DC/DC12017

200W DC/DC Power Modules

Series DC/DC, half Brick Family Power Modules: 16.8~137.5V in, 48/24/12/5V out,200W

The DC/DC series Half-Brick is isolated 200W DC/DC converters with 3000VDC isolation. The DC/DC family comes with a host of industry-standard features, such as over current protection, over voltage protection, over temperature protection and remote on/off. All models have an ultra-wide 8:1 input voltage range (16.8V to 137.5V). With operating temperature of -40°C to +85°C, it is suitable for customers' critical applications, such as process control and automation, transportation, data communication and telecom equipment, test equipment, medical device and wherever space on the PCB is critical.

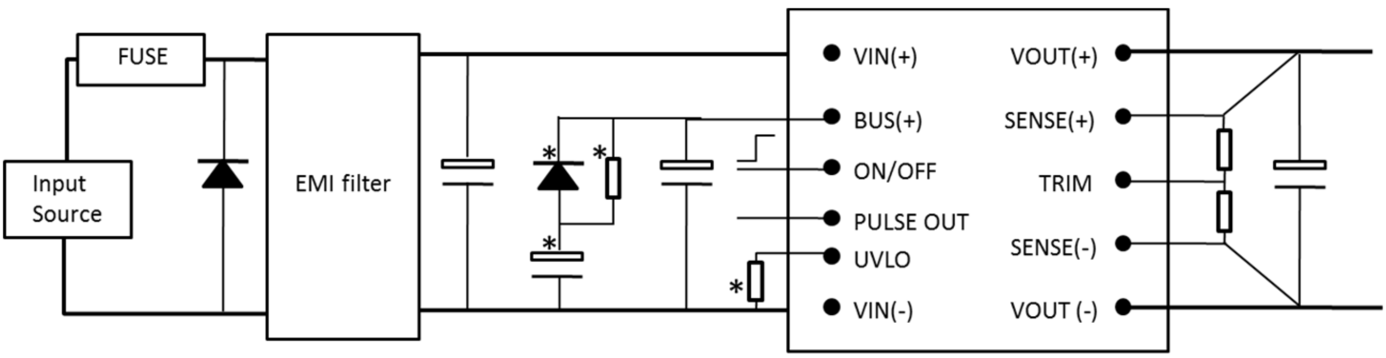
FEATURES

- Efficiency up to 90.5% @72Vin 12Vout
- Ultra wide input range, 16.8V-137.5V
- 14.4V/1S, 154V/1S transient voltage
- Package with Industry Standard Pinout
- Package Dimension: 2.39''*2.49''*0.5'',(60.6**63.1*12.7mm)
- OVP,OCP,OTP
- Positive or Negative Remote ON/OFF
- Without tantalum capacitor inside module
- Operating Base plate Temperature range - 40°C to +100°C
- 3000VDC input to output reinforced isolation
- Unit operation monitor PIN option
- A fixed frequency pulse PIN option
- Hold up time PIN option
- UVLO set up PIN option
- RoHs Compliant
- 3 Years Product Warranty
- Heat-sink is optional
- Meet requirements of EN50155
- UL60950-1, 2nd Edition (pending)

