

# GCP20GX65SGT1

## General Description

GRECON IGBT Power Discrete provides ultra low conduction loss as well as low switching loss. They are designed for the applications such as general inverters and UPS.RoHS compliant

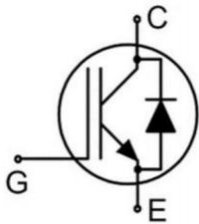
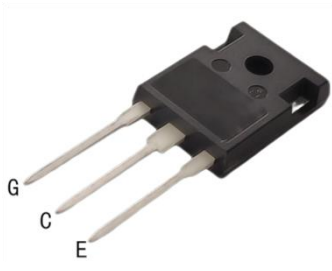
|                              |      |   |
|------------------------------|------|---|
| $V_{CES}$                    | 650  | V |
| $I_C$                        | 20   | A |
| $V_{cesat}(T_C=25^{\circ}C)$ | 1.84 | V |
| $P_{tot}(T_C=25^{\circ}C)$   | 150  | W |

## Typical Applications

- Solar Inverter
- AC and DC servo drive amplifier
- Uninterruptible power supply

## Electrical Features

- Low Switching Losses
- Maximum junction temperature 175°C
- $V_{CEsat}$  with positive Temperature Coefficient
- Low  $V_{CEsat}$
- external insulation



| Device        | Package   | Marking       |
|---------------|-----------|---------------|
| GCP20GX65SGT1 | TO-247-3L | GCP20GX65SGT1 |

## Maximum Rated Values

| Parameter                                                        | Symbol             | Conditions                                                          | Value       | Unit               |
|------------------------------------------------------------------|--------------------|---------------------------------------------------------------------|-------------|--------------------|
| Collector-emitter voltage                                        | $V_{CES}$          | $T_{vj}=25^{\circ}\text{C}$                                         | 650         | V                  |
| Gate-emitter peak voltage                                        | $V_{GES}$          |                                                                     | $\pm 20$    | V                  |
| DC collector current,<br>limited by $T_{vj\text{ max}}$          | $I_C$              | $T_C=25^{\circ}\text{C}$ , $T_{vj\text{ max}}=175^{\circ}\text{C}$  | 40          | A                  |
|                                                                  |                    | $T_C=100^{\circ}\text{C}$ , $T_{vj\text{ max}}=175^{\circ}\text{C}$ | 20          |                    |
| Pulse collector current,<br>$t_p$ limited by $T_{vj\text{ max}}$ | $I_{Cpulse}$       |                                                                     | 60          | A                  |
| DC forward current,<br>limited by $T_{vj\text{ max}}$            | $I_F$              | $T_C=25^{\circ}\text{C}$ , $T_{vj\text{ max}}=175^{\circ}\text{C}$  | 40          | A                  |
|                                                                  |                    | $T_C=100^{\circ}\text{C}$ , $T_{vj\text{ max}}=175^{\circ}\text{C}$ | 20          |                    |
| Pulse forward current,<br>$t_p$ limited by $T_{vj\text{ max}}$   | $I_{Fpulse}$       |                                                                     | 60          | A                  |
| power dissipation                                                | $P_D$              | $T_C=25^{\circ}\text{C}$ , $T_{vj\text{ max}}=175^{\circ}\text{C}$  | 150         | W                  |
| Maximum junction temperature                                     | $T_{jmax}$         |                                                                     | 175         | $^{\circ}\text{C}$ |
| Operating junction temperature                                   | $T_{vj\text{ op}}$ |                                                                     | -40 to +175 | $^{\circ}\text{C}$ |
| Storage temperature                                              | $T_{stg}$          |                                                                     | -55 to +150 | $^{\circ}\text{C}$ |
| Maximum Temperature for Soldering                                | $T_L$              |                                                                     | 260         | $^{\circ}\text{C}$ |

## Thermal Characteristic

| Parameter                                      | Symbol     | Value | Unit                        |
|------------------------------------------------|------------|-------|-----------------------------|
| Thermal resistance, junction to case for IGBT  | $R_{thJC}$ | 1.00  | $^{\circ}\text{C}/\text{W}$ |
| Thermal resistance, junction to case for Diode | $R_{thJC}$ | 1.44  | $^{\circ}\text{C}/\text{W}$ |
| Thermal resistance, junction-ambient           | $R_{thJA}$ | 40    | $^{\circ}\text{C}/\text{W}$ |

