June 1, 2009

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
Basic Contents Explanation
基本内容说明

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。

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   MLCC市场趋势(高容量品和小型化)

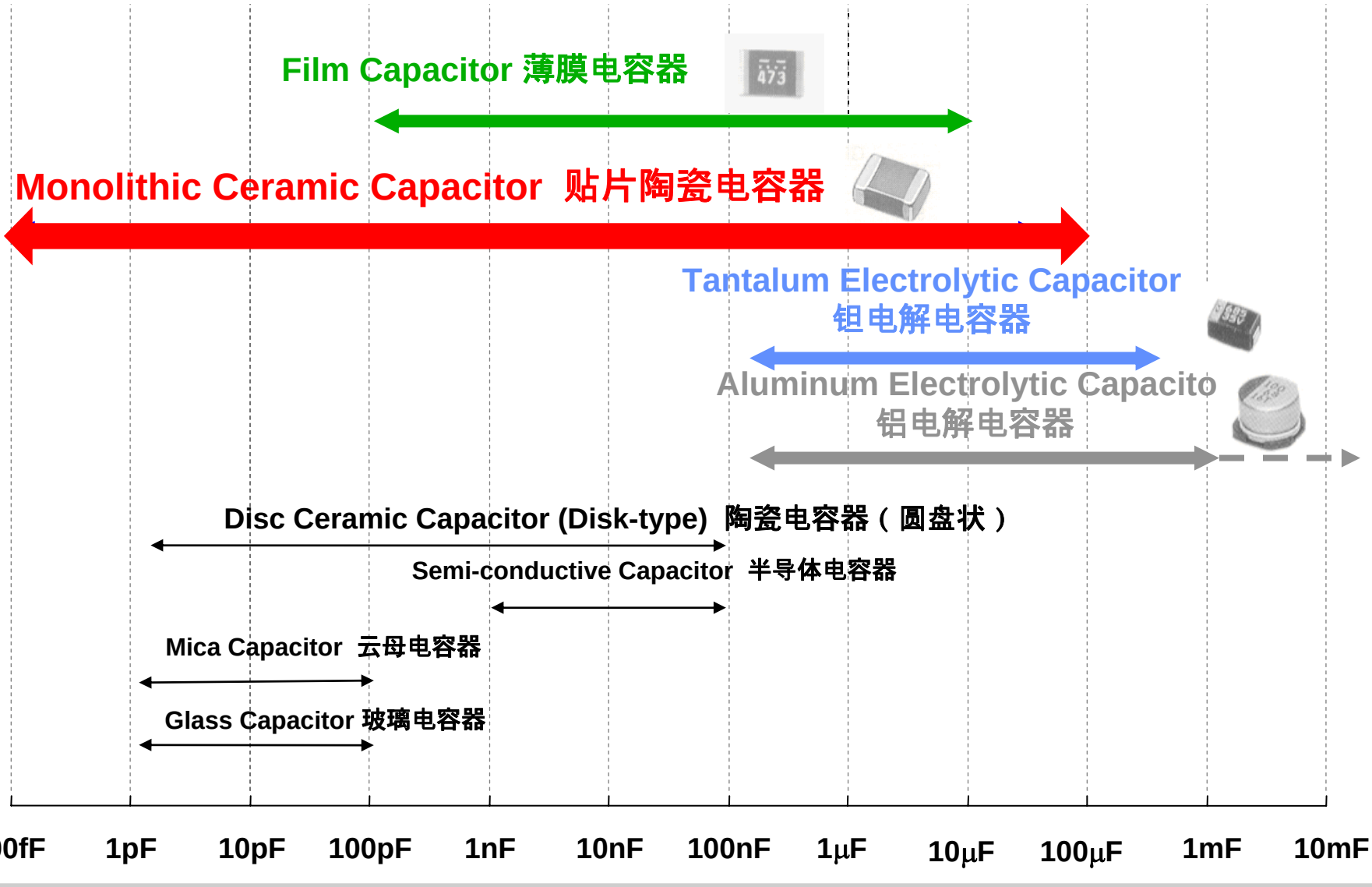
Contents
内容

Material of Capacitor
电容器的材料

Fixed Capacitor 固定电容器

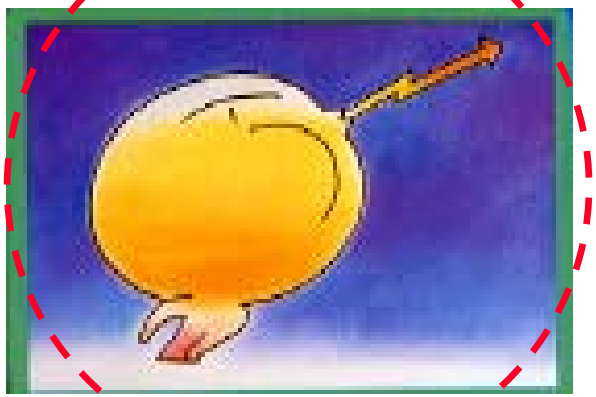
- **Film 薄膜** — Using plastic film as the dielectric , thin metal film metal as inner electrodes , stacked and rolled up together.
  Non polarized organic film capacitor.
- **Ceramic 陶瓷** — Using Ceramic as the dielectric , metal baked with ceramic as inner electrodes , non-polarized and non-organic 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

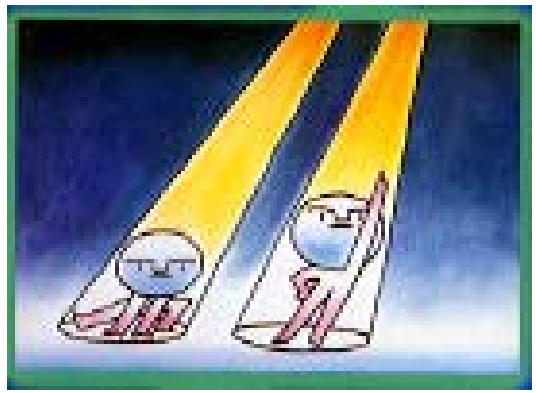


The Wonder Stones - Ceramic
