20V COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET

Product Summary

Device	$V_{(BR)DSS}$	$R_{DS(on)}$ max	I_D Max T_A = +25°C
Q1	20V	20mΩ @ V_{GS} = 4.5V	8.5A
		28mΩ @ V_{GS} = 2.5V	7.2A
Q2	-20V	33mΩ @ V_{GS} = -4.5V	-6.8A
		45mΩ @ V_{GS} = -2.5V	-5.8A

Description and Applications

This MOSFET has been designed to minimize the on-state resistance ($R_{DS(ON)}$) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- Motor control
- DC-DC Converters
- Power management functions
- Notebook Computers and Printers

Features and Benefits

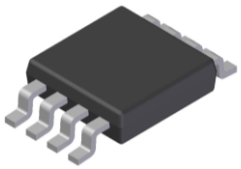
- Reduced footprint with two discretes in a single SO8
- Low gate drive
- Low input capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- **ESD Protected up to 2kV**
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e.: parts qualified to AEC-Q100/101/200, 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-Q) for High Reliability. https://www.diodes.com/quality/product-definitions/**

Mechanical Data

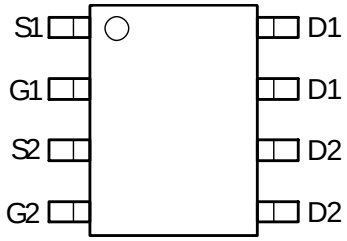
- Case: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals Connections: See Diagram
- Terminals: Finish - Matte Tin annealed over Copper lead frame. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.074 grams (approximate)

ESD PROTECTED TO 2kV

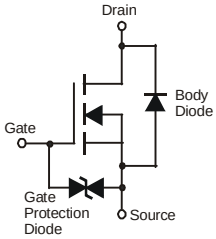
SO-8



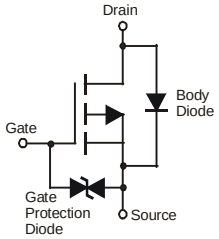
Top View



Top View



Q1 N-Channel



Q2 P-Channel

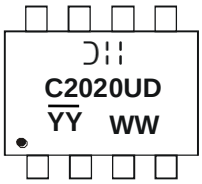
Equivalent Circuit

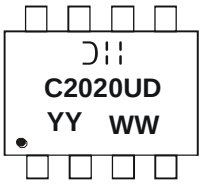
Ordering Information (Note 4)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
DMC2020USD-13	C2020UD	13	12	2,500

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
C2022UD = Product Type Marking Code
YYWW = Date Code Marking
YY or YY = Year (ex: 14 = 2014)
WW = Week (01 - 53)
YY = Date Code Marking for SAT (Shanghai Assembly/ Test site)
YY = Date Code Marking for CAT (Chengdu Assembly/ Test site)

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

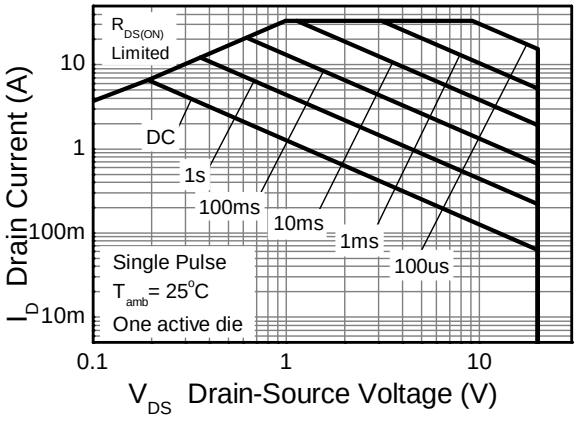
Characteristic			Symbol	N-Channel - Q1	P-Channel - Q2	Units
Drain-Source Voltage			V_{DSS}	20	-20	V
Gate-Source Voltage			V_{GSS}	±10	±10	
Continuous Drain Current	V_{GS} = 4.5V	(Notes 6 & 8)	I_D	8.5	-6.8	A
		T_A = 70°C (Notes 6 & 8)		6.8	-5.4	
		(Notes 5 & 8)		6.5	-5.2	
		(Notes 5 & 9)		7.8	-6.3	
Pulsed Drain Current	V_{GS} = 4.5V	(Notes 7 & 8)	I_{DM}	33.6	-26.8	
Continuous Source Current (Body diode)		(Notes 6 & 8)	I_S	4.0	-4.0	
Pulsed Source Current (Body diode)		(Notes 7 & 8)	I_{SM}	33.6	-26.8	

