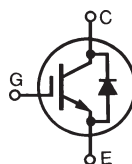


# GenX3™ 600V IGBT w/ Diode

## IXGR72N60B3H1

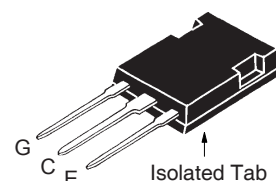
(Electrically Isolated Tab)

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



$$\begin{aligned} V_{CES} &= 600V \\ I_{C110} &= 40A \\ V_{CE(sat)} &\leq 1.80V \\ t_{fi(typ)} &= 92ns \end{aligned}$$

ISOPLUS247™



G = Gate      C = Collector  
E = Emitter

| 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                |
| $I_{C25}$                     | $T_C = 25^\circ\text{C}$                                                            | 80                                      | A                |
| $I_{C110}$                    | $T_C = 110^\circ\text{C}$                                                           | 40                                      | A                |
| $I_{F110}$                    | $T_C = 110^\circ\text{C}$                                                           | 34                                      | A                |
| $I_{CM}$                      | $T_C = 25^\circ\text{C}, 1\text{ms}$                                                | 450                                     | A                |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V, T_{VJ} = 125^\circ\text{C}, R_G = 3\Omega$<br>Clamped Inductive Load | $I_{CM} = 240$<br>$V_{CE} \leq V_{CES}$ | A                |
| $P_C$                         | $T_C = 25^\circ\text{C}$                                                            | 200                                     | W                |
| $T_J$                         |                                                                                     | -55 ... +150                            | $^\circ\text{C}$ |
| $T_{JM}$                      |                                                                                     | 150                                     | $^\circ\text{C}$ |
| $T_{stg}$                     |                                                                                     | -55 ... +150                            | $^\circ\text{C}$ |
| $V_{ISOL}$                    | 50/60 Hz, 1 Minute                                                                  | 2500                                    | V~               |
| $F_C$                         | Mounting Force                                                                      | 20..120/4.5..27                         | N/lb             |
| $T_L$                         | Maximum Lead Temperature for Soldering                                              | 300                                     | $^\circ\text{C}$ |
| $T_{SOLD}$                    | 1.6mm (0.062 in.) from Case for 10s                                                 | 260                                     | $^\circ\text{C}$ |
| <b>Weight</b>                 |                                                                                     | 5                                       | g                |

### Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Isolated Mounting Surface Optimized for Low Conduction and Switching Losses
- 2500V~ Electrical Isolation
- Square RBSOA
- Anti-Parallel Ultra Fast Diode

### 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.                      |
| $V_{GE(th)}$  | $I_C = 250\mu\text{A}, V_{CE} = V_{GE}$                                     | 3.0                   |              | 5.0 V                     |
| $I_{CES}$     | $V_{CE} = V_{CES}, V_{GE} = 0V$<br>$T_J = 125^\circ\text{C}$                |                       |              | 300 $\mu\text{A}$<br>5 mA |
| $I_{GES}$     | $V_{CE} = 0V, V_{GE} = \pm 20V$                                             |                       |              | $\pm 100$ nA              |
| $V_{CE(sat)}$ | $I_C = 60A, V_{GE} = 15V$ , Note 1<br>$I_C = 120A$                          |                       | 1.50<br>1.75 | V<br>V                    |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                                                   | Characteristic Values |      |                         |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
|              |                                                                                                                                               | Min.                  | Typ. | Max.                    |
| $g_{fs}$     | $I_C = 50\text{A}$ , $V_{CE} = 10\text{V}$ , Note 1                                                                                           | 45                    | 76   | S                       |
| $C_{ies}$    | $V_{CE} = 25\text{V}$ , $V_{GE} = 0\text{V}$ , $f = 1\text{MHz}$                                                                              |                       | 6800 | pF                      |
| $C_{oes}$    |                                                                                                                                               |                       | 576  | pF                      |
| $C_{res}$    |                                                                                                                                               |                       | 80   | pF                      |
| $Q_g$        | $I_C = 60\text{A}$ , $V_{GE} = 15\text{V}$ , $V_{CE} = 0.5 \cdot V_{CES}$                                                                     |                       | 225  | nC                      |
| $Q_{ge}$     |                                                                                                                                               |                       | 40   | nC                      |
| $Q_{gc}$     |                                                                                                                                               |                       | 82   | nC                      |
| $t_{d(on)}$  | Inductive load, $T_J = 25^\circ\text{C}$<br>$I_C = 50\text{A}$ , $V_{GE} = 15\text{V}$<br>$V_{CE} = 480\text{V}$ , $R_G = 3\Omega$<br>Note 2  |                       | 31   | ns                      |
| $t_{ri}$     |                                                                                                                                               |                       | 33   | ns                      |
| $E_{on}$     |                                                                                                                                               |                       | 1.4  | mJ                      |
| $t_{d(off)}$ |                                                                                                                                               |                       | 152  | ns                      |
| $t_{fi}$     |                                                                                                                                               |                       | 92   | ns                      |
| $E_{off}$    |                                                                                                                                               |                       | 1.0  | mJ                      |
| $t_{d(on)}$  | Inductive load, $T_J = 125^\circ\text{C}$<br>$I_C = 50\text{A}$ , $V_{GE} = 15\text{V}$<br>$V_{CE} = 480\text{V}$ , $R_G = 3\Omega$<br>Note 2 |                       | 29   | ns                      |
| $t_{ri}$     |                                                                                                                                               |                       | 34   | ns                      |
| $E_{on}$     |                                                                                                                                               |                       | 2.7  | mJ                      |
| $t_{d(off)}$ |                                                                                                                                               |                       | 228  | ns                      |
| $t_{fi}$     |                                                                                                                                               |                       | 142  | ns                      |
| $E_{off}$    |                                                                                                                                               |                       | 2.2  | mJ                      |
| $R_{thJC}$   |                                                                                                                                               |                       |      | 0.62 $^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                               | 0.15                  |      | $^\circ\text{C/W}$      |

