FGA25N120ANTDTU
1200 V, 25 A NPT Trench IGBT

Features
• NPT Trench Technology, Positive Temperature Coefficient
• Low Saturation Voltage: $V_{CE(sat), \text{typ}} = 2.0 \text{ V}$
  @ $I_C = 25 \text{ A}$ and $T_C = 25^\circ \text{C}$
• Low Switching Loss: $E_{off, \text{typ}} = 0.96 \text{ mJ}$
  @ $I_C = 25 \text{ A}$ and $T_C = 25^\circ \text{C}$
• Extremely Enhanced Avalanche Capability

Applications
• Induction Heating, Microwave Oven

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CES}$</td>
<td>Collector-Emitter Voltage</td>
<td>1200</td>
<td>V</td>
</tr>
<tr>
<td>$V_{GES}$</td>
<td>Gate-Emitter Voltage</td>
<td>± 20</td>
<td>V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>Collector Current</td>
<td>@ $T_C = 25^\circ \text{C}$</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Collector Current</td>
<td>@ $T_C = 100^\circ \text{C}$</td>
<td>25</td>
</tr>
<tr>
<td>$I_{CM(1)}$</td>
<td>Pulsed Collector Current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_F$</td>
<td>Diode Continuous Forward Current</td>
<td>@ $T_C = 25^\circ \text{C}$</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Diode Continuous Forward Current</td>
<td>@ $T_C = 100^\circ \text{C}$</td>
<td>25</td>
</tr>
<tr>
<td>$I_{FM}$</td>
<td>Diode Maximum Forward Current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P_D$</td>
<td>Maximum Power Dissipation</td>
<td>@ $T_C = 25^\circ \text{C}$</td>
<td>312</td>
</tr>
<tr>
<td></td>
<td>Maximum Power Dissipation</td>
<td>@ $T_C = 100^\circ \text{C}$</td>
<td>125</td>
</tr>
<tr>
<td>$T_J$</td>
<td>Operating Junction Temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_{SLG}$</td>
<td>Storage Temperature Range</td>
<td></td>
<td></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>
</tr>
</tbody>
</table>

Notes:
(1) Repetitive rating: Pulse width limited by max. junction temperature

Thermal Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>$R_{UJC}(\text{IGBT})$</td>
<td>Thermal Resistance, Junction-to-Case</td>
<td>--</td>
<td>0.4</td>
<td>°C/W</td>
</tr>
<tr>
<td>$R_{UJC}(\text{DIODE})$</td>
<td>Thermal Resistance, Junction-to-Case</td>
<td>--</td>
<td>2.0</td>
<td>°C/W</td>
</tr>
<tr>
<td>$R_{UA}$</td>
<td>Thermal Resistance, Junction-to-Ambient</td>
<td>--</td>
<td>40</td>
<td>°C/W</td>
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### Package Marking and Ordering Information

<table>
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<tr>
<th>Part Number</th>
<th>Top Mark</th>
<th>Package</th>
<th>Packing Method</th>
<th>Reel Size</th>
<th>Tape Width</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>FGA25N120ANTDTU_F109</td>
<td>FGA25N120ANTDTU</td>
<td>TO-3PN</td>
<td>Tube</td>
<td>N/A</td>
<td>N/A</td>
<td>30</td>
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### Electrical Characteristics of the IGBT \( T_C = 25^\circ\text{C} \) unless otherwise noted

#### Test Conditions

<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>
</tr>
</thead>
<tbody>
<tr>
<td>( I_{CES} )</td>
<td>Collector Cut-Off Current</td>
<td>( V_{CE} = V_{CES}, V_{GE} = 0 \text{V} )</td>
<td>--</td>
<td>--</td>
<td>3</td>
<td>mA</td>
</tr>
<tr>
<td>( I_{GES} )</td>
<td>G-E Leakage Current</td>
<td>( V_{GE} = V_{GES}, V_{CE} = 0 \text{V} )</td>
<td>--</td>
<td>--</td>
<td>± 250</td>
<td>nA</td>
</tr>
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#### Off Characteristics

