

Silicon Carbide (SiC) MOSFET – EliteSiC, 53 mohm, 1700 V, M1, TO-247-4L NVH4L050N170M1

Features

- Typ. $R_{DS(on)} = 53 \text{ m}\Omega$ @ $V_{GS} = 20 \text{ V}$
- Ultra Low Gate Charge ($Q_{G(tot)} = 105 \text{ nC}$)
- High Speed Switching with Low Capacitance ($C_{oss} = 98 \text{ pF}$)
- 100% Avalanche Tested
- These Devices are Pb-Free and are RoHS Compliant

Typical Applications

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

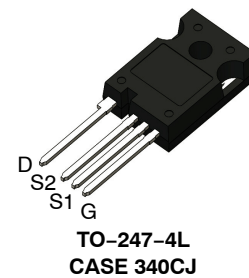
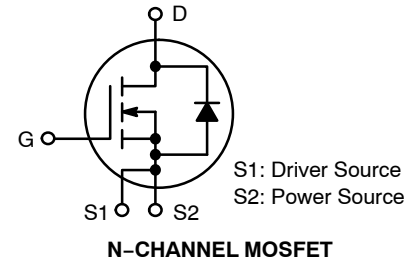
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

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°C	V _{GSop}	-5/+20	V
Continuous Drain Current (Note 1)	Steady State	T _C = 25°C	I _D	45	A
Power Dissipation (Note 1)			P _D	333	W
Continuous Drain Current (Note 1)	Steady State	T _C = 100°C	I _D	32	A
Power Dissipation (Note 1)			P _D	167	W
Pulsed Drain Current (Note 2)	T _C = 25°C t _p = 100 μs		I _{DM}	147	A
Operating Junction and Storage Temperature Range			T _J , T _{stg}	-55 to +175	°C
Continuous Source Current (Body Diode)			I _S	77	A
Single Pulse Drain-to-Source Avalanche Energy (I _{L(pk)} = 22.8 A, L = 1 mH) (Note 3)			E _{AS}	260	mJ
Maximum Lead Temperature for Soldering (1/25" from case for 10 s)			T _L	270	°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. Single pulse, limited by max junction temperature.
3. EAS of 260 mJ is based on starting $T_J = 25^\circ\text{C}$; $L = 1 \text{ mH}$, $I_{AS} = 22.8 \text{ A}$, $V_{DD} = 120 \text{ V}$, $V_{GS} = 18 \text{ V}$.

$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
1700 V	76 m Ω @ 20 V	45 A



MARKING DIAGRAM



H4L050N170M1 = Specific Device Code

A = Assembly Location

Y = Year

WW = Work Week

ZZ = Lot Traceability

ORDERING INFORMATION

Device	Package	Shipping
NVH4L050N170M1	TO-247-4L	30 Units / Tube

NVH4L050N170M1

THERMAL CHARACTERISTICS

Parameter	Symbol	Max	Unit
Junction-to-Case – Steady State (Note 1)	$R_{\theta JC}$	0.45	$^{\circ}\text{C/W}$

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	–	0.5	–	$\text{V}/^{\circ}\text{C}$
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
		$V_{GS} = 0\text{ V}, V_{DS} = 1700\text{ V}, T_J = 175^{\circ}\text{C}$ (Note 5)	–	–	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	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 10\text{ mA}$	1.8	3.1	4.3	V
Recommended Gate Voltage	V_{GOP}		–5	–	+20	V
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 20\text{ V}, I_D = 35\text{ A}, T_J = 25^{\circ}\text{C}$	–	53	76	$\text{m}\Omega$
		$V_{GS} = 20\text{ V}, I_D = 35\text{ A}, T_J = 175^{\circ}\text{C}$ (Note 5)	–	112	–	
Forward Transconductance	g_{FS}	$V_{DS} = 20\text{ V}, I_D = 35\text{ A}$ (Note 5)	–	23	–	S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 1000\text{ V}$ (Note 5)	–	2063	–	pF
Output Capacitance	C_{OSS}		–	98	–	
Reverse Transfer Capacitance	C_{RSS}		–	7.9	–	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -5/20\text{ V}, V_{DS} = 1000\text{ V}, I_D = 35\text{ A}$ (Note 5)	–	105	–	nC
Gate-to-Source Charge	Q_{GS}		–	31	–	
Gate-to-Drain Charge	Q_{GD}		–	24	–	
Gate-Resistance	R_G	$f = 1\text{ MHz}$	–	2.1	–	Ω

