

Silicon Carbide (SiC) MOSFET

28 mΩ, 1700 V, M1, D2PAK-7L NTBG028N170M1

Features

- Typ. $R_{DS(on)} = 28\text{ m}\Omega$
- Ultra Low Gate Charge (typ. $Q_{G(tot)} = 222\text{ nC}$)
- Low Effective Output Capacitance (typ. $C_{oss} = 200\text{ pF}$)
- 100% Avalanche Tested
- RoHS Compliant

Typical Applications

- UPS
- DC/DC Converter
- Boost Converter

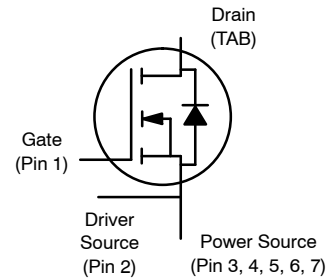
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

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		$T_C < 175^\circ\text{C}$ V_{GSop}	-5/+20	V	
Continuous Drain Current (Note 2)	Steady State	$T_C = 25^\circ\text{C}$	I_D	71	A
			P_D	428	W
Continuous Drain Current (Note 2)	Steady State	$T_C = 100^\circ\text{C}$	I_D	53	A
			P_D	214	W
Pulsed Drain Current (Note 3)	$T_A = 25^\circ\text{C}$		I_{DM}	195	A
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to +175	$^\circ\text{C}$	
Source Current (Body Diode)		I_S	99	A	
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 30\text{ A}$, $L = 1\text{ mH}$) (Note 4)		E_{AS}	450	mJ	
Maximum Lead Temperature for Soldering (1/8" from case for 5 s)		T_L	300	$^\circ\text{C}$	

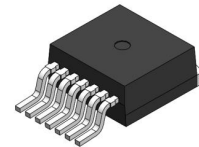
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Surface mounted on a FR-4 board using 1 in2 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. Repetitive rating, limited by max junction temperature.
4. EAS of 450 mJ is based on starting $T_J = 25^\circ\text{C}$; $L = 1\text{ mH}$, $I_{AS} = 30\text{ A}$, $V_{DD} = 120\text{ V}$, $V_{GS} = 18\text{ V}$.

$V_{(BR)DSS}$	$R_{DS(ON)}\text{ MAX}$	$I_D\text{ MAX}$
1700 V	40 mΩ @ 20 V	71 A



N-CHANNEL MOSFET



D2PAK-7L
CASE 418BJ

MARKING DIAGRAM



- A = Assembly Location
- Y = Year
- WW = Work Week
- ZZ = Lot Traceability
- BG028N170M1 = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping†
NTBG028N170M1	D2PAK-7L	800 ea/ 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.

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THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Typ	Max	Unit
Junction-to-Case – Steady State (Note 2)	$R_{\theta JC}$	0.35		°C/W
Junction-to-Ambient – Steady State (Notes 1, 2)	$R_{\theta JA}$		40	

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		0.44		V/°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
			$T_J = 175^\circ\text{C}$		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	3.0	4.3	V
Recommended Gate Voltage	V_{GOP}		-5		+20	V
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 20\text{ V}, I_D = 60\text{ A}, T_J = 25^\circ\text{C}$		28	40	m Ω
		$V_{GS} = 20\text{ V}, I_D = 60\text{ A}, T_J = 175^\circ\text{C}$		57		
Forward Transconductance	g_{FS}	$V_{DS} = 20\text{ V}, I_D = 60\text{ A}$		27		S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 800\text{ V}$		4160		pF
Output Capacitance	C_{OSS}			200		
Reverse Transfer Capacitance	C_{RSS}			15		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -5/20\text{ V}, V_{DS} = 800\text{ V}, I_D = 60\text{ A}$		222		nC
Threshold Gate Charge	$Q_{G(TH)}$			40		
Gate-to-Source Charge	Q_{GS}			72		
Gate-to-Drain Charge	Q_{GD}			53		
Gate-Resistance	R_G		$f = 1\text{ MHz}$		6.1	

