

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 (8/20 μ s)	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.

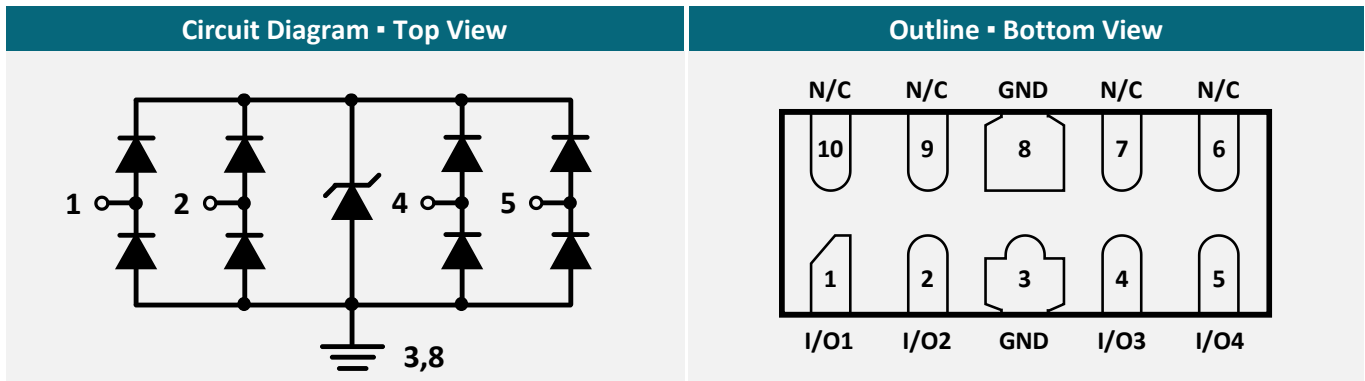
EMC STANDARDS

- ▲ 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 (8/20 μ s)

APPLICATIONS

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

PIN DESCRIPTION



ELECTRICAL CHARACTERISTICS ▲ $T_J = 25^\circ\text{C}$, 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	$I_{BR} = 1\text{mA}$, any I/O Pin to GND	V_{BR}	5	6.5	8.5	V
Forward Voltage	$I_F = 15\text{mA}$, any I/O Pin to GND	V_F		1		V
Reverse Leakage Current	$V_{RWM} = 3.3\text{V}$, any I/O Pin to GND	I_R			1	μA
Surge Clamping Voltage (8/20 μs)	$I_{PP} = 5\text{A}$, any I/O Pin to GND	V_C		6.2	7	V
TLP Clamping Voltage ^{Note1}	$I_{TLP} = 1\text{A}$, any I/O Pin to GND	V_C		5.3		V
TLP Clamping Voltage ^{Note1}	$I_{TLP} = 16\text{A}$, 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	$V_R = 0\text{V}$, $f = 1\text{MHz}$, any I/O Pin to GND	C_J		0.45	0.6	pF
	$V_R = 1.65\text{V}$, $f = 1\text{MHz}$, any I/O Pin to GND			0.44	0.6	
	$V_R = 0\text{V}$, $f = 1\text{MHz}$, between I/O Pins			0.05	0.06	
	$V_R = 1.65\text{V}$, $f = 1\text{MHz}$, between I/O Pins			0.05	0.06	

Note

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

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

TYPICAL OPERATING CHARACTERISTICS

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

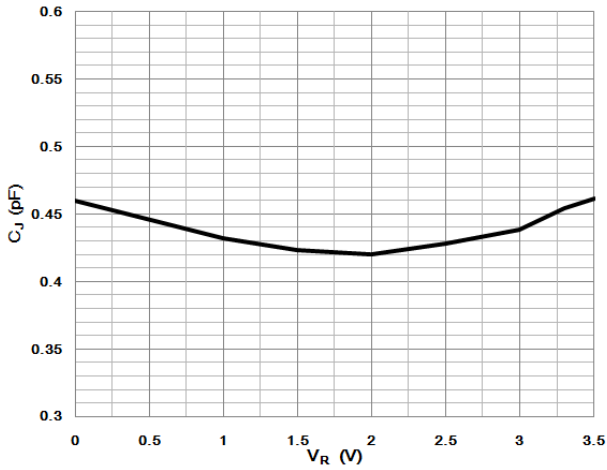


Fig. 2 • TLP Clamping Voltage ($t_{period} = 100ns, t_r = 1ns$)

