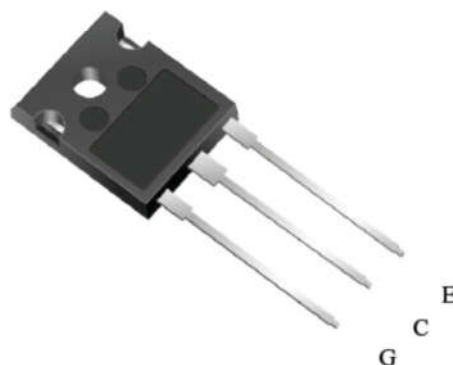
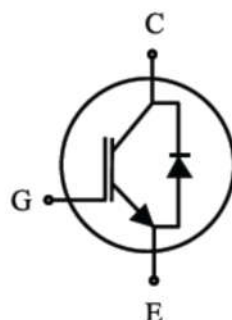


### FEATURES

- High breakdown voltage to 1200V for improved reliability
- Trench-Stop Technology offering :
  - High speed switching
  - High ruggedness, temperature stable
  - Short circuit withstand time – 10μs
  - Low  $V_{CEsat}$
  - Easy parallel switching capability due to positive temperature coefficient in  $V_{CEsat}$
- Enhanced avalanche capability

|                             |      |   |
|-----------------------------|------|---|
| $V_{CE}$                    | 1200 | V |
| $I_C$                       | 40   | A |
| $V_{CE(SAT)} \quad I_C=40A$ | 2.0  | V |



### APPLICATION

- Uninterruptible Power Supplies
- Solar inverter
- Welding
- PFC applications

## Maximum Ratings

| Parameter                                                                                   | Symbol      | Value      | Unit        |
|---------------------------------------------------------------------------------------------|-------------|------------|-------------|
| Collector-Emitter Breakdown Voltage                                                         | $V_{CE}$    | 1200       | V           |
| DC collector current, limited by $T_{jmax}$<br>$T_C = 25^{\circ}C$<br>$T_C = 100^{\circ}C$  | $I_C$       | 80<br>40   | A           |
| Diode Forward current, limited by $T_{jmax}$<br>$T_C = 25^{\circ}C$<br>$T_C = 100^{\circ}C$ | $I_F$       | 80<br>40   | A           |
| Pulsed Collector Current, limited by $T_{jmax}$                                             | $I_{Cpuls}$ | 160        | A           |
| Turn off safe operating area $V_{CE} \leq 1200V$ ,<br>$T_j \leq 150^{\circ}C$               | -           | 160        | A           |
| Diode Pulsed Current, limited by $T_{jmax}$                                                 | $I_{Fpuls}$ | 160        | A           |
| Short Circuit Withstand Time, $V_{GE} = 15V$ ,<br>$V_{CE} \leq 600V$                        | $T_{sc}$    | 10         | $\mu s$     |
| Power dissipation , $T_j = 25^{\circ}C$                                                     | $P_{tot}$   | 417        | W           |
| Operating junction temperature                                                              | $T_j$       | -40...+150 | $^{\circ}C$ |
| Storage temperature                                                                         | $T_s$       | -55...+150 | $^{\circ}C$ |
| Soldering temperature, wave soldering 1.6mm<br>(0.063in.) from case for 10s                 | -           | 260        | $^{\circ}C$ |

## Thermal Resistance

| Parameter                                    | Symbol            | Max. Value | Unit |
|----------------------------------------------|-------------------|------------|------|
| IGBT thermal resistance,<br>junction - case  | $R_{\theta(j-c)}$ | 0.3        | K/W  |
| Diode thermal resistance,<br>junction - case | $R_{\theta(j-c)}$ | 0.6        | K/W  |
| Thermal resistance,<br>junction - ambient    | $R_{\theta(j-a)}$ | 40         | K/W  |



