PRELIMINARY

Q30

30W Low-Noise DC/DC Converter

2”×2”x0.5”

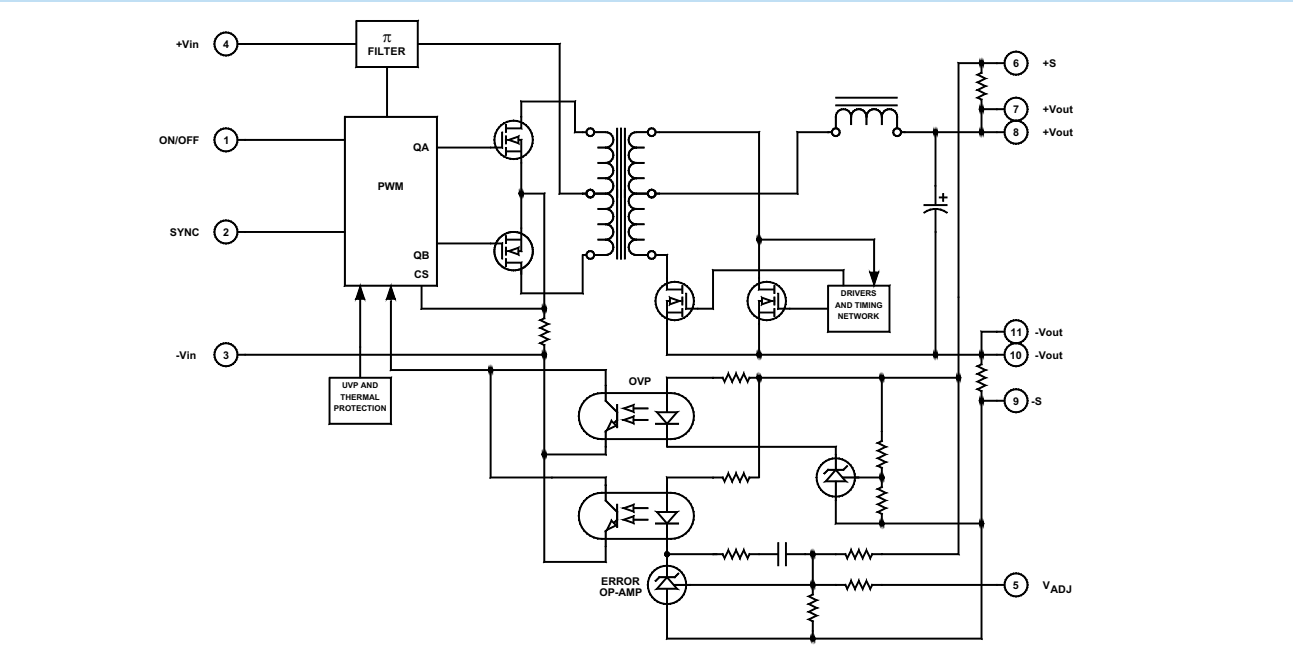
$9V_{IN}$ to $72V_{IN}$, $3.3V_{OUT}$ to $15V_{OUT}$

Key Features

- Efficiency up to 91%
- Output overvoltge protection (OVP)
- 4:1 input voltage range
- Six-sided shielding
- Output synchronous rectification
- 1500Vdc input-to-output isolation
- Soft start
- Adjustable output
- Short circuit protection
- Thermal protection
- Input undervoltage protection
- 300µA off state current

Functional Description

The Q30 is a series of 30W Low-Noise isolated single output DC/DC converters based on patented technology for synchronous rectification combined with a low dropout regulator which achieves low output noise. The converter offers a power output of 30W to 40W, a 4:1 input voltage range from 9-36V_{IN} and 18-72V_{IN} and an output voltage from 3.3V_{OUT} to 15V_{OUT}. Other standard features include input undervoltage protection, thermal protection, external synchronization, and six-sided shielding.



Typical Block Diagram

Unless otherwise specified, all parameters are given under typical ambient temperature of +25°C with an airflow rate = 400LFM. With the given power derating, the operating range is -40°C to +125°C. Specifications subject to change without notice.

