

60V COMPLEMENTARY ENHANCEMENT MODE MOSFET H-BRIDGE
Product Summary

Device	$V_{(BR)DSS}$	$R_{DS(ON)}$ Max	I_D Max $T_A = 25^\circ C$
N-Channel	60V	100m Ω @ $V_{GS} = 10V$	4.1A
		120m Ω @ $V_{GS} = 4.5V$	3.7A
P-Channel	-60V	170m Ω @ $V_{GS} = -10V$	3.1A
		250m Ω @ $V_{GS} = -4.5V$	2.6A

Description

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

Applications

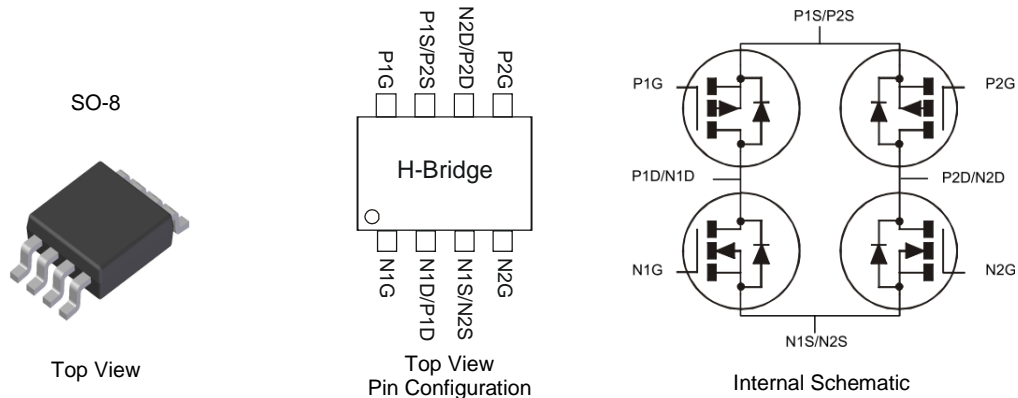
- DC Motor Control
- DC-AC Inverters

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)**

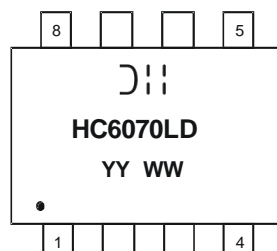
Mechanical Data

- 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)


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


- DII = 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 (@ $T_A = +25^\circ\text{C}$, 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) $V_{GS} = 10\text{V}$	Steady State	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	I_D	3.1 2.5	A
	$t < 10\text{s}$	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	I_D	4.1 3.3	A
Maximum Continuous Body Diode Forward Current (Note 5)			I_S	2.0	A
Pulsed Drain Current (10 μs Pulse, Duty Cycle = 1%)			I_{DM}	15	A
Avalanche Current (Note 6) $L = 0.1\text{mH}$			I_{AS}	12	A
Avalanche Energy (Note 6) $L = 0.1\text{mH}$			E_{AS}	8	mJ

Maximum Ratings – P-Channel (@ $T_A = +25^\circ\text{C}$, 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) $V_{GS} = -10\text{V}$	Steady State	$T_A = 25^\circ\text{C}$ $T_A = 70^\circ\text{C}$	I_D	-2.4 -1.9	A
	$t < 10\text{s}$	$T_A = 25^\circ\text{C}$ $T_A = 70^\circ\text{C}$	I_D	-3.1 -2.5	A
Maximum Continuous Body Diode Forward Current (Note 5)			I_S	-2.0	A
Pulsed Drain Current (10 μs Pulse, Duty Cycle = 1%)			I_{DM}	-12	A
Avalanche Current (Note 6) $L = 0.1\text{mH}$			I_{AS}	-12	A
Avalanche Energy (Note 6) $L = 0.1\text{mH}$			E_{AS}	8	mJ

Thermal Characteristics (@ $T_A = +25^\circ\text{C}$, 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	$^\circ\text{C/W}$
	$t < 10\text{s}$		45	
Thermal Resistance, Junction to Case (Note 5)		$R_{\theta JC}$	11	
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	$^\circ\text{C}$

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 _{GS} = 10V V _{DS} = 30V I _D = 3A
Total Gate Charge	Q _G	—	11.5	—		
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 ≅ 50Ω, R _G ≅ 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 _{GS} = -10V V _{DS} = -30V I _D = -2A
Total Gate Charge	Q _G	—	8.9	—		
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 ≅ 50Ω, R _G ≅ 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:
- Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
 - I_{AS} and E_{AS} rating are based on low frequency and duty cycles to keep T_J = +25°C
 - Short duration pulse test used to minimize self-heating effect.
 - Guaranteed by design. Not subject to product testing.

