

40V COMPLEMENTARY ENHANCEMENT MODE MOSFET H-BRIDGE

Product Summary

Device	BV _{DSS}	R _{DS(ON)} Max	I _D Max T _A = +25°C
N-Channel	40V	45mΩ @ V _{GS} = 10V	4.5A
		58mΩ @ V _{GS} = 4.5V	4A
P-Channel	-40V	65mΩ @ V _{GS} = -10V	-3.7A
		100mΩ @ V _{GS} = -4.5V	-2.9A

Description and Applications

This new generation complementary MOSFET H-Bridge features 2 N and 2 P channels in an SO-8 package. Qualified to AEC-Q101 the H bridge is ideally suited to driving :

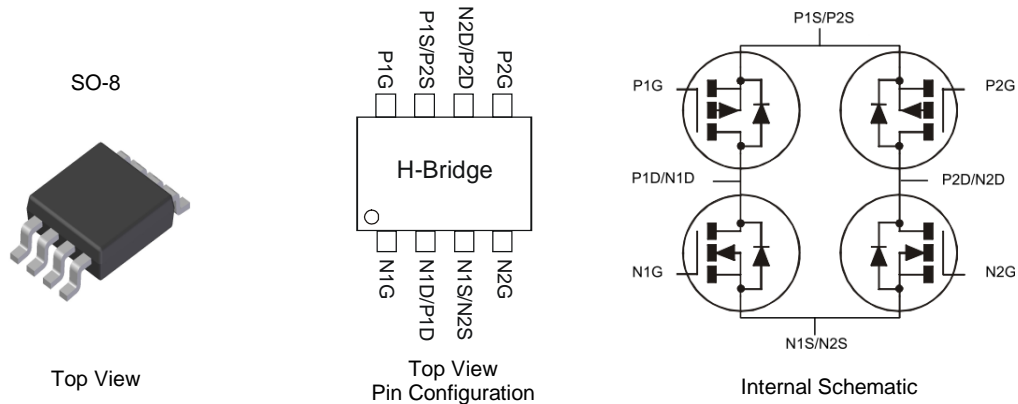
- Solenoids
- DC Motors
- Audio Outputs

Features

- 2 x N + 2 x P Channels in An SO-8 Package
- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speed
- **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**
- **PPAP Capable (Note 4)**

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
- Terminal Connections Indicator: See Diagram
- Terminals: Finish — Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 Ⓔ3
- Weight: 0.074 grams (Approximate)

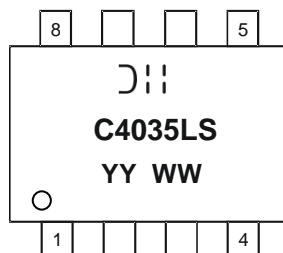


Ordering Information (Note 5)

Part Number	Compliance	Case	Packaging
DMHC4035LSDQ-13	Automotive	SO-8	2,500/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. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to <https://www.diodes.com/quality/>.
 5. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

Marking Information



Diodes = Manufacturer's Marking
 C4035LS = Product Type Marking Code
 YYWW = Date Code Marking
 YY = Year (ex: 18 = 2018)
 WW = Week (01 to 53)

Thermal Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 6)	P_D	1.5	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	85	$^\circ\text{C/W}$
	$t < 10\text{s}$	53	
Thermal Resistance, Junction to Case	$R_{\theta JC}$	15	
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	$^\circ\text{C}$

Maximum Ratings N-CHANNEL (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	40	V
Gate-Source Voltage	V_{GSS}	± 20	V
Continuous Drain Current (Note 6) $V_{GS} = 10\text{V}$	Steady State $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	4.5 3.5	A
	$t < 10\text{s}$ $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	5.8 4.5	A
Continuous Drain Current (Note 6) $V_{GS} = 4.5\text{V}$	Steady State $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	4 3.1	A
	$t < 10\text{s}$ $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	5.1 4	A
Maximum Continuous Body Diode Forward Current (Note 6)	I_S	1.5	A
Pulsed Drain Current (10 μs Pulse, Duty Cycle = 1%)	I_{DM}	25	A

Maximum Ratings P-CHANNEL (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-40	V
Gate-Source Voltage	V_{GSS}	± 20	V
Continuous Drain Current (Note 6) $V_{GS} = -10\text{V}$	Steady State $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	-3.7 -2.9	A
	$t < 10\text{s}$ $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	-4.8 -3.8	A
Continuous Drain Current (Note 6) $V_{GS} = -4.5\text{V}$	Steady State $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	-2.9 -2.3	A
	$t < 10\text{s}$ $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	-3.9 -3.0	A
Maximum Continuous Body Diode Forward Current (Note 6)	I_S	-1.5	A
Pulsed Drain Current (10 μs Pulse, Duty Cycle = 1%)	I_{DM}	-15	A

