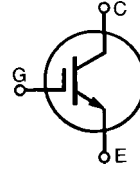


# HiPerFAST™ IGBT

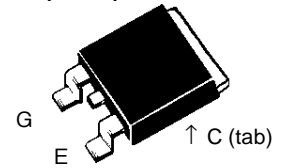
**IXGA 12N60C**  
**IXGP 12N60C**

**$V_{CES} = 600$  V**  
 **$I_{C25} = 24$  A**  
 **$V_{CE(sat)} = 2.7$  V**  
 **$t_{fi(typ)} = 55$  ns**

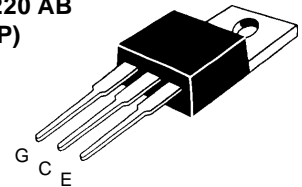


| Symbol                        | Test Conditions  | Maximum Ratings                      |                  |
|-------------------------------|--|--------------------------------------|------------------|
| $V_{CES}$                     | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$  | 600                                  | 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                |
| $I_{C25}$                     | $T_C = 25^\circ\text{C}$   | 24                                   | A                |
| $I_{C90}$                     | $T_C = 90^\circ\text{C}$   | 12                                   | A                |
| $I_{CM}$                      | $T_C = 25^\circ\text{C}$ , 1 ms  | 48                                   | A                |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15\text{ V}$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 33\ \Omega$<br>Clamped inductive load, $L = 300\ \mu\text{H}$ | $I_{CM} = 24$<br>@ $0.8 V_{CES}$     | A                |
| $P_C$                         | $T_C = 25^\circ\text{C}$   | 100                                  | 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 with screw M3<br>Mounting torque with screw M3.5   | 0.45/4 Nm/lb.in.<br>0.55/5 Nm/lb.in. |                  |
| <b>Weight</b>                 |  | 4                                    | g                |
|                               | Maximum lead temperature for soldering<br>1.6 mm (0.062 in.) from case for 10 s  | 300                                  | $^\circ\text{C}$ |

**TO-263 AA (IXGA)**



**TO-220 AB (IXGP)**



G = Gate      C = Collector  
E = Emitter    TAB = Collector

## Features

- Very high frequency IGBT
- New generation HDMOS™ process
- International standard package  
JEDEC TO-220AB and TO-263AA
- High peak current handling capability

## Applications

- PFC circuits
- AC motor speed control
- DC servo & robot drives
- Switch-mode and resonant-mode power supplies
- High power audio amplifiers

