$ = 600 V | | | 10 | μA |
| Peak Reverse Current (D1, D2, D3, D4) | $I_{rr}$ | $I_F$ = 30 A | | | 100 | A |
| Thermal Resistance | $R_{th\ (j\text{-}c)}$ | | — | — | 3.5 | °C / W |

IGBT

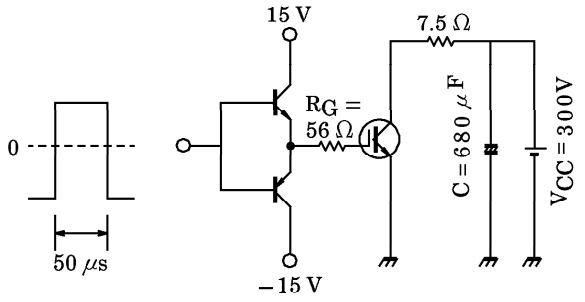
| CHARACTERISTIC | | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Gate Leakage Current | | $I_{GES}$ | $V_{GE}$ = ±20 V, $V_{CE}$ = 0 | — | — | ±500 | nA |
| Collector Cut-off Current | | $I_{CES}$ | $V_{CE}$ = 600 V, $V_{GE}$ = 0 | — | — | 1.0 | mA |
| Gate-Emitter Cut-off Voltage | | $V_{GE\ (OFF)}$ | $I_C$ = 40 mA, $V_{CE}$ = 5 V | 3.0 | — | 6.0 | V |
| Collector-Emitter Saturation Voltage | | $V_{CE\ (sat)}$ | $I_C$ = 40 A, $V_{GE}$ = 15 V | — | 1.9 | 2.7 | V |
| Input Capacitance | | $C_{ies}$ | $V_{CE}$ = 10 V, $V_{GE}$ = 0, f = 1 MHz | — | 2900 | — | pF |
| Switching Time | Rise Time | $t_r$ | Load Resistance | — | 0.4 | — | μs |
| | Turn-on Time | $t_{on}$ | $V_{CC}$ = 300 V, $I_C$ = 40 A | — | 0.7 | — | |
| | Fall Time | $t_f$ | $V_{GE}$ = ±15 V, ($R_G$ = 56 Ω) | — | 0.3 | 0.42 | |
| | Turn-off Time | $t_{off}$ | (Note 1) | — | 0.7 | — | |
| Thermal Resistance | | $R_{th\ (j\text{-}c)}$ | | — | — | 3.3 | °C / W |

3. Mechanical Rating

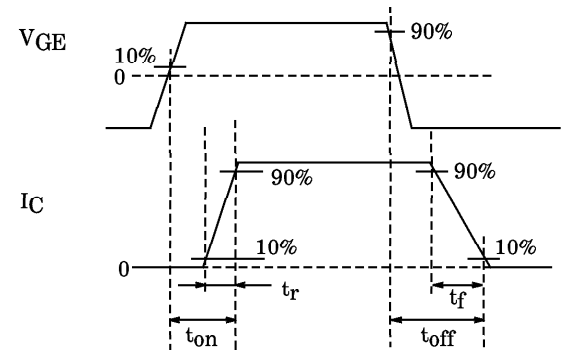
| CHARACTERISTIC | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|
| Fastening Torque | — | — | 1.5 | Nm |

