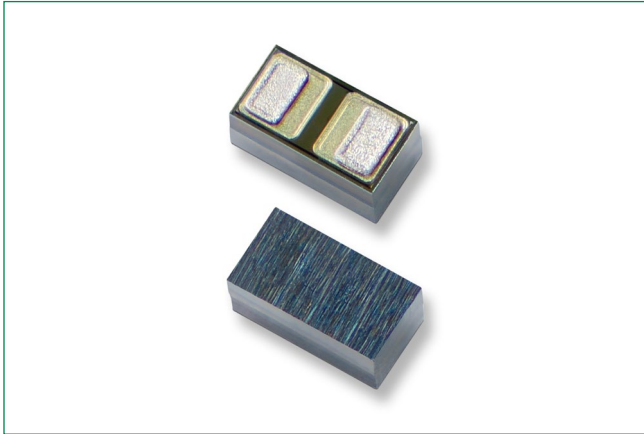


SPxx Series

100W Discrete Bidirectional TVS Diode

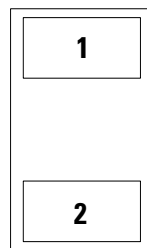


Web Resources

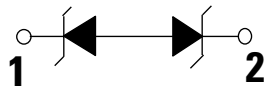


Download ECAD models, order samples, and find technical resources at www.littelfuse.com

Pinout



Functional Block Diagram



Description

The SPxx-01WTG-C-HV series is designed to replace multilayer varistors (MLVs) in portable applications, LED lighting modules, and low speed I/Os. It will protect sensitive equipment from damage due to electrostatic discharge (ESD) and other overvoltage transients.

The SPxx-01WTG-C-HV series can safely absorb repetitive ESD strikes above the maximum level of the IEC 61000-4-2 international standard (Level 4, $\pm 8\text{kV}$ contact discharge) without performance degradation and safely dissipate up to 8A (SP12-01WTG-C-HV) of induced surge current (IEC 61000-4-5, $t_p=8/20\mu\text{s}$) with very low clamping voltages.

Features & Benefits

- ESD, IEC 61000-4-2, $\pm 30\text{kV}$ contact, $\pm 30\text{kV}$ air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- IEC 61000-4-5, 2nd Edition: 8/20 Surge, 8A Surge Immunity. SP12-01WTG-C-HV.
- Low clamping voltage
- Low leakage current
- Halogen free, Lead free and RoHS compliant

Applications

- LED Lighting Modules
- Portable Instrumentation
- General Purpose I/O
- Mobile & Handhelds
- RS232 / RS485
- CAN bus

Life Support Note:

Not Intended for Use in Life Support or Life Saving Applications
The products shown herein are not designed for use in life sustaining or life saving applications unless otherwise expressly indicated.

SPxx Series

100W Discrete Bidirectional TVS Diode

Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|------------|--------------------------------------|------------|-------|
| P_{pk} | Peak Pulse Power ($t_p=8/20\mu s$) | 100 | W |
| T_{OP} | Operating Temperature | -40 to 125 | °C |
| T_{STOR} | Storage Temperature | -55 to 150 | °C |

Caution: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the component. This is a stress only rating and operation of the component at these or any other conditions above those indicated in the operational sections of this specification is not implied.

Thermal Information

| Parameter | Rating | Units |
|---|--------|-------|
| Maximum Junction Temperature | 150 | °C |
| Maximum Lead Temperature (Soldering 20-40s) | 260 | °C |

SP12-01WTG-C-HV Electrical Characteristics ($T_{OP}=25^\circ C$)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|------------------------------------|-------------|-------------------------------------|----------|-----|------|----------|
| Reverse Standoff Voltage | V_{RWM} | $I_R \leq 1\mu A$ | | | 12.0 | V |
| Reverse Breakdown Voltage | V_{BR} | $I_R = 1mA$ | 13.3 | | | V |
| Leakage Current | I_{LEAK} | $V_R = 12V$ | | | 0.1 | μA |
| Clamp Voltage ¹ | V_C | $I_{PP} = 1A, t_p = 8/20\mu s, Fwd$ | | 16 | | V |
| | | $I_{PP} = 8A, t_p = 8/20\mu s, Fwd$ | | 19 | | V |
| Dynamic Resistance ² | R_{DYN} | TLP, $t_p = 100ns$ | | 0.4 | | Ω |
| Peak Pulse Current | I_{PP} | $t_p = 8/20\mu s$ | | | 8.0 | A |
| ESD Withstand Voltage ¹ | V_{ESD} | IEC61000-4-2 (Contact Discharge) | ± 30 | | | kV |
| | | IEC61000-4-2 (Air Discharge) | ± 30 | | | kV |
| Diode Capacitance ¹ | C_{D-GND} | Reverse Bias=0V, f=1MHz | | 26 | 30 | pF |

Note:

¹ Parameter is guaranteed by design and/or component characterization.

