



PRODUCT SPECIFICATION

DOCUMENT NO. ENS000155530

| DESCRIPTION | DRAWN BY | DESIGNED BY | CHECKED BY | APPROVED BY |
|--------------------|-----------------|--------------------|-------------------|--------------------|
| TFE10402 Series | Sandy | James | James | Shawn Yeh |



TFE Series Engineering Specification

1. Scope

This specification is applied to electrostatic discharge (ESD) protection. It is designed to protect the high-speed data lines against ESD transients. It has very low capacitance and fast turn on times makes it ideal for data and transmission lines with high data rates.

According to the special property of device, we recommend not to use on such application as: DC/AC power line.

For RoHS Compliance.

Feature

- Protection against ESD voltages and currents (IEC61000-4-2 Level 4)
- Extremely quick response time (<1ns) present ideal ESD protection
- Ultra low capacitance (0.05pF typical)
- Extremely low leakage current
- Bi-directional device
- SMD (Surface Mount Device)
- Zero signal distortion
- MSL Level:Level 1

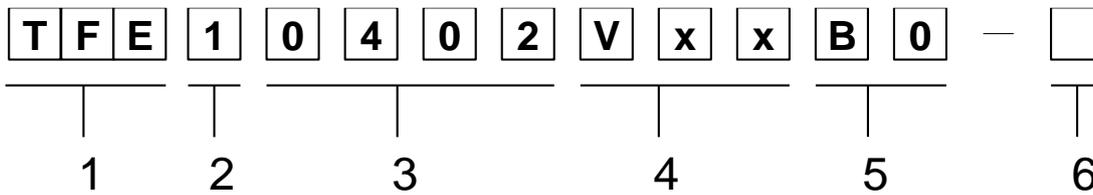
Applications

- Antenna circuit
- USB 3.2 Gen 1 and Gen2
- HDMI 1.3/1.4/2.0
- SATA and eSATA Interface

Product Model

- Digital Video Equipment
- Mobile Phone
- RF Modules
- GPS Antenna

2. Explanation of Part Number



- 1 : TFE : Thin Film ESD Suppressor
- 2 : Single element
- 3 : Chip size:0402
- 4 : Max Rated voltage, VDC=6, 12, 15, 24, 30
- 5 : "B0" : Model Code , Pb Free
- 6 : Suffix for Special Code

3. Circuit Symbol

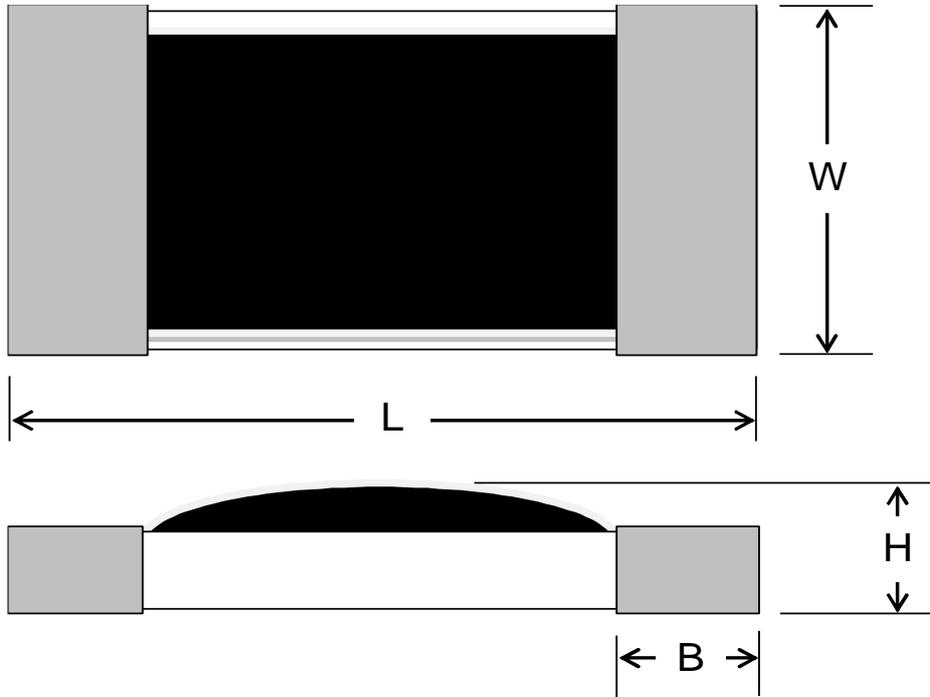


4. Construction & Dimensions

4.1 Substrate : Ceramic (Alumina)

4.2. End termination : Ag/Ni/Sn

4.3. Construction & Dimension :



Unit: mm

| Chip size | L | W | H | B |
|-----------|-----------|-----------|-----------|-----------|
| 0402 | 1.00±0.10 | 0.50±0.10 | 0.36±0.10 | 0.20±0.15 |

