



# 6W DC-DC CONVERTERS

# DHC2800S SERIES

4707 Dey Road Liverpool, N.Y. 13088

(315) 701-6751

## HI-REL DESIGN

- WAVE SOLDERABLE PACKAGE
- ALL CERAMIC CAPACITORS
- SURFACE MOUNT MAGNETICS
- WITHSTANDS 5000G

## FEATURES — SINGLE OUTPUT

- REPLACES APEX DHC2803S & DHC2805S
- NO DERATING —  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- WIDE SUPPLY RANGE — 12V to 50V
- HIGH ISOLATION — 500V
- HIGH POWER DENSITY —  $17\text{W}/\text{IN}^3$
- OUTPUT VOLTAGE ADJUSTMENT — STANDARD
- REMOTE SHUTDOWN
- OPERATES TO  $11\text{VIN}$  AT 5W
- AVAILABLE WITH 3.3V OR 5V OUTPUTS
- SEE DAC2800S SERIES FOR 12V AND 15V VERSIONS

## DESCRIPTION

The DHC2800S series of DC-DC converters provides the ruggedness, reliability, and features required to meet the advanced design challenges of today's hi-rel market. This is accomplished while retaining a power density of  $17\text{ W}/\text{in}^3$  and  $425\text{ mW}/\text{gram}$  of power/package performance. The use of advanced substrate and reflow soldering techniques during construction results in a rugged, cost-effective, and completely solderable package.

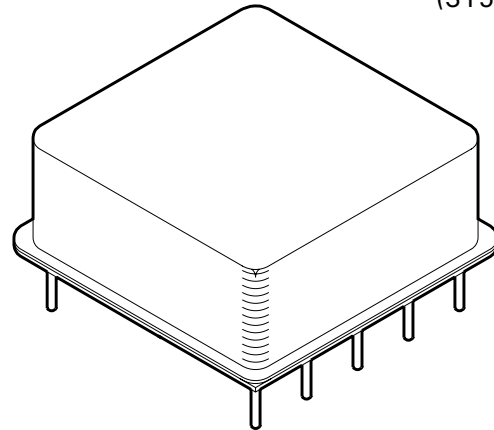
DHC2800S hybrid converter series utilizes all ceramic capacitors and surface mount magnetics to provide reliable operation at all operating temperatures while surviving very high G forces.

DHC2800S standard features include output fault monitoring and/or turn on voltage point programming via the shutdown pin. All three functions may be implemented simultaneously with a minimum of external components. An output voltage adjustment/load compensation pin is also standard.

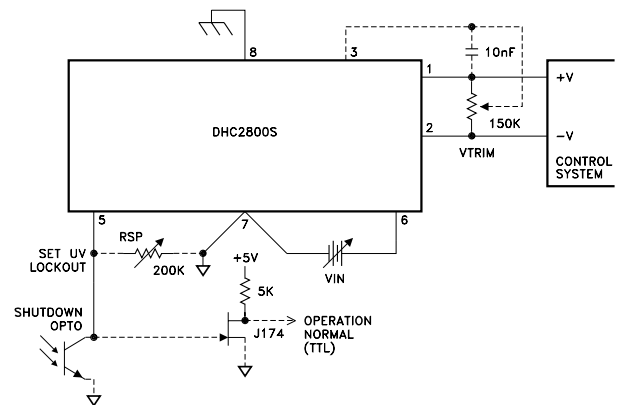
Fault tolerant design protects these converters from most external circuit faults. The output and output adjust pins will withstand  $+35\text{ V}$  while the shutdown pin will withstand  $+50\text{ V}$  protecting the converters from a variety of system or board faults i.e. solder bridges etc. Unique load fault protection circuitry allows this converter to pull up loads having difficult static load line characteristics and allows short term load excursions significantly beyond ratings in most applications.

A transformer isolated forward converter topology operating at a switching frequency of  $400\text{ kHz}$  allows operation over a wide input voltage range. Internal filtering of both input and output eliminates the need for external capacitors in many applications.