² Transmission Line Pulse (TLP) test setting : Std.TDR(50 Ω), $t_p=100ns$, $t_r=0.2ns$ ITLP and VTLP averaging window: start $t_1=70ns$ to end $t_2=80ns$

SP15-01WTG-C-HV Electrical Characteristics ($T_{OP}=25^\circ C$)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|------------------------------------|---------------|-------------------------------------|----------|------|------|----------|
| Reverse Standoff Voltage | V_{RWM} | $I_R \leq 1\mu A$ | | | 15.0 | V |
| Reverse Breakdown Voltage | V_{BR} | $I_R = 1mA$ | 16.7 | | | V |
| Leakage Current | I_{LEAK} | $V_R = 15V$ | | | 0.1 | μA |
| Clamp Voltage ¹ | V_C | $I_{PP} = 1A, t_p = 8/20\mu s, Fwd$ | | 21 | | V |
| | | $I_{PP} = 5A, t_p = 8/20\mu s, Fwd$ | | 27 | | V |
| Dynamic Resistance ² | R_{DYN} | TLP, $t_p = 100ns$ | | 0.43 | | Ω |
| Peak Pulse Current | I_{PP} | $t_p = 8/20\mu s$ | | | 5.0 | A |
| ESD Withstand Voltage ¹ | V_{ESD} | IEC61000-4-2 (Contact Discharge) | ± 30 | | | kV |
| | | IEC61000-4-2 (Air Discharge) | ± 30 | | | kV |
| Diode Capacitance ¹ | $C_{I/O-GND}$ | Reverse Bias=0V, f=1MHz | | 21 | 24 | pF |

Note:

¹ Parameter is guaranteed by design and/or component characterization.

² Transmission Line Pulse (TLP) test setting : Std.TDR(50 Ω), $t_p=100ns$, $t_r=0.2ns$ ITLP and VTLP averaging window: start $t_1=70ns$ to end $t_2=80ns$

SPxx Series

100W Discrete Bidirectional TVS Diode

SP24-01WTG-C-HV Electrical Characteristics ($T_{OP}=25^{\circ}\text{C}$)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|------------------------------------|----------------|--|----------|-----|------|---------------|
| Reverse Standoff Voltage | V_{RWM} | $I_R \leq 1\mu\text{A}$ | | | 24.0 | V |
| Reverse Breakdown Voltage | V_{BR} | $I_R = 1\text{mA}$ | 26.7 | | | V |
| Leakage Current | I_{LEAK} | $V_R = 24\text{V}$ | | | 0.1 | μA |
| Clamp Voltage ¹ | V_C | $I_{PP} = 1\text{A}$, $t_p = 8/20\mu\text{s}$, Fwd | | 32 | | V |
| | | $I_{PP} = 3.0\text{A}$, $t_p = 8/20\mu\text{s}$, Fwd | | 40 | | V |
| Dynamic Resistance ² | R_{DYN} | TLP, $t_p = 100\text{ns}$ | | 0.7 | | Ω |
| Peak Pulse Current | I_{PP} | $t_p = 8/20\mu\text{s}$ | | | 3.0 | A |
| ESD Withstand Voltage ¹ | V_{ESD} | IEC61000-4-2 (Contact Discharge) | ± 18 | | | kV |
| | | IEC61000-4-2 (Air Discharge) | ± 24 | | | kV |
| Diode Capacitance ¹ | $C_{J(O-GND)}$ | Reverse Bias=0V, f=1MHz | | 13 | 17 | pF |

