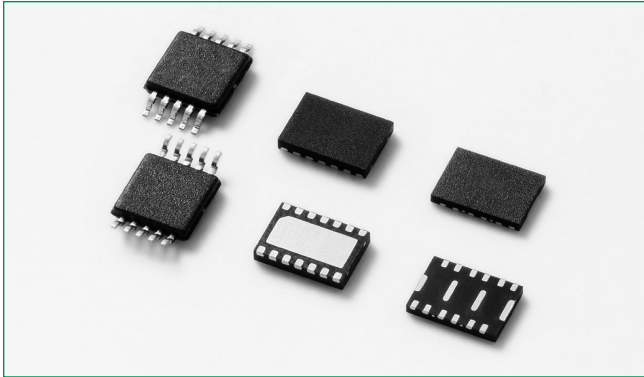


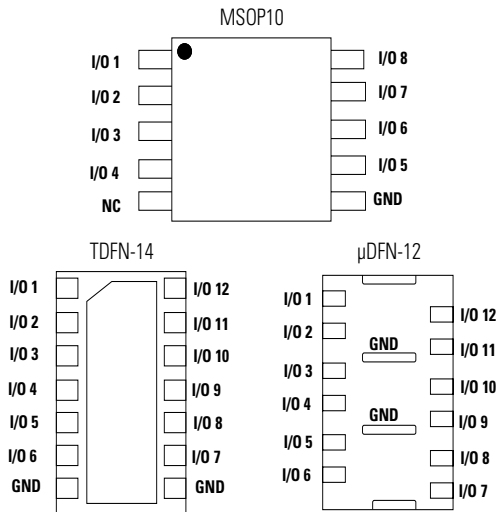
**SP4050 Series**



**OBSOLETE** DATE: 06/10th/2020 PCN/ECN# ESU270-51  
REPLACED BY: SP4060-08ATG

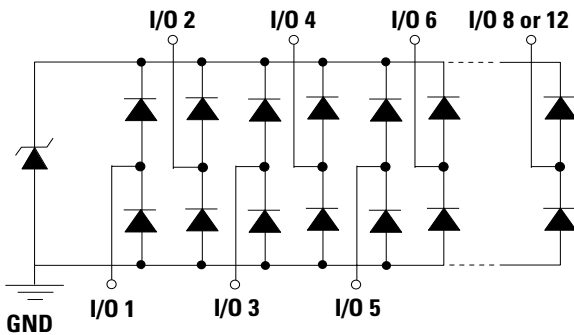


**Pinout**



Note: Pinout diagrams above shown as component footprint on circuit board.

**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 SP4050 integrates low capacitance diodes with an additional zener diode to protect each I/O pin against ESD and high surge events. This robust component can safely absorb up to 20A per IEC 61000-4-5 2<sup>nd</sup> edition ( $t_p=8/20\mu s$ ) without performance degradation and a minimum  $\pm 30kV$  ESD per IEC 61000-4-2 International Standard. Their low loading capacitance also makes them ideal for protecting high speed signal pins.

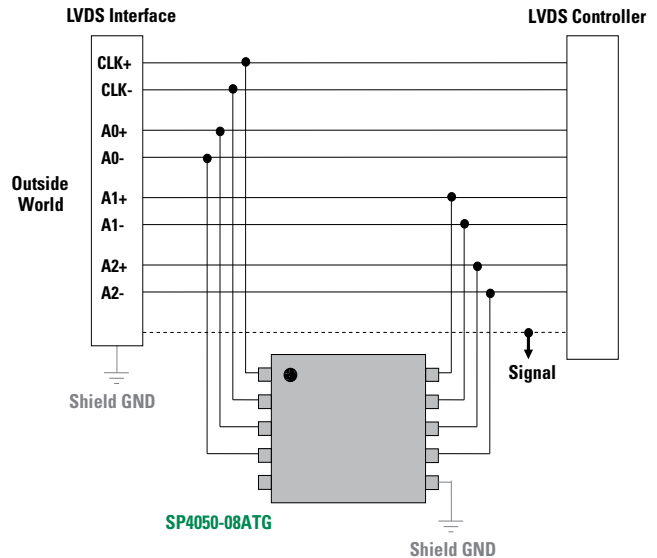
**Features**

- ESD, IEC 61000-4-2,  $\pm 30kV$  contact,  $\pm 30kV$  air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, IEC 61000-4-5 2<sup>nd</sup> edition, 20A ( $t_p=8/20\mu s$ )
- Low capacitance of 4.4pF (TYP) per I/O
- Low leakage current of 0.5 $\mu A$  (MAX) at 2.5V
- Moisture Sensitivity Level (MSL -1)
- Halogen free, lead free and RoHS compliant

