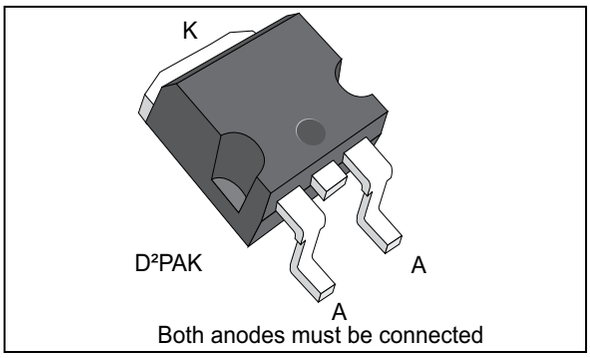
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LDP01-xxAY

Automotive TVS for load dump protection

Datasheet - production data



Both anodes must be connected

Features

- Stand-off voltage range: from 22 to 70 V
- Low leakage current: 1 µA at 25 °C
- Operating T_j max: 175 °C
- High power capability at T_j max
- JEDEC registered package outline
- ROHS and Halogen free
- Resin meets UL 94, V0
- AEC-Q101 compliant

Complies with the following standards:

- IEC 61000-4-2 exceeds level 4
  - 30 kV (air discharge)
  - 30 kV (contact discharge)
- ISO10605 – C = 330 pF, R = 330 Ω
  - 30 kV (air discharge)
  - 30 kV (contact discharge)
- ISO 7637-2
  - Pulse 1: V_S = -150 V
  - Pulse 2a: V_S = +112 V
  - Pulse 3a: Vs = -220 V
  - Pulse 3b: Vs = +150 V
  - Formerly pulses 5a and 5b
- ISO 16750-2
  - Tests A and B

Description

The LDP01-xxAY Transil™ series have been designed to protect automotive sensitive circuits against surges defined in ISO 7637-2 and ISO 16750 tests A and B also called load-dump.

The planar technology makes it compatible with high-end circuits where low leakage current and high junction temperature are required to provide reliability and stability over time.

LDP01-xxAY is packaged in D²PAK.

Table 1. Device summary

Part number	Breakdown voltage (V_{BR} at I_R = 1 mA)		
	min.	typ.	max.
	V		
LDP01-26AY	24.4	26	27.0
LDP01-28AY	26.7	28	29.5
LDP01-30AY	28.9	30	31.9
LDP01-33AY	31.1	33	34.3
LDP01-35AY	33.3	35	36.9
LDP01-39AY	36.7	39	40.5
LDP01-42AY	40	42	44.2
LDP01-47AY	44.4	47	49
LDP01-50AY	47.8	50	52.8
LDP01-56AY	53.3	56	58.9
LDP01-68AY	64.4	68	71.2
LDP01-82AY	77.8	82	86

This is information on a product in full production. www.st.com

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1 Characteristics

Table 2. Absolute maximum ratings (T_{amb} = 25 °C)

Symbol	Parameter		Value	Unit
V_{PP}	Peak pulse voltage	ISO 10605 (C = 330 pF, R = 330 Ω) – contact discharge – air discharge IEC 61000-4-2 – contact discharge – air discharge	 30 30 30 30	kV
T_{stg}	Storage temperature range		-65 to + 175	°C
T_j	Operating junction temperature range		-55 to + 175	°C
T_L	Maximum lead temperature for soldering during 10 s		260	°C

Table 3. Thermal parameter

Symbol	Parameter		Maximum	Unit
$R_{th(j-c)}$	Junction to case	D^2PAK	0.24	°C/W

Figure 1. Electrical characteristics (definitions)

Symbol		Parameter
V_{BR}	=	Breakdown voltage
V_{CL}	=	Clamping voltage
I_{RM}	=	Leakage current at V_{RM}
V_{RM}	=	Stand-off voltage
I_{PP}	=	Peak pulse current
V_F	=	Forward voltage drop
R_d	=	Dynamic impedance
αT	=	Voltage temperature

