

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

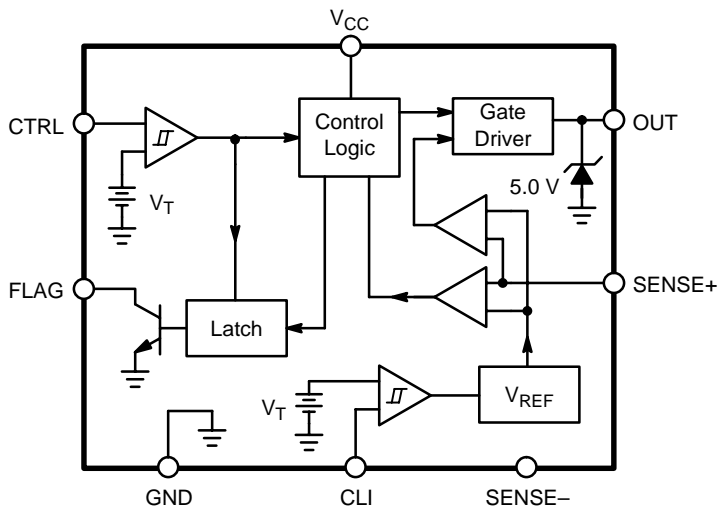
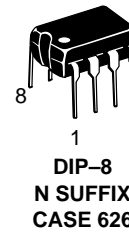


Figure 1. Block Diagram

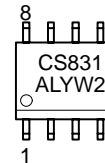
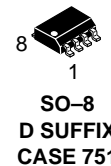
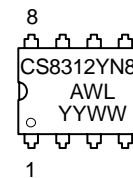


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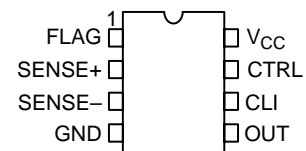


MARKING DIAGRAMS



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 $^\circ\text{C}$ $^\circ\text{C}$ |

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 |

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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. |

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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.

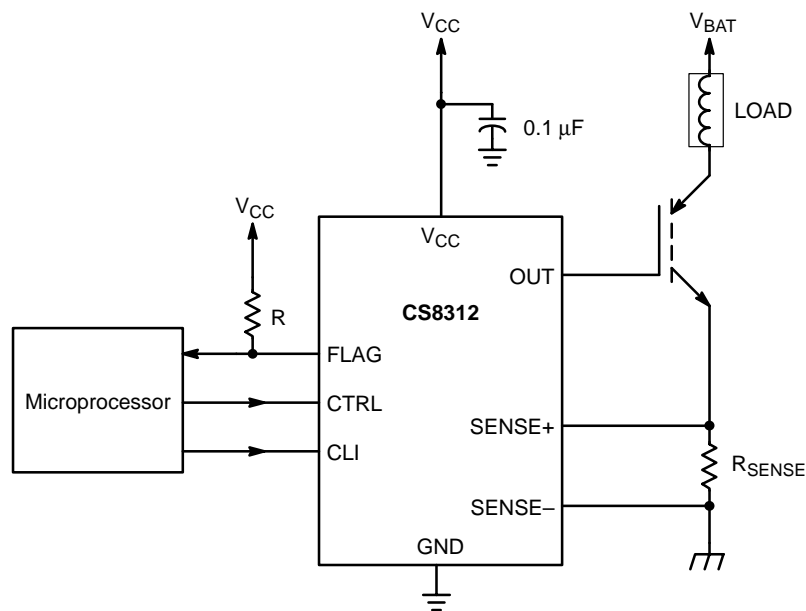


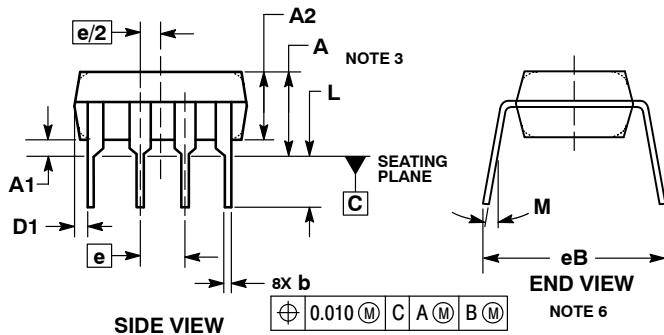
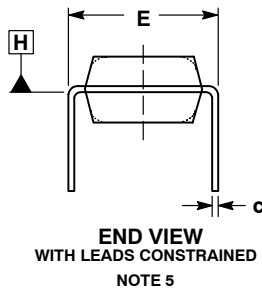
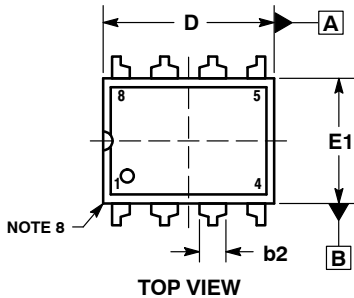
Figure 2. Application and Test Diagram



SCALE 1:1

PDIP-8
CASE 626-05
ISSUE P

DATE 22 APR 2015

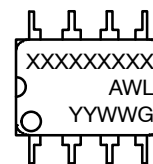


NOTES:

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).

