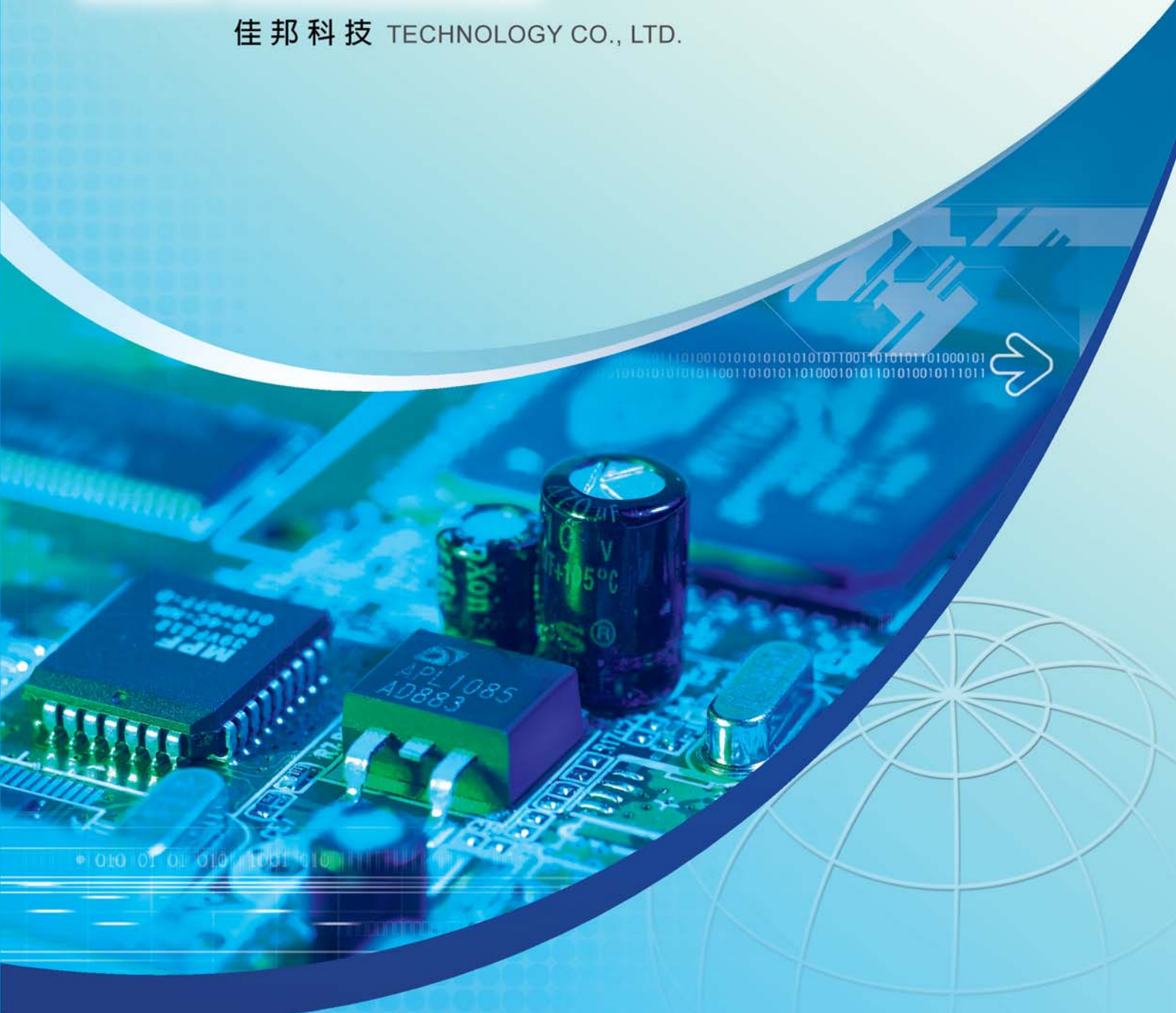




佳邦科技 TECHNOLOGY CO., LTD.



# Circuit Protection



ISO9001  
TS16949  
ISO14001



RoHS



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## Over Voltage Protection

### ▶ ESD Guard™

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<b>Over Voltage Protection</b>				
<i>Product ID</i>	<i>Product Name</i>	<i>Series</i>	<i>Size (EIA)</i>	<i>Size (EIAJ)</i>
	ESD Guard™	EGA	0402 0603	1005 1608
		EGA Array	1206	3216
	Multilayer Varistor	MLVS	0201 0402 0603 1206	0603 1005 1608 3216
		MLVG	0402 0603	1005 1608
		MLV Array	0805	2012
	EMI / ESD Suppressor	VPORT	0402 0603	1005 1608
	Transient Voltage Suppressor	TVS	--	--
	ESD Array Series	TVU	1004	2510



**Features**

- Protection against high ESD voltage and current
- Compact size for EIA 0402 and 0603
- Extremely quick response time (<1ns)
- Extremely low capacitance (<0.5pF)
- Extremely low leakage current
- Zero signal distortion
- Bi-directional

**Applications**

- EGA10402V05AH, EGA10402V12A0, EGA10603 Series are applied to RF module, Antenna circuit, IEEE-1394, USB2.0, DVI, HDMI and DisplayPort...etc. high speed signal interface.
- EGA10402V05A2 is recommended to use the application of RF antenna front-end circuit without DC bias.

**How to Order**

**EGA 1 0603 V05 A1 - B**

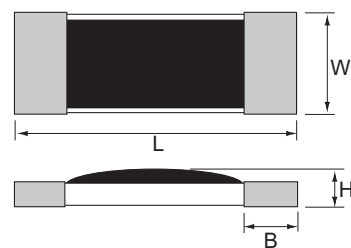
1    2    3    4    5    6

- 1 Series Type : ESD Guard™ Series
- 2 Elements Type
- 3 Chip Size (EIA) : 0402/0603
- 4 Rated Voltage,  $V_{DC}$
- 5 Model Code
- 6 Suffix for Special Code

**Dimensions**

Unit: mm

Size EIA (EIAJ)	0402 (1005)	0603 (1608)
L	1.00±0.1	1.60±0.1
W	0.50±0.1	0.85±0.15
H	0.34±0.1	0.51±0.05
B	0.20±0.1	0.30±0.2



**Specifications**

Part Number	EGA10402V05A2 <sup>1</sup>	EGA10402V05AH	EGA10402V12A0
Maximum Operating Voltage (V <sub>bc</sub> )	Without DC Bias	5V	12V
Leakage Current <sup>2</sup> (I <sub>l</sub> )	Without measuring I <sub>l</sub>	0.05μA	0.05μA
Capacitance <sup>3</sup> , @1MHz(C <sub>p</sub> )	0.2pF	0.2pF	0.2 pF
Trigger Voltage (V <sub>t</sub> )	100V	150V	300V
Clamping Voltage <sup>4</sup> (V <sub>c</sub> )	17V	30V	30V
ESD Voltage Capability, Contact Discharge Mode(KV)	8KV	8KV	8KV
ESD Voltage Capability, Air Discharge Mode(KV)	15KV	15KV	15KV
Minimum ESD Pulse Withstand	100	100	100

