60V 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	60V	100mΩ @ V_{GS} = 10V	4.1A
		120mΩ @ V_{GS} = 4.5V	3.7A
P-Channel	-60V	170mΩ @ V_{GS} = -10V	3.1A
		250mΩ @ V_{GS} = -4.5V	2.6A

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)**

Description

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

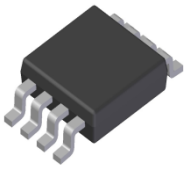
Applications

- DC Motor Control
- DC-AC Inverters

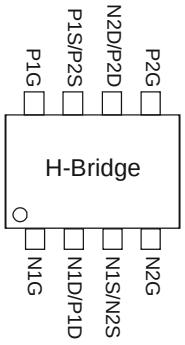
Mechanical Data

- 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)

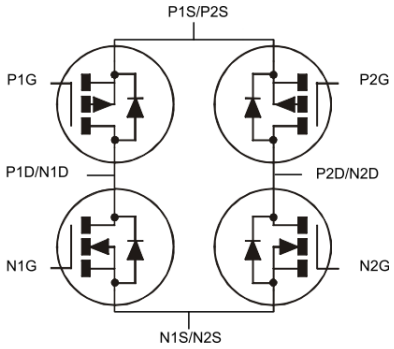
SO-8



Top View



Top View
Pin Configuration



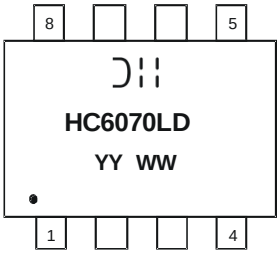
Internal Schematic

Ordering Information (Note 4)

Part Number	Case	Packaging
DMHC6070LSD-13	SO-8	2,500/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
HC6070LD = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 16 = 2016)
WW = Week (01 - 53)

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

Characteristic			Symbol	Value	Units
Drain-Source Voltage			V_{DSS}	60	V
Gate-Source Voltage			V_{GSS}	±20	V
Continuous Drain Current (Note 5) V_{GS} = 10V	Steady State	T_A = +25°C T_A = +70°C	I_D	3.1 2.5	A
	t<10s	T_A = +25°C T_A = +70°C	I_D	4.1 3.3	A
Maximum Continuous Body Diode Forward Current (Note 5)			I_S	2.0	A
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)			I_{DM}	15	A
Avalanche Current (Note 6) L = 0.1mH			I_{AS}	12	A
Avalanche Energy (Note 6) L = 0.1mH			E_{AS}	8	mJ

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

Characteristic			Symbol	Value	Units
Drain-Source Voltage			V_{DSS}	-60	V
Gate-Source Voltage			V_{GSS}	±20	V
Continuous Drain Current (Note 5) V_{GS} = -10V	Steady State	T_A = 25°C T_A = 70°C	I_D	-2.4 -1.9	A
	t<10s	T_A = 25°C T_A = 70°C	I_D	-3.1 -2.5	A
Maximum Continuous Body Diode Forward Current (Note 5)			I_S	-2.0	A
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)			I_{DM}	-12	A
Avalanche Current (Note 6) L = 0.1mH			I_{AS}	-12	A
Avalanche Energy (Note 6) L = 0.1mH			E_{AS}	8	mJ

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

Characteristic		Symbol	Value	Units
Total Power Dissipation (Note 5)		P_D	1.6	W
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	$R_{\theta JA}$	75	°C/W
	t<10s		45	
Thermal Resistance, Junction to Case (Note 5)		$R_{\theta JC}$	11	
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

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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}	60	—	—	V	I_D = 250µA, V_{GS}= 0V
Zero Gate Voltage Drain Current	I_{DSS}	—	—	1	µA	V_{DS}= 60V, V_{GS}= 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS}= ±20V, V_{DS}= 0V
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{GS(TH)}$	1.0	—	3.0	V	I_D= 250µA, V_{DS}= V_{GS}
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	60	100	mΩ	V_{GS}= 10V, I_D= 1.0A
			70	120		V_{GS}= 4.5V, I_D= 0.5A
Diode Forward Voltage	V_{SD}	—	0.8	1.2	V	V_{GS}= 0V, I_S= 3A
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C_{ISS}	—	731	—	pF	V_{DS}= 20V, V_{GS}= 0V f= 1MHz
Output Capacitance	C_{OSS}	—	34	—		
Reverse Transfer Capacitance	C_{RSS}	—	23	—		
Gate resistance	R_G	—	1.3	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1.0MHz
Total Gate Charge	Q_G	—	5.2	—	nC	V_{GS}= 4.5V; V_{DS}= 30V, I_D= 3A
Total Gate Charge	Q_G	—	11.5	—		V_{GS}= 10V; V_{DS}= 30V, I_D= 3A
Gate-Source Charge	Q_{GS}	—	2.1	—		
Gate-Drain Charge	Q_{GD}	—	1.5	—		
Turn-On Delay Time	$t_{D(ON)}$	—	9.6	—	ns	V_{DD}= 30V, V_{GS}= 10V $R_L \cong 50Ω$, $R_G \cong 20Ω$
Turn-On Rise Time	t_R	—	11	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	61	—		
Turn-Off Fall Time	t_F	—	21	—		
Body Diode Reverse Recovery Time	t_{RR}	—	10.5	—	ns	I_S = 1.0A, dI/dt = 100A/µs
Body Diode Reverse Recovery Charge	Q_{RR}	—	4.0	—	nC	I_S = 1.0A, dI/dt = 100A/µs

