20V P-CHANNEL ENHANCEMENT MODE MOSFET POWERDI

Product Summary

BV_{DSS}	$R_{DS(ON)}$	I_D T_C = +25°C
-20V	1.9mΩ @ V_{GS} = -10V	-60A
	2.4mΩ @ V_{GS} = -4.5V	-60A
	3.8mΩ @ V_{GS} = -2.5V	-60A

Description

This new generation P-Channel Enhancement Mode MOSFET is designed to minimize $R_{DS(ON)}$ and yet maintain superior switching performance. This device is ideal for use in notebook battery power management and load switch.

Applications

- Switch

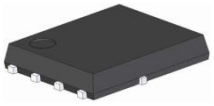
Features

- Thermally Efficient Package-Cooler Running Applications
- High Conversion Efficiency
- Low $R_{DS(ON)}$ – Minimizes On State Losses
- <1.1mm Package Profile – Ideal for Thin Applications
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

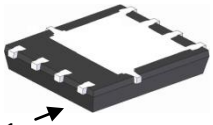
Mechanical Data

- Case: PowerDI5060-8 (Type K)
- Case Material: Molded Plastic, "Green" Molding Compound; UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Finish - Matte Tin Annealed over Copper Leadframe; Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.097 grams (Approximate)

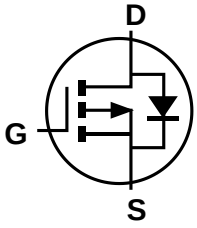
PowerDI5060-8 (Type K)



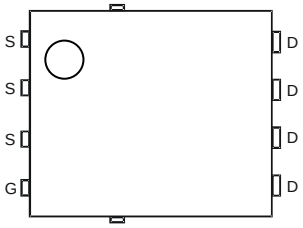
Top View



Bottom View



Internal Schematic



Top View
Pin Configuration

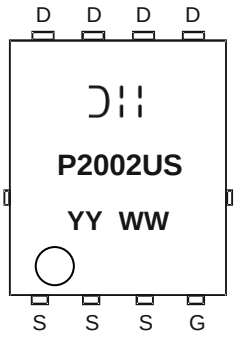
Ordering Information (Note 4)

Part Number	Case	Packaging
DMP2002UPS-13	PowerDI5060-8 (Type K)	2,500 / Tape & Reel

Notes:
1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

Marking Information

PowerDI5060-8 (Type K)



= Manufacturer's Marking
P2002US = Product Type Marking Code
YYWW = Date Code Marking
YY = Last Two Digits of Year (ex: 16 = 2016)
WW = Week Code (01 to 53)

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Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

Characteristic			Symbol	Value	Units
Drain-Source Voltage			V_{DSS}	-20	V
Gate-Source Voltage			V_{GSS}	±12	V
Continuous Drain Current, V_{GS} = -10V (Note 5)	Steady State (Note 8)	T_C = +25°C T_C = +70°C	I_D	-60 -60	A
	t<10s	T_A = +25°C T_A = +70°C		-42 -33.5	A
Pulsed Drain Current (10µs pulse, duty cycle = 1%)			I_{DM}	-100	A
Continuous Body Diode Forward Current (Note 5)	Steady State (Note 8)	T_C = +25°C	I_S	-60	A
	t<10s	T_A = +25°C		-5.6	A
Pulsed Body Diode Forward Current (10µs pulse, duty cycle = 1%)			I_{SM}	-100	A
Avalanche Current, L = 0.1mH			I_{AS}	-37	A
Avalanche Energy, L = 0.1mH			E_{AS}	69.8	mJ

Thermal Characteristics

Characteristic		Symbol	Value	Units
Total Power Dissipation (Note 5)	Steady State	P_D	2.3	W
	t<10s		6.25	
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	$R_{\theta JA}$	55	°C/W
	t<10s		20	
Total Power Dissipation (Note 5)	Steady State	P_D	104	W
Thermal Resistance, Junction to Case (Note 5)		$R_{\theta JC}$	0.9	°C/W
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

