

## GenX3™ 600V IGBT

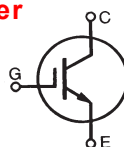
**IXGA48N60B3**

**IXGP48N60B3\***

**IXGH48N60B3**

**\*Obsolete Part Number**

Medium speed low  $V_{sat}$  PT  
IGBTs 5-40 kHz switching



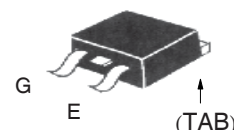
$$V_{CES} = 600V$$

$$I_{C110} = 48A$$

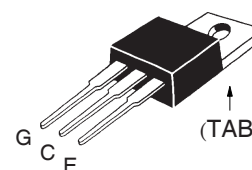
$$V_{CE(sat)} \leq 1.8V$$

| Symbol                        | Test Conditions                                                                                   | Maximum Ratings |            |
|-------------------------------|---------------------------------------------------------------------------------------------------|-----------------|------------|
| $V_{CES}$                     | $T_C = 25^\circ C$ 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          |
| $I_{C110}$                    | $T_C = 110^\circ C$                                                                               | 48              | A          |
| $I_{CM}$                      | $T_C = 25^\circ C$ , 1ms                                                                          | 280             | A          |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_{VJ} = 125^\circ C$ , $R_G = 5\Omega$<br>Clamped inductive load @ $\leq 600V$ | $I_{CM} = 120$  | A          |
| $P_C$                         | $T_C = 25^\circ C$                                                                                | 300             | W          |
| $T_J$                         |                                                                                                   | -55 ... +150    | $^\circ C$ |
| $T_{JM}$                      |                                                                                                   | 150             | $^\circ C$ |
| $T_{stg}$                     |                                                                                                   | -55 ... +150    | $^\circ C$ |
| $T_L$                         | 1.6mm (0.062 in.) from case for 10s                                                               | 300             | $^\circ C$ |
| $T_{SOLD}$                    | Plastic body for 10 seconds                                                                       | 260             | $^\circ C$ |
| $M_d$                         | Mounting torque (TO-247)(TO-220)                                                                  | 1.13/10         | Nm/lb.in.  |
| <b>Weight</b>                 | TO-263                                                                                            | 2.5             | g          |
|                               | TO-220                                                                                            | 3.0             | g          |
|                               | TO-247                                                                                            | 6.0             | g          |

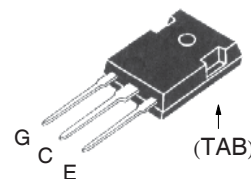
### TO-263 (IXGA)



### TO-220 (IXGP)



### TO-247 (IXGH)



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

### Features

- Optimized for low conduction and switching losses
- Square RBSOA
- International standard packages

### Advantages

- High power density
- Low gate drive requirement

### Applications

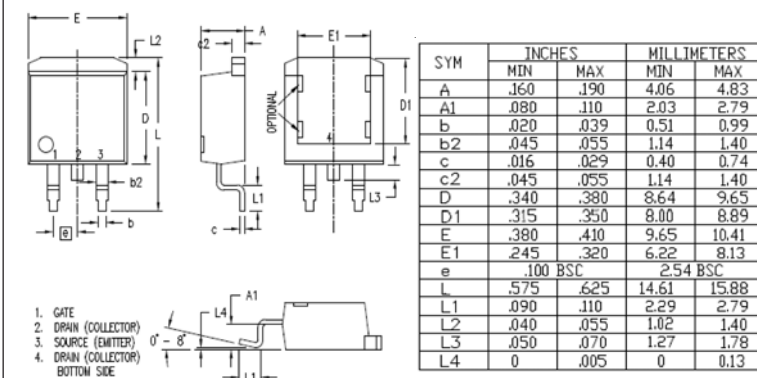
- Power Inverters
- UPS
- Motor Drives
- SMPS
- PFC Circuits
- Battery Chargers
- Welding Machines
- Lamp Ballasts

