

Typical Features	
◆	Wide input voltage range 4:1
◆	Ultra thin Package:11.8mm
◆	Transfer Efficiency up to 93%
◆	Ultra-low standby power consumption 0.7W
◆	Fast startup time 20ms
◆	Long-term short circuit protection, automatic recovery
◆	Protection: Input under voltage, output over voltage, short circuit, over current
◆	Isolation Voltage 1500VDC
◆	Operating Temperature: -40°C~+105°C
◆	Good EMI performance
◆	International standard pin-out



**FD60-XXSXXB3R2** series ----- 60W DC-DC module power supply, 4:1 wide range input voltage, ultra-fast startup, isolated regulated output, DIP/binding post/guide rail package, single output. Isolation voltage 1500VDC. With input undervoltage protection, output overcurrent protection, output short circuit protection, output overvoltage protection and other functions, it is widely used in industrial control, power equipment, communications, locomotives, industrial robots, and railway onboard electronic equipment. When the product is used in an environment with relatively harsh electromagnetic compatibility, please refer to the application circuit provided by our company.

### Typical Product List

Part No	Input Voltage Range (VDC)		Output Voltage/Current (Vo/Io)		Input Current (mA) (Nominal Voltage)		Max. Capacitive Load u F	Ripple & Noise mVp-p (mV) Typ	Efficiency (%)	
	Nominal	Range	Voltage (V)	Current (A)	Full load (mA)	No Load (mA)			Min	Typ.
*FD60-18S05B3R2	24	9-36	5	12	2718	30	10000	100	90	92
FD60-18S12B3R2			12	5	2718	30	6000	100	91	93
*FD60-18S15B3R2			15	4	2718	30	4000	100	91	93
FD60-18S24B3R2			24	2.5	2718	30	2000	130	91	93
*FD60-36S05B3R2	48	18-75	5	12	1344	15	10000	100	90	92
*FD60-36S12B3R2			12	5	1344	15	6000	100	91	93
*FD60-36S15B3R2			15	4	1344	15	4000	100	91	93
*FD60-36S24B3R2			24	2.5	1344	15	2000	130	91	93

Note:

- 1: "\*" indicates a model under development;
- 2: Model description: R indicates a model with remote control pin and output voltage adjustment pin;
- 3: Package description: Suffix -H indicates a model with heat sink, -T (H) indicates a wiring type (with heat sink) package, and -TS (H) indicates a guide rail type (with heat sink) package;

- 4: The above efficiency is measured by the nominal input voltage and output rated load;
- 5: The maximum capacitive load refers to the maximum capacity allowed by the external output capacitor when the power supply is started at the rated load. If this capacity is exceeded, the power supply may not start;
- 6: The above is only a partial product list. If you need products outside the list, please contact our sales department.

**Input Specifications**

Item	Working conditions	Min	Typ.	Max	Unit
Standby power consumption	Input voltage range	/	0.7	/	W
Input surge voltage (1Sec.max)	24Vdc Input	-0.7	/	50	VDC
	48Vdc Input	-0.7	/	100	
Start-up voltage	24Vdc Input	5	/	9	
	48Vdc Input	13	/	18	
Input filter	Pi filter				
Hot Plug	Unavailable				
CTRL	Module is turned on	CTRL is left floating or connected to high level (3V-12VDC)			
	Module shutdown	CTRL connected to-Vin or low level (0-1.2VDC)			
	Input current at shutdown	30mA (TYP)			

\*Ctrl controls the voltage on the pin relative to the input -Vin pin.

**Output Specification**

Items	Test Conditions	Min	Typ.	Max	Unit
Output Voltage Accuracy	Input voltage range, nominal load	/	±1	±2	%
Voltage Regulation	Full voltage range, nominal load	/	±0.2	±0.5	%
Load Regulation	5%~100% nominal load	/	±0.5	±1	%
Ripple & Noise	5%-100%load, nominal voltage (20MHz bandwidth)	/	130	/	mVp-p
Dynamic response deviation	25% nominal load step, 5V output voltage	/	±5	±10	%
	25% of nominal load step, other output voltages	/	±3	±5	
Dynamic Response	25% of nominal load step, nominal input voltage	/	250	500	us
Output voltage adjustable (Trim)	Input voltage range, nominal load	90	/	110	%Vo
Output over-voltage Protection		110	140	160	%Vo
Output over-current Adjustment		110	140	200	%Io
Output Short circuit Protection		Continuous, self-recovery			