奇石 – 陶瓷

Ceramics that Store Electricity
能贮存电的陶瓷



Ceramics that Expand and Contract
陶瓷的扩展和缩短



Ceramics that Change an Electric Flow According to the Environment
由环境能改变电流动的陶瓷

Ceramics that Sense Infrared Rays
能放射红外线的陶瓷

Ceramics that Shut out Electricity
断电陶瓷

Ceramics that Induce Magnetism
感应磁力的陶瓷

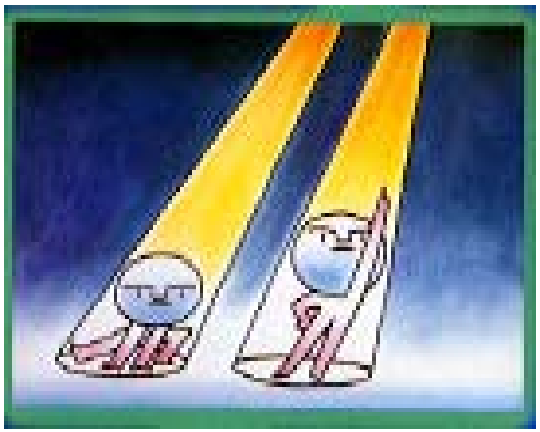
Ceramics that Transmit Light
传输光的陶瓷

The Wonder Stones - Ceramic
奇石 – 陶瓷

Ceramics that Store Electricity <DIELECTRIC CERAMICS>
陶瓷储存电荷 <介电陶瓷>

* **The capacity to store electricity temporarily by dielectric polarization.**
  用介电体的极化来暂时储存电荷
* **AC Passes, but DC is Stopped. (Capacitor、EMIFIL…)**
  AC能通过，但CD被卡住了。（电容器，滤波器…）

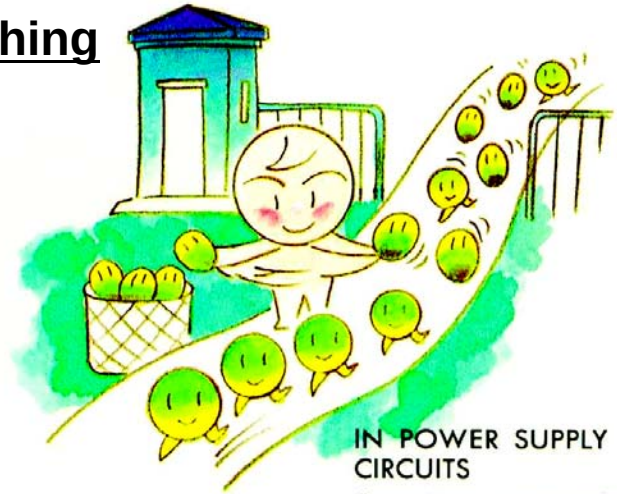
Ceramics that Expand and Contract <PIEZOELECTRIC CERAMICS>
陶瓷的扩展和缩短 <压电陶瓷>



