Silicon Carbide (SiC) MOSFET - EliteSiC, 53 mohm, 1700 V, M1, D2PAK-7L

NVBG050N170M1

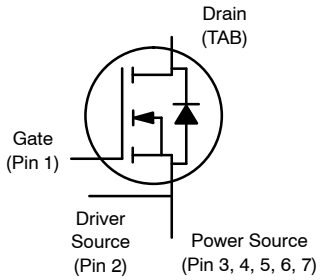
$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
1700 V	76 mΩ @ 20 V	50 A

Features

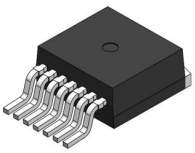
- Typ. $R_{DS(on)}$ = 53 mΩ @ V_{GS} = 20 V
- Ultra Low Gate Charge (typ. $Q_{G(tot)}$ = 107 nC)
- Low Effective Output Capacitance (typ. C_{oss} = 97 pF)
- 100% Avalanche Tested
- This Device is Halide Free and RoHS Compliant with Exemption 7a, Pb-Free 2LI (on second level interconnection)

Typical Applications

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



N−CHANNEL MOSFET



D2PAK-7L
CASE 418BJ

MARKING DIAGRAM

A = Assembly Location
Y = Year
WW = Work Week
ZZ = Lot Traceability
BG050N170M1 = Specific Device Code

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 2)	Steady State	T_C = 25 °C	I_D	50	A
Power Dissipation (Note 2)	Steady State	T_C = 25 °C	P_D	385	W
Continuous Drain Current (Note 2)	Steady State	T_C = 100 °C	I_D	35	A
Power Dissipation (Note 2)	Steady State	T_C = 100 °C	P_D	192	W
Pulsed Drain Current (Note 3)	T_C = 25 °C, t_p = 100 μs		I_{DM}	179	A
Operating Junction and Storage Temperature Range			T_J, T_{stg}	−55 to +175	°C
Continuous Source Current (Body Diode)			I_S	87	A
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)}$ = 22.8 A, L = 1 mH) (Note 4)			E_{AS}	260	mJ
Maximum Lead Temperature for Soldering (1/8″ 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. Surface mounted on a FR-4 board using1 in^2 pad of 2 oz copper.
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. Single pulse, limited by max junction temperature.
4. E_{AS} of 260 mJ is based on starting T_J = 25 °C; L = 1 mH, I_{AS} = 22.8 A, V_{DD} = 120 V, V_{GS} = 18 V.

ORDERING INFORMATION

Device	Package	Shipping†
NVBG050N170M1	D2PAK-7L	800 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Case – Steady State (Note 2)	$R_{\theta JC}$	0.39	°C/W
Junction-to-Ambient – Steady State (Notes 1, 2)	$R_{\theta JA}$	40	

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		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
		V_{GS} = 0 V, V_{DS} = 1700 V, T_J = 175 °C (Note 6)			1	mA
Gate-to-Source Leakage Current	I_{GSS}	V_{GS} = +25/–15 V, V_{DS} = 0 V			±1	μA
ON CHARACTERISTICS (Note 3)						
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 10 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 V, I_D = 35 A, T_J = 25 °C		53	76	mΩ
		V_{GS} = 20 V, I_D = 35 A, T_J = 175 °C (Note 6)		107		
Forward Transconductance	g_{FS}	V_{DS} = 20 V, I_D = 35 A (Note 6)		18		S
CHARGES, CAPACITANCES & GATE RESISTANCE						
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = 1000 V (Note 6)		2078		pF
Output Capacitance	C_{OSS}			97		
Reverse Transfer Capacitance	C_{RSS}			7.7		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = –5/20 V, V_{DS} = 1000 V, I_D = 35 A (Note 6)		107		nC
Threshold Gate Charge	$Q_{G(TH)}$			7.6		
Gate-to-Source Charge	Q_{GS}			31		
Gate-to-Drain Charge	Q_{GD}			25		
Gate-Resistance	R_G	f = 1 MHz		2.2		Ω
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{d(ON)}$	V_{GS} = –5/20 V, V_{DS} = 1200 V, I_D = 35 A, R_G = 3.9 Ω inductive load (Notes 5, 6)		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		

ELECTRICAL CHARACTERISTICS (T_J = 25 °C unless otherwise specified) (continued)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
DRAIN-SOURCE DIODE CHARACTERISTICS (continued)						
Continuous Drain-Source Diode Forward Current	I_{SD}	V_{GS} = −5 V, T_J = 25 °C			87	A
Pulsed Drain-Source Diode Forward Current (Note 3)	I_{SDM}				463	
Forward Diode Voltage	V_{SD}	V_{GS} = −5 V, I_{SD} = 35 A, T_J = 25 °C		4.3		V
Reverse Recovery Time	t_{RR}	V_{GS} = −5/20 V, I_{SD} = 35 A, dI_S/dt = 1000 A/μs (Note 6)		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.

