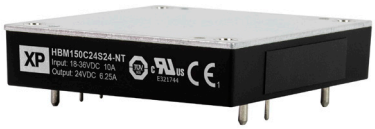
HBM150C series

150W Baseplate cooled

DC-DC converters

The HBM150C series of compact 150W half-brick DC-DC converters offer single output voltages of 12V, 15V and 24V from a wide 2:1 input range and are specifically designed for demanding medical applications. Its high efficiency and baseplate cooling enable effective thermal management ensuring high reliability in critical applications.

Featuring worldwide medical safety approvals, 2 x MOPP isolation, <10µA leakage current, remote On/Off, remote sense and output trim, the HBM150C enables easy integration into a wide range of CF-rated medical applications including patient monitoring, medical imaging, diagnostic equipment, surgical systems and industrial robotics, telecommunications and battery-powered equipment.



Features

- Suitable for CF-rated applications
- Single voltage outputs from 12V to 24VDC
- Industry standard half brick format
- 2:1 wide input range 18V to 36VDC
- IEC60601-1 medical safety agency approvals
- <10µA patient leakage current
- 5kVAC input to output isolation
- Overvoltage, overtemperature, overload and short circuit protection
- Wide output voltage trim
- High efficiency, up to 91.5%
- Remote On/Off and remote sense
- -40°C to +100°C operating temperature
- 3 year warranty

Applications

Healthcare

Medical diagnostics

Process control

Robotics

Dimensions

61.0 x 57.9 x 13.2mm (2.40" x 2.28" x 0.52")
½ brick package

Documentation

For further information click the link or scan the code

→ xppower.com

Models & ratings

Model number[1,2]	Input voltage	Output voltage	Output current	Input current[3]		Efficiency[4]
				No load	Full load	
HBM150C24S12	18-36VDC (24VDC nominal)	12.0VDC	12.5A	10mA	6831mA	91.5%
HBM150C24S15		15.0VDC	10.0A	10mA	6831mA	91.5%
HBM150C24S24		24.0VDC	6.25A	10mA	6868mA	91.0%

Notes:
1. Add suffix '-N' to the model number to receive the unit with negative logic Remote On/Off.
2. Standard mounting hole are 3.2mm clear holes. Add suffix -T for optional M3 x 0.5 threaded holes e.g HBM150C24S12-T.
3. Input current specified at 24VDC nominal input voltage.
4. Typical value at 24VDC nominal input voltage and full load
5. To order optional heatsink, use model number ICH HEATSINK.

HBM150C series

Input

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Input voltage range	18		36	VDC	24VDC nominal
Undervoltage lockout		16.5		VDC	Turn on voltage, full load
		15.5			Turn off voltage, full load
Input surge			50	VDC	For 100ms
Input current	See models and ratings table				
Input reflected ripple current		30		mA	Through 12µH inductor, 5Hz to 20mHz, 24VDC nominal
Input filter	Pi type				

Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Output voltage trim	-20		+10	%	See application notes
Initial set accuracy			±1.0	%	24VDC input voltage, full load
Line regulation			±0.2	%	Measured from high line to low line, full load
Load regulation			±0.2	%	Single output, measured from 0-100% load
Transient response			5	%	Maximum deviation, recovery to within 1% in 250µs, slew rate 0.1A/µs, 25% (75% - 100% - 75%) step load change
Start up delay		5		ms	
Rise time		10		ms	
Ripple and noise			150	mV pk-pk	24S12 & 24S15 , 20MHz bandwidth with 10µF ceramic capacitor, full load
			240		24S24, 20MHz bandwidth with 10µF ceramic capacitor, full load
Overcurrent protection	110		160	%	Hiccup, auto recovery
Short circuit protection	Continuous, auto recovery				
Overvoltage protection	115		140	%	Clamp, auto recovery
Thermal shutdown		105		°C	Case temperature (center), non latching
		88			Restart
Patient leakage current			10	µA	
Temperature coefficient			±0.02	%/°C	
Remote On/Off	Output is 'ON' if remote On/Off (pin 2) is open or high (3.5-36VDC) with respect to -Vin (pin 4) Output turns 'OFF' if remote On/Off (pin 2) is low (<1.2VDC max) with respect to -Vin (pin 4) Negative Logic: Output is 'OFF' if remote On/Off (pin 2) is open or high (3.5-36VDC) with respect to -Vin (pin 4) Output turns 'ON" if remote On/Off (pin 2) is low (<1.2VDC max) with respect to -Vin (pin 4)				
Remote Sense	Compensates up to 10% of Vout nominal				

