

# GP400LSS12S

## POWERLINE N-CANNEL 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 (10μs).

### CIRCUIT

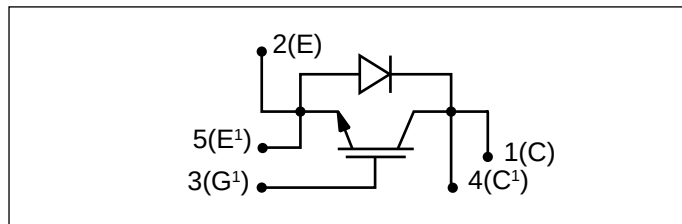


Fig.1 Single switch circuit diagram

### RATINGS

| $T_{case} = 25^{\circ}C$ unless stated otherwise. |                           |                                                          |      |       |
|---------------------------------------------------|---------------------------|----------------------------------------------------------|------|-------|
| Symbol                                            | Parameter                 | Test Conditions                                          | Max. | Units |
| $V_{CES}$                                         | Collector-emitter voltage | $V_{GE} = 0V$                                            | 1200 | V     |
| $V_{GES}$                                         | Gate-emitter voltage      | -                                                        | ±20  | V     |
| $I_C$                                             | Collector current         | DC, $T_{case} = 75^{\circ}C$                             | 400  | A     |
| $I_{C(PK)}$                                       |                           | 1ms, $T_{case} = 75^{\circ}C$                            | 800  | A     |
| $P_{max}$                                         | Maximum power dissipation |                                                          | 2500 | W     |
| $V_{isol}$                                        | Isolation voltage         | Commoned terminals to base plate.<br>AC RMS, 1 min, 50Hz | 2500 | V     |

### TYPICAL KEY PARAMETERS

|               |       |
|---------------|-------|
| $V_{CES}$     | 1200V |
| $V_{CE(sat)}$ | 2.8V  |
| $I_{C(CONT)}$ | 400A  |
| $I_{C(PK)}$   | 800A  |
| $t_r$         | 190ns |
| $t_f$         | 840ns |

### PACKAGE OUTLINE

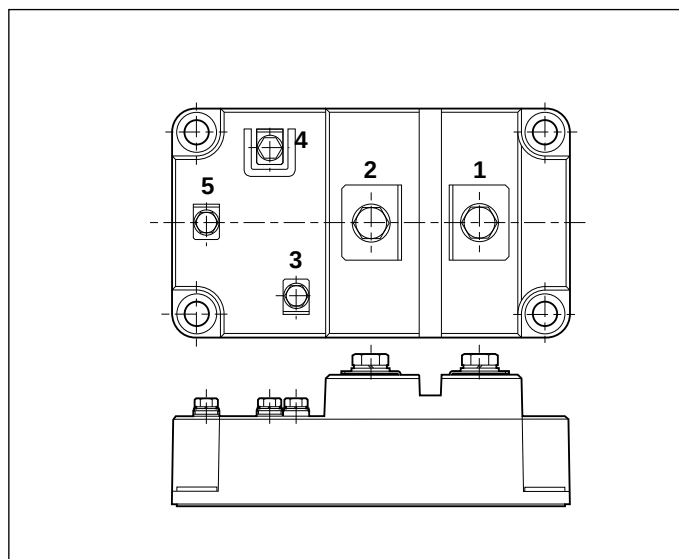


Fig.2

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

THERMAL AND MECHANICAL RATINGS

| Symbol        | Parameter                             | Conditions                                 | Min. | Max.  | Units |
|---------------|---------------------------------------|--------------------------------------------|------|-------|-------|
| $R_{th(j-c)}$ | Thermal resistance                    | DC junction to case                        | -    | 0.05  | °C/W  |
| $R_{th(c-h)}$ | Thermal resistance - Case to heatsink | Mounting torque 5Nm (with mounting grease) | -    | 0.007 | °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

| $T_{case} = 25^{\circ}C$ unless stated otherwise. |                                      |                                                     |      |      |         |         |
|---------------------------------------------------|--------------------------------------|-----------------------------------------------------|------|------|---------|---------|
| Symbol                                            | Parameter                            | Conditions                                          | Min. | Typ. | Max.    | Units   |
| $I_{CES}$                                         | Collector cut-off current            | $V_{GE} = 0V, V_{CE} = V_{CES}$                     | -    | -    | 4       | mA      |
| $I_{GES}$                                         | Gate leakage current                 | $V_{GE} = \pm 20V$                                  | -    | -    | $\pm 2$ | $\mu A$ |
| $V_{GE(TH)}$                                      | Gate threshold voltage               | $I_C = 20mA, V_{GE} = V_{CE}$                       | 4    | -    | 7.5     | V       |
| $V_{CE(SAT)}$                                     | Collector-emitter saturation voltage | $V_{GE} = 15V, I_C = 400A$                          | -    | 2.8  | 3.6     | V       |
|                                                   |                                      | $V_{GE} = 15V, I_C = 400A, T_{case} = 125^{\circ}C$ | -    | 3.0  | 3.6     | V       |

