

NVHL080N120SC1

MOSFET – Power, N-Channel, Silicon Carbide, TO-247-3L

1200 V, 80 mΩ

Description

Silicon Carbide (SiC) MOSFET uses a completely new technology that provide superior switching performance and higher reliability compared to Silicon. In addition, the low ON resistance and compact chip size ensure low capacitance and gate charge. Consequently, system benefits include highest efficiency, faster operation frequency, increased power density, reduced EMI, and reduced system size.

Features

- 1200 V @ $T_J = 175^\circ\text{C}$
- Max $R_{DS(on)} = 110\text{ m}\Omega$ at $V_{GS} = 20\text{ V}$, $I_D = 20\text{ A}$
- High Speed Switching with Low Capacitance
- 100% UIL Tested
- Qualified for Automotive According to AEC-Q101
- These Devices are Pb-Free and are RoHS Compliant

Applications

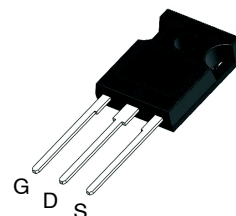
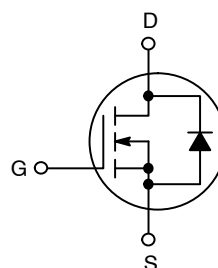
- Automotive Auxiliary Motor Drive
- Automotive On Board Charger
- Automotive DC/DC Converter for EV/HEV



ON Semiconductor®

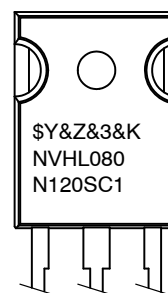
www.onsemi.com

| V_{DSS} | $R_{DS(on)}$ TYP | I_D MAX |
|-----------|------------------|-----------|
| 1200 V | 80 mΩ | 44 A |



TO-247
long leads
CASE 340CX

MARKING DIAGRAM



\$Y = ON Semiconductor Logo
&Z = Assembly Plant Code
&3 = Data Code (Year & Week)
&K = Lot
NVHL080N120SC1 = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

NVHL080N120SC1

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C, unless otherwise noted)

| Symbol | Parameter | | Ratings | Unit |
|-----------------------------------|--|--|-------------|------|
| V _{DSmax} | Drain-to-Source Voltage | | 1200 | V |
| V _{GSmax} | Max. Gate-to-Source Voltage | @ T _C < 175°C | -15 / +25 | V |
| V _{GSop(DC)} | Recommended operation Values of Gate - Source Voltage | @ T _C < 175°C | -5 / +20 | V |
| V _{GSop(AC)} | Recommended operation Values of Gate - Source Voltage (f > 1 Hz) | @ T _C < 175°C | -5 / +20 | V |
| I _D | Continuous Drain Current | V _{GS} = 20 V, T _C = 25°C | 44 | A |
| | | V _{GS} = 20 V, T _C = 100°C | 31 | |
| I _{D(Pulse)} | Pulse Drain Current | Pulse width tp limited by T _j max | 136 | A |
| E _{AS} | Single Pulse Avalanche Energy (Note 1) | | 171 | mJ |
| P _{tot} | Power Dissipation | T _C = 25°C | 348 | W |
| | | T _C = 150°C | 58 | |
| T _J , T _{STG} | Operating and Storage Junction Temperature Range | | -55 to +175 | °C |

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. E_{AS} of 171 mJ is based on starting T_J = 25°C, L = 1 mH, I_{AS} = 18.5 A, V_{DD} = 50 V, R_G = 25 Ω.

