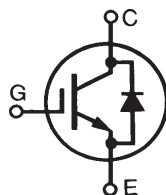


# GenX3™ 600V IGBT w/ Diode

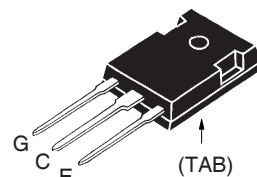
## IXGH36N60B3D1

Medium-Speed Low-V<sub>sat</sub> PT IGBT  
for 5 - 40kHz Switching



$$\begin{aligned} V_{CES} &= 600V \\ I_{C110} &= 36A \\ V_{CE(sat)} &\leq 1.8V \end{aligned}$$

TO-247



G = Gate      C = Collector  
E = Emitter    TAB = Collector

| Symbol                        | Test Conditions                                                                     | Maximum Ratings                        |                  |
|-------------------------------|-------------------------------------------------------------------------------------|----------------------------------------|------------------|
| $V_{CES}$                     | $T_J = 25^\circ\text{C to } 150^\circ\text{C}$                                      | 600                                    | V                |
| $V_{CGR}$                     | $T_J = 25^\circ\text{C to } 150^\circ\text{C}, R_{GE} = 1M\Omega$                   | 600                                    | V                |
| $V_{GES}$                     | Continuous                                                                          | $\pm 20$                               | V                |
| $V_{GEM}$                     | Transient                                                                           | $\pm 30$                               | V                |
| $I_{C110}$                    | $T_C = 110^\circ\text{C}$                                                           | 36                                     | A                |
| $I_{F110}$                    | $T_C = 110^\circ\text{C}$                                                           | 30                                     | A                |
| $I_{CM}$                      | $T_C = 25^\circ\text{C}, 1\text{ms}$                                                | 200                                    | A                |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V, T_{VJ} = 125^\circ\text{C}, R_G = 5\Omega$<br>Clamped Inductive Load | $I_{CM} = 80$<br>$V_{CE} \leq V_{CES}$ | A                |
| $P_C$                         | $T_C = 25^\circ\text{C}$                                                            | 250                                    | W                |
| $T_J$                         |                                                                                     | -55 ... +150                           | $^\circ\text{C}$ |
| $T_{JM}$                      |                                                                                     | 150                                    | $^\circ\text{C}$ |
| $T_{stg}$                     |                                                                                     | -55 ... +150                           | $^\circ\text{C}$ |
| $T_L$                         | 1.6mm (0.062 in.) from Case for 10s                                                 | 300                                    | $^\circ\text{C}$ |
| $T_{SOLD}$                    | Plastic Body for 10s                                                                | 260                                    | $^\circ\text{C}$ |
| $M_d$                         | Mounting Torque                                                                     | 1.13/10                                | Nm/lb.in.        |
| <b>Weight</b>                 |                                                                                     | 6                                      | g                |

### Features

- Optimized for Low Conduction and Switching Losses
- Square RBSOA
- Anti-Parallel Ultra Fast Diode
- International Standard Package

### Advantages

- High Power Density
- Low Gate Drive Requirement

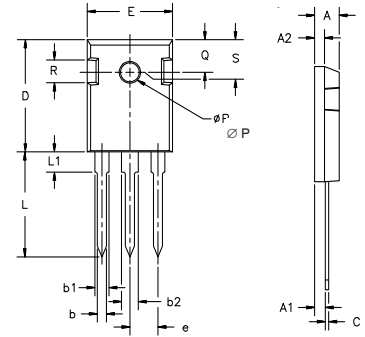
### Applications

- Power Inverters
- UPS
- Motor Drives
- SMPS
- PFC Circuits
- Battery Chargers
- Welding Machines
- Lamp Ballasts

