



# U30

## 30W UNIVERSAL DUAL DC/DC CONVERTER

Customizable for specific inputs and outputs  
*Incorporates technology from Beta Dyne's patents*

### Key Features

- Efficiency up to 85%
- Synchronous rectification
- 3:1 input voltage range
- Input under/overvoltage protection
- Input-to-output isolation
- Soft start
- Master/slave synchronization
- Hiccup mode
- 2mA off state current
- Adjustable outputs
- 330kHz switching frequency
- Thermal protection
- Dual isolated outputs
- Six-sided shielding
- External synchronization (Optional)

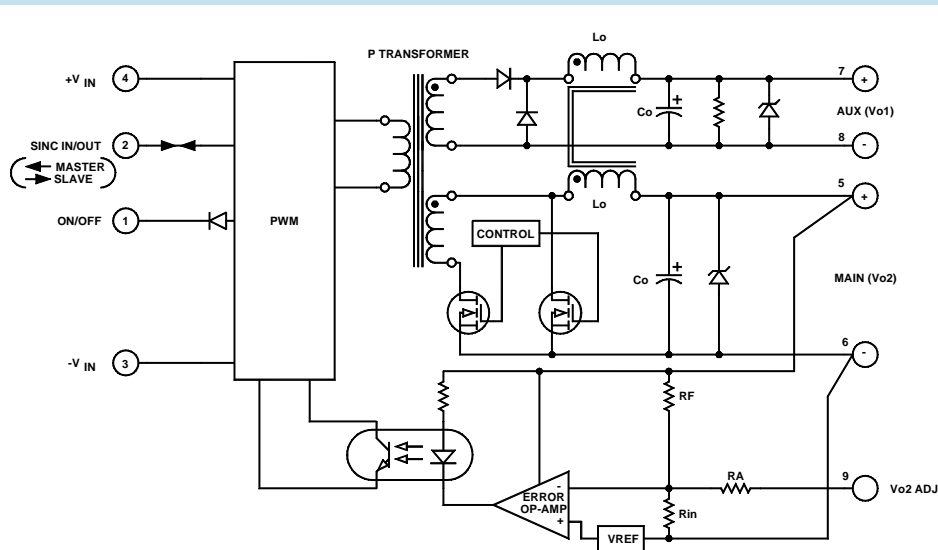


### Applications

- Instrumentation
- Communications
- DSL Power
- Computers
- Test Equipment

### Functional Description

The U30 is a family of 30W Universal Dual DC/DC Converters with operating ranges from 10–30, 22–68, 40–120V<sub>IN</sub>; and a maximum output power of 30W. The converter incorporates synchronous rectification for its main output V<sub>O2</sub> and rectifying diodes for its auxiliary output V<sub>O1</sub>. The customer can specify any output voltage range from 2.5V to 18V for V<sub>O1</sub> and V<sub>O2</sub>. V<sub>O2</sub> can deliver 25W, while V<sub>O1</sub> can deliver up to 10W. *The total output power must not exceed 30W* (see Table 1). The converter can be set to accept an external sync signal or provide a sync signal as master to synchronize other slave units. Its input stage is designed to meet UL60950 and EN55022 specifications. The converter incorporates technology from Beta Dyne's patents. (The specs under Output Specifications on Sheet 2 are examples for a ±5V<sub>OUT</sub> converter; complete specs will be provided based on customer specified models.)



Typical Block Diagram

## Electrical Specifications

Unless otherwise specified, all parameters are given under typical +25°C with nominal input voltage and under full output load conditions.

### INPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Input Voltage Range	See Model Selection Guide				
Input Startup Voltage	See Model Selection Guide				
Input Overvoltage Protection	See Model Selection Guide				
Overvoltage Hysteresis			5	10	Vdc
Undervoltage Hysteresis			3	6	Vdc
Input Filter	$\pi$ (Pi)				
Reverse Polarity	External series-blocking diode				
Reflected Ripple <sup>1,2</sup>	$I_o = FL, C_{IN} = 50\mu F$ , See Figures 3 & 5		6		mA <sub>PP</sub>
No Load Input Current	See Model Selection Guide				
Input Surge Current (20 $\mu$ S Spike)				10	A
Short Circuit Current Limit <sup>3</sup>	Hiccup mode		130		% I <sub>IN</sub> Max
Off State Current			2		mA
Remote ON/OFF Control					
Supply ON	Pin 1 Open (Open circuit voltage: 10V max.)				
Supply OFF		0		0.8	Vdc
Logic Input Reference	-Input for ON/OFF and SYNC				
Logic Compatibility for Reference	TTL Open Collector or CMOS Open Drain				
Sync In <sup>4</sup>	TTL, Input resistance 50k $\Omega$ minimum, See Figure 9 <b>Must read Footnote 4</b>	3		5	Vdc
Sync Out <sup>4</sup>	See Figure 9, <b>Must read Footnote 4</b>	7	10	15	Vdc