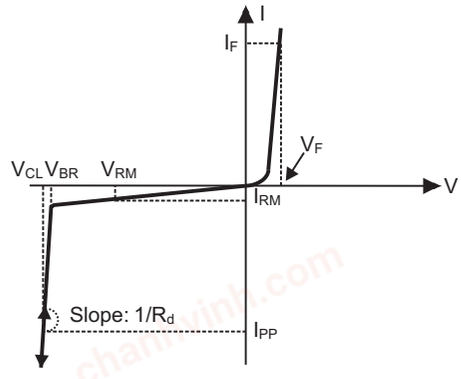
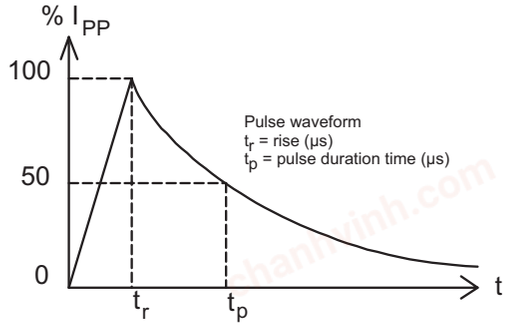


Figure 2. Pulse definition for electrical characteristics



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Table 4. Electrical characteristics (parameter)

Order code	I_{RM} max. at V_{RM}			V_{BR} at I_R(1)				V_{CL} at I_{PP} 10/1000 µs		R_D(2) 10/1000 µs	V_{CL} at I_{PP} 8/20 µs		R_D(2) 8/20 µs	αT(3)
	25 °C	175 °C		min.	typ.	max.		max.			max.			max.
	µA		V	V			mA	V	A	m Ω	V	A	m Ω	10^{-4}/°C
LDP01-26AY	1	100	22	24.4	26	27.0	1	36	140	64	42	1400	11	9.6
LDP01-28AY	1	100	24	26.7	28	29.5	1	40	120	88	45	1250	12	9.7
LDP01-30AY	1	100	27	28.9	30	31.9	1	40	125	65	49	1400	12	9.7
LDP01-33AY	1	100	28	31.1	33	34.3	1	43.5	110	75	56	1250	17	9.8
LDP01-35AY	1	100	30	33.3	35	36.9	1	45.5	95	91	60	1150	20	9.9
LDP01-39AY	1	100	33	36.7	39	40.5	1	51.5	85	129	66	1050	24	10
LDP01-42AY	1	100	36	40	42	44.2	1	57	77	166	71	1000	27	10
LDP01-47AY	1	100	40	44.4	47	49	1	63	65	215	76.5	950	29	10.1
LDP01-50AY	1	100	43	47.8	50	52.8	1	68	55	276	81	900	31	10.2
LDP01-56AY	1	100	48	53.3	56	58.9	1	76	48	356	90	770	40	10.3
LDP01-68AY	1	100	58	64.4	68	71.2	1	92	42	495	110	620	63	10.4
LDP01-82AY	1	100	70	77.8	82	86	1	113	35	771	135	550	89	10.5

1. Pulse test: t_P < 50 ms
2. To calculate maximum clamping voltage at other surge level, use the following formula: $V_{CL}max = R_D \times I_{PP} + V_{BR}max$
3. To calculate V_{BR} or V_{CL} versus junction temperature, use the following formulas:

V_{BR} at T_j = V_{BR} at 25 °C x (1 + α T x (T_j - 25))

V_{CL} at T_j = V_{CL} at 25 °C x (1 + α T x (T_j - 25))

Figure 3. Peak pulse power dissipation versus initial junction temperature (LDP01-30AY)

