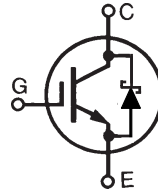


## GenX3™ 600V IGBTs w/ SiC Anti-Parallel Diode

**IXGA30N60C3C1**  
**IXGP30N60C3C1**  
**IXGH30N60C3C1**

$V_{CES} = 600V$   
 $I_{C110} = 30A$   
 $V_{CE(sat)} \leq 3.0V$   
 $t_{fi(typ)} = 47ns$

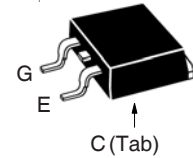
High-Speed PT IGBTs for  
40 - 100kHz Switching



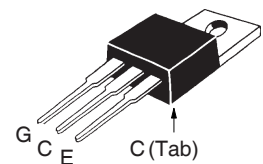
| Symbol                        | Test Conditions   | Maximum Ratings                   |            |
|-------------------------------|---|-----------------------------------|------------|
| $V_{CES}$                     | $T_C = 25^\circ C$ to $150^\circ C$   | 600                               | V          |
| $V_{CGR}$                     | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GE} = 1M\Omega$                           | 600                               | V          |
| $V_{GES}$                     | Continuous  | $\pm 20$                          | V          |
| $V_{GEM}$                     | Transient   | $\pm 30$                          | V          |
| $I_{C25}$                     | $T_C = 25^\circ C$  | 60                                | A          |
| $I_{C110}$                    | $T_C = 110^\circ C$   | 30                                | A          |
| $I_{F110}$                    | $T_C = 110^\circ C$   | 13                                | A          |
| $I_{CM}$                      | $T_C = 25^\circ C$ , 1ms  | 150                               | A          |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_{VJ} = 125^\circ C$ , $R_G = 5\Omega$<br>Clamped Inductive Load | $I_{CM} = 60$<br>@ $\leq V_{CES}$ | A          |
| $P_C$                         | $T_C = 25^\circ C$  | 220                               | 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-220 & TO-247)   | 1.13/10                           | Nm/lb.in.  |
| <b>Weight</b>                 | TO-263  | 2.5                               | g          |
|                               | TO-220  | 3.0                               | g          |
|                               | TO-247  | 6.0                               | g          |

| 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                   |            | 5.5 V                     |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 125^\circ C$           |                       |            | 25 $\mu A$<br>300 $\mu A$ |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                  |                       |            | $\pm 100$ nA              |
| $V_{CE(sat)}$ | $I_C = 20A$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 125^\circ C$        |                       | 2.6<br>1.8 | 3.0 V<br>V                |

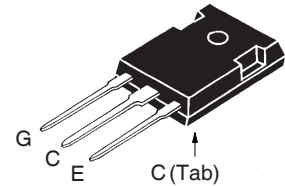
TO-263 AA (IXGA)



TO-220AB (IXGP)



TO-247 (IXGH)



G = Gate      D = Collector  
S = Emitter    Tab = Collector

### Features

- Optimized for Low Switching Losses
- Square RBSOA
- Anti-Parallel Schottky Diode
- International Standard Packages

