



M.S.KENNEDY CORP.

6W
DC-DC
CONVERTERS

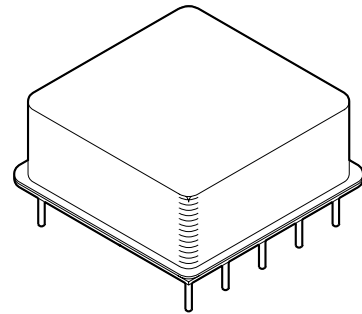
DHC2800S
SERIES

4707 Dey Road Liverpool, N.Y. 13088

(315) 701-6751

FEATURES:

- 70% Typical Efficiency
- All Ceramic Capacitors
- Surface Mount Magnetics
- Withstands 5000G
- MIL STD 461C CE03 (With EFJ2803 Filter)
- 80 Volt Input Transient Tolerant
- No Derating - -55°C to $+125^{\circ}\text{C}$
- Wide Supply Range - 10V to 50V
- High Isolation - 500V
- High Power Density - $17\text{W}/\text{in}^3$
- Output Voltage Adjustment - Standard
- Remote Shutdown
- Operates to 11V Input at 5W
- Available with 3.3V or 5V Outputs
- See DAC2800s Series for 12V and 15V Versions
- Available to DSCC SMD 5962-94629 and 5962-93092

MIL-PRF-38534 CERTIFIED**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. 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.

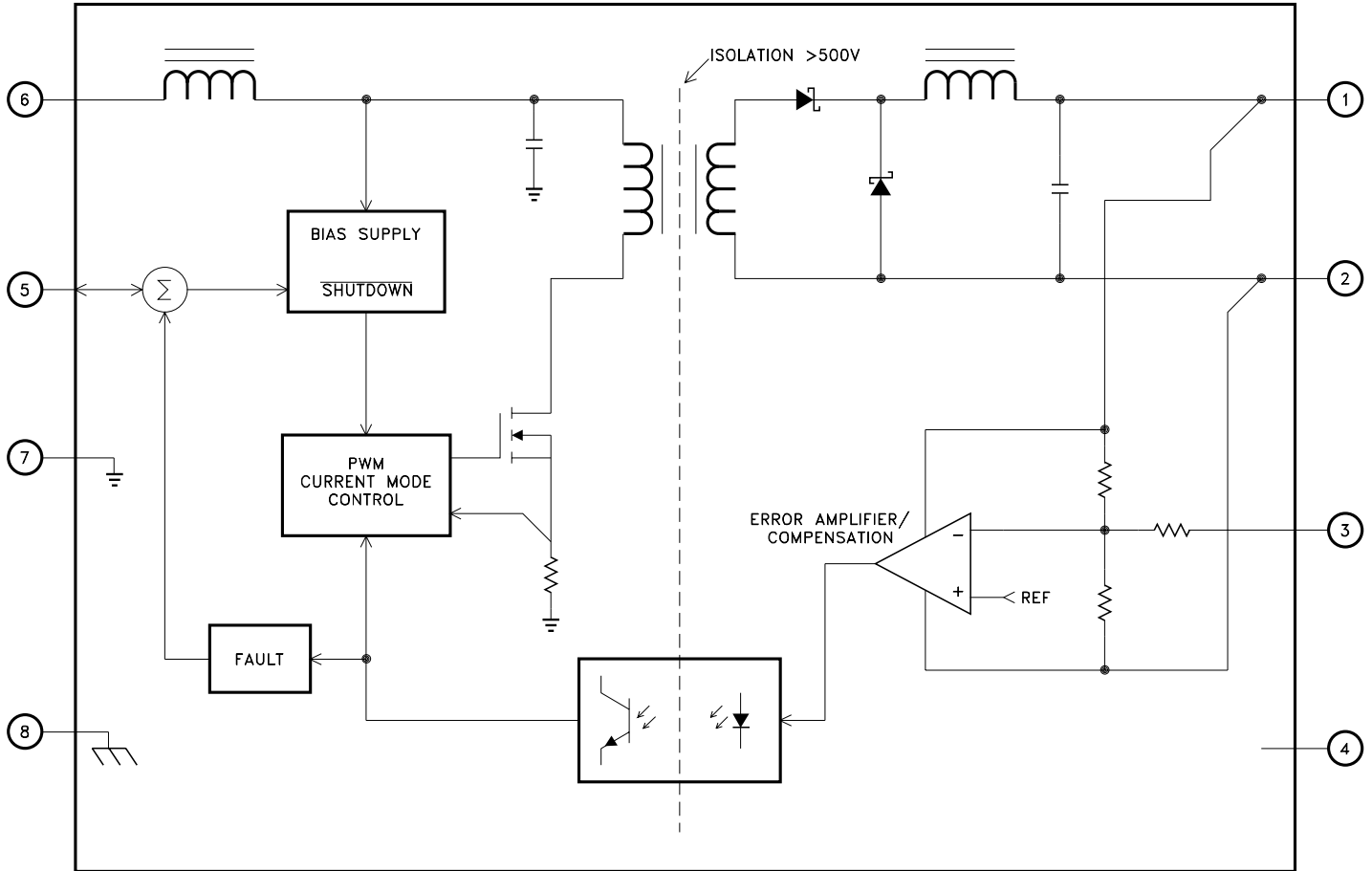
DHC2800S standard features include output fault monitoring and/or turn on voltage point programming via the shutdown pin. All three functions may be implemented simultaneously with a minimum of external components. An output voltage adjustment/load compensation pin is also standard.

