

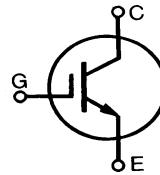
# IGBT High Speed

**IXSH 50N60B**

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 75 \text{ A} \\ V_{CE(sat)} &= 2.5 \text{ V} \end{aligned}$$

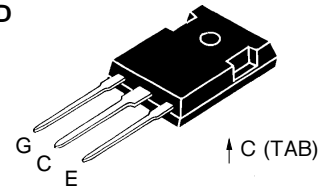
Short Circuit SOA Capability

Preliminary data sheet



| 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                |
| $I_{C90}$   | $T_C = 90^\circ\text{C}$   | 50                                | A                |
| $I_{CM}$  | $T_C = 25^\circ\text{C}$ , 1 ms  | 200                               | A                |
| <b>SSOA (RBSOA)</b>   | $V_{GE} = 15 \text{ V}$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 22 \Omega$<br>Clamped inductive load, $L = 30 \mu\text{H}$ | $I_{CM} = 100$<br>@ $0.8 V_{CES}$ | 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>$R_G = 22 \Omega$ , non repetitive       | 10                                | $\mu\text{s}$    |
| $P_c$   | $T_C = 25^\circ\text{C}$   | 250                               | 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>   | TO-247 SMD   | 4                                 | g                |
|   | TO-247   | 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, and TO-247 SMD for surface mount
- Guaranteed Short Circuit SOA capability
- High frequency IGBT
- Latest generation HDMOS™ process
- Low  $V_{CE(sat)}$ 
  - for minimum 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

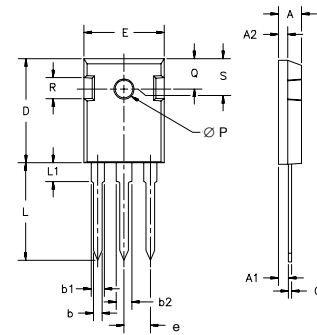
## Advantages

- Easy to mount with 1 screw (isolated mounting screw hole)
- Reduces assembly time and cost
- High power density

| Symbol        | Test Conditions  | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                           |
|---------------|--|---|------|---------------------------|
|               |  | min.  | typ. | max.                      |
| $BV_{CES}$    | $I_C = 250 \mu\text{A}$ , $V_{GE} = 0 \text{ V}$       | 600   |      | V                         |
| $V_{GE(th)}$  | $I_C = 4 \text{ mA}$ , $V_{CE} = V_{GE}$               | 4   |      | V                         |
| $I_{CES}$     | $V_{CE} = 0.8 \cdot V_{CES}$<br>$V_{GE} = 0 \text{ V}$ |   |      | 200 $\mu\text{A}$<br>1 mA |
| $I_{GES}$     | $V_{CE} = 0 \text{ V}$ , $V_{GE} = \pm 20 \text{ V}$   |   |      | $\pm 100 \text{ nA}$      |
| $V_{CE(sat)}$ | $I_C = I_{C90}$ , $V_{GE} = 15 \text{ V}$              | 2.2   | 2.5  | 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 $\leq 2\%$   | 16  | 23   | S       |
| $I_{C(on)}$  | $V_{GE} = 15\text{ V}$ , $V_{CE} = 10\text{ V}$   |   | 160  | A       |
| $C_{ies}$    | $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 1\text{ MHz}$   |   | 3850 | pF      |
| $C_{oes}$    |   |   | 440  | pF      |
| $C_{res}$    |   |   | 50   | pF      |
| $Q_g$        | $I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $V_{CE} = 0.5 V_{CES}$   |   | 167  | nC      |
| $Q_{ge}$     |   |   | 45   | nC      |
| $Q_{gc}$     |   |   | 88   | nC      |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b>  | 70  |      | ns      |
| $t_{ri}$     | $I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $L = 100\text{ }\mu\text{H}$ ,<br>$V_{CE} = 0.8 V_{CES}$ , $R_G = 2.7\text{ }\Omega$<br>Remarks: Switching times may increase<br>for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$ , higher $T_J$ or<br>increased $R_G$ | 70  |      | ns      |
| $t_{d(off)}$ |   | 150   | 300  | ns      |
| $t_{fi}$     |   | 150   | 300  | ns      |
| $E_{off}$    |   | 3.3   | 6.0  | mJ      |
| $t_{d(on)}$  |   | 70  |      | ns      |
| $t_{ri}$     | <b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b>   | 70  |      | ns      |
| $E_{on}$     | $I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $L = 100\text{ }\mu\text{H}$ ,<br>$V_{CE} = 0.8 V_{CES}$ , $R_G = 2.7\text{ }\Omega$<br>Remarks: Switching times may increase<br>for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$ , higher $T_J$ or<br>increased $R_G$ | 0.6   |      | mJ      |
| $t_{d(off)}$ |   | 230   |      | ns      |
| $t_{fi}$     |   | 230   |      | ns      |
| $E_{off}$    |   | 4.8   |      | mJ      |
| $R_{thJC}$   |   |   |      | 0.5 K/W |
| $R_{thCK}$   |   | 0.25  |      | K/W     |

