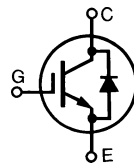


# HiPerFAST™ IGBT

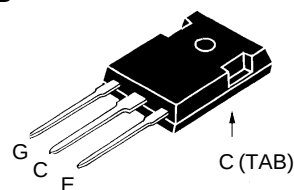
## IXGH40N30BD1

$$\begin{aligned} V_{CES} &= 300 \text{ V} \\ I_{C25} &= 60 \text{ A} \\ V_{CE(sat)} &= 2.4 \text{ V} \\ t_{fi} &= 75 \text{ ns} \end{aligned}$$



| Symbol                                                                          | Test Conditions                                                                                                      | Maximum Ratings                  |                  |
|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------|
| $V_{CES}$                                                                       | $T_J = 25^\circ\text{C to } 150^\circ\text{C}$                                                                       | 300                              | V                |
| $V_{CGR}$                                                                       | $T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$                                           | 300                              | V                |
| $V_{GES}$                                                                       | Continuous                                                                                                           | $\pm 20$                         | V                |
| $V_{GEM}$                                                                       | Transient                                                                                                            | $\pm 30$                         | V                |
| $I_{C25}$                                                                       | $T_C = 25^\circ\text{C}$                                                                                             | 60                               | A                |
| $I_{C90}$                                                                       | $T_C = 90^\circ\text{C}$                                                                                             | 40                               | A                |
| $I_{CM}$                                                                        | $T_C = 25^\circ\text{C}, 1 \text{ ms}$                                                                               | 160                              | A                |
| <b>SSOA (RBSOA)</b>                                                             | $V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$<br>Clamped inductive load, $L = 30 \mu\text{H}$ | $I_{CM} = 80$<br>@ $0.8 V_{CES}$ | A                |
| $P_C$                                                                           | $T_C = 25^\circ\text{C}$                                                                                             | 200                              | W                |
| $T_J$                                                                           |                                                                                                                      | -55 ... +150                     | $^\circ\text{C}$ |
| $T_{JM}$                                                                        |                                                                                                                      | 150                              | $^\circ\text{C}$ |
| $T_{stg}$                                                                       |                                                                                                                      | -55 ... +150                     | $^\circ\text{C}$ |
| Maximum Lead temperature for soldering<br>1.6 mm (0.062 in.) from case for 10 s |                                                                                                                      | 300                              | $^\circ\text{C}$ |
| $M_d$                                                                           | Mounting torque (M3)                                                                                                 | 1.13/10                          | Nm/lb.in.        |

### TO-247 AD



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

### Features

- International standard package JEDEC TO-247 AD
- High current IGBT and paralred FRED in one package
- Low leakage current FRED
- Newest generation HDMOST™ process
- MOS Gate turn-on - drive simplicity

### Applications

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

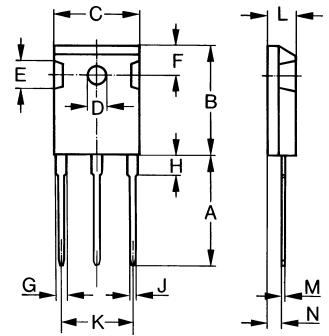
### Advantages

- High power density (two devices in one package)
- Switching speed for high frequency applications
- Easy to mount with 1 screw, (isolated mounting screw hole)