**Applications**

- LCD/PDP TVs
- Desktops
- Game Consoles
- Set Top Boxes
- Notebooks

**Application Example**



### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$I_{PP}$	Peak Current ( $t_p=8/20\mu s$ )	20.0	A
$P_{PK}$	Peak Pulse Power ( $t_p=8/20\mu s$ )	300	W
$T_{OP}$	Operating Temperature	-40 to 125	°C
$T_{STOR}$	Storage Temperature	-55 to 150	°C

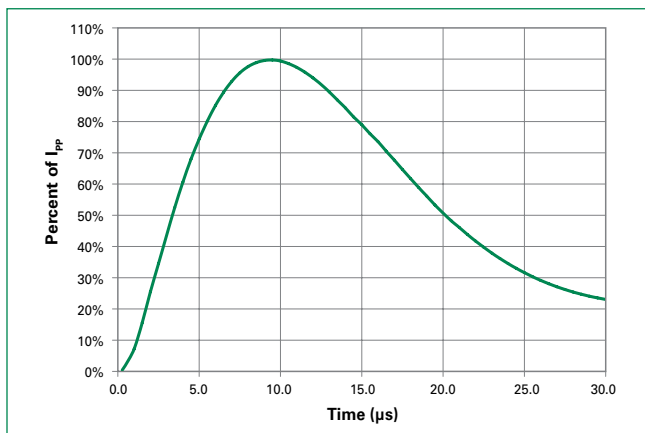
**CAUTION:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the component. This is a stress only rating and operation of the component at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### Electrical Characteristics ( $T_{OP}=25^\circ C$ )

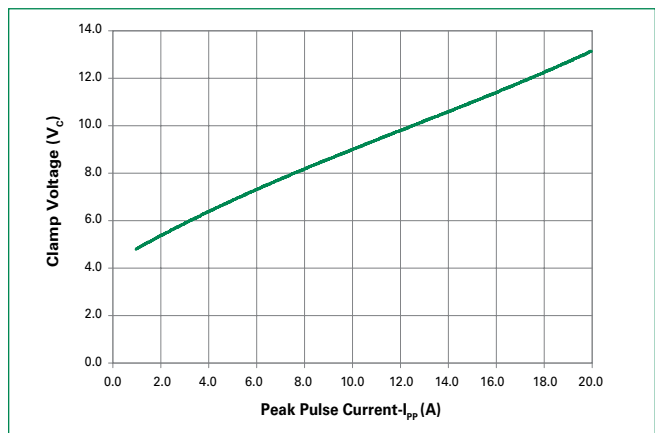
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	$V_{RWM}$				2.5	V
Snap Back Voltage	$V_{SB}$	$I_{SB}=50mA$	2.0			V
Reverse Leakage Current	$I_{LEAK}$	$V_R=2.5V$ , I/O to GND			0.5	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP}=1A$ , $t_p=8/20\mu s$ , Fwd		4.5		V
		$I_{PP}=10A$ , $t_p=8/20\mu s$ , Fwd		8.9		V
		$I_{PP}=20A$ , $t_p=8/20\mu s$ , Fwd		13.2		V
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC 61000-4-2 (Contact)	$\pm 30$			kV
		IEC 61000-4-2 (Air)	$\pm 30$			kV
Diode Capacitance <sup>1</sup>	$C_{I/O-GND}$	Reverse Bias=0V		4.4		pF
Diode Capacitance <sup>1</sup>	$C_{I/O-I/O}$	Reverse Bias=0V		2.2		pF

