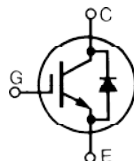


XPT™ 650V IGBT GenX4™ w/Sonic Diode

IXXX140N65B4H1

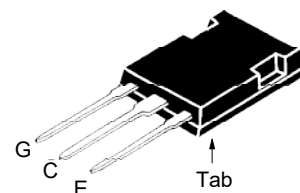
Extreme Light Punch Through
IGBT for 10-30kHz Switching



$V_{CES} = 650V$
 $I_{C110} = 140A$
 $V_{CE(sat)} \leq 1.90V$
 $t_{fi(typ)} = 44ns$

| 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 | ± 20 | V |
| V_{GEM} | Transient | ± 30 | V |
| I_{C25} | $T_C = 25^\circ C$ (Chip Capability) | 340 | A |
| I_{LRMS} | Terminal Current Limit | 160 | A |
| I_{C110} | $T_C = 110^\circ C$ | 140 | A |
| I_{F110} | $T_C = 110^\circ C$ | 72 | A |
| I_{CM} | $T_C = 25^\circ C$, 1ms | 840 | A |
| SSOA (RBSOA) | $V_{GE} = 15V$, $T_{VJ} = 150^\circ C$, $R_G = 4.7\Omega$ Clamped Inductive Load | $I_{CM} = 240$ $V_{CE} \leq V_{CES}$ | A |
| t_{sc} (SCSOA) | $V_{GE} = 15V$, $V_{CE} = 400V$, $T_J = 150^\circ C$ $R_G = 10\Omega$, Non Repetitive | 10 | μs |
| P_C | $T_C = 25^\circ C$ | 1200 | 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 1.6 mm (0.062 in.) from Case for 10s | 300 | $^\circ C$ |
| F_C | Mounting Force | 20..120 /4.5..27 | N/lb |
| Weight | | 6 | g |

PLUS247



G = Gate E = Emitter
C = Collector Tab = Collector

Features

- Optimized for 10-30kHz Switching
- Square RBSOA
- Short Circuit Capability
- Anti-Parallel Sonic Diode
- High Current Handling Capability
- International Standard Package

Advantages

- High Power Density
- Low Gate Drive Requirement

Applications

- Power Inverters
- UPS
- Motor Drives
- SMPS
- PFC Circuits
- Battery Chargers
- Welding Machines
- Lamp Ballasts
- High Frequency Power Inverters

| Symbol | Test Conditions ($T_J = 25^\circ C$, 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} | $V_{CE} = V_{CES}$, $V_{GE} = 0V$ $T_J = 150^\circ C$ | | | 25 μA 5 mA |
| I_{GES} | $V_{CE} = 0V$, $V_{GE} = \pm 20V$ | | | ± 100 nA |
| $V_{CE(sat)}$ | $I_C = 120A$, $V_{GE} = 15V$, Note 1 $T_J = 150^\circ C$ | 1.55 1.76 | | V V |

| Symbol Test Conditions ($T_J = 25^\circ\text{C}$ Unless Otherwise Specified) | | Characteristic Values | | |
|--|--|-----------------------|-------|--------------------|
| | | Min. | Typ. | Max. |
| g_{fs} | $I_C = 60\text{A}, V_{CE} = 10\text{V}$, Note 1 | 40 | 70 | S |
| C_{ies} | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$ | | 8000 | pF |
| C_{oes} | | | 560 | pF |
| C_{res} | | | 107 | pF |
| $Q_{g(on)}$ | $I_C = 140\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$ | | 250 | nC |
| Q_{ge} | | | 70 | nC |
| Q_{gc} | | | 90 | nC |
| $t_{d(on)}$ | Inductive load, $T_J = 25^\circ\text{C}$ $I_C = 100\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 4.7\Omega$ Note 2 | | 54 | ns |
| t_{ri} | | | 105 | ns |
| E_{on} | | | 5.75 | mJ |
| $t_{d(off)}$ | | | 270 | ns |
| t_{fi} | | | 44 | ns |
| E_{off} | | | 2.67 | mJ |
| $t_{d(on)}$ | Inductive load, $T_J = 150^\circ\text{C}$ $I_C = 100\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 4.7\Omega$ Note 2 | | 43 | ns |
| t_{ri} | | | 85 | ns |
| E_{on} | | | 6.80 | mJ |
| $t_{d(off)}$ | | | 240 | ns |
| t_{fi} | | | 100 | ns |
| E_{off} | | | 3.90 | mJ |
| R_{thJC} | | | 0.125 | $^\circ\text{C/W}$ |
| R_{thCS} | | 0.15 | | $^\circ\text{C/W}$ |

Reverse Sonic Diode (FRD)

| Symbol Test Conditions ($T_J = 25^\circ\text{C}$ Unless Otherwise Specified) | | Characteristic Values | | |
|--|---|-----------------------|------------|--------------------|
| | | Min. | Typ. | Max. |
| V_F | $I_F = 100\text{A}, V_{GE} = 0\text{V}$, Note 1 $T_J = 150^\circ\text{C}$ | | 2.1 2.2 | V V |
| I_{RM} | $I_F = 100\text{A}, V_{GE} = 0\text{V}, T_J = 150^\circ\text{C}$ $-di_F/dt = 600\text{A}/\mu\text{s}, V_R = 400\text{V}$ | | 43 | A |
| t_{rr} | | | 210 | ns |
| R_{thJC} | | | 0.24 | $^\circ\text{C/W}$ |

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 .

