

**40V COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET**

**Product Summary**

Device	V <sub>(BR)DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub> max (A) T <sub>A</sub> = 25°C (Notes 3 & 5)
Q1	40V	25mΩ @ V <sub>GS</sub> = 10V	7.5
		40mΩ @ V <sub>GS</sub> = 4.5V	6.2
Q2	-40V	25mΩ @ V <sub>GS</sub> = -10V	-7.3
		45mΩ @ V <sub>GS</sub> = -4.5V	-5.7

**Description and Applications**

This MOSFET has been designed to ensure that R<sub>DS(on)</sub> of N and P channel FET are matched to minimize losses in both arms of the bridge. The DMC4040SSD is optimized for use in 3 phases brushless DC motor circuits (BLDC), CCFL backlighting.

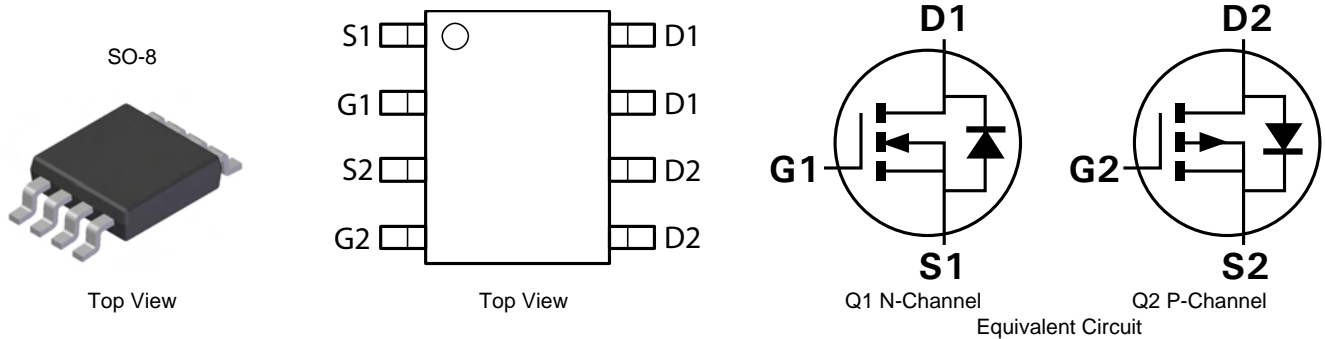
- 3 phases BLDC motor
- CCFL backlighting

**Features and Benefits**

- Matched N & P R<sub>DS(on)</sub> - Minimizes power losses
- Fast switching – Minimizes switching losses
- Dual device – Reduces PCB area
- "Green" component and RoHS compliant (Note 1)
- Qualified to AEC-Q101 Standards for High Reliability

**Mechanical Data**

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

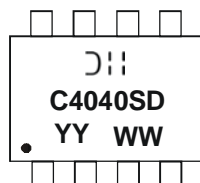


**Ordering Information** (Note 1)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
DMC4040SSD-13	C4040SD	13	12	2,500

Note: 1. Diodes, Inc. defines "Green" products as those which are RoHS compliant and contain no halogens or antimony compounds; further information about Diodes Inc.'s "Green" Policy can be found on our website. For packaging details, go to our website.

**Marking Information**



⌋⌋ = Manufacturer's Marking  
 C4040SD = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 10 = 2010)  
 WW = Week (01 - 53)

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

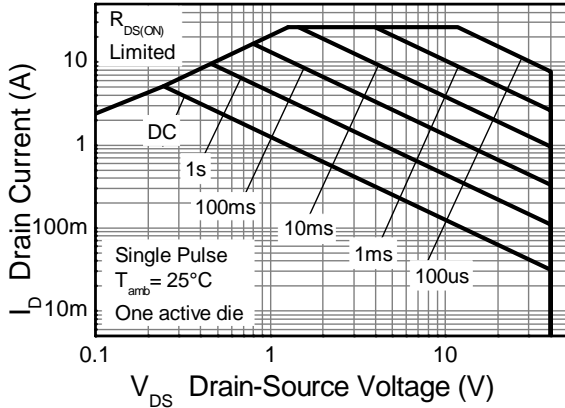
Characteristic			Symbol	N-Channel - Q1	P-Channel - Q2	Unit
Drain-Source Voltage			$V_{DSS}$	40	-40	V
Gate-Source Voltage			$V_{GSS}$	$\pm 20$	$\pm 20$	
Continuous Drain Current	$V_{GS} = 10\text{V}$	(Notes 3 & 5)	$I_D$	7.5	-7.5	A
		$T_A = 70^\circ\text{C}$ (Notes 3 & 5)		5.8	-5.8	
		(Notes 2 & 5)		5.7	-5.7	
		(Notes 2 & 6)		6.8	-6.8	
Pulsed Drain Current	$V_{GS} = 10\text{V}$	(Notes 4 & 5)	$I_{DM}$	29.0	-29.0	
Continuous Source Current (Body diode)			(Notes 3 & 5)	$I_S$	3.0	
Pulsed Source Current (Body diode)			(Notes 4 & 5)	$I_{SM}$	29.0	-29.0

