



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

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)**

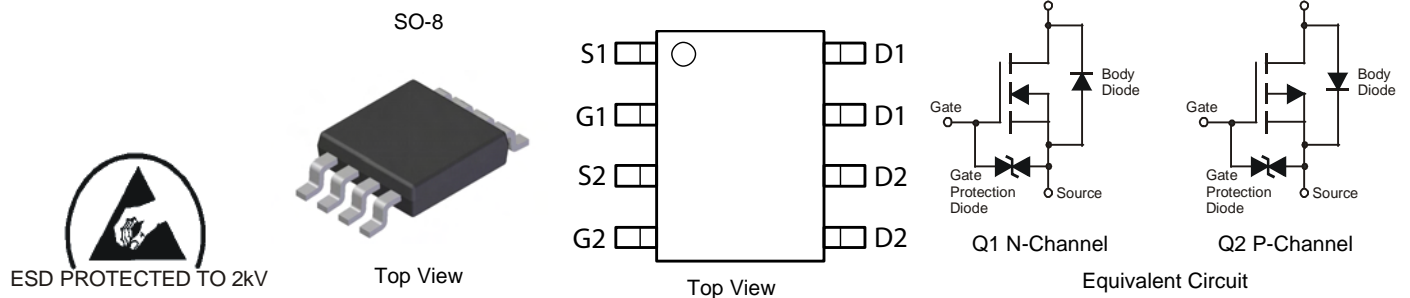
Mechanical Data

- 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)

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

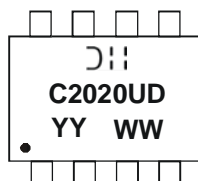


Ordering Information (Note 1)

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 @ $T_A = 25^\circ\text{C}$ unless otherwise specified

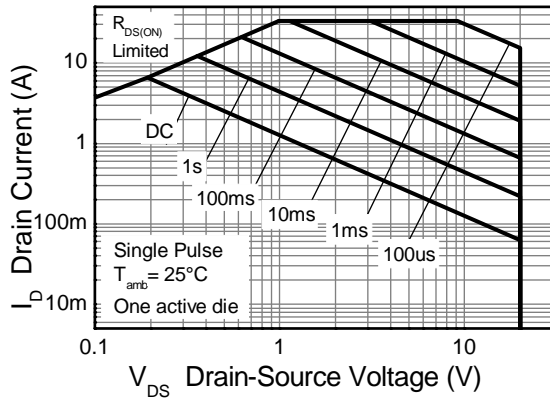
Characteristic			Symbol	N-Channel - Q1	P-Channel - Q2	Units
Drain-Source Voltage			V_{DSS}	20	-20	V
Gate-Source Voltage			V_{GSS}	± 10	± 10	
Continuous Drain Current	$V_{GS} = 4.5\text{V}$	(Notes 3 & 5)	I_D	8.5	-6.8	A
		$T_A = 70^\circ\text{C}$ (Notes 3 & 5)		6.8	-5.4	
		(Notes 2 & 5)		6.5	-5.2	
		(Notes 2 & 6)		7.8	-6.3	
Pulsed Drain Current	$V_{GS} = 4.5\text{V}$	(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 @ $T_A = 25^\circ\text{C}$ unless otherwise specified

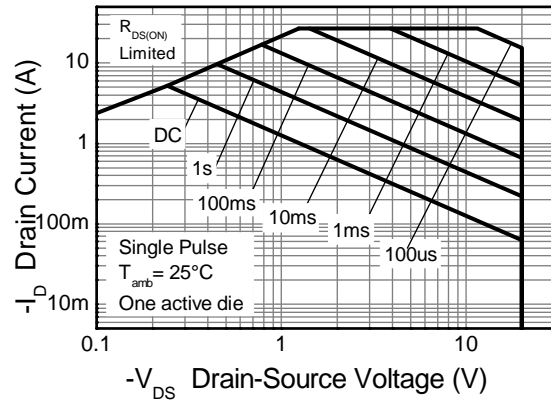
Characteristic		Symbol	N-Channel - Q1	P-Channel - Q2	Unit
Power Dissipation Linear Derating Factor	(Notes 2 & 5)	P_D	1.25		W mW/ $^\circ\text{C}$
			10		
	(Notes 2 & 6)		1.8		
			14.3		
Thermal Resistance, Junction to Ambient	(Notes 3 & 5)	$R_{\theta JA}$	2.14		$^\circ\text{C}/\text{W}$
			17.2		
	(Notes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

- 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 $t \leq 10$ sec.
 4. Same as note (2), except the device is pulsed with $D = 0.02$ and pulse width 300 μs .
 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).

