

# GP1000DHB06S

## POWERLINE N-CHANNEL IGBT MODULE

### APPLICATIONS

- High Power Switching.
- Motor Control.
- UPS.
- AC And DC Servo Drive Amplifiers.

### FEATURES

- n - Channel.
- Enhancement Mode.
- High Input Impedance.
- High Switching Speed.
- Latch-Free Operation.
- Low Forward Voltage Drop.
- Isolated Base.
- Short Circuit Capability (10 $\mu$ s).

### CIRCUIT

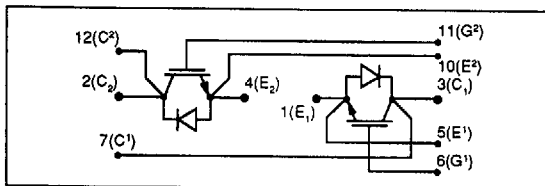


Fig.1 Half bridge circuit diagram

### TYPICAL KEY PARAMETERS

|               |       |
|---------------|-------|
| $V_{CES}$     | 600V  |
| $V_{CE(sat)}$ | 2.1V  |
| $I_{C(CONT)}$ | 1000A |
| $I_{C(PK)}$   | 2000A |
| $t_r$         | 290ns |
| $t_f$         | 430ns |

### PACKAGE OUTLINE

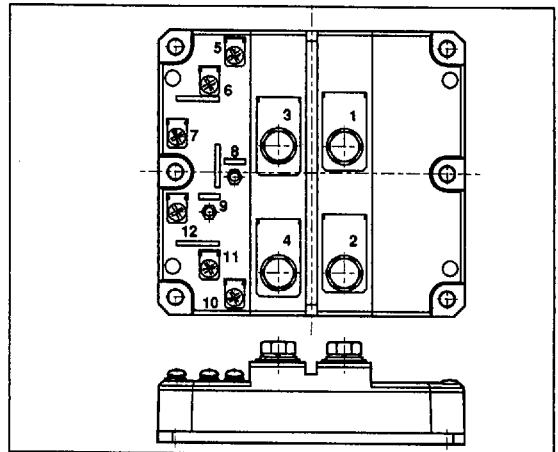


Fig.2

Outline type code: D. See package details for further information.

### RATINGS

| $T_{case} = 25^{\circ}\text{C}$ unless stated otherwise. |                           |                                                          |          |       |
|----------------------------------------------------------|---------------------------|----------------------------------------------------------|----------|-------|
| Symbol                                                   | Parameter                 | Test Conditions                                          | Max.     | Units |
| $V_{CES}$                                                | Collector-emitter voltage | $V_{GE} = 0V$                                            | 600      | V     |
| $V_{GES}$                                                | Gate-emitter voltage      | -                                                        | $\pm 20$ | V     |
| $I_C$                                                    | Collector current         | DC, $T_{case} = 75^{\circ}\text{C}$                      | 1000     | A     |
| $I_{C(PK)}$                                              |                           | 1ms, $T_{case} = 75^{\circ}\text{C}$                     | 2000     | A     |
| $P_{max}$                                                | Maximum power dissipation | Per arm                                                  | 5000     | W     |
| $V_{isol}$                                               | Isolation voltage         | Commoned terminals to base plate.<br>AC RMS, 1 min, 50Hz | 2500     | V     |

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## THERMAL AND MECHANICAL RATINGS

| Symbol            | Parameter                             | Conditions                                 | Min. | Max.  | Units |
|-------------------|---------------------------------------|--------------------------------------------|------|-------|-------|
| $R_{\theta(j-c)}$ | Thermal resistance                    | DC junction to case per arm                | -    | 0.025 | °C/W  |
| $R_{\theta(c-h)}$ | Thermal resistance - Case to heatsink | Mounting torque 5Nm (with mounting grease) | -    | 0.004 | °C/W  |
| $T_j$             | Junction temperature                  | -                                          | -    | 150   | °C    |
| $T_{stg}$         | Storage temperature range             | -                                          | -40  | 150   | °C    |
| -                 | Screw torque (mounting)               | -                                          | -    | 6.0   | Nm    |