Part Number	EGA10603V05A1-B	EGA10603V12A1-B	EGA10603V24A0
Maximum Operating Voltage (V <sub>bc</sub> )	5V	12V	24V
Leakage Current <sup>2</sup> (I <sub>l</sub> )	0.01μA	0.01μA	0.01μA
Capacitance <sup>3</sup> , @1MHz (C <sub>p</sub> )	0.2pF	0.2pF	0.2pF
Trigger Voltage (V <sub>t</sub> )	150V	150V	300V
Clamping Voltage <sup>4</sup> (V <sub>c</sub> )	30V	30V	30V
ESD Voltage Capability, Contact Discharge Mode (KV)	8KV	8KV	8KV
ESD Voltage Capability, Air Discharge Mode (KV)	15KV	15KV	15KV
Minimum ESD Pulse Withstand	100	100	500

**Notes:**

1. EGA10402V05A2 is recommended to use the application of RF antenna front end circuit without DC bias.
2. Leakage current at maximum operating voltage.
3. Capacitance is measured with 1V<sub>rms</sub>.
4. Per IEC 61000-4-2, 30A@8KV, level 4, clamp measurement made 30 ns after initiation of pulse, all test in contact discharge mode.

**General Technical Data**

Operating Temperature	-40°C ~ +85°C
Storage Temperature	-55°C ~ +125°C
Response Time	<1 ns
Solderability	245±5°C, 3±1sec.

**Environmental Performance**

Item	Specifications	Test Condition
Bias Humidity	I <sub>l</sub> ≤10μA	90%RH, 40°C, Rated Voltage, 1000 hr
Thermal Shock		-40°C to 85°C, 30 min. cycle, 5 cycles
Full Load Voltage		Rated Voltage, 85°C, 1000 hr
Solder Leach Resistance		260±5°C, 10±1sec.

I<sub>l</sub> – Leakage current at rated voltage, the maximum leakage current was measured after reliability test.

**Package**

Size EIA (EIAJ)	0402 (1005)	0603 (1608)
Standard Packing Quantity (pcs / reel)	10,000	5,000



**Features**

- Protection against high ESD voltage and current
- Compact size for EIA 1206
- Extremely quick response Time (<1ns)
- Extremely low capacitance (<0.5pF)
- Extremely low leakage current
- Zero signal distortion
- Bi-directional

**Applications**

EGA Array is applied to RF module, Antenna circuit, IEEE-1394, USB2.0, DVI, HDMI and Displayport...etc. high speed signal interface.

**How to Order**

**EGA 4 1206 V12 A** □

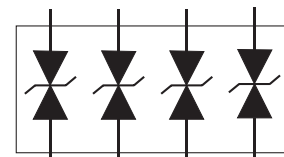
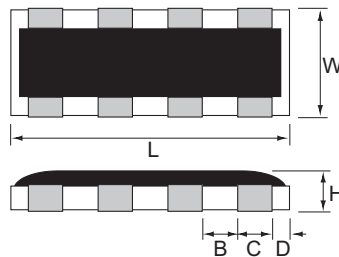
1 2 3 4 5 6

- 1 Series Type : ESD Guard™ Series
- 2 Elements Per Chip
- 3 Chip Size (EIA) : 1206
- 4 Rated Voltage,  $V_{DC}$
- 5 Model Code
- 6 Suffix for Special Code

**Dimensions**

Unit: mm

Size EIA (EIAJ)	1206 (3216)
L	3.20±0.1
W	1.60±0.1
H	0.50±0.1
B	0.40±0.2
C	0.40±0.2
D	0.20±0.1



## Specifications

Part Number	EGA41206V12A
Maximum Operating Voltage (V <sub>DC</sub> )	12V
Leakage Current <sup>1</sup> (I <sub>L</sub> )	0.01μA
Capacitance <sup>2</sup> , @1MHz(C <sub>p</sub> )	0.2pF
Trigger Voltage (V <sub>t</sub> )	150V typ.
Clamping Voltage <sup>3</sup> (V <sub>c</sub> )	30V typ.
Response time	1ns max.
ESD Voltage Capability, Contact Discharge Mode(KV)	8KV typ.
ESD Voltage Capability, Air Discharge Mode(KV)	15KV typ.
Minimum ESD Pulse Withstand	100

**Notes:**

1. Leakage current at maximum operating voltage.
2. Capacitance is measured with 1Vrms.
3. Per IEC 61000-4-2, 30A@8KV, level 4, clamp measurement made 30 ns after initiation of pulse, all test in contact discharge mode.

## General Technical Data

Operating Temperature	-40°C ~ +85°C
Storage Temperature	-55°C ~ +125°C
Response Time	<1 ns
Solderability	245±5°C, 3±1sec

## Environmental Performance

Item	Specifications	Test Condition
Bias Humidity	I <sub>L</sub> ≤ 10 μA	90%RH, 40°C, Rated Voltage, 1000 hrs
Thermal Shock		-40°C to 85°C, 30 min. cycle, 5 cycles
Full Load Voltage		Rated Voltage, 85°C, 1000 hrs
Solder Leach Resistance		260±5°C, 10±1sec.

I<sub>L</sub> – Leakage current at rated voltage, the maximum leakage current was measured after reliability test.

## Package

Size EIA (EIAJ)	1206 (3216)
Standard Packing Quantity (pcs / reel)	5,000



### Features

- SMD type zinc oxide based ceramic chip
- Lead free plating termination provided good solderability characteristic
- Insulator overcoat keeps excellent low and stable leakage current
- Quick response time (<1ns)
- Low clamping voltage
- High transient current capability
- Meet IEC 61000-4-2, 61000-4-4, and 61000-4-5 standard
- Compact size for EIA 0201/0402/0603/1206

### Applications

- **Applications** for Mother Board, Notebook, Cellular Phone, PDA, handheld device, DSC, DV, Scanner, and Set-Top Box...etc.
- **Suitable** for Push-Button, Power Line and Low Frequency single line over voltage protect.

