



## ■ Features

- Land Grid Array(LGA)surface mount
- Ultra compact size (12.19x12.19x3.1mm)
- 3~14.4Vdc wide input range
- Programmable output voltage from 0.6~5.5Vdc
- High efficiency up to 91%@ 12Vin
- Remote ON/OFF control
- Ultra-wide operating temperature range -40 ~ +90°C
- Protections: Short circuit (Continuous)
- No minimum load required
- 3 years warranty

## ■ Applications

- Telecom system
- Server and storage equipment
- Industrial control facility
- Distributed power architectures
- Intermediate bus voltage applications
- Renewable energy
- Battery management system(BMS)
- Field programmable gate array(FPGA)

## ■ GTIN CODE

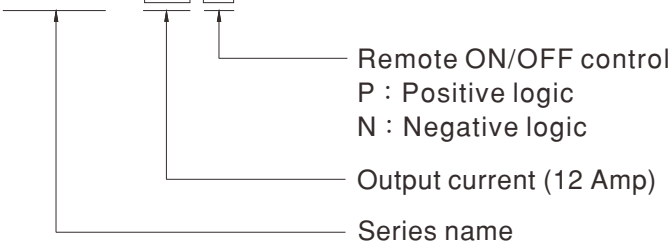
MW Search: <https://www.meanwell.com/serviceGTIN.aspx>

## ■ Description

The SPOL-12 series is a 12 Ampere non-isolated programmable point-of-load DC-to-DC converter with SMD package ideal for embedded applications. Its main features include ultra-compact size (12.19\*12.19\*3.1mm), wide input range 3~14.4Vdc and tunable output voltage from 0.6~5.5 Vdc via external resistor, wide working temperature -40~+90°C, remote ON/OFF function and short circuit protection. This makes it very suitable for intermediate bus architectures found in various applications such as industrial, distributed power, telecom and datacom applications.

## ■ Model Encoding

SPOL - 12 P





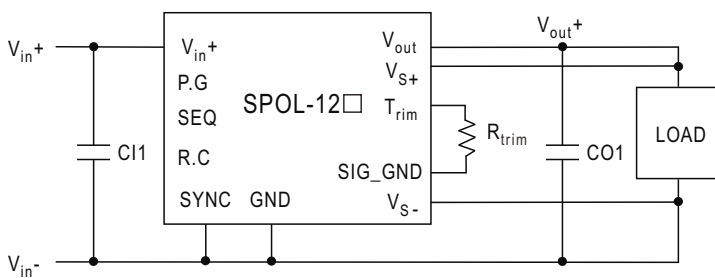
ORDER NO.	INPUT			OUTPUT		EFFICIENCY (TYP.)	CAPACITOR LOAD (MAX.)
	V <sub>in</sub> RANGE	I <sub>in</sub>		V <sub>out</sub>	I <sub>out</sub>		
		NO LOAD	FULL LOAD				
<b>SPOL-12</b> □ □ = P,N P: Postive N: Negative	Normal 12V (3 ~ 14.4V)	200mA	6A	5.5V	12A max.	91%@5.5V	200μF
		180mA	5.4A	5V		91%@5V	
		110mA	3.8A	3.3V		88%@3.3V	
		80mA	2.9A	2.5V		86%@2.5V	
		60mA	2.2A	1.8V		82.5%@1.8V	
		50mA	1.85A	1.5V		82%@1.5V	
		50mA	1.6A	1.2V		77%@1.2V	
		30mA	0.93A	0.6V		65%@0.6V	

