



#### 40V COMPLEMENTARY ENHANCEMENT MODE MOSFET H-BRIDGE

#### **Product Summary**

Device	BV <sub>DSS</sub>	R <sub>DS(ON)</sub> Max	I <sub>D</sub> Max T <sub>A</sub> = +25°C
N-Channel	40V	45mΩ @ V <sub>GS</sub> = 10V	4.5A
N-Channel	40 V	$58m\Omega$ @ $V_{GS} = 4.5V$	4A
D Channal	-40V	$65m\Omega$ @ $V_{GS} = -10V$	-3.7A
P-Channel	-40V	100mΩ @ V <sub>GS</sub> = -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**

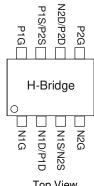
- 2 x N + 2 x P Channels in An SO-8 Package
- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speed
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)
- Qualified to AEC-Q101 Standards for High Reliability
- PPAP Capable (Note 4)

#### **Mechanical Data**

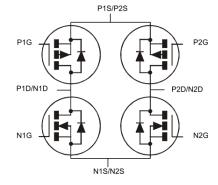
- Case: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound.
   UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections Indicator: See Diagram
- Terminals: Finish Matte Tin Annealed over Copper Leadframe.
   Solderable per MIL-STD-202, Method 208 @3
- Weight: 0.074 grams (Approximate)







Top View Pin Configuration



Internal Schematic

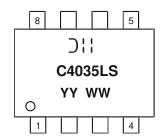
#### Ordering Information (Note 5)

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**



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



# Thermal Characteristics (@ $T_A = +25$ °C, unless otherwise specified.)

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

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

Characteristic		Symbol	Value	Unit		
Drain-Source Voltage		V <sub>DSS</sub>	40	V		
Gate-Source Voltage			V <sub>GSS</sub>	±20	V	
Continuous Drain Current (Note 6) V <sub>GS</sub> = 10V		$T_A = +25$ °C $T_A = +70$ °C	I <sub>D</sub>	4.5 3.5	А	
		$T_A = +25$ °C $T_A = +70$ °C	I <sub>D</sub>	5.8 4.5	Α	
Continuous Drain Current (Note 6) V <sub>GS</sub> = 4.5V  t<10s		$T_A = +25$ °C $T_A = +70$ °C	I <sub>D</sub>	4 3.1	А	
		$T_A = +25$ °C $T_A = +70$ °C	I <sub>D</sub>	5.1 4	Α	
Maximum Continuous Body Diode Forward Current	(Note 6)	Is	1.5	Α		
Pulsed Drain Current (10μs Pulse, Duty Cycle = 1%)			I <sub>DM</sub>	25	A	

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

Characteristic		Symbol	Value	Unit	
Drain-Source Voltage		V <sub>DSS</sub>	-40	V	
Gate-Source Voltage			V <sub>GSS</sub>	±20	V
State		$T_A = +25^{\circ}C$ $T_A = +70^{\circ}C$	I <sub>D</sub>	-3.7 -2.9	А
Continuous Drain Current (Note 6) V <sub>GS</sub> = -10V	t<10s	$T_A = +25^{\circ}C$ $T_A = +70^{\circ}C$	I <sub>D</sub>	-4.8 -3.8	А
St		$T_A = +25$ °C $T_A = +70$ °C	I <sub>D</sub>	-2.9 -2.3	А
Continuous Drain Current (Note 6) V <sub>GS</sub> = -4.5V	t<10s	$T_A = +25$ °C $T_A = +70$ °C	I <sub>D</sub>	-3.9 -3.0	А
Maximum Continuous Body Diode Forward Current	(Note 6)	I <sub>S</sub>	-1.5	Α	
Pulsed Drain Current (10μs Pulse, Duty Cycle = 1%	I <sub>DM</sub>	-15	Α		