| Symbol        | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified) | Characteristic Values |      |                              |
|---------------|---------------------------------------------------------------------------|-----------------------|------|------------------------------|
|               |                                                                           | Min.                  | Typ. | Max.                         |
| $BV_{CES}$    | $I_C = 250\mu\text{A}, V_{GE} = 0V$                                       | 600                   |      | V                            |
| $V_{GE(th)}$  | $I_C = 250\mu\text{A}, V_{CE} = V_{GE}$                                   | 3.0                   |      | 5.0 V                        |
| $I_{CES}$     | $V_{CE} = V_{CES}, V_{GE} = 0V$<br><br>$T_J = 125^\circ\text{C}$          |                       |      | 300 $\mu\text{A}$<br>1.75 mA |
| $I_{GES}$     | $V_{CE} = 0V, V_{GE} = \pm 20V$                                           |                       |      | $\pm 100$ nA                 |
| $V_{CE(sat)}$ | $I_C = 30A, V_{GE} = 15V, \text{Note 1}$                                  |                       | 1.5  | 1.8 V                        |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                                         | Characteristic Values |      |                         |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
|              |                                                                                                                                     | Min.                  | Typ. | Max.                    |
| $g_{fs}$     | $I_C = 30\text{A}$ , $V_{CE} = 10\text{V}$ , Note 1                                                                                 | 28                    | 42   | S                       |
| $C_{ies}$    | $V_{CE} = 25\text{V}$ , $V_{GE} = 0\text{V}$ , $f = 1\text{MHz}$                                                                    |                       | 2280 | pF                      |
| $C_{oes}$    |                                                                                                                                     |                       | 120  | pF                      |
| $C_{res}$    |                                                                                                                                     |                       | 32   | pF                      |
| $Q_g$        | $I_C = 30\text{A}$ , $V_{GE} = 15\text{V}$ , $V_{CE} = 0.5 \cdot V_{CES}$                                                           |                       | 80   | nC                      |
| $Q_{ge}$     |                                                                                                                                     |                       | 12   | nC                      |
| $Q_{gc}$     |                                                                                                                                     |                       | 36   | nC                      |
| $t_{d(on)}$  | Inductive Load, $T_J = 25^\circ\text{C}$<br>$I_C = 30\text{A}$ , $V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}$ , $R_G = 5\Omega$  |                       | 19   | ns                      |
| $t_{ri}$     |                                                                                                                                     |                       | 24   | ns                      |
| $E_{on}$     |                                                                                                                                     |                       | 0.54 | mJ                      |
| $t_{d(off)}$ |                                                                                                                                     |                       | 125  | ns                      |
| $t_{fi}$     |                                                                                                                                     |                       | 100  | ns                      |
| $E_{off}$    |                                                                                                                                     |                       | 0.8  | mJ                      |
| $t_{d(on)}$  | Inductive Load, $T_J = 125^\circ\text{C}$<br>$I_C = 30\text{A}$ , $V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}$ , $R_G = 5\Omega$ |                       | 19   | ns                      |
| $t_{ri}$     |                                                                                                                                     |                       | 26   | ns                      |
| $E_{on}$     |                                                                                                                                     |                       | 0.9  | mJ                      |
| $t_{d(off)}$ |                                                                                                                                     |                       | 180  | ns                      |
| $t_{fi}$     |                                                                                                                                     |                       | 170  | ns                      |
| $E_{off}$    |                                                                                                                                     |                       | 1.5  | mJ                      |
| $R_{thJC}$   |                                                                                                                                     |                       |      | 0.50 $^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                     |                       | 0.21 | $^\circ\text{C/W}$      |

TO-247 Outline (IXGH)



| Dim.           | Millimeter |       | Inches |       |
|----------------|------------|-------|--------|-------|
|                | Min.       | Max.  | Min.   | Max.  |
| A              | 4.7        | 5.3   | .185   | .209  |
| A <sub>1</sub> | 2.2        | 2.54  | .087   | .102  |
| A <sub>2</sub> | 2.2        | 2.6   | .059   | .098  |
| b              | 1.0        | 1.4   | .040   | .055  |
| b <sub>1</sub> | 1.65       | 2.13  | .065   | .084  |
| b <sub>2</sub> | 2.87       | 3.12  | .113   | .123  |
| C              | .4         | .8    | .016   | .031  |
| D              | 20.80      | 21.46 | .819   | .845  |
| E              | 15.75      | 16.26 | .610   | .640  |
| e              | 5.20       | 5.72  | 0.205  | 0.225 |
| L              | 19.81      | 20.32 | .780   | .800  |
| L1             |            | 4.50  |        | .177  |
| ØP             | 3.55       | 3.65  | .140   | .144  |
| Q              | 5.89       | 6.40  | 0.232  | 0.252 |
| R              | 4.32       | 5.49  | .170   | .216  |
| S              | 6.15       | BSC   | .242   | BSC   |

## Reverse Diode (FRED)

| Symbol     | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                                         | Characteristic Values |           |                        |
|------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------|------------------------|
|            |                                                                                                                                     | Min.                  | Typ.      | Max.                   |
| $V_F$      | $I_F = 30\text{A}$ , $V_{GE} = 0\text{V}$ , Note 1<br>$T_J = 150^\circ\text{C}$                                                     |                       |           | 2.8 V<br>1.7 V         |
| $I_{RM}$   | $I_F = 30\text{A}$ , $V_{GE} = 0\text{V}$ , $-di_F/dt = 100\text{A}/\mu\text{s}$ , $T_J = 100^\circ\text{C}$<br>$V_R = 100\text{V}$ |                       | 6         | A                      |
| $t_{rr}$   | $I_F = 1\text{A}$ , $-di_F/dt = 100\text{A}/\mu\text{s}$ , $V_R = 30\text{V}$<br>$T_J = 100^\circ\text{C}$                          |                       | 25<br>100 | ns<br>ns               |
| $R_{thJC}$ |                                                                                                                                     |                       |           | 0.9 $^\circ\text{C/W}$ |