### Advantages

- High Power Density
- Low Gate Drive Requirement

### Applications

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

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)   | Characteristic Values |      |                    |
|--------------|---|-----------------------|------|--------------------|
|              |   | Min.                  | Typ. | Max.               |
| $g_{fs}$     | $I_C = 20\text{A}, V_{CE} = 10\text{V}$ , Note 1  | 9                     | 16   | S                  |
| $C_{ies}$    | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$  |                       | 1075 | pF                 |
| $C_{oes}$    |   |                       | 196  | pF                 |
| $C_{res}$    |   |                       | 29   | pF                 |
| $Q_g$        | $I_C = 20\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$   |                       | 38   | nC                 |
| $Q_{ge}$     |   |                       | 8    | nC                 |
| $Q_{gc}$     |   |                       | 17   | 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>$V_{CE} = 300\text{V}, R_G = 5\Omega$<br>Note 2  |                       | 17   | ns                 |
| $t_{ri}$     |   |                       | 20   | ns                 |
| $E_{on}$     |   |                       | 0.12 | mJ                 |
| $t_{d(off)}$ |   |                       | 42   | 75 ns              |
| $t_{fi}$     |   |                       | 47   | ns                 |
| $E_{off}$    |   |                       | 0.09 | 0.18 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>$V_{CE} = 300\text{V}, R_G = 5\Omega$<br>Note 2 |                       | 16   | ns                 |
| $t_{ri}$     |   |                       | 21   | ns                 |
| $E_{on}$     |   |                       | 0.16 | mJ                 |
| $t_{d(off)}$ |   |                       | 70   | ns                 |
| $t_{fi}$     |   |                       | 90   | ns                 |
| $E_{off}$    |   |                       | 0.33 | mJ                 |
| $R_{thJC}$   |   |                       | 0.56 | $^\circ\text{C/W}$ |
| $R_{thCS}$   | TO-220  | 0.50                  |      | $^\circ\text{C/W}$ |
|              | TO-247  | 0.21                  |      | $^\circ\text{C/W}$ |

**Reverse Diode (SiC)**

| Symbol     | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)    | Characteristic Values |              |                         |
|------------|--|-----------------------|--------------|-------------------------|
|            |  | Min.                  | Typ.         | Max.                    |
| $V_F$      | $I_F = 10\text{A}, V_{GE} = 0\text{V}$ , Note 1<br>$T_J = 125^\circ\text{C}$ |                       | 1.65<br>1.80 | V<br>V                  |
| $R_{thJC}$ |  |                       |              | 1.10 $^\circ\text{C/W}$ |

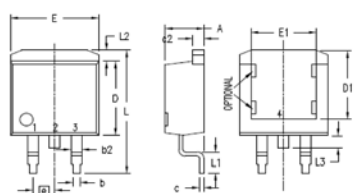
**Notes**

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  $R_G$ .

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 | 7,157,338 B2 |
| 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    |              |

