## REGULATORY COMPLIANCE

Lead Free COMPLIANT

EU RoHS 2011/65 + 2015/863 COMPLIANT

China RoHS COMPLIANT

REACH SVHC COMPLIANT

DRC CONFLICT FREE

## ITEM DESCRIPTION

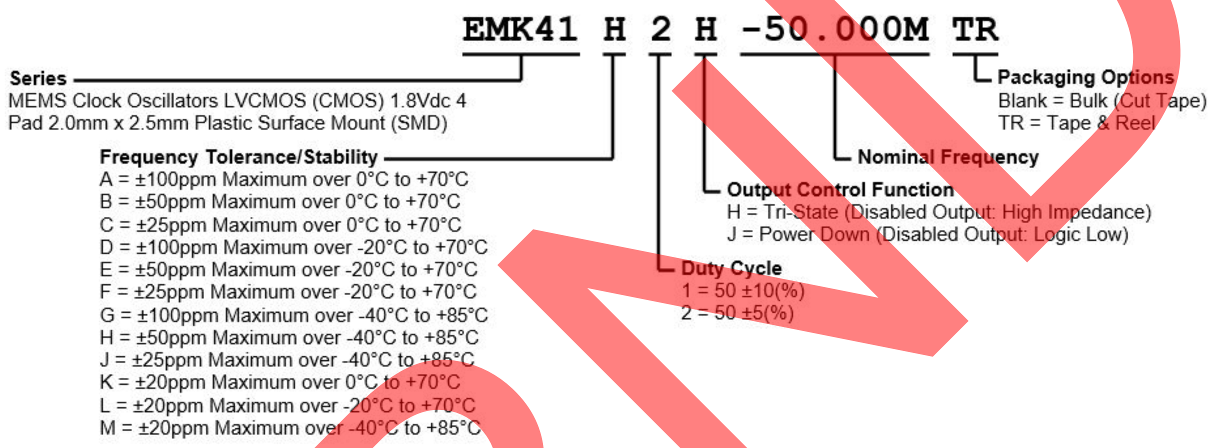
MEMS Clock Oscillators LVCMOS (CMOS) 1.8Vdc 4 Pad 2.0mm x 2.5mm Plastic Surface Mount (SMD)

## ELECTRICAL SPECIFICATIONS

| | |
|---|---|
| **Nominal Frequency** | 1MHz to 125MHz |
| **Frequency Tolerance/Stability** | Inclusive of all conditions: Calibration Tolerance at 25°C, Frequency Stability over the Operating Temperature Range, Supply Voltage Change, and Output Load Change<br>±100ppm Maximum over 0°C to +70°C<br>±50ppm Maximum over 0°C to +70°C<br>±25ppm Maximum over 0°C to +70°C<br>±20ppm Maximum over 0°C to +70°C<br>±100ppm Maximum over -20°C to +70°C<br>±50ppm Maximum over -20°C to +70°C<br>±25ppm Maximum over -20°C to +70°C<br>±20ppm Maximum over -20°C to +70°C<br>±100ppm Maximum over -40°C to +85°C<br>±50ppm Maximum over -40°C to +85°C<br>±25ppm Maximum over -40°C to +85°C<br>±20ppm Maximum over -40°C to +85°C |
| **Aging at 25°C** | ±1.5ppm Maximum First Year |
| **Supply Voltage** | 1.8Vdc ±10% |
| **Input Current** | No Load<br>4.5mA Maximum over Nominal Frequency of 1MHz to 20MHz<br>5mA Maximum over Nominal Frequency of 20.000001MHz to 50MHz<br>6mA Maximum over Nominal Frequency of 50.000001MHz to 80MHz<br>7mA Maximum over Nominal Frequency of 80.000001MHz to 125MHz |
| **Output Voltage Logic High ($V_{OH}$)** | IOH = -2mA<br>90% of Vdd Minimum |
| **Output Voltage Logic Low ($V_{OL}$)** | IOL = +2mA<br>10% of Vdd Maximum |
| **Rise/Fall Time** | Measured from 20% to 80% of waveform<br>1.5nSec Typical, 3.5nSec Maximum |
| **Duty Cycle** | Measured at 50% of waveform<br>50 ±10(%)<br>50 ±5(%) |
| **Load Drive Capability** | 15pF Maximum |
| **Output Logic Type** | CMOS |
| **Output Control Function** | Tri-State (Disabled Output: High Impedance)<br>Power Down (Disabled Output: Logic Low) |
| **Output Control Input Voltage Logic High (Vih)** | 70% of Vdd Minimum or No Connect to Enable Output |
| **Output Control Input Voltage Logic Low (Vil)** | 30% of Vdd Maximum to Disable Output |
| **Power Down Output Enable Time** | 5mSec Maximum (Disabled Output: Logic Low) |
| **Tri-State Output Enable Time** | 150nSec Maximum (Disabled Output: High Impedance) |
| **Power Down Output Disable Time** | 150nSec Maximum (Disabled Output: Logic Low) |
| **Tri-State Output Disable Time** | 150nSec Maximum (Disabled Output: High Impedance) |
| **Standby Current** | 5µA Maximum (Disabled Output: Logic Low) |
| **Period Jitter (RMS)** | 2pSec Typical, 5pSec Maximum |