(Note 1) Switching Time Test Circuit & Timing Chart

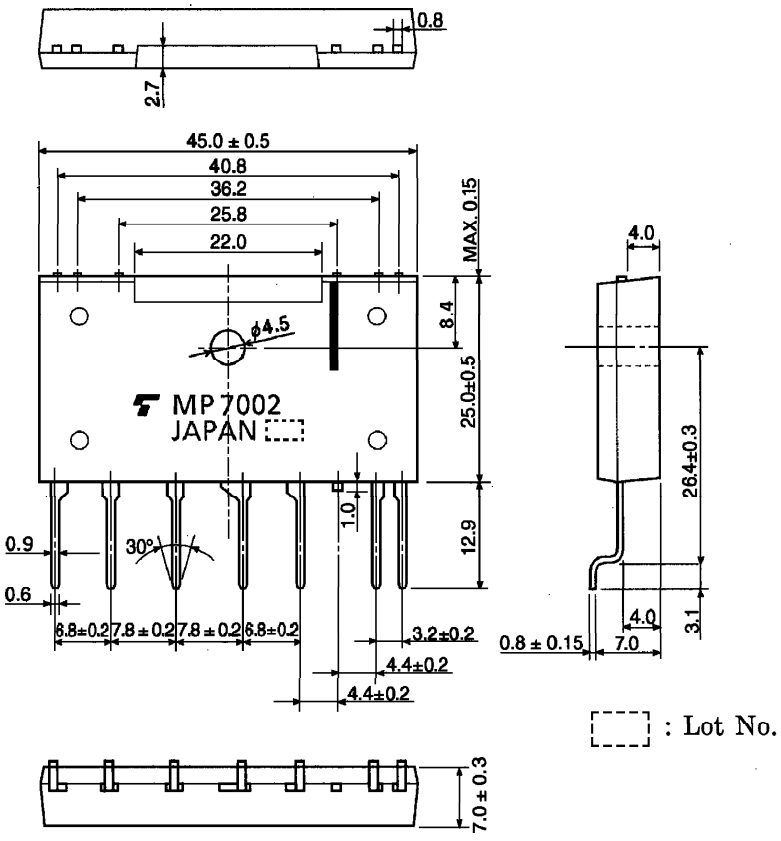
Load Resistance Test Circuit



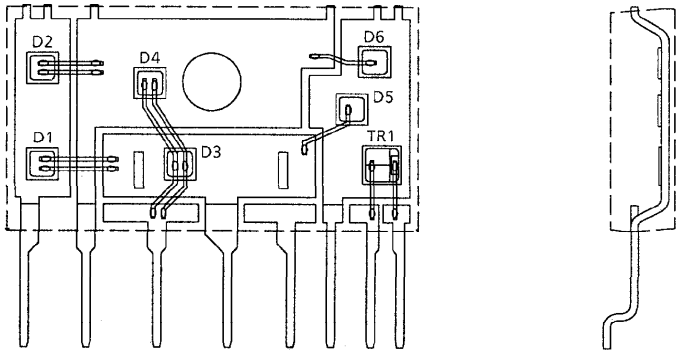

Waveform



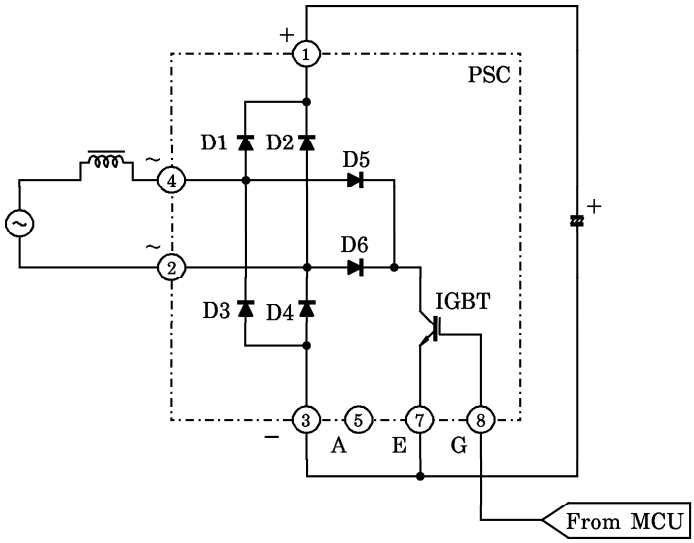

4. Package Dimension



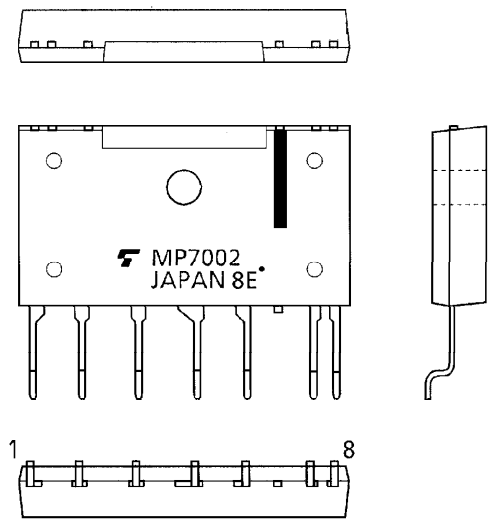