| Symbol        | Test Conditions<br>( $T_J = 25^\circ C$ unless otherwise specified) | Characteristic Values |      |                           |
|---------------|---------------------------------------------------------------------|-----------------------|------|---------------------------|
|               |                                                                     | Min.                  | Typ. | Max.                      |
| $BV_{CES}$    | $I_C = 250\mu A$ , $V_{GE} = 0V$                                    | 600                   |      | V                         |
| $V_{GE(th)}$  | $I_C = 250\mu A$ , $V_{CE} = V_{GE}$                                | 3.0                   |      | 5.0 V                     |
| $I_{CES}$     | $V_{CE} = V_{CES}$<br>$V_{GE} = 0V$ $T_J = 125^\circ C$             |                       |      | 25 $\mu A$<br>250 $\mu A$ |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                  |                       |      | $\pm 100$ nA              |
| $V_{CE(sat)}$ | $I_C = 32A$ , $V_{GE} = 15V$ , Note 1                               |                       |      | 1.8 V                     |

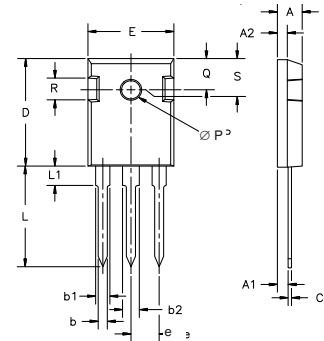
| Symbol                                                | Test Conditions                                                                                                                                 | Characteristic Values |      |                         |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
| $(T_J = 25^\circ\text{C unless otherwise specified})$ |                                                                                                                                                 | Min.                  | Typ. | Max.                    |
| $g_{fs}$                                              | $I_C = 30\text{A}, V_{CE} = 10\text{V}, \text{Note 1}$                                                                                          | 28                    | 46   | S                       |
| $C_{ies}$                                             | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$                                                                                      |                       | 3980 | pF                      |
| $C_{oes}$                                             |                                                                                                                                                 |                       | 170  | pF                      |
| $C_{res}$                                             |                                                                                                                                                 |                       | 45   | pF                      |
| $Q_g$                                                 | $I_C = 40\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$                                                                             |                       | 115  | nC                      |
| $Q_{ge}$                                              |                                                                                                                                                 |                       | 21   | nC                      |
| $Q_{gc}$                                              |                                                                                                                                                 |                       | 40   | nC                      |
| $t_{d(on)}$                                           | <b>Inductive Load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 30\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 480\text{V}, R_G = 5\Omega$  |                       | 22   | ns                      |
| $t_{ri}$                                              |                                                                                                                                                 |                       | 25   | ns                      |
| $E_{on}$                                              |                                                                                                                                                 |                       | 0.84 | mJ                      |
| $t_{d(off)}$                                          |                                                                                                                                                 |                       | 130  | ns                      |
| $t_{fi}$                                              |                                                                                                                                                 |                       | 116  | ns                      |
| $E_{off}$                                             |                                                                                                                                                 |                       | 0.66 | mJ                      |
| $t_{d(on)}$                                           | <b>Inductive Load, <math>T_J = 125^\circ\text{C}</math></b><br>$I_C = 30\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 480\text{V}, R_G = 5\Omega$ |                       | 19   | ns                      |
| $t_{ri}$                                              |                                                                                                                                                 |                       | 25   | ns                      |
| $E_{on}$                                              |                                                                                                                                                 |                       | 1.71 | mJ                      |
| $t_{d(off)}$                                          |                                                                                                                                                 |                       | 190  | ns                      |
| $t_{fi}$                                              |                                                                                                                                                 |                       | 157  | ns                      |
| $E_{off}$                                             |                                                                                                                                                 |                       | 1.30 | mJ                      |
| $R_{thJC}$                                            |                                                                                                                                                 |                       |      | 0.42 $^\circ\text{C/W}$ |
| $R_{thCS}$                                            | (TO-247)                                                                                                                                        |                       | 0.25 | $^\circ\text{C/W}$      |
|                                                       | (TO-220)                                                                                                                                        |                       | 0.50 | $^\circ\text{C/W}$      |

