# CTL0412ND

## N-Channel Enhancement MOSFET

## Features

- Drain-Source Breakdown Voltage $V_{DSS}$ 20 V
- Drain-Source On-Resistance
  $R_{DS(ON)}$ 22mΩ, at $V_{GS}$= 4.5V, $I_D$= 4.1A
  $R_{DS(ON)}$ 27mΩ, at $V_{GS}$= 2.5V, $I_D$= 3.8A
- Continuous Drain Current at $T_C$=25°C $I_D$ = 4.1A
- Advanced high cell density Trench Technology
- RoHS Compliance & Halogen Free

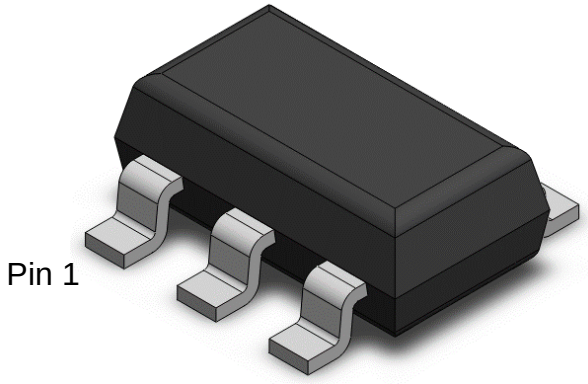
## Description

The CTL0412ND uses high performance Trench Technology to provide excellent $R_{DS(ON)}$ and low gate charge which is suitable for most of the synchronous buck converter applications tions.

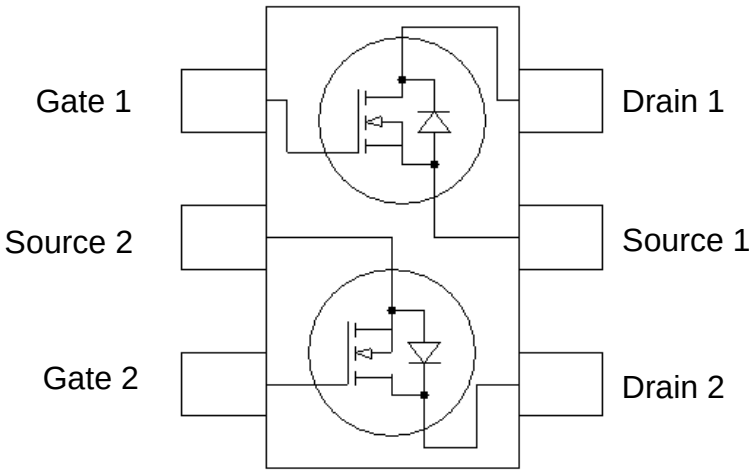
## Applications

- Power Management
- Lithium Ion Battery

## Package Outline




## Schematic



## Absolute Maximum Rating at 25°C

| Symbol | Parameters | Test Conditions | Min | Notes |
|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 20 | V | |
| $V_{GS}$ | Gate-Source Voltage | ±8 | V | |
| $I_D$ | Continuous Drain Current | 4.1 | A | 1 |
| $I_{DM}$ | Pulsed Drain Current | 12 | A | 1 |
| $P_D$ | Total Power Dissipation | 1.25 | W | 2 |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | °C | |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | °C | |

### Thermal Characteristics

| Symbol | Parameters | Test Conditions | Min | Typ | Max | Units | Notes |
|---|---|---|---|---|---|---|---|
| $R_{\Theta JA}$ | Thermal Resistance Junction-Ambient | | -- | 150 | -- | °C /W | 1,4 |

## Electrical Characteristics $T_A$ = 25°C (unless otherwise specified)

### Static Characteristics

| Symbol | Parameters | Test Conditions | Min | Typ | Max | Units | Notes |
|---|---|---|---|---|---|---|---|
| $B_{VDSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$= 0V, $I_D$= 250μA | 20 | - | - | V | |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$ = 20V, $V_{GS}$ = 0V | - | - | 1 | μ A | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$ = ±8V, $V_{DS}$ = 0V | - | - | ±100 | nA | |

### On Characteristics

| Symbol | Parameters | Test Conditions | Min | Typ | Max | Units | Notes |
|---|---|---|---|---|---|---|---|
| $R_{DS(ON)}$ | Drain-Source On-Resistance | $V_{GS}$ = 4.5V, $I_D$ = 4.1A | - | 22 | 47 | mΩ | 3 |
| | | $V_{GS}$ = 2.5V, $I_D$ = 3.8A | - | 27 | 55 | mΩ | |
| $V_{GS(th)}$ | Gate-Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ =250μA | 0.4 | --- | 1.0 | V | 3 |

