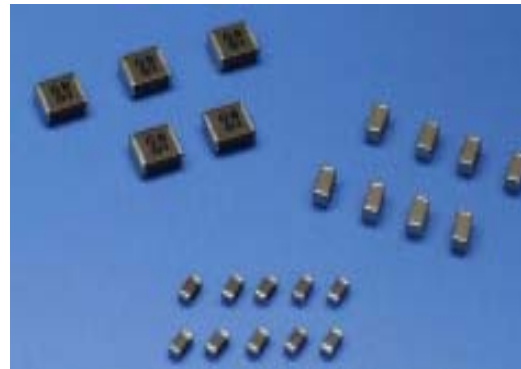


September 1<sup>st</sup>, 2005.  
Component Business Unit  
Murata Manufacturing Co., Ltd.  
株式会社 村田制作所 元件事业本部

**Chip Monolithic Ceramic Capacitor**  
**贴片独石陶瓷电容器**

**Electrical Characteristic Explanation**  
**电气特性说明说明**



**Note : 注 :**

The information of this material are as of the date mentioned above. They are subject to change without advance notice. If there are any questions, please contact our sales representatives or product engineers.

对于这些材料信息以上面的日期为准。信息若有变更，恕不另行通知。若有任何疑问，请与我公司销售代表或产品工程师联系。

### 1. Material of Capacitor

电容器的材料

### 2. Ceramic material (Class 1, Class 2)

陶瓷材料

### 3. Electrical Characteristic (Class 1, Class 2)

陶瓷电容器的电气特性

### 4. Function of Ceramic Capacitor

陶瓷电容器的功能

### 5. Rated Voltage Explanation (Ceramic Capacitor)

额定电压说明(陶瓷电容器)

### Fixed Capacitor 固定电容器

#### Film 薄膜

Using plastic film as the dielectric , thin metal film metal as inner electrodes , stacked and rolled up together.  
Non polarized organic film capacitor.

#### Ceramic 陶瓷

Using Ceramic as the dielectric , metal baked with ceramic as inner electrodes , non-polarized and non-organic capacitors.

#### Aluminum 铝

Using high purity conductive material as positive electrodes , oxidized layers on the electrodes , either liquid or solid electrolyte contacting oxidized layers as the negative electrodes.

#### Glass 玻璃

Using glass film or glass powder as the dielectric , metallic foil or metallic paste as electrodes.

#### Mica 云母

Using natural Mica as the dielectric , metallic foil as inner electrodes.

#### Electrolytic

#### Double Layer

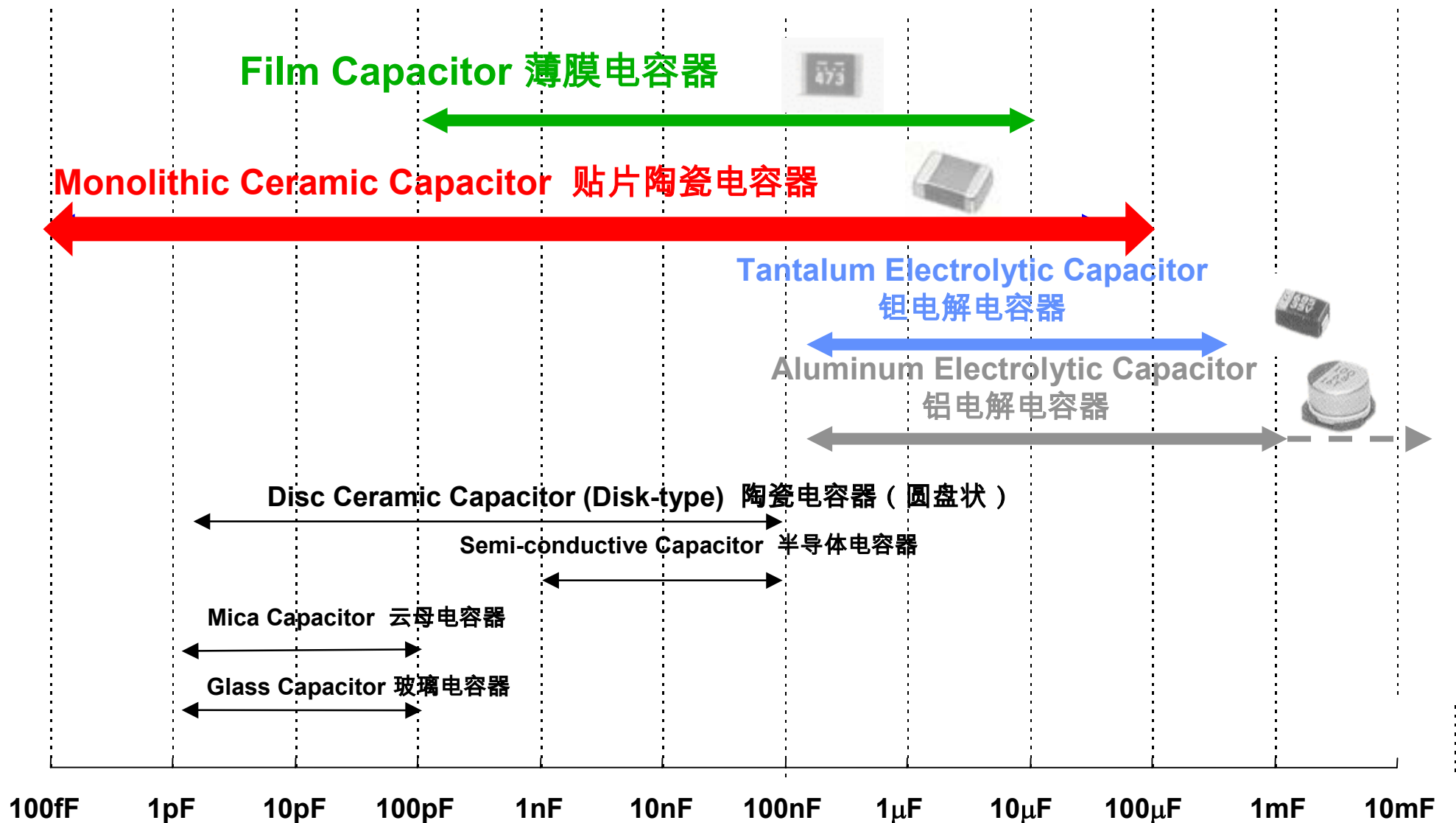
#### 双倍电解层

Impregnated collecting electrode with liquid electrolyte , divided into positive / negative / by a porous separator as polarized capacitors.

