# 7MBP75TEA120

## Econo IPM series

**1200V / 75A 7 in one-package**

## Features

- **Temperature protection provided by directly detecting the junction temperature of the IGBTs**
- Low power loss and soft switching
- High performance and high reliability IGBT with overheating protection
- Higher reliability because of a big decrease in number of parts in built-in control circuit

## Maximum ratings and characteristics

● **Absolute maximum ratings**(at Tc=25°C unless otherwise specified)

| Item | | | Symbol | Rating | | Unit |
|---|---|---|---|---|---|---|
| | | | | Min. | Max. | |
| Bus voltage | | DC | $V_{DC}$ | 0 | 900 | V |
| | | Surge | $V_{DC(surge)}$ | 0 | 1000 | V |
| | | Short operating | $V_{SC}$ | 400 | 800 | V |
| Collector-Emitter voltage *1 | | | $V_{CES}$ | 0 | 1200 | V |
| Inverter | Collector current | DC | $I_C$ | - | 75 | A |
| | | 1ms | $I_{CP}$ | - | 150 | A |
| | | DC | $-I_C$ | - | 75 | A |
| | Collector power dissipation | One transistor *3 | $P_C$ | - | 368 | W |
| Brake | Collector current | DC | $I_C$ | - | 25 | A |
| | | 1ms | $I_{CP}$ | - | 50 | A |
| | Forward current diode | | $I_F$ | - | 25 | A |
| | Collector power dissipation | One transistor *3 | $P_C$ | - | 212 | W |
| Supply voltage of Pre-Driver *4 | | | $V_{CC}$ | -0.5 | 20 | V |
| Input signal voltage *5 | | | $V_{in}$ | -0.5 | Vcc+0.5 | V |
| Input signal current | | | $I_{in}$ | - | 3 | mA |
| Alarm signal voltage *6 | | | $V_{ALM}$ | -0.5 | Vcc | V |
| Alarm signal current *7 | | | $I_{ALM}$ | - | 20 | mA |
| Junction temperature | | | $T_j$ | - | 150 | ℃ |
| Operating case temperature | | | $T_{opr}$ | -20 | 100 | ℃ |
| Storage temperature | | | $T_{stg}$ | -40 | 125 | ℃ |
| Solder temperature *8 | | | $T_{sol}$ | - | 260 | ℃ |
| Isolating voltage (Terminal to base, 50/60Hz sine wave 1min.) | | | $V_{iso}$ | - | AC2500 | V |
| Screw torque | Mounting (M5) | | | - | 3.5 | N·m |

Note

*1 : Vces shall be applied to the input voltage between terminal P and U or ,V or W or DB, N and U or V or W or DB

*2 : 125°C/FWD Rth(j-c)/(Ic x VF MAX)=125/0.61/(75 x 2.0) x 100>100%

*3 : Pc=125°C/IGBT Rth(j-c)=125/0.34=368W [Inverter]

Pc=125°C/IGBT Rth(j-c)=125/0.59=212W [Brake]

*4 : VCC shall be applied to the input voltage between terminal No.4 and 1, 8 and 5, 12 and 9, 14 and 13

*5 : Vin shall be applied to the input voltage between terminal No.3 and 1, 7 and 5, 11 and 9, 16,17,18 and 13.

*6 :VALM shall be applied to the voltage between terminal No.2 and 1, No6 and 5, No10 and 9, No.19 and 13.

*7 : IALMshall be applied to the input current to terminal No.2,6,10 and 19.

*8 : Immersion time 10±1sec.

**Electrical characteristics** (at Tc=Tj=25°C, Vcc=15V unless otherwise specified.)

### ● Main circuit

| | Item | Symbol | Condition | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Inverter | Collector current at off signal input | $I_{CES}$ | $V_{CE}$=1200V Vin terminal open. | | - | - | 1.0 | mA |
| | Collector-Emitter saturation voltage | $V_{CE(sat)}$ | Ic=75A | Terminal | - | - | 3.1 | V |
| | | | | Chip | - | 2.2 | - | |
| | Forward voltage of FWD | $V_F$ | -Ic=75A | Terminal | - | - | 2.0 | V |
| | | | | Chip | - | 1.6 | - | |
| Brake | Collector current at off signal input | $I_{CES}$ | $V_{CE}$=1200V Vin terminal open. | | - | - | 1.0 | mA |
| | Collector-Emitter saturation voltage | $V_{CE(sat)}$ | Ic=25A | Terminal | - | - | 2.6 | V |
| | | | | Chip | - | 1.9 | - | |
| | Forward voltage of Diode | $V_F$ | -Ic=25A | Terminal | - | - | 3.7 | V |
| | | | | Chip | - | 2.3 | - | |
| Turn-on time | | ton | $V_{DC}$=600V,Tj=125°C | | 1.2 | - | - | µs |
| Turn-off time | | toff | $I_C$=75A Fig.1, Fig.6 | | - | - | 3.6 | |
| Reverse recovery time | | trr | $V_{DC}$=600V, $I_F$=75A Fig.1, Fig.6 | | - | - | 0.3 | |

