

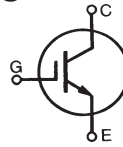
# GenX3™ 1200V IGBT

## IXGA24N120C3

## IXGH24N120C3

## IXGP24N120C3

High speed PT IGBTs for  
10-50kHz Switching



$$V_{CES} = 1200V$$

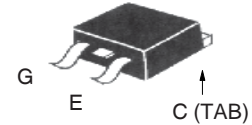
$$I_{C25} = 48A$$

$$V_{CE(sat)} \leq 4.2V$$

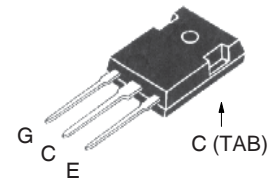
$$t_{fi(typ)} = 110ns$$

| Symbol                        | Test Conditions  | Maximum Ratings |            |
|-------------------------------|--|-----------------|------------|
| $V_{CES}$                     | $T_J = 25^\circ C$ to $150^\circ C$  | 1200            | V          |
| $V_{CGR}$                     | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GE} = 1M\Omega$  | 1200            | V          |
| $V_{GES}$                     | Continuous   | $\pm 20$        | V          |
| $V_{GEM}$                     | Transient  | $\pm 30$        | V          |
| $I_{C25}$                     | $T_C = 25^\circ C$   | 48              | A          |
| $I_{C100}$                    | $T_C = 100^\circ C$  | 24              | A          |
| $I_{CM}$                      | $T_C = 25^\circ C$ , 1ms   | 96              | A          |
| $I_A$                         | $T_C = 25^\circ C$   | 20              | A          |
| $E_{AS}$                      | $T_C = 25^\circ C$   | 250             | mJ         |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_J = 125^\circ C$ , $R_G = 5\Omega$<br>Clamped inductive load @ $V_{CE} \leq 1200V$ | $I_{CM} = 48$   | A          |
| $P_C$                         | $T_C = 25^\circ C$   | 250             | W          |
| $T_J$                         |  | -55 ... +150    | $^\circ C$ |
| $T_{JM}$                      |  | 150             | $^\circ C$ |
| $T_{stg}$                     |  | -55 ... +150    | $^\circ C$ |
| $M_d$                         | Mounting torque  | 1.13/10         | Nm/lb.in.  |
| $T_L$                         | 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-263   | 2.5             | g          |
|                               | TO-247   | 6.0             | g          |
|                               | TO-220   | 3.0             | g          |

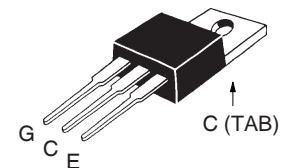
### TO-263 (IXGA)



### TO-247 (IXGH)



### TO-220 (IXGP)



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

| Symbol        | Test Conditions<br>( $T_J = 25^\circ C$ , unless otherwise specified) | Characteristic Values |      |              |
|---------------|---|-----------------------|------|--------------|
|               |   | Min.                  | Typ. | Max.         |
| $BV_{CES}$    | $I_C = 250\mu A$ , $V_{GE} = 0V$                                      | 1200                  |      | V            |
| $V_{GE(th)}$  | $I_C = 250\mu A$ , $V_{CE} = V_{GE}$                                  | 2.5                   |      | V            |
| $I_{CES}$     | $V_{CE} = V_{CES}$  |                       |      | 100 $\mu A$  |
|               | $V_{GE} = 0V$ $T_J = 125^\circ C$                                     |                       |      | 1.5 mA       |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |      | $\pm 100$ nA |
| $V_{CE(sat)}$ | $I_C = 20A$ , $V_{GE} = 15V$ , Note 2                                 | 3.6                   | 4.2  | V            |
|               | $T_J = 125^\circ C$   | 3.1                   |      | V            |

### Features

- International standard packages: JEDEC TO-247AD
- MOS Gate turn-on - drive simplicity
- Avalanche rated

