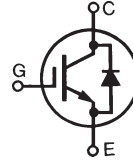


# GenX3™ 600V IGBT w/ Diode

# IXGK72N60B3H1 IXGX72N60B3H1

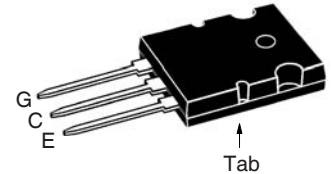
Medium Speed Low V<sub>sat</sub> PT  
IGBTs 5-40 kHz Switching



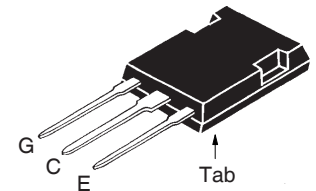
$V_{CES} = 600V$   
 $I_{C110} = 72A$   
 $V_{CE(sat)} \leq 1.8V$   
 $t_{fi(typ)} = 92ns$

| Symbol                        | Test Conditions   | Maximum Ratings                           |            |
|-------------------------------|---|---|------------|
| $V_{CES}$                     | $T_J = 25^\circ C$ to $150^\circ C$   | 600                                       | V          |
| $V_{CGR}$                     | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GE} = 1M\Omega$                           | 600                                       | V          |
| $V_{GES}$                     | Continuous  | $\pm 20$                                  | V          |
| $V_{GEM}$                     | Transient   | $\pm 30$                                  | V          |
| $I_{C25}$                     | $T_C = 25^\circ C$ ( Chip Capability)   | 178                                       | A          |
| $I_{LRMS}$                    | Terminal Current Limit  | 160                                       | A          |
| $I_{C110}$                    | $T_C = 110^\circ C$   | 72  | A          |
| $I_{CM}$                      | $T_C = 25^\circ C$ , 1ms  | 450                                       | A          |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_{VJ} = 125^\circ C$ , $R_G = 3\Omega$<br>Clamped Inductive Load | $I_{CM} = 240$<br>@ $V_{CE} \leq V_{CES}$ | A          |
| $P_C$                         | $T_C = 25^\circ C$  | 540                                       | W          |
| $T_J$                         |   | -55 ... +150                              | $^\circ C$ |
| $T_{JM}$                      |   | 150                                       | $^\circ C$ |
| $T_{stg}$                     |   | -55 ... +150                              | $^\circ C$ |
| $T_L$                         | Maximum Lead Temperature for Soldering  | 300                                       | $^\circ C$ |
| $T_{SOLD}$                    | 1.6 mm (0.062in.) from Case for 10s   | 260                                       | $^\circ C$ |
| $M_d$                         | Mounting Torque (TO-264)  | 1.13/10                                   | Nm/lb.in   |
| $F_C$                         | Mounting Force (PLUS247)  | 20..120 /4.5..27                          | N/lb       |
| <b>Weight</b>                 | TO-264  | 10  | g          |
|                               | PLUS247   | 6   | g          |

TO-264 (IXGK)



PLUS247 (IXGX)



G = Gate                      E = Emitter  
 C = Collector                Tab = Collector

## Features

- Optimized for Low Conduction and Switching Losses
- 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>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |      |                     |
|---------------|---|-----------------------|------|---------------------|
|               |   | Min.                  | Typ. | Max.                |
| $V_{GE(th)}$  | $I_C = 250\mu A$ , $V_{CE} = V_{GE}$                                  | 3.0                   |      | 5.0 V               |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 150^\circ C$             |                       |      | 300 $\mu A$<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                  | 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                 |    |
| $C_{oes}$    |   |                       | 575  | pF                 |    |
| $C_{res}$    |   |                       | 80   | pF                 |    |
| $Q_{g(on)}$  | $I_C = 60\text{A}$ , $V_{GE} = 15\text{V}$ , $V_{CE} = 0.5 \cdot V_{CES}$   |                       | 225  | nC                 |    |
| $Q_{ge}$     |   |                       | 40   | nC                 |    |
| $Q_{gc}$     |   |                       | 82   | nC                 |    |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><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  | 240                | ns |
| $t_{fi}$     |   |                       | 92   | 150                | ns |
| $E_{off}$    |   |                       | 1.0  | 2.0                | mJ |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b><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                 |    |
| $R_{thJC}$   |   |                       | 0.23 | $^\circ\text{C/W}$ |    |
| $R_{thCS}$   |   | 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>$-di_F/dt = 200\text{A}/\mu\text{s}$ , $V_R = 300\text{V}$ | $T_J = 100^\circ\text{C}$ | 8.3  | A                  |
| $t_{rr}$   |   |                           | 140  | ns                 |
| $R_{thJC}$ |   |                           | 0.30 | $^\circ\text{C/W}$ |

### Notes:

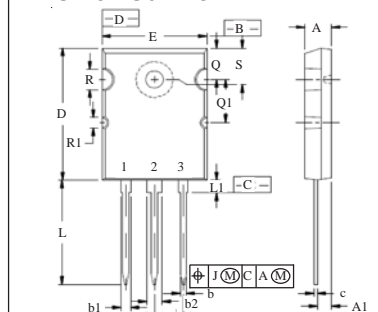
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}$  (Clamp),  $T_J$  or  $R_G$ .