## Electrical Characteristics of the IGBT ( $T_j = 25^\circ\text{C}$ unless otherwise specified) :

| Parameter                            | Symbol        | Conditions                                                                             | Min.   | Typ.       | Max.       | Unit    |
|--------------------------------------|---------------|----------------------------------------------------------------------------------------|--------|------------|------------|---------|
| <b>Static</b>                        |               |                                                                                        |        |            |            |         |
| Collector-Emitter breakdown voltage  | $BV_{CES}$    | $V_{GE}=0V, I_C=250\mu A$                                                              | 1200   | 1300       | -          | V       |
| Gate threshold voltage               | $V_{GE(th)}$  | $V_{GE}=V_{CE}, I_C=250\mu A$                                                          | 5.1    | 5.8        | 6.4        | V       |
| Collector-Emitter Saturation voltage | $V_{CE(sat)}$ | $V_{GE}=15V, I_C=40A$<br>$T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$         | -<br>- | 2.0<br>2.5 | 2.5<br>-   | V       |
| Zero gate voltage collector current  | $I_{CES}$     | $V_{CE} = 1200V, V_{GE} = 0V$<br>$T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | -<br>- | -<br>-     | 10<br>2500 | $\mu A$ |
| Gate-emitter leakage current         | $I_{GES}$     | $V_{CE} = 0V, V_{GE} = 20V$                                                            | -      | -          | 100        | nA      |
| Transconductance                     | $g_{fs}$      | $V_{CE}=20V, I_C=15A$                                                                  | -      | 15         | -          | S       |

| Parameter                       | Symbol      | Conditions                                                                            | Min. | Typ. | Max. | Unit |
|---------------------------------|-------------|---------------------------------------------------------------------------------------|------|------|------|------|
| <b>Dynamic</b>                  |             |                                                                                       |      |      |      |      |
| Input capacitance               | $C_{ies}$   | $V_{CE} = 25V, V_{GE} = 0V,$<br>$f = 1\text{MHz}$                                     | -    | 4400 | -    | pF   |
| Output capacitance              | $C_{oes}$   |                                                                                       | -    | 180  | -    |      |
| Reverse transfer capacitance    | $C_{res}$   |                                                                                       | -    | 100  | -    |      |
| Gate charge                     | $Q_G$       | $V_{CC} = 960V, I_C = 40A,$<br>$V_{GE} = 15V$                                         | -    | 270  | -    | nC   |
| Short circuit collector current | $I_{C(SC)}$ | $V_{GE}=15V, t_{sc}\leq 10\mu s$<br>$V_{CC}=600V,$<br>$T_{j, start}=25^\circ\text{C}$ | -    | 240  | -    | A    |



## Switching Characteristic, Inductive Load

| Parameter                                                | Symbol       | Conditions                                                           | Min. | Typ. | Max. | Unit |
|----------------------------------------------------------|--------------|----------------------------------------------------------------------|------|------|------|------|
| <b>Dynamic , at <math>T_j = 25^\circ \text{C}</math></b> |              |                                                                      |      |      |      |      |
| Turn-on delay time                                       | $t_{d(on)}$  | $V_{CC} = 600V, I_C = 40A,$<br>$V_{GE} = 0/15V,$<br>$R_g = 12\Omega$ | -    | 60   | -    | ns   |
| Rise time                                                | $t_r$        |                                                                      | -    | 27   | -    | ns   |
| Turn-on energy                                           | $E_{on}$     |                                                                      | -    | 2.9  | -    | mJ   |
| Turn-off delay time                                      | $t_{d(off)}$ |                                                                      | -    | 230  | -    | ns   |
| Fall time                                                | $t_f$        |                                                                      | -    | 110  | -    | ns   |
| Turn-off energy                                          | $E_{off}$    |                                                                      | -    | 0.8  | -    | mJ   |

## Electrical Characteristics of the DIODE ( $T_j = 25^\circ \text{C}$ unless otherwise specified)

| Parameter                | Symbol   | Conditions                                             | Min. | Typ. | Max. | Unit |
|--------------------------|----------|--------------------------------------------------------|------|------|------|------|
| <b>Dynamic</b>           |          |                                                        |      |      |      |      |
| Diode Forward Voltage    | $V_{FM}$ | $I_F = 40A$                                            | -    | 3.5  | -    | V    |
| Reverse Recovery Time    | $T_{rr}$ | $I_F = 40A,$<br>$V_R = 600V,$<br>$di/dt = 400A/\mu s,$ | -    | 190  | -    | ns   |
| Reverse Recovery Current | $I_{rr}$ |                                                        | -    | 6    | -    | A    |
| Reverse Recovery Charge  | $Q_{rr}$ |                                                        | -    | 530  | -    | nC   |



