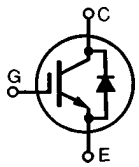
IXYS

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

## IXGH 38N60U1

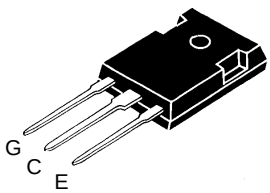
$V_{CES}$ = 600 V
$I_{C25}$ = 76 A
$V_{CE(sat)}$ = 1.8 V

## Combi Pack




| Symbol | Test Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{CES}$ | $T_J$ = 25°C to 150°C | 600 | V |
| $V_{CGR}$ | $T_J$ = 25°C to 150°C; $R_{GE}$ = 1 MΩ | 600 | V |
| $V_{GES}$ | Continuous | ±20 | V |
| $V_{GEM}$ | Transient | ±30 | V |
| $I_{C25}$ | $T_C$ = 25°C | 76 | A |
| $I_{C90}$ | $T_C$ = 90°C | 38 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1 ms | 152 | A |
| **SSOA (RBSOA)** | $V_{GE}$ = 15 V, $T_{VJ}$ = 125°C, $R_G$ = 10 Ω<br>Clamped inductive load, L = 100 µH | $I_{CM}$ = 76<br>@ 0.8 $V_{CES}$ | A |
| $P_C$ | $T_C$ = 25°C | 200 | W |
| $T_J$ | | -55 ... +150 | °C |
| $T_{JM}$ | | 150 | °C |
| $T_{stg}$ | | -55 ... +150 | °C |
| $M_d$ | Mounting torque (M3) | 1.13/10 | Nm/lb.in. |
| **Weight** | | 6 | g |
| Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s | | 300 | °C |

**TO-247 AD**




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

### Features

- International standard package JEDEC TO-247 AD
- IGBT and anti-parallel FRED in one package
- 2nd generation HDMOS™ process
- Low $V_{CE(sat)}$
  - for minimum on-state conduction losses
- MOS Gate turn-on
  - drive simplicity
- Fast Recovery Epitaxial Diode (FRED)
  - soft recovery with low $I_{RM}$

### Applications

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

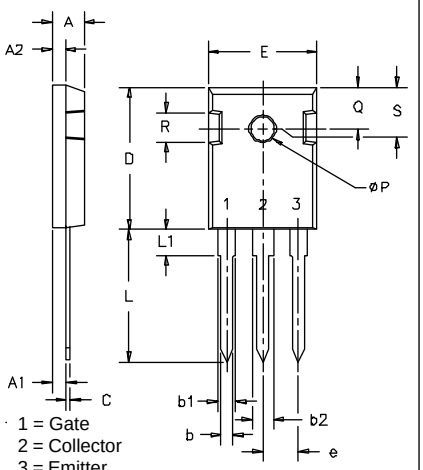
### Advantages

- Space savings (two devices in one package)
- Easy to mount with 1 screw (isolated mounting screw hole)
- Reduces assembly time and cost
- High power density

| Symbol | Test Conditions | | Characteristic Values ($T_J$ = 25°C, unless otherwise specified) min. | typ. | max. | |
|---|---|---|---|---|---|---|
| $BV_{CES}$ | $I_C$ = 750 µA, $V_{GE}$ = 0 V | | 600 | | | V |
| $V_{GE(th)}$ | $I_C$ = 250 µA, $V_{CE}$ = $V_{GE}$ | | 2.5 | | 5.5 | V |
| $I_{CES}$ | $V_{CE}$ = 0.8 • $V_{CES}$<br>$V_{GE}$ = 0 V | $T_J$ = 25°C<br>$T_J$ = 125°C | | | 500<br>8 | µA<br>mA |
| $I_{GES}$ | $V_{CE}$ = 0 V, $V_{GE}$ = ±20 V | | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = $I_{C90}$, $V_{GE}$ = 15 V | | | | 1.8 | V |