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 400kHz 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.

EQUIVALENT SCHEMATIC



TYPICAL APPLICATIONS

- Isolated Step Down Power Supply
- Microprocessor Power Source
- Low Voltage Subsystem Power Source

PIN-OUT INFORMATION

| | | | |
|---|---------------|---|--------|
| 1 | + Output | 8 | Case |
| 2 | -Output | | |
| 3 | Adjust/Comp | 7 | -Input |
| 4 | NC | | |
| 5 | Shutdown Plus | 6 | +Input |

ABSOLUTE MAXIMUM RATINGS ^①

| | | |
|-----------|---|-----------------|
| V_{IN} | Input Voltage (pin 7 to pin 6) | +50V |
| V_{INT} | Input Transient (pin 7 to pin 6 @ 50mS) | 80V |
| I_{OUT} | Output Current | |
| | DHC2803S | 2.0A |
| | DHC2805S | 1.5A |
| T_C | Case Temperature Range | |
| | DHC2800S H/E | -55°C to +125°C |
| | DHC2800S | -40°C to +85°C |

| | | |
|---------------|--|----------------------|
| T_{ST} | Storage Temperature Range | -65°C to +150°C |
| T_{LD} | Lead Temperature Range (10 Seconds) | 300°C |
| P_D | Power Dissipation | See Efficiency Curve |
| T_J | Junction Temperature | 150°C |
| θ_{JC} | Thermal Resistance (Switches) | 6.5°C/W |

NOTE:

- ① Continuous operation at or above absolute maximum ratings may adversely effect the performance and/or life cycle.

ELECTRICAL SPECIFICATIONS

DHC2803S

| Parameter ⑧ | Test Conditions ① | Group A Subgroup | DHC2803S H/E | | | DHC2803S | | | Units |
|-------------------------------|--|------------------|--------------|------|------|----------|------|------|-------------------|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| Output Voltage | | 1 | 3.20 | 3.30 | 3.40 | 3.18 | 3.30 | 3.42 | VDC |
| | | 2,3 | 3.15 | - | 3.45 | - | - | - | VDC |
| Output Current ② | 12V ≤ VIN ≤ 50V | 1 | 152 | - | 1520 | 152 | - | 1520 | mA |
| | | 2,3 | 152 | - | 1520 | - | - | - | mA |
| | 16V ≤ VIN ≤ 50V | 1 | 152 | - | 1820 | 152 | - | 1820 | mA |
| | | 2,3 | 152 | - | 1820 | - | - | - | mA |
| Output Voltage Ripple | BW = 10KHz to 2MHz | 1 | - | 85 | 190 | - | 85 | 190 | mVp-p |
| | | 2,3 | - | - | 475 | - | - | - | mVp-p |
| Input Current Ripple ② | BW = 10KHz to 2MHz | 1 | - | 165 | 200 | - | 165 | 225 | mA _{p-p} |
| | | 2,3 | - | - | 200 | - | - | - | mA _{p-p} |
| Line Regulation | VIN = 16V to 40V | 1 | - | ±6 | ±15 | - | ±6 | ±20 | mV |
| | | 2,3 | - | - | ±50 | - | - | - | mV |
| Load Regulation | VIN = 16V, 28V and 40V IOUT = 0A, 0.9A and 1.8A | 1 | - | ±10 | ±25 | - | ±10 | ±30 | mV |
| | | 2,3 | - | - | ±50 | - | - | - | mV |
| Efficiency | | 1 | 61 | 66 | - | 61 | 66 | - | % |
| | | 2,3 | 58 | - | - | - | - | - | % |
| Step Load Response | IOUT = 0.9A to/from 1.8A Transition Time = 30μS | 4 | - | ±430 | ±600 | - | ±430 | ±650 | mV |
| | | 5,6 | - | - | ±850 | - | - | - | mV |
| Step Load Recovery | IOUT = 0.9A to/from 1.8A Transition Time = 30μS | 4 | - | 85 | 300 | - | 85 | 300 | μS |
| | | 5,6 | - | - | 300 | - | - | - | μS |
| Step Line Response ② | VIN = 16V to/from 40V Transition Time = 30μS | 4 | - | ±190 | ±500 | - | ±190 | ±500 | mV |
| | | 5,6 | - | - | ±500 | - | - | - | mV |
| Step Line Recovery ② | VIN = 16V to/from 40V Transition Time = 30μS | 4 | - | 120 | 500 | - | 120 | 500 | μS |
| | | 5,6 | - | - | 500 | - | - | - | μS |
| Start Up Overshoot | | 4 | - | 0 | 200 | - | 0 | 200 | mV |
| | | 5,6 | - | 0 | 200 | - | - | - | mV |
| Start Up Delay | | 4 | - | 30 | 50 | - | 30 | 50 | mS |
| | | 5,6 | - | - | 50 | - | - | - | mS |
| Shutdown Delay ② | | 4 | - | 220 | 500 | - | 220 | 500 | μS |
| | | 5,6 | - | - | 500 | - | - | - | μS |
| Shutdown Recovery ② | | - | - | 60 | - | 60 | - | mS | |
| Input Voltage Range ② | POUT = 6W MAX. | 1,2,3 | 12 | - | 50 | 12 | - | 50 | V |
| | POUT = 5W MAX. | 1,2,3 | 11 | - | 50 | 11 | - | 50 | V |
| | POUT = 2.5W MAX. | 1,2,3 | 10 | - | 50 | 10 | - | 50 | V |
| Quiescent Current | Enabled, IOUT = 0mA | 1,2,3 | - | 35 | 40 | - | 35 | 45 | mA |
| | Disabled IOUT = 0mA | 1,2,3 | - | 2 | 5 | - | 2 | 5 | mA |
| Capacitive Load ② | No Effect on DC Performance | 1,2,3 | - | - | 300 | - | - | 300 | μF |
| Isolation | Input to output or any pin to case @ 500V | 1 | 100 | - | - | 100 | - | - | MΩ |
| Short Circuit Current Limit ⑦ | | 1 | 2.3 | 2.8 | 3.6 | 2.3 | 2.8 | 3.6 | A |
| Switching Frequency | | 4 | 375 | 400 | 425 | 350 | 400 | 450 | KHz |
| VOUT Adjustment Range | RPOT = 50KΩ | 1 | ±10 | - | - | ±10 | - | - | % |