Fig. 1 FBSOA characteristics

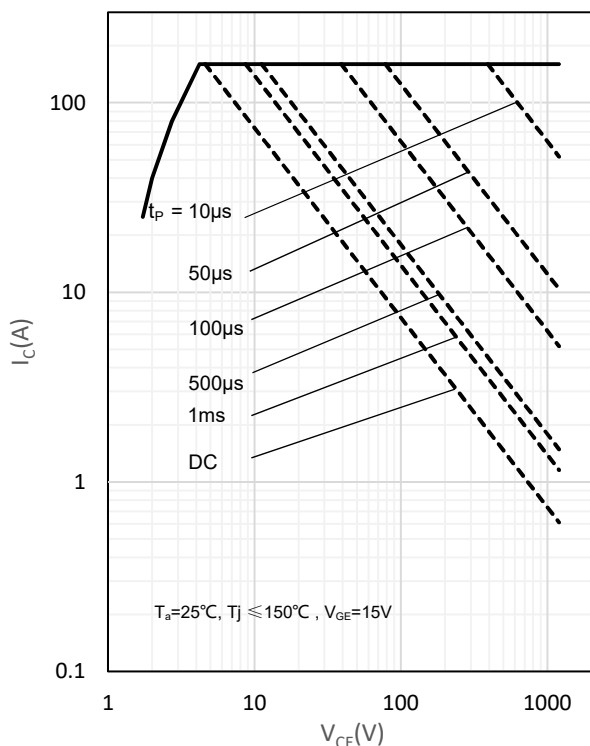


Fig. 2 Load Current vs. Frequency

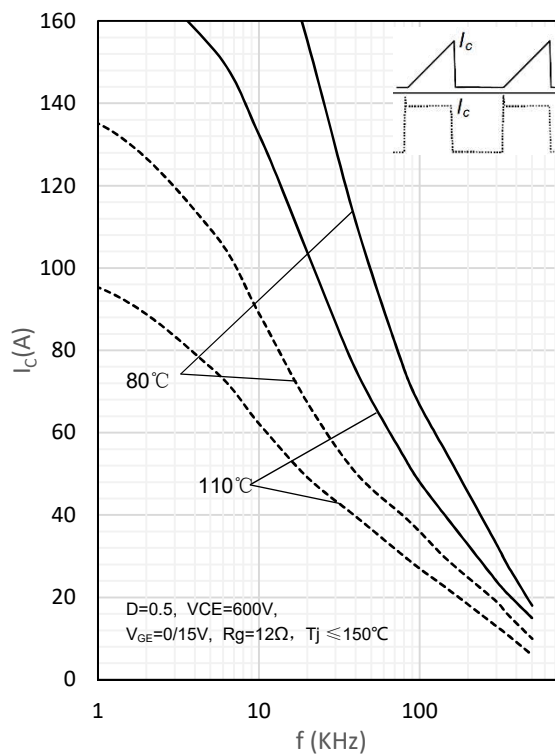


Fig. 3 Power dissipation as a function of  $T_c$

