

40V COMPLEMENTARY ENHANCEMENT MODE MOSFET H-BRIDGE
Product Summary

Device	V _{(BR)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

This new generation complementary MOSFET H-Bridge features low on-resistance achievable with low gate drive.

Applications

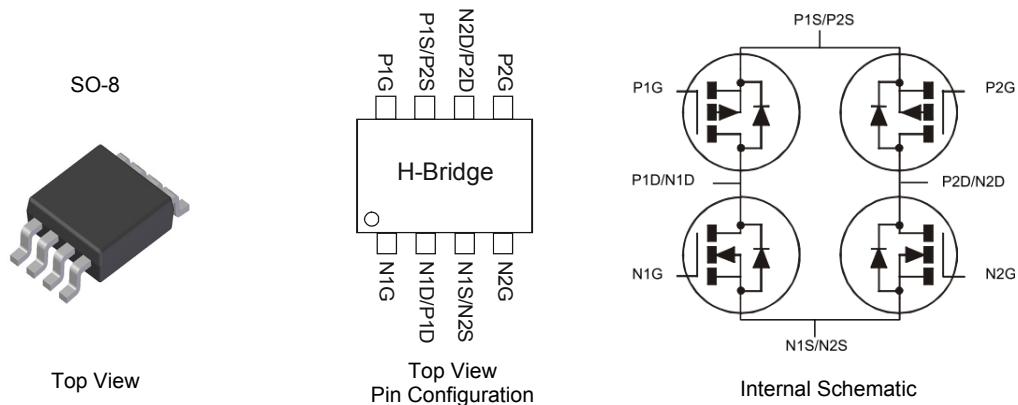
- DC Motor Control
- DC-AC Inverters

Features

- 2 x N + 2 x P channels in a SOIC 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**

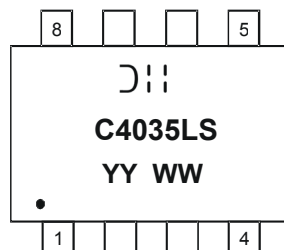
Mechanical Data

- 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 (E3)
- Weight: 0.074 grams (approximate)

NEW PRODUCT

Ordering Information (Note 4)

Part Number	Compliance	Case	Packaging
DMHC4035LSD-13	Standard	SO-8	2500/Tape & Reel

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
 2. See http://www.diodes.com/quality/lead_free.html 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
 C4035LS = Product Type Marking Code
 YYWW = Date Code Marking
 YY = Year (ex: 13 = 2013)
 WW = Week (01 - 53)

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

Characteristic	Symbol	Value	Units
Total Power Dissipation (Note 5)	P_D	1.5	W
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	Steady State	85
		$t < 10\text{s}$	53
Thermal Resistance, Junction to Case	$R_{\theta JC}$	15	$^\circ\text{C/W}$
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	Units
Drain-Source Voltage	V_{DSS}	40	V
Gate-Source Voltage	V_{GSS}	± 20	V
Continuous Drain Current (Note 5) $V_{GS} = 10\text{V}$	I_D	Steady State $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	4.5 3.5
		$t < 10\text{s}$ $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	5.8 4.5
Continuous Drain Current (Note 5) $V_{GS} = 4.5\text{V}$	I_D	Steady State $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	4 3.1
		$t < 10\text{s}$ $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	5.1 4
Maximum Continuous Body Diode Forward Current (Note 5)	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	Units
Drain-Source Voltage	V_{DSS}	-40	V
Gate-Source Voltage	V_{GSS}	± 20	V
Continuous Drain Current (Note 5) $V_{GS} = -10\text{V}$	I_D	Steady State $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	-3.7 -2.9
		$t < 10\text{s}$ $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	-4.8 -3.8
Continuous Drain Current (Note 5) $V_{GS} = -4.5\text{V}$	I_D	Steady State $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	-2.9 -2.3
		$t < 10\text{s}$ $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	-3.9 -3.0
Maximum Continuous Body Diode Forward Current (Note 5)	I_S	-1.5	A
Pulsed Drain Current (10 μs pulse, duty cycle = 1%)	I_{DM}	-15	A

Note: 5. 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 6)						
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 6)						
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 7)						
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 6)						
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 6)						
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 7)						
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: 6. Short duration pulse test used to minimize self-heating effect.
7. Guaranteed by design. Not subject to product testing.

