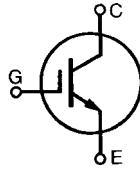
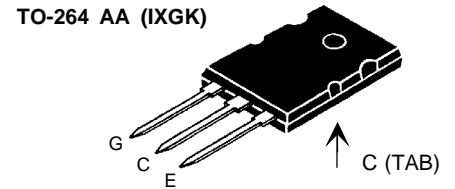
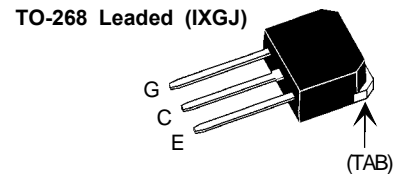
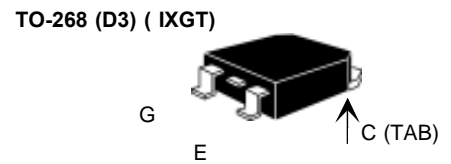
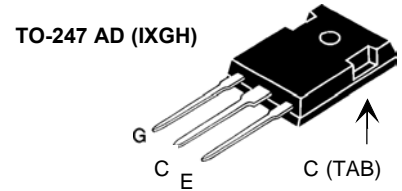


# HiPerFAST™ IGBT

IXGH 50N60B  
IXGK 50N60B  
IXGT 50N60B  
IXGJ 50N60B



$V_{CES} = 600 \text{ V}$   
 $I_{C25} = 75 \text{ A}$   
 $V_{CE(sat)} = 2.3 \text{ V}$   
 $t_{fi(typ)} = 120 \text{ ns}$



G = Gate  
E = Emitter  
D = Drain  
TAB = Collector

## Features

- International standard packages
- High frequency IGBT
- Latest generation HDMOS™ process
- High current handling capability
- MOS Gate turn-on - drive simplicity

## Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

## Advantages

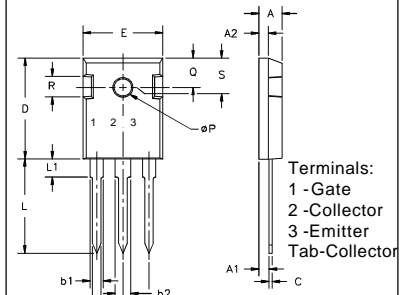
- Easy to mount with 1 screw (insulated mounting screw hole)
- Switching speed for high frequency applications
- High power density

| Symbol  | Test Conditions  | Maximum Ratings                   |                   |
|---|--|-----------------------------------|-------------------|
| $V_{CES}$   | $T_J = 25^\circ\text{C to } 150^\circ\text{C}$   | 600                               | V                 |
| $V_{CGR}$   | $T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$                     | 600                               | V                 |
| $V_{GES}$   | Continuous   | $\pm 20$                          | V                 |
| $V_{GEM}$   | Transient  | $\pm 30$                          | V                 |
| $I_{C25}$   | $T_C = 25^\circ\text{C}$   | 75                                | A                 |
| $I_{C90}$   | $T_C = 90^\circ\text{C}$   | 50                                | A                 |
| $I_{CM}$  | $T_C = 25^\circ\text{C}, 1 \text{ ms}$   | 200                               | A                 |
| <b>SSOA (RBSOA)</b>   | $V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$<br>Clamped inductive load | $I_{CM} = 100$<br>@ $0.8 V_{CES}$ | A                 |
| $P_C$   | $T_C = 25^\circ\text{C}$   | 300                               | W                 |
| $T_J$   |  | -55 ... +150                      | $^\circ\text{C}$  |
| $T_{JM}$  |  | 150                               | $^\circ\text{C}$  |
| $T_{stg}$   |  | -55 ... +150                      | $^\circ\text{C}$  |
| $M_d$   | Mounting torque  | TO-247AD                          | 1.13/10 Nm/lb.in. |
|   |  | TO-264                            | 0.9/6 Nm/lb.in.   |
| Maximum lead temperature for soldering<br>1.6 mm (0.062 in.) from case for 10 s |  | 300                               | $^\circ\text{C}$  |
| <b>Weight</b>   |  | TO-247                            | 6 g               |
|   |  | TO-264                            | 10 g              |
|   |  | TO-268                            | 4 g               |