5. Image of Chips Mounting




6. PSC Equivalent Circuit Diagram (including application circuit)

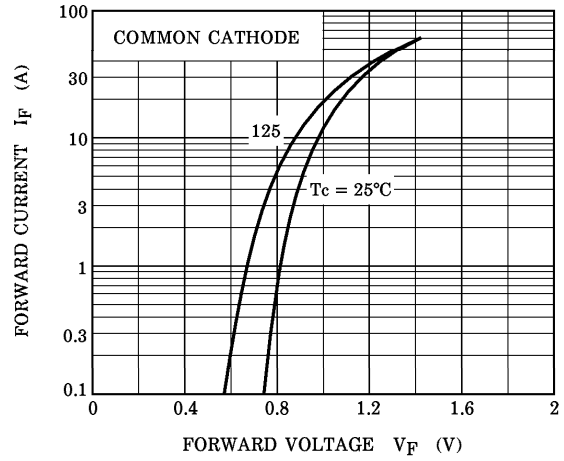


7. Pin Assignment

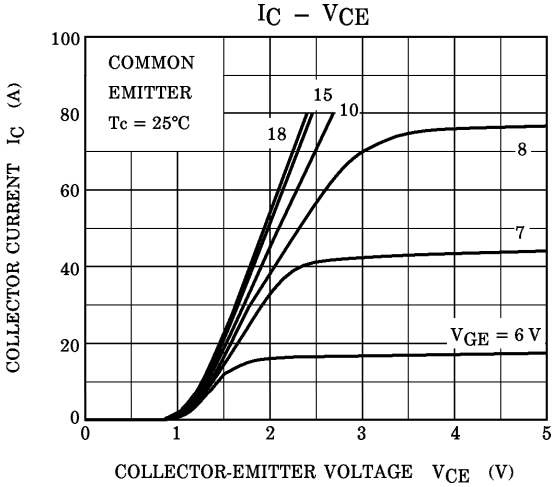



1. + pin
2. ~ pin
3. − pin
4. ~ pin
5. A pin
6. C pin (TOSHIBA test pin)
7. E pin
8. G pin

