

# HiPerFAST™ IGBTs

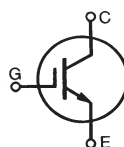
## C2-Class

## High Speed

# IXGA16N60C2

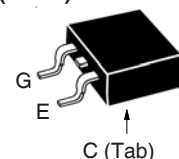
# IXGP16N60C2

$V_{CES} = 600V$   
 $I_{C110} = 16A$   
 $V_{CE(sat)} \leq 3.0V$   
 $t_{fi(typ)} = 33ns$

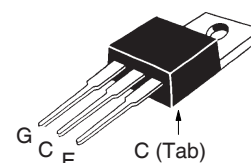


| Symbol                        | Test Conditions                                                                   | Maximum Ratings                        |            |
|-------------------------------|-----------------------------------------------------------------------------------|----------------------------------------|------------|
| $V_{CES}$                     | $T_J = 25^\circ C$ 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          |
| $I_{C25}$                     | $T_C = 25^\circ C$                                                                | 40                                     | A          |
| $I_{C110}$                    | $T_C = 110^\circ C$                                                               | 16                                     | A          |
| $I_{CM}$                      | $T_C = 25^\circ C$ , 1ms                                                          | 100                                    | A          |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_J = 125^\circ C$ , $R_G = 22\Omega$<br>Clamped Inductive load | $I_{CM} = 32$<br>$V_{CE} \leq V_{CES}$ | A          |
| $P_C$                         | $T_C = 25^\circ C$                                                                | 150                                    | W          |
| $T_J$                         |                                                                                   | -55 ... +150                           | $^\circ C$ |
| $T_{JM}$                      |                                                                                   | 150                                    | $^\circ C$ |
| $T_{stg}$                     |                                                                                   | -55 ... +150                           | $^\circ C$ |
| $M_d$                         | Mounting Torque (TO-220)                                                          | 1.13/10                                | Nm/lb.in.  |
| $F_C$                         | Mounting Force (TO-263)                                                           | 10..65 / 2.2..14.6                     | 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-263                                                                            | 2.5                                    | g          |
|                               | TO-220                                                                            | 3.0                                    | g          |

TO-263 AA (IXGA)



TO-220AB (IXGP)



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

## Features

- Optimized for Low 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

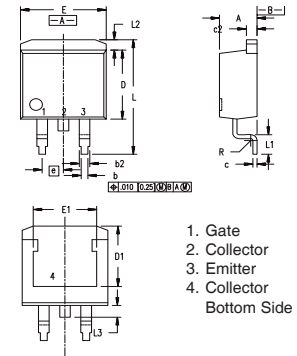
| Symbol        | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |      |                           |
|---------------|-----------------------------------------------------------------------|-----------------------|------|---------------------------|
|               |                                                                       | 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                   |      | 5.5 V                     |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 125^\circ C$             |                       |      | 15 $\mu A$<br>250 $\mu A$ |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |      | $\pm 100$ nA              |
| $V_{CE(sat)}$ | $I_C = 12A$ , $V_{GE} = 15V$ , Note1<br>$T_J = 125^\circ C$           |                       | 1.8  | 3.0 V<br>V                |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                                                    | Characteristic Values |      |                         |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
|              |                                                                                                                                                | Min.                  | Typ. | Max.                    |
| $g_{fs}$     | $I_C = 12\text{A}$ , $V_{CE} = 10\text{V}$ , Note 1                                                                                            | 8                     |      | S                       |
| $C_{ies}$    | $V_{CE} = 25\text{V}$ , $V_{GE} = 0\text{V}$ , $f = 1\text{MHz}$                                                                               |                       | 657  | pF                      |
| $C_{oes}$    |                                                                                                                                                |                       | 62   | pF                      |
| $C_{res}$    |                                                                                                                                                |                       | 22   | pF                      |
| $Q_{g(on)}$  | $I_C = 12\text{A}$ , $V_{GE} = 15\text{V}$ , $V_{CE} = 0.5 \cdot V_{CES}$                                                                      |                       | 25   | nC                      |
| $Q_{ge}$     |                                                                                                                                                |                       | 5    | nC                      |
| $Q_{gc}$     |                                                                                                                                                |                       | 13   | nC                      |
| $t_{d(on)}$  | Inductive load, $T_J = 25^\circ\text{C}$<br>$I_C = 12\text{A}$ , $V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}$ , $R_G = 22\Omega$<br>Note 2  |                       | 16   | ns                      |
| $t_{ri}$     |                                                                                                                                                |                       | 17   | ns                      |
| $E_{on}$     |                                                                                                                                                |                       | 0.16 | mJ                      |
| $t_{d(off)}$ |                                                                                                                                                |                       | 75   | ns                      |
| $t_{fi}$     |                                                                                                                                                |                       | 33   | ns                      |
| $E_{off}$    |                                                                                                                                                |                       | 0.09 | mJ                      |
| $t_{d(on)}$  | Inductive load, $T_J = 125^\circ\text{C}$<br>$I_C = 12\text{A}$ , $V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}$ , $R_G = 22\Omega$<br>Note 2 |                       | 16   | ns                      |
| $t_{ri}$     |                                                                                                                                                |                       | 18   | ns                      |
| $E_{on}$     |                                                                                                                                                |                       | 0.27 | mJ                      |
| $t_{d(off)}$ |                                                                                                                                                |                       | 115  | ns                      |
| $t_{fi}$     |                                                                                                                                                |                       | 100  | ns                      |
| $E_{off}$    |                                                                                                                                                |                       | 0.27 | mJ                      |
| $R_{thJC}$   | TO-220                                                                                                                                         |                       |      | 0.83 $^\circ\text{C/W}$ |
| $R_{thCK}$   |                                                                                                                                                |                       | 0.50 | $^\circ\text{C/W}$      |

