

Typical Features

- ◆ Wide input voltage range (4:1), output power 20W
- ◆ Efficiency up to 89%(Typ.)
- ◆ Standby power consumption 0.2W (Typ.)
- ◆ Input under voltage protection
- ◆ Continuous short circuit protection, self-recovery
- ◆ Output over voltage & over current protections
- ◆ Isolation voltage 5000VDC
- ◆ Operating Temperature from -40°C to +85°C
- ◆ Good EMI performance
- ◆ International standard pin-out alignment



Application Field

FD20-110SXXB3C5 Series ----- DIP package DC-DC modular converters with wide input voltage 40-160VDC, low standby power consumption, fast start-up, isolated & regulated single output 20W. This series of products can be widely used in the fields of Industrial control, Instrumentation, Communication, Electricity power, IoT & railway, etc. Additional circuit for EMC is recommended for the application with high EMC requirement.

Typical Product List

Certificate	Part No	Input Voltage Range		Output Voltage/Current (Vo/Io)		Input Current (mA) Typ. @Nominal volt.		Max Capacitive Load (uF)	Efficiency (%) @Full load, Nominal volt.	
		Nominal (VDC)	Range (VDC)	Vo (VDC)	Io (mA)	Full load	No Load		Min	Typ.
-	*FD20-110S3V3B3C5	110	40-160	3.3	5000	176	30	10000	83	85
-	FD20-110S05B3C5			5	4000	209	30	8000	85	87
-	*FD20-110S09B3C5			9	2222	207	30	4000	86	88
-	FD20-110S12B3C5			12	1667	207	1	2000	86	88
-	*FD20-110S15B3C5			15	1333	204	1	1000	85	87
-	*FD20-110S24B3C5			24	833	204	1	600	87	89
-	*FD20-110S40B3C5			40	500	207	1	600	86	88

Note 1: The * marked parts have been developed in process. The part number letter C indicates the part with ON/OFF Control function, N indicates without the control function.

Note 2: The suffix -H indicates the part with Heat sink, -T (H) indicates the chassis package (with heat sink), -TS (H) indicates the package of DIN Rail (with heat sink) which rail width is 35mm.

Note 3: The maximum capacitive load is the capacitance allowed to be used when the power supply starts at full load. The converter may not start if the capacitor exceeds this value.

Note 4: The chip could operate at jitter frequency situation with no load or light load to decrease no-load power consumption, so no load is not available. $\geq 20\%$ load or a high-frequency resistance E-cap($\geq 330\mu\text{F}$) load is recommended, to avoid the output ripple increasing.

Note 5: Please contact Aipu sales for other output voltages requirement of this series but not listed in this table.

Input Specifications

Items	Test conditions	Min	Typ.	Max	Unit
Standby power consumption	Full input voltage range	/	0.2	/	W
Max input current	Full input voltage range	/	/	0.6	A
Start-up voltage	/	/	/	40	VDC
Under voltage protection	/	32	35	/	VDC
Inrush voltage (1sec.max)	/	-0.7	/	180	
Reflected ripple current	Nominal input voltage	/	30	/	mA
Hot plug	/	N/A			
Input filter	/	Pi filter			
ON/OFF Control (Ctrl)	Turn ON the converter	No connection or connected to high level (3.5V-12VDC)			
	Turn OFF the converter	Connected to -Vin or low level (0-1.2VDC)			
	Current value for switching off	/	3	/	mA

Note: The voltage of Ctrl is relative to the input -Vin.

