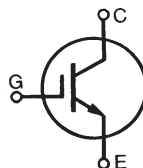


# 1200V XPT™ IGBT GenX3™

## IXYH40N120C3

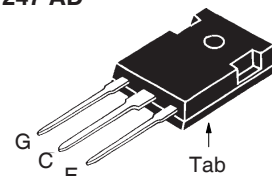
High-Speed IGBT  
for 20-50 kHz Switching



$$\begin{aligned} V_{CES} &= 1200V \\ I_{C110} &= 40A \\ V_{CE(sat)} &\leq 3.5V \\ t_{fi(typ)} &= 50ns \end{aligned}$$

| Symbol                        | Test Conditions                                                                            | Maximum Ratings                          |                  |
|-------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------|------------------|
| $V_{CES}$                     | $T_J = 25^\circ\text{C}$ to $175^\circ\text{C}$                                            | 1200                                     | V                |
| $V_{CGR}$                     | $T_J = 25^\circ\text{C}$ to $175^\circ\text{C}$ , $R_{GE} = 1M\Omega$                      | 1200                                     | V                |
| $V_{GES}$                     | Continuous                                                                                 | $\pm 20$                                 | V                |
| $V_{GEM}$                     | Transient                                                                                  | $\pm 30$                                 | V                |
| $I_{C25}$                     | $T_C = 25^\circ\text{C}$ (Chip Capability)                                                 | 90                                       | A                |
| $I_{C110}$                    | $T_C = 110^\circ\text{C}$                                                                  | 40                                       | A                |
| $I_{CM}$                      | $T_C = 25^\circ\text{C}$ , 1ms                                                             | 175                                      | A                |
| $I_A$                         | $T_C = 25^\circ\text{C}$                                                                   | 20                                       | A                |
| $E_{AS}$                      | $T_C = 25^\circ\text{C}$                                                                   | 400                                      | mJ               |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_{VJ} = 150^\circ\text{C}$ , $R_G = 10\Omega$<br>Clamped Inductive Load | $I_{CM} = 80$<br>@ $V_{CE} \leq V_{CES}$ | A                |
| $P_C$                         | $T_C = 25^\circ\text{C}$                                                                   | 577                                      | 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                                      | $^\circ\text{C}$ |
| $M_d$                         | 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  $V_{ce(sat)}$
- Avalanche Rated
- 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.                                  |
| $BV_{CES}$    | $I_C = 250\mu\text{A}$ , $V_{GE} = 0V$                                      | 1200                  |            | V                                     |
| $V_{GE(th)}$  | $I_C = 250\mu\text{A}$ , $V_{CE} = V_{GE}$                                  | 3.0                   |            | 5.0 V                                 |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 150^\circ\text{C}$             |                       |            | 10 $\mu\text{A}$<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>$T_J = 150^\circ\text{C}$          |                       | 2.9<br>3.7 | 3.5 V<br>V                            |

