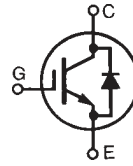


GenX3™ 600V IGBT with Diode

IXGR48N60C3D1

(Electrically Isolated Back Surface)

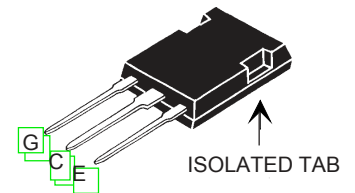
High Speed PT IGBTs for
40-100kHz Switching



$V_{CES} = 600V$
 $I_{C25} = 56A$
 $V_{CE(sat)} \leq 2.7V$
 $t_{fi(typ)} = 38ns$

| Symbol | Test Conditions | Maximum Ratings | |
|-------------------------------|---|---------------------------------------|------------|
| V_{CES} | $T_J = 25^\circ C$ to $150^\circ C$ | 600 | V |
| V_{CGR} | $T_J = 25^\circ C$ to $150^\circ C$, $R_{GE} = 1M\Omega$ | 600 | V |
| V_{GES} | Continuous | ± 20 | V |
| V_{GEM} | Transient | ± 30 | V |
| I_{C25} | $T_C = 25^\circ C$ | 56 | A |
| I_{C110} | $T_C = 110^\circ C$ | 26 | A |
| I_{D110} | $T_C = 110^\circ C$ | 27 | A |
| I_{CM} | $T_C = 25^\circ C$, 1ms | 230 | A |
| I_A | $T_C = 25^\circ C$ | 30 | A |
| E_{AS} | $T_C = 25^\circ C$ | 300 | mJ |
| SSOA (RBSOA) | $V_{GE} = 15V$, $T_{VJ} = 125^\circ C$, $R_G = 3\Omega$ Clamped Inductive Load | $I_{CM} = 100$ @ $V_{CE} \leq 600$ | A V |
| P_C | $T_C = 25^\circ C$ | 125 | W |
| T_J | | -55 ... +150 | $^\circ C$ |
| T_{JM} | | 150 | $^\circ C$ |
| T_{stg} | | -55 ... +150 | $^\circ C$ |
| T_L | 1.6mm (0.062 in.) from Case for 10s | 300 | $^\circ C$ |
| T_{SOLD} | Plastic Body for 10 Seconds | 260 | $^\circ C$ |
| V_{ISOL} | 50/60 Hz RMS, $t = 1min$ | 2500 | V~ |
| F_C | Mounting Force | 20..120 / 4.5..27 | N/lb. |
| Weight | | 5 | g |

ISOPLUS 247™



G = Gate C = Collector
E = Emitter

Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
 - UL Recognized Package
 - Isolated Mounting Surface
 - 2500V Electrical Isolation
- Avalanche Rated
- Square RBSOA
- Anti-Parallel Ultra Fast Diode
- Fast Switching
- International Standard Package

Advantages

- High Power Density
- Low Gate Drive Requirement

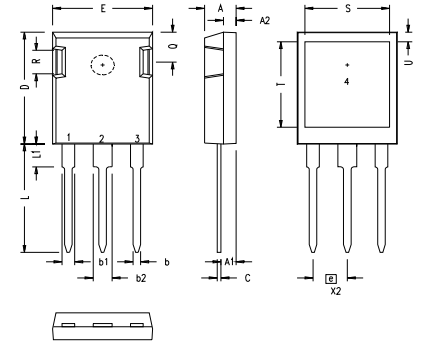
Applications

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

| Symbol | Test Conditions | Characteristic Values ($T_J = 25^\circ C$, Unless Otherwise Specified) | | |
|---------------|--|---|------------|------------------------|
| | | Min. | Typ. | Max. |
| $V_{GE(th)}$ | $I_C = 250\mu A$, $V_{CE} = V_{GE}$ | 3.0 | | 5.5 V |
| I_{CES} | $V_{CE} = V_{CES}$ $V_{GE} = 0V$ $T_J = 125^\circ C$ | | | 300 μA 1.75 mA |
| I_{GES} | $V_{CE} = 0V$, $V_{GE} = \pm 20V$ | | | ± 100 nA |
| $V_{CE(sat)}$ | $I_C = 30A$, $V_{GE} = 15V$, Note 1 $T_J = 125^\circ C$ | | 2.3 1.8 | 2.7 V V |

