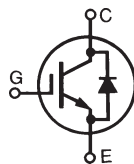


# 900V XPT™ IGBT GenX3™ w/ Diode

## IXYH40N90C3D1

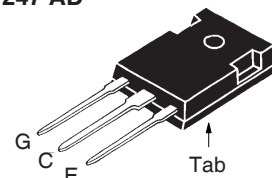


High-Speed IGBT  
for 20-50 kHz Switching

$$\begin{aligned} V_{CES} &= 900V \\ I_{C110} &= 40A \\ V_{CE(sat)} &\leq 2.5V \\ t_{fi(typ)} &= 110ns \end{aligned}$$

| Symbol                        | Test Conditions                                                                           | Maximum Ratings                          |                  |
|-------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------|------------------|
| $V_{CES}$                     | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                                           | 900                                      | V                |
| $V_{CGR}$                     | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ , $R_{GE} = 1M\Omega$                     | 900                                      | V                |
| $V_{GES}$                     | Continuous                                                                                | $\pm 20$                                 | V                |
| $V_{GEM}$                     | Transient                                                                                 | $\pm 30$                                 | V                |
| $I_{C25}$                     | $T_C = 25^\circ\text{C}$                                                                  | 90                                       | A                |
| $I_{C110}$                    | $T_C = 110^\circ\text{C}$                                                                 | 40                                       | A                |
| $I_{F110}$                    | $T_C = 110^\circ\text{C}$                                                                 | 25                                       | A                |
| $I_{CM}$                      | $T_C = 25^\circ\text{C}$ , 1ms                                                            | 180                                      | A                |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 5\Omega$<br>Clamped Inductive Load | $I_{CM} = 80$<br>@ $V_{CE} \leq V_{CES}$ | A                |
| $P_C$                         | $T_C = 25^\circ\text{C}$                                                                  | 500                                      | W                |
| $T_J$                         |                                                                                           | -55 ... +150                             | $^\circ\text{C}$ |
| $T_{JM}$                      |                                                                                           | 150                                      | $^\circ\text{C}$ |
| $T_{stg}$                     |                                                                                           | -55 ... +150                             | $^\circ\text{C}$ |
| $T_L$                         | Maximum Lead Temperature for Soldering                                                    | 300                                      | $^\circ\text{C}$ |
| $T_{SOLD}$                    | 1.6 mm (0.062in.) from Case for 10s                                                       | 260                                      | $^\circ\text{C}$ |
| $M_d$                         | 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 Low Switching Losses
- Square RBSOA
- Positive Thermal Coefficient of  $V_{ce(sat)}$
- Anti-Parallel Ultra Fast Diode
- High Current Handling Capability
- International Standard Package

### 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<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |            |                                       |
|---------------|-----------------------------------------------------------------------------|-----------------------|------------|---------------------------------------|
|               |                                                                             | Min.                  | Typ.       | Max.                                  |
| $BV_{CES}$    | $I_C = 250\mu\text{A}$ , $V_{GE} = 0V$                                      | 950                   |            | V                                     |
| $V_{GE(th)}$  | $I_C = 250\mu\text{A}$ , $V_{CE} = V_{GE}$                                  | 3.5                   |            | 5.5 V                                 |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 125^\circ\text{C}$             |                       |            | 25 $\mu\text{A}$<br>750 $\mu\text{A}$ |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                          |                       |            | $\pm 100$ nA                          |
| $V_{CE(sat)}$ | $I_C = 40A$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 150^\circ\text{C}$          |                       | 2.2<br>2.9 | 2.5 V<br>V                            |

| Symbol       | Test Conditions                                                                                                                             | Characteristic Values |      |              |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|--------------|
|              |                                                                                                                                             | Min.                  | Typ. | Max.         |
| $g_{fs}$     | $I_C = 40A, V_{CE} = 10V, \text{Note 1}$                                                                                                    | 14                    | 24   | S            |
| $C_{ies}$    | $V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$                                                                                                       |                       | 2170 | pF           |
| $C_{oes}$    |                                                                                                                                             |                       | 160  | pF           |
| $C_{res}$    |                                                                                                                                             |                       | 40   | pF           |
| $Q_{g(on)}$  | $I_C = 40A, V_{GE} = 15V, V_{CE} = 0.5 \cdot V_{CES}$                                                                                       |                       | 74   | nC           |
| $Q_{ge}$     |                                                                                                                                             |                       | 18   | nC           |
| $Q_{gc}$     |                                                                                                                                             |                       | 34   | nC           |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ C</math></b><br>$I_C = 40A, V_{GE} = 15V$<br>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 5\Omega$<br>Note 2  |                       | 27   | ns           |
| $t_{ri}$     |                                                                                                                                             |                       | 54   | ns           |
| $E_{on}$     |                                                                                                                                             |                       | 1.9  | mJ           |
| $t_{d(off)}$ |                                                                                                                                             |                       | 78   | ns           |
| $t_{fi}$     |                                                                                                                                             |                       | 110  | ns           |
| $E_{off}$    |                                                                                                                                             |                       | 1.0  | 1.7 mJ       |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 125^\circ C</math></b><br>$I_C = 40A, V_{GE} = 15V$<br>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 5\Omega$<br>Note 2 |                       | 27   | ns           |
| $t_{ri}$     |                                                                                                                                             |                       | 54   | ns           |
| $E_{on}$     |                                                                                                                                             |                       | 2.7  | mJ           |
| $t_{d(off)}$ |                                                                                                                                             |                       | 87   | ns           |
| $t_{fi}$     |                                                                                                                                             |                       | 150  | ns           |
| $E_{off}$    |                                                                                                                                             |                       | 1.2  | mJ           |
| $R_{thJC}$   |                                                                                                                                             |                       | 0.25 | $^\circ C/W$ |
| $R_{thCS}$   |                                                                                                                                             | 0.21                  |      | $^\circ C/W$ |

