

**40V COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET**

### Product Summary

Device	BV <sub>DSS</sub>	R <sub>DS(ON)</sub> Max	I <sub>D</sub> Max T <sub>A</sub> = +25°C (Notes 7 & 9)
Q1	40V	45mΩ @ V <sub>GS</sub> = 10V	5.8A
		60mΩ @ V <sub>GS</sub> = 4.5V	4.2A
Q2	-40V	45mΩ @ V <sub>GS</sub> = -10V	-5.8A
		60mΩ @ V <sub>GS</sub> = -4.5V	-4.2A

### Description and Applications

This MOSFET is designed to meet the stringent requirements of automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- 3-Phase BLDC motors
- CCFL backlighting

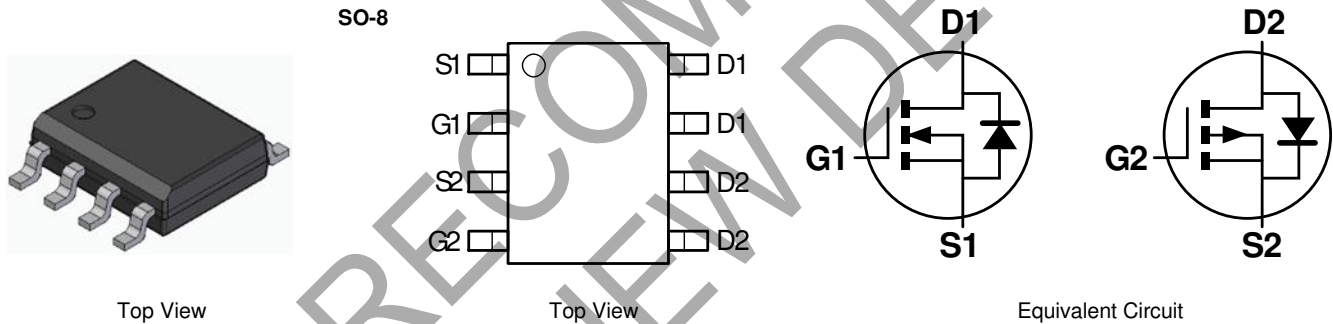
### Features and Benefits

- Matched N & P R<sub>DS(ON)</sub>—Minimizes Power Losses
- Fast Switching—Minimizes Switching Losses
- Dual Device—Reduces PCB Area
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The DIODES DMC4050SSDQ is suitable for automotive applications requiring specific change control; this part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**

<https://www.diodes.com/quality/product-definitions/>

### Mechanical Data

- Package: SO-8
- Package Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish—Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 (E3)
- Weight: 0.074 grams (Approximate)

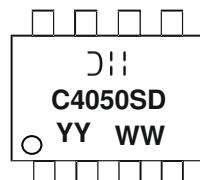


### Ordering Information (Note 4)

Part Number	Package	Packing	
		Qty.	Carrier
DMC4050SSDQ-13	SO-8	2500	Tape & Reel

- 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  
 C4050SD = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY or YY = Year (ex: 23 = 2023)  
 WW = Week (01 to 53)

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

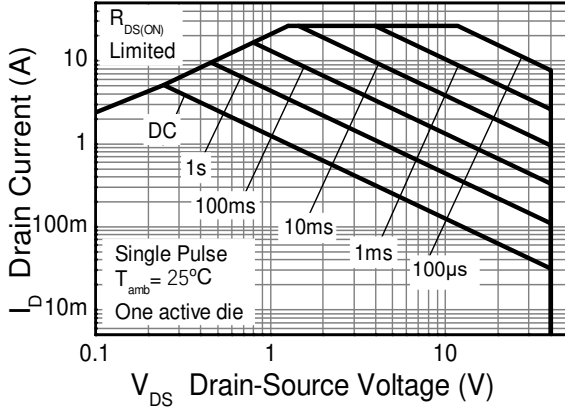
Characteristic			Symbol	N-Channel - Q1	P-Channel - Q2	Unit
Drain-Source Voltage			V <sub>DSS</sub>	40	-40	V
Gate-Source Voltage			V <sub>GSS</sub>	±20	±20	
Continuous Drain Current	V <sub>GS</sub> = 10V	(Notes 6 & 8)	I <sub>D</sub>	5.8	-5.8	A
		T <sub>A</sub> = +70°C (Notes 6 & 8)		4.38	-4.52	
		(Notes 5 & 8)		4.2	-4.2	
		(Notes 5 & 9)		5.3	-5.3	
Pulsed Drain Current	V <sub>GS</sub> = 10V	(Notes 7 & 8)	I <sub>DM</sub>	24.1	-24.9	
Continuous Source Current (Body Diode)			(Notes 6 & 8)	I <sub>S</sub>	2.5	
Pulsed Source Current (Body Diode)			(Notes 7 & 8)	I <sub>SM</sub>	24.1	-24.9

