优尚

YOUSHANG SEMICONDUCTOR

设计研发新型功率器件

各类小信号开关

中低压及高压大电流等场效应管

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企业微信二维码

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Product Summary

Device	BV_{DSS}	$R_{DS(ON)}$ Max	I_D Max T_C = +25°C
Q1	12V	17mΩ @ V_{GS} = 4.5V	31.3A
		25mΩ @ V_{GS} = 2.5V	25.8A
Q2	-20V	38mΩ @ V_{GS} = -4.5V	-20.9A
		53mΩ @ V_{GS} = -2.5V	-17.7A

Features and Benefits

- 100% Unclamped Inductive Switching, Test in Production– Ensures More Reliable and Robust End Application
- High Conversion Efficiency
- Low $R_{DS(ON)}$ – Minimizes On State Losses
- Low Input Capacitance
- Fast Switching Speed
- Wettable Flank for Improved Optical Inspection

Description and Applications

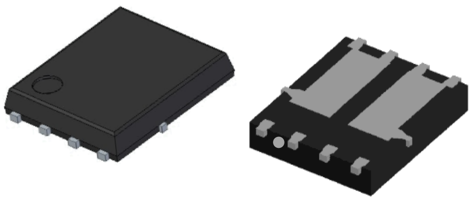
This MOSFET is designed to meet the stringent requirements of automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- Motor control
- Power-management functions
- DC-DC converters

Mechanical Data

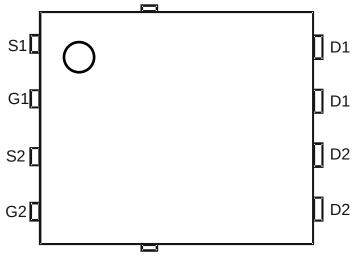
- Package: PowerDI®5060-8
- Package Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.097 grams (Approximate)

PowerDI5060-8/SWP (Type UXD)

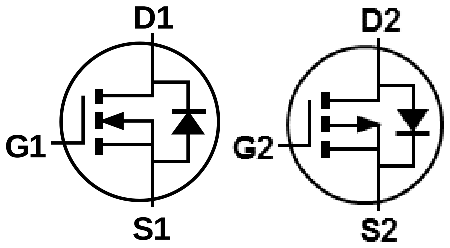


Top View

Bottom View



Pin Out
Top View



Equivalent Circuit

Maximum Ratings (@T_A = +25°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	±12	V
Continuous Drain Current (Note 5)	T_A = +25°C T_A = +70°C	I_D	10 8	-6.7 -5.4	A
Continuous Drain Current (Note 6)	T_C = +25°C T_C = +70°C	I_D	31.3 25.0	-20.9 -16.7	A
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%) (Note 6)		I_{DM}	125	-80	A
Maximum Continuous Body Diode Forward Current (Note 5)		I_S	3.6	-3.2	A
Pulsed Body Diode Forward Current (10µs Pulse, Duty Cycle = 1%) (Note 6)		I_{SM}	125	-83.6	A
Avalanche Current, L = 0.1mH		I_{AS}	24.1	-16.4	A
Avalanche Energy, L = 0.1mH		E_{AS}	29	13.5	mJ

Thermal Characteristics

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 5)	T_A = +25°C	P_D	2.6	W
Thermal Resistance, Junction to Ambient (Note 5)		$R_{\theta JA}$	48.3	°C/W
Total Power Dissipation (Note 6)	T_C = +25°C	P_D	25	W
Thermal Resistance, Junction to Case (Note 6)		$R_{\theta JC}$	5.0	°C/W
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

Electrical Characteristics Q1 N-Channel (@T_A = +25°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 = 250μA
Zero Gate Voltage Drain Current	I_{DSS}	—	—	1	μA	V_{DS} = 12V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±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 = 250μA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	9.6	17	mΩ	V_{GS} = 4.5V, I_D = 11.8A
		—	11.2	25	mΩ	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 = 1MHz
Output Capacitance	C_{oss}	—	329	—	pF	
Reverse Transfer Capacitance	C_{rss}	—	303	—	pF	
Gate Resistance	R_g	—	1.6	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
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	—	nC	
Gate-Source Charge	Q_{gs}	—	2.6	—	nC	
Gate-Drain Charge	Q_{gd}	—	4.3	—	nC	
Turn-On Delay Time	$t_{D(ON)}$	—	6.6	—	ns	V_{DD} = 6V, R_L = 6Ω , V_{GS} = 4.5V, R_g = 6Ω, I_D = 1A
Turn-On Rise Time	t_R	—	5.7	—	ns	
Turn-Off Delay Time	$t_{D(OFF)}$	—	41.5	—	ns	
Turn-Off Fall Time	t_F	—	21.9	—	ns	
Body Diode Reverse Recovery Time	t_{RR}	—	14.3	—	ns	I_F = 11.8A, di/dt = 100A/μs
Body Diode Reverse Recovery Charge	Q_{RR}	—	2.3	—	nC	I_F = 11.8A, di/dt = 100A/μs