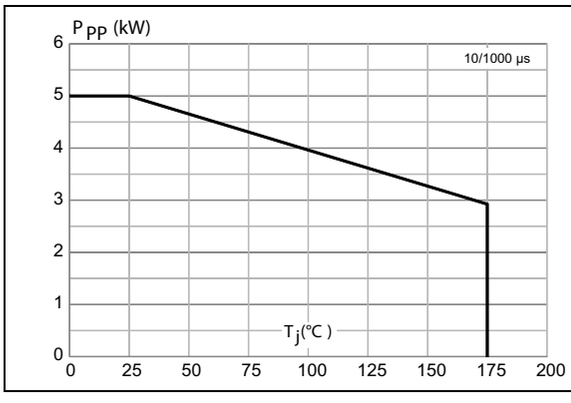
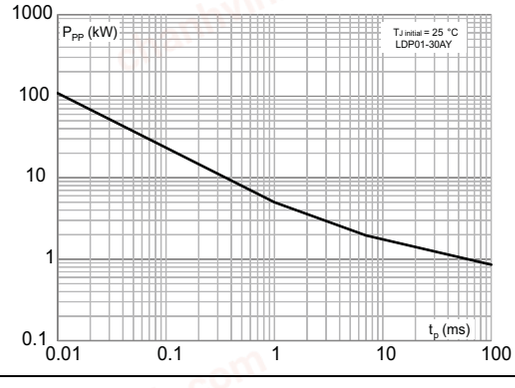


Figure 4. Peak pulse power versus exponential pulse duration (LDP01-30AY)



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Figure 5. ISO7637-2, pulse 5a definition

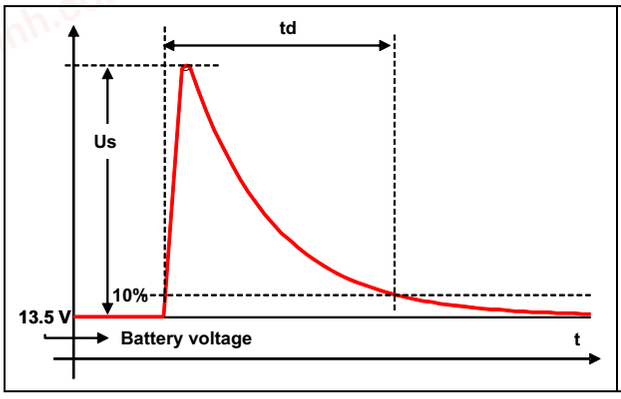


Figure 6. Load dump capability (LDP01-30AY Us = f(Ri) pulse 5a)

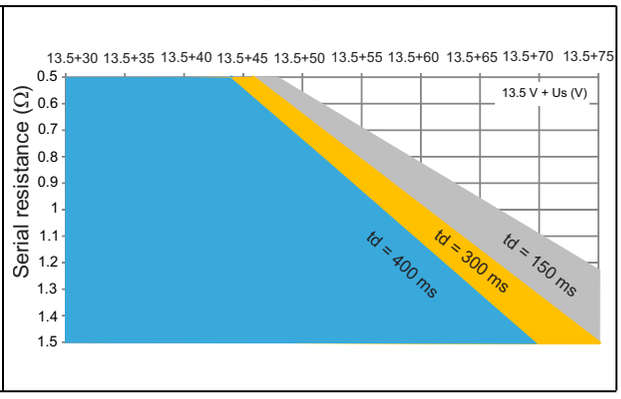


Figure 7. ISO7637-2, pulse 5b definition

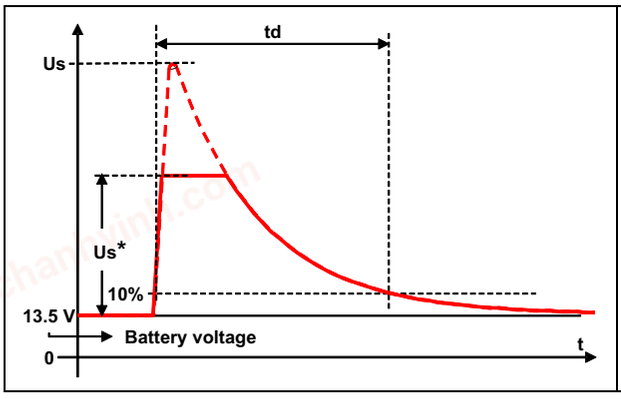


Figure 8. Load dump capability (LDP01-30AY Us* = f(Ri) pulse 5b, U_S = 87 V)

