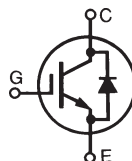


# High Voltage XPT™ IGBT w/ Diode

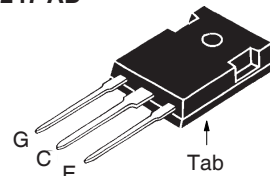
## IXYH24N170CV1



$$\begin{aligned} V_{CES} &= 1700V \\ I_{C110} &= 24A \\ V_{CE(sat)} &\leq 4.0V \\ t_{fi(typ)} &= 78ns \end{aligned}$$

| Symbol                  | Test Conditions                                                                     | Maximum Ratings |            |
|-------------------------|-------------------------------------------------------------------------------------|-----------------|------------|
| $V_{CES}$               | $T_J = 25^\circ C$ to $175^\circ C$                                                 | 1700            | V          |
| $V_{CGR}$               | $T_J = 25^\circ C$ to $175^\circ C$ , $R_{GE} = 1M\Omega$                           | 1700            | V          |
| $V_{GES}$               | Continuous                                                                          | $\pm 20$        | V          |
| $V_{GEM}$               | Transient                                                                           | $\pm 30$        | V          |
| $I_{C25}$               | $T_C = 110^\circ C$                                                                 | 58              | A          |
| $I_{C110}$              | $T_C = 110^\circ C$                                                                 | 24              | A          |
| $I_{F110}$              | $T_C = 110^\circ C$                                                                 | 28              | A          |
| $I_{CM}$                | $T_C = 25^\circ C$ , 1ms                                                            | 140             | A          |
| <b>SSOA<br/>(RBSOA)</b> | $V_{GE} = 15V$ , $T_{VJ} = 150^\circ C$ , $R_G = 5\Omega$<br>Clamped Inductive Load | $I_{CM} = 96$   | A          |
|                         |                                                                                     | 1360            | V          |
| $P_C$                   | $T_C = 25^\circ C$                                                                  | 500             | W          |
| $T_J$                   |                                                                                     | -55 ... +175    | $^\circ C$ |
| $T_{JM}$                |                                                                                     | 175             | $^\circ C$ |
| $T_{stg}$               |                                                                                     | -55 ... +175    | $^\circ C$ |
| $T_L$                   | 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                                                                     | 1.13/10         | Nm/lb.in.  |
| <b>Weight</b>           |                                                                                     | 6               | g          |

### TO-247 AD



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

### Features

- High Voltage Package
- High Blocking Voltage
- Low Saturation Voltage

### Advantages

- Low Gate Drive Requirement
- High Power Density

### Applications

- Switch-Mode and Resonant-Mode Power Supplies
- Uninterruptible Power Supplies (UPS)
- Laser Generators
- Capacitor Discharge Circuits
- AC Switches

| Symbol        | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |            |                    |
|---------------|-----------------------------------------------------------------------|-----------------------|------------|--------------------|
|               |                                                                       | Min.                  | Typ.       | Max.               |
| $BV_{CES}$    | $I_C = 250\mu A$ , $V_{GE} = 0V$                                      | 1700                  |            | V                  |
| $V_{GE(th)}$  | $I_C = 250\mu A$ , $V_{CE} = V_{GE}$                                  | 3.0                   |            | 5.0 V              |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 150^\circ C$             |                       |            | 25 $\mu A$<br>5 mA |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |            | $\pm 100$ nA       |
| $V_{CE(sat)}$ | $I_C = 24A$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 150^\circ C$          |                       | 3.5<br>5.0 | V<br>V             |

## Symbol Test Conditions

( $T_J = 25^\circ\text{C}$  Unless Otherwise Specified)

## Characteristic Values

|              |                                                                                                                                                                 | Min. | Typ. | Max.                   |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------------------------|
| $g_{fs}$     | $I_C = 24\text{A}, V_{CE} = 10\text{V}$ , Note 1                                                                                                                | 12   | 20   | S                      |
| $R_{Gi}$     | Gate Input Resistance                                                                                                                                           |      | 5    | $\Omega$               |
| $C_{ies}$    | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$                                                                                                      |      | 2000 | pF                     |
| $C_{oes}$    |                                                                                                                                                                 |      | 130  | pF                     |
| $C_{res}$    |                                                                                                                                                                 |      | 44   | pF                     |
| $Q_{g(on)}$  | $I_C = 24\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$                                                                                             |      | 96   | nC                     |
| $Q_{ge}$     |                                                                                                                                                                 |      | 11   | nC                     |
| $Q_{gc}$     |                                                                                                                                                                 |      | 40   | nC                     |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 24\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 5\Omega$<br>Note 2  |      | 12   | ns                     |
| $t_{ri}$     |                                                                                                                                                                 |      | 33   | ns                     |
| $E_{on}$     |                                                                                                                                                                 |      | 3.00 | mJ                     |
| $t_{d(off)}$ |                                                                                                                                                                 |      | 155  | ns                     |
| $t_{fi}$     |                                                                                                                                                                 |      | 78   | ns                     |
| $E_{off}$    |                                                                                                                                                                 |      | 1.76 | mJ                     |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 150^\circ\text{C}</math></b><br>$I_C = 24\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 5\Omega$<br>Note 2 |      | 10   | ns                     |
| $t_{ri}$     |                                                                                                                                                                 |      | 37   | ns                     |
| $E_{on}$     |                                                                                                                                                                 |      | 3.85 | mJ                     |
| $t_{d(off)}$ |                                                                                                                                                                 |      | 196  | ns                     |
| $t_{fi}$     |                                                                                                                                                                 |      | 140  | ns                     |
| $E_{off}$    |                                                                                                                                                                 |      | 2.66 | mJ                     |
| $R_{thJC}$   |                                                                                                                                                                 |      |      | $0.30^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                                                 |      | 0.21 | $^\circ\text{C/W}$     |

