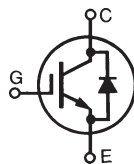


## GenX3™ 600V IGBT with Diode

**IXGK64N60B3D1**  
**IXGX64N60B3D1**

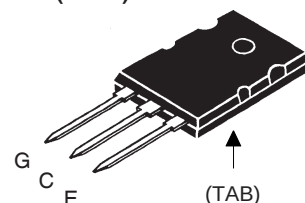
Medium speed low V<sub>sat</sub> PT  
IGBTs 5-40 kHz switching



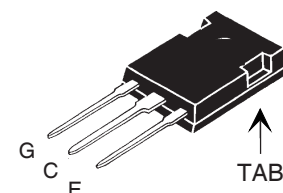
$$\begin{aligned} V_{CES} &= 600V \\ I_{C110} &= 64A \\ V_{CE(sat)} &\leq 1.8V \\ t_{fi(typ)} &= 88ns \end{aligned}$$

| 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          |
| $I_{C110}$                    | $T_C = 110^\circ C$                                                                                      | 64                | A          |
| $I_{CM}$                      | $T_C = 25^\circ C$ , 1ms                                                                                 | 400               | A          |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_{VJ} = 125^\circ C$ , $R_G = 3\Omega$<br>Clamped inductive load @ $V_{CE} \leq 600V$ | $I_{CM} = 200$    | A          |
| $P_C$                         | $T_C = 25^\circ C$                                                                                       | 460               | W          |
| $T_J$                         |                                                                                                          | -55 ... +150      | $^\circ C$ |
| $T_{JM}$                      |                                                                                                          | 150               | $^\circ C$ |
| $T_{stg}$                     |                                                                                                          | -55 ... +150      | $^\circ C$ |
| $M_d$                         | Mounting torque (TO-264)                                                                                 | 1.13 / 10         | Nm/lb.in.  |
| $F_C$                         | Mounting force (PLUS247)                                                                                 | 20..120 / 4.5..27 | N/lb.      |
| $T_L$                         | Maximum lead temperature for soldering                                                                   | 300               | $^\circ C$ |
| $T_{SOLD}$                    | 1.6mm (0.062 in.) from case for 10s                                                                      | 260               | $^\circ C$ |
| <b>Weight</b>                 | TO-264                                                                                                   | 10                | g          |
|                               | PLUS247                                                                                                  | 6                 | g          |

### TO-264 (IXGK)



### PLUS247 (IXGX)



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

### Features

- Optimized for low conduction and switching losses
- Square RBSOA
- Anti-parallel ultra fast diode
- International standard packages

### 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                 |
| $I_{CES}$     | $V_{CE} = V_{CES}$<br>$V_{GE} = 0V$ $T_J = 125^\circ C$               |                       |      | 700 $\mu A$<br>2.5 mA |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |      | $\pm 100$ nA          |
| $V_{CE(sat)}$ | $I_C = 50A$ , $V_{GE} = 15V$ , Note 1                                 | 1.59                  | 1.80 | V                     |

| Symbol       | Test Conditions                                                                                    | Characteristic Values |      |                  |
|--------------|----------------------------------------------------------------------------------------------------|-----------------------|------|------------------|
|              |                                                                                                    | Min.                  | Typ. | Max.             |
| $g_{fs}$     | $I_C = 50A, V_{CE} = 10V$ , Note 1                                                                 | 38                    | 64   | S                |
| $C_{ies}$    | $V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$                                                              |                       | 4750 | pF               |
| $C_{oes}$    |                                                                                                    |                       | 260  | pF               |
| $C_{res}$    |                                                                                                    |                       | 65   | pF               |
| $Q_g$        | $I_C = 50A, V_{GE} = 15V, V_{CE} = 0.5 \cdot V_{CES}$                                              |                       | 168  | nC               |
| $Q_{ge}$     |                                                                                                    |                       | 28   | nC               |
| $Q_{gc}$     |                                                                                                    |                       | 61   | nC               |
| $t_{d(on)}$  | Inductive load, $T_J = 25^\circ C$<br>$I_C = 50A, V_{GE} = 15V$<br>$V_{CE} = 480V, R_G = 3\Omega$  |                       | 25   | ns               |
| $t_{ri}$     |                                                                                                    |                       | 41   | ns               |
| $E_{on}$     |                                                                                                    |                       | 1.5  | mJ               |
| $t_{d(off)}$ |                                                                                                    |                       | 138  | ns               |
| $t_{fi}$     |                                                                                                    |                       | 88   | ns               |
| $E_{off}$    |                                                                                                    |                       | 1.0  | mJ               |
| $t_{d(on)}$  | Inductive load, $T_J = 125^\circ C$<br>$I_C = 50A, V_{GE} = 15V$<br>$V_{CE} = 480V, R_G = 3\Omega$ |                       | 24   | ns               |
| $t_{ri}$     |                                                                                                    |                       | 40   | ns               |
| $E_{on}$     |                                                                                                    |                       | 2.70 | mJ               |
| $t_{d(off)}$ |                                                                                                    |                       | 195  | ns               |
| $t_{fi}$     |                                                                                                    |                       | 131  | ns               |
| $E_{off}$    |                                                                                                    |                       | 1.95 | mJ               |
| $R_{thJC}$   |                                                                                                    |                       | 0.15 | $0.27^\circ C/W$ |
| $R_{thCS}$   |                                                                                                    |                       |      | $^\circ C/W$     |