## DC ELECTRICAL CHARACTERISTICS

| $T_{case} = 25^{\circ}\text{C}$ unless stated otherwise. |                                      |                                                                           |      |      |         |               |
|----------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------|------|------|---------|---------------|
| Symbol                                                   | Parameter                            | Conditions                                                                | Min. | Typ. | Max.    | Units         |
| $I_{CES}$                                                | Collector cut-off current            | $V_{GE} = 0\text{V}, V_{CE} = V_{CES}$                                    | -    | -    | 8       | mA            |
| $I_{GES}$                                                | Gate leakage current                 | $V_{GE} = \pm 20\text{V}, V_{CE} = 0\text{V}$                             | -    | -    | $\pm 4$ | $\mu\text{A}$ |
| $V_{GE(TH)}$                                             | Gate threshold voltage               | $I_C = 40\text{mA}, V_{GE} = V_{CE}$                                      | 4    | -    | 7.5     | V             |
| $V_{CE(SAT)}$                                            | Collector-emitter saturation voltage | $V_{GE} = 15\text{V}, I_C = 1000\text{A}$                                 | -    | 2.1  | 2.8     | V             |
|                                                          |                                      | $V_{GE} = 15\text{V}, I_C = 1000\text{A}, T_{case} = 125^{\circ}\text{C}$ | -    | 2.3  | 3.0     | V             |

## DIODE DC CHARACTERISTICS

| $T_{case} = 25^{\circ}\text{C}$ unless stated otherwise. |                               |                                                   |      |      |       |       |
|----------------------------------------------------------|-------------------------------|---------------------------------------------------|------|------|-------|-------|
| Symbol                                                   | Parameter                     | Conditions                                        | Min. | Typ. | Max.  | Units |
| $I_F$                                                    | Diode forward current         | DC, $T_{case} = 75^{\circ}\text{C}$               | -    | -    | 600   | A     |
| $I_{FM}$                                                 | Diode maximum forward current | $T_{case} = 75^{\circ}\text{C}, t_p = 1\text{ms}$ | -    | -    | 2000  | A     |
| $V_F$                                                    | Diode forward voltage         | $I_F = 1000\text{A}$                              | -    | 1.7  | 2.2   | V     |
| $R_{\theta(j-c)}$                                        | Thermal resistance            | DC junction to case per arm                       | -    | -    | 0.085 | °C/W  |

## AC ELECTRICAL CHARACTERISTICS

| Symbol    | Parameter                    | Conditions                                                 | Min. | Typ.   | Max. | Units |
|-----------|------------------------------|------------------------------------------------------------|------|--------|------|-------|
| $C_{ies}$ | Input capacitance            | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$ | -    | 116000 | -    | pF    |
| $C_{oes}$ | Output capacitance           | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$ | -    | 17600  | -    | pF    |
| $C_{res}$ | Reverse transfer capacitance | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$ | -    | 16800  | -    | pF    |