Output Specifications

Items	Test conditions		Min	Typ.	Max	Unit
Voltage accuracy	Full input voltage range		/	±1	±2	%
Line regulation	Full input voltage range, rated load		/	±0.2	±0.5	%
Load regulation	Nominal input voltage, 10%~100% load		/	±0.5	±1	%
Ripple & Noise	20%-100% load, 20MHz bandwidth		/	50	100	mVp-p
Dynamic response	25% rated load step, full input voltage range		/	300	500	uS
Dynamic response deviation	25% rated load step, nominal input voltage	3.3V, 5V output	/	±5	±8	%
		Others	/	±3	±5	%
Temperature drift coefficient	Full load		/	/	±0.03	%/°C
Turn-on delay time	Nominal input voltage		/	40	/	mS
Output voltage Trim	Full input voltage range		90	/	110	%Vo
Output overshoot			/	/	10	%Vo
Over voltage protection			110	150	230	%Vo
Over current protection			110	150	220	%Io
Short circuit protection			Continuous, self-recovery			

Note: Ripple & Noise ≤5%Io at 0%-20% load, it is tested by the Parallel-line method (please refer to the following test instruction).

General Specifications

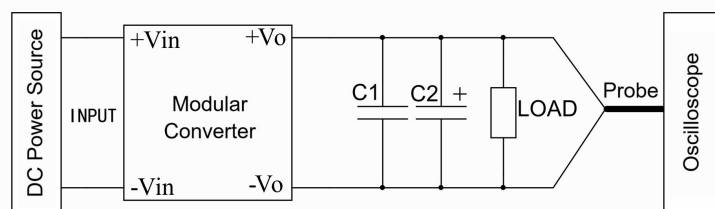
Items	Test Conditions	Min	Typ.	Max	Unit
Switching frequency	Operating mode (PWM)	/	230	/	KHz
Operating temperature	Refer to the temperature derating graph	-40	/	+85	°C
Storage temperature	/	-55	/	+125	
Case temperature	Within the operating derating range	/	/	+105	

Pin soldering temperature	1.5mm from the case, 10S	/	/	300	
Relative humidity	No condensation	5	/	95	%RH
Isolation voltage	I/P-O/P, test 1min, leakage current $\leq 0.5\text{mA}$	5000	/	/	VDC
Isolation capacitance	I/P-O/P, 100KHz/0.1V	/	2200	/	pF
MTBF	MIL-HDBK-217F@25°C	1000	/	/	K hours
Cooling method	Nature air				
Vibration	10-150Hz, 5G, 0.75mm, along X, Y and Z				
Case material	Aluminum				
Weights/Dimensions	Part No.	Weight (Typ)	Dimensions L x W x H		
	FD20-110SXXB3C5	28g	50.8X25.4X13.0 mm	2.00X1.00X0.511 inch	
	FD20-110SXXB3C5-H	40g	50.8X25.4X23.0 mm	2.00X1.00X0.906 inch	
	FD20-110SXXB3C5-T	49g	76.0X31.5X22.3 mm	2.99X1.24X0.877 inch	
	FD20-110SXXB3C5-TH	61g	76.0X31.5X32.5 mm	2.99X1.24X1.279 inch	
	FD20-110SXXB3C5-TS	69g	76.0X31.5X27.0 mm	2.99X1.24X1.063 inch	
	FD20-110SXXB3C5-TSH	81g	76.0X31.5X36.5 mm	2.99X1.24X1.437 inch	

