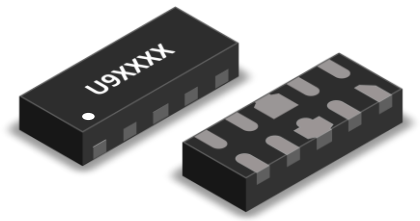



# UT8413A

## 4-CHANNEL ▲ TVS ARRAY

**TVS ARRAY** ▲ SMD type
ESD Protection for high-speed data lines
Protects four I/O lines
Ultra-low capacitance (I/O) to GND ▲ 0.45pF
2.5mm x 1.0mm x 0.5mm ▲ DFN2510-10L package
**AEC-Q101 qualified**

## SPECIFICATION

| Item | | Characteristics |
|---|---|---|
| Operating Junction Temperature Range | $T_J$ | -55°C to +125°C |
| Storage Temperature Range | $T_S$ | -55°C to +150°C |
| Peak Pulse Current (8/20μs) | $I_{PP}$ | 5A |
| ESD Rating (Per IEC 61000-4-2 ▲ Contact) | $V_{ESD}$ | ±15kV |
| ESD Rating (Per IEC 61000-4-2 ▲ Air) | $V_{ESD}$ | ±15kV |

## DESCRIPTION

**The UT8413A is a high-performance transient voltage suppressor (TVS) array designed to protect four channel 3.3V high speed data lines from Electrostatic Discharge (ESD), Cable Discharge Event (CDE), and Electrical Fast Transient (EFT).**

**This TVS array features ultra-low capacitance and low ESD clamping voltage using iPU's proprietary deep snap-back technology.**

**The small flow-through style package enables simple PCB layout and facilitates necessary matched trace lengths to maintain consistent impedance between high-speed differential lines such as USB 3.0, HDMI 1.3/1.4, DisplayPort™ and eSATA interfaces.**

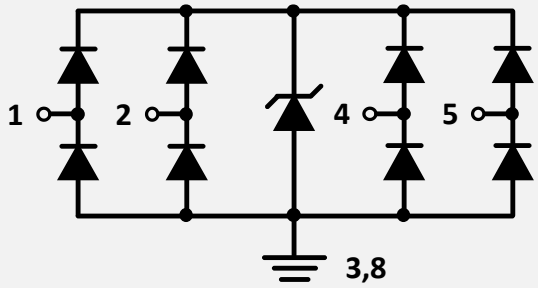
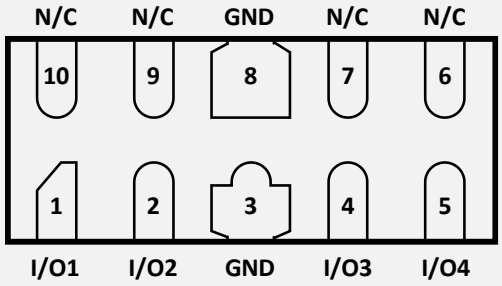
## EMC STANDARDS

- ▲ **IEC 61000-4-2 (ESD): ±15kV (Contact)**
- ▲ **IEC 61000-4-2 (ESD): ±15kV (Air)**
- ▲ **IEC 61000-4-4 (EFT): 50A (5/50ns)**
- ▲ **IEC 61000-4-5 (Lightning): 5A (8/20μs)**

## APPLICATIONS

| Automotive | Display Port Interface | Data and I/O Lines Protection | SATA/eSATA Interface | Thunderbolt Interface | USB 2.0, 3.0 and 3.1 |
|---|---|---|---|---|---|
| | | | | 3 | |