Typical Characteristics - N-CHANNEL

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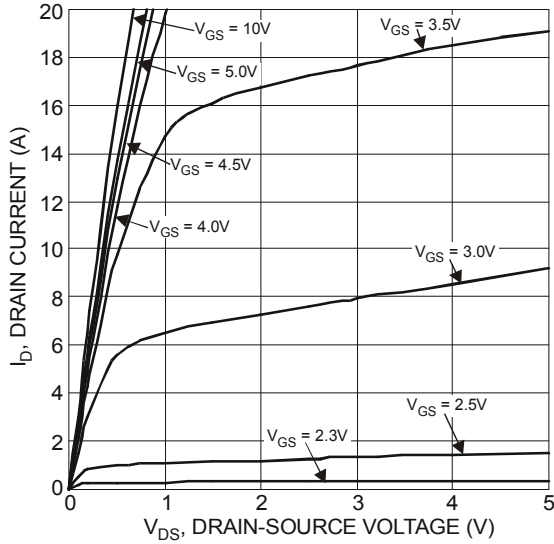


Figure 1 Typical Output Characteristics

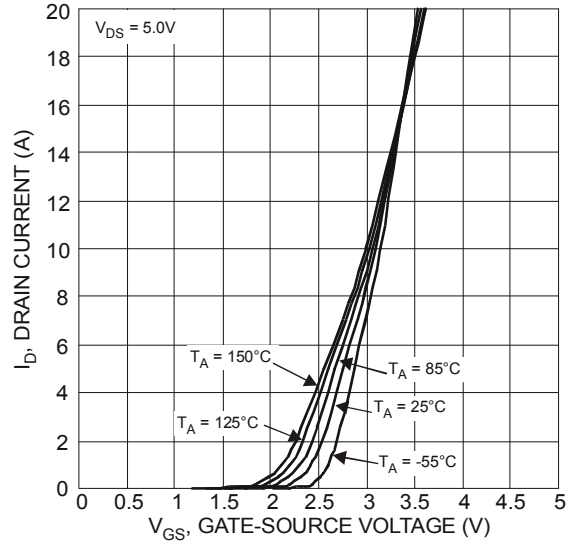


Figure 2 Typical Transfer Characteristics

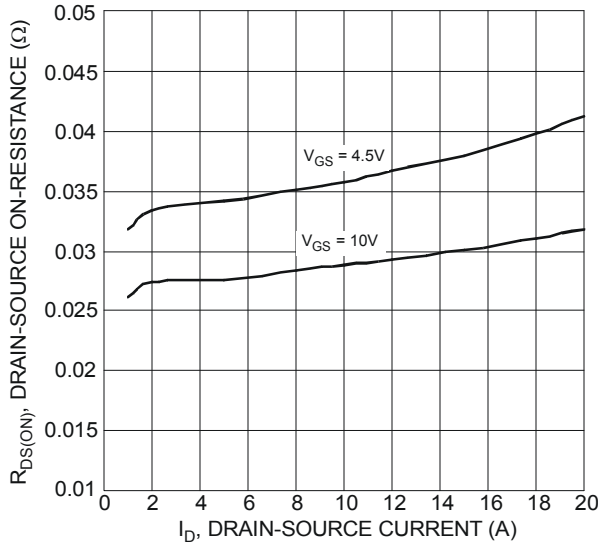


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

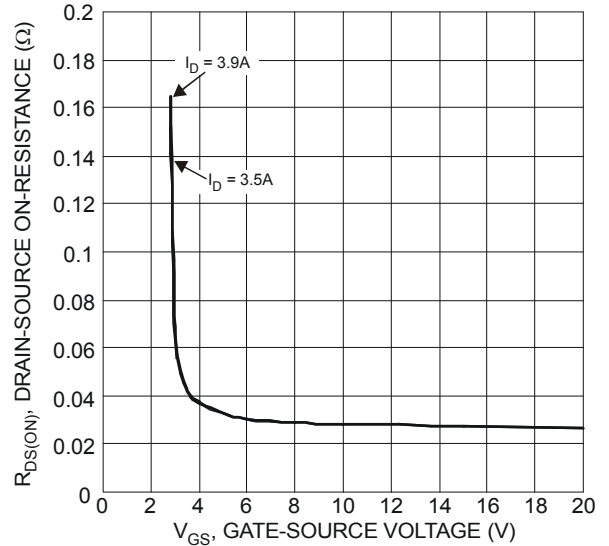


Figure 4 Typical Transfer Characteristics

