The Bourns® Model BIDNW30N60H3 IGBT device combines technology from a MOS gate and a bipolar transistor, resulting in an optimum component for high voltage and high current applications. This device uses Trench-Gate Field-Stop technology providing greater control of dynamic characteristics while resulting in a lower Collector-Emitter Saturation Voltage ($V_{CE(sat)}$) and fewer switching losses.

**Maximum Electrical Ratings ($T_C = 25 \, ^\circ C$, unless otherwise specified)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-Emitter Voltage</td>
<td>$V_{CES}$</td>
<td>600</td>
<td>V</td>
</tr>
<tr>
<td>Continuous Collector Current ($T_C = 25 , ^\circ C$), limited by $T_{j\text{max}}$</td>
<td>$I_C$</td>
<td>60</td>
<td>A</td>
</tr>
<tr>
<td>Continuous Collector Current ($T_C = 100 , ^\circ C$), limited by $T_{j\text{max}}$</td>
<td>$I_C$</td>
<td>30</td>
<td>A</td>
</tr>
<tr>
<td>Pulsed Collector Current, $t_p$ limited by $T_{j\text{max}}$</td>
<td>$I_{CP}$</td>
<td>120</td>
<td>A</td>
</tr>
<tr>
<td>Gate-Emitter Voltage</td>
<td>$V_{GE}$</td>
<td>$\pm$20</td>
<td>V</td>
</tr>
<tr>
<td>Continuous Forward Current ($T_C = 100 , ^\circ C$), limited by $T_{j\text{max}}$</td>
<td>$I_F$</td>
<td>12</td>
<td>A</td>
</tr>
<tr>
<td>Total Power Dissipation</td>
<td>$P_{total}$</td>
<td>230</td>
<td>W</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>$T_{STG}$</td>
<td>-55 to +150</td>
<td>$^\circ C$</td>
</tr>
<tr>
<td>Operating Junction Temperature</td>
<td>$T_j$</td>
<td>-55 to +150</td>
<td>$^\circ C$</td>
</tr>
</tbody>
</table>

**Thermal Resistance**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGBT Thermal Resistance Junction - Case</td>
<td>$R_{(j-c)}_{\text{IGBT}}$</td>
<td>0.54</td>
<td>$^\circ C/W$</td>
</tr>
<tr>
<td>Diode Thermal Resistance Junction - Case</td>
<td>$R_{(j-c)}_{\text{Diode}}$</td>
<td>1.5</td>
<td>$^\circ C/W$</td>
</tr>
</tbody>
</table>

**Typical Part Marking**

MFR’S TRADEMARK
W30N60H3
YYYYYYY

1ST CHARACTER INDICATES PRODUCTION LINE
2ND CHARACTER INDICATES GRADE
3RD CHARACTER INDICATES YEAR OF MANUFACTURE
4TH CHARACTER INDICATES MONTH OF MANUFACTURE
5TH, 6TH & 7TH CHARACTERS INDICATE SERIAL NO.
(7TH CHARACTER COULD BE OMITTED)

**Internal Circuit**

1 – GATE
2 – COLLECTOR
3 – Emitter

*1 – BUILT-IN FRD
BACK SIDE TAB – COLLECTOR

**WARNING**
Cancer and Reproductive Harm
www.P65Warnings.ca.gov

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# BIDNW30N60H3 Insulated Gate Bipolar Transistor (IGBT)

## Static Electrical Characteristics (TC = 25 °C, Unless Otherwise Specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-Emitter Breakdown Voltage</td>
<td>BV_{CES}</td>
<td>V_{GE} = 0 V, I_C = 250 µA</td>
<td>600</td>
<td>—</td>
</tr>
<tr>
<td>Collector-Emitter Saturation Voltage</td>
<td>V_{CE(sat)}</td>
<td>V_{GE} = 15 V, I_C = 30 A, T_C = 25 °C</td>
<td>—</td>
<td>1.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_{GE} = 15 V, I_C = 30 A, T_C = 125 °C</td>
<td>—</td>
<td>1.9</td>
</tr>
<tr>
<td>Diode Forward On-Voltage</td>
<td>V_F</td>
<td>I_F = 12 A, T_C = 25 °C</td>
<td>—</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I_F = 12 A, T_C = 125 °C</td>
<td>—</td>
<td>1.4</td>
</tr>
<tr>
<td>Gate Threshold Voltage</td>
<td>V_{GE(th)}</td>
<td>V_{CE} = V_{GE}, I_C = 250 µA</td>
<td>4.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Collector Cut-off Current</td>
<td>I_{CES}</td>
<td>V_{GE} = 0 V, V_{CE} = 600 V</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Gate-Emitter Leakage Current</td>
<td>I_{GES}</td>
<td>V_{CE} = 0 V, V_{GE} = ±20 V</td>
<td>400</td>
<td>—</td>
</tr>
</tbody>
</table>