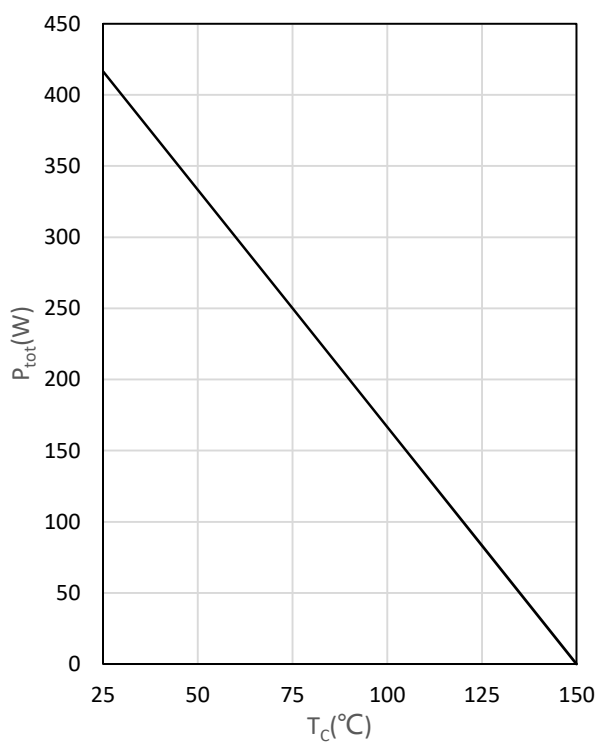


Fig. 4 Short circuit time and current vs.  $V_{GE}$

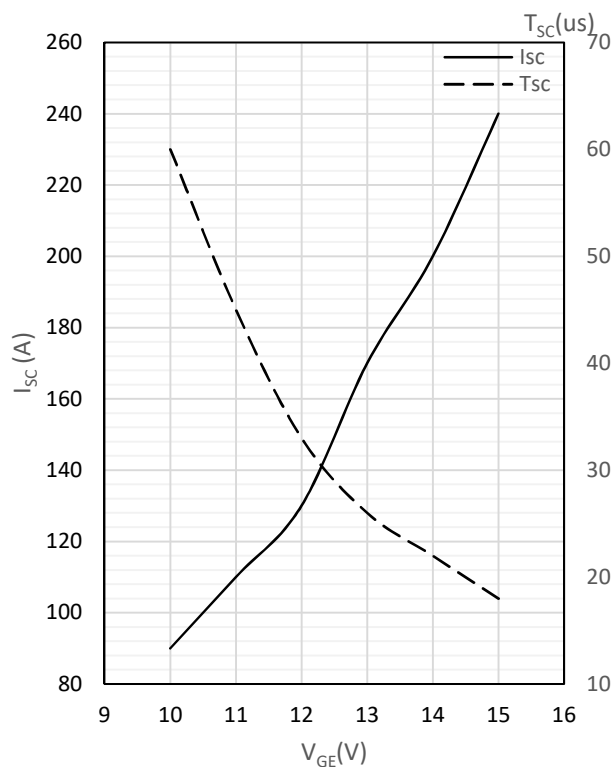




Fig. 5 Output characteristics

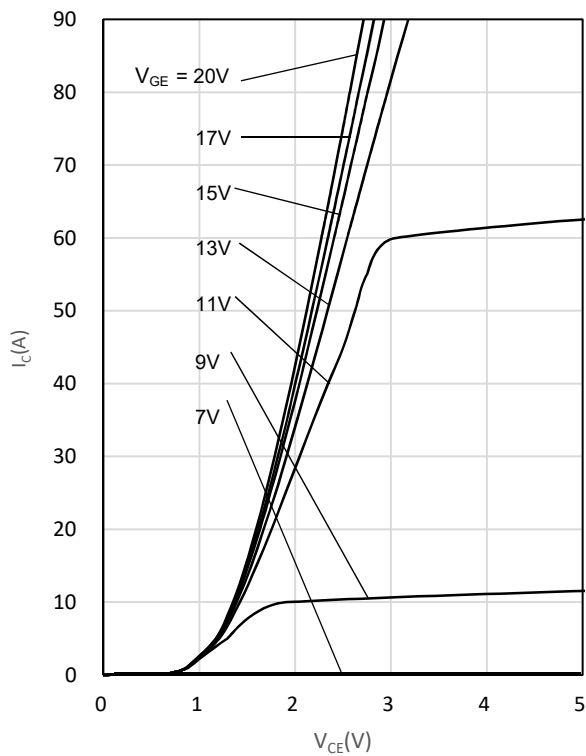