**General Specification**

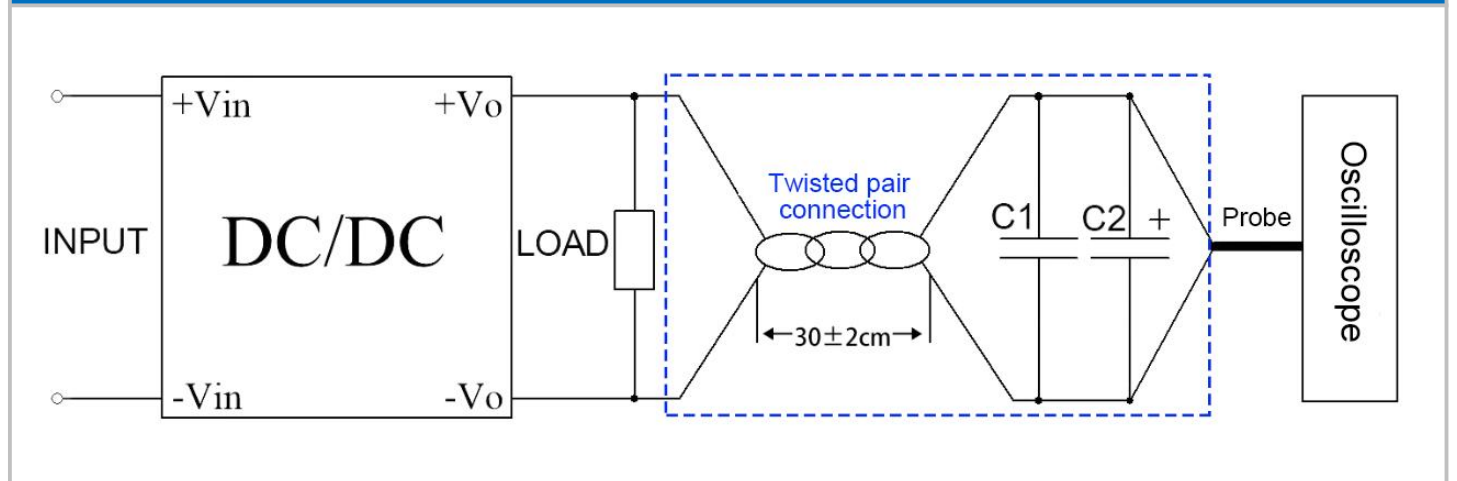
Items	Test Conditions	Min	Typ.	Max	Unit
Switching Frequency	Operating mode (PWM)	/	370	/	KHz
Operating Temperature	Refer to temperature derating curve	-40	/	+105	°C
Storage Temperature	/	-55	/	+125	
Max Case Temperature	Refer to product characteristic curve	/	/	+105	
Pin resistance soldering	The distance between the soldering point	/	/	300	

temperature	and the shell is 1.5mm, 10 seconds				
Relative Humidity	No condensation	5	/	95	%RH
Isolation Voltage	I/P-O/P, test for 1min, leakage current is less than 1mA	1500	/	/	VDC
	I/P or O/P - CASE, test for 1 minute, leakage current is less than 1mA	1000	/	/	
Isolation capacitor	I/P-O/P, 100KHz/0.1V	/	2200	/	pF
MTBF	MIL-HDBK-217F@25°C	1000	/	/	KHrs
Vibration	/	10-150Hz,5G,0.75mm, along X, Y and Z			
Cooling method	Natural air cooling				
Shell material	Metal Aluminum				
Weight/ Dimension	Model No.	Weight (Typ)	L x W x H		
	FD60-18SXXB3R2	41g	50.8 X 25.4 X 11.8 mm	2.00 X 1.00 X 0.464 inch	
	FD60-18SXXB3R2-H	53g	50.8 X 25.4 X 21.8 mm	2.00 X 1.00 X 0.858 inch	
	FD60-18SXXB3R2-T	62g	76.0 X 31.5 X 21.3 mm	2.99 X 1.24 X 0.838 inch	
	FD60-18SXXB3R2-TH	74g	76.0 X 31.5 X 31.0 mm	2.99 X 1.24 X 1.220 inch	
	FD60-18SXXB3R2-TS	82g	76.0 X 31.5 X 26.0 mm	2.99 X 1.24 X 1.023 inch	
	FD60-18SXXB3R2-TSH	94g	76.0 X 31.5 X 35.5 mm	2.99 X 1.24 X 1.397 inch	

