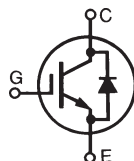


## HiPerFAST™ IGBTs w/ Diode

**IXGT40N60C2D1**  
**IXGJ40N60C2D1**  
**IXGH40N60C2D1**

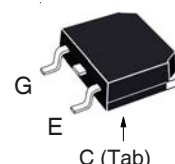
**$V_{CES} = 600V$**   
 **$I_{C110} = 40A$**   
 **$V_{CE(SAT)} \leq 2.7V$**   
 **$t_{fi(typ)} = 32ns$**

### C2-Class High Speed IGBTs

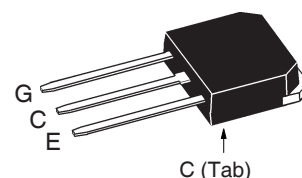


| Symbol                        | Test Conditions                                                                   | Maximum Ratings                        |            |
|-------------------------------|-----------------------------------------------------------------------------------|----------------------------------------|------------|
| $V_{CES}$                     | $T_J = 25^\circ C$ 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                                                                        | $\pm 20$                               | V          |
| $V_{GEM}$                     | Transient                                                                         | $\pm 30$                               | V          |
| $I_{C25}$                     | $T_C = 25^\circ C$ ( Limited by Lead)                                             | 75                                     | A          |
| $I_{C110}$                    | $T_C = 110^\circ C$                                                               | 40                                     | A          |
| $I_{CM}$                      | $T_C = 25^\circ C$ , 1ms                                                          | 200                                    | A          |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_J = 125^\circ C$ , $R_G = 10\Omega$<br>Clamped Inductive Load | $I_{CM} = 80$<br>$V_{CE} \leq V_{CES}$ | A          |
| $P_C$                         | $T_C = 25^\circ C$                                                                | 300                                    | 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                                    | $^\circ C$ |
| $M_d$                         | Mounting Torque (TO-247)                                                          | 1.13/10                                | Nm/lb.in.  |
| <b>Weight</b>                 | TO-247                                                                            | 6                                      | g          |
|                               | TO-268                                                                            | 4                                      | g          |

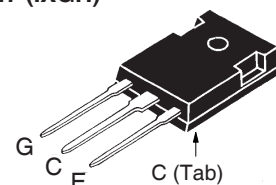
TO-268 (IXGT)



TO-268 (IXGJ)



TO-247 (IXGH)



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

### Features

- Very High Frequency IGBT
- Square RBSOA
- High Current Handling Capability

### Applications

- Uninterruptible Power Supplies (UPS)
- Switch-Mode and Resonant-Mode Power Supplies
- AC Motor Speed Control
- DC Servo and Robot Drives
- DC Choppers

### Advantages

- High Power Density
- Very Fast Switching Speeds for High Frequency Applications
- High Power Surface Mountable Packages

| Symbol        | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |            |                     |
|---------------|-----------------------------------------------------------------------|-----------------------|------------|---------------------|
|               |                                                                       | Min.                  | Typ.       | Max.                |
| $V_{GE(th)}$  | $I_C = 250\mu A$ , $V_{CE} = V_{GE}$                                  | 3.0                   |            | 5.0 V               |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 125^\circ C$             |                       |            | 200 $\mu A$<br>3 mA |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |            | $\pm 100$ nA        |
| $V_{CE(sat)}$ | $I_C = 30A$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 125^\circ C$          |                       | 2.2<br>1.7 | 2.7 V<br>V          |

## Symbol Test Conditions

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

## Characteristic Values

Min. Typ. Max.