Notes: 5. Device mounted on FR-4 substrate PC board, 2oz. copper, with thermal bias to bottom layer 1inch square copper plate.
6. Thermal resistance from junction to soldering point (on the exposed drain pad).
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°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 = -250µA
Zero Gate Voltage Drain Current	I_{DSS}	—	—	-1	µA	V_{DS} = -16V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±12V, V_{DS} = 0V
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{GS(TH)}$	-0.6	-0.85	-1.5	V	V_{DS} = V_{GS}, I_D = -250µA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	30	38	mΩ	V_{GS} = -4.5V, I_D = -8.9A
		—	41	53		V_{GS} = -2.5V, I_D = -6.9A
Diode Forward Voltage	V_{SD}	—	-0.8	-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 = 6Ω V_{GS} = -4.5V, R_G = 6Ω, I_D = -1A
Turn-On Rise Time	t_R	—	7.2	—		
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/µs
Body Diode Reverse Recovery Charge	Q_{RR}	—	2.7	—	nC	I_F = -8.9A, di/dt = -100A/µs

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

Q1 N-Channel

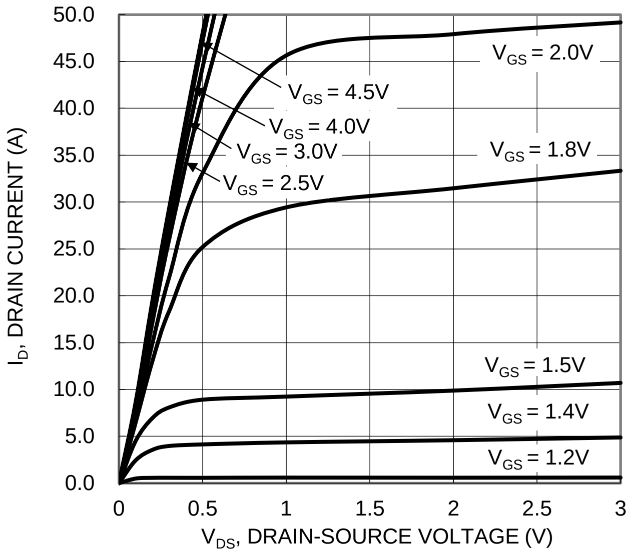


Figure 1. Typical Output Characteristic

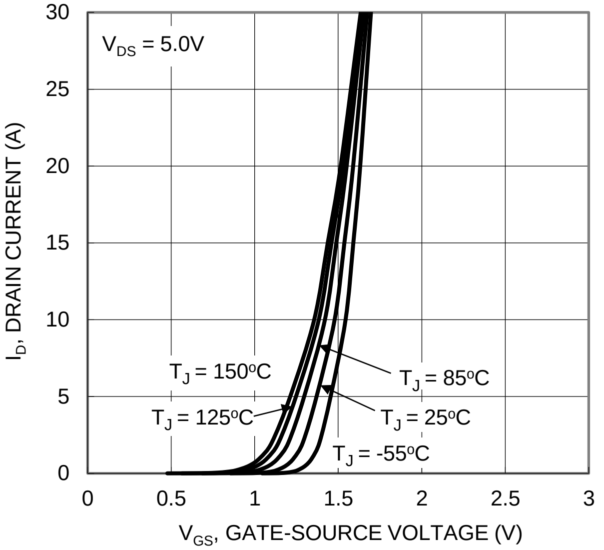


Figure 2. Typical Transfer Characteristic

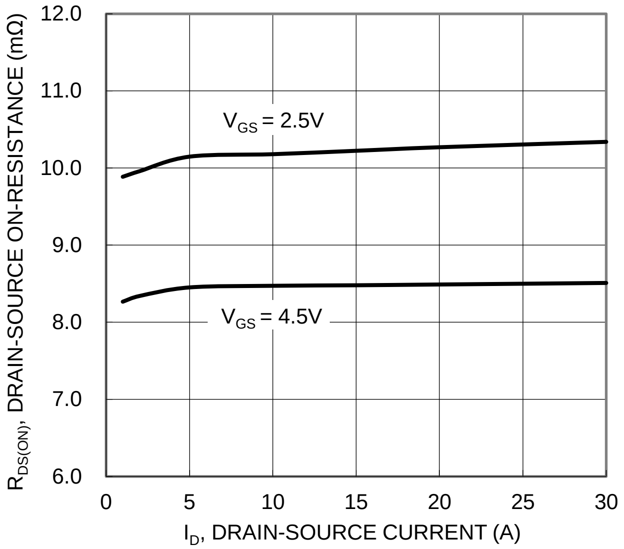


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

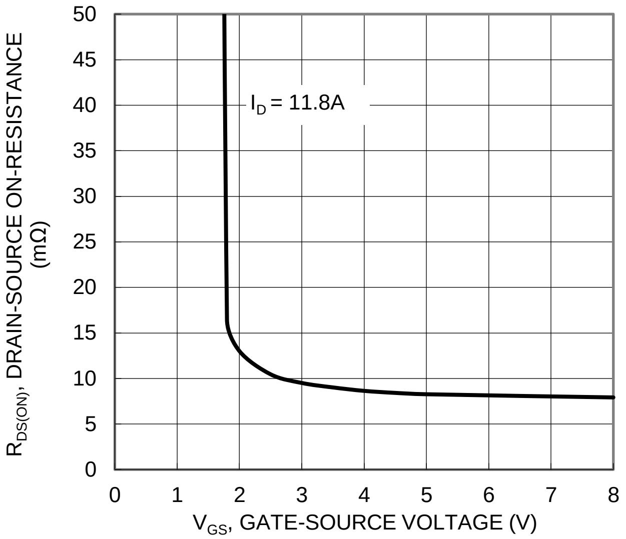


Figure 4. Typical Transfer Characteristic

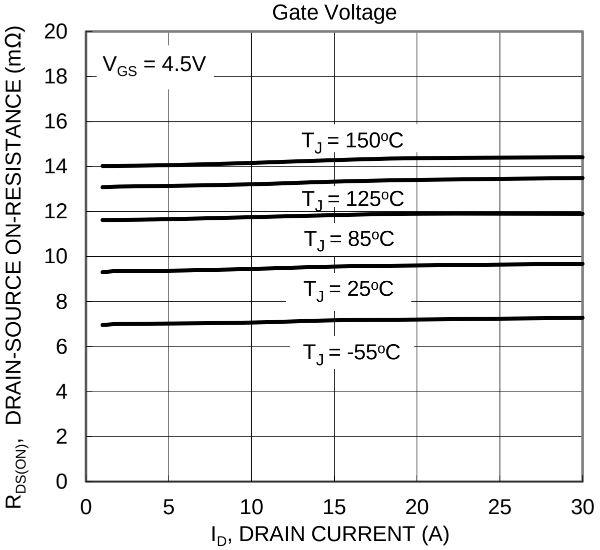


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

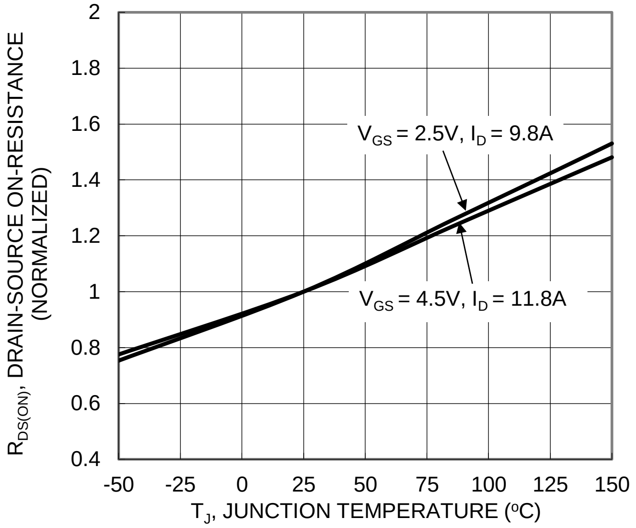


Figure 6. On-Resistance Variation with Junction Temperature

Q1 N-Channel (continued)

