

# IGBT with optional Diode

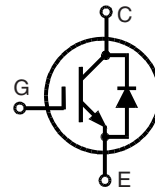
$V_{CES} = 600 \text{ V}$   
 $I_{C25} = 60 \text{ A}$   
 $V_{CE(sat) \text{ typ}} = 2.1 \text{ V}$

High Speed,  
Low Saturation Voltage

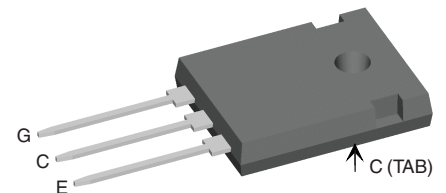
### Replacements:

IXXH30N60B3D1 / IXYP30N65B3D1

IXXH30N65B4D1 / IXXH30N65B4D1



TO-247 AD



Gate, Emitter, Collector, TAB = Collector

| Symbol                                 | Conditions  | Maximum Ratings                       |                  |
|--|---|---------------------------------------|------------------|
| $V_{CES}$                              | $T_J = 25^\circ\text{C to } 150^\circ\text{C}$  | 600                                   | V                |
| $V_{CGR}$                              | $T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 20 \text{ k}\Omega$   | 600                                   | V                |
| $V_{GES}$                              | Continuous  | $\pm 20$                              | V                |
| $V_{GEM}$                              | Transient   | $\pm 30$                              | V                |
| $I_{C25}$                              | $T_C = 25^\circ\text{C}$  | 60                                    | A                |
| $I_{C90}$                              | $T_C = 90^\circ\text{C}$  | 35                                    | A                |
| $I_{CM}$                               | $T_C = 90^\circ\text{C}, t_p = 1 \text{ ms}$  | 70                                    | A                |
| <b>RBSOA</b>                           | $V_{GE} = \pm 15 \text{ V}, T_J = 125^\circ\text{C}, R_G = 10 \Omega$<br>Clamped inductive load, $L = 30 \mu\text{H}$ | $I_{CM} = 110$<br>$V_{CEK} < V_{CES}$ | A                |
| <b><math>t_{SC}</math><br/>(SCSOA)</b> | $V_{GE} = \pm 15 \text{ V}, V_{CE} = 600 \text{ V}, T_J = 125^\circ\text{C}$<br>$R_G = 10 \Omega$ , non repetitive    | 10                                    | $\mu\text{s}$    |
| $P_C$                                  | $T_C = 25^\circ\text{C}$  | IGBT                                  | 250 W            |
|  |   | Diode                                 | 80 W             |
| $T_J$                                  |   | -55 ... +150                          | $^\circ\text{C}$ |
| $T_{stg}$                              |   | -40 ... +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   | TO-220                                | 0.4 - 0.6 Nm     |
|  |   | TO-247                                | 0.8 - 1.2 Nm     |
| <b>Weight</b>                          |   | 6                                     | g                |

### Features

- NPT IGBT technology
- low switching losses
- low tail current
- no latch up
- short circuit capability
- positive temperature coefficient for easy paralleling
- MOS input, voltage controlled
- optional ultra fast diode
- International standard package

### Advantages

- Space savings
- High power density

### Typical Applications

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

| Symbol        | Conditions  | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                      |
|---------------|---|---|------|----------------------|
|               |   | min.  | typ. | max.                 |
| $V_{(BR)CES}$ | $V_{GE} = 0 \text{ V}$                            | 600   |      | V                    |
| $V_{GE(th)}$  | $I_C = 0.7 \text{ mA}, V_{CE} = V_{GE}$           | 3   |      | V                    |
| $I_{CES}$     | $V_{CE} = V_{CES}$                                | $T_J = 25^\circ\text{C}$  |      | 0.1 mA               |
|               |   | $T_J = 125^\circ\text{C}$   | 1    | mA                   |
| $I_{GES}$     | $V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$ |   |      | $\pm 500 \text{ nA}$ |
| $V_{CE(sat)}$ | $I_C = 35 \text{ A}, V_{GE} = 15 \text{ V}$       | 2.2   | 2.7  | V                    |

IXYS reserves the right to change limits, test conditions and dimensions.