HBM150C series

General

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Efficiency	See models & ratings table				
Isolation: input to output	5000			VAC	
Isolation resistance	1[9]			Ω	
Isolation capacitance			80	pF	
Switching frequency		200		kHz	
Mean time between failure		1300		khrs	MIL-HDBK-217F, +25°C GB
Power density		3.22 (52.72)		Wcm^3 (W/in^3)	
Weight		128 (0.28)		g (lbs)	

Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Operating temperature	-40		+100	°C	See derating curve
Maximum baseplate temperature			+100	°C	Measured at the center of the baseplate
Storage temperature	-55		+125	°C	
Operating humitidy			95	%RH	Non-condensing
Operating altitude			5000	m	
Vibration	Single axis 10-500Hz at 2g sweep and endurance at resonance in all 3 planes. Conforms to EN60068-2-6				
Shock	±3 x 30g shocks in each plane, total 18 shocks. 30g = 11ms (±0.5msecs), half sine. Conforms to EN60068-2-27				

EMC: emissions

Phenomenon	Standard	Test level	Notes & conditions
Conducted	EN55032 / EN55011	A	With external components, see application notes
Radiated	EN55032 / EN55011	A	With external components, see application notes

EMC: Immunity

Phenomenon	Standard	Test level	Criteria	Notes & conditions
Medical device EMC	IEC60601-1-2	Ed 4.1: 2014	as below	
ITE / Low voltage PSU EMC	EN55035/ EN 61204-3		as below	
ESD immunity	EN61000-4-2	±8kV contact, ±15kV air	A	
Radiated	EN61000-4-3	10V/m	A	
EFT/burst	EN61000-4-4	±2kV	A	On power input port with external components
Surges	EN61000-4-5	±2kV	A	With external components
Conducted	EN61000-4-6	10Vrms	A	
Magnetic fields	EN61000-4-8	30A/m	A	

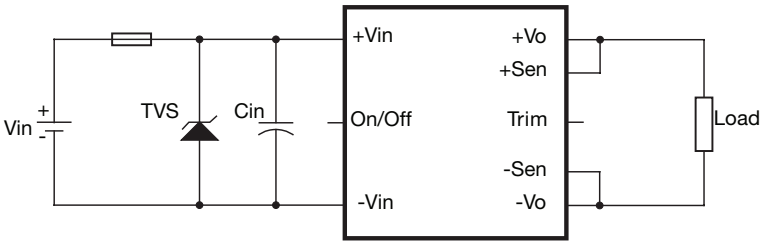
Safety approvals

Safety agency	Standard	Notes & conditions
CB	IEC60601-1	Medical, 2 x MOPP, suitable for CF applications
EN	EN60601-1	Medical, 2 x MOPP, suitable for CF applications
UL	ANSI/AAMI ES60601-1	Medical, 2 x MOPP, suitable for CF applications
CE	Meets all applicable directives	
UKCA	Meets all applicable legislation	

Application notes

Input fusing and safety considerations

The HBM150C series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 12A time delay fuse. It is recommended that the circuit has a transient voltage suppressor diode (TVS) and external input capacitor (Cin) across the input terminals to protect the unit against surge or spike voltages and input reverse voltage (as shown). A suitable part would be SMDJ40A (TVS) and 220µF / 100V (Cin).



Output voltage adjustment

The Trim input permits the user to adjust the output voltage up by 10% or down by 20%. This is accomplished by connecting an external resistor between the Trim pin and either the +Sense pin or the -Sense pin.

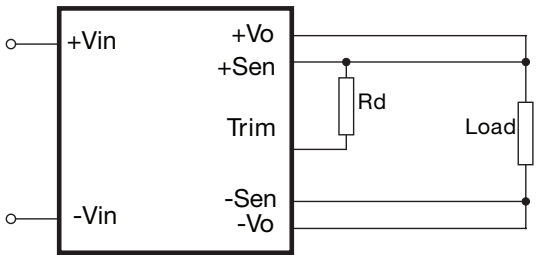
To trim down

Connecting an external resistor (Rd) between the Trim pin and the +Sense pin decreases the output voltage. The following table can be used to determine the required external resistor value to obtain a percentage output voltage change of Δ%.

