POWER GENERAL

HDQ1-100 Series

SINGLE OUTPUT DC-DC CONVERTERS

— 48V Input, 25A Output at 3.3V, 2.5V or 1.8V, 20A Output at 5V —

Features

- 36-75 VDC Input (48V, Nominal)
- 90% Efficiency (Typ.)
- Adjustable Output Voltage
- Remote On/Off Control
- Remote Sense
- Fixed, 375 kHz Operating Frequency
- Over-Voltage/Short-Circuit Protection
- Thermal Protection
- 1500V I/O Isolation
- Aluminum Base Plate
- International Safety Approvals
- Quarter-Brick Package only 0.4” High

Absolute Maximum Ratings

Characteristic	Description	Min.	Max.	Unit
T_C	Operating Case Temperature	-40	+115	°C
T_S	Storage Temperature	-40	+125	°C
V_{IN}	Input Voltage	-0.5	+80	V
V_{ISO}	Isolation Voltage (Input-to-Output Test Voltage)	1500	—	V
	Isolation Voltage (Input-to-Case)	750	—	V
	Isolation Voltage (Output-to-Case)	750	—	V
V_{RC}	Remote Control Voltage	—	75	V
I^2t	Inrush Transient	—	1.0	A^2s
V_{TRIM}	Maximum Trim Pin Input Voltage	—	6.0	V

Stress in excess of absolute maximum ratings may cause permanent damage. Absolute maximum ratings, sometimes referred to as no destruction limits, are normally tested with one parameter at a time exceeding the limits of output data or electrical characteristics.

If exposed to stress above these limits, function and performance may degrade in an unspecified manner. For design margin and to enhance system reliability, Power General recommends that HD series converters be operated at case temperatures below +90°C.

Input Ratings $T_C < T_{C(MAX)}$

Characteristic	Description	Conditions	Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage Range		36	—	75	V
$V_{I(OFF)}$	Turn-Off Input Voltage	Moving from higher voltage	31	33	—	V
$V_{I(ON)}$	Turn-On Input Voltage	Moving from lower voltage	—	33	35	V
C_I	Input Capacitance		—	1.0	—	µF
$i_{IRipple}$	Reflected Ripple Current	5 Hz to 20 MHz	—	10	—	mA_{pp}
$I_{I(MAX)}$	Maximum Input Current	V_{OUT} = 5.0V, V_{IN} = 36 to 75V, P_{OUT} = 100W	—	—	3.50	A
		V_{OUT} = 3.3V, V_{IN} = 36 to 75V, P_{OUT} = 66W	—	—	2.25	A
		V_{OUT} = 2.5V, V_{IN} = 36 to 75V, P_{OUT} = 50W	—	—	1.75	A
		V_{OUT} = 1.8V, V_{IN} = 36 to 75V, P_{OUT} = 36W	—	—	1.29	A
P_{IDLE}	Idling Input Power	I_{OUT} = 0	—	2.6	4.6	W
$P_{RC(OFF)}$	Standby Input Power*	V_I = 48V, Remote Control = OFF	—	0.4	0.6	W

POWER GENERAL
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HDQ1-100-5R0D

Output Characteristics T_C = -40 to +100°C, V_{IN} = 36 to 75 V, unless otherwise specified.

Characteristic and Description		Conditions	Min.	Typ.	Max.	Unit
$V_{OUT(0)}$	Initial Setting and Accuracy	T_C = +85°C, V_{IN} = 48V, I_{OUT} = 20A	4.97	5.00	5.03	V
V_{OUTAdj}	Ouput Adjustment Range	I_{OUT} = 0 to 20A	4.33	—	5.29	V
V_{OUTtol}	Ouput Tolerance Band	I_{OUT} = 0 to 20A	4.95	—	5.05	V
$V_{LineReg}$	Line Regulation	I_{OUT} = 20A	—	1.0	10	mV
$V_{LoadReg}$	Load Regulation	V_{IN} = 48V, I_{OUT} = 0 to 20A	—	1.0	10	mV
t_{tr}	V_{OUT} Transient Recovery Time	Load step = 5A, di/dt = 1.0A/10 µs (Notes 1, 2)	—	50	60	µs
V_{tr}	V_{OUT} Load Transient Deviation	Load step = 5A, di/dt = 1.0A/10 µs (Note 1)	—	100	—	mV_{pk}
t_{Start}	Start-up Time	From V_{IN} connection to V_{OUT} = 5.0V	—	25	40	ms
I_{OUT}	Output Current		0	—	20	A
P_{OUT}	Total Output Power		0	—	100	W
I_{LIMIT}	Current-Limit Threshold	T_C < +100°C	22	25	27	A
I_{SC}	Short-Circuit Current		—	25	29	A
V_{Ripple}	Output Ripple and Noise	I_{OUT} = 20A, f = 0 to 20 MHz (Note 1)	—	100	125	mV_{pp}
V_{inREJ}	Input Ripple Rejection	f < 1.0 kHz (Note 1)	-53	—	—	dB
OVP	V_{OUT} Over-Voltage Protection	V_{IN} = 48V	6.4	6.5	6.6	V
$t_{OVP(latch)}$	Over-Voltage Latch Delay		—	50	—	ms

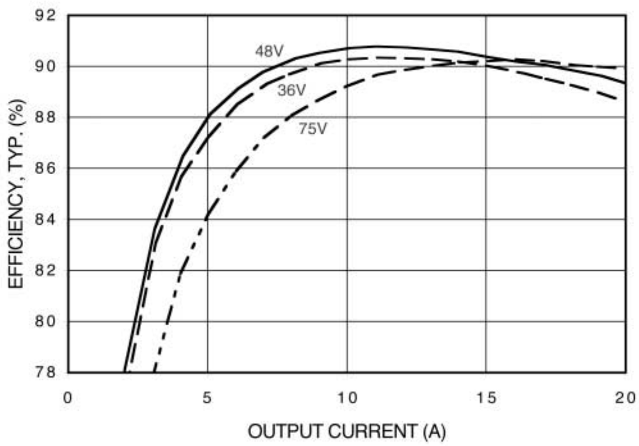
Note 1: Measured with 200 µF low-ESR (Ta) capacitor connected from $+V_{OUT}$ to $-V_{OUT}$
Note 2: To within 1 percent of initial V_{OUT}.

Device Characteristics

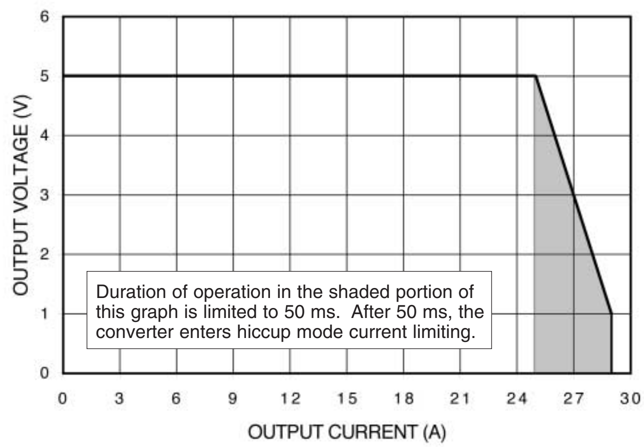
Characteristic and Description		Conditions	Min.	Typ.	Max.	Unit
η	Efficiency	T_C = +85°C, V_{IN} = 48V, P_{OUT} = 100W	—	89	—	%
		T_C = +85°C, V_{IN} = 36V, P_{OUT} = 100W	—	89	—	%
		T_C = +85°C, V_{IN} = 75V, P_{OUT} = 100W	—	90	—	%
P_D	Power Dissipation	V_{IN} = 48V, P_{OUT} = 100W	—	12	—	W
f_0	Switching Frequency	P_{OUT} = 10 to 100W	365	375	385	kHz