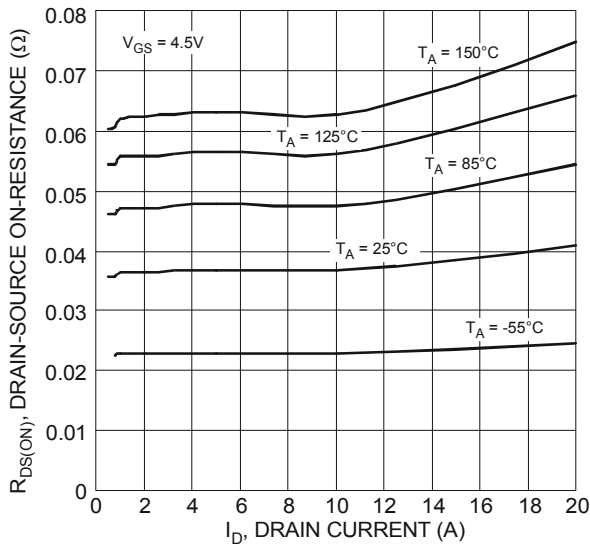


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

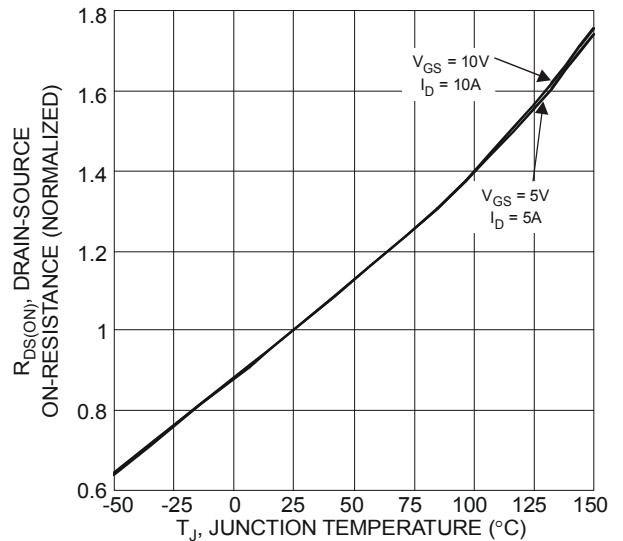


Figure 6 On-Resistance Variation with Temperature

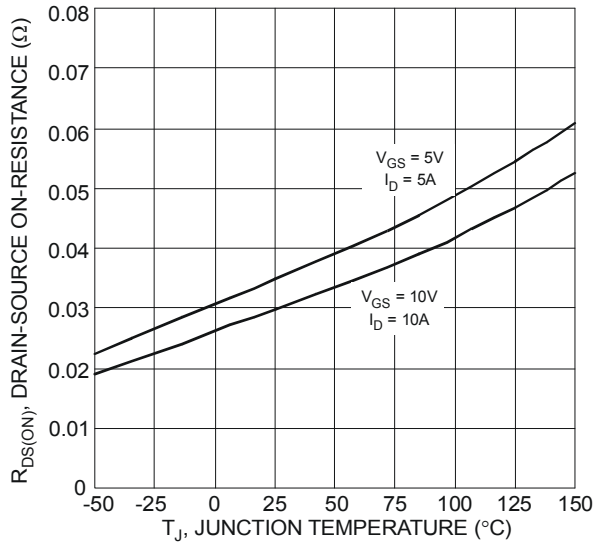


Figure 7 On-Resistance Variation with Temperature

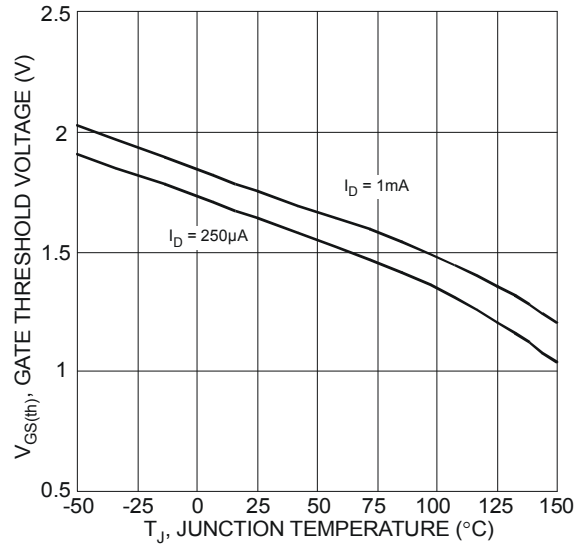


Figure 8 Gate Threshold Variation vs. Ambient Temperature