### Reverse Diode (FRED)

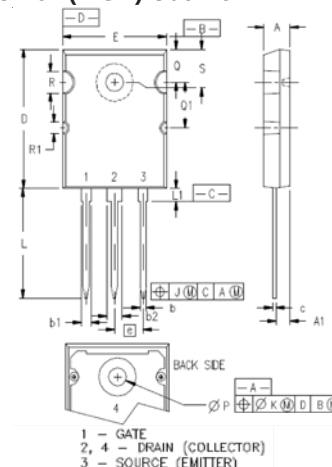
| Symbol     | Test Conditions                                                                          | Characteristic Values |      |                   |
|------------|------------------------------------------------------------------------------------------|-----------------------|------|-------------------|
|            |                                                                                          | Min.                  | Typ. | Max.              |
| $V_F$      | $I_F = 60A, V_{GE} = 0V$ , Note 1<br>$T_J = 150^\circ C$                                 |                       | 1.4  | 2.1 V             |
| $I_{RM}$   | $I_F = 60A, V_{GE} = 0V$ ,<br>$-di_F/dt = 100A/\mu s, V_R = 100V$<br>$T_J = 100^\circ C$ |                       | 8.3  | A                 |
| $t_{rr}$   | $I_F = 1A, -di/dt = 200A/\mu s, V_R = 30V$                                               |                       | 35   | ns                |
| $R_{thJC}$ |                                                                                          |                       |      | 1.35 $^\circ C/W$ |

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

IXYS reserves the right to change limits, test conditions, and dimensions.

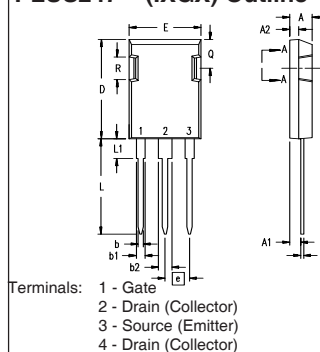
|                                                                                  |           |           |           |           |              |              |              |              |              |             |
|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 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 | 7,157,338B2 |
|                                                                                  | 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    |             |

### TO-264 (IXGK) Outline



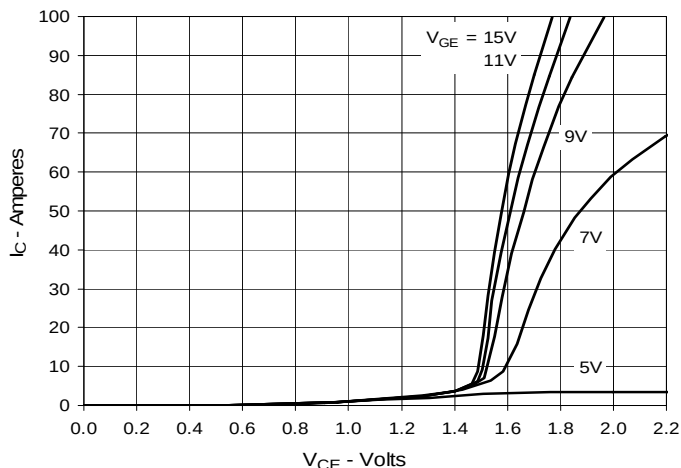
| DIM | INCHES   |       | MILLIMETERS |       |
|-----|----------|-------|-------------|-------|
|     | MIN      | MAX   | MIN         | MAX   |
| A   | 0.185    | 0.209 | 4.70        | 5.31  |
| A1  | 0.102    | 0.118 | 2.59        | 3.00  |
| b   | 0.037    | 0.055 | 0.94        | 1.40  |
| b1  | 0.087    | 0.102 | 2.21        | 2.59  |
| b2  | 0.110    | 0.126 | 2.79        | 3.20  |
| c   | 0.017    | 0.029 | 0.43        | 0.74  |
| D   | 1.007    | 1.047 | 25.58       | 26.59 |
| E   | 0.760    | 0.799 | 19.30       | 20.29 |
| e   | .215 BSC |       | 5.46 BSC    |       |
| J   | 0.000    | 0.010 | 0.00        | 0.25  |
| K   | 0.000    | 0.010 | 0.00        | 0.25  |
| L   | 0.779    | 0.842 | 19.79       | 21.39 |
| L1  | 0.087    | 0.102 | 2.21        | 2.59  |
| ØP  | 0.122    | 0.138 | 3.10        | 3.51  |
| Q   | 0.240    | 0.256 | 6.10        | 6.50  |
| Q1  | 0.330    | 0.346 | 8.38        | 8.79  |
| ØR  | 0.155    | 0.187 | 3.94        | 4.75  |
| ØR1 | 0.085    | 0.093 | 2.16        | 2.36  |
| S   | 0.243    | 0.253 | 6.17        | 6.43  |