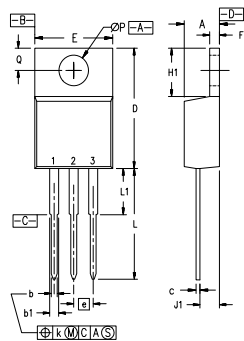
## TO-263 (IXGA) Outline



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

| 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  |

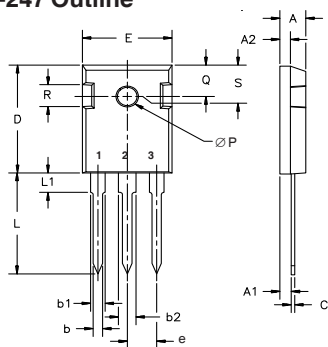
## TO-220 (IXGP) Outline



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

| 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-247 Outline



Pins: 1 - Gate  
2 - Collector  
3 - Emitter

| 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  |

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

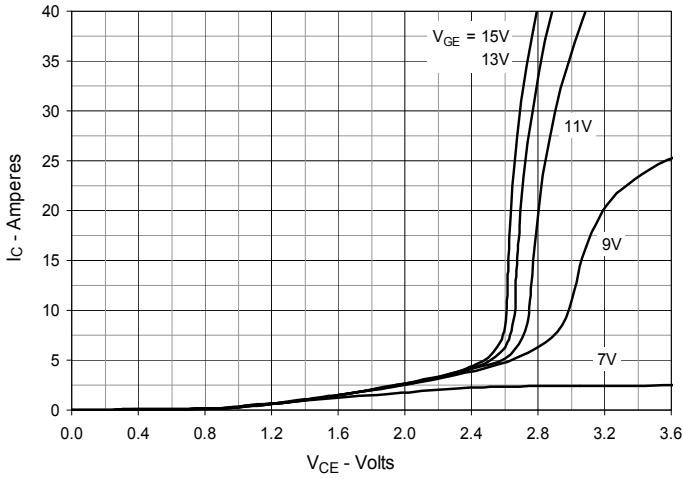


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

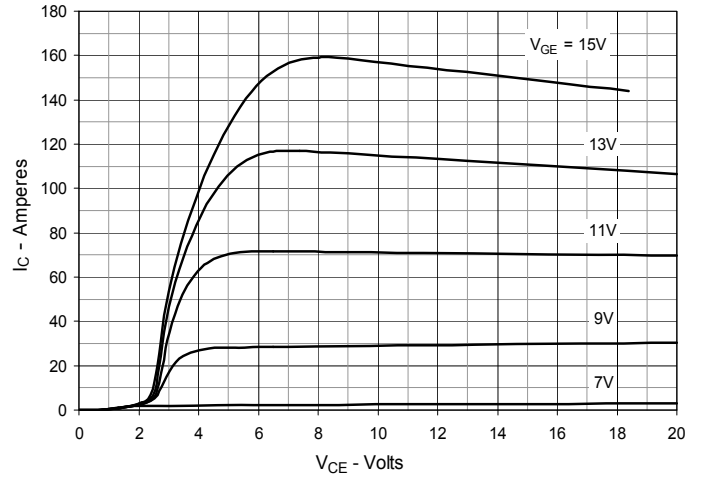


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

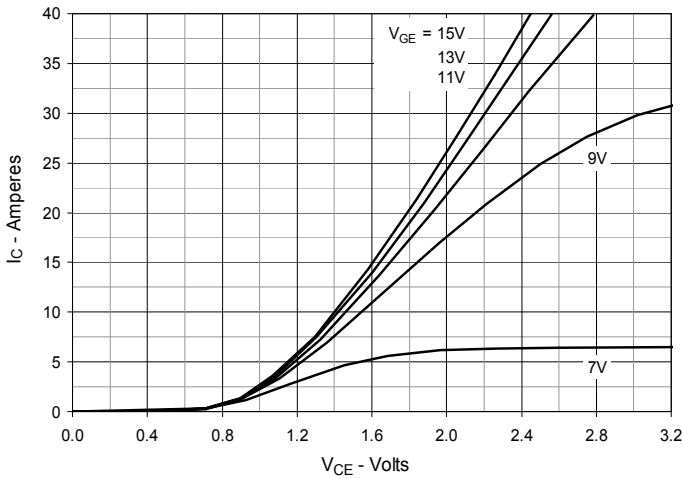


Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature

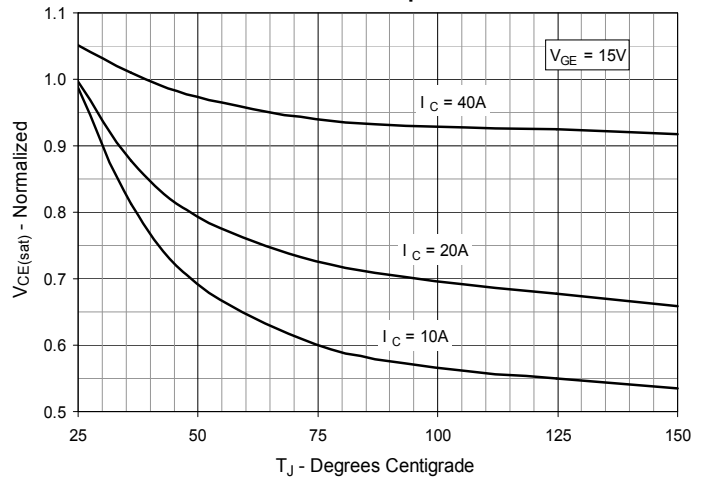


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