### ● Control circuit

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Supply current of P-line side pre-driver(one unit) | $I_{ccp}$ | Switching Frequency : 0 to 15kHz | - | - | 15 | mA |
| Supply current of N-line side pre-driver | $I_{CCN}$ | Tc=-20 to 125°C Fig.7 | - | - | 45 | mA |
| Input signal threshold voltage (on/off) | $V_{in(th)}$ | ON | 1.00 | 1.35 | 1.70 | V |
| | | OFF | 1.25 | 1.60 | 1.95 | V |
| Input zener voltage | $V_Z$ | Rin=20k ohm | - | 8.0 | - | V |
| Alarm signal hold time | $t_{ALM}$ | Tc=-20°C Fig.2 | 1.1 | - | - | ms |
| | | Tc=25°C Fig.2 | - | 2.0 | - | ms |
| | | Tc=125°C Fig.2 | - | - | 4.0 | ms |
| Current limit resistor | $R_{ALM}$ | Alarm terminal | 1425 | 1500 | 1575 | ohm |

### ● Protection Section ( Vcc=15V)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Over Current Protection Level of Inverter circuit | $I_{OC}$ | Tj=125°C | 113 | - | - | A |
| Over Current Protection Level of Brake circuit | $I_{OC}$ | Tj=125°C | 38 | - | - | A |
| Over Current Protection Delay time | $t_{DOC}$ | Tj=125°C | - | 5 | - | µs |
| SC Protection Delay time | $t_{SC}$ | Tj=125°C Fig.4 | - | - | 8 | µs |
| IGBT Chip Over Heating<br>Protection Temperature Level | $T_{jOH}$ | Surface of IGBT chips | 150 | - | - | ℃<br>℃ |
| Over Heating Protection Hysteresis | $T_{jH}$ | | - | 20 | - | V |
| Under Voltage Protection Level | $V_{UV}$ | | 11.0 | - | 12.5 | V |
| Under Voltage Protection Hysteresis | $V_H$ | | 0.2 | 0.5 | - | |

### ● Thermal characteristics( Tc=25°C)

| Item | | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Junction to Case thermal resistance *9 | Inverter | IGBT | Rth(j-c) | - | - | 0.34 | °C/W |
| | | FWD | Rth(j-c) | - | - | 0.61 | °C/W |
| | Brake | IGBT | Rth(j-c) | - | - | 0.59 | °C/W |
| Case to fin thermal resistance with compound | | | Rth(c-f) | - | 0.05 | - | °C/W |

*9 For 1device, Case is under the device

### ● Noise Immunity ( VDC=300V, Vcc=15V, Test Circuit Fig.5)

| Item | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Common mode rectangular noise | Pulse width 1µs, polarity ±,10minuets<br>Judge : no over-current, no miss operating | ±2.0 | - | - | kV |
| Common mode lightning surge | Rise time 1.2µs, Fall time 50µs<br>Interval 20s, 10 times<br>Judge : no over-current, no miss operating | ±5.0 | - | - | kV |

### ● Recommendable value

| Item | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| DC Bus Voltage | $V_{DC}$ | - | - | 800 | V |
| Operating Supply Voltage of Pre-Driver | $V_{CC}$ | 13.5 | 15.0 | 16.5 | V |
| Screw torque (M5) | - | 2.5 | - | 3.0 | Nm |

### ● Weight

| Item | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Weight | Wt | - | 270 | - | g |

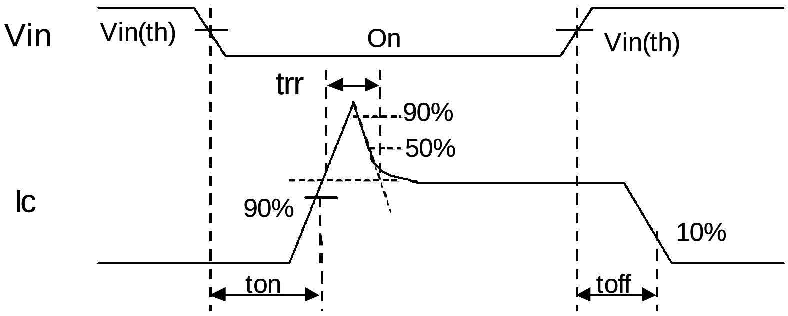
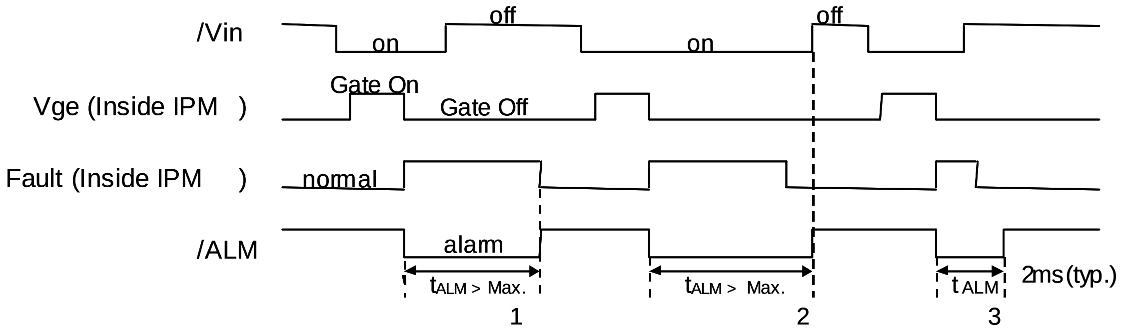