| Symbol        | Test Conditions                                        | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                                                                                    |
|---------------|--------------------------------------------------------|-----------------------------------------------------------------------------------|------|------------------------------------------------------------------------------------|
|               |                                                        | min.                                                                              | typ. | max.                                                                               |
| $BV_{CES}$    | $I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$          | 300                                                                               |      | V                                                                                  |
| $V_{GE(th)}$  | $I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$               | 2.5                                                                               |      | V                                                                                  |
| $I_{CES}$     | $V_{CE} = 0.8 \cdot V_{CES}$<br>$V_{GE} = 0 \text{ V}$ |                                                                                   |      | $T_J = 25^\circ\text{C}$<br>$T_J = 125^\circ\text{C}$<br>200 $\mu\text{A}$<br>1 mA |
| $I_{GES}$     | $V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$      |                                                                                   |      | $\pm 100 \text{ nA}$                                                               |
| $V_{CE(sat)}$ | $I_C = I_{C90}, V_{GE} = 15 \text{ V}$                 |                                                                                   |      | 2.4 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 $\leq 2\%$                                                                                                                                                                                                                        | 20                                                                                | 28   | S        |
| $C_{ies}$    | $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 1\text{ MHz}$                                                                                                                                                                                                                                                                   |                                                                                   | 2500 | pF       |
| $C_{oes}$    |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 210  | pF       |
| $C_{res}$    |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 60   | pF       |
| $Q_g$        | $I_C = I_{C90}, V_{GE} = 15\text{ V}$ , $V_{CE} = 0.5 V_{CES}$                                                                                                                                                                                                                                                                        |                                                                                   | 145  | nC       |
| $Q_{ge}$     |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 23   | nC       |
| $Q_{gc}$     |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 50   | 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>$V_{CE} = 0.8 V_{CES}$ , $R_G = R_{off} = 1.0\text{ }\Omega$<br>Remarks: Switching times may<br>increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$ ,<br>higher $T_J$ or increased $R_G$  |                                                                                   | 25   | ns       |
| $t_{ri}$     |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 45   | ns       |
| $t_{d(off)}$ |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 75   | ns       |
| $t_{fi}$     |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 75   | ns       |
| $E_{off}$    |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 0.3  | 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>$V_{CE} = 0.8 V_{CES}$ , $R_G = R_{off} = 1.0\text{ }\Omega$<br>Remarks: Switching times may<br>increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$ ,<br>higher $T_J$ or increased $R_G$ |                                                                                   | 25   | ns       |
| $t_{ri}$     |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 45   | ns       |
| $E_{on}$     |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 0.5  | mJ       |
| $t_{d(off)}$ |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 90   | 180 ns   |
| $t_{fi}$     |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 130  | 230 ns   |
| $E_{off}$    |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 0.6  | 1.4 mJ   |
| $R_{thJC}$   |                                                                                                                                                                                                                                                                                                                                       |                                                                                   |      | 0.62 K/W |
| $R_{thCK}$   |                                                                                                                                                                                                                                                                                                                                       |                                                                                   | 0.25 | K/W      |

TO-247 AD (IXGH) 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 |

| Symbol     | Test Conditions                                                                                                                                                                                                                               | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |       |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|-------|
|            |                                                                                                                                                                                                                                               | min.                                                                              | typ. | max.  |
| $V_F$      | $I_F = I_{C90}, V_{GE} = 0\text{ V}$ ,<br>Pulse test, $t \leq 300\text{ }\mu\text{s}$ , duty cycle $d \leq 2\%$                                                                                                                               |                                                                                   |      | 1.8 V |
| $I_{RM}$   | $I_F = I_{C90}, V_{GE} = 0\text{ V}$ , $-di_F/dt = 100\text{ A}/\mu\text{s}$<br>$V_R = 100\text{ V}$ ; $T_J = 100^\circ\text{C}$<br>$I_F = 1\text{ A}$ ; $-di_F/dt = 100\text{ A}/\mu\text{s}$ ; $V_R = 30\text{ V}$ $T_J = 25^\circ\text{C}$ |                                                                                   | 1.5  | 1.8 A |
| $t_{rr}$   |                                                                                                                                                                                                                                               |                                                                                   | 30   | ns    |
| $R_{thJC}$ |                                                                                                                                                                                                                                               |                                                                                   |      | 1 K/W |