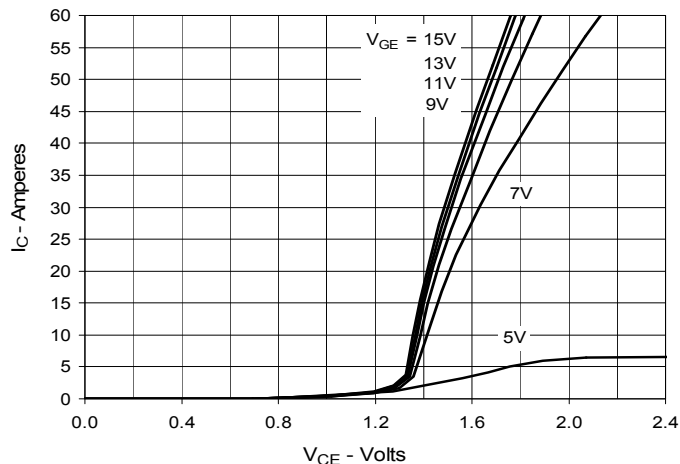
Note 1. Pulse test,  $t \leq 300\mu\text{s}$ ; duty cycle,  $d \leq 2\%$ .

IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

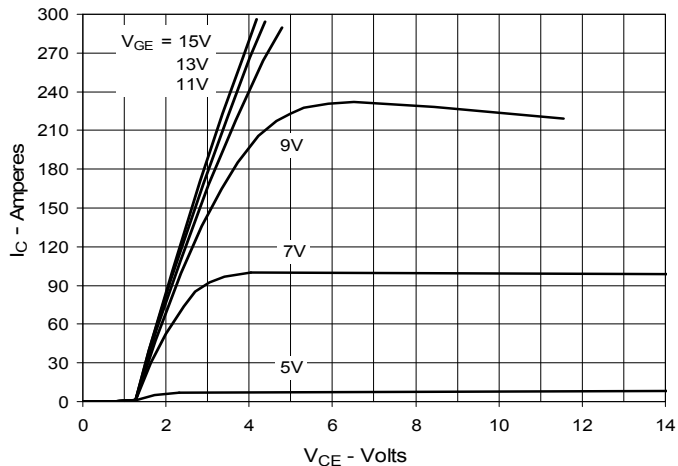
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

|           |           |           |           |              |              |              |              |              |              |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|--------------|
| 4,835,592 | 4,931,844 | 5,049,961 | 5,237,481 | 6,162,665    | 6,404,065 B1 | 6,683,344    | 6,727,585    | 7,005,734 B2 | 7,157,338 B2 |
| 4,850,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123 B1 | 6,534,343    | 6,710,405 B2 | 6,759,692    | 7,063,975 B2 |              |
| 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728 B1 | 6,583,505    | 6,710,463    | 6,771,478 B2 | 7,071,537    |              |

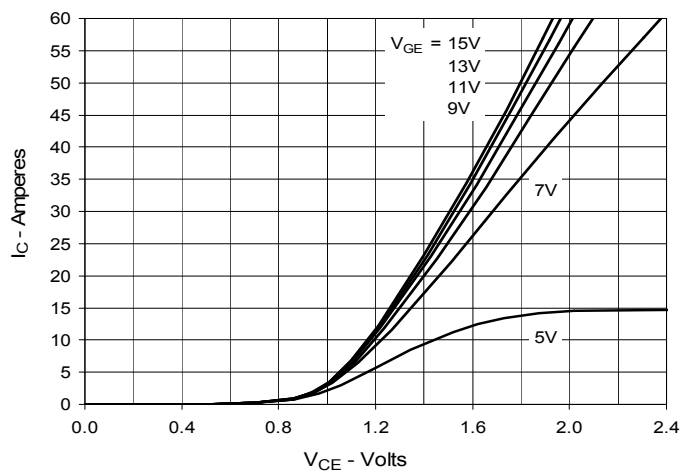
**Fig. 1. Output Characteristics  
@ 25°C**



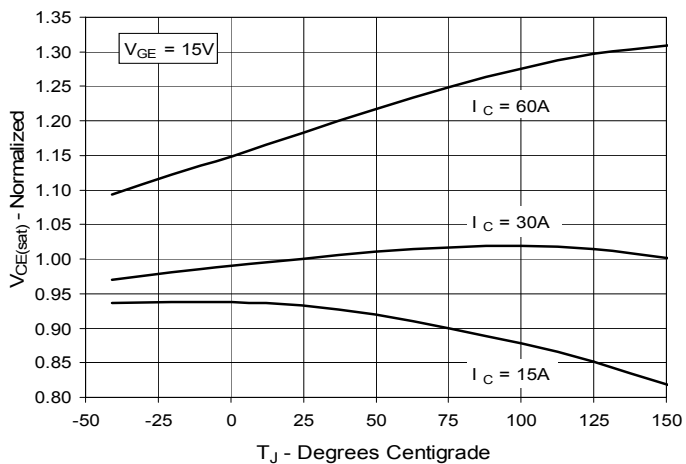
**Fig. 2. Extended Output Characteristics  
@ 25°C**



