

Product Summary

Device	V _{(BR)DSS}	R _{DS(ON)}	I _D T _A = +25°C
Q1	12V	17mΩ @ V _{GS} = 4.5V	9.5A
		25mΩ @ V _{GS} = 2.5V	7.8A
Q2	-20V	32mΩ @ V _{GS} = -4.5V	-6.9A
		53mΩ @ V _{GS} = -2.5V	-5.4A

Description and Applications

This new generation Complementary Pair Enhancement Mode MOSFET has been designed to minimize R_{DS(ON)} and yet maintain superior switching performance. This device is ideal for use in Notebook battery power management and Loadswitch.

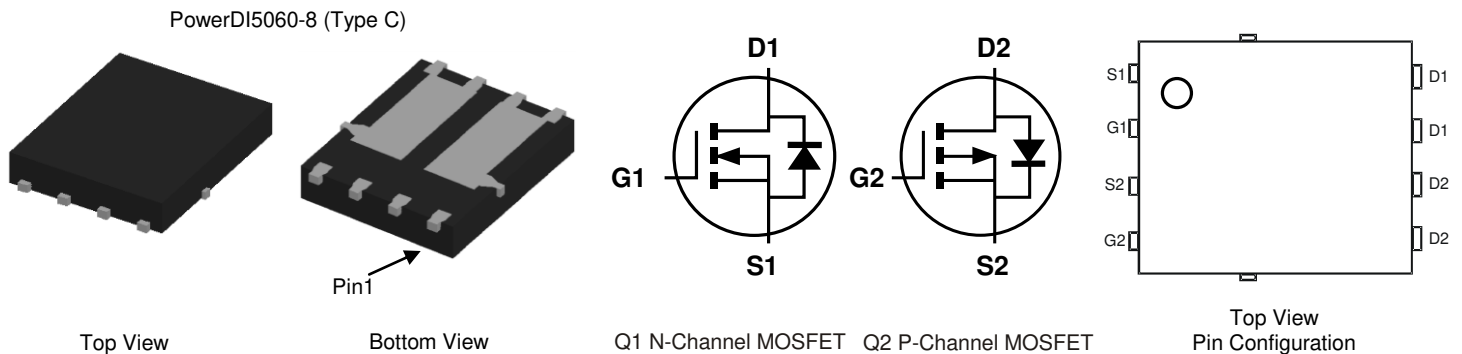
- Notebook Battery Power Management
- DC-DC Converters
- Loadswitch

Features and Benefits

- Thermally Efficient Package-Cooler Running Applications
- High Conversion Efficiency
- Low R_{DS(ON)} – Minimizes On State Losses
- Low Input Capacitance
- Fast Switching Speed
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e.: parts qualified to AEC-Q101, PPAP capable, and manufactured in IATF 16949 certified facilities), please refer to the related automotive grade (Q-suffix) part. A listing can be found at <https://www.diodes.com/products/automotive/automotive-products/>.**
- **This part is qualified to JEDEC standards (as references in AEC-Q101) for High Reliability. <https://www.diodes.com/quality/product-definitions/>**

Mechanical Data

- Case: PowerDI[®]5060-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – 100% Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 (e3)
- Terminal Connections: See Diagram Below
- Weight: 0.097 grams (Approximate)

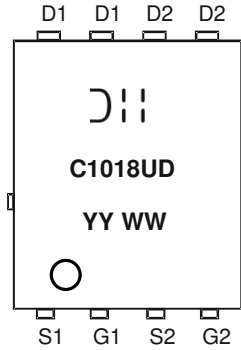


Ordering Information (Note 4)

Part Number	Case	Packaging
DMC1018UPD-13	PowerDI5060-8 (Type C)	2500 / Tape & Reel

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
 2. See <https://www.diodes.com/quality/lead-free/> 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 <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

Marking Information



⌋|| = Manufacturer's Marking
 C1018UD = Product Type Marking Code
 YYWW = Date Code Marking
 YY = Year (ex: 15 = 2015)
 WW = Week (01 - 53)

Maximum Ratings (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic		Symbol	Q1 Value	Q2 Value	Units	
Drain-Source Voltage		V_{DSS}	12	-20	V	
Gate-Source Voltage		V_{GSS}	± 8	± 12	V	
Continuous Drain Current (Note 5) $V_{GS} = 4.5\text{V}$	Steady State	I_D	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	9.5 7.6	-6.9 -5.5	A
	$t < 10\text{s}$		$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	13.0 10.4	-9.4 -7.5	A
Maximum Body Diode Forward Current (Note 5)		I_S	2.5	-2.5	A	
Pulsed Drain Current (10 μs pulse, duty cycle = 1%)		I_{DM}	60	-40	A	
Avalanche Current (Note 6) $L = 0.1\text{mH}$		I_{AS}	20	-17	A	
Avalanche Energy (Note 6) $L = 0.1\text{mH}$		E_{AS}	25	14	mJ	

Thermal Characteristics

Characteristic	Symbol	Value	Units
Total Power Dissipation (Note 5)	P_D	$T_A = +25^\circ\text{C}$	2.3
		$T_A = +70^\circ\text{C}$	1.5
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	Steady State	54
		$t < 10\text{s}$	29
Thermal Resistance, Junction to Case	$R_{\theta JC}$	6.5	$^\circ\text{C/W}$
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	

Notes: 5. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
 6. I_{AS} and E_{AS} rating are based on low frequency and duty cycles to keep $T_J = +25^\circ\text{C}$.