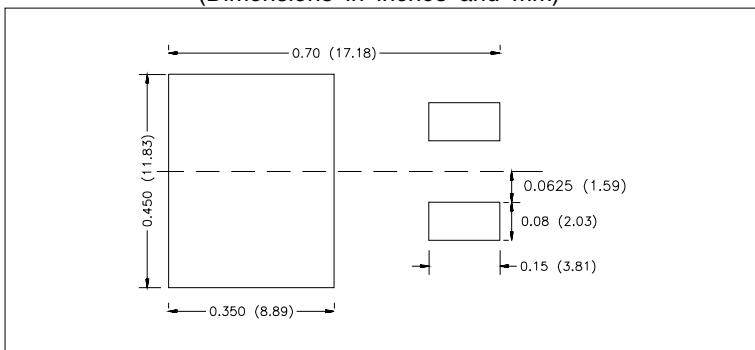
## Advantages

- Fast switching speed
- High power density

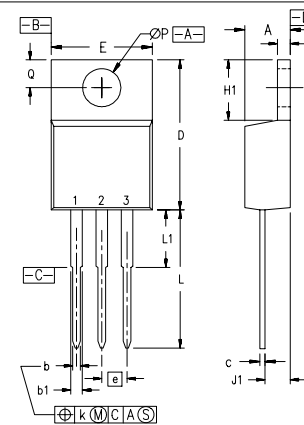
| Symbol        | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) | Characteristic Values |      |                     |
|---------------|---|-----------------------|------|---------------------|
|               |   | Min.                  | Typ. | Max.                |
| $BV_{CES}$    | $I_C = 250\ \mu\text{A}$ , $V_{GE} = 0\text{ V}$                            | 600                   |      | V                   |
| $V_{GE(th)}$  | $I_C = 250\ \mu\text{A}$ , $V_{GE} = V_{GE}$                                | 2.5                   |      | 5.0 V               |
| $I_{CES}$     | $V_{CE} = 0.8$ , $V_{CES}$  |                       |      | 200 $\mu\text{A}$   |
|               | $V_{GE} = 0\text{ V}$   |                       |      | 1 mA                |
| $I_{GES}$     | $V_{CE} = 0\text{ V}$ , $V_{GE} = \pm 20\text{ V}$                          |                       |      | $\pm 100\text{ nA}$ |
| $V_{CE(sat)}$ | $I_C = I_{CE90}$ , $V_{GE} = 15$  |                       | 2.1  | 2.7 V               |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified)   | Characteristic Values |         |        |
|--------------|---|-----------------------|---------|--------|
|              |   | 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 $\leq 2\%$   | 7                     | 11      | S      |
| $C_{ies}$    | $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 1\text{ MHz}$   |                       | 860     | pF     |
| $C_{oes}$    |   |                       | 64      | pF     |
| $C_{res}$    |   |                       | 15      | pF     |
| $Q_g$        | $I_C = I_{C90}$ ; $V_{GE} = 15\text{ V}$ , $V_{CE} = 0.5 V_{CES}$   |                       | 32      | nC     |
| $Q_{ge}$     |   |                       | 10      | nC     |
| $Q_{gc}$     |   |                       | 10      | nC     |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = I_{C90}$ ; $V_{GE} = 15\text{ V}$ , $L = 300\ \mu\text{H}$<br>$V_{CE} = 0.8 V_{CES}$ ; $R_G = R_{off} = 18\ \Omega$<br>Remarks: Switching times may increase for $V_{CE}$ (Clamp) $> 0.8 V_{CES}$ , higher $T_J$ or increased $R_G$  |                       | 20      | ns     |
| $t_{ri}$     |   |                       | 20      | ns     |
| $t_{d(off)}$ |   |                       | 60      | ns     |
| $t_{fi}$     |   |                       | 55      | ns     |
| $E_{off}$    |   |                       | 0.09    | mJ     |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b><br>$I_C = I_{C90}$ ; $V_{GE} = 15\text{ V}$ , $L = 300\ \mu\text{H}$<br>$V_{CE} = 0.8 V_{CES}$ ; $R_G = R_{off} = 18\ \Omega$<br>Remarks: Switching times may increase for $V_{CE}$ (Clamp) $> 0.8 V_{CES}$ , higher $T_J$ or increased $R_G$ |                       | 20      | ns     |
| $t_{ri}$     |   |                       | 20      | ns     |
| $E_{on}$     |   |                       | 0.15    | mJ     |
| $t_{d(off)}$ |   |                       | 85      | 180 ns |
| $t_{fi}$     |   |                       | 85      | 180 ns |
| $E_{off}$    |   | 0.27                  | 0.60 mJ |        |
| $R_{thJC}$   |   |                       | 1.25    | KW     |
| $R_{thCK}$   |   |                       | 0.25    | KW     |

**Min. Recommended Footprint**  
(Dimensions in inches and mm)



### TO-220 AB Dimensions

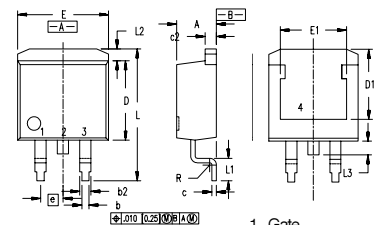


Pins: 1 - Gate  
2 - Collector  
3 - Emitter  
4 - Collector  
Bottom Side

| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .170     | .190 | 4.32        | 4.83  |
| b   | .025     | .040 | 0.64        | 1.02  |
| b1  | .045     | .065 | 1.15        | 1.65  |
| c   | .014     | .022 | 0.35        | 0.56  |
| D   | .580     | .630 | 14.73       | 16.00 |
| E   | .390     | .420 | 9.91        | 10.66 |
| e   | .100 BSC |      | 2.54 BSC    |       |
| F   | .045     | .055 | 1.14        | 1.40  |
| H1  | .230     | .270 | 5.85        | 6.85  |
| J1  | .090     | .110 | 2.29        | 2.79  |
| k   | 0        | .015 | 0           | 0.38  |
| L   | .500     | .550 | 12.70       | 13.97 |
| L1  | .110     | .230 | 2.79        | 5.84  |
| ØP  | .139     | .161 | 3.53        | 4.08  |
| Q   | .100     | .125 | 2.54        | 3.18  |

NOTE: This drawing will meet all dimensions requirement of JEDEC outline TO-220 AB.