# Capacitance Range by Material

电容器的材料

muRata

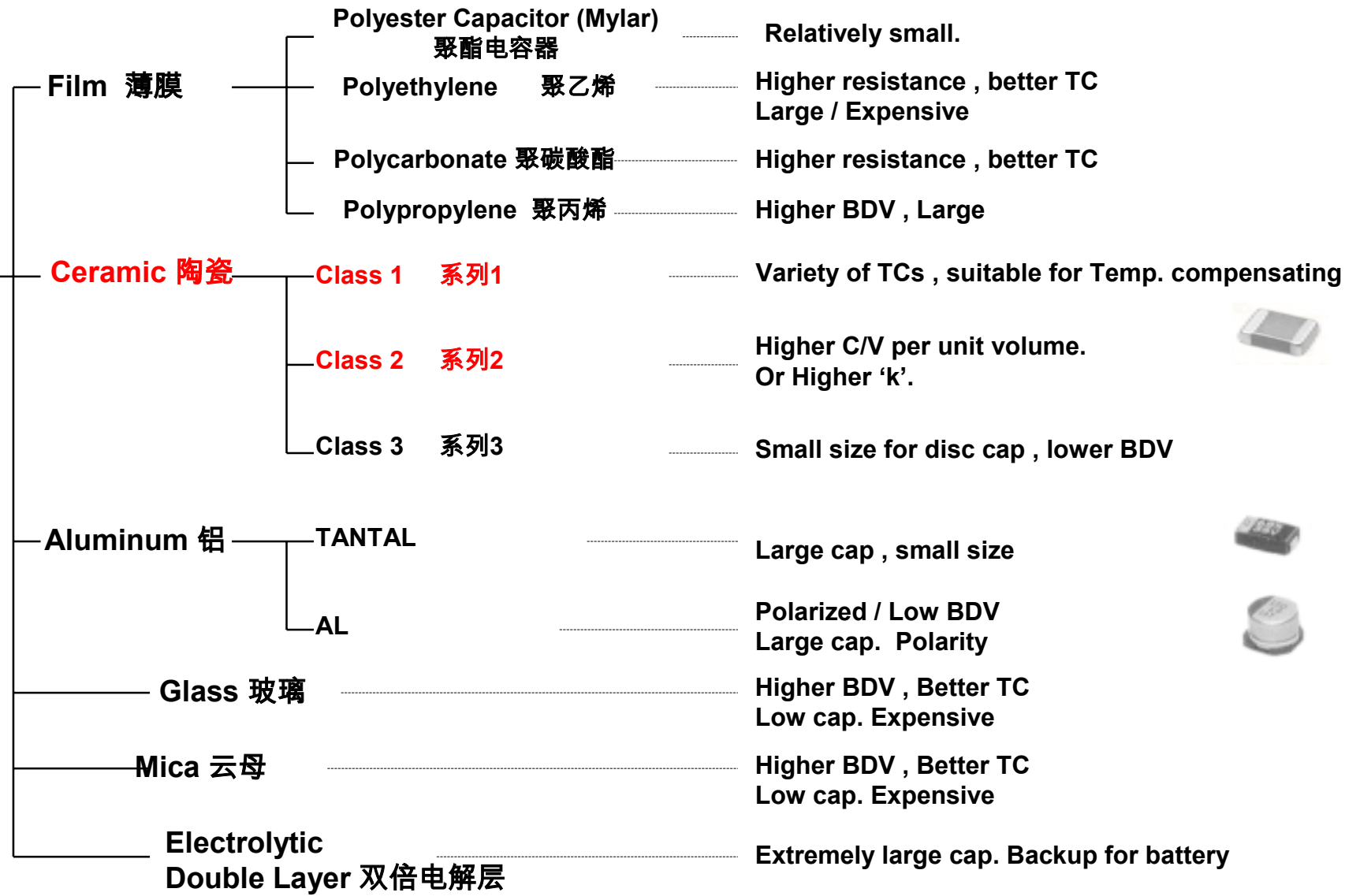


# Material of Capacitor

## 电容器的材料



### Fixed Capacitor 固定的电容器



# Ceramic Material & Characteristic

## 陶瓷材料和特性

Class 分类	Ceramic Material 陶瓷材料	Ceramic Character 陶瓷特性	Temp. Char. 温度特性	Capacitance Range 容量範圍	Recommended Circuit 推荐电路
Class 1 分类1	Temperature Compensation 温度補償用 (TC系)	Capacitance Accuracy for temperature 对温度容量值精度大	<EIA> C0G,U2J <EIA-J> CH,UJ,SL	CHIP 0.1pF - 0.1uF 片状独石 (0R1 - 104)	In Band Pass Filter Circuit 带通滤波电路
				LEAD 1pF - 680nF 插脚 (010 - 683)	In Coupling Circuit 耦合电路
					In Temp. Compensasion Circuit 温度補償电路
Class2 分类2	High Dielectric 高介电系列 (Hi-K系)	Hi Capacitance Value 大容量	<EIA> X7R,Y5V, X5R,X6S <EIA-J> B, R, F	CHIP 100pF - 100uF 片状独石 (101 - 107)	In By-Pass Circuit 旁路电路
				LEAD 220pF - 4.7uF 插脚 (221 - 475)	In Decoupling Circuit 去耦电路
					In Resonance Circuit 振荡电路

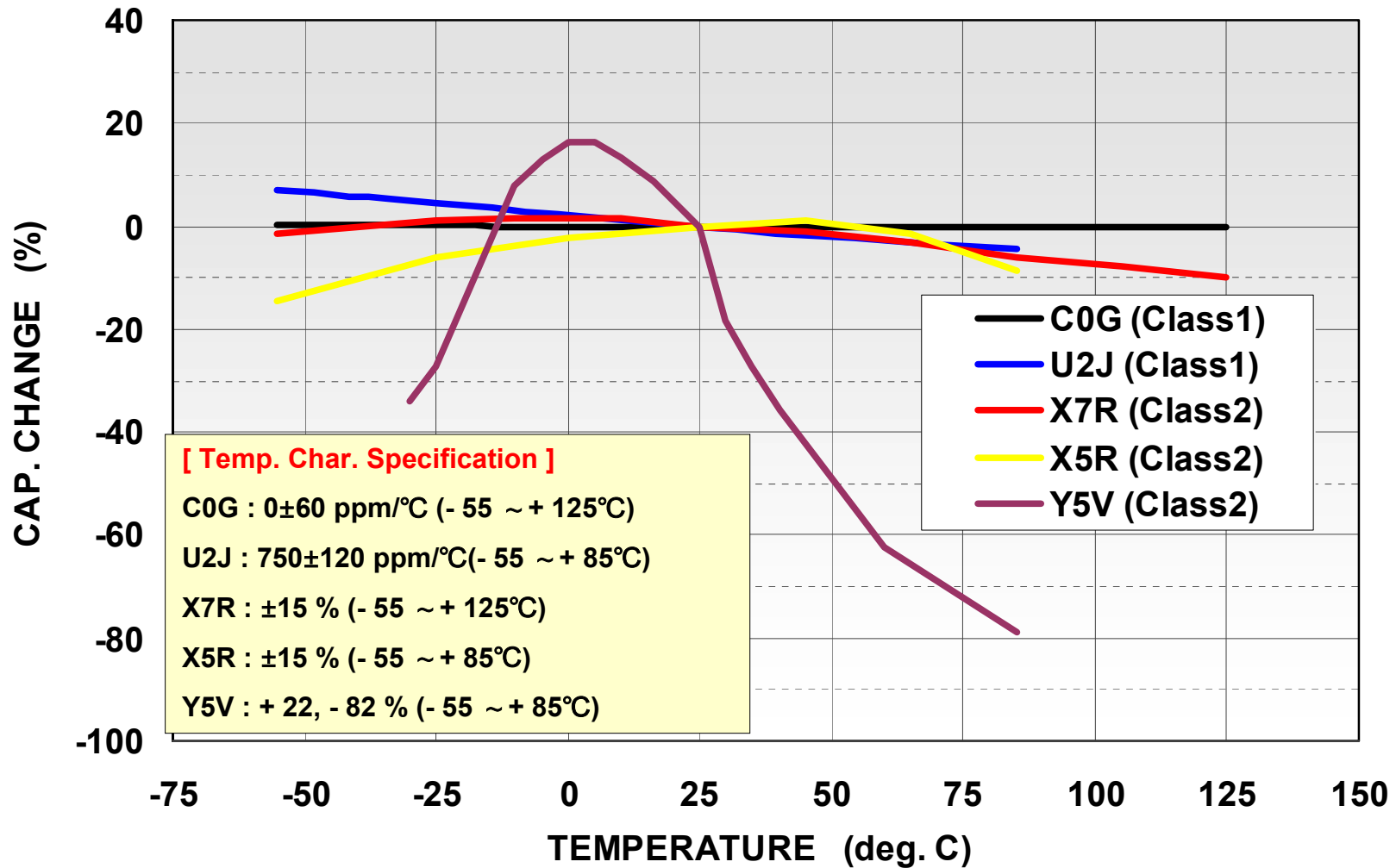
### [ Classification by Temperature Characteristic ]

