onsemi

DATA SHEET
www.onsemi.com

Silicon Carbide (SiC) MOSFET – 80 mohm, 1200 V, M1, TO-247-4L

NVH4L080N120SC1

V_{DSS}	$R_{DS(ON)}$ TYP	I_D MAX
1200 V	80 mΩ	29 A

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.

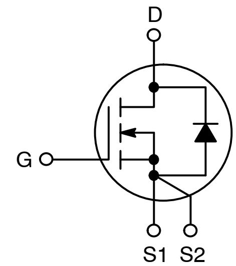
Features

- 1200 V @ T_J = 175°C
- Max $R_{DS(on)}$ = 110 mΩ at V_{GS} = 20 V, I_D = 20 A
- High Speed Switching with Low Capacitance
- 100% Avalanche Tested
- AEC−Q101 Qualified and PPAP Capable
- This Device is Halide Free and RoHS Compliant with exemption 7a, Pb−Free 2LI (on second level interconnection)

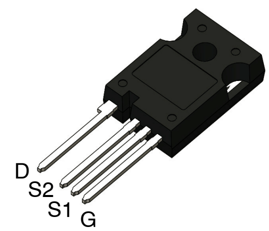
Applications

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

N−CHANNEL MOSFET

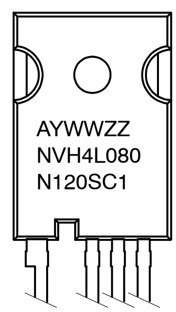


S1: Kelvin Source
S2: Power Source



TO−247−4LD
CASE 340CJ

MARKING DIAGRAM



A = Assembly Location
Y = Year
WW = Work Week
ZZ = Lot Traceability
NVH4L080N120SC1 = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
NVH4L080N120SC1	TO−247−4L	30 Units / Tube

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 < 150°C	−15 / +25	V
V_{GSop}(DC)	Recommended operation Values of Gate − Source Voltage	@ T_C < 150°C	−5 / +20	V
V_{GSop}(AC)	Recommended operation Values of Gate − Source Voltage (f > 1 Hz)	@ T_C < 150°C	−5 / +20	V
I_D	Continuous Drain Current	V_{GS} = 20 V, T_C = 25°C	29	A
		V_{GS} = 20 V, T_C = 100°C	21	
$I_{D(Pulse)}$	Pulse Drain Current	Pulse width tp limited by Tj max	125	A
E_{AS}	Single Pulse Avalanche Energy (Note 1)		171	mJ
P_{tot}	Power Dissipation	T_C = 25°C	170	W
		T_C = 150°C	28	
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 Tj = 25°C, L = 1 mH, I_{AS} = 18.5 A, , V_{DD} = 50 V, R_G = 25 Ω.

THERMAL CHARACTERISTICS

Symbol	Parameter	Ratings	Unit
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case	0.88	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient	40	

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
$\Delta BV_{DSS}/\Delta T_J$	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	–	–	100	μA
			T_C = 150°C	–	–	1.0	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	2.75	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		–	127	162	
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 20 A		–	11.3	–	S
		V_{DS} = 20 V, I_D = 20 A, T_C = 150°C		–	9.8	–	
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		–	9	18	ns
t_r	Rise Time			–	4.2	10	ns
$t_{d(off)}$	Turn-Off Delay Time			–	26.8	43	ns
t_f	Fall Time			–	5.4	11	ns
E_{on}	Turn−on Switching Loss			–	314	–	μJ
E_{off}	Turn−off Switching Loss			–	32	–	μJ
E_{ts}	Total Switching Loss			–	346	–	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	–	3.7	–	V
			T_C = 150°C	–	3.3	–	
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°C unless otherwise noted)

