NIF62514

Self-protected FET, Temp and Current Limit, Voltage Clamp, ESD, SOT-223

HDPlus devices are an advanced series of power MOSFETs which utilize ON Semiconductor’s latest MOSFET technology process to achieve the lowest possible on–resistance per silicon area while incorporating smart features. Integrated thermal and current limits work together to provide short circuit protection. The devices feature an integrated Drain–to–Gate Clamp that enables them to withstand high energy in the avalanche mode. The Clamp also provides additional safety margin against unexpected voltage transients. Electrostatic Discharge (ESD) protection is provided by an integrated Gate–to–Source Clamp.

Features
• Current Limitation
• Thermal Shutdown with Automatic Restart
• Short Circuit Protection
• Low RDS(on)
• IDSS Specified at Elevated Temperature
• Avalanche Energy Specified
• Slew Rate Control for Low Noise Switching
• Overvoltage Clamped Protection
• This is a Pb–Free Device

6.0 AMPERES*
40 VOLTS CLAMPED
RDS(on) = 90 mΩ

MARKING DIAGRAM

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Device</th>
<th>Package</th>
<th>Shipping†</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIF62514T1G</td>
<td>SOT–223</td>
<td>1000/Tape &amp; Reel</td>
</tr>
<tr>
<td></td>
<td>(Pb–Free)</td>
<td></td>
</tr>
<tr>
<td>NIF62514T3G</td>
<td>SOT–223</td>
<td>4000/Tape &amp; Reel</td>
</tr>
<tr>
<td></td>
<td>(Pb–Free)</td>
<td></td>
</tr>
</tbody>
</table>

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

*Limited by the current limit circuit.
MOSFET MAXIMUM RATINGS (TJ = 25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Rating</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain–to–Source Voltage Internally Clamped</td>
<td>V_DSS</td>
<td>40</td>
<td>Vdc</td>
</tr>
<tr>
<td>Drain–to–Gate Voltage Internally Clamped (R_{GS} = 1.0 MΩ)</td>
<td>V_DGR</td>
<td>40</td>
<td>Vdc</td>
</tr>
<tr>
<td>Gate–to–Source Voltage</td>
<td>V_{GS}</td>
<td>± 16</td>
<td>Vdc</td>
</tr>
<tr>
<td>Drain Current</td>
<td>I_D</td>
<td>Internally Limited</td>
<td></td>
</tr>
<tr>
<td>- Continuous @ TA = 25°C</td>
<td>I_{DM}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Continuous @ TA = 100°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Pulsed (t_p ≤ 10 μs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Power Dissipation</td>
<td>P_D</td>
<td>1.1</td>
<td>W</td>
</tr>
<tr>
<td>@ TA = 25°C (Note 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>@ TA = 25°C (Note 2)</td>
<td>1.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>@ TA = 25°C (Note 3)</td>
<td>8.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal Resistance,</td>
<td>R_{JUT}</td>
<td>14</td>
<td>°C/W</td>
</tr>
<tr>
<td>Junction–to–Tab</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junction–to–Ambient (Note 1)</td>
<td>R_{JUA}</td>
<td>114</td>
<td></td>
</tr>
<tr>
<td>Junction–to–Ambient (Note 2)</td>
<td>R_{JUA}</td>
<td>72.3</td>
<td></td>
</tr>
<tr>
<td>Single Pulse Drain–to–Source Avalanche Energy</td>
<td>E_{AS}</td>
<td>300</td>
<td>mJ</td>
</tr>
<tr>
<td>(V_{DD} = 25 Vdc, V_{GS} = 5.0 Vdc, V_{DS} = 40 Vdc, I_L = 2.8 Apk, L = 80 mH, R_{G} = 25 Ω)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating and Storage Temperature Range</td>
<td>T_J, T_{stg}</td>
<td>−55 to 150</td>
<td>°C</td>
</tr>
</tbody>
</table>