Class 1 : C0G, U2J

Class 2 : X7R, X5R, Y5V

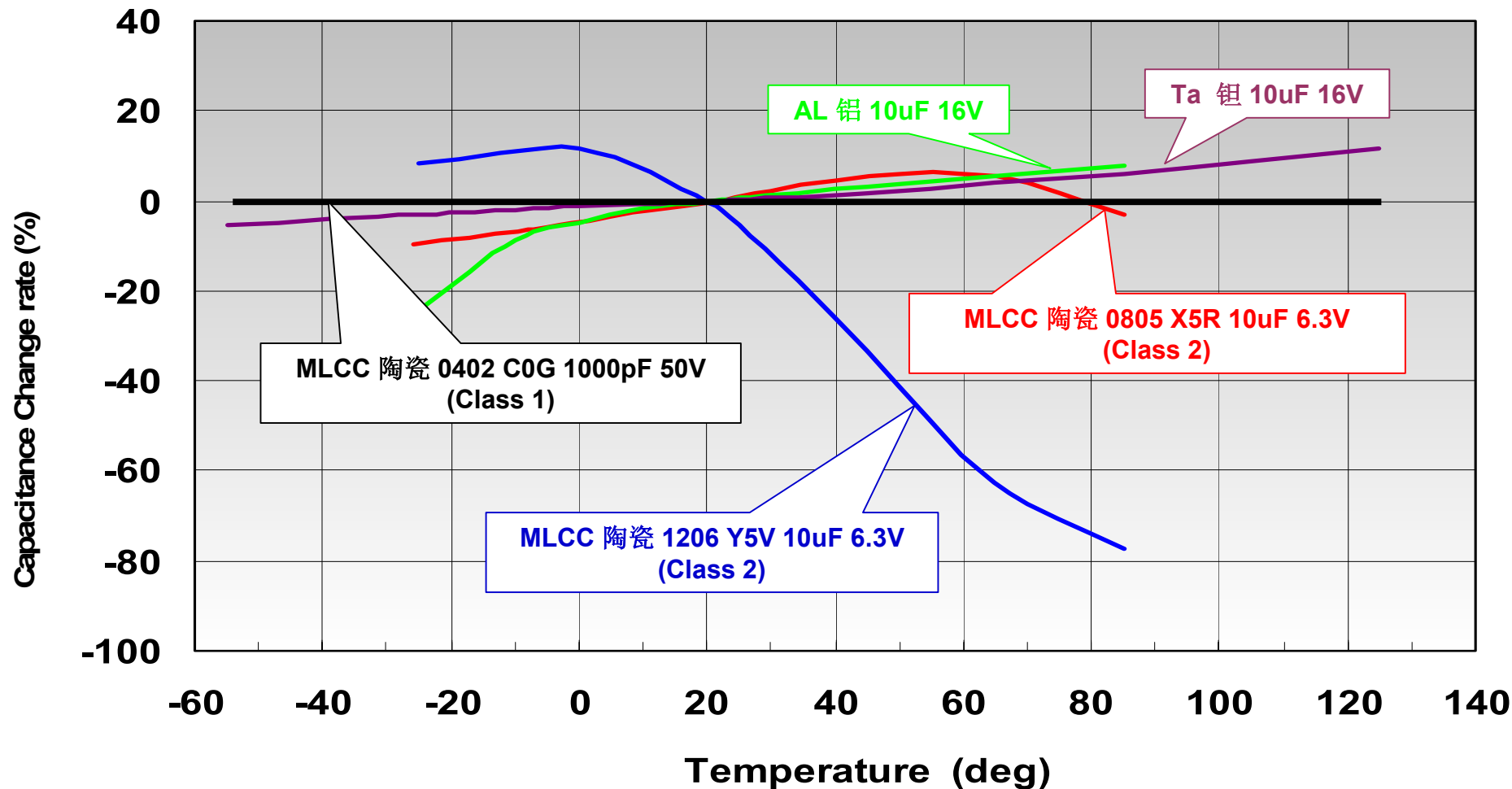
# Temp. Characteristic (Class 1 & Class 2)

## 温度特性 (例)



# Temp. Characteristic (AL/TAN-CAP Comparison)

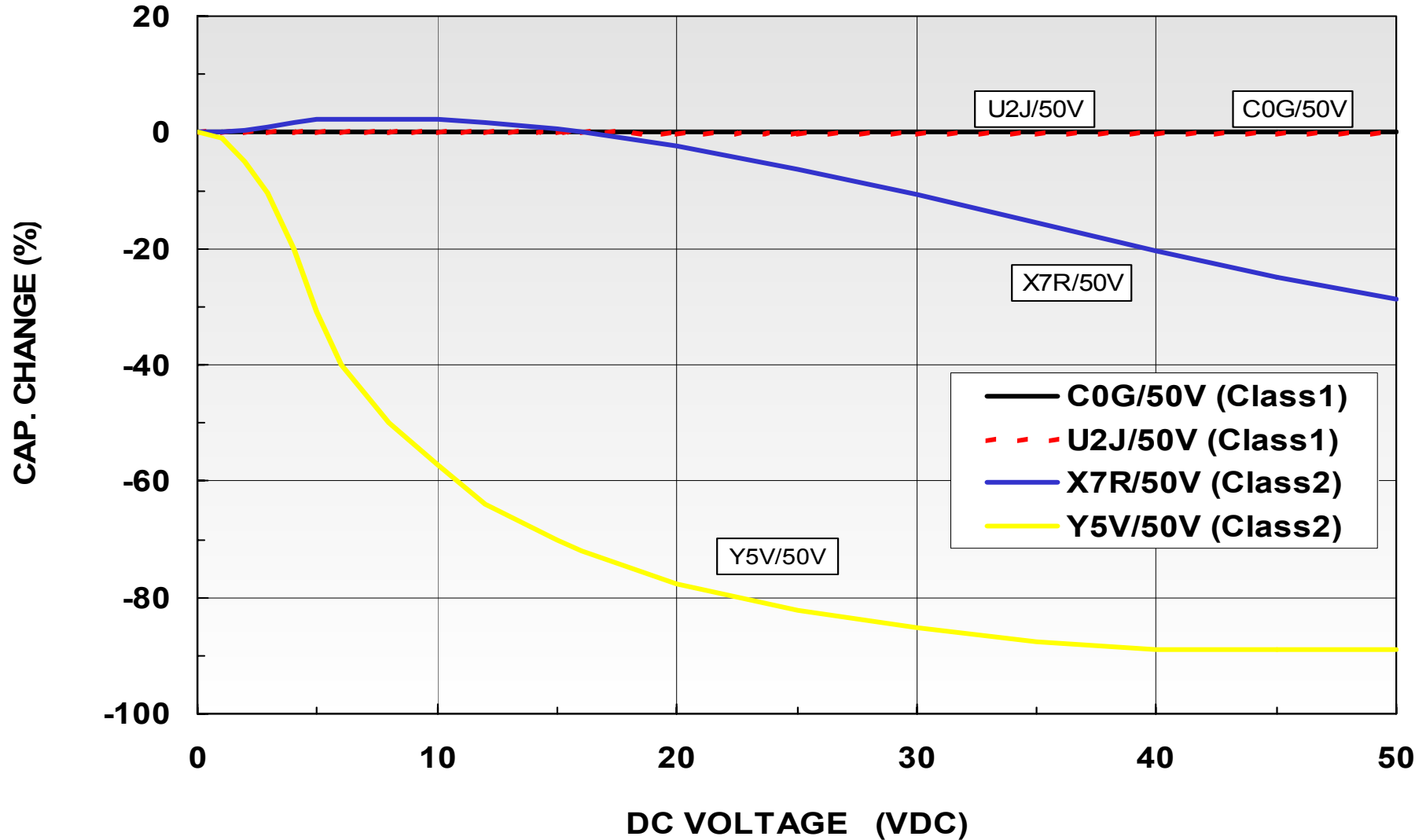
温度特性 (例)





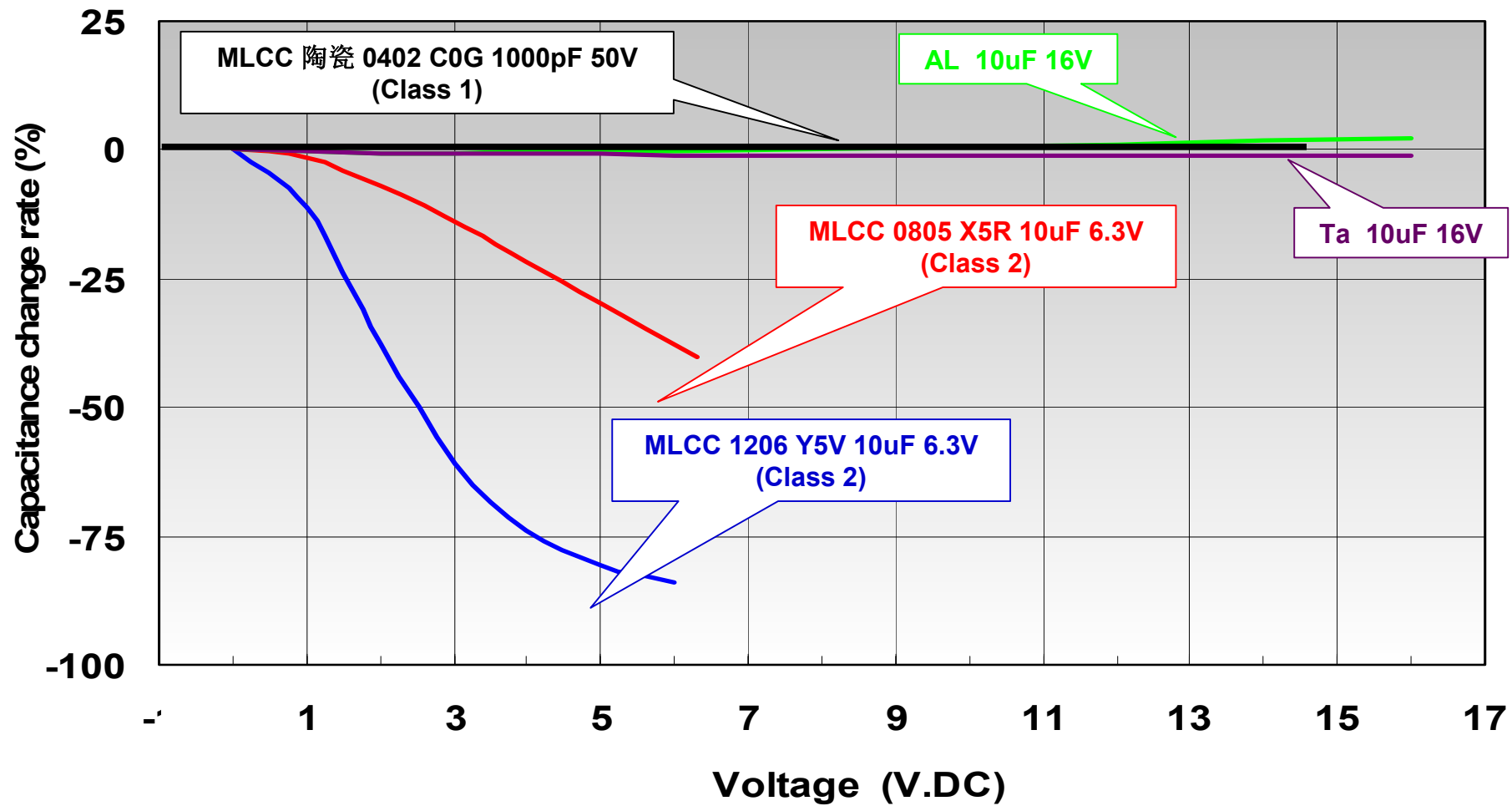
# Bias Characteristic (Class 1 & Class 2)