Littelfuse 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 @ $T_J = 25^\circ\text{C}$

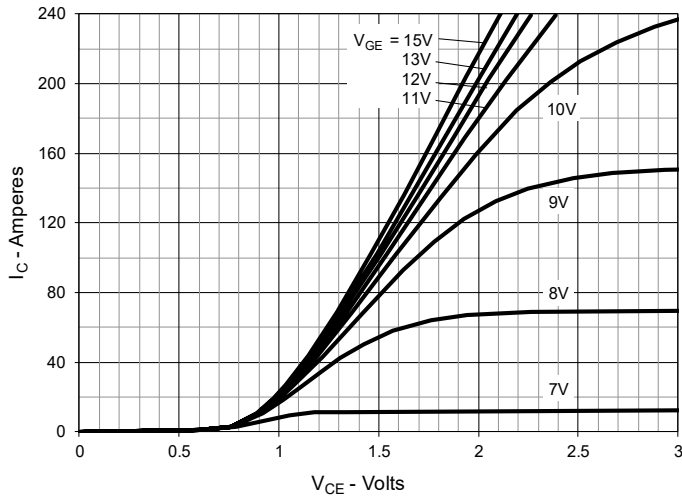


Fig. 2. Extended Output Characteristics @ $T_J = 25^\circ\text{C}$

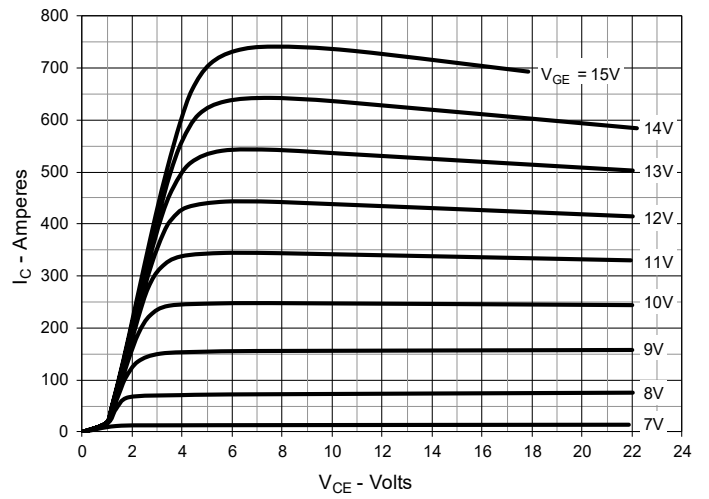


Fig. 3. Output Characteristics @ $T_J = 150^\circ\text{C}$

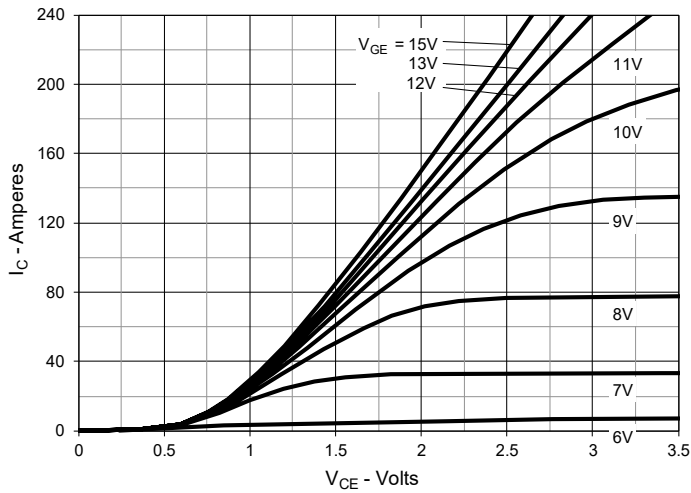


