

# XPT™ 650V IGBT GenX4™ w/ Sonic Diode

## IXXH40N65B4H1

$V_{CES} = 650V$   
 $I_{C110} = 40A$   
 $V_{CE(sat)} \leq 2.0V$   
 $t_{fi(typ)} = 40ns$



Extreme Light Punch Through  
IGBT for 5-30 kHz Switching

| Symbol         | Test Conditions  | Maximum Ratings         |            |
|----------------|--|-------------------------|------------|
| $V_{CES}$      | $T_J = 25^\circ C$ to $175^\circ C$                        | 650                     | V          |
| $V_{CGR}$      | $T_J = 25^\circ C$ to $175^\circ C$ , $R_{GE} = 1M\Omega$  | 650                     | V          |
| $V_{GES}$      | Continuous   | $\pm 20$                | V          |
| $V_{GEM}$      | Transient  | $\pm 30$                | V          |
| $I_{C25}$      | $T_C = 25^\circ C$   | 123                     | A          |
| $I_{C110}$     | $T_C = 110^\circ C$  | 40                      | A          |
| $I_{F110}$     | $T_C = 110^\circ C$  | 40                      | A          |
| $I_{CM}$       | $T_C = 25^\circ C$ , 1ms                                   | 225                     | A          |
| <b>SSOA</b>    | $V_{GE} = 15V$ , $T_{VJ} = 150^\circ C$ , $R_G = 10\Omega$ | $I_{CM} = 80$           | A          |
| <b>(RBSOA)</b> | Clamped Inductive Load                                     | @ $V_{CE} \leq V_{CES}$ |            |
| $t_{sc}$       | $V_{GE} = 15V$ , $V_{CE} = 360V$ , $T_J = 150^\circ C$     | 10                      | $\mu s$    |
| <b>(SCSOA)</b> | $R_G = 82\Omega$ , Non Repetitive                          |                         |            |
| $P_C$          | $T_C = 25^\circ C$   | 455                     | 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

- Optimized for 5-30kHz Switching
- Square RBSOA
- Anti-Parallel Sonic Diode
- Avalanche Rated
- Short Circuit Capability
- International Standard Package

### Advantages

- High Power Density
- Extremely Rugged
- 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.               |
| $BV_{CES}$    | $I_C = 250\mu A$ , $V_{GE} = 0V$                                      | 650                   |      | V                  |
| $V_{GE(th)}$  | $I_C = 250\mu A$ , $V_{CE} = V_{GE}$                                  | 4.0                   |      | 6.5 V              |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 150^\circ C$             |                       |      | 25 $\mu A$<br>3 mA |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |      | $\pm 100$ nA       |
| $V_{CE(sat)}$ | $I_C = 40A$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 150^\circ C$          | 1.60                  | 1.87 | 2.00 V<br>V        |

| Symbol Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified) |   | Characteristic Values |      |                    |
|--|---|-----------------------|------|--------------------|
|  |   | Min.                  | Typ. | Max.               |
| $g_{fs}$   | $I_C = 40\text{A}, V_{CE} = 10\text{V}$ , Note 1  | 14                    | 23   | S                  |
| $C_{ies}$  | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$  |                       | 2110 | pF                 |
| $C_{oes}$  |   |                       | 200  | pF                 |
| $C_{res}$  |   |                       | 33   | pF                 |
| $Q_{g(on)}$  | $I_C = 40\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$   |                       | 66   | nC                 |
| $Q_{ge}$   |   |                       | 16   | nC                 |
| $Q_{gc}$   |   |                       | 27   | nC                 |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 40\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}, R_G = 5\Omega$<br>Note 2  |                       | 19   | ns                 |
| $t_{ri}$   |   |                       | 48   | ns                 |
| $E_{on}$   |   |                       | 1.40 | mJ                 |
| $t_{d(off)}$   |   |                       | 112  | ns                 |
| $t_{fi}$   |   |                       | 40   | ns                 |
| $E_{off}$  |   |                       | 0.75 | mJ                 |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 150^\circ\text{C}</math></b><br>$I_C = 40\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}, R_G = 5\Omega$<br>Note 2 |                       | 17   | ns                 |
| $t_{ri}$   |   |                       | 44   | ns                 |
| $E_{on}$   |   |                       | 2.20 | mJ                 |
| $t_{d(off)}$   |   |                       | 134  | ns                 |
| $t_{fi}$   |   |                       | 73   | ns                 |
| $E_{off}$  |   |                       | 1.40 | mJ                 |
| $R_{thJC}$   |   |                       | 0.33 | $^\circ\text{C/W}$ |
| $R_{thCS}$   |   | 0.21                  |      | $^\circ\text{C/W}$ |

TO-247 (IXXH) Outline



Terminals: 1 - Gate 2 - Collector  
3 - Emitted

| 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  |
| S              | 6.15       | BSC   | 242    | BSC   |