电压特性 ( 例 )



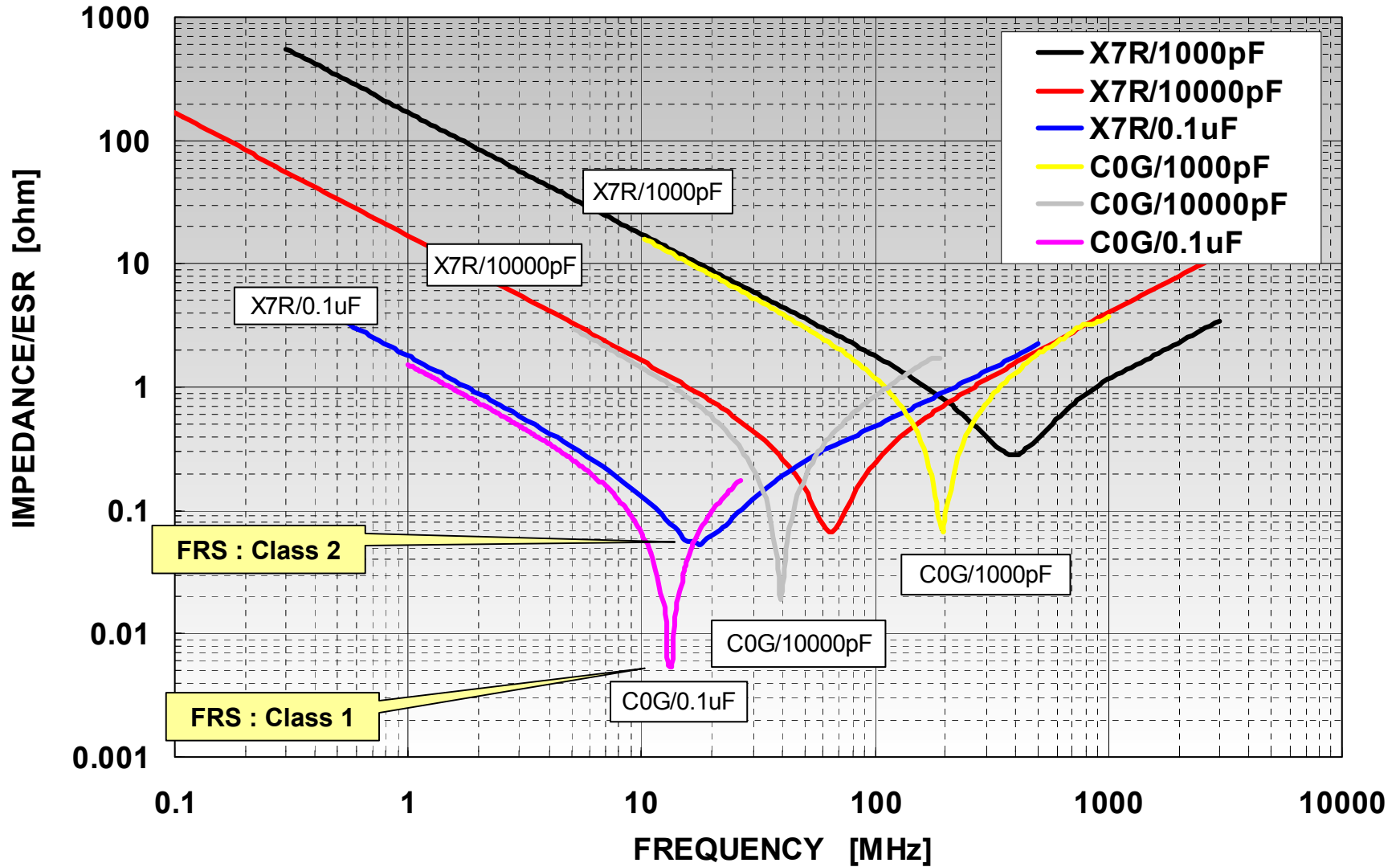
# Bias Characteristic (AL/TAN-CAP Comparison)

电压特性 (例)



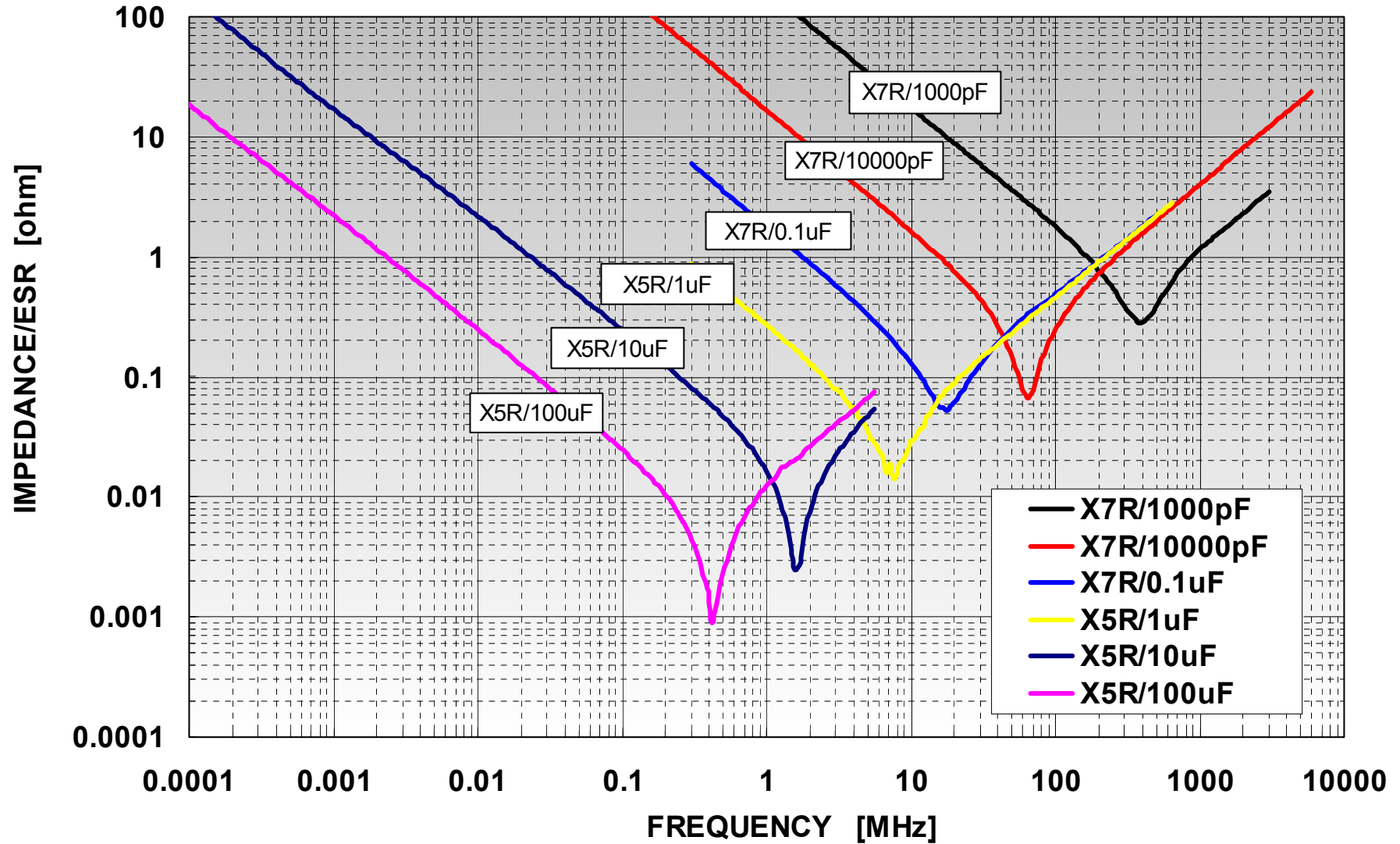
# Freq. Characteristic (Class 1 & Class 2)