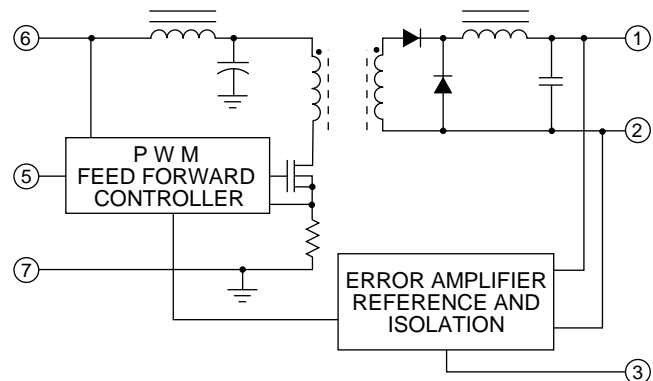
The 8-pin DIP package is hermetically sealed and isolated from the internal circuits. Heat sinking is recommended for full power operation at elevated ambient temperatures.



## TYPICAL APPLICATION WITH OPTIONS



## BLOCK DIAGRAM



## EXTERNAL CONNECTIONS

|                 |          |
|-----------------|----------|
| 1 +OUTPUT       | 8 CASE   |
| 2 -OUTPUT       | 7 -INPUT |
| 3 ADJUST/COMP   | 6 +INPUT |
| 4 NO CONNECTION |          |
| 5 SHUTDOWN PLUS |          |

# DHC2800S SERIES

## ABSOLUTE MAXIMUM RATINGS SPECIFICATIONS

### ABSOLUTE MAXIMUM RATINGS

INPUT VOLTAGE RANGE (Pin 7 to 6 or 5)  
INPUT TRANSIENT (Pin 7 to 6)  
OUTPUT WITHSTAND (Pin 2 to 1 or 3)  
OUTPUT CURRENT (Continuous)  
TEMPERATURE, Storage  
TEMPERATURE, Pin Soldering 10s