### TO-247 AD Outline



| Dim.           | Millimeter |       | Inches |       |
|----------------|------------|-------|--------|-------|
|                | Min.       | Max.  | Min.   | Max.  |
| A              | 4.7        | 5.3   | .185   | .209  |
| A <sub>1</sub> | 2.2        | 2.54  | .087   | .102  |
| A <sub>2</sub> | 2.2        | 2.6   | .059   | .098  |
| b              | 1.0        | 1.4   | .040   | .055  |
| b <sub>1</sub> | 1.65       | 2.13  | .065   | .084  |
| b <sub>2</sub> | 2.87       | 3.12  | .113   | .123  |
| C              | .4         | .8    | .016   | .031  |
| D              | 20.80      | 21.46 | .819   | .845  |
| E              | 15.75      | 16.26 | .610   | .640  |
| e              | 5.20       | 5.72  | 0.205  | 0.225 |
| L              | 19.81      | 20.32 | .780   | .800  |
| L1             |            | 4.50  |        | .177  |
| ØP             | 3.55       | 3.65  | .140   | .144  |
| Q              | 5.89       | 6.40  | 0.232  | 0.252 |
| R              | 4.32       | 5.49  | .170   | .216  |
| S              | 6.15       | BSC   | .242   | BSC   |

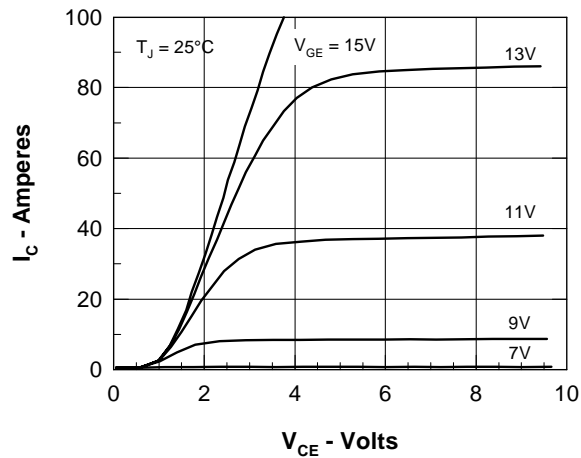


Figure 1. Saturation Voltage Characteristics

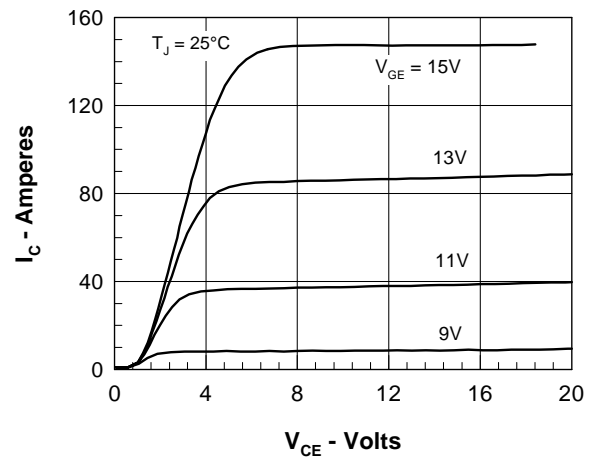


Figure 2. Extended Output Characteristics

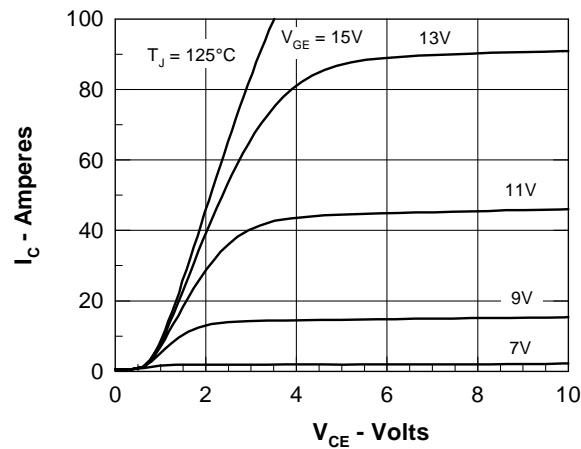


Figure 3. Saturation Voltage Characteristics

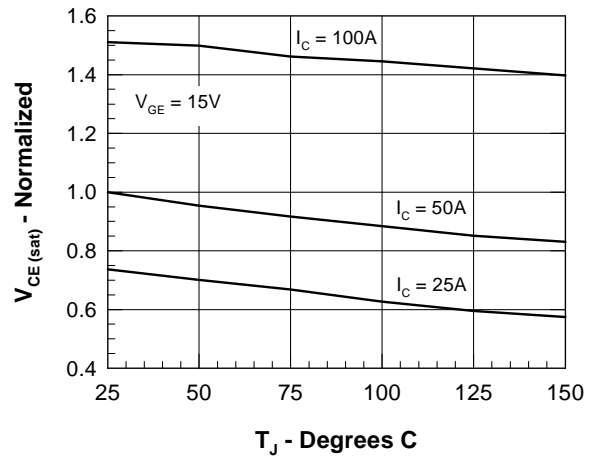


Figure 4. Temperature Dependence of  $V_{CE(sat)}$

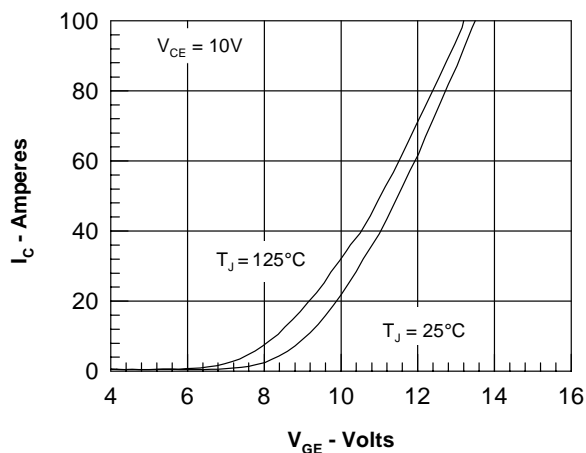


Figure 5. Admittance Curves

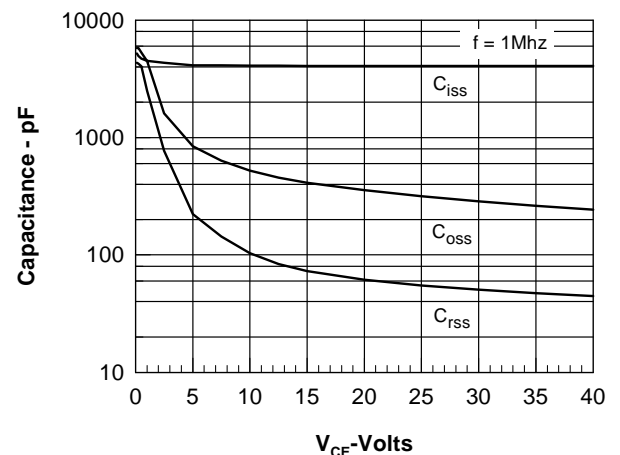


Figure 6. Capacitance Curves

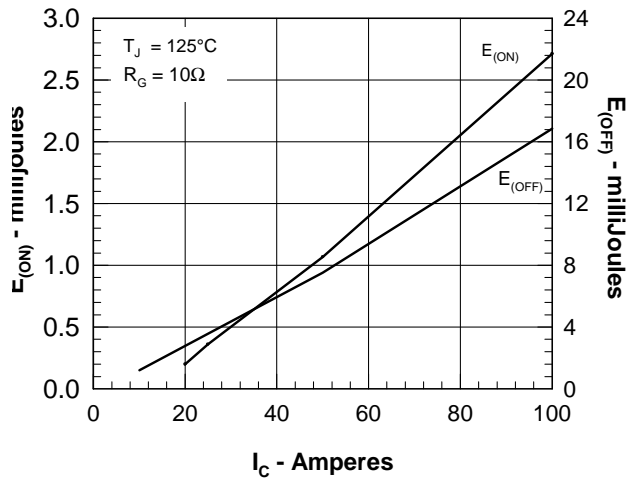


Figure 7. Dependence of  $E_{ON}$  and  $E_{OFF}$  on  $I_C$ .