### EMC Characteristics

EMI	CE	CISPR22/EN55032	CLASS A CLASS B	(EMC Recommended Circuit 1) (EMC Recommended Circuit 2)
	RE	CISPR22/EN55032	CLASS A CLASS B	(EMC Recommended Circuit 1) (EMC Recommended Circuit 2)
EMS	ESD	IEC/EN61000-4-3	10V/m	Perf.Criteria A
	RS	IEC/EN61000-4-6	3Vr.m.s	Perf.Criteria A
	EFT	IEC/EN61000-4-2	Contact ±6KV	Perf.Criteria B
	Surge	IEC/EN61000-4-5	±2KV	Perf.Criteria A (EMC Recommended Circuit 2)
	Pulse group immunity	IEC/EN61000-4-4	±2KV	Perf.Criteria A (EMC Recommended Circuit 2)

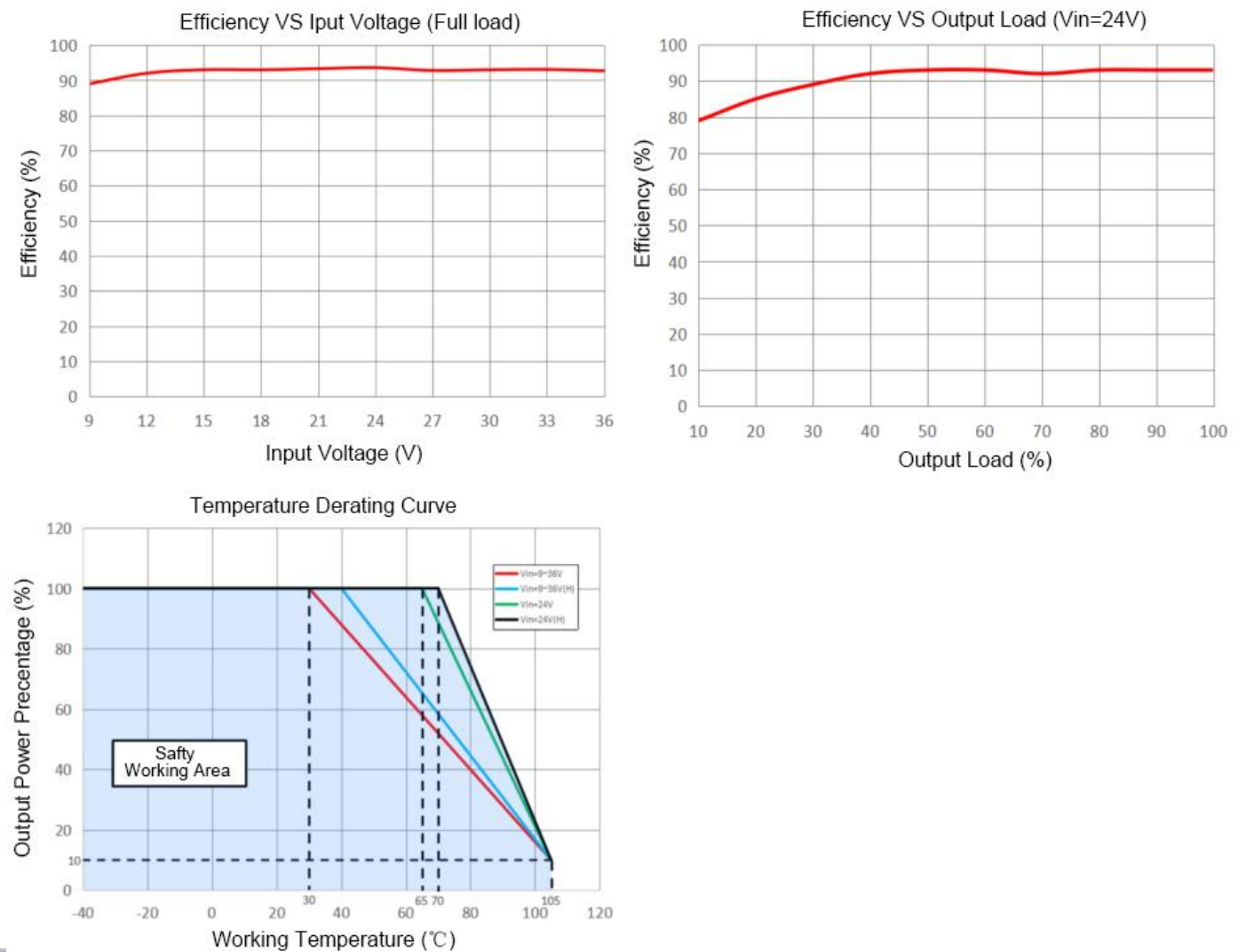
### Ripple & Noise Test (Twisted Pair Method)