## INDUCTIVE SWITCHING CHARACTERISTICS

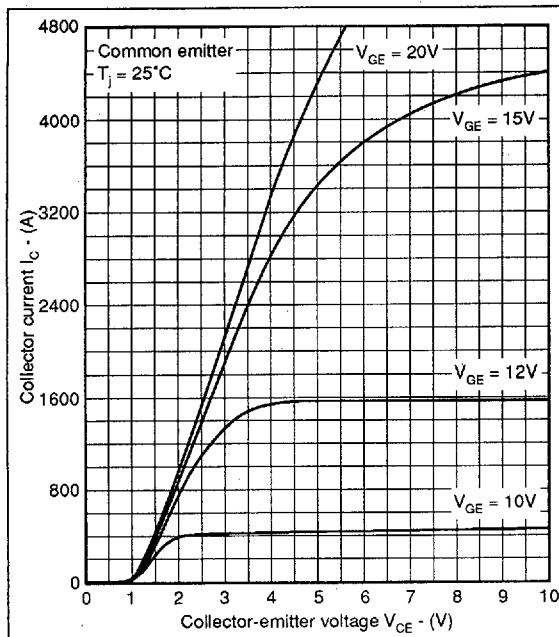
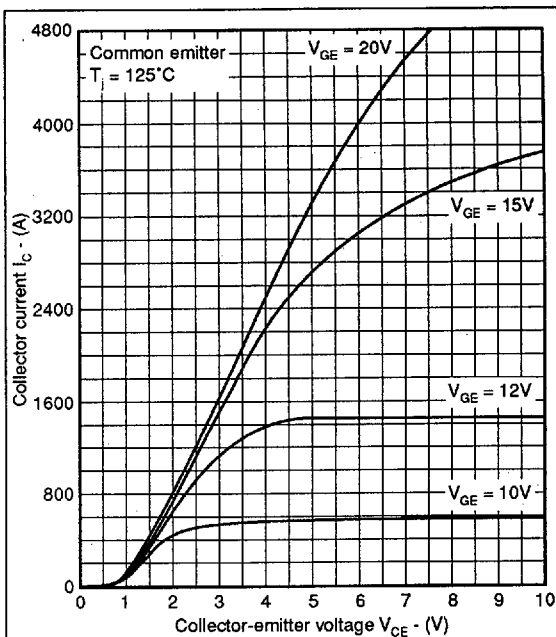
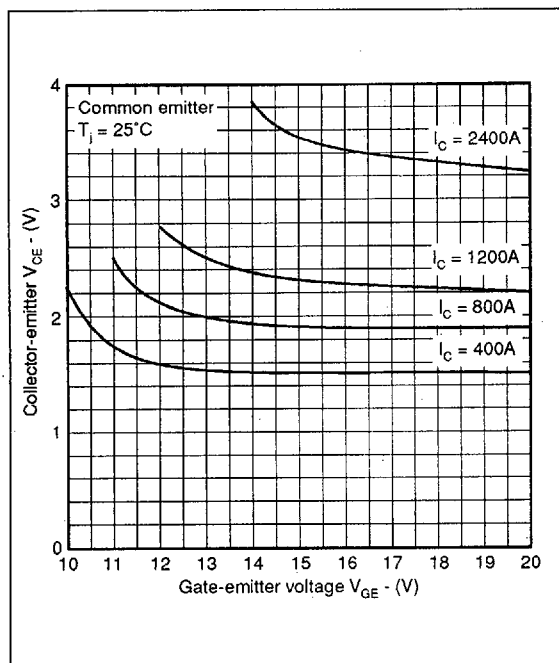
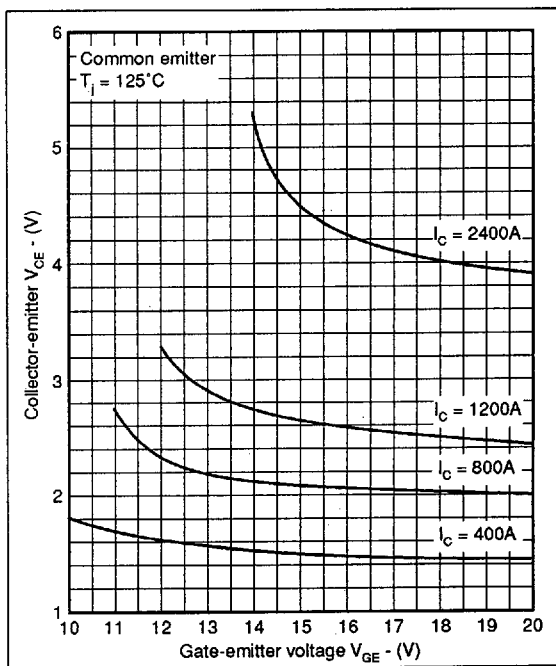
For definition of switching waveforms, refer to figures 6 and 7 shown in application note AN4504 IGBT Ratings and Characteristics.

| $T_{case} = 125^{\circ}\text{C}$ unless stated otherwise. |                      |                                                                                                                         |      |      |      |       |
|-----------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------|------|------|------|-------|
| Symbol                                                    | Parameter            | Conditions                                                                                                              | Min. | Typ. | Max. | Units |
| $t_{d(off)}$                                              | Turn-off delay time  | $I_C = 1000\text{A},$<br>$V_{GE} = \pm 15\text{V},$<br>$V_{CE} = 50\% V_{CES},$<br>$R_{G(ON)} = R_{G(OFF)} = 0.8\Omega$ | -    | 560  | -    | ns    |
| $t_f$                                                     | Fall time            |                                                                                                                         | -    | 430  | -    | ns    |
| $E_{OFF}$                                                 | Turn-off energy loss |                                                                                                                         | -    | 96   | -    | mJ    |
| $t_{d(on)}$                                               | Turn-on delay time   |                                                                                                                         | -    | 810  | -    | ns    |
| $t_r$                                                     | Rise time            |                                                                                                                         | -    | 290  | -    | ns    |
| $E_{ON}$                                                  | Turn-on energy loss  |                                                                                                                         | -    | 80   | -    | mJ    |

## DIODE DYNAMIC CHARACTERISTICS (INDUCTIVE)

| $T_{case} = 125^{\circ}\text{C}$ unless stated otherwise. |                         |                                                                                                                  |      |      |      |               |
|-----------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| Symbol                                                    | Parameter               | Conditions                                                                                                       | Min. | Typ. | Max. | Units         |
| $t_{rr}$                                                  | Reverse recovery time   | $T_{case} = 25^{\circ}\text{C}, I_F = 1000\text{A},$<br>$V_R = 50\% V_{CES}, di_F/dt = 1600\text{A}/\mu\text{s}$ | -    | 90   | -    | ns            |
| $Q_{rr}$                                                  | Reverse recovery charge |                                                                                                                  | -    | 4    | -    | $\mu\text{C}$ |
| $t_{rr}$                                                  | Reverse recovery time   | $I_F = 1000\text{A}$<br>$V_R = 50\% V_{CES}, di_F/dt = 1600\text{A}/\mu\text{s}$                                 | -    | 228  | -    | ns            |
| $Q_{rr}$                                                  | Reverse recovery charge |                                                                                                                  | -    | 22   | -    | $\mu\text{C}$ |

