



HI-SINCERITY MICROELECTRONICS CORP.

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H432 Series

ADJUSTABLE SHUNT REGULATOR

Description

The H432 series are three-terminal adjustable regulators with guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between V_{REF} (approximately 1.24 or 1.25 volts) and 30 volts with two external resistors. These devices have a typical dynamic output impedance of 0.2Ω . Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacement for zener diodes in many applications.

Features

- Programmable output voltage
- Temperature coefficient is 50ppm/°C typical
- Temperature compensated for operation over full temperature range
- Low output noise voltage
- Fast turn on response

Ordering Information

| Package | V_{REF} 1.24V±2% | V_{REF} 1.24V±1% | V_{REF} 1.24V±0.5% | V_{REF} 1.25V±2% | V_{REF} 1.25V±1% | V_{REF} 1.25V±0.5% |
|---------|-----------------------|-----------------------|-------------------------|-----------------------|-----------------------|-------------------------|
| SOT-23 | H432AN | H432BN | H432CN | H432DN | H432EN | H432FN |
| SOT-89 | H432AM | H432BM | H432CM | H432DM | H432EM | H432FM |
| TO-92 | H432AA | H432BA | H432CA | H432DA | H432EA | H432FA |

Absolute Maximum Ratings

(Operating temperature range applies unless otherwise specified)

| Characteristics | Symbol | Value | Unit |
|------------------------------------|-----------|----------|------|
| Cathode Voltage | V_{KA} | 30 | V |
| Cathode Current Range (Continuous) | I_K | 50 | mA |
| Reference Input Current Range | I_{REF} | 0.05~+10 | mA |
| Power Dissipation | P_D | SOT-23 | 280 |
| | | SOT-89 | 770 |
| | | TO-92 | 770 |
| Operating Temperature Range | T_{opr} | 0~+70 | °C |
| Junction Temperature | T_J | 150 | °C |
| Storage Temperature Range | T_{stg} | -65~+150 | °C |

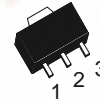
Operating Conditions

| Characteristics | Symbol | Min. | Typ. | Max. | Unit |
|------------------------------------|----------|-----------|------|------|------|
| Cathode Voltage | V_{KA} | V_{REF} | - | 30 | V |
| Cathode Current Range (Continuous) | I_K | 1 | 10 | - | mA |

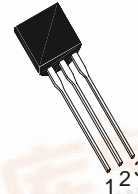
H432 Series Pin Assignment



3-Lead Plastic **SOT-23**
 Package Code: N
 Pin 1: Reference
 Pin 2: Cathode
 Pin 3: Anode



3-Lead Plastic **SOT-89**
 Package Code: M
 Pin 1: Reference
 Pin 2: Anode
 Pin 3: Cathode

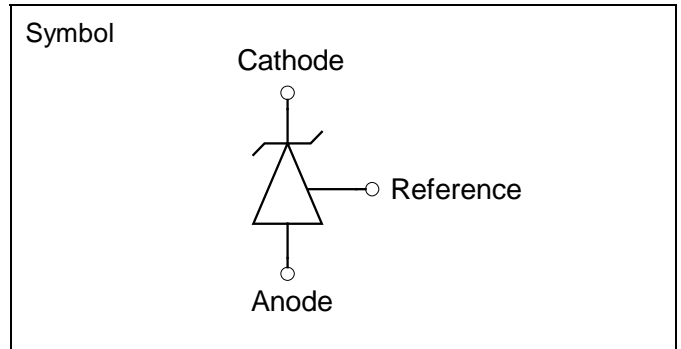
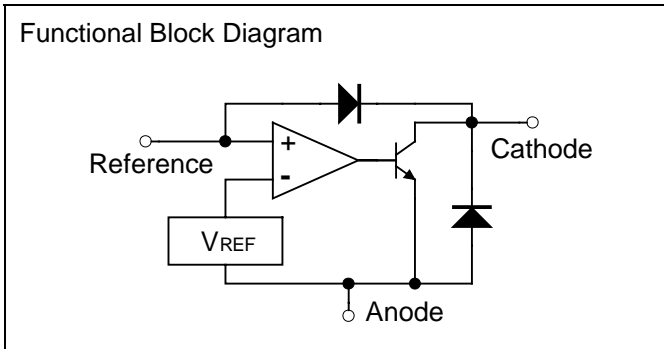