5. Performance Characteristics

| Characteristic | Symbol | Unit | TFE10402 | | | | |
|---------------------------------------------------|--------|--------|----------|----|----|----|----|
| | | | 6 | 12 | 15 | 24 | 30 |
| Rated voltage (Max) | VDC | V | 6 | 12 | 15 | 24 | 30 |
| | | | Typical. | | | | |
| Leakage current | IL | μA | 0.01 | | | | |
| Trigger voltage | Vt | V | 300 | | | | |
| Clamping voltage | Vc | V | 20 | | | | |
| Capacitance, @1MHz | Cp | pF | 0.05 | | | | |
| ESD voltage capability, Contact discharge mode | | kV | 8 | | | | |
| ESD voltage capability, Air discharge mode | | kV | 15 | | | | |
| Response time | | ns | 1(Max) | | | | |
| ESD withstand pulses | | pulses | 1000 | | | | |

Rated voltage - IL measurement rated voltage

Vt – measurement by using Transmission Line Pulse (TLP)

Vc – measurement by using Transmission Line Pulse (TLP)

Cp – Device capacitance measured with 1Vrms

6. General specifications

6.1. Temperature Specifications

Operating Temperature range : -40°C to +85°C

Storage Temperature range : -40°C to +85°C

6.2 Environmental Specifications

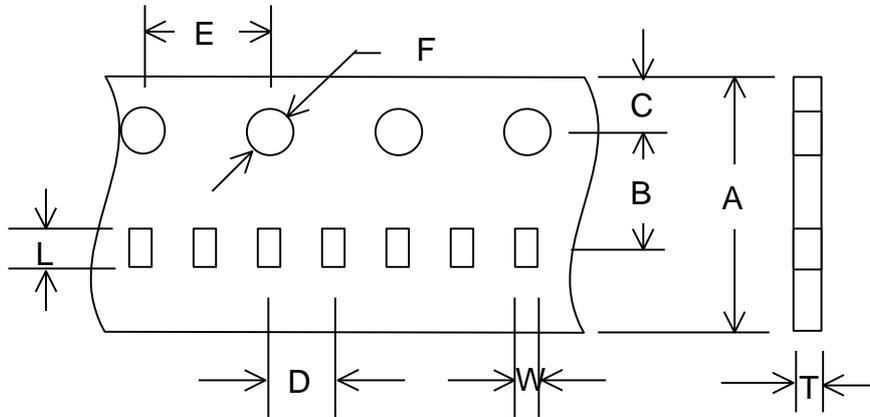
| Item | Specifications | Test condition | Reference |
|----------------------------------|---------------------|-------------------------------------------|-----------------------------|
| Bias humidity | $I_L \leq 10 \mu A$ | Rated voltage ,90%RH, 40°C , 1000 hrs | MIL-STD-202 Method 103 |
| Thermal Shock | $I_L \leq 10 \mu A$ | -40°C to 85°C, 30 min. cycle, 5 cycles | JIS C 0025 (1998)Test Na |
| High Temperature load voltage | $I_L \leq 10 \mu A$ | Rated voltage, 85°C , 1000hrs | MIL-STD-202G Method 108 |
| Solder leach resistance | $I_L \leq 10 \mu A$ | 260°C, 10s | MIL-STD-202G Method 210F |

I_L – Leakage current at rated voltage, the maximum leakage current was measured after reliability test.

7. Taping Package and Label Marking

7.1. Carrier tape dimensions

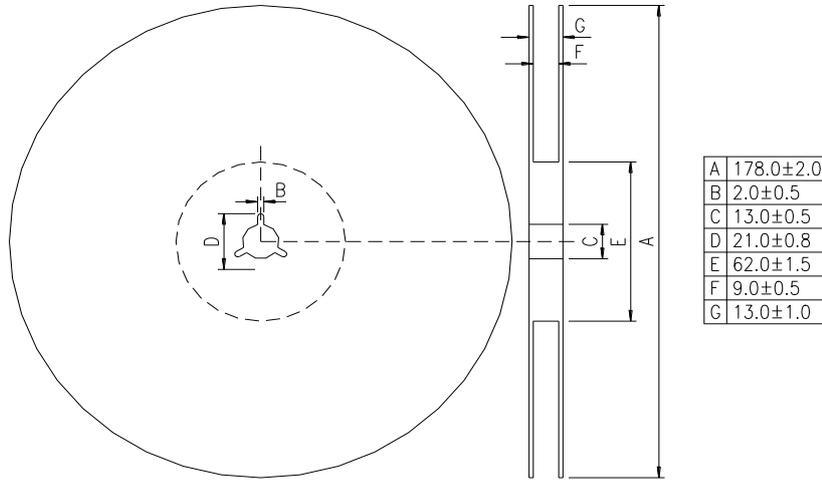
Tape material: paper



| | 0402 |
|---|-----------|
| A | 8.00±0.30 |
| B | 3.50±0.05 |
| C | 1.75±0.10 |
| D | 2.00±0.05 |
| E | 4.00±0.10 |
| F | 1.50±0.10 |
| L | 1.13±0.03 |
| W | 0.63±0.03 |
| T | 0.43±0.03 |

7.2. Taping Reel Dimensions

Reel material: plastic



7.2. Taping Specifications

There shall be the portion having no product in both the head and the end of taping, and there shall be the cover tape in the head of taping.

