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Product Summary

Device	BV_{DSS}	$R_{DS(ON)}$	I_D $T_A = +25^\circ C$
Q1	12V	17m Ω @ $V_{GS} = 4.5V$	9.5A
		25m Ω @ $V_{GS} = 2.5V$	7.8A
Q2	-20V	35m Ω @ $V_{GS} = -4.5V$	-6.8A
		55m Ω @ $V_{GS} = -2.5V$	-5.3A

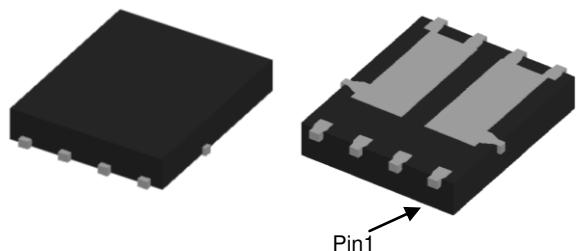
Features and Benefits

- 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)**
 - **Qualified to AEC-Q101 Standards for High Reliability**

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 Load switch.

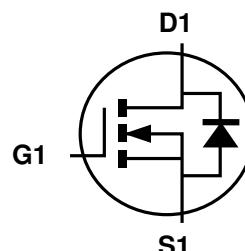
- Notebook Battery Power Management
 - DC-DC Converters
 - Load Switch



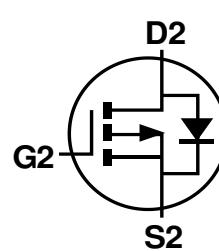
Top View



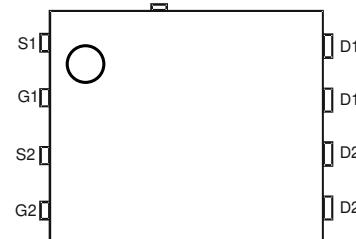
Q1 N-Channel MOSFET



Q1 N-Channel MOSFET



Q2 P-Channel MOSFET



Top View Pin Configuration

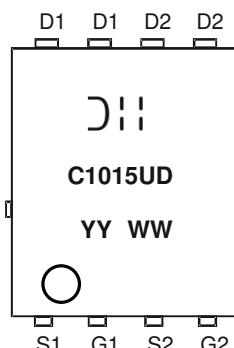
Ordering Information (Note 4)

Part Number	Case	Packaging
DMC1015UPD-13	PowerDI5060-8 (Type C)	2,500 / Tape & Reel

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
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



DI = Manufacturer's Marking
C1015UD = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 16 = 2016)
WW = Week (01 to 53)

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

Characteristic			Symbol	Q1 Value	Q2 Value	Unit	
Drain-Source Voltage			V_{DSS}	12	-20	V	
Gate-Source Voltage			V_{GSS}	± 8	± 8	V	
Continuous Drain Current (Note 5) $V_{GS} = 4.5\text{V}$	Steady State	$T_A = +25^\circ\text{C}$	I_D	9.5	-6.8	A	
		$T_A = +70^\circ\text{C}$		7.6	-5.4		
Maximum Body Diode Forward Current (Note 5)	$t < 10\text{s}$	$T_A = +25^\circ\text{C}$	I_D	13.0	-9.4	A	
		$T_A = +70^\circ\text{C}$		10.4	-7.5		
Pulsed Drain Current (10 μs Pulse, Duty Cycle = 1%)			I_{DM}	65	-35	A	
Avalanche Current (Note 6) $L = 0.1\text{mH}$			I_{AS}	22	-20	A	
Avalanche Energy (Note 6) $L = 0.1\text{mH}$			E_{AS}	25	20	mJ	

Thermal Characteristics

Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 5)	P_D	2.3	W
		1.5	
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	56	$^\circ\text{C/W}$
		29	
Thermal Resistance, Junction to Case	$R_{\theta JC}$	5.4	
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	$^\circ\text{C}$

 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	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$
Zero Gate Voltage Drain Current	I_{DSS}	—	—	1	μA	$V_{DS} = 12\text{V}, V_{GS} = 0\text{V}$
Gate-Source Leakage	I_{GSS}	—	—	± 100	nA	$V_{GS} = \pm 8\text{V}, V_{DS} = 0\text{V}$
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{GS(TH)}$	0.6	0.8	1.5	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	9.6	17	$\text{m}\Omega$	$V_{GS} = 4.5\text{V}, I_D = 11.8\text{A}$
		—	11	25		$V_{GS} = 2.5\text{V}, I_D = 9.8\text{A}$
Diode Forward Voltage	V_{SD}	—	0.7	1.2	V	$V_{GS} = 0\text{V}, I_S = 2.9\text{A}$
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C_{iss}	—	1495	—	pF	$V_{DS} = 6\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$
Output Capacitance	C_{oss}	—	310	—		
Reverse Transfer Capacitance	C_{rss}	—	285	—		
Gate Resistance	R_g	—	1.6	—	Ω	$V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$
Total Gate Charge ($V_{GS} = 3.3\text{V}$)	Q_g	—	11.5	—		
Total Gate Charge ($V_{GS} = 4.5\text{V}$)	Q_g	—	15.6	—		
Gate-Source Charge	Q_{gs}	—	2.3	—	nC	$V_{DS} = 6\text{V}, I_D = 11.8\text{A}$
Gate-Drain Charge	Q_{gd}	—	4.6	—		
Turn-On Delay Time	$t_{D(ON)}$	—	5.7	—		
Turn-On Rise Time	t_R	—	10.1	—	ns	$V_{DD} = 6\text{V}, R_L = 6\Omega$ $V_{GS} = 4.5\text{V}, R_g = 6\Omega, I_D = 1\text{A}$
Turn-Off Delay Time	$t_{D(OFF)}$	—	40.4	—		
Turn-Off Fall Time	t_F	—	22.5	—		
Body Diode Reverse Recovery Time	t_{RR}	—	16.4	—	ns	$I_F = 2.9, \text{di}/\text{dt} = 100\text{A}/\mu\text{s}$
Body Diode Reverse Recovery Charge	Q_{RR}	—	3.2	—		$I_F = 2.9\text{A}, \text{di}/\text{dt} = 100\text{A}/\mu\text{s}$