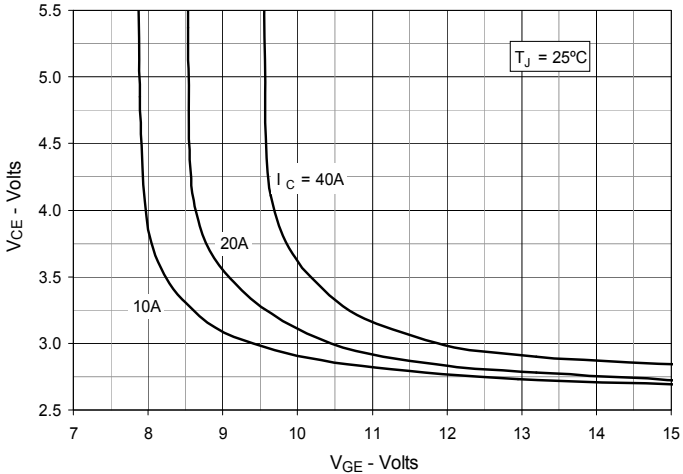


Fig. 6. Input Admittance

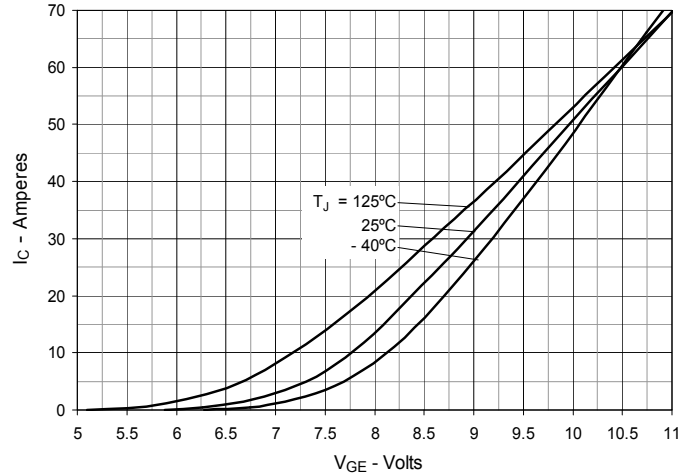


Fig. 7. Transconductance

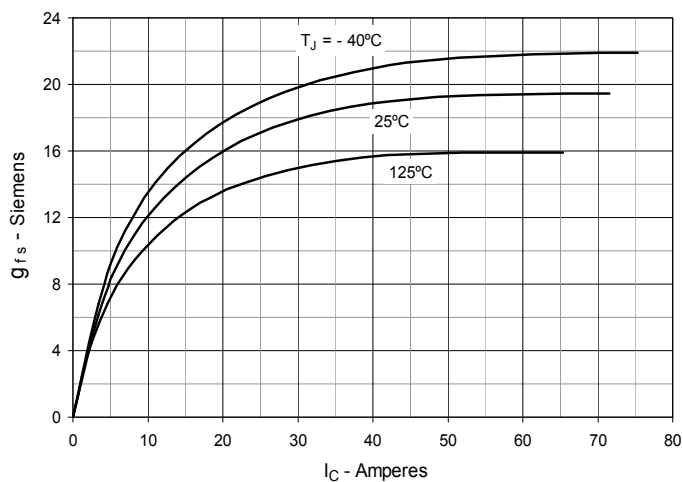


Fig. 8. Gate Charge

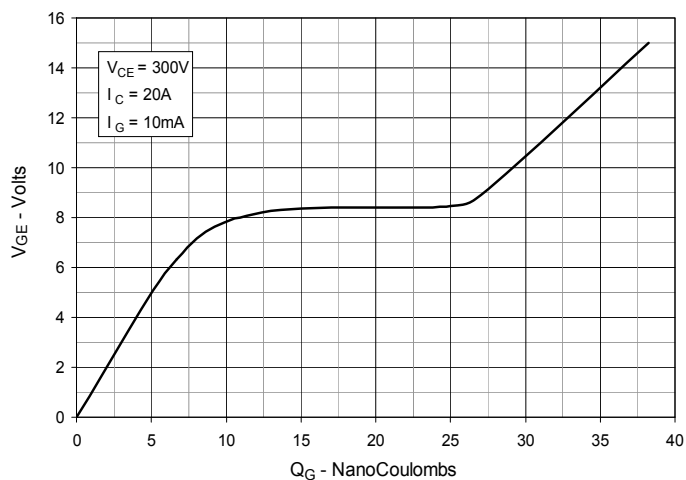


Fig. 9. Capacitance

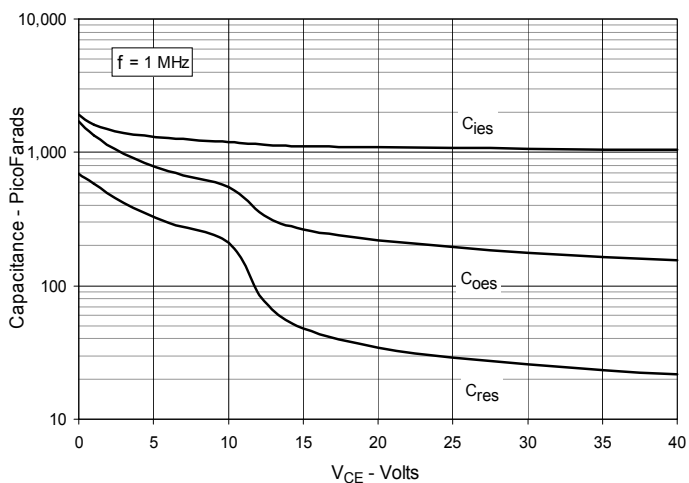


Fig. 10. Reverse-Bias Safe Operating Area

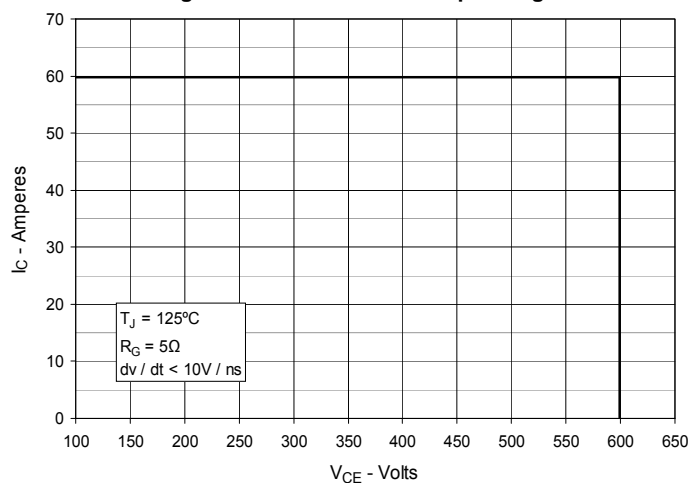
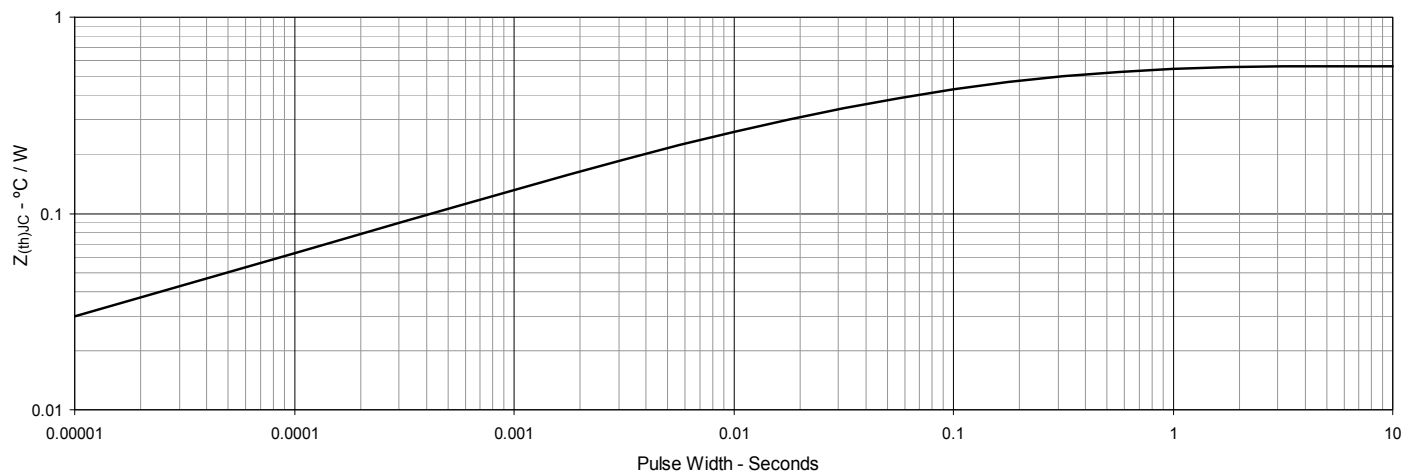
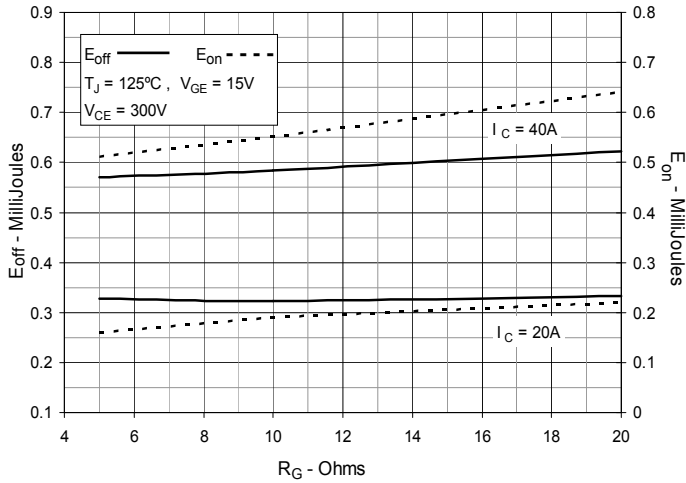


