

## Buffered H-Bridge Driver with Integrate MOSFET

### DESCRIPTION

The Si9987 is an integrated, buffered H-bridge with TTL compatible inputs and the capability of delivering a continuous 1 A at  $V_{DD} = 5\text{ V}$  (room temperature) at switching rates up to 500 kHz. Internal logic prevents the upper and lower outputs of either half-bridge from being turned on simultaneously. Unique input codes allow both outputs to be forced low (for braking) or forced to a high impedance level.

The Si9987 is available in an 8-pin SOIC package, specified to operate over a voltage range of 3.8 V to 13.2 V, and the commercial temperature range of 0 °C to 70 °C (C suffix) and - 40 °C to 85 °C (D suffix). The Si9987 is available in lead free.

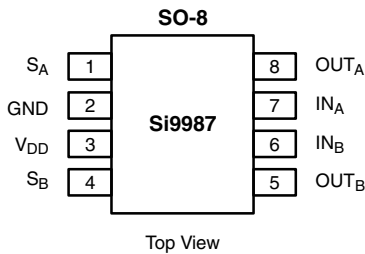
### FEATURES

- 1 A H-bridge
- 500 kHz switching rate
- Shoot-through limited
- TTL compatible inputs
- 3.8 V to 13.2 V operating range
- Surface mount packaging 1 A H-bridge

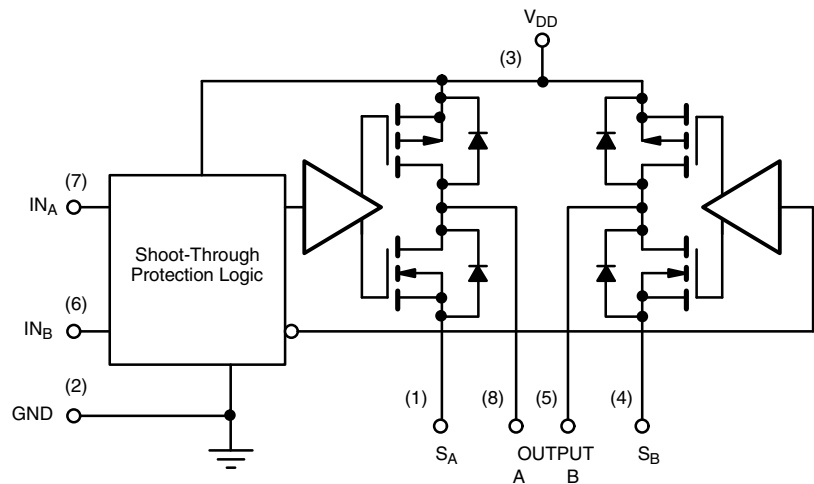
### APPLICATIONS

- VCM driver
- Brushed motor driver
- Stepper motor driver
- Power converter
- Optical disk drives
- Power supplies
- High performance servo

### FUNCTIONAL BLOCK DIAGRAM, PIN CONFIGURATION AND TRUTH TABLE



TRUTH TABLE			
IN <sub>A</sub>	IN <sub>B</sub>	OUT <sub>A</sub>	OUT <sub>B</sub>
1	0	1	0
0	1	0	1
0	0	0	0
1	1	HiZ	HiZ



ORDERING INFORMATION		
Part Number	Temperature Range	Package
Si9987CY-T1	0 °C to 70 °C	Tape and reel
Si9987DY-T1	- 40 °C to 85 °C	
Si9987CY-T1-E3	0 °C to 70 °C	Lead free Tape and reel
Si9987DY-T1-E3	- 40 °C to 85 °C	
Si9987CY	0 °C to 70 °C	Bulk (tubes)
Si9987DY	- 40 °C to 85 °C	

ABSOLUTE MAXIMUM RATINGS <sup>a</sup>			
Parameter		Limit	Unit
Voltage on any Pin with Respect to Ground		- 0.3 V to $V_{DD} + 0.3$ V	V
Voltage on Pins 5, 8 with Respect to Ground		- 1 V to $V_{DD} + 1$ V	
Voltage on Pins 1, 4		- 0.3 V to GND + 1 V	
Maximum $V_{DD}$		15	V
Peak Output Current		1.5	A
Storage Temperature		- 65 to 150	°C
Maximum Junction Temperature ( $T_J$ )		150	
Power Dissipation <sup>b</sup>		1	W
$\theta_{JA}$		100	°C/W
Continuous $I_{OUT}$ Current ( $T_J = 135$ °C) <sup>c</sup>	$T_A = 25$ °C	$\pm 1.02$	A
	$T_A = 70$ °C	$\pm 0.75$	
	$T_A = 85$ °C	$\pm 0.65$	
Operating Temperature Range	Si9987CY	0 to 70	°C
	Si9987DY	- 45 to 85	