THERMAL CHARACTERISTICS

| Symbol | Parameter | Ratings | Unit |
|------------------|---|---------|------|
| R _{θJC} | Thermal Resistance, Junction-to-Case | 0.43 | °C/W |
| R _{θJA} | Thermal Resistance, Junction-to-Ambient | 40 | |

PACKAGE MARKING AND ORDERING INFORMATION

| Part Number | Top Marking | Package | Packing Method | Reel Size | Tape Width | Quantity |
|----------------|----------------|---------------------|----------------|-----------|------------|----------|
| NVHL080N120SC1 | NVHL080N120SC1 | TO-247 Long Lead | Tube | N/A | N/A | 30 Units |

NVHL080N120SC1

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--------|-----------|-----------------|-----|-----|-----|------|
|--------|-----------|-----------------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | | |
|-------------------------------------|---|--|--------|--------|------------|----------|
| BV _{DSS} | Drain-to-Source Breakdown Voltage | I _D = 100 μA, V _{GS} = 0 V | 1200 | - | - | V |
| ΔBV _{DSS} /ΔT _J | Breakdown Voltage Temperature Coefficient | I _D = 5 mA, Referenced to 25°C | - | 0.3 | - | V/°C |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} = 1200 V, V _{GS} = 0 V T _C = 25°C T _C = 175°C | - - | - - | 100 1.0 | μA mA |
| I _{GSS} | Gate-to-Source Leakage Current | V _{GS} = 25 V, V _{DS} = 0 V | - | - | 1 | μA |
| I _{GSSR} | Gate-to-Source Leakage Current, Reverse | V _{GS} = -15 V, V _{DS} = 0 V | - | - | -1 | μA |

ON CHARACTERISTICS

| | | | | | | |
|---------------------|--------------------------------------|---|-----|-----|-----|----|
| V _{GS(th)} | Gate-to-Source Threshold Voltage | V _{GS} = V _{DS} , I _D = 5 mA | 1.8 | 2.5 | 4.3 | V |
| R _{DS(on)} | Static Drain-to-Source On Resistance | V _{GS} = 20 V, I _D = 20 A | - | 80 | 110 | mΩ |
| | | V _{GS} = 20 V, I _D = 20 A, T _C = 150°C | - | 114 | 162 | |
| g _{FS} | Forward Transconductance | V _{DS} = 20 V, I _D = 20 A | - | 13 | - | S |
| | | V _{DS} = 20 V, I _D = 20 A, T _C = 150°C | - | 11 | - | |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|------------------|--------------------------------|---|---|------|------|----|
| C _{iss} | Input Capacitance | V _{DS} = 800 V, V _{GS} = 0 V, f = 1 MHz | - | 1112 | 1670 | pF |
| C _{oss} | Output Capacitance | | - | 80 | 120 | pF |
| C _{rss} | Reverse Transfer Capacitance | | - | 6.5 | 10 | pF |
| E _{oss} | C _{oss} Stored Energy | | - | 32 | - | μJ |

SWITCHING CHARACTERISTICS

| | | | | | | |
|---------------------|-------------------------|---|---|-----|----|----|
| t _{d(on)} | Turn-On Delay Time | V _{CC} = 800 V, I _C = 20 A, V _{GS} = -5/20 V, R _G = 4.7 Ω Inductive Load, T _C = 25°C | - | 6.2 | 13 | ns |
| t _r | Rise Time | | - | 5.8 | 12 | ns |
| t _{d(off)} | Turn-Off Delay Time | | - | 28 | 45 | ns |
| t _f | Fall Time | | - | 8 | 16 | ns |
| E _{on} | Turn-on Switching Loss | | - | 361 | - | μJ |
| E _{off} | Turn-off Switching Loss | | - | 37 | - | μJ |
| E _{ts} | Total Switching Loss | | - | 398 | - | μJ |
| Q _g | Total Gate Charge | V _{DD} = 600 V, I _D = 20 A V _{GS} = -5/20 V | - | 56 | - | nC |
| Q _{gs} | Gate-to-Source Charge | | - | 11 | - | nC |
| Q _{gd} | Gate-to-Drain Charge | | - | 12 | - | nC |
| R _G | Gate input resistance | f = 1 MHz, D-S short | - | 1.7 | - | Ω |