HDQ1-100-5R0D

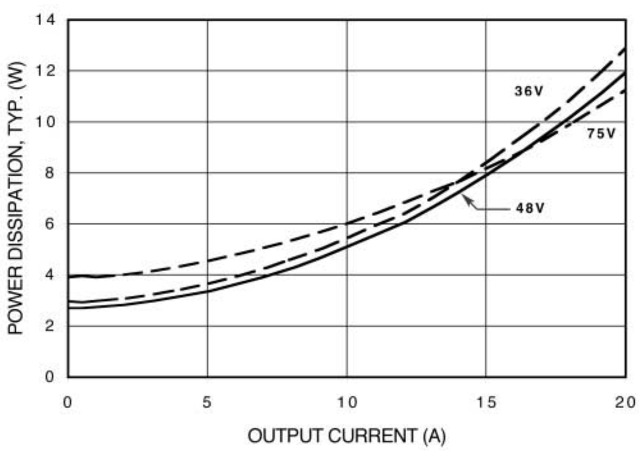
EFFICIENCY
AS A FUNCTION OF OUTPUT CURRENT



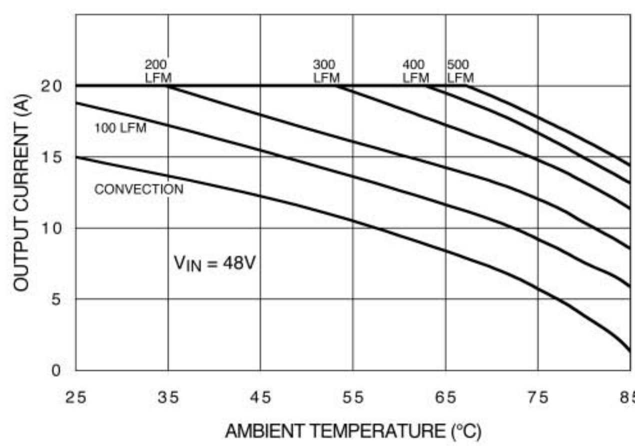
OUTPUT VOLTAGE
AS A FUNCTION OF OUTPUT CURRENT



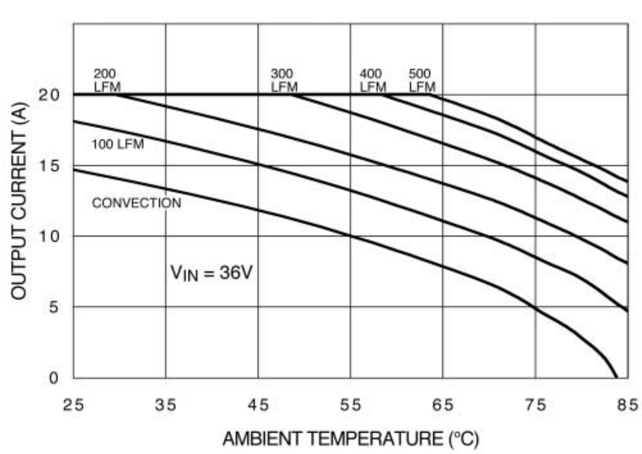
POWER LOSS
AS A FUNCTION OF OUTPUT CURRENT



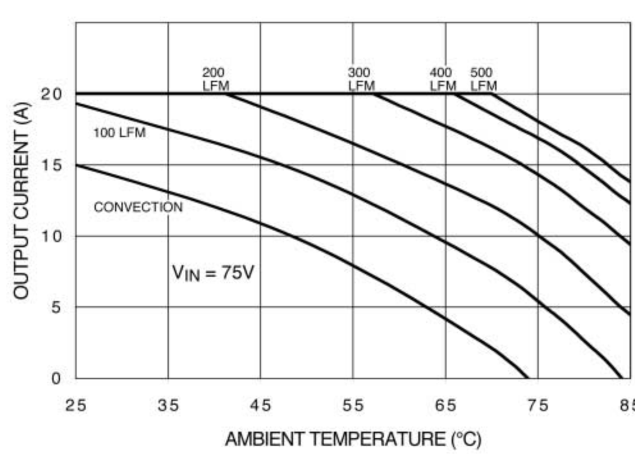
OUTPUT CURRENT DE-RATING
48V INPUT, NO HEAT SINK



OUTPUT CURRENT DE-RATING
36V INPUT, NO HEAT SINK



OUTPUT CURRENT DE-RATING
75V INPUT, NO HEAT SINK



HDQ1-100-3R3D

Output Characteristics T_C = -40 to +100°C, V_{IN} = 36 to 75 V, unless otherwise specified.

Characteristic and Description		Conditions	Min.	Typ.	Max.	Unit
$V_{OUT(0)}$	Initial Setting and Accuracy	T_C = +85°C, V_{IN} = 48V, I_{OUT} = 20A	3.25	3.30	3.35	V
V_{OUTAdj}	Ouput Adjustment Range	I_{OUT} = 0 to 20A	3.05	—	3.47	V
V_{OUTtol}	Ouput Tolerance Band	I_{OUT} = 0 to 20A	3.20	—	3.40	V
$V_{LineReg}$	Line Regulation	I_{OUT} = 20A	—	1.0	10	mV
$V_{LoadReg}$	Load Regulation	V_{IN} = 48V, I_{OUT} = 0 to 20A	—	1.0	10	mV
t_{tr}	V_{OUT} Transient Recovery Time	Load step = 5A, di/dt = 1.0A/10 µs (Notes 1, 2)	—	100	125	µs
V_{tr}	V_{OUT} Load Transient Deviation	Load step = 5A, di/dt = 1.0A/10 µs (Note 1)	—	100	—	mV_{pk}
t_{Start}	Start-up Time	From V_{IN} connection to V_{OUT} = 3.3V	—	25	40	ms
I_{OUT}	Output Current		0	—	25	A
P_{OUT}	Total Output Power		0	—	66	W
I_{LIMIT}	Current-Limit Threshold	T_C < +100°C	27	30	32	A
I_{SC}	Short-Circuit Current		—	30	34	A
V_{Ripple}	Output Ripple and Noise	I_{OUT} = 20A, f = 0 to 20 MHz (Note 1)	—	75	100	mV_{pp}
V_{inREJ}	Input Ripple Rejection	f < 1.0 kHz (Note 1)	-53	—	—	dB
OVP	V_{OUT} Over-Voltage Protection	V_{IN} = 48V	4.1	4.3	4.5	V
$t_{OVP(latch)}$	Over-Voltage Latch Delay		—	50	—	ms

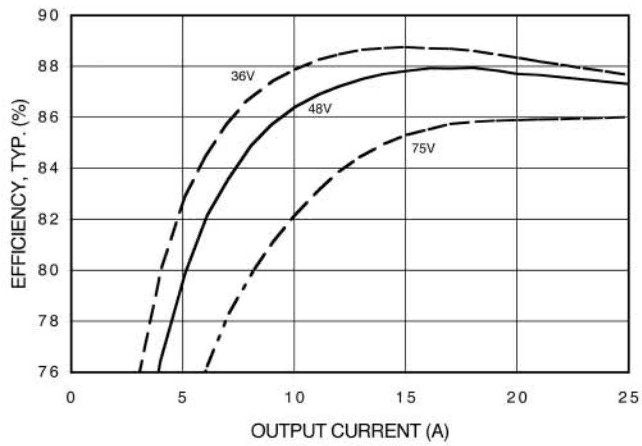
Note 1: Measured with 200 µF low-ESR (Ta) capacitor connected from $+V_{OUT}$ to $-V_{OUT}$
Note 2: To within 1 percent of initial V_{OUT}.

