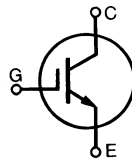


# Low $V_{CE(sat)}$ IGBT

**IXSH 45N100**  
**IXSM 45N100**

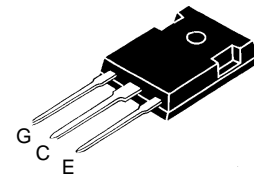
$V_{CES} = 1000\text{ V}$   
 $I_{C25} = 75\text{ A}$   
 $V_{CE(sat)} = 2.7\text{ V}$

## Short Circuit SOA Capability

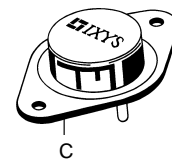


| Symbol  | Test Conditions   | Maximum Ratings                  |                  |
|---|---|----------------------------------|------------------|
| $V_{CES}$   | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$   | 1000                             | V                |
| $V_{CGR}$   | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ ; $R_{GE} = 1\text{ M}\Omega$   | 1000                             | V                |
| $V_{GES}$   | Continuous  | $\pm 20$                         | V                |
| $V_{GEM}$   | Transient   | $\pm 30$                         | V                |
| $I_{C25}$   | $T_C = 25^\circ\text{C}$  | 75                               | A                |
| $I_{C90}$   | $T_C = 90^\circ\text{C}$  | 45                               | A                |
| $I_{CM}$  | $T_C = 25^\circ\text{C}$ , 1 ms   | 180                              | A                |
| <b>SSOA (RBSOA)</b>   | $V_{GE} = 15\text{ V}$ , $T_J = 125^\circ\text{C}$ , $R_G = 2.7\ \Omega$<br>Clamped inductive load, $L = 30\ \mu\text{H}$ | $I_{CM} = 90$<br>@ $0.8 V_{CES}$ | A                |
| <b><math>t_{SC}</math> (SCSOA)</b>  | $V_{GE} = 15\text{ V}$ , $V_{CE} = 0.6 \cdot V_{CES}$ , $T_J = 125^\circ\text{C}$<br>$R_G = 22\ \Omega$ , non repetitive  | 10                               | $\mu\text{s}$    |
| $P_C$   | $T_C = 25^\circ\text{C}$  | 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   | 1.13/10                          | Nm/lb.in.        |
| <b>Weight</b>   |   | TO-204 = 18 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 (IXSH)



TO-204 AE (IXSM)



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

### Features

- International standard packages
- Guaranteed Short Circuit SOA capability
- Low  $V_{CE(sat)}$ 
  - for low on-state conduction losses
- High current handling capability
- MOS Gate turn-on
  - drive simplicity

### Applications

- AC motor speed control
- Uninterruptible power supplies (UPS)
- Welding

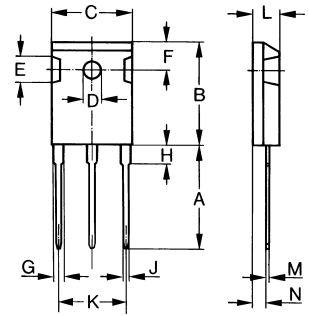
### Advantages

- Easy to mount with 1 screw (TO-247) (isolated mounting screw hole)
- High power density

| Symbol        | Test Conditions                                       | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                     |
|---------------|---|---|------|---------------------|
|               |   | min.  | typ. | max.                |
| $BV_{CES}$    | $I_C = 3\text{ mA}$ , $V_{GE} = 0\text{ V}$           | 1000  |      | V                   |
| $V_{GE(th)}$  | $I_C = 4\text{ mA}$ , $V_{CE} = V_{GE}$               | 5   |      | V                   |
| $I_{CES}$     | $V_{CE} = 0.8 \cdot V_{CES}$<br>$V_{GE} = 0\text{ V}$ | $T_J = 25^\circ\text{C}$  |      | 250 $\mu\text{A}$   |
|               |   | $T_J = 125^\circ\text{C}$   |      | 1 mA                |
| $I_{GES}$     | $V_{CE} = 0\text{ V}$ , $V_{GE} = \pm 20\text{ V}$    |   |      | $\pm 100\text{ nA}$ |
| $V_{CE(sat)}$ | $I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$              |   |      | 2.7 V               |