## Reverse Diode (FRED)

( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)

| Symbol     | Test Conditions                                                                                                               | Characteristic Value      | Min. | Typ. | Max.                   |
|------------|-------------------------------------------------------------------------------------------------------------------------------|---------------------------|------|------|------------------------|
| $V_F$      | $I_F = 24\text{A}, V_{GE} = 0\text{V}$ , Note 1                                                                               |                           |      | 2.6  | 3.3 V                  |
|            |                                                                                                                               | $T_J = 150^\circ\text{C}$ |      | 3.3  | V                      |
| $I_{RM}$   | $I_F = 24\text{A}, V_{GE} = 0\text{V}, -di_F/dt = 500\text{A}/\mu\text{s}$ ,<br>$V_R = 1200\text{V}, T_J = 150^\circ\text{C}$ |                           |      | 22   | A                      |
| $t_{rr}$   |                                                                                                                               |                           |      | 195  | ns                     |
| $R_{thJC}$ |                                                                                                                               |                           |      |      | $0.55^\circ\text{C/W}$ |

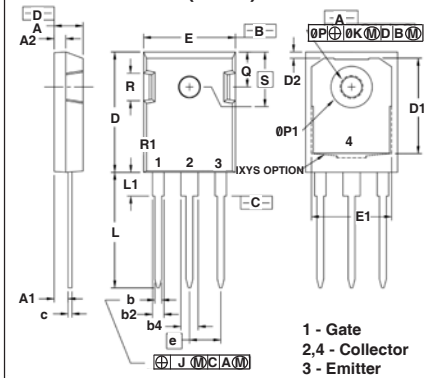
## Notes:

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

## PRELIMINARY TECHNICAL INFORMATION

The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

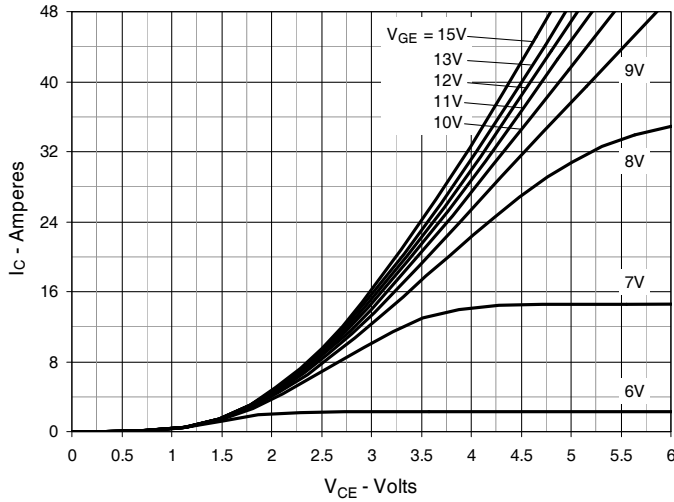
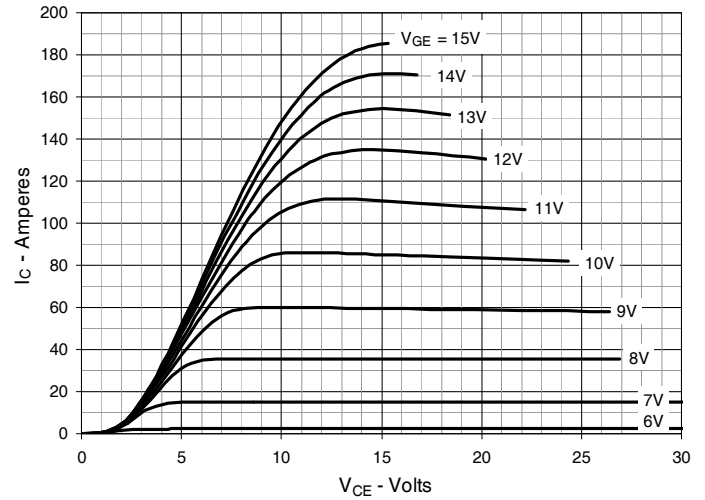
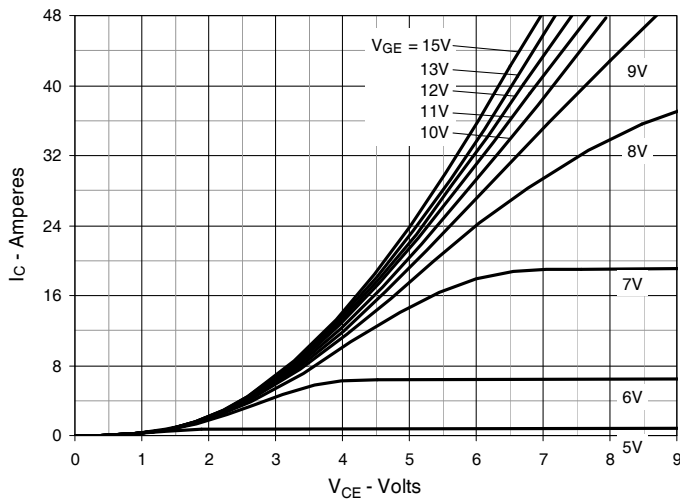
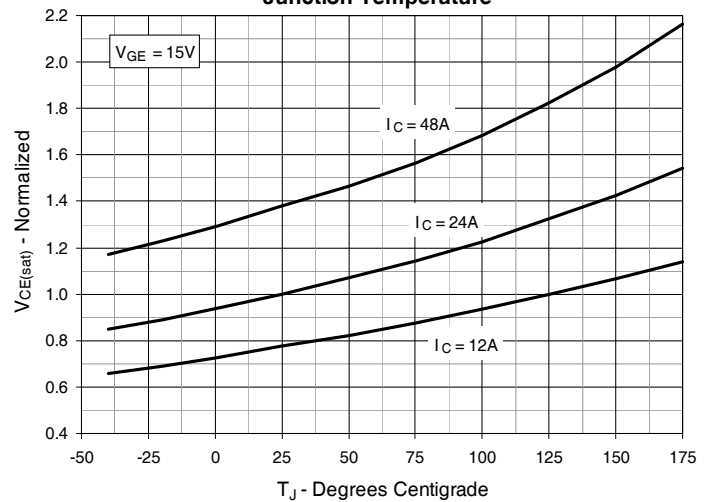
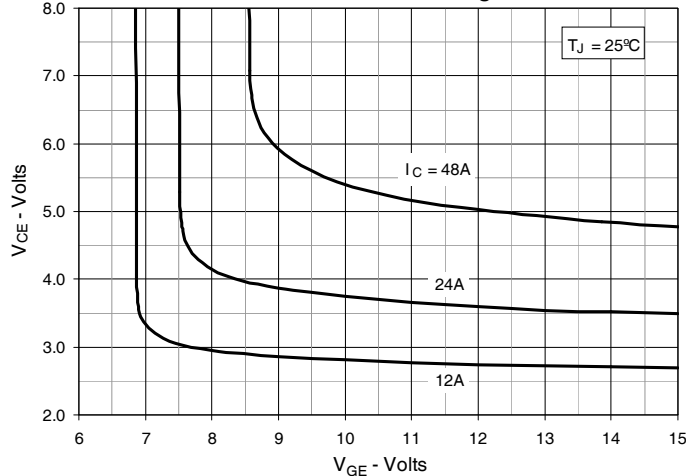
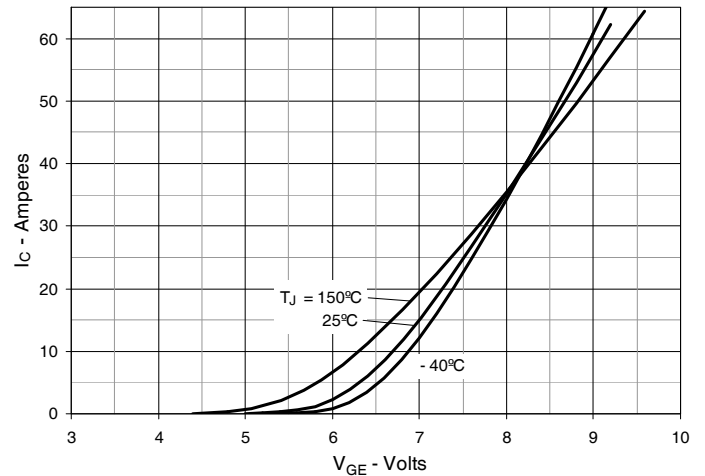
## TO-247 (IXYH) Outline

