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.

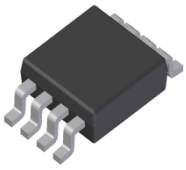
Applications

- DC Motor Control
- DC-AC Inverters

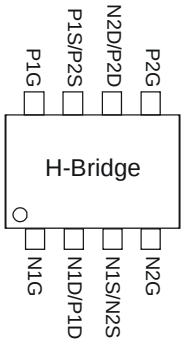
Mechanical Data

- 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)

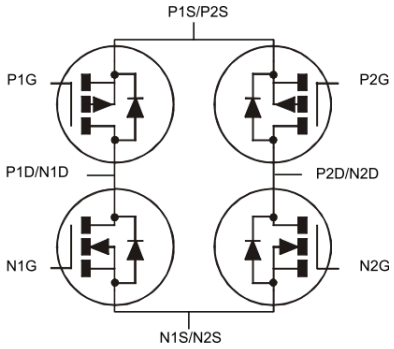
SO-8



Top View



Top View
Pin Configuration



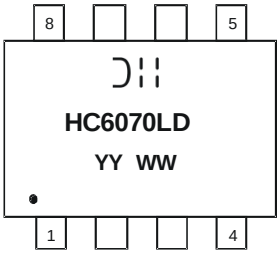
Internal Schematic

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)

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

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.

