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

1200 V, 80 mΩ

NTHL080N120SC1A

ON Semiconductor®

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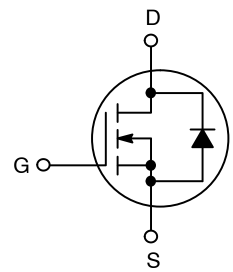
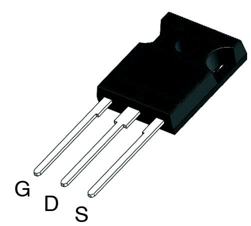
V_{DSS}	$R_{DS(ON)}$ TYP	I_D MAX
1200 V	80 mΩ	31 A





TO–247
long leads
CASE 340CX

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.

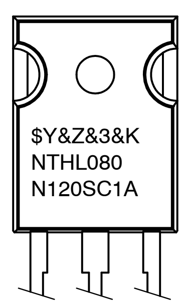
Features

- 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% UIL Tested
- Qualified for Automotive According to AEC−Q101
- These Devices are RoHS Compliant

Applications

- Industrial Motor Drive
- UPS
- Boost Inverter
- PV Charger

MARKING DIAGRAM



$Y = ON Semiconductor Logo
&Z = Assembly Plant Code
&3 = Data Code (Year & Week)
&K = Lot
NTHL080N120SC1A = Specific Device Code

ORDERING INFORMATION

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

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	31	A
		V_{GS} = 20 V, T_C = 100°C	22	
$I_{D(Pulse)}$	Pulse Drain Current	Pulse width tp limited by Tj max	136	A
E_{AS}	Single Pulse Avalanche Energy (Note 1)		171	mJ
P_{tot}	Power Dissipation	T_C = 25°C	178	W
		T_C = 150°C	30	
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	0.84	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient	40	

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Packing Method	Reel Size	Tape Width	Quantity
NTHL080N120SC1A	NTHL080N120SC1A	TO−247 Long Lead	Tube	N/A	N/A	30 Units

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 = 175°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	2.5	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°C unless otherwise noted

