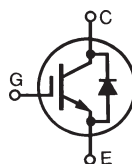


# XPT™ 600V IGBTs GenX3™ w/ Diode

# IXXK100N60B3H1 IXXX100N60B3H1

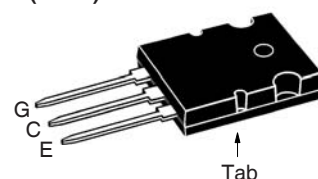
Extreme Light Punch Through  
IGBT for 10-30kHz Switching



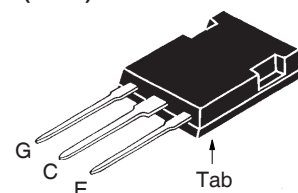
$$\begin{aligned} V_{CES} &= 600V \\ I_{C100} &= 100A \\ V_{CE(sat)} &\leq 1.80V \\ t_{fi(typ)} &= 150ns \end{aligned}$$

| 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          |
| $I_{C25}$                     | $T_C = 25^\circ C$ (Chip Capability)                                                        | 200                                       | A          |
| $I_{LRMS}$                    | Terminal Current Limit                                                                      | 160                                       | A          |
| $I_{C100}$                    | $T_C = 100^\circ C$                                                                         | 100                                       | A          |
| $I_{F110}$                    | $T_C = 110^\circ C$                                                                         | 65                                        | A          |
| $I_{CM}$                      | $T_C = 25^\circ C$ , 1ms                                                                    | 440                                       | A          |
| $I_A$                         | $T_C = 25^\circ C$                                                                          | 50                                        | A          |
| $E_{AS}$                      | $T_C = 25^\circ C$                                                                          | 600                                       | mJ         |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_{VJ} = 150^\circ C$ , $R_G = 2\Omega$<br>Clamped Inductive Load         | $I_{CM} = 200$<br>@ $V_{CE} \leq V_{CES}$ | A          |
| $t_{sc}$<br><b>(SCSOA)</b>    | $V_{GE} = 15V$ , $V_{CE} = 360V$ , $T_J = 150^\circ C$<br>$R_G = 10\Omega$ , Non Repetitive | 10                                        | $\mu s$    |
| $P_C$                         | $T_C = 25^\circ C$                                                                          | 695                                       | W          |
| $T_J$                         |                                                                                             | -55 ... +150                              | $^\circ C$ |
| $T_{JM}$                      |                                                                                             | 150                                       | $^\circ C$ |
| $T_{stg}$                     |                                                                                             | -55 ... +150                              | $^\circ C$ |
| $T_L$                         | Maximum Lead Temperature for Soldering                                                      | 300                                       | $^\circ C$ |
| $T_{SOLD}$                    | 1.6 mm (0.062in.) from Case for 10s                                                         | 260                                       | $^\circ C$ |
| $M_d$                         | Mounting Torque (TO-264)                                                                    | 1.13/10                                   | Nm/lb.in.  |
| $F_C$                         | Mounting Force (PLUS247)                                                                    | 20..120 /4.5..27                          | N/lb.      |
| <b>Weight</b>                 | TO-264                                                                                      | 10                                        | g          |
|                               | PLUS247                                                                                     | 6                                         | g          |

TO-264 (IXXK)



PLUS247 (IXXX)



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

## Features

- Optimized for 10-30kHz Switching
- Square RBSOA
- Avalanche Rated
- Short Circuit Capability
- Anti-Parallel Ultra Fast Diode
- High Current Handling Capability

## 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>$T_J = 125^\circ C$             |                       |              | 50 $\mu A$<br>4 mA |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |              | $\pm 100$ nA       |
| $V_{CE(sat)}$ | $I_C = 70A$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 150^\circ C$          |                       | 1.50<br>1.77 | V<br>V             |

**Symbol Test Conditions**
 $(T_J = 25^\circ\text{C Unless Otherwise Specified})$ 
**Characteristic Values**
**Min. Typ. Max.**