APPLICATIONS

- Railway /Transportation system

SIMPLIFIED APPLICATION CIRCUIT



* Option for hold up time and UVLO

Preliminary Datasheet

TECHNICAL SPECIFICATION

PARAMETER	NOTES and CONDITIONS	DC/DC12017			
		Min.	Typ.	Max.	Units
1. ABSOLUTE MAXIMUM RATINGS					
1.1 Input Voltage	EN50155			156	Vdc
1.2 Input surge withstand	<1s			156	Vdc
1.3 Operating Temperature	Ambient temperature	-40		85	°C
	Baseplate temperature	-40		100	°C
1.4 Storage Temperature		-55		125	°C
1.5 Input/Output Isolation Voltage	reinforce			3000	Vdc
2. INPUT CHARACTERISTICS					
2.1 Operating Input Voltage		16.8	72	137.5	Vdc
2.2 Input Under-Voltage Lockout					
2.2.1 Turn-On Voltage Threshold		15.6	16.0	16.4	Vdc
2.2.2 Turn-Off Voltage Threshold		13.6	14.0	14.4	Vdc
2.3 Input Over-Voltage Lockout					
2.3.1 Turn-On Voltage Threshold		144	148	152	Vdc
2.3.2 Turn-Off Voltage Threshold		154	156	160	Vdc
2.4 Maximum Input Current	Full Load, Vin=16.8V	13.5	14	14.5	A
2.5 No-Load Input Current	Vin=72, Io=0A	30	60	90	mA
2.6 Off Converter Input Current	Vin=72V			25	mA
2.7 Input Reflected-Ripple Current（pk-pk）	Vin=72V, Io=full load，Cin=TBD/200V			TBD	mA
3. OUTPUT CHARACTERISTICS					
3.1 Output Voltage Set Point	Vin=72V, Io=0, Tc=25°C	11.80	12.00	12.20	Vdc
3.1.1 Load regulation	Vin=72V, Io=Io min to Io max		±0.05	±0.2	%
3.1.2 Line regulation	Vin=16.8V to137.5/V, Io=full load		±0.01	±0.2	%
3.1.3 Temperature regulation	Vin=72V, Tc= min to max case temperature		±0.004	±0.007	%/℃
3.2 Output Voltage Ripple and Noise	5Hz to 20MHz bandwidth				
3.2.1 Peak-to-Peak	Full Load,			420	mV
3.2.2 rms	Full Load,			130	mV
3.3 Operating Output Current Range				17	A
3.4 Output DC Current-Limit Inception		17		24	A
4.DYNAMIC CHARACTERISTICS					
4.1 Output Voltage Current Transient	Vin=72V, 0.1A/µs				
4.1.1 Positive Step Change in Output Current	50% Io.max to 75%			450	mV
4.1.2 Negative Step Change in Output Current	75% Io.max to 50%			450	mV
4.2 Turn-On Transient					
4.2.1 Start-Up Time, From On/Off Control		200		460	ms
4.2.2 Start-Up Time, From Input		200		460	ms
4.2.3 Rise time (Vout from 10% to 90%)				100	ms
4.3 output capacitor				2200	µF
5. EFFICIENCY					
5.1 100% Load	Vin=72V		90.5		%
5.2 60% Load	Vin=72V		90.5		%
6.ISOLATION CHARACTERISTICS					
6.1 Input to Output				3000	Vdc
6.2 Input to base				3000	Vdc
6.3 Output to base				3000	Vdc
6.4 Isolation Resistance		10			MΩ
7. FEATURE CHARACTERISTICS					
7.1 Switching Frequency			140		kHz
7.2 ON/OFF Control, Negative Remote On/Off logic					
7.2.1 Logic High (Module On)		3		5	V
7.2.2 Logic Low (Module Off)		0		0.4	V
7.3 Output Voltage Trim Range		-10		10	%
7.4 Output Over-Voltage Protection	Over full temp range; % of nominal Vout	110	120	130	%
8 GENERAL SPECIFICATIONS					
8.1 MTBF			TBD		hours
8.2 Weight	With heat spreader		95		grams
8.3.Over-Temperature Shutdown （NTC resistor）			120		°C