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



# Electrical Characteristics N-CHANNEL (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Тур	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 7)						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	40	_	_	V	$V_{GS} = 0V, I_D = 250\mu A$
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	_	_	1	μA	$V_{DS} = 40V, V_{GS} = 0V$
Gate-Source Leakage	I <sub>GSS</sub>		_	±100	nA	$V_{GS} = \pm 20V, V_{DS} = 0V$
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{GS(TH)}$	1	_	3	V	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$
Static Drain-Source On-Resistance		_	26	45	mΩ	$V_{GS} = 10V, I_D = 3.9A$
Static Drain-Source On-nesistance	R <sub>DS(ON)</sub>	_	35	58	11122	$V_{GS} = 4.5V, I_D = 3.5A$
Diode Forward Voltage	$V_{SD}$		0.7	1	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 1.25A
DYNAMIC CHARACTERISTICS (Note 8)						•
Input Capacitance	C <sub>iss</sub>	_	574	_		V 00V V 0V
Output Capacitance	Coss	_	87.8	_	рF	$V_{DS} = 20V$ , $V_{GS} = 0V$ , $f = 1MHz$
Reverse Transfer Capacitance	C <sub>rss</sub>	_	38.7	_		
Gate Resistance	$R_g$	_	1.6	_	Ω	$V_{DS} = 0V$ , $V_{GS} = 0V$ , $f = 1MHz$
Total Gate Charge (V <sub>GS</sub> = 4.5V)	Qg	_	5.9	_		
Total Gate Charge (V <sub>GS</sub> = 10V)	Qg		12.5	_	nC	V 20V I 2.0A
Gate-Source Charge	Q <sub>gs</sub>	_	1.7	_	iiC	$V_{DS} = 20V, I_D = 3.9A$
Gate-Drain Charge	$Q_{gd}$		2.2	_		
Turn-On Delay Time	t <sub>D(ON)</sub>		3.1	_		
Turn-On Rise Time	t <sub>R</sub>		2.6	_	ns	$V_{DD} = 20V, V_{GS} = 10V,$
Turn-Off Delay Time	t <sub>D(OFF)</sub>	1	15	_	115	$R_L = 20\Omega$ , $R_G = 6\Omega$
Turn-Off Fall Time	t <sub>F</sub>		5.5	_		
Reverse Recovery Time	t <sub>RR</sub>	_	6.5	_	ns	I <sub>F</sub> = 3.9A, di/dt = 500A/µs
Reverse Recovery Charge	Q <sub>RR</sub>	_	1.2	_	nC	1 σ.σ.ν, αναι – σσσλιμο

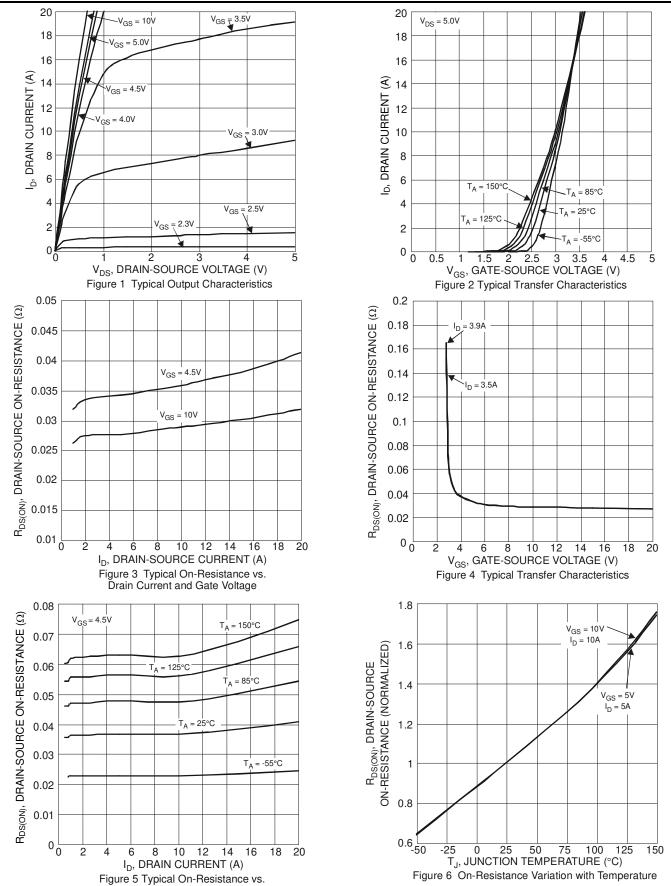
## Electrical Characteristics P-CHANNEL (@TA = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Тур	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 7)						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	-40	_	_	V	$V_{GS} = 0V, I_D = -250\mu A$
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	_	_	-1	μA	$V_{DS} = -40V, V_{GS} = 0V$
Gate-Source Leakage	Igss	_	_	±100	nA	$V_{GS} = \pm 20V, V_{DS} = 0V$
ON CHARACTERISTICS (Note 7)	•					
Gate Threshold Voltage	V <sub>GS(TH)</sub>	-1	_	-3	V	$V_{DS} = V_{GS}, I_{D} = -250 \mu A$
Static Drain-Source On-Resistance		_	49	65	mΩ	$V_{GS} = -10V, I_D = -4.2A$
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	_	73	100	11122	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3.3A
Diode Forward Voltage	$V_{SD}$	_	-0.7	-1.2	V	$V_{GS} = 0V, I_{S} = -1A$
DYNAMIC CHARACTERISTICS (Note 8)		ı	ı	I.		
Input Capacitance	C <sub>iss</sub>	_	587	_	pF	.,
Output Capacitance	Coss	_	88.1	_	pF	$V_{DS} = -20V, V_{GS} = 0V,$ f = 1MHz
Reverse Transfer Capacitance	$C_{rss}$	_	40.2	_	pF	-I = IIVIHZ
Gate Resistance	$R_g$	_	12.3	_	Ω	$V_{DS} = 0V$ , $V_{GS} = 0V$ , $f = 1MHz$
Total Gate Charge (V <sub>GS</sub> = -4.5V)	Qg	_	5.4	_	nC	
Total Gate Charge (V <sub>GS</sub> = -10V)	Qg	_	11.1	_	nC	1,, ,,,,,
Gate-Source Charge	Q <sub>gs</sub>	_	1.5	_	nC	$V_{DS} = -20V, I_D = -4.2A$
Gate-Drain Charge	Q <sub>gd</sub>	_	2	_	nC	7
Turn-On Delay Time	t <sub>D(ON)</sub>	_	3.6	_	ns	
Turn-On Rise Time	t <sub>R</sub>	_	2.9	_	ns	$V_{DD} = -15V, V_{GS} = -10V,$
Turn-Off Delay Time	t <sub>D(OFF)</sub>	_	36.3	_	ns	$R_G = 6\Omega$ , $I_D = -1A$
Turn-Off Fall Time	t <sub>F</sub>	_	15.3	_	ns	
Reverse Recovery Time	t <sub>RR</sub>	_	15.5	_	ns	I <sub>F</sub> = -4.2A, di/dt = 500A/µs
Reverse Recovery Charge	Q <sub>RR</sub>	_	16.9	_	nC	114.2A, αί/αι = 300A/μS