|  |  |
|---|---|
| **RMS Phase Jitter (Fj = 900kHz to 7.5MHz; Random)** | 0.5pSec Typical, 1pSec Maximum |
| **RMS Phase Jitter (Fj = 12kHz to 20MHz; Random)** | 1.5pSec Typical, 3pSec Maximum |
| **Start Up Time** | 5mSec Maximum |
| **Storage Temperature Range** | -65°C to +150°C |

## PART NUMBERING GUIDE



EMK41 H 2 H -50.000M TR

**Series**
MEMS Clock Oscillators LVCMOS (CMOS) 1.8Vdc 4 Pad 2.0mm x 2.5mm Plastic Surface Mount (SMD)

**Frequency Tolerance/Stability**
A = ±100ppm Maximum over 0°C to +70°C
B = ±50ppm Maximum over 0°C to +70°C
C = ±25ppm Maximum over 0°C to +70°C
D = ±100ppm Maximum over -20°C to +70°C
E = ±50ppm Maximum over -20°C to +70°C
F = ±25ppm Maximum over -20°C to +70°C
G = ±100ppm Maximum over -40°C to +85°C
H = ±50ppm Maximum over -40°C to +85°C
J = ±25ppm Maximum over -40°C to +85°C
K = ±20ppm Maximum over 0°C to +70°C
L = ±20ppm Maximum over -20°C to +70°C
M = ±20ppm Maximum over -40°C to +85°C

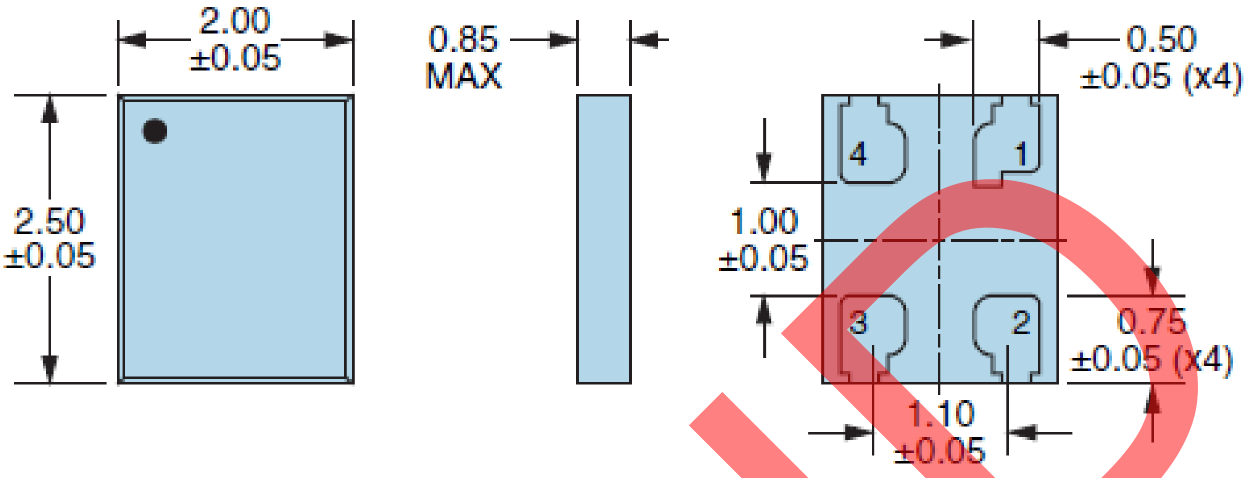
**Duty Cycle**
1 = 50 ±10(%)
2 = 50 ±5(%)