### Notes:

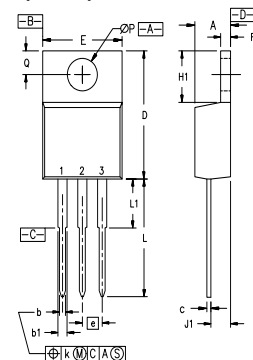
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}(\text{Clamp})$ ,  $T_J$  or  $R_G$ .

### TO-263 (IXGA) Outline

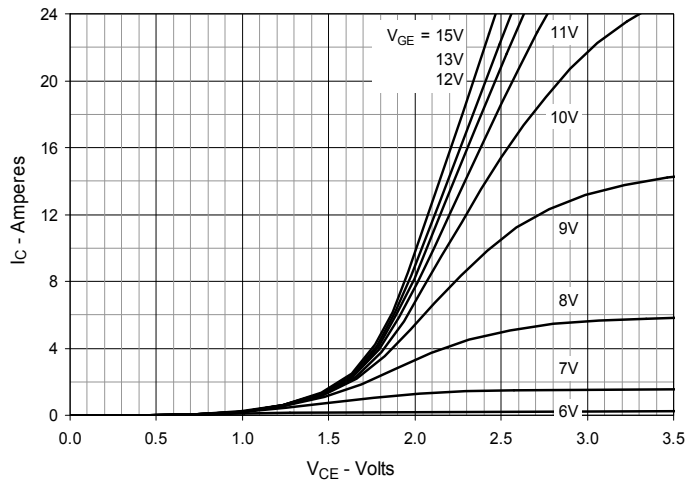


| Dim. | Millimeter |       | Inches |      |
|------|------------|-------|--------|------|
|      | Min.       | Max.  | Min.   | Max. |
| A    | 4.06       | 4.83  | .160   | .190 |
| b    | 0.51       | 0.99  | .020   | .039 |
| b2   | 1.14       | 1.40  | .045   | .055 |
| c    | 0.40       | 0.74  | .016   | .029 |
| c2   | 1.14       | 1.40  | .045   | .055 |
| D    | 8.64       | 9.65  | .340   | .380 |
| D1   | 8.00       | 8.89  | .280   | .320 |
| E    | 9.65       | 10.41 | .380   | .405 |
| E1   | 6.22       | 8.13  | .270   | .320 |
| e    | 2.54       | BSC   | .100   | BSC  |
| L    | 14.61      | 15.88 | .575   | .625 |
| L1   | 2.29       | 2.79  | .090   | .110 |
| L2   | 1.02       | 1.40  | .040   | .055 |
| L3   | 1.27       | 1.78  | .050   | .070 |
| L4   | 0          | 0.13  | 0      | .005 |

