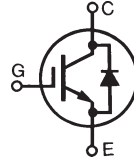


HiPerFAST™

High Speed IGBT

C2-Class w/ Diode

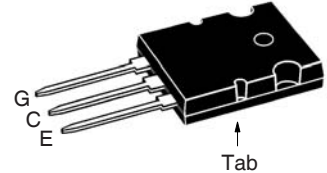
IXGK50N60C2D1
IXGX50N60C2D1



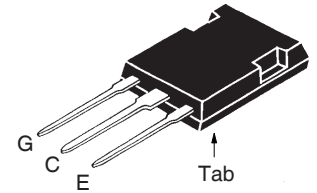
$V_{CES} = 600V$
 $I_{C110} = 50A$
 $V_{CE(sat)} \leq 2.7V$
 $t_{fi(typ)} = 48ns$

| 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} | $T_C = 25^\circ C$ (Limited by Leads) | 75 | A |
| I_{C110} | $T_C = 110^\circ C$ | 50 | A |
| I_{F110} | $T_C = 110^\circ C$ | 48 | A |
| I_{CM} | $T_C = 25^\circ C$, 1ms | 300 | A |
| SSOA (RBSOA) | $V_{GE} = 15V$, $T_{VJ} = 125^\circ C$, $R_G = 10\Omega$ Clamped Inductive Load | $I_{CM} = 100$ $V_{CE} \leq V_{CES}$ | A |
| P_C | $T_C = 25^\circ C$ | 480 | W |
| T_J | | -55 ... +150 | $^\circ C$ |
| T_{JM} | | 150 | $^\circ C$ |
| T_{stg} | | -55 ... +150 | $^\circ C$ |
| M_d | Mounting Torque (TO-264) | 1.13 / 10 | Nm/lb.in |
| F_C | Mounting Force (PLUS247) | 20..120 / 4.5..27 | N/lb |
| T_L | Maximum Lead Temperature for Soldering | 300 | $^\circ C$ |
| T_{SOLD} | 1.6mm (0.062 in.) from Case for 10s | 260 | $^\circ C$ |
| Weight | TO-264 | 10 | g |
| | PLUS247 | 6 | g |

TO-264 (IXGK)



PLUS247 (IXGX)



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

Features

- Very High Frequency IGBT
- Square RBSOA
- Anti-Parallel Ultra Fast Diode
- High Current Handling Capability

Advantages

- High Power Density
- Low Gate Drive Requirement

Applications

- Switch-Mode and Resonant-Mode Power Supplies
- Uninterruptible Power Supplies (UPS)
- PFC Circuits
- AC Motor Drives
- DC Servo & Robot Drives
- DC Choppers

| Symbol | Test Conditions ($T_J = 25^\circ C$, Unless Otherwise Specified) | Characteristic Values | | |
|---------------|---|-----------------------|------|---------------------|
| | | Min. | Typ. | Max. |
| $V_{GE(th)}$ | $I_C = 250\mu A$, $V_{CE} = V_{GE}$ | 3.0 | | 5.5 V |
| I_{CES} | $V_{CE} = V_{CES}$, $V_{GE} = 0V$ $T_J = 125^\circ C$ | | | 650 μA 5 mA |
| I_{GES} | $V_{CE} = 0V$, $V_{GE} = \pm 20V$ | | | ± 100 nA |
| $V_{CE(sat)}$ | $I_C = 40A$, $V_{GE} = 15V$, Note 1 $T_J = 125^\circ C$ | | 1.8 | 2.7 V V |

Symbol Test Conditions

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

Characteristic Values

| Symbol | Test Conditions | Characteristic Values | | |
|--------------|---|---|------|--------------------|
| | | Min. | Typ. | Max. |
| g_{fs} | $I_C = 40\text{A}, V_{CE} = 10\text{V}, \text{Note 1}$ | 40 | 51 | S |
| C_{ies} | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$ | | 3700 | pF |
| C_{oes} | | | 290 | pF |
| C_{res} | | | 50 | pF |
| $Q_{g(on)}$ | $I_C = 40\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$ | | 138 | nC |
| Q_{ge} | | | 25 | nC |
| Q_{gc} | | | 40 | nC |
| $t_{d(on)}$ | Inductive load, $T_J = 25^\circ\text{C}$ | | 18 | ns |
| t_{ri} | | $I_C = 40\text{A}, V_{GE} = 15\text{V}$ | 25 | ns |
| $t_{d(off)}$ | $V_{CE} = 0.8 \cdot V_{CES}, R_G = 2\Omega$ | | 115 | 150 ns |
| t_{fi} | | Note 2 | 48 | ns |
| E_{off} | | 0.38 | 0.70 | mJ |
| $t_{d(on)}$ | Inductive load, $T_J = 125^\circ\text{C}$ | | 18 | ns |
| t_{ri} | | $I_C = 40\text{A}, V_{GE} = 15\text{V}$ | 25 | ns |
| E_{on} | $V_{CE} = 0.8 \cdot V_{CES}, R_G = 2\Omega$ | | 1.4 | mJ |
| $t_{d(off)}$ | | Note 2 | 170 | ns |
| t_{fi} | | 60 | ns | |
| E_{off} | | 0.74 | mJ | |
| R_{thJC} | | | 0.31 | $^\circ\text{C/W}$ |
| R_{thCS} | | 0.15 | | $^\circ\text{C/W}$ |

