Chip Varistor

DESCRIPTION

The LVS series is metal oxide based chip varistor for transient voltage suppression. They have non-linear voltage-current behavior, similar to zener diode. Multilayer structured varistor, however, shows superiority in electrical reliability than zener diode, since each grain exhibits small p-n junction. In addition, LVS series shows better electrical properties such as high clamping voltage and low leakage current.

FEATURES

*Chip varistor provides high reliability on surface mounting
*Wide range of working voltage (V_W = 5.6V~30V)
*Good clamping ratio and low leakage current
*Electroplating of Ni and solder gives higher solderability
*Wide operating temperature (-55~125°C)
*Various capacitance is available

APPLICATIONS

*Protection from transient voltage noise in all kinds of IC
*Protection from ESD, EFT and surge in power I/O port
*Replacement of zener diode

ORDERING INFORMATION

LVS 10 033 B 200 401

Series
LVS = Standard
LVSL = Low Capacitance

Size
10 = 1005(0402)
16 = 1608(0603)
20 = 2012(0805)
32 = 3216(1206)

Working voltage
056 = 5.6V
090 = 9.0V
260 = 26V

Capacitance
030 = 3pF
300 = 30pF
301 = 300pF

Clamping voltage
100 = 10V
300 = 30V

Transient energy
Z = 0.005J
A = 0.02J
B = 0.05J
C = 0.1J
D = 0.2J
E = 0.3J
F = 0.4J
G = 0.6J
H = 0.8J
I = 1.0J
J = 1.3J
K = 1.5J

SPECIFICATIONS

Part No.	Working Voltage (<25μA)	Breakdown Voltage (@ 1mA)	Clamping Voltage (8/20μS)	Peak Current (8/20μS)	Transient Energy (10/1000μS)	Capacitance (@ 1 kHz)
Symbol	V_W (V)	V_B (V)	V_C (V)	I_P (A)	E_T (J)	C (pF)

1005(0402) size

Part No.	V_W (V)	V_B (V)	V_C (V)	I_P (A)	E_T (J)	C (pF)
LVS10056B160...	5.6	7.2~9.6	16	20	0.05	370
LVS10090B200...	9	10.8~14.3	20	20	0.05	200
LVS10140B300...	14	16.8~22.2	30	20	0.05	100
LVS10180B400...	18	21.5~28.5	40	20	0.05	50
LVS10260B580...	26	30.9~40.9	58	20	0.05	30

1608(0603) size

Part No.	V_W (V)	V_B (V)	V_C (V)	I_P (A)	E_T (J)	C (pF)
LVS16056C160...	5.6	7.2~9.6	16	30	0.1	1000
LVS16090C200...	9	10.8~14.3	20	30	0.1	650
LVS16140C300...	14	16.8~22.2	30	30	0.1	350
LVS16180C400...	18	21.5~28.5	40	30	0.1	230
LVS16260C580...	26	30.9~40.9	58	30	0.1	180
LVS16300C650...	30	35.7~47.3	65	30	0.1	100

2012(0805) size

Part No.	V_W (V)	V_B (V)	V_C (V)	I_P (A)	E_T (J)	C (pF)
LVS20056C160...	5.6	7.2~9.6	16	40	0.1	3000
LVS20090C200...	9	10.8~14.3	20	40	0.1	1300
LVS20140C300...	14	16.8~22.2	30	35	0.1	800
LVS20180C400...	18	21.5~28.5	40	35	0.1	450
LVS20260C580...	26	30.9~40.9	58	35	0.1	300
LVS20300C650...	30	35.7~47.3	65	35	0.1	200

3216(1206) size

Part No.	V_W (V)	V_B (V)	V_C (V)	I_P (A)	E_T (J)	C (pF)
LVS32056C160...	5.6	7.2~9.6	16	40	0.1	1800
LVS32090C200...	9	10.8~14.3	20	40	0.1	1300
LVS32140C300...	14	16.8~22.2	30	35	0.1	800
LVS32180C400...	18	21.5~28.5	40	35	0.1	450
LVS32260C580...	26	30.9~40.9	58	35	0.1	300
LVS32300C650...	30	35.7~47.3	65	35	0.1	200
* LVS32180F400...	18	21.5~28.5	40	150	0.4	1500

* For Automotive Application : Withstand 24.5V DC for 5minutes

Low Capacitance Series

Part No.	Working Voltage	Breakdown Voltage	Clamping Voltage	Peak Current	Transient Energy	Capacitance
LVS10090C200...	9	10.8~14.3	20	40	0.1	1300
LVS10140C300...	14	16.8~22.2	30	35	0.1	800
LVS10180C400...	18	21.5~28.5	40	35	0.1	450
LVS10260C580...	26	30.9~40.9	58	35	0.1	300
LVS10300C650...	30	35.7~47.3	65	35	0.1	200

* 1MHz

V_W = Maximum DC voltage, that is applied continuously in the maximum operating temperature of the device.

