

MOSFET - N-Channel Silicon Carbide

900 V, 20.1 mΩ, 148 A



ON Semiconductor®

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Product Preview

NTH4L020N090SC1

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DS}	900	V
Gate-to-Source Voltage	V_{GS}	+19/-8	V
Continuous Drain Current $R_{\theta JC}$	$T_C = 25^\circ\text{C}$	I_{DC}	148 A
Power Dissipation $R_{\theta JC}$		P_{DC}	719 W
Continuous Drain Current $R_{\theta JC}$	$T_C = 100^\circ\text{C}$	I_{DC}	113 A
Power Dissipation $R_{\theta JC}$		P_{DC}	359 W
Continuous Drain Current $R_{\theta JA}$	$T_A = 25^\circ\text{C}$	I_{DA}	TBD A
Power Dissipation $R_{\theta JA}$		P_{DA}	TBD W
Continuous Drain Current $R_{\theta JA}$	$T_A = 100^\circ\text{C}$	I_{DA}	TBD A
Power Dissipation $R_{\theta JA}$		P_{DA}	TBD W
Pulsed Drain Current $R_{\theta JC}$	$T_C = 25^\circ\text{C}$, $t_p = 10 \mu\text{s}$	I_{DM}	1039 A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +175	$^\circ\text{C}$
Source Current (Body Diode)	I_S	154	A
Single Pulse Drain-to-Source Avalanche Energy ($T_J = 25^\circ\text{C}$, $V_{GS} = 15\text{ V}$, $I_{LPK} = 1\text{ A}$, $L = 0.1\text{ mH}$, $R_G = 25\ \Omega$)	E_{AS}	TBD	mJ
Lead Temperature for Soldering Purposes	T_L	TBD	$^\circ\text{C}$

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.

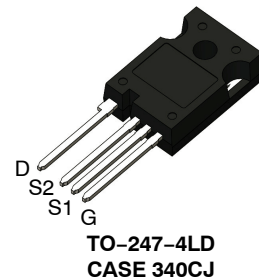
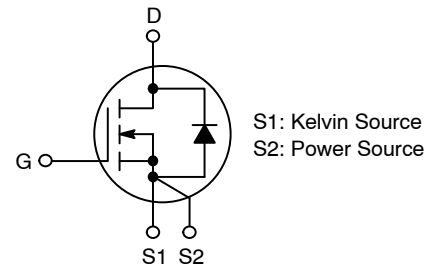
THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.208	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	TBD	

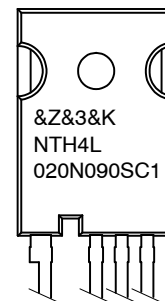
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$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
900 V	20.1 mΩ @ 15 V	148 A

N-CHANNEL MOSFET



MARKING DIAGRAM



&Z = Assembly Plant Code
&3 = Data Code (Year & Week)
&K = Lot
NTH4L020N090SC1 = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

NTH4L020N090SC1

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 2.50\text{e} - 04\text{A}, T_C = 25^\circ\text{C}$	900	-	-	V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}T_J$	$V_{GS} = 0\text{ V}, I_D = 2.50\text{e} - 04\text{A}, T_{Jmax} = 175^\circ\text{C}$	-	-2.07e-03	-	V/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 900\text{ V}, T_C = 25^\circ\text{C}$	-	-	100	μA
		$V_{DS} = 900\text{ V}, T_C = 175^\circ\text{C}$	-	-	1	mA
Gate-to-Source Leakage Current	I_{GSS}	$V_{GS} = +19/-8\text{ V}, V_{DS} = 0\text{ V}$	-	-	± 1	μA

ON CHARACTERISTICS

Drain-to-Source On Resistance	$R_{DS(on)}$	$V_G = 15\text{ V}, I_D = 61.5\text{ A}, T_C = 25^\circ\text{C}$	-	20.07	-	m Ω
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_G = 15\text{ V}, I_D = 61.5\text{ A}, T_C = 175^\circ\text{C}$	-	26.12	-	m Ω
Gate Threshold Voltage	$V_{GS(th)}$	$V_G = V_D, I_D = 0.015\text{ A}$	-	2.46	-	V
Gate Threshold Voltage Temperature Coefficient	$V_{GS(th)}/T_J$		-	-5.89	-	mV/°C
Forward Transconductance	g_{FS}	$V_D = 10.0\text{ V}, I_D = 61.5\text{ A}$	-	33.58	-	S