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

### TO-263 (IXGA) Outline

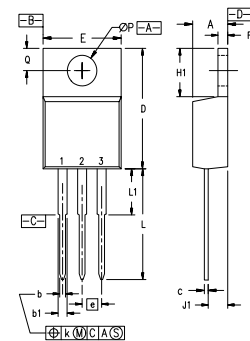


### TO-247 (IXGH) Outline



| 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   |

### TO-220 (IXGP) Outline



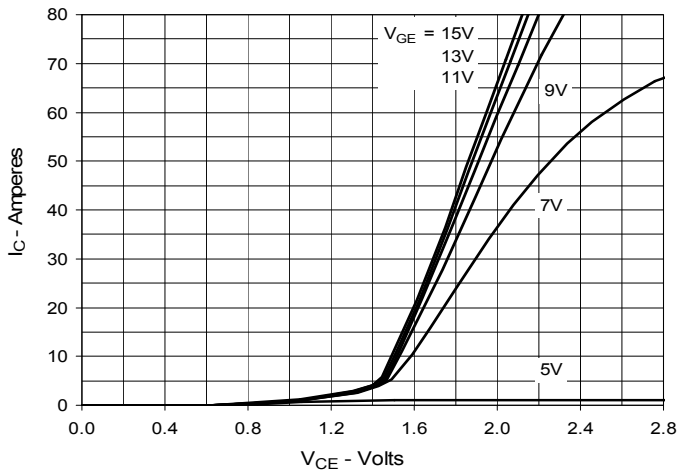
Pins: 1 - Gate 2 - Drain  
3 - Source 4 - Drain

| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .170     | .190 | 4.32        | 4.83  |
| b   | .025     | .040 | 0.64        | 1.02  |
| b1  | .045     | .065 | 1.15        | 1.65  |
| c   | .014     | .022 | 0.35        | 0.56  |
| D   | .580     | .630 | 14.73       | 16.00 |
| E   | .390     | .420 | 9.91        | 10.66 |
| e   | .100 BSC |      | 2.54 BSC    |       |
| F   | .045     | .055 | 1.14        | 1.40  |
| H1  | .230     | .270 | 5.85        | 6.85  |
| J1  | .090     | .110 | 2.29        | 2.79  |
| k   | 0        | .015 | 0           | 0.38  |
| L   | .500     | .550 | 12.70       | 13.97 |
| L1  | .110     | .230 | 2.79        | 5.84  |
| ØP  | .139     | .161 | 3.53        | 4.08  |
| Q   | .100     | .125 | 2.54        | 3.18  |

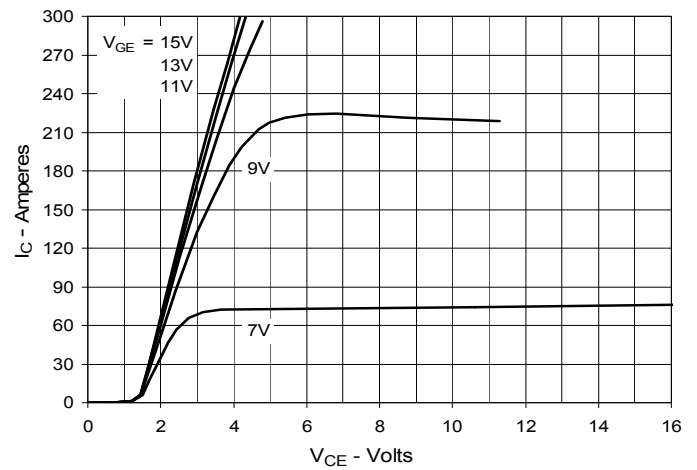
IXYS reserves the right to change limits, test conditions and dimensions.

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

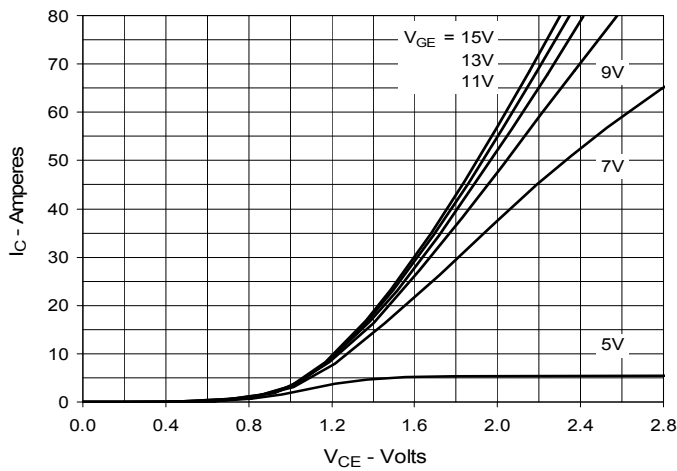
**Fig. 1. Output Characteristics  
@ 25°C**



