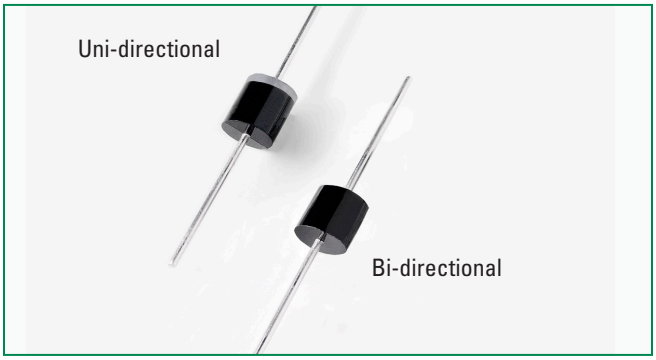
TLP Series



Agency Approvals

AGENCY	AGENCY FILE NUMBER
	E230531

Maximum Ratings and Thermal Characteristics (T_A=25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation 10/1000µs Test Waveform	P_{PPM}	5000	W
Steady State Power Dissipation on Inifinite Heat Sink at T_L=75°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	°C
Typical Thermal Resistance Junction to Lead	$R_{\theta JL}$	8.0	°C/W
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	40	°C/W

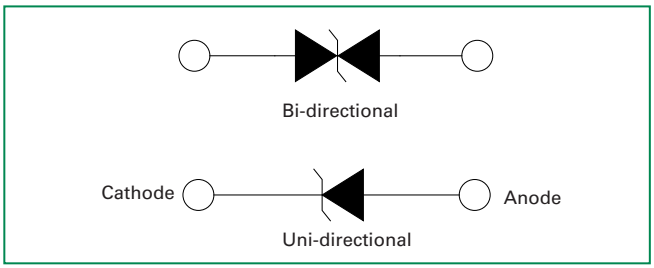
Description

The TLP 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°C/10 seconds / 0.375",(9.5mm) lead length, 5 lbs., (2.3kg) tension
- V_{BR} @T_J= V_{BR}@25°C x (1+0.1% x (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)

Functional Diagram



Applications

Designed to protect sensitive electronics from:

- 50ms Square Test Waveform

Revised: 04/25/19

Electrical Characteristics (T_A=25°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 (µA)	Maximum Peak Pulse Current I_{pp} (10/1000µS) (A)	Maximum Peak Pulse Current I_{pp} (50ms Square) (A)	Maximum Clamping Voltage @ I_{PP} (10/1000µS) V_C (V)	Maximum Clamping Voltage @ I_{PP} (50ms Square) V_C (V)	Agency Approval
		MIN	MAX								
TLP10A	TLP10CA	11.8	13.0	5.0	10	10	300.0	82	17.0	21	X
TLP11A	TLP11CA	12.2	13.5	5.0	11	10	280.0	78	18.2	22	X
TLP12A	TLP12CA	13.3	14.7	5.0	12	10	256.3	72	19.9	24	X
TLP13A	TLP13CA	14.4	15.9	5.0	13	10	237.2	68	21.5	25	X
TLP14A	TLP14CA	15.6	17.2	5.0	14	10	219.8	63	23.2	27	X
TLP15A	TLP15CA	16.7	18.5	5.0	15	10	209.0	61	24.4	28	X
TLP16A	TLP16CA	17.8	19.7	5.0	16	10	196.2	57	26.0	30	X
TLP17A	TLP17CA	18.9	20.9	5.0	17	10	184.8	54	27.6	32	X
TLP18A	TLP18CA	20.0	22.1	5.0	18	10	174.4	52	29.2	33	X
TLP20A	TLP20CA	22.2	24.5	5.0	20	10	157.4	48	32.4	36	X
TLP22A	TLP22CA	24.4	26.9	5.0	22	10	143.7	44	35.5	39	X
TLP24A	TLP24CA	26.7	29.5	5.0	24	10	131.1	41	38.9	42	X
TLP26A	TLP26CA	28.9	31.9	5.0	26	10	121.1	38	42.1	46	X
TLP28A	TLP28CA	31.1	34.4	5.0	28	10	112.3	35	45.4	49	X
TLP30A	TLP30CA	33.3	36.8	5.0	30	10	105.4	33	48.4	52	X
TLP33A	TLP33CA	36.7	40.6	5.0	33	10	95.7	30	53.3	57	X
TLP36A	TLP36CA	40.0	44.2	5.0	36	10	87.8	28	58.1	62	X
TLP40A	TLP40CA	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 300µs, I_t= square wave pulse or equivalent.
2. All terms and symbols are consistent with ANSI/IEEE C62.35.