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

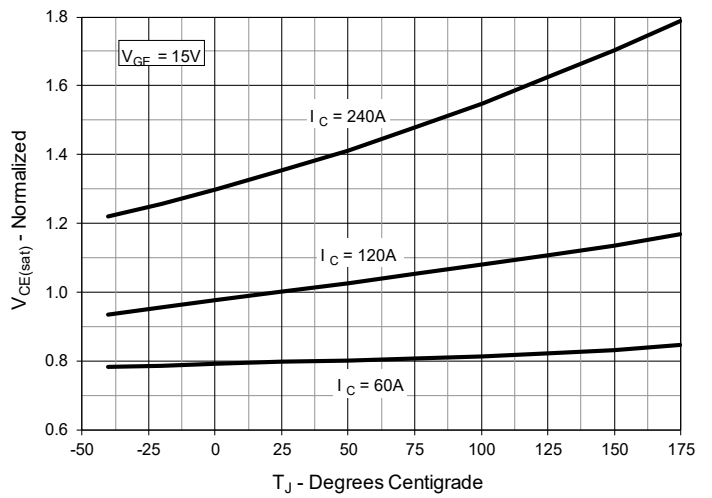


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

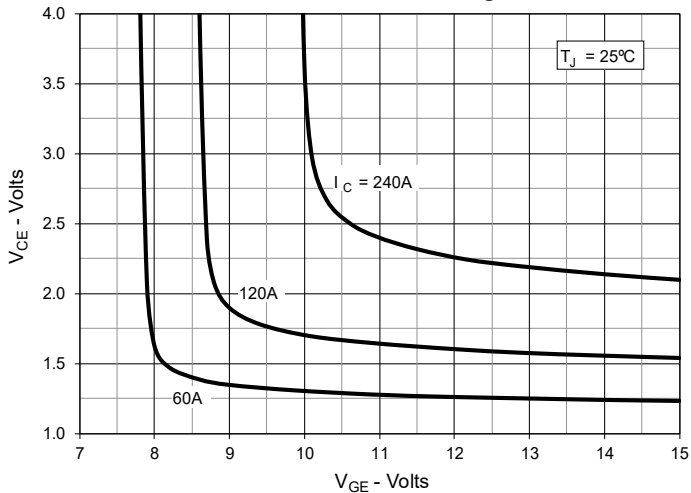


Fig. 6. Input Admittance

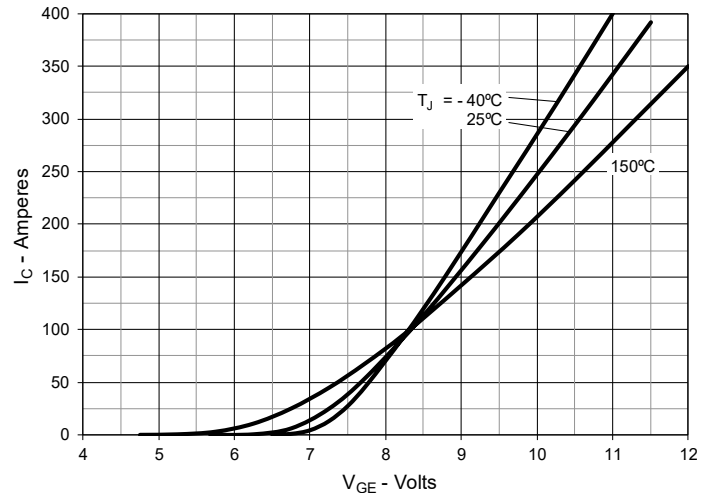


Fig. 7. Transconductance

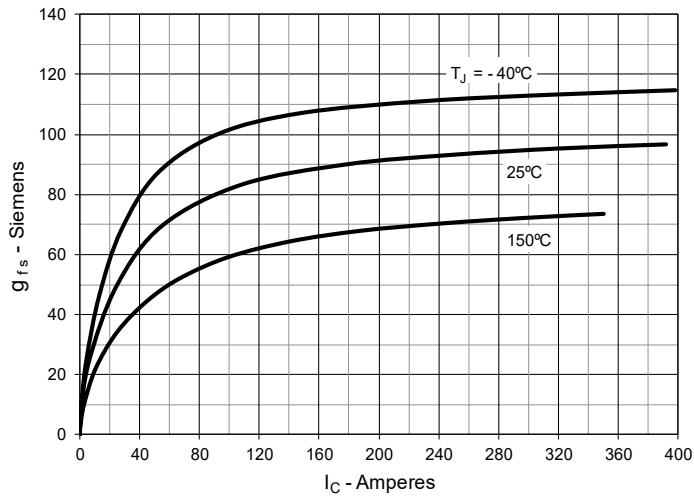