### OUTPUT SPECIFICATIONS (EXAMPLE FOR A U30D5-5/XX, SEE ORDERING GUIDE)

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Output Voltage, Main (V <sub>O2</sub> ) <sup>*</sup>			$\pm 5$		Vdc
Output Accuracy, Main (V <sub>O2</sub> ) <sup>*</sup>			1	2	%
Output Voltage, Aux (V <sub>O1</sub> )	Output loading FL to 10% FL	$\pm 5$	$\pm 5.2$	$\pm 6.8$	Vdc
Output Accuracy, Aux (V <sub>O1</sub> )	Output fully loaded (1A)		$\pm 10$	$\pm 15$	%
Ripple & Noise	See Figure 6A		1		%V <sub>PP</sub> of V <sub>OUT</sub>
Output Current, Main (I <sub>O2</sub> )				5	A
Output Current, Aux (I <sub>O1</sub> )		100		1000	mA
Line Regulation, Main (V <sub>O2</sub> )			$\pm 0.5$	$\pm 1$	%
Line Regulation, Aux (V <sub>O1</sub> )	Output fully loaded (V <sub>O2</sub> load = 10% FL)		$\pm 3$	$\pm 5$	%
Load Regulation, Main (V <sub>O2</sub> )	10% FL to FL, See Figure 7		$\pm 1$	$\pm 2$	%
Load Regulation, Aux (V <sub>O1</sub> ) <sup>5</sup>	FL to 10% FL	5	10	40	%
Temperature Coefficient @ FL			0.02		%/°C
Transient Response Time	Main output (50% FL to FL to 50% FL), V <sub>O1</sub> Fully loaded See Figures 6A & 6B		50	100	$\mu$ S
Short Circuit Protection	By input current limiting (Hiccup mode)				
Output Adjust Range <sup>6</sup>	V <sub>O1</sub> & V <sub>O2</sub> (Tracking)	$\pm 5$		$\pm 10$	%
Output Overvoltage Protection	V <sub>O1</sub> & V <sub>O2</sub> by zener diode across each output		6.8		Vdc
Output Capacitance	Total capacitance of V <sub>O1</sub> + V <sub>O2</sub>		1000	3300	$\mu$ F

\* The  $\pm$  sign for the V<sub>O2</sub> and V<sub>O1</sub> values indicate that both outputs can be connected at the system ground to provide either voltage polarity.

### GENERAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Efficiency			85		%
Isolation Voltage (1 min.), Input to Output			1500		Vdc
Isolation Voltage (1 min.), Output to Output			500		Vdc
Isolation Resistance	Input to output		10 <sup>9</sup>		$\Omega$
Isolation Capacitance	Input to output		2700		pF
Switching Frequency			330		kHz
Turn On Delay	See Figure 4		5		mS
Soft Start Time	See Figure 4		2.5		mS

## ENVIRONMENTAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Operating Temperature Range (Ambient)	Industrial, See Figure 2	-40		+71	°C
Storage Temperature Range		-55		+125	°C
Thermal Resistance	°C per watt internally dissipated		4	5	°C/W <sub>DISS</sub>
Maximum Operating Case Temperature				115	°C
Derating	See Figure 2				
Cooling	Free-air convection				
EMWRFI	Six-sided continuous shielded metal case				
MTBF	per MIL-HNBK-217F (Ground benign, +25°C)		534,000		hours
Humidity	Up to 95% non-condensing				
Thermal Shutdown	Case Temperature	105	110	115	°C
Thermal Hysteresis		2	5		°C

## PHYSICAL CHARACTERISTICS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Dimensions (LxWxH)	2.00x2.00x0.50 in. (50.80x50.80x12.70mm)				
Weight	2.43 oz. (69g)				
Case Material	Coated metal				
Shielding Connection, 24V <sub>IN</sub> <sup>7</sup>	Case and Header connected to -V <sub>N</sub> (Pin 3)				
Shielding Connection, 48V <sub>IN</sub> to 120V <sub>N</sub> <sup>7</sup>	Case and Header connected to +V <sub>N</sub> (Pin 4)				

<sup>1</sup> A minimum 56µF 200V capacitor is required to be installed at the input of the converter for EN55022-A compatibility.

<sup>2</sup> For EN55022-B compatibility, the external filter given in Figure 3 is recommended.

<sup>3</sup> The maximum input current at any given input range measured at minimum input voltage is given as 1.6\*I<sub>NOMINAL</sub>. Nominal input current is the typical value measured at the input of the converter under full-load room temperature and nominal input voltage (80Vdc).

<sup>4</sup> When the converter is designated as a Master, the output driver's amplitude can be anywhere from 7 to 15V with a typical of 10V. Use a resistance divider to reduce the amplitude to the required logic voltage. For 5V TTL, use 210kΩ. Do not forget to take into consideration the 50kΩ minimum sync-in resistance if more than three Slaves will be driven from the Master unit.

<sup>5</sup> A dual isolated output converter is generated from the single output converter by floating V<sub>O1</sub> (see Figure 1). A 10% minimum load is required.

<sup>6</sup> The internal voltage reference of the error amplifier is referenced to -V<sub>O2</sub> (Pin 6).