DIODE DC CHARACTERISTICS

| $T_{case} = 25^{\circ}C$ unless stated otherwise. |                               |                                     |      |      |      |       |
|---------------------------------------------------|-------------------------------|-------------------------------------|------|------|------|-------|
| Symbol                                            | Parameter                     | Conditions                          | Min. | Typ. | Max. | Units |
| $I_F$                                             | Diode forward current         | DC, $T_{case} = 75^{\circ}C$        | -    | -    | 280  | A     |
| $I_{FM}$                                          | Diode maximum forward current | $T_{case} = 75^{\circ}C, t_p = 1ms$ | -    | -    | 800  | A     |
| $V_F$                                             | Diode forward voltage         | $I_F = 400A$                        | -    | 2.25 | 2.7  | V     |
| $R_{th(j-c)}$                                     | Thermal resistance            | DC junction to case                 | -    | -    | 0.17 | °C/W  |

AC ELECTRICAL CHARACTERISTICS

| Symbol    | Parameter                    | Conditions                            | Min. | Typ.  | Max. | Units |
|-----------|------------------------------|---------------------------------------|------|-------|------|-------|
| $C_{ies}$ | Input capacitance            | $V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$ | -    | 54000 | -    | pF    |
| $C_{oes}$ | Output capacitance           | $V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$ | -    | 3000  | -    | pF    |
| $C_{res}$ | Reverse transfer capacitance | $V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$ | -    | 3600  | -    | pF    |

## INDUCTIVE SWITCHING CHARACTERISTICS

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

| $T_{\text{case}} = 125^{\circ}\text{C}$ unless stated otherwise. |                      |                                                                                                                                                                    |      |      |      |       |
|------------------------------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|-------|
| Symbol                                                           | Parameter            | Conditions                                                                                                                                                         | Min. | Typ. | Max. | Units |
| $t_{\text{d(off)}}$                                              | Turn-off delay time  | $I_{\text{C}} = 400\text{A},$<br>$V_{\text{GE}} = \pm 15\text{V},$<br>$V_{\text{CE}} = 50\% V_{\text{CES}},$<br>$R_{\text{G(ON)}} = R_{\text{G(OFF)}} = 1.5\Omega$ | -    | 620  | -    | ns    |
| $t_{\text{f}}$                                                   | Fall time            |                                                                                                                                                                    | -    | 840  | -    | ns    |
| $E_{\text{OFF}}$                                                 | Turn-off energy loss |                                                                                                                                                                    | -    | 112  | -    | mJ    |
| $t_{\text{d(on)}}$                                               | Turn-on delay time   |                                                                                                                                                                    | -    | 750  | -    | ns    |
| $t_{\text{r}}$                                                   | Rise time            |                                                                                                                                                                    | -    | 190  | -    | ns    |
| $E_{\text{ON}}$                                                  | Turn-on energy loss  |                                                                                                                                                                    | -    | 112  | -    | mJ    |

## DIODE DYNAMIC CHARACTERISTICS (INDUCTIVE)

| $T_{\text{case}} = 125^{\circ}\text{C}$ unless stated otherwise. |                         |                                                                                                                                                          |      |      |      |               |
|------------------------------------------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| Symbol                                                           | Parameter               | Conditions                                                                                                                                               | Min. | Typ. | Max. | Units         |
| $t_{\text{rr}}$                                                  | Reverse recovery time   | $T_{\text{case}} = 25^{\circ}\text{C}, I_{\text{F}} = 400\text{A},$<br>$V_{\text{R}} = 50\% V_{\text{CES}}, di_{\text{F}}/dt = 1200\text{A}/\mu\text{s}$ | -    | 110  | -    | ns            |
| $Q_{\text{rr}}$                                                  | Reverse recovery charge |                                                                                                                                                          | -    | 16   | -    | $\mu\text{C}$ |
| $t_{\text{rr}}$                                                  | Reverse recovery time   | $I_{\text{F}} = 400\text{A}$<br>$V_{\text{R}} = 50\% V_{\text{CES}}, di_{\text{F}}/dt = 1200\text{A}/\mu\text{s}$                                        | -    | 240  | -    | ns            |
| $Q_{\text{rr}}$                                                  | Reverse recovery charge |                                                                                                                                                          | -    | 48   | -    | $\mu\text{C}$ |