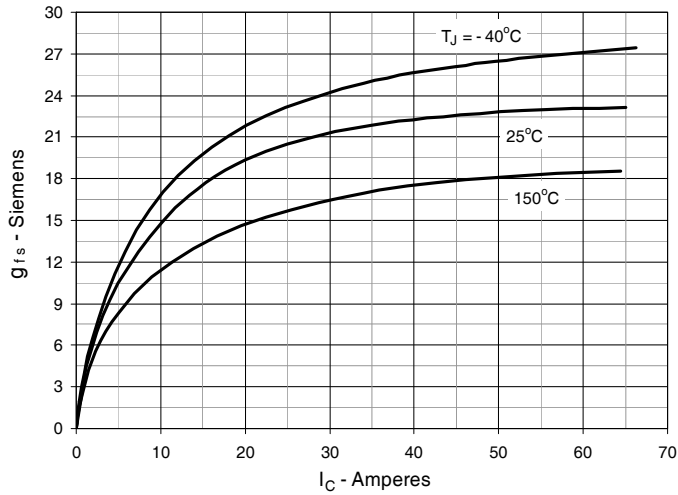
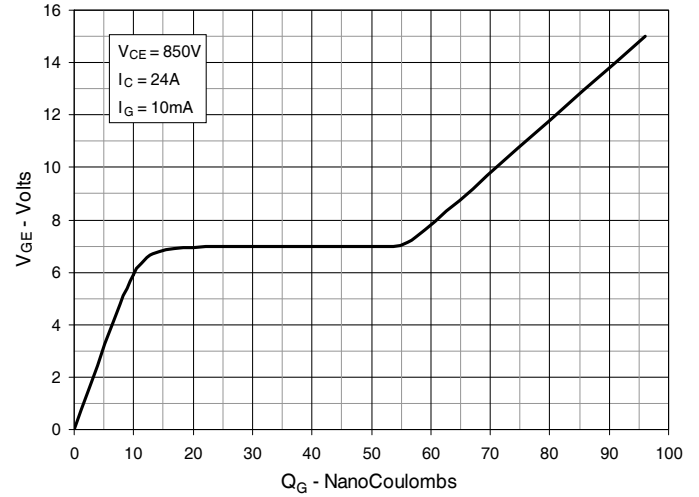
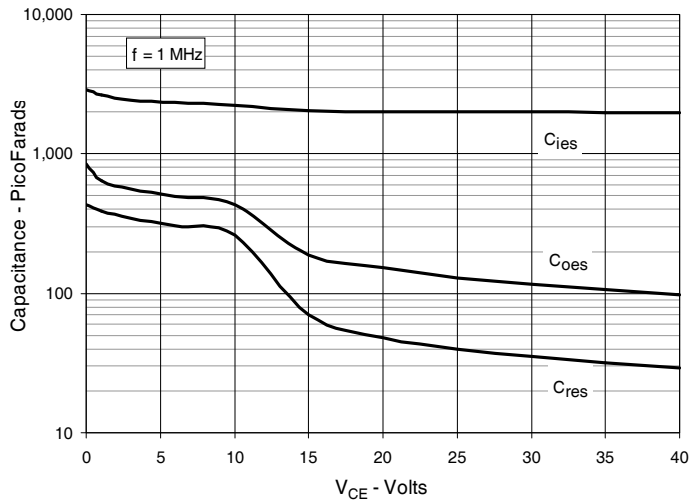
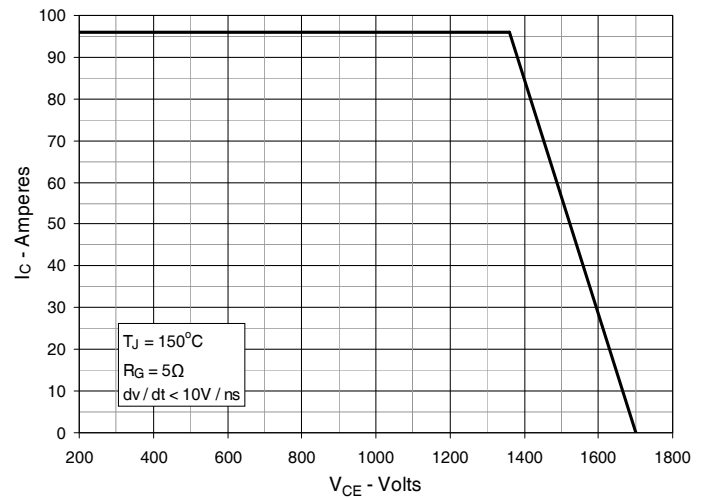
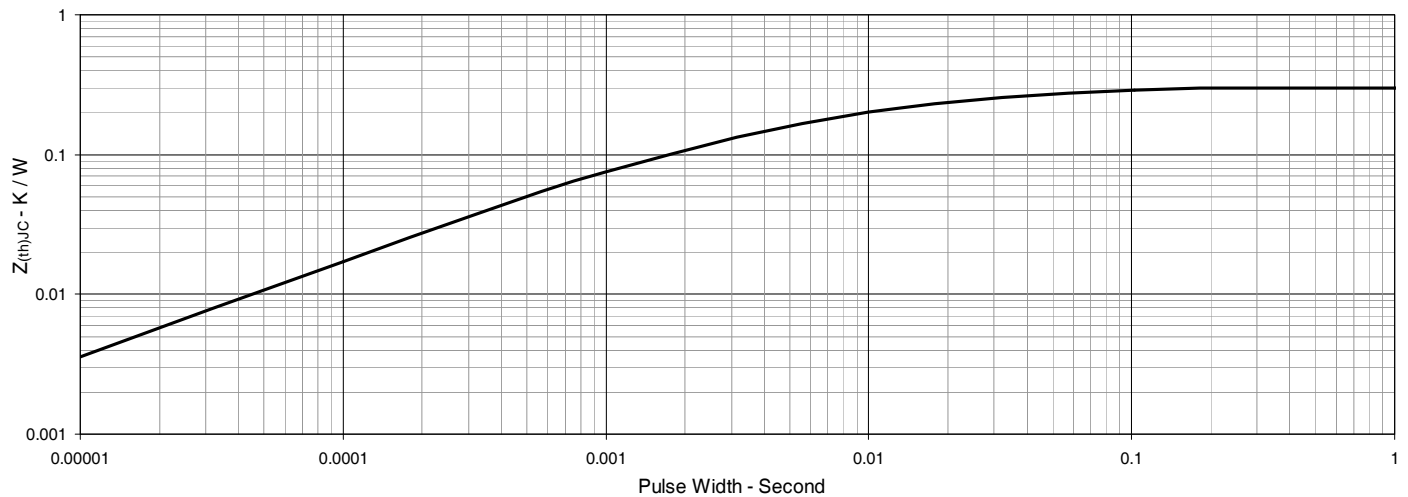