Note: The efficiency is test by normal input, 12Vout and full load @25°C

**Output Voltage Trim**

The formula for output voltage T<sub>rim</sub>

$$R_{trim} (K\Omega) = \frac{12K}{V_o - 0.6}$$

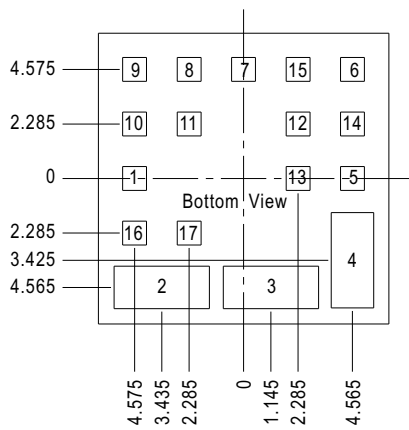
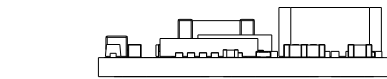
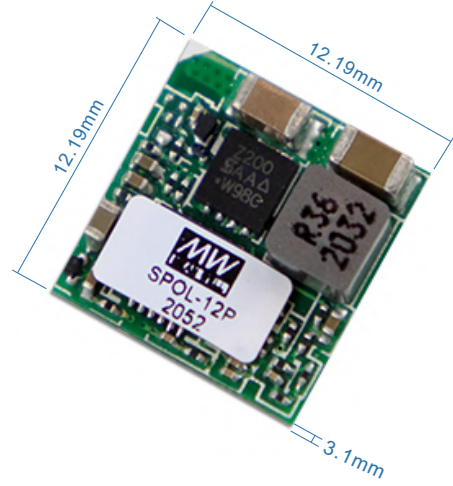
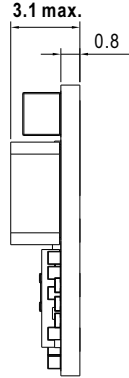
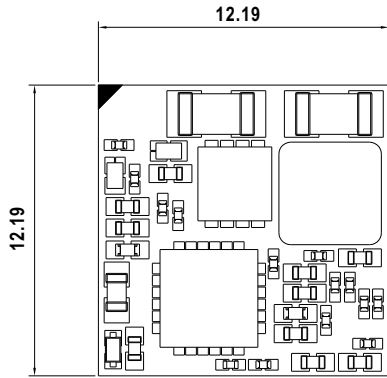


Output Voltage	Calculated R <sub>trim</sub> (KΩ)
5.5V	2.44
5V	2.727
3.3V	4.444
2.5V	6.316
1.8V	10
1.5V	13.33
1.2V	20
0.6V	∞(Open)

