Onsemi

Silicon Carbide (SiC) MOSFET – 40 mohm, 1200 V, M1, TO-247-4L

NVH4L040N120SC1

Features

- Typ. $R_{DS(on)} = 40 \text{ m}\Omega$
- Ultra Low Gate Charge ($Q_{G(tot)} = 106 \text{ nC}$)
- High Speed Switching with Low Capacitance ($C_{oss} = 137 \text{ pF}$)
- 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)

Typical Applications

- Automotive On Board Charger
- Automotive DC-DC Converter for EV/HEV

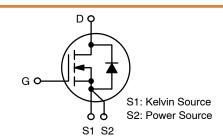
MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V _{DSS}	1200	V
Gate-to-Source Voltage			V _{GS}	-15/+25	V
	Recommended Operation Values T _C < 175°C of Gate-to-Source Voltage		V _{GSop}	-5/+20	V
Continuous Drain Current (Note 2)	Steady State	$T_C = 25^{\circ}C$	۱ _D	58	А
Power Dissipation (Note 2)			PD	319	W
Continuous Drain Current (Notes 1, 2)	Steady State	$T_{C} = 100^{\circ}C$	۱ _D	41	А
Power Dissipation (Notes 1, 2)			P _D	160	W
Pulsed Drain Current (Note 3)	$T_A = 25^{\circ}C$		I _{DM}	232	A
Single Pulse Surge Drain Current Capability	$\begin{array}{l} T_{C} = 25^{\circ}C, t_{p} = 10 \; \mu s, \\ R_{G} = 4.7 \; \Omega \end{array}$		I _{DSC}	416	А
Operating Junction and Storage Temperature Range			T _J , T _{stg}	–55 to +175	°C
Source Current (Body Diode)			IS	32	А
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 34 A, L = 1 mH$) (Note 4)			E _{AS}	578	mJ
Maximum Lead Temperature for Soldering (1/8" from case for 5 s)			ΤL	300	°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. JA is constant value to follow guide table of LV/HV discrete final datasheet
- generation. 2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
- 3. Repetitive rating, limited by max junction temperature.
- 4. EAS of 578 mJ is based on starting $T_J = 25^{\circ}C$; L = 1 mH, $I_{AS} = 34$ A, $V_{DD} = 120 \text{ V}, V_{GS} = 20 \text{ V}.$

V _{(BR)DSS}	R _{DS(ON)} MAX	I _D MAX
1200 V	56 mΩ @ 20 V	58 A



N-CHANNEL MOSFET



CASE 340CJ

MARKING DIAGRAM



= Assembly Location Α

Y = Year

ww = Work Week

= Lot Traceability ΖZ

NVH4L040N120SC1 = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
NVH4L040N120SC1	TO247-4L	30 Units / Tube

Table 1. THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Мах	Unit
Junction-to-Case - Steady State (Note 2)		0.47	°C/W
Junction-to-Ambient - Steady State (Notes 1, 2)	$R_{\theta JA}$	40	

Table 2. ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified)