EMC Performance

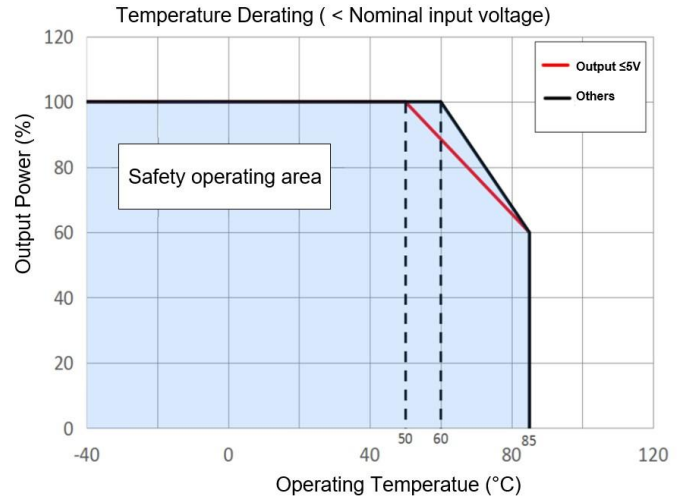
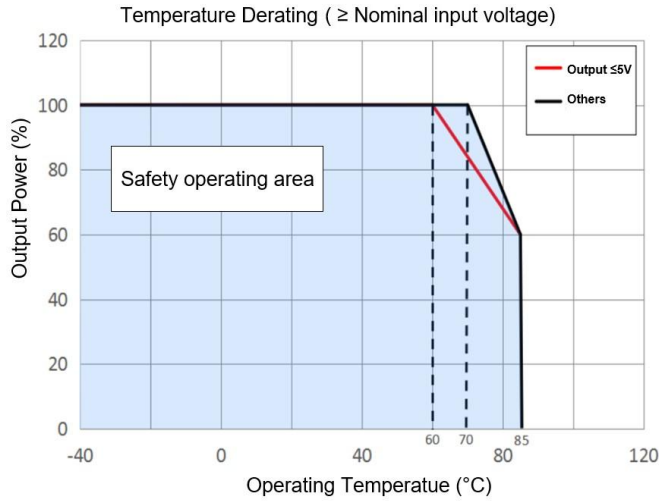
Items			Test Standard	Performance/ Class	
EMC	EMI	CE	CISPR32/EN55032	CLASS B (With the Recommended EMC Circuit)	
	EMS	RS	IEC/EN61000-4-3	10V/m	Perf. Criteria A (With the Recommended EMC Circuit)
		CS	IEC/EN61000-4-6	3Vr.m.s	Perf. Criteria A (With the Recommended EMC Circuit)
		ESD	IEC/EN61000-4-2	Contact $\pm 4\text{KV}$, Air $\pm 6\text{KV}$	Perf. Criteria B
		Surge	IEC/EN61000-4-5	$\pm 2\text{KV}$	Perf. Criteria B (With the Recommended EMC Circuit)
		EFT	IEC/EN61000-4-4	$\pm 2\text{KV}$	Perf. Criteria B (With the Recommended EMC Circuit)

Ripple & Noise Test Instructions (Parallel-line Method, 20MHz Bandwidth)

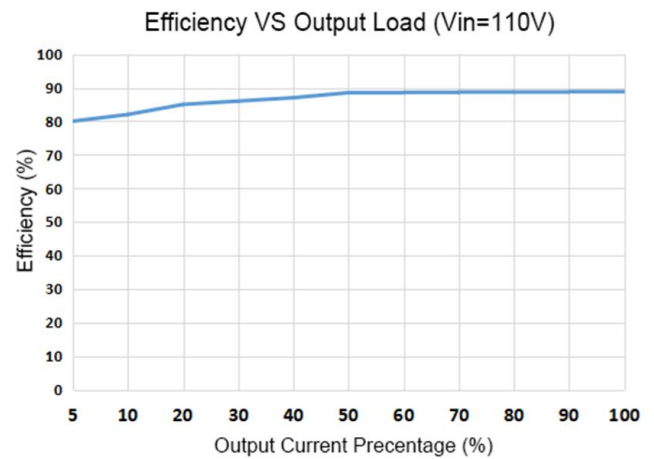
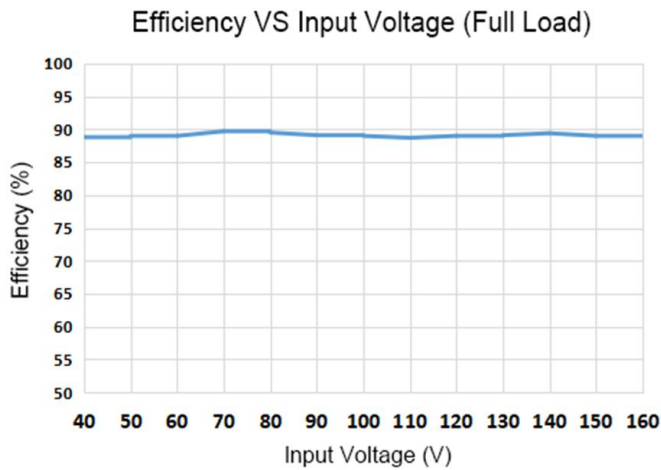