### Reverse Sonic Diode (FRD)

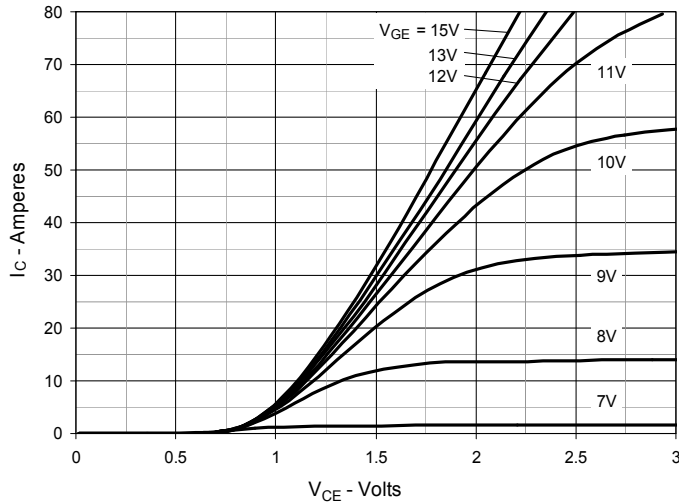
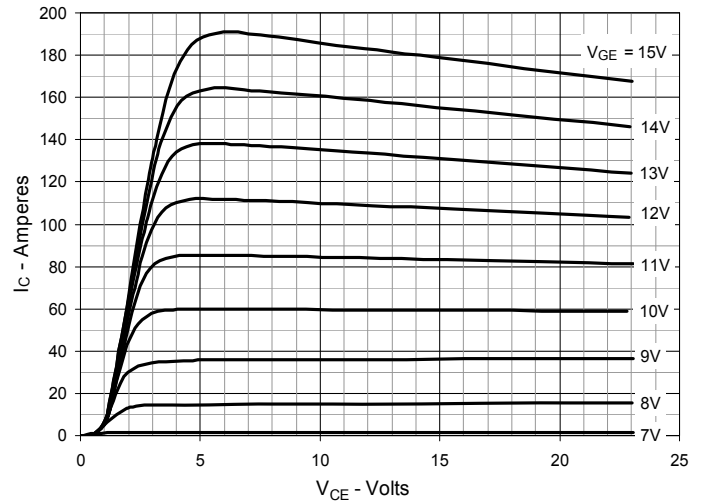
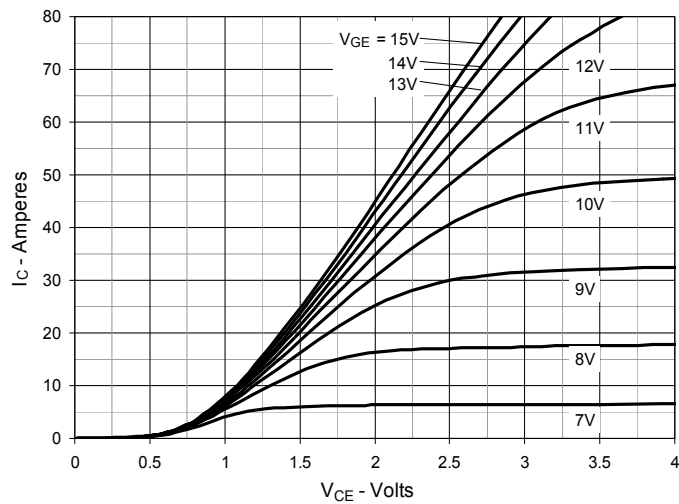
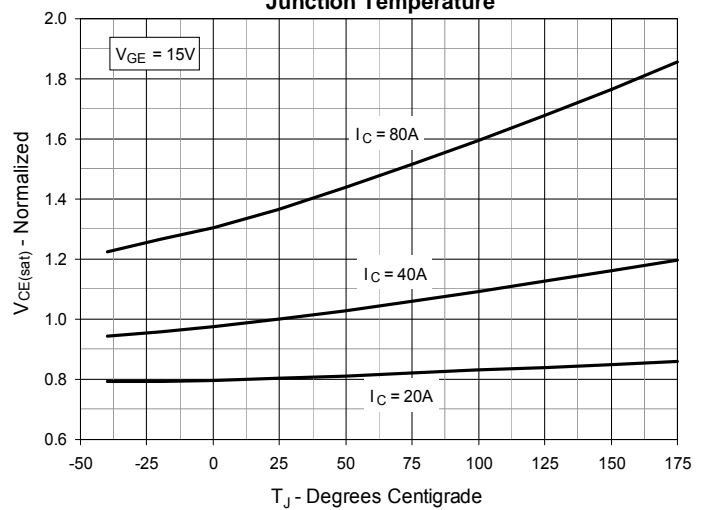
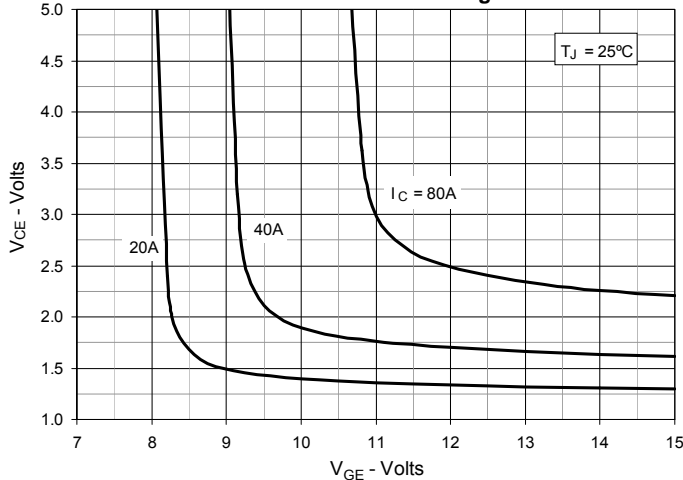
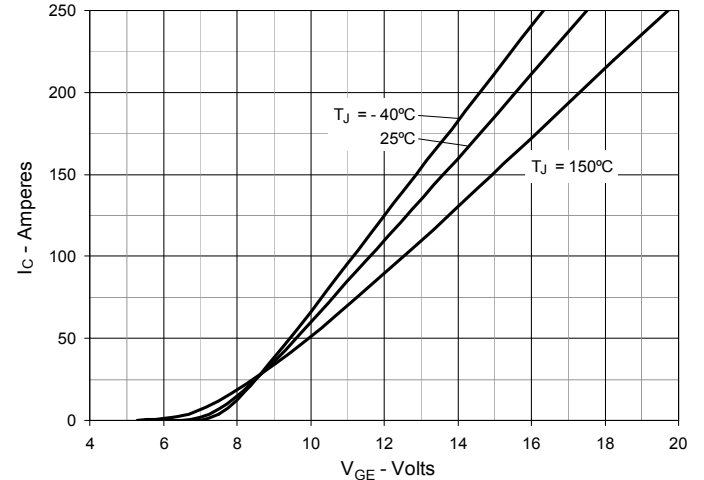
| Symbol Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified) |  | Characteristic Values     |      |                         |
|--|--|---------------------------|------|-------------------------|
|  |  | Min.                      | Typ. | Max.                    |
| $V_F$  | $I_F = 30\text{A}, V_{GE} = 0\text{V}$ , Note 1  |                           |      | 2.5 V                   |
|  |  | $T_J = 150^\circ\text{C}$ | 2.15 | V                       |
| $I_{RM}$   | $I_F = 30\text{A}, V_{GE} = 0\text{V}, T_J = 150^\circ\text{C}$<br>$-di_F/dt = 500\text{A}/\mu\text{s}, V_R = 300\text{V}$ |                           | 25   | A                       |
| $t_{rr}$   |  |                           | 120  | ns                      |
| $R_{thJC}$   |  |                           |      | 0.60 $^\circ\text{C/W}$ |