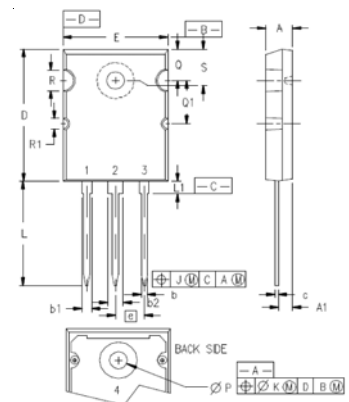
|              |                                                                                                                                 |    |      |                   |
|--------------|---------------------------------------------------------------------------------------------------------------------------------|----|------|-------------------|
| $g_{fs}$     | $I_C = 60A, V_{CE} = 10V, \text{Note 1}$                                                                                        | 22 | 40   | S                 |
| $C_{ies}$    | $V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$                                                                                           |    | 4860 | pF                |
| $C_{oes}$    |                                                                                                                                 |    | 475  | pF                |
| $C_{res}$    |                                                                                                                                 |    | 83   | pF                |
| $Q_{g(on)}$  | $I_C = 70A, V_{GE} = 15V, V_{CE} = 0.5 \bullet V_{CES}$                                                                         |    | 143  | nC                |
| $Q_{ge}$     |                                                                                                                                 |    | 37   | nC                |
| $Q_{gc}$     |                                                                                                                                 |    | 60   | nC                |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^{\circ}C</math></b><br>$I_C = 70A, V_{GE} = 15V$<br>$V_{CE} = 360V, R_G = 2\Omega$<br>Note 2  |    | 30   | ns                |
| $t_{ri}$     |                                                                                                                                 |    | 70   | ns                |
| $E_{on}$     |                                                                                                                                 |    | 1.9  | mJ                |
| $t_{d(off)}$ |                                                                                                                                 |    | 120  | ns                |
| $t_{fi}$     |                                                                                                                                 |    | 150  | ns                |
| $E_{off}$    |                                                                                                                                 |    | 2.0  | 2.8 mJ            |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 150^{\circ}C</math></b><br>$I_C = 70A, V_{GE} = 15V$<br>$V_{CE} = 360V, R_G = 2\Omega$<br>Note 2 |    | 32   | ns                |
| $t_{ri}$     |                                                                                                                                 |    | 60   | ns                |
| $E_{on}$     |                                                                                                                                 |    | 2.3  | mJ                |
| $t_{d(off)}$ |                                                                                                                                 |    | 150  | ns                |
| $t_{fi}$     |                                                                                                                                 |    | 200  | ns                |
| $E_{off}$    |                                                                                                                                 |    | 2.8  | mJ                |
| $R_{thJC}$   |                                                                                                                                 |    | 0.15 | $0.18^{\circ}C/W$ |
| $R_{thCS}$   |                                                                                                                                 |    |      | $^{\circ}C/W$     |

**Reverse Diode (FRED)**
**Symbol Test Conditions**
 $(T_J = 25^\circ\text{C Unless Otherwise Specified})$ 
**Characteristic Values**
**Min. Typ. Max.**

|            |                                                                  |                      |            |            |               |
|------------|------------------------------------------------------------------|----------------------|------------|------------|---------------|
| $V_F$      | $I_F = 60A, V_{GE} = 0V, \text{Note 1}$                          | $T_J = 150^{\circ}C$ | 1.6<br>1.4 | 2.5<br>1.8 | V<br>V        |
| $I_{RM}$   | $I_F = 60A, V_{GE} = 0V,$<br>$-di_F/dt = 200A/\mu s, V_R = 300V$ | $T_J = 100^{\circ}C$ | 8.3        |            | A             |
| $t_{rr}$   |                                                                  |                      | 140        |            | ns            |
| $R_{thJC}$ |                                                                  |                      |            | 0.30       | $^{\circ}C/W$ |

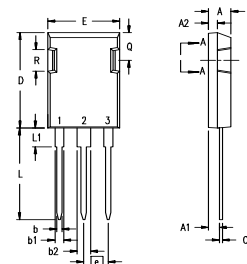
**Notes:**

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-264 Outline**


Terminals: 1 = Gate  
2,4 = Collector  
3 = Emitter

| SYM | INCHES   |       | MILLIMETERS |       |
|-----|----------|-------|-------------|-------|
|     | MIN      | MAX   | MIN         | MAX   |
| A   | .185     | .209  | 4.70        | 5.31  |
| A1  | .102     | .118  | 2.59        | 3.00  |
| b   | .037     | .055  | 0.94        | 1.40  |
| b1  | .087     | .102  | 2.21        | 2.59  |
| b2  | .110     | .126  | 2.79        | 3.20  |
| c   | .017     | .029  | 0.43        | 0.74  |
| D   | 1.007    | 1.047 | 25.58       | 26.59 |
| E   | .760     | .799  | 19.30       | 20.29 |
| e   | .215 BSC |       | 5.46 BSC    |       |
| J   | .000     | .010  | 0.00        | 0.25  |
| K   | .000     | .010  | 0.00        | 0.25  |
| L   | .779     | .842  | 19.79       | 21.39 |
| L1  | .087     | .102  | 2.21        | 2.59  |
| ØP  | .122     | .138  | 3.10        | 3.51  |
| Q   | .240     | .256  | 6.10        | 6.50  |
| Q1  | .330     | .346  | 8.38        | 8.79  |
| ØR  | .155     | .187  | 3.94        | 4.75  |
| ØR1 | .085     | .093  | 2.16        | 2.36  |
| S   | .243     | .253  | 6.17        | 6.43  |