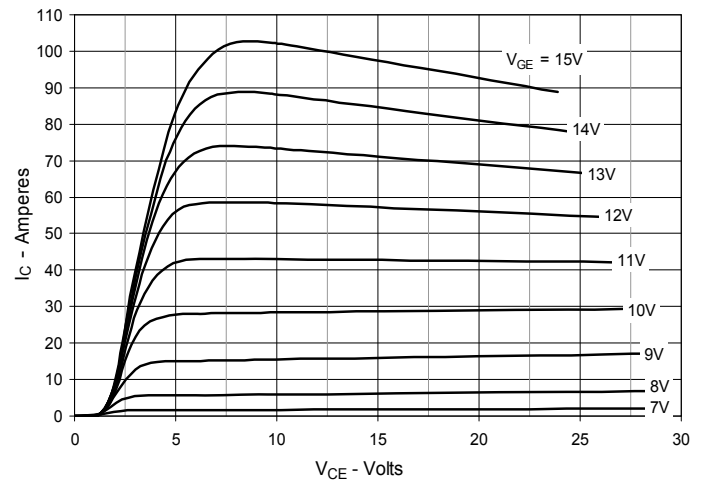
### TO-220 (IXGP) Outline



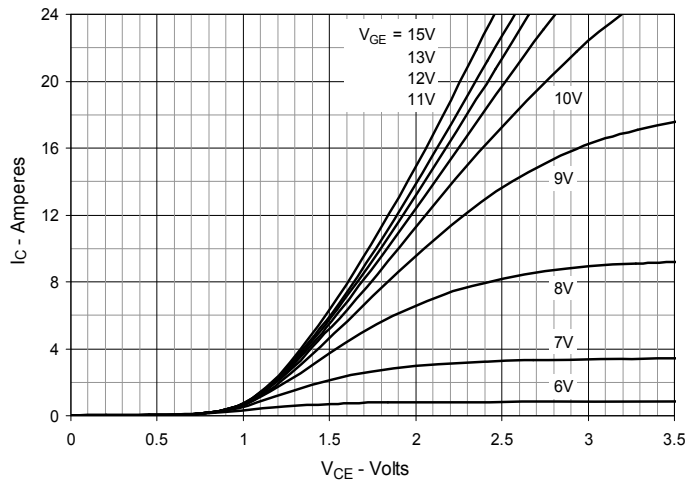
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$**



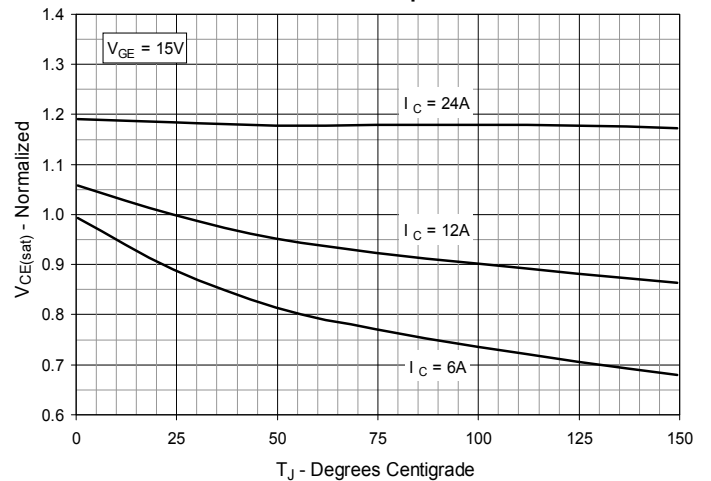
**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$**



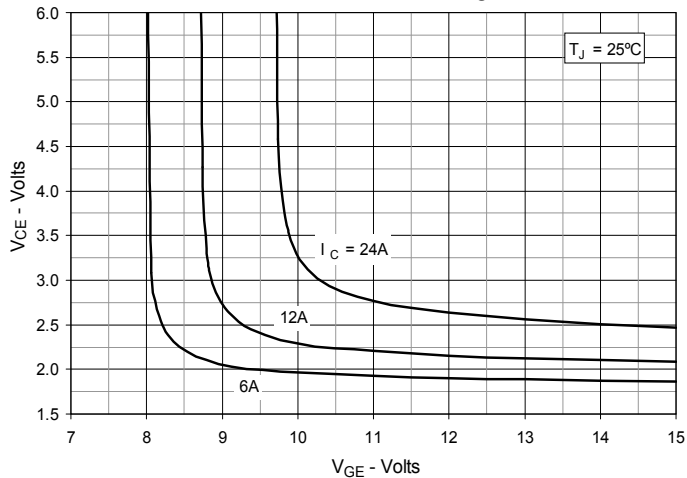
**Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$**