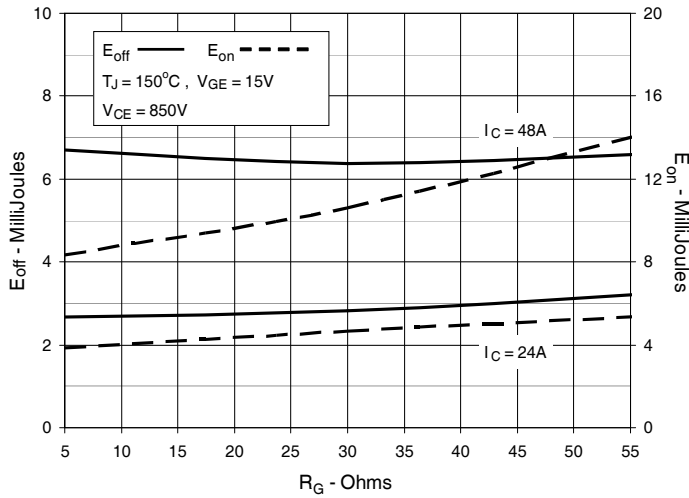
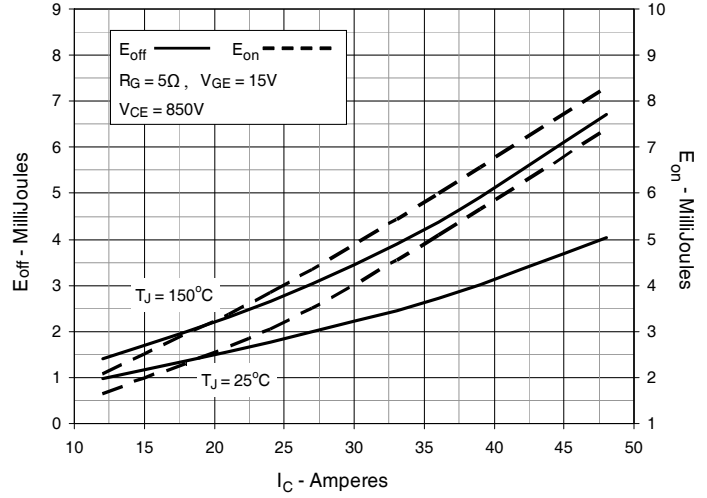
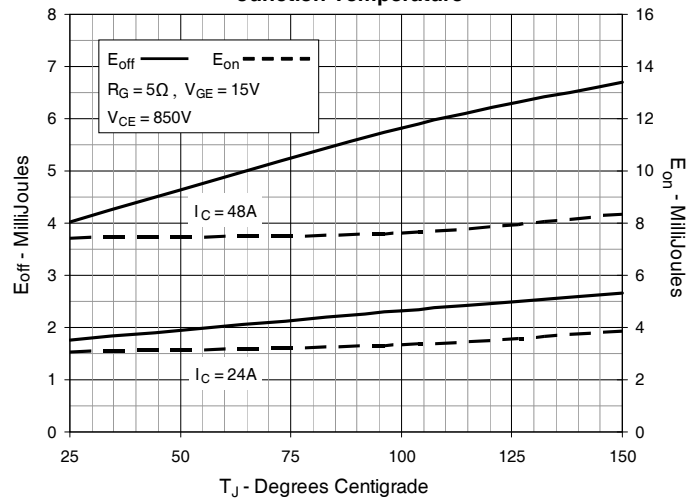
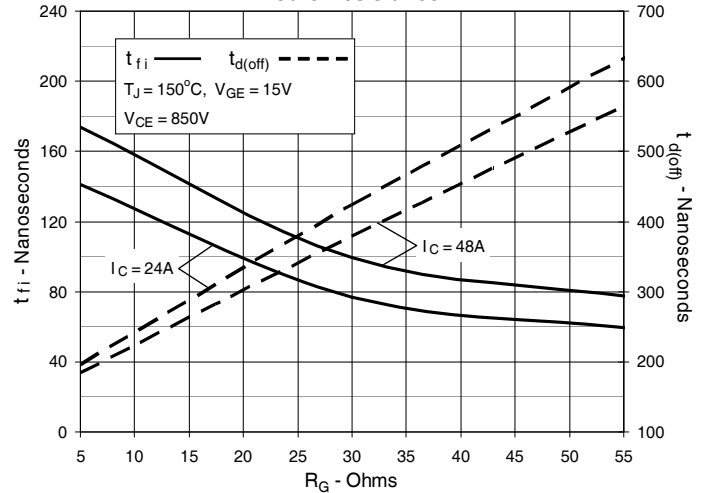
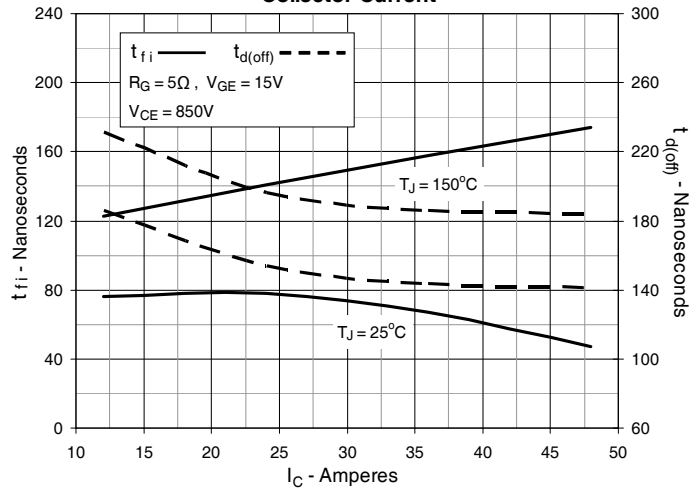
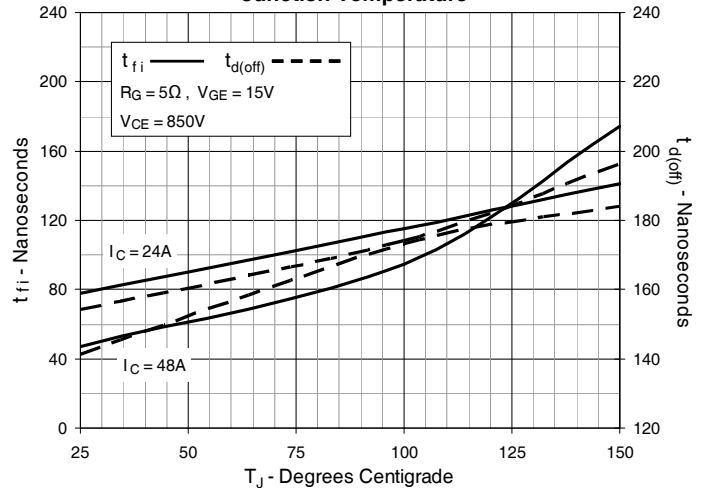
| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .190     | .205 | 4.83        | 5.21  |
| A1  | .090     | .100 | 2.29        | 2.54  |
| A2  | .075     | .085 | 1.91        | 2.16  |
| b   | .045     | .055 | 1.14        | 1.40  |
| b2  | .075     | .087 | 1.91        | 2.20  |
| b4  | .115     | .126 | 2.92        | 3.20  |
| C   | .024     | .031 | 0.61        | 0.80  |
| D   | .819     | .840 | 20.80       | 21.34 |
| D1  | .650     | .690 | 16.51       | 17.53 |
| D2  | .035     | .050 | 0.89        | 1.27  |
| E   | .620     | .635 | 15.75       | 16.13 |
| E1  | .545     | .565 | 13.84       | 14.35 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| J   | --       | .010 | --          | 0.25  |
| K   | --       | .025 | --          | 0.64  |
| L   | .780     | .810 | 19.81       | 20.57 |
| L1  | .150     | .170 | 3.81        | 4.32  |
| ØP  | .140     | .144 | 3.55        | 3.65  |
| ØP1 | .275     | .290 | 6.99        | 7.37  |
| Q   | .220     | .244 | 5.59        | 6.20  |
| R   | .170     | .190 | 4.32        | 4.83  |
| S   | .242 BSC |      | 6.15 BSC    |       |