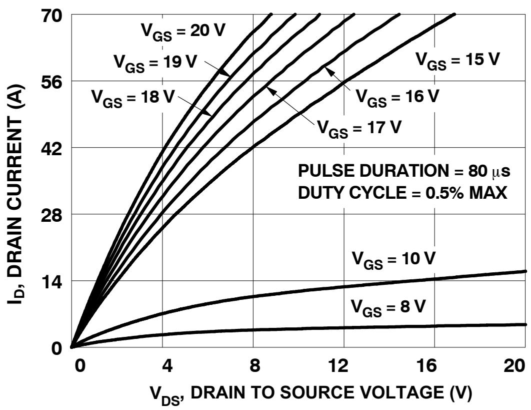


Figure 1. On Region Characteristics

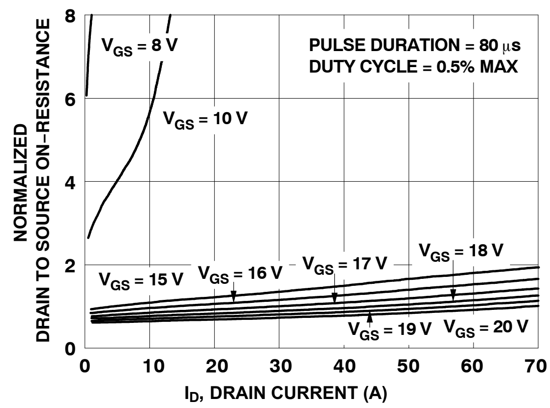


Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage

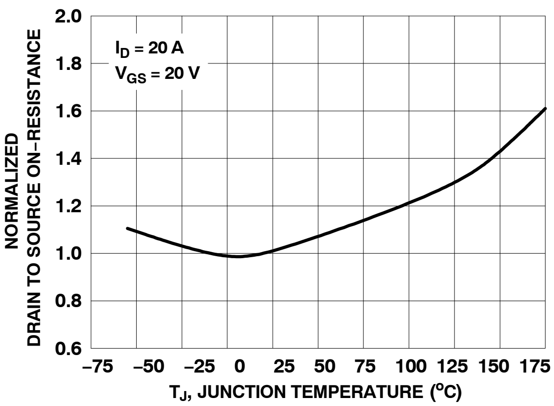


Figure 3. Normalized On Resistance vs. Junction Temperature

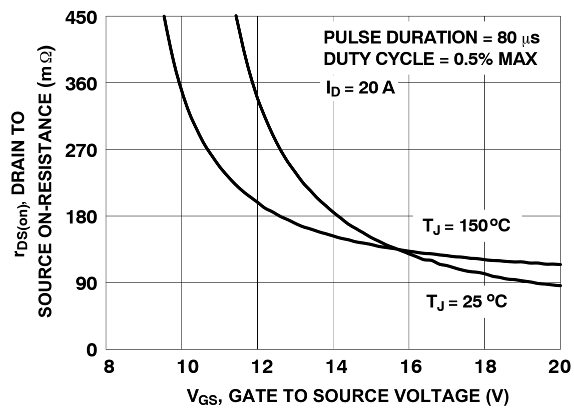


Figure 4. On−Resistance vs. Gate−to−Source Voltage

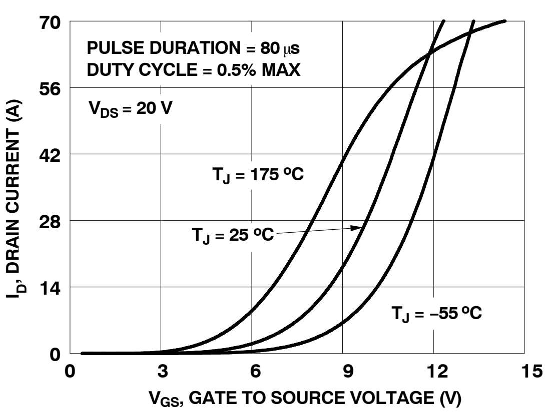


Figure 5. Transfer Characteristics

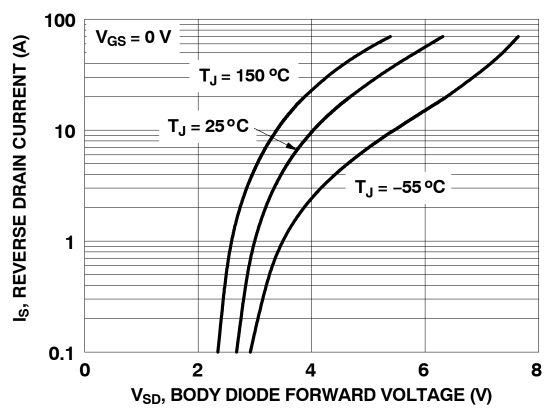


Figure 6. Source−to−Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (continued)