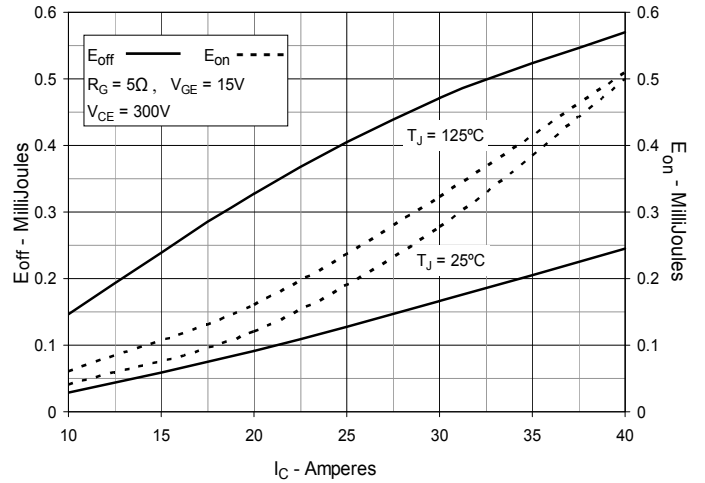
Fig. 11. Maximum Transient Thermal Impedance for IGBT



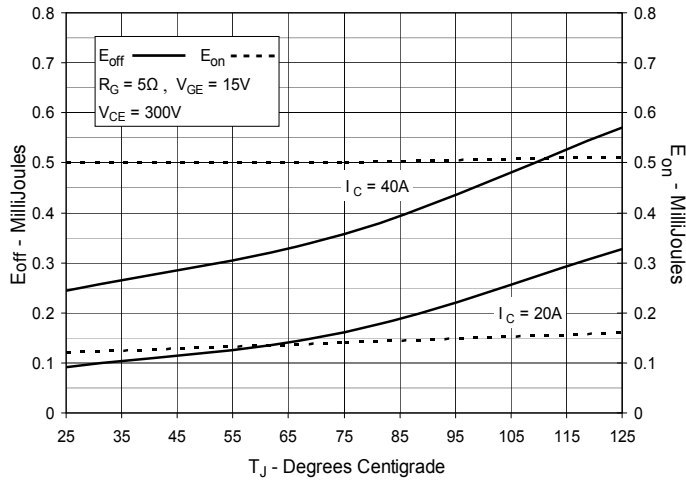
**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**