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:

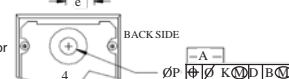
|           |           |           |           |              |              |              |              |              |             |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 4,835,592 | 4,931,844 | 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    |             |

### TO-264 Outline



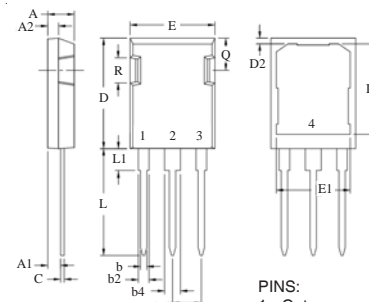
PINS:

- 1 - Gate
- 2,4 - Collector
- 3 - Emitter



| SYM | INCHES  |       | MILLIMETERS |       |
|-----|---------|-------|-------------|-------|
|     | MIN     | MAX   | MIN         | MAX   |
| A   | .185    | .209  | 4.70        | 5.31  |
| A1  | .102    | .118  | 2.59        | 3.00  |
| b   | .037    | .055  | 0.94        | 1.40  |
| b1  | .087    | .102  | 2.21        | 2.59  |
| b2  | .110    | .126  | 2.79        | 3.20  |
| c   | .017    | .029  | 0.43        | 0.74  |
| D   | 1.007   | 1.047 | 25.58       | 26.59 |
| E   | .760    | .799  | 19.30       | 20.29 |
| e   | .215BSC |       | 5.46 BSC    |       |
| J   | .000    | .010  | 0.00        | 0.25  |
| K   | .000    | .010  | 0.00        | 0.25  |
| L   | .779    | .842  | 19.79       | 21.39 |
| L1  | .087    | .102  | 2.21        | 2.59  |
| ØP  | .122    | .138  | 3.10        | 3.51  |
| Q   | .240    | .256  | 6.10        | 6.50  |
| Q1  | .330    | .346  | 8.38        | 8.79  |
| ØR  | .155    | .187  | 3.94        | 4.75  |
| ØR1 | .085    | .093  | 2.16        | 2.36  |
| S   | .243    | .253  | 6.17        | 6.43  |

### PLUS247™ Outline



PINS:

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

| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .190     | .205 | 4.83        | 5.21  |
| A1  | .090     | .100 | 2.29        | 2.54  |
| A2  | .075     | .085 | 1.91        | 2.16  |
| b   | .045     | .055 | 1.14        | 1.40  |
| b2  | .075     | .087 | 1.91        | 2.20  |
| b4  | .115     | .126 | 2.92        | 3.20  |
| C   | .024     | .031 | 0.61        | 0.80  |
| D   | .819     | .840 | 20.80       | 21.34 |
| D1  | .650     | .690 | 16.51       | 17.53 |
| D2  | .035     | .050 | 0.89        | 1.27  |
| E   | .620     | .635 | 15.75       | 16.13 |
| E1  | .545     | .565 | 13.84       | 14.35 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| L   | .780     | .810 | 19.81       | 20.57 |
| L1  | .150     | .170 | 3.81        | 4.32  |
| Q   | .220     | .244 | 5.59        | 6.20  |
| R   | .170     | .190 | 4.32        | 4.83  |

