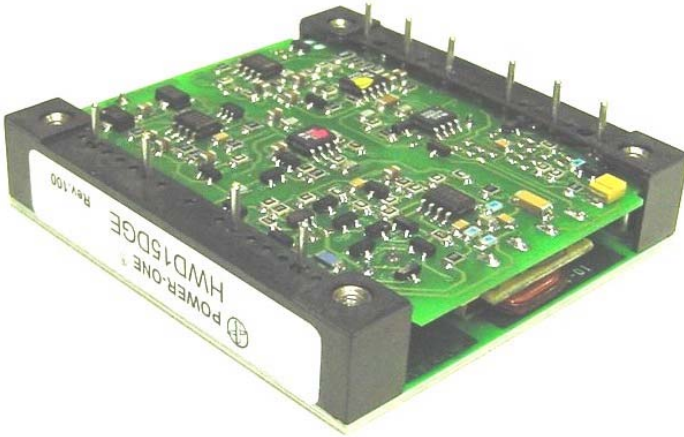


HWD Series – 75 Watt, Half-Brick DC/DC Converter
Wide Input Range
Dual Output



Features

- 75 Watts total output power
- Wide input range 18V – 60V
- Independent dual outputs
- Flexible load sharing
- Open-frame design with IMS board
- Low profile – 12.7mm height
- Start-up into high capacitive load
- Output overcurrent protection (self re-start)
- Output overvoltage protection (self re-start)
- Overtemperature protection (self re-start)
- Setpoint accuracy $\pm 2.0\%$
- Output voltage trim adjust, independent for each output
- Input/output isolation: 1500V
- UL 1950 Recognition, CSA 22.2 No. 950-95 certification

Applications

- Distributed power architectures
- Telecommunications equipment
- LAN/WAN applications
- Data processing applications

Description

The HWD series provides onboard conversion of standard telecom and datacom input voltages into two isolated low-voltage outputs. These products offer a unique combination of wide input range, low profile, and high current capability. High efficiency and advanced thermal management enable these half-brick products to deliver full rated power at 55°C ambient temperature, with 200 LFM airflow, without the addition of heatsinks.

| Selection Chart | | | | | | |
|-----------------|--------------------------|-------------------------|---------------------|---------------------------|---------------------------------|----------------------------|
| Model | Input voltage range, VDC | Input current, max, ADC | Output voltage, VDC | Output rated current, ADC | Output Ripple and Noise, mV p-p | Efficiency % |
| HWD075DGE-A | 18-60 | 5.5 | 5.0/3.3 | 15/15 | 100 | 81% @ 24Vin 79% @ 48Vin |

**HWD Series – 75 Watt, Half-Brick DC/DC Converter
Wide Input Range
Dual Output**
Absolute Maximum Ratings Table 1.

| Parameter | Symbol | Min | Max | Units |
|---|------------|-----|------------|-------|
| Input Voltage | | | | |
| Continuous | V_i | - | 60 | Vdc |
| Transient (100 msec) | V_i | - | 100 | Vdc |
| Operating Baseplate Temperature Note 1 | T_b | -40 | +100 | °C |
| Storage Temperature | T_{stg} | -55 | +125 | °C |
| Input to Output Isolation | - | - | 1500 | Vdc |
| Output Short Circuit Duration | - | - | Continuous | - |
| Total Output Power | P_{omax} | - | 75 | W |
| No Load Power Dissipation | | - | 6 | W |

Electrical Specifications

Unless otherwise indicated, specifications apply over all input voltages, resistive load, and $T_{bp}=+40^{\circ}\text{C}$.

Table 2. Input Specifications

| Parameter | Symbol | Min | Typ | Max | Units |
|---------------------------------------|--------|-----|-------|-----|----------------------|
| Voltage Range | V_i | 18* | 24/48 | 60 | Vdc |
| Maximum Input Current | I_i | - | - | 5.5 | A |
| Input Ripple Rejection (120Hz) | | - | 60 | - | dB |
| Inrush Transient | | - | - | 1 | A^2s |
| Input Reflected Ripple (see figure 1) | | - | - | 250 | mAp-p |

* Module will operate within specification with an input voltage of 18 Vdc, but must be turned on with an input voltage > 19.5 Vdc. See Undervoltage Lockout Specification.

Fusing considerations

Caution: This DC-DC converter is not internally fused. An external input fuse must always be used.