**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**

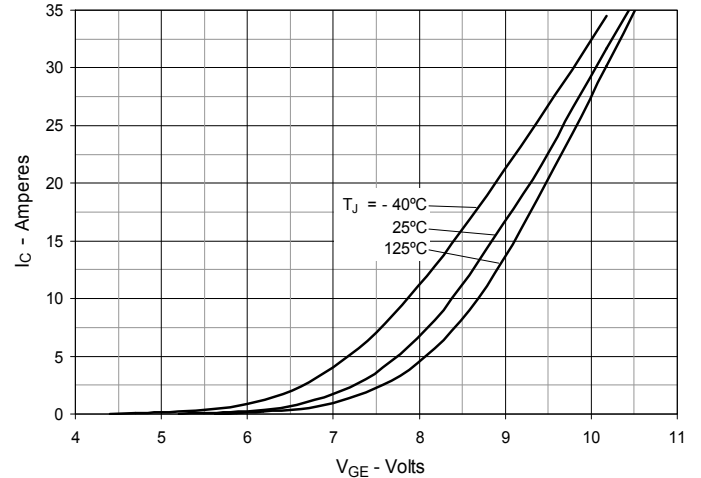


Fig. 7. Transconductance

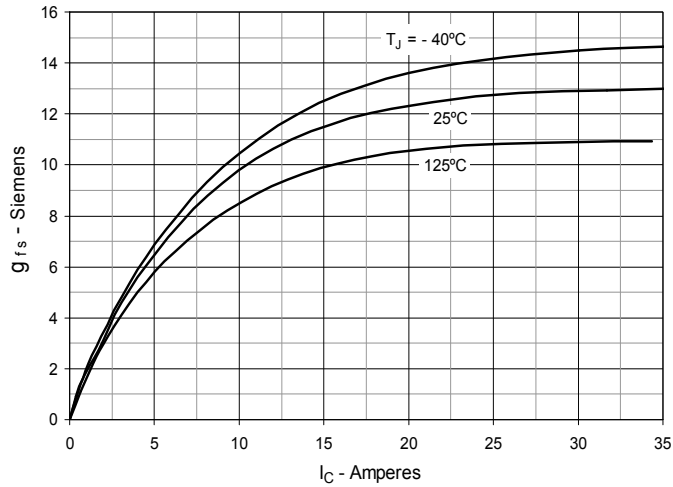


Fig. 8. Gate Charge

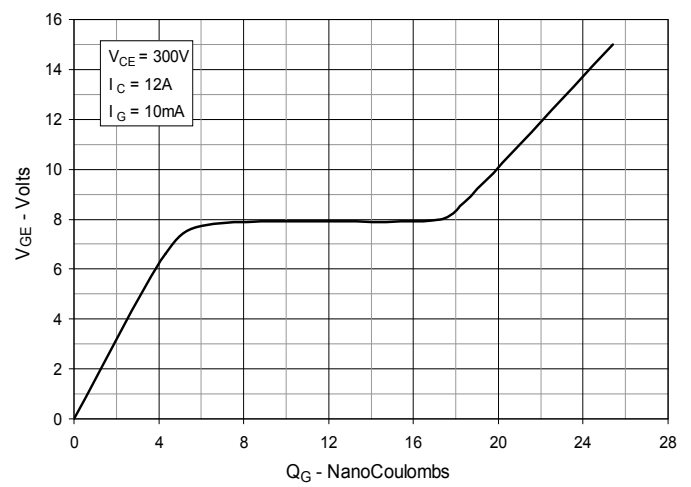