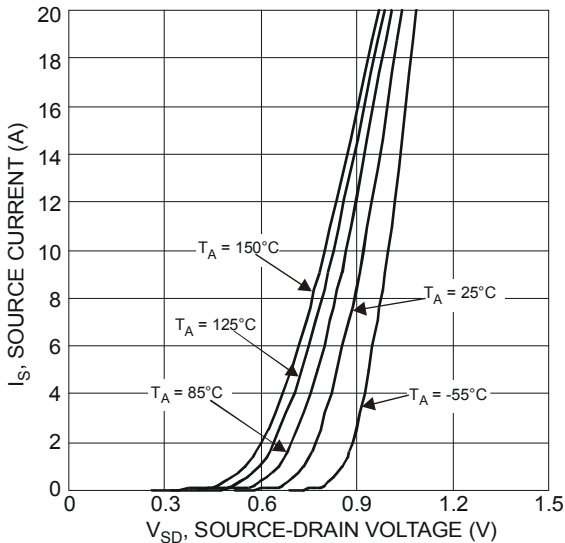


Figure 9 Diode Forward Voltage vs. Current

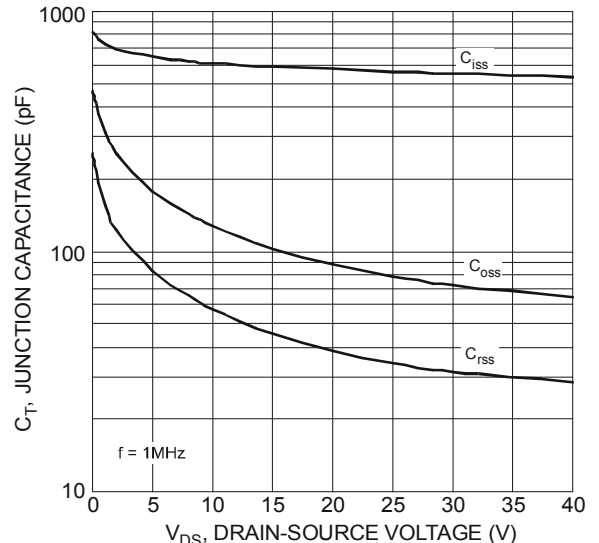


Figure 10 Typical Junction Capacitance

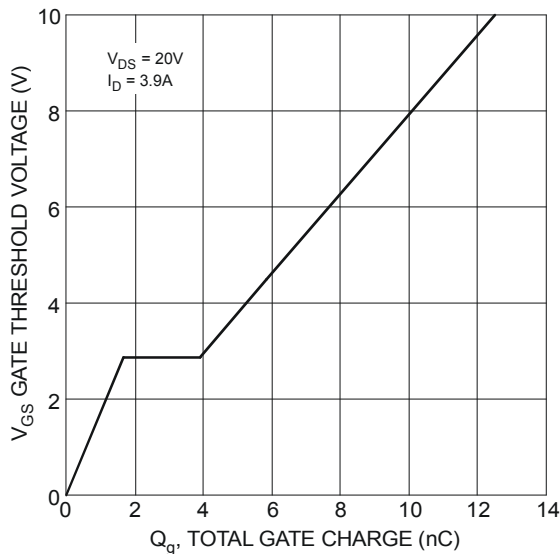


Figure 11 Gate Charge

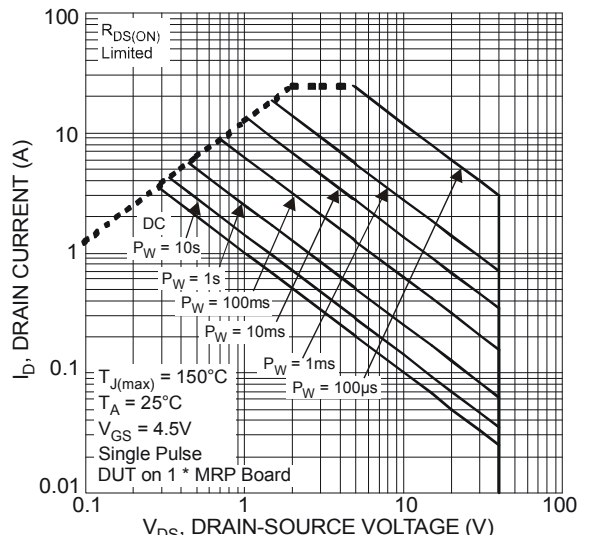


Figure 12 SOA, Safe Operation Area

Typical Characteristics - P-CHANNEL

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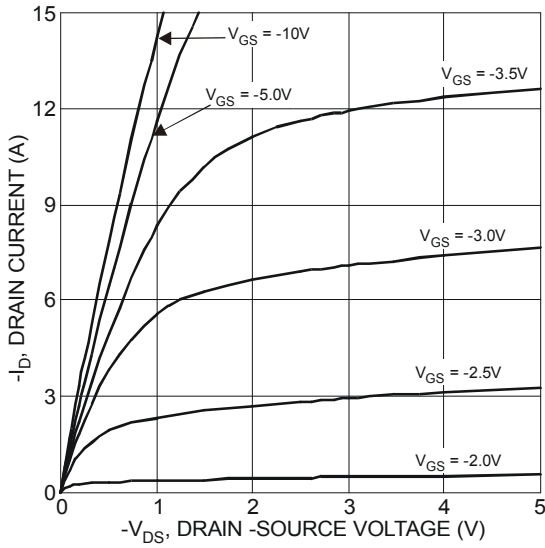