Typical Performance Characteristics – N-Channel

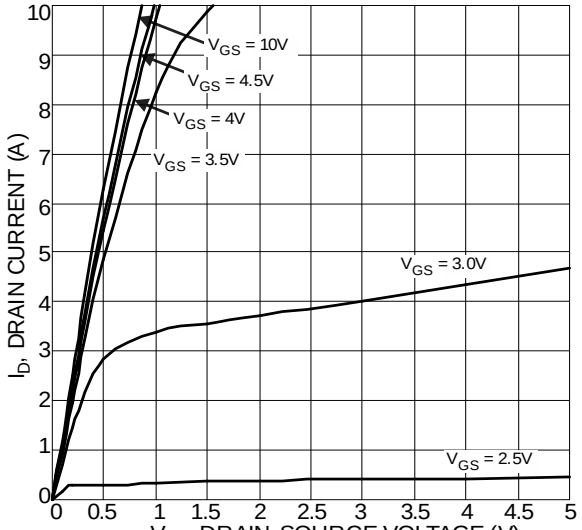


Figure 1 Typical Output Characteristic

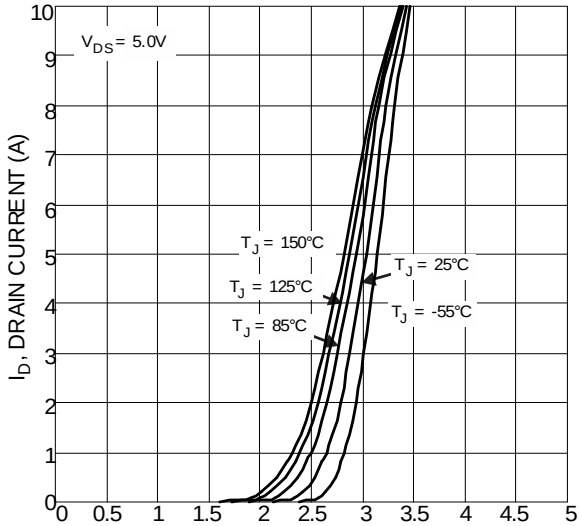


Figure 2 Typical Transfer Characteristics

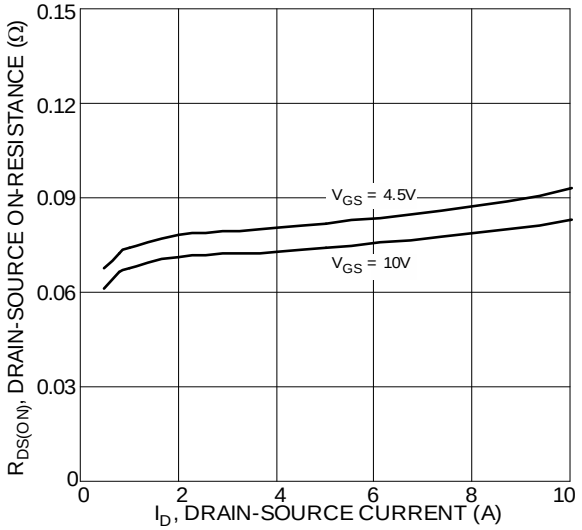


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

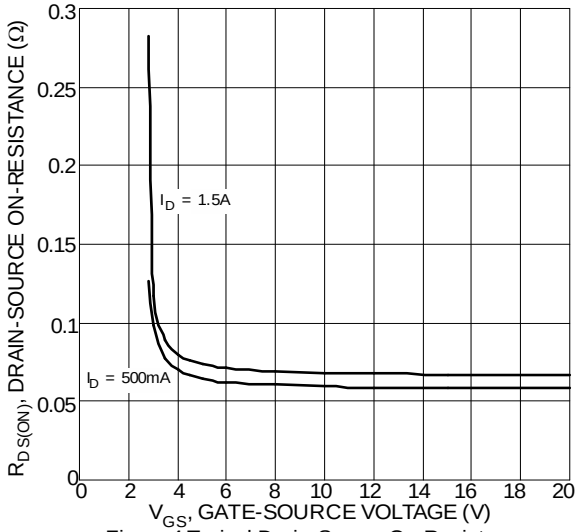


Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