3-Lead Plastic **TO-92**
 Package Code: A
 Pin 1: Reference
 Pin 2: Anode
 Pin 3: Cathode

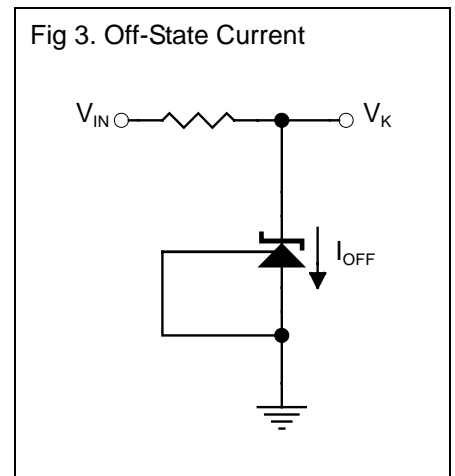
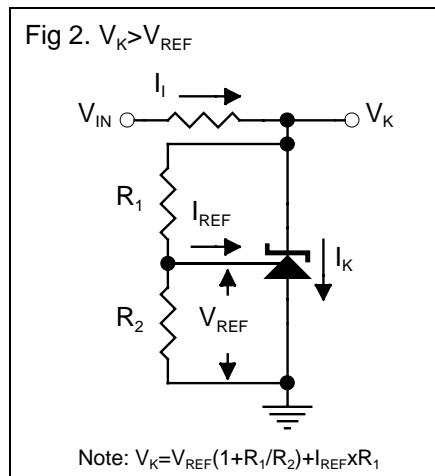
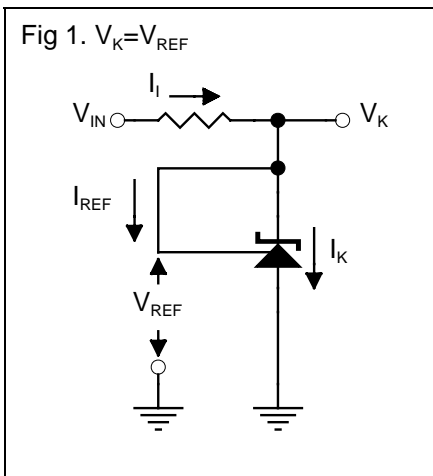




