Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor’s system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.
FGA30N120FTD
1200 V, 30 A Field Stop Trench IGBT

Features
- Field Stop Trench Technology
- High Speed Switching
- Low Saturation Voltage: \( V_{CE(sat)} = 1.6 \text{ V} \) @ \( I_C = 30 \text{ A} \)
- High Input Impedance

Applications
- Solar Inverter, UPS, Welder, PFC

General Description
Using advanced field stop trench technology, Fairchild®'s 1200V trench IGBTs offer superior conduction and switching performances for soft switching applications. The device can operate in parallel configuration with exceptional avalanche ruggedness. This device is designed for induction heating and 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 to Emitter Voltage</td>
<td>1200</td>
<td>V</td>
</tr>
<tr>
<td>( V_{GES} )</td>
<td>Gate to Emitter Voltage</td>
<td>± 25</td>
<td>V</td>
</tr>
<tr>
<td>( I_C )</td>
<td>Collector Current @ ( T_C = 25^\circ\text{C} )</td>
<td>60</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Collector Current @ ( T_C = 100^\circ\text{C} )</td>
<td>30</td>
<td>A</td>
</tr>
<tr>
<td>( I_{CM} )</td>
<td>Pulsed Collector Current @ ( T_C = 25^\circ\text{C} )</td>
<td>90</td>
<td>A</td>
</tr>
<tr>
<td>( I_F )</td>
<td>Diode Continuous Forward Current @ ( T_C = 100^\circ\text{C} )</td>
<td>30</td>
<td>A</td>
</tr>
<tr>
<td>( P_D )</td>
<td>Maximum Power Dissipation @ ( T_C = 25^\circ\text{C} )</td>
<td>339</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td>Maximum Power Dissipation @ ( T_C = 100^\circ\text{C} )</td>
<td>132</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&quot; 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>
</tr>
</thead>
<tbody>
<tr>
<td>( R_{jJC(IGBT)} )</td>
<td>Thermal Resistance, Junction to Case</td>
<td>-</td>
<td>0.38</td>
<td>°C/W</td>
</tr>
<tr>
<td>( R_{jJC(Diode)} )</td>
<td>Thermal Resistance, Junction to Case</td>
<td>-</td>
<td>1.2</td>
<td>°C/W</td>
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### Package Marking and Ordering Information

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<tr>
<th>Device Marking</th>
<th>Device</th>
<th>Package</th>
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<th>Packaging Type</th>
<th>Qty per Tube</th>
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<tr>
<td>FGA30N120FTD</td>
<td>FGA30N120FTDU</td>
<td>TO-3PN</td>
<td>RoHS</td>
<td>Tube</td>
<td>30ea</td>
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For Fairchild's definition of “green” Eco Status, please visit: [http://www.fairchildsemi.com/company/green/rohs_green.html](http://www.fairchildsemi.com/company/green/rohs_green.html).

### Electrical Characteristics of the IGBT

$T_C = 25^\circ C$ unless otherwise noted.

#### 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>$B_{VCES}$</td>
<td>Collector to Emitter Breakdown Voltage</td>
<td>$V_{GE} = 0V, I_C = 250\mu A$</td>
<td>1200</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$I_{CES}$</td>
<td>Collector Cut-Off Current</td>
<td>$V_{CE} = V_{CES}, V_{GE} = 0V$</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>mA</td>
</tr>
<tr>
<td>$I_{GES}$</td>
<td>G-E Leakage Current</td>
<td>$V_{GE} = V_{GES}, V_{CE} = 0V$</td>
<td>-</td>
<td>-</td>
<td>±250</td>
<td>nA</td>
</tr>
</tbody>
</table>

#### On Characteristics

<table>
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<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>$V_{GE(th)}$</td>
<td>G-E Threshold Voltage</td>
<td>$I_C = 30mA, V_{CE} = V_{GE}$</td>
<td>3.5</td>
<td>6</td>
<td>7.5</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CE(sat)}$</td>
<td>Collector to Emitter Saturation Voltage</td>
<td>$I_C = 30A, V_{GE} = 15V$</td>
<td>-</td>
<td>1.6</td>
<td>2</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = 30A, V_{GE} = 15V, T_C = 125^\circ C$</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>V</td>
</tr>
</tbody>
</table>

