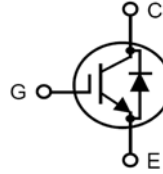


**XPT™ 650V IGBT**  
**GenX3™ w/Diode**
**IXYA15N65C3D1**  
**IXYP15N65C3D1**

Extreme Light Punch Through  
IGBT for 20-60kHz Switching

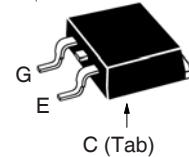


$$\begin{aligned} V_{CES} &= 650V \\ I_{C110} &= 15A \\ V_{CE(sat)} &\leq 2.5V \\ t_{fi(typ)} &= 28ns \end{aligned}$$

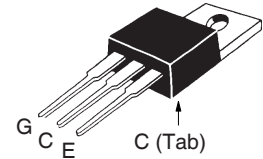
| Symbol                        | Test Conditions                                                                                   | Maximum Ratings                          |                  |
|-------------------------------|---------------------------------------------------------------------------------------------------|------------------------------------------|------------------|
| $V_{CES}$                     | $T_J = 25^\circ\text{C to } 175^\circ\text{C}$                                                    | 650                                      | V                |
| $V_{CGR}$                     | $T_J = 25^\circ\text{C to } 175^\circ\text{C}, R_{GE} = 1M\Omega$                                 | 650                                      | V                |
| $V_{GES}$                     | Continuous                                                                                        | $\pm 20$                                 | V                |
| $V_{GEM}$                     | Transient                                                                                         | $\pm 30$                                 | V                |
| $I_{C25}$                     | $T_C = 25^\circ\text{C}$                                                                          | 38                                       | A                |
| $I_{C110}$                    | $T_C = 110^\circ\text{C}$                                                                         | 15                                       | A                |
| $I_{F110}$                    | $T_C = 110^\circ\text{C}$                                                                         | 23                                       | A                |
| $I_{CM}$                      | $T_C = 25^\circ\text{C}, 1\text{ms}$                                                              | 80                                       | A                |
| $I_A$                         | $T_C = 25^\circ\text{C}$                                                                          | 5                                        | A                |
| $E_{AS}$                      | $T_C = 25^\circ\text{C}$                                                                          | 100                                      | mJ               |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V, T_{VJ} = 150^\circ\text{C}, R_G = 20\Omega$<br>Clamped Inductive Load              | $I_{CM} = 30$<br>$@ V_{CE} \leq V_{CES}$ | A                |
| $t_{sc}$<br><b>(SCSOA)</b>    | $V_{GE} = 15V, V_{CE} = 360V, T_J = 150^\circ\text{C}$<br>$R_G = 82\Omega, \text{Non Repetitive}$ | 8                                        | $\mu\text{s}$    |
| $P_C$                         | $T_C = 25^\circ\text{C}$                                                                          | 200                                      | 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                                      | $^\circ\text{C}$ |
| $M_d$<br>$F_C$                | Mounting Torque (TO-220)<br>Mounting Force (TO-263)                                               | 1.13/10<br>10..65 / 2.2..14.6            | Nm/lb.in<br>N/lb |
| <b>Weight</b>                 | TO-263<br>TO-220                                                                                  | 2.5<br>3.0                               | g<br>g           |

| Symbol        | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |              |                                       |
|---------------|-----------------------------------------------------------------------------|-----------------------|--------------|---------------------------------------|
|               |                                                                             | Min.                  | Typ.         | Max.                                  |
| $BV_{CES}$    | $I_C = 250\mu\text{A}, V_{GE} = 0V$                                         | 650                   |              | V                                     |
| $V_{GE(th)}$  | $I_C = 250\mu\text{A}, V_{CE} = V_{GE}$                                     | 3.5                   |              | 6.0 V                                 |
| $I_{CES}$     | $V_{CE} = V_{CES}, V_{GE} = 0V$<br>$T_J = 150^\circ\text{C}$                |                       |              | 10 $\mu\text{A}$<br>400 $\mu\text{A}$ |
| $I_{GES}$     | $V_{CE} = 0V, V_{GE} = \pm 20V$                                             |                       |              | $\pm 100$ nA                          |
| $V_{CE(sat)}$ | $I_C = 15A, V_{GE} = 15V, \text{Note 1}$<br>$T_J = 150^\circ\text{C}$       |                       | 1.96<br>2.45 | 2.50 V<br>V                           |

TO-263 AA (IXYA)



TO-220AB (IXYP)



G = Gate  
E = Emitter

C = Collector  
Tab = Collector

### Features

- Optimized for 20-60kHz Switching
- Square RBSOA
- Avalanche Rated
- Anti-Parallel Fast Diode
- Short Circuit Capability
- International Standard Packages