<sup>7</sup> If synchronization is not required, the case and header can be connected to Pin 2 (per customer requirements).

## Model Selection Guide

Models listed below are examples. See the Ordering Guide to create your own model.

MODEL NUMBER	INPUT					OUTPUT				
	Voltage (Vdc)		Current (mA)		Reflected Ripple (mA <sub>PP</sub> )	Voltage (Vdc)		Current (mA)		Efficiency Full Load (%)
	Nominal	Range	No Load	Full Load		V <sub>O2</sub>	V <sub>O1</sub>	V <sub>O2</sub>	V <sub>O1</sub>	
U30D5-5/24	24	10-30	140	1580	20	5	5	5	1	81
U30D5-5/48	48	22-68	70	766	15	5	5	5	1	83
U30D5-5/120	80	40-120	40	450	10	5	5	5	1	85

\* For Master/Slave Synchronization, see Ordering Guide.

### ORDERING GUIDE

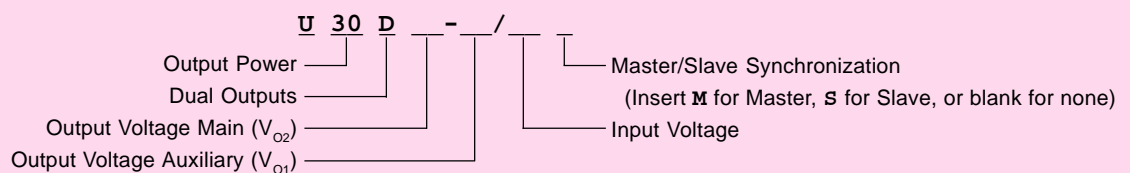
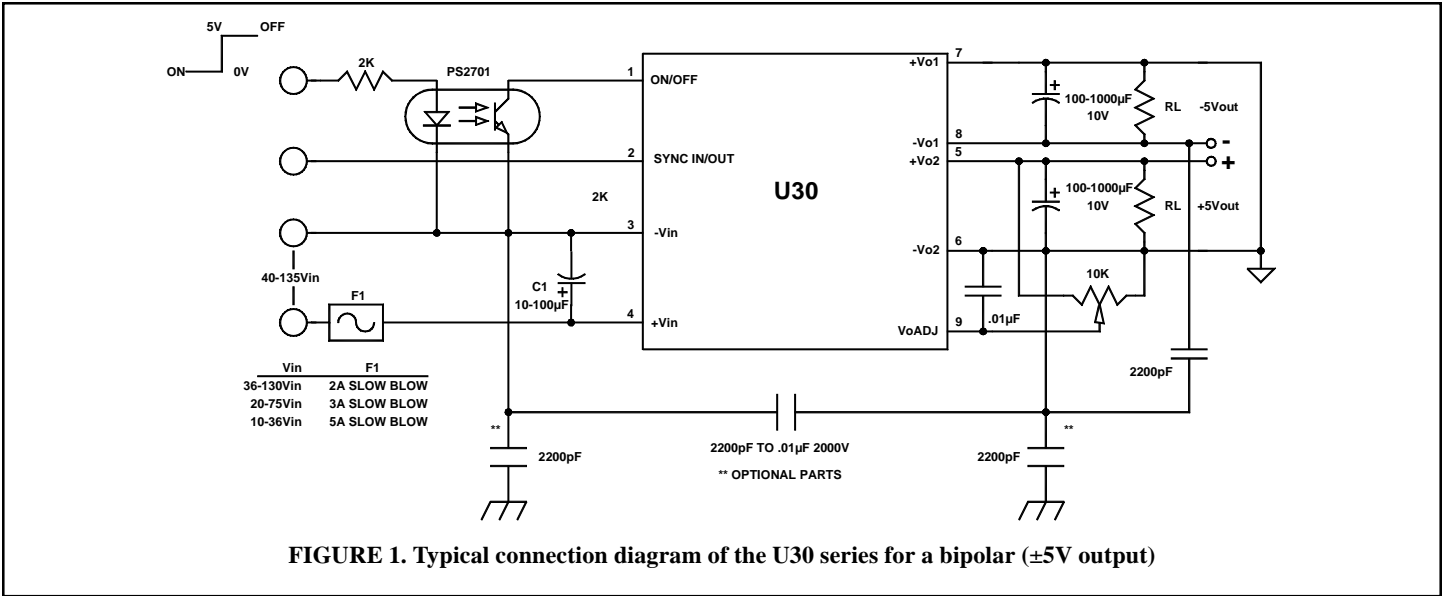


TABLE 1. Examples of V/I combinations for V<sub>O2</sub> and V<sub>O1</sub>

V <sub>O2</sub> (V)	I <sub>O2</sub> (A)	V <sub>O1</sub> (V)	I <sub>O1</sub> (A)	P <sub>O</sub> (W)
2.5	6	18	0.83	30
3.3	6	12	0.83	30
5	4	15	0.67	30
12	2	5	1.20	30
12	1.5	12	1.00	30

NOTE: The total output power must not exceed 30W and the maximum output current rating per output must not exceed 7A for V<sub>O2</sub> and 2A for V<sub>O1</sub>.