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

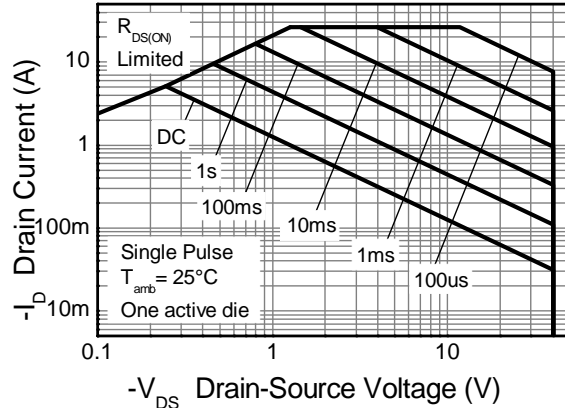
Characteristic		Symbol	N-Channel - Q1	P-Channel - Q2	Unit
Power Dissipation Linear Derating Factor	(Notes 2 & 5)	$P_D$	1.25		W mW/ $^\circ\text{C}$
			10		
	(Notes 2 & 6)		1.8		
			14.3		
Thermal Resistance, Junction to Ambient	(Notes 3 & 5)	$R_{\theta JA}$	2.14		$^\circ\text{C/W}$
			17.2		
	(Notes 2 & 5)		100		
	(Notes 2 & 6)		70		
Thermal Resistance, Junction to Lead	(Notes 3 & 5)	$R_{\theta JL}$	58		$^\circ\text{C/W}$
	(Notes 5 & 7)		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 $\mu\text{s}$ .
  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).

