Lead-free Green

DMC2020USD

20V COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET

Product Summary

Device	$V_{(BR)DSS}$	$R_{DS(on)}$ max	I_D Max T_A = 25°C (Notes 3 & 5)
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

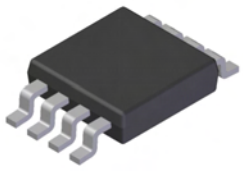
- Reduced footprint with two discretes in a single SO8
- Low gate drive
- Low input capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- **ESD Protected up to 2kV**
- **"Lead Free", RoHS Compliant (Note 1)**
- **Halogen and Antimony Free. "Green" Device (Note 1)**

Mechanical Data

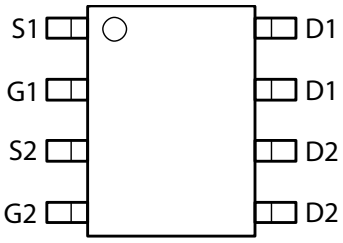
- Case: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals Connections: See Diagram
- Terminals: Finish - Matte Tin annealed over Copper lead frame. Solderable per MIL-STD-202, Method 208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

ESD PROTECTED TO 2kV

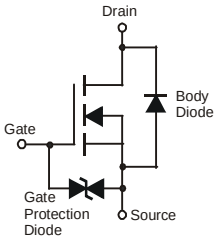
SO-8



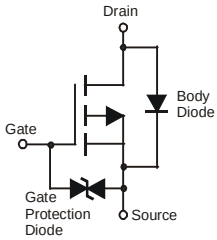
Top View



Top View



Q1 N-Channel



Q2 P-Channel

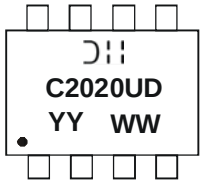
Equivalent Circuit

Ordering Information (Note 1)

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

Notes: 1. No purposefully added lead. Diodes Inc.'s "Green" policy and packaging details can be found on our website at http://www.diodes.com.

Marking Information



= Manufacturer's Marking
C2020UD = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 09 = 2009)
WW = Week (01 - 53)

Maximum Ratings @T_A = 25°C unless otherwise specified

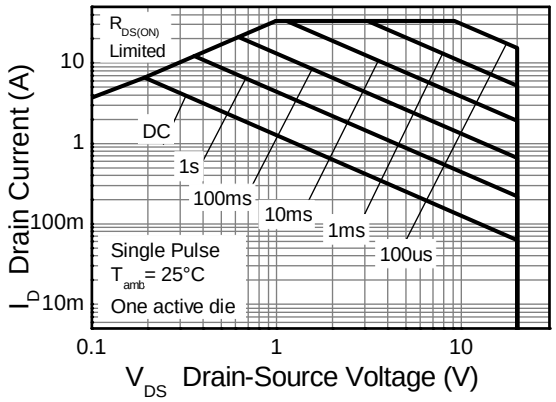
Characteristic			Symbol	N-Channel - Q1	P-Channel - Q2	Units
Drain-Source Voltage			V_{DSS}	20	-20	V
Gate-Source Voltage			V_{GSS}	±10	±10	
Continuous Drain Current	V_{GS} = 4.5V	(Notes 3 & 5)	I_D	8.5	-6.8	A
		T_A = 70°C (Notes 3 & 5)		6.8	-5.4	
		(Notes 2 & 5)		6.5	-5.2	
		(Notes 2 & 6)		7.8	-6.3	
Pulsed Drain Current	V_{GS} = 4.5V	(Notes 4 & 5)	I_{DM}	33.6	-26.8	
Continuous Source Current (Body diode)		(Notes 3 & 5)	I_S	4.0	-4.0	
Pulsed Source Current (Body diode)		(Notes 4 & 5)	I_{SM}	33.6	-26.8	

Thermal Characteristics @T_A = 25°C unless otherwise specified

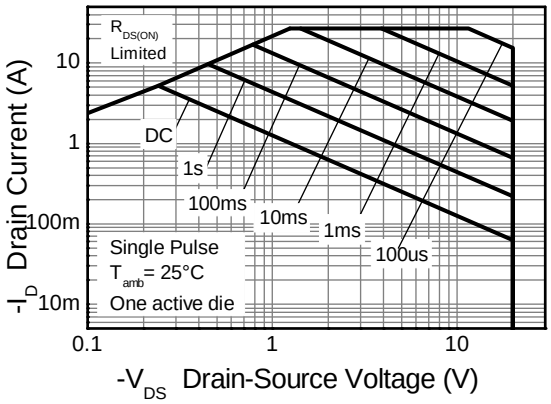
Characteristic		Symbol	N-Channel - Q1	P-Channel - Q2	Unit
Power Dissipation Linear Derating Factor	(Notes 2 & 5)	P_D	1.25 10		W mW/°C
	(Notes 2 & 6)		1.8 14.3		
	(Notes 3 & 5)		2.14 17.2		
Thermal Resistance, Junction to Ambient	(Notes 2 & 5)	$R_{\theta JA}$	100		°C/W
	(Notes 2 & 6)		70		
	(Notes 3 & 5)		58		
Thermal Resistance, Junction to Lead	(Notes 5 & 7)	$R_{\theta JL}$	51		
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150		°C

Notes:
2. 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.
3. Same as note (2), except the device is measured at t ≤ 10 sec.
4. Same as note (2), except the device is pulsed with D = 0.02 and pulse width 300µs.
5. For a dual device with one active die.
6. For a device with two active die running at equal power.
7. Thermal resistance from junction to solder-point (at the end of the drain lead).