5. E_{ON}/E_{OFF} result is with body diode.
6. Defined by design, not subject to production test.

TYPICAL CHARACTERISTICS

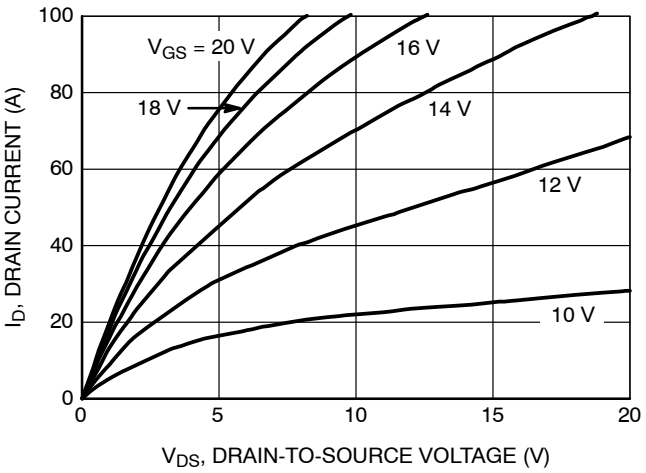


Figure 1. On-Region Characteristics

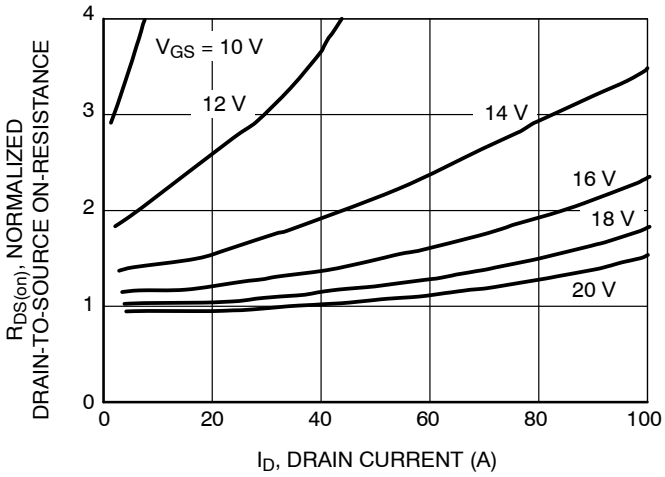


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

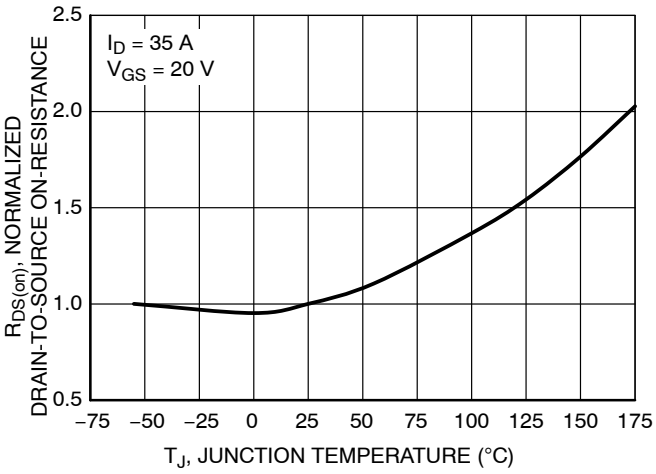


Figure 3. On-Resistance Variation with Temperature