## Symbol Test Conditions

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

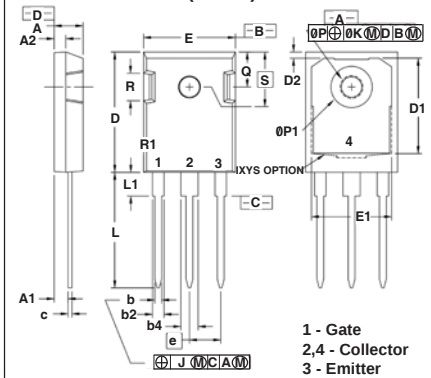
## Characteristic Values

|              |                                                                                                                                                                  | Min. | Typ. | Max.                    |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-------------------------|
| $g_{fs}$     | $I_C = 40\text{A}, V_{CE} = 10\text{V}$ , Note 1                                                                                                                 | 11   | 18   | S                       |
| $C_{ies}$    | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$                                                                                                       |      | 1870 | pF                      |
| $C_{oes}$    |                                                                                                                                                                  |      | 107  | pF                      |
| $C_{res}$    |                                                                                                                                                                  |      | 38   | pF                      |
| $Q_{g(on)}$  | $I_C = 40\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$                                                                                              |      | 80   | nC                      |
| $Q_{ge}$     |                                                                                                                                                                  |      | 14   | nC                      |
| $Q_{gc}$     |                                                                                                                                                                  |      | 37   | 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>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 10\Omega$<br>Note 2  |      | 18   | ns                      |
| $t_{ri}$     |                                                                                                                                                                  |      | 64   | ns                      |
| $E_{on}$     |                                                                                                                                                                  |      | 3.8  | mJ                      |
| $t_{d(off)}$ |                                                                                                                                                                  |      | 133  | ns                      |
| $t_{fi}$     |                                                                                                                                                                  |      | 50   | ns                      |
| $E_{off}$    |                                                                                                                                                                  |      | 1.1  | 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>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 10\Omega$<br>Note 2 |      | 22   | ns                      |
| $t_{ri}$     |                                                                                                                                                                  |      | 73   | ns                      |
| $E_{on}$     |                                                                                                                                                                  |      | 6.6  | mJ                      |
| $t_{d(off)}$ |                                                                                                                                                                  |      | 160  | ns                      |
| $t_{fi}$     |                                                                                                                                                                  |      | 143  | ns                      |
| $E_{off}$    |                                                                                                                                                                  |      | 2.1  | mJ                      |
| $R_{thJC}$   |                                                                                                                                                                  |      |      | 0.26 $^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                                                  |      | 0.21 | $^\circ\text{C/W}$      |