Table 3. Output Specifications

| Parameter | Symbol | Min | Typ | Max | Units |
|--|--------------------------------------|-------------|-------------|----------------|-------------|
| Output Power | P_{o1} P_{o2} P_{o1+Po2} | - - - | - - - | 75 50 75 | W W W |
| Output Voltage Set Point ($V_i=24\text{Vdc}$ or $V_i=48\text{Vdc}$, $I_{o1}, I_{o2}=7.5\text{A}$) | V_{o1} V_{o2} | 4.9 3.23 | 5.0 3.3 | 5.1 3.37 | Vdc Vdc |
| Output Line Regulation: ($V_i=V_{i,min}$ to $V_{i,max}$) ($I_{o1}, I_{o2}=7.5\text{A}$) | V_{o1}, V_{o2} | - | 0.05 | 0.2 | % |
| Output Load Regulation: ($I_{o,min}$ to $I_{o,max}$) | V_{o1}, V_{o2} | - | 0.5 | 1 | % |

HWD Series – 75 Watt, Half-Brick DC/DC Converter
Wide Input Range
Dual Output

| | | | | | |
|---|------------------------|------------|------------|------------|-----------------|
| Output Temperature Regulation: (Tbase = -40°C to +100°C) | All Outputs | - | 0.02 | 0.05 | %/°C |
| Output Current (Maximum output power limited to 75W) | Io1 Io2 | 0.5 0.5 | 7.5 7.5 | 15 15 | A A |
| Output Ripple (See Figure 2) (DC to 20MHz) (Io1, Io2 = 7.5A) | Vo1 Vo2 | - - | 75 75 | 100 100 | mVp-p mVp-p |
| Output Current Limit inception (Other outputs at no load) | Io1 Io2 | - - | 17 21 | 19 23 | A A |
| Transient Response (50% to 100% Load Step, $\Delta I_o/\Delta t = 0.1A/\mu\text{Sec}$) | | | | | |
| Peak Deviation | Vo1 Vo2 | - - | 100 200 | 200 300 | mV mV |
| Settling Time (Vo, 1% of Vo1) | | - | 150 | 250 | μsec |
| Overvoltage Limit | Vo1,clamp Vo2,clamp | 5.9 3.6 | - - | 6.5 4.7 | Vdc Vdc |

Table 4. Feature Specifications

| Parameter | Symbol | Min | Typ | Max | Units |
|--------------------------------|------------|--------------|-------------|--------------|------------|
| Remote On/Off, Primary side | | | | | |
| Vlow | | - | - | 1 | V |
| Vhigh | | - | - | 7 | V |
| Sink Current-Logic Low | | - | - | 2 | mA |
| Turn-on time (Within 1% Vonom) | | - | 3.5 | 5 | msec |
| Switching Frequency | | - | 350 | - | kHz |
| Output Voltage Adjust | | | | | |
| Adjust Up | Vo1 Vo2 | 5.39 3.55 | 5.5 3.63 | 5.61 3.71 | Vdc Vdc |
| Adjust Down | Vo1 Vo2 | 4.41 2.91 | 4.5 2.97 | 4.59 3.03 | Vdc Vdc |
| Thermal Shutdown | | +105 | | +115 | °C |
| Undervoltage Lockout | | | | | |
| Turn-on | | - | 19.2 | 19.5 | V |
| Turn-off | | 16.5 | 16.8 | - | V |

Table 5. Environmental

| Parameter | Min | Typ | Max | Units |
|-------------------------------------|-----|-----|------|-------|
| Operating Baseplate Temperature | -40 | - | +100 | °C |
| Operating Humidity (non-condensing) | - | - | 95 | % |
| Storage Humidity (non-condensing) | - | - | 95 | % |

HWD Series – 75 Watt, Half-Brick DC/DC Converter
Wide Input Range
Dual Output

Table 6. Isolation Specifications

| Parameter | Min | Typ | Max | Units |
|-----------------------------|------|------|-----|-------|
| Input to Each Output | 1500 | - | - | Vdc |
| Input to Baseplate | 1500 | - | - | Vdc |
| Output to Output | - | - | - | Vdc |
| Resistance, Input - Output | 10 | - | - | MΩ |
| Capacitance, Input - Output | - | 2200 | - | pF |

Table 7. EMI & Regulatory Agency Compliance

| | |
|---|---|
| Conducted Emissions (With input filter configuration in Figure 3.) | CISPR 22 class A |
| Safety | UL60950 Recognized, CAN/CSA C22.2 No. 60950-00 Recognized |

Table 8. General Specifications

| Parameter | Min | Typ | Max | Units |
|---|----------|----------|--------|-------|
| Efficiency η ($V_i=24V_{dc}$, $I_{o1}, I_{o2} = 7.5A$) ($V_i=48V_{dc}$, $I_{o1}, I_{o2} = 7.5A$) | 79 77 | 81 79 | - - | % |
| Calculated MTBF ($P_o=60W$, $T_{bp}=40^{\circ}C$) | - | 900 | - | kHrs |