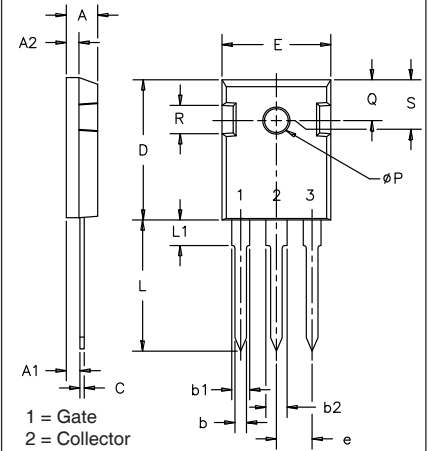
### Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified)   | Characteristic Values |      |                         |
|--------------|---|-----------------------|------|-------------------------|
|              |   | Min.                  | Typ. | Max.                    |
| $g_{fs}$     | $I_C = 24\text{A}, V_{CE} = 10\text{V}$ , Note 2  | 10                    | 17   | S                       |
| $C_{ies}$    | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$  |                       | 1900 | pF                      |
| $C_{oes}$    |   |                       | 125  | pF                      |
| $C_{res}$    |   |                       | 52   | pF                      |
| $Q_g$        | $I_C = 24\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$   |                       | 79   | nC                      |
| $Q_{ge}$     |   |                       | 12   | nC                      |
| $Q_{gc}$     |   |                       | 36   | nC                      |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 20\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 600\text{V}, R_G = 5\Omega$<br>Note 1  |                       | 16   | ns                      |
| $t_{ri}$     |   |                       | 27   | ns                      |
| $E_{on}$     |   |                       | 1.16 | mJ                      |
| $t_{d(off)}$ |   |                       | 93   | ns                      |
| $t_{fi}$     |   |                       | 110  | ns                      |
| $E_{off}$    |   |                       | 0.47 | 0.85 mJ                 |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b><br>$I_C = 20\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 600\text{V}, R_G = 5\Omega$<br>Note 1 |                       | 16   | ns                      |
| $t_{ri}$     |   |                       | 35   | ns                      |
| $E_{on}$     |   |                       | 2.18 | mJ                      |
| $t_{d(off)}$ |   |                       | 125  | ns                      |
| $t_{fi}$     |   |                       | 305  | ns                      |
| $E_{off}$    |   |                       | 1.18 | 2.00 mJ                 |
| $R_{thJC}$   | TO-220<br>TO-247  |                       |      | 0.50 $^\circ\text{C/W}$ |
| $R_{thCK}$   |   |                       | 0.50 | $^\circ\text{C/W}$      |
|              |   |                       | 0.21 | $^\circ\text{C/W}$      |

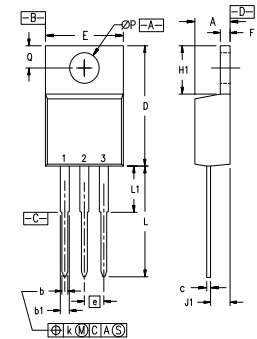
- Notes:
- Switching times may increase for  $V_{CE}$  (Clamp)  $> 0.8 \cdot V_{CES}$ , higher  $T_J$  or increased  $R_G$ .
  - Pulse test,  $t \leq 300\mu\text{s}$ ; duty cycle,  $d \leq 2\%$ .

### TO-247 (IXGH) AD Outline



| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .185     | .209 | 4.7         | 5.3   |
| A1  | .087     | .102 | 2.2         | 2.54  |
| A2  | .059     | .098 | 2.2         | 2.6   |
| b   | .040     | .055 | 1.0         | 1.4   |
| b1  | .065     | .084 | 1.65        | 2.13  |
| b2  | .113     | .123 | 2.87        | 3.12  |
| C   | .016     | .031 | .4          | .8    |
| D   | .819     | .845 | 20.80       | 21.46 |
| E   | .610     | .640 | 15.75       | 16.26 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| L   | .780     | .800 | 19.81       | 20.32 |
| L1  |          | .177 |             | 4.50  |
| ØP  | .140     | .144 | 3.55        | 3.65  |
| Q   | .212     | .244 | 5.4         | 6.2   |
| R   | .170     | .216 | 4.32        | 5.49  |
| S   | .242 BSC |      | 6.15 BSC    |       |