NOTES:

- ① + VIN = 28V, IOUT = 1.8A for DHC2803S, IOUT = 1.0A for DHC2805S, TA = TC = 25°C unless otherwise specified.
- ② Guaranteed by design but not tested. Typical parameters are representative of actual device performance but are for reference only.
- ③ Industrial grade and "E" suffix devices shall be tested to subgroups 1 and 4 unless otherwise specified.
- ④ Military grade devices ("H" suffix) shall be 100% tested to subgroups 1, 2, 3 and 4.
- ⑤ Subgroups 5 and 6 testing available upon request.
- ⑥ Subgroup 1, 4 TA = TC = +25°C
2, 5 TA = TC = +125°C
3, 6 TA = TC = -55°C
- ⑦ Device has internal shutdown feature that pulses the output with a low duty cycle during faults.
- ⑧ Refer to DSCC SMD for electrical specifications for devices purchased as such.

ELECTRICAL SPECIFICATIONS

DHC2805S

| Parameter ⑧ | Test Conditions ① | Group A Subgroup | DHC2805S H/E | | | DHC2805S | | | Units |
|-------------------------------|---|------------------|--------------|------|------|----------|------|------|-------|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| Output Voltage | | 1 | 4.95 | 5.00 | 5.05 | 4.90 | 5.00 | 5.10 | VDC |
| | | 2,3 | 4.80 | - | 5.20 | - | - | - | VDC |
| Output Current ② | 12V ≤ VIN ≤ 50V | 1 | 120 | - | 1200 | 120 | - | 1200 | mA |
| | | 2,3 | 120 | - | 1200 | - | - | - | mA |
| | 16V ≤ VIN ≤ 50V | 1 | 120 | - | 1500 | 120 | - | 1500 | mA |
| | | 2,3 | 120 | - | 1500 | - | - | - | mA |
| Output Voltage Ripple | BW = 10KHz to 2MHz | 1 | - | 75 | 190 | - | 75 | 190 | mVp-p |
| | | 2,3 | - | - | 475 | - | - | - | mVp-p |
| Input Current Ripple ② | BW = 10KHz to 2MHz | 1 | - | 100 | 200 | - | 100 | 225 | mAp-p |
| | | 2,3 | - | - | 200 | - | - | - | mAp-p |
| Line Regulation | VIN = 16V to 40V | 1 | - | ±6 | ±15 | - | ±6 | ±20 | mV |
| | | 2,3 | - | - | ±50 | - | - | - | mV |
| Load Regulation | VIN = 16V, 28V and 40V IOUT = 0A, 0.5A and 1A | 1 | - | ±10 | ±25 | - | ±10 | ±30 | mV |
| | | 2,3 | - | - | ±50 | - | - | - | mV |
| Efficiency | | 1 | 64 | 70 | - | 64 | 70 | - | % |
| | | 2,3 | 62 | - | - | - | - | - | % |
| Step Load Response | IOUT = 500mA to/from 1000mA Transition Time = 30μS | 4 | - | ±300 | ±500 | - | ±300 | ±500 | mV |
| | | 5,6 | - | - | ±750 | - | - | - | mV |
| Step Load Recovery | IOUT = 500mA to/from 1000mA Transition Time = 30μS | 4 | - | 90 | 300 | - | 90 | 300 | μS |
| | | 5,6 | - | - | 300 | - | - | - | μS |
| Step Line Response ② | VIN = 16V to/from 40V Transition Time = 30μS | 4 | - | ±160 | ±500 | - | ±160 | ±500 | mV |
| | | 5,6 | - | - | ±500 | - | - | - | mV |
| Step Line Recovery ② | VIN = 16V to/from 40V Transition Time = 30μS | 4 | - | 140 | 500 | - | 140 | 500 | μS |
| | | 5,6 | - | - | 500 | - | - | - | μS |
| Start Up Overshoot | IOUT = 1A | 4 | - | 0 | 200 | - | 0 | 200 | mV |
| | | 5,6 | - | 0 | 200 | - | - | - | mV |
| Start Up Delay | IOUT = 0A and 1A | 4 | - | 30 | 50 | - | 30 | 50 | mS |
| | | 5,6 | - | - | 50 | - | - | - | mS |
| Shutdown Delay ② | | 4 | - | 220 | 500 | - | 220 | 500 | μS |
| | | 5,6 | - | - | 500 | - | - | - | μS |
| Shutdown Recovery ② | | - | - | 60 | - | 60 | - | mS | |
| Input Voltage Range ② | POUT = 6W MAX. | 1,2,3 | 12 | - | 50 | 12 | - | 50 | V |
| | POUT = 5W MAX. | 1,2,3 | 11 | - | 50 | 11 | - | 50 | V |
| | POUT = 2.5W MAX. | 1,2,3 | 10 | - | 50 | 10 | - | 50 | V |
| Quiescent Current | Enabled, IOUT = 0mA | 1,2,3 | - | 35 | 40 | - | 35 | 45 | mA |
| | Disabled IOUT = 0mA | 1,2,3 | - | 2 | 5 | - | 2 | 5 | mA |
| Capacitive Load ② | No Effect on DC Performance | 1,2,3 | - | - | 300 | - | - | 300 | μF |
| Isolation | Input to output or any pin to case @ 500V | 1 | 100 | - | - | 100 | - | - | MΩ |
| Short Circuit Current Limit ⑦ | | 1 | 1.6 | 1.9 | 2.2 | 1.5 | 1.9 | 2.3 | A |
| Switching Frequency | | 4 | 375 | 400 | 425 | 350 | 400 | 450 | KHz |
| VOUT Adjustment Range | RPOT = 50KΩ | 1 | ±10 | - | - | ±10 | - | - | % |

