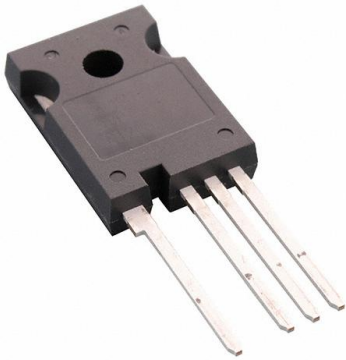


NVH4L020N120SC1 Datasheet

www.digi-electronics.com



<https://www.DiGi-Electronics.com>

DiGi Electronics Part Number	NVH4L020N120SC1-DG
Manufacturer	onsemi
Manufacturer Product Number	NVH4L020N120SC1
Description	SICFET N-CH 1200V 102A TO247
Detailed Description	N-Channel 1200 V 102A (Tc) 510W (Tc) Through Hole TO-247-4L



Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

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Purchase and inquiry

Manufacturer Product Number:

NVH4L020N120SC1

Series:

-

FET Type:

N-Channel

Drain to Source Voltage (Vdss):

1200 V

Drive Voltage (Max Rds On, Min Rds On):

20V

Vgs(th) (Max) @ Id:

4.3V @ 20mA

Vgs (Max):

+25V, -15V

FET Feature:

-

Operating Temperature:

-55°C ~ 175°C (Tj)

Qualification:

AEC-Q101

Supplier Device Package:

TO-247-4L

Base Product Number:

NVH4L020

Manufacturer:

onsemi

Product Status:

Active

Technology:

SiCFET (Silicon Carbide)

Current - Continuous Drain (Id) @ 25°C:

102A (Tc)

Rds On (Max) @ Id, Vgs:

28mOhm @ 60A, 20V

Gate Charge (Qg) (Max) @ Vgs:

220 nC @ 20 V

Input Capacitance (Ciss) (Max) @ Vds:

2943 pF @ 800 V

Power Dissipation (Max):

510W (Tc)

Grade:

Automotive

Mounting Type:

Through Hole

Package / Case:

TO-247-4

Environmental & Export classification

RoHS Status:

ROHS3 Compliant

REACH Status:

REACH Unaffected

HTSUS:

8541.29.0095

Moisture Sensitivity Level (MSL):

Not Applicable

ECCN:

EAR99

Silicon Carbide (SiC) MOSFET – 20 mohm, 1200 V, M1, TO-247-4L

NVH4L020N120SC1

Features

- Typ. $R_{DS(on)} = 20\text{ m}\Omega$
- Ultra Low Gate Charge ($Q_{G(tot)} = 220\text{ nC}$)
- High Speed Switching with Low Capacitance ($C_{oss} = 258\text{ pF}$)
- 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
- Automotive Traction Inverter

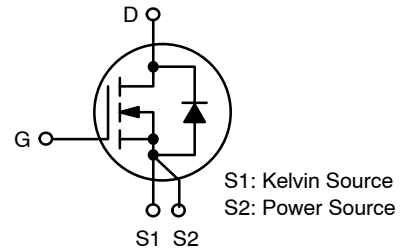
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

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		$T_C < 175^\circ\text{C}$ V_{GSop}	-5/+20	V	
Continuous Drain Current (Note 2)	Steady State	$T_C = 25^\circ\text{C}$	I_D	101	A
			P_D	500	W
Power Dissipation (Note 2)	Steady State	$T_C = 100^\circ\text{C}$	I_D	71.4	A
			P_D	250	W
Pulsed Drain Current (Note 3)	$T_A = 25^\circ\text{C}$		I_{DM}	408	A
Single Pulse Surge Drain Current Capability	$T_A = 25^\circ\text{C}$, $t_p = 10\text{ }\mu\text{s}$, $R_G = 4.7\text{ }\Omega$		I_{DSC}	807	A
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to +175	$^\circ\text{C}$	
Source Current (Body Diode)		I_S	46	A	
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 23\text{ A}$, $L = 1\text{ mH}$) (Note 4)		E_{AS}	264	mJ	
Maximum Lead Temperature for Soldering (1/8" from case for 5 s)		T_L	300	$^\circ\text{C}$	