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -5/20\text{ V}, V_{DS} = 1200\text{ V}, I_D = 60\text{ A}, R_G = 2\text{ }\Omega$ inductive load		47		ns
Rise Time	t_r			18		
Turn-Off Delay Time	$t_{d(OFF)}$			121		
Fall Time	t_f			13		μJ
Turn-On Switching Loss	E_{ON}			1311		
Turn-Off Switching Loss	E_{OFF}			683		
Total Switching Loss	E_{tot}			1994		

DRAIN-SOURCE DIODE CHARACTERISTICS

Continuous Drain-Source Diode Forward Current	I_{SD}	$V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$			99	A
Pulsed Drain-Source Diode Forward Current (Note 3)	I_{SDM}				195	
Forward Diode Voltage	V_{SD}	$V_{GS} = -5\text{ V}, I_{SD} = 60\text{ A}, T_J = 25^\circ\text{C}$		4.3		V
Reverse Recovery Time	t_{RR}	$V_{GS} = -5/20\text{ V}, I_{SD} = 60\text{ A}, dI_S/dt = 1000\text{ A}/\mu\text{s}$		33		ns
Reverse Recovery Charge	Q_{RR}			247		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.

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TYPICAL CHARACTERISTICS

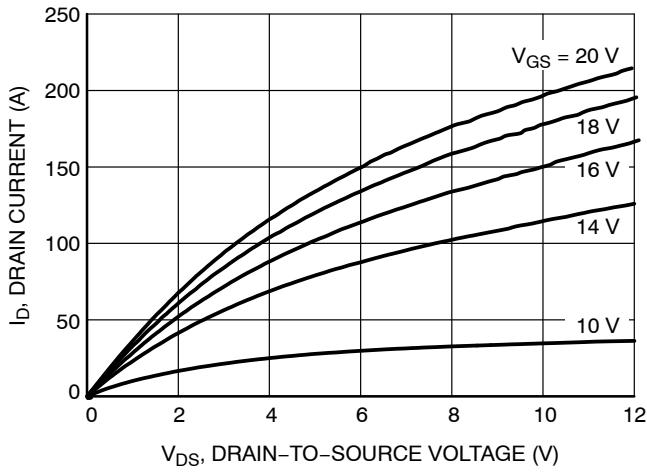


Figure 1. On-Region Characteristics

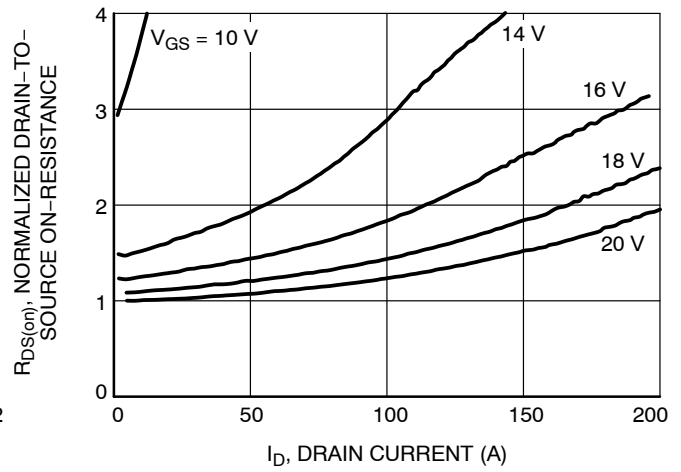