### How to Order

**MLV** **S** **0201** **V05** - **330**

1      2      3      4      5

- 1 Series Type : MLV — Multilayer Varistor
- 2 Model Code
- 3 Chip Size (EIA) : 0201
- 4 Working Voltage :  $V_{DC}$
- 5 Capacitance : Value —  $XX \times 10^N \rightarrow XXN$   
ex: 33pF=  $33 \times 10^0 \rightarrow 330$

**MLV** **S** **1206** **M** **04** - **362**

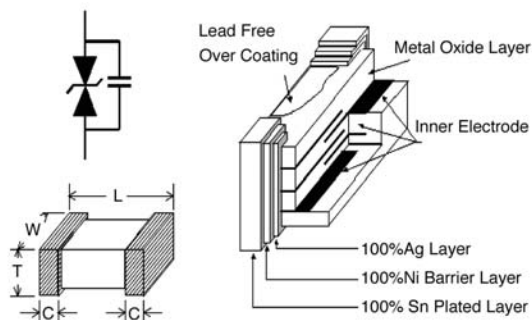
1      2      3      4      5      6

- 1 Series Type : MLV — Multilayer Varistor
- 2 Model Code
- 3 Chip Size (EIA) : 0402 / 0603 / 1206
- 4 Varistor Voltage Tolerance :  
M —  $\pm 20\%$  ; L —  $\pm 15\%$  ; K —  $\pm 10\%$
- 5  $V_{RMS}$  : AC Working Voltage  $V_{RMS}$
- 6 Capacitance : Value —  $XX \times 10^N \rightarrow XXN$   
ex: 3600pF=  $36 \times 10^2 \rightarrow 362$

### Dimensions

Unit: mm

Size EIA (EIAJ)	0201 (0603)	0402 (1005)	0603 (1608)	1206 (3216)
L	0.60±0.05	1.00±0.15	1.60±0.15	3.20±0.15
W	0.30±0.05	0.50±0.10	0.80±0.10	1.60±0.15
T	0.30±0.05	0.50±0.10	0.80±0.10	1.7 max.
C	0.20±0.10	0.25±0.15	0.30±0.20	0.50±0.25



# MULTILAYER VARISTOR

## MLVS Series

### Specifications

Symbol	Working Voltage		Varistor Voltage		Clamping Voltage	Capacitance	Peak Current	Transient Energy
	$V_{RMS}$	$V_{DC}$	$V_V$	$\Delta V_V$	$V_C$	$C_p$	$I_{max}$	$W_{max}$
Units	Volts	Volts (Max.)	Volts	V/%	Volts (Max.)	pF (typ.)	Amps (Max.)	Joules (Max.)
<b>MLVS 0201</b>								
MLVS0201V05330 (NEW)	4	5.5	11	±3V	28	33	-	-
MLVS0201V05470 (NEW)	4	5.5	11	±3V	26	47	-	-
MLVS0201V05640 (NEW)	4	5.5	11	±3V	26	64	-	-
<b>MLVS 0402</b>								
MLVS0402M04	4	5.5	8	±20V	19	270	20	0.05
MLVS0402M07	7	9	12.5	±20V	32	130	20	0.05
MLVS0402K11	11	14	18	±10V	38	90	20	0.05
MLVS0402K14	14	18	22	±10V	45	85	20	0.05
<b>MLVS 0603</b>								
MLVS0603M04	4	5.5	8	±20%	19	270	30	0.1
MLVS0603M07	7	9	12.5	±20%	27	210	30	0.1
MLVS0603K11	11	14	18	±10%	35	150	30	0.1
MLVS0603K14	14	18	22	±10%	40	130	30	0.1
MLVS0603K20	20	26	31	±10%	58	100	30	0.1
<b>MLVS 1206</b>								
MLVS1206M04-362	4	5.5	8	±20%	19	3600	150	0.4
MLVS1206K14-182	14	18	22	±10%	40	1800	150	0.4
MLVS1206K14-651*	14	18	22	±10%	40	650	200	0.4
MLVS1206K20-601	20	26	34	±10%	60	600	200	1.0
MLVS1206K25-501	25	31	41	±10%	70	500	200	1.0
MLVS1206K30-421	30	42	53	±10%	90	420	200	1.0
MLVS1206K40-181	40	56	70	±10%	110	180	200	1.0

$V_{RMS}$  —Maximum AC operating voltage the varistor can maintain and not exceed 10 $\mu$ A leakage current for 0402,0603/50 $\mu$ A leakage current for 1206.

$V_{DC}$  —Maximum DC operating voltage the varistor can maintain and not exceed 10 $\mu$ A leakage current for 0402,0603/50 $\mu$ A leakage current for 1206.

$V_V$  —Voltage across the device measured at 1mA DC current.

Equivalent to  $V_B$ , "break down voltage."

$V_C$  —Maximum peak current across the varistor with 8/20 $\mu$ s waveform and 1A pulse current.

$C_p$  —Device capacitance measured with zero volt bias 1Vrms at 1MHz (0201 / 0402 / 0603) or 1KHz (1206).

$i_{max}$  —Maximum peak current which may be applied with 8/20 $\mu$ s waveform without device failure.

$W_{max}$  —Maximum energy which may be dissipated with the 10/1000 $\mu$ s waveform without device failure.

\* —Withstands 24.5 VDC for 5 minutes (automotive applications)

**General Technical Data**

Operating Temperature	0201, 0402, 0603: -40°C ~ +85°C / 1206: -55°C ~ +125°C
Storage Temperature (on board)	0201, 0402, 0603: -40°C ~ +85°C / 1206: -55°C ~ +150°C
Response Time	<1 ns
Solderability	245±5°C, 3±1sec.

**Environmental Performance**

Item	Specifications	Test Condition
Bias Humidity	$\Delta V_v / V_v \leq \pm 10 \%$	90%RH, 40°C, Working Voltage, 1000 hrs
Thermal Shock		0201 & 0402 & 0603: -40°C to 85°C, 30 min. cycle, 5 cycles 1206: -55°C to 125°C, 30 min. cycle, 5 cycles
Full Load Voltage		0201 & 0402 & 0603: Working Voltage, 85°C, 1000 hrs 1206: Working Voltage, 125°C, 1000 hrs
Solder Leach Resistance	(1) $\Delta V_v / V_v \leq \pm 10 \%$ (2) $I_L \leq 10\mu A$ at Working Voltage (3) Solder Wetting Area $\geq 95\%$	260±5°C, 10±1sec.

**Package**

Size EIA (EIAJ)	0201 (0603)	0402 (1005)	0603 (1608)	1206 (3216)
Standard Packing Quantity (pcs / reel)	15,000	10,000	4,000	4,000



### Features

- Lead free type
- SMD type zinc oxide based ceramic chip
- Insulator over coat keeps excellent low and stable leakage current
- Plating termination provided good solderability characteristic
- Wide operating voltage range, VDC: 5.5V to 18V
- Quick response time (<1ns)
- Low clamping voltage
- Meet IEC 61000-4-2 standard
- Low capacitance can meet high speed single transient voltage protection

### Applications

- Low capacitance product applications for high-speed signal lines such as HDMI, DVI, USB, IEEE1394 Port etc.
- Normal capacitance product applications for I/O Port (RS232, USB, PS2, VGA, Audio) on Mother Board and Notebook, Set-Top Box, MP3 Players, DVD Players, and Docking System etc.