Reverse Diode (FRED)

Symbol Test Conditions

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

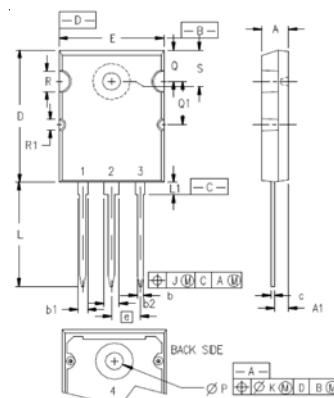
Characteristic Values

| Symbol | Test Conditions | Characteristic Values | | |
|------------|---|-----------------------|---------------------------|-------------------------|
| | | Min. | Typ. | Max. |
| V_F | $I_F = 60\text{A}, V_{GE} = 0\text{V}, \text{Note 1}$ | | | 2.1 V |
| | | | $T_J = 150^\circ\text{C}$ | 1.4 V |
| I_{RM} | $I_F = 60\text{A}, V_{GE} = 0\text{V}, -di_F/dt = 100\text{A}/\mu\text{s}, T_J = 100^\circ\text{C}$ | | | 8.3 A |
| | $V_R = 100\text{V}$ | | | |
| t_{rr} | $I_F = 1\text{A}, -di/dt = 200\text{A}/\mu\text{s}, V_R = 30\text{V}$ | | 35 | ns |
| R_{thJC} | | | | 0.65 $^\circ\text{C/W}$ |

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 .

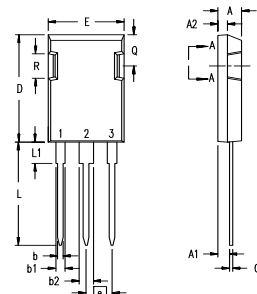
TO-264 Outline



Terminals: 1 = Gate
2,4 = Collector
3 = Emitter

| SYM | INCHES | | MILLIMETERS | |
|------------------|----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | .185 | .209 | 4.70 | 5.31 |
| A1 | .102 | .118 | 2.59 | 3.00 |
| b | .037 | .055 | 0.94 | 1.40 |
| b1 | .087 | .102 | 2.21 | 2.59 |
| b2 | .110 | .126 | 2.79 | 3.20 |
| c | .017 | .029 | 0.43 | 0.74 |
| D | 1.007 | 1.047 | 25.58 | 26.59 |
| E | .760 | .799 | 19.30 | 20.29 |
| e | .215 BSC | | 5.46 BSC | |
| J | .000 | .010 | 0.00 | 0.25 |
| K | .000 | .010 | 0.00 | 0.25 |
| L | .779 | .842 | 19.79 | 21.39 |
| L1 | .087 | .102 | 2.21 | 2.59 |
| $\varnothing P$ | .122 | .138 | 3.10 | 3.51 |
| Q | .240 | .256 | 6.10 | 6.50 |
| Q1 | .330 | .346 | 8.38 | 8.79 |
| $\varnothing R$ | .155 | .187 | 3.94 | 4.75 |
| $\varnothing R1$ | .085 | .093 | 2.16 | 2.36 |
| S | .243 | .253 | 6.17 | 6.43 |

PLUS247™ Outline



Terminals: 1 - Gate
2 - Collector
3 - Emitter

| Dim. | Millimeter | | Inches | |
|----------------|------------|-------|----------|-------|
| | Min. | Max. | Min. | Max. |
| A | 4.83 | 5.21 | .190 | .205 |
| A ₁ | 2.29 | 2.54 | .090 | .100 |
| A ₂ | 1.91 | 2.16 | .075 | .085 |
| b | 1.14 | 1.40 | .045 | .055 |
| b ₁ | 1.91 | 2.13 | .075 | .084 |
| b ₂ | 2.92 | 3.12 | .115 | .123 |
| C | 0.61 | 0.80 | .024 | .031 |
| D | 20.80 | 21.34 | .819 | .840 |
| E | 15.75 | 16.13 | .620 | .635 |
| e | 5.45 BSC | | .215 BSC | |
| L | 19.81 | 20.32 | .780 | .800 |
| L1 | 3.81 | 4.32 | .150 | .170 |
| Q | 5.59 | 6.20 | .220 | 0.244 |
| R | 4.32 | 4.83 | .170 | .190 |

