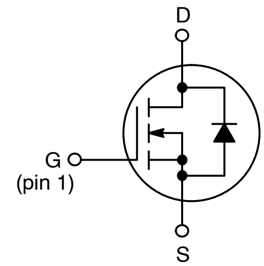
Silicon Carbide (SiC) MOSFET - EliteSiC, 960 mohm, 1700 V, M1, TO-247-3L

NVHL1000N170M1

$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	I_D MAX
1700 V	960 mΩ @ 20 V	4.2 A



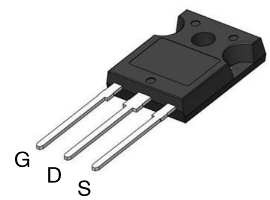
N−CHANNEL MOSFET

Features

- Typ. $R_{DS(on)}$ = 960 mΩ @ VGS = 20 V
- Ultra Low Gate Charge ($Q_{G(tot)}$ = 14 nC)
- High Speed Switching with Low Capacitance (C_{oss} = 11 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

- Flyback Converter



TO−247−3LD
CASE 340CX

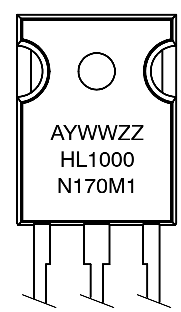
MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

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	4.2	A
Power Dissipation (Note 1)			P_D	48	W
Continuous Drain Current (Note 1)	Steady State	T_C = 100°C	I_D	3	A
Power Dissipation (Note 1)			P_D	24	W
Pulsed Drain Current (Note 2)	T_C = 25°C		I_{DM}	14	A
Operating Junction and Storage Temperature Range			T_J, T_{stg}	−55 to +175	°C
Source Current (Body Diode)			I_S	9.5	A
Single Pulse Drain−to−Source Avalanche Energy (Note 3)			E_{AS}	24	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. Repetitive rating, limited by max junction temperature.
3. E_{AS} of 24 mJ is based on starting T_J = 25°C; L = 1 mH, I_{AS} = 6.9 A, V_{DD} = 120 V, V_{GS} = 20 V.

MARKING DIAGRAM



A = Assembly Location
Y = Year
WW = Work Week
ZZ = Lot Traceability
HL1000N170M1 = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
NVHL1000N170M1	TO−247−3L	30 Units / Tube

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Max	Unit
Junction−to−Case − Steady State (Note 1)	$R_{\theta JC}$	3.1	°C/W

ELECTRICAL CHARACTERISTICS (T_J = 25°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 V, I_D = 1 mA		1700			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	I_D = 1 mA, referenced to 25°C (Note 4)			0.5		V/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 1700 V	T_J = 25°C			100	μA
			T_J = 175°C			1	mA
Gate−to−Source Leakage Current	I_{GSS}	V_{GS} = +25/−15 V, V_{DS} = 0 V				±1	μA
ON CHARACTERISTICS (Note 2)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 640 μA		1.8	3.2	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 = 2 A, T_J = 25°C			960	1430	mΩ
		V_{GS} = 20 V, I_D = 2 A, T_J = 175°C (Note 4)			1800		
Forward Transconductance	g_{FS}	V_{DS} = 10 V, I_D = 2 A (Note 4)			0.6		S
CHARGES, CAPACITANCES & GATE RESISTANCE (Note 4)							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = 1000 V			150		pF
Output Capacitance	C_{OSS}				11		
Reverse Transfer Capacitance	C_{RSS}				0.6		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −5/20 V, V_{DS} = 800 V, I_D = 2 A			14		nC
Threshold Gate Charge	$Q_{G(TH)}$				1.5		
Gate−to−Source Charge	Q_{GS}				2.6		
Gate−to−Drain Charge	Q_{GD}				7.5		
Gate−Resistance	R_G	f = 1 MHz			5.7		Ω
SWITCHING CHARACTERISTICS (Notes 4, 5)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = −5/20 V, V_{DS} = 800 V, I_D = 2 A, R_G = 25 Ω inductive load L = 300 μH			5.6		ns
Rise Time	t_r				30		
Turn−Off Delay Time	$t_{d(OFF)}$				11		
Fall Time	t_f				84		
Turn−On Switching Loss	E_{ON}				120		μJ
Turn−Off Switching Loss	E_{OFF}				11		
Total Switching Loss	E_{tot}				131		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Continuous Drain−Source Diode Forward Current (Note 1)	I_{SD}	V_{GS} = −5 V, T_J = 25°C				9.5	A
Pulsed Drain−Source Diode Forward Current (Note 2)	I_{SDM}					48	
Forward Diode Voltage	V_{SD}	V_{GS} = −5 V, I_{SD} = 2 A, T_J = 25°C			4.2		V
Reverse Recovery Time	t_{RR}	V_{GS} = −5/20 V, I_{SD} = 2 A, dI_S/dt = 1000 A/μs (Note 4)			5.9		ns
Reverse Recovery Charge	Q_{RR}				11		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. Defined by design, not subject to production test.
5. E_{ON}/E_{OFF} result is with body diode.