|              |                                                                                                                                                           |    |      |                    |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|--------------------|
| $g_{fs}$     | $I_C = 30\text{A}, V_{CE} = 10\text{V}, \text{Note 1}$                                                                                                    | 20 | 36   | S                  |
| $C_{ies}$    | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$                                                                                                |    | 2500 | pF                 |
| $C_{oes}$    |                                                                                                                                                           |    | 220  | pF                 |
| $C_{res}$    |                                                                                                                                                           |    | 54   | pF                 |
| $Q_g$        | $I_C = 30\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$                                                                                       |    | 95   | nC                 |
| $Q_{ge}$     |                                                                                                                                                           |    | 14   | nC                 |
| $Q_{gc}$     |                                                                                                                                                           |    | 36   | nC                 |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 30\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}, R_G = 3\Omega$<br>Note 2  |    | 18   | ns                 |
| $t_{ri}$     |                                                                                                                                                           |    | 20   | ns                 |
| $t_{d(off)}$ |                                                                                                                                                           |    | 90   | ns                 |
| $t_{fi}$     |                                                                                                                                                           |    | 32   | ns                 |
| $E_{off}$    |                                                                                                                                                           |    | 0.20 | mJ                 |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b><br>$I_C = 30\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}, R_G = 3\Omega$<br>Note 2 |    | 18   | ns                 |
| $t_{ri}$     |                                                                                                                                                           |    | 20   | ns                 |
| $E_{on}$     |                                                                                                                                                           |    | 0.60 | mJ                 |
| $t_{d(off)}$ |                                                                                                                                                           |    | 130  | ns                 |
| $t_{fi}$     |                                                                                                                                                           |    | 80   | ns                 |
| $E_{off}$    |                                                                                                                                                           |    | 0.50 | mJ                 |
| $R_{thJC}$   | TO-247 & TO-268                                                                                                                                           |    | 0.42 | $^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                                           |    |      | $^\circ\text{C/W}$ |

## Reverse Diode (FRED)

## Symbol Test Conditions

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

## Characteristic Values

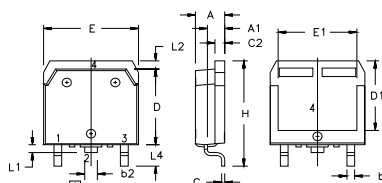
Min. Typ. Max.

|            |                                                                                             |                           |     |                        |
|------------|---------------------------------------------------------------------------------------------|---------------------------|-----|------------------------|
| $V_F$      | $I_F = 30\text{A}, V_{GE} = 0\text{V}, \text{Note 1}$                                       | $T_J = 150^\circ\text{C}$ | 1.6 | 2.5 V                  |
| $I_{RM}$   | $I_F = 30\text{A}, V_{GE} = 0\text{V}, -di_F/dt = 100\text{A}/\mu\text{s},$                 | $T_J = 100^\circ\text{C}$ | 100 | 4 A                    |
| $t_{rr}$   | $V_R = 100\text{V}$                                                                         | $T_J = 100^\circ\text{C}$ |     | ns                     |
|            | $I_F = 1\text{A}, V_{GE} = 0\text{V}, -di_F/dt = 100\text{A}/\mu\text{s}, V_R = 30\text{V}$ |                           | 25  | ns                     |
| $R_{thJC}$ |                                                                                             |                           |     | 0.9 $^\circ\text{C/W}$ |

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  $R_G$ .

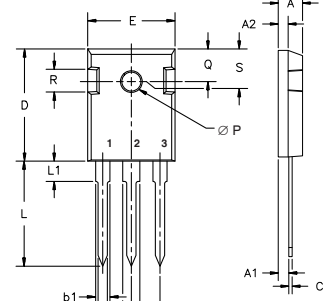
## TO-268 Outline



1 = Gate 2,4 = Collector  
3 = Emitter

| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .193     | .201 | 4.90        | 5.10  |
| A1  | .106     | .114 | 2.70        | 2.90  |
| A2  | .001     | .010 | 0.02        | 0.25  |
| b   | .045     | .057 | 1.15        | 1.45  |
| b2  | .075     | .083 | 1.90        | 2.10  |
| C   | .016     | .026 | 0.40        | 0.65  |
| C2  | .057     | .063 | 1.45        | 1.60  |
| D   | .543     | .551 | 13.80       | 14.00 |
| D1  | .488     | .500 | 12.40       | 12.70 |
| E   | .624     | .632 | 15.85       | 16.05 |
| E1  | .524     | .535 | 13.30       | 13.60 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| H   | .736     | .752 | 18.70       | 19.10 |
| L   | .094     | .106 | 2.40        | 2.70  |
| L1  | .047     | .055 | 1.20        | 1.40  |
| L2  | .039     | .045 | 1.00        | 1.15  |
| L3  | .010 BSC |      | 0.25 BSC    |       |
| L4  | .150     | .161 | 3.80        | 4.10  |