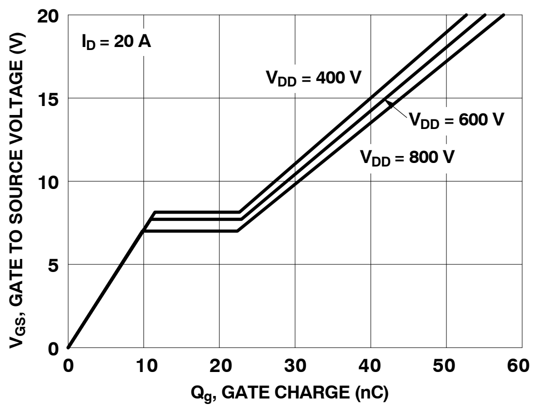


Figure 7. Gate Charge Characteristics

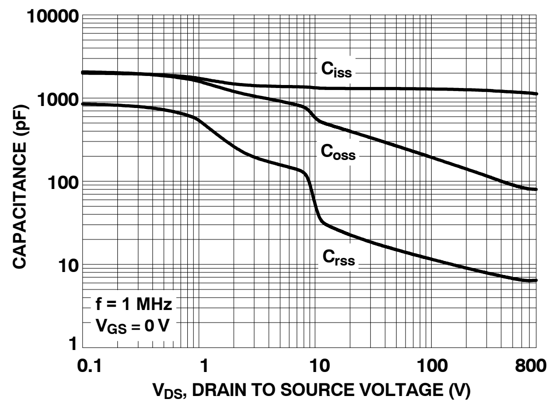


Figure 8. Capacitance vs. Drain−to−Source Voltage

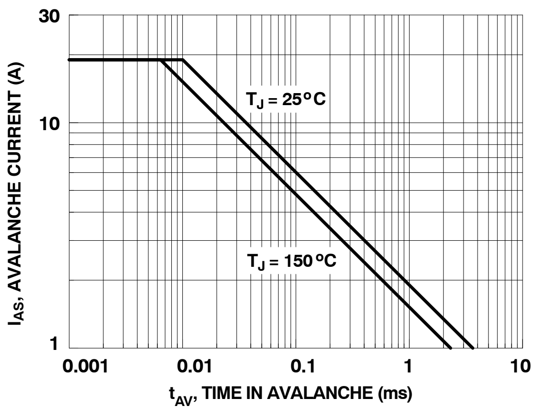


Figure 9. Unclamped Inductive Switching Capability

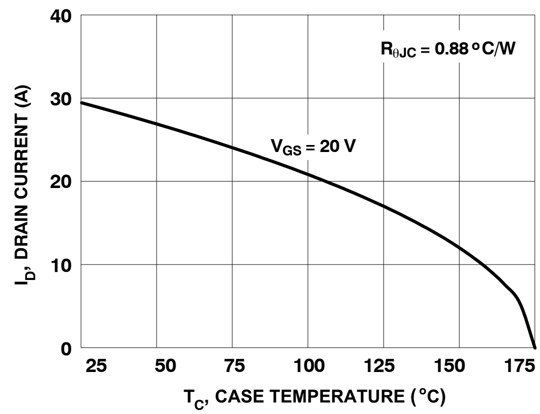


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

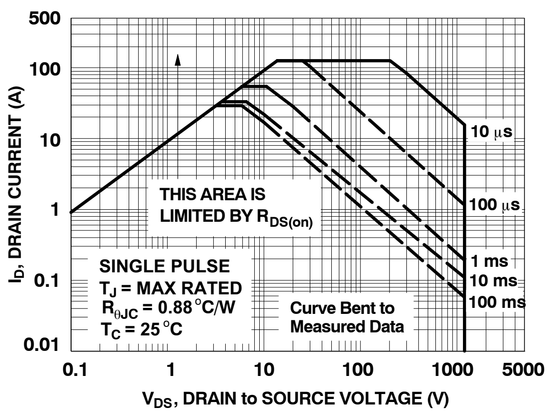


Figure 11. Forward Bias Safe Operating Area

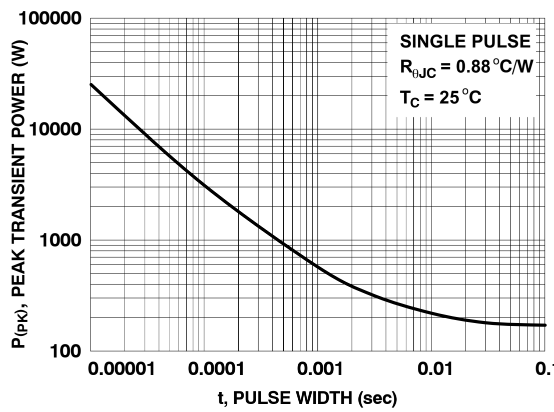


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS T_J = 25°C unless otherwise noted (continued)