* **When voltage is applied, piezoelectric ceramics expand and contract.**
  一旦电压被应用，压电陶瓷就会被扩展和缩短
* **When force is applied, they generate a voltage.**
  (PIEZOELECTRIC BUZZERS, ULTRASONIC SENSORS…)
  一旦施加外力，他们会产生电压。（压电蜂鸣器，超声波传感器）

The Function of Ceramic Capacitor
陶瓷电容器的特点

Smoothing
过滤

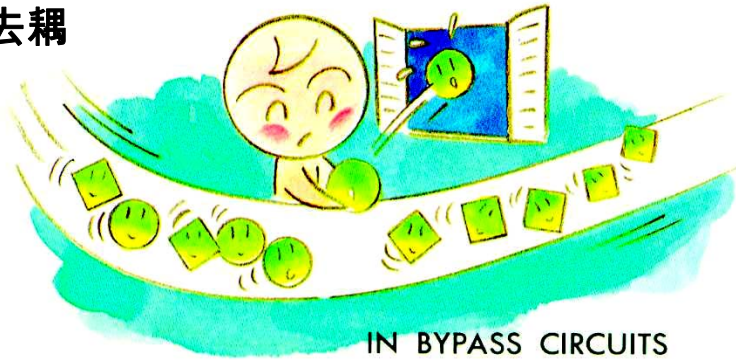


IN POWER SUPPLY CIRCUITS

Capacitors remove noise from the electric power coming from an outlet.

在电源电路上
电容器从来自出路的电能中消除噪音

De-coupling
去耦

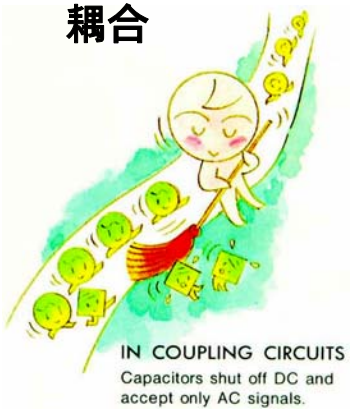


IN BYPASS CIRCUITS

Capacitors filter signals and lead unnecessary signals into a bypass.

在旁路电路上
电容器过滤信号并在回路里导致了不必要的信号

Coupling
耦合

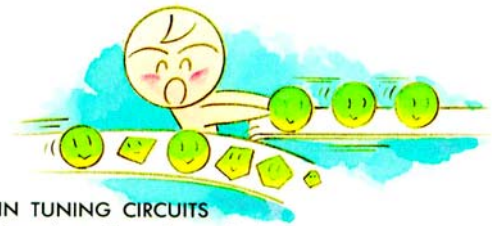


IN COUPLING CIRCUITS

Capacitors shut off DC and accept only AC signals.

在耦合电路上
电容器对DC会切断，并只能接受AC信号

Tuning
调谐



IN TUNING CIRCUITS

Capacitors pick up the required signals from among the many available.

在调谐电路上
电容器从众多应用中获得要求信号

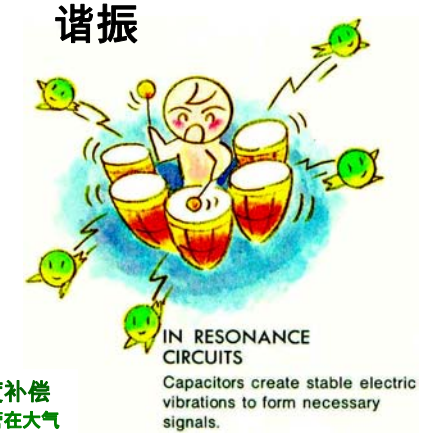
Temp compensation
温度补偿

TEMPERATURE COMPENSATION FOR CIRCUITS

The functions of components such as transistors are affected by changes in atmospheric temperature. Capacitors compensate for this affection and ensure normal operation.