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Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 6)						
Drain-Source Breakdown Voltage	BV_{DSS}	-20	—	—	V	V_{GS} = 0V, I_D = -250µA
Zero Gate Voltage Drain Current	I_{DSS}	—	—	-1	µA	V_{DS} = -20V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±12V, V_{DS} = 0V
ON CHARACTERISTICS (Note 6)						
Gate Threshold Voltage	$V_{GS(TH)}$	-0.5	—	-1.4	V	V_{DS} = V_{GS}, I_D = -250µA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	1.3	1.9	mΩ	V_{GS} = -10V, I_D = -25A
		—	1.5	2.4		V_{GS} = -4.5V, I_D = -20A
		—	2	3.8		V_{GS} = -2.5V, I_D = -15A
DYNAMIC CHARACTERISTICS (Note 7)						
Input Capacitance	C_{iss}	—	12826	—	pF	V_{DS} = -10V, V_{GS} = 0V f = 1MHz
Output Capacitance	C_{oss}	—	2547	—		
Reverse Transfer Capacitance	C_{rss}	—	1924	—		
Gate Resistance	R_G	0.9	4.2	6.6	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge (V_{GS} = -10V)	Q_g	—	476	585	nC	V_{DS} = -10V, I_D = -20A
Total Gate Charge (V_{GS} = -4.5V)	Q_g	—	228	282		
Gate-Source Charge	Q_{gs}	—	24.8	—		
Gate-Drain Charge	Q_{gd}	—	61.9	—		
Turn-On Delay Time	$t_{D(ON)}$	—	14.2	28	ns	V_{DD} = -10V, V_{GEN} = -4.5V, R_{GEN} = 1Ω, I_D = -10A
Turn-On Rise Time	t_R	—	35.4	70		
Turn-Off Delay Time	$t_{D(OFF)}$	—	361	578		
Turn-Off Fall Time	t_F	—	224	358		
BODY DIODE CHARACTERISTICS						
Continuous Body Diode Forward Current (Notes 5 & 8)	I_S	—	—	-60	A	T_C = +25°C
Diode Forward Voltage	V_{SD}	—	-0.58	-1.1	V	V_{GS} = 0V, I_S = -5A
Reverse Recovery Time (Note 7)	t_{RR}	—	137	219	ns	I_F = -10A, di/dt = 100A/µs
Reverse Recovery Charge (Note 7)	Q_{RR}	—	221	332	nC	
Reverse Recovery Fall Time (Note 7)	t_A	—	39	—	ns	
Reverse Recovery Raise Time (Note 7)	t_B	—	98	—		

Notes: 5. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate.
6. Short duration pulse test used to minimize self-heating effect.
7. Guaranteed by design. Not subject to product testing.
8. Package limited.

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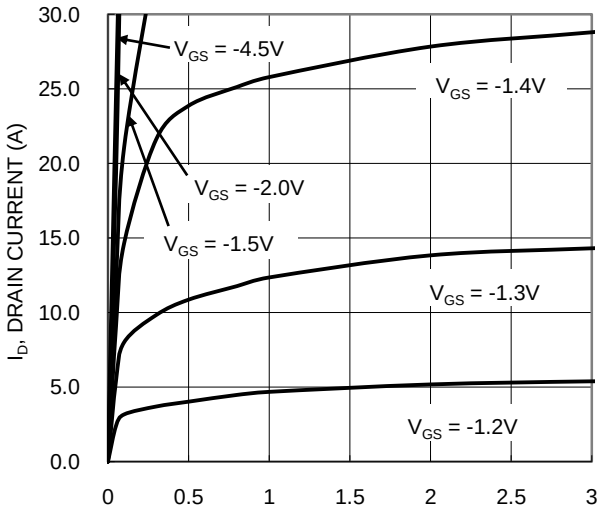