**Test conditions:**

1. Ripple noise is connected using 12# twisted pair cable, oscilloscope sampling uses sampling mode, oscilloscope bandwidth is set to 20MHz, 100M bandwidth probe is used, probe cap and ground clip are removed; and C1 (0.1uF) polypropylene capacitor and C2 (10uF) high frequency low resistance electrolytic capacitor are connected in parallel at the probe end of the twisted pair cable;
2. Ripple noise test: The module input end (INPUT) is connected to the input power supply, and the power supply output is connected to the electronic load (LOAD) through the power line. The test is sampled from the power output port using a 30±2 cm twisted pair cable alone, and connected to the oscilloscope probe according to polarity;

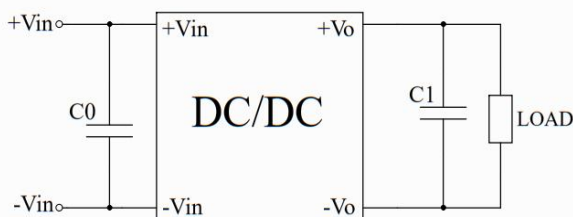
**Characteristic Curve**



**Design and Application Reference**

**Recommended Circuit**

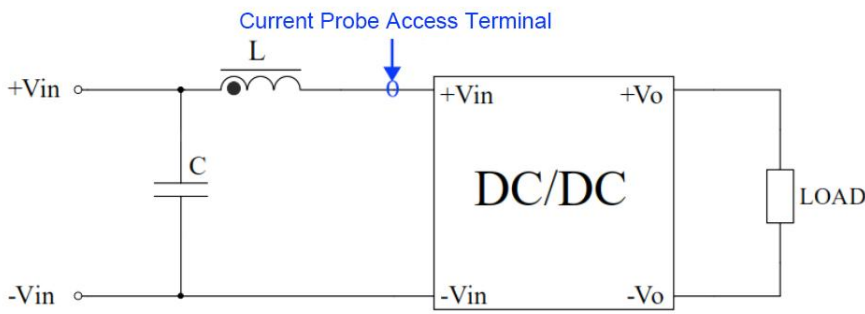
1. This series of module power supplies are tested according to this peripheral circuit before leaving the factory. Increasing the capacity of C0 or C1 can reduce the output ripple, but the output capacity must be less than the maximum capacitive load;



**Parameter Description:**

Components	Parameter
C0	47-220uF/100V
C1	47uF/50V

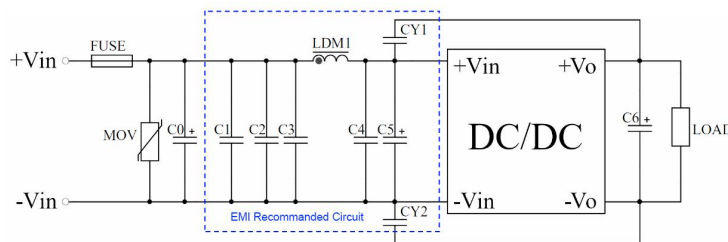
2. Input reflected ripple current test peripheral circuit:



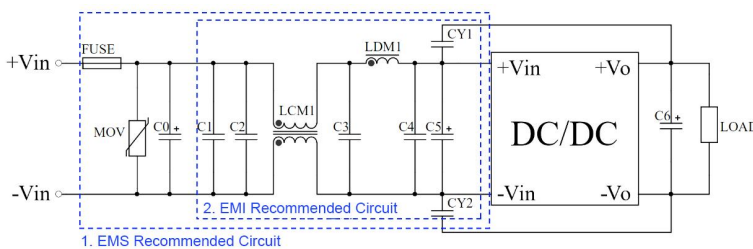
Parameter Description:

Components	Parameter
C	220uF/100V
L	4.7uH/15A

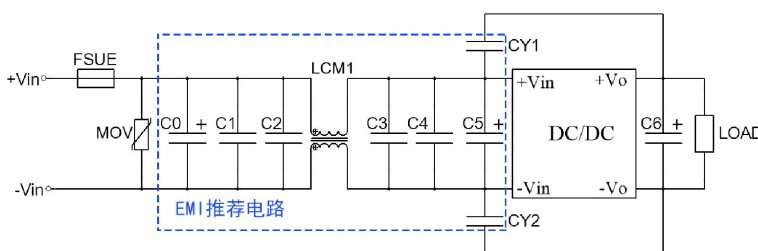
3. Recommended EMC external circuits:



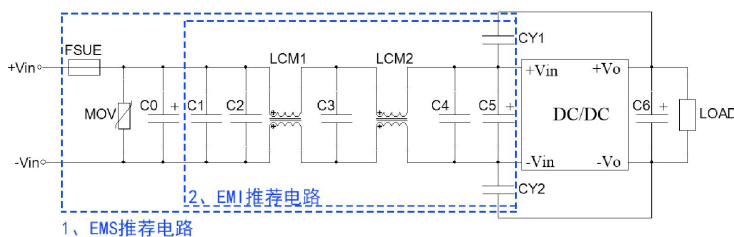
Recommended Circuit 1



Recommended Circuit 2



Recommended Circuit 3



Recommended Circuit 4

Parameter recommendation:

Device code	Recommended Circuit 1	Recommended Circuit 2
FUSE	Select according to customer needs	
MOV	14D470K	14D470K
LDM1	2.2uH	2.2uH
LCM1	/	2.2mH
C0	680uF/100V	680uF/100V
C1、C2	4.7uF/100V	4.7uF/100V
C3、C4	10uF/100V	10uF/100V
C5	330uF/100V	330uF/100V
C6	100uF/50V	100uF/50V
CY1,CY2	2.2nF/2KV	

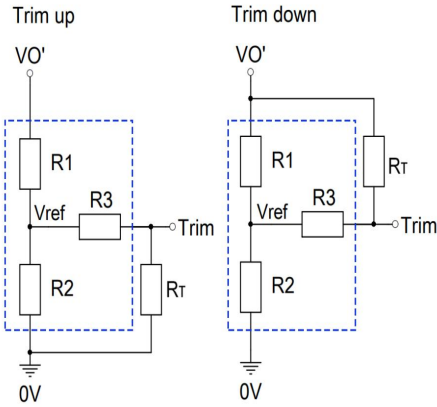
Parameter recommendation:

Device code	Recommended Circuit 3	Recommended Circuit 4
FUSE	Select according to customer needs	
MOV	14D470K	14D470K
LCM1	10mH	10mH
LCM2	/	10mH
C0	680uF/100V	680uF/100V
C1、C2	4.7uF/100V	4.7uF/100V
C3、C4	10uF/100V	C3:10uF/100V; C4:47uF/100V
C5	330uF/100V	330uF/100V
C6	100uF/50V	100uF/50V
CY1,CY2	2.2nF/2KV	



4. Use of Trim and calculation of Trim resistance

Trim resistance calculation formula:



**Note:**

Trim uses circuits, and the dotted box area is the interior of the product

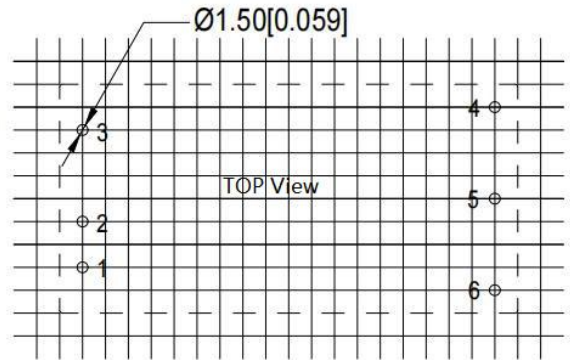
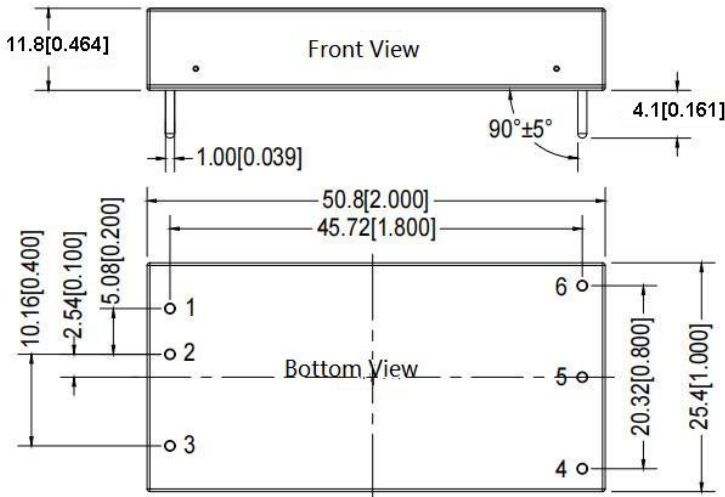
$$\begin{aligned} \text{up: } R_T &= \frac{aR_2}{R_2-a} - R_3 & a &= \frac{V_{ref}}{V_o' - V_{ref}} \cdot R_1 \\ \text{down: } R_T &= \frac{aR_1}{R_1-a} - R_3 & a &= \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2 \end{aligned}$$

RT is the Trim resistor, a is a custom parameter, and Vo' is the actual voltage that needs to be adjusted up or down.