#### Dynamic Characteristics

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<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>$V_{CE} = 30V, V_{GE} = 0V, f = 1MHz$</td>
<td>-</td>
<td>5140</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>$C_{ces}$</td>
<td>Output Capacitance</td>
<td></td>
<td>-</td>
<td>150</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>$C_{res}$</td>
<td>Reverse Transfer Capacitance</td>
<td></td>
<td>-</td>
<td>95</td>
<td>-</td>
<td>pF</td>
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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>$t_{d(on)}$</td>
<td>Turn-On Delay Time</td>
<td>$V_{CC} = 600V, I_C = 30A, R_G = 10\Omega, V_{GE} = 15V, Resistive Load, T_C = 25^\circ C$</td>
<td>-</td>
<td>31</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_r$</td>
<td>Rise Time</td>
<td></td>
<td>-</td>
<td>101</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_{d(off)}$</td>
<td>Turn-Off Delay Time</td>
<td>$V_{CC} = 600V, I_C = 30A, R_G = 10\Omega, V_{GE} = 15V, Resistive Load, T_C = 25^\circ C$</td>
<td>-</td>
<td>198</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_f$</td>
<td>Fall Time</td>
<td></td>
<td>-</td>
<td>259</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$E_{on}$</td>
<td>Turn-On Switching Loss</td>
<td></td>
<td>-</td>
<td>0.54</td>
<td>-</td>
<td>mJ</td>
</tr>
<tr>
<td>$E_{off}$</td>
<td>Turn-Off Switching Loss</td>
<td></td>
<td>-</td>
<td>1.16</td>
<td>1.51</td>
<td>mJ</td>
</tr>
<tr>
<td>$E_{gs}$</td>
<td>Total Switching Loss</td>
<td></td>
<td>-</td>
<td>1.70</td>
<td>-</td>
<td>mJ</td>
</tr>
<tr>
<td>$t_{d(on)}$</td>
<td>Turn-On Delay Time</td>
<td></td>
<td>-</td>
<td>40</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_r$</td>
<td>Rise Time</td>
<td></td>
<td>-</td>
<td>127</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_{d(off)}$</td>
<td>Turn-Off Delay Time</td>
<td>$V_{CC} = 600V, I_C = 30A, R_G = 10\Omega, V_{GE} = 15V, Resistive Load, T_C = 125^\circ C$</td>
<td>-</td>
<td>211</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_f$</td>
<td>Fall Time</td>
<td></td>
<td>-</td>
<td>364</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$E_{on}$</td>
<td>Turn-On Switching Loss</td>
<td></td>
<td>-</td>
<td>0.74</td>
<td>-</td>
<td>mJ</td>
</tr>
<tr>
<td>$E_{off}$</td>
<td>Turn-Off Switching Loss</td>
<td></td>
<td>-</td>
<td>1.63</td>
<td>-</td>
<td>mJ</td>
</tr>
<tr>
<td>$E_{gs}$</td>
<td>Total Switching Loss</td>
<td></td>
<td>-</td>
<td>2.37</td>
<td>-</td>
<td>mJ</td>
</tr>
<tr>
<td>$Q_g$</td>
<td>Total Gate Charge</td>
<td></td>
<td>-</td>
<td>208</td>
<td>-</td>
<td>nC</td>
</tr>
<tr>
<td>$Q_{ge}$</td>
<td>Gate to Emitter Charge</td>
<td>$V_{CE} = 600V, I_C = 30A, V_{GE} = 15V$</td>
<td>-</td>
<td>41</td>
<td>-</td>
<td>nC</td>
</tr>
<tr>
<td>$Q_{gc}$</td>
<td>Gate to Collector Charge</td>
<td></td>
<td>-</td>
<td>97</td>
<td>-</td>
<td>nC</td>
</tr>
</tbody>
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# Electrical Characteristics of the Diode

$T_C = 25^\circ C$ 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>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{FM}$</td>
<td>Diode Forward Voltage</td>
<td>$I_F = 30A$</td>
<td>$T_C = 25^\circ C$</td>
<td>-</td>
<td>1.3</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$T_C = 125^\circ C$</td>
<td>-</td>
<td>1.3</td>
<td>-</td>
</tr>
<tr>
<td>$t_{rr}$</td>
<td>Diode Reverse Recovery Time</td>
<td>$I_F = 30A$, $di/dt = 200A/\mu s$</td>
<td>$T_C = 25^\circ C$</td>
<td>-</td>
<td>730</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$T_C = 125^\circ C$</td>
<td>-</td>
<td>775</td>
<td>-</td>
</tr>
<tr>
<td>$I_{rr}$</td>
<td>Diode Peak Reverse Recovery Current</td>
<td></td>
<td>$T_C = 25^\circ C$</td>
<td>-</td>
<td>43</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$T_C = 125^\circ C$</td>
<td>-</td>
<td>47</td>
<td>-</td>
</tr>
<tr>
<td>$Q_{rr}$</td>
<td>Diode Reverse Recovery Charge</td>
<td></td>
<td>$T_C = 25^\circ C$</td>
<td>-</td>
<td>5.9</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$T_C = 125^\circ C$</td>
<td>-</td>
<td>18.2</td>
<td>-</td>
</tr>
</tbody>
</table>
Typical Performance Characteristics

