INNOVATION and EXCELLENCE

Single Output
UNR Series

Non-Isolated, 5V-to-2.5V 8 and 10 Amp, DC/DC Converters

Features

- **Low cost!**
- **+4.75V to +5.5V inputs**
- **+2.5V (±25mV), 8 or 10 Amp outputs**
- **200kHz, synchronous-rectifier topology**
- **Low output noise, 40mVp-p**
- **Quick transient response, 30µsec**
- **High efficiencies: 90% for 8A, 89% for 10A**
- **–40 to +60/50°C operation with no derating**
- **Highly reliable, 100% SMT construction**
- **Remote on/off control**
- **Output short-circuit protection**
- **1" x 2" metal packages; EMC compliant**
- **IEC950/EN60950/UL1950 pending**
- **Modifications and customs for OEM's**

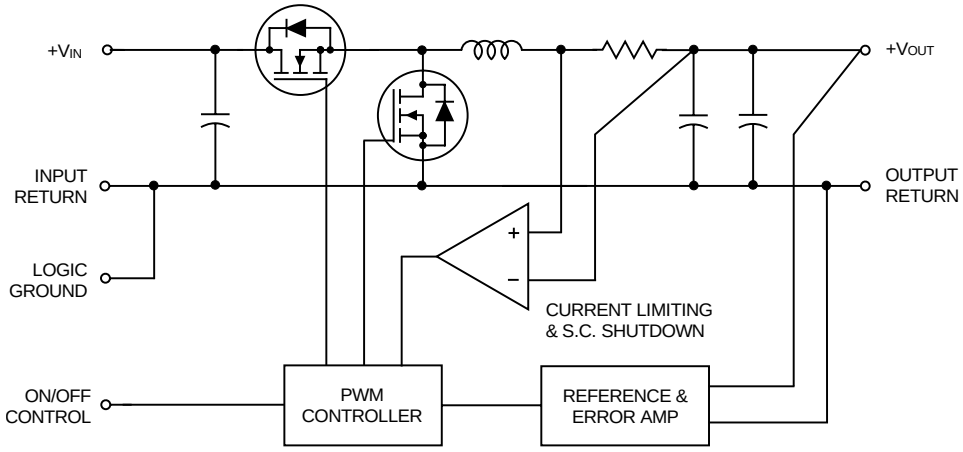
As supply voltages trend lower and load currents increase, centralized power systems become more impractical. The tight accuracy, low noise and quick transient response demanded by today's low-voltage, high-current CPU's, ASIC's and DSP's make power processing at the "point of use" the only viable solution.

Designing your own circuit to efficiently derive local, low-voltage power from higher-voltage buses (5V, 12V, 48V, etc.) becomes significantly more challenging as voltages decrease much below 3.3V.

When you are designing power-hungry 2.5V partitions or boards, consider DATEL's new UNR-2.5/8-D5 and UNR-2.5/10-D5 as your local power source. These non-isolated, 5V-to-2.5V DC/DC's deliver up to 8A or 10A, respectively. Packaged in 1" x 2" x 0.39" metal cases, these converters use synchronous rectification, planar magnetics and 100% automatic SMT assembly to bring you the most cost-effective 2.5V power available.

The 89% efficient 10A unit (UNR-2.5/10-D5) delivers its full 25 Watts from –40 to +50°C without heat sinking or forced-air cooling. The 90% efficient 8A unit (UNR-3.3/8-D5) operates at full power to +60°C. Both are fully line (±0.1%) and load (±0.5%) regulated and feature TTL-compatible on/off control. They can withstand sustained output short circuits and automatically recover to rated accuracy.

Because true low-voltage, high-current DC/DC's are not yet widely available, you're no doubt considering building your own buck regulator or compromising with an inefficient, step-down, linear regulator. It's time to consider the high efficiency, ease-of-use, and overall cost effectiveness of DATEL's 2.5V UNR's. Safety agency approvals and full EMI characterizations are currently in progress.



Signals applied to the On/Off Control are referenced to Logic Ground which is internally connected to Input/Output Return. The Logic Ground pin is not designed to carry heavy current. Do not install units with the Return pins open or connected via high-impedance runs.

