

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

NTH4L080N120SC1

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

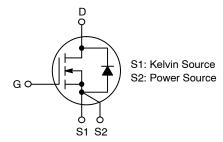
- 1200 V @ T_J = 175°C
- Max $R_{DS(on)} = 110 \text{ m}\Omega$ at $V_{GS} = 20 \text{ V}$, $I_D = 20 \text{ A}$
- High Speed Switching with Low Capacitance
- 100% Avalanche Tested
- This Device is Halide Free and RoHS Compliant with exemption 7a, Pb–Free 2LI (on second level interconnection)

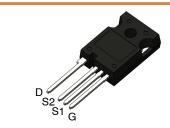
Applications

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

V _{DSS}	R _{DS(ON)} TYP	I _D MAX
1200 V	80 mΩ	29 A

N-CHANNEL MOSFET





TO-247-4LD CASE 340CJ

MARKING DIAGRAM



A = Assembly Location

Y = Year

WW = Work Week

ZZ = Lot Traceability

NTH4L080N120SC1 = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
NTH4L080N120SC1	TO-247-4LD	30 Units / Tube

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^{\circ}C$, 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	Α	
		V _{GS} = 20 V, T _C = 100°C	21		
I _{D(Pulse)}	Pulse Drain Current	Pulse width tp limited by Tj max	125	А	
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 ₀ 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)