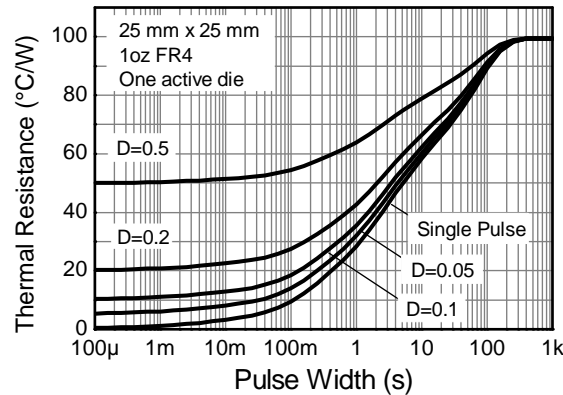
Thermal Characteristics



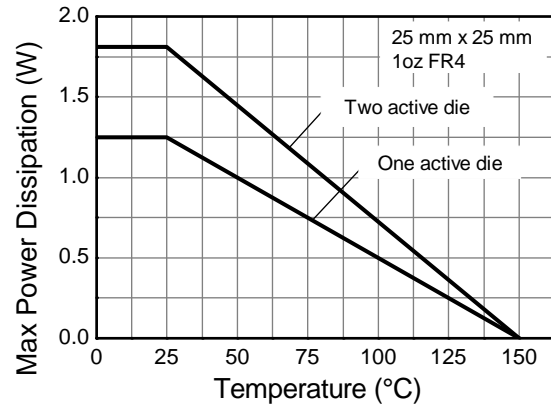
N-channel Safe Operating Area



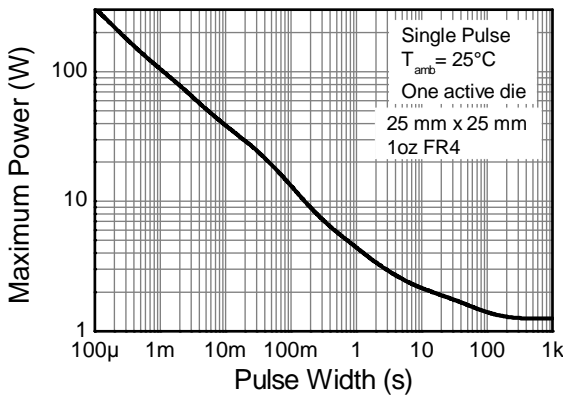
P-channel Safe Operating Area



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 _{DS} = 10V I _D = 9.4A
Total Gate Charge (Note 10)	Q _g	-	11.6	-		
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	-	ns	V _{GS} = 4.5V, V _{DS} = 10V, R _G = 6Ω, I _D = 1A
Turn-On Rise Time (Note 10)	t _r	-	12.49	-		
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