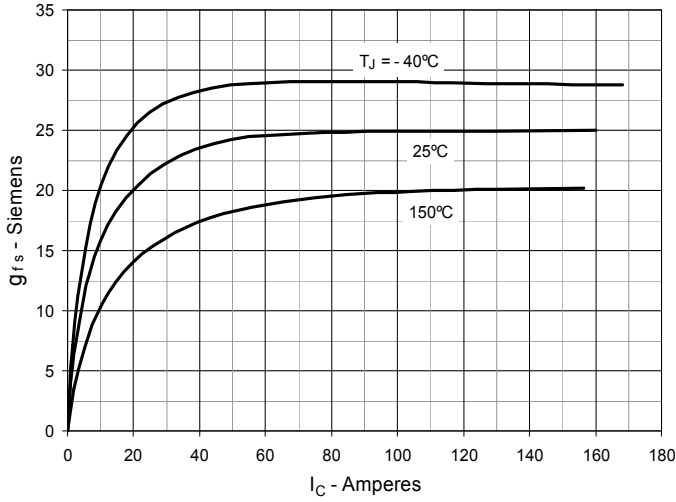
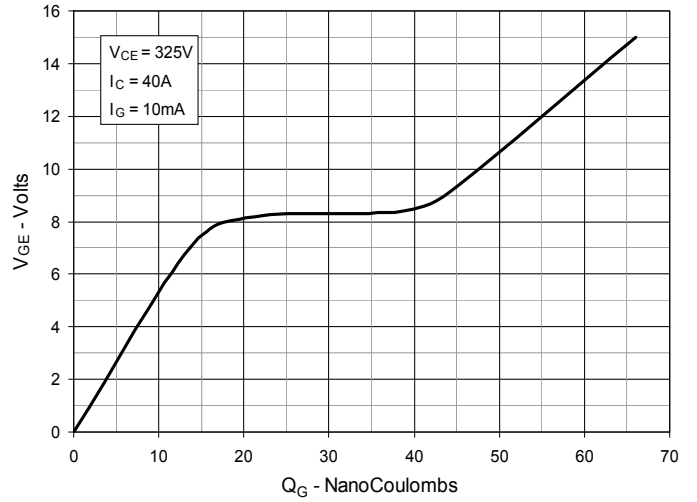
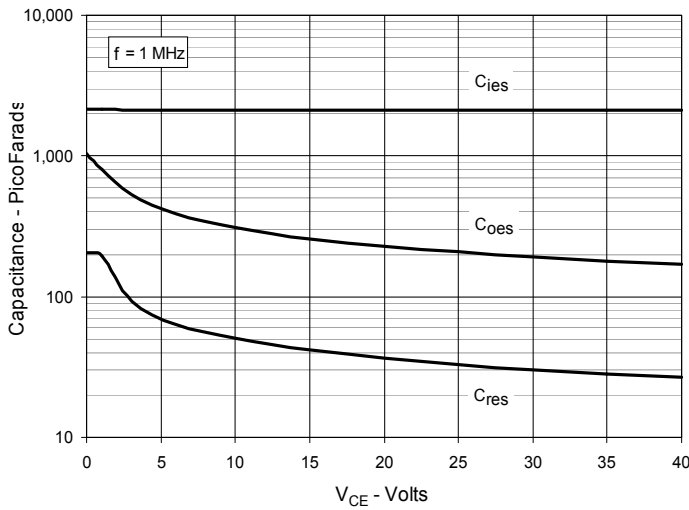
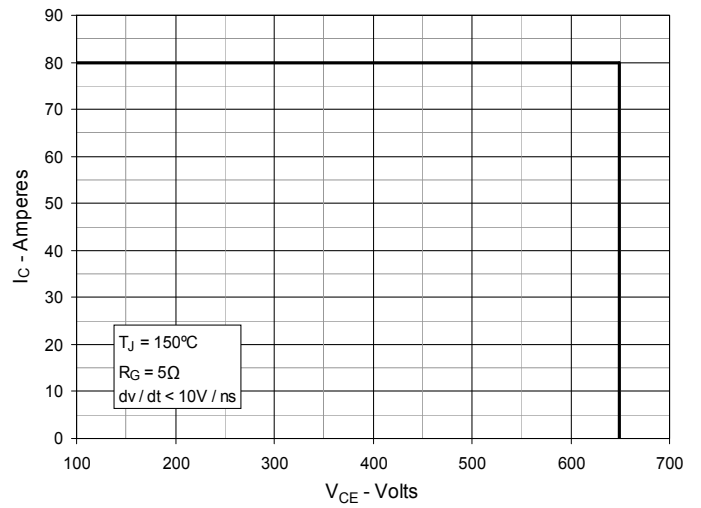
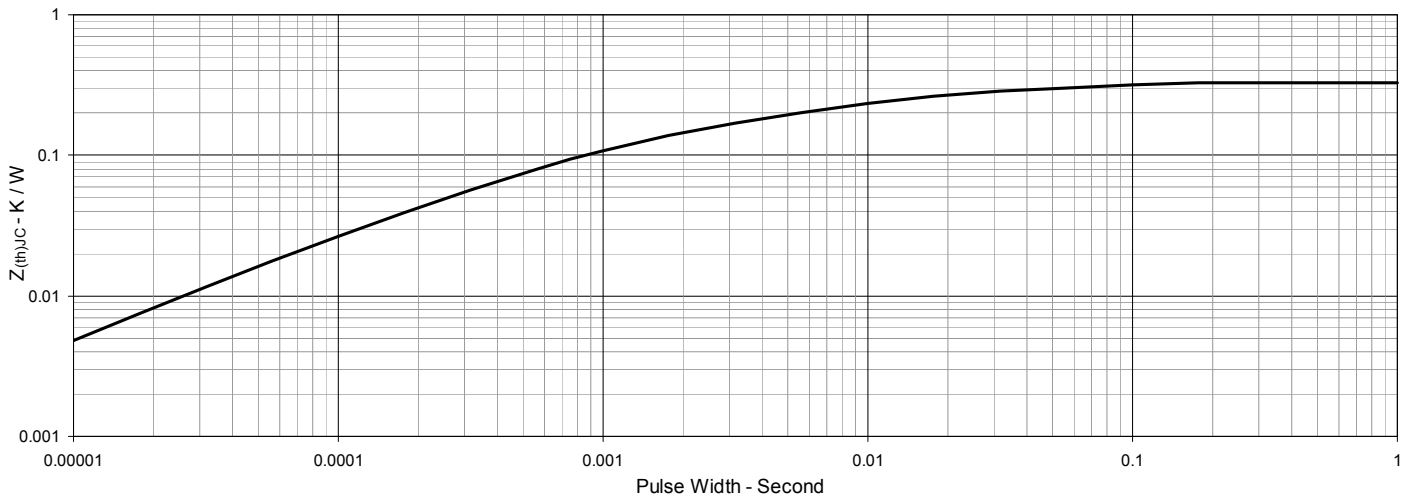
Notes:

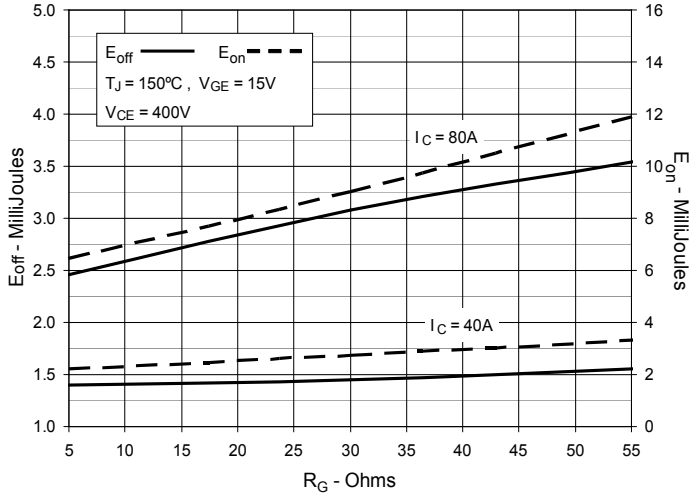
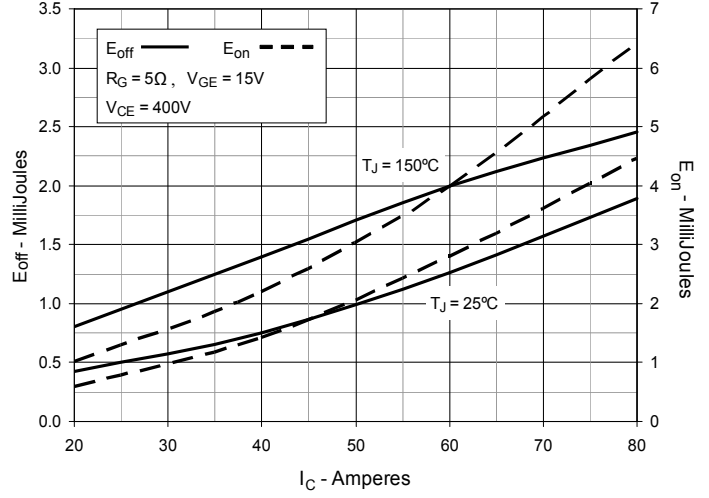
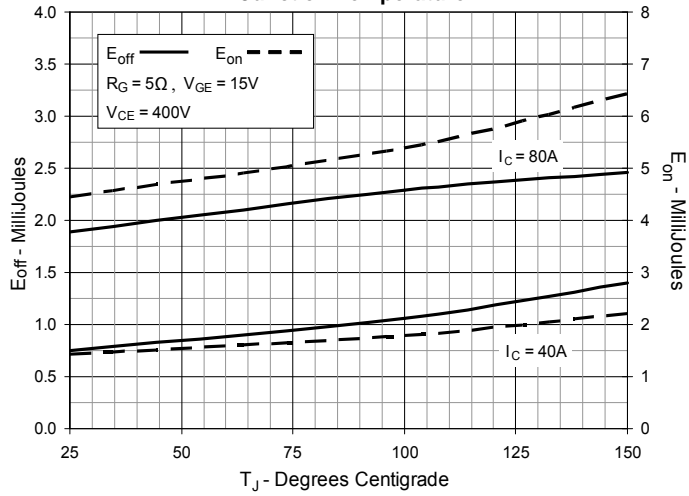
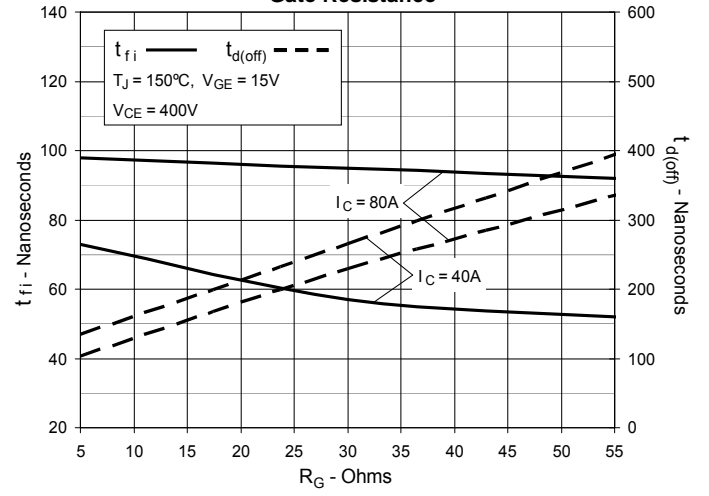
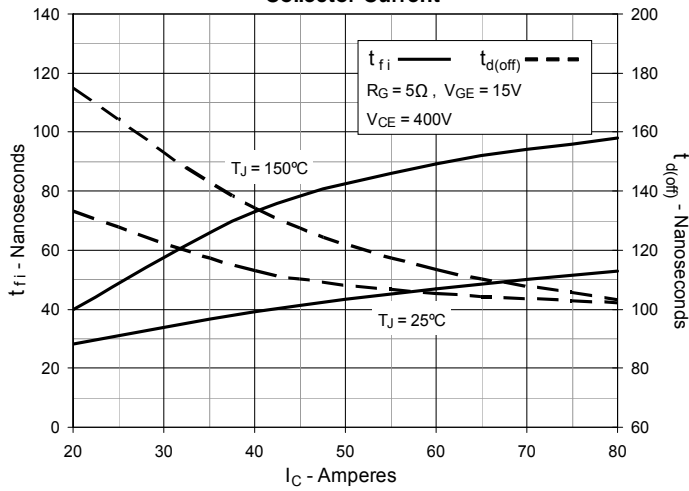
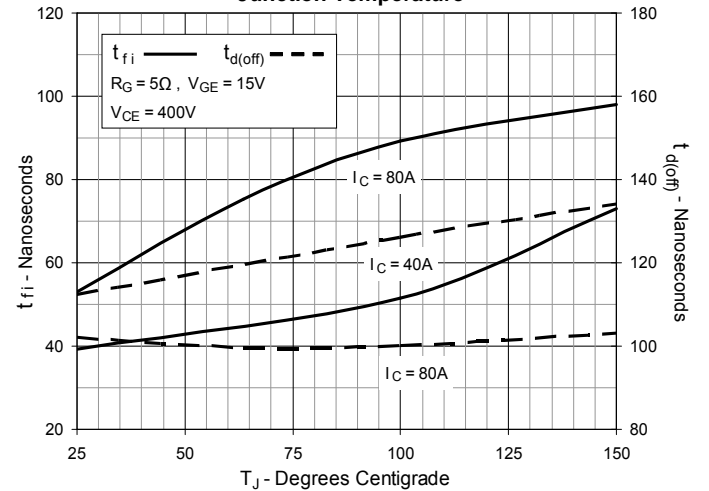
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}$ (clamp),  $T_J$  or  $R_G$ .

