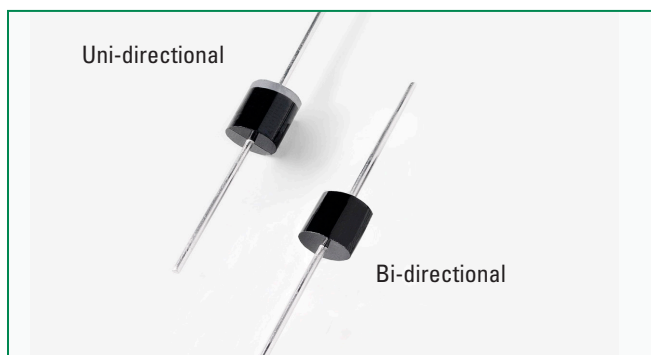


## TLPA Series



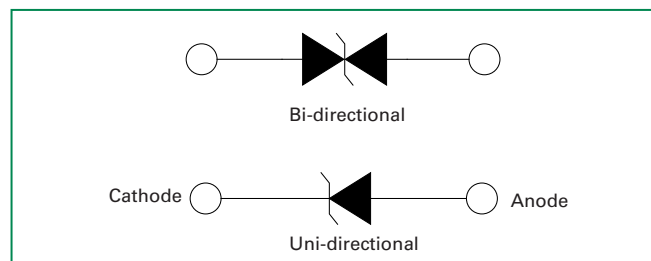
### Agency Approvals

AGENCY	AGENCY FILE NUMBER
	E230531

### Maximum Ratings and Thermal Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation 10/1000 $\mu\text{s}$ Test Waveform	$P_{PPM}$	5000	W
Steady State Power Dissipation on Infinite Heat Sink at $T_L = 75^\circ\text{C}$ (Fig. 6)	$P_{M(AV)}$	8.0	W
Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)	$I_{FSM}$	400	A
Maximum Instantaneous Forward Voltage at 100A for Unidirectional Only	$V_F$	3.5	V
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 175	$^\circ\text{C}$
Typical Thermal Resistance Junction to Lead	$R_{\theta JL}$	8.0	$^\circ\text{C/W}$
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	40	$^\circ\text{C/W}$

### Functional Diagram



### Description

The TLPA Series is packaged in a highly reliable industry standard P600 axial leaded package and is designed to provide precision overvoltage protection for sensitive electronics.

### Features


- High reliability application
  - Glass passivated chip junction in P600 package
  - Fast response time: typically less than 1.0ps from 0 Volts to  $V_{BR}$  min
  - Excellent clamping capability
  - Typical failure mode is short from over-specified voltage or current
  - Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
  - ESD protection of data lines in accordance with IEC 61000-4-2, 30kV(Air), 30kV (Contact)
  - EFT protection of data lines in accordance with IEC 61000-4-4
  - Low incremental surge resistance
  - High temperature soldering guaranteed:
- 260 $^\circ\text{C}$ /10 seconds / 0.375"(9.5mm) lead length, 5 lbs., (2.3kg) tension
  - $V_{BR} @ T_J = V_{BR} @ 25^\circ\text{C} \times (1 + 0.1\% \times (T_J - 25))$   
(0.1%:Typical Temperature Coefficient)
  - UL Recognized body that meets flammability rating V-0.
  - UL Recognized to ANSI/UL 497B: Protectors for Data Communications and Fire-Alarm Circuits.
  - Matte tin lead-free plated
  - Halogen free and RoHS compliant
  - Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/ JEDEC J-STD-609A.01)

### Applications

Designed to protect sensitive electronics from:

- 50ms Square Test Waveform

### Electrical Characteristics ( $T_A=25^{\circ}\text{C}$ unless otherwise noted)

Part Number (Uni)	Part Number (Bi)	Breakdown Voltage $V_{BR}$ @ $I_T$ (V)		Test Current $I_T$ (mA)	Reverse Stand off Voltage $V_R$ (Volts)	Maximum Reverse Leakage @ $V_R$ $I_R$ ( $\mu\text{A}$ )	Maximum Peak Pulse Current $I_{PP}$ (10/1000 $\mu\text{s}$ ) (A)	Maximum Peak Pulse Current $I_{PP}$ (50ms Square) (A)	Maximum Clamping Voltage @ $I_{PP}$ (10/1000 $\mu\text{s}$ ) $V_C$ (V)	Maximum Clamping Voltage @ $I_{PP}$ (50ms Square) $V_C$ (V)	Agency Approval 
		MIN	MAX								
TLPA10A	TLPA10CA	11.8	13.0	5.0	10	10	300.0	82	17.0	21	X
TLPA11A	TLPA11CA	12.2	13.5	5.0	11	10	280.0	78	18.2	22	X
TLPA12A	TLPA12CA	13.3	14.7	5.0	12	10	256.3	72	19.9	24	X
TLPA13A	TLPA13CA	14.4	15.9	5.0	13	10	237.2	68	21.5	25	X
TLPA14A	TLPA14CA	15.6	17.2	5.0	14	10	219.8	63	23.2	27	X
TLPA15A	TLPA15CA	16.7	18.5	5.0	15	10	209.0	61	24.4	28	X
TLPA16A	TLPA16CA	17.8	19.7	5.0	16	10	196.2	57	26.0	30	X
TLPA17A	TLPA17CA	18.9	20.9	5.0	17	10	184.8	54	27.6	32	X
TLPA18A	TLPA18CA	20.0	22.1	5.0	18	10	174.4	52	29.2	33	X
TLPA20A	TLPA20CA	22.2	24.5	5.0	20	10	157.4	48	32.4	36	X
TLPA22A	TLPA22CA	24.4	26.9	5.0	22	10	143.7	44	35.5	39	X
TLPA24A	TLPA24CA	26.7	29.5	5.0	24	10	131.1	41	38.9	42	X
TLPA26A	TLPA26CA	28.9	31.9	5.0	26	10	121.1	38	42.1	46	X
TLPA28A	TLPA28CA	31.1	34.4	5.0	28	10	112.3	35	45.4	49	X
TLPA30A	TLPA30CA	33.3	36.8	5.0	30	10	105.4	33	48.4	52	X
TLPA33A	TLPA33CA	36.7	40.6	5.0	33	10	95.7	30	53.3	57	X
TLPA36A	TLPA36CA	40.0	44.2	5.0	36	10	87.8	28	58.1	62	X
TLPA40A	TLPA40CA	44.4	49.1	5.0	40	10	79.1	25	64.5	68	X

Notes:

1.  $V_{BR}$  measured after  $I_T$  applied for 300 $\mu\text{s}$ ,  $I_T$  = square wave pulse or equivalent.

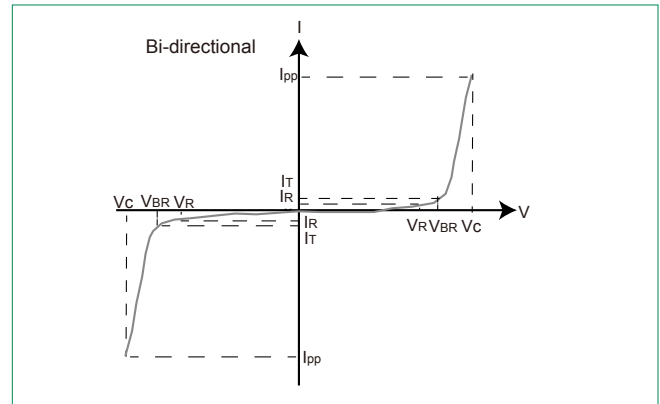
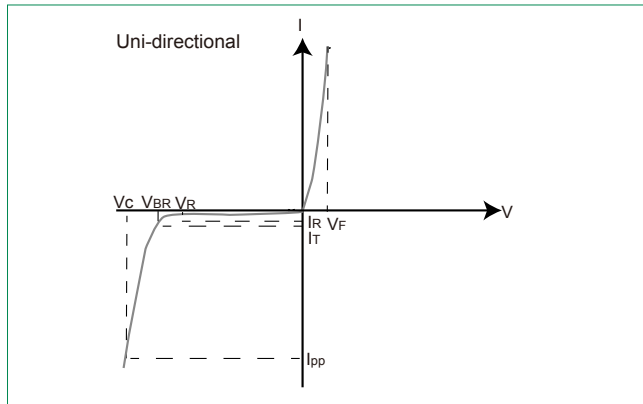
2. All terms and symbols are consistent with ANSI/IEEE C62.35.

