

Silicon Carbide (SiC) MOSFET – EliteSiC, 28 mohm, 1700 V, M1, TO-247-4L

NTH4L028N170M1

Features

- Typ. $R_{DS(on)}$ = 28 mΩ @ $V_{GS} = 20$ V
- Ultra Low Gate Charge ($Q_{G(tot)} = 200$ nC)
- High Speed Switching with Low Capacitance ($C_{oss} = 200$ pF)
- 100% Avalanche Tested
- These Devices are Pb-Free and are RoHS Compliant

Typical Applications

- UPS
- DC-DC Converter
- Boost Converter

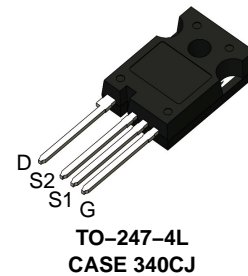
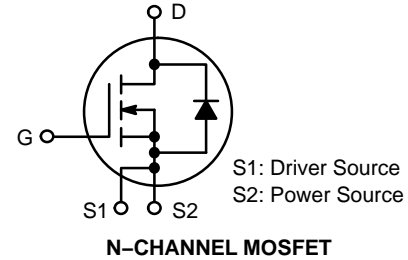
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter		Symbol	Value	Unit	
Drain-to-Source Voltage		V_{DSS}	1700	V	
Gate-to-Source Voltage		V_{GS}	-15/+25	V	
Recommended Operation Values of Gate-to-Source Voltage		$T_C < 175^\circ\text{C}$ V_{GSop}	-5/+20	V	
Continuous Drain Current (Note 1)	Steady State	$T_C = 25^\circ\text{C}$	I_D	81	A
			P_D	535	W
Power Dissipation (Note 1)	Steady State	$T_C = 100^\circ\text{C}$	I_D	57	A
			P_D	267	W
Pulsed Drain Current (Note 2)	$T_C = 25^\circ\text{C}$		I_{DM}	363	A
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to +175	$^\circ\text{C}$	
Source Current (Body Diode)		I_S	124	A	
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 30$ A, $L = 1$ mH) (Note 3)		E_{AS}	450	mJ	
Maximum Lead Temperature for Soldering (1/8" from case for 5 s)		T_L	300	$^\circ\text{C}$	

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. 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. EAS of 450 mJ is based on starting $T_J = 25^\circ\text{C}$; $L = 1$ mH, $I_{AS} = 30$ A, $V_{DD} = 120$ V, $V_{GS} = 18$ V.

$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
1700 V	40 mΩ @ 20 V	81 A



MARKING DIAGRAM



H4L028N170M1 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Lot Traceability

ORDERING INFORMATION

Device	Package	Shipping
NTH4L028N170M1	TO-247-4L	30 Units / Tube

NTH4L028N170M1

THEMAL CHARACTERISTICS

Parameter	Symbol	Max	Unit
Junction-to-Case – Steady State (Note 1)	$R_{\theta JC}$	0.28	$^{\circ}\text{C/W}$

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	1700	–	–	V	
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 1\text{ mA}$, referenced to 25°C	–	0.46	–	$\text{V}/^{\circ}\text{C}$	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 1700\text{ V}$	$T_J = 25^{\circ}\text{C}$	–	–	100	μA
			$T_J = 175^{\circ}\text{C}$	–	–	1	mA
Gate-to-Source Leakage Current	I_{GSS}	$V_{GS} = +25/-15\text{ V}, V_{DS} = 0\text{ V}$	–	–	± 1	μA	

ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 20\text{ mA}$	1.8	2.75	4.3	V
Recommended Gate Voltage	V_{GOP}		–5	–	+20	V
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 20\text{ V}, I_D = 60\text{ A}, T_J = 25^{\circ}\text{C}$	–	28	40	m Ω
		$V_{GS} = 20\text{ V}, I_D = 60\text{ A}, T_J = 175^{\circ}\text{C}$	–	57	–	
Forward Transconductance	g_{FS}	$V_{DS} = 20\text{ V}, I_D = 60\text{ A}$	–	31	–	S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 800\text{ V}$	–	4230	–	pF
Output Capacitance	C_{OSS}		–	200	–	
Reverse Transfer Capacitance	C_{RSS}		–	10	–	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -5/20\text{ V}, V_{DS} = 800\text{ V}, I_D = 60\text{ A}$	–	200	–	nC
Gate-to-Source Charge	Q_{GS}		–	77	–	
Gate-to-Drain Charge	Q_{GD}		–	46	–	
Gate-Resistance	R_G	$f = 1\text{ MHz}$	–	5.8	–	Ω