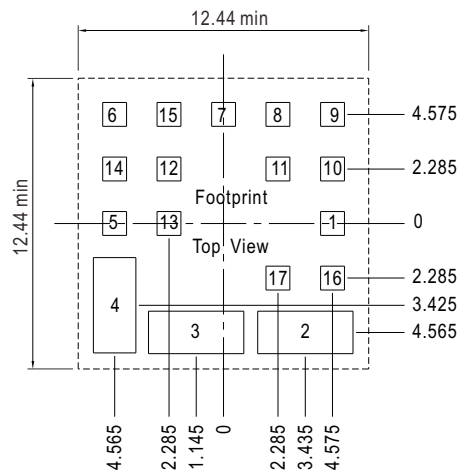
SPECIFICATION				
INPUT	VOLTAGE RANGE	3~14.4Vdc		
	START-UP TIME	30ms		
	START-UP VOLTAGE	3.0V max.		
	UNDER VOLTAGE SHUTDOWN (Typ.)	2.6V		
	RECOMMEND EXTERNAL FUSE	15A		
OUTPUT	VOLTAGE ACCURACY	±3%		
	RATED CURRENT	12A		
	OUTPUT VOLTAGE TRIM <small>Note.2</small>	0.6V ~ 5.5V max. (Please see page 2 for more detail)		
	RATED POWER	66W max.		
	RIPPLE & NOISE <small>Note.3</small>	50mVp-p max. @Vo<1.2Vdc ; Vo>1.2Vdc 3% Vo mVp-p		
	LINE REGULATION <small>Note.4</small>	±0.4%		
	LOAD REGULATION <small>Note.5</small>	±0.2%		
	SWITCHING FREQUENCY (Typ.)	800KHz		
	MINIMUM LOAD	No minimum load required		
PROTECTION	SHORT CIRCUIT	Protection type : Continuous(No damage), automatic recovery		
FUNCTION	REMOTE CONTROL	Positive Power ON : Open or 1.6Vdc ≤ R.C ≤ 5.5Vdc ; Power OFF: Short to GND or ≤R.C≤0.6Vdc Negative Power OFF: Short or 0Vdc ≤ R.C ≤ 0.6Vdc ; Power OFF: 1Vdc ≤R.C≤5.5Vdc		
	POWER GOOD(P.G)	Over voltage threshold for P.G ON 116.5% Vo		
		Over voltage threshold for P.G OFF 120% Vo		
		Under voltage threshold for P.G ON 91% Vo		
P.G low sink current @P.G = 0.2V 100μA				
ENVIRONMENT	COOLING METHOD	Force air convection		
	WORKING TEMP. <small>Note.7</small>	-40 ~ +90°C (Refer to "Derating Curve")		
	WORKING HUMIDITY	20% ~ 90% RH non-condensing		
	STORAGE TEMP., HUMIDITY	-55 ~ +125°C, 10 ~ 95% RH non-condensing		
	TEMP. COEFFICIENT	0.03% / °C (0 ~ 90°C)		
	SOLDERING TEMPERATURE	Please see page 7 for more detail		
	VIBRATION	MIL-STD 202G ( 0~55Hz, 10G/1min period, 2hr.)		
SAFETY & EMC ( <small>Note.6</small> )	SAFETY STANDARDS	LVD BS EN/EN62368-1 approved ; EAC TP TC 004 pending		
	EMC EMISSION	Parameter	Standard	Test Level / Note
		Conducted	BS EN/EN55032	Class A(with external components)
	EMC IMMUNITY	Radiated	BS EN/EN55032	Class A(with external components)
		Parameter	Standard	Test Level / Note
		ESD	BS EN/EN61000-4-2	Level 3, ± 8KV air, ± 6KV contact
		EFT/Burest	BS EN/EN61000-4-4	Level 3, 2.0KV
Surge		BS EN/EN61000-4-5	Level 4, 2KV	
OTHERS	MTBF	1132Khrs MIL-HDBK-217F(25°C)		
	DIMENSION (L*W*H)	12.19*12.19*3.10mm (0.48*0.48*0.122 inch)		
	PACKING	0.8g ; Please see page 11 for more detail		
NOTE	1.All parameters are specified at normal input(12Vdc), rated load, 25°C 70% RH ambient. 2.The output voltage range is limited by Vin. (Vout ≤ Vin - 2Vdc). 3.Ripple & noise are measured at 20MHz by using a 12" twisted pair terminated with a 0.1μf & 2x47μf capacitor, show at Vout= 1Vdc. 4.Line regulation is measured from low line to high line at rated load. 5.Load regulation is measured from 10% to 100% rated load. 6.The final equipment must be re-confirm that it still meet EMC directives. For guidance on how to perform these EMC tests, please refer to "EMI testing of component power supplies."(as available on <a href="http://www.meanwell.com">http://www.meanwell.com</a> ) 7. The working temperature is test by 95.4x85mm, 2oz and 2 layer test board. ※ Product Liability Disclaimer : For detailed information, please refer to <a href="https://www.meanwell.com/serviceDisclaimer.aspx">https://www.meanwell.com/serviceDisclaimer.aspx</a>			

**Mechanical Specification**

• Tolerance:  $\pm 0.25\text{mm}$



Pad2~4 Dimension =  $4 \times 1.78\text{mm}$   
Pad1 & Pad5~17 Dimension =  $1 \times 1\text{mm}$



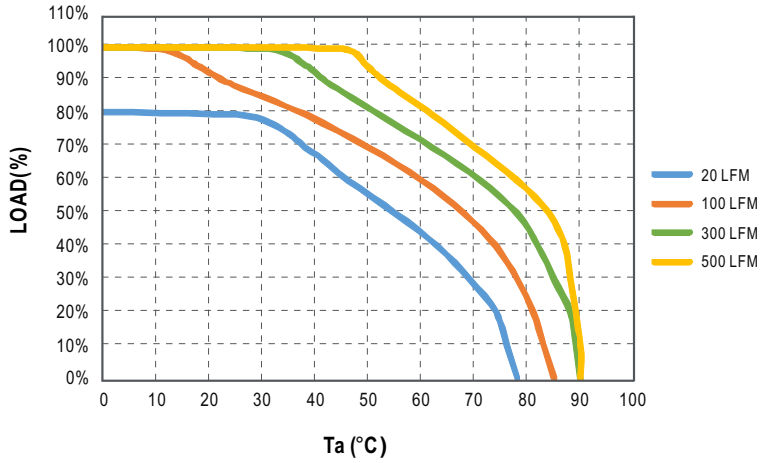
Pad2~4 Dimension =  $4.2 \times 1.87\text{mm}$   
Pad1 & Pad5~17 Dimension =  $1.05 \times 1.05\text{mm}$