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}	-60	—	—	V	V_{GS} = 0V, I_D = -250µA
Zero Gate Voltage Drain Current	I_{DSS}	—	—	-1	µA	V_{DS} = -60V, 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	$R_{DS(ON)}$	—	120	170	mΩ	V_{GS} = -10V, I_D = -1.0A
			170	250		V_{GS} = -4.5V, I_D = -0.5A
Diode Forward Voltage	V_{SD}	—	-0.8	-1.2	V	V_{GS} = 0V, I_S = -2A
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C_{ISS}	—	618	—	pF	V_{DS} = -20V, V_{GS} = 0V, f = 1.0MHz
Output Capacitance	C_{OSS}	—	36	—		
Reverse Transfer Capacitance	C_{RSS}	—	26	—		
Gate resistance	R_G	—	13	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1.0MHz
Total Gate Charge	Q_G	—	4.3	—	nC	V_{GS}= -4.5V; V_{DS}= -30V, I_D= -2A
Total Gate Charge	Q_G	—	8.9	—		V_{GS}= -10V; V_{DS}= -30V, I_D= -2A
Gate-Source Charge	Q_{GS}	—	1.4	—		
Gate-Drain Charge	Q_{GD}	—	1.7	—		
Turn-On Delay Time	$t_{D(ON)}$	—	7.6	—	ns	V_{DD}= -30V, V_{GS}= -10V $R_L \cong 50Ω$, $R_G \cong 20Ω$
Turn-On Rise Time	t_R	—	11.6	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	79.8	—		
Turn-Off Fall Time	t_F	—	37.8	—		
Body Diode Reverse Recovery Time	t_{RR}	—	10.8	—	ns	I_S = -1.0A, dI/dt = 100A/µs
Body Diode Reverse Recovery Charge	Q_{RR}	—	3.8	—	nC	I_S = -1.0A, dI/dt = 100A/µs

Notes: 5. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
6. I_{AS} and E_{AS} rating are based on low frequency and duty cycles to keep T_J = +25°C
7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to product testing.

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Typical Performance Characteristics – N-Channel