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

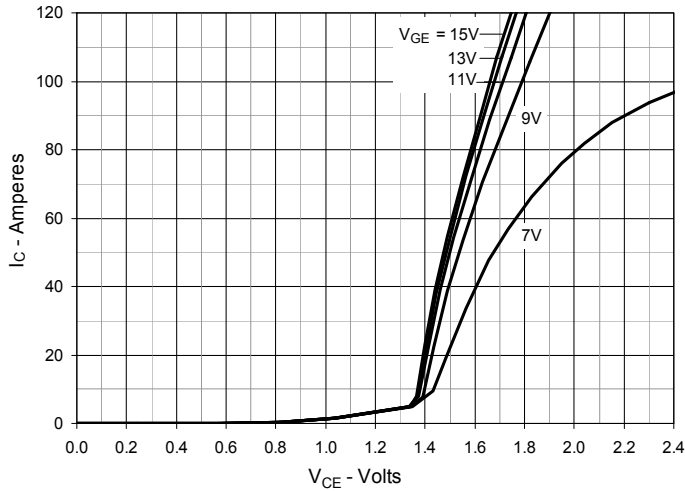


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

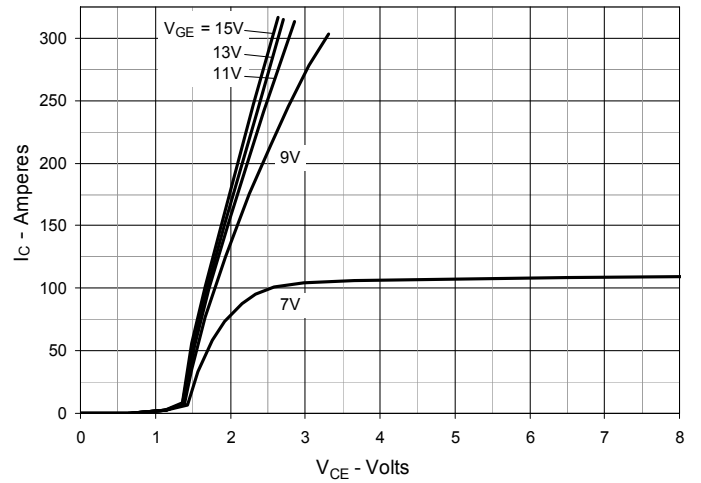


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

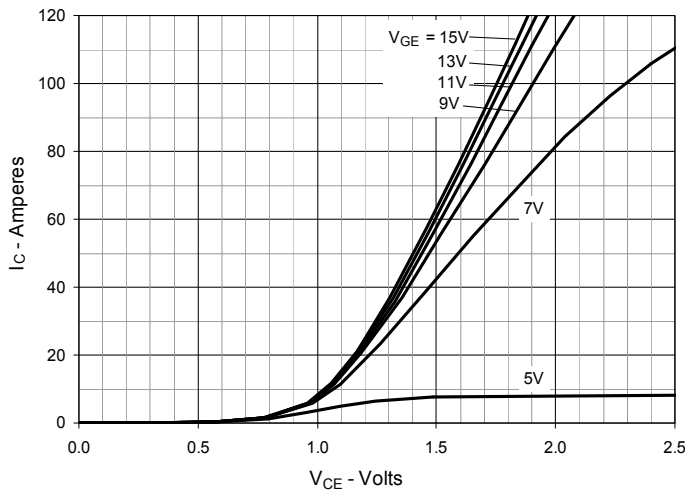


Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature

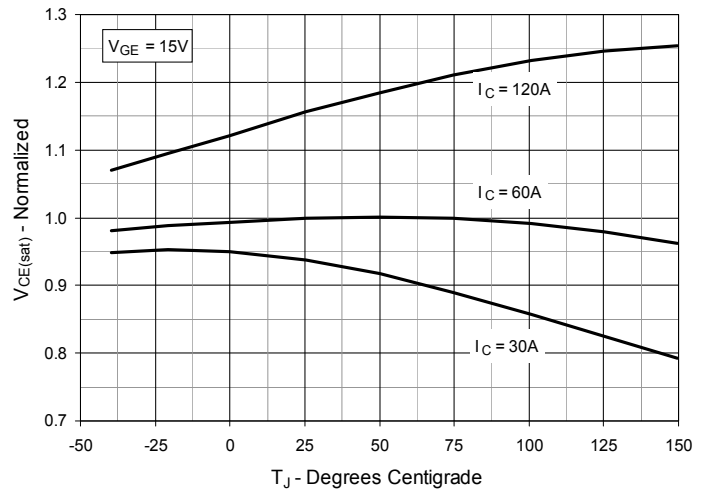


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

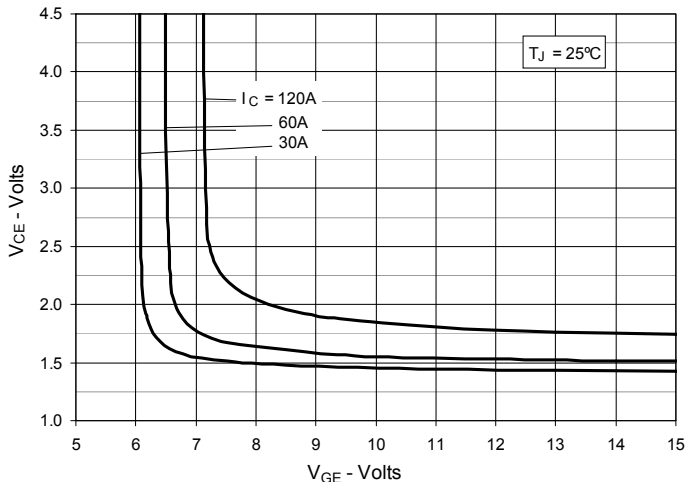


Fig. 6. Input Admittance

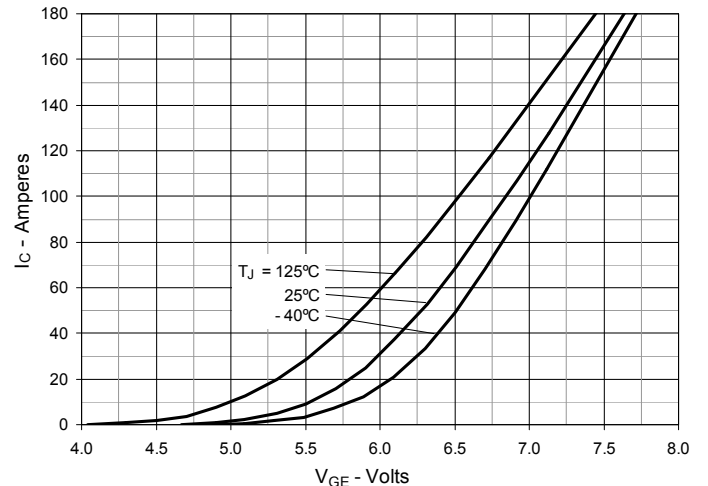


Fig. 7. Transconductance

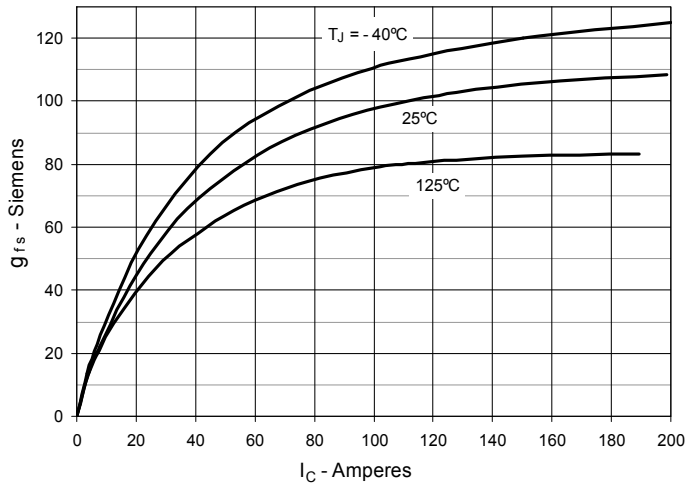


