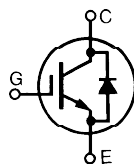


XPT™ 650V IGBT GenX4™ w/ Diode

IXXH80N65B4D1

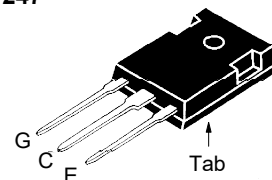
Extreme Light Punch Through
IGBT for 5-30 kHz Switching



$$\begin{aligned} V_{CES} &= 650V \\ I_{C110} &= 80A \\ V_{CE(sat)} &\leq 2.1V \\ t_{fi(typ)} &= 53ns \end{aligned}$$

| Symbol | Test Conditions | Maximum Ratings | |
|----------------|--|-------------------------|------------------|
| V_{CES} | $T_J = 25^\circ\text{C}$ to 175°C | 650 | V |
| V_{CGR} | $T_J = 25^\circ\text{C}$ to 175°C , $R_{GE} = 1M\Omega$ | 650 | V |
| V_{GES} | Continuous | ± 20 | V |
| V_{GEM} | Transient | ± 30 | V |
| I_{C25} | $T_C = 25^\circ\text{C}$ (Chip Capability) | 180 | A |
| I_{C110} | $T_C = 110^\circ\text{C}$ | 80 | A |
| I_{F110} | $T_C = 110^\circ\text{C}$ | 65 | A |
| I_{CM} | $T_C = 25^\circ\text{C}$, 1ms | 430 | A |
| SSOA | $V_{GE} = 15V$, $T_{VJ} = 150^\circ\text{C}$, $R_G = 3\Omega$ | $I_{CM} = 160$ | A |
| (RBSOA) | Clamped Inductive Load | @ $V_{CE} \leq V_{CES}$ | |
| t_{sc} | $V_{GE} = 15V$, $V_{CE} = 360V$, $T_J = 150^\circ\text{C}$ | 10 | μs |
| (SCSOA) | $R_G = 82\Omega$, Non Repetitive | | |
| P_C | $T_C = 25^\circ\text{C}$ | 625 | 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 1.6 mm (0.062 in.) from Case for 10s | 300 | $^\circ\text{C}$ |
| M_d | Mounting Torque | 1.13/10 | Nm/lb.in. |
| Weight | | 6 | g |

TO-247



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

Features

- Optimized for 5-30kHz Switching
- Square RBSOA
- Anti-Parallel Diode
- 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 ($T_J = 25^\circ\text{C}$, Unless Otherwise Specified) | Characteristic Values | | |
|---------------|---|-----------------------|------|--------------------------|
| | | Min. | Typ. | Max. |
| BV_{CES} | $I_C = 250\mu\text{A}$, $V_{GE} = 0V$ | 650 | | V |
| $V_{GE(th)}$ | $I_C = 250\mu\text{A}$, $V_{CE} = V_{GE}$ | 4.0 | | 6.5 V |
| I_{CES} | $V_{CE} = V_{CES}$, $V_{GE} = 0V$ $T_J = 150^\circ\text{C}$ | | | 25 μA 2 mA |
| I_{GES} | $V_{CE} = 0V$, $V_{GE} = \pm 20V$ | | | ± 100 nA |
| $V_{CE(sat)}$ | $I_C = 80A$, $V_{GE} = 15V$, Note 1 $T_J = 150^\circ\text{C}$ | 1.65 2.00 | | 2.10 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 | 25 | 42 | S |
| C_{ies} | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$ | | 3860 | pF |
| C_{oes} | | | 395 | pF |
| C_{res} | | | 58 | pF |
| $Q_{g(on)}$ | $I_C = 80\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$ | | 120 | nC |
| Q_{ge} | | | 32 | nC |
| Q_{gc} | | | 46 | nC |
| $t_{d(on)}$ | Inductive load, $T_J = 25^\circ\text{C}$ $I_C = 80\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 3\Omega$ Note 2 | | 26 | ns |
| t_{ri} | | | 100 | ns |
| E_{on} | | | 3.36 | mJ |
| $t_{d(off)}$ | | | 112 | ns |
| t_{fi} | | | 53 | ns |
| E_{off} | | | 1.83 | mJ |
| $t_{d(on)}$ | Inductive load, $T_J = 150^\circ\text{C}$ $I_C = 80\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 3\Omega$ Note 2 | | 23 | ns |
| t_{ri} | | | 102 | ns |
| E_{on} | | | 5.50 | mJ |
| $t_{d(off)}$ | | | 128 | ns |
| t_{fi} | | | 94 | ns |
| E_{off} | | | 2.70 | mJ |
| R_{thJC} | | | | 0.24 $^\circ\text{C/W}$ |
| R_{thCS} | | 0.21 | | $^\circ\text{C/W}$ |