Screen Process

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

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

Group B Test Requirement

Screen	Method	Condition	Requirement
Surge test	10/1000 µs Peak Pulse Waveform	Maximum clamping Voltage (V_C) @ Peak Pulse Current (I_{PP})	Sample Size 45 perform 10x Accept 0 failures
Burn - In (HTRB)	MIL-STD-750, Method 1038.5	Applied voltage 100% V_R@150°C	Sample size 45 340 hours (680 hours for bi-direction products, each direction 340 hours) Accept 0 failures
Electrical test	–	I_R@V_R, $V_{(BR)}$@I_T	Sample size 45 Accept 0 failures

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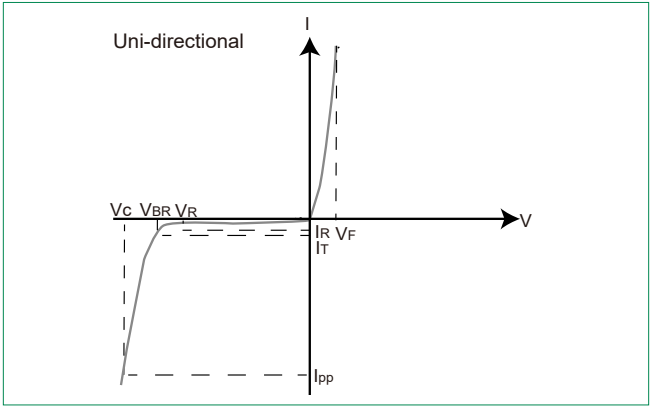
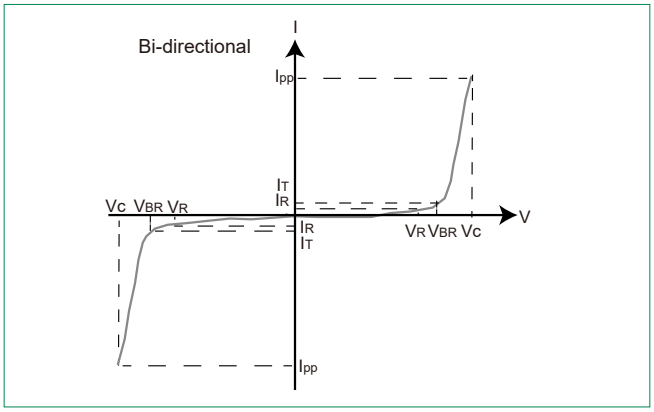
I-V Curve Characteristics





P_{PPM} Peak Pulse Power Dissipation (I_{PP} x 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 though the TVS at a specified test current (I_T)

V_C Clamping Voltage -- Peak voltage measured across the TVS at a specified Ippm (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°C unless otherwise noted)