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

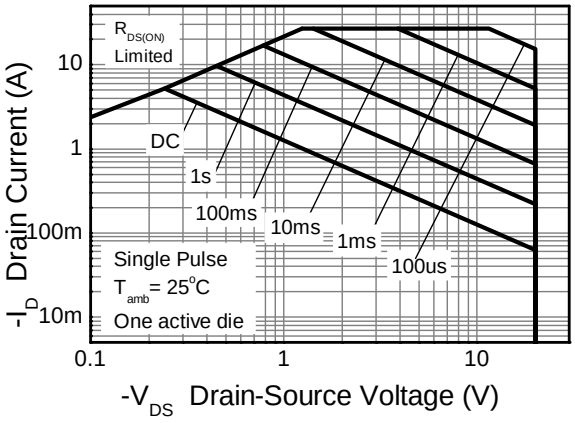
Characteristic		Symbol	N-Channel - Q1 / P-Channel - Q2	Unit
Power Dissipation Linear Derating Factor	(Notes 5 & 8)	P_D	1.25 10	W mW/°C
	(Notes 5 & 9)		1.8 14.3	
	(Notes 6 & 8)		2.14 17.2	
Thermal Resistance, Junction to Ambient	(Notes 5 & 8)	$R_{\theta JA}$	100	°C/W
	(Notes 5 & 9)		70	
	(Notes 6 & 8)		58	
Thermal Resistance, Junction to Lead	(Notes 8 & 10)	$R_{\theta JL}$	51	
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

Notes:
5. For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
6. Same as note (2), except the device is measured at t ≤ 10 sec.
7. Same as note (2), except the device is pulsed with D = 0.02 and pulse width 300µs.
8. For a dual device with one active die.
9. For a device with two active die running at equal power.
10. Thermal resistance from junction to solder-point (at the end of the drain lead).

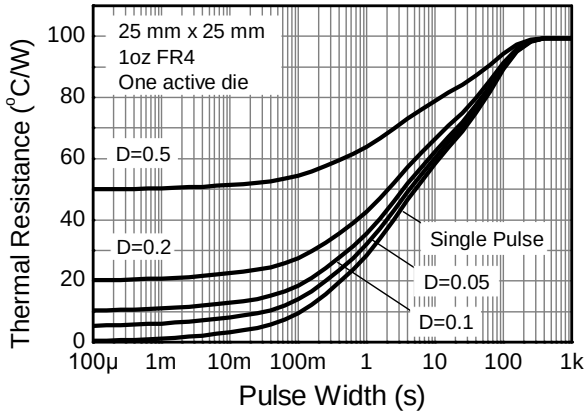
Thermal Characteristics



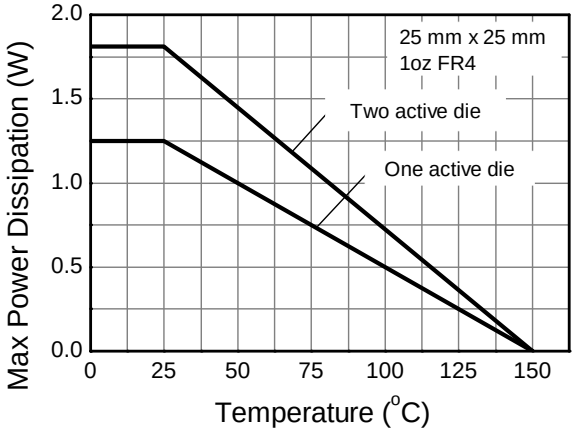
N-channel Safe Operating Area



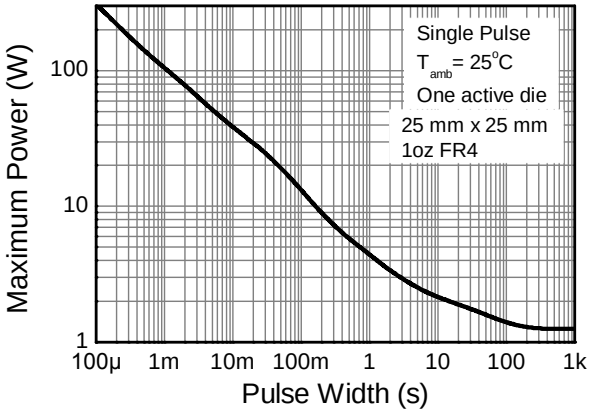
P-channel Safe Operating Area



Transient Thermal Impedance



Derating Curve



Pulse Power Dissipation

Electrical Characteristics – Q1 N-CHANNEL (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	20	—	—	V	V_{GS} = 0V, I_D = 250μA
Zero Gate Voltage Drain Current	I_{DSS}	—	—	1.0	μA	V_{DS} = 20V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±10	μA	V_{GS} = ±10V, V_{DS} = 0V
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(th)}$	0.5	1.1	1.5	V	V_{DS} = V_{GS}, I_D = 250μA
Static Drain-Source On-Resistance (Note 11)	$R_{DS\ (ON)}$	—	13	20	mΩ	V_{GS} = 4.5V, I_D = 7A
			18	28		V_{GS} = 2.5V, I_D = 3A
Forward Transfer Admittance (Notes 11 & 12)	$\|Y_{fs}\|$	—	16	—	S	V_{DS} = 5V, I_D = 9.4A
Diode Forward Voltage (Note 11)	V_{SD}	—	0.7	1.2	V	V_{GS} = 0V, I_S = 1.3A
Continuous Source Current	I_S	—	—	1.8	A	—
DYNAMIC CHARACTERISTICS (Note 12)						
Input Capacitance	C_{iss}	—	1149	—	pF	V_{DS} = 10V, V_{GS} = 0V, f = 1.0MHz
Output Capacitance	C_{oss}	—	157	—		
Reverse Transfer Capacitance	C_{rss}	—	142	—		
Gate Resistance	R_g	—	1.51	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge (Note 13)	Q_g	—	6.0	—	nC	V_{GS} = 2.5V; V_{DS} = 10V, I_D = 9.4A
Total Gate Charge (Note 13)	Q_g	—	11.6	—		V_{GS} = 4.5V; V_{DS} = 10V, I_D = 9.4A
Gate-Source Charge (Note 13)	Q_{gs}	—	2.7	—		
Gate-Drain Charge (Note 13)	Q_{gd}	—	3.4	—		
Turn-On Delay Time (Note 13)	$t_{D(on)}$	—	11.67	—		
Turn-On Rise Time (Note 13)	t_r	—	12.49	—	ns	V_{GS} = 4.5V, V_{DS} = 10V, R_G = 6Ω , I_D = 1A
Turn-Off Delay Time (Note 13)	$t_{D(off)}$	—	35.89	—		
Turn-Off Fall Time (Note 13)	t_f	—	12.33	—		