Figure 13 Typical Output Characteristics

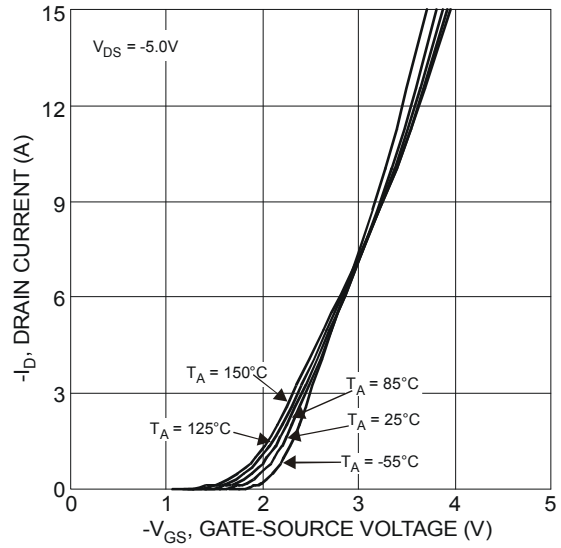


Figure 14 Typical Transfer Characteristics

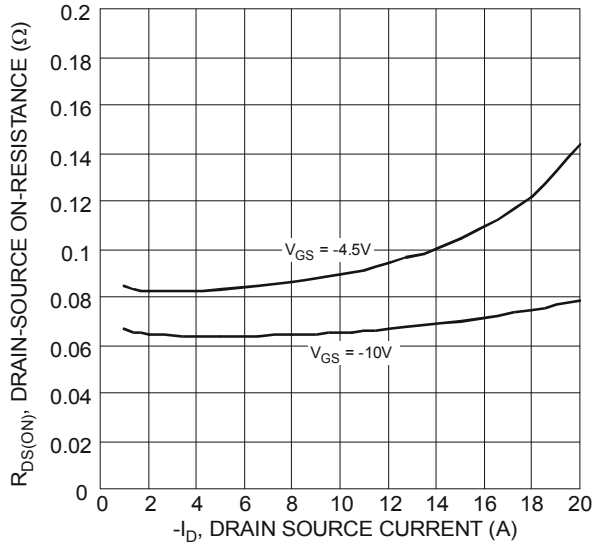


Figure 15 Typical On-Resistance vs. Drain Current and Gate Voltage

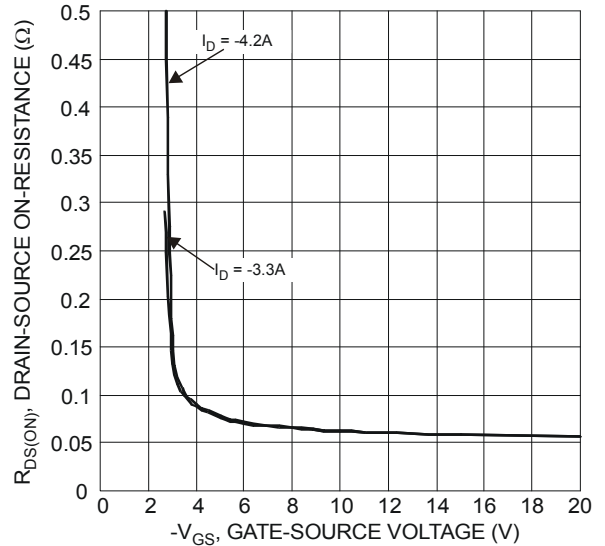


Figure 16 Typical Transfer Characteristics

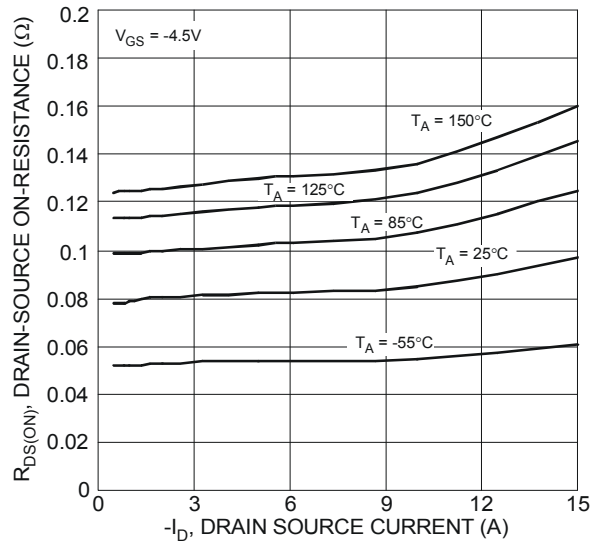


Figure 17 Typical On-Resistance vs. Drain Current and Temperature

