Product Information:
M57182N-315 and M57184N-715 Hybrid DC-DC Converters

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(1) Introduction

The M57182N-315 and M57184N-715 are high input voltage, non-isolated, step down, DC-DC converters designed to provide low voltage control power for Application Specific Intelligent Power Modules (ASIPM), Original DIP-IPMs, Mini DIP-IPMs and hybrid gate drivers. These converters accept input voltages of 140VDC to 380VDC allowing them to operate directly from rectified AC line voltages of 100VAC to 240VAC. The M57182N-315 provides a 200mA regulated 15V DC output. The M57184N-715 supplies a 350mA, 15 VDC output and a 200mA, 5V DC output. Photographs of the M57182N-315 and M57184N-715 are shown in Figure 1. Each circuit is configured in a compact SIP (Single In-line Package) to allow efficient layout with minimum printed circuit board space.

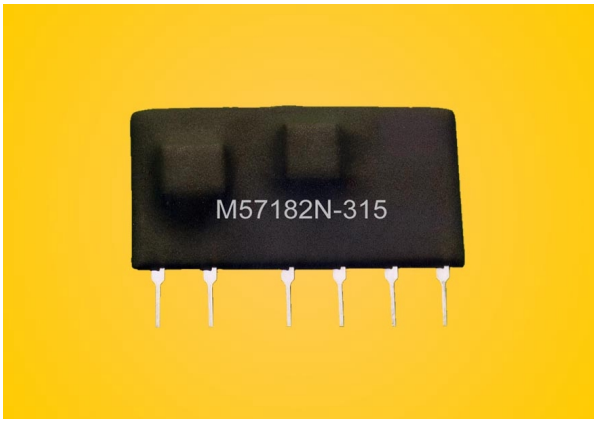


Figure 1a: M57182N-315

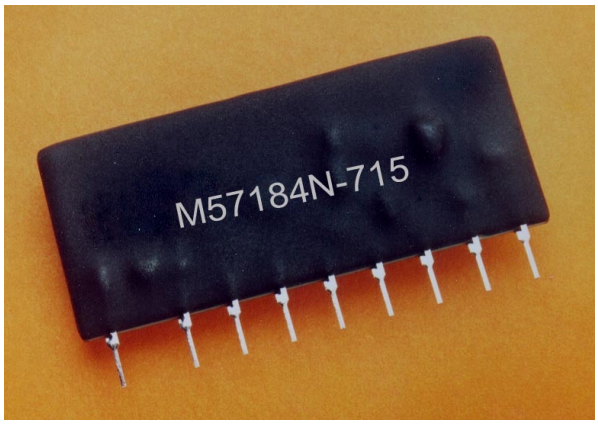
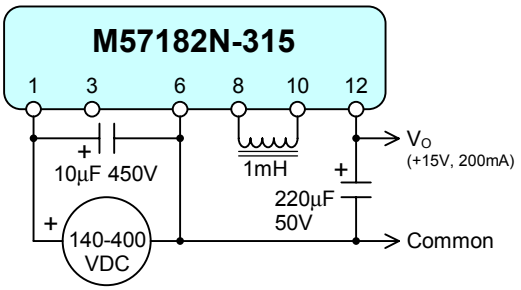


Figure 1b: M57184N-715

(2) Basic Circuit for the M57182N-315

Figure 2 shows the basic application circuit for M57182N-315. Only three external components are required to complete the circuit. A 10µF 450V low impedance type electrolytic capacitor is connected between pins 1 and 6 to provide decoupling for the input voltage. For effective high frequency decoupling the capacitor should be located as close as possible to the hybrid circuit and connected with short traces. The output voltage is filtered by connecting a 220µF 50V low impedance electrolytic from pin 12 to common. Like the input decoupling capacitor, this capacitor should also be connected with short traces to the hybrid circuit. A 1mH, 500mA inductor connected between pins 8 and 10 completes the circuit. The selection and characteristics of this inductor will be discussed in detail in Section (4). Pin 3 of the M57182N-315 is used for factory testing purposes. Do not connect any external circuits to this pin.