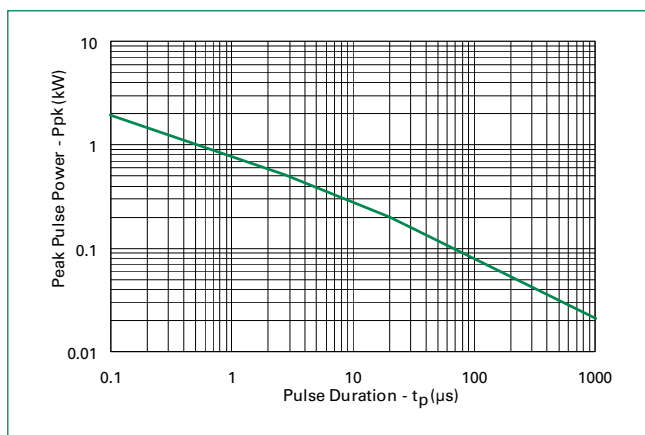
Note:¹ Parameter is guaranteed by design and/or component characterization.² Transmission Line Pulse (TLP) test setting : Std.TDR(50 Ω), $t_p=100\text{ns}$, $t_r=0.2\text{ns}$ ITLP and VTLP averaging window: start $t_1=70\text{ns}$ to end $t_2=80\text{ns}$

SP36-01WTG-C-HV Electrical Characteristics ($T_{OP}=25^{\circ}\text{C}$)

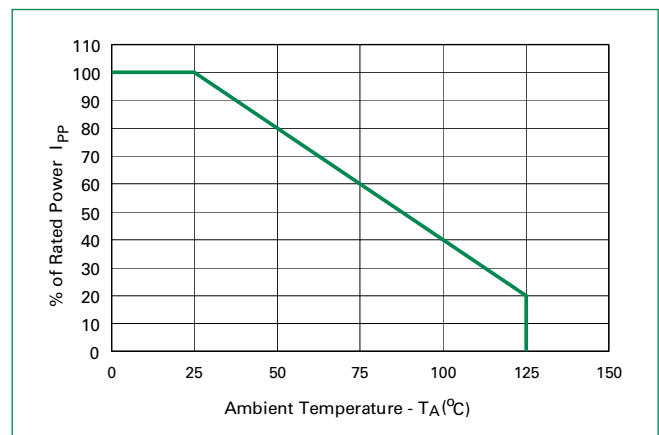
| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|------------------------------------|----------------|--|----------|-----|------|---------------|
| Reverse Standoff Voltage | V_{RWM} | $I_R \leq 1\mu\text{A}$ | | | 36.0 | V |
| Reverse Breakdown Voltage | V_{BR} | $I_R = 1\text{mA}$ | 40.0 | | | V |
| Leakage Current | I_{LEAK} | $V_R = 36\text{V}$ | | | 0.1 | μA |
| Clamp Voltage ¹ | V_C | $I_{PP} = 1\text{A}$, $t_p = 8/20\mu\text{s}$, Fwd | | 48 | | V |
| Dynamic Resistance ² | R_{DYN} | TLP, $t_p = 100\text{ns}$ | | 1.4 | | Ω |
| Peak Pulse Current | I_{PP} | $t_p = 8/20\mu\text{s}$ | | | 1.5 | A |
| ESD Withstand Voltage ¹ | V_{ESD} | IEC61000-4-2 (Contact Discharge) | ± 10 | | | kV |
| | | IEC61000-4-2 (Air Discharge) | ± 15 | | | kV |
| Diode Capacitance ¹ | $C_{J(O-GND)}$ | Reverse Bias=0V, f=1MHz | | 10 | 13 | pF |

Note:¹ Parameter is guaranteed by design and/or component characterization.² Transmission Line Pulse (TLP) test setting : Std.TDR(50 Ω), $t_p=100\text{ns}$, $t_r=0.2\text{ns}$ ITLP and VTLP averaging window: start $t_1=70\text{ns}$ to end $t_2=80\text{ns}$