Note: 6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 7)						
Drain-Source Breakdown Voltage	BV _{DSS}	40	—	—	V	V _{GS} = 0V, I _D = 250μA
Zero Gate Voltage Drain Current	I _{DSS}	—	—	1	μA	V _{DS} = 40V, V _{GS} = 0V
Gate-Source Leakage	I _{GSS}	—	—	±100	nA	V _{GS} = ±20V, V _{DS} = 0V
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	V _{GS(TH)}	1	—	3	V	V _{DS} = V _{GS} , I _D = 250μA
Static Drain-Source On-Resistance	R _{DS(ON)}	—	26	45	mΩ	V _{GS} = 10V, I _D = 3.9A
		—	35	58		V _{GS} = 4.5V, I _D = 3.5A
Diode Forward Voltage	V _{SD}	—	0.7	1	V	V _{GS} = 0V, I _S = 1.25A
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C _{iss}	—	574	—	pF	V _{DS} = 20V, V _{GS} = 0V, f = 1MHz
Output Capacitance	C _{oss}	—	87.8	—		
Reverse Transfer Capacitance	C _{rss}	—	38.7	—		
Gate Resistance	R _g	—	1.6	—	Ω	V _{DS} = 0V, V _{GS} = 0V, f = 1MHz
Total Gate Charge (V _{GS} = 4.5V)	Q _g	—	5.9	—	nC	V _{DS} = 20V, I _D = 3.9A
Total Gate Charge (V _{GS} = 10V)	Q _g	—	12.5	—		
Gate-Source Charge	Q _{gs}	—	1.7	—		
Gate-Drain Charge	Q _{gd}	—	2.2	—		
Turn-On Delay Time	t _{D(ON)}	—	3.1	—	ns	V _{DD} = 20V, V _{GS} = 10V, R _L = 20Ω, R _G = 6Ω
Turn-On Rise Time	t _R	—	2.6	—		
Turn-Off Delay Time	t _{D(OFF)}	—	15	—		
Turn-Off Fall Time	t _F	—	5.5	—		
Reverse Recovery Time	t _{RR}	—	6.5	—	ns	I _F = 3.9A, di/dt = 500A/μs
Reverse Recovery Charge	Q _{RR}	—	1.2	—	nC	

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 7)						
Drain-Source Breakdown Voltage	BV _{DSS}	-40	—	—	V	V _{GS} = 0V, I _D = -250μA
Zero Gate Voltage Drain Current	I _{DSS}	—	—	-1	μA	V _{DS} = -40V, V _{GS} = 0V
Gate-Source Leakage	I _{GSS}	—	—	±100	nA	V _{GS} = ±20V, V _{DS} = 0V
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	V _{GS(TH)}	-1	—	-3	V	V _{DS} = V _{GS} , I _D = -250μA
Static Drain-Source On-Resistance	R _{DS(ON)}	—	49	65	mΩ	V _{GS} = -10V, I _D = -4.2A
		—	73	100		V _{GS} = -4.5V, I _D = -3.3A
Diode Forward Voltage	V _{SD}	—	-0.7	-1.2	V	V _{GS} = 0V, I _S = -1A
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C _{iss}	—	587	—	pF	V _{DS} = -20V, V _{GS} = 0V, f = 1MHz
Output Capacitance	C _{oss}	—	88.1	—	pF	
Reverse Transfer Capacitance	C _{rss}	—	40.2	—	pF	
Gate Resistance	R _g	—	12.3	—	Ω	V _{DS} = 0V, V _{GS} = 0V, f = 1MHz
Total Gate Charge (V _{GS} = -4.5V)	Q _g	—	5.4	—	nC	V _{DS} = -20V, I _D = -4.2A
Total Gate Charge (V _{GS} = -10V)	Q _g	—	11.1	—		
Gate-Source Charge	Q _{gs}	—	1.5	—		
Gate-Drain Charge	Q _{gd}	—	2	—		
Turn-On Delay Time	t _{D(ON)}	—	3.6	—	ns	V _{DD} = -15V, V _{GS} = -10V, R _G = 6Ω, I _D = -1A
Turn-On Rise Time	t _R	—	2.9	—		
Turn-Off Delay Time	t _{D(OFF)}	—	36.3	—		
Turn-Off Fall Time	t _F	—	15.3	—		
Reverse Recovery Time	t _{RR}	—	15.5	—	ns	I _F = -4.2A, di/dt = 500A/μs
Reverse Recovery Charge	Q _{RR}	—	16.9	—	nC	

Notes: 7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to product testing.