## 频率特性 (例)



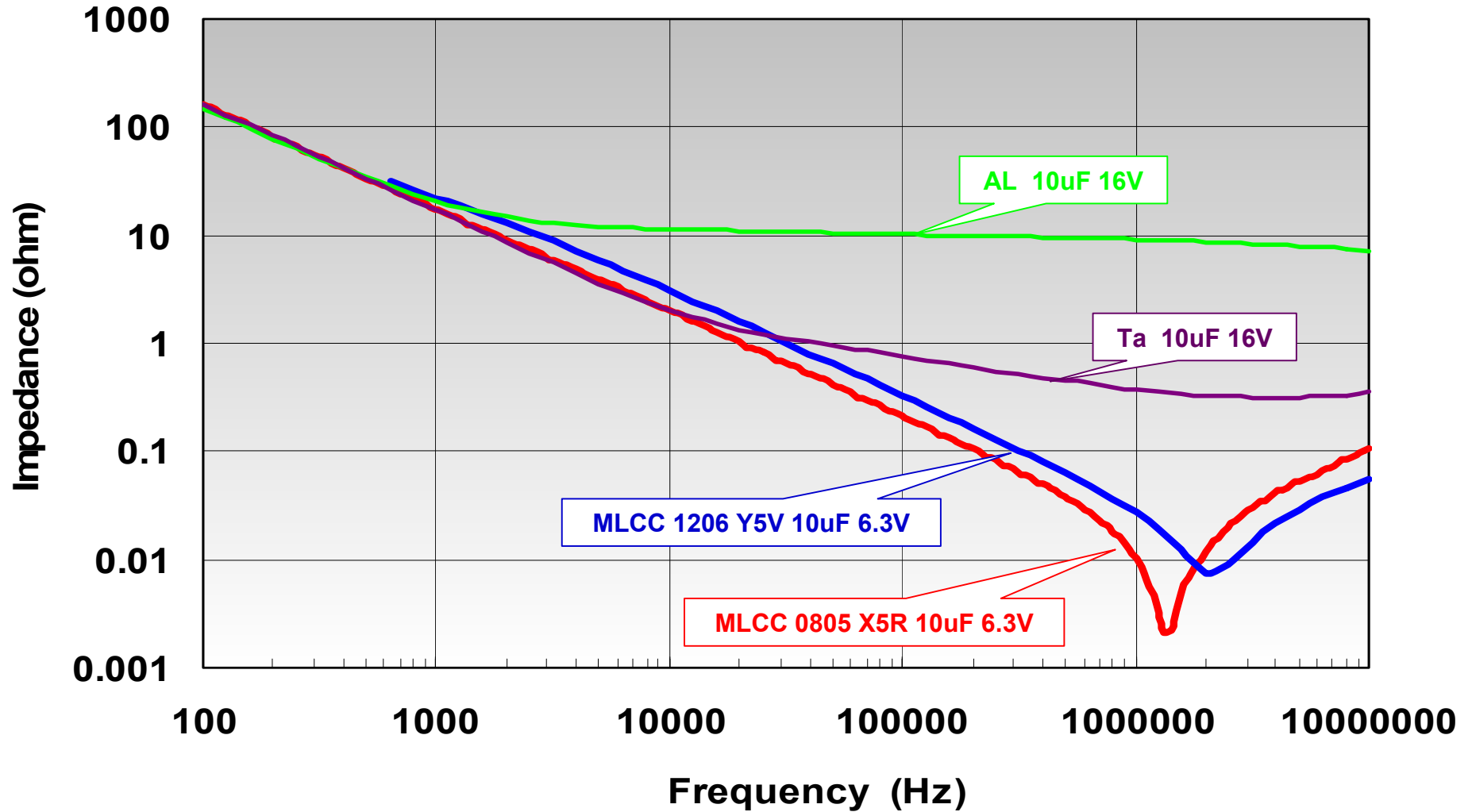
# Freq. Characteristic (Capacitance Value)

频率特性 (例)

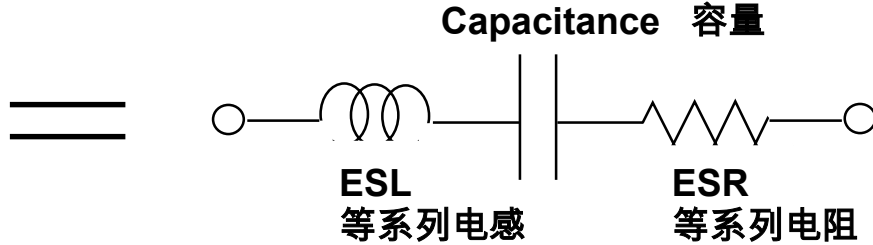
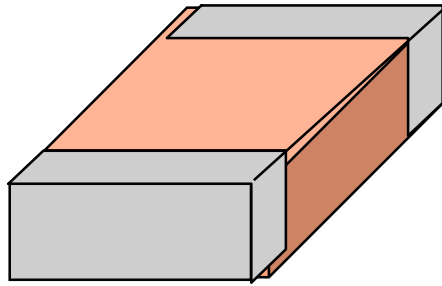


# Freq. Characteristic (AL/TAN-CAP Comparison)

频率特性 (例)



### Equivalent capacitor circuit 相等的电容电流



#### ABSTRACT 摘要

- Every capacitor has ESR(equivalent series resistance) and ESL.每个电容器都有ESR (等系列电阻) 和ESL(等系列电感)。

- For high frequency (MHz to GHz range) microwave applications, ESR should be lowered in order to reduce loss.对于高频率 (由MHz到GHz的范围) 微波的应用和ESR为了减少损失都应减低。

-Q stand for head word of Quality Factor. 字母Q代表质量因素

-  $Q = 1 / DF (\Rightarrow \text{loss tangent})$

$$Z = \sqrt{R^2 + (\omega L - 1/\omega C)^2}$$

(微量)      (微量)

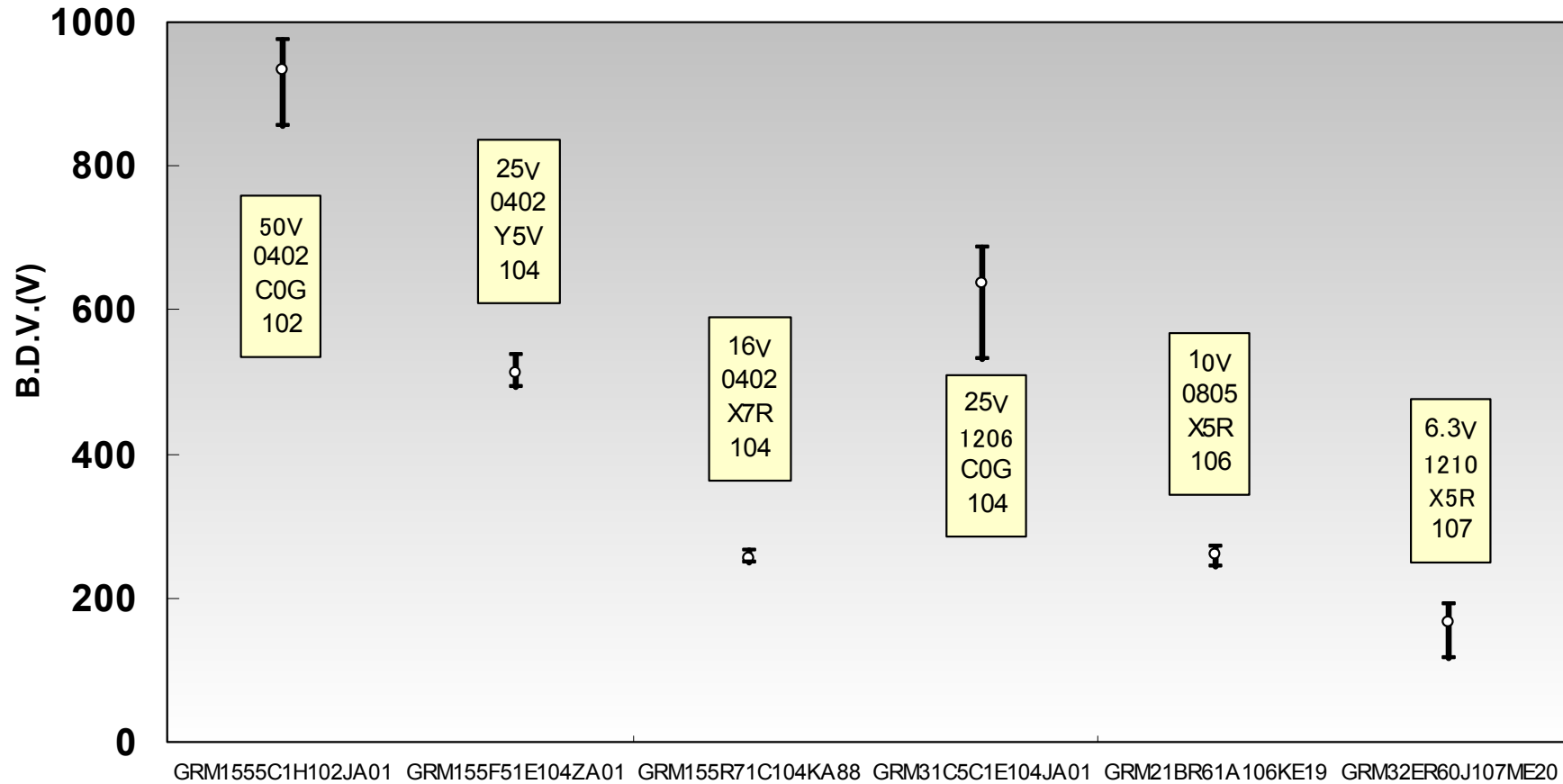
$$= \sqrt{R^2 + (2\pi fL - 1/2\pi fC)^2}$$

