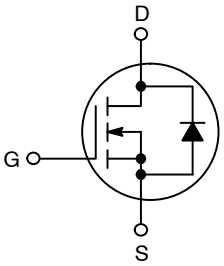
Silicon Carbide (SiC) MOSFET – 160 mohm, 1200 V, M1, Bare Die

NTC160N120SC1

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	I_D MAX
1200 V	224 mΩ @ 20 V	17 A

N−CHANNEL MOSFET



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.

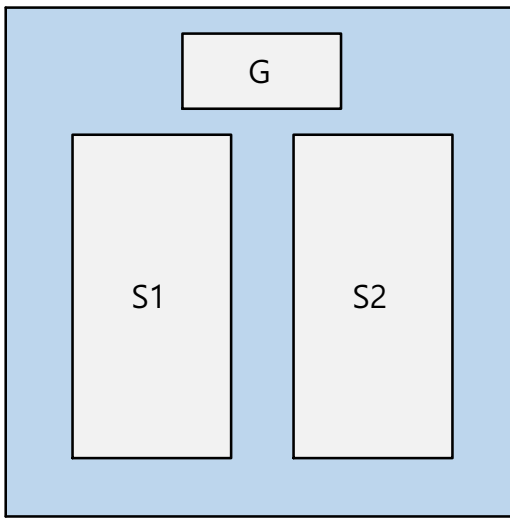
Features

- 1200 V @ T_J = 175°C
- Typ $R_{DS(on)}$ = 160 mΩ at V_{GS} = 20 V, I_D = 10 A
- High Speed Switching with Low Capacitance
- 100% UIL 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

DIE DIAGRAM

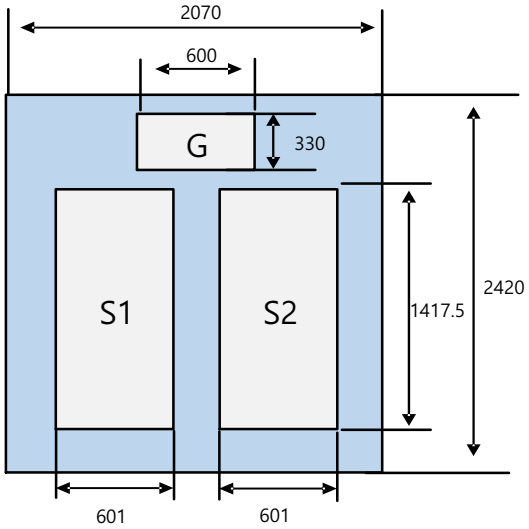


Die Information

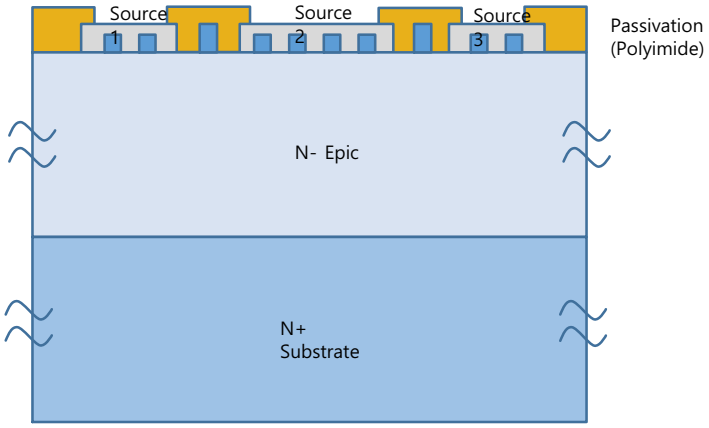
• Wafer Diameter	6 inch	
• Die Size	2,070 x 2,420 μm	
• Metallization		
· Top	Ti/TiN/Al	5 μm
· Back	Ti/NiV/Ag	
• Die Thickness	Typ. 200 μm	
• Gate Pad Size	600 x 330 μm	

© Semiconductor Components Industries, LLC, 2018

Die Layout



Die Cross Section



Passivation Information

– Passivation Material: Polymide (PSPI)