ELECTRICAL CHARACTERISTICS CURVES

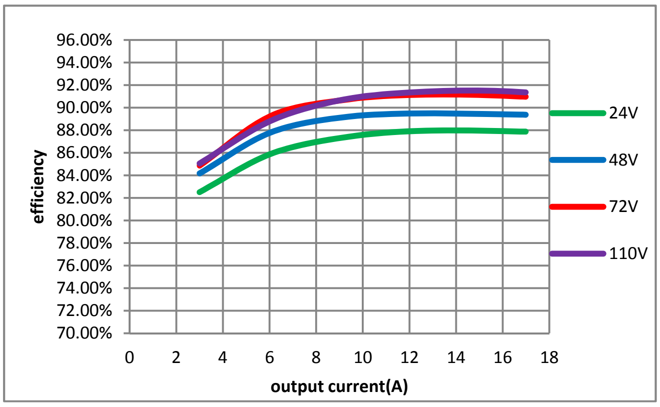


Figure 1: *Efficiency vs. load current at 25°C.*

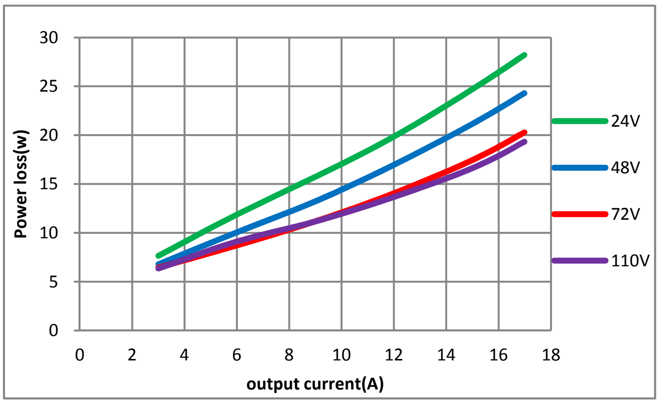


Figure 2: *Efficiency vs. load current for input voltage at 25°C.*

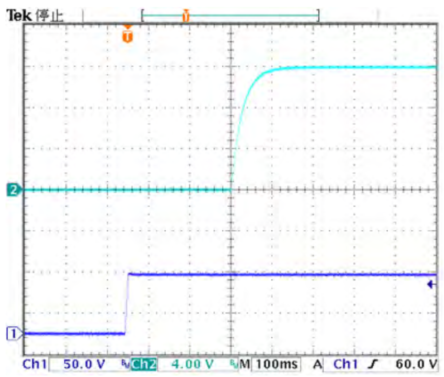


Figure 3: *Turn-on transient at full load current (100ms/div).*
Top Trace: Vout: 4V/div; Bottom Trace:Vin:50V/div

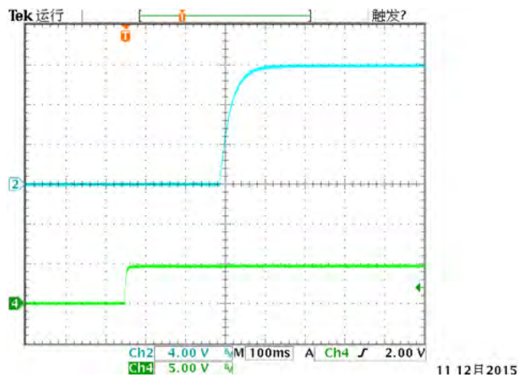


Figure 4: *Turn-on transient at full load current (100ms/div).*
Top Trace: Vout: 4V/div; Bottom Trace:ON/OFF:5V/div

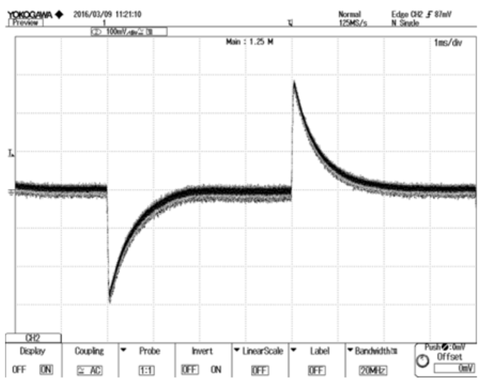


Figure 5: *Output voltage response to step-change in load current (50%-75%-50% of full load; di/dt = 0.1A/µs).*
Trace: Vout;100mV/div; Time: 1ms/div

