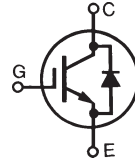


# GenX3™ 600V IGBT with Diode

# IXGH30N60C3D1 IXGT30N60C3D1

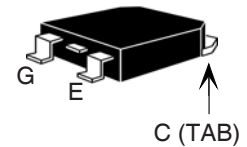
High speed PT IGBTs for  
40-100 kHz Switching



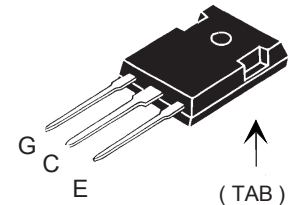
$V_{CES} = 600V$   
 $I_{C110} = 30A$   
 $V_{CE(sat)} \leq 3.0V$   
 $t_{fi(typ)} = 47ns$

| 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          |
| $I_{C25}$                     | $T_C = 25^\circ C$   | 60              | A          |
| $I_{C110}$                    | $T_C = 110^\circ C$  | 30              | A          |
| $I_{D110}$                    | $T_C = 110^\circ C$  | 30              | 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 @ $V_{CE} \leq 600V$ | $I_{CM} = 60$   | 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             | $^\circ C$ |
| $F_c$                         | Mounting torque (TO-247)   | 1.13/10         | Nm/lb.in   |
| <b>Weight</b>                 | TO-268   | 4               | g          |
|                               | TO-247   | 6               | g          |

## TO-268 (IXGT)



## TO-247 (IXGH)



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

## Features

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

## Advantages

- High power density
- Low gate drive requirement

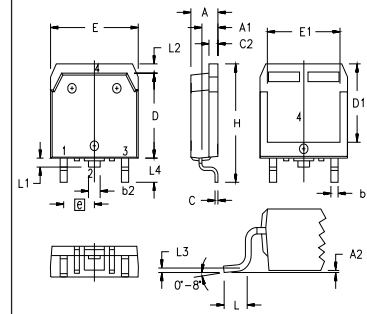
## Applications

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

| Symbol        | Test Conditions  | Characteristic Values<br>( $T_J = 25^\circ C$ , unless otherwise specified) |      |                    |
|---------------|--|---|------|--------------------|
|               |  | Min.  | Typ. | Max.               |
| $BV_{CES}$    | $I_C = 250\mu A$ , $V_{GE} = 0V$                             | 600   |      | V                  |
| $V_{GE(th)}$  | $I_C = 250\mu A$ , $V_{CE} = V_{GE}$                         | 3.5   |      | V                  |
| $I_{CES}$     | $V_{CE} = V_{CES}$<br>$V_{GE} = 0V$ $T_J = 125^\circ C$      |   |      | 75 $\mu A$<br>1 mA |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                           |   |      | $\pm 100$ 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<br>V           |

| Symbol   | Test Conditions  | Characteristic Values |      |                              |    |
|--|--|-----------------------|------|------------------------------|----|
|  |  | Min.                  | Typ. | Max.                         |    |
| $g_{fs}$   | $I_C = 20A, V_{CE} = 10V$ , Note 1   | 9                     | 30   | S                            |    |
| $C_{ies}$<br>$C_{oes}$<br>$C_{res}$  | $V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$  |                       | 915  | pF                           |    |
|  |  |                       | 78   | pF                           |    |
|  |  |                       | 32   | pF                           |    |
| $Q_g$<br>$Q_{ge}$<br>$Q_{gc}$  | $I_C = 20A, V_{GE} = 15V, V_{CE} = 0.5 \cdot V_{CES}$  |                       | 38   | nC                           |    |
|  |  |                       | 8    | nC                           |    |
|  |  |                       | 17   | nC                           |    |
| $t_{d(on)}$<br>$t_{ri}$<br>$E_{on}$<br>$t_{d(off)}$<br>$t_{fi}$<br>$E_{off}$ | Inductive load, $T_J = 25^\circ C$<br>$I_C = 20A, V_{GE} = 15V$<br>$V_{CE} = 300V, R_G = 5\Omega$  |                       | 16   | ns                           |    |
|  |  |                       | 26   | ns                           |    |
|  |  |                       | 0.27 | mJ                           |    |
|  |  |                       | 42   | 75                           | ns |
|  |  |                       | 47   | ns                           |    |
|  |  |                       | 0.09 | 0.18                         | mJ |
| $t_{d(on)}$<br>$t_{ri}$<br>$E_{on}$<br>$t_{d(off)}$<br>$t_{fi}$<br>$E_{off}$ | Inductive load, $T_J = 125^\circ C$<br>$I_C = 20A, V_{GE} = 15V$<br>$V_{CE} = 300V, R_G = 5\Omega$ |                       | 17   | ns                           |    |
|  |  |                       | 28   | ns                           |    |
|  |  |                       | 0.44 | mJ                           |    |
|  |  |                       | 70   | ns                           |    |
|  |  |                       | 90   | ns                           |    |
|  |  |                       | 0.33 | mJ                           |    |
| $R_{thJC}$<br>$R_{thCS}$   | (TO-247)   | 0.21                  | 0.56 | $^\circ C/W$<br>$^\circ C/W$ |    |

