

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

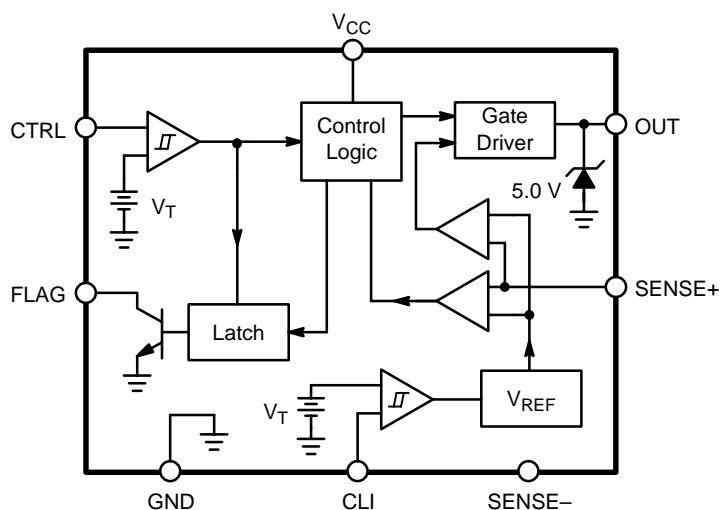
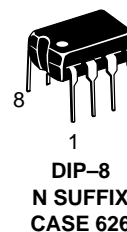


Figure 1. Block Diagram



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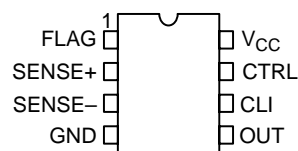


MARKING DIAGRAMS



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 $^\circ\text{C}$

1. 10 seconds max.

2. 60 seconds max above 183°C

*The maximum package power dissipation must be observed.

ELECTRICAL CHARACTERISTICS ($7.0\text{ V} \leq V_{CC} \leq 10\text{ V}$, $-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$, $-0.2\text{ V} \leq \text{Differential Ground Voltage} \leq 0.8\text{ V}$; 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
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Current Limit Increase Function (continued)

Input Capacitance	–	–	–	50	pF
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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.

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.

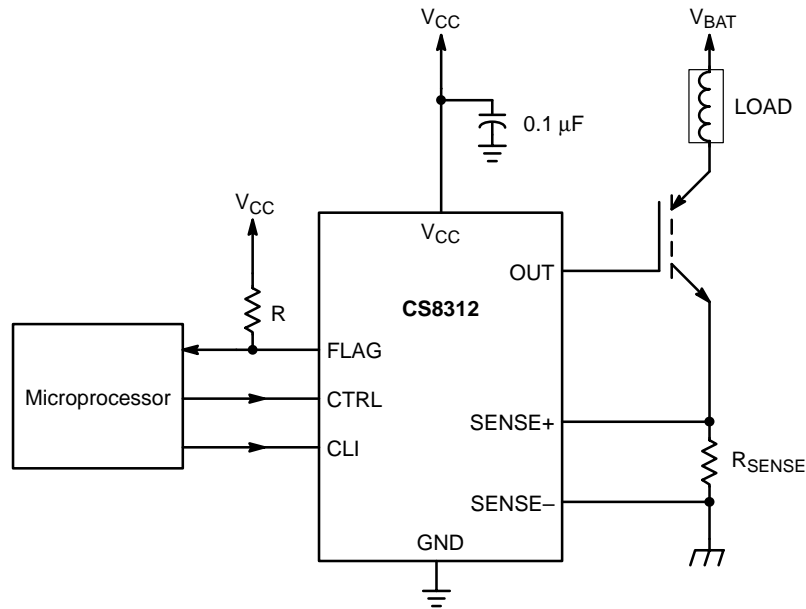
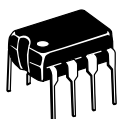