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	$V_{\text{GS}} = 0\text{V}$, $I_D = -250\mu\text{A}$
Zero Gate Voltage Drain Current	I_{DSS}	—	—	-1	μA	$V_{\text{DS}} = -20\text{V}$, $V_{\text{GS}} = 0\text{V}$
Gate-Source Leakage	I_{GSS}	—	—	± 100	nA	$V_{\text{GS}} = \pm 8\text{V}$, $V_{\text{DS}} = 0\text{V}$
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{\text{GS(TH)}}$	-0.6	-0.8	-1.5	V	$V_{\text{DS}} = V_{\text{GS}}$, $I_D = -250\mu\text{A}$
Static Drain-Source On-Resistance	$R_{\text{DS(ON)}}$	—	25	35	$\text{m}\Omega$	$V_{\text{GS}} = -4.5\text{V}$, $I_D = -8.9\text{A}$
		—	34	55		$V_{\text{GS}} = -2.5\text{V}$, $I_D = -6.9\text{A}$
Diode Forward Voltage	V_{SD}	—	-0.8	-1.2	V	$V_{\text{GS}} = 0\text{V}$, $I_S = -2.9\text{A}$
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C_{iss}	—	1745	—	pF	$V_{\text{DS}} = -10\text{V}$, $V_{\text{GS}} = 0\text{V}$, $f = 1.0\text{MHz}$
Output Capacitance	C_{oss}	—	146	—		
Reverse Transfer Capacitance	C_{rss}	—	119	—		
Gate Resistance	R_g	—	7.5	—	Ω	$V_{\text{DS}} = 0\text{V}$, $V_{\text{GS}} = 0\text{V}$, $f = 1.0\text{MHz}$
Total Gate Charge ($V_{\text{GS}} = -3.3\text{V}$)	Q_g	—	11.2	—	nC	$V_{\text{DS}} = -6\text{V}$, $I_D = -8.9\text{A}$
Total Gate Charge ($V_{\text{GS}} = -4.5\text{V}$)	Q_g	—	15.4	—		
Gate-Source Charge	Q_{gs}	—	1.9	—		
Gate-Drain Charge	Q_{gd}	—	2.9	—		
Turn-On Delay Time	$t_{\text{D(ON)}}$	—	7.4	—	ns	$V_{\text{DD}} = -6\text{V}$, $R_g = 6\Omega$ $V_{\text{GS}} = -4.5\text{V}$, $I_D = -1\text{A}$
Turn-On Rise Time	t_R	—	6.2	—		
Turn-Off Delay Time	$t_{\text{D(OFF)}}$	—	60.1	—		
Turn-Off Fall Time	t_F	—	16.3	—		
Body Diode Reverse Recovery Time	t_{RR}	—	9.2	—	ns	$I_F = -2.9\text{A}$, $di/dt = -100\text{A}/\mu\text{s}$
Body Diode Reverse Recovery Charge	Q_{RR}	—	2.8	—	nC	$I_F = -2.9\text{A}$, $di/dt = -100\text{A}/\mu\text{s}$

- 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 $T_J = +25^\circ\text{C}$.
 7. Short duration pulse test used to minimize self-heating effect.
 8. Guaranteed by design. Not subject to product testing.