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 | 7,157,338 B2 |
| | 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
@ $T_J = 25^\circ\text{C}$

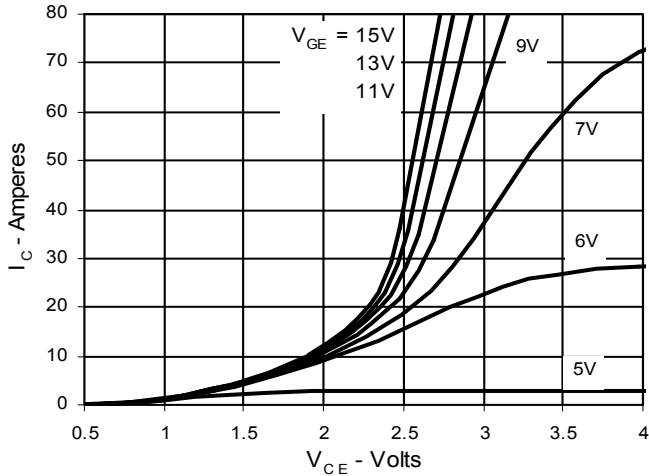


Fig. 2. Extended Output Characteristics
@ $T_J = 25^\circ\text{C}$

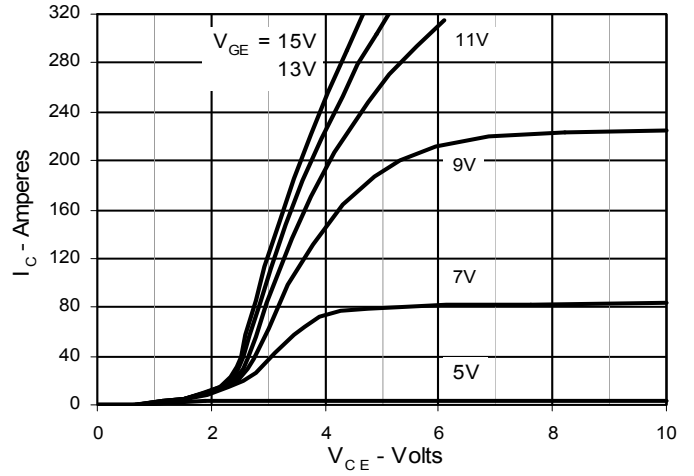