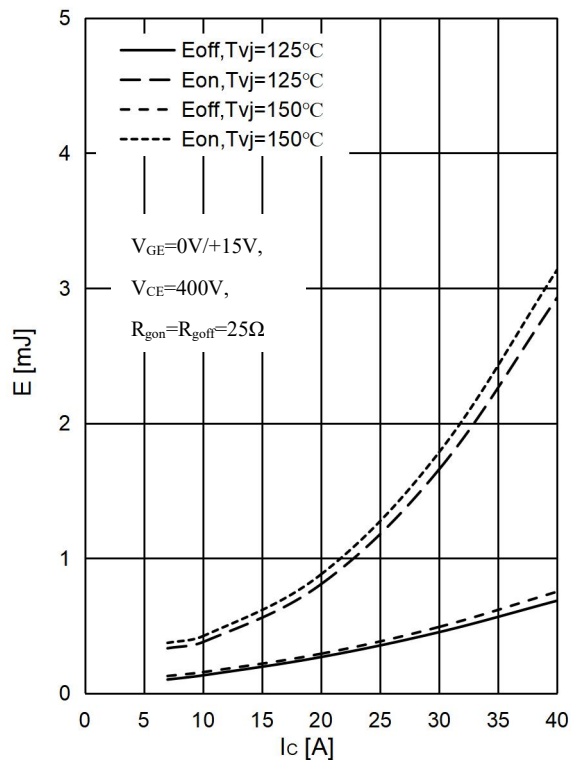
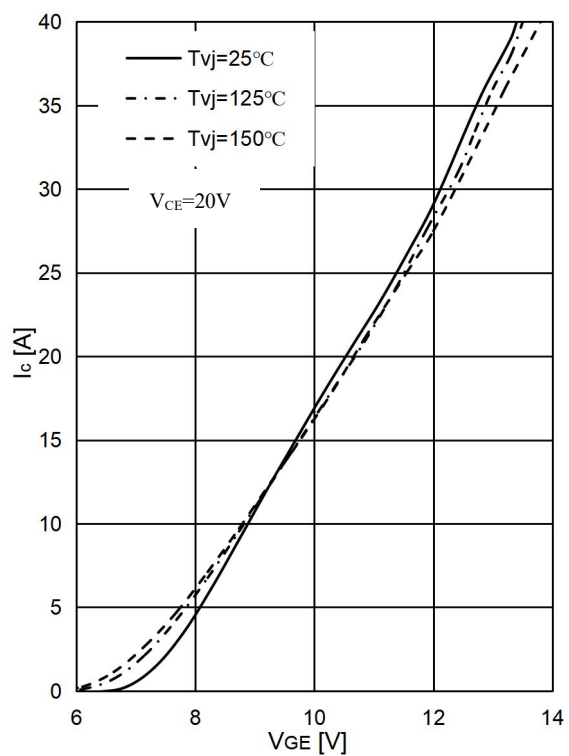
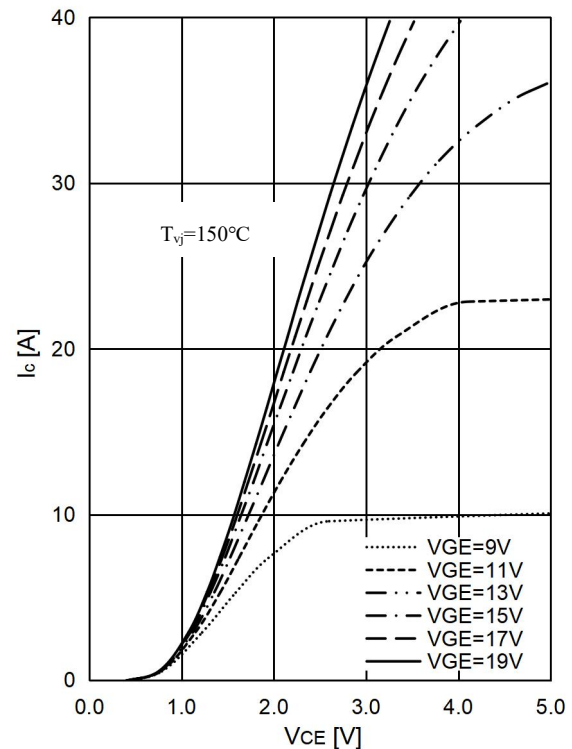
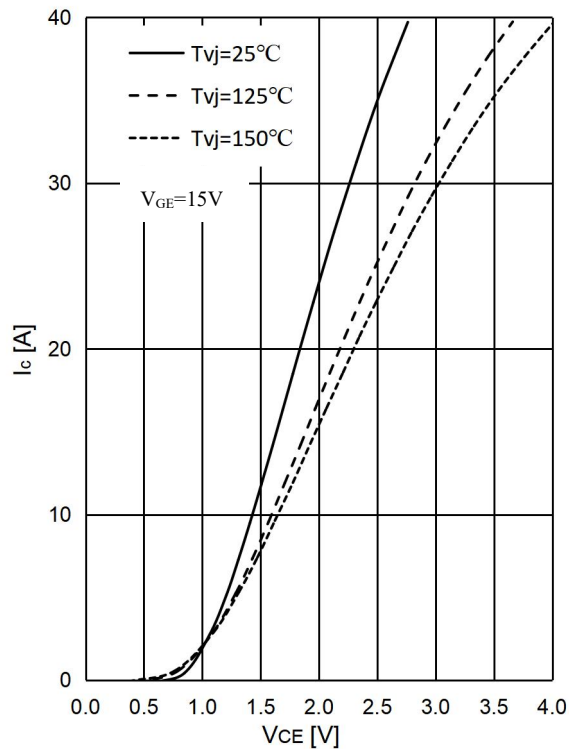
## Characteristic Values Of The IGBT