Figure 1. Switching Time Waveform Definitions



Fault : Over-current,Over-heat or Under-voltage

Figure 2. Input/Output Timing Diagram

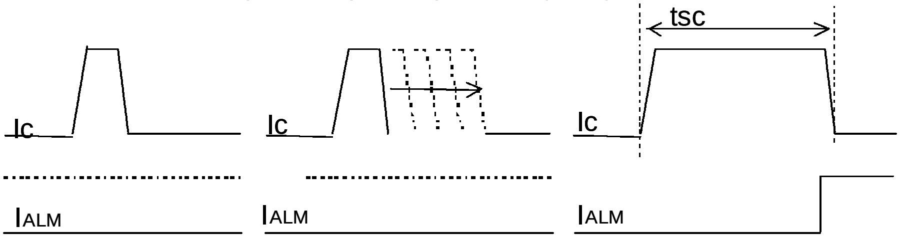


Figure.4 Definition of tsc

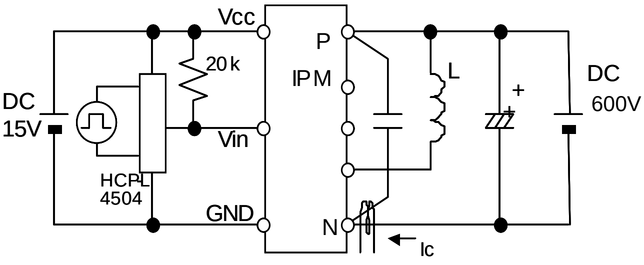


Figure 6. Switching Characteristics Test Circuit

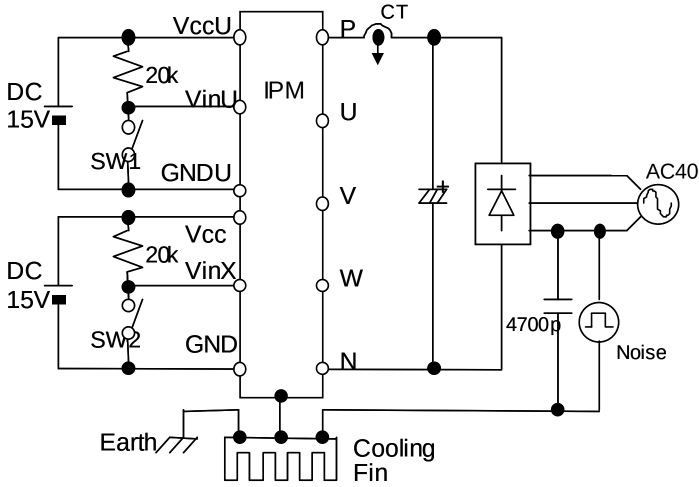


Figure 5. Noise Test Circuit

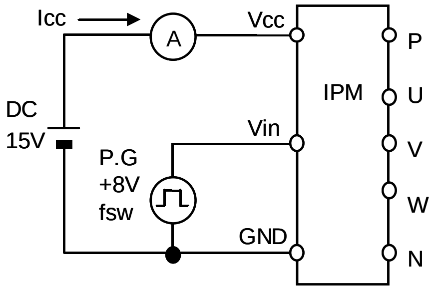
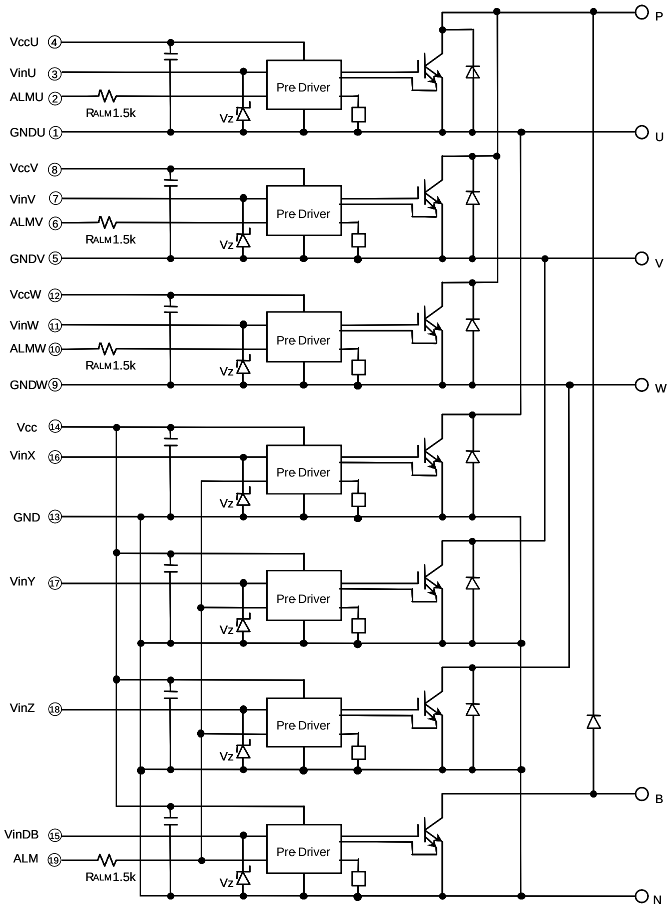