CURVES

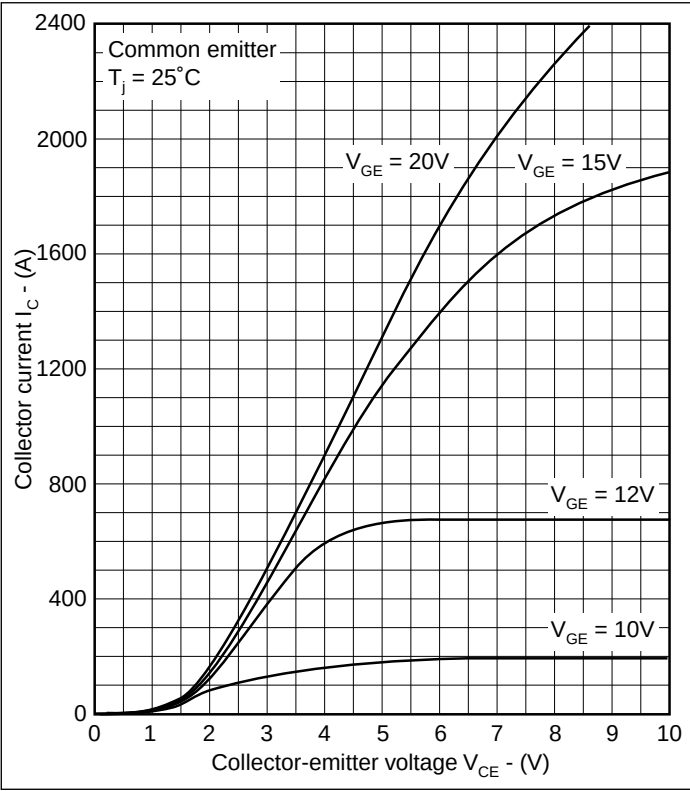


Fig.3 Typical output characteristics @ 25°C

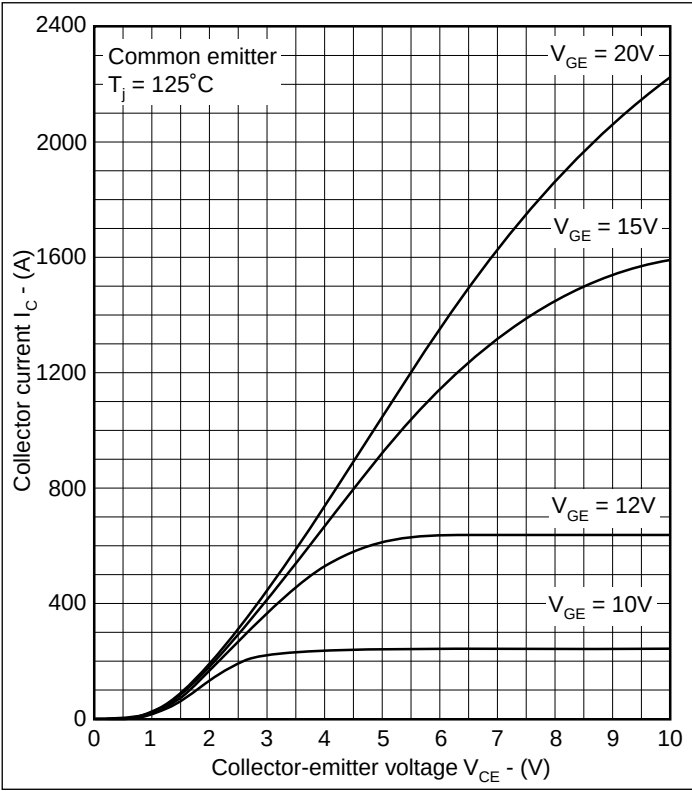


Fig.4 Typical output characteristics @ 125°C

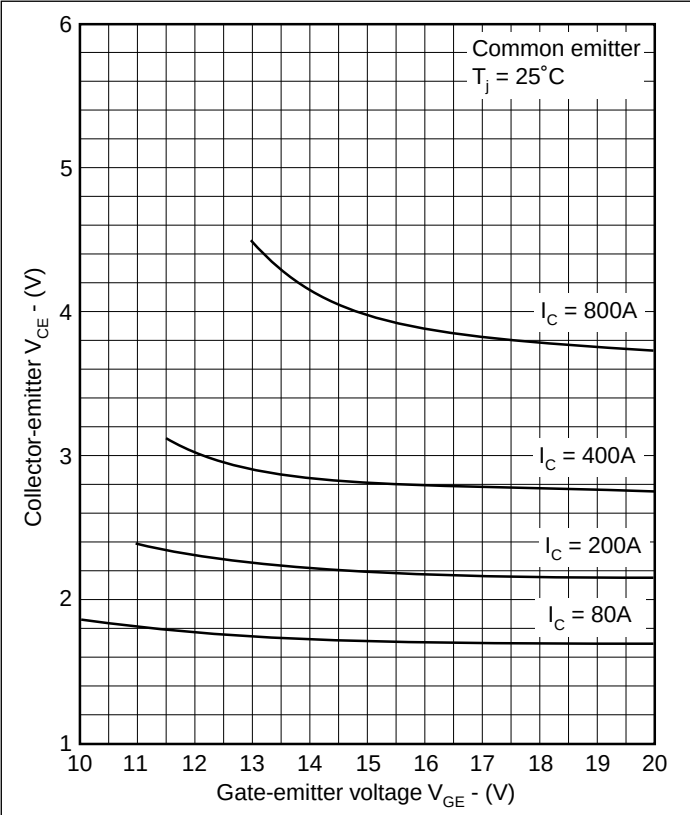


Fig.5 Typical transfer characteristics @ 25°C

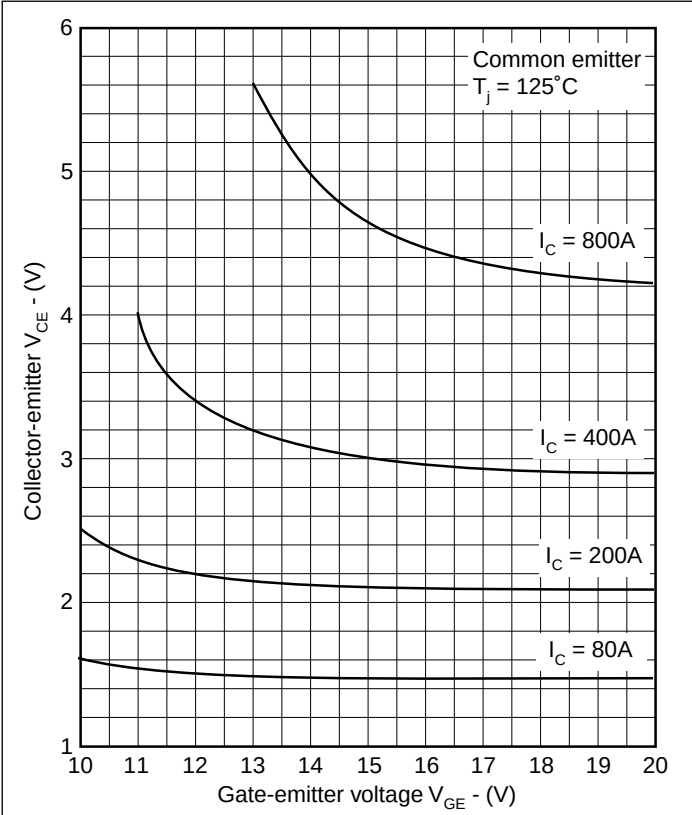