Electrical Specifications

INPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Input Voltage Range	See model selection guide				Vdc
Input Startup Voltage 24 V_{IN}		8		9	Vdc
Input Startup Voltage 48 V_{IN}		14		17	Vdc
Overvoltage Shutdown 24 V_{IN}		37			Vdc
Overvoltage Shutdown 48 V_{IN}		73			Vdc
Input Filter	LC				
No Load Input Current	See model selection guide				mA
Full Load Input Current	See model selection guide				A
Input Surge Current (20μS Spike)				10	A
Short Circuit Current Limit	120% Of I_{IN} @ Full Load				
Off State Current			150		μA
Remote ON/OFF Control					
Supply ON	Pin 3 Open (Open circuit voltage: 10V Max.)				
Supply OFF		0		0.6	Vdc
Logic Input Reference	$-V_{IN}$				
Logic Compatability	TTL Open Collector or CMOS Open Drain				

OUTPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Voltage	See model selection guide				Vdc
Output Voltage Accuracy			1		%
Output Current	See model selection guide				A
Output Voltage Adjustment	See Figure 9		±5	±10	%
Ripple & Noise	For further reduction see Figure 1		40		mV
Line Regulation	Minimum V_{IN} to maximum V_{IN}		±.1		%
Load Regulation	NL to FL		±.1		%
Temperature Coefficient @ FL			.01	.02	%/°C
Transient Response Time	50% FL to FL to 50% FL, See Figure 4	100			μS
Short Circuit Protection	By input current limiting				
Turn On Delay with Soft Start	See Figure				
Output Overvoltage Protection	None				

GENERAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Efficiency (at full power)	See model selection guide				%
Isolation Voltage (1 min.), Input to Output	All models		1500		Vdc
Isolation Resistance			10^9		Ω
Isolation Capacitance			300		pF
Switching Frequency (FC)			200		kHz
External Sync Frequency (Fe)	See figure 7		210		kHz

PHYSICAL CHARACTERISTICS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Dimensions (L×W×H)	2.00×1.00×0.450 in. (50.80×25.40×11.43mm)				
Weight	1.3 oz. (37g)				

ENVIRONMENTAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Operating Temperature Range (Ambient)	Industrial, See Note 2	-40		+71	°C
Storage Temperature Range		-55		+125	°C
Maximum Operating Case Temperature[1]				110	°C
MTBF	per MIL-HNBK-217F (Ground benign, +25°C)		1.1×10^6		hours
Shielding Connection	- V_{IN} for 24 V_{IN}				
Shielding Connection	+ V_{IN} for 48 V_{IN}				

Model Selection Guide

MODEL NUMBER	INPUT		INPUT		OUTPUT	OUTPUT	OUTPUT	OUTPUT
	Voltage (Vdc)		**Current** (mA)		**Voltage** (Vdc)	**Current** (mA)	**Efficiency Full Load** (%)	**Capacitor** (mF)
	Nominal	**Range**	**No Load**	**Full Load**				
Q30S3.3/24	24	9-36	50	1360	3.3	9000	90	
Q30S5/24	24	9-36	50	1400	5	6000	89	
Q30S12/24	24	9-36	60	1390	12	2500	90	
Q30S15/24	24	9-36	70	1370	15	2000	91	
Q30S3.3/48	48	18-72	30	1360	3.3	9000	90	
Q30S5/48	48	18-72	30	700	5	6000	89	
Q30S12/48	48	18-72	30	690	12	2500	91	
Q30S15/48	48	18-72	30	695	15	2000	91	

[1] When converter enters thermal protection on mode, its duty cycle is reduced momentarily and will resume after its internal temperature (pwm) drops down a few degrees (ºC).The converter's output behaves similar to hiccup short circuit mode.
[2] Contact factory for -55° to +85°C operating temperature range.
[3] The maximum input current at any given input range measured at minimum input voltage is given as $1.6*I_{NOMINAL}$. Nominal input current is the typical value measured at the input of the converter under full-load room temperature and nominal input voltage (24 and $48V_{IN}$).
[4] Adequate insulation is to be provided to the converters at the end usage as per applicable requirements.
[5] Temperature rise on the case of the converters is to be considered during the end usage as per applicable requirements.