Figure 7. Icc Test Circuit

## Block diagram

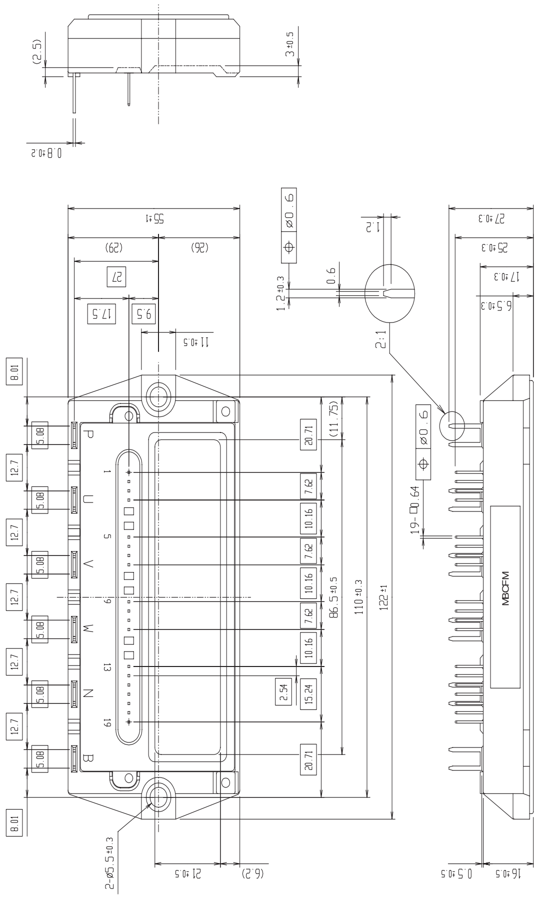


Pre-drivers include following functions

1.Amplifier for driver
2.Short circuit protection
3.Under voltage lockout circuit
4.Over current protection
5.IGBT chip over heating protection

## Outline drawings, mm

Package Type : P622

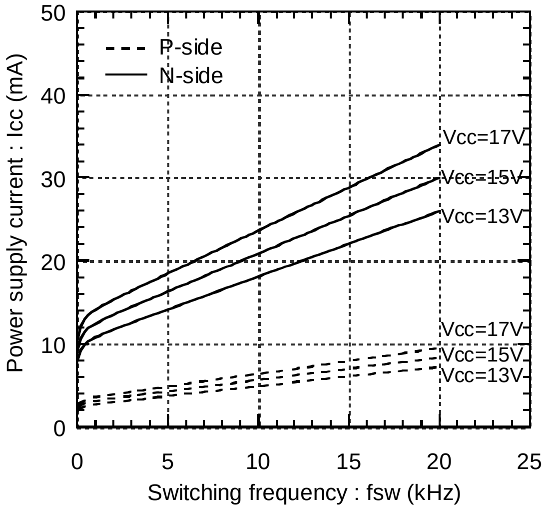


Mass : 270g

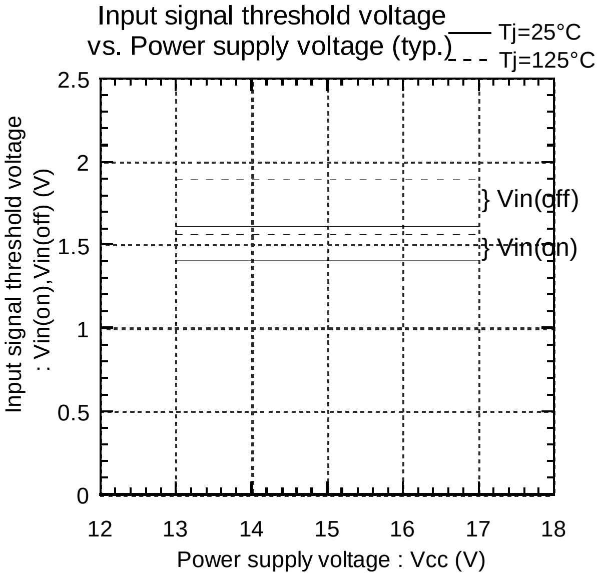
## ■ Characteristics

- **Control circuit characteristics (Representative)**

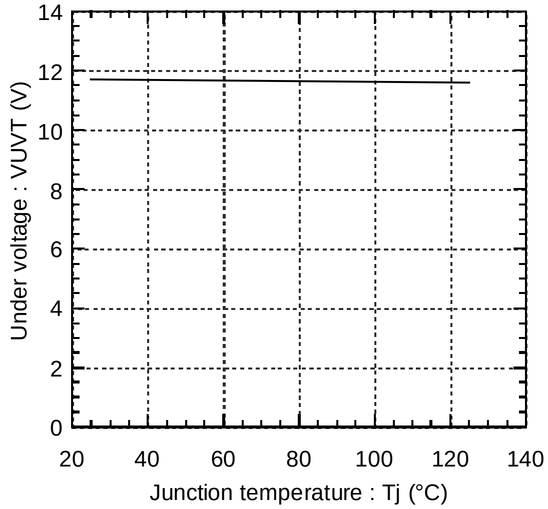
Power supply current vs. Switching frequency
Tc=125°C (typ.)



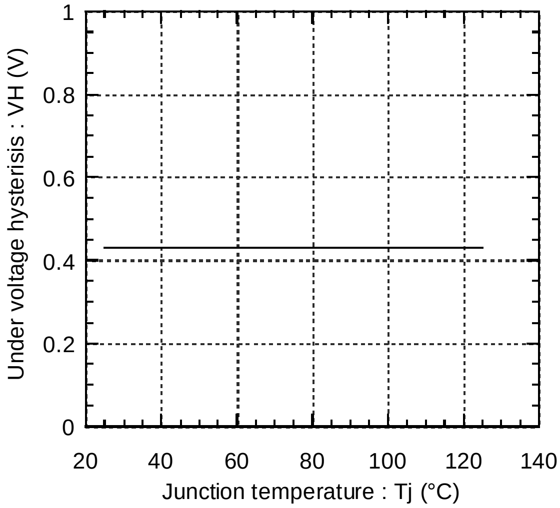
Input signal threshold voltage
vs. Power supply voltage (typ.)