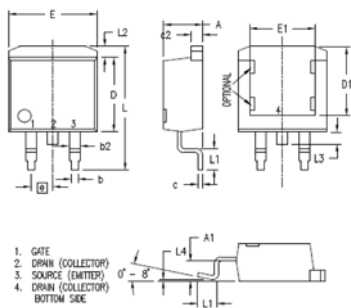
### TO-220 (IXGP) Outline



- 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  |

### TO-263 (IXGA) Outline



| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .160     | .190 | 4.06        | 4.83  |
| A1  | .080     | .110 | 2.03        | 2.79  |
| b   | .020     | .039 | 0.51        | 0.99  |
| b2  | .045     | .055 | 1.14        | 1.40  |
| c   | .016     | .029 | 0.40        | 0.74  |
| c2  | .045     | .055 | 1.14        | 1.40  |
| D   | .340     | .380 | 8.64        | 9.65  |
| D1  | .315     | .350 | 8.00        | 8.89  |
| E   | .380     | .410 | 9.65        | 10.41 |
| E1  | .245     | .320 | 6.22        | 8.13  |
| e   | .100 BSC |      | 2.54 BSC    |       |
| L   | .575     | .625 | 14.61       | 15.88 |
| L1  | .090     | .110 | 2.29        | 2.79  |
| L2  | .040     | .055 | 1.02        | 1.40  |
| L3  | .050     | .070 | 1.27        | 1.78  |
| L4  | 0        | .005 | 0           | 0.13  |

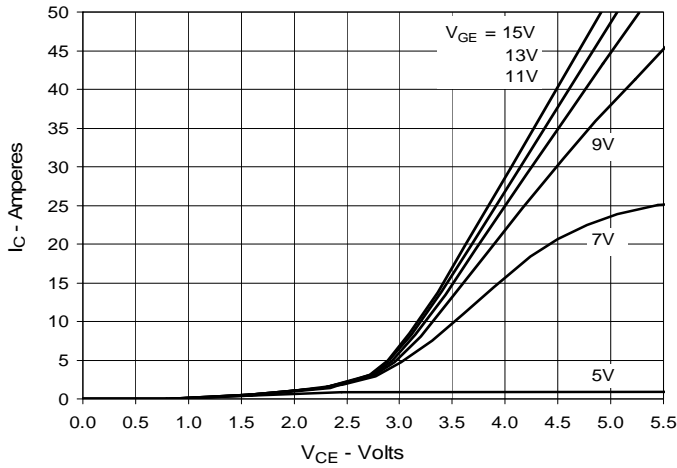
### PRELIMINARY TECHNICAL INFORMATION

The product presented herein is under development. The Technical Specifications offered are derived from data gathered during objective characterizations of preliminary engineering lots; but also may yet contain some information supplied during a pre-production design evaluation. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

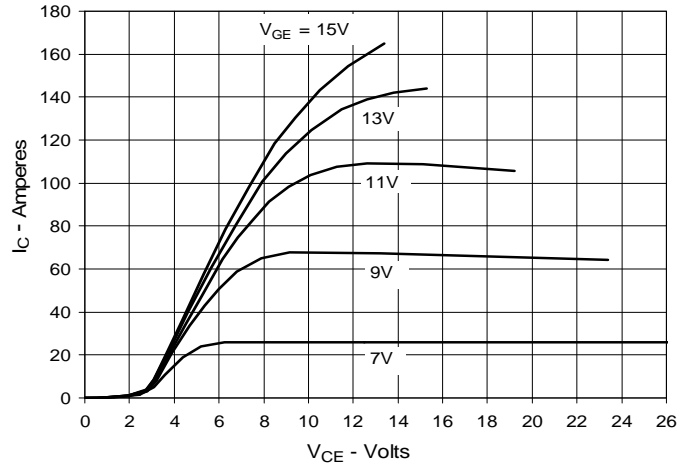
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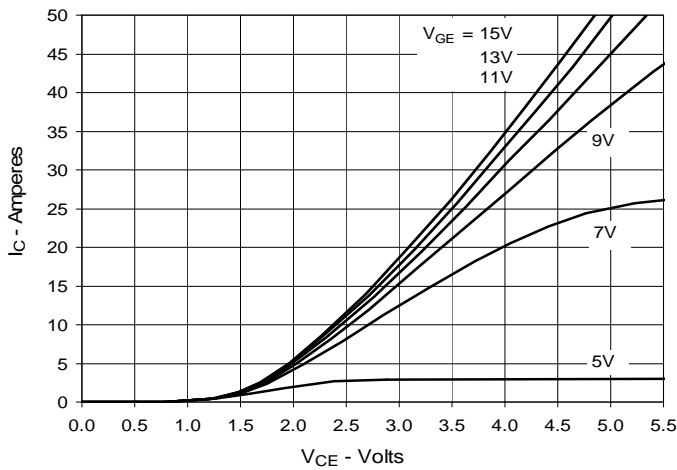
**Fig. 1. Output Characteristics**  
@ 25°C