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -5/20\text{ V}, V_{DS} = 1200\text{ V}, I_D = 35\text{ A}, R_G = 3.9\Omega$ inductive load (Note 4) and (Note 5)	–	14	–	ns
Rise Time	t_r		–	22	–	
Turn-Off Delay Time	$t_{d(OFF)}$		–	44	–	
Fall Time	t_f		–	13	–	
Turn-On Switching Loss	E_{ON}		–	803	–	μJ
Turn-Off Switching Loss	E_{OFF}		–	198	–	
Total Switching Loss	E_{tot}		–	1001	–	

SOURCE-DrAIN DIODE CHARACTERISTICS

Continuous Source-Drain Diode Forward Current	I_{SD}	$V_{GS} = -5\text{ V}, T_J = 25^{\circ}\text{C}$	–	–	77	A
Pulsed Source-Drain Diode Forward Current (Note 2)	I_{SDM}		–	–	404	
Forward Diode Voltage	V_{SD}	$V_{GS} = -5\text{ V}, I_{SD} = 35\text{ A}, T_J = 25^{\circ}\text{C}$	–	4.3	–	V
Reverse Recovery Time	t_{RR}	$V_{GS} = -5/20\text{ V}, I_{SD} = 35\text{ A}, dI_S/dt = 1000\text{ A}/\mu\text{s}$ (Note 5)	–	27	–	ns
Reverse Recovery Charge	Q_{RR}		–	233	–	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.