## Notes:

a. Device mounted with all leads soldered or welded to PC board.

b. Derate 10 mW/°C above 25 °C.

c.  $T_J = T_A + (P_D \times \theta_{JA})$ ,  $P_D$  = power dissipation.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

RECOMMENDED OPERATING RANGE			
Parameter		Limit	Unit
$V_{DD}$		3.8 to 13.2	V
Maximum Junction Temperature ( $T_J$ )		135	°C

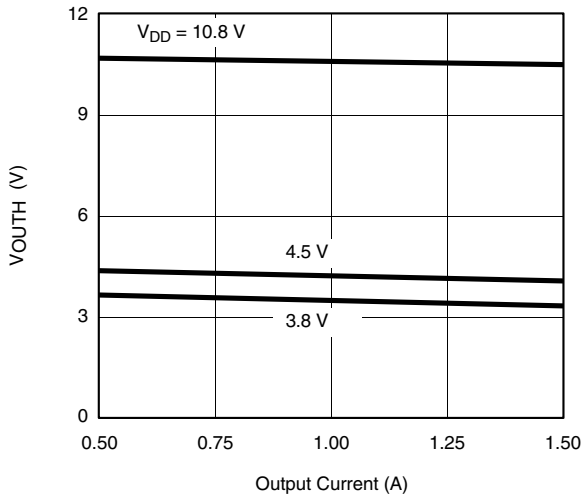
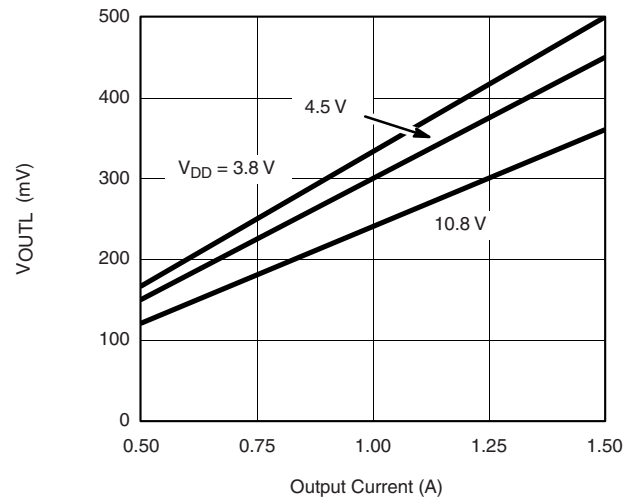
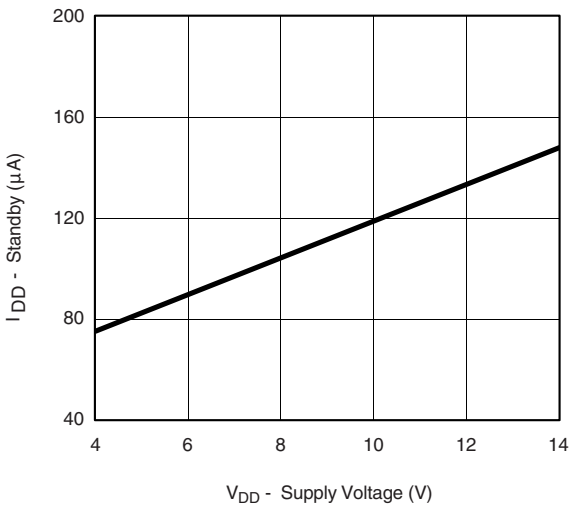
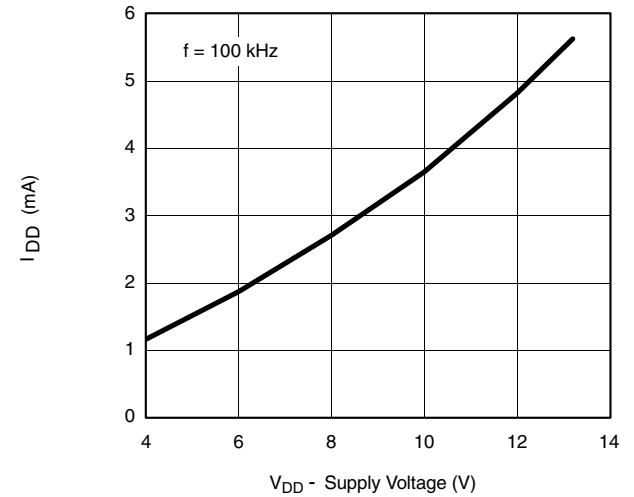
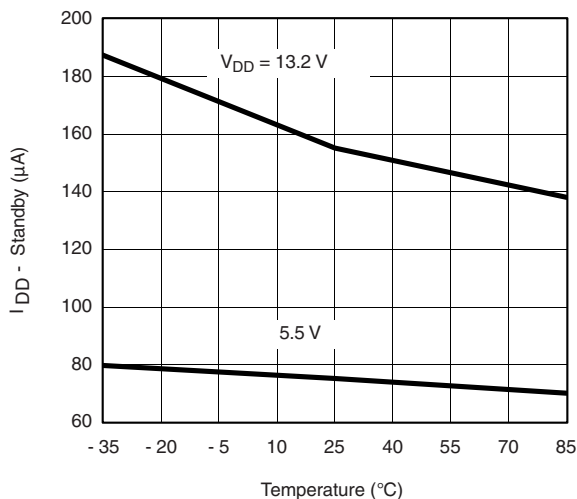
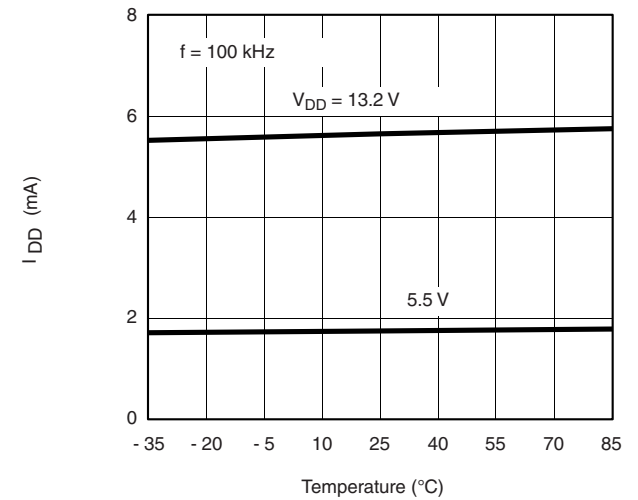
SPECIFICATIONS						
Parameter	Symbol	Test Conditions Unless Specified $V_{DD} = 3.8$ V to 13.2 V $S_A$ at GND, $S_B$ at GND	Limits			Unit
			Min <sup>a</sup>	Typ <sup>b</sup>	Max <sup>a</sup>	
<b>Input</b>						
Input Voltage High	$V_{INH}$		2			V
Input Voltage Low	$V_{INL}$				1	
Input Current with Input Voltage High	$I_{INH}$	$V_{IN} = 2$ V			1	µA
Input Current with Input Voltage Low	$I_{INL}$	$V_{IN} = 0$ V	- 1			
<b>Output</b>						