### How to Order

**MLV** **G** **0402** **1R0** **U** **V18**    
 1      2      3      4      5      6      7      8

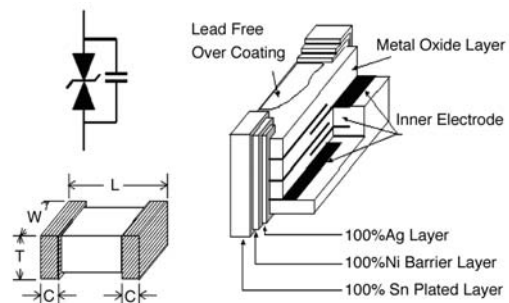
**MLV** **G** **0603** **331** **N** **V18**    
 1      2      3      4      5      6      7      8

- 1 Series Type : MLV — Multilayer Varistor
- 2 Model Code
- 3 Chip Size(EIA) : 0402 / 0603
- 4 Capacitance : Value-XXR=0.XpF, ex: 1R0=1.0pF, XXx10<sup>n</sup>→XXN, ex: 330pF=33x10<sup>1</sup>→331
- 5 Capacitance Tolerance : T-±1.4pF, Q or L- ±2.0pF, U - ±0.9pF, N - ±30%
- 6 Working Voltage : V<sub>bc</sub>
- 7 Special Code
- 8 Special Code

### Dimensions

Unit: mm

Size EIA (EIAJ)	0402 (1005)	0603 (1608)
L	1.00±0.15	1.60±0.20
W	0.50±0.10	0.80±0.20
T	0.50±0.10	0.80±0.20
C	0.25±0.15	0.30±0.20



### Specifications

Symbol	Working Voltage $V_{DC}$	Varistor Voltage $V_V$	Clamping Voltage $V_C$	Capacitance $C_p$	Leakage Current $I_L$
Units	Volts (Max.)	Volts	Volts (Max.)	pF	$\mu A$ (Max.)
<b>MLVG0402</b>					
MLVG04021R0UV18BP	~18	46~60	110*	1.0	<10
MLVG04023R0TV18BP	~18	22~34	58	3.0	<10
MLVG04025R0QV18BP	~18	22~34	58	5.0	<10
MLVG0402100NV18BP	~18	22~34	58	10	<10
MLVG0402120NV18BP	~18	22~34	58	12	<10
MLVG0402220NV18BP	~18	22~34	58	22	<10
MLVG04025R0QV05BP	~5.5	7.6~12	25	5.0	<10
MLVG0402331NV05BP	~5.5	7.6~12	25	330	<10
MLVG0402100NV09BP	~9	11~17	35	10	<10
MLVG04025R0QV26BP	~26	46~60	110	5.0	<10
MLVG04023R0LV42BP	~42	46~75	135	3.0	<10
<b>MLVG0603</b>					
MLVG06031R0UV18BP	~18	46~60	110*	1.0	<10
MLVG06033R0TV18BP	~18	22~34	58	3.0	<10
MLVG06035R0QV18BP	~18	22~34	58	5.0	<10
MLVG0603100NV18BP	~18	22~34	58	10	<10
MLVG0603120NV18BP	~18	22~34	58	12	<10
MLVG0603220NV18BP	~18	22~34	58	22	<10
MLVG0603331NV18BP	~18	22~34	58	330	<10
MLVG06035R0QV05BP	~5.5	7.6~12	25	5.0	<10
MLVG0603100NV05BP	~5.5	7.6~12	25	10	<10
MLVG0603951NV05BP	~5.5	7.6~12	25	950	<10
MLVG0603551NV09BP	~9	11~17	35	550	<10
MLVG06033R0LV42BP	~42	46~75	135	3.0	<10

$V_{DC}$  – Maximum DC operating voltage the varistor can maintain and not exceed 10  $\mu A$  leakage current.

$V_V$  – Voltage across the device measured at 1mA DC current.

Equivalent to  $V_b$ , "break down voltage."

$V_C$  – Maximum peak current across the varistor with 8/20 $\mu s$  waveform and 1A pulse current.

\*: Maximum peak current across the varistor with 8/20 $\mu s$  waveform and 0.5A pulse current.

$C_p$  – Device capacitance measured with zero volt bias 1Vrms at 1MHz.

### General Technical Data

Operating Temperature	-40°C ~ +85°C
Storage Temperature (on board)	-40°C ~ +85°C
Response Time	<1 ns
Solderability	245 $\pm$ 5°C, 3 $\pm$ 1sec.
Solder Leach Resistance	260 $\pm$ 5°C, 10 $\pm$ 1sec.

### Environmental Performance

Item	Specifications	Test Condition
Bias Humidity	$\Delta V_V / V_V \leq \pm 10 \%$	90%RH, 40°C, Working Voltage, 1000 hrs
Thermal Shock		-40°C to 85°C, 30 min. cycle, 5 cycles
Full Load Voltage		Working Voltage, 85°C, 1000 hrs

### Package

Size EIA (EIAJ)	0402 (1005)	0603 (1608)
Standard Packing Quantity (pcs / reel)	10,000	4,000



### Features

- SMD type zinc oxide based ceramic chip
- Lead free plating termination provided good solderability characteristic
- Insulator overcoat keeps excellent low and stable leakage current
- Quick response time (<1ns)
- Low clamping voltage
- High transient current capability
- Meet IEC 61000-4-2, 61000-4-4, and 61000-4-5 standard

### Applications

Applications for Mother Board, Notebook, Cellular Phone, PDA, handheld device, DSC, DV, Scanner, and Set-Top Box...etc.

### How to Order

**MLV** **A** **0805** **M** **04 - 330**

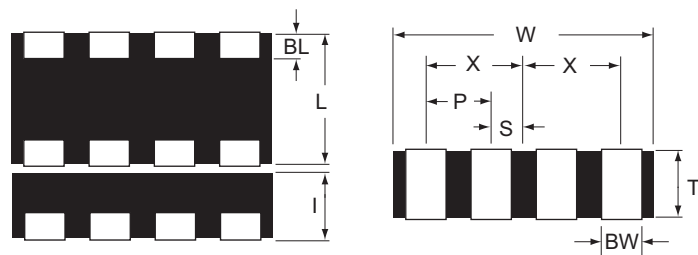
1 2 3 4 5 6 7

- 1 Series Type : MLV—Multilayer Varistor
- 2 Model Code : A—Array
- 3 Chip Size(EIA) : 0805
- 4 Varistor Voltage Tolerance:  
M—±20%, L—±15%, K—±10%
- 5  $V_{RMS}$ : AC Working Voltage  $V_{RMS}$
- 6 Capacitance : Value— XX x  $10^N$ → XXN  
ex.33pF= 33x $10^0$ → 330
- 7 Suffix for Special Requirement

### Dimensions

Unit: mm

Size EIA (EIAJ)	0805 (2012)
L	1.25±0.20
W	2.00±0.20
T	0.90 max.
BW	0.20±0.1
BL	0.20±0.1
P	0.50 ref.
X	0.75±0.10
S	0.25±0.10