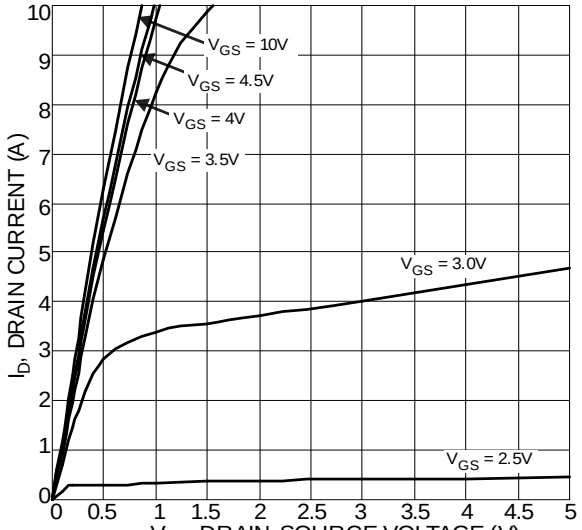

Figure 1 Typical Output Characteristic

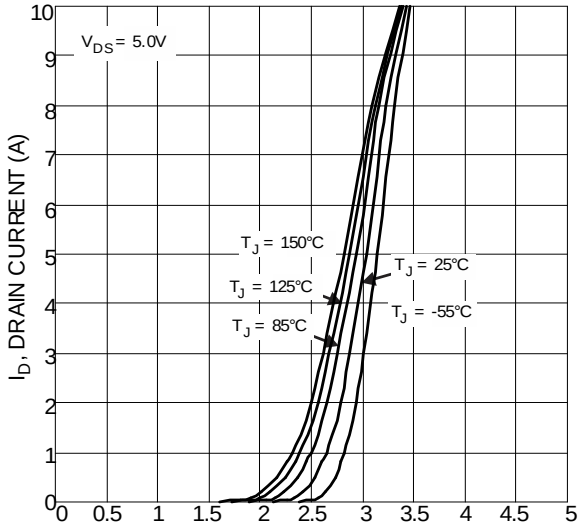

Figure 2 Typical Transfer Characteristics

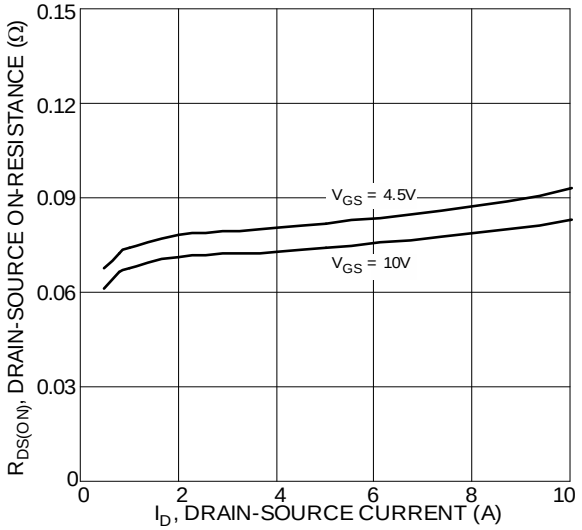

Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

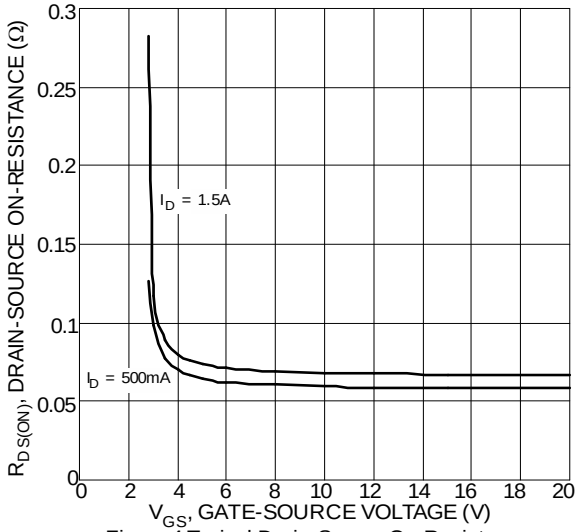

Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

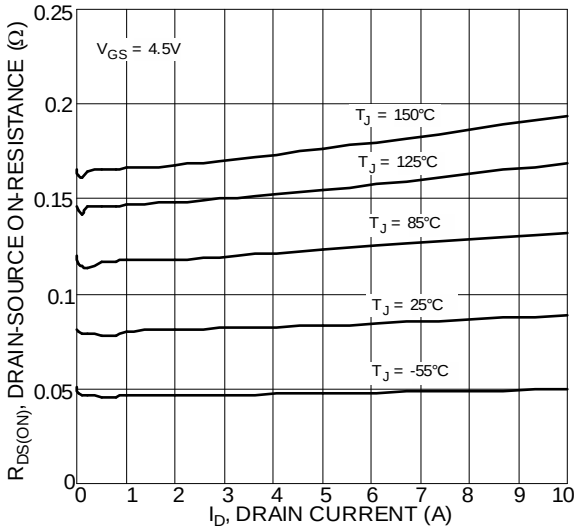

Figure 5 Typical On-Resistance vs. Drain Current and Temperature

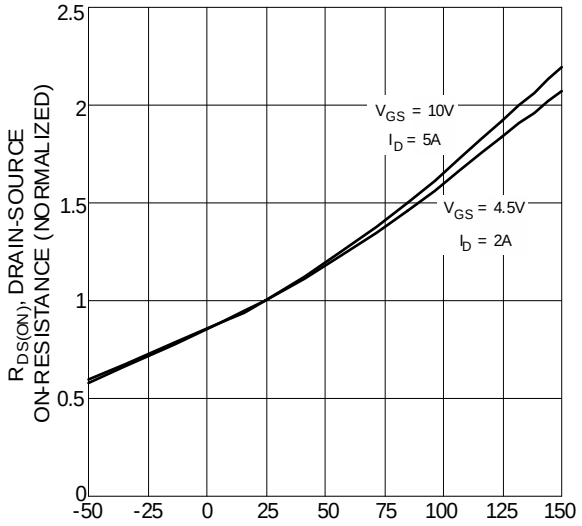

Figure 6 On-Resistance Variation with Temperature

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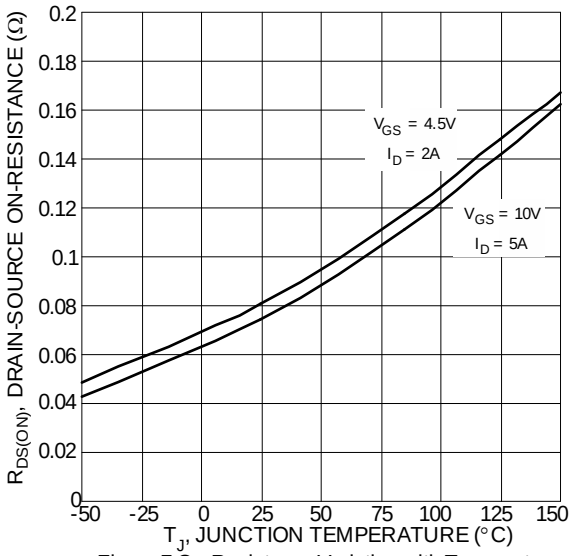