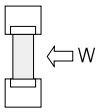
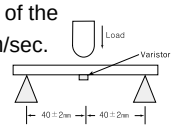
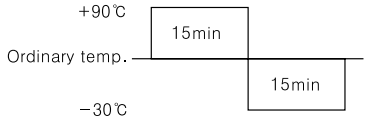
V_B = Varistor voltage or normal voltage, that is measured at the applied current of 1mA.

V_C = Peak voltage appearing across the varistor when measured at the condition of specified pulsed current and waveform. (8/20μS, 0.1J 2A, 0.05J 1A)

I_P = Surge current or peak current, the maximum current without causing device failure measured with specified waveform.(8/20μS)

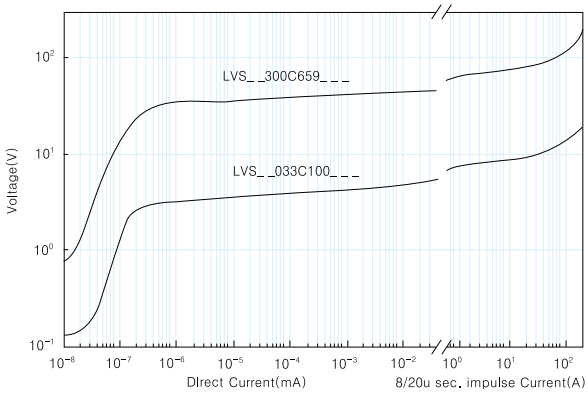
E_T = Maximum rated transient energy that is dissipated for a single current pulse at a specified impulse duration.(10/1000μS)

RELIABILITY TEST METHOD

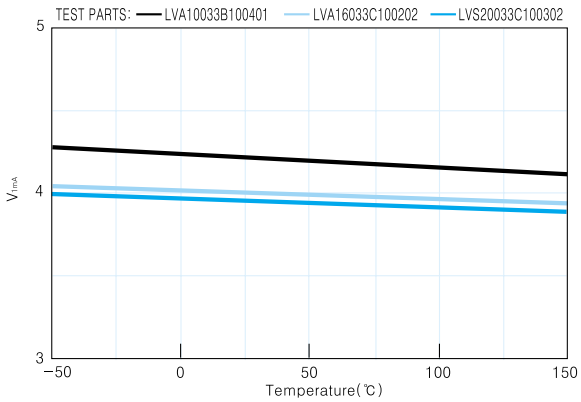
Item	Test Method	Criteria for judging
Resistance to Soldering Heat	Soldering temperature : 260± 5°C Duration of immersion : 10 ± 1sec. Preheating : 150°C , 1min.	Visual : No mechanical damage $\Delta V_B/V_B$≤10%
Solderability Test	Soldering temperature : 230 ± 5°C Duration of immersion : 5± 1sec. Preheating : 150°C , 1min.	At least 75% of the electrode must be covered with new solder.
Adhesion	The Force W is applied to DUT. 	Visual : No mechanical damage 0805 : over 2.0Kgf 0603 : over 1.0Kgf 0402 : over 0.7Kgf
Resistance to Flexure of Substrate	The middle part of substrate shall, successively, be pressurized by means of the pressurizing rod at a rate of about 1mm/sec. Maintenance time : 5 sec. Bending distane : 1mm 	Visual : No mechanical damage
Dry Heat Test	Test temperature : 125 ± 2°C Test duration : 1000+48hrs. After completion of the test, leaving the sample under the standard conditions for 24¡ 2hrs.	Visual : No mechanical damage $\Delta V_B/V_B$ <10%
Cold Test	Test temperature : -30± 2°C Test duration : 1000+48hrs. After completion of the test, leaving the sample under the standard conditions for 24+ 2hrs.	Visual : No mechanical damage $\Delta V_B/V_B$ <10%
Damp Heat Test (Steady State)	Test temperature : 40± 2°C Test relative humidity : 90˜95RH% Test duration : 56days+24hrs. After completion of the test, leaving the sample under the standard conditions for 24± 2hrs.(IEC60068-2-3)	Visual : No mechanical damage $\Delta V_B/V_B$ <10%
Thermal Shock Test	 This cycle is repeated 50 times. After completion of the test, leave the sample under standard condition for 24± 2hrs.	Visual : No mechanical damage $\Delta V_B/V_B$ <10%
ESD Test (Contact discharge)	Test Voltage : 8 kV Type of discharge : direct contact discharge Number of test pulses : 20 times Polarity : +/- (IEC 61000-4-2)	Visual : No mechanical damage $\Delta V_B/V_B$ <15%
ESD Test (Air Discharge)	Test Voltage : 15 kV Type of discharge : air discharge Number of test pulses : 20 times Polarity : +/- (IEC 61000-4-2)	Visual : No mechanical damage $\Delta V_B/V_B$ <15%
High Temperature Life Test	Temp. : 125± 2°C Duration : 1000¡ 48hrs. Applied voltage : $V_{dc\ max}$ After completion of the test, leave the sample under standard condition for 24± 2hrs.	Visual : No mechanical damage $\Delta V_B/V_B$ <10%