Reverse Diode (FRED)

| Symbol Test Conditions ($T_J = 25^\circ\text{C}$ Unless Otherwise Specified) | | Characteristic Values | | |
|--|--|---------------------------|------|-------------------------|
| | | Min. | Typ. | Max. |
| V_F | $I_F = 50\text{A}, V_{GE} = 0\text{V}$, Note 1 | | | 2.5 V |
| | | $T_J = 150^\circ\text{C}$ | 1.35 | V |
| I_{RM} | $I_F = 50\text{A}, V_{GE} = 0\text{V}, -di_F/dt = 500\text{A}/\mu\text{s},$ $V_R = 400\text{V}$ | | 26 | A |
| t_{rr} | | | 140 | ns |
| R_{thJC} | | | | 0.47 $^\circ\text{C/W}$ |

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 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 | |

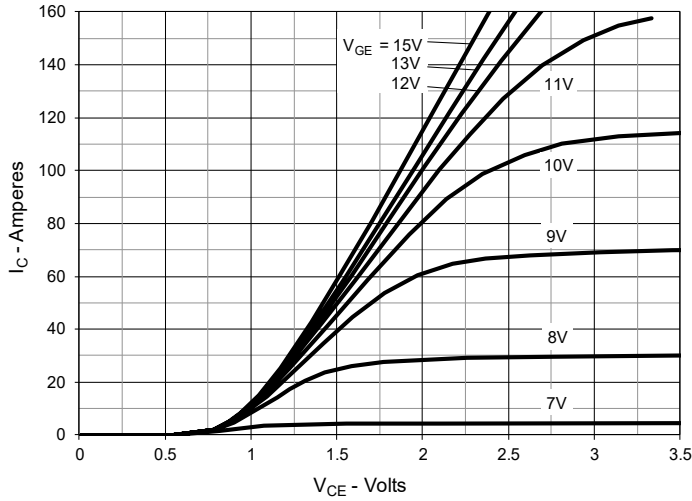
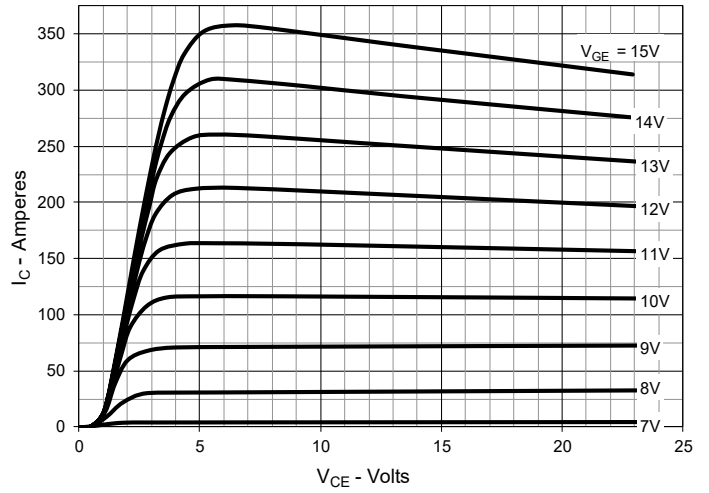
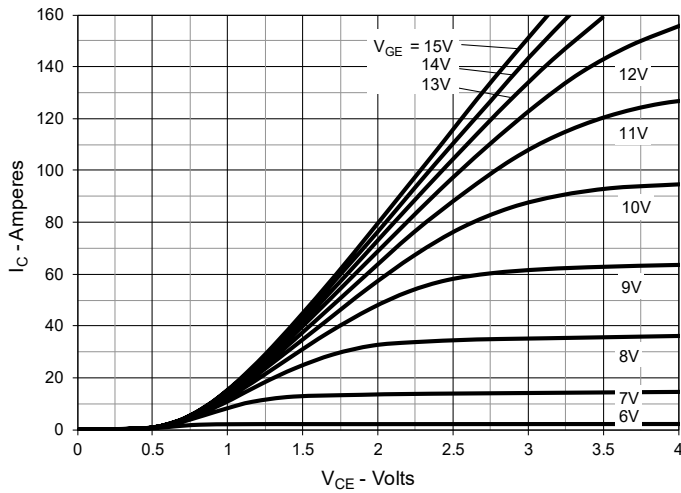
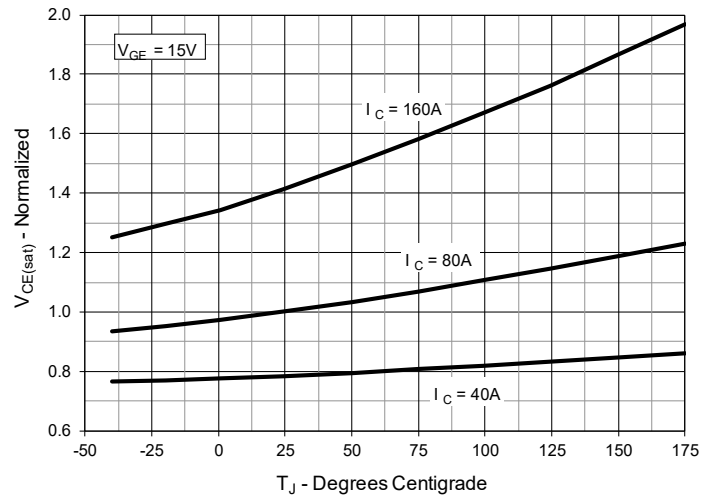
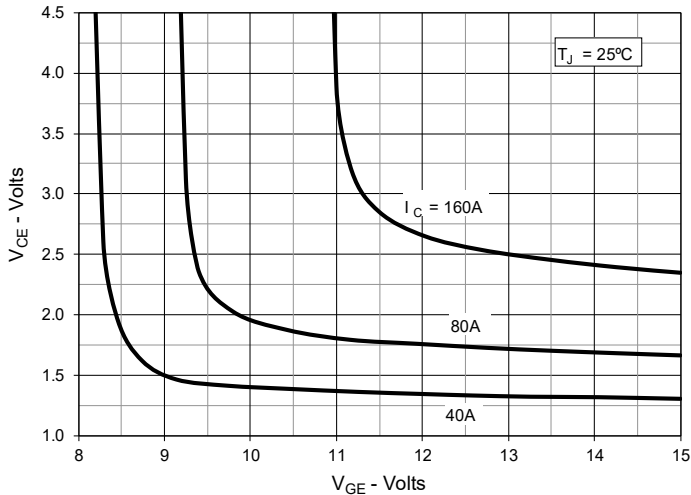
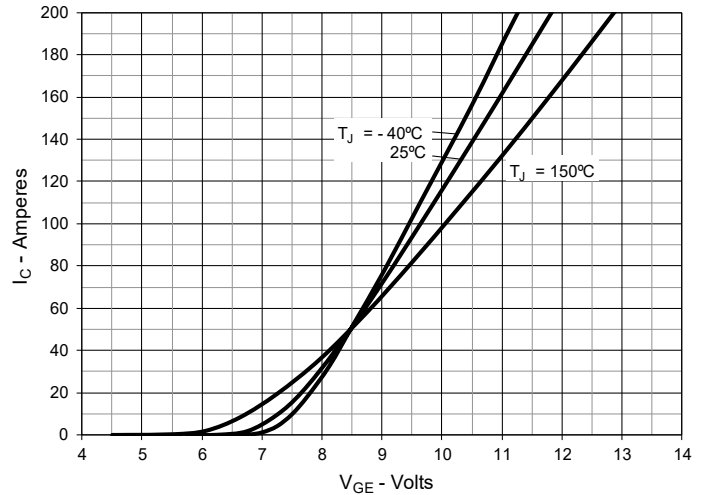
Fig. 1. Output Characteristics @ $T_J = 25^\circ\text{C}$