<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>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{CE(th)} )</td>
<td>G-E Threshold Voltage</td>
<td>( I_C = 25 \text{mA}, V_{CE} = V_{GE} )</td>
<td>3.5</td>
<td>5.5</td>
<td>7.5</td>
<td>V</td>
</tr>
<tr>
<td>( V_{CE(sat)} )</td>
<td>Collector to Emitter Saturation Voltage</td>
<td>( I_C = 25 \text{A}, V_{GE} = 15 \text{V} )</td>
<td>--</td>
<td>2.0</td>
<td>--</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_C = 25 \text{A}, V_{GE} = 15 \text{V}, T_C = 125^\circ\text{C} )</td>
<td>--</td>
<td>2.15</td>
<td>--</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_C = 50 \text{A}, V_{GE} = 15 \text{V} )</td>
<td>--</td>
<td>2.65</td>
<td>--</td>
<td>V</td>
</tr>
</tbody>
</table>

#### On Characteristics

<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>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{CE(sat)} )</td>
<td>Collector to Emitter Saturation Voltage</td>
<td>( I_C = 25 \text{A}, V_{GE} = 15 \text{V} )</td>
<td>--</td>
<td>2.0</td>
<td>--</td>
<td>V</td>
</tr>
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#### Dynamic Characteristics

<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>
</tr>
</thead>
<tbody>
<tr>
<td>( C_{ies} )</td>
<td>Input Capacitance</td>
<td>( V_{CE} = 30 \text{V}, V_{GE} = 0 \text{V}, f = 1 \text{MHz} )</td>
<td>--</td>
<td>3700</td>
<td>--</td>
<td>pF</td>
</tr>
<tr>
<td>( C_{oes} )</td>
<td>Output Capacitance</td>
<td>( f = 1 \text{MHz} )</td>
<td>--</td>
<td>130</td>
<td>--</td>
<td>pF</td>
</tr>
<tr>
<td>( C_{res} )</td>
<td>Reverse Transfer Capacitance</td>
<td></td>
<td>--</td>
<td>80</td>
<td>--</td>
<td>pF</td>
</tr>
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</table>