Device Characteristics

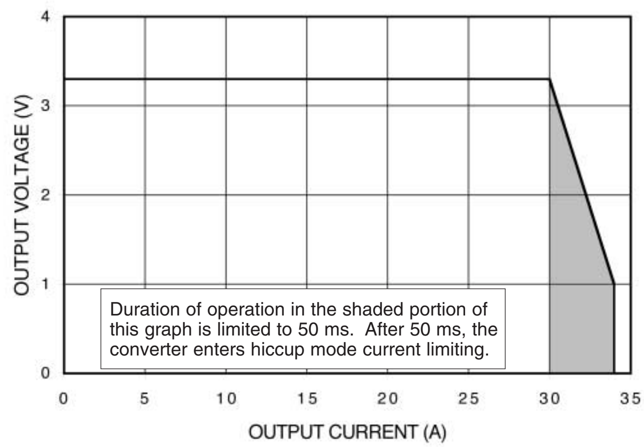
Characteristic and Description		Conditions	Min.	Typ.	Max.	Unit
η	Efficiency	T_C = +85°C, V_{IN} = 48V, P_{OUT} = 66W	—	88	—	%
		T_C = +85°C, V_{IN} = 36V, P_{OUT} = 66W	—	89	—	%
		T_C = +85°C, V_{IN} = 75V, P_{OUT} = 66W	—	86	—	%
P_D	Power Dissipation	V_{IN} = 48V, P_{OUT} = 66W	—	9.3	—	W
f_0	Switching Frequency	P_{OUT} = 6.6 to 66W	365	375	385	kHz

HDQ1-100-3R3D

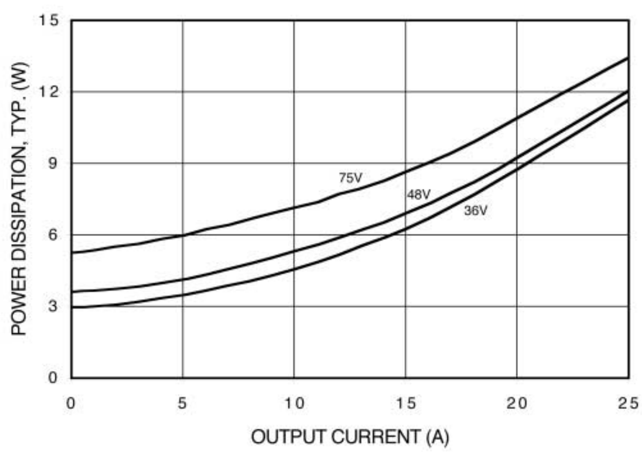
EFFICIENCY
AS A FUNCTION OF OUTPUT CURRENT



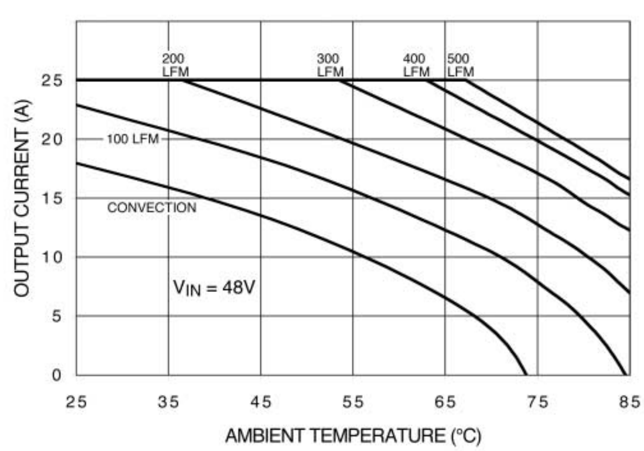
OUTPUT VOLTAGE
AS A FUNCTION OF OUTPUT CURRENT



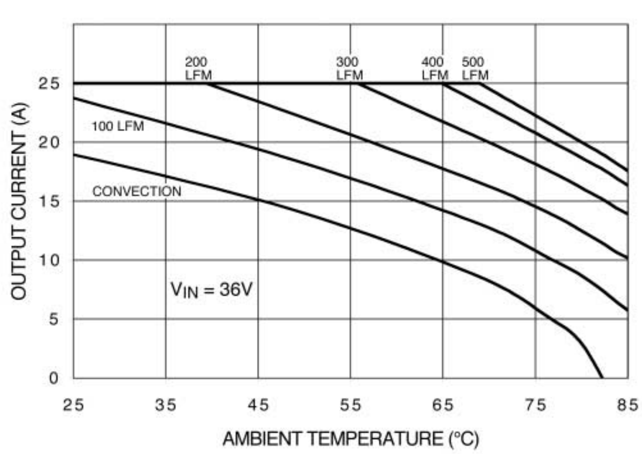
POWER LOSS
AS A FUNCTION OF OUTPUT CURRENT



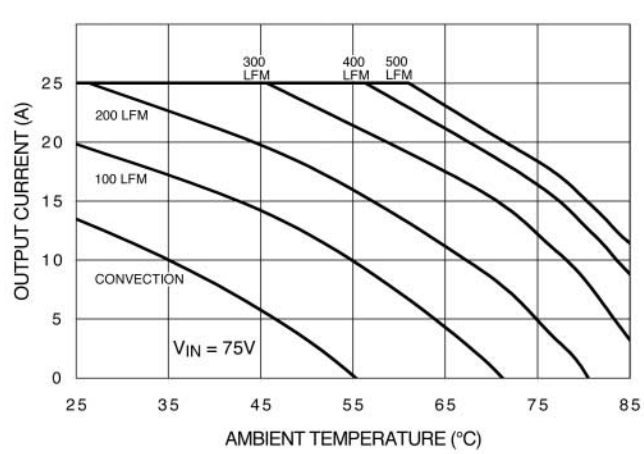
OUTPUT CURRENT DE-RATING
48V INPUT, NO HEAT SINK



OUTPUT CURRENT DE-RATING
36V INPUT, NO HEAT SINK



OUTPUT CURRENT DE-RATING
75V INPUT, NO HEAT SINK



HDQ1-100-2R5D

Output Characteristics T_C = -40 to +100°C, V_{IN} = 36 to 75 V, unless otherwise specified.

Characteristic and Description		Conditions	Min.	Typ.	Max.	Unit
$V_{OUT(0)}$	Initial Setting and Accuracy	T_C = +85°C, V_{IN} = 48V, I_{OUT} = 20A	2.475	2.50	2.525	V
V_{OUTAdj}	Ouput Adjustment Range	I_{OUT} = 0 to 20A	2.33	—	2.70	V
V_{OUTtol}	Ouput Tolerance Band	I_{OUT} = 0 to 20A	2.47	—	2.53	V
$V_{LineReg}$	Line Regulation	I_{OUT} = 20A	—	1.0	10	mV
$V_{LoadReg}$	Load Regulation	V_{IN} = 48V, I_{OUT} = 0 to 20A	—	1.0	10	mV
t_{tr}	V_{OUT} Transient Recovery Time	Load step = 5A, di/dt = 1.0A/10 µs (Notes 1, 2)	—	375	400	µs
V_{tr}	V_{OUT} Load Transient Deviation	Load step = 5A, di/dt = 1.0A/10 µs (Note 1)	—	300	—	mV_{pk}
t_{Start}	Start-up Time	From V_{IN} connection to V_{OUT} = 2.5V	—	25	40	ms
I_{OUT}	Output Current		0	—	25	A
P_{OUT}	Total Output Power		0	—	50	W
I_{LIMIT}	Current-Limit Threshold	T_C < +100°C	27	30	32	A
I_{SC}	Short-Circuit Current		—	30	34	A
V_{Ripple}	Output Ripple and Noise	I_{OUT} = 20A, f = 0 to 20 MHz (Note 1)	—	60	75	mV_{pp}
V_{inREJ}	Input Ripple Rejection	f < 1.0 kHz (Note 1)	-53	—	—	dB
OVP	V_{OUT} Over-Voltage Protection	V_{IN} = 48V	3.12	3.25	3.38	V
$t_{OVP(latch)}$	Over-Voltage Latch Delay		—	50	—	ms