DIODE CHARACTERISTICS

| | | | | | | | |
|------------------|---------------------------------------|---|------------------------|----|-----|---|----|
| V _{SD} | Source-to-Drain Diode Forward Voltage | V _{GS} = -5 V, I _{SD} = 10 A | T _C = 25°C | - | 4.0 | - | V |
| | | | T _C = 150°C | - | 3.4 | - | |
| E _{rec} | Reverse Recovery Energy | I _{SD} = 20 A, V _{GS} = -5 V, V _R = 600 V, di _{SD} /dt = 1000 A/μs | T _C = 150°C | - | 29 | - | μJ |
| t _{rr} | Diode Reverse Recovery Time | | T _C = 25°C | - | 18 | - | ns |
| | | | T _C = 150°C | - | 31 | - | |
| Q _{rr} | Diode Reverse Recovery Charge | | T _C = 25°C | - | 80 | - | nC |
| | | | T _C = 150°C | - | 212 | - | |
| I _{rrm} | Peak Reverse Recovery Current | T _C = 25°C | - | 9 | - | A | |
| | | T _C = 150°C | - | 14 | - | | |

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.

TYPICAL CHARACTERISTICS $T_J = 25^\circ\text{C}$ unless otherwise noted

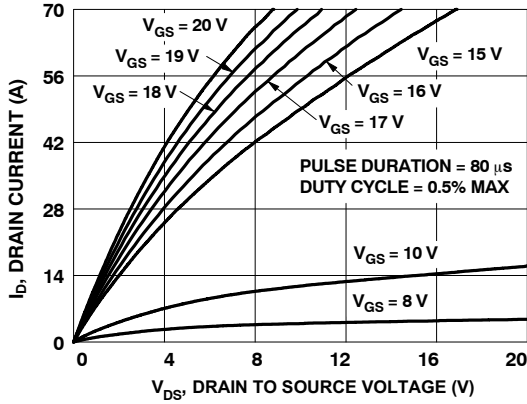


Figure 1. On Region Characteristics

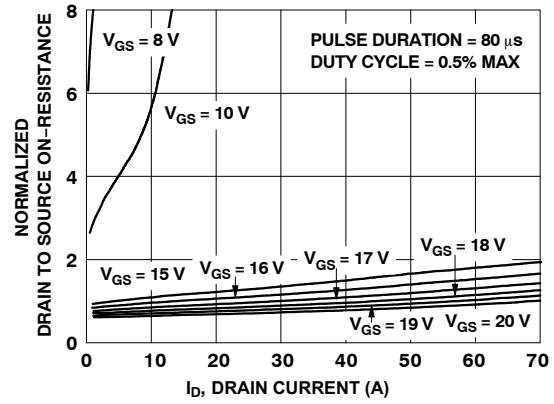


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

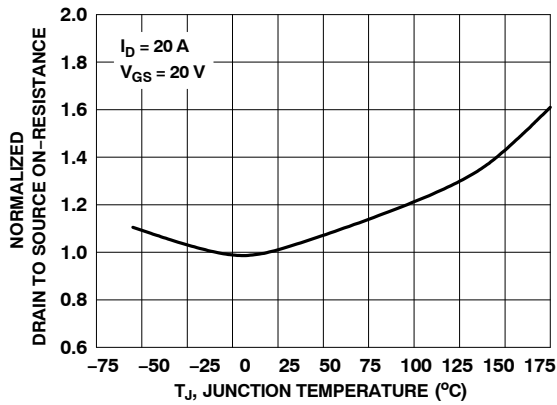


Figure 3. Normalized On Resistance vs. Junction Temperature

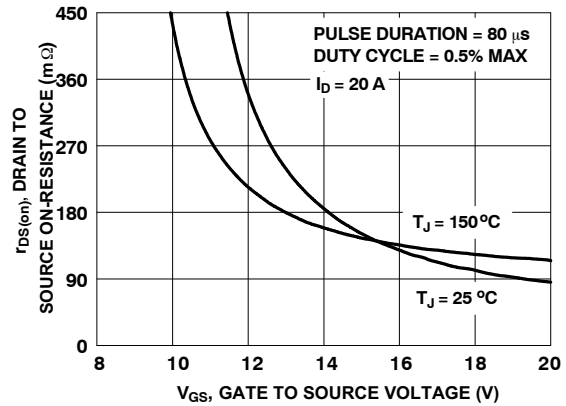


Figure 4. On-Resistance vs. Gate-to-Source Voltage

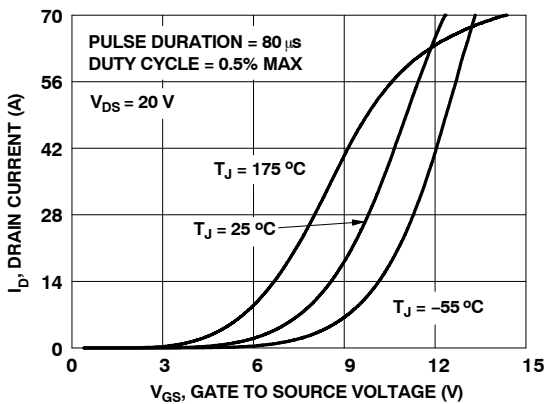


Figure 5. Transfer Characteristics

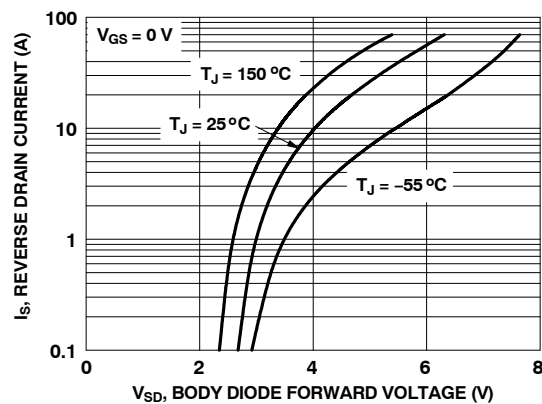


Figure 6. Source-to-Drain Diode Forward Voltage vs. Source Current

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TYPICAL CHARACTERISTICS $T_J = 25^\circ\text{C}$ unless otherwise noted