Fig. 8. Gate Charge

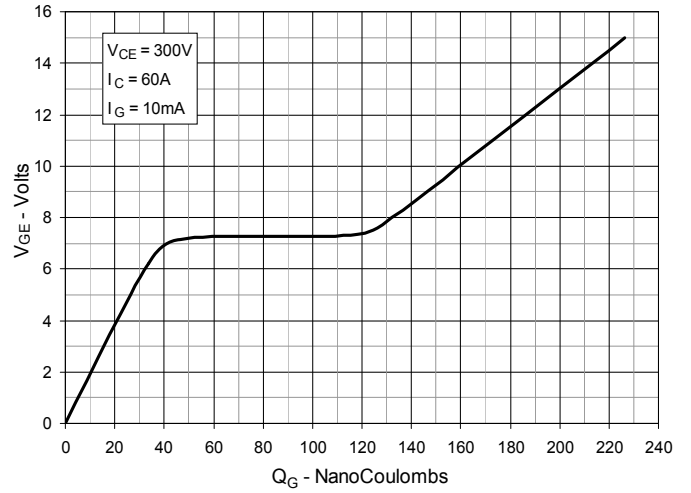


Fig. 9. Capacitance

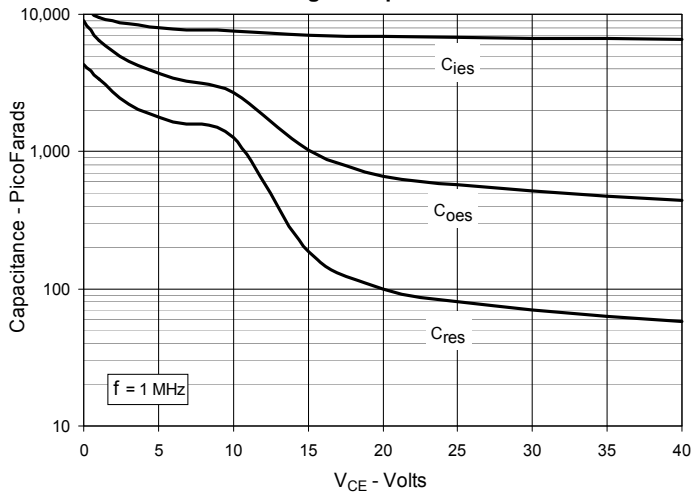


Fig. 10. Reverse-Bias Safe Operating Area

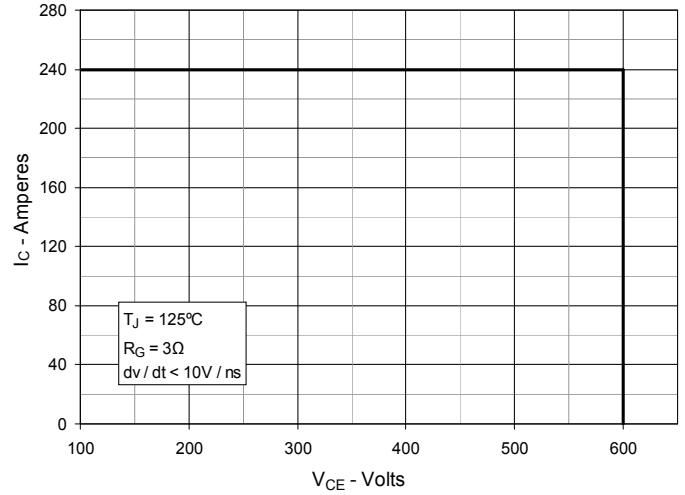
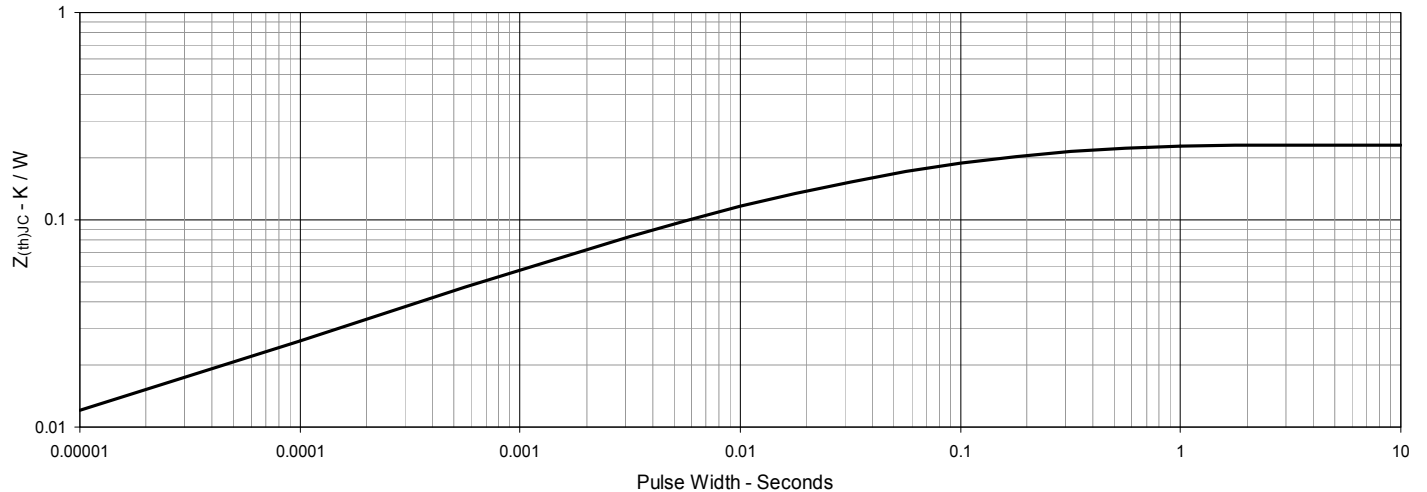
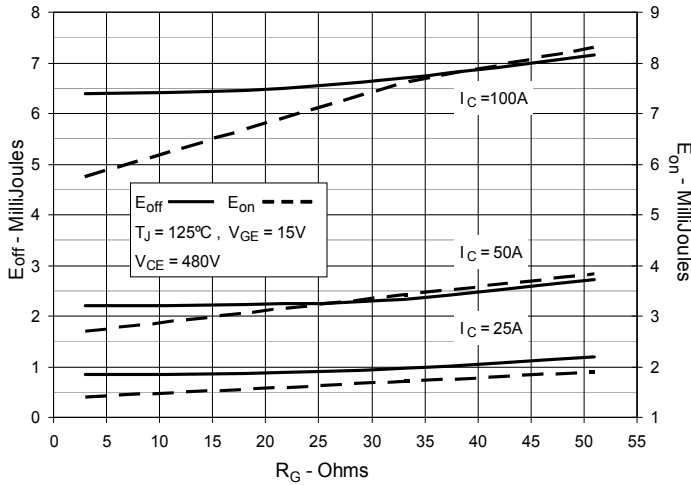