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


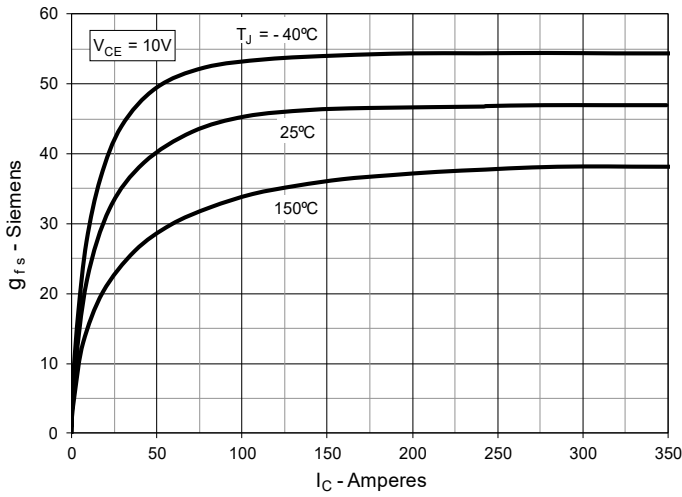
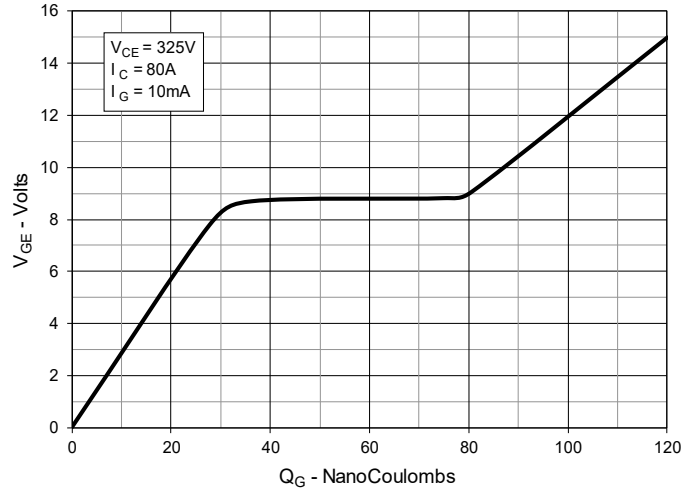
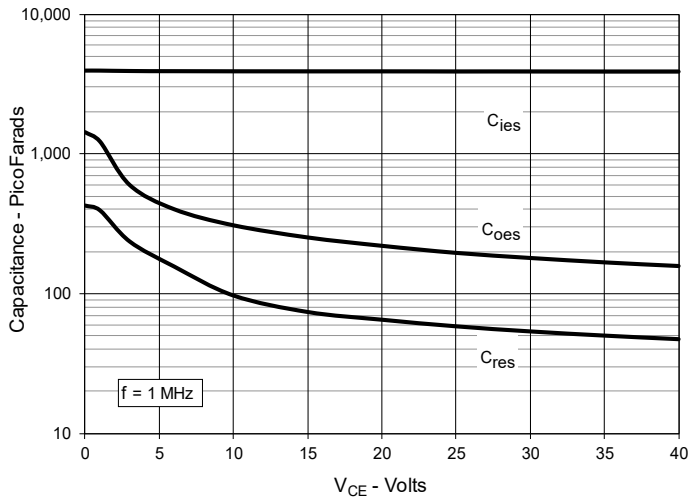
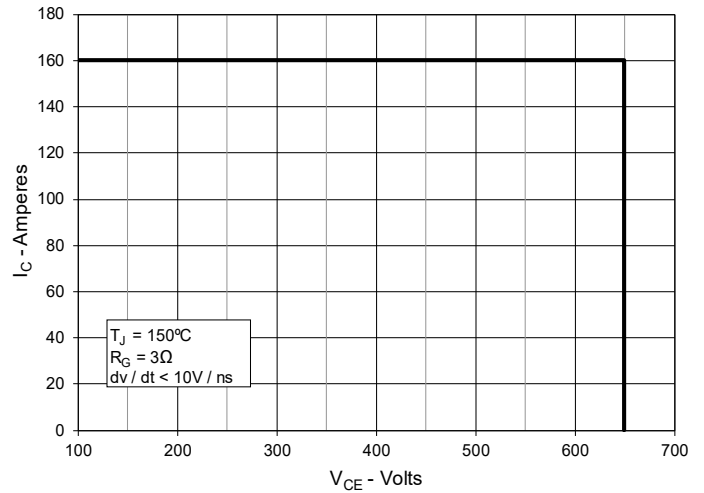
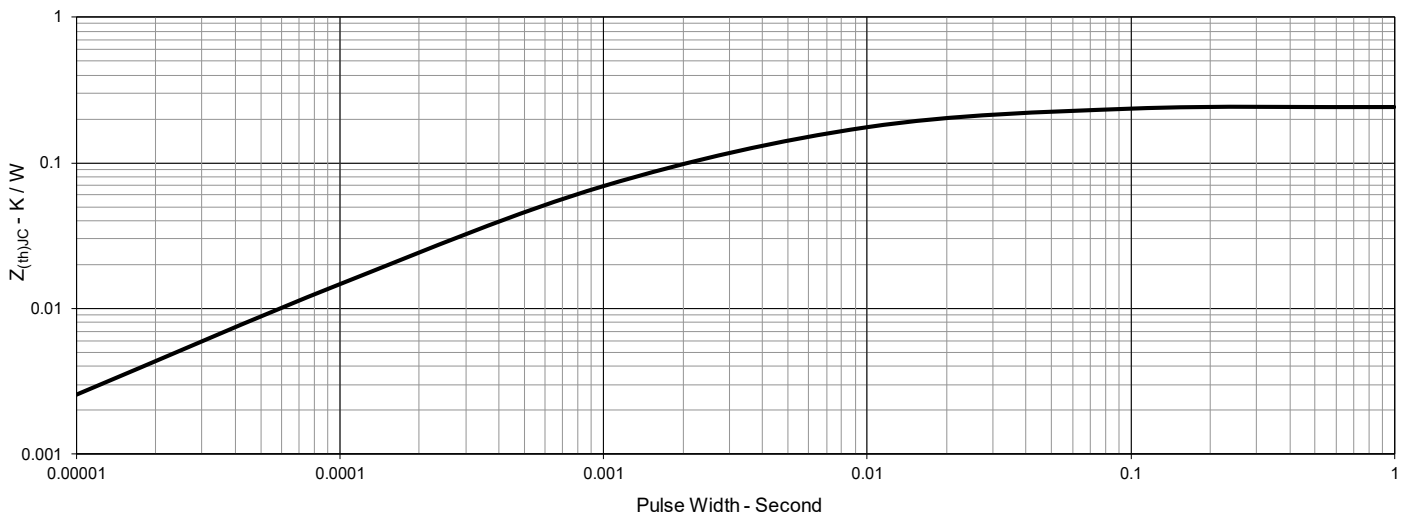
Fig. 7. Transconductance