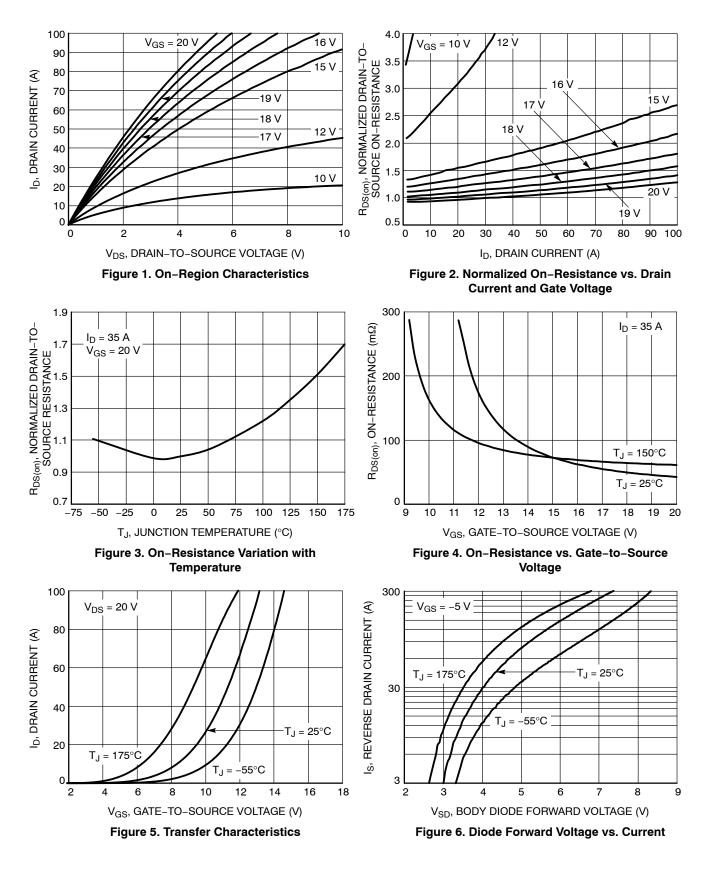
Parameter	Symbol	Test Condition		Min	Тур	Max	Unit
OFF CHARACTERISTICS							
Drain-to-Source Breakdown Voltage	V _{(BR)DSS}	V _{GS} = 0 V, I _D = 1 mA		1200	-	-	V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V _{(BR)DSS} /T _J	$I_D = 1$ mA, referenced to 25°C		_	0.45	-	V/°C
Zero Gate Voltage Drain Current	I _{DSS}	V _{GS} = 0 V,	$T_J = 25^{\circ}C$	-	_	100	μA
		V _{DS} = 1200 V	T _J = 175°C	-	-	1	mA
Gate-to-Source Leakage Current	I _{GSS}	V _{GS} = +25/-15 V, V _D	_S = 0 V	_	_	±1	μA
ON CHARACTERISTICS (Note 3)		1					
Gate Threshold Voltage	V _{GS(TH)}	V _{GS} = V _{DS} , I _D = 10 m	A	1.8	3.0	4.3	V
Recommended Gate Voltage	V _{GOP}			-5	-	+20	V
Drain-to-Source On Resistance	R _{DS(on)}	V _{GS} = 20 V, I _D = 35 A	, Т _Ј = 25°С	_	40	56	mΩ
		V _{GS} = 20 V, I _D = 35 A	, Т _Ј = 175°С	_	70	100	
Forward Transconductance	9 _{FS}	V _{DS} = 20 V, I _D = 35 A		_	20	_	S
CHARGES, CAPACITANCES & GATE RES							
Input Capacitance	C _{ISS}	V _{GS} = 0 V, f = 1 MHz, V _{DS} = 800 V		_	1762	_	pF
Output Capacitance	C _{OSS}			_	137	_	1
Reverse Transfer Capacitance	C _{RSS}			_	11	_	
Total Gate Charge	Q _{G(TOT)}	$V_{GS} = -5/20$ V, $V_{DS} = 600$ V, $I_D = 47$ A		_	106	_	nC
Threshold Gate Charge	Q _{G(TH)}			_	16	-	
Gate-to-Source Charge	Q _{GS}			-	34	-	
Gate-to-Drain Charge	Q _{GD}			_	26	-	
Gate-Resistance	R _G	f = 1 MHz		-	2.4	-	Ω
SWITCHING CHARACTERISTICS, VGS =	10 V	1					
Turn-On Delay Time	t _{d(ON)}	$V_{GS} = -5/20 \text{ V}, \text{ V}_{DS} =$		-	17	30	ns
Rise Time	t _r	$I_D = 47 \text{ A}, R_G = 4.7 \Omega$ Inductive load		-	20	36	-
Turn-Off Delay Time	t _{d(OFF)}			_	32	51	
Fall Time	t _f			_	10	20	
Turn-On Switching Loss	E _{ON}			_	411	-	μJ
Turn–Off Switching Loss	E _{OFF}			_	205	-	
Total Switching Loss	E _{tot}			_	616	-	
DRAIN-SOURCE DIODE CHARACTERIST				<u>. </u>	1		
Continuous Drain-Source Diode Forward Current	I _{SD}	$V_{GS} = -5 \text{ V}, \text{ T}_{J} = 25^{\circ}\text{ C}$	>	-	-	32	A
Pulsed Drain-Source Diode Forward Current (Note 3)	I _{SDM}			_	-	232	
Forward Diode Voltage	V _{SD}	$V_{GS} = -5 \text{ V}, \text{ I}_{SD} = 17.4 \text{ T}_{J} = 25^{\circ}\text{C}$	5 A,	_	3.7	-	V

Table 2. ELECTRICAL CHARACTERISTICS (T_J = 25° C unless otherwise specified) (continued)