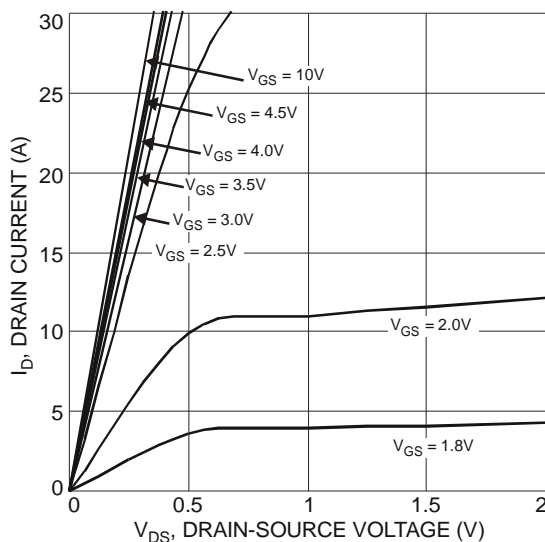


Fig. 1 Typical Output Characteristics

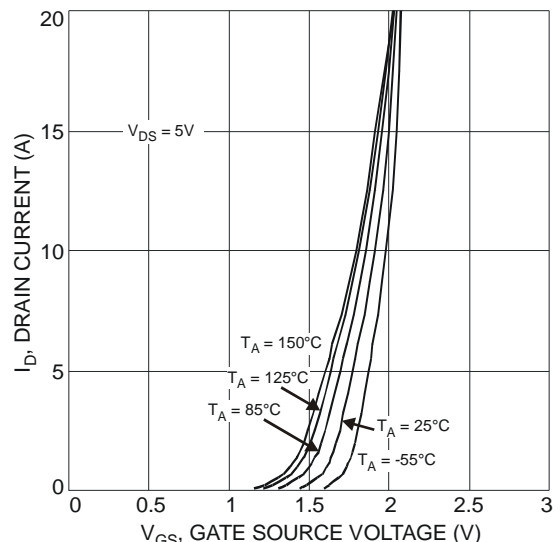


Fig. 2 Typical Transfer Characteristics

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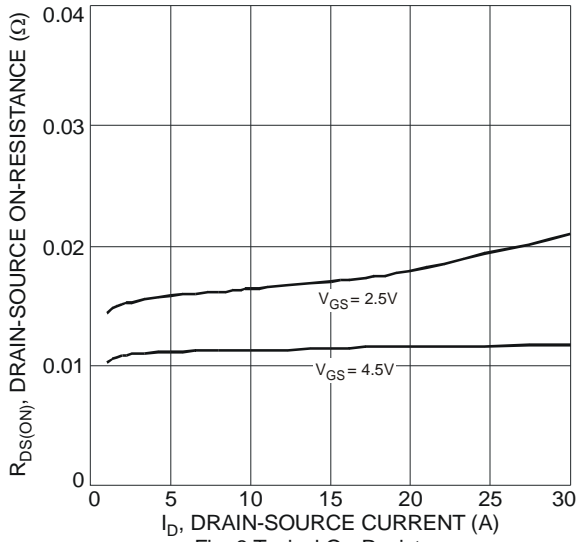


