



Q25010 36W DC/DC CONVERTER 2"×1"×0.45" 16-36Vin, 12Vout@3.0A

Key Features

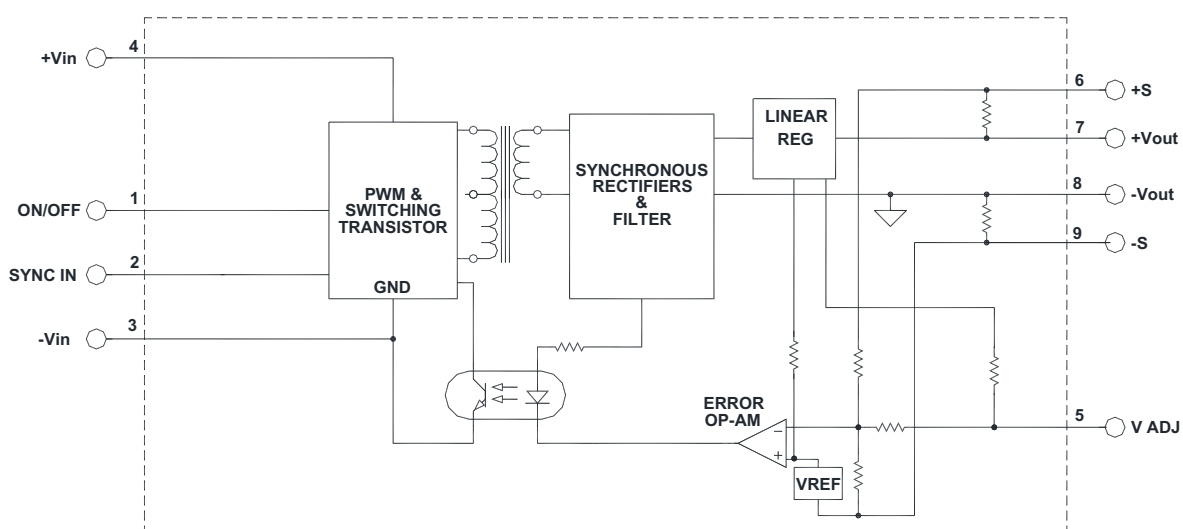
- Efficiency up to 88%
- Low output noise
- Six-sided shielding
- Output synchronous rectification
- Input-to-output isolation
- Soft start
- External synchronization
- Short circuit protection
- Thermal protection
- Industry standard pinout



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 Q25010 is a DC/DC converter that accepts 16-36Vin and provides 12Vout at 3.0 A. The converter is designed to synchronize to an external clock. Output synchronous rectification followed by a very low dropout linear regulator makes possible to achieve up to 88% efficiency with less than 20mV output noise with external capacitors. Standard features include input undervoltage protection, external synchronization and thermal protection. The converter is packaged in a 2 x 1 x .45" metal case with six-sided shielding.



Typical Block Diagram

Electrical Specifications

INPUT SPECIFICATIONS

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|--|---|-----|------|-----|---------|
| Input Voltage Range | | 16 | 24 | 36 | Vdc |
| Input Startup Voltage $24 V_{IN}$ | | 15 | | | Vdc |
| Overvoltage Shutdown $24 V_{IN}$ | | 37 | | | Vdc |
| Input Filter | Capacitor | | | | |
| No Load Input Current | | | 110 | | mA |
| Full Load Input Current | $V_{IN}=24V, I_{OUT}=3A$ with $1300\mu F$ in parallel | | 1710 | | mA |
| Input Surge Current (20 μ S Spike) | | | | 10 | A |
| Short Circuit Current Limit | 120% Of I_{IN} @ Full Load | | | | |
| Off State Current | | | 2.3 | | μ A |
| Remote ON/OFF Control | | | | | |
| Supply ON | Pin 3 Open (Open circuit voltage: 10V Max.) | | | | |
| Supply OFF | | 0 | | 0.6 | Vdc |
| Logic Input Reference | | | | | |
| Logic Compatibility | TTL Open Collector or CMOS Open Drain | | | | |

OUTPUT SPECIFICATIONS

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|-------------------------------|--------------------------------------|-----|---------|----------|-----------------|
| Voltage | | | 12 | | Vdc |
| Output Voltage Accuracy | | | 1 | | % |
| Output Current | | | 3.0 | 3 | A |
| Output Voltage Adjustment | See Figure 4 | | ± 5 | ± 10 | % |
| Ripple & Noise | For further reduction see Figure 3 | | 20 | | mV |
| Line Regulation | Minimum V_{IN} to maximum V_{IN} | | ± 1 | | % |
| Load Regulation | NL to FL | | ± 1 | | % |
| Temperature Coefficient @ FL | | | .01 | .02 | %/ $^{\circ}$ C |
| Transient Response Time | 50% FL to FL to 50% FL, See Figure 1 | 100 | | | μ 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 | | | 1218 | | Vdc |
| Isolation Resistance | | | 10^9 | | Ω |
| Isolation Capacitance | | | 300 | | pF |
| Switching Frequency (FC) | | | 175 | | kHz |
| External Sync Frequency (Fe) | See Figure 1 & 2 | | 350 | | kHz |

PHYSICAL CHARACTERISTICS

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

ENVIRONMENTAL SPECIFICATIONS

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|---|--|-----|---------------------|------|-------|
| Operating Temperature Range (Ambient) | | -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} | | | | |

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 1. 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 2. 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.