Figure 2. Application and Test Diagram

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

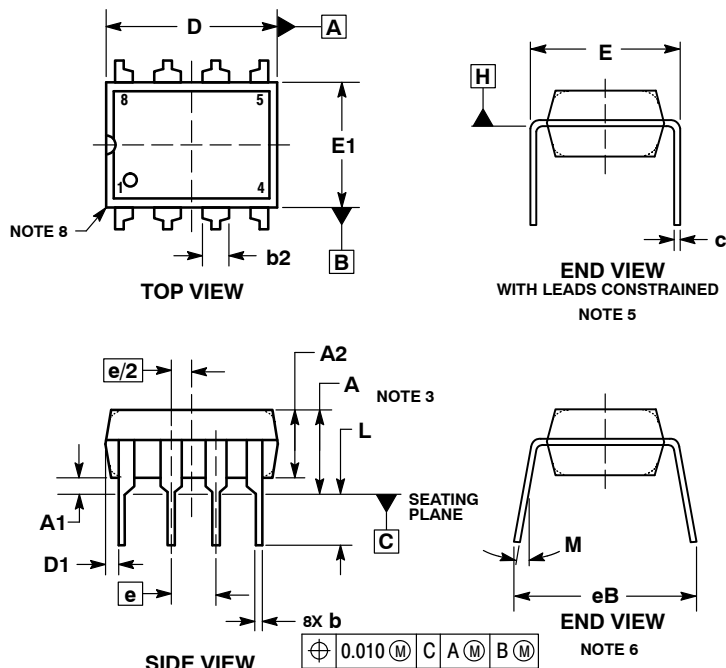
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SCALE 1:1

PDIP-8
CASE 626-05
ISSUE P

DATE 22 APR 2015

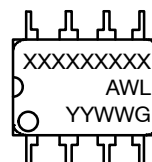


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. DIMENSIONS A, A1 AND L ARE MEASURED WITH THE PACKAGE SEATED IN JEDEC SEATING PLANE GAUGE GS-3.
4. DIMENSIONS D, D1 AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 0.10 INCH.
5. DIMENSION E IS MEASURED AT A POINT 0.015 BELOW DATUM PLANE H WITH THE LEADS CONSTRAINED PERPENDICULAR TO DATUM C.
6. DIMENSION eB IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
7. DATUM PLANE H IS COINCIDENT WITH THE BOTTOM OF THE LEADS, WHERE THE LEADS EXIT THE BODY.
8. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	---	0.210	---	5.33
A1	0.015	---	0.38	---
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.35	0.56
b2	0.060 TYP	---	1.52 TYP	---
C	0.008	0.014	0.20	0.36
D	0.355	0.400	9.02	10.16
D1	0.005	---	0.13	---
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.100 BSC	---	2.54 BSC	---
eB	---	0.430	---	10.92
L	0.115	0.150	2.92	3.81
M	---	10°	---	10°

GENERIC MARKING DIAGRAM*



- XXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week
G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

STYLE 1:

- PIN 1: AC IN
2: DC + IN
3: DC - IN
4: AC IN
5: GROUND
6: OUTPUT
7: AUXILIARY
8: V_{CC}

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MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

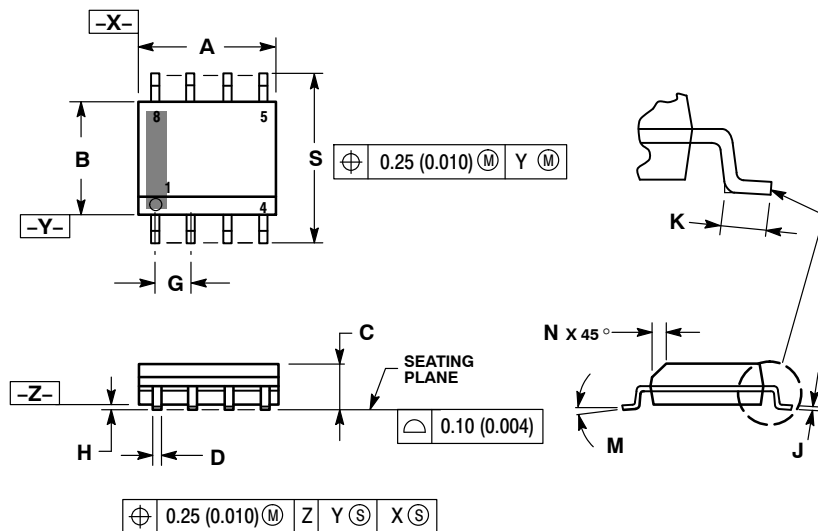
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SCALE 1:1