Typical Characteristics - N-CHANNEL

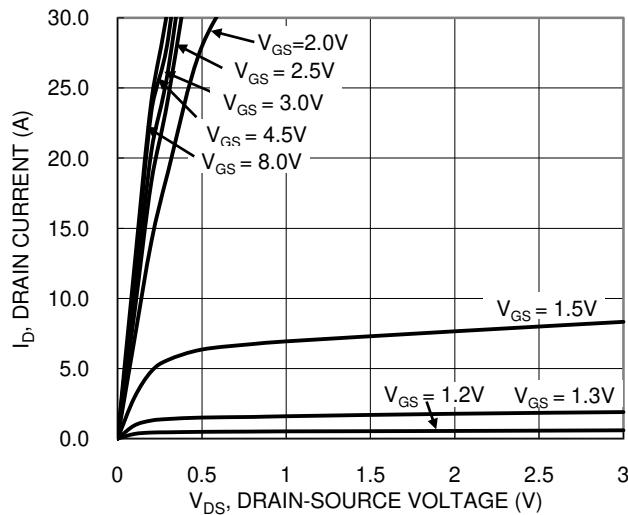


Figure 1. Typical Output Characteristic

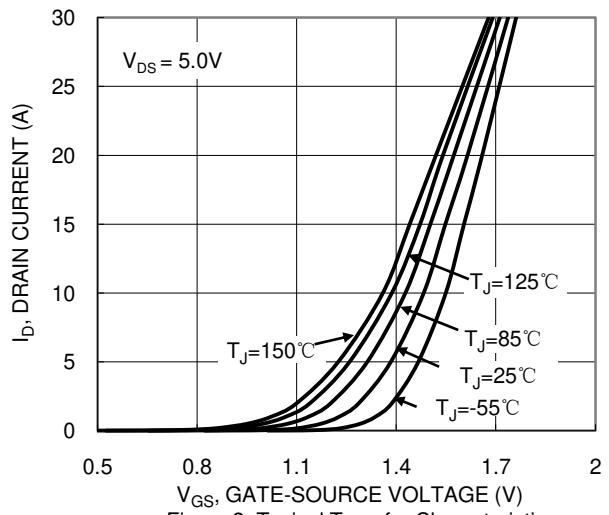


Figure 2. Typical Transfer Characteristic

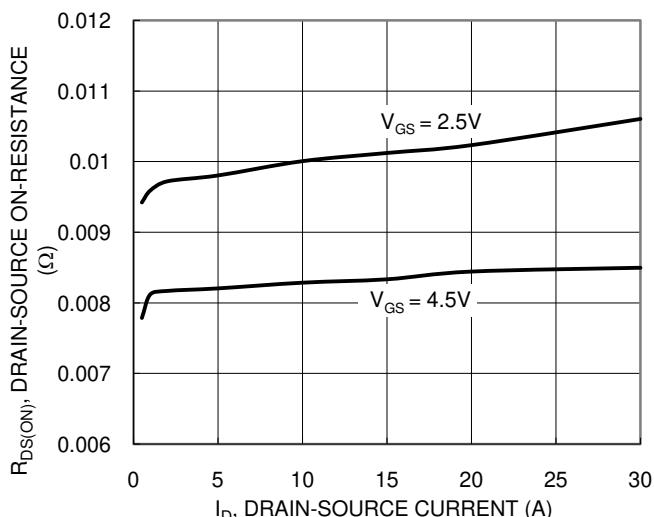


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

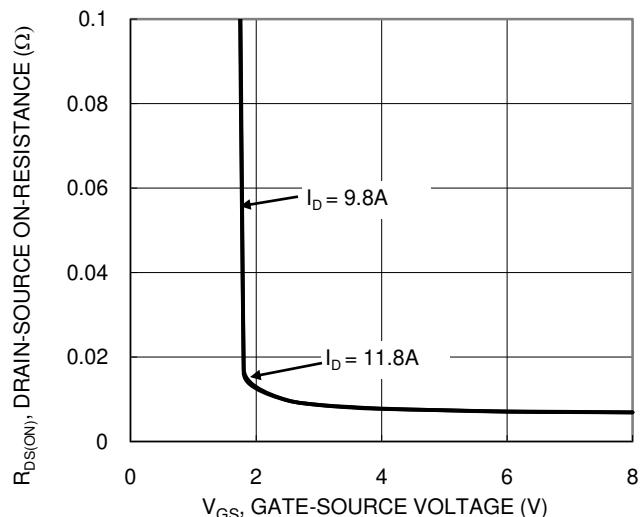


Figure 4. Typical Transfer Characteristic

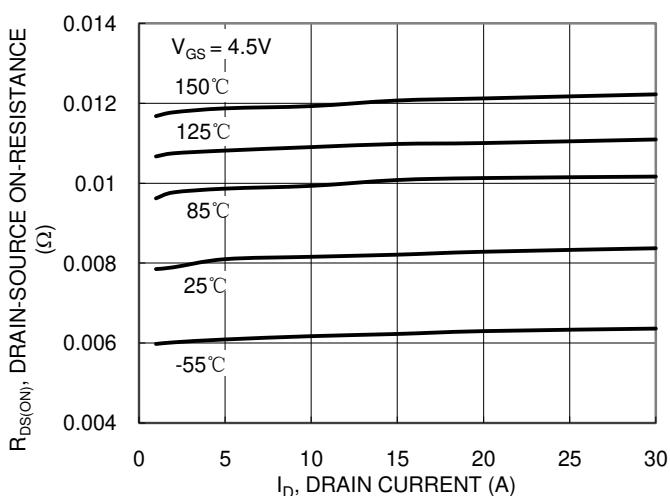


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

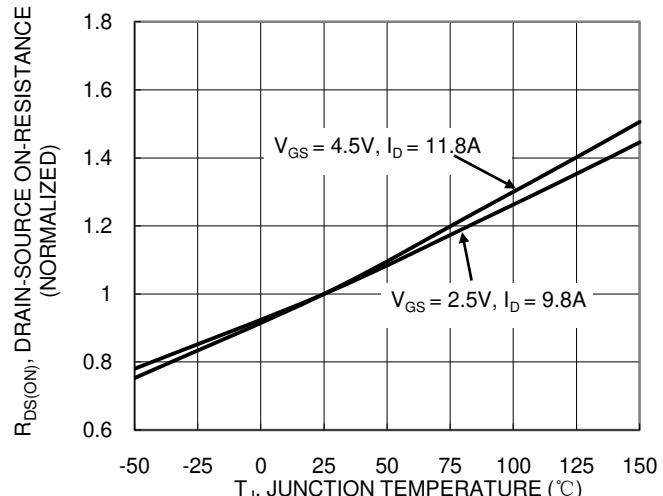


Figure 6. On-Resistance Variation with Junction Temperature

Typical Characteristics - N-CHANNEL (Cont.)