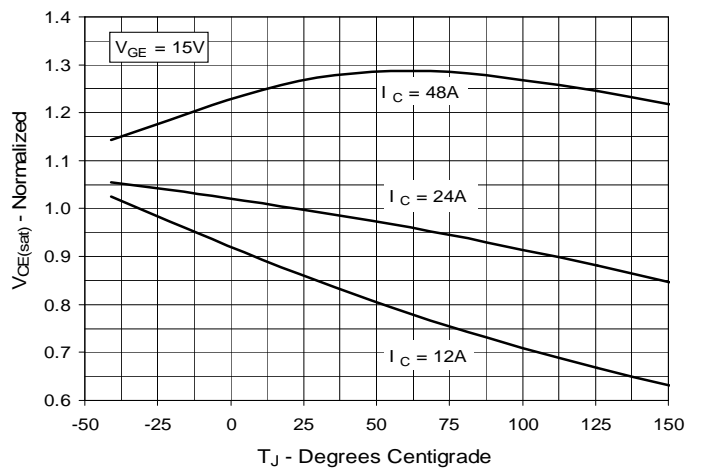
**Fig. 2. Extended Output Characteristics**  
@ 25°C



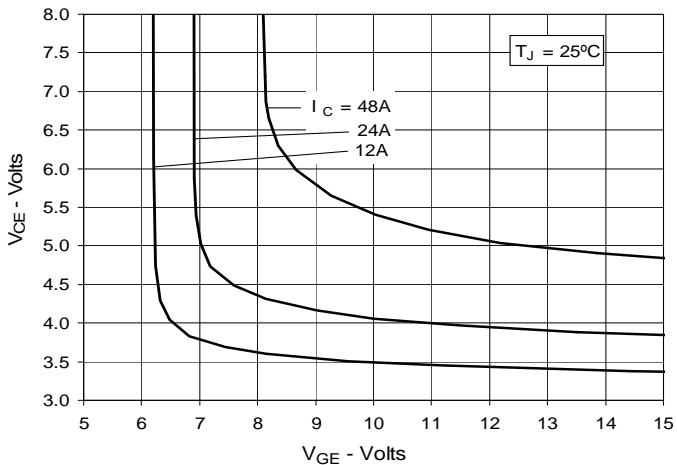
**Fig. 3. Output Characteristics**  
@ 125°C



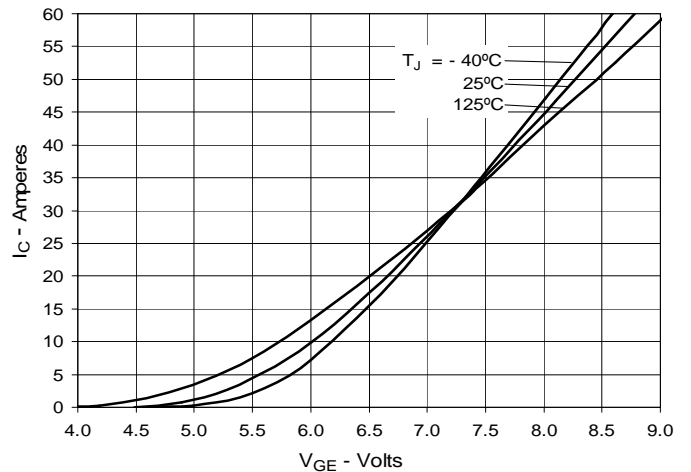
**Fig. 4. Dependence of VCE(sat) on Junction Temperature**