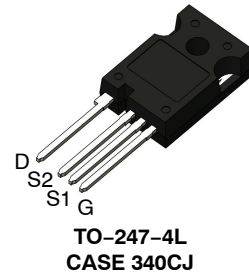
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. 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 264 mJ is based on starting $T_J = 25^\circ\text{C}$; $L = 1\text{ mH}$, $I_{AS} = 23\text{ A}$, $V_{DD} = 120\text{ V}$, $V_{GS} = 18\text{ V}$.

$V_{(BR)DSS}$	$R_{DS(ON)}\text{ MAX}$	$I_D\text{ MAX}$
1200 V	28 m Ω @ 20 V	102 A



N-CHANNEL MOSFET



MARKING DIAGRAM



- A = Assembly Location
 Y = Year
 WW = Work Week
 ZZ = Lot Traceability
 NVH4L020N120SC1 = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
NVH4L020N120SC1	TO-247-4L	30 Units / Tube

NVH4L020N120SC1**Table 1. THERMAL RESISTANCE MAXIMUM RATINGS**

Parameter	Symbol	Max	Unit
Junction-to-Case – Steady State (Note 2)	$R_{\theta JC}$	0.3	°C/W
Junction-to-Ambient – Steady State (Notes 1, 2)	$R_{\theta JA}$	40	

Table 2. ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit	
OFF CHARACTERISTICS							
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	1200	–	–	V	
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 1\text{ mA}$, referenced to 25°C	–	0.5	–	V/°C	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 1200\text{ V}$	$T_J = 25^\circ\text{C}$	–	–	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 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 20\text{ mA}$	1.8	2.7	4.3	V
Recommended Gate Voltage	V_{GOP}		–5	–	+20	V
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 20\text{ V}, I_D = 60\text{ A}, T_J = 25^\circ\text{C}$	–	20	28	m Ω
		$V_{GS} = 20\text{ V}, I_D = 60\text{ A}, T_J = 175^\circ\text{C}$	–	37	50	
Forward Transconductance	g_{FS}	$V_{DS} = 20\text{ V}, I_D = 60\text{ A}$	–	36	–	S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 800\text{ V}$	–	2943	–	pF
Output Capacitance	C_{OSS}		–	258	–	
Reverse Transfer Capacitance	C_{RSS}		–	24	–	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -5/20\text{ V}, V_{DS} = 600\text{ V}, I_D = 80\text{ A}$	–	220	–	nC
Threshold Gate Charge	$Q_{G(TH)}$		–	33	–	
Gate-to-Source Charge	Q_{GS}		–	66	–	
Gate-to-Drain Charge	Q_{GD}		–	63	–	
Gate-Resistance	R_G	$f = 1\text{ MHz}$	–	1.6	–	Ω

SWITCHING CHARACTERISTICS, $V_{GS} = 10\text{ V}$

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -5/20\text{ V}, V_{DS} = 800\text{ V}, I_D = 80\text{ A}, R_G = 2\text{ }\Omega$ Inductive load	–	21.6	35	ns
Rise Time	t_r		–	21	34	
Turn-Off Delay Time	$t_{d(OFF)}$		–	41	66	
Fall Time	t_f		–	10	20	
Turn-On Switching Loss	E_{ON}		–	494	–	μJ
Turn-Off Switching Loss	E_{OFF}		–	397	–	
Total Switching Loss	E_{tot}		–	891	–	

DRAIN-SOURCE DIODE CHARACTERISTICS

Continuous Drain-Source Diode Forward Current	I_{SD}	$V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$	–	–	46	A
Pulsed Drain-Source Diode Forward Current (Note 3)	I_{SDM}		–	–	408	
Forward Diode Voltage	V_{SD}	$V_{GS} = -5\text{ V}, I_{SD} = 30\text{ A}, T_J = 25^\circ\text{C}$	–	3.7	–	V