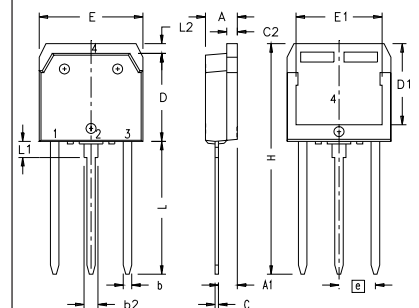
## TO-247 Outline



1 = Gate 2 = Collector  
3 = Emitter

| Dim. | Millimeter |       | Inches |       |
|------|------------|-------|--------|-------|
|      | Min.       | Max.  | Min.   | Max.  |
| A    | 4.7        | 5.3   | .185   | .209  |
| A1   | 2.2        | 2.54  | .087   | .102  |
| A2   | 2.2        | 2.6   | .059   | .098  |
| b    | 1.0        | 1.4   | .040   | .055  |
| b1   | 1.65       | 2.13  | .065   | .084  |
| b2   | 2.87       | 3.12  | .113   | .123  |
| C    | .4         | .8    | .016   | .031  |
| D    | 20.80      | 21.46 | .819   | .845  |
| E    | 15.75      | 16.26 | .610   | .640  |
| e    | 5.20       | 5.72  | 0.205  | 0.225 |
| L    | 19.81      | 20.32 | .780   | .800  |
| L1   |            | 4.50  |        | .177  |
| ØP   | 3.55       | 3.65  | .140   | .144  |
| Q    | 5.89       | 6.40  | 0.232  | 0.252 |
| R    | 4.32       | 5.49  | .170   | .216  |
| S    | 6.15       | BSC   | 242    | BSC   |

## TO-268 Ledged Outline



1 = Gate 2,4 = Collector  
3 = Emitter

| SYM | INCHES   |       | MILLIMETERS |       |
|-----|----------|-------|-------------|-------|
|     | MIN      | MAX   | MIN         | MAX   |
| A   | .193     | .201  | 4.90        | 5.10  |
| A1  | .106     | .114  | 2.70        | 2.90  |
| b   | .045     | .057  | 1.15        | 1.45  |
| b2  | .075     | .083  | 1.90        | 2.10  |
| C   | .016     | .026  | 0.40        | 0.65  |
| C2  | .057     | .063  | 1.45        | 1.60  |
| D   | .543     | .551  | 13.80       | 14.00 |
| D1  | .488     | .500  | 12.40       | 12.70 |
| E   | .624     | .632  | 15.85       | 16.05 |
| E1  | .524     | .535  | 13.30       | 13.60 |
| e   | .215 BSC |       | 5.45 BSC    |       |
| H   | 1.365    | 1.395 | 34.67       | 35.43 |
| L   | .780     | .800  | 19.81       | 20.32 |
| L1  | .079     | .091  | 2.00        | 2.30  |
| L2  | .039     | .045  | 1.00        | 1.15  |

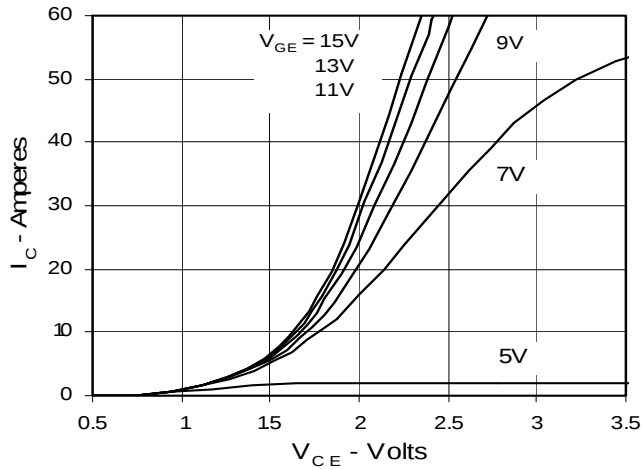
NOTE: ALL METAL AREA ARE SOLDER PLATED.