Typical Performance Characteristics – N-Channel

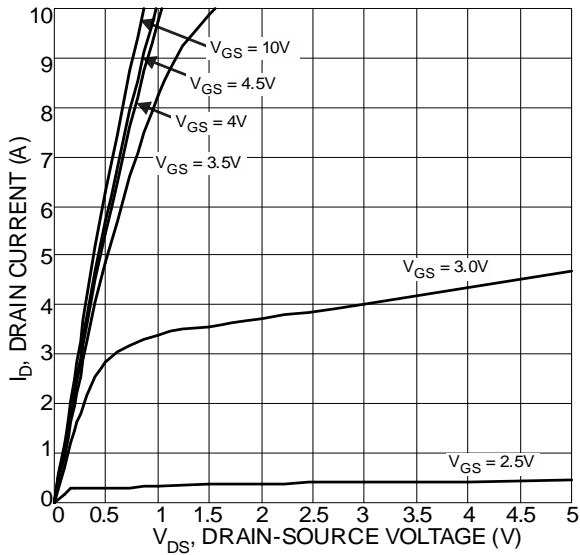


Figure 1 Typical Output Characteristic

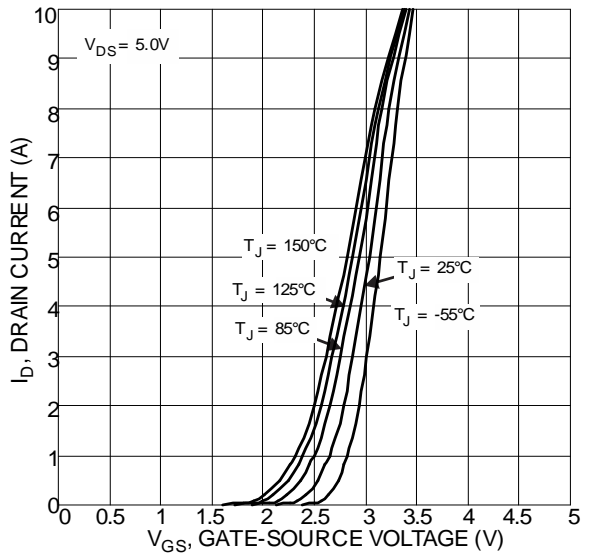


Figure 2 Typical Transfer Characteristics

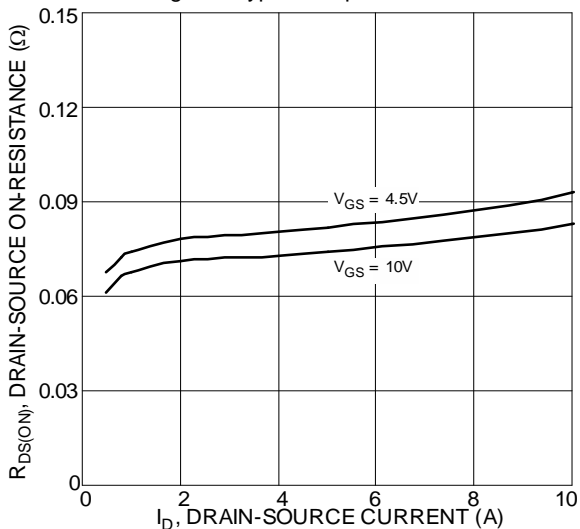


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

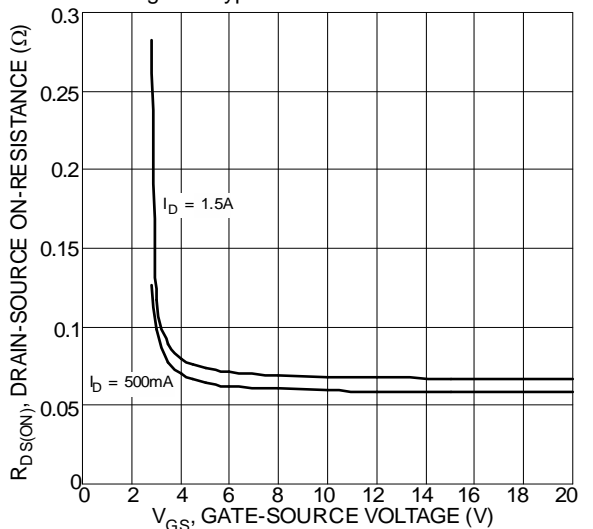


Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

