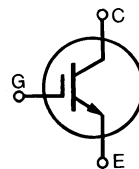


## Ultra-Low $V_{CE(sat)}$ IGBT

**IXGH 60N60**  
**IXGK 60N60**  
**IXGT 60N60**

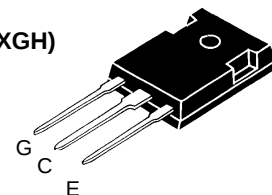
$V_{CES} = 600\text{ V}$   
 $I_{C25} = 75\text{ A}$   
 $V_{CE(sat)} = 1.7\text{ V}$

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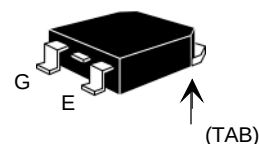


| Symbol                                                                          | Test Conditions                                                                                                             | Maximum Ratings                          |                  |
|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------------|------------------|
| $V_{CES}$                                                                       | $T_J = 25^\circ\text{C}$ 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                |
| $I_{C25}$                                                                       | $T_C = 25^\circ\text{C}$ , limited by leads                                                                                 | 75                                       | A                |
| $I_{C90}$                                                                       | $T_C = 90^\circ\text{C}$                                                                                                    | 60                                       | A                |
| $I_{CM}$                                                                        | $T_C = 25^\circ\text{C}$ , 1 ms                                                                                             | 200                                      | A                |
| <b>SSOA</b><br><b>(RBSOA)</b>                                                   | $V_{GE} = 15\text{ V}$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 10\ \Omega$<br>Clamped inductive load, $L = 30\ \mu\text{H}$ | $I_{CM} = 100$<br>@ $0.8\text{ V}_{CES}$ | 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 (M3)                                                                                                        | 1.13/10                                  | 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                |

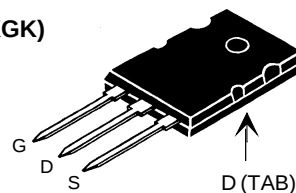
TO-247 AD (IXGH)



TO-268  
(IXGT)



TO-264 (IXGK)



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

### Features

- International standard package JEDEC TO-247 AD, TO-264, TO-268
- New generation HDMOS™ process
- Low  $V_{CE(sat)}$  for minimum on-state conduction losses
- High current handling capability
- MOS Gate turn-on drive simplicity

### Applications

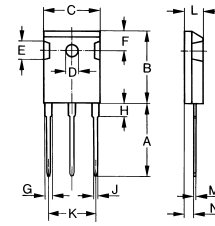
- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

### Advantages

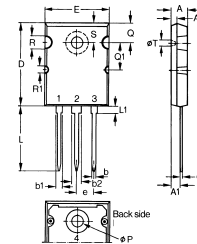
- Easy to mount with 1 screw (isolated mounting screw hole)
- Low losses, high efficiency
- High power density
- High power, surface mount package

| 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 V                       |
| $I_{CES}$     | $V_{CE} = 0.8 \cdot V_{CES}$<br>$V_{GE} = 0\text{ V}$<br>$T_J = 25^\circ\text{C}$<br>$T_J = 125^\circ\text{C}$ |                                                                                   |      | 200 $\mu\text{A}$<br>1 mA |
| $I_{GES}$     | $V_{CE} = 0\text{ V}$ , $V_{GE} = \pm 20\text{ V}$                                                             |                                                                                   |      | $\pm 100\text{ nA}$       |
| $V_{CE(sat)}$ | $I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$                                                                       |                                                                                   |      | 1.7 V                     |