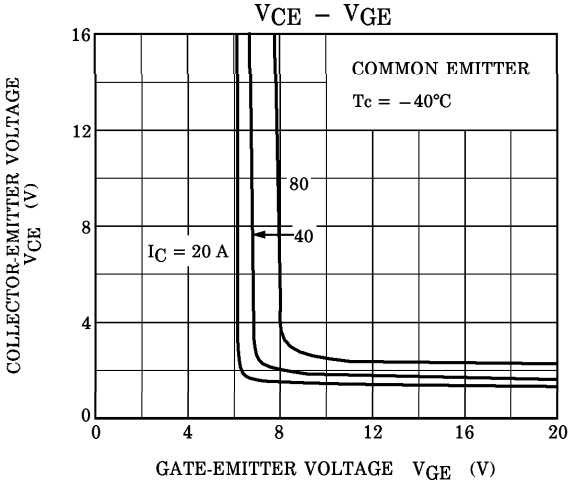
$I_F - V_F$



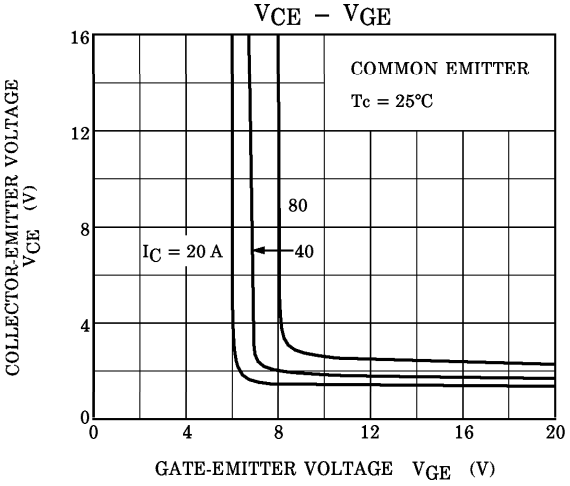

$I_C - V_{CE}$



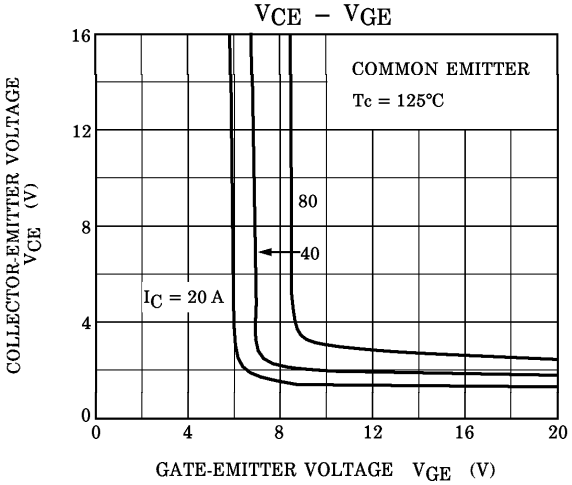

$V_{CE} - V_{GE}$



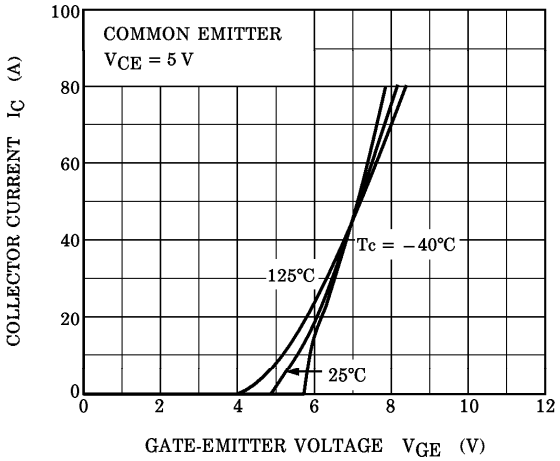

$V_{CE} - V_{GE}$



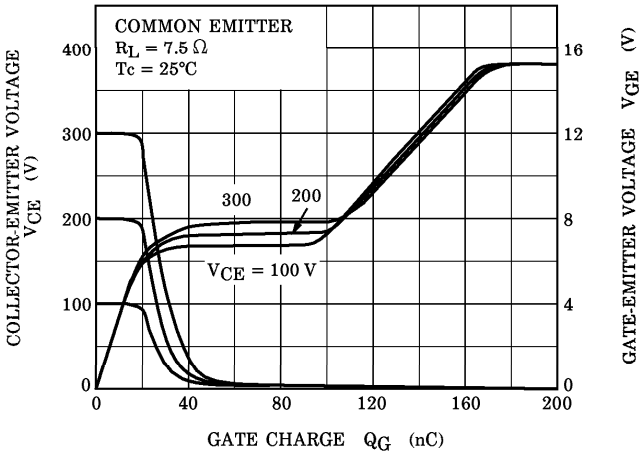

