



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



企业QQ二维码

Product Summary

Device	$V_{(BR)DSS}$	$R_{DS(ON)}$	I_D $T_A = +25^\circ\text{C}$
Q1	12V	$17\text{m}\Omega @ V_{GS} = 4.5\text{V}$	9.5A
		$25\text{m}\Omega @ V_{GS} = 2.5\text{V}$	7.8A
Q2	-20V	$32\text{m}\Omega @ V_{GS} = -4.5\text{V}$	-6.9A
		$53\text{m}\Omega @ V_{GS} = -2.5\text{V}$	-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.

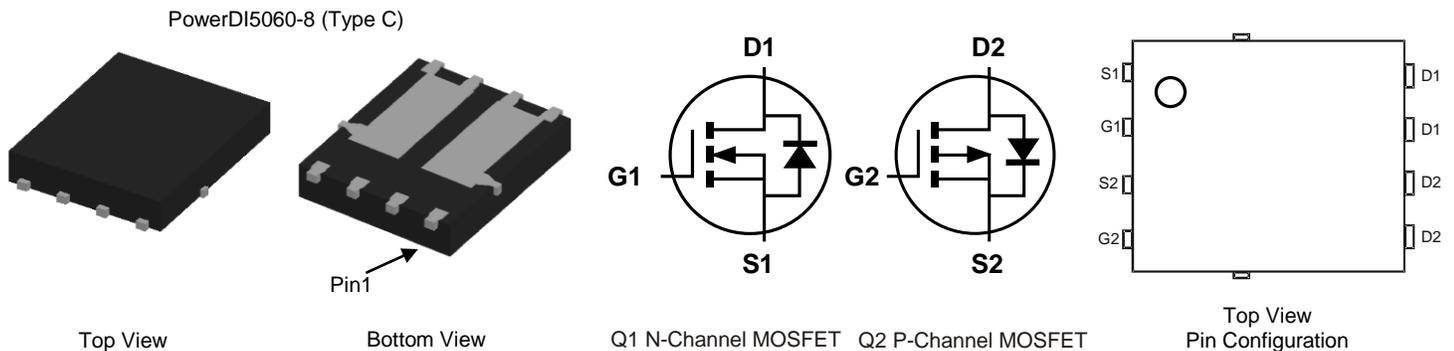
- Notebook Battery Power Management
- DC-DC Converters
- Loadswitch

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

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)



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	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	I_D	9.5 7.6	-6.9 -5.5	A
	$t < 10\text{s}$	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	I_D	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)	$T_A = +25^\circ\text{C}$	P_D	2.3	W
	$T_A = +70^\circ\text{C}$		1.5	
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	$R_{\theta JA}$	54	$^\circ\text{C/W}$
	$t < 10\text{s}$		29	
Thermal Resistance, Junction to Case		$R_{\theta JC}$	6.5	
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	$^\circ\text{C}$

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°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)}	—	8	17	mΩ	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 _{RSS}	—	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 = 6Ω V _{GS} = 4.5V, R _G = 6Ω, 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/μs
Body Diode Reverse Recovery Charge	Q _{RR}	—	2.3	—	nC	I _F = 11.8A, 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.

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	-0.8	-1.5	V	V _{DS} = V _{GS} , I _D = -250μA
Static Drain-Source On-Resistance	R _{DS(ON)}	—	22	32	mΩ	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 = 6Ω V _{GS} = -4.5V, R _G = 6Ω, 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/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.

