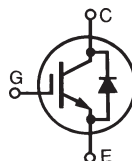


# High Voltage XPT™ IGBT w/ Diode

## IXYL50N170CV1

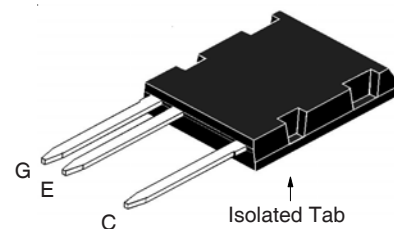
$$\begin{aligned} V_{CES} &= 1700V \\ I_{C110} &= 46A \\ V_{CE(sat)} &\leq 3.7V \\ t_{fi(typ)} &= 95ns \end{aligned}$$



(Electrically Isolated Tab)

| Symbol                  | Test Conditions                                                                     | Maximum Ratings |                  |
|-------------------------|-------------------------------------------------------------------------------------|-----------------|------------------|
| $V_{CES}$               | $T_J = 25^\circ\text{C to } 175^\circ\text{C}$                                      | 1700            | V                |
| $V_{CGR}$               | $T_J = 25^\circ\text{C to } 175^\circ\text{C}, R_{GE} = 1M\Omega$                   | 1700            | V                |
| $V_{GES}$               | Continuous                                                                          | $\pm 20$        | V                |
| $V_{GEM}$               | Transient                                                                           | $\pm 30$        | V                |
| $I_{C25}$               | $T_C = 25^\circ\text{C}$                                                            | 90              | A                |
| $I_{C110}$              | $T_C = 110^\circ\text{C}$                                                           | 46              | A                |
| $I_{F110}$              | $T_C = 110^\circ\text{C}$                                                           | 26              | A                |
| $I_{CM}$                | $T_C = 25^\circ\text{C}, 1\text{ms}$                                                | 325             | A                |
| <b>SSOA<br/>(RBSOA)</b> | $V_{GE} = 15V, T_{VJ} = 150^\circ\text{C}, R_G = 1\Omega$<br>Clamped Inductive Load | $I_{CM} = 200$  | A                |
|                         |                                                                                     | 1360            | V                |
| $P_C$                   | $T_C = 25^\circ\text{C}$                                                            | 580             | W                |
| $T_J$                   |                                                                                     | -55 ... +175    | $^\circ\text{C}$ |
| $T_{JM}$                |                                                                                     | 175             | $^\circ\text{C}$ |
| $T_{stg}$               |                                                                                     | -55 ... +175    | $^\circ\text{C}$ |
| $T_L$                   | Maximum Lead Temperature for Soldering                                              | 300             | $^\circ\text{C}$ |
| $T_{SOLD}$              | 1.6 mm (0.062in.) from Case for 10s                                                 | 260             | $^\circ\text{C}$ |
| $F_C$                   | Mounting Force                                                                      | 40..120 / 9..27 | N/lb             |
| $V_{ISOL}$              | 50/60 Hz, RM, t = 1min                                                              | 2500            | V~               |
| <b>Weight</b>           |                                                                                     | 8               | g                |

### ISOPLUS i5-Pak™



G = Gate  
C = Collector

E = Emitter

### Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Isolated Mounting Surface
- 4500V~ Electrical Isolation
- High Voltage Package
- High Blocking Voltage
- High Peak Current Capability
- Low Saturation Voltage

### Advantages

- Low Gate Drive Requirement
- High Power Density

### Applications

- UPS
- Motor Drives
- SMPS
- PFC Circuits
- High Frequency Power Inverters

| Symbol        | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |                  |
|---------------|-----------------------------------------------------------------------------|-----------------------|------|------------------|
|               |                                                                             | Min.                  | Typ. | Max.             |
| $BV_{CES}$    | $I_C = 250\mu\text{A}, V_{GE} = 0V$                                         | 1700                  |      | V                |
| $V_{GE(th)}$  | $I_C = 250\mu\text{A}, V_{CE} = V_{GE}$                                     | 3.0                   |      | 5.0 V            |
| $I_{CES}$     | $V_{CE} = V_{CES}, V_{GE} = 0V$                                             |                       |      | 25 $\mu\text{A}$ |
|               | $V_{CE} = 0.8 \cdot V_{CES}$ $T_J = 125^\circ\text{C}$                      |                       |      | 5 mA             |
| $I_{GES}$     | $V_{CE} = 0V, V_{GE} = \pm 20V$                                             |                       |      | $\pm 100$ nA     |
| $V_{CE(sat)}$ | $I_C = 50A, V_{GE} = 15V, \text{Note 1}$<br>$T_J = 150^\circ\text{C}$       | 2.8                   | 3.7  | V                |
|               |                                                                             | 3.9                   |      | V                |