Fig.6 Typical transfer characteristics @ 125°C

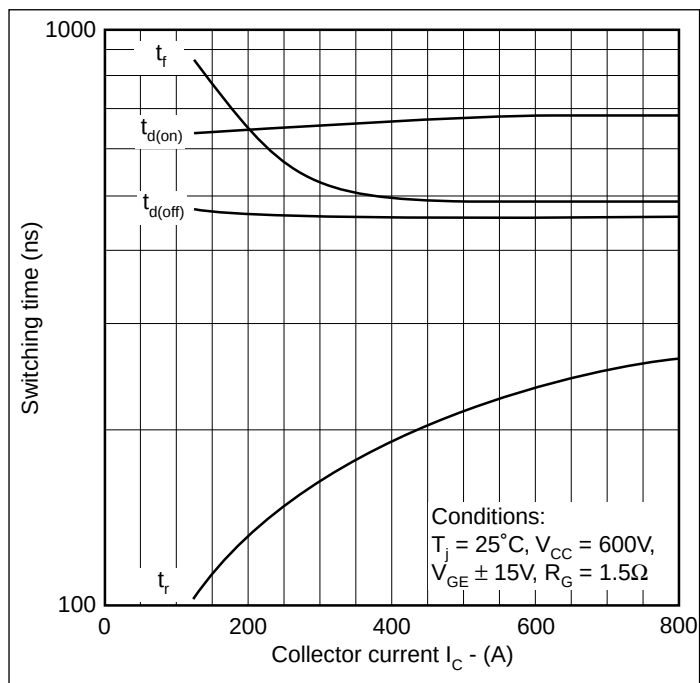
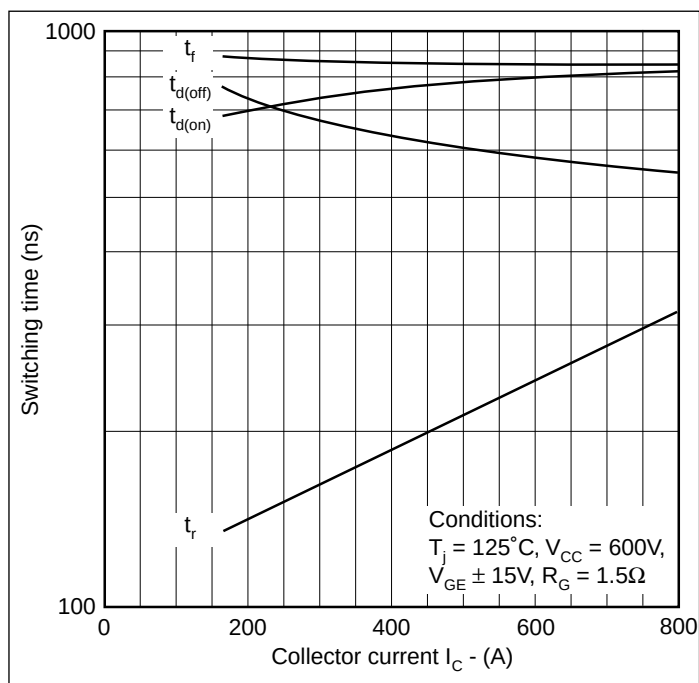
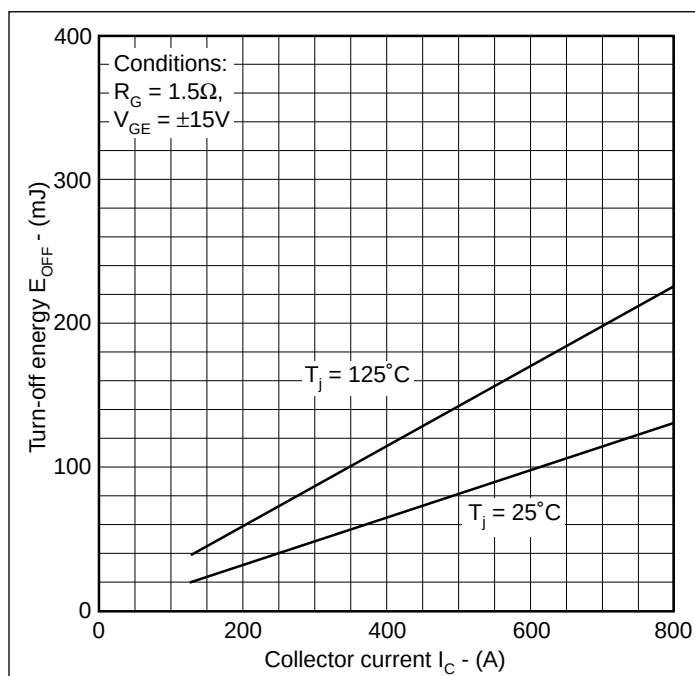
Fig.7 Typical switching time vs  $I_C$  @  $25^\circ\text{C}$ Fig.8 Typical switching time vs  $I_C$  @  $125^\circ\text{C}$ 

