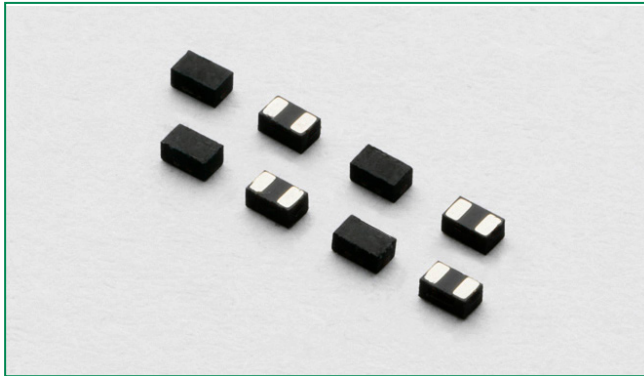
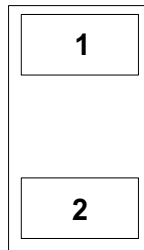


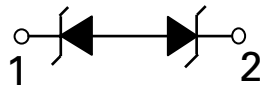
**SPHV-C Series 200W Discrete Bidirectional TVS Diode**  **AUTOMOTIVE GRADE**  **RoHS**  **Pb**  **GREEN**



**Pinout**



**Functional Block Diagram**



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.

**Description**

The Bidirectional SPHV-C series is designed for use in portable applications, LED lighting modules, automotive applications, and low speed I/Os. It will protect sensitive equipment from damage due to electrostatic discharge (ESD) and other overvoltage transients.

The SPHV-C series can safely absorb repetitive ESD strikes above the maximum level of the IEC 61000-4-2 international standard (Level 4, ±8kV contact discharge) without performance degradation and safely dissipate up to 8A (SPHV12-C) of induced surge current (IEC 61000-4-5, 2nd Edition  $t_p=8/20\mu s$ ) with very low clamping voltages.

**Features**

- ESD, IEC 61000-4-2, ±30kV contact, ±30kV air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, IEC 61000-4-5 2nd edition, 8A ( $t_p=8/20\mu s$ , SPHV12-C)
- Low clamping voltage
- Low leakage current
- Small SOD882 packaging helps save board space
- AEC-Q101 qualified
- Lead-free and RoHS compliant
- Side exposed leadframe helps to verify solderability (SPHVxx-KTG-C series)

**Applications**

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

**Additional Information**



**Datasheet**



**Resources**



**Samples**

### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$P_{pk}$	Peak Pulse Power ( $t_p=8/20\mu s$ )	200	W
$T_{OP}$	Operating Temperature	-40 to 125	°C
$T_{STOR}$	Storage Temperature	-55 to 150	°C

Notes:

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

### Thermal Information

Parameter	Rating	Units
Storage Temperature Range	-55 to 150	°C
Maximum Junction Temperature	150	°C
Maximum Lead Temperature (Soldering 20-40s)	260	°C

### SPHV12-C 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	$I_{LEAK}$	$V_R = 12V$			1.0	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP} = 1A, t_p = 8/20\mu s, Fwd$			19.0	V
		$I_{PP} = 8A, t_p = 8/20\mu s, Fwd$			25.0	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p = 100ns, I/O$ to GND		0.48		$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p = 8/20\mu s$			8.0	A
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC61000-4-2 (Contact Discharge)	$\pm 30$			kV
		IEC61000-4-2 (Air Discharge)	$\pm 30$			kV
Diode Capacitance <sup>1</sup>	$C_{D-GND}$	Reverse Bias=0V, f=1MHz			30	pF

Note:

<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

<sup>2</sup> Transmission Line Pulse (TLP) with 100ns width and 200ps rise time.