(频率 f → 大)      (2πfL → 大)      (1/2πfL → 少)

(容量 C → 大)      (1/2 π fL → 少)

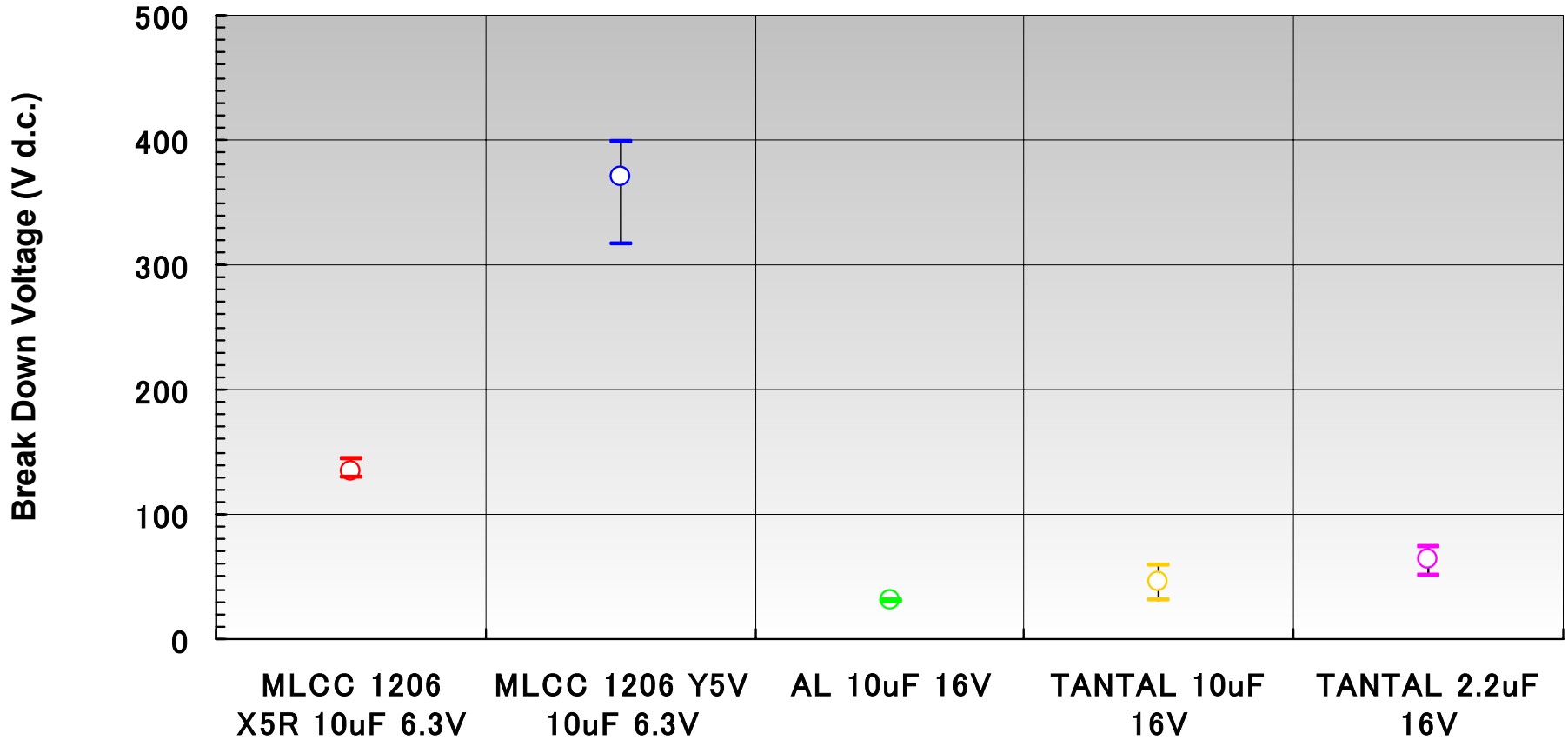
# B.D.V. (Break Down Voltage)

击穿电压 (例)



# B.D.V. (Ceramic, AL/TAN-CAP Comparison)

## 击穿电压 (例)





# Comparison of various Capacitors

## 各类电容器的比较

		Cap	F - char	TC	High Voltage	High Temp	Size	Life	Cost
AL capacitor	electrolyte	excellent	no good	no good	good	Fair	good	no good	excellent
	OS	good	good	excellent	no good	no good	fair	good	fair
	SP	good	good	excellent	no good	good	fair	good	fair
TA capacitor		good	fair	excellent	fair	good	good	fair	good
Film capacitor		no good	excellent	excellent	excellent	fair	no good	excellent	fair
<b>MLCC</b>		good	excellent	fair	excellent	excellent	good	excellent	good

# Ceramic Material & Characteristic

## 陶瓷材料和特性

Class 分类	Ceramic Material 陶瓷材料	Ceramic Character 陶瓷特性	Temp. Char. 温度特性	Capacitance Range 容量範圍	Recommended Circuit 推荐电路
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				LEAD 1pF - 680nF 插脚 (010 - 683)	In Coupling Circuit 耦合电路 In Temp. Compensasion Circuit 温度補償电路
Class2 分类2	High Dielectric 高介电系列 (Hi-K系)	Hi Capacitance Value 大容量	<EIA> X7R,Y5V, X5R,X6S <EIA-J> B, R, F	CHIP 100pF - 100uF 片状独石 (101 - 107)	In By-Pass Circuit 旁路电路
				LEAD 220pF - 4.7uF 插脚 (221 - 475)	In Decoupling Circuit 去耦电路 In Resonance Circuit 振荡电路