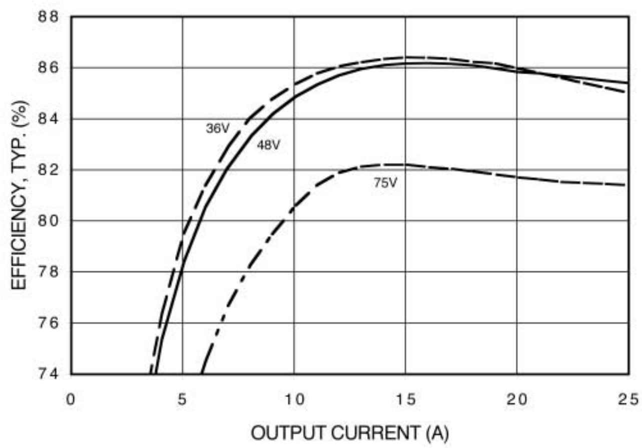
Note 1: Measured with 200 µF low-ESR (Ta) capacitor connected from $+V_{OUT}$ to $-V_{OUT}$
Note 2: To within 1 percent of initial V_{OUT}.

Device Characteristics

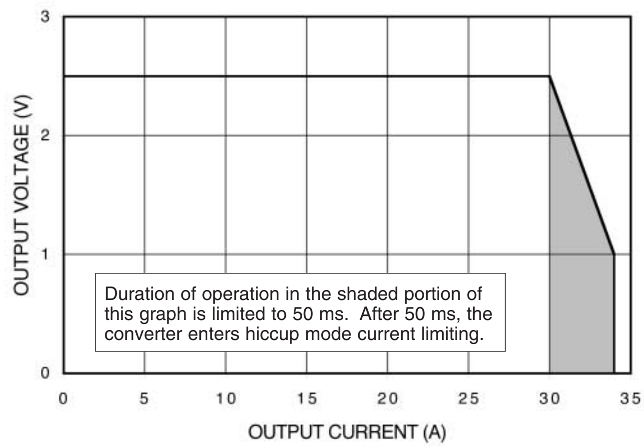
Characteristic and Description		Conditions	Min.	Typ.	Max.	Unit
η	Efficiency	T_C = +85°C, V_{IN} = 48V, P_{OUT} = 50W	—	86	—	%
		T_C = +85°C, V_{IN} = 36V, P_{OUT} = 50W	—	86	—	%
		T_C = +85°C, V_{IN} = 75V, P_{OUT} = 50W	—	82	—	%
P_D	Power Dissipation	V_{IN} = 48V, P_{OUT} = 50W	—	8.2	—	W
f_0	Switching Frequency	P_{OUT} = 5.0 to 50W	365	375	385	kHz

HDQ1-100-2R5D

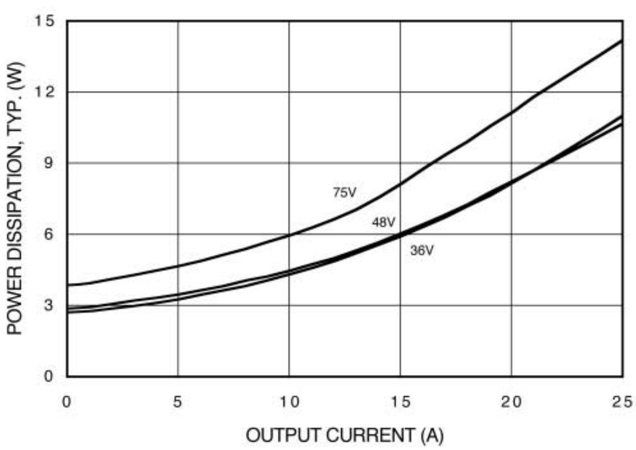
EFFICIENCY
AS A FUNCTION OF OUTPUT CURRENT



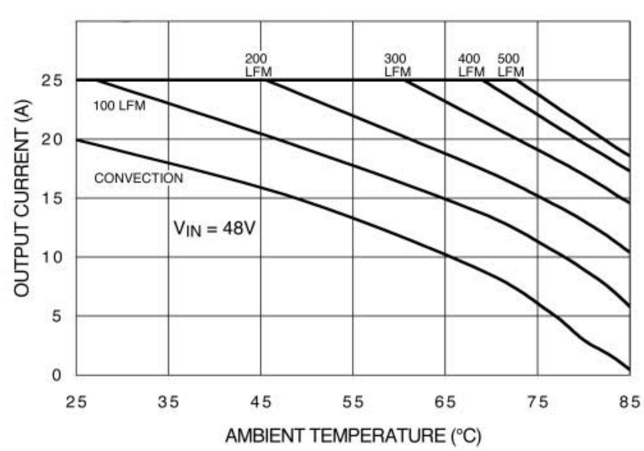
OUTPUT VOLTAGE
AS A FUNCTION OF OUTPUT CURRENT



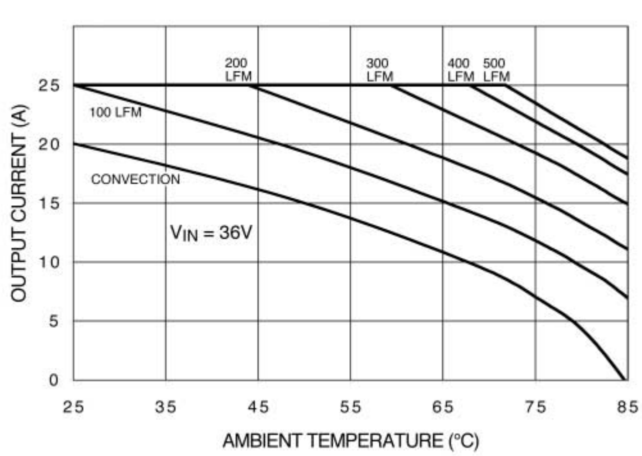
POWER LOSS
AS A FUNCTION OF OUTPUT CURRENT



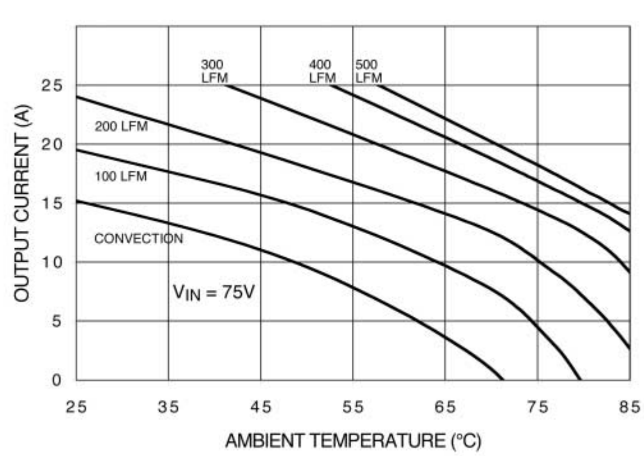
OUTPUT CURRENT DE-RATING
48V INPUT, NO HEAT SINK



OUTPUT CURRENT DE-RATING
36V INPUT, NO HEAT SINK



OUTPUT CURRENT DE-RATING
75V INPUT, NO HEAT SINK



HDQ1-100-1R8D

Output Characteristics T_C = -40 to +100°C, V_{IN} = 36 to 75 V, unless otherwise specified.