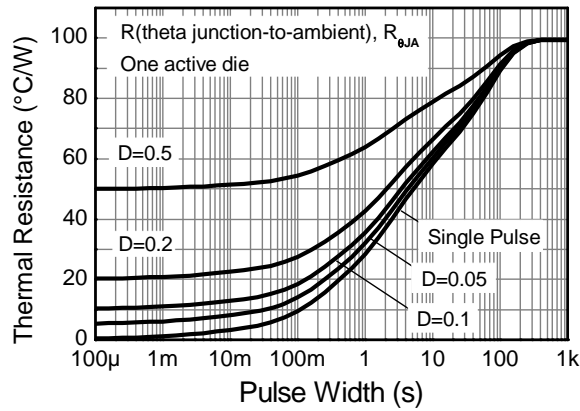
**Thermal Characteristics**



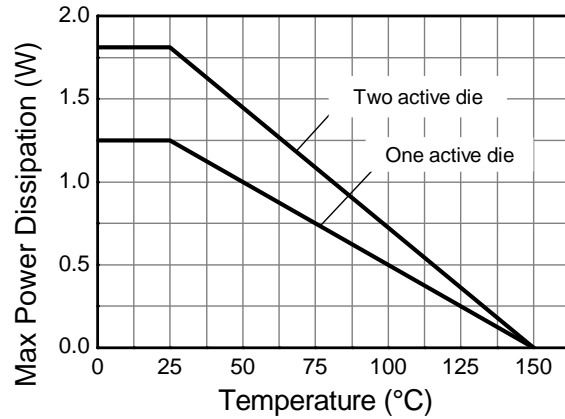
**N-channel Safe Operating Area**



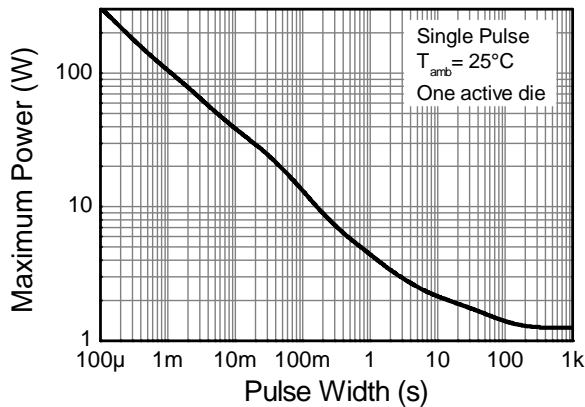
**P-channel Safe Operating Area**



**Transient Thermal Impedance**



**Derating Curve**



**Pulse Power Dissipation**

**Electrical Characteristics – Q1 N-CHANNEL** @T<sub>A</sub> = 25°C unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	40	—	—	V	I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	1.0	μA	V <sub>DS</sub> = 40V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	0.8	1.3	1.8	V	I <sub>D</sub> = 250μA, V <sub>DS</sub> = V <sub>GS</sub>
Static Drain-Source On-Resistance (Note 8)	R <sub>DS(on)</sub>	—	0.013	0.025	Ω	V <sub>GS</sub> = 10V, I <sub>D</sub> = 3A
			0.028	0.040		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 3A
Forward Transconductance (Notes 8 & 9)	g <sub>fs</sub>	—	12.6	—	S	V <sub>DS</sub> = 5V, I <sub>D</sub> = 3A
Diode Forward Voltage (Note 8)	V <sub>SD</sub>	—	0.7	1.0	V	I <sub>S</sub> = 1A, V <sub>GS</sub> = 0V
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	C <sub>iss</sub>	—	1790	—	pF	V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V f = 1MHz
Output Capacitance	C <sub>oss</sub>	—	160	—		
Reverse Transfer Capacitance	C <sub>rss</sub>	—	120	—		
Gate Resistance	R <sub>g</sub>	—	1.03	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (Note 10)	Q <sub>g</sub>	—	16.0	—	nC	V <sub>GS</sub> = 4.5V V <sub>GS</sub> = 10V V <sub>DS</sub> = 20V I <sub>D</sub> = 3A
Total Gate Charge (Note 10)	Q <sub>g</sub>	—	37.6	—		
Gate-Source Charge (Note 10)	Q <sub>gs</sub>	—	7.8	—		
Gate-Drain Charge (Note 10)	Q <sub>gd</sub>	—	6.6	—		
Turn-On Delay Time (Note 10)	t <sub>D(on)</sub>	—	8.1	—	ns	V <sub>DD</sub> = 20V, V <sub>GS</sub> = 10V I <sub>D</sub> = 3A
Turn-On Rise Time (Note 10)	t <sub>r</sub>	—	15.1	—		
Turn-Off Delay Time (Note 10)	t <sub>D(off)</sub>	—	24.3	—		
Turn-Off Fall Time (Note 10)	t <sub>f</sub>	—	5.3	—		