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

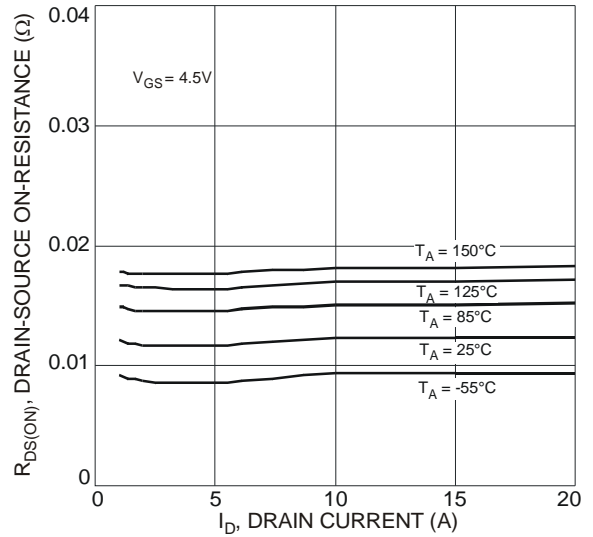


Fig. 4 Typical Drain-Source On-Resistance vs. Drain Current and Temperature

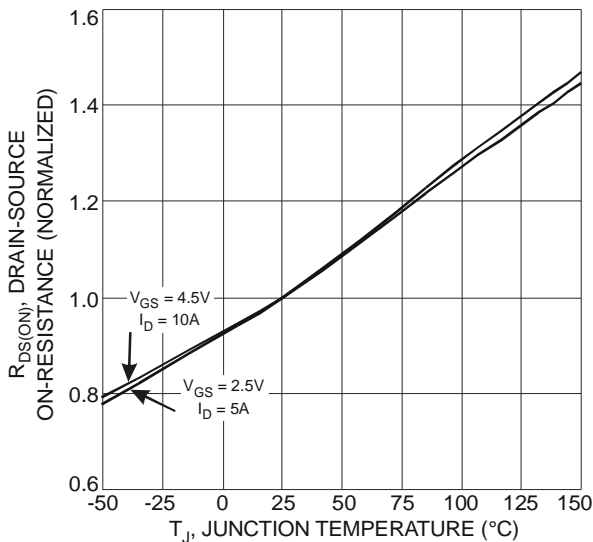


Fig. 5 On-Resistance Variation with Temperature

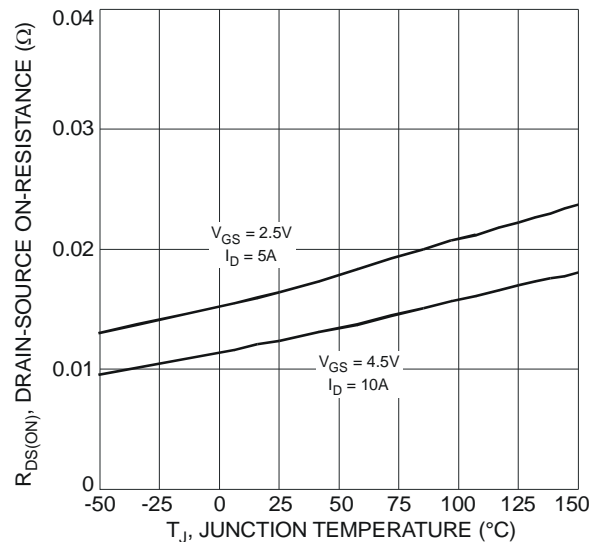


Fig. 6 On-Resistance Variation with Temperature

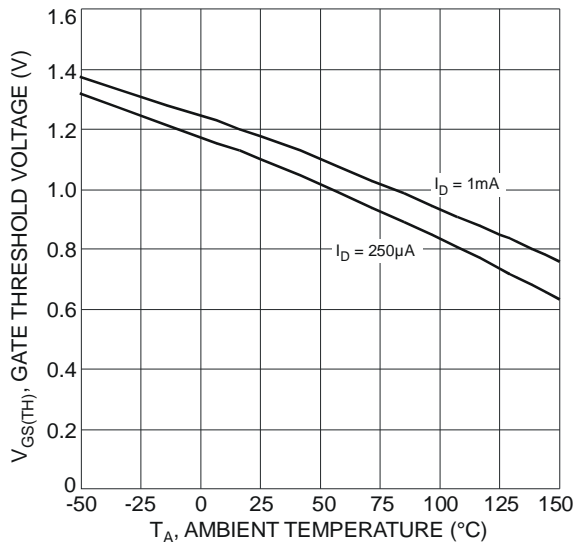


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

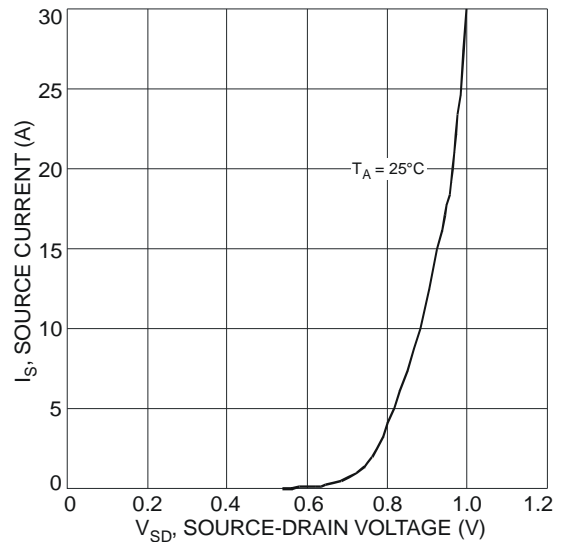
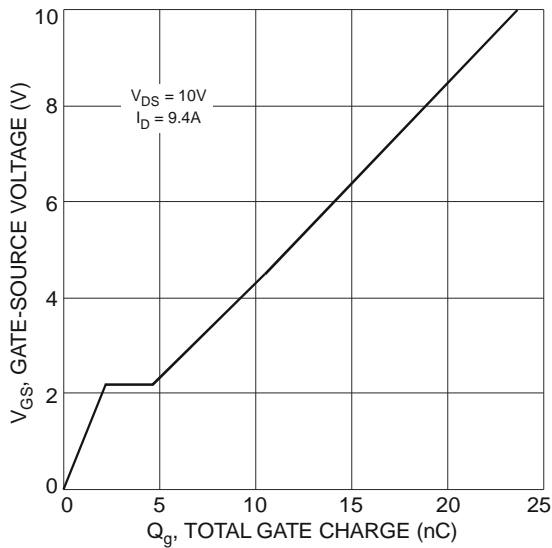
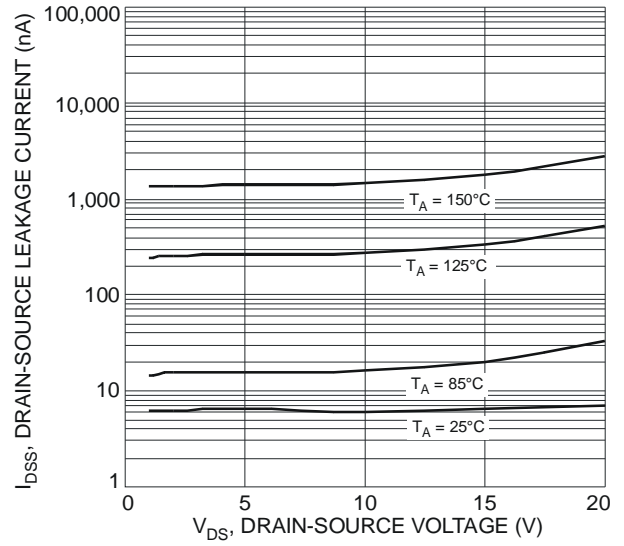
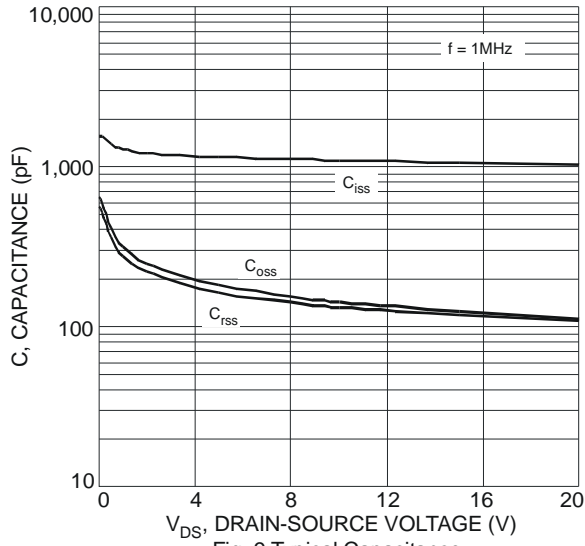