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

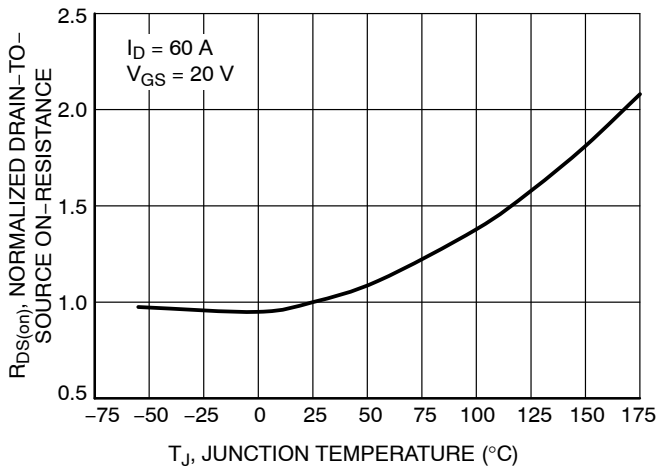


Figure 3. Normalized On-Resistance Variation with Temperature

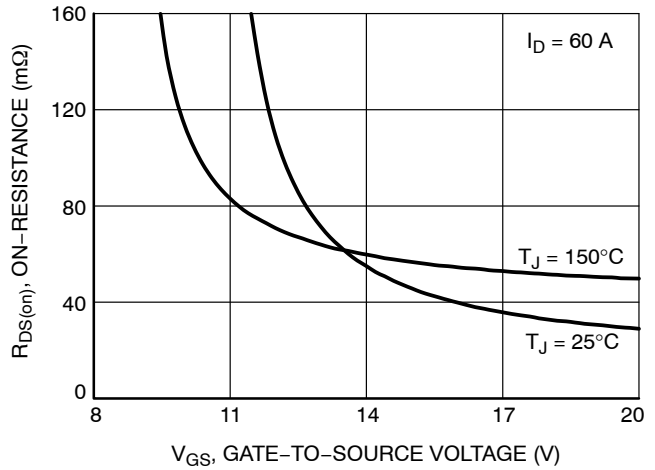


Figure 4. On-Resistance vs. Gate-to-Source Voltage

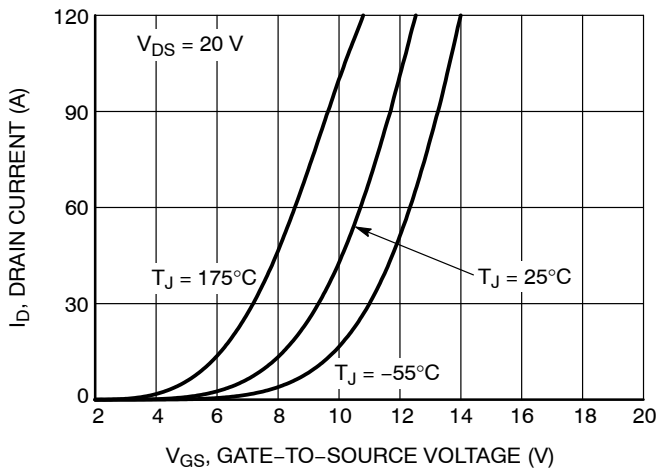


Figure 5. Transfer Characteristics

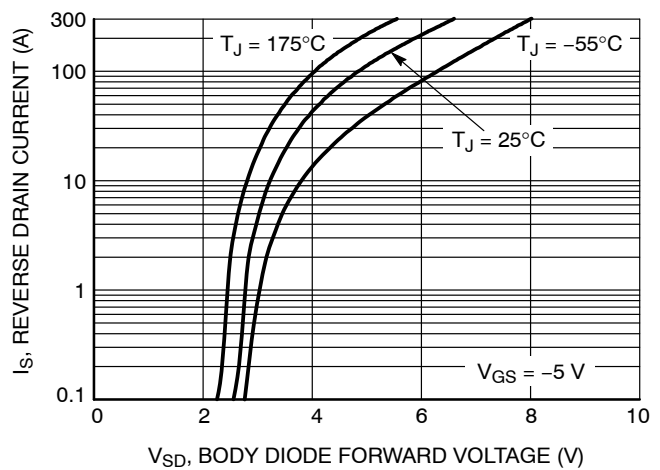


Figure 6. Diode Forward Voltage vs. Current

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TYPICAL CHARACTERISTICS

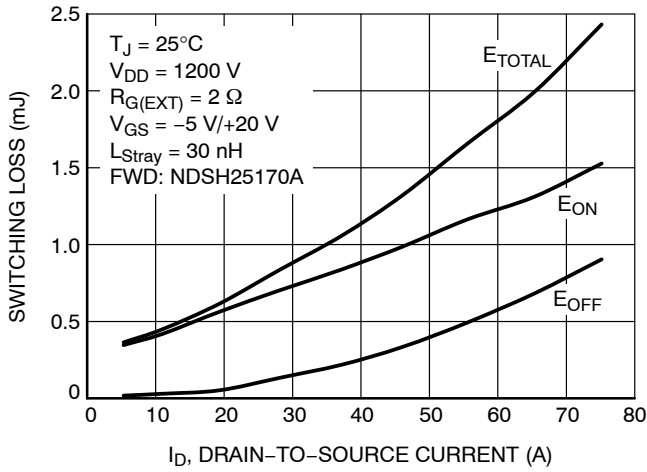


Figure 7. SW Loss vs. ID 25°C