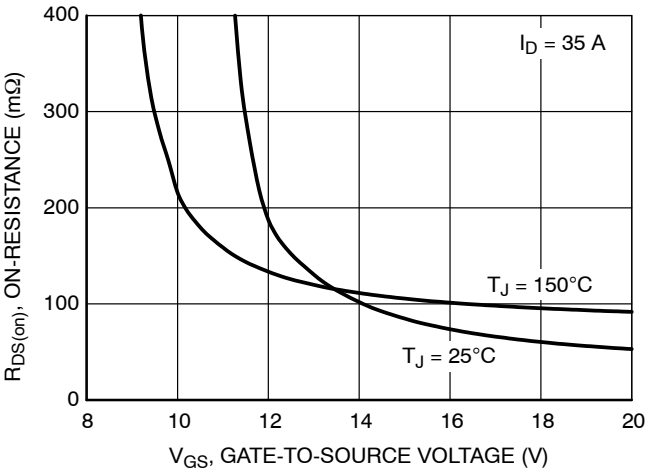


Figure 4. On-Resistance vs. Gate-to-Source Voltage

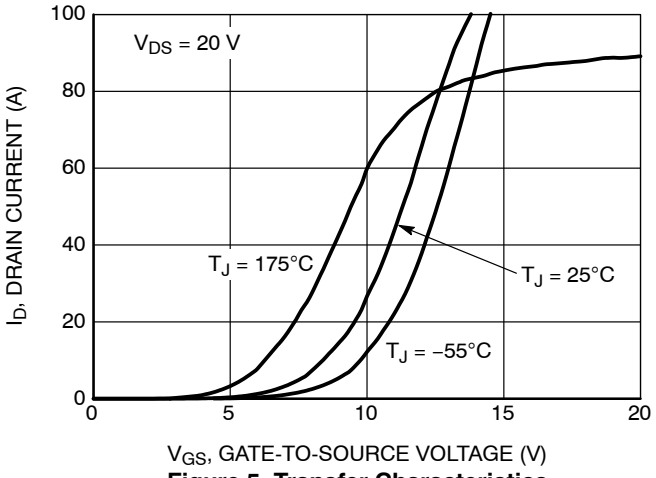


Figure 5. Transfer Characteristics

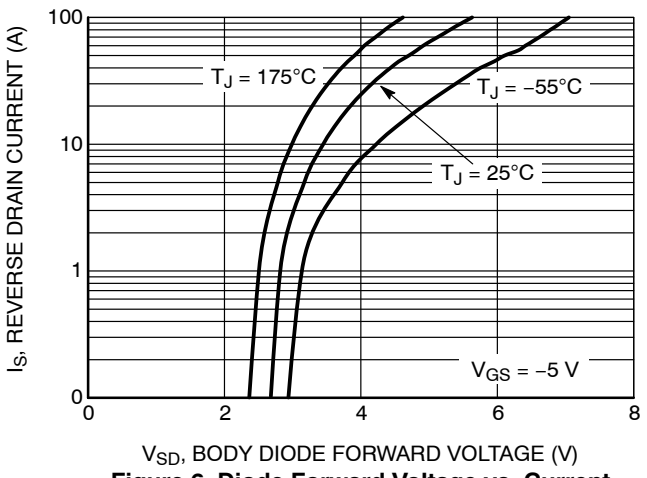


Figure 6. Diode Forward Voltage vs. Current

TYPICAL CHARACTERISTICS

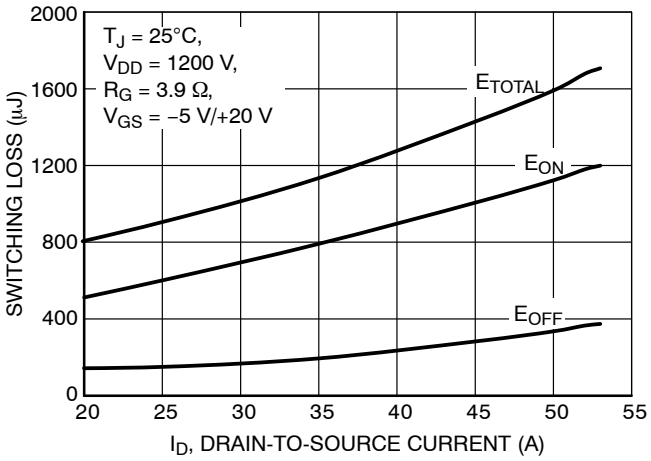


Figure 7. Switching Loss vs. Drain-to-Source Current (25 °C)