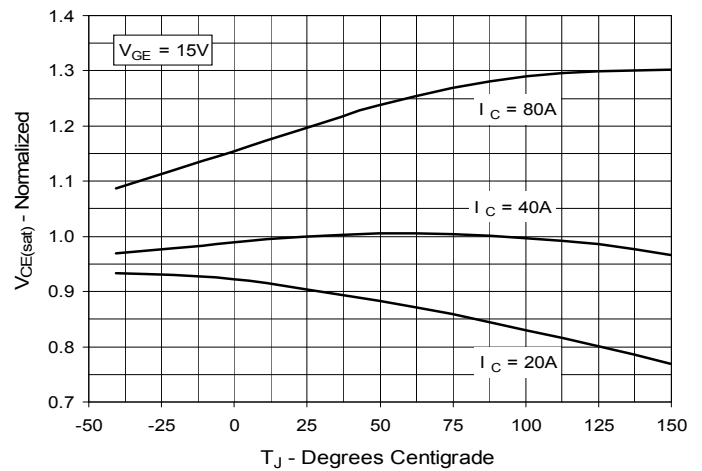
**Fig. 2. Extended Output Characteristics  
@ 25°C**



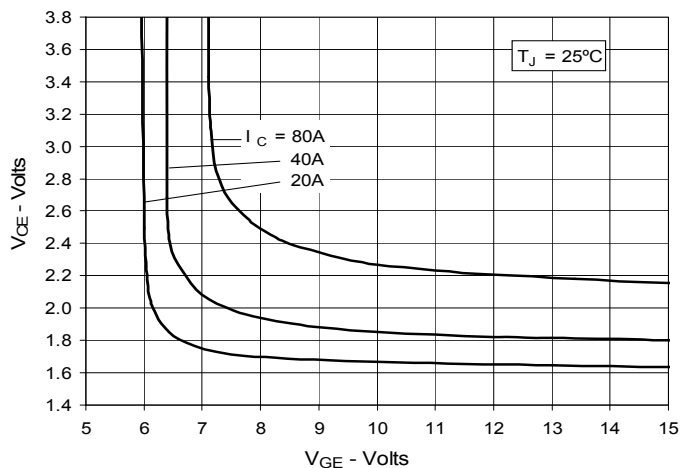
**Fig. 3. Output Characteristics  
@ 125°C**