## CURVES

Fig.3 Typical output characteristics @  $25^\circ\text{C}$ Fig.4 Typical output characteristics @  $125^\circ\text{C}$ Fig.5 Typical transfer characteristics @  $25^\circ\text{C}$ Fig.6 Typical transfer characteristics @  $125^\circ\text{C}$

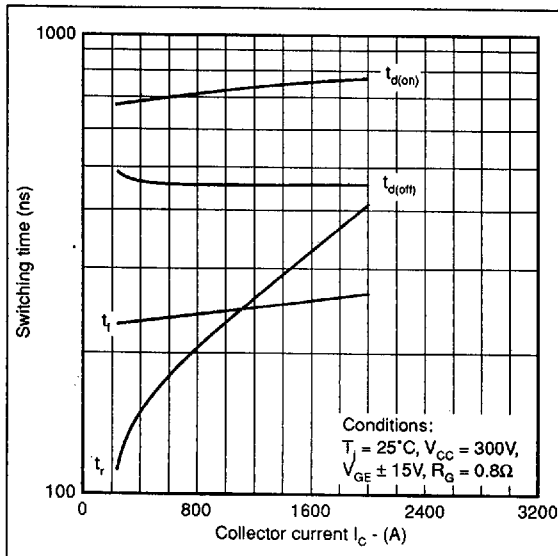
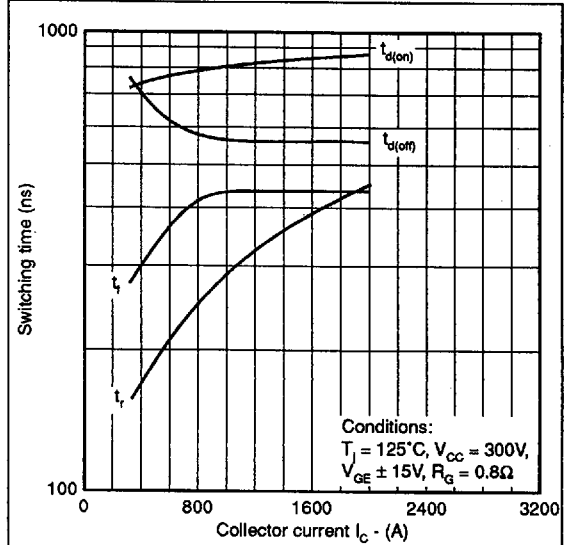
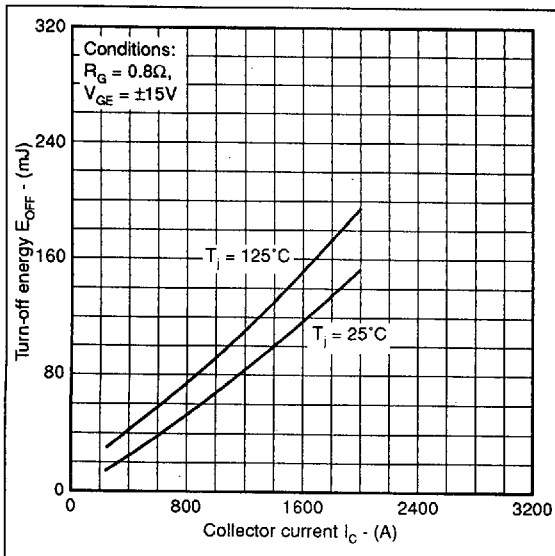
Fig.7 Typical switching time vs  $I_C$  @  $25^\circ\text{C}$ Fig.8 Typical switching time vs  $I_C$  @  $125^\circ\text{C}$ 