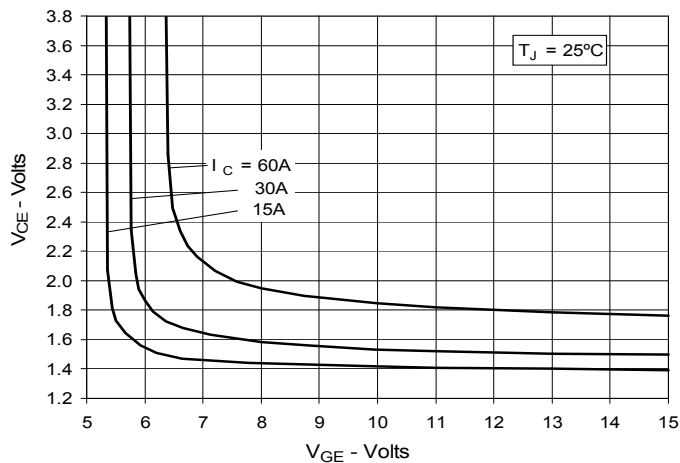
**Fig. 3. Output Characteristics  
@ 125°C**



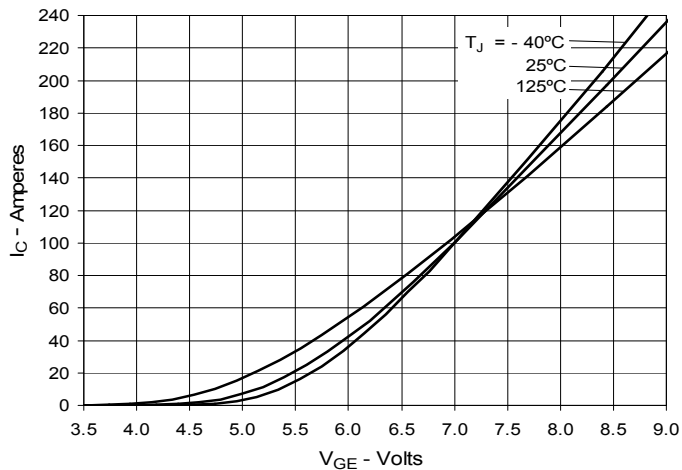
**Fig. 4. Dependence of  $V_{CE(sat)}$  on  
Junction Temperature**