### Screen Process

<b>100% Vision Inspection</b>	MIL-STD-750 method 2074
<b>100% High Temperature Storage Life (168hrs,175°C)</b>	MIL-STD-750 method 1031
<b>100% Temperature Cycle Test (-55 to150°C, 20 cycles, dwell time 15 min)</b>	MIL-STD-750 method 1051
<b>100% Surge Test (2x)</b>	MIL-STD-750 method 4066
<b>100% HTRB 150°C Bias=VR(80% breakdown voltage, 96hrs, and each direction 96hrs for Bi-directional products)</b>	MIL-STD-750 method 1038
<b>Final Electrical Test( 100% 3 sigma limit, 100% dynamic test and PAT limit)</b>	MIL-STD-750 method 4016.4021.4011

Note: Up-screen program can be specified by customer's request by contacting Littelfuse customer service

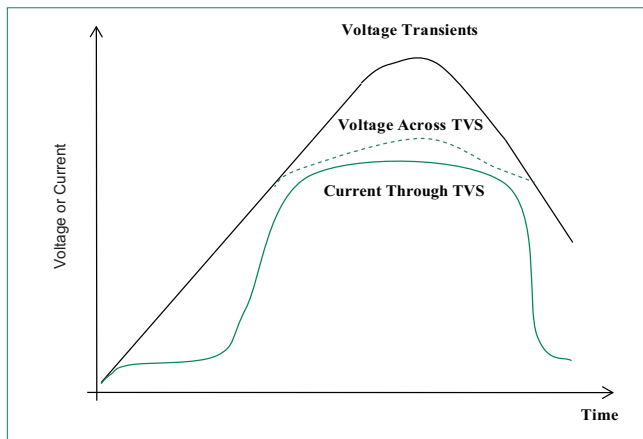
## I-V Curve Characteristics



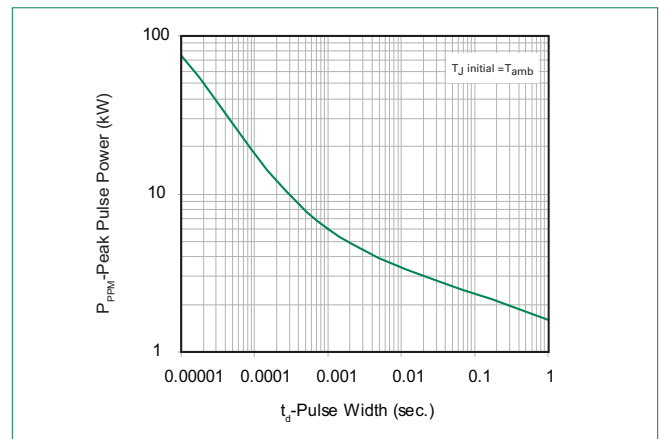
- $P_{PPM}$  Peak Pulse Power Dissipation** ( $I_{PP} \times V_C$ )-- Max power dissipation  
 **$V_R$  Stand-off Voltage** -- Maximum voltage that can be applied to the TVS without operation  
 **$V_{BR}$  Breakdown Voltage** -- Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )  
 **$V_C$  Clamping Voltage** -- Peak voltage measured across the TVS at a specified  $I_{PPM}$  (peak impulse current)  
 **$I_R$  Reverse Leakage Current** -- Current measured at  $V_R$   
 **$V_F$  Forward Voltage Drop for Uni-directional**

## Ratings and Characteristic Curves ( $T_A=25^\circ\text{C}$ unless otherwise noted)

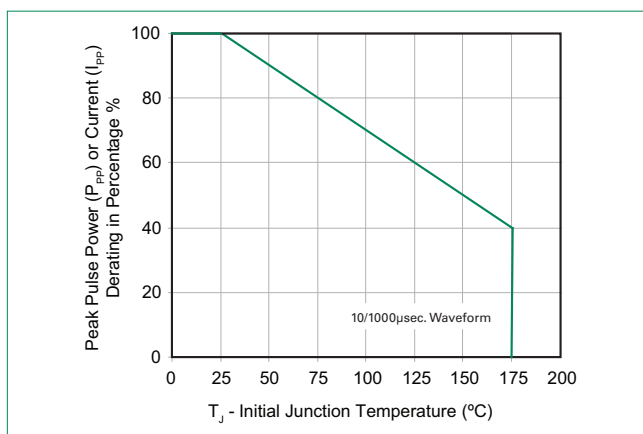
**Figure 1 - TVS Transients Clamping Waveform**