### TO-268 (IXGT) Outline



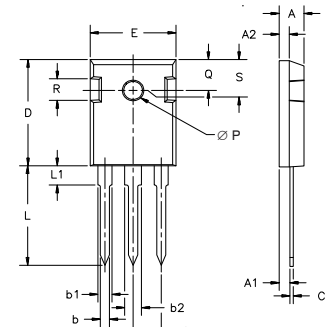
| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .193     | .201 | 4.90        | 5.10  |
| A1  | .106     | .114 | 2.70        | 2.90  |
| A2  | .001     | .010 | 0.02        | 0.25  |
| b   | .045     | .057 | 1.15        | 1.45  |
| b2  | .075     | .083 | 1.90        | 2.10  |
| C   | .016     | .026 | 0.40        | 0.65  |
| C2  | .057     | .063 | 1.45        | 1.60  |
| D   | .543     | .551 | 13.80       | 14.00 |
| D1  | .488     | .500 | 12.40       | 12.70 |
| E   | .624     | .632 | 15.85       | 16.05 |
| E1  | .524     | .535 | 13.30       | 13.60 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| H   | .736     | .752 | 18.70       | 19.10 |
| L   | .094     | .106 | 2.40        | 2.70  |
| L1  | .047     | .055 | 1.20        | 1.40  |
| L2  | .039     | .045 | 1.00        | 1.15  |
| L3  | .010 BSC |      | 0.25 BSC    |       |
| L4  | .150     | .161 | 3.80        | 4.10  |

### Reverse Diode (FRED)

| Symbol               | Test Conditions   | Characteristic Values |      |                  |
|----------------------|---|-----------------------|------|------------------|
|                      |   | Min.                  | Typ. | Max.             |
| $V_F$                | $I_F = 30A, V_{GE} = 0V$ , Note 1<br>$T_J = 150^\circ C$  |                       | 1.6  | 2.7 V            |
| $I_{RM}$<br>$t_{rr}$ | $I_F = 30A, V_{GE} = 0V, -di_F/dt = 100A/\mu s, T_J = 100^\circ C$<br>$V_R = 100V, T_J = 100^\circ C$<br>$I_F = 1A, -di/dt = 100A/\mu s, V_R = 30V$ |                       | 100  | 4 A              |
|                      |   |                       | 25   | ns               |
| $R_{thJC}$           |   |                       |      | 0.9 $^\circ C/W$ |

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

### TO-247 AD Outline



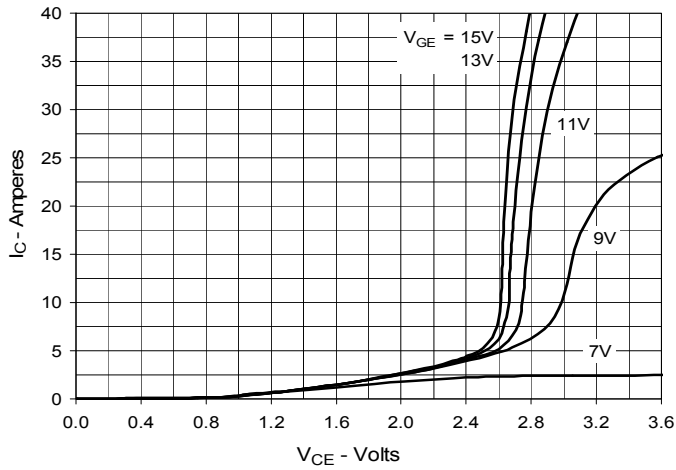
| Dim.           | Millimeter |       | Inches |       |
|----------------|------------|-------|--------|-------|
|                | Min.       | Max.  | Min.   | Max.  |
| A              | 4.7        | 5.3   | .185   | .209  |
| A <sub>1</sub> | 2.2        | 2.54  | .087   | .102  |
| A <sub>2</sub> | 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  |
| ∅P             | 3.55       | 3.65  | .140   | .144  |
| Q              | 5.89       | 6.40  | 0.232  | 0.252 |
| R              | 4.32       | 5.49  | .170   | .216  |