Figure 1 - TVS Transients Clamping Waveform

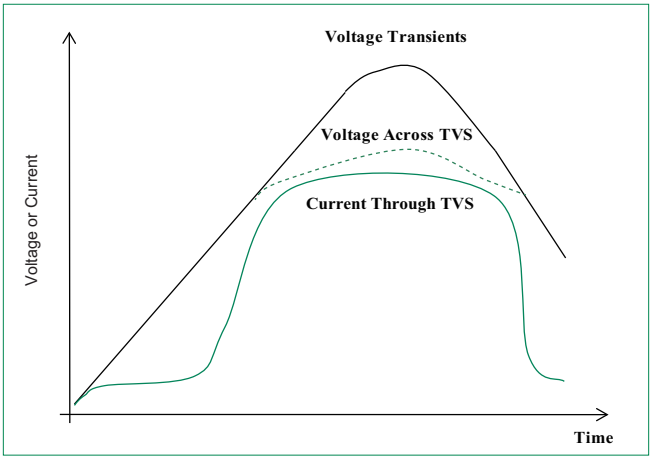


Figure 2 - Peak Pulse Power Rating Curve

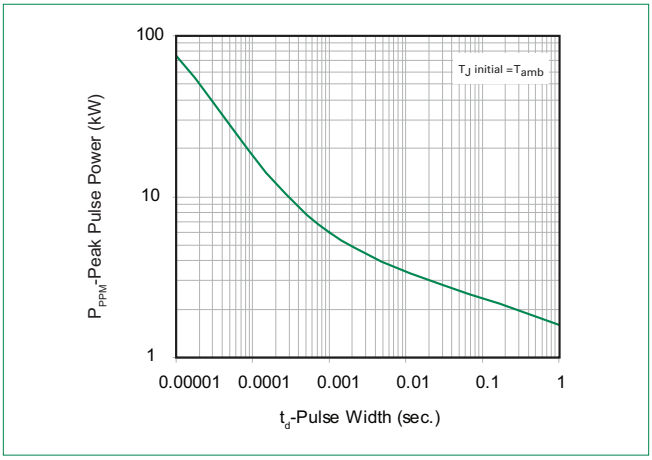


Figure 3 - Pulse Derating Curve

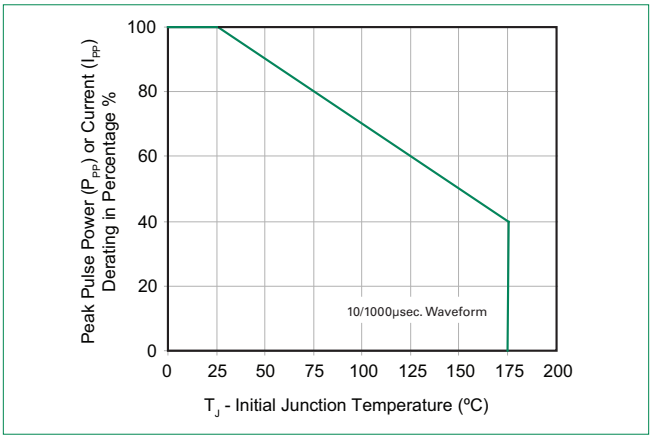


Figure 4 - Pulse Waveform

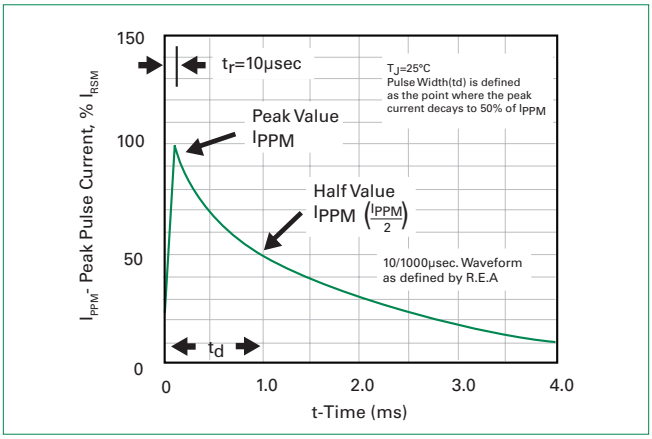


Figure 5 - Typical Junction Capacitance

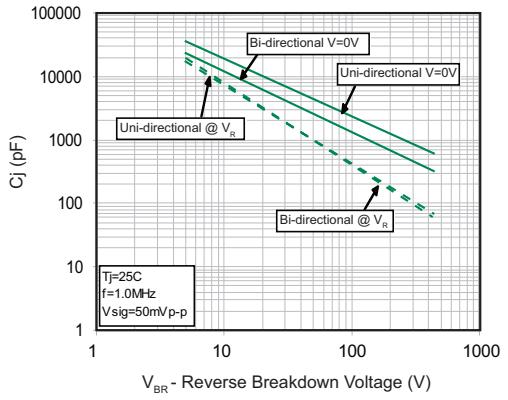
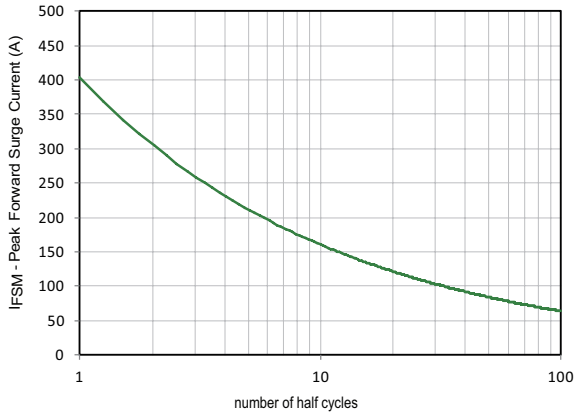


Figure 6 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only



Physical Specifications

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

Flow/Wave Soldering (Solder Dipping)

Peak Temperature :	265°C
Dipping Time :	10 seconds
Soldering :	1 time

Environmental Specifications

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

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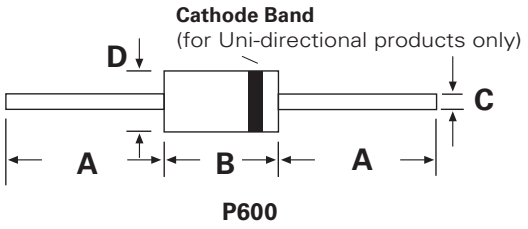
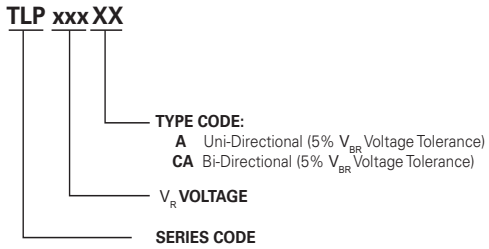
Dimensions