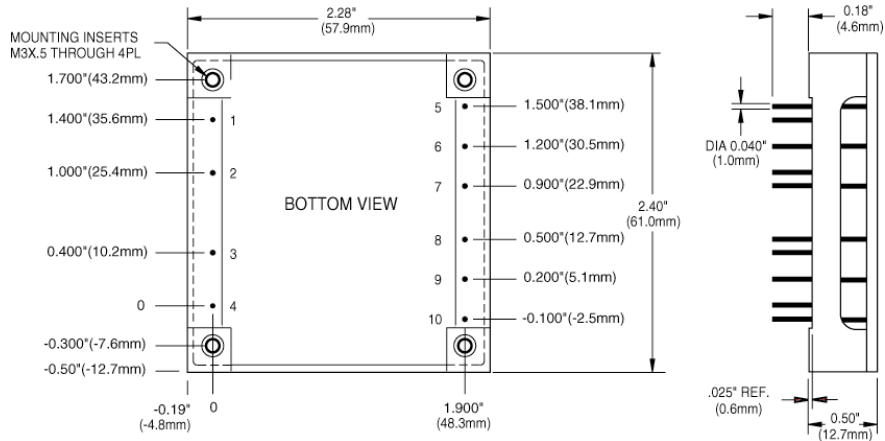
Table 7. Physical

| Parameter | | | | Units |
|---------------------|--|------------|-------------|------------------|
| Dimensions | 2.30(58.4) | 2.40(60.9) | 0.50(12.70) | In. (mm) |
| Weight | | | | 2.4(68) oz(g) |
| Markings & labeling | Includes Part Number, Power-One Logo, Date Code and Country of Manufacture | | | |

HWD Series – 75 Watt, Half-Brick DC/DC Converter
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Dual Output

Mechanical Diagram

| Pin | Function |
|-----|----------|
| 1 | -Vin |
| 2 | Case |
| 3 | On/Off |
| 4 | +Vin |
| 5 | +Vo2 |
| 6 | +Vo2 Rtn |
| 7 | Trim 2 |
| 8 | +Vo1 |
| 9 | +Vo1 Rtn |
| 10 | Trim 1 |



Ordering Information

| Options | Suffixes to add to part number |
|---------------|--|
| Remote On/Off | Positive- Standard, no suffix required |
| | Negative- Add "N" suffix |
| Trim | Negative- Standard, no suffix required |
| | |
| Pin Length | 0.18"- Standard, no suffix required |
| | 0.11"- Add "8" suffix |
| | 0.15"- Add "9" suffix |

Notes

1. Consult factory for the complete list of available options.
2. Power-One products are not authorized for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems without the express written consent of the President of Power-One, Inc.
3. Specifications are subject to change without notice.

HWD Series – 75 Watt, Half-Brick DC/DC Converter
Wide Input Range
Dual Output

Test Setup

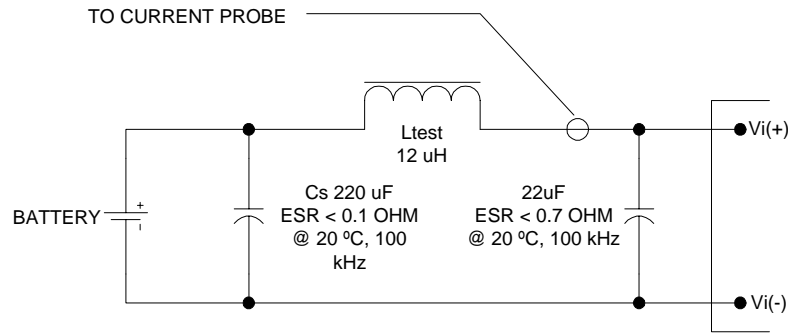


Figure 1 Input Reflected Ripple Current Test Set-up:

Note: Measure input reflected-ripple current with a simulated inductance (L_{test}) of 12 μ H. Capacitor C_s offsets possible battery impedance. Measure current as shown above.

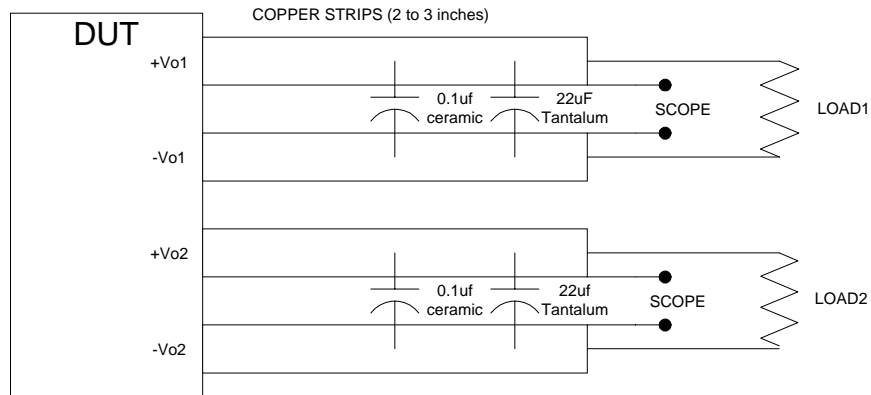


Figure 2: Output Ripple Measurement Test Set-up:

Note: Use a 0.1 μ F ceramic and 22 μ F tantalum capacitor. Scope measurement should be made using a BNC socket. Position loads between 51 mm and 76 mm (2 in. and 3 in.) from module.