Fig. 9. Capacitance

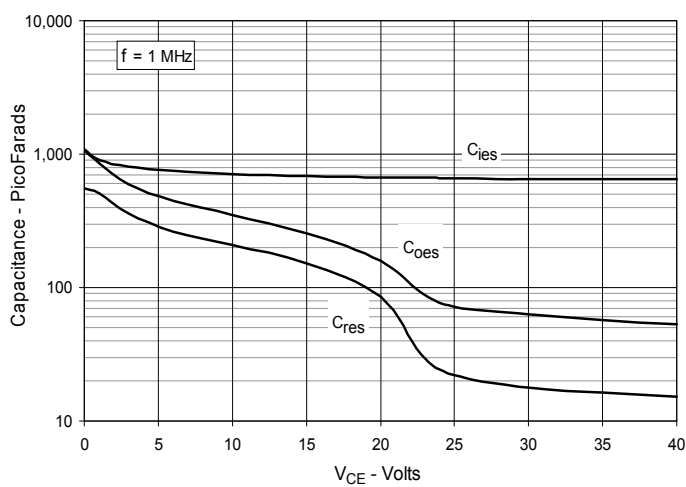


Fig. 10. Reverse-Bias Safe Operating Area

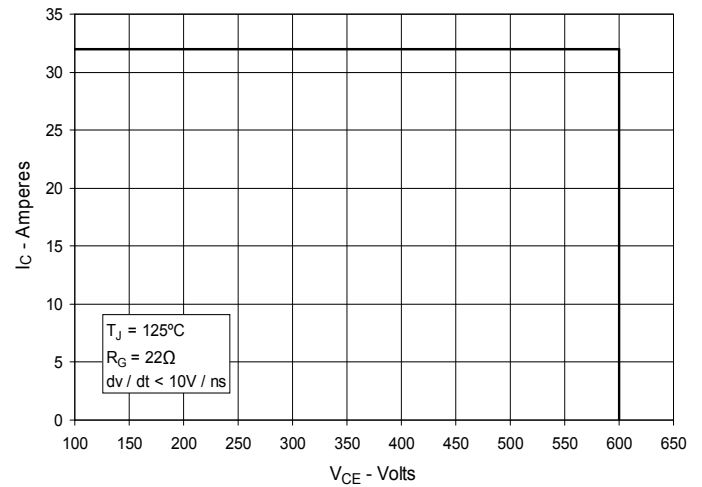
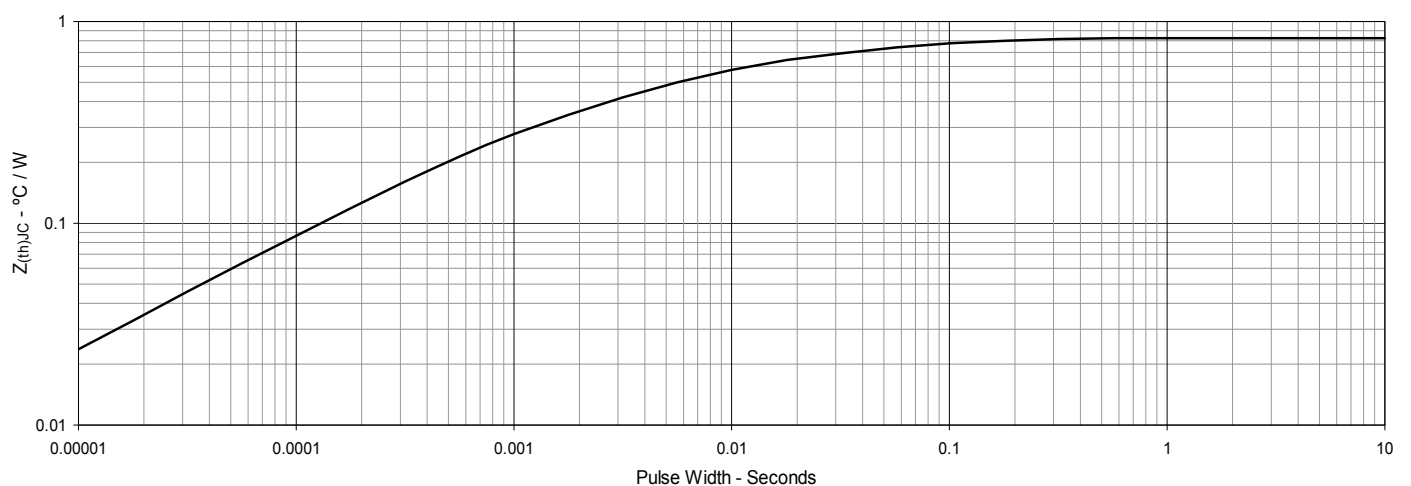
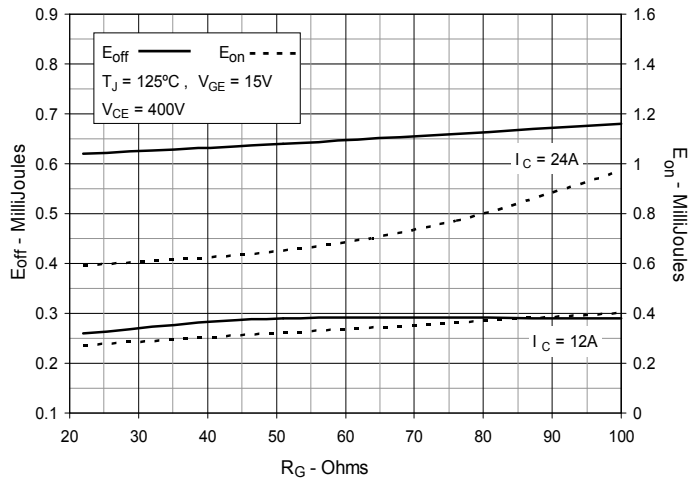