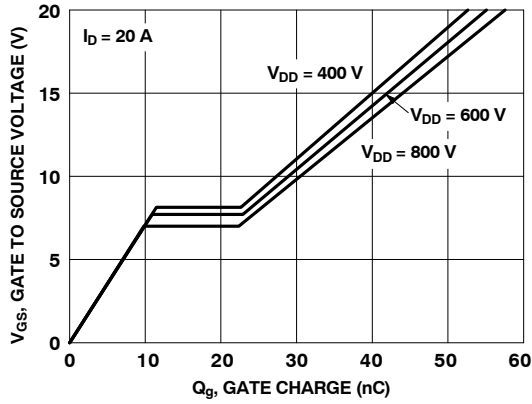


Figure 7. Gate Charge Characteristics

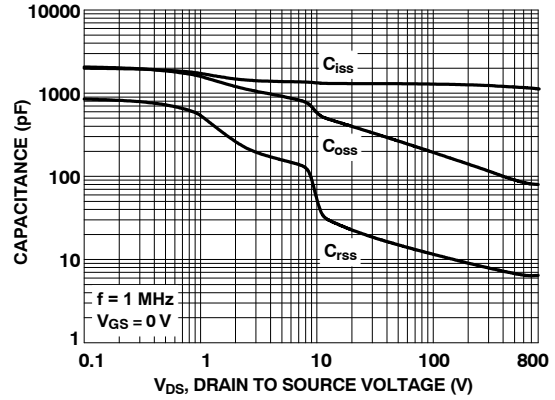


Figure 8. Capacitance vs. Drain-to-Source Voltage

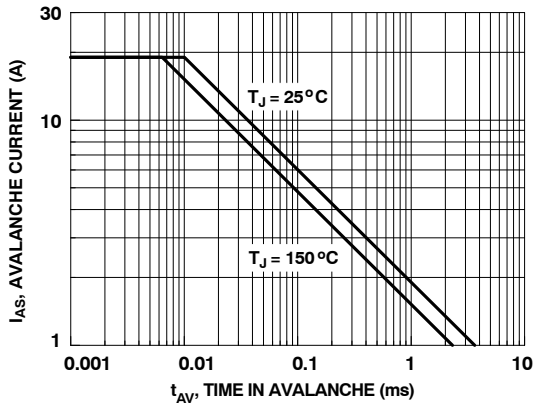


Figure 9. Unclamped Inductive Switching Capability

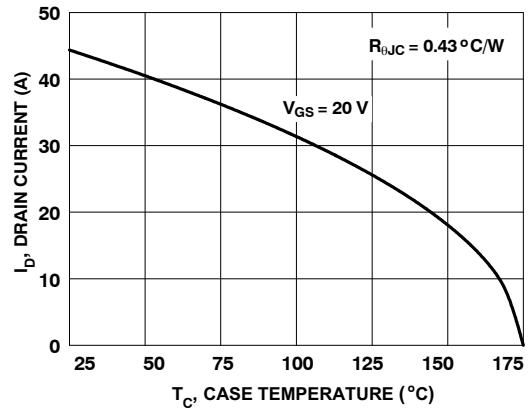


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

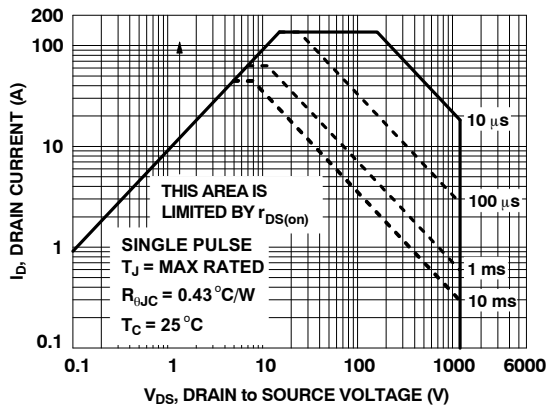


Figure 11. Forward Bias Safe Operating Area

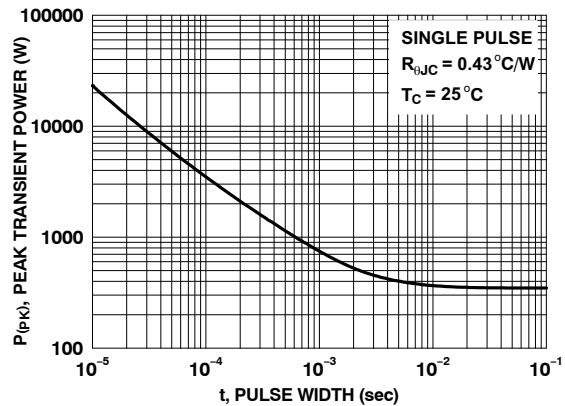


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS $T_J = 25^\circ\text{C}$ unless otherwise noted