HWD Series – 75 Watt, Half-Brick DC/DC Converter
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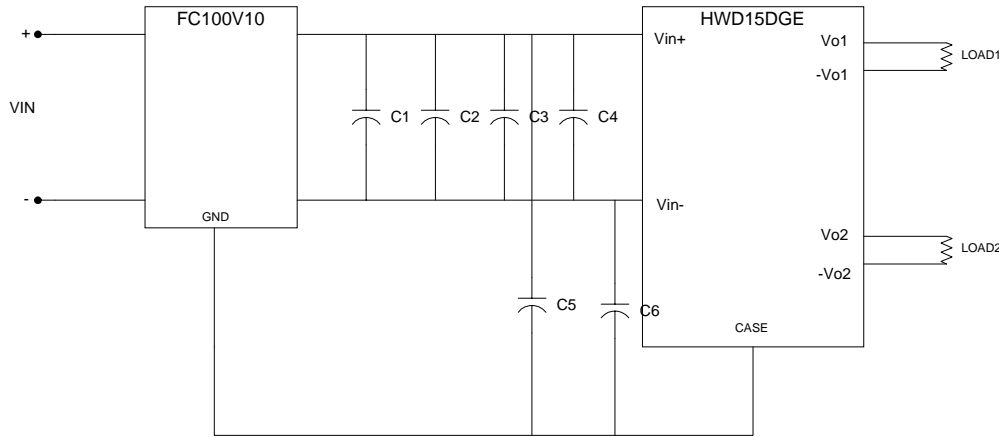


Figure 3: Input filter configuration required to meet CISPR 22 Class A for Conducted Emissions.

Part List for Input Filter

| <u>Ref. Des</u> | <u>Description</u> | <u>Manufacture</u> |
|-----------------|---|--------------------------------------|
| C1, 2 | 0.47uF @100V MLC Capacitor (1812) | AVX or Equivalent (Equiv.) |
| C3 | 100uF @ 100V Alum. Electrolytic Capacitor | Nichicon NRSZ Series or Equiv. |
| C4 | 22uF@ 100V Alum. Electrolytic Capacitor | United Chemicon KMG Series or Equiv. |
| C5, 6 | 0.01uF MLC Capacitor | AVX or Equiv. |
| F1 | FC100V10 Input Filter Module | Power-One |

Feature Descriptions

Output Overvoltage Clamp

The output overvoltage clamp consists of a separate control loop, independent of the primary control loop. This control loop has a higher voltage setpoint than the primary loop. In a fault condition the converter goes into “Hiccup Mode”, and the output overvoltage clamp ensures that the output voltage does not exceed $V_{o,clamp,max}$. This secondary control loop provides a redundant voltage-control that reduces the risk of output overvoltage.

HWD Series – 75 Watt, Half-Brick DC/DC Converter

Wide Input Range

Dual Output

Output Current Protection

To provide protection in an output overload or short circuit condition, the converter is equipped with current limiting circuitry and can endure the fault condition for an unlimited duration. At the point of current-limit inception, the converter goes into “Hiccup Mode”, causing the output current to be limited both in peak and duration. The converter operates normally once the output current is brought back into its specified range.

Enable

Two enable options are available. Positive Logic Enable and Negative Logic Enable. Positive Logic Enable turns the converter on during a logic-high voltage on the enable pin, and off during a logic-low. Negative Logic Enable turns the converter off during a logic-high and on during a logic-low.

Output Voltage Adjustment

Output voltage adjustment is accomplished by connecting an external resistor between the Trim Pin and either the +Vo1 or –Vo1 Pins.

With an external resistor between the Trim Pin and +Vo1 Pin ($R_{adj, dn}$) the output voltage set point ($V_{o,adj}$) decreases. The following equation determines the required external resistor value to obtain an adjusted output voltage:

$$R_{adj, dn} = \left[\frac{(V_{o,adj} - D) \cdot A}{V_{o,nom} - V_{o,adj}} - B \right] \cdot \text{ohm}$$

Where $R_{adj, dn}$ is the resistance value and A, B, and D are defined in Table 7.