| Symbol        | Test Conditions  | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                      |
|---------------|--|---|------|----------------------|
|               |  | Min.  | Typ. | Max.                 |
| $BV_{CES}$    | $I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$          | 600   |      | V                    |
| $V_{GE(th)}$  | $I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$               | 2.5   |      | 5.0 V                |
| $I_{CES}$     | $V_{CE} = 0.8 \cdot V_{CES}$<br>$V_{GE} = 0 \text{ V}$ | $T_J = 25^\circ\text{C}$  |      | 200 $\mu\text{A}$    |
|               |  | $T_J = 125^\circ\text{C}$   |      | 1 mA                 |
| $I_{GES}$     | $V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$      |   |      | $\pm 100 \text{ nA}$ |
| $V_{CE(sat)}$ | $I_C = I_{C90}, V_{GE} = 15 \text{ V}$                 |   |      | 2.3 V                |

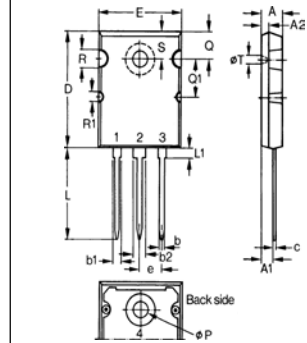
| Symbol       | Test Conditions   | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |      |    |
|--------------|---|---|------|------|----|
|              |   | min.  | typ. | max. |    |
| $g_{fs}$     | $I_C = I_{C90}$ ; $V_{CE} = 10\text{ V}$ ,<br>Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $\leq 2\%$   | 25  | 42   | S    |    |
| $C_{ies}$    | $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 1\text{ MHz}$   |   | 4100 | pF   |    |
| $C_{oes}$    |   |   | 310  | pF   |    |
| $C_{res}$    |   |   | 95   | pF   |    |
| $Q_G$        | $I_C = I_{C90}$ ; $V_{GE} = 15\text{ V}$ , $V_{CE} = 0.5 V_{CES}$   |   | 160  | nC   |    |
| $Q_{GE}$     |   |   | 30   | nC   |    |
| $Q_{GC}$     |   |   | 55   | nC   |    |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = I_{C90}$ ; $V_{GE} = 15\text{ V}$<br>$V_{CE} = 0.8 \cdot V_{CES}$ ; $R_G = R_{off} = 2.7\ \Omega$<br>Remarks: Switching times may increase for $V_{CE}$ (Clamp) $> 0.8 \cdot V_{CES}$ , higher $T_J$ or increased $R_G$  |   | 50   | ns   |    |
| $t_{ri}$     |   |   | 50   | ns   |    |
| $t_{d(off)}$ |   |   | 150  | 250  | ns |
| $t_{fi}$     |   |   | 120  | 250  | ns |
| $E_{off}$    |   |   | 3.0  | 4.5  | mJ |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b><br>$I_C = I_{C90}$ ; $V_{GE} = 15\text{ V}$<br>$V_{CE} = 0.8 \cdot V_{CES}$ ; $R_G = R_{off} = 2.7\ \Omega$<br>Remarks: Switching times may increase for $V_{CE}$ (Clamp) $> 0.8 \cdot V_{CES}$ , higher $T_J$ or increased $R_G$ |   | 50   | ns   |    |
| $t_{ri}$     |   |   | 50   | ns   |    |
| $E_{on}$     |   |   | 3    | mJ   |    |
| $t_{d(off)}$ |   |   | 200  | ns   |    |
| $t_{fi}$     |   |   | 250  | ns   |    |
| $E_{off}$    |   | 4.2   | mJ   |      |    |
| $R_{thJC}$   |   |   | 0.42 | KW   |    |
| $R_{thCK}$   | TO-247 & TO-268 leaded packages   | 0.25  |      | KW   |    |
|              | TO-264 package  | 0.15  |      | KW   |    |