| Symbol | Test Conditions | Characteristic Values | | |
|---------------------------|--|---|------|---------|
| | | (T _J = 25°C, Unless Otherwise Specified) | | |
| | | Min. | Typ. | Max. |
| g_{fs} | I _C = 30A V _{CE} = 10V, Note 1 | 20 | 30 | S |
| C_{ies} | V _{CE} = 25V, V _{GE} = 0V, f = 1MHz | | 1960 | pF |
| C_{oes} | | | 220 | pF |
| C_{res} | | | 66 | pF |
| Q_g | I _C = 30A, V _{GE} = 15V, V _{CE} = 0.5 • V _{CES} | | 77 | nC |
| Q_{ge} | | | 16 | nC |
| Q_{gc} | | | 32 | nC |
| t_{d(on)} | Inductive Load, T _J = 25°C I _C = 30A, V _{GE} = 15V V _{CE} = 400V, R _G = 3Ω | | 19 | ns |
| t_{ri} | | | 26 | ns |
| E_{on} | | | 0.41 | mJ |
| t_{d(off)} | | | 60 | ns |
| t_{fi} | | | 38 | ns |
| E_{off} | | | 0.23 | 0.55 mJ |
| t_{d(on)} | Inductive Load, T _J = 125°C I _C = 30A, V _{GE} = 15V V _{CE} = 400V, R _G = 3Ω | | 19 | ns |
| t_{ri} | | | 26 | ns |
| E_{on} | | | 0.65 | mJ |
| t_{d(off)} | | | 92 | ns |
| t_{fi} | | | 95 | ns |
| E_{off} | | | 0.57 | mJ |
| R_{thJC} | | | 1.0 | °C/W |
| R_{thCS} | | 0.15 | | °C/W |

ISOPLUS247 (IXGR) 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 |
| b1 | .075 | .084 | 1.91 | 2.13 |
| b2 | .115 | .123 | 2.92 | 3.12 |
| C | .024 | .031 | 0.61 | 0.80 |
| D | .819 | .840 | 20.80 | 21.34 |
| E | .620 | .635 | 15.75 | 16.13 |
| e | .215 BSC | | 5.45 BSC | |
| L | .780 | .800 | 19.81 | 20.32 |
| L1 | .150 | .170 | 3.81 | 4.32 |
| Q | .220 | .244 | 5.59 | 6.20 |
| R | .170 | .190 | 4.32 | 4.83 |
| S | .520 | .540 | 13.21 | 13.72 |
| T | .620 | .640 | 15.75 | 16.26 |
| U | .065 | .080 | 1.65 | 2.03 |

- 1 - GATE
- 2 - DRAIN (COLLECTOR)
- 3 - SOURCE (EMITTER)
- 4 - NO CONNECTION

NOTE: This drawing will meet all dimensions requirement of JEDEC outline TO-247AD except screw hole.

Reverse Diode (FRED)

| Symbol | Test Conditions | Characteristic Values | | |
|-------------------------|---|---|------|----------|
| | | (T _J = 25°C, Unless Otherwise Specified) | | |
| | | Min. | Typ. | Max. |
| V_F | I _F = 30A, V _{GE} = 0V, Note 1 | T _J = 25°C | | 2.7 V |
| I_{RM} | I _F = 30A, V _{GE} = 0V, -di _F /dt = 100A/μs, V _R = 100V | T _J = 100°C | | 4 A |
| t_{rr} | | T _J = 100°C | 100 | |
| | I _F = 1A, -di/dt = 100A/μs; V _R = 30V | | 25 | ns |
| R_{thJC} | | | | 1.5 °C/W |

Note 1: Pulse test, t ≤ 300μs, Duty cycle, d ≤ 2 %.

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 |
| | 4,850,072 | 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 | |