Figure 1. Typical Output Characteristic

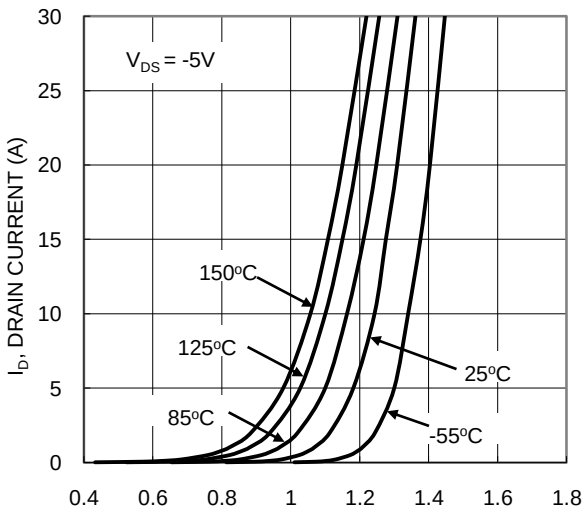

Figure 2. Typical Transfer Characteristic

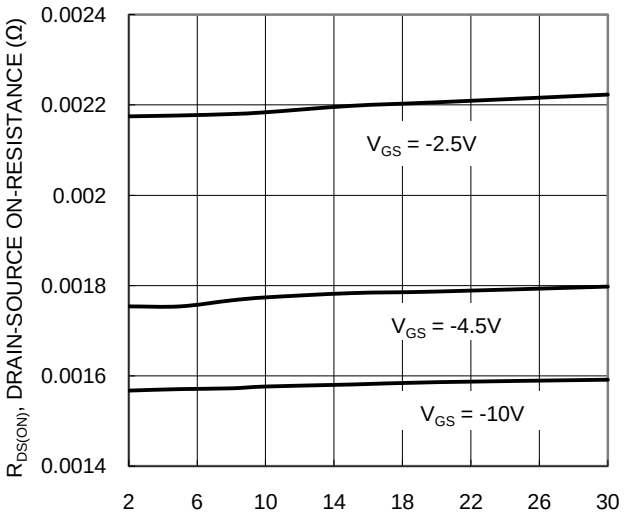

Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

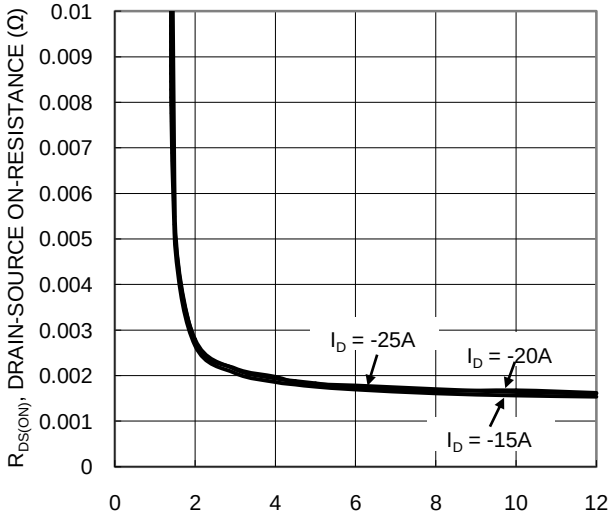

Figure 4. Typical Transfer Characteristic

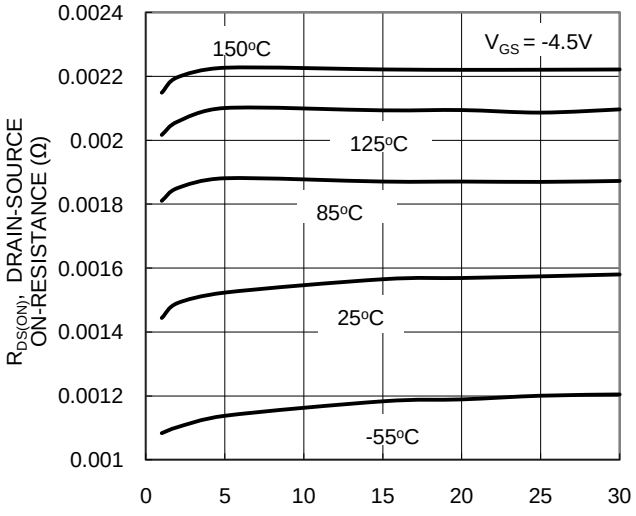

Figure 5. Typical On-Resistance vs. Drain Current and Temperature

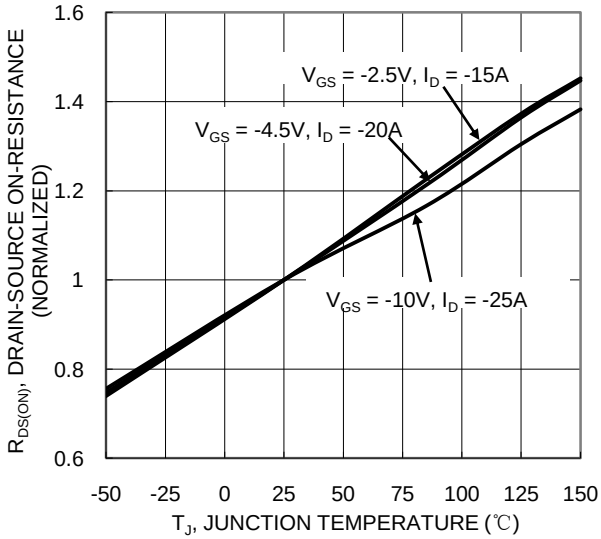

Figure 6. On-Resistance Variation with Temperature

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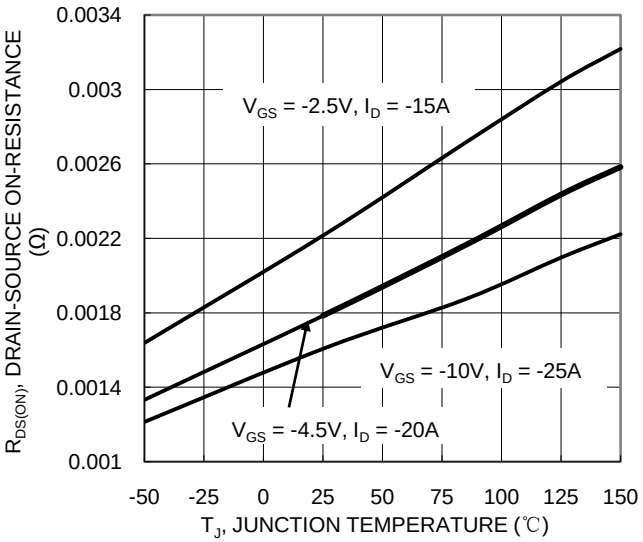