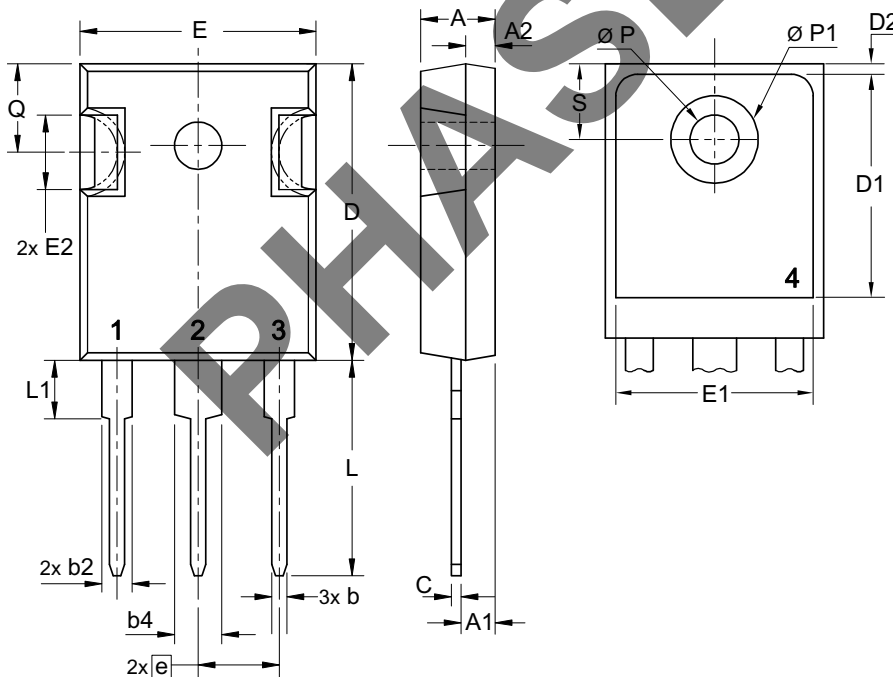
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| Symbol              | Conditions  | Characteristic Values                               |      |         |
|---------------------|---|---|------|---------|
|                     |   | (T <sub>J</sub> = 25°C, unless otherwise specified) |      |         |
|                     |   | min.  | typ. | max.    |
| C <sub>ies</sub>    | V <sub>CE</sub> = 25 V, V <sub>GE</sub> = 0 V, f = 1 MHz  |   | 1600 | pF      |
| C <sub>oes</sub>    |   |   | 150  | pF      |
| C <sub>res</sub>    |   |   | 90   | pF      |
| Q <sub>g</sub>      | I <sub>C</sub> = 35 A, V <sub>GE</sub> = 15 V, V <sub>CE</sub> = 480 V  |   | 120  | nC      |
| t <sub>d(on)</sub>  | Inductive load, T <sub>J</sub> = 125°C<br>I <sub>C</sub> = 35 A, V <sub>GE</sub> = ±15 V,<br>V <sub>CE</sub> = 300 V, R <sub>G</sub> = 10 Ω |   | 30   | ns      |
| t <sub>r</sub>      |   |   | 45   | ns      |
| t <sub>d(off)</sub> |   |   | 320  | ns      |
| t <sub>f</sub>      |   |   | 70   | ns      |
| E <sub>on</sub>     |   |   | 1.6  | mJ      |
| E <sub>off</sub>    |   |   | 0.8  | mJ      |
| R <sub>thJC</sub>   |   |   |      | 0.5 K/W |
| R <sub>thCH</sub>   | TO 247 Package with heatsink compound   | 0.25  |      | K/W     |
| R <sub>thCH</sub>   | TO 220 Package with heatsink compound   | 0.5   |      | K/W     |

**Reverse Diode (FRED) [D1 version only]**

(T<sub>J</sub> = 25°C, unless otherwise specified)

| Symbol            | Conditions  | Characteristic Values |      |         |
|-------------------|---|-----------------------|------|---------|
|                   |   | min.                  | typ. | max.    |
| V <sub>F</sub>    | I <sub>F</sub> = 35 A, V <sub>GE</sub> = 0 V  | 2.1                   | 2.4  | V       |
|                   | I <sub>F</sub> = 35 A, V <sub>GE</sub> = 0 V, T <sub>J</sub> = 125°C                                | 1.6                   |      | V       |
| I <sub>F</sub>    | T <sub>C</sub> = 25°C   |                       |      | 45 A    |
|                   | T <sub>C</sub> = 90°C   |                       |      | 25 A    |
| I <sub>RM</sub>   | I <sub>F</sub> = 15 A, -di <sub>F</sub> /dt = 400 A/μs, V <sub>R</sub> = 300 V                      | 13                    |      | A       |
| t <sub>rr</sub>   | V <sub>GE</sub> = 0 V, T <sub>J</sub> = 125°C   | 90                    |      | ns      |
| t <sub>rr</sub>   | I <sub>F</sub> = 1 A, -di <sub>F</sub> /dt = 100 A/μs, V <sub>R</sub> = 30 V, V <sub>GE</sub> = 0 V | 40                    |      | ns      |
| R <sub>thJC</sub> |   |                       |      | 1.6 K/W |