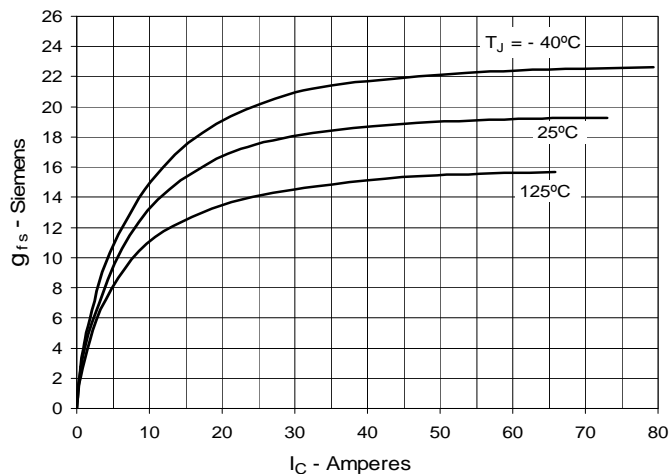
**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**



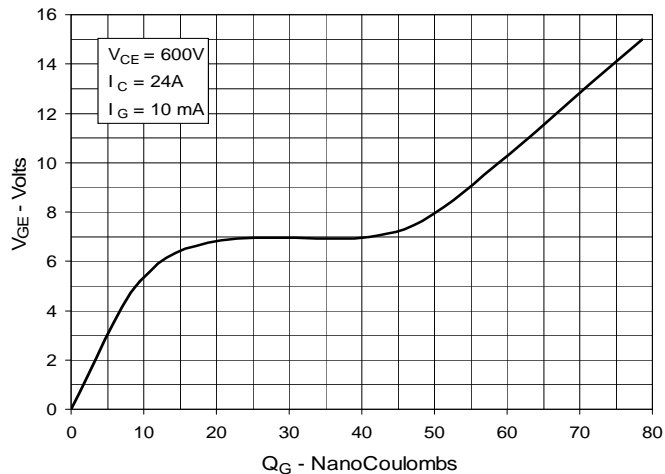
**Fig. 6. Input Admittance**



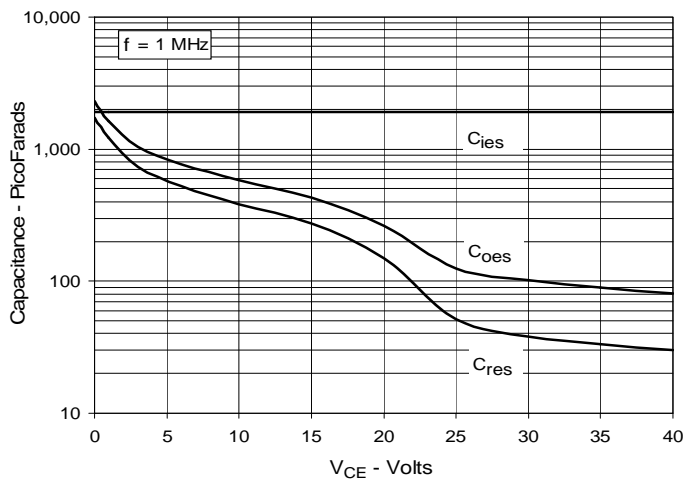
**Fig. 7. Transconductance**



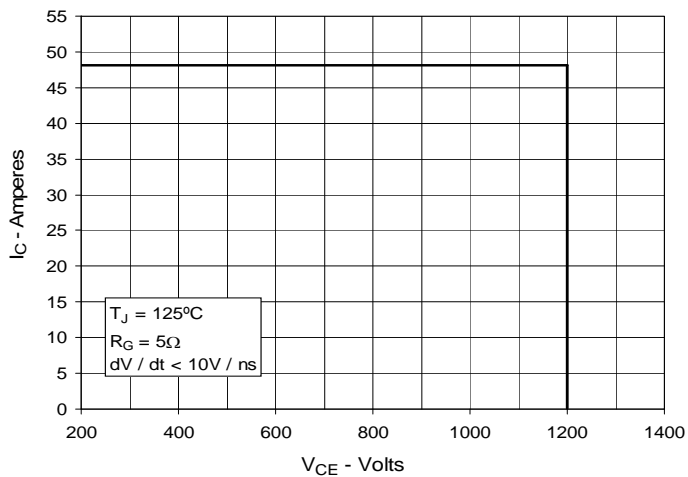
**Fig. 8. Gate Charge**



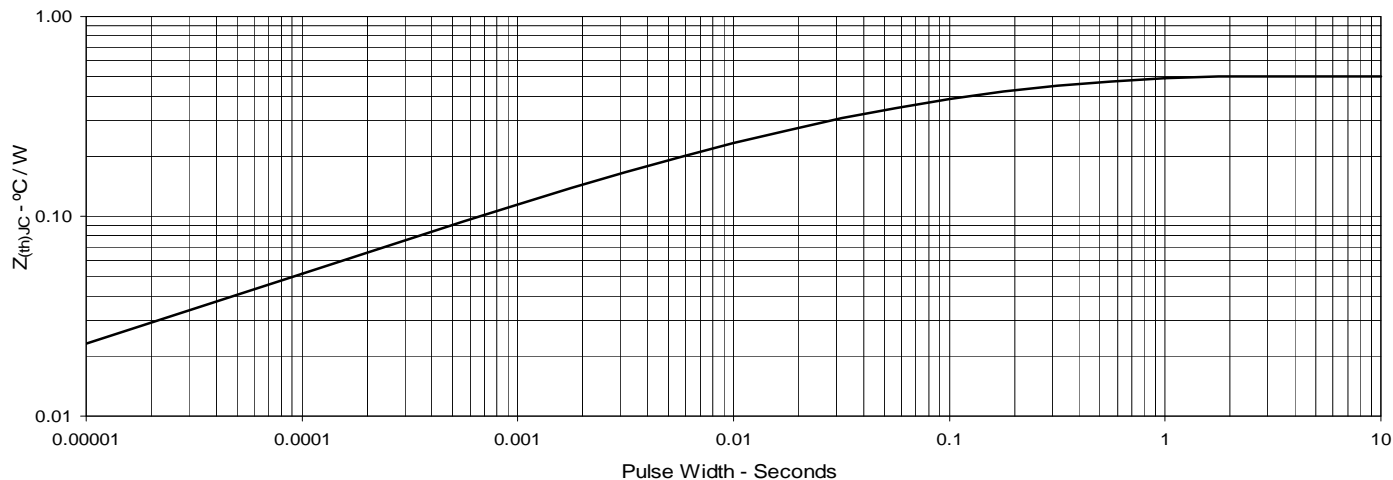