Output Voltage High <sup>c</sup>	$V_{OUTH}$	$I_{OUT} = - 1$ mA	$V_{DD} = 10.8$ V	10.40	10.56	V
			$V_{DD} = 4.5$ V	4.00	4.20	
		$I_{OUT} = - 500$ mA	$V_{DD} = 10.8$ V	10.60	10.68	
			$V_{DD} = 4.5$ V	4.25	4.35	
		$I_{OUT} = - 300$ mA, $V_{DD} = 3.8$ V	3.63	3.70		
Output Voltage Low <sup>c</sup>	$V_{OUTL}$	$I_{OUT} = 1$ mA	$V_{DD} = 10.8$ V		0.24	0.40
			$V_{DD} = 4.5$ V		0.30	0.50
		$I_{OUT} = 500$ mA	$V_{DD} = 10.8$ V		0.12	0.20
			$V_{DD} = 4.5$ V		0.15	0.25
				$I_{OUT} = 300$ mA, $V_{DD} = 3.8$ V		0.10
Output Leakage Current Low	$I_{OLL}$	$I_{NA} = I_{NB} \geq 2$ V, $V_{OUT} = V_{DD} = 13.2$ V		0	10	µA
Output Leakage Current High	$I_{OLH}$	$V_{OUT} = 0$ , $V_{DD} = 13.2$ V	- 10	0		
Output V Clamp High	$V_{CLH}$	$I_{NA} = I_{NB} \geq 2$ V	$I_{OUT} = 100$ mA		$V_{DD} + 0.7$	$V_{DD} + 0.9$
Output V Clamp Low	$V_{CLL}$		$I_{OUT} = - 100$ mA	- 0.9	- 0.7	
<b>Supply</b>						
$V_{DD}$ Supply Current	$I_{DD}$	$I_N = 100$ kHz, $V_{DD} = 5.5$ V		1.8	2.5	mA
		$I_{NA} = I_{NB} = 4.5$ V, $V_{DD} = 5.5$ V		75	125	
<b>Dynamic</b>						
Propagation Delay Time	$T_{PLH}$	$V_{DD} = 5$ V		300		nS
	$T_{PHL}$			100		