– Passivation Type: Local Passivation

– Passivation Thickness 10 μm

: Passivation Area

Die Layout

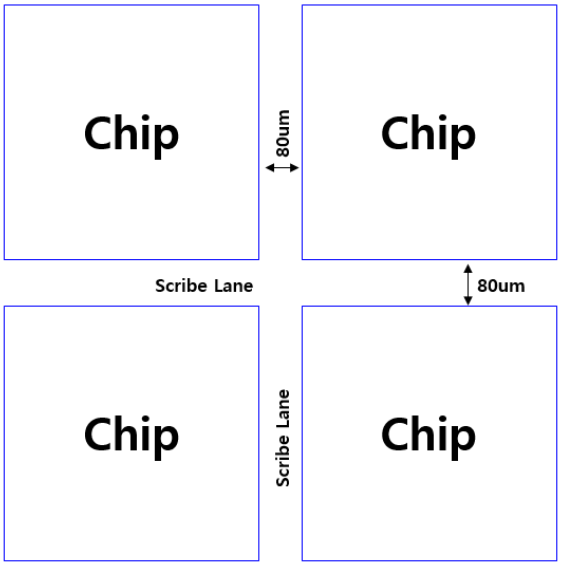


Figure 1. Bare Die Dimensions

MAXIMUM RATINGS (T_C = 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 of Gate−to−Source Voltage	T_C < 175°C		V_{GSop}	−5/+20	V
Continuous Drain Current $R_{\theta JC}$	Steady State	T_C = 25°C	I_D	17	A
Power Dissipation $R_{\theta JC}$			P_D	119	W
Continuous Drain Current $R_{\theta JC}$	Steady State	T_C = 100°C	I_D	12	A
Power Dissipation $R_{\theta JC}$			P_D	59	W
Pulsed Drain Current (Note 2)	T_C = 25°C		I_{DM}	69	A
Single Pulse Surge Drain Current Capability	T_C = 25°C, t_p = 10 μs, R_G = 4.7 Ω		I_{DSC}	140	A
Operating Junction and Storage Temperature Range			T_J, T_{stg}	−55 to +175	°C
Source Current (Body Diode)			I_S	11	A
Single Pulse Drain−to−Source Avalanche Energy ($I_{L(pk)}$ = 23 A, L = 1 mH) (Note 3)			E_{AS}	128	mJ

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.

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction−to−Case (Note 1)	$R_{\theta JC}$	1.3	°C/W

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Repetitive rating, limited by max junction temperature.
3. E_{AS} of 128 mJ is based on starting T_J = 25°C; L = 1 mH, I_{AS} = 16 A, V_{DD} = 120 V, V_{GS} = 18 V.

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

Parameter	Symbol	Test Conditions	Min	Typ	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	–	600	–	mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 1200 V, T_J = 25°C	–	–	100	μA
		V_{GS} = 0 V, V_{DS} = 1200 V, T_J = 175°C	–	–	250	
Gate−to−Source Leakage Current	I_{GSS}	V_{GS} = +25/−15 V, V_{DS} = 0 V	–	–	±1	μA
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS} = V_{DS}, I_D = 2.5 mA	1.8	3.1	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 = 12 A, T_J = 25°C	–	162	224	mΩ
		V_{GS} = 20 V, I_D = 12 A, T_J = 150°C	–	247	–	
Forward Transconductance	g_{FS}	V_{DS} = 10 V, I_D = 12 A	–	3	–	S
CHARGES, CAPACITANCES & GATE RESISTANCE						
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = 800 V	–	665	–	pF
Output Capacitance	C_{OSS}		–	50	–	
Reverse Transfer Capacitance	C_{RSS}		–	5	–	
Total Gate Charge	$Q_{G(tot)}$	V_{GS} = −5/20 V, V_{DS} = 600 V, I_D = 16 A	–	34	–	nC
Threshold Gate Charge	$Q_{G(th)}$		–	6	–	
Gate−to−Source Charge	Q_{GS}		–	12.5	–	
Gate−to−Drain Charge	Q_{GD}		–	9.6	–	
Gate Resistance	R_G	f = 1 MHz	–	1.4	–	Ω
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{d(on)}$	V_{GS} = −5/20 V, V_{DS} = 800 V, I_D = 16 A, R_G = 6 Ω, Inductive Load	–	11	–	ns
Rise Time	t_r		–	19	–	
Turn−Off Delay Time	$t_{d(off)}$		–	15	–	
Fall Time	t_f		–	8	–	
Turn-On Switching Loss	E_{ON}		–	200	–	μJ
Turn-Off Switching Loss	E_{OFF}		–	34	–	
Total Switching Loss	E_{TOT}		–	234	–	
DRAIN−SOURCE DIODE CHARACTERISTICS						
Continuous Drain−to−Source Diode Forward Current	I_{SD}	V_{GS} = −5 V	–	–	11	A
Pulsed Drain−to−Source Diode Forward Current (Note 2)	I_{SDM}	V_{GS} = −5 V	–	–	69	A
Forward Diode Voltage	V_{SD}	V_{GS} = −5 V, I_{SD} = 6 A	–	4	10	V
Reverse Recovery Time	t_{RR}	V_{GS} = −5/20 V, I_{SD} = 16 A, dI_S/dt = 1000 A/μs	–	15	–	ns
Reverse Recovery Charge	Q_{RR}		–	45	–	nC
Reverse Recovery Energy	E_{REC}		–	3.9	–	μJ
Peak Reverse Recovery Current	I_{RRM}		–	6.2	–	A
Charge Time	Ta		–	7.4	–	ns
Discharge Time	Tb		–	7	–	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 (T_J = 25°C unless otherwise noted)