## Notes:

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

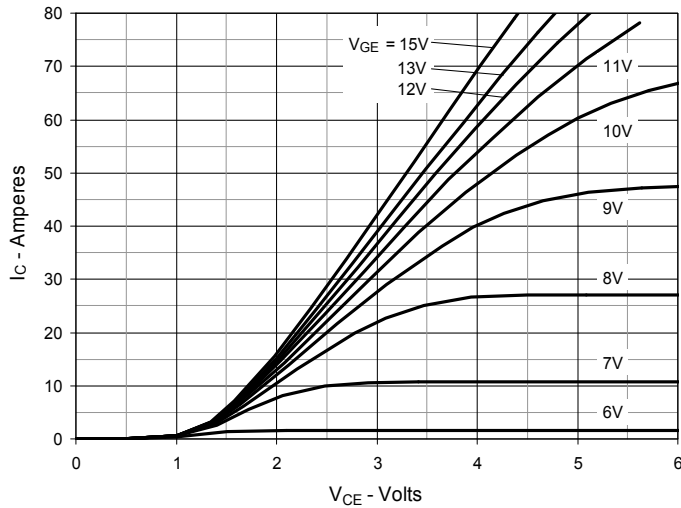
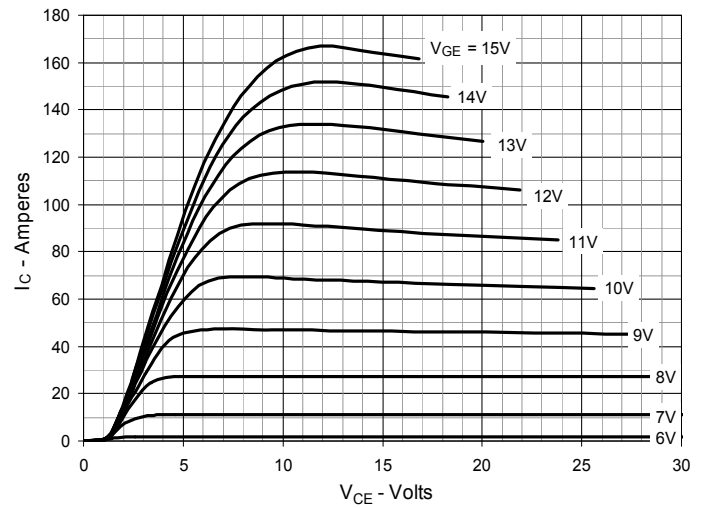
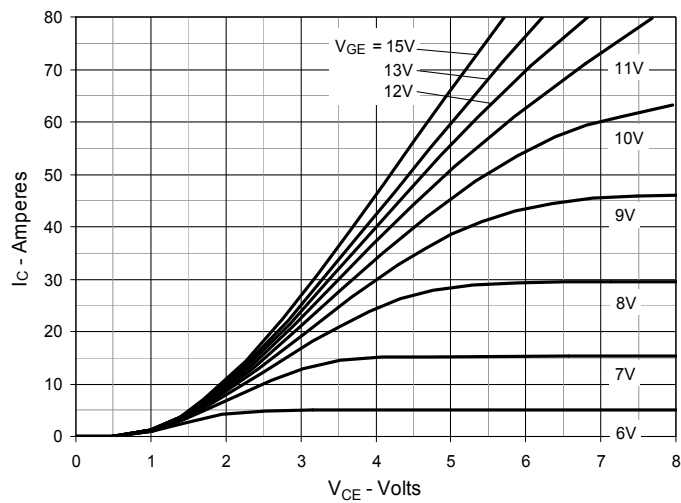
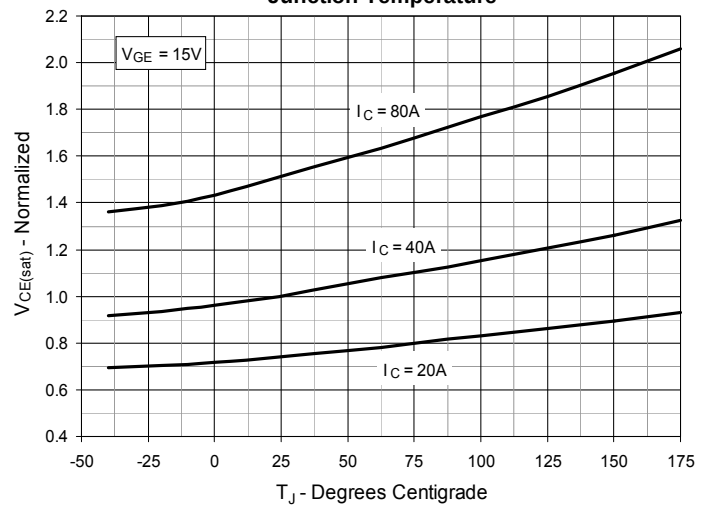
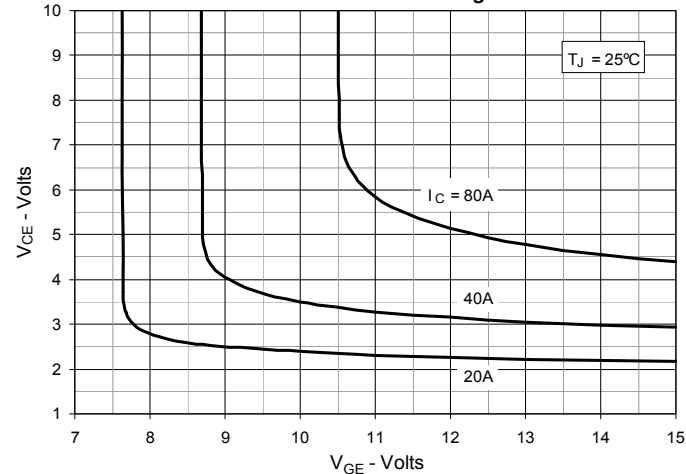
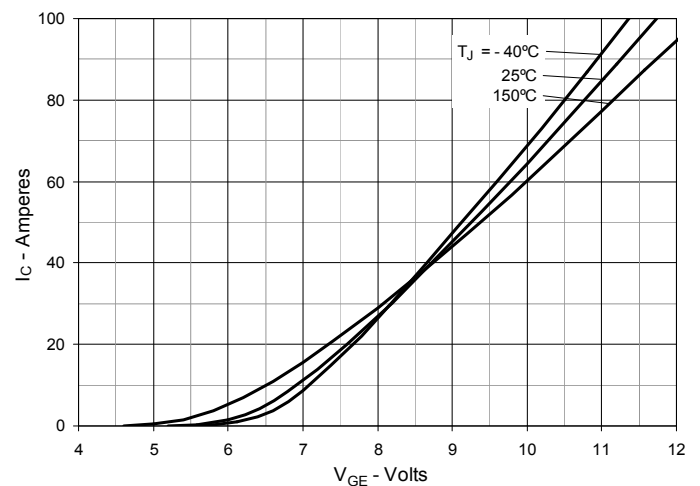
## TO-247 (IXYH) Outline