### Specifications

Symbol	Working Voltage		Varistor Voltage		Clamping Voltage	Capacitance	Peak Current	Transient Energy
	$V_{RMS}$	$V_{DC}$	$V_V$	$\Delta V_V$	$V_C$	$C_p$	$I_{max}$	$W_{max}$
Units	Volts	Volts (Max.)	Volts	%	Volts (Max.)	pF (typ.)	Amps (Max.)	Joules (Max.)
<b>MLVA 0805</b>								
MLVA0805M04-100	4	5.5	12	$\pm 20$	34	10	1	0.05
MLVA0805M04-330	4	5.5	12	$\pm 20$	28	33	10	0.01
MLVA0805M04-500	4	5.5	12	$\pm 20$	27	50	10	0.01
MLVA0805K14-150	14	18	28	$\pm 10$	58	15	5	0.01

$V_{RMS}$  —Maximum AC operating voltage the varistor can maintain and not exceed 10 $\mu$ A leakage current.

$V_{DC}$  —Maximum DC operating voltage the varistor can maintain and not exceed 10 $\mu$ A leakage current.

$V_V$  —Voltage across the device measured at 1mA DC current.  
Equivalent to  $V_B$ , "break down voltage."

$V_C$  —Maximum peak current across the varistor with 8/20 $\mu$ s waveform and 1A pulse current.

$C_p$  —Device capacitance measured with zero volt bias 1Vrms at 1MHz.

$I_{max}$  —Maximum peak current which may be applied with 8/20 $\mu$ s waveform without device failure.

$W_{max}$  —Maximum energy which may be dissipated with the 10/1000 $\mu$ s waveform without device failure.

### General Technical Data

Operating Temperature	-40°C ~ +85°C
Storage Temperature (on board)	-40°C ~ +85°C
Response Time	<1 ns
Solderability	245 $\pm$ 5°C, 3 $\pm$ 1sec.
Solder Leach Resistance	260 $\pm$ 5°C, 10 $\pm$ 1sec.

### Environmental Performance

Item	Specifications	Test Condition
Bias Humidity	$\Delta V_V / V_V \leq \pm 10 \%$	90%RH, 40°C, Working Voltage, 1000 hrs
Thermal Shock		-40°C to 85°C, 30 min. cycle, 5 cycles
Full Load Voltage		Working Voltage, 85°C, 1000 hrs

### Package

Size EIA (EIAJ)	0805 (2012)
Standard Packing Quantity (pcs / reel)	4,000



### Features

- Dual function for EMI and ESD
- Compact size for EIA 0402 and 0603
- ESD protection for IEC61000-4-2 Level 4
- Fixed capacitance suitable for high-speed I/O port transient voltage protection
- RoHS Compliant

### Applications

Applications for I/O Port for Mother Board and Notebook (RS232, USB, PS2, VGA, Audio), Set-Top Box, MP3 Players, DVD Players, and Docking System etc.

### How to Order

**VPORT** **0402** **100** **M** **V05**

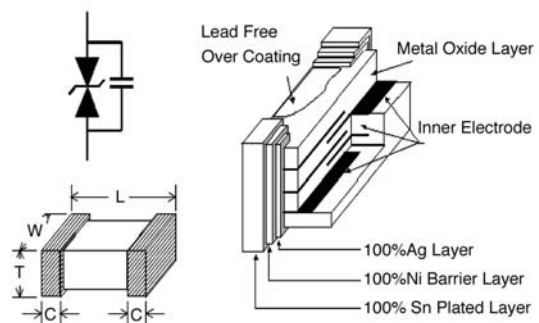
1            2            3            4            5            6

- 1 Series Type : V—Over Voltage Protection  
PORT—EMI Protection for I/O Port
- 2 Chip Size(EIA) : 0402 / 0603
- 3 Capacitance : Value—XXx10<sup>N</sup>→ XXN  
ex:10pF=10x10<sup>0</sup>→ 100
- 4 Capacitance Tolerance : M—±20%
- 5 Working Voltage : 0402→ 5V  
0603→ 5V/12V
- 6 Suffix for Special Code

### Dimensions

Unit: mm

Size EIA (EIAJ)	0402 (1005)	0603 (1608)
L	1.00±0.15	1.60±0.20
W	0.50±0.10	0.80±0.20
T	0.50±0.10	0.80±0.20
C	0.25±0.15	0.30±0.20



### Specifications

#### General Characteristics (25±5°C)

*Description	A	B	C	D	E	F	G
Part Number	Operating Voltage (V <sub>oc</sub> )	Leakage Current (I <sub>L</sub> )	Capacitance (C <sub>p</sub> )	Clamping Voltage (V <sub>c</sub> )	Capacitance Tolerance	Dissipation Factor	Temperature Characteristic
<b>VPORT 0402 XXXX V05 Series</b>							
VPORT0402100MV05	5V	<15μA	10	34	M: ±20%	4.0%max.	ΔC: +15%/-15%
VPORT0402220MV05			22	30			
VPORT0402330MV05			33	28			
VPORT0402470MV05			47	26			
VPORT0402101MV05			100	23			
VPORT0402151MV05			150	22			
VPORT0402181MV05			180	22			
VPORT0402221MV05			220	20			
<b>VPORT 0603 XXXX V05 Series</b>							
VPORT0603100MV05	5V	<15μA	10	34	M: ±20%	4.0%max.	ΔC: +15%/-15%
VPORT0603220MV05			22	30			
VPORT0603330MV05			33	28			
VPORT0603470MV05			47	26			
VPORT0603101MV05			100	23			
VPORT0603151MV05			150	22			
VPORT0603181MV05			180	22			
VPORT0603221MV05			220	20			
VPORT0603331MV05			330	19			
VPORT0603471MV05			470	19			
VPORT0603102MV05			1000	19			
<b>VPORT 0603 XXXX V12 Series</b>							
VPORT0603220MV12	12V	<15μA	22	42	M: ±20%	4.0%max.	ΔC: +15%/-15%
VPORT0603330MV12			33	40			
VPORT0603470MV12			47	38			
VPORT0603151MV12			150	35			
VPORT0603181MV12			180	31			
VPORT0603331MV12			330	30			

### Specifications

#### \*Description

Item	Description
A	Max. Continuous Operating Voltage ( $V_{bc}$ ).
B	Leakage Current ( $I_L$ ). Measured at rated continuous operating voltage.
C	Capacitance ( $C_p$ ) . The test condition is 1KHz ( $\geq 100\text{pF}$ ) /1MHz ( $< 100\text{pF}$ ) 1Vrms $\pm 10\%$ and the environment temperature is $25\pm 2^\circ\text{C}$ .
D	Max. Clamping voltage ( $V_c$ ). Maximum peak current across the chip with 8/20 $\mu\text{s}$ waveform and 1A pulse current.
E	Capacitance Tolerance. Capacitance Tolerance, $M=\pm 20\%$ .
F	Dissipation Factor.
G	Temperature Characteristic. $-30^\circ\text{C} \sim +85^\circ\text{C}$ .