Non-Repetitive Peak Pulse Power vs. Pulse Time



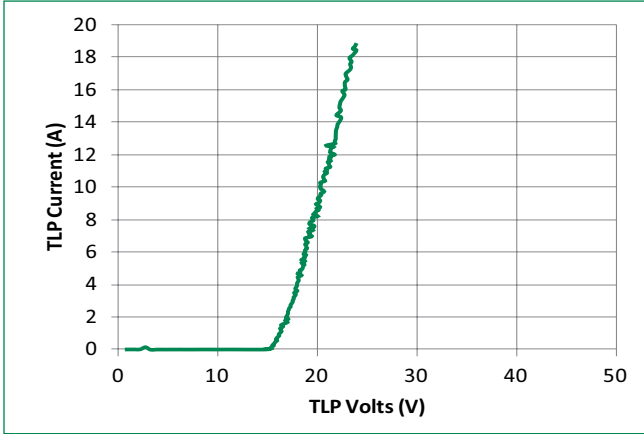
Power Derating Curve



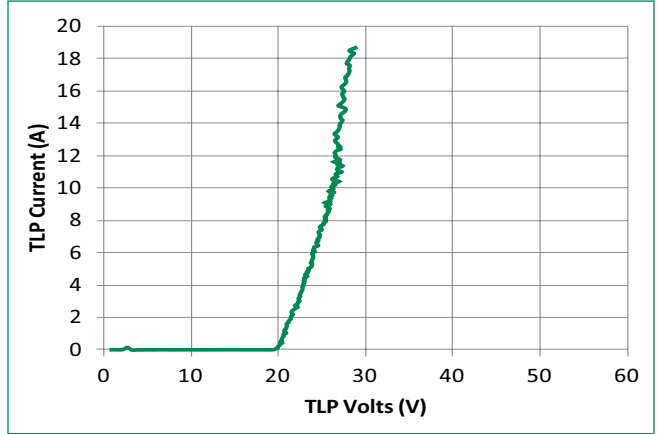
SPxx Series

100W Discrete Bidirectional TVS Diode

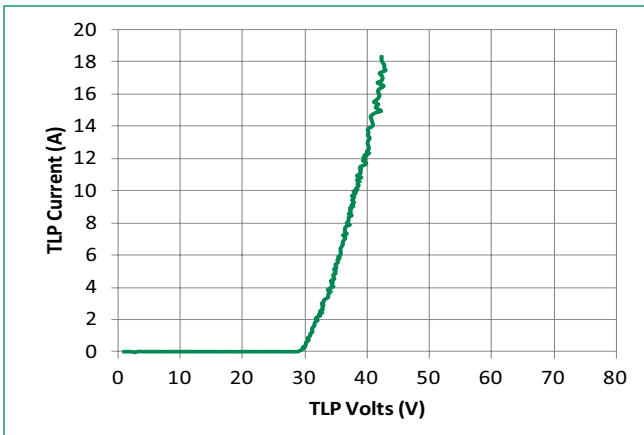
SP12-01WTG-C-HV Transmission Line Pulsing(TLP) Plot



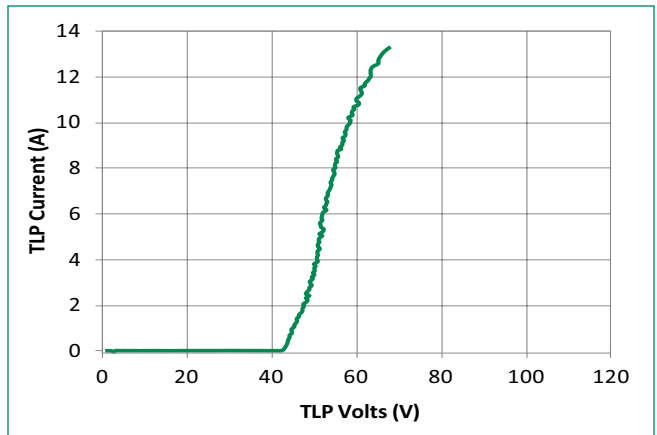
SP15-01WTG-C-HV Transmission Line Pulsing(TLP) Plot



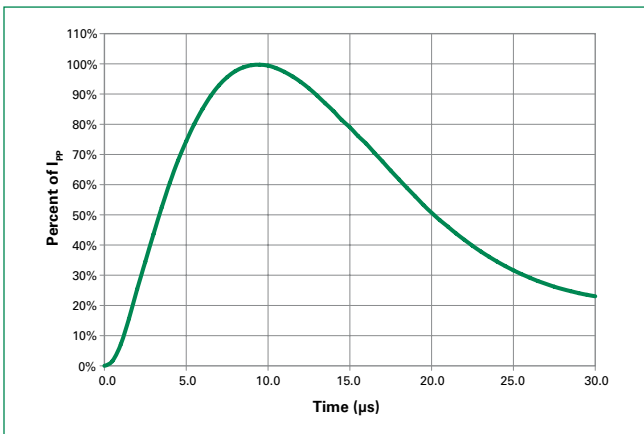
SP24-01WTG-C-HV Transmission Line Pulsing(TLP) Plot