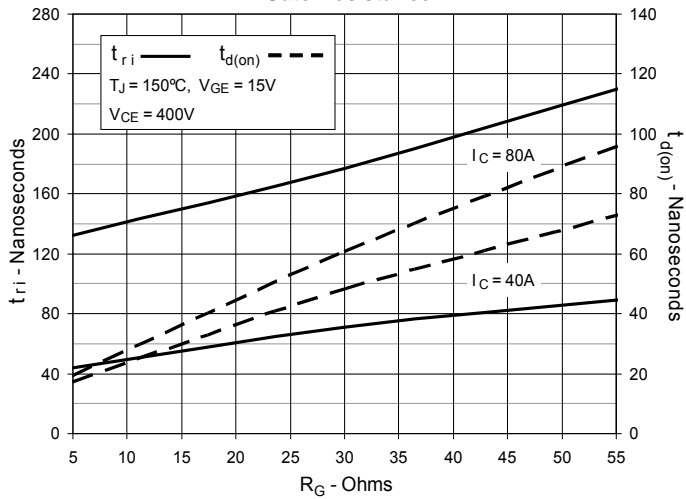
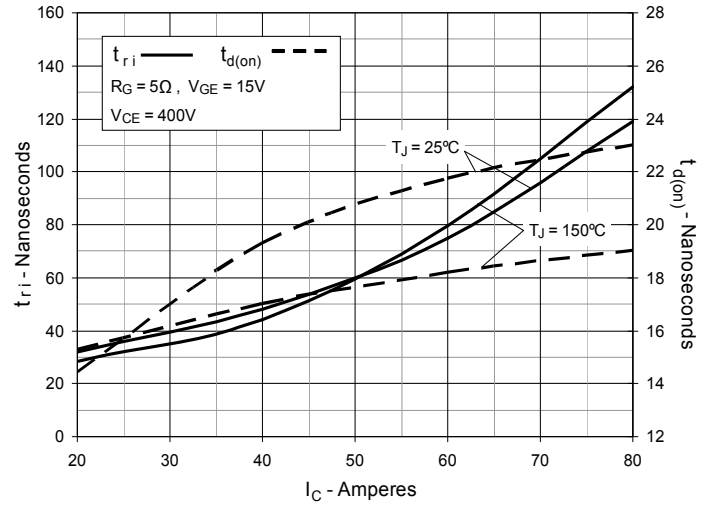
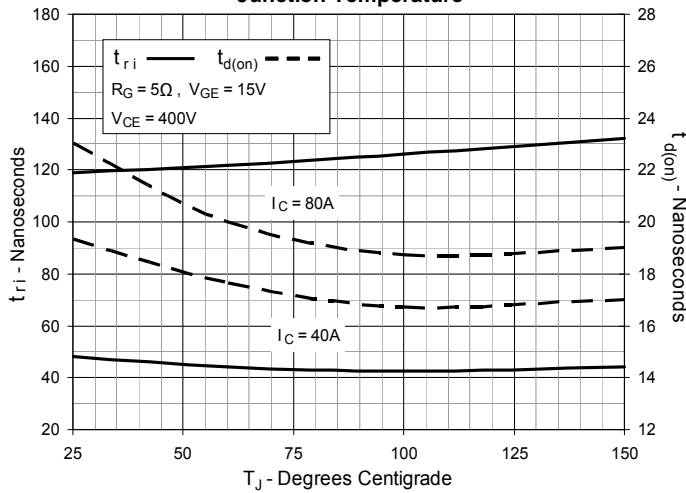
IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