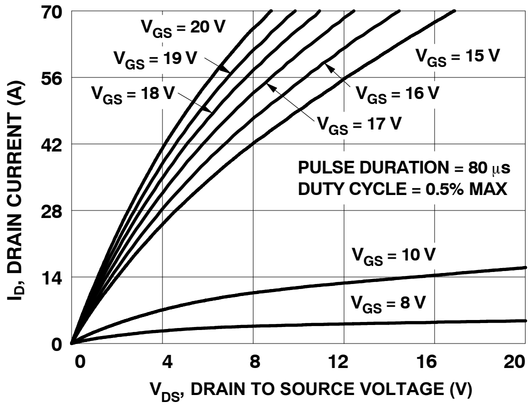


Figure 1. On Region Characteristics

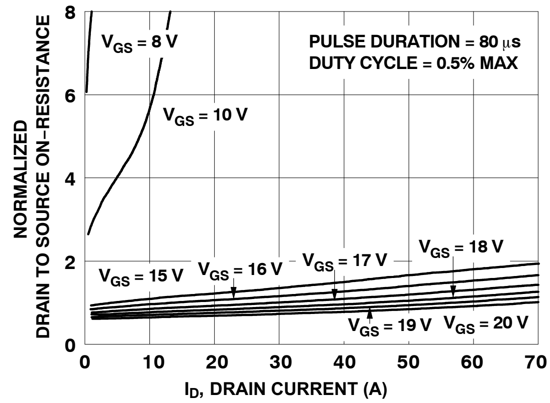


Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage

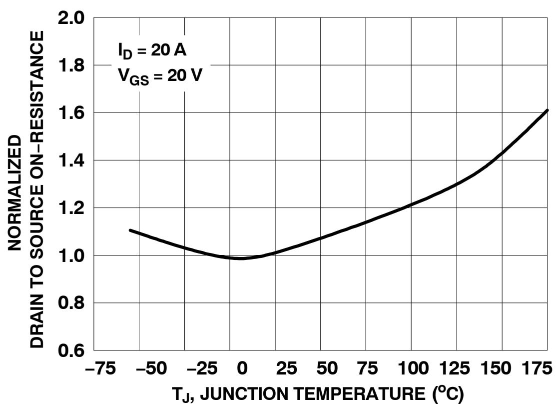


Figure 3. Normalized On Resistance vs. Junction Temperature

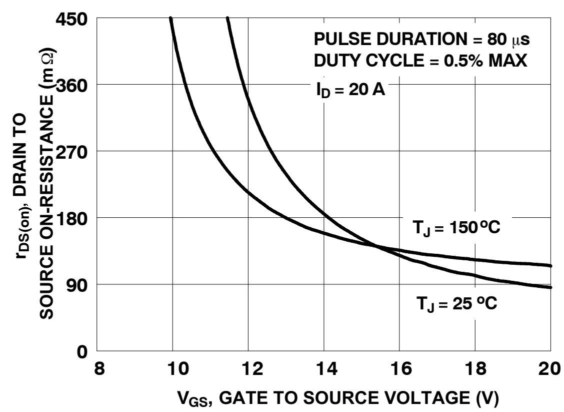


Figure 4. On−Resistance vs. Gate−to−Source Voltage

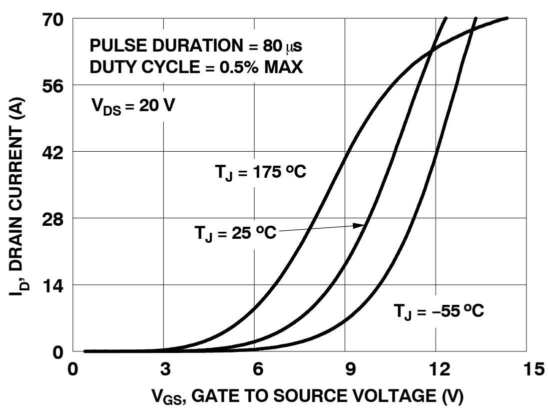


Figure 5. Transfer Characteristics

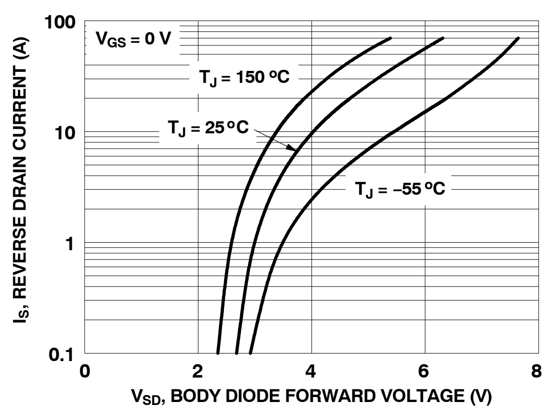


Figure 6. Source−to−Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS T_J = 25°C unless otherwise noted