**Pin Define**

Pin-Out			
Pin No.	Single	Pin No.	Single
1	Remote ON/OFF	8,14,15,16,17	N.C
2	Vin	9	SEQ
3,7	GND	10	P.G
4	Vout	11	SYNC
5	VS+	12	VS-
6	Trim	13	SIG_GND

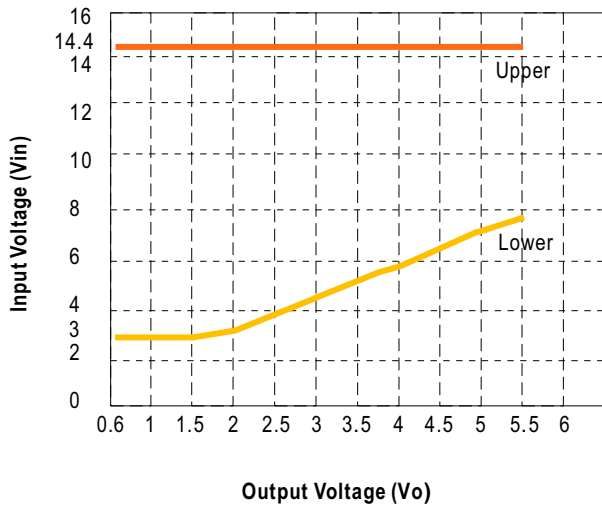
If Pin11 is not being used, connect the SYNC pin to GND.  
N.C= No Connection

■ Derating Curve

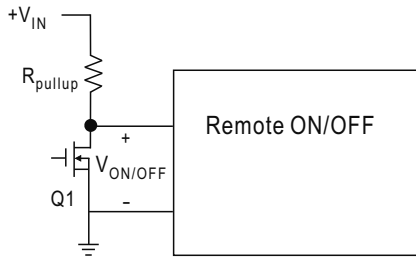


The derating curve was measured at 12V input and 5V output., all of the element can't be higher than 125°C.

■ Output Voltage vs. Input Voltage Set Point Area Plot



### Remote ON/OFF Example Application Circuit



The circuit configuration for using the Remote ON/OFF pin is shown in figure. And the logic type active mode as the description below.

Positive Logic

SPOL-12P ON : Q1 OFF

SPOL-12P OFF : Q1 ON

Negative Logic

SPOL-12N ON : Q1 ON

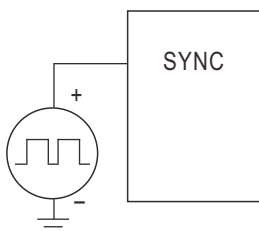
SPOL-12N OFF : Q1 OFF

### Power Good

Power Good monitor output. This open-drain output goes low during overcurrent, short-circuit, UVLO, overvoltage and undervoltage, overtemperature, or when the output is not regulated (such as an prebias output). An external pullup resistor to VDD or to an external rail is required. Included is a 20- $\mu$ s deglitch filter. P.G pin can be connected through a pullup resistor suggested value 100K $\Omega$ ) to a source of 5VDC or lower.

### Synchronization

The module switching frequency can be synchronized to a signal with an external frequency within a specified range. Synchronization can be done by using the external signal applied to the SYNC pin of the module, with the converter being synchronized by the rising edge of the external signal. The Electrical Specifications table specifies the requirements of the external SYNC signal. If the SYNC pin is not used, the module should free run at the default switching frequency. If synchronization is not being used, connect the SYNC pin to GND.

