Specification for Approval

Date: 2023/03/14

Customer :

TAI-TECH P/N: THMC0421SPV-Series(G)-HD

CUSTOMER P/N:

DESCRIPTION:

QUANTITY: pcs

REMARK:		
Customer Approval Feedback		

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APPROVED	CHECKED
Eric Kuan	Zhang mengmeng

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APPROVED	CHECKED	DRAWN
Sky Luo	Mr.Liang	Cui lingling

SMD Power Inductor THMC0421SPV-Series(G)-HD

ECN HISTORY LIST

REV	DATE	DESCRIPTION	APPROVED	CHECKED	DRAWN
1.0	23/03/14	New Issue	Sky Luo	Mr.Liang	Cui lingling
備注					

SMD Power Inductor

THMC0421SPV-Series(G)-HD

1. Features

1. Low loss realized with low DCR.
2. High performance realized by metal dust core.
3. Ultra low buzz noise, due to composite construction.
4. 100% Lead(Pb)-Free and RoHS compliant.
5. High reliability -Reliability test complied to AEC-Q200.

AEC-Q200

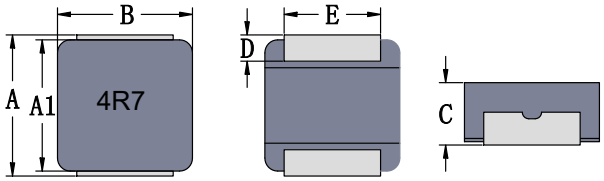
Halogen-free

RoHS

2. Applications

Automotive applications.

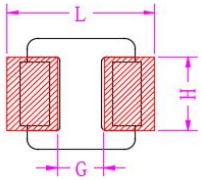
3. Dimensions



Series	A	A1	B	C	D	E
THMC0421SP	4.3±0.3	4.1±0.3	4.2±0.2	1.9±0.2	0.8±0.3	3.0±0.2

Unit:mm

Recommend PC Board Pattern



L(mm)	G(mm)	H(mm)
5.2	2.2	3.5

Note: 1.PCB layout is referred to standard IPC-7351B
2. The above PCB layout reference only.
3. Recommend solder paste thickness at 0.12mm and above.

4. Part Numbering

THMC	0421	SPV	-	4R7	MG	-HD
A	B	C		D	E	F

A: Series
B: Dimension — BxC
C: Type — Standard.
D: Inductance — 4R7=4.7uH
E: Inductance Tolerance — M=±20%
Marking: Black.4R7
F:Code