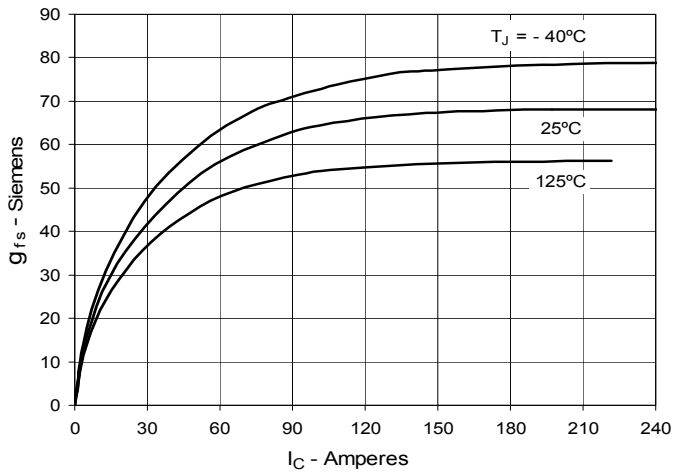
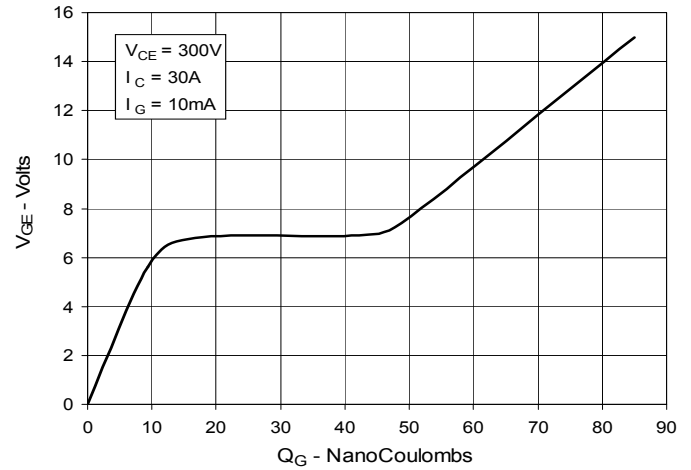
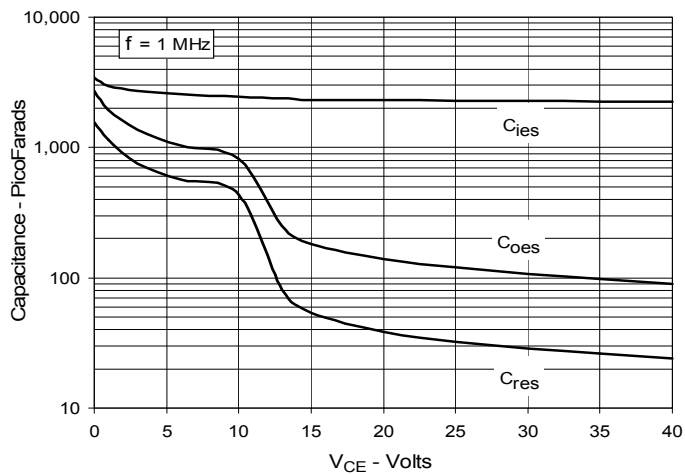
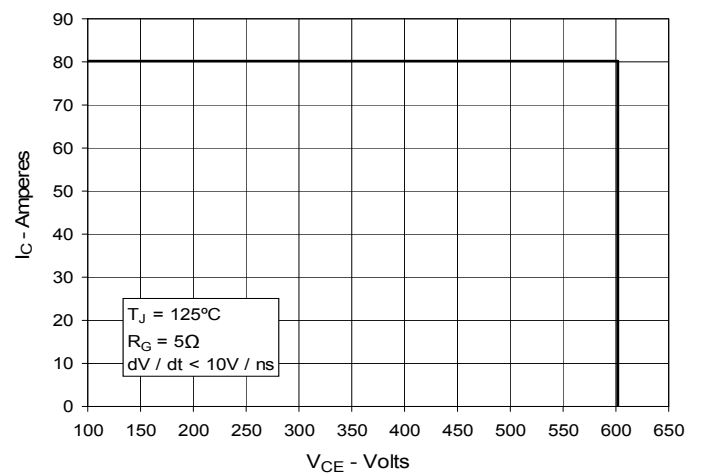
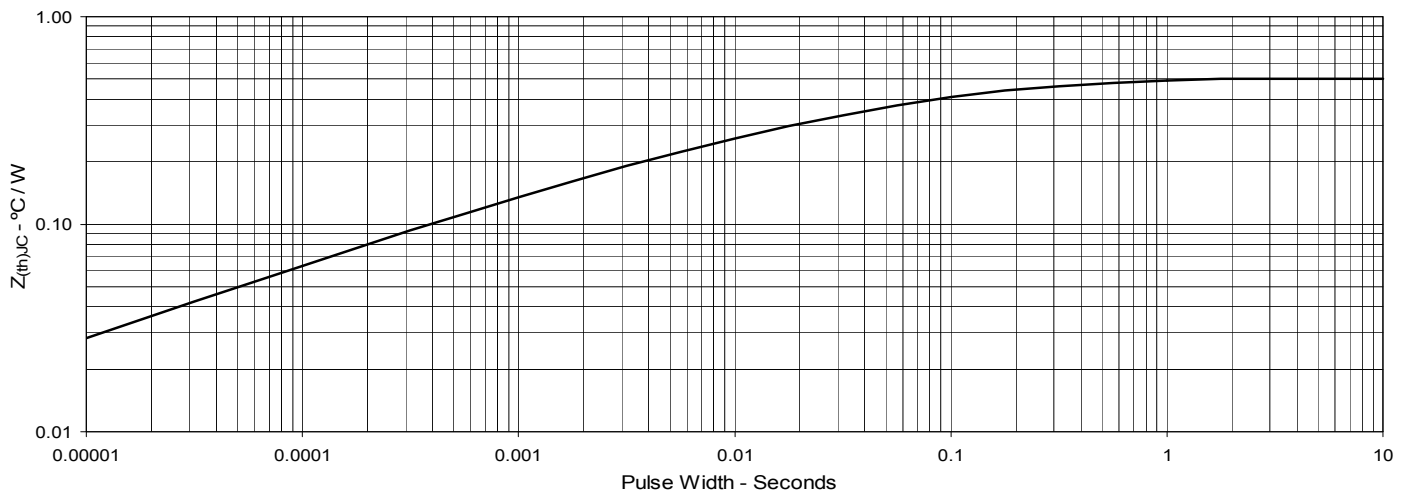