Figure 1. Simplified Schematic

DATEL, Inc., Mansfield, MA 02048 (USA) • Tel: (508)339-3000, (800)233-2765 Fax: (508)339-6356 • Email: sales@datel.com • Internet: www.datel.com

Performance/Functional Specifications

Typical @ T_A = +25°C under nominal line voltage and full-load conditions, unless noted. ①

Input	
Input Voltage Range	4.75-5.5 Volts (5V nominal)
Input Current ②: UNR-2.5/8-D5	0.1/4.44A
UNR-2.5/10-D5	0.15/5.62A
Input Filter Type	Capacitive
Overvoltage Protection	None
Reverse-Polarity Protection	None
On/Off Control (Pin 2) ③	TTL high (or open) = on, low = off
Output	
V_{OUT} Accuracy (50% load)	±1% (±25mV) maximum
Temperature Coefficient	±0.02% per °C
Ripple/Noise (20MHz BW) ④	40mVp-p typical, 80mVp-p maximum
Line/Load Regulation	±0.1% maximum/±0.5% maximum
Efficiency: UNR-2.5/8-D5	90% typical, 86% minimum
UNR-2.5/10-D5	89% typical, 85% minimum
Current Limiting ⑤	Auto-recovery
Dynamic Characteristics	
Transient Response (50% load step)	30µsec to ±1% of final value
Switching Frequency	200kHz (±20kHz)
Environmental	
Operating Temperature (Ambient):	
Without Derating (8A/10A models)	–40 to +60/50°C
With Derating	to +100°C (Straight line to 0 Watts)
Storage Temperature	–40 to +105°C
Physical	
Dimensions	2" x 1" x 0.39" (51 x 25 x 9.9mm)
Shielding	5-sided
Case Connection	Pin 5 (Input Return)
Case Material	Corrosion resistant steel with non-conductive, epoxy-based, black enamel finish and plastic baseplate
Pin Material	Brass, solder coated
Weight	1.4 ounces (39.7 grams)

① Specifications apply to both models and require an external 470µF input capacitor rated for 6Arms ripple current and an external 22µF output capacitor with an ESR lower than 200mΩ. Both models have no minimum load requirements and will regulate under no-load conditions.
② No-load/full-load conditions. When the unit is off, the input "standby" current is typically 10mA.
③ See On/Off Control Functionality.
④ Output noise may be reduced by installing additional external capacitors across the output terminals. Caps should be selected for low ESR (typically 60mΩ) and located as close to the unit as possible.
⑤ Current limiting initiates at approximately 30% above rated load. Under short-circuit conditions, output current folds back to approximately 1A and remains there until the short is removed.

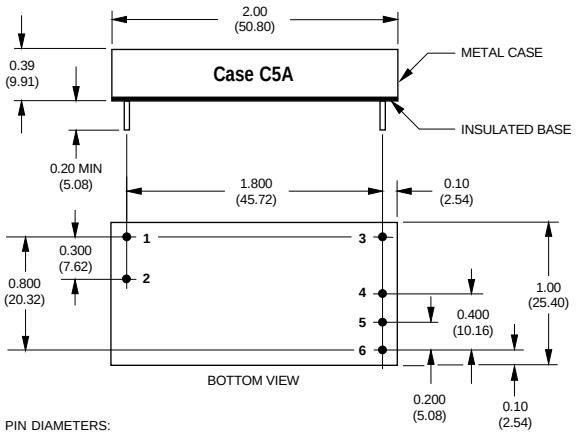
Absolute Maximum Ratings	
Input Voltage	7 Volts
Output Current	Current limited. Devices can withstand a sustained output short circuit without damage.
Storage Temperature	–40 to +105°C
Lead Temperature (soldering, 10 sec.)	+300°C

These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than those listed in the Performance/Functional Specifications Table is not implied.

On/Off Control Functionality

The On/Off Control pin has an internal 5kΩ pull-up resistor to $+V_{IN}$. It can be driven with any logic circuit capable of meeting the following drive requirements. Logic "0" = 0 to +0.8V. Logic "1" = +2.0V to $+V_{IN}$. I_{IH} ($@V_{IN}$ = +2.0V) = –0.7mA. I_{IL} ($@V_{IN}$ = 0V) = –1.1mA. Open collector logic or a single NPN drive transistor can be used. The drive circuit should be rated for more than 5.5V. Applying a voltage to pin 2 when no input power is applied to the converter can cause permanent damage to the converter.