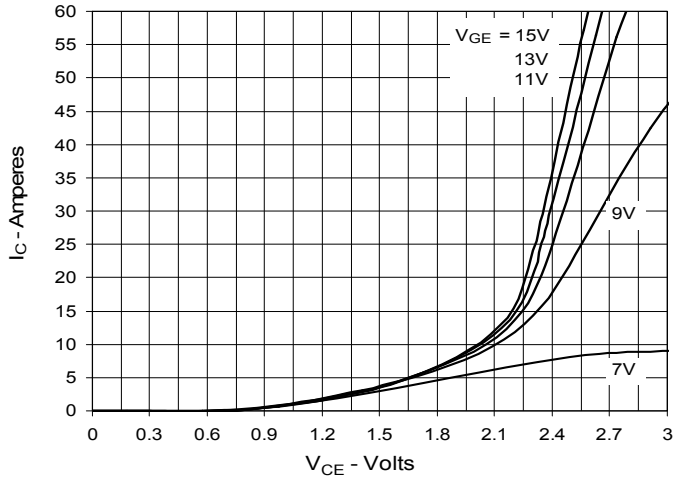
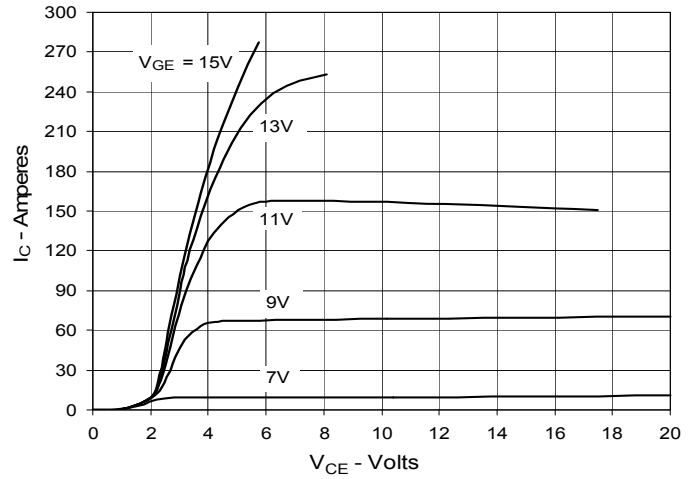
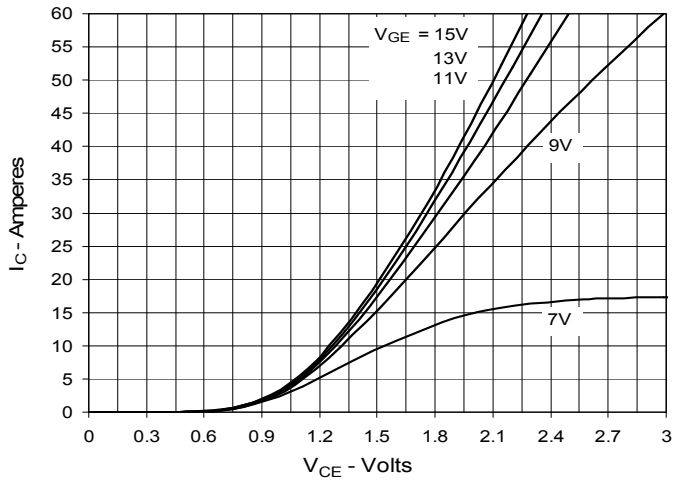
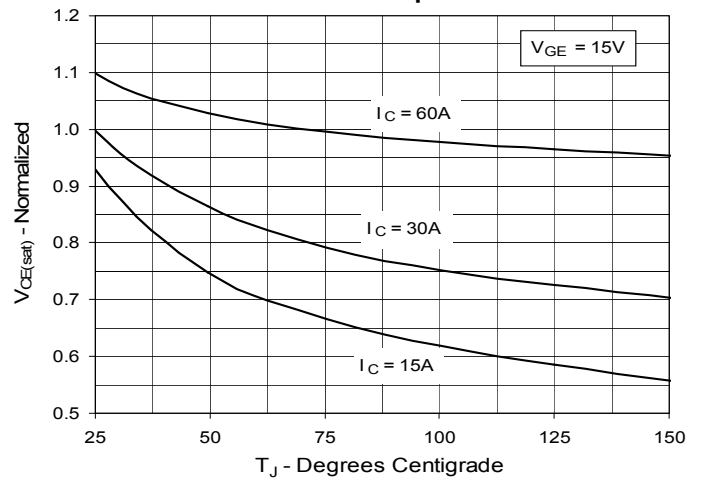
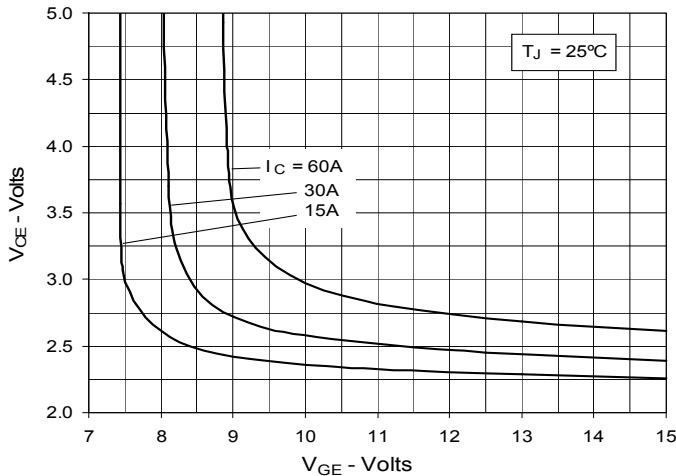
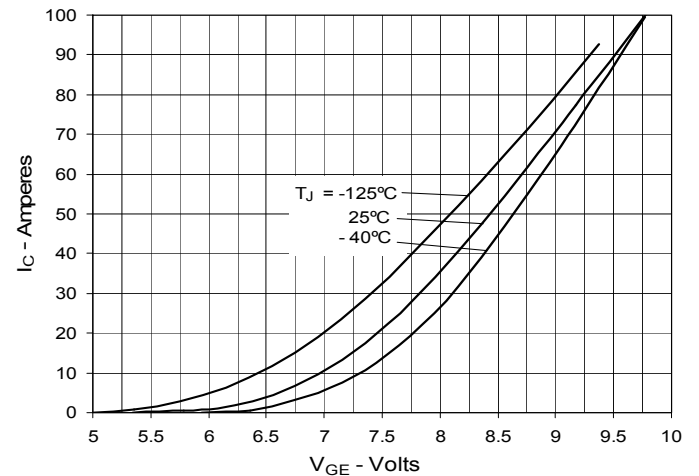
**Fig. 1. Output Characteristics
@ 25°C**

**Fig. 2. Extended Output Characteristics
@ 25°C**

**Fig. 3. Output Characteristics
@ 125°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

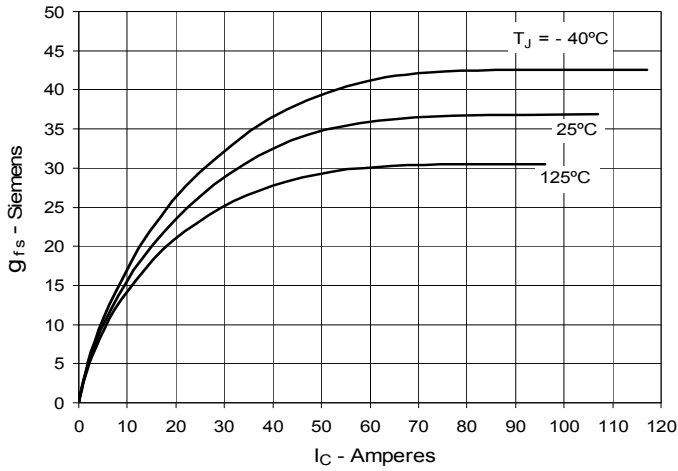


Fig. 8. Gate Charge

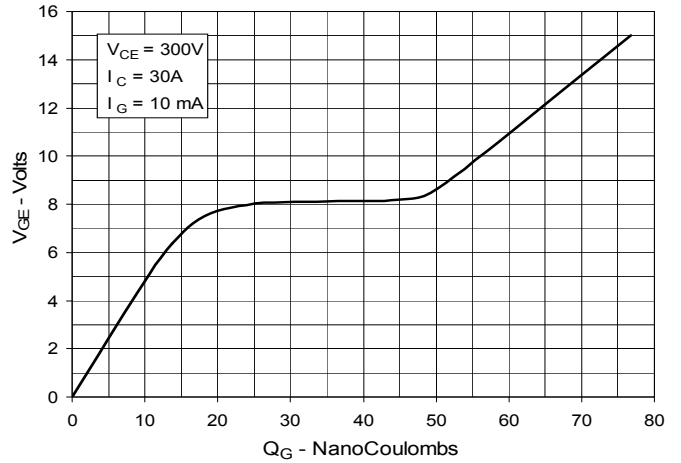


Fig. 9. Capacitance

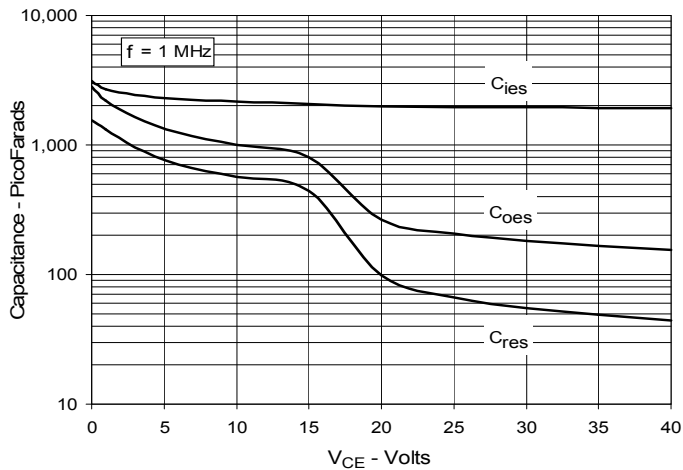


Fig. 10. Reverse-Bias Safe Operating Area

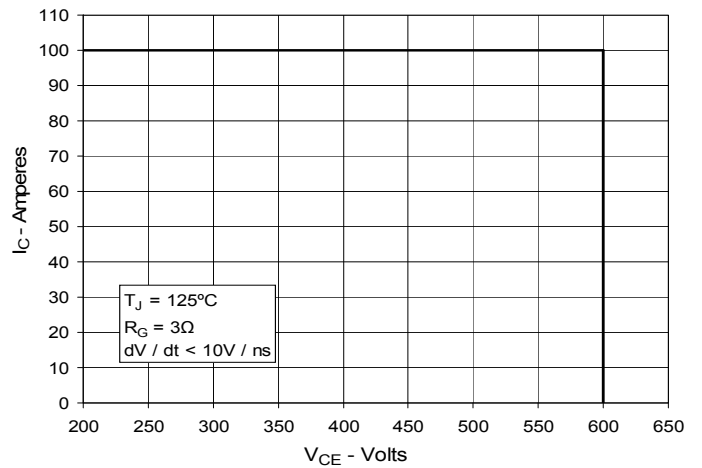


Fig. 11. Maximum Transient Thermal Impedance

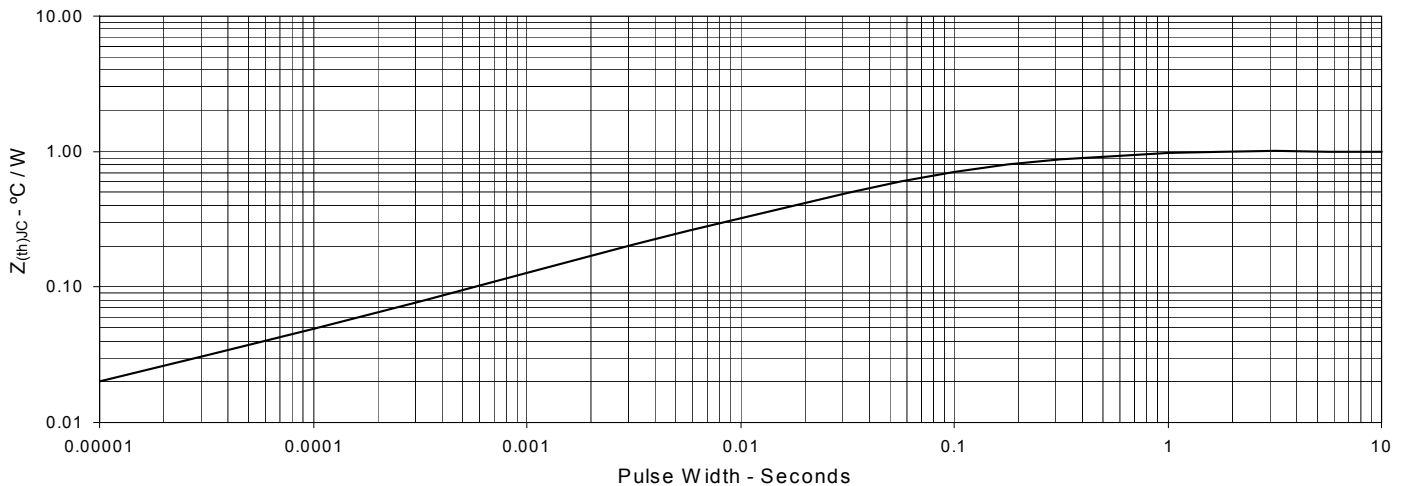


Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance

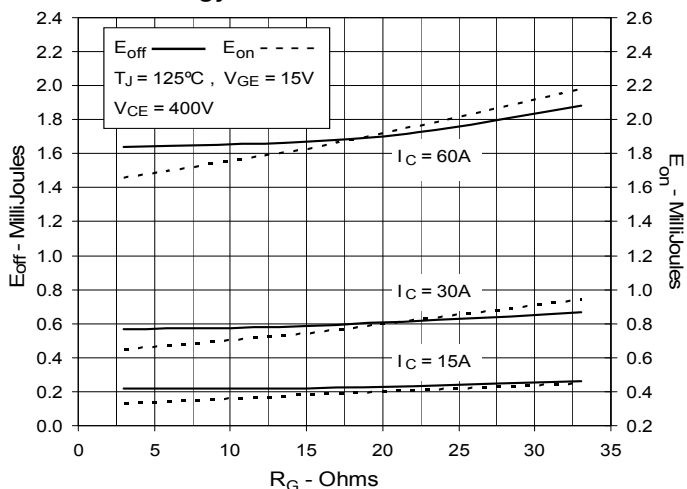


Fig. 13. Inductive Switching Energy Loss vs. Collector Current