### Dynamic Characteristics

| Symbol | Parameters | Test Conditions | Min | Typ | Max | Units | Notes |
|---|---|---|---|---|---|---|---|
| $C_{ISS}$ | Input Capacitance | $V_{GS}$ =0V, | - | 599 | - | pF | |
| $C_{OSS}$ | Output Capacitance | $V_{DS}$ =10V | - | 81 | - | | |
| $C_{RSS}$ | Reverse Transfer Capacitance | f=1MHz | - | 73 | - | | |

### Switching Characteristics

| Symbol | Parameters | Test Conditions | Min | Typ | Max | Units | Notes |
|---|---|---|---|---|---|---|---|
| $T_{D(ON)}$ | Turn-On Delay Time | $V_{DS}$ = 15V , | - | 3.5 | - | ns | |
| $T_R$ | Rise Time | $V_{GS}$ = 4.5V, | - | 23 | - | | |
| $T_{D(OFF)}$ | Turn-Off Delay Time | $R_G$ = 6Ω, | - | 39 | - | | |
| $T_F$ | Fall Time | $I_D$ =1A | - | 24 | - | | |
| $Q_G$ | Total Gate Charge | $V_{DS}$ = 10V , | - | 7.5 | - | nC | |
| $Q_{GS}$ | Gate-Source Charge | $V_{GS}$ = 4.5V, | - | 1 | - | | |
| $Q_{GD}$ | Gate-Drain (Miller) Charge | $I_D$ =1A | - | 2 | - | | |

## Drain-Source Diode Characteristics

| Symbol | Parameters | Test Conditions | Min | Typ | Max | Units | Notes |
|---|---|---|---|---|---|---|---|
| $V_{SD}$ | Body Diode Forward Voltage | $V_{GS}$ = 0V, $I_D$ = 4.1 | - | - | 1.2 | V | |
| $I_{SD}$ | Body Diode Continuous Current | | - | - | 4.1 | A | 1 |

Note:

1. The power dissipation is limited by 150°C junction temperature.
2. Device mounted on a glass-epoxy board

   FR-4

   25.4 × 25.4 mm

   2 Oz Copper
3. The data tested by pulsed , pulse width ≦ 300μs , duty cycle ≦ 2%
4. Thermal Resistance follow JESD51-3.

## Typical Characteristic Curves

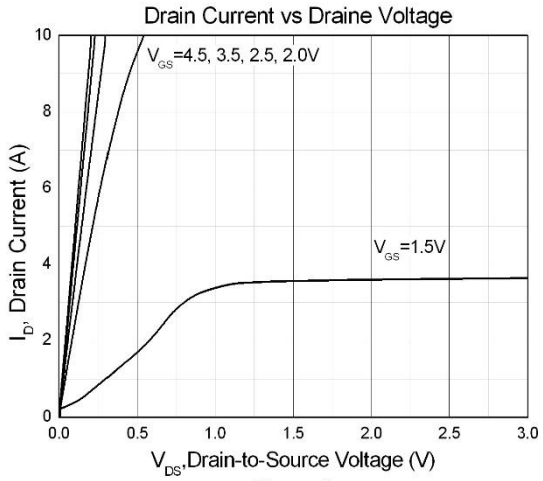



Figure 1

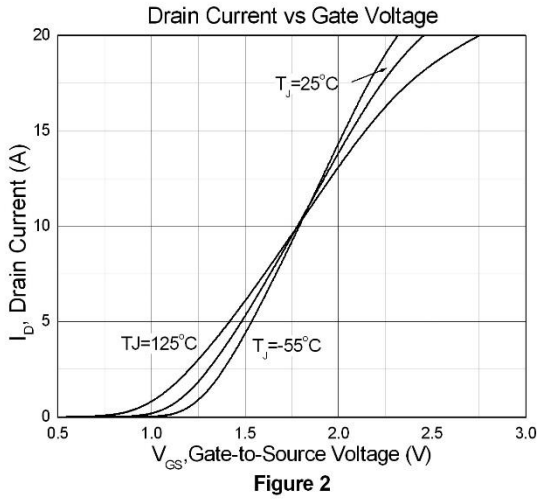



Figure 2

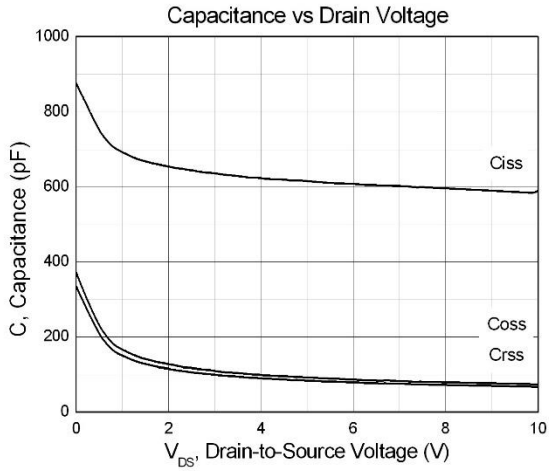



Figure 3

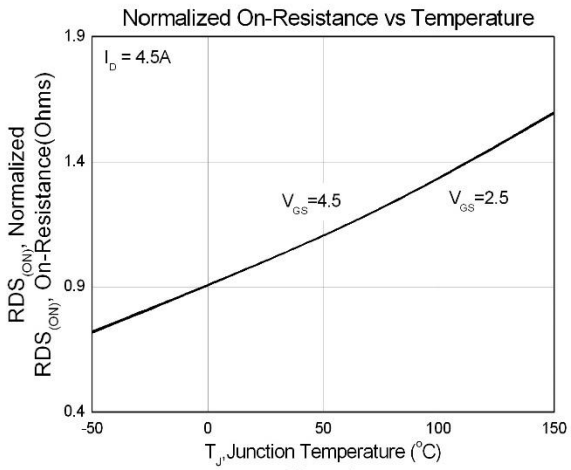



Figure 4

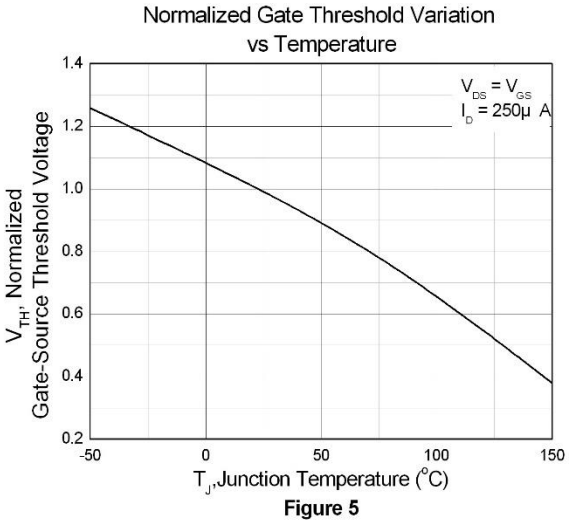



Figure 5

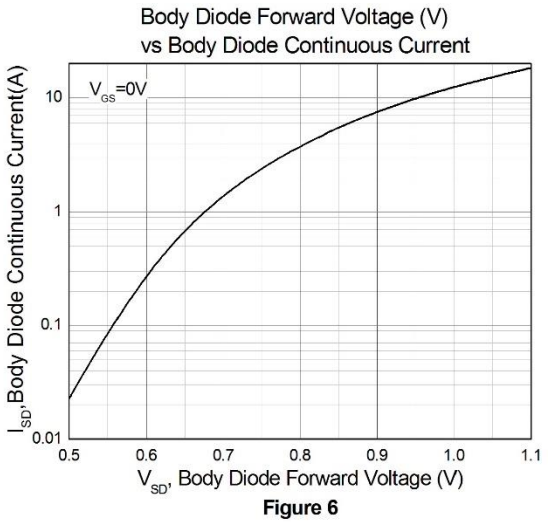



Figure 6

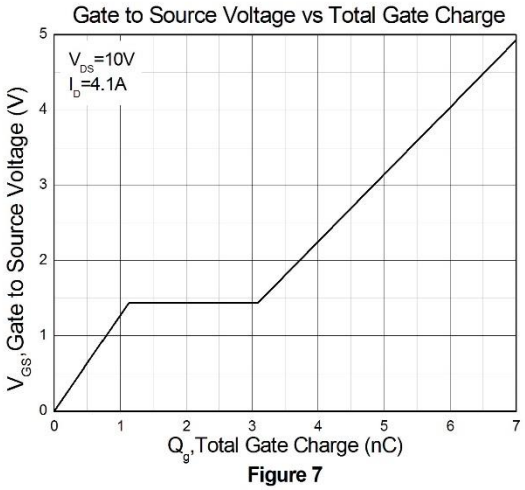



**Figure 7**

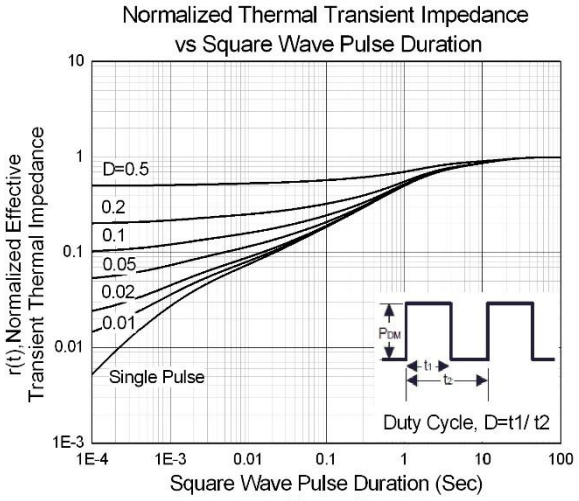