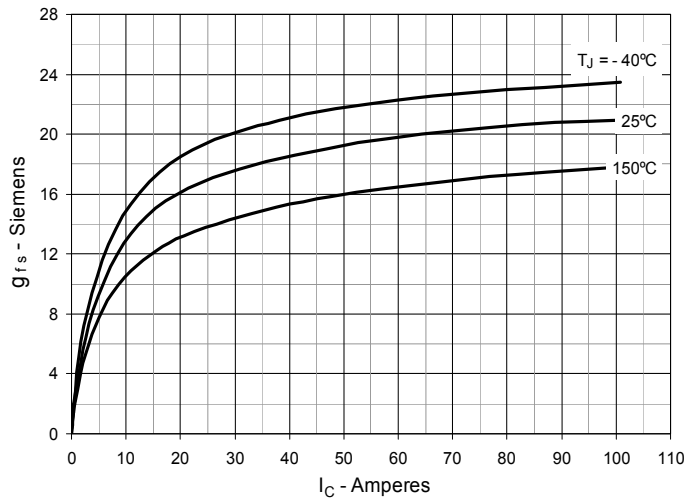
| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .190     | .205 | 4.83        | 5.21  |
| A1  | .090     | .100 | 2.29        | 2.54  |
| A2  | .075     | .085 | 1.91        | 2.16  |
| b   | .045     | .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    |       |

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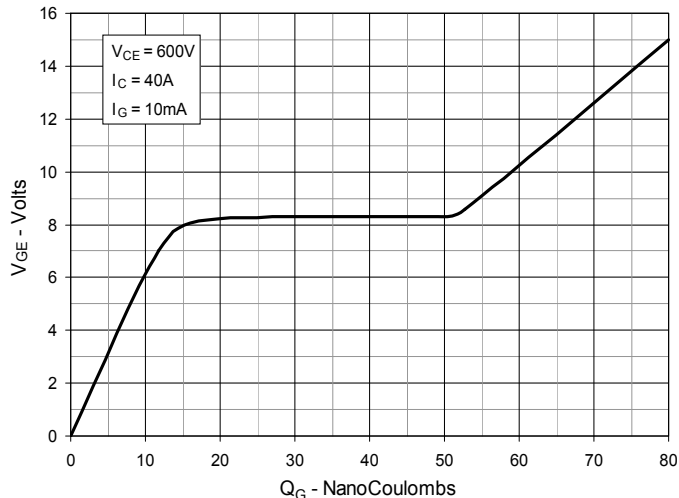
|                                                                                  |           |           |           |           |              |              |              |              |              |             |
|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------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