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

|              |                                                                                                                                                                 |    |      |                        |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|------------------------|
| $g_{fs}$     | $I_C = 50\text{A}, V_{CE} = 10\text{V}$ , Note 1                                                                                                                | 30 | 50   | S                      |
| $R_{Gi}$     | Gate Input Resistance                                                                                                                                           |    | 2.0  | $\Omega$               |
| $C_{ies}$    | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$                                                                                                      |    | 5500 | pF                     |
| $C_{oes}$    |                                                                                                                                                                 |    | 380  | pF                     |
| $C_{res}$    |                                                                                                                                                                 |    | 105  | pF                     |
| $Q_{g(on)}$  | $I_C = 50\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$                                                                                             |    | 260  | nC                     |
| $Q_{ge}$     |                                                                                                                                                                 |    | 28   | nC                     |
| $Q_{gc}$     |                                                                                                                                                                 |    | 110  | nC                     |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 50\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 1\Omega$<br>Note 2  |    | 20   | ns                     |
| $t_{ri}$     |                                                                                                                                                                 |    | 44   | ns                     |
| $E_{on}$     |                                                                                                                                                                 |    | 8.7  | mJ                     |
| $t_{d(off)}$ |                                                                                                                                                                 |    | 180  | ns                     |
| $t_{fi}$     |                                                                                                                                                                 |    | 95   | ns                     |
| $E_{off}$    |                                                                                                                                                                 |    | 5.6  | mJ                     |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 150^\circ\text{C}</math></b><br>$I_C = 50\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 1\Omega$<br>Note 2 |    | 22   | ns                     |
| $t_{ri}$     |                                                                                                                                                                 |    | 40   | ns                     |
| $E_{on}$     |                                                                                                                                                                 |    | 11.9 | mJ                     |
| $t_{d(off)}$ |                                                                                                                                                                 |    | 236  | ns                     |
| $t_{fi}$     |                                                                                                                                                                 |    | 160  | ns                     |
| $E_{off}$    |                                                                                                                                                                 |    | 8.2  | mJ                     |
| $R_{thJC}$   |                                                                                                                                                                 |    | 0.15 | $0.26^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                                                 |    |      | $^\circ\text{C/W}$     |

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

|            |                                                                                                     |                           |            |                        |
|------------|-----------------------------------------------------------------------------------------------------|---------------------------|------------|------------------------|
| $V_F$      | $I_F = 50\text{A}, V_{GE} = 0\text{V}$ , Note 1                                                     | $T_J = 150^\circ\text{C}$ | 2.5<br>3.2 | 3.2<br>V<br>V          |
| $I_{RM}$   | $I_F = 50\text{A}, V_{GE} = 0\text{V},$<br>$-di_F/dt = 500\text{A}/\mu\text{s}, V_R = 1200\text{V}$ | $T_J = 150^\circ\text{C}$ | 40         | A                      |
| $t_{rr}$   |                                                                                                     |                           | 255        | ns                     |
| $R_{thJC}$ |                                                                                                     |                           |            | $0.83^\circ\text{C/W}$ |

Notes:

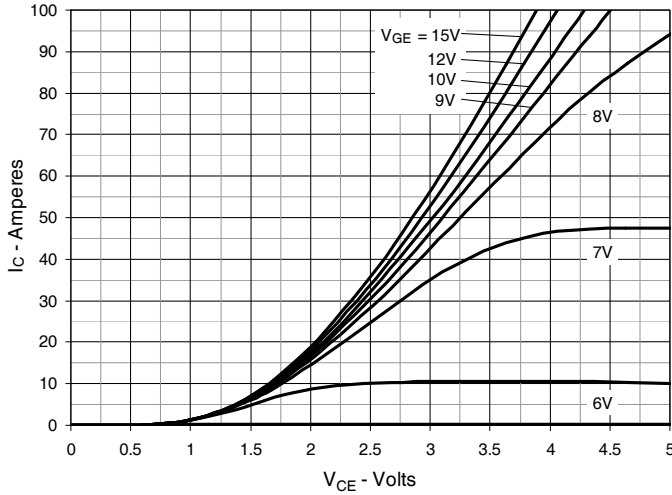
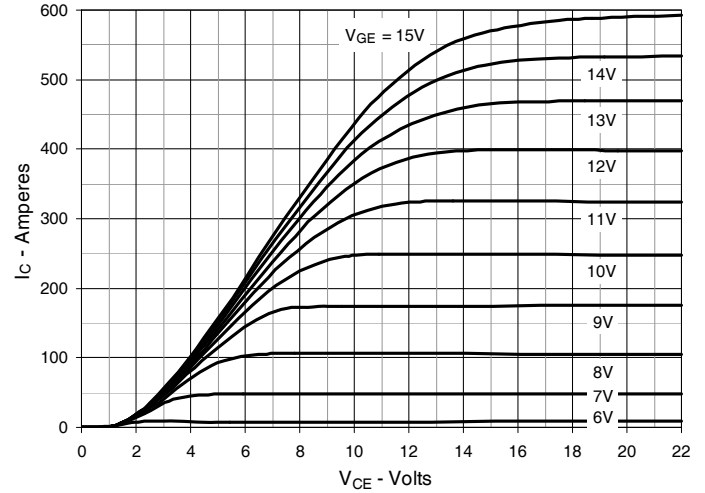
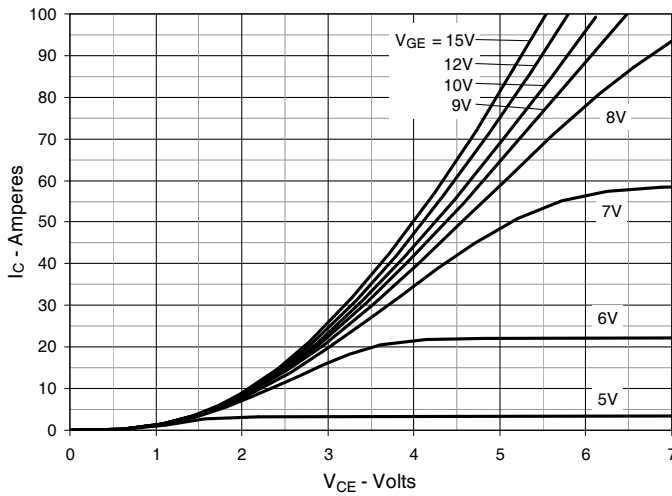
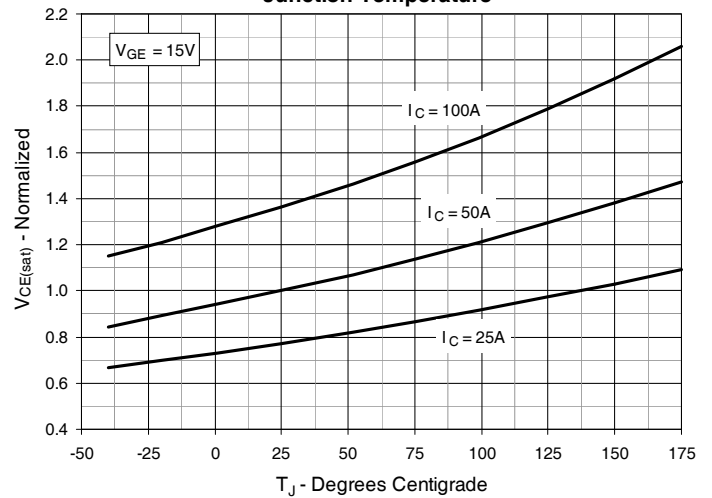
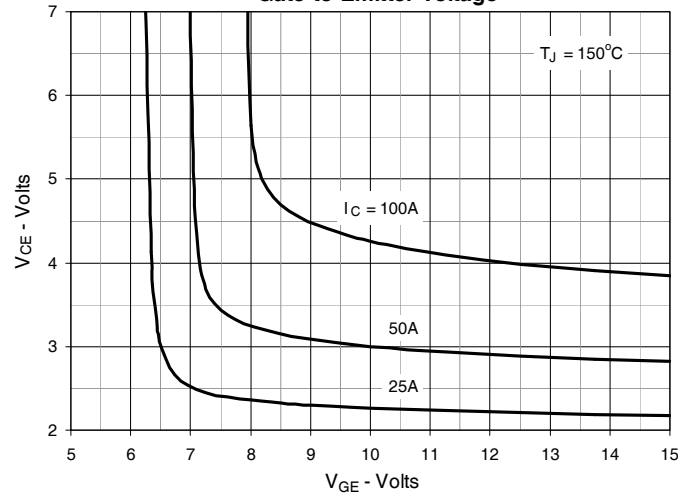
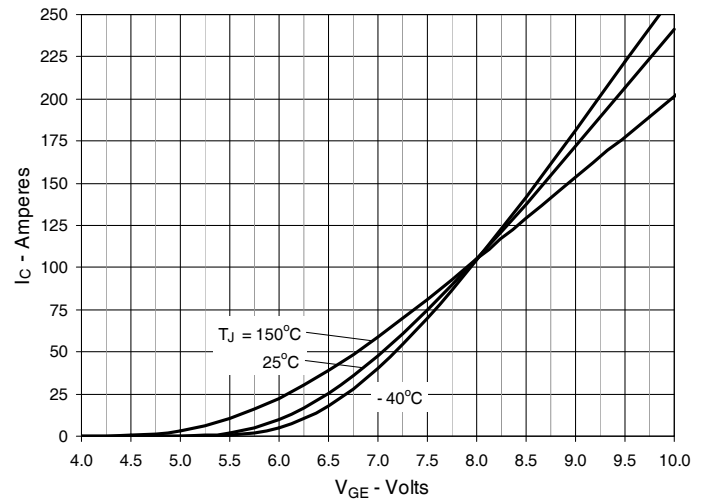
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}$  (Clamp),  $T_J$  or  $R_G$ .