CHARGES, CAPACITANCES & GATE RESISTANCE

Gate Resistance	R_G	$V_G = 0\text{ V}, V_D = 450\text{ V}, f = 1\text{e}6$	-	1.14	-	Ω
Input Capacitance	C_{ISS}		-	5505	-	pF
Reverse Transfer Capacitance	C_{RSS}		-	29.64	-	
Output Capacitance	C_{OSS}		-	280	-	
Effective Output Capacitance	C_{OSSef}	$V_{DS} = 0\text{ to }450\text{ V}, V_G = 0\text{ V}, f = 1\text{e}6$	-	567	-	pF
Energy Related Output Capacitance	C_{OSSer}		-	373	-	
Coss Stored Energy	E_{OSS}		-	37.78	-	
Total Gate Charge	$Q_{G(tot)}$	$V_D = 720\text{ V}, I_D = 30.75\text{ A}, V_G = -8/15\text{ V}$	-	232	-	nC
Gate-to-Source Charge	Q_{GS}		-	87.1	-	
Gate-to-Drain Charge	Q_{GD}		-	62.5	-	

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(on)}$	$V_G = -8/15\text{ V}, I_D = 30.75\text{ A}, V_D = 720\text{ V}, R_G = 6\text{ }\Omega$	-	-7.73	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	59.5	-	
Rise Time	t_r		-	16.63	-	
Fall Time	t_f		-	15.75	-	
Turn-On Switching Loss	E_{ON}		-	0.624	-	mJ
Turn-Off Switching Loss	E_{OFF}		-	0.113	-	
Total Switching Loss	E_{TOT}		-	0.738	-	

SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$I_D = 30.75\text{ A}, V_{GS} = 0\text{ V}$	-	4.45	-	V
Reverse Recovery Time	t_{RR}	$I_D = 30.75\text{ A}, di/dt = 1000\text{ A}/\mu\text{s}, V_{DS} = 720\text{ V}, V_{GS} = -8/15\text{ V}$	-	90.2	-	ns
Reverse Recovery Charge	Q_{RR}		-	525	-	nC
Reverse Recovery Energy	E_{REC}		-	123	-	μJ
Peak Reverse Recovery Current	I_{RRM}		-	15.05	-	A

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 PERFORMANCE CHARACTERISTICS