Figure 7. Saturation Voltage vs. $V_{GE}$

![Graph showing saturation voltage vs. gate-emitter voltage for different collector-emitter voltages and temperatures.]

Common Emitter
$T_C = 125^\circ C$

30A
$I_C = 15A$
60A

Figure 8. Capacitance Characteristics

![Graph showing capacitance characteristics for different collector-emitter voltages and temperatures.]

Common Emitter
$V_{CE} = 0V$, $f = 1MHz$
$T_C = 25^\circ C$
$C_{jao}, C_{jeb}, C_{res}$

Figure 9. Gate charge Characteristics

![Graph showing gate charge characteristics for different collector-emitter voltages and temperatures.]

Common Emitter
$T_C = 25^\circ C$

$V_{CC} = 200V, 400V, 600V$

$Q_g, I_C = 30A$

Figure 10. SOA Characteristics

![Graph showing stress conditions for different collector-emitter voltages and temperatures.]

Common Emitter
$V_{CC} = 600V, V_{GE} = 15V$
$T_C = 25^\circ C$
$T_C = 125^\circ C$
$t_{on}, t_{off}$

Figure 11. Turn-on Characteristics vs. Gate Resistance

![Graph showing turn-on characteristics vs. gate resistance for different collector-emitter voltages and temperatures.]

Common Emitter
$V_{CC} = 600V, V_{GE} = 15V$
$I_C = 30A$
$T_C = 25^\circ C$
$T_C = 125^\circ C$

Figure 12. Turn-off Characteristics vs. Gate Resistance

![Graph showing turn-off characteristics vs. gate resistance for different collector-emitter voltages and temperatures.]

Common Emitter
$V_{CC} = 600V, V_{GE} = 15V$
$I_C = 30A$
$T_C = 25^\circ C$
$T_C = 125^\circ C$

*Notes:
1. $T_C = 25^\circ C$
2. $T_J = 150^\circ C$
3. Single Pulse

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FGH30N120FTD Rev. C0  
5  
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Typical Performance Characteristics

Figure 13. Turn-on Characteristics vs. Collector Current

Figure 14. Turn-off Characteristics vs. Collector Current

Figure 15. Switching Loss vs. Gate Resistance

Figure 16. Switching Loss vs. Collector Current

Figure 17. Turn-off Switching SOA Characteristics

Figure 18. Forward Characteristics

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Typical Performance Characteristics

Figure 19. Reverse Current

Reverse Recovery Current, $I_{rr}$ [A]

$di/dt = 100A/\mu s$

$di/dt = 200A/\mu s$

Forward Current, $I_F$ [A]

Figure 20. Stored Charge

Stored Recovery Charge, $Q_{rr}$ [$\mu C$]

$di/dt = 100A/\mu s$

$di/dt = 200A/\mu s$

Forward Current, $I_F$ [A]

Figure 21. Reverse Recovery Time

Reverse Recovery Time, $t_{rr}$ [ns]

$di/dt = 100A/\mu s$

$di/dt = 200A/\mu s$

Forward Current, $I_F$ [A]

Figure 22. Transient Thermal Impedance of IGBT

Thermal Response [C/C]

Rectangular Pulse Duration [sec]
Mechanical Dimensions

TO-3PN

Dimensions in Millimeters
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CoreSiC™
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CTL™
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2. A critical component in any component of a life support device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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PRODUCT STATUS DEFINITIONS
Definition of Terms

<table>
<thead>
<tr>
<th>Datasheet Identification</th>
<th>Product Status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<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>
</tr>
<tr>
<td>Preliminary</td>
<td>First Production</td>
<td>Datasheet contains preliminary data; additional 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>
</tr>
<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>
</tr>
<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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Rev. 66