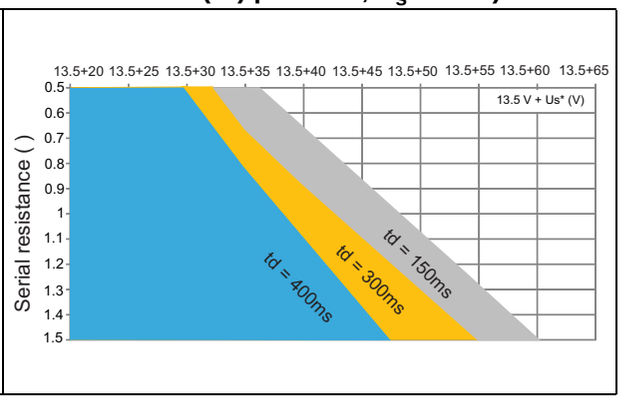


Figure 9. ISO 16750-2, test A definition

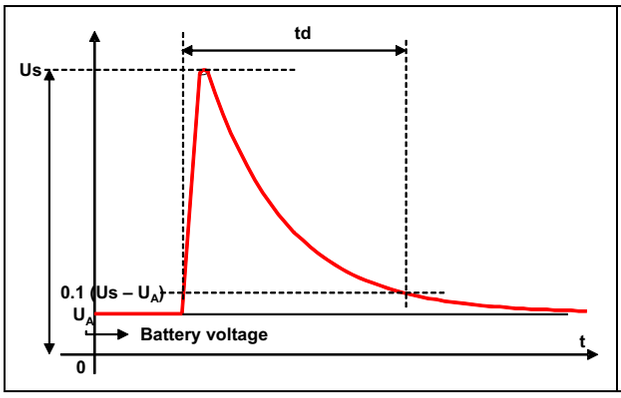
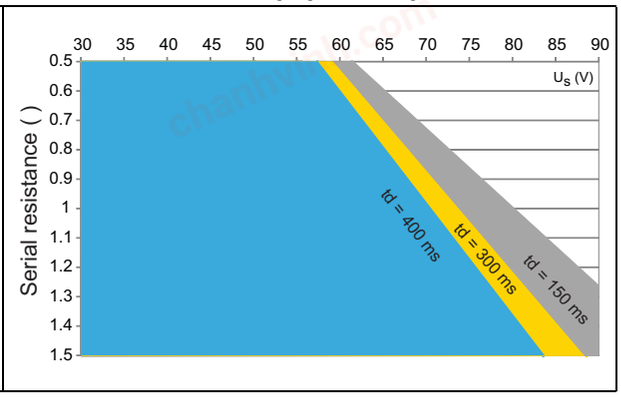


Figure 10. Load dump capability (LDP01-30AY Us = f(Ri), Test A)



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Figure 11. ISO 16750-2, test B definition

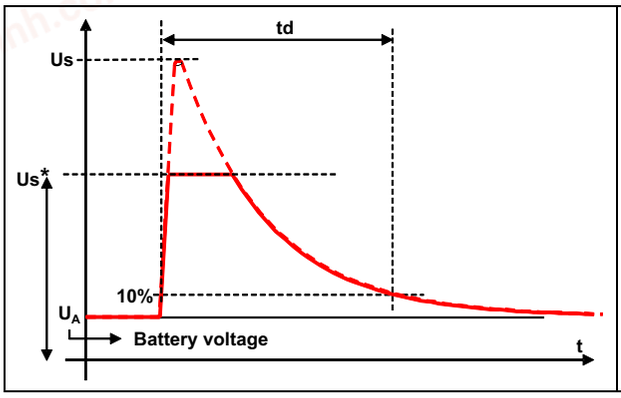


Figure 12. Load dump capability (LDP01-30AY Us* = f(Ri) Test B, U_S = 87 V)