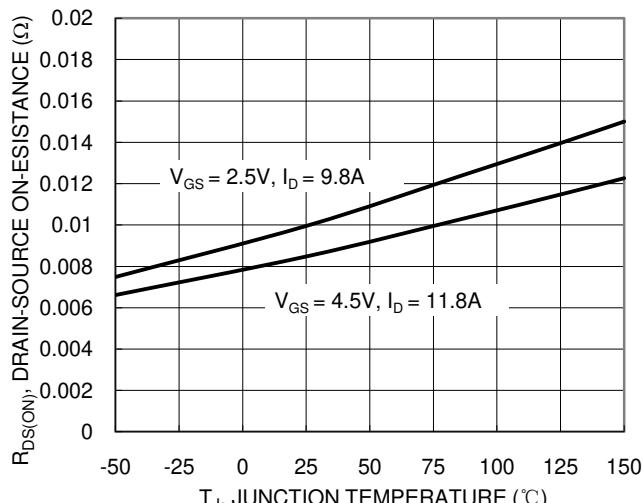


Figure 7. On-Resistance Variation with Junction Temperature

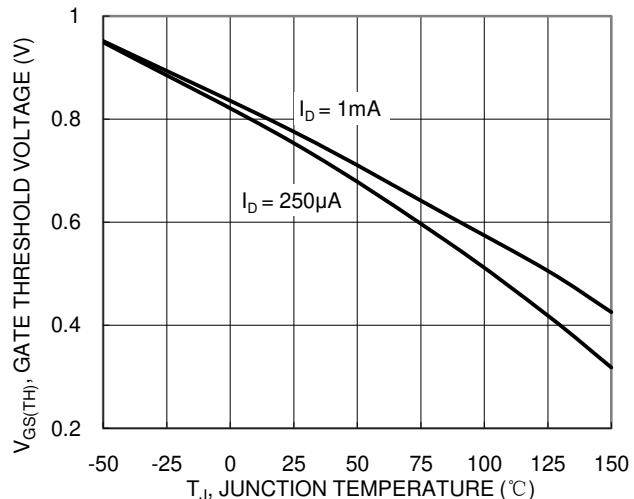


Figure 8. Gate Threshold Variation vs. Junction Temperature

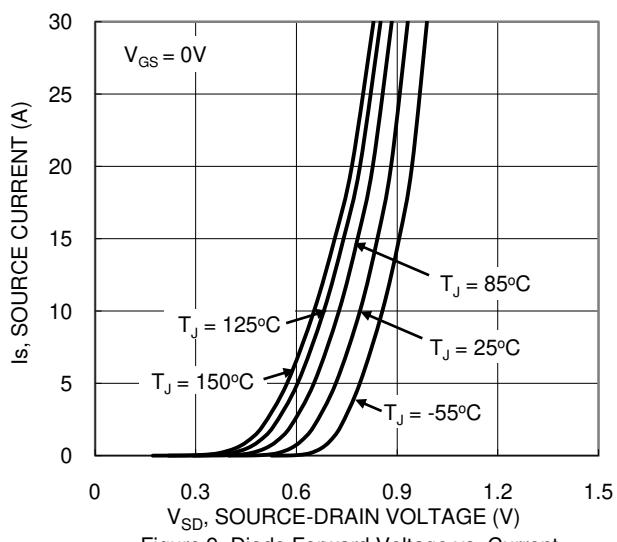


Figure 9. Diode Forward Voltage vs. Current

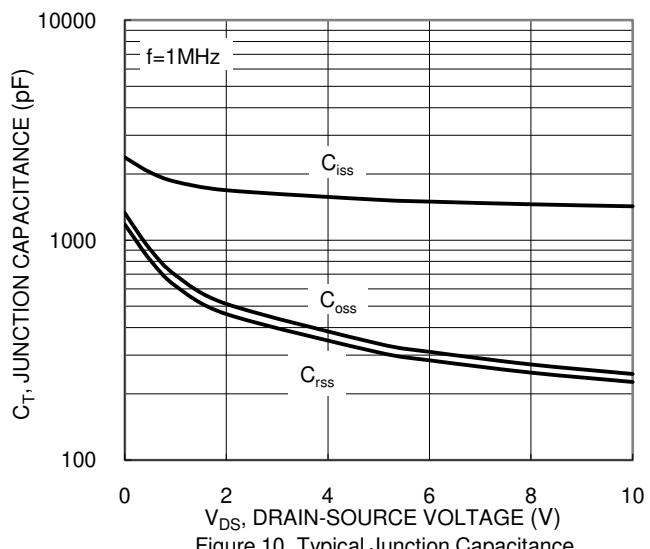


Figure 10. Typical Junction Capacitance