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

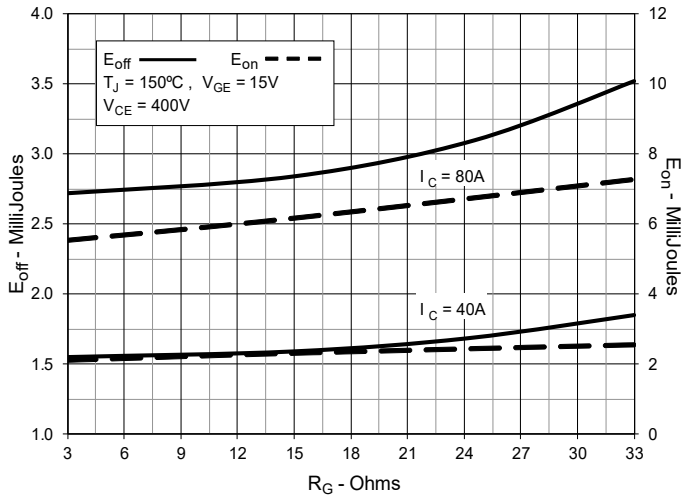


Fig. 13. Inductive Switching Energy Loss vs. Collector Current

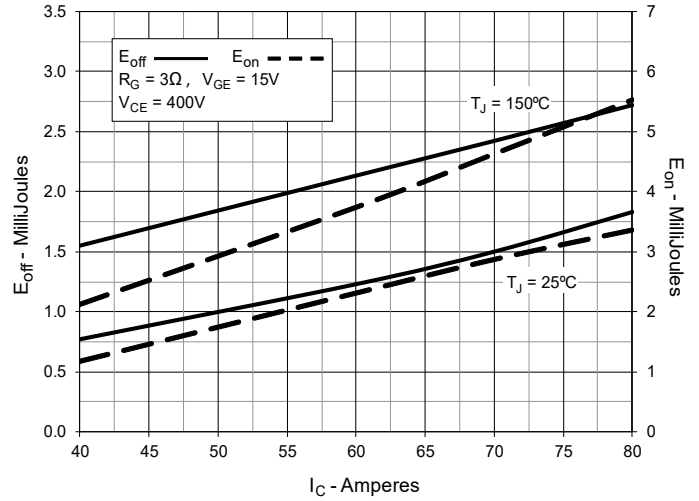


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

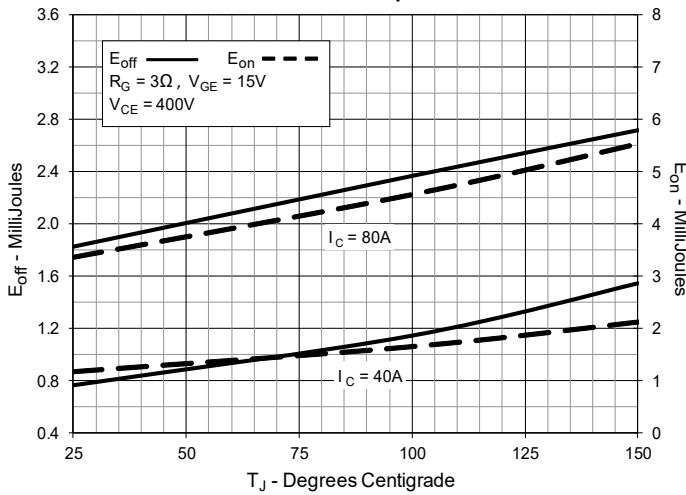


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