- 1 - GATE
- 2 - DRAIN (COLLECTOR)
- 3 - SOURCE (EMITTER)
- 4 - DRAIN (COLLECTOR)

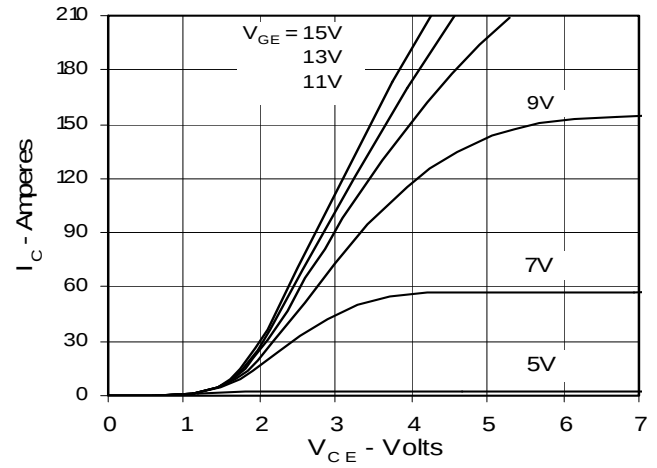
IXYS Reserves The Right to Change Limits, Test Conditions, and Dimensions.

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 7,157,338 B2  
by one or more of the following U.S. patents: 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

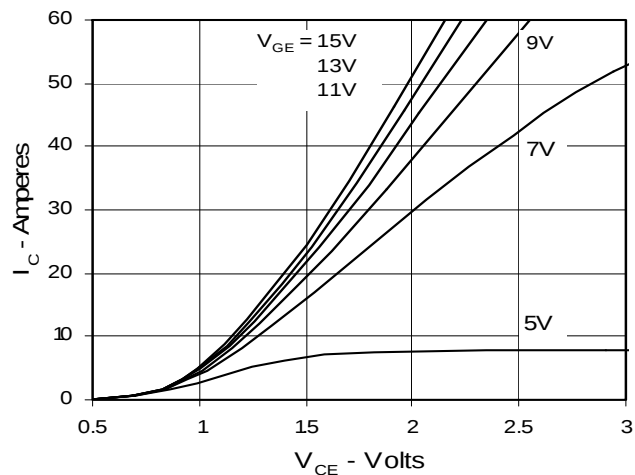
**Fig. 1. Output Characteristics**  
@ 25 Deg. C



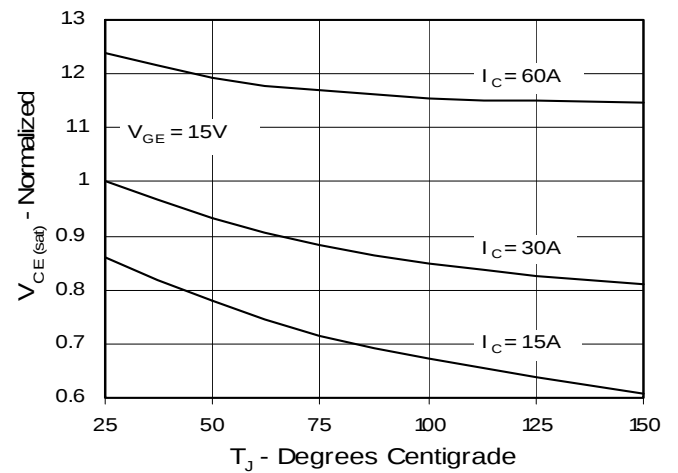
**Fig. 2. Extended Output Characteristics**  
@ 25 deg. C



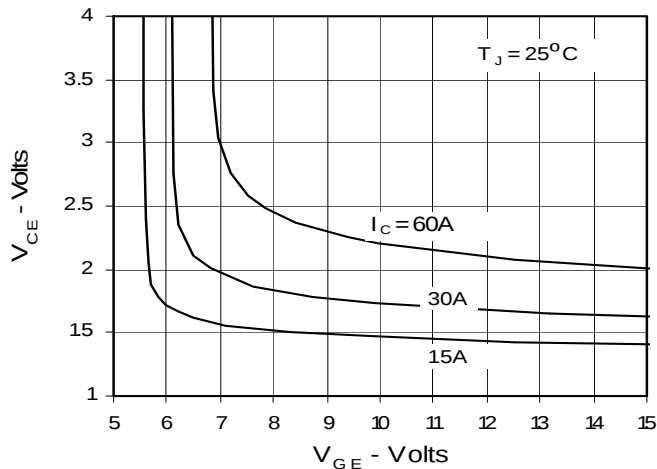
**Fig. 3. Output Characteristics**  
@ 125 Deg. C