Figure 7. On-Resistance Variation with Temperature

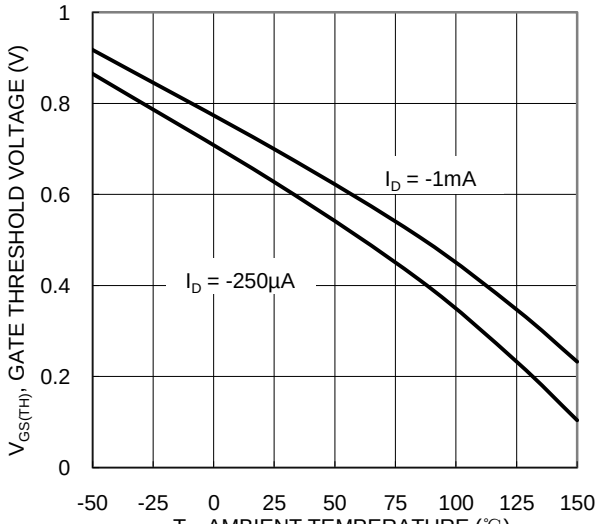

Figure 8. Gate Threshold Variation vs Ambient Temperature

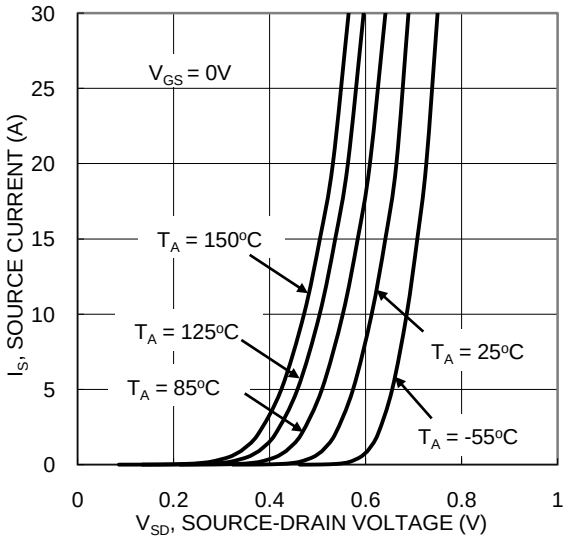

Figure 9. Diode Forward Voltage vs. Current

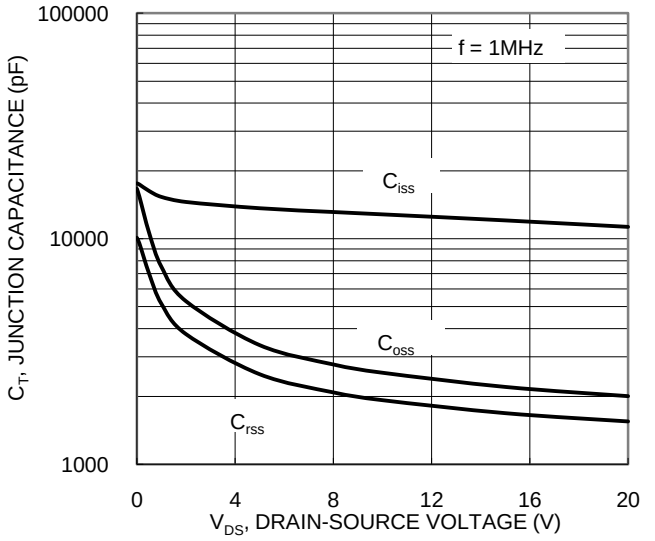