SP36-01WTG-C-HV Transmission Line Pulsing(TLP) Plot



Pulse Waveform

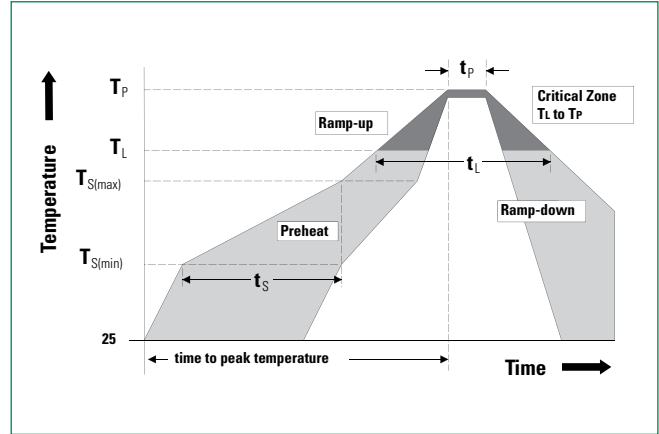


SPxx Series

100W Discrete Bidirectional TVS Diode

Soldering Parameters

| | | |
|--|------------------------------------|-------------------------|
| Reflow Condition | | Pb – Free assembly |
| Pre Heat | - Temperature Min ($T_{s(min)}$) | 150°C |
| | - Temperature Max ($T_{s(max)}$) | 200°C |
| | - Time (min to max) (t_s) | 60 – 120 secs |
| Average ramp up rate (Liquidus) Temp (T_L) to peak | | 3°C/second max |
| $T_{S(max)}$ to T_L - Ramp-up Rate | | 3°C/second max |
| Reflow | - Temperature (T_L) (Liquidus) | 217°C |
| | - Temperature (t_L) | 60 – 150 seconds |
| Peak Temperature (T_p) | | 260 ^{+0/-5} °C |
| Time within 5°C of actual peak Temperature (t_p) | | 30 seconds |
| Ramp-down Rate | | 6°C/second max |
| Time 25°C to peak Temperature (T_p) | | 8 minutes Max. |
| Do not exceed | | 260°C |



Product Characteristics

| | |
|----------------------------|---|
| Lead Plating | Matte Tin |
| Lead Material | Copper bump |
| Substitute Material | Silicon |
| Flammability | 'UL Recognized compound meeting flammability rating V-0 |

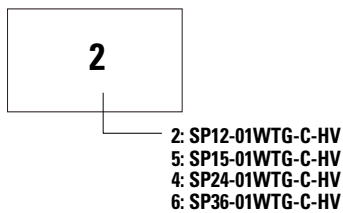
Notes :

1. All dimensions are in millimeters
2. Dimensions include solder plating.
3. Dimensions are exclusive of mold flash & metal burr.
4. Bto is facing up for mold and facing down for trim/form, i.e. reverse trim/form.
5. Package surface matte finish VDI 11-13.

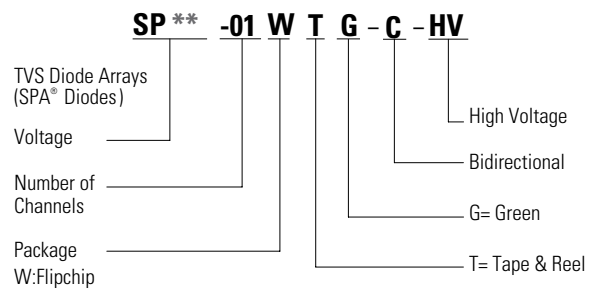
Ordering Information

| Part Number | Package | Marking | Min. Order Qty. |
|-----------------|----------|---------|-----------------|
| SP12-01WTG-C-HV | FLIPCHIP | 2 | 10000 |
| SP15-01WTG-C-HV | FLIPCHIP | 5 | 10000 |
| SP24-01WTG-C-HV | FLIPCHIP | 4 | 10000 |
| SP36-01WTG-C-HV | FLIPCHIP | 6 | 10000 |