#### Switching Characteristics

<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>
</tr>
</thead>
<tbody>
<tr>
<td>( t_{(on)} )</td>
<td>Turn-On Delay Time</td>
<td>( V_{CC} = 600 \text{V}, I_C = 25 \text{A}, R_G = 10 \text{\Omega}, V_{GE} = 15 \text{V}, \text{Inductive Load}, T_C = 25^\circ\text{C} )</td>
<td>--</td>
<td>50</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>( t_r )</td>
<td>Rise Time</td>
<td></td>
<td>--</td>
<td>60</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>( t_{(off)} )</td>
<td>Turn-Off Delay Time</td>
<td>( V_{CC} = 600 \text{V}, I_C = 25 \text{A}, R_G = 10 \text{\Omega}, V_{GE} = 15 \text{V}, \text{Inductive Load}, T_C = 125^\circ\text{C} )</td>
<td>--</td>
<td>190</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>( t_f )</td>
<td>Fall Time</td>
<td></td>
<td>--</td>
<td>100</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>( E_{on} )</td>
<td>Turn-On Switching Loss</td>
<td></td>
<td>--</td>
<td>4.1</td>
<td>--</td>
<td>mJ</td>
</tr>
<tr>
<td>( E_{off} )</td>
<td>Turn-Off Switching Loss</td>
<td></td>
<td>--</td>
<td>0.96</td>
<td>--</td>
<td>mJ</td>
</tr>
<tr>
<td>( E_{ls} )</td>
<td>Total Switching Loss</td>
<td></td>
<td>--</td>
<td>5.06</td>
<td>--</td>
<td>mJ</td>
</tr>
<tr>
<td>( t_{(on)} )</td>
<td>Turn-On Delay Time</td>
<td>( V_{CC} = 600 \text{V}, I_C = 25 \text{A}, R_G = 10 \text{\Omega}, V_{GE} = 15 \text{V}, \text{Inductive Load}, T_C = 125^\circ\text{C} )</td>
<td>--</td>
<td>50</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>( t_r )</td>
<td>Rise Time</td>
<td></td>
<td>--</td>
<td>60</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>( t_{(off)} )</td>
<td>Turn-Off Delay Time</td>
<td>( V_{CC} = 600 \text{V}, I_C = 25 \text{A}, R_G = 10 \text{\Omega}, V_{GE} = 15 \text{V}, \text{Inductive Load}, T_C = 125^\circ\text{C} )</td>
<td>--</td>
<td>200</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>( t_f )</td>
<td>Fall Time</td>
<td></td>
<td>--</td>
<td>154</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>( E_{on} )</td>
<td>Turn-On Switching Loss</td>
<td></td>
<td>--</td>
<td>4.3</td>
<td>--</td>
<td>mJ</td>
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<tr>
<td>( E_{off} )</td>
<td>Turn-Off Switching Loss</td>
<td></td>
<td>--</td>
<td>1.5</td>
<td>--</td>
<td>mJ</td>
</tr>
<tr>
<td>( E_{ls} )</td>
<td>Total Switching Loss</td>
<td></td>
<td>--</td>
<td>5.8</td>
<td>--</td>
<td>mJ</td>
</tr>
<tr>
<td>( Q_g )</td>
<td>Total Gate Charge</td>
<td>( V_{CE} = 600 \text{V}, I_C = 25 \text{A}, V_{GE} = 15 \text{V} )</td>
<td>--</td>
<td>200</td>
<td>--</td>
<td>nC</td>
</tr>
<tr>
<td>( Q_{ge} )</td>
<td>Gate-Emitter Charge</td>
<td>( V_{CE} = 600 \text{V}, I_C = 25 \text{A}, V_{GE} = 15 \text{V} )</td>
<td>--</td>
<td>15</td>
<td>--</td>
<td>nC</td>
</tr>
<tr>
<td>( Q_{gc} )</td>
<td>Gate-Collector Charge</td>
<td></td>
<td>--</td>
<td>100</td>
<td>--</td>
<td>nC</td>
</tr>
</tbody>
</table>
### Electrical Characteristics of DIODE $T_C = 25°C$ 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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</thead>
<tbody>
<tr>
<td>$V_{FM}$</td>
<td>Diode Forward Voltage</td>
<td>$I_F = 25$ A</td>
<td>$T_C = 25°C$</td>
<td>--</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$T_C = 125°C$</td>
<td>--</td>
<td>2.1</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>$t_{rr}$</td>
<td>Diode Reverse Recovery Time</td>
<td></td>
<td>$T_C = 25°C$</td>
<td>--</td>
<td>235</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$T_C = 125°C$</td>
<td>--</td>
<td>300</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>$I_{rr}$</td>
<td>Diode Peak Reverse Recovery Current</td>
<td>$I_F = 25$ A</td>
<td>$T_C = 25°C$</td>
<td>--</td>
<td>27</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$T_C = 125°C$</td>
<td>--</td>
<td>31</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>$Q_{rr}$</td>
<td>Diode Reverse Recovery Charge</td>
<td>$T_C = 25°C$</td>
<td>--</td>
<td>3130</td>
<td>4700</td>
<td>nC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$T_C = 125°C$</td>
<td>--</td>
<td>4650</td>
<td>--</td>
<td></td>
</tr>
</tbody>
</table>
Typical Performance Characteristics

Figure 1. Typical Output Characteristics

![Figure 1](image1)

Figure 2. Typical Saturation Voltage Characteristics

![Figure 2](image2)

Figure 3. Saturation Voltage vs. Case Temperature at Variant Current Level

![Figure 3](image3)

Figure 4. Saturation Voltage vs. $V_{GE}$

![Figure 4](image4)

Figure 5. Saturation Voltage vs. $V_{GE}$

![Figure 5](image5)

Figure 6. Saturation Voltage vs. $V_{GE}$

![Figure 6](image6)
Typical Performance Characteristics (Continued)

Figure 7. Capacitance Characteristics

![Capacitance Characteristics Graph]

Figure 8. Turn-On Characteristics vs. Gate Resistance

![Turn-On Characteristics Graph]