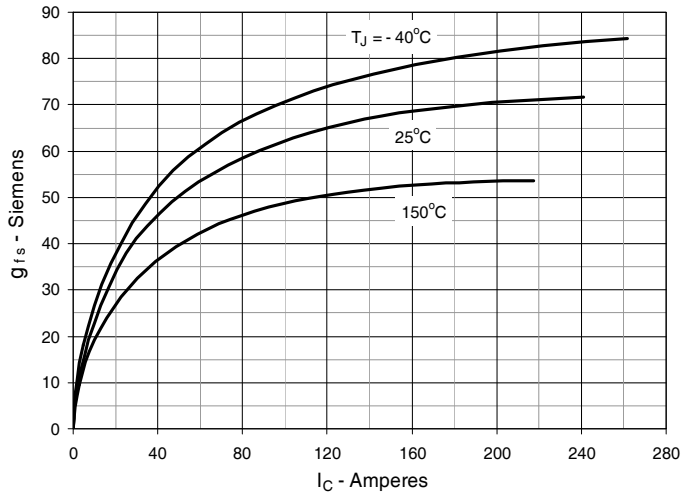
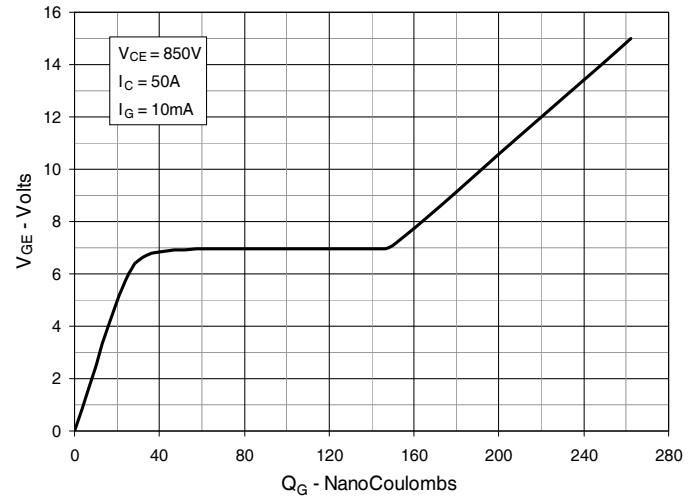
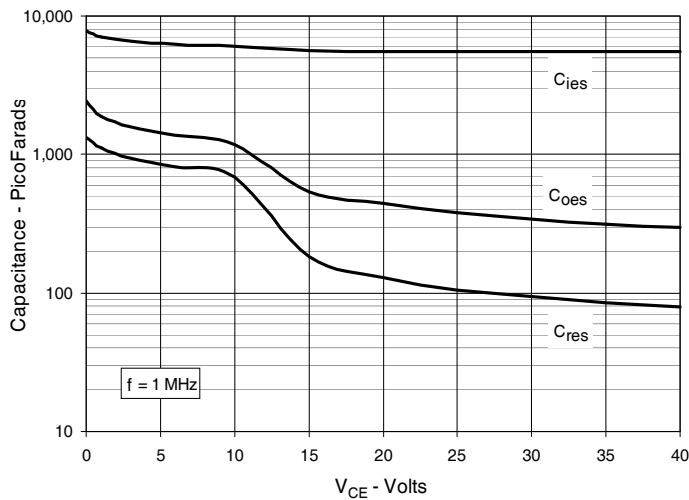
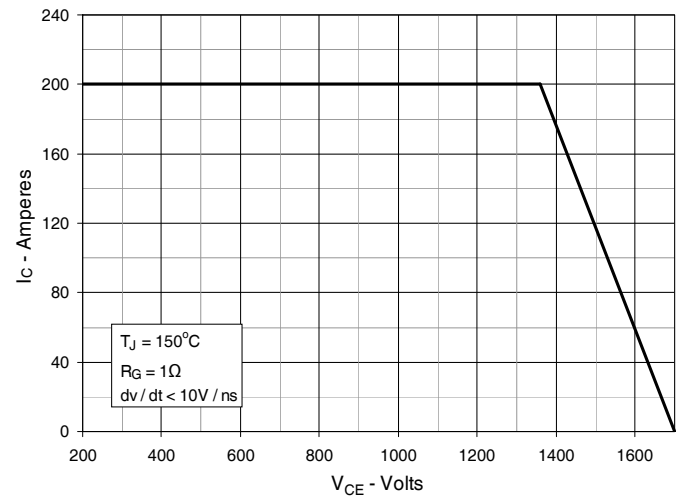
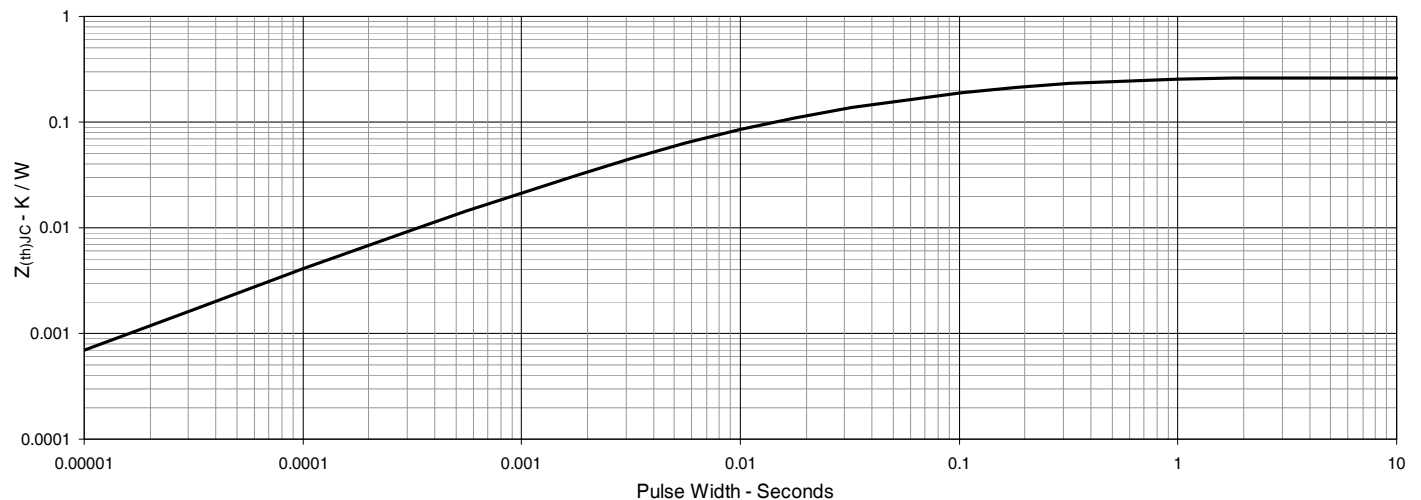
**ADVANCE TECHNICAL INFORMATION**

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.