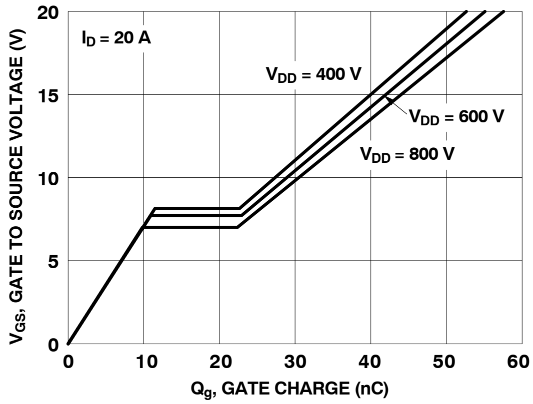


Figure 7. Gate Charge Characteristics

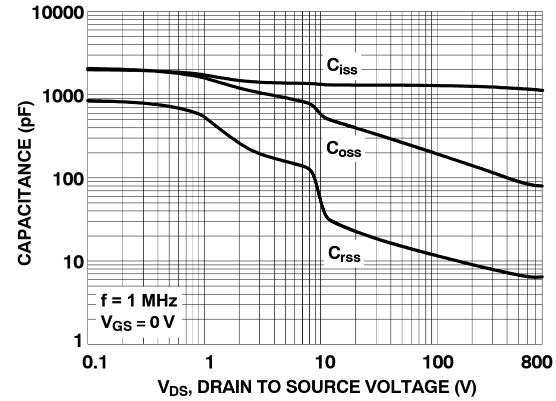


Figure 8. Capacitance vs. Drain−to−Source Voltage

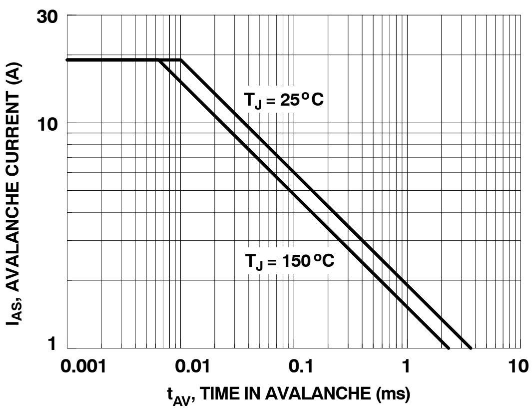


Figure 9. Unclamped Inductive Switching Capability

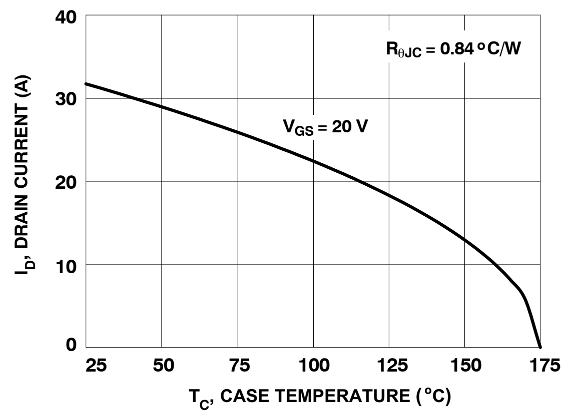


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

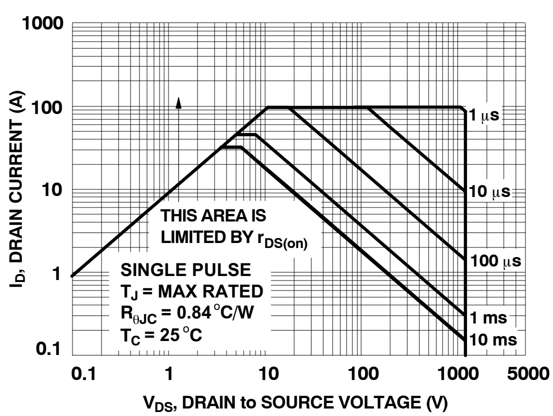


Figure 11. Forward Bias Safe Operating Area

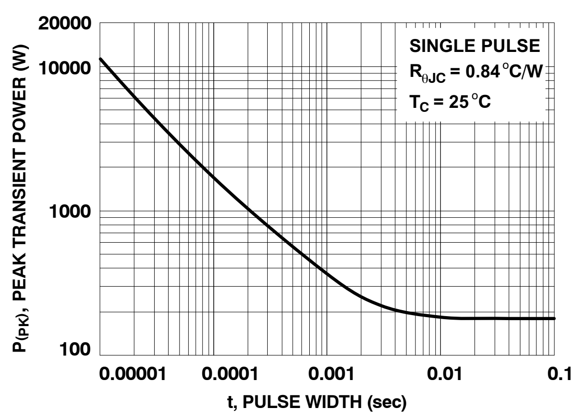


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS T_J = 25°C unless otherwise noted