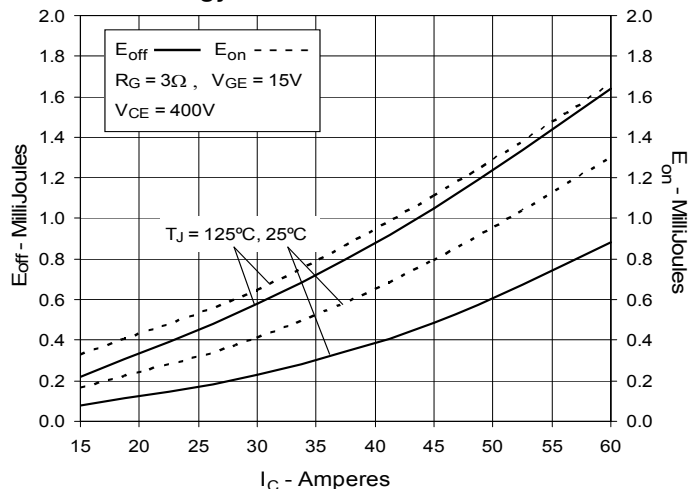


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

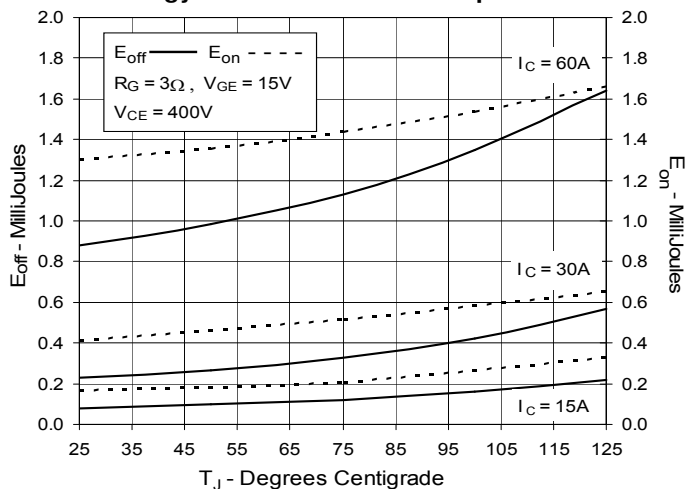


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

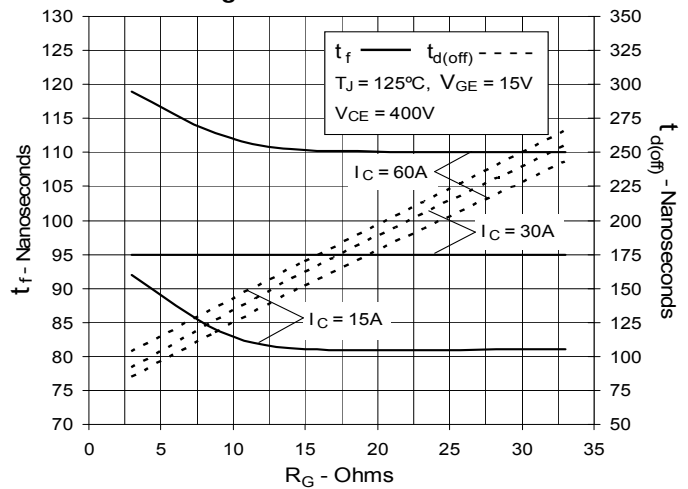


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

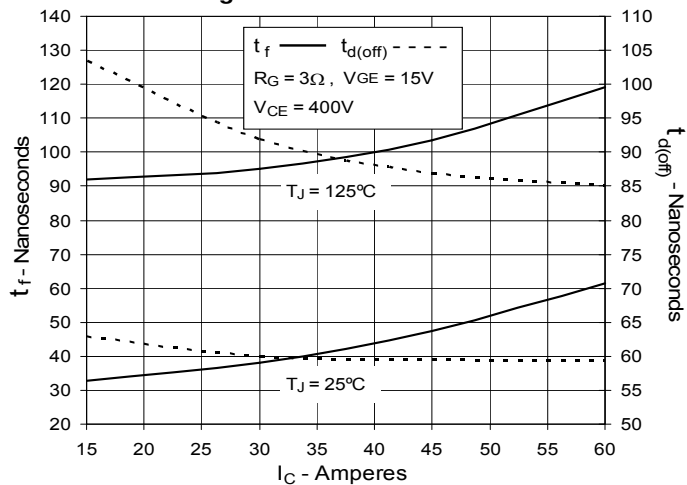


