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FGA50N100BNTD
1000 V NPT Trench IGBT

General Description
Using Fairchild’s proprietary trench design and advanced NPT technology, the 1000V NPT IGBT offers superior conduction and switching performances, high avalanche ruggedness and easy parallel operation. This device offers the optimum performance for hard switching application such as UPS, welder applications.

Features
• High Speed Switching
• Low Saturation Voltage : $V_{CE(sat)} = 2.5\, \text{V} @ I_C = 60\, \text{A}$
• High Input Impedance
• Built-in Fast Recovery Diode

Application
UPS, Welder, Induction Heating, Microwave Oven

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Ratings</th>
<th>Unit</th>
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<tbody>
<tr>
<td>$V_{CES}$</td>
<td>Collector-Emitter Voltage</td>
<td>1000</td>
<td>V</td>
</tr>
<tr>
<td>$V_{GES}$</td>
<td>Gate-Emitter Voltage</td>
<td>± 25</td>
<td>V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>Collector Current $\quad @ T_C = 25^\circ\text{C}$</td>
<td>50</td>
<td>A</td>
</tr>
<tr>
<td>$I_{CM(1)}$</td>
<td>Pulsed Collector Current $\quad @ T_C = 25^\circ\text{C}$</td>
<td>100</td>
<td>A</td>
</tr>
<tr>
<td>$I_F$</td>
<td>Diode Continuous Forward Current $\quad @ T_C = 25^\circ\text{C}$</td>
<td>30</td>
<td>A</td>
</tr>
<tr>
<td>$P_D$</td>
<td>Maximum Power Dissipation $\quad @ T_C = 25^\circ\text{C}$</td>
<td>156</td>
<td>W</td>
</tr>
<tr>
<td>$T_J$</td>
<td>Operating Junction Temperature</td>
<td>-55 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>Storage Temperature Range</td>
<td>-55 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>$T_L$</td>
<td>Maximum Lead Temp. for soldering Purposes, 1/8” from case for 5 seconds</td>
<td>300</td>
<td>°C</td>
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Notes:
(1) Repetitive rating : Pulse width limited by max. junction temperature

Thermal Characteristics

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<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
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<td>$R_{UC(IGBT)}$</td>
<td>Thermal Resistance, Junction-to-Case</td>
<td>--</td>
<td>0.8</td>
<td>°C/W</td>
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<tr>
<td>$R_{UC(DIODE)}$</td>
<td>Thermal Resistance, Junction-to-Case</td>
<td>--</td>
<td>2.4</td>
<td>°C/W</td>
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<tr>
<td>$R_{UA}$</td>
<td>Thermal Resistance, Junction-to-Ambient</td>
<td>--</td>
<td>25</td>
<td>°C/W</td>
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### Package Marking and Ordering Information

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<th>Reel Size</th>
<th>Tape Width</th>
<th>Quantity</th>
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<tr>
<td>FGA50N100BNTDTU</td>
<td>FGA50N100BNTD</td>
<td>TO-3P</td>
<td>Rail / Tube</td>
<td>N/A</td>
<td>N/A</td>
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### Electrical Characteristics of IGBT
\( T_C = 25^\circ\text{C} \) unless otherwise noted