Typical Characteristics - N-CHANNEL

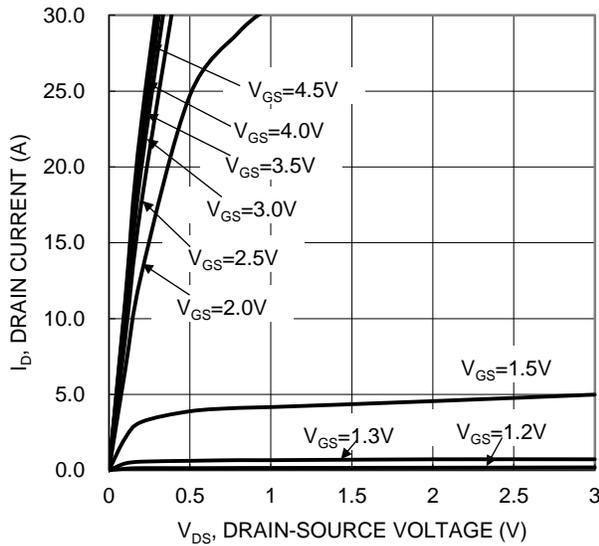


Figure 1. Typical Output Characteristic

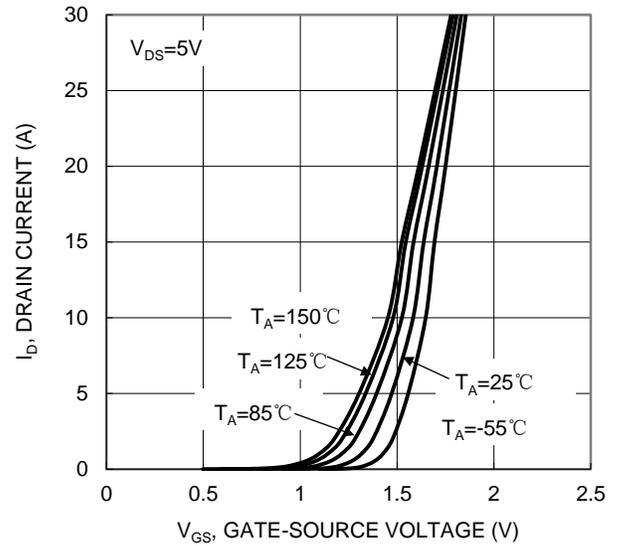


Figure 2. Typical Transfer Characteristic

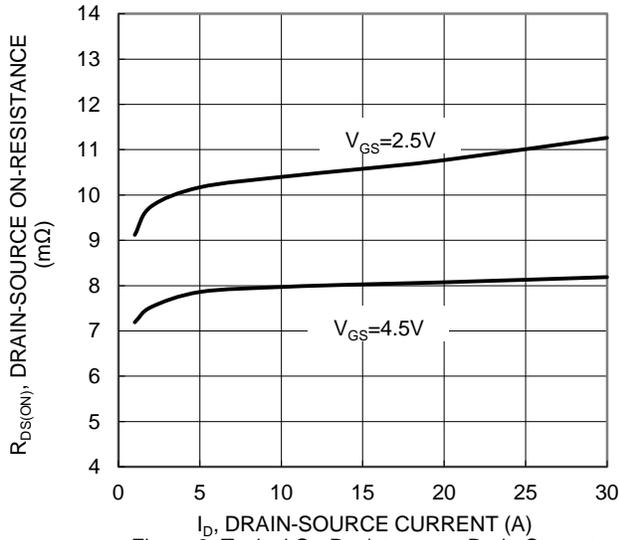


Figure 3. Typical On-Resistance vs Drain Current and Gate Voltage

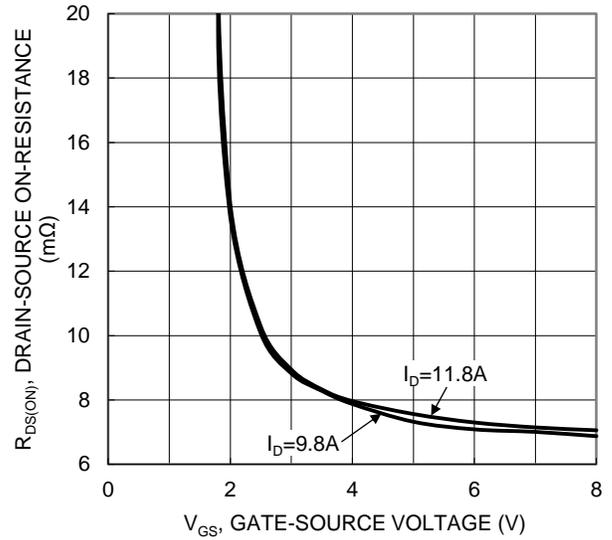