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

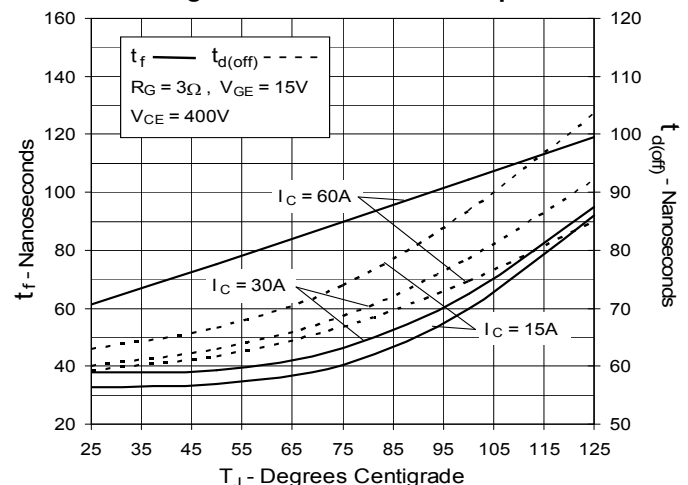


Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

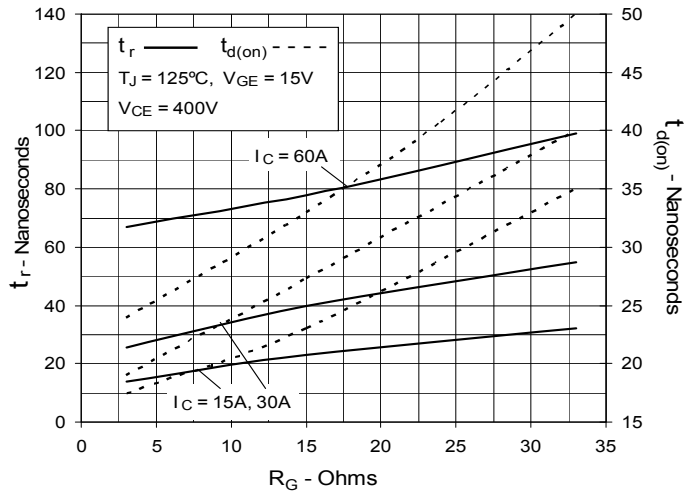


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

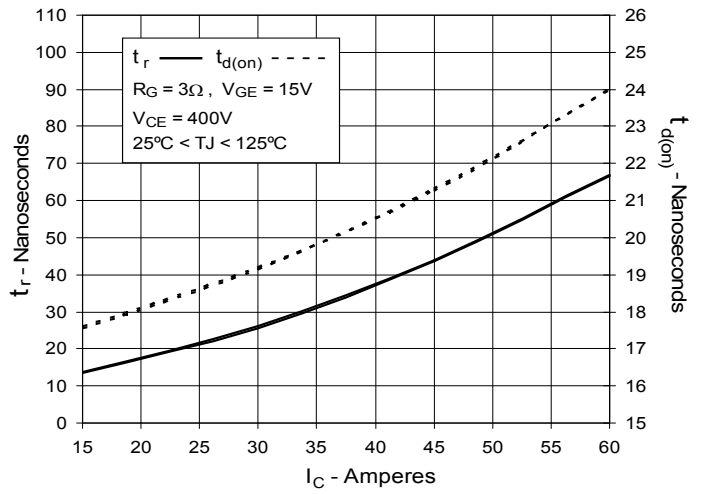
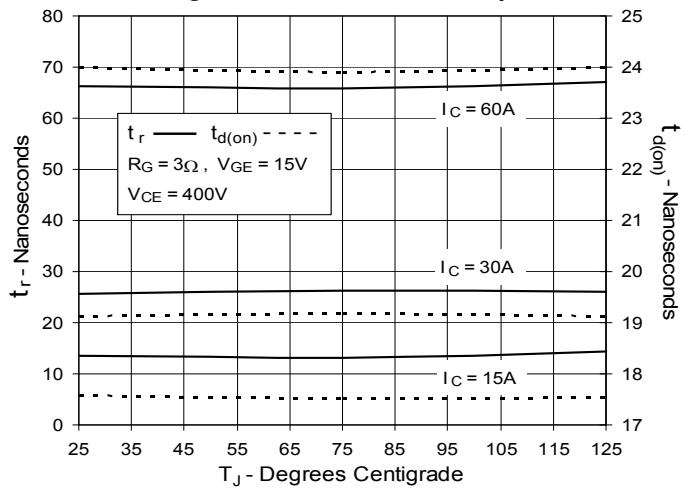