## PIN DESCRIPTION

| Circuit Diagram ▪ Top View | Outline ▪ Bottom View |
|---|---|
|  |  |





## ELECTRICAL CHARACTERISTICS ▲ $T_J$ = 25°C, unless otherwise noted

| Item | Condition | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Reverse Working Voltage | Any I/O Pin to GND | $V_{RWM}$ | | | 3.3 | V |
| Breakdown Voltage | $I_{BR}$ = 1mA, any I/O Pin to GND | $V_{BR}$ | 5 | 6.5 | 8.5 | V |
| Forward Voltage | $I_F$ = 15mA, any I/O Pin to GND | $V_F$ | | 1 | | V |
| Reverse Leakage Current | $V_{RWM}$ = 3.3V, any I/O Pin to GND | $I_R$ | | | 1 | μA |
| Surge Clamping Voltage (8/20μs) | $I_{PP}$ = 5A, any I/O Pin to GND | $V_C$ | | 6.2 | 7 | V |
| TLP Clamping Voltage Note1 | $I_{TLP}$ = 1A, any I/O Pin to GND | $V_C$ | | 5.3 | | V |
| TLP Clamping Voltage Note1 | $I_{TLP}$ = 16A, any I/O Pin to GND | $V_C$ | | 9 | | V |
| TLP Dynamic Resistance Note2 | Any I/O Pin to GND | $R_{DYN}$ | | 0.25 | | Ω |
| Junction Capacitance | $V_R$ = 0V, f = 1MHz, any I/O Pin to GND | $C_J$ | | 0.45 | 0.6 | pF |
| | $V_R$ = 1.65V, f = 1MHz, any I/O Pin to GND | | | 0.44 | 0.6 | |
| | $V_R$ = 0V, f = 1MHz, between I/O Pins | | | 0.05 | 0.06 | |
| | $V_R$ = 1.65V, f = 1MHz, between I/O Pins | | | 0.05 | 0.06 | |