## Dynamic Electrical Characteristics (TC = 25 °C, Unless Otherwise Specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Capacitance</td>
<td>C_{ies}</td>
<td>V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz</td>
<td>—</td>
<td>1780</td>
</tr>
<tr>
<td>Output Capacitance</td>
<td>C_{oes}</td>
<td></td>
<td>—</td>
<td>100</td>
</tr>
<tr>
<td>Reverse Transfer Capacitance</td>
<td>C_{res}</td>
<td></td>
<td>—</td>
<td>32</td>
</tr>
<tr>
<td>Total Gate Charge</td>
<td>Q_g</td>
<td>V_{CE} = 400 V, V_{GE} = 15 V, I_C = 30.0 A</td>
<td>—</td>
<td>76</td>
</tr>
<tr>
<td>Gate-Emitter Charge</td>
<td>Q_{ge}</td>
<td></td>
<td>—</td>
<td>20</td>
</tr>
<tr>
<td>Gate-Collector Charge</td>
<td>Q_{gc}</td>
<td></td>
<td>—</td>
<td>38</td>
</tr>
</tbody>
</table>

## IGBT Switching Characteristics (Inductive Load, TC = 25 °C, unless otherwise specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turn-on Delay Time</td>
<td>t_{d(on)}</td>
<td>V_{CE} = 400 V, V_{GE} = 15 V, I_C = 30.0 A, R_{G} = 10 Ω</td>
<td>—</td>
<td>30</td>
</tr>
<tr>
<td>Current Rise Time</td>
<td>t_r</td>
<td></td>
<td>—</td>
<td>105</td>
</tr>
<tr>
<td>Turn-off Delay Time</td>
<td>t_{d(off)}</td>
<td></td>
<td>—</td>
<td>67</td>
</tr>
<tr>
<td>Current Fall Time</td>
<td>t_f</td>
<td></td>
<td>—</td>
<td>100</td>
</tr>
<tr>
<td>Turn-on Switching Energy</td>
<td>E_{on}</td>
<td></td>
<td>—</td>
<td>1.85</td>
</tr>
<tr>
<td>Turn-off Switching Energy</td>
<td>E_{off}</td>
<td></td>
<td>0.45</td>
<td>—</td>
</tr>
<tr>
<td>Total Switching Energy</td>
<td>E_{ts}</td>
<td></td>
<td>2.3</td>
<td>—</td>
</tr>
</tbody>
</table>

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**BIDNW30N60H3 Insulated Gate Bipolar Transistor (IGBT)**

**Diode Switching Characteristics** (\(T_C = 25 \, ^\circ\text{C}\), unless otherwise specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Recovery Time</td>
<td>(t_{rr})</td>
<td>(\frac{dI_F}{dt} = 200 , \text{A/\mu s}) (I_F = 12.0 , \text{A})</td>
<td>— 28 — ns</td>
</tr>
<tr>
<td>Reverse Recovery Charge</td>
<td>(Q_{rr})</td>
<td></td>
<td>— 55 — nC</td>
</tr>
</tbody>
</table>

**Electrical Characteristic Performance**

**Typical Output Characteristics**

- **Common Emitter**
  - \(T_C = 25 \, ^\circ\text{C}\)
  - \(V_{GE} = 9 \, \text{V}\)
  - Collector-emitter Voltage – \(V_{CE}\) (V)
  - Collector Current – \(I_C\) (A)

- **Common Emitter**
  - \(T_C = 125 \, ^\circ\text{C}\)
  - \(V_{GE} = 9 \, \text{V}\)
  - Collector-emitter Voltage – \(V_{CE}\) (V)
  - Collector Current – \(I_C\) (A)

**Typical Saturation Voltage Characteristics**

- **Common Emitter**
  - \(V_{GE} = 15 \, \text{V}\)
  - Collector-emitter Voltage – \(V_{CE}\) (V)
  - Collector Current – \(I_C\) (A)

**Typical Transfer Characteristics**

- **Common Emitter**
  - \(V_{CE} = 10 \, \text{V}\)
  - Gate-emitter Voltage – \(V_{GE}\) (V)
  - Collector Current – \(I_C\) (A)

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BIDNW30N60H3 Insulated Gate Bipolar Transistor (IGBT)

Electrical Characteristic Performance (continued)