**Fig. 4. Dependence of VCE(sat) on  
Junction Temperature**



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



**Fig. 6. Input Admittance**

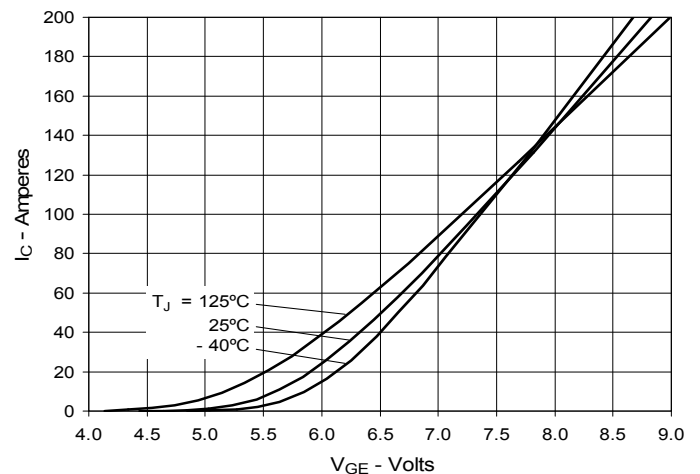


Fig. 7. Transconductance

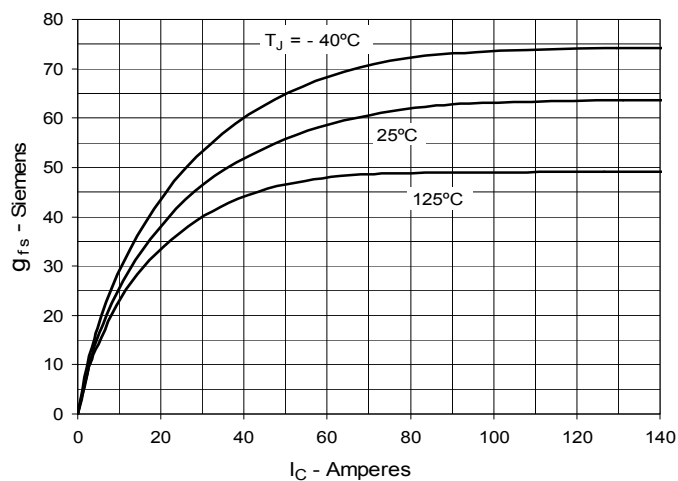


Fig. 8. Gate Charge