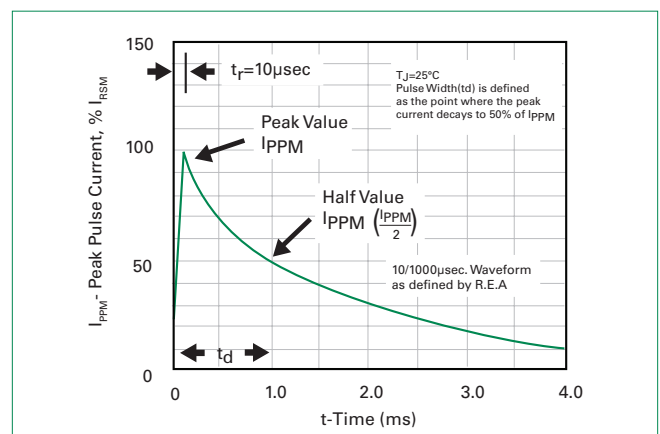
**Figure 2 - Peak Pulse Power Rating Curve**



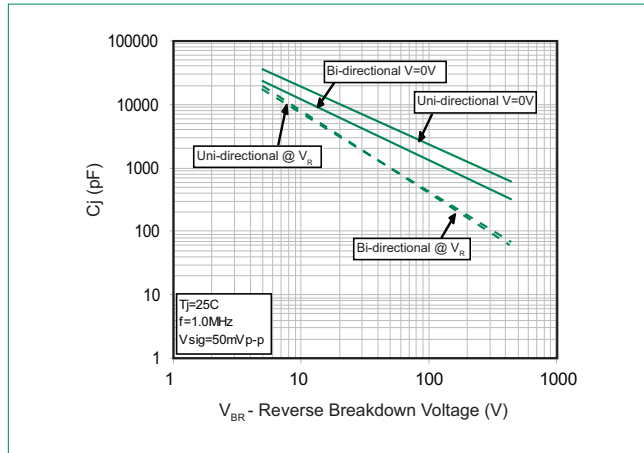
**Figure 3 - Pulse Derating Curve**



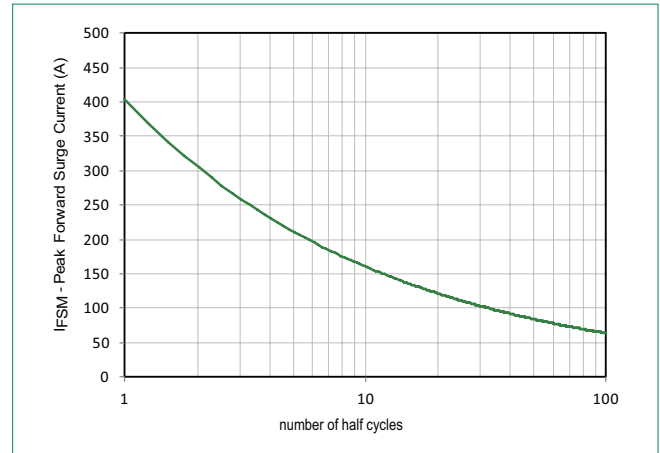
**Figure 4 - Pulse Waveform**



**Figure 5 - Typical Junction Capacitance**



**Figure 6 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only**



### Physical Specifications

<b>Weight</b>	0.07oz., 2.1g
<b>Case</b>	P600 molded plastic body over passivated junction.
<b>Polarity</b>	Color band denotes cathode for unidirectional components
<b>Terminal</b>	Matte Tin axial leads, solderable per JESD22-B102.

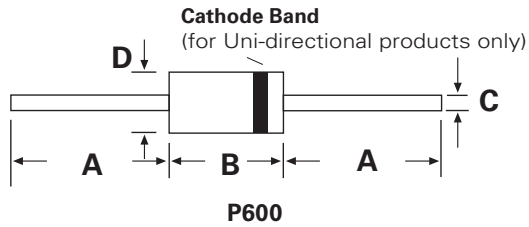
### Flow/Wave Soldering (Solder Dipping)

<b>Peak Temperature :</b>	265°C
<b>Dipping Time :</b>	10 seconds
<b>Soldering :</b>	1 time

### Environmental Specifications

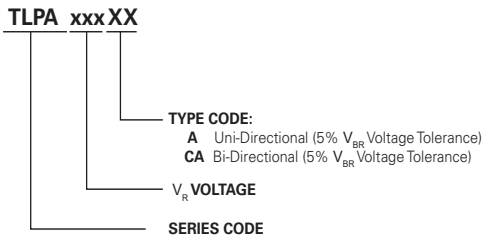
<b>High Temp. Storage</b>	JESD22-A103
<b>HTRB</b>	JESD22-A108
<b>Temperature Cycling</b>	JESD22-A104
<b>H3TRB</b>	JESD22-A101
<b>RSH</b>	JESD22-B106