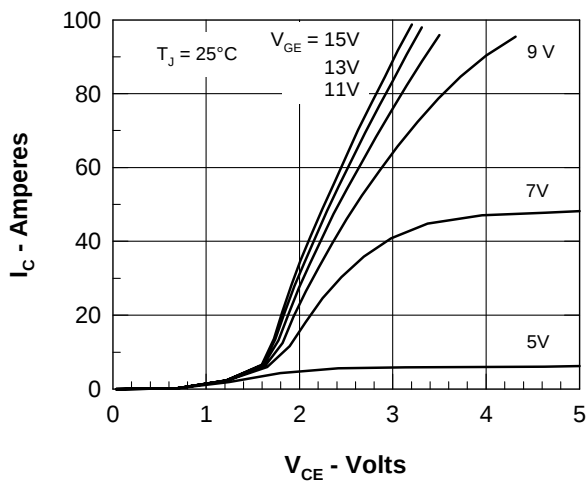


Fig. 1. Output Characteristics

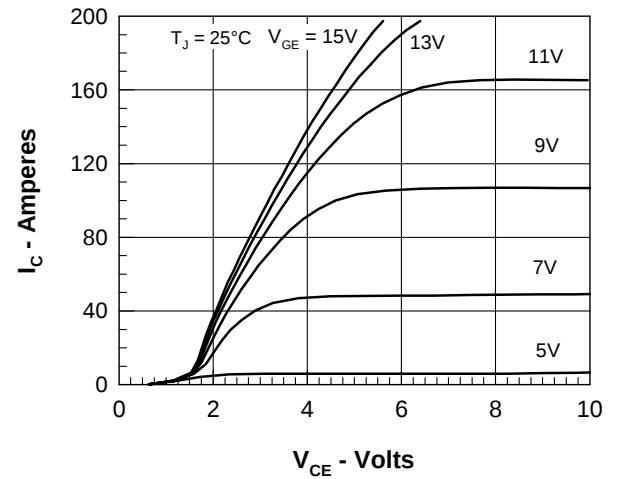


Fig. 2. Extended Output Characteristics

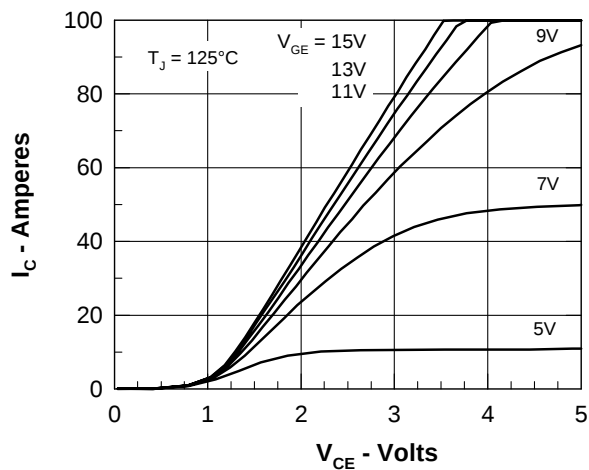


Fig. 3. High Temperature Output Characteristics

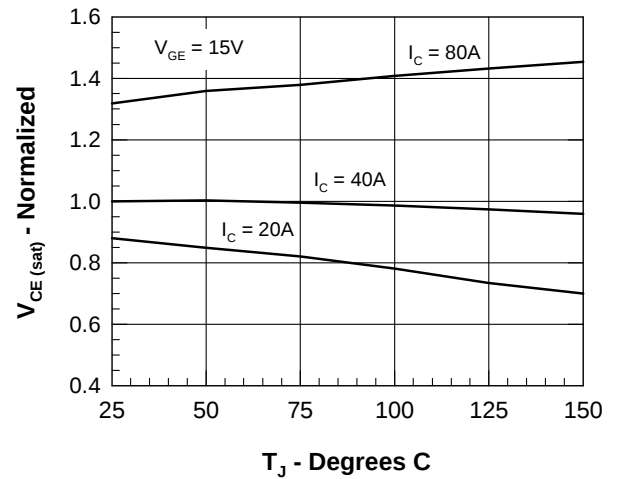


Fig. 4. Temperature Dependence of  $V_{CE(sat)}$

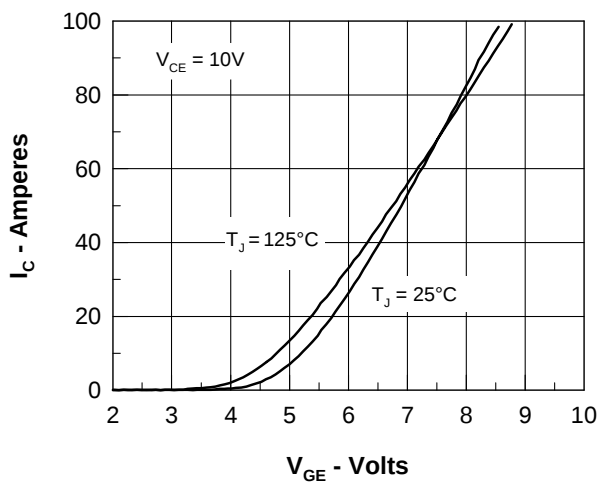


Fig. 5. Admittance Curves

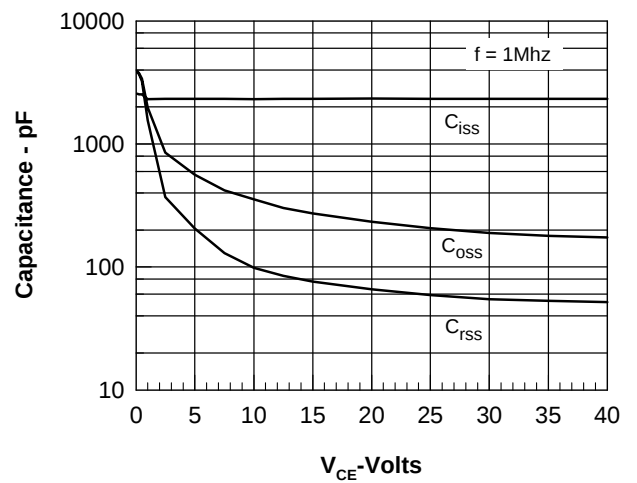