NVH4L020N120SC1**Table 2. ELECTRICAL CHARACTERISTICS** ($T_J = 25^\circ\text{C}$ unless otherwise specified) (continued)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
DRAIN-SOURCE DIODE CHARACTERISTICS						
Reverse Recovery Time	t_{RR}	$V_{GS} = -5/20\text{ V}$, $I_{SD} = 80\text{ A}$, $di_S/dt = 1000\text{ A}/\mu\text{s}$	-	30	-	ns
Reverse Recovery Charge	Q_{RR}		-	225	-	nC
Reverse Recovery Energy	E_{REC}		-	16	-	μJ
Peak Reverse Recovery Current	I_{RRM}		-	15	-	A
Charge Time	T_a		-	16	-	ns
Discharge Time	T_b		-	15	-	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.

NVH4L020N120SC1

TYPICAL CHARACTERISTICS

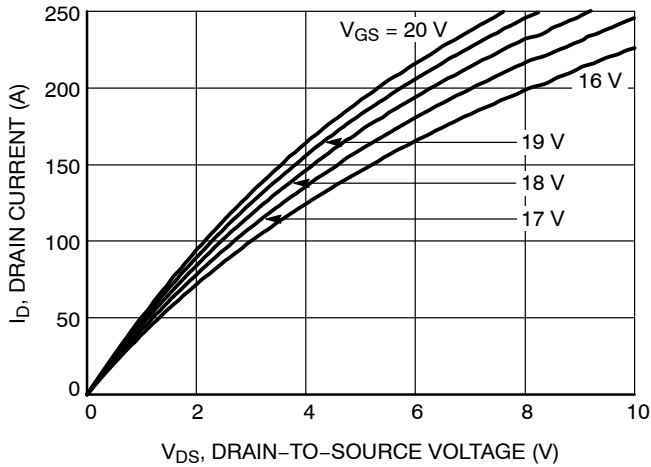


Figure 1. On-Region Characteristics

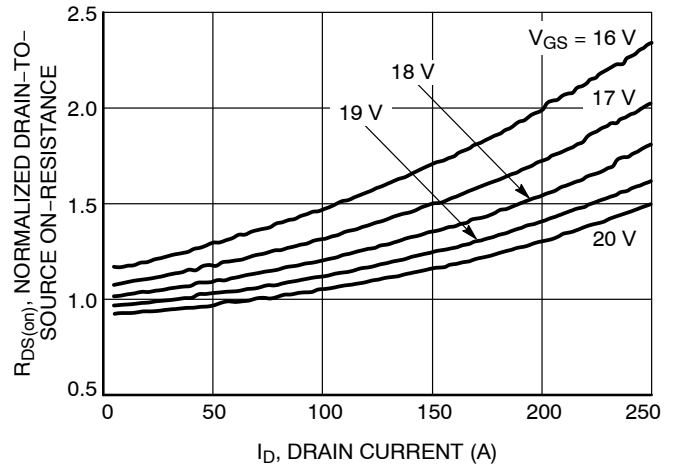


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

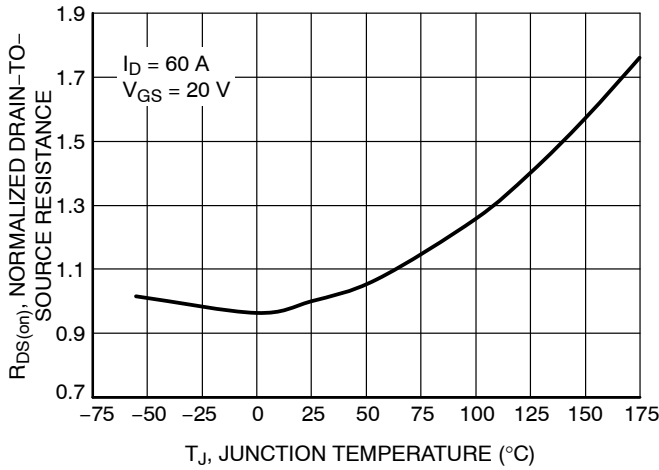


Figure 3. On-Resistance Variation with Temperature

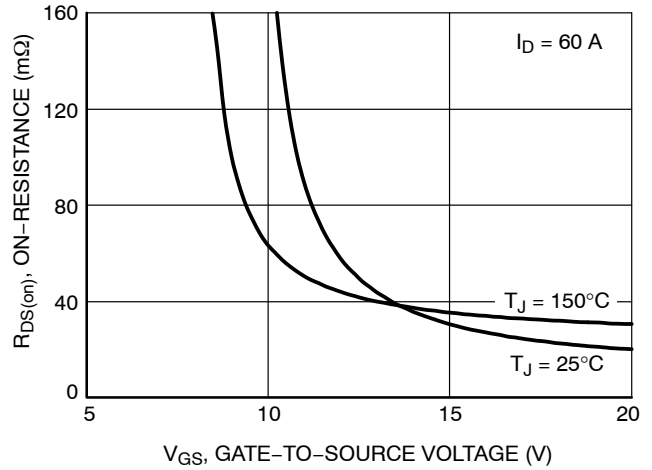


Figure 4. On-Resistance vs. Gate-to-Source Voltage

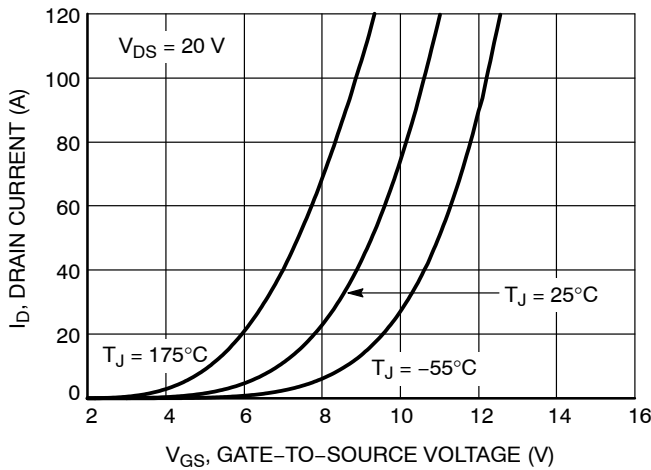


Figure 5. Transfer Characteristics

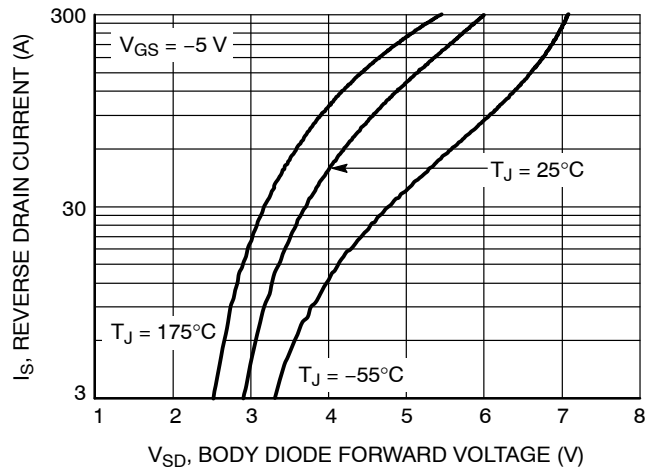


Figure 6. Diode Forward Voltage vs. Current

NVH4L020N120SC1

TYPICAL CHARACTERISTICS (continued)

