

CS8312

IGBT Ignition Predriver with Dynamic Current Regulation

The CS8312 is a bipolar microprocessor interface IC designed to drive an IGBT (or logic level MOSFETs) powering large inductive loads in harsh operating environments. The IC's dynamic current limit function lets the microprocessor adjust the current limit threshold to the real time needs of the system.

CLI, the current limit input, sets the current limit for the IGBT high or low as directed by the system microprocessor. CLI also raises and lowers the threshold on the diagnostic FLAG output signal. The FLAG output signals the microprocessor when the current level approaches current limit on the IGBT. The CTRL input enables the FLAG function.

Features

- μ P Compatible Inputs
- Adjustable Current Limit Thresholds
- External Sense Resistor
- Flag Signal to Indicate Output Status

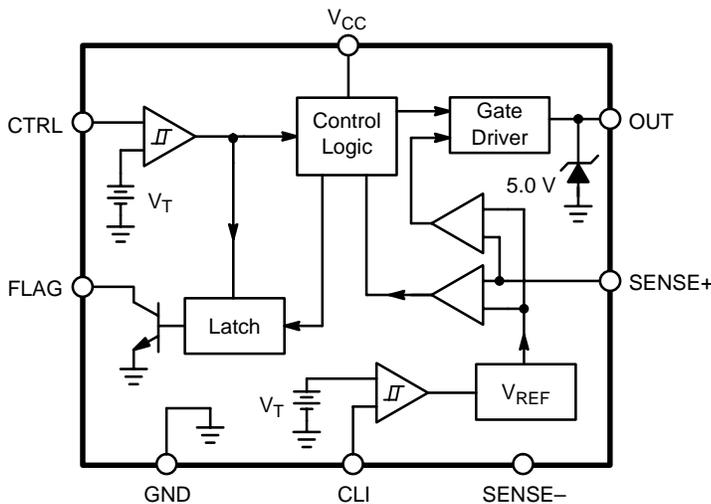
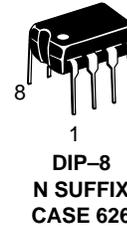


Figure 1. Block Diagram

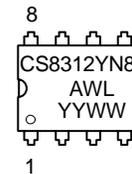


ON Semiconductor™

<http://onsemi.com>

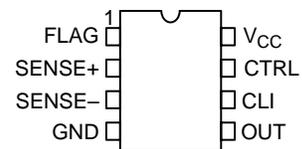


MARKING DIAGRAMS



A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week

PIN CONNECTIONS



ORDERING INFORMATION

Device	Package	Shipping
CS8312YN8	DIP-8	50 Units/Rail
CS8312YD8	SO-8	95 Units/Rail
CS8312YDR8	SO-8	2500 Tape & Reel

ABSOLUTE MAXIMUM RATINGS*

Rating	Value	Unit
Supply Voltage	-0.3 to 12	V
Digital Input Currents	2.0	mA
Internal Power Dissipation ($T_A = 25^\circ\text{C}$)	700	mW
Junction Temperature Range	-40 to +150	$^\circ\text{C}$
Storage Temperature Range	-55 to +165	$^\circ\text{C}$
Electrostatic Discharge (Human Body Model)	2.0	kV
Lead Temperature Soldering	Wave Solder (through hole styles only) Note 1. Reflow (SMD styles only) Note 2.	260 peak 230 peak $^\circ\text{C}$ $^\circ\text{C}$

1. 10 seconds max.

2. 60 seconds max above 183°C

*The maximum package power dissipation must be observed.

ELECTRICAL CHARACTERISTICS ($7.0\text{ V} \leq V_{CC} \leq 10\text{ V}$, $-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$,
 $-0.2\text{ V} \leq$ Differential Ground Voltage $\leq 0.8\text{ V}$; unless otherwise specified.)