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

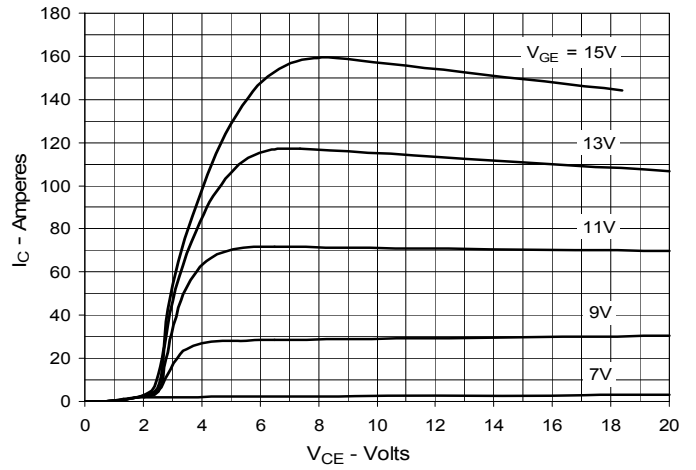
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

|           |           |           |           |              |              |              |              |              |             |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 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    |             |

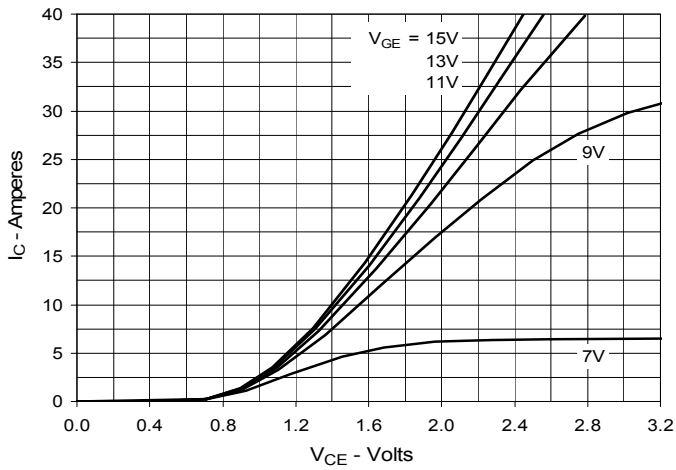
**Fig. 1. Output Characteristics @ 25°C**



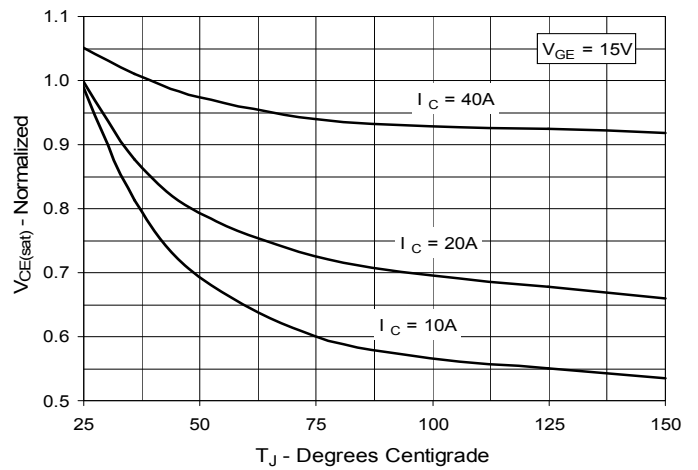
**Fig. 2. Extended Output Characteristics @ 25°C**



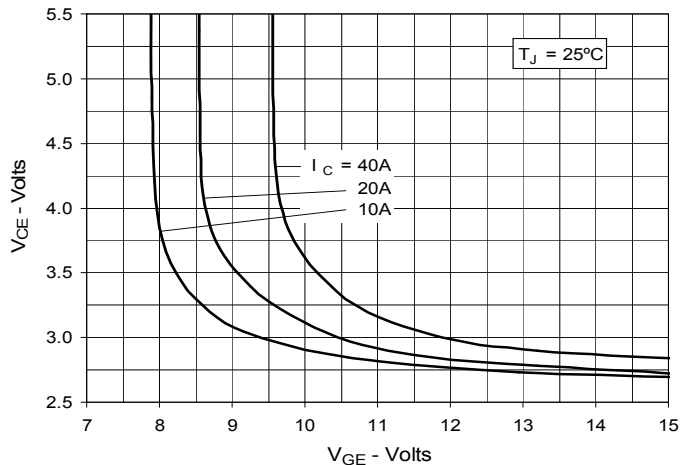
**Fig. 3. Output Characteristics @ 125°C**