对于电路的温度补偿
元件的功能如晶体管在大气的温度中受影响。
电容器对于这些影响作了补偿并确保正常操作。

Resonance
谐振



IN RESONANCE CIRCUITS

Capacitors create stable electric vibrations to form necessary signals.

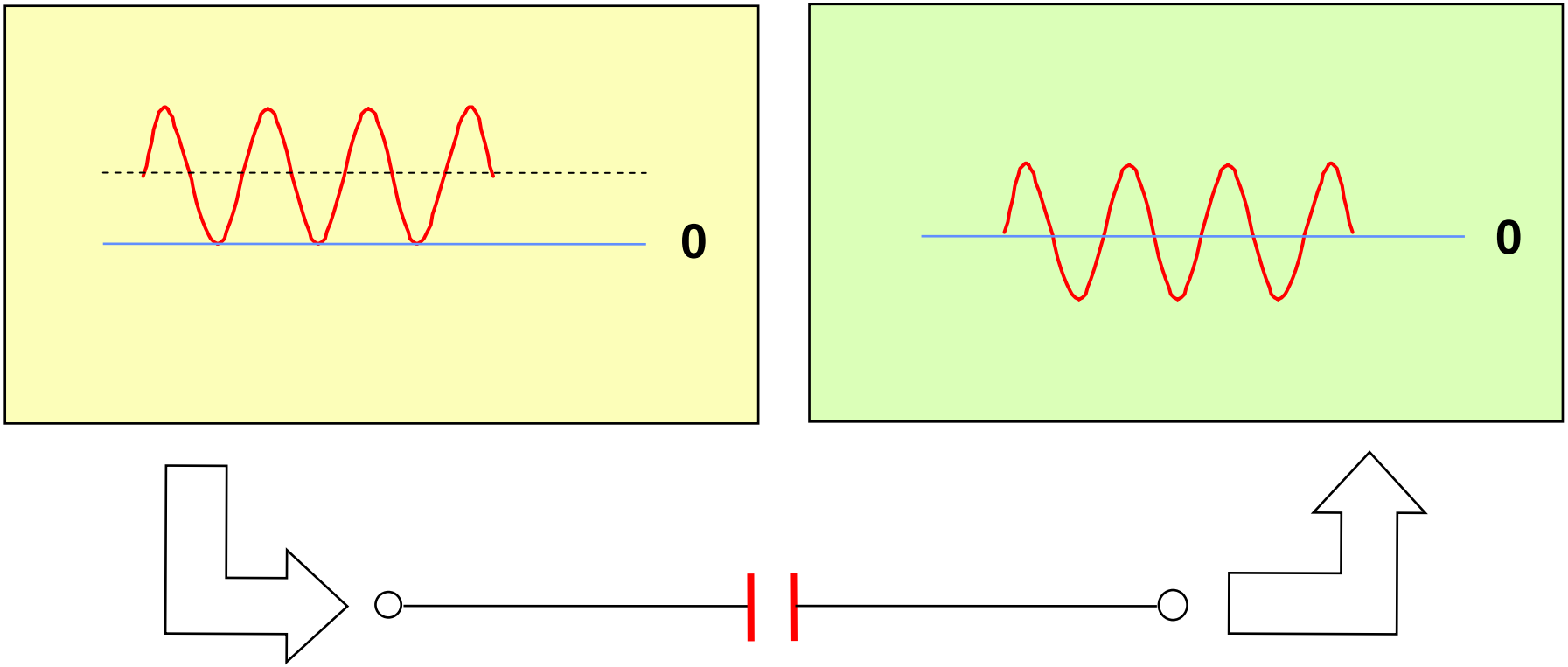
在谐振电路上
电容器稳定的电震动去形成需要的信号

The Function of Ceramic Capacitor
陶瓷电容器的功能

Use 用途	Function 特点
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

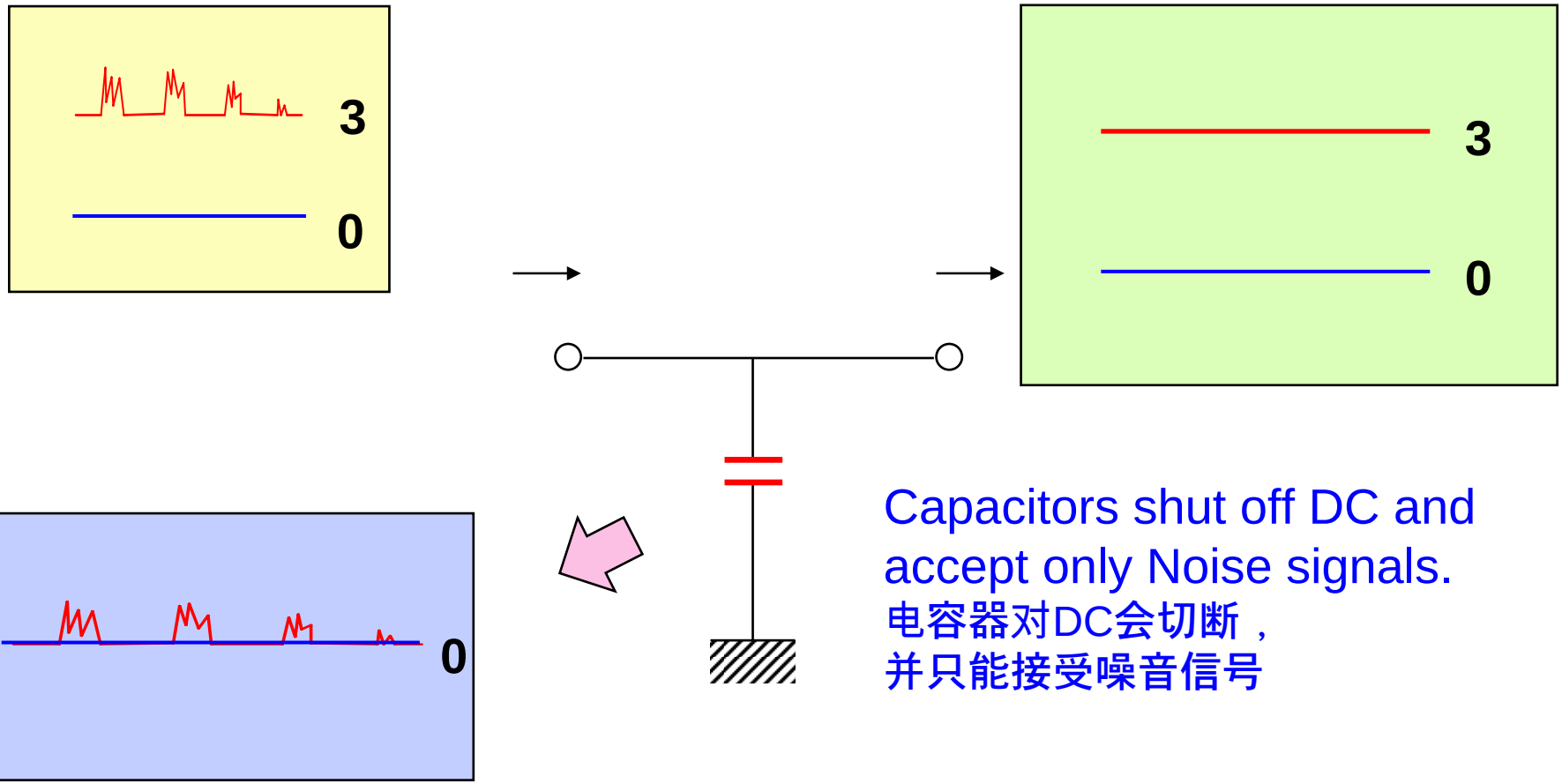
Coupling　耦合



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

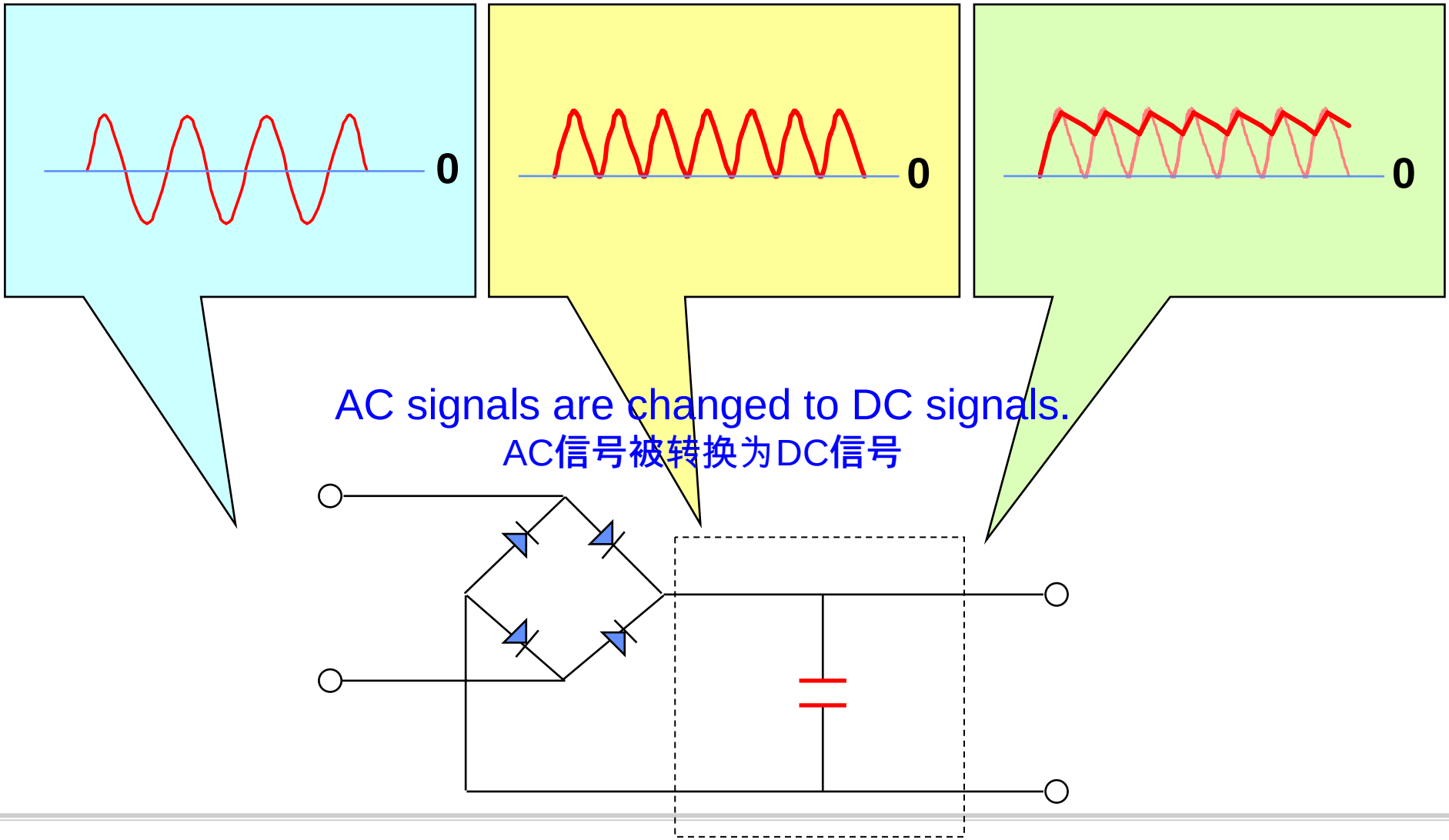
Decoupling　去耦



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

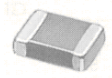


Contents
内容

Material of Capacitor
电容器的材料

Fixed Capacitor
固定的电容器

- **Film 薄膜**
  - Polyester Capacitor (Mylar) 聚酯电容器 — Relatively small.
  - Polyethylene 聚乙烯 — Higher resistance , better TC; Large / Expensive
  - Polycarbonate 聚碳酸酯 — Higher resistance , better TC
  - Polypropylene 聚丙烯 — Higher BDV , Large
- **Ceramic 陶瓷**
  - Class 1 系列1 — Variety of TCs , suitable for Temp. compensating
  - Class 2 系列2 — Higher C/V per unit volume. Or Higher 'k'.
  - Class 3 系列3 — Small size for disc cap , lower BDV



- **Aluminum 铝**
  - TANTAL — Large cap , small size
  - AL — Polarized / Low BDV; Large cap. Polarity

- **Glass 玻璃** — Higher BDV , Better TC; Low cap. Expensive
- **Mica 云母** — Higher BDV , Better TC; Low cap. Expensive
- **Electrolytic Double Layer 双倍电解层** — Extremely large cap. Backup for battery

Ceramic Material & Characteristic
陶瓷材料和特性