Fig. 6. Capacitance Curves

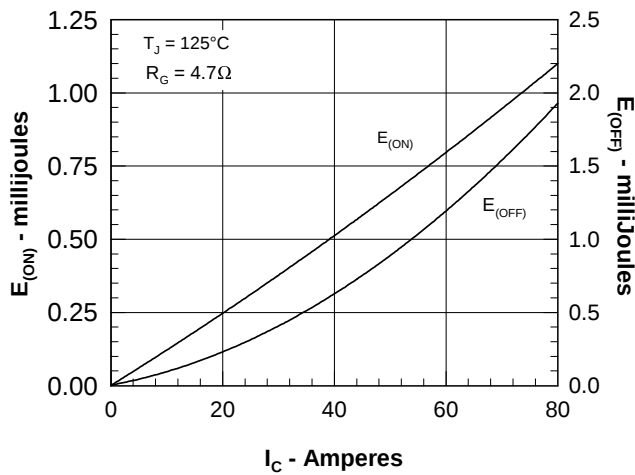


Fig. 7. Dependence of  $E_{ON}$  and  $E_{OFF}$  on  $I_C$ .

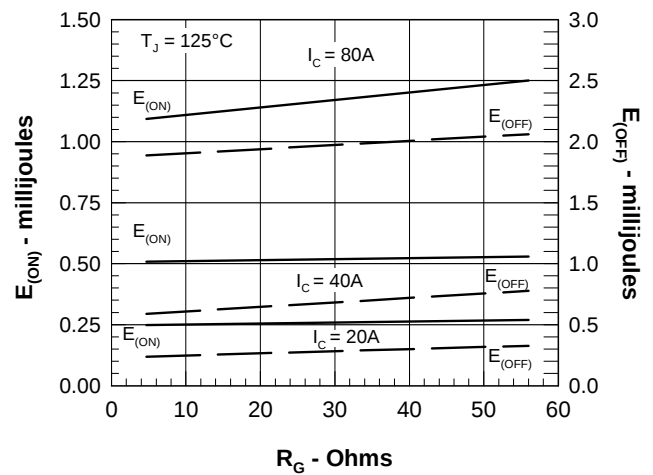


Fig. 8. Dependence of  $E_{ON}$  and  $E_{OFF}$  on  $R_G$ .

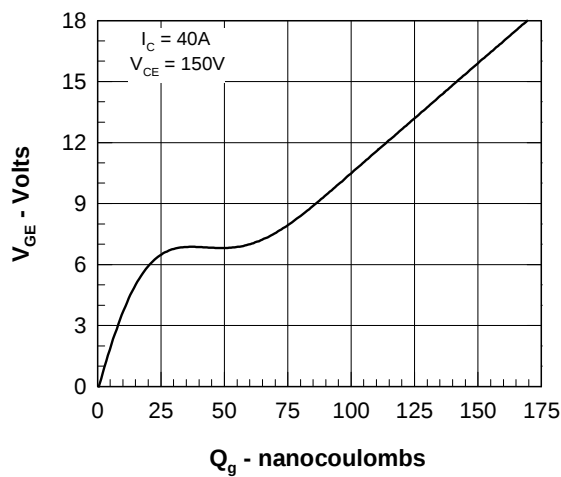


Fig. 9. Gate Charge

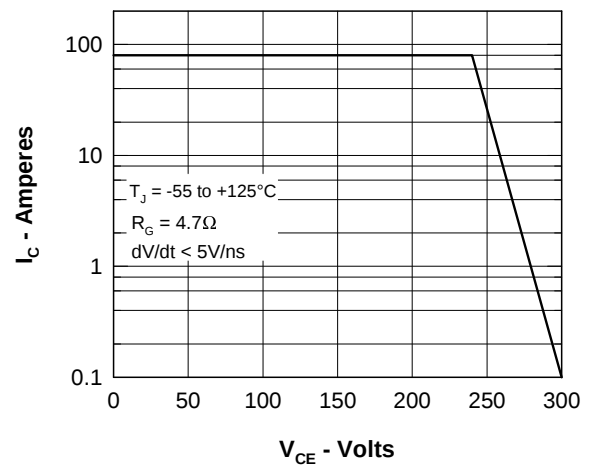


Fig. 10. Turn-off Safe Operating Area



Fig. 11. Transient Thermal Resistance