Fig.9 Typical turn-off losses

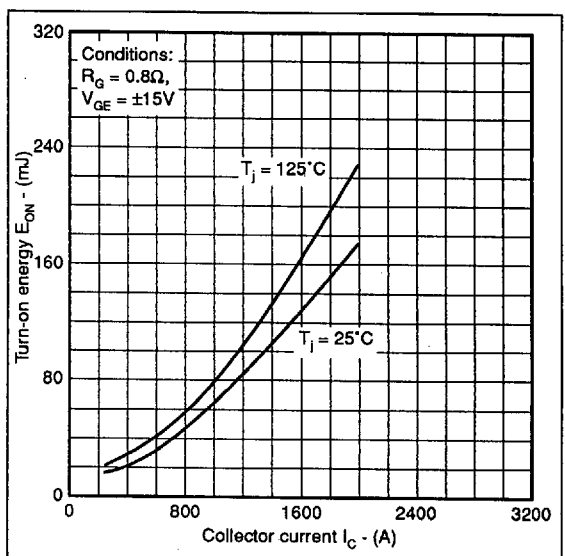


Fig.10 Typical turn-on losses

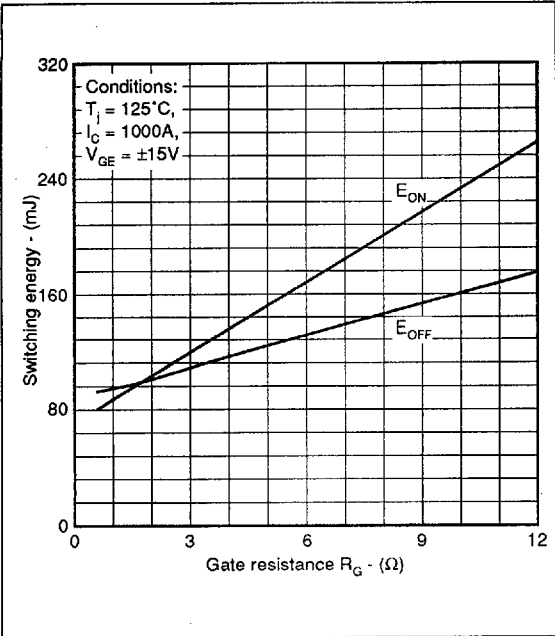


Fig.11 Typical switching energy @125°C

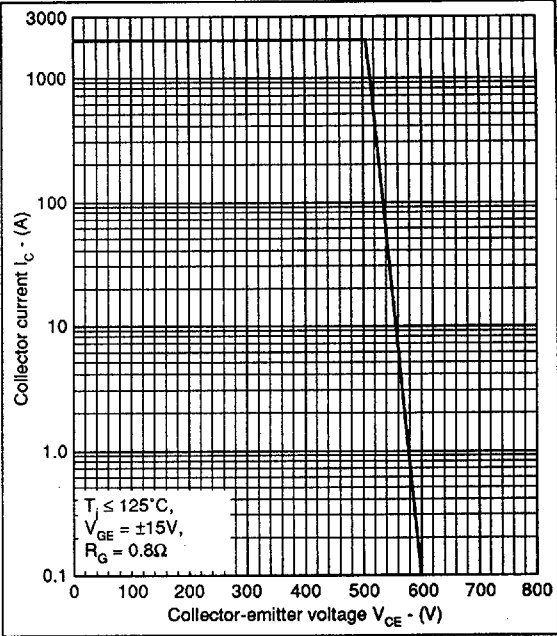


Fig.12 Reverse bias safe operating area