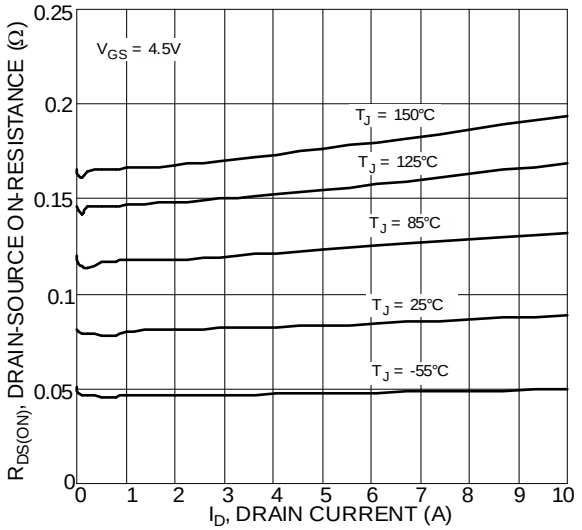


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

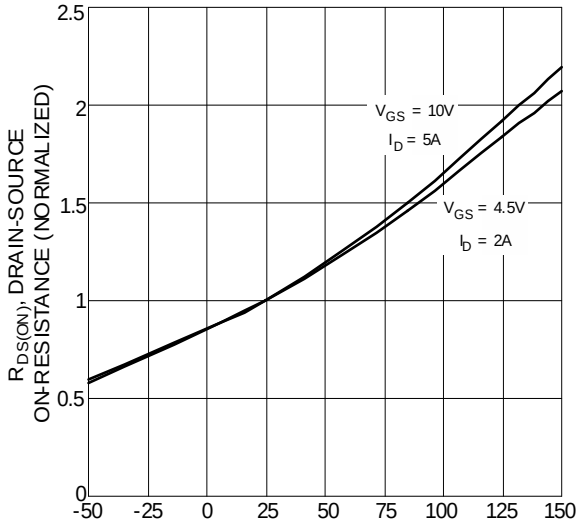


Figure 6 On-Resistance Variation with Temperature

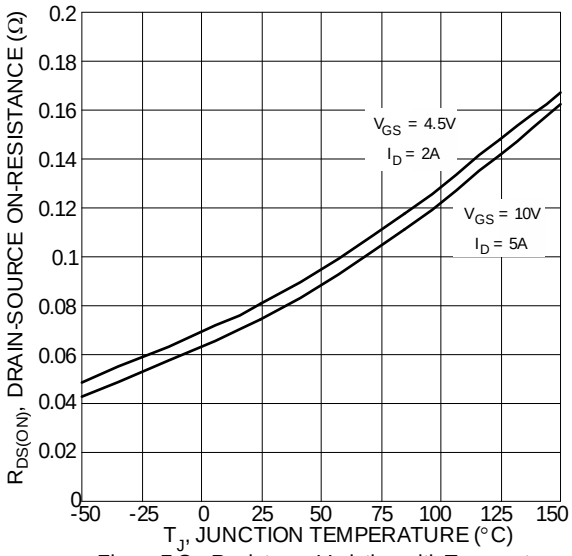


Figure 7 On-Resistance Variation with Temperature

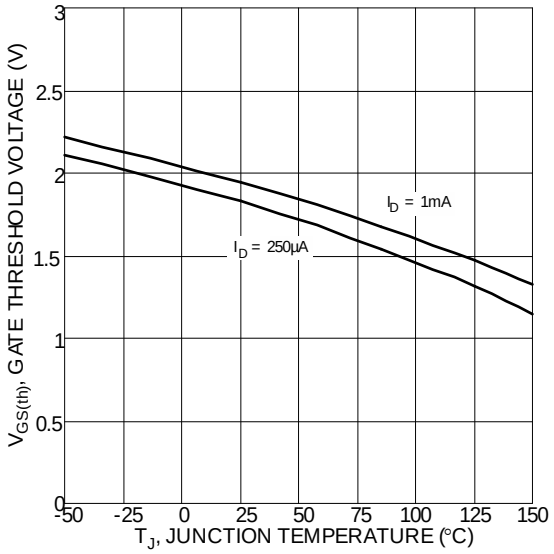


Figure 8 Gate Threshold Variation vs. Ambient Temperature

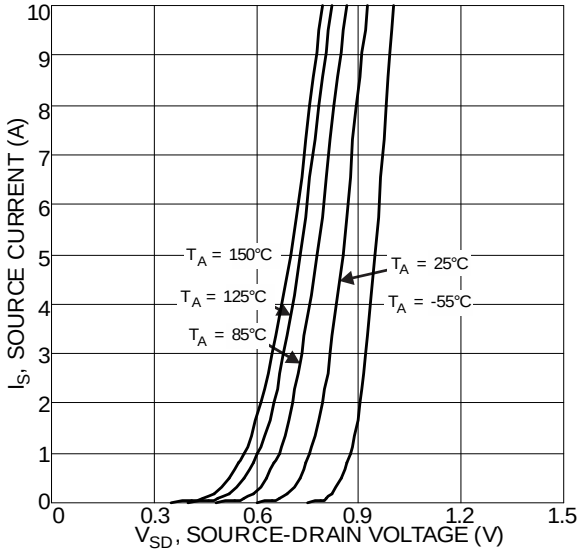