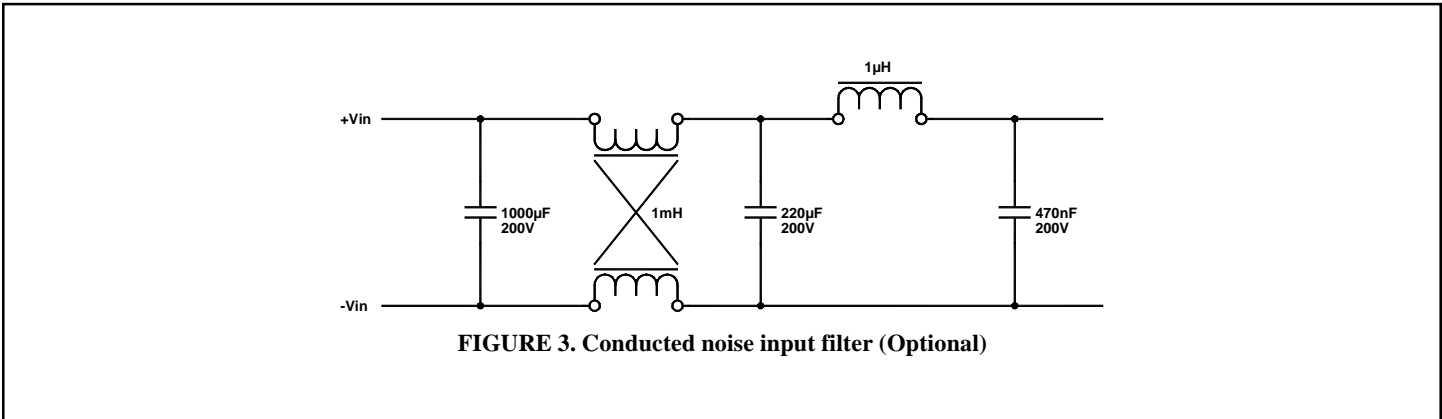
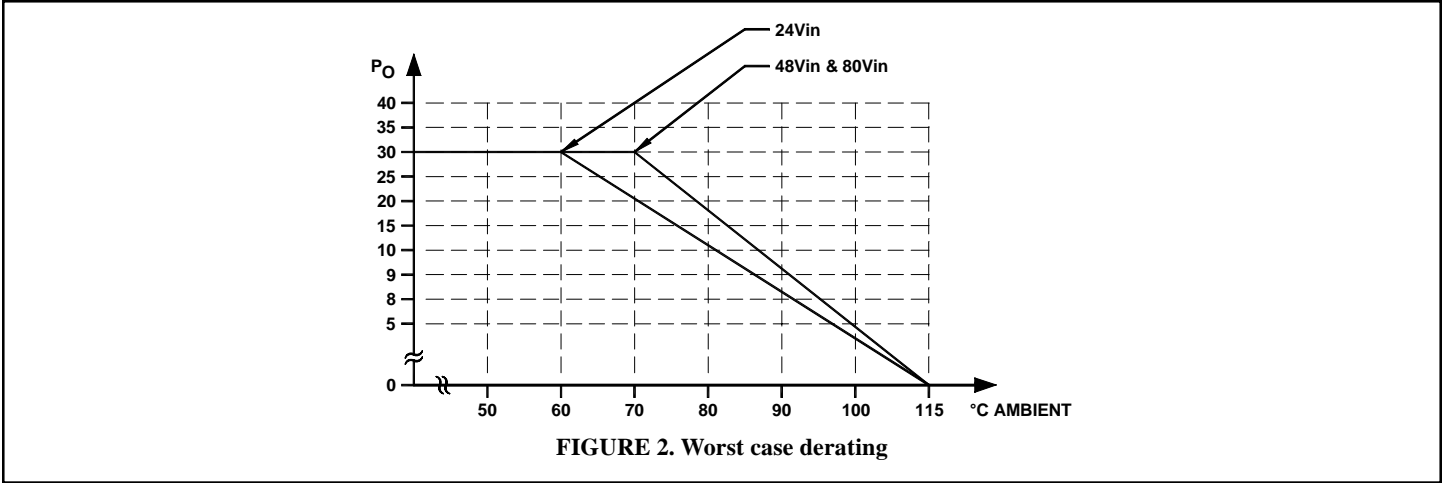
**EXTERNAL TRIMMING OF OUTPUT VOLTAGES**

To trim the output voltage DOWN, connect a 5% ¼W resistor between the +V<sub>o2</sub> (Pin 5) output and trim pin of the converter. To trim the output voltage UP, connect a 5% ¼W resistor between the -V<sub>o2</sub> (Pin 6) output and trim pins of the converter. For UP/DOWN trimming capability, connect a 10kΩ potentiometer between the +V<sub>o2</sub> and -V<sub>o2</sub> output pins, with the wiper arm connected to the trim pin.