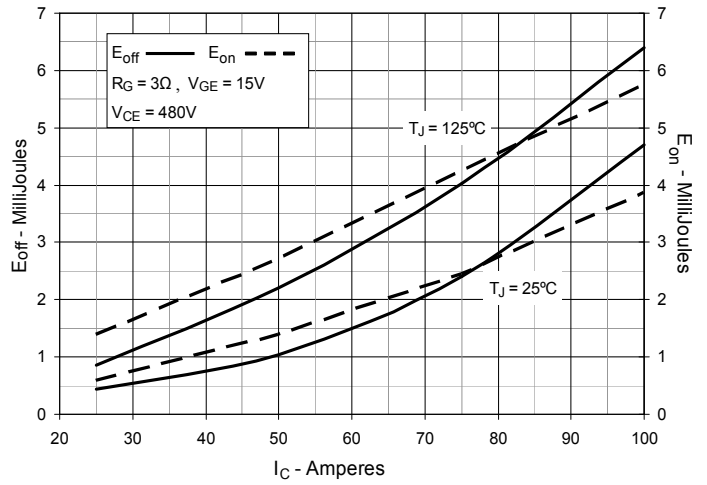
Fig. 11. Maximum Transient Thermal Impedance for IGBT



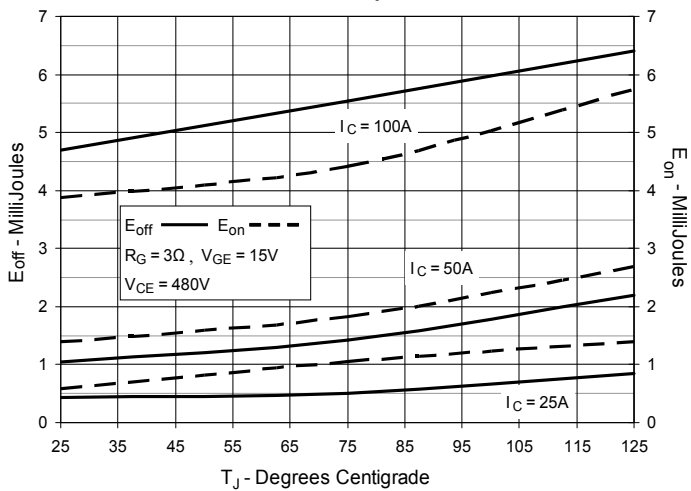
**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**



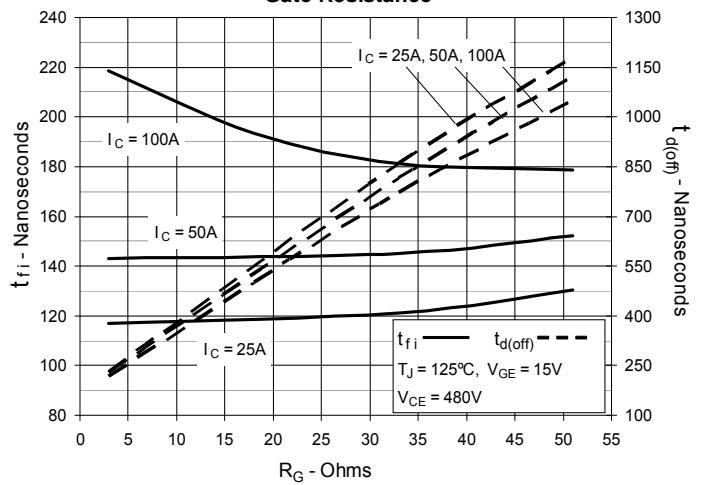
**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**



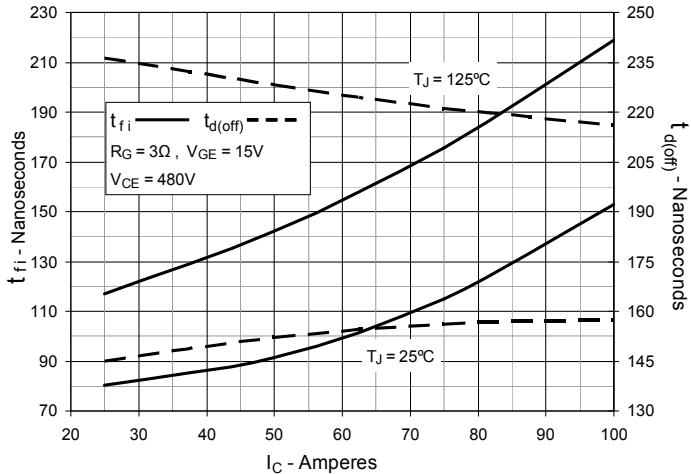
**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**