Fig. 3. Output Characteristics
@ $T_J = 125^\circ\text{C}$

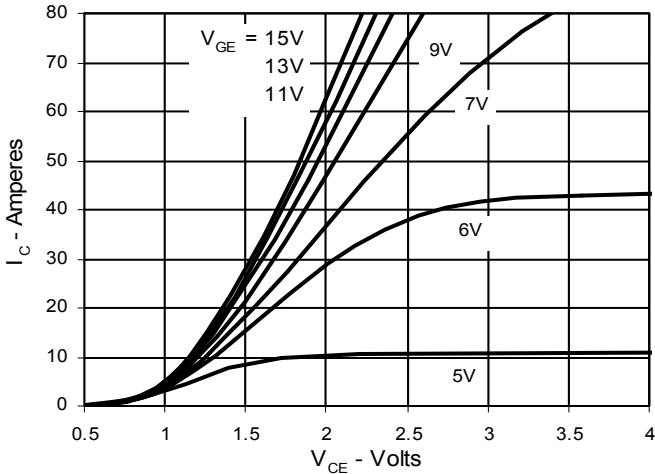


Fig. 4. Dependence of $V_{CE(sat)}$ on Temperature

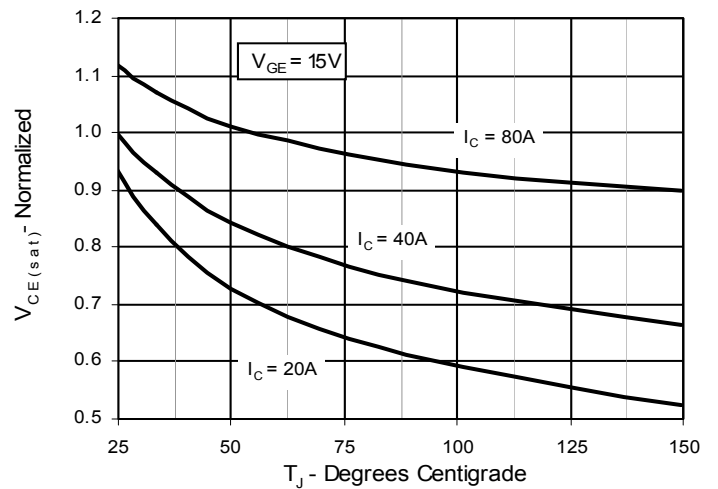


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter voltage

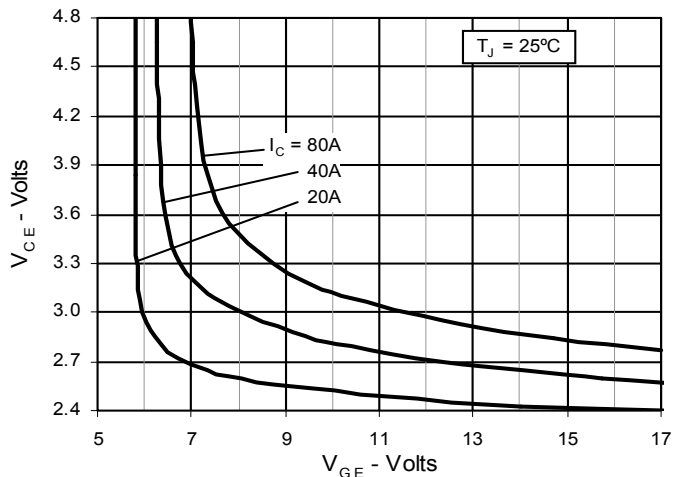


Fig. 6. Input Admittance