Fig.9 Typical turn-off losses

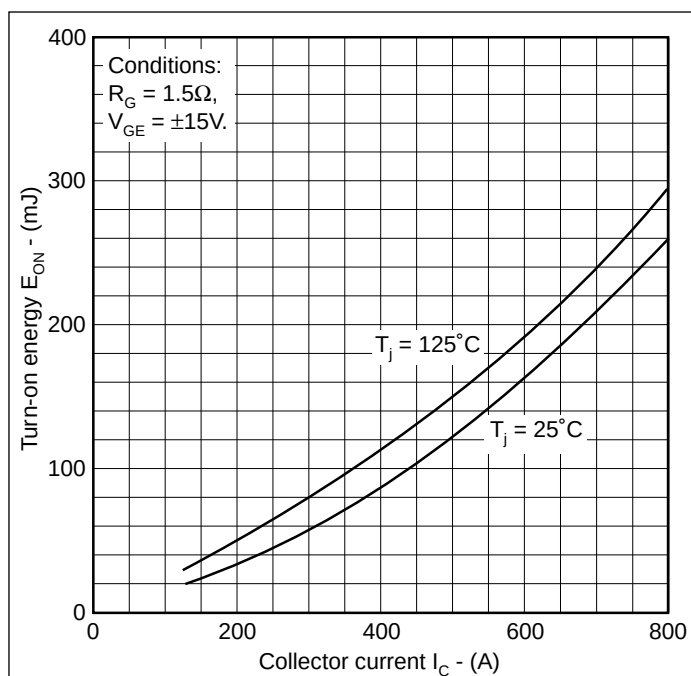


Fig.10 Typical turn-on losses

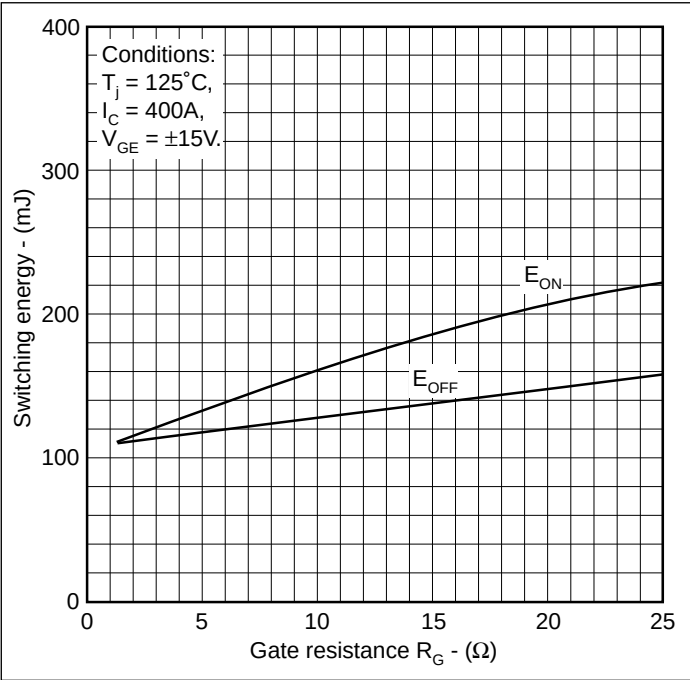


Fig.11 Typical switching energy @125°C