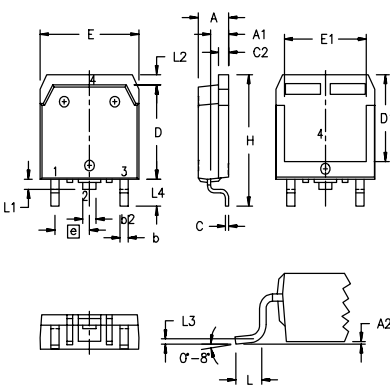
| Symbol       | Test Conditions                                                                                                                                                                                                                                                                                                                      | 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, $t \leq 300\text{ }\mu\text{s}$ , duty cycle $\leq 2\%$                                                                                                                                                                                                                       | 30                                                                                | 55   | S        |
| $C_{ies}$    | $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 1\text{ MHz}$                                                                                                                                                                                                                                                                  |                                                                                   | 3700 | pF       |
| $C_{oes}$    |                                                                                                                                                                                                                                                                                                                                      |                                                                                   | 290  | pF       |
| $C_{res}$    |                                                                                                                                                                                                                                                                                                                                      |                                                                                   | 86   | pF       |
| $Q_g$        | $I_C = I_{C90}, V_{GE} = 15\text{ V}$ , $V_{CE} = 0.5 V_{CES}$                                                                                                                                                                                                                                                                       |                                                                                   | 130  | nC       |
| $Q_{ge}$     |                                                                                                                                                                                                                                                                                                                                      |                                                                                   | 30   | nC       |
| $Q_{gc}$     |                                                                                                                                                                                                                                                                                                                                      |                                                                                   | 45   | nC       |
| $t_{d(on)}$  | <b>Inductive load, <math>T_j = 25^\circ\text{C}</math></b><br>$I_C = I_{C90}, V_{GE} = 15\text{ V}$ , $L = 100\text{ }\mu\text{H}$ ,<br>$V_{CE} = 0.8 V_{CES}$ , $R_G = R_{off} = 2.7\text{ }\Omega$<br>Remarks: Switching times may increase<br>for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$ , higher $T_j$ or<br>increased $R_G$ |                                                                                   | 50   | ns       |
| $t_{ri}$     |                                                                                                                                                                                                                                                                                                                                      |                                                                                   | 25   | ns       |
| $t_{d(off)}$ |                                                                                                                                                                                                                                                                                                                                      |                                                                                   | 300  | 600 ns   |
| $t_{fi}$     |                                                                                                                                                                                                                                                                                                                                      |                                                                                   | 360  | 570 ns   |
| $E_{off}$    |                                                                                                                                                                                                                                                                                                                                      |                                                                                   | 8    | 15 mJ    |
| $t_{d(on)}$  | <b>Inductive load, <math>T_j = 125^\circ\text{C}</math></b><br>$I_C = I_{C90}, V_{GE} = 15\text{ V}$ , $L = 100\text{ }\mu\text{H}$<br>$V_{CE} = 0.8 V_{CES}$ , $R_G = R_{off} = 2.7\text{ }\Omega$<br>Remarks: Switching times may increase<br>for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$ , higher $T_j$ or<br>increased $R_G$  |                                                                                   | 50   | ns       |
| $t_{ri}$     |                                                                                                                                                                                                                                                                                                                                      |                                                                                   | 25   | ns       |
| $E_{on}$     |                                                                                                                                                                                                                                                                                                                                      |                                                                                   | 3    | mJ       |
| $t_{d(off)}$ |                                                                                                                                                                                                                                                                                                                                      |                                                                                   | 650  | ns       |
| $t_{fi}$     |                                                                                                                                                                                                                                                                                                                                      |                                                                                   | 550  | ns       |
| $E_{off}$    |                                                                                                                                                                                                                                                                                                                                      |                                                                                   | 17   | mJ       |
| $R_{thJC}$   |                                                                                                                                                                                                                                                                                                                                      |                                                                                   |      | 0.42 K/W |
| $R_{thCK}$   | (IXGH)                                                                                                                                                                                                                                                                                                                               | 0.25                                                                              |      | K/W      |
|              | (IXGK)                                                                                                                                                                                                                                                                                                                               | 0.15                                                                              |      | K/W      |

[www.datasheet4u.com](http://www.datasheet4u.com)
**TO-247 AD (IXFH) Outline**


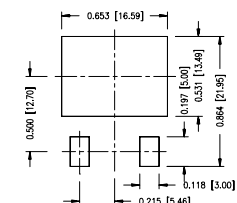
| Dim. | Millimeter |       | Inches |       |
|------|------------|-------|--------|-------|
|      | Min.       | Max.  | Min.   | Max.  |
| A    | 19.81      | 20.32 | 0.780  | 0.800 |
| B    | 20.80      | 21.46 | 0.819  | 0.845 |
| C    | 15.75      | 16.26 | 0.610  | 0.640 |
| D    | 3.55       | 3.65  | 0.140  | 0.144 |
| E    | 4.32       | 5.49  | 0.170  | 0.216 |
| F    | 5.4        | 6.2   | 0.212  | 0.244 |
| G    | 1.65       | 2.13  | 0.065  | 0.084 |
| H    | -          | 4.5   | -      | 0.177 |
| J    | 1.0        | 1.4   | 0.040  | 0.055 |
| K    | 10.8       | 11.0  | 0.426  | 0.433 |
| L    | 4.7        | 5.3   | 0.185  | 0.209 |
| M    | 0.4        | 0.8   | 0.016  | 0.031 |
| N    | 1.5        | 2.49  | 0.087  | 0.102 |