**Fig. 9. Capacitance**



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



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

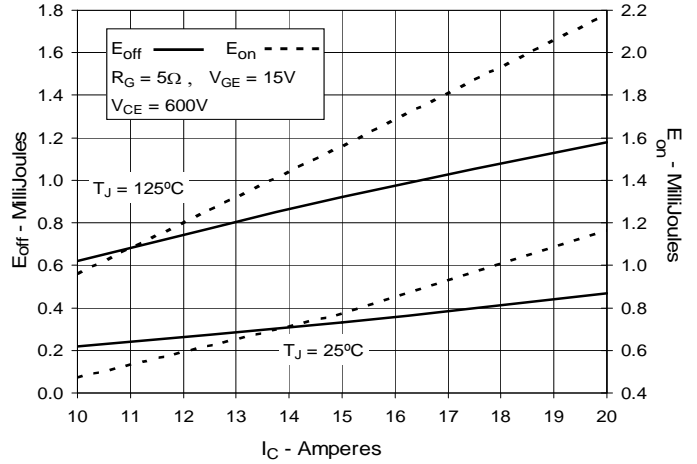


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**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**



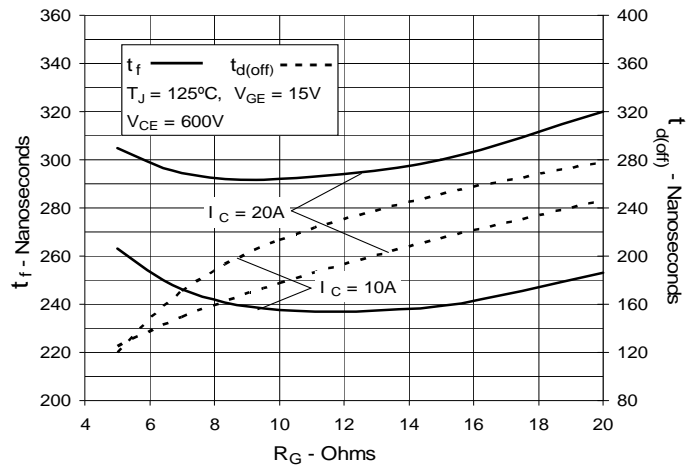
**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**