Fig. 6 Saturation voltage characteristics

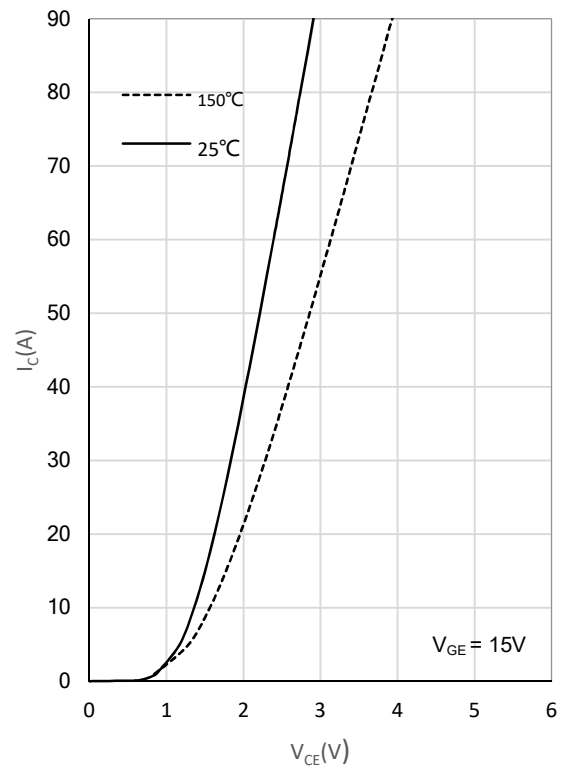


Fig. 7 Switching times vs. gate resistor

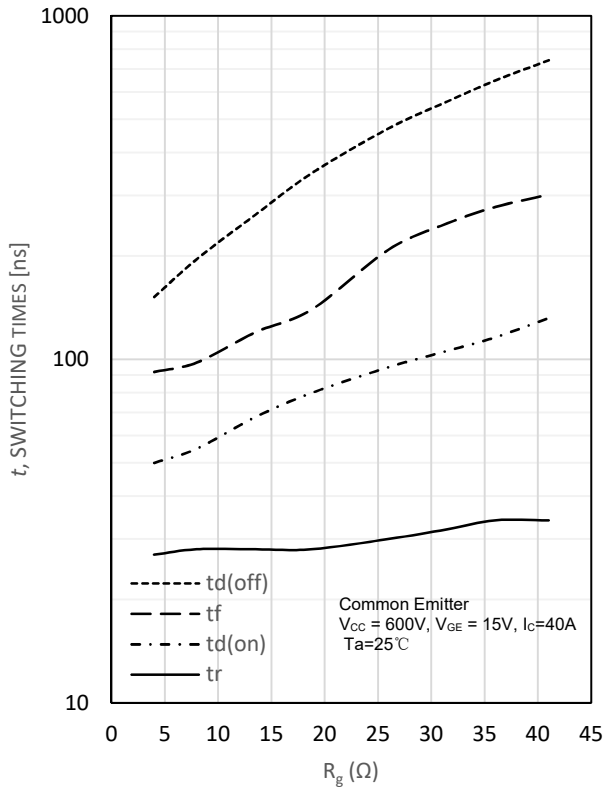