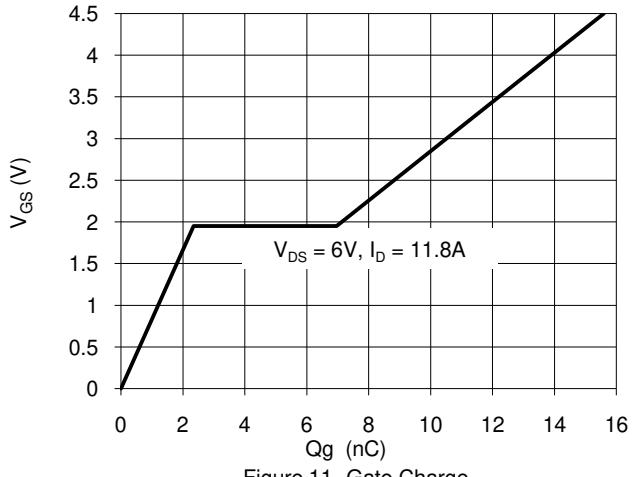


Figure 11. Gate Charge

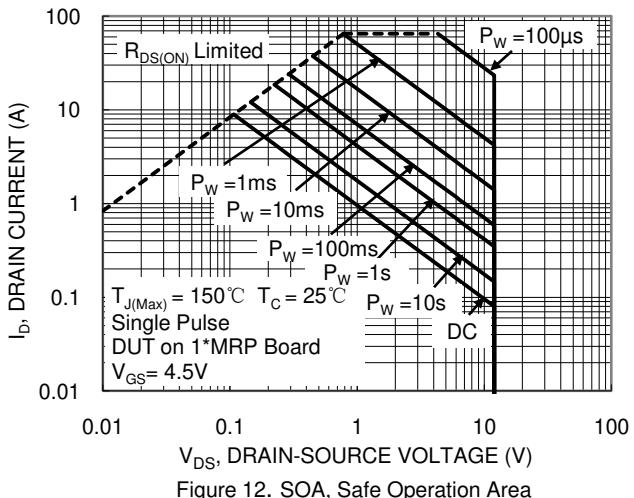


Figure 12. SOA, Safe Operation Area

Typical Characteristics - P-CHANNEL

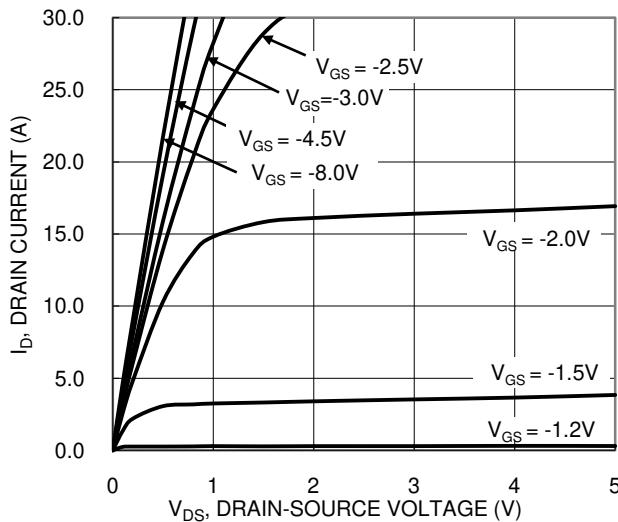


Figure 13. Typical Output Characteristic

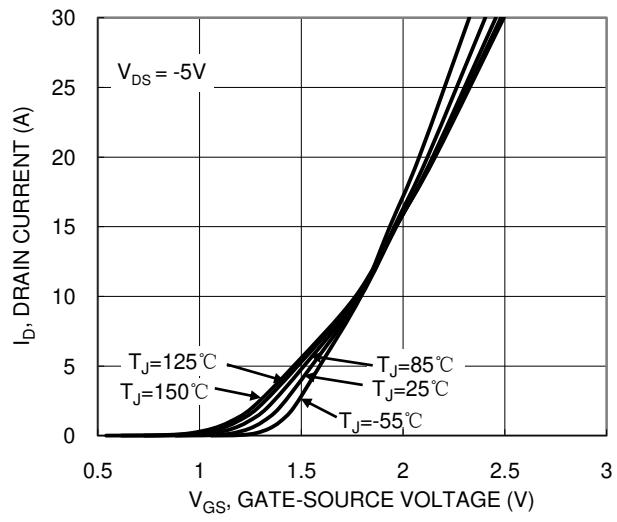


Figure 14. Typical Transfer Characteristic