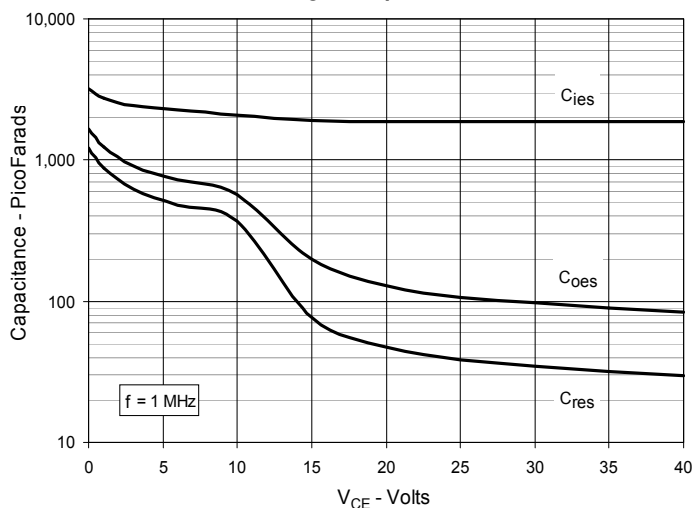
**Fig. 7. Transconductance**



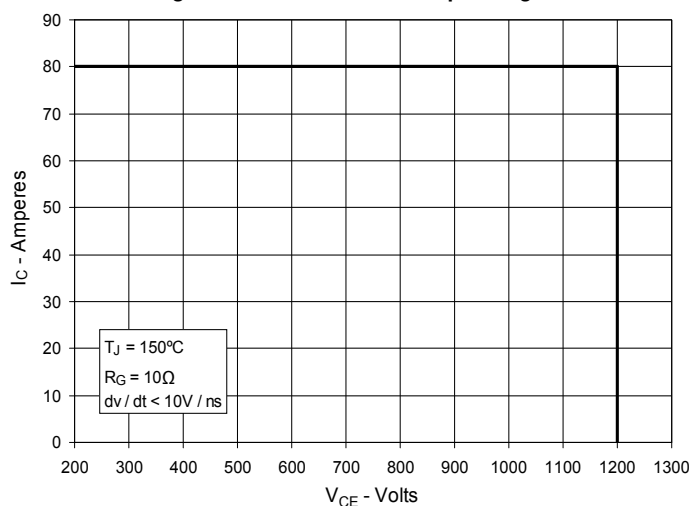
**Fig. 8. Gate Charge**



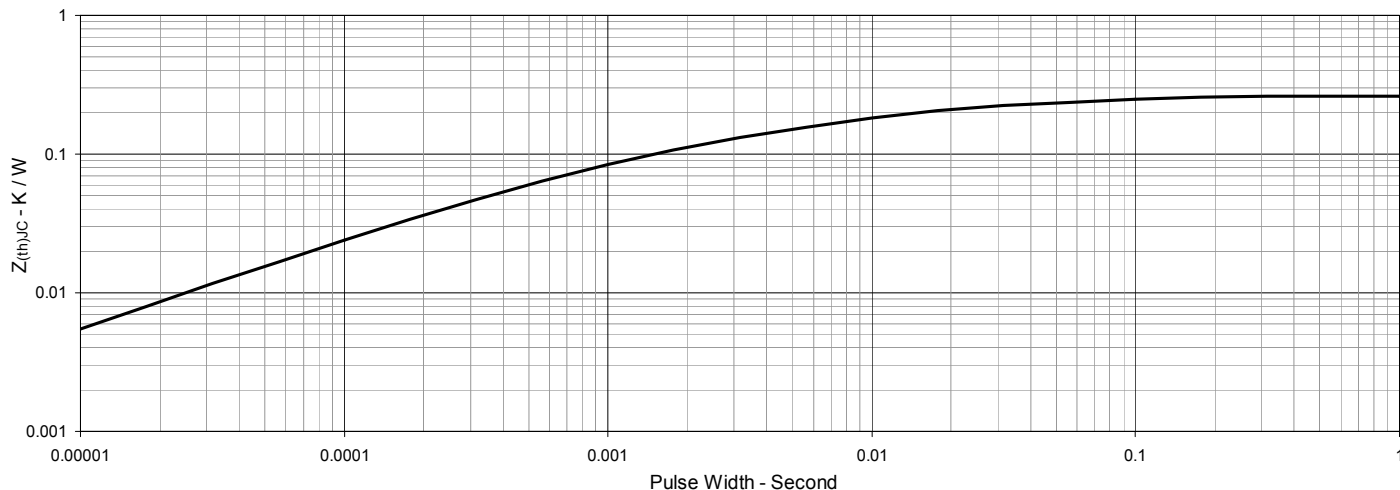
**Fig. 9. Capacitance**



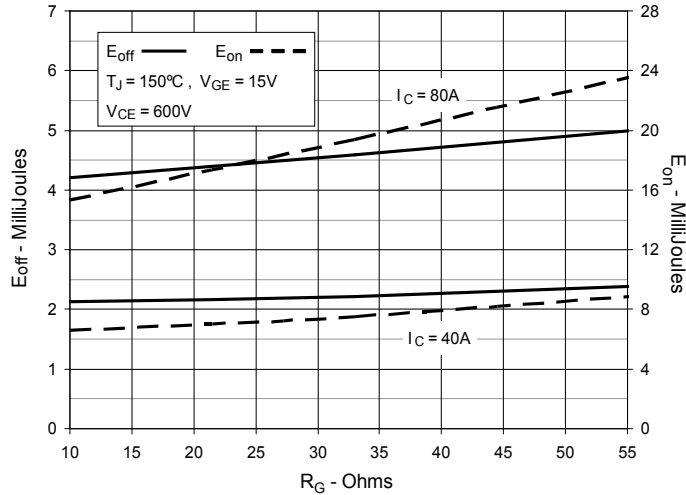