Fig. 8 Diode Forward Voltage vs. Current

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Electrical Characteristics – Q2 P-CHANNEL @ $T_A = 25^\circ\text{C}$ unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	-20	-	-	V	$V_{GS} = 0V, I_D = -250\mu A$
Zero Gate Voltage Drain Current	I_{DSS}	-	-	-1.0	μA	$V_{DS} = -20V, V_{GS} = 0V$
Gate-Source Leakage	I_{GSS}	-	-	± 10	μA	$V_{GS} = \pm 8V, V_{DS} = 0V$
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{GS(th)}$	-0.4	-0.7	-1.0	V	$V_{DS} = V_{GS}, I_D = -250\mu A$
Static Drain-Source On-Resistance (Note 11)	$R_{DS(on)}$	-	26	33	m Ω	$V_{GS} = -4.5V, I_D = -6A$
			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_{g1}	-	15.4	-		
Gate-Source Charge (Note 13)	Q_{gs}	-	2.5	-		
Gate-Drain Charge (Note 13)	Q_{gd}	-	3.3	-		
Turn-On Delay Time (Note 13)	$t_{D(on)}$	-	16.8	-	ns	$V_{GS} = -4.5V, V_{DS} = -10V,$ $R_G = 6\Omega, I_D = -1A$
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 $\leq 300\mu s$; duty cycle $\leq 2\%$
 12. For design aid only, not subject to production testing.
 13. Switching characteristics are independent of operating junction temperatures.