Functional Block Diagram & Symbol



Test Circuits

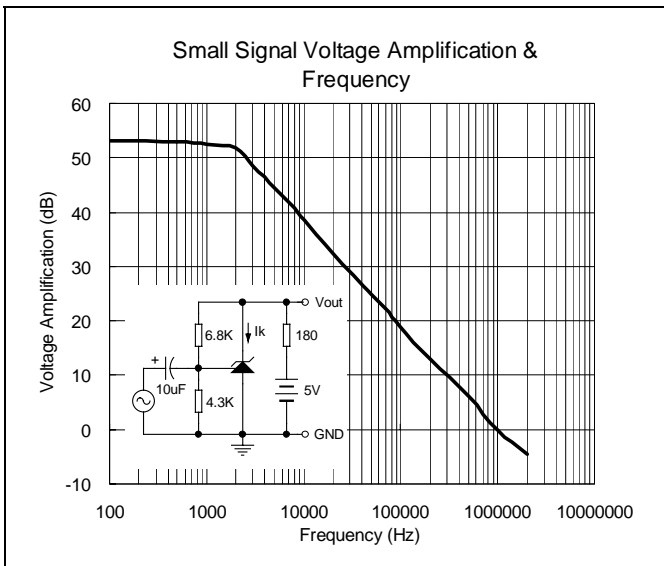
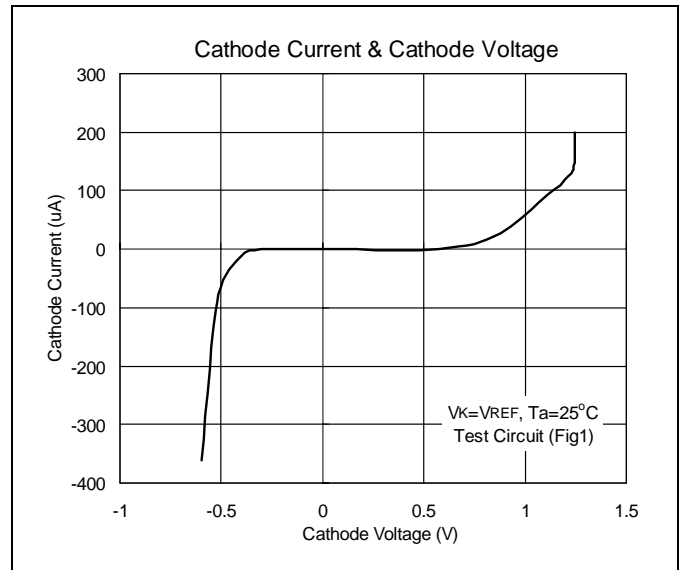
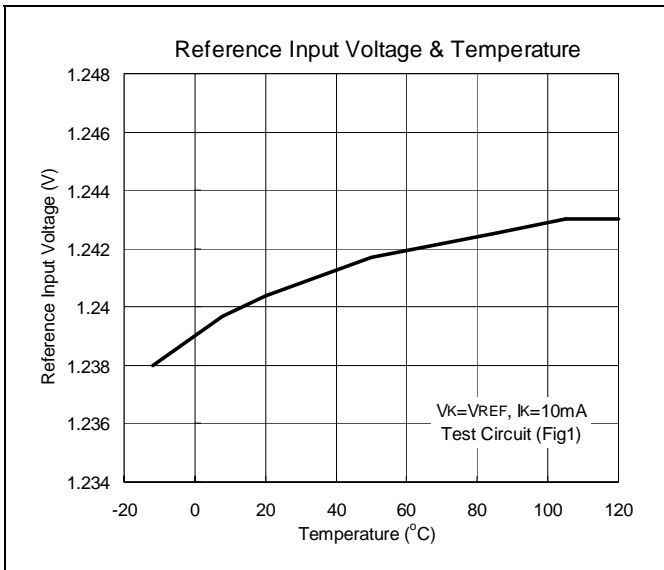
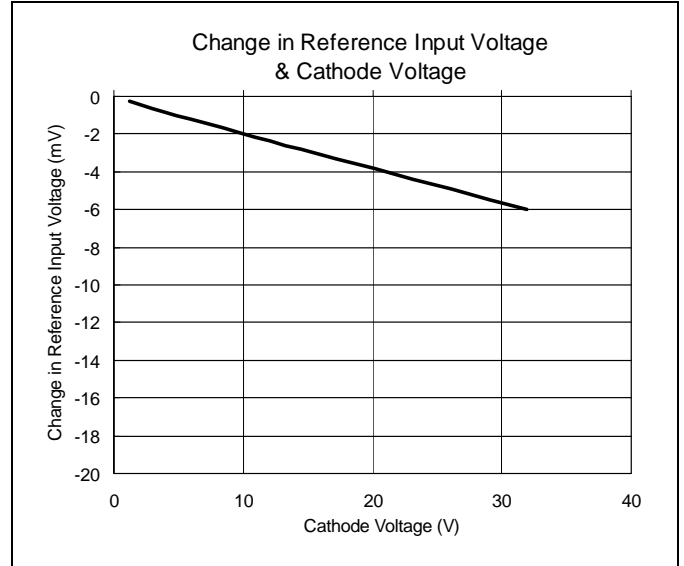
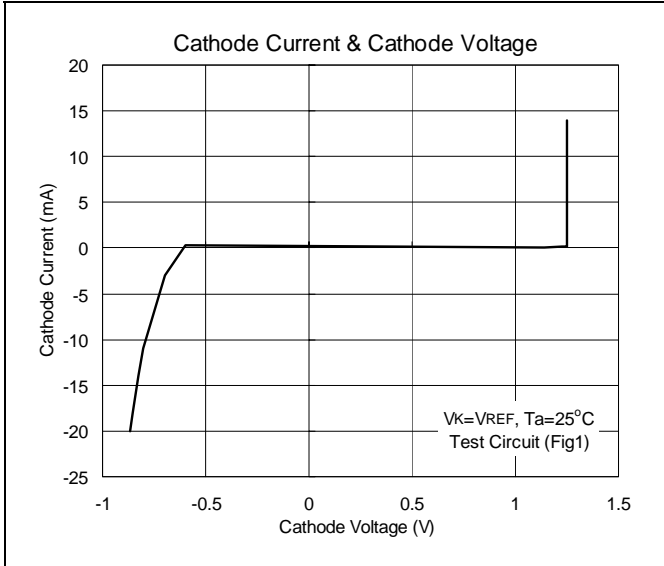