Electrical Characteristics Q1 N-Channel (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 7)						
Drain-Source Breakdown Voltage	BV_{DSS}	12	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
Zero Gate Voltage Drain Current	I_{DSS}	—	—	1	μA	$V_{DS} = 12V, V_{GS} = 0V$
Gate-Source Leakage	I_{GSS}	—	—	± 100	nA	$V_{GS} = \pm 8V, V_{DS} = 0V$
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{GS(TH)}$	0.6	0.8	1.5	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	8	17	m Ω	$V_{GS} = 4.5V, I_D = 11.8A$
		—	11	25		$V_{GS} = 2.5V, I_D = 9.8A$
Diode Forward Voltage	V_{SD}	—	0.7	1.2	V	$V_{GS} = 0V, I_S = 2.9A$
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C_{iss}	—	1525	—	pF	$V_{DS} = 6V, V_{GS} = 0V, f = 1.0MHz$
Output Capacitance	C_{oss}	—	329	—		
Reverse Transfer Capacitance	C_{riss}	—	303	—		
Gate Resistance	R_G	—	1.6	—	Ω	$V_{DS} = 0V, V_{GS} = 0V, f = 1.0MHz$
Total Gate Charge ($V_{GS} = 4.5V$)	Q_g	—	17.1	—	nC	$V_{DS} = 6V, I_D = 11.8A$
Total Gate Charge ($V_{GS} = 8V$)	Q_g	—	30.4	—		
Gate-Source Charge	Q_{gs}	—	2.6	—		
Gate-Drain Charge	Q_{gd}	—	4.3	—		
Turn-On Delay Time	$t_{D(ON)}$	—	6.6	—	ns	$V_{DD} = 6V, R_L = 6\Omega, V_{GS} = 4.5V, R_G = 6\Omega, I_D = 1A$
Turn-On Rise Time	t_R	—	10.8	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	41.5	—		
Turn-Off Fall Time	t_F	—	21.9	—		
Body Diode Reverse Recovery Time	t_{RR}	—	14.3	—	ns	$I_F = 11.8A, di/dt = 100A/\mu s$
Body Diode Reverse Recovery Charge	Q_{RR}	—	2.3	—	nC	$I_F = 11.8A, di/dt = 100A/\mu s$

Notes: 7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to product testing.

Electrical Characteristics Q2 P-Channel (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 7)						
Drain-Source Breakdown Voltage	BV_{DSS}	-20	—	—	V	$V_{GS} = 0V, I_D = -250\mu A$
Zero Gate Voltage Drain Current	I_{DSS}	—	—	-1	μA	$V_{DS} = -16V, V_{GS} = 0V$
Gate-Source Leakage	I_{GSS}	—	—	± 100	nA	$V_{GS} = \pm 12V, V_{DS} = 0V$
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{GS(TH)}$	-0.6	-0.8	-1.5	V	$V_{DS} = V_{GS}, I_D = -250\mu A$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	22	32	m Ω	$V_{GS} = -4.5V, I_D = -8.9A$
		—	31	53		$V_{GS} = -2.5V, I_D = -6.9A$
Diode Forward Voltage	V_{SD}	—	-0.7	-1.2	V	$V_{GS} = 0V, I_S = -2.9A$
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C_{iss}	—	866	—	pF	$V_{DS} = -6V, V_{GS} = 0V,$ $f = 1.0MHz$
Output Capacitance	C_{oss}	—	167	—		
Reverse Transfer Capacitance	C_{rss}	—	131	—		
Gate Resistance	R_G	—	4.9	—	Ω	$V_{DS} = 0V, V_{GS} = 0V, f = 1.0MHz$
Total Gate Charge ($V_{GS} = -4.5V$)	Q_g	—	8.6	—	nC	$V_{DS} = -6V, I_D = -8.9A$
Total Gate Charge ($V_{GS} = -8V$)	Q_g	—	19	—		
Gate-Source Charge	Q_{gs}	—	1.5	—		
Gate-Drain Charge	Q_{gd}	—	2.5	—		
Turn-On Delay Time	$t_{D(ON)}$	—	5.8	—	ns	$V_{DD} = -6V, R_L = 6\Omega$ $V_{GS} = -4.5V, R_G = 6\Omega, I_D = -1A$
Turn-On Rise Time	t_R	—	7.7	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	28.1	—		
Turn-Off Fall Time	t_F	—	14.6	—		
Body Diode Reverse Recovery Time	t_{RR}	—	9.8	—	ns	$I_F = -8.9A, di/dt = -100A/\mu s$
Body Diode Reverse Recovery Charge	Q_{RR}	—	2.7	—	nC	$I_F = -8.9A, di/dt = -100A/\mu s$

Notes: 7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to product testing.