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
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<tr>
<td>Off Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>( B_{V_{CE}} )</td>
<td>Collector Emitter Breakdown Voltage</td>
<td>( V_{GE} = 0 ) V, ( I_C = 1 ) mA</td>
<td>1000</td>
<td>--</td>
<td>--</td>
<td>V</td>
</tr>
<tr>
<td>( I_{CES} )</td>
<td>Collector Cut-Off Current</td>
<td>( V_{CE} = 1000 ) V, ( V_{GE} = 0 ) V</td>
<td>--</td>
<td>--</td>
<td>1.0</td>
<td>mA</td>
</tr>
<tr>
<td>( I_{GES} )</td>
<td>G-E Leakage Current</td>
<td>( V_{GE} = \pm 25 ) V, ( V_{CE} = 0 ) V</td>
<td>--</td>
<td>--</td>
<td>( \pm 500 )</td>
<td>nA</td>
</tr>
<tr>
<td>On Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_{GE(th)} )</td>
<td>G-E Threshold Voltage</td>
<td>( I_C = 60 ) mA, ( V_{CE} = V_{GE} )</td>
<td>4.0</td>
<td>5.0</td>
<td>7.0</td>
<td>V</td>
</tr>
<tr>
<td>( V_{CE(sat)} )</td>
<td>Collector to Emitter Saturation Voltage</td>
<td>( I_C = 10 ) A, ( V_{CE} = 15 ) V</td>
<td>--</td>
<td>1.5</td>
<td>1.8</td>
<td>V</td>
</tr>
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<td>Dynamic Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( C_{ies} )</td>
<td>Input Capacitance</td>
<td>( V_{CE} = 10 ) V, ( V_{GE} = 0 ) V</td>
<td>--</td>
<td>6000</td>
<td>--</td>
<td>pF</td>
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<tr>
<td>( C_{oes} )</td>
<td>Output Capacitance</td>
<td>( f = 1 ) MHz</td>
<td>--</td>
<td>260</td>
<td>--</td>
<td>pF</td>
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<tr>
<td>( C_{res} )</td>
<td>Reverse Transfer Capacitance</td>
<td></td>
<td>--</td>
<td>200</td>
<td>--</td>
<td>pF</td>
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<tr>
<td>Switching Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( t_{on} )</td>
<td>Turn-On Delay Time</td>
<td>( V_{CC} = 600 ) V, ( I_C = 60 ) A, ( R_G = 51 ) ( \Omega ), ( V_{GE} = 15 ) V, Resistive Load, ( T_C = 25^\circ\text{C} )</td>
<td>--</td>
<td>140</td>
<td>--</td>
<td>ns</td>
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<tr>
<td>( t_r )</td>
<td>Rise Time</td>
<td></td>
<td>--</td>
<td>320</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>( t_{off} )</td>
<td>Turn-Off Delay Time</td>
<td></td>
<td>--</td>
<td>630</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>( t_f )</td>
<td>Fall Time</td>
<td></td>
<td>--</td>
<td>130</td>
<td>250</td>
<td>ns</td>
</tr>
<tr>
<td>( Q_g )</td>
<td>Total Gate Charge</td>
<td>( V_{GE} = 600 ) V, ( I_C = 60 ) A, ( V_{CE} = 15 ) V, ( T_C = 25^\circ\text{C} )</td>
<td>--</td>
<td>275</td>
<td>350</td>
<td>nC</td>
</tr>
<tr>
<td>( Q_{ge} )</td>
<td>Gate-Emitter Charge</td>
<td></td>
<td>--</td>
<td>45</td>
<td>--</td>
<td>nC</td>
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<tr>
<td>( Q_{gc} )</td>
<td>Gate-Collector Charge</td>
<td></td>
<td>--</td>
<td>95</td>
<td>--</td>
<td>nC</td>
</tr>
<tr>
<td>Electrical Characteristics of DIODE ( T_C = 25^\circ\text{C} ) unless otherwise noted</td>
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</tr>
<tr>
<td>Symbol</td>
<td>Parameter</td>
<td>Test Conditions</td>
<td>Min.</td>
<td>Typ.</td>
<td>Max.</td>
<td>Unit</td>
</tr>
<tr>
<td>( V_{FM} )</td>
<td>Diode Forward Voltage</td>
<td>( I_F = 15 ) A</td>
<td>--</td>
<td>1.2</td>
<td>1.7</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_F = 60 ) A</td>
<td>--</td>
<td>1.8</td>
<td>2.1</td>
<td>V</td>
</tr>
<tr>
<td>( t_{rr} )</td>
<td>Diode Reverse Recovery Time</td>
<td>( I_F = 60 ) A, ( dI_F/dt = 20 ) A/us</td>
<td>--</td>
<td>1.2</td>
<td>1.5</td>
<td>us</td>
</tr>
<tr>
<td>( I_{im} )</td>
<td>Instantaneous Reverse Current</td>
<td>( V_{RRM} = 1000 ) V</td>
<td>--</td>
<td>0.05</td>
<td>2</td>
<td>( \mu A )</td>
</tr>
</tbody>
</table>
Fig 1. Typical Output Characteristics

Fig 2. Typical Saturation Voltage Characteristics

Fig 3. Saturation Voltage vs. Case Temperature at Various Current Levels

Fig 4. Saturation Voltage vs. VGE

Fig 5. Saturation Voltage vs. VGE

Fig 6. Saturation Voltage vs. VGE
**FGA50N100BNTD — 1000 V NPT Trench IGBT**

**Fig 7. Capacitance Characteristics**

![Capacitance Characteristics Graph]

**Common Emitter**
- $V_{CE} = 0 \text{V}$, $f = 1 \text{MHz}$
- $T_J = 25 \degree \text{C}$

**Fig 8. Switching Characteristics vs. Gate Resistance**

![Switching Characteristics Graph]

- $V_{CC} = 600 \text{V}$, $I_C = 60 \text{A}$
- $V_{GE} = \pm 15 \text{V}$
- $T_J = 25 \degree \text{C}$

**Fig 9. Switching Characteristics vs. Collector Current**

![Switching Characteristics Graph]

- $V_{CC} = 600 \text{V}$, $R_L = 10 \text{\Omega}$
- $T_J = 25 \degree \text{C}$

**Fig 10. Gate Charge Characteristics**

![Gate Charge Characteristics Graph]

- $V_{CC} = 600 \text{V}$, $R_g = 51 \text{\Omega}$
- $V_{GE} = \pm 15 \text{V}$
- $T_J = 25 \degree \text{C}$

**Fig 11. SOA Characteristics**

![SOA Characteristics Graph]

- Max DC Operation
- $V_{CE} = 1000 \text{V}$
- $I_C = 50 \text{A}$

**Fig 12. Transient Thermal Impedance of IGBT**

![Transient Thermal Impedance Graph]

- Rectangular Pulse Duration [sec]
- Thermal Response [$Z_{thjc}$]
Fig 13. Forward Characteristics

Fig 14. Reverse Recovery Characteristics vs. di/dt

Fig 15. Reverse Recovery Characteristics vs. Forward Current

Fig 16. Reverse Current vs. Reverse Voltage

Fig 17. Junction capacitance
Figure 18. TO-3P 3L - 3LD, T03, PLASTIC, EIAJ SC-65

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PRODUCT STATUS DEFINITIONS

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<th>Datasheet Identification</th>
<th>Product Status</th>
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<td>Formative / In Design</td>
<td>Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.</td>
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<tr>
<td>Preliminary</td>
<td>First Production</td>
<td>Datasheet contains preliminary data; supplementary data will be published at a later date.</td>
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