Figure 7 On-Resistance Variation with Temperature

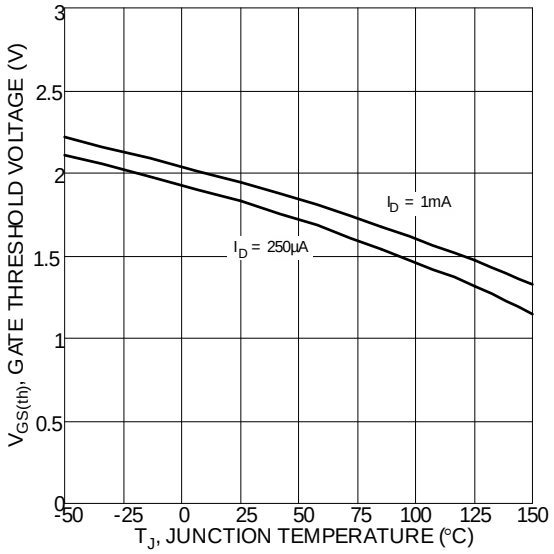

Figure 8 Gate Threshold Variation vs. Ambient Temperature

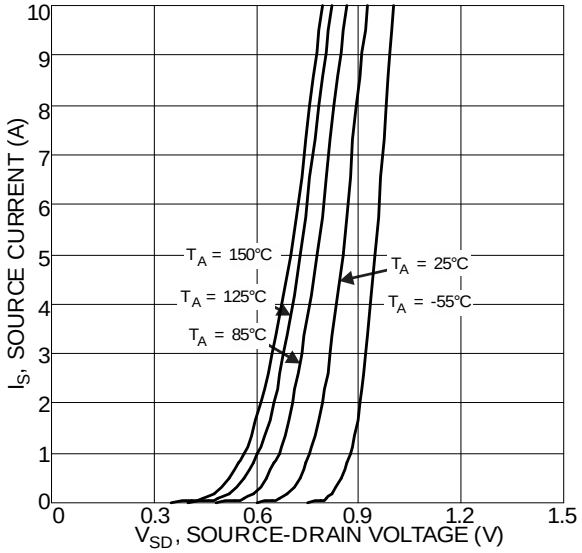

Figure 9 Diode Forward Voltage vs. Current

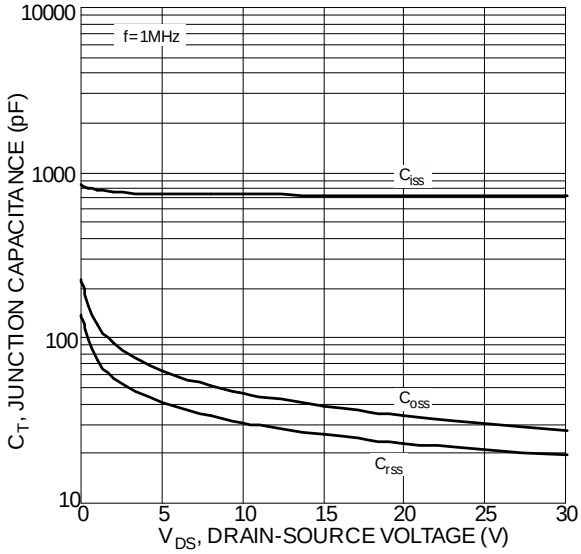

Figure 10 Typical Junction Capacitance

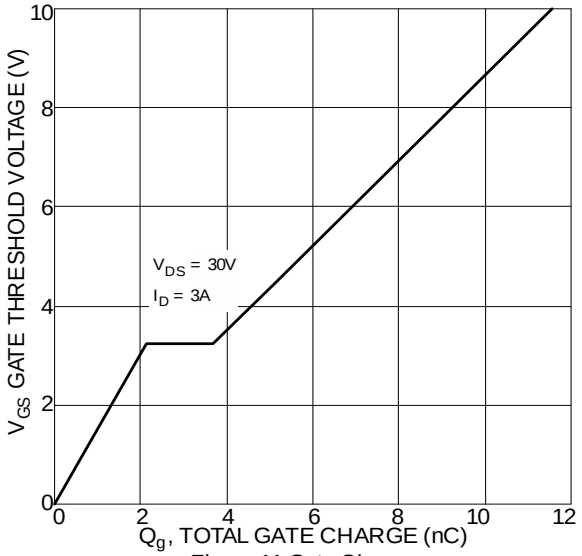

Figure 11 Gate Charge

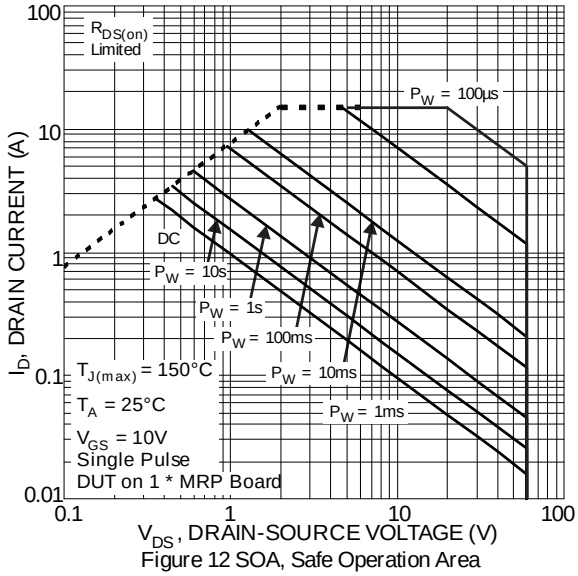

Figure 12 SOA, Safe Operation Area

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Typical Performance Characteristics – P-Channel