**Note**

**1:** **$t_{period}$ = 100ns, $t_r$ = 1ns**

**2:** **$t_{period}$ = 100ns, $t_r$ = 1ns**

## TYPICAL OPERATING CHARACTERISTICS

**Fig. 1 ▪ Junction Capacitance (I/O Pin to GND)**

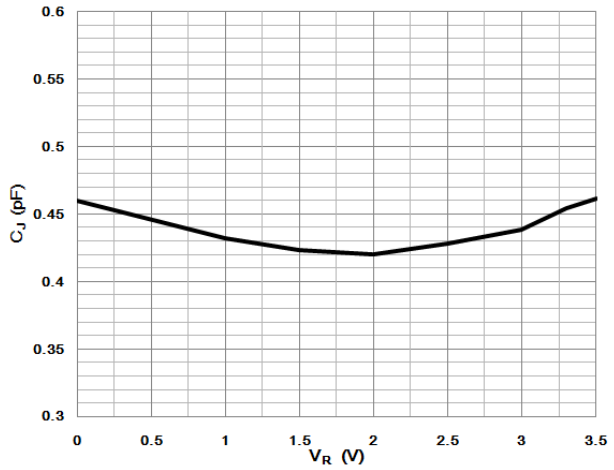



**Fig. 2 ▪ TLP Clamping Voltage ($t_{period}$ = 100ns, $t_r$ = 1ns)**

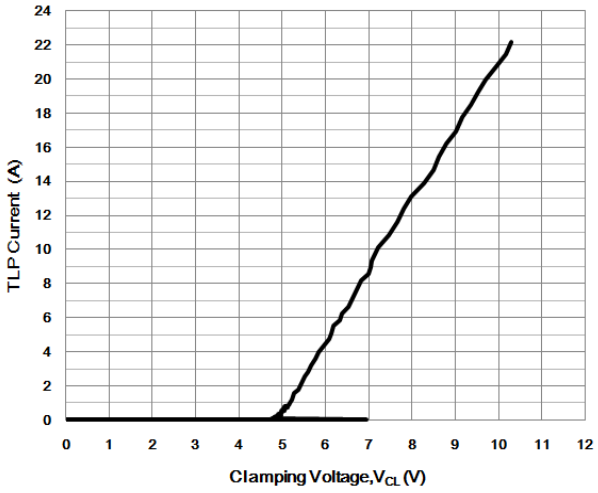



**Fig. 3 ▪ Junction Capacitance (I/O Pin to I/O Pin)**

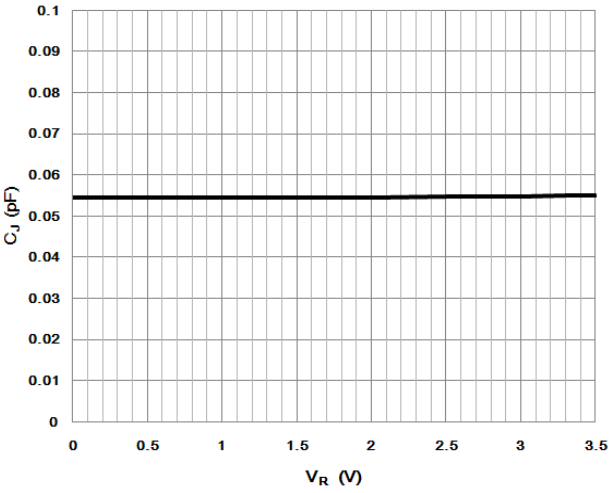
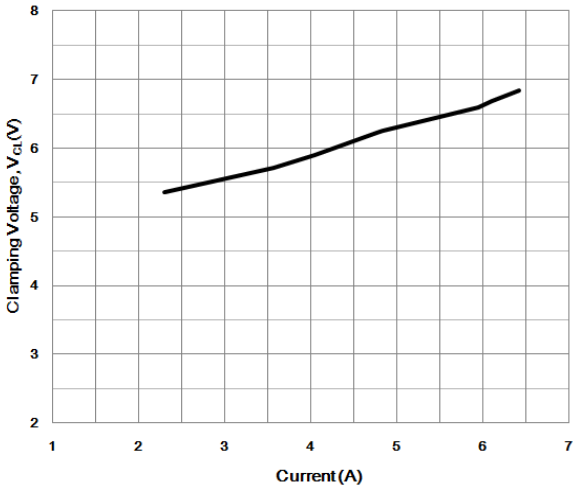
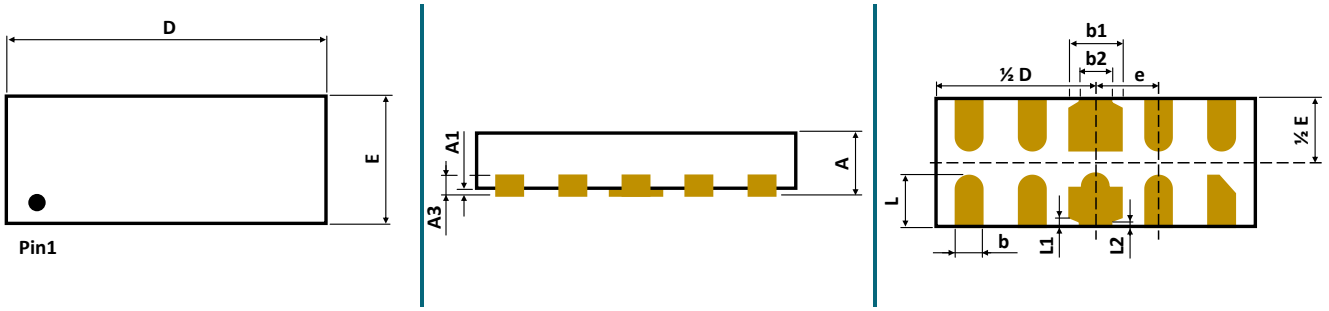



**Fig. 4 ▪ Positive Surge Clamping Voltage (8/20μs)**



## PACKAGE OUTLINE AND PART MARKING

| Top View | Side View | Bottom View |
|---|---|---|




| Sym | Millimeters (Min.) | Millimeters (Typ.) | Millimeters (Max.) |
|---|---|---|---|
| A | 0.40 | 0.50 | 0.60 |
| A1 | 0.00 | 0.02 | 0.05 |
| A3 | | 0.152 REF | |
| b | 0.15 | 0.20 | 0.25 |
| b1 | 0.35 | | 0.45 |
| b2 | 0.13 | | 0.30 |
| D | 2.40 | 2.50 | 2.60 |
| E | 0.90 | 1.00 | 1.10 |
| e | | 0.50 BSC | |
| L1 | | 0.075 REF | |
| L2 | | 0.050 REF | |
| L | 0.30 | 0.40 | 0.50 |