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

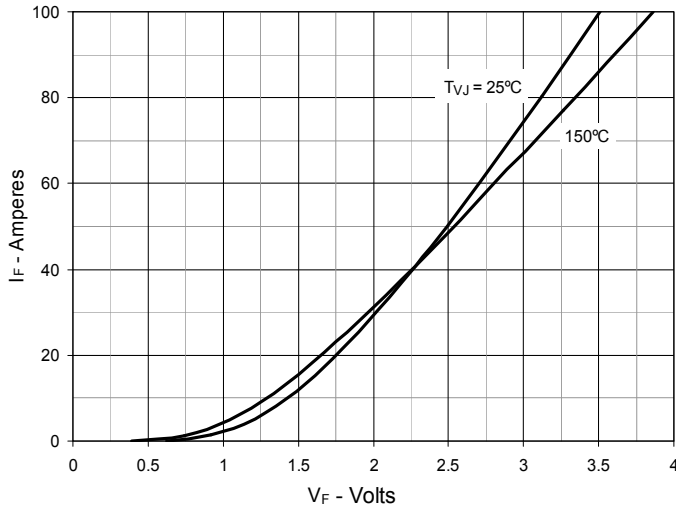
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$** 

**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)**


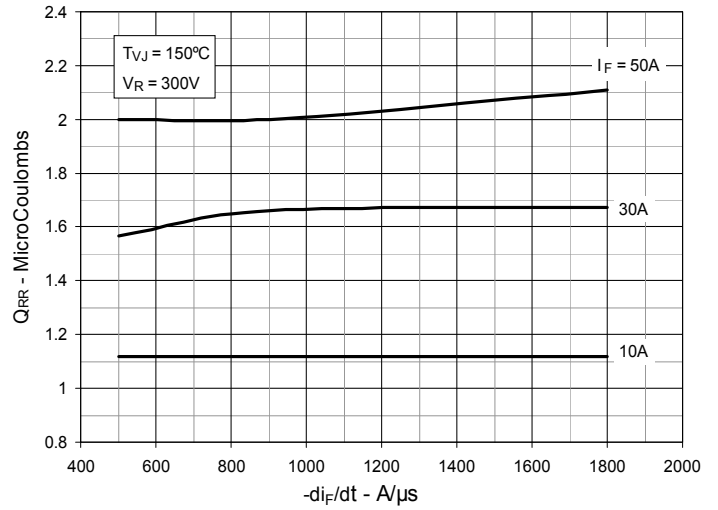
**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**