4. EON / EOFF result is with body diode.

5. Defined by design, not subject to production.

TYPICAL CHARACTERISTICS

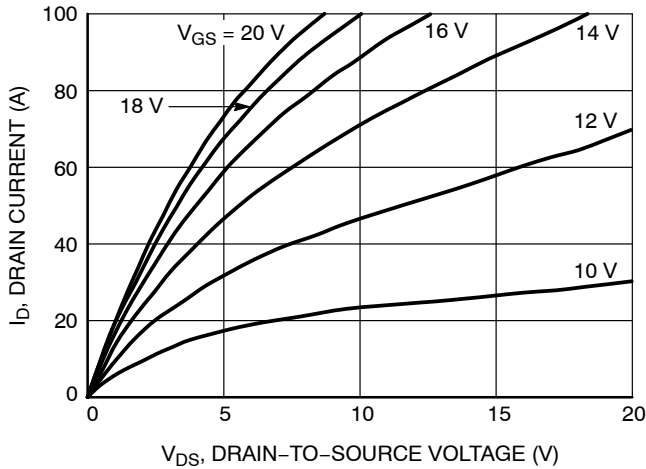


Figure 1. On-Region Characteristics

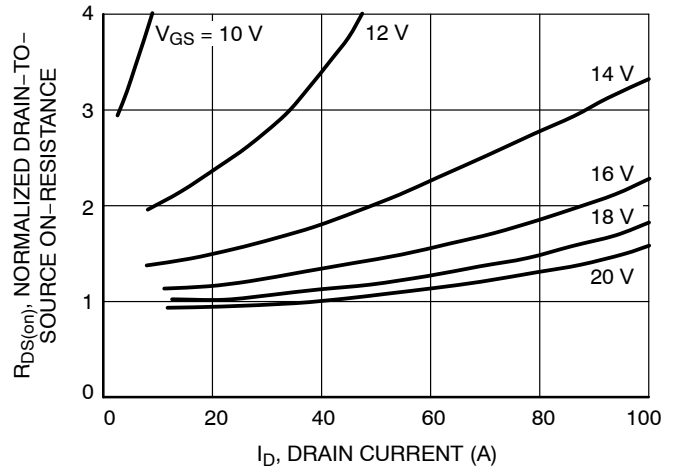


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

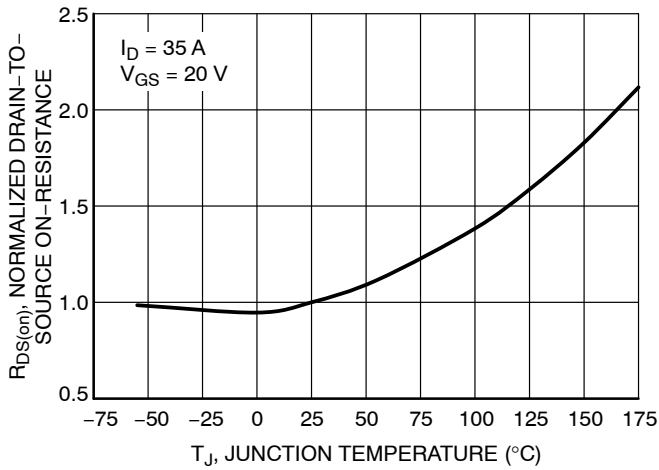


Figure 3. On-Resistance Variation with Temperature