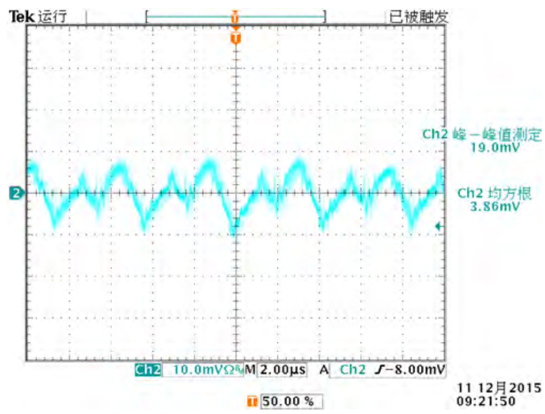


Figure 6: *Output voltage ripple at Vin=72V and full load*
Trace:Vout;20 mV/div, 2us/div; Bandwidth: 20 MHz.

FEATURE DISCRIPTION

Over-Current Protection

The modules include an internal output over-current protection circuit, which will endure current limiting for an unlimited duration during output overload. If the output current exceeds the OCP set point, the module will shut down, and always try to restart (hiccup mode) until the over current condition is corrected.

Over-Voltage Protection

The modules include an internal output over-voltage protection circuit, which monitors the voltage on the output terminals. If this voltage exceeds the over-voltage set point, the module will shut down, and always try to restart until the over current condition is corrected

Over-Temperature Protection

The over-temperature protection consists of circuitry that provides protection from thermal damage. If the over-temperature is detected the module will shut down, and restart after the temperature is within specification.

Remote ON/OFF

The remote on/off feature on the module can be either negative or positive logic. Negative logic turns the module on during logic low and off during logic high. Positive logic turns the modules on during logic high and off during a logic low.

Remote on/off can be controlled by an external switch between the on/off terminal and the Vin (-) terminal. The switch can be an open collector or open drain. For negative logic if the remote on/off feature is not used, please short the on/off pin to Vin (-). For positive logic if the remote on/off feature is not used, please leave the on/off pin floating.

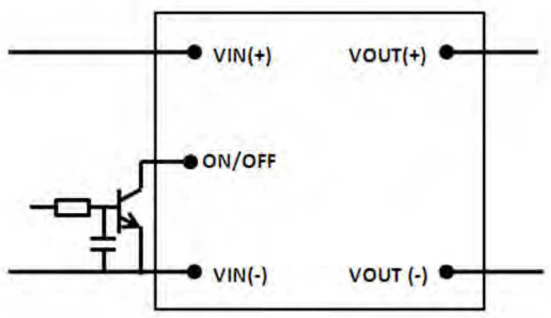


Figure 7: Remote ON/OFF Implementation

PULSE OUT

This pin outputs a 1KHz 50% duty cycle pulse voltage with 12V amplitude. It is designed to provide a bootstrap signal for the input inrush current limit circuit, and also could indicate operating status with a LED connected. if you don`t need it, please let it open.

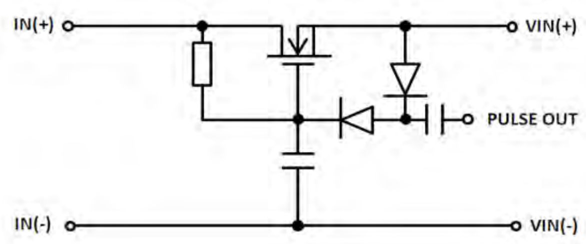


Figure 8: An Active Circuit Design For Inrush Current Limit

UVLO.

H80SV Series converters have an under voltage lockout feature that will shut down the converter if the input voltage falls below the adjustable threshold. Devices will automatically restart when input voltage rises above the UVLO threshold. The hysteresis built into this function prevents an indeterminate on/off condition at a single input voltage. The under voltage threshold is determined by the value of a resister placed between the UVLO and VIN (-). Figure 9 shows a typical configuration.