Typical Characteristics – Q2 P-CHANNEL

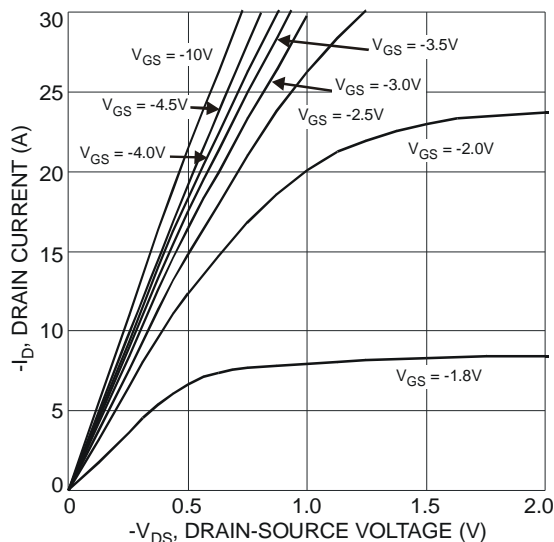


Fig. 12 Typical Output Characteristics

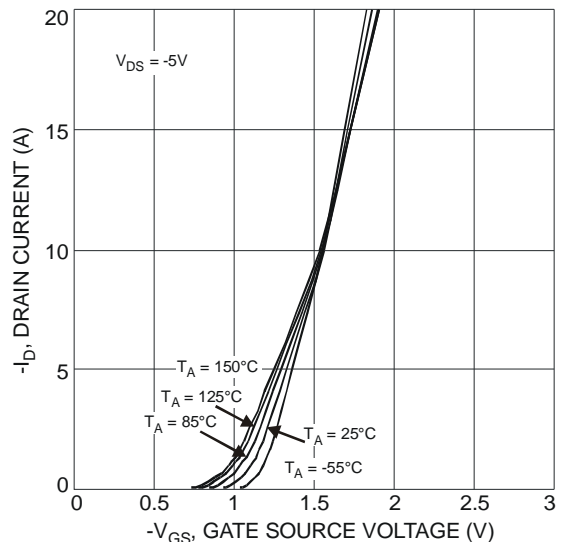


Fig. 13 Typical Transfer Characteristics

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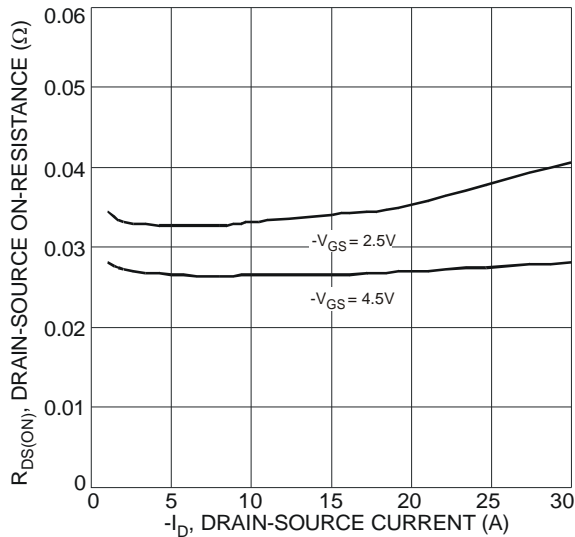