Fig. 8. Gate Charge

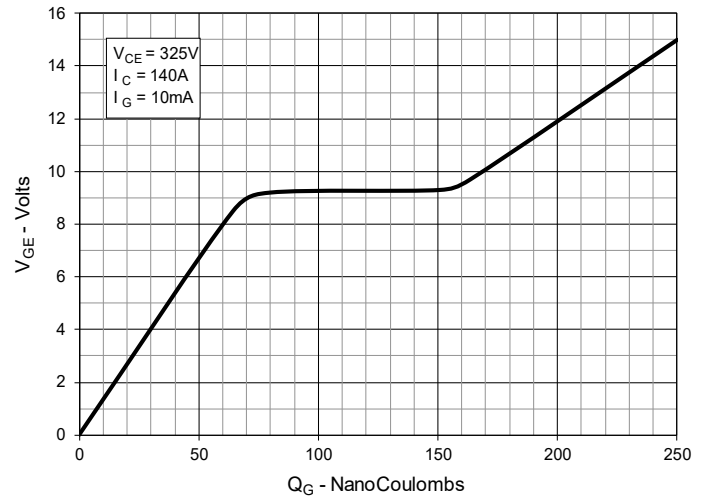


Fig. 9. Capacitance

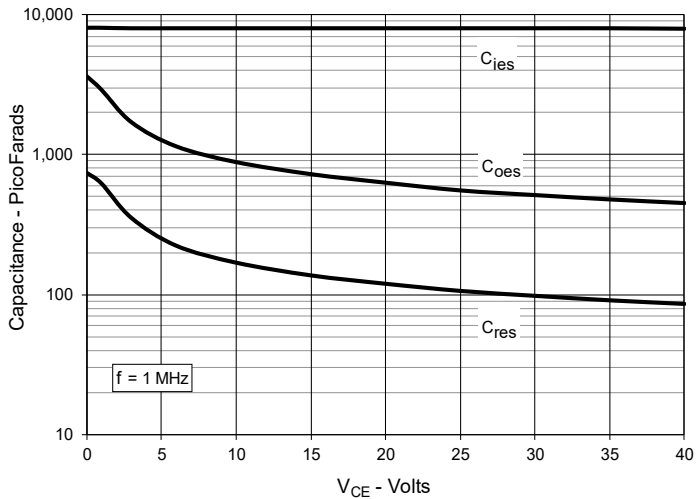


Fig. 10. Reverse-Bias Safe Operating Area

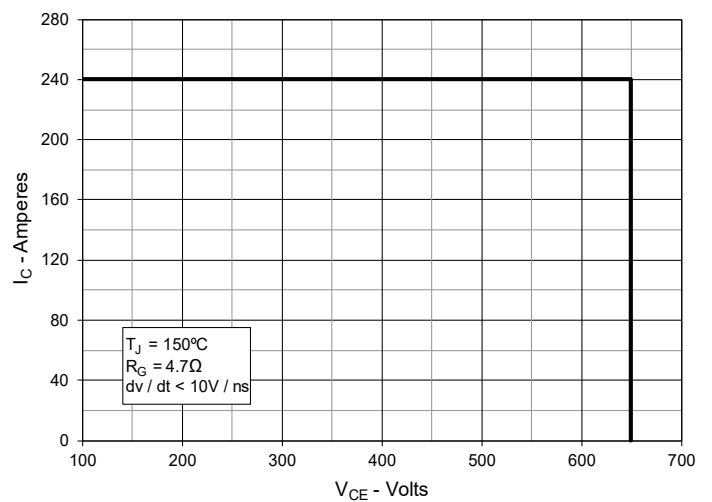


Fig. 11. Forward-Bias Safe Operating Area

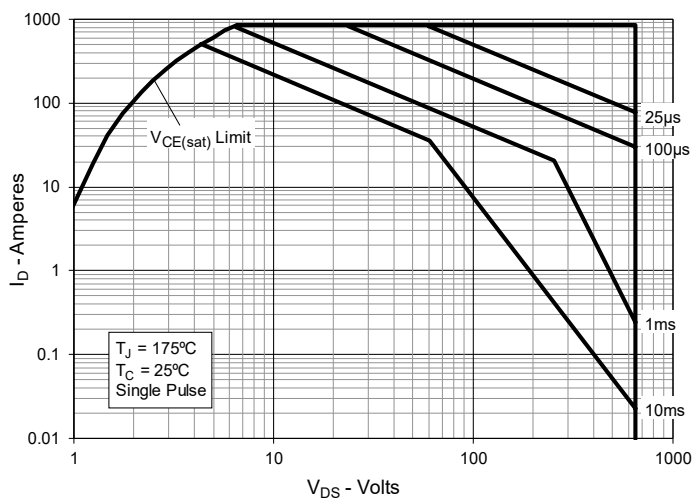


Fig. 12. Maximum Transient Thermal Impedance (IGBT)