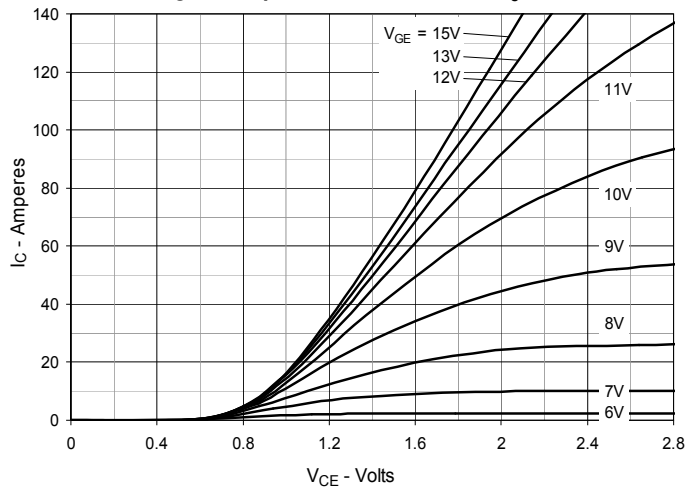
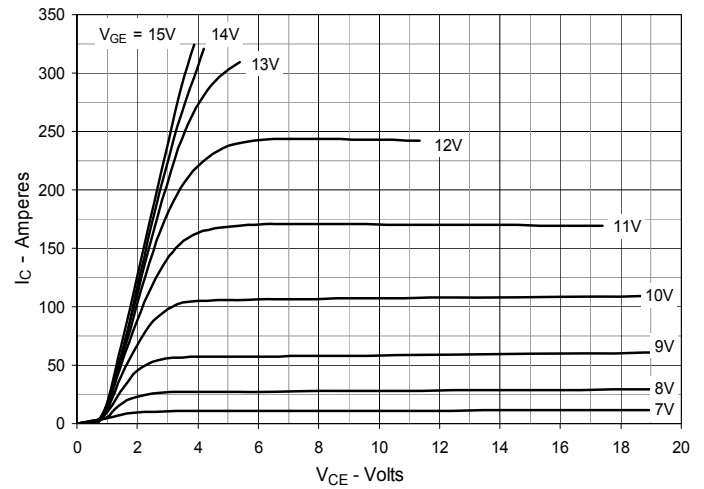
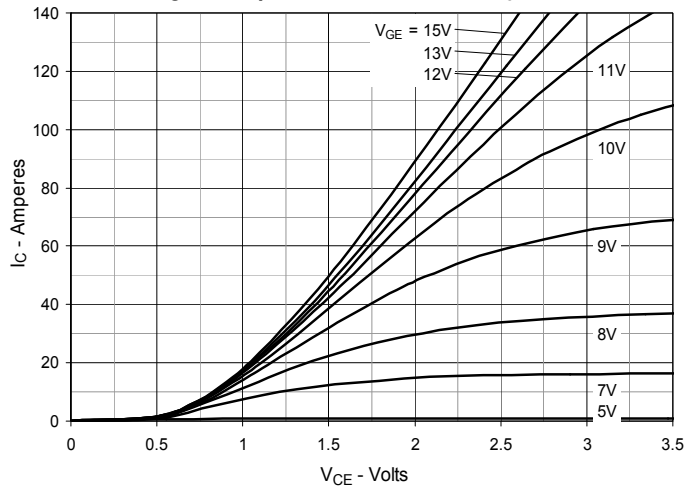
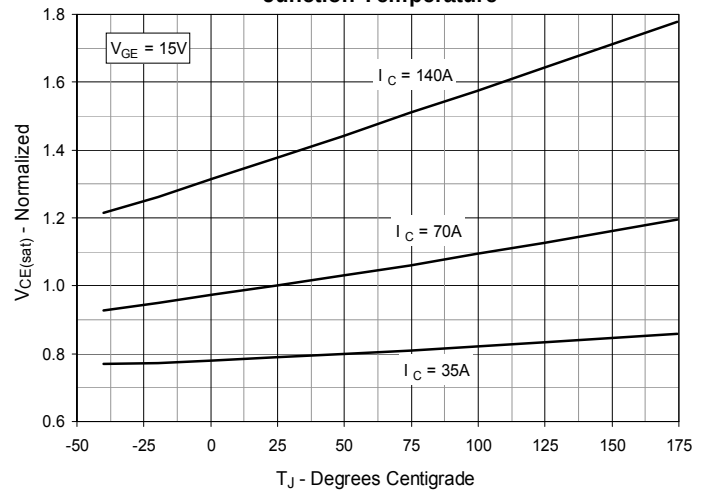
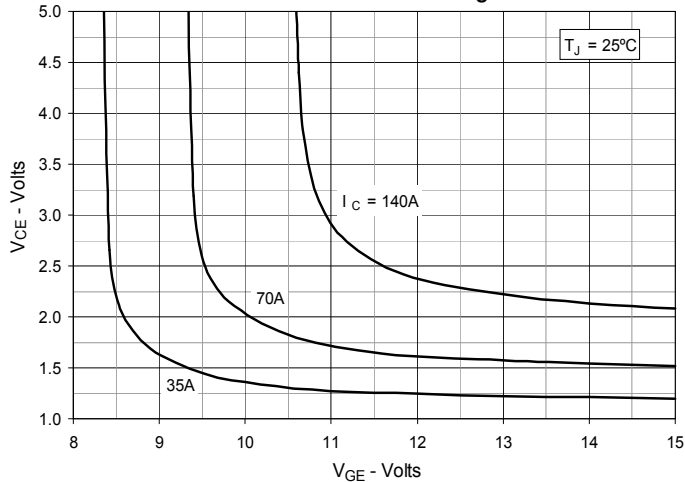
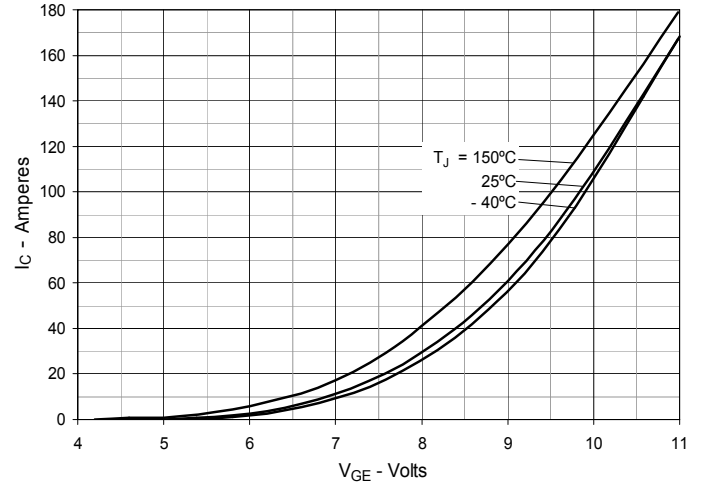
**PLUS247™ Outline**