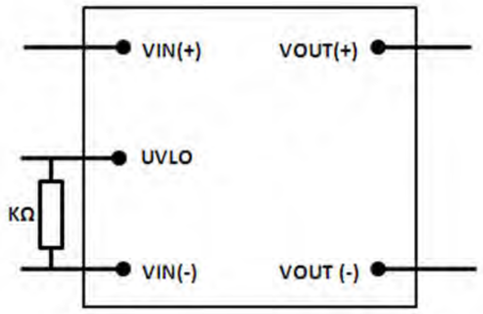


Figure 9: Under voltage Lockout Configuration

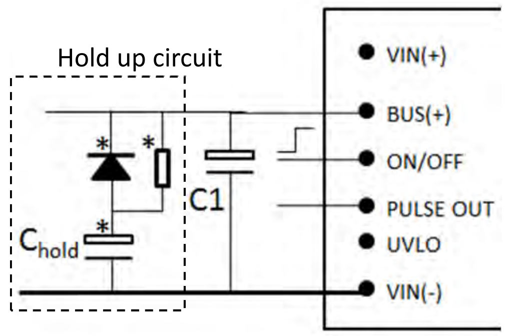


Figure 10: Connection of External Hold-up Circuit

The table below shows UVLO values for various nominal input voltages and the required resistor for each.

Norminal Vin	24V	36V	48V	72V	96V	110V
Turn-off Threshold	14.0±0.4V	21.2 ±0.4V	28.4 ±0.4V	42.8 ±1V	57.2 ±1V	65.6 ±2V
Turn-on Threshold	16.0±0.4V	24.5 ±0.4V	33.6 ±0.4V	50.4 ±1V	67.6 ±1V	76.8 ±2V
UVLO External Resistor (KΩ)	open	24.9	12.4	6.19	4.12	3.48

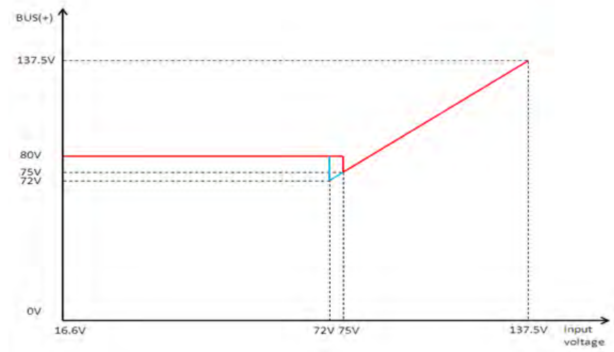


Figure 11: BUS(+) VS Input Voltage

Hold up time

The BUS+ pin is for hold-up time function. It is designed to work with an external circuit comprises a cap (C_{hold}), a resistor and a diode.(Hold up time is defined as the duration of time that the DC/DC converter output will remain active following a loss of input power). When this function is activated, the 12017 use the energy stored in external circuit to support operation. A typical configuration shows as Figure 10. The voltage BUS+ varies with input voltage and the relationship is showed in figure3. The red curve, BUS(+) keeps stable at 80V when input voltage rise from 16.6V to 75V, when the input voltage is above 75V, then BUS(+) follows input voltage. The blue one, BUS(+) falls with input voltage until the input voltage falls to 72V, then BUS(+) will maintain 80V until input voltage falls below the UVLO.

This function provides energy that maintains the DC-DC converter in operation for 10mS of hold up time. The capacity in the application is recommended below. (Note: for the rated voltage of capacitor please refer to the BUS(+) voltage curve showed in figure 11).The recommended resistor value is 100ohm.

Nominal Vin	24V	36V	48V	72V	96V	110V
Capacity	2300uF	2300uF	2300uF	2300uF	1200uF	800uF

Output Voltage Adjustment (TRIM)

To increase or decrease the output voltage set point, connect an external resistor between the TRIM pin and SENSE (+) pin or SENSE (-) pin. The TRIM pin should be left open if this feature is not used.