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



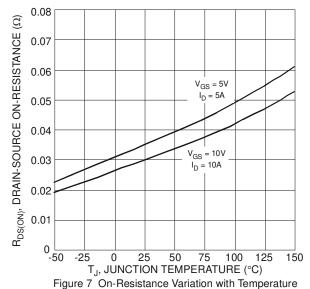
# Typical Characteristics - N-CHANNEL

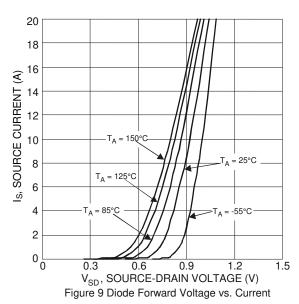


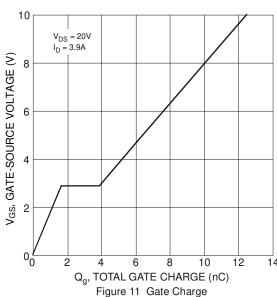
Drain Current and Temperature











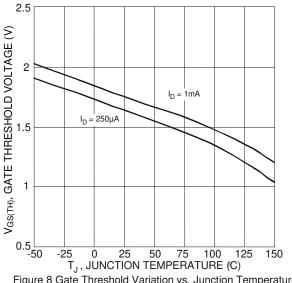
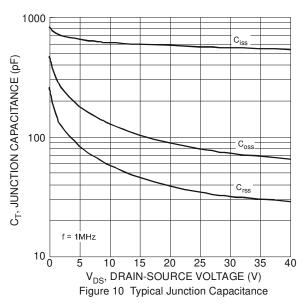
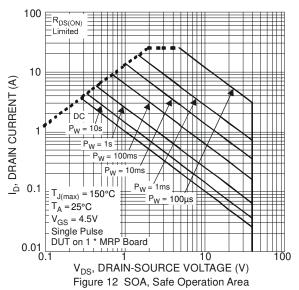