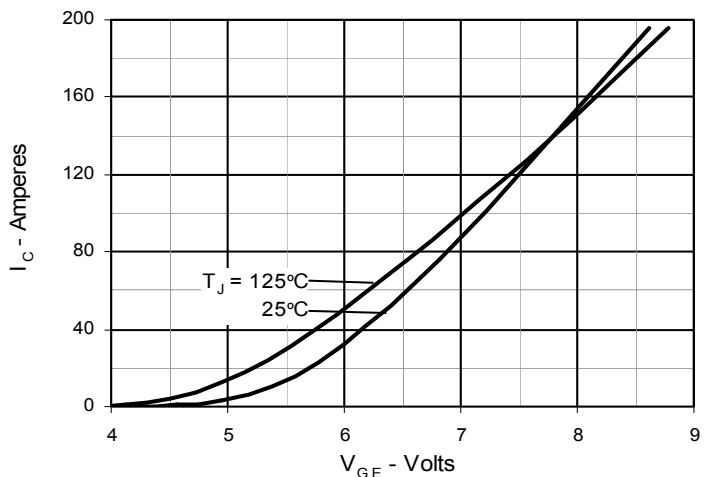


Fig. 7. Transconductance

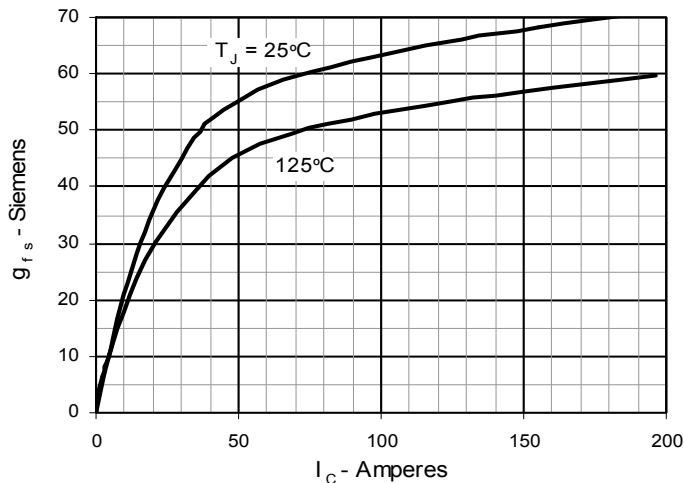


Fig. 8. Dependence of Turn-Off Energy on R_G

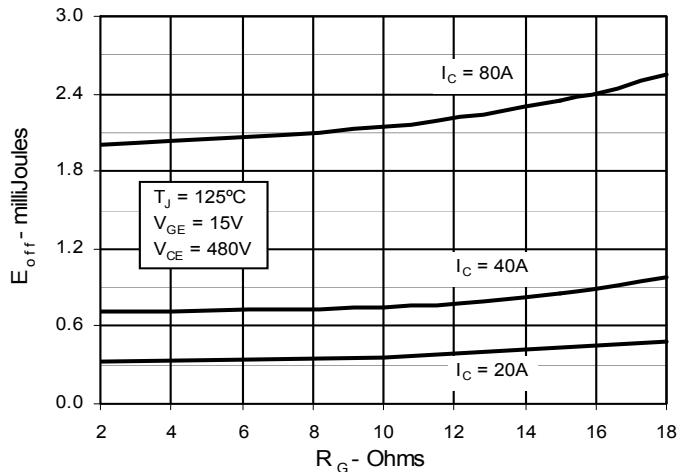


Fig. 9. Dependence of Turn-Off Energy on I_C

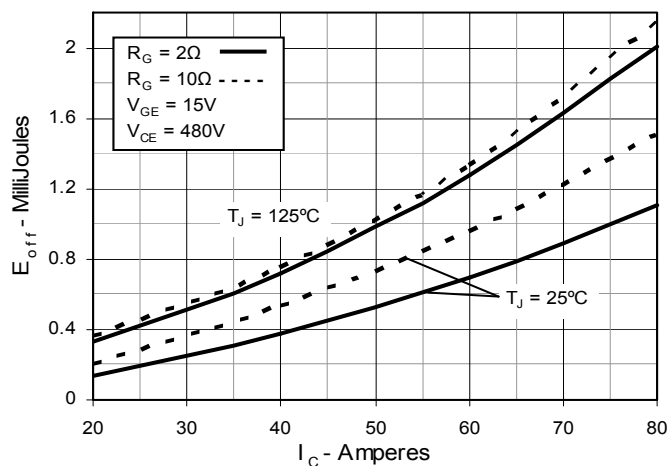