#### DHC2803S

0 – 50Vdc  
80V @ 50ms  
35Vdc  
2Adc<sup>5</sup>  
–65°C, 150°C  
300°C

#### DHC2805S

0-50Vdc  
80V @ 50ms  
35Vdc  
1.2Adc  
–65°C, 150°C  
300°C

### SPECIFICATIONS

| SPECIFICATIONS                                |   | DHC2803S |      |                   | DHC2805S |      |      |       |
|---|---|----------|------|-------------------|----------|------|------|-------|
| PARAMETER                                     | TEST CONDITIONS <sup>1</sup>                              | MIN      | TYP  | MAX               | MIN      | TYP  | MAX  | UNITS |
| STEADY STATE CHARACTERISTICS                  |   |          |      |                   |          |      |      |       |
| INPUT VOLTAGE RANGE                           |   | 12       | 28   | 50                | 12       | 28   | 50   | Vdc   |
| OUTPUT VOLTAGE                                | V <sub>IN</sub> ; min ↔ max Vdc @ I <sub>MIN</sub>        | 3.2      | 3.3  | 3.4               | 5.00     | 5.05 | 5.1  | Vdc   |
| OUTPUT CURRENT                                | V <sub>IN</sub> ; min ↔ max Vdc                           | 180      |      | 1520              | 120      |      | 1200 | mAdc  |
|   | V <sub>IN</sub> ; 13 ↔ max Vdc                            |          |      | 1820 <sup>5</sup> |          |      |      | mAdc  |
| EFFICIENCY                                    |   | 61       | 66   |                   | 64       | 69   |      | %     |
| OUTPUT RIPPLE VOLTAGE                         | Bandwidth 10kHz ↔ 1MHz                                    |          | 38   | 80                |          | 30   | 80   | mVrms |
| INPUT RIPPLE CURRENT                          | Bandwidth 10kHz ↔ 1MHz                                    |          | 30   | 100               |          | 30   | 100  | mArms |
| OUTPUT POWER <sup>2</sup>                     |   | .5       |      | 5.0 <sup>6</sup>  | .6       |      | 6.0  | W     |
| LINE REGULATION                               | V <sub>IN</sub> ; min ↔ max <sup>3</sup>                  |          | 6    | 15                |          | 6    | 15   | mVdc  |
| LOAD REGULATION                               | I <sub>OUT</sub> ; min ↔ max <sup>3</sup>                 |          | 10   | 25                |          | 10   | 25   | mVdc  |
| TEMPERATURE COEFFICIENT                       |   |          | .006 |                   |          | .006 |      | %/°C  |
| TEMPERATURE RANGE, case <sup>2</sup>          |   | −55      |      | 125               | −55      |      | 125  | °C    |
| QUIESCENT CURRENT                             | I <sub>OUT</sub> = 0A                                     |          | 38   | 45                |          | 38   | 45   | mAdc  |
| INHIBITED                                     | V <sub>pin5</sub> ; < 8Vdc                                | .09      | 1.25 | 2.5               | .09      | 1.25 | 2.5  | mAdc  |
| ISOLATION CHARACTERISTICS (input/output/case) |   |          |      |                   |          |      |      |       |
| LEAKAGE RESISTANCE                            | V <sub>TEST</sub> = 500Vdc                                | 100      |      |                   | 100      |      |      | MΩ    |
| LEAKAGE CAPACITANCE                           | f = 10kHz   |          | 55   |                   |          | 60   |      | pF    |
| DYNAMIC CHARACTERISTICS                       |   |          |      |                   |          |      |      |       |
| LINE STEP RESPONSE                            | V <sub>IN</sub> ; T <sub>R</sub> , T <sub>F</sub> = 10μs  |          |      |                   |          |      |      |       |
| VOLTAGE CHANGE                                | V <sub>IN</sub> ; 16 ↔ 40 Vdc                             |          | 350  |                   |          | 300  |      | mV    |
| RECOVERY TIME (95%)                           |   |          | 30   |                   |          | 30   |      | μs    |
| LOAD STEP RESPONSE                            | I <sub>OUT</sub> ; T <sub>R</sub> , T <sub>F</sub> = 10μs |          |      |                   |          |      |      |       |
| VOLTAGE CHANGE                                | I <sub>OUT</sub> ; 50% ↔ max Adc                          |          | 700  |                   |          | 700  |      | mV    |
| RECOVERY TIME (95%)                           |   |          | 30   |                   |          | 40   |      | μs    |
| DYNAMIC CHARACTERISTICS                       |   |          |      |                   |          |      |      |       |
| START-UP OVERSHOOT                            | V <sub>IN</sub> ; 0-50 Vdc                                |          | 0    | 400               |          | 0    | 400  | mV    |
| SHUTDOWN DELAY                                | V <sub>PIN5</sub> ; > 10Vdc → <8Vdc                       |          | 220  | 500               |          | 220  | 500  | μs    |
| SHUTDOWN RECOVERY TIME <sup>4</sup>           | V <sub>PIN5</sub> ; < 8Vdc → > 10Vdc                      |          |      | 60                |          |      | 60   | ms    |