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

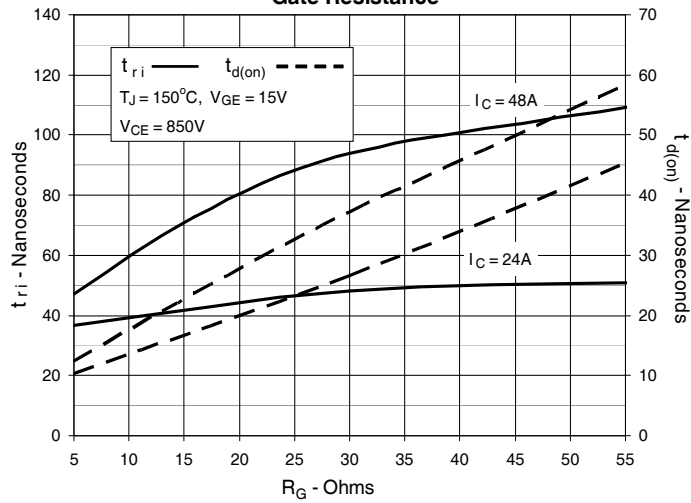
|                                                                                  |           |           |           |           |              |              |              |              |              |             |
|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 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 |
|                                                                                  | 4,860,072 | 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**


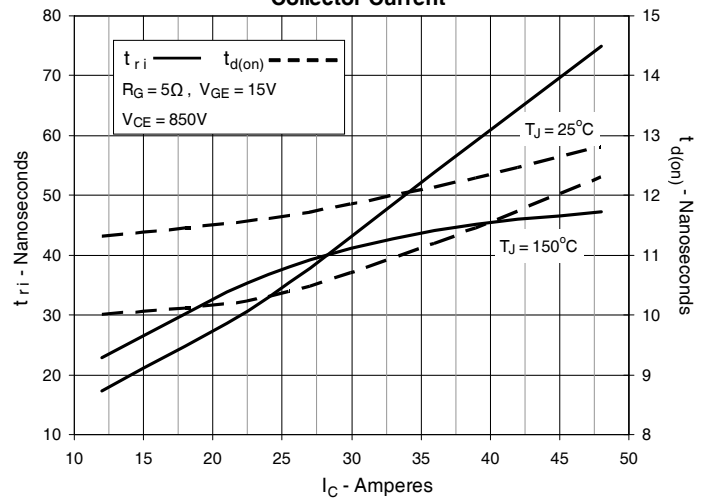
**Fig. 7. Transconductance**

**Fig. 8. Gate Charge**

**Fig. 9. Capacitance**

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

**Fig. 11. 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**


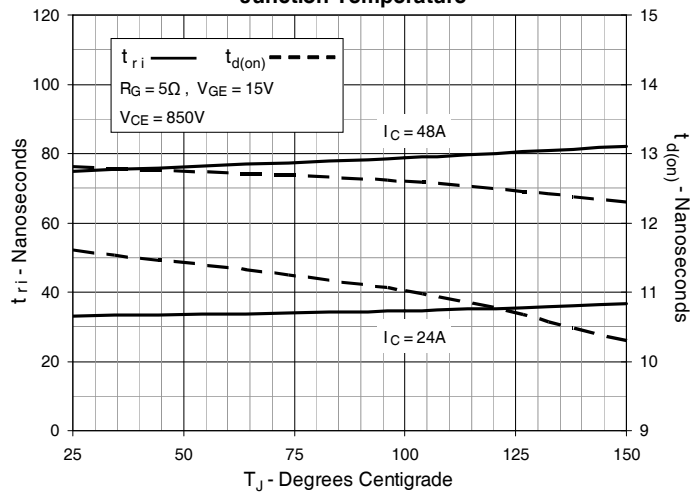
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**