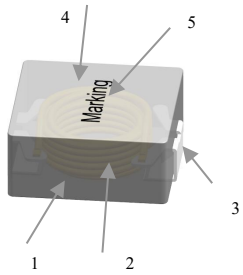
5. Specification

Part Number	Inductance L0 A(uH) ±20%	Irms(A)		I sat (A)		DCR(mΩ)		Impulse Chroma 19301/19301A
		Typ	Max	Typ	Max	Typ	Max	
THMC0421SPV-R10MG-HD	0.10	19.0	18.0	35.0	32.0	1.9	2.3	50V
THMC0421SPV-R15MG-HD	0.15	16.5	15.0	29.0	26.0	3.1	3.8	50V
THMC0421SPV-R22MG-HD	0.22	16.0	14.0	18.0	16.0	3.3	4.0	50V
THMC0421SPV-R33MG-HD	0.33	15.0	13.0	15.0	13.0	5.0	5.8	50V
THMC0421SPV-R47MG-HD	0.47	13.0	11.0	13.0	11.0	6.0	7.2	50V
THMC0421SPV-R56MG-HD	0.56	12.0	10.5	12.0	10.5	6.8	8.2	50V
THMC0421SPV-R68MG-HD	0.68	11.0	10.0	11.0	10.0	8.2	9.9	50V
THMC0421SPV-1R0MG-HD	1.0	10.0	9.5	10.0	9.5	11.5	13.8	50V
THMC0421SPV-1R5MG-HD	1.5	9.0	8.0	9.0	8.0	15.4	18.5	50V
THMC0421SPV-2R2MG-HD	2.2	7.2	6.5	7.2	6.5	25.0	30.0	50V
THMC0421SPV-3R3MG-HD	3.3	5.5	5.0	6.9	6.2	41.0	49.2	50V
THMC0421SPV-4R7MG-HD	4.7	4.7	4.1	5.8	5.2	60.0	69.0	50V
THMC0421SPV-5R6MG-HD	5.6	4.1	3.5	4.3	3.7	68.0	78.2	30V
THMC0421SPV-6R8MG-HD	6.8	3.8	3.3	3.9	3.4	80.5	92.5	30V
THMC0421SPV-8R2MG-HD	8.2	3.3	3.0	3.5	3.1	105.0	121.0	30V
THMC0421SPV-100MG-HD	10.0	3.1	2.9	3.3	3.0	126.0	145.0	30V
THMC0421SPV-120MG-HD	12.0	2.7	2.4	2.7	2.4	140.0	161.0	30V
THMC0421SPV-150MG-HD	15.0	2.4	2.1	2.4	2.1	165.0	190.0	30V

Note:

1. Test frequency : Ls : 100KHz /1.0V.
2. All test data referenced to 25℃ ambient.
3. Testing Instrument(or equ) : Agilent 4284A,E4991A,4339B,KEYSIGHT E4980A/AL,chroma3302,3250,16502.
4. Heat Rated Current (Irms) will cause the coil temperature rise approximately ΔT of 40℃
5. Saturation Current (Isat) will cause L0 to drop approximately 30%.
6. The part temperature (ambient + temp rise) should not exceed 150℃under worst case operating conditions.Circuit design,component,PCB trace size and thickness,airflow and other cooling provisions all affect the part temperature. Part temperature should be verified in the end application.
7. Irms Testing : Temperature rise is highly dependent on many factors including pcb land pattern, trace size, and proximity to other components. Therefore temperature rise should be verified in application conditions.
8. Rated DC current: The lower value of Irms and Isat.

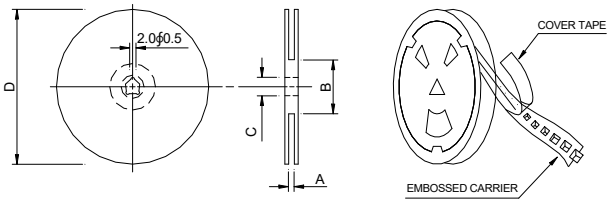
6. Material List



NO	Items	Materials
1	Core	Metal Powder
2	Wire	Polyester Wire or equivalent.
3	Clip	100% Pb free solder(Ni+Sn---Plating)
4	paint	Epoxy resin
5	Ink	Halogen-free ketone