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



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



**Fig. 6. Input Admittance**

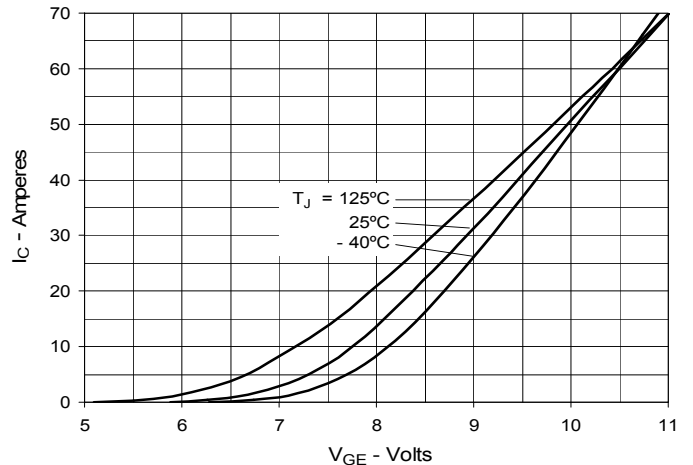


Fig. 7. Transconductance

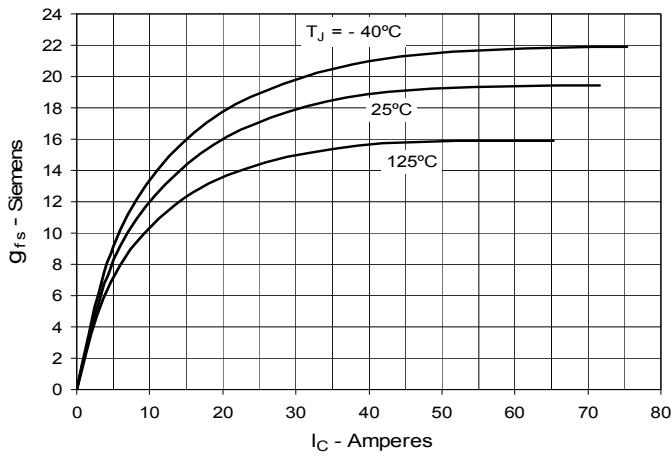


Fig. 8. Gate Charge

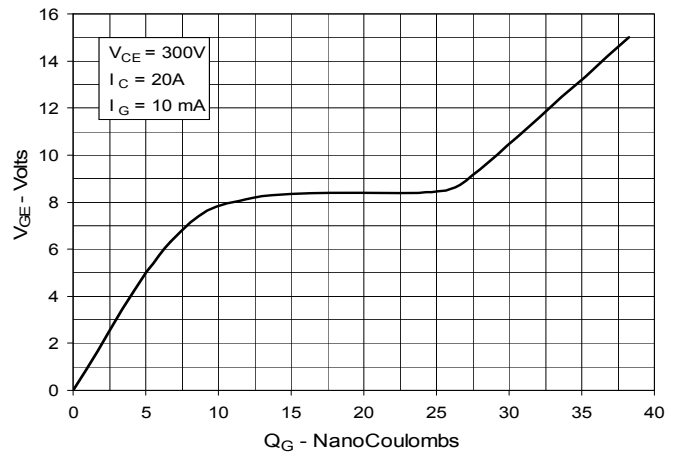