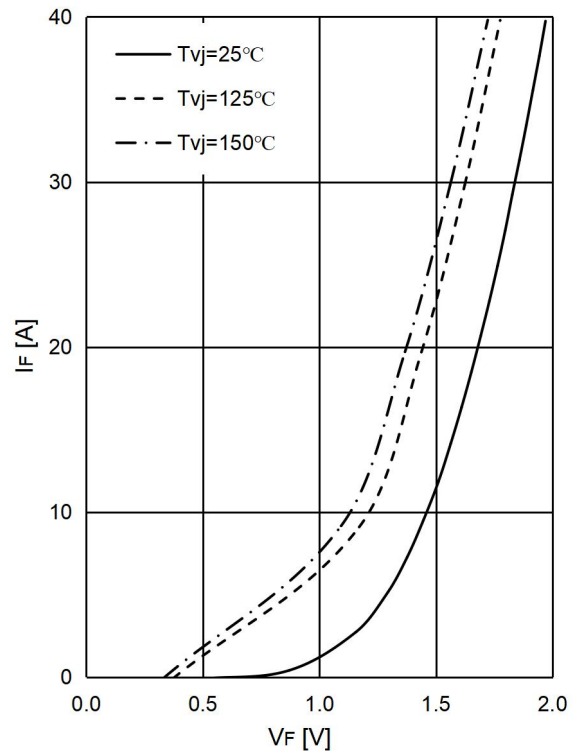
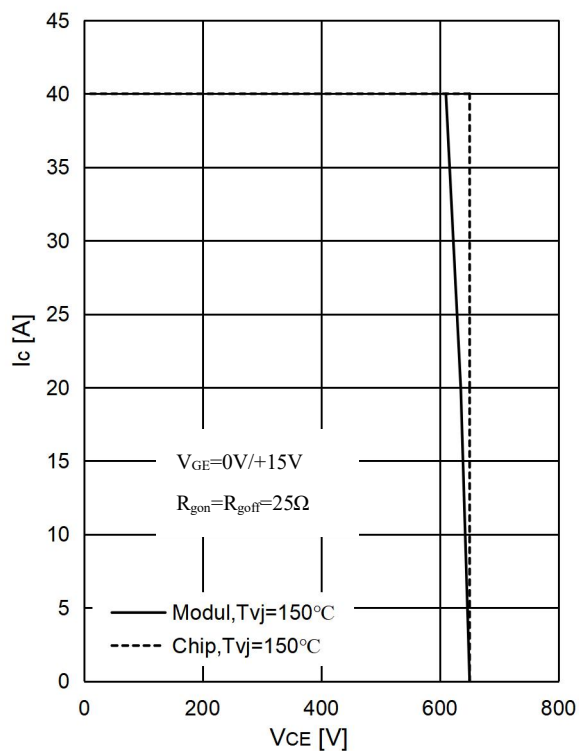
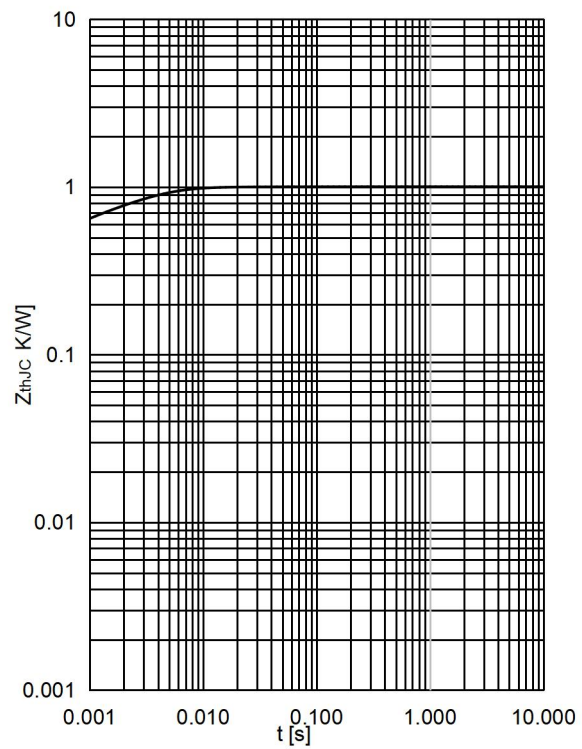
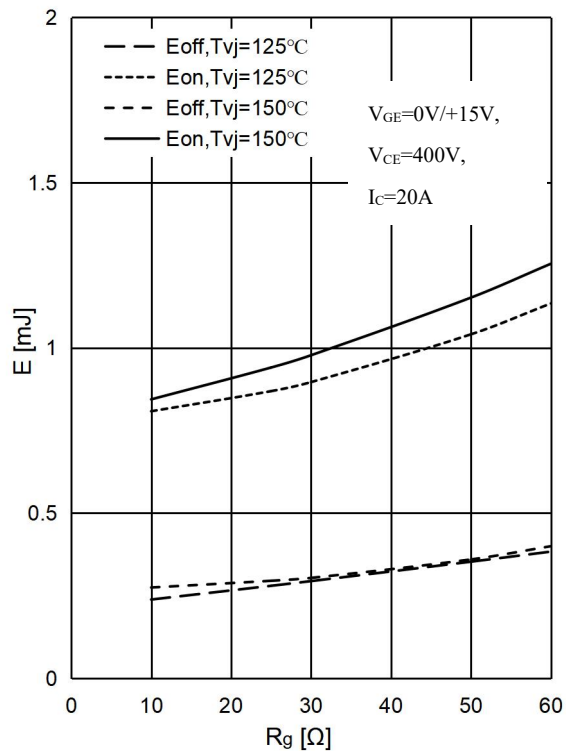
| Parameter                            | Symbol       | Conditions                                                                                  |                       | Value |       |      | Unit     |
|--------------------------------------|--------------|---------------------------------------------------------------------------------------------|-----------------------|-------|-------|------|----------|
|                                      |              |                                                                                             |                       | Min   | Typ   | Max  |          |
| Gate threshold voltage               | $V_{GEth}$   | $V_{GE}=V_{CE}$ , $I_C=0.2mA$                                                               | $T_{vj}=25^{\circ}C$  |       | 5.80  | 6.30 | V        |
| Gate-emitter leakage current         | $I_{GES}$    | $V_{CE}=0V$ , $V_{GE}=20V$                                                                  | $T_{vj}=25^{\circ}C$  |       |       | 100  | nA       |
| Collector-emitter cut-off current    | $I_{CES}$    | $V_{CE}=650V$ , $V_{GE}=0V$                                                                 | $T_{vj}=25^{\circ}C$  |       |       | 1    | mA       |
| Collector-emitter saturation voltage | $V_{CE sat}$ | $I_C=20A$ , $V_{GE}=15V$                                                                    | $T_{vj}=25^{\circ}C$  |       | 1.84  | 2.10 | V        |
|                                      |              |                                                                                             | $T_{vj}=150^{\circ}C$ |       | 2.18  |      |          |
|                                      |              |                                                                                             | $T_{vj}=175^{\circ}C$ |       | 2.25  |      |          |
| Internal gate resistance             | $R_{gint}$   | $f=1MHz$                                                                                    | $T_{vj}=25^{\circ}C$  |       | 2.0   |      | $\Omega$ |
| Gate charge                          | $Q_G$        | $V_{CC}=400V$ , $I_C=20A$ , $V_{GE}=15V$                                                    | $T_{vj}=25^{\circ}C$  |       | 80    |      | nC       |