1. The Ripple & Noise test needs the cables in parallel, an oscilloscope that should be set at the Sample Mode, bandwidth 20MHz. 100M bandwidth probe with cap and ground removed. One polypropylene capacitor C1(0.1uF) and one high-frequency low-resistance electrolytic capacitor C2(10uF) are connected in parallel with the probe.
2. Refer to the test diagram, the converter output connects to the electronic load by the jig with cables which size should be defined according to the output current value. The test can start at the converter output terminals after the input power on.
3. It is recommended to use a $\geq 20\%$ load or a high-frequency low resistance electrolytic capacitor ($\geq 330\mu\text{F}$) load at the output to avoid the output ripple increasing.

Temperature Derating Graphs



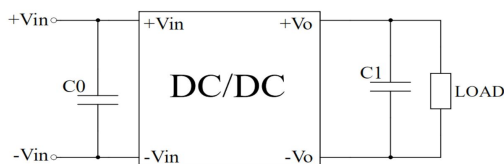
Efficiency Graphs



FD20-110S24B3C5

Recommended Circuits for Application

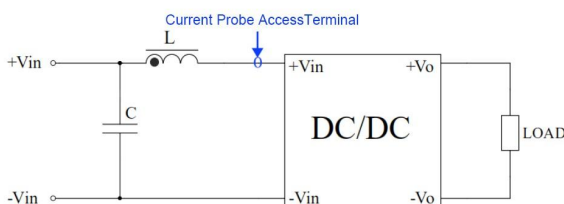
1. DC-DC test circuit diagram



Component	Parameters
C0	47-100uF/200V
C1	330uF/50V

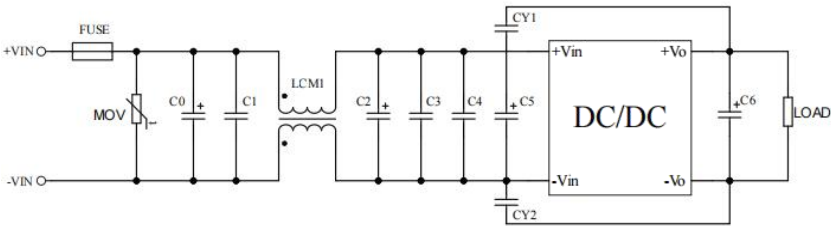
2. Input reflected ripple current test circuit

Low ESR capacitor is recommended for C which withstand voltage should be more than the maximum of input voltage.



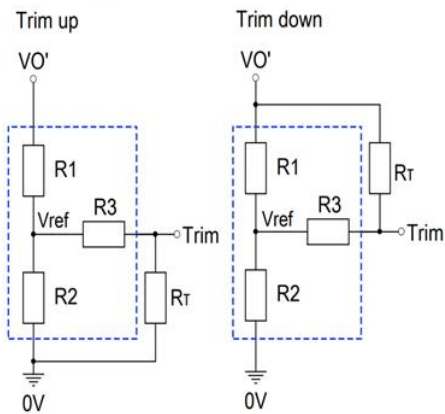
Component	Parameters
C	220uF/200V
L	4.7uH/15A

3. Recommended EMC circuit diagram



Component No.	Parameters
FUSE	TBD by customer
MOV	14D201K
C0, C2, C5	330uF/200V
C1, C3, C4	100nF/250V
LCM1	4.7mH
C6	330uF/50V
CY1, CY2	Y1/222M/400VAC