### SPHV15-C 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	$I_{LEAK}$	$V_R = 15V$			1.0	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP} = 1A, t_p = 8/20\mu s, Fwd$			22.0	V
		$I_{PP} = 5A, t_p = 8/20\mu s, Fwd$			30.0	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p = 100ns, I/O$ to GND		0.43		$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p = 8/20\mu s$			5.0	A
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC61000-4-2 (Contact Discharge)	$\pm 30$			kV
		IEC61000-4-2 (Air Discharge)	$\pm 30$			kV
Diode Capacitance <sup>1</sup>	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz			24	pF

Note:

<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

<sup>2</sup> Transmission Line Pulse (TLP) with 100ns width and 200ps rise time.

**SPHV24-C Electrical Characteristics (T<sub>OP</sub>=25°C)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V <sub>RWM</sub>	I <sub>R</sub> ≤ 1 μA			24.0	V
Reverse Breakdown Voltage	V <sub>BR</sub>	I <sub>R</sub> = 1mA	26.7			V
Leakage Current	I <sub>LEAK</sub>	V <sub>R</sub> = 24V			1.0	μA
Clamp Voltage <sup>1</sup>	V <sub>C</sub>	I <sub>PP</sub> = 1A, t <sub>p</sub> = 8/20μs, Fwd			36.0	V
		I <sub>PP</sub> = 3A, t <sub>p</sub> = 8/20μs, Fwd			50.0	V
Dynamic Resistance <sup>2</sup>	R <sub>DYN</sub>	TLP, t <sub>p</sub> = 100ns, I/O to GND		0.65		Ω
Peak Pulse Current	I <sub>PP</sub>	t <sub>p</sub> = 8/20μs			3.0	A
ESD Withstand Voltage <sup>1</sup>	V <sub>ESD</sub>	IEC61000-4-2 (Contact Discharge)	±24			kV
		IEC61000-4-2 (Air Discharge)	±30			kV
Diode Capacitance <sup>1</sup>	C <sub>I/O-GND</sub>	Reverse Bias=0V, f=1MHz			17	pF

Note:

<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

<sup>2</sup> Transmission Line Pulse (TLP) with 100ns width and 200ps rise time.

**SPHV36-C Electrical Characteristics (T<sub>OP</sub>=25°C)**

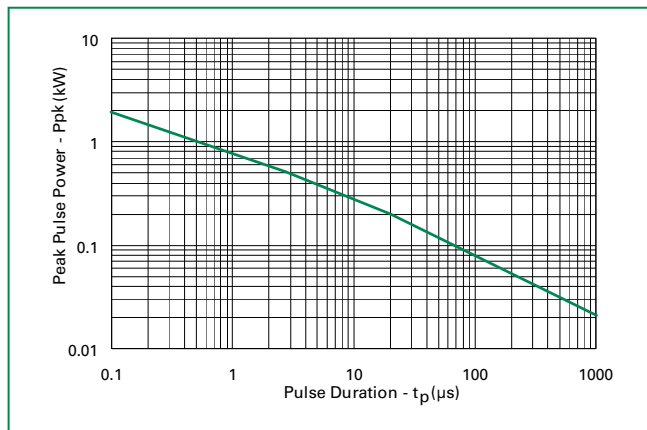
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V <sub>RWM</sub>	I <sub>R</sub> ≤ 1 μA			36.0	V
Reverse Breakdown Voltage	V <sub>BR</sub>	I <sub>R</sub> = 1mA	40.0			V
Leakage Current	I <sub>LEAK</sub>	V <sub>R</sub> = 36V			1.0	μA
Clamp Voltage <sup>1</sup>	V <sub>C</sub>	I <sub>PP</sub> = 1A, t <sub>p</sub> = 8/20μs, Fwd			52.0	V
		I <sub>PP</sub> = 2A, t <sub>p</sub> = 8/20μs, Fwd			65.0	V
Dynamic Resistance <sup>2</sup>	R <sub>DYN</sub>	TLP, t <sub>p</sub> = 100ns, I/O to GND		1.33		Ω
Peak Pulse Current	I <sub>PP</sub>	t <sub>p</sub> = 8/20μs			2.0	A
ESD Withstand Voltage <sup>1</sup>	V <sub>ESD</sub>	IEC61000-4-2 (Contact Discharge)	±15			kV
		IEC61000-4-2 (Air Discharge)	±20			kV
Diode Capacitance <sup>1</sup>	C <sub>I/O-GND</sub>	Reverse Bias=0V, f=1MHz			13	pF

