

**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 $\Omega$ @ $V_{GS} = 10V$	4.1A
		120m $\Omega$ @ $V_{GS} = 4.5V$	3.7A
P-Channel	-60V	170m $\Omega$ @ $V_{GS} = -10V$	3.1A
		250m $\Omega$ @ $V_{GS} = -4.5V$	2.6A

**Description**

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

**Applications**

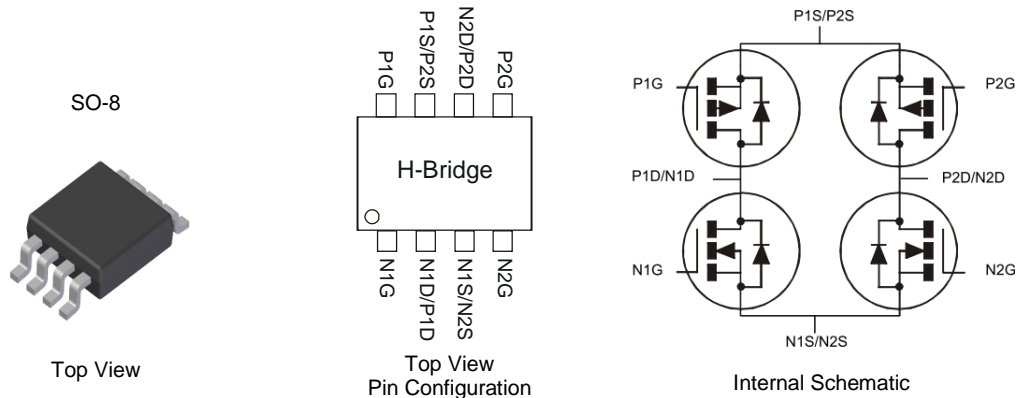
- DC Motor Control
- DC-AC Inverters

**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)**

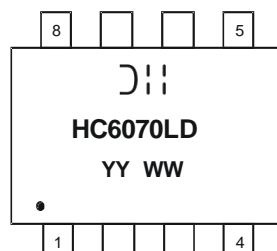
**Mechanical Data**

- 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](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			$V_{GSS}$	$\pm 20$	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 $\mu\text{s}$ 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			$V_{GSS}$	$\pm 20$	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 $\mu\text{s}$ 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<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b> (Note 7)						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	60	—	—	V	I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	1	μA	V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS</b> (Note 7)						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	1.0	—	3.0	V	I <sub>D</sub> = 250μA, V <sub>DS</sub> = V <sub>GS</sub>
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	60	100	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 1.0A
			70	120		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 0.5A
Diode Forward Voltage	V <sub>SD</sub>	—	0.8	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 3A
<b>DYNAMIC CHARACTERISTICS</b> (Note 8)						
Input Capacitance	C <sub>ISS</sub>	—	731	—	pF	V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V f = 1MHz
Output Capacitance	C <sub>OSS</sub>	—	34	—		
Reverse Transfer Capacitance	C <sub>RSS</sub>	—	23	—		
Gate resistance	R <sub>G</sub>	—	1.3	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1.0MHz
Total Gate Charge	Q <sub>G</sub>	—	5.2	—	nC	V <sub>GS</sub> = 4.5V V <sub>DS</sub> = 30V I <sub>D</sub> = 3A
Total Gate Charge	Q <sub>G</sub>	—	11.5	—		
Gate-Source Charge	Q <sub>GS</sub>	—	2.1	—		
Gate-Drain Charge	Q <sub>GD</sub>	—	1.5	—		
Turn-On Delay Time	t <sub>D(ON)</sub>	—	9.6	—	ns	V <sub>DD</sub> = 30V, V <sub>GS</sub> = 10V R <sub>L</sub> ≅ 50Ω, R <sub>G</sub> ≅ 20Ω
Turn-On Rise Time	t <sub>R</sub>	—	11	—		
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	61	—		
Turn-Off Fall Time	t <sub>F</sub>	—	21	—		
Body Diode Reverse Recovery Time	t <sub>RR</sub>	—	10.5	—	ns	I <sub>S</sub> = 1.0A, dI/dt = 100A/μs
Body Diode Reverse Recovery Charge	Q <sub>RR</sub>	—	4.0	—	nC	I <sub>S</sub> = 1.0A, dI/dt = 100A/μs