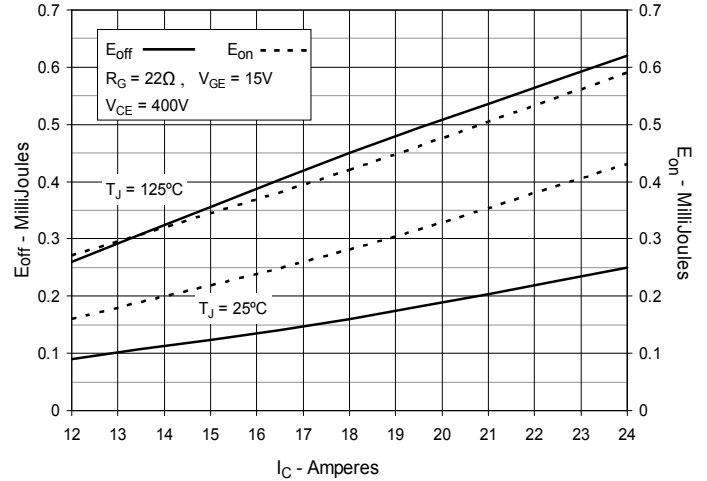
Fig. 11. Maximum Transient Thermal Impedance



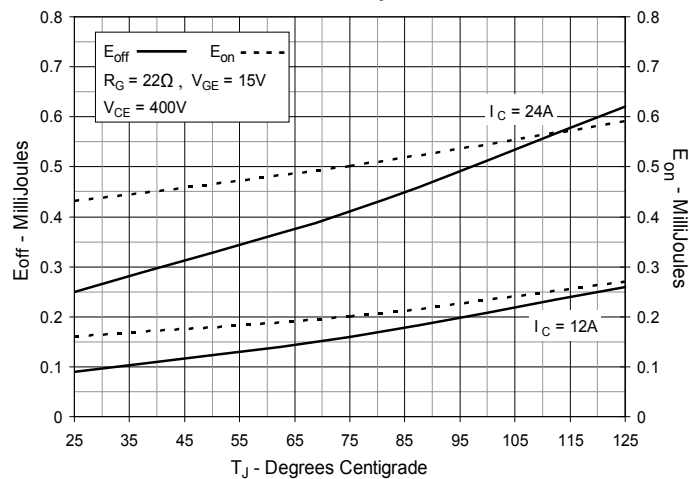
**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**



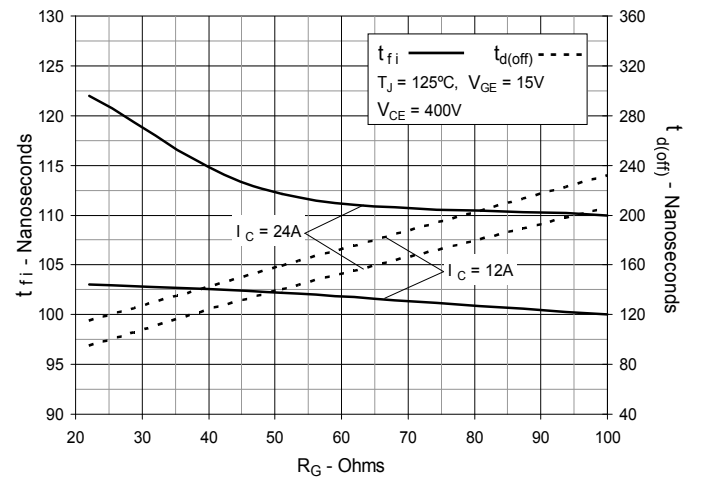
**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**