ORDERING GUIDE

Q30 S __/__ _ _

- Power
- Number of Outputs (**S** = Single)
- Output Voltage
- Input Voltage
- Insert **R** for RoHS models *(Optional)*
- Insert **X** for -55°C to +85°C *(Optional)*

Contact factory for custom input and output voltage combinations

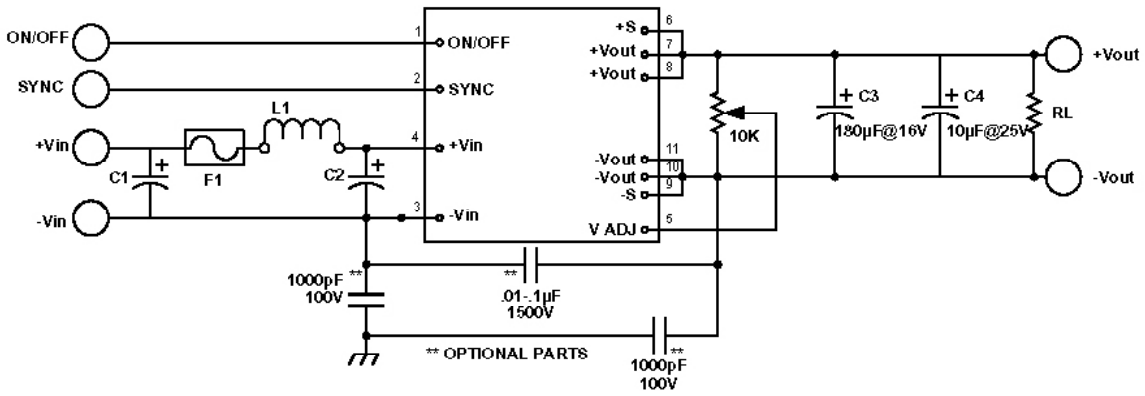


FIGURE 1. Typical connection diagram for Q30 series with capacitor only on the outputs.

Part list for Figure 1:
L1= 2.2µH
C1= 50µF@100V Electrolytic
C2=2.2µF@100V Ceramic
C4,= 10µF@25V Ceramic Capacitors
C3=180µF@16V United Chemi Con type

CMC*=Typically Not Used,Common Mode Capacitor
CMC= .01µF@Vcmc
Vcmc >= than required isolation, voltage can be up to 1500V dc max.

Part list for Figure 2:
L1= 2.2µH
C1= 50µF@100V Electrolytic
C2=2.2µF@100V Ceramic
C5,= 10µF@25V Ceramic Capacitors
C3,C4=39µF@25V United Chemi Con type

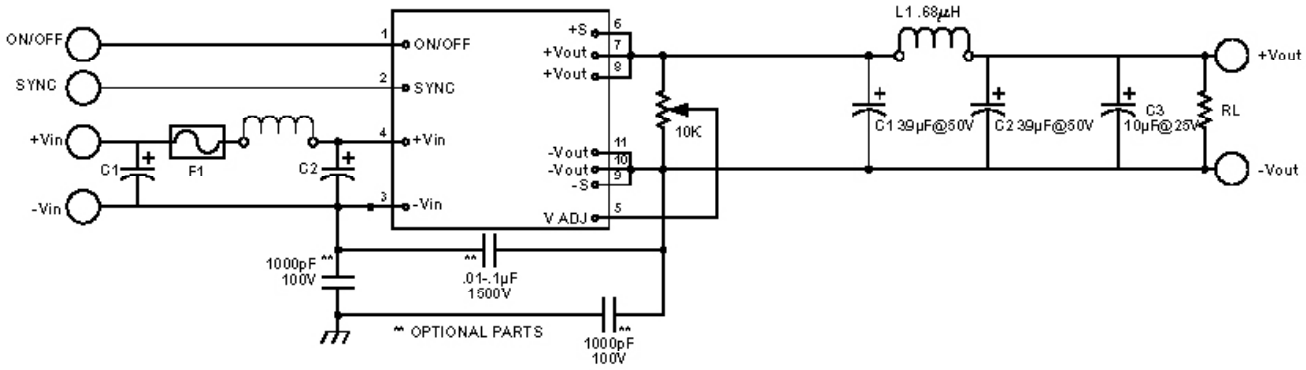


FIGURE 2. Typical connection diagram for Q30 series with only Pi filter on the output.