Fig. 8 Switching times vs. collector current

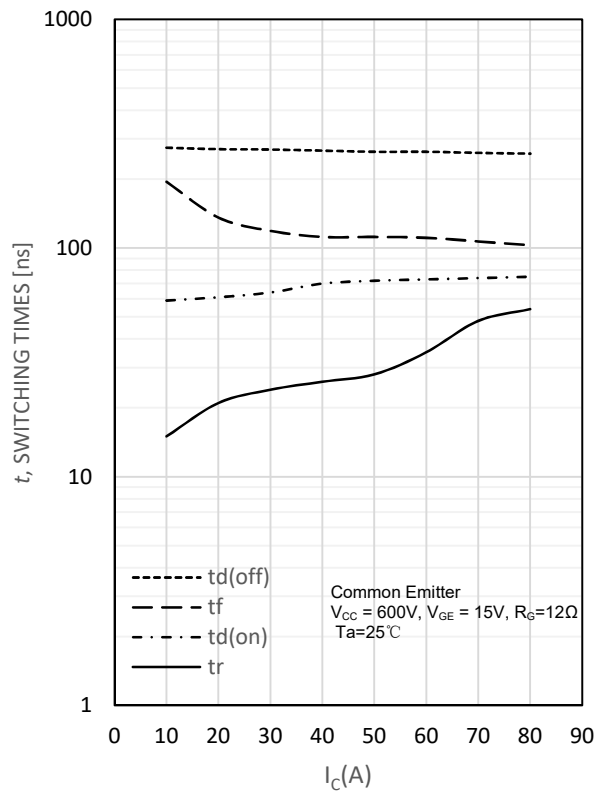




Fig. 9 Switching loss vs. gate resistor

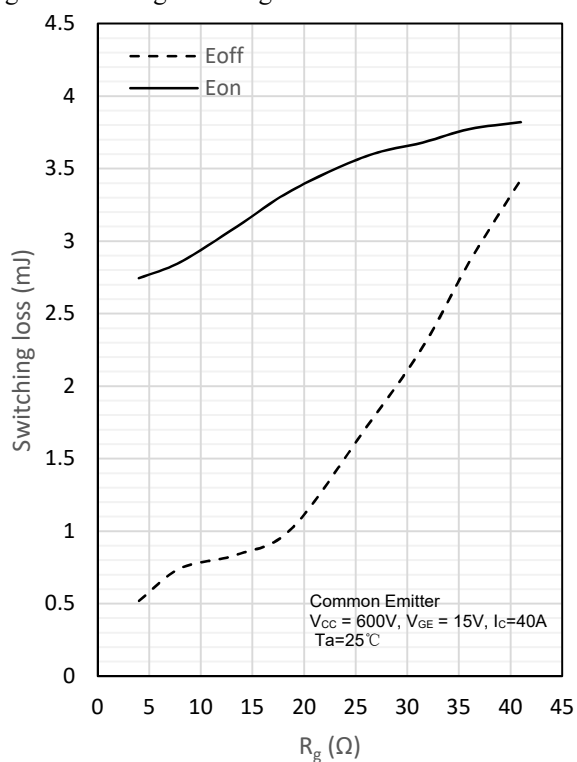


Fig. 10 Switching loss vs. collector current