TO-247 (IXYH) Outline



Terminals: 1 - Gate 2 - Collector 3 - Emitter

| 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 Diode (FRED)

| Symbol     | Test Conditions                                                    | Characteristic Value            |      |                  |
|------------|--------------------------------------------------------------------|---------------------------------|------|------------------|
|            |                                                                    | Min.                            | Typ. | Max.             |
| $V_F$      | $I_F = 30A, V_{GE} = 0V, \text{Note 1}$<br>$T_J = 150^\circ C$     |                                 | 1.6  | 2.8 V            |
| $I_{RM}$   | $I_F = 30A, V_{GE} = 0V, -di_F/dt = 100A/\mu s, T_J = 100^\circ C$ |                                 |      | 4 A              |
| $t_{rr}$   |                                                                    | $V_R = 300V, T_J = 100^\circ C$ | 100  | ns               |
| $R_{thJC}$ |                                                                    |                                 |      | 0.9 $^\circ C/W$ |

Notes:

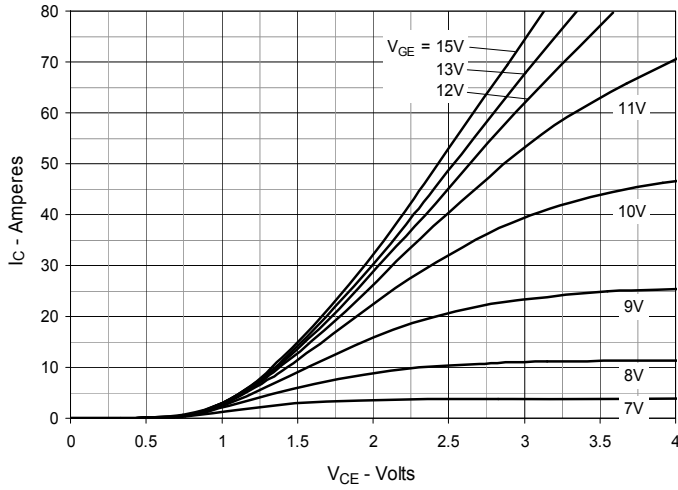
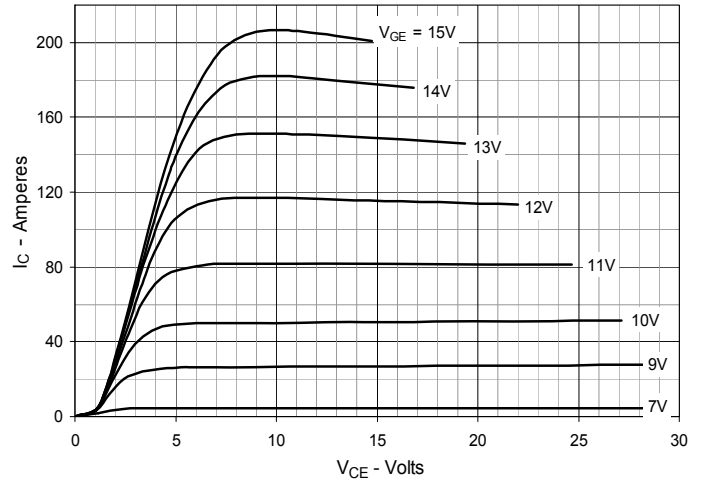
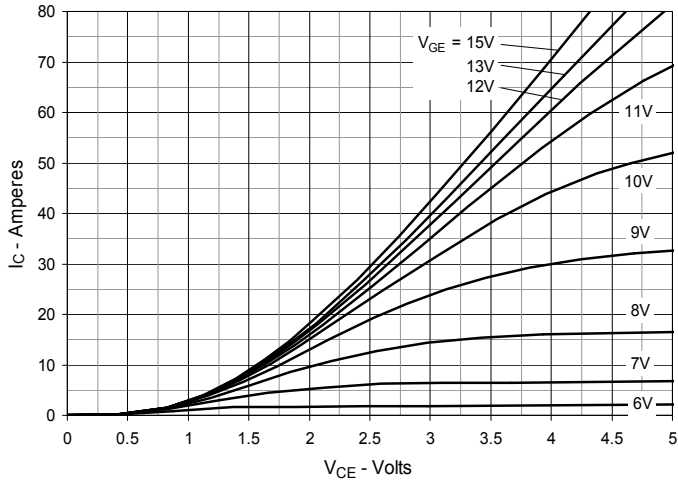
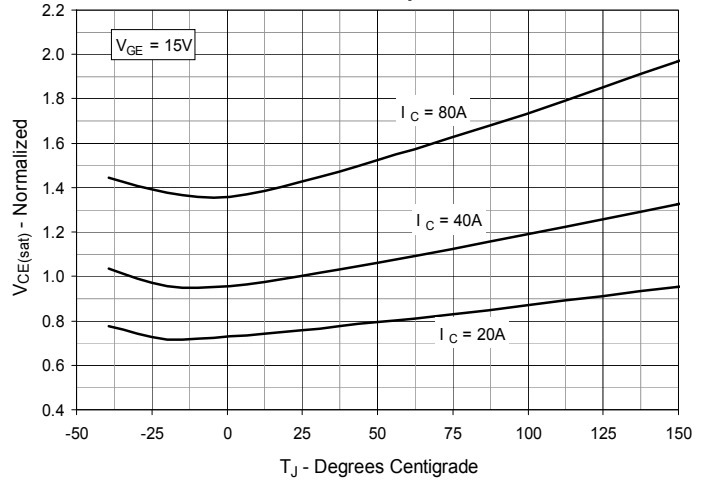
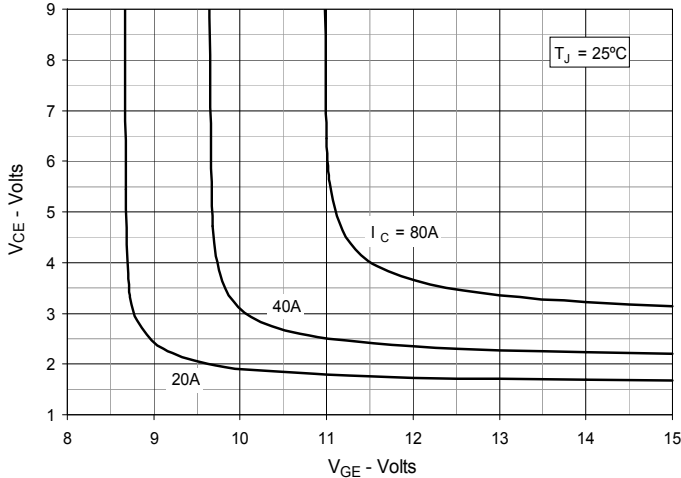
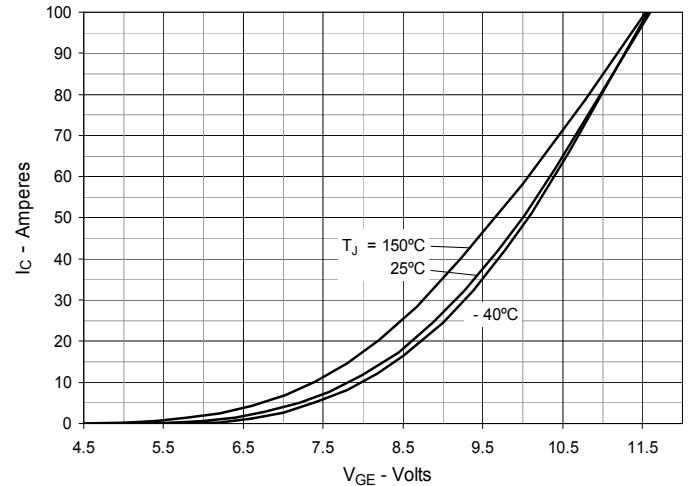
1. Pulse test,  $t \leq 300\mu s$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}$  (clamp),  $T_J$  or  $R_G$ .