Fig. 10. Dependence of Turn-Off Energy on Temperature

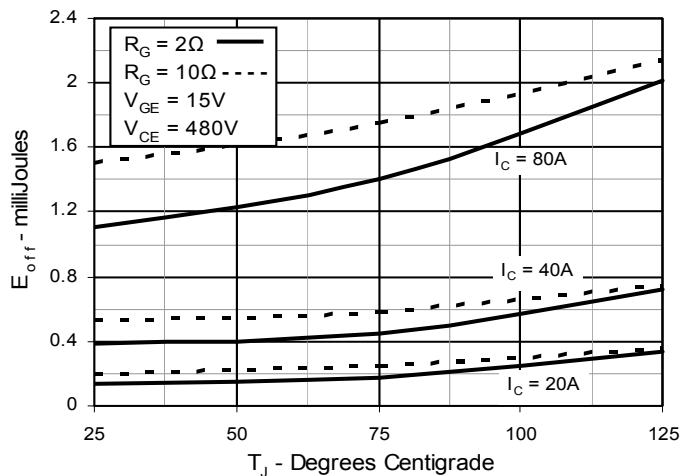


Fig. 11. Dependence of Turn-Off Switching Time on R_G

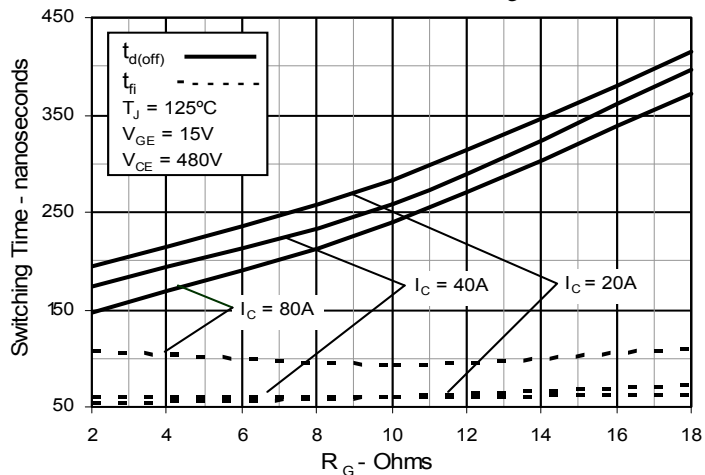


Fig. 12. Dependence of Turn-Off Switching Time on I_C

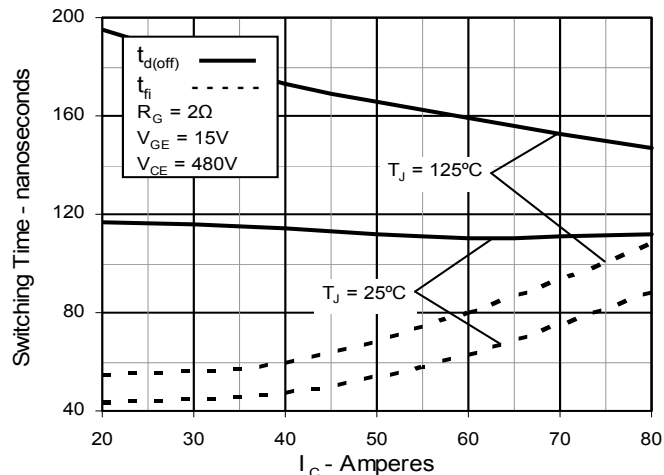


Fig. 13. Dependence of Turn-Off Switching Time on Temperature