**Output Control Function**
H = Tri-State (Disabled Output: High Impedance)
J = Power Down (Disabled Output: Logic Low)

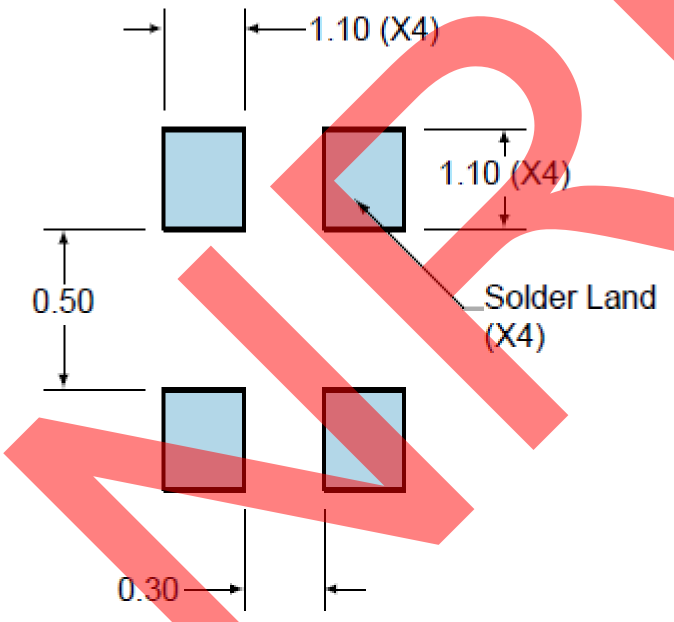
**Nominal Frequency**

**Packaging Options**
Blank = Bulk (Cut Tape)
TR = Tape & Reel

## MECHANICAL DIMENSIONS



## SUGGESTED SOLDER PAD LAYOUT

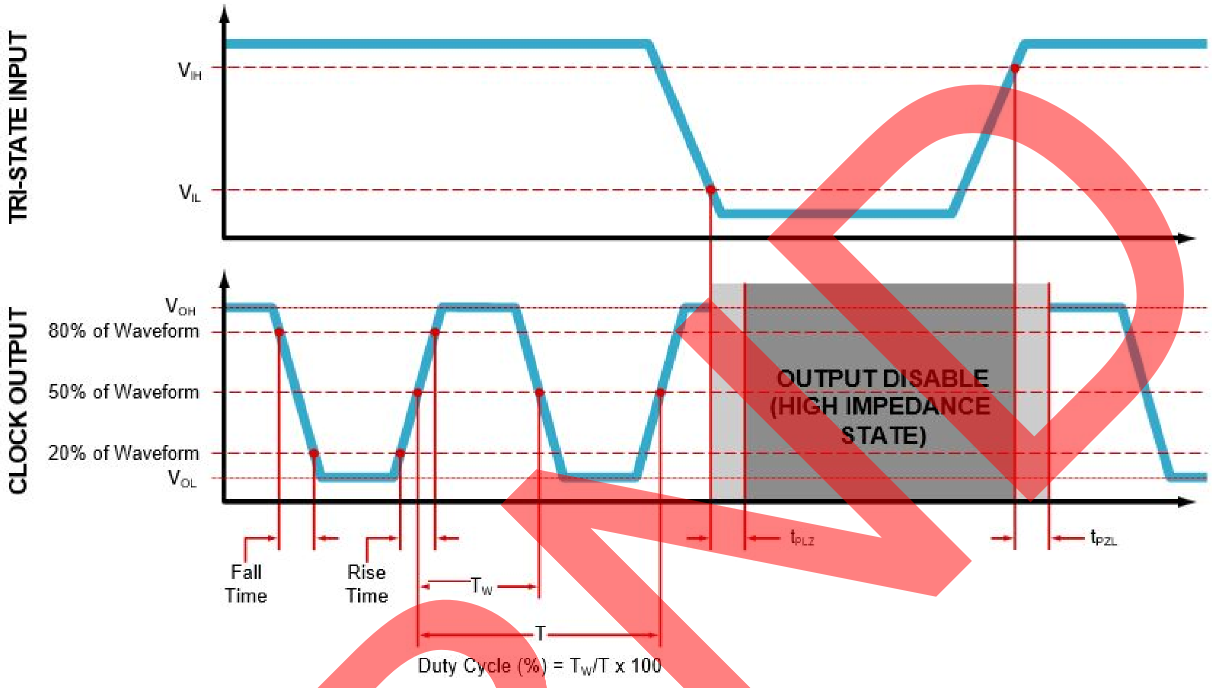


| PIN | CONNECTION |
|---|---|
| 1 | Power Down Or Tri-State |
| 2 | Ground |
| 3 | Output |
| 4 | Supply Voltage |