### 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
- High Frequency Power Inverters



**IXYA15N65C3D1**  
**IXYP15N65C3D1**

### Symbol Test Conditions

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

### Characteristic Values

|              |                                                                                                                                                            | Min. | Typ. | Max.                    |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-------------------------|
| $g_{fs}$     | $I_C = 15\text{A}, V_{CE} = 10\text{V}$ , Note 1                                                                                                           | 5.0  | 8.5  | S                       |
| $C_{ies}$    | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$                                                                                                 |      | 583  | pF                      |
| $C_{oes}$    |                                                                                                                                                            |      | 52   | pF                      |
| $C_{res}$    |                                                                                                                                                            |      | 13   | pF                      |
| $Q_{g(on)}$  | $I_C = 15\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$                                                                                        |      | 19   | nC                      |
| $Q_{ge}$     |                                                                                                                                                            |      | 4    | nC                      |
| $Q_{gc}$     |                                                                                                                                                            |      | 10   | nC                      |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 15\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}, R_G = 20\Omega$<br>Note 2  |      | 15   | ns                      |
| $t_{ri}$     |                                                                                                                                                            |      | 20   | ns                      |
| $E_{on}$     |                                                                                                                                                            |      | 0.27 | mJ                      |
| $t_{d(off)}$ |                                                                                                                                                            |      | 68   | ns                      |
| $t_{fi}$     |                                                                                                                                                            |      | 28   | ns                      |
| $E_{off}$    |                                                                                                                                                            |      | 0.23 | mJ                      |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 150^\circ\text{C}</math></b><br>$I_C = 15\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}, R_G = 20\Omega$<br>Note 2 |      | 15   | ns                      |
| $t_{ri}$     |                                                                                                                                                            |      | 21   | ns                      |
| $E_{on}$     |                                                                                                                                                            |      | 0.53 | mJ                      |
| $t_{d(off)}$ |                                                                                                                                                            |      | 80   | ns                      |
| $t_{fi}$     |                                                                                                                                                            |      | 42   | ns                      |
| $E_{off}$    |                                                                                                                                                            |      | 0.24 | mJ                      |
| $R_{thJC}$   | TO-220                                                                                                                                                     |      |      | 0.75 $^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                                            |      | 0.50 | $^\circ\text{C/W}$      |

### Reverse Diode (FRED)

### Symbol Test Conditions

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

### Characteristic Values

|            |                                                                                                                              | Min. | Typ. | Max.                    |
|------------|------------------------------------------------------------------------------------------------------------------------------|------|------|-------------------------|
| $V_F$      | $I_F = 10\text{A}, V_{GE} = 0\text{V}$ , Note 1<br>$T_J = 125^\circ\text{C}$                                                 |      |      | 3.0 V                   |
| $I_{RM}$   | $I_F = 12\text{A}, V_{GE} = 0\text{V}$ ,<br>$-di_F/dt = 100\text{A}/\mu\text{s}, V_R = 100\text{V}, T_J = 125^\circ\text{C}$ |      | 2.5  | A                       |
| $t_{rr}$   |                                                                                                                              |      | 110  | ns                      |
| $t_{rr}$   | $I_F = 1\text{A}, V_{GE} = 0\text{V}, -di_F/dt = 100\text{A}/\mu\text{s}, V_R = 30\text{V}$                                  |      | 30   | ns                      |
| $R_{thJC}$ |                                                                                                                              |      |      | 1.85 $^\circ\text{C/W}$ |

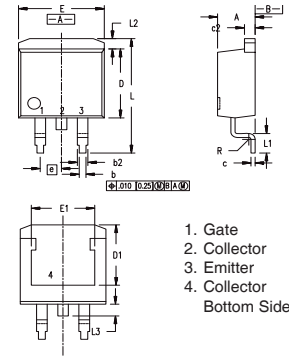
### Notes:

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  $R_G$ .

### PRELIMINARY TECHNICAL INFORMATION

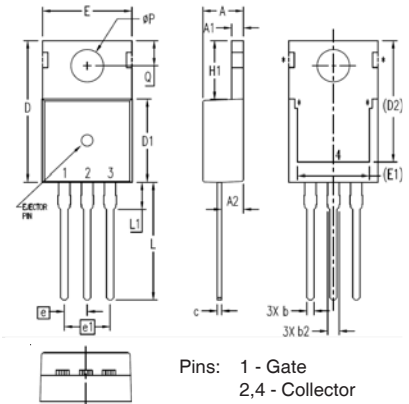
The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test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

### TO-263 Outline



| Dim. | Millimeter |       | Inches |      |
|------|------------|-------|--------|------|
|      | Min.       | Max.  | Min.   | Max. |
| A    | 4.06       | 4.83  | .160   | .190 |
| b    | 0.51       | 0.99  | .020   | .039 |
| b2   | 1.14       | 1.40  | .045   | .055 |
| c    | 0.40       | 0.74  | .016   | .029 |
| c2   | 1.14       | 1.40  | .045   | .055 |
| D    | 8.64       | 9.65  | .340   | .380 |
| D1   | 8.00       | 8.89  | .280   | .320 |
| E    | 9.65       | 10.41 | .380   | .405 |
| E1   | 6.22       | 8.13  | .270   | .320 |
| e    | 2.54       | BSC   | .100   | BSC  |
| L    | 14.61      | 15.88 | .575   | .625 |
| L1   | 2.29       | 2.79  | .090   | .110 |
| L2   | 1.02       | 1.40  | .040   | .055 |
| L3   | 1.27       | 1.78  | .050   | .070 |
| L4   | 0          | 0.13  | 0      | .005 |