Note:

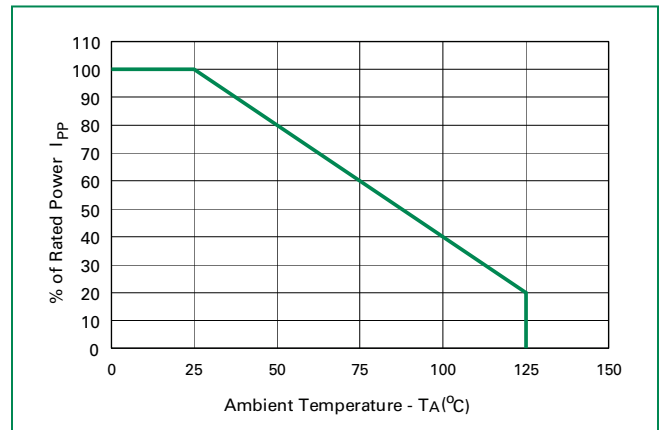
<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

<sup>2</sup> Transmission Line Pulse (TLP) with 100ns width and 200ps rise time.

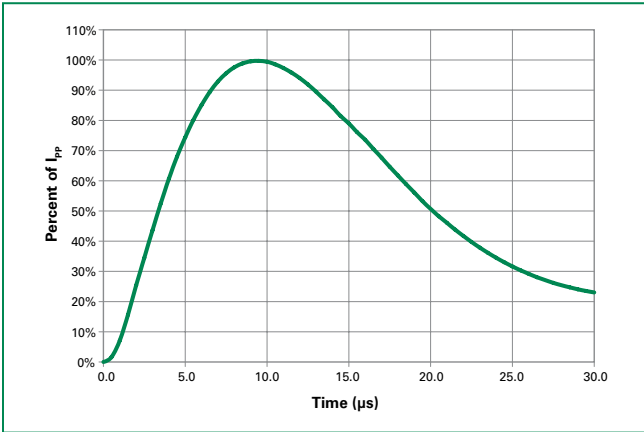
**Non-Repetitive Peak Pulse Power vs. Pulse Time**