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



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



**Fig. 6. Input Admittance**

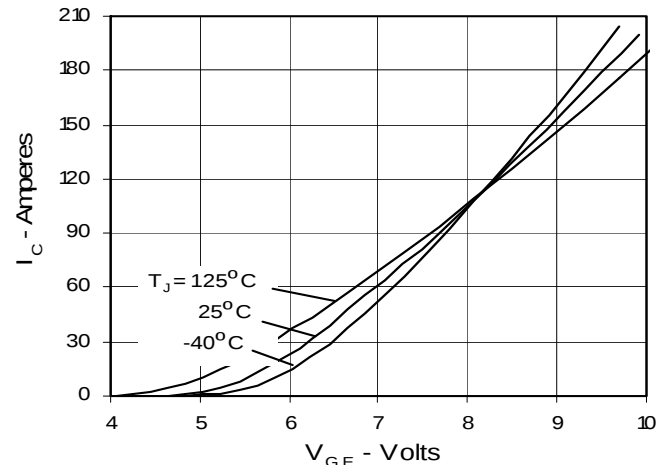


Fig. 7. Transconductance

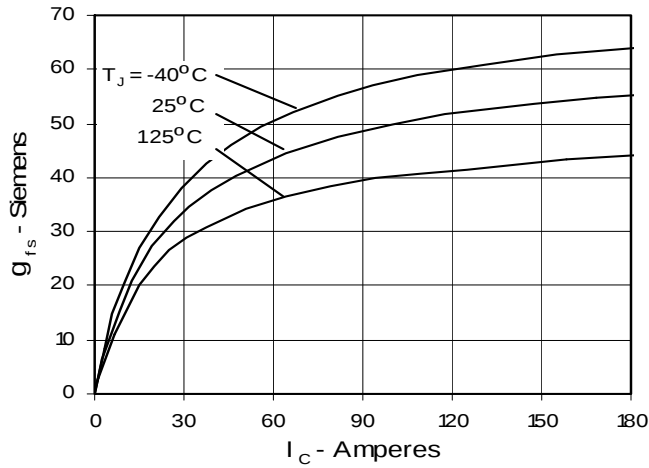


Fig. 8. Dependence of  $E_{off}$  on  $R_G$

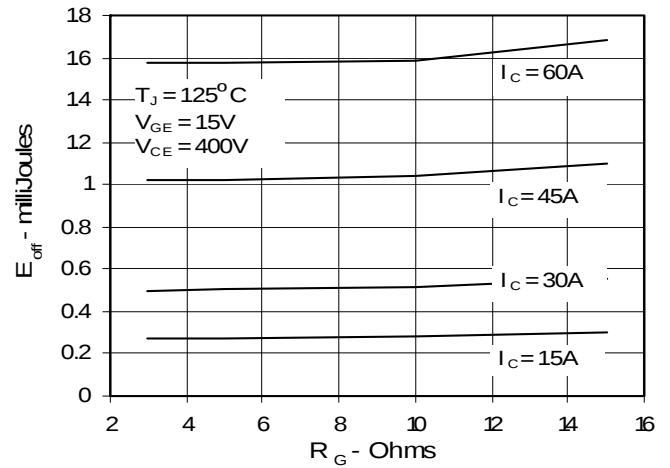