Output Voltage	Trim uses internal circuit parameters			
Vout(VDC)	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
5	24	24	68	2.5
12	18	4.7	30	2.5
15	24	4.78	30	2.5
24	25.5	2.955	18	2.5

**B3 Package(without Heat Sink)**

THIRD ANGLE PROJECTION



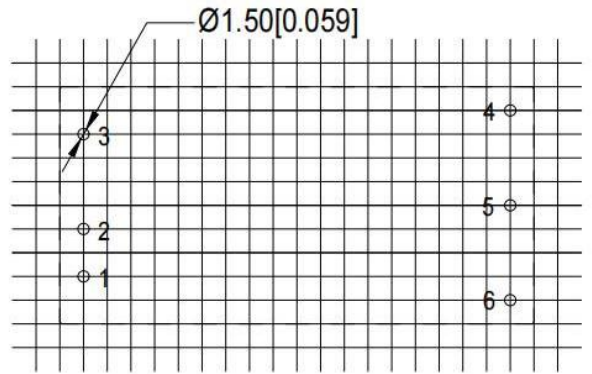
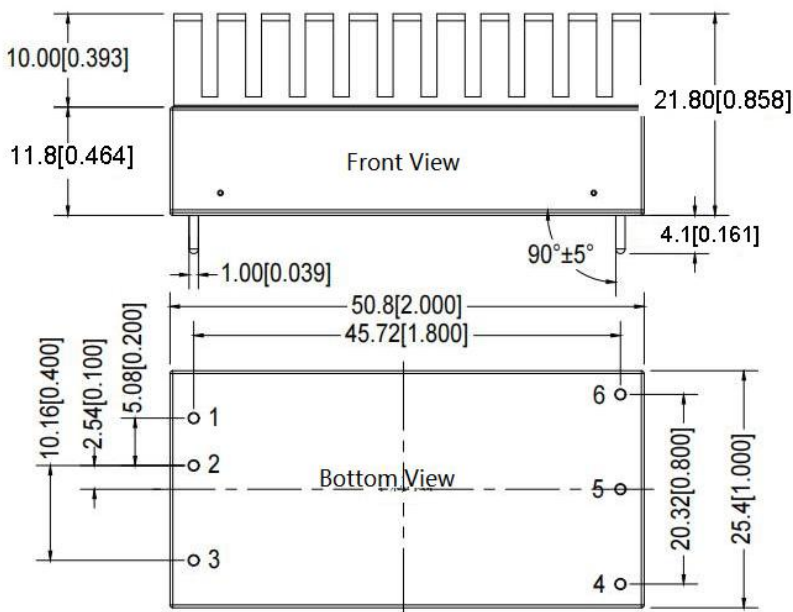
Grid:2.54\*2.54mm  
Unit:mm[inch]  
Pin tolerance:±0.10[±0.004]  
General tolerance:±0.50[±0.020]