Figure 4. Typical Transfer Characteristic

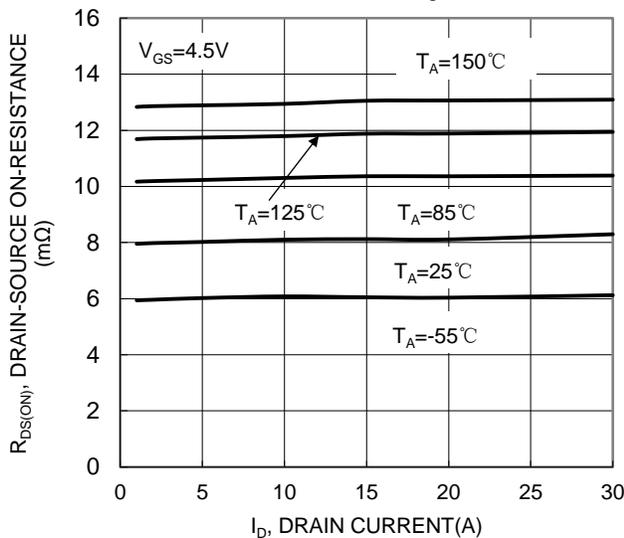


Figure 5. Typical On-Resistance vs Drain Current and Junction Temperature

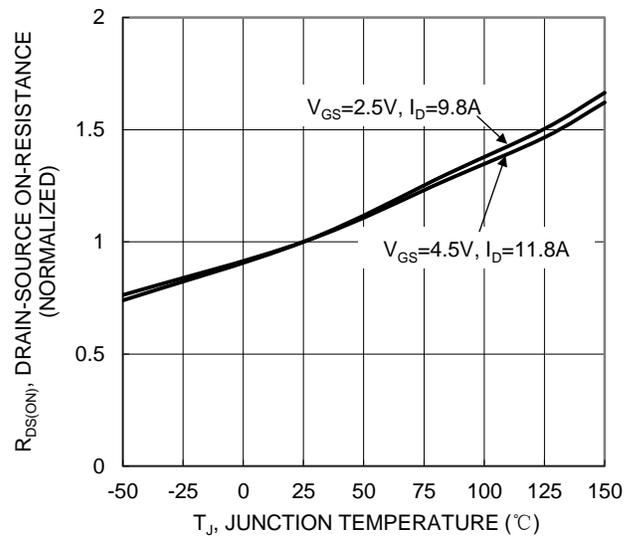


Figure 6. On-Resistance Variation with Junction Temperature

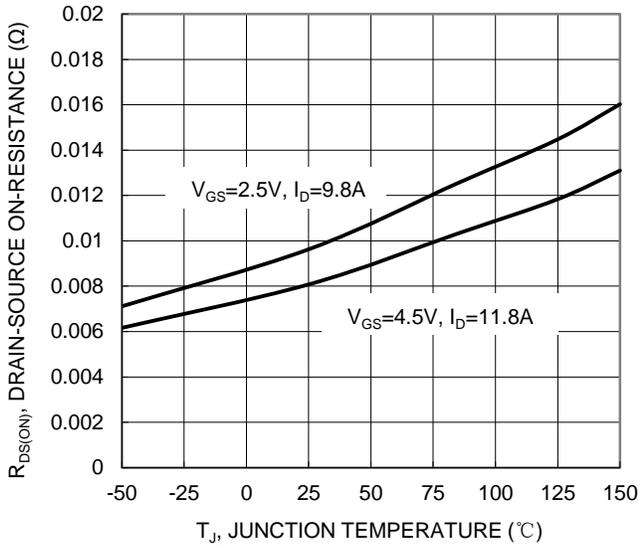


Figure 7. On-Resistance Variation with Junction Temperature