**Electrical Characteristics – P-Channel** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b> (Note 7)						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	-60	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	-1	μA	V <sub>DS</sub> = -60V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS</b> (Note 7)						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	-1	—	-3	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	120	170	mΩ	V <sub>GS</sub> = -10V, I <sub>D</sub> = -1.0A
			170	250		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -0.5A
Diode Forward Voltage	V <sub>SD</sub>	—	-0.8	-1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = -2A
<b>DYNAMIC CHARACTERISTICS</b> (Note 8)						
Input Capacitance	C <sub>ISS</sub>	—	618	—	pF	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>OSS</sub>	—	36	—		
Reverse Transfer Capacitance	C <sub>RSS</sub>	—	26	—		
Gate resistance	R <sub>G</sub>	—	13	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1.0MHz
Total Gate Charge	Q <sub>G</sub>	—	4.3	—	nC	V <sub>GS</sub> = -4.5V V <sub>DS</sub> = -30V I <sub>D</sub> = -2A
Total Gate Charge	Q <sub>G</sub>	—	8.9	—		
Gate-Source Charge	Q <sub>GS</sub>	—	1.4	—		
Gate-Drain Charge	Q <sub>GD</sub>	—	1.7	—		
Turn-On Delay Time	t <sub>D(ON)</sub>	—	7.6	—	ns	V <sub>DD</sub> = -30V, V <sub>GS</sub> = -10V R <sub>L</sub> ≅ 50Ω, R <sub>G</sub> ≅ 20Ω
Turn-On Rise Time	t <sub>R</sub>	—	11.6	—		
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	79.8	—		
Turn-Off Fall Time	t <sub>F</sub>	—	37.8	—		
Body Diode Reverse Recovery Time	t <sub>RR</sub>	—	10.8	—	ns	I <sub>S</sub> = -1.0A, dI/dt = 100A/μs
Body Diode Reverse Recovery Charge	Q <sub>RR</sub>	—	3.8	—	nC	I <sub>S</sub> = -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<sub>AS</sub> and E<sub>AS</sub> rating are based on low frequency and duty cycles to keep T<sub>J</sub> = +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**