### TO-220 Outline



| SYM  | INCHES |      | MILLIMETERS |       |
|------|--------|------|-------------|-------|
|      | MIN    | MAX  | MIN         | MAX   |
| A    | .169   | .185 | 4.30        | 4.70  |
| A1   | .047   | .055 | 1.20        | 1.40  |
| A2   | .079   | .106 | 2.00        | 2.70  |
| b    | .024   | .039 | 0.60        | 1.00  |
| b2   | .045   | .057 | 1.15        | 1.45  |
| c    | .014   | .026 | 0.35        | 0.65  |
| D    | .587   | .626 | 14.90       | 15.90 |
| D1   | .335   | .370 | 8.50        | 9.40  |
| (D2) | .500   | .531 | 12.70       | 13.50 |
| E    | .382   | .406 | 9.70        | 10.30 |
| (E1) | .283   | .323 | 7.20        | 8.20  |
| e    | .100   | BSC  | 2.54        | BSC   |
| e1   | .200   | BSC  | 5.08        | BSC   |
| H1   | .244   | .268 | 6.20        | 6.80  |
| L    | .492   | .547 | 12.50       | 13.90 |
| L1   | .110   | .154 | 2.80        | 3.90  |
| ØP   | .134   | .150 | 3.40        | 3.80  |
| Q    | .106   | .126 | 2.70        | 3.20  |

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

IXYS MOSFETs and IGBTs are covered 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  
by one or more of the following U.S. patents: 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

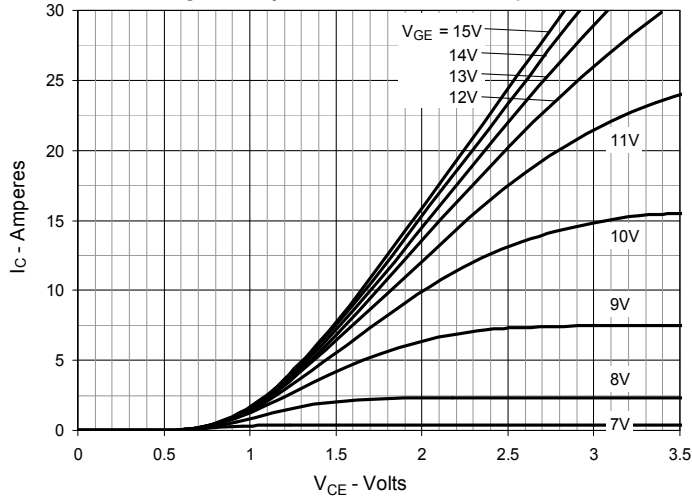
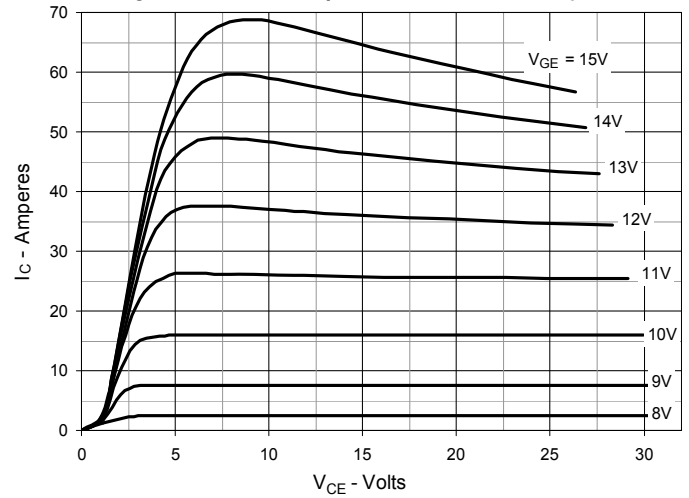
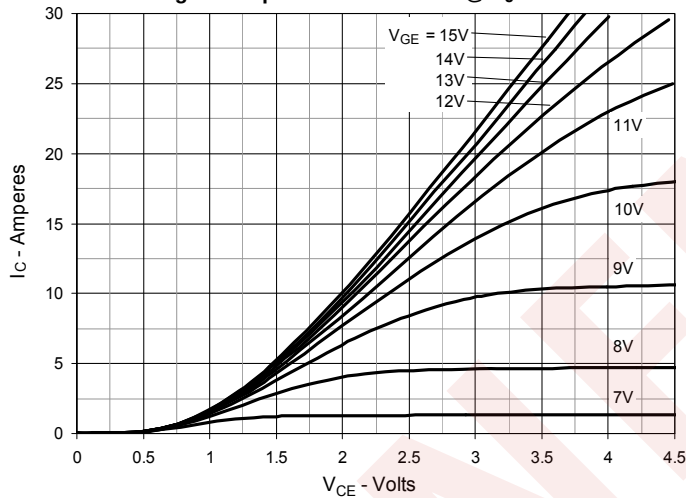
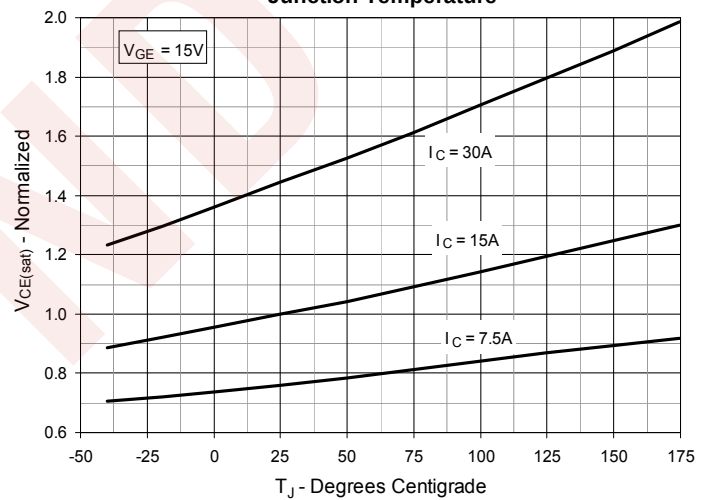
Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$ Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$ Fig. 3. Output Characteristics @  $T_J = 150^\circ\text{C}$ Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature

Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

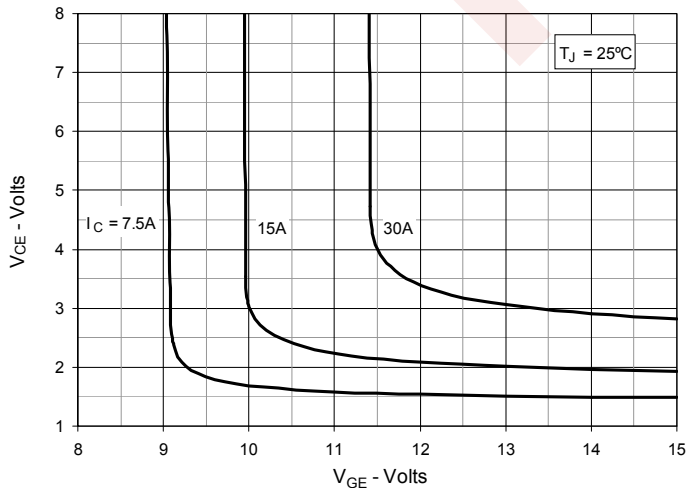


Fig. 6. Input Admittance

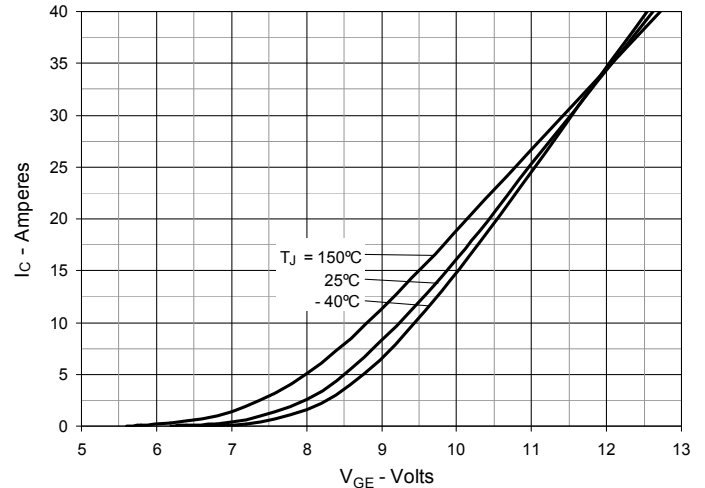


Fig. 7. Transconductance

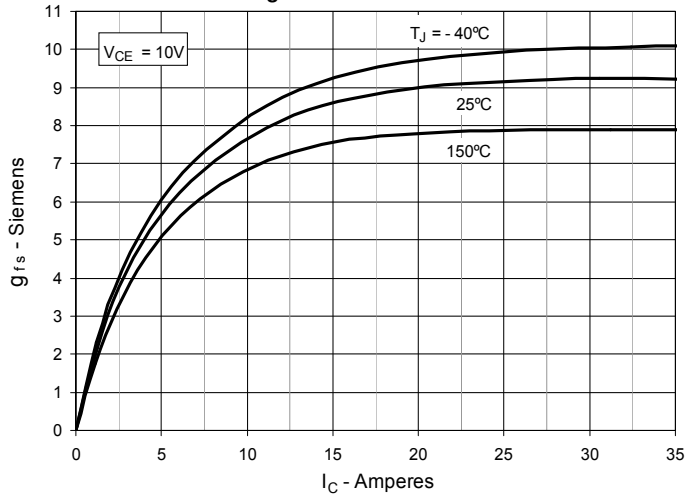


Fig. 8. Gate Charge

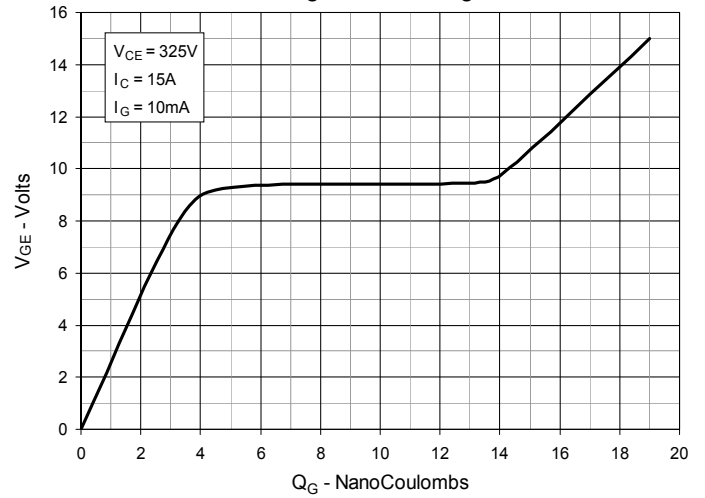


Fig. 9. Capacitance