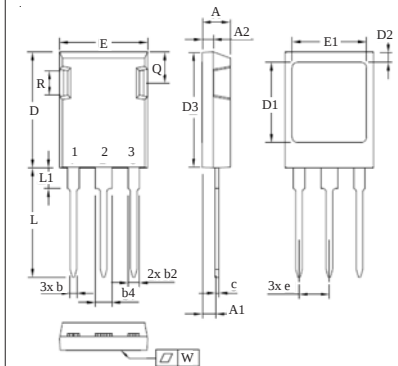
## Reverse Diode (FRED)

| (Symbol    | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                 | Characteristic Values |      |                         |
|------------|-------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
|            |                                                                                                             | Min.                  | Typ. | Max.                    |
| $V_F$      | $I_F = 60\text{A}$ , $V_{GE} = 0\text{V}$ , Note 1                                                          |                       |      | 2.45 V                  |
|            | $T_J = 150^\circ\text{C}$                                                                                   |                       | 1.40 | 1.80 V                  |
| $I_{RM}$   | $I_F = 60\text{A}$ , $V_{GE} = 0\text{V}$ ,<br>$-di_F/dt = 200\text{A}/\mu\text{s}$ , $V_R = 300\text{V}$   |                       | 8.3  | A                       |
| $t_{rr}$   | $I_F = 60\text{A}$ , $-di_F/dt = 200\text{A}/\mu\text{s}$ , $V_R = 300\text{V}$ , $T_J = 100^\circ\text{C}$ |                       | 140  | ns                      |
| $R_{thJC}$ |                                                                                                             |                       |      | 0.80 $^\circ\text{C/W}$ |

## Notes:

1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}$  (Clamp),  $T_J$  or  $R_G$ .