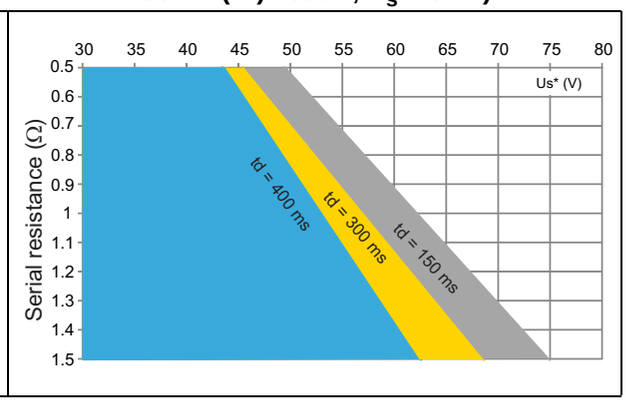


Figure 13. Clamping voltage versus peak pulse current (maximum values)

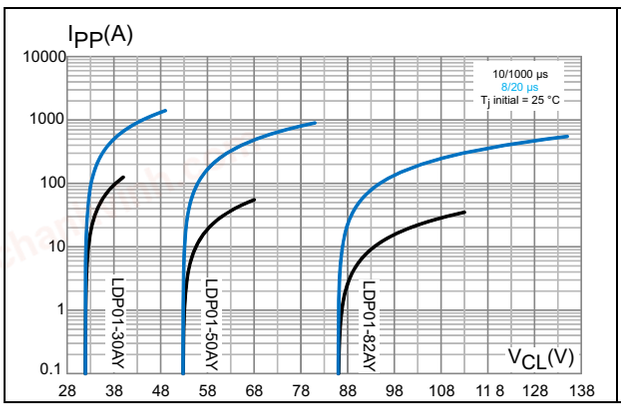


Figure 14. ISO 16750-2 test B response (U_A + U_S* = 13.5 + 30 V, U_S = 87 V, t_d = 400 ms, R_i = 0.5 Ω)

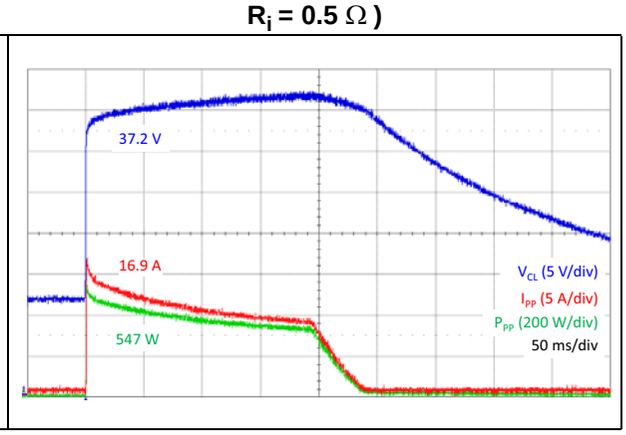


Figure 15. Peak forward voltage versus peak forward current (typical values)