For trim down, the external resistor value required to obtain a percentage of output voltage change △ is defined as:

$$Rtrim-down=\left[\frac{5.11}{\Delta}-10.22\right](K\Omega)$$

Ex. When Trim-down -10% (12V×0.9=10.8V)

$$Rtrim-down=\left[\frac{5.11}{10\%}-10.22\right](K\Omega)=40.88(K\Omega)$$

For trim up, the external resistor value required to obtain a percentage output voltage change △% is defined as:

$$Rtrim-up=\left[\frac{45}{\Delta}+40\right]K\Omega$$

Ex. When Trim-up +10% (12V×110%=13.2V)

$$Rtrim-up=\left[\frac{45}{10\%}+40\right]=495(K\Omega)$$

DESIGN CONSIDERATIONS

Input Source Impedance

The impedance of the input source connecting to the DC/DC power modules will interact with the modules and affect the stability. A low ac-impedance input source is recommended. If the source inductance is more than a few µH, we advise 150µF electrolytic capacitor (ESR < 0.7 Ω at 100 kHz) mounted close to the input of the module to improve the stability.

Bus Cap

An electrolytic cap connected between bus+ and Vin-(C1 in figure10) is necessary for stability, and the recommended capacity is 200uF.

Layout and EMC Considerations

DC/DC power modules are designed to operate in a wide variety of systems and applications. For design assistance with EMC compliance and related PWB layout issues, please contact our technical support team.

Schematic and Components List

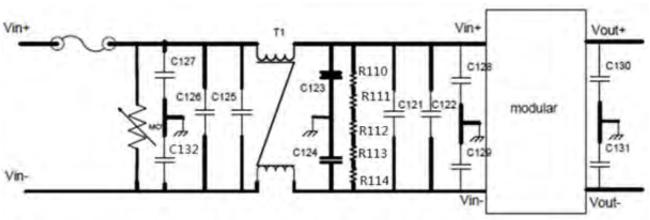


Figure 12 EMC test schematic

The component list is TBD

Safety Considerations

The power module must be installed in compliance with the spacing and separation requirements of the end-user's safety agency standard, i.e., UL 60950-1, 2nd Edition, 2014-10-14, CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10, IEC 60950-1: 2005 + A1: 2009 + A2: 2013 and EN 60950-1: 2006 + A11: 2009 + A1: 2010 + A12: 2011 + A2: 2013, if the system in which the power module is to be used must meet safety agency requirements.

Reinforced insulation is provided between the input and output of the module. Input is considered as secondary hazardous voltage which main transient is up to 1500Vpk and output is considered as SELV circuit.

The input source must be insulated from the ac mains by reinforced or double insulation.

The input terminals of the module are not considered as operator accessible.

A SELV reliability test may require when install on the system where the module is used, in combination with the module, to ensure that under a single fault, hazardous voltage does not appear at the module's output.

Soldering and Cleaning Considerations

Post solder cleaning is usually the final board assembly process before the board or system undergoes electrical testing. Inadequate cleaning and/or drying may lower the reliability of a power module and severely affect the finished circuit board assembly test. Adequate cleaning and/or drying is especially important for un-encapsulated and/or open frame type power modules. For assistance on appropriate soldering and cleaning procedures, please contact our technical support team.

THERMAL CONSIDERATIONS

The thermal curve is based on the test setup shown as figure13. The module is mounted on an Al plate and was cooled by cooling liquid.

Figure14 shows the location to monitor the temperature of the module's baseplate. The baseplate temperature in thermal curve is a reference for customer to make thermal evaluation and make sure the module is operated under allowable temperature. (Thermal curves shown in Figure15 are based on different input voltage).