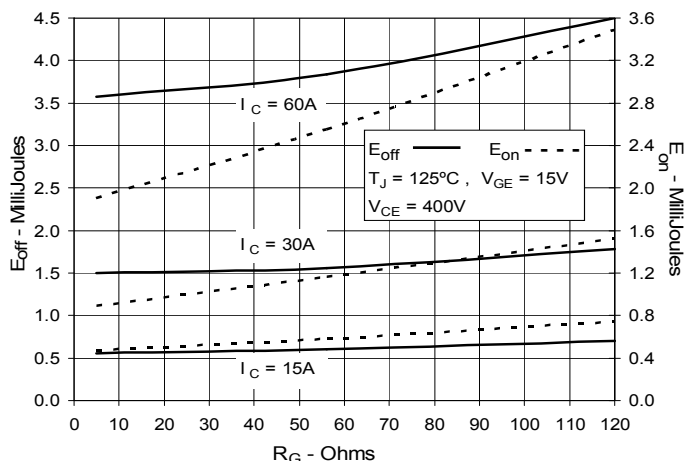
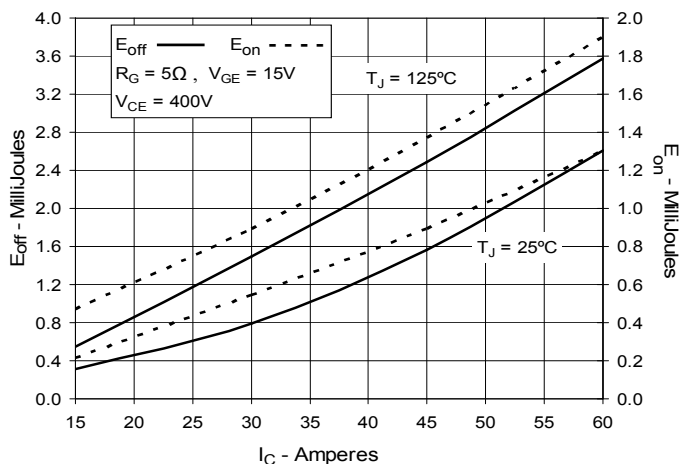
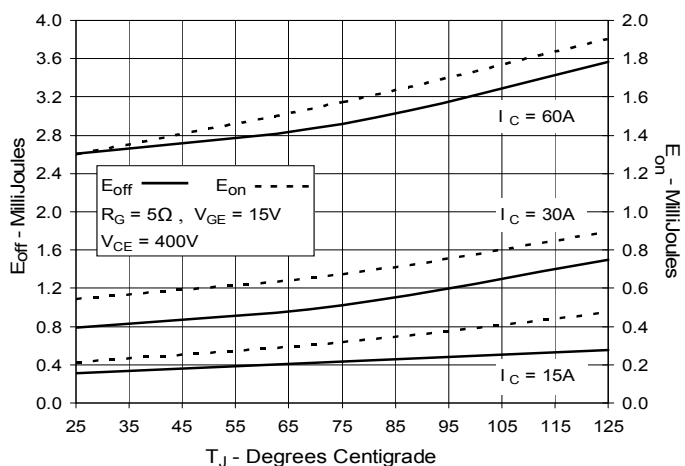
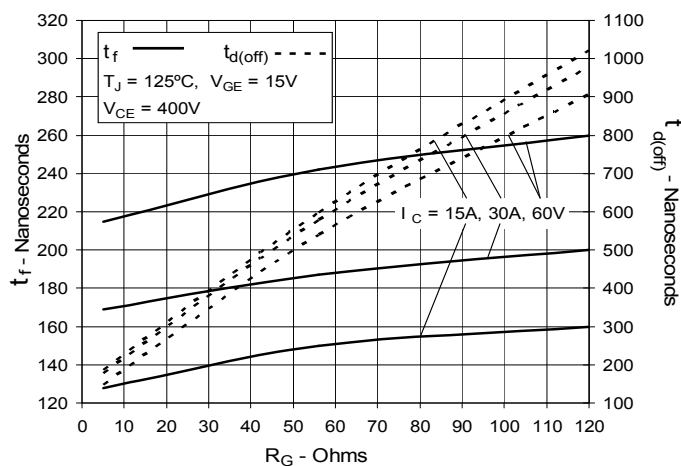
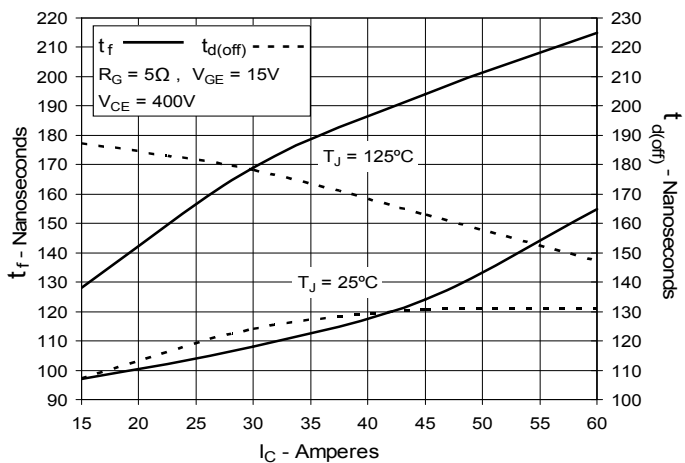
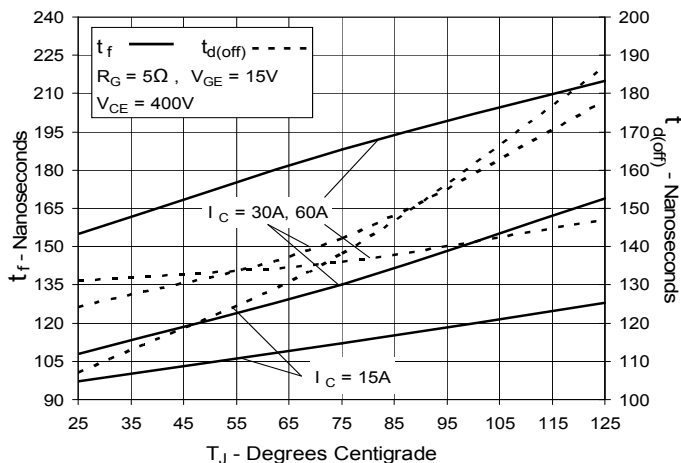
**Fig. 5. Collector-to-Emitter Voltage  
vs. Gate-to-Emitter Voltage**