**TO-247 AD Outline**

| Sym. | Inches    |       | Millimeter |       |
|------|-----------|-------|------------|-------|
|      | min.      | max.  | min.       | max.  |
| A    | 0.185     | 0.209 | 4.70       | 5.30  |
| A1   | 0.087     | 0.102 | 2.21       | 2.59  |
| A2   | 0.059     | 0.098 | 1.50       | 2.49  |
| D    | 0.819     | 0.845 | 20.79      | 21.45 |
| E    | 0.610     | 0.640 | 15.48      | 16.24 |
| E2   | 0.170     | 0.216 | 4.31       | 5.48  |
| e    | 0.215 BSC |       | 5.46 BSC   |       |
| L    | 0.780     | 0.800 | 19.80      | 20.30 |
| L1   | -         | 0.177 | -          | 4.49  |
| Ø P  | 0.140     | 0.144 | 3.55       | 3.65  |
| Q    | 0.212     | 0.244 | 5.38       | 6.19  |
| S    | 0.242 BSC |       | 6.14 BSC   |       |
| b    | 0.039     | 0.055 | 0.99       | 1.40  |
| b2   | 0.065     | 0.094 | 1.65       | 2.39  |
| b4   | 0.102     | 0.135 | 2.59       | 3.43  |
| c    | 0.015     | 0.035 | 0.38       | 0.89  |
| D1   | 0.515     | -     | 13.07      | -     |
| D2   | 0.020     | 0.053 | 0.51       | 1.35  |
| E1   | 0.530     | -     | 13.45      | -     |
| Ø P1 | -         | 0.29  | -          | 7.39  |