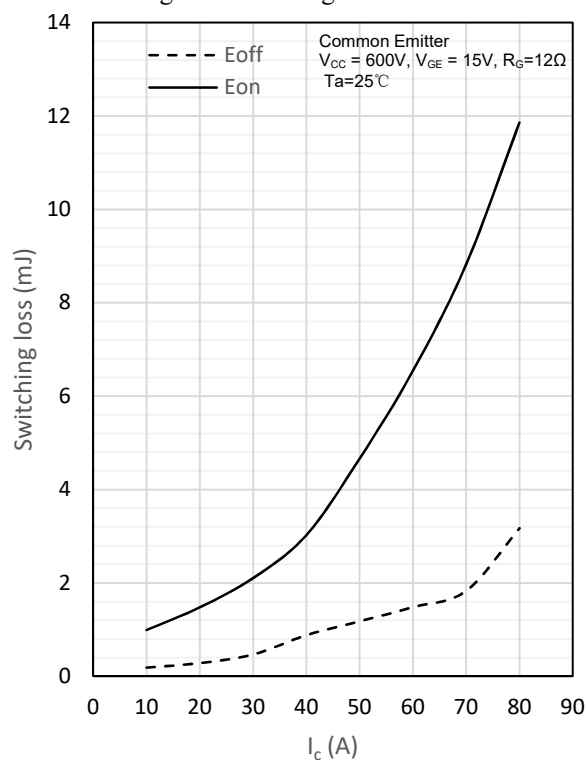


Fig. 11 Gate charge characteristics

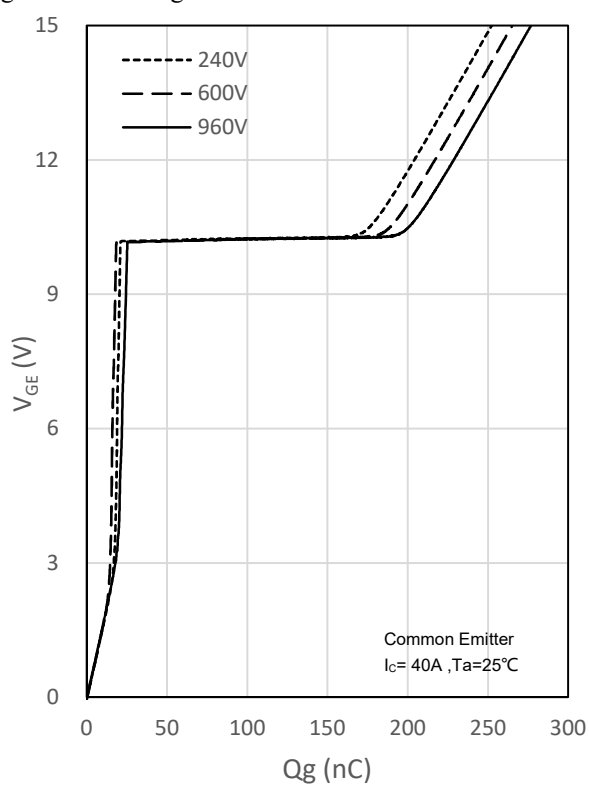
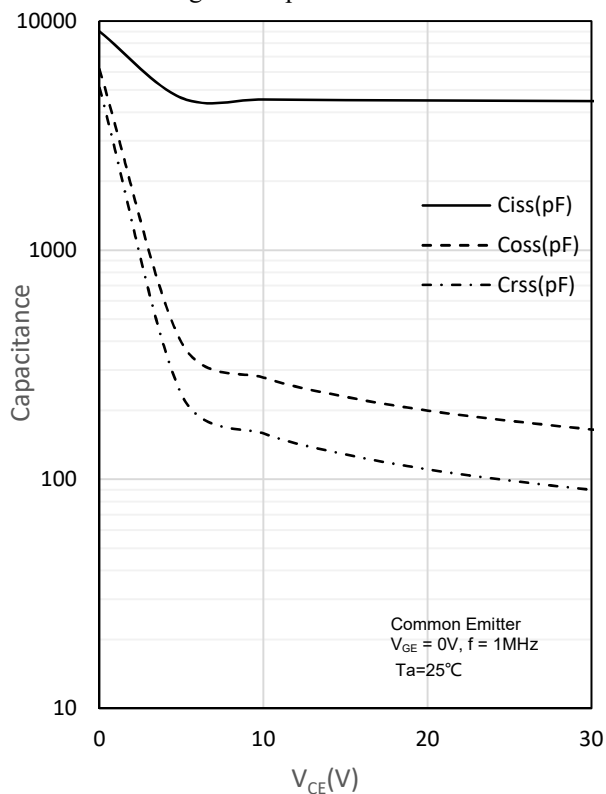
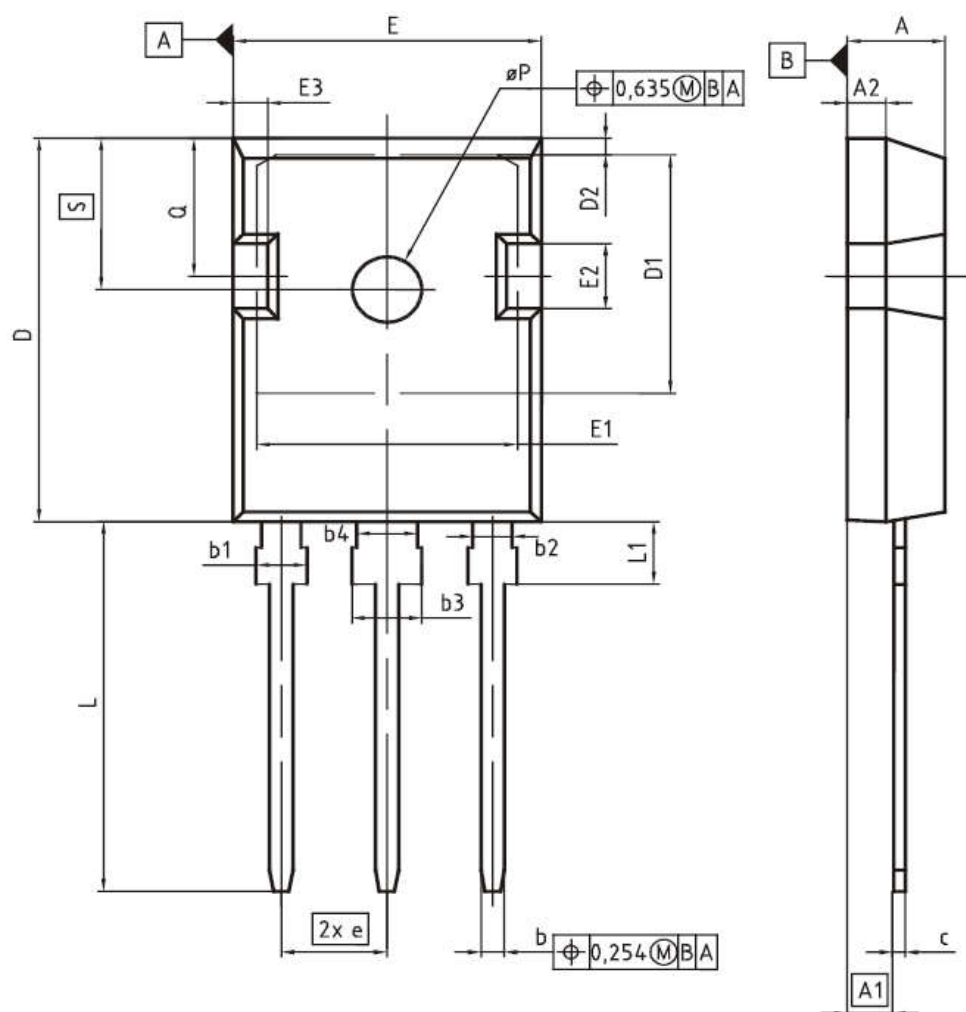