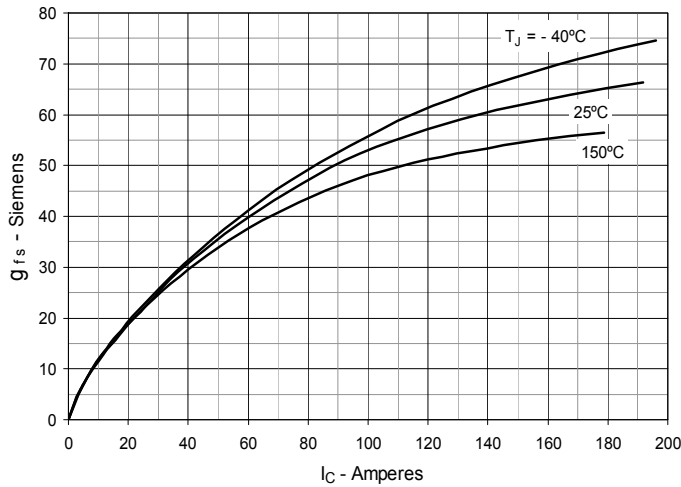
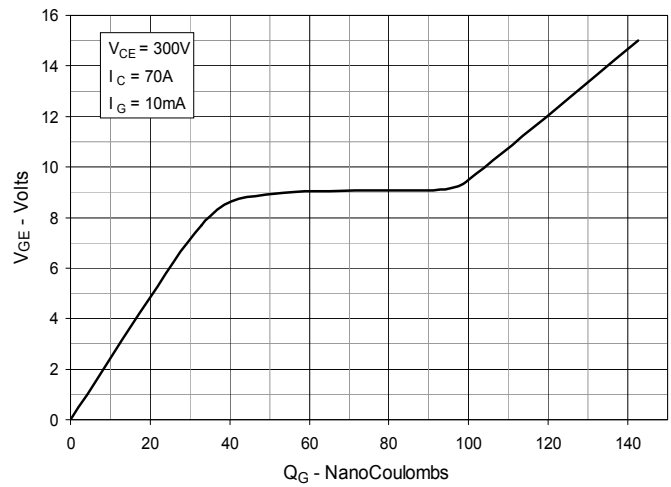
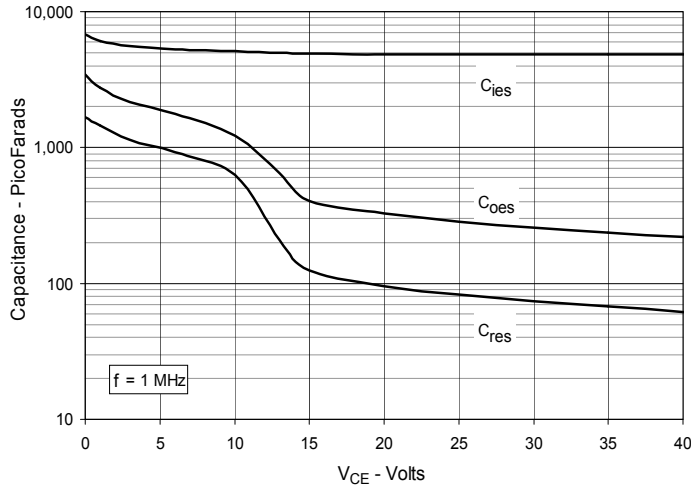
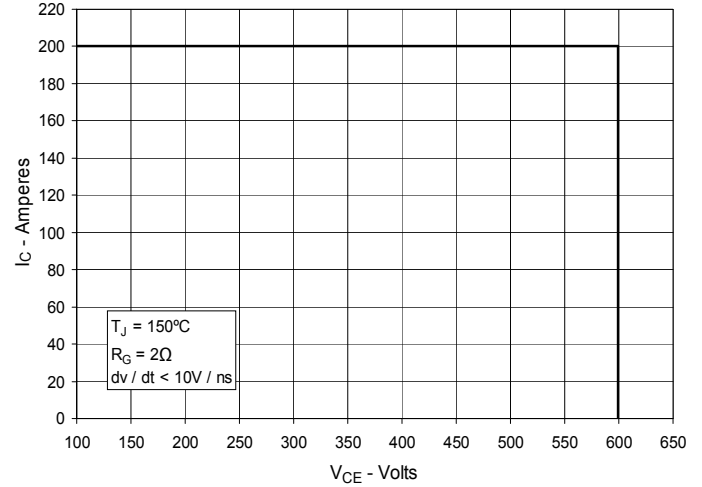
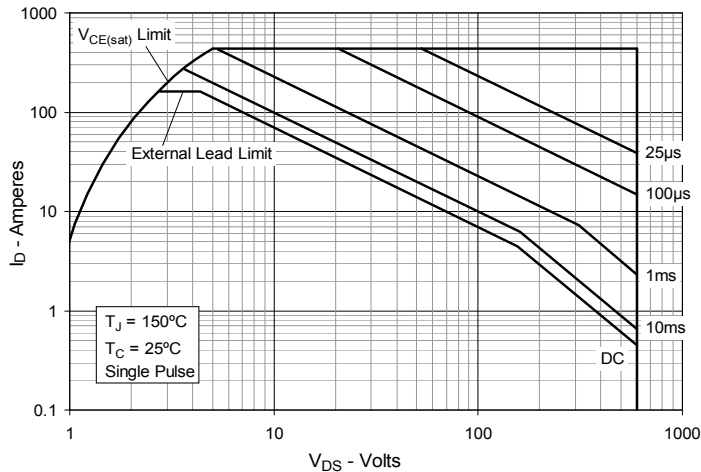
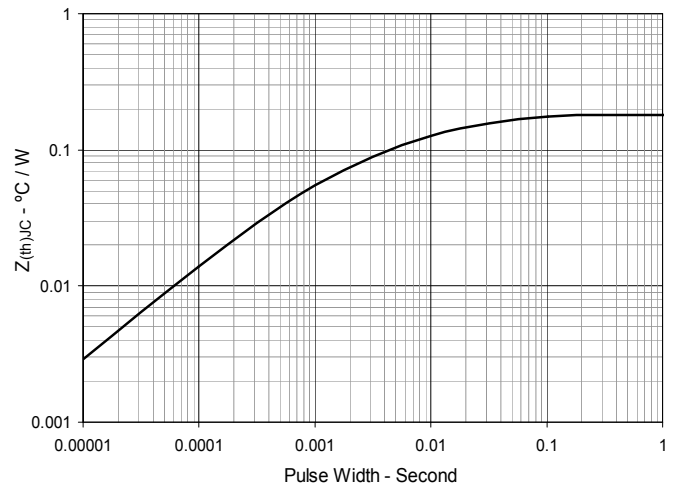
Terminals: 1 - Gate  
2 - Collector  
3 - Emitter