### PRELIMINARY TECHNICAL INFORMATION

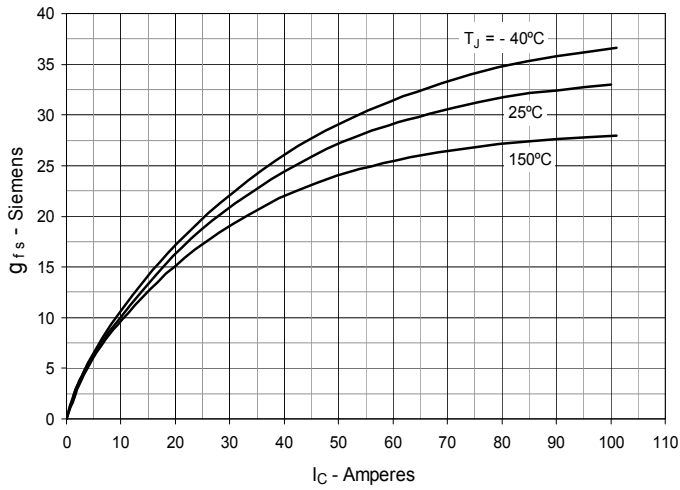
The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test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

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

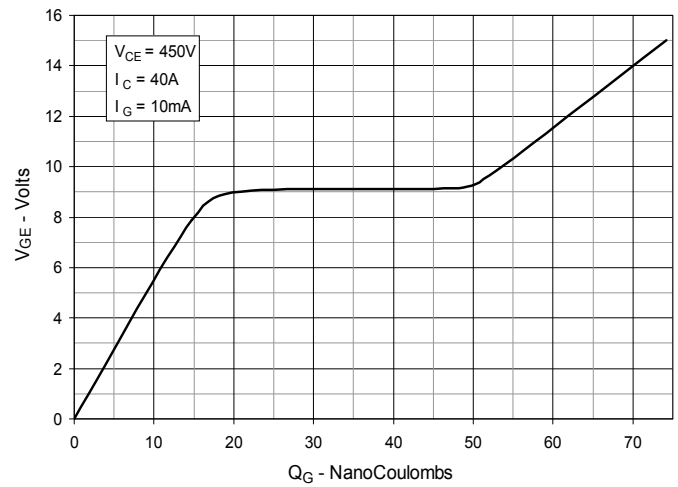
|                                                                                  |           |           |           |           |              |              |              |              |              |             |
|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 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**