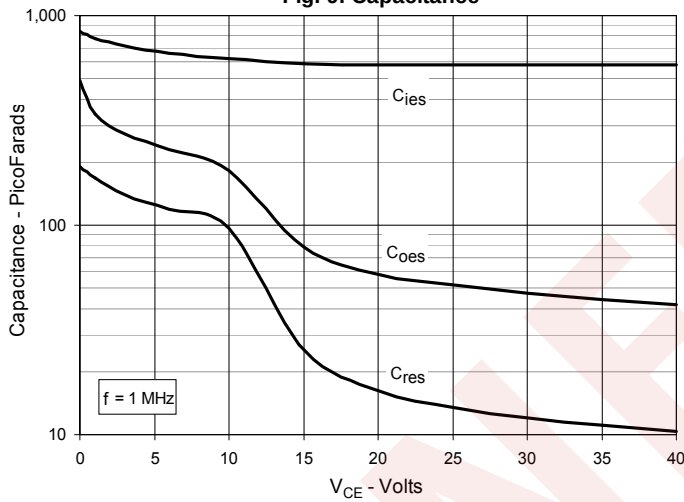


Fig. 10. Reverse-Bias Safe Operating Area

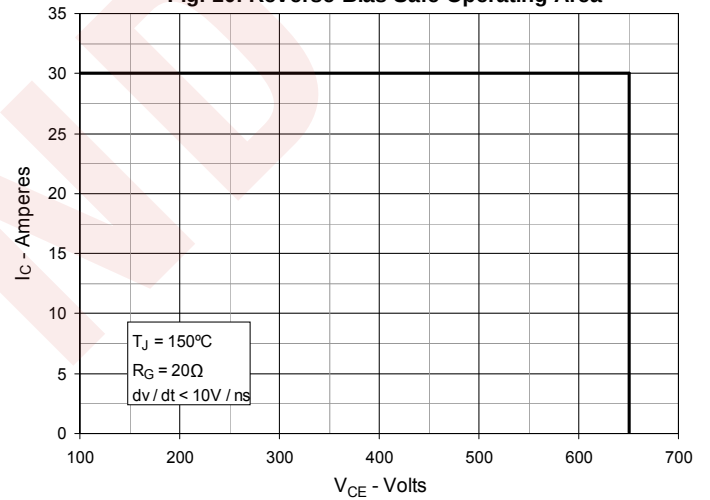


Fig. 11. Maximum Transient Thermal Impedance

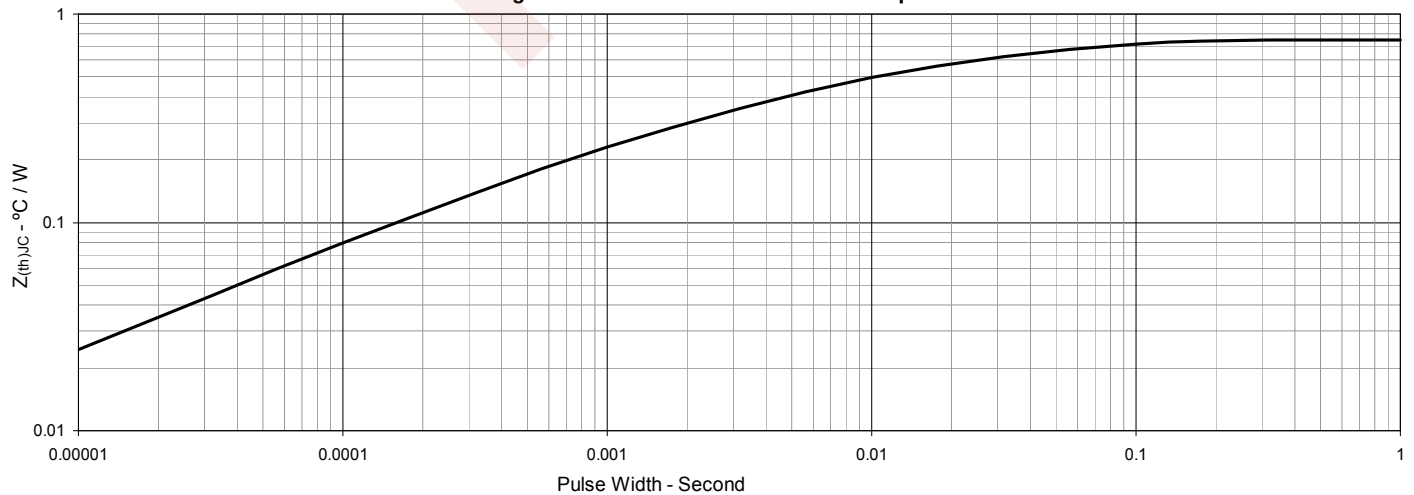


Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance

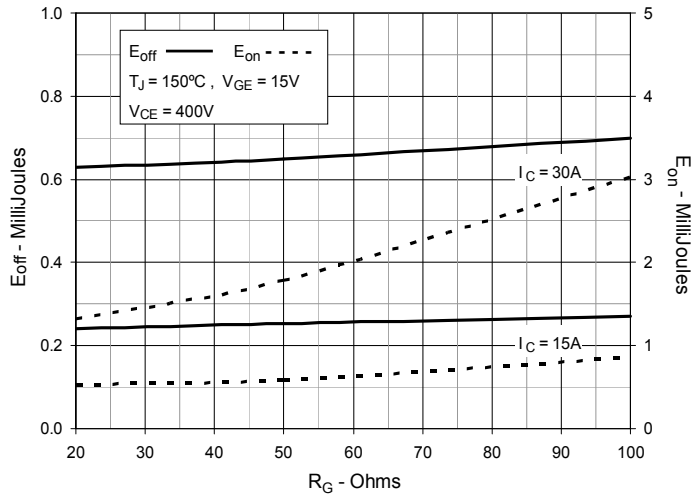