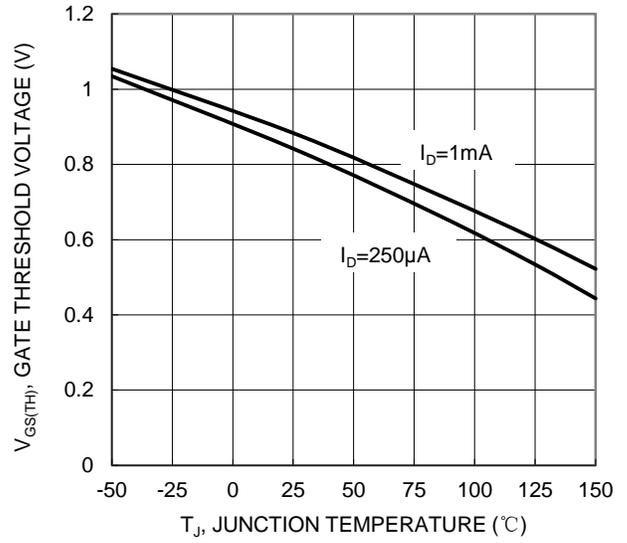


Figure 8. Gate Threshold Variation vs Junction Temperature

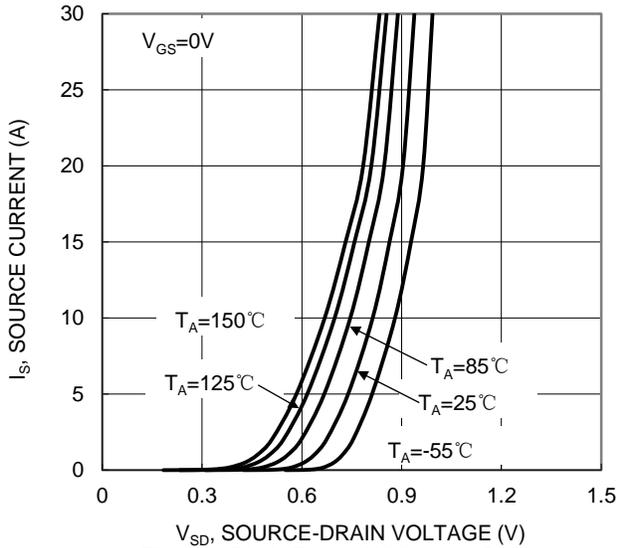


Figure 9. Diode Forward Voltage vs Current

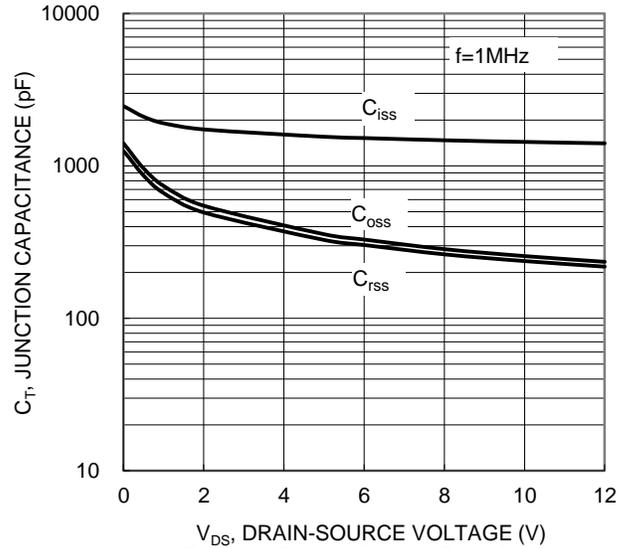


Figure 10. Typical Junction Capacitance

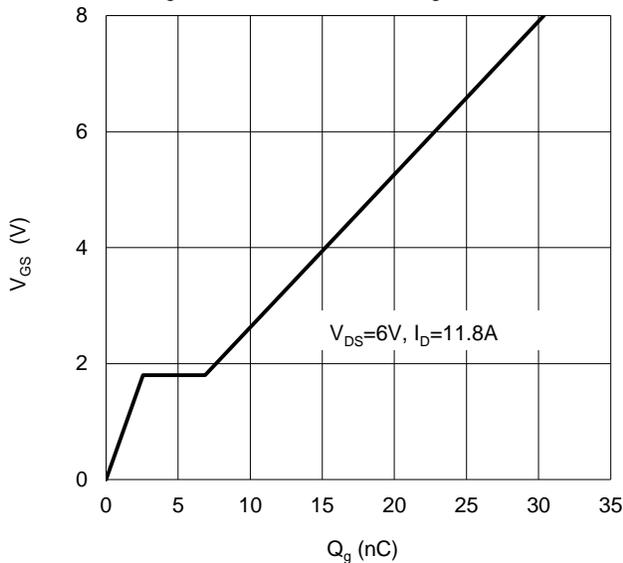


Figure 11. Gate Charge

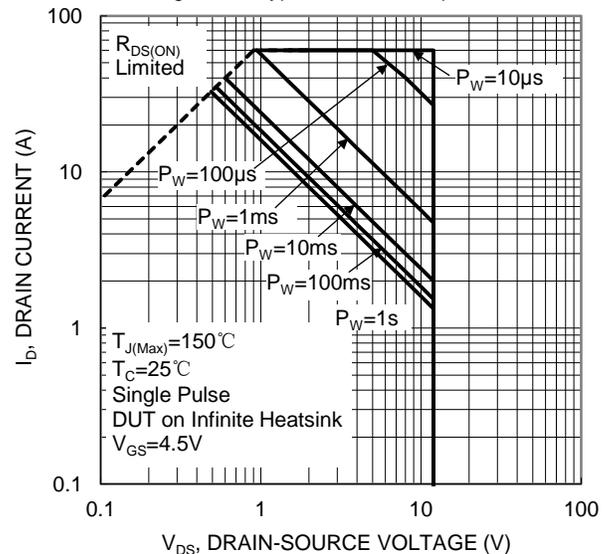