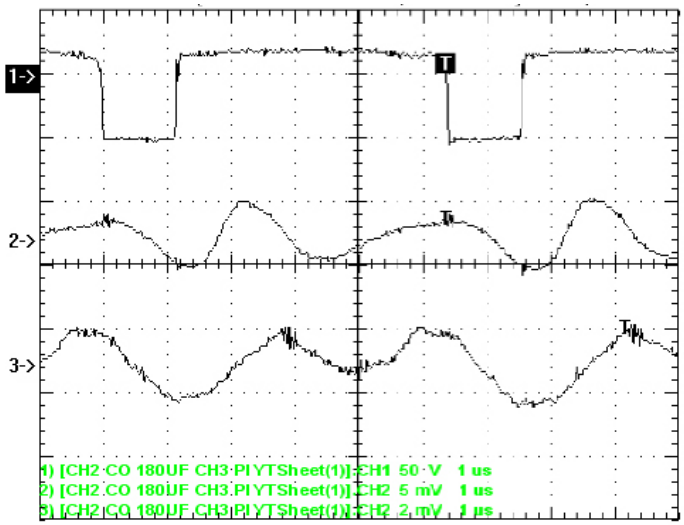


FIGURE 3. Channel 2 is output ripple of Q30S12/24 as shown in figure 1. Channel 3 is output ripple of Q30S12/24 as shown in figure 2.

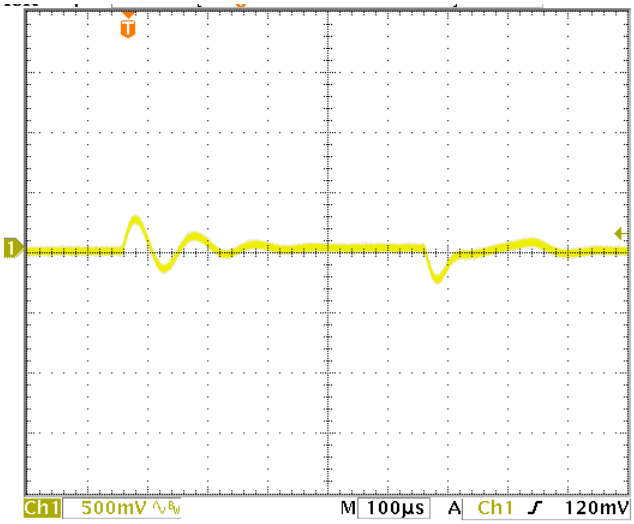


FIGURE 4. Transient response of Q30S5/24 with I_{OUT} changing from Full Load to 1/2 Full Load/

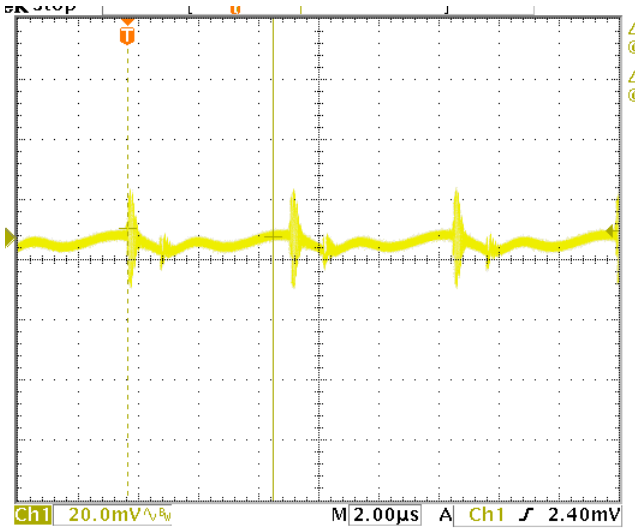


FIGURE 5: Output ripple of Q30S15/24 as shown in Figure 1.