MECHANICAL SPECIFICATIONS



PIN DIAMETERS:
MODEL UNR-2.5/8-D5, PINS 1-6: 0.040 ±0.002DIA. (1.016 ±0.051)
MODEL UNR-2.5/10-D5, PINS 1-2: 0.040 ±0.002DIA. (1.016 ±0.051)
PINS 3-6: 0.062 ±0.002DIA. (1.575 ±0.051)

I/O Connections	
Pin	**Function P9**
1	Logic Ground
2	On/Off Control
3	+Output
4	Output Return
5	Input Return
6	+Input

Note:

The case is connected to pin 5 (Input Return).

ORDERING INFORMATION

UNR-2.5/8-D5	Non-Isolated, 5V-to-2.5V, 20 Watt, DC/DC Converter
UNR-2.5/10-D5	Non-Isolated, 5V-to-2.5V, 25 Watt, DC/DC Converter

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DS-0431A 6/99

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DATEL®
INNOVATION and EXCELLENCE

Single Output
UNR Series

Non-Isolated, 12V-to-2.5V 8 and 10 Amp, DC/DC Converters

Features

- **+10.4V to +13.6V inputs**
- **+2.5V (±25mV), 8 or 10 Amp outputs**
- **200kHz, synchronous-rectifier topology**
- **Low output noise, 60mVp-p**
- **Quick transient response, 30µsec**
- **High efficiencies: 88% for 8A, 86% for 10A**
- **–40 to +50/40°C operation with no derating**
- **On/off control; Undervoltage shutdown**
- **Output short-circuit protection**
- **Highly reliable, 100% SMT construction**
- **1" x 2" metal packages; EMC compliant**
- **IEC950/EN60950/UL1950 pending**
- **Modifications and customs for OEM's**

As supply voltages trend lower, centralized power becomes more impractical. The tight accuracy, low noise and quick transient response demanded by today's low-voltage, high-current CPU's, ASIC's and DSP's make power processing at the "point of use" the only viable solution. Designing your own circuit to efficiently derive local, low-voltage power from higher-voltage buses (5V, 12V, 48V, etc.) becomes significantly more challenging as voltages decrease much below 3.3V.

If you're designing a power-hungry 2.5V partition and you cannot get enough power (via step-down regulators) from your already-overloaded +5V bus, consider tapping into your +12V bus with one of DATEL's non-isolated, 12V-to-2.5V DC/DC's. The UNR-2.5/8-D12 (8A output) and UNR-2.5/10-D12 (10A output) combine synchronous rectification, planar magnetics and 100% automatic SMT assembly in a 2" x 1" x 0.48" metal package to bring you the most cost-effective 2.5V power.

The 86% efficient 10A unit delivers 25 Watts from –40 to +40°C. The 88% efficient 8A unit delivers full power to +50°C. Both are fully line and load regulated. They feature input undervoltage shutdown (at 9.6V), output short-circuit protection (foldback technique with auto-recovery), and TTL-compatible on/off control.

Because true low-voltage, high-current DC/DC's are not yet widely available, you're no doubt considering building your own buck regulator or compromising with an inefficient, step-down, linear regulator. It's time to consider the high efficiency, ease-of-use, and overall cost effectiveness of DATEL's 2.5V UNR's. Safety agency approvals and full EMI characterizations are currently in progress.