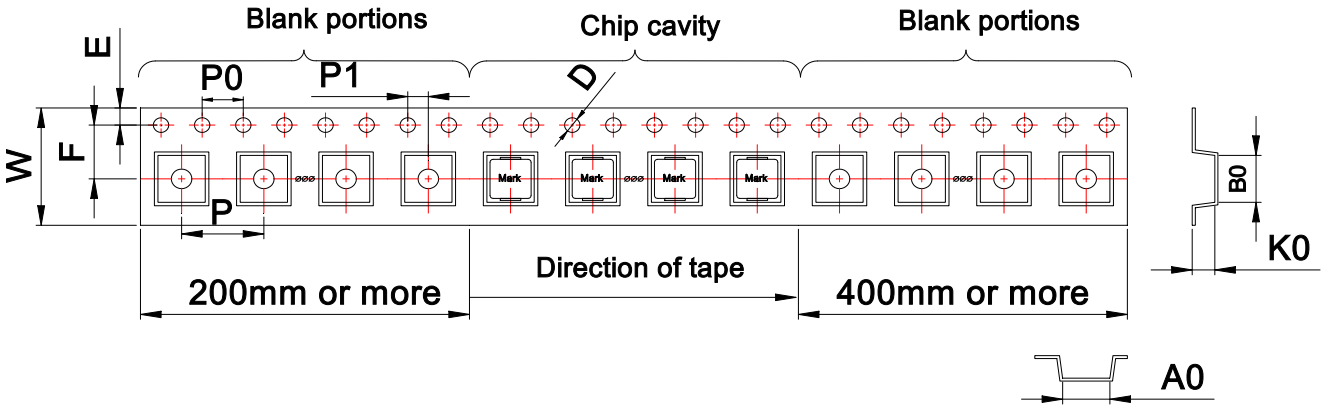
7. Packaging Information

(1) Reel Dimension



Type	A(mm)	B(mm)	C(mm)	D(mm)
13"x12mm	12.4+2/-0	100±2	13+0.5/-0.2	330±0.3

(2) Tape Dimension

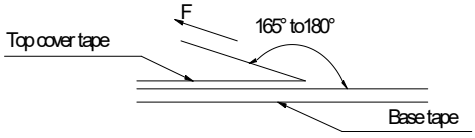


Series	Bo(mm)	Ao(mm)	Ko(mm)	W(mm)	P(mm)	P0(mm)	P1(mm)	F(mm)	E(mm)	D(mm)
THMC0421	4.9±0.1	4.6±0.1	2.3±0.1	12±0.3	8.0±0.1	4.0±0.1	2.0±0.1	5.5±0.1	1.75±0.1	1.5±0.1

(3) Packaging Quantity

Series	Reel
THMC0421	3000

(4) Tearing Off Force



The force for tearing off cover tape is 10 to 130 grams in the arrow direction under the following conditions(referenced ANSI/EIA-481-D-2008 standard).

Tearing Speed mm	Room Temp. (℃)	Room Humidity (%)	Room atm (hPa)
300±10%	5~35	45~85	860~1060