Figure 12. SOA, Safe Operation Area

Typical Characteristics - P-CHANNEL

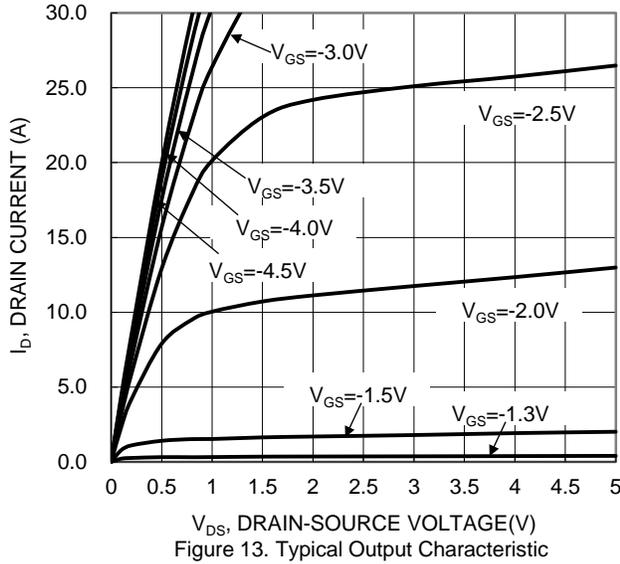


Figure 13. Typical Output Characteristic

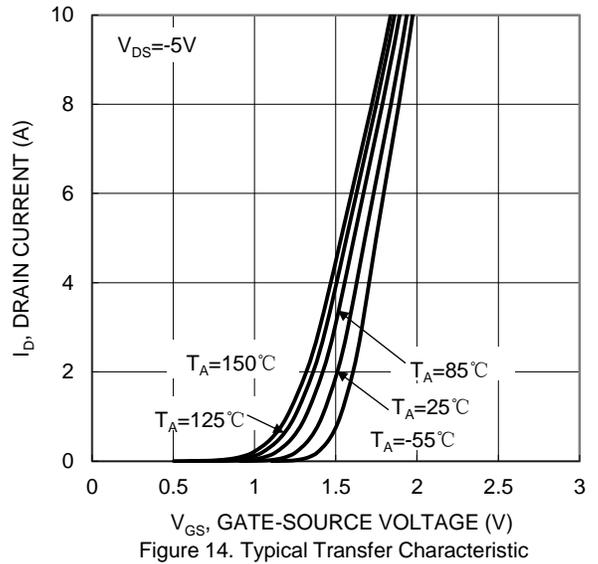


Figure 14. Typical Transfer Characteristic

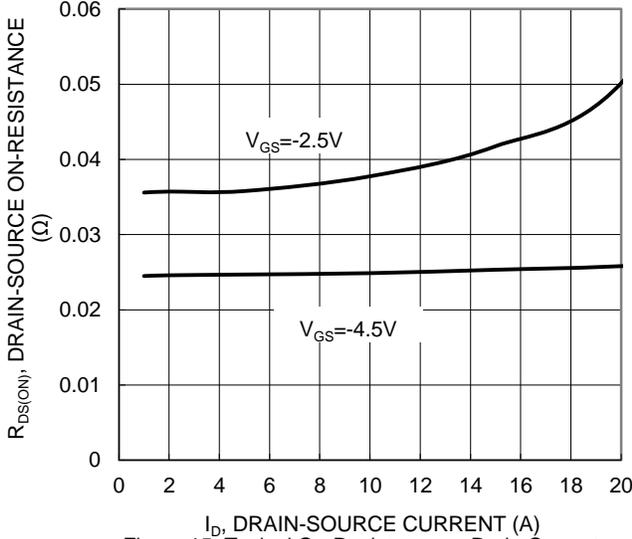


Figure 15. Typical On-Resistance vs Drain Current and Gate Voltage