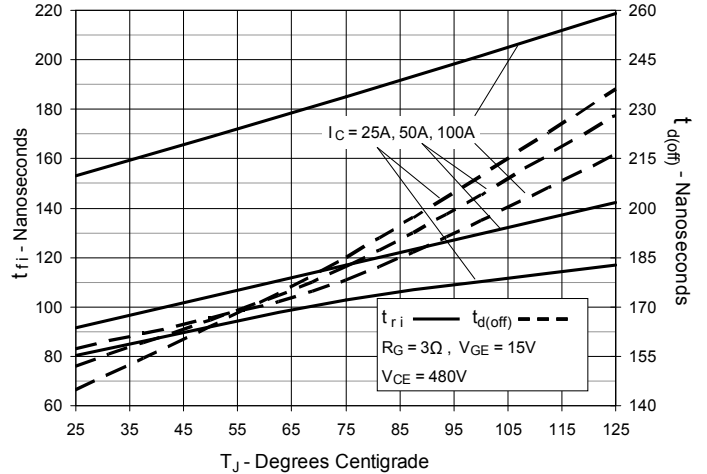
**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**



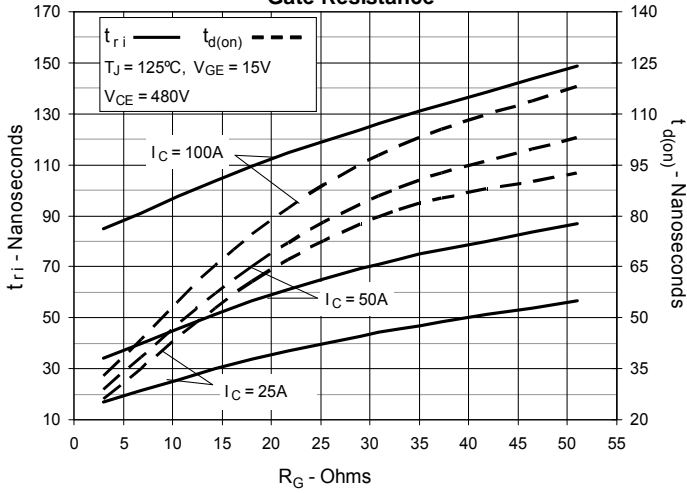
**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**



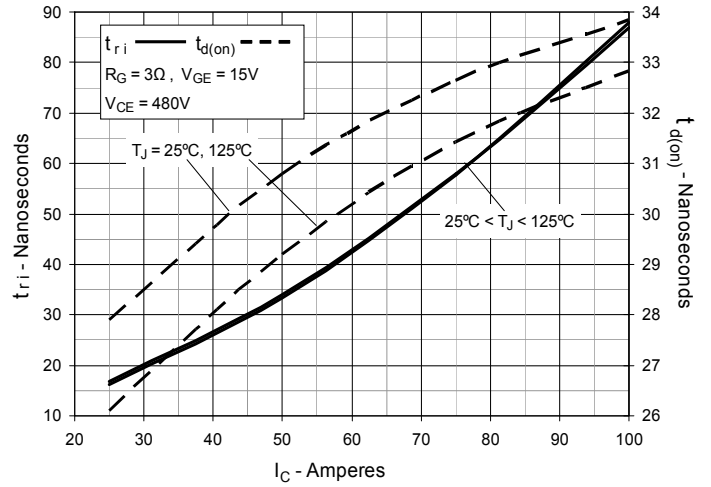
**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**



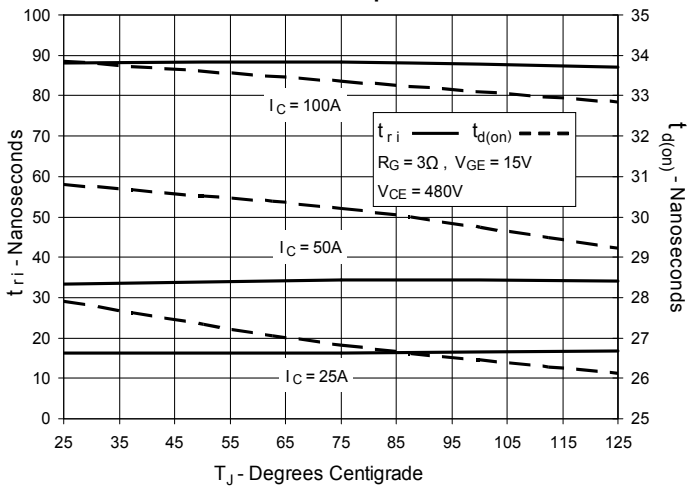
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**