CHARACTERISTIC CURVES

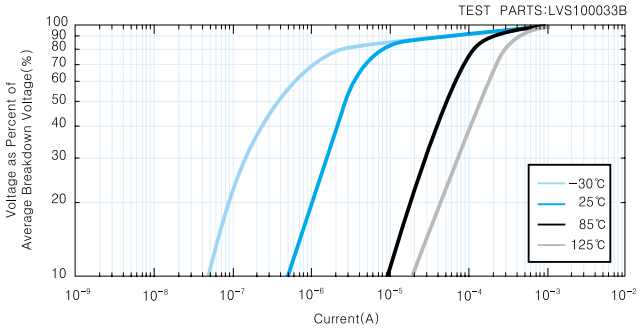
I-V Characteristics

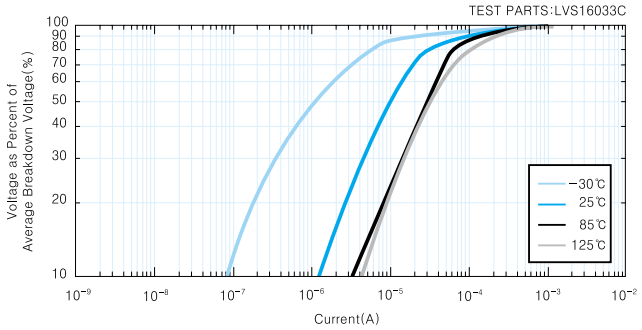


Temperature vs. V_B

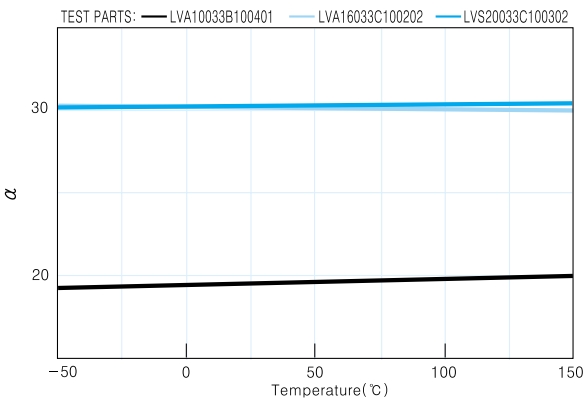


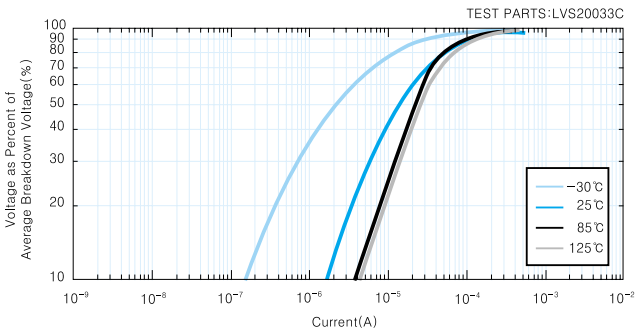
Typical Temperature Dependence of V_B





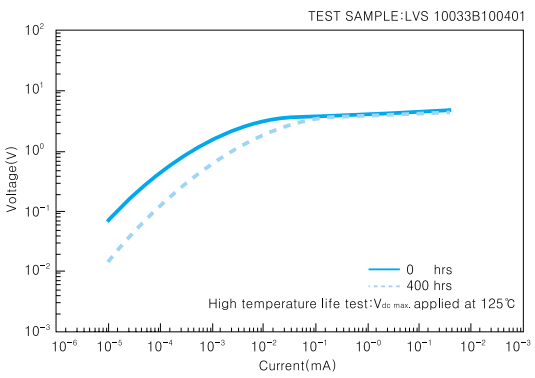
Temperature vs. a



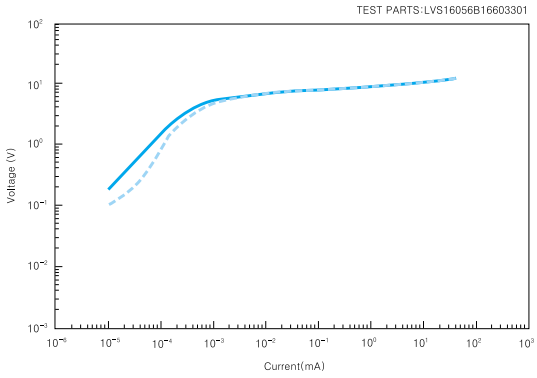


RELIABILITY TEST DATA

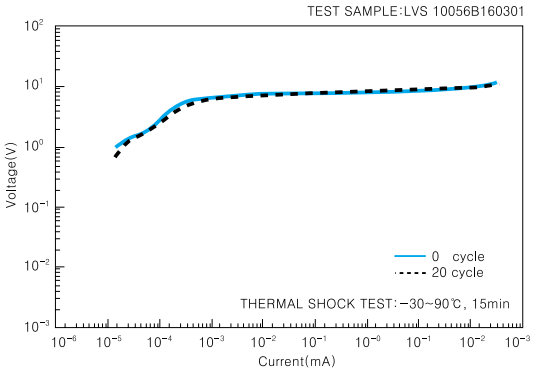
High Temperature Life Test



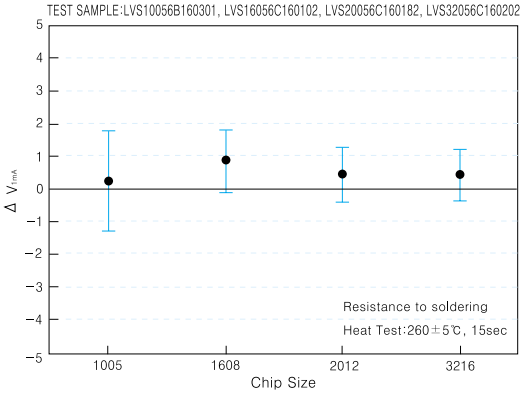
Cold Test



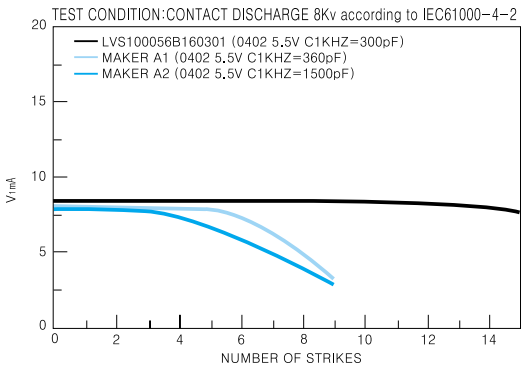
Thermal Shock Test



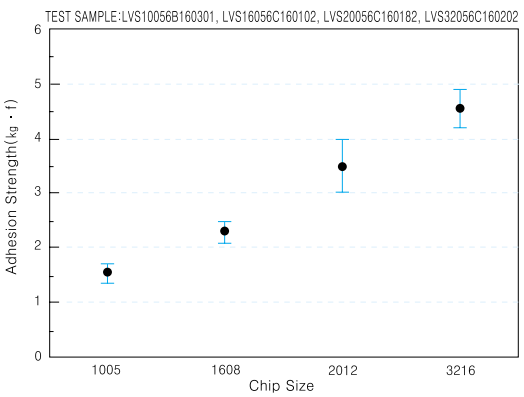
Resistance to Soldering Heat



ESD Test



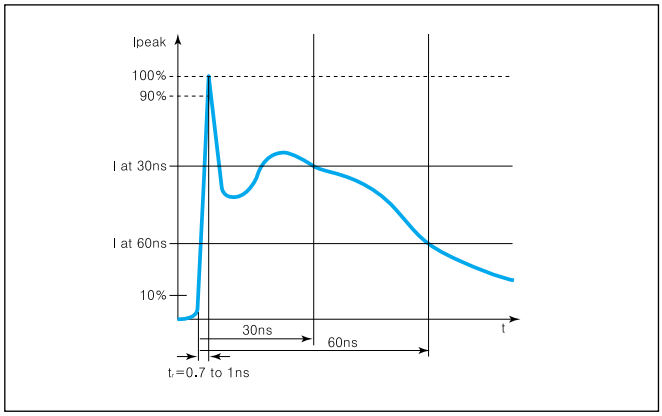
Adhesion



APPLICATION FOR ESD

What is ESD ?