4. Output voltage Trim & Trim resistance calculation



Rrim Resistance calculating fomula

up: $R_T = \frac{\alpha R_2}{R_2 - \alpha} - R_3$ $\alpha = \frac{V_{ref}}{V_o' - V_{ref}} \cdot R_1$

down: $R_T = \frac{\alpha R_1}{R_1 - \alpha} - R_3$ $\alpha = \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2$

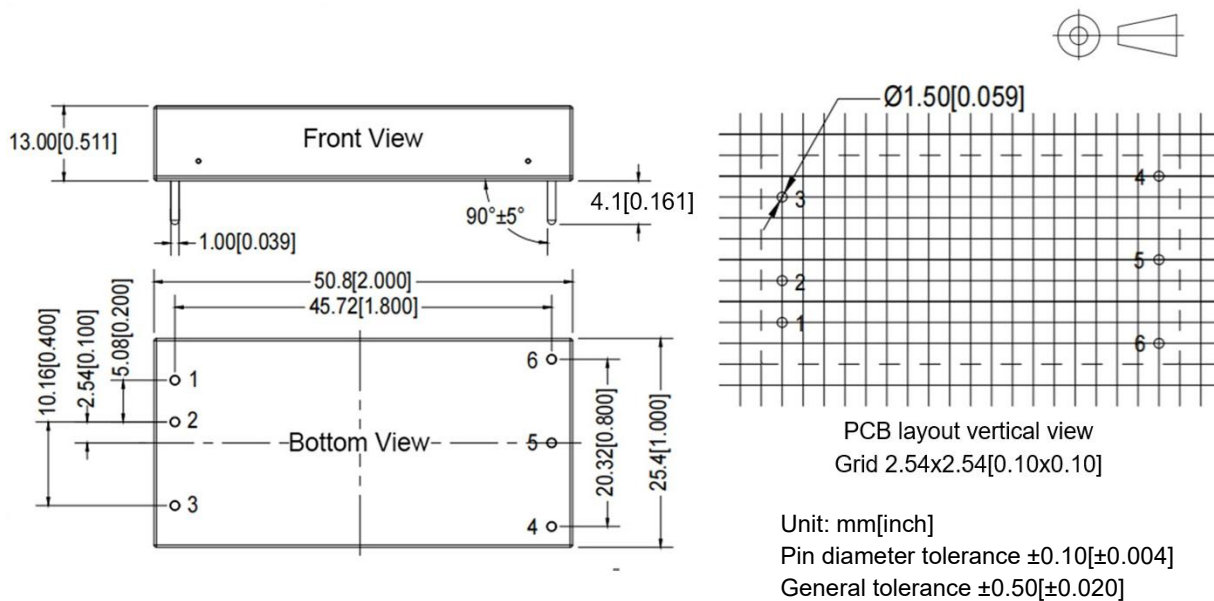
R_T is the Trim resistance
 α is a self-defined parameter
 V_o' is the required Up-voltage or Down-voltage

Note: Trim up & down circuits, the components in the dotted area are inside of the converter.

Output Voltage	Trim circuit components parameters			
Vout (VDC)	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
3.3	24	14.53	68	1.25
5	20	20	68	2.5
9	25.5	9.79	30	2.5
12	18	4.7	30	2.5
15	25.5	5.1	30	2.5
24	25.5	2.95	18	2.5
40	30	2	10	2.5