Notes: 11. Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%
12. For design aid only, not subject to production testing.
13. Switching characteristics are independent of operating junction temperatures.

Typical Characteristics – Q1 N-CHANNEL

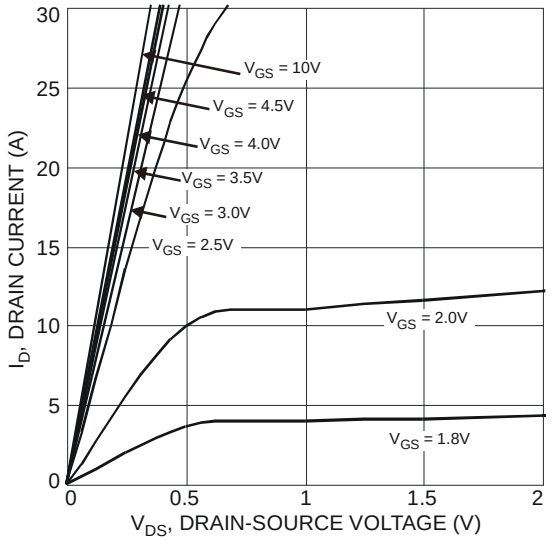


Fig. 1 Typical Output Characteristics

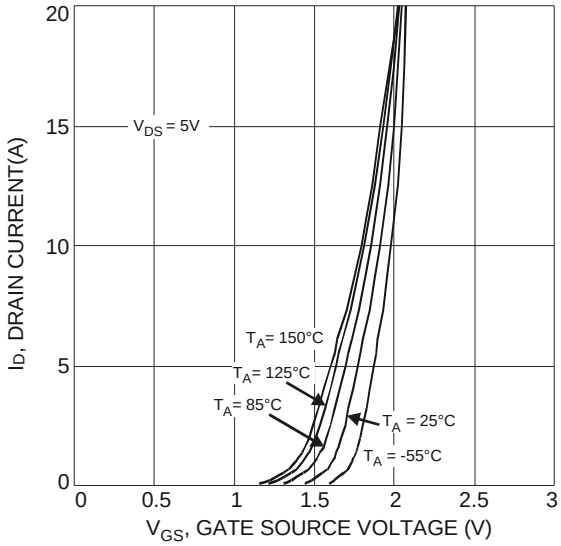


Fig. 2 Typical Transfer Characteristics

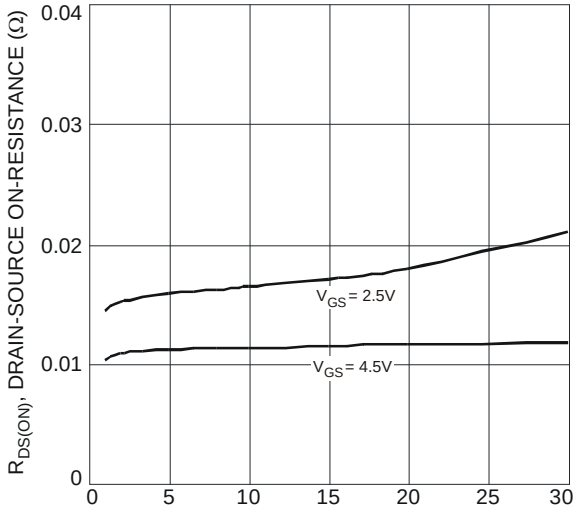


Fig. 3 Typical On-Resistance
vs. Drain Current and Gate Voltage

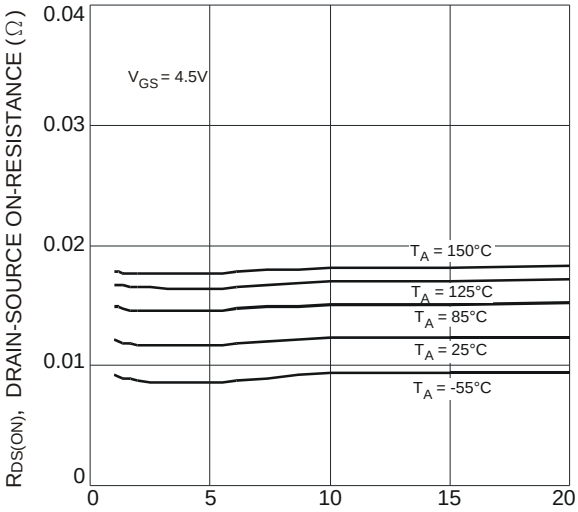


Fig. 4 Typical Drain-Source On-Resistance
vs. Drain Current and Temperature

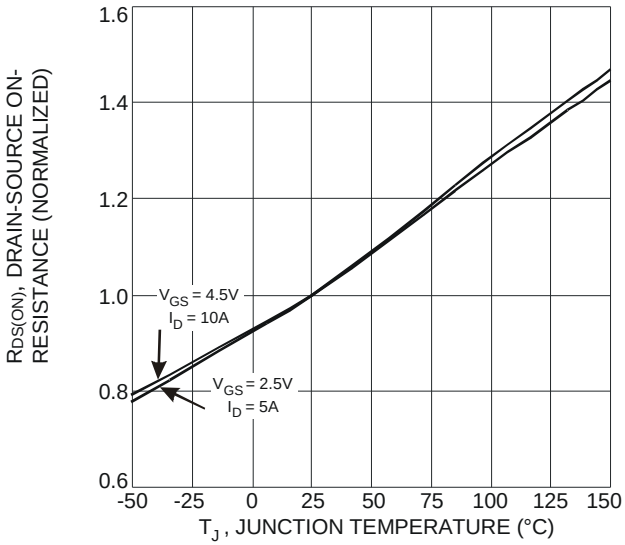


Fig. 5 On-Resistance Variation with Temperature

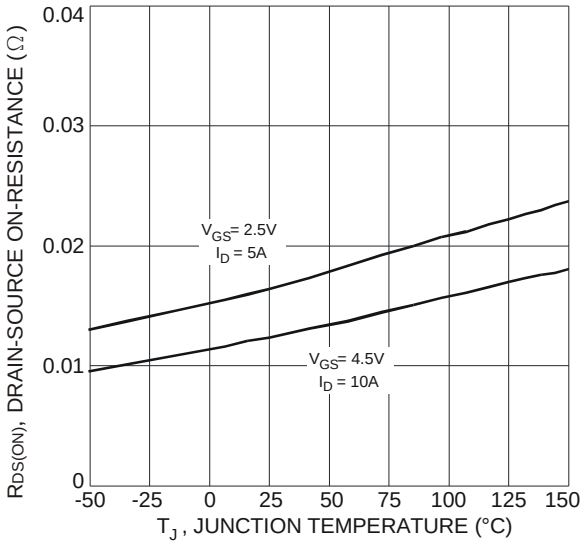


Fig. 6 On-Resistance Variation with Temperature

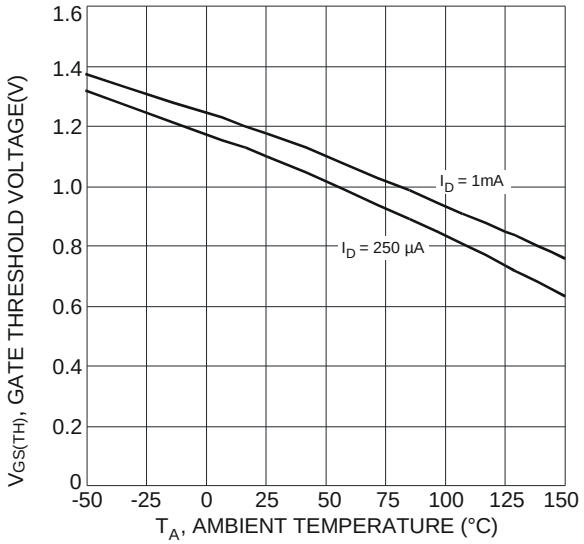


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