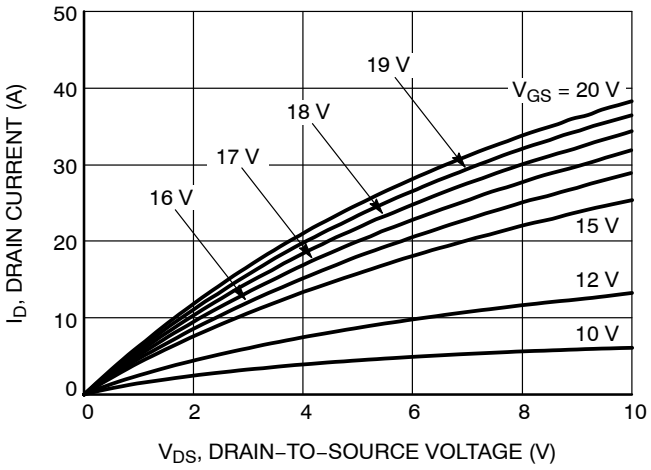


Figure 2. On−Region Characteristics

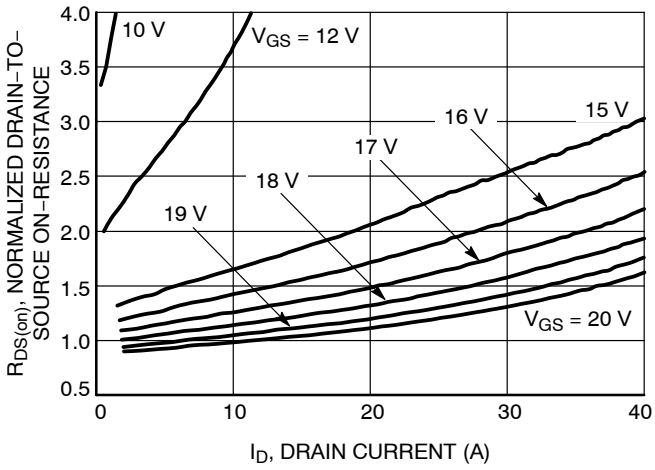


Figure 3. Normalized On−Resistance vs. Drain Current and Gate Voltage

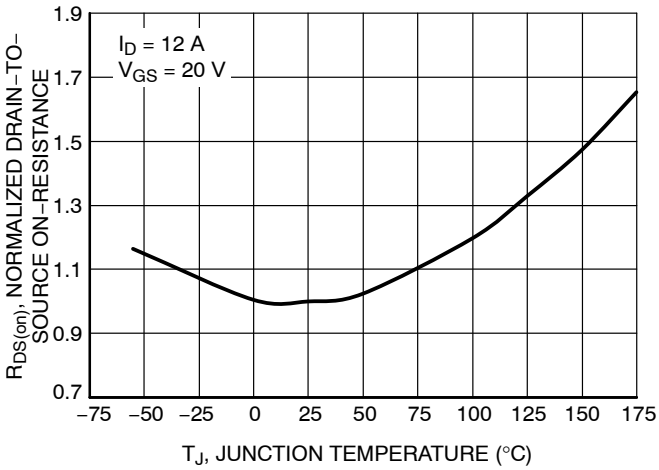


Figure 4. On−Resistance Variation with Temperature

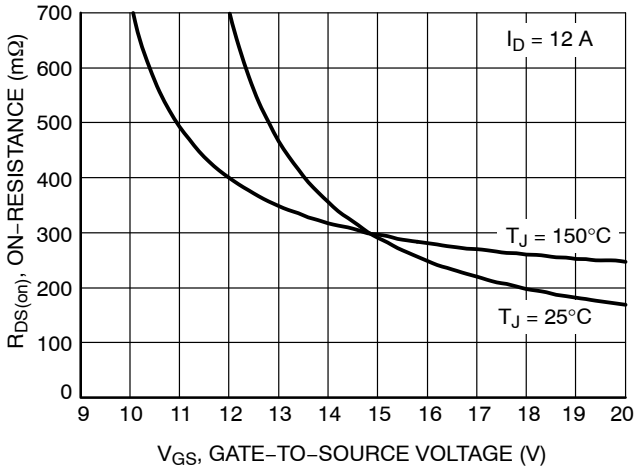


Figure 5. On−Resistance vs. Gate−to−Source Voltage

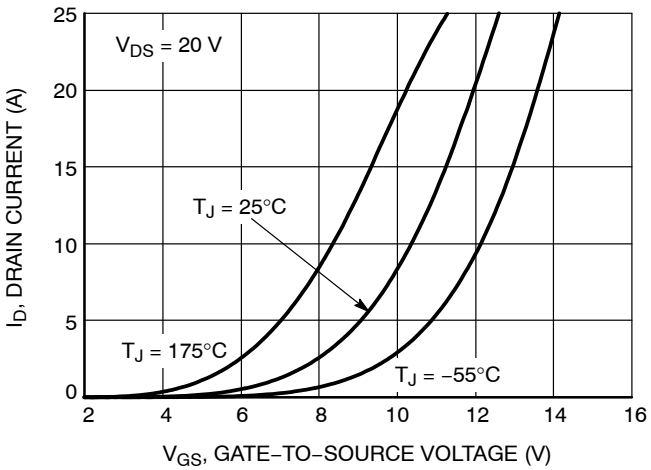


Figure 6. Transfer Characteristics