### PLUS247™ (IXGX) Outline

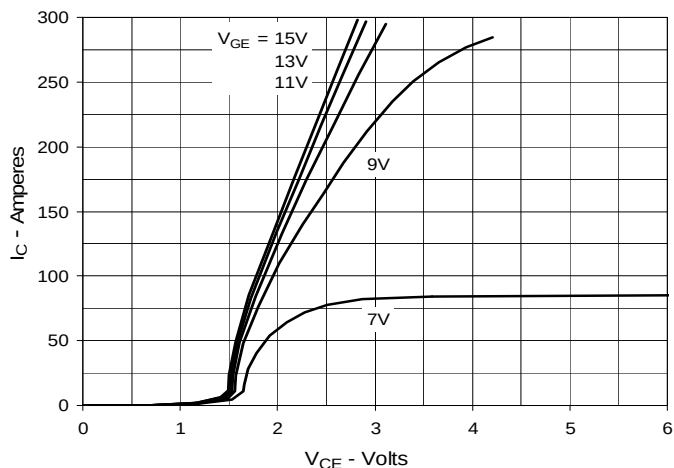


| Dim.           | Millimeter |       | Inches   |       |
|----------------|------------|-------|----------|-------|
|                | Min.       | Max.  | Min.     | Max.  |
| A              | 4.83       | 5.21  | .190     | .205  |
| A <sub>1</sub> | 2.29       | 2.54  | .090     | .100  |
| A <sub>2</sub> | 1.91       | 2.16  | .075     | .085  |
| b              | 1.14       | 1.40  | .045     | .055  |
| b <sub>1</sub> | 1.91       | 2.13  | .075     | .084  |
| b <sub>2</sub> | 2.92       | 3.12  | .115     | .123  |
| C              | 0.61       | 0.80  | .024     | .031  |
| D              | 20.80      | 21.34 | .819     | .840  |
| E              | 15.75      | 16.13 | .620     | .635  |
| e              | 5.45 BSC   |       | .215 BSC |       |
| L              | 19.81      | 20.32 | .780     | .800  |
| L1             | 3.81       | 4.32  | .150     | .170  |
| Q              | 5.59       | 6.20  | .220     | 0.244 |
| R              | 4.32       | 4.83  | .170     | .190  |

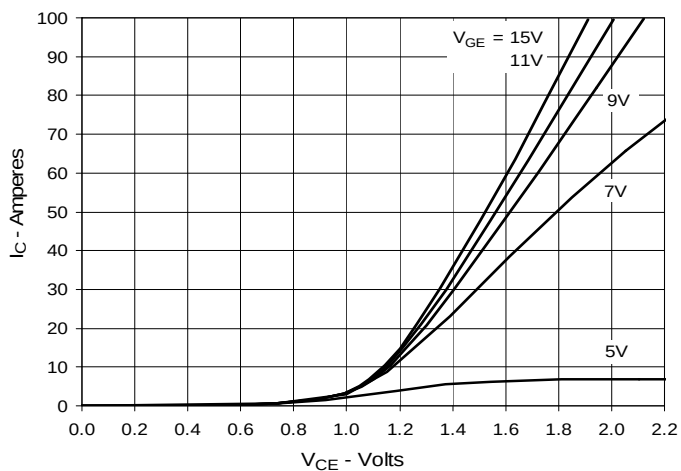
**Fig. 1. Output Characteristics**  
**@ 25°C**



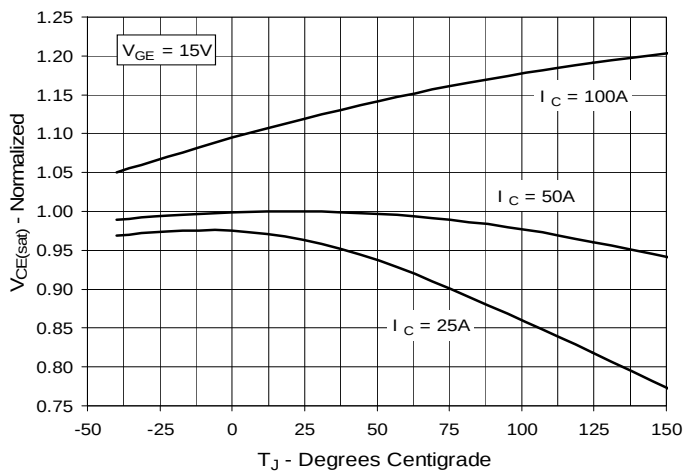
**Fig. 2. Extended Output Characteristics**  
**@ 25°C**



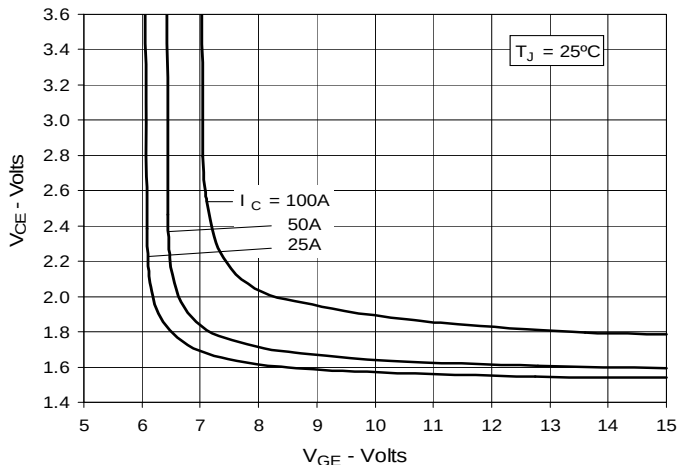
**Fig. 3. Output Characteristics**  
**@ 125°C**