Part Marking System



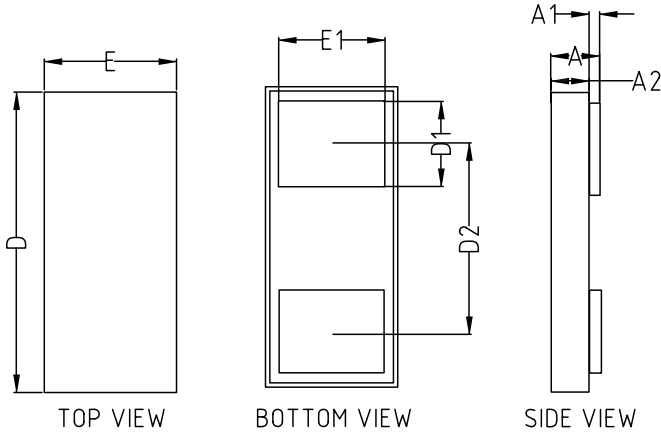
Part Numbering System



SPxx Series

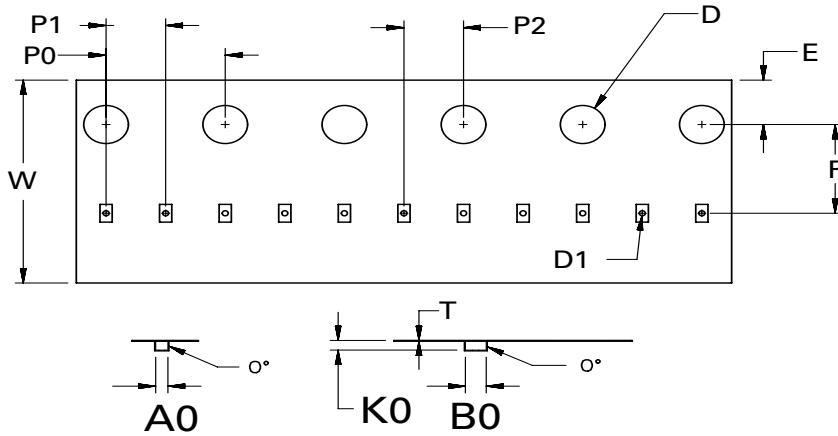
100W Discrete Bidirectional TVS Diode

Package Dimensions – FLIPCHIP

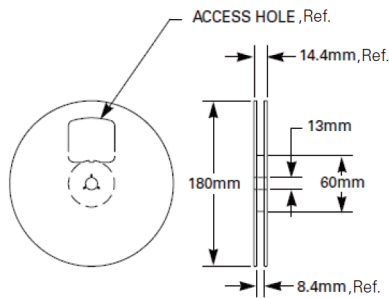


| Symbol | Package | | FLIPCHIP | | | | |
|-----------|-----------|-------------|----------|-----------|--------|-------|--|
| | JEDEC | MO-236 | | | | | |
| | | Millimeters | | | Inches | | |
| | Min | Typ | Max | Min | Typ | Max | |
| A | 0.273 | 0.301 | 0.329 | 0.011 | 0.012 | 0.013 | |
| A1 | 0.008 | 0.011 | 0.014 | 0.000 | 0.000 | 0.001 | |
| A2 | 0.265 | 0.290 | 0.315 | 0.011 | 0.012 | 0.013 | |
| D | 0.605 | 0.640 | 0.655 | 0.024 | 0.026 | 0.027 | |
| D1 | 0.145 | 0.15 | 0.155 | 0.006 | 0.006 | 0.006 | |
| D2 | 0.400 REF | | | 0.016 REF | | | |
| E | 0.305 | 0.340 | 0.355 | 0.012 | 0.014 | 0.015 | |
| E1 | 0.245 | 0.25 | 0.255 | 0.010 | 0.010 | 0.010 | |

Embossed Carrier Tape & Reel Specification – FLIPCHIP



| Symbol | Millimeters |
|-----------|-------------------|
| A0 | 0.41+/-0.03 |
| B0 | 0.70+/-0.03 |
| D | ∅ 1.50 + 0.10 |
| D1 | ∅ 0.20 +/- 0.05 |
| E | 1.75+/-0.10 |
| F | 3.50+/-0.05 |
| K0 | 0.38+/-0.03 |
| P0 | 4.00+/-0.10 |
| P1 | 2.00+/-0.05 |
| P2 | 2.00+/-0.05 |
| W | 8.00 + 0.30 -0.10 |
| T | 0.23+/-0.02 |



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