**Note:** <sup>1</sup> Parameter is guaranteed by design and/or component characterization.

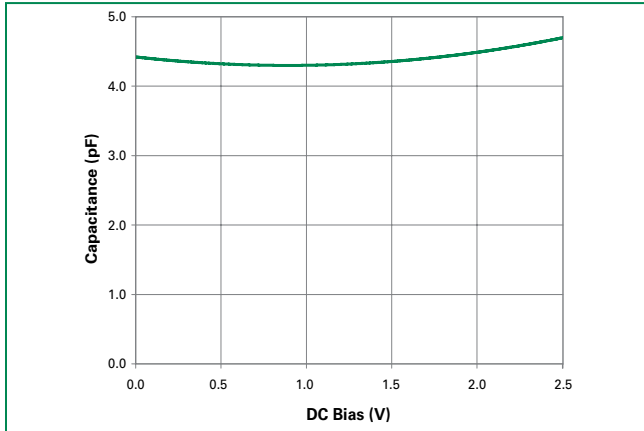
### 8/20 $\mu s$ Pulse Waveform



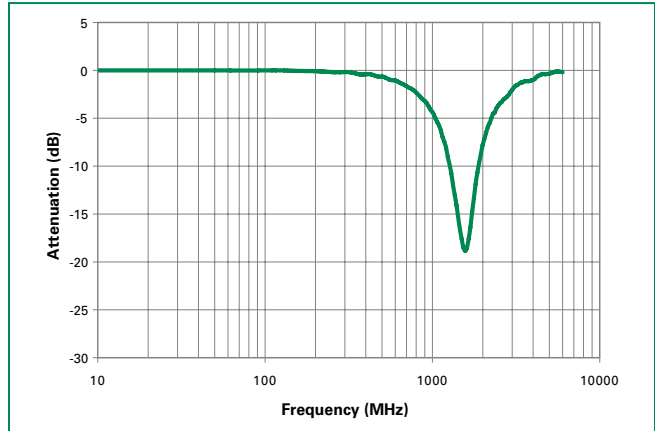
### Clamping Voltage vs. $I_{PP}$



**Capacitance vs. Bias**

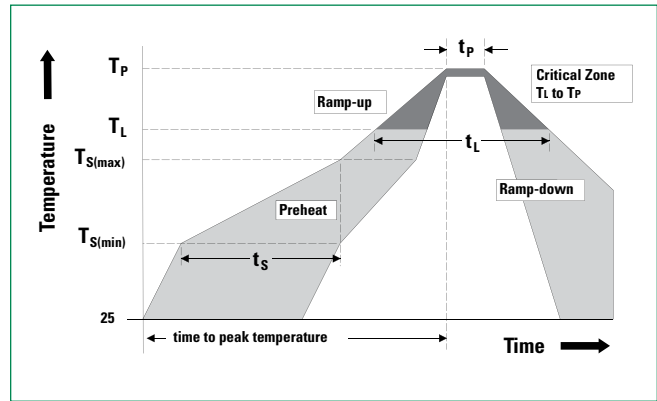


**Insertion Loss (S21) I/O to GND**



**Soldering Parameters**

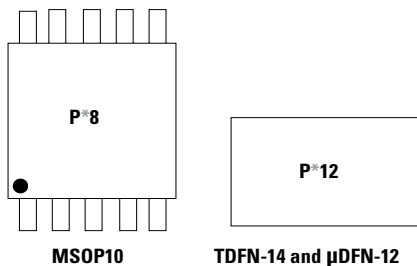
<b>Reflow Condition</b>		Pb – Free assembly
<b>Pre Heat</b>	- Temperature Min ( $T_{s(min)}$ )	150°C
	- Temperature Max ( $T_{s(max)}$ )	200°C
	- Time (min to max) ( $t_s$ )	60 – 180 secs
<b>Average ramp up rate (Liquidus) Temp (<math>T_L</math>) to peak</b>		3°C/second max
<b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>		3°C/second max
<b>Reflow</b>	- Temperature ( $T_L$ ) (Liquidus)	217°C
	- Temperature ( $t_L$ )	60 – 150 seconds
<b>Peak Temperature (<math>T_p</math>)</b>		250 <sup>+0/-5</sup> °C
<b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>		20 – 40 seconds
<b>Ramp-down Rate</b>		6°C/second max
<b>Time 25°C to peak Temperature (<math>T_p</math>)</b>		8 minutes Max.
<b>Do not exceed</b>		260°C