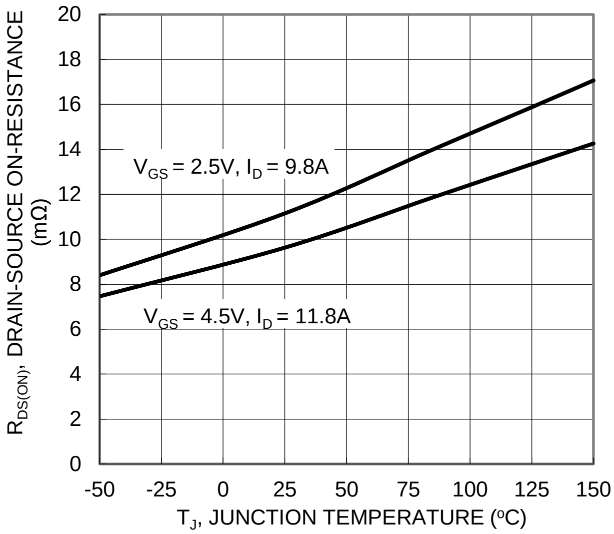


Figure 7. On-Resistance Variation with Junction Temperature

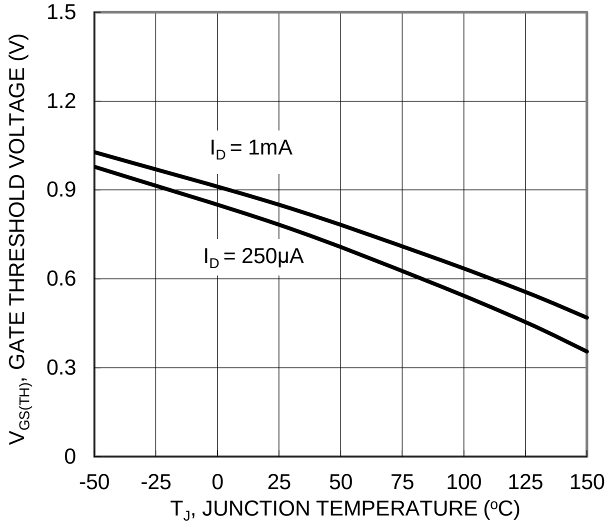


Figure 8. Gate Threshold Variation vs. Junction Temperature

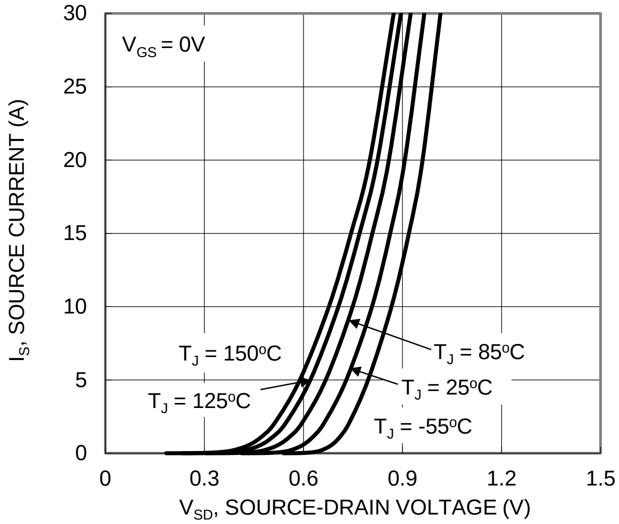


Figure 9. Diode Forward Voltage vs. Current

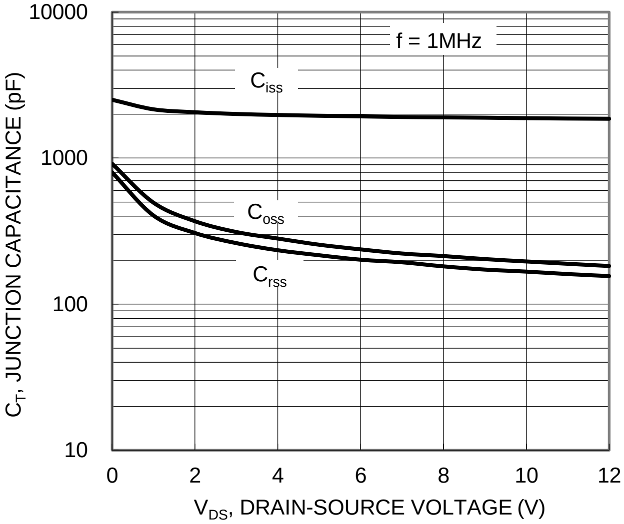


Figure 10. Typical Junction Capacitance

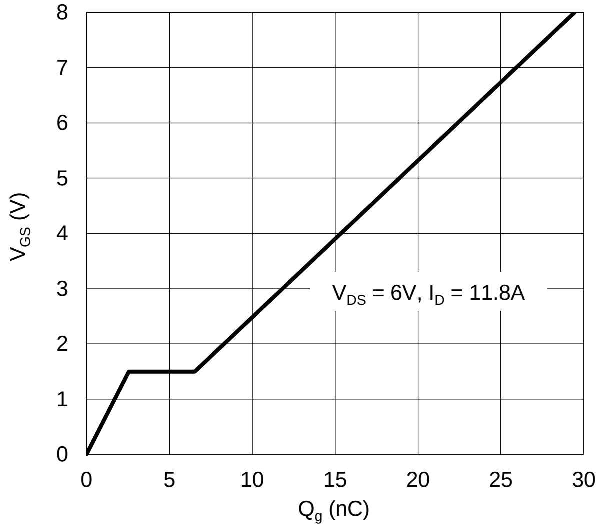


Figure 11. Gate Charge

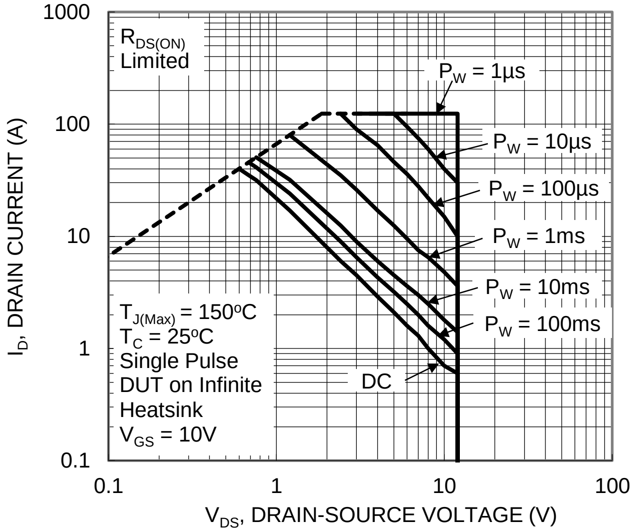


Figure 12. SOA, Safe Operation Area

Q1 N-Channel (continued)