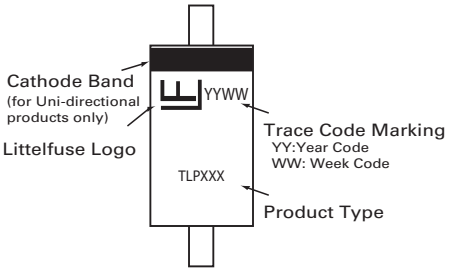
P600

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



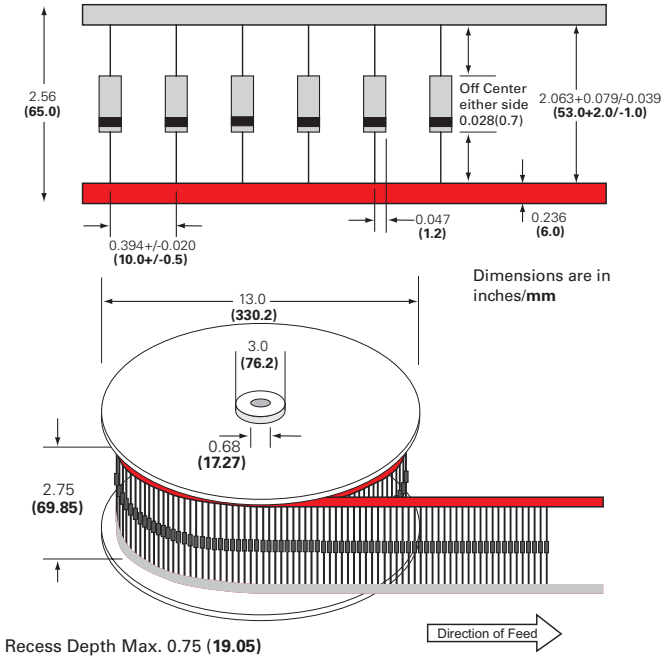
Part Marking System



Packing Options

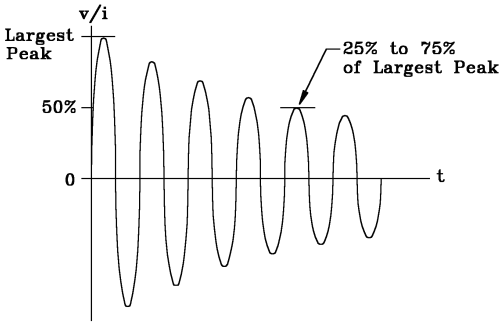
Part Number	Component Package	Quantity	Packaging Option	Packaging Specification
TLPxxXXX	P600	800	Tape & Reel	EIA STD RS-296

Tape and Reel Specification



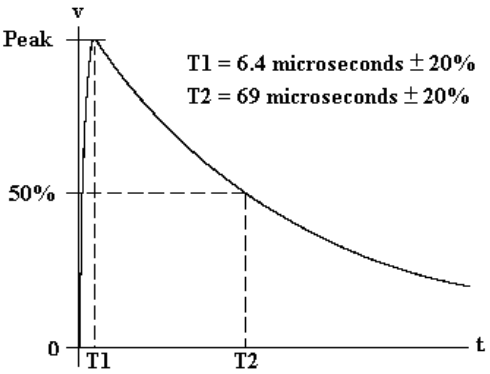
Recess Depth Max. 0.75 (**19.05**)

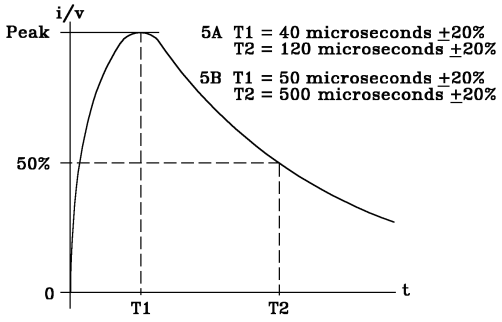
RTCA/DO-160G Wave 3



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	-	-
TLPA22A	TLPA22CA	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	-	-
TLPA26A	TLPA26CA	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	-	-
TLPA30A	TLPA30CA	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 = Level1, L2 = Level 2, L3 = Level 3, L4 = Level 4, L5 = Level 5