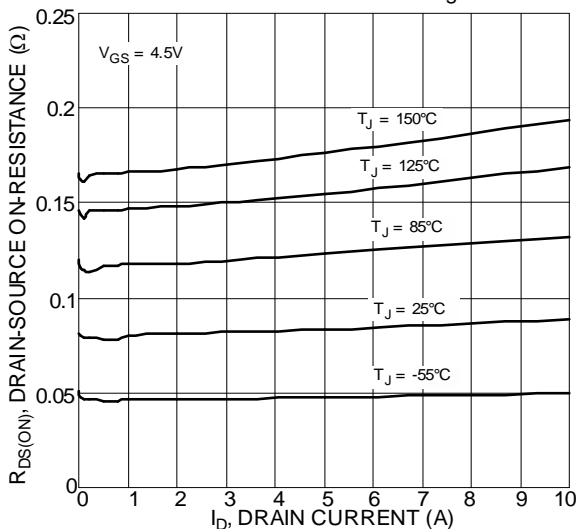


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

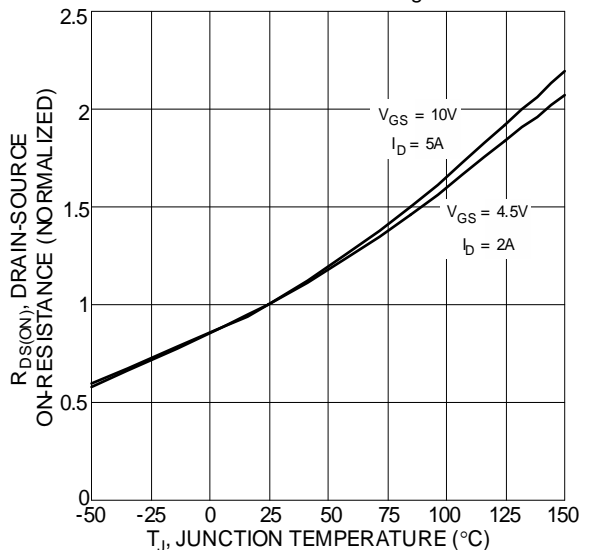


Figure 6 On-Resistance Variation with Temperature

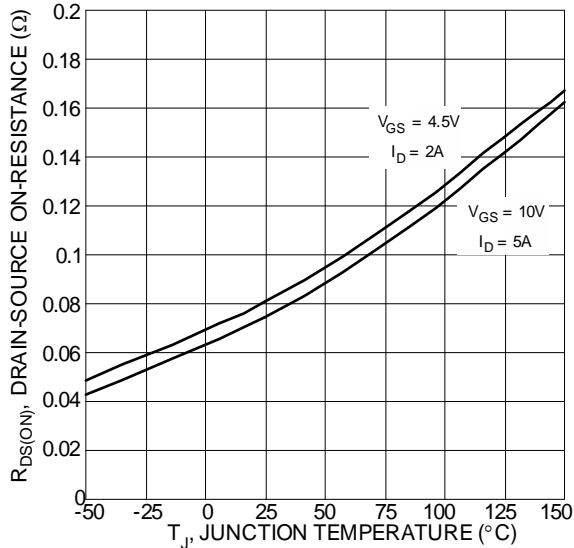


Figure 7 On-Resistance Variation with Temperature

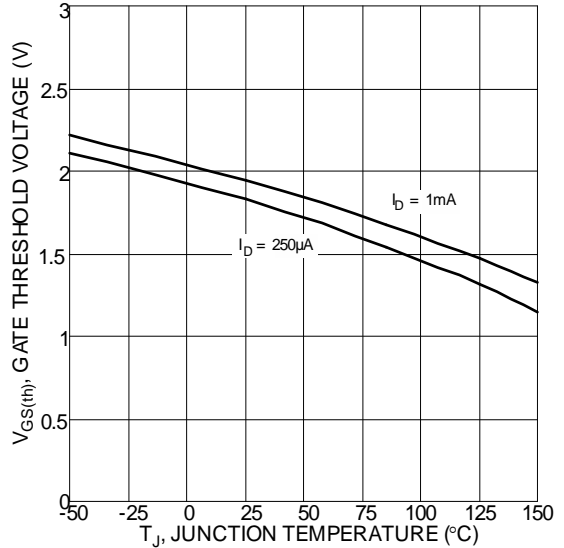


Figure 8 Gate Threshold Variation vs. Ambient Temperature