Typical Characteristics - N-CHANNEL

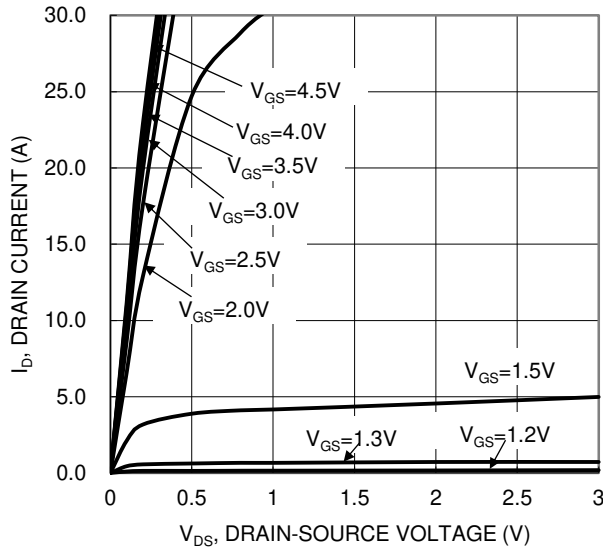


Figure 1. Typical Output Characteristic

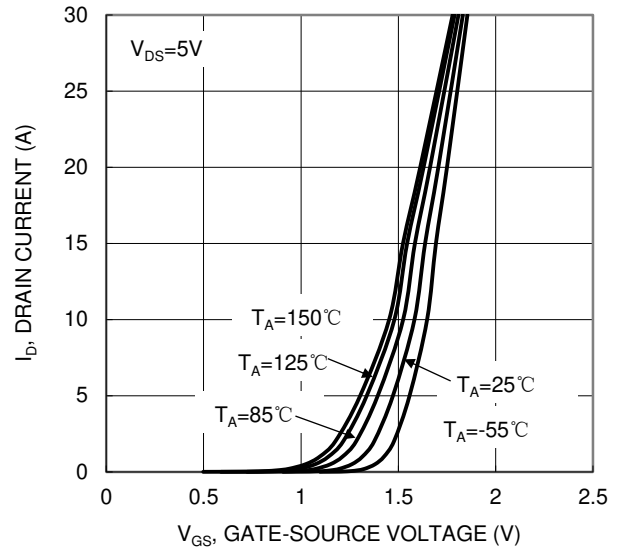


Figure 2. Typical Transfer Characteristic

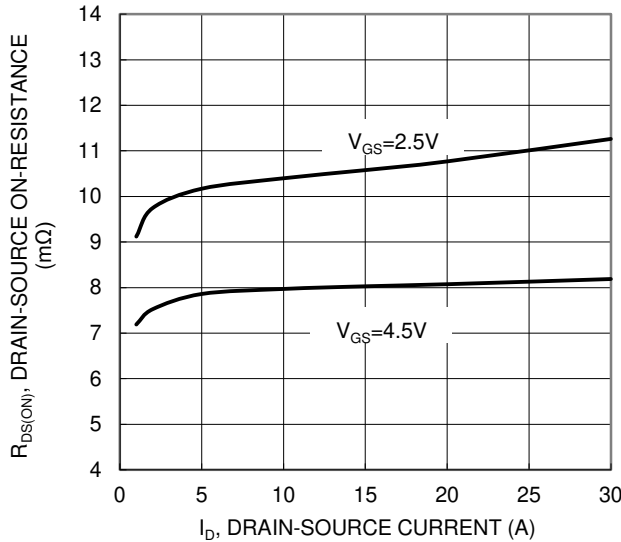


Figure 3. Typical On-Resistance vs Drain Current and Gate Voltage

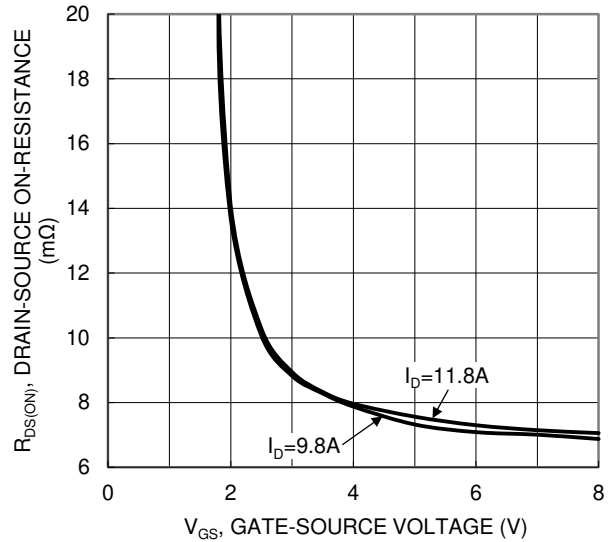


Figure 4. Typical Transfer Characteristic

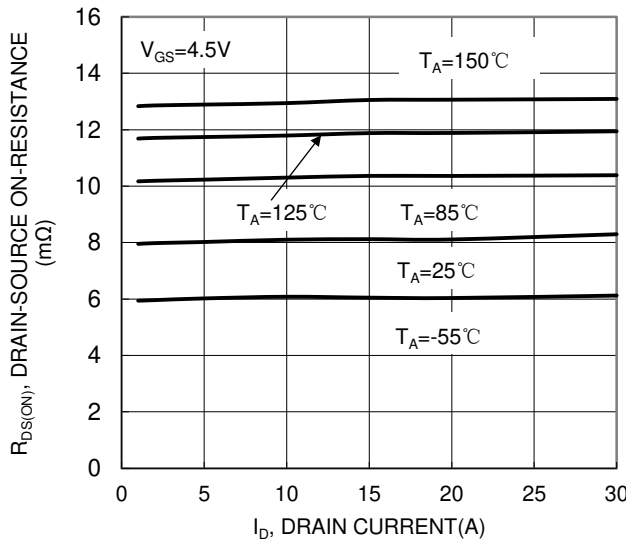


Figure 5. Typical On-Resistance vs Drain Current and Junction Temperature