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Mounted onto min pad board.
2. Mounted onto 1″ pad board.
3. Mounted onto large heatsink.
## MOSFET ELECTRICAL CHARACTERISTICS  (T_J = 25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OFF CHARACTERISTICS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Drain–to–Source Clamped Breakdown Voltage (V_GS = 0 Vdc, I_D = 250 μAdc)  
(V_GS = 0 Vdc, I_D = 250 μAdc, T_J = 150°C) (Note 4) | V_(BR)DSS | 42   | 46   | 50   | Vdc   |
| Zero Gate Voltage Drain Current (V_DS = 32 Vdc, V_GS = 0 Vdc)  
(V_DS = 32 Vdc, V_GS = 0 Vdc, T_J = 150°C) (Note 4) | I_DSS | –    | 0.5  | 2.0  | μAdc  |
| Gate Input Current (V_GS = 5.0 Vdc, V_DS = 0 Vdc)  
(V_GS = −5.0 Vdc, V_DS = 0 Vdc) | I_GS   | –    | 50   | 100  | μAdc  |
| **ON CHARACTERISTICS**                 |         |      |      |      |       |
| Gate Threshold Voltage  
(V_DS = V_GS, I_D = 150 μAdc) | V_GS(th) | 1.0  | 1.7  | 2.0  | Vdc   |
| Static Drain–to–Source On–Resistance (Note 5)  
(V_GS = 10 Vdc, I_D = 1.4 Adc, T_J @ 25°C) | R_D((on)) | –    | 90   | 100  | mΩ    |
| Static Drain–to–Source On–Resistance (Note 5)  
(V_GS = 5.0 Vdc, I_D = 1.4 Adc, T_J @ 150°C) | R_D((on)) | –    | 105  | 120  | mΩ    |
| Source–Drain Forward On Voltage  
(I_S = 7 A, V_GS = 0 V) | V_SD   | –    | 1.05 | –    | V     |
| **SWITCHING CHARACTERISTICS** (Note 4)   |         |      |      |      |       |
| Turn–on Delay Time  
R_L = 4.7 Ω, V_in = 0 to 10 V, V_DD = 12 V | t_(on) | –    | 4.0  | 8.0  | μs    |
| Turn–on Rise Time  
R_L = 4.7 Ω, V_in = 0 to 10 V, V_DD = 12 V | t_rise | –    | 11   | 20   | μs    |
| Turn–off Delay Time  
R_L = 4.7 Ω, V_in = 0 to 10 V, V_DD = 12 V | t_(off) | –    | 32   | 50   | μs    |
| Turn–off Fall Time  
R_L = 4.7 Ω, V_in = 0 to 10 V, V_DD = 12 V | t_fall | –    | 27   | 50   | μs    |
| Slew–Rate On  
R_L = 4.7 Ω, V_in = 0 to 10 V, V_DD = 12 V | –dV_DS/dt(on) | –    | 1.5  | 2.5  | μs    |
| Slew–Rate Off  
R_L = 4.7 Ω, V_in = 0 to 10 V, V_DD = 12 V | –dV_DS/dt(off) | –    | 0.6  | 1.0  | μs    |
| **SELF PROTECTION CHARACTERISTICS** (T_J = 25°C unless otherwise noted) |         |      |      |      |       |
| Current Limit  
(V_GS = 5.0 Vdc) | I_LIM | 6.0  | 9.0  | 11   | Adc   |
| Current Limit  
(V_GS = 10 Vdc) | I_LIM | 7.0  | 10.5 | 13   | Adc   |
| Temperature Limit (Turn–off) (Note 4)  
V_GS = 5.0 Vdc | T_LIM(off) | 150  | 175  | 200  | °C    |
| Temperature Hysteresis (Note 4) | ΔT_LIM(on) | –    | 15   | –    | °C    |
| Temperature Limit (Turn–off) (Note 4)  
V_GS = 10 Vdc | T_LIM(off) | 150  | 165  | 185  | °C    |
| Temperature Hysteresis (Note 4) | ΔT_LIM(on) | –    | 15   | –    | °C    |
| **ESD ELECTRICAL CHARACTERISTICS** (T_J = 25°C unless otherwise noted) |         |      |      |      |       |
| Electro–Static Discharge Capability  
Human Body Model (HBM) | ESD | 4000 | –    | –    | V     |
| Electro–Static Discharge Capability  
Machine Model (MM) | ESD | 400  | –    | –    | V     |