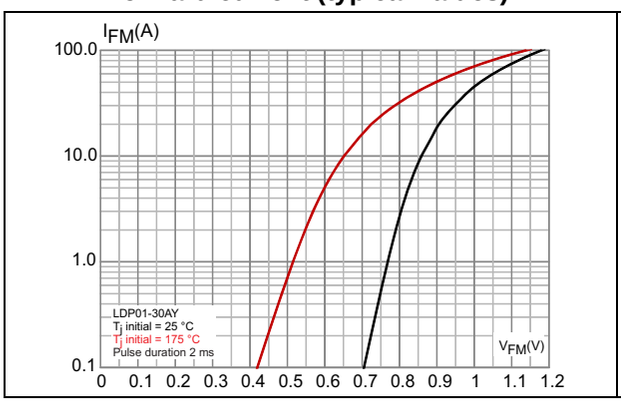
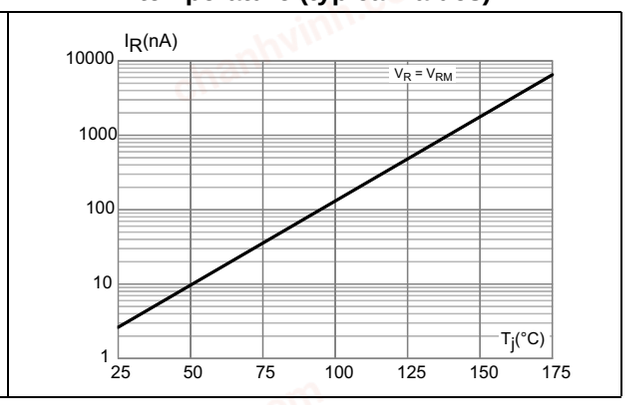
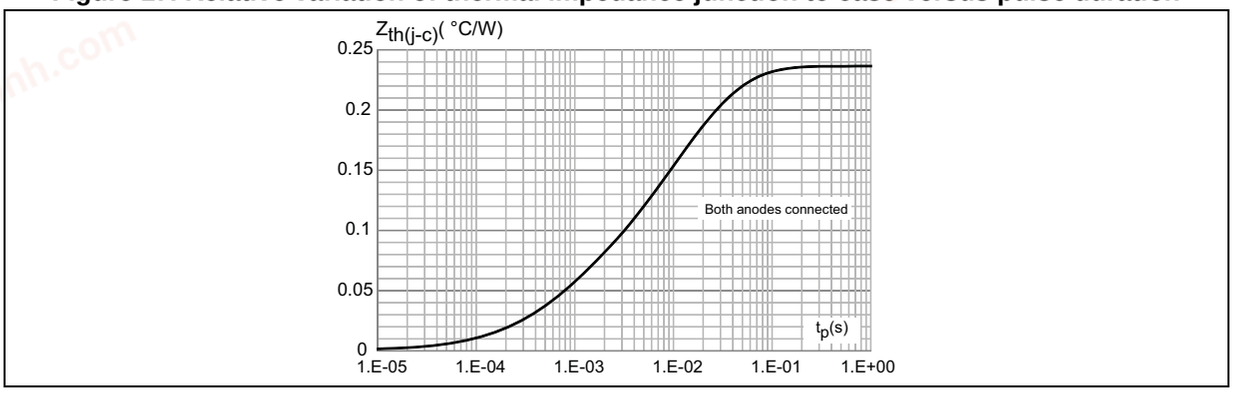


Figure 16. Leakage current versus junction temperature (typical values)



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Figure 17. Relative variation of thermal impedance junction to case versus pulse duration



More information available in *AN2689* on www.st.com: Protection of automotive electronics from electrical hazards, guidelines for design and component selection.

