

# PRELIMINARY



## Q25009 30W DC/DC CONVERTER 18-36Vin, +/-15Vout@+/-830mA

### Key Features

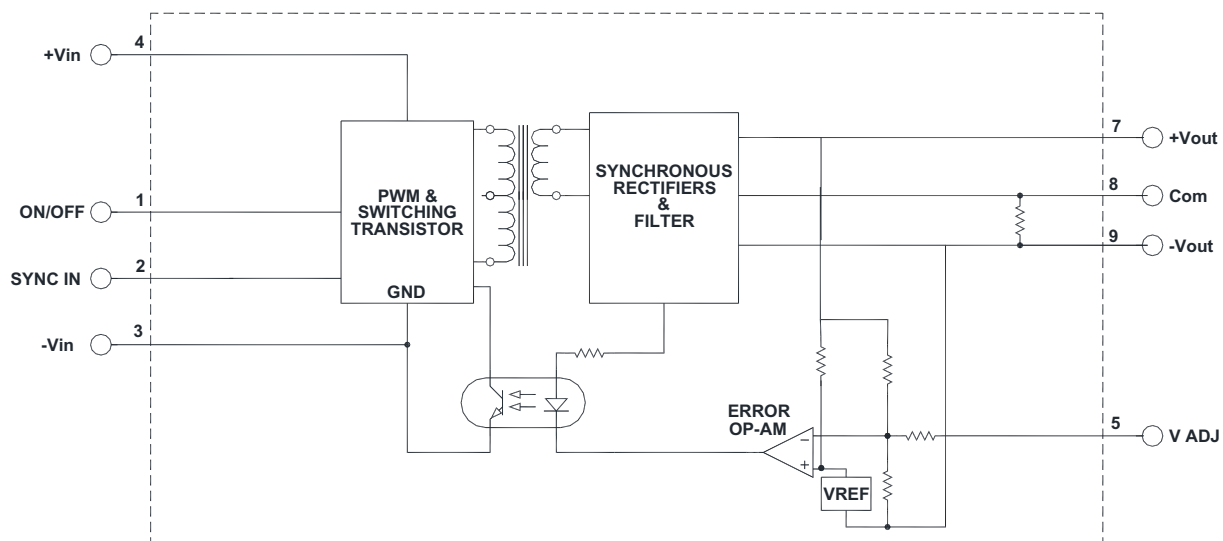
- Efficiency 88%
- Low output noise
- Six-sided shielding
- Input-to-output isolation
- Soft start
- External synchronization
- Short circuit protection
- Thermal protection
- Industry standard pinout



Beta Dyne is protected under various patents, including but not limited to U.S. Patent numbers: 5,777,519; 6,188,276; 6,262,901; 6,452,818; 6,473,3171.

### Functional Description

The Q25009 is a 2:1 input range DC/DC converter that accepts 18-36Vin and provides +/-15Vout @ +/-830mA. Standard features include input undervoltage protection, thermal protection, and short circuit protection. The converter is designed to synchronize to an external clock frequency of a 220kHz. The converter is packaged in a 1.00x2.00x0.450 in metal case with six-sided shielding.



Typical Block Diagram

## Electrical Specifications

### INPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Input Voltage Range		18	24	36	Vdc
Input Startup Voltage		16.5		18	Vdc
Input Overvoltage Shutdown $24 V_{IN}$		37			Vdc
Input Filter	C				
No Load Input Current	$V_{IN} = 24V$		22.5		mA
Full Load Input Current	$V_{IN} = 24V$		1173		mA
Input Surge Current (20 $\mu$ S Spike)				10	A
Short Circuit Current Limit	120% Of $I_{IN}$ @ Full Load				
Off State Current			18		mA
Remote ON/OFF Control					
Supply ON	Pin 3 Open (Open circuit voltage: 10V Max.)				
Supply OFF		0		0.6	Vdc
Logic Input Reference	To -Vin				
Logic Compatibility	TTL Open Collector or CMOS Open Drain				

### OUTPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Voltage			+/-15		Vdc
Output Voltage Accuracy	With balanced loads		1	1.5	%
Output Current			+/-830		mA
Output Voltage Adjustment			$\pm 5$	$\pm 10$	%
Ripple & Noise	To further reduce ripple, see Figure 2		20		mV
Line Regulation	Minimum $V_{IN}$ to maximum $V_{IN}$		$\pm 1$		%
Load Regulation	10% to FL, with balanced loads		$\pm 1$		%
Temperature Coefficient @ FL			.01	.02	%/ $^{\circ}$ C
Transient Response Time	50% FL to FL to 50% FL, within 1% of $V_o$ , See Figure 5	100			$\mu$ S
Short Circuit Protection	By Hiccup Technique				
Output Overvoltage Protection	None				

### GENERAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Efficiency (at full power)			88		%
Isolation Voltage (1 min.), Input to Output			1500		Vdc
Isolation Resistance			$10^9$		$\Omega$
Isolation Capacitance			300		pF
Switching Frequency (FC)		202	210		kHz
External Sync Frequency ( $F_e$ )	See Figure 7 & 8	210	220	220	kHz

### PHYSICAL CHARACTERISTICS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Dimensions (LxWxH)	2.00x1.00x0.450 in. (50.80x25.40x11.43mm)				
Weight	1.3 oz. (37g)				

### ENVIRONMENTAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Operating Temperature Range (Ambient)	Industrial, See Note 2	-40		+71	$^{\circ}$ C
Storage Temperature Range		-55		+125	$^{\circ}$ C
Maximum Operating Case Temperature				110	
Thermal Resistance	See derating curve, Figure 5	4.3		4.7	$^{\circ}$ C/W
MTBF	per MIL-HNBK-217F(Ground benign, +25 $^{\circ}$ C)		$1.1 \times 10^6$		hours
Shielding Connection	-Vin for 24Vin				

<sup>1</sup> 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 (°C).The converter's output behaves similar to hiccup short circuit mode.

<sup>2</sup> Contact factory for -55° to +85°C operating temperature range.

<sup>3</sup> The maximum input current at any given input range measured at minimum input voltage is given as  $1.6 \cdot I_{NOMINAL}$ . 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<sub>IN</sub>).

<sup>4</sup> Adequate insulation is to be provided to the converters at the end usage as per applicable requirements.

<sup>5</sup> Temperature rise on the case of the converters is to be considered during the end usage as per applicable requirements. To maintain a less than 110°C case temperature, with a Iout=+/-1A, you need 200LFM.

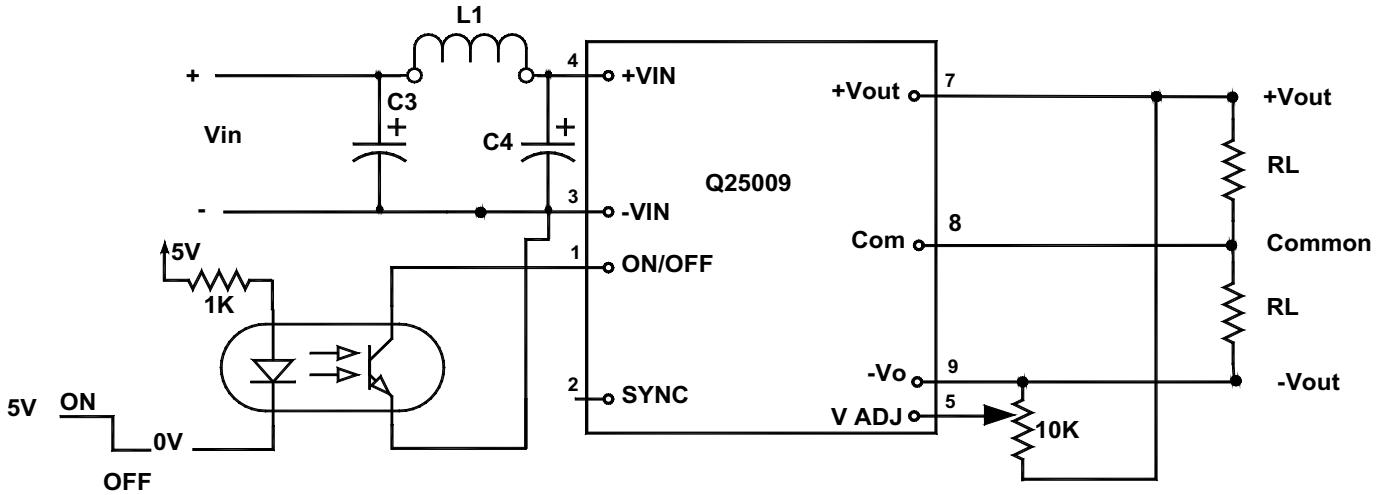


FIGURE 1. Typical connection diagram for Q25009

Part list for Figure 1:

L1= 2.2μH

C3= 50μF@100V Electrolytic

C4=50μF@100V Electrolytic

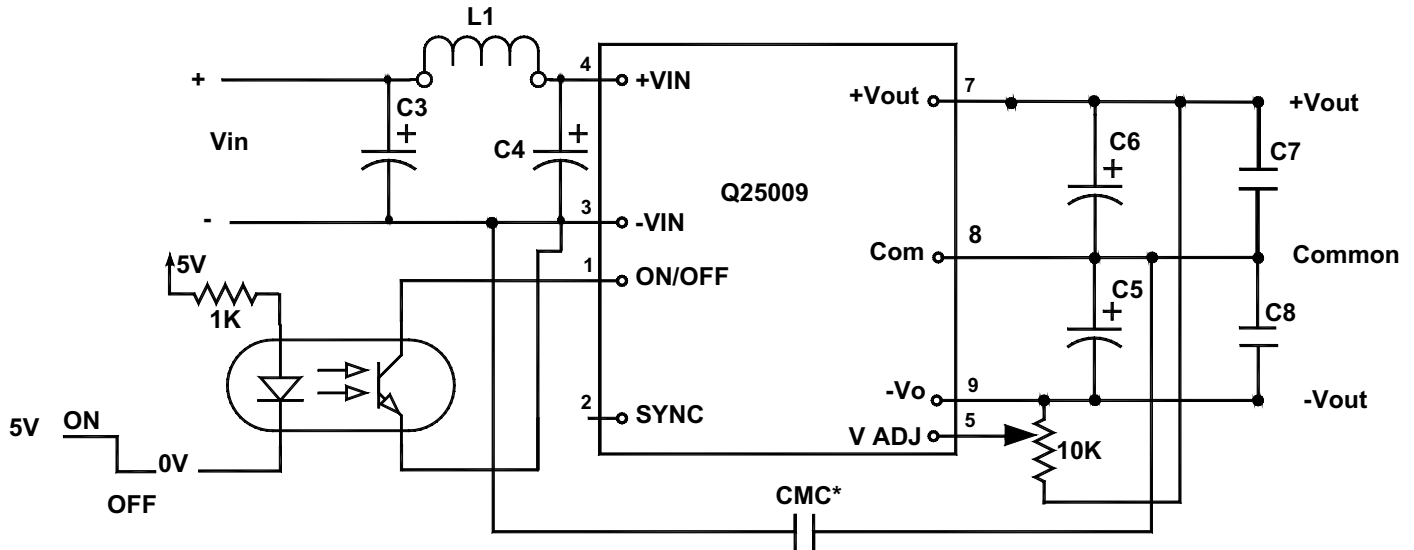


FIGURE 2. Connection diagram for further reducing noise

Part list for Figure 2:

L1= 2.2μH

C3= 50μF@100V Electrolytic

C4= 50μF@100V Electrolytic

C5,C6= 47μF@20V Loe ESR Tantalum

C7,C8= 2.2μF@25V Ceramic Capacitor

CMC\*= Typically Not Used, Common Mode Capacitor

CMC= .01μF@Vcmc

Vcmc >= Than required isolation, voltage can be up to 1500Vdc max

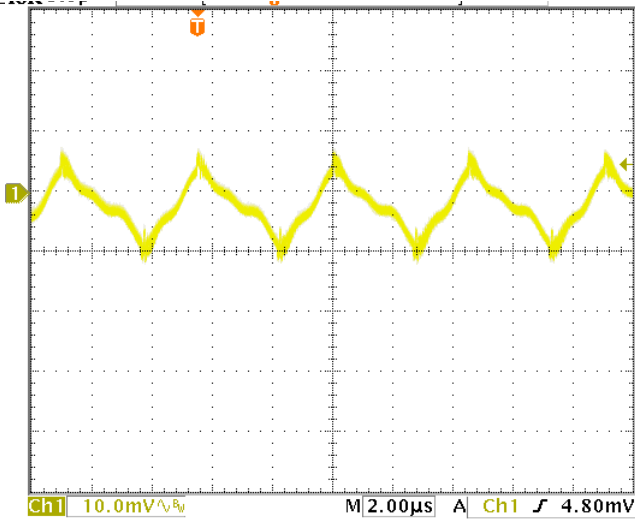


FIGURE 3: Output ripple of Q25009 on +Vout as shown in Figure 1, no output capacitors, only  $I_{OUT}=0.83A$  on the load. The input voltage is 24V.