Note: Trim function works only for above output voltages

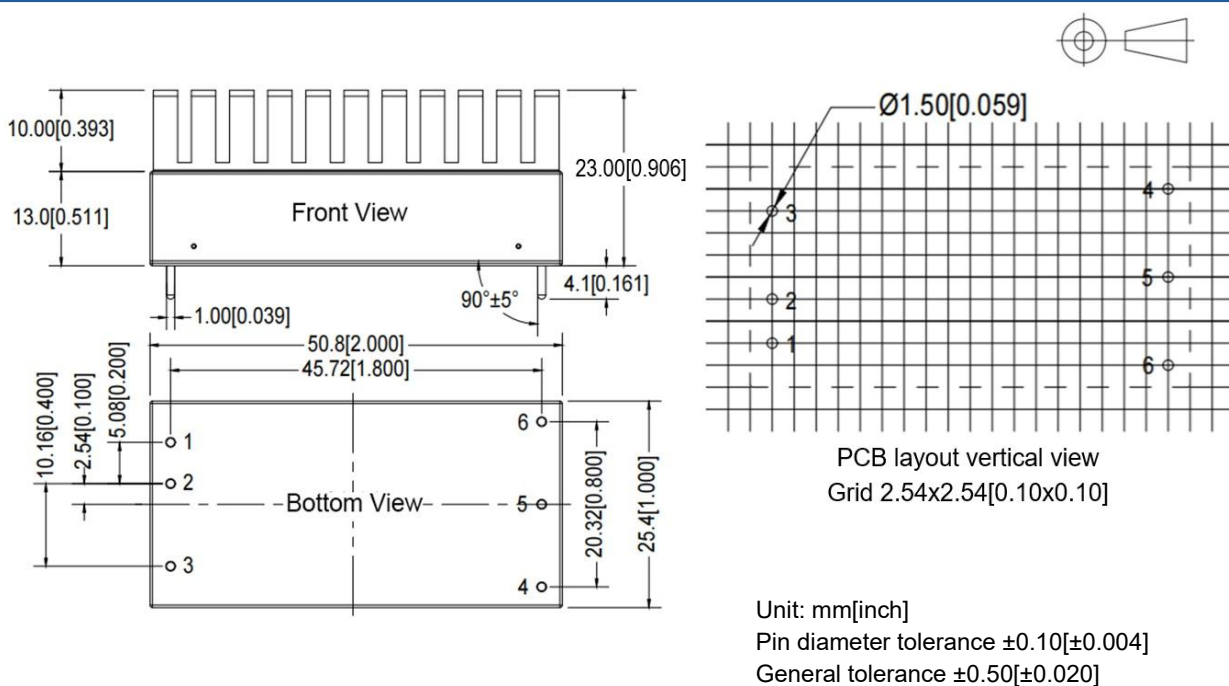
Mechanical Dimensions (Without heat-sink)



Pin-out Function Description

Pin No.	1	2	3	4	5	6
FD20-110SXXB3C5	+Vin	-Vin	Ctrl	Trim	-Vo	+Vo

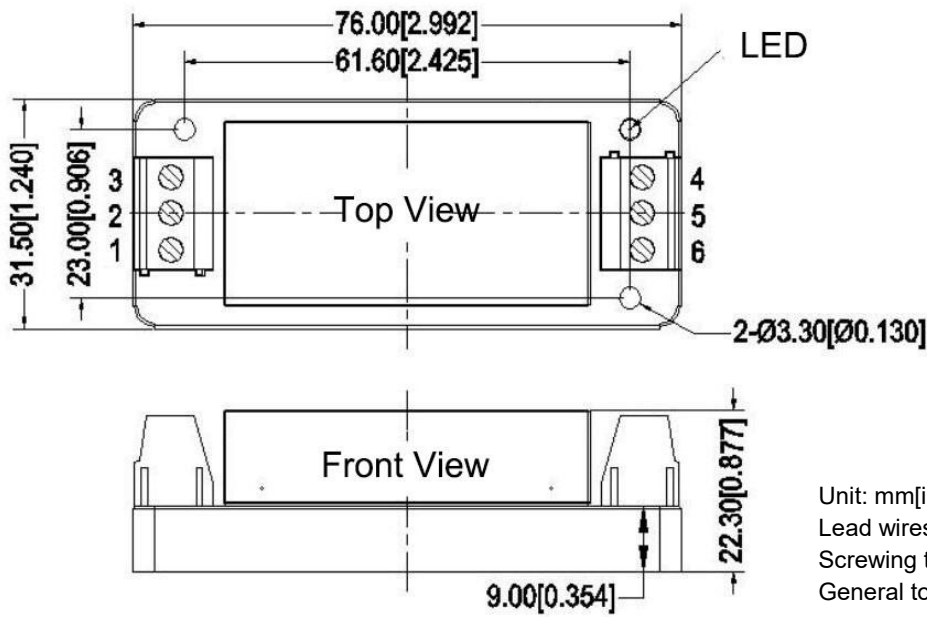
-H Mechanical Dimensions (With heat-sink)