## Dimensions

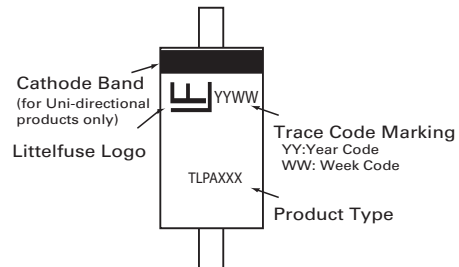


Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
A	1.000	-	25.40	-
B	0.340	0.360	8.60	9.10
C	0.048	0.054	1.22	1.36
D	0.340	0.360	8.60	9.10

## Part Numbering System



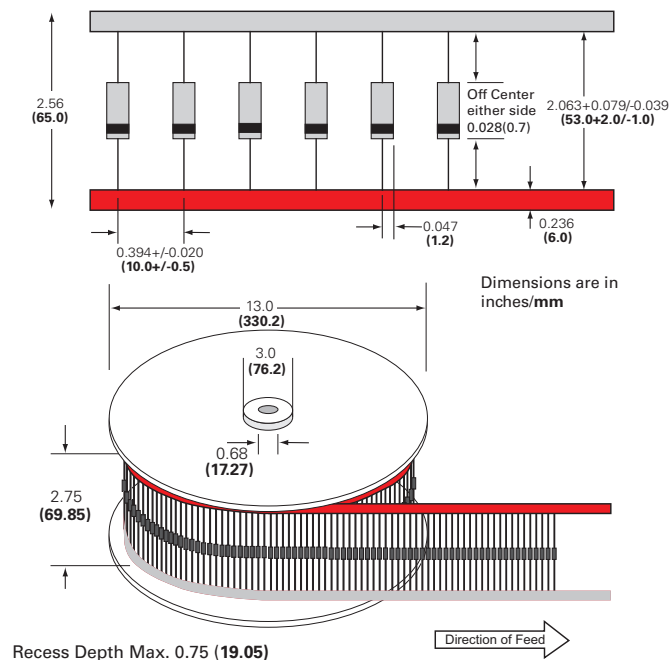
## Part Marking System



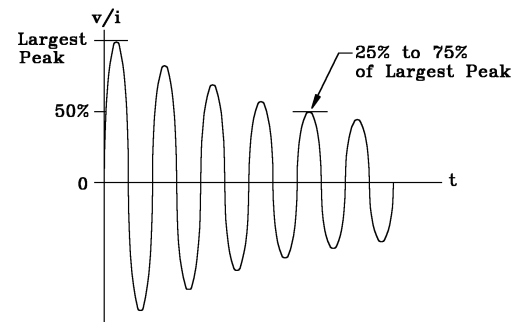
## Packing Options

Part Number	Component Package	Quantity	Packaging Option	Packaging Specification
TLPAXXX	P600	800	Tape & Reel	EIA STD RS-296

## Tape and Reel Specification

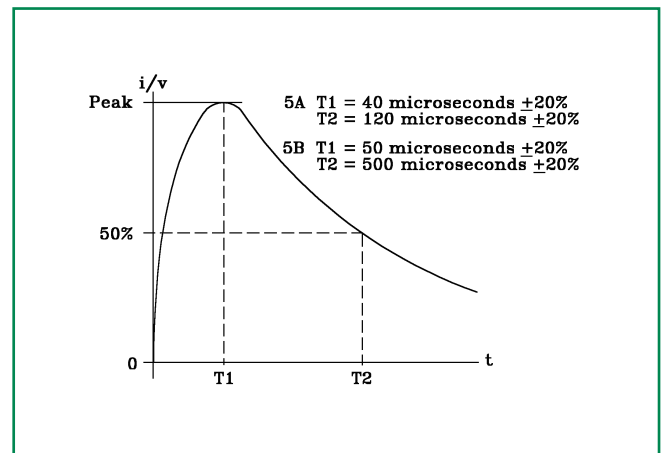
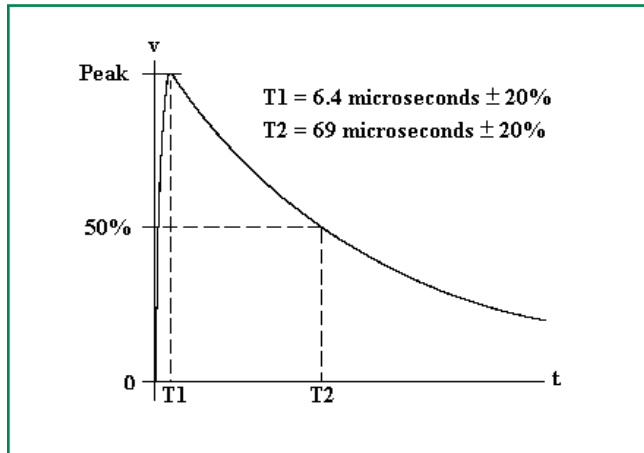