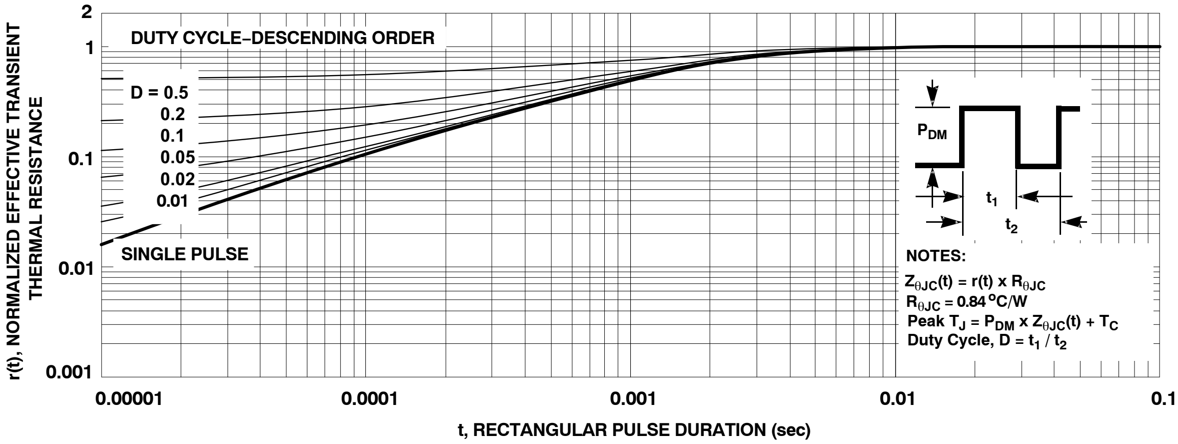
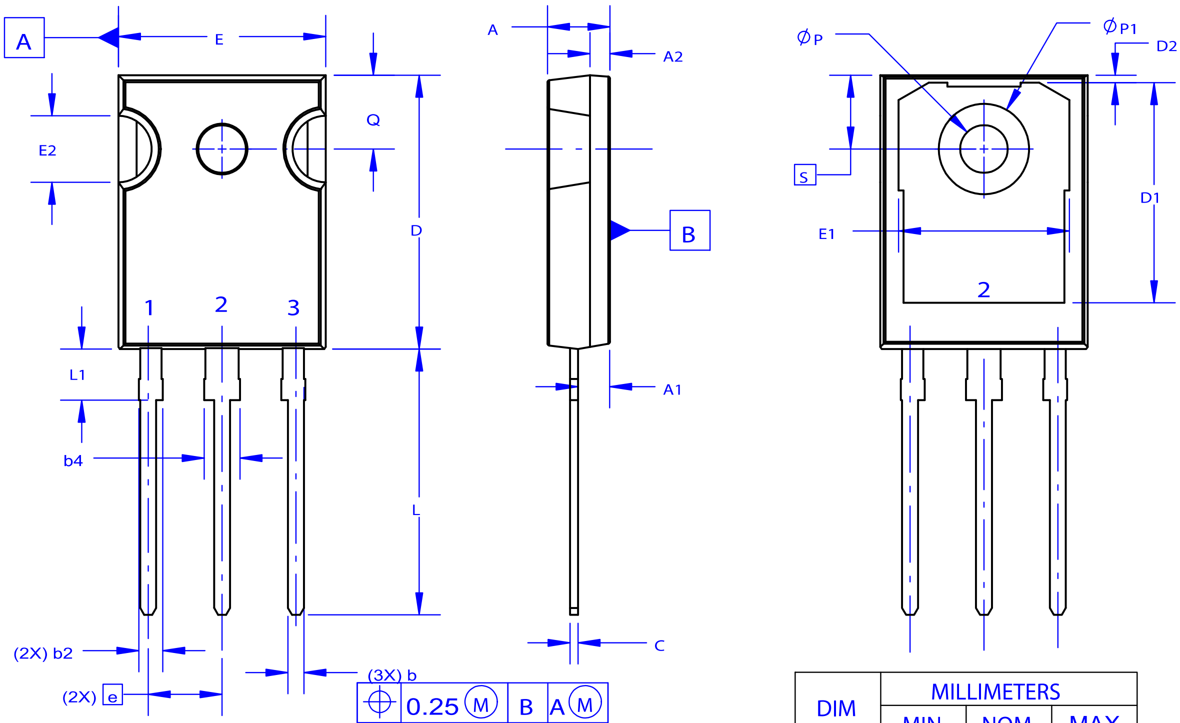


Figure 13. Junction−to−Case Transient Thermal Response Curve

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.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
D	20.32	20.57	20.82
E	15.37	15.62	15.87
E2	4.96	5.08	5.20
e	~	5.56	~
L	19.75	20.00	20.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
Q	5.34	5.46	5.58
S	5.34	5.46	5.58
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D1	13.08	~	~
D2	0.51	0.93	1.35
E1	12.81	~	~
ØP1	6.60	6.80	7.00

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