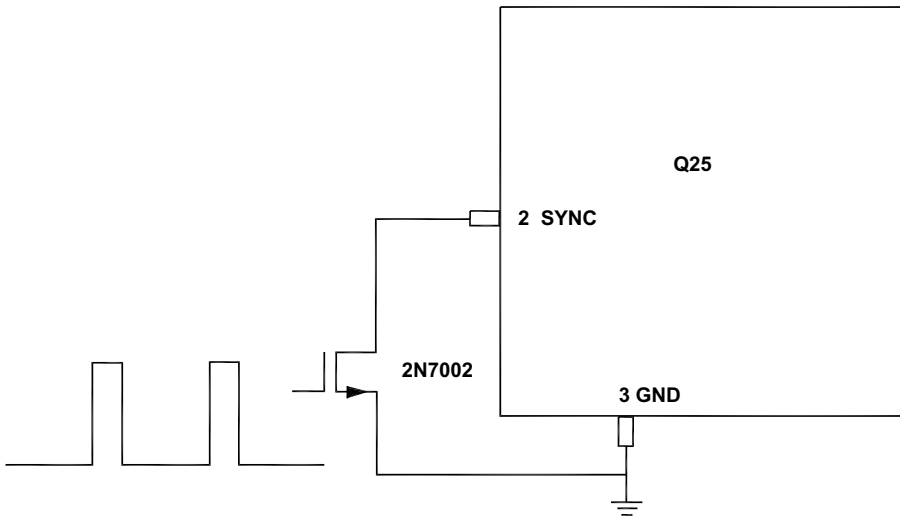


FIGURE 1. SYNC from external clock

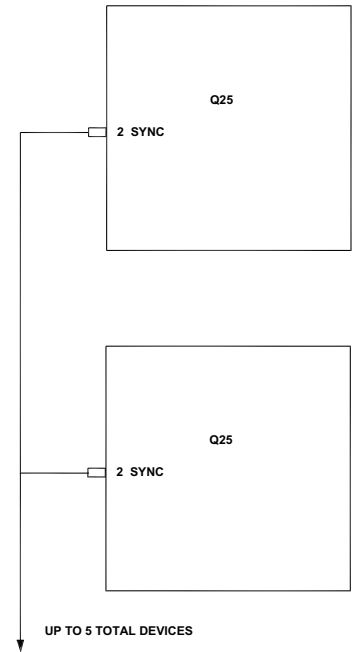


FIGURE 2. SYNC of multiple devices

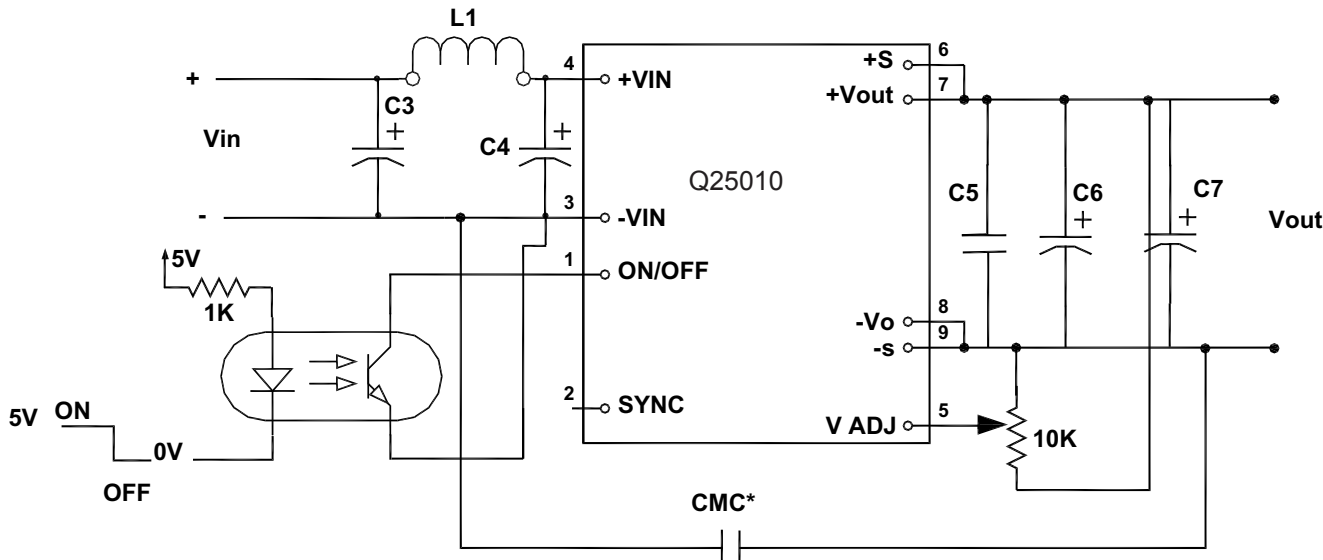


FIGURE 3. Typical connection diagram for Q25010 to further reduce output ripple.