Typical Characteristics - N-CHANNEL

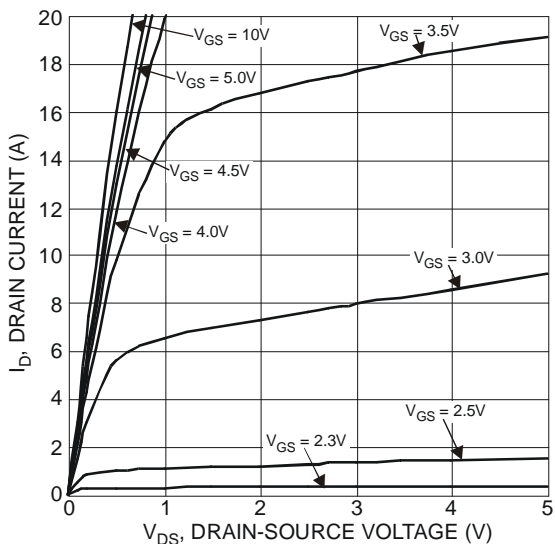


Figure 1 Typical Output Characteristics

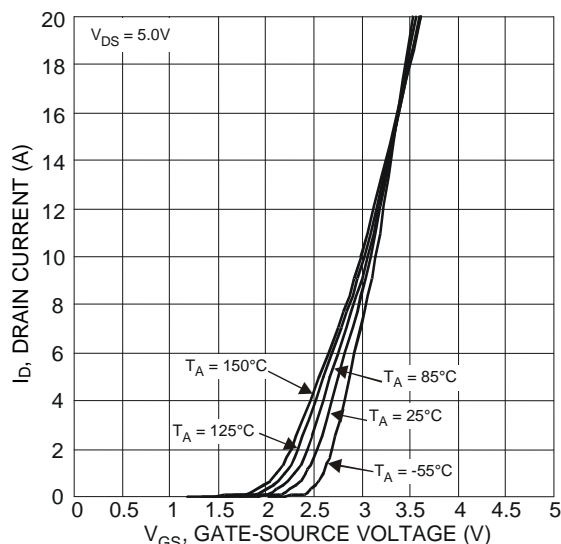


Figure 2 Typical Transfer Characteristics

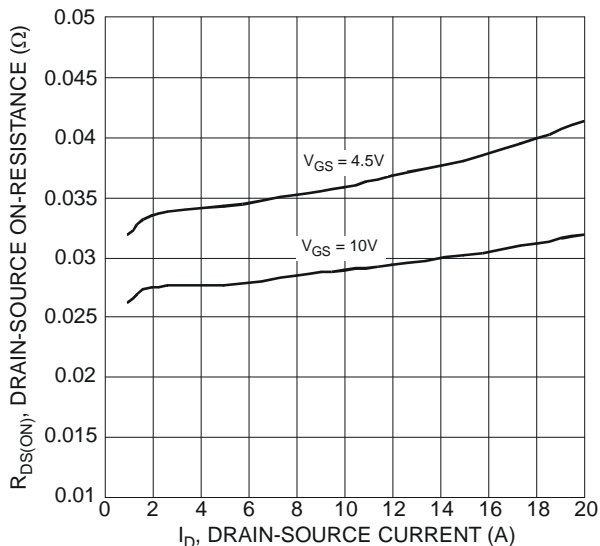


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

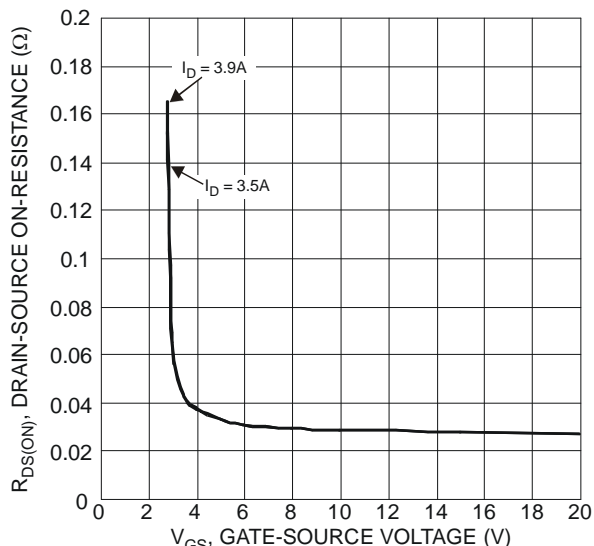


Figure 4 Typical Transfer Characteristics

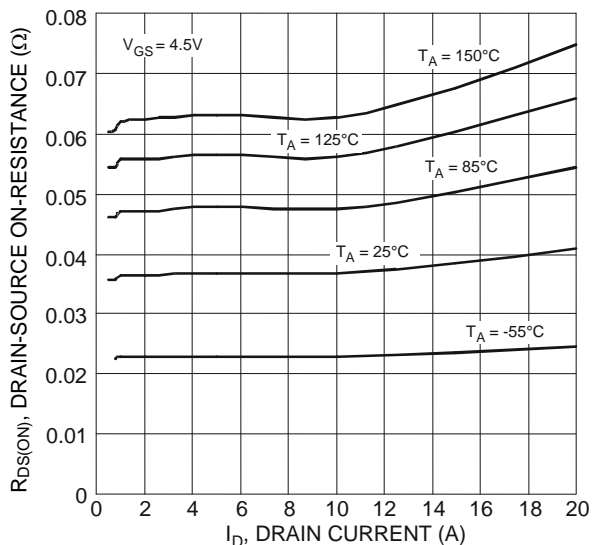