Fig. 14 Typical On-Resistance vs. Drain Current and Gate Voltage

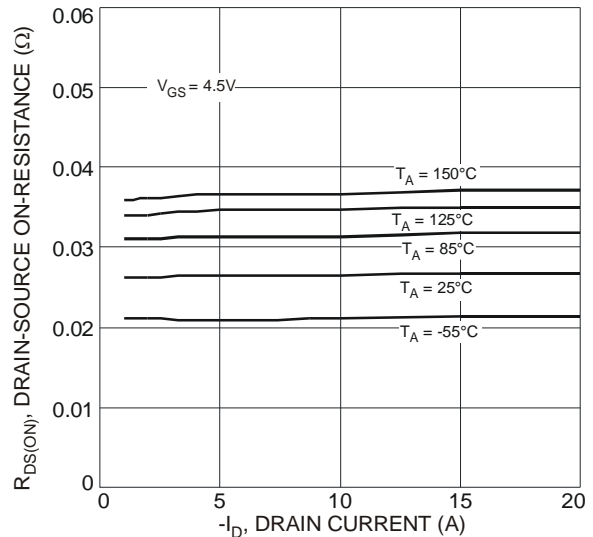


Fig. 15 Typical Drain-Source On-Resistance vs. Drain Current and Temperature

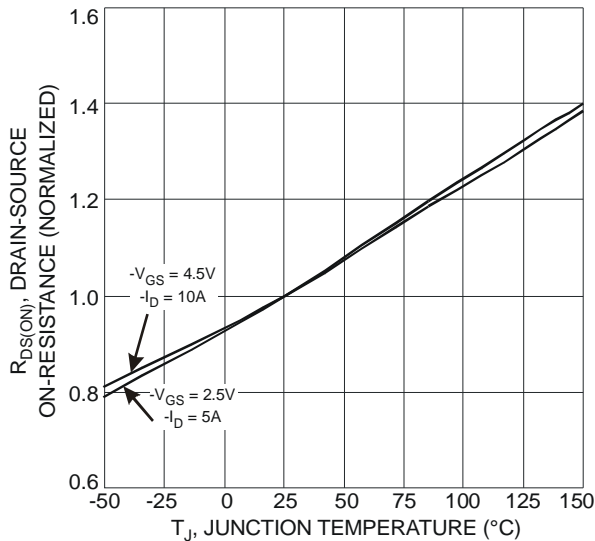


Fig. 16 On-Resistance Variation with Temperature

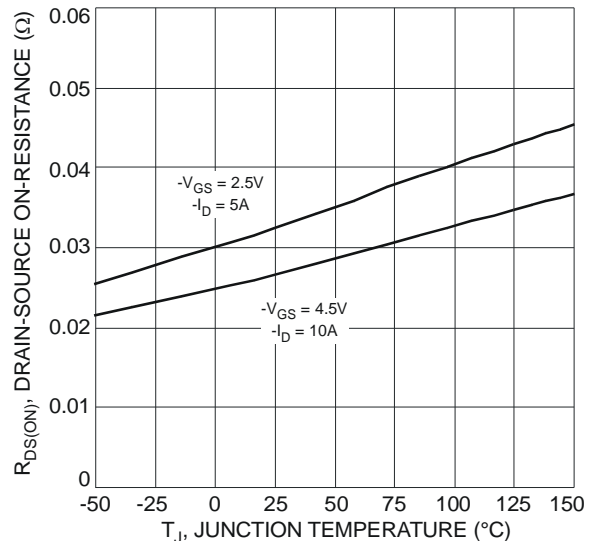


Fig. 17 On-Resistance Variation with Temperature

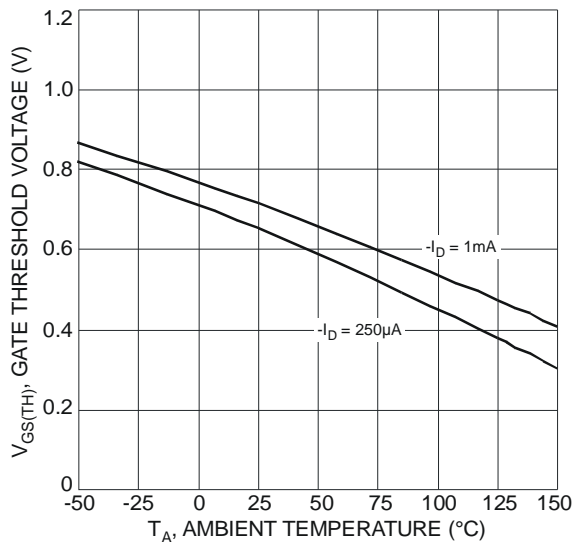


Fig. 18 Gate Threshold Variation vs. Ambient Temperature