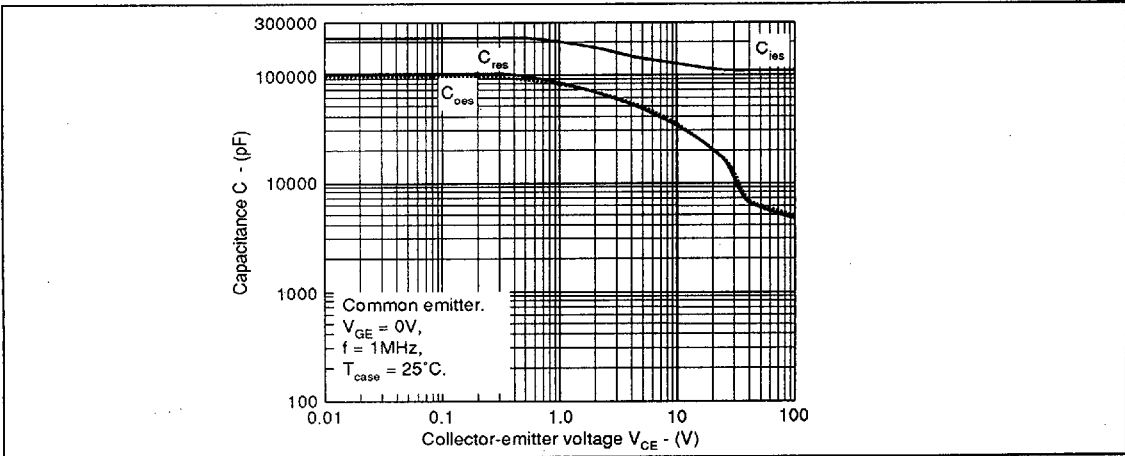


Fig.13 Typical capacitance

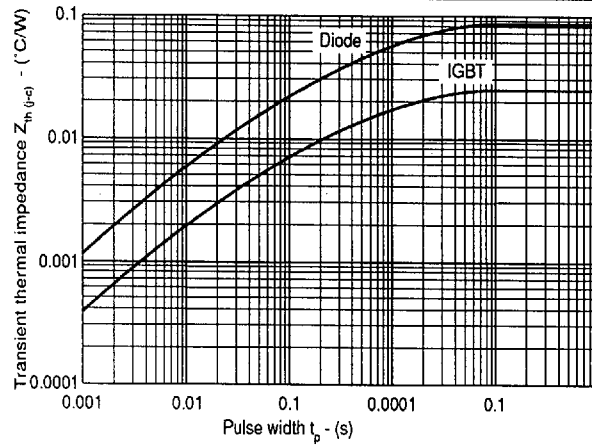


Fig.14 Transient thermal impedance

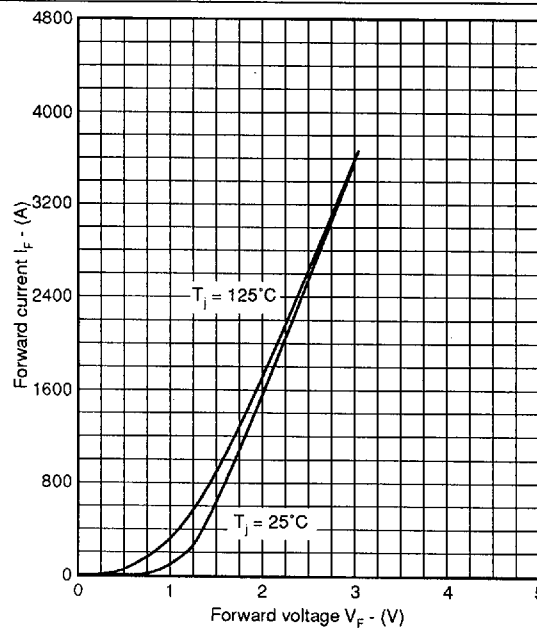
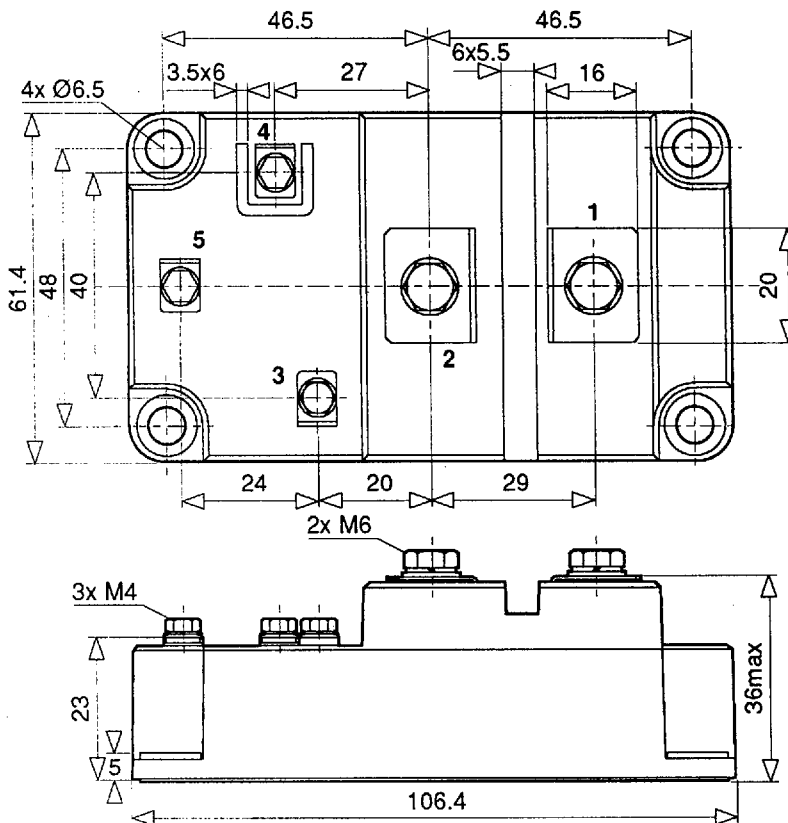
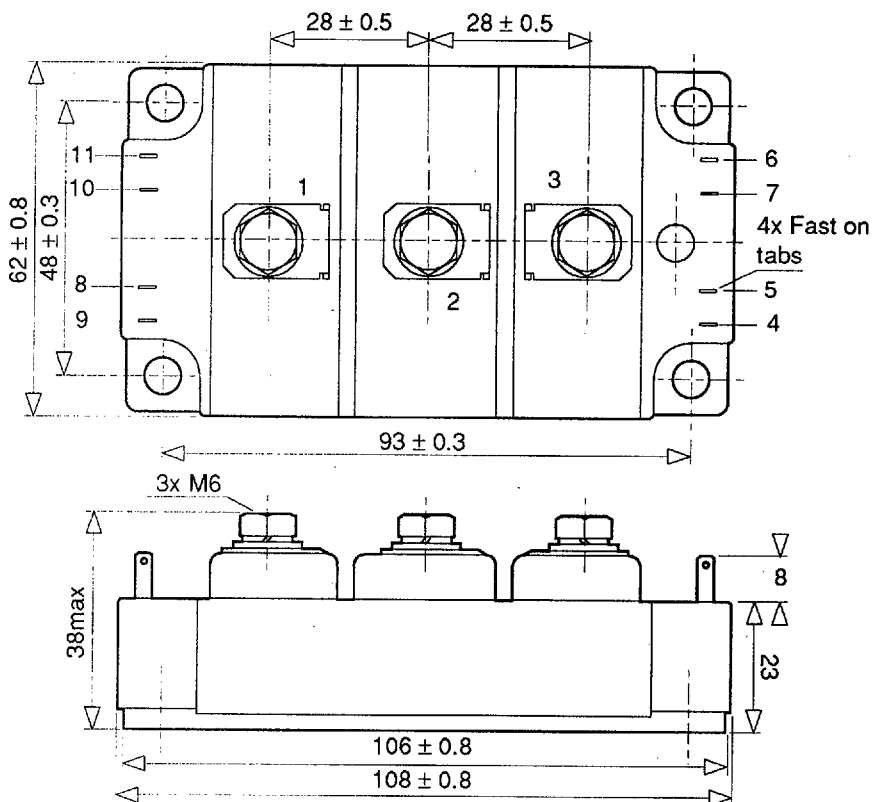