**Thermal Characteristics**

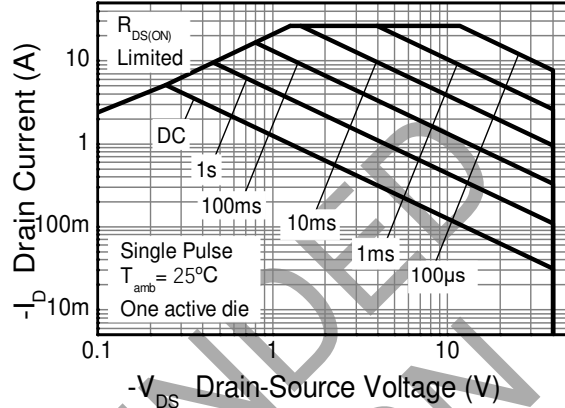
Characteristic		Symbol	Value	Unit
Power Dissipation Linear Derating Factor	(Notes 5 & 8)	P <sub>D</sub>	1.25	W
	(Notes 5 & 9)		1.8	
	(Notes 6 & 8)		2.14	
Thermal Resistance, Junction to Ambient	(Notes 5 & 8)	R <sub>θJA</sub>	100	°C/W
	(Notes 5 & 9)		70	
	(Notes 6 & 8)		58	
Thermal Resistance, Junction to Lead	(Notes 5 & 10)	R <sub>θJAL</sub>	51	
Operating and Storage Temperature Range		T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

- Notes:
5. For a device surface mounted on 25mm × 25mm × 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 5, except the device is measured at t ≤ 10sec.
  7. Same as Note 5, 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).

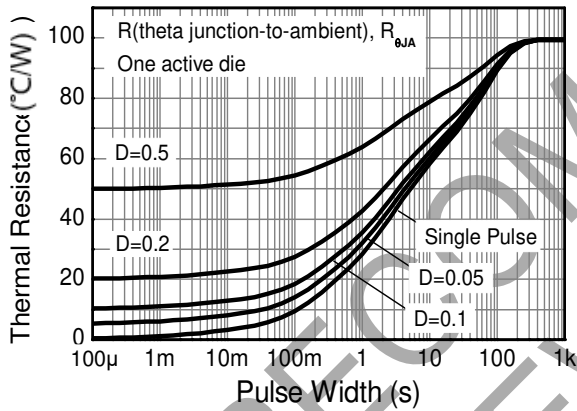
**Thermal Characteristics** (continued)



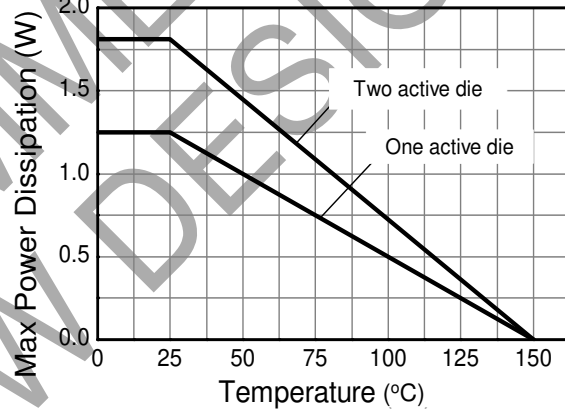
**N-channel Safe Operating Area**



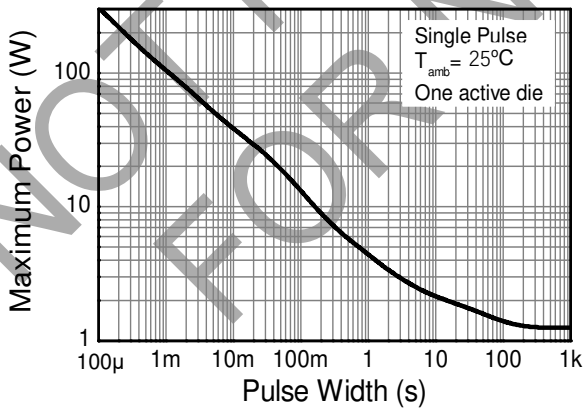
**P-channel Safe Operating Area**



**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> (Note 11)						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	40	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
Zero Gate Voltage Drain Current T <sub>J</sub> = +25°C	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> (Note 11)						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	0.8	1.3	1.8	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	20	45	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 3A
			33	60		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 3A
Forward Transfer Admittance	Y <sub>FS</sub>	—	12.6	—	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	V <sub>GS</sub> = 0V, I <sub>S</sub> = 1A
<b>DYNAMIC CHARACTERISTICS</b> (Note 12)						
Input Capacitance	C <sub>iss</sub>	—	1,790.8	—	pF	V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	160.6	—	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	—	120.5	—	pF	
Gate Resistance	R <sub>g</sub>	—	1.03	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge	Q <sub>g</sub>	—	37.56	—	nC	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 20V, I <sub>D</sub> = 3A
Gate-Source Charge	Q <sub>gs</sub>	—	7.8	—	nC	
Gate-Drain Charge	Q <sub>gd</sub>	—	6.6	—	nC	
Turn-On Delay Time	t <sub>D(ON)</sub>	—	8.08	—	ns	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 20V, I <sub>D</sub> = 3A
Turn-On Rise Time	t <sub>R</sub>	—	15.14	—	ns	
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	24.29	—	ns	
Turn-Off Fall Time	t <sub>F</sub>	—	5.27	—	ns	