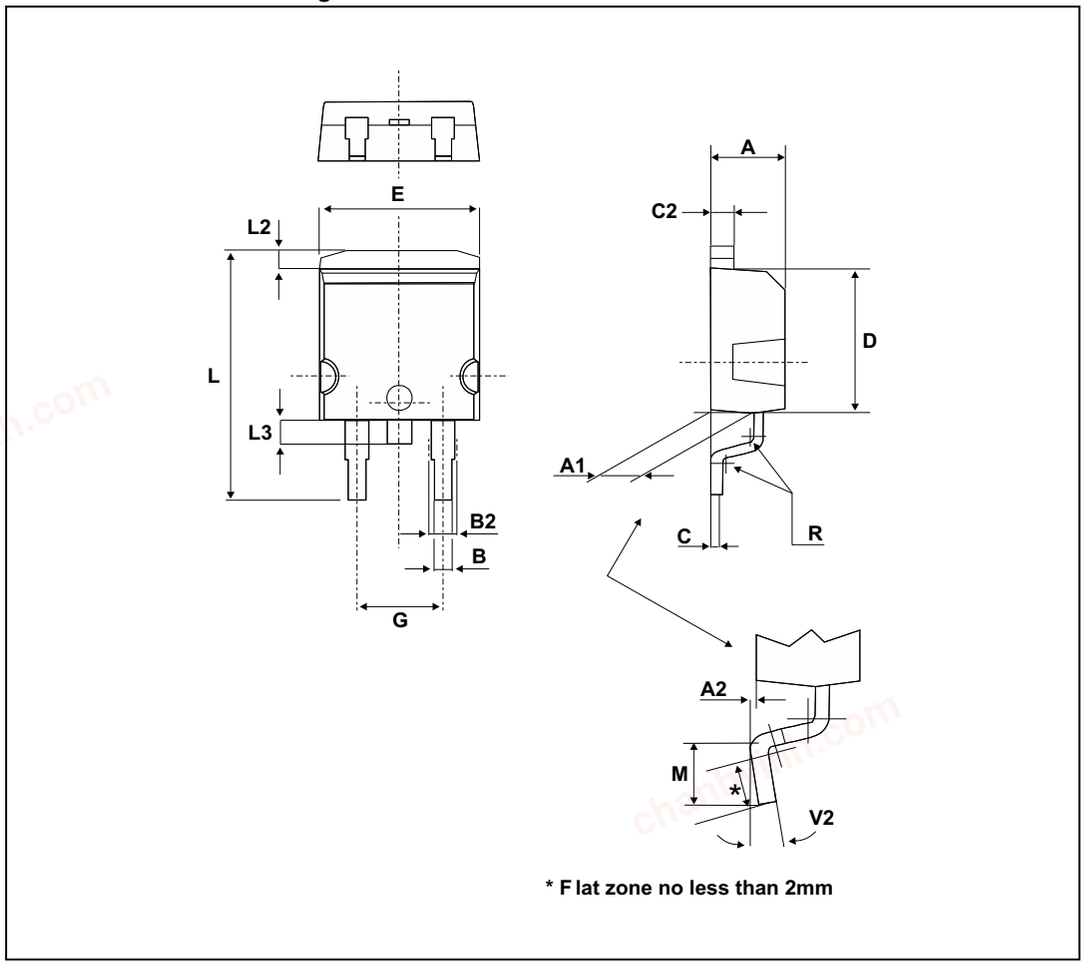
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2 Package information

- Epoxy meets UL94, V0

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at:www.st.com. ECOPACK® is an ST trademark.

Figure 18. D²PAK dimension definitions

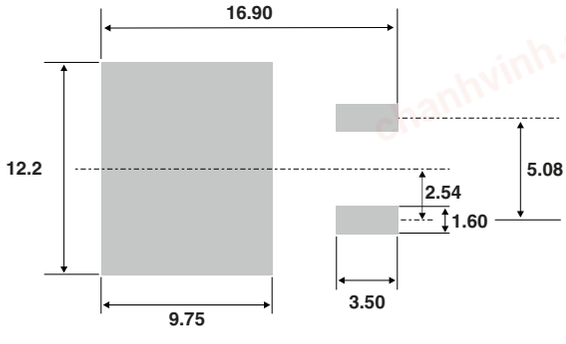


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Table 5. D^2PAK dimension values