8. Reliability and Test Condition

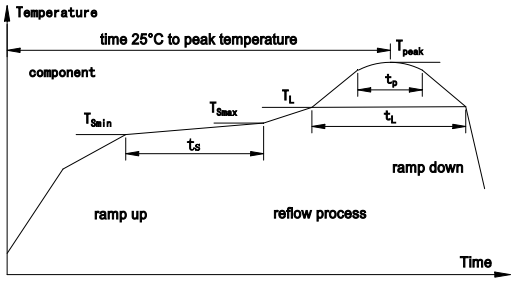
Item		Performance	Test Condition
Operating temperature		-55~+150°C(Including self - temperature rise)	NA
Storage temperature and Humidity range		1. -10~+40°C, 50~60%RH (Product with taping) 2. -55~+150°C(on board)	NA
Electrical Performance Test			
Inductance		Refer to standard electrical characteristics list.	HP4284A, CH11025, CH3302, CH1320, CH1320S LCR Meter.
DCR			CH16502, Agilent33420A Micro-Ohm Meter.
Saturation Current (Isat)		Approximately △L30%	Saturation DC Current (Isat) will cause L0 to drop △L(%).
Heat Rated Current (Irms)		Approximately △T40℃	Heat Rated Current (Irms) will cause the coil temperature rise △T(℃). 1. Applied the allowed DC current. 2. Temperature measured by digital surface thermometer.
Reliability Test（For AEC-Q200-E）			
8.1	Pre- and Post-Stress Electrical Test	User Specification	Test is performed at room temperature except as specified in the applicable stress reference and the additional requirements in this Table（e.g. 8.3, 8.4, 8.5） Preconditioning : run through reflow for 3 times. (IPC/JEDECJ-STD-020F Classification Reflow Profiles)
8.2	High Temperature Exposure(Storage) Reference MIL-STD-202 Method 108	Appearance : no damage. Inductance : within±10% of initial value DCR : within±15% of initial value and shall not exceed the specification value.	Unpowered，Temperature : 150±2°C Upper Temperature: maximum specified operating temperature or maximum specified storage temperature (whichever is higher). Duration : 1000hrs Min. Measured at room temperature after placing for 24±4 hrs.
8.3	Temperature Cycling Reference JESD22-A104		Conduct Temperature Cycling testing on the product after performing the Pre- and Post-Stress Electrical Tests as specified in section 8.1 Unpowered Lower Temperature of the Chamber: -40℃(For Inductors/Transformers) Upper Temperature of the Chamber: maximum specified operating temperature and shall not exceed 125℃ Condition for 1 cycle Step1 : -40±2℃ 30min Min. Step2 : 125±2℃ transition time 1min MAX Step3 : 125±2℃ 30min Min. Step4 : Dwell Time (Soak Time) 15 minutes minimum, 30 minutes minimum if component weighs above 28g Transition Time : 1 minute maximum Number of cycles : 1000 Measured at room temperature at least 24 hours after test conclusion.
8.4	Humidity Bias Reference MIL-STD-202 Method 103		Conduct Humidity Bias testing on the product after performing the Pre- and Post-Stress Electrical Tests as specified in section 8.1 Unpowered(For Inductors/Transformers) Humidity : 85±3% R.H, Temperature : 85℃±2℃ Duration : 1000hrs Min. Measured at room temperature after placing for 24±4hrs.
8.5	High Temperature Operating Life Reference MIL-STD-202 Method 108		Conduct High Temperature Operating Life testing on the product after performing the Pre- and Post-Stress Electrical Tests as specified in section 8.1 Temperature : 110±2°C Upper Temperature of the Chamber: maximum specified operating temperature (not including heat rise) at maximum rated power and shall not exceed 125°C. (For Inductors/Transformers) Duration : 1000hrs Min. with 100% rated current. Measured at room temperature after placing for 24±4 hrs.
8.6	External Visual Reference MIL-STD-883 Method 2009	Appearance : no damage.	Inspect device construction, marking and workmanship. Pre and Post Electrical Test not required.
8.7	Physical Dimension Reference JESD22-B100	According to the product specification size measurement.	Verify physical dimensions to the applicable component detail specification. Pre and Post Electrical Test not required.
8.8	Terminal Strength (for axial and radial THT components) Reference MIL-STD-202 Method 211	Appearance : no damage. Inductance : within±10% of initial value DCR : within±15% of initial value and shall not exceed the specification value.	Test THT component lead integrity only. Test Condition A (pull test) Nominal cross- sectional area(mm^2) / Force (N): ≤0.05 — 1 0.06 to 0.10 — 2.5 0.11 to 0.20 — 5 0.21 to 0.50 — 10 0.51 to 1.20 — 20 ＞1.20 — 40 Test Condition C (wire-lead bend test) : Section Modulus (Zx) (mm^3) / Force (N): ≤$1.5x10^{-3}$ — 0.5 $1.6x10^{-3}$ to $4.2x10^{-3}$ — 1.25 $4.3x10^{-3}$ to $1.2x10^{-2}$ — 2.5 $1.3x10^{-2}$ to $0.5x10^{-1}$ — 5 $0.6x10^{-1}$ to $1.9x10^{-1}$ — 10 > $1.9x10^{-1}$ — 20 For round terminations : ZX = (πd3)/32 where d is the lead diameter. For strip terminations : ZX = (ba2)/6 where is the thickness of the rectangular strip perpendicular to the bending axis, b is the other dimension of the rectangular strip.