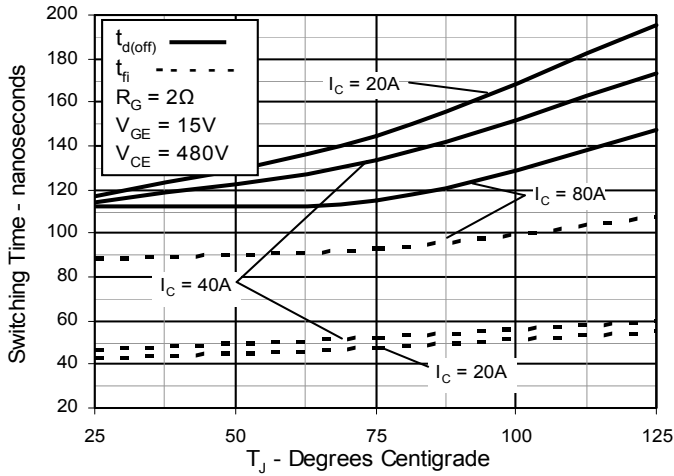


Fig. 14. Reverse-Bias Safe Operating Area

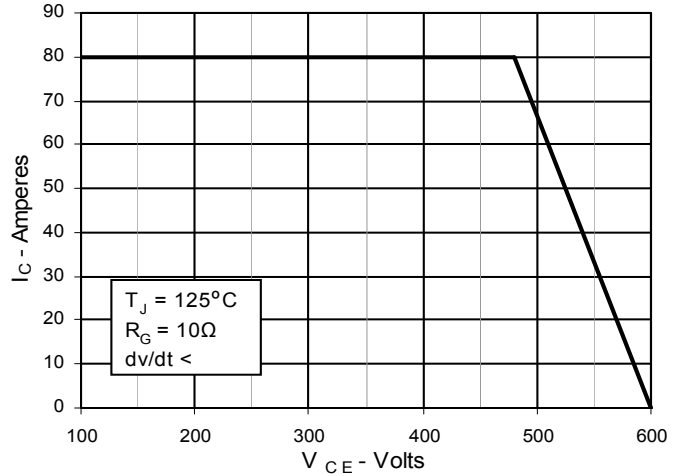


Fig. 15. Gate Charge

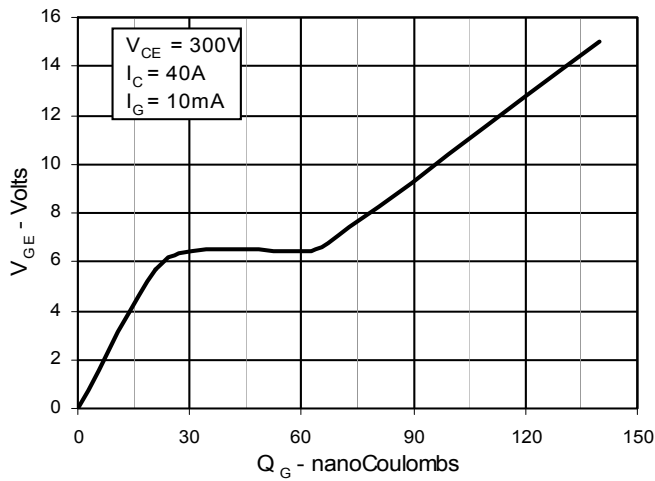


Fig. 16. Capacitance

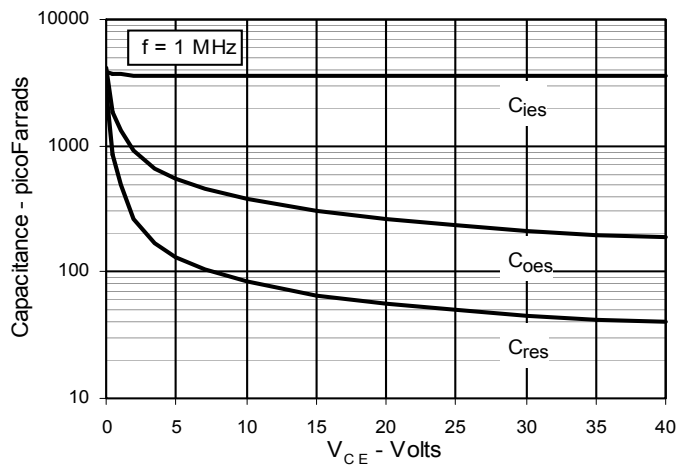
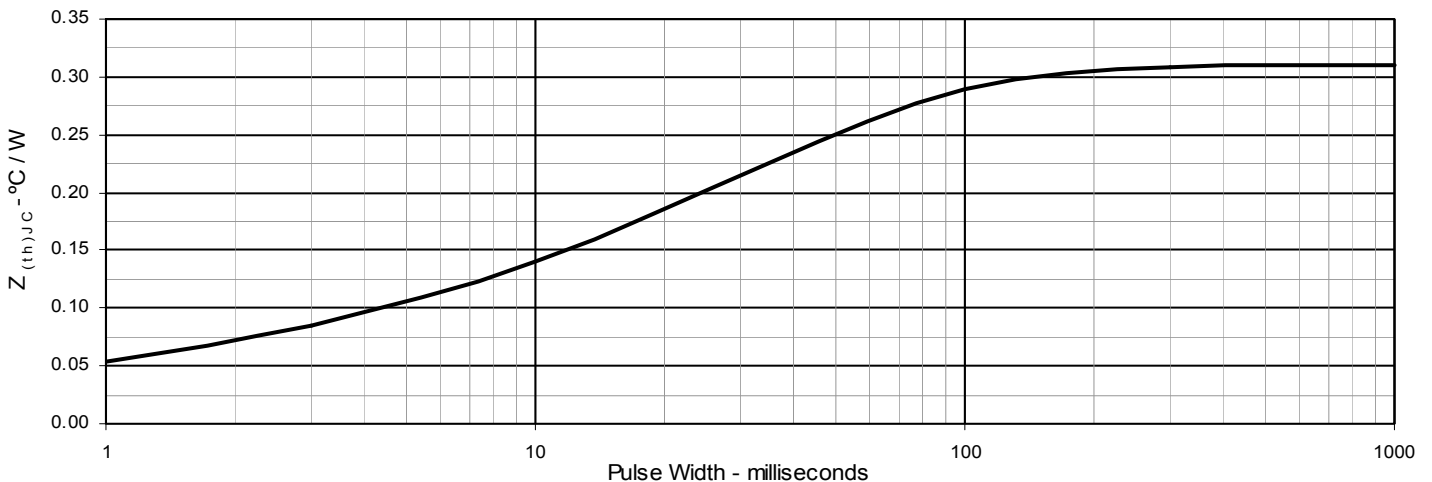