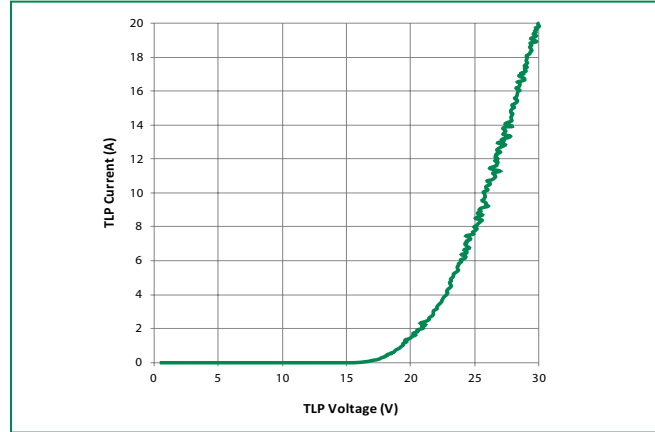
**Power Derating Curve**



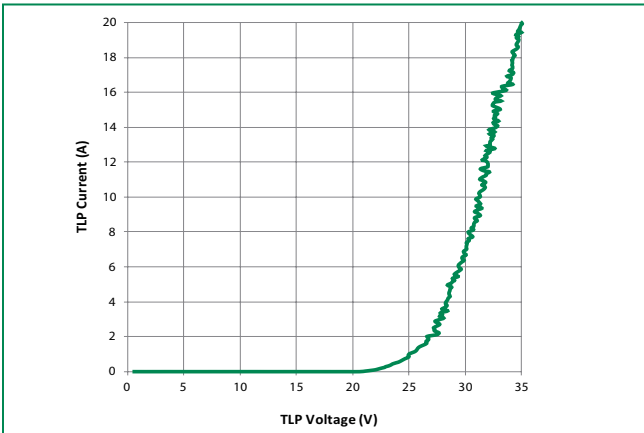
**8/20µs Pulse Waveform**



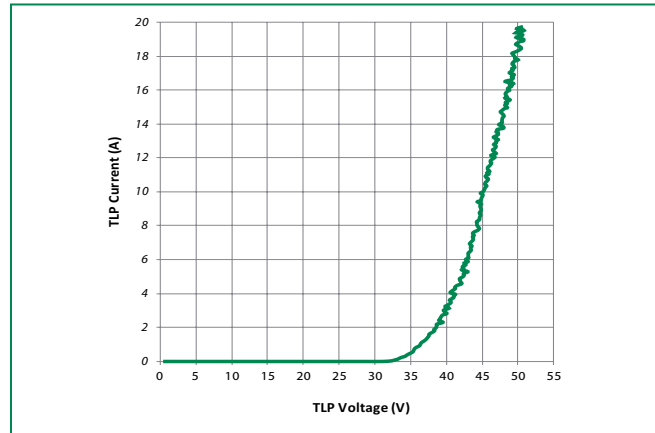
**SPHV12-C Transmission Line Pulsing(TLP) Plot**



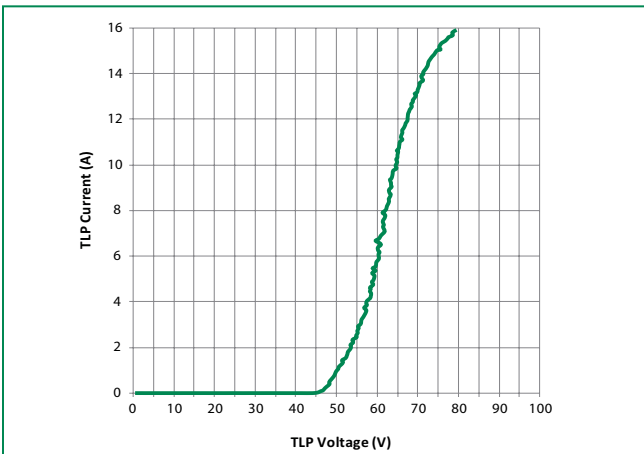
**SPHV15-C Transmission Line Pulsing(TLP) Plot**



**SPHV24-C Transmission Line Pulsing(TLP) Plot**

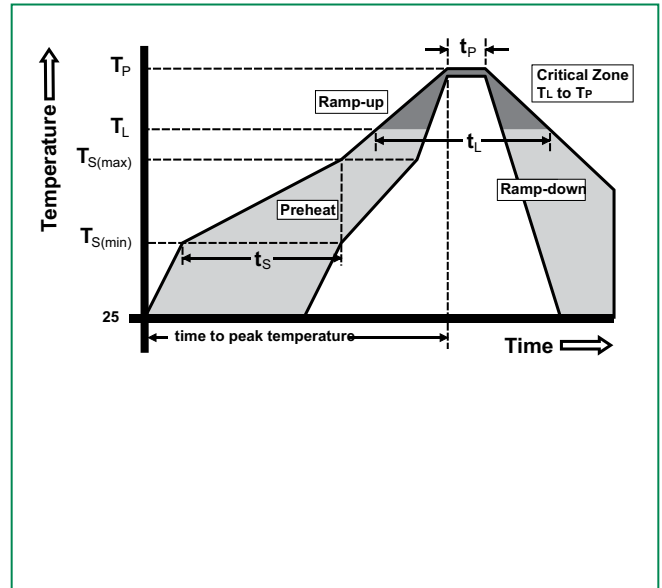


**SPHV36-C Transmission Line Pulsing(TLP) Plot**



**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 – 180 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 <sup>+0/-5</sup> °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 ( $T_p$ )		8 minutes Max.
Do not exceed		260°C