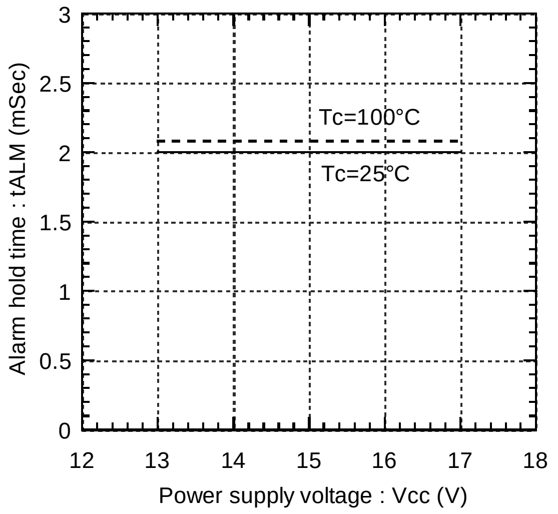
Under voltage vs. Junction temperature (typ.)



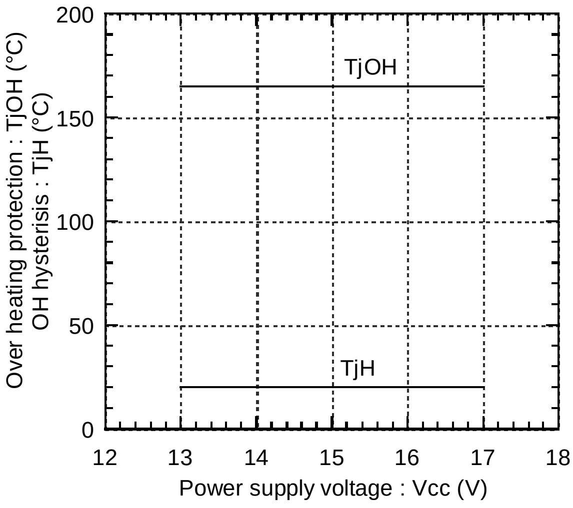
Under voltage hysterisis vs. Jnction temperature (typ.)



Alarm hold time vs. Power supply voltage (typ.)

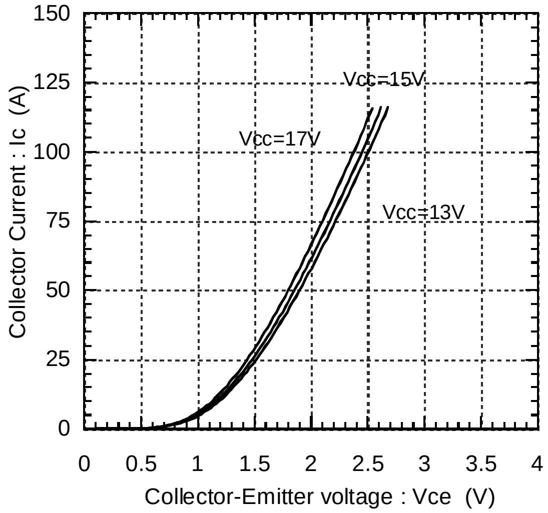


Over heating characteristics
TjOH,TjH vs. Vcc (typ.)

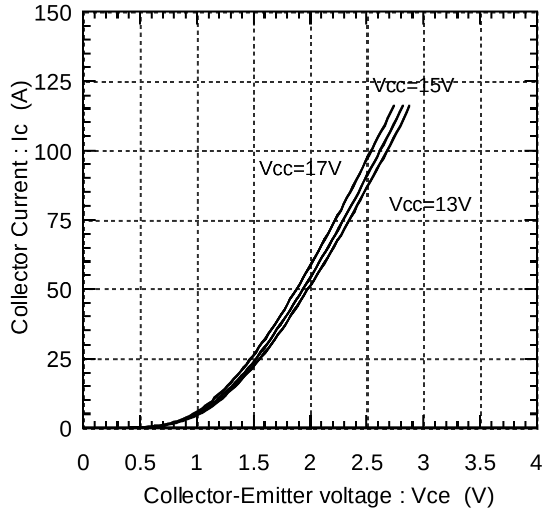


- **Main circuit characteristics (Representative)**

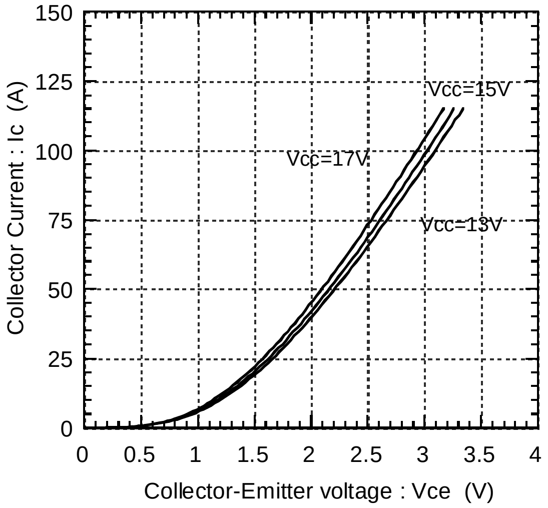
Collector current vs. Collector-Emitter voltage (typ.)
Tj=25°C(Chip)