**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**

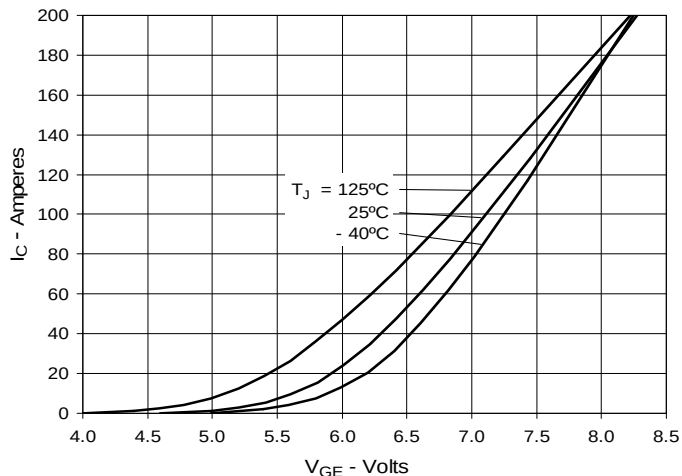


Fig. 7. Transconductance

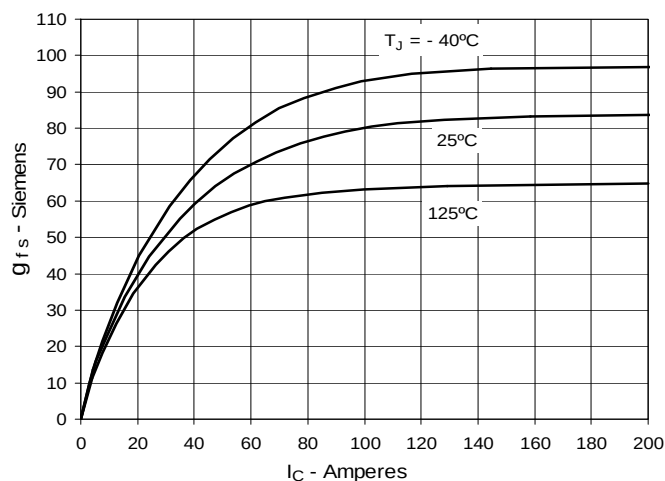


Fig. 8. Gate Charge

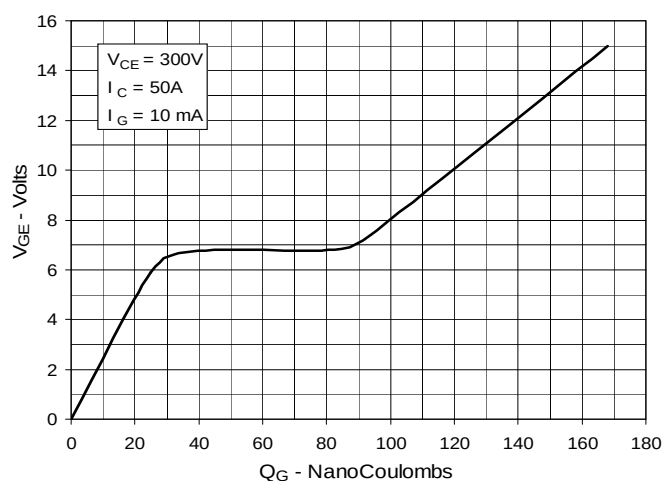


Fig. 9. Reverse-Bias Safe Operating Area