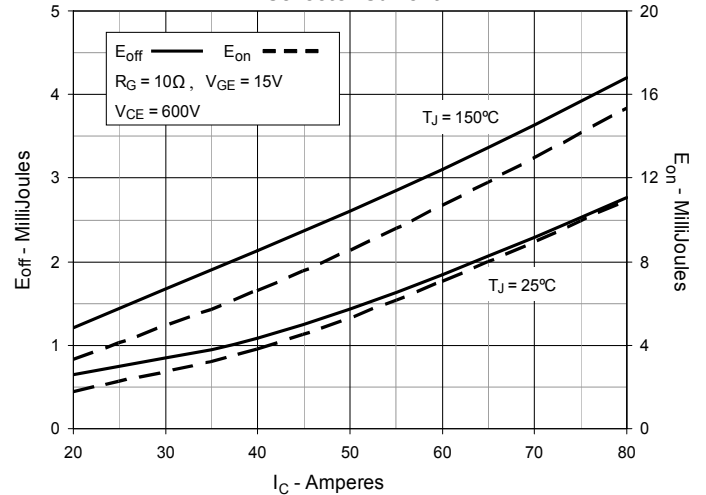
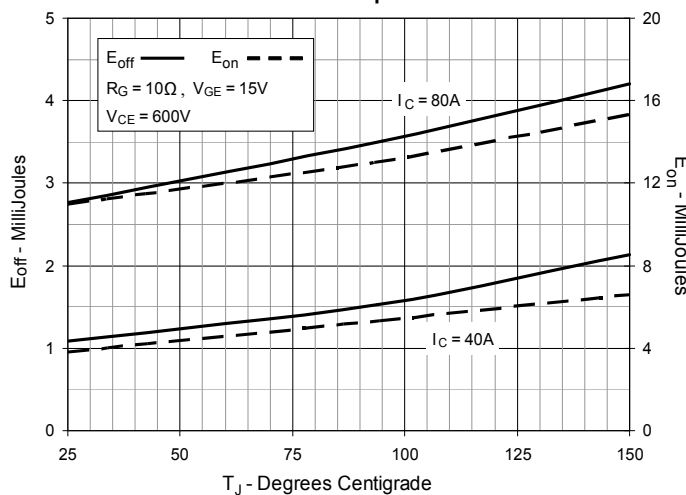
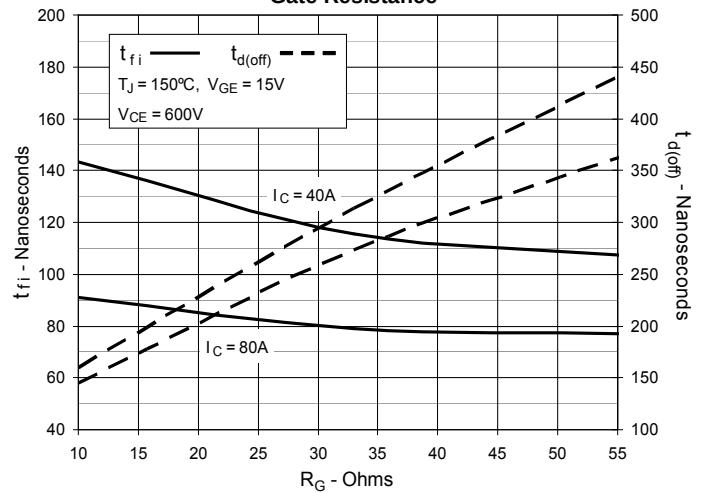
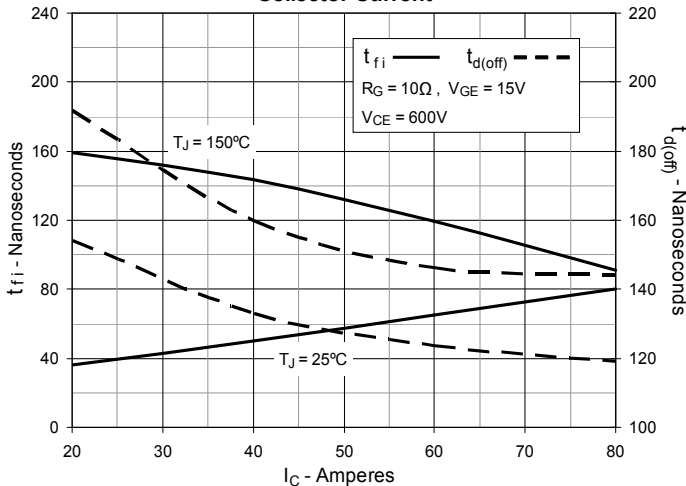
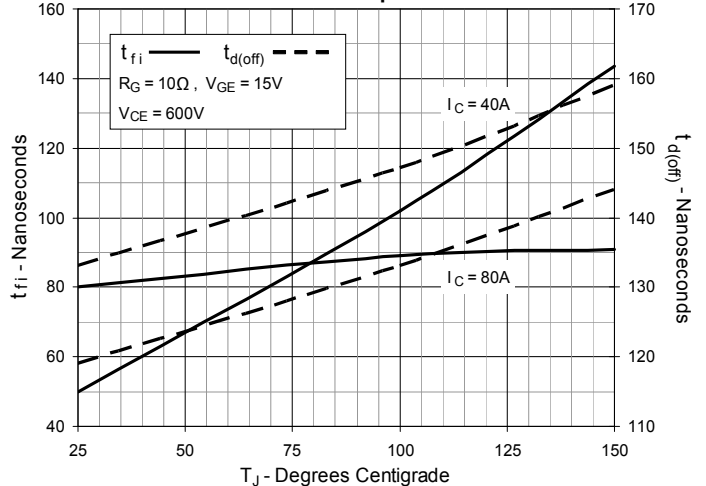
**Fig. 10. Reverse-Bias Safe Operating Area**