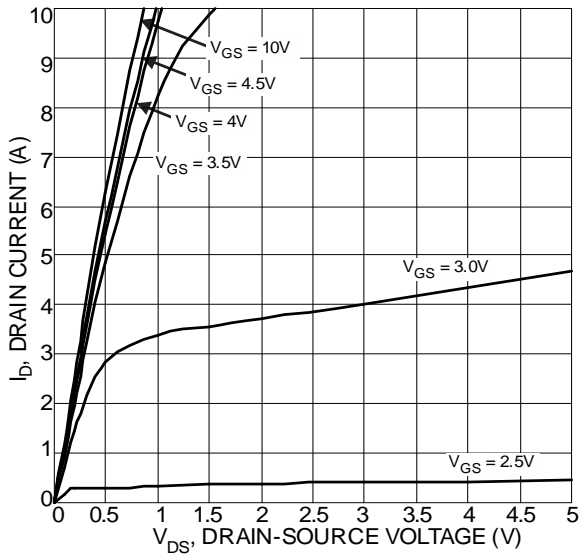


Figure 1 Typical Output Characteristic

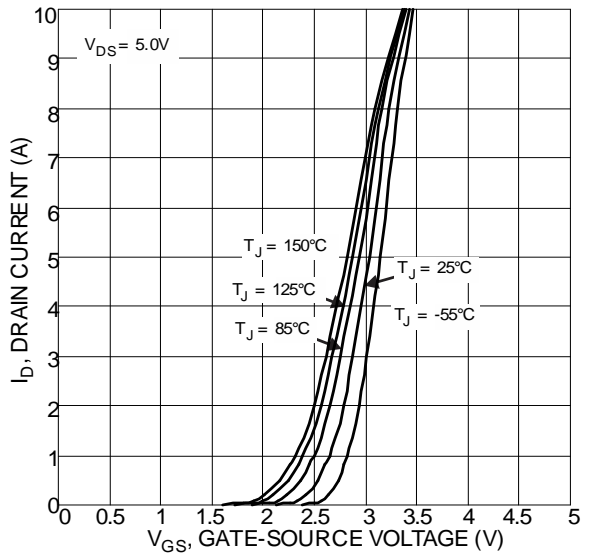


Figure 2 Typical Transfer Characteristics

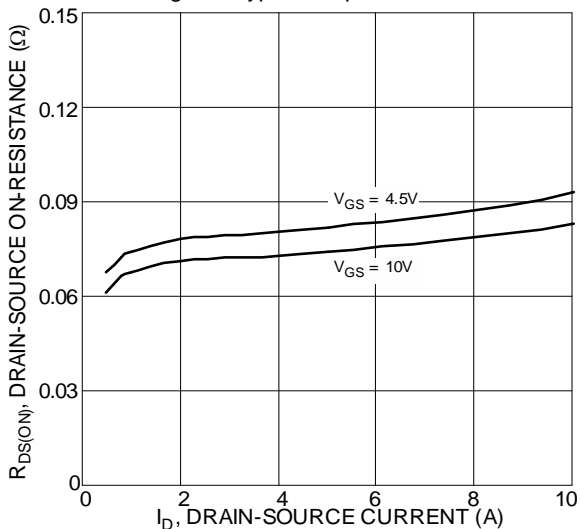


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

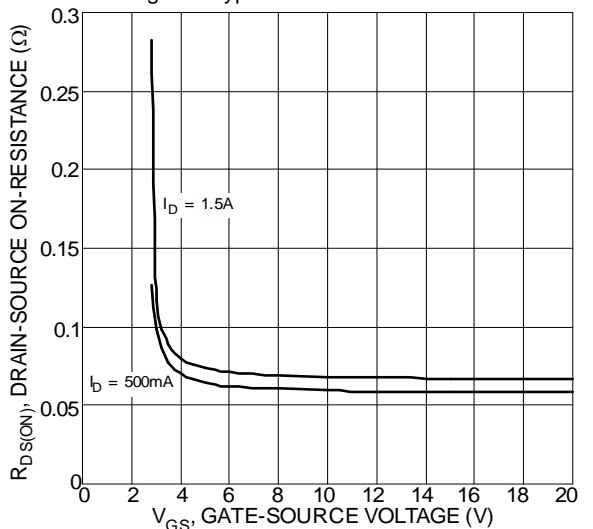


Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

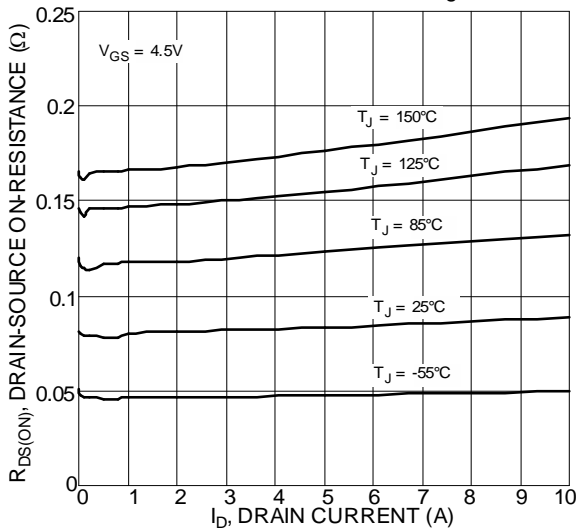


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