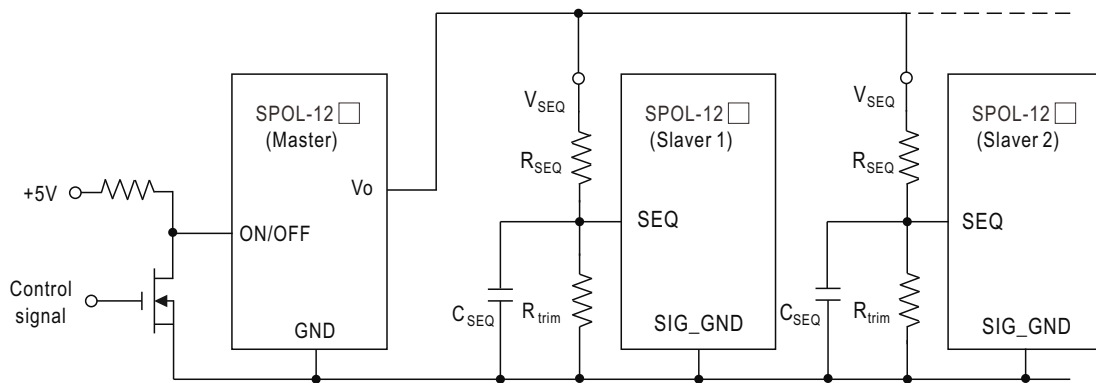


### ■ Output Voltage Sequencing

The SEQ pin can be used when master-slave power-supply tracking is required. The voltage applied to the SEQ pin should be scaled down by the same ratio as used to scale the output voltage down to the reference voltage of the module. This is accomplished by an external resistive divider connected across the sequencing voltage before it is fed to the SEQ pin. The minimum recommended delay between the ON/OFF signal and the sequencing signal is 10ms to ensure that the module output is ramped up according to the sequencing signal. This ensures that the module soft-start routine is completed before the sequencing signal is allowed to ramp up.

When an analog voltage is applied to the SEQ pin, the output voltage tracks this voltage until the output reaches the set-point voltage. The final value of the SEQ voltage must be set higher than the set-point voltage of the module. The output voltage follows the voltage on the SEQ pin on a one-to-one basis. By connecting multiple modules together, multiple modules can track their output voltages to the voltage applied on the SEQ pin.

To initiate simultaneous shutdown of the modules, the SEQ pin voltage is lowered in a controlled manner. The output voltage of the modules tracks the voltages below their setpoint voltages on a one-to-one basis. A valid input voltage must be maintained until the tracking and output voltages reach ground potential.



Schematic for Output Sequencing

### ■ Surface Mount Information

#### 1. Pick and Place

The SPOL-12 □ Open Frame modules use an open frame construction and are designed for a fully automated assembly process. We suggest the pick and place operations is inductor.

#### 2. MSL Rating

The SPOL-12 □ Open Frame modules have a MSL rating of level 3.

#### 3. Storage and Handling

The recommended storage environment and handling procedures for moisture-sensitive surface mount packages is detailed in J-STD-033 (Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices).

Moisture barrier bags (MBB) with desiccant are required for MSL ratings of 3 or greater. These sealed packages should not be broken until time of use. Once the original package is broken, the floor life of the product at conditions of  $\leq 30^{\circ}\text{C}$  and 60% relative humidity 168 hours varies according to the MSL rating (see J-STD-033). The shelf life for dry packed SMT packages will be a maximum of 12 months from the bag seal date, when stored at the following conditions:  $< 40^{\circ}\text{C}$ ,  $< 90\%$  relative humidity.

**4. Post Solder Cleaning and Drying Considerations**

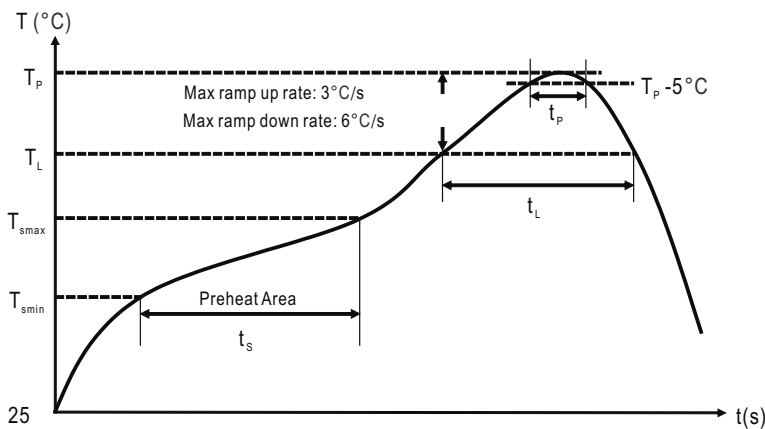
To avoid contamination on the soldering pads extra care has to be taken when handling the boards. Clean soldering surfaces do not generate as much gases when the flux reduce the metal oxides or react with contaminants during the soldering process.

**5. Nozzle**

The SPOL-12 weight has been kept to a minimum by using open frame construction. Variables such as nozzle size, tip style, vacuum pressure and placement speed should be considered to optimize this process.