Characteristic	Test Conditions	Min	Typ	Max	Unit
General					
Power Supply Including Ripple Voltage	-	7.0	-	10	V
Supply Ripple Frequency	-	10	-	60	kHz
Differential Ground Frequency	-	10	-	60	kHz
Quiescent Current, I_Q					
Turn On	$V_{CTRL} = 5.5\text{ V}$	-	-	15	mA
Turn Off	$V_{CTRL} = -0.3\text{ V}$	-	-	5.0	mA
Supply Voltage Rejection	$V_{CTRL} = 5.5\text{ V}$	30	-	-	dB
Differential Ground Rejection Ratio	$V_{CTRL} = 5.5\text{ V}$	30	-	-	dB
Differential Ground Current Ratio	$V_{CTRL} = -0.3\text{ V}$, ($V_{SENSE-} - V_{GND}$)DC = 1.0 V ($V_{SENSE-} - V_{GND}$)AC = 0.6 V	-	-	3.0	mA
Unity Gain Bandwidth	$V_{CTRL} = 5.5\text{ V}$	400	-	-	kHz
Turn On Delay	CTRL Increasing	-	-	30	μs
Turn Off Delay	CTRL Decreasing	-	-	30	μs

Control Function

Input Voltage Range	$I_{CTRL} = 2.0\text{ mA}$	-0.3	-	5.5	V
Input Threshold					
Turn On	CTRL Increasing	-	-	3.5	V
Turn Off	CTRL Decreasing	1.5	-	-	V
Hysteresis		0.4	-	2.0	V
Voltage	$I_{CTRL} = 10\text{ }\mu\text{A max}$	-	-	1.1	V
Input Capacitance	-	-	-	50	pF

Current Limit Increase Function

Input Voltage Range	$I_{CTRL} = 2.0\text{ mA}$	-0.3	-	5.5	V
Input Threshold					
Turn On	CLI Increasing	-	-	3.5	V
Turn Off	CLI Decreasing	1.5	-	-	V
Hysteresis		0.4	-	2.0	V
Voltage	$I_{CLI} = 10\text{ }\mu\text{A max}$	-	-	1.1	V

CS8312

ELECTRICAL CHARACTERISTICS (continued) ($7.0\text{ V} \leq V_{CC} \leq 10\text{ V}$, $-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$, $-0.2\text{ V} \leq \text{Differential Ground Voltage} \leq 0.8\text{ V}$; unless otherwise specified.)

Characteristic	Test Conditions	Min	Typ	Max	Unit
----------------	-----------------	-----	-----	-----	------

Current Limit Increase Function (continued)

Input Capacitance	–	–	–	50	pF
-------------------	---	---	---	----	----

Output Stage

I_{OUT}	–	–	–	5.0	mA
Clamp Voltage	$V_{CTRL} = 5.5\text{ V}$, $I_{OUT} = 1.0\text{ mA}$	4.0	–	5.5	V
Output Off Voltage	$V_{CTRL} = -0.3\text{ V}$, $I_{OUT} = 10\text{ }\mu\text{A}$ $V_{CTRL} = -0.3\text{ V}$, $I_{OUT} = 200\text{ }\mu\text{A}$	–	–	0.5 1.2	V V

Flag Function

Output Low	$V_{CTRL} = 5.5\text{ V}$, $I_{FLAG} = 1.5\text{ mA}$	–	–	0.9	V
Leakage Current	$V_{CTRL} = -0.3\text{ V}$	–	–	10	μA
Output Capacitance	–	–	–	50	pF
Turn On ($V_{SENSE+} - V_{SENSE-}$)	$V_{CTRL} = 5.5\text{ V}$, $V_{CLI} = -0.3\text{ V}$ $V_{CTRL} = 5.5\text{ V}$, $V_{CLI} = 5.5\text{ V}$	210 300	225 –	240 350	mV mV
Turn Off Delay	CTRL Decreasing	–	–	10	μs
Turn On Delay	–	–	–	10	μs
Disable Time	–	100	–	450	μs

Sense Function

Input Voltage Range	–	-0.3	–	2.5	V
Sense Regulation Voltage	$V_{CTRL} = 5.5\text{ V}$, $V_{CLI} = -0.3\text{ V}$ $V_{CTRL} = 5.5\text{ V}$, $V_{CLI} = 5.5\text{ V}$	270 380	295 410	320 440	mV mV
Input Leakage Current	$V_{CTRL} = 5.5\text{ V}$	–	–	5.0	μA
Propagation Delay	$V_{CTRL} = 5.5\text{ V}$	–	–	20	μs

PACKAGE PIN DESCRIPTION

PACKAGE PIN #		PIN SYMBOL	FUNCTION
DIP-8	SO-8		
1	1	FLAG	Indicates whether current through the IGBT has reached a pre-set level.
2	2	SENSE+	Positive input to current comparator.
3	3	SENSE-	Ground (SENSE-) for current sense resistor.
4	4	GND	Ground connection.
5	5	OUT	Output voltage to IGBT (MOSFET) gate.
6	6	CLI	Current limit input increase.
7	7	CTRL	Control input.
8	8	V_{CC}	Supply voltage.