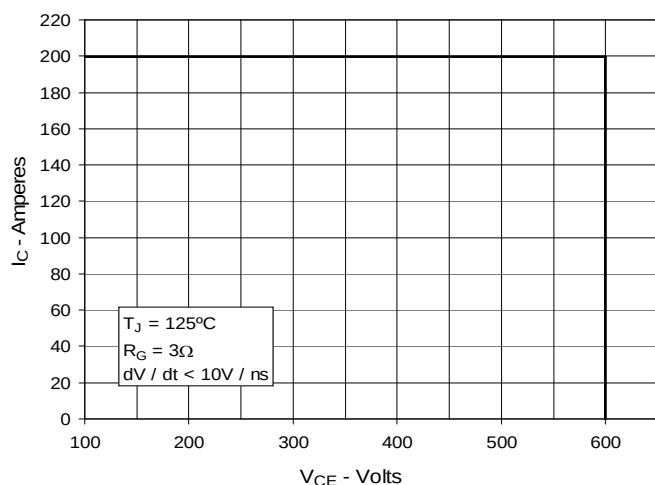


Fig. 10. Capacitance

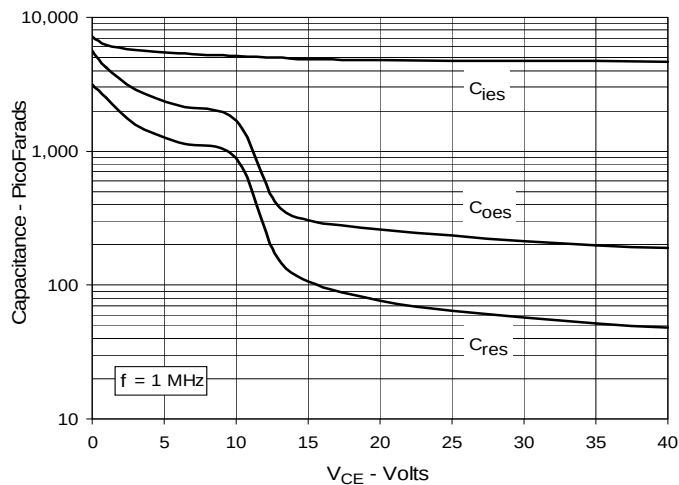
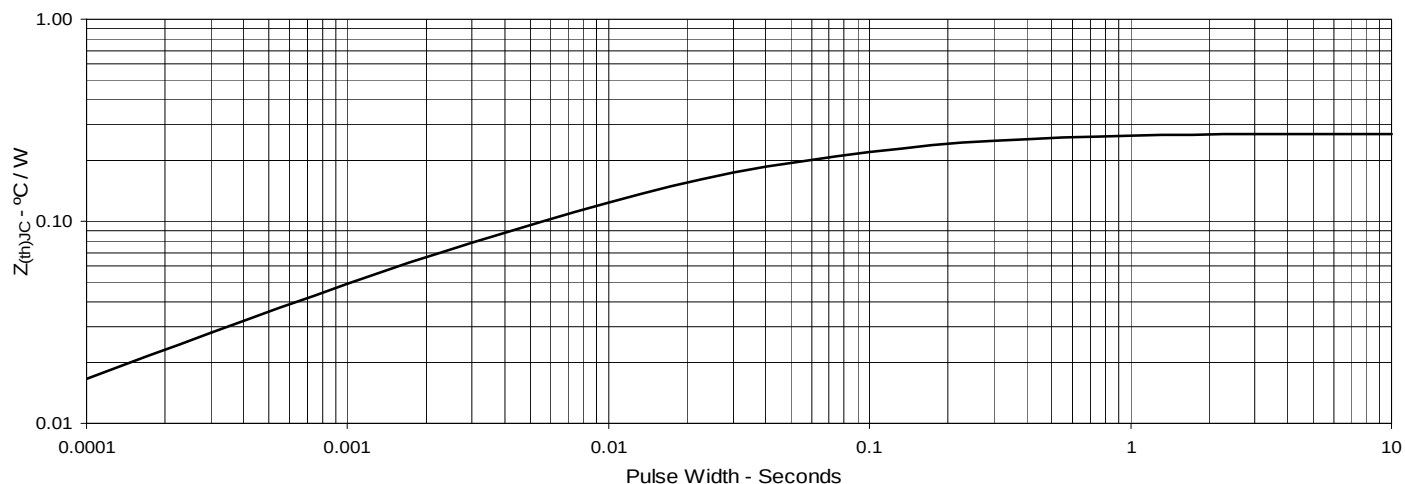
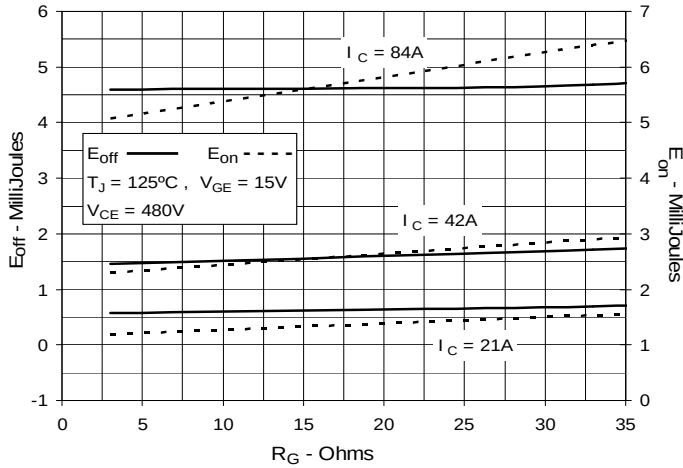


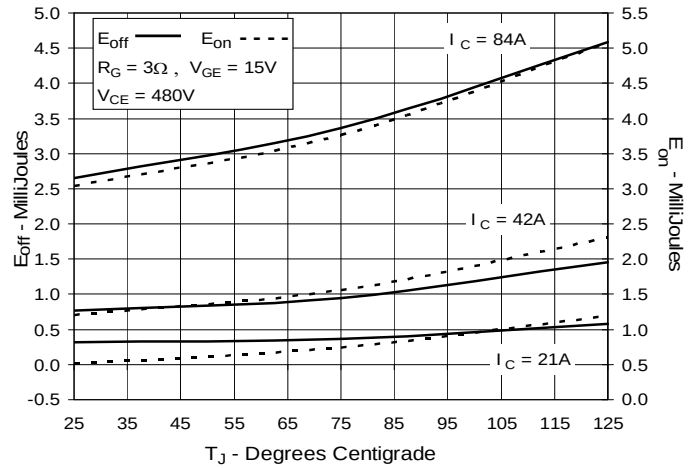
Fig. 11. Maximum Transient Thermal Impedance