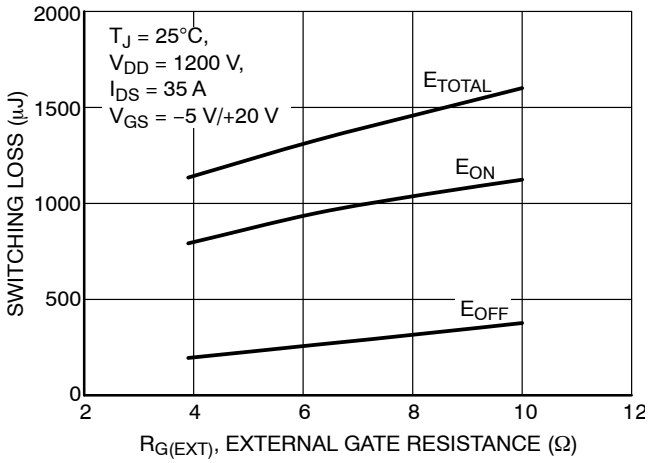


Figure 8. Switching Loss vs. External Gate Resistance

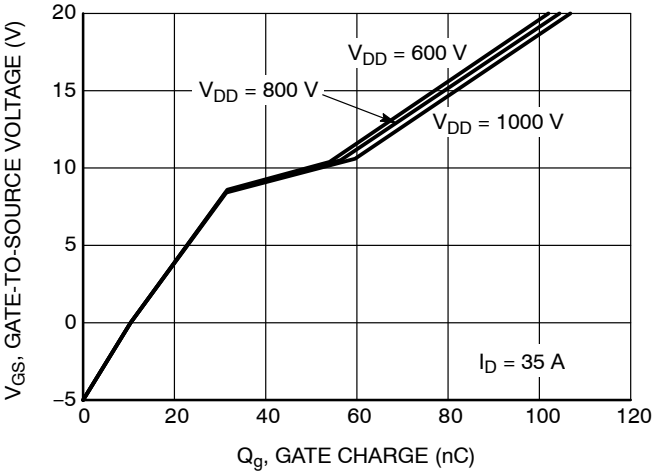


Figure 9. Gate-to-Source Voltage vs. Total Charge

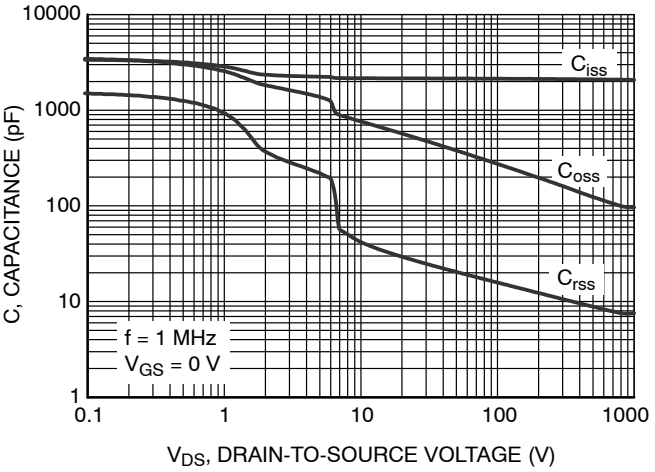


Figure 10. Capacitance vs. Drain-to-Source Voltage

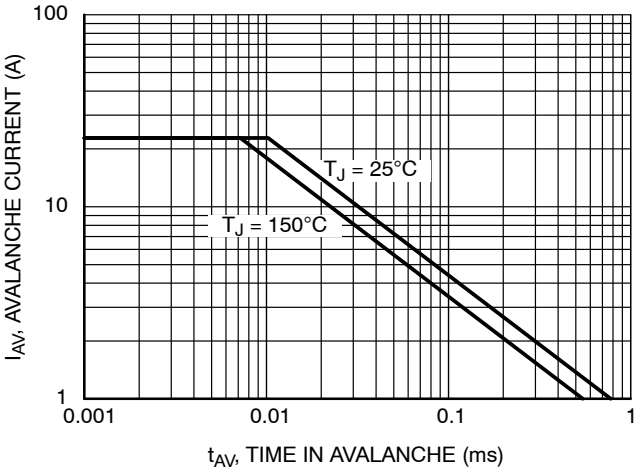


Figure 11. Unclamped Inductive Switching Capability

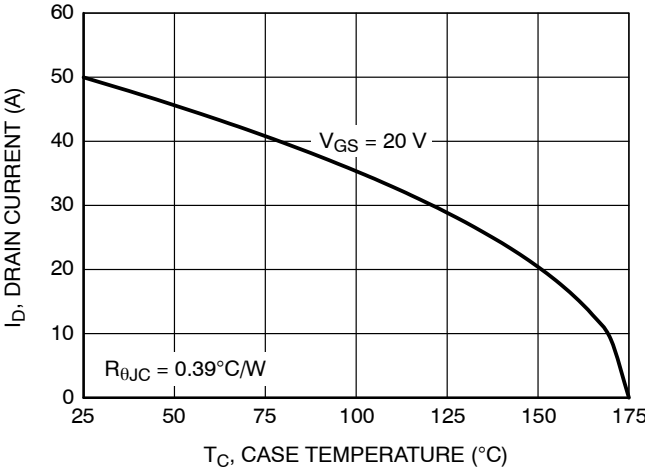