| Input capacitance                    | $C_{ies}$    | $V_{CE}=25V$ , $V_{GE}=0V$ , $f=1MHz$                                                       | $T_{vj}=25^{\circ}C$  |       | 1.59  |      | nF       |
| Output capacitance                   | $C_{oes}$    |                                                                                             |                       |       | 0.06  |      |          |
| Reverse transfer capacitance         | $C_{res}$    |                                                                                             |                       |       | 0.01  |      |          |
| Turn-on delay time , inductive load  | $t_{don}$    | $I_C=20A$ ,<br>$V_{CC}=400V$ , $V_{GE}=0/15V$ ,<br>$R_{gon}=25\Omega$ , $R_{goff}=25\Omega$ | $T_{vj}=25^{\circ}C$  |       | 43.8  |      | ns       |
|                                      |              |                                                                                             | $T_{vj}=125^{\circ}C$ |       | 43.3  |      |          |
|                                      |              |                                                                                             | $T_{vj}=150^{\circ}C$ |       | 42.2  |      |          |
| Rise time , inductive load           | $t_r$        | $I_C=20A$ ,<br>$V_{CC}=400V$ , $V_{GE}=0/15V$ ,<br>$R_{gon}=25\Omega$ , $R_{goff}=25\Omega$ | $T_{vj}=25^{\circ}C$  |       | 45.3  |      | ns       |
|                                      |              |                                                                                             | $T_{vj}=125^{\circ}C$ |       | 50.2  |      |          |
|                                      |              |                                                                                             | $T_{vj}=150^{\circ}C$ |       | 47.0  |      |          |
| Turn-off delay time , inductive load | $t_{doff}$   | $I_C=20A$ ,<br>$V_{CC}=400V$ , $V_{GE}=0/15V$ ,<br>$R_{gon}=25\Omega$ , $R_{goff}=25\Omega$ | $T_{vj}=25^{\circ}C$  |       | 137.4 |      | ns       |
|                                      |              |                                                                                             | $T_{vj}=125^{\circ}C$ |       | 127.0 |      |          |
|                                      |              |                                                                                             | $T_{vj}=150^{\circ}C$ |       | 141.0 |      |          |