Fig.15 Typical diode forward characteristics



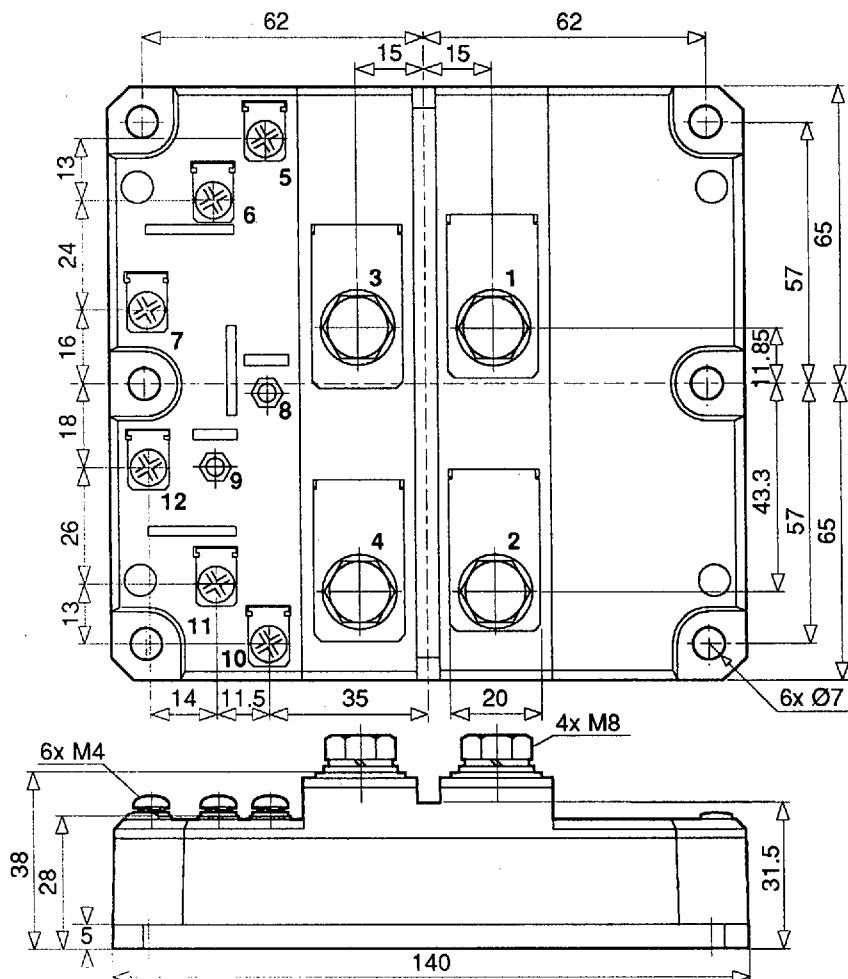
### PACKAGE OUTLINE - L

|                                                     |                 |
|-----------------------------------------------------|-----------------|
| Recommended fixings for mounting:                   | M6              |
| Recommended mounting torque:                        | 5Nm (44lbs.ins) |
| Recommended torque for electrical connections (M6): | 5Nm (44lbs.ins) |
| Max. torque for electrical connections (M4):        | 2Nm (18lbs.ins) |
| Nominal weight:                                     | 265g            |