### General Technical Data

Operating Temperature	$-40^\circ\text{C} \sim +85^\circ\text{C}$
Storage Temperature (on board)	$-40^\circ\text{C} \sim +85^\circ\text{C}$
Response Time	$< 1 \text{ ns}$
Solderability	$245\pm 5^\circ\text{C}$ , $3\pm 1\text{sec}$

### Environmental Performance

Item	Specifications	Test Condition
Bias Humidity	(1) $I_L \leq 15\mu\text{A}$ at Working Voltage (2) $\Delta C_p/C_p \leq \pm 10\%$ (3) Solder Wetting Area $\geq 95\%$	90%RH, $40^\circ\text{C}$ , Working Voltage, 1000 hrs
Thermal Shock		$-40^\circ\text{C}$ to $85^\circ\text{C}$ , 30 min. cycle, 5 cycles
Full Load Voltage		Working Voltage, $85^\circ\text{C}$ , 1000 hrs
Solder Leach Resistance		$260\pm 5^\circ\text{C}$ , $10\pm 1\text{sec}$ .

### Package

Size EIA (EIAJ)	0402 (1005)	0603 (1608)
Standard Packing Quantity (pcs / reel)	10,000	4,000

### Specifications



### Features

- SMD type silicon based chip
- Quick response time (<1ns)
- Low leakage current and clamping voltage
- Low capacitance can meet high speed single transient voltage protection
- Protect multiple I/O lines and one V<sub>CC</sub> line
- Small package to save board space
- Meet IEC 61000-4-2 standard Level 4 for ESD 15kV (Air), 8kV (Contact)
- Solid-state silicon-avalanche technology
- Lead free type

### Applications

- Low Capacitance Product Applications for High-Speed Signal Lines such as HDMI, DVI, USB, IEEE1394 Port etc.
- Applications for I/O Port (RS232, USB, PS2, VGA, Audio) on Mother Board and Notebook, Set-Top Box, MP3 Players, DVD Players, and Docking System etc.

### How to Order

**TV N 0402 01 AB1**

1 2 3 4 5

- 1 Series Type: TV-TVS Diode
- 2 Capacitance (Cp) Code: N – Normal: Cp>20pF,  
L – Low: 1pF ≤ Cp ≤ 10pF, W – Ultra Low: Cp<1pF,  
H- High: >50pF
- 3 Package Size Code: MSOP, SC70, ST23 – SOT23,  
S523 – SOD523, S323 – SOD323, S143 – ST143,  
TP38 – TSSOP38, QF16 – QFN16, 0402-EIA 0402, 0201-EIA 0201
- 4 Channel Code: 02-2 Channels, 01-1 Channel
- 5 Specialized Specification Code

### Specifications

P/N	Package	Capacitance	V <sub>B</sub> (Reverse Breakdown Voltage)	V <sub>RWM</sub> (Reverse Stand-off Voltage)	Channel	Surge Clamping Voltage (I <sub>pp</sub> =5A)	ESD Air/Contact	RoHS	Direction
Units		pF	Volts	Volts		Volts	kV (Max.)		
TVW ST23 04 AD0	SOT23-6L	0.55	6	5	4	-	19/12	Yes	-
TVW MSOP 04 AD0	MSOP-10L	0.55	6	5	4	-	19/12	Yes	-
TVL ST23 04 AD0	SOT23-6L	1	6.2	5	4	8	15/8	Yes	-
TVL S143 02 AC0	SOT143-4L	1.2	6.2	5	2	8.1	17/12	Yes	-
TVL SC70 04 AC0	SC70-6L	1.3	6	5	4	8.1	18/14	Yes	-
TVL QF16 04 AC0	QFN1616P6E	1.3	6	5	4	8.1	18/14	Yes	-
TVN S323 01 AB0	SOD323-2L	11.5	6.1	5	1	7	23/15	Yes	Bi-direction
TVN S523 01 AB0	SOD523-2L	11.5	6.1	5	1	7	22/15	Yes	Bi-direction
TVN ST23 02 AB0	SOT23-3L	12	6.1	5	2	7	22/15	Yes	-
TVN ST23 04 AB1	SOT23-5L	12	6.1	5	4	7	22/15	Yes	-
TVN QF16 05 AB0	QFN1616P6E	13	6	5	5	6.8	16/10	Yes	-
TVN SC70 04 AB0	SC70-5L	13	6	5	4	6.5	16/10	Yes	-
TVN S523 01 AA0	SOD523-2L	20	6.1	5	1	7	23/15	Yes	-
TVN ST23 02 AA0	SOT23-3L	90	6.1	5	2	7	23/17	Yes	-
TVL 0402 01 AB1 <i>(NEW)</i>	0402	6	10	6	1	14 (I <sub>PP</sub> =1A)	15/8	Yes	Bi-direction
TVL 0201 01 AB0 <i>(NEW)</i>	0201	3	10	5	1	14 (I <sub>PP</sub> =1A)	15/8	Yes	Bi-direction
TVN 0402 01 AB1 <i>(NEW)</i>	0402	50	10	5	1	12 (I <sub>PP</sub> =1A)	15/8	Yes	Bi-direction
TVN 0201 01 AB0 <i>(NEW)</i>	0201	20	10	5	1	13 (I <sub>PP</sub> =1A)	15/8	Yes	Bi-direction
TVH 0402 01 AB1 <i>(NEW)</i>	0402	60	6	5	1	10 (I <sub>PP</sub> =1A)	15/8	Yes	Bi-direction

V<sub>B</sub> – Measured voltage at any I/O pin to Ground at 1mA DC current. IPP–Maximum peak current in 8/20ms waveform.  
C<sub>p</sub> – Device capacitance measured with zero volt bias at 1MHz.

### General Technical Data

Operating Temperature	-55°C ~ +85°C
Storage Temperature	-55°C ~ +150°C
Response Time	<1 ns
Solderability	245 ± 5°C, 3±1sec.