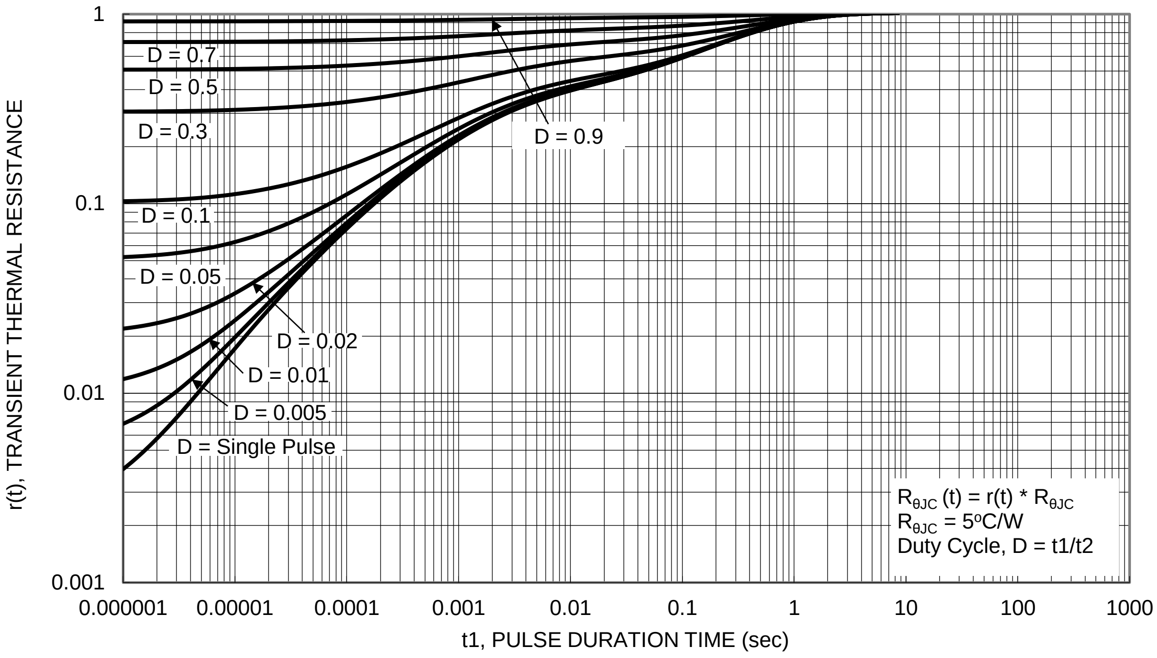


Figure 13. Transient Thermal Resistance

Q2 P-Channel

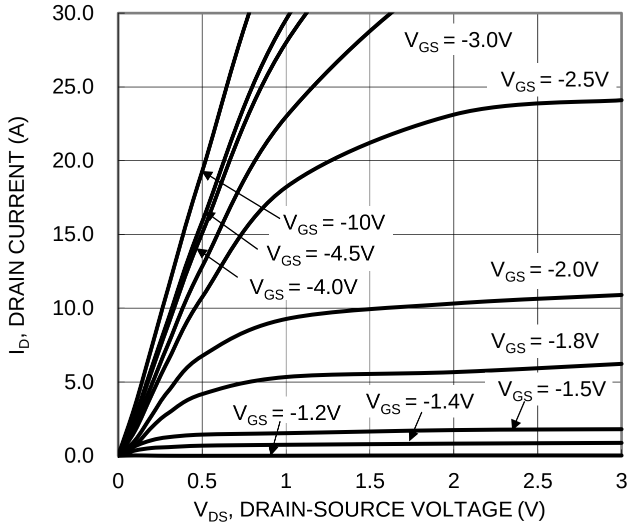


Figure 14. Typical Output Characteristic

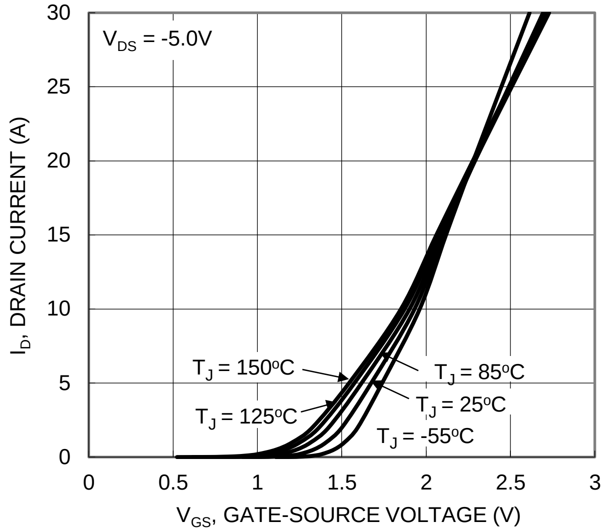


Figure 15. Typical Transfer Characteristic

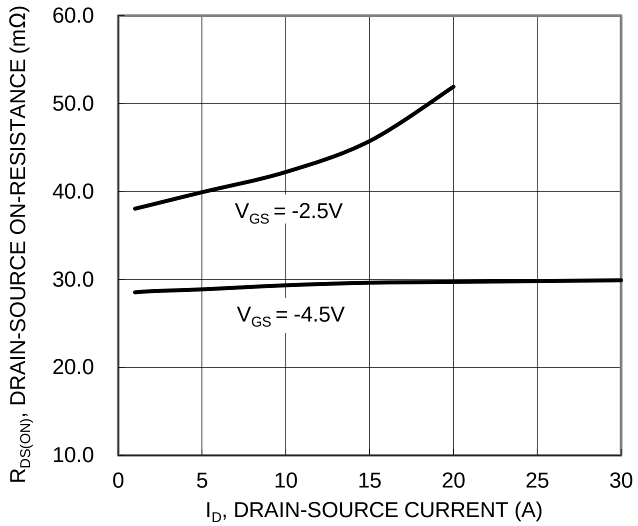


Figure 16. Typical On-Resistance vs. Drain Current and Gate Voltage