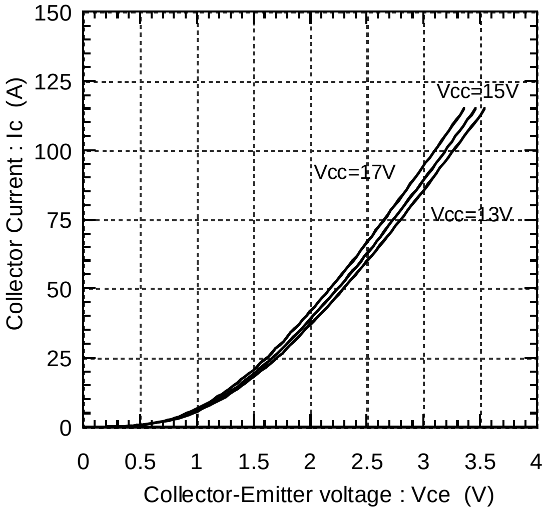
Collector current vs. Collector-Emitter voltage (typ.)
Tj=25°C(Terminal)



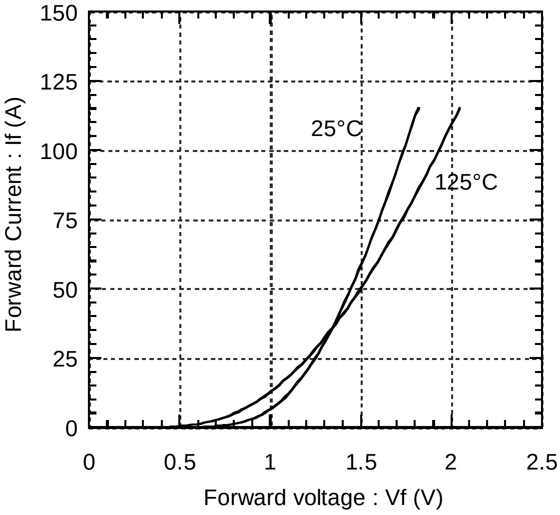
Collector current vs. Collector-Emitter voltage (typ.)
Tj=125°C(Chip)



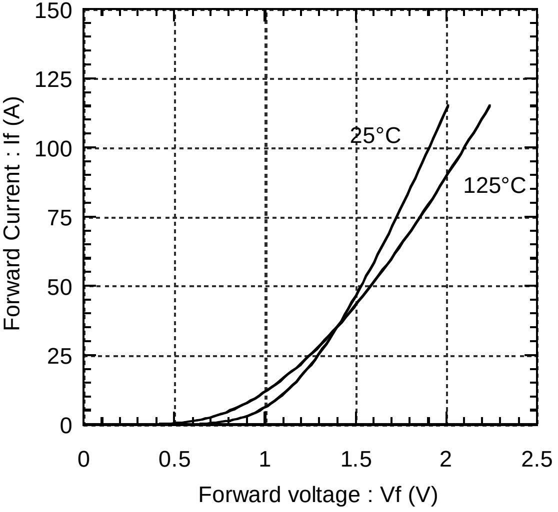
Collector current vs. Collector-Emitter voltage (typ.)
Tj=125°C(Terminal)



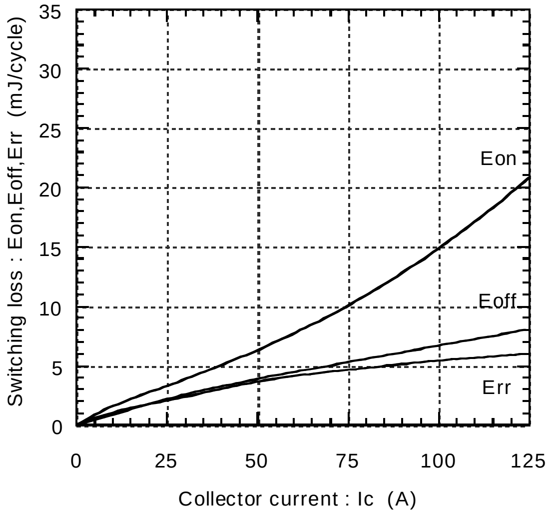
Forward current vs. Forward voltage (typ.)
(Chip)



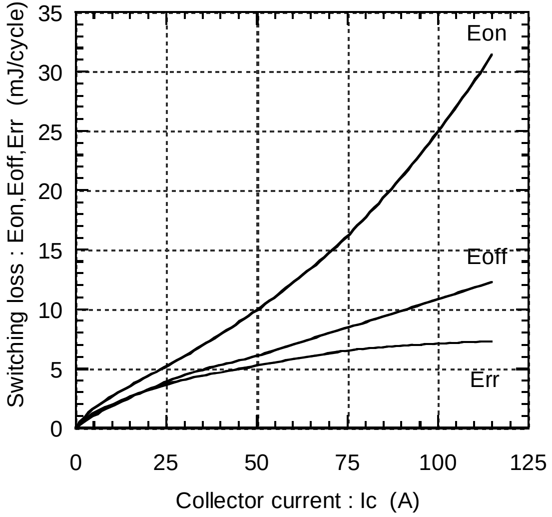
Forward current vs. Forward voltage (typ.)
(Terminal)



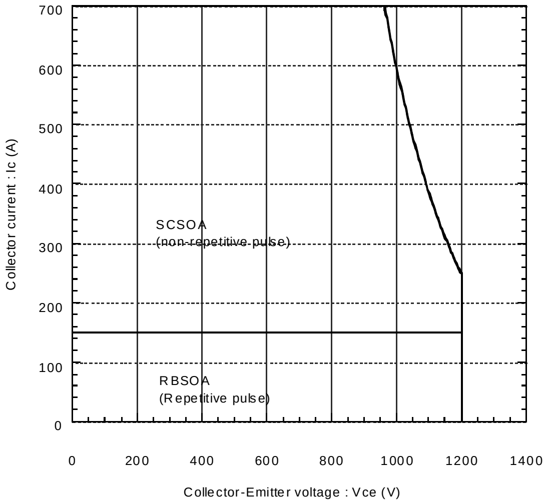
Switching Loss vs. Collector Current (typ.)
Edc=600V,Vcc=15V,Tj=25°C