### TO-263 AA Outline



1. Gate  
2. Collector  
3. Emitter  
4. Collector  
Bottom Side

| Dim. | Millimeter |       | Inches |      |
|------|------------|-------|--------|------|
|      | Min.       | Max.  | Min.   | Max. |
| A    | 4.06       | 4.83  | .160   | .190 |
| A1   | 2.03       | 2.79  | .080   | .110 |
| b    | 0.51       | 0.99  | .020   | .039 |
| b2   | 1.14       | 1.40  | .045   | .055 |
| c    | 0.46       | 0.74  | .018   | .029 |
| c2   | 1.14       | 1.40  | .045   | .055 |
| D    | 8.64       | 9.65  | .340   | .380 |
| D1   | 7.11       | 8.13  | .280   | .320 |
| E    | 9.65       | 10.29 | .380   | .405 |
| E1   | 6.86       | 8.13  | .270   | .320 |
| e    | 2.54       | BSC   | .100   | BSC  |
| L    | 14.61      | 15.88 | .575   | .625 |
| L1   | 2.29       | 2.79  | .090   | .110 |
| L2   | 1.02       | 1.40  | .040   | .055 |
| L3   | 1.27       | 1.78  | .050   | .070 |
| L4   | 0          | 0.38  | 0      | .015 |
| R    | 0.46       | 0.74  | .018   | .029 |

IXYS reserves the right to change limits, test conditions, and dimensions.