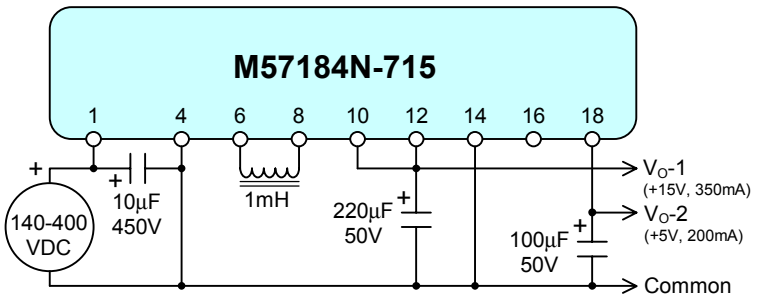
Figure 2: M57182N-315 Basic Circuit



(3) Basic Circuit for the M57184N-715

Figure 3 shows the basic application circuit for M57184N-715. Only four external components are required to complete the circuit. A 10µF 450V low impedance type electrolytic capacitor is connected between pins 1 and 4 to provide decoupling for the input voltage. For effective high frequency decoupling this capacitor should be located as close as possible to the hybrid circuit and connected with short traces. The output voltages are filtered by connecting a 220µF 50V low impedance electrolytic from pin 10 to common and a 100µF 50V low impedance electrolytic from pin 18 to common. The +15V output on pin 10 is connected to the input of the +5V regulator at pin 12. Like the input decoupling capacitor, these capacitors should also be connected with short traces to the hybrid circuit. A 1mH, 500mA inductor connected between pins 6 and 8 completes the circuit. The selection and characteristics of this inductor will be discussed in detail in Section (4). Pin 16 of the M57184N-715 is used for factory testing purposes. Do not connect any external circuits to this pin.

Figure 3: M57184N-715 Basic Circuit



(4) Inductor Selection for the M57184N-715 and M57184N-715

The 1mH inductor should be rated for at least 500mA and be free of saturation with superimposed DC. Undesirable saturation of the inductor can be detected by monitoring the ripple voltage across the filter capacitor on the +15V output. Figure 4 shows an AC coupled oscilloscope waveforms of the output ripple voltage with acceptable and unacceptable inductors. This measurement should be made using the maximum input voltage expected in the application and the +15V output fully loaded. For the M57184N-715 the +5V output should be unloaded while measuring the ripple voltage on the +15V output. Table 1 lists some acceptable inductors.

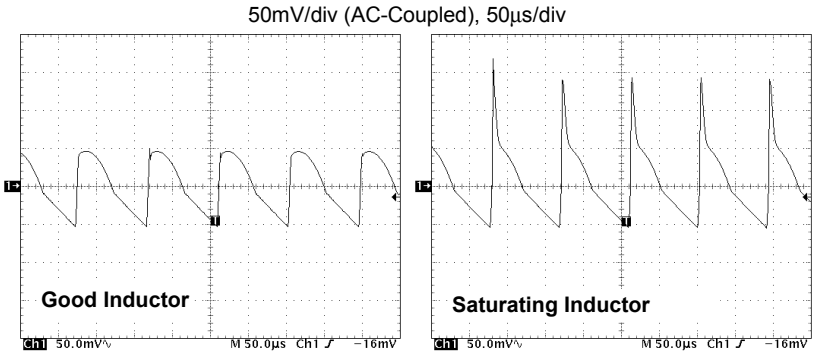


Figure 4: Output Ripple Voltage Waveforms

Manufacturer	Part Number
Mitsumi	C13-FR Series, Type #GA 102
API Delevan	4590-105K
J.W. Miller	5900-102

Table 1: Example Inductors

Caution - electrical shock hazard: The M57182N-315 and M57184N-715 are non-isolated DC-DC converters. Even though the output voltage is low (15V and 5V) their common ground potentials are directly tied to the high voltage DC input supply. All circuits connected to the output of the M57182N-315 and M57184N-715 must be treated as high voltage.

(5) Application Examples

The M57182N-315 and M57184N-715 are general-purpose high input voltage step down converters. They are useful for variety of applications where low voltage control power must be derived from rectified AC line voltages. The examples presented in this section show a few possible uses for these DC-DC converters.

A. Control Power for DIP-IPMs

The M57184N-715 is ideal for use with Powerex DIP-IPMs. These intelligent power modules are designed to use bootstrap techniques to develop the required floating supplies for the high side gate drive from a single 15VDC supply referenced to the negative side of the main DC bus. The DIP-IPMs also require a 5VDC supply for pull-up of the logic level control inputs. Figure 5 shows an example application circuit using the M57184N-715 to provide both control and logic power for a DIP-IPM. As shown in figure 5 the required power supplies are derived directly from the main DC link voltage (V_{CC}).

B. Power for Hybrid IGBT Gate drivers.

The M57182N-315 can be used to derive power for IGBT gate drive circuits directly from the high voltage DC link. Figure 6 shows a complete self-powered IGBT gate driver with short circuit protection. The control input signal and fault feedback are opto-isolated allowing direct connection to control logic. In Figure 6 an IGBT module and a free-wheeling diode configured as a DC chopper. The M57182N-315 converts the main DC bus voltage to 15V that is then fed to an M57145L-01 to create an isolated +15V/-8V supply for the hybrid IGBT gate driver. The isolation eliminates problems with ground loop noise.