**Marking:**
**U9: Product code**
**UT8413A**
**XXXX: Date code**

**Note**

**1: Package Outline Unit Description:**
**BSC: Basic. Represents theoretical exact dimension or dimension target.**
**MIN: Minimum dimension specified**
**MAX: Maximum dimension specified**
**REF: Reference. Represents dimension for reference use only. This value is not a device specification.**
**TYP: Typical. Provided as a general value. This value is not a device specification.**

**2: Dimensions in Millimeters**

**3: Drawing not to scale**

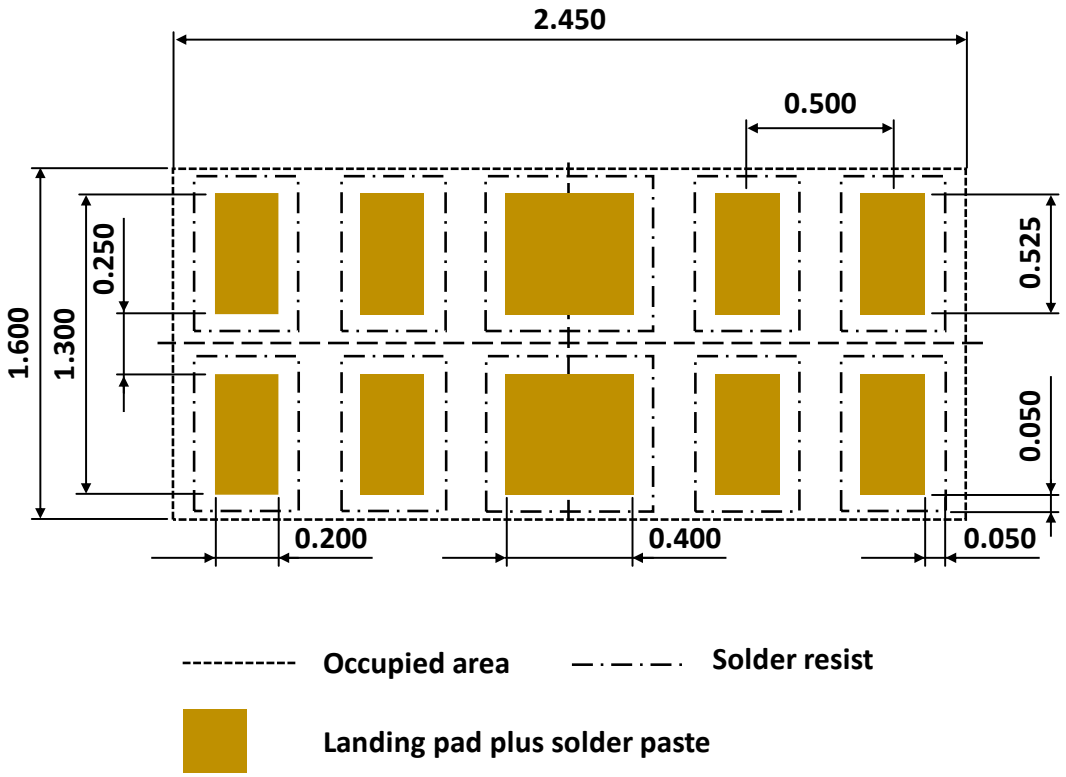
**4: These dimensions do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm.**

## ORDERING INFORMATION

| Part Number | Package Type | Package Code | Part Marking | Parameter |
|---|---|---|---|---|
| UT8413AD5A | DFN2510-10L | D5A | U9XXXX | U9 = Product Code<br>XXXX = Date Code |