Trim down	12V	15V	24V
%	Rd (kΩ)		
1	572.55	826.28	1614.98
2	280.23	406.14	795.99
3	182.78	266.09	522.99
4	134.06	196.07	386.49
5	104.83	154.06	304.60
6	85.34	126.05	250.00
7	71.42	106.04	211.00
8	60.98	91.03	181.75
9	52.86	79.36	159.00
10	46.37	70.03	140.80
11	41.05	62.39	125.91
12	36.62	56.02	113.50
13	32.87	50.64	103.00
14	29.66	46.02	94.00
15	26.88	42.02	86.20
16	24.44	38.52	79.37
17	22.29	35.43	73.35
18	20.38	32.68	68.00
19	18.67	30.23	63.21
20	17.13	28.01	58.90

External trim

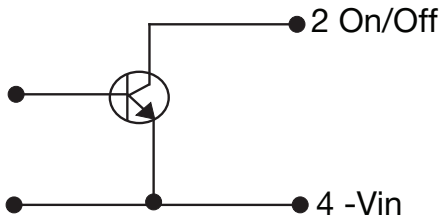
Voltage trim down



Output voltage sensing

The module will automatically trim the output voltage via the sense pins to the default values either locally or at the load. If not required, the sense pins should be connected locally as indicated in the example circuit.

Remote On/Off control



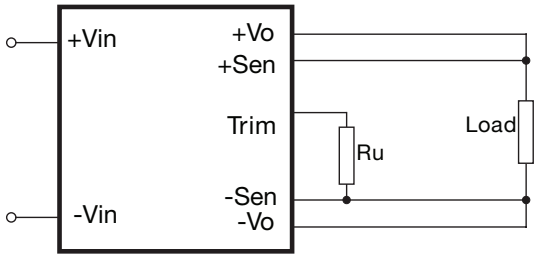
Positive logic: "On" if pin 2 is high >3.5V to 36VDC
"Off" if pin 2 is low <1.2V to 0VDC

To trim up

Connecting an external resistor (Ru) between the Trim pin and the -Sense pin increases the output voltage. The following table can be used to determine the required external resistor value to obtain a percentage output voltage change of Δ%.

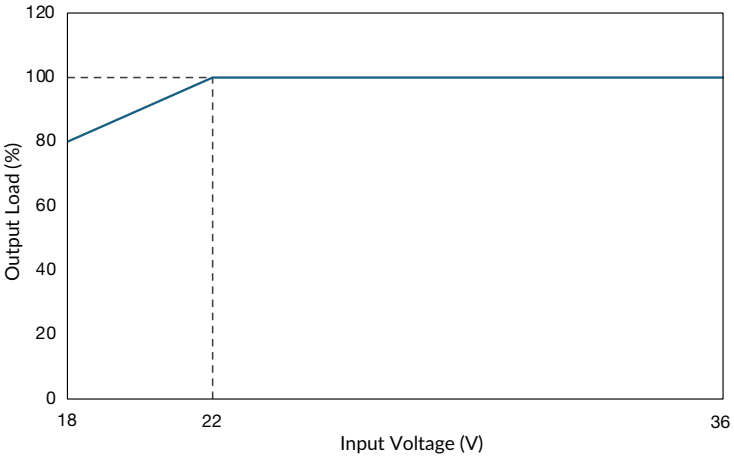
Trim up	12V	15V	24V
%	Ru (kΩ)		
1	231.82	256.72	267.52
2	113.96	126.86	131.81
3	74.67	83.57	86.57
4	55.03	61.93	63.96
5	43.24	48.94	50.38
6	35.39	40.29	41.34
7	29.77	34.10	34.87
8	25.56	29.47	30.03
9	22.29	25.86	26.26
10	19.67	22.97	23.24

Voltage trim up



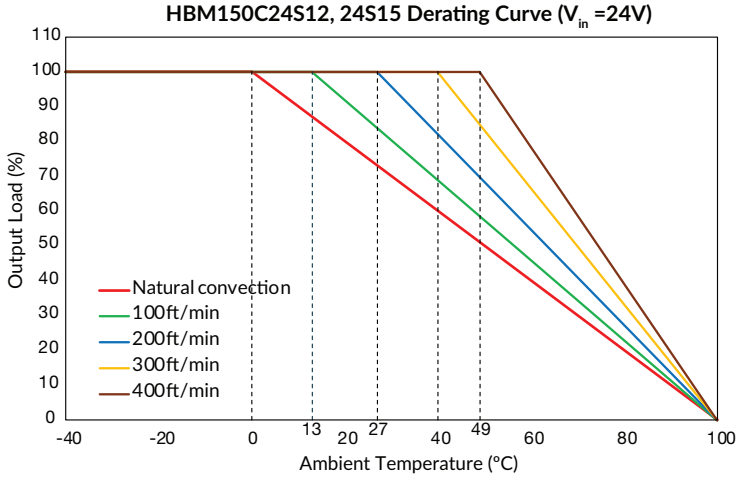
Application notes

Input derating curve

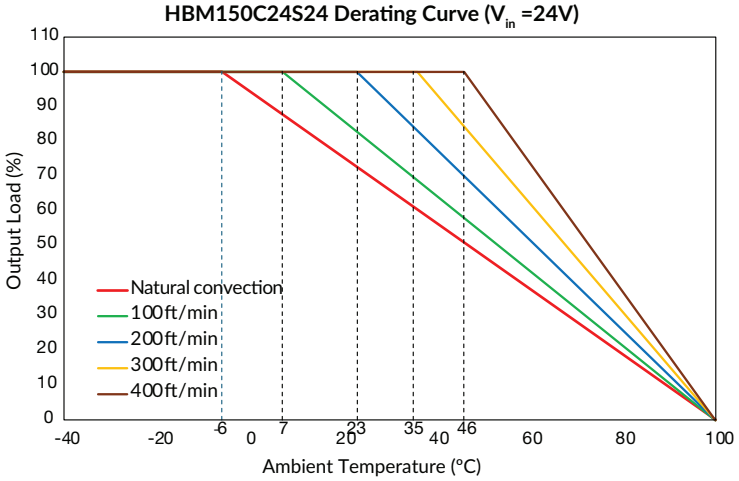


Power derating curves

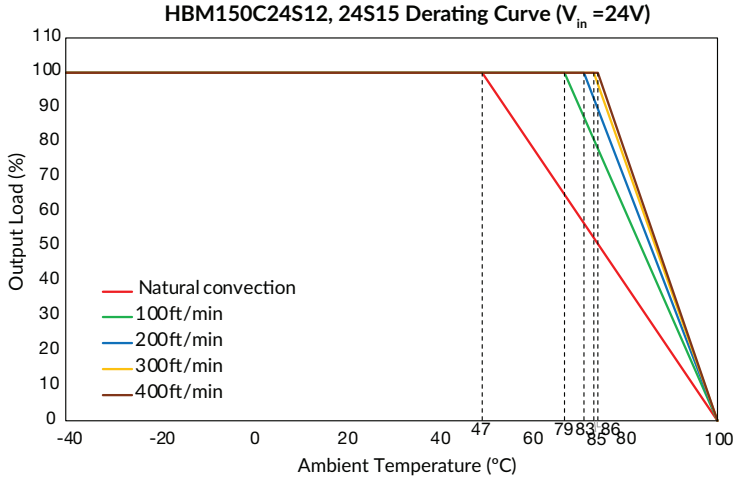
Without heatsink



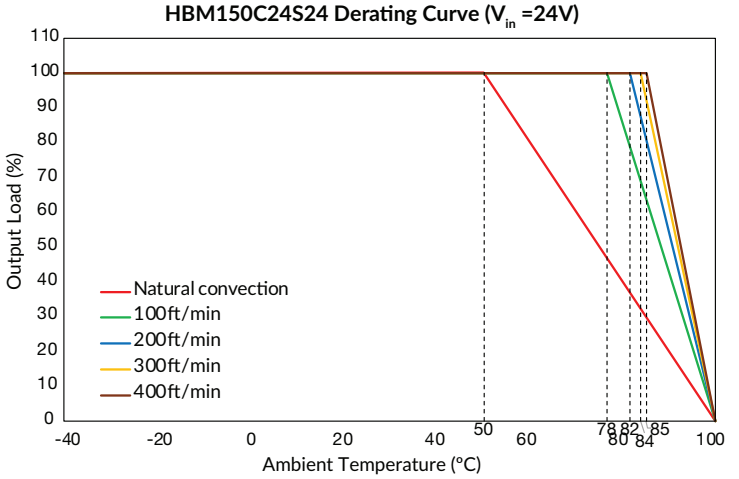
Without heatsink



With heatsink



With heatsink



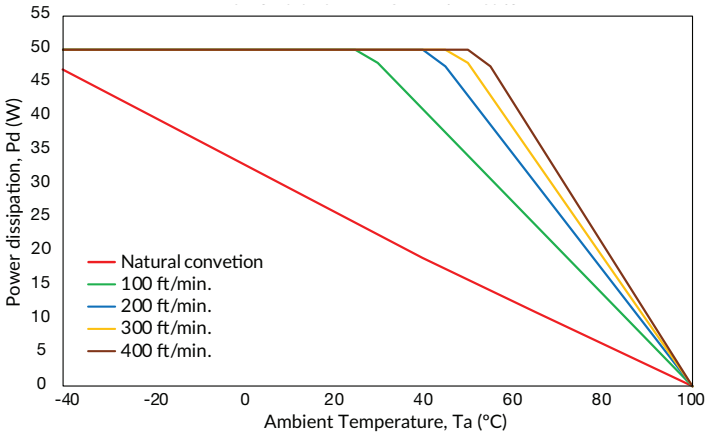
Notes:

1. To order optional heatsink, use model number ICH HEATSINK.

Application notes

Airflow derating graph

Maximum power dissipation vs. Ambient temperature & Air Flow with heatsink (V_{in}=24)



Air flow rate	Typical Rca
Natural Convection 20ft./min. (0.1m/s)	3.00 °C/W
100 ft./min. (0.5m/s)	1.44 °C/W
200 ft./min. (1.0m/s)	1.17 °C/W
300 ft./min. (1.5m/s)	1.04 °C/W
400 ft./min. (2.0m/s)	0.95 °C/W

Rca = Thermal resistance from case to ambient
To order heatsink, use part number ICH HEATSINK