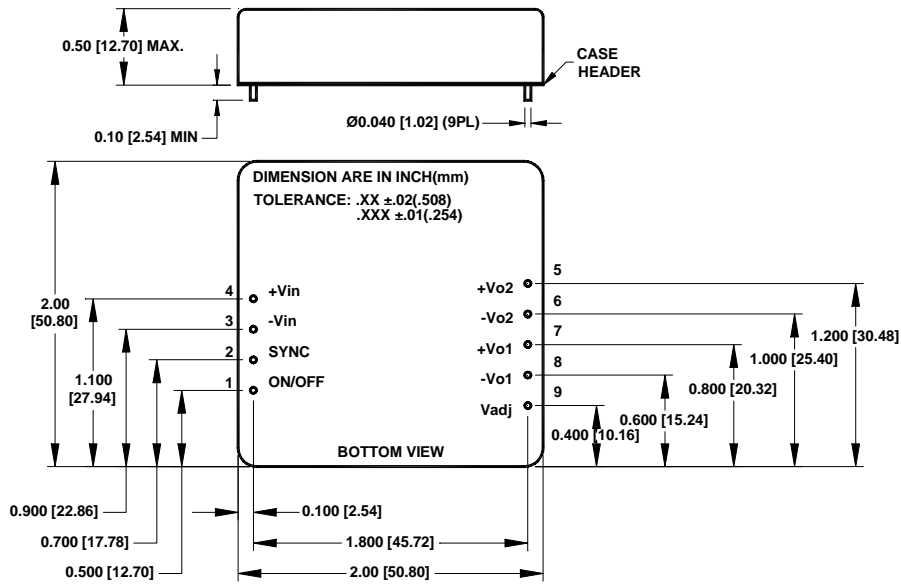
The trim resistors/potentiometer can be connected at the converter output pins or the load. However, if connected at the load,

the resistance of the runs becomes part of the feedback network which improves load regulation. If the load is some distance from the converter, the use of #20 gauge wire is recommended to avoid excessive voltage drop due to the resistance of the circuit paths. See our application notes:

- DC-001: Testing Transient Response in DC/DC Converters
- DC-004: Thermal Consideration for DC/DC Converters



### MECHANICAL SPECIFICATIONS



Pin	Function
	<b>DUAL ISOLATED</b>
1	ON/OFF
2	SYNC IN/SYNC OUT
3	-V <sub>IN</sub>
4	+V <sub>IN</sub>
5	+V <sub>O2</sub> (MAIN)
6	-V <sub>O2</sub> (MAIN)
7	+V <sub>O1</sub> (AUX)
8	-V <sub>O1</sub> (AUX)
9	V <sub>OUT</sub> ADJ

NOTE: Per customer requirement, a Custom/Special Product can be developed when the case and header are connected to Pin 2 to provide a floating shield and if sync is not required.