Figure 12. Maximum Continuous Drain Current vs. Case Temperature

TYPICAL CHARACTERISTICS

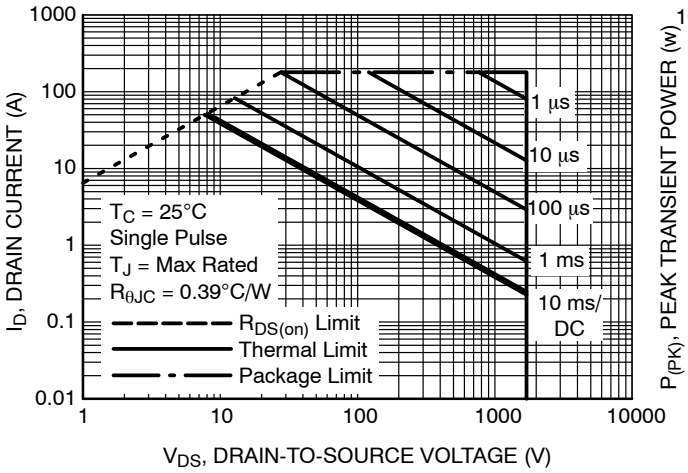


Figure 13. Maximum Rated Forward Biased Safe Operating Area

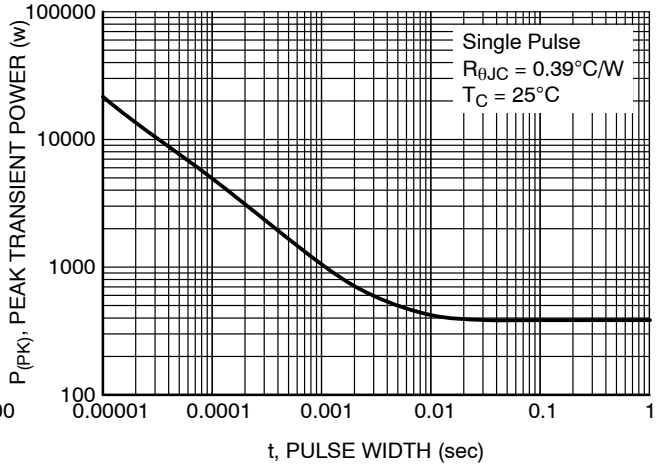


Figure 14. Single Pulse Maximum Power Dissipation

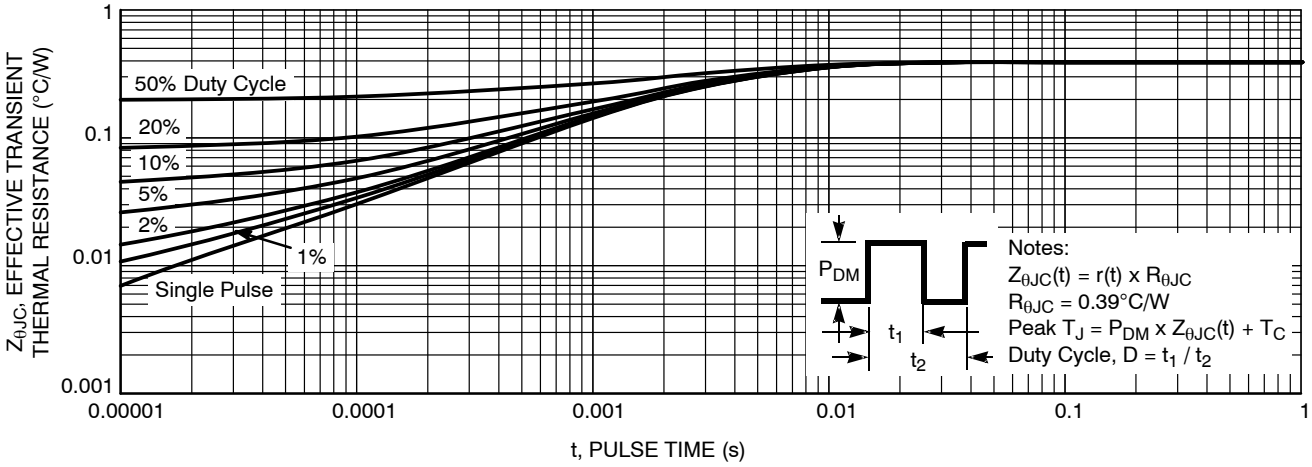
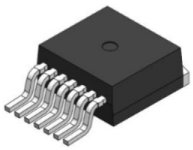
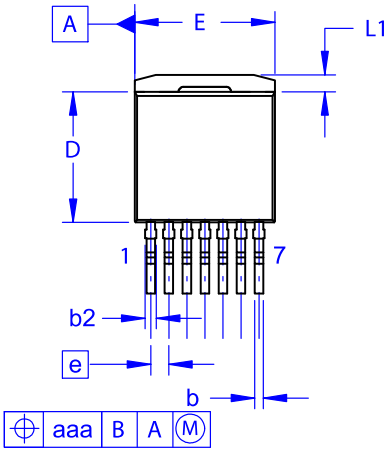