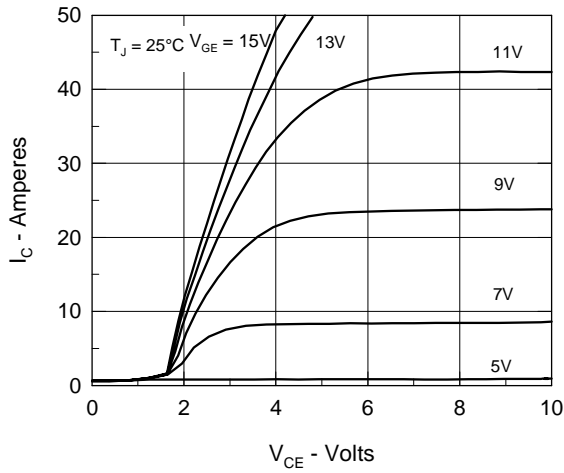


Fig. 1. Saturation Voltage Characteristics

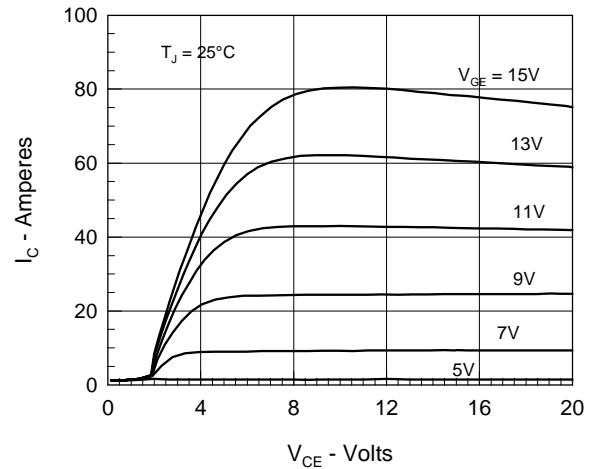


Fig. 2. Extended Output Characteristics

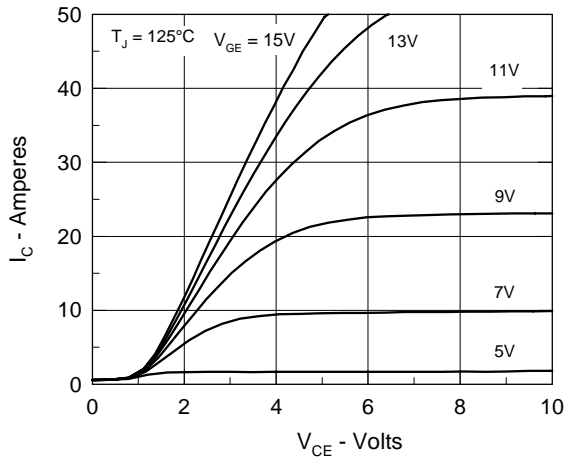


Fig. 3. Saturation Voltage Characteristics

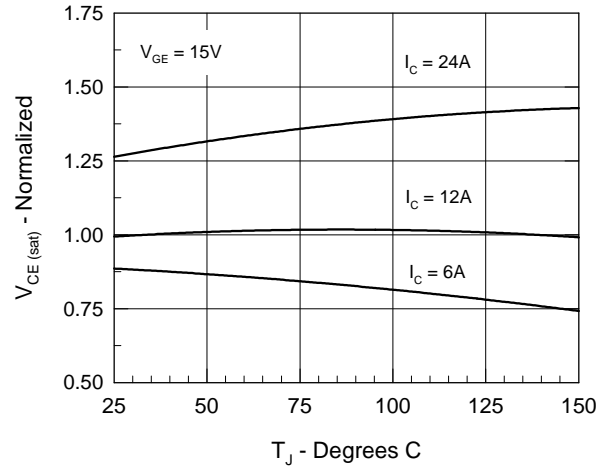
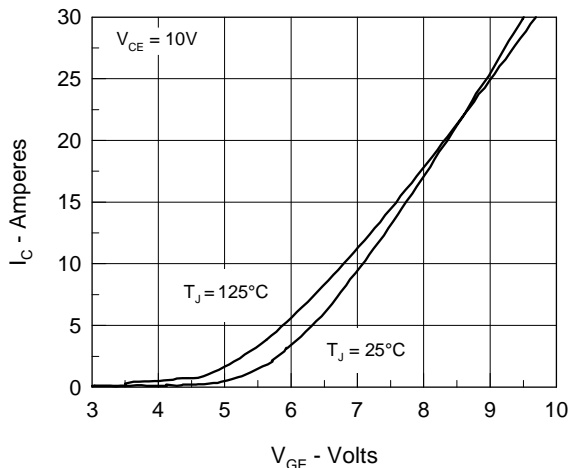

 Fig. 4. Temperature Dependence of  $V_{CE(sat)}$ 


Fig. 5. Saturation Voltage Characteristics

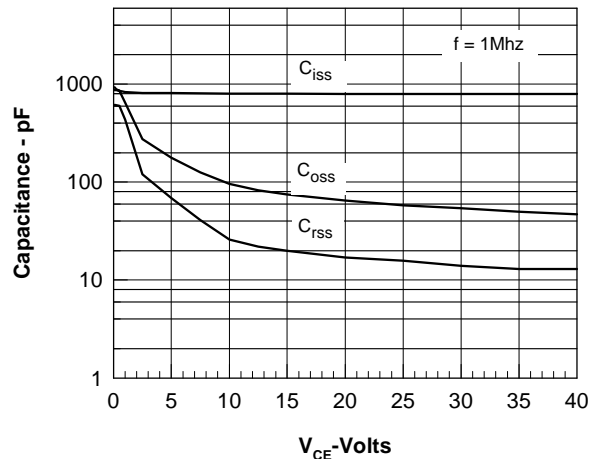


Fig. 6. Junction Capacitance Curves

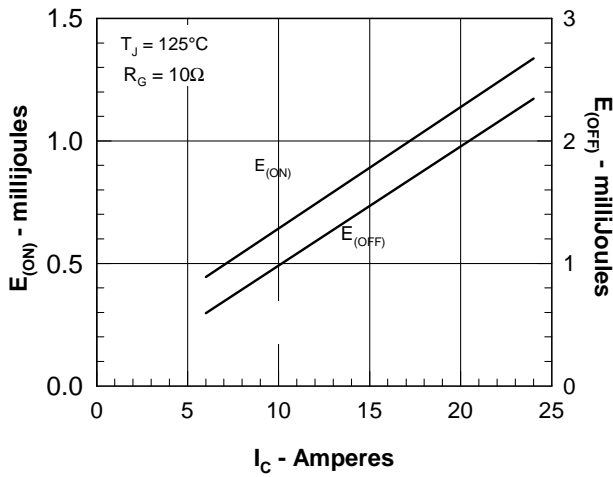


Fig. 7. Dependence of  $E_{ON}$  and  $E_{OFF}$  on  $I_C$ .

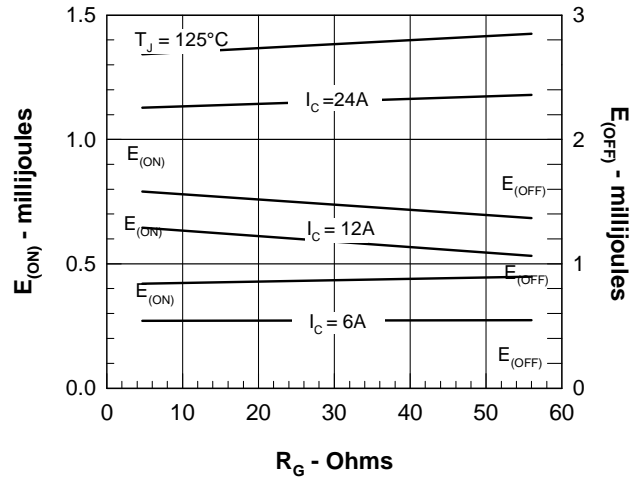


Fig. 8. Dependence of  $E_{ON}$  and  $E_{OFF}$  on  $R_G$ .