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -5/20\text{ V}, V_{DS} = 1200\text{ V}, I_D = 60\text{ A}, R_G = 2\text{ }\Omega$ inductive load	–	47	–	ns
Rise Time	t_r		–	18	–	
Turn-Off Delay Time	$t_{d(OFF)}$		–	121	–	
Fall Time	t_f		–	13	–	
Turn-On Switching Loss	E_{ON}		–	1311	–	μJ
Turn-Off Switching Loss	E_{OFF}		–	683	–	
Total Switching Loss	E_{tot}		–	1994	–	

SOURCE-DRAIN DIODE CHARACTERISTICS

Continuous Source-Drain Diode Forward Current	I_{SD}	$V_{GS} = -5\text{ V}, T_J = 25^{\circ}\text{C}$	–	–	124	A
Pulsed Source-Drain Diode Forward Current (Note 2)	I_{SDM}		–	–	363	
Forward Diode Voltage	V_{SD}	$V_{GS} = -5\text{ V}, I_{SD} = 60\text{ A}, T_J = 25^{\circ}\text{C}$	–	4.3	–	V
Reverse Recovery Time	t_{RR}	$V_{GS} = -5/20\text{ V}, I_{SD} = 60\text{ A}, dI_S/dt = 1000\text{ A}/\mu\text{s}$	–	34	–	ns
Reverse Recovery Charge	Q_{RR}		–	263	–	nC