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

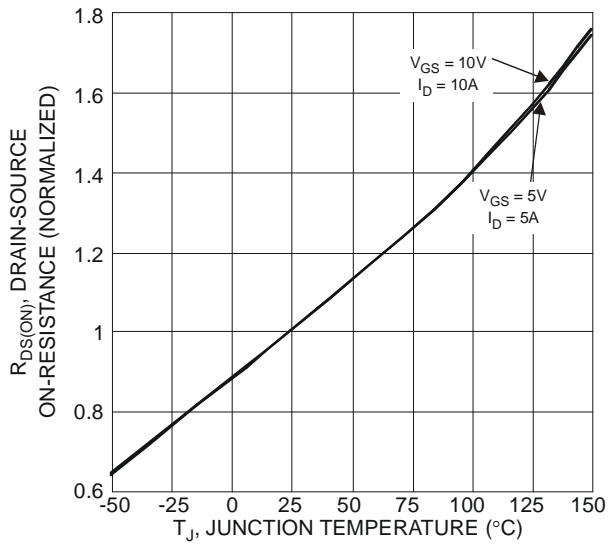


Figure 6 On-Resistance Variation with Temperature

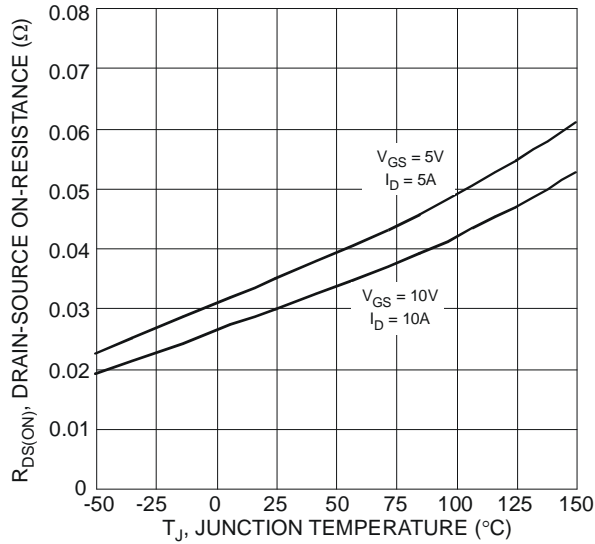


Figure 7 On-Resistance Variation with Temperature

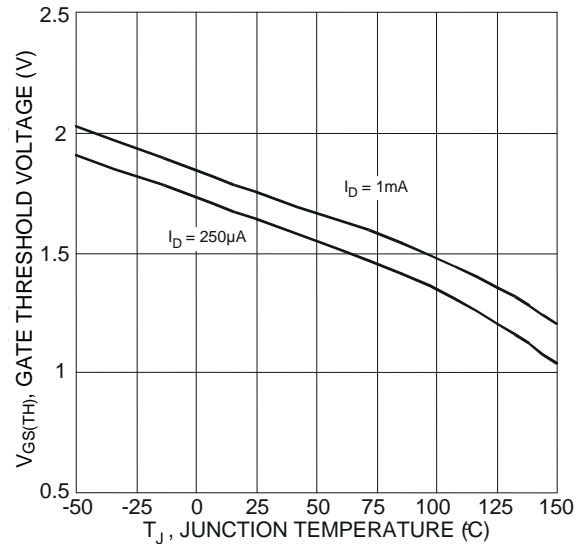


Figure 8 Gate Threshold Variation vs. Junction Temperature

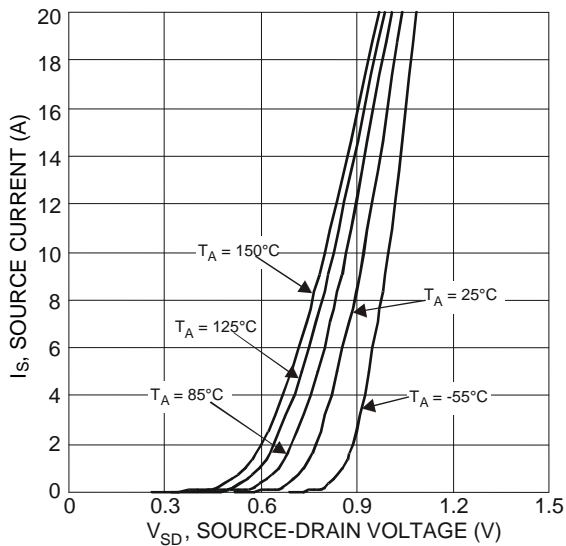


Figure 9 Diode Forward Voltage vs. Current

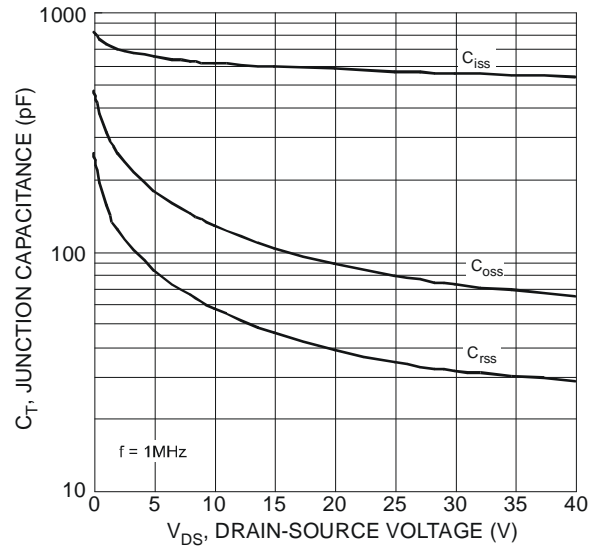