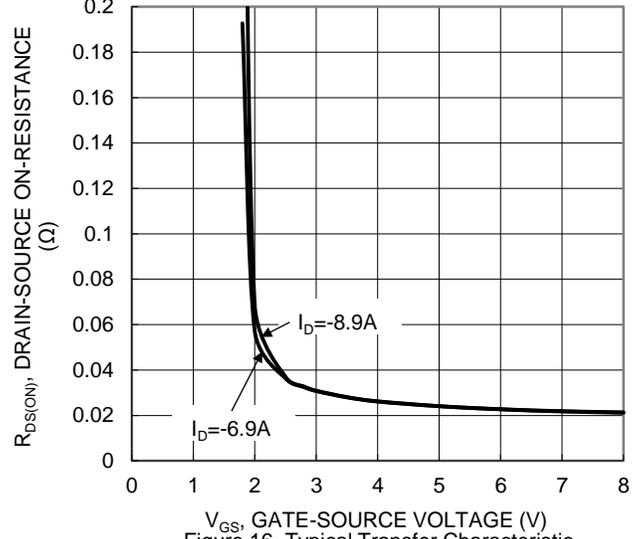


Figure 16. Typical Transfer Characteristic

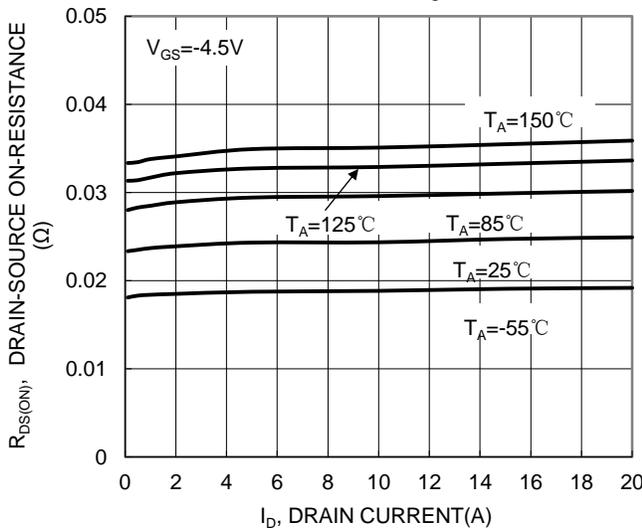


Figure 17. Typical On-Resistance vs Drain Current and Temperature

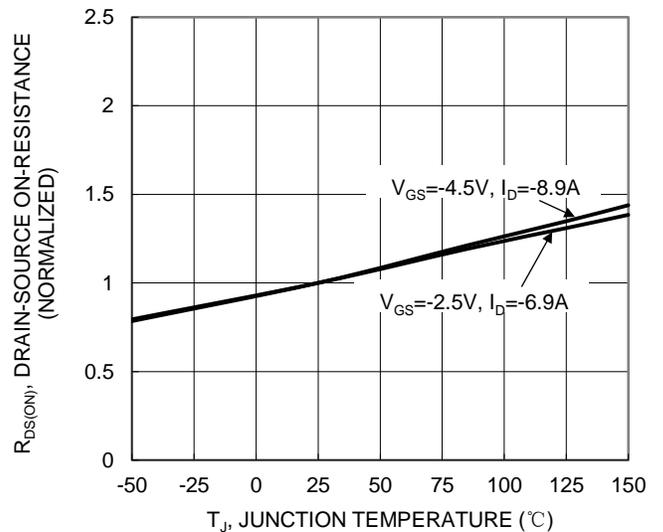


Figure 18. On-Resistance Variation with Temperature

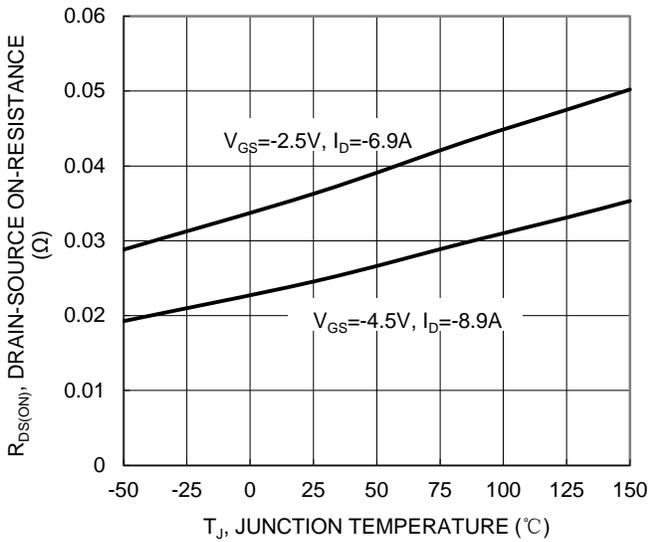


Figure 19. On-Resistance Variation with Temperature