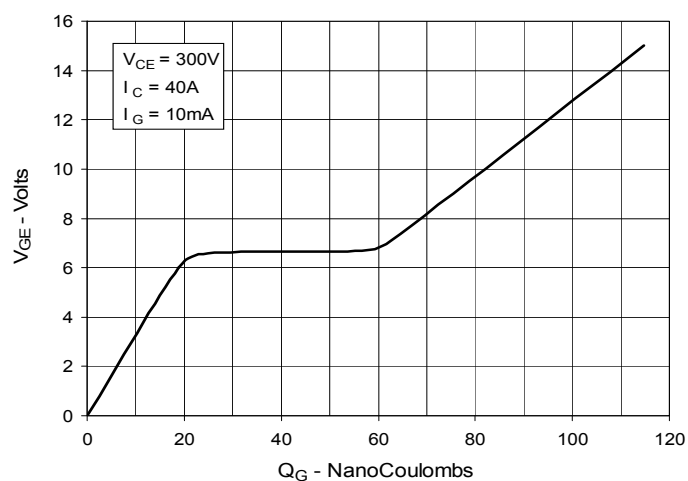


Fig. 9. Capacitance

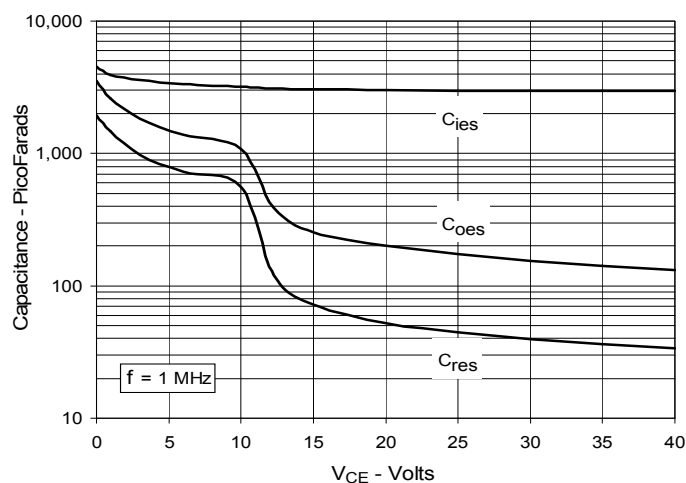


Fig. 10. Reverse-Bias Safe Operating Area

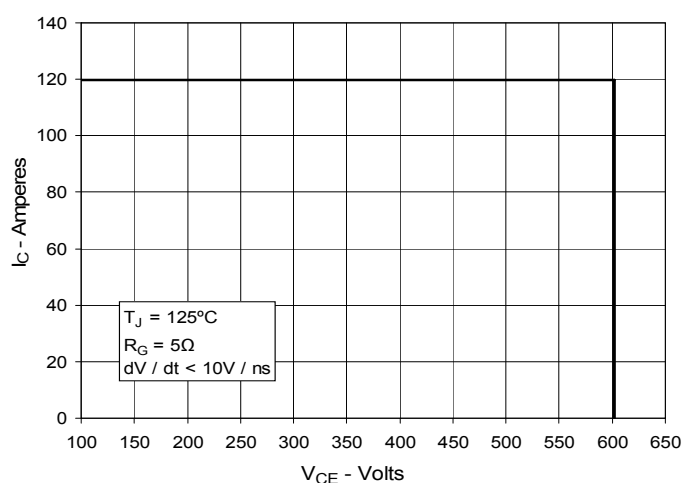
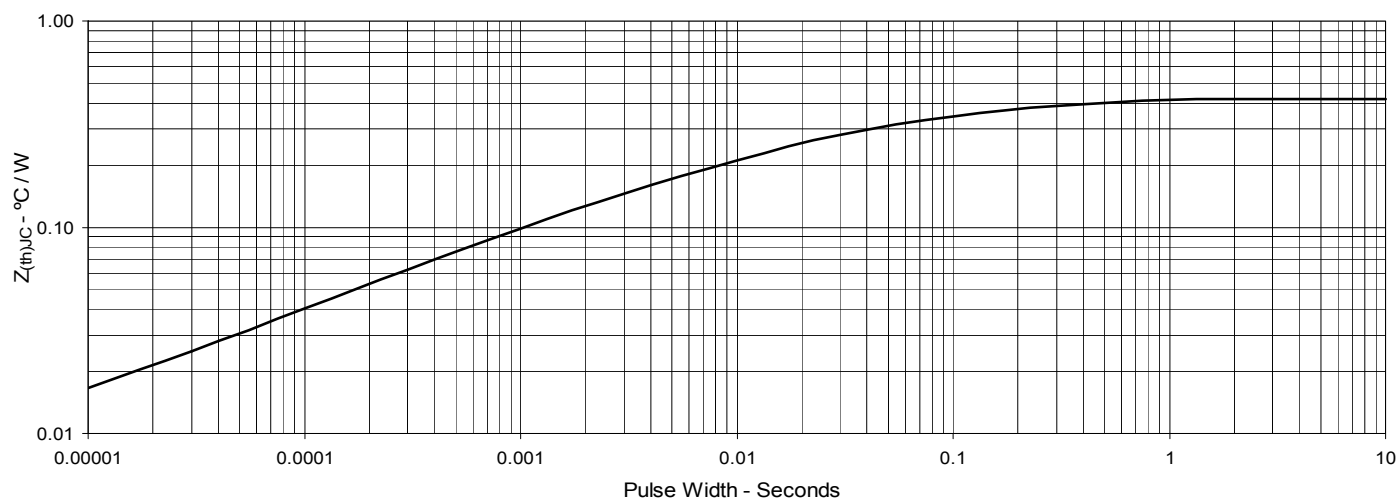
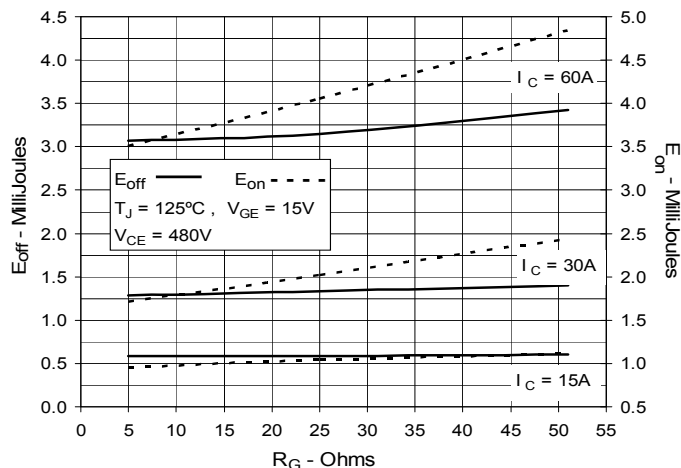