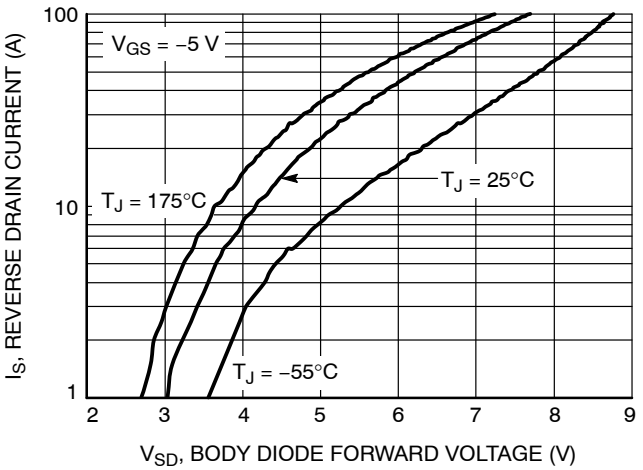


Figure 7. Diode Forward Voltage vs. Current

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

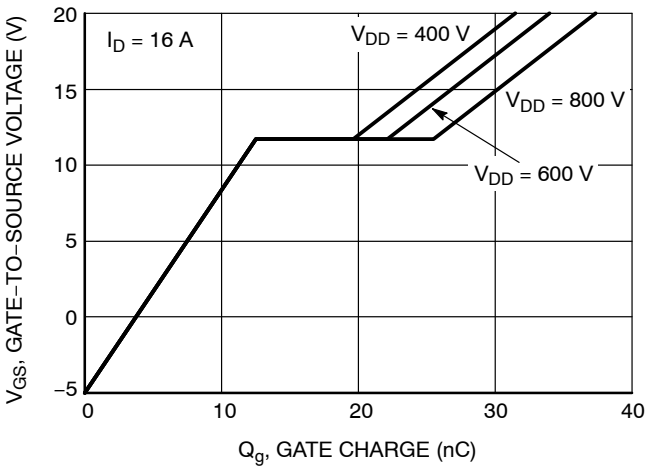


Figure 8. Gate−to−Source Voltage vs. Total Charge

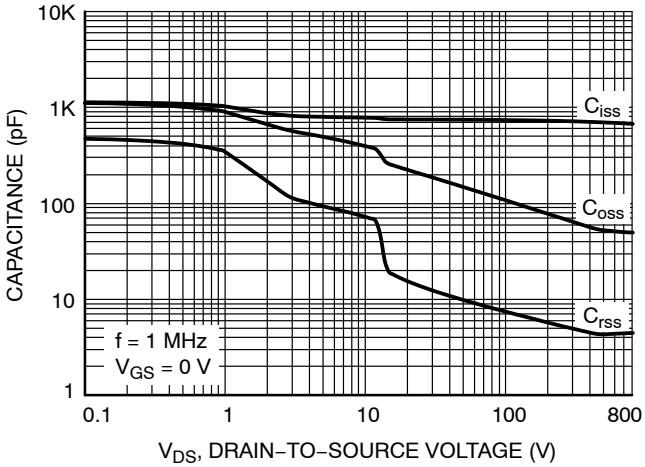


Figure 9. Capacitance vs. Drain−to−Source Voltage

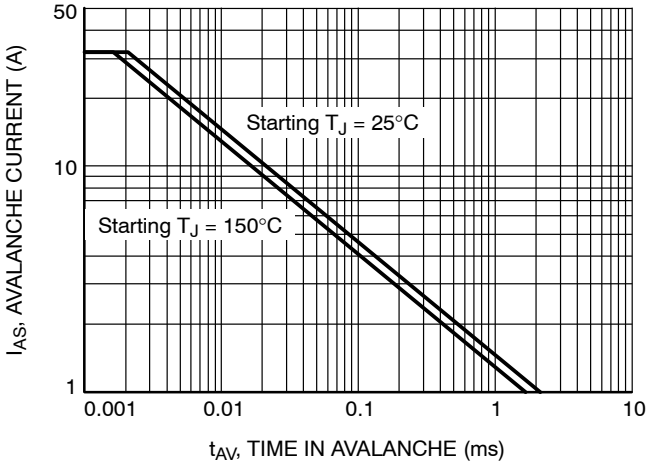


Figure 10. Unclamped Inductive Switching Capability

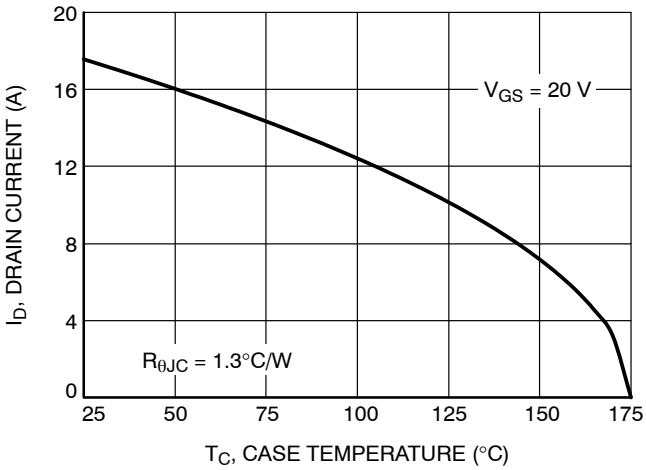