$V_{CE} - V_{GE}$



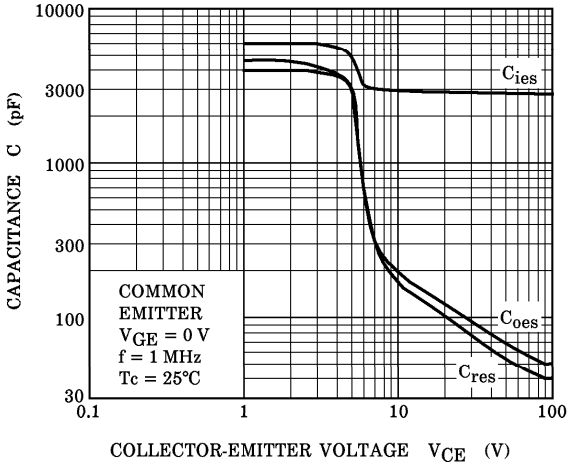

$I_C - V_{GE}$



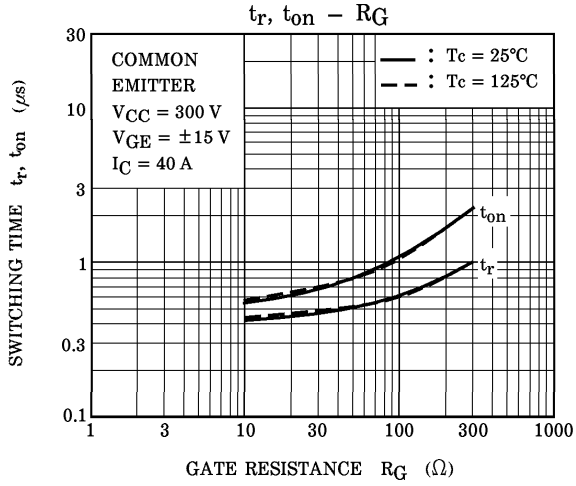
$V_{CE}$, $V_{GE}$ – $Q_G$



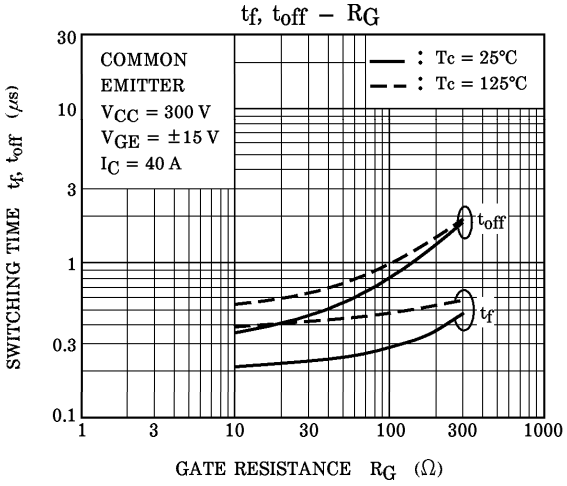

C – $V_{CE}$



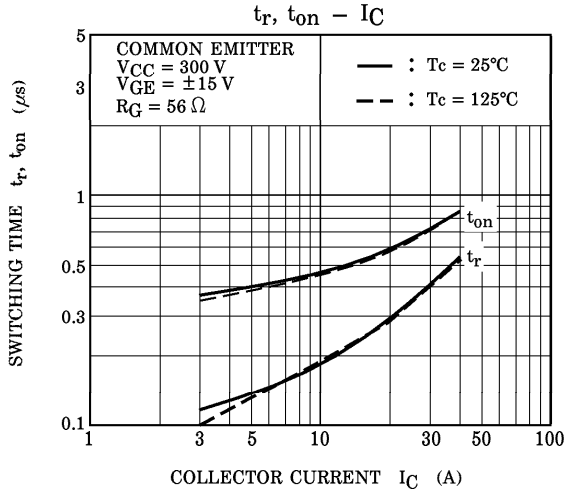

$t_r$, $t_{on}$ – $R_G$