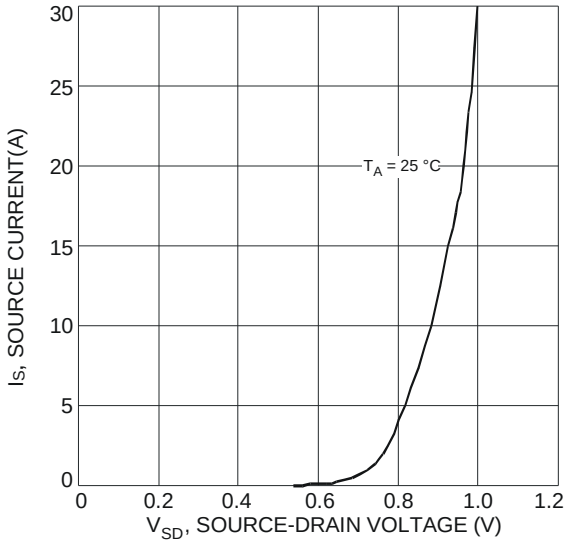


Fig. 8 Diode Forward Voltage vs. Current

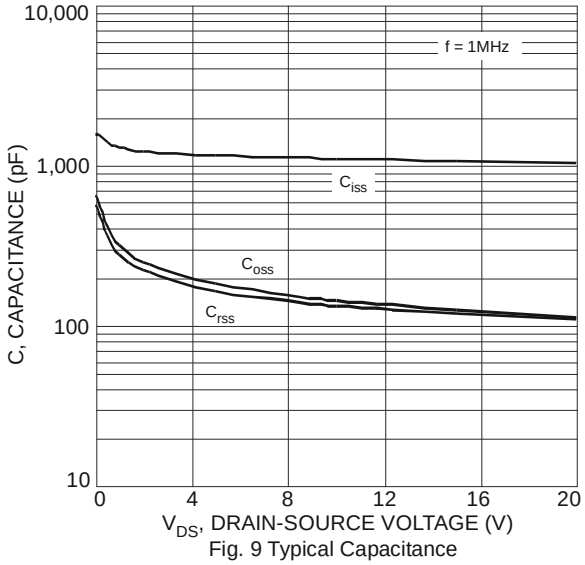


Fig. 9 Typical Capacitance

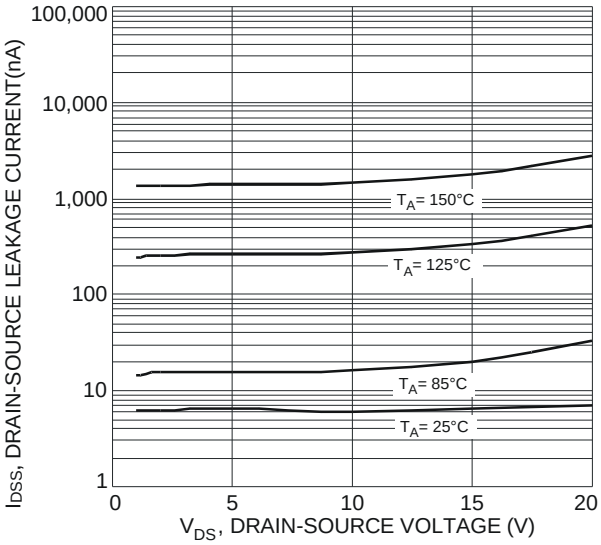


Fig. 10 Typical Drain-Source Leakage Current vs. Drain-Source Voltage

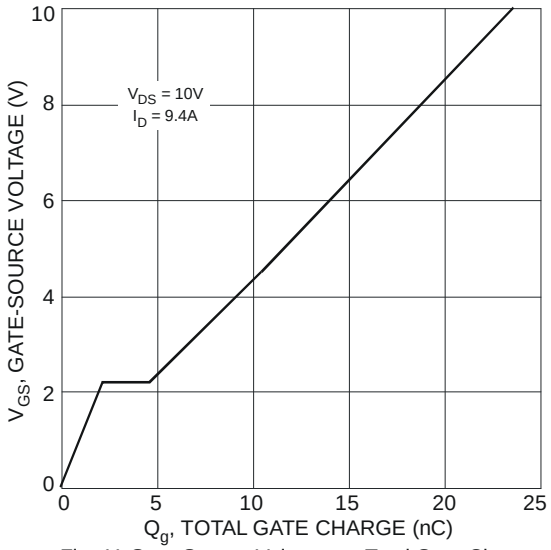


Fig. 11 Gate-Source Voltage vs. Total Gate Charge

Electrical Characteristics – Q2 P-CHANNEL (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	-20	—	—	V	V_{GS} = 0V, I_D = -250μA
Zero Gate Voltage Drain Current	I_{DSS}	—	—	-1.0	μA	V_{DS} = -20V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±10	μA	V_{GS} = ±8V, V_{DS} = 0V
ON CHARACTERISTICS (Note 10)						
Gate Threshold Voltage	$V_{GS(th)}$	-0.4	-0.7	-1.0	V	V_{DS} = V_{GS}, I_D = -250μA
Static Drain-Source On-Resistance (Note 14)	$R_{DS\ (ON)}$	—	26	33	mΩ	V_{GS} = -4.5V, I_D = -6A
			33	45		V_{GS} = -2.5V, I_D = -3A
Forward Transfer Admittance (Note 14 & 15)	$\|Y_{fs}\|$	—	14	—	S	V_{DS} = -5V, I_D = -4A