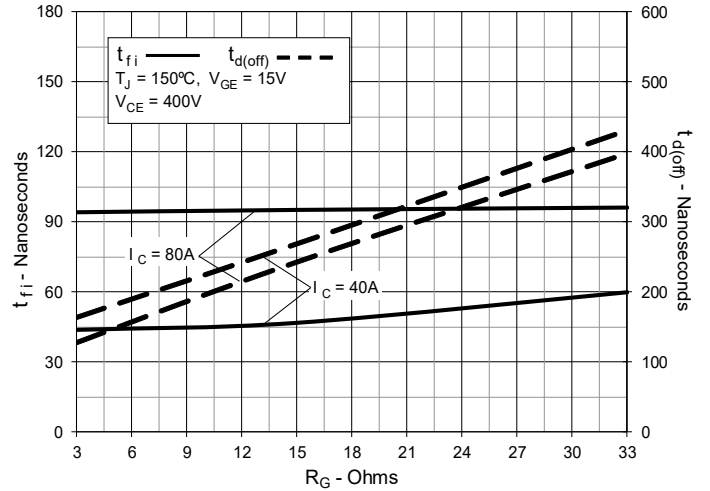


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

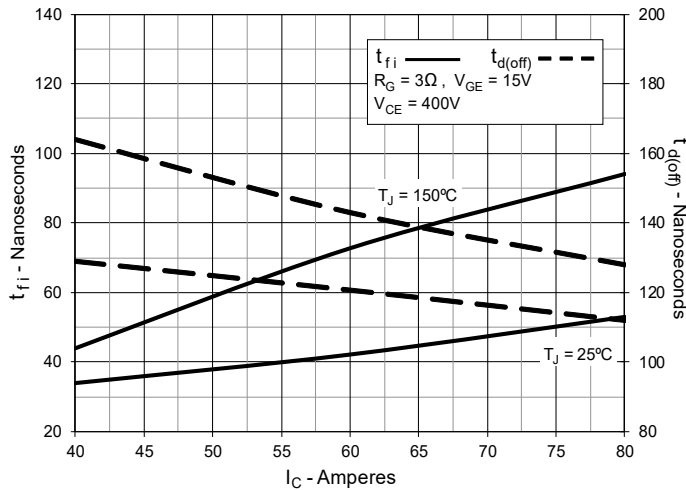


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

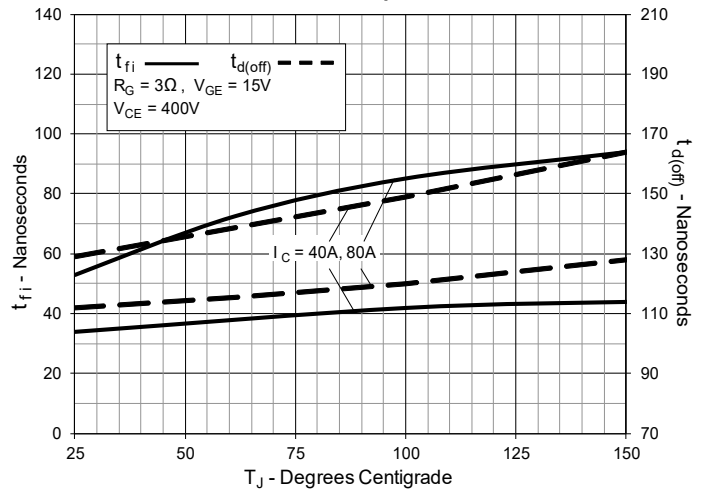


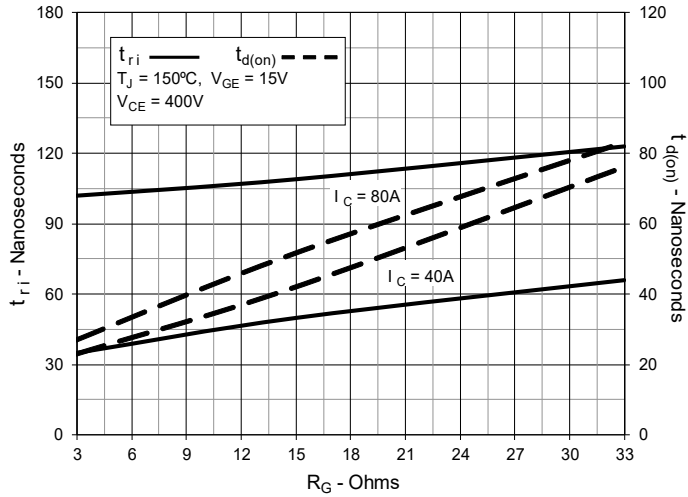
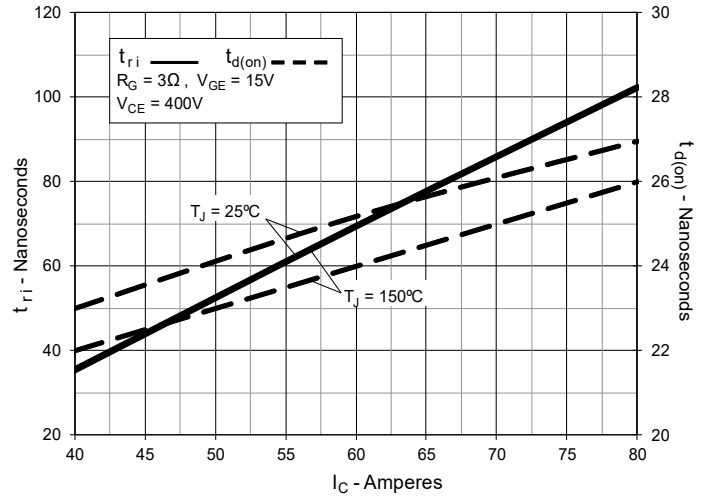
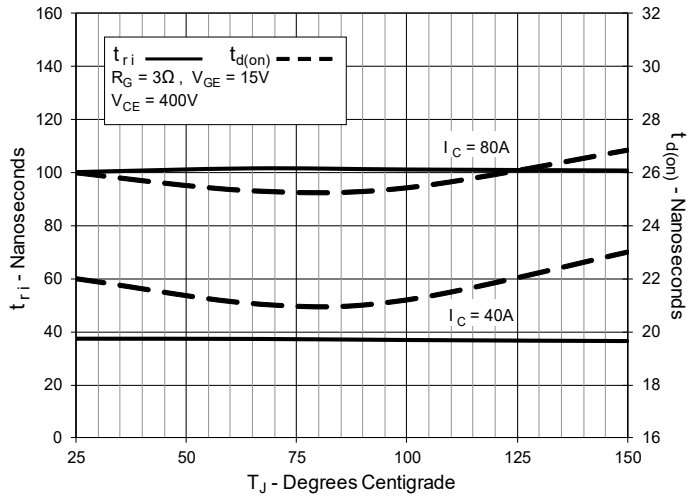