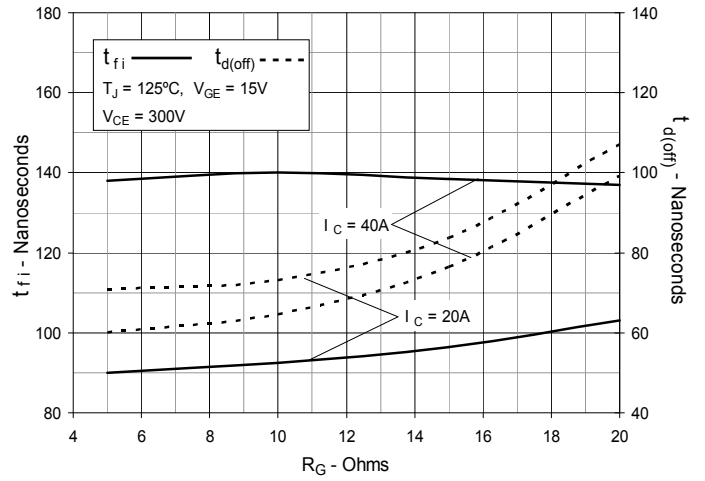
**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**



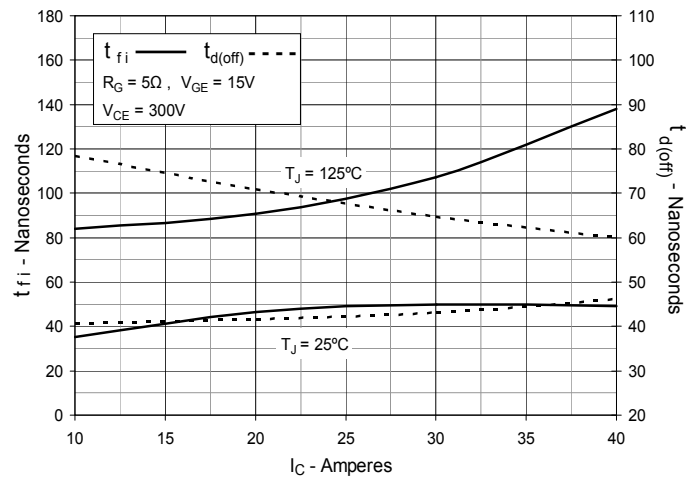
**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**



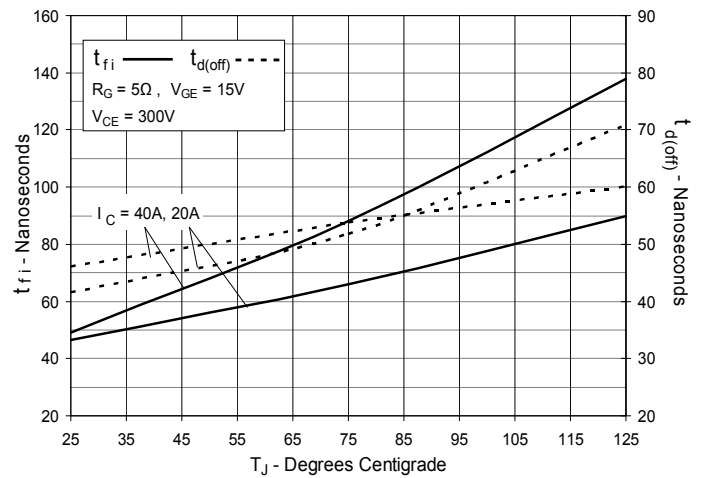
**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**



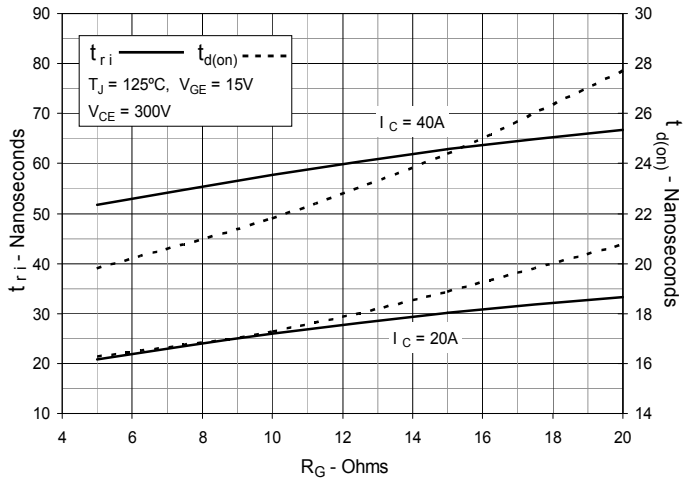
**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**



