IGBT – Hybrid, Field Stop, Trench
650 V, 75 A, TO247

AFGHL75T65SQDC

Using the novel field stop 4th generation IGBT technology and the 1.5th generation SiC Schottky Diode technology, AFGHL75T65SQDC offers the optimum performance with both low conduction and switching losses for high efficiency operations in various applications, especially totem pole bridgeless PFC and Inverter.

Features
- Maximum Junction Temperature: Tj = 175°C
- Positive Temperature Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: VCESat = 1.6 V (Typ.) @ Ic = 75 A
- 100% of the Parts are Tested for ILM (Note 2)
- Fast Switching
- Tight Parameter Distribution
- No Reverse Recovery/No Forward Recovery
- AEC–Q101 Qualified and PPAP Capable

Typical Applications
- Automotive
- On & Off Board Chargers
- DC–DC Converters
- PFC
- Industrial Inverter

MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Rating</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Collector-to–Emitter Voltage</td>
<td>VCES</td>
<td>650</td>
<td>V</td>
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<tr>
<td>Gate–to–Emitter Voltage</td>
<td>VGES</td>
<td>±20</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>±30</td>
<td></td>
</tr>
<tr>
<td>Transient Gate–to–Emitter Voltage</td>
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<td></td>
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<tr>
<td>Collector Current (Note 1)</td>
<td>IC</td>
<td>80</td>
<td>A</td>
</tr>
<tr>
<td>@ TC = 25°C</td>
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<td>ILM</td>
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<td>A</td>
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<tr>
<td>Pulsed Collector Current (Note 2)</td>
<td>IC</td>
<td>300</td>
<td>A</td>
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<tr>
<td>Diode Forward Current (Note 1)</td>
<td>IF</td>
<td>35</td>
<td>A</td>
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<td>@ TC = 25°C</td>
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<td></td>
<td>IFM</td>
<td>200</td>
<td>A</td>
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<td>Maximum Power Dissipation</td>
<td>PD</td>
<td>375</td>
<td>W</td>
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<td>188</td>
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<tr>
<td>Operating Junction / Storage Temperature Range</td>
<td>TJ, TSTG</td>
<td>-55 to +175</td>
<td>°C</td>
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<tr>
<td>Maximum Lead Temp. for Soldering Purposes, 1/8&quot; from case for 10 seconds</td>
<td>TL</td>
<td>265</td>
<td>°C</td>
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Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Value limited by bond wire
2. VCC = 400 V, VGE = 15 V, IC = 300 A, RG = 15 Ω, Inductive Load, 100% of the Parts are Tested.
3. Repetitive Rating: pulse width limited by max. Junction temperature

ORDERING INFORMATION

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<tr>
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<td>AFGHL75T65SQDC</td>
<td>TO–247–3L</td>
<td>30 Units / Rail</td>
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## THERMAL CHARACTERISTICS

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## ELECTRICAL CHARACTERISTICS (TJ = 25°C unless otherwise noted)

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<th>Test Conditions</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
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<td>Collector–emitter breakdown voltage, gate–emitter short–circuited</td>
<td>$V_{\text{GE}} = 0 , \text{V}$, $I_C = 1 , \text{mA}$</td>
<td>$B_{\text{VCES}}$</td>
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<td>–</td>
<td>V</td>
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<td>Temperature Coefficient of Breakdown Voltage</td>
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<td>$\Delta B_{\text{VCES}}/\Delta T_J$</td>
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<td>0.6</td>
<td>–</td>
<td>V/°C</td>
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<td>Collector–emitter cut–off current, gate–emitter short–circuited</td>
<td>$V_{\text{GE}} = 0 , \text{V}$, $V_{\text{CE}} = 650 , \text{V}$</td>
<td>$I_{\text{CES}}$</td>
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<td>Gate leakage current, collector–emitter short–circuited</td>
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<td>Gate–emitter threshold voltage</td>
<td>$V_{\text{GE}} = V_{\text{CE}}$, $I_C = 75 , \text{mA}$</td>
<td>$V_{\text{GE(th)}}$</td>
<td>3.4</td>
<td>4.9</td>
<td>6.4</td>
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<td>Collector–emitter saturation voltage</td>
<td>$V_{\text{GE}} = 15 , \text{V}$, $I_C = 75 , \text{A}$</td>
<td>$V_{\text{CE(sat)}}$</td>
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<td>2.1</td>
<td>V</td>
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<td>Input capacitance</td>
<td>$V_{\text{CE}} = 30 , \text{V}$, $V_{\text{GE}} = 0 , \text{V}$, $f = 1 , \text{MHz}$</td>
<td>$C_{\text{ies}}$</td>
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<td>4574</td>
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<td>pF</td>
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<td>Output capacitance</td>
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<td>Reverse transfer capacitance</td>
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<td>Gate charge total</td>
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<td>–</td>
<td>nC</td>
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<td>Turn–on delay time</td>
<td>$T_C = 25, ^\circ \text{C}$, $V_{\text{CC}} = 400 , \text{V}$, $I_C = 37.5 , \text{A}$, $R_G = 4.7 , \Omega$, $V_{\text{GE}} = 15 , \text{V}$, Inductive Load</td>
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<td>–</td>
<td>ns</td>
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<td>$t_{\text{id(off)}}$</td>
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<td>116.8</td>
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<td>Fall time</td>
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<td></td>
<td>$t_f$</td>
<td>–</td>
<td>9.6</td>
<td>–</td>
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<td>$E_{\text{on}}$</td>
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<td>Turn–off switching loss</td>
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<td>$E_{\text{off}}$</td>
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<td>0.24</td>
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<td>Total switching loss</td>
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<td>$E_{\text{ts}}$</td>
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<td>$T_C = 25, ^\circ \text{C}$, $V_{\text{CC}} = 400 , \text{V}$, $I_C = 75 , \text{A}$, $R_G = 4.7 , \Omega$, $V_{\text{GE}} = 15 , \text{V}$, Inductive Load</td>
<td>$t_{\text{id(on)}}$</td>
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<td>–</td>
<td>ns</td>
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<td>Fall time</td>
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<td>$t_f$</td>
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<td>70.4</td>
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<td>$E_{\text{on}}$</td>
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<td>$E_{\text{off}}$</td>
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<td>$E_{\text{ts}}$</td>
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**ELECTRICAL CHARACTERISTICS**  \( (T_J = 25^\circ C \text{ unless otherwise noted}) \)