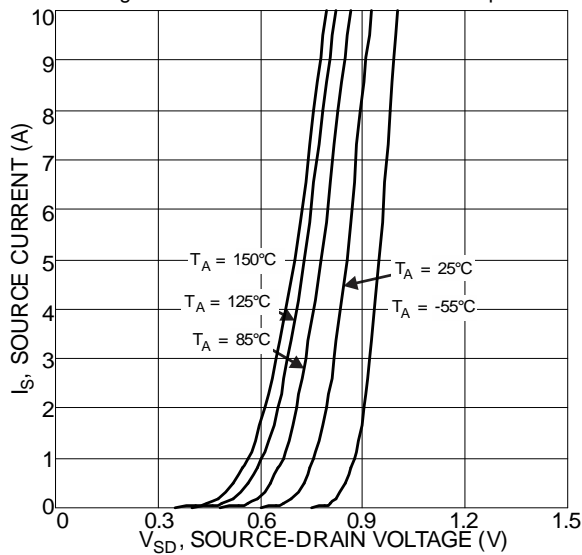


Figure 9 Diode Forward Voltage vs. Current

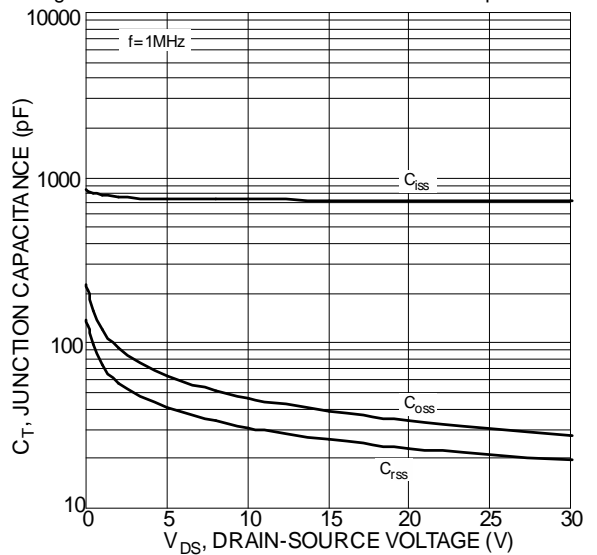


Figure 10 Typical Junction Capacitance

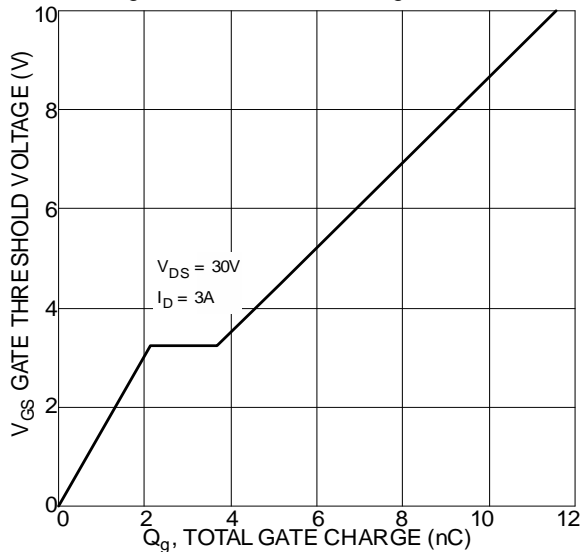


Figure 11 Gate Charge

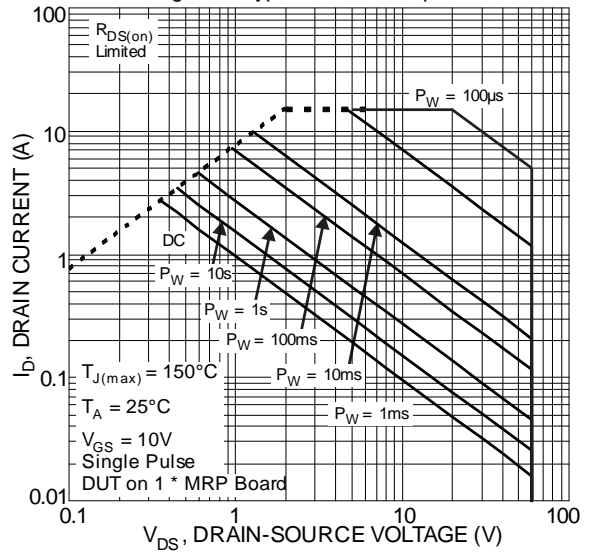


Figure 12 SOA, Safe Operation Area

Typical Performance Characteristics – P-Channel

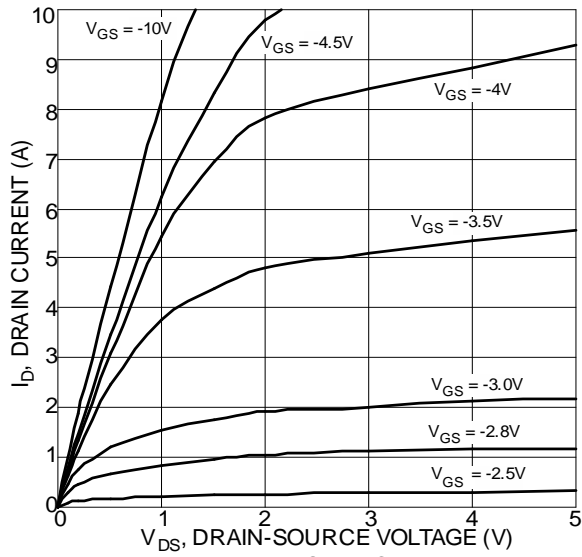