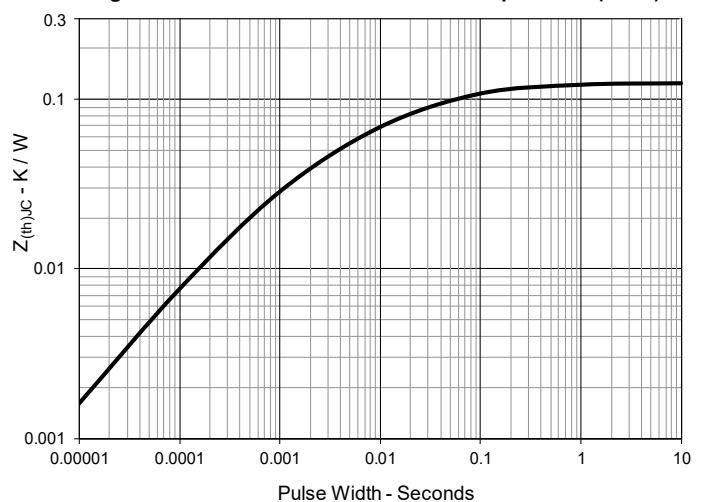


Fig. 13. Inductive Switching Energy Loss vs. Gate Resistance

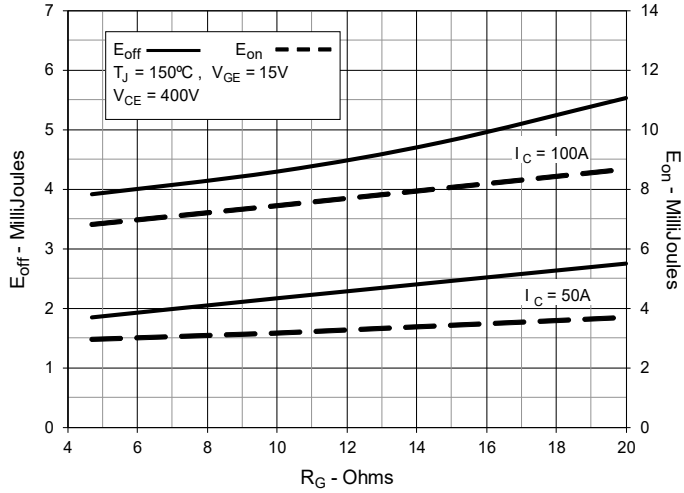


Fig. 14. Inductive Switching Energy Loss vs. Collector Current

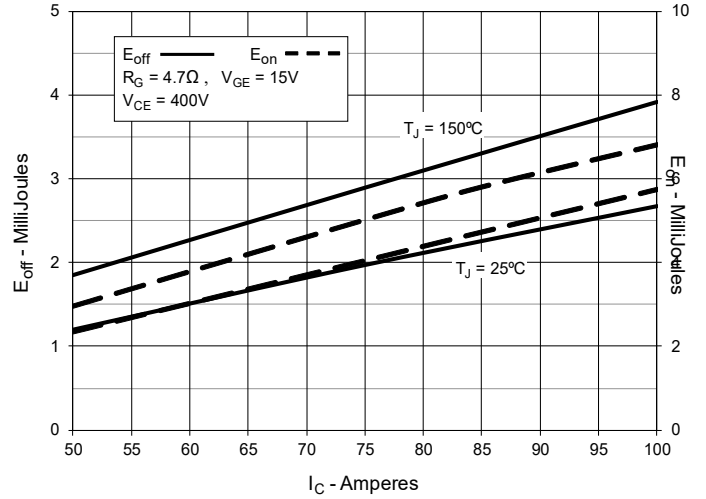


Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature

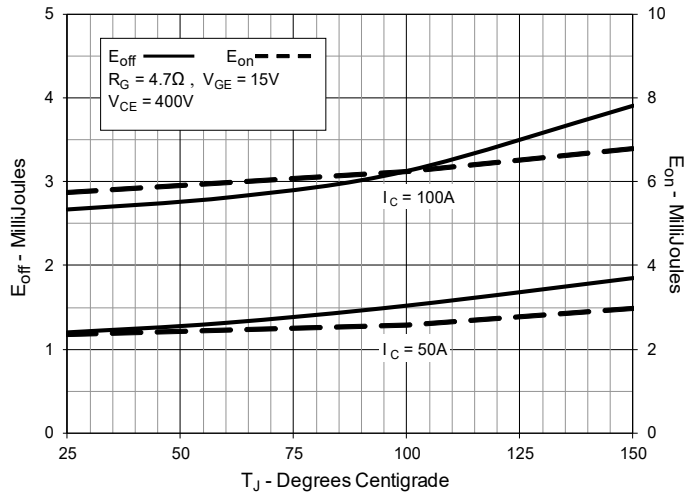


Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance

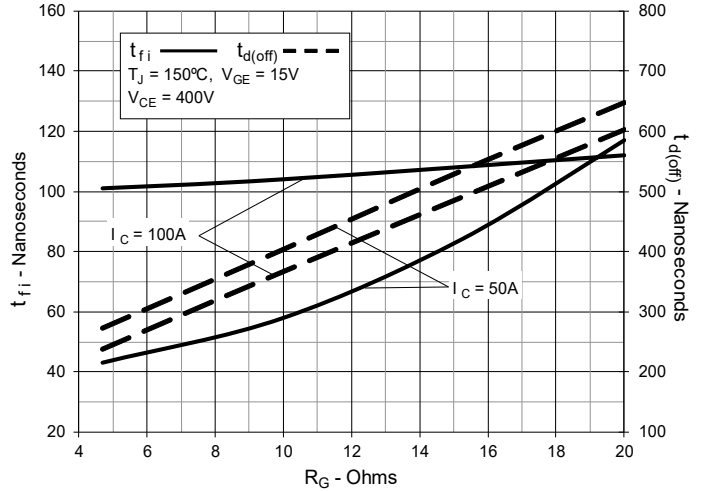