**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. 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**


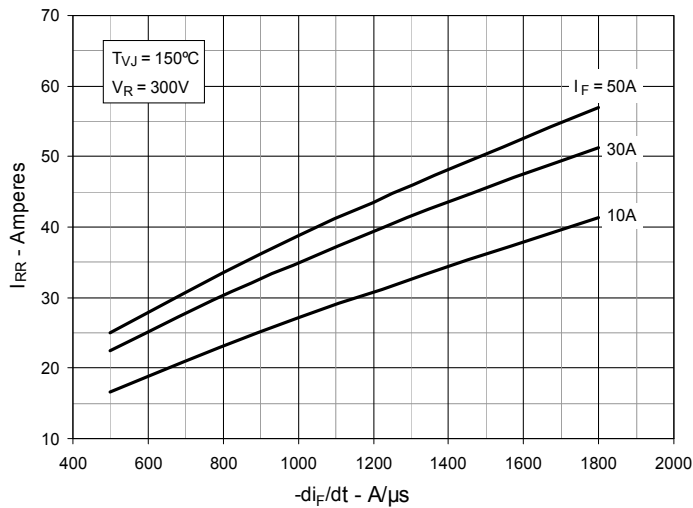
**Fig. 21. Forward Current vs. Forward Voltage**



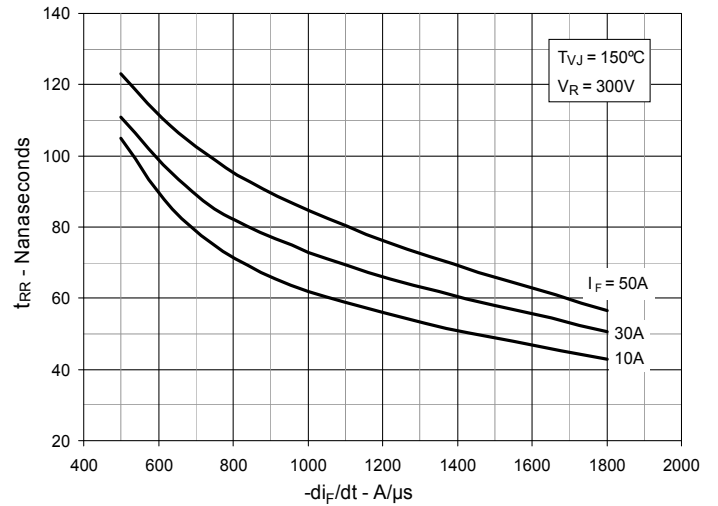
**Fig. 22. Reverse Recovery Charge  $Q_{RR}$  vs.  $-di_F/dt$**



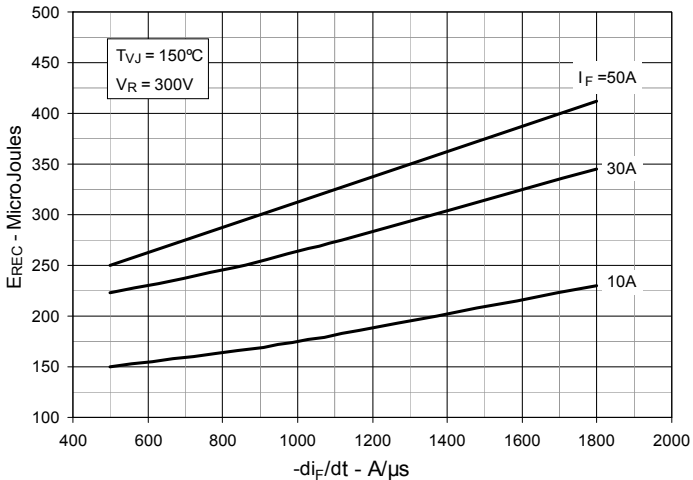
**Fig. 23. Peak Reverse Current  $I_{RM}$  vs.  $-di_F/dt$**