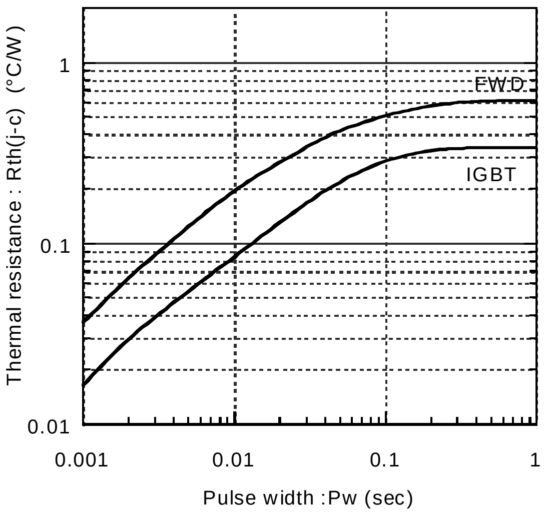
Switching Loss vs. Collector Current (typ.)
Edc=600V,Vcc=15V,Tj=125°C



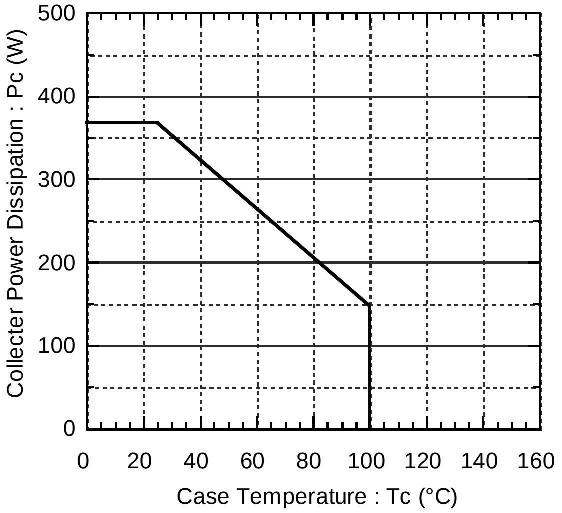
Reversed biased safe operating area
Vcc=15V,Tj<=125°C(min.)



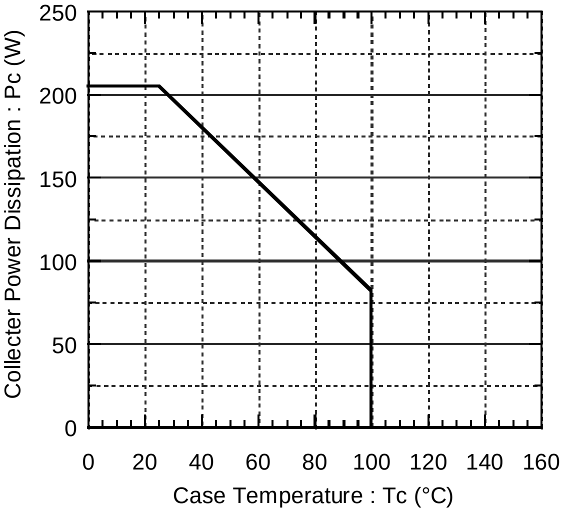
Transient thermal resistance (max.)

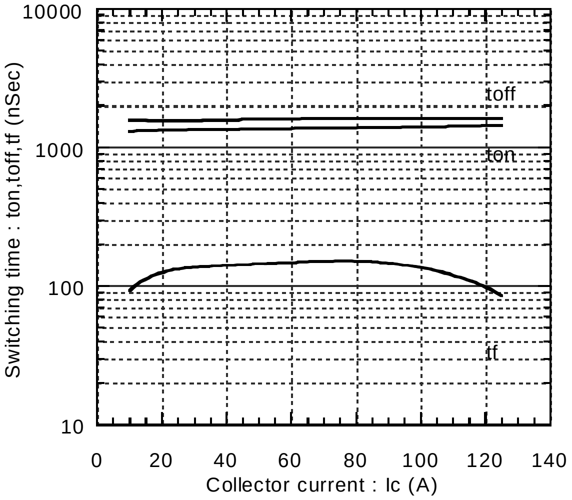


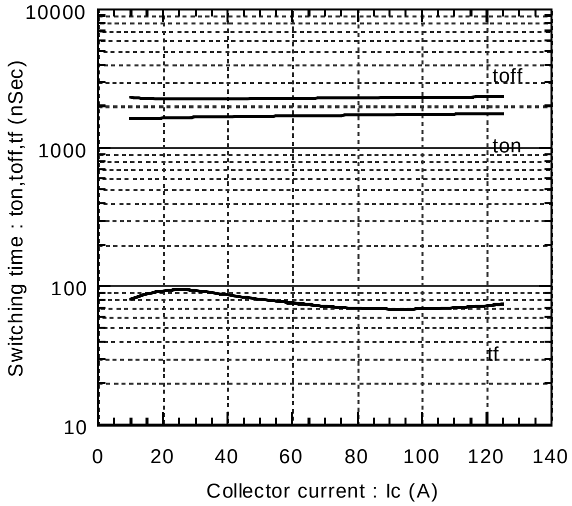
Power derating for IGBT (max.)
(per device)