**Figure 8**

## Test Circuits & Waveforms

**Figure 9: Gate Charge Test Circuit**

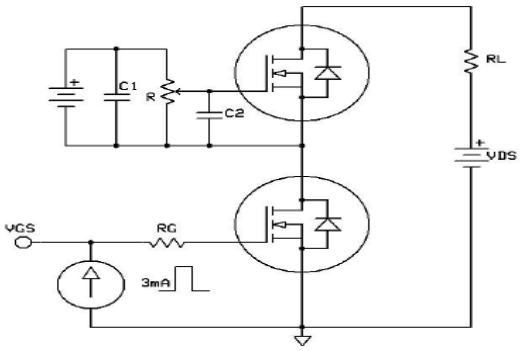



**Figure 10: Gate Charge Waveform**

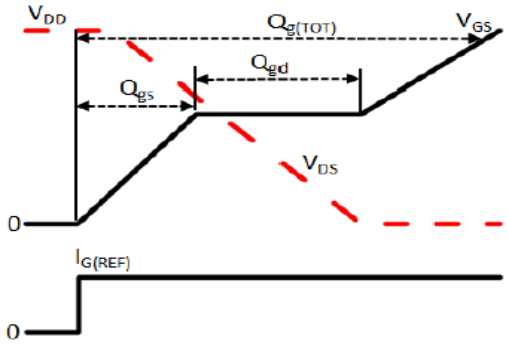



**Figure 11: Switching Time Test Circuit**

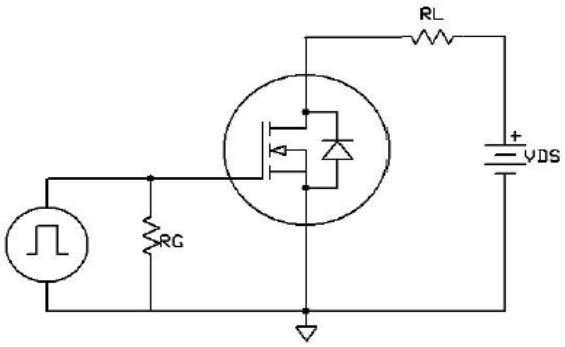
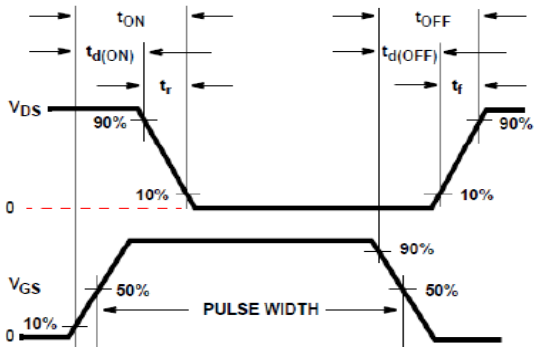
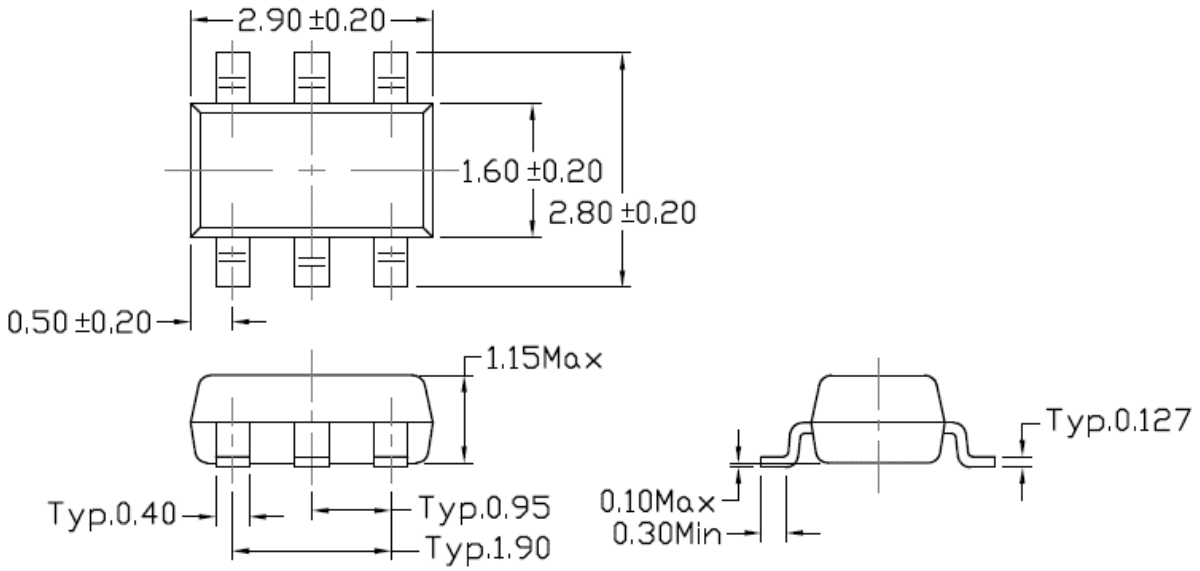