Fig. 9. Capacitance

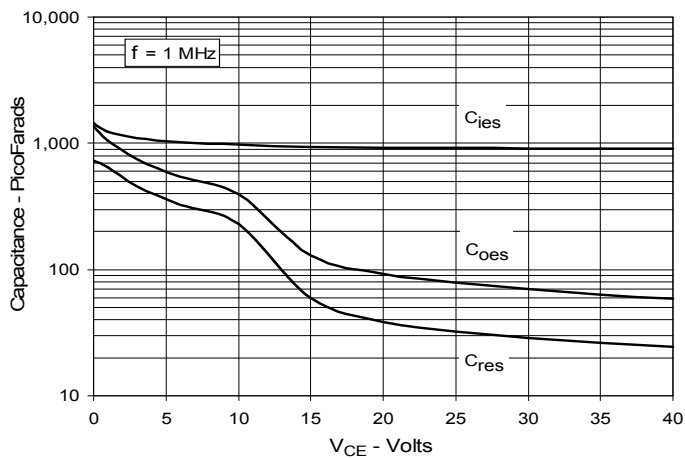


Fig. 10. Reverse-Bias Safe Operating Area

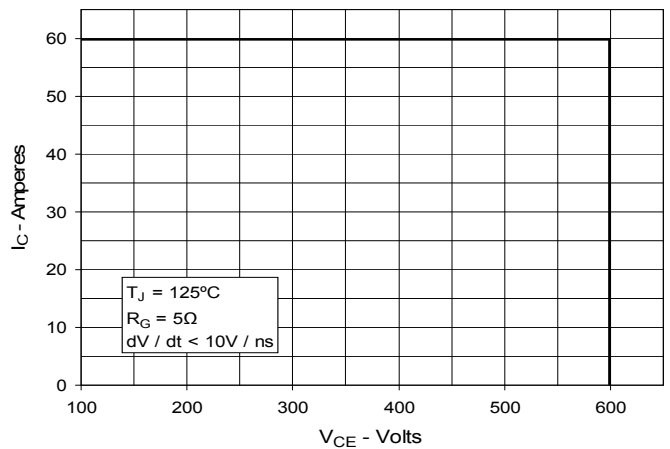
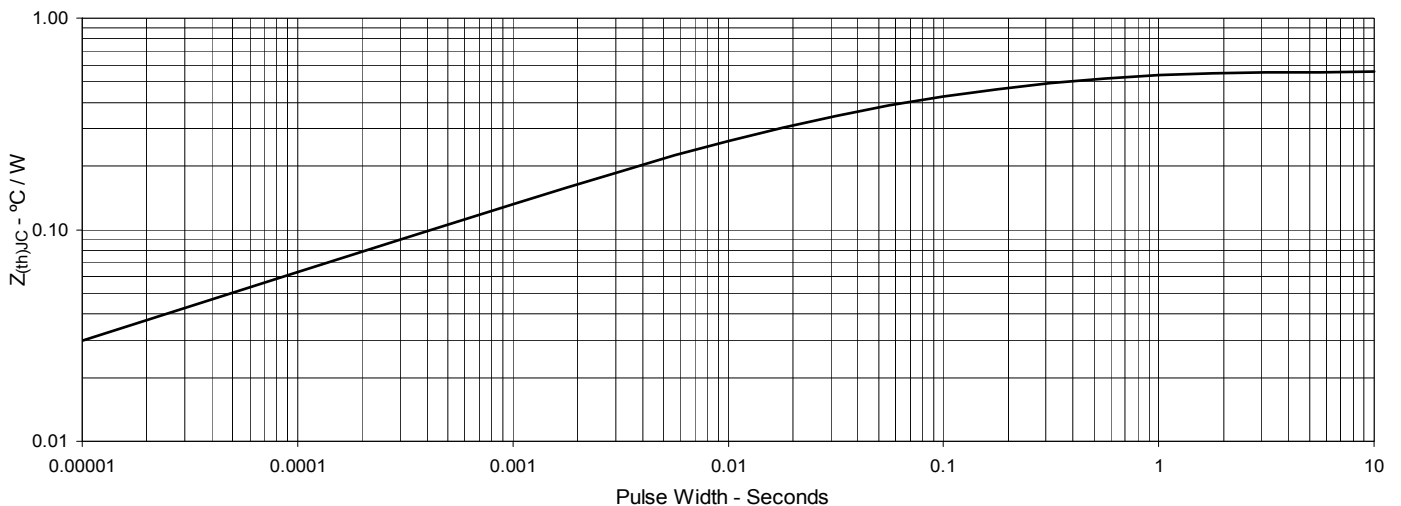
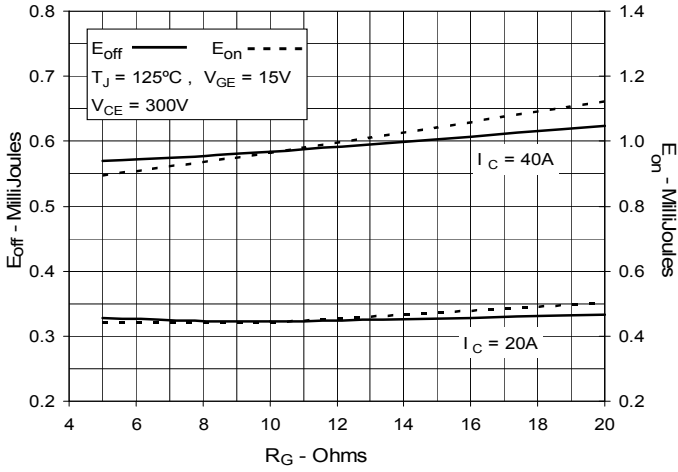


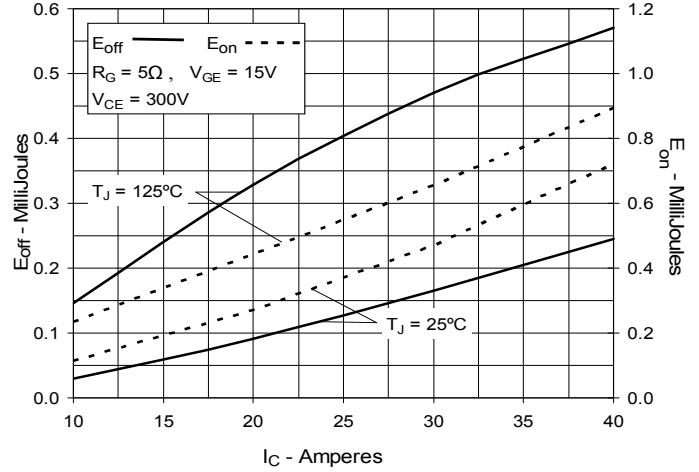
Fig. 11. Maximum Transient Thermal Impedance