Figure 9 Diode Forward Voltage vs. Current

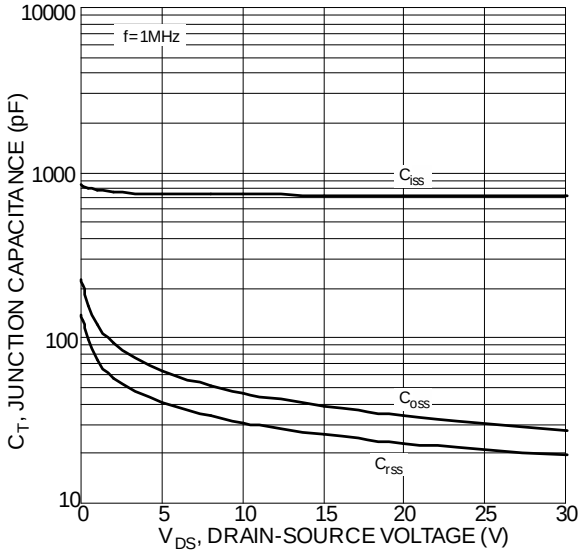


Figure 10 Typical Junction Capacitance

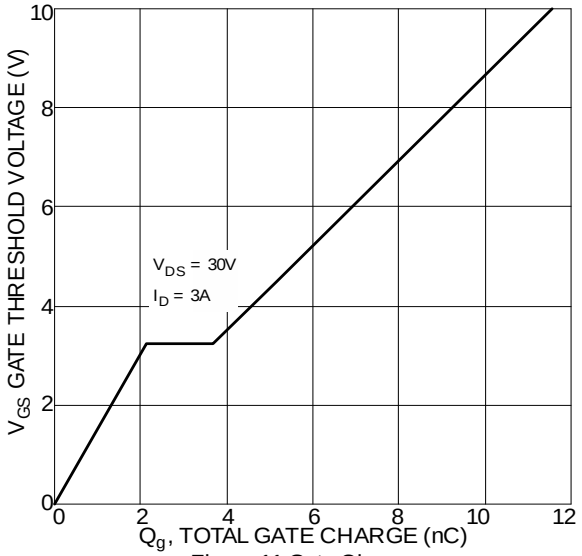


Figure 11 Gate Charge

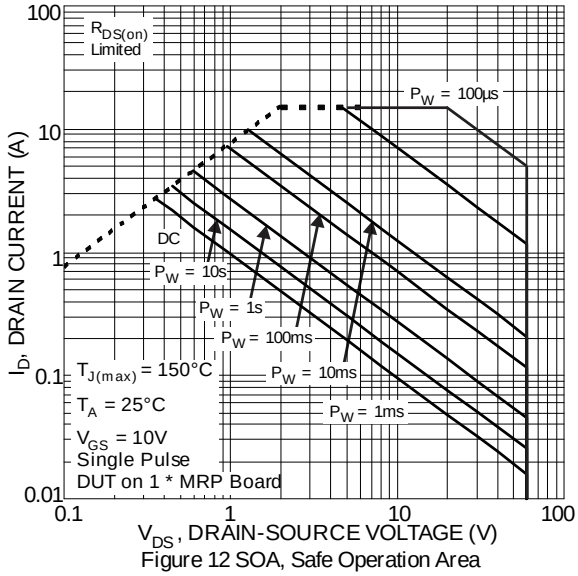


Figure 12 SOA, Safe Operation Area

Typical Performance Characteristics – P-Channel

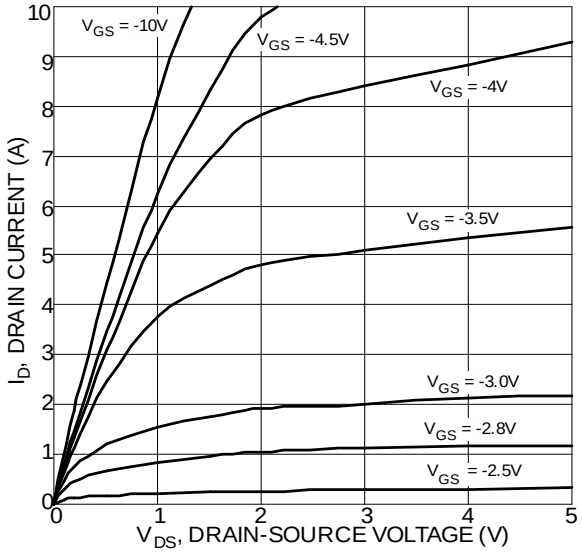


Figure 13 Typical Output Characteristic