TYPICAL CHARACTERISTICS

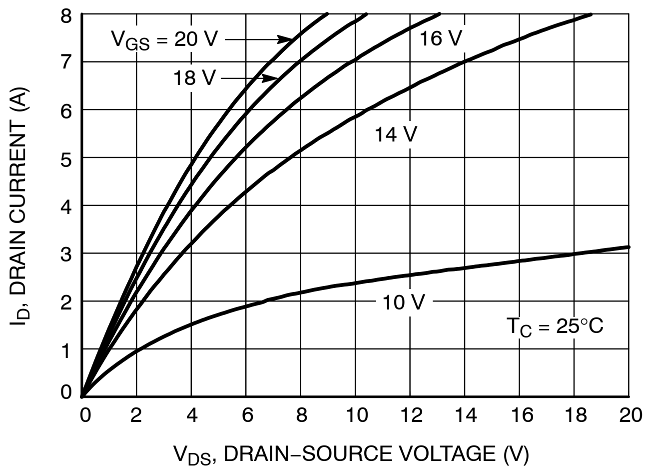


Figure 1. On−Region Characteristics

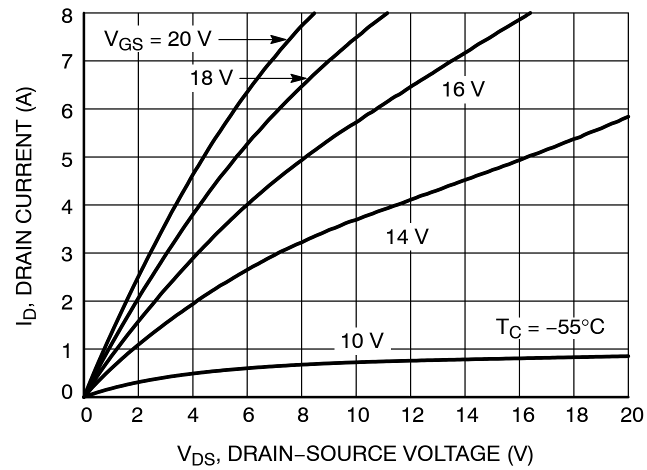


Figure 2. On−Region Characteristics

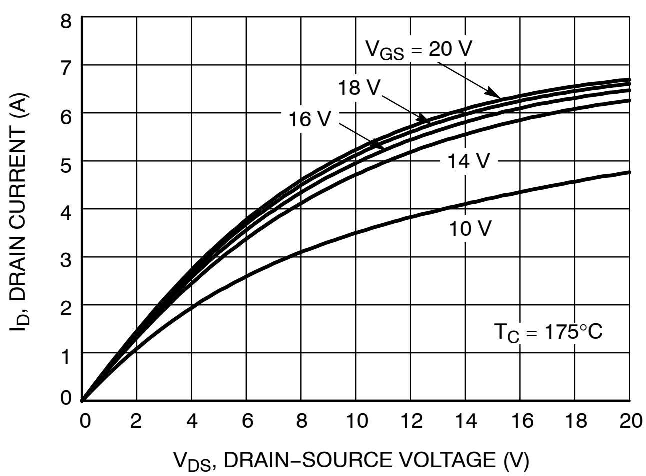


Figure 3. On−Region Characteristics

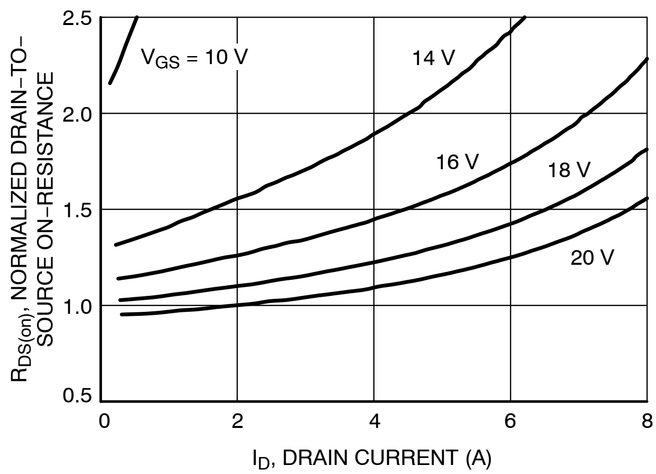


Figure 4. Normalized On−Resistance vs. Drain Current and Gate Voltage

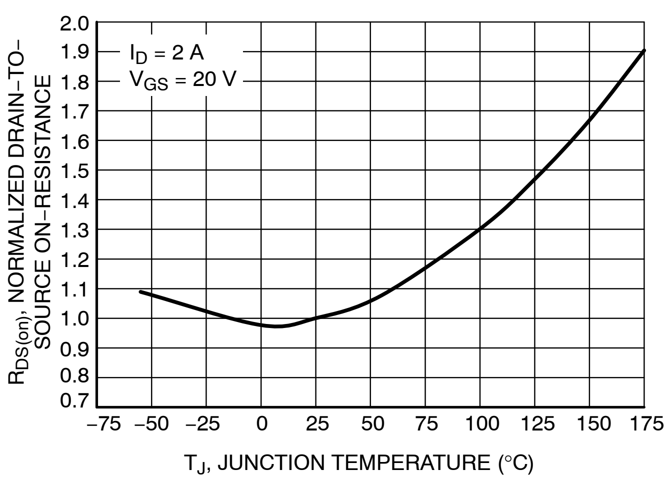


Figure 5. Normalized On−Resistance Variation with Temperature