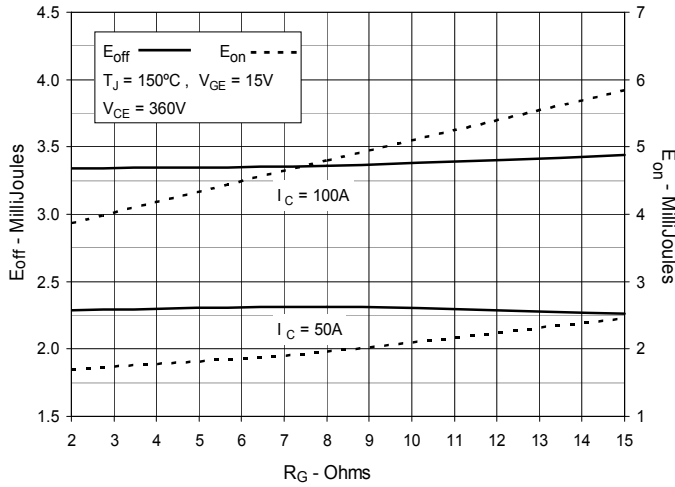
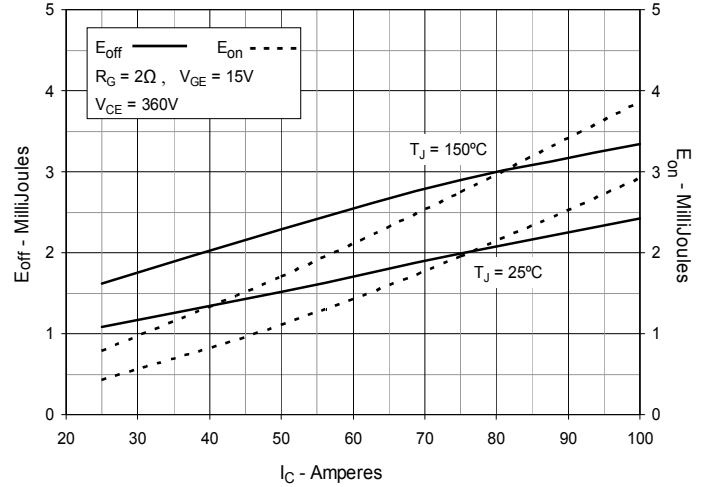
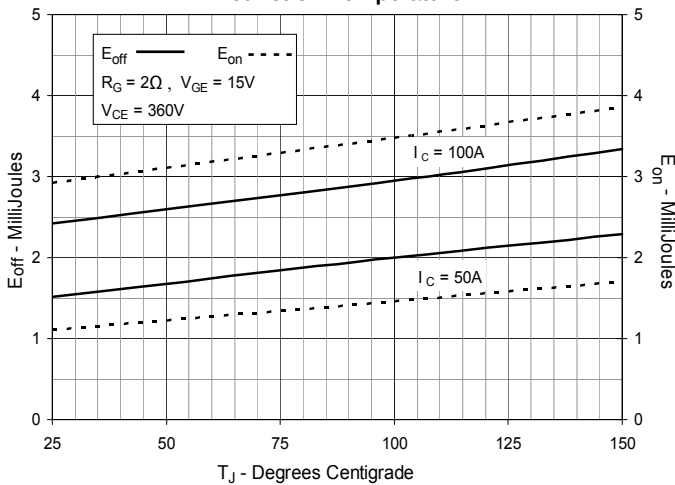
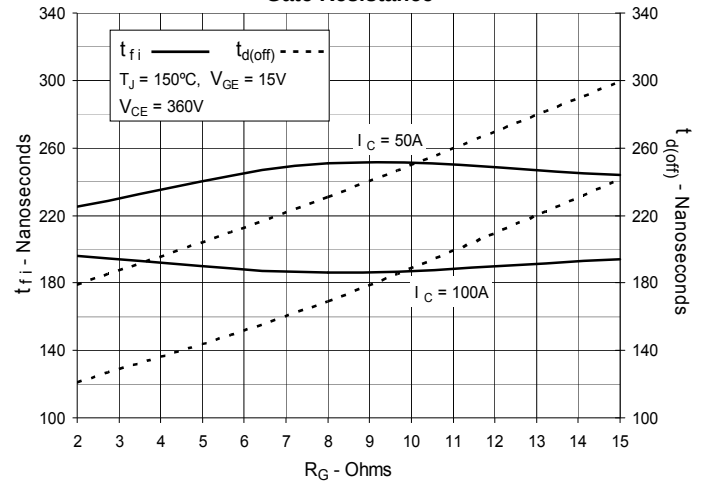
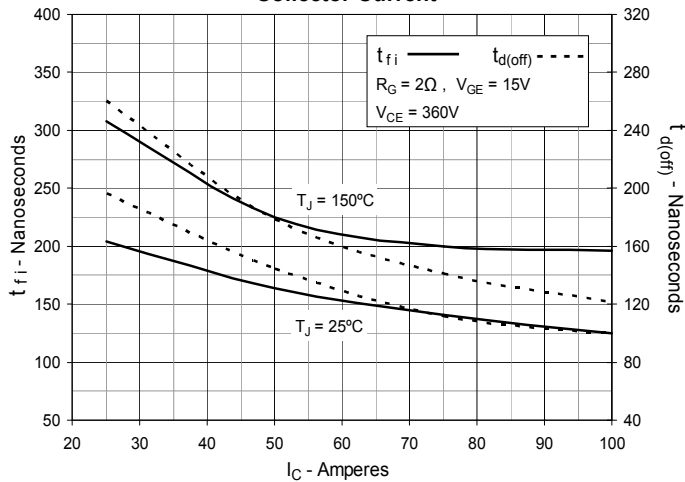
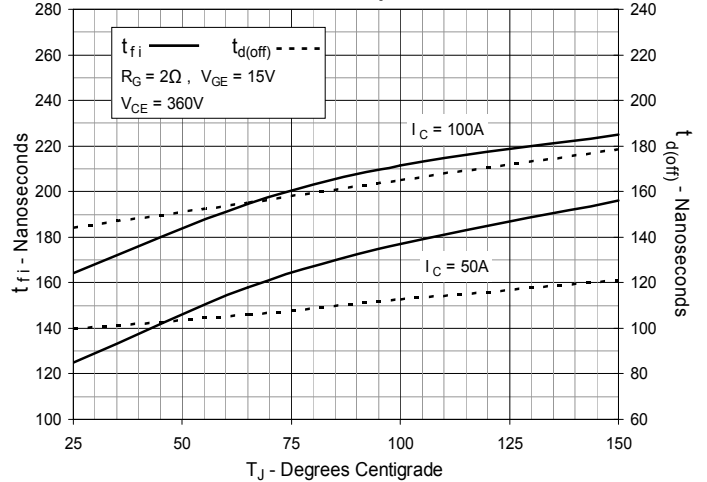
| Dim. | Millimeter |       | Inches   |       |
|------|------------|-------|----------|-------|
|      | Min.       | Max.  | Min.     | Max.  |
| A    | 4.83       | 5.21  | .190     | .205  |
| A1   | 2.29       | 2.54  | .090     | .100  |
| A2   | 1.91       | 2.16  | .075     | .085  |
| b    | 1.14       | 1.40  | .045     | .055  |
| b1   | 1.91       | 2.13  | .075     | .084  |
| b2   | 2.92       | 3.12  | .115     | .123  |
| C    | 0.61       | 0.80  | .024     | .031  |
| D    | 20.80      | 21.34 | .819     | .840  |
| E    | 15.75      | 16.13 | .620     | .635  |
| e    | 5.45 BSC   |       | .215 BSC |       |
| L    | 19.81      | 20.32 | .780     | .800  |
| L1   | 3.81       | 4.32  | .150     | .170  |
| Q    | 5.59       | 6.20  | .220     | 0.244 |
| R    | 4.32       | 4.83  | .170     | .190  |