## ISOPLUS247 (IXGR) Outline

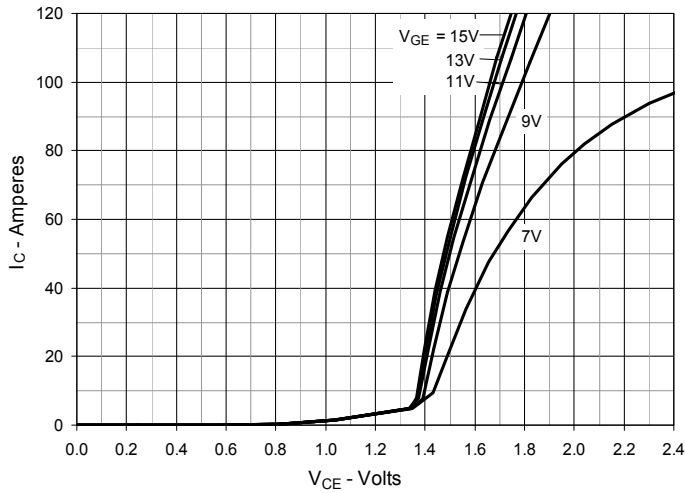
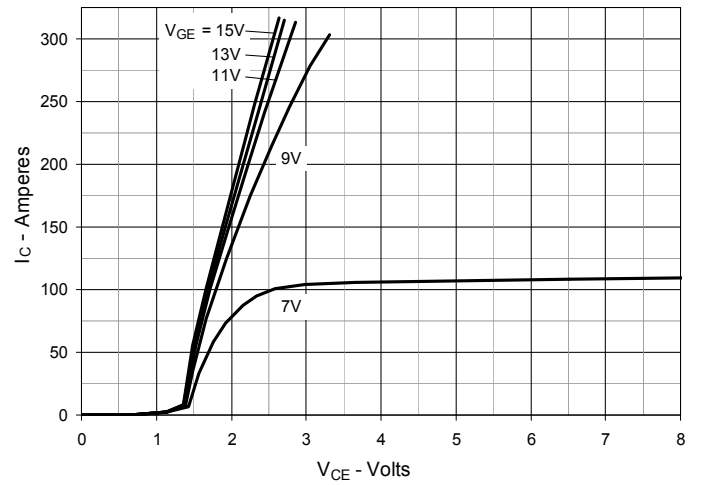
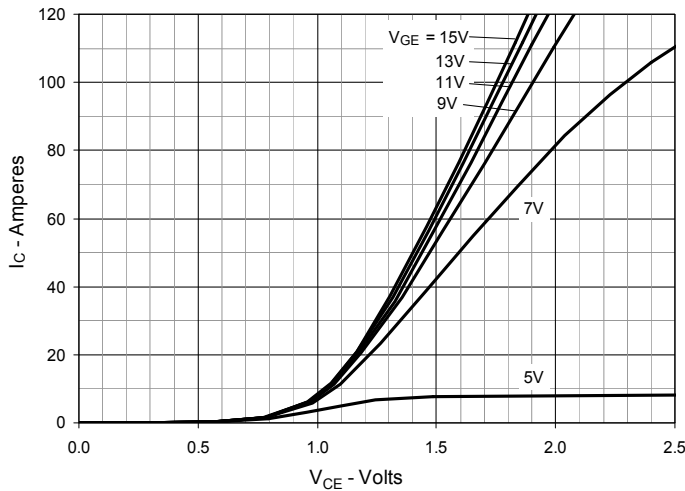
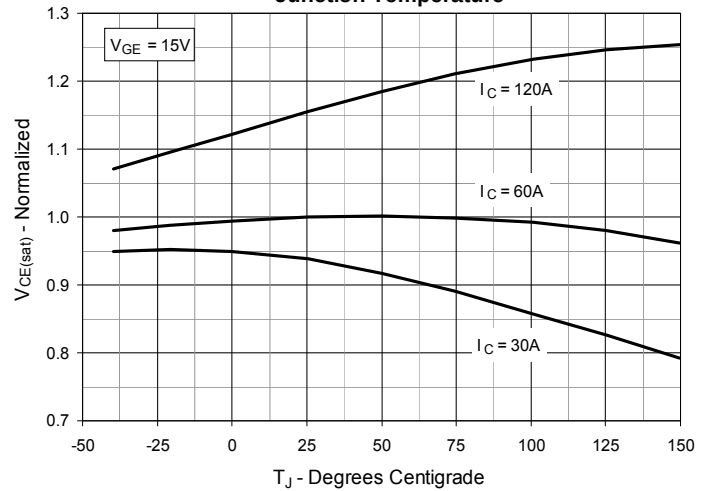
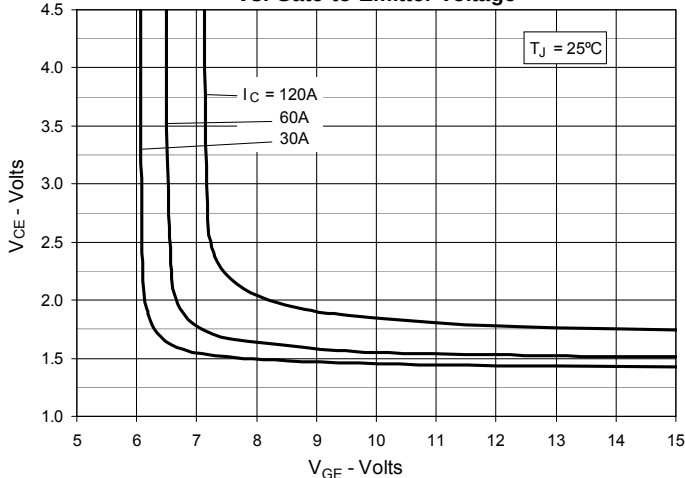
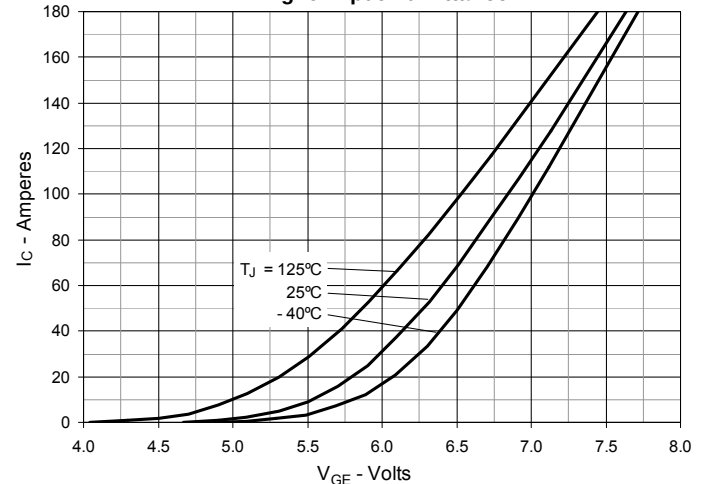