With an external resistor between the Trim Pin and –Vo1 Pin ($R_{adj, up}$) the output voltage set point ($V_{o,adj}$) increases. The following equation determines the required external resistor value to obtain an adjusted output voltage:

$$R_{adj, up} = \left[\frac{A \cdot D}{(V_{o,adj} - D) - C} - B \right] \cdot \text{ohm}$$

Where $R_{adj, up}$ is the resistance value and A, B, C, and D are defined in Table 7:

Table 8 Output Adjustment Variables.

| Output | A | B | C | D |
|--------|------|------|-----|-----|
| Vo1 | 4990 | 2000 | 2.5 | 2.5 |
| Vo2 | 4990 | 2000 | 0.8 | 2.5 |

HWD Series – 75 Watt, Half-Brick DC/DC Converter
Wide Input Range
Dual Output

Thermal Considerations

The power converter operates in a variety of thermal environments: however, sufficient cooling should be provided to help ensure reliable operation of the converter. Heat-dissipating components are thermally coupled to the case. Heat is removed by conduction, convection, and radiation to the surrounding environment. Proper cooling can be verified by measuring the case temperature.

Heat Transfer Characteristics

Increasing airflow over the converter enhances the heat transfer via convection. Figure 3 shows the maximum power that can be dissipated by the converter without exceeding the maximum case temperature versus local ambient temperature (T_A) for natural convection through 400 ft/min.

Systems in which these converters are used generate airflow rates of 50 ft/min due to other heat dissipating components in the system. Therefore, the natural convection condition represents airflow rates of approximately 50 ft/min. Use of Figure 3 is shown in the following example.

Example

What is the minimum airflow required for the device operating at 24 V, an output power of 60 W, and maximum ambient temperature of 60 °C.

Solution:

Given: $V_i = 24\text{ V}$, $P_o = 60\text{ W}$, $T_A = 60\text{ °C}$.
 Determine P_D (Figure 4): $P_D = 13\text{ W}$.
 Determine airflow (Figure 3): $v = 200\text{ ft/min}$

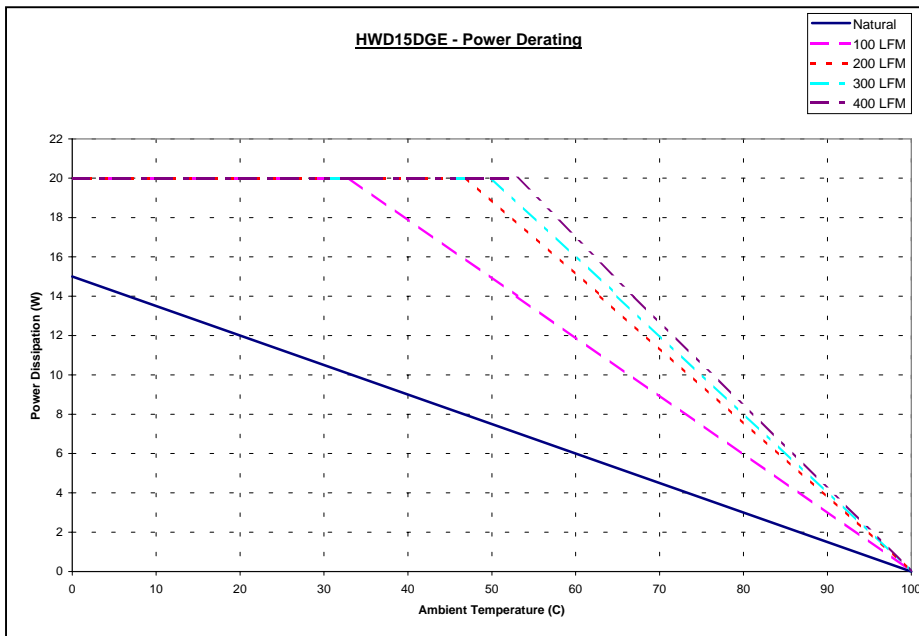


Figure 3. Power Derating Curve

HWD Series – 75 Watt, Half-Brick DC/DC Converter
Wide Input Range
Dual Output

Thermal Considerations (continued)