## Notes:

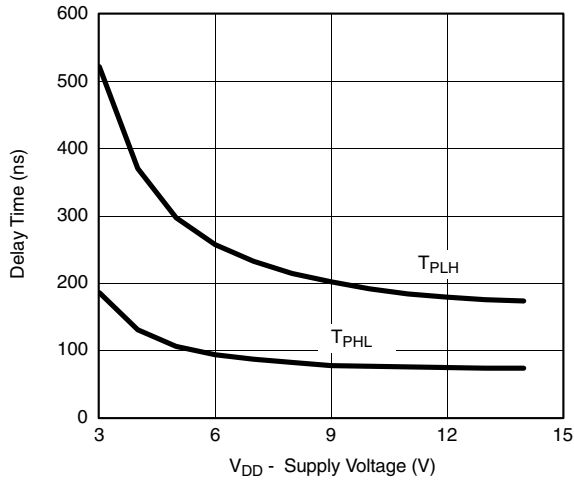
a. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.

b. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

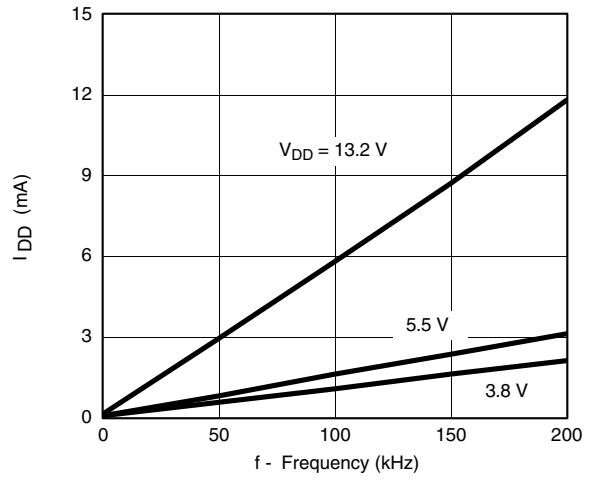
c. Maximum value measured at  $T_J = 135$  °C. Typical value measured at  $T_J = T_A = 25$  °C (pulse width  $\leq 300$  µsec, duty cycle  $\leq 2$  %).

**TYPICAL CHARACTERISTICS** (25 °C unless otherwise noted)

**Output High Voltage vs. Output Current**

**Output Low Voltage vs. Output Current**

**Supply Current vs. Supply Voltage**

**Supply Current vs. Supply Voltage**

**Supply Current vs. Temperature**

**Supply Current vs. Temperature**

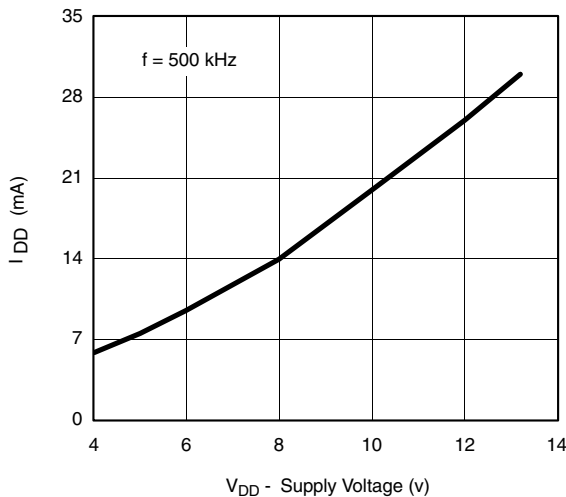
**TYPICAL CHARACTERISTICS** (25 °C unless otherwise noted)