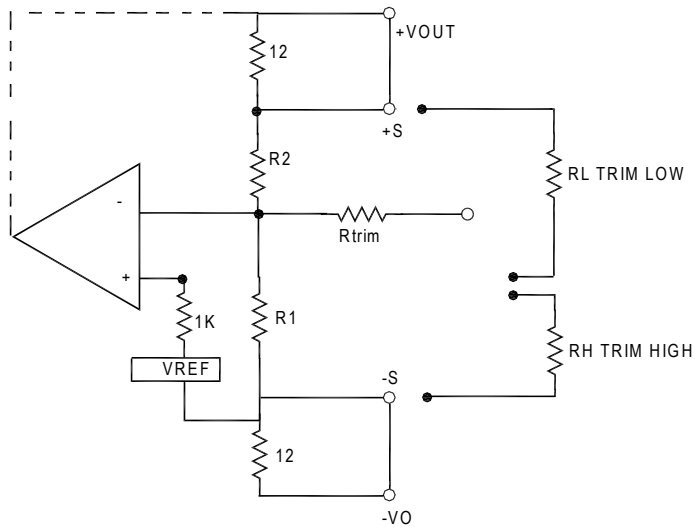
Part list for Figure 3:

- L1= 2.2μH
- C3= 47μF@50V Electrolytic
- C4=47μF@50V Electrolytic
- C5= 1.5μF@25V Ceramic Capacitors
- C6=47μF@20V Low ESR Tantalum
- C7=180μF@16V Low ESR Tantalum

CMC*=Common Mode Capacitor

CMC= .01μF@Vcmc
 Vcmc >= than required isolation, voltage can be up to 1500V dc max.

$$R_L = \frac{(V_o - V_{ref})R_1 \cdot R_2}{V_{ref}(R_1 + R_2) - V_o R_1} \quad \text{--- } R_t \quad \text{in k}\Omega$$

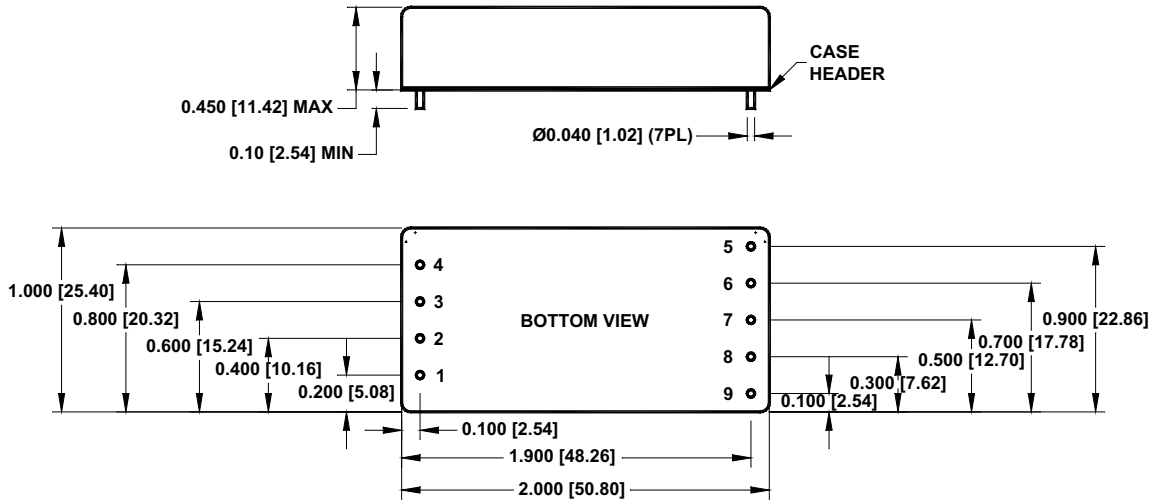


$$R_H = \frac{R_1 \cdot R_2}{\left(\frac{V_o}{V_{ref}} - 1\right) R_1 - R_2} \quad \text{--- } R_t \quad \text{in k}\Omega$$

| VO | VREF | R2 | R1 | Rtrim |
|-----|------|-------|-------|-------|
| 12V | 2.5 | 9.53K | 2.49K | 20.0K |

FIGURE 4. Single Output adjustment equations.

MECHANICAL SPECIFICATIONS



| 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 |

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