Fig. 17. Inductive Turn-off Switching Times vs. Collector Current

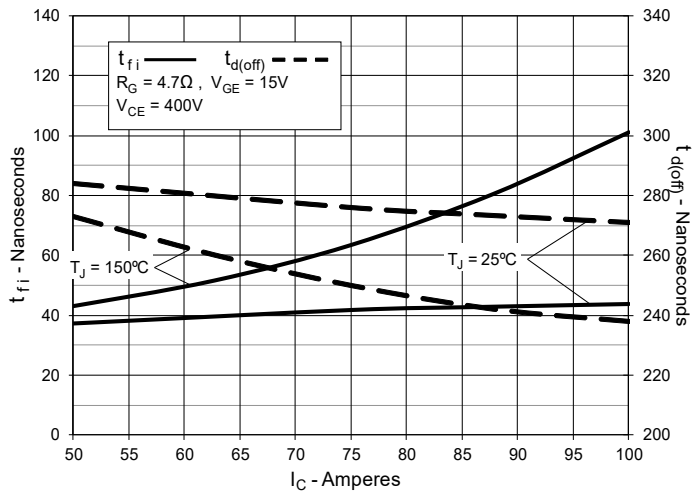


Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature

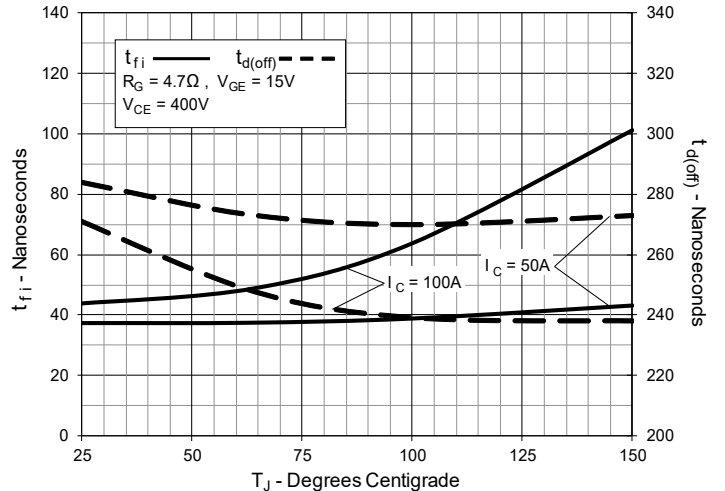


Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance

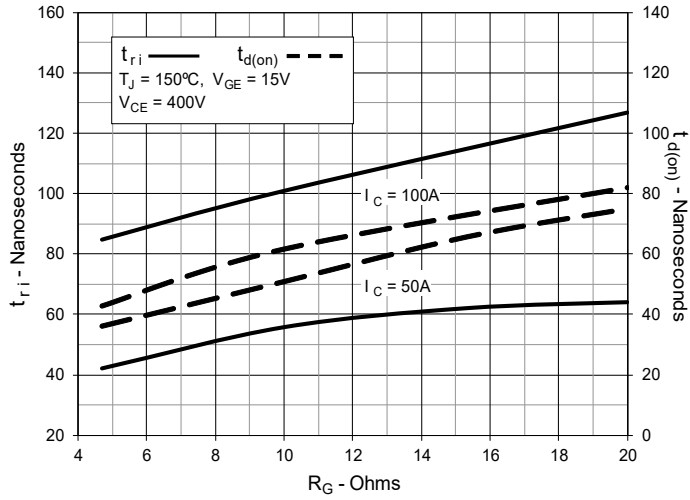


Fig. 20. Inductive Turn-on Switching Times vs. Collector Current

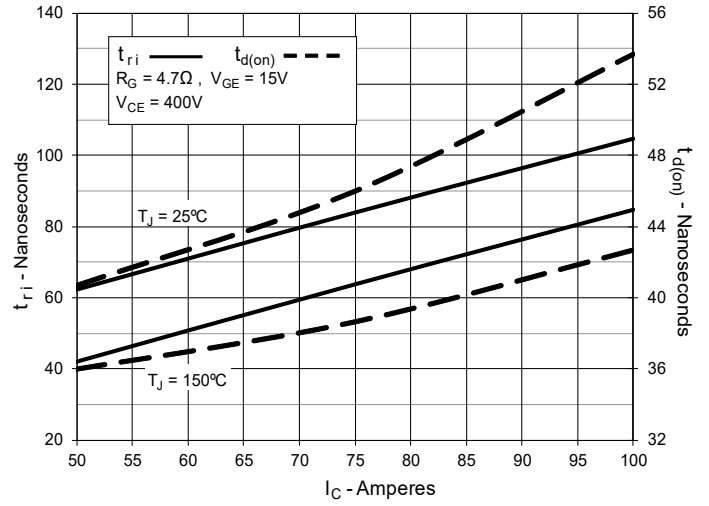


Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature

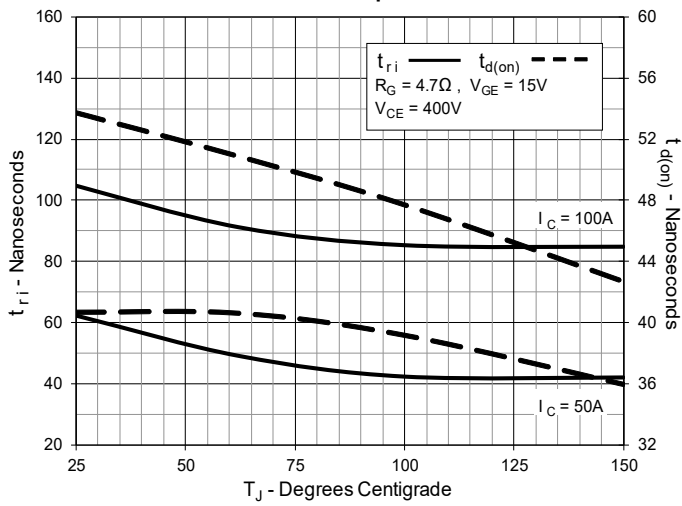