Figure 10. Typical Junction Capacitance

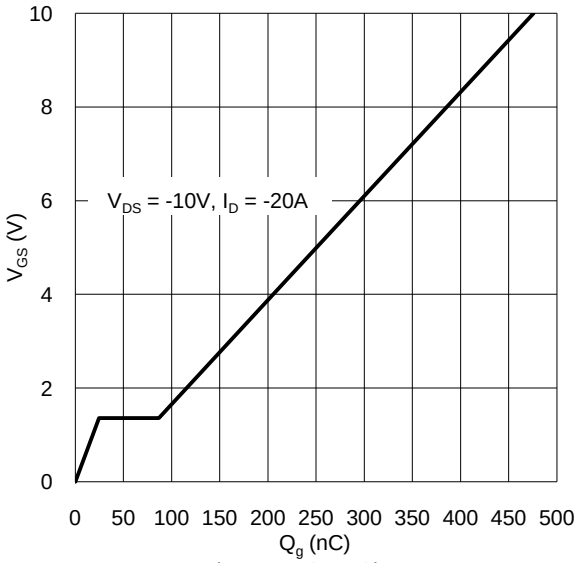

Figure 11. Gate Charge

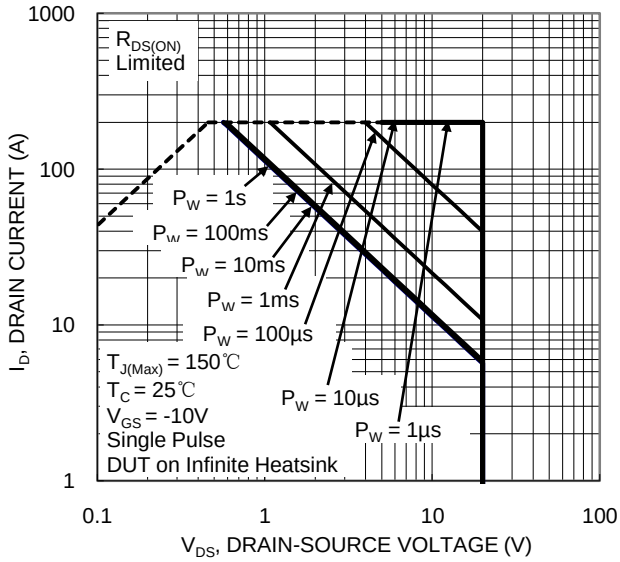

Figure 12. SOA, Safe Operation Area

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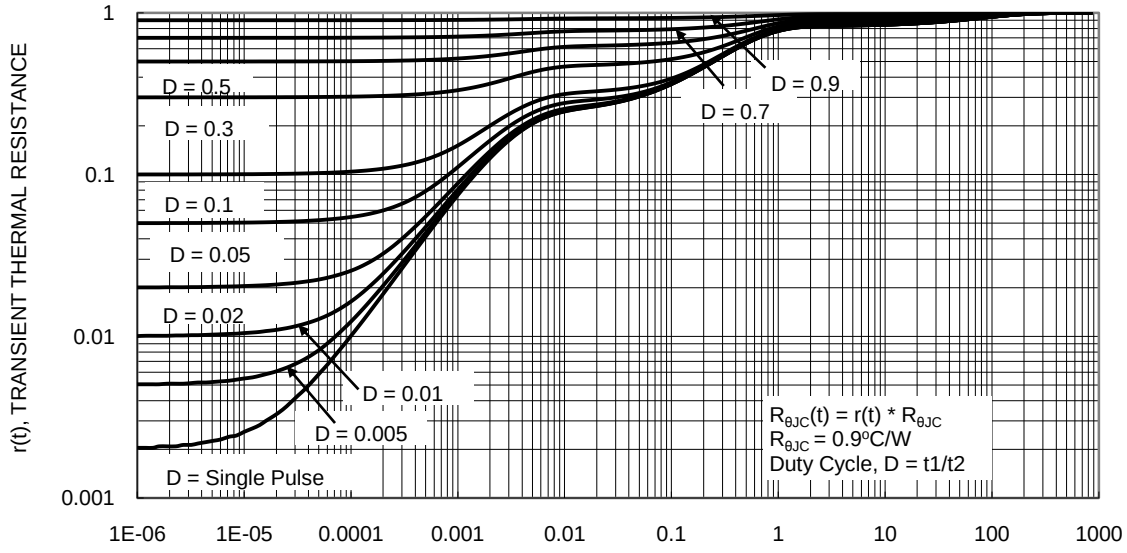