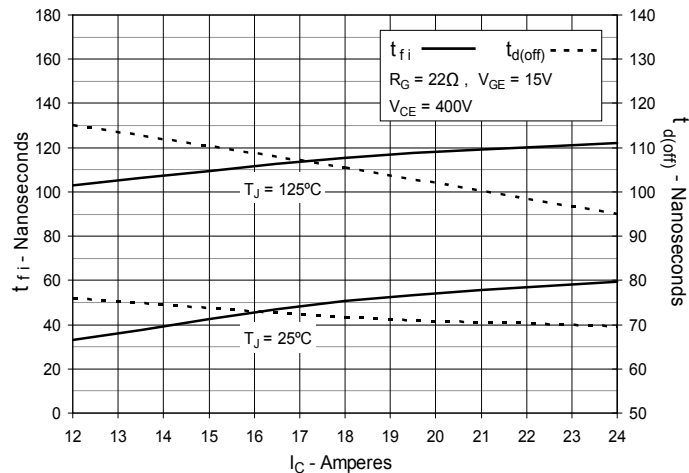
**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**



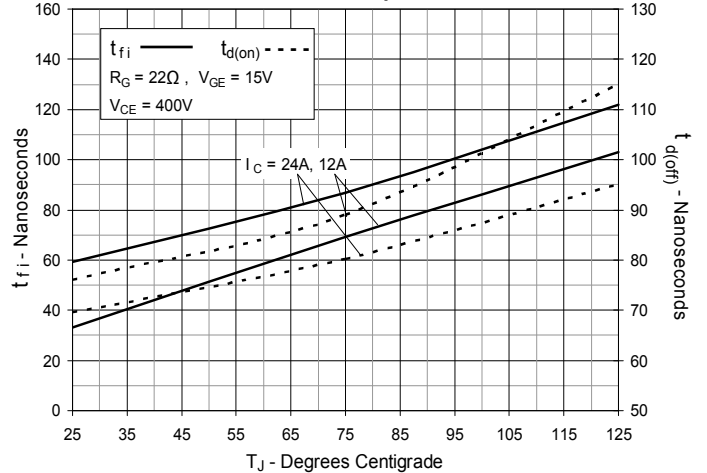
**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**



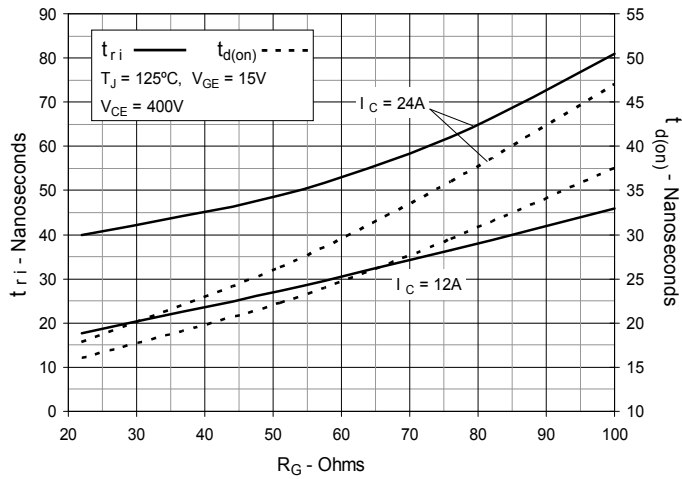
**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**



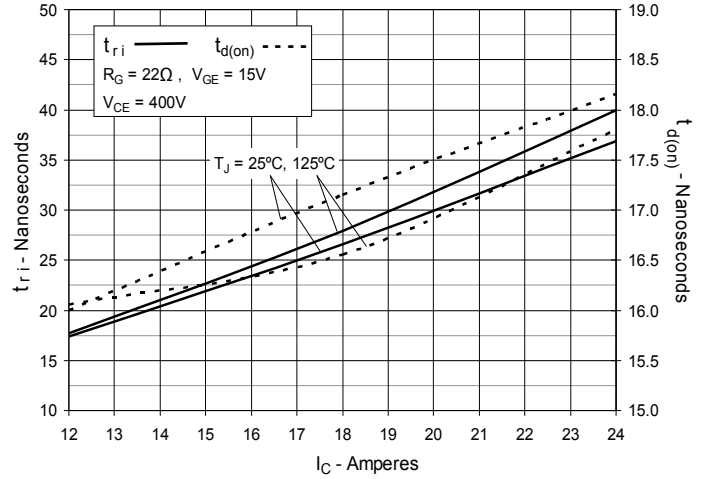
**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**



**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**