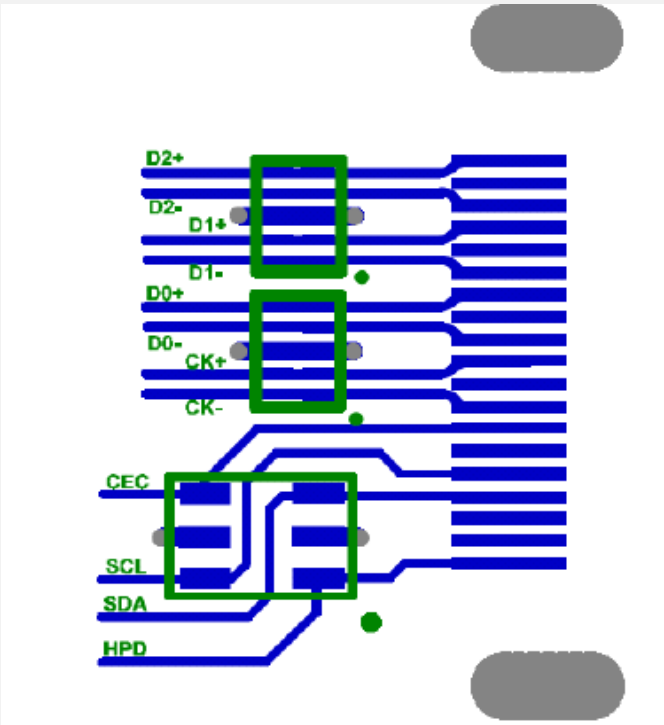
| Package Type | Vacuum Package | | | |
|---|---|---|---|---|
| DFN2510-10L | Packing | Reel 180mm (7”) | Inner Box (3 Reels) | Carton (12 Boxes) |
| | Tape and Reel | 3 000pcs | 9 000pcs | 108 000pcs |