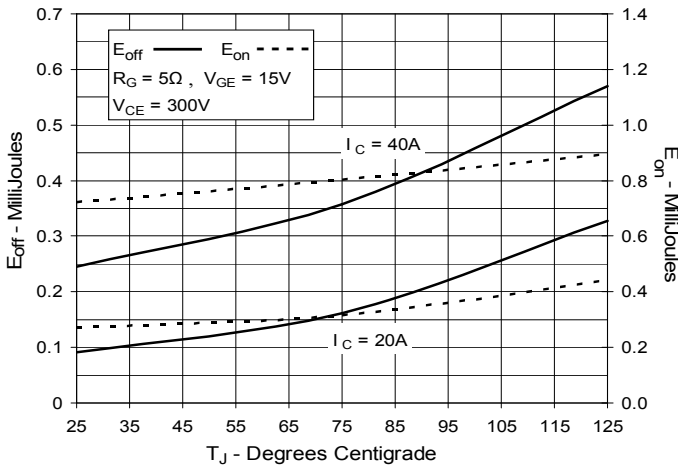
**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**



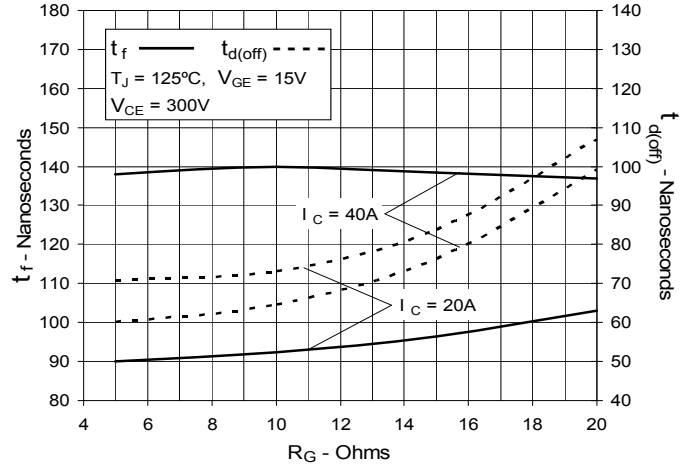
**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**



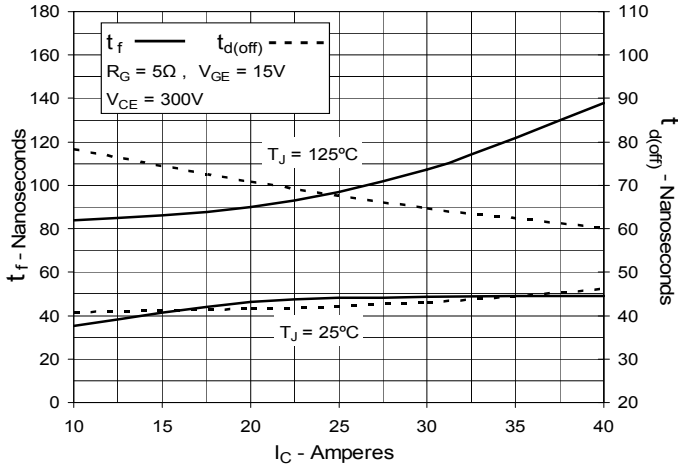
**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**



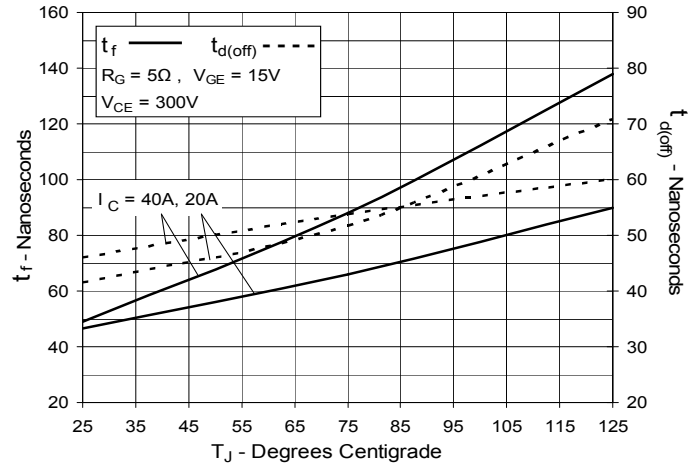
**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**