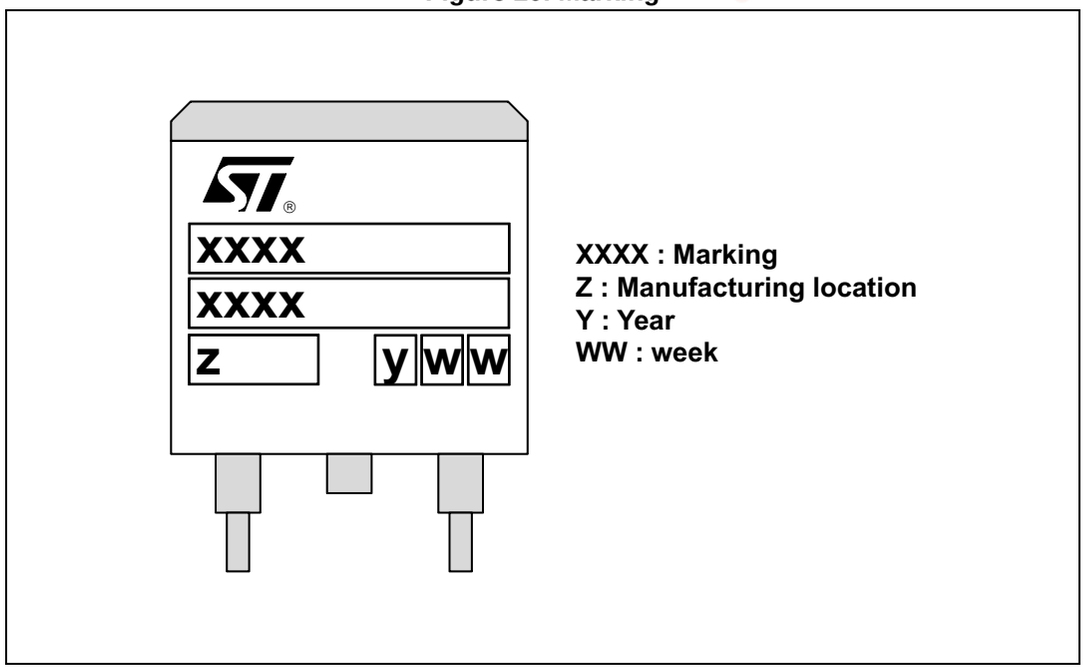
Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
A1	2.49	2.69	0.098	0.106
A2	0.03	0.23	0.001	0.009
B	0.70	0.93	0.027	0.037
B2	1.14	1.70	0.045	0.067
C	0.45	0.60	0.017	0.024
C2	1.23	1.36	0.048	0.054
D	8.95	9.35	0.352	0.368
E	10.00	10.40	0.393	0.409
G	4.88	5.28	0.192	0.208
L	15.00	15.85	0.590	0.624
L2	1.27	1.40	0.050	0.055
L3	1.30	1.75	0.051	0.069
M	2.29	2.79	0.090	0.110
R	0.40 typ.		0.016 typ.	
V2	0°	8°	0°	8°

Figure 19. Footprint (dimensions in mm)



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Figure 20. Marking



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3 Ordering information

Table 6. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
LDP01-26AY	LDP01-26AY	D²PAK	1.38 g	1000	Tape and reel
LDP01-28AY	LDP01-28AY				
LDP01-30AY	LDP01-30AY				
LDP01-33AY	LDP01-33AY				
LDP01-35AY	LDP01-35AY				
LDP01-39AY	LDP01-39AY				
LDP01-42AY	LDP01-42AY				
LDP01-47AY	LDP01-47AY				
LDP01-50AY	LDP01-50AY				
LDP01-56AY	LDP01-56AY				
LDP01-68AY	LDP01-68AY				
LDP01-82AY	LDP01-82AY				

4 Revision history

Table 7. Document revision history

Date	Revision	Changes
26-Nov-2014	1	Initial release.
01-Oct-2015	2	Added wildcard character in part number on the cover page. Updated *Figure 4*. Minor text changes.

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