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CASE 751-07
ISSUE AK

DATE 16 FEB 2011

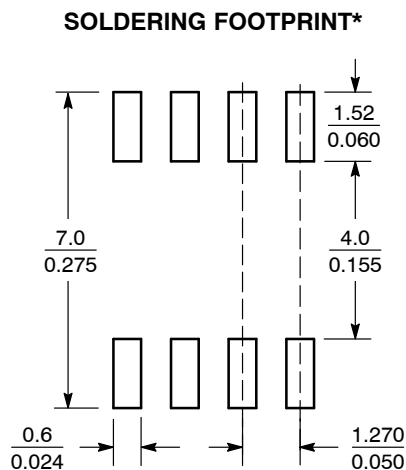


NOTES:

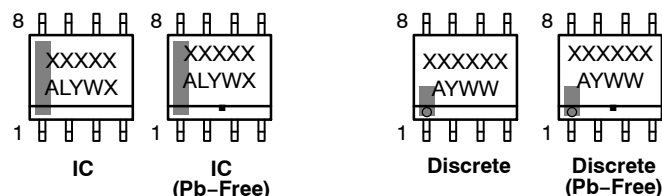
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

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

GENERIC MARKING DIAGRAM*



SCALE 6:1 (mm/inches)



XXXXXX = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
■ = Pb-Free Package

XXXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
■ = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