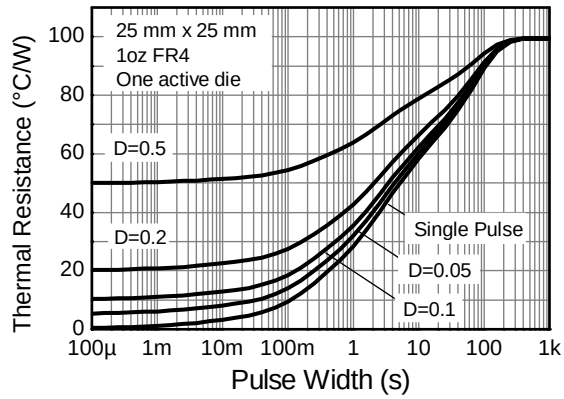
Thermal Characteristics



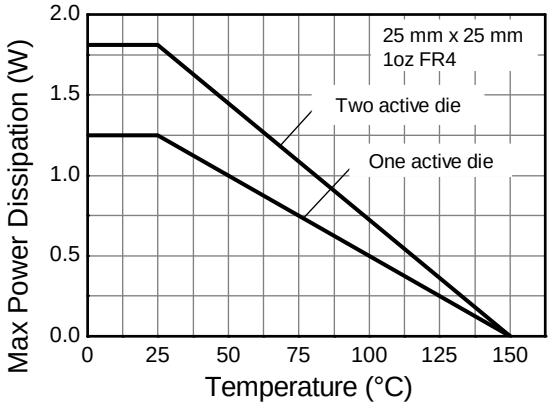
N-channel Safe Operating Area



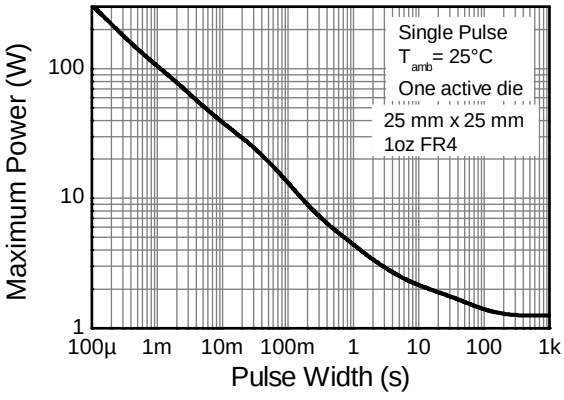
P-channel Safe Operating Area



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 8)	$R_{DS\ (ON)}$	-	13	20	mΩ	V_{GS} = 4.5V, I_D = 7A
			18	28		V_{GS} = 2.5V, I_D = 3A
Forward Transfer Admittance (Notes 8 & 9)	$\|Y_{fs}\|$	-	16	-	S	V_{DS} = 5V, I_D = 9.4A
Diode Forward Voltage (Note 8)	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 9)						
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 10)	Q_g	-	6.0	-	nC	V_{GS} = 2.5V; V_{DS} = 10V, I_D = 9.4A
Total Gate Charge (Note 10)	Q_g	-	11.6	-		V_{GS} = 4.5V; V_{DS} = 10V, I_D = 9.4A
Gate-Source Charge (Note 10)	Q_{gs}	-	2.7	-		
Gate-Drain Charge (Note 10)	Q_{gd}	-	3.4	-		
Turn-On Delay Time (Note 10)	$t_{D(on)}$	-	11.67	-		
Turn-On Rise Time (Note 10)	t_r	-	12.49	-	ns	V_{GS} = 4.5V, V_{DS} = 10V, R_G = 6Ω , I_D = 1A
Turn-Off Delay Time (Note 10)	$t_{D(off)}$	-	35.89	-		
Turn-Off Fall Time (Note 10)	t_f	-	12.33	-		

Notes: 8. Measured under pulsed conditions. Pulse width ≤ 300µs; duty cycle ≤ 2%
9. For design aid only, not subject to production testing.
10. Switching characteristics are independent of operating junction temperatures.