Figure 13 Typical Output Characteristic

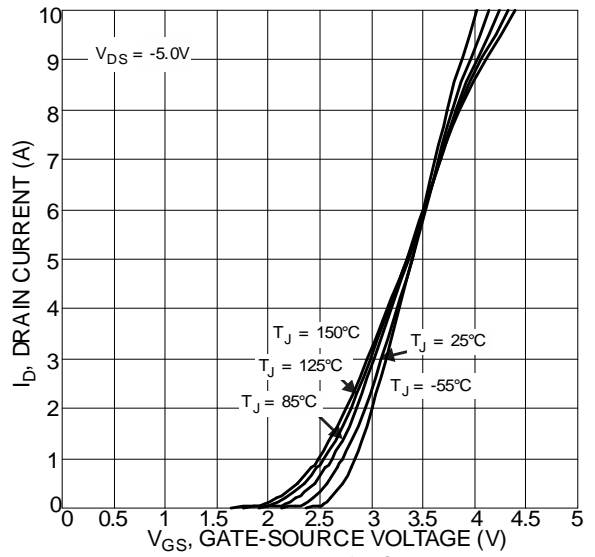


Figure 14 Typical Transfer Characteristics

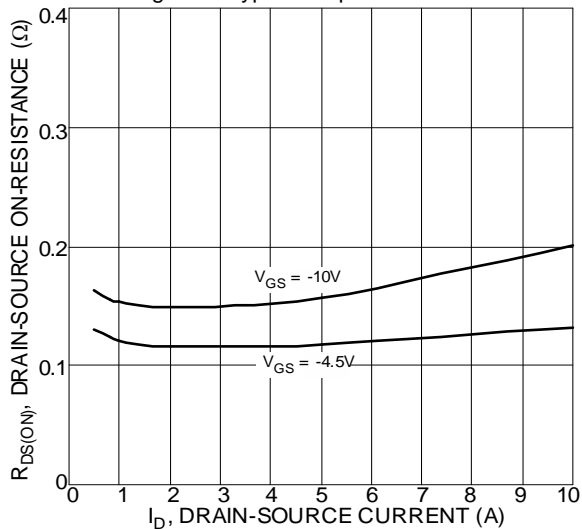


Figure 15 Typical On-Resistance vs. Drain Current and Gate Voltage

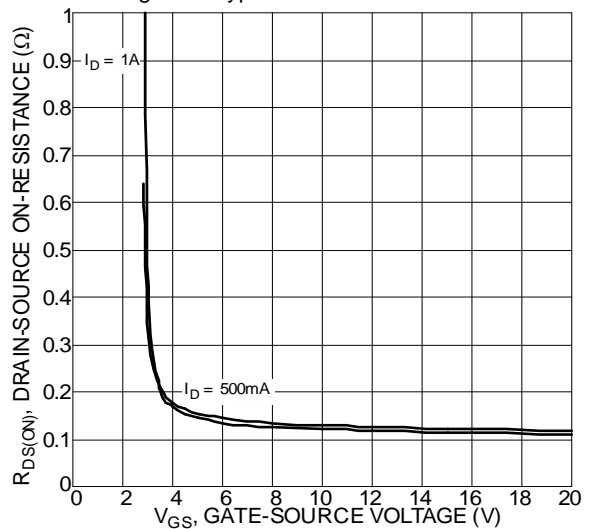


Figure 16 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

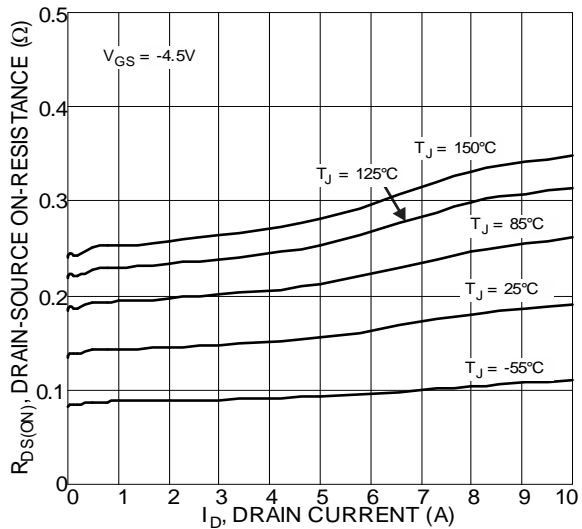