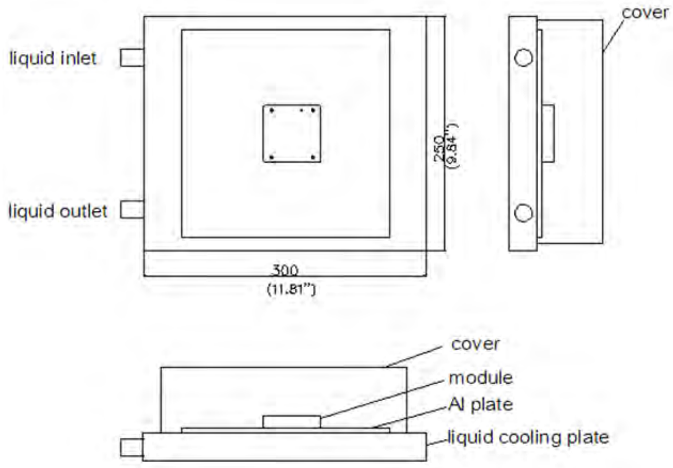


Figure 13: *Test setup*

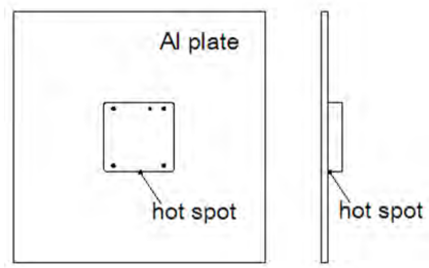


Figure 14: *Temperature measured point*

THERMAL CURVES

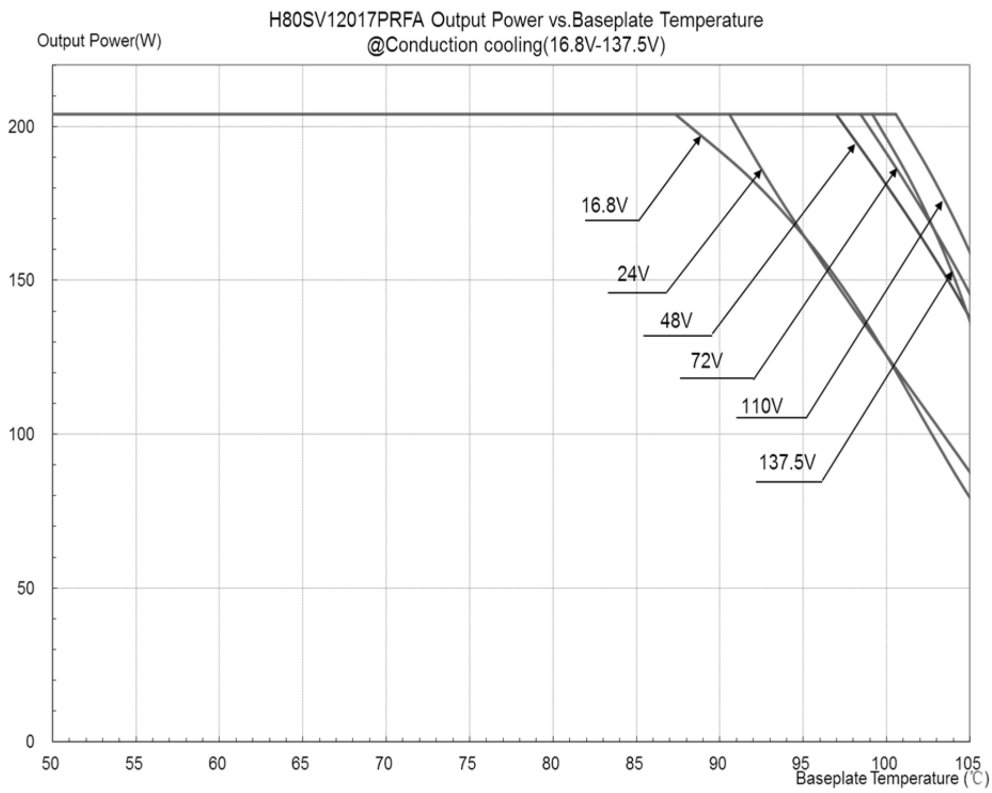


Figure 15: *Output Power vs Baseplate temperature @Vin=16.8V～137.5V*

LEAD FREE (SAC) PROCESS RECOMMEND TEMP. PROFILE

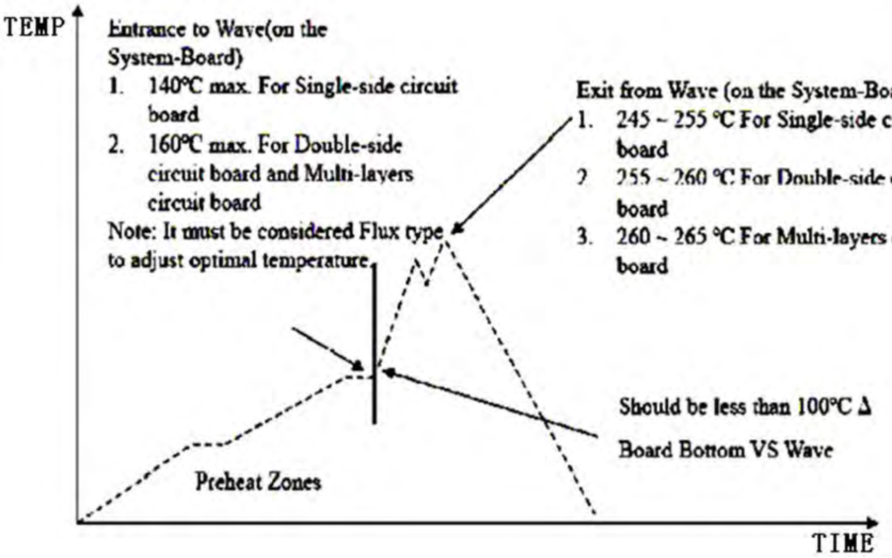
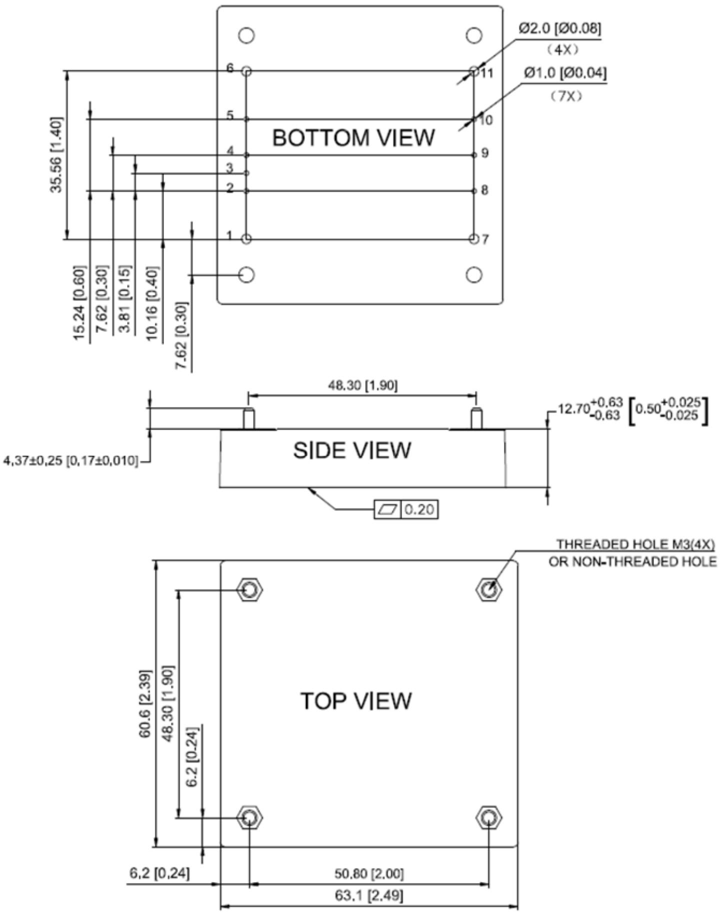


Figure 17: *Recommended temperature profile for lead-free wave soldering*

MECHANICAL DRAWING(BASEPLATE)



PIN #	Function
1	+Vin
2	UVLO
3	PLUSE OUT
4	ON/OFF
5	BUS
6	-Vin
7	+Vout
8	+Sense
9	Trim
10	-Sense
11	-Vout

DIMENSIONAL TOLERANCE
X[X.X] : ±0.5mm[±0.002in]
X.X[X.XX]: ±0.30mm[±0.012in]
X.XX[X.XXX]: ±0.10mm[±0.004in]

Figure 18: *The pin function and mechanical drawing*