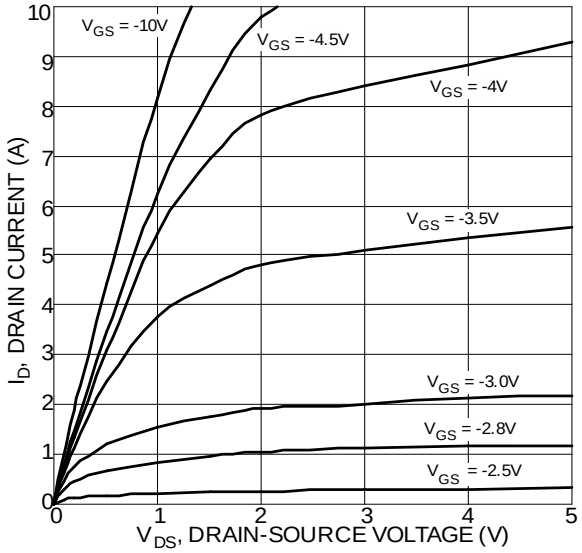

Figure 13 Typical Output Characteristic

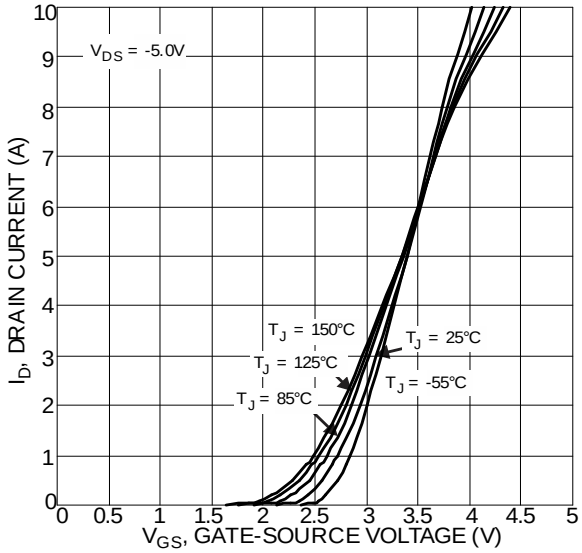

Figure 14 Typical Transfer Characteristics

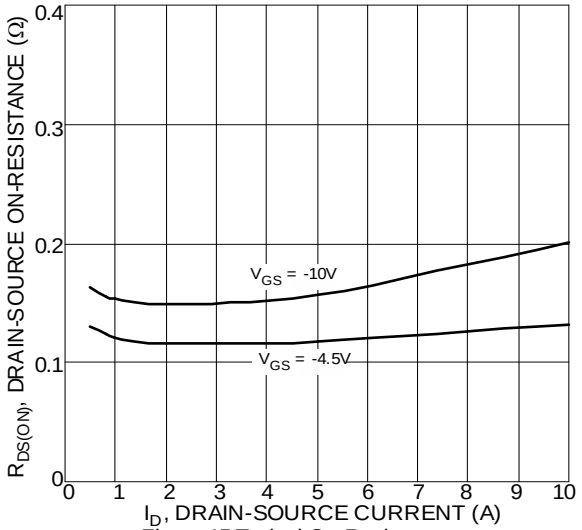

Figure 15 Typical On-Resistance vs. Drain Current and Gate Voltage

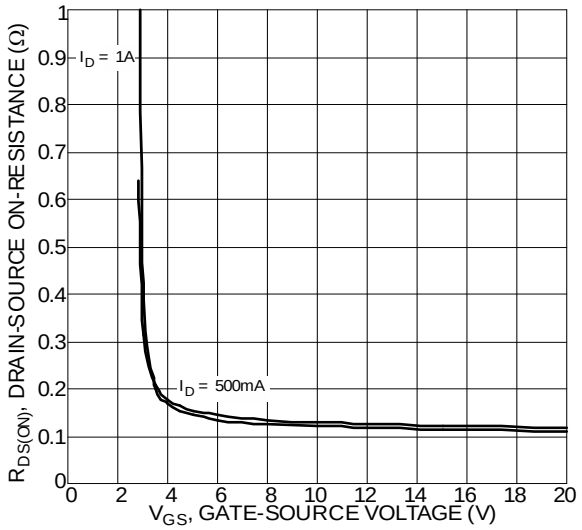