**Fig. 24. Recover Time  $t_{RR}$  vs.  $-di_F/dt$**



**Fig. 25. Recovery Energy  $E_{REC}$  vs.  $-di_F/dt$**



**Fig. 26. Dynamic Parameters  $Q_{RR}$ ,  $I_{RM}$  vs. Virtual Junction Temperature  $T_{VJ}$**

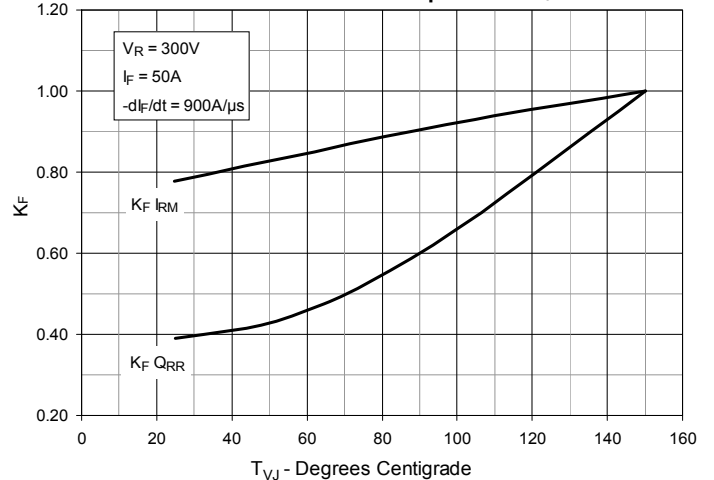
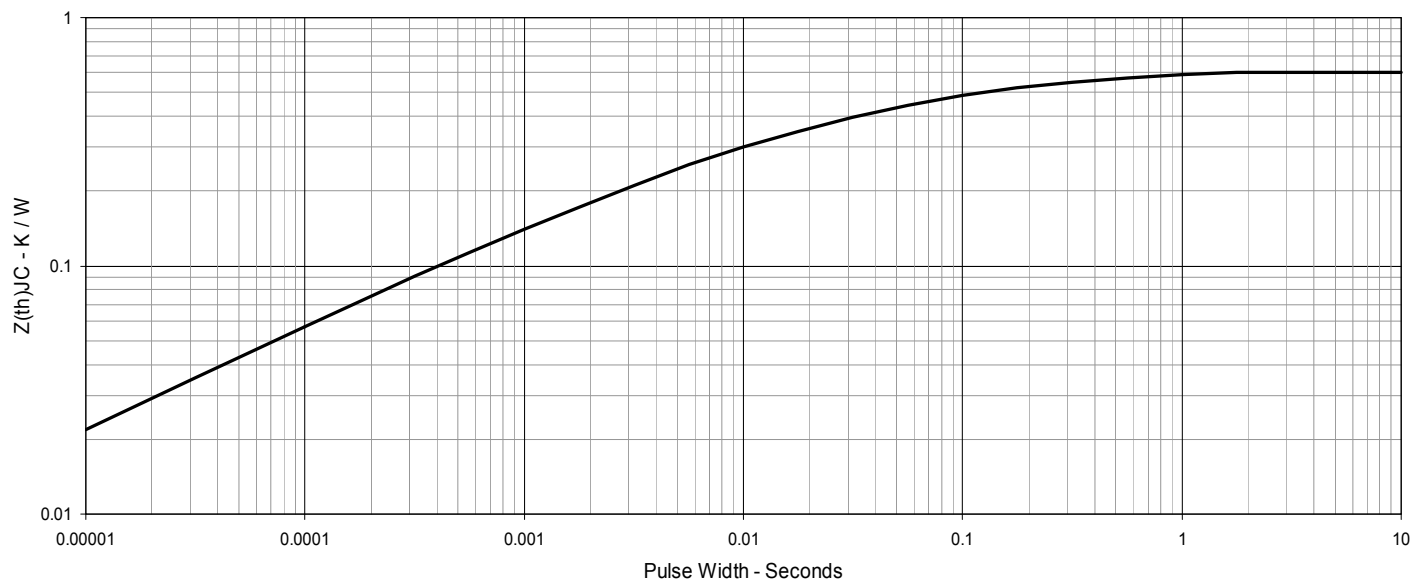


Fig. 27. Maximum Transient Thermal Impedance (Diode)





## X-ON Electronics

Largest Supplier of Electrical and Electronic Components

*Click to view similar products for [IGBT Transistors](#) category:*

*Click to view products by [IXYS](#) manufacturer:*

Other Similar products are found below :

[748152A](#) [APT20GT60BRDQ1G](#) [APT50GT60BRG](#) [NGTB10N60FG](#) [STGFW20V60DF](#) [APT30GP60BG](#) [APT45GR65B2DU30](#)  
[GT50JR22\(STA1ES\)](#) [TIG058E8-TL-H](#) [IGW40N120H3FKSA1](#) [VS-CPV364M4KPBF](#) [NGTB25N120FL2WAG](#) [NGTG40N120FL2WG](#)  
[RJH60F3DPQ-A0#T0](#) [APT40GR120B2SCD10](#) [APT15GT120BRG](#) [APT20GT60BRG](#) [NGTB75N65FL2WAG](#) [NGTG15N120FL2WG](#)  
[IXA30RG1200DHGLB](#) [IXA40RG1200DHGLB](#) [APT70GR65B2DU40](#) [NTE3320](#) [QP12W05S-37A](#) [IHF40N65R5SXXSA1](#) [APT70GR120J](#)  
[APT35GP120JDQ2](#) [IKZA40N65RH5XKSA1](#) [IKFW75N65ES5XKSA1](#) [IKFW50N65ES5XKSA1](#) [IKFW50N65EH5XKSA1](#)  
[IKFW40N65ES5XKSA1](#) [IKFW60N65ES5XKSA1](#) [IMBG120R090M1HXTMA1](#) [IMBG120R220M1HXTMA1](#) [XD15H120CX1](#)  
[XD25H120CX0](#) [XP15PJS120CL1B1](#) [IGW30N60H3FKSA1](#) [STGWA8M120DF3](#) [IGW08T120FKSA1](#) [IGW75N60H3FKSA1](#)  
[FGH60N60SMD\\_F085](#) [FGH75T65UPD](#) [STGWA15H120F2](#) [IKA10N60TXKSA1](#) [IHW20N120R5XKSA1](#) [RJH60D2DPP-M0#T2](#)  
[IKP20N60TXKSA1](#) [IHW20N65R5XKSA1](#)