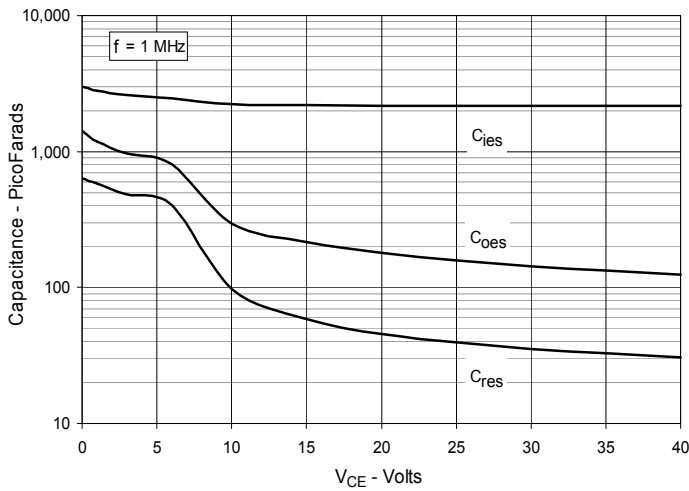
**Fig. 7. Transconductance**



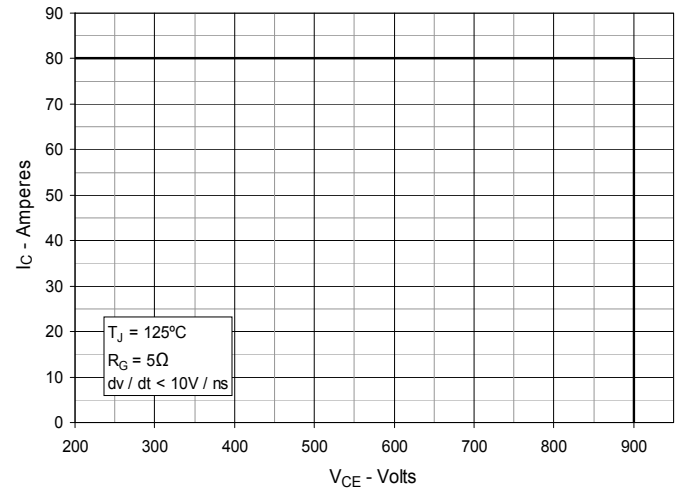
**Fig. 8. Gate Charge**



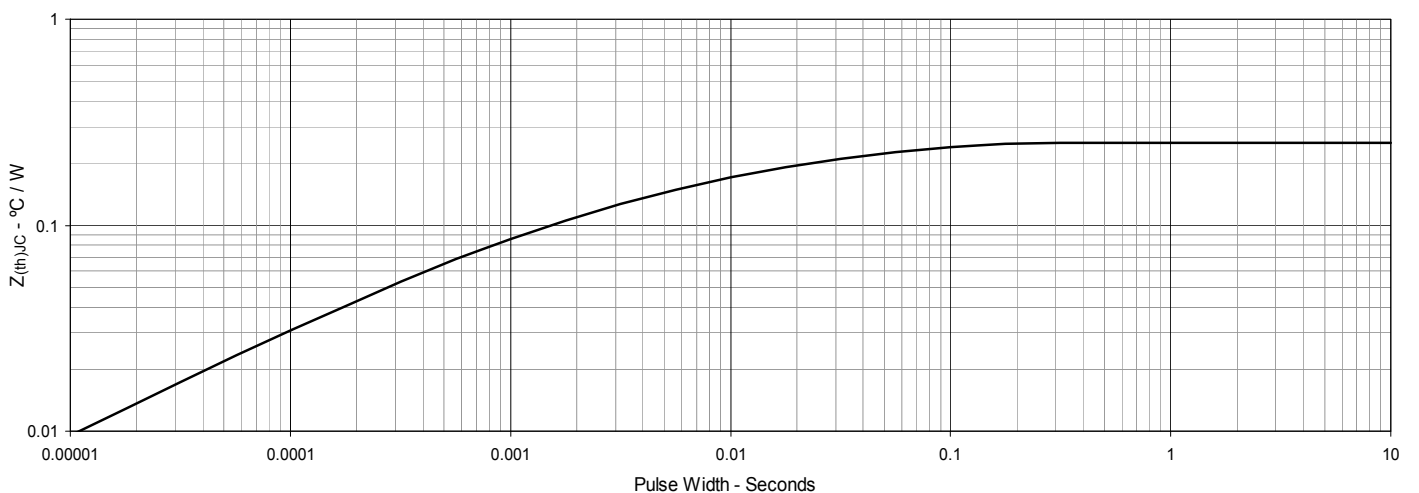
**Fig. 9. Capacitance**

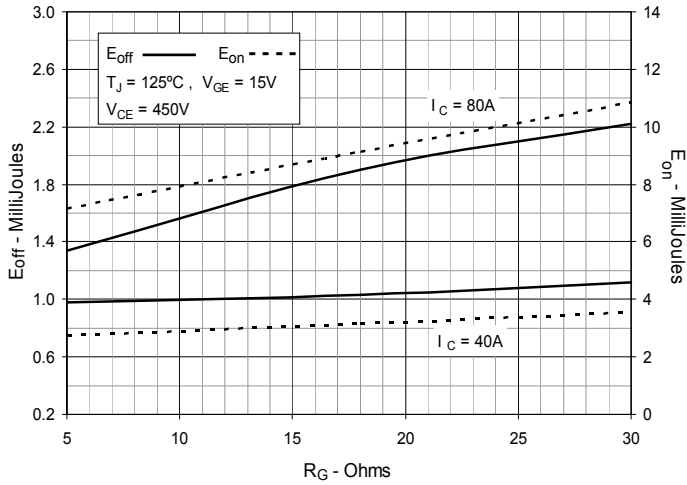