**Product Characteristics**

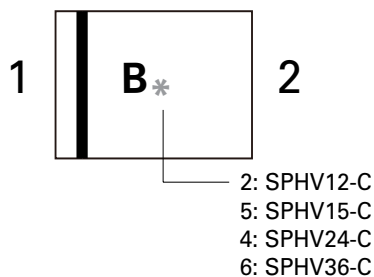
<b>Lead Plating</b>	Pre-Plated Frame
<b>Lead Material</b>	Copper Alloy
<b>Lead Coplanarity</b>	0.0004 inches (0.102mm)
<b>Substitute Material</b>	Silicon
<b>Body Material</b>	Molded Epoxy, rated UL 94 V-0

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

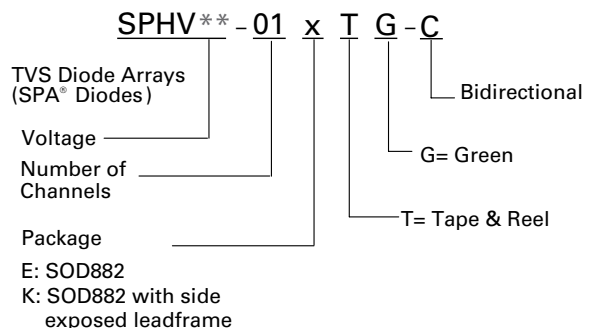
**Ordering Information**

Part Number	Package	Marking	Min. Order Qty.
SPHV12-01ETG-C	SOD882	B2	10000
SPHV15-01ETG-C		B5	
SPHV24-01ETG-C		B4	
SPHV36-01ETG-C		B6	
SPHV12-01KTG-C	SOD882 with side exposed leadframe	B2	10000
SPHV15-01KTG-C		B5	
SPHV24-01KTG-C		B4	
SPHV36-01KTG-C		B6	