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

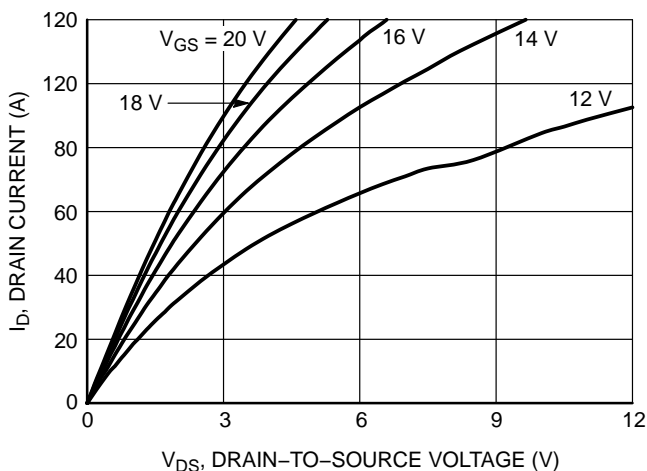


Figure 1. On-Region Characteristics

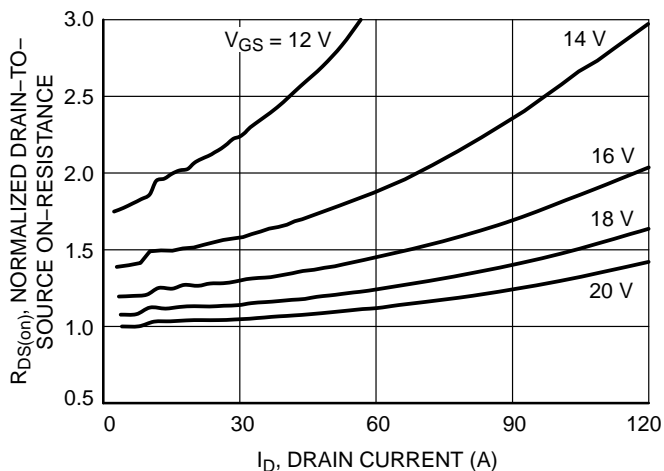


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

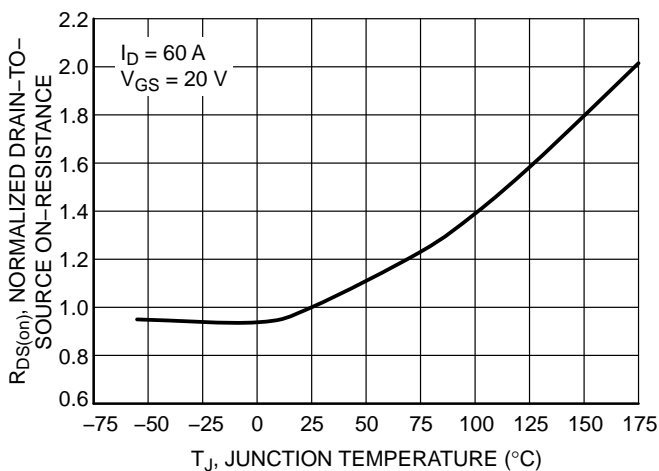


Figure 3. On-Resistance Variation with Temperature

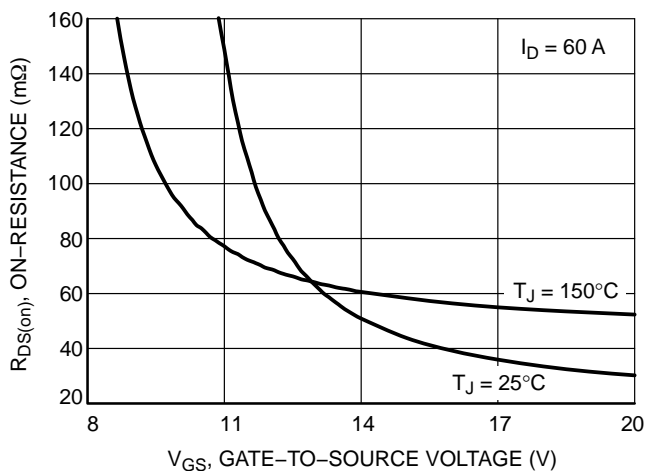


Figure 4. On-Resistance vs. Gate-to-Source Voltage