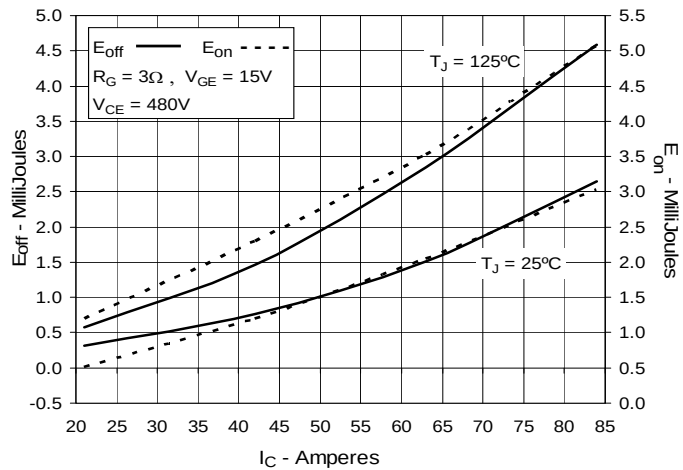
**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**



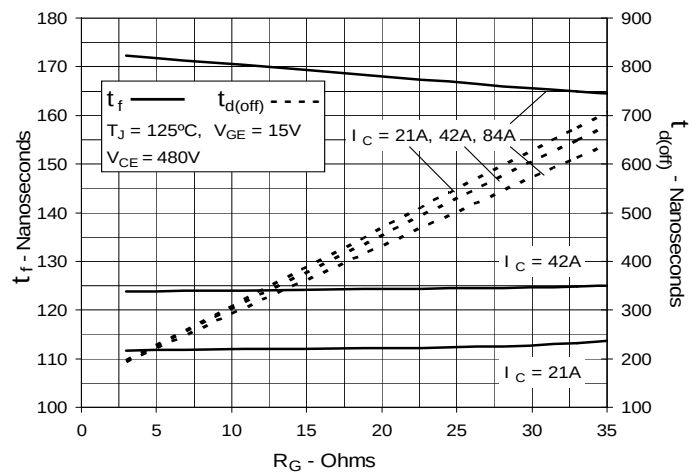
**Fig. 13. Inductive Switching Energy Loss vs. Junction Temperature**



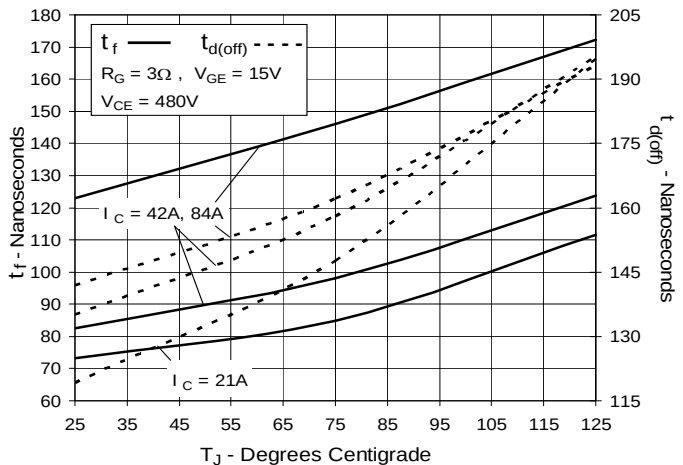
**Fig. 14. Inductive Switching Energy Loss vs. Collector Current**



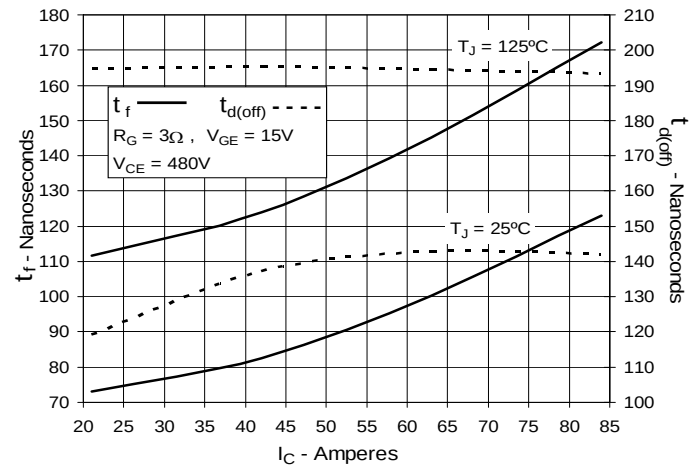
**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**