**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> (Note 11)						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	-40	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA
Zero Gate Voltage Drain Current T <sub>J</sub> = +25°C	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> (Note 11)						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	-0.8	-1.3	-1.8	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	28	45	mΩ	V <sub>GS</sub> = -10V, I <sub>D</sub> = -3A
			30	60		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3A
Forward Transfer Admittance	Y <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	V <sub>GS</sub> = 0V, I <sub>S</sub> = -1A
<b>DYNAMIC CHARACTERISTICS</b> (Note 12)						
Input Capacitance	C <sub>iss</sub>	—	1,643.17	—	pF	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	179.13	—	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	—	127.82	—	pF	
Gate Resistance	R <sub>g</sub>	—	6.43	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge	Q <sub>g</sub>	—	33.66	—	nC	V <sub>GS</sub> = -10V, V <sub>DS</sub> = -20V, I <sub>D</sub> = -3A
Gate-Source Charge	Q <sub>gs</sub>	—	5.54	—	nC	
Gate-Drain Charge	Q <sub>gd</sub>	—	7.30	—	nC	
Turn-On Delay Time	t <sub>D(ON)</sub>	—	6.85	—	ns	V <sub>GS</sub> = -10V, V <sub>DS</sub> = -20V, I <sub>D</sub> = -3A
Turn-On Rise Time	t <sub>R</sub>	—	14.72	—	ns	
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	53.65	—	ns	
Turn-Off Fall Time	t <sub>F</sub>	—	30.86	—	ns	

Notes: 11. Short duration pulse test used to minimize self-heating effect.  
12. Guaranteed by design. Not subject to production testing.