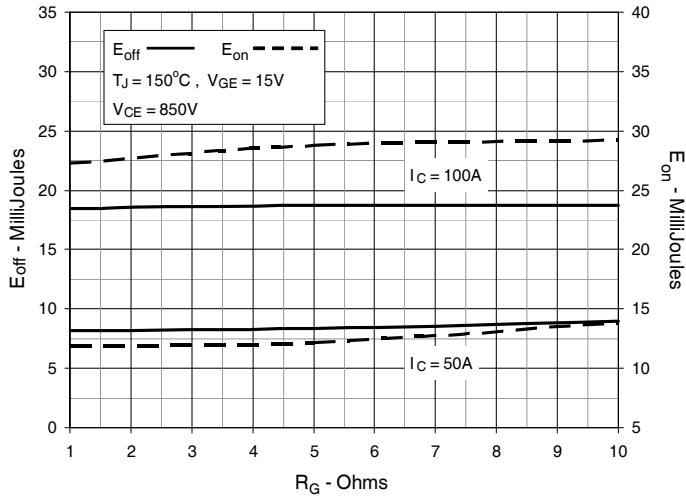
IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

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

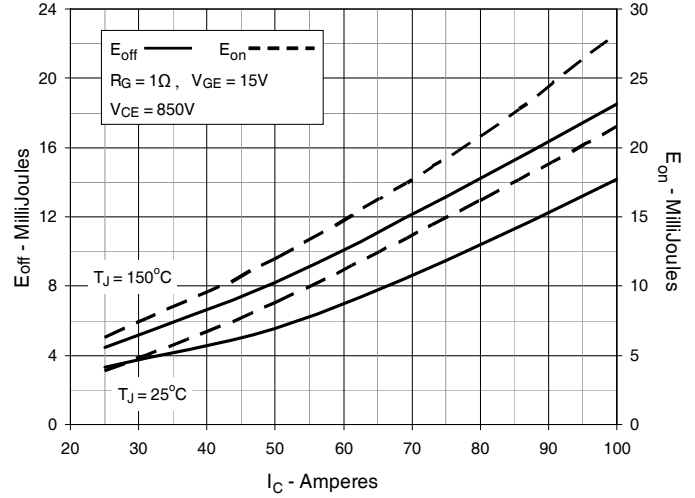
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$** 

**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 (IGBT)**


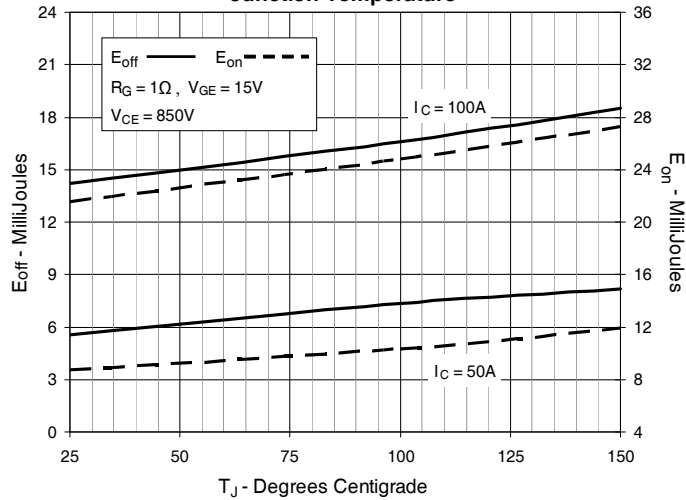
**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**



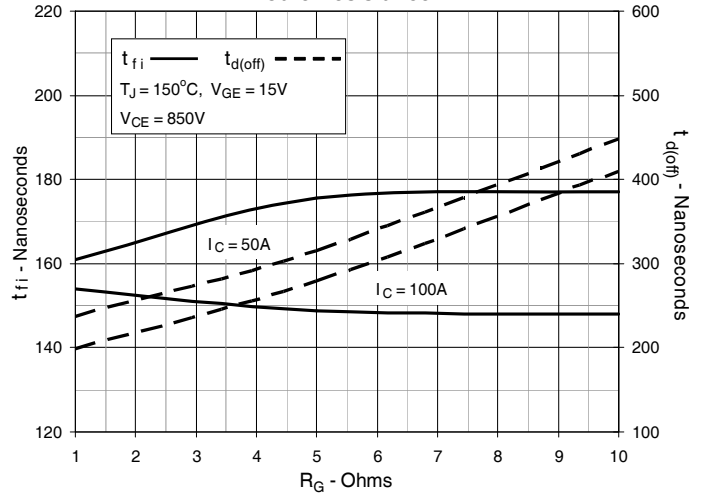
**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**