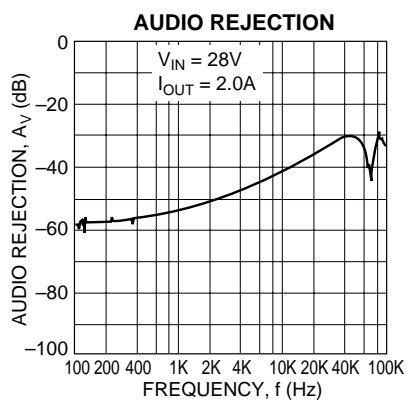
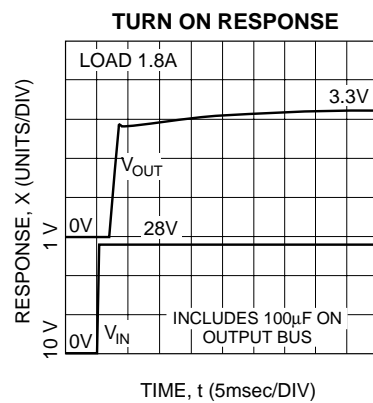
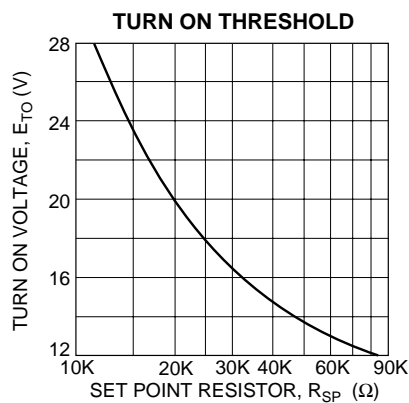
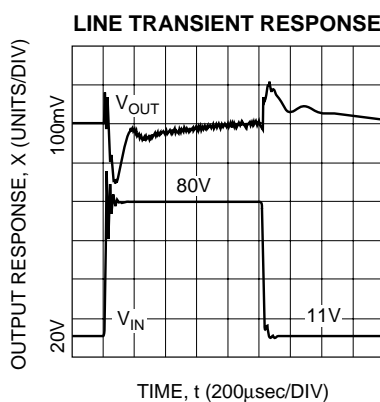
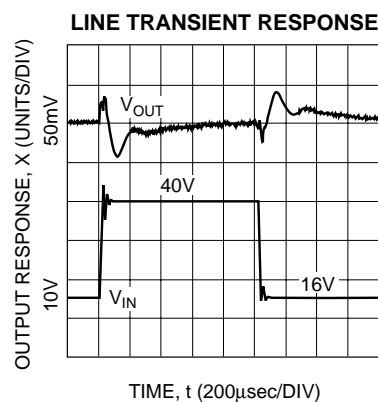
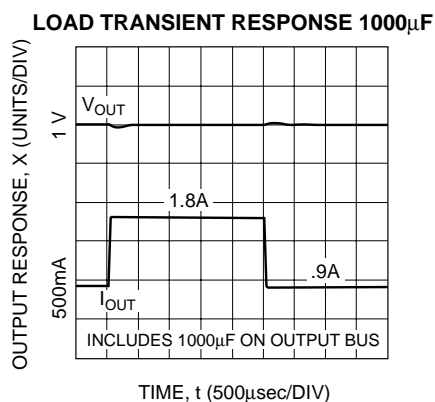
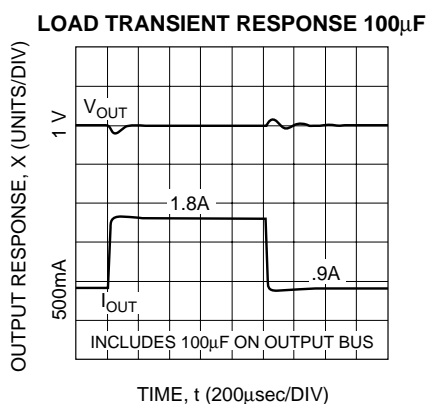
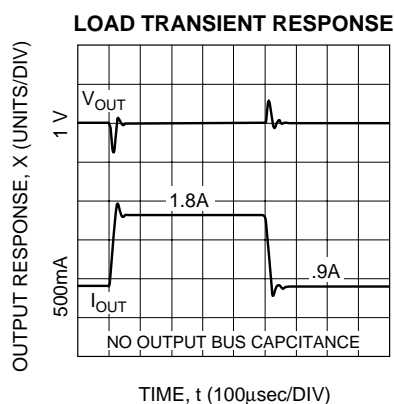
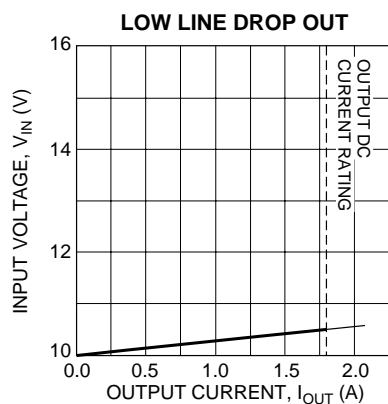
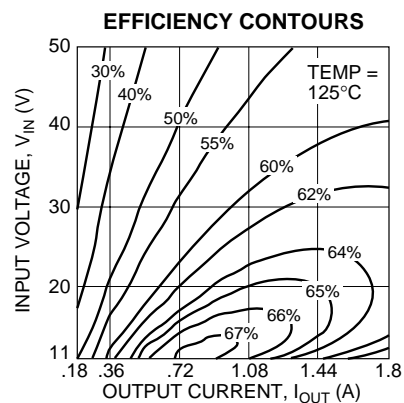
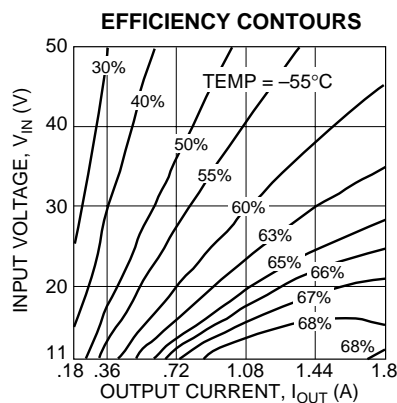
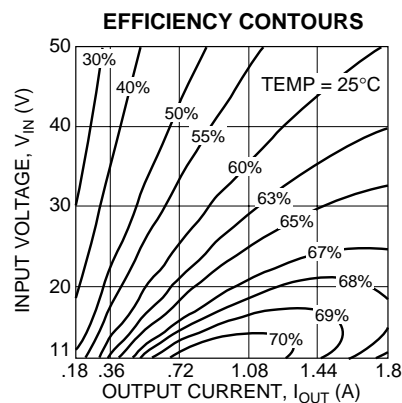
- NOTES: 1. Unless otherwise stated:  $T_C = 25^\circ C$ ,  $V_{IN} = 28V$ ,  $I_{OUT} = I_{OUT MAX}$ .  
 2. Derate power linearly to zero from 125°C to 135°C.  
 3. Regulation measured between pin 1 and pin 2 1/6" from case.  
 4. Recovery spec assumes that converter has been OFF for at least 500ms.  
 5. DHC2803S  $I_{OUT MAX} = 2.0ADC$  when voltage is adjusted to 3.0Vdc,  $V_{IN} = 13-50Vdc$ , and  $C_{LOAD} = 100\mu F$ .  
 6. DHC2803S  $P_{OUT MAX} = 6W$  when  $V_{IN} = 13-50Vdc$