| Fall time , inductive load           | $t_f$        | $I_C=20A$ ,<br>$V_{CC}=400V$ , $V_{GE}=0/15V$ ,<br>$R_{gon}=25\Omega$ , $R_{goff}=25\Omega$ | $T_{vj}=25^{\circ}C$  |       | 31.4  |      | ns       |
|                                      |              |                                                                                             | $T_{vj}=125^{\circ}C$ |       | 42.7  |      |          |
|                                      |              |                                                                                             | $T_{vj}=150^{\circ}C$ |       | 38.0  |      |          |
| Turn-on energy loss per pulse        | $E_{on}$     | $I_C=20A$ ,<br>$V_{CC}=400V$ , $V_{GE}=0/15V$ ,<br>$R_{gon}=25\Omega$ , $R_{goff}=25\Omega$ | $T_{vj}=25^{\circ}C$  |       | 0.50  |      | mJ       |
|                                      |              |                                                                                             | $T_{vj}=125^{\circ}C$ |       | 0.87  |      |          |
|                                      |              |                                                                                             | $T_{vj}=150^{\circ}C$ |       | 0.94  |      |          |
| Turn-off energy loss per pulse       | $E_{off}$    | $I_C=20A$ ,<br>$V_{CC}=400V$ , $V_{GE}=0/15V$ ,<br>$R_{gon}=25\Omega$ , $R_{goff}=25\Omega$ | $T_{vj}=25^{\circ}C$  |       | 0.25  |      | mJ       |
|                                      |              |                                                                                             | $T_{vj}=125^{\circ}C$ |       | 0.28  |      |          |
|                                      |              |                                                                                             | $T_{vj}=150^{\circ}C$ |       | 0.28  |      |          |
| Total energy loss per pulse          | $E_{ts}$     | $I_C=20A$ ,<br>$V_{CC}=400V$ , $V_{GE}=0/15V$ ,<br>$R_{gon}=25\Omega$ , $R_{goff}=25\Omega$ | $T_{vj}=25^{\circ}C$  |       | 0.75  |      | mJ       |
|                                      |              |                                                                                             | $T_{vj}=125^{\circ}C$ |       | 1.15  |      |          |
|                                      |              |                                                                                             | $T_{vj}=150^{\circ}C$ |       | 1.22  |      |          |