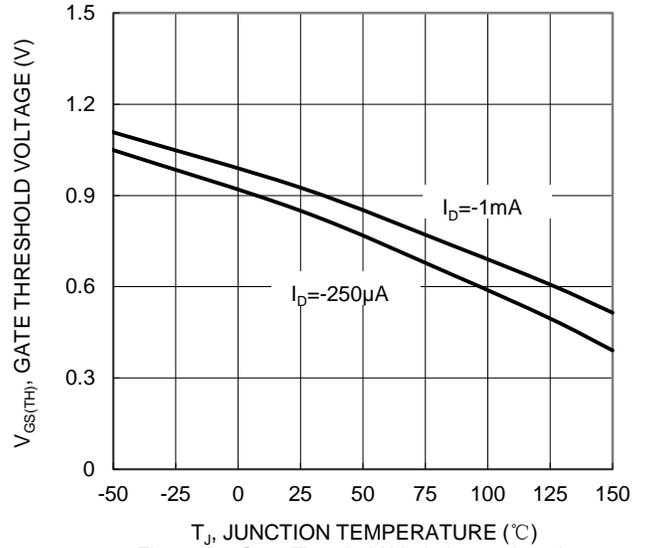


Figure 20. Gate Threshold Variation vs Junction Temperature

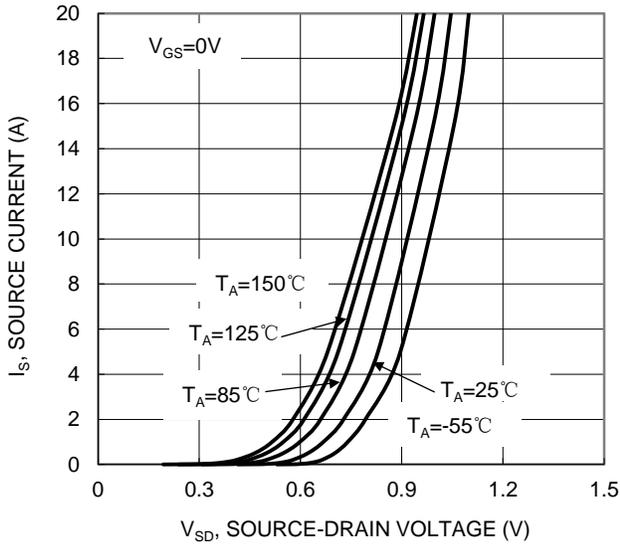


Figure 21. Diode Forward Voltage vs Current

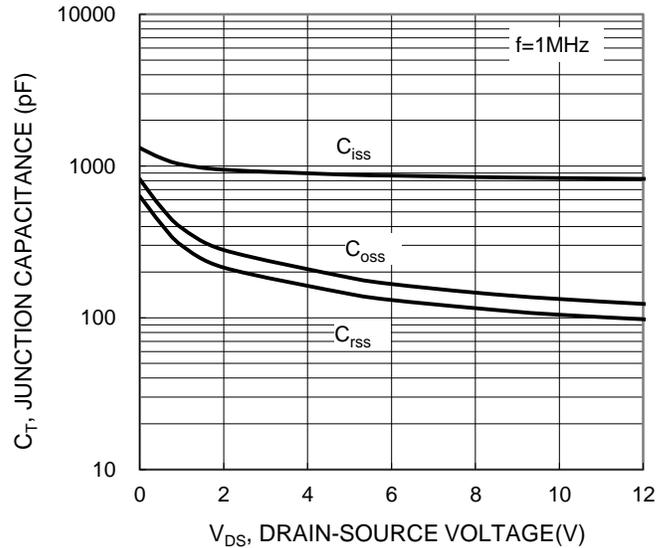


Figure 22. Typical Junction Capacitance

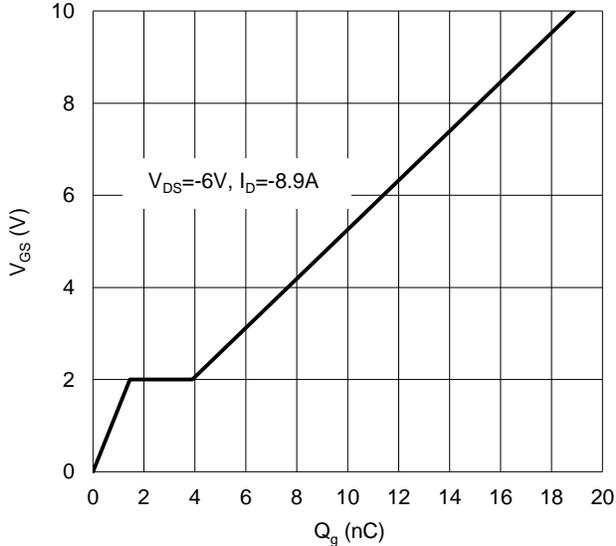


Figure 23. Gate Charge

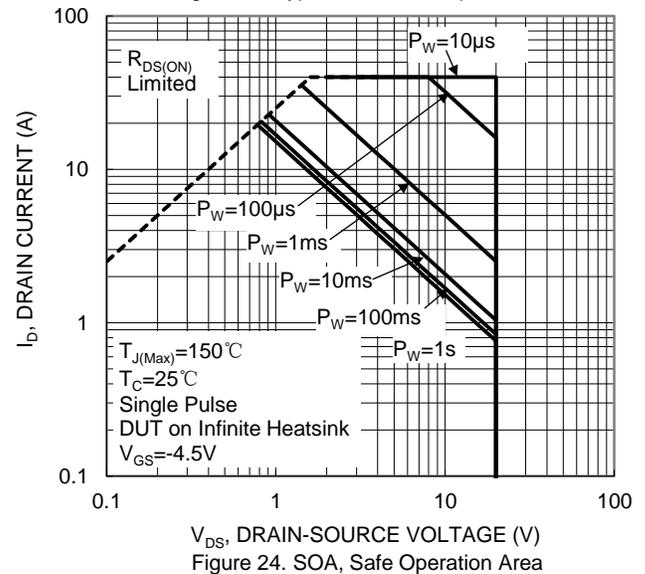