Fig. 9. Dependence of  $E_{off}$  on  $I_C$

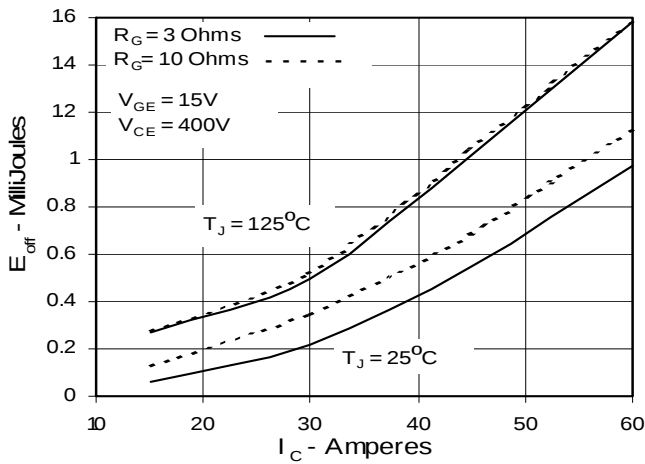


Fig. 10. Dependence of  $E_{off}$  on Temperature

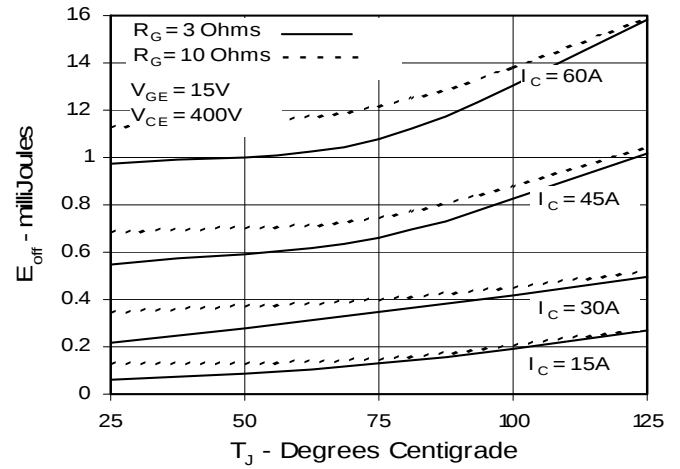


Fig. 11. Gate Charge

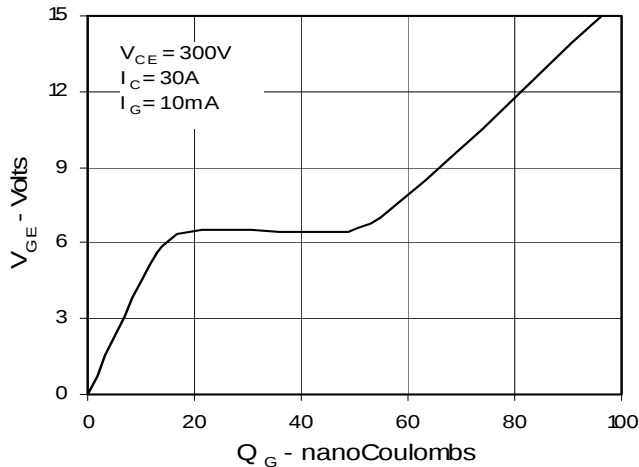


Fig. 12. Capacitance

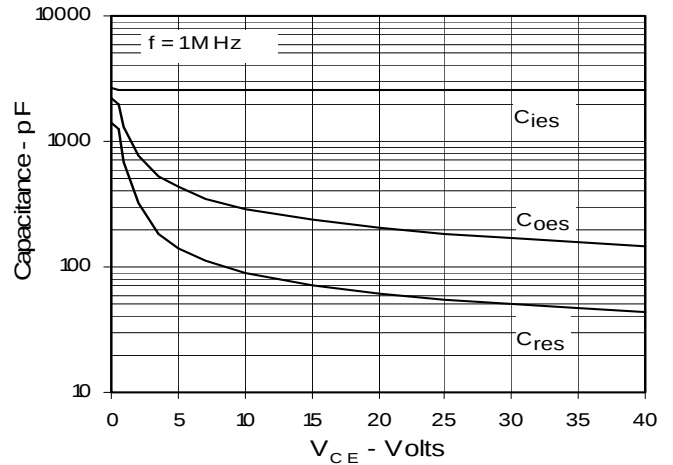
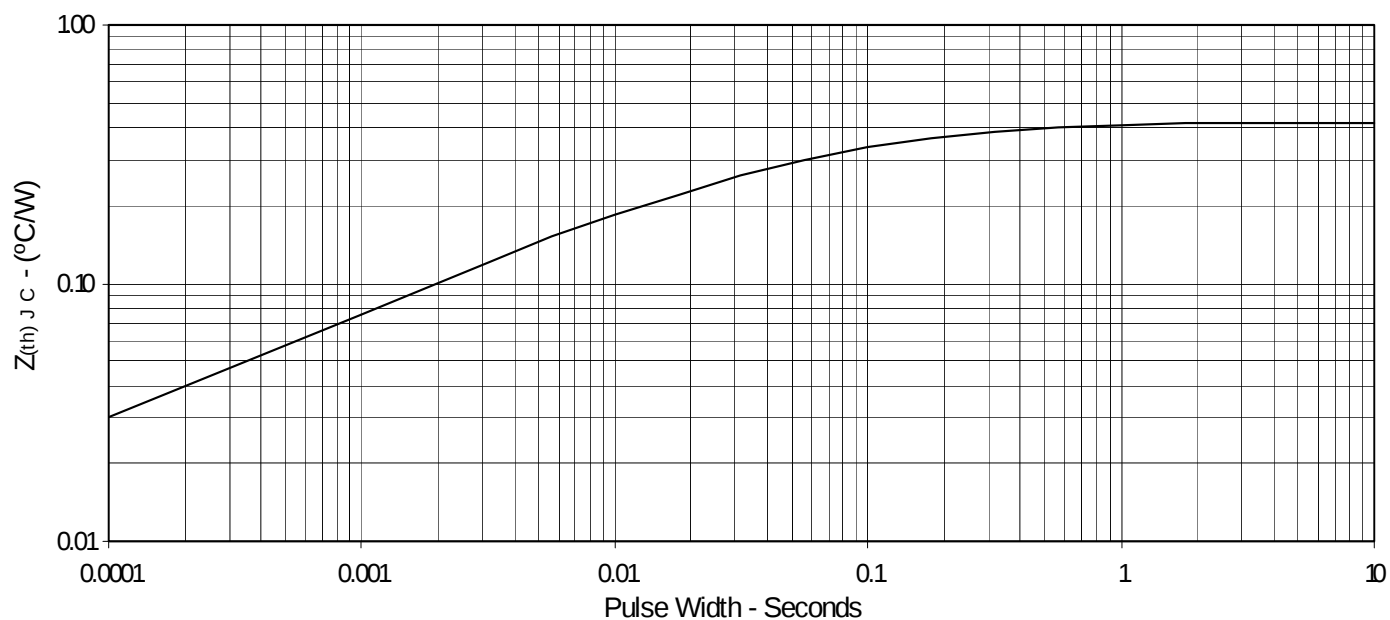