## Characteristic Values Of The Diode

| Parameter                                           | Symbol       | Conditions                                                 |                       | Value |       |      | Unit    |
|-----------------------------------------------------|--------------|------------------------------------------------------------|-----------------------|-------|-------|------|---------|
|                                                     |              |                                                            |                       | Min   | Typ   | Max  |         |
| Forward voltage                                     | $V_F$        | $I_F=20A, V_{GE}=0V$                                       | $T_{vj}=25^{\circ}C$  |       | 1.68  | 1.85 | V       |
|                                                     |              |                                                            | $T_{vj}=125^{\circ}C$ |       | 1.44  |      |         |
|                                                     |              |                                                            | $T_{vj}=150^{\circ}C$ |       | 1.37  |      |         |
| Recovered charge                                    | $Q_{rr}$     | $I_F=20A,$<br>$V_R=400V, R_{gon}=25\Omega,$<br>$V_{GE}=0V$ | $T_{vj}=25^{\circ}C$  |       | 0.40  |      | $\mu C$ |
|                                                     |              |                                                            | $T_{vj}=125^{\circ}C$ |       | 0.90  |      |         |
|                                                     |              |                                                            | $T_{vj}=150^{\circ}C$ |       | 1.10  |      |         |
| Peak reverse recovery current                       | $I_{rrm}$    | $I_F=20A,$<br>$V_R=400V, R_{gon}=25\Omega,$<br>$V_{GE}=0V$ | $T_{vj}=25^{\circ}C$  |       | 6.6   |      | A       |
|                                                     |              |                                                            | $T_{vj}=125^{\circ}C$ |       | 10.6  |      |         |
|                                                     |              |                                                            | $T_{vj}=150^{\circ}C$ |       | 13.0  |      |         |
| reverse recovery time                               | $t_{rr}$     | $I_F=20A,$<br>$V_R=400V, R_{gon}=25\Omega,$<br>$V_{GE}=0V$ | $T_{vj}=25^{\circ}C$  |       | 74.3  |      | ns      |
|                                                     |              |                                                            | $T_{vj}=125^{\circ}C$ |       | 98.2  |      |         |
|                                                     |              |                                                            | $T_{vj}=150^{\circ}C$ |       | 109.2 |      |         |
| Diode peak rate of fall of reverse recovery current | $di_{rr}/dt$ | $I_F=20A,$<br>$V_R=400V, R_{gon}=25\Omega,$<br>$V_{GE}=0V$ | $T_{vj}=25^{\circ}C$  |       | 330   |      | A/us    |
|                                                     |              |                                                            | $T_{vj}=125^{\circ}C$ |       | 304   |      |         |
|                                                     |              |                                                            | $T_{vj}=150^{\circ}C$ |       | 328   |      |         |
| Reverse recovery energy                             | $E_{rec}$    | $I_F=20A,$<br>$V_R=400V, R_{gon}=25\Omega,$<br>$V_{GE}=0V$ | $T_{vj}=25^{\circ}C$  |       | 0.08  |      | mJ      |
|                                                     |              |                                                            | $T_{vj}=125^{\circ}C$ |       | 0.17  |      |         |
|                                                     |              |                                                            | $T_{vj}=150^{\circ}C$ |       | 0.20  |      |         |