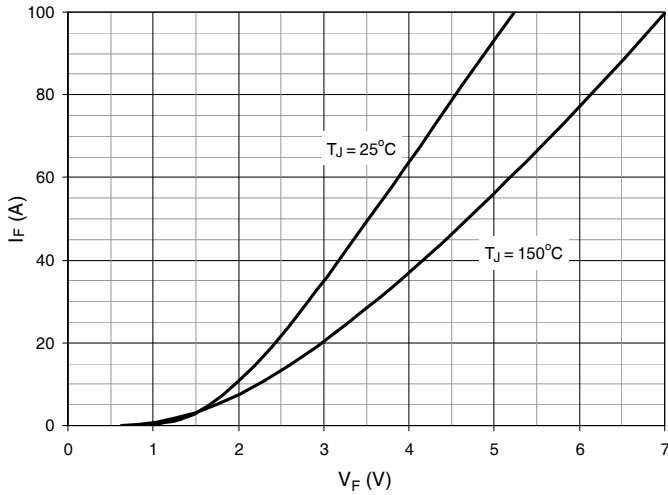
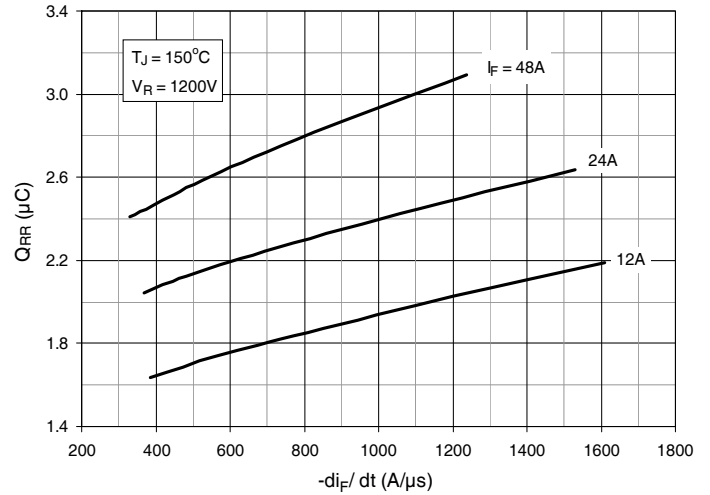
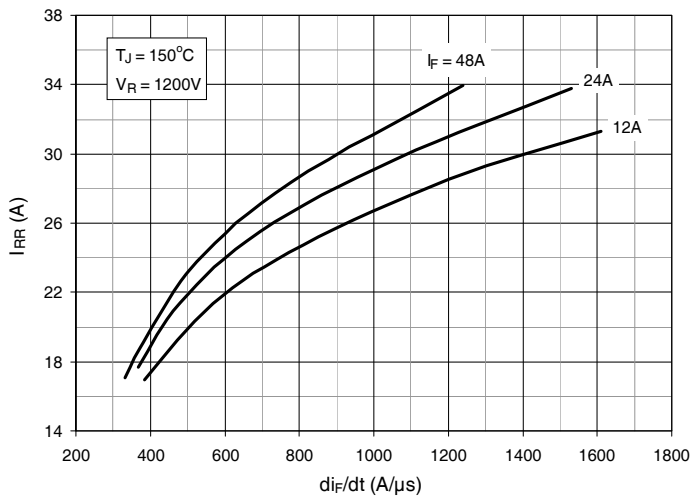
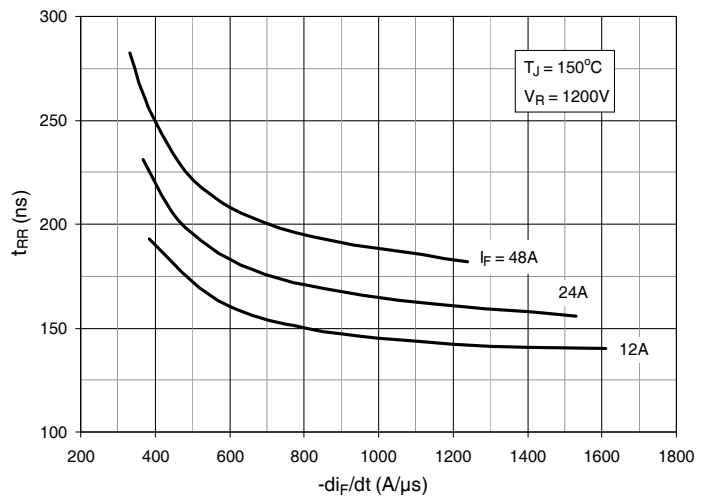
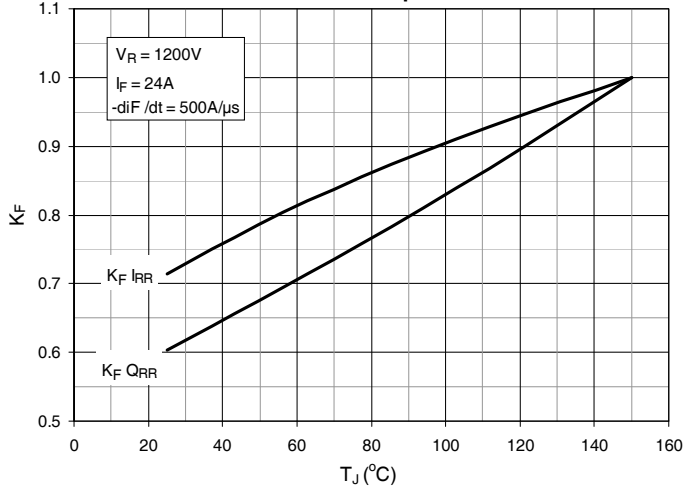
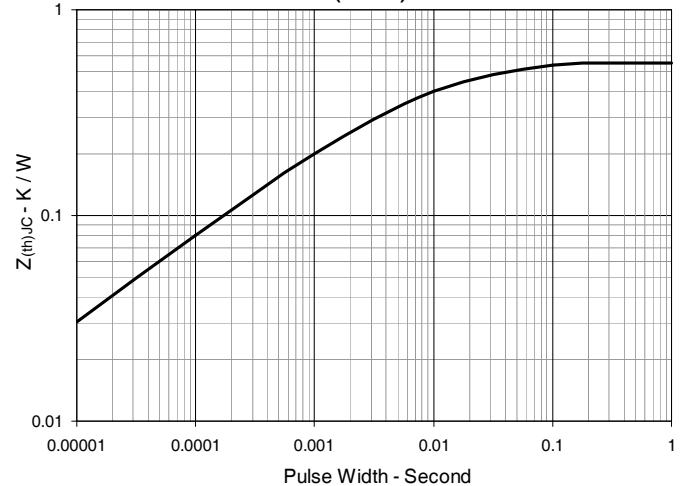


**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**



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



**Fig. 21. Diode Forward Characteristics**

**Fig. 22. Reverse Recovery Charge vs.  $-di_F/dt$** 

**Fig. 23 Reverse Recovery Current vs.  $-di_F/dt$** 

**Fig. 24. Reverse Recovery Time vs.  $-di_F/dt$** 

**Fig. 25. Dynamic Parameters  $Q_{RR}$ ,  $I_{RR}$  vs. Junction Temperature**

**Fig. 26. Maximum Transient Thermal Impedance (Diode)**




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