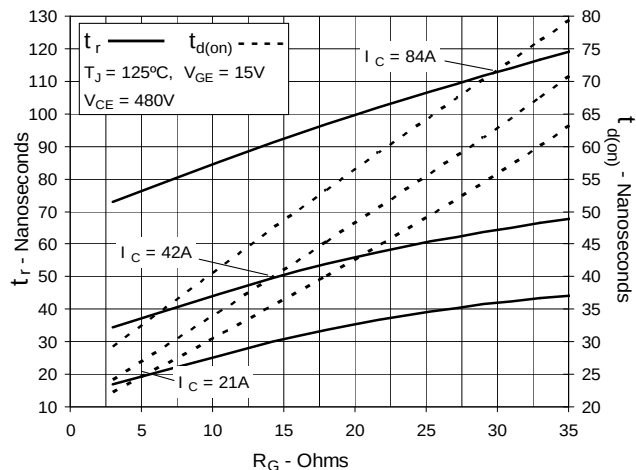
**Fig. 16. Inductive Turn-off Switching Times vs. Junction Temperature**



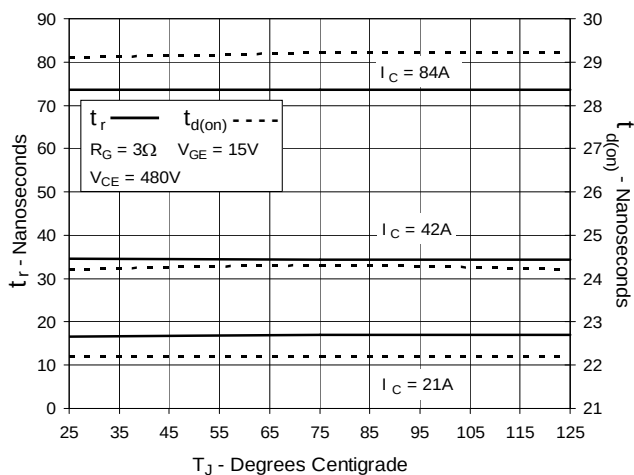
**Fig. 17. Inductive Turn-off Switching Times vs. Collector Current**



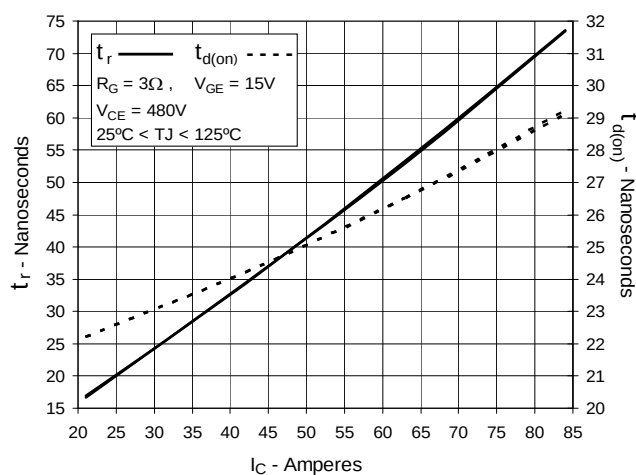
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**