### TO-247 AD (IXGH) Outline



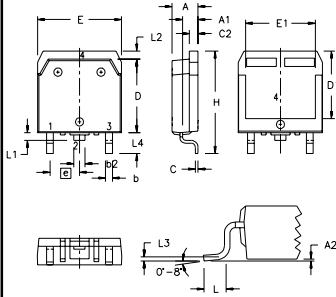
| Dim.           | Millimeter |       | Inches |       |
|----------------|------------|-------|--------|-------|
|                | Min.       | Max.  | Min.   | Max.  |
| A              | 4.7        | 5.3   | .185   | .209  |
| A <sub>1</sub> | 2.2        | 2.54  | .087   | .102  |
| A <sub>2</sub> | 2.2        | 2.6   | .089   | .098  |
| b              | 1.0        | 1.4   | .040   | .055  |
| b <sub>1</sub> | 1.65       | 2.13  | .065   | .084  |
| b <sub>2</sub> | 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  |
| L <sub>1</sub> |            | 4.50  |        | .177  |
| ∅P             | 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-264 AA (IXGK) Outline



| Dim.           | Millimeter |       | Inches   |       |
|----------------|------------|-------|----------|-------|
|                | Min.       | Max.  | Min.     | Max.  |
| A              | 4.82       | 5.13  | .190     | .202  |
| A <sub>1</sub> | 2.54       | 2.89  | .100     | .114  |
| A <sub>2</sub> | 2.00       | 2.10  | .079     | .083  |
| b              | 1.12       | 1.42  | .044     | .056  |
| b <sub>1</sub> | 2.39       | 2.69  | .094     | .106  |
| b <sub>2</sub> | 2.90       | 3.09  | .114     | .122  |
| c              | 0.53       | 0.83  | .021     | .033  |
| D              | 25.91      | 26.16 | 1.020    | 1.030 |
| E              | 19.81      | 19.96 | .780     | .786  |
| e              | 5.46 BSC   |       | .215 BSC |       |
| J              | 0.00       | 0.25  | .000     | .010  |
| K              | 0.00       | 0.25  | .000     | .010  |
| L              | 20.32      | 20.83 | .800     | .820  |
| L <sub>1</sub> | 2.29       | 2.59  | .090     | .102  |
| P              | 3.17       | 3.66  | .125     | .144  |
| Q              | 6.07       | 6.27  | .239     | .247  |
| Q <sub>1</sub> | 8.38       | 8.69  | .330     | .342  |
| R              | 3.81       | 4.32  | .150     | .170  |
| R <sub>1</sub> | 1.78       | 2.29  | .070     | .090  |
| S              | 6.04       | 6.30  | .238     | .248  |
| T              | 1.57       | 1.83  | .062     | .072  |

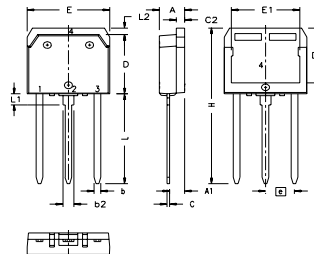
### TO-268 (IXGT) Outline



| SYM            | INCHES   |      | MILLIMETERS |       |
|----------------|----------|------|-------------|-------|
|                | MIN      | MAX  | MIN         | MAX   |
| A              | .193     | .201 | 4.90        | 5.10  |
| A <sub>1</sub> | .106     | .114 | 2.70        | 2.90  |
| A <sub>2</sub> | .001     | .010 | 0.02        | 0.25  |
| b              | .045     | .057 | 1.15        | 1.45  |
| b <sub>1</sub> | .075     | .083 | 1.90        | 2.10  |
| C              | .016     | .026 | 0.40        | 0.65  |
| C <sub>2</sub> | .057     | .063 | 1.45        | 1.60  |
| D              | .543     | .551 | 13.80       | 14.00 |
| D <sub>1</sub> | .488     | .500 | 12.40       | 12.70 |
| E              | .624     | .632 | 15.85       | 16.05 |
| E <sub>1</sub> | .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  |
| L <sub>1</sub> | .047     | .055 | 1.20        | 1.40  |
| L <sub>2</sub> | .039     | .045 | 1.00        | 1.15  |
| L <sub>3</sub> | .010 BSC |      | 0.25 BSC    |       |
| L <sub>4</sub> | .150     | .161 | 3.80        | 4.10  |

Terminals:  
1 - Gate  
2 - Collector

### TO-268 (IXGJ) Leaded Outline



| SYM            | INCHES   |       | MILLIMETERS |       |
|----------------|----------|-------|-------------|-------|
|                | MIN      | MAX   | MIN         | MAX   |
| A              | .193     | .201  | 4.90        | 5.10  |
| A <sub>1</sub> | .106     | .114  | 2.70        | 2.90  |
| b              | .045     | .057  | 1.15        | 1.45  |
| b <sub>1</sub> | .075     | .083  | 1.90        | 2.10  |
| C              | .016     | .026  | 0.40        | 0.65  |
| C <sub>2</sub> | .057     | .063  | 1.45        | 1.60  |
| D              | .543     | .551  | 13.80       | 14.00 |
| D <sub>1</sub> | .488     | .500  | 12.40       | 12.70 |
| E              | .624     | .632  | 15.85       | 16.05 |
| E <sub>1</sub> | .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 |
| L <sub>1</sub> | .079     | .091  | 2.00        | 2.30  |
| L <sub>2</sub> | .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 by one or more of the following U.S. patents:

4,835,592 4,881,106 5,017,508  
4,850,072 4,931,844 5,034,796

5,049,961 5,187,117  
5,063,307 5,237,481

5,486,715 5,305,283  
5,381,025

Figure 1. Saturation Voltage Characteristics

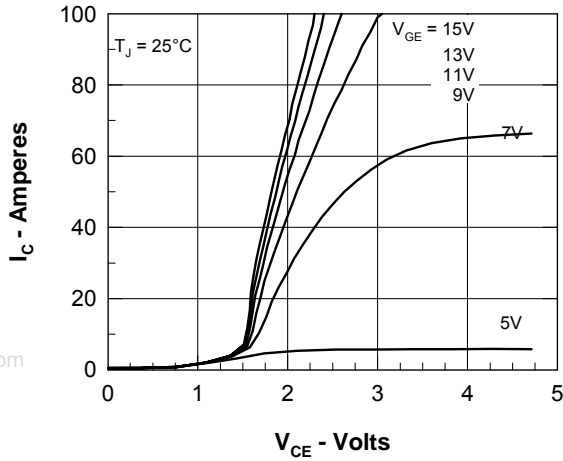


Figure 2. Extended Output Characteristics

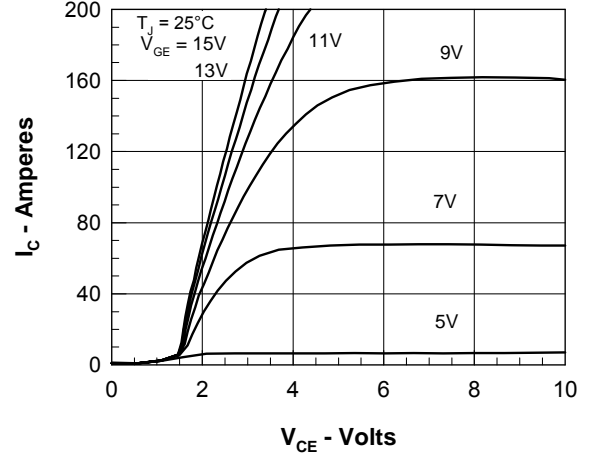


Figure 3. Saturation Voltage Characteristics

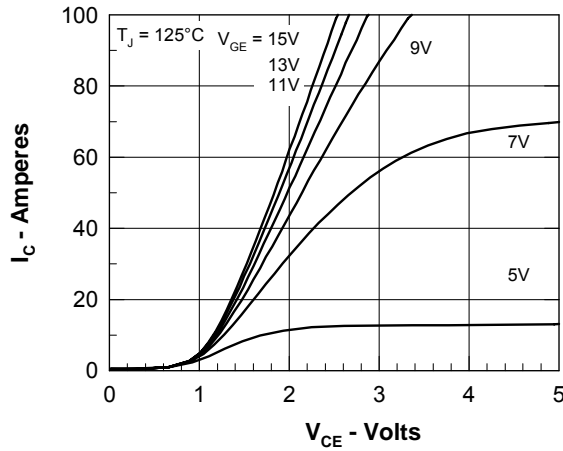


Figure 4. Temperature Dependence of  $V_{CE(sat)}$

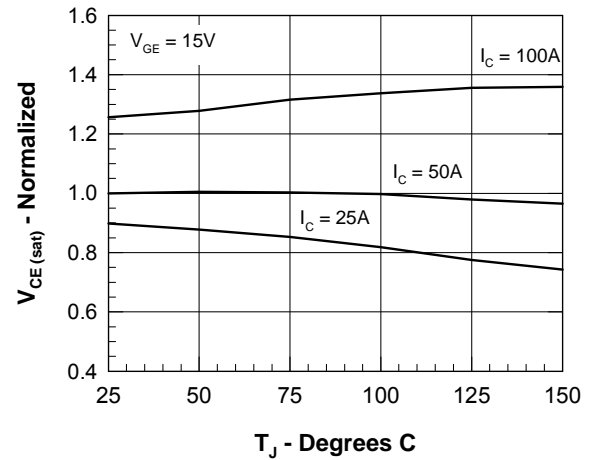