Fig. 11. Maximum Transient Thermal Impedance

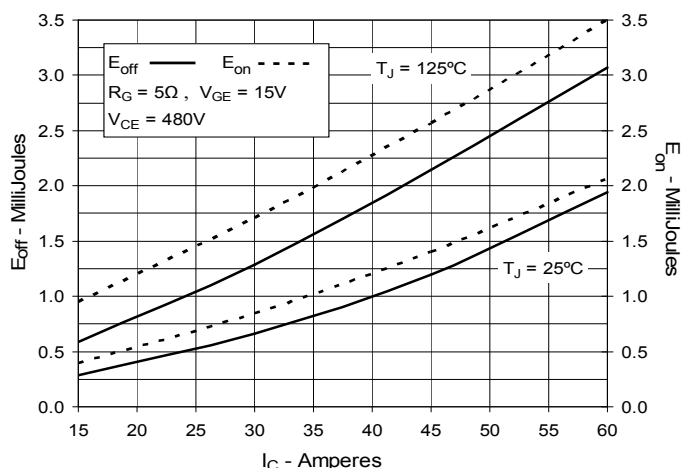


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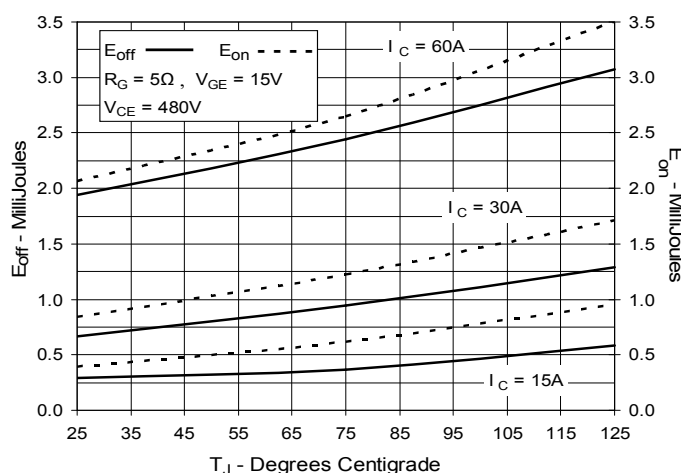
**Fig. 12. Inductive Switching  
Energy Loss vs. Gate Resistance**



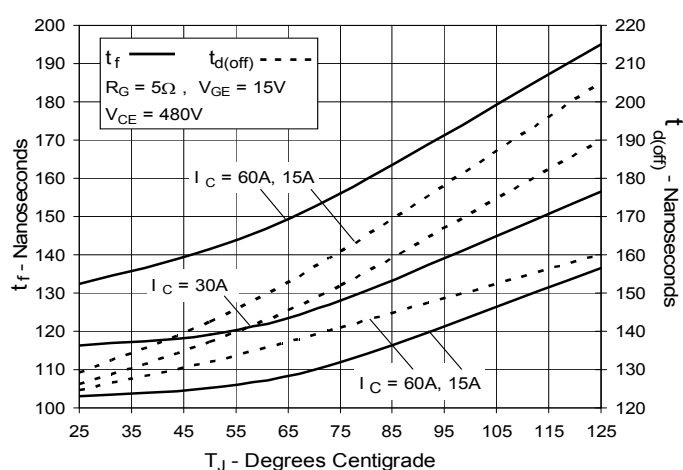
**Fig. 13. Inductive Switching  
Energy Loss vs. Collector Current**



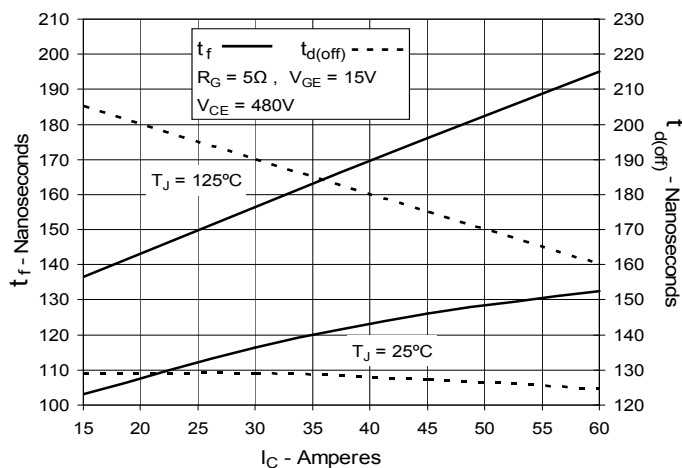
**Fig. 14. Inductive Switching  
Energy Loss vs. Junction Temperature**