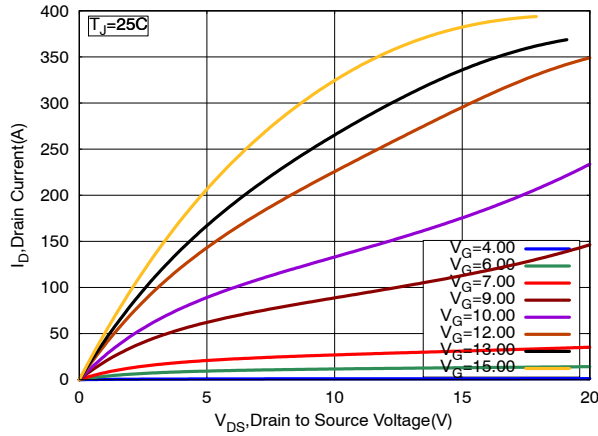


Figure 1. On-Region Characteristics

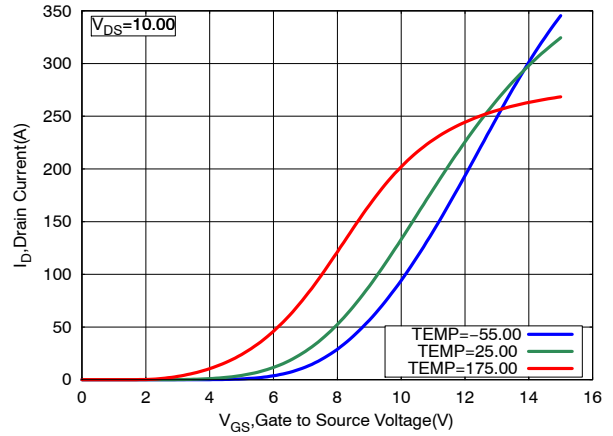


Figure 2. Transfer Characteristics

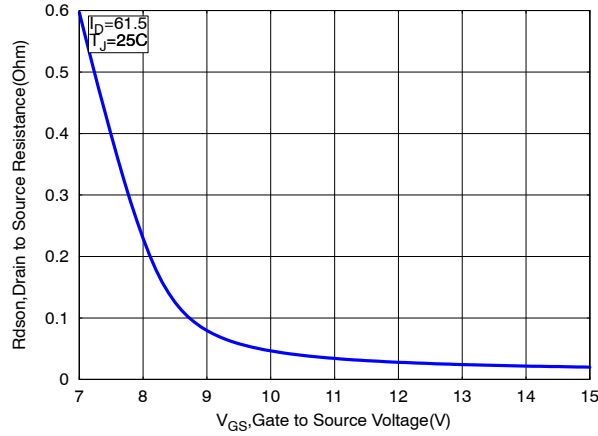


Figure 3. On-Resistance vs. VGS

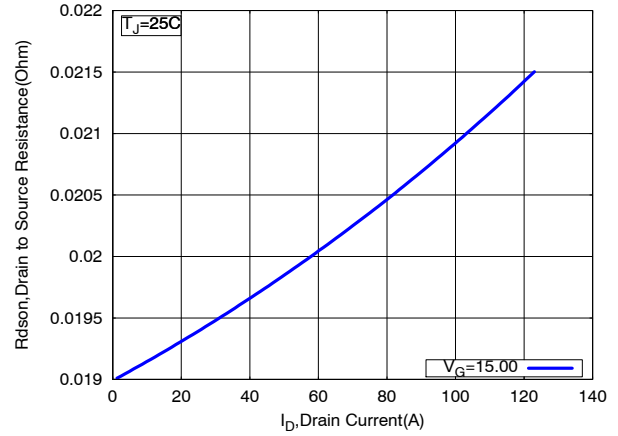


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

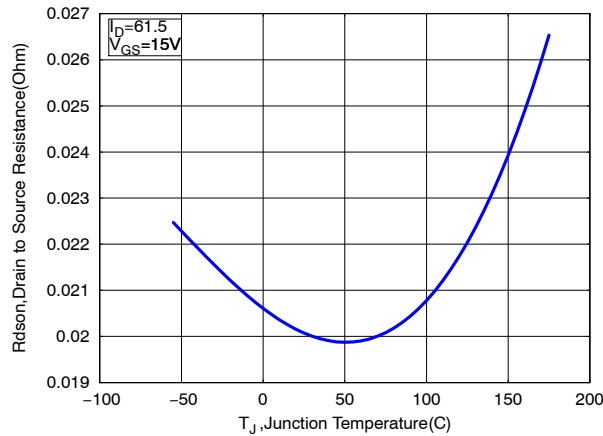


Figure 5. On-Resistance Variation with Temperature