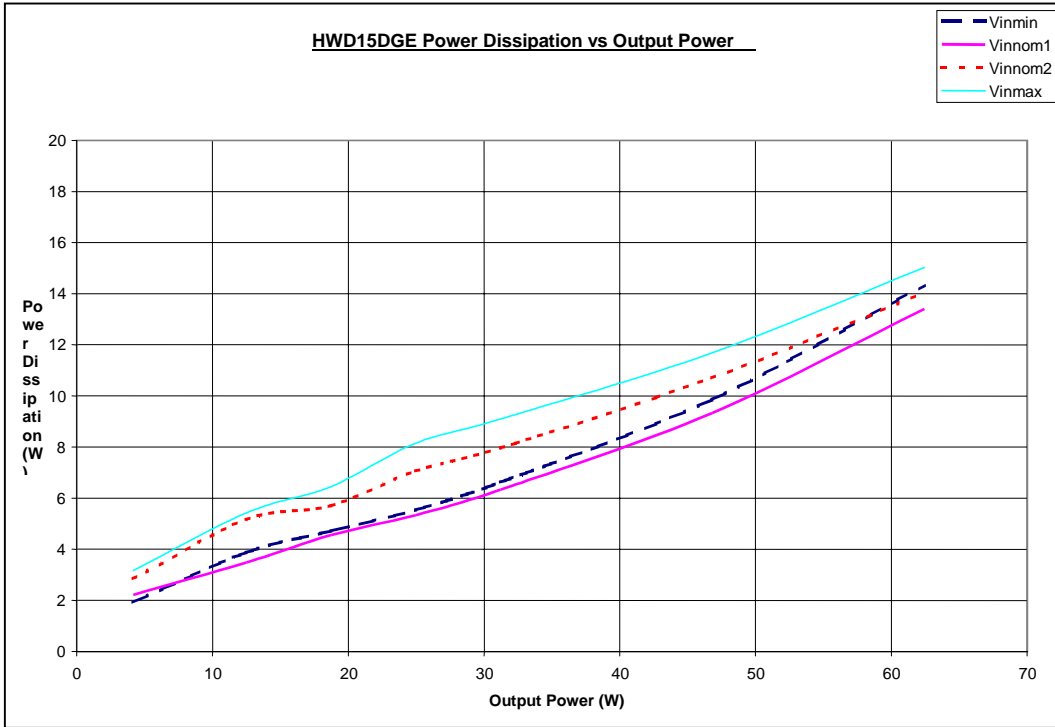


Figure 4. Power Dissipation vs Output Power

HWD Series – 75 Watt, Half-Brick DC/DC Converter
Wide Input Range
Dual Output

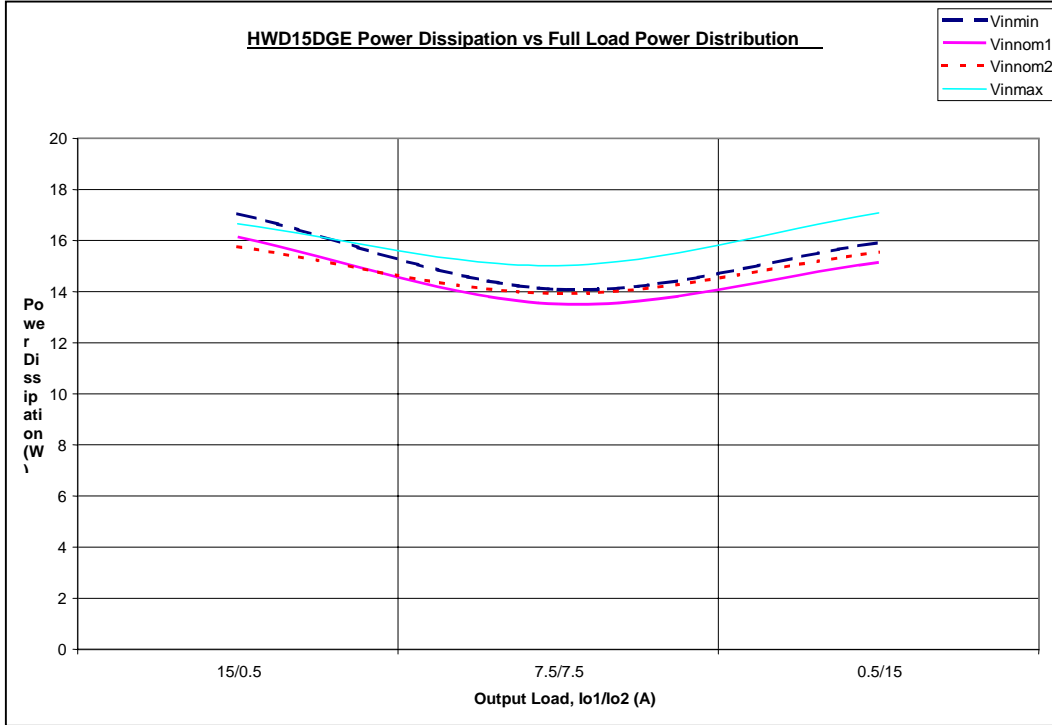


Figure 5. Power Dissipation vs Full Load Distribution

HWD Series – 75 Watt, Half-Brick DC/DC Converter
Wide Input Range
Dual Output

Characteristic Curves

T_b = 40 °C, nominal input voltage, and rated load unless otherwise specified.