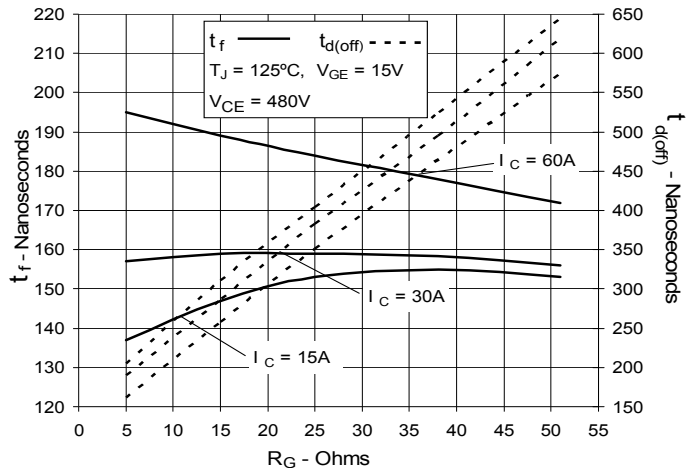
**Fig. 15. Inductive Turn-off  
Switching Times vs. Junction Temperature**



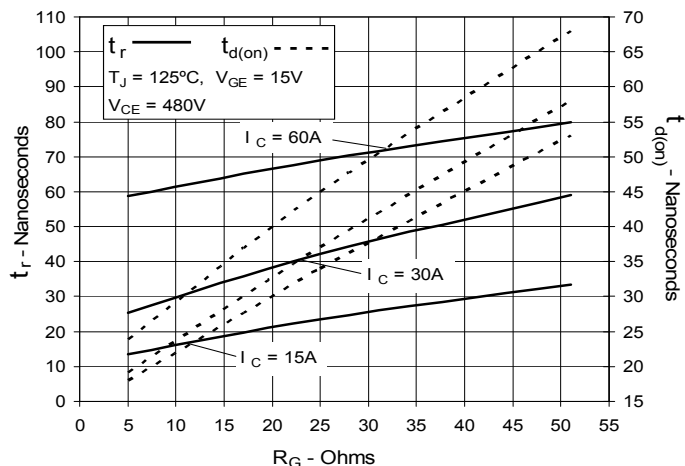
**Fig. 16. Inductive Turn-off  
Switching Times vs. Collector Current**



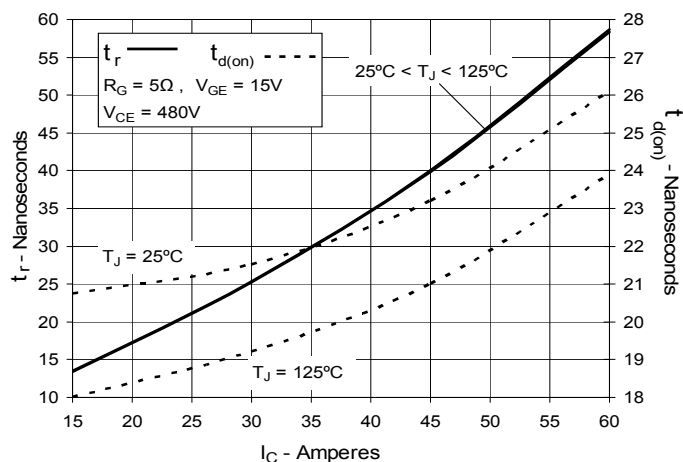
**Fig. 17. Inductive Turn-off  
Switching Times vs. Gate Resistance**



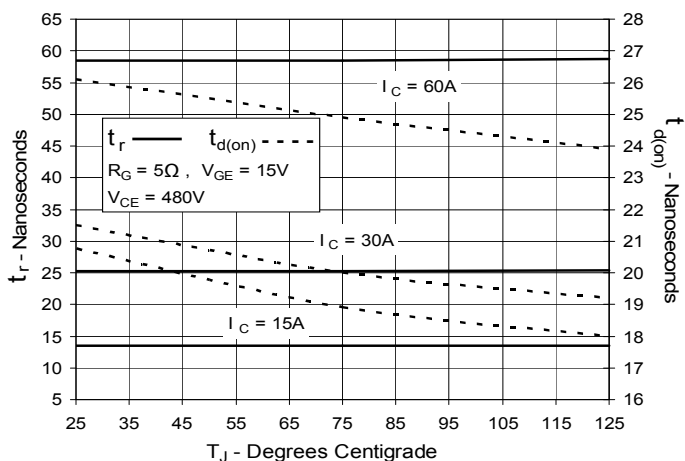
**Fig. 18. Inductive Turn-on  
Switching Times vs. Gate Resistance**



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



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





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