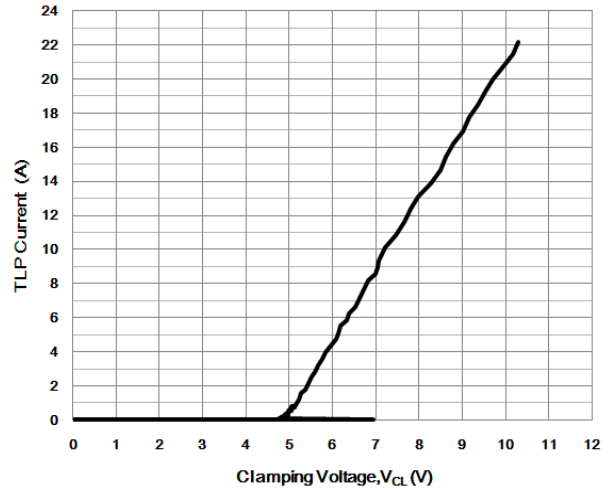


Fig. 3 • Junction Capacitance (I/O Pin to I/O Pin)

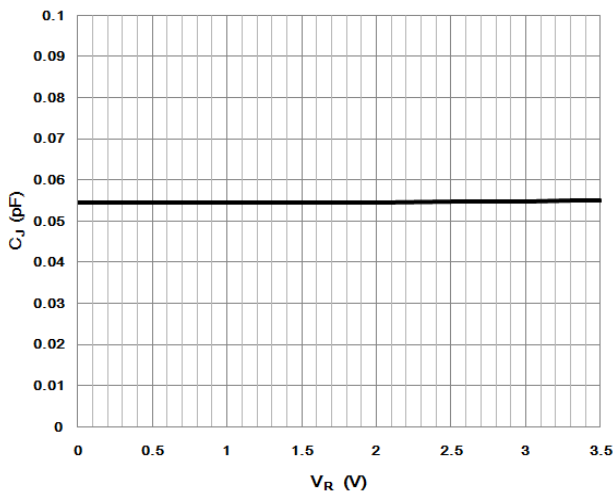
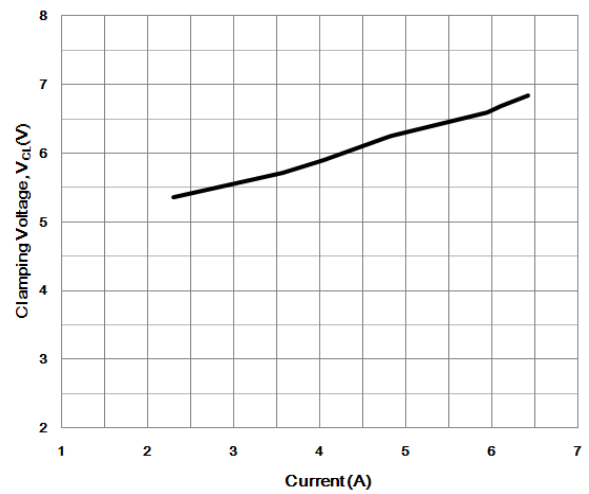
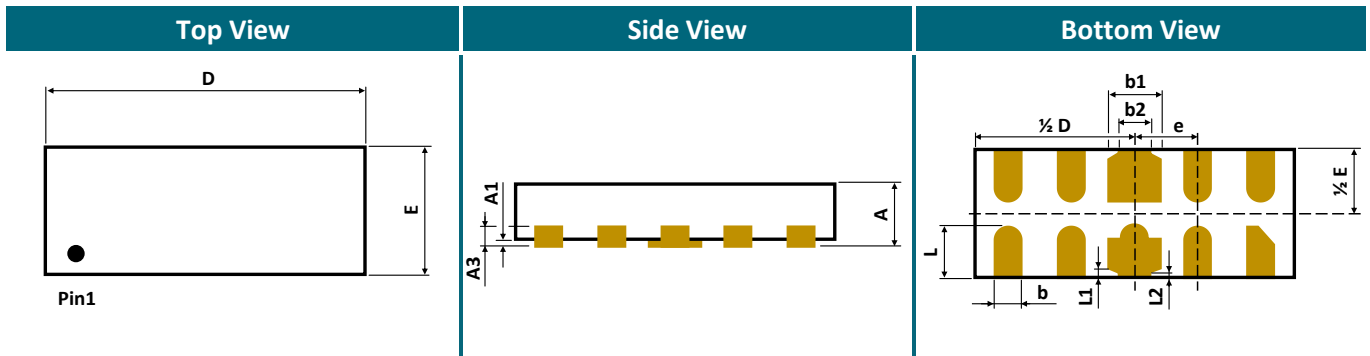