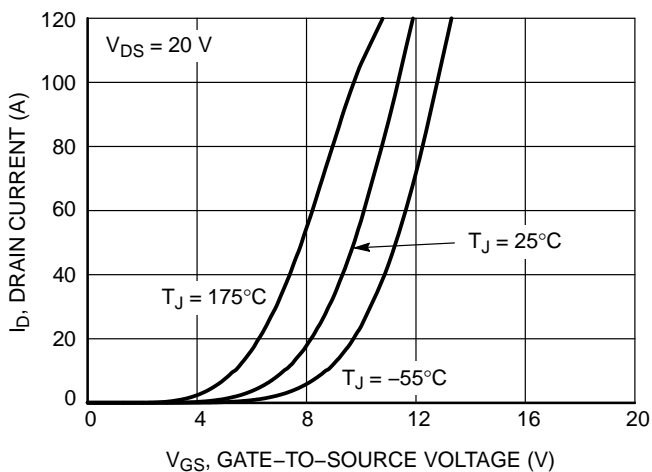


Figure 5. Transfer Characteristics

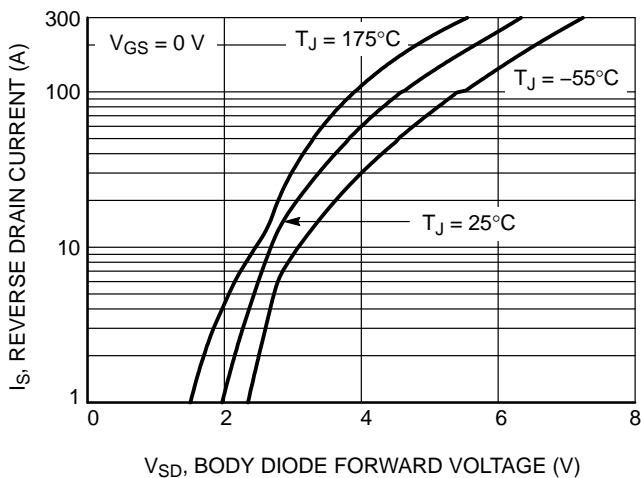


Figure 6. Diode Forward Voltage vs. Current

NTH4L028N170M1

TYPICAL CHARACTERISTICS

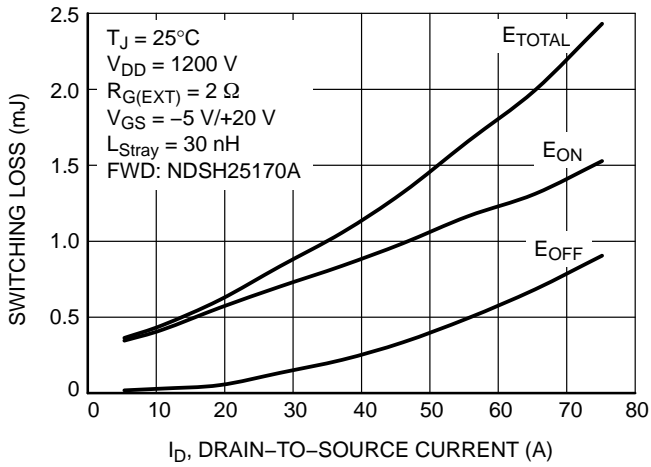


Figure 7. Switching Loss vs. Drain-to-Source Current (25°C)

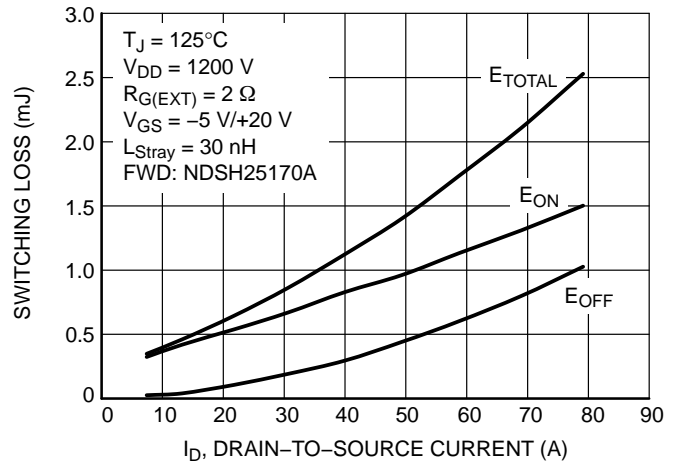


Figure 8. Switching Loss vs. Drain-to-Source Current (125°C)