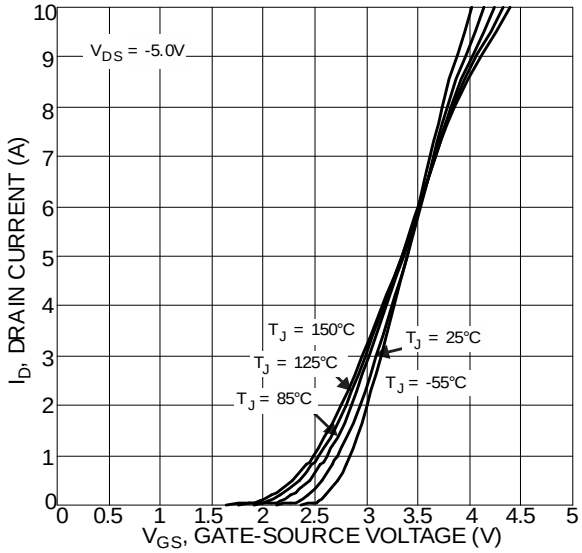


Figure 14 Typical Transfer Characteristics

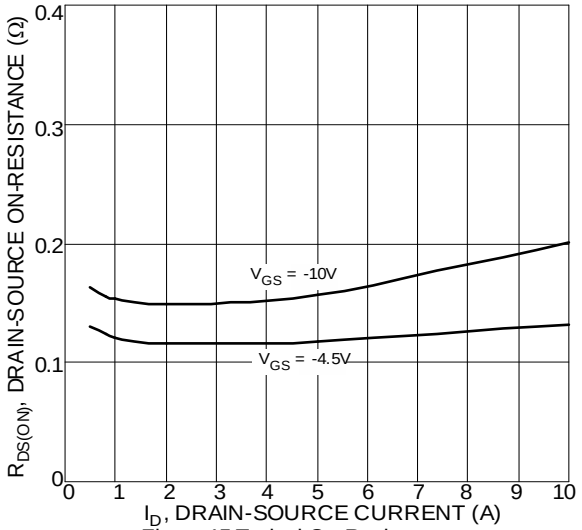


Figure 15 Typical On-Resistance vs. Drain Current and Gate Voltage

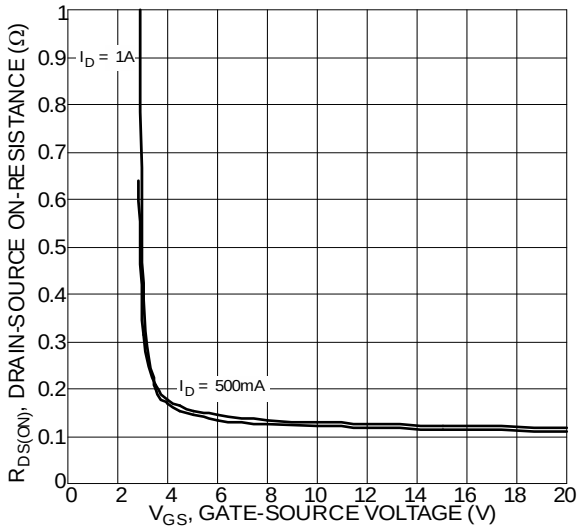


Figure 16 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

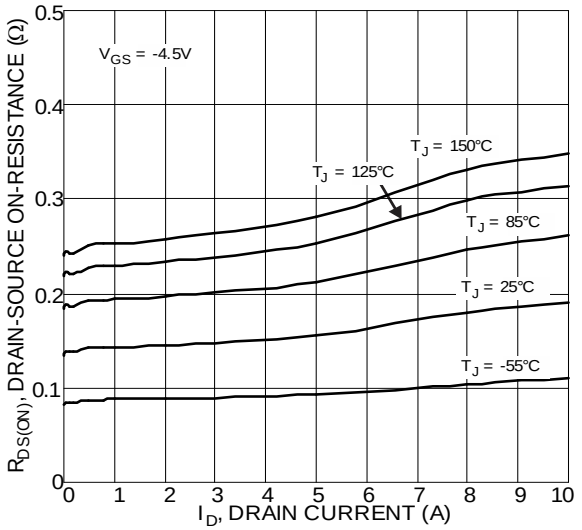


Figure 17 Typical On-Resistance vs. Drain Current and Temperature