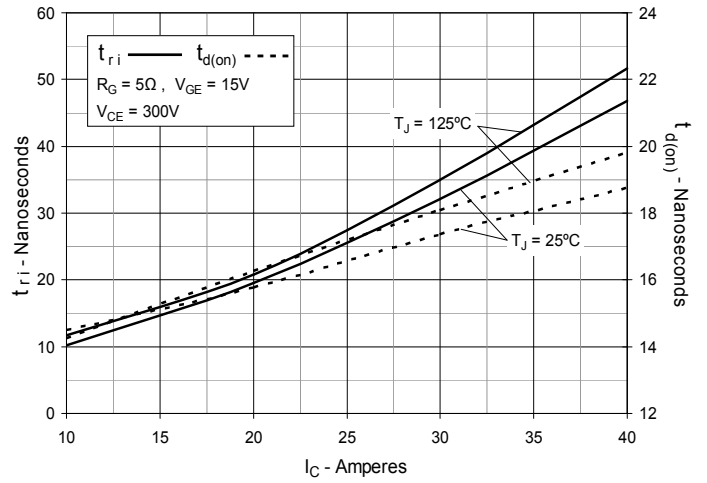
**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**



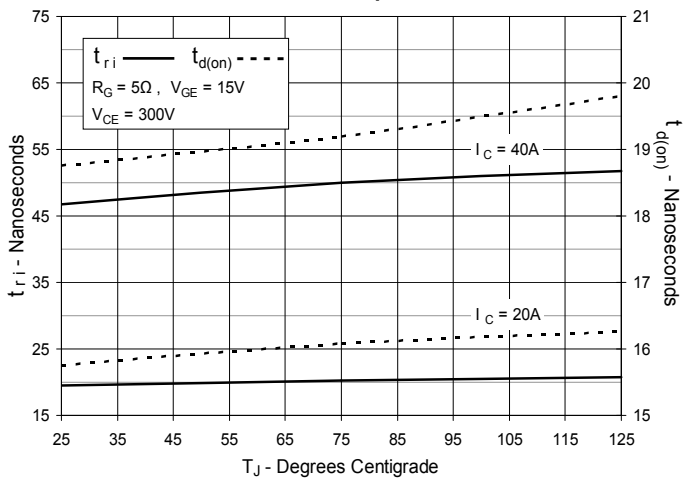
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**



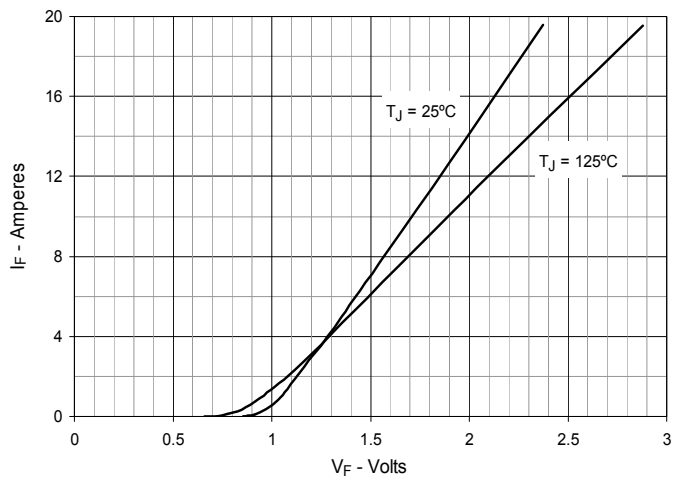
**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**



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



**Fig. 21. Forward Current vs. Forward Voltage**



**Fig. 22. Maximum Transient Thermal Impedance for Diode**