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<th>Parameter</th>
<th>Test Conditions</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
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<tr>
<td><strong>SWITCHING CHARACTERISTICS, INDUCTIVE LOAD</strong></td>
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<td>Turn–on delay time</td>
<td>( T_C = 175^\circ C, ) ( V_{CC} = 400 ) V, ( I_C = 37.5 ) A, ( R_G = 4.7 ) ( \Omega ), ( V_G = 15 ) V, Inductive Load</td>
<td>( t_{d(on)} )</td>
<td>–</td>
<td>20.8</td>
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<td>ns</td>
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<tr>
<td>Rise time</td>
<td></td>
<td>( t_r )</td>
<td>–</td>
<td>22.4</td>
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<td>( t_{d(off)} )</td>
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<td>130</td>
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<td>Fall time</td>
<td></td>
<td>( t_f )</td>
<td>–</td>
<td>9.6</td>
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<td>Turn–on switching loss</td>
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<td>( E_{on} )</td>
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<td>0.53</td>
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<td>–</td>
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<td>Rise time</td>
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<td><strong>DIODE CHARACTERISTICS</strong></td>
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<td>Forward Voltage</td>
<td>( I_F = 20 ) A</td>
<td>( V_F )</td>
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<td>( I_F = 20 ) A, ( T_J = 175^\circ C )</td>
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<td>Total Capacitance</td>
<td>( V_R = 400 ) V, ( f = 1 ) MHz</td>
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<td></td>
<td>( V_R = 600 ) V, ( f = 1 ) MHz</td>
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Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.
AFGHL75T65SQDC

TYPICAL CHARACTERISTICS

Figure 1. Typical Output Characteristics
(Tc = 25°C)

Figure 2. Typical Output Characteristics
(Tc = 175°C)

Figure 3. Transfer Characteristics

Figure 4. Typical Saturation Voltage Characteristics

Figure 5. Collector Current Derating

Figure 6. Power Dissipation
TYPICAL CHARACTERISTICS

Figure 7. Saturation Voltage vs. Case Temperature at Variant Current Level

Figure 8. Saturation Voltage vs. VGE (Tc = 25°C)

Figure 9. Saturation Voltage vs. VGE (Tc = 175°C)

Figure 10. Saturation Voltage vs. VGE (Tc = -40°C)

Figure 11. Capacitance Characteristics

Figure 12. Gate Charge Characteristic (Tc = 25°C)
TYPICAL CHARACTERISTICS

Figure 13. Turn-On Characteristics vs. Gate Resistance

Figure 14. Turn-Off Characteristics vs. Gate Resistance

Figure 15. Turn-On Characteristics vs. Collector Current

Figure 16. Turn-Off Characteristics vs. Collector Current

Figure 17. Switching Loss vs. Gate Resistance

Figure 18. Switching Loss vs. Collector Current
TYPICAL CHARACTERISTICS

**Figure 19. SOA Characteristics (FBSOA)**

**Figure 20. (Diode) Forward Characteristics vs. Normal I–V**

**Figure 21. (Diode) Forward Current Derating**

**Figure 22. (Diode) Power Derating**

**Figure 23. (Diode) Output Capacitance (Coes) vs. Reverse Voltage**

**Figure 24. (Diode) Output Capacitance Stored Energy**
Figure 25. Transient Thermal Impedance of IGBT

Figure 26. Transient Thermal Impedance of Diode
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

TO-247-3LD
CASE 340CX
ISSUE A

DATE 06 JUL 2020

NOTES: UNLESS OTHERWISE SPECIFIED.
A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD
FLASH, AND TIE BAR EXTRUSIONS.
B. ALL DIMENSIONS ARE IN MILLIMETERS.
C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

GENERAL MARKING DIAGRAM*

XXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
G = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking.
Pb−Free indicator, “G” or microdot “*”, may or may not be present. Some products may
not follow the Generic Marking.

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<td>12.81 ~ ~</td>
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