Typical Characteristics – Q1 N-CHANNEL

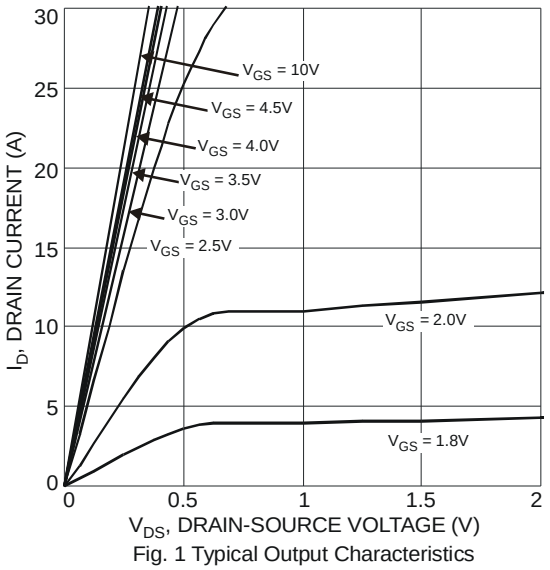


Fig. 1 Typical Output Characteristics

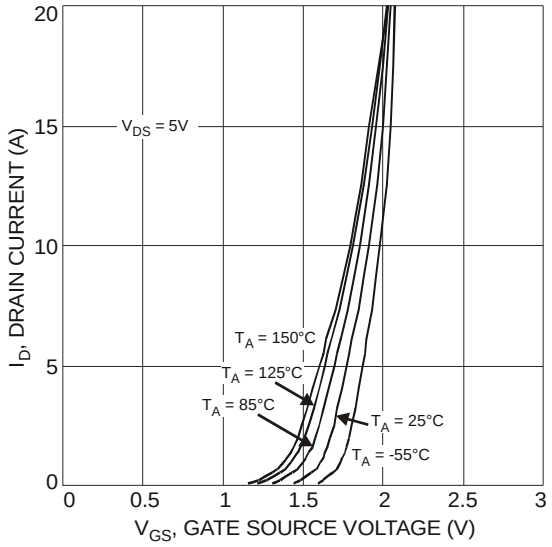


Fig. 2 Typical Transfer Characteristics

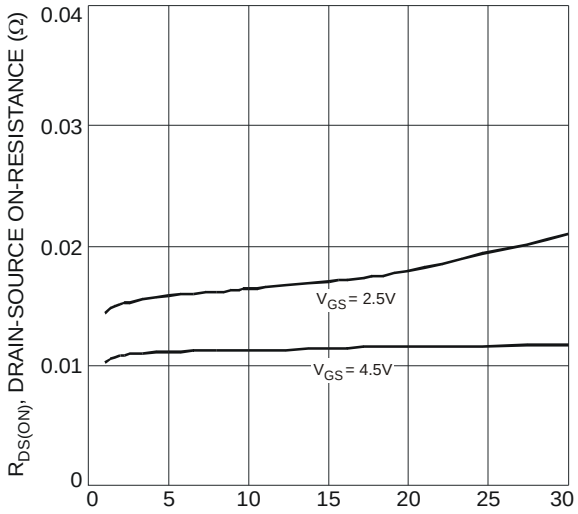


Fig. 3 Typical On-Resistance
vs. Drain Current and Gate Voltage

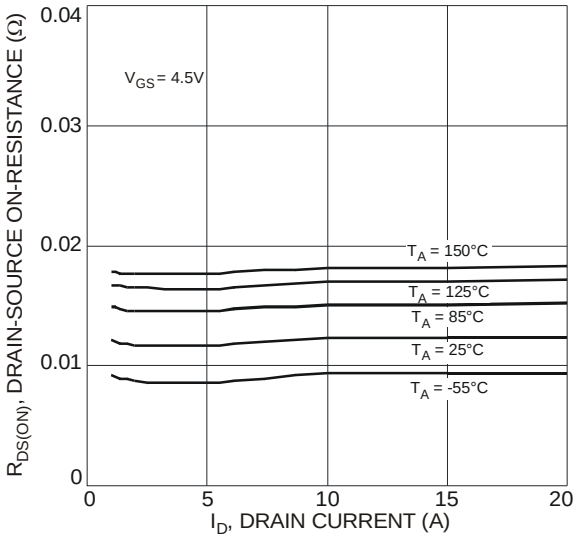


Fig. 4 Typical Drain-Source On-Resistance
vs. Drain Current and Temperature

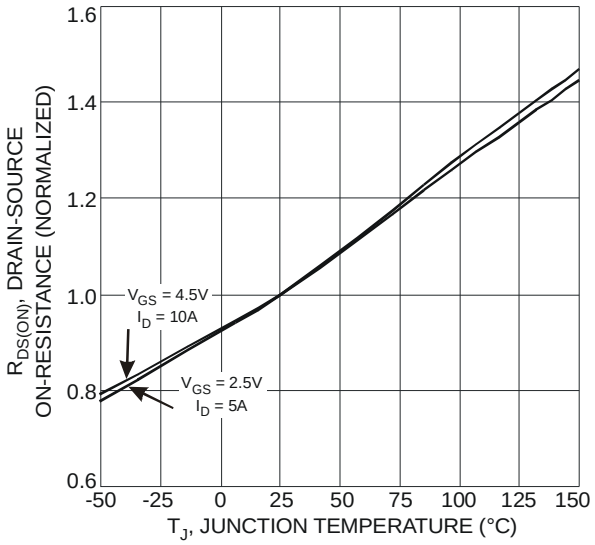


Fig. 5 On-Resistance Variation with Temperature

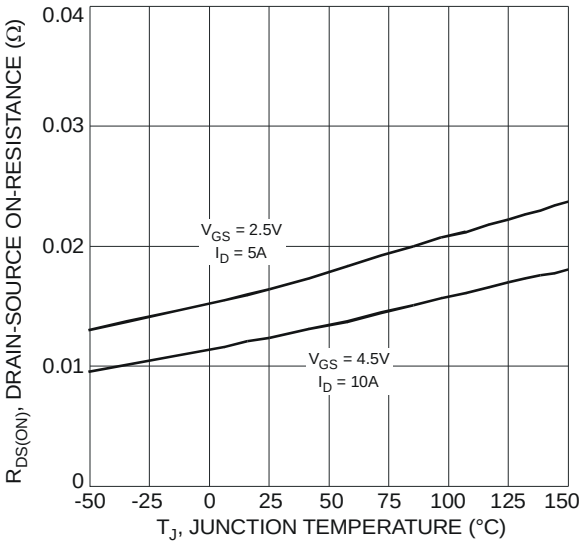


Fig. 6 On-Resistance Variation with Temperature

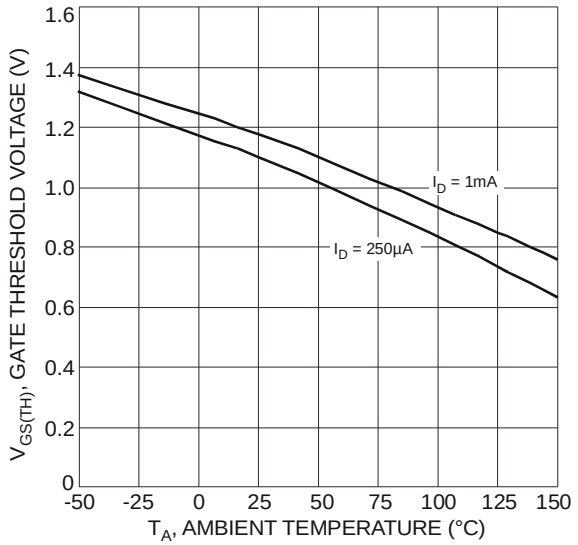


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