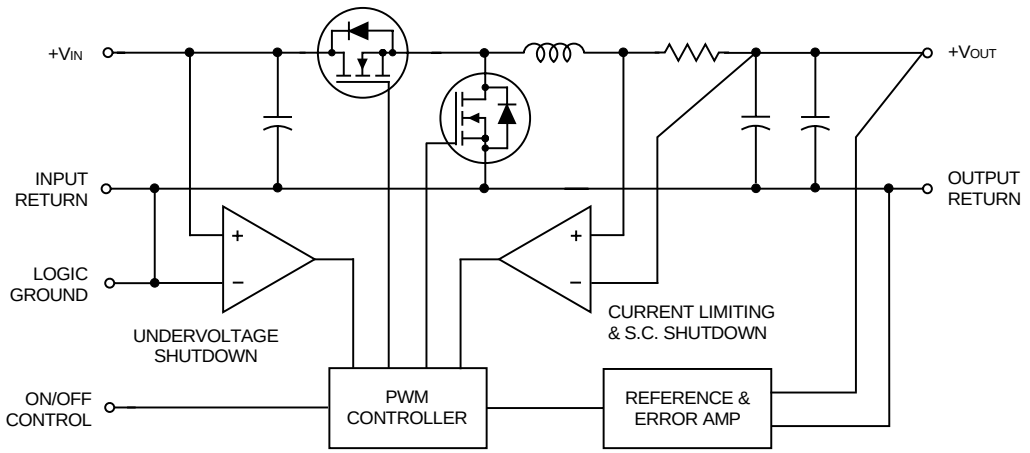

Figure 1. Simplified Schematic

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Performance/Functional Specifications

Typical @ T_A = +25°C under nominal line voltage and full-load conditions, unless noted. ①

Input	
Input Voltage Range	10.4-13.6 Volts (12V nominal)
Input Current ②: UNR-2.5/8-D12	0.1/1.89A
UNR-2.5/10-D12	0.1/2.41A
Input Filter Type	Capacitive
Overvoltage Protection	None
Reverse-Polarity Protection	None
Start-Up Threshold ③	10.2V typical, 10.4V maximum
Undervoltage Shutdown ③	9.6V typical, 8.2V minimum
On/Off Control (Pin 2) ④	TTL high (or open) = on, low = off
Output	
V_{OUT} Accuracy (50% load)	±1% (±25mV) maximum
Temperature Coefficient	±0.02% per °C
Ripple/Noise (20MHz BW) ⑤	40mVp-p typical, 80mVp-p maximum
Line/Load Regulation	±0.1% maximum/±0.625% maximum
Efficiency: UNR-2.5/8-D12	88% typical, 85% minimum
UNR-2.5/10-D12	86% typical, 83% minimum
Current Limiting ⑥	Auto-recovery
Dynamic Characteristics	
Transient Response (50% load step)	30µsec to ±1% of final value
Switching Frequency	200kHz (±20kHz)
Environmental	
Operating Temperature (Ambient):	
Without Derating (8A/10A models)	–40 to +50/40°C
With Derating	to +100°C (Straight line to 0 Watts)
Storage Temperature	–40 to +105°C
Physical	
Dimensions	2" x 1" x 0.48" (51 x 25 x 12.2mm)
Shielding	5-sided
Case Connection	Pin 5 (Input Return)
Case Material	Corrosion resistant steel with non-conductive, epoxy-based, black enamel finish and plastic baseplate
Pin Material	Brass, solder coated
Weight	1.4 ounces (39.7 grams)

① Specifications apply to both models and require an external 470µF input capacitor rated for 6Arms ripple current and an external 22µF output capacitor with an ESR lower than 200mΩ. Both models have no minimum load requirements and will regulate under no-load conditions.
② No-load/full-load conditions. When the unit is off, the input "standby" current is typically 10mA.
③ On start-up, devices will not regulate properly until the input reaches approximately +10.2V. If the input drops below +9.6V, units will turn off. Restart requires bringing the input back to +10.2V.
④ See On/Off Control Functionality.
⑤ Output noise may be reduced with additional external capacitors across the output terminals. Caps should have low ESR (typically 60mΩ) and be located as close to the unit as possible.
⑥ Current limiting initiates at approximately 30% above rated load. Under short-circuit conditions, output current folds back to approximately 1A and remains there until the short is removed.