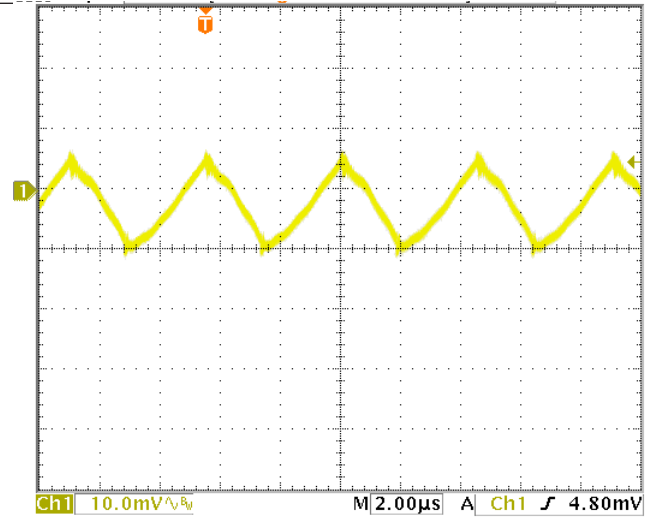


FIGURE 4: Output ripple of Q25009 on -Vout as shown in Figure 1, no output capacitors, only  $I_{OUT}=0.83A$  on the load. The input voltage is 24V.

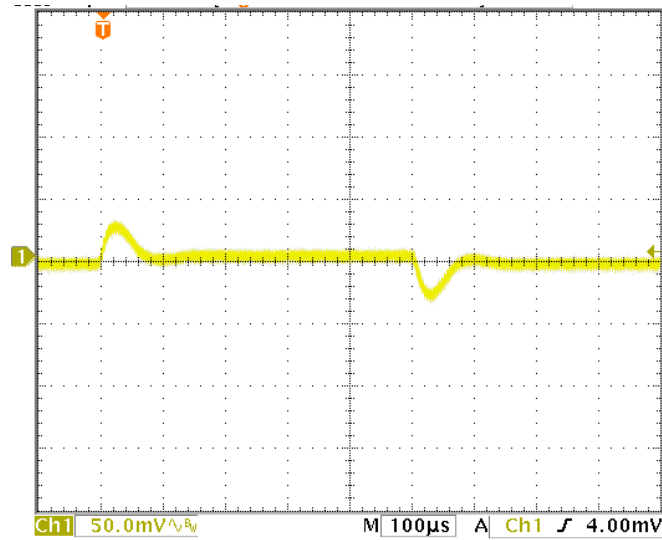


FIGURE 5. Transient Response at  $V_{in}=24$ ,  $I_{out}$  changing from Full load to Half load on a Q25009.

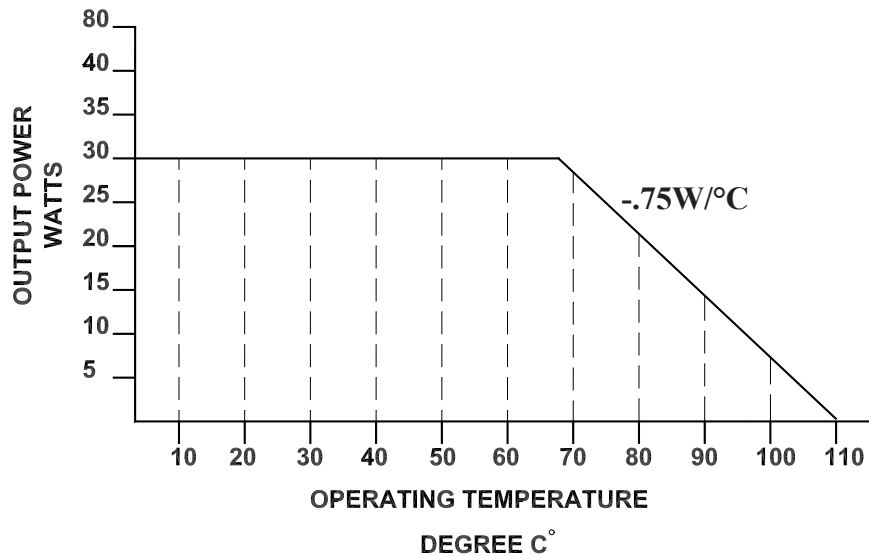


FIGURE 6. Derating Curve of Q25009

**EXTERNAL SYNCHRONIZATION**

The SYNC pin can be used to synchronize the internal oscillator to external clock. An open drain output is the recommended interface between the external clock to the Q25 SYNC pin as shown in figure 8. The clock pulse width must be greater than 15ns. The external clock frequency must be greater than the frequency of the Q25.

Multiple Q25 converters can be synchronized together simply by connecting the converters SYNC pins together as shown in figure 9. 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 frequency 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 Q25 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.