Fig. 12 Capacitance characteristics



**PG-TO247-3**

| DIM | MILLIMETERS |       | INCHES      |       |
|-----|-------------|-------|-------------|-------|
|     | MIN         | MAX   | MIN         | MAX   |
| A   | 4.83        | 5.21  | 0.190       | 0.205 |
| A1  | 2.27        | 2.54  | 0.089       | 0.100 |
| A2  | 1.85        | 2.16  | 0.073       | 0.085 |
| b   | 1.07        | 1.33  | 0.042       | 0.052 |
| b1  | 1.90        | 2.41  | 0.075       | 0.095 |
| b2  | 1.90        | 2.16  | 0.075       | 0.085 |
| b3  | 2.87        | 3.38  | 0.113       | 0.133 |
| b4  | 2.87        | 3.13  | 0.113       | 0.123 |
| c   | 0.55        | 0.68  | 0.022       | 0.027 |
| D   | 20.80       | 21.10 | 0.819       | 0.831 |
| D1  | 16.25       | 17.65 | 0.640       | 0.695 |
| D2  | 0.95        | 1.35  | 0.037       | 0.053 |
| E   | 15.70       | 16.13 | 0.618       | 0.635 |
| E1  | 13.10       | 14.15 | 0.516       | 0.557 |
| E2  | 3.68        | 5.10  | 0.145       | 0.201 |
| E3  | 1.00        | 2.60  | 0.039       | 0.102 |
| e   | 5.44 (BSC)  |       | 0.214 (BSC) |       |
| N   | 3           |       | 3           |       |
| L   | 19.80       | 20.32 | 0.780       | 0.800 |
| L1  | 4.10        | 4.47  | 0.161       | 0.176 |
| øP  | 3.50        | 3.70  | 0.138       | 0.146 |
| Q   | 5.49        | 6.00  | 0.216       | 0.236 |
| S   | 6.04        | 6.30  | 0.238       | 0.248 |