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**

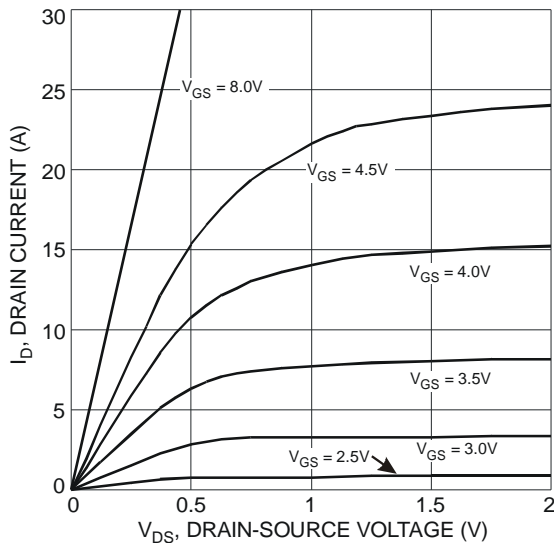


Fig. 1 Typical Output Characteristic

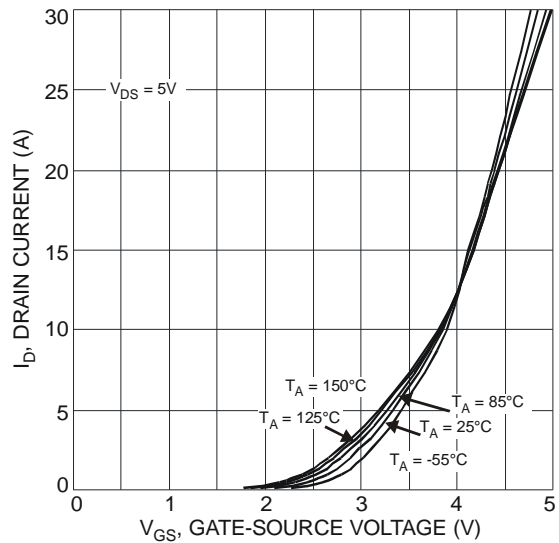


Fig. 2 Typical Transfer Characteristic

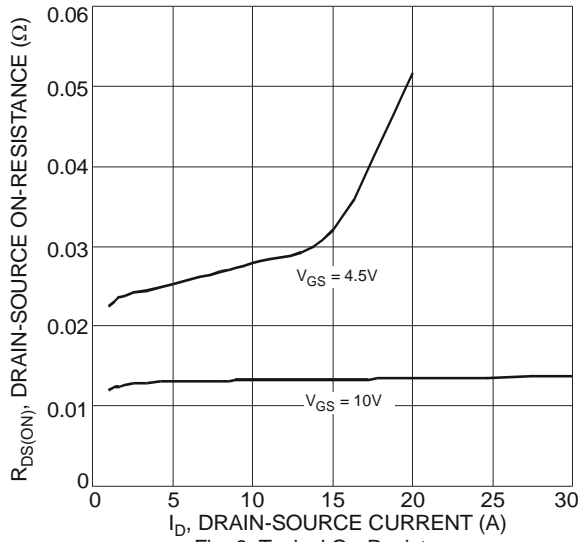


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

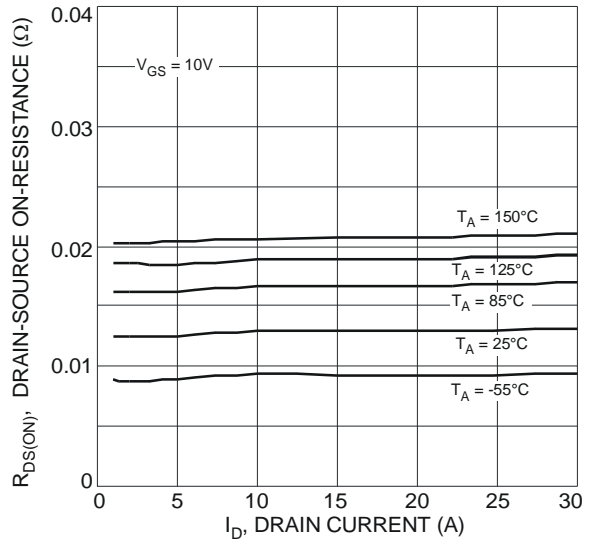


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

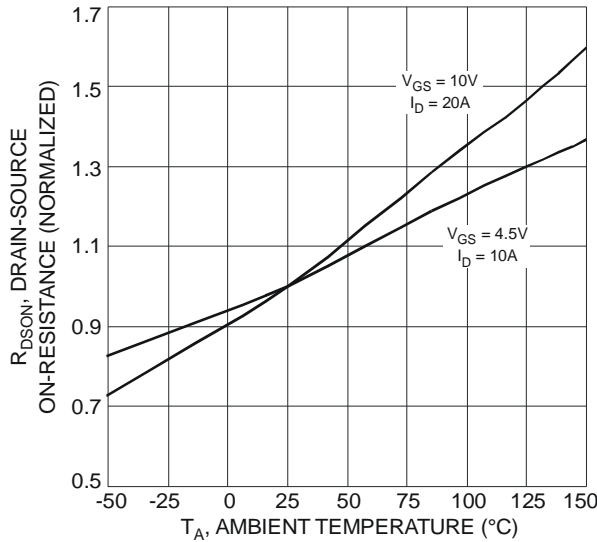


Fig. 5 On-Resistance Variation with Temperature

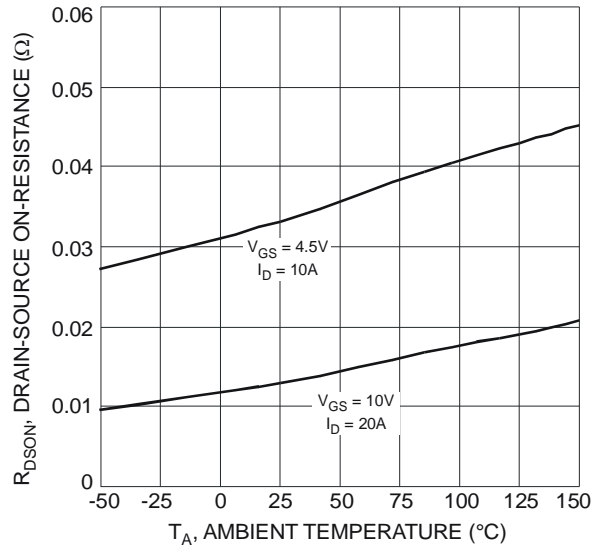


Fig. 6 On-Resistance Variation with Temperature

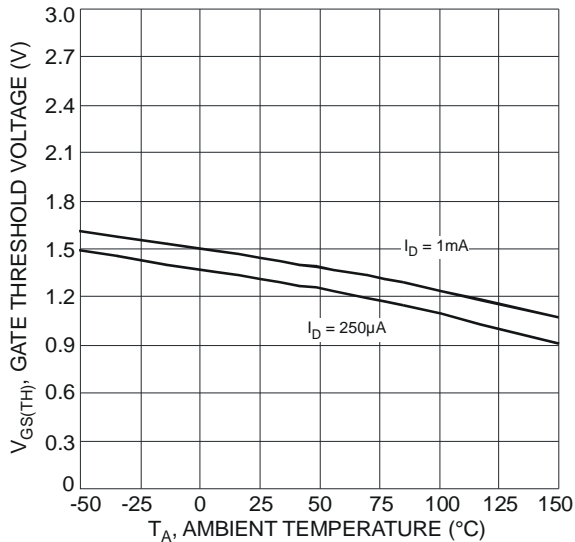


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

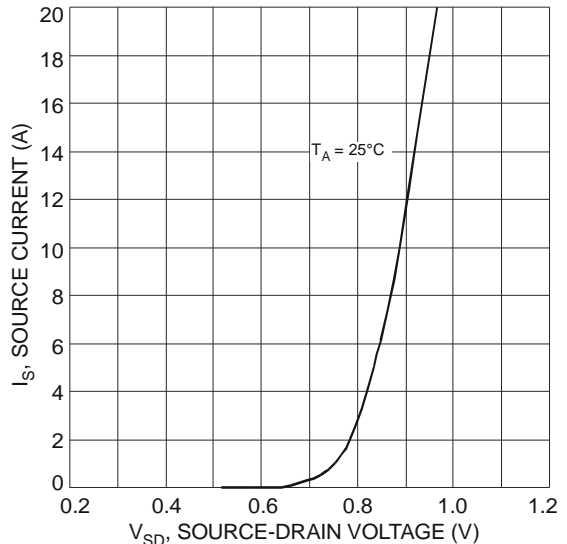


Fig. 8 Diode Forward Voltage vs. Current

**DMC4040SSD**

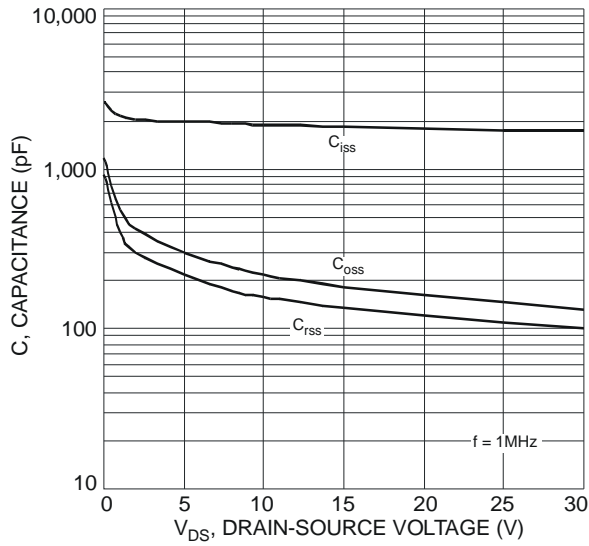


Fig. 9 Typical Total Capacitance

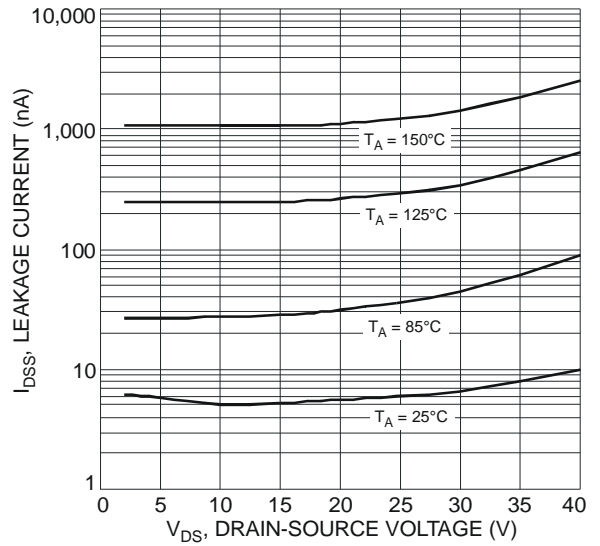


Fig. 10 Typical Leakage Current vs. Drain-Source Voltage