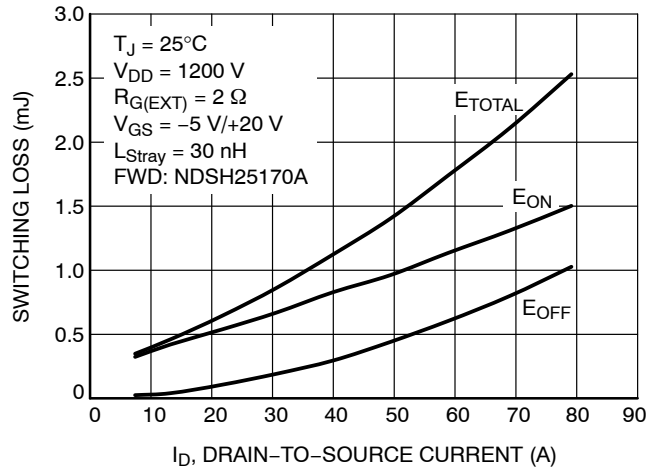


Figure 8. SW Loss vs. ID 125°C

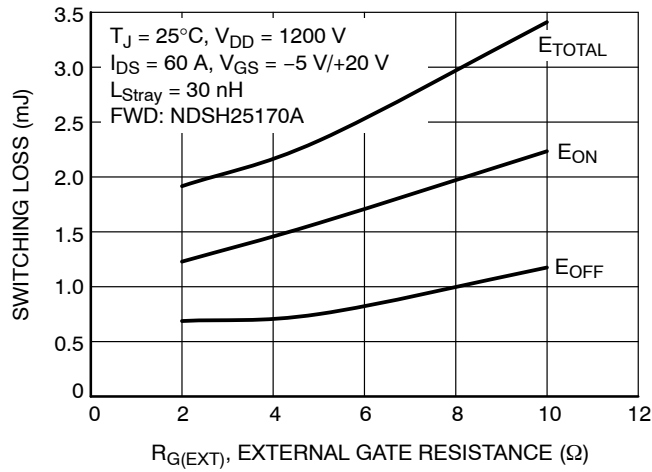


Figure 9. SW Loss vs. Rg

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TYPICAL CHARACTERISTICS

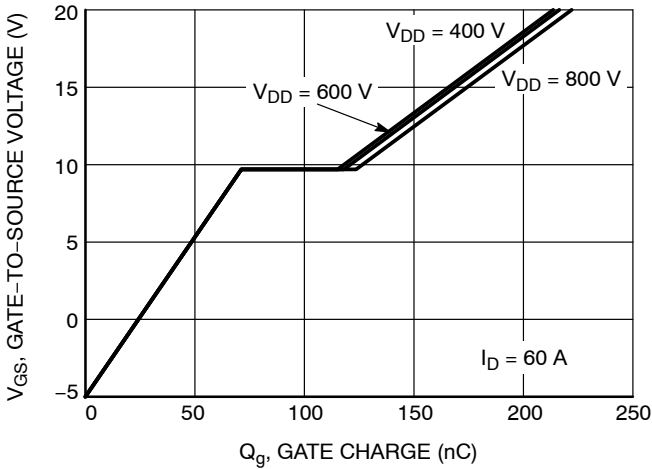


Figure 10. Gate-to-Source Voltage vs. Total Charge

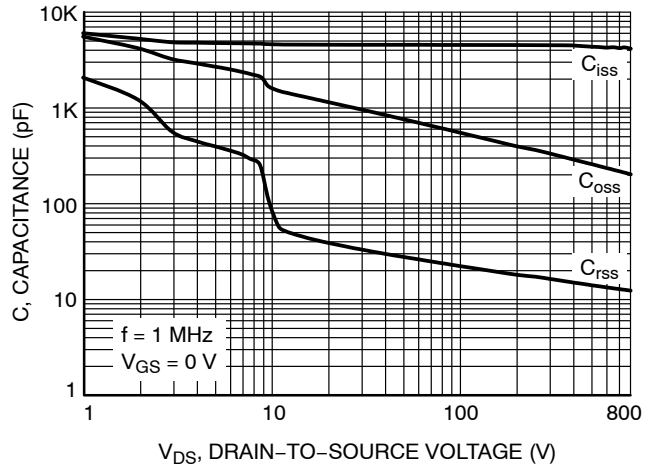


Figure 11. Capacitance vs. Drain-to-Source Voltage

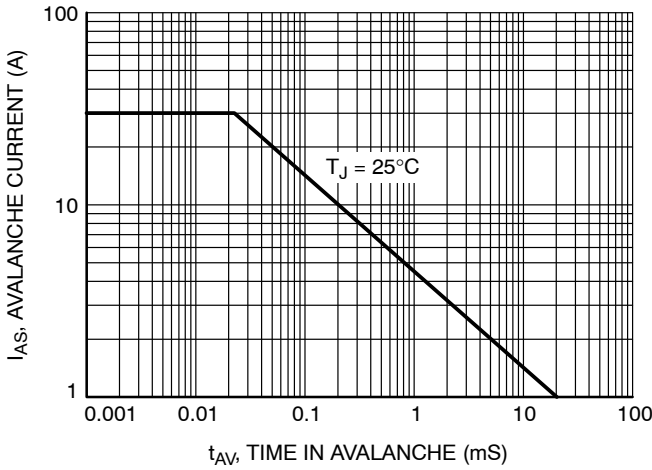


Figure 12. Unclamped Inductive Switching Capability

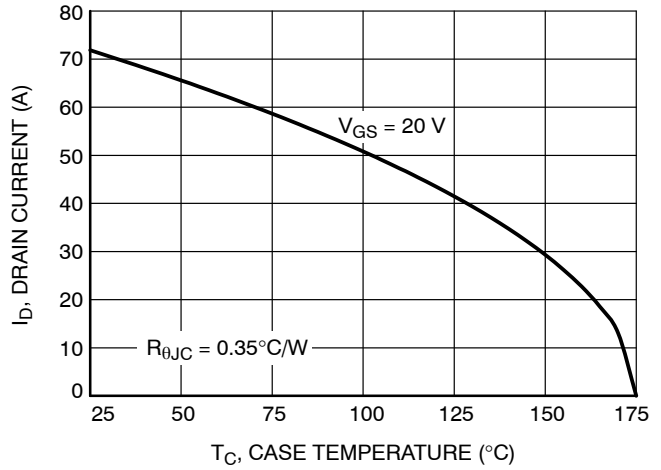