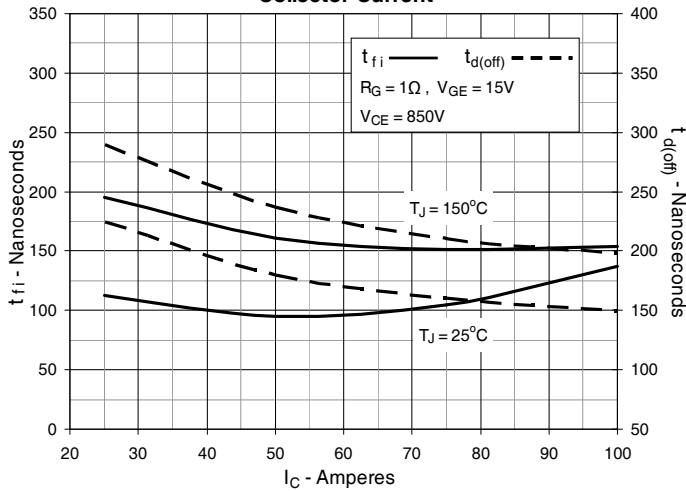
**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**



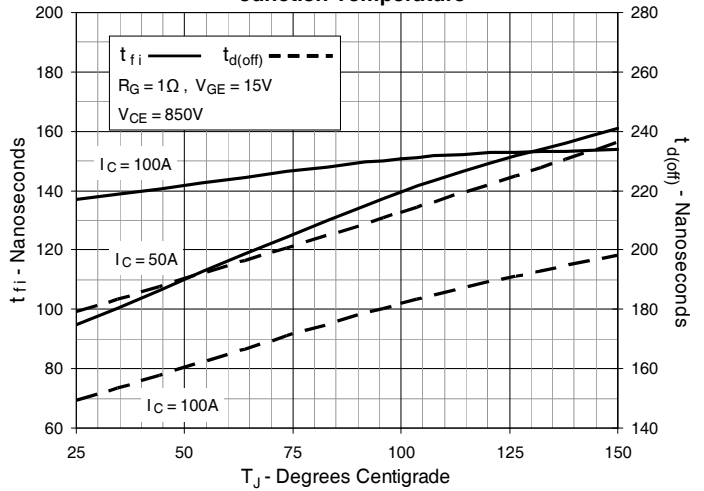
**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**



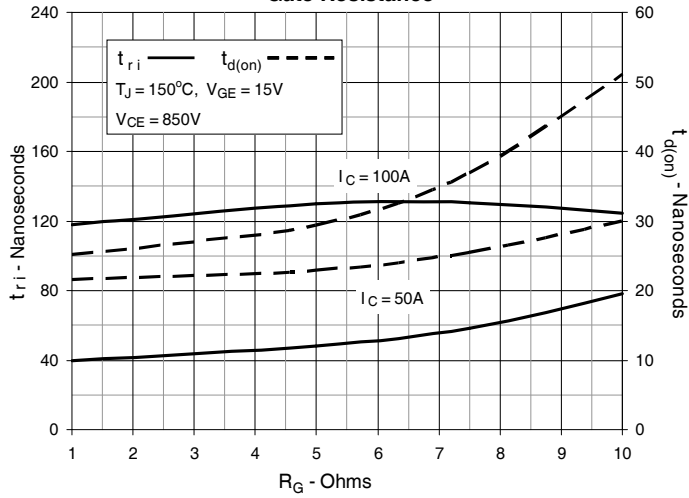
**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**



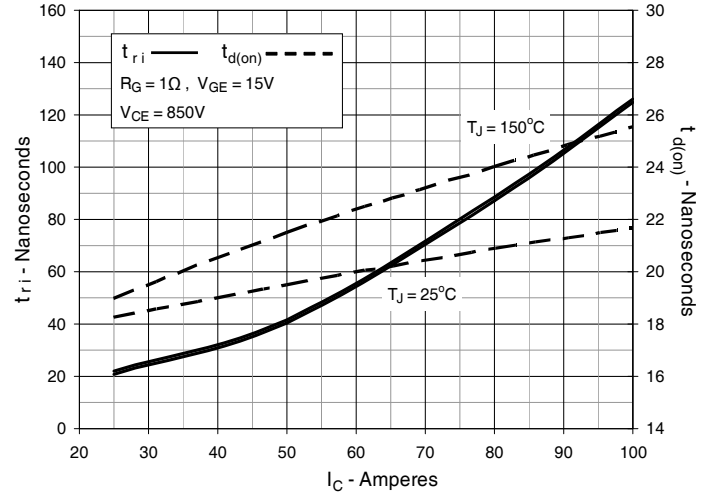
**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**



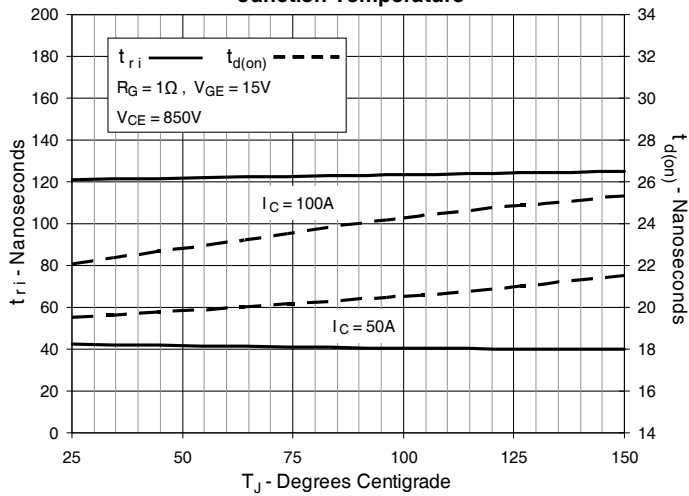
**Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance**