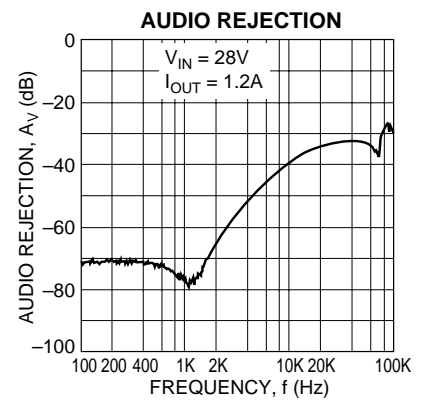
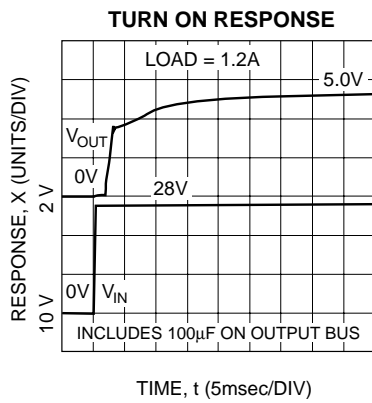
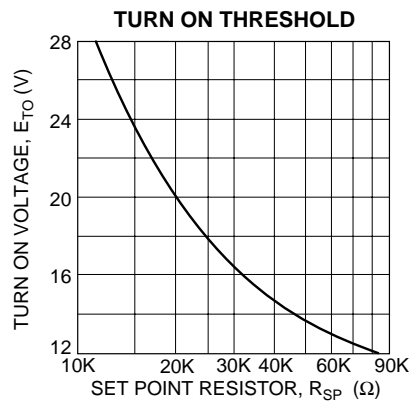
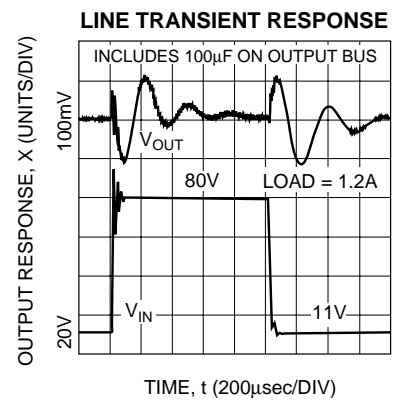
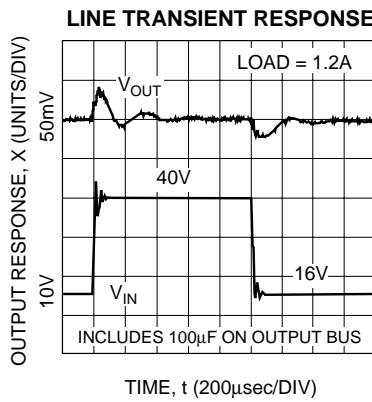
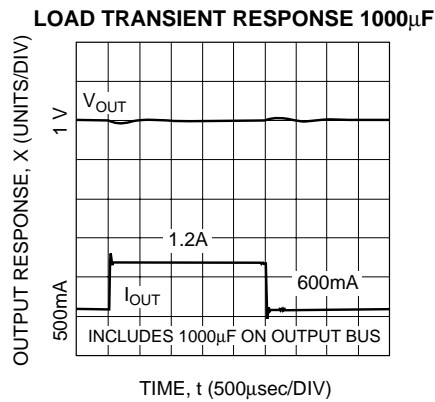
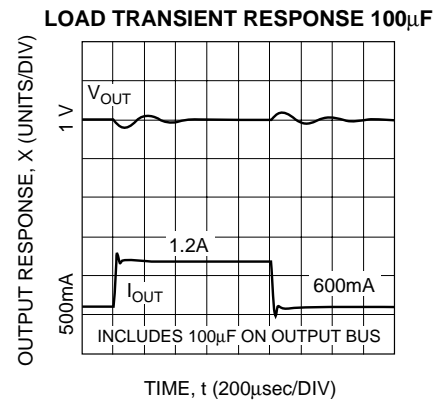
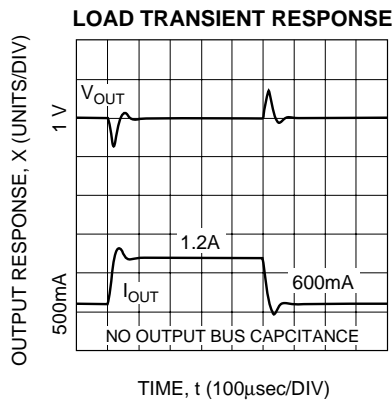
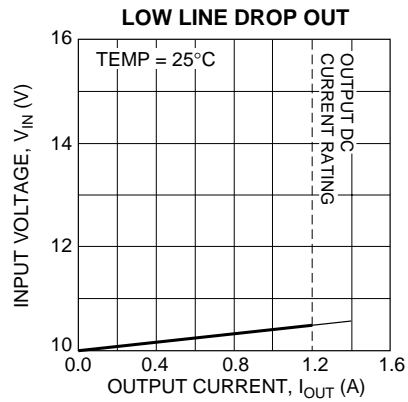
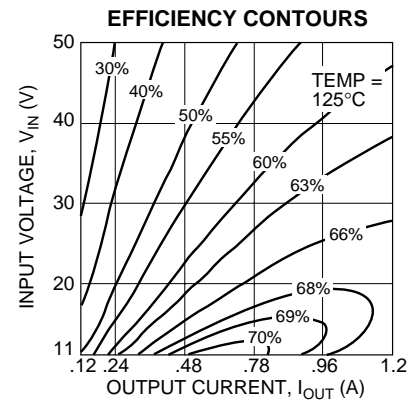
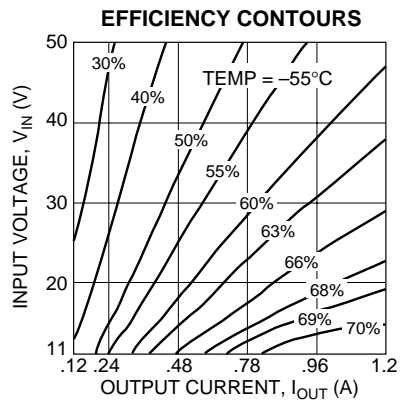
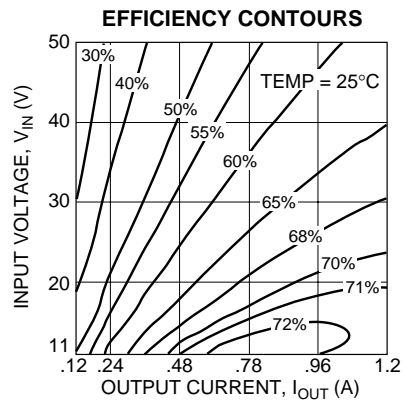
### CAUTION