**Figure 12: Switching Time Waveform**

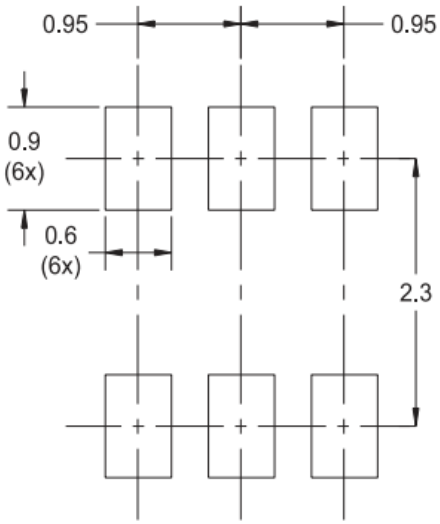


## Package Dimension *Dimensions in mm unless otherwise stated*



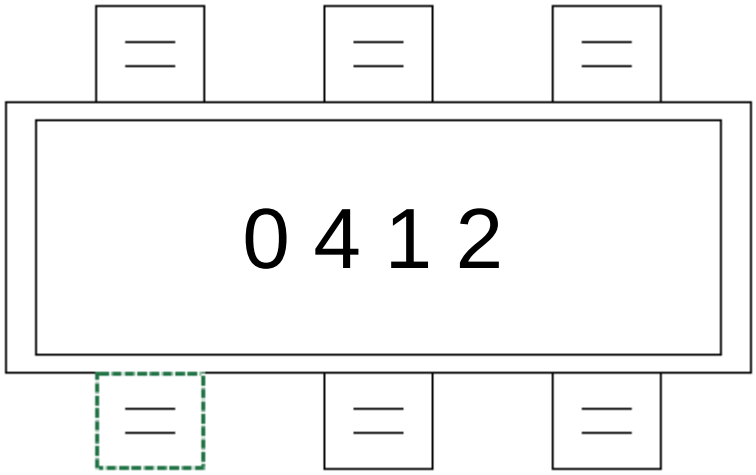

Note: Dimensions in mm

## Recommended pad layout for surface mount leadform




Note: Dimensions in mm

## Marking Information

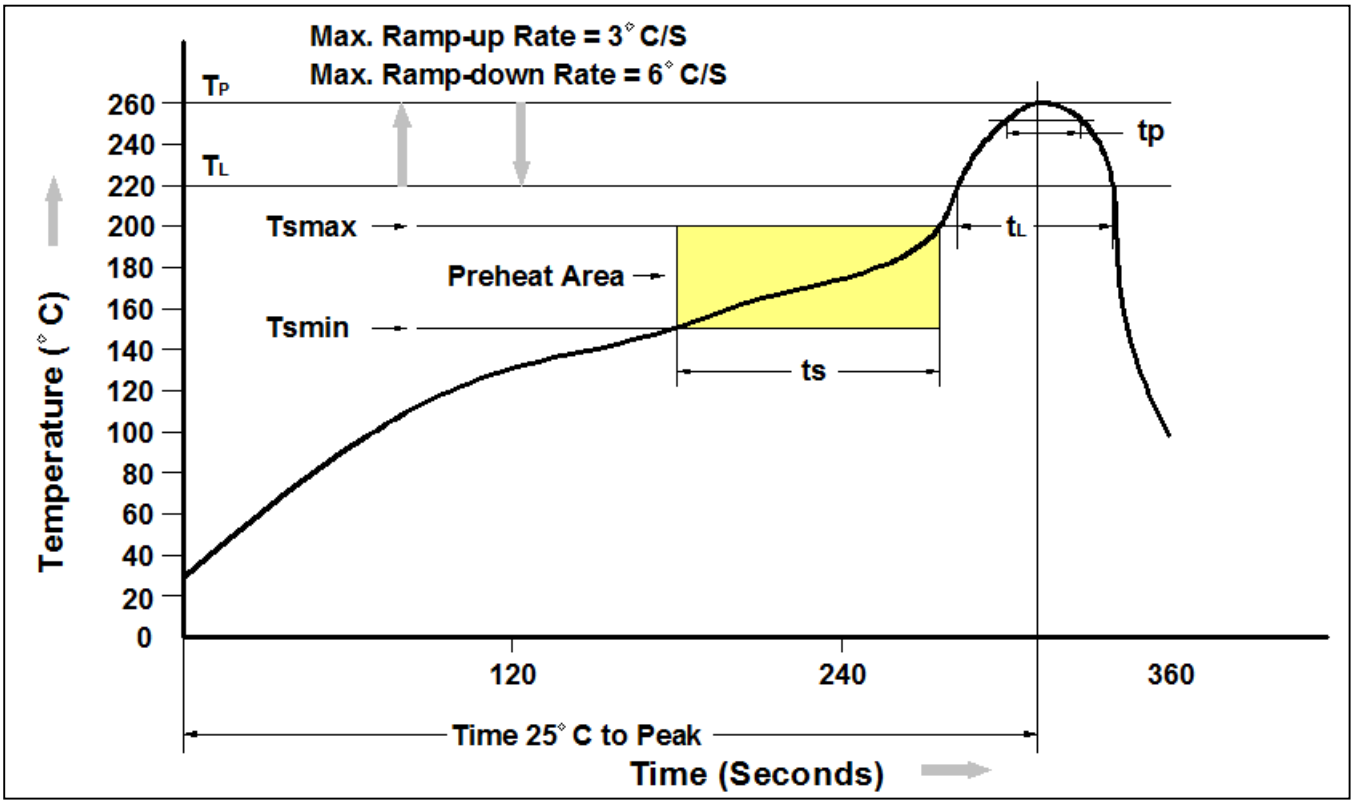



0412: Device Number

## Ordering Information

| Part Number | *Description* | *Quantity* |
|---|---|---|
| CTL0412ND | SOT-26 Reel | 3000 pcs |

## Reflow Profile




| Profile Feature | Pb-Free Assembly Profile |
|---|---|
| Temperature Min. (Tsmin) | 150°C |
| Temperature Max. (Tsmax) | 200°C |
| Time (ts) from (Tsmin to Tsmax) | 60-120 seconds |
| Ramp-up Rate ($t_L$ to $t_P$) | 3°C/second max. |
| Liquidous Temperature ($T_L$) | 217°C |
| Time ($t_L$) Maintained Above ($T_L$) | 60 – 150 seconds |
| Peak Body Package Temperature | 260°C +0°C / -5°C |
| Time ($t_P$) within 5°C of 260°C | 30 seconds |
| Ramp-down Rate ($T_P$ to $T_L$) | 6°C/second max |
| Time 25°C to Peak Temperature | 8 minutes max. |

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