Figure 10 Typical Junction Capacitance

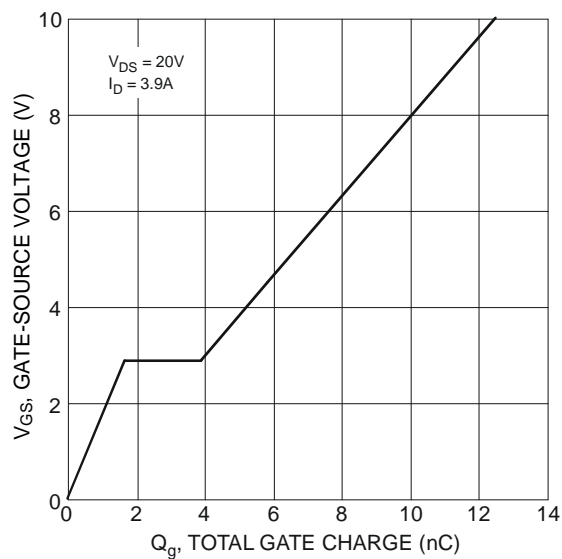


Figure 11 Gate Charge

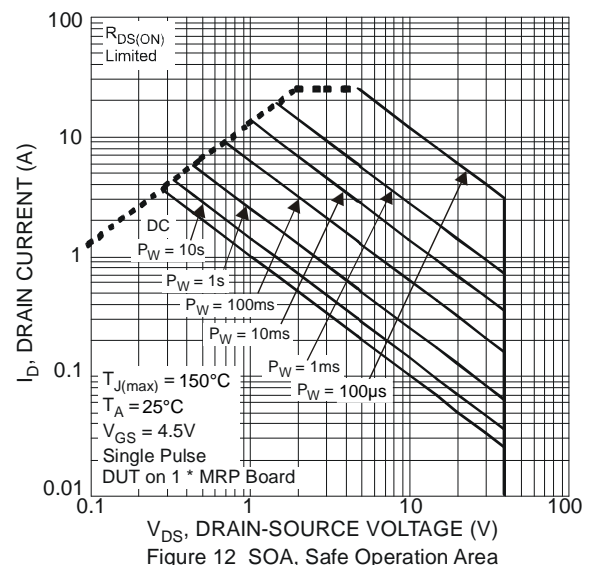


Figure 12 SOA, Safe Operation Area

Typical Characteristics - P-CHANNEL

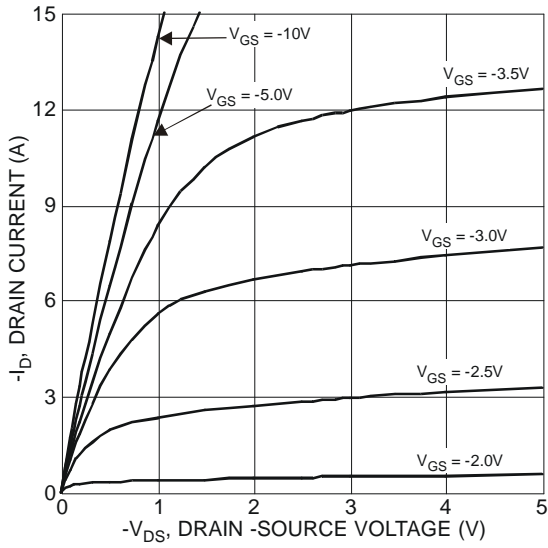


Figure 13 Typical Output Characteristics

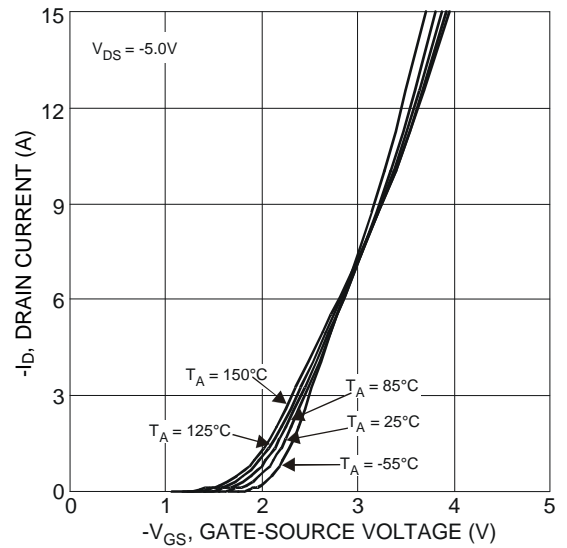


Figure 14 Typical Transfer Characteristics

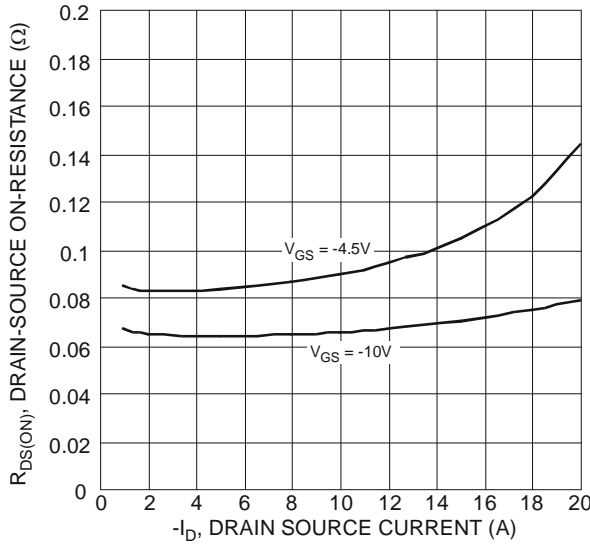