<table>
<tr><th colspan="2">Item</th><th>Performance</th><th>Test Condition</th></tr>
<tr><td>8.9</td><td>Resistance to Solvents

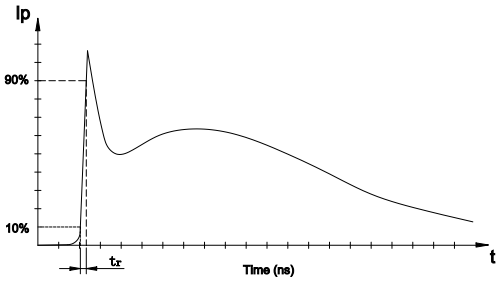
Reference
MIL-STD-202 Method 215</td><td rowspan="5">Appearance : no damage.
Inductance : within±10% of initial value
DCR : within±15% of initial value and shall not exceed the specification value.</td><td>Add an Aqueous wash chemical and follow chemical manufacturer's recommended parameters (i.e. solution temperature and immersion time).
Applicable to ink marked components and not laser marked components</td></tr>
<tr><td>8.10</td><td>Mechanical Shock

Reference
MIL-STD-202 Method 213</td><td>
<table>
<tr><th>Type</th><th>Peak value (g's)</th><th>Normal duration (D) (ms)</th><th>Wave form</th><th>Velocity change (Vi)ft/sec</th></tr>
<tr><td>SMD</td><td>100</td><td>6</td><td>Half-sine</td><td>12.3</td></tr>
<tr><td>THT</td><td>100</td><td>6</td><td>Half-sine</td><td>12.3</td></tr>
</table>
3 shocks in each direction along 3 perpendicular axes.
(18 shocks).</td></tr>
<tr><td>8.11</td><td>Vibration

Reference
MIL-STD-202 Method 204</td><td>Oscillation Frequency : 10Hz～2kHz～10Hz for 20 minutes
Equipment : Vibration checker
Total Amplitude : 5g
Testing Time : 12 hours(20 minutes, 12 cycles each of 3 orientations)</td></tr>
<tr><td>8.12</td><td>Resistance to Soldering Heat

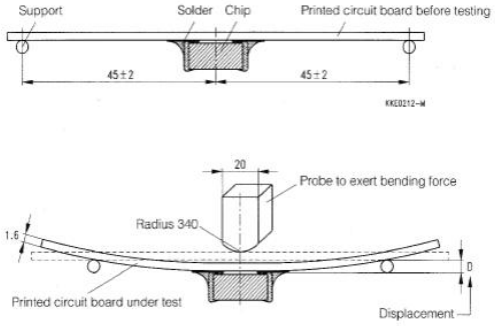
Reference
MIL-STD-202 Method 210</td><td>Test condition :
THT : Conditions B or C
<table>
<tr><th>Solder technique simulation</th><th>Test condition</th><th>Temperature (℃)</th><th>Time(s)</th><th>Temperature ramp/immersion and emersion rate</th><th>Number of heat cycles</th></tr>
<tr><td>Dip</td><td>B</td><td>260 ±5 (solder temp)</td><td>10±1</td><td>25mm/s ±6mm/s</td><td>1</td></tr>
<tr><td>Wave : Topside board-mount product</td><td>C</td><td>260 ±5 (solder temp)</td><td>20±1</td><td></td><td>1</td></tr>
</table>
Depth : completely cover the termination
SMD : Condition K, time above 217° C, 60s-150s, Number of heat cycles : 3
Continental