**TO-264 AA (IXFK) Outline**


| Dim. | Millimeter |       | Inches   |       |
|------|------------|-------|----------|-------|
|      | Min.       | Max.  | Min.     | Max.  |
| A    | 4.82       | 5.13  | .190     | .202  |
| A1   | 2.54       | 2.89  | .100     | .114  |
| A2   | 2.00       | 2.10  | .079     | .083  |
| b    | 1.12       | 1.42  | .044     | .056  |
| b1   | 2.39       | 2.69  | .094     | .106  |
| b2   | 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  |
| L1   | 2.29       | 2.59  | .090     | .102  |
| P    | 3.17       | 3.66  | .125     | .144  |
| Q    | 6.07       | 6.27  | .239     | .247  |
| Q1   | 8.38       | 8.69  | .330     | .342  |
| R    | 3.81       | 4.32  | .150     | .170  |
| R1   | 1.78       | 2.29  | .070     | .090  |
| S    | 6.04       | 6.30  | .238     | .248  |
| T    | 1.57       | 1.83  | .062     | .072  |

**TO-268AA (IXFT) (D<sup>3</sup> PAK)**


| Dim. | Millimeter |       | Inches   |      |
|------|------------|-------|----------|------|
|      | Min.       | Max.  | Min.     | Max. |
| A    | 4.9        | 5.1   | .193     | .201 |
| A1   | 2.7        | 2.9   | .106     | .114 |
| A2   | .02        | .25   | .001     | .010 |
| b    | 1.15       | 1.45  | .045     | .057 |
| b2   | 1.9        | 2.1   | .75      | .83  |
| C    | .4         | .65   | .016     | .026 |
| D    | 13.80      | 14.00 | .543     | .551 |
| E    | 15.85      | 16.05 | .624     | .632 |
| E1   | 13.3       | 13.6  | .524     | .535 |
| e    | 5.45 BSC   |       | .215 BSC |      |
| H    | 18.70      | 19.10 | .736     | .752 |
| L    | 2.40       | 2.70  | .094     | .106 |
| L1   | 1.20       | 1.40  | .047     | .055 |
| L2   | 1.00       | 1.15  | .039     | .045 |
| L3   | 0.25 BSC   |       | .010 BSC |      |
| L4   | 3.80       | 4.10  | .150     | .161 |