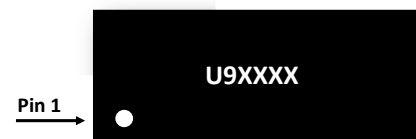
Fig. 4 • Positive Surge Clamping Voltage (8/20 μs)



PACKAGE OUTLINE AND PART MARKING



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

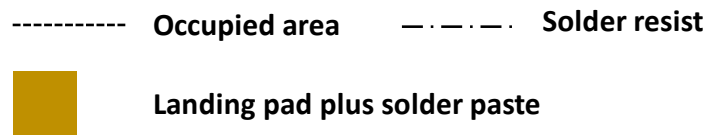
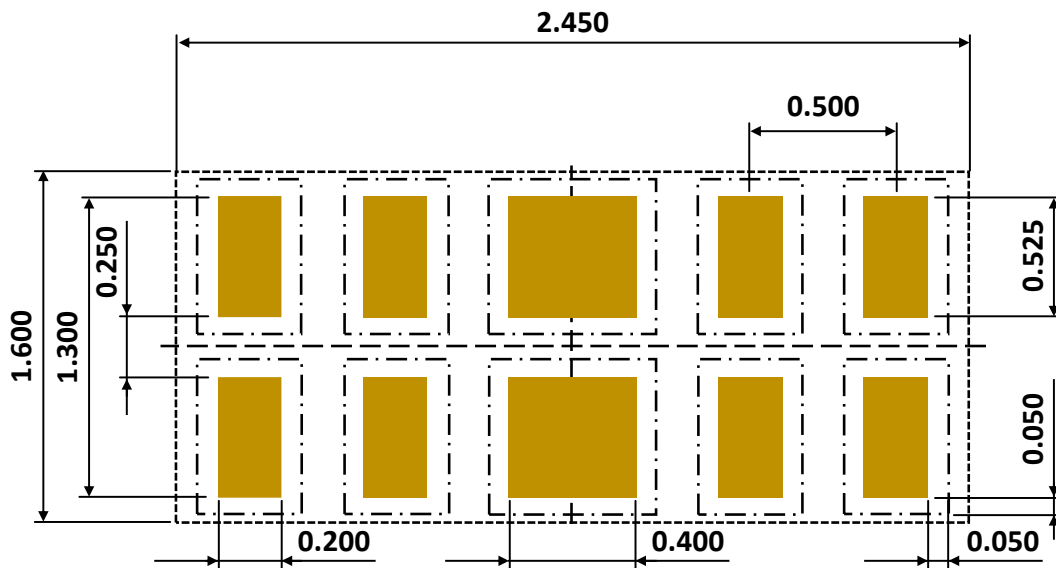
- Package Outline Unit Description:**
BSC: Basic. Represents theoretical exact dimension or dimension target.
MIN: Minimum dimension specified
MAX: Maximum dimension specified
REF: Reference. Represents dimension for reference use only. This value is not a device specification.
TYP: Typical. Provided as a general value. This value is not a device specification.
- Dimensions in Millimeters
- Drawing not to scale
- 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 XXXX = Date Code