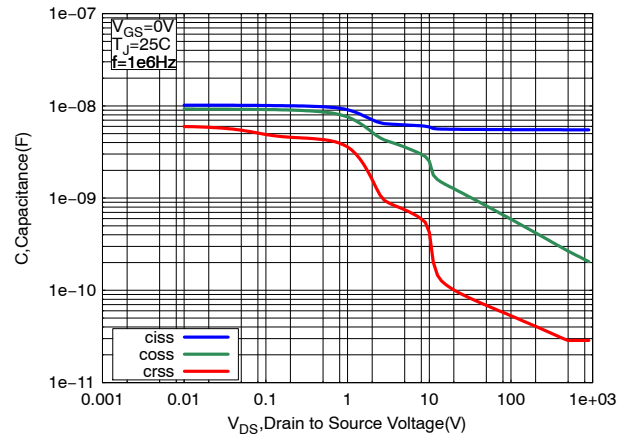


Figure 6. Capacitance Variation

NTH4L020N090SC1

TYPICAL PERFORMANCE CHARACTERISTICS

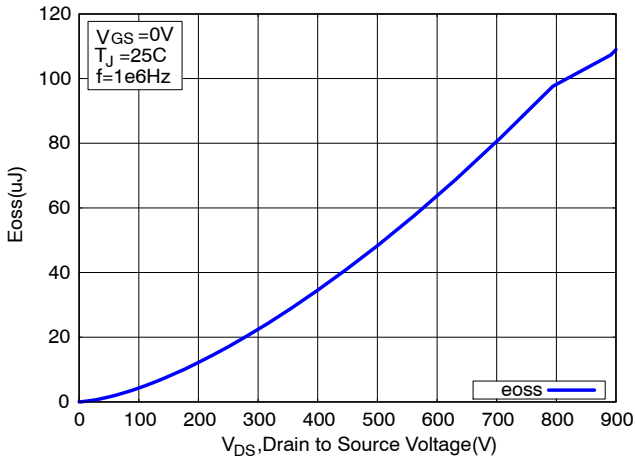


Figure 7. Eoss vs. Drain-to-Source Voltage

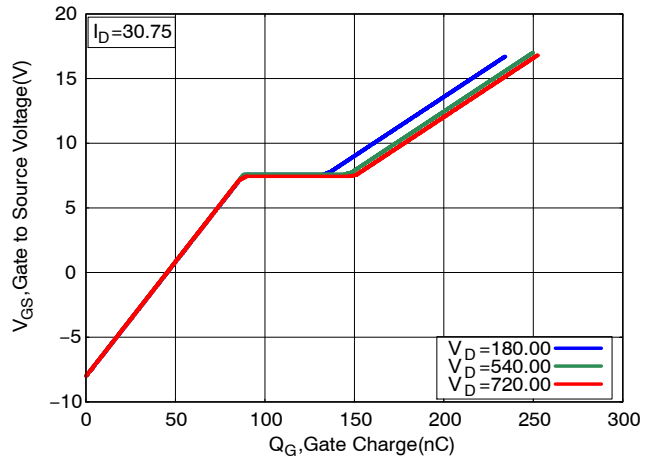


Figure 8. Gate-to-Source Voltage vs. Total Charge

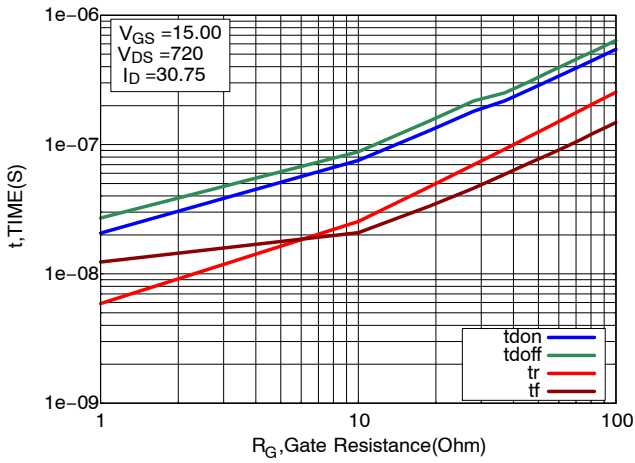


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

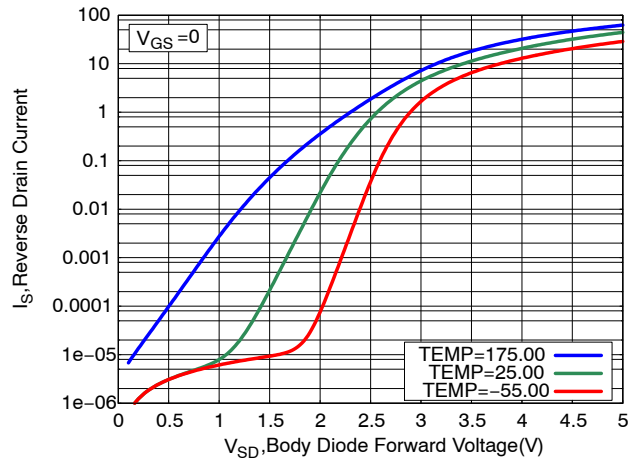