Electrical Characteristics (Ta=25°C unless otherwise specified)

| Characteristics | | Symbol | Test Conditions | Min | Typ | Max | Unit |
|--|-------------------------------|---|------------------------------------|-------|------|---------------|------|
| Reference Input Voltage (Fig1) | H432AN/AM/AA | V_{REF} | $V_K = V_{REF}, I_K = 10\text{mA}$ | 1.215 | 1.24 | 1.265 | V |
| | H432BN/BM/BA | | | 1.228 | 1.24 | 1.252 | |
| | H432CA/CM/CA | | | 1.234 | 1.24 | 1.246 | |
| | H432DN/DM/DA | | | 1.225 | 1.25 | 1.275 | |
| | H432EN/EM/EA | | | 1.238 | 1.25 | 1.262 | |
| | H432FN/FM/FA | | | 1.244 | 1.25 | 1.256 | |
| Deviation of Reference Input Voltage Over-Temperature (Fig1) | $V_{REF(\text{dev})}$ | $V_K = V_{REF}, I_K = 10\text{mA}$ $T_{\text{min}} \leq T_a \leq T_{\text{max}}$ | - | 4 | 17 | mV | |
| Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage (Fig2) | $\Delta V_{REF} / \Delta V_K$ | $I_K = 10\text{mA}, \Delta V_K = 10\text{V to } V_{REF}$ | - | -1.4 | -2.7 | mV/V | |
| | | $I_K = 10\text{mA}, \Delta V_K = 30\text{V to } 10\text{V}$ | - | -1 | -2 | mV/V | |
| Reference Input Current (Fig2) | I_{REF} | $I_K = 10\text{mA}, R_1 = 10\text{k}\Omega, R_2 = \infty$ | - | 1 | 4 | μA | |
| Deviation of Reference Input Current Over Full Temperature Range (Fig2) | $I_{REF(\text{dev})}$ | $I_K = 10\text{mA}, R_1 = 10\text{k}\Omega, R_2 = \infty, T_a = \text{Full Range}$ | - | 0.4 | 1.2 | μA | |
| Minimum Cathode Current for Regulation (Fig1) | $I_{K(\text{min})}$ | $V_K = V_{REF}$ | - | 0.4 | 1 | mA | |
| Off-State Cathode Current (Fig3) | $I_{K(\text{off})}$ | $V_K = 30\text{V}, V_{REF} = 0$ | - | 0.1 | 1 | μA | |