Diode Forward Voltage (Note 14)	V_{SD}	—	-0.7	-1.0	V	V_{GS} = 0V, I_S = -1A
Continuous Source Current	I_S	—	—	-1.8	A	-
DYNAMIC CHARACTERISTICS (Note 15)						
Input Capacitance	C_{iss}	—	1610	—	pF	V_{DS} = -10V, V_{GS} = 0V, f = 1.0MHz
Output Capacitance	C_{oss}	—	157	—		
Reverse Transfer Capacitance	C_{rss}	—	145	—		
Gate Resistance	R_g	—	9.45	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge (Note 16)	Q_g	—	8.0	—	nC	V_{GS} = -2.5V; V_{DS} = -10V, I_D = -4A
Total Gate Charge (Note 16)	Q_g	—	15.4	—		V_{GS} = -4.5V; V_{DS} = -10V, I_D = -4A
Gate-Source Charge (Note 16)	Q_{gs}	—	2.5	—		
Gate-Drain Charge (Note 16)	Q_{gd}	—	3.3	—		
Turn-On Delay Time (Note 16)	$t_{D(on)}$	—	16.8	—	ns	V_{GS} = -4.5V, V_{DS} = -10V, R_G = 6Ω , I_D = -1A
Turn-On Rise Time (Note 16)	t_r	—	12.4	—		
Turn-Off Delay Time (Note 16)	$t_{D(off)}$	—	94.1	—		
Turn-Off Fall Time (Note 16)	t_f	—	42.4	—		