## Electrical Characteristics (curves)





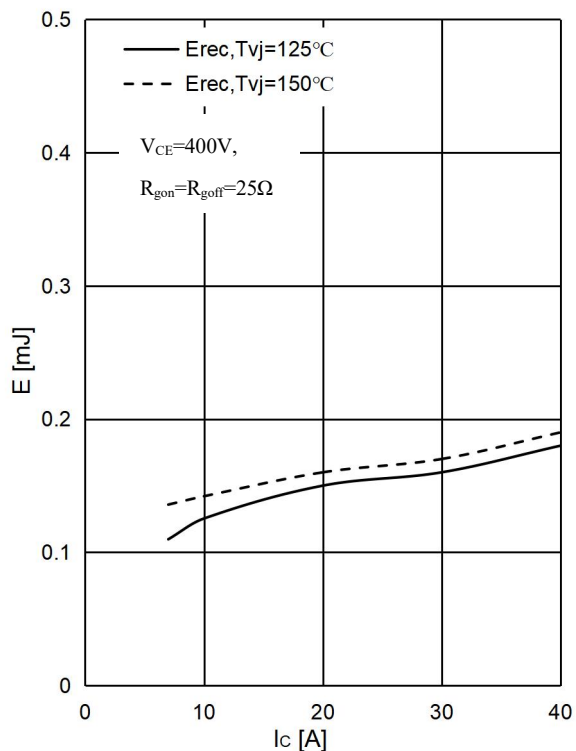


Fig 9. Diode Switching Loss  $E_{rec}$  vs.  $I_F$

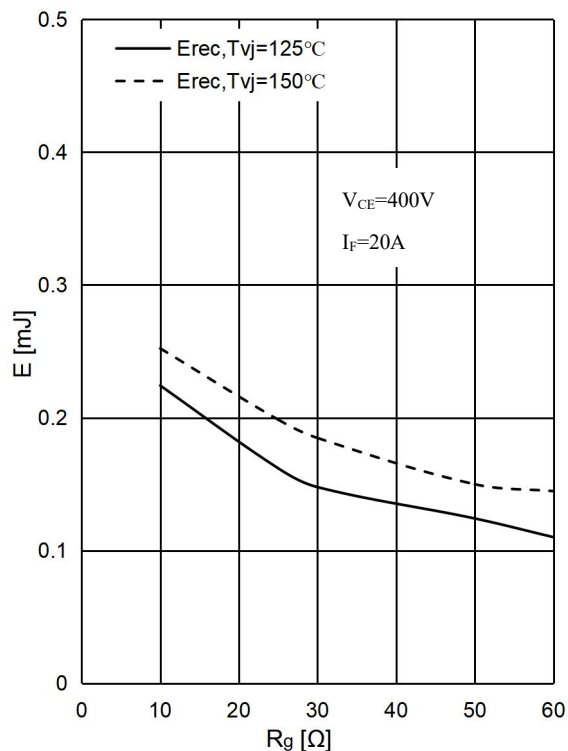


Fig 10. Diode Switching Loss  $E_{rec}$  vs.  $R_G$

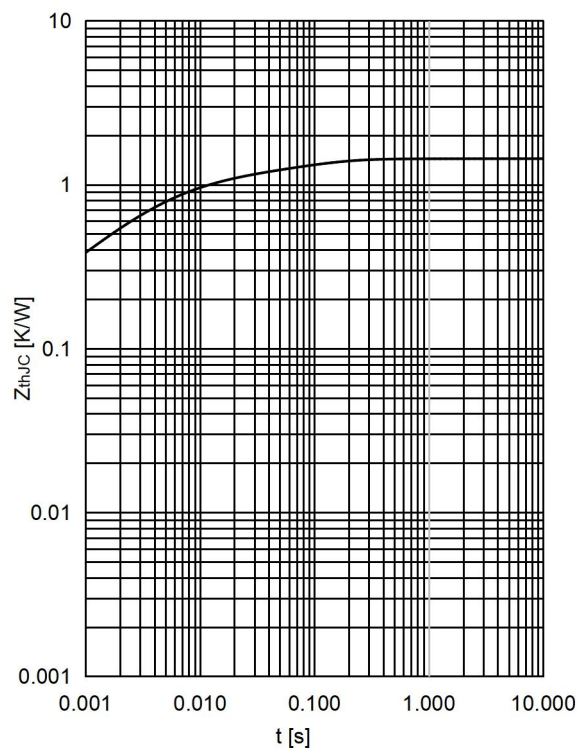


Fig 11. Diode Transient thermal impedance

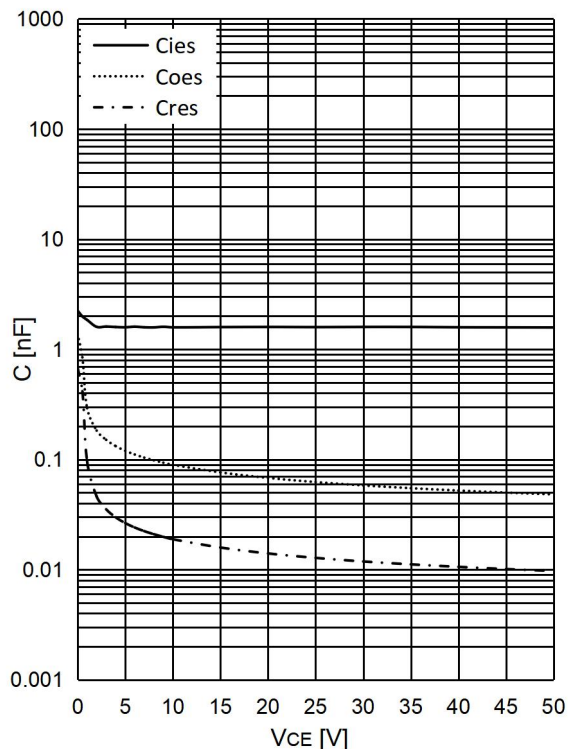
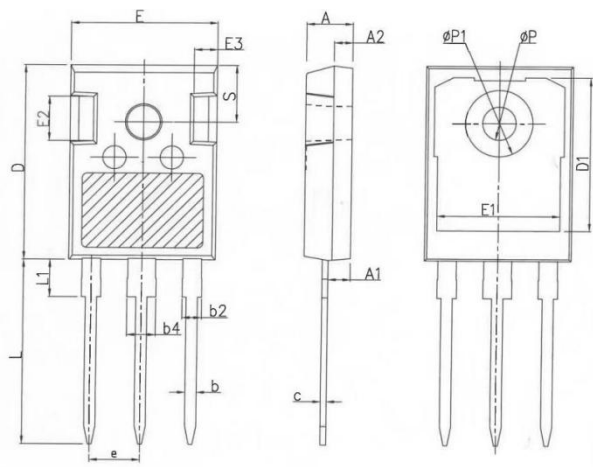


Fig 12. IGBT Capacity Characteristic

Package Dimensions



| SYMBOL | mm      |       |       |
|--------|---------|-------|-------|
|        | MIN     | NOM   | MAX   |
| A      | 4.80    | 5.00  | 5.20  |
| A1     | 2.21    | 2.41  | 2.59  |
| A2     | 1.85    | 2.00  | 2.15  |
| b      | 1.11    | 1.21  | 1.36  |
| b2     | 1.91    | 2.01  | 2.21  |
| b4     | 2.91    | 3.01  | 3.21  |
| c      | 0.51    | 0.61  | 0.75  |
| D      | 20.70   | 21.00 | 21.30 |
| D1     | 16.25   | 16.55 | 16.85 |
| E      | 15.50   | 15.80 | 16.10 |
| E1     | 13.00   | 13.30 | 13.60 |
| E2     | 4.80    | 5.00  | 5.20  |
| E3     | 2.30    | 2.50  | 2.70  |
| e      | 5.44BSC |       |       |
| L      | 19.62   | 19.92 | 20.22 |
| L1     | -       | -     | 4.30  |
| Φ P    | 3.40    | 3.60  | 3.80  |
| Φ P1   | -       | -     | 7.30  |
| S      | 6.15BSC |       |       |



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Should you intend to use the Product in aviation applications, in health or live endangering or life support applications, please notify. Please note, that for any such applications we urgently recommend:

- to perform joint Risk and Quality Assessments;
- the conclusion of Quality Agreements;
- to establish joint measures of an ongoing product survey, and that we may make delivery depended on the realization of any such measures.

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