Characteristic and Description		Conditions	Min.	Typ.	Max.	Unit
$V_{OUT(0)}$	Initial Setting and Accuracy	T_C = +85°C, V_{IN} = 48V, I_{OUT} = 20A	1.78	1.80	1.82	V
V_{OUTAdj}	Ouput Adjustment Range	I_{OUT} = 0 to 20A	1.76	—	1.90	V
V_{OUTtol}	Ouput Tolerance Band	I_{OUT} = 0 to 20A	1.76	—	1.84	V
$V_{LineReg}$	Line Regulation	I_{OUT} = 20A	—	1.0	10	mV
$V_{LoadReg}$	Load Regulation	V_{IN} = 48V, I_{OUT} = 0 to 20A	—	1.0	10	mV
t_{tr}	V_{OUT} Transient Recovery Time	Load step = 5A, di/dt = 1.0A/10 µs (Notes 1, 2)	—	600	650	µs
V_{tr}	V_{OUT} Load Transient Deviation	Load step = 5A, di/dt = 1.0A/10 µs (Note 1)	—	300	—	mV_{pk}
t_{Start}	Start-up Time	From V_{IN} connection to V_{OUT} = 1.8V	—	25	40	ms
I_{OUT}	Output Current		0	—	25	A
P_{OUT}	Total Output Power		0	—	36	W
I_{LIMIT}	Current-Limit Threshold	T_C < +100°C	27	30	32	A
I_{SC}	Short-Circuit Current		—	30	34	A
V_{Ripple}	Output Ripple and Noise	I_{OUT} = 20A, f = 0 to 20 MHz (Note 1)	—	50	65	mV_{pp}
V_{inREJ}	Input Ripple Rejection	f < 1.0 kHz (Note 1)	-53	—	—	dB
OVP	V_{OUT} Over-Voltage Protection	V_{IN} = 48V	2.25	2.35	2.43	V
$t_{OVP(latch)}$	Over-Voltage Latch Delay		—	50	—	ms

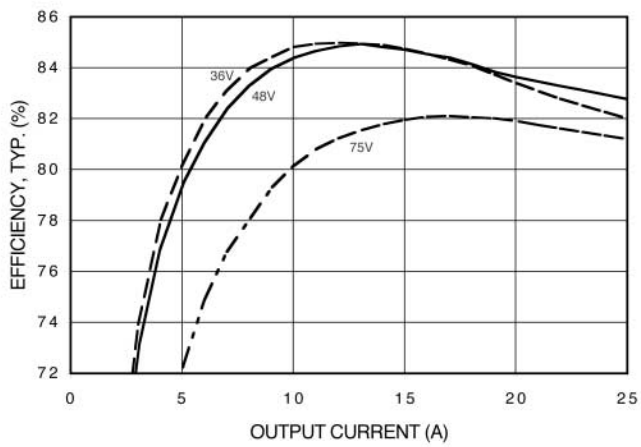
Note 1: Measured with 200 µF low-ESR (Ta) capacitor connected from $+V_{OUT}$ to $-V_{OUT}$
Note 2: To within 1 percent of initial V_{OUT}.

Device Characteristics

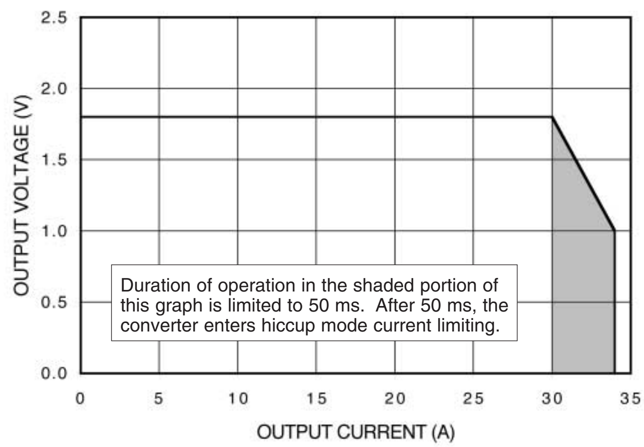
Characteristic and Description		Conditions	Min.	Typ.	Max.	Unit
η	Efficiency	T_C = +85°C, V_{IN} = 48V, P_{OUT} = 36W	—	84	—	%
		T_C = +85°C, V_{IN} = 36V, P_{OUT} = 36W	—	83	—	%
		T_C = +85°C, V_{IN} = 75V, P_{OUT} = 36W	—	82	—	%
P_D	Power Dissipation	V_{IN} = 48V, P_{OUT} = 36W	—	7.1	—	W
f_0	Switching Frequency	P_{OUT} = 3.6 to 36W	365	375	385	kHz