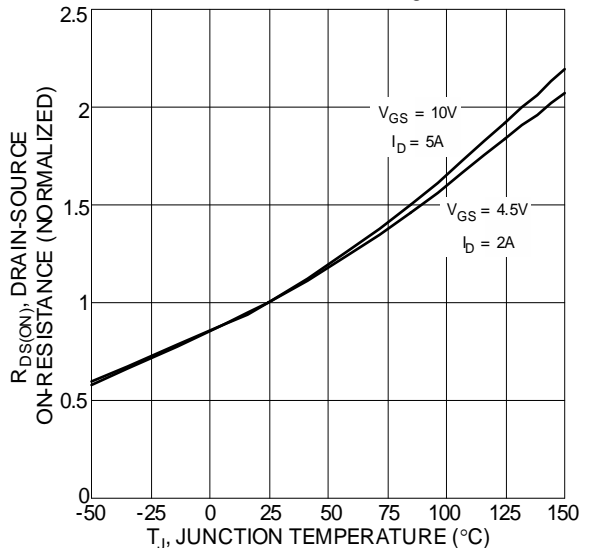


Figure 6 On-Resistance Variation with Temperature

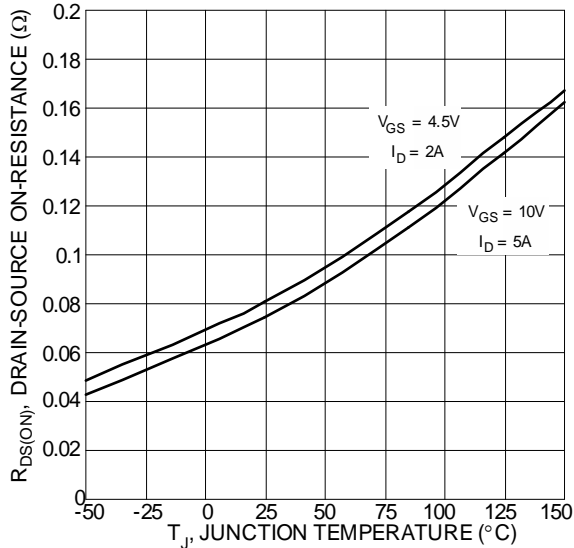


Figure 7 On-Resistance Variation with Temperature

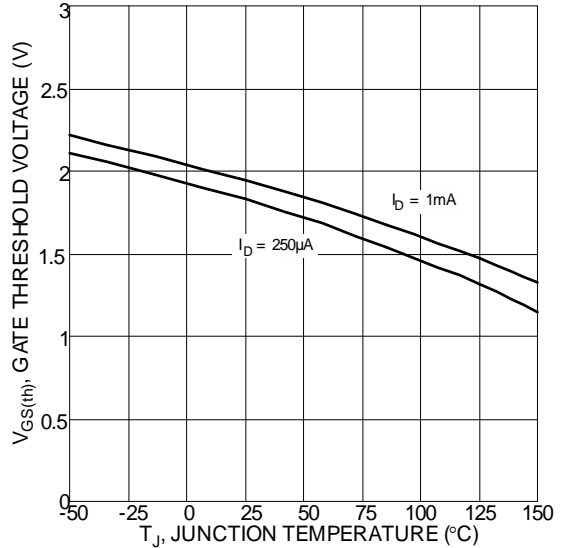


Figure 8 Gate Threshold Variation vs. Ambient Temperature

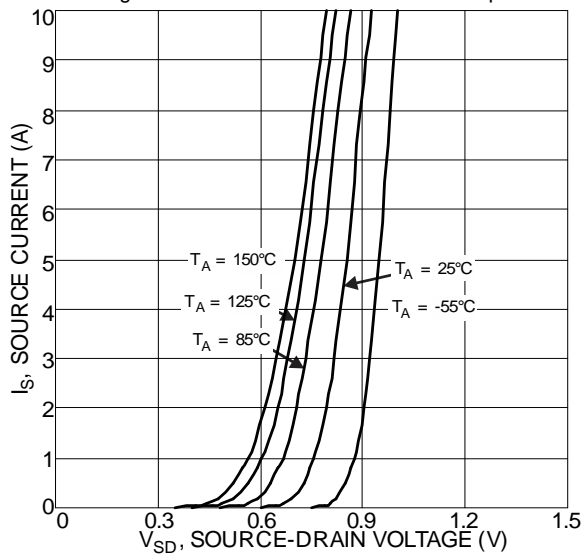


Figure 9 Diode Forward Voltage vs. Current

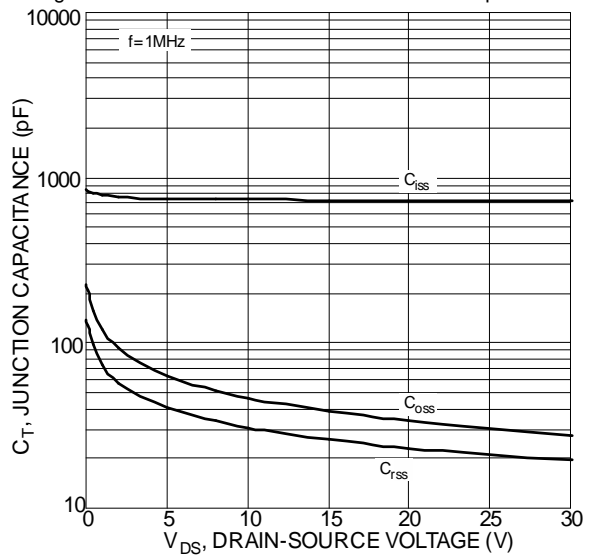


Figure 10 Typical Junction Capacitance