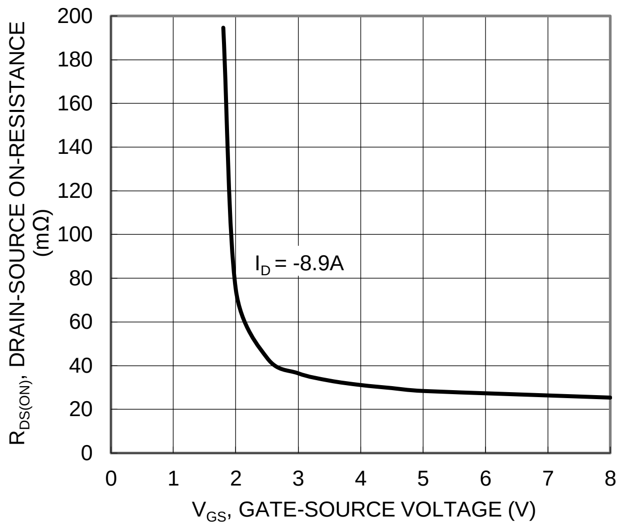


Figure 17. Typical Transfer Characteristic

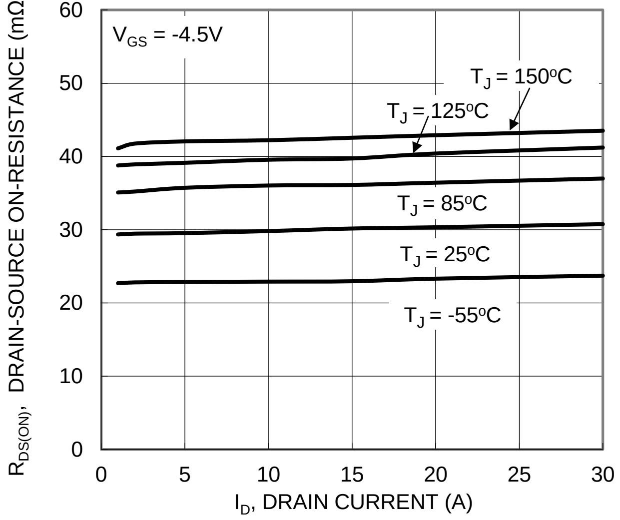


Figure 18. Typical On-Resistance vs. Drain Current and Temperature

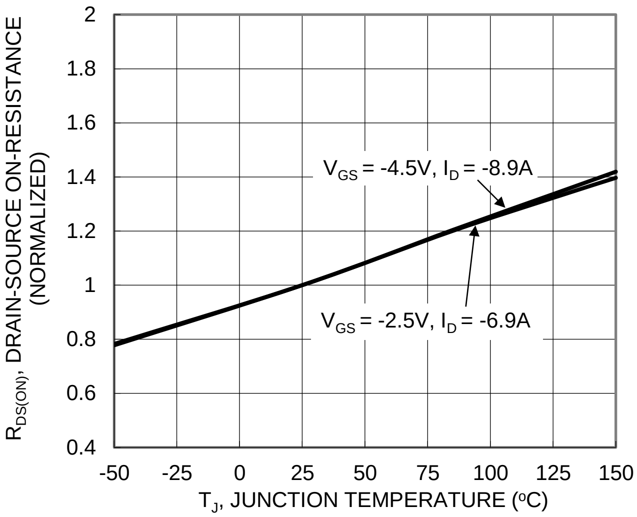


Figure 19. On-Resistance Variation with Junction Temperature

Q2 P-Channel (continued)