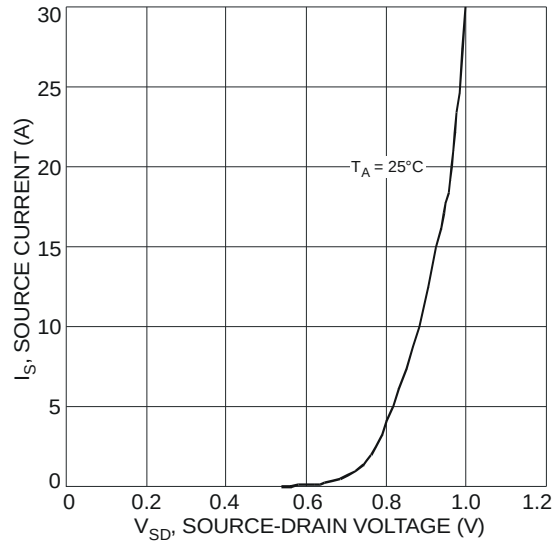


Fig. 8 Diode Forward Voltage vs. Current

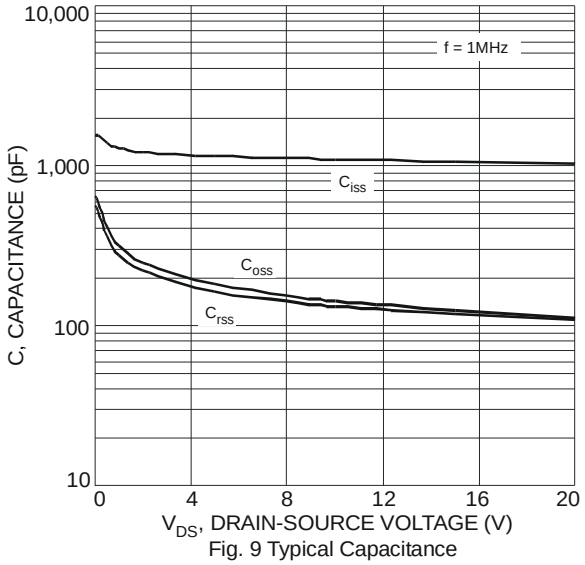


Fig. 9 Typical Capacitance

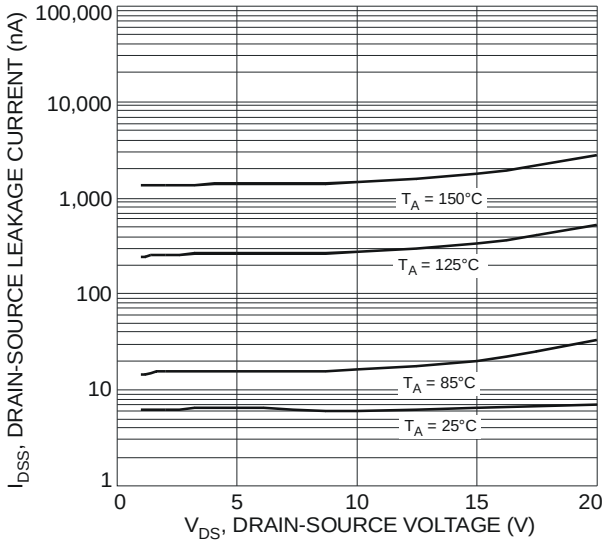


Fig. 10 Typical Drain-Source Leakage Current vs. Drain-Source Voltage

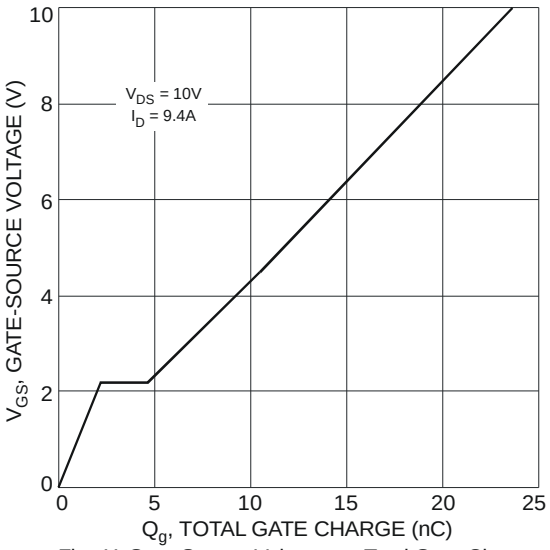


Fig. 11 Gate-Source Voltage vs. Total Gate Charge

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 7)						
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 11)	$R_{DS\ (ON)}$	-	26	33	mΩ	V_{GS} = -4.5V, I_D = -6A
			33	45		V_{GS} = -2.5V, I_D = -3A
Forward Transfer Admittance (Note 11 & 12)	$\|Y_{fs}\|$	-	14	-	S	V_{DS} = -5V, I_D = -4A
Diode Forward Voltage (Note 11)	V_{SD}	-	-0.7	-1.0	V	V_{GS} = 0V, I_S = -1A
Continuous Source Current	I_S	-	-	-1.8	A	-
DYNAMIC CHARACTERISTICS (Note 12)						
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 13)	Q_g	-	8.0	-	nC	V_{GS} = -2.5V; V_{DS} = -10V, I_D = -4A
Total Gate Charge (Note 13)	Q_g	-	15.4	-		V_{GS} = -4.5V; V_{DS} = -10V, I_D = -4A
Gate-Source Charge (Note 13)	Q_{gs}	-	2.5	-		V_{GS} = -4.5V; V_{DS} = -10V, I_D = -4A
Gate-Drain Charge (Note 13)	Q_{gd}	-	3.3	-		V_{GS} = -4.5V; V_{DS} = -10V, I_D = -4A
Turn-On Delay Time (Note 13)	$t_{D(on)}$	-	16.8	-	ns	V_{GS} = -4.5V, V_{DS} = -10V, R_G = 6Ω , I_D = -1A
Turn-On Rise Time (Note 13)	t_r	-	12.4	-		
Turn-Off Delay Time (Note 13)	$t_{D(off)}$	-	94.1	-		
Turn-Off Fall Time (Note 13)	t_f	-	42.4	-		