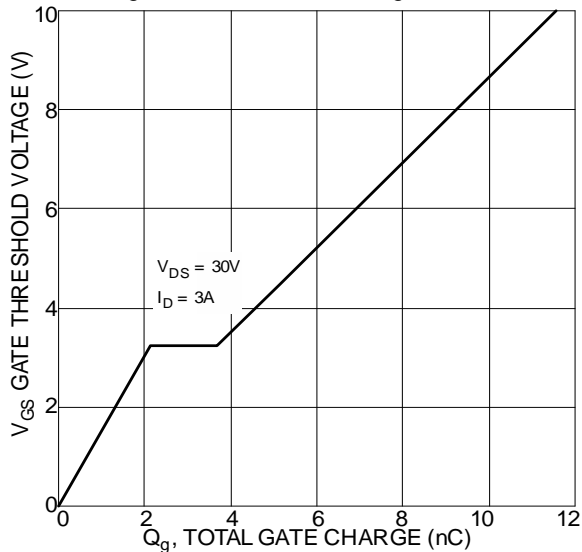


Figure 11 Gate Charge

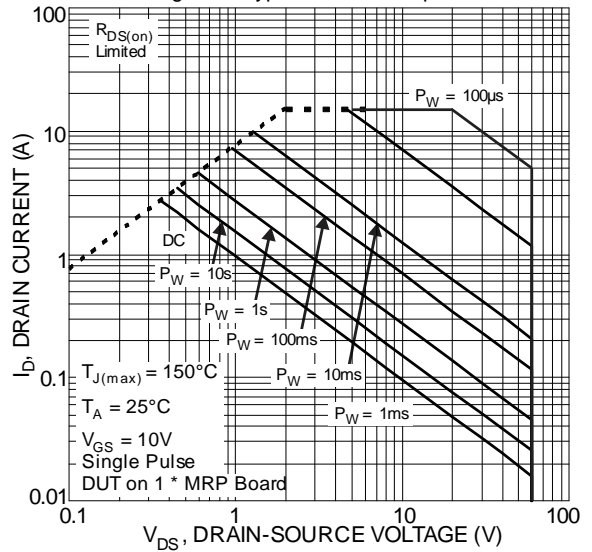


Figure 12 SOA, Safe Operation Area

**Typical Performance Characteristics – P-Channel**

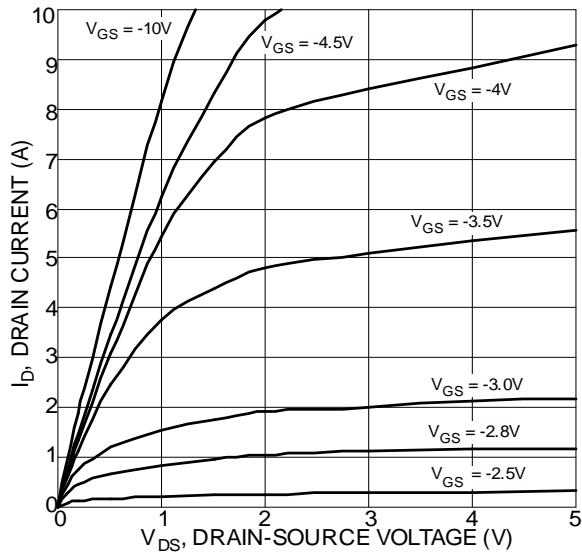


Figure 13 Typical Output Characteristic

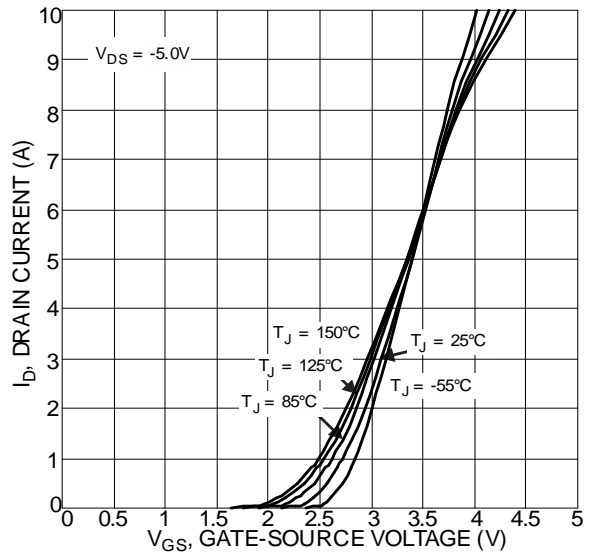


Figure 14 Typical Transfer Characteristics

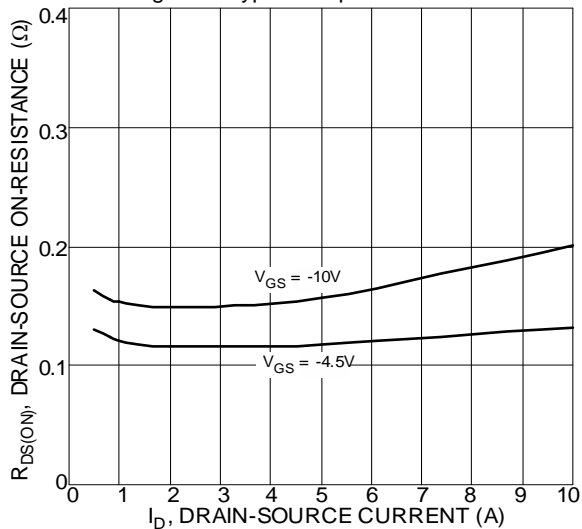


Figure 15 Typical On-Resistance vs. Drain Current and Gate Voltage