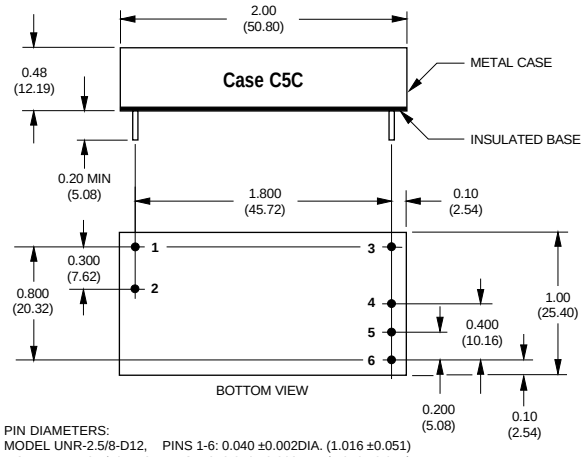
Absolute Maximum Ratings	
Input Voltage	15 Volts
Output Current	Current limited. Devices can withstand a sustained output short circuit without damage.
Storage Temperature	–40 to +105°C
Lead Temperature (soldering, 10 sec.)	+300°C

These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than those listed in the Performance/Functional Specifications Table is not implied.

On/Off Control Functionality

The On/Off Control pin has an internal 12kΩ pull-up resistor to $+V_{IN}$. It can be driven with any logic circuit capable of meeting the following drive requirements. Logic "0" = 0 to +0.8V. Logic "1" = +2.0V to $+V_{IN}$. I_{IH} (@V_{IN} = +2.0V) = –1mA. I_{IL} (@V_{IN} = 0V) = –1.1mA. Open collector logic or a single NPN drive transistor can be used. The drive circuit should be rated for more than 13.6V. Applying a voltage to pin 2 when no input power is applied to the converter can cause permanent damage to the converter.

MECHANICAL SPECIFICATIONS



PIN DIAMETERS:
MODEL UNR-2.5/8-D12, PINS 1-6: 0.040 ±0.002DIA. (1.016 ±0.051)
MODEL UNR-2.5/10-D12, PINS 1-2: 0.040 ±0.002DIA. (1.016 ±0.051)
PINS 3-6: 0.062 ±0.002DIA. (1.575 ±0.051)

I/O Connections	
Pin	**Function P9**
1	Logic Ground
2	On/Off Control
3	+Output
4	Output Return
5	Input Return
6	+Input

Note:

The case is connected to pin 5 (Input Return).

ORDERING INFORMATION

UNR-2.5/8-D12	Non-Isolated, 12V-to-2.5V, 20 Watt, DC/DC Converter
UNR-2.5/10-D12	Non-Isolated, 12V-to-2.5V, 25 Watt, DC/DC Converter

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NON-ISOLATED DC/DC CONVERTER SELECTION GUIDE

2.5V SINGLE OUTPUT, NON-ISOLATED

Output Current (Amps, Max.)	Input Voltage, Nominal (Range) (Volts)	Package ①		Regulation		Ripple / Noise ② (mVp-p)	Efficiency (Min.)	DATEL Model Number	Data Sheet @ www.datel.com
		Dimensions (Inches)	Case, Pinout	Line (Max.)	Load (Max.)				
2	5 (4.75-5.5)	1 x 1 x 0.45	C7A, P9	±0.25%	±0.5%	30	83%	UNR-2.5/2-D5	UNR, 5W
8	5 (4.75-5.5)	2 x 1 x 0.39	C5A, P9	±0.1%	±0.5%	40	86%	UNR-2.5/8-D5	UNR, 20/25W
	12 (10.4-13.6)	2 x 1 x 0.48	C5C, P9	±0.1%	±0.6%	40	85%	UNR-2.5/8-D12	UNR, 20/25W
10	5 (4.75-5.5)	2 x 1 x 0.39	C5A, P9	±0.1%	±0.5%	40	85%	UNR-2.5/10-D5	UNR, 20/25W
	12 (10.4-13.6)	2 x 1 x 0.48	C5C, P9	±0.1%	±0.6%	40	83%	UNR-2.5/10-D12	UNR, 20/25W
12	5 (4.75-5.5)	2 x 1 x 0.44	C5B, P9	±0.1%	±0.5%	40	84%	UNR-2.5/12-D5	UNR, 30W
20	5 (4.5-5.5)	2 x 2 x 0.49	C21, P26	±0.1%	±1.0%	60	85%	UNR-2.5/20-D5 ③	Contact DATEL