**Pin Definition**

	1	2	3	4	5	6
FD60-18SXXB3R2	+Vin	-Vin	CTRL	Trim	-Vo	+Vo

**B3-H Package(with Heat Sink)**

THIRD ANGLE PROJECTION

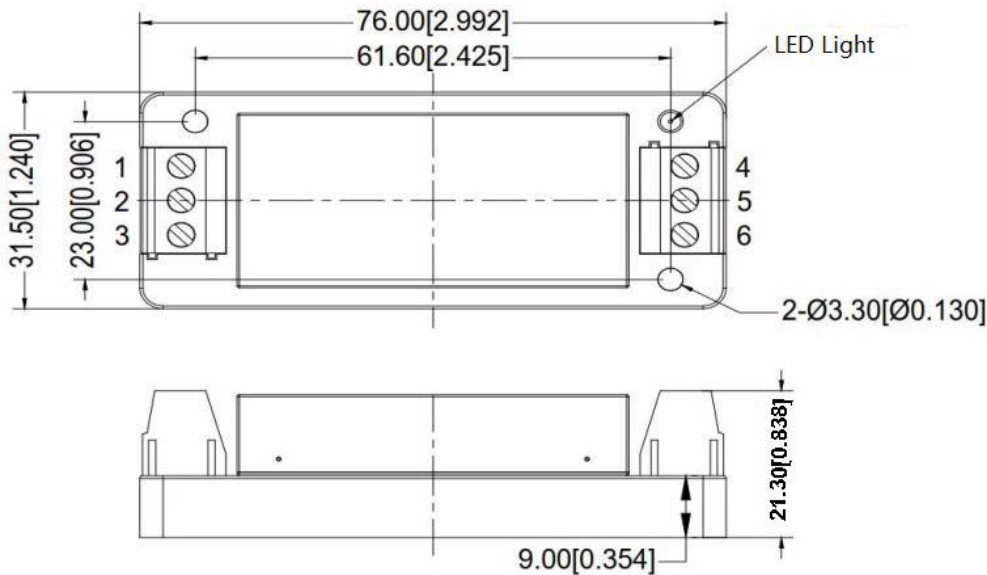


Note:  
Grid:2.54\*2.54mm  
Unit:mm[inch]  
Pin tolerance:±0.10[±0.004]  
General tolerance:±0.50[±0.020]

**Pin Definition**

FD60-18SXXB3R2-H	1	2	3	4	5	6
	+Vin	-Vin	CTRL	Trim	-Vo	+Vo

**B3-T Package( Wiring type without Heat Sink)**

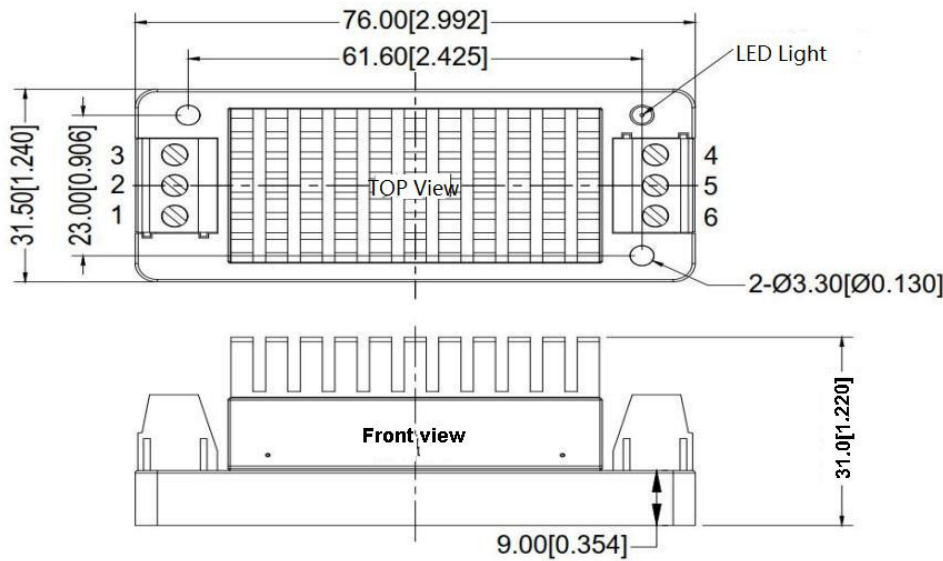


Note:  
Unit: mm(inch)  
Wiring specifications: 24-12AWG  
Unmarked Tolerance: ±1.0 (±0.039)