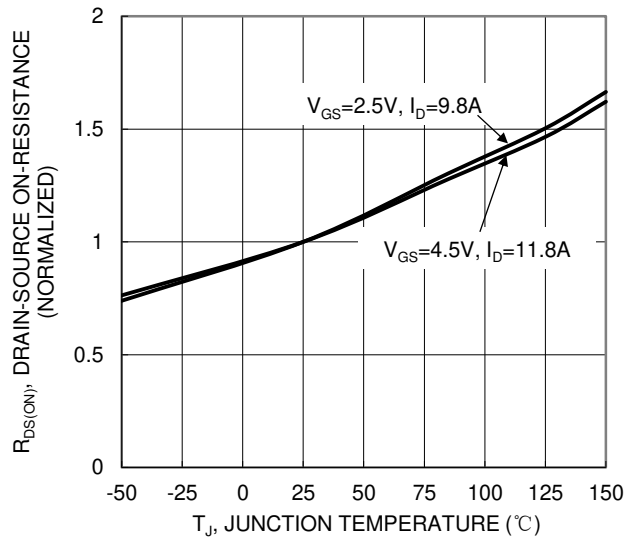


Figure 6. On-Resistance Variation with Junction Temperature

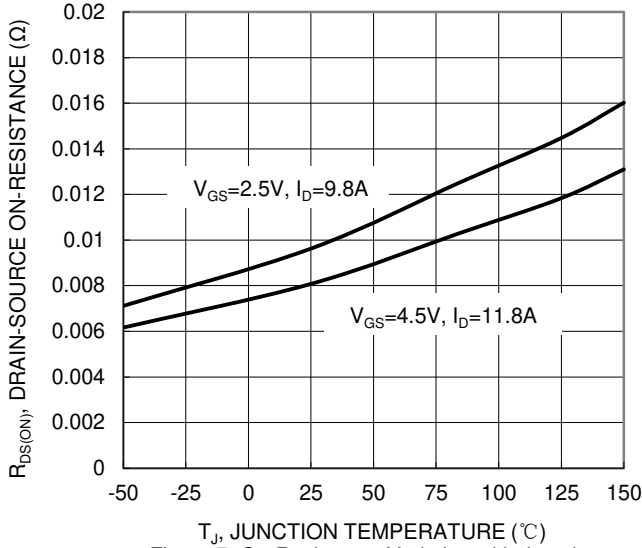


Figure 7. On-Resistance Variation with Junction Temperature

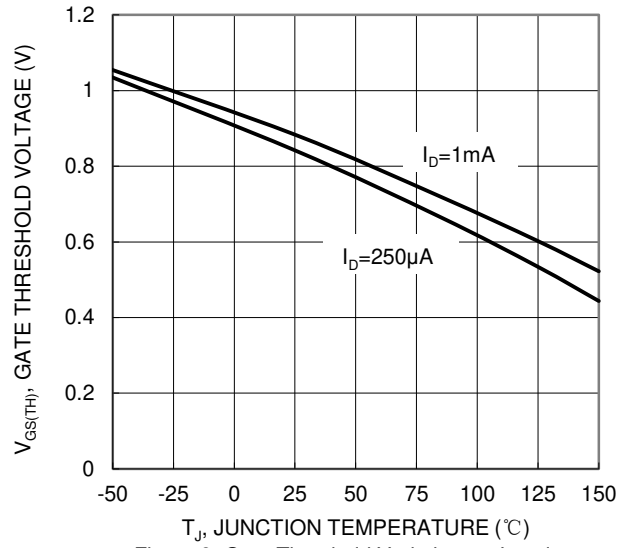


Figure 8. Gate Threshold Variation vs Junction Temperature

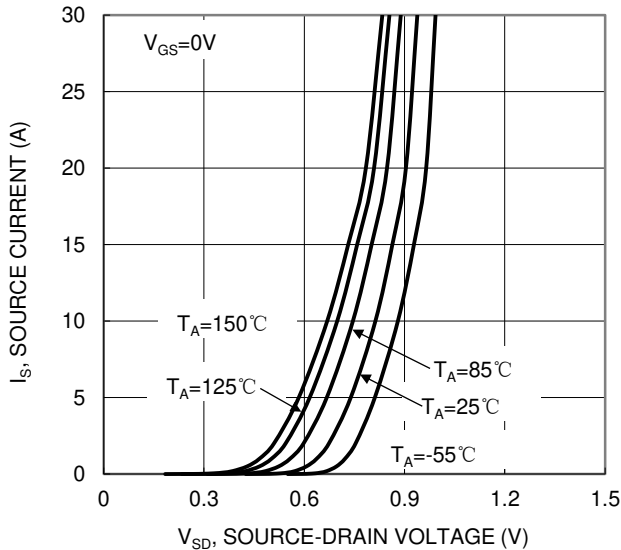


Figure 9. Diode Forward Voltage vs Current

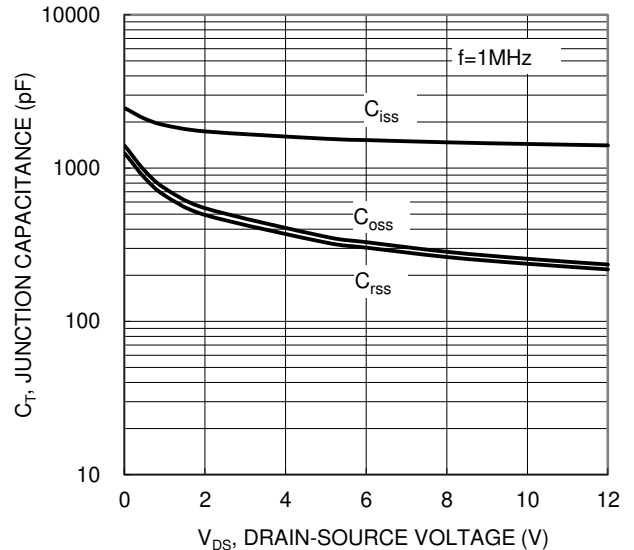


Figure 10. Typical Junction Capacitance

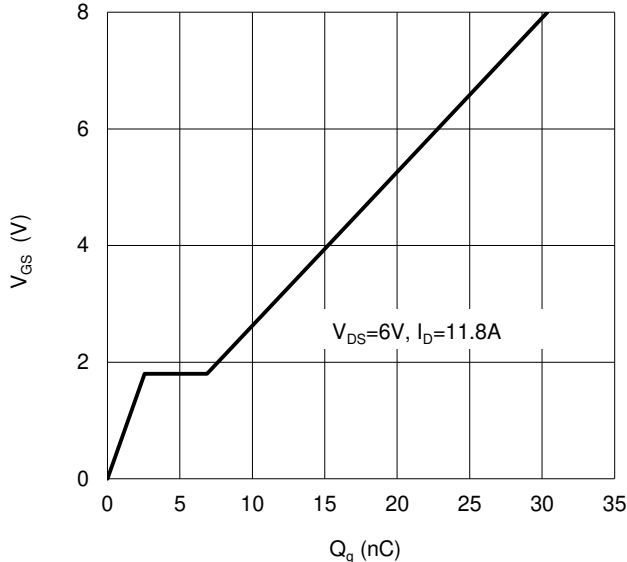