### PACKAGE OUTLINE - M

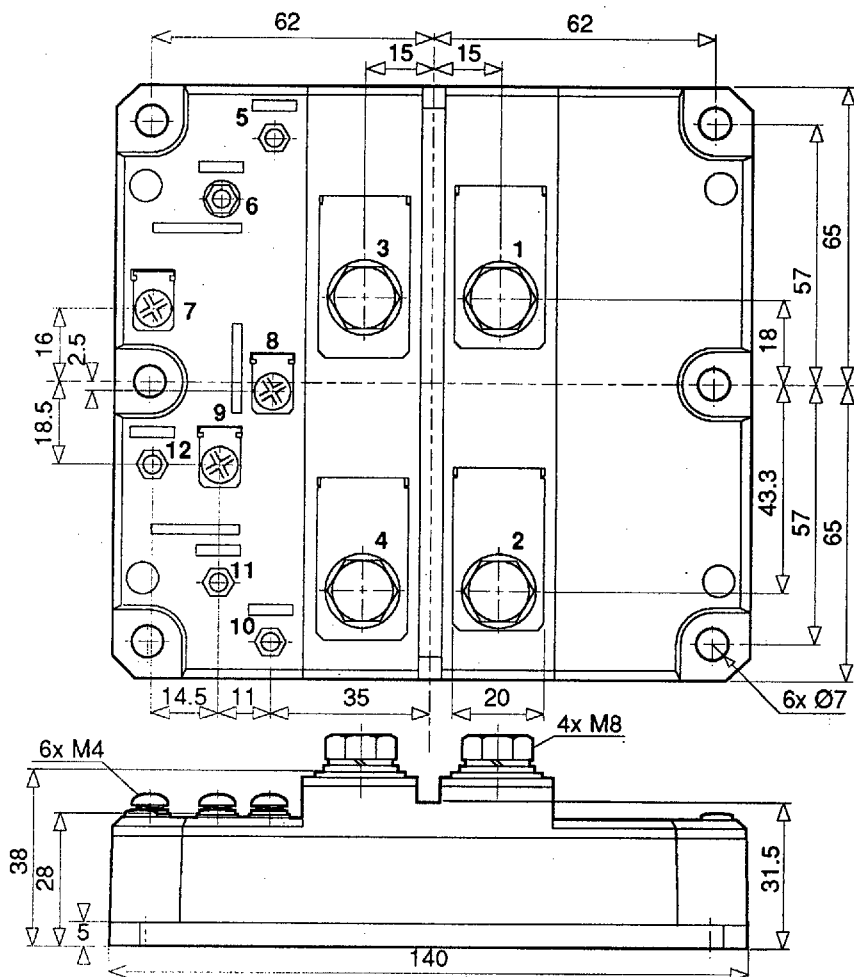
|                                                     |                 |
|-----------------------------------------------------|-----------------|
| Recommended fixings for mounting:                   | M6              |
| Recommended mounting torque:                        | 5Nm (44lbs.ins) |
| Recommended torque for electrical connections (M6): | 5Nm (44lbs.ins) |
| Max. torque for electrical connections:             | 8Nm (70lbs.ins) |
| Nominal weight:                                     | 265g            |



### PACKAGE OUTLINE - D

Recommended fixings for mounting: M6  
 Recommended mounting torque: 5Nm (44lbs.ins)  
 Recommended torque for electrical connections (M8): 8Nm (70lbs.ins)  
 Max. torque for electrical connections (M8): 10Nm (88lbs.ins)  
 Recommended torque for electrical connections (M4): 2Nm (18lbs.ins)

Nominal weight: 1500g



### PACKAGE OUTLINE F

Recommended fixings for mounting: M6  
 Recommended mounting torque: 5Nm (44lbs.ins)  
 Recommended torque for electrical connections (M8): 8Nm (70lbs.ins)  
 Max. torque for electrical connections (M8): 10Nm (88lbs.ins)  
 Recommended torque for electrical connections (M4): 2Nm (18lbs.ins)

Nominal weight: 1500g