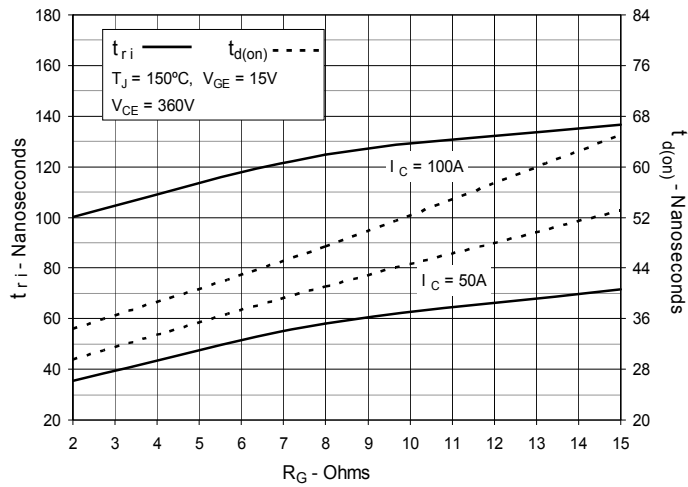
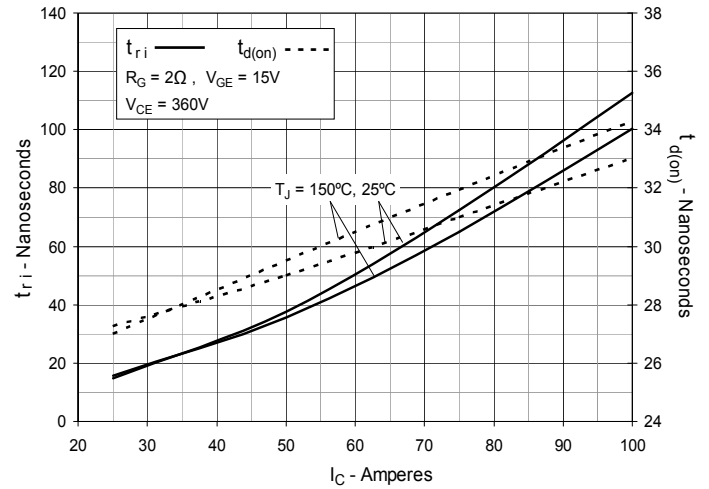
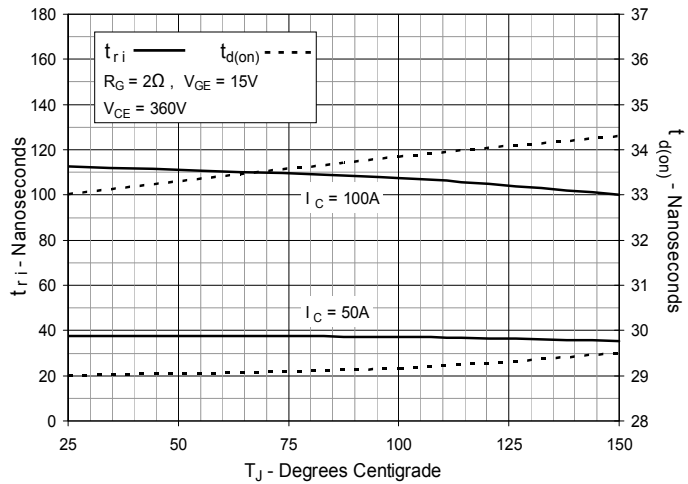
IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