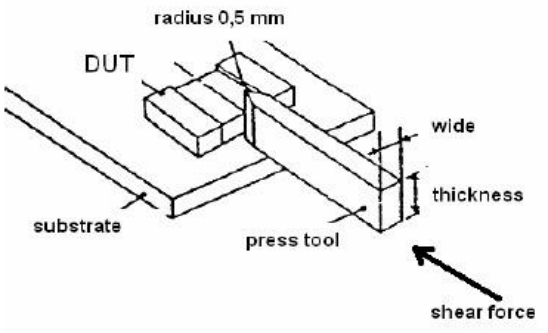
<table>
<tr><th>Component Size</th><th>Ramp up to 150℃</th><th>T_{smin}</th><th>T_s</th><th>T_{smax}</th><th>T_L</th><th>t_L</th><th>T_{peak}*</th><th>T_p**</th><th>Time 25℃ to peak</th><th>Ramp down</th></tr>
<tr><td>Thickness ＜ 1.6mm or Thickness 1.6mm-2.5mm and Volume＜ 350mm3</td><td rowspan="3">3.0±0.1℃/s (The component shall be specified for usage in serial production with up to 3.0℃/s)</td><td rowspan="3">⩾ 190℃</td><td rowspan="3">⩾ 110s</td><td rowspan="3">⩾ 200℃</td><td rowspan="3">⩾ 217℃</td><td rowspan="3">⩾ 90s</td><td>⩾ 260℃</td><td>⩾ 40s</td><td rowspan="3">⩾300s</td><td rowspan="3">6.0±0.1℃/s (The component shall be specified for usage in serial production with up to 6.0℃/s)</td></tr>
<tr><td>Thickness 1.6mm-2.5mm and Volume＜ 350-2000mm³ or Thickness ＞ 2.5mm and Volume ＜350mm3</td><td>⩾ 250℃</td><td rowspan="2">⩾ 30s</td></tr>
<tr><td>Thickness 1.6mm-2.5mm and Volume＞ 2000mm³ or Thickness ＞ 2.5mm and Volume ＞ 350mm3</td><td>⩾ 245℃</td></tr>
</table>
Table 1 : Minimum requirements for lead-free soldering
*peak temperature is measured on the centre top of the component package
**tp measured @ T peak-5℃</td></tr>
<tr><td>8.13</td><td>ESD

Reference
AEC-Q200-002</td><td>Direct Contact and Air Discharge PASSIVE COMPONENT HBM ESD
Discharge Waveform to a Coaxial Target
Test method : AEC-Q200-002
Test mode : Contact Discharge
Discharge level : 4 KV (Level : 2)

</td></tr>
</table>

<table>
<tr><th colspan="2">Item</th><th>Performance</th><th>Test Condition</th></tr>
<tr><td>8.14</td><td>Solderability

Reference
J-STD-002</td><td>More than 95% of the terminal electrode should be covered with solder.</td><td>Through-hole Technology (THT : Method A1, Coating Durability Category 2)
▪ SMD :
Method B1, Coating Durability Category 2
Method D, Coating Durability Category 2
▪ Magnification 50x
▪ Pre and Post Electrical Test not required.
▪ Non-soldered type mounting/attach are not applicable.
<table>
<tr><th>Reference</th><th>Method A1</th><th>Method B1</th><th>Method D</th></tr>
<tr><td>Welding Process</td><td>Reflow Soldering</td><td>Reflow Soldering for Other Components</td><td>Lead-free Soldering</td></tr>
<tr><td>Type of Solder</td><td>Tin-Silver-Copper Solder</td><td>Tin-Silver-Copper Solder</td><td>Tin-Silver-Copper Solder</td></tr>
<tr><td>Flux Immersion Time</td><td>5-10s</td><td>5-10s</td><td>5-10s</td></tr>
<tr><td>Immersion Angle</td><td>20˚~45˚</td><td>20˚~45˚</td><td>20˚~45˚</td></tr>
<tr><td>Solder Temperature</td><td>245±5° C</td><td>245±5° C</td><td>260±5° C</td></tr>
<tr><td>Solder Immersion Time</td><td>5+0/-0.5s</td><td>5+0/-0.5s</td><td>30+5/-0s</td></tr>
<tr><td>Speed of Immersion and Withdrawal</td><td>25±6mm/s</td><td>25±6mm/s</td><td>25±6mm/s</td></tr>
</table></td></tr>
<tr><td>8.15</td><td>Electrical Characterization</td><td>Refer Specification for Approval.</td><td>Parametrically test per lot and sample size requirements, summary to show Min, Max, Mean and Standard deviation at room as well as Min and Max operating temperatures.
Pre and Post Electrical Test not required</td></tr>
<tr><td>8.16</td><td>Flammability</td><td>In accordance with Referenced Standards.</td><td>Reference UL-94 or IEC 60695-11-5</td></tr>
<tr><td>8.17</td><td>Board Flex(SMD)