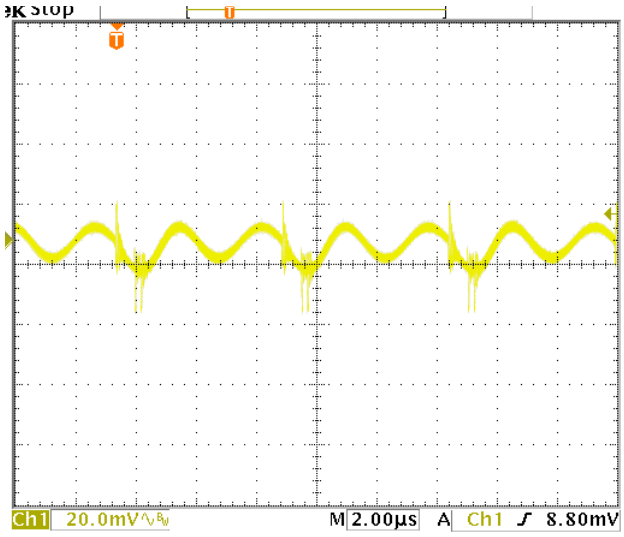


FIGURE 6: Output ripple of Q30S15/48 as shown in Figure 1.

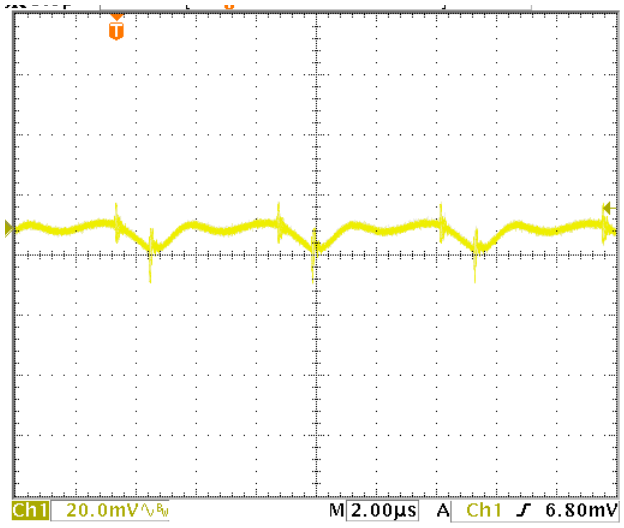


FIGURE 7:

FIGURE 7: Output ripple of Q30S5/24 as shown in Figure1.

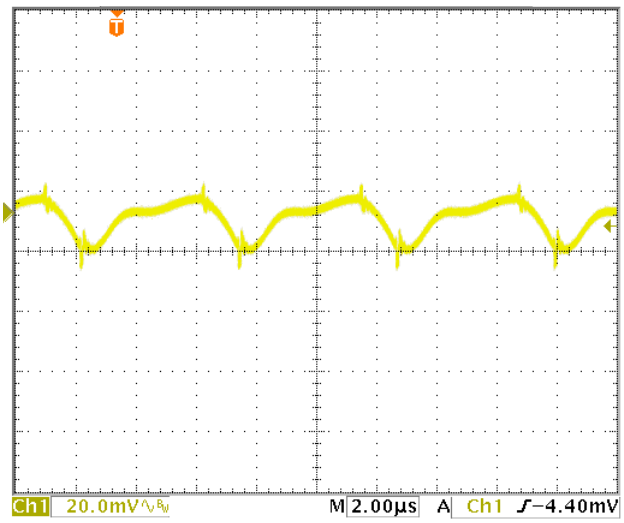


FIGURE 8:

FIGURE 8: Output ripple of Q30S5/48 as shown in Figure1.

EXTERNAL SYNCHRONIZATION

The SYNC pin can be used to synchronize the internal oscilllator to external clock. An open drain output is the recommended interface between the external clock to the Q30 SYNC pin as shown in figure 9. The clock pulse width must be greater than 15ns. The external clock frequency must be greater than the frequency of the Q30.

Multiple Q30 converters can be synchronized together simply by connecting the converters SYNC pins together as shown in figure 10. Care should be taken to ensure the ground potential differences between the converters are minimized. In this configuration all the converters will be synchronized to the highest frequeny device. The SYNC pin is a CMOS buffer with pull-up current limited to 200micro amps. If the external device forces the SYNC pin low before the internal oscillator ramp completes its charging cycle, the ramp will reset and another cycle begins. If the SYNC pins of multiple Q30 converters are connected together, the first SYNC pin that pulls low will reset the oscillator ramp of all the other converters. All converters will operate in phase when synchronized using the SYNC feature. Up to five devices can be synchronized using this method.