Figure 17 Typical On-Resistance vs. Drain Current and Temperature

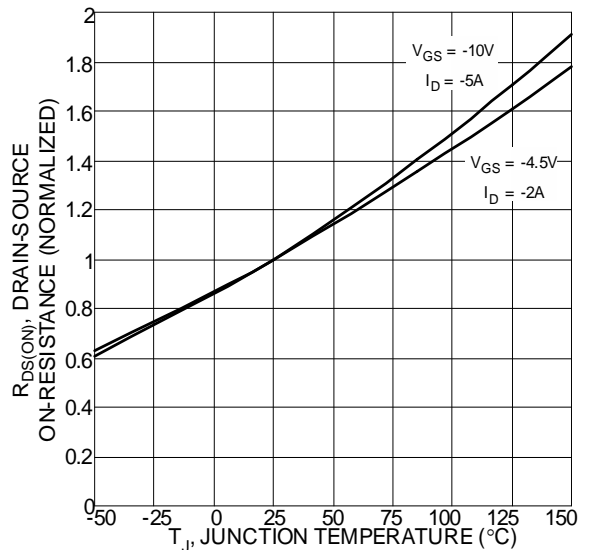


Figure 18 On-Resistance Variation with Temperature

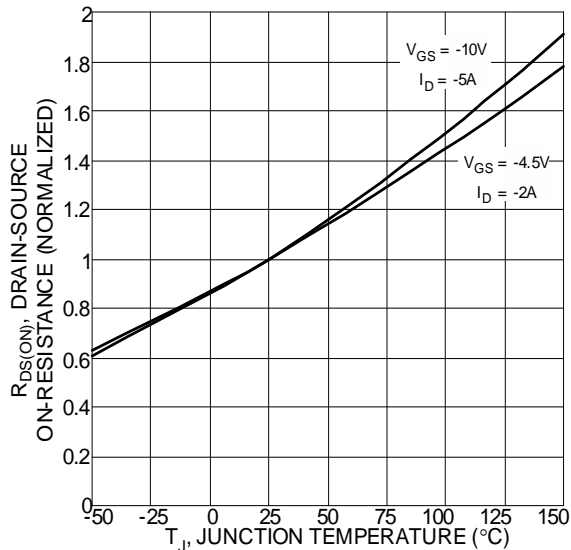


Figure 18 On-Resistance Variation with Temperature

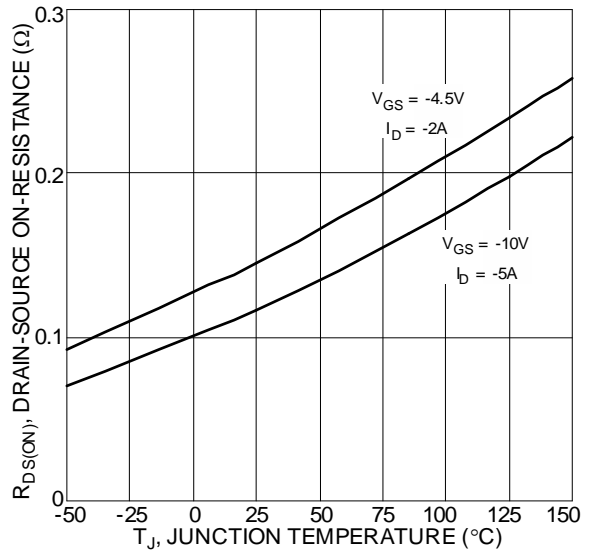


Figure 19 On-Resistance Variation with Temperature

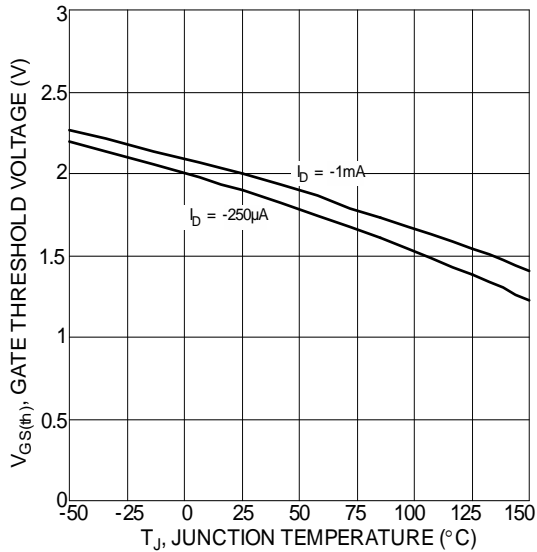