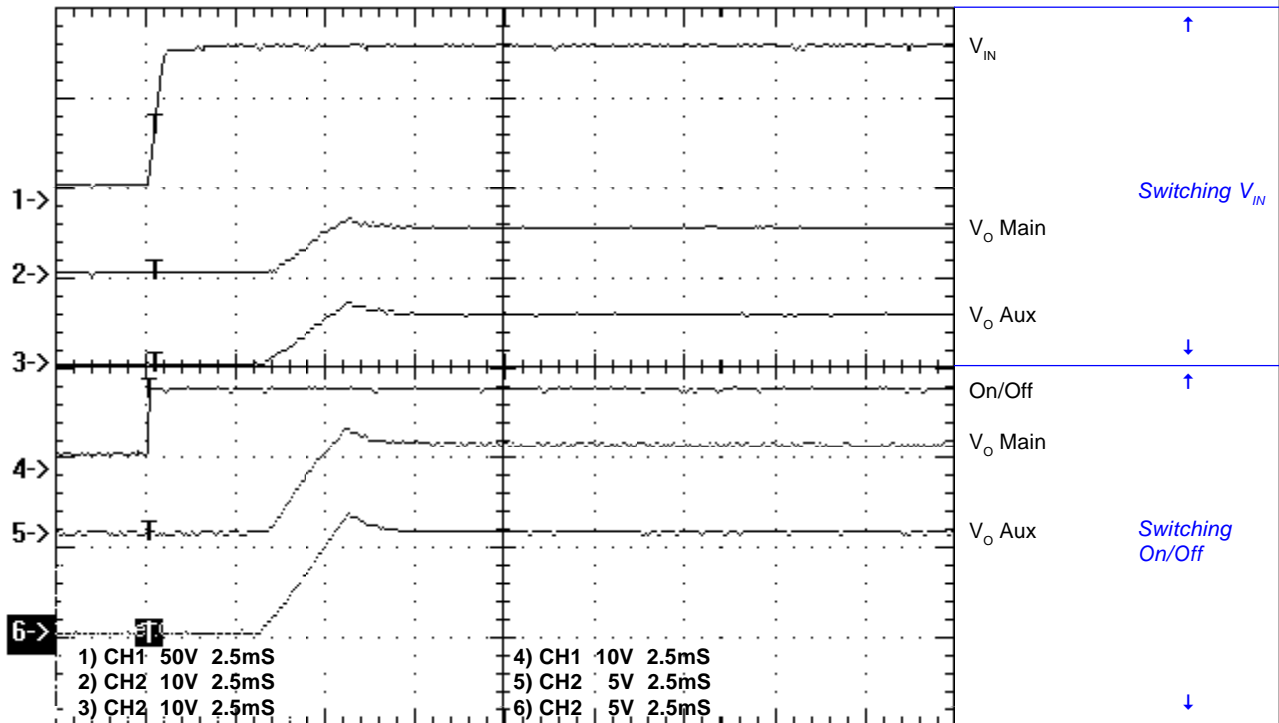
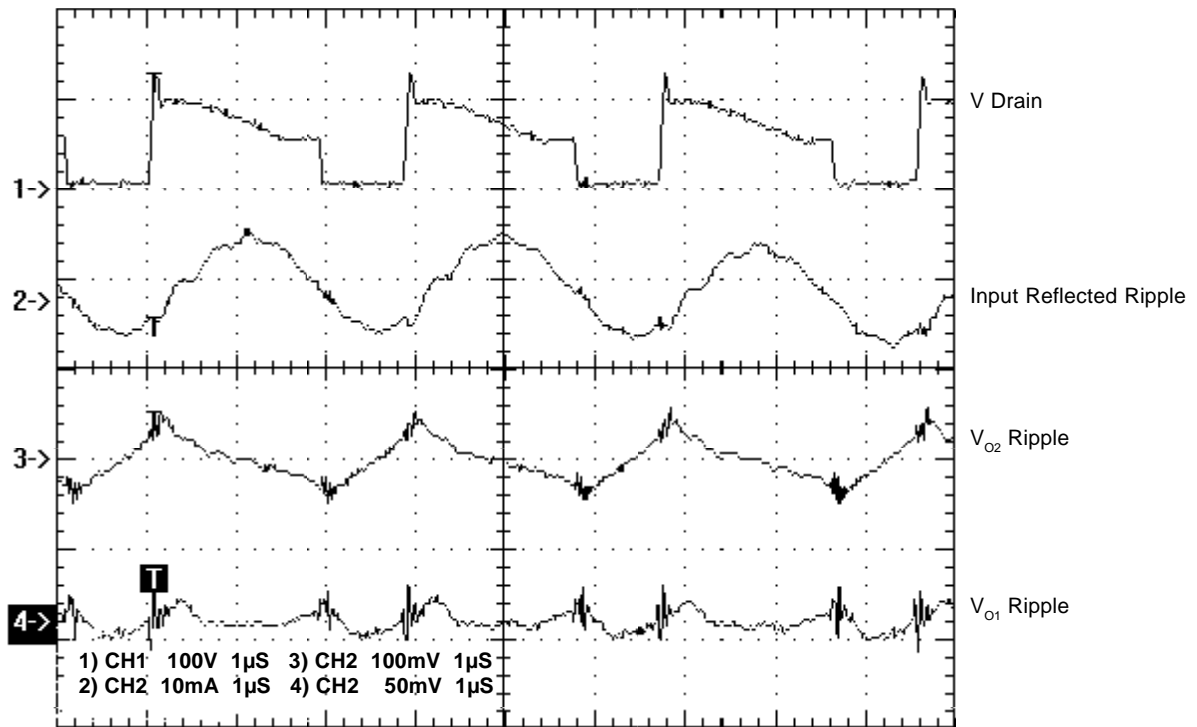
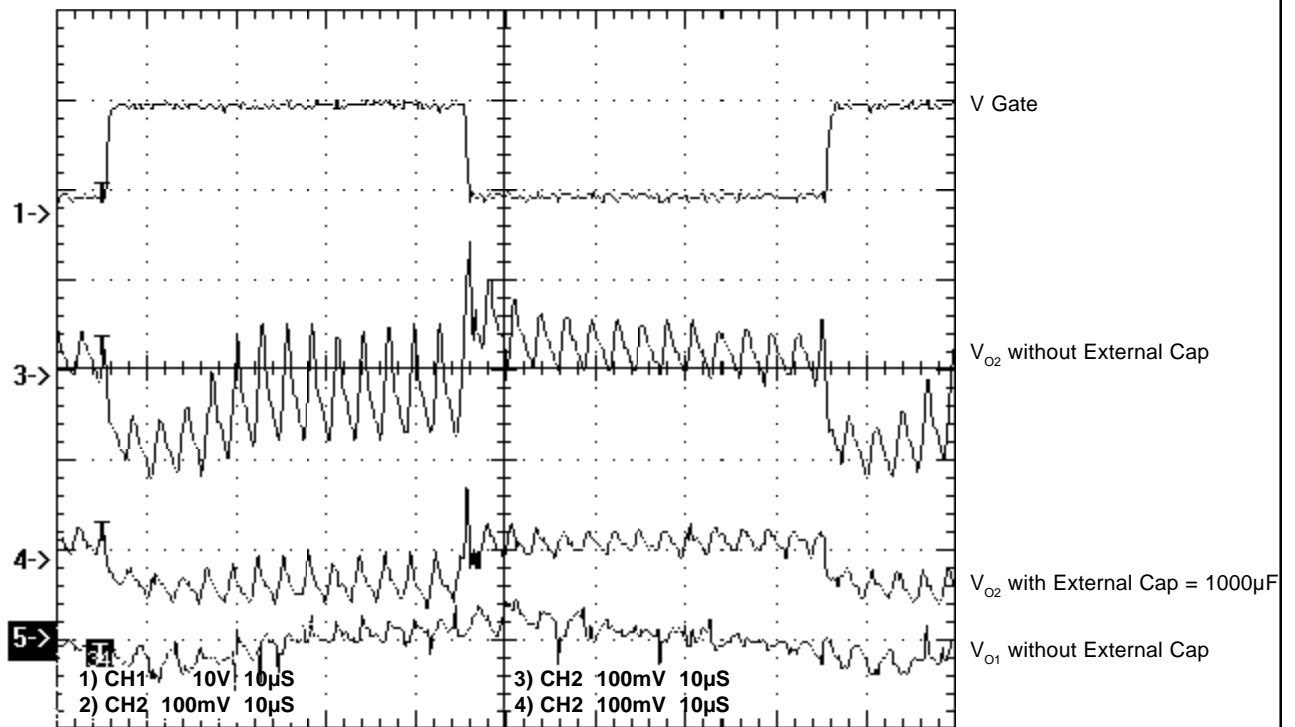