Figure 5. Admittance Curves

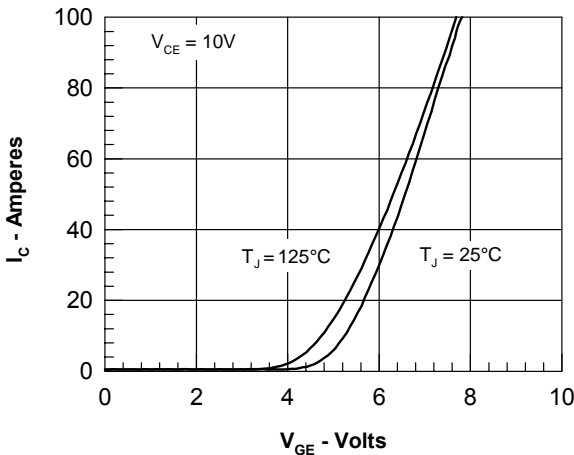


Figure 6. Capacitance Curves

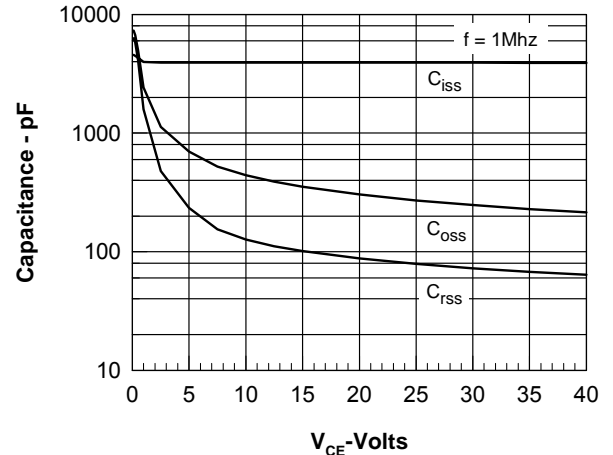


Figure 7. Dependence of  $E_{ON}$  and  $E_{OFF}$  on  $I_C$

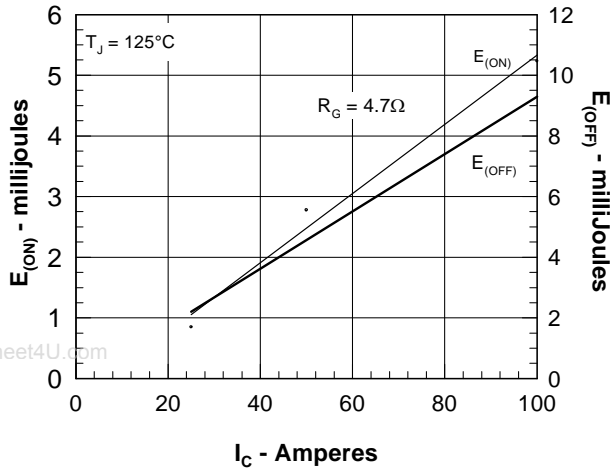


Figure 8. Dependence of  $E_{ON}$  and  $E_{OFF}$  on  $R_G$

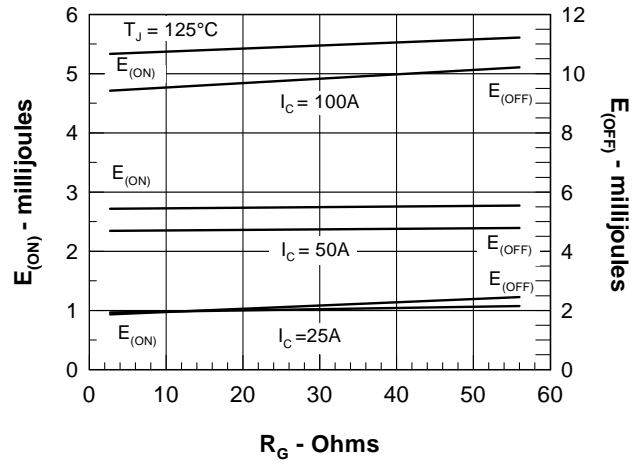


Figure 9. Gate Charge

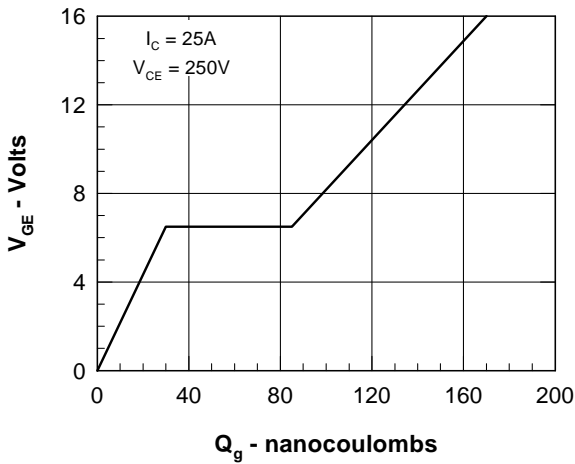


Figure 10. Turn-off Safe Operating Area

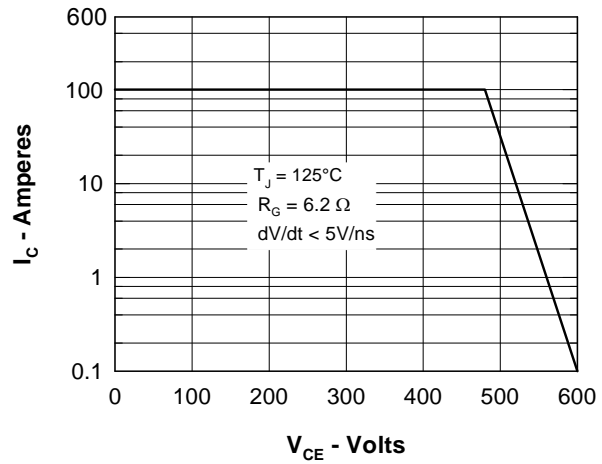
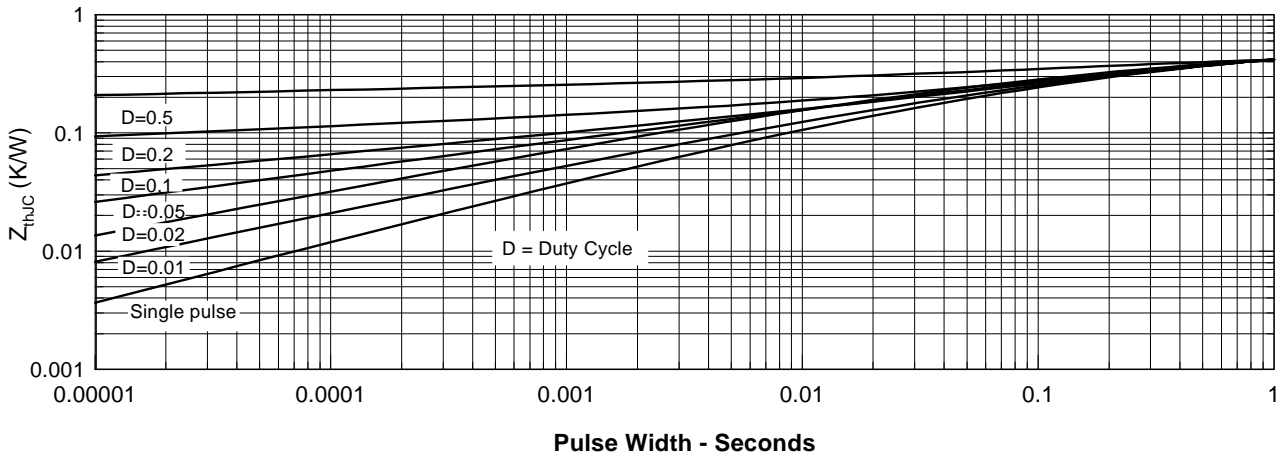


Figure 11. IGBT Transient Thermal Resistance



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IXYS MOSFETS and IGBTs are covered by one or more of the following U.S. patents:

|           |           |           |           |           |           |           |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 4,835,592 | 4,881,106 | 5,017,508 | 5,049,961 | 5,187,117 | 5,486,715 | 6,306,283 |
| 4,850,072 | 4,931,844 | 5,034,796 | 5,063,307 | 5,237,481 | 5,381,025 |           |