Figure 20 Gate Threshold Variation vs. Ambient Temperature

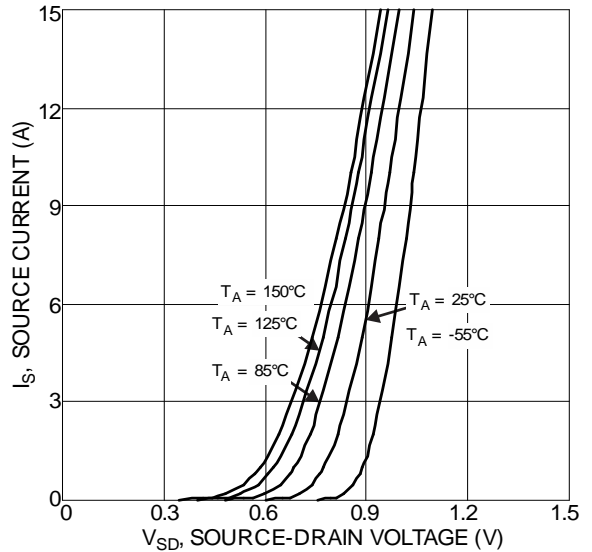


Figure 21 Diode Forward Voltage vs. Current

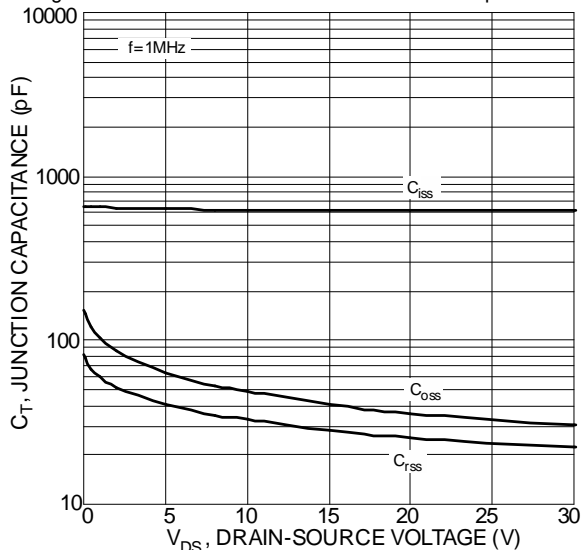


Figure 22 Typical Junction Capacitance

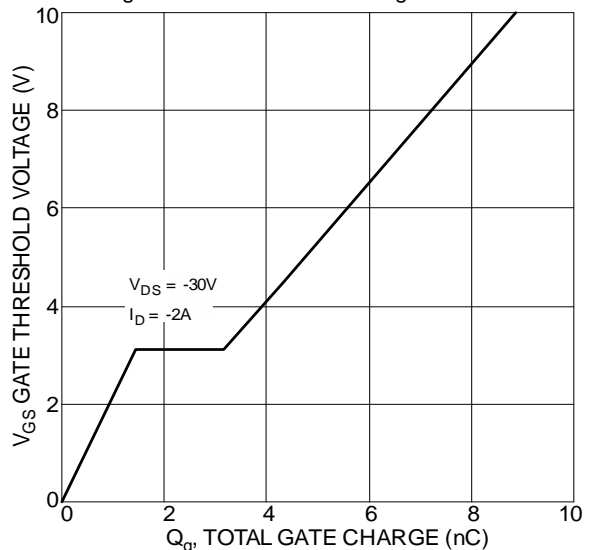
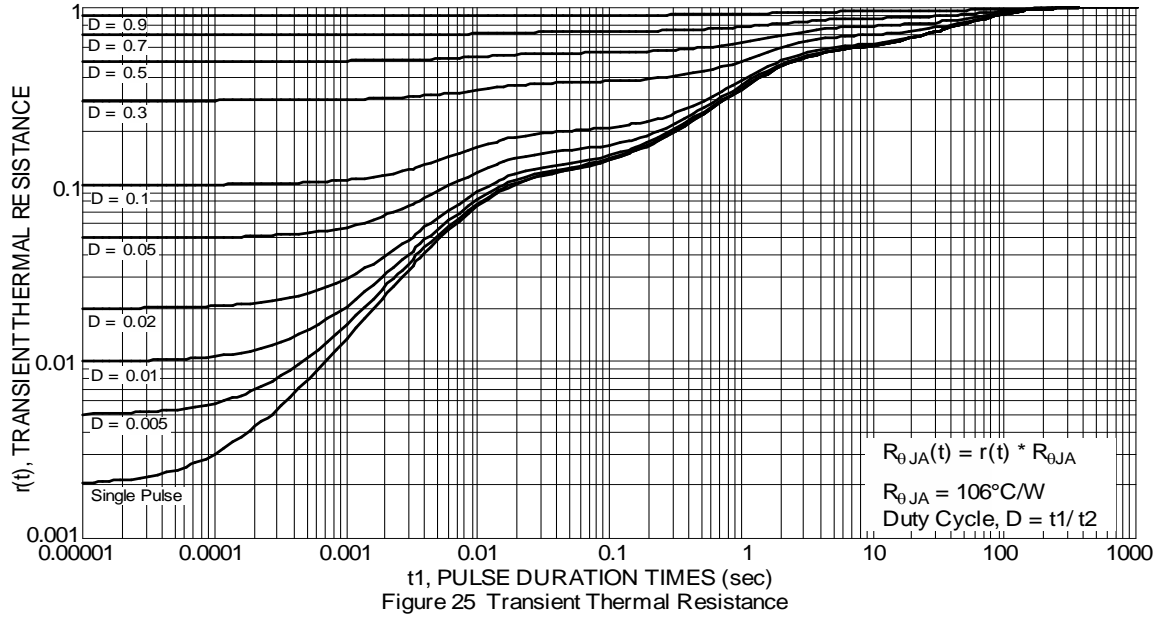
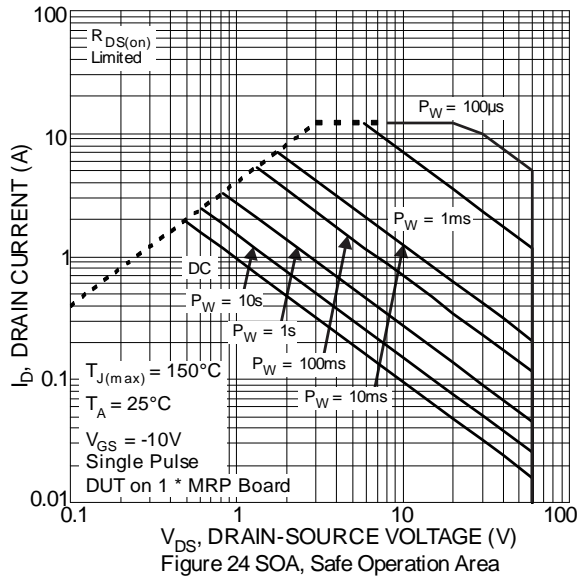


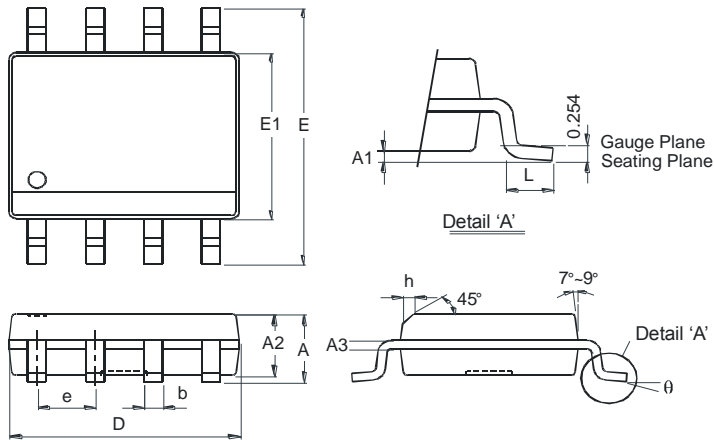
Figure 23 Gate Charge



Package Outline Dimensions

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

SO-8

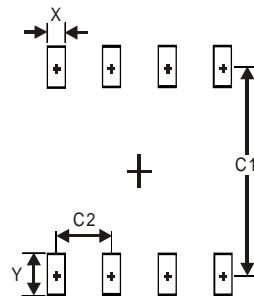


SO-8		
Dim	Min	Max
A	-	1.75
A1	0.10	0.20
A2	1.30	1.50
A3	0.15	0.25
b	0.3	0.5
D	4.85	4.95
E	5.90	6.10
E1	3.85	3.95
e	1.27 Typ	
h	-	0.35
L	0.62	0.82
θ	0°	8°
All Dimensions in mm		

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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