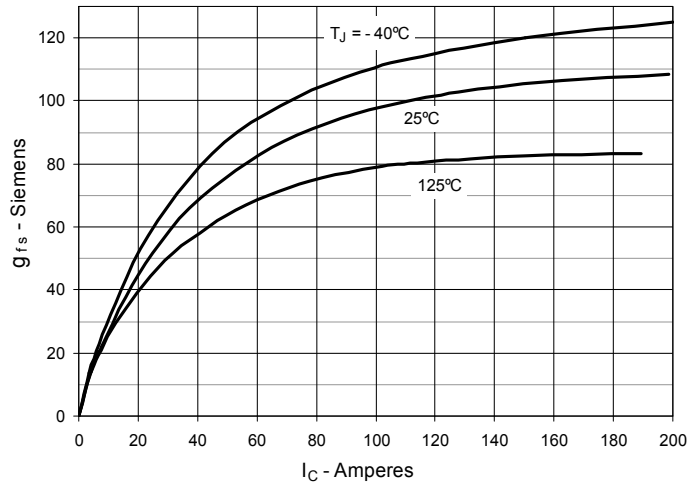
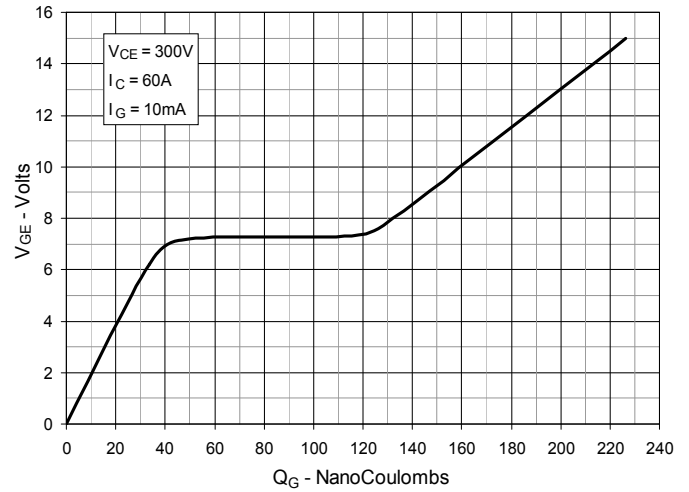
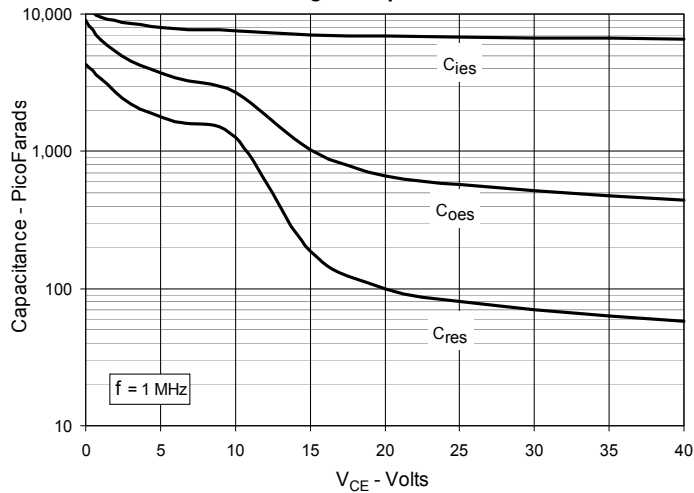
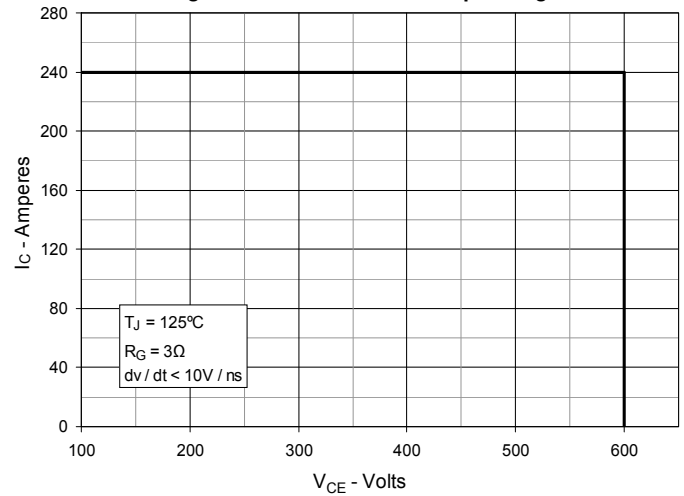
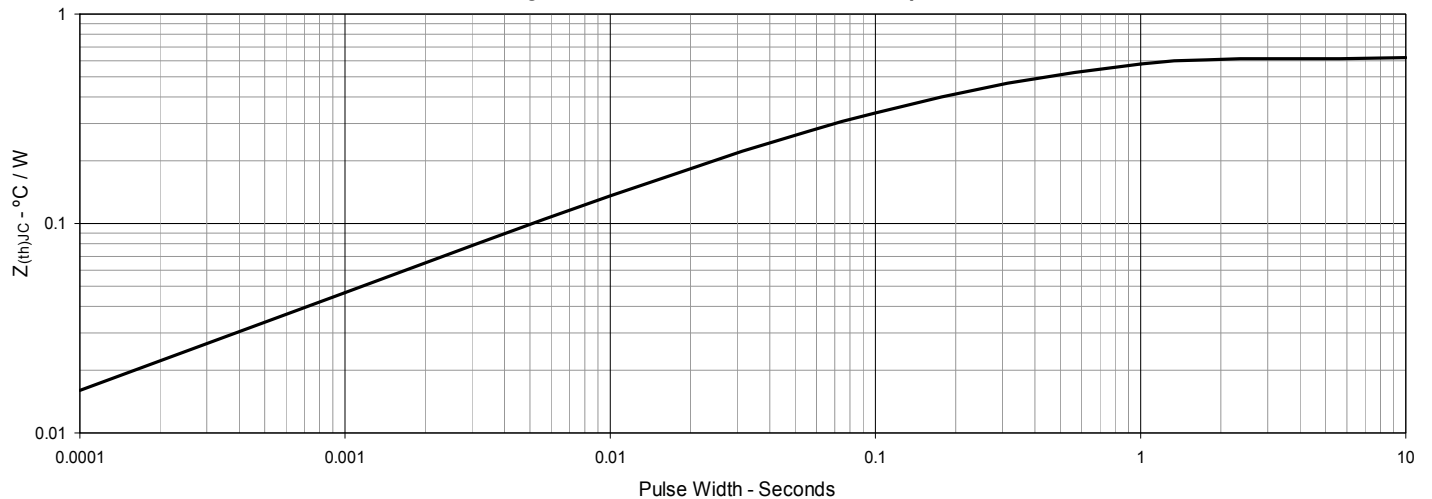
- 1 - Gate
- 2 - Collector
- 3 - Emitter