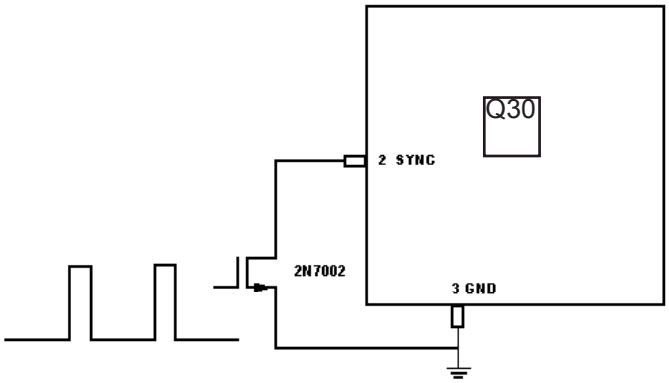


FIGURE 9. SYNC from external clock

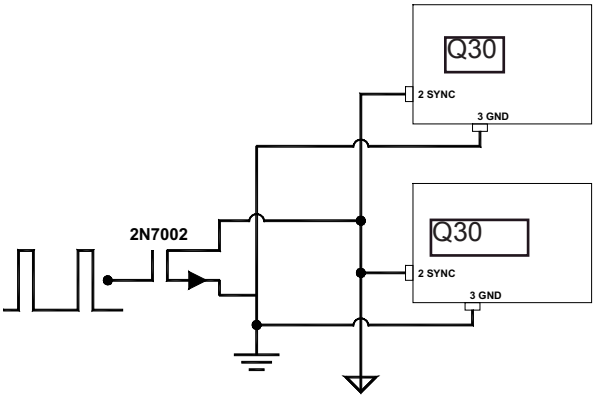
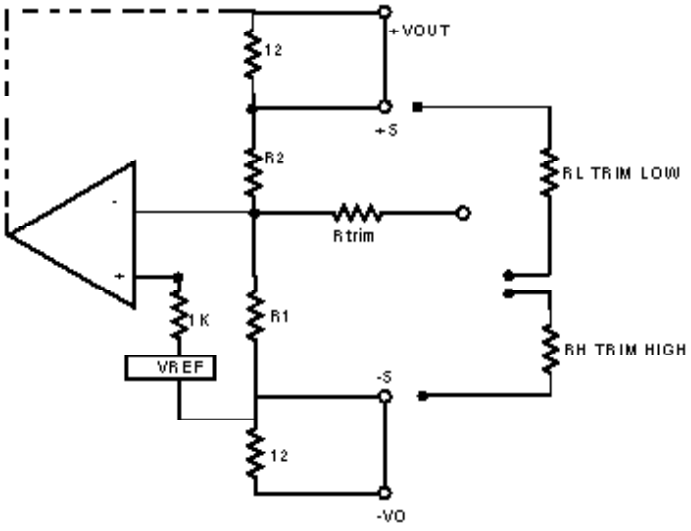


FIGURE 10. SYNC of multiple devices



NOTE: Vo is the adjusted output voltage

$$RL = \frac{(Vo-Vref)R1*R2}{Vref(R1+R2) - VoR1} - Rt \quad \text{in k}\Omega$$

$$RH = \frac{R1*R2}{\left(\frac{Vo}{Vref} - 1\right)R1 - R2} - Rt \quad \text{in k}\Omega$$

VO	VREF	R2	R1	Rtrim
3.3V	1.24V	4.12K	2.49K	15K
5V	2.55V	2.49K	2.49K	9.53K
12V	2.55V	9.53K	2.49K	20K
15V	2.55V	23.7K	2.49K	20K

FIGURE 11. Single Output adjustment equations.

Pin	Function
SINGLE	
INPUT	
1	ON/OFF
2	SYNC IN
3	$-V_{IN}$
4	$+V_{IN}$
OUTPUT	
5	V_{ADJ}
6	+S
7	$+V_{OUT}$
8	$-V_{OUT}$
9	-S

MECHANICAL SPECIFICATIONS