Parameter	Test Condi	tions	Min	Тур	Max	Unit
ERISTICS						
Drain-to-Source Breakdown Voltage	$I_D = 100 \mu\text{A}, V_{GS} = 0 \text{V}$		1200	-	-	V
Breakdown Voltage Temperature Coefficient	I _D = 5 mA, Referenced to 25 °C		-	0.3	-	V/°C
Zero Gate Voltage Drain Current	$V_{DS} = 1200 \text{ V}, V_{GS} = 0$	$T_{C} = 25^{\circ}C$ $T_{C} = 150^{\circ}C$	-	_ _	100 1.0	μA mA
Gate-to-Source Leakage Current	$V_{GS} = 25 \text{ V}, V_{DS} = 0 \text{ V}$,	-	_	1	μΑ
Gate-to-Source Leakage Current, Reverse	$V_{GS} = -15 \text{ V}, V_{DS} = 0$	V	-	-	-1	μΑ
RISTICS						
Gate-to-Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 5 \text{ mA}$		1.8	2.75	4.3	V
Static Drain-to-Source On Resistance	$V_{GS} = 20 \text{ V}, I_D = 20 \text{ A}$		_	80	110	mΩ
	$V_{GS} = 20 \text{ V}, I_D = 20 \text{ A},$	T _C = 150°C	_	127	162	
Forward Transconductance	$V_{DS} = 20 \text{ V}, I_D = 20 \text{ A}$		_	11.3	_	S
	$V_{DS} = 20 \text{ V}, I_D = 20 \text{ A},$	T _C = 150°C	_	9.8	_	
RACTERISTICS						
Input Capacitance	V _{DS} = 800 V, V _{GS} = 0	V, f = 1 MHz	-	1112	1670	pF
Output Capacitance			-	80	120	pF
Reverse Transfer Capacitance			-	6.5	10	pF
C _{oss} Stored Energy	1		_	32	_	μJ
IARACTERISTICS]		<u>L</u>
Turn-On Delay Time	V _{CC} = 800 V, I _C = 20 A	۸,	-	9	18	ns
Rise Time	$V_{GS} = -5/20 \text{ V}, R_G = 4$ Inductive Load, $T_C = 2$.7 Ω !5°C	-	4.2	10	ns
Turn-Off Delay Time	, 0		-	26.8	43	ns
Fall Time			-	5.4	11	ns
Turn-on Switching Loss			-	314	_	μJ
Turn-off Switching Loss			-	32	_	μJ
Total Switching Loss			_	346	_	μJ
Total Gate Charge	V _{DD} = 600 V, I _D = 20 A	١	_	56	_	nC
Gate-to-Source Charge	$V_{GS} = -5/20 \text{ V}$		_	11	_	nC
Gate-to-Drain Charge			-	12	-	nC
Gate input resistance	f = 1 MHz, D-S short		-	1.7	_	Ω
CTERISTICS				<u>. </u>		<u> </u>
Source-to-Drain Diode Forward	V _{GS} = -5 V,	T _C = 25°C	_	3.7	_	V
Voltage	I _{SD} = 10 A	T _C = 150°C	_	3.3	_	
Reverse Recovery Energy	I _{SD} = 20 A,	T _C = 150°C	_	29	_	μJ
Diode Reverse Recovery Time	V _{GS} = -5 V,	T _C = 25°C	_	18	_	ns
,	$dI_{SD}/dt = 1000 \text{ A}/\mu\text{s}$	T _C = 150°C	_	31	-	
Diode Reverse Recovery Charge		T _C = 25°C	_	80	_	nC
, , ,	T _C = 150°C		_	212	_	
					1	1
Peak Reverse Recovery Current		T _C = 25°C	_	9	_	Α
	Drain-to-Source Breakdown Voltage Breakdown Voltage Temperature Coefficient Zero Gate Voltage Drain Current Gate-to-Source Leakage Current, Reverse RISTICS Gate-to-Source Threshold Voltage Static Drain-to-Source On Resistance Forward Transconductance Forward Transconductance RACTERISTICS Input Capacitance Output Capacitance Coss Stored Energy ARACTERISTICS Turn-On Delay Time Rise Time Turn-Off Delay Time Fall Time Turn-off Switching Loss Total Switching Loss Total Gate Charge Gate-to-Drain Charge Gate input resistance CTERISTICS Source-to-Drain Diode Forward Voltage Reverse Recovery Energy Diode Reverse Recovery Time	ERISTICS Drain-to-Source Breakdown Voltage $I_D = 100 \mu A$, $V_{GS} = 0 N$ Breakdown Voltage Temperature Coefficient $I_D = 5 \text{ mA}$, Referenced Coefficient Zero Gate Voltage Drain Current $V_{DS} = 1200 \text{ V}$, $V_{GS} = 0 \text{ N}$ Gate-to-Source Leakage Current, Reverse $V_{GS} = 25 \text{ V}$, $V_{DS} = 0 \text{ N}$ RISTICS Gate-to-Source Chreshold Voltage $V_{GS} = -15 \text{ V}$, $V_{DS} = 0 \text{ M}$ Static Drain-to-Source On Resistance $V_{GS} = 20 \text{ V}$, $I_D = 20 \text{ A}$ Forward Transconductance $V_{DS} = 20 \text{ V}$, $I_D = 20 \text{ A}$ Forward Transconductance $V_{DS} = 20 \text{ V}$, $I_D = 20 \text{ A}$ Pactoristics Input Capacitance Input Capacitance $V_{DS} = 800 \text{ V}$, $V_{CS} = 0 \text{ N}$ Output Capacitance $V_{DS} = 800 \text{ V}$, $V_{CS} = 0 \text{ N}$ ARACTERISTICS Turn-On Delay Time Rise Time $V_{CC} = 800 \text{ V}$, $V_{CS} = 20 \text{ A}$ Turn-Off Delay Time $V_{CC} = 800 \text{ V}$, $V_{CS} = 20 \text{ A}$ Fall Time $V_{CC} = 800 \text{ V}$, $V_{CS} = 20 \text{ A}$ Turn-Off Switching Loss $V_{CS} = -5/20 \text{ V}$ Total Gate Charge $V_{CS} = -5/20 \text{ V}$ Gate-to-Drain Charge $V_{CS} = -5 \text{ V}$ <	Drain-to-Source Breakdown Voltage ID = 100 μA, VGS = 0 V	Drain-to-Source Breakdown Voltage I _D = 100 μA, V _{GS} = 0 V 1200	Drain-to-Source Breakdown Voltage I _D = 100 μA, V _{GS} = 0 V 1200 -	Parin-to-Source Breakdown Voltage ID = 100 μA, VGS = 0 V

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)