Figure 16 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

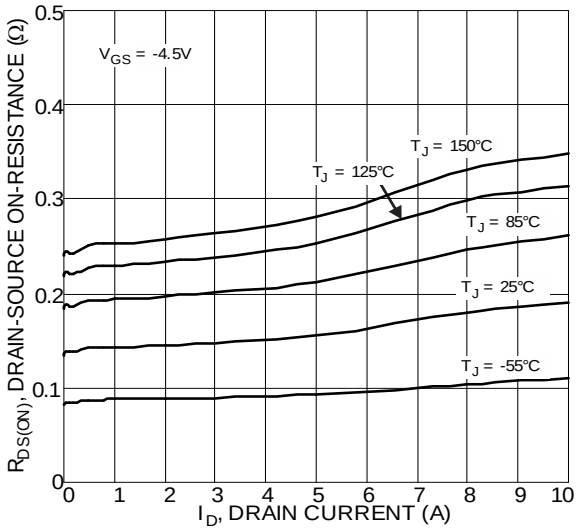

Figure 17 Typical On-Resistance vs. Drain Current and Temperature

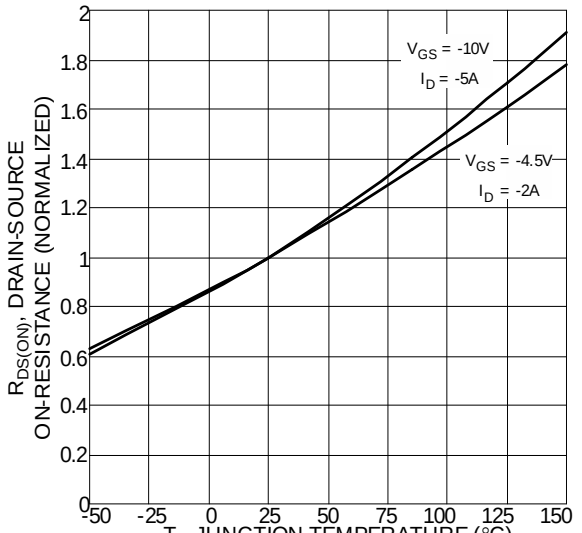

Figure 6 On-Resistance Variation with Temperature

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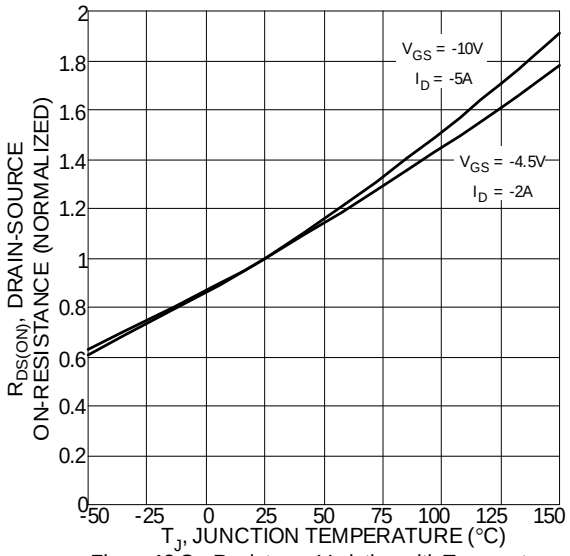