4. Not subject to production testing.
5. Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2%.
TYPICAL ELECTRICAL CHARACTERISTICS

Figure 1. Output Characteristics

Figure 2. Output Characteristics

Figure 3. Output Characteristics

Figure 4. Transfer Characteristics

Figure 5. Drain-to-Source Resistance versus Junction Temperature

Figure 6. Drain-to-Source Resistance versus Junction Temperature
Figure 7. Drain-to-Source Resistance versus Junction Temperature

Figure 8. Gate Threshold Voltage versus Temperature

Figure 9. Short-circuit Response

Figure 10. Transient Thermal Resistance
(Non-normalized Junction-to-Ambient mounted on minimum pad area)
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

SOT-223 (TO-261)
CASE 318E-04
ISSUE R

DATE 02 OCT 2018

NOTES:
2. CONTROLLING DIMENSION MILLIMETERS.
3. DIMENSIONS D & E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.200MM PER SIDE.
4. DATUMS A AND B ARE DETERMINED AT DATUM H.
5. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT OF THE PACKAGE BODY.
6. POSITIONAL TOLERANCE APPLIES TO DIMENSIONS b AND b1.

<table>
<thead>
<tr>
<th>MILLIMETERS</th>
<th>DIM</th>
<th>MIN.</th>
<th>NOM.</th>
<th>MAX.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.50</td>
<td>1.63</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>0.02</td>
<td>0.06</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>0.60</td>
<td>0.75</td>
<td>0.89</td>
<td></td>
</tr>
<tr>
<td>b1</td>
<td>2.90</td>
<td>3.06</td>
<td>3.20</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>0.24</td>
<td>0.29</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>6.30</td>
<td>6.50</td>
<td>6.70</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>3.30</td>
<td>3.50</td>
<td>3.70</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>2.30</td>
<td></td>
<td>BSC</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>0.20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1</td>
<td>1.50</td>
<td>1.75</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td>He</td>
<td>6.70</td>
<td>7.00</td>
<td>7.30</td>
<td></td>
</tr>
<tr>
<td>( \theta )</td>
<td>0*</td>
<td></td>
<td>10*</td>
<td></td>
</tr>
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</table>

RECOMMENDED MOUNTING FOOTPRINT

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SOT–223 (TO–261)
CASE 318E–04
ISSUE R

DATE 02 OCT 2018

1. BASE
   2. COLLECTOR
   3. EMITTER
   4. COLLECTOR

1. ANODE
   2. CATHODE
   3. NC
   4. CATHODE

1. GATE
   2. DRAIN
   3. SOURCE
   4. DRAIN

1. SOURCE
   2. DRAIN
   3. GATE
   4. SOURCE

1. DRAIN
   2. GATE
   3. SOURCE
   4. DRAIN

1. RETURN
   2. INPUT
   3. OUTPUT
   4. INPUT

1. ANODE 1
   2. CATHODE
   3. ANODE 2
   4. CATHODE

1. ANODE
   2. CATHODE
   3. NC
   4. CATHODE

1. INPUT
   2. GROUND
   3. LOGIC
   4. GROUND

1. CATHODE
   2. ANODE
   3. GATE
   4. ANODE

1. MT 1
   2. MT 2
   3. GATE
   4. MT 2

1. INPUT
   2. OUTPUT
   3. NC
   4. OUTPUT

1. GATE
   2. COLLECTOR
   3. EMITTER
   4. COLLECTOR

**GENERIC MARKING DIAGRAM**

AYW

XXXXX

* = Pb–Free Package

(Note: Microdot may be in either location)

*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.