**Min. Recommended Footprint**


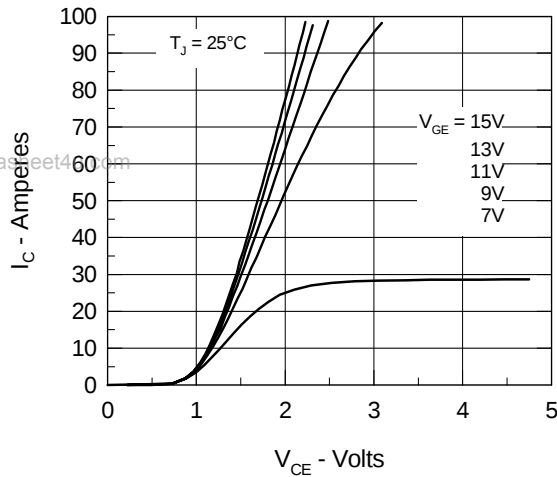


Fig. 1. Saturation Voltage Characteristics

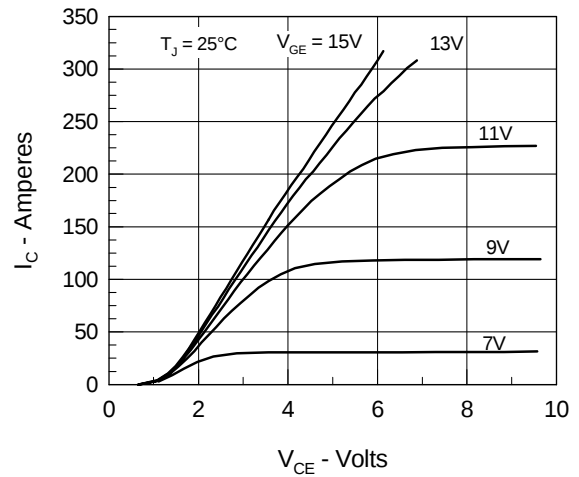


Fig. 2. Extended Output Characteristics

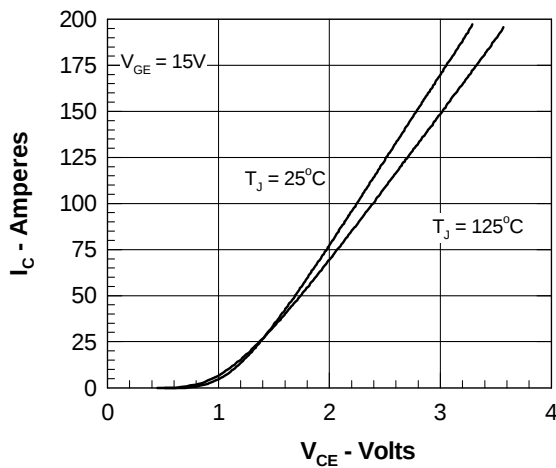


Fig. 3. Saturation Voltage Characteristics

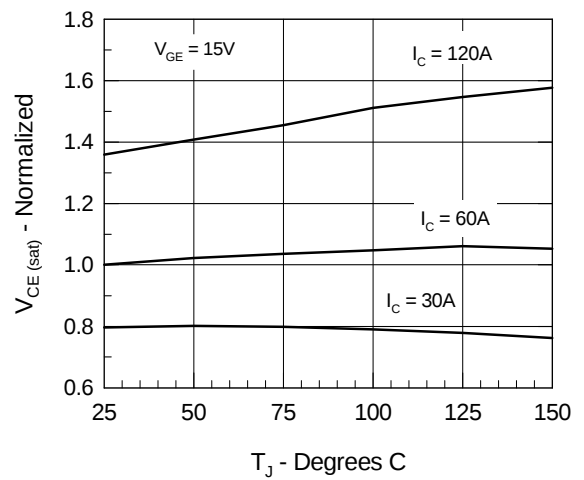


Fig. 4. Temperature Dependence of  $V_{CE(sat)}$

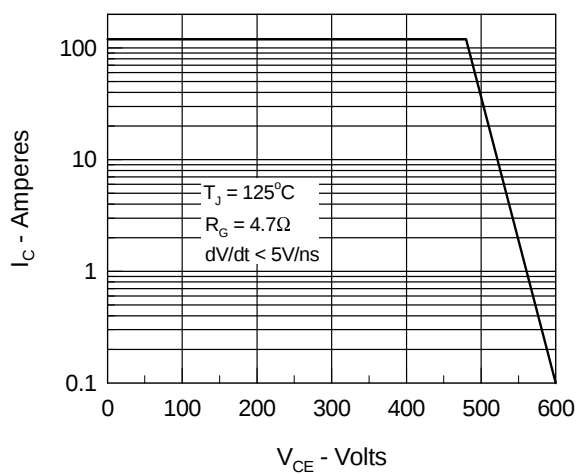


Fig. 5. Turn-off Safe Operating Area

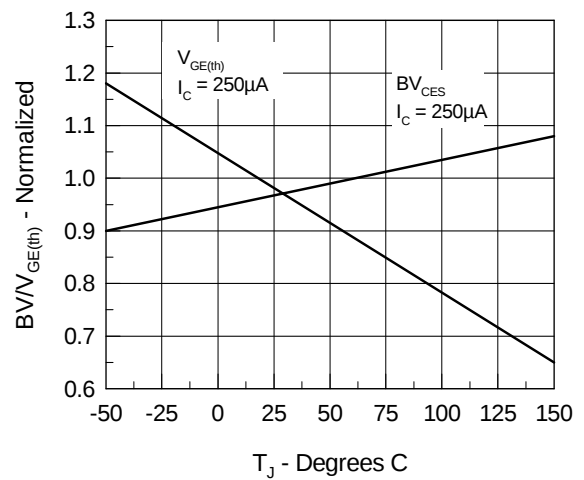


Fig. 6. Temperature Dependence of  $BV_{CES}$  &  $V_{GE(th)}$