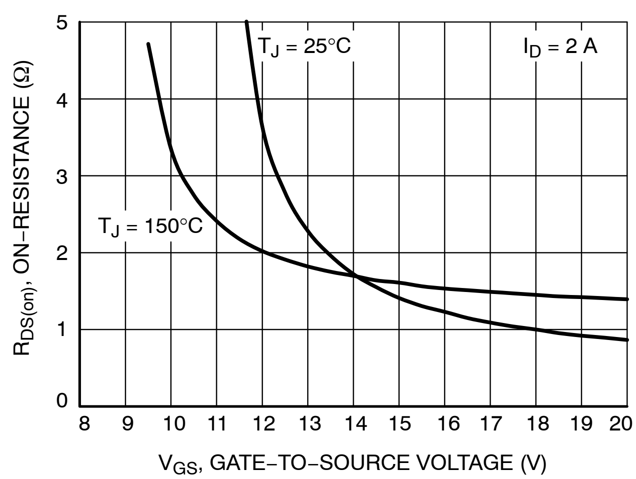


Figure 6. On−Resistance vs. Gate−to−Source Voltage

TYPICAL CHARACTERISTICS

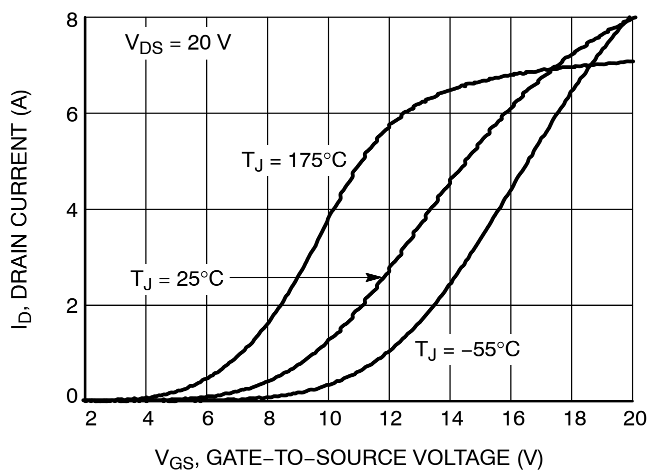


Figure 7. Transfer Characteristics

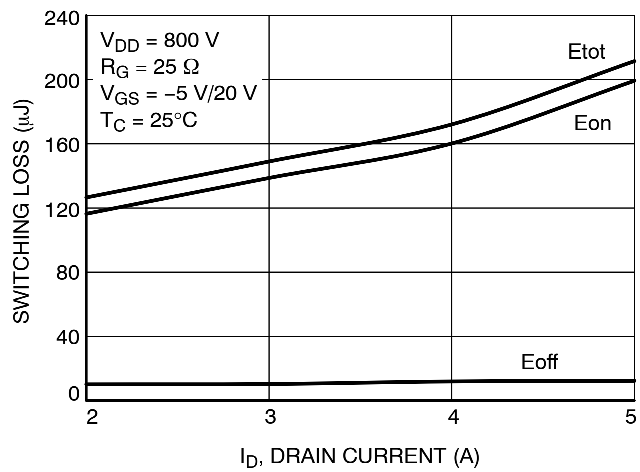


Figure 8. Switching Loss vs. Drain Current

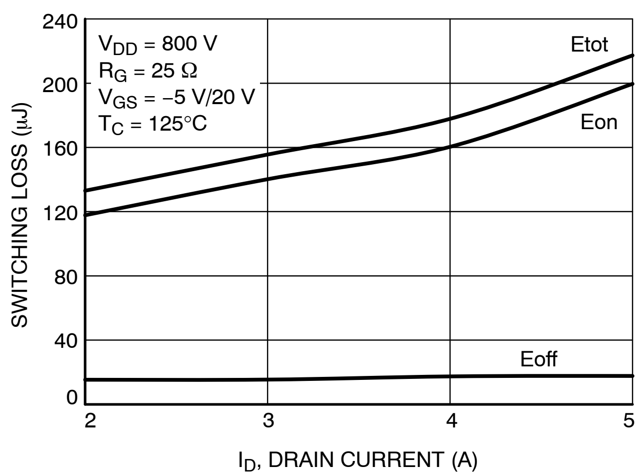


Figure 9. Switching Loss vs. Drain Current

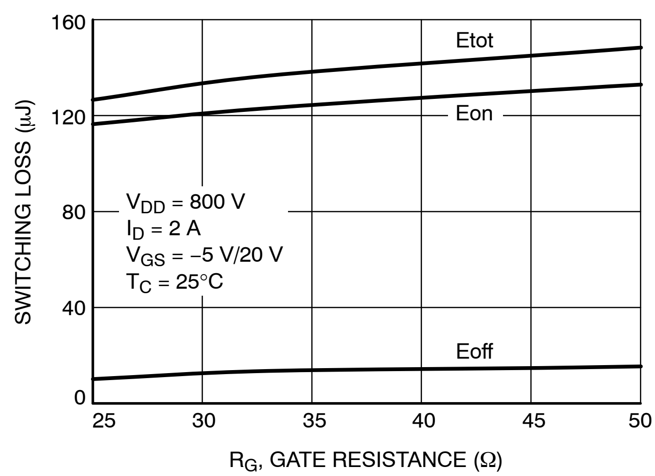


Figure 10. Switching Loss vs. Gate Resistance