FIGURE 4. Turn on delay



**FIGURE 5. Input/output noise waveforms of U30D5-5/48**

NOTE: Common-mode capacitor = 0.01µF (Input ground to output ground)



**FIGURE 6A. Transient response of U30D5-5/48**  
 Main = 50% FL to 100% FL to 50% FL (IFL = 3A)  
 Aux Load = 5Ω (Not switching)

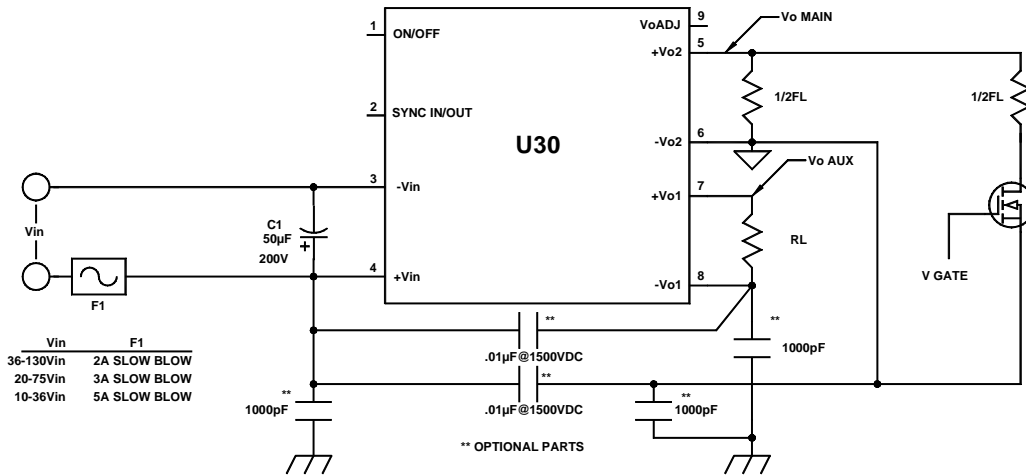


FIGURE 6B. Setup for transient response

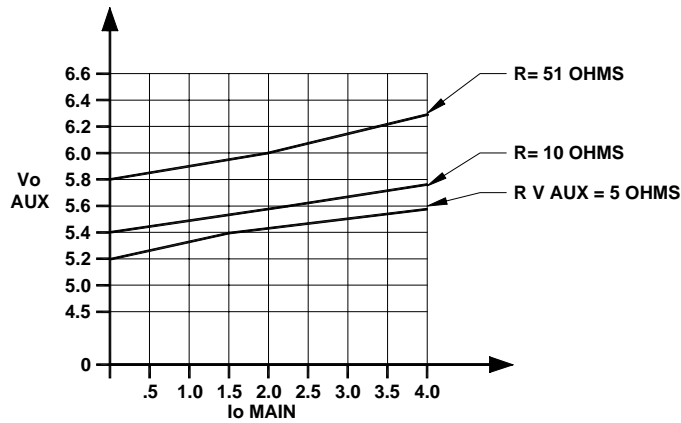


FIGURE 7.  $V_o$  Aux vs.  $I_L$  Main for U30D5-5/xx  
Auxiliary cross load regulation