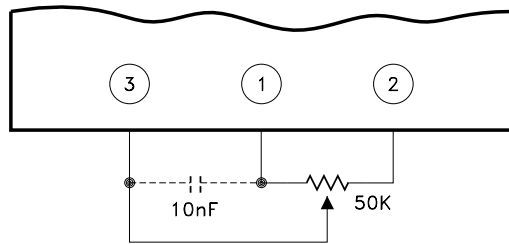
NOTES:

- ① +VIN = 28V, IOUT = 1.8A for DHC2803S, IOUT = 1.0A for DHC2805S, TA = TC = 25°C unless otherwise specified.
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- ③ Industrial grade and "E" suffix devices shall be tested to subgroups 1 and 4 unless otherwise specified.
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- ⑤ Subgroups 5 and 6 testing available upon request.
- ⑥ Subgroup 1, 4 TA = TC = +25°C
2, 5 TA = TC = +125°C
3, 6 TA = TC = -55°C
- ⑦ Device has internal shutdown feature that pulses the output with a low duty cycle during faults.
- ⑧ Refer to DSCC SMD for electrical specifications for devices purchased as such.

APPLICATION NOTES

POWER SUPPLIES

The output voltage of the DHC2800S may be adjusted from 90% to 110% of nominal value by the use of a 50KΩ 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 1.3V causes output voltage to decrease. Pin 3 may be driven through 10KΩ or more if connection of the comp function is also required.

The comp function of pin 3 allows capacitive loads as large as 1000μF to be accommodated on the DHC2805S without loss of stability. This feature may be utilized by connecting a 10nF capacitor between pins 3 and 1. This is generally recommended when low ESR load capacitances of 100μF 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 2.5mA, 25Vdc 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:

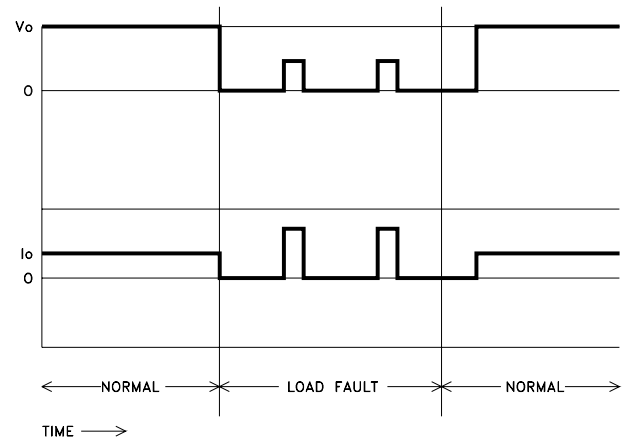
$$R = \frac{210 \cdot 10^3}{E_{TO} - 9.5} \quad (\pm 10\% \text{ accuracy at } 25^\circ\text{C})$$

Set point temperature coefficient is typically +400ppm/°C.

