Onsemi

Silicon Carbide (SiC) **MOSFET** – EliteSiC, 13 mohm, 1200 V, M3S, Die

NTCR013N120M3S

Description

Silicon Carbide (SiC) MOSFET uses a completely new technology that provides 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

- Typ. $R_{DS(on)} = 13 \text{ m}\Omega @ V_{GS} = 18 \text{ V}$
- Low Switching Losses (Typ. E_{ON} 563 J at 75 A, 800 V)

Applications

- Solar Inverters
- Electric Vehicle Charging Stations
- Uninterruptible Power Supplies (UPS)
- Energy Storage Systems
- Switch Mode Power Supplies (SMPS)



N-CHANNEL MOSFET







Die Information

- Wafer Diameter
- Die Size • Тор
- Metallization Al/Si/Cu 5 µm · Back Ti/NiV/Ag 0.5 μm Die Thickness Typ. 100 μm

6 inch

4,380 x 6,380 µm

1300 x 1068 µm

Gate F

Pad	Size	

Die Layout

Die Cross Section



Passivation Information

- Passivation Material: Polymide (PSPI)
- Passivation Type: Local Passivation
- Passivation Thickness 15 μ m
 - : Passivation Area



Figure 1. Bare Die Dimensions

- 1. Based on TO-247 package of onsemi
- 2. Tested 100% on wafer
- 3. Sawn-on-film frame packing based on wafer tested

For Additional Product Information and Electrical Characteristics on Package Refer to the NTH4L013N120M3S product datasheet.

ORDERING INFORMATION AND PACKAGE MARKING

Part Number	Package	Packing Method
NTCR013N120M3S	Die	Wafer sawn-on-film



THERMAL CHARACTERISTICS

Parameter	Symbol	Тур	Max	Unit
Junction-to-Case - Steady State (Note 4)	$R_{ hetaJC}$	0.17	0.22	°C/W
Junction-to-Ambient - Steady State (Note 4)	R _{θJA}	_	40	

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

Parameter	Symbol	Test Condition	Min	Тур	Max	Unit
OFF-STATE 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 (Note 9)	-	0.3	-	V/°C
Zero Gate Voltage Drain Current	I _{DSS}	V_{GS} = 0 V, V_{DS} = 1200 V, T_{J} = 25°C	-	-	100	μA
Gate-to-Source Leakage Current	I _{GSS}	$V_{GS} = +22/-10 \text{ V}, \text{ V}_{DS} = 0 \text{ V}$	-	-	±1	μA
ON-STATE CHARACTERISTICS (Note 5)						
Gate Threshold Voltage	V _{GS(TH)}	$V_{GS} = V_{DS}, I_D = 37 \text{ mA}$	2.04	2.8	4.4	V
Recommended Gate Voltage	V _{GOP}		-3	-	+18	V
Drain-to-Source On Resistance	R _{DS(on)}	V_{GS} = 18 V, I _D = 75 A, T _J = 25°C	-	13	20	mΩ
		V _{GS} = 18 V, I _D = 75 A, T _J = 175°C (Note 9)	-	29	-	
Forward Transconductance	9 FS	V _{DS} = 10 V, I _D = 75 A (Note 9)	-	57	-	S
CHARGES, CAPACITANCES & GATE RES	ISTANCE					
Input Capacitance	C _{ISS}	V _{GS} = 0 V, f = 1 MHz, V _{DS} = 800 V	-	5813	-	pF
Output Capacitance	C _{OSS}	(Note 9)	-	262	-	
Reverse Transfer Capacitance	C _{RSS}		-	21	-	
Total Gate Charge	Q _{G(TOT)}	$V_{GS} = -3/18 \text{ V}, V_{DS} = 800 \text{ V},$	-	254	-	nC
Threshold Gate Charge	Q _{G(TH)}	I _D = 75 A (Note 9)	-	37	-	
Gate-to-Source Charge	Q _{GS}		-	46	-	
Gate-to-Drain Charge	Q _{GD}		-	61	-	
Gate-Resistance	R _G	f = 1 MHz	-	1.4	-	Ω
SWITCHING CHARACTERISTICS	-					
Turn-On Delay Time	t _{d(ON)}	$V_{GS} = -3/18 \text{ V}, V_{DS} = 800 \text{ V},$	-	22	-	ns
Rise Time	t _r	$I_D = 75 \text{ A}, \text{ H}_G = 4.7 \Omega$ Inductive load (Notes 8, 9)	-	23	-	
Turn-Off Delay Time	t _{d(OFF)}		-	56	-	
Fall Time	t _f		-	10	-	
Turn–On Switching Loss	E _{ON}		-	563	-	μJ
Turn-Off Switching Loss	E _{OFF}		-	390	-]
Total Switching Loss	E _{tot}		-	953	-	
Total Officiality 2000						
SOURCE-DRAIN DIODE CHARACTERIST	CS					
SOURCE-DRAIN DIODE CHARACTERIST	CS I _{SD}	V _{GS} = -3 V, T _C = 25°C (Note 9)	-	-	151	A
SOURCE-DRAIN DIODE CHARACTERIST Continuous Source-Drain Diode Forward Current Pulsed Source-Drain Diode Forward Current (Note 5)	I _{SD}	V _{GS} = -3 V, T _C = 25°C (Note 9)	-	-	151 505	A





ELECTRICAL CHARACTERISTICS ($T_J = 25^{\circ}C$ unless otherwise specified) (continued)

Parameter	Symbol	Test Condition	Min	Тур	Max	Unit	
SOURCE-DRAIN DIODE CHARACTERISTICS							
Reverse Recovery Time	t _{RR}	V _{GS} = -3/18 V, I _{SD} = 75 A, dI _S /dt = 1000 A/µs, V _{DS} = 800 V (Note 9)	-	29	-	ns	
Reverse Recovery Charge	Q _{RR}		-	252	-	nC	
Reverse Recovery Energy	E _{REC}		-	26	-	μJ	
Peak Reverse Recovery Current	I _{RRM}		-	18	-	А	
Charge Time	T _A		-	17	-	ns	
Discharge Time	Τ _B		-	12	-	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.

4. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

5. Repetitive rating, limited by max junction temperature.

6. The maximum current rating is based on typical $R_{DS(on)}$ performance. 7. E_{AS} of 800 mJ is based on starting $T_J = 25^{\circ}C$; L = 1 mH, $I_{AS} = 40$ A,

 $V_{DD} = 100 \text{ V}, V_{GS} = 18 \text{ V}.$ 8. E_{ON}/E_{OFF} result is with body diode.

9. Defined by design, not subject to production test.



TYPICAL CHARACTERISTICS





TYPICAL CHARACTERISTICS





TYPICAL CHARACTERISTICS





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