**Typical Characteristics (Q1 N-Channel)**

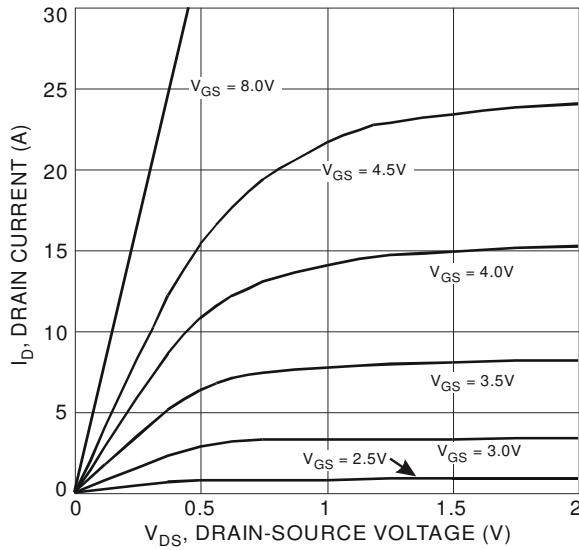


Fig. 1 Typical Output Characteristic

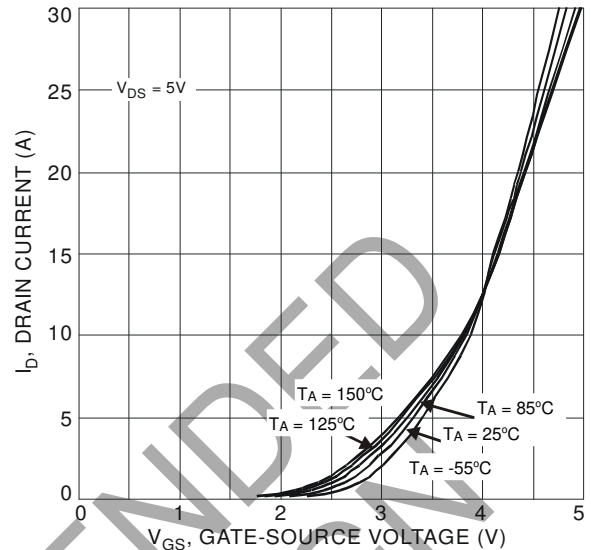


Fig. 2 Typical Transfer Characteristic

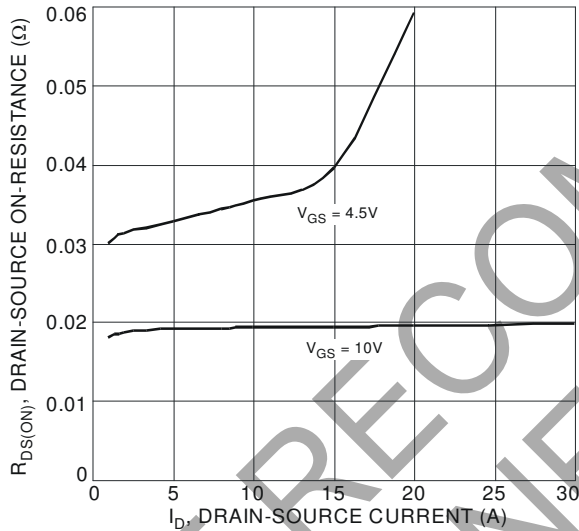


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

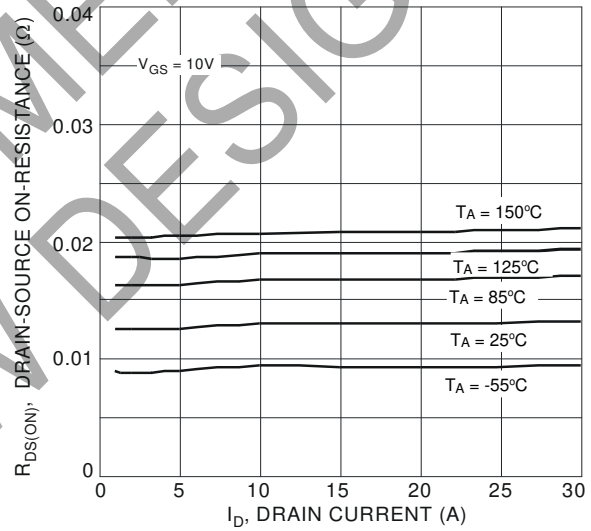


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

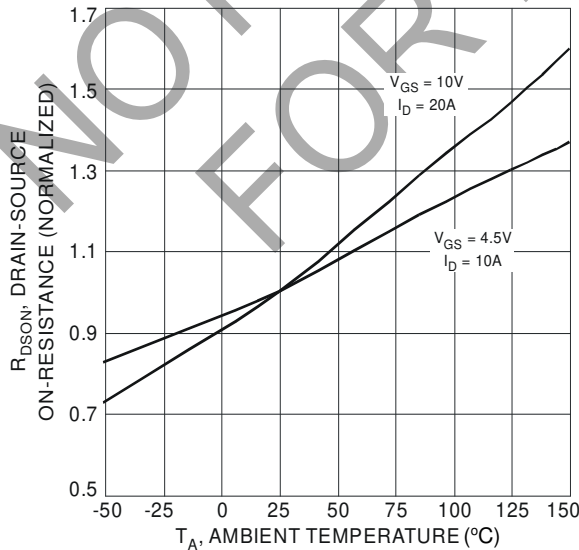


Fig. 5 On-Resistance Variation with Temperature

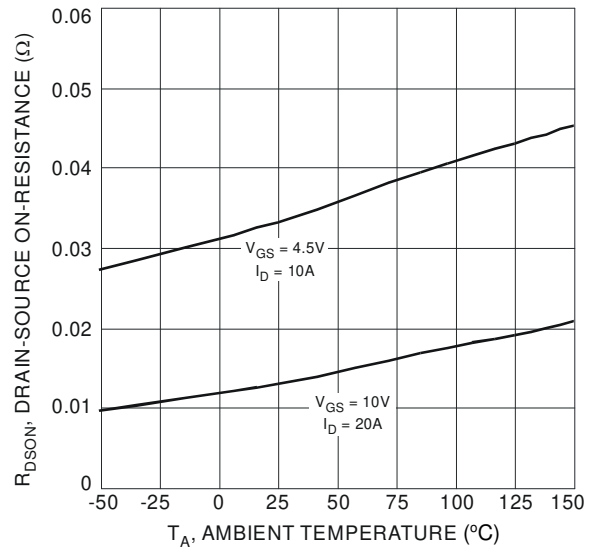


Fig. 6 On-Resistance Variation with Temperature