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 – Q2 P-CHANNEL

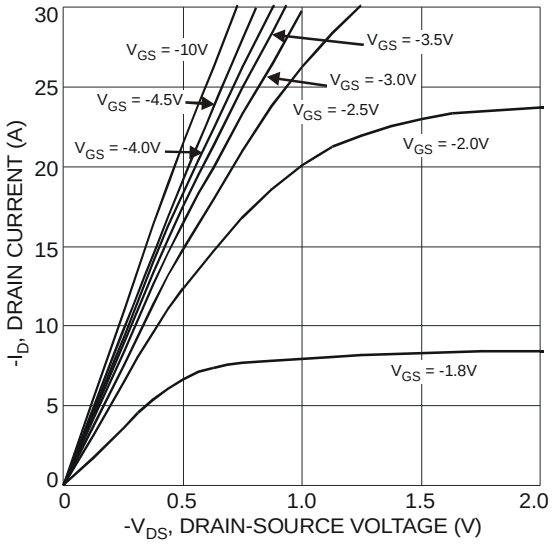


Fig. 12 Typical Output Characteristics

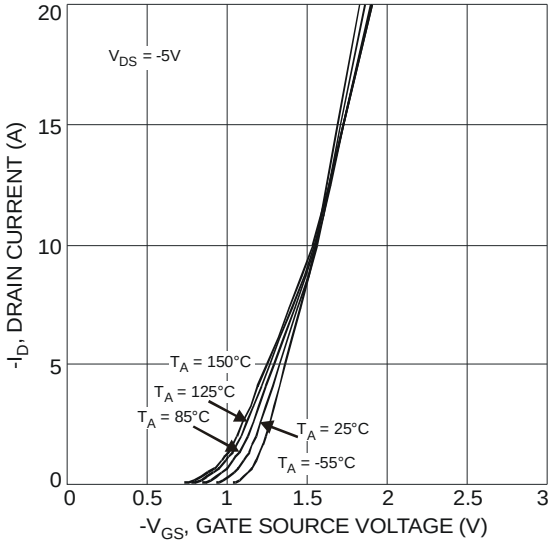


Fig. 13 Typical Transfer Characteristics

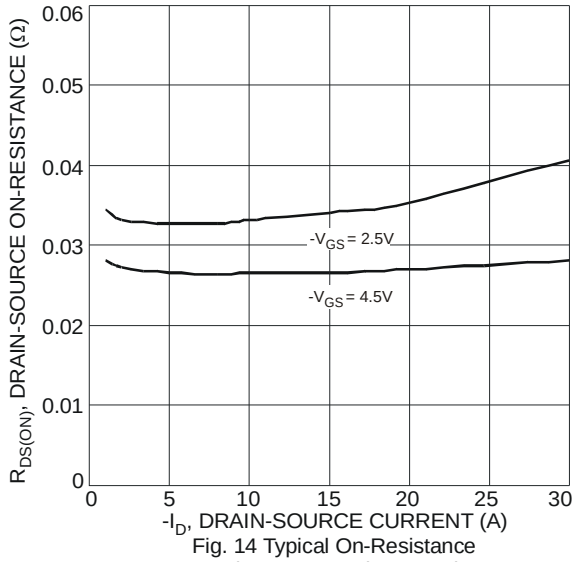


Fig. 14 Typical On-Resistance
vs. Drain Current and Gate Voltage

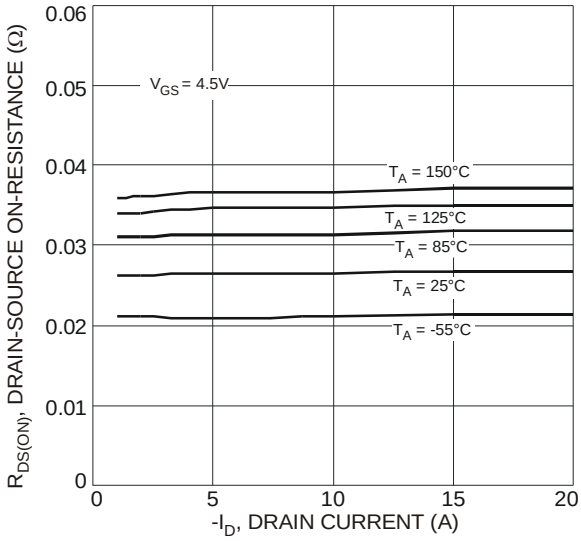


Fig. 15 Typical Drain-Source On-Resistance
vs. Drain Current and Temperature

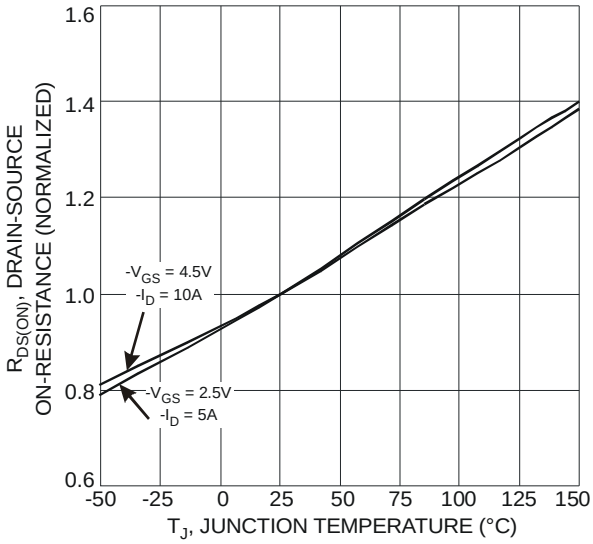


Fig. 16 On-Resistance Variation with Temperature