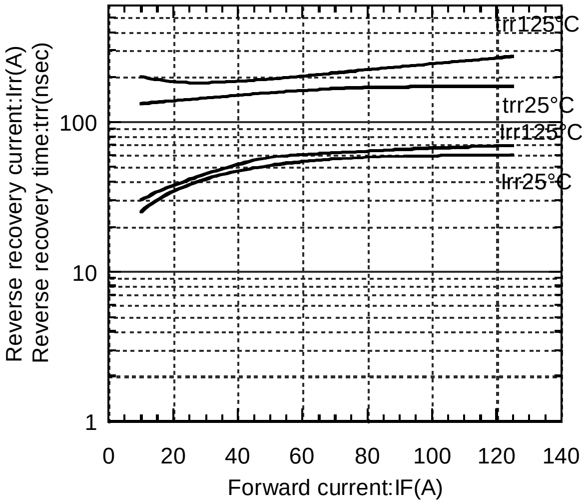


Power derating for FWD (max.)
(per device)




Switching time vs. Collector current (typ.)
Edc=600V,Vcc=15V,Tj=25°C

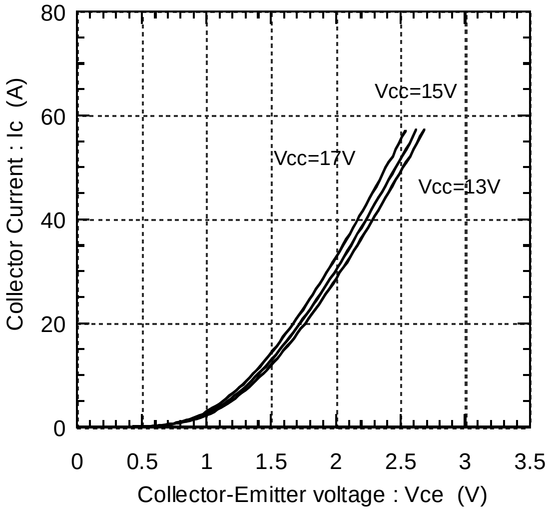

Switching time vs. Collector current (typ.)
Edc=600V,Vcc=15V,Tj=125°C


Reverse recovery characteristics (typ.)
trr,Irr vs.IF

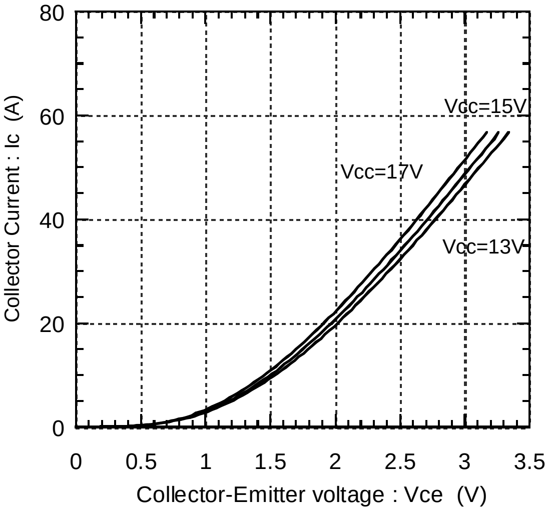
## ■ Characteristics

### ● Dynamic Brake Characteristics (Representative)

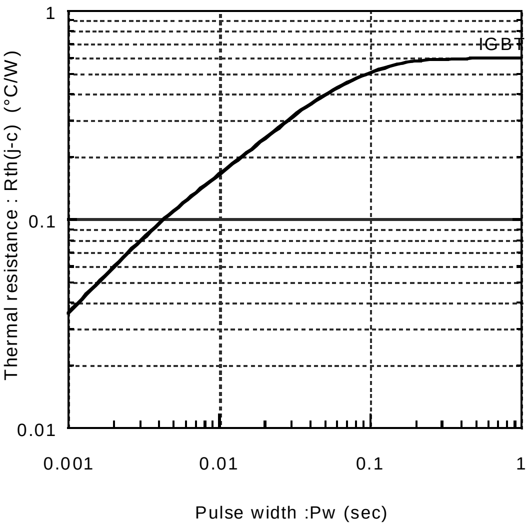
Collector current vs. Collector-Emitter voltage (typ.)
Tj=25°C



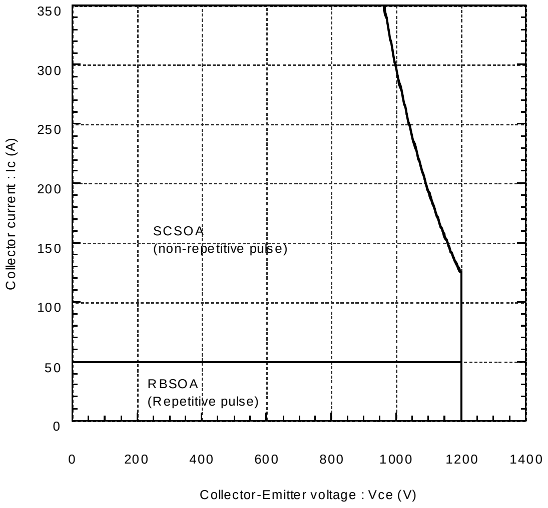
Collector current vs. Collector-Emitter voltage (typ.)
Tj=125°C



Transient thermal resistance (max.)



Reversed biased safe operating area
Vcc=15V,Tj<=125°C (min.)



Power derating for IGBT (max.)
(per device)