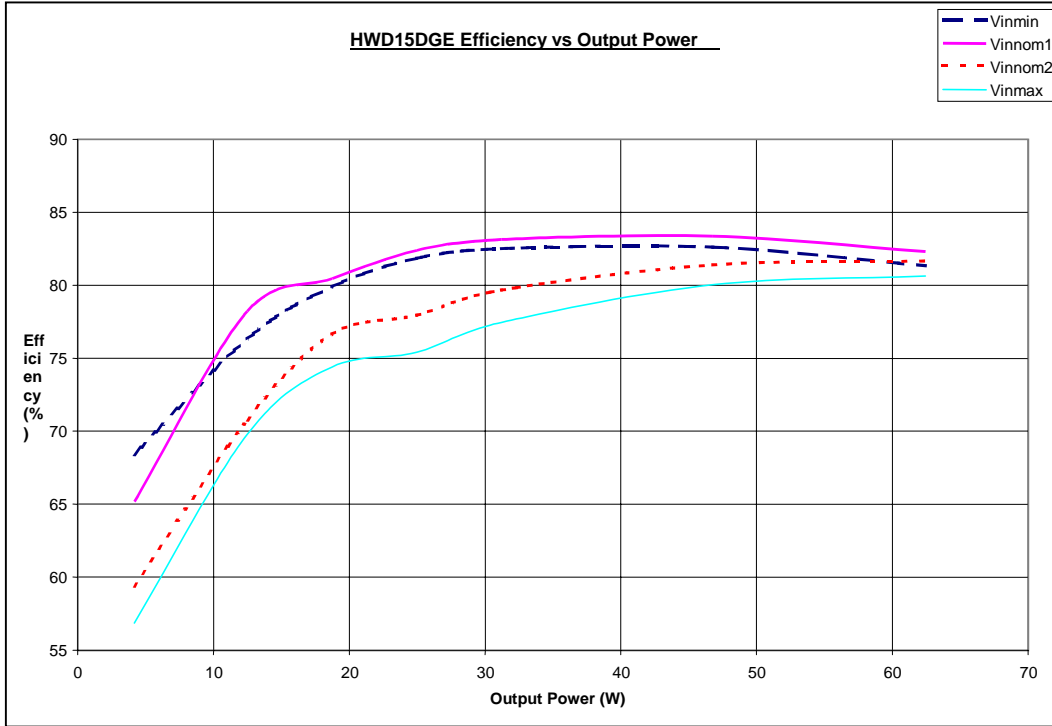


Figure 6. Efficiency vs Output Power

HWD Series – 75 Watt, Half-Brick DC/DC Converter
Wide Input Range
Dual Output

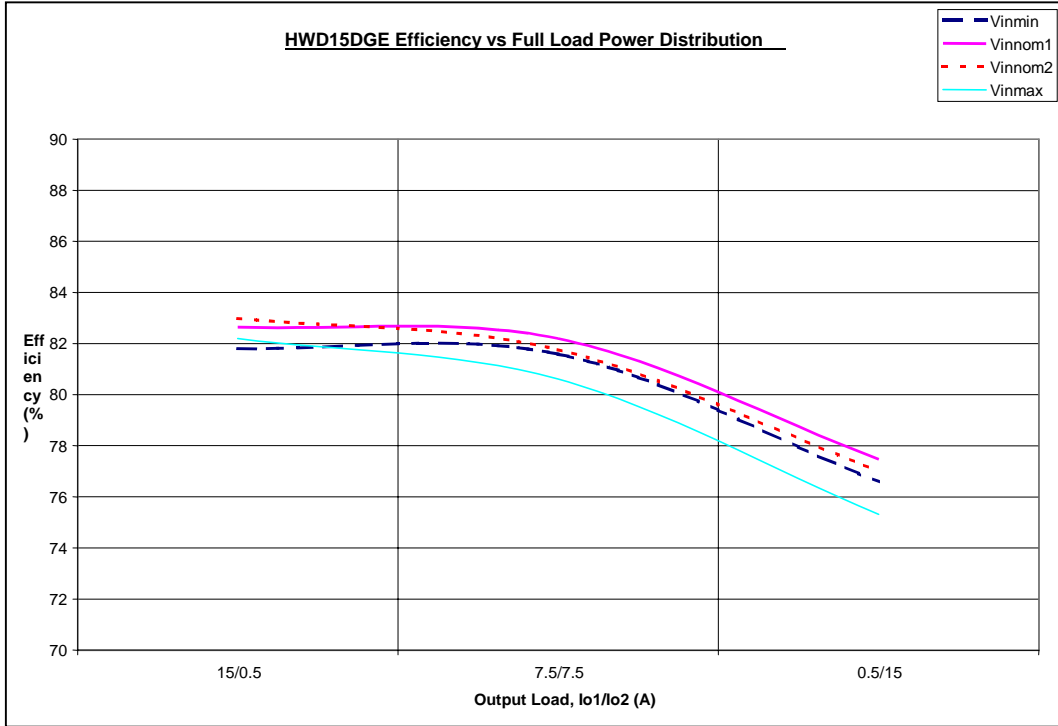


Figure 7. Efficiency vs Full Load Power Distribution

HWD Series – 75 Watt, Half-Brick DC/DC Converter
Wide Input Range
Dual Output

Characteristic Curves (con't)