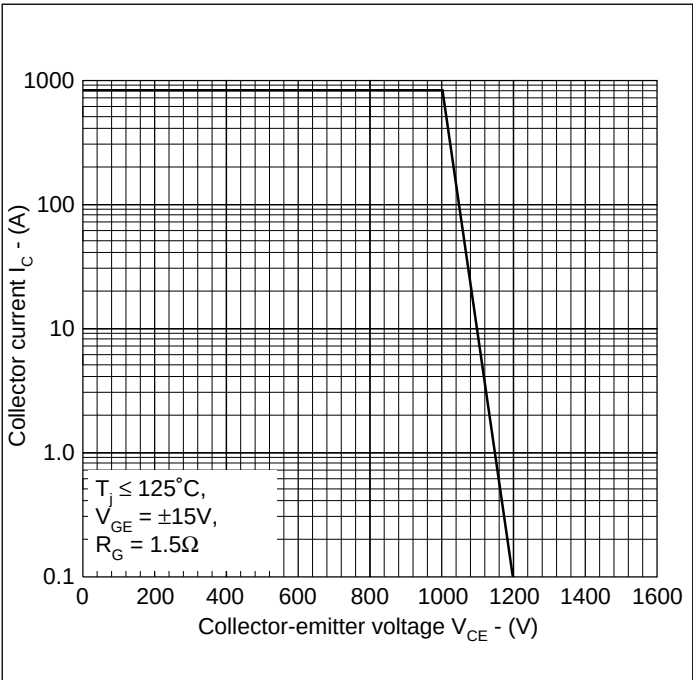


Fig.12 Reverse bias safe operating area

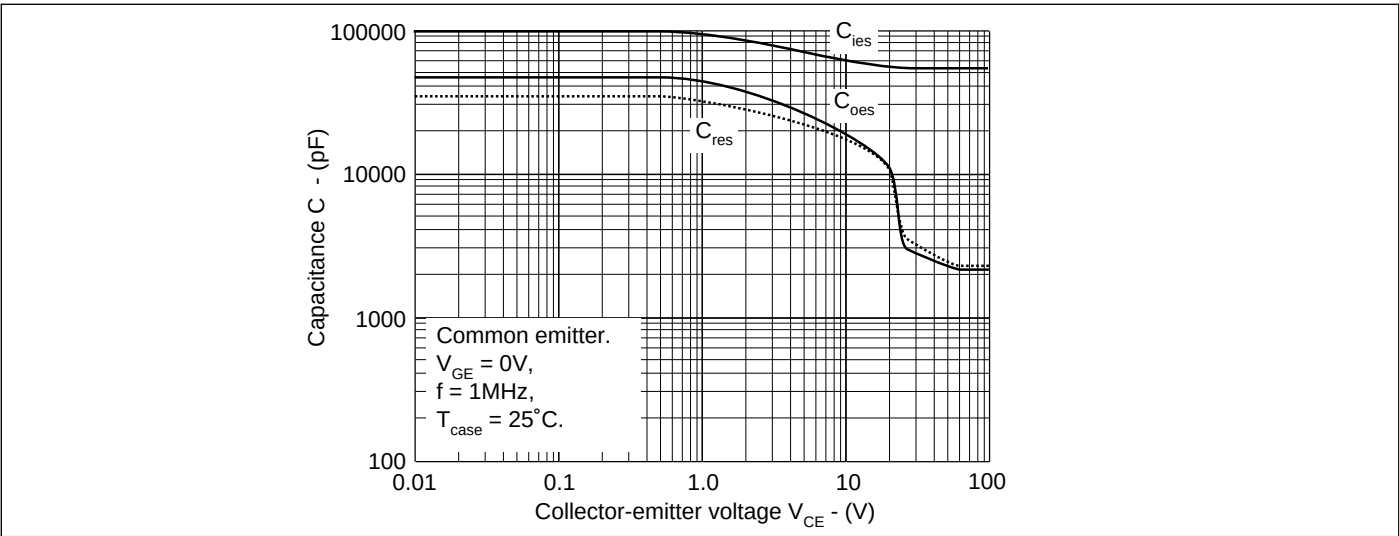


Fig.13 Typical capacitance

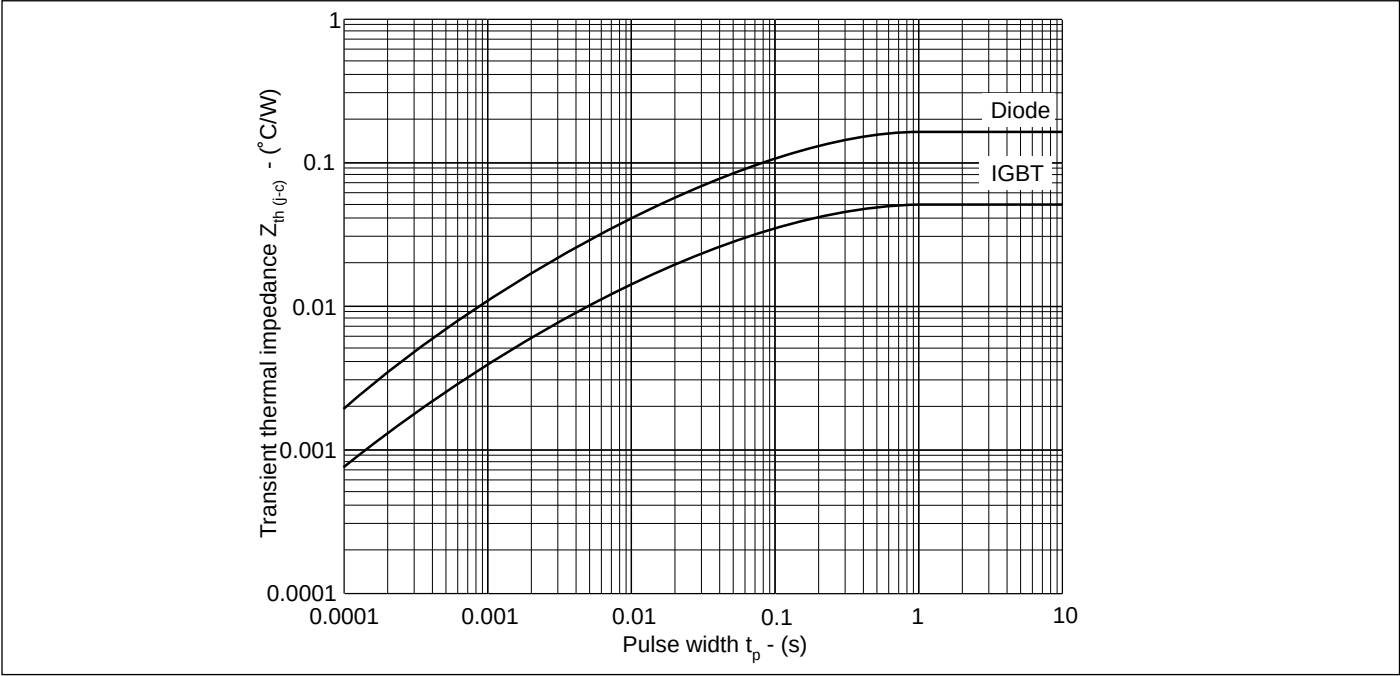


