# DC/DC CONVERTERS
# 12 VOLT INPUT

# HSH SERIES
# 1.5 WATT

**FEATURES**

- **-55°C to +150°C operation**
- **6 to 20 VDC input voltage range**
- Fully isolated
- Magnetic feedback
- Variable operating frequency
- Topology –
  Self Oscillating Flyback
- Inhibit function

| MODELS |
|---|
| VDC OUTPUT |
| DUAL |
| ±5 |

Size (max.): 0.980 x 0.805 x 0.270 inches (24.89 x 20.45 x 6.86 mm)
Weight: 12 grams max.
Screening: HSH Standard or HSH ES

## DESCRIPTION

With a miniature footprint of just 0.8 square inches, the HSH Series™ of DC/DC converters delivers 1.5 watts of output power while saving significant board real estate. The wide input voltage range of 6 to 20 VDC accepts the varying voltages of military, industrial, or battery 15V bus power and tightly regulates output voltages to protect downstream components. Transient protection of 40 volts for up to 120 milliseconds.

### CONVERTER DESIGN

HSH Series DC/DC converters incorporate a flyback topology with a variable frequency, nominally 370 kHz. Output voltage is magnetically fed back to the input side of the PWM to regulate output voltage.

Up to 80% of the load may be on one output providing that the other output carries a minimum of 20% of the total load. This dual model can be used as a single output voltage by connecting the load between positive and negative outputs, leaving the common unconnected resulting in double the output voltage. (ex: HSH1205D can be used as a 10 VDC output.)

### INHIBIT FUNCTION

When an open collector TTL logic low is applied to the inhibit terminal, pin 7, the converter shuts down and lowers the output voltage to near zero and input current to as low 5 mA. Leaving the terminal open or applying an open collector TTL logic high will enable the converter.

## MIL-STD-461

Use Interpoint's FMSA-461 EMI filter to pass the CE03 requirements of MIL-STD-461C.

### CONVENIENT PACKAGING

The HSH Series converters are packaged in hermetically sealed metal cases which provide EMI/RFI shielding and protection from the environment.

### ABSOLUTE MAXIMUM RATINGS

**Input Voltage**
- 6 to 20 VDC

**Output Power**
- 1.5 W

**Lead Soldering Temperature (10 sec per lead)**
- 300°C

**Storage Temperature Range (Case)**
- –65°C to +150°C

### INHIBIT

**Inhibit – TTL Open Collector**
- Logic low (output disabled)
- Referenced to input common
- Logic high (output enabled) open collector

### RECOMMENDED OPERATING CONDITIONS

**Input Voltage Range**
- 6 to 20 VDC continuous, 600 mW max
- 12 to 18 VDC continuous, 1.5 W max

**Case Operating Temperature (Tc)**
- +125°C to +150°C 1 watt
- –55°C to +125°C 1.5 watt

### TYPICAL CHARACTERISTICS

**Output Voltage Temperature Coefficient**
- 100 ppm/°C typical

**Isolation**
- 100 megohm minimum at 500 V
- Any pin to case except case pin

**Audio Rejection 40 dB, typical**

**Conversion Frequency (kHz)**
- 90 min kHz, Vin=6V, ±Iout=60 mA, Tc=-55 to +125°C

**Inhibit Pin Voltage (unit enabled)**
- 7 to 8 V

## Electrical Characteristics:14 VDC Vin, ±100mA load, unless otherwise specified.

| HSH1205D | | 25°C | | | +125°C/-55°C[1] | | | +150°C[1] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PARAMETER | CONDITIONS | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | UNITS |
| OUTPUT VOLTAGE | $V_{IN}$ = 6, $I_{OUT}$ = ±60mA | ±4.75 | ±5 | ±5.25 | ±4.75 | ±5 | ±5.25 | ±4.75 | ±5 | ±5.25 | VDC |
| | $V_{IN}$ = 16, $I_{OUT}$ = ±60mA | ±4.75 | ±5 | ±5.25 | ±4.75 | ±5 | ±5.25 | ±4.75 | ±5 | ±5.25 | |
| | $V_{IN}$ = 16, $I_{OUT}$ = ±120mA | ±4.75 | ±5 | ±5.25 | ±4.75 | ±5 | ±5.25 | ±4.75 | ±5 | ±5.25 | |
| OUTPUT CURRENT[5] | $V_{IN}$ = 12 TO 18 VDC | 0 | ±150 | 240 | 0 | ±150 | 240 | 0 | ±100 | 160 | mA |
| | $V_{IN}$ = 6 TO 20 VDC | 0 | ±60 | 96 | 0 | ±60 | 96 | 0 | ±60 | 96 | |
| OUTPUT POWER | $V_{IN}$ = 12 TO 18 VDC | 0 | — | 1.5 | 0 | — | 1.5 | 0 | — | 1.0 | W |
| | $V_{IN}$ = 6 TO 20 VDC | 0 | — | 0.6 | 0 | — | 0.6 | 0 | — | 0.6 | |
| OUTPUT RIPPLE VOLTAGE | 10 kHz - 2 MHz | — | 35 | 180 | — | 50 | 250 | — | 50 | 250 | mV p-p |
| INPUT VOLTAGE | NO LOAD TO 1.5 W | 12 | 14 | 18 | 12 | 14 | 18 | — | — | — | VDC |
| | NO LOAD TO 600 mW | 6 | 14 | 20 | 6 | 14 | 20 | 6 | 14 | 20 | |
| INPUT CURRENT | NO LOAD | — | 5.0 | 10 | — | 8 | 12 | — | 18 | 25 | mA |
| | INHIBITED | — | 2.4 | 3.2 | — | 8 | 12 | — | 2.4 | 3.5 | |
| INPUT RIPPLE[2] CURRENT | 10 kHz - 10 MHz | — | — | 50 | — | — | 100 | — | — | 100 | mA p-p |
| EFFICIENCY | | 71 | 74 | — | 63 | 67 | — | 59 | — | — | % |
| START–UP | DELAY | — | 3 | 18 | — | 3 | 18 | — | 3 | 18 | ms |
| | OVERSHOOT[1] | — | 0 | 100 | — | 0 | 150 | — | 0 | 150 | mV pk |
| LOAD FAULT[1, 3, 4] | POWER DISSIPATION | — | — | 2.2 | — | — | 2.5 | — | — | 2.5 | W |