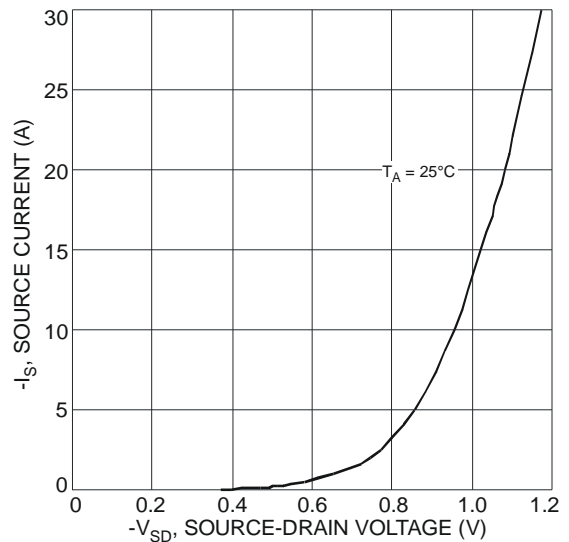
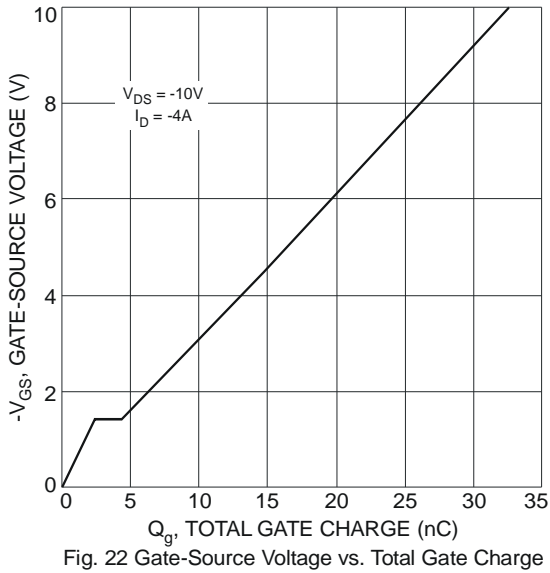
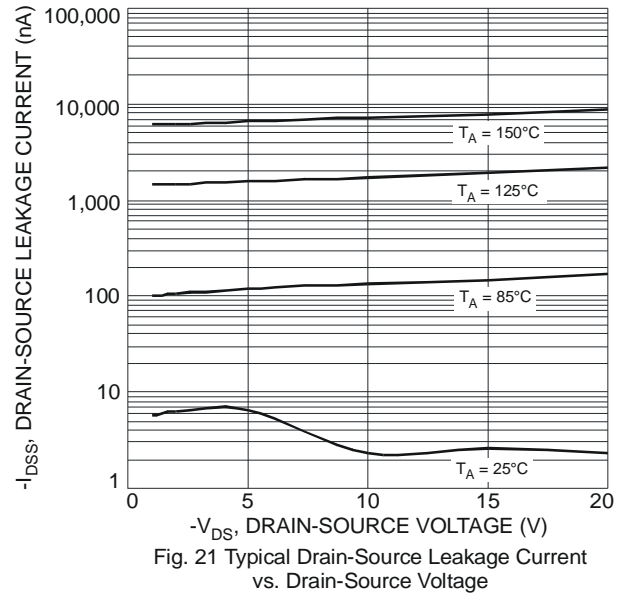
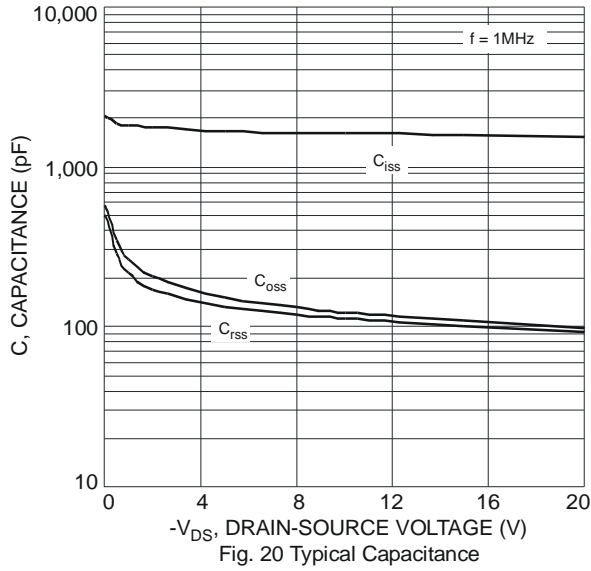
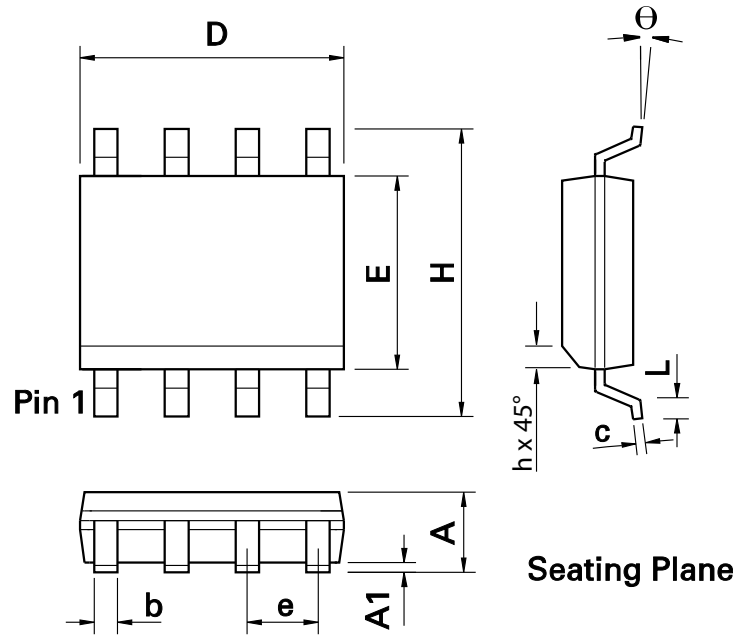


Fig. 19 Diode Forward Voltage vs. Current

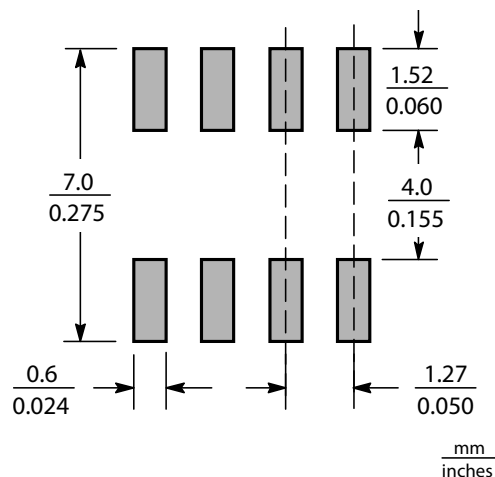


Package Outline Dimensions



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	theta	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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