7.3. Label Marking

The label specified as follows shall be put on the side of reel.

- (1) Part No.
- (2) Quantity
- (3) Lot No.

* Part No. And Quantity shall be marked on outer packaging.

7.4. Quantity of products in the Taping Package

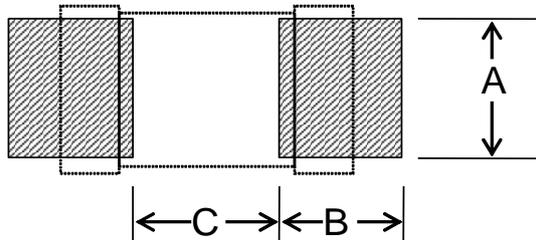
- (1) Standard quantity : 10000pcs/Reel
- (2) Shipping quantity is a multiple of standard quantity.

8. Precautions for Handling

8.1. Solder Cream in Reflow Soldering

Refer to the recommendable land pattern as printing mask pattern for solder cream.

(1) Print solder in a thickness of 0.10 to 0.15 mm.



Unit : mm

| | |
|---|---------|
| | 0402 |
| A | 0.5±0.1 |
| B | 0.5±0.1 |
| C | 0.5±0.1 |

8.2. Precaution for Handling of Substrate

Do not exceed to bend the board after soldering this product extremely. (reference examples)

- Mounting place must be as far as possible from the position, which is close to the break line of board, or on the line of large holes of board.
- Do not bend extremely the board, in mounting another components.

If necessary, use back-up pin (support pin) to prevent from bending extremely.

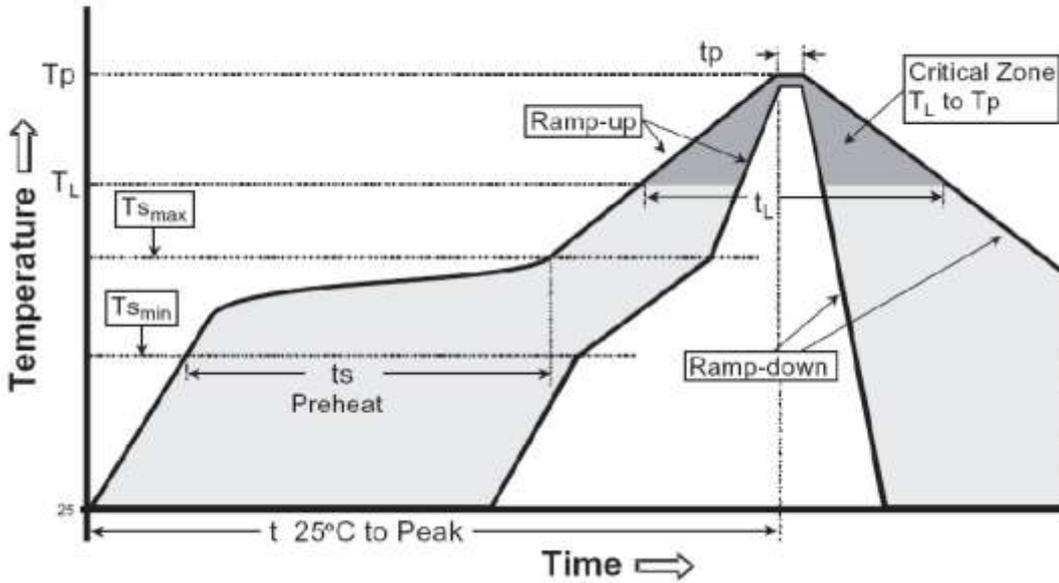
- Do not break the board by hand. We recommend to use the machine or the jig to break it.

8.3. Precaution for Soldering

Note that this product will be easily damaged by rapid heating, rapid cooling or local heating.

Do not give heat shock over 100°C in the process of soldering. We recommend to take preheating and gradual cooling.

8.4. Reflow Soldering



Reference IPC-020c-5-1

| | |
|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Profile Feature | Pb free Assembly |
| Average Ramp Rate (Ts max to Tp) | 3 °C/second max |
| Preheat - Temperature Min (T _{Smin}) - Temperature Min (T _{Smax}) - Time(t _{Smin} to t _{Smin}) | 150°C 200°C 60-180 seconds |
| Time maintained above: - Temperature (T _L) Time (t _L) | 217°C 60-150 seconds |
| Peak Temperature (T _p) | 260°C +0/-5 °C |
| Time within 5 °C of actual Peak Temperature (T _p) | 20-40 seconds |
| Ramp-Down Rate | 6 °C/second max. |
| Time 25°C to Peak Temperature | 8 minutes max |

8.5. Soldering gun procedure

Note the follows, in case of using solder gun for replacement.

- (1) The tip temperature must be less than 280°C for the period within 3 seconds by using soldering gun under 30 W.
- (2) The soldering gun tip shall not touch this product directly.

8.6. Soldering volume

Note that excess of soldering volume will easily get crack the body of this product.

8.7. Taping Package Storage Condition

Storage Temperature : 5 to 40 °C

Relative Humidity : < 65%RH

Storage Time : 12 months max