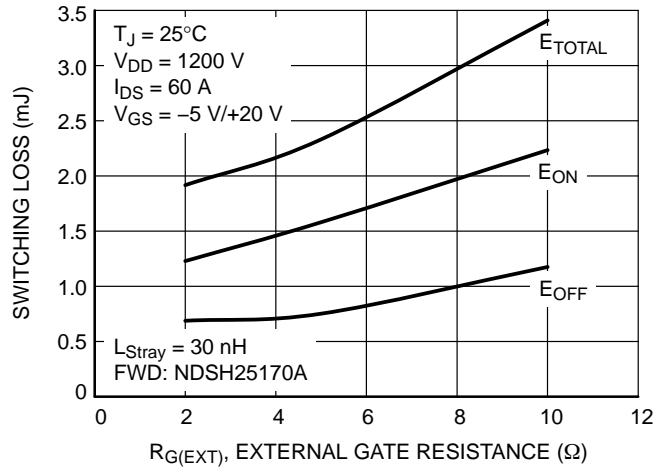


Figure 9. Switching Loss vs. External Gate Resistance

TYPICAL CHARACTERISTICS

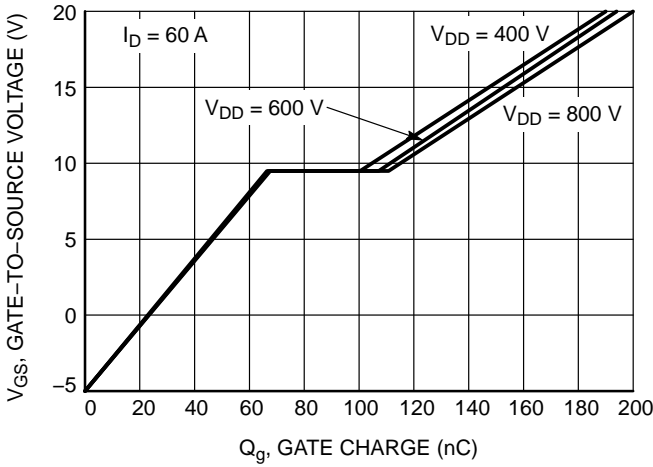


Figure 10. Gate-to-Source Voltage vs. Total Charge

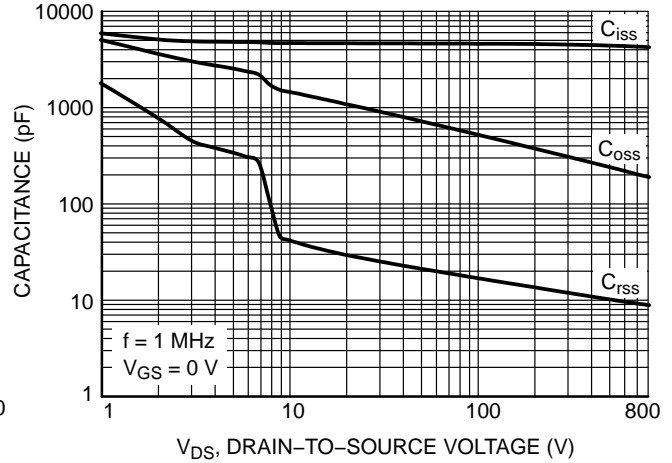


Figure 11. Capacitance vs. Drain-to-Source Voltage

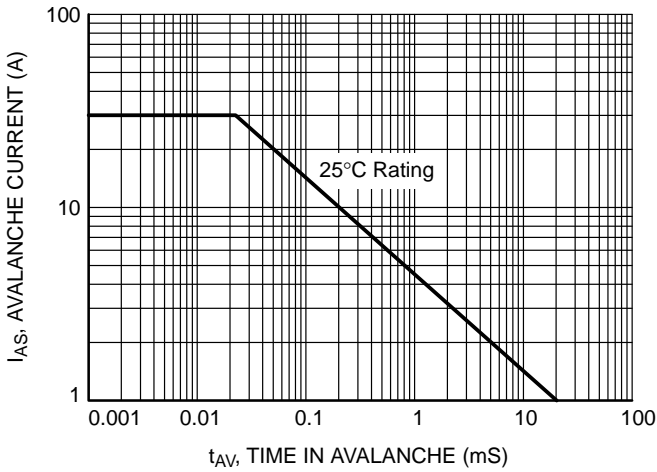


Figure 12. Unclamped Inductive Switching Capability

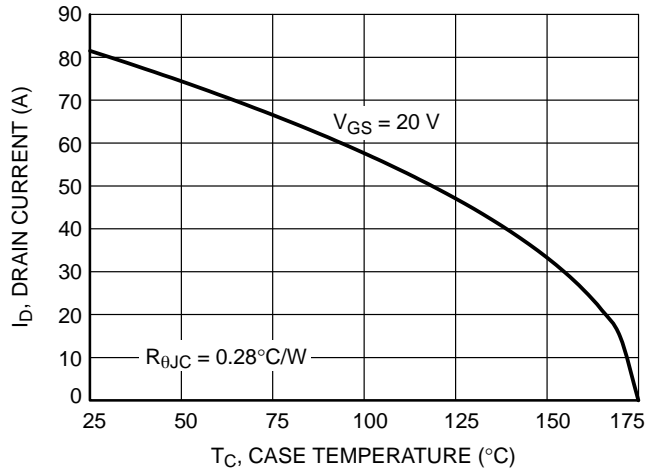


Figure 13. Maximum Continuous Drain Current vs. Case Temperature

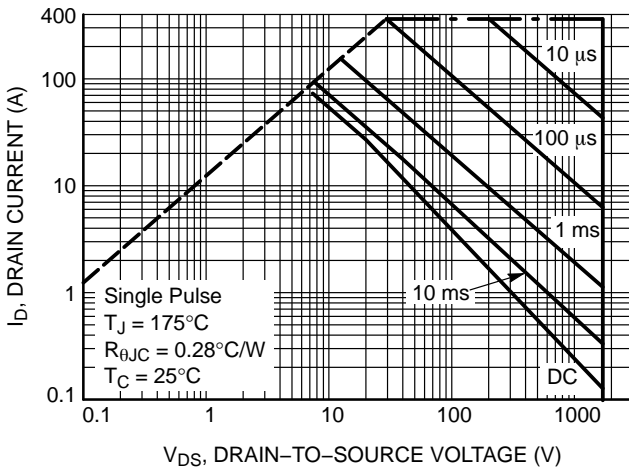


Figure 14. Safe Operating Area

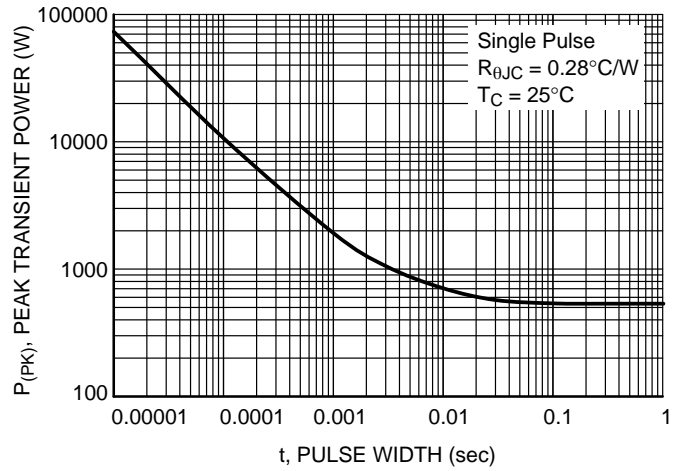


Figure 15. Single Pulse Maximum Power Dissipation