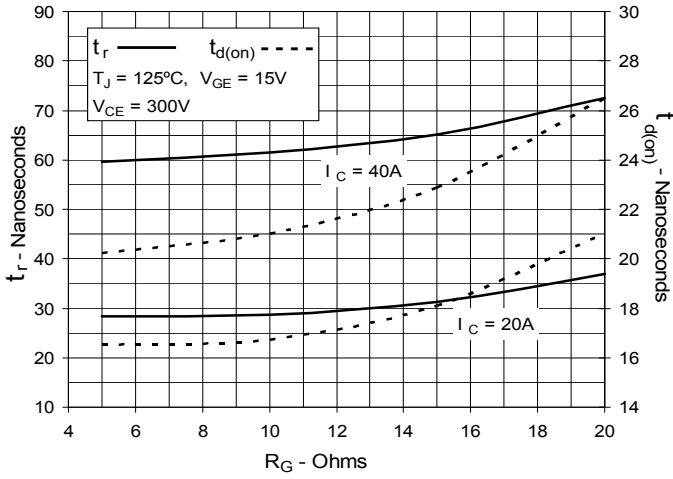
**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**



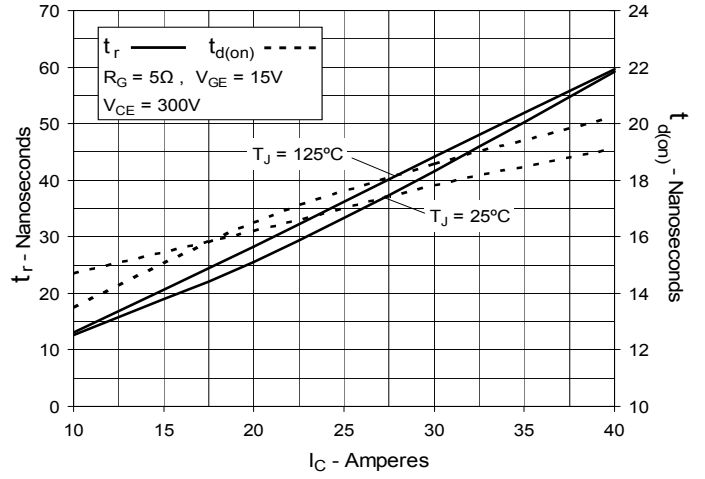
**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**



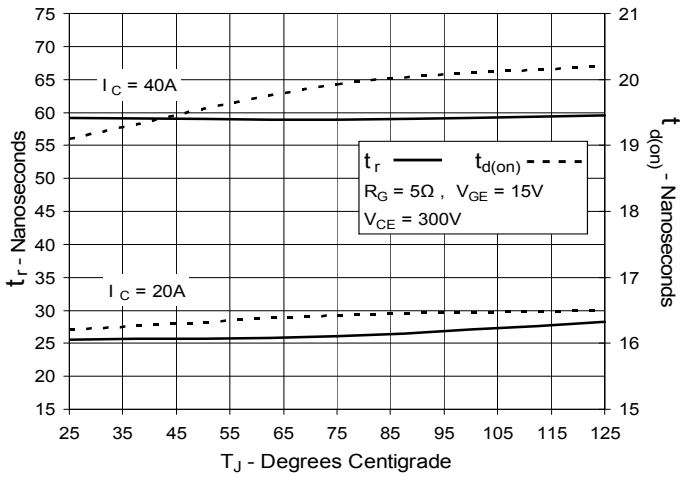
**Fig. 18. Inductive Turn-on  
Switching Times vs. Gate Resistance**