Pin-out Function Description

Pin No.	1	2	3	4	5	6
FD20-110SXXB3C5	+Vin	-Vin	Ctrl	Trim	-Vo	+Vo

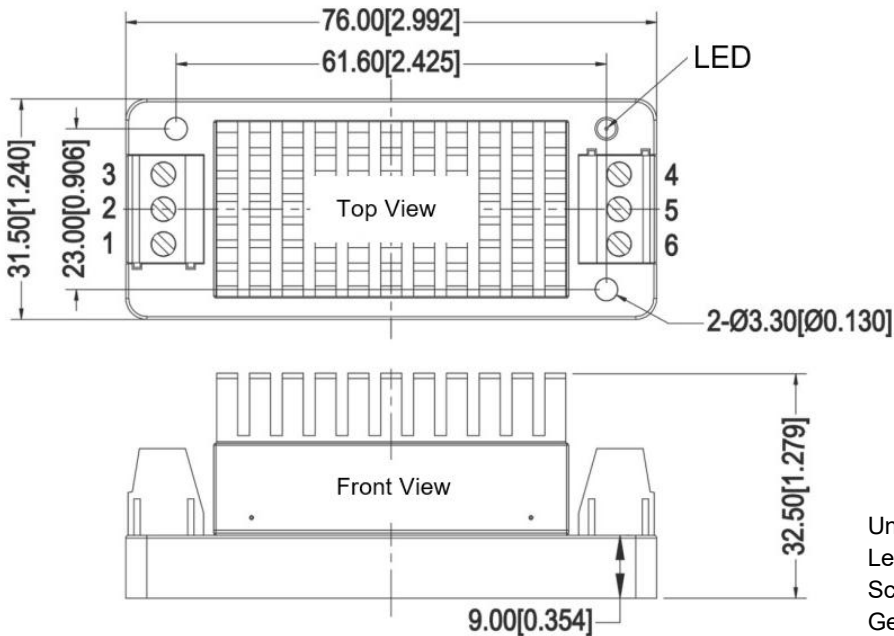
-T Mechanical Dimensions (Without heat-sink)



Terminal Function Description

Terminal No.	1	2	3	4	5	6
FD20-110SXXB3C5	+Vin	-Vin	Ctrl	Trim	-Vo	+Vo

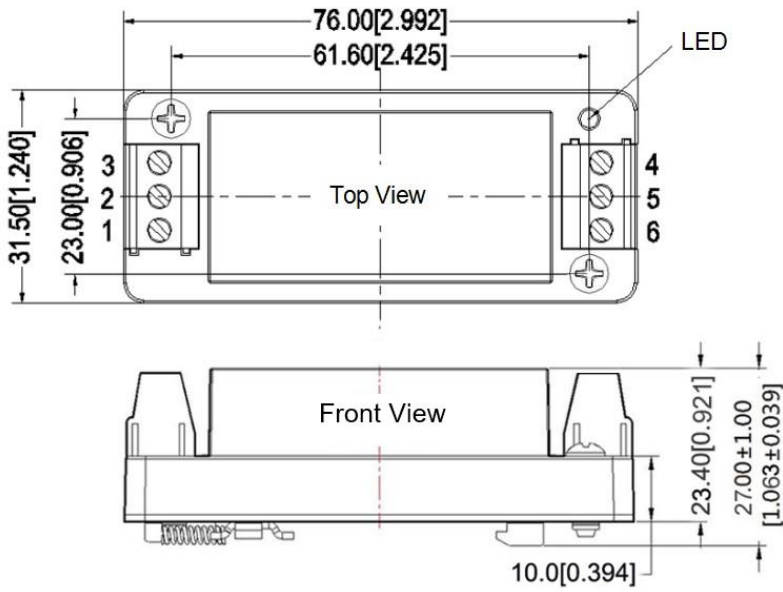
-TH Mechanical Dimensions (With heat-sink)