Fig.14 Transient thermal impedance

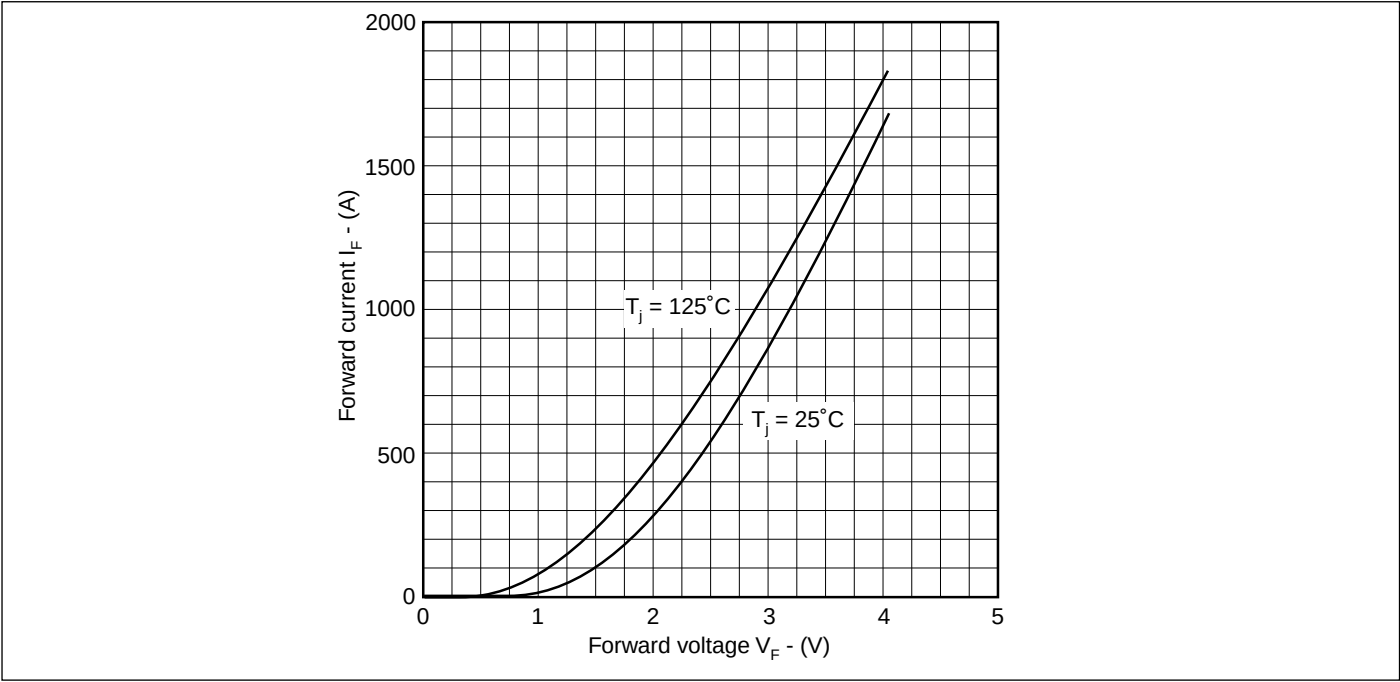
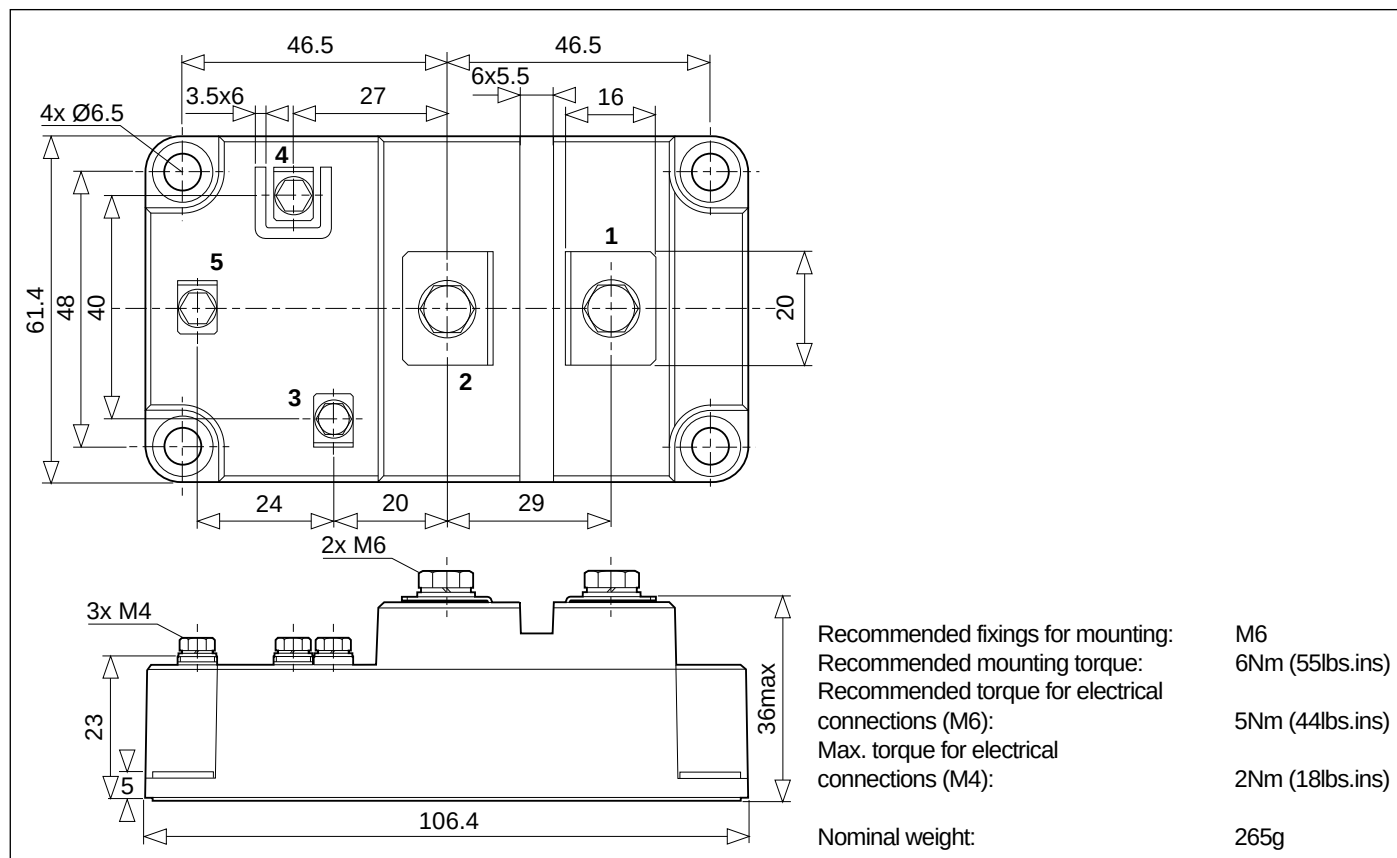


Fig.15 Typical diode forward characteristics

## PACKAGE DETAILS - L

For further package information, please contact your local Customer Service Centre. All dimensions in mm, unless stated otherwise. DO NOT SCALE.



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