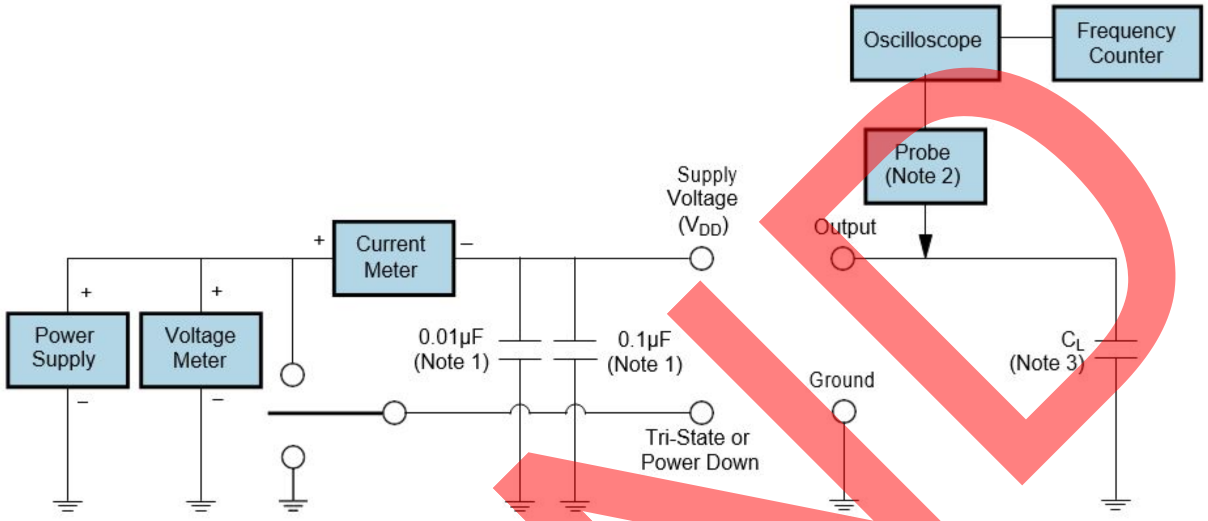
All Tolerances are ±0.1

**All Dimensions in Millimeters**

## OUTPUT WAVEFORM & TIMING DIAGRAM



## TEST CIRCUIT FOR CMOS OUTPUT



**Note 1:** An external 0.01µF ceramic bypass capacitor in parallel with a 0.1µF high frequency ceramic bypass capacitor close (less Than 2mm) to the package ground and supply voltage pin is required.

**Note 2:** A low input capacitance (<12pF), 10X Attentuation Factor, High Impedance (>10Mohms), and High bandwidth (>300MHz) Passive probe is recommended.

**Note 3:** Capacitance value CL includes sum of all probe and fixture capacitance. See applicable specification sheet for ‘Load Drive Capability’.