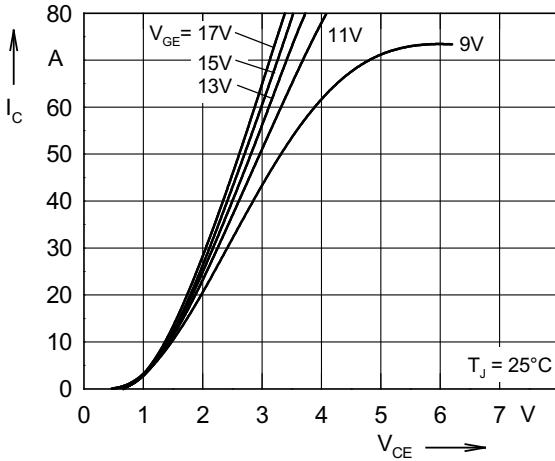


Fig. 1 Typ. output characteristics

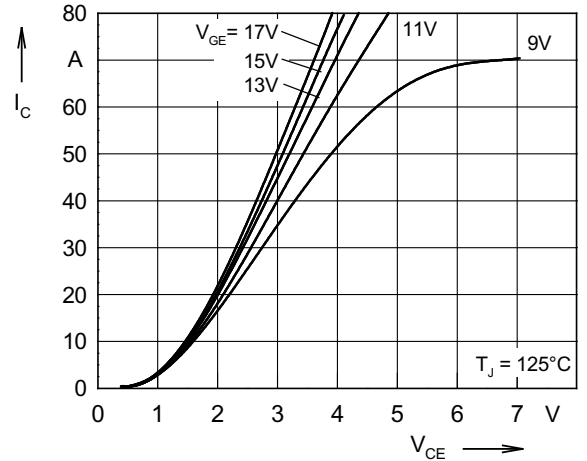


Fig. 2 Typ. output characteristics

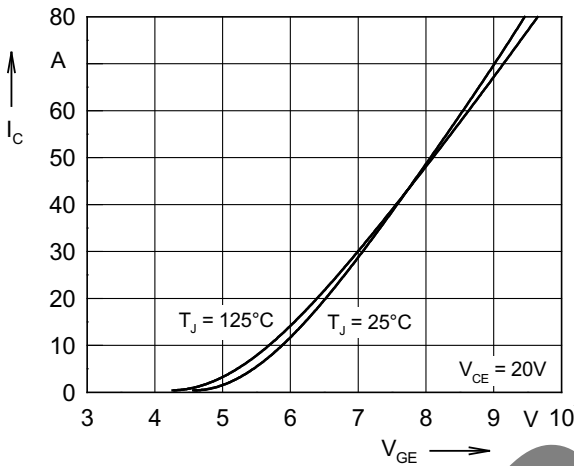


Fig. 3 Typ. transfer characteristics

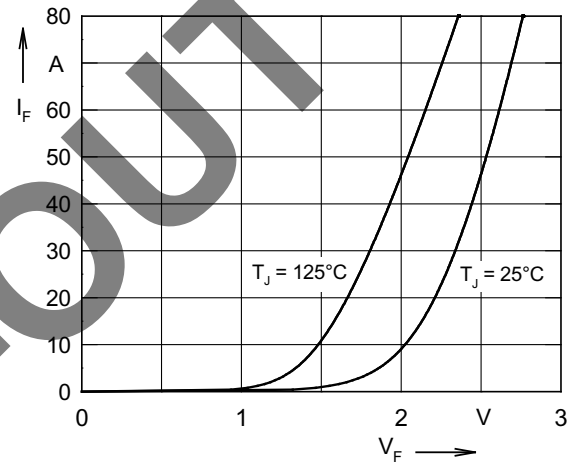


Fig. 4 Typ. forward characteristics of free wheeling diode

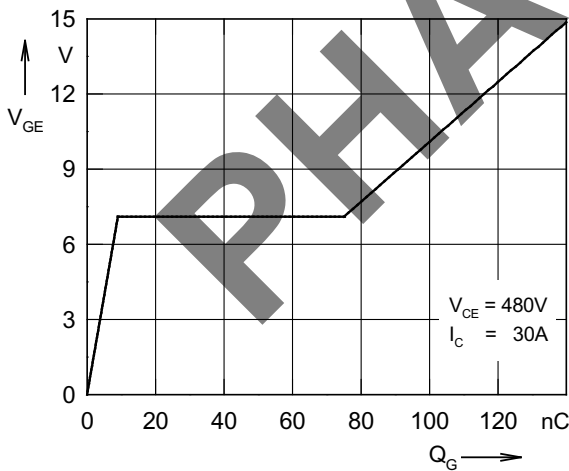


Fig. 5 Typ. turn on gate charge

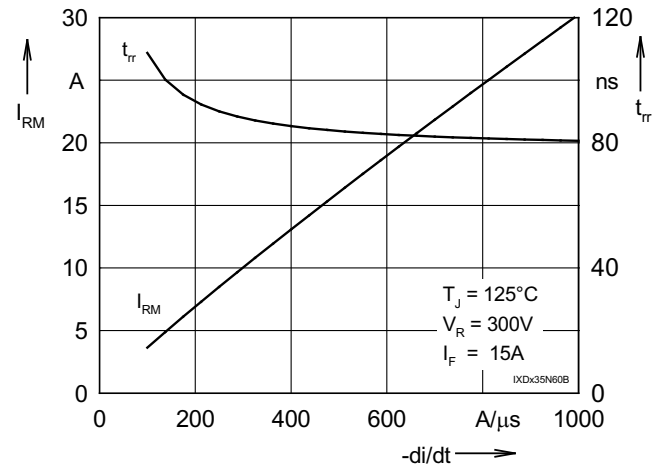


Fig. 6 Typ. turn off characteristics of free wheeling diode

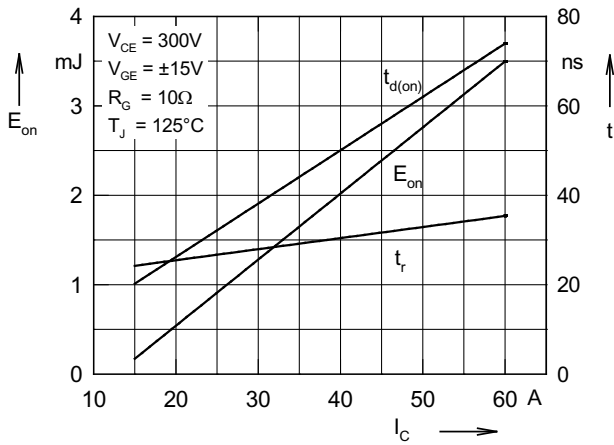