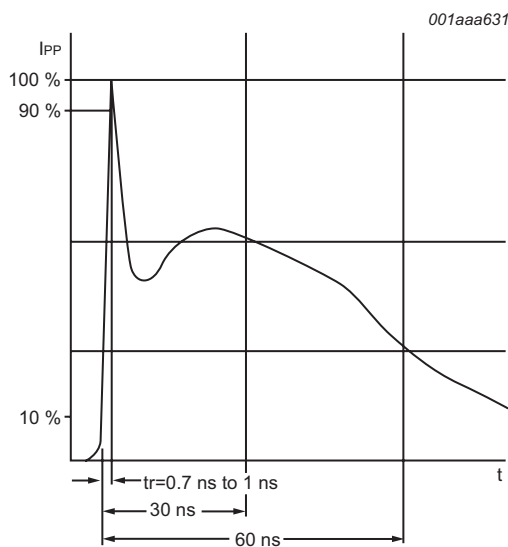
### Environmental Performance

Item	Specifications	Test Condition
Bias Humidity	$I_L \leq 10\mu A$	90%RH, 40°C, Working Voltage, 1000 hrs
Thermal Shock		-40°C to 85°C, 30 min. cycle, 5 cycles
Full Load Voltage		Working Voltage, 85°C, 1000 hrs
Solder Leach Resistance	(1) $I_L \leq 10\mu A$ at Working Voltage (2) Solder Wetting Area $\geq 95\%$	260±5°C, 10±1sec.

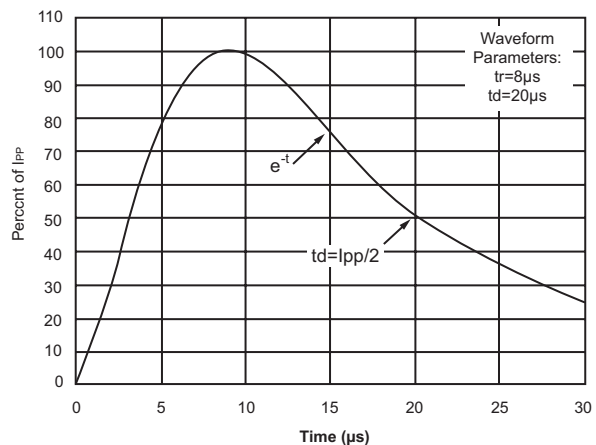
### Package

Package Size	SOT23	SOD523	SOD323	SOT143	SC70	MSOP10	QFN	FBPA	0402	0201
Standard Packing Quantity	3,000	4,000	3,000	3,000	3,000	3,000	3,000	3,000	10,000	15,000

### Typical Characteristics

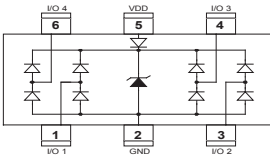
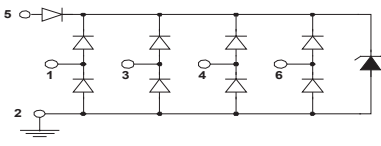
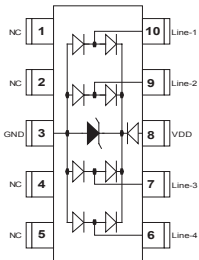
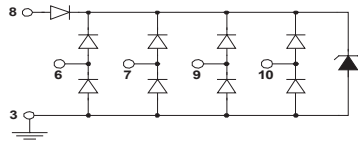
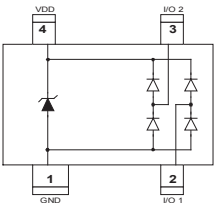
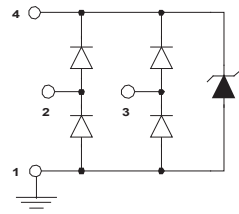
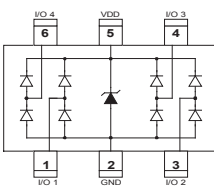
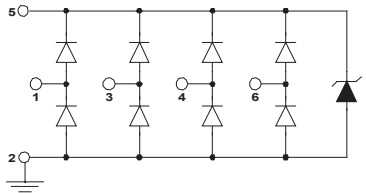
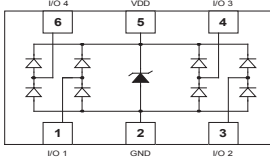
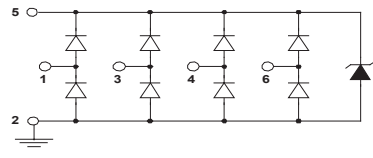
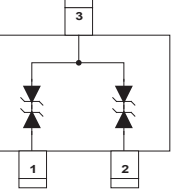
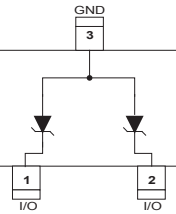


**ESD Pulse Waveform**  
According to IEC 61000-4-2

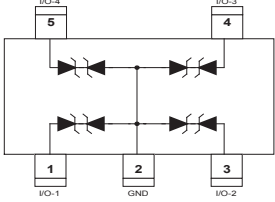
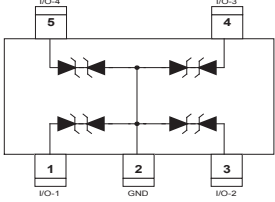
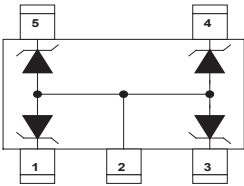
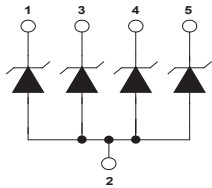
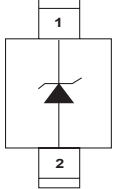
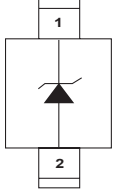








**Surge (8/20 μ sec) Pulse Waveform**

### Pin Configuration and Circuit Diagram

Part Number	Package	Pin Configuration	Circuit Diagram
TVW ST23 04 AD0	SOT23-6L		
TVL ST23 04 AD0			
TVW MSOP 04 AD0	MSOP-10L		
TVL S143 02 AC0	SOT143-4L		
TVL SC70 04 AC0	SC70-6L		
TVL QF16 04 AC0	QFN1616P6E		
TVN QF16 05 AB0			
TVN ST23 02 AB0	SOT23-3L		
TVN ST23 02 AA0			

### Pin Configuration and Circuit Diagram

Part Number	Package	Pin Configuration	Circuit Diagram
TVN ST23 04 AB1	SOT23-5L		
TVN SC70 04 AB0	SC70-5L		
TVN S323 01 AB0	SOD323-2L		
TVN S523 01 AB0 TVN S523 01 AA0	SOD323-2L		
TVL 0402 01 AB1 TVN 0402 01 AB1 TVH 0402 01 AB1	0402		
TVL 0201 01 AB0 TVN 0201 01 AB0	0201		

### Package Dimension

Unit: mm

Package	Length		Width		Thickness	
	Min.	Max.	Min.	Max.	Min.	Max.
MSOP-10L	2.9	3.1	2.9	3.1	0.81	1.12
SC70-5L	1.9	2.1	1.15	1.35	0.9	1.1
SC70-6L	1.9	2.1	1.15	1.35	0.9	1.1
QFN1616P6E	1.55	1.65	1.55	1.65	0.5	0.6
SOD323-2L	1.56	1.76	1.2	1.4	0.8	1.1
SOD523-2L	1.1	1.3	0.7	0.9	0.5	0.7
SOT143-4L	2.8	3.04	1.2	1.4	0.95	1.17
SOT23-6L	2.84	3	1.5	1.7	0.95	1.45
SOT23-3L	2.84	3	1.2	1.4	0.95	1.17
SOT23-5L	2.84	3	1.5	1.7	0.95	1.45
0402	1.00	1.20	0.4	0.6	0.4	0.6
0201	0.55	0.65	0.25	0.35	0.25	0.35