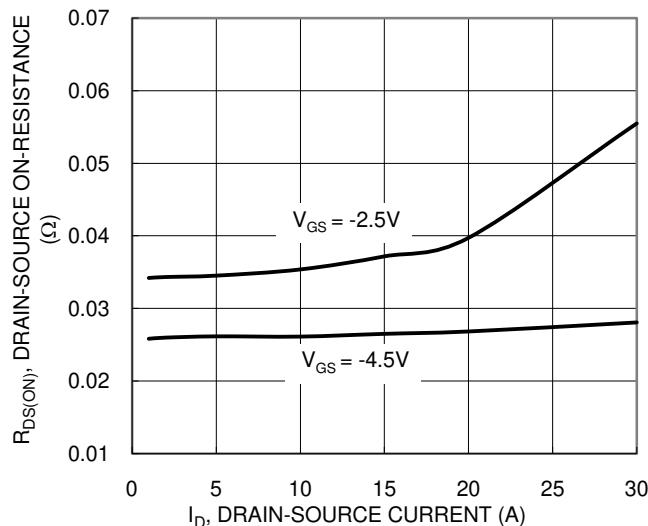


Figure 15. Typical On-Resistance vs. Drain Current and Gate Voltage

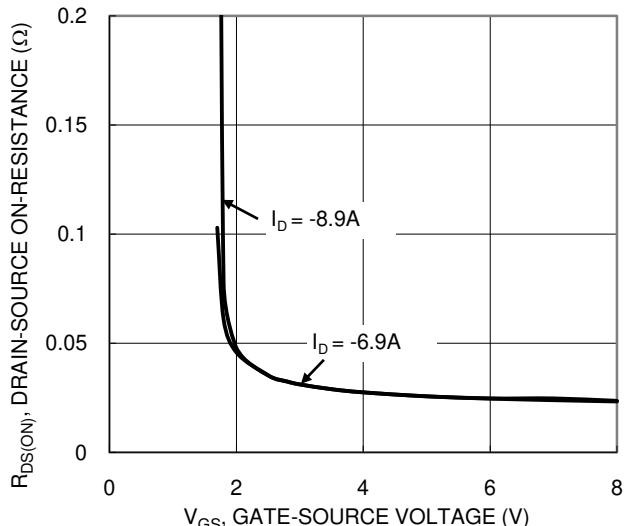


Figure 16. Typical Transfer Characteristic

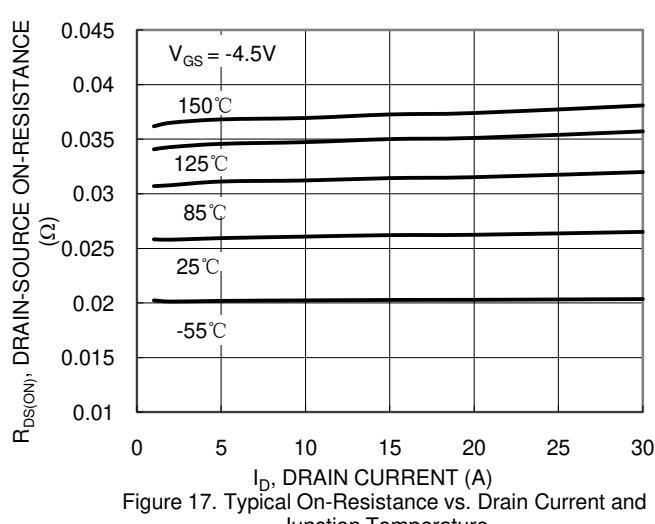


Figure 17. Typical On-Resistance vs. Drain Current and Junction Temperature

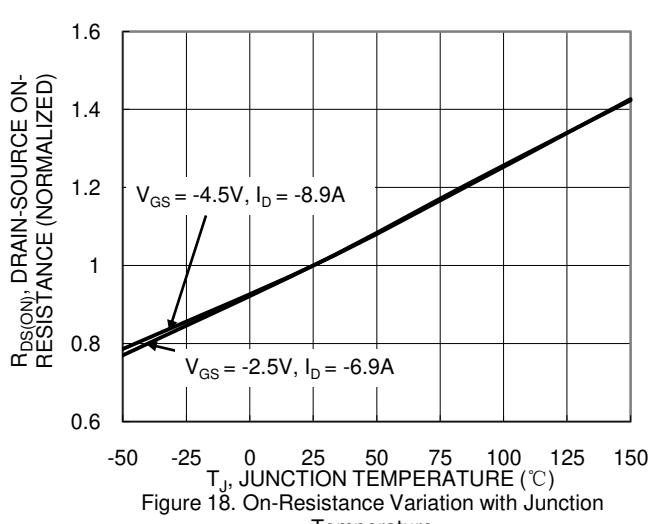