**Pin Definition**

FD60-18SXXB3R2-T	1	2	3	4	5	6
	+Vin	-Vin	CTRL	Trim	-Vo	+Vo

**B3-TH Package(Wiring type with Heat Sink)**



**Note:**

**Unit: mm(inch)**

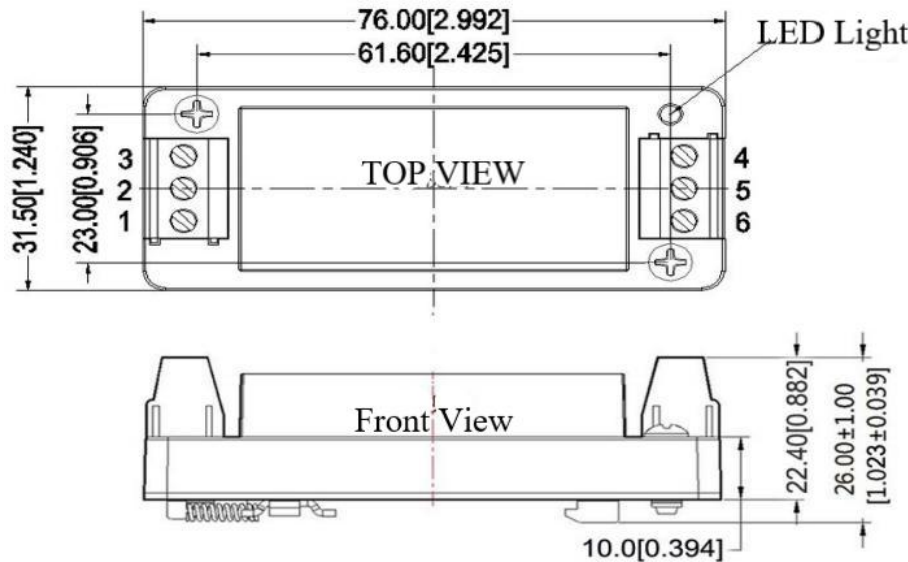
**Wiring specifications: 24-12AWG**

**Unmarked Tolerance: ±1.0 (±0.039)**

**Pin Definition**

FD60-18SXXB3R2-TH	1	2	3	4	5	6
	+Vin	-Vin	CTRL	Trim	-Vo	+Vo

**B3-TS Package(Wiring type with Heat Sink)**



**Note:**

**Unit: mm(inch)**

**Wiring specifications: 24-12AWG**

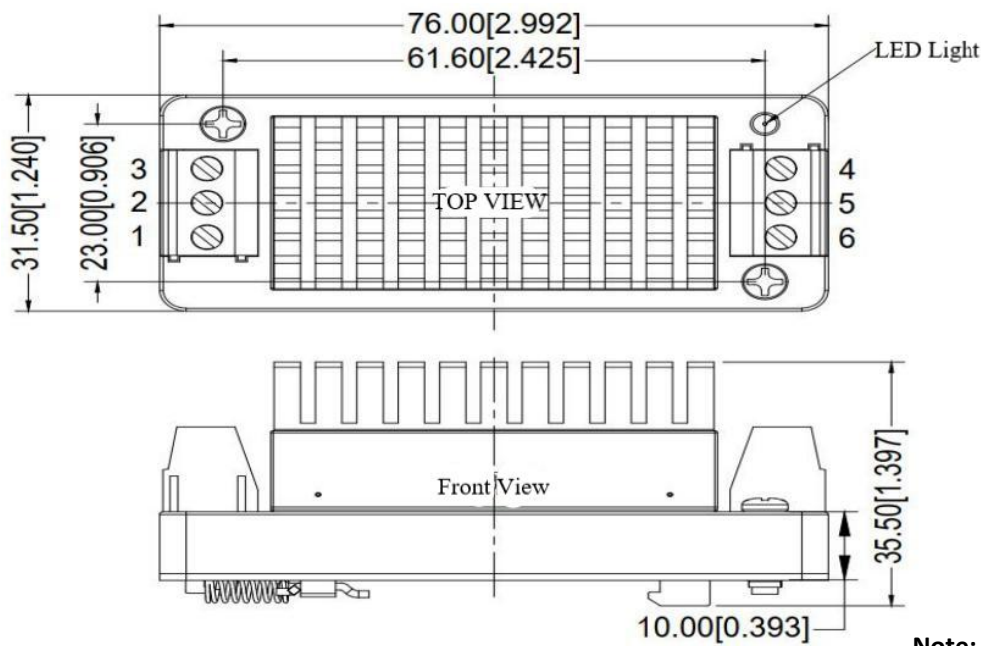
**Unmarked Tolerance: ±1.0 (±0.039)**

**Pin Definition**

FD60-18SXXB3R2-TS	1	2	3	4	5	6
	+Vin	-Vin	CTRL	Trim	-Vo	+Vo



**B3-TSH Package (Din-rail with Heat Sink)**



**Note:**  
**Unit: mm(inch)**  
**Wiring specifications: 24-12AWG**  
**Unmarked Tolerance: ±1.0 (±0.039)**

**Pin Definition**

	1	2	3	4	5	6
FD60-18SXXB3R2-TSH	+Vin	-Vin	CTRL	Trim	-Vo	+Vo

- Note:
- The product should be used within the specification range, otherwise it will cause permanent damage to the product;
  - The product does not support parallel output to increase power;
  - If the product works below the minimum required load, it cannot be guaranteed that the product performance meets all performance indicators in this manual;
  - If the product works beyond the product load range, it cannot be guaranteed that the product performance meets all performance indicators in this manual;
  - Unless otherwise specified, the above data are measured at Ta=25°C, humidity<75%, input nominal voltage and output rated load (pure resistance load);
  - All the above index test methods are based on our company's standards;
  - The above are the performance indicators of the product models listed in this manual. Some indicators of non-standard model products will exceed the above requirements. Please consult our technical personnel for details;
  - Our company can provide product customization;
  - Product specifications are subject to change without prior notice. Please pay attention to the latest manual published on our official website.

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