## RECOMMENDED PAD LAYOUT FOR DFN2510-10L ▲ All dimensions in mm

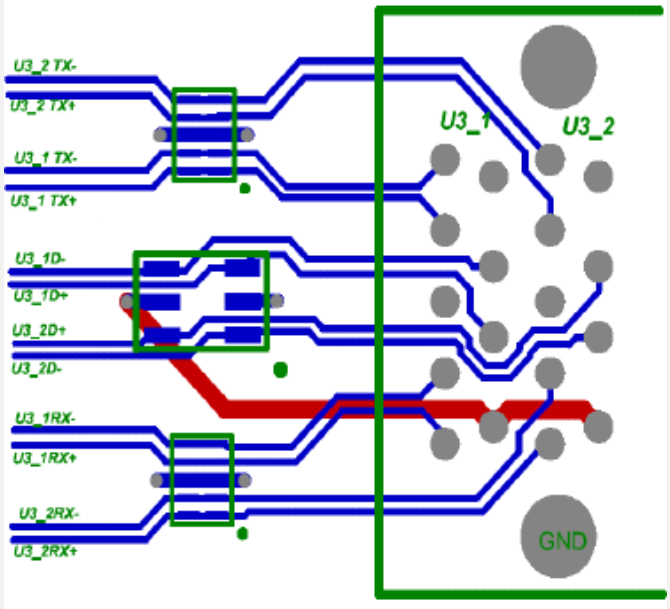


## TYPICAL APPLICATION CIRCUIT

**Fig. 5 ▪ USB HDMI A Type and USB 3.0 Type A Protection**

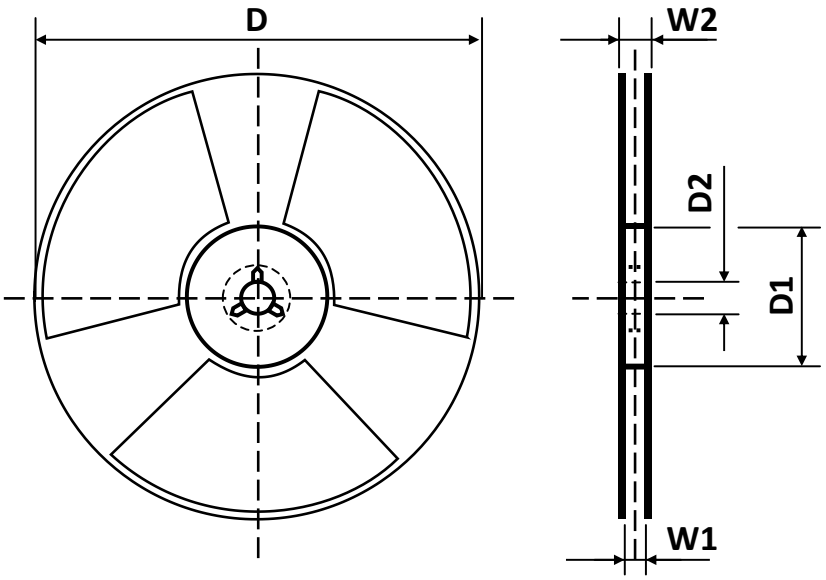



**UT8413AD5A HDMI A Type Layout Diagram**



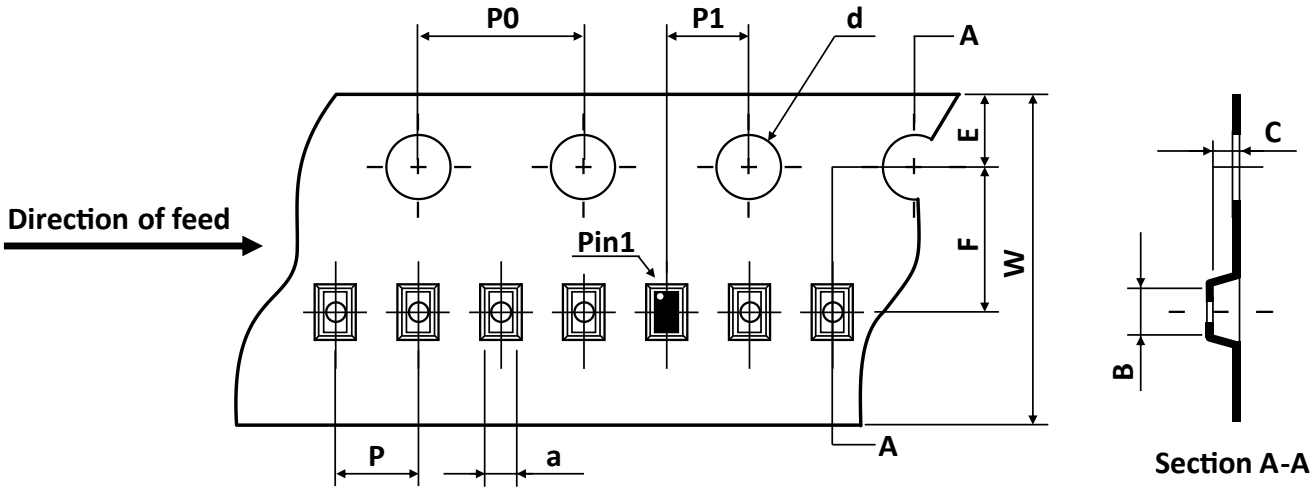

**UT8413AD5A USB3.0 Type A Layout Diagram**

## REEL DIMENSIONS ▲ All dimensions in mm




| Tape Size | Reel Size | D | D1 | D2 | W1 | W2 |
|---|---|---|---|---|---|---|
| 8mm | 7 inch | Ø178.00 | 54.40 | 13.00 | 9.50 | 12.30 |