Figure 15 Typical On-Resistance vs. Drain Current and Gate Voltage

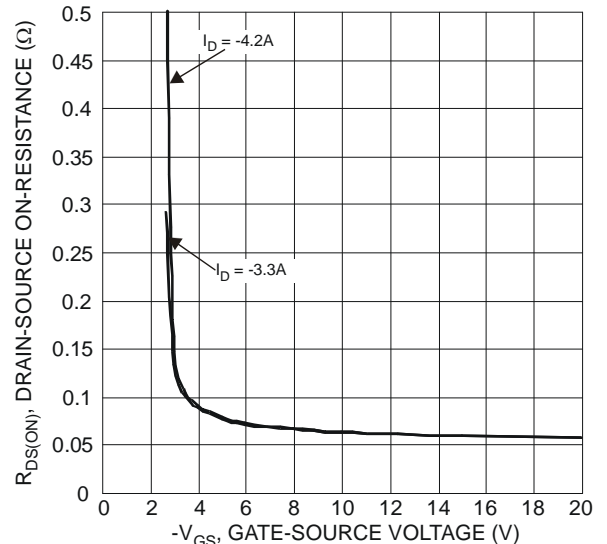


Figure 16 Typical Transfer Characteristics

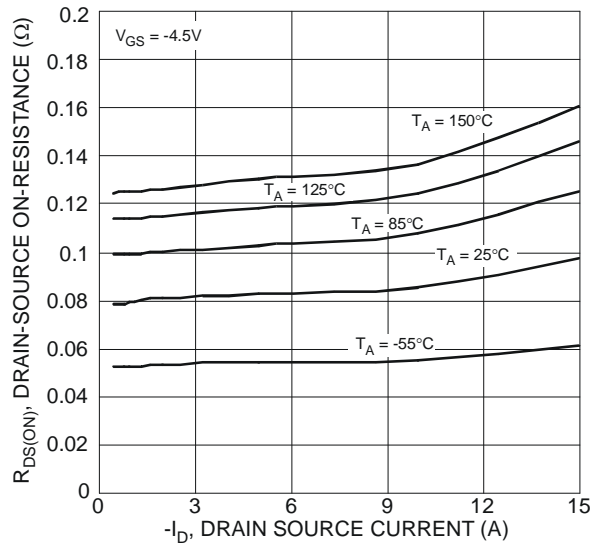


Figure 17 Typical On-Resistance vs. Drain Current and Temperature

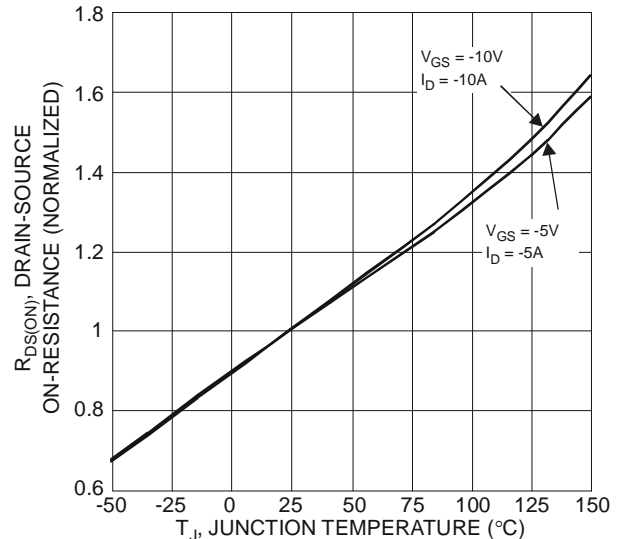


Figure 18 On-Resistance Variation with Temperature

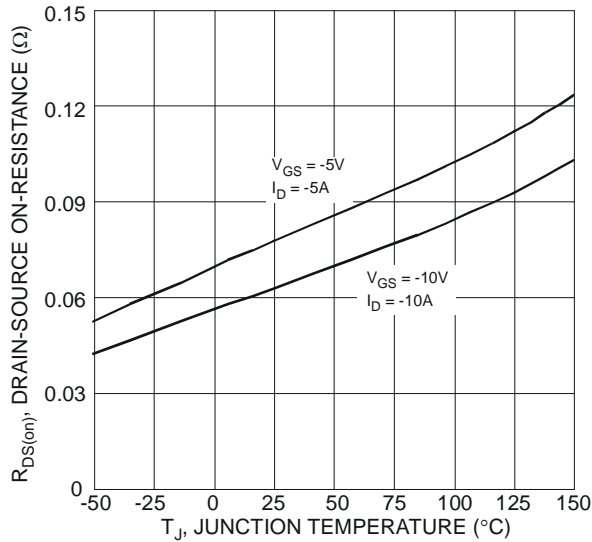


Figure 19 On-Resistance Variation with Temperature