It is a kind of transient voltage noise. The definition of transient voltage is listed in IEC 61000-4 series, which describes the immunity requirements and test methods for electrical and electric equipments, subjected to ESD, EFT, and surge. Figure 1 is the waveform of ESD, defined in IEC 61000-4-2.



Picture 1.

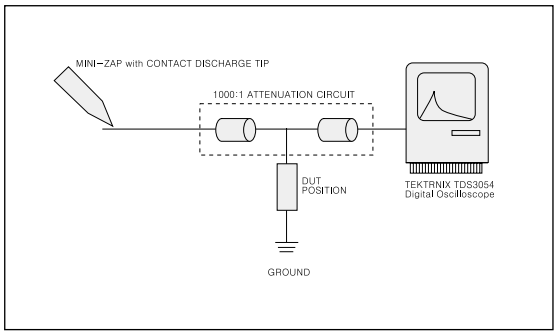
Varistor vs. TVS Diode

ESD current has the rise time of sub-nanosecond, duration of tens of nanosecond, and its amplitude reaches over 10KV. So, the protecting device from ESD also needs fast response time.
TVS diode has a similar performance with that of LATTRON's varistor, in terms of response time and handling capacity. Which, however, shows inferiority in surge current, leakage current, operating directionality, polarity, and miniaturization as shown in the table.

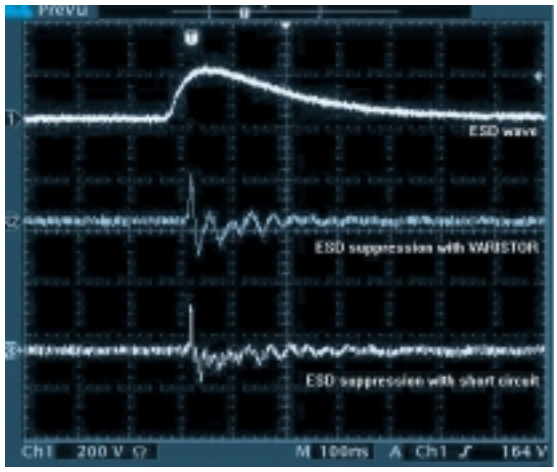
	LATTRON® VARISTOR	TVS DIODE
Response time	< 1ns	> 1ns
ESD handling capability	> Contact 8kV, 10 cycle	
Leakage current	Low in all spec.	High in case of low voltage spec.
Surge current handling capability	High in all spec.	Low especially in high voltage spec.
Operating temp.	Characteristics are deteriorated over 80°C	Characteristics are deteriorated from 25°C
Size	Min. 0603 mm	Min. 1608 mm

Protection Performance of Lattron is Varistor for ESD

The performance of Lattron is varistor against ESD noise is tested with the test circuit as shown in Picture 2.
Test procedure includes three different circuit configurations; without varistor, with varistor at DUT position, and shorted circuit at DUT position. The test results that had collected with digital scope are shown in Picture 3.
The performance of ESD suppression with Lattron is varistor is as good as that of short circuit.



Picture 2.



TEST INSTRUMENTS : TEKTRONIX TDS3054. MINIZAP

Picture 3.