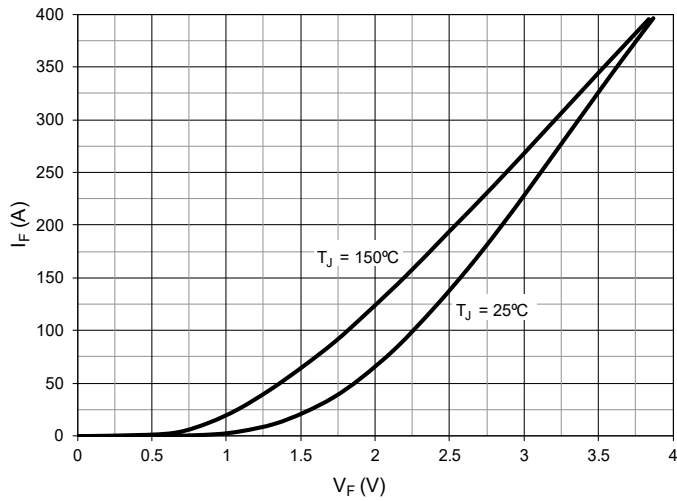
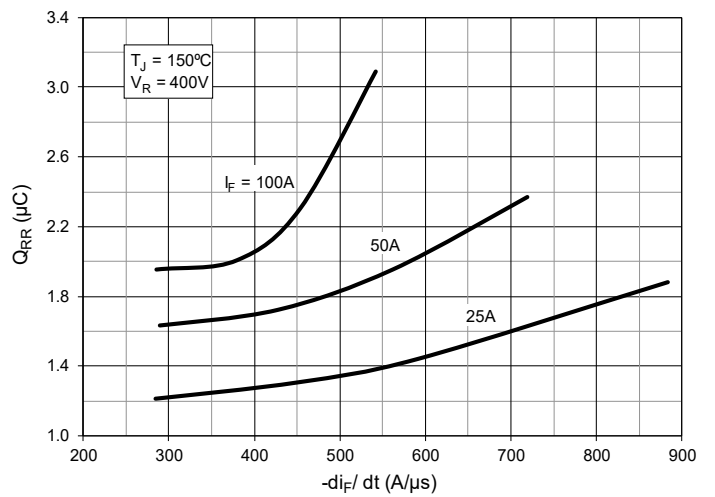
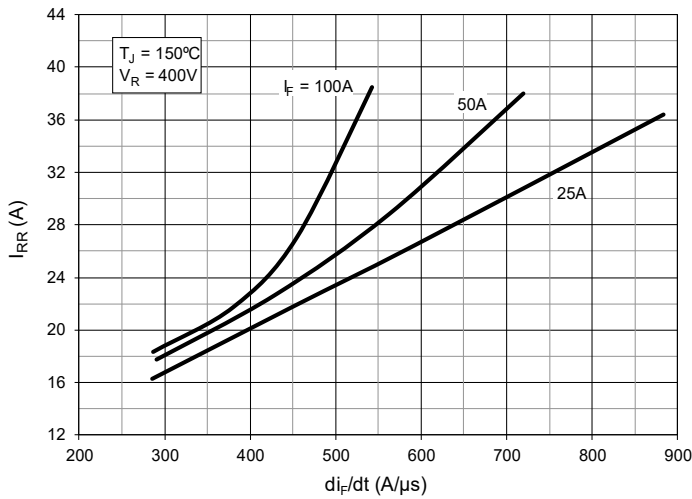
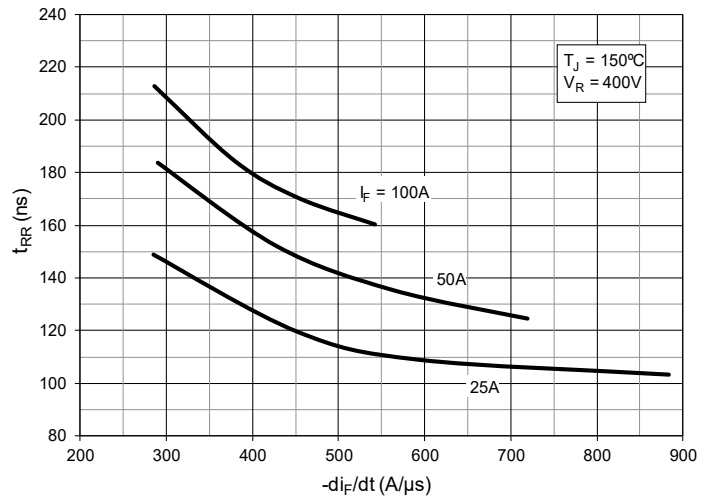
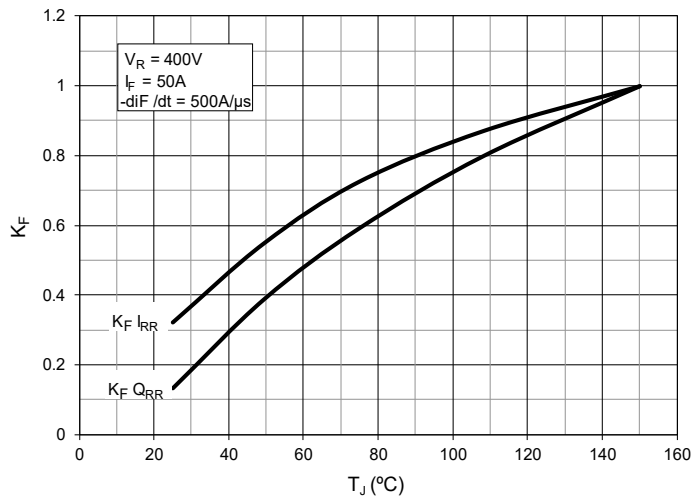
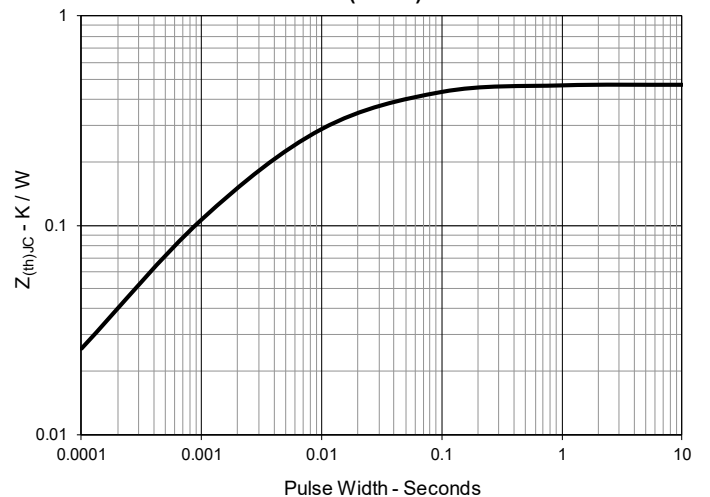
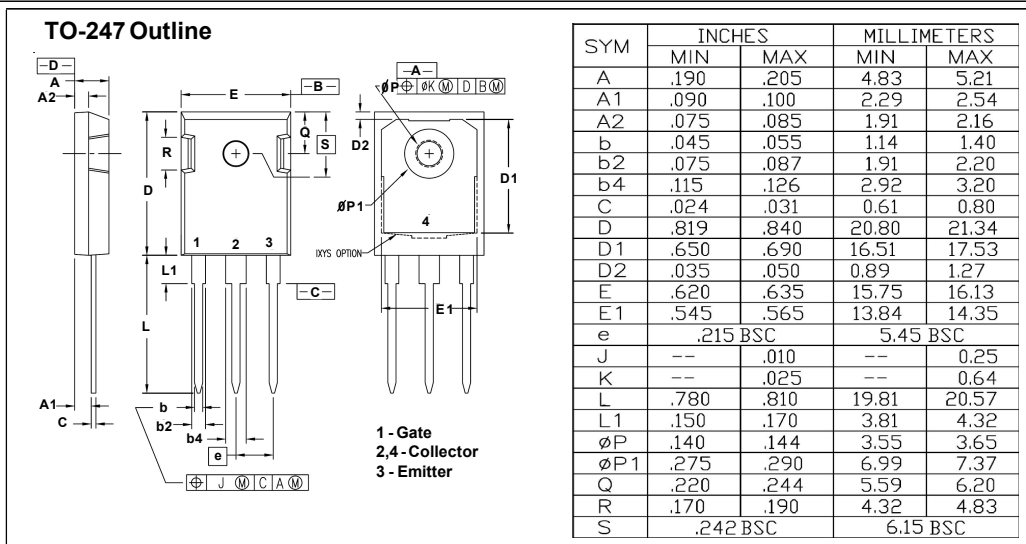
Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature


Fig. 21. Diode Forward Characteristics

Fig. 22. Reverse Recovery Charge vs. $-di_F/dt$

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

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

Fig. 25. Dynamic Parameters Q_{RR} , I_{RR} vs. Junction Temperature

Fig. 26. Maximum Transient Thermal Impedance (Diode)






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