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature



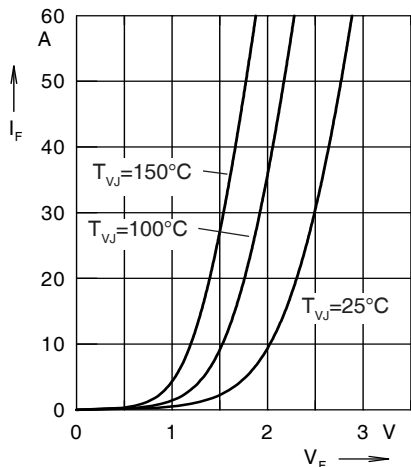


Fig. 21. Forward current I_F versus V_F

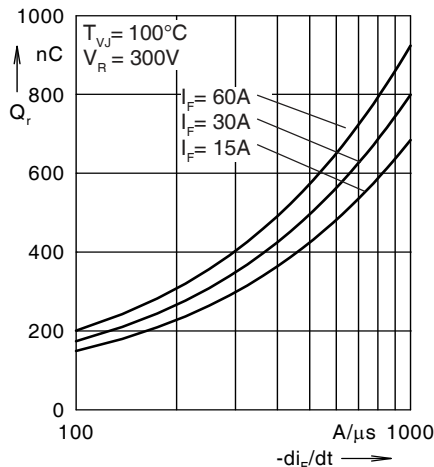


Fig. 22. Reverse recovery charge Q_r versus $-di_F/dt$

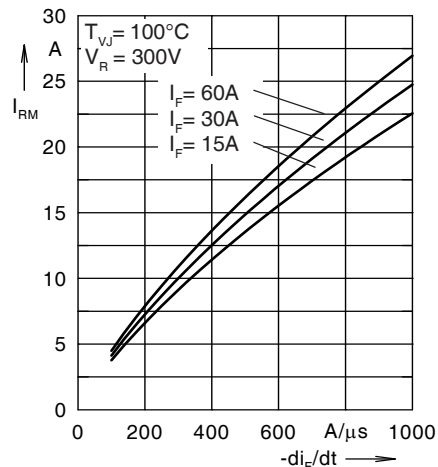


Fig. 23. Peak reverse current I_{RM} versus $-di_F/dt$

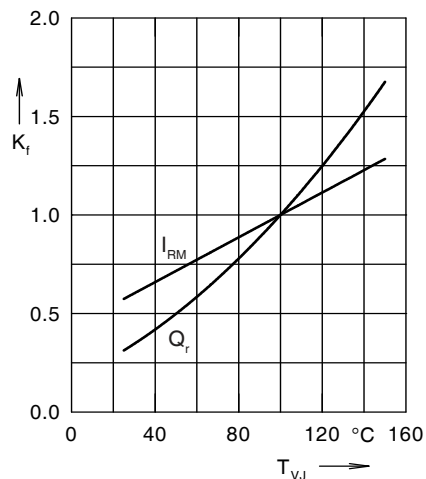


Fig. 24. Dynamic parameters Q_r , I_{RM} versus T_{VJ}

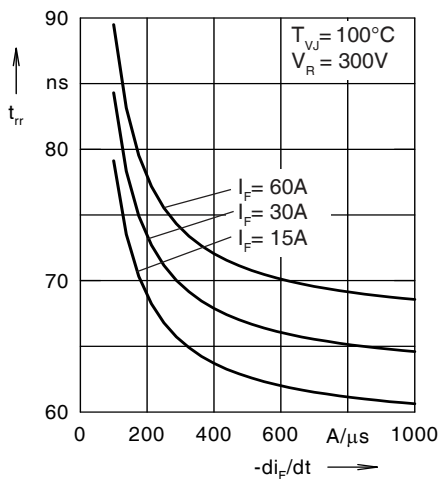


Fig. 25. Recovery time t_{rr} versus $-di_F/dt$

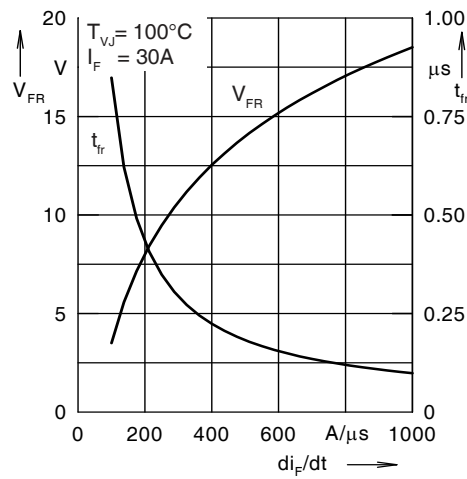


Fig. 26. Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

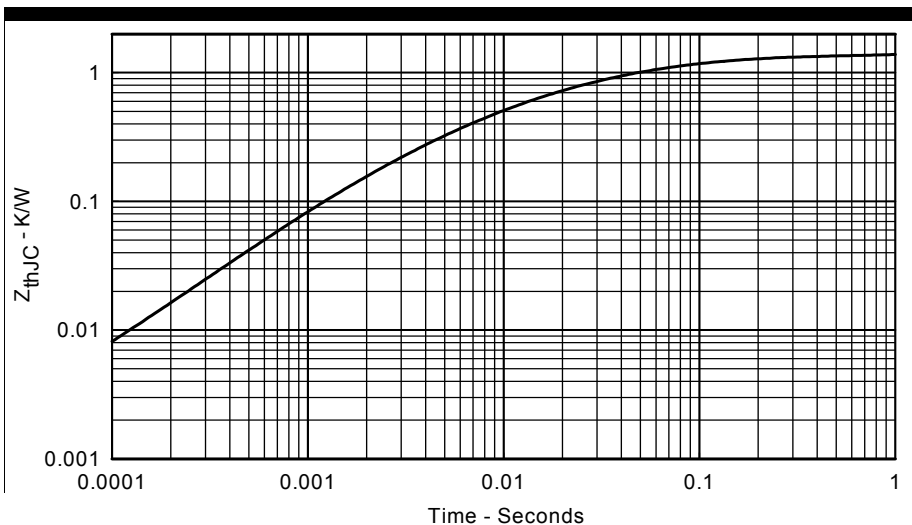


Fig. 27. Transient thermal resistance junction to case



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