The internal substrate contains beryllia (BeO). Do not break the seal. If accidentally broken, do not crush, machine, or subject to temperatures in excess of 850°C to avoid generating toxic fumes.

### PACKAGE THERMAL SPECIFICATIONS

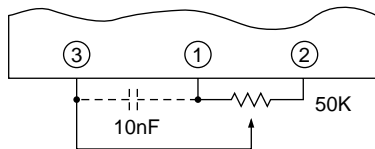
|                                    | MIN | TYP | MAX | UNITS |
|------------------------------------|-----|-----|-----|-------|
| RESISTANCE, case to air            |     | 30  |     | °C/W  |
| TEMPERATURE RISE, junction to case |     | 10  | 15  | °C    |





## OUTPUT ADJUST / COMP

The output voltage of the DHC2800S may be adjusted from 90% to 110% of nominal value by the use of a 50K $\Omega$  potentiometer as shown. Adjustment beyond this range is possible however certain characteristics of the converter such as but not limited to input voltage range, efficiency, ripple and temperature performance will change. Characterization by the user is recommended in such applications.



Adjust/comp (pin 3) may be driven by external circuitry referenced to pin 2 (-output) if desired. Grounding pin 3 causes voltage to increase (25% typically) while driving pin 3 above 1.3 V causes output voltage to decrease. Pin 3 may be driven through 10K $\Omega$  or more if connection of the comp function is also required.

The comp function of pin 3 allows capacitive loads as large as 1000  $\mu$ F to be accommodated on the DHC2805S without loss of stability. This feature may be utilized by connecting a 10 nF capacitor between pins 3 and 1. This is generally recommended when low ESR load capacitances of 100  $\mu$ F or greater are used.

## SHUTDOWN PLUS

Pin 5 is used for remote shutdown, output fault detection, and/or setting the input voltage point at which the converter will turn on as shown in the typical application diagram. No connection to pin 5 is necessary for normal operation of the converter. Pin 5 is referenced to the -input (pin 7).

Shutdown may be implemented by simply connecting pin 5 to an open collector logic output or switch rated at 2.5 mA, 25 Vdc or higher.

Input voltage turn on point is programmed with a single resistor from pin 5 to 7. An input turn on/off hysteresis (typically 3.5% of  $V_{in}$ ) will be observed. This should be considered when making or verifying set point adjustment. The value of the setpoint resistor may be determined by the following:

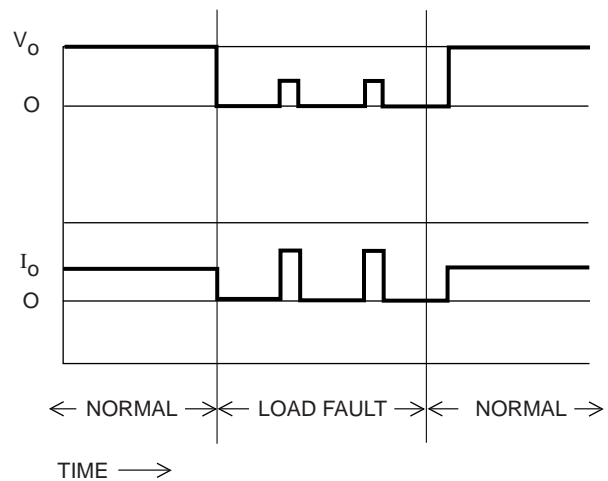
$$R = \frac{210 \cdot 10^3}{E_{TO} - 9.5} \quad (\pm 10\% \text{ accuracy at } 25^\circ\text{C})$$

Set point temperature coefficient is typically +400ppm/ $^\circ$ C.