HDQ1-100-1R8D

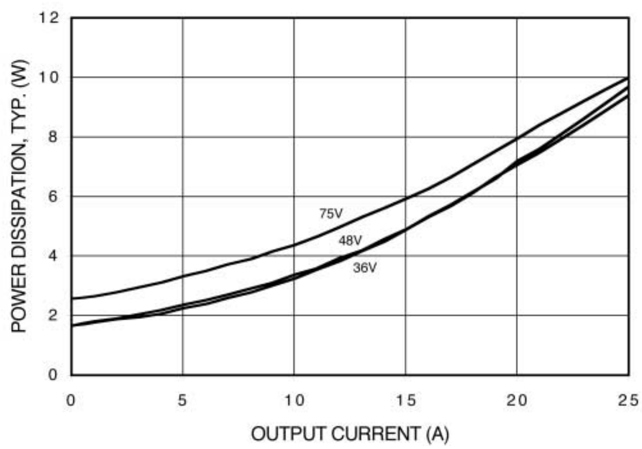
EFFICIENCY
AS A FUNCTION OF OUTPUT CURRENT



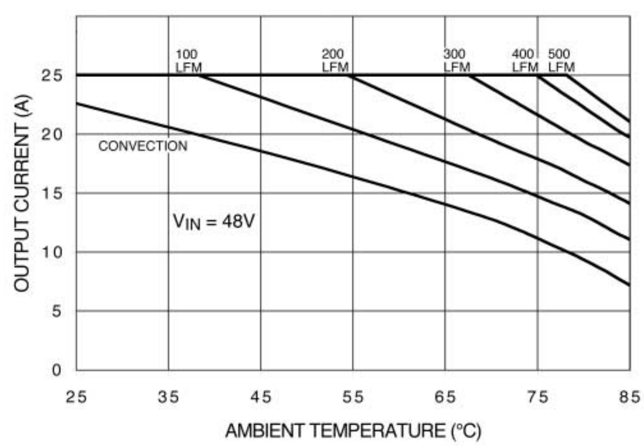
OUTPUT VOLTAGE
AS A FUNCTION OF OUTPUT CURRENT



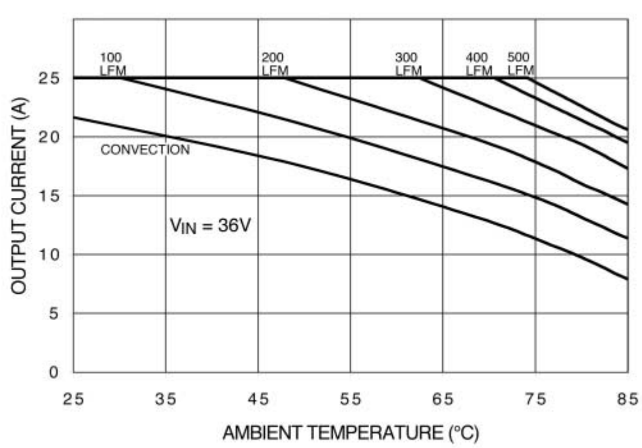
POWER LOSS
AS A FUNCTION OF OUTPUT CURRENT



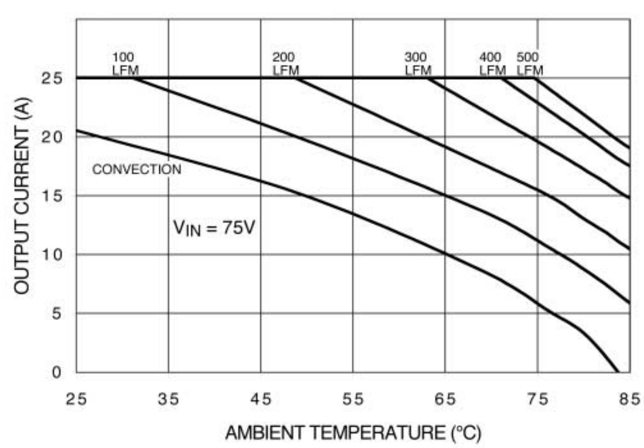
OUTPUT CURRENT DE-RATING
48V INPUT, NO HEAT SINK



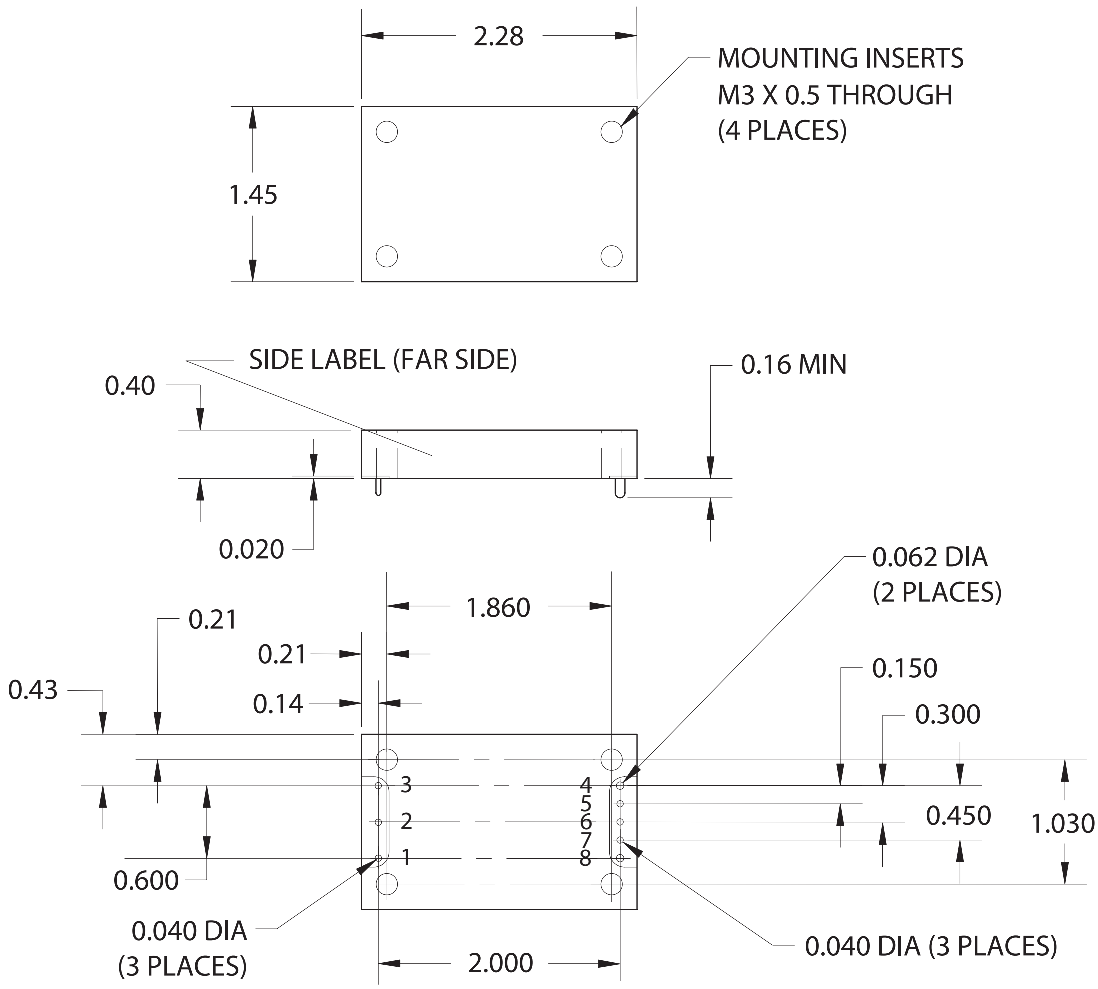
OUTPUT CURRENT DE-RATING
36V INPUT, NO HEAT SINK



OUTPUT CURRENT DE-RATING
75V INPUT, NO HEAT SINK



Mechanical Outline and Pin-Out



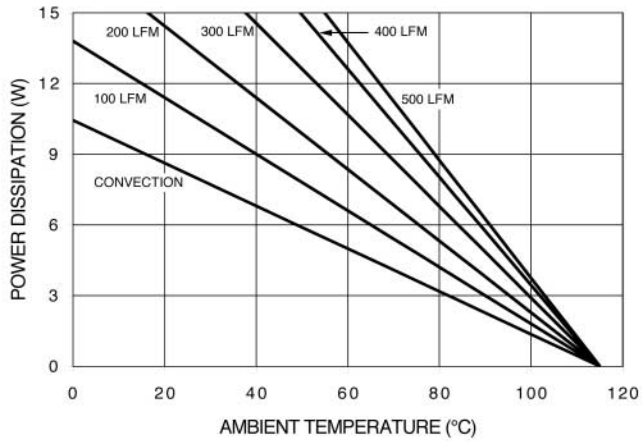
Pin	Function	Diameter*
1	+VIN	0.040 in.
2	On/Off	0.040 in.
3	–VIN	0.040 in.
4	–VOUT	0.060 in.
5	–Sense	0.040 in.
6	Trim	0.040 in.
7	+Sense	0.040 in.
8	+VOUT	0.060 in.

* Tolerance = ±0.002

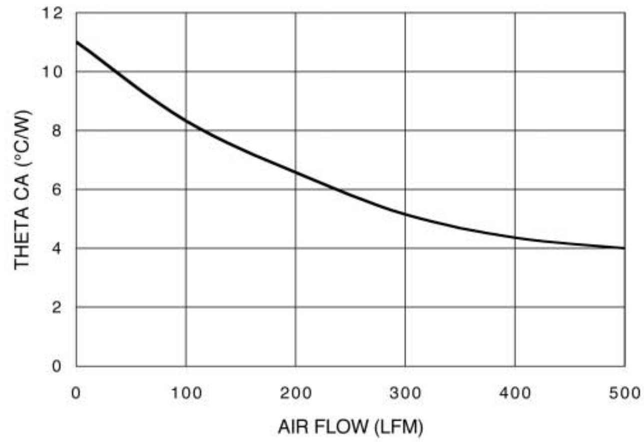
Note:

1. Dimensions are in inches.
2. Tolerances: 0.00 = ±0.02
   0.000 = ±0.010
3. Unit weight is 34g (1.2oz.).
4. Pins 2,5,6, and 7 are brass, plated with tin/lead over nickel.
5. Pins 1,3,4, and 8 are brass, plated with tin/lead over copper.

ALLOWABLE POWER DISSIPATION
NO HEAT SINK



THERMAL RESISTANCE
CASE-TO-AMBIENT, NO HEAT SINK



HDQ series dc-dc converters include a robust thermal design that allows operation at baseplate temperatures (T_C) of up to +115°C. The main cooling mechanism is convection (free or forced air) over the case or through an optional heat sink. Graphs on the preceding pages show output current limits for the converters that restrict case temperature to the baseplate maximum rating. Note that the ambient temperature is the air temperature adjacent to the converter, which is typically higher than room air temperature.

The thermal resistance plot of Θ_{CA}, in conjunction with the other graphs, can be used to estimate case temperatures and maximum output for specific system operating conditions. The thermal data can be used to determine thermal performance without a heat sink.