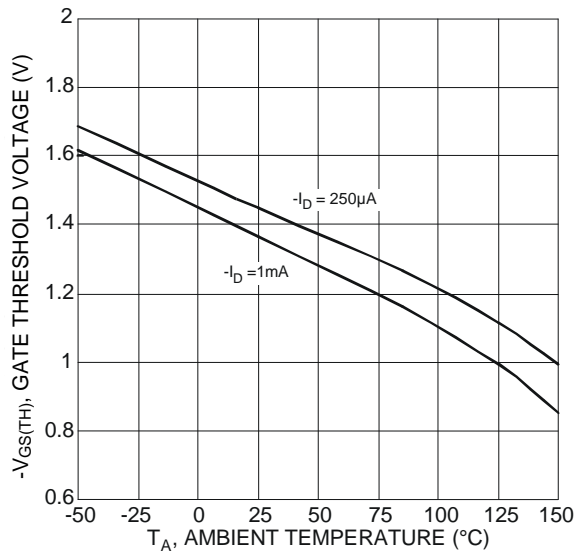


Figure 20 Gate Threshold Variation vs. Ambient Temperature

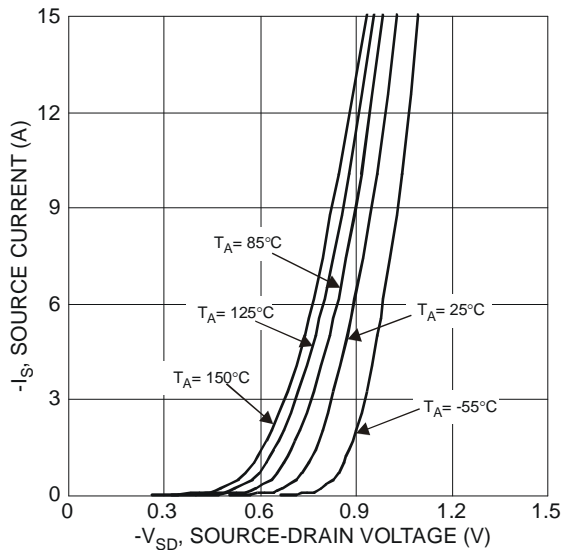


Figure 21 Diode Forward Voltage vs. Current

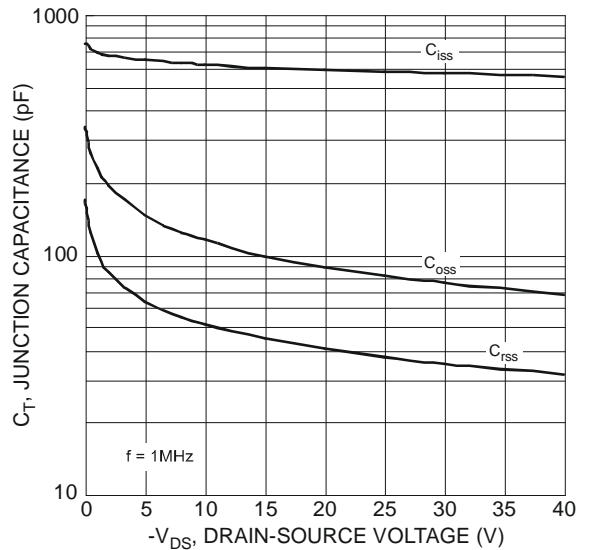


Figure 22 Typical Junction Capacitance

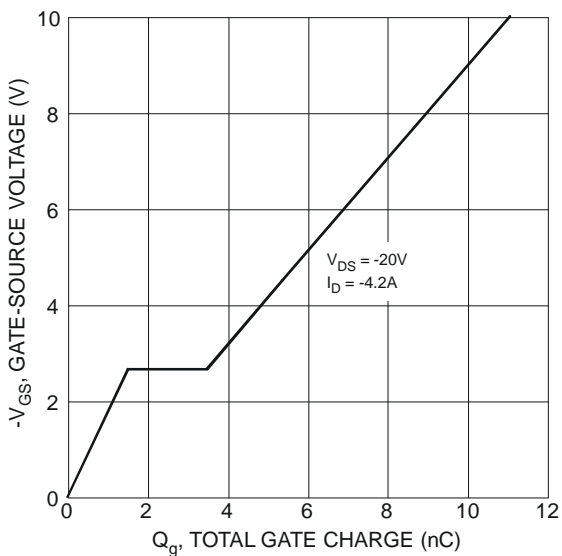


Figure 23 Gate-Charge Characteristics

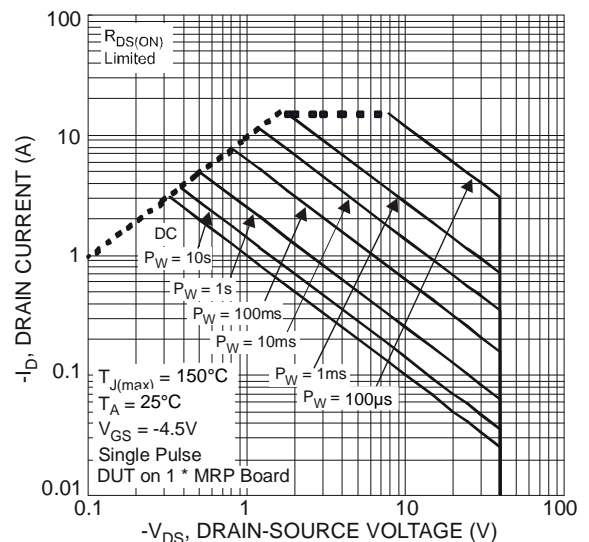


Figure 24 SOA, Safe Operation Area