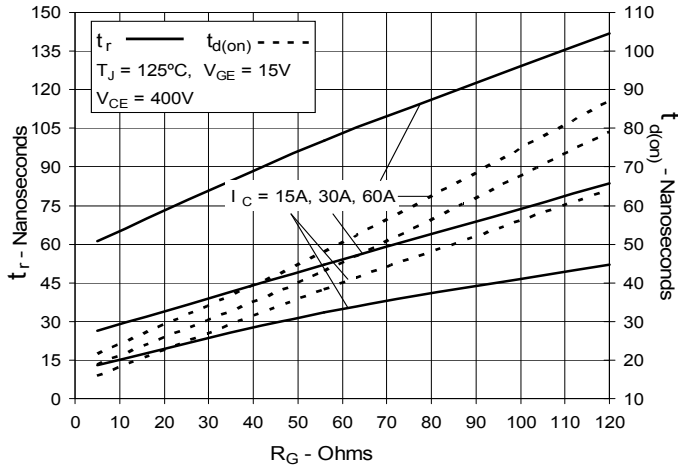
**Fig. 6. Input Admittance**



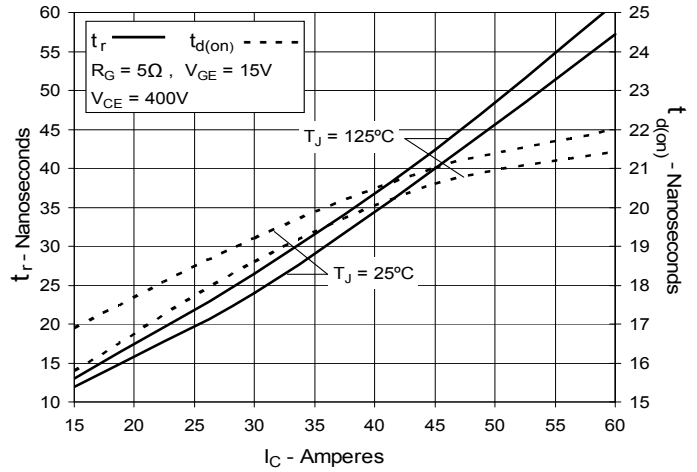
**Fig. 7. Transconductance**

**Fig. 8. Gate Charge**

**Fig. 9. Capacitance**

**Fig. 10. Reverse-Bias Safe Operating Area**

**Fig. 11. Maximum Transient Thermal Impedance**


**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**

**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**

**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**

**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**

**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**

**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**


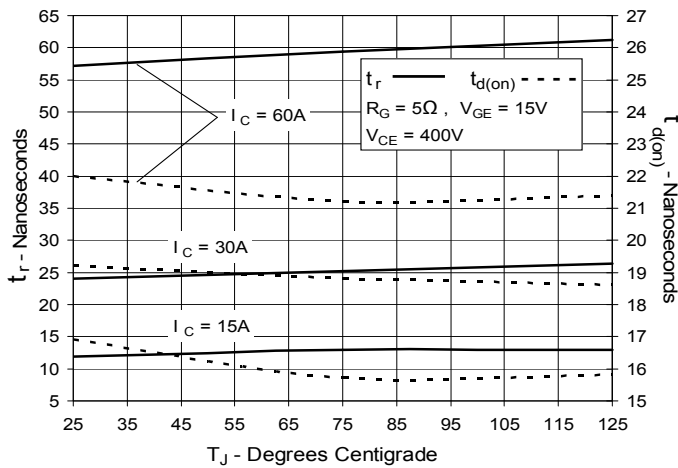
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**