Notes:
1. Guaranteed by design, not tested.
2. Lin = 2 $\mu$H.
3. Maximum duration of short circuit: 25°C-— 90 seconds, 150°C – 5 seconds.
4. Load fault is a short circuit (<50 mohms). Recovery is into resistive full load.
5. Max. spec indicates 80% of the converter's total power, available from either output providing the other output carries a minimum of 20% of the total load.



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**PIN OUT**

| Pin | Dual Output |
|---|---|
| 1 | Positive Input |
| 2 | Input Common |
| 3 | Positive Output |
| 4 | Output Common |
| 5 | Case Ground |
| 6 | Negative Output |
| 7 | Inhibit |

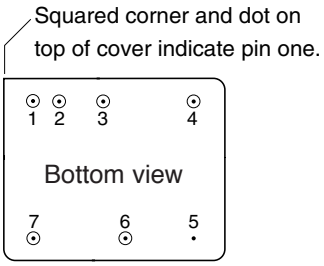
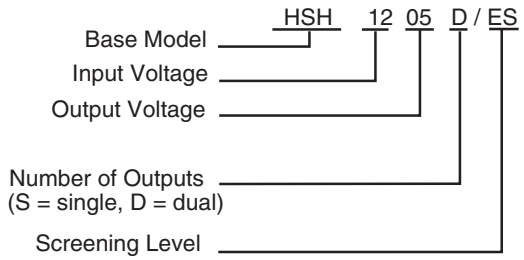
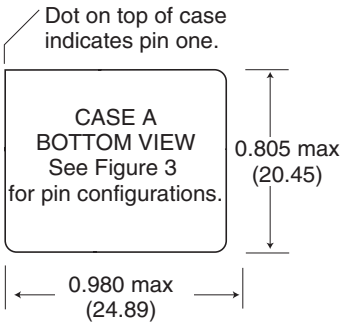



**FIGURE 1: PIN OUT**

**MODEL NUMBERING KEY**




**Materials**

| | |
|---|---|
| Header | Kovar/Nickel/Gold (Case A3, Kovar/Nickel) |
| Cover | Kovar/Nickel |
| Pins | Kovar/Nickel/Gold, matched glass seal |

**Case dimensions in inches (mm)**

Tolerance ±0.005 (0.13) for three decimal places
±0.01 (0.3) for two decimal places
unless otherwise specified

**CAUTION**

Heat from reflow or wave soldering may damage the device. Solder pins individually with heat application not exceeding 300°C for 10 seconds per pin.

**FIGURE 2: CASE A MAXIMUM DIMENSIONS**

BOTTOM VIEW CASE A2
HSH Series: Screening – Standard or ES

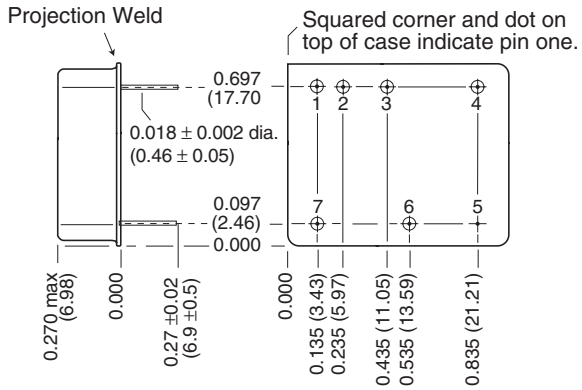



**FIGURE 3: CASE A2**

Note: Although every effort has been made to render the case drawings at actual size, variations in the printing process may cause some distortion. Please refer to the numerical dimensions for accuracy.

# ENVIRONMENTAL SCREENING

| TEST | HSH STANDARD | HSH /ES |
|---|---|---|
| PRE-CAP INSPECTION | | |
| Method 2017, 2032 | yes | yes |
| TEMPERATURE CYCLE (10 times) | | |
| Method 1010, Cond. C, -65°C to 150°C | no | no |
| Method 1010, Cond. B, -55°C to 125°C | no | yes |
| CONSTANT ACCELERATION | | |
| Method 2001, 3000 g | no | no |
| Method 2001, 500 g | no | yes |
| BURN-IN | | |
| 24 hours at 150°C case (typical) | yes | no |
| 96 hours at 150°C case (typical) | no | yes |
| FINAL ELECTRICAL TEST MIL-PRF-38534, Group A | | |
| Subgroups 1, 2, 4, 5: +25°C, +125°C | yes | yes |
| HERMETICITY TESTING | | |
| Fine Leak, Method 1014, Cond. A | no | yes |
| Gross Leak, Method 1014, Cond. C | no | yes |
| Gross Leak, Dip (1 x $10^{-3}$) | yes | no |
| FINAL VISUAL INSPECTION | | |
| Method 2009 | yes | yes |

Test methods are referenced to MIL-STD-883 as determined by MIL-PRF-38534.

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