Figure 11. Gate Charge

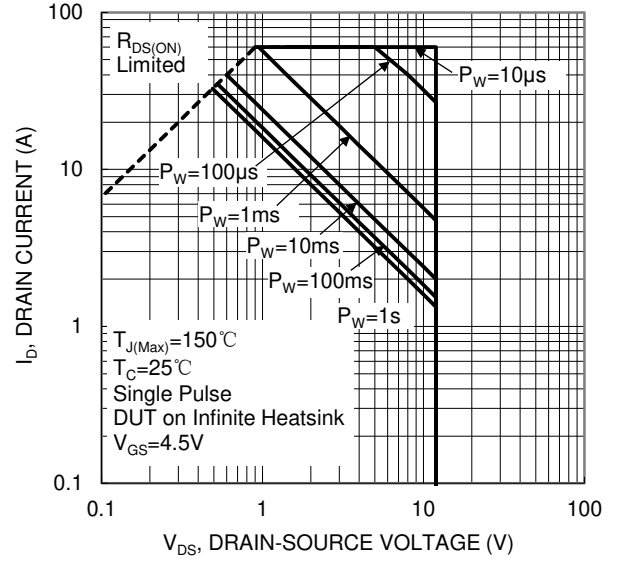


Figure 12. SOA, Safe Operation Area

Typical Characteristics - P-CHANNEL

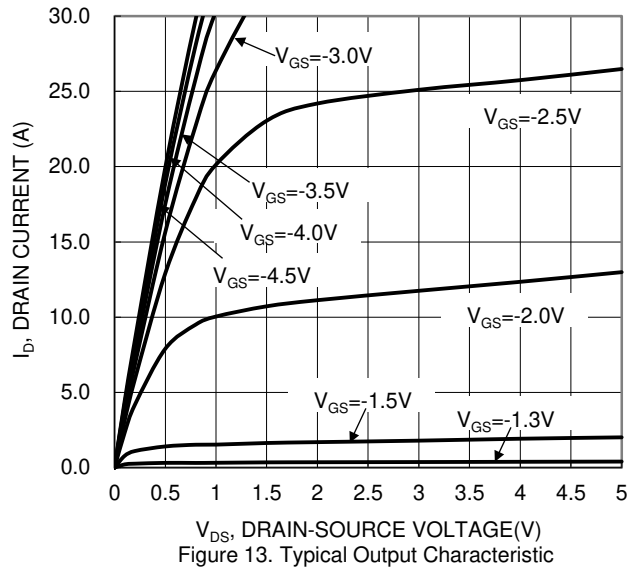


Figure 13. Typical Output Characteristic

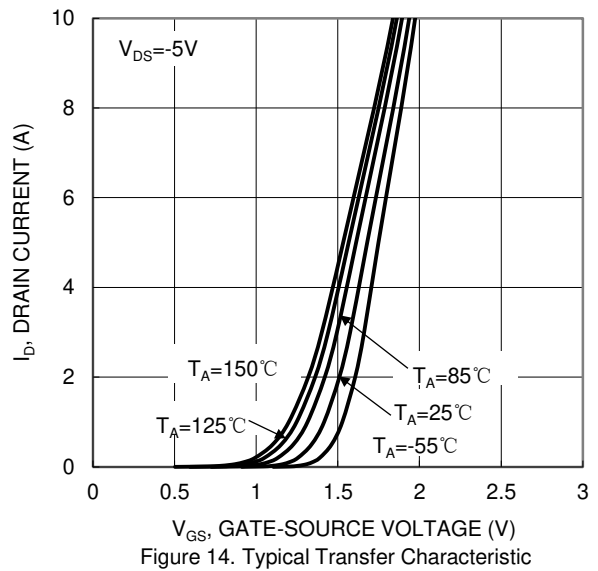


Figure 14. Typical Transfer Characteristic

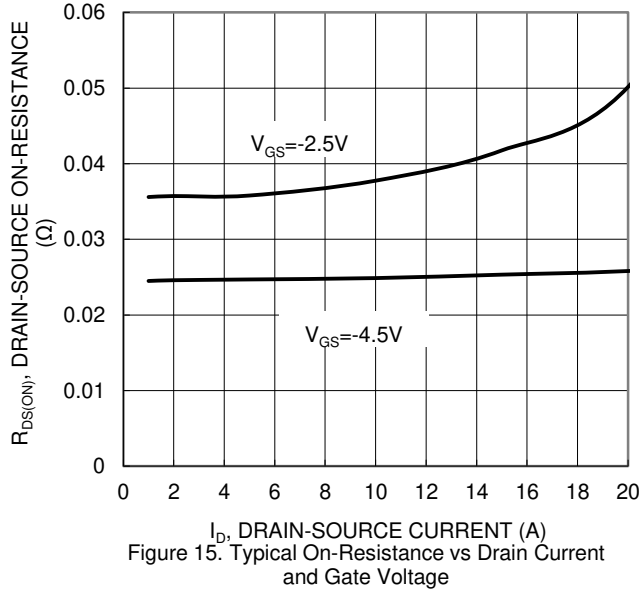


Figure 15. Typical On-Resistance vs Drain Current and Gate Voltage

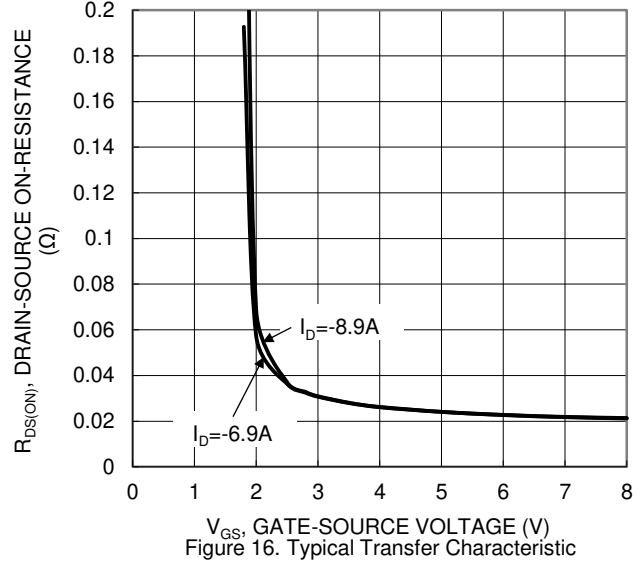


Figure 16. Typical Transfer Characteristic