Reference
AEC-Q200-005</td><td rowspan="2">Appearance : no damage.
Inductance : within±10% of initial value
DCR : within±15% of initial value and shall not exceed the specification value.</td><td>Preconditioning : run through reflow for 3 times.
(IPC/JEDEC J-STD-020F Classification Reflow Profiles)
Place the 100mm X 40mm board into a fixture similar to the one shown in below Figure with the component facing down. The apparatus shall consist of mechanical means to apply a force which will bend the board (D) x = 2 mm minimum. The duration of the applied forces shall be 60 (+ 5) sec. The force is to be applied only once to the board.
 
</td></tr>
<tr><td>8.18</td><td>Terminal Strength(SMD)

Reference
AEC-Q200-006</td><td>With the component mounted on a PCB with the device to be tested, apply a 17.7 N (1.8 Kg) force to the side of a device being tested. This force shall be applied for 60 +1 seconds. Also the force shall be applied gradually as not to apply a shock to the component being tested.
 
</td></tr>
</table>

Note : When there are questions concerning measurement result : measurement shall be made after 48 ± 2 hours of recovery under the standard condition.

9. Soldering Specifications

(1) Soldering

Mildly activated rosin fluxes are preferred. TAI-TECH terminations are suitable for re-flow soldering systems. If hand soldering cannot be avoided, the preferred technique is the utilization of hot air soldering tools.

(2) Soldering Reflow:

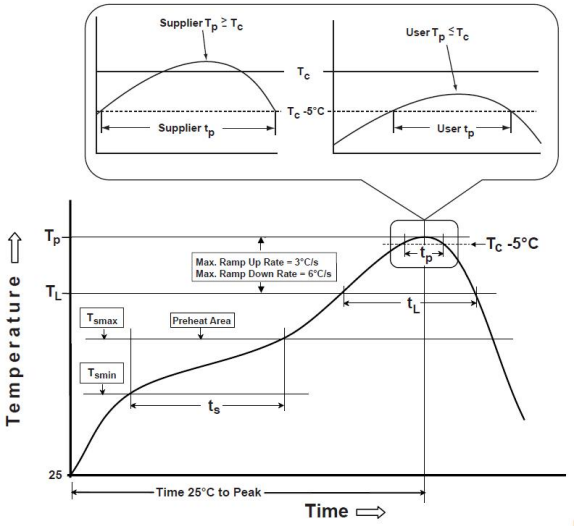
Recommended temperature profiles for lead free re-flow soldering in Figure 1. Table 1.1&1.2 (J-STD-020F)

(3) Iron Reflow:

Products attachment with a soldering iron is discouraged due to the inherent process control limitations. In the event that a soldering iron must be employed the following precautions are recommended.(Fig. 2)

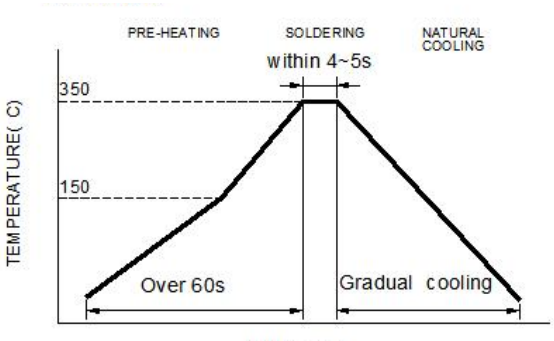
- Preheat circuit and products to 150℃
- Never contact the ceramic with the iron tip
- Use a 20 watt soldering iron with tip diameter of 1.0mm
- 355℃ tip temperature (max)
- 1.0mm tip diameter (max)
- Limit soldering time to 4~5sec.