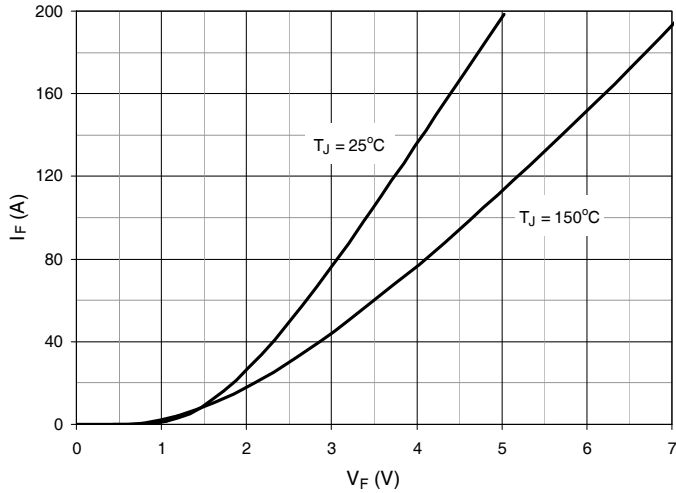
**Fig. 20. Inductive Turn-on Switching Times vs. Collector Current**



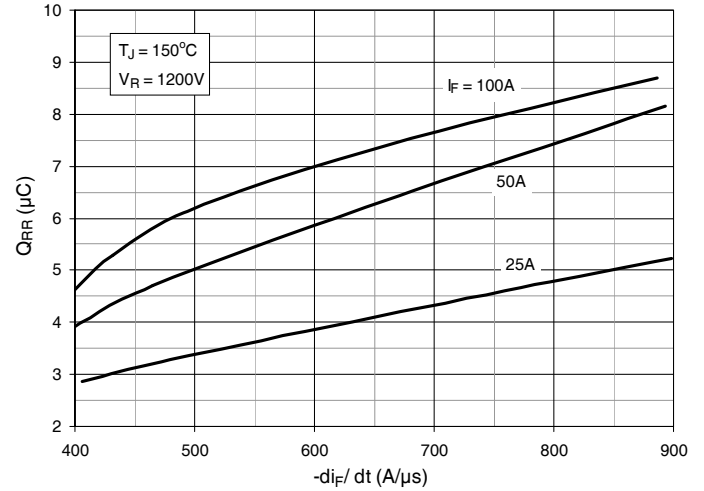
**Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature**



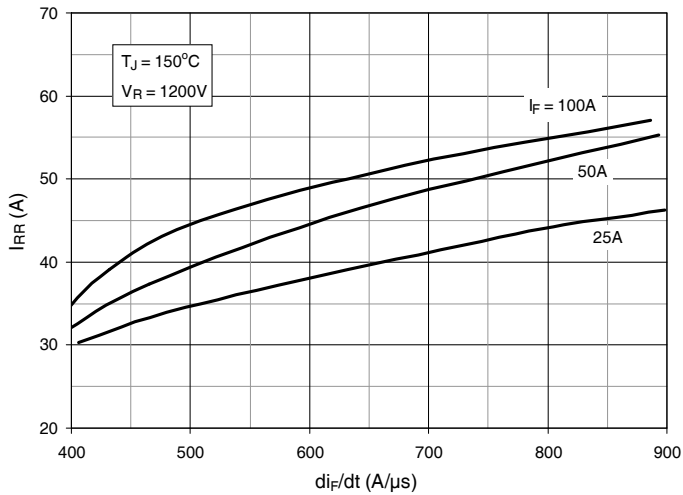
**Fig. 22. Diode Forward Characteristics**



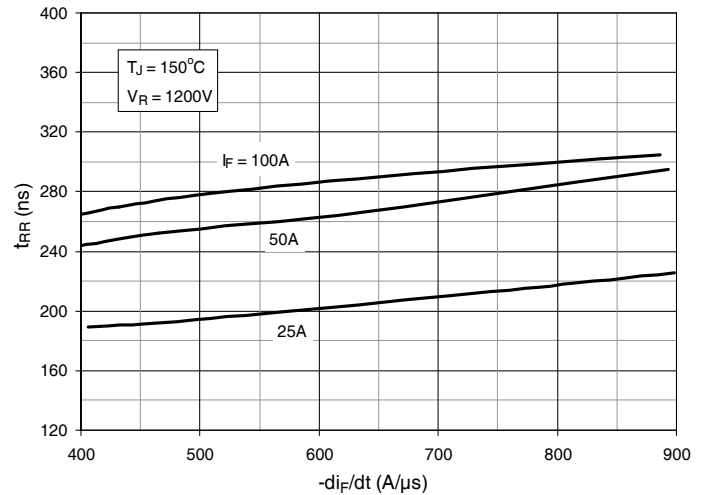
**Fig. 23. Reverse Recovery Charge vs.  $-di_F/dt$**