**Ordering Information**

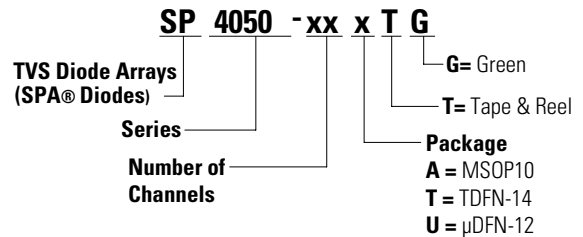
Part Number	Package	Marking	Min. Order Qty.
SP4050-08ATG	MSOP10	P*8	4000
SP4050-12TTG	TDFN-14	P*12	3000
SP4050-12UTG	µDFN-12	P*12	3000

**Part Marking System**

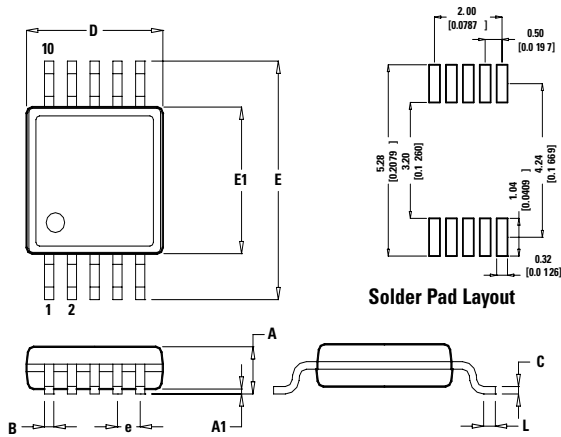


Note: \* Assembly Site

**Part Numbering System**

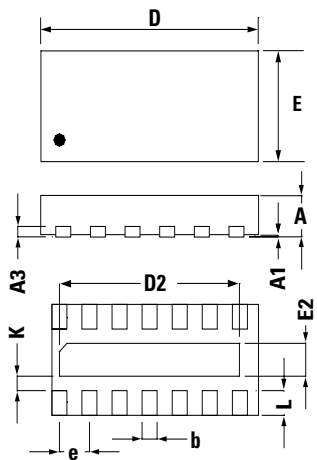


### Package Dimensions - MSOP10



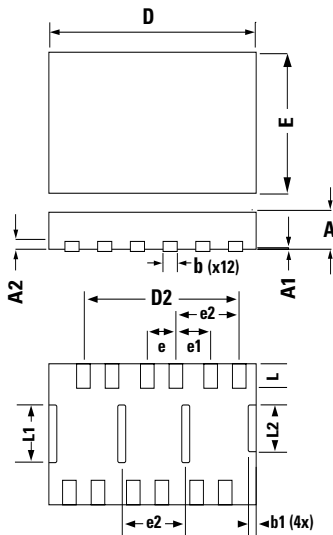
Package	MSOP10			
Pins	10			
Units	Millimeters		Inches	
DIM	Min	Max	Min	Max
A	-	1.10	-	0.043
A1	0.00	0.15	0.000	0.006
B	0.17	0.27	0.007	0.011
c	0.08	0.23	0.003	0.009
D	2.90	3.10	0.114	0.122
E	4.67	5.10	0.184	0.200
E1	2.90	3.10	0.114	0.122
e	0.50 BSC		0.020 BSC	
L	0.40	0.80	0.016	0.032

### Package Dimensions - TDFN-14



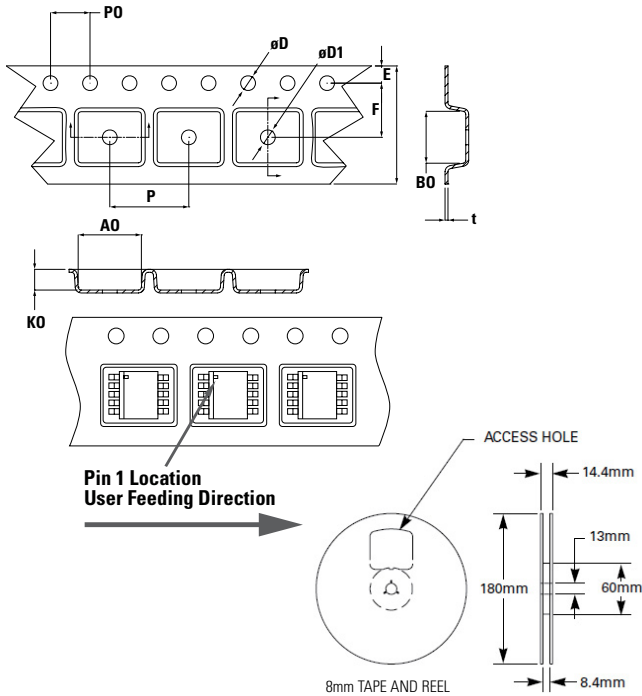
Symbol	TDFN-14			
	Millimeters		Inches	
	Min	Max	Min	Max
A	0.70	0.80	0.028	0.032
A1	0.00	0.05	0.00	0.002
A3	0.203 REF		0.008 REF	
b	0.20	0.30	0.008	0.012
D	3.40	3.60	0.134	0.142
D2	2.95	3.05	0.117	0.121
E	2.40	2.60	0.095	0.103
E2	1.40	1.50	0.056	0.060
e	0.50 BSC		0.02 BSC	
K	0.20	0.25	0.0075	0.095
L	0.25	0.35	0.01	0.014