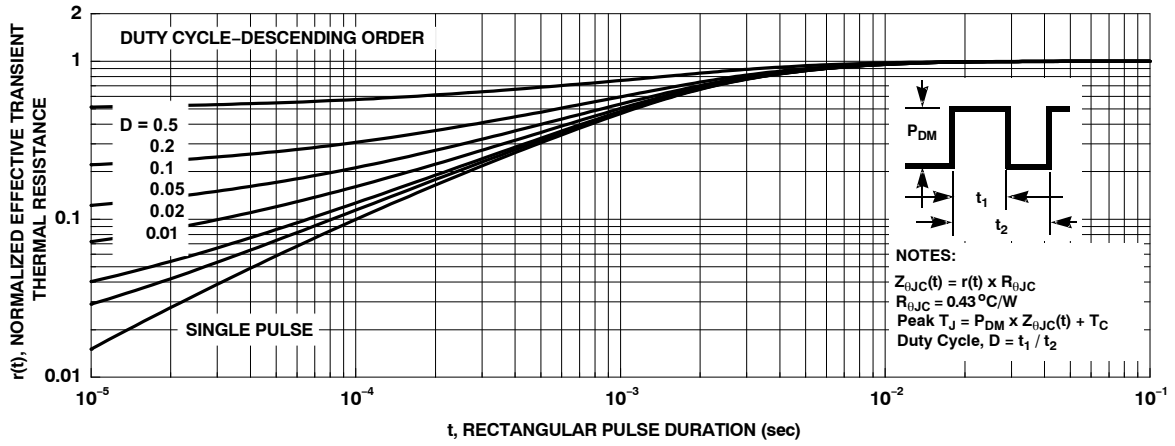
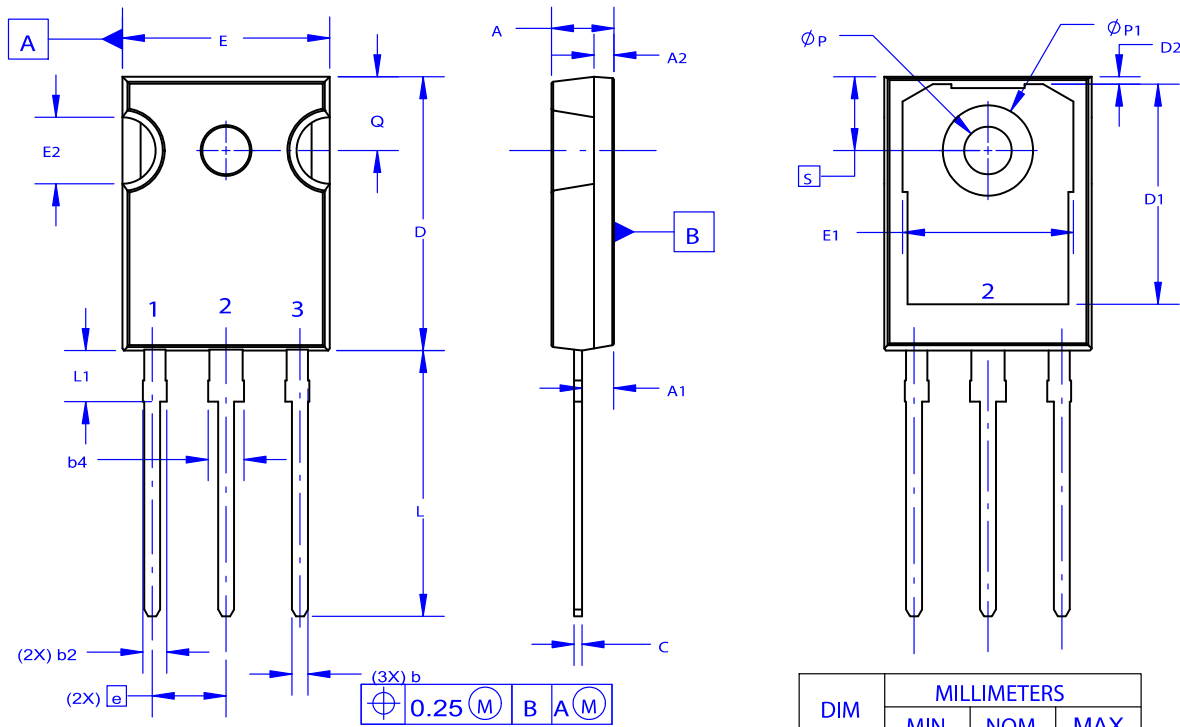


Figure 13. Junction-to-Case Transient Thermal Response Curve

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PACKAGE DIMENSIONS

TO-247-3LD
CASE 340CX
ISSUE O



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.

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