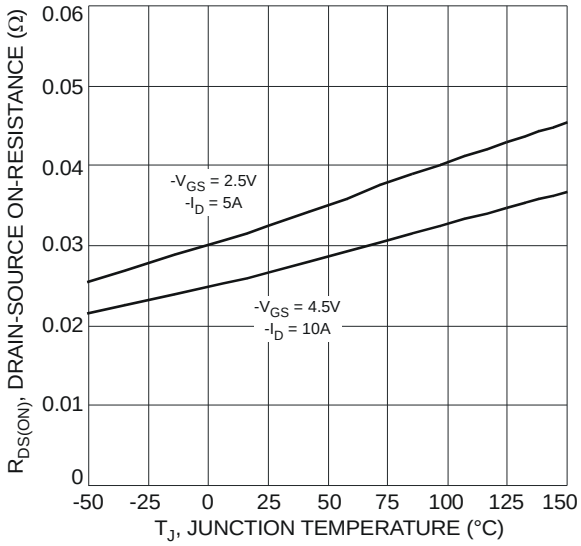


Fig. 17 On-Resistance Variation with Temperature

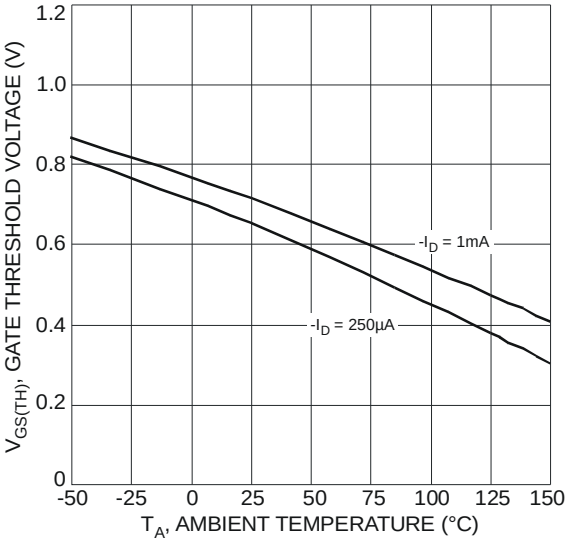


Fig. 18 Gate Threshold Variation vs. Ambient Temperature

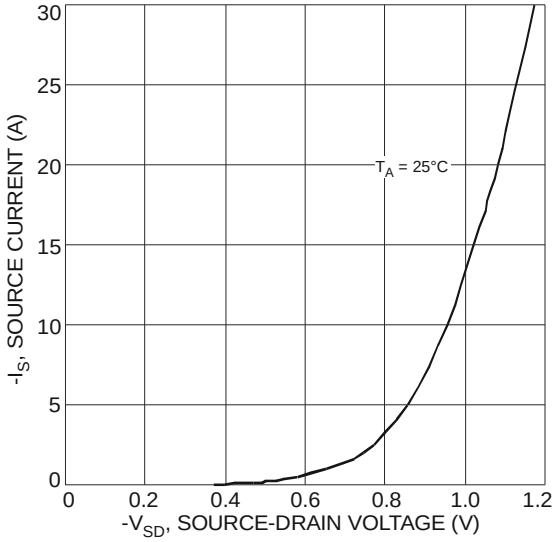


Fig. 19 Diode Forward Voltage vs. Current

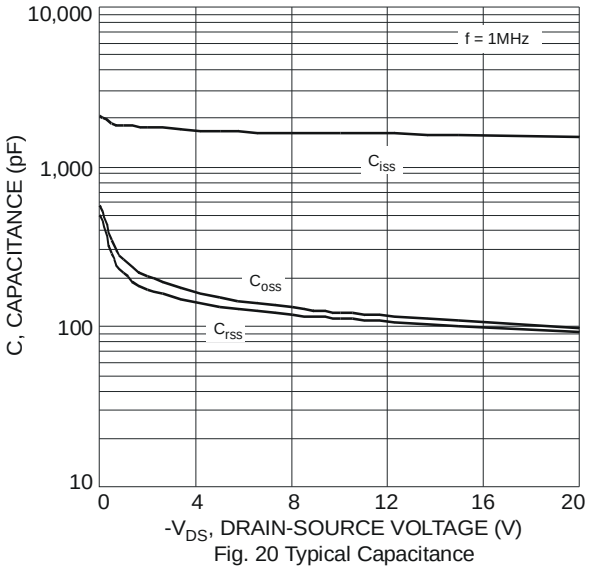


Fig. 20 Typical Capacitance

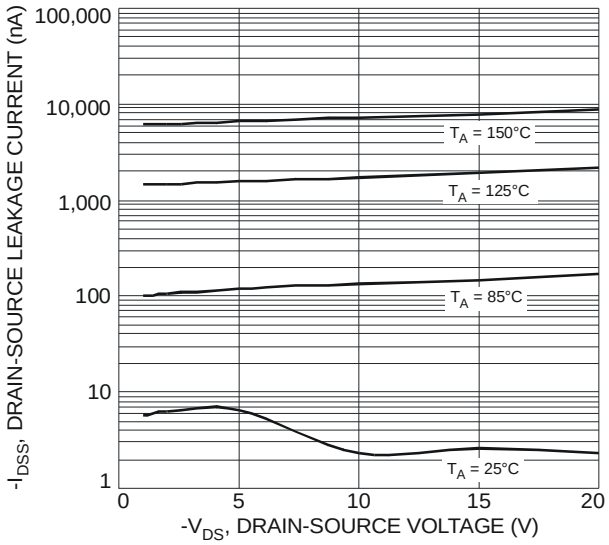


Fig. 21 Typical Drain-Source Leakage Current vs. Drain-Source Voltage

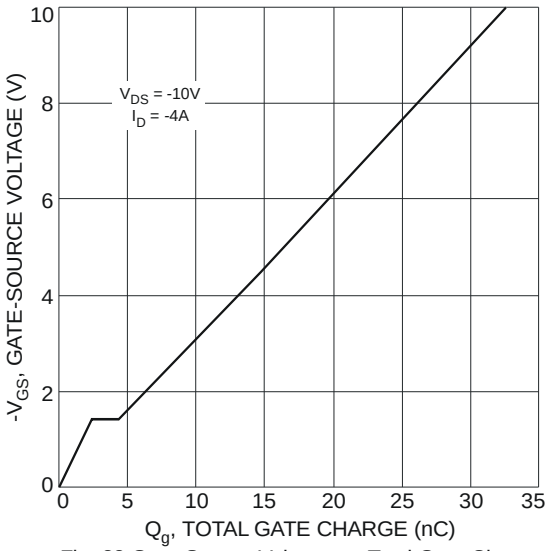