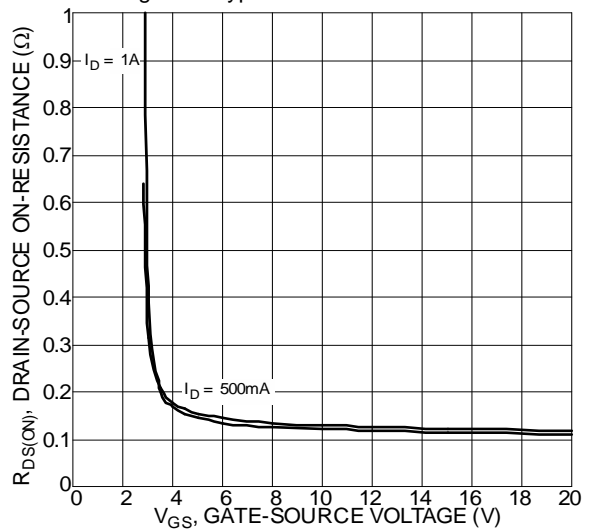


Figure 16 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

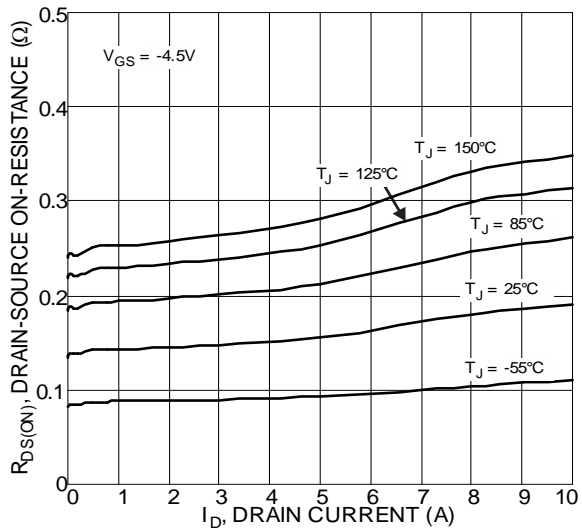


Figure 17 Typical On-Resistance vs. Drain Current and Temperature

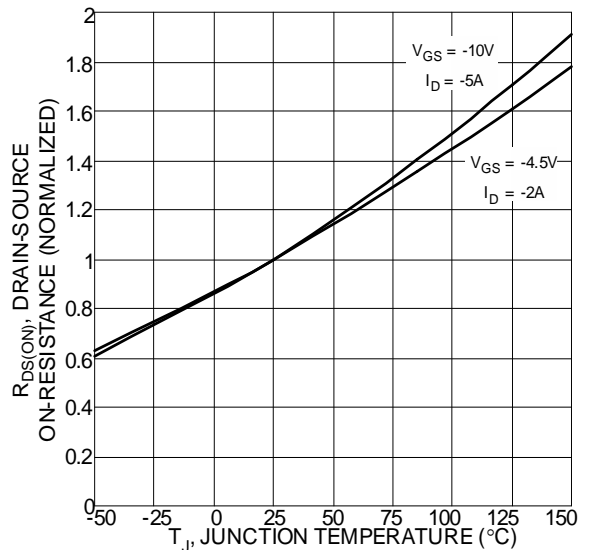


Figure 18 On-Resistance Variation with Temperature

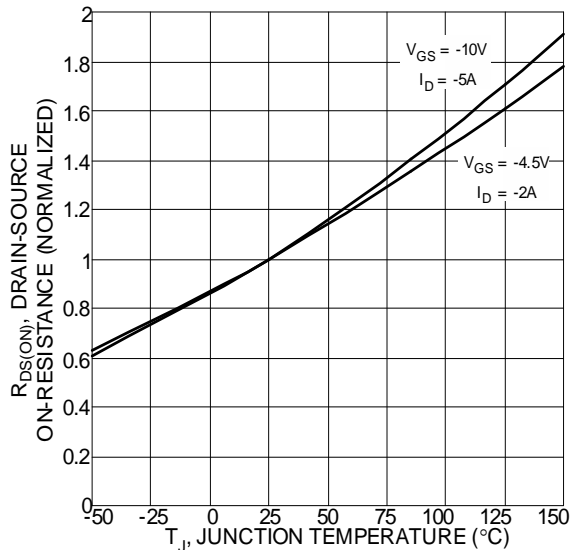


Figure 18 On-Resistance Variation with Temperature

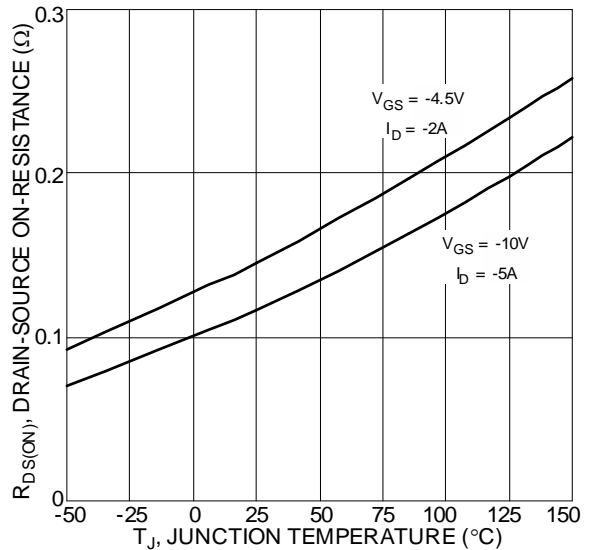