## TAPE & REEL DIMENSIONS

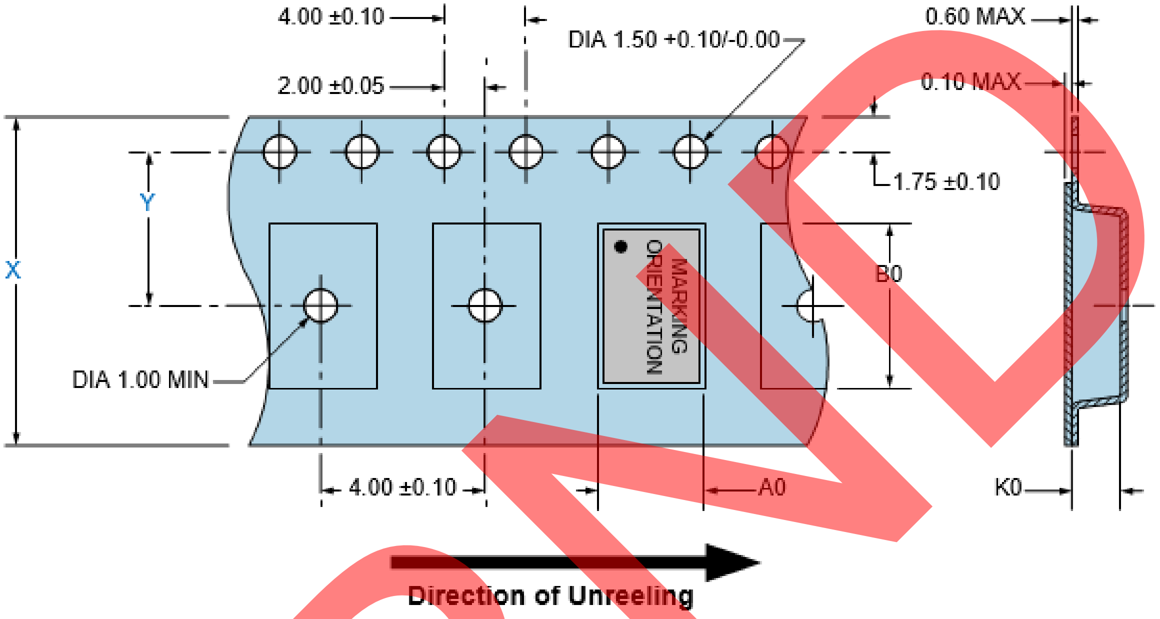
Quantity per Reel: 1,000 Units

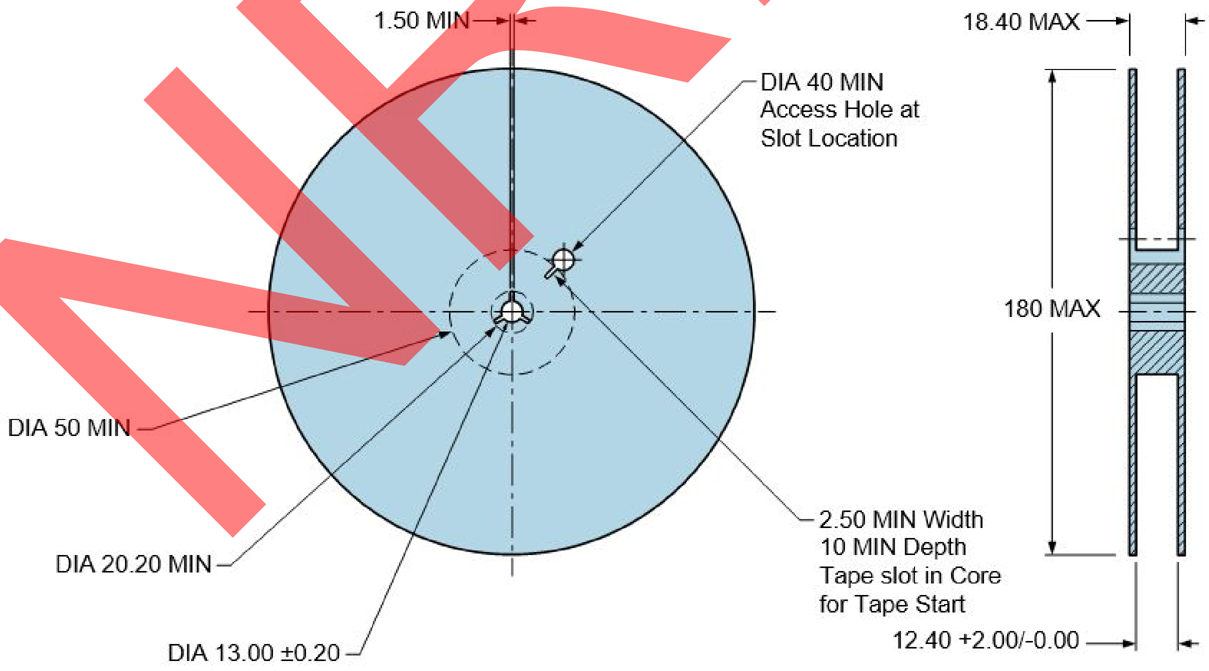
All Dimensions in Millimeters

Compliant to EIA-481

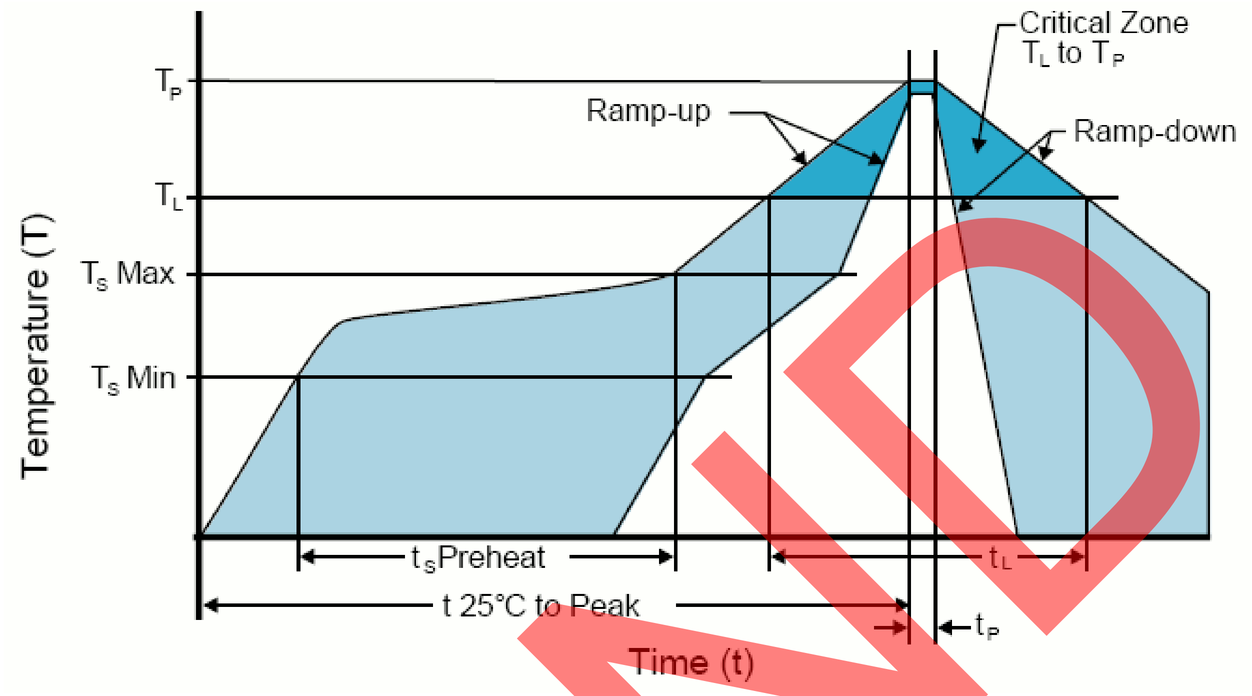
X = 8.00±0.30 or 12±0.30

Y = 3.50±0.05 or 5.5±0.05





## RECOMMENDED SOLDER REFLOW METHOD

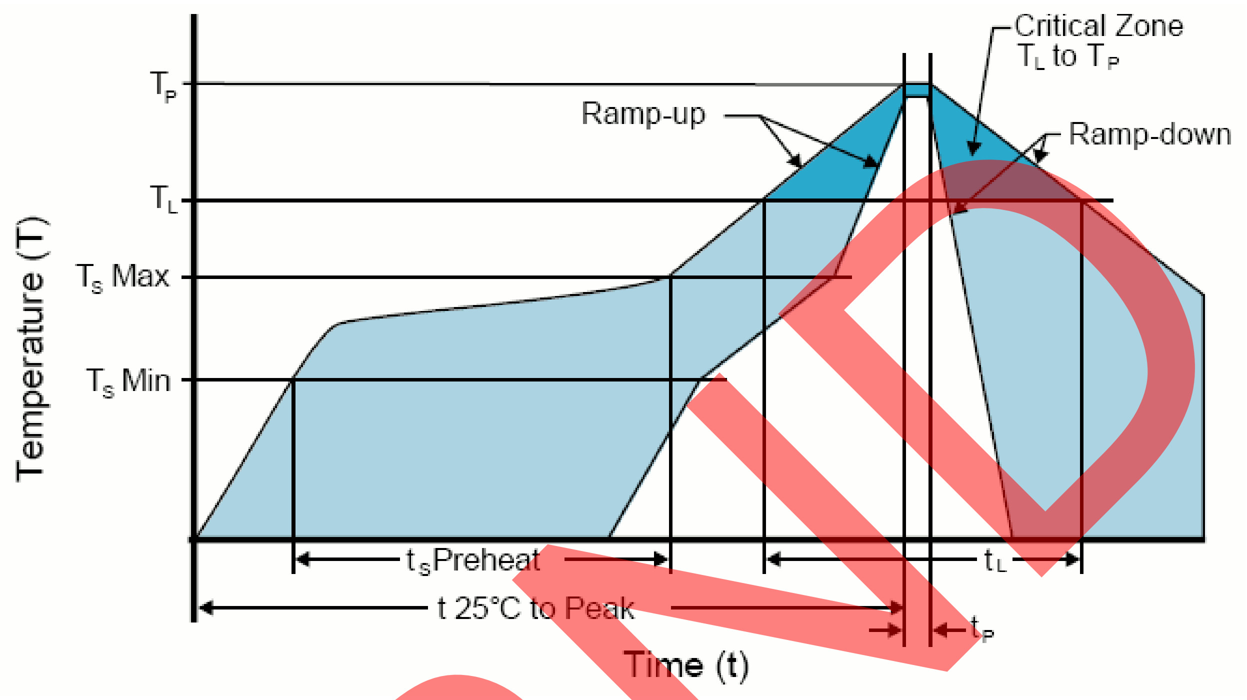


| HIGH TEMPERATURE INFRARED/CONVECTION | |
|---|---|
| **$T_S$ MAX to $T_L$ (Ramp-up Rate)** | 3°C/Second Maximum |
| **Preheat**<br>**- Temperature Minimum ($T_S$ MIN)**<br>**- Temperature Typical ($T_S$ TYP)**<br>**- Temperature Maximum($T_S$ MAX)**<br>**- Time ($t_s$ MIN)** | 150°C<br>175°C<br>200°C<br>60 - 180 Seconds |
| **Ramp-up Rate ($T_L$ to $T_P$)** | 3°C/Second Maximum |
| **Time Maintained Above:**<br>**- Temperature ($T_L$)**<br>**- Time ($t_L$)** | 217°C<br>60 - 150 Seconds |