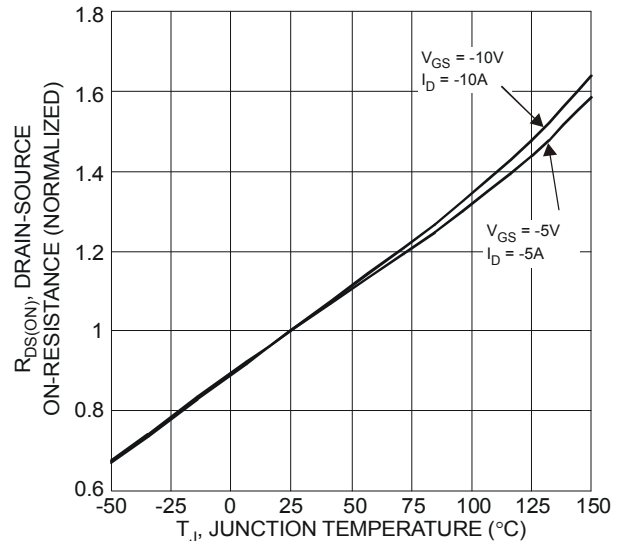


Figure 18 On-Resistance Variation with Temperature

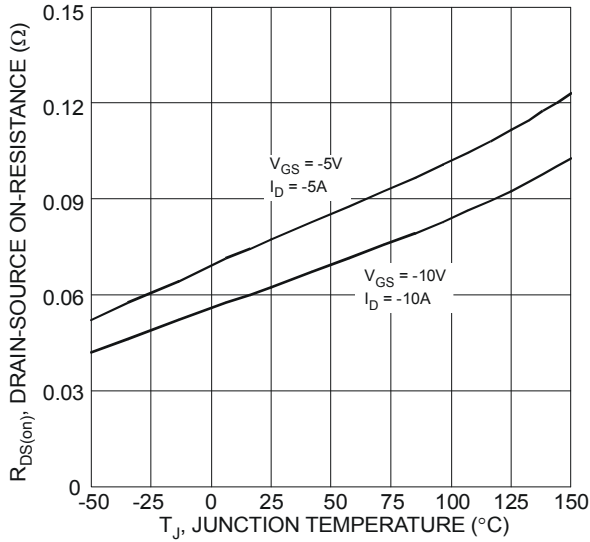


Figure 19 On-Resistance Variation with Temperature

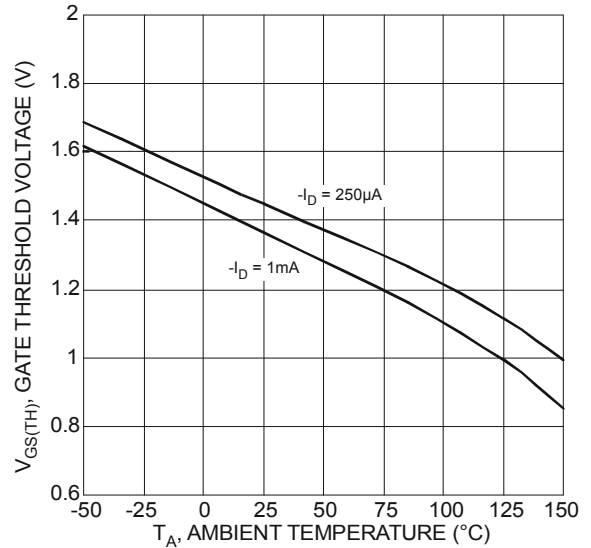


Figure 20 Gate Threshold Variation vs. Ambient Temperature

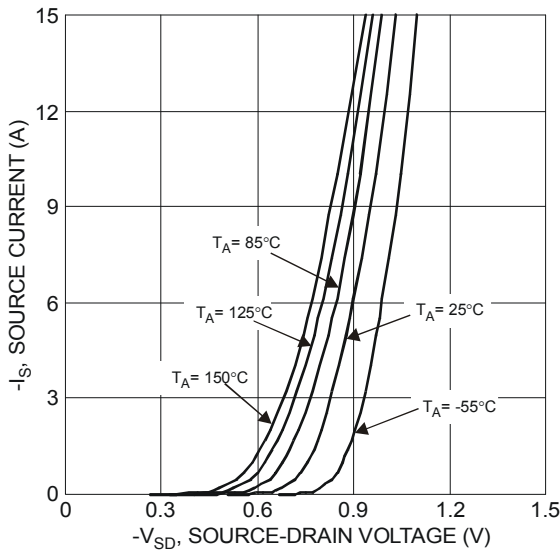


Figure 21 Diode Forward Voltage vs. Current