Fig. 13. Maximum Transient Thermal Impedance



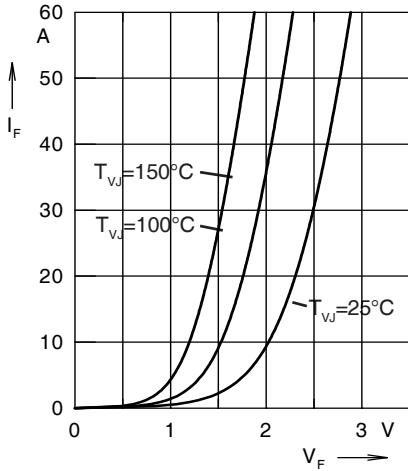


Fig. 14. Forward current  $I_F$  versus  $V_F$

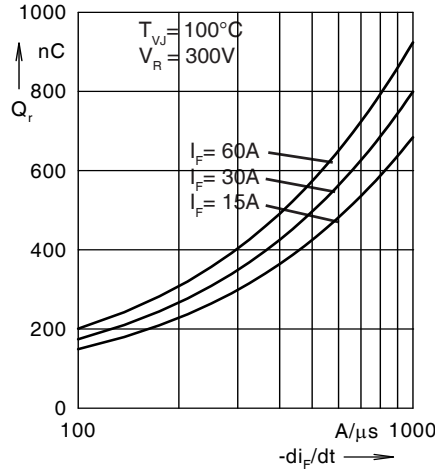


Fig. 15. Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

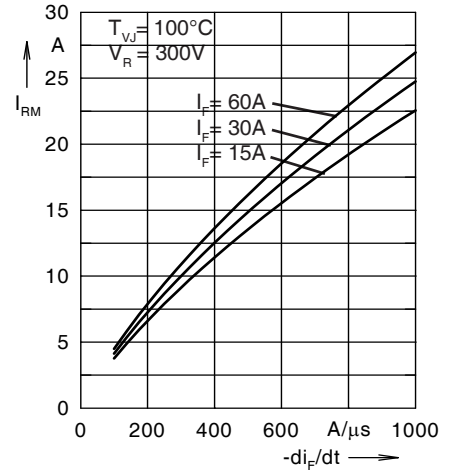


Fig. 16. Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

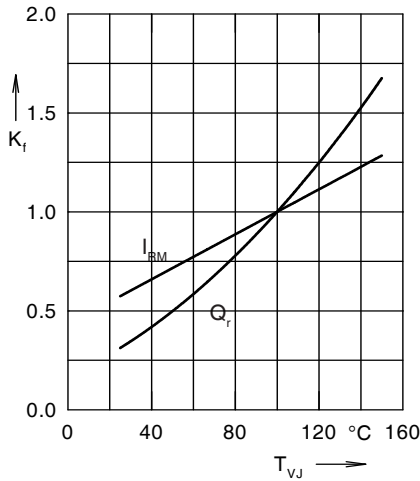


Fig. 17. Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

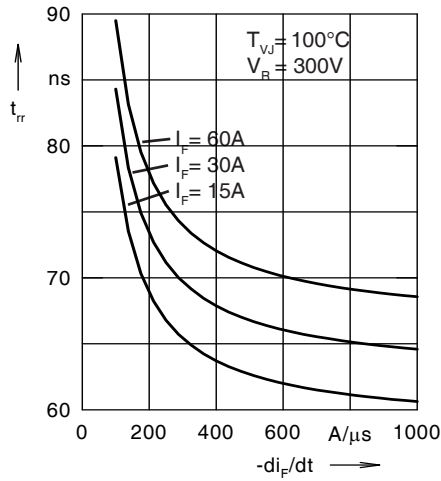