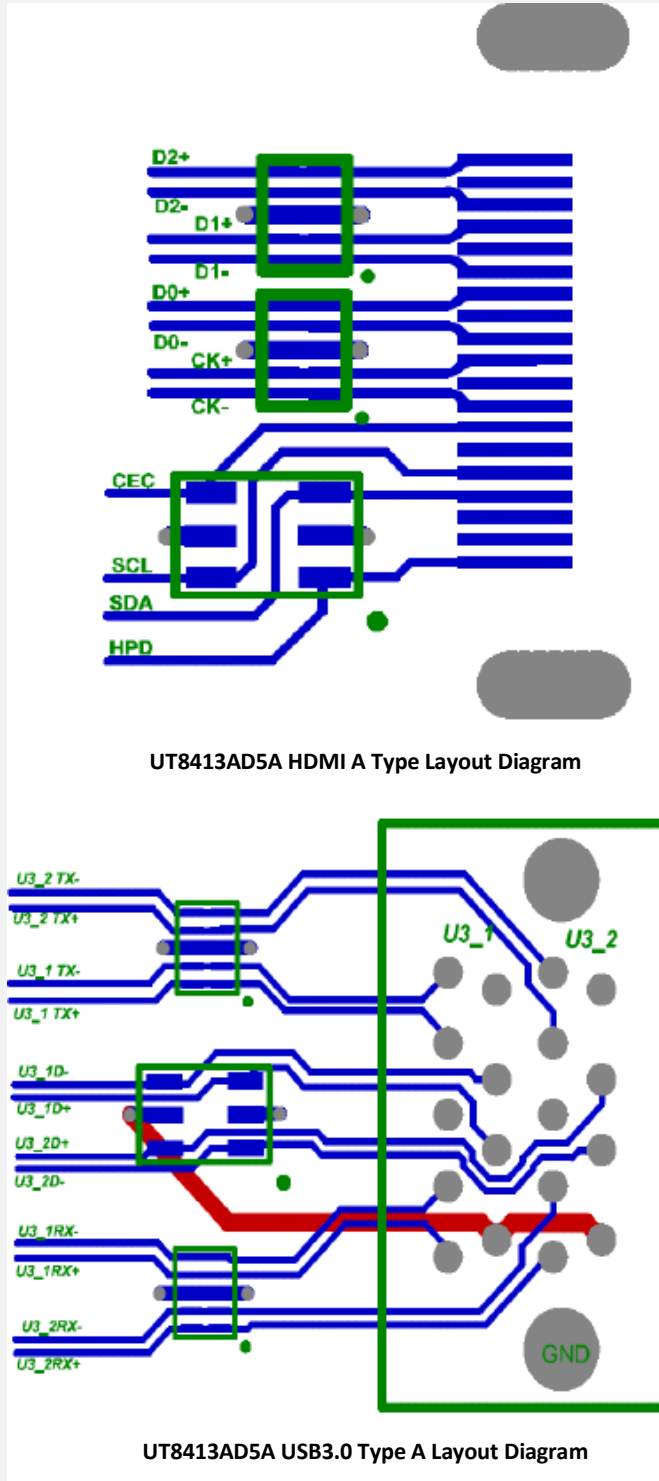
Package Type	Vacuum Package			
DFN2510-10L	Packing	Reel 180mm (7")	Inner Box (3 Reels)	Carton (12 Boxes)
	Tape and Reel	3 000pcs	9 000pcs	108 000pcs

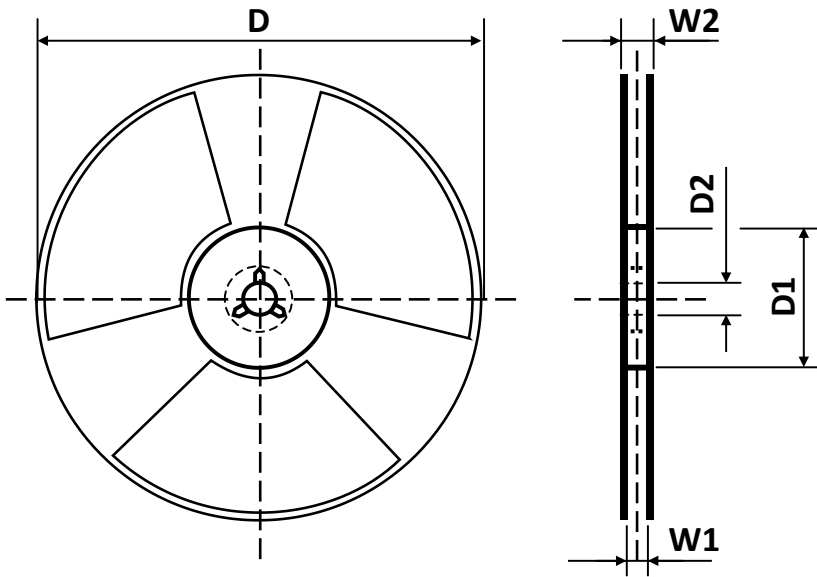
RECOMMENDED PAD LAYOUT FOR DFN2510-10L ▲ All dimensions in mm