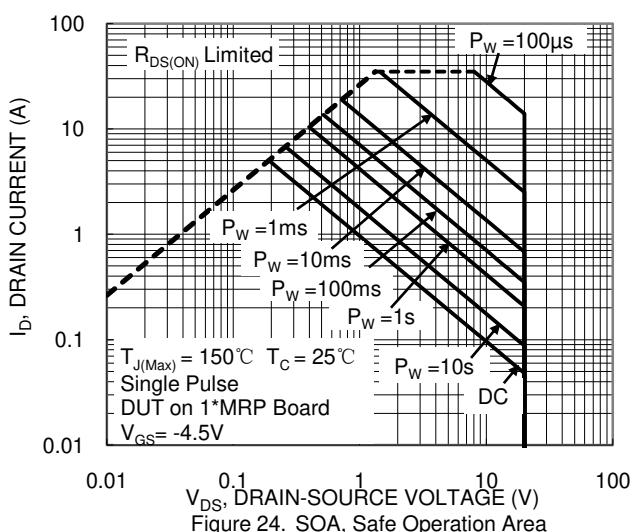
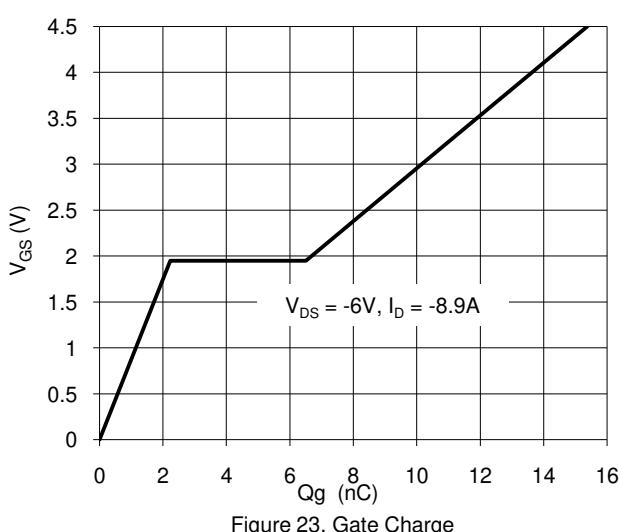
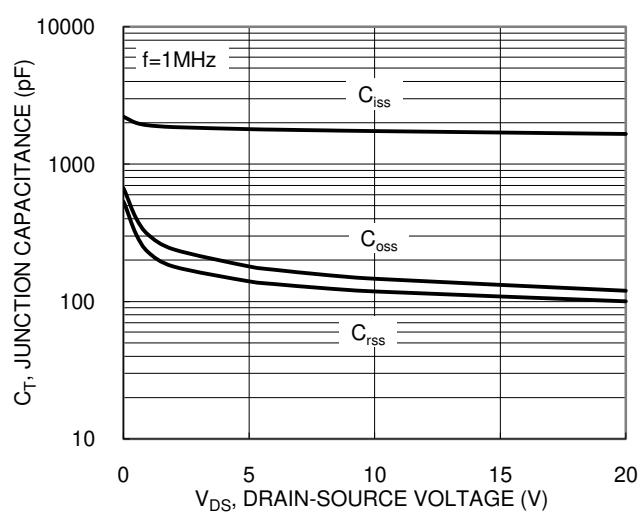
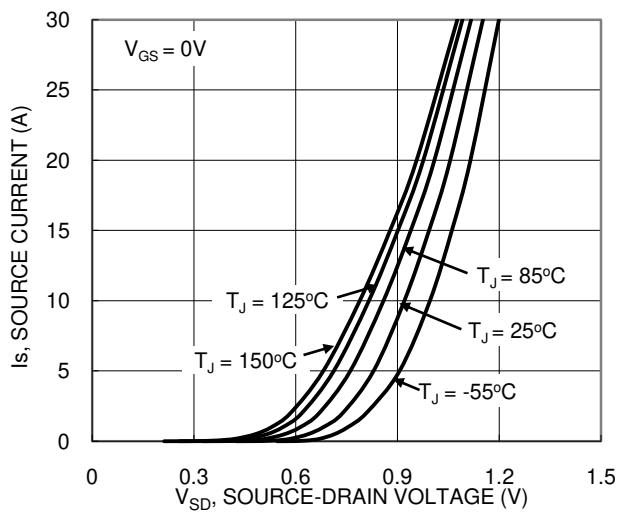
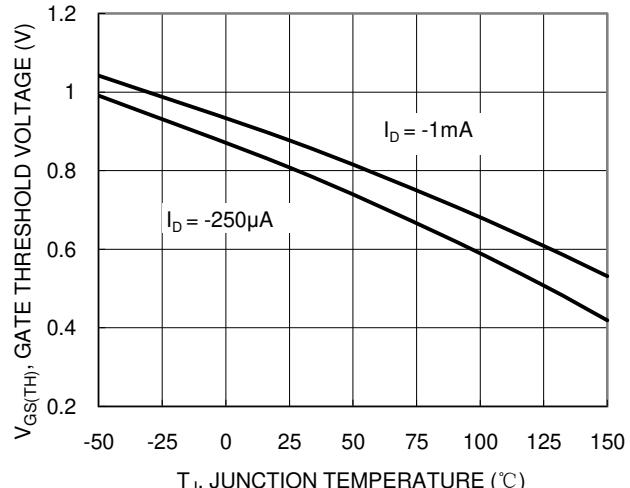
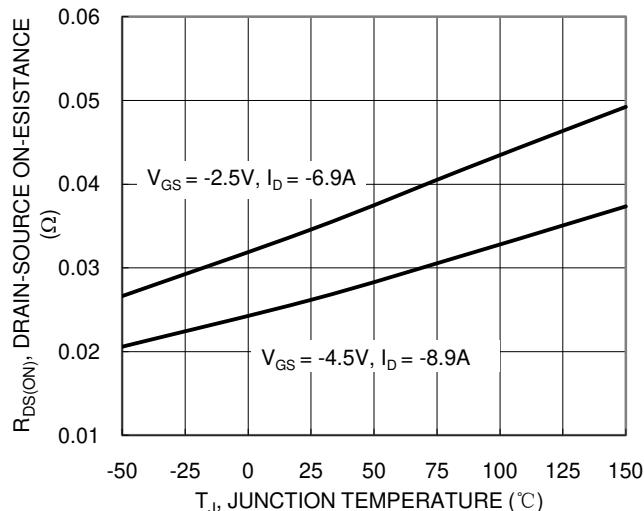


Figure 18. On-Resistance Variation with Junction Temperature

Typical Characteristics - P-CHANNEL (Cont.)