Figure 19 On-Resistance Variation with Temperature

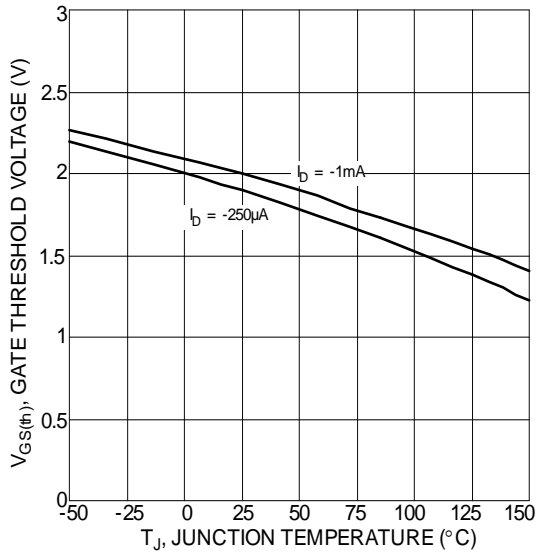


Figure 20 Gate Threshold Variation vs. Ambient Temperature

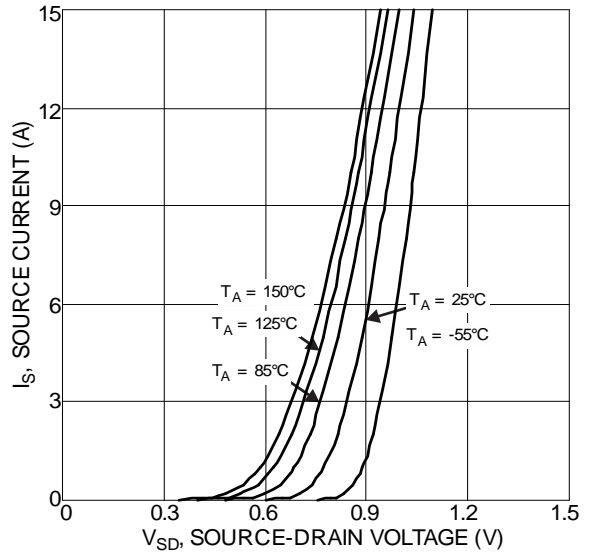


Figure 21 Diode Forward Voltage vs. Current

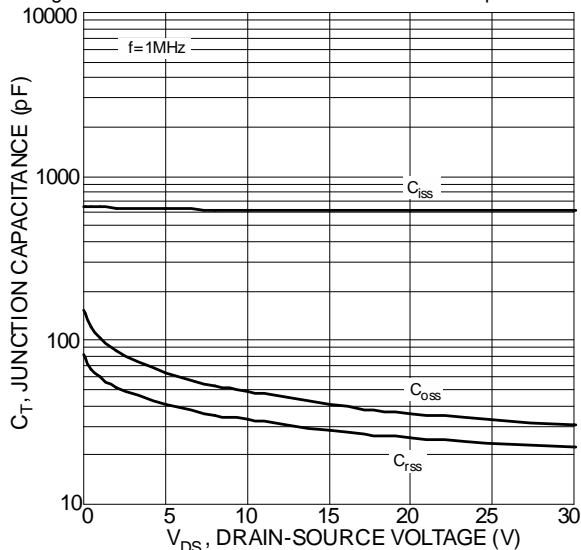


Figure 22 Typical Junction Capacitance

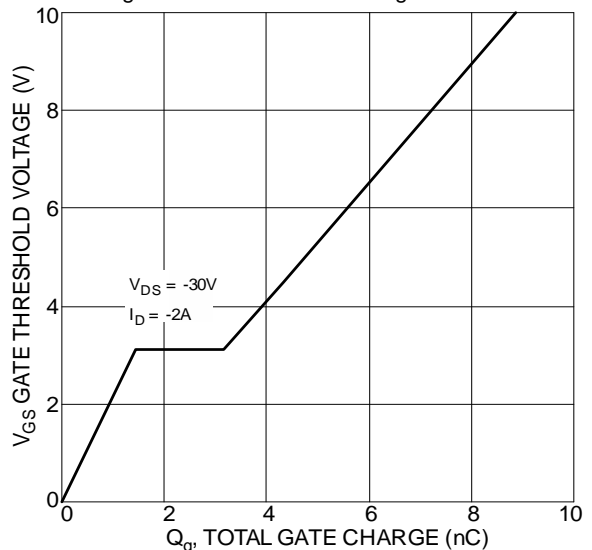
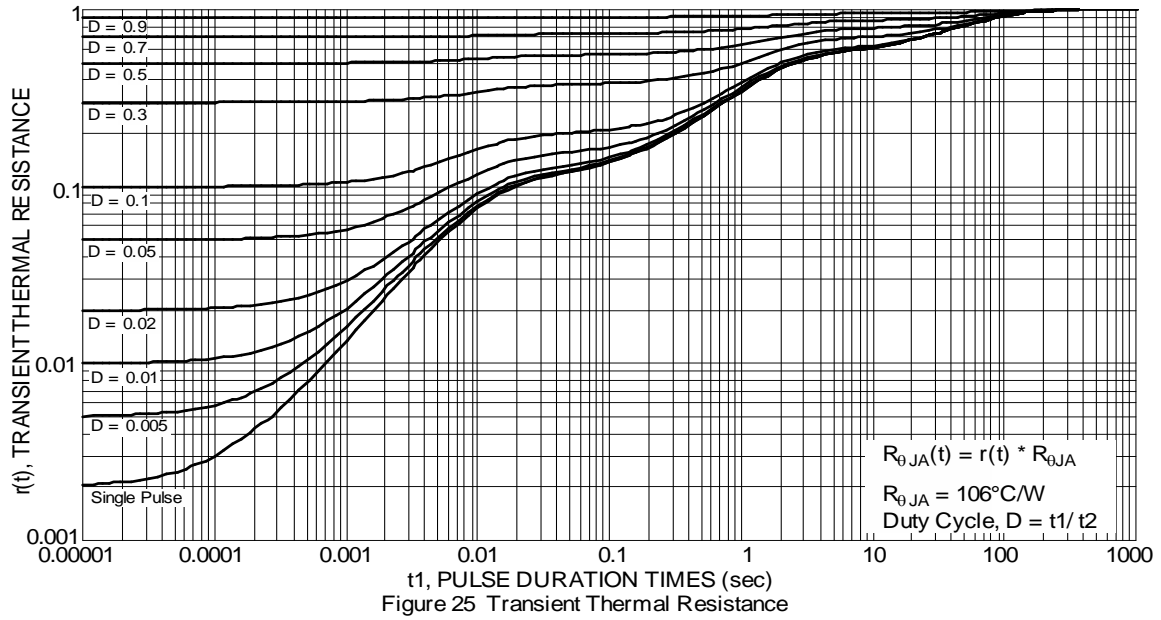
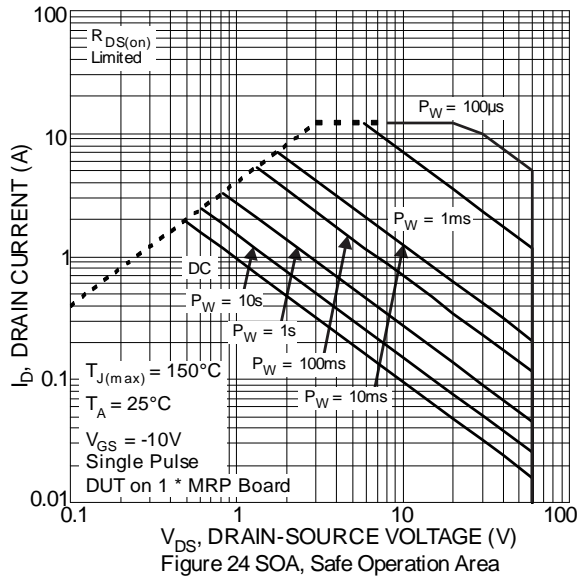


Figure 23 Gate Charge