## RTCA/DO-160G Wave 3



- Notes:
1. Voltage and current are not required to be in phase.
  2. The waveshape may have either a damped sine or cosine waveshape.

**RTCA/DO-160G Wave 4 and Wave 5**



**Pin Injection Protection Per RTCA/DO-160G**

Part Number (Uni)	Part Number (Bi)	25C							70C						120C					
		Wave 3	Wave 4 (6.4/69us)			Wave 5a (40/120us)			Wave 3	Wave 4 (6.4/69us)			Wave 5a (40/120us)		Wave 3	Wave 4 (6.4/69us)			Wave 5a (40/120us)	
		L5	L3	L4	L5	L3	L4	L5	L5	L3	L4	L5	L3	L4	L5	L3	L4	L5	L3	L4
		128A	60A	150A	320A	300A	750A	1600A	128A	60A	150A	320A	300A	750A	128A	60A	150A	320A	300A	750A
TLPA10A	TLPA10CA	pass	pass	pass	pass	pass	pass	-	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass
TLPA11A	TLPA11CA	pass	pass	pass	pass	pass	pass	-	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass
TLPA12A	TLPA12CA	pass	pass	pass	pass	pass	pass	-	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	-
TLPA13A	TLPA13CA	pass	pass	pass	pass	pass	pass	-	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	-
TLPA14A	TLPA14CA	pass	pass	pass	pass	pass	pass	-	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	-
TLPA15A	TLPA15CA	pass	pass	pass	pass	pass	pass	-	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	-
TLPA16A	TLPA16CA	pass	pass	pass	pass	pass	-	-	pass	pass	pass	pass	pass	-	pass	pass	pass	pass	pass	-
TLPA17A	TLPA17CA	pass	pass	pass	pass	pass	-	-	pass	pass	pass	pass	pass	-	pass	pass	pass	pass	pass	-
TLPA18A	TLPA18CA	pass	pass	pass	pass	pass	-	-	pass	pass	pass	pass	pass	-	pass	pass	pass	pass	pass	-
TLPA20A	TLPA20CA	pass	pass	pass	pass	pass	-	-	pass	pass	pass	pass	pass	-	pass	pass	pass	pass	pass	-
TLPA22A	TLPA22CA	pass	pass	pass	pass	pass	-	-	pass	pass	pass	pass	-	-	pass	pass	pass	pass	pass	-
TLPA24A	TLPA24CA	pass	pass	pass	pass	pass	-	-	pass	pass	pass	pass	-	-	pass	pass	pass	pass	pass	-
TLPA26A	TLPA26CA	pass	pass	pass	pass	pass	-	-	pass	pass	pass	pass	-	-	pass	pass	pass	pass	pass	-
TLPA28A	TLPA28CA	pass	pass	pass	pass	pass	-	-	pass	pass	pass	pass	-	-	pass	pass	pass	pass	pass	-
TLPA30A	TLPA30CA	pass	pass	pass	pass	pass	-	-	pass	pass	pass	pass	-	-	pass	pass	pass	pass	pass	-
TLPA33A	TLPA33CA	pass	pass	pass	pass	-	-	-	pass	pass	pass	pass	-	-	pass	pass	pass	-	-	-
TLPA36A	TLPA36CA	pass	pass	pass	pass	-	-	-	pass	pass	pass	pass	-	-	pass	pass	pass	-	-	-
TLPA40A	TLPA40CA	pass	pass	pass	pass	-	-	-	pass	pass	pass	pass	-	-	pass	pass	pass	-	-	-

Note:

1. L1 = Level 1, L2 = Level 2, L3 = Level 3, L4 = Level 4, L5 = Level 5

**Disclaimer Notice - Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications.**

**Read complete Disclaimer Notice at <http://www.littelfuse.com/disclaimer-electronics>.**