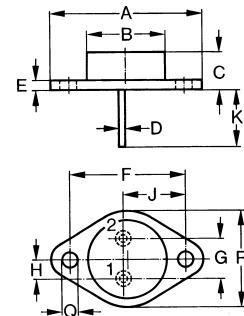
| Symbol       | Test Conditions  | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |      |     |
|--------------|--|---|------|------|-----|
|              |  | min.  | typ. | max. |     |
| $g_{fs}$     | $I_C = I_{C90}$ ; $V_{CE} = 10\text{ V}$ ,<br>Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $d \leq 2\%$  | 20  | 25   | S    |     |
| $I_{C(on)}$  | $V_{GE} = 15\text{ V}$ , $V_{CE} = 10\text{ V}$  |   | 195  | A    |     |
| $C_{ies}$    | $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 1\text{ MHz}$  |   | 4150 | pF   |     |
| $C_{oes}$    |  |   | 300  | pF   |     |
| $C_{res}$    |  |   | 60   | pF   |     |
| $Q_g$        | $I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $V_{CE} = 0.5 V_{CES}$  |   | 165  | 260  | nC  |
| $Q_{ge}$     |  |   | 40   | 60   | nC  |
| $Q_{gc}$     |  |   | 80   | 200  | nC  |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $L = 100\ \mu\text{H}$<br>$V_{CE} = 0.8 V_{CES}$ , $R_G = 2.7\ \Omega$<br>Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$ , higher $T_J$ or increased $R_G$  |   | 80   | ns   |     |
| $t_{ri}$     |  |   | 150  | ns   |     |
| $t_{d(off)}$ |  |   | 400  | ns   |     |
| $t_{fi}$     |  |   | 1000 | 1500 | ns  |
| $E_{off}$    |  |   | 15   |      | mJ  |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b><br>$I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $L = 100\ \mu\text{H}$<br>$V_{CE} = 0.8 V_{CES}$ , $R_G = 2.7\ \Omega$<br>Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$ , higher $T_J$ or increased $R_G$ |   | 100  | ns   |     |
| $t_{ri}$     |  |   | 300  | ns   |     |
| $E_{on}$     |  |   | 5.4  |      | mJ  |
| $t_{d(off)}$ |  |   | 550  | 900  | ns  |
| $t_{fi}$     |  |   | 2200 | 2900 | ns  |
| $E_{off}$    |  | 25  |      | mJ   |     |
| $R_{thJC}$   |  |   |      | 0.42 | K/W |
| $R_{thCK}$   |  |   |      | 0.25 | K/W |