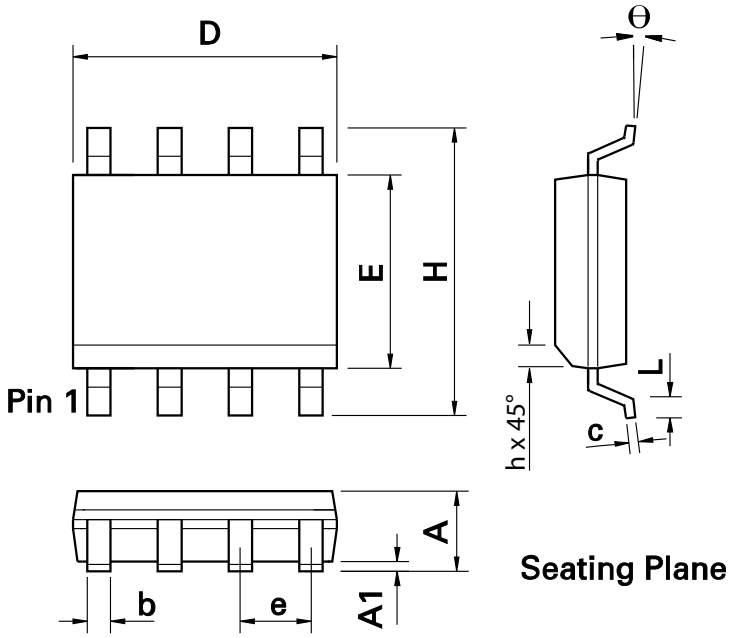


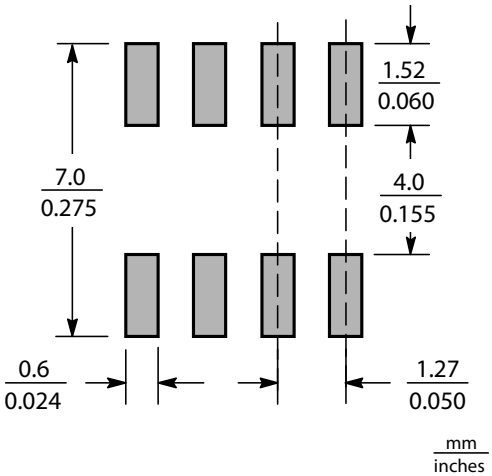
Fig. 22 Gate-Source Voltage vs. Total Gate Charge

Package Outline Dimensions



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.053	0.069	1.35	1.75	e	0.050 BSC		1.27 BSC	
A1	0.004	0.010	0.10	0.25	b	0.013	0.020	0.33	0.51
D	0.189	0.197	4.80	5.00	c	0.008	0.010	0.19	0.25
H	0.228	0.244	5.80	6.20	θ	0°	8°	0°	8°
E	0.150	0.157	3.80	4.00	h	0.010	0.020	0.25	0.50
L	0.016	0.050	0.40	1.27	-	-	-	-	-

Suggested Pad Layout



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