Figure 10. Diode Forward Voltage vs. Current

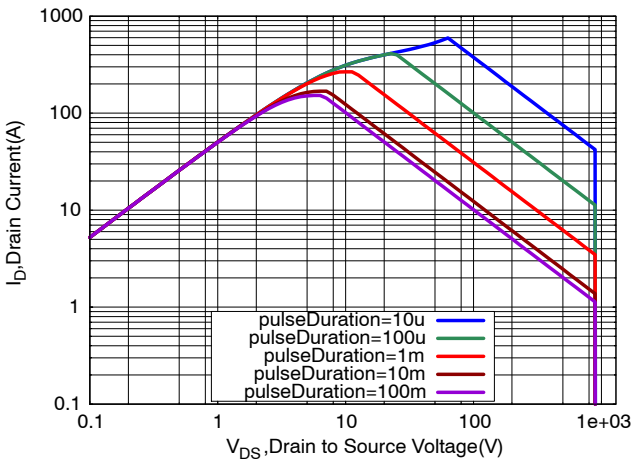


Figure 11. Maximum Rated Forward Biased Safe Operating Area

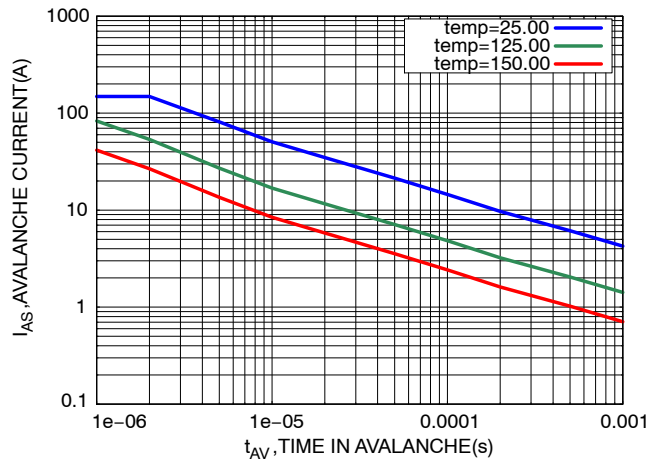


Figure 12. I_peak vs. Time in Avalanche

NTH4L020N090SC1

TYPICAL PERFORMANCE CHARACTERISTICS

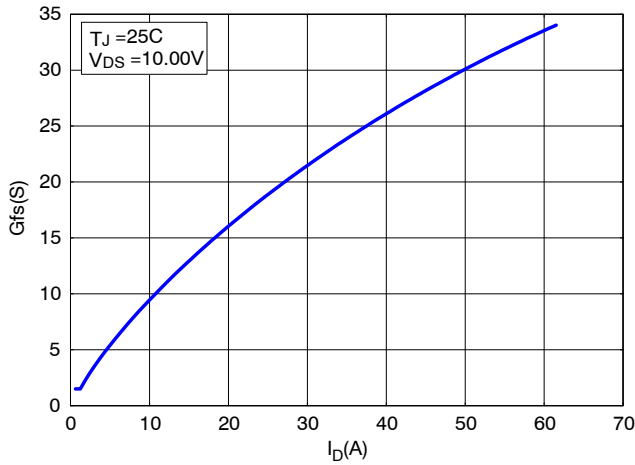


Figure 13. GFS vs. ID

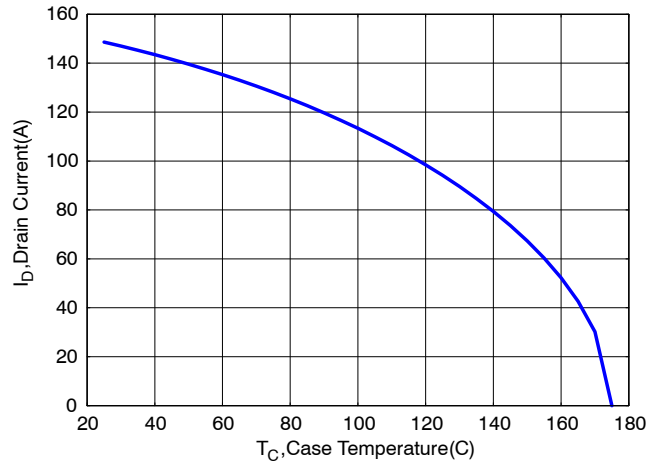


Figure 14. Maximum Current vs. Case Temperature