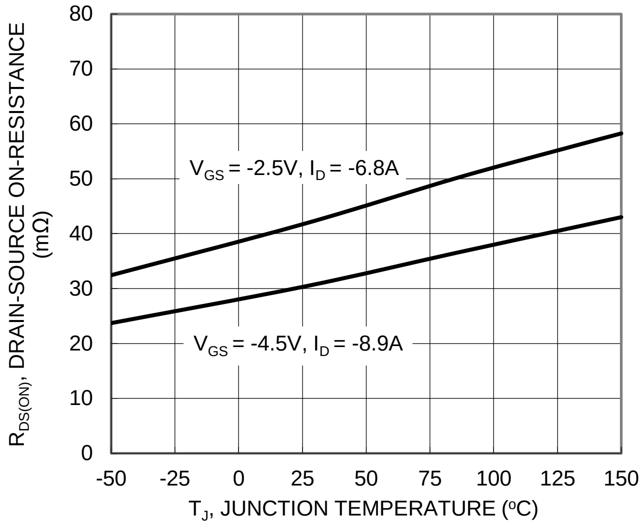


Figure 20. On-Resistance Variation with Temperature

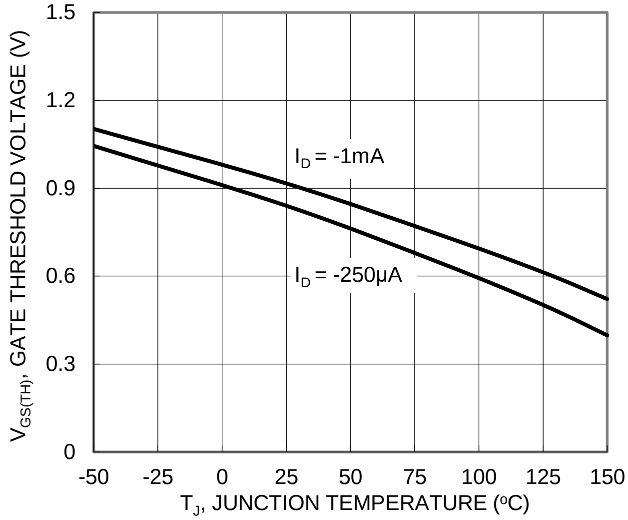


Figure 21. Gate Threshold Variation vs. Junction Temperature

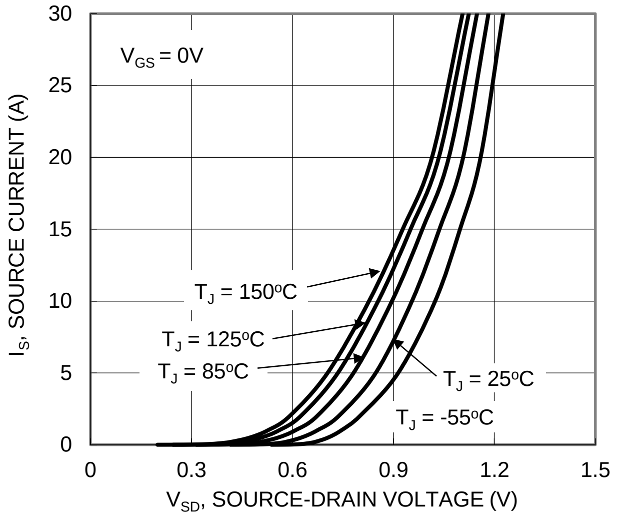


Figure 22. Diode Forward Voltage vs. Current

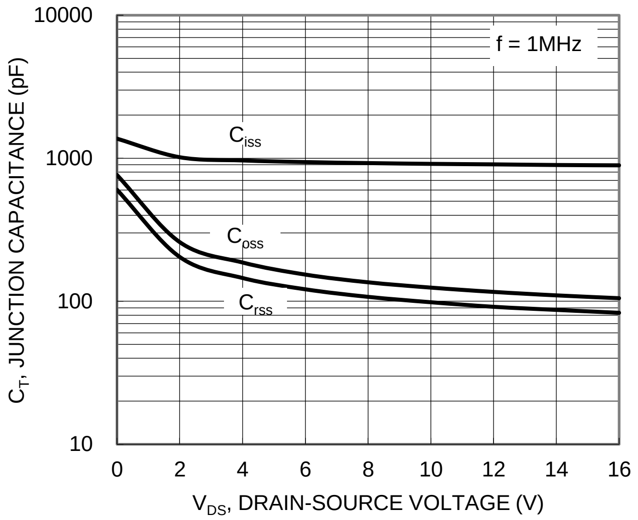


Figure 23. Typical Junction Capacitance

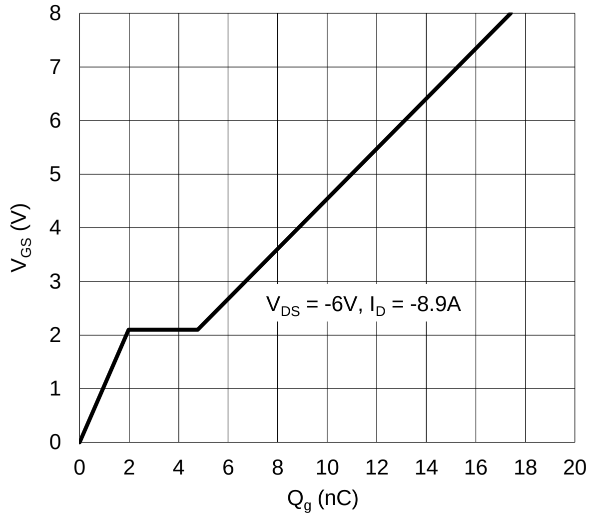


Figure 24. Gate Charge

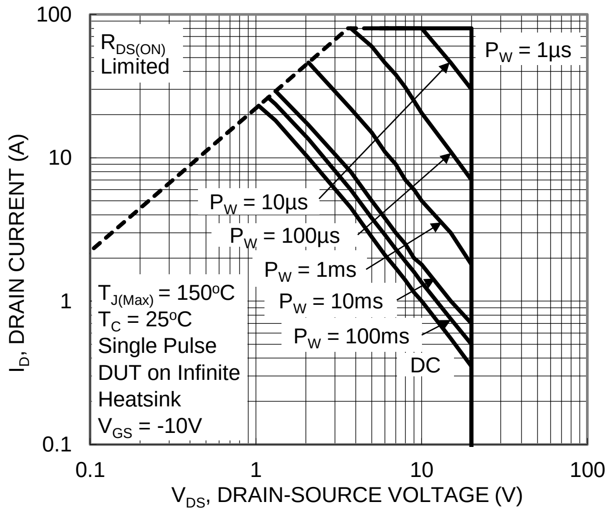
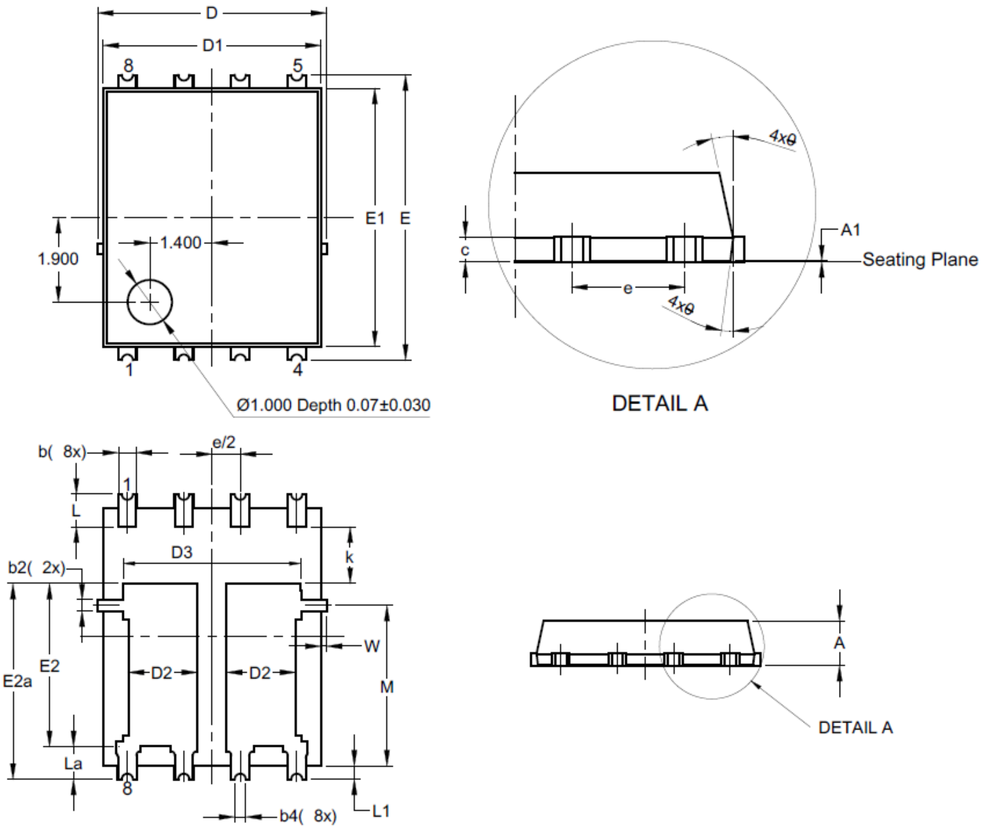


Figure 25. SOA, Safe Operation Area

Package Outline Dimensions

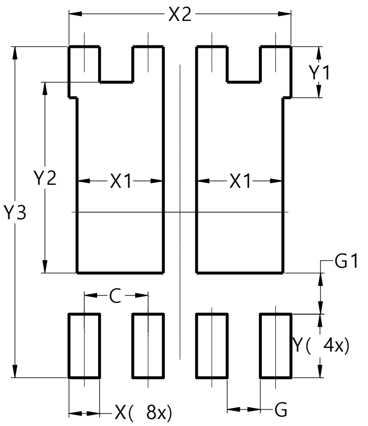
PowerDI5060-8/SWP (Type UXD)



PowerDI5060-8/SWP (Type UXD)			
Dim	**Min**	**Max**	**Typ**
A	0.90	1.10	1.00
A1	0.00	0.05	--
b	0.30	0.50	0.41
b2	0.20	0.35	0.25
b4	0.25REF		
c	0.230	0.330	0.277
D	5.15 BSC		
D1	4.70	5.10	4.90
D2	1.46	1.66	1.55
D3	3.78	4.18	3.98
E	6.40 BSC		
E1	5.60	6.00	5.80
E2	3.46	3.86	3.66
E2a	4.195	4.595	4.395
e	1.27BSC		
k	1.05	--	--
L	0.635	0.835	0.735
La	0.635	0.835	0.735
L1	0.200	0.400	0.300
M	3.205	4.005	3.605
W	0.025	0.225	0.125
θ	10°	12°	11°
θ1	6°	8°	7°
All Dimensions in mm			

Suggested Pad Layout

PowerDI5060-8/SWP (Type UXD)



Dimensions	Value (in mm)
C	1.270
G	0.660
G1	0.820
X	0.610
X1	1.720
X2	4.420
Y	1.270
Y1	1.020
Y2	3.810
Y3	6.610