CS8312

CIRCUIT DESCRIPTION

Flag Function (See Figure 2)

The flag indicates when the voltage across the two sense pins is approaching a current limit level that has been determined by the value of the external sense resistor (R_{SENSE}) and the state of the CTRL and CLI pins. If the voltage across the sense pins ($SENSE+$, $SENSE-$) is less than the flag turn-on voltage, then the FLAG is off. When the voltage between the sense pins equals the FLAG turn on voltage, the FLAG will latch on until the CTRL pin goes low. FLAG is disabled whenever CTRL is low. Changing the CLI pin from low to high will increase nominal FLAG turn on voltage by approximately 45%.

Table 1. FLAG Timing Sequence

State	CONTROL	SENSE+	FLAG
0	Low	X	OFF
1	High	Below Threshold	OFF
2	High	Above Threshold	ON
3	High	X	ON
0	Low	X	OFF

Output Stage

The CS8312 output (OUT) saturates and supplies voltage to the IGBT (or MOSFET) gate once the CTRL switches from low to high. As current through the IGBT (MOSFET) increases and the voltage across the sense resistor passes the flag turn on voltage, the FLAG will turn on. If the current through the sense resistor continues to rise and the sense resistor voltage reaches the regulation sense voltage, then the gate voltage will fall to a level that regulates the driver and maintains the regulation sense voltage at the sense resistor.

Current Limit Function

Changing the CLI pin from a logic low to a logic high increases the FLAG turn on voltage by approximately 45% and the regulation sense voltage by approximately 39% respectively.

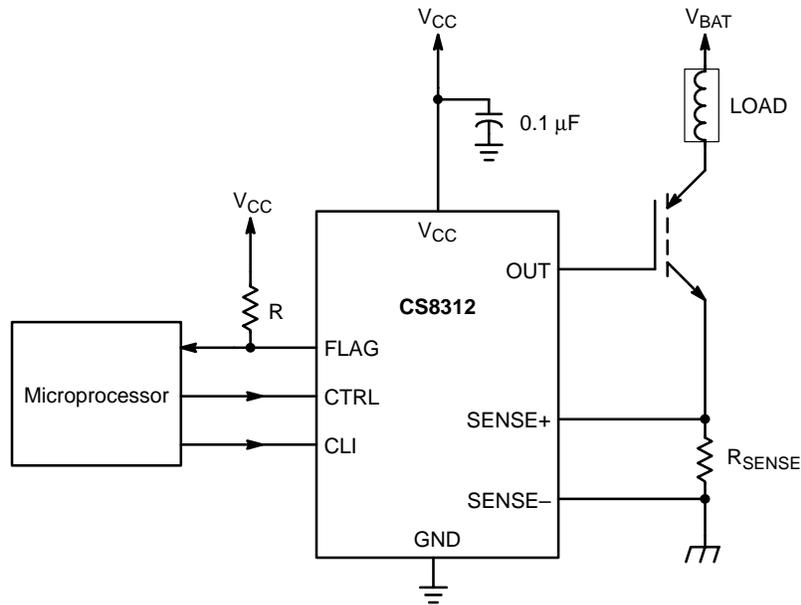
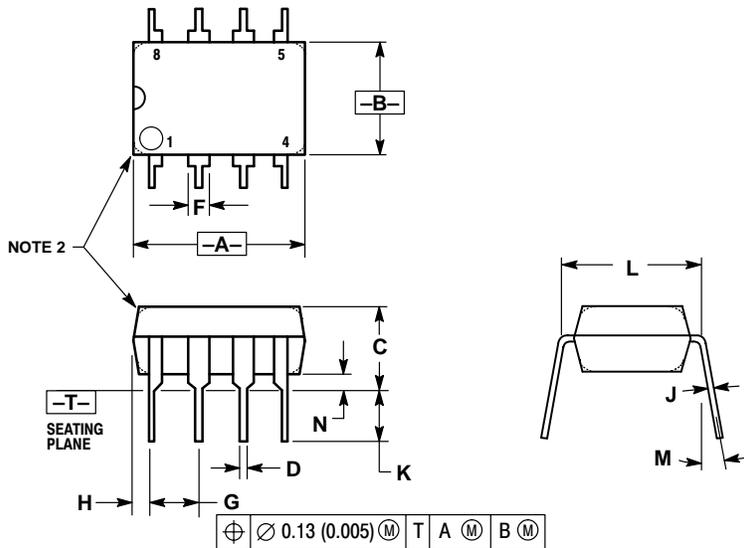