| Symbol | Test Conditions ($T_J$ = 25°C, unless otherwise specified) | min. | typ. | max. | |
|---|---|---|---|---|---|
| $g_{fs}$ | $I_C = I_{C90}$; $V_{CE}$ = 10 V, Pulse test, t ≤ 300 µs, duty cycle ≤ 2 % | 15 | 20 | | S |
| $C_{ies}$ | $V_{CE}$ = 25 V, $V_{GE}$ = 0 V, f = 1 MHz | | 2500 | | pF |
| $C_{oes}$ | | | 270 | | pF |
| $C_{res}$ | | | 70 | | pF |
| $Q_g$ | $I_C = I_{C90}$, $V_{GE}$ = 15 V, $V_{CE}$ = 0.5 $V_{CES}$ | | 125 | 150 | nC |
| $Q_{ge}$ | | | 23 | 35 | nC |
| $Q_{gc}$ | | | 50 | 75 | nC |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 25°C** | | 30 | | ns |
| $t_{ri}$ | $I_C = I_{C90}$, $V_{GE}$ = 15 V, L = 100 µH, | | 150 | | ns |
| $t_{d(off)}$ | $V_{CE}$ = 0.8 $V_{CES}$, $R_G = R_{off}$ = 10 Ω | | 600 | 1200 | ns |
| $t_{fi}$ | Remarks: Switching times may increase | | 500 | 700 | ns |
| $E_{off}$ | for $V_{CE}$ (Clamp) > 0.8 • $V_{CES}$, higher $T_J$ or increased $R_G$ | | 9 | 15 | mJ |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 125°C** | | 40 | | ns |
| $t_{ri}$ | $I_C = I_{C90}$, $V_{GE}$ = 15 V, L = 100 µH | | 160 | | ns |
| $E_{on}$ | $V_{CE}$ = 0.8 $V_{CES}$, $R_G = R_{off}$ = 10 Ω | | 1 | | mJ |
| $t_{d(off)}$ | Remarks: Switching times may increase | | 800 | | ns |
| $t_{fi}$ | for $V_{CE}$ (Clamp) > 0.8 • $V_{CES}$, higher $T_J$ or | | 1000 | | ns |
| $E_{off}$ | increased $R_G$ | | 15 | | mJ |
| $R_{thJC}$ | | | | 0.62 | K/W |
| $R_{thCK}$ | | | 0.25 | | K/W |

**TO-247 AD Outline**




1 = Gate
2 = Collector
3 = Emitter
Tab = Collector

| SYM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS MAX |
|---|---|---|---|---|
| A | .185 | .209 | 4.7 | 5.3 |
| $A_1$ | .087 | .102 | 2.2 | 2.54 |
| $A_2$ | .059 | .098 | 2.2 | 2.6 |
| b | .040 | .055 | 1.0 | 1.4 |
| $b_1$ | .065 | .084 | 1.65 | 2.13 |
| $b_2$ | .113 | .123 | 2.87 | 3.12 |
| C | .016 | .031 | .4 | .8 |
| D | .819 | .845 | 20.80 | 21.46 |
| E | .610 | .640 | 15.75 | 16.26 |
| e | .215 BSC | | 5.45 BSC | |
| L | .780 | .800 | 19.81 | 20.32 |
| L1 | | .177 | | 4.50 |
| øP | .140 | .144 | 3.55 | 3.65 |
| Q | .212 | .244 | 5.4 | 6.2 |
| R | .170 | .216 | 4.32 | 5.49 |
| S | .242 BSC | | 6.15 BSC | |

**Reverse Diode (FRED)**

| Symbol | Test Conditions ($T_J$ = 25°C, unless otherwise specified) | min. | typ. | max. | |
|---|---|---|---|---|---|
| $V_F$ | $I_F = I_{C90}$, $V_{GE}$ = 0 V, Pulse test, t ≤ 300 µs, duty cycle d ≤ 2 % | | | 1.6 | V |
| $I_{RM}$ | $I_F = I_{C90}$, $V_{GE}$ = 0 V, -$di_F$/dt = 240 A/µs | | 10 | 15 | A |
| $t_{rr}$ | $V_R$ = 360 V $T_J$ = 125°C | | 150 | | ns |
| | $I_F$ = 1 A; -di/dt = 100 A/µs; $V_R$ = 30 V $T_J$ = 25°C | | 35 | 50 | ns |
| $R_{thJC}$ | | | | 1 | K/W |