Figure 24. SOA, Safe Operation Area

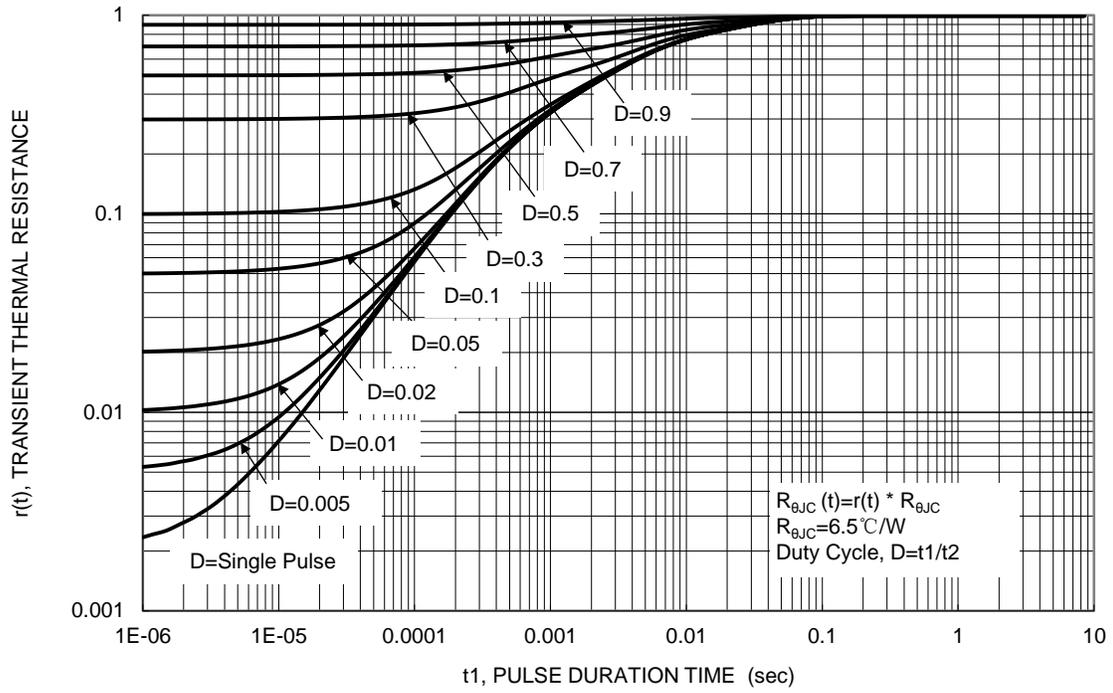
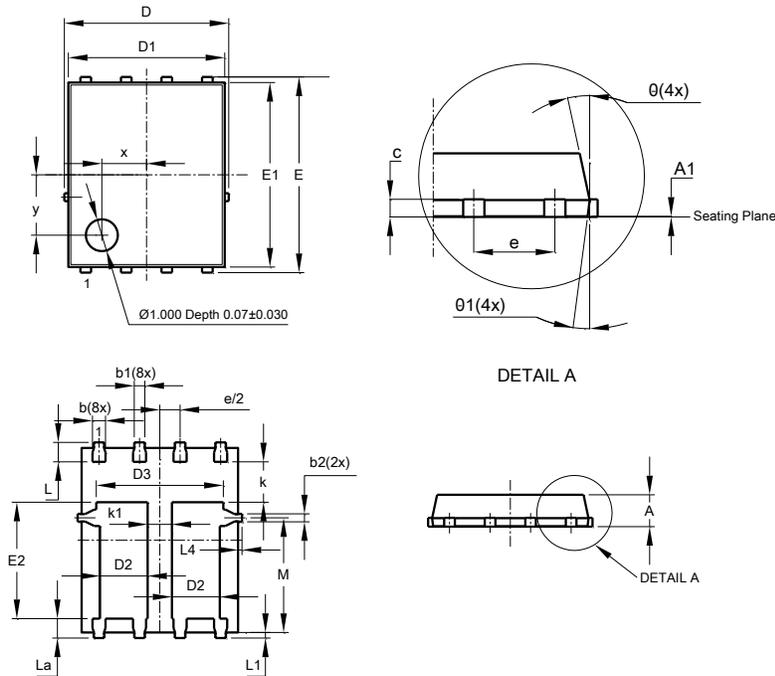


Figure 25. Transient Thermal Resistance

Package Outline Dimensions

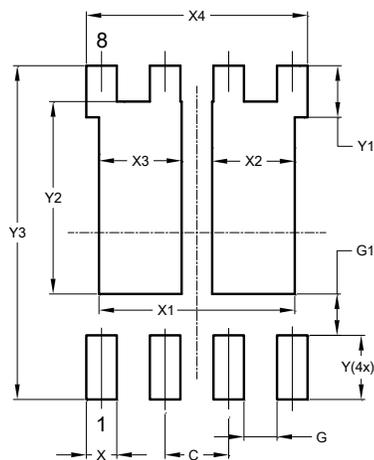
PowerDI5060-8 (Type C)



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

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