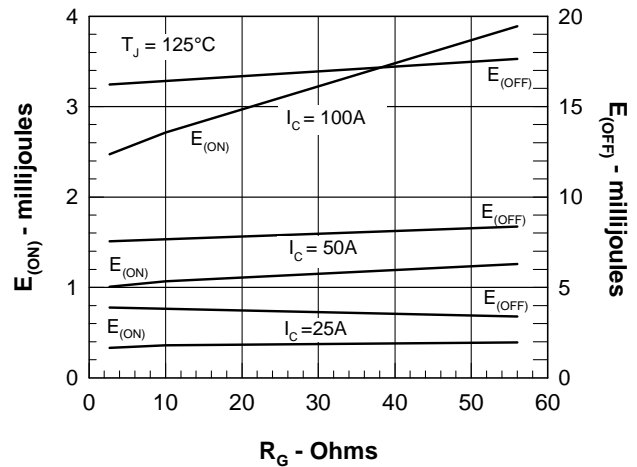


Figure 8. Dependence of  $E_{ON}$  and  $E_{OFF}$  on  $R_G$ .

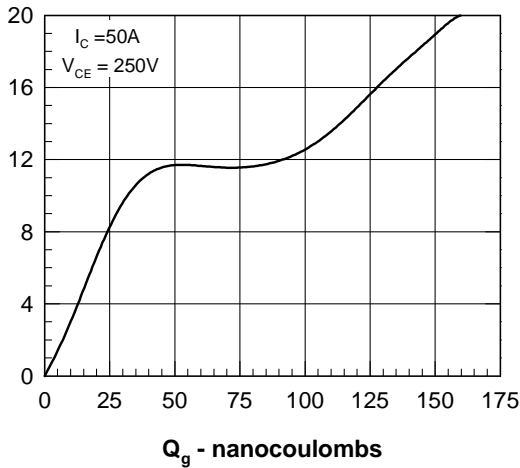


Figure 9. Gate Charge

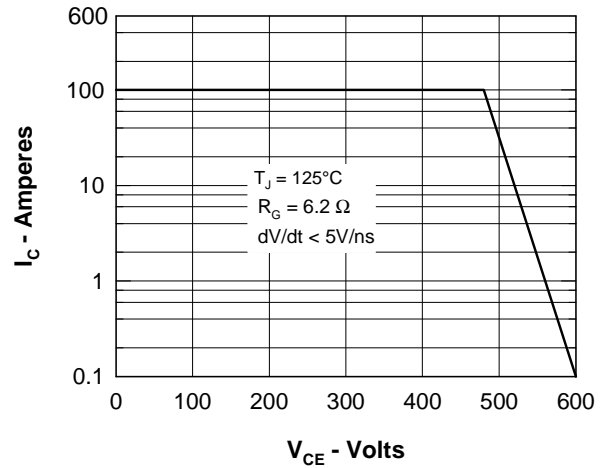


Figure 10. Turn-off Safe Operating Area

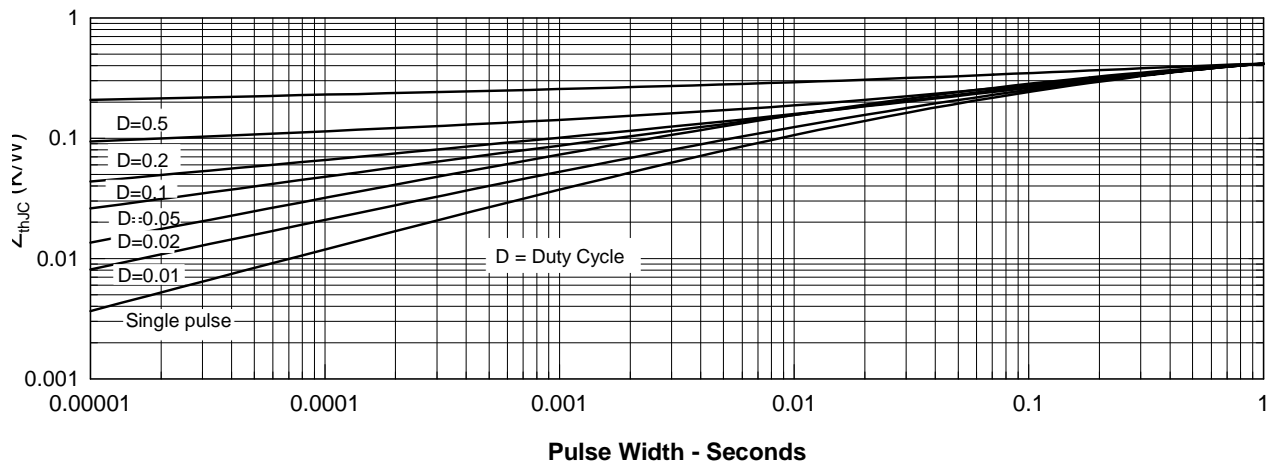


Figure 11. Transient Thermal Resistance