Fig.1 Soldering Reflow



Reflow times: 3 times max

Fig.2 Iron soldering temperature profiles



Iron Soldering times: 1 times max.

Soldering iron Method : 350± 5℃ max

Table (1.1): Reflow Profiles

Profile Type:	Pb-Free Assembly
Preheat -Temperature Min(T_{smin}) -Temperature Max(T_{smax}) -Time(t_s)from(T_{smin} to T_{smax})	 150℃ 200℃ 60-120seconds
Ramp-up rate($T_L$to T_p)	3℃/second max.
Liquidus temperature(T_L) Time(t_L)maintained above T_L	217℃ 60-150 seconds
Classification temperature(T_c)	See Table (1.2)
Time(t_p) at Tc- 5℃ (Tp should be equal to or less than Tc.)	*< 30 seconds
Ramp-down rate(T_p to T_L)	6℃ /second max.
Time 25℃ to peak temperature	8 minutes max.

Tp: maximum peak package body temperature, **Tc**: the classification temperature.

For user (customer) **Tp** should be equal to or less than **Tc.**

* Tolerance for peak profile temperature (Tp) is defined as a supplier minimum and a user maximum.

Table (1.2) Package Thickness/Volume and Classification Temperature (T_c)

	Package Thickness	Volume mm^3 <350	Volume mm^3 350-2000	Volume mm^3 >2000
PB-Free Assembly	<1.6mm	260℃	260℃	260℃
	1.6-2.5mm	260℃	250℃	245℃
	≥2.5mm	250℃	245℃	245℃

Reflow is referred to standard IPC/JEDEC J-STD-020F。

10. Notes

(1) When there are questions concerning measurement result : measurement shall be made after 48 ± 2 hours of recovery under the standard condition

(2) This power choke coil itself does not have any protective function in abnormal condition such as overload, short-circuit and open-circuit conditions, etc. Therefore, it shall be confirmed as the end product that there is no risk of smoking, fire, dielectric withstand voltage, insulation resistance, etc. in abnormal conditions to provide protective devices and/or protection circuit in the end product.

(3) When this power choke coil was used in a similar or new product to the original one, sometimes it might not be able to satisfy the specifications due to different condition of use.

(4) Dielectric withstanding test with higher voltage than specific value will damage insulating material and shorten its life.

(5) This power choke coil must not be used in wet condition by water, coffee or any liquid because insulation strength becomes very low in this condition.

(6) Please consult our company to confirm the reliability of the process required to wash or use or exposure to a chemical solvent used in this product.PCB washing tested to MIL-STD-202 Method，and dry it off immediately。

(7) The rated current as listed is either the saturation current or the heating current depending on which value is lower.

(8) If this power choke is dipped in the cleaning agent, such as toluene, xylene, ketone, and ether system, there is a possibility that the performance decreases greatly，and marking disappearnc。

(9) The high power ultrasonic washing may damage the choke body。

(10) Before use，the user should determine whether this product is suitable for their own design，Our company only guarantees that the product meets the requirements of this specification。

Application Notice

- Storage Conditions(component level)
  To maintain the solderability of terminal electrodes:
  1. TAI-TECH products meet IPC/JEDEC J-STD-020F standard-MSL, level 1.
  2. Temperature and humidity conditions:Less than40℃,85%RH.
  3. Recommended products should be used within 12 months form the time of delivery.
  4. The packaging material should be kept where no chlorine or sulfur exists in the air.
- Transportation
  1. Products should be handled with care to avoid damage or contamination from perspiration and skin oils.
  2. The use of tweezers or vacuum pick up is strongly recommended for individual components.
  3. Bulk handling should ensure that abrasion and mechanical shock are minimized.

11. Typical Performance Curves