Notes: 14. Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%
15. For design aid only, not subject to production testing.
16. Switching characteristics are independent of operating junction temperatures.

Typical Characteristics – Q2 P-CHANNEL

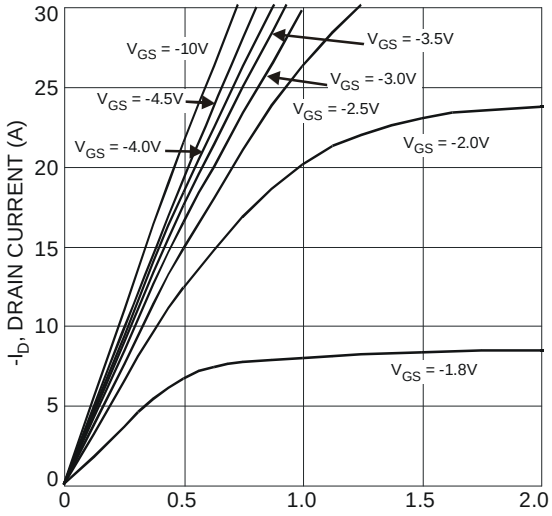


Fig. 12 Typical Output Characteristics

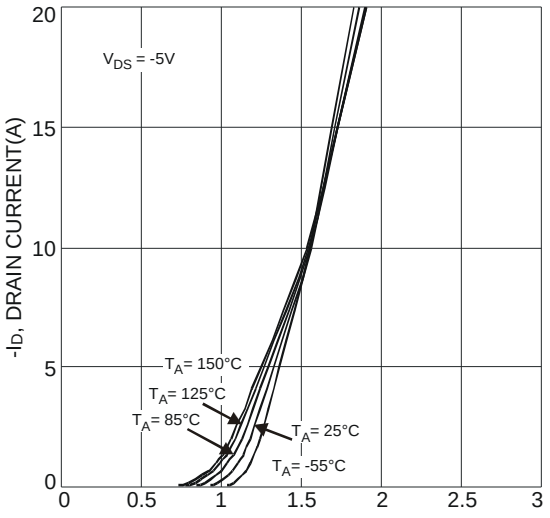


Fig. 13 Typical Transfer Characteristics

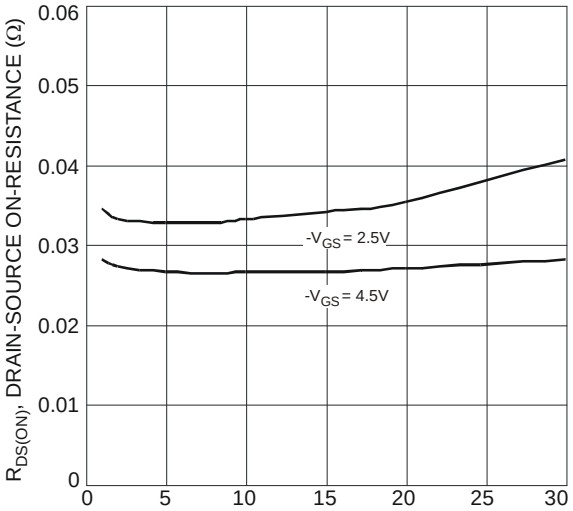


Fig. 14 Typical On-Resistance
vs. Drain Current and Gate Voltage

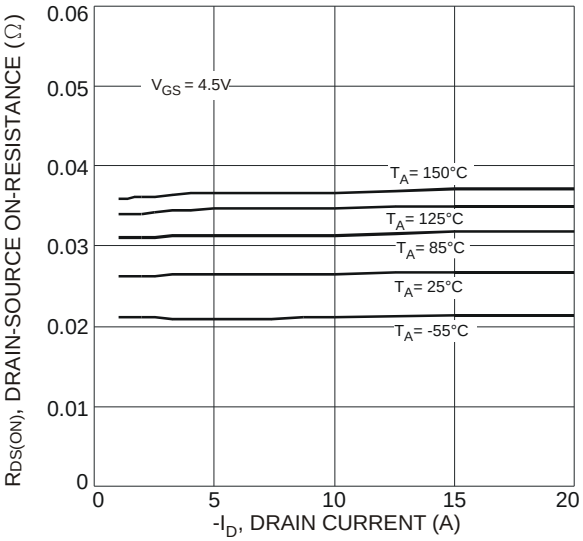


Fig. 15 Typical Drain-Source On-Resistance