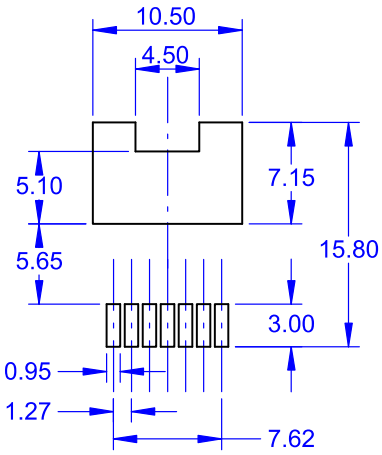
Figure 15. Transient Thermal Impedance



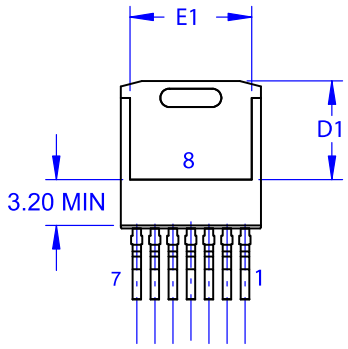
D²PAK7 (TO−263−7L HV)
CASE 418BJ
ISSUE B

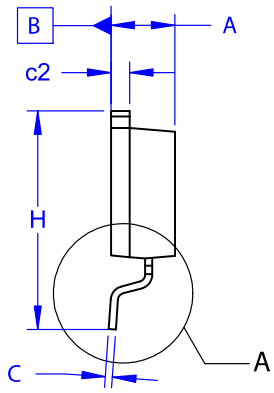
DATE 16 AUG 2019





LAND PATTERN RECOMMENDATION





NOTES:

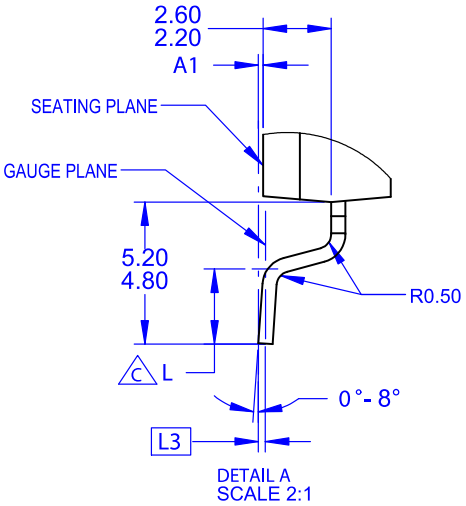
A. PACKAGE CONFORMS TO JEDEC TO-263 VARIATION CB EXCEPT WHERE NOTED.
B. ALL DIMENSIONS ARE IN MILLIMETERS.
C OUT OF JEDEC STANDARD VALUE.
D. DIMENSION AND TOLERANCE AS PER ASME Y14.5-2009.
E. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.30	4.50	4.70
A1	0.00	0.10	0.20
b2	0.60	0.70	0.80
b	0.51	0.60	0.70
c	0.40	0.50	0.60
c2	1.20	1.30	1.40
D	9.00	9.20	9.40
D1	6.15	6.80	7.15
E	9.70	9.90	10.20
E1	7.15	7.65	8.15
e	~	1.27	~
H	15.10	15.40	15.70
L	2.44	2.64	2.84
L1	1.00	1.20	1.40
L3	~	0.25	~
aaa	~	~	0.25

GENERIC MARKING DIAGRAM*

XXXX = 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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DESCRIPTION:	**D²PAK7 (TO−263−7L HV)**		**PAGE 1 OF 1**

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