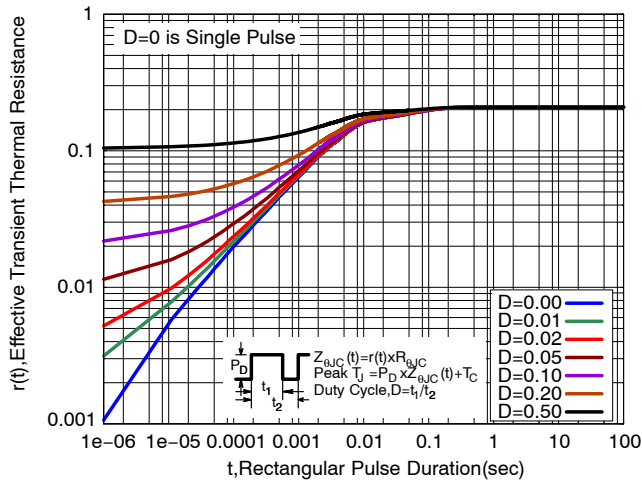


Figure 15. Thermal Response

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Packing Method	Reel Size	Tape Width	Quantity
NTH4L020N090SC1	NTH4L020N090SC1	TO-247	Tube	N/A	N/A	30 Units

MECHANICAL CASE OUTLINE

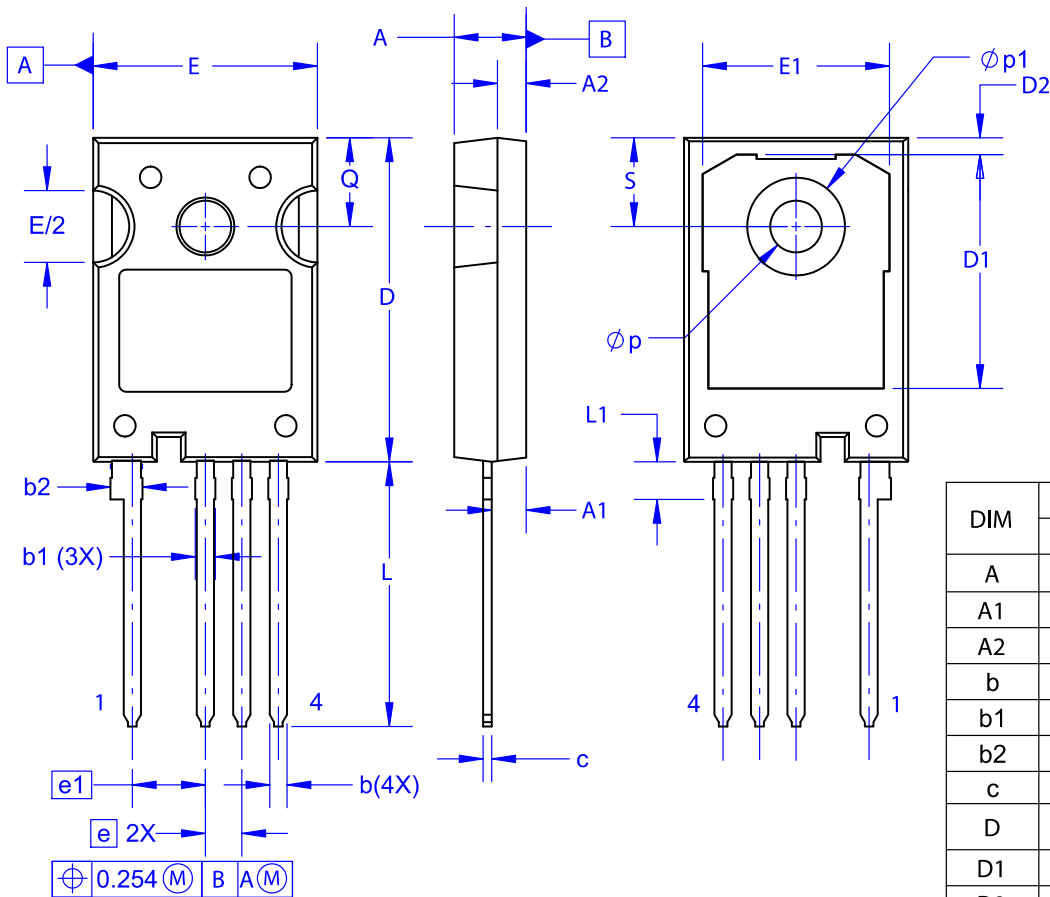
PACKAGE DIMENSIONS

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.
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