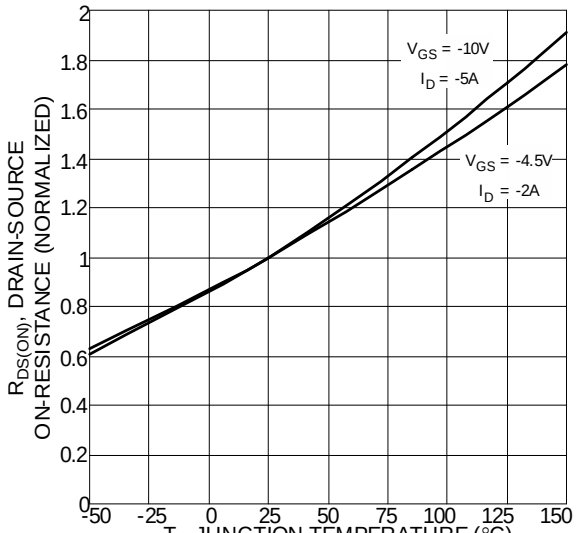


Figure 6 On-Resistance Variation with Temperature

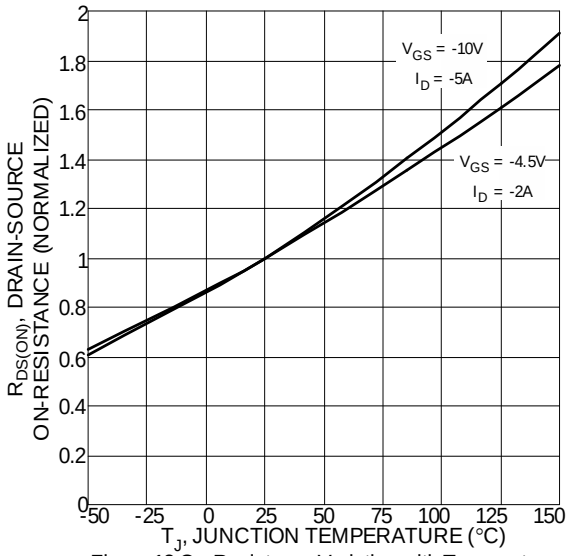


Figure 18 On-Resistance Variation with Temperature

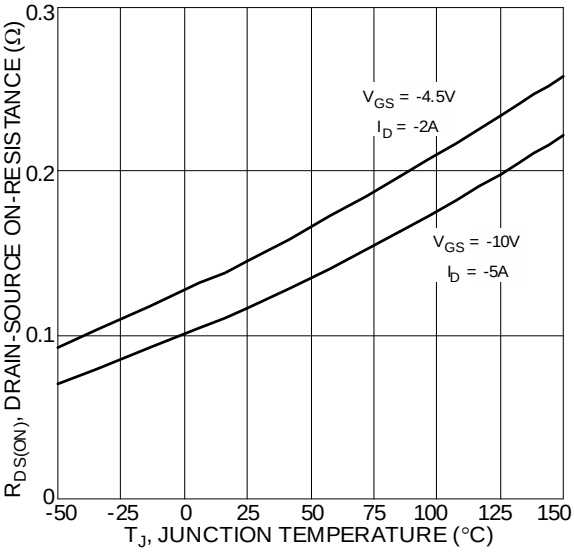


Figure 19 On-Resistance Variation with Temperature

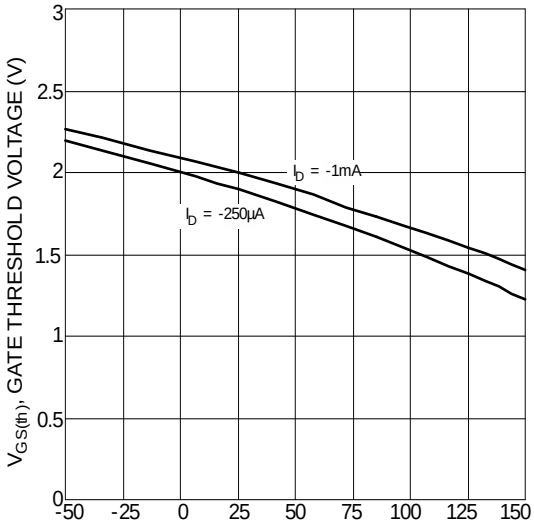


Figure 20 Gate Threshold Variation vs. Ambient Temperature

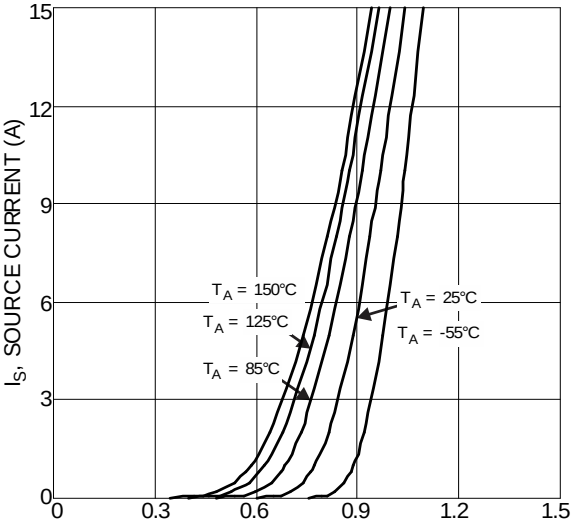