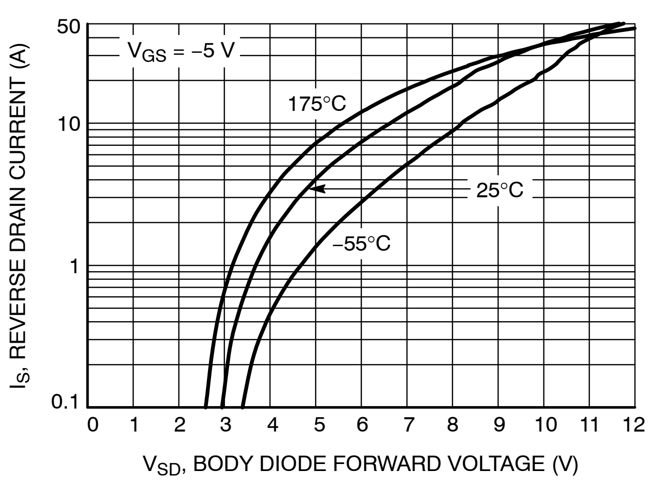


Figure 11. Reverse Drain Current vs. Body Diode Forward Voltage

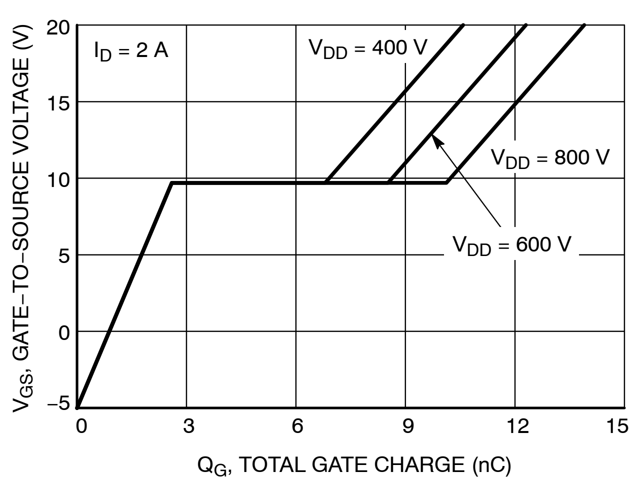


Figure 12. Gate−to−Source Voltage vs. Total Charge

TYPICAL CHARACTERISTICS

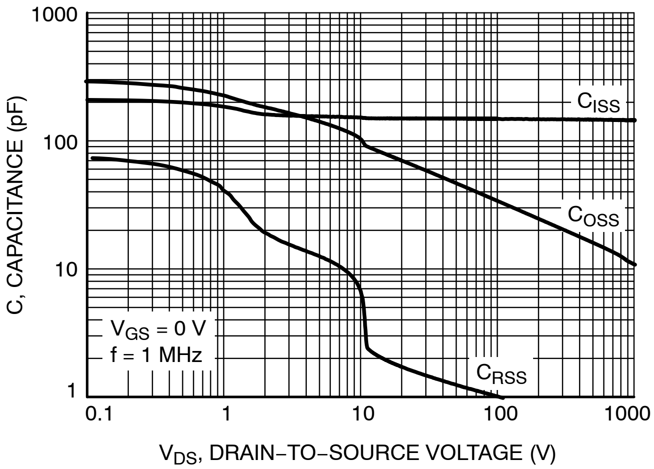


Figure 13. Capacitance vs. Drain−to−Source Voltage

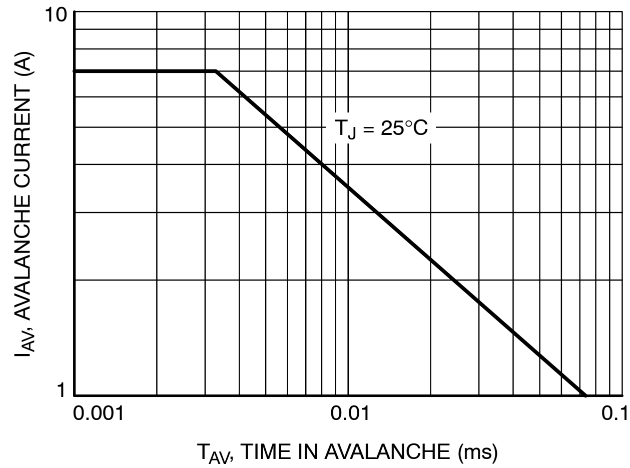


Figure 14. Unclamped Inductive Switching Capability

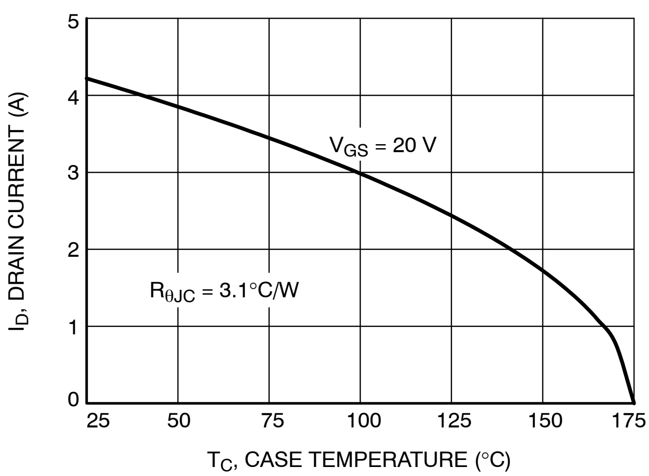