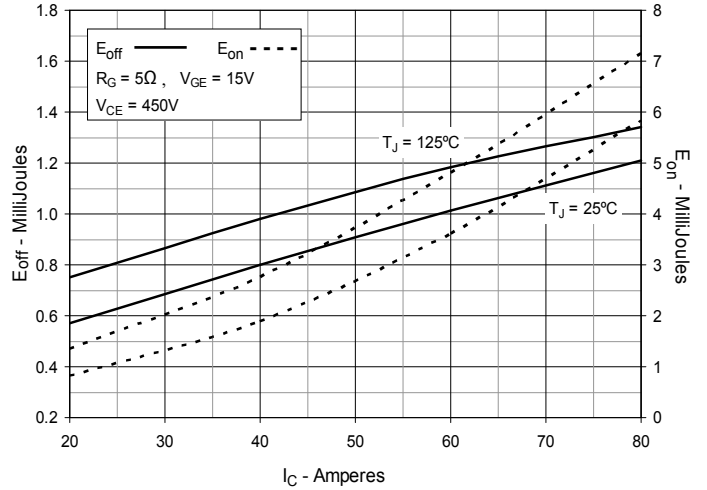
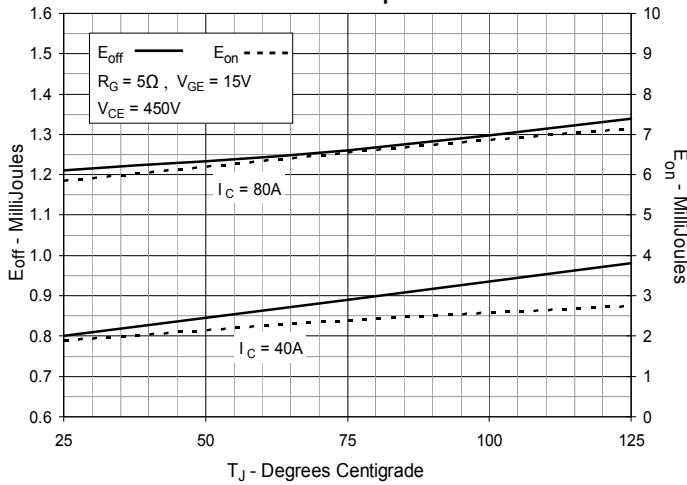
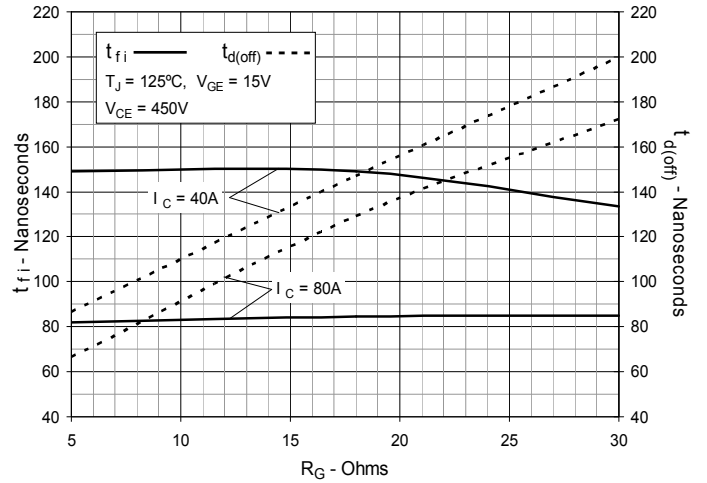
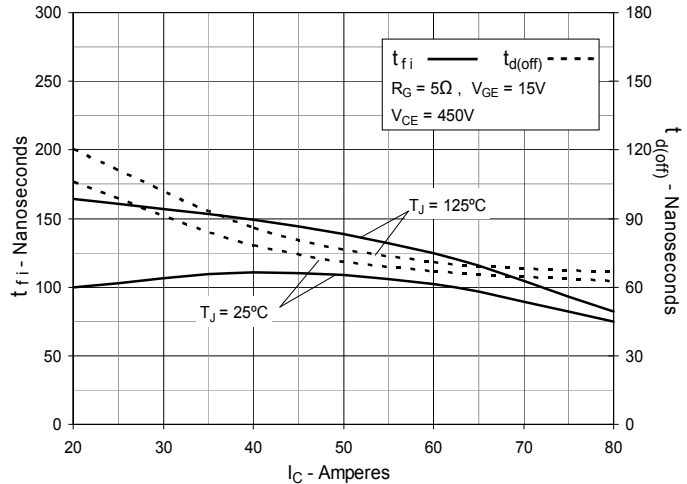
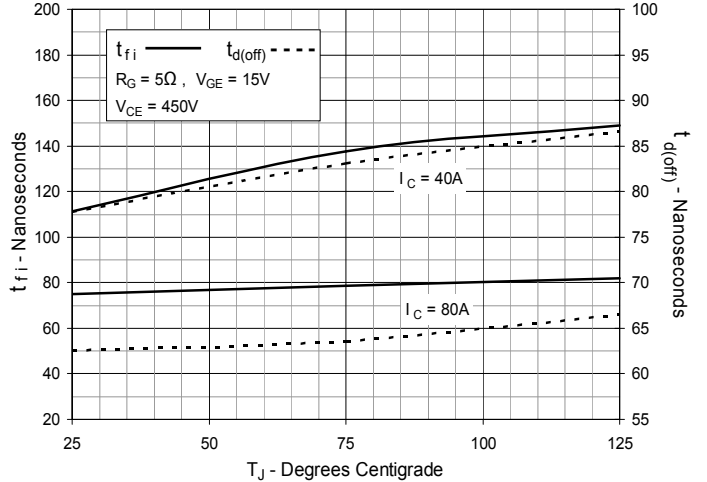