Fig. 13. Inductive Switching Energy Loss vs. Collector Current

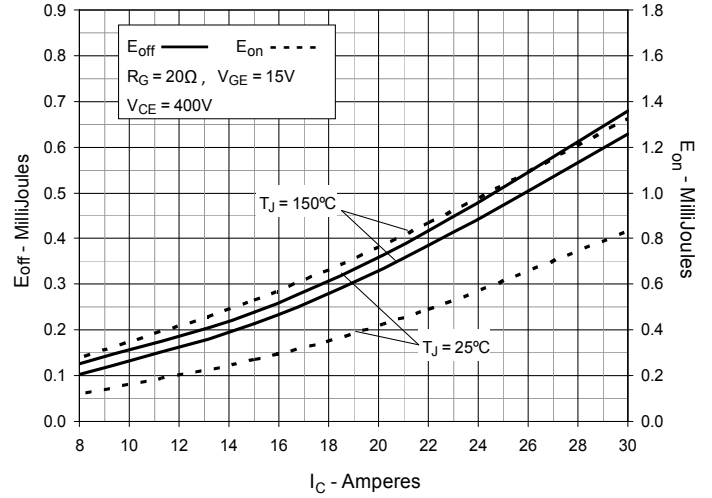


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

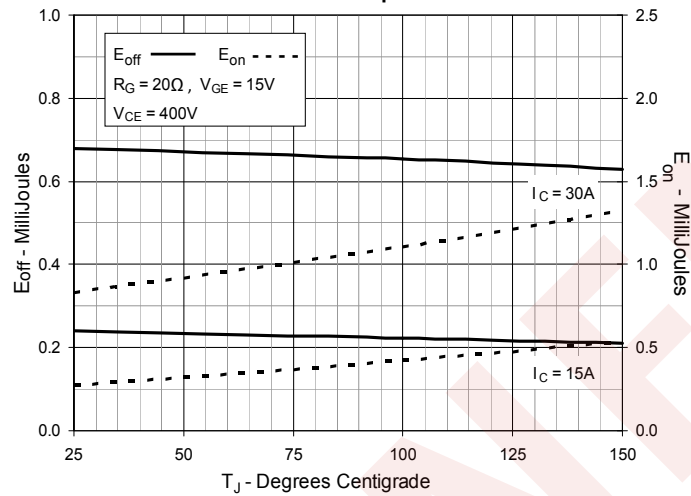


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

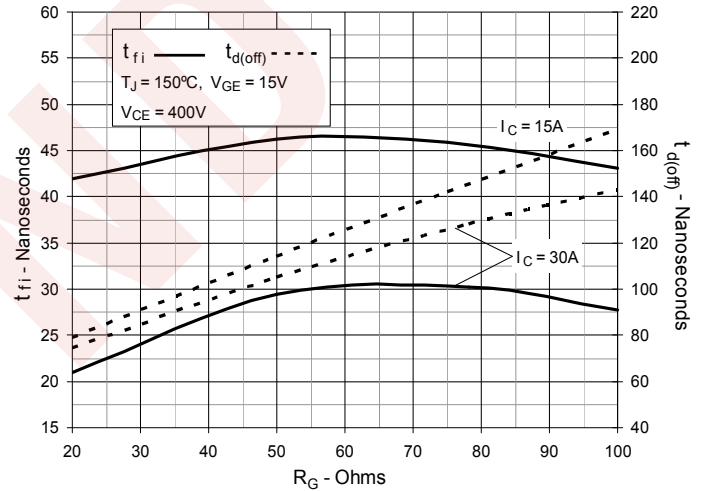


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