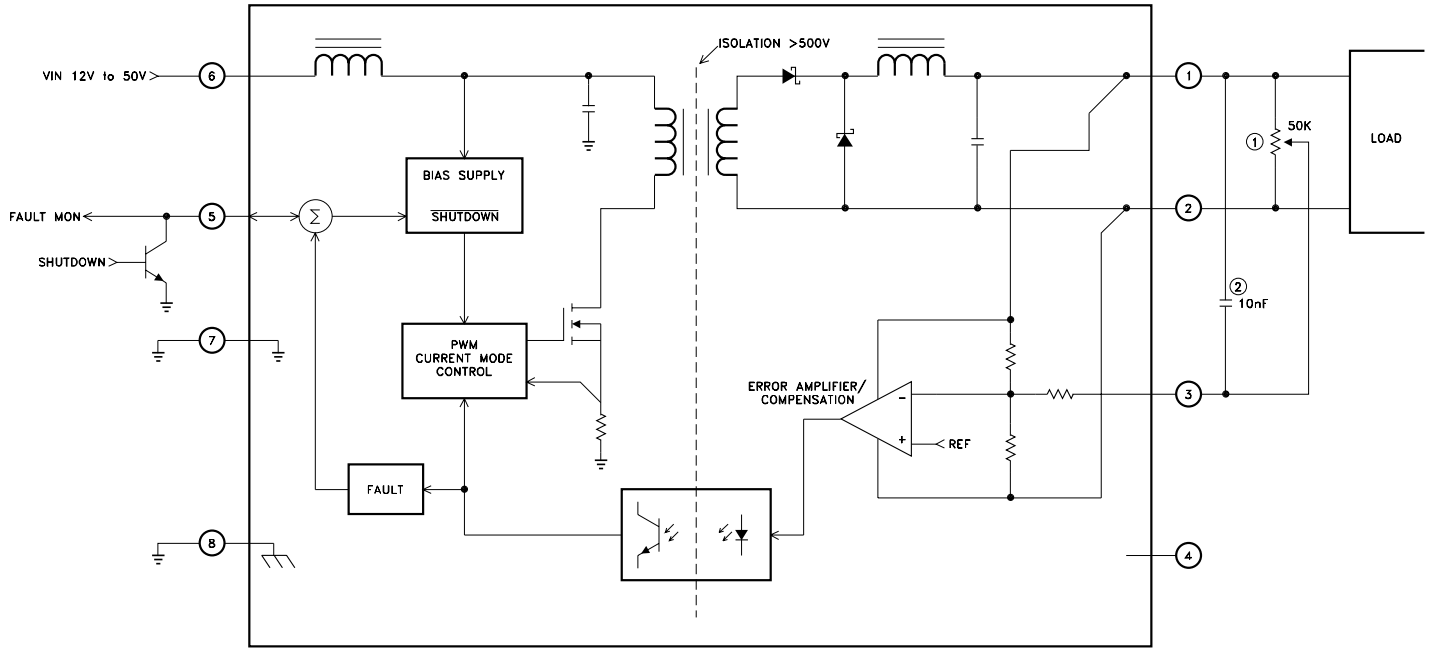
Output fault monitoring is accomplished by observing pin 5 with a high impedance monitoring circuit. Pin 5 voltage drops from over 10V to below 1V when a load fault causes the converters fault protection circuitry to activate. It will remain low for at least 100mS and return high. If the load fault is still present pin 5 will return low and the cycle will repeat. A resistor >400KΩ 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 DHC2800S converter series responds to load faults by turning off all power conversion circuits for 250mS and then attempting to restart for 10mS (typical). The net "on" duty factor during a fault is very low resulting in low converter dissipation and immunity from overheating at 125°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.