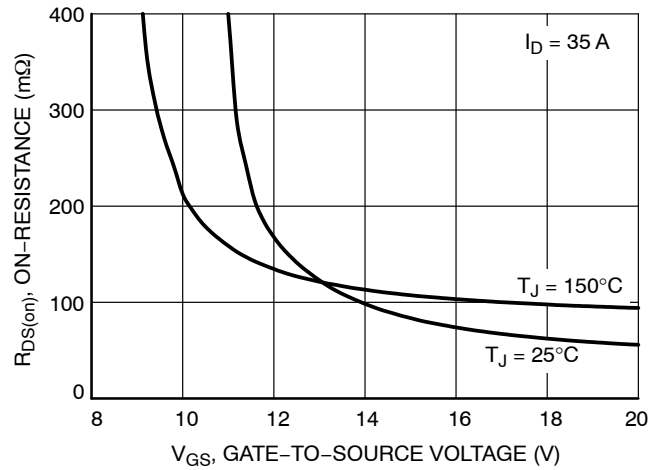


Figure 4. On-Resistance vs. Gate-to-Source Voltage

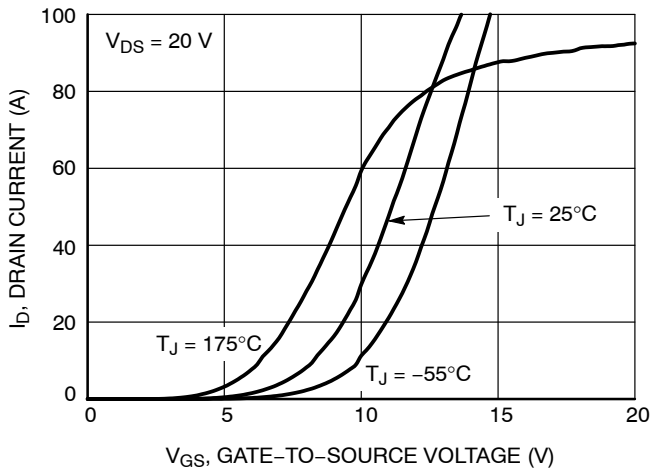


Figure 5. Transfer Characteristics

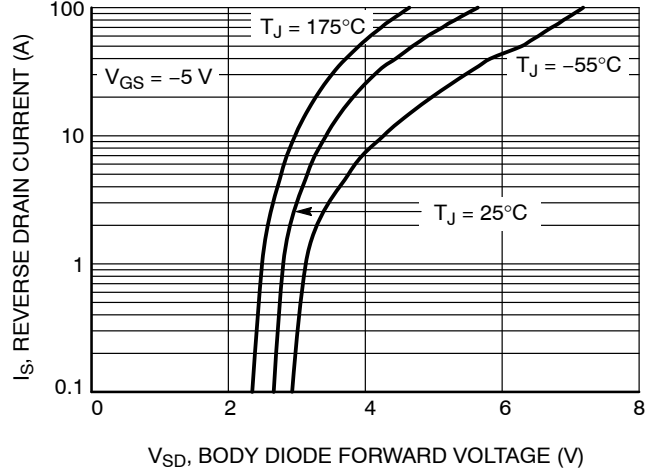


Figure 6. Diode Forward Voltage vs. Current

TYPICAL CHARACTERISTICS

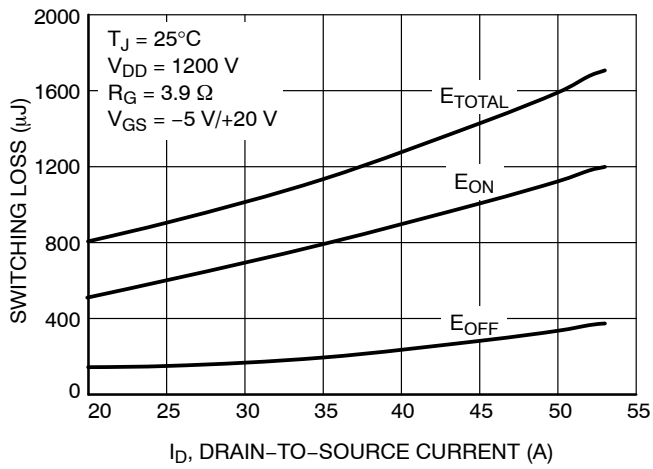


Figure 7. Switching Loss vs. Drain-to-Source Current (25°C)