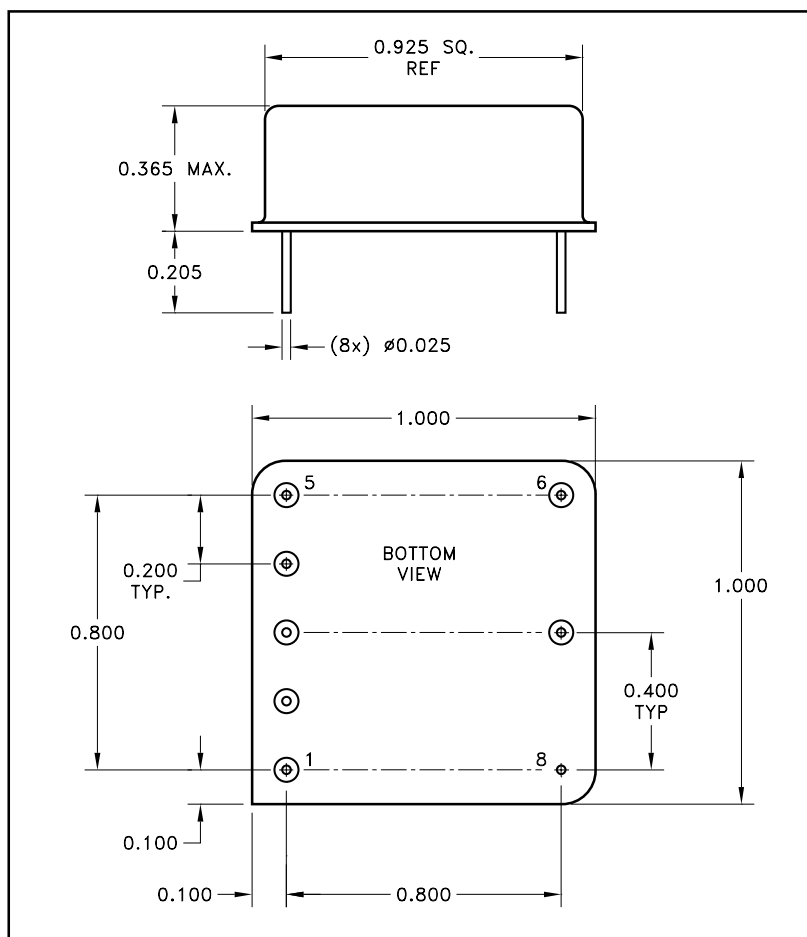
Output fault monitoring is accomplished by observing pin 5 with a high impedance monitoring circuit. Pin 5 voltage drops from over 10 V to below 1 V when a load fault causes the converters fault protection circuitry to activate. It will remain low for at least 100 ms and return high. If the load fault is still present pin 5 will return low and the cycle will repeat. A resistor > 400 K $\Omega$  from pin 5 to 7 provides pull down for pin 5 if there is no input setpoint programming resistor already in place.

## LOAD FAULT RESPONSE

The DHC2800S series of dc-dc converters share load fault philosophies. Load fault conditions include short-circuit and severe overload conditions. The DHC2800 converter series responds to load faults by turning off all power conversion circuits for 250 mS and then attempting to restart for 10 mS (typical). The net "on" duty factor during a fault is very low resulting in low converter dissipation and immunity from overheating at 125 $^\circ$ C. Current beyond rated can flow into the load at startup time. This allows the converter to bring up capacitive and other difficult load types more reliably than competing converters.



## MECHANICAL SPECIFICATIONS



NOTE: ALL DIMENSIONS ARE  $\pm 0.010$  INCHES UNLESS OTHERWISE LABELED.  
ESD Triangle indicates Pin 1.

## ORDERING INFORMATION

**DHC2805S**

### SCREENING

BLANK = INDUSTRIAL; E = EXTENDED RELIABILITY;  
H = CLASS H; K = CLASS K

### SINGLE OUTPUT

### OUTPUT VOLTAGE

03 = 3.3V; 05 = 5V

### NOMINAL INPUT VOLTAGE

### GENERAL PART NUMBER

The above example is an industrial grade 5V single output converter

**M.S. Kennedy Corp.**

4707 Dey Road, Liverpool, New York 13088

Phone (315) 701-6751

FAX (315) 701-6752

[www.mskennedy.com](http://www.mskennedy.com)

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