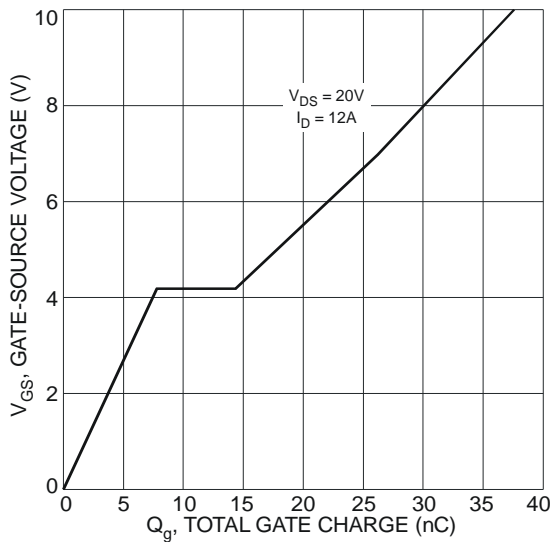


Fig. 11 Gate-Charge Characteristics

**Electrical Characteristics – Q2 P-CHANNEL** @T<sub>A</sub> = 25°C unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	-40	–	–	V	I <sub>D</sub> = -250μA, V <sub>GS</sub> = 0V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	–	–	-1.0	μA	V <sub>DS</sub> = -40V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	–	–	±100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	-0.8	-1.3	-1.8	V	I <sub>D</sub> = -250μA, V <sub>DS</sub> = V <sub>GS</sub>
Static Drain-Source On-Resistance (Note 11)	R <sub>DS(on)</sub>	–	0.018	0.025	Ω	V <sub>GS</sub> = -10V, I <sub>D</sub> = -3A
			0.030	0.045		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3A
Forward Transconductance (Notes 11 & 12)	g <sub>fs</sub>	–	16.6	–	S	V <sub>DS</sub> = -5V, I <sub>D</sub> = -3A
Diode Forward Voltage (Note 11)	V <sub>SD</sub>	–	-0.7	-1.0	V	I <sub>S</sub> = -1A, V <sub>GS</sub> = 0V