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



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



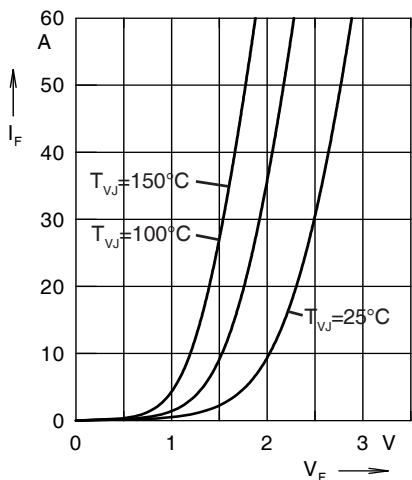


Fig. 21. Forward current  $I_F$  versus  $V_F$

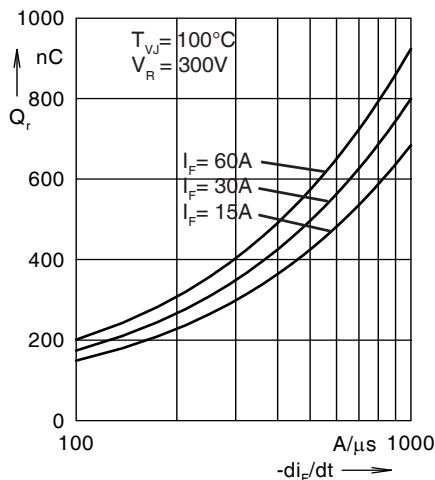


Fig. 22. Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

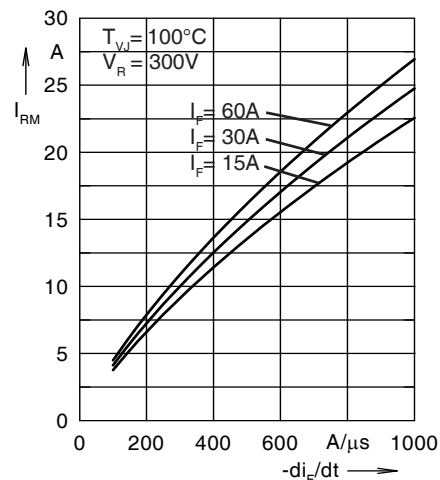


Fig. 23. Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

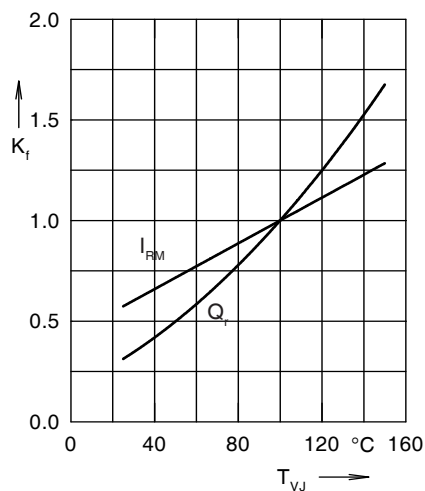


Fig. 24. Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

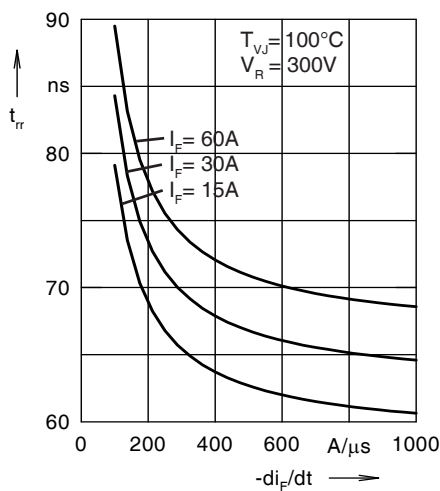


Fig. 25. Recovery time  $t_{rr}$  versus  $-di_F/dt$

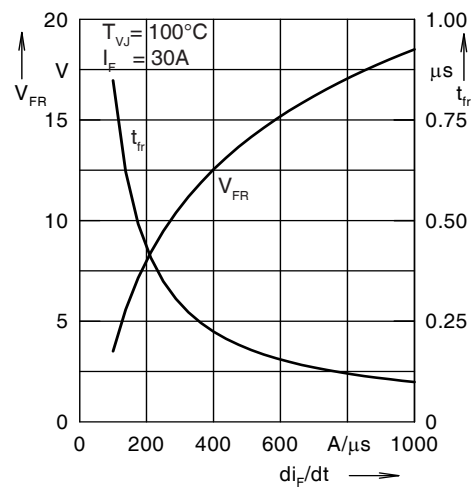


Fig. 26. Peak forward voltage  $V_{FR}$  and  $t_{rr}$  versus  $di_F/dt$

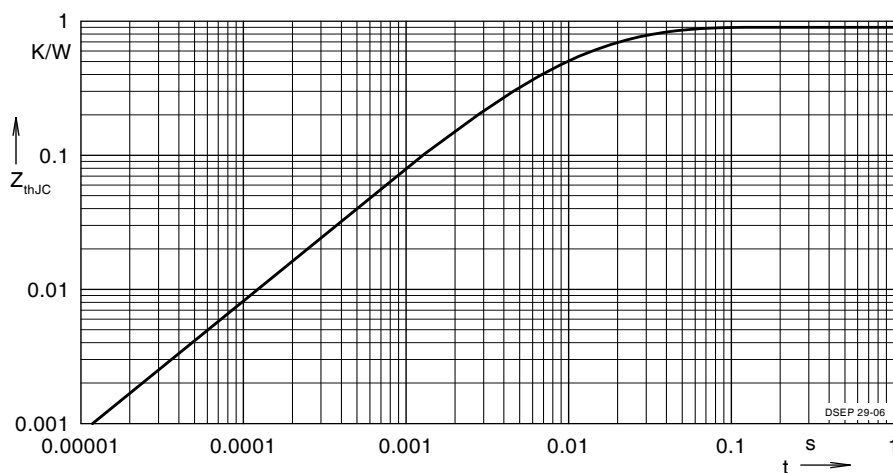


Fig. 27. Transient thermal resistance junction to case

Constants for  $Z_{thJC}$  calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|-----------------|-----------|
| 1 | 0.502           | 0.0052    |
| 2 | 0.193           | 0.0003    |
| 3 | 0.205           | 0.0162    |