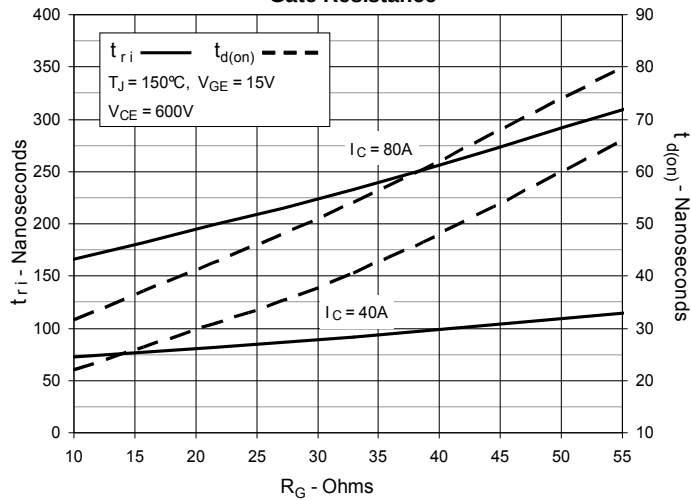
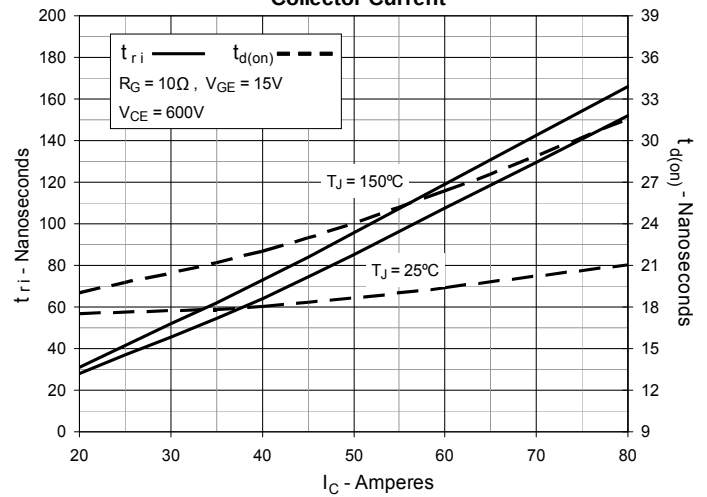
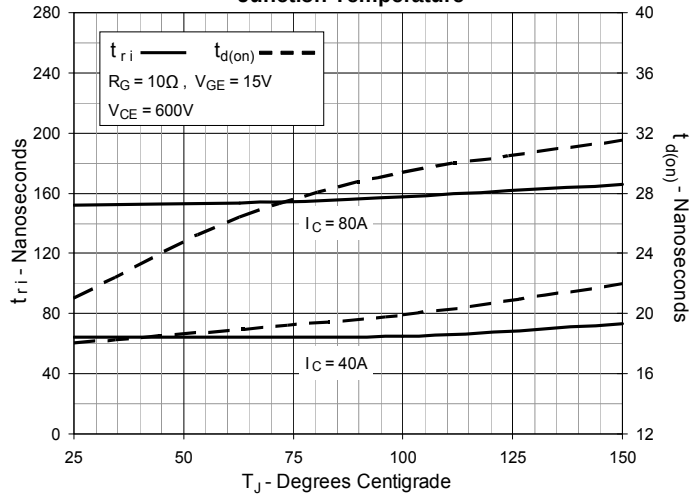


**Fig. 11. Maximum Transient Thermal Impedance**



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**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**




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