**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**



**Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature**



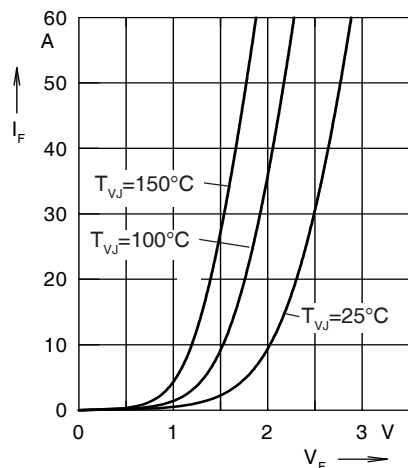


Fig. 21. Forward current  $I_F$  versus  $V_F$

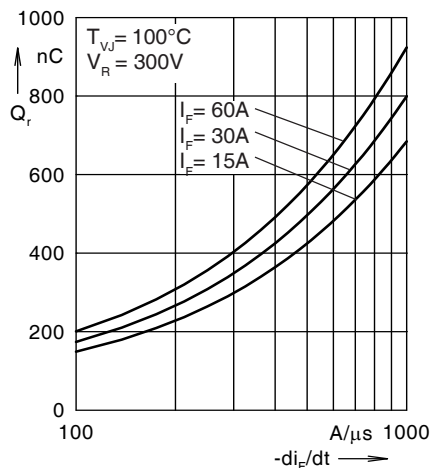


Fig. 22. Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

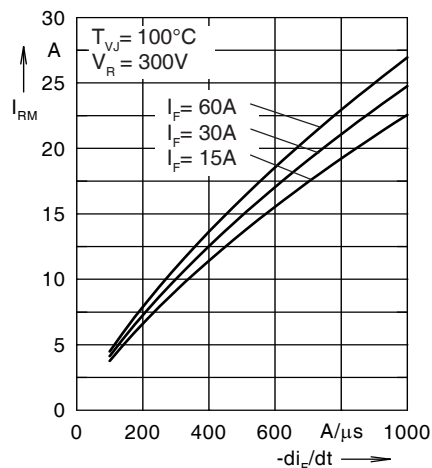


Fig. 23. Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

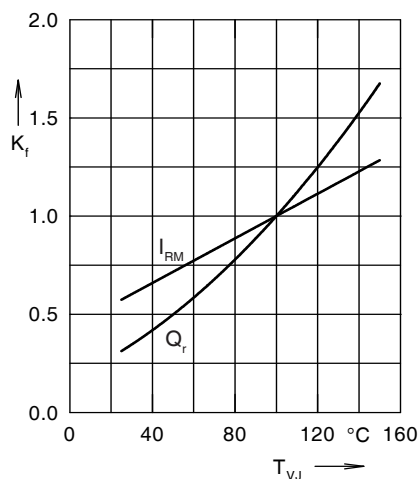


Fig. 24. Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

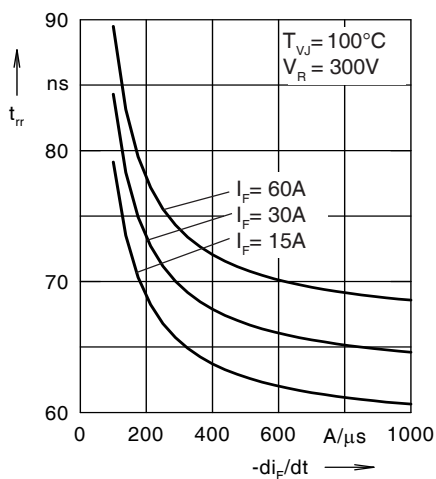


Fig. 25. Recovery time  $t_{rr}$  versus  $-di_F/dt$

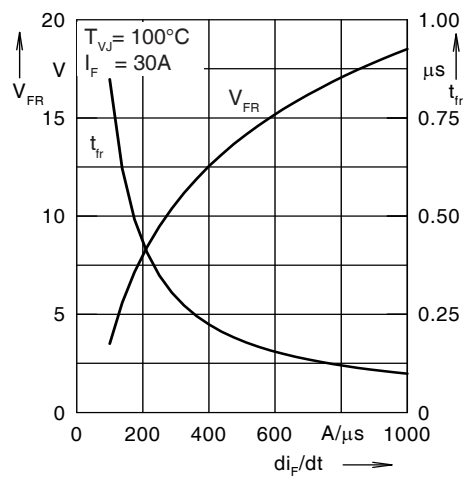


Fig. 26. Peak forward voltage  $V_{FR}$  and  $t_{fr}$  versus  $di_F/dt$

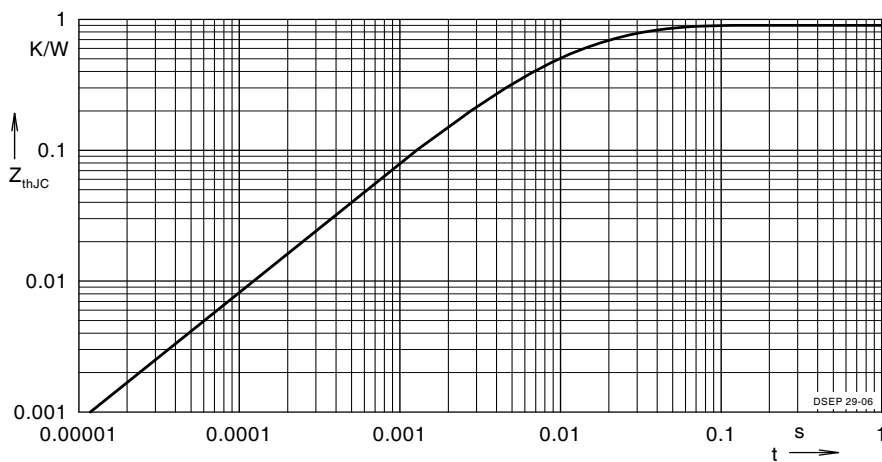


Fig. 27. Transient thermal resistance junction to case

Constants for  $Z_{thJC}$  calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|-----------------|-----------|
| 1 | 0.502           | 0.0052    |
| 2 | 0.193           | 0.0003    |
| 3 | 0.205           | 0.0162    |



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