Figure 2. Application and Test Diagram

CS8312

PACKAGE DIMENSIONS

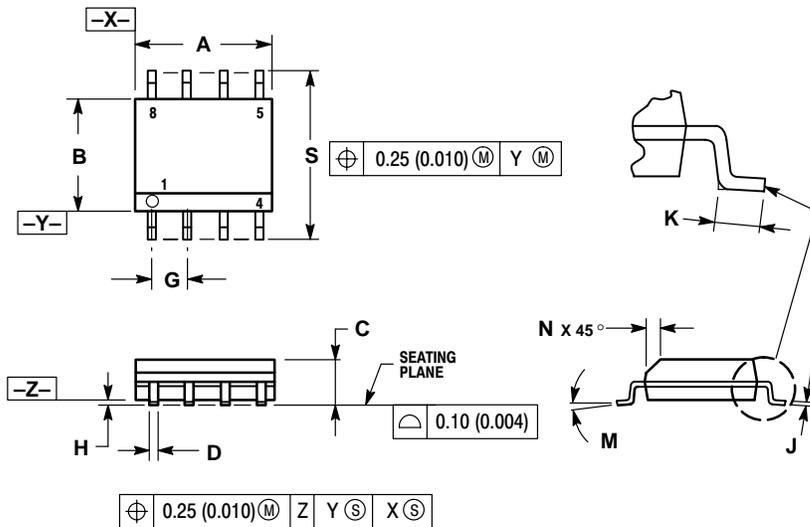
DIP-8
N SUFFIX
CASE 626-05
ISSUE L



- NOTES:
1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
 2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
 3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	---	10°	---	10°
N	0.76	1.01	0.030	0.040

SO-8
D SUFFIX
CASE 751-07
ISSUE W



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.
 3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
 4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
 5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

PACKAGE THERMAL DATA

Parameter		DIP-8	SO-8	Unit
R _{θJC}	Typical	52	45	°C/W
R _{θJA}	Typical	100	165	°C/W

Notes

Notes

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

PUBLICATION ORDERING INFORMATION

NORTH AMERICA Literature Fulfillment:

Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: ONlit@hibbertco.com
Fax Response Line: 303-675-2167 or 800-344-3810 Toll Free USA/Canada

N. American Technical Support: 800-282-9855 Toll Free USA/Canada

EUROPE: LDC for ON Semiconductor – European Support

German Phone: (+1) 303-308-7140 (Mon-Fri 2:30pm to 7:00pm CET)
Email: ONlit-german@hibbertco.com
French Phone: (+1) 303-308-7141 (Mon-Fri 2:00pm to 7:00pm CET)
Email: ONlit-french@hibbertco.com
English Phone: (+1) 303-308-7142 (Mon-Fri 12:00pm to 5:00pm GMT)
Email: ONlit@hibbertco.com

EUROPEAN TOLL-FREE ACCESS*: 00-800-4422-3781

*Available from Germany, France, Italy, UK, Ireland

CENTRAL/SOUTH AMERICA:

Spanish Phone: 303-308-7143 (Mon-Fri 8:00am to 5:00pm MST)
Email: ONlit-spanish@hibbertco.com
Toll-Free from Mexico: Dial 01-800-288-2872 for Access –
then Dial 866-297-9322

ASIA/PACIFIC: LDC for ON Semiconductor – Asia Support

Phone: 1-303-675-2121 (Tue-Fri 9:00am to 1:00pm, Hong Kong Time)
Toll Free from Hong Kong & Singapore:
001-800-4422-3781
Email: ONlit-asia@hibbertco.com

JAPAN: ON Semiconductor, Japan Customer Focus Center

4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031
Phone: 81-3-5740-2700
Email: r14525@onsemi.com

ON Semiconductor Website: <http://onsemi.com>

For additional information, please contact your local Sales Representative.