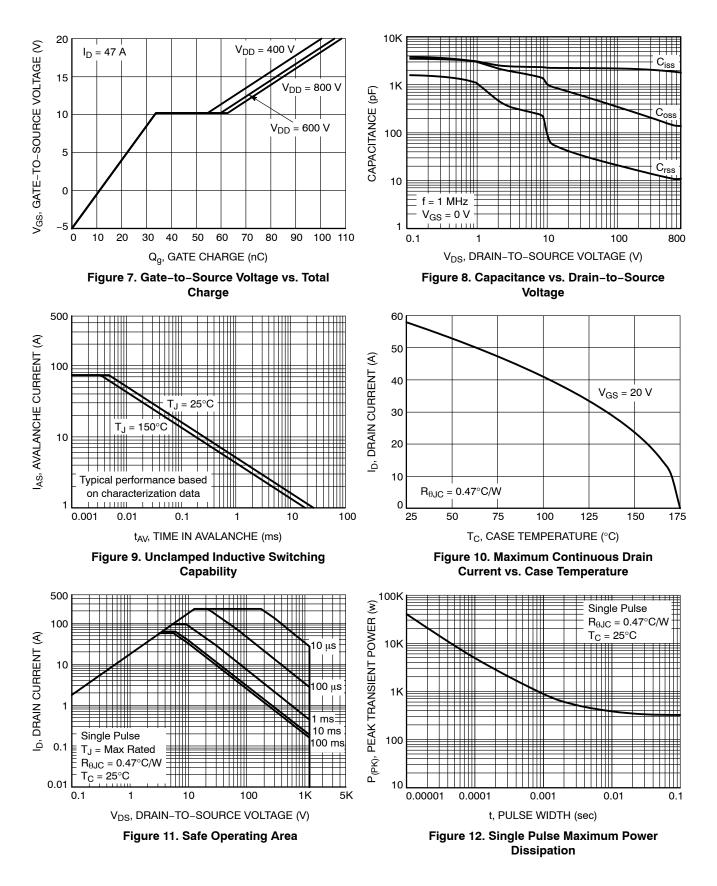
Parameter	Symbol	Test Condition	Min	Тур	Max	Unit		
DRAIN-SOURCE DIODE CHARACTERISTICS								
Reverse Recovery Time	t _{RR}	V _{GS} = -5/20 V, I _{SD} = 47 A, dI _S /dt = 1000 A/μs	-	24	-	ns		
Reverse Recovery Charge	Q _{RR}	dI _S /dt = 1000 A/μs	-	124.8	-	nC		
Reverse Recovery Energy	E _{REC}		-	8.4	-	μJ		
Peak Reverse Recovery Current	I _{RRM}		-	10.4	-	Α		
Charge Time	Та		-	12.4	-	ns		
Discharge Time	Tb		-	11.6	-	ns		

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



TYPICAL CHARACTERISTICS (continued)



TYPICAL CHARACTERISTICS (continued)

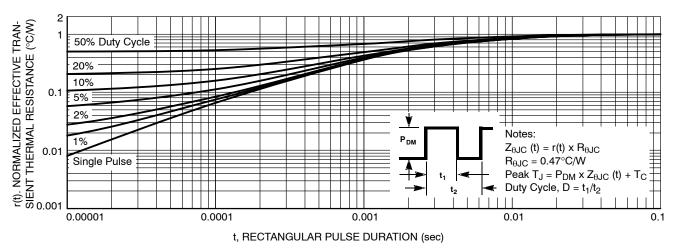
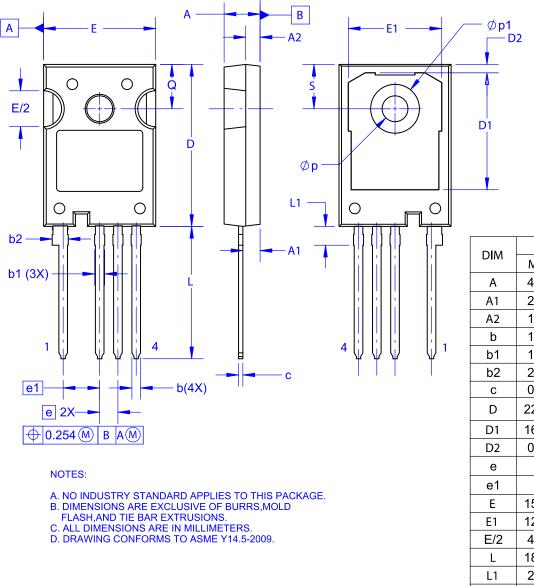


Figure 13. Junction-to-Ambient Thermal Response



TO-247-4LD CASE 340CJ ISSUE A

DATE 16 SEP 2019



	MILLIMETERS					
DIM	MIN	NOM	MAX			
А	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	2.54 BSC				
e1	Ę	5.08 BSC	2			
Е	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			

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