Figure 13. Maximum Continuous Drain Current vs. Case Temperature

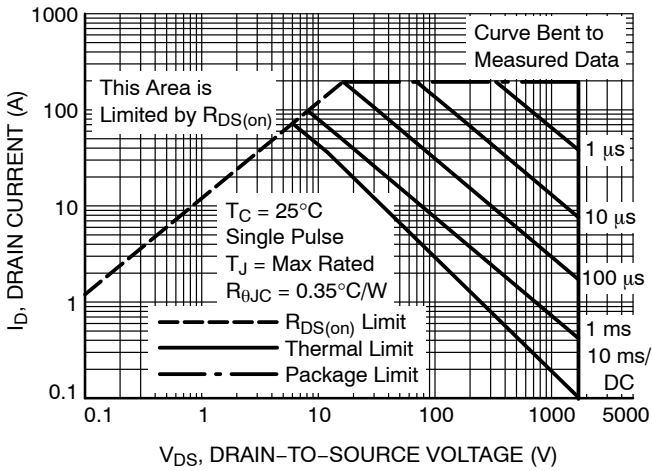


Figure 14. Maximum Rated Forward Biased Safe Operating Area

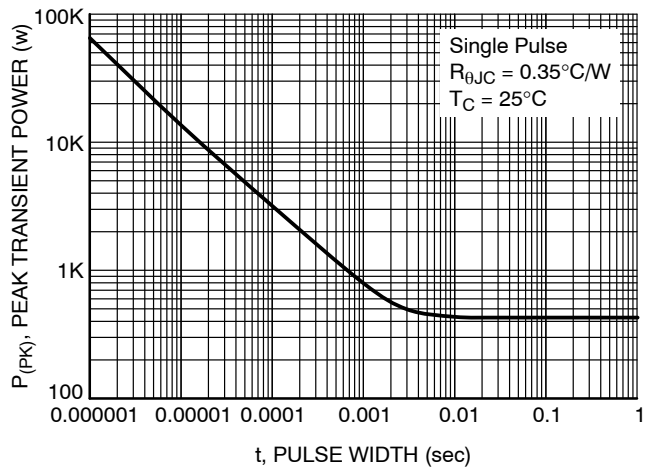


Figure 15. Single Pulse Maximum Power Dissipation

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TYPICAL CHARACTERISTICS

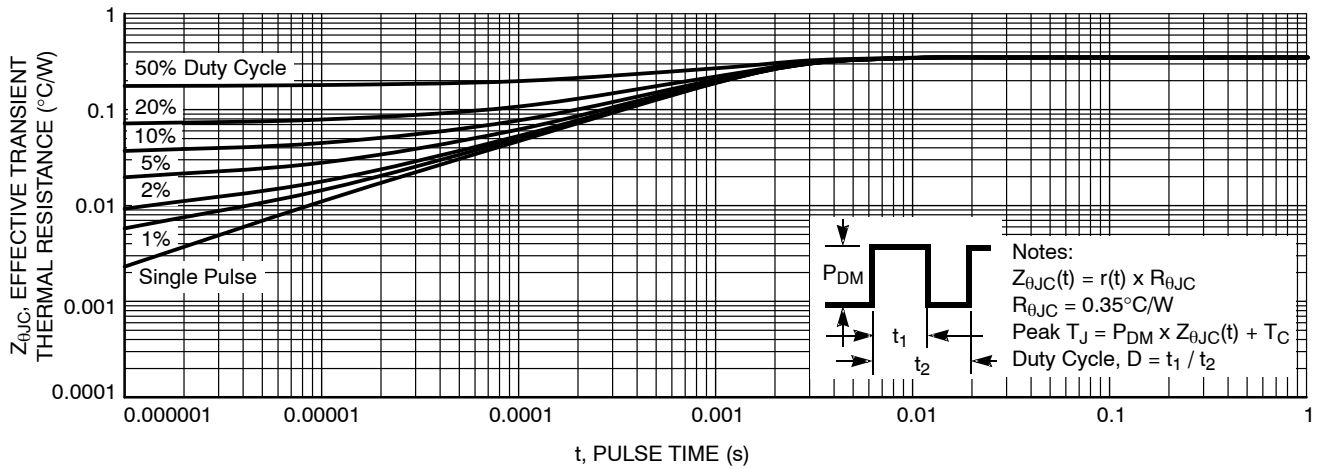
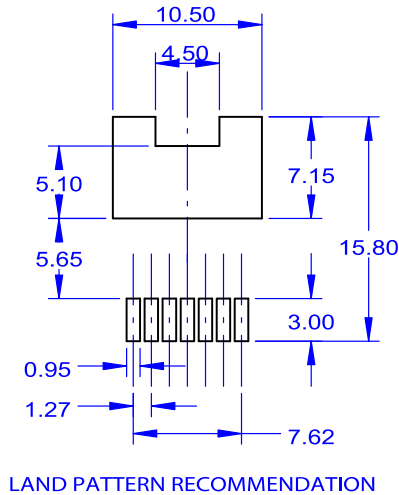
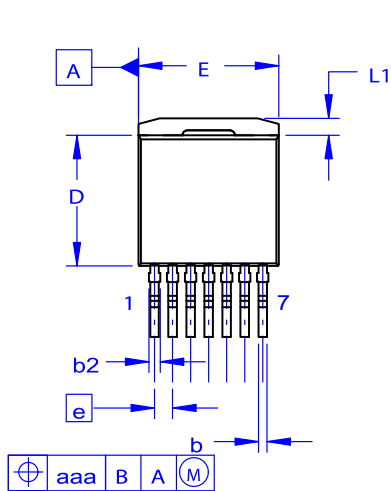


Figure 16. Transient Thermal Impedance

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PACKAGE DIMENSIONS