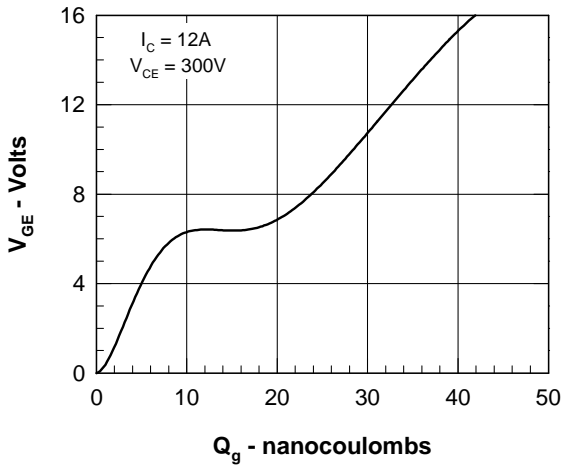


Fig. 9. Gate Charge

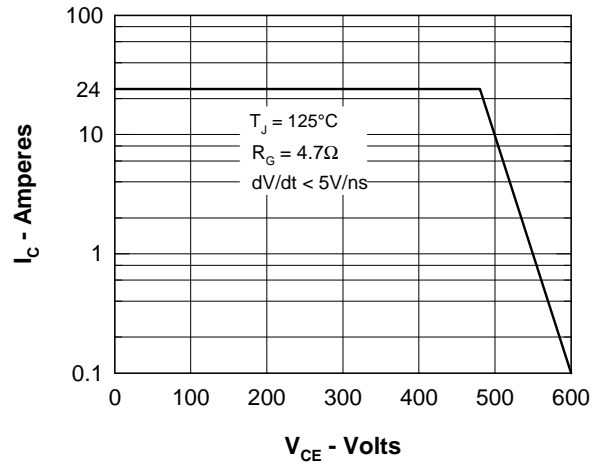


Fig. 10. Turn-off Safe Operating Area

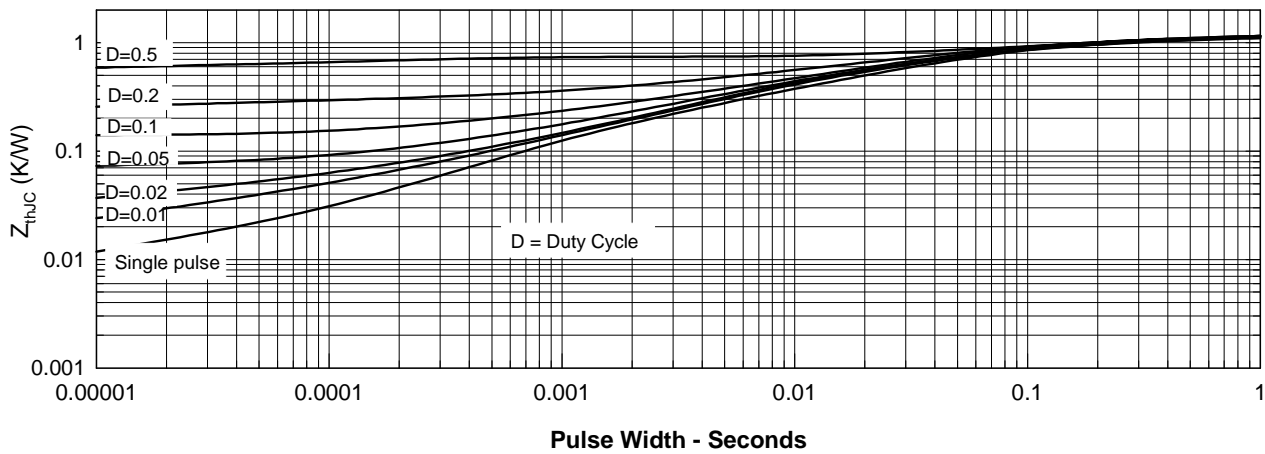


Fig. 11. Transient Thermal Resistance

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 | 5,049,961 | 5,187,117 | 5,486,715 | 6,306,728B1 |
| 4,850,072 | 4,931,844 | 5,034,796 | 5,063,307 | 5,237,481 | 5,381,025 |             |