| **Peak Temperature ($T_P$)** | 260°C Maximum for 10 Seconds Maximum |
| **Target Peak Temperature($T_P$ Target)** | 250°C +0/-5°C |
| **Time within 5°C of actual peak ($t_p$)** | 20 - 40 Seconds |
| **Ramp-down Rate** | 6°C/Second Maximum |
| **Time 25°C to Peak Temperature (t)** | 8 Minutes Maximum |
| **Moisture Sensitivity Level** | Level 1 |
| **Additional Notes** | Temperatures shown are applied to body of device. |

### High Temperature Manual Soldering

260°C Maximum for 5 Seconds Maximum, 2 times Maximum. (Temperatures shown are applied to body of device.)

## RECOMMENDED SOLDER REFLOW METHOD



### LOW TEMPERATURE INFRARED/CONVECTION

| | |
|---|---|
| **$T_S$ MAX to $T_L$ (Ramp-up Rate)** | 5°C/Second Maximum |
| **Preheat**<br>**- Temperature Minimum ($T_S$ MIN)**<br>**- Temperature Typical ($T_S$ TYP)**<br>**- Temperature Maximum($T_S$ MAX)**<br>**- Time ($t_S$ MIN)** | N/A<br>150°C<br>N/A<br>60 - 120 Seconds |
| **Ramp-up Rate ($T_L$ to $T_P$)** | 5°C/Second Maximum |
| **Time Maintained Above:**<br>**- Temperature ($T_L$)**<br>**- Time ($t_L$)** | 150°C<br>200 Seconds Maximum |
| **Peak Temperature ($T_P$)** | 240°C Maximum |
| **Target Peak Temperature($T_P$ Target)** | 240°C Maximum 2 Times/230°C Maximum 1Time |
| **Time within 5°C of actual peak ($t_P$)** | 10 Seconds Maximum 2 Times / 80 Seconds Maximum 1 Time |
| **Ramp-down Rate** | 5°C/Second Maximum |
| **Time 25°C to Peak Temperature (t)** | N/A |
| **Moisture Sensitivity Level** | Level 1 |
| **Additional Notes** | Temperatures shown are applied to body of device. |

### Low Temperature Manual Soldering

185°C Maximum for 10 Seconds Maximum, 2 times Maximum. (Temperatures shown are applied to body of device.)