**6. Lead-free Reflow Profile**

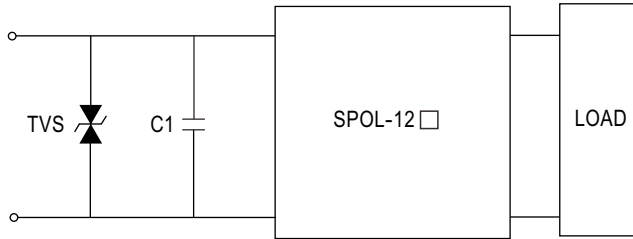
Power Systems will comply with J-STD-020 (Moisture/Reflow Sensitivity Classification for non-hermetic Solid State Surface Mount Devices) for both Pb-free solder profiles and MSL classification procedures. This standard provides a recommended forced-air-convection reflow profile based on the volume and thickness of the package. The suggested Pb-free solder paste is Sn/Ag/Cu (SAC). The recommended linear reflow profile using Sn/Ag/Cu solder is shown. Soldering outside of the recommended profile requires testing to verify results and performance.



Profile	Pb-Free Assembly
Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> )	3°C/s max.
Preheat	
Temperature Min. (T <sub>smin</sub> )	150°C
Temperature Max. (T <sub>smax</sub> )	200°C
T <sub>s</sub> (T <sub>smin</sub> to T <sub>smax</sub> )	60-120s
Temperature (T <sub>p</sub> )	245°C
Time maintained above	
Temperature (T <sub>L</sub> )	217°C
Time (t <sub>l</sub> )	60-150s
Time within 5°C of the specified	
Peak temperature (T <sub>p</sub> )	20-40s
Ramp down rate (T <sub>p</sub> to T <sub>L</sub> )	6°C/s max
Time 25°C to peak temperature	8 minutes max.



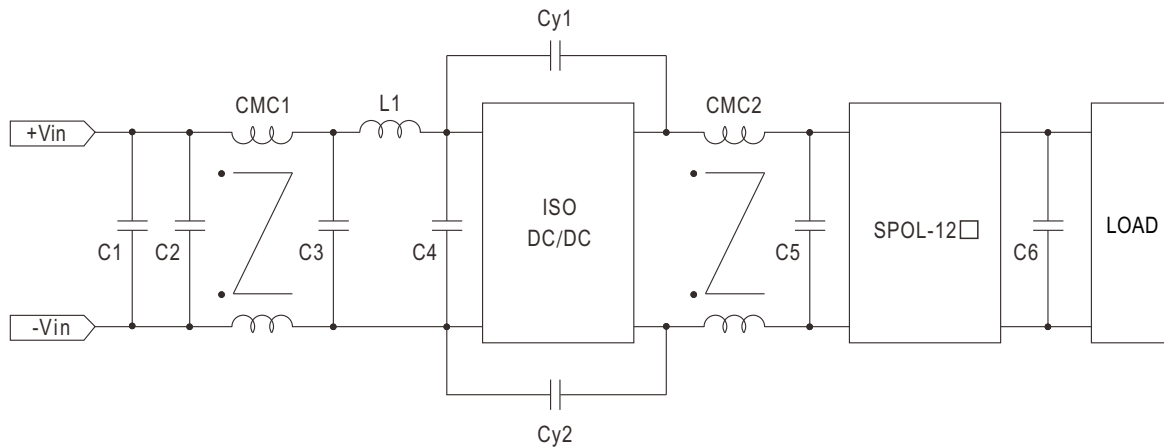
■ EFT and surge external input capacitor required