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



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



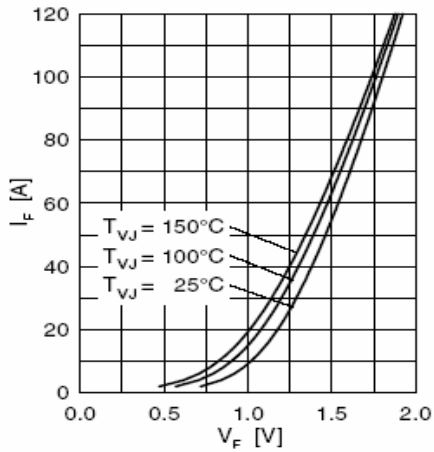


Fig. 21 Forward current  $I_F$  vs.  $V_F$

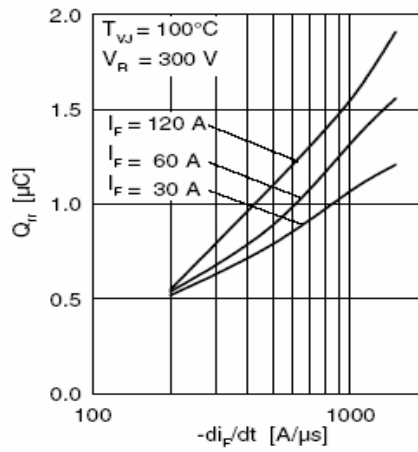


Fig. 22 Typ. reverse recovery charge  $Q_{rr}$

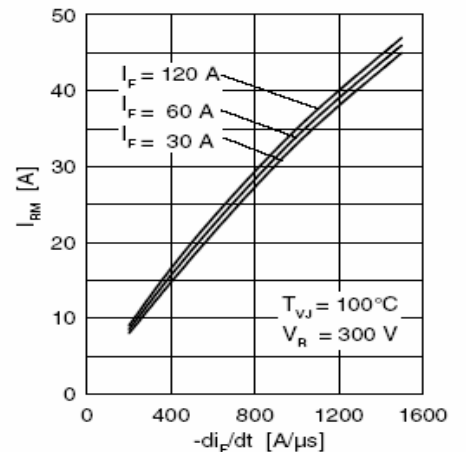


Fig. 23 Typ. peak reverse current  $I_{RM}$



Fig. 24 Typ. dynamic parameters  $Q_{rr}$ ,  $I_{RM}$



Fig. 25 Typ. recovery time  $t_{rr}$

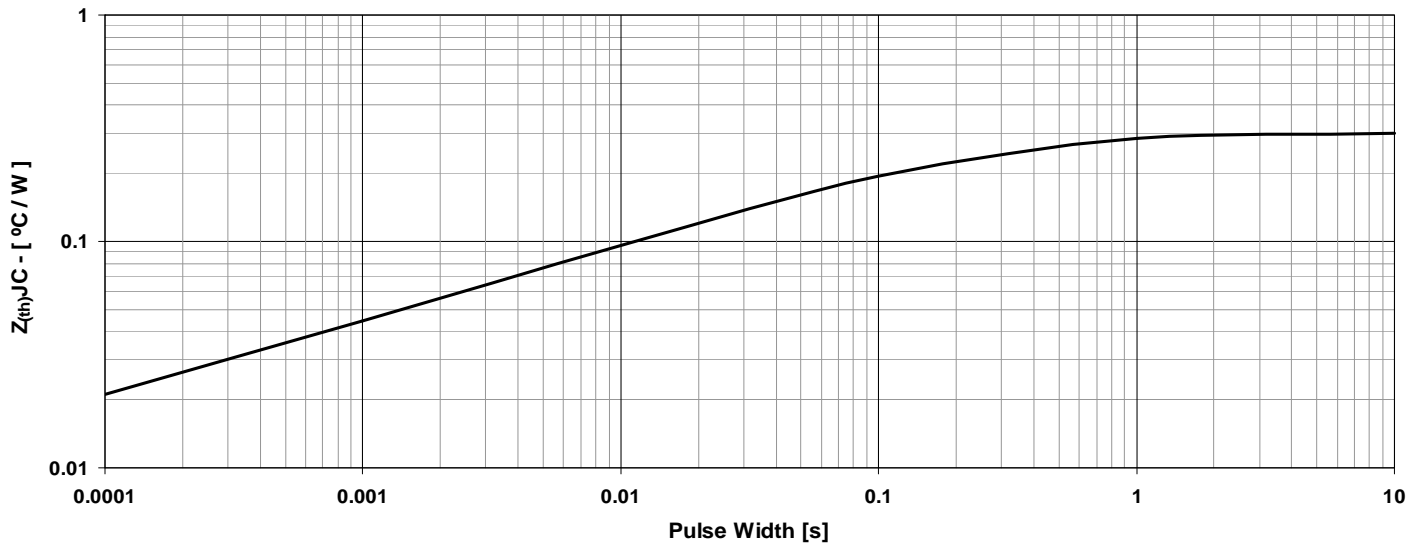


Fig. 26 Maximum Transient Thermal Impedance Junction to Case (for Diode)



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