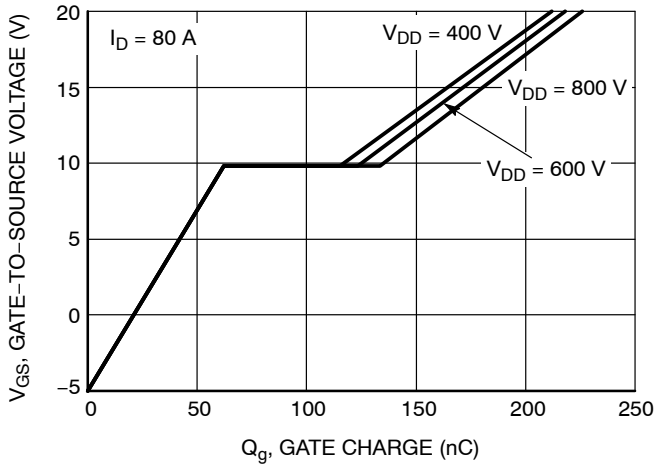


Figure 7. Gate-to-Source Voltage vs. Total Charge

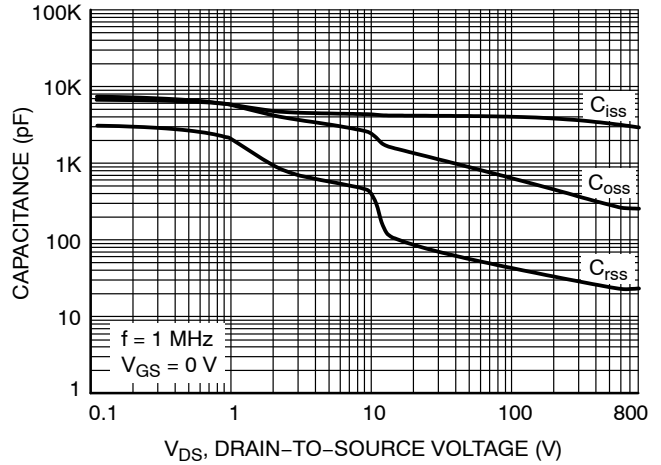


Figure 8. Capacitance vs. Drain-to-Source Voltage

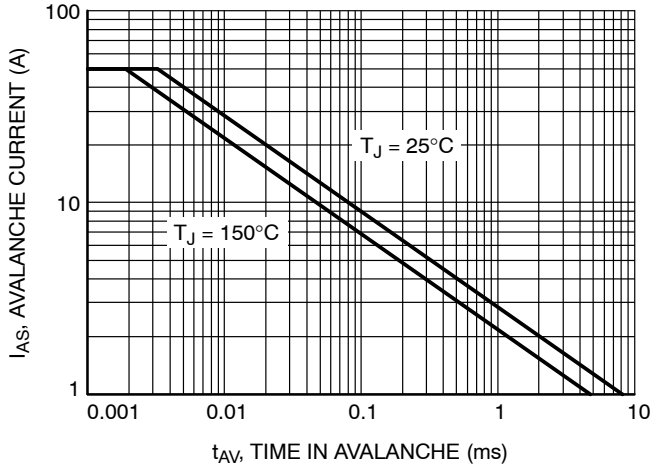


Figure 9. Unclamped Inductive Switching Capability