Figure 18 On-Resistance Variation with Temperature

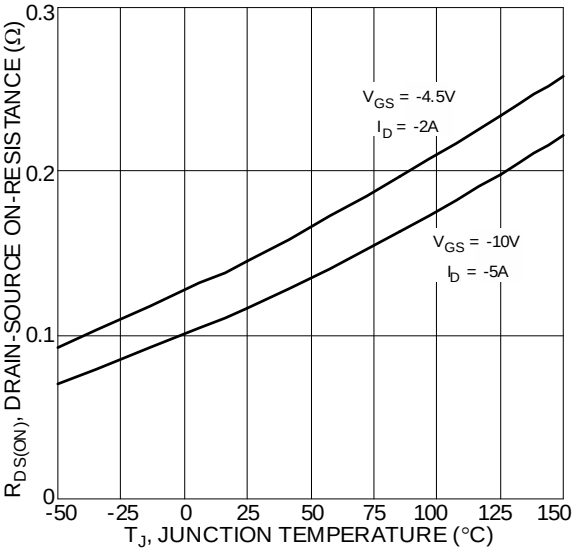

Figure 19 On-Resistance Variation with Temperature

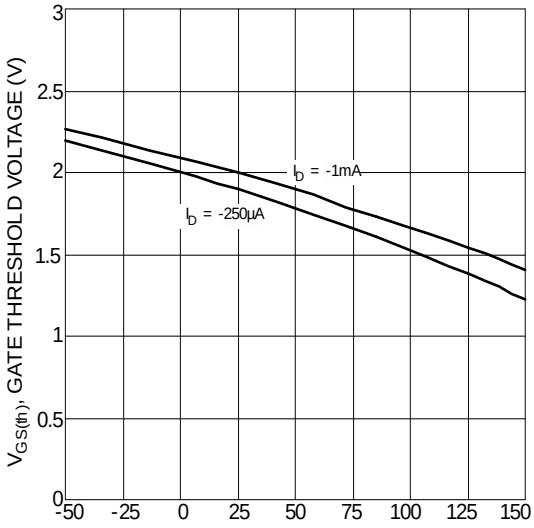

Figure 20 Gate Threshold Variation vs. Ambient Temperature

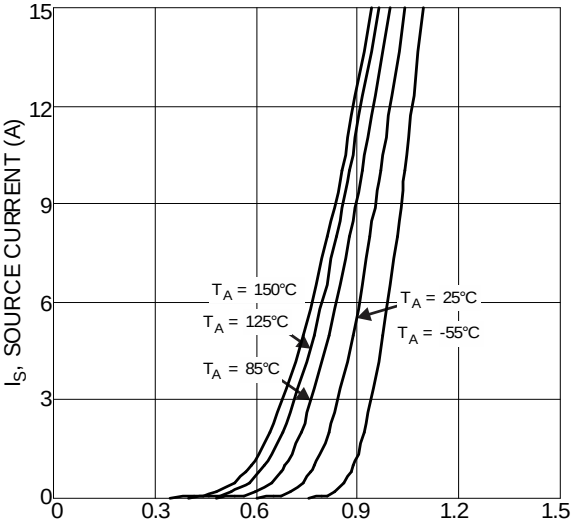

Figure 21 Diode Forward Voltage vs. Current

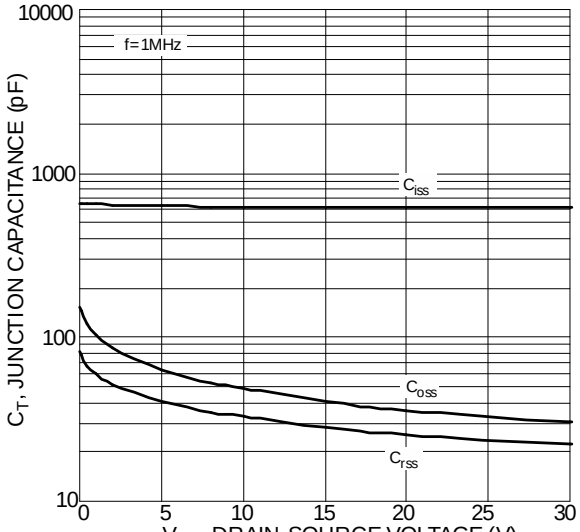

Figure 22 Typical Junction Capacitance

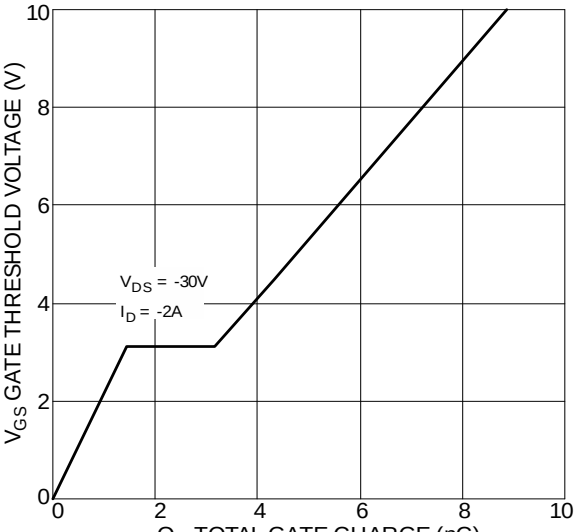

Figure 23 Gate Charge

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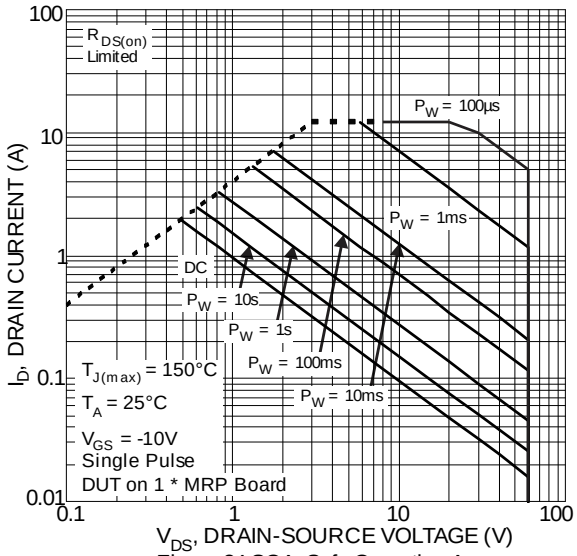