<b>DYNAMIC CHARACTERISTICS (Note 12)</b>						
Input Capacitance	C <sub>iSS</sub>	–	1643	–	pF	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V f = 1MHz
Output Capacitance	C <sub>oss</sub>	–	179	–		
Reverse Transfer Capacitance	C <sub>rSS</sub>	–	128	–		
Gate Resistance	R <sub>g</sub>	–	6.43	–	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (Note 13)	Q <sub>g</sub>	–	14.0	–	nC	V <sub>GS</sub> = -4.5V V <sub>DS</sub> = -20V I <sub>D</sub> = -3A
Total Gate Charge (Note 13)	Q <sub>g</sub>	–	33.7	–		
Gate-Source Charge (Note 13)	Q <sub>gs</sub>	–	5.5	–		
Gate-Drain Charge (Note 13)	Q <sub>gd</sub>	–	7.3	–		
Turn-On Delay Time (Note 13)	t <sub>D(on)</sub>	–	6.9	–	ns	V <sub>DD</sub> = -20V, V <sub>GS</sub> = -10V I <sub>D</sub> = -3A
Turn-On Rise Time (Note 13)	t <sub>r</sub>	–	14.7	–		
Turn-Off Delay Time (Note 13)	t <sub>D(off)</sub>	–	53.7	–		
Turn-Off Fall Time (Note 13)	t <sub>f</sub>	–	30.9	–		