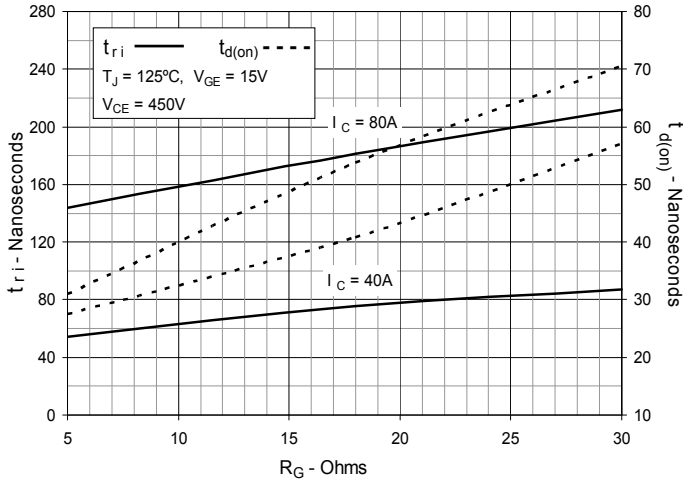
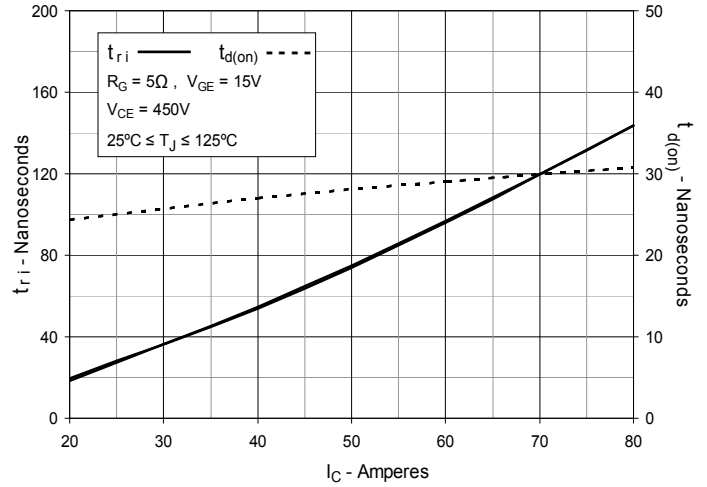
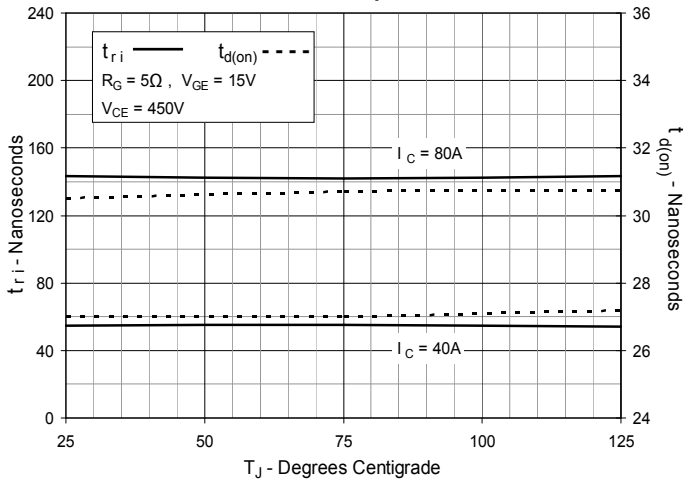
**Fig. 10. Reverse-Bias Safe Operating Area**