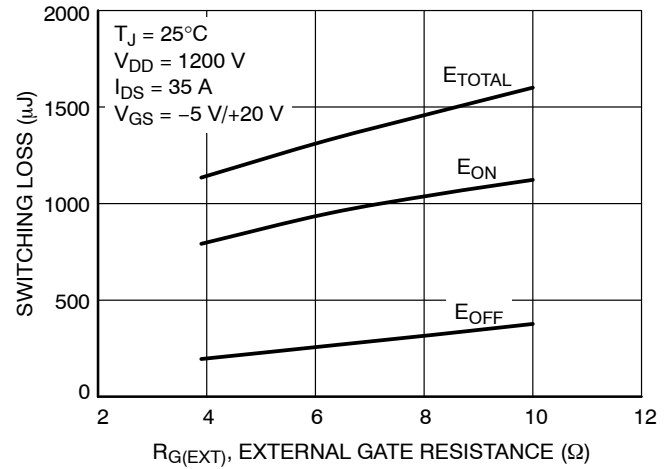


Figure 8. Switching Loss vs. External Gate Resistance

TYPICAL CHARACTERISTICS

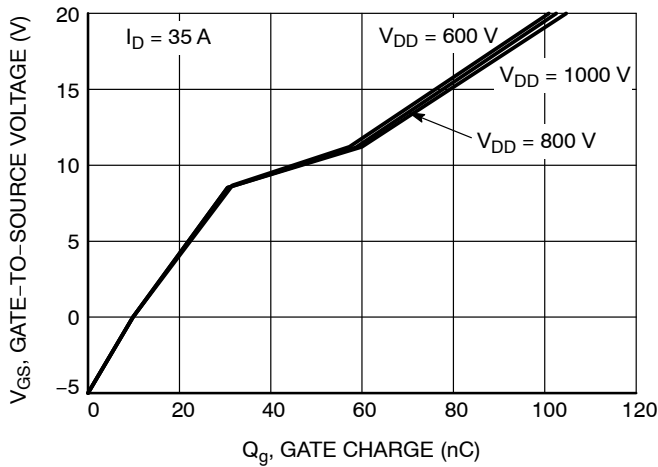


Figure 9. Gate-to-Source Voltage vs. Total Charge

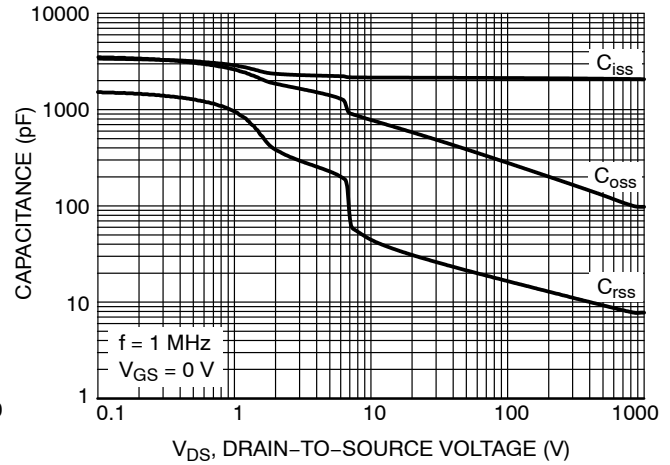


Figure 10. Capacitance vs. Drain-to-Source Voltage

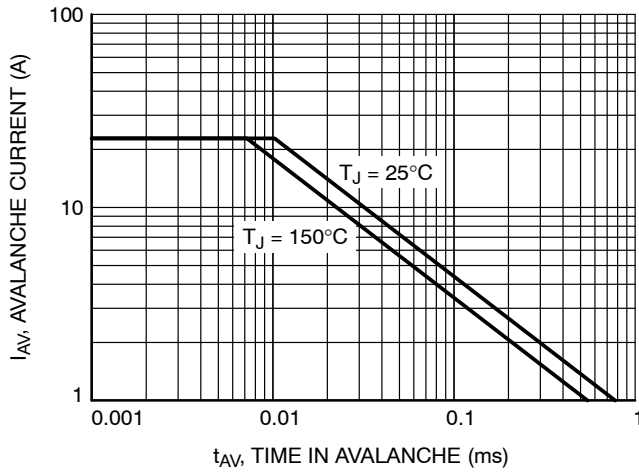


Figure 11. Unclamped Inductive Switching Capability

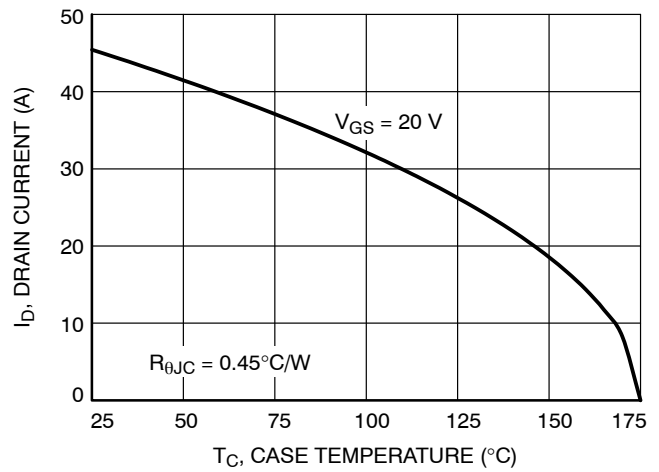


Figure 12. Maximum Continuous Drain Current vs. Case Temperature