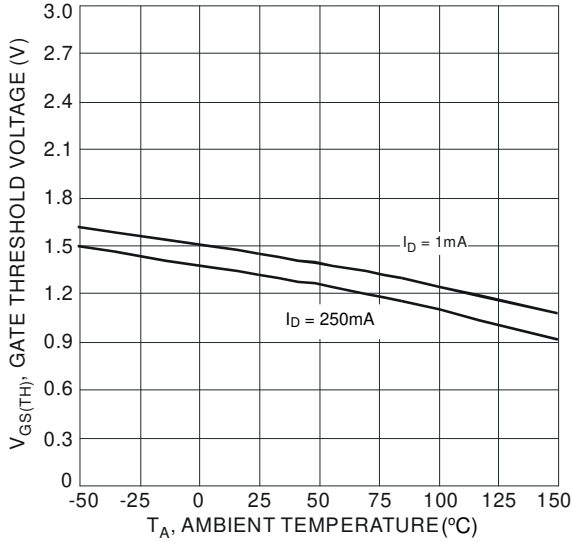


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

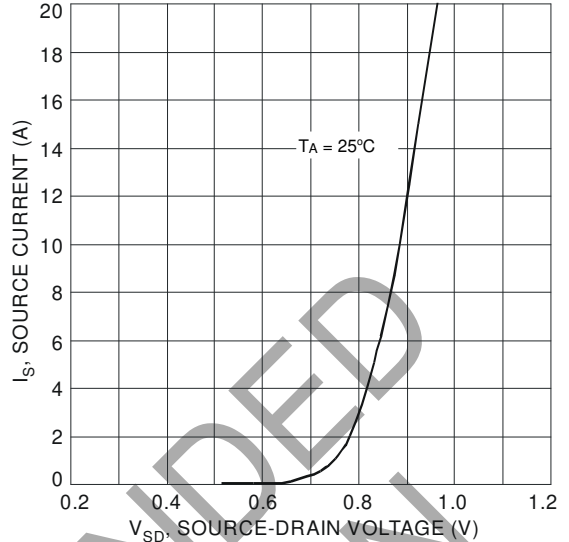


Fig. 8 Diode Forward Voltage vs. Current

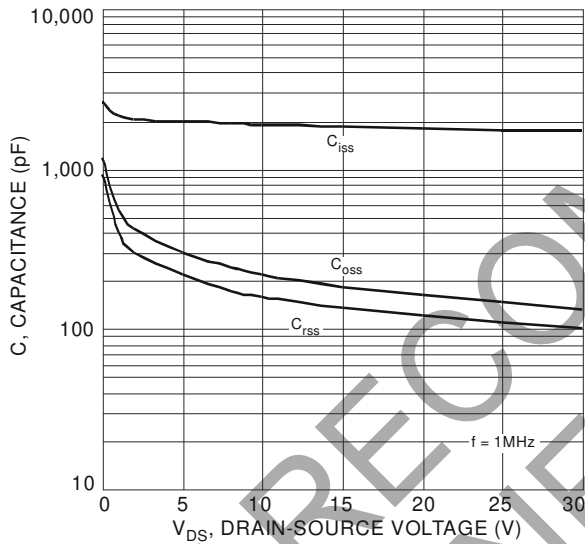


Fig. 9 Typical Total Capacitance

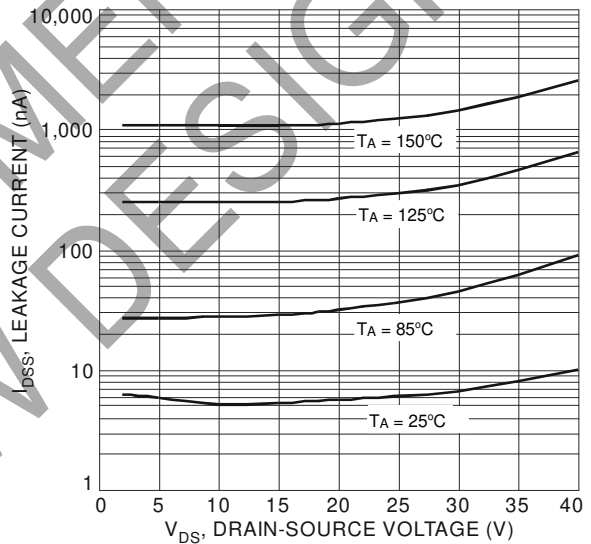


Fig. 10 Typical Leakage Current vs. Drain-Source Voltage

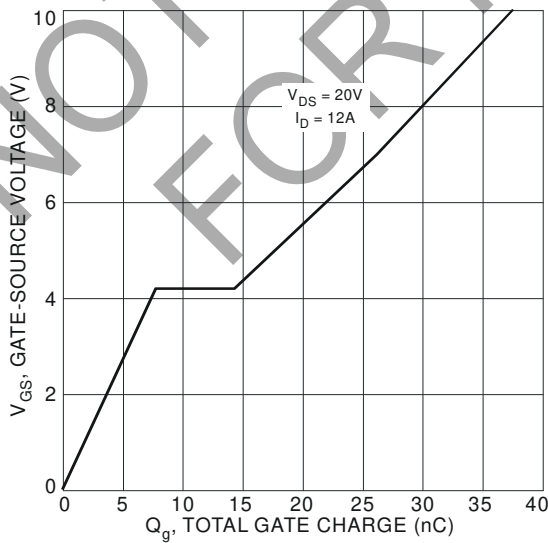


Fig. 11 Gate-Charge Characteristics

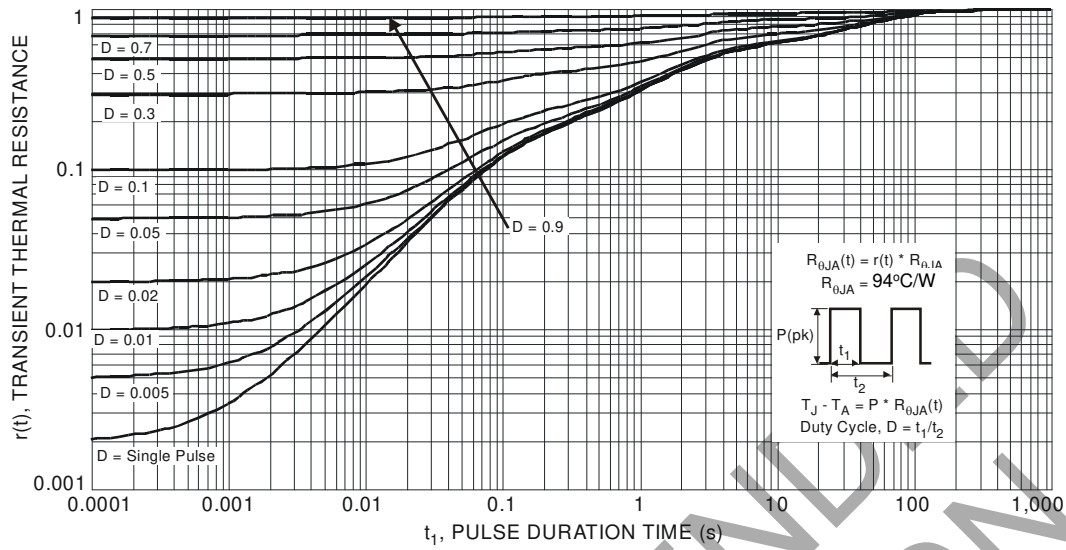


Fig. 12 Transient Thermal Response

NOT RECOMMENDED FOR NEW DESIGN

**Typical Characteristics (Q2 P-Channel)**

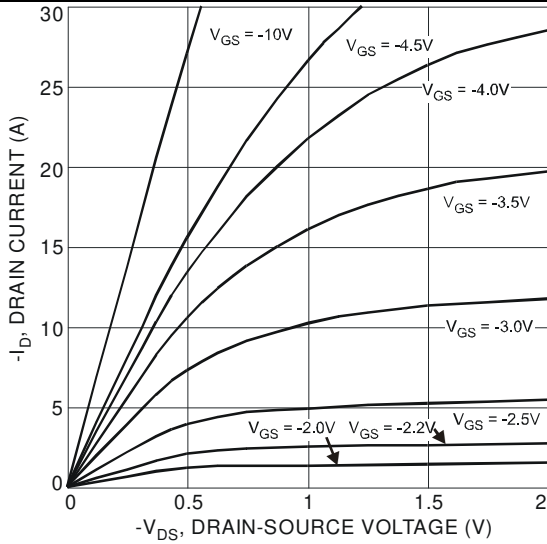


Fig. 13 Typical Output Characteristic

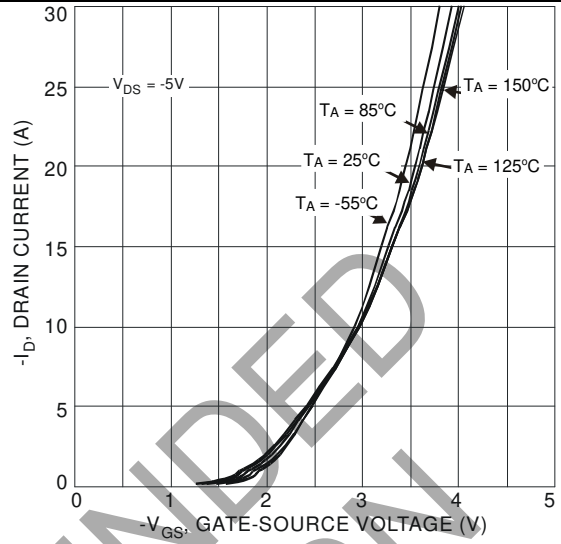


Fig. 14 Typical Transfer Characteristic

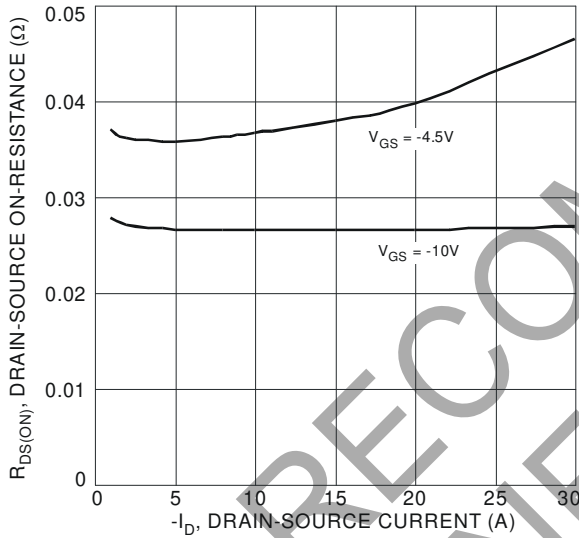


Fig. 15 Typical On-Resistance vs. Drain Current and Gate Voltage

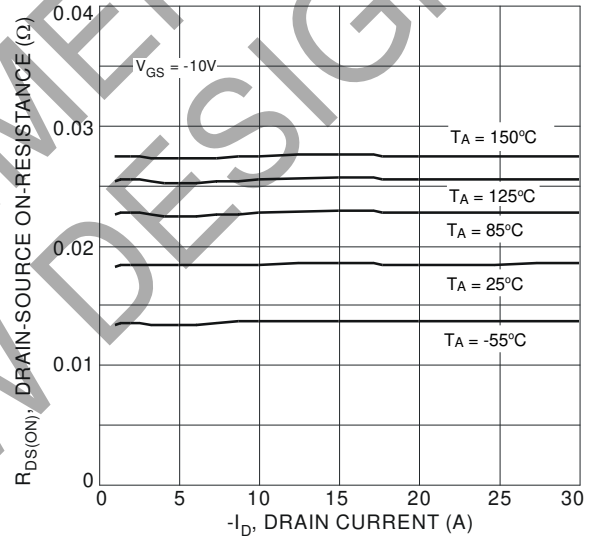


Fig. 16 Typical On-Resistance vs. Drain Current and Temperature

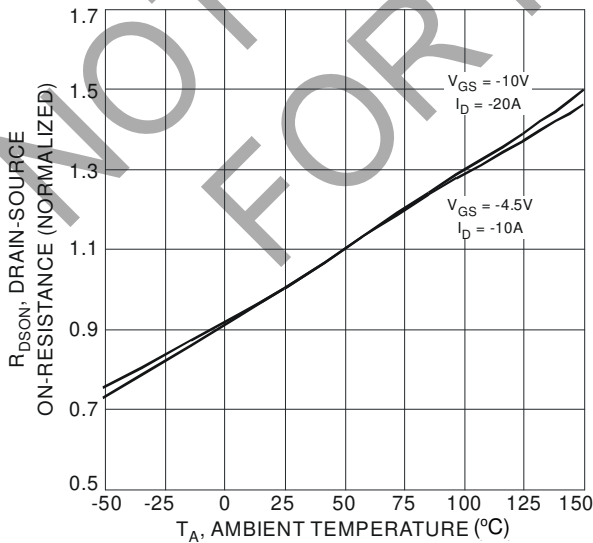


Fig. 17 On-Resistance Variation with Temperature

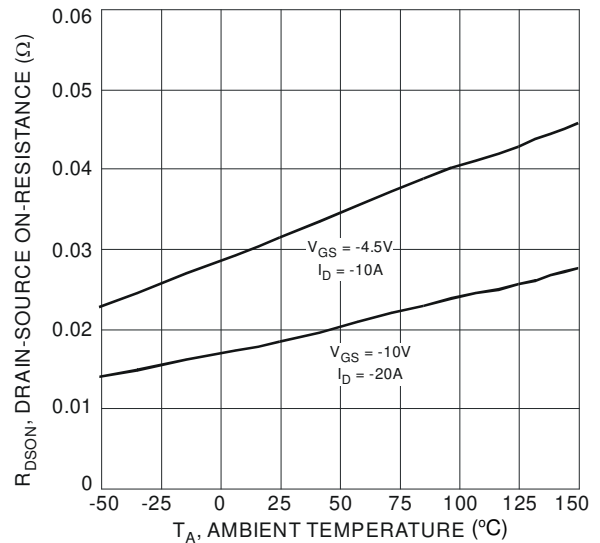


Fig. 18 On-Resistance Variation with Temperature



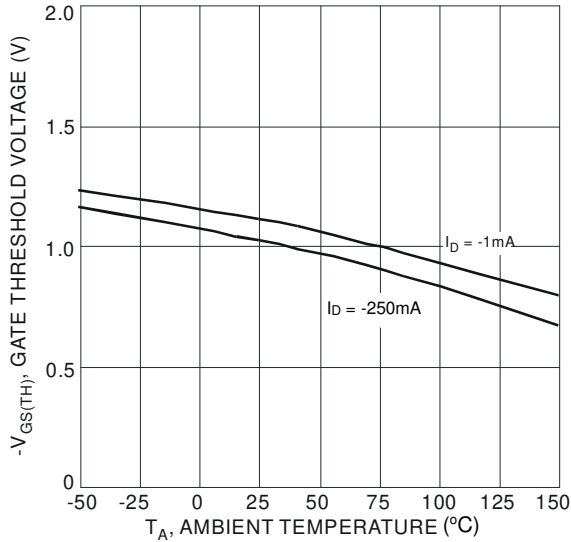


Fig. 19 Gate Threshold Variation vs. Ambient Temperature

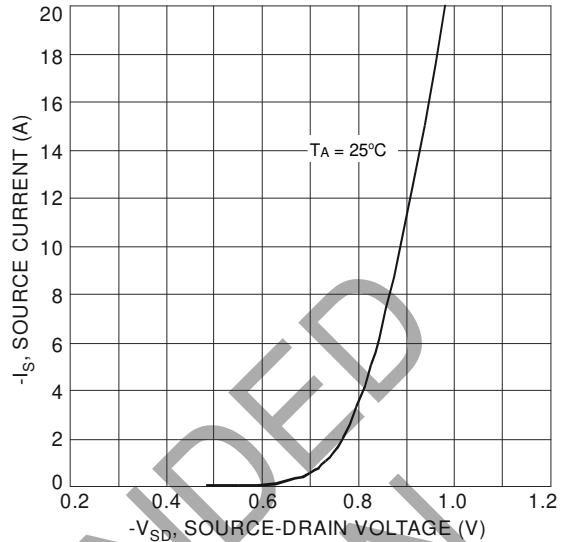


Fig. 20 Diode Forward Voltage vs. Current

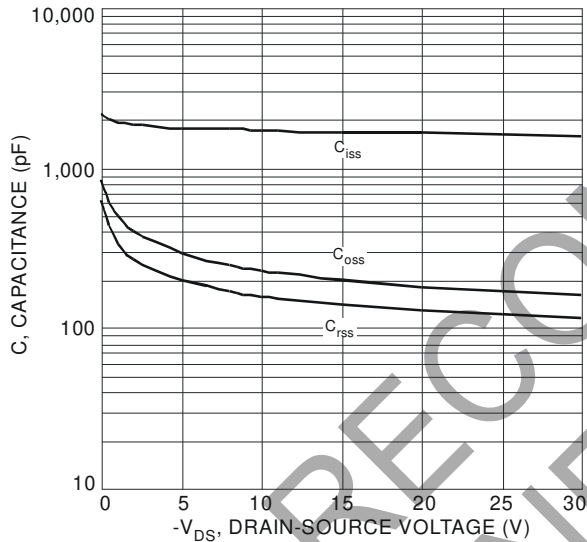


Fig. 21 Typical Total Capacitance

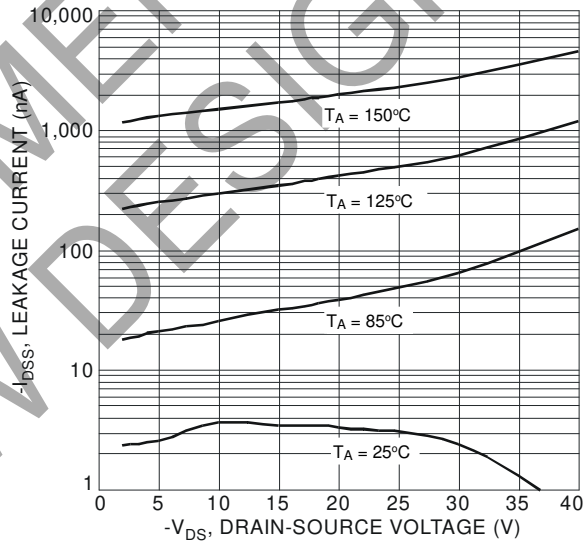


Fig. 22 Typical Leakage Current vs. Drain-Source Voltage

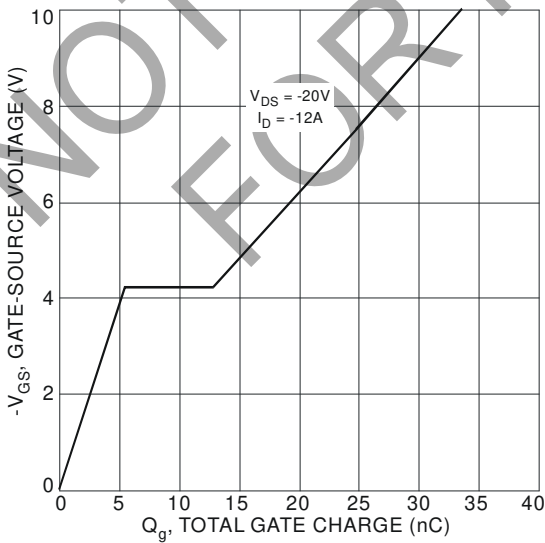


Fig. 23 Gate-Charge Characteristics

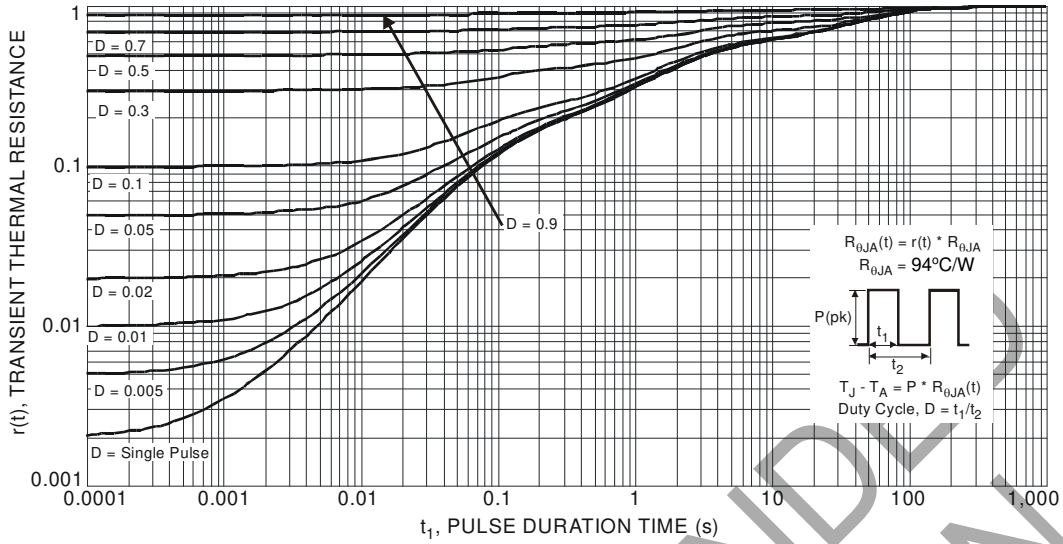


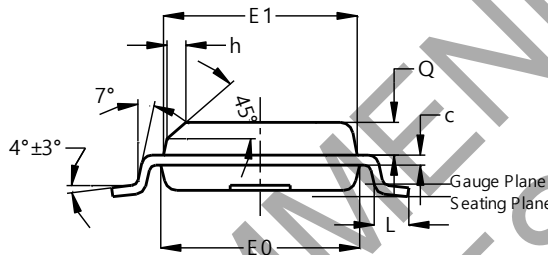
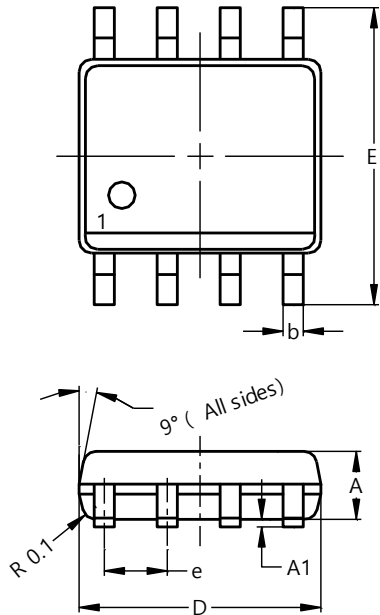
Fig. 24 Transient Thermal Response

NOT RECOMMENDED FOR NEW DESIGN