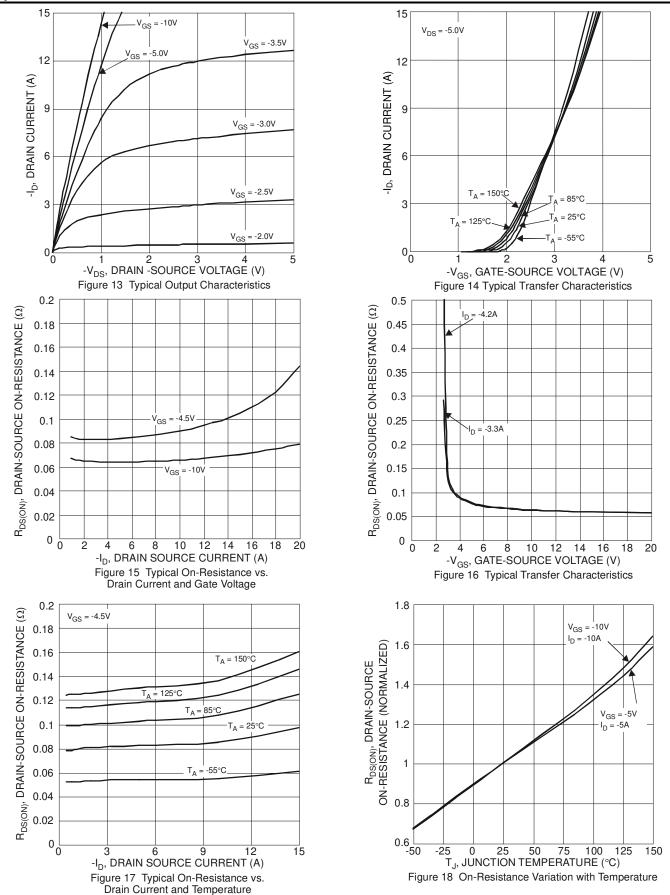
Figure 8 Gate Threshold Variation vs. Junction Temperature



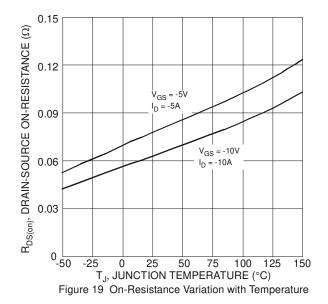


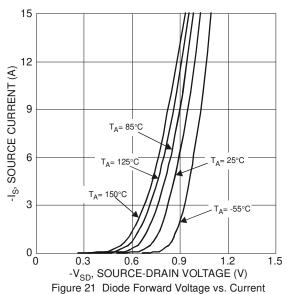


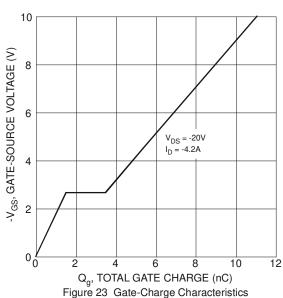
## **Typical Characteristics - P-CHANNEL**











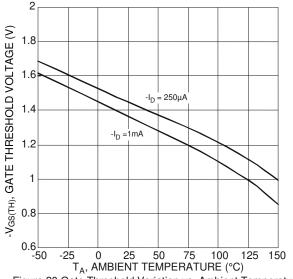
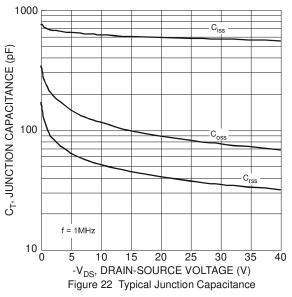
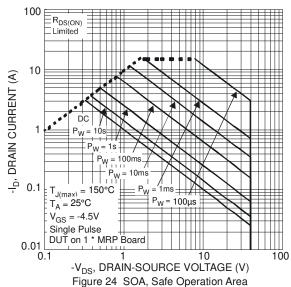
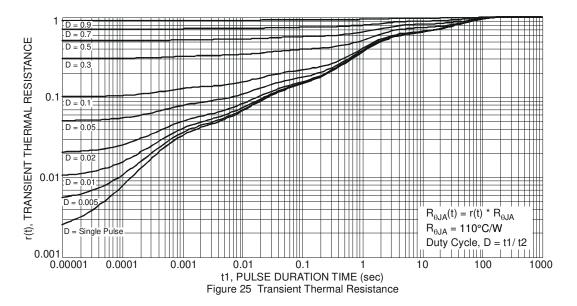


Figure 20 Gate Threshold Variation vs. Ambient Temperature



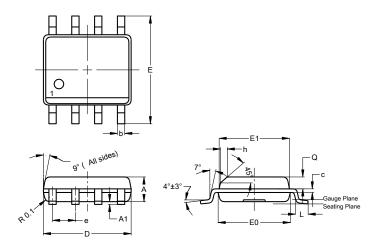






## **Package Outline Dimensions**

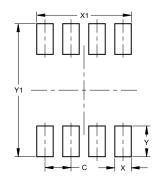
Please see http://www.diodes.com/package-outlines.html for the latest version.



SO-8						
Dim	Min	Max	Тур			
Α	1.40	1.50	1.45			
A1	0.10	0.20	0.15			
b	0.30	0.50	0.40			
С	0.15	0.25	0.20			
D	4.85	4.95	4.90			
Е	5.90	6.10	6.00			
E1	3.80	3.90	3.85			
E0	3.85	3.95	3.90			
е	-		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)
С	1.27
Х	0.802
X1	4.612
Υ	1.505
Y1	6.50



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