Case temperature is calculated by this formula:

$T_C = T_A + (P_D \times \Theta_{CA})$,
with $P_D = P_{OUT} (1/\eta - 1)$

Where:

T_C = Case Temperature (°C)
T_A = Air Temperature Adjacent to the Converter (°C)
P_D = Dissipated Power (W)
Θ_{CA} = Thermal Resistance from T_C to T_A (°C/W)

The efficiency ratings, η, can be found in tables and graphs on other pages. For design margin, and to enhance system reliability, Power General recommends that HDQ series dc-dc converters power modules be operated at case temperatures below +90°C.

Environmental Characteristics

Characteristic	Test Method	Specification	Conditions
Random Vibration	IEC 68-2-34 F_c	Frequency Spectral Density Duration	10 to 500 Hz 0.025 g^2/Hz 10 minutes, each direction
Sinusoidal Vibration	IEC 68-2-6 F_c	Frequency Amplitude Acceleration Number of Cycles	10 to 500 Hz 0.75 mm 10 g 10, each axis
Shock (Half-Sine)	IEC 68-2-27 E_a	Peak Acceleration Duration	100 g 3 ms
Temperature Change	IEC 68-2-14 N_a	Temperature Number of Cycles	-40°C to +100°C 300
Accelerated Damp Heat	IEC 68-2-3 C_a with Bias	Temperature Humidity Duration	+85°C 85% RH 500 hours
Solder Resistibility	IEC 68-2-20 T_b (Method 1A)	Solder Temperature Duration	+260°C 10 to 13 s

Safety

HDQ series dc-dc converters are designed in accordance with applicable requirements of EN60950, CAN/CSA-22.2 No. 60950-00, and UL60950 for the safety of information technology equipment.

The HDQ1-100 series is approved to CUL (File E140439), and EN60950 (TÜV file B 01 1018781 078). The IEC60950 CB test report for the series (090-106681-000) is available as part of CB Test Certificate DE 3-51064.

The converter's isolation attribute is a basic insulation rating. HD converters should be installed in end equipment in compliance with the requirements of the ultimate application, and are intended to be supplied by an isolated secondary circuit.

When the supply to the dc-dc converter meets all requirements for SELV (<60 VDC), the output is considered to remain within SELV Level 3 limits. If the converter is connected to a 60 VDC or higher voltage power system, basic insulation must be provided in the power supply that isolates the input from the mains.

Single-fault testing in the power supply must be performed in combination with the dc-dc converter to demonstrate that the output meets requirements for SELV: One pole of the input and one pole of the output is to be grounded, or both are to be kept floating. The galvanic isolation is verified in an electric strength test. The test voltage between input and output is 1,500 VDC for 60 seconds. In production tests, the test duration may be decreased to 1 second. I/O leakage current is less than 25 μA at 50 VDC.

Flammability ratings of terminal supports and internal plastic construction details meet UL 94V-0 rating requirements.

A fuse should be used at the input of each HDQ converter. If a fault occurs in the converter that imposes a short on the input source, this fuse will perform two functions:

- Isolate the failed module from the input source so that the remainder of the system may continue operation.
- Protect the distribution wiring from overheating.

A fast-blow fuse with a rating of 5A or less should be used. Power General recommends use a fuse with the lowest current rating that is suitable for the application.

Consideration should be given to measuring the converter's case temperature to comply with $T_{C(MAX)}$ rating when in operation. Good engineering practice in observation of that limit, including the use of auxiliary heat sinks or forced air cooling, is entirely the responsibility of the user.

Operating Information

Input Voltage

The input voltage range of 36V to 75V meets requirements for normal input ranges in -48V and -60V dc power systems. For most models, power loss is greater at input voltages elevated above the converters' nominal rating than at normal input voltage. The absolute maximum continuous input voltage is 75 VDC.

Remote Sense

HDQ series dc-dc converters have remote sense that can be used to compensate for moderate amounts of resistance in the distribution system and allow for voltage regulation at the load or another selected point. The remote sense lines carry very little current, and do not need a large cross-sectional area; however, the sense lines on a PCB should be located close to a ground trace or ground plane. In a discrete wiring situation, the use of twisted pair wires or other technique for reducing noise susceptibility is recommended. The power module will compensate for a voltage drop of up to 0.5V between the sense voltage and the voltage at the power module output pins. The output voltage and the remote sense voltage offset must be less than the minimum over-voltage trip point.

Current Limiting

Series HDQ dc-dc converters include current limiting circuitry that allows them able to withstand continuous overloads or short-circuit conditions on the output. The output voltage will decrease toward zero for heavy overloads. The power converter will resume normal operation after removal of the overload. The load distribution system should be designed to carry the maximum short-circuit output current specified.

Remote Control

The HDQ series offers a choice of remote ON/OFF control logic:

HDQ1-100 Model Suffix	V_{RC}*	Output
1	<=1.4V	OFF
	>1.4V to $V_{IN(MAX)}$ or open	ON
2	<=1.4V	ON
	>1.4V to $V_{IN(MAX)}$ or open	OFF

* Reference = $-V_{IN}$.

A mechanical device, or a semiconductor, such as an open-collector transistor or open-drain FET, can be used to switch remote control states. The mechanical switch or semiconductor should be capable of sinking up to 1.0 mA over the input voltage range of the converter.

Over-Voltage Protection

HDQ series dc-dc converters have latching output over-voltage protection. In the event of an over-voltage condition, the converter shuts down. Shut down is latched. Operation is restored by an input power OFF/ON reset.

Turn-On/Turn-Off Input Voltage

HDQ converters monitor the input voltage and turn on and off at preset levels shown in the Input Characteristics table.

Output Voltage Adjustment

HDQ series converters have an output voltage adjustment (trim) pin that can be used to move the output voltage above or below the factory-set initial V_{OUT}. Trim resistance values for upward and downward adjustment of output voltage can be taken from graphs on the following page.

When increasing output voltage, the voltage at the output pins (including any remote sensing offset) must be kept below the over-voltage trip point. At elevated output voltages, the maximum power rating of the converter remains the same, so output current capability will decrease.

Over-Temperature Protection

HDQ dc-dc converters are protected from thermal overload by an internal over-temperature shutdown circuit. When the case temperature exceeds +115°C, the converter will shut down. Operation is restored automatically as case temperature of the converter falls below +105°C.

Output Ripple and Noise

Output ripple is measured as a peak-to-peak voltage from 0 to 20 MHz, and includes the noise voltage and fundamental ripple. It is measured directly at the output pins.

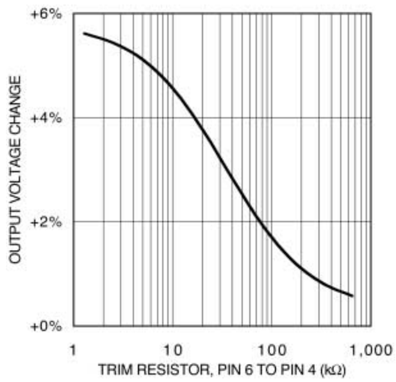
Input and Output Impedance

The impedance of both the power source and the load will interact with the impedance of the dc-dc converter. It is important to have the LC ratio as low as possible (a low characteristic impedance) at the input and output of the converter, since the HDQ series has a low energy storage capability. The converters are designed to be completely stable without the need for external capacitors on the input or output when configured with low-inductance input and output circuits. Performance in some applications, however, can be enhanced by the addition of external capacitance. If the distribution line from the input voltage source to the HDQ converter contains significant inductance, the addition of a 220 μF to 470 μF capacitor across the input of the power converter will help ensure stability. Tantalum capacitors are not recommended for this application, due to their low ESR value. This capacitor is not required when powering the converter from a low impedance source with short, low-inductance, input power leads.