D²PAK7 (TO-263-7L HV) CASE 418BJ ISSUE A

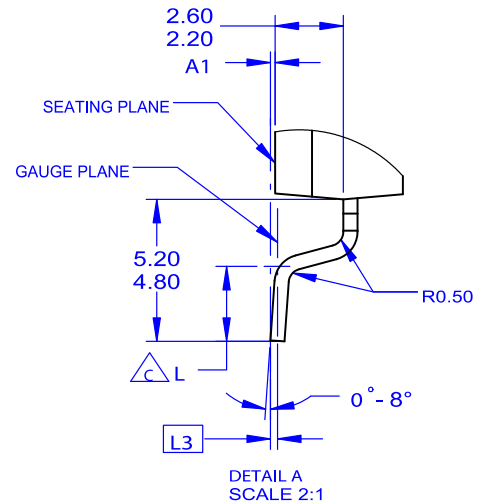
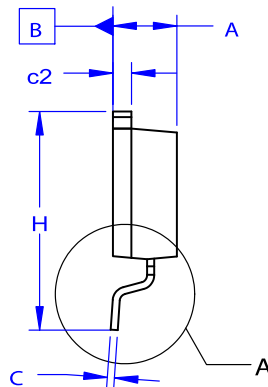
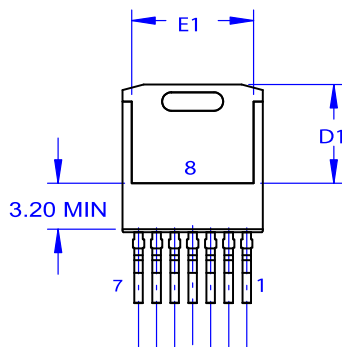


NOTES:

- A. PACKAGE CONFORMS TO JEDEC TO-263 VARIATION CB EXCEPT WHERE NOTED.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.

- △ 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	6.75	6.95	7.15
E	9.70	9.90	10.20
E1	7.70	7.90	8.10
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



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