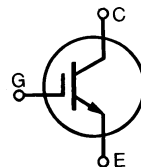


# HiPerFAST™ IGBT

**IXSH 24N60**  
**IXSH 24N60A**

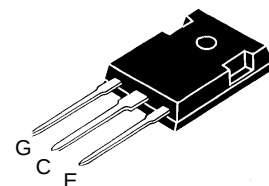
| $V_{CES}$    | $I_{C25}$   | $V_{CE(sat)}$ |
|--------------|-------------|---------------|
| <b>600 V</b> | <b>48 A</b> | <b>2.2 V</b>  |
| <b>600 V</b> | <b>48 A</b> | <b>2.7 V</b>  |

## Short Circuit SOA Capability



| 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                |
| $I_{C25}$                                                                       | $T_C = 25^\circ\text{C}$                                                                                                              | 48                                      | A                |
| $I_{C90}$                                                                       | $T_C = 90^\circ\text{C}$                                                                                                              | 24                                      | A                |
| $I_{CM}$                                                                        | $T_C = 25^\circ\text{C}$ , 1 ms                                                                                                       | 96                                      | A                |
| <b>SSOA (RBSOA)</b>                                                             | $V_{GE} = 15\text{ V}$ , $T_J = 125^\circ\text{C}$ , $R_G = 10\text{ }\Omega$<br>Clamped inductive load, $L = 100\text{ }\mu\text{H}$ | $I_{CM} = 48$<br>@ $0.8\text{ V}_{CES}$ | A                |
| <b><math>t_{SC}</math> (SCSOA)</b>                                              | $V_{GE} = 15\text{ V}$ , $V_{CE} = 360\text{ V}$ , $T_J = 125^\circ\text{C}$<br>$R_G = 82\text{ }\Omega$ , non repetitive             | 10                                      | $\mu\text{s}$    |
| $P_C$                                                                           | $T_C = 25^\circ\text{C}$                                                                                                              | 150                                     | 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                                                                                                                       | 1.13/10                                 | Nm/lb.in.        |
| <b>Weight</b>                                                                   |                                                                                                                                       | 6                                       | g                |
| Maximum lead temperature for soldering<br>1.6 mm (0.062 in.) from case for 10 s |                                                                                                                                       | 300                                     | $^\circ\text{C}$ |

TO-247 AD



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

## Features

- International standard package JEDEC TO-247 AD
- High frequency IGBT with guaranteed Short Circuit SOA capability
- 2nd generation HDMOS™ process
- Low  $V_{CE(sat)}$ 
  - for low on-state conduction losses
- 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

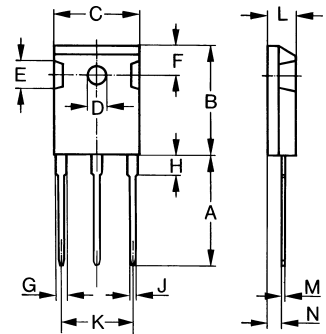
## Advantages

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

| Symbol        | Test Conditions                                        | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                                             |
|---------------|--------------------------------------------------------|-----------------------------------------------------------------------------------|------|---------------------------------------------|
|               |                                                        | min.                                                                              | typ. | max.                                        |
| $BV_{CES}$    | $I_C = 250\text{ }\mu\text{A}$ , $V_{GE} = 0\text{ V}$ | 600                                                                               |      | V                                           |
| $V_{GE(th)}$  | $I_C = 1.5\text{ mA}$ , $V_{CE} = V_{GE}$              | 3.5                                                                               |      | V                                           |
| $I_{CES}$     | $V_{CE} = 0.8 \cdot V_{CES}$<br>$V_{GE} = 0\text{ V}$  |                                                                                   |      | 200 $\mu\text{A}$<br>1 mA                   |
| $I_{GES}$     | $V_{CE} = 0\text{ V}$ , $V_{GE} = \pm 20\text{ V}$     |                                                                                   |      | $\pm 100\text{ nA}$                         |
| $V_{CE(sat)}$ | $I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$               |                                                                                   |      | IXSH 24N60<br>IXSH 24N60A<br>2.2 V<br>2.7 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 $\leq 2\%$                                                                                                                                                                                                          | 9                                                                                 | 13   | S        |
| $I_{C(on)}$  | $V_{GE} = 15\text{ V}, V_{CE} = 10\text{ V}$                                                                                                                                                                                                                                                                            |                                                                                   | 65   | A        |
| $C_{ies}$    | $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$                                                                                                                                                                                                                                                           |                                                                                   | 1800 | pF       |
| $C_{oes}$    |                                                                                                                                                                                                                                                                                                                         |                                                                                   | 160  | pF       |
| $C_{res}$    |                                                                                                                                                                                                                                                                                                                         |                                                                                   | 45   | pF       |
| $Q_g$        | $I_C = I_{C90}, V_{GE} = 15\text{ V}, V_{CE} = 0.5 V_{CES}$                                                                                                                                                                                                                                                             |                                                                                   | 75   | nC       |
| $Q_{ge}$     |                                                                                                                                                                                                                                                                                                                         |                                                                                   | 20   | nC       |
| $Q_{gc}$     |                                                                                                                                                                                                                                                                                                                         |                                                                                   | 35   | 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>$V_{CE} = 0.8 V_{CES}, R_G = 10\text{ }\Omega$<br>Remarks: Switching times<br>may increase for<br>$V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$ ,<br>higher $T_j$ or increased $R_G$  |                                                                                   | 100  | ns       |
| $t_{ri}$     |                                                                                                                                                                                                                                                                                                                         |                                                                                   | 200  | ns       |
| $t_{d(off)}$ |                                                                                                                                                                                                                                                                                                                         |                                                                                   | 450  | ns       |
| $t_{fi}$     |                                                                                                                                                                                                                                                                                                                         | 24N60                                                                             | 500  | ns       |
|              |                                                                                                                                                                                                                                                                                                                         | 24N60A                                                                            | 275  | ns       |
| $E_{off}$    |                                                                                                                                                                                                                                                                                                                         | 24N60A                                                                            | 2.0  | 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>$V_{CE} = 0.8 V_{CES}, R_G = 10\text{ }\Omega$<br>Remarks: Switching times<br>may increase for<br>$V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$ ,<br>higher $T_j$ or increased $R_G$ |                                                                                   | 100  | ns       |
| $t_{ri}$     |                                                                                                                                                                                                                                                                                                                         |                                                                                   | 200  | ns       |
| $E_{on}$     |                                                                                                                                                                                                                                                                                                                         |                                                                                   | 1.2  | mJ       |
| $t_{d(off)}$ |                                                                                                                                                                                                                                                                                                                         |                                                                                   | 475  | ns       |
| $t_{fi}$     |                                                                                                                                                                                                                                                                                                                         | 24N60                                                                             | 600  | ns       |
|              |                                                                                                                                                                                                                                                                                                                         | 24N60A                                                                            | 450  | ns       |
| $E_{off}$    |                                                                                                                                                                                                                                                                                                                         | 24N60                                                                             | 4    | mJ       |
|              |                                                                                                                                                                                                                                                                                                                         | 24N60A                                                                            | 3    | mJ       |
| $R_{thJC}$   |                                                                                                                                                                                                                                                                                                                         |                                                                                   |      | 0.83 K/W |
| $R_{thCK}$   |                                                                                                                                                                                                                                                                                                                         |                                                                                   | 0.25 | K/W      |

TO-247 AD (IXSH) 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 |