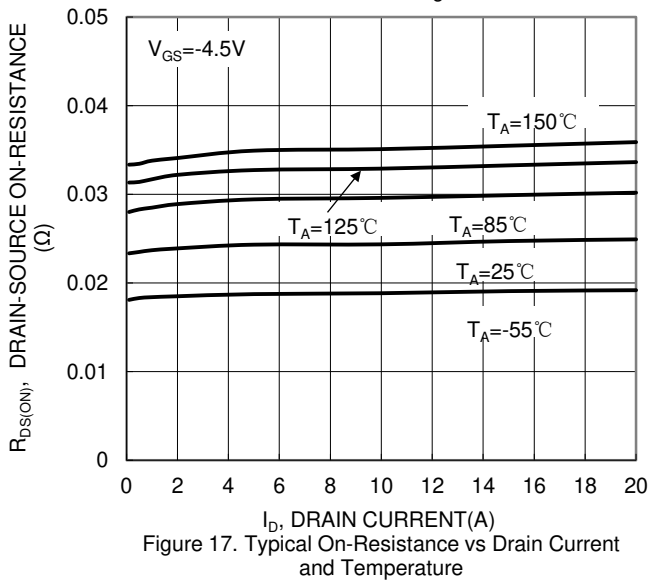


Figure 17. Typical On-Resistance vs Drain Current and Temperature

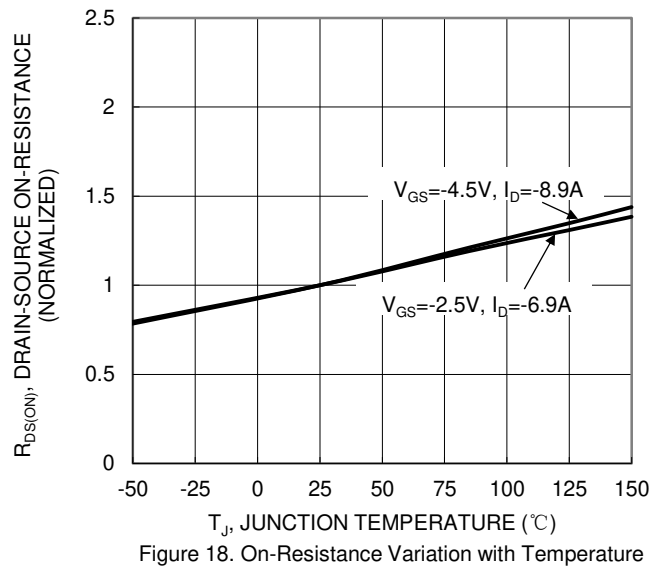


Figure 18. On-Resistance Variation with Temperature

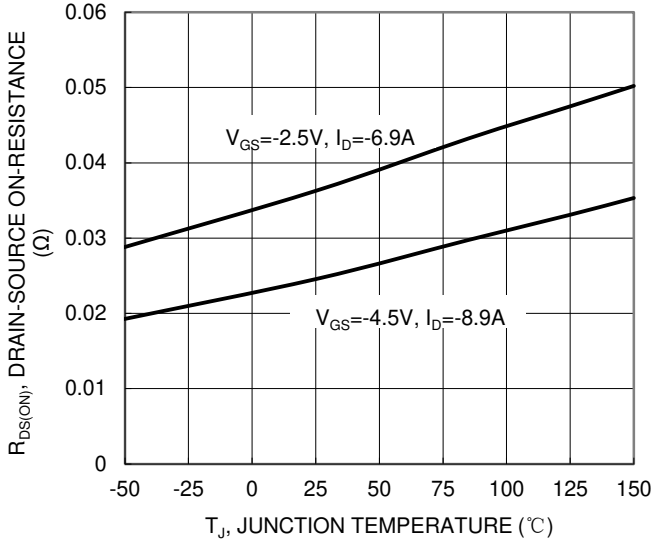


Figure 19. On-Resistance Variation with Temperature

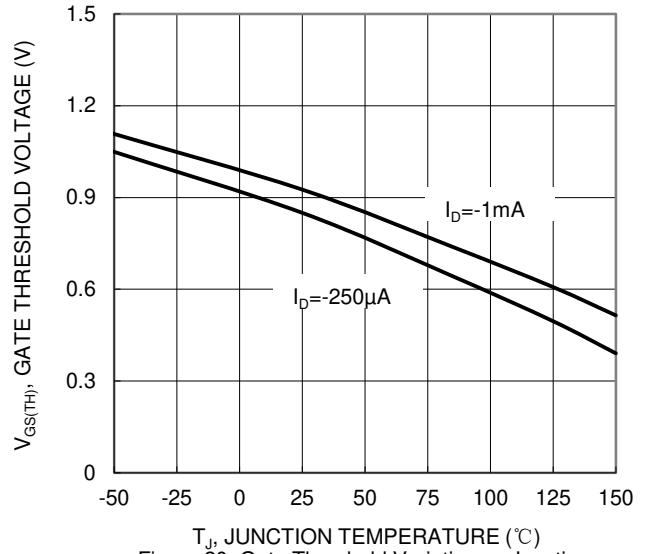


Figure 20. Gate Threshold Variation vs Junction Temperature

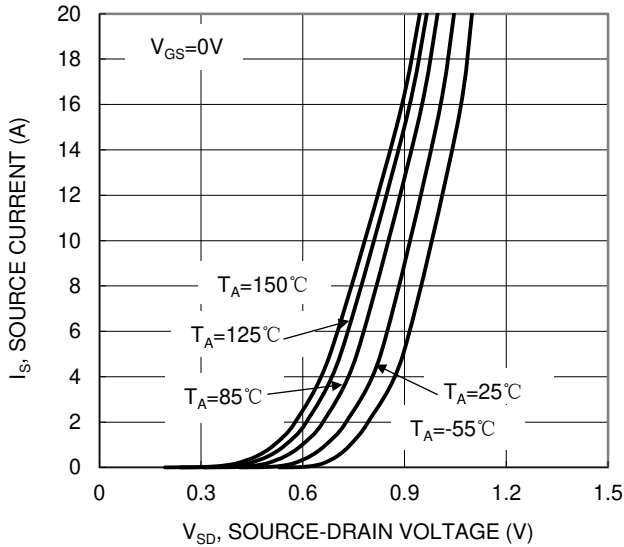


Figure 21. Diode Forward Voltage vs Current

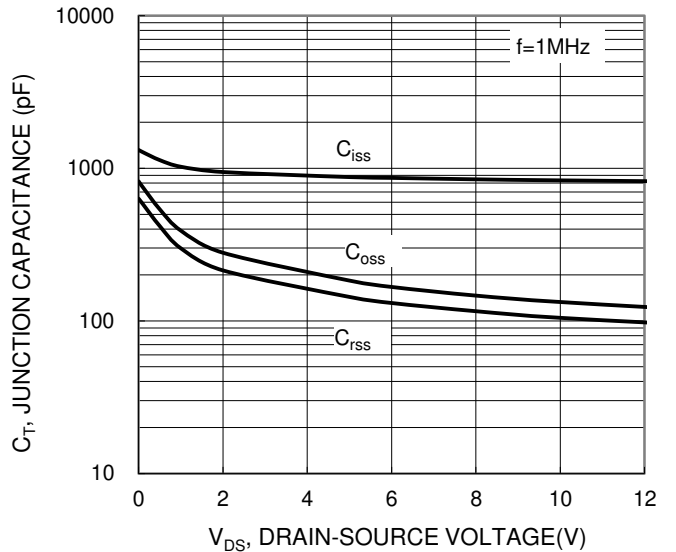