**Application Block Diagrams**

Data Rate (Mbit/sec)			0	0.03	0.13	2	12	25	125	320	400	480	800	5,000	10,000
Interface (I/O port)				Audio	RS232	IEEE1284	USB 1.1	RS485	Ethernet		IEEE1394a		IEEE1394b	HDMI 1.2	HDMI 1.3
Capacitance	Rated Voltage	Suggest Spec.								LCDs		USB 2.0			DisplayPort
0.2pF	~12V	EGA Series													
0.5pF	~18V	MLVG 0R5IV18													
1.0pF	~18V	MLVG 1R0IV18													
3.0pF	~18V	MLVG 3R0TV18													
5.0pF	~9V	MLVG 5R0QV09													
10pF	~5.5V	MLVG 100NV05													
22pF	~5.5V	MLVG 220NV05													
110pF	~26V	MLVS K20													
110pF	~18V	MLVS K14													
130pF	~14V	MLVS K11													
190pF	~9V	MLVS M07													
300pF	~5.5V	MLVS M04													
0.55pF	~6V	TVW MSOP 04 AD0													
		TVW ST23 04 AD0													
1pF	~6.2V	TVL ST23 04 AD0													
1.2pF	~6.2V	TVL S143 02 AC0													
1.3pF	~6V	TVL SC70 04 AC0													
		TVL QF16 04 AC0													
7pF	~6V	TVN SC70 05 AB0													
		TVN ST23 05 AB0													
8pF	~6V	TVN SC70 04 AB0													
11.5pF	~6.1V	TVN S523 01 AB0													
		TVN S323 01 AB0													
12pF	~6.1V	TVN ST23 04 AB1													
		TVN ST23 02 AB0													
13pF	~6V	TVN ST23 04 AB2													
		TVN QF16 05 AB0													
20pF	~6.1V	TVN S523 01 AA0													
90pF	~6.1V	TVN ST23 02 AA0													
Typical System Application			DC Power Bus	Speaker	Serial Port (com)	Parallel Port(LPT)	Mouse	Control System	Network Hardware	TFT Display	Digital Video Recorder	Digital Still Camera	Digital Video Recorder	Set Top Box	Set Top Box
			Keypad	Microphone	Keyboard	Printer	Keyboard		PCI Adapter		Hard Disk Drive	Scanner	Hard Disk Drive	DVD	DVD
			Buttons	Audio Headset	Mouse	Scanner	Hub		Hub		Video Editing System	Hard Disk Drive	Video Editing System	HDTV	HDTV
							PDA		Router		Scanner	Desktop	Scanner	Projector	Projector
							Digital Camera		Webswitch		Desktop	Laptop	Desktop	LCD Monitor	LCD Monitor
							Scanner		Cable /xDSL Modem		Laptop	Webpad	Laptop		
							Game Controller					Printer			
							Cell Phone								



### Features

- Protection against ESD voltages and currents (IEC61000-4-2 Level 4)
- Extremely quick response time (<1ns) present ideal ESD protection
- Extremely low capacitance (0.1pF typical)
- Extremely low leakage current
- SMD (Surface Mount Device)
- Zero signal distortion

### Applications

- TVU1240R1A is applied to high speed signal interface, including Antenna circuit, USB2.0, IEEE-1394, DVI HDMI
- Suitable for Digital Video Equipment Mobile Phone, GPS Antenna, Bluetooth Communication Equipment.

### How to Order

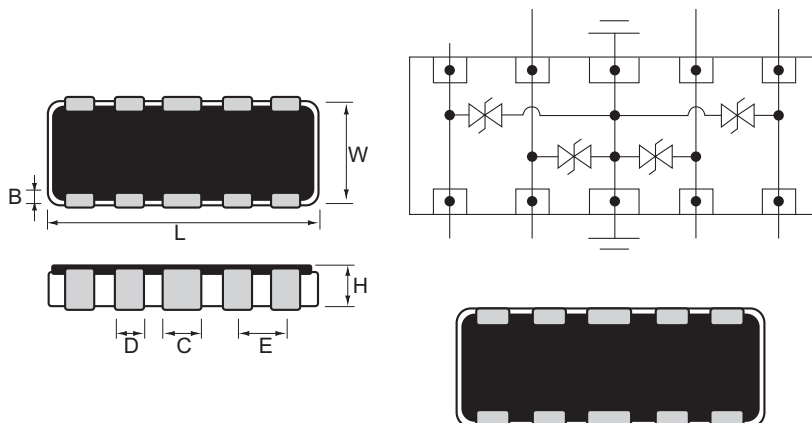
**TVU**    **12**    **4**    **0R1**    **A**  
1    2    3    4    5

- 1 TVU : Ultra Capacitance
- 2 Working Voltage:  $V_{DC}$  12V
- 3 Channel: 4 channels
- 4 Capacitance: 0.1pF
- 5 Chip Size: L:2.5mm W:1.0mm

### Dimensions

Unit: mm

Size EIA (EIAJ)	1004 (2510)
L	2.5±0.1
W	1.0±0.1
T	0.5±0.1
B	0.2±0.1
C	0.3±0.05
D	0.2±0.05
E	0.5±0.05



### Specifications

Characteristics	TVU1240R1A (NEW)
Rated Voltage (max)	12V
Leakage Current (max) (@12VDC)	0.01μA
Trigger Voltage (Vt)	300V typ.
Clamping Voltage (Vc)	30V typ.
Capacitance (Cp), @1MHz	0.1pF typ.
Response Time	<1ns
ESD Voltage Capability, IEC 61000-4-2 Contact Discharge Mode	8KV
ESD Voltage Capability, IEC 61000-4-2 Air Discharge Mode	15KV
ESD Withstand Pulses	100 typ.

### General Technical Data

Operating Temperature	-40°C ~ +85°C
Storage Temperature	-55°C ~ +125°C
Response Time	<1 ns
Solderability	245±5°C, 3±1sec

### Environmental Performance

Item	Specifications	Test Condition
Bias Humidity	$I_L \leq 10 \mu A$	90%RH, 40°C, Rated Voltage, 1000 hrs
Thermal Shock		-40°C to 85°C, 30 min. cycle, 5 cycles
Full Load Voltage		Rated Voltage, 85°C, 1000 hrs
Solder Leach Resistance		260±5°C, 10±1sec.

$I_L$  – Leakage current at rated voltage, the maximum leakage current was measured after reliability test.

### Package

Size EIA (EIAJ)	1004 (2510)
Standard Packing Quantity (pcs / reel)	5,000