**Typical V\textsubscript{CE(sat)} vs V\textsubscript{GE} @ T\textsubscript{C} = 25 °C**

![Graph showing Typical V\textsubscript{CE(sat)} vs V\textsubscript{GE} @ T\textsubscript{C} = 25 °C](image1)

**Typical V\textsubscript{CE(sat)} vs V\textsubscript{GE} @ T\textsubscript{C} = 125 °C**

![Graph showing Typical V\textsubscript{CE(sat)} vs V\textsubscript{GE} @ T\textsubscript{C} = 125 °C](image2)

**Typical V\textsubscript{CE(sat)} vs Case Temperature**

![Graph showing Typical V\textsubscript{CE(sat)} vs Case Temperature](image3)

**Typical Capacitance Characteristics**

![Graph showing Typical Capacitance Characteristics](image4)

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BIDNW30N60H3 Insulated Gate Bipolar Transistor (IGBT)

Electrical Characteristic Performance (continued)

**Typical Gate Charge Characteristic**

![Gate Charge Characteristic Graph]

**Typical Switching Time Characteristics vs IC**

![Switching Time Characteristics vs IC Graph]

**Typical Switching Time Characteristics vs RG**

![Switching Time Characteristics vs RG Graph]

**Typical Switching Loss vs RG**

![Switching Loss vs RG Graph]

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BIDNW30N60H3 Insulated Gate Bipolar Transistor (IGBT)

Electrical Characteristic Performance (continued)

**Typical Switching Loss Characteristics vs I_C**

![Switching Loss vs Collector Current Graph]

**Typical Diode I_F vs V_F**

![Diode Current-Voltage Graph]

**Typical Reverse Recovery Time vs I_F**

![Reverse Recovery Time vs Forward Current Graph]

**Typical Reverse Recovery Charge vs I_F**

![Reverse Recovery Charge vs Forward Current Graph]

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Electrical Characteristic Performance (continued)

IGBT Transient Thermal Impedance vs $t_{p(on)}$ Duration ($D=t_{p}/T$)

Diode Transient Thermal Impedance vs $t_{p(on)}$ Duration ($D=t_{p}/T$)
Electrical Characteristic Performance (continued)

Forward Bias Safe Operating Area

![Graph showing the forward bias safe operating area for the IGBT.](image)

Note:
1. Max. junction temperature: 150 °C
2. Max. reference temperature: 25 °C

Inductive Load Test Circuit

![Diagram of the inductive load test circuit.](image)

L = 1.87 mH, \( V_{CE} = 400 \text{ V} \), \( V_{GE} = 15 \text{ V} \), \( I_C = 30 \text{ A} \), \( R_G = 10 \Omega \)

Environmental Characteristics

ESD Class (HBM).............................................................................2

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BIDNW30N60H3 Insulated Gate Bipolar Transistor (IGBT)

**Product Dimensions**

**Packaging Specifications**

BIDNW30N60H3 ............................................ 30 pieces per tube

**Specifications**

- **Symbol**: A, A1, b, b1, c, D, D1, D2, E, E1, E2, E3, e, L, L1, M, R, R1, Q, S
- **Min.**: 4.90, 2.31, 1.16, 0.59, 20.90, 16.25, 1.05, 15.70, 13.10, 4.40, 1.50, 5.436, 19.80, 0.35, 3.40, 7.00, 5.60, 6.05
- **Nom.**: 5.00, 2.41, 1.26, 0.66, 21.00, 16.55, 1.17, 15.80, 13.30, 4.50, 1.60, 5.00, 19.92, 0.95, 3.50, 7.40, 6.00, 6.15
- **Max.**: 5.10, 2.51, 1.26, 0.66, 21.10, 16.85, 1.35, 15.90, 13.50, 4.60, 1.70, 5.436, 20.10, 0.95, 3.60, 7.40, 6.00, 6.25

**DIMENSIONS:**

- A: 4.90 – 5.10
- A1: 2.31 – 2.51
- b: 1.16 – 1.26
- b1: — 2.25
- c: 0.59 – 0.66
- D: 20.90 – 21.10
- D1: 16.25 – 16.85
- D2: 1.05 – 1.35
- E: 15.70 – 15.90
- E1: 13.10 – 13.50
- E2: 4.40 – 4.60
- E3: 1.50 – 1.70
- e: 5.436
- L: 19.80 – 20.10
- L1: — 4.30
- M: 0.35 – 0.95
- R: 3.40 – 3.60
- R1: 7.00 – 7.40
- Q: 5.60 – 6.00
- S: 6.05 – 6.25

**REV. 08/23**

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