TYPICAL APPLICATION CIRCUIT

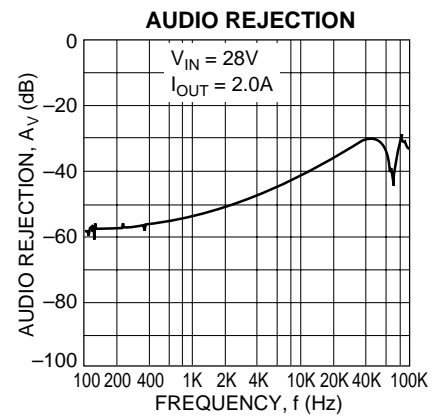
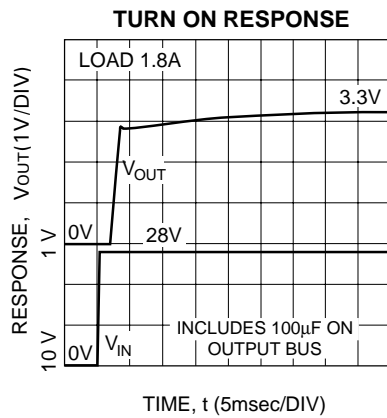
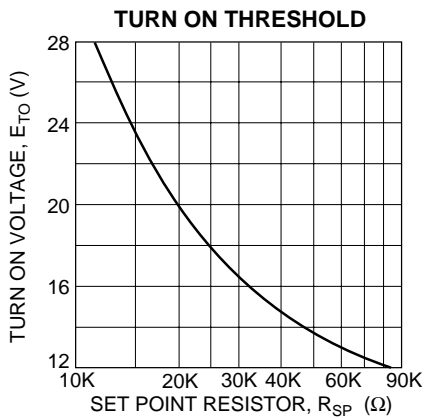
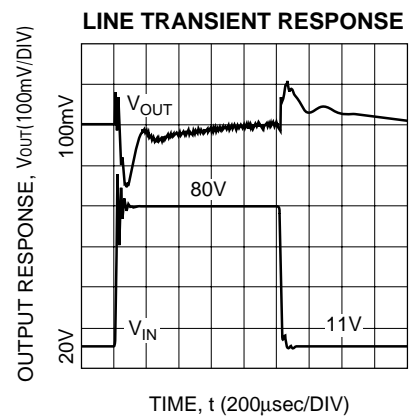
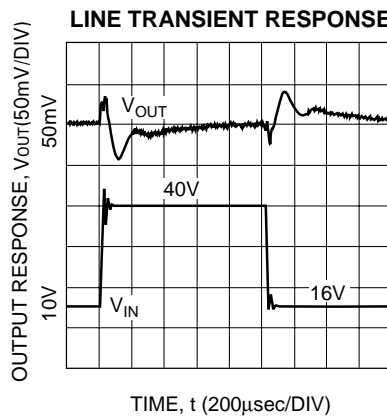
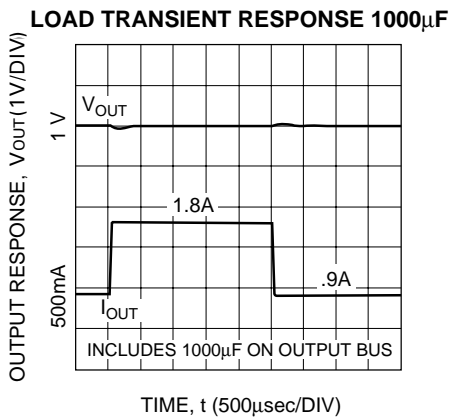
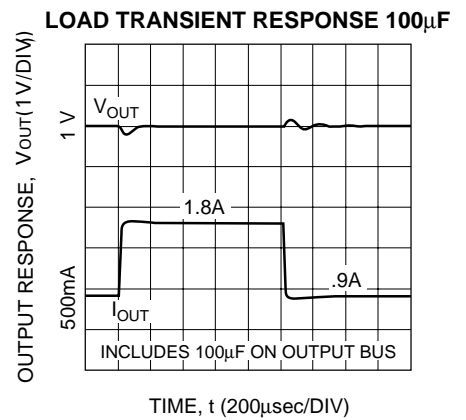
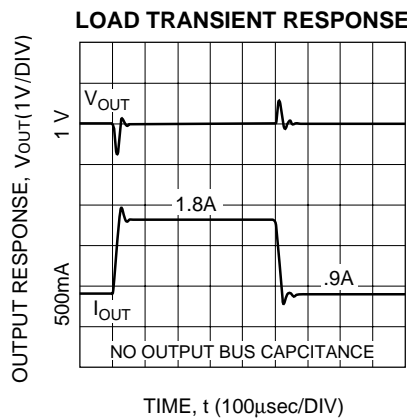
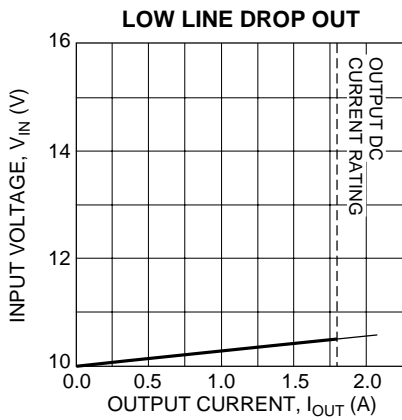
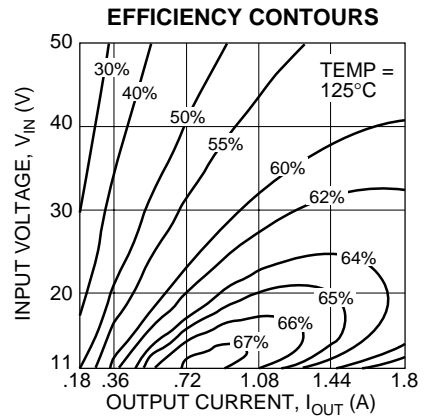
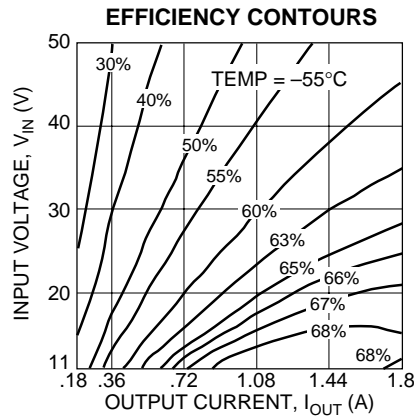
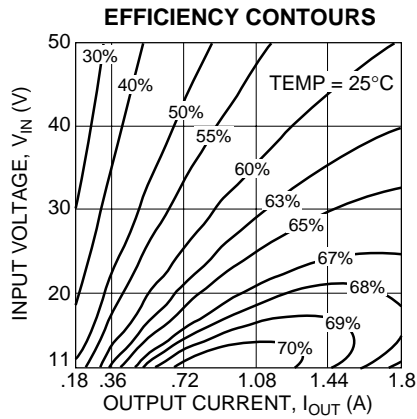


NOTES:

1. OPTIONAL OUTPUT ADJUSTMENT RESISTOR. SEE PARAGRAPH TITLED POWER SUPPLIES.
2. OPTIONAL COMPENSATION CAPACITOR. SEE PARAGRAPH TITLED POWER SUPPLIES.