| Dim. | Millimeter |       | Inches    |       |
|------|------------|-------|-----------|-------|
|      | min        | max   | min       | max   |
| A    | 4.83       | 5.21  | 0.190     | 0.205 |
| A1   | 2.29       | 2.54  | 0.090     | 0.100 |
| A2   | 1.91       | 2.16  | 0.075     | 0.085 |
| b    | 1.14       | 1.40  | 0.045     | 0.055 |
| b2   | 1.91       | 2.20  | 0.075     | 0.087 |
| b4   | 2.92       | 3.24  | 0.115     | 0.128 |
| c    | 0.61       | 0.83  | 0.024     | 0.033 |
| D    | 20.80      | 21.34 | 0.819     | 0.840 |
| D1   | 15.75      | 16.26 | 0.620     | 0.640 |
| D2   | 1.65       | 2.15  | 0.065     | 0.085 |
| D3   | 20.30      | 20.70 | 0.799     | 0.815 |
| E    | 15.75      | 16.13 | 0.620     | 0.635 |
| E1   | 13.21      | 13.72 | 0.520     | 0.540 |
| e    | 5.45 BSC   |       | 0.215 BSC |       |
| L    | 19.81      | 20.60 | 0.780     | 0.811 |
| L1   | 3.81       | 4.38  | 0.150     | 0.172 |
| Q    | 5.59       | 6.20  | 0.220     | 0.244 |
| R    | 4.25       | 5.50  | 0.167     | 0.217 |
| W    | -          | 0.10  | -         | 0.004 |

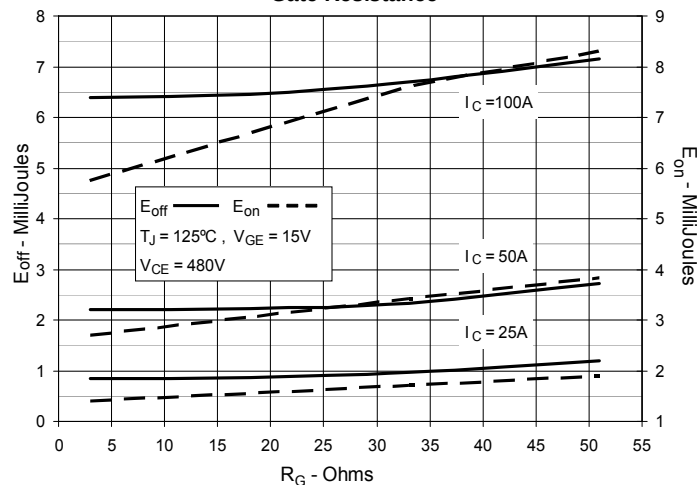
IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

|                                                                                  |           |           |           |           |              |              |              |              |              |             |
|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 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 | 7,157,338B2 |
|                                                                                  | 4,860,072 | 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    |             |

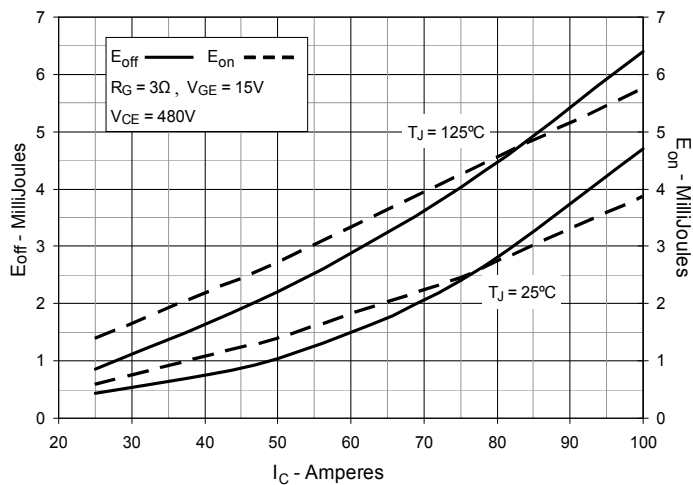
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$** 