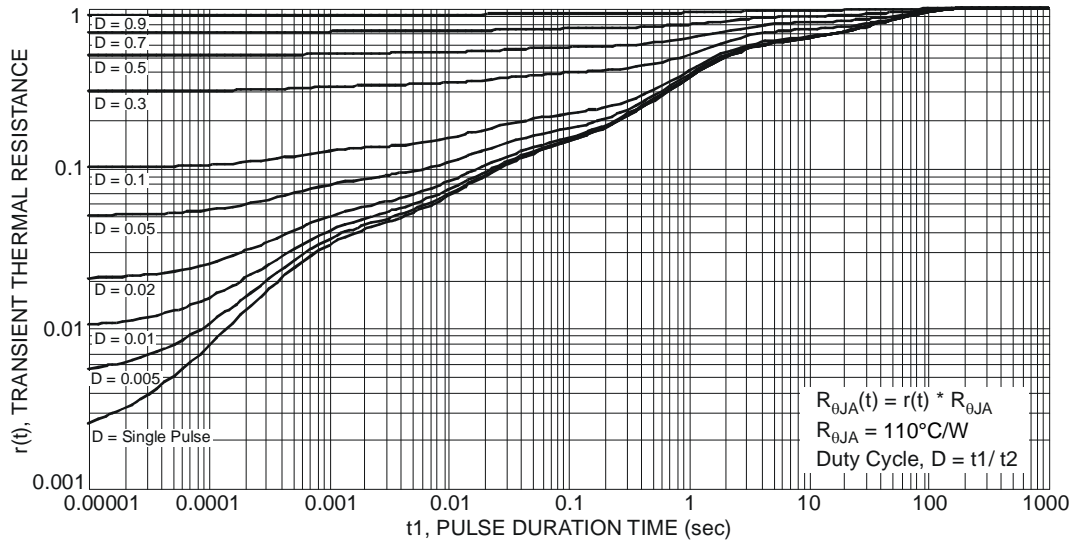
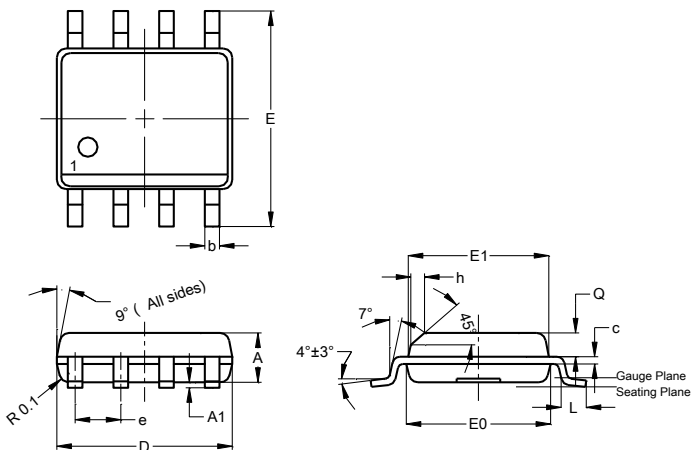


Figure 25 Transient Thermal Resistance

Package Outline Dimensions

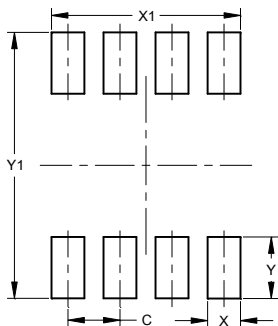
Please see <http://www.diodes.com/package-outlines.html> for the latest version.



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.



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

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