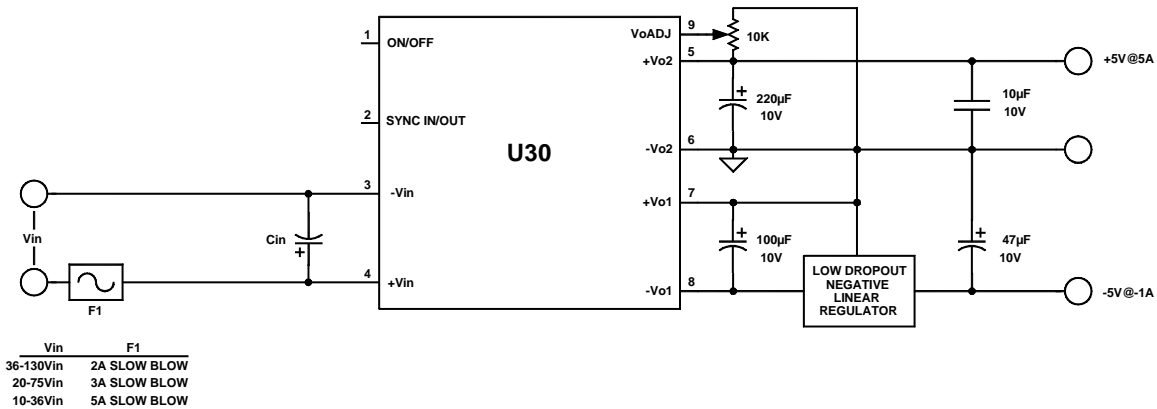
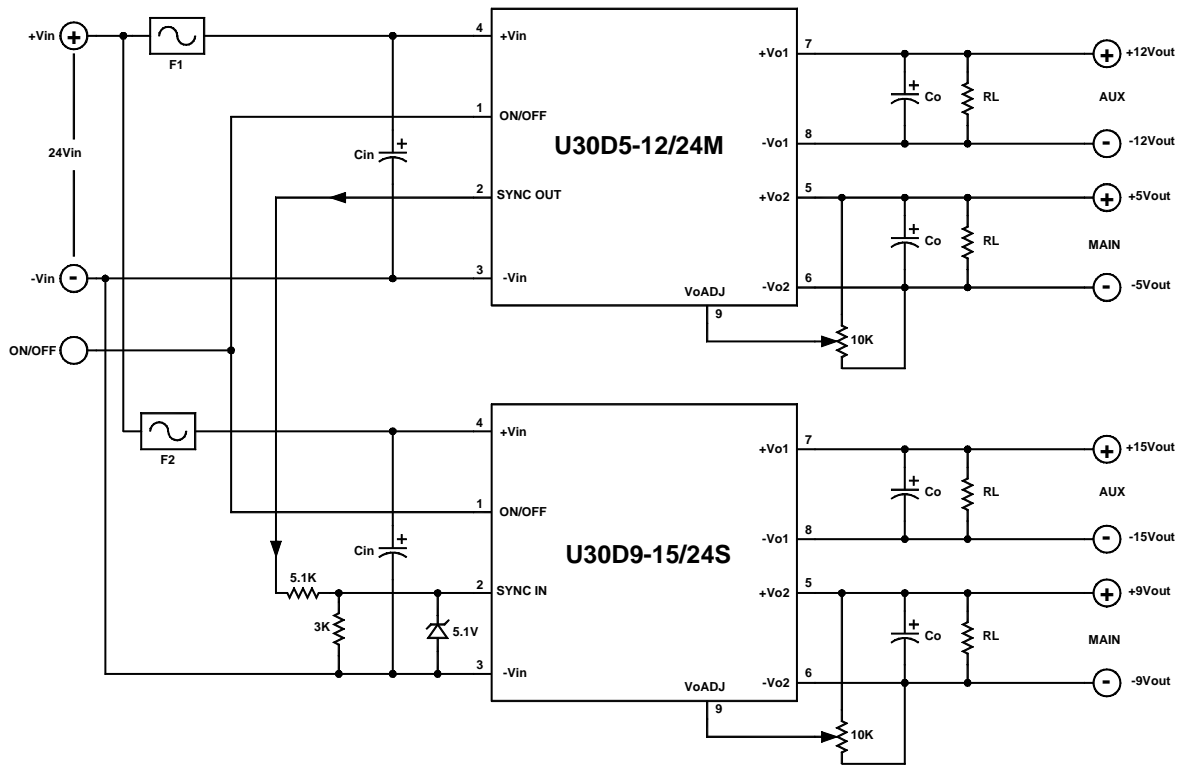


FIGURE 8. Typical connection diagram for bipolar DC/DC converter  
(Regulator drop out minimum voltage = 200mV)



**FIGURE 9. Master-slave connection of two U30 30W converters for a system requiring four different output voltages to be generated from a single input power bus**

NOTE: The sync-out voltage from the master is divided down and the sync-in to the slave (U2) is protected by a 5.1V zener diode. All outputs are floating and can be connected as per customer requirements. The internal reference voltage is referenced to -VO2 of each unit. For common-mode noise reduction, please use bypass capacitors as shown in Figure 1 (as required).