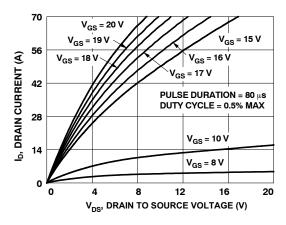


Figure 1. On Region Characteristics

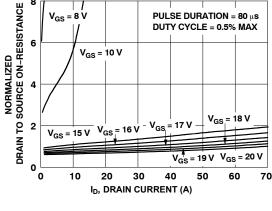


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

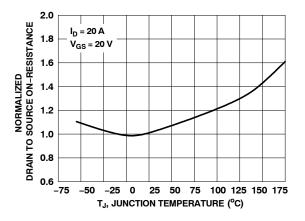


Figure 3. Normalized On Resistance vs. Junction Temperature

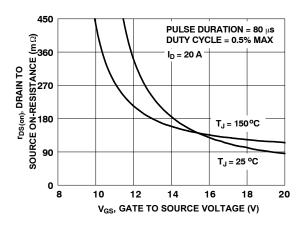


Figure 4. On-Resistance vs. Gate-to-Source Voltage

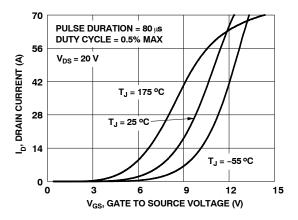


Figure 5. Transfer Characteristics

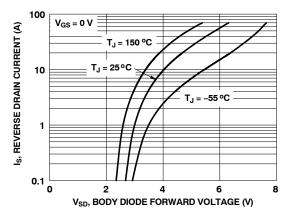


Figure 6. Source-to-Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS (T_J = 25°C UNLESS OTHERWISE NOTED) (CONTINUED)

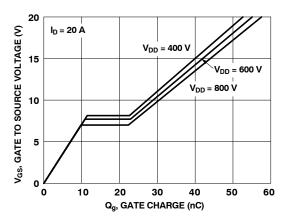


Figure 7. Gate Charge Characteristics

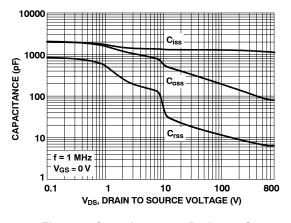


Figure 8. Capacitance vs. Drain-to-Source Voltage

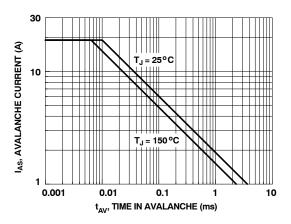


Figure 9. Unclamped Inductive Switching Capability

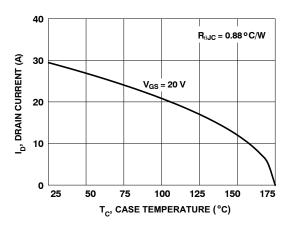


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

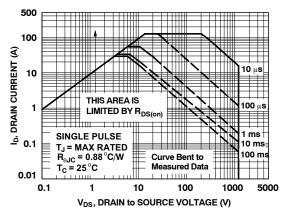


Figure 11. Forward Bias Safe Operating Area

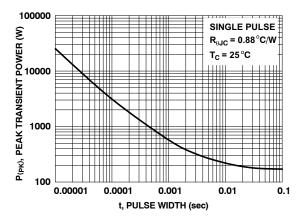


Figure 12. Single Pulse Maximum Power Dissipation

$\textbf{TYPICAL CHARACTERISTICS} \ (T_J = 25^{\circ}\text{C UNLESS OTHERWISE NOTED)} \ (\text{CONTINUED})$

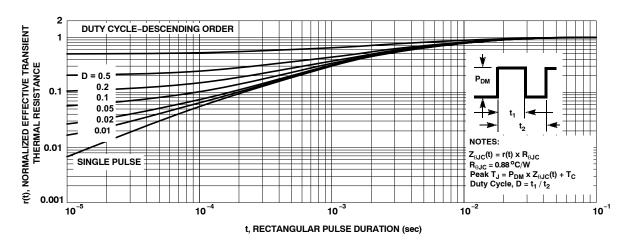
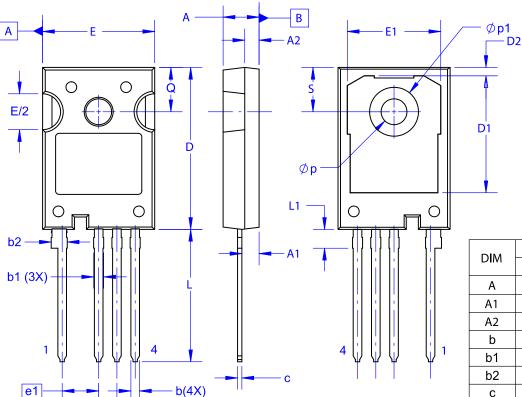


Figure 13. Junction-to-Case Transient Thermal Response Curve

TO-247-4LD CASE 340CJ **ISSUE A**

DATE 16 SEP 2019



NOTES:

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- 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.

DIM	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
С	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
е	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
р	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

MILLIMETERS

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