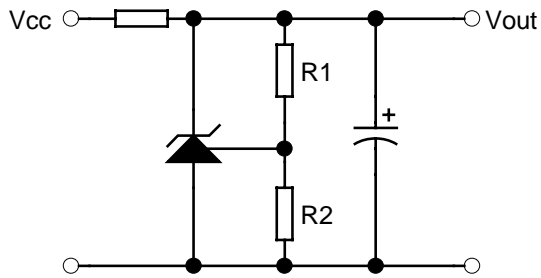
Characteristics Curve





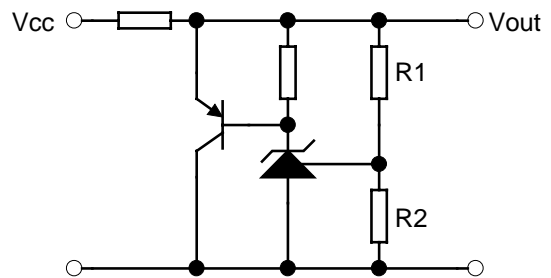
Typical Application

Fig 4. Shunt Regulator



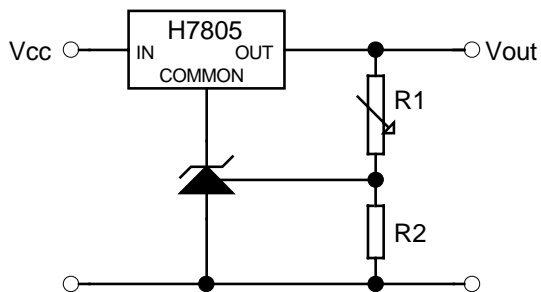
$$V_{out} = (1 + R_1/R_2)V_{REF}$$

Fig 5. High Current Shunt Regulator



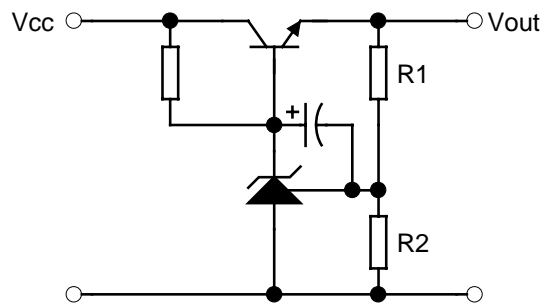
$$V_{out} = (1 + R_1/R_2)V_{REF}$$

Fig 6. Output Control of a Three-Terminal Fixed Regulator



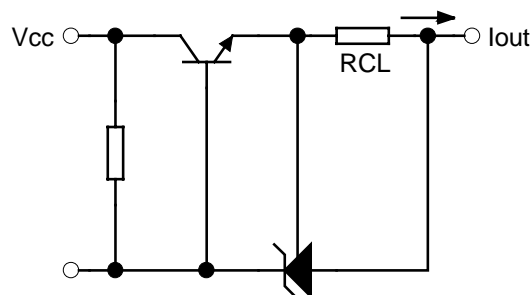
$$V_{out} = (1 + R_1/R_2)V_{REF}; V_{out(min)} = V_{REF} + 5V$$

Fig 7. Series Pass Regulator



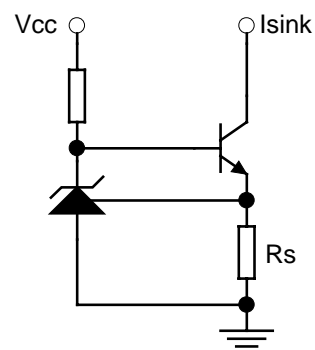
$$V_{out} = (1 + R_1/R_2)V_{REF}; V_{out(min)} = V_{REF} + V_{BE}$$

Fig 8. Current Limiter or Current Source



$$I_{out} = V_{REF}/R_{CL}$$

Fig 9. Constant Current Sink



$$I_{sink} = V_{REF}/R_s$$



SOT-89 Dimension

3-Lead SOT-89 Plastic
Surface Mounted Package
HSMC Package Code: M

Marking:

Date Code Control Code

HSMC Logo → H 4 3 2 Pb Free Mark
 Pb-Free: "●" (Note)
 Normal: None

Note: Green label is used for pb-free packing

Pin Style: 1.Reference 2.Anode 3.Cathode

Material:

- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

| DIM | Min. | Max. |
|-----|-------|------|
| A | 4.40 | 4.60 |
| B | 4.05 | 4.25 |
| C | 1.50 | 1.70 |
| D | 2.40 | 2.60 |
| E | 0.36 | 0.51 |
| F | *1.50 | - |
| G | *3.00 | - |
| H | 1.40 | 1.60 |
| I | 0.35 | 0.41 |

*: Typical, Unit: mm

TO-92 Dimension

3-Lead TO-92 Plastic Package
HSMC Package Code: A

Marking:

Pb Free Mark Date Code Control Code

Pb-Free: "●" (Note)
 Normal: None

H A
 4 3 2

Note: Green label is used for pb-free packing

Pin Style: 1.Reference 2.Anode 3.Cathode

Material:

- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

| DIM | Min. | Max. |
|------------|-------|-------|
| A | 4.33 | 4.83 |
| B | 4.33 | 4.83 |
| C | 12.70 | - |
| D | 0.36 | 0.56 |
| E | - | *1.27 |
| F | 3.36 | 3.76 |
| G | 0.36 | 0.56 |
| H | - | *2.54 |
| I | - | *1.27 |
| $\alpha 1$ | - | *5° |
| $\alpha 2$ | - | *2° |
| $\alpha 3$ | - | *2° |

*: Typical, Unit: mm



SOT-23 Dimension

3-Lead SOT-23 Plastic
Surface Mounted Package
HSMC Package Code: N

Marking:

Pb Free Mark
Pb-Free: "●" (Note)
Normal: None

Note: Pb-free product can distinguish by the green label or the extra description on the right side of the label.