### [ Classification by Temperature Characteristic ]

Class 1 : C0G, U2J

Class 2 : X7R, X5R, Y5V

# The Function of Ceramic Capacitor

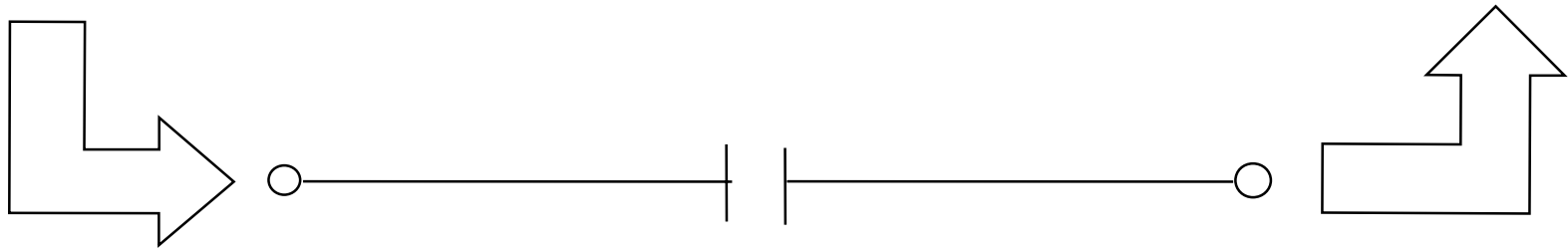
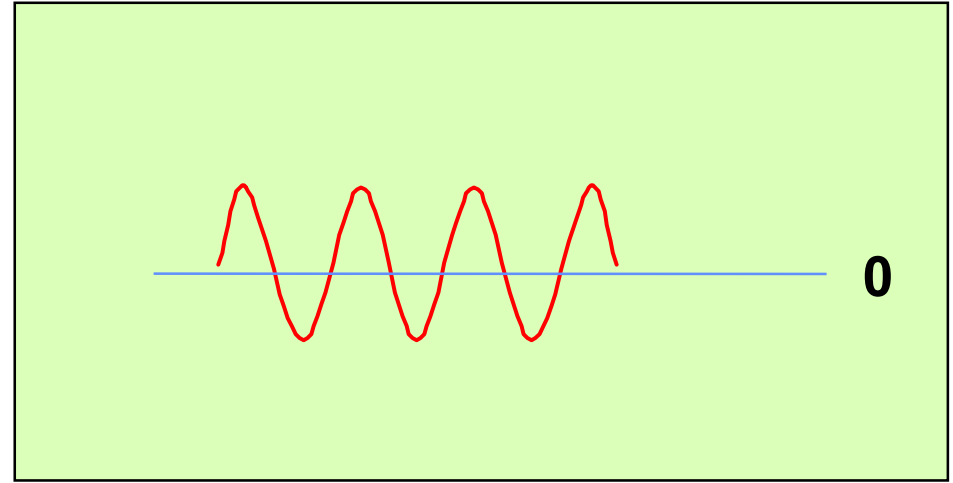
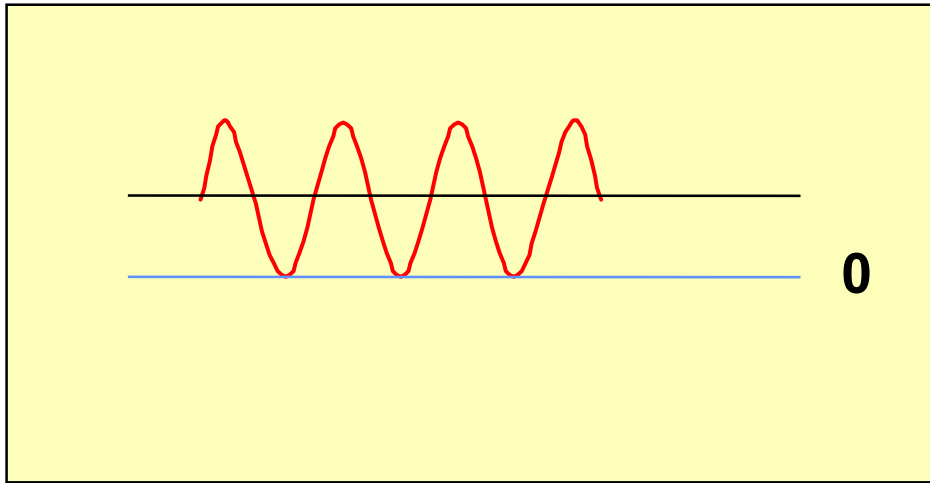
## 陶瓷电容器的功能

<b>Use 用途</b>	<b>Function 特点</b>
Decoupling 去耦	When more than 2 amplifiers connected, capacitors are used so that even the slightest amplified signal will not be fed back from the front amplifier, which causes unstable operation or oscillation.
Coupling 耦合	When a capacitor is connected to a number of amplifiers or other circuits, it effectively blocks the DC current and permits A.C signal.
Smoothing the voltage waveform 平整波形电压	A monolithic capacitor is connected to a position following a rectifying diode of the power supply circuit, and where this diode is used for rectifying the AC ripple elements contained in the incoming AC current. When the voltage waveform rectified by the diode contains excessive ripple, it should be properly smoothed before eventually being passed to other circuits.
Temp. Compensation 温度补偿	The functions of components such as transistors are affected by changes in atmospheric temperature. Capacitors compensate for this effect and ensure normal operation.
Oscillation 振荡	An RC oscillation circuit is formed by being connected to a resistor where T.C or tolerance are not required, e.g., tuning circuits
Tuning 调谐	Capacitors are used to select the desired signal.

# The Function of Ceramic Capacitor

## 陶瓷电容器的功能

### Coupling 耦合

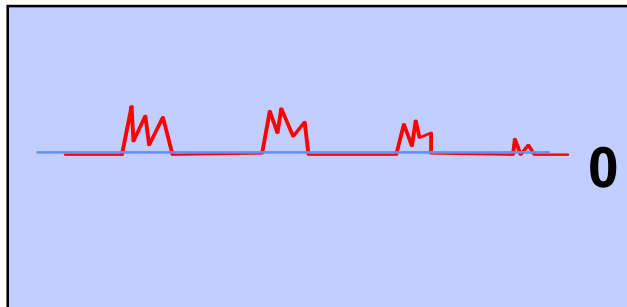
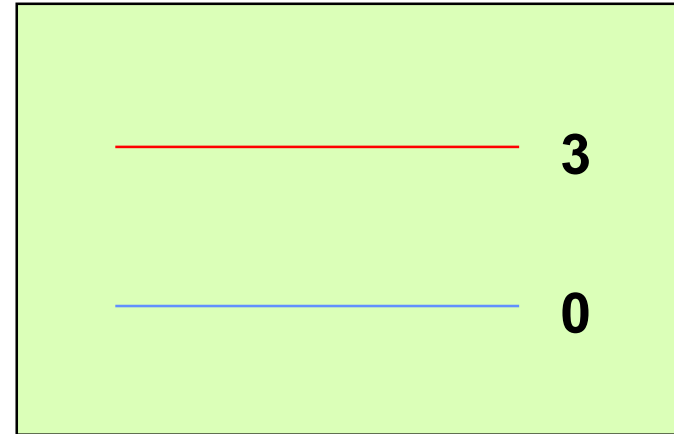
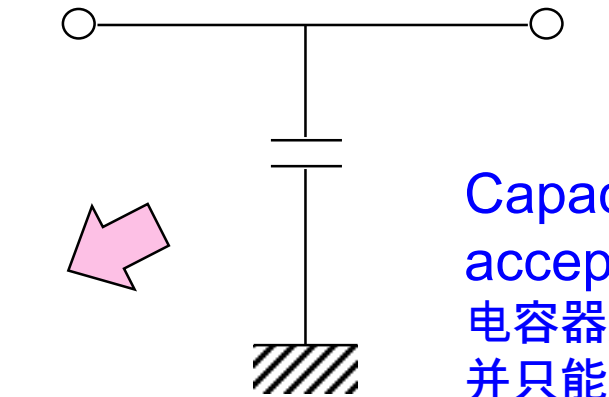
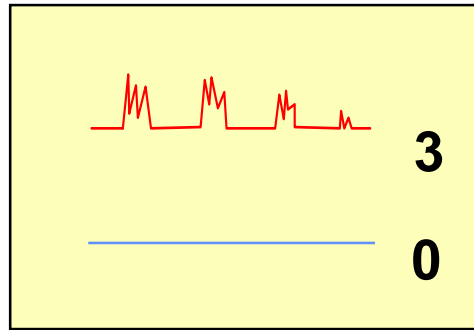