**Fig. 19. Inductive Turn-on Switching Times vs. Junction Temperature**



**Fig. 20. Inductive Turn-on Switching Times vs. Collector Current**



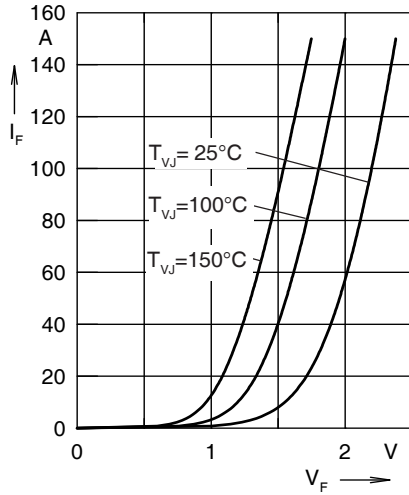


Fig. 21. Forward current  $I_F$  versus  $V_F$

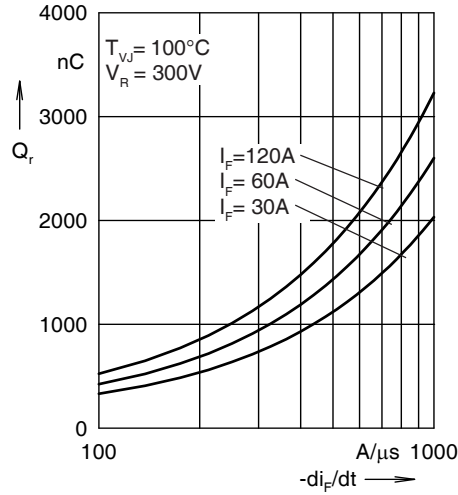


Fig. 22. Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

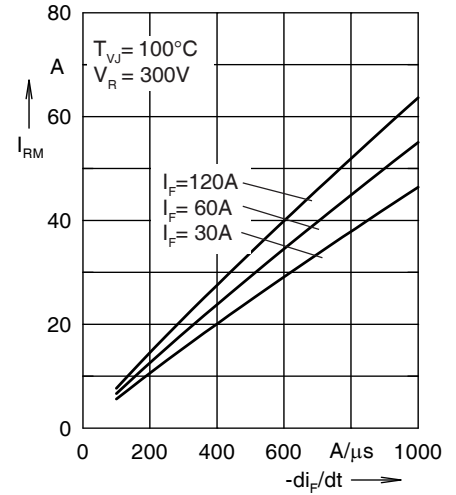


Fig. 23. Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

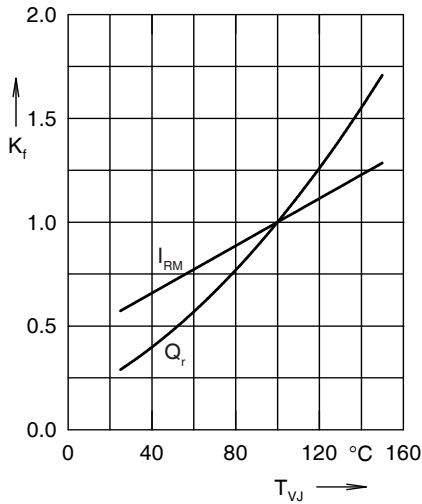


Fig. 24. Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

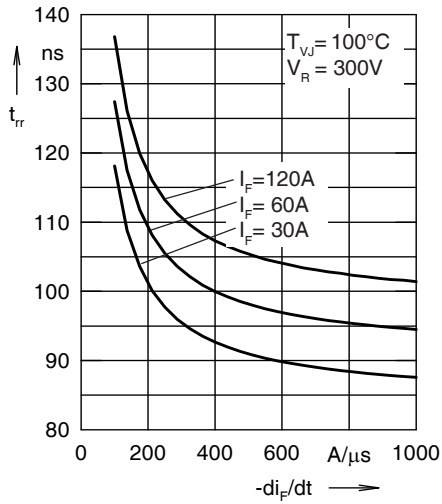


Fig. 25. Recovery time  $t_{rr}$  versus  $-di_F/dt$

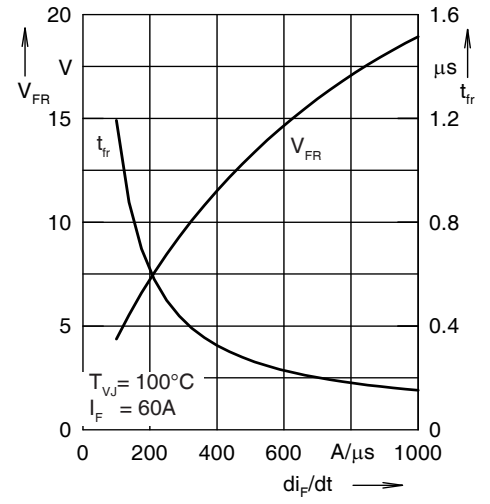


Fig. 26. Peak forward voltage  $V_{FR}$  and  $t_{rr}$  versus  $di_F/dt$

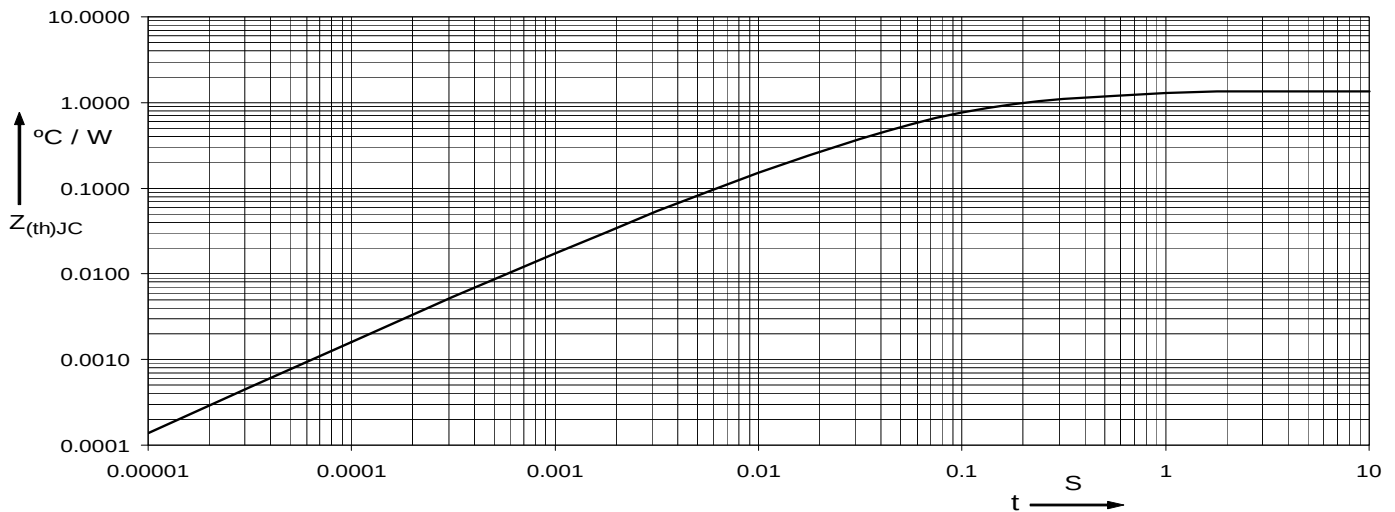


Fig. 27. Maximum transient thermal impedance junction to case (for diode)

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