TVS	C1
P4SMAJ13CA	10000 $\mu$ F/25V

■ EMC Suggestion Circuit

※ Required external components to meet BS EN/EN55032 radiated Class A

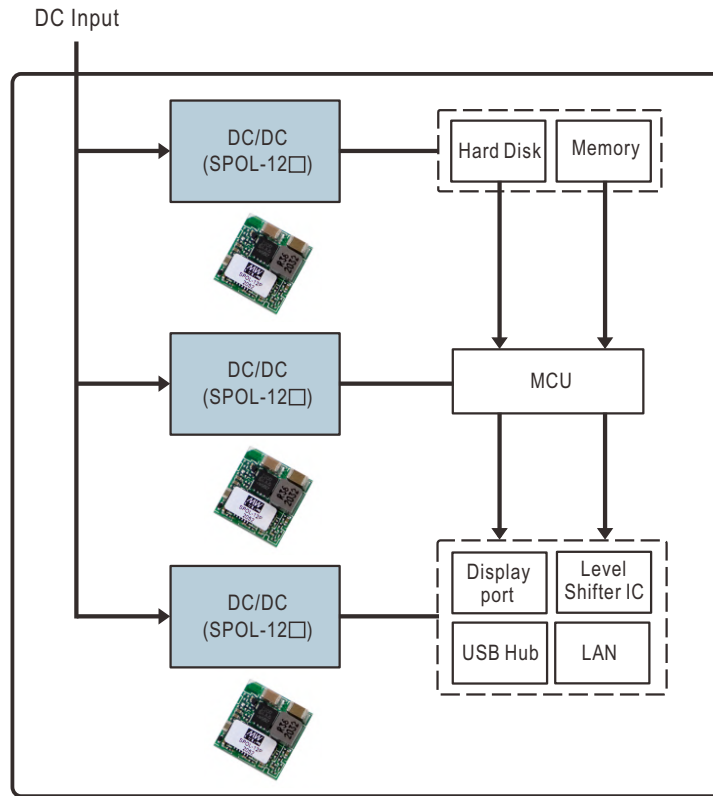


C1	C2,C3,C4	L1	C5	C6
220 $\mu$ F (E-cap)	4.7 $\mu$ F x 2 (MLCC)	3.3 $\mu$ H	10 $\mu$ F x 5 (MLCC)	47 $\mu$ F x 2 (MLCC)

CMC1	CMC2	Cy1, Cy2
2.4mH (CMC, T22x12x8)	2.1mH (CMC, T22x12x8)	2200pF x 3 (MLCC)

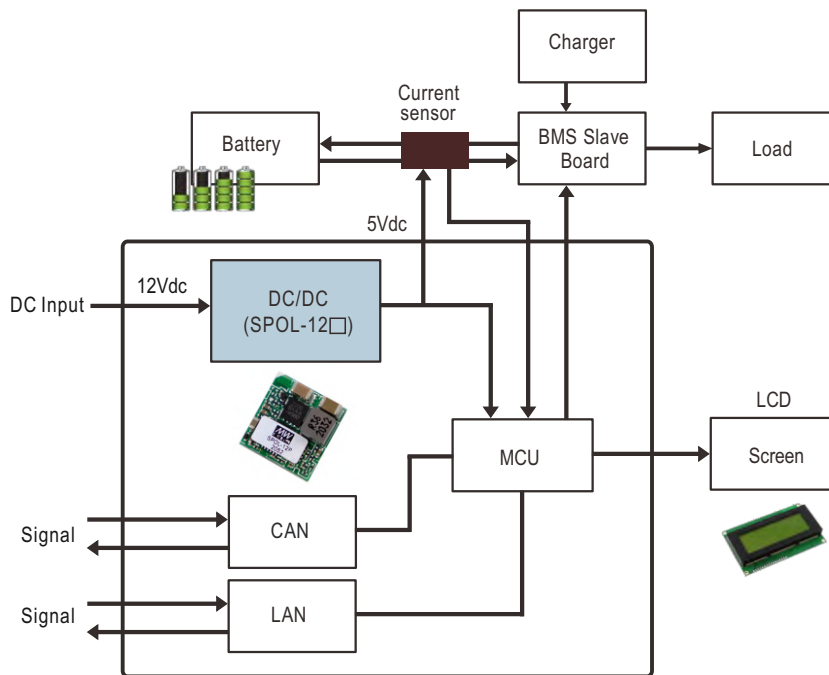
## Typical Application

※ IPC (Industrial PC)



Field-Programmable Gate Array

※ Green Energy



**Packing**

Reel Packing	MPQ Per Reel (PCS)	One Box G.W.	Max. Q'TY/ Carton(PCS)	One Carton G.W.
<p>Unit : mm</p> <p>1). 10 sprocket hole pitch cumulative tolerance <math>\pm 0.2</math> mm.                  2). All dimensions meet EIA-481-2A requirements.                  3). Component loader per 13" reel : 850 pcs.                  4). All dimensions = <math>\pm 0.1</math> mm.</p> <p>Package : 1 Tape Reel = 850 pcs</p> <p>1 Tape Reel = 850 converters                  Carton accommodates 2 boxes 1700 converters per carton</p>	850	1.11Kg	1700	3Kg

**Installation Manual**

Please refer to : <http://www.meanwell.com/manual.html>