Fig. 7 Typ. turn on energy and switching times versus collector current

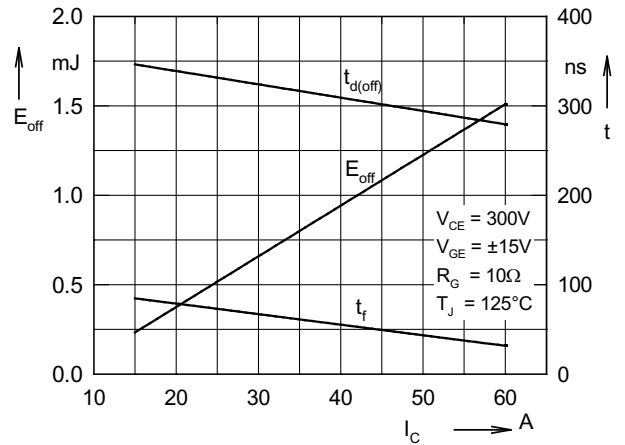


Fig. 8 Typ. turn off energy and switching times versus collector current

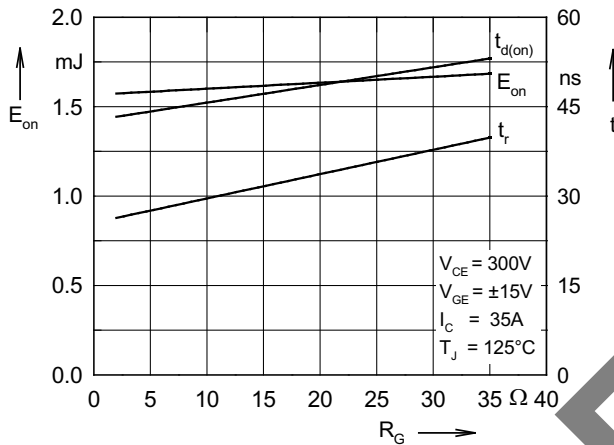


Fig. 9 Typ. turn on energy and switching times versus gate resistor

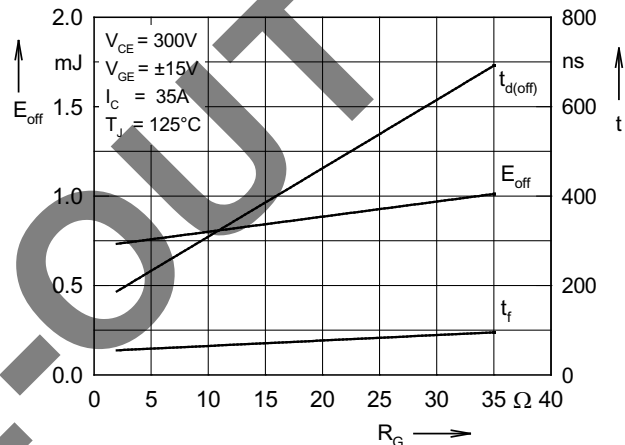


Fig. 10 Typ. turn off energy and switching times versus gate resistor

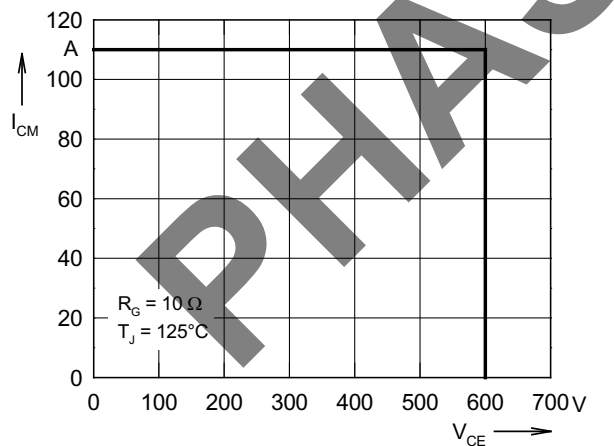


Fig. 11 Reverse biased safe operating area RBSOA

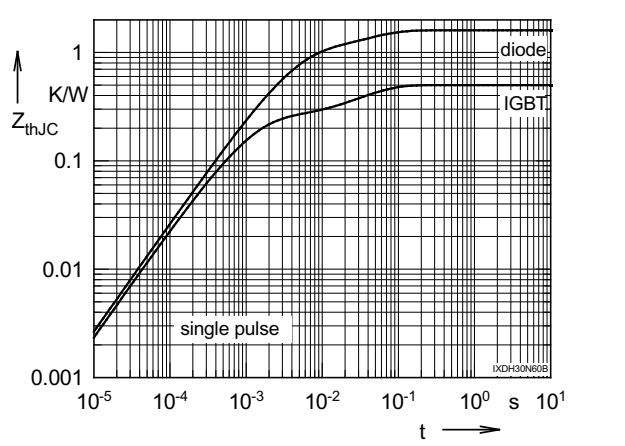


Fig. 12 Typ. transient thermal impedance