NTH4L028N170M1

TYPICAL CHARACTERISTICS

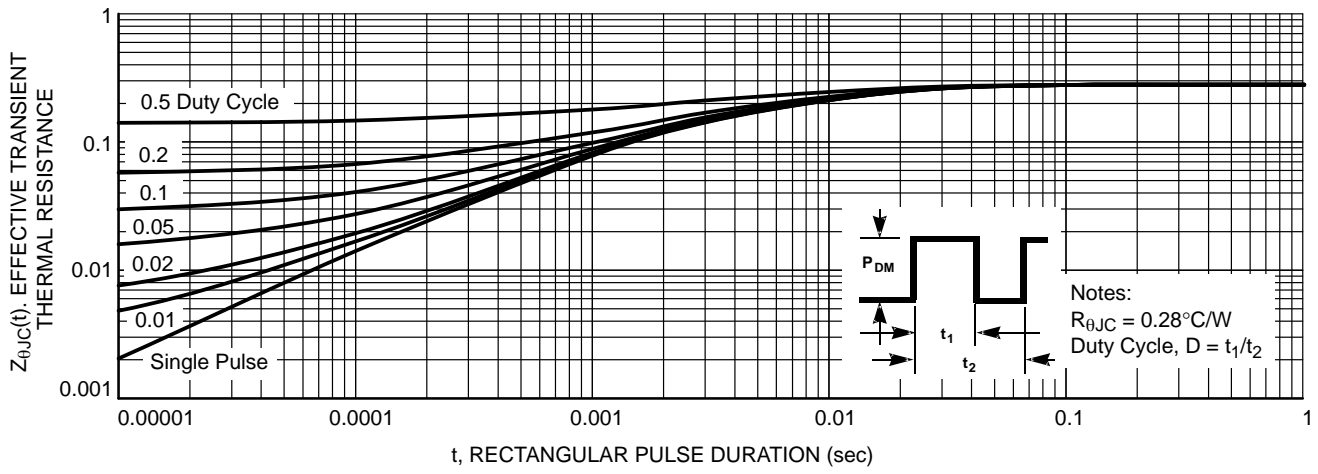


Figure 16. Junction-to-Case Thermal Response

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®



TO-247-4LD
CASE 340CJ
ISSUE A

DATE 16 SEP 2019



DIM	MILLIMETERS		
	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
c	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
e	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
p	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

NOTES:

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- 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.

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