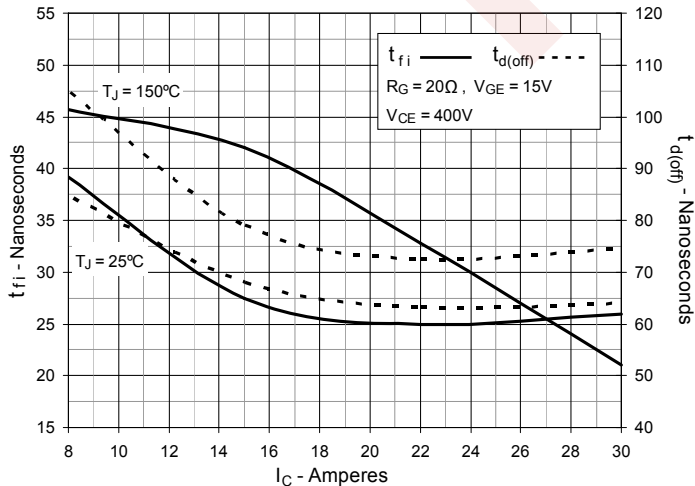


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

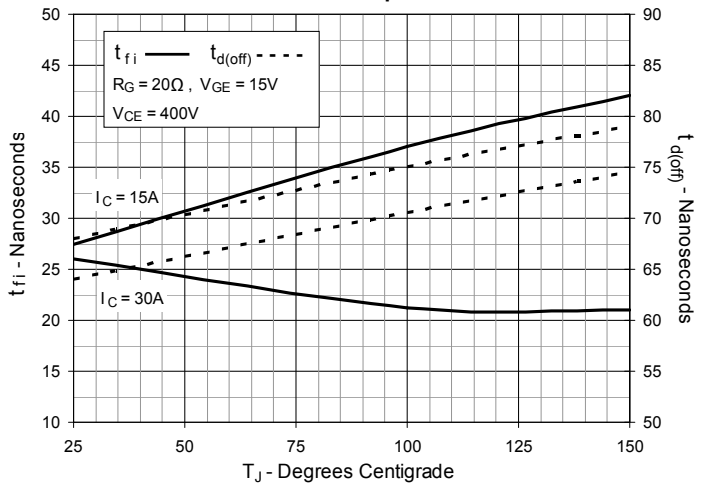


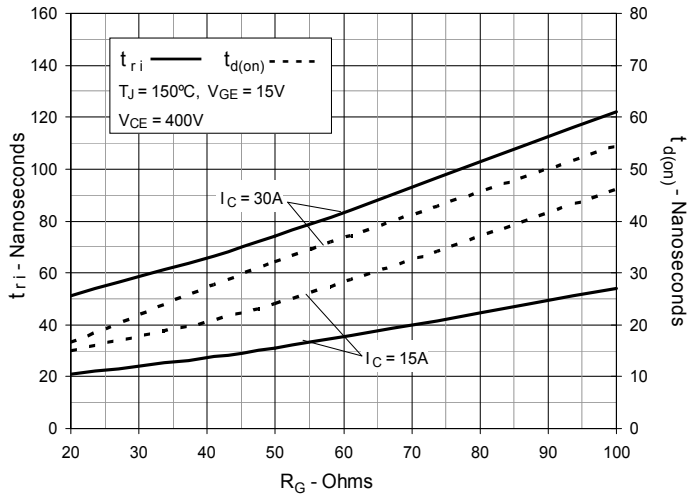
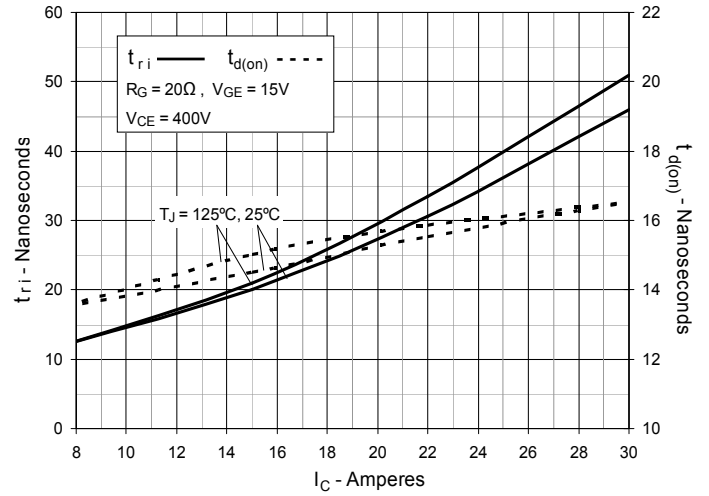
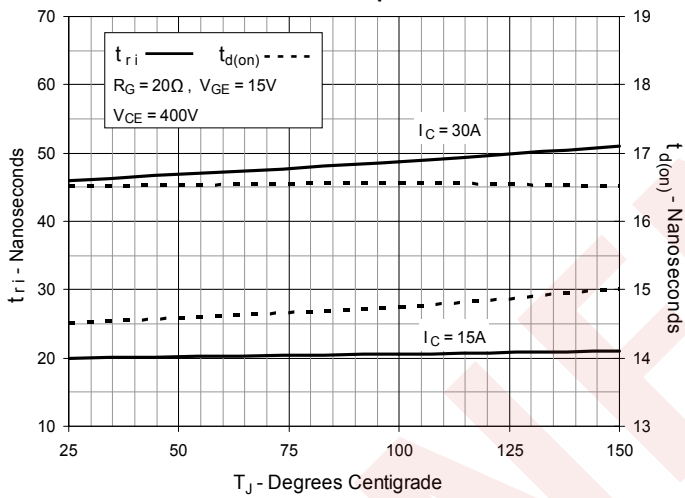
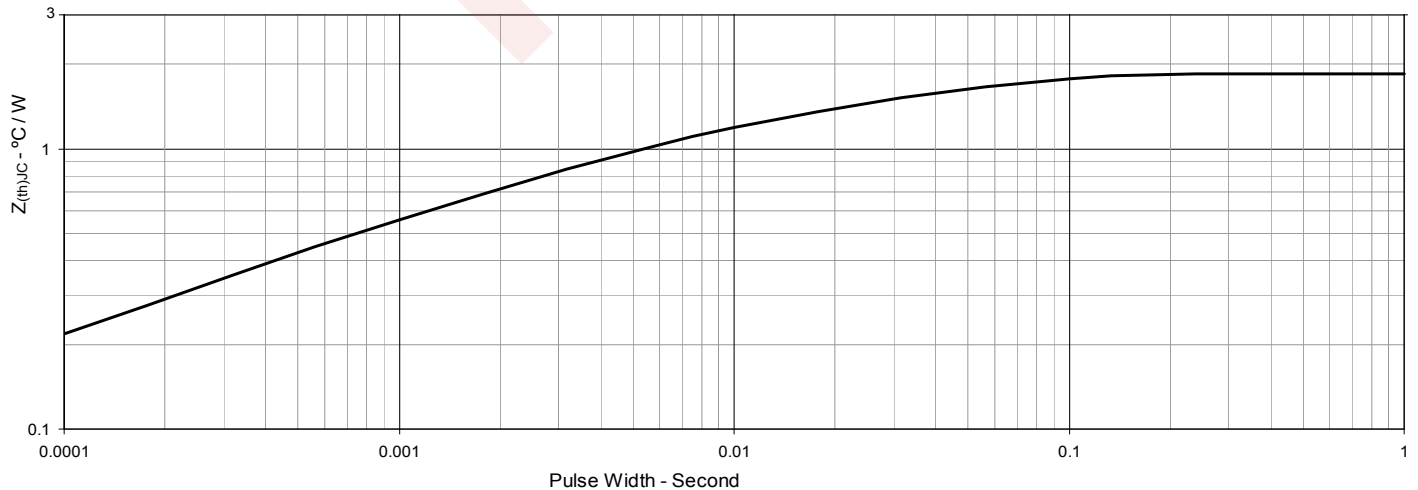
Fig. 18. Inductive Turn-on Switching Times vs.  
Gate ResistanceFig. 19. Inductive Turn-on Switching Times vs.  
Collector CurrentFig. 20. Inductive Turn-on Switching Times vs.  
Junction Temperature

Fig. 21. Maximum Transient Impedance for Diode



NOT FOR NEW DESIGN

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