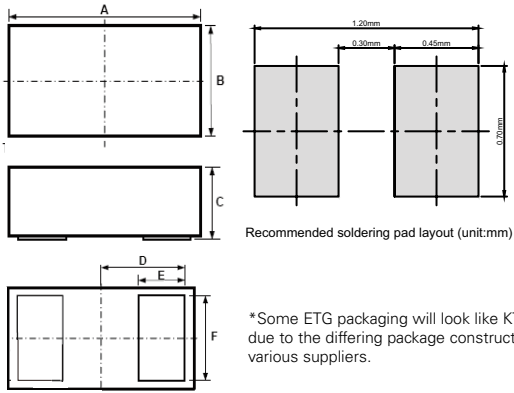
**Part Marking System**



**Part Numbering System**

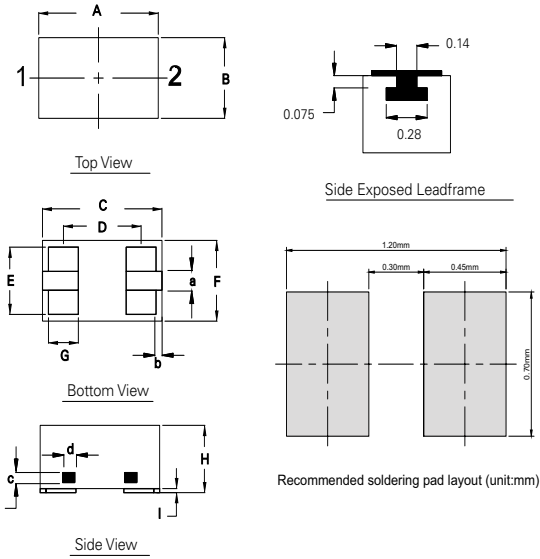


**Package Dimensions — SOD882(SPHVxx-01ETG-C)**



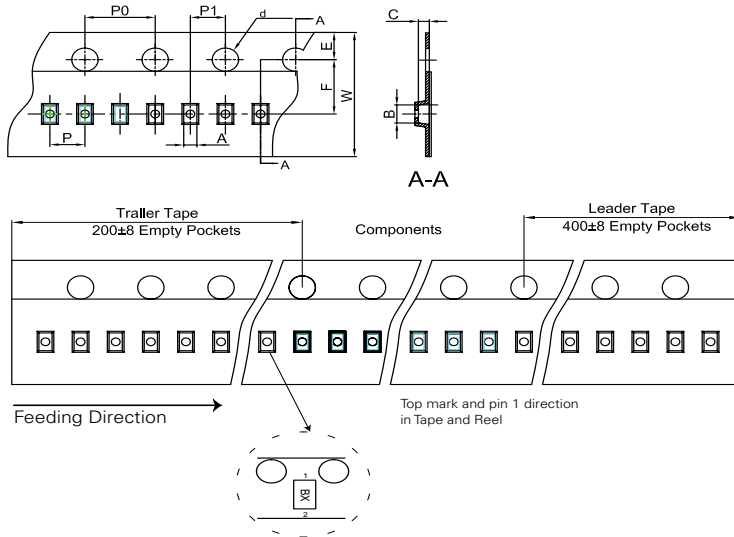
Symbol	Package	SOD882				
	JEDEC	MO-236				
	Millimeters			Inches		
	Min	Typ	Max	Min	Typ	Max
<b>A</b>	0.90	1.00	1.10	0.037	0.039	0.041
<b>B</b>	0.50	0.60	0.70	0.022	0.024	0.026
<b>C</b>	0.40	0.50	0.60	0.016	0.020	0.024
<b>D</b>	0.45			0.018		
<b>E</b>	0.20	0.25	0.35	0.008	0.010	0.012
<b>F</b>	0.45	0.50	0.55	0.018	0.020	0.022

**Package Dimensions — SOD882 with side exposed leadframe(SPHVxx-01KTG-C)**



Symbol	Package	SOD882 with side exposed leadframe				
	JEDEC	MO-236				
	Millimeters			Inches		
	Min	Typ	Max	Min	Typ	Max
<b>A</b>	0.90	1.00	1.10	0.037	0.039	0.043
<b>B</b>	0.50	0.60	0.70	0.020	0.024	0.028
<b>C</b>	0.90	1.00	1.10	0.037	0.039	0.043
<b>D</b>	0.55	0.65	0.75	0.022	0.026	0.030
<b>E</b>	0.40	0.50	0.60	0.016	0.020	0.024
<b>F</b>	0.50	0.60	0.70	0.020	0.024	0.028
<b>G</b>	0.20	0.25	0.30	0.008	0.010	0.012
<b>H</b>	0.40	0.50	0.60	0.016	0.020	0.024
<b>I</b>	0.05 max			0.002 max		
<b>a</b>	-	0.14	-	-	0.006	-
<b>b</b>	-	0.05	-	-	0.002	-
<b>c</b>	-	0.075	-	-	0.003	-
<b>d</b>	-	0.10	-	-	0.004	-

**Embossed Carrier Tape & Reel Specification**



Symbol	Millimeters
<b>A</b>	0.70+/-0.045
<b>B</b>	1.10+/-0.045
<b>C</b>	0.65+/-0.045
<b>d</b>	1.55+/-0.10
<b>E</b>	1.75+/-0.05
<b>F</b>	3.50+/-0.05
<b>P</b>	2.00+/-0.10
<b>P0</b>	4.00+/-0.10
<b>P1</b>	2.00+/-0.10
<b>W</b>	8.00 + 0.30 -0.10