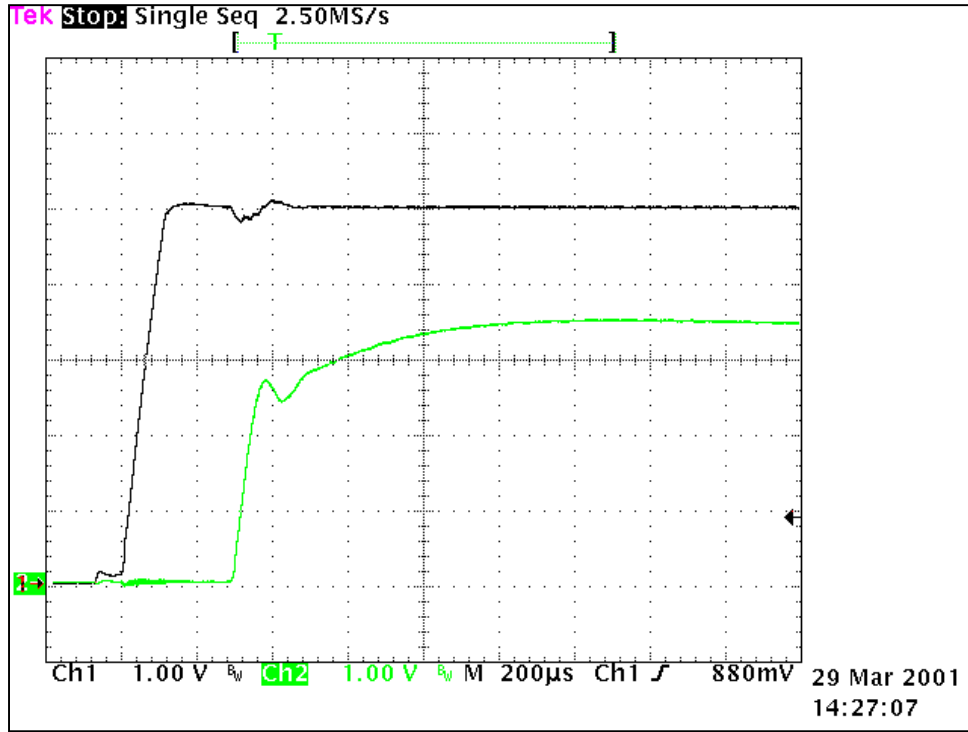


Figure 8. Typical Turn-on Characteristics

HWD Series – 75 Watt, Half-Brick DC/DC Converter
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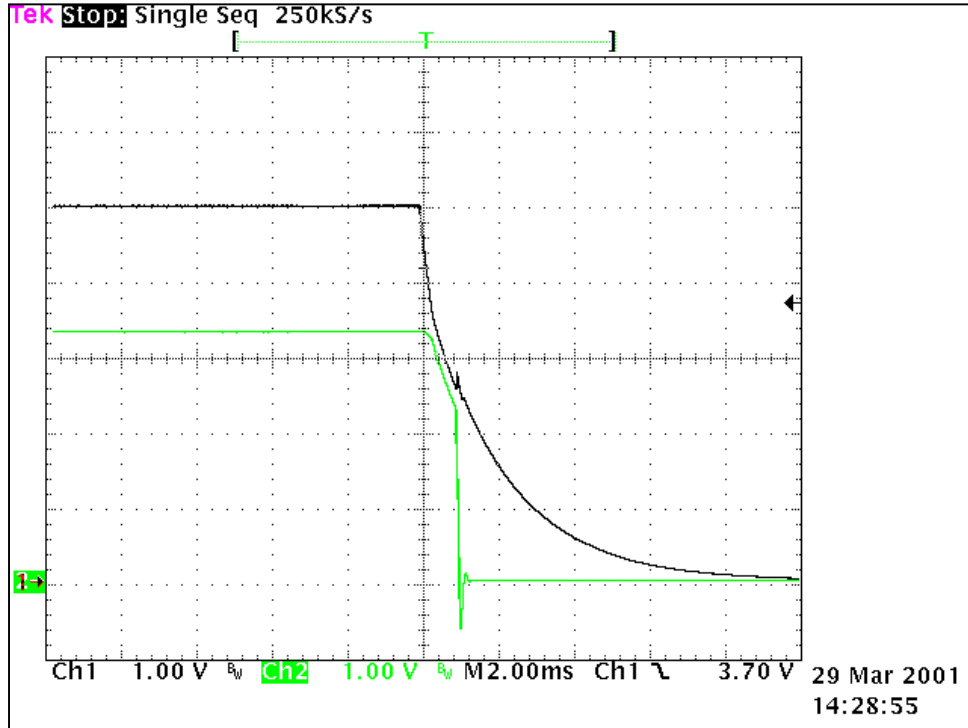


Figure 9. Typical Turn-off Characteristics