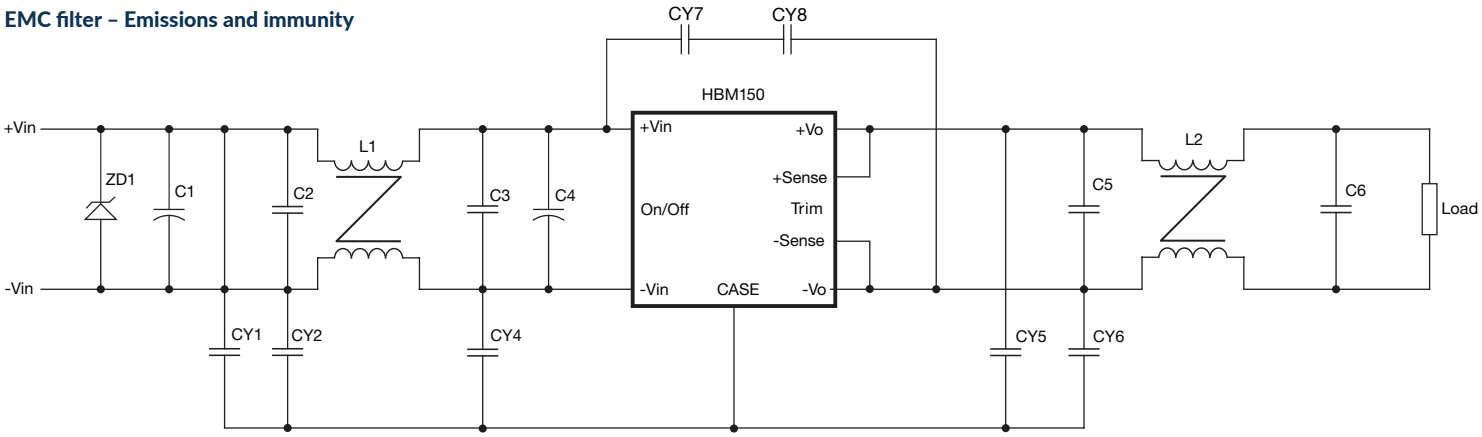
Example with heatsink

To determine the minimum airflow necessary for a HBM150C24S12 operating at nominal line voltage, an output current of 12.5A and maximum ambient of +70°C
Determine power dissipation (Pd): Pd=Pi-Po=Po(1-η)/η,
Where Pi = Input power, Po = Output power and η = Efficiency (refer to models & ratings table)
Pd=12×12.5×(1-0.915)/0.915=13.93Watts
Determine airflow from airflow derating graph using data points for Pd = 13.93W and Ta=+70°C,
then take the next line up to get the minimum airflow = 100ft/min
To determine the heatsink/typical Rca, refer to the Air flow Rate table.
To check the maximum case temperature of +100°C is not exceeded:
Determine maximum temperature rise (ΔT) :
ΔT= Pd×Rca, where Rca is the thermal resistance from case to ambient
ΔT= 13.93×1.44=20.06°C
Determine maximum case temperature (Tc) :
Tc=Ta+ΔT, where Ta is ambient temperature
Tc=70+20.06=90.06°C <100°C

HBM150C series

Application notes

EMC filter – Emissions and immunity



HBM150C24S12, 24S15

ZD1	C1	C2	C3	C4	C5, C6	CY1, CY2, CY4, CY5, CY6	CY7, CY8	L1	L2
SMDJ40A	470µF/100V	0.01µF/2KV	4.7µF/100V	220µF/100V	10µF/50V	33pF	68pF	0.72mH (CMK-05)	0.12mH (CMK-07)

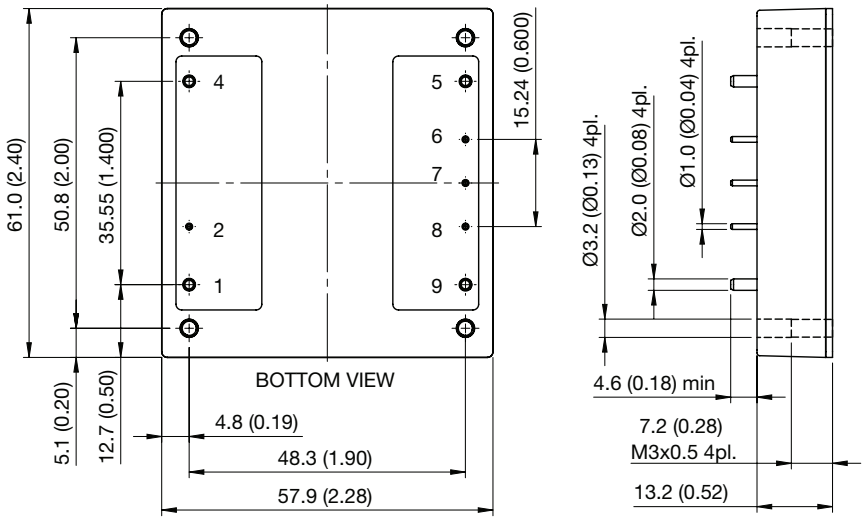
HBM150C24S24

ZD1	C1	C2	C3	C4	C5, C6	CY1, CY2, CY4, CY5, CY6	CY7, CY8	L1	L2
SMDJ40A	470µF/100V	0.01µF/2KV	4.7µF/100V	220µF/100V	10µF/50V	33pF	100pF	0.72mH (CMK-05)	0.52mH (CMK-06)

Notes:

C1: 470µF/100V Nichicon PW(M) series aluminum capacitor or equivalent
C4: 220µF/100V Chemi-Con KY series aluminum capacitor or equivalent
C2, C3: 1812 ceramic capacitors
C5, C6: 1210 ceramic capacitors

Mechanical details



Pin	Function
1	+Vin
2	Remote On/Off
4	-Vin
5	-Vout
6	-Sense
7	Trim
8	+Sense
9	+Vout

Notes:

1. All dimensions are in mm (inches)
2. Weight: 128g (0.28lbs) approx.
3. Tolerance: x.xx = x.x = ±0.5 (±0.02), x.xxx = x.xx = ±0.25 (±0.01)
4. Optional M3 x 05 threaded mounting holes add suffix -T