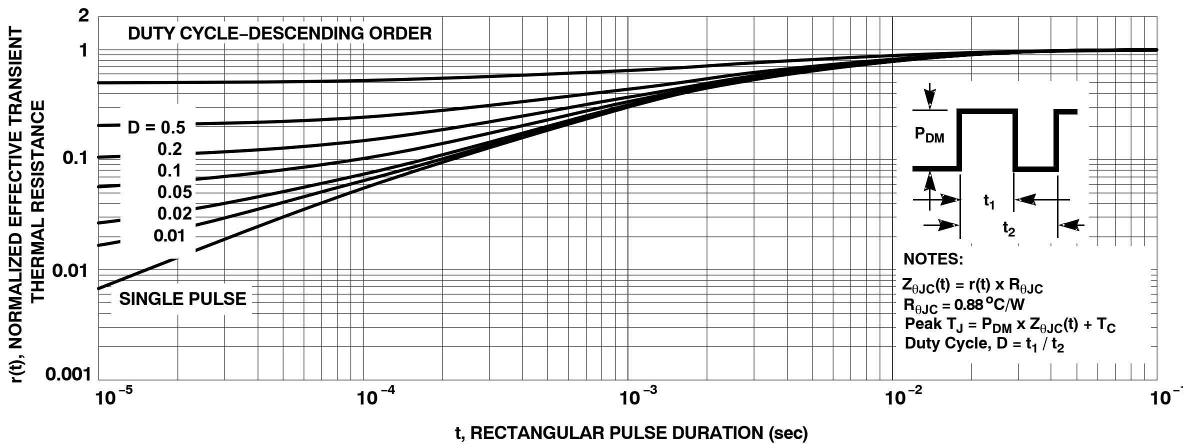
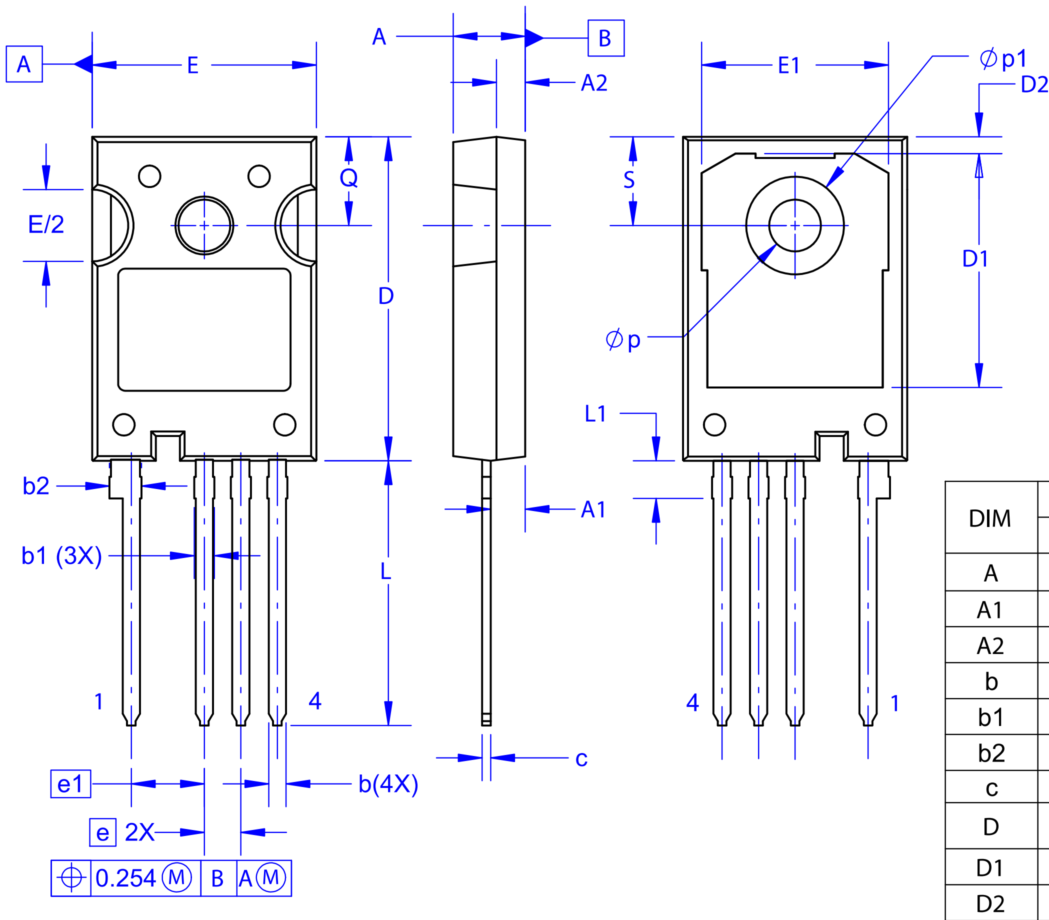


Figure 13. Junction−to−Case Transient Thermal Response Curve

TO−247−4LD
CASE 340CJ
ISSUE A

DATE 16 SEP 2019



DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.10	2.40	2.70
A2	1.80	2.00	2.20
b	1.07	1.20	1.33
b1	1.20	1.40	1.60
b2	2.02	2.22	2.42
c	0.50	0.60	0.70
D	22.34	22.54	22.74
D1	16.00	16.25	16.50
D2	0.97	1.17	1.37
e	2.54 BSC		
e1	5.08 BSC		
E	15.40	15.60	15.80
E1	12.80	13.00	13.20
E/2	4.80	5.00	5.20
L	18.22	18.42	18.62
L1	2.42	2.62	2.82
p	3.40	3.60	3.80
p1	6.60	6.80	7.00
Q	5.97	6.17	6.37
S	5.97	6.17	6.37

NOTES:

A. NO INDUSTRY STANDARD APPLIES TO THIS PACKAGE.
B. DIMENSIONS ARE EXCLUSIVE OF BURRS,MOLD FLASH,AND TIE BAR EXTRUSIONS.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DRAWING CONFORMS TO ASME Y14.5-2009.

DOCUMENT NUMBER:	98AON13852G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	TO−247−4LD	PAGE 1 OF 1

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support
For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales