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Lead-free Green

DMC4050SSDQ

40V COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET

Product Summary

Device	BV_{DSS}	$R_{DS(ON)}$ Max	I_D Max T_A = +25°C (Notes 7 & 9)
Q1	40V	45mΩ @ V_{GS}= 10V	5.8A
		60mΩ @ V_{GS}= 4.5V	4.2A
Q2	-40V	45mΩ @ V_{GS}= -10V	-5.8A
		60mΩ @ V_{GS}= -4.5V	-4.2A

Features and Benefits

- Matched N & P $R_{DS(ON)}$—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)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **The 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/

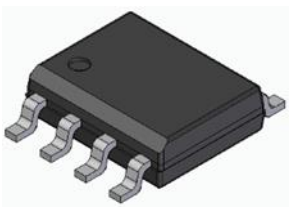
Description and Applications

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 Motor
- CCFL Backlighting

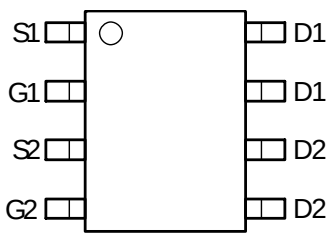
Mechanical Data

- 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: Finish—Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.074 grams (Approximate)

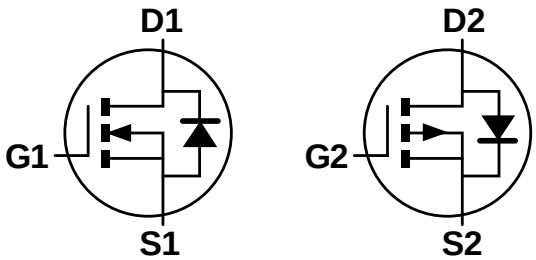


Top View

SO-8



Top View



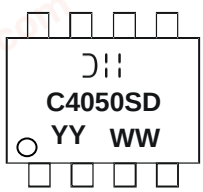
Equivalent Circuit

Ordering Information (Note 4)

Part Number	Case	Packaging
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 http://www.diodes.com/products/packages.html.

Marking Information



= Manufacturer's Marking
C4050SD = Product Type Marking Code
YYWW = Date Code Marking
YY or YY= Year (ex: 20 = 2020)
WW = Week (01 - 53)

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

Characteristic			Symbol	N-Channel - Q1	P-Channel - Q2	Units
Drain-Source Voltage			V_{DSS}	40	-40	V
Gate-Source Voltage			V_{GSS}	±20	±20	
Continuous Drain Current	V_{GS} = 10V	(Notes 6 & 8)	I_D	5.8	-5.8	A
		T_A = +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_{GS} = 10V	(Notes 7 & 8)	I_{DM}	24.1	-24.9	
Continuous Source Current (Body Diode)		(Notes 6 & 8)	I_S	2.5	-2.5	
Pulsed Source Current (Body Diode)		(Notes 7 & 8)	I_{SM}	24.1	-24.9	

Thermal Characteristics

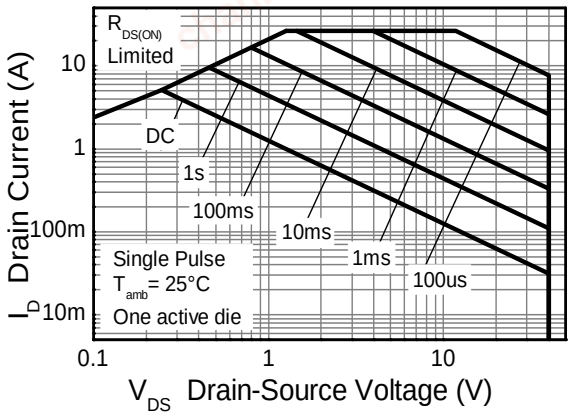
Characteristic		Symbol	Value	Unit
Power Dissipation Linear Derating Factor	(Notes 5 & 8)	P_D	1.25	W
	(Notes 5 & 9)		1.8	
	(Notes 6 & 8)		2.14	
Thermal Resistance, Junction to Ambient	(Notes 5 & 8)	$R_{\Theta JA}$	100	°C/W
	(Notes 5 & 9)		70	
	(Notes 6 & 8)		58	
Thermal Resistance, Junction to Lead	(Notes 5 & 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 × 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 ≤ 10 sec.
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).

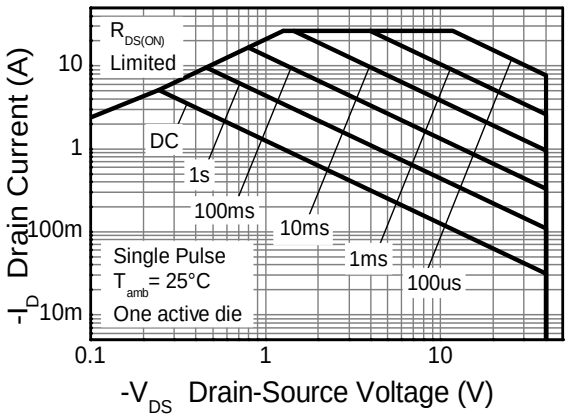
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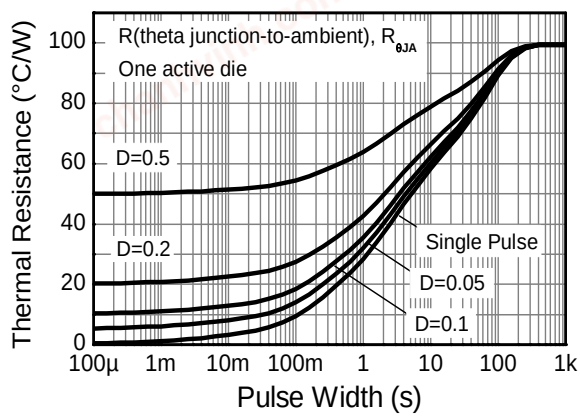
Thermal Characteristics (continued)



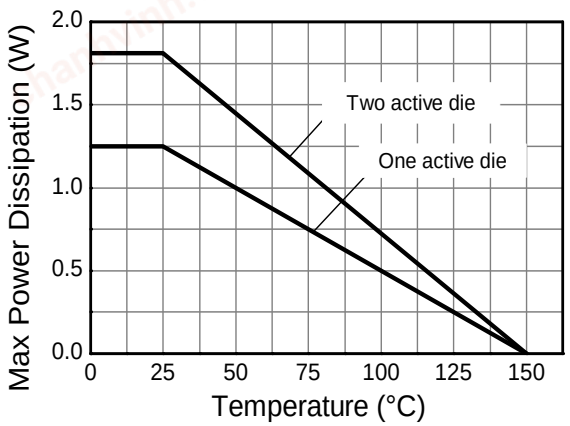
N-channel Safe Operating Area



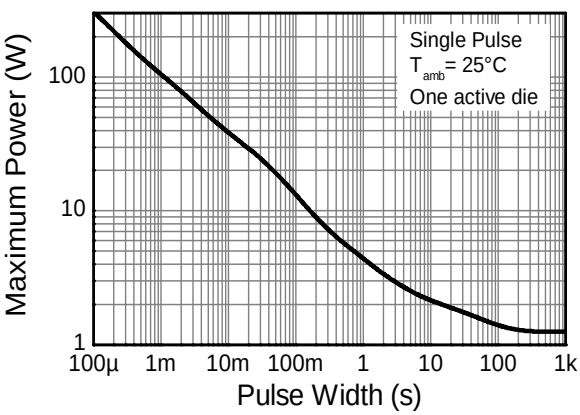
P-channel Safe Operating Area



Transient Thermal Impedance



Derating Curve



Pulse Power Dissipation

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 11)						
Drain-Source Breakdown Voltage	BV_{DSS}	40	—	—	V	V_{GS} = 0V, I_D = 250μA
Zero Gate Voltage Drain Current T_J = +25°C	I_{DSS}	—	—	1.0	μA	V_{DS} = 40V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±20V, V_{DS} = 0V
ON CHARACTERISTICS (Note 11)						
Gate Threshold Voltage	$V_{GS(TH)}$	0.8	1.3	1.8	V	V_{DS} = V_{GS}, I_D = 250μA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	20 33	45 60	mΩ	V_{GS} = 10V, I_D = 3A V_{GS} = 4.5V, I_D = 3A
Forward Transfer Admittance	$\|Y_{FS}\|$	—	12.6	—	S	V_{DS} = 5V, I_D = 3A
Diode Forward Voltage (Note 11)	V_{SD}	—	0.7	1.0	V	V_{GS} = 0V, I_S = 1A
DYNAMIC CHARACTERISTICS (Note 12)						
Input Capacitance	C_{ISS}	—	1,790.8	—	pF	V_{DS} = 20V, V_{GS} = 0V, f = 1.0MHz
Output Capacitance	C_{OSS}	—	160.6	—	pF	
Reverse Transfer Capacitance	C_{RSS}	—	120.5	—	pF	
Gate Resistance	R_G	—	1.03	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge	Q_G	—	37.56	—	nC	V_{GS} = 10V, V_{DS} = 20V, I_D = 3A
Gate-Source Charge	Q_{GS}	—	7.8	—	nC	
Gate-Drain Charge	Q_{GD}	—	6.6	—	nC	
Turn-On Delay Time	$t_{D(ON)}$	—	8.08	—	ns	V_{GS} = 10V, V_{DS} = 20V, I_D = 3A
Turn-On Rise Time	t_R	—	15.14	—	ns	
Turn-Off Delay Time	$t_{D(OFF)}$	—	24.29	—	ns	
Turn-Off Fall Time	t_F	—	5.27	—	ns	

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 11)						
Drain-Source Breakdown Voltage	BV_{DSS}	-40	—	—	V	V_{GS} = 0V, I_D = -250μA
Zero Gate Voltage Drain Current T_J = +25°C	I_{DSS}	—	—	-1.0	μA	V_{DS} = -40V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±20V, V_{DS} = 0V
ON CHARACTERISTICS (Note 11)						
Gate Threshold Voltage	$V_{GS(TH)}$	-0.8	-1.3	-1.8	V	V_{DS} = V_{GS}, I_D = -250μA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	28 30	45 60	mΩ	V_{GS} = -10V, I_D = -3A V_{GS} = -4.5V, I_D = -3A
Forward Transfer Admittance	$\|Y_{FS}\|$	—	16.6	—	S	V_{DS} = -5V, I_D = -3A
Diode Forward Voltage (Note 11)	V_{SD}	—	-0.7	-1.0	V	V_{GS} = 0V, I_S = -1A
DYNAMIC CHARACTERISTICS (Note 12)						
Input Capacitance	C_{ISS}	—	1,643.17	—	pF	V_{DS} = -20V, V_{GS} = 0V, f = 1.0MHz
Output Capacitance	C_{OSS}	—	179.13	—	pF	
Reverse Transfer Capacitance	C_{RSS}	—	127.82	—	pF	
Gate Resistance	R_G	—	6.43	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge	Q_G	—	33.66	—	nC	V_{GS} = -10V, V_{DS} = -20V, I_D = -3A
Gate-Source Charge	Q_{GS}	—	5.54	—	nC	
Gate-Drain Charge	Q_{GD}	—	7.30	—	nC	
Turn-On Delay Time	$t_{D(ON)}$	—	6.85	—	ns	V_{GS} = -10V, V_{DS} = -20V, I_D = -3A
Turn-On Rise Time	t_R	—	14.72	—	ns	
Turn-Off Delay Time	$t_{D(OFF)}$	—	53.65	—	ns	
Turn-Off Fall Time	t_F	—	30.86	—	ns	

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

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Typical Characteristics (Q1 N-Channel)

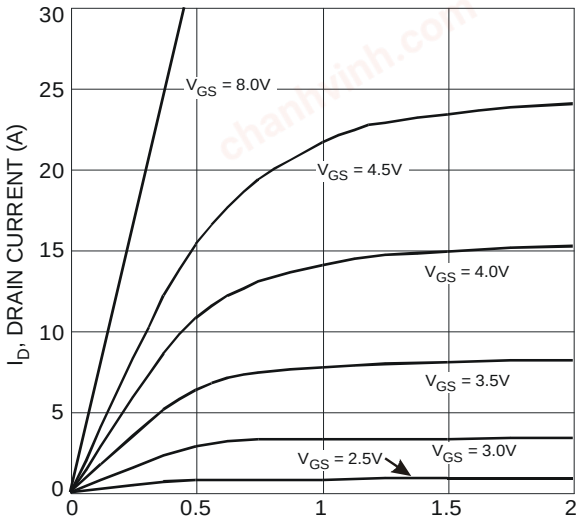


Fig. 1 Typical Output Characteristic

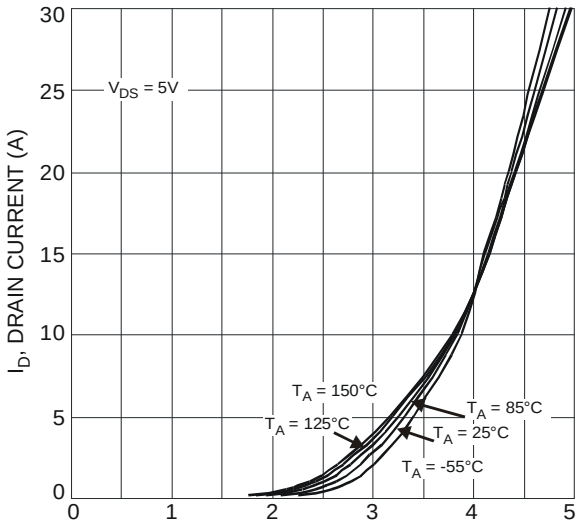


Fig. 2 Typical Transfer Characteristic

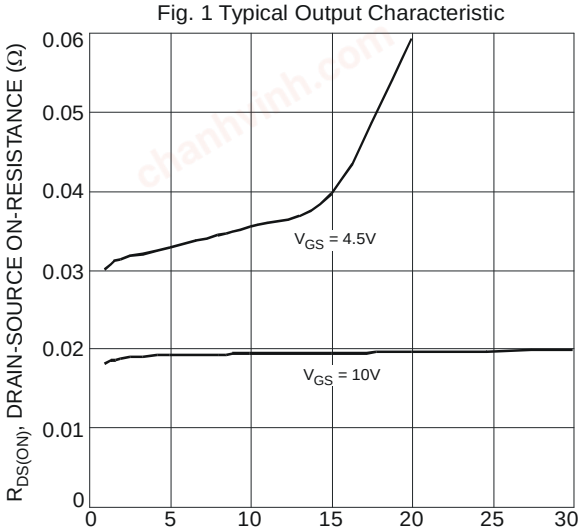


Fig. 3 Typical On-Resistance
vs. Drain Current and Gate Voltage

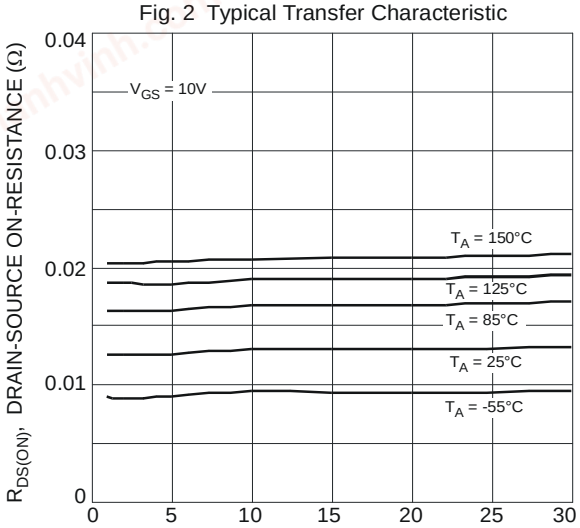


Fig. 4 Typical On-Resistance
vs. Drain Current and Temperature

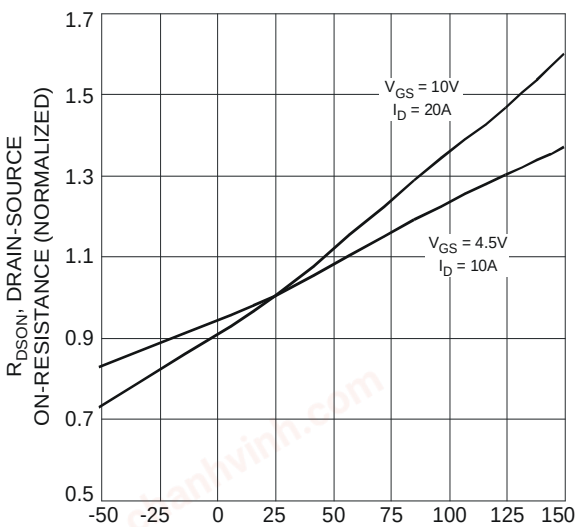


Fig. 5 On-Resistance Variation with Temperature

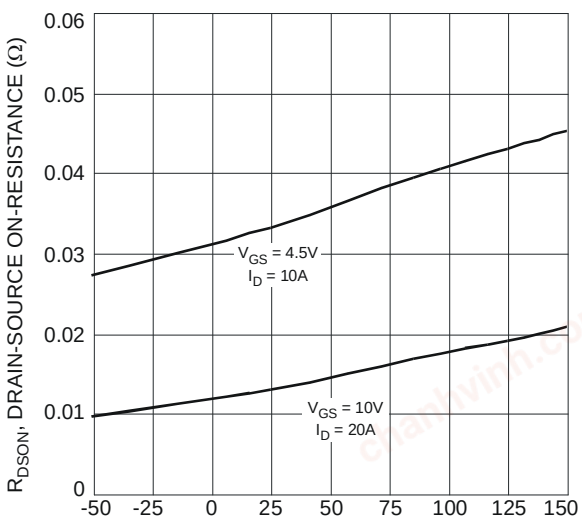


Fig. 6 On-Resistance Variation with Temperature

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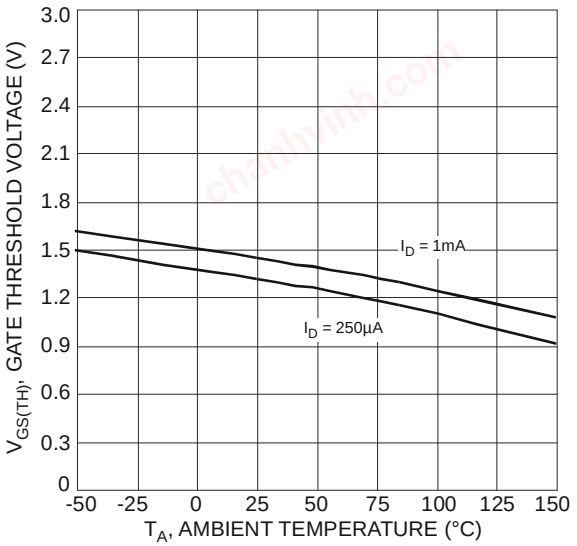


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

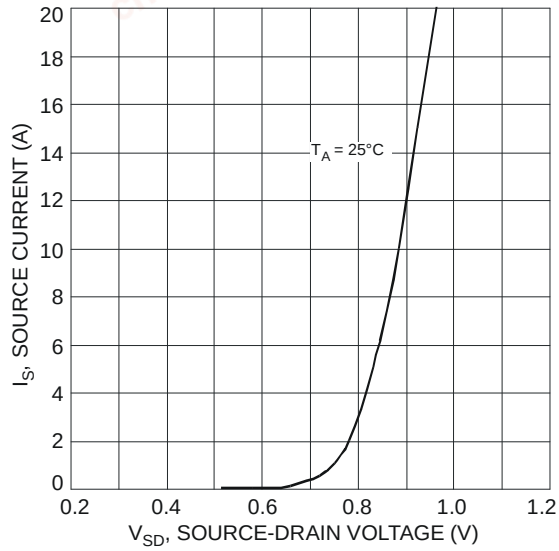


Fig. 8 Diode Forward Voltage vs. Current

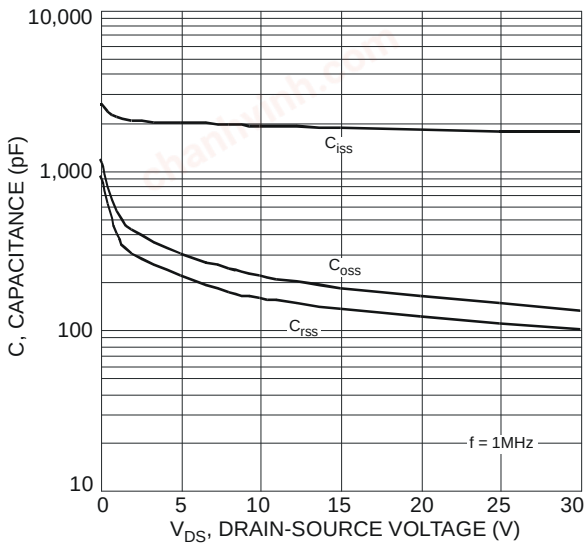


Fig. 9 Typical Total Capacitance

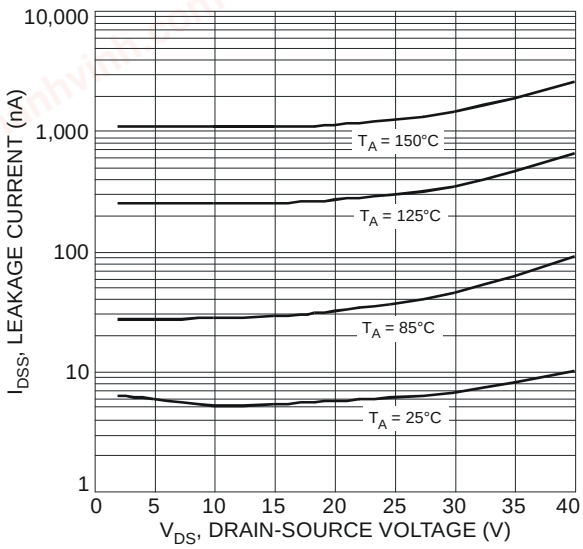


Fig. 10 Typical Leakage Current vs. Drain-Source Voltage

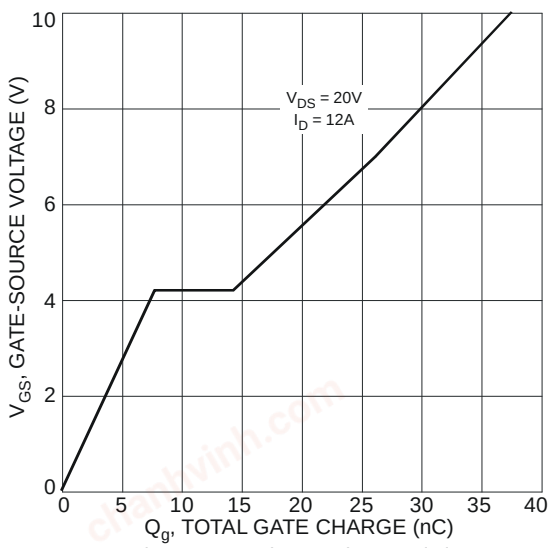


Fig. 11 Gate-Charge Characteristics

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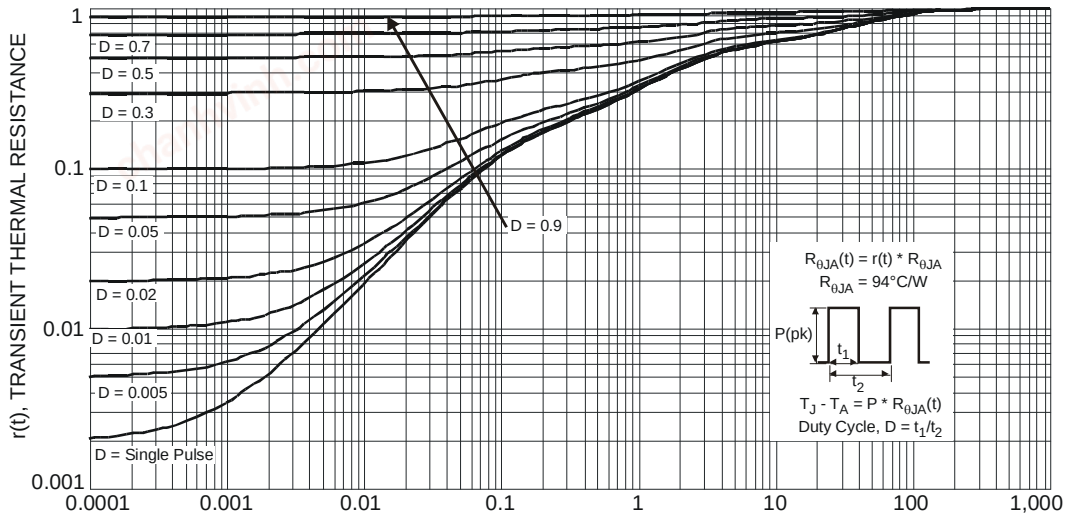


Fig. 12 Transient Thermal Response

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Typical Characteristics (Q2 P-Channel)

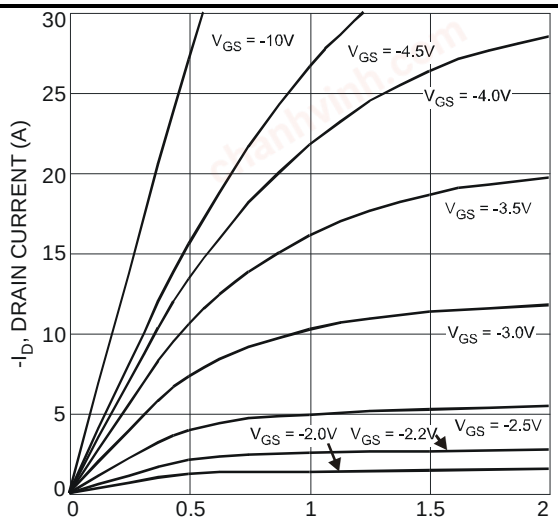


Fig. 13 Typical Output Characteristic

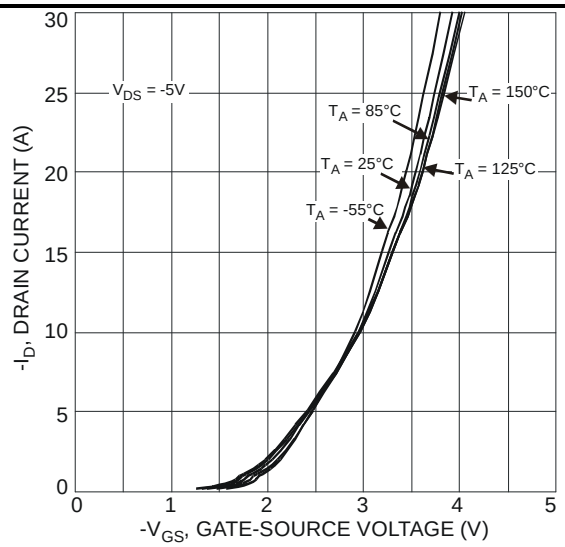


Fig. 14 Typical Transfer Characteristic

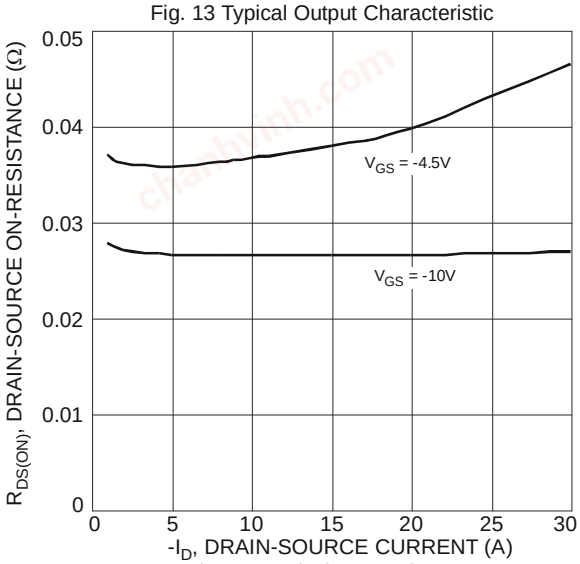


Fig. 15 Typical On-Resistance
vs. Drain Current and Gate Voltage

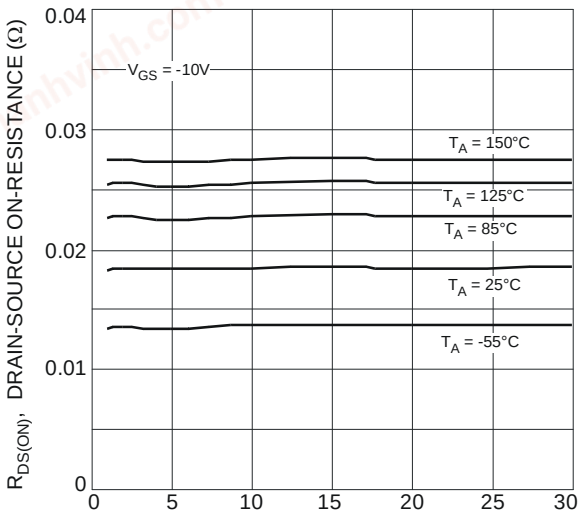


Fig. 16 Typical On-Resistance
vs. Drain Current and Temperature

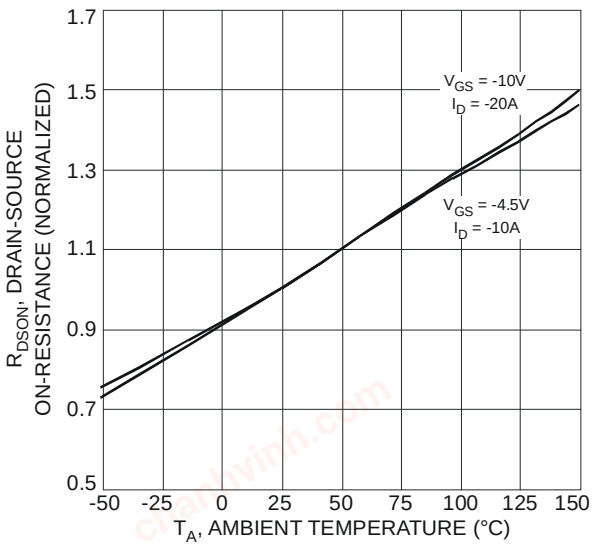


Fig. 17 On-Resistance Variation with Temperature

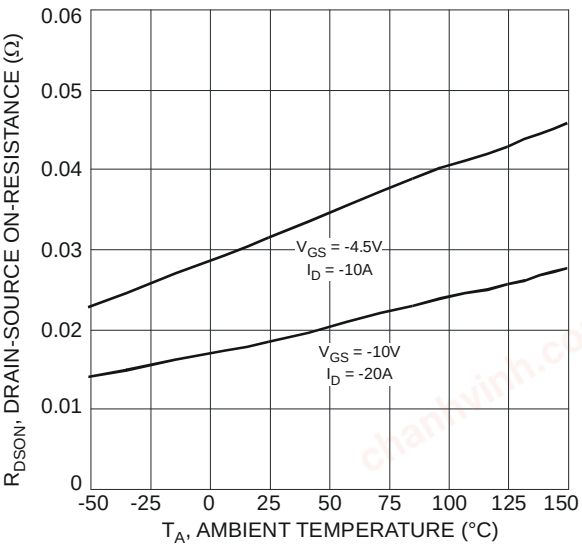


Fig. 18 On-Resistance Variation with Temperature

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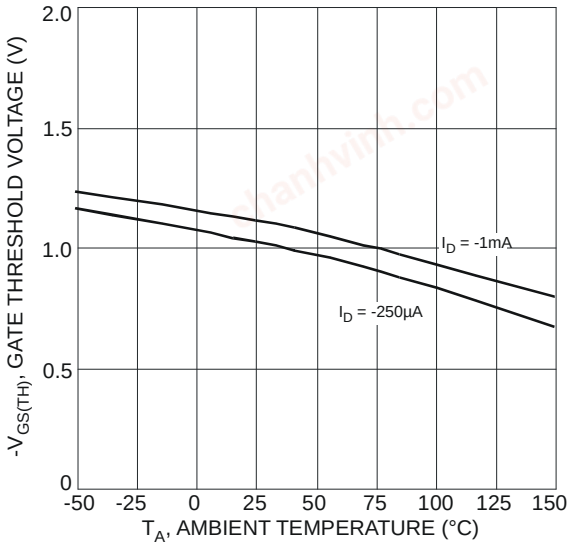


Fig. 19 Gate Threshold Variation vs. Ambient Temperature

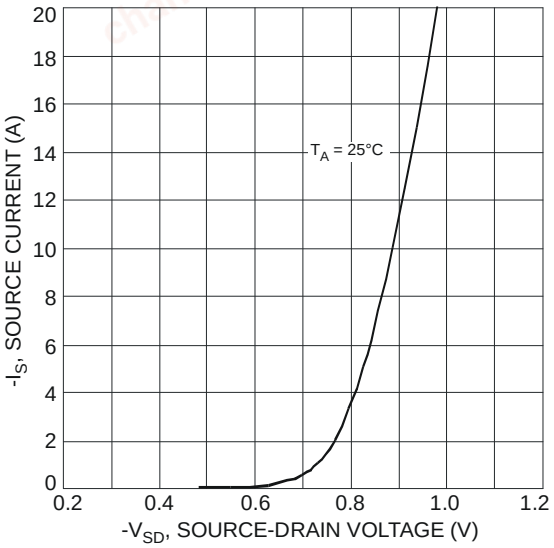


Fig. 20 Diode Forward Voltage vs. Current

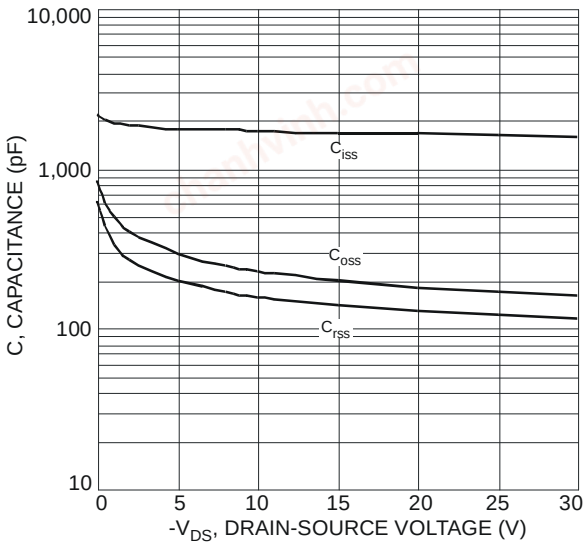


Fig. 21 Typical Total Capacitance

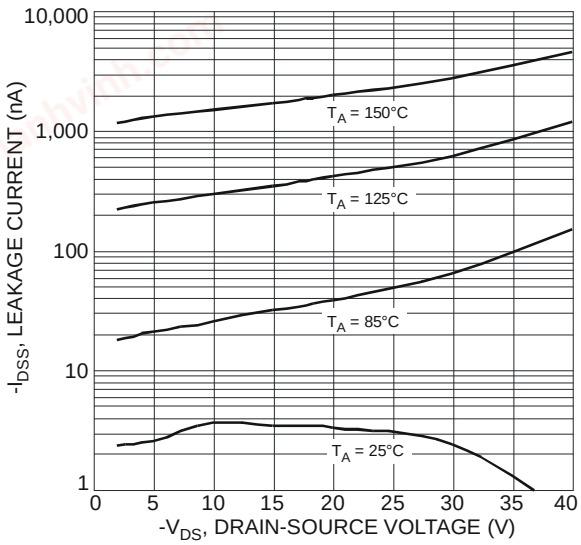


Fig. 22 Typical Leakage Current vs. Drain-Source Voltage

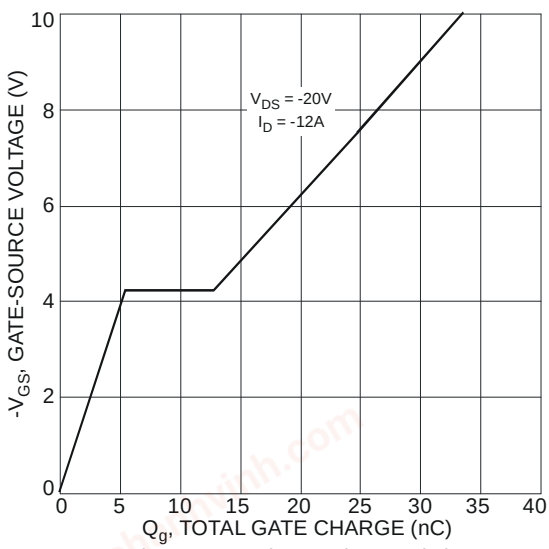


Fig. 23 Gate-Charge Characteristics

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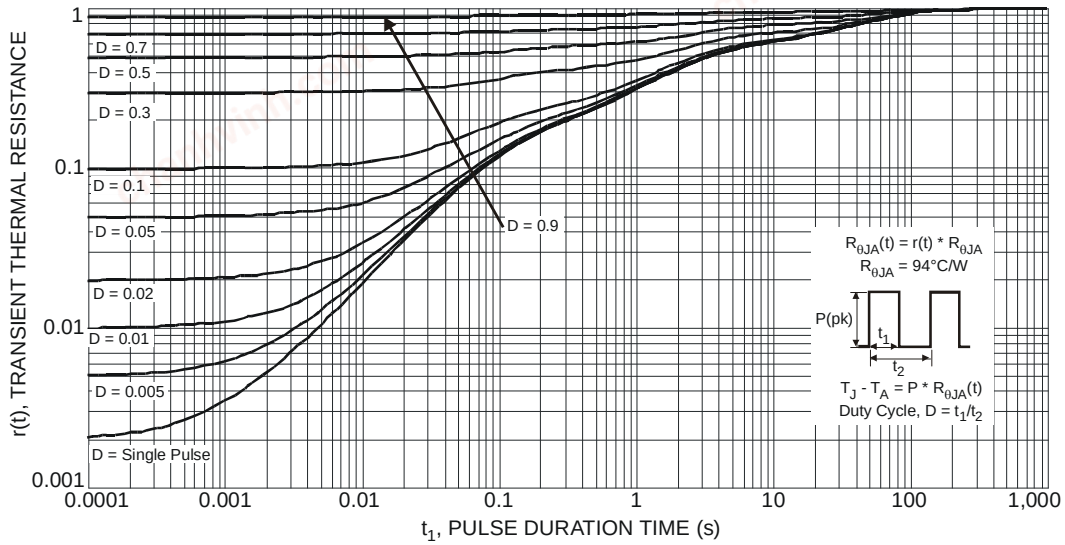


Fig. 24 Transient Thermal Response

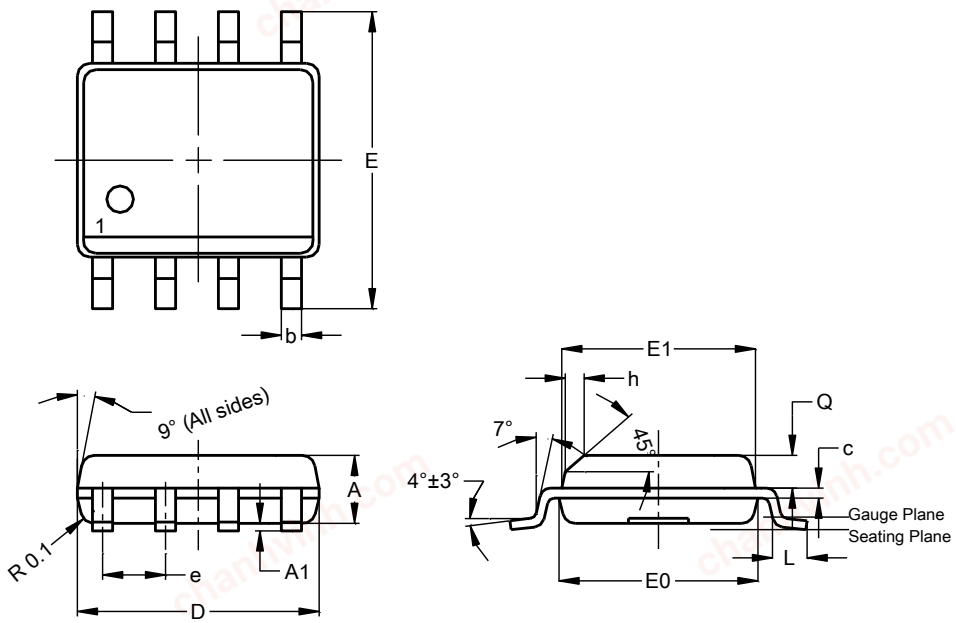
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Package Outline Dimensions

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

SO-8

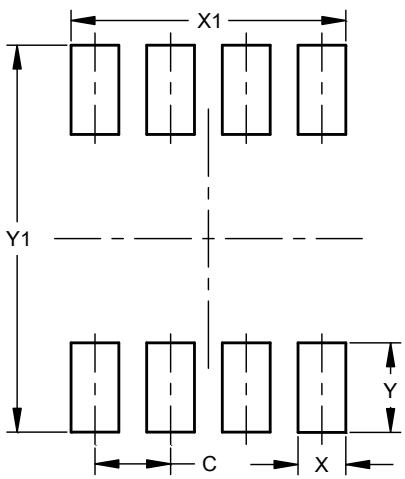


SO-8			
Dim	**Min**	**Max**	**Typ**
A	1.40	1.50	1.45
A1	0.10	0.20	0.15
b	0.30	0.50	0.40
c	0.15	0.25	0.20
D	4.85	4.95	4.90
E	5.90	6.10	6.00
E1	3.80	3.90	3.85
E0	3.85	3.95	3.90
e	--	--	1.27
h	-	--	0.35
L	0.62	0.82	0.72
Q	0.60	0.70	0.65
All Dimensions in mm			

Suggested Pad Layout

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

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

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