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CASE 751-07
ISSUE AK

DATE 16 FEB 2011

STYLE 1: PIN 1. EMITTER 2. COLLECTOR 3. COLLECTOR 4. EMITTER 5. EMITTER 6. BASE 7. BASE 8. EMITTER	STYLE 2: PIN 1. COLLECTOR, DIE, #1 2. COLLECTOR, #1 3. COLLECTOR, #2 4. COLLECTOR, #2 5. BASE, #2 6. EMITTER, #2 7. BASE, #1 8. EMITTER, #1	STYLE 3: PIN 1. DRAIN, DIE #1 2. DRAIN, #1 3. DRAIN, #2 4. DRAIN, #2 5. GATE, #2 6. SOURCE, #2 7. GATE, #1 8. SOURCE, #1	STYLE 4: PIN 1. ANODE 2. ANODE 3. ANODE 4. ANODE 5. ANODE 6. ANODE 7. ANODE 8. COMMON CATHODE
STYLE 5: PIN 1. DRAIN 2. DRAIN 3. DRAIN 4. DRAIN 5. GATE 6. GATE 7. SOURCE 8. SOURCE	STYLE 6: PIN 1. SOURCE 2. DRAIN 3. DRAIN 4. SOURCE 5. SOURCE 6. GATE 7. GATE 8. SOURCE	STYLE 7: PIN 1. INPUT 2. EXTERNAL BYPASS 3. THIRD STAGE SOURCE 4. GROUND 5. DRAIN 6. GATE 3 7. SECOND STAGE Vd 8. FIRST STAGE Vd	STYLE 8: PIN 1. COLLECTOR, DIE #1 2. BASE, #1 3. BASE, #2 4. COLLECTOR, #2 5. COLLECTOR, #2 6. EMITTER, #2 7. EMITTER, #1 8. COLLECTOR, #1
STYLE 9: PIN 1. EMITTER, COMMON 2. COLLECTOR, DIE #1 3. COLLECTOR, DIE #2 4. EMITTER, COMMON 5. EMITTER, COMMON 6. BASE, DIE #2 7. BASE, DIE #1 8. EMITTER, COMMON	STYLE 10: PIN 1. GROUND 2. BIAS 1 3. OUTPUT 4. GROUND 5. GROUND 6. BIAS 2 7. INPUT 8. GROUND	STYLE 11: PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. DRAIN 2 7. DRAIN 1 8. DRAIN 1	STYLE 12: PIN 1. SOURCE 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN
STYLE 13: PIN 1. N.C. 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN	STYLE 14: PIN 1. N-SOURCE 2. N-GATE 3. P-SOURCE 4. P-GATE 5. P-DRAIN 6. P-DRAIN 7. N-DRAIN 8. N-DRAIN	STYLE 15: PIN 1. ANODE 1 2. ANODE 1 3. ANODE 1 4. ANODE 1 5. CATHODE, COMMON 6. CATHODE, COMMON 7. CATHODE, COMMON 8. CATHODE, COMMON	STYLE 16: PIN 1. EMITTER, DIE #1 2. BASE, DIE #1 3. EMITTER, DIE #2 4. BASE, DIE #2 5. COLLECTOR, DIE #2 6. COLLECTOR, DIE #2 7. COLLECTOR, DIE #1 8. COLLECTOR, DIE #1
STYLE 17: PIN 1. VCC 2. V2OUT 3. V1OUT 4. TXE 5. RXE 6. VEE 7. GND 8. ACC	STYLE 18: PIN 1. ANODE 2. ANODE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. CATHODE 8. CATHODE	STYLE 19: PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. MIRROR 2 7. DRAIN 1 8. MIRROR 1	STYLE 20: PIN 1. SOURCE (N) 2. GATE (N) 3. SOURCE (P) 4. GATE (P) 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN
STYLE 21: PIN 1. CATHODE 1 2. CATHODE 2 3. CATHODE 3 4. CATHODE 4 5. CATHODE 5 6. COMMON ANODE 7. COMMON ANODE 8. CATHODE 6	STYLE 22: PIN 1. I/O LINE 1 2. COMMON CATHODE/VCC 3. COMMON CATHODE/VCC 4. I/O LINE 3 5. COMMON ANODE/GND 6. I/O LINE 4 7. I/O LINE 5 8. COMMON ANODE/GND	STYLE 23: PIN 1. LINE 1 IN 2. COMMON ANODE/GND 3. COMMON ANODE/GND 4. LINE 2 IN 5. LINE 2 OUT 6. COMMON ANODE/GND 7. COMMON ANODE/GND 8. LINE 1 OUT	STYLE 24: PIN 1. BASE 2. EMITTER 3. COLLECTOR/ANODE 4. COLLECTOR/ANODE 5. CATHODE 6. CATHODE 7. COLLECTOR/ANODE 8. COLLECTOR/ANODE
STYLE 25: PIN 1. VIN 2. N/C 3. REXT 4. GND 5. IOUT 6. IOUT 7. IOUT 8. IOUT	STYLE 26: PIN 1. GND 2. dv/dt 3. ENABLE 4. ILIMIT 5. SOURCE 6. SOURCE 7. SOURCE 8. VCC	STYLE 27: PIN 1. ILIMIT 2. OVLO 3. UVLO 4. INPUT+ 5. SOURCE 6. SOURCE 7. SOURCE 8. DRAIN	STYLE 28: PIN 1. SW_TO_GND 2. DASIC_OFF 3. DASIC_SW_DET 4. GND 5. V_MON 6. VBULK 7. VBULK 8. VIN
STYLE 29: PIN 1. BASE, DIE #1 2. EMITTER, #1 3. BASE, #2 4. EMITTER, #2 5. COLLECTOR, #2 6. COLLECTOR, #2 7. COLLECTOR, #1 8. COLLECTOR, #1	STYLE 30: PIN 1. DRAIN 1 2. DRAIN 1 3. GATE 2 4. SOURCE 2 5. SOURCE 1/DRAIN 2 6. SOURCE 1/DRAIN 2 7. SOURCE 1/DRAIN 2 8. GATE 1		

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