Figure 13. Transient Thermal Resistance

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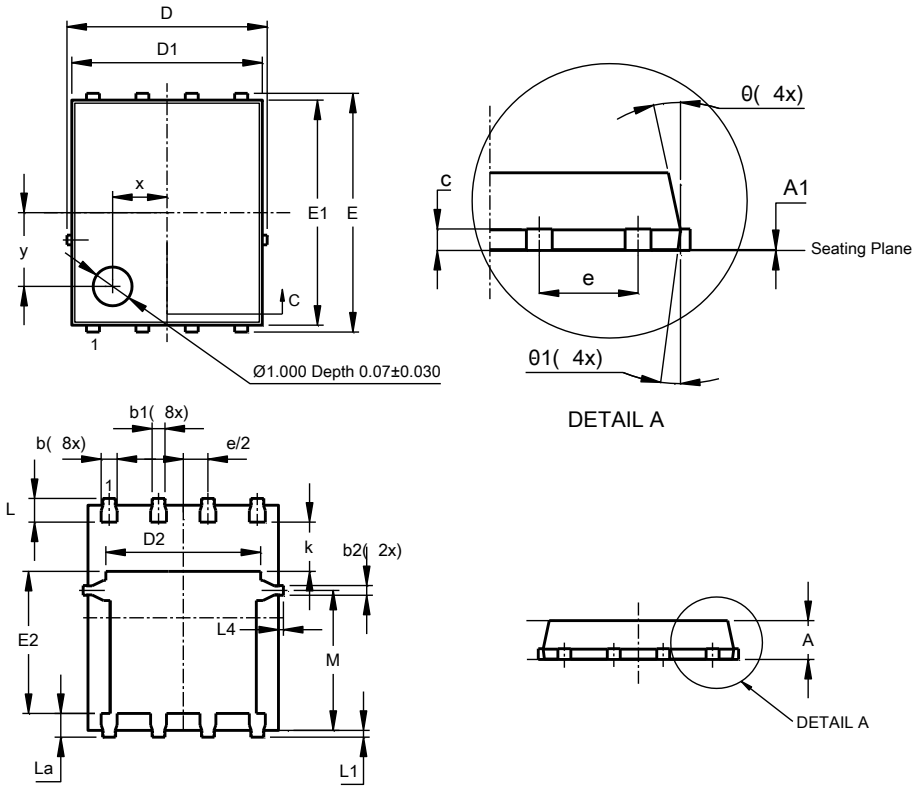
Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

PowerDI5060-8 (Type K)

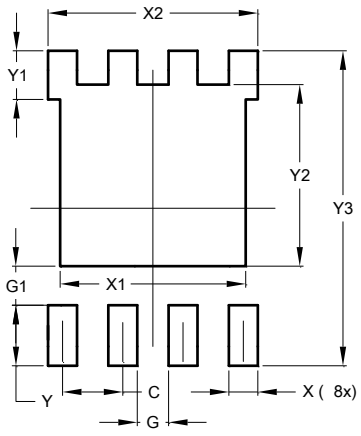


PowerDI5060-8 (Type K)			
Dim	**Min**	**Max**	**Typ**
A	0.90	1.10	1.00
A1	0	0.05	0.02
b	0.33	0.51	0.41
b1	0.300	0.366	0.333
b2	0.20	0.35	0.25
c	0.23	0.33	0.277
D	5.15 BSC		
D1	4.85	4.95	4.90
D2	-	-	3.98
E	6.15 BSC		
E1	5.75	5.85	5.80
E2	3.56	3.725	3.66
E	1.27BSC		
k	-	-	1.27
L	0.51	0.71	0.61
La	0.51	0.675	0.61
L1	0.05	0.20	0.175
L4	-	-	0.125
M	3.50	3.71	3.605
x	-	-	1.400
y	-	-	1.900
θ	10°	12°	11°
θ1	6°	8°	7°
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

PowerDI5060-8 (Type K)



Dimensions	Value (in mm)
C	1.270
G	0.660
G1	0.820
X	0.610
X1	3.910
X2	4.420
Y	1.270
Y1	1.020
Y2	3.810
Y3	6.610

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