vs. Drain Current and Temperature

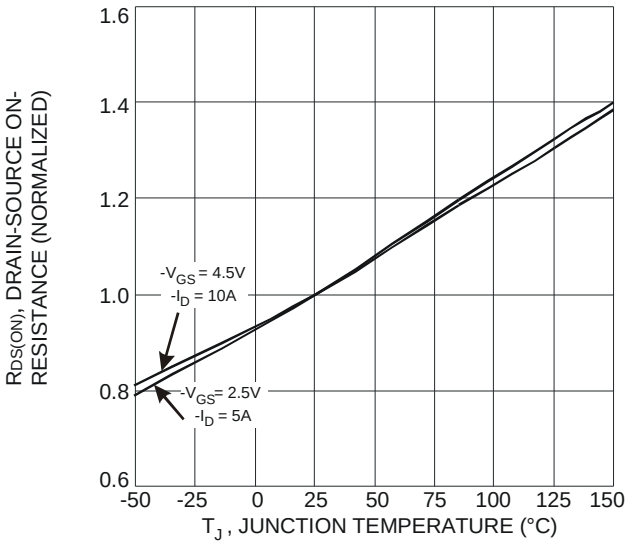


Fig. 16 On-Resistance Variation with Temperature

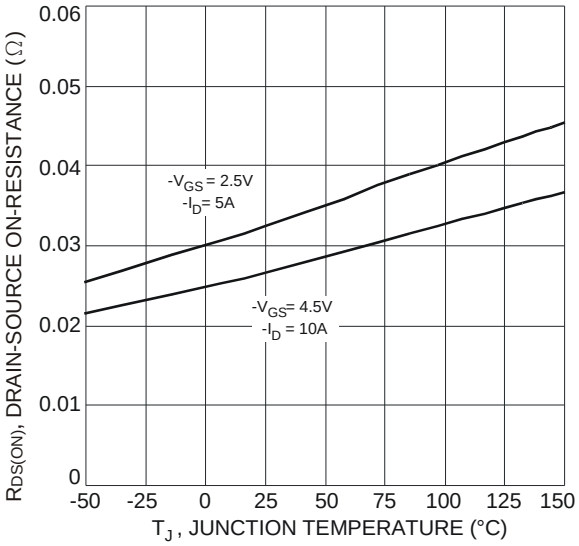


Fig. 17 On-Resistance Variation with Temperature

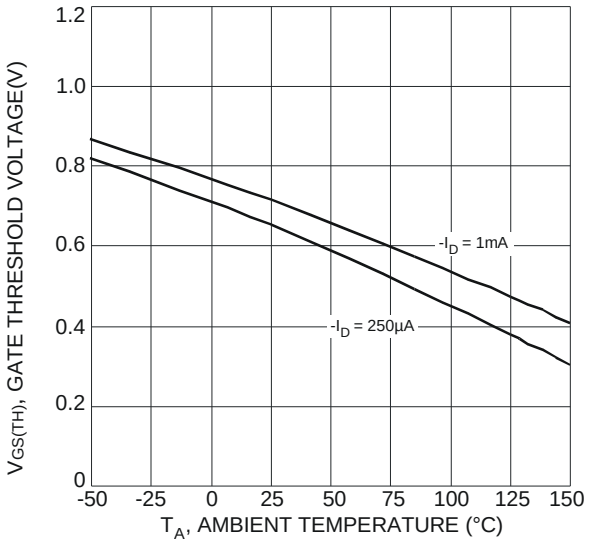


Fig. 18 Gate Threshold Variation vs. Ambient Temperature

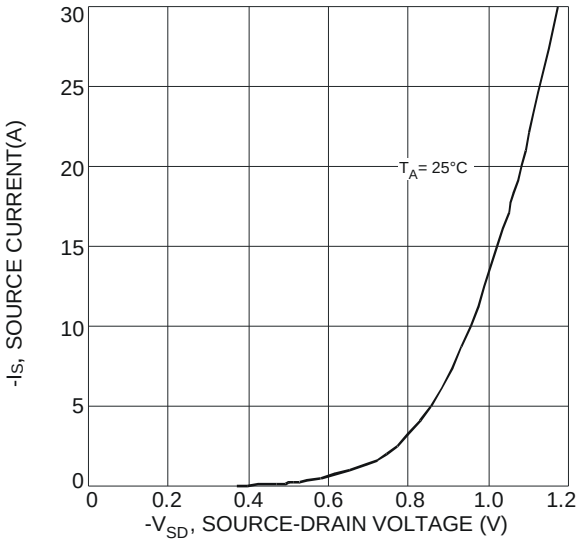


Fig. 19 Diode Forward Voltage vs. Current

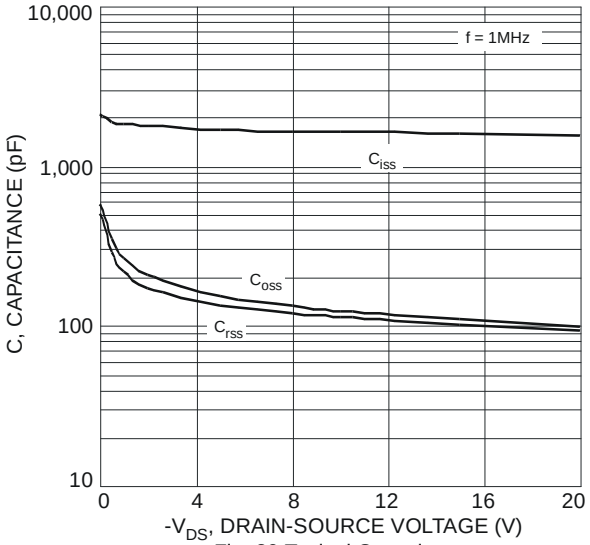


Fig. 20 Typical Capacitance

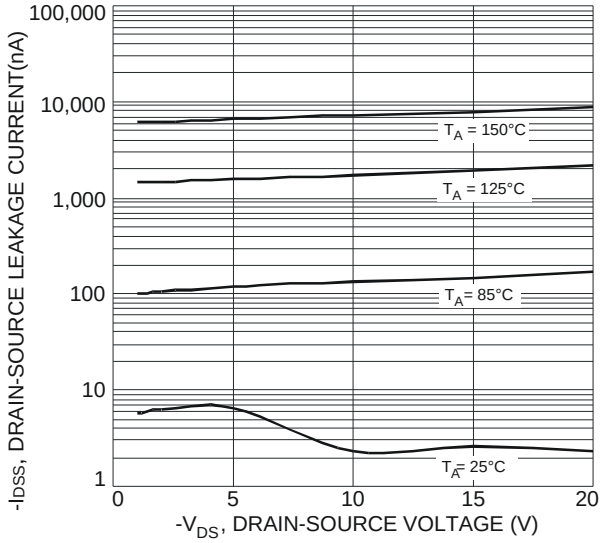


Fig. 21 Typical Drain-Source Leakage Current vs. Drain-Source Voltage