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



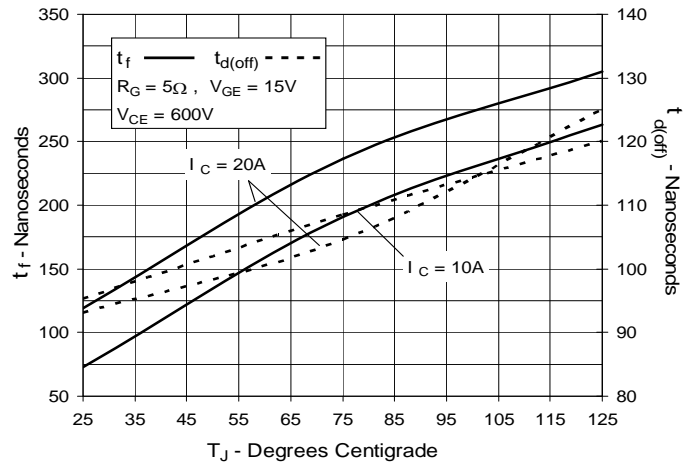
**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**



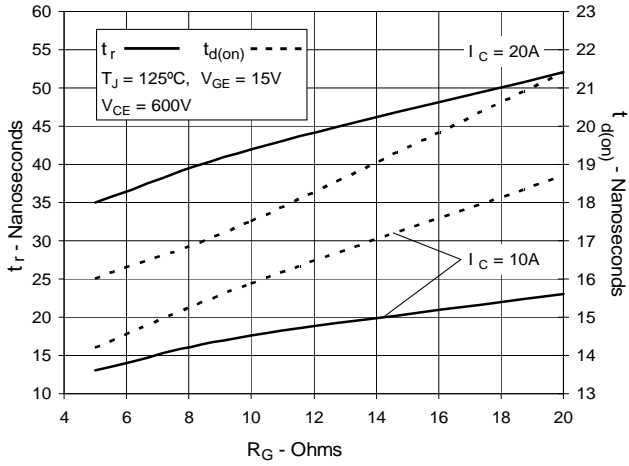
**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**



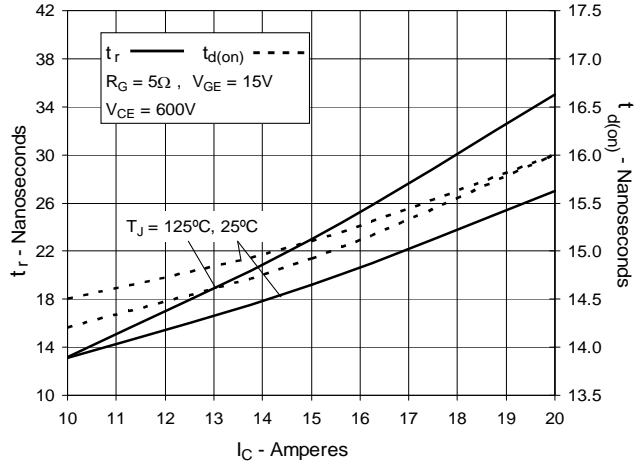
**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**



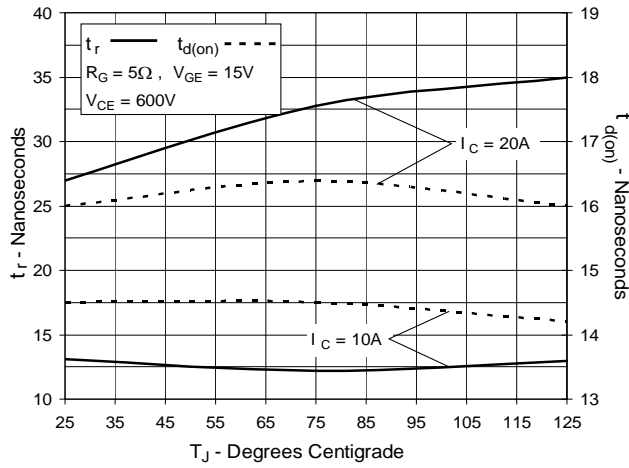
**Fig. 18. Inductive Turn-on  
Switching Times vs. Gate Resistance**



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



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



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