Fig. 22. Diode Forward Characteristics

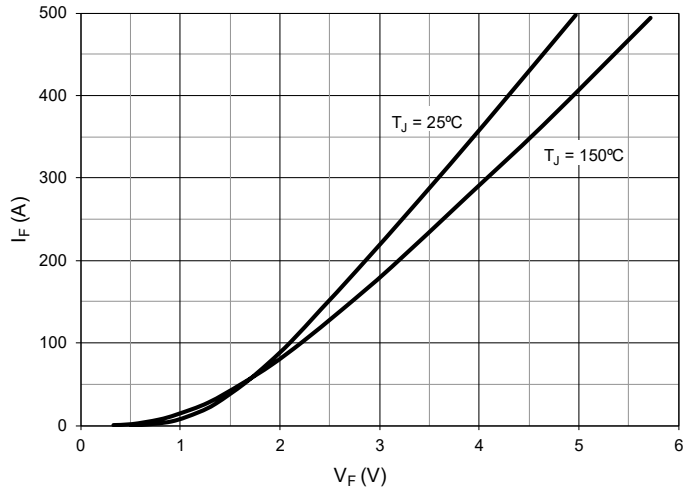


Fig. 23. Reverse Recovery Charge vs. $-di_F/dt$

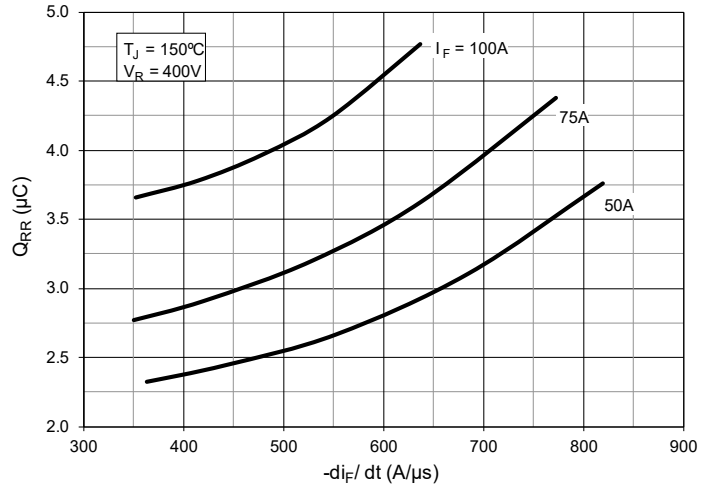


Fig. 24. Reverse Recovery Current vs. $-di_F/dt$

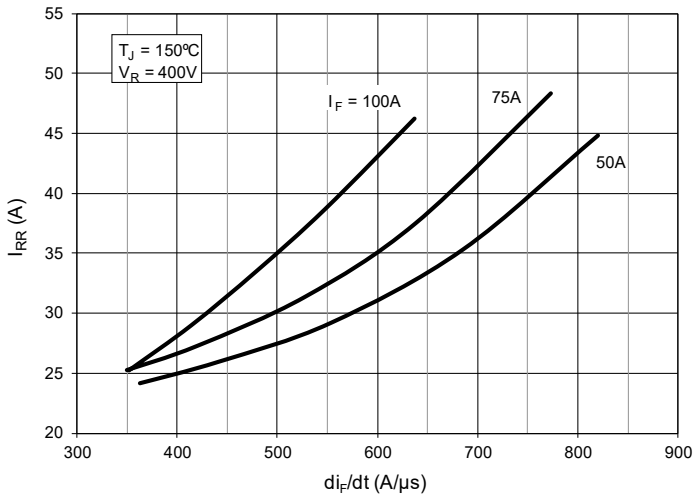


Fig. 25. Reverse Recovery Time vs. $-di_F/dt$

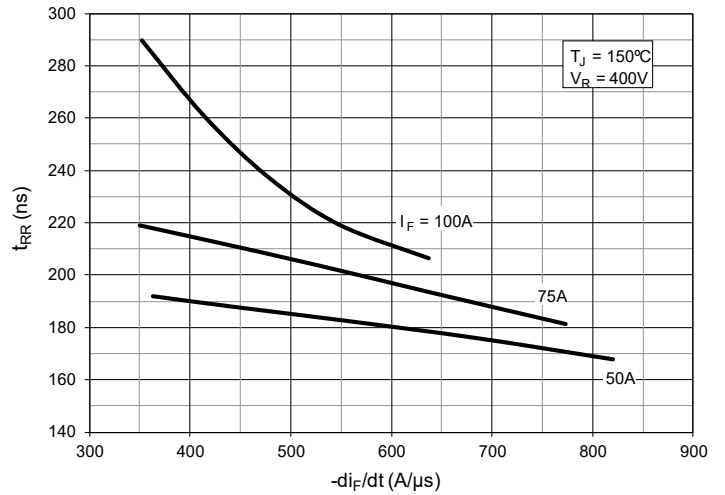


Fig. 26. Dynamic Parameters Q_{RR} , I_{RR} vs. Junction Temperature

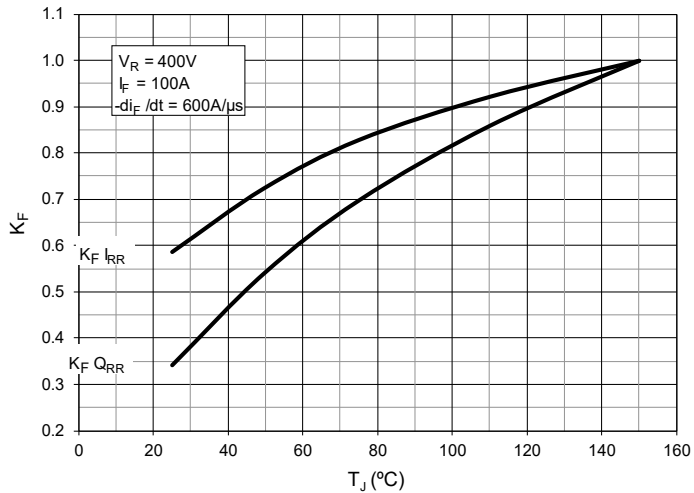