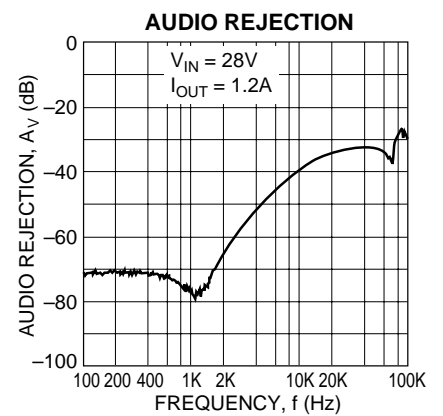
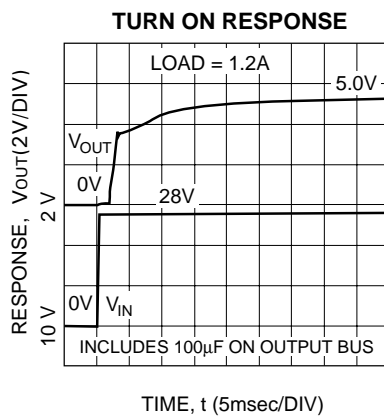
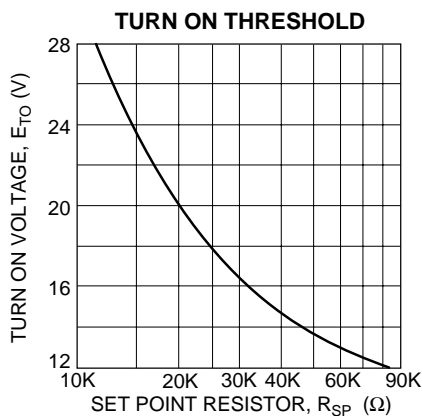
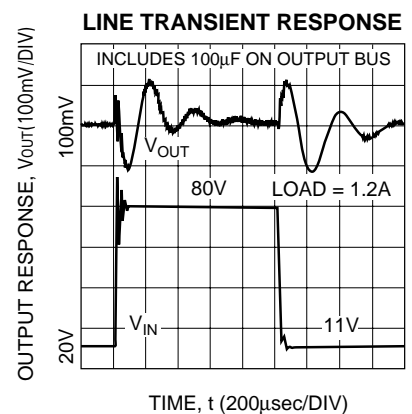
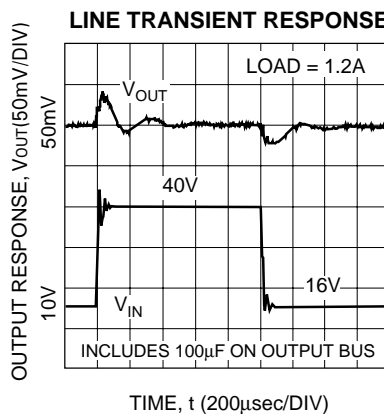
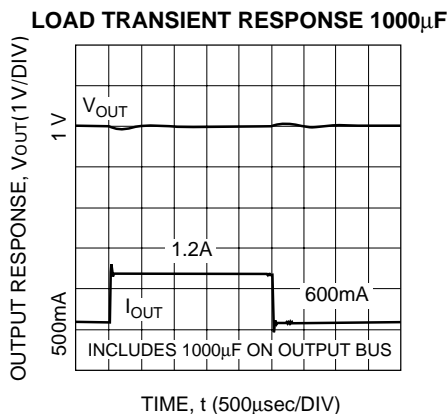
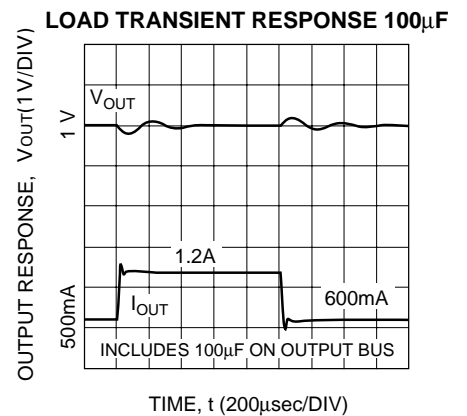
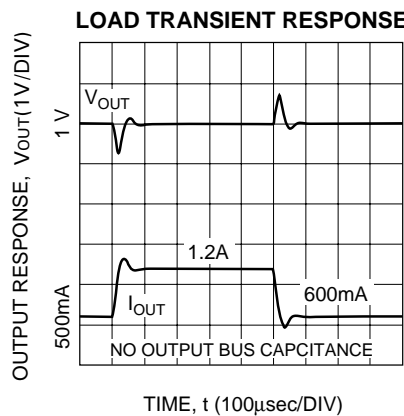
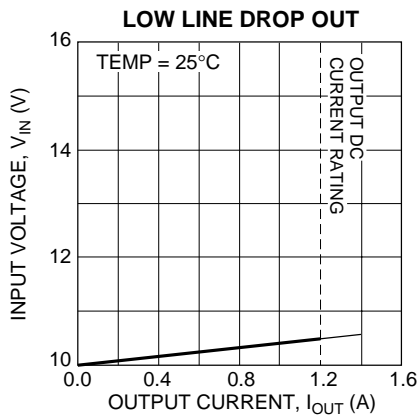
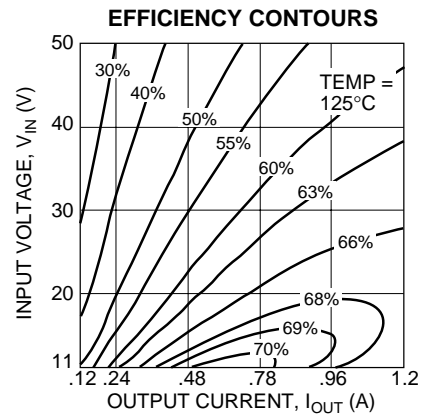
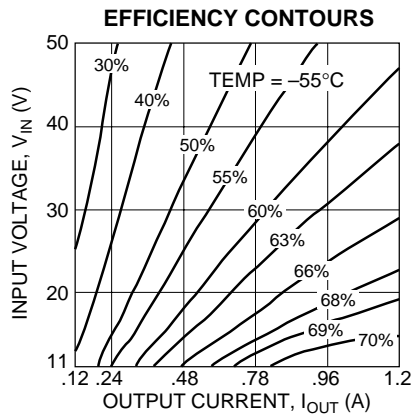
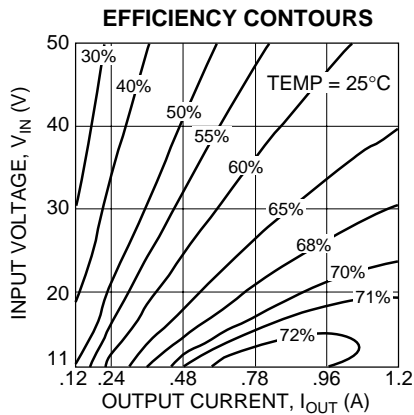
TYPICAL PERFORMANCE CURVES