Fig. 17. Maximum Transient Thermal Resistance



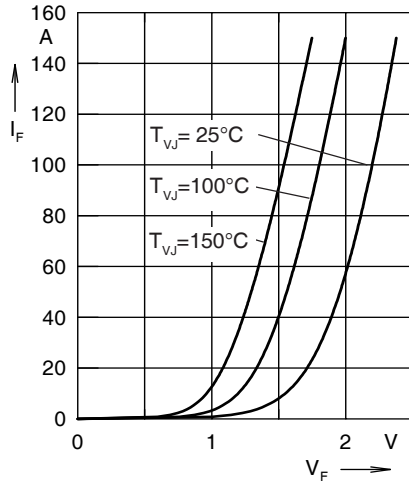


Fig. 18. Forward current I_F versus V_F

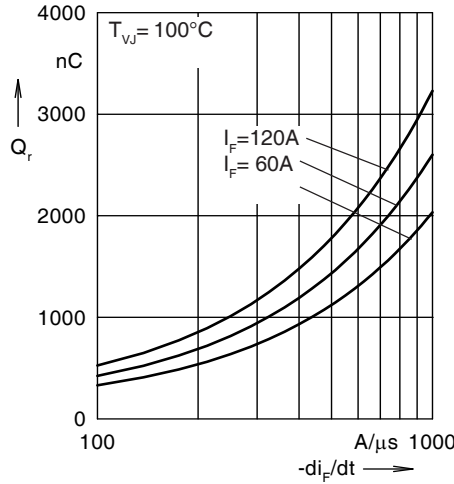


Fig. 19. Reverse recovery charge Q_r

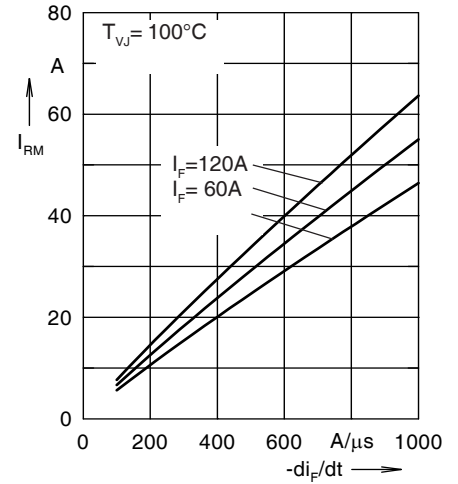


Fig. 20. Peak reverse current I_{RM}

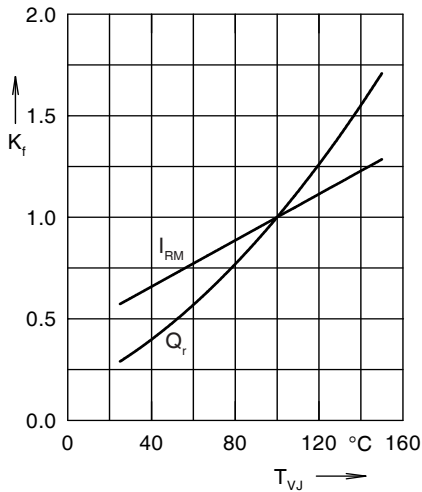


Fig. 21. Dynamic parameters Q_r , I_{RM}

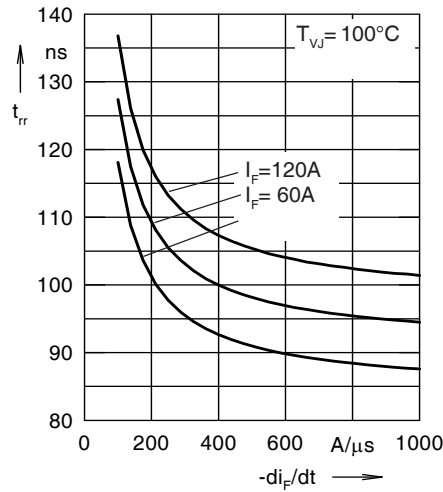


Fig. 22. Recovery time t_{rr} versus $-di_F/dt$

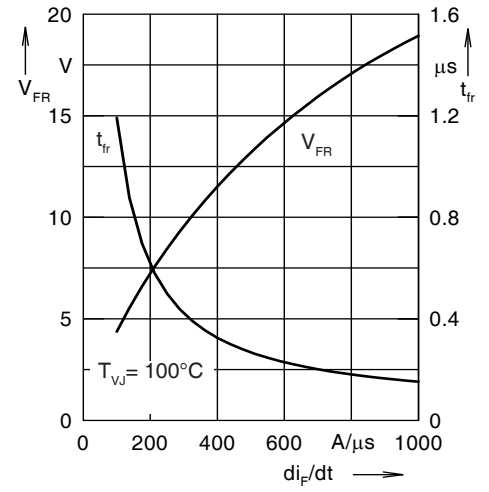


Fig. 23. Peak forward voltage V_{FR} and t_{rr}

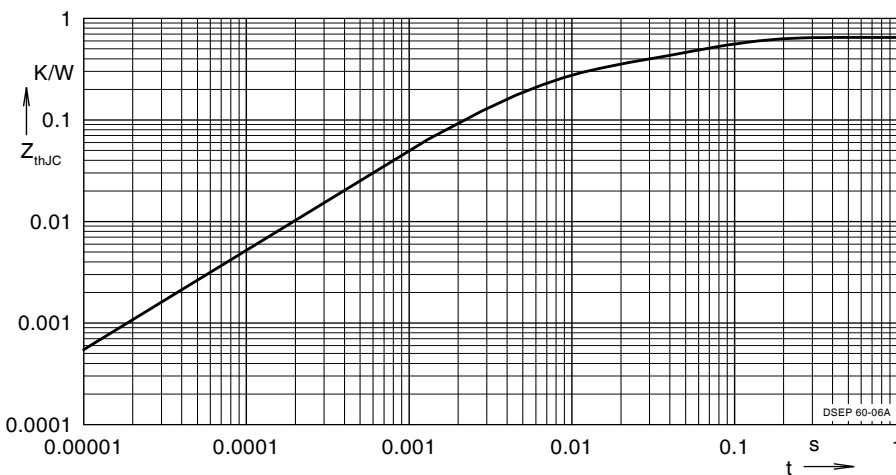


Fig. 24. Transient thermal resistance junction to case

Constants for Z_{thJC} calculation:

| i | R_{thi} (K/W) | t_i (s) |
|---|-----------------|-----------|
| 1 | 0.324 | 0.0052 |
| 2 | 0.125 | 0.0003 |

Note: Fig. 2 through Fig. 6 show typical



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