### TO-247 AD (IXSH) Outline

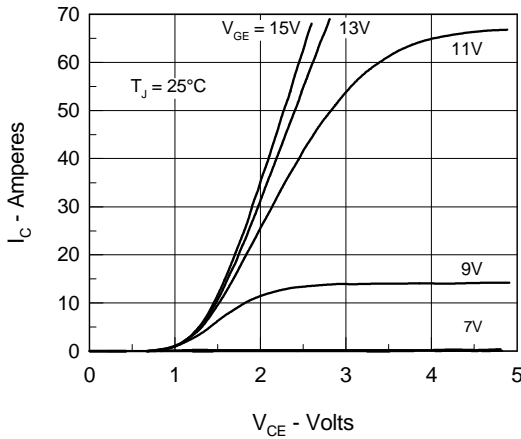
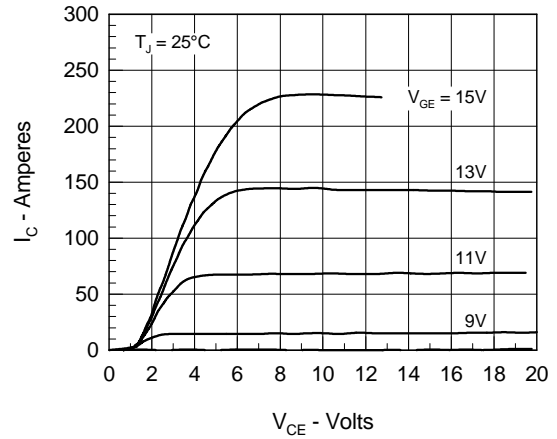
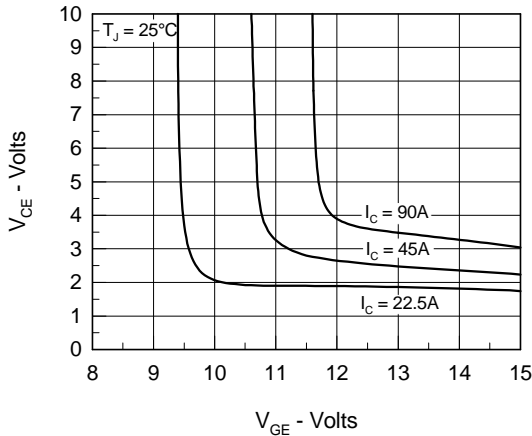
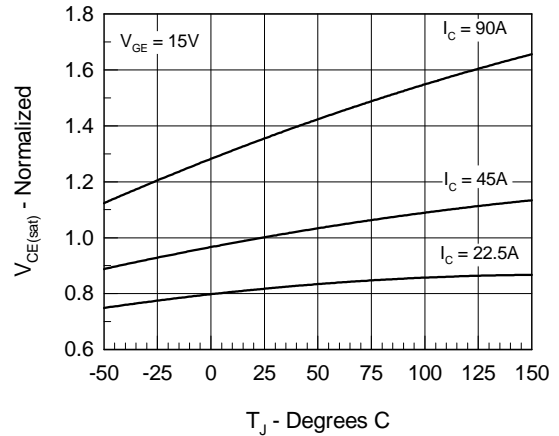
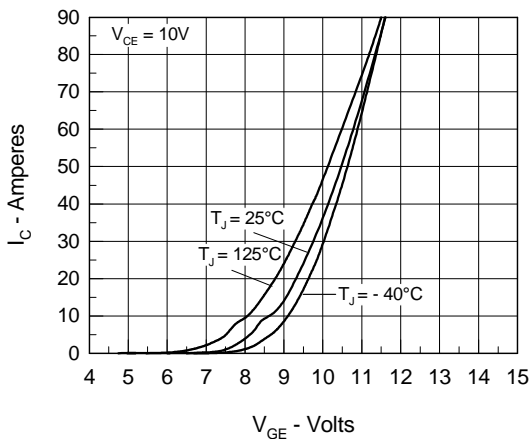
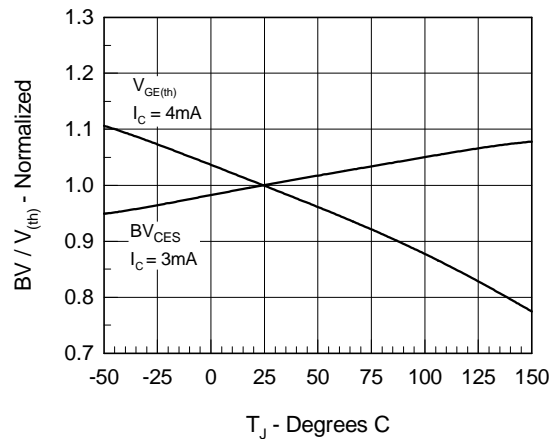


| Dim. | Millimeter |       | Inches |       |
|------|------------|-------|--------|-------|
|      | Min.       | Max.  | Min.   | Max.  |
| A    | 19.81      | 20.32 | 0.780  | 0.800 |
| B    | 20.80      | 21.46 | 0.819  | 0.845 |
| C    | 15.75      | 16.26 | 0.610  | 0.640 |
| D    | 3.55       | 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 |