Fig. 18. Recovery time  $t_{rr}$  versus  $-di_F/dt$

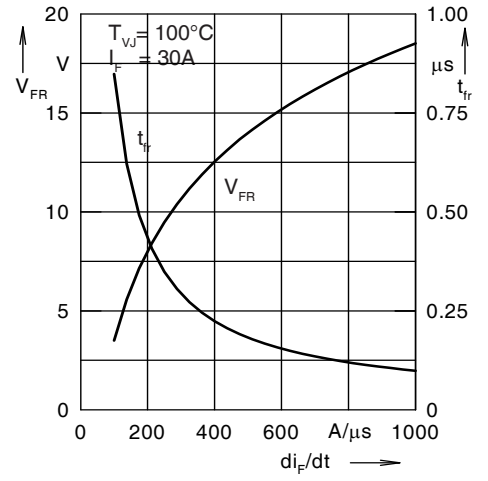


Fig. 19. Peak forward voltage  $V_{FR}$  and  $t_{rr}$  versus  $di_F/dt$

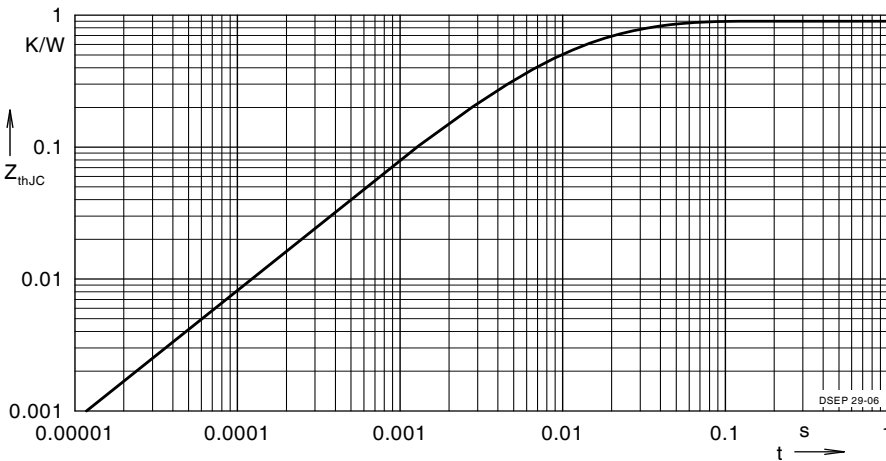


Fig. 20. Transient thermal resistance junction to case

Constants for  $Z_{thJC}$  calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|-----------------|-----------|
| 1 | 0.502           | 0.0052    |
| 2 | 0.193           | 0.0003    |
| 3 | 0.205           | 0.0162    |