Figure 9. Turn-Off Characteristics vs. Gate Resistance

![Turn-Off Characteristics Graph]

Figure 10. Switching Loss vs. Gate Resistance

![Switching Loss Graph]

Figure 11. Turn-On Characteristics vs. Collector Current

![Turn-On Characteristics Graph]

Figure 12. Turn-Off Characteristics vs. Collector Current

![Turn-Off Characteristics Graph]
Typical Performance Characteristics (Continued)

Figure 13. Switching Loss vs. Collector Current

- Common Emitter
  - $V_{GE} = \pm 15\,\text{V}$, $R_G = 10\,\Omega$
  - $T_J = 25^\circ\text{C}$
  - $T_J = 125^\circ\text{C}$

Switching Loss [mJ] vs. Collector Current [A]

- GateEmitter Voltage, $V_{GE} = \pm 15\,\text{V}$
- Collector Voltage, $V_{CE} = 600\,\text{V}$
- Collector Voltage, $V_{CE} = 400\,\text{V}$

Figure 14. Gate Charge Characteristics

- Common Emitter
  - $R_G = 24\,\Omega$
  - $T_J = 25^\circ\text{C}$

Gate Charge, $Q_g$ [nC] vs. Collector Current [A]

- Collector - Emitter Voltage, $V_{CE} = 15\,\text{V}$
- Collector - Emitter Voltage, $V_{CE} = 125\,\text{V}$

Figure 15. SOA Characteristics

- Collector Current, $I_{c\,\text{MAX}}$ (Pulsed)
- Collector Current, $I_{c\,\text{MAX}}$ (Continuous)
- Single Nonrepetitive Pulse, $T_p = 25^\circ\text{C}$
- Curves must be derated linearly with increase in temperature

Figure 16. Turn-Off SOA

- Collector Current, $I_{c\,\text{MAX}}$ (Pulsed)
- Collector Current, $I_{c\,\text{MAX}}$ (Continuous)
- Single Nonrepetitive Pulse, $T_p = 25^\circ\text{C}$
- Curves must be derated linearly with increase in temperature

Figure 17. Transient Thermal Impedance of IGBT

- Thermal Response, $Z_{thjc}$ vs. Rectangular Pulse Duration, $t_1$
- Duty Factor, $D = t_1 / t_2$
- Peak $T_j = P_{dm} \times Z_{thjc} + T_C$

Rectangular Pulse Duration [sec] vs. Thermal Response [Zthjc]

- Duty Factor $D = t_1 / t_2$
- Peak $T_j = P_{dm} \times Z_{thjc} + T_C$
Typical Performance Characteristics (Continued)

Figure 18. Forward Characteristics

- Forward Voltage, $V_F$ [V]
- Forward Current, $I_F$ [A]
- $T_J = 25^\circ°C$ and $T_J = 125^\circ°C$
- $dI_F/dt = 100A/\mu s$ and $dI_F/dt = 200A/\mu s$

Figure 19. Reverse Recovery Current

- Reverse Recovery Current, $I_{RR}$ [A]
- $dI_F/dt = 100A/\mu s$ and $dI_F/dt = 200A/\mu s$

Figure 20. Stored Charge

- Stored Recovery Charge, $Q_{rr}$ [nC]
- $dI_F/dt = 100A/\mu s$ and $dI_F/dt = 200A/\mu s$

Figure 21. Reverse Recovery Time

- Reverse Recovery Time, $t_{rr}$ [ns]
- $dI_F/dt = 100A/\mu s$ and $dI_F/dt = 200A/\mu s$
Mechanical Dimensions

Figure 22. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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SignalWise™
SmartMax™
SMART START™
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SuperSOT™-9
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SyncFET™
Sync-Lock™

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Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild’s full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address and warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

<table>
<thead>
<tr>
<th>Datasheet Identification</th>
<th>Product Status</th>
<th>Definition</th>
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<td>Advance Information</td>
<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. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.</td>
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<tr>
<td>No Identification Needed</td>
<td>Full Production</td>
<td>Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.</td>
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<tr>
<td>Obsolete</td>
<td>Not In Production</td>
<td>Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.</td>
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