DHC2803S

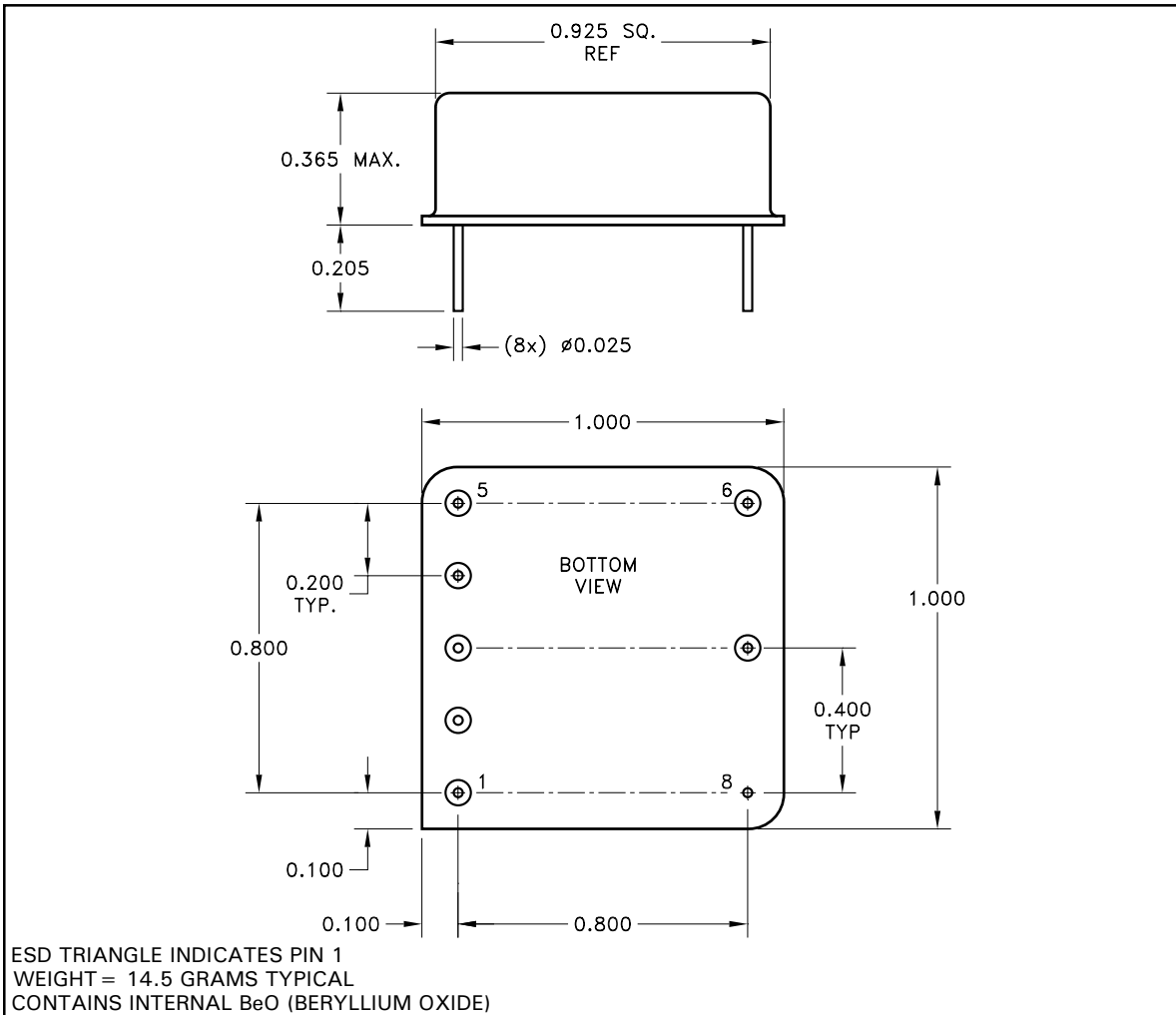


TYPICAL PERFORMANCE CURVES

DHC2805S



MECHANICAL SPECIFICATIONS



ALL DIMENSIONS ARE ± 0.010 INCHES UNLESS OTHERWISE LABELED

ORDERING INFORMATION

| Part Number | Screening Level | Output Voltage |
|-------------|-----------------------|----------------|
| DHC2803S | Industrial | 3.3V |
| DHC2803SE | Extended Reliability | |
| DHC2803SH | Mil-PRF-38534 Class H | |
| DHC2805S | Industrial | 5.0V |
| DHC2805SE | Extended Reliability | |
| DHC2805SH | Mil-PRF-38534 Class H | |
| 5962-93092 | DSCC-SMD for DHC2805S | |
| 5962-94629 | DSCC-SMD for DHC2805S | |

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