Terminal Function Description

Terminal No.	1	2	3	4	5	6
FD20-110SXXB3C5	+Vin	-Vin	Ctrl	Trim	-Vo	+Vo

-TS Mechanical Dimensions (Without heat-sink)

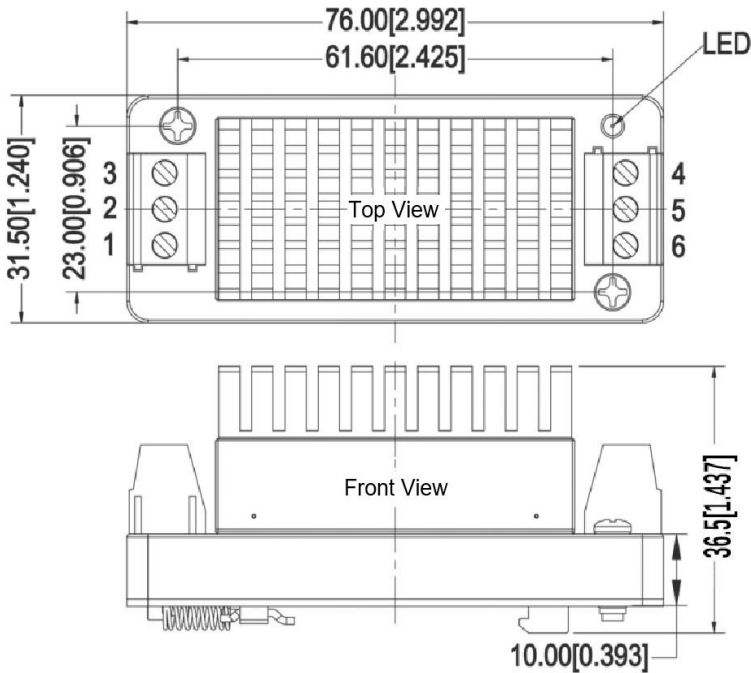


Unit: mm[inch]
Lead wires gauge: 24-12AWG
Screwing torque: 0.4N.m Max
General tolerance ±1.00[±0.039]

Terminal Function Description

Terminal No.	1	2	3	4	5	6
FD20-110SXXB3C5	+Vin	-Vin	Ctrl	Trim	-Vo	+Vo

-TSH Mechanical Dimensions (With heat-sink)



Unit: mm[inch]
Lead wires gauge: 24-12AWG
Screwing torque: 0.4N.m Max
General tolerance ±1.00[±0.039]

Terminal Function Description

Terminal No.	1	2	3	4	5	6
FD20-110SXXB3C5	+Vin	-Vin	Ctrl	Trim	-Vo	+Vo

Application Notice

1. The product should be used according to the specifications, otherwise it could be permanently damaged.
2. The product performance cannot be guaranteed if it works at a lower load than the minimum load defined.
3. The product performance cannot be guaranteed if it works under over-load condition.
4. Unless otherwise specified, all values or indicators on this datasheet are tested at Ta=25℃, humidity<75%RH, nominal input voltage and rated load (pure resistance load).
5. All values or indicators on this datasheet have been tested based on Aipupower test specifications.
6. The specifications are specially for the parts listed on this datasheet, any other non-standard model performances could be out of the specifications. Please contact our technician for specific requirements.
7. Aipupower can provide customization service.

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