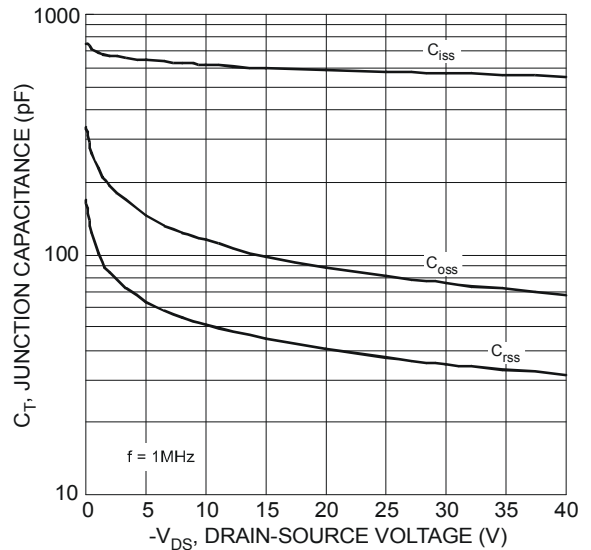


Figure 22 Typical Junction Capacitance

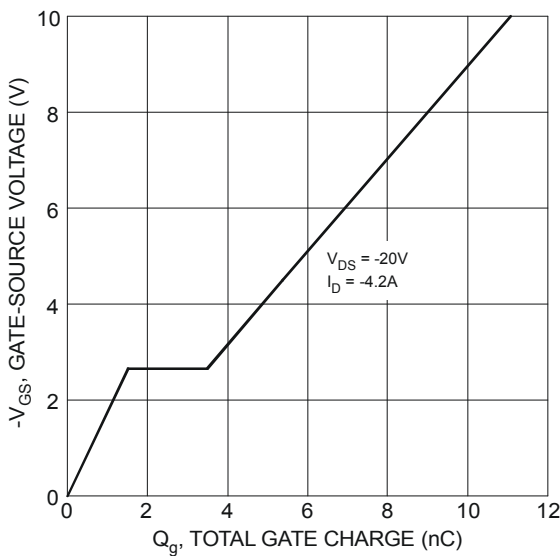


Figure 23 Gate-Charge Characteristics

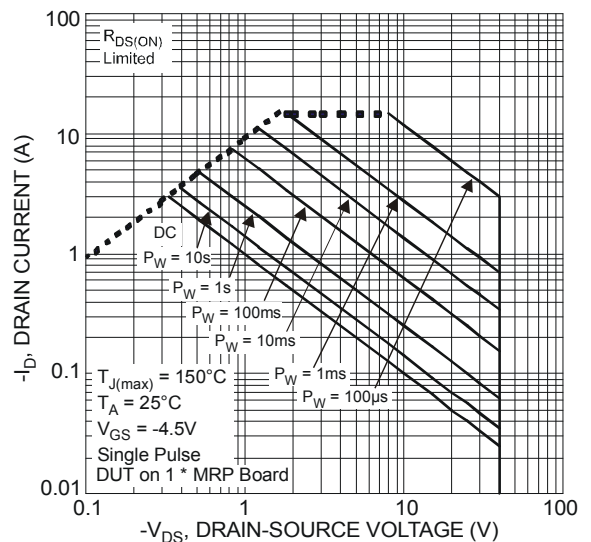


Figure 24 SOA, Safe Operation Area

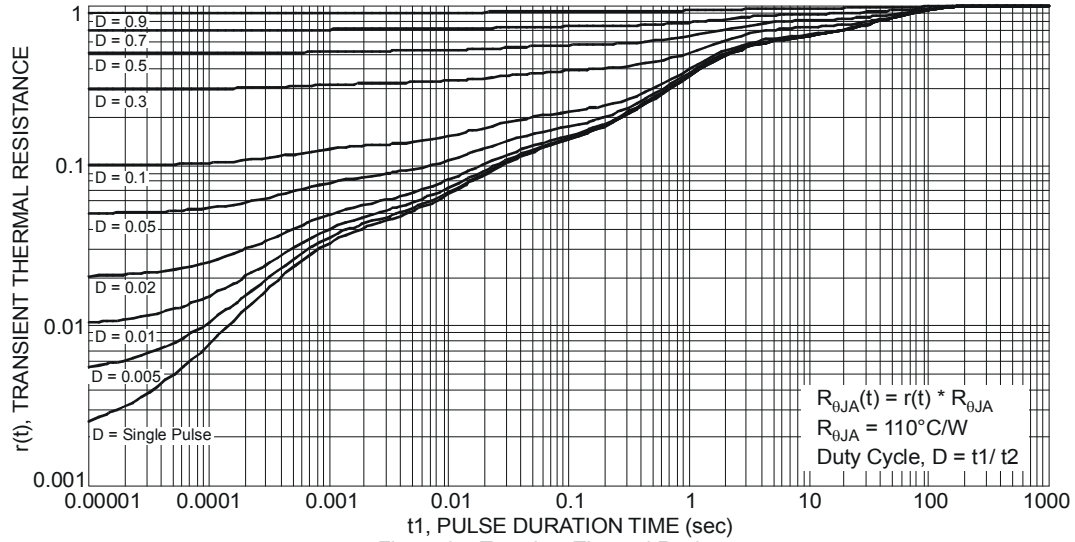
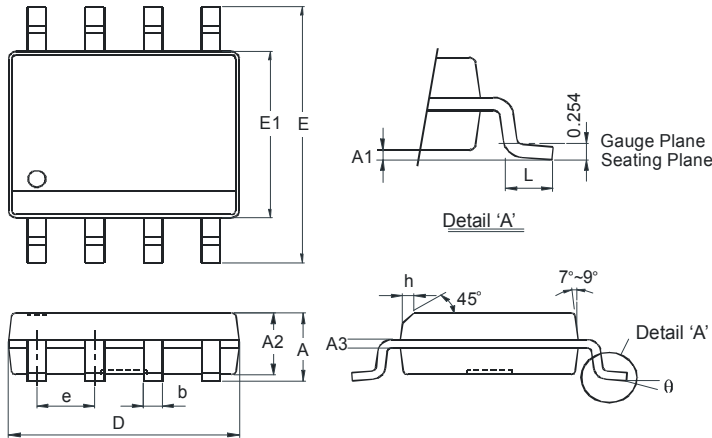


Figure 25 Transient Thermal Resistance

Package Outline Dimensions

Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

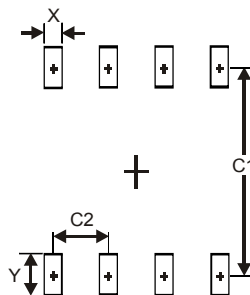


SO-8		
Dim	Min	Max
A	-	1.75
A1	0.10	0.20
A2	1.30	1.50
A3	0.15	0.25
b	0.3	0.5
D	4.85	4.95
E	5.90	6.10
E1	3.85	3.95
e	1.27 Typ	
h	-	0.35
L	0.62	0.82
θ	0°	8°

All Dimensions in mm

Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



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

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