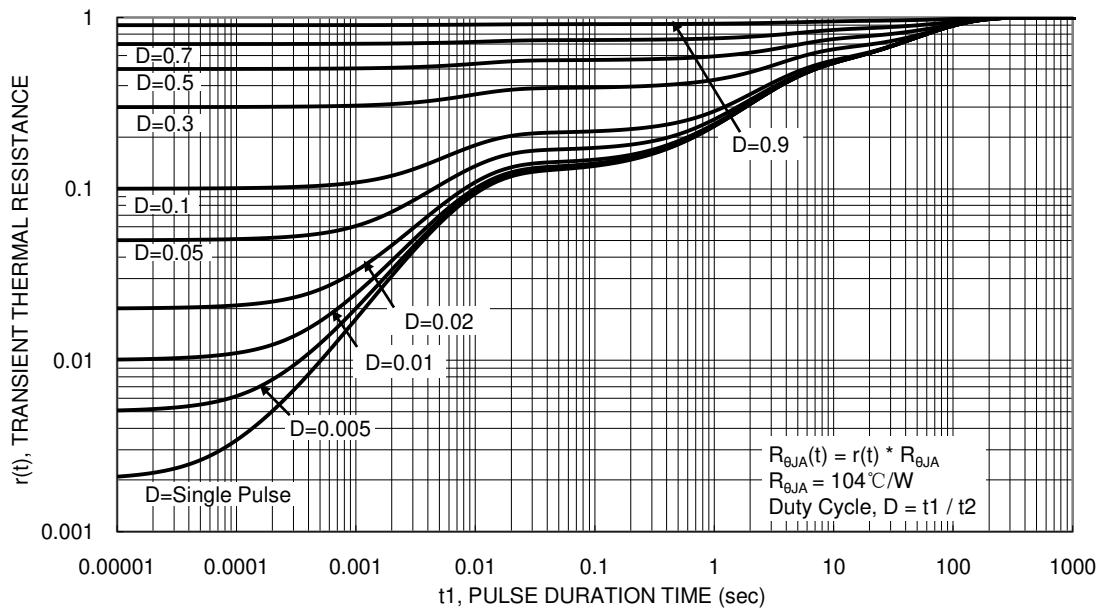
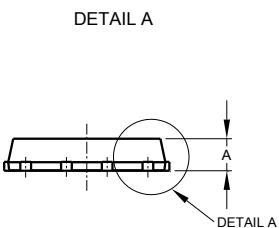
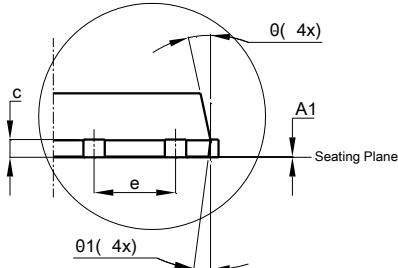
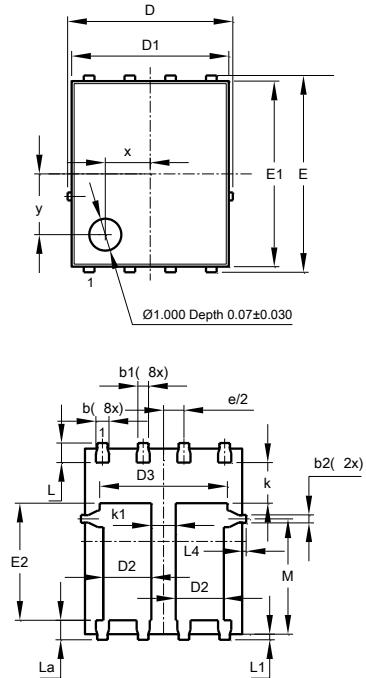


Figure 25. Transient Thermal Resistance

Package Outline Dimensions

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

PowerDI5060-8 (Type C)

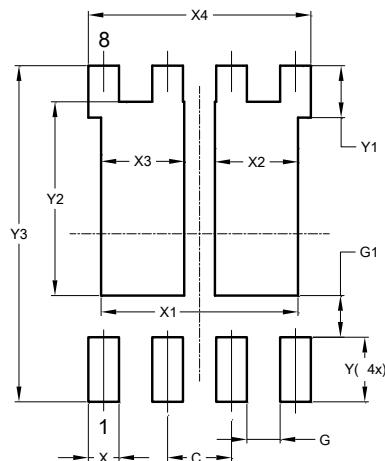


PowerDI5060-8 (Type C)			
Dim	Min	Max	Typ
A	0.90	1.10	1.00
A1	0	0.05	0.02
b	0.33	0.51	0.41
b1	0.300	0.366	0.333
b2	0.20	0.35	0.25
c	0.23	0.33	0.277
D	5.15 BSC		
D1	4.85	4.95	4.90
D2	1.40	1.60	1.50
D3	-	-	3.98
E	6.15 BSC		
E1	5.75	5.85	5.80
E2	3.56	3.76	3.66
e	1.27 BSC		
k	-	-	1.27
k1	0.56	-	-
L	0.51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

1. are intended to implant into the body, or
2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

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