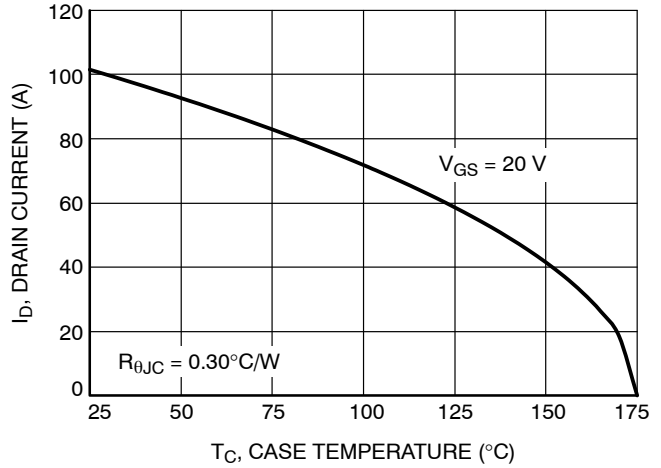


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

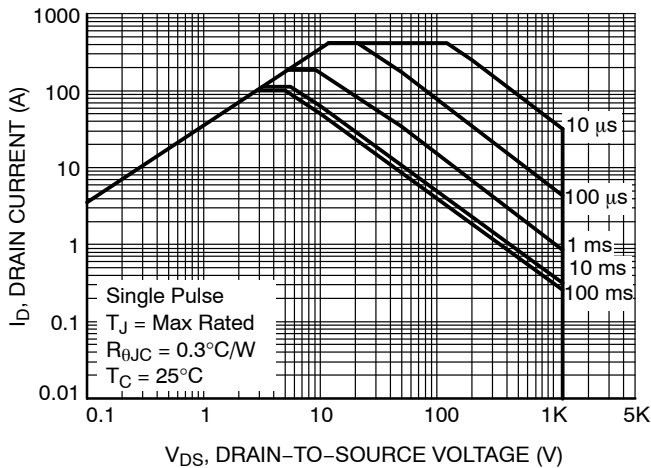


Figure 11. Safe Operating Area

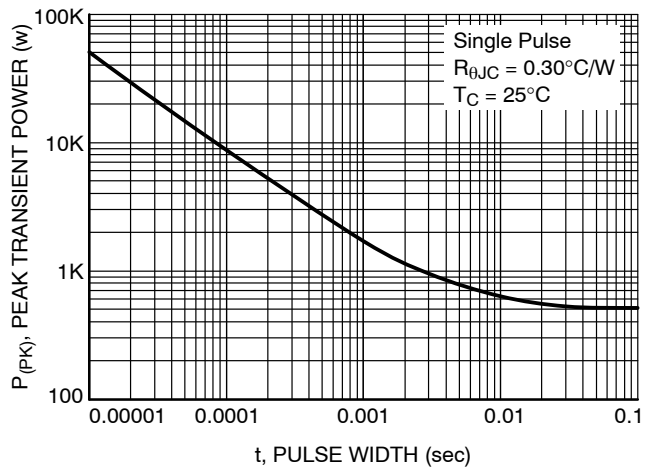


Figure 12. Single Pulse Maximum Power Dissipation

NVH4L020N120SC1

TYPICAL CHARACTERISTICS (continued)