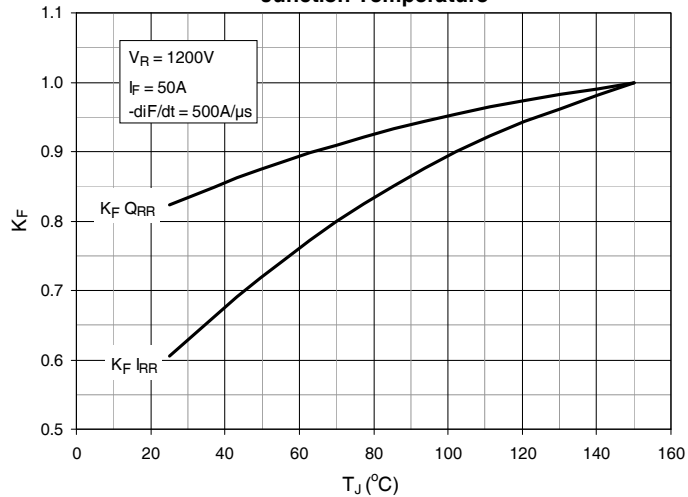
**Fig. 23. Reverse Recovery Current vs.  $-di_F/dt$**



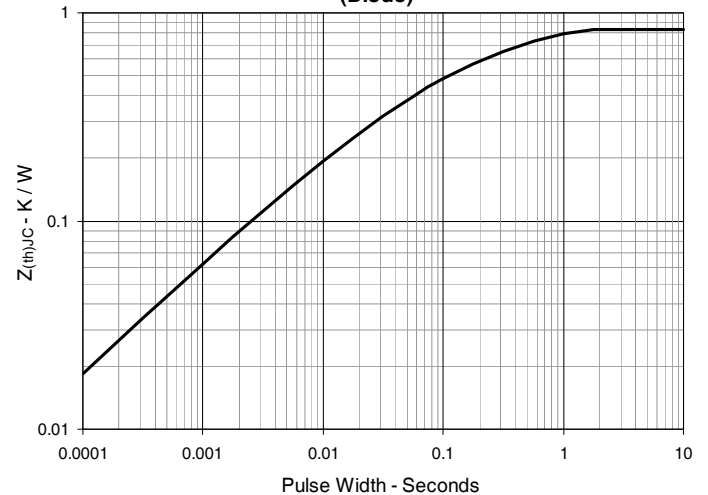
**Fig. 24. Reverse Recovery Time vs.  $-di_F/dt$**

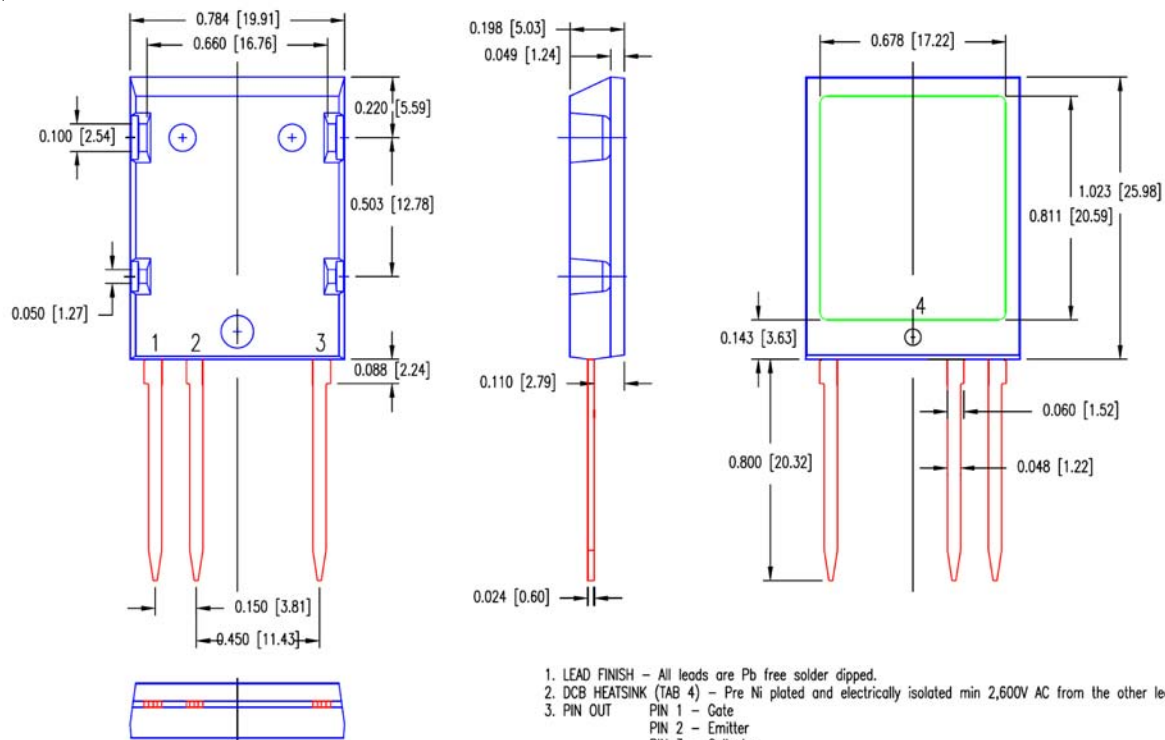


**Fig. 25. Dynamic Parameters  $Q_{RR}$ ,  $I_{RR}$  vs. Junction Temperature**



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



**ISOPLUS i5-Pak™ (IXYL) Outline**


1. LEAD FINISH - All leads are Pb free solder dipped.
2. DCB HEATSINK (TAB 4) - Pre Ni plated and electrically isolated min 2,600V AC from the other leads.
3. PIN OUT
  - PIN 1 - Gate
  - PIN 2 - Emitter
  - PIN 3 - Collector
  - TAP 4 - Isolated DCB Cu





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