Figure 21 Diode Forward Voltage vs. Current

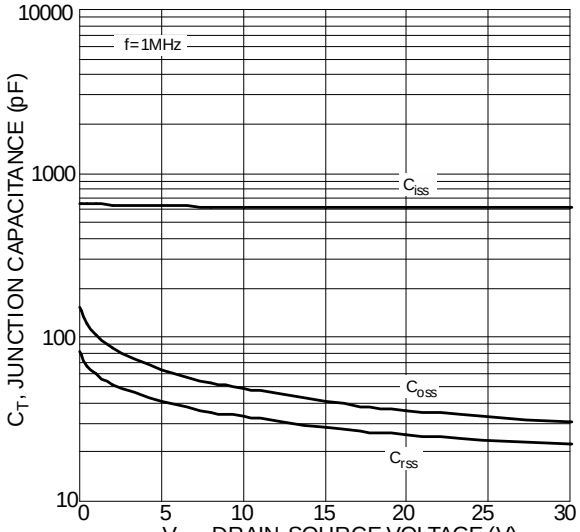


Figure 22 Typical Junction Capacitance

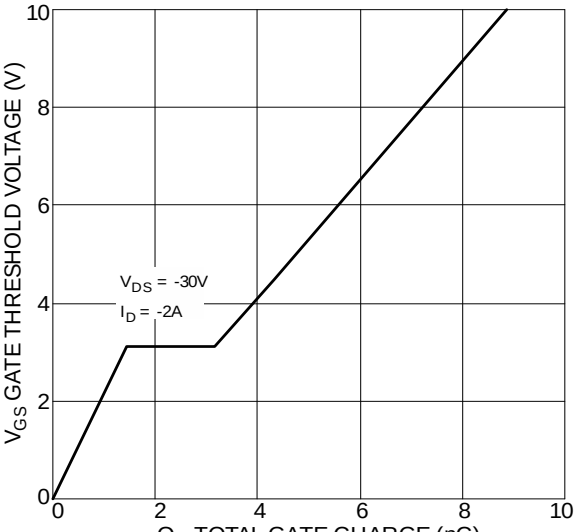


Figure 23 Gate Charge

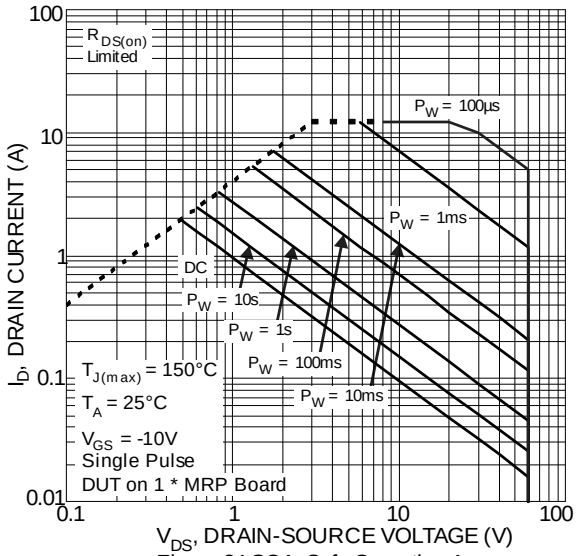


Figure 24 SOA, Safe Operation Area

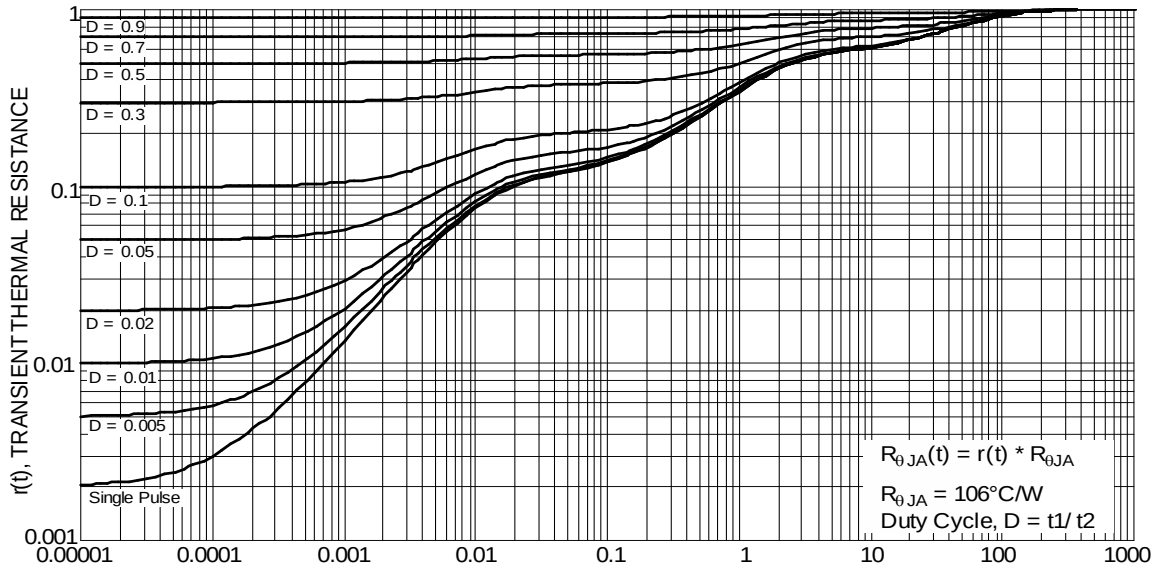
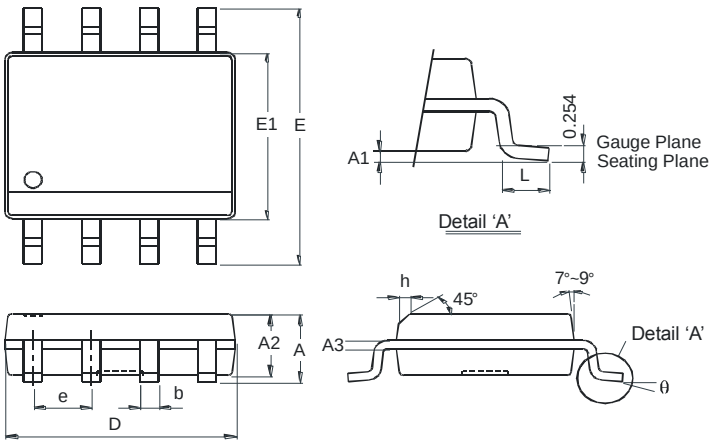


Figure 25 Transient Thermal Resistance

Package Outline Dimensions

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

SO-8

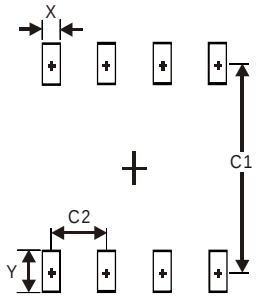


SO-8		
Dim	**Min**	**Max**
A	–	1.75
A1	0.10	0.20
A2	1.30	1.50
A3	0.15	0.25
b	0.3	0.5
D	4.85	4.95
E	5.90	6.10
E1	3.85	3.95
e	1.27 Typ	
h	–	0.35
L	0.62	0.82
θ	0°	8°
All Dimensions in mm		

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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