**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$** 

**Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$** 

**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**


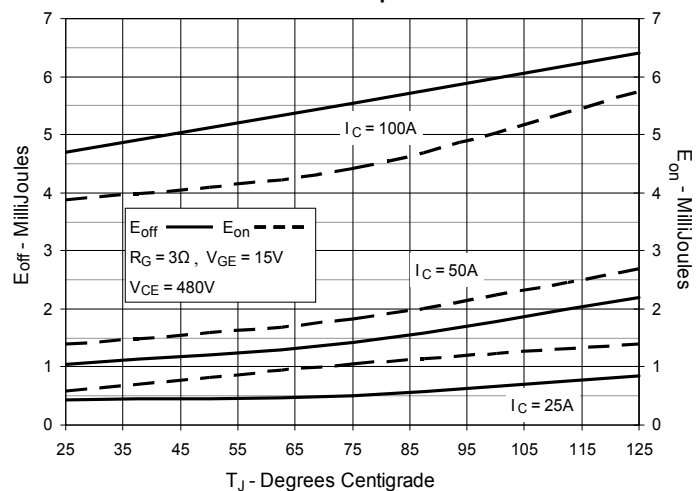
**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**



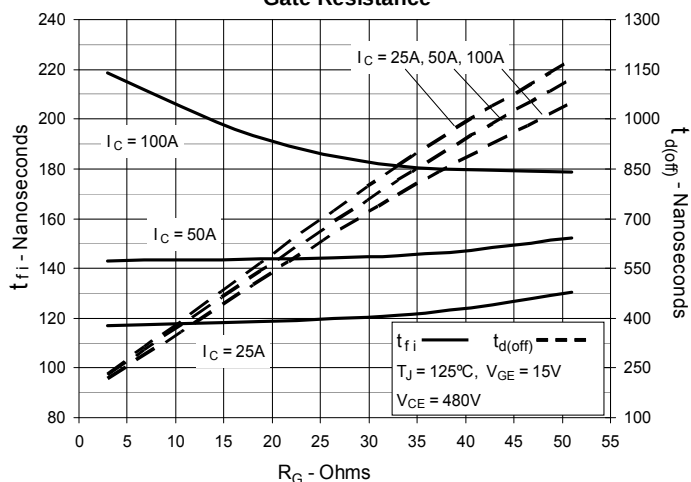
**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**



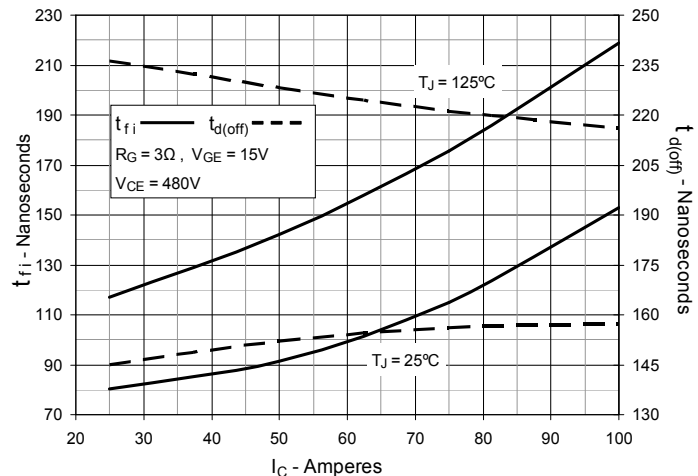
**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**



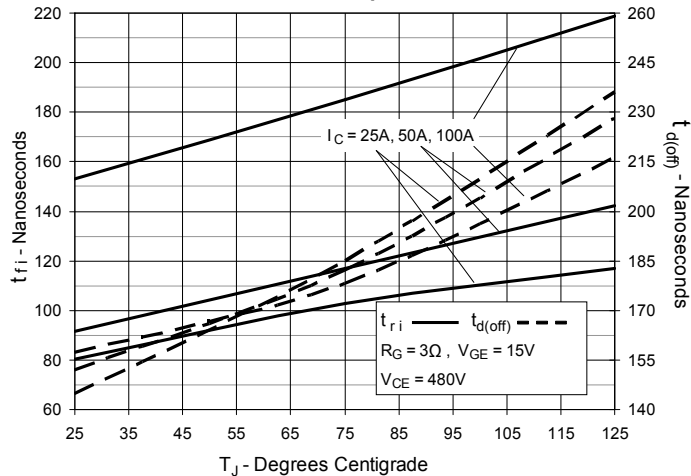
**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**