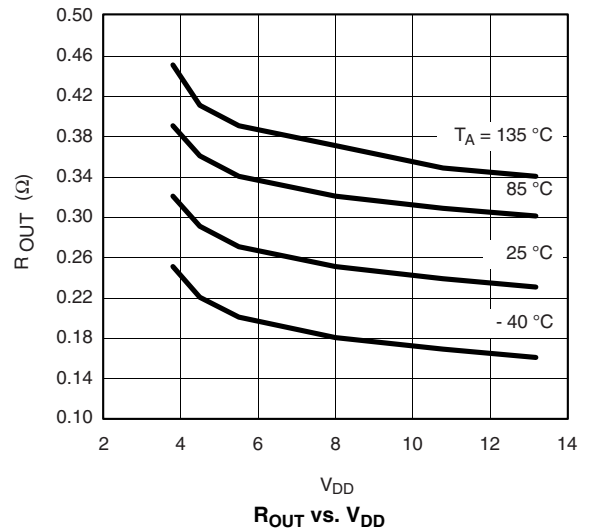
**Propagation Time vs. Supply Voltage**



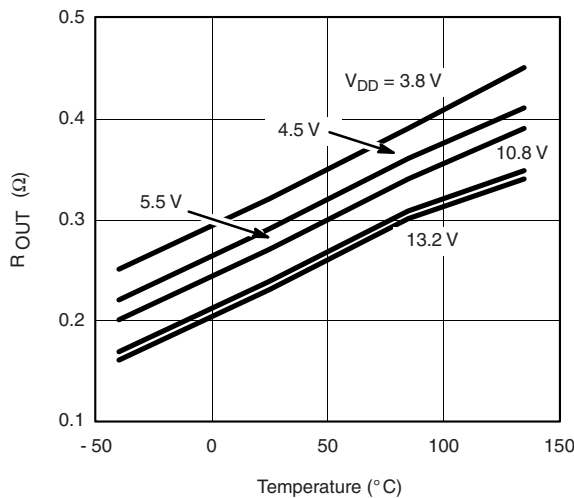
**Supply Current vs. Frequency**



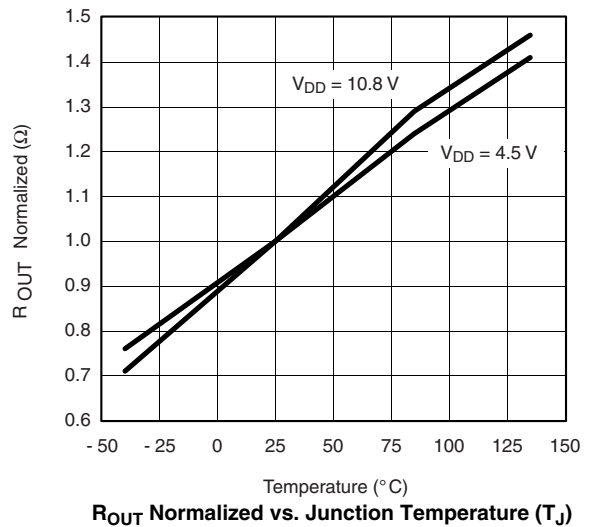
**Supply Current vs. Supply Voltage**



**ROUT vs. VDD**



**ROUT vs. Junction Temperature (T<sub>J</sub>)**



**ROUT Normalized vs. Junction Temperature (T<sub>J</sub>)**

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## SOIC (NARROW): 8-LEAD

JEDEC Part Number: MS-012



DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A <sub>1</sub>	0.10	0.20	0.004	0.008
B	0.35	0.51	0.014	0.020
C	0.19	0.25	0.0075	0.010
D	4.80	5.00	0.189	0.196
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.020
L	0.50	0.93	0.020	0.037
q	0°	8°	0°	8°
S	0.44	0.64	0.018	0.026
ECN: C-06527-Rev. I, 11-Sep-06				
DWG: 5498				



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