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**

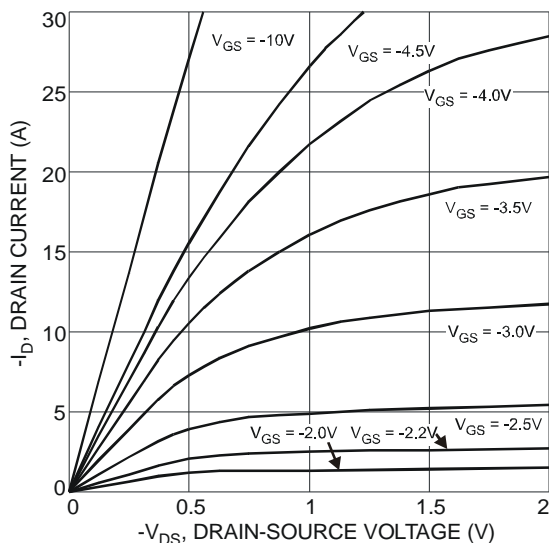


Fig. 12 Typical Output Characteristic

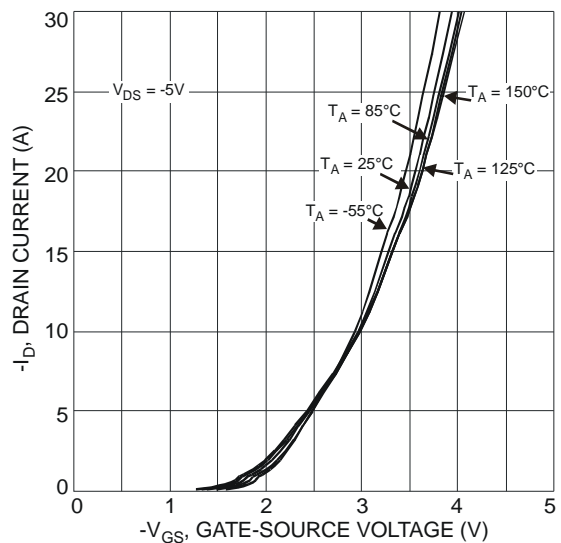


Fig. 13 Typical Transfer Characteristic

**DMC4040SSD**

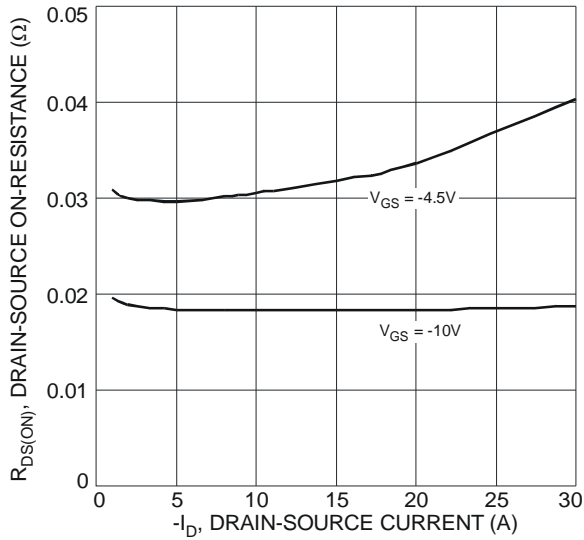


Fig. 14 Typical On-Resistance vs. Drain Current and Gate Voltage

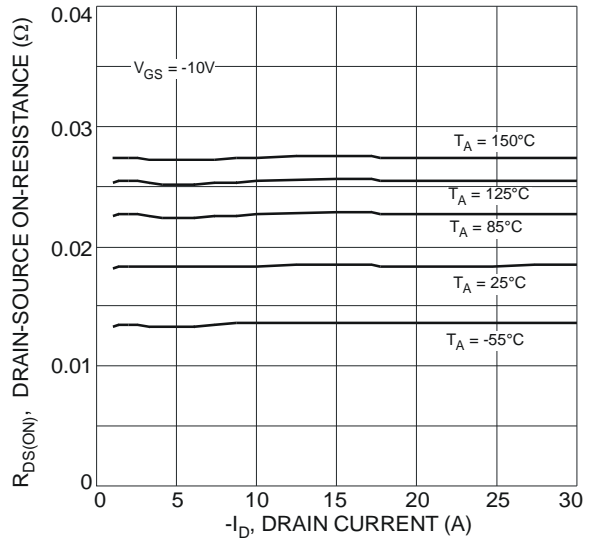


Fig. 15 Typical On-Resistance vs. Drain Current and Temperature

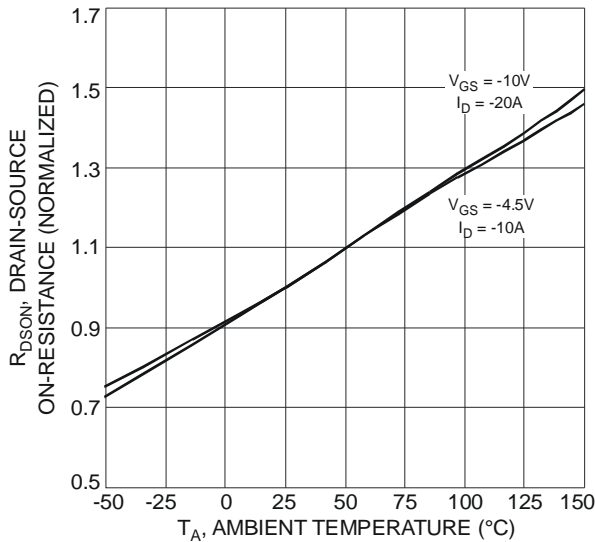


Fig. 16 On-Resistance Variation with Temperature

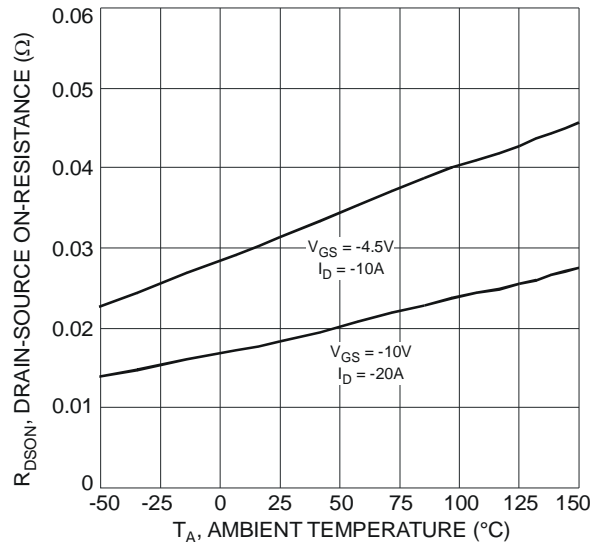


Fig. 17 On-Resistance Variation with Temperature

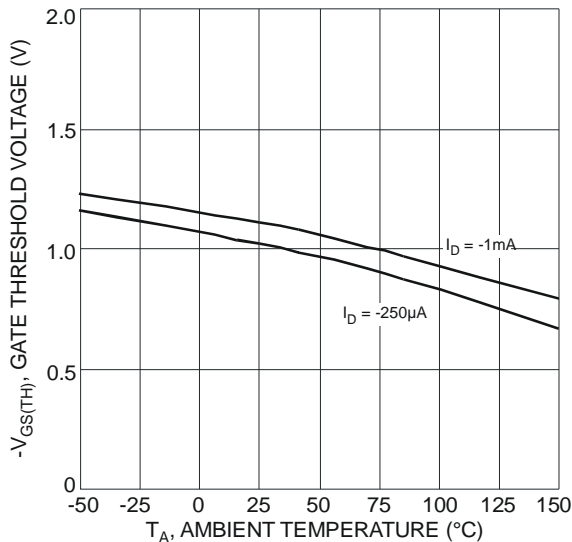