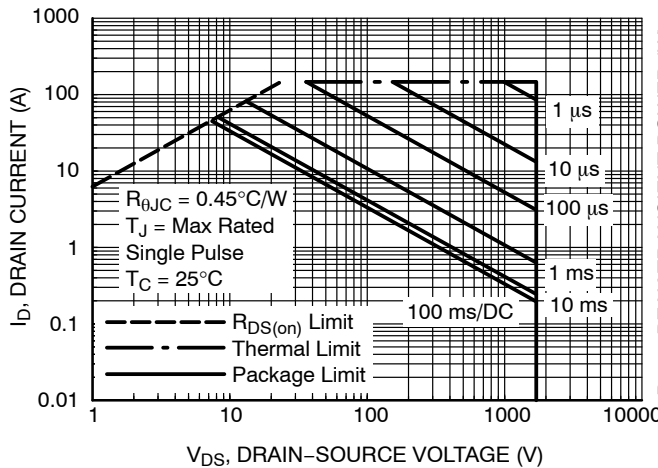


Figure 13. Safe Operating Area

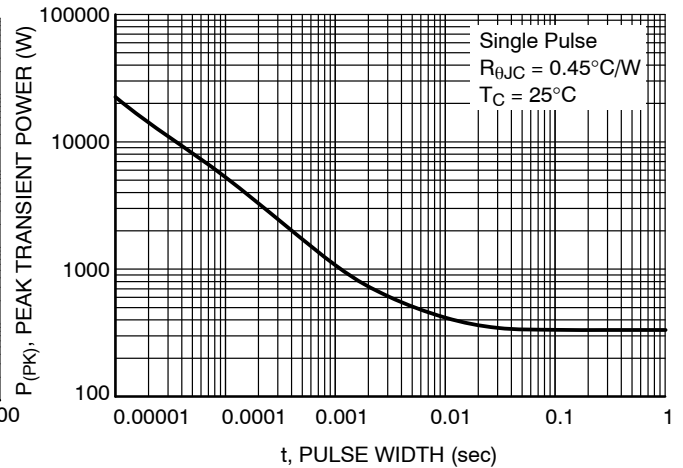


Figure 14. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS

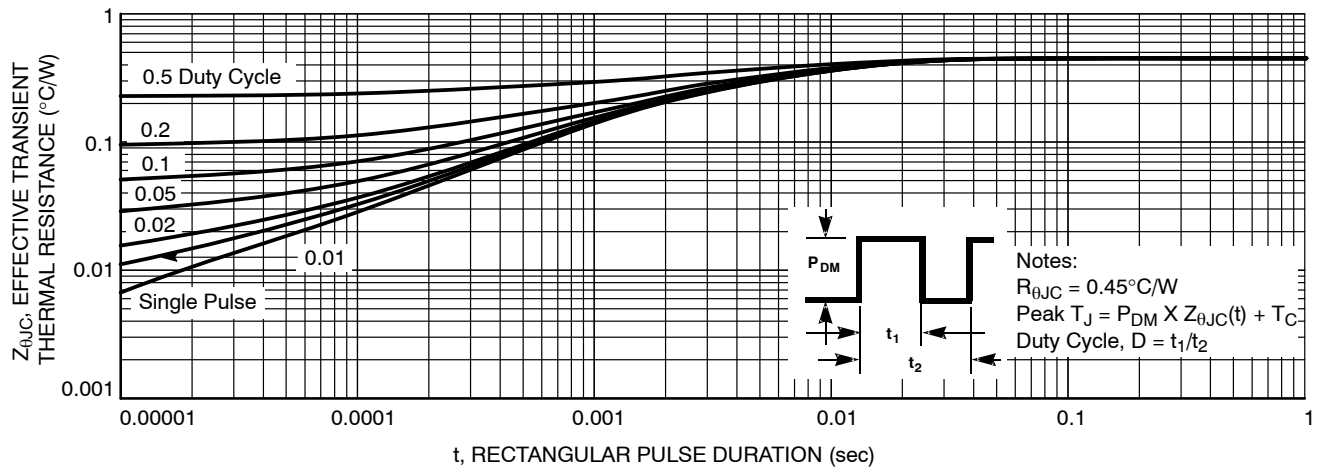


Figure 15. Junction-to-Case Thermal Response

TO-247-4LD
CASE 340CJ
ISSUE A

DATE 16 SEP 2019


NOTES:

- 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	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

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