3.3V SINGLE OUTPUT, NON-ISOLATED

3	5 (4.75-5.5)	1 x 1 x 0.45	C7A, P9	±0.4%	±0.5%	30	86%	UNR-3.3/3-D5	UNR, 10W
	7.5 (4.75-13.6)	2 x 0.4 x 0.8 ④	B1, P18	±1.0%	±3.0%	50	90% ⑥	UNS-3.3/3-D5	UNS, 10/15W
	7.5 (4.75-13.6)	2 x 0.8 x 0.4 ⑤	B2, P18	±1.0%	±3.0%	50	90% ⑥	UNS-3.3/3-D5D	UNS, 10/15W
	12 (10.4-13.6)	1 x 1 x 0.45	C7A, P9	±0.25%	±0.5%	100	87%	UNR-3.3/3-D12	UNR, 10W
8	5 (4.75-5.5)	2 x 1 x 0.39	C5A, P9	±0.1%	±0.5%	40	88%	UNR-3.3/8-D5	UNR, 26/33W
	5 (4.75-5.5)	2 x 1 x 0.39	C16A, P23	±0.1%	±0.5%	40	88%	UNR-3.3/8-D5T ③ ⑧	Contact DATEL
	5 (4.75-5.5)	2 x 0.4 x 0.53 ⑨	B3, P27	±0.1%	±0.5%	40	88%	USN-3.3/8-D5 ③	Contact DATEL
	12 (10.4-13.6)	2 x 1 x 0.48	C5C, P9	±0.1%	±0.6%	60	86%	UNR-3.3/8-D12	UNR, 26/33W
	12 (10.4-13.6)	2 x 1 x 0.48	C16C, P23	±0.1%	±0.6%	60	86%	UNR-3.3/8-D12T ③ ⑧	Contact DATEL
10	5 (4.75-5.5)	2 x 1 x 0.39	C5A, P9	±0.1%	±0.5%	40	86%	UNR-3.3/10-D5	UNR, 26/33W
	5 (4.75-5.5)	2 x 1 x 0.39	C16A, P23	±0.1%	±0.5%	40	86%	UNR-3.3/10-D5T ③ ⑧	Contact DATEL
	5 (4.75-5.5)	2 x 0.4 x 0.53 ⑨	B3, P27	±0.1%	±0.5%	40	86%	USN-3.3/10-D5 ③	Contact DATEL
	12 (10.4-13.6)	2 x 1 x 0.48	C5C, P9	±0.1%	±0.6%	60	85%	UNR-3.3/10-D12	UNR, 26/33W
	12 (10.4-13.6)	2 x 1 x 0.48	C16C, P23	±0.1%	±0.6%	60	85%	UNR-3.3/10-D12T ③ ⑧	Contact DATEL
12	5 (4.75-5.5)	2 x 1 x 0.44	C5B, P9	±0.1%	±0.5%	40	87%	UNR-3.3/12-D5	UNR, 40W
20	5 (4.5-5.5)	2 x 2 x 0.49	C21, P26	±0.1%	±1.0%	50	87%	UNR-3.3/20-D5 ③	Contact DATEL

5V SINGLE OUTPUT, NON-ISOLATED

3	12 (6-16.5)	2 x 0.4 x 0.8 ④	B1, P18	±1.0%	±3.0%	50	92% ⑥	UNS-5/3-D12	UNS, 10/15W
	12 (6-16.5)	2 x 0.8 x 0.4 ⑤	B2, P18	±1.0%	±3.0%	50	92% ⑥	UNS-5/3-D12D	UNS, 10/15W
5 ⑦	12 (10.4-13.6)	2 x 1 x 0.48	C13, P21	±0.25%	±0.5%	60	87%	UNR-5/5-D12	UNR, 25W

Listed specifications are typical at T_A = +25°C under nominal line voltage and full-load conditions, unless noted.
① See individual product data sheets for mechanical specifications and pinouts.
② Ripple/Noise is specified over a 20MHz bandwidth.
③ Listed specifications for these products are preliminary.
④ 10-pin SIP package.
⑤ 10-pin DIP package.
⑥ Listed specification is a typical.
⑦ Output voltage is user adjustable from 3.3 to 6V.
⑧ Output voltage is user adjustable from 1.4 to 3.6V.
⑨ Industry-standard, 11-pin SIP package.

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