Capacitors shut off DC and accept only AC signals.  
电容器对DC会切断，只能接受AC信号

# The Function of Ceramic Capacitor

## 陶瓷电容器的功能

### Decoupling 去耦

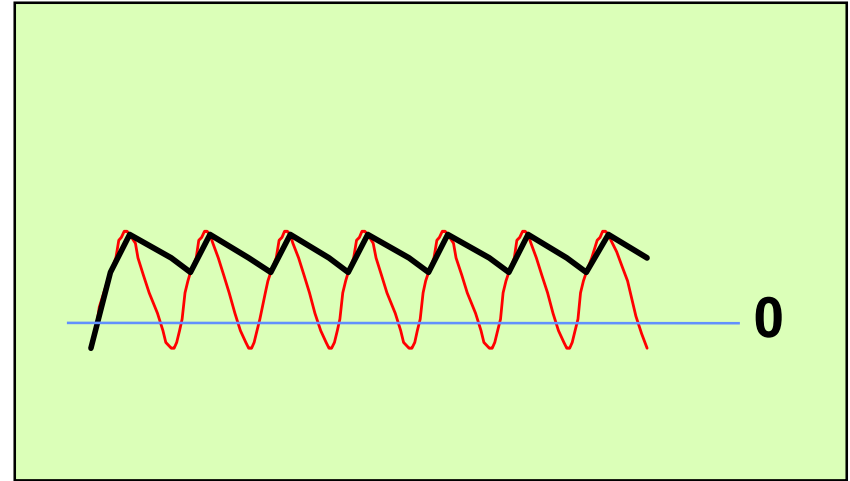
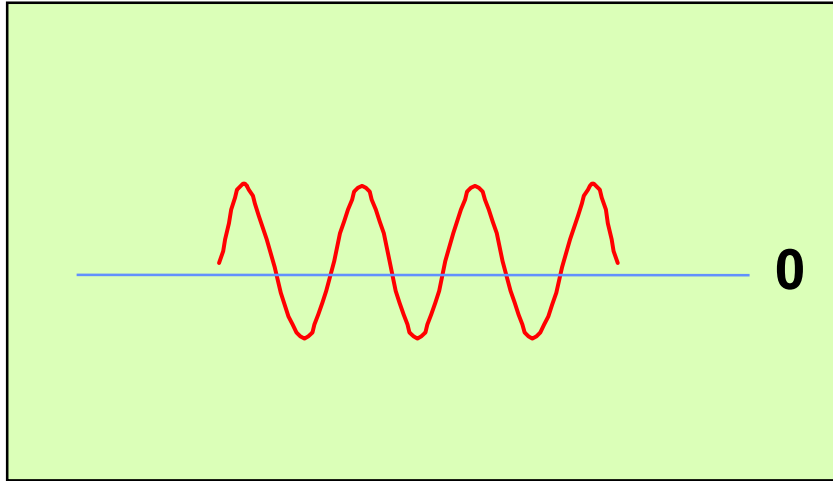


Capacitors shut off DC and accept only Noise signals.  
电容器对DC会切断，并只能接受噪音信号

# The Function of Ceramic Capacitor

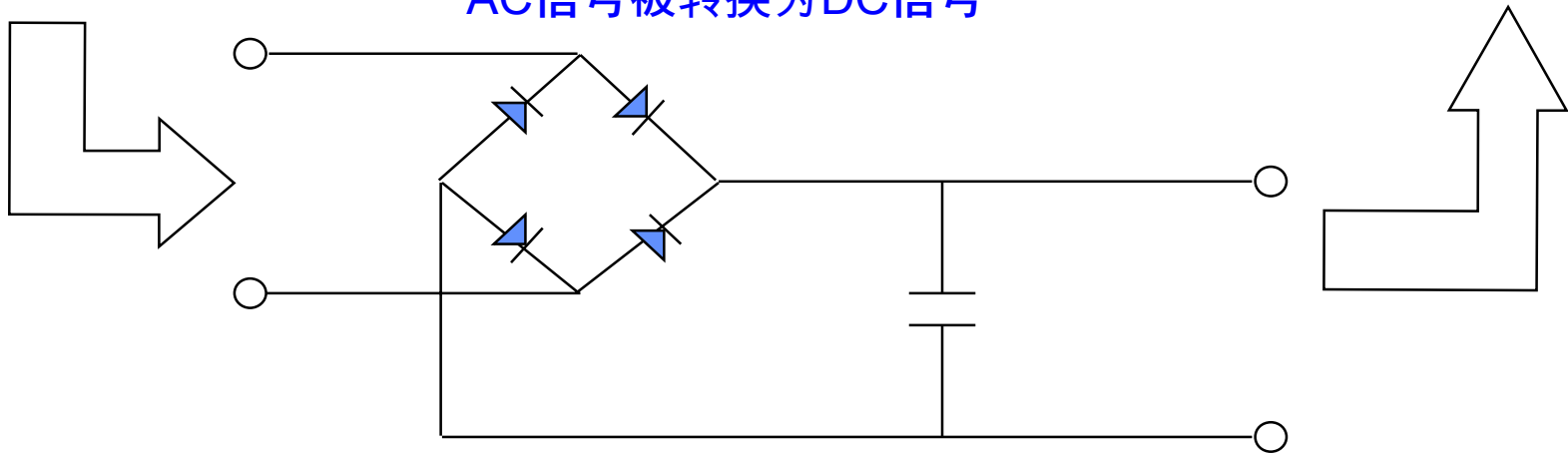
## 陶瓷电容器的功能

### Smoothing 过滤



AC signals are changed to DC signals.

AC信号被转换为DC信号



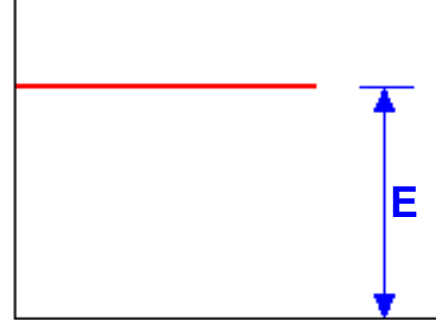
Application 用途	QTY (pcs/set) 数量	
	SMD type	Lead type
CTV 彩色电视	50 ~ 100	50 ~ 100
HDTV 高清晰度电视	400 ~ 500	~ 50
VTR 磁带录像机	100 ~ 200	~ 10
8mm VTR	200 ~ 300	~ 10
Laser Disc 雷射影碟	200 ~ 300	~ 10
Digital Camera 数码相机	100 ~ 200	-
CD 光盘	~ 100	-
MD	~ 100	-
Fax 传真	100 ~ 200	~ 10
Cellar Phone 手机	150 ~ 250	-
PDA	~ 100	-
Navigation System 航行系统	200 ~ 300	-
Desk Top PC 台式电脑	300 ~ 500	~ 10
Note Book PC 笔记本电脑	300 ~ 500	-
Automotive 汽车	300 ~ 500	~ 50
TV game TV游戏	100 ~ 200	
Refrigerator 电冰箱	~ 10	~ 10
Lighting 亮度	~ 10	~ 10

# Rated Voltage - Explanation

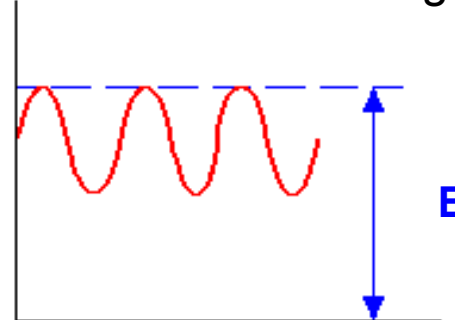
## 额定电压说明 (EIA规格)

1. Applied DC Voltage must be within the Rated Voltage.  
应用的DC电压必须在额定电压内
2. In case of AC and/or Pulse,  $V_{o-p}$  &  $V_{p-p}$  must be within Rated Voltage.  
假设是AC或脉搏,  $V_{o-p}$ 和 $V_{p-p}$ 必须在额定电压内

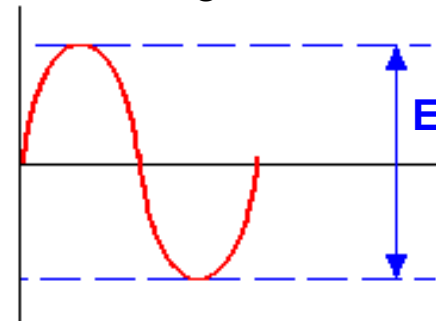
Direct Current 直流



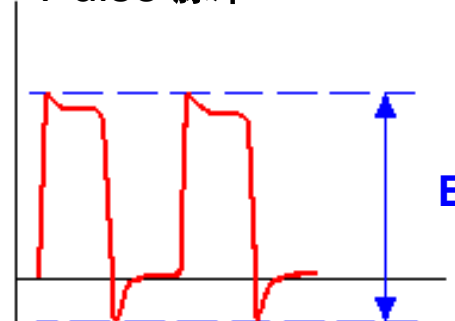
Direct + Alternating 直流和交流



Alternating current 交流



Pulse 脉冲





# Rated Voltage description (IEC)

## 额定电压表示方法 (IEC规格)

		Second Digit 第二个字母									
		A	B	C	D	E	F	G	H	J	K
First Digit 第一个数字	0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0
	1	10	13	16	20	25	32	40	50	63	80
	2	100	125	160	200	250	315	400	500	630	800
	3	1,000	1,250	1,600	2,000	2,500	3,150	4,000	5,000	6,300	8,000
	4	10,000	12,500	16,000	20,000	25,000	31,500	40,000	50,000	63,000	80,000

**0J = 6.3V**

**0G = 4V**

**1E = 25V**

**2E = 250V**

**1H = 50V**

**3A = 1,000V**

**2J = 630V**

**3F = 3,150V**

**多谢观赏**

***Thank you for your attention***

**September 1<sup>st</sup>, 2005.**

**Component Business Unit**

**Murata Manufacturing Co., Ltd.**

**株式会社 村田制作所 元件事業本部**