Operating Information (Continued)

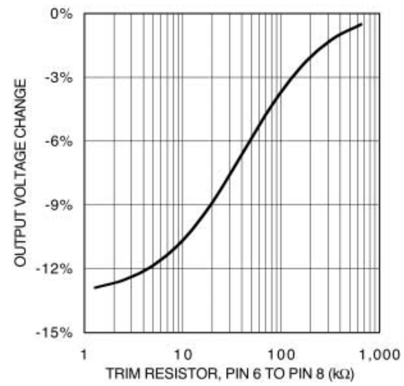
HDQ1-100-5R0D

Upward Output Voltage Adjustment



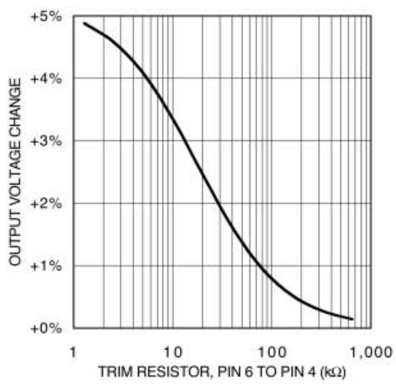
HDQ1-100-5R0D

Downward Output Voltage Adjustment



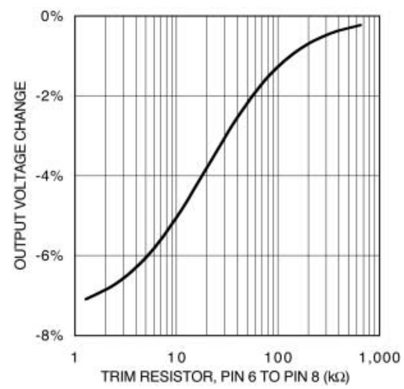
HDQ1-100-3R3D

Upward Output Voltage Adjustment



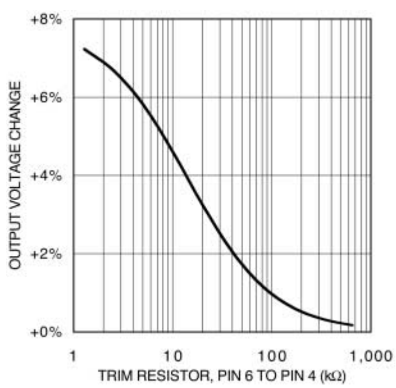
HDQ1-100-3R3D

Downward Output Voltage Adjustment



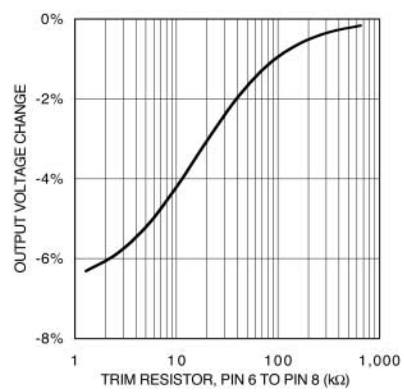
HDQ1-100-2R5D

Upward Output Voltage Adjustment



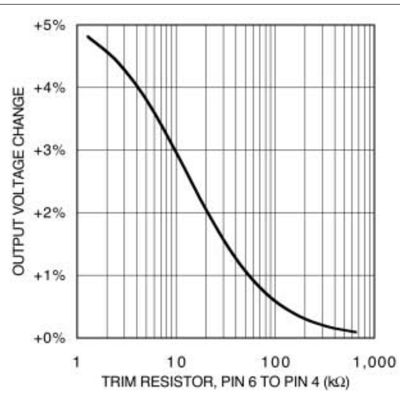
HDQ1-100-2R5D

Downward Output Voltage Adjustment



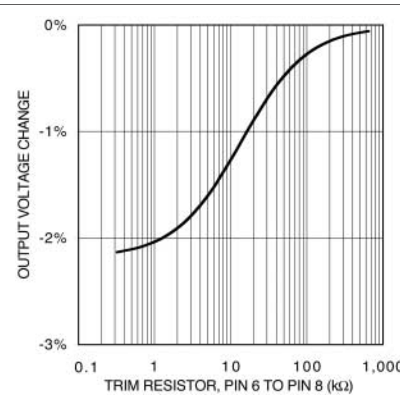
HDQ1-100-1R8D

Upward Output Voltage Adjustment



HDQ1-100-1R8D

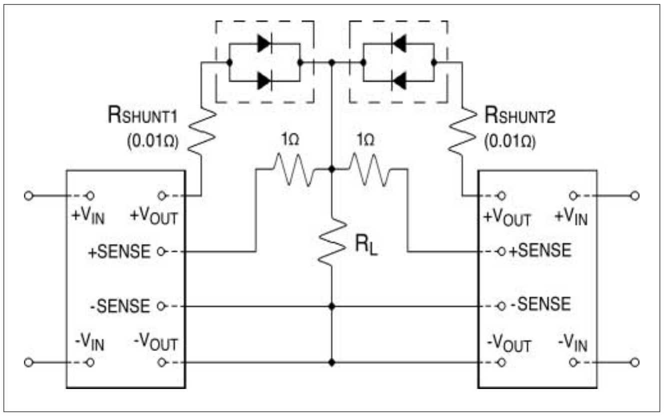
Downward Output Voltage Adjustment



Operating Information (Continued)

Parallel Operation for Redundancy

The drawing below shows how n+1 redundancy can be achieved. The diodes at the power converter outputs allow a failed unit to remove itself from the shared group without pulling down the common output bus. This configuration can be extended to additional numbers of HDQ converters, which can be controlled individually or in groups with appropriate signals to the converters' remote control pins.



Output Capacitance

When powering loads with significant dynamic current requirements, voltage regulation at the load can be improved by the addition of decoupling capacitance. The most effective technique is to install low-ESR ceramic capacitors as close to the load as possible, using several capacitors to lower the effective ESR. These ceramic capacitors will handle short-duration, high-frequency components of the dynamic current requirement. In addition, larger capacitance values, supplied by electrolytic capacitors, should be used to handle mid-frequency components. It is equally important to use good design practices when configuring the dc distribution system. Low-resistance and low-inductance PCB layouts and cabling should be used. When using remote sensing, all resistance, inductance and capacitance of the distribution system is within the feedback loop of the power converter. This can negatively affect the converter's compensation circuitry and the resulting stability and dynamic response performance. As a rule of thumb, a capacitance value of 100 µF for each ampere of output current can be used without additional analysis. For example, with a 20A, max., power converter, values of decoupling capacitance of up to 3,000 µF can be used without regard to stability. With larger values of capacitance, the load transient recovery time can exceed the specified value. As much of the capacitance as possible should be outside of the remote sensing loop and close to the load. The absolute maximum value of output capacitance is 10,000 µF. If use of values larger than this is under consideration, consult Power General applications engineering.

Quality

Reliability

The calculated MTBF of the HDQ converter family is 1.8 million hours, using Bellcore TR-332 methodology. The calculation is valid for a +85°C baseplate temperature.

Quality Systems

HD power converters are designed and manufactured in an industrial environment where quality systems and methods such as ISO 9000 and SPC are intensively used to enhance the company's continuous improvement strategy. Infant mortality or early failures in the products are screened out. All products are subjected to burn-in and ATE-based final test. Conservative design rules, strict design reviews, exacting component qualifications, and a competent, experienced and engaged work force contribute to the high quality of Power General products.

Warranty

Power General warrants to the original purchaser that the products conform to this data sheet and are free from material and workmanship defects for a period of two (2) years from the date of manufacture, if the product is used within specified conditions and not opened.

Limitation of Liability

Power General makes no other warranties, expressed or implied, including any warranty of merchantability or fitness for a particular purpose (including, but not limited to, use in life-support applications, where malfunctions of product can cause injury to a person's health or life).