Pin Style: 1.Reference 2.Cathode 3.Anode

Material:

- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

| DIM | Min. | Max. |
|-----|-------|-------|
| A | 2.80 | 3.04 |
| B | 1.20 | 1.60 |
| C | 0.89 | 1.30 |
| D | 0.30 | 0.50 |
| G | 1.70 | 2.30 |
| H | 0.013 | 0.10 |
| J | 0.085 | 0.177 |
| K | 0.32 | 0.67 |
| L | 0.85 | 1.15 |
| S | 2.10 | 2.75 |
| V | 0.25 | 0.65 |

*: Typical, Unit: mm

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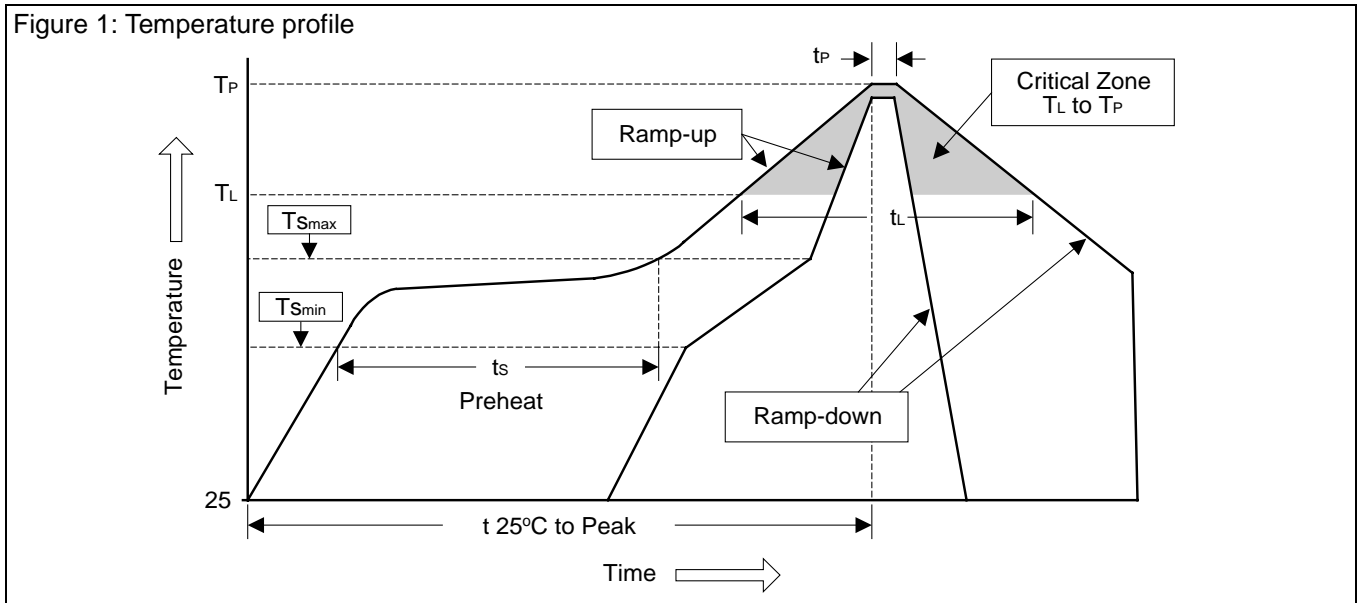
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Soldering Methods for HSMC's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



| Profile Feature | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|--|-------------------------|------------------|
| Average ramp-up rate (T_L to T_P) | <3°C/sec | <3°C/sec |
| Preheat | | |
| - Temperature Min (T_{smin}) | 100°C | 150°C |
| - Temperature Max (T_{smax}) | 150°C | 200°C |
| - Time (min to max) (t_s) | 60~120 sec | 60~180 sec |
| T_{smax} to T_L | | |
| - Ramp-up Rate | <3°C/sec | <3°C/sec |
| Time maintained above: | | |
| - Temperature (T_L) | 183°C | 217°C |
| - Time (t_L) | 60~150 sec | 60~150 sec |
| Peak Temperature (T_P) | 240°C +0/-5°C | 260°C +0/-5°C |
| Time within 5°C of actual Peak Temperature (t_p) | 10~30 sec | 20~40 sec |
| Ramp-down Rate | <6°C/sec | <6°C/sec |
| Time 25°C to Peak Temperature | <6 minutes | <8 minutes |

3. Flow (wave) soldering (solder dipping)

| Products | Peak temperature | Dipping time |
|------------------|------------------|--------------|
| Pb devices. | 245°C ±5°C | 5sec ±1sec |
| Pb-Free devices. | 260°C +0/-5°C | 5sec ±1sec |