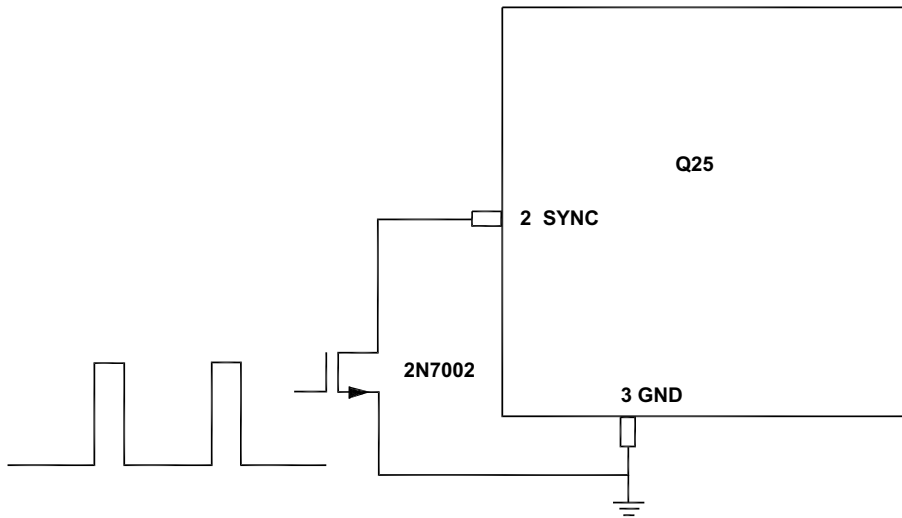


FIGURE 7. SYNC from external clock

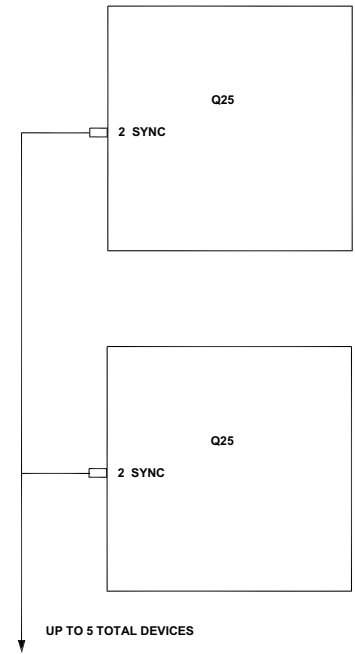
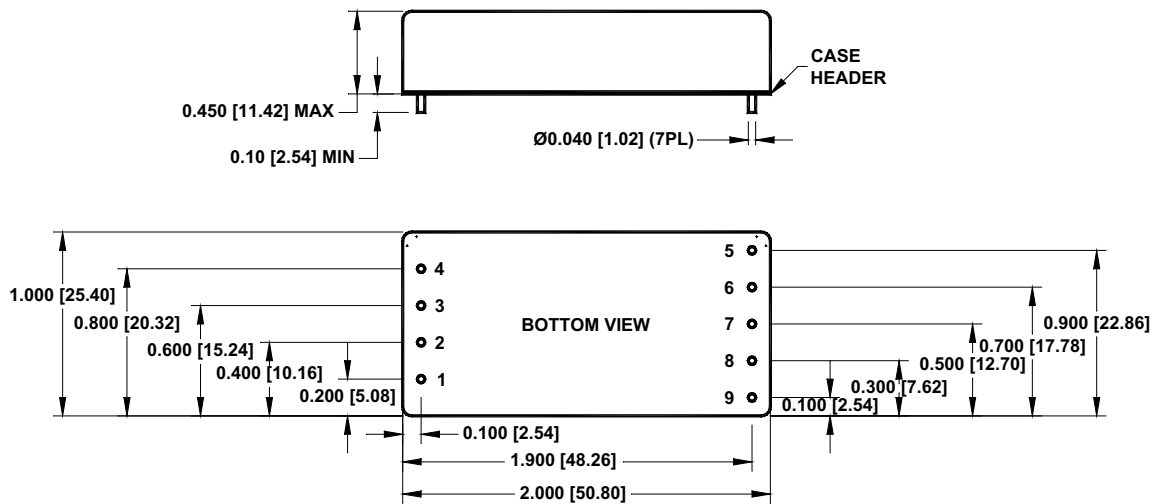


FIGURE 8. SYNC of multiple devices

**MECHANICAL SPECIFICATIONS**



Pin	Function
<b>DUAL</b>	
<b>INPUT</b>	
1	ON/OFF
2	SYNC IN
3	-V <sub>IN</sub>
4	+V <sub>IN</sub>
<b>OUTPUT</b>	
5	V <sub>ADJ</sub>
6	No Pin
7	+V <sub>OUT</sub>
8	Common
9	-V <sub>OUT</sub>

DIMENSIONS ARE IN INCH(mm)  
 TOLERANCE: .XX ±.02(.508)  
 .XXX ±.01(.254)