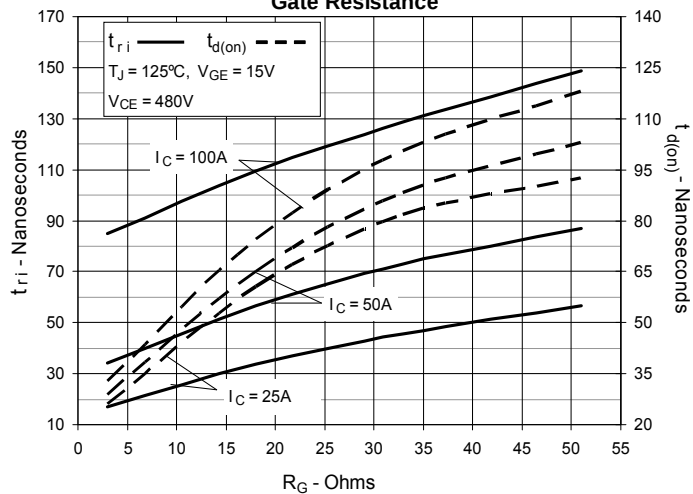
**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**



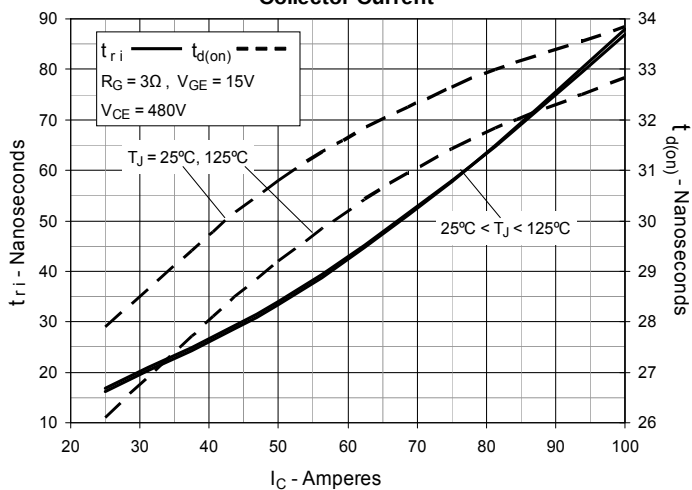
**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**



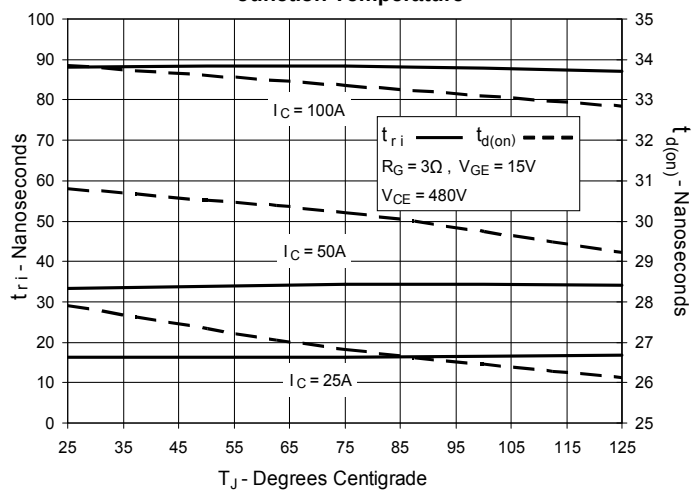
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**