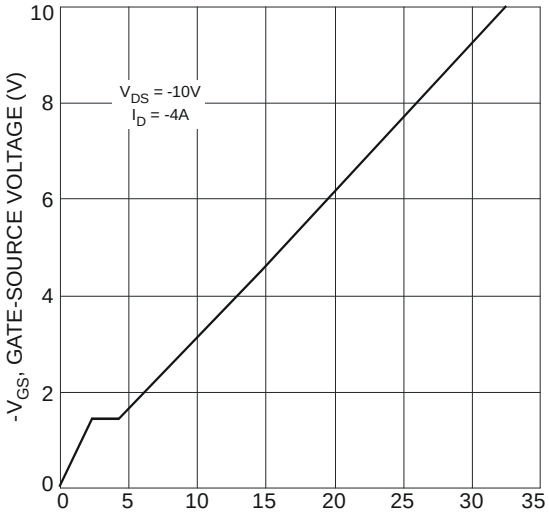
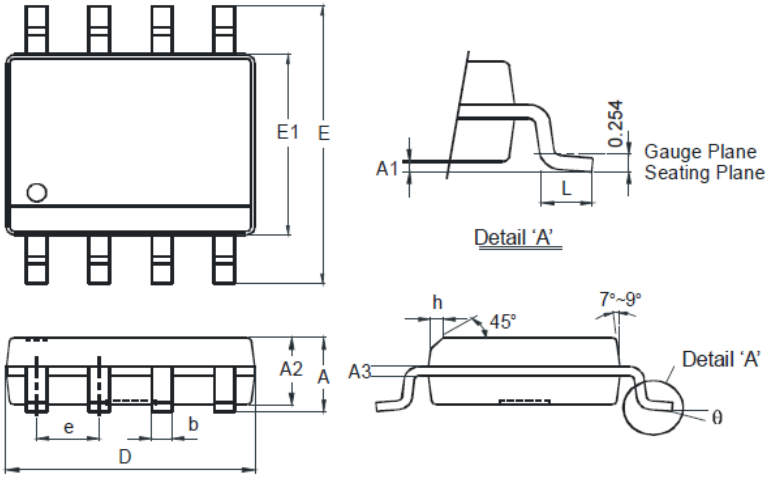


Fig. 22 Gate-Source Voltage vs. Total Gate Charge

Package Outline Dimensions

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



SO-8		
Dim	**Min**	**Max**
A	-	1.75
A1	0.10	0.20
A2	1.30	1.50
A3	0.15	0.25
b	0.3	0.5
D	4.85	4.95
E	5.90	6.10
E1	3.85	3.95
e	1.27 Typ	
h	-	0.35
L	0.62	0.82
θ	0°	8°
All Dimensions in mm		

Suggested Pad Layout

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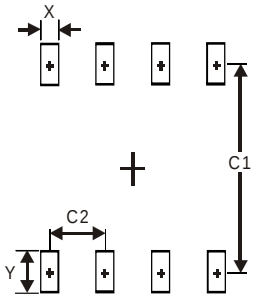

Dimensions	Value (in mm)
X	0.60
Y	1.55
C1	5.4
C2	1.27

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