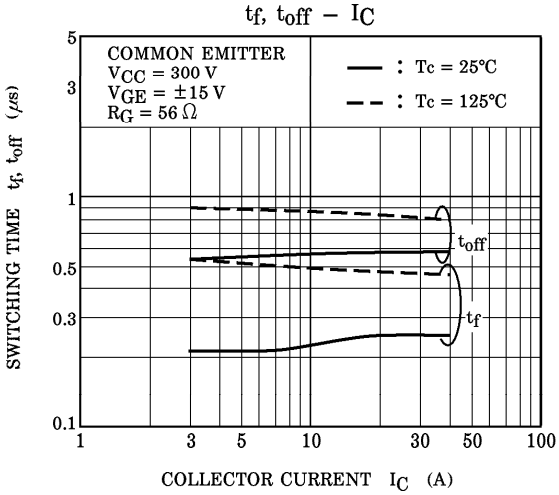

$t_f$, $t_{off}$ – $R_G$



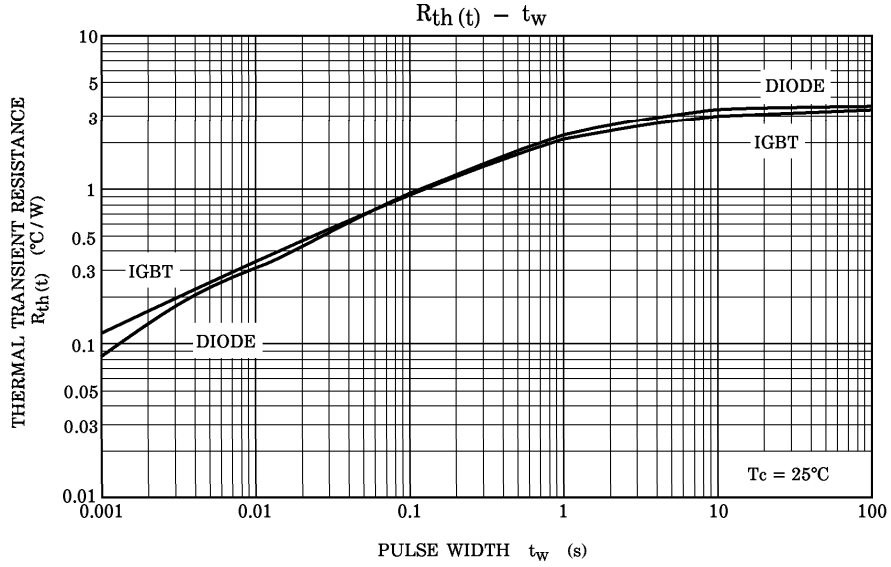

$t_r$, $t_{on}$ – $I_C$



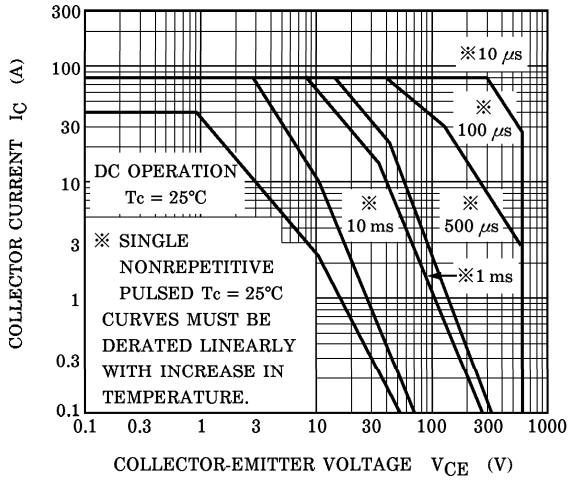

$t_f$, $t_{off}$ – $I_C$



$R_{th}(t) - t_w$




SAFE OPERATING AREA




REVERSE BIAS SOA