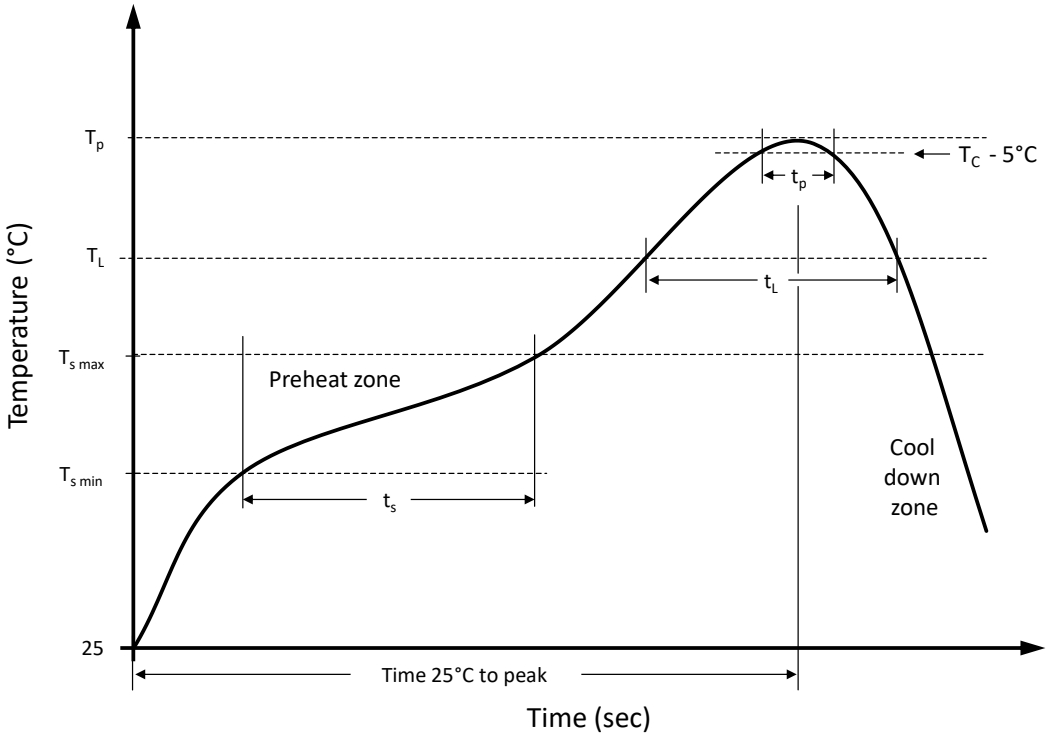
## TAPE DIMENSIONS ▲ All dimensions in mm




| Package | a | B | C | d | E | F | P0 | P | P1 | W |
|---|---|---|---|---|---|---|---|---|---|---|
| DFN2510-10L | 1.15 | 2.65 | 0.70 | 1.50 | 1.75 | 3.50 | 4.00 | 4.00 | 2.00 | 8.00 |

**Note:** **All dimensions meet EIA-481-D requirements.**

## RECOMMENDED REFLOW SOLDERING PROFILE




**Recommended reflow soldering conditions ▲ Refer to JEDEC J-STD-020E**

| Profile Features | | Sn-Pb Eutetic Assembly | Pb-Free Assembly |
|---|---|---|---|
| Preheat temperature min. | $T_{s\,min}$ | 100 °C | 150 °C |
| Preheat temperature max. | $T_{s\,max}$ | 150 °C | 200 °C |
| Preheat time $t_s$ from $T_{s\,min}$ to $T_{s\,max}$ | $t_s$ | 120 seconds | 120 seconds |
| Ramp-up rate ($T_L$ to $T_p$) | | max. 3 °C/second | max. 3 °C/second |
| Liquidous temperature | $T_L$ | 183 °C | 217 °C |
| Time $t_L$ maintained above $T_L$ | $t_L$ | 150 seconds max. | 150 seconds max. |
| Peak package body temperature | $T_p$ | 235°C | 260°C |
| Timeframe of within 5°C below and up to max actual peak body temperature | $t_p$ | 20 seconds max. | 30 seconds max. |
| Ramp-down rate ($T_L$ to $T_p$) | | max. 6 °C/second | max. 6 °C/second |
| Time 25°C to peak temperature | | max. 6 minutes | max. 8 minutes |

## REVISION TABLE

| Revision | Date | Status | Notes |
|---|---|---|---|
| 001 | 01/10/2021 | Initial release | Initial publication |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

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