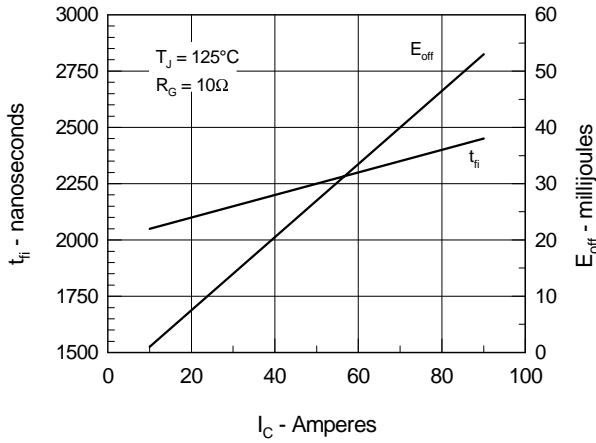
### TO-204 AE (IXSM) Outline



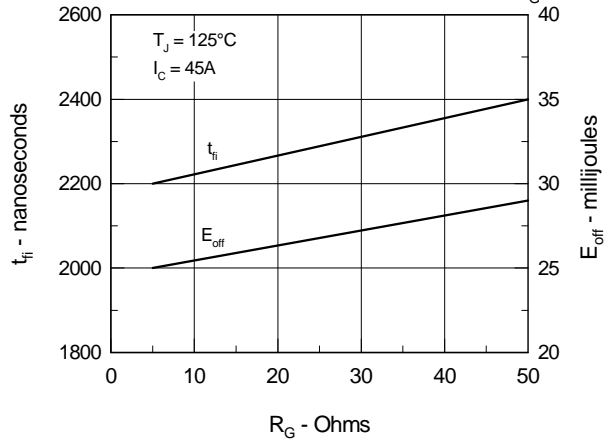
| Dim. | Millimeter |       | Inches |       |
|------|------------|-------|--------|-------|
|      | Min.       | Max.  | Min.   | Max.  |
| A    | 38.61      | 39.12 | 1.520  | 1.540 |
| B    | -          | 22.22 | -      | 0.875 |
| C    | 6.40       | 11.40 | 0.252  | 0.449 |
| D    | 1.45       | 1.60  | 0.057  | 0.063 |
| E    | 1.52       | 3.43  | 0.060  | 0.135 |
| F    | 30.15      | BSC   | 1.187  | BSC   |
| G    | 10.67      | 11.17 | 0.420  | 0.440 |
| H    | 5.21       | 5.71  | 0.205  | 0.225 |
| J    | 16.64      | 17.14 | 0.655  | 0.675 |
| K    | 11.18      | 12.19 | 0.440  | 0.480 |
| Q    | 3.84       | 4.19  | 0.151  | 0.165 |
| R    | 25.16      | 26.66 | 0.991  | 1.050 |

**Fig.1 Saturation Characteristics**

**Fig.2 Output Characteristics**

**Fig.3 Collector-Emitter Voltage vs. Gate-Emitter Voltage**

**Fig.4 Temperature Dependence of Output Saturation Voltage**

**Fig.5 Input Admittance**

**Fig.6 Temperature Dependence of Breakdown and Threshold Voltage**


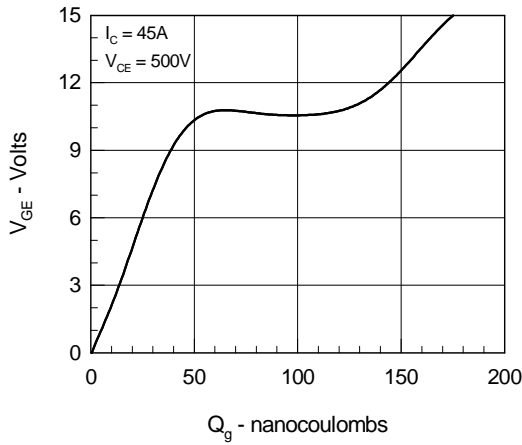
**Fig.7 Turn-Off Energy per Pulse and Fall Time on Collector Current**



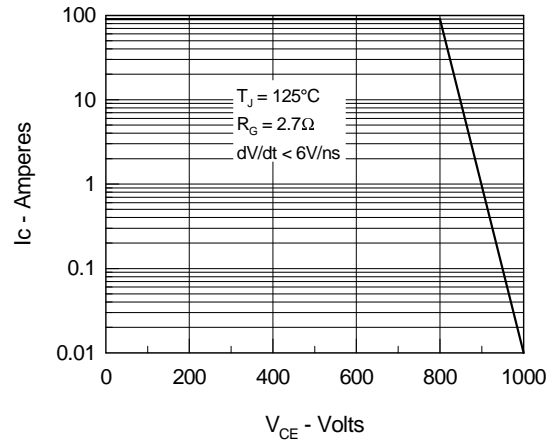
**Fig.8 Dependence of Turn-Off Energy Per Pulse and Fall Time on  $R_G$**



**Fig.9 Gate Charge Characteristic Curve**



**Fig.10 Turn-Off Safe Operating Area**



**Fig.11 Transient Thermal Impedance**