### Package Dimensions - $\mu$ DFN-12



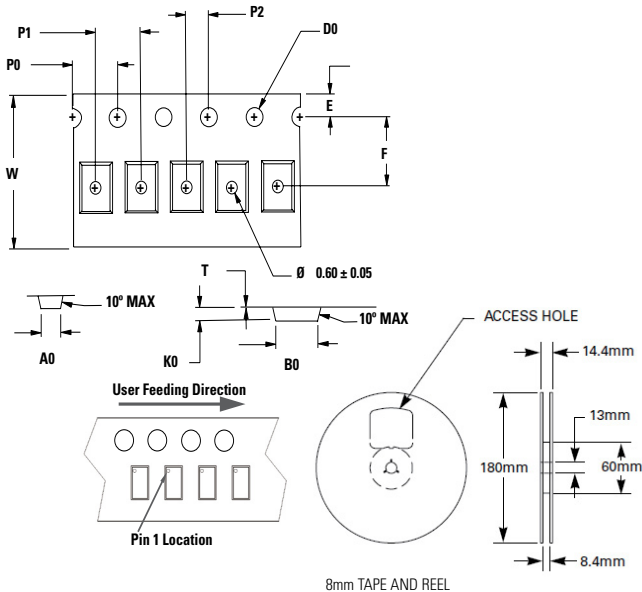
Symbol	$\mu$ DFN-12			
	Millimeters		Inches	
	Min	Max	Min	Max
A	0.50	0.65	0.020	0.026
A1	0.00	0.05	0.00	0.002
A2	0.150 REF		0.006 REF	
b	0.15	0.25	0.006	0.010
b1	0.10	0.30	0.004	0.012
D	3.40	3.60	0.134	0.142
D2	2.70		0.106	
E	2.40	2.60	0.095	0.103
e	0.50 BSC		0.020 BSC	
e1	0.60 BSC		0.024 BSC	
e2	1.10 BSC		0.044 BSC	
L	0.30	0.40	0.012	0.016
L1	0.90	1.10	0.036	0.044
L2	0.70	0.90	0.028	0.036

**Embossed Carrier Tape & Reel Specification - MSOP10**



Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A0	5.20	5.40	0.205	0.213
B0	3.20	3.40	0.126	0.134
D	1.50	1.60	0.059	0.063
D1	1.50 Min		0.059 Min	
E	1.65	1.85	0.065	0.073
F	5.40	5.60	0.213	0.220
P0	3.90	4.10	0.154	0.161
10P0	40.0+/- 0.20		1.574+/-0.008	
W	11.90	12.10	0.469	0.476
P	7.90	8.10	0.311	0.319
K0	1.20	1.40	0.047	0.055
t	0.30 +/- 0.05		0.012+/- 0.002	

**Embossed Carrier Tape & Reel Specification - TDFN-14 and μDFN-12**



Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A0	2.63	2.83	0.104	0.112
B0	3.63	3.83	0.143	0.151
D0	1.40	1.60	0.055	0.063
E	1.65	1.85	0.065	0.073
F	5.45	5.55	0.215	0.219
K0	0.85	1.05	0.033	0.041
P0	3.90	4.10	0.154	0.161
P1	3.90	4.10	0.154	0.161
P2	1.95	2.05	0.077	0.081
T	0.18	0.22	0.007	0.009
W	11.90	12.30	0.469	0.484