Figure 5: Power Supply for DIP IPM

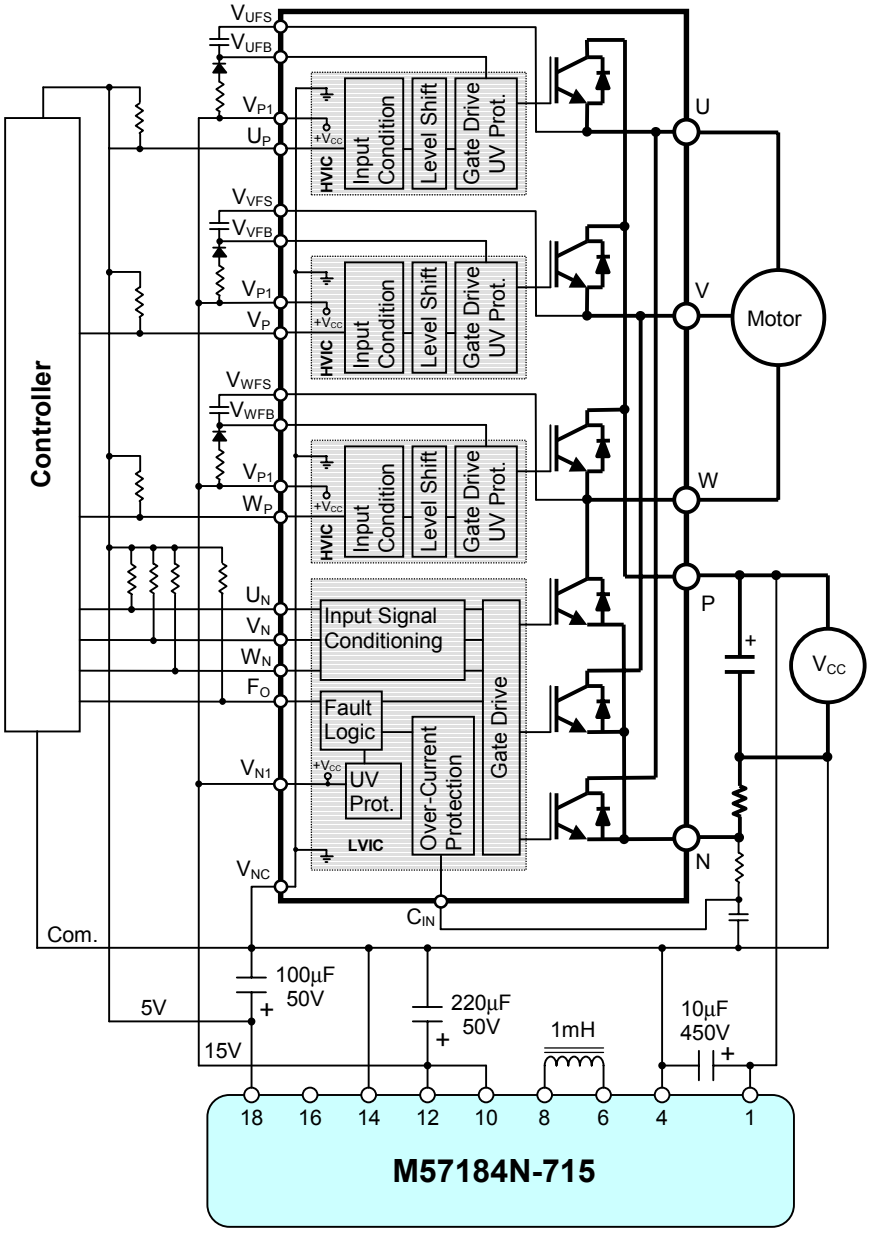
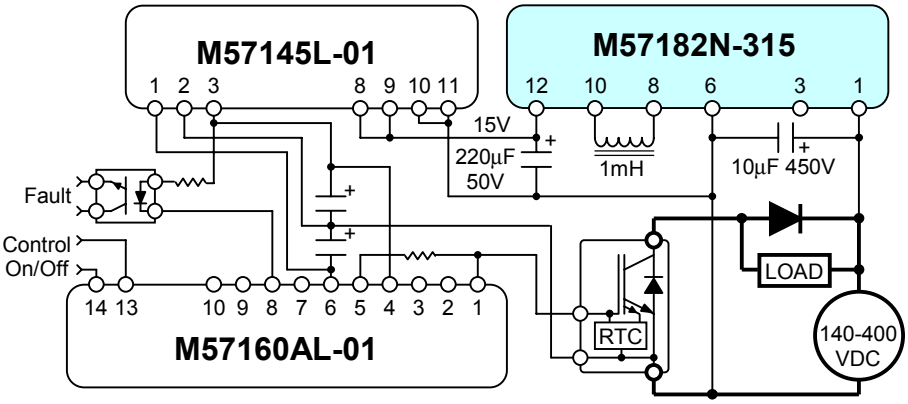


Figure 6: Power Supply for IGBT Gate Driver



C. Control Power for ASIPM

Powerex ASIPMs have integrated bootstrap circuits to provide floating power for the high side gate drivers. These modules are designed to use a single 15V control power supply to power all of the built in gate drive and protection circuits. The M57182N-315 provides a simple low cost means for generating the required power directly from the main DC bus voltage. Figure 7 shows a typical application circuit for a Powerex version 3 ASIPM (PS1103X series) using the M57182N-315 for control power.

Figure 7: Control Power Supply for Version 3 ASIPM