**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**


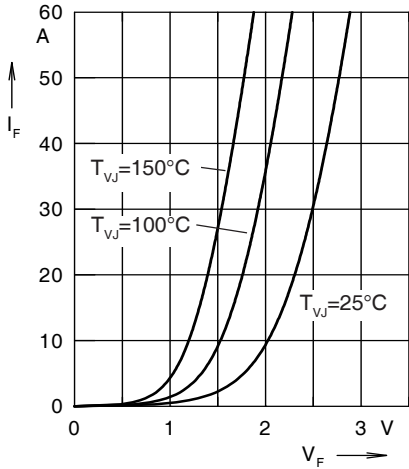


Fig. 21. Forward Current  $I_F$  Versus  $V_F$

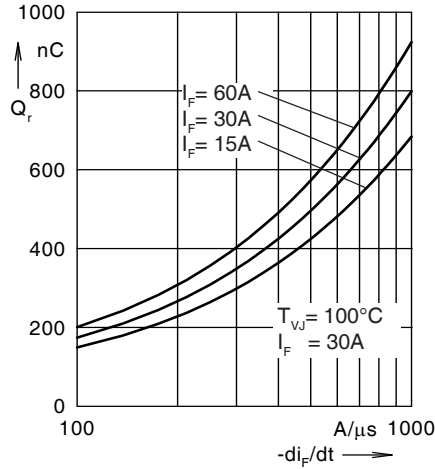


Fig. 22. Reverse Recovery Charge  $Q_r$  Versus  $-di_F/dt$

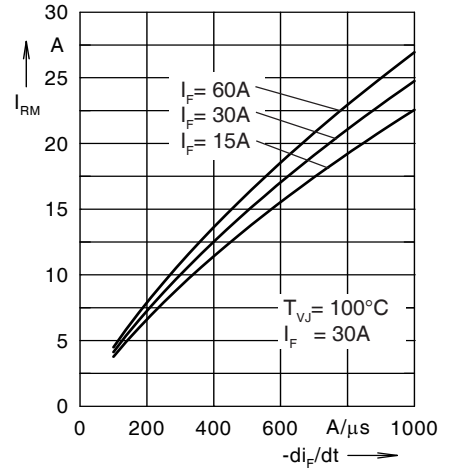


Fig. 23. Peak Reverse Current  $I_{RM}$  Versus  $-di_F/dt$

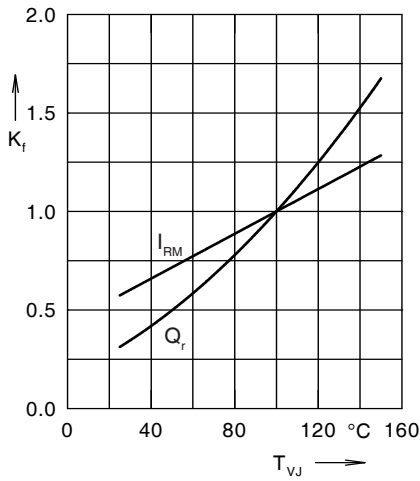


Fig. 24. Dynamic Parameters  $Q_r$ ,  $I_{RM}$  Versus  $T_{VJ}$

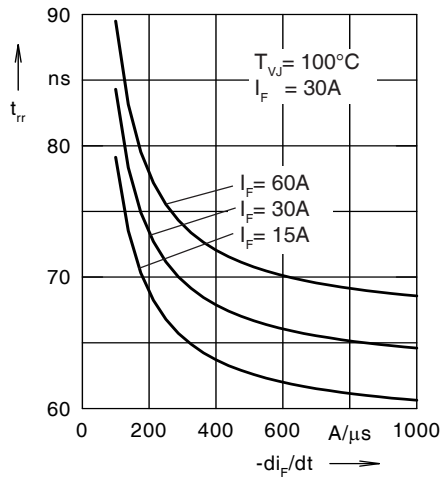


Fig. 25. Recovery Time  $t_{rr}$  Versus  $-di_F/dt$

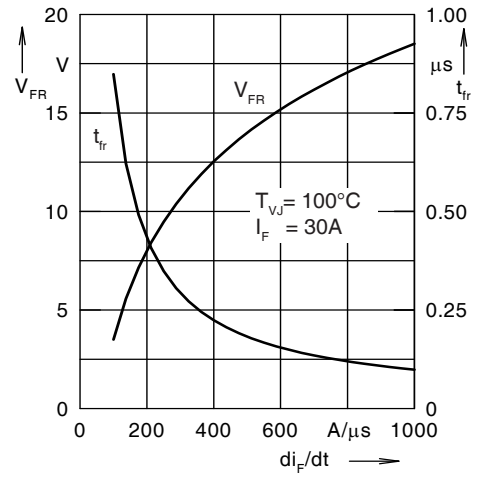


Fig. 26. Peak Forward Voltage  $V_{FR}$  and  $t_{fr}$  Versus  $di_F/dt$

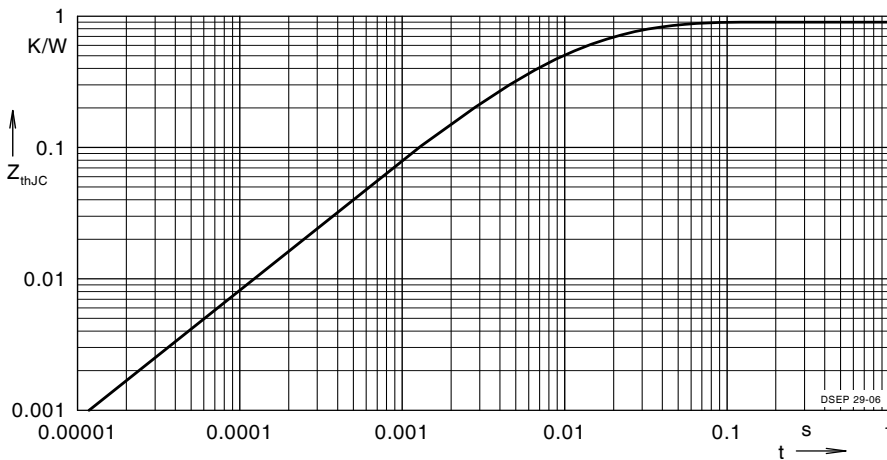


Fig. 27. Transient Thermal Resistance Junction to Case



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