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | 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. Some products may not follow the Generic Marking.

- 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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SCALE 1:1

SOIC-8 NB
CASE 751-07
ISSUE AK

DATE 16 FEB 2011

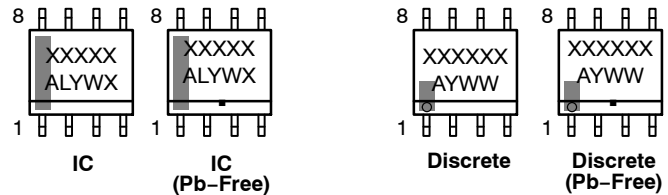
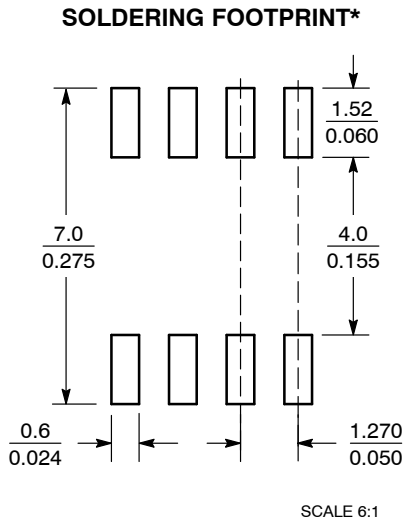


NOTES:

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*



XXXXX = 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 onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

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SOIC-8 NB
CASE 751-07
ISSUE AK

DATE 16 FEB 2011

- | | | | |
|---|--|--|--|
| <p>STYLE 1: PIN 1. EMITTER 2. COLLECTOR 3. COLLECTOR 4. EMITTER 5. EMITTER 6. BASE 7. BASE 8. EMITTER</p> | <p>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</p> | <p>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</p> | <p>STYLE 4: PIN 1. ANODE 2. ANODE 3. ANODE 4. ANODE 5. ANODE 6. ANODE 7. ANODE 8. COMMON CATHODE</p> |
| <p>STYLE 5: PIN 1. DRAIN 2. DRAIN 3. DRAIN 4. DRAIN 5. GATE 6. GATE 7. SOURCE 8. SOURCE</p> | <p>STYLE 6: PIN 1. SOURCE 2. DRAIN 3. DRAIN 4. SOURCE 5. SOURCE 6. GATE 7. GATE 8. SOURCE</p> | <p>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</p> | <p>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</p> |
| <p>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</p> | <p>STYLE 10: PIN 1. GROUND 2. BIAS 1 3. OUTPUT 4. GROUND 5. GROUND 6. BIAS 2 7. INPUT 8. GROUND</p> | <p>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</p> | <p>STYLE 12: PIN 1. SOURCE 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN</p> |
| <p>STYLE 13: PIN 1. N.C. 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN</p> | <p>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</p> | <p>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</p> | <p>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</p> |
| <p>STYLE 17: PIN 1. VCC 2. V2OUT 3. V1OUT 4. TXE 5. RXE 6. VEE 7. GND 8. ACC</p> | <p>STYLE 18: PIN 1. ANODE 2. ANODE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. CATHODE 8. CATHODE</p> | <p>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</p> | <p>STYLE 20: PIN 1. SOURCE (N) 2. GATE (N) 3. SOURCE (P) 4. GATE (P) 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN</p> |
| <p>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</p> | <p>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</p> | <p>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</p> | <p>STYLE 24: PIN 1. BASE 2. EMITTER 3. COLLECTOR/ANODE 4. COLLECTOR/ANODE 5. CATHODE 6. CATHODE 7. COLLECTOR/ANODE 8. COLLECTOR/ANODE</p> |
| <p>STYLE 25: PIN 1. VIN 2. N/C 3. REXT 4. GND 5. IOUT 6. IOUT 7. IOUT 8. IOUT</p> | <p>STYLE 26: PIN 1. GND 2. dv/dt 3. ENABLE 4. ILIMIT 5. SOURCE 6. SOURCE 7. SOURCE 8. VCC</p> | <p>STYLE 27: PIN 1. ILIMIT 2. OVLO 3. UVLO 4. INPUT+ 5. SOURCE 6. SOURCE 7. SOURCE 8. DRAIN</p> | <p>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</p> |
| <p>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</p> | <p>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</p> | | |

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