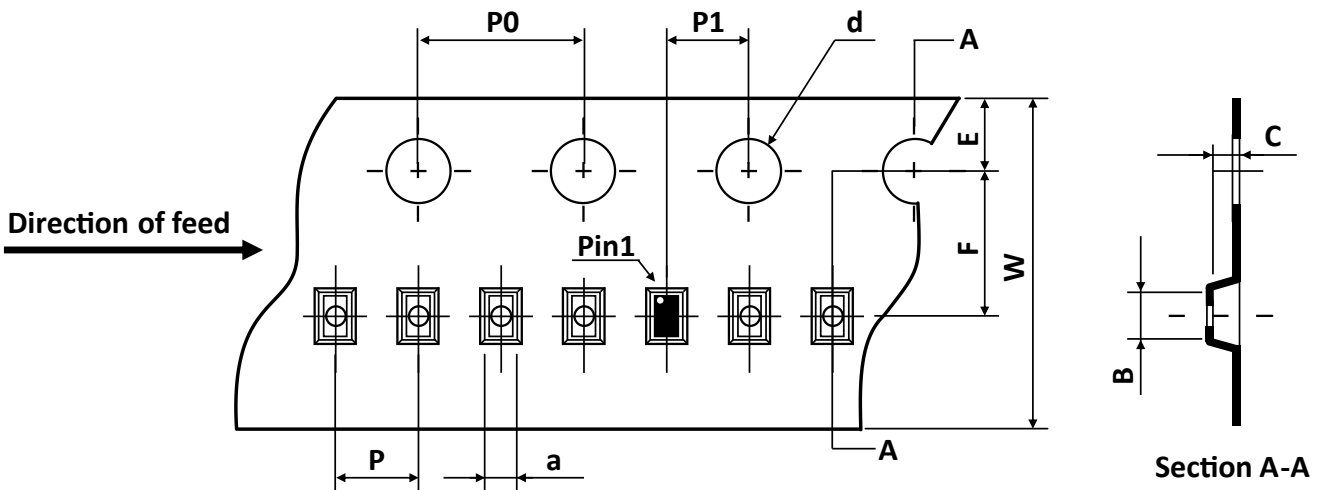
TYPICAL APPLICATION CIRCUIT

Fig. 5 • USB HDMI A Type and USB 3.0 Type A Protection



REEL DIMENSIONS ▲ All dimensions in mm


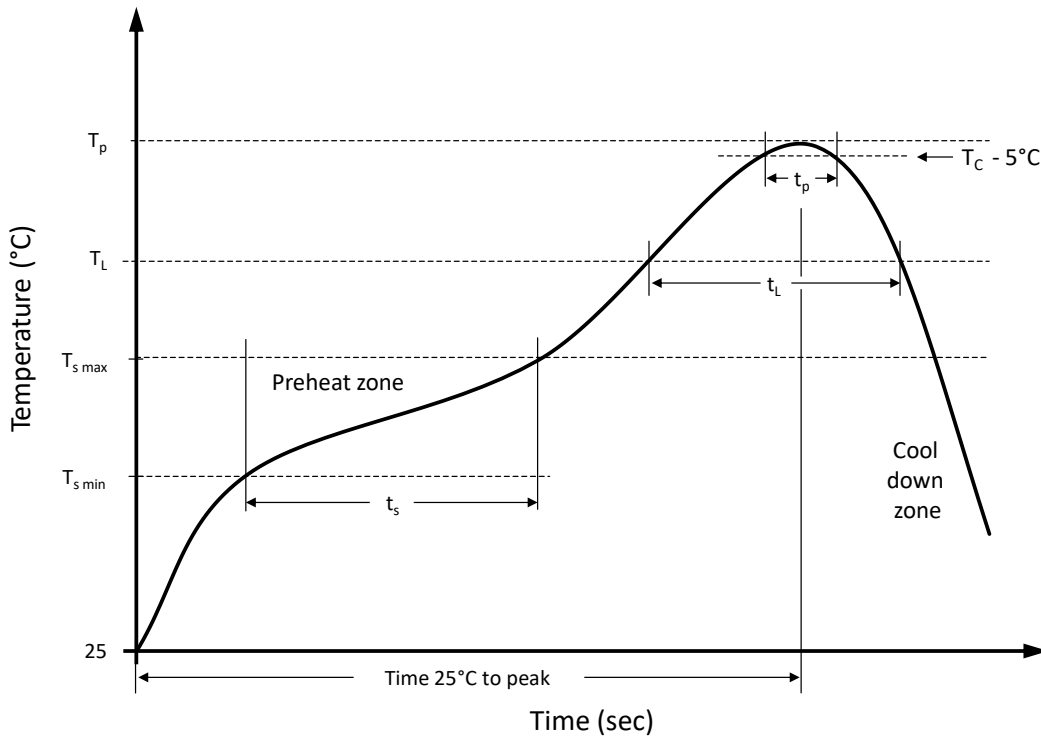
Tape Size	Reel Size	D	D1	D2	W1	W2
8mm	7 inch	∅178.00	54.40	13.00	9.50	12.30

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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