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



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



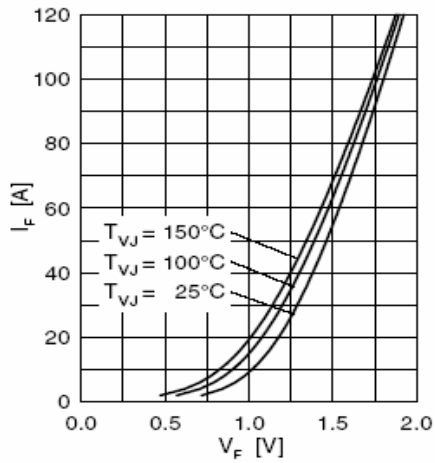


Fig. 21 Forward Current  $I_F$  vs.  $V_F$

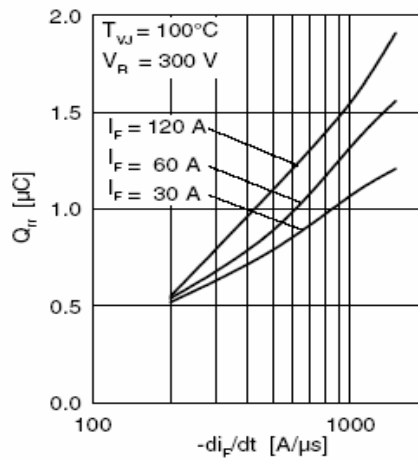


Fig. 22 Typ. Reverse Recovery Charge  $Q_{rr}$

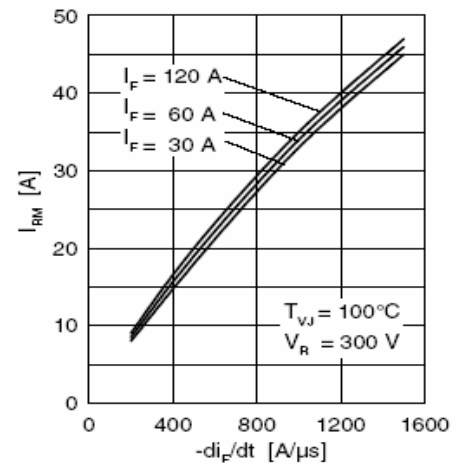


Fig. 23 Typ. Peak Reverse Current  $I_{RM}$

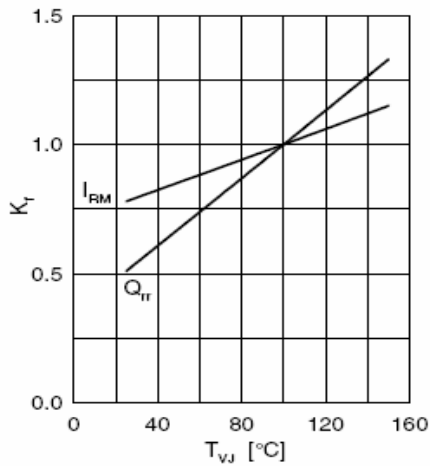


Fig. 24 Typ. Dynamic Parameters  $Q_{rr}$ ,  $I_{RM}$

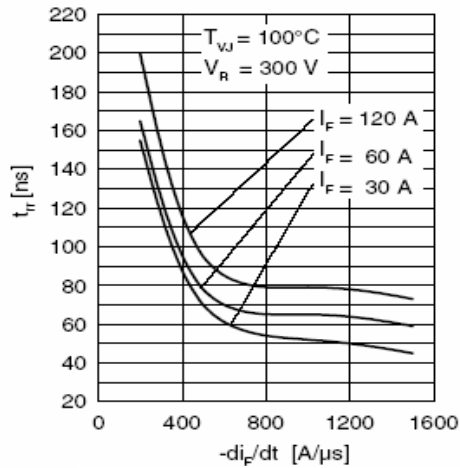


Fig. 25 Typ Recovery Time  $t_{rr}$

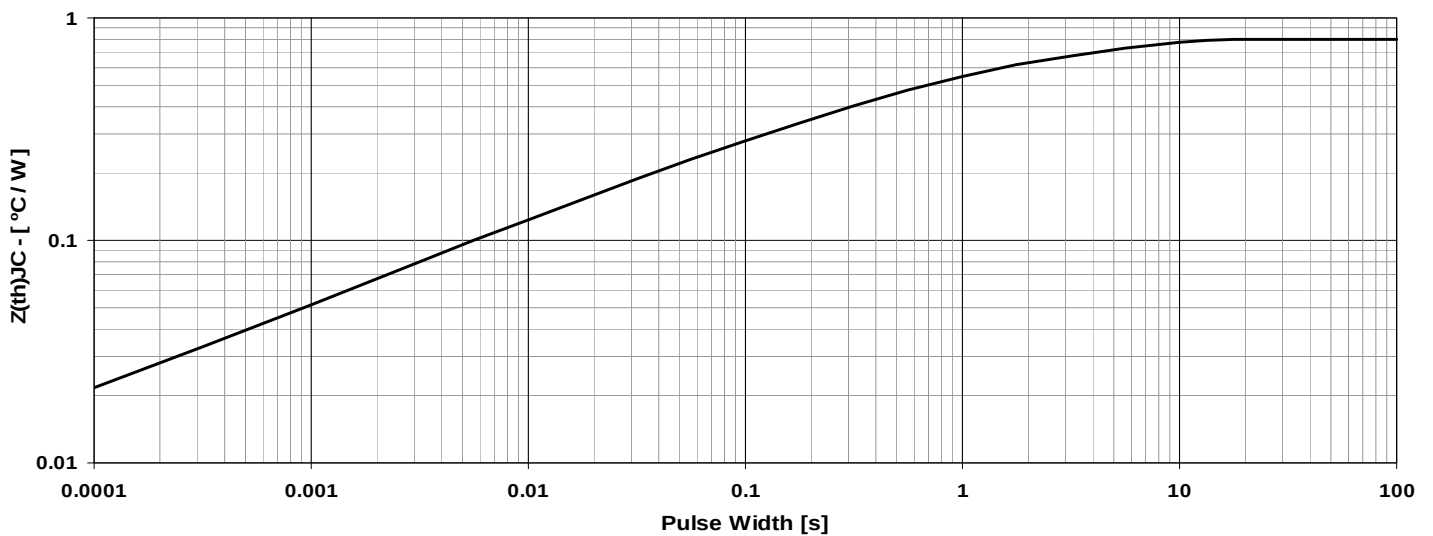


Fig. 26 Maximum Transient Thermal Impedance Junction to Case (for Diode)



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