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: 4,860,072 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 @  $T_J = 25^\circ\text{C}$** 

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

**Fig. 3. Output Characteristics @  $T_J = 150^\circ\text{C}$** 

**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. Forward-Bias Safe Operating Area**

**Fig. 12. Maximum Transient Thermal Impedance**


**Fig. 13. Inductive Switching Energy Loss vs. Gate Resistance**

**Fig. 14. Inductive Switching Energy Loss vs. Collector Current**

**Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature**

**Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance**

**Fig. 17. Inductive Turn-off Switching Times vs. Collector Current**

**Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature**


**Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance**

**Fig. 20. Inductive Turn-on Switching Times vs. Collector Current**

**Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature**


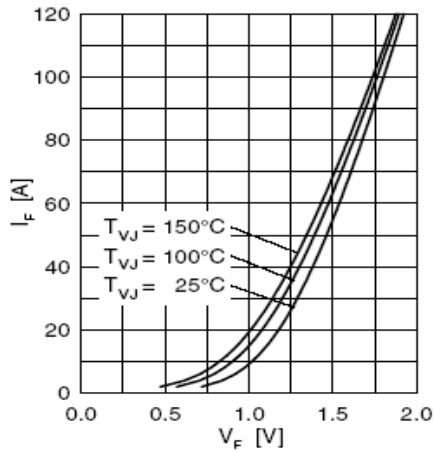


Fig. 22. Forward Current  $I_F$  Versus  $V_F$

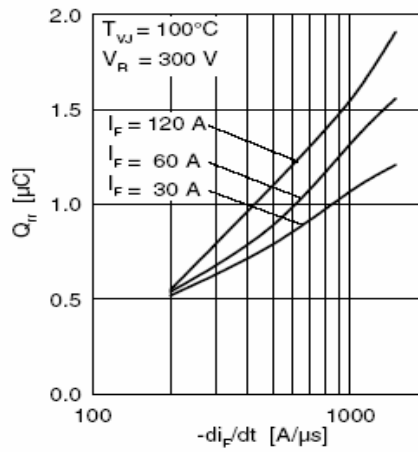


Fig. 23. Reverse Recovery Charge  $Q_{rr}$  Versus  $-di_F/dt$

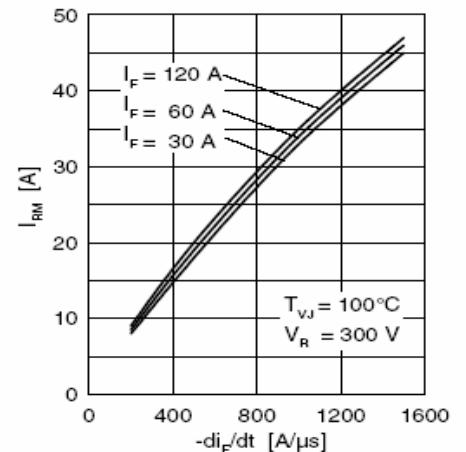


Fig. 24. Peak Reverse Current  $I_{RM}$  Versus  $-di_F/dt$

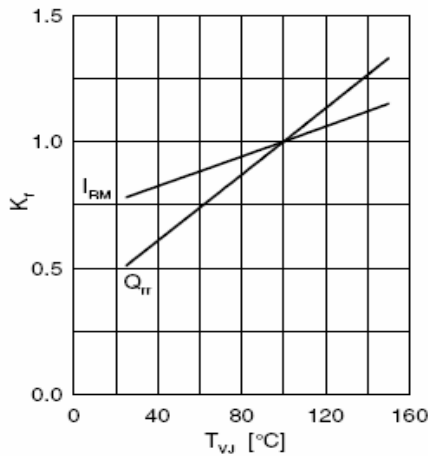


Fig. 25. Dynamic Parameters  $Q_{rr}$ ,  $I_{RM}$  Versus  $T_{VJ}$

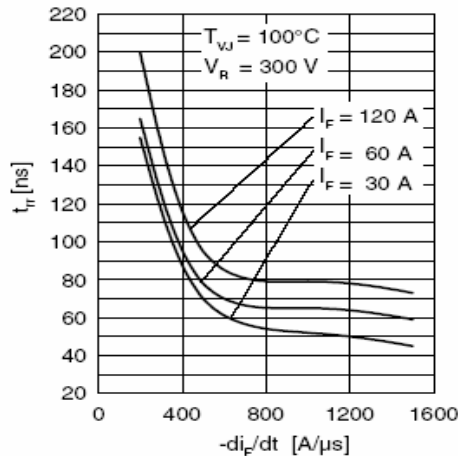


Fig. 26. Recovery Time  $t_{rr}$  Versus  $-di_F/dt$

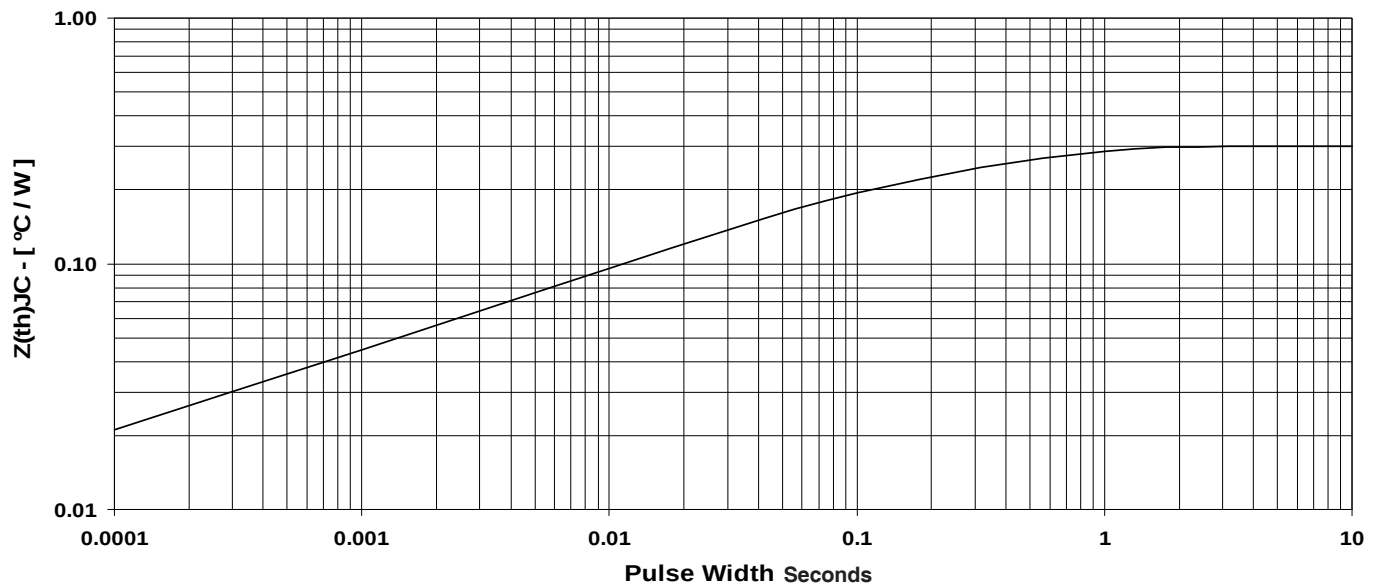


Fig. 27. Maximum transient thermal impedance junction to case (for diode)



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