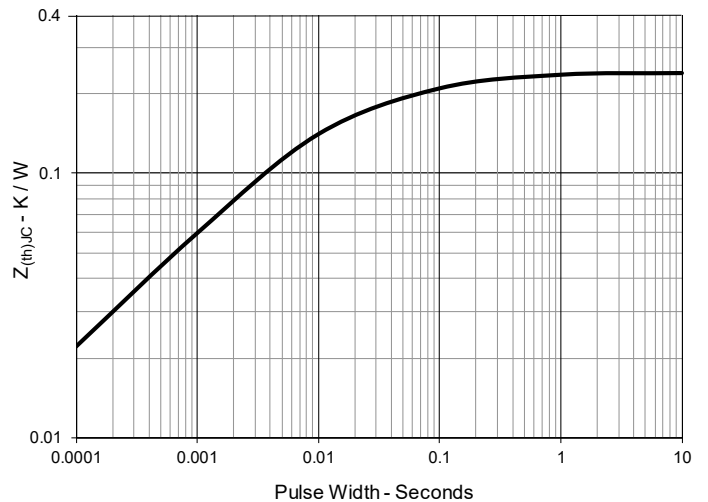
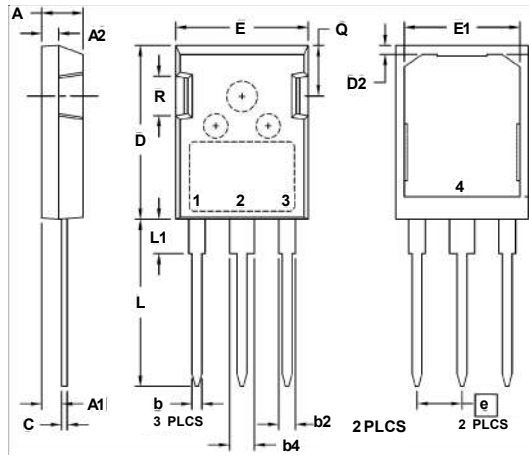


Fig. 27. Maximum Transient Thermal Impedance (Diode)



PLUS247™ Outline


1 = Gate
2,4 = Collector
3 = Emitter

| 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 | .520 | .560 | 13.08 | 14.22 |
| e | .215 BSC | | 5.45 BSC | |
| L | .780 | .810 | 19.81 | 20.57 |
| L1 | .150 | .170 | 3.81 | 4.32 |
| Q | .220 | .244 | 5.59 | 6.20 |
| R | .170 | .190 | 4.32 | 4.83 |



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