Figure 15. Maximum Continuous Drain Current vs. Case Temperature

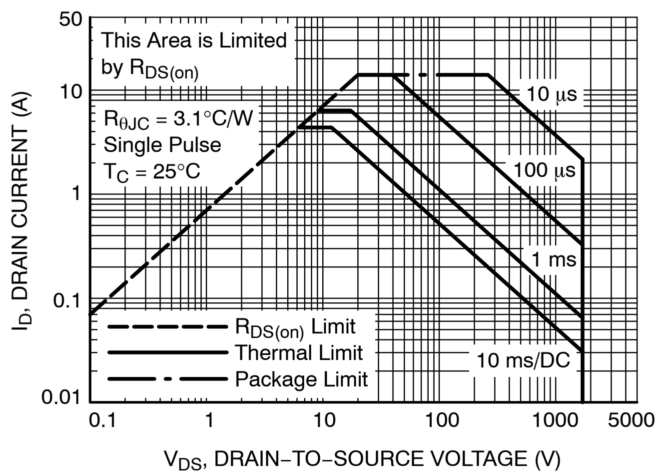


Figure 16. Maximum Rated Forward Biased Safe Operating Area

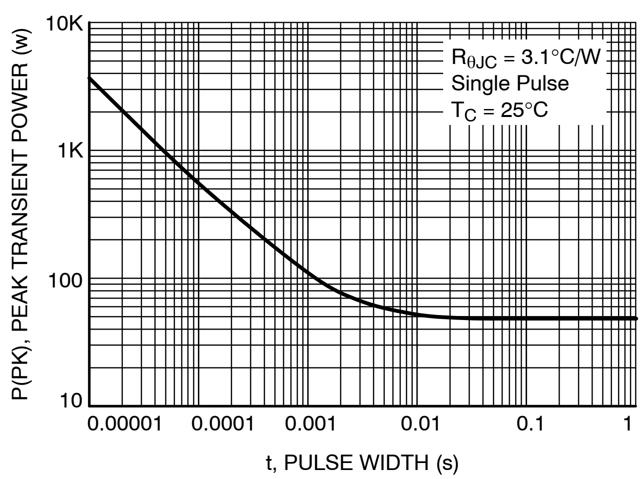


Figure 17. Single Pulse Maximum Power Dissipation

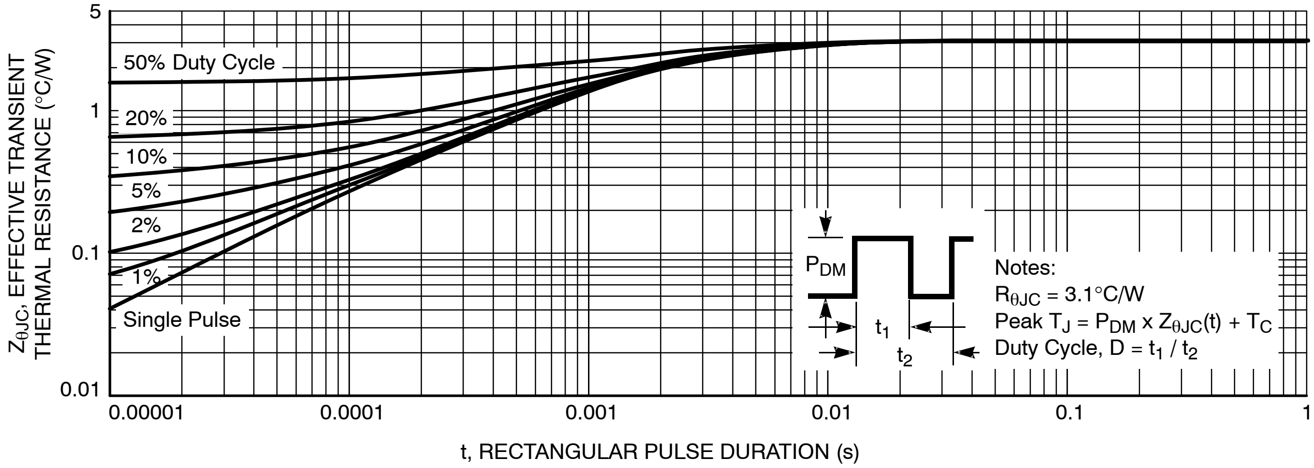


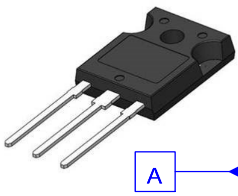
Figure 18. Transient Thermal Impedance

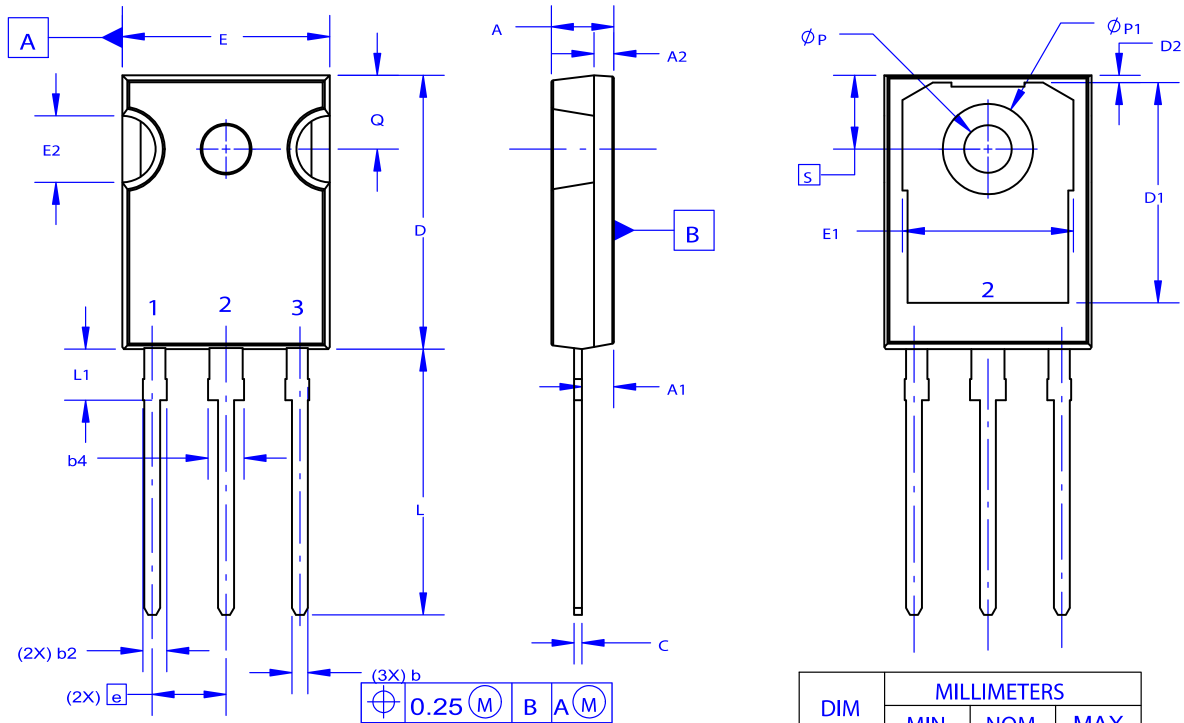
ESD RATINGS

ESD Test	Classification	Standard
ESD−HBM	0B (125 V to <250 V)	ANSI/ESDA/JEDEC JS−001
ESD−CDM	C3 (>1000 V)	ANSI/ESDA/JEDEC JS−002

TO−247−3LD
CASE 340CX
ISSUE A

DATE 06 JUL 2020



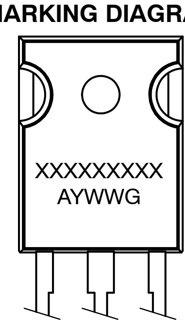


NOTES: UNLESS OTHERWISE SPECIFIED.

A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
B. ALL DIMENSIONS ARE IN MILLIMETERS.
C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
D	20.32	20.57	20.82
E	15.37	15.62	15.87
E2	4.96	5.08	5.20
e	~	5.56	~
L	19.75	20.00	20.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
Q	5.34	5.46	5.58
S	5.34	5.46	5.58
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D1	13.08	~	~
D2	0.51	0.93	1.35
E1	12.81	~	~
ØP1	6.60	6.80	7.00

GENERIC MARKING DIAGRAM*



XXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
G = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present. Some products may not follow the Generic Marking.

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