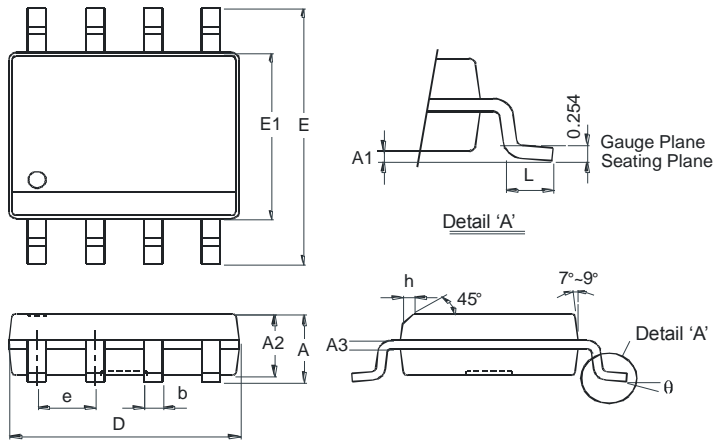




**Package Outline Dimensions**

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

**SO-8**

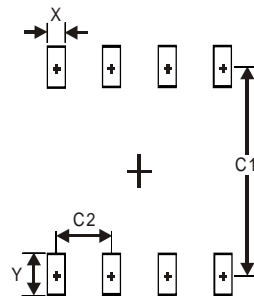


SO-8		
Dim	Min	Max
A	-	1.75
A1	0.10	0.20
A2	1.30	1.50
A3	0.15	0.25
b	0.3	0.5
D	4.85	4.95
E	5.90	6.10
E1	3.85	3.95
e	1.27 Typ	
h	-	0.35
L	0.62	0.82
θ	0°	8°
<b>All Dimensions in mm</b>		

**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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