Figure 11. Maximum Continuous Drain Current vs. Case Temperature

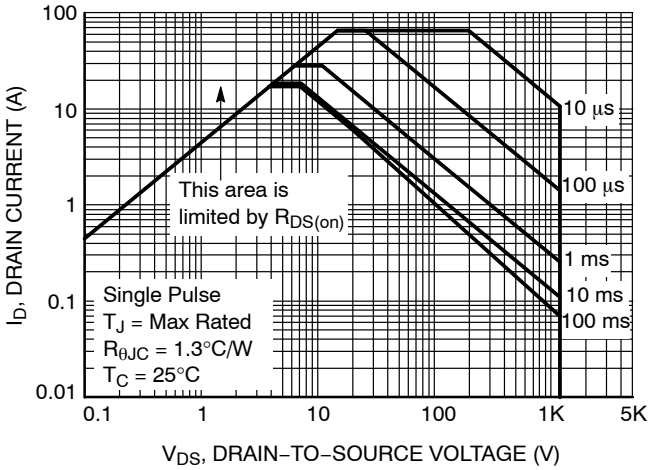


Figure 12. Safe Operating Area

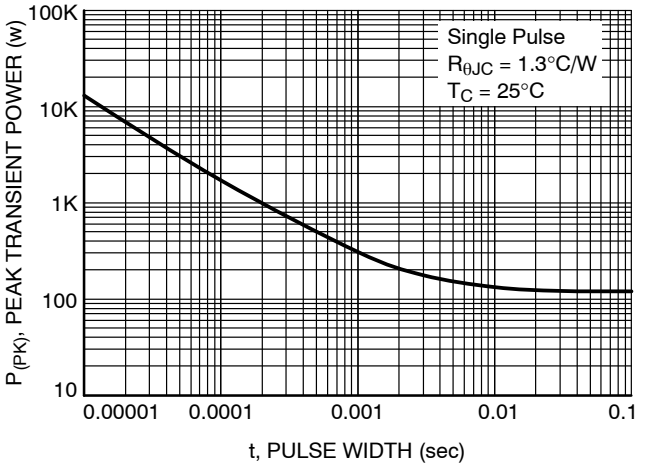


Figure 13. Single Pulse Maximum Power Dissipation

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

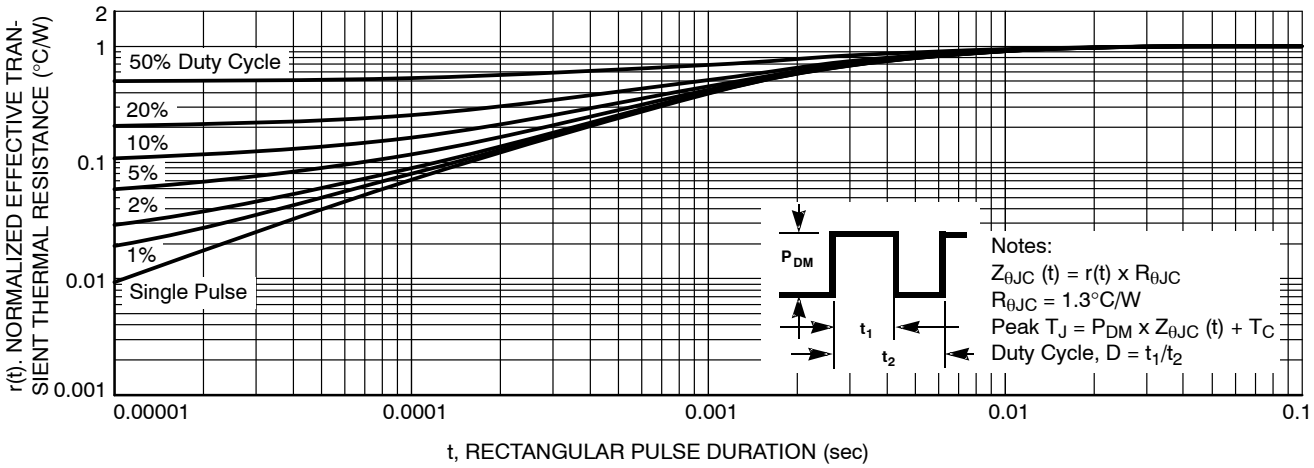


Figure 14. Junction−to−Ambient Thermal Response

ORDERING INFORMATION AND PACKAGE MARKING

Orderable Part Number	Top Marking	Package	Packing Method	Reel Size	Tape Width	Quantity
NTC160N120SC1	N/A	Die	Wafer	N/A	N/A	N/A

onsemi, ONSEMI , and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent−Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as−is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

TECHNICAL SUPPORT
North American Technical Support:
Voice Mail: 1 800−282−9855 Toll Free USA/Canada
Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative

◊