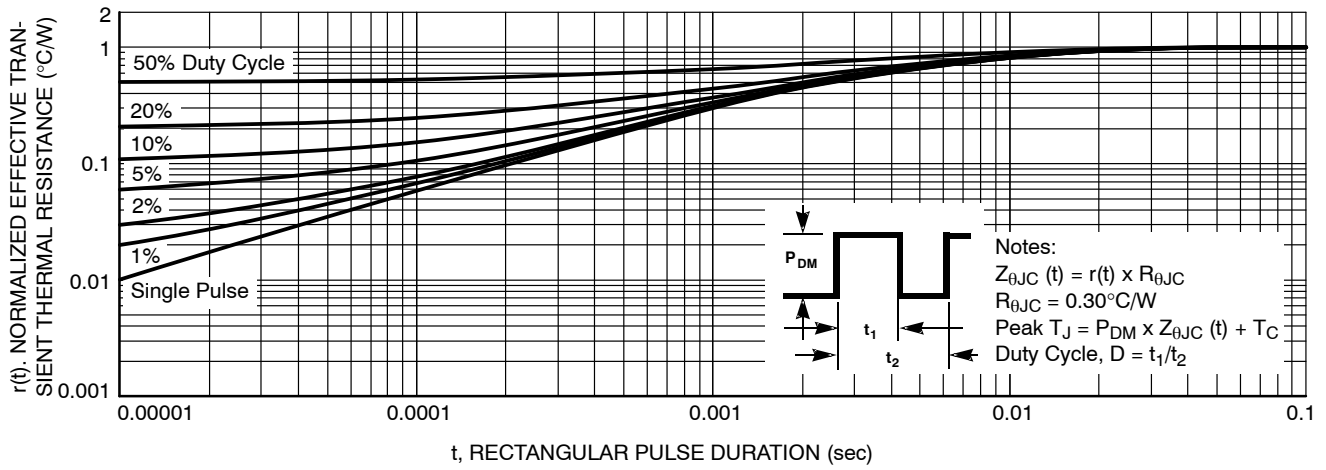
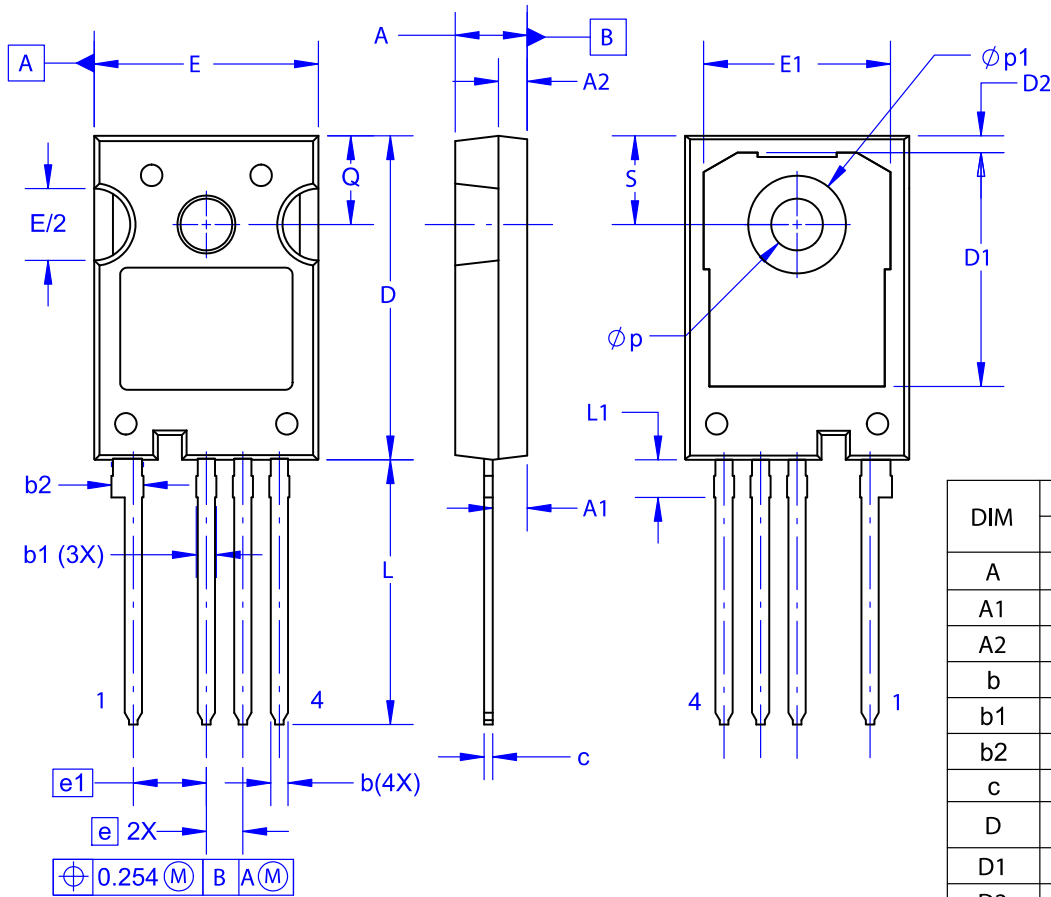


Figure 13. Junction-to-Ambient Thermal Response

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

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- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
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