**Package Outline Dimensions**

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

SO-8

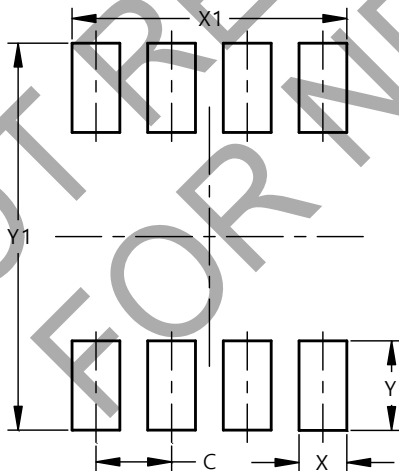


SO-8			
Dim	Min	Max	Typ
A	1.40	1.50	1.45
A1	0.10	0.20	0.15
b	0.30	0.50	0.40
c	0.15	0.25	0.20
D	4.85	4.95	4.90
E	5.90	6.10	6.00
E1	3.80	3.90	3.85
E0	3.85	3.95	3.90
e	--	--	1.27
h	--	--	0.35
L	0.62	0.82	0.72
Q	0.60	0.70	0.65
All Dimensions in mm			

**Suggested Pad Layout**

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

SO-8



Dimensions	Value (in mm)
C	1.27
X	0.802
X1	4.612
Y	1.505
Y1	6.50

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