Figure 22. Typical Junction Capacitance

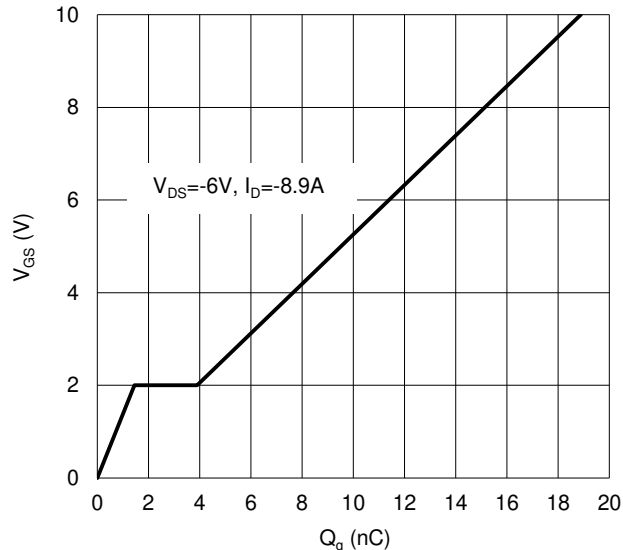


Figure 23. Gate Charge

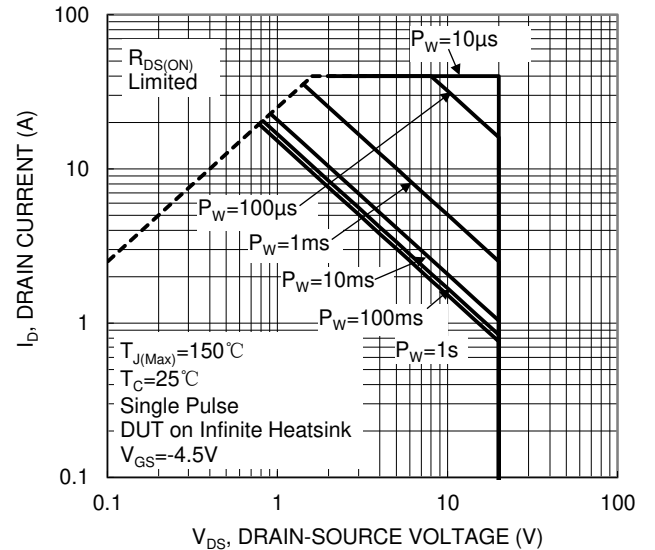


Figure 24. SOA, Safe Operation Area

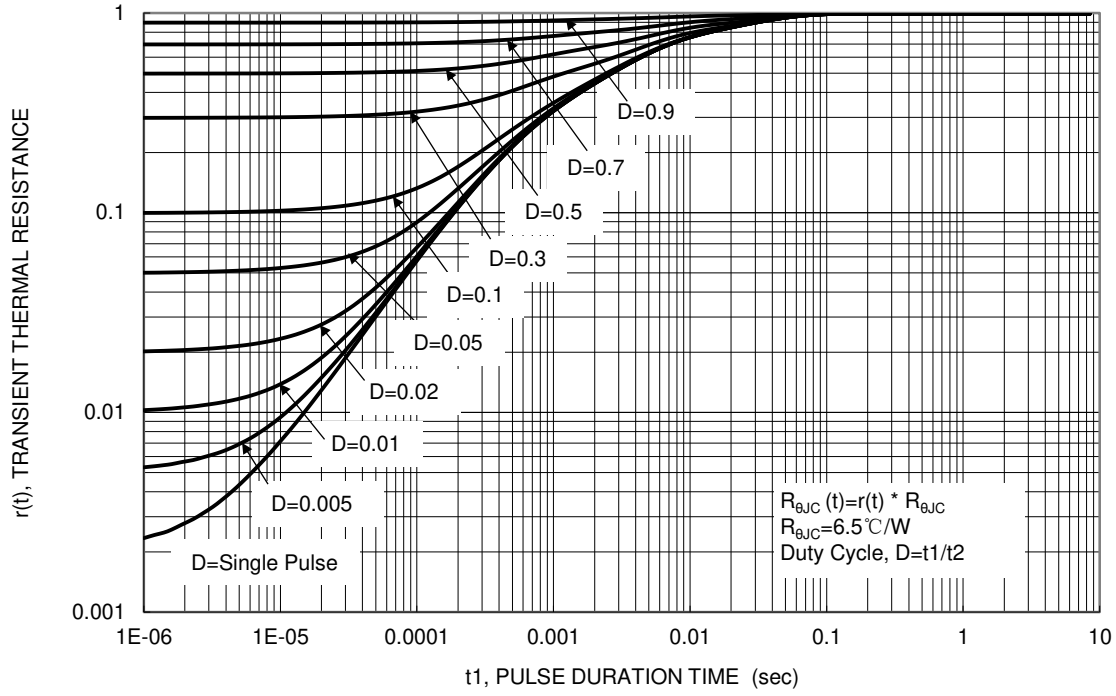
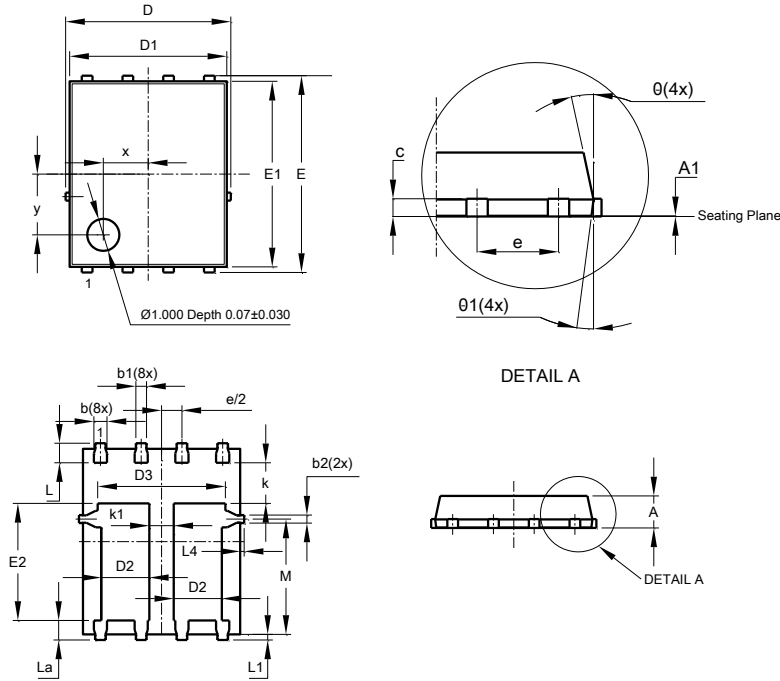


Figure 25. Transient Thermal Resistance

Package Outline Dimensions

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

PowerDI5060-8 (Type C)

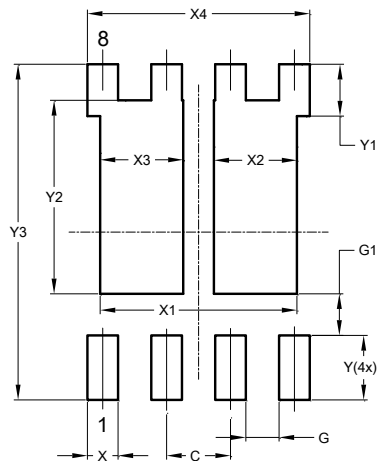


PowerDI5060-8 (Type C)			
Dim	Min	Max	Typ
A	0.90	1.10	1.00
A1	0	0.05	0.02
b	0.33	0.51	0.41
b1	0.300	0.366	0.333
b2	0.20	0.35	0.25
c	0.23	0.33	0.277
D	5.15 BSC		
D1	4.85	4.95	4.90
D2	1.40	1.60	1.50
D3	-	-	3.98
E	6.15 BSC		
E1	5.75	5.85	5.80
E2	3.56	3.76	3.66
e	1.27BSC		
k	-	-	1.27
k1	0.56	-	-
L	0.51	0.71	0.61
La	0.51	0.71	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 C)



Dimensions	Value (in mm)
C	1.270
G	0.660
G1	0.820
X	0.610
X1	3.910
X2	1.650
X3	1.650
X4	4.420
Y	1.270
Y1	1.020
Y2	3.810
Y3	6.610

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