Fig. 18 Gate Threshold Variation vs. Ambient Temperature

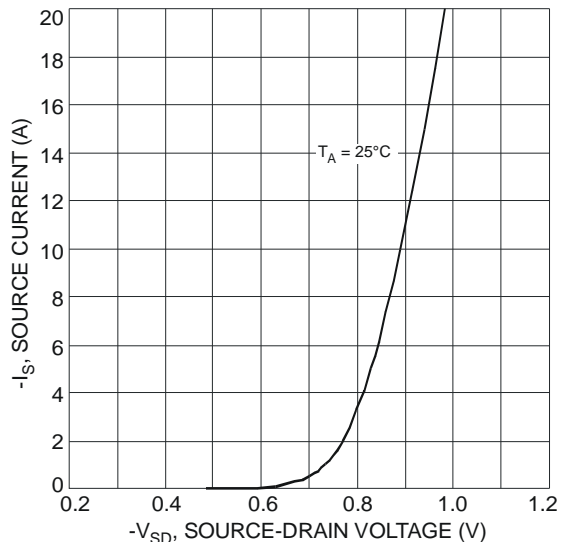


Fig. 19 Diode Forward Voltage vs. Current



**DMC4040SSD**

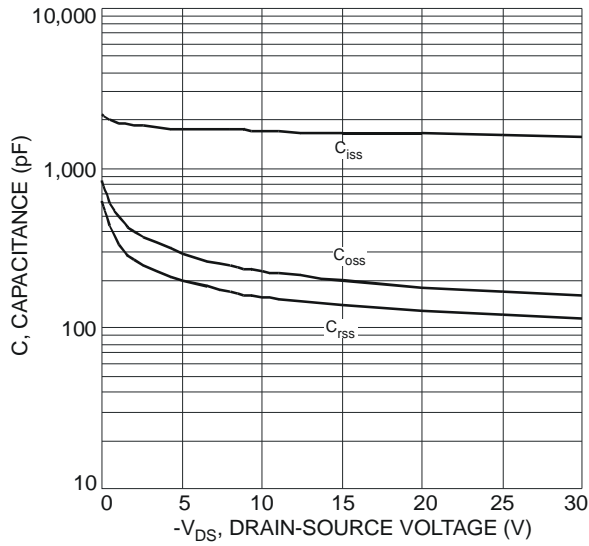


Fig. 20 Typical Total Capacitance

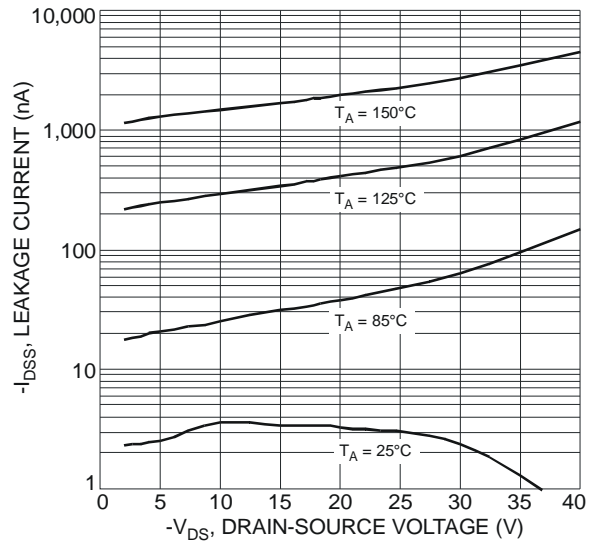


Fig. 21 Typical Leakage Current vs. Drain-Source Voltage

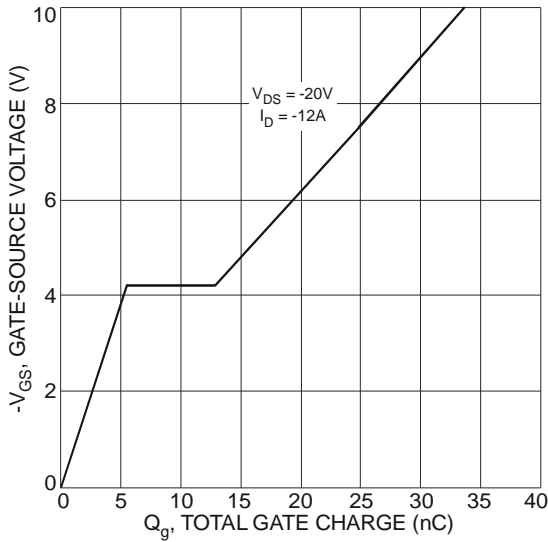
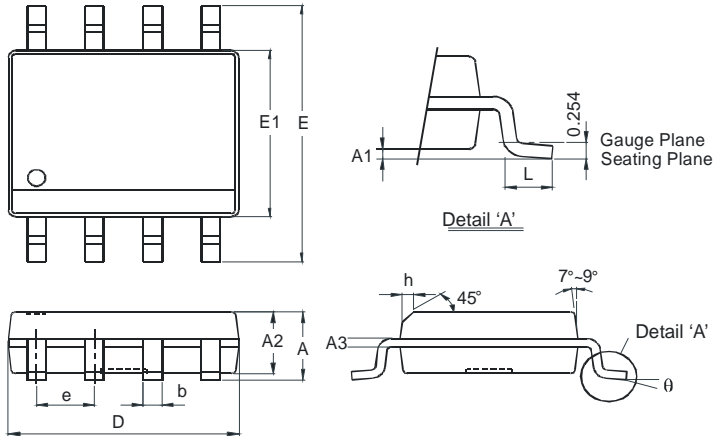


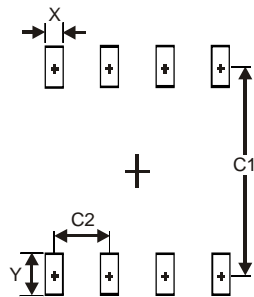
Fig. 22 Gate-Charge Characteristics

**Package Outline Dimensions**



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**



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

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