Figure 24 SOA, Safe Operation Area

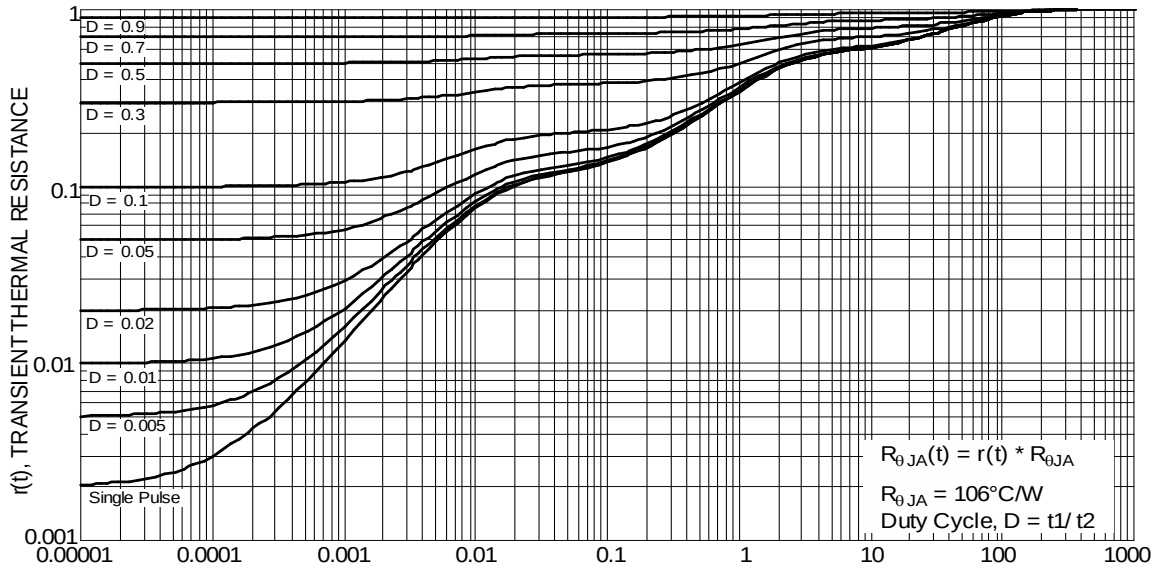

Figure 25 Transient Thermal Resistance

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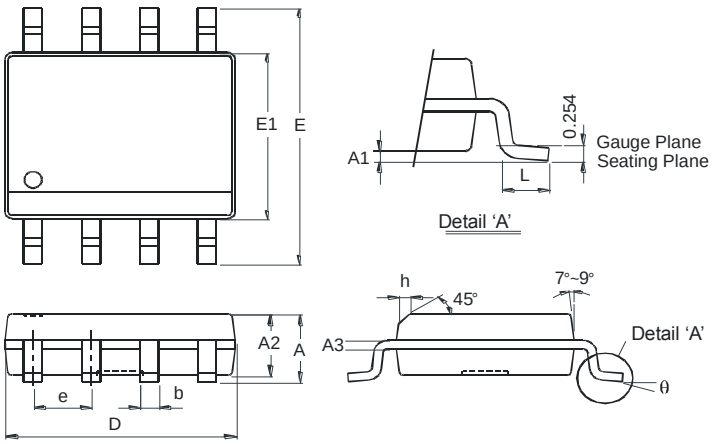
Package Outline Dimensions

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

SO-8

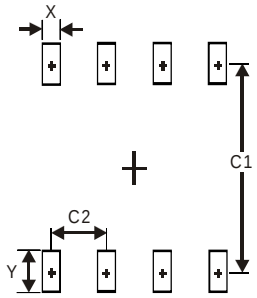


SO-8		
Dim	**Min**	**Max**
A	–	1.75
A1	0.10	0.20
A2	1.30	1.50
A3	0.15	0.25
b	0.3	0.5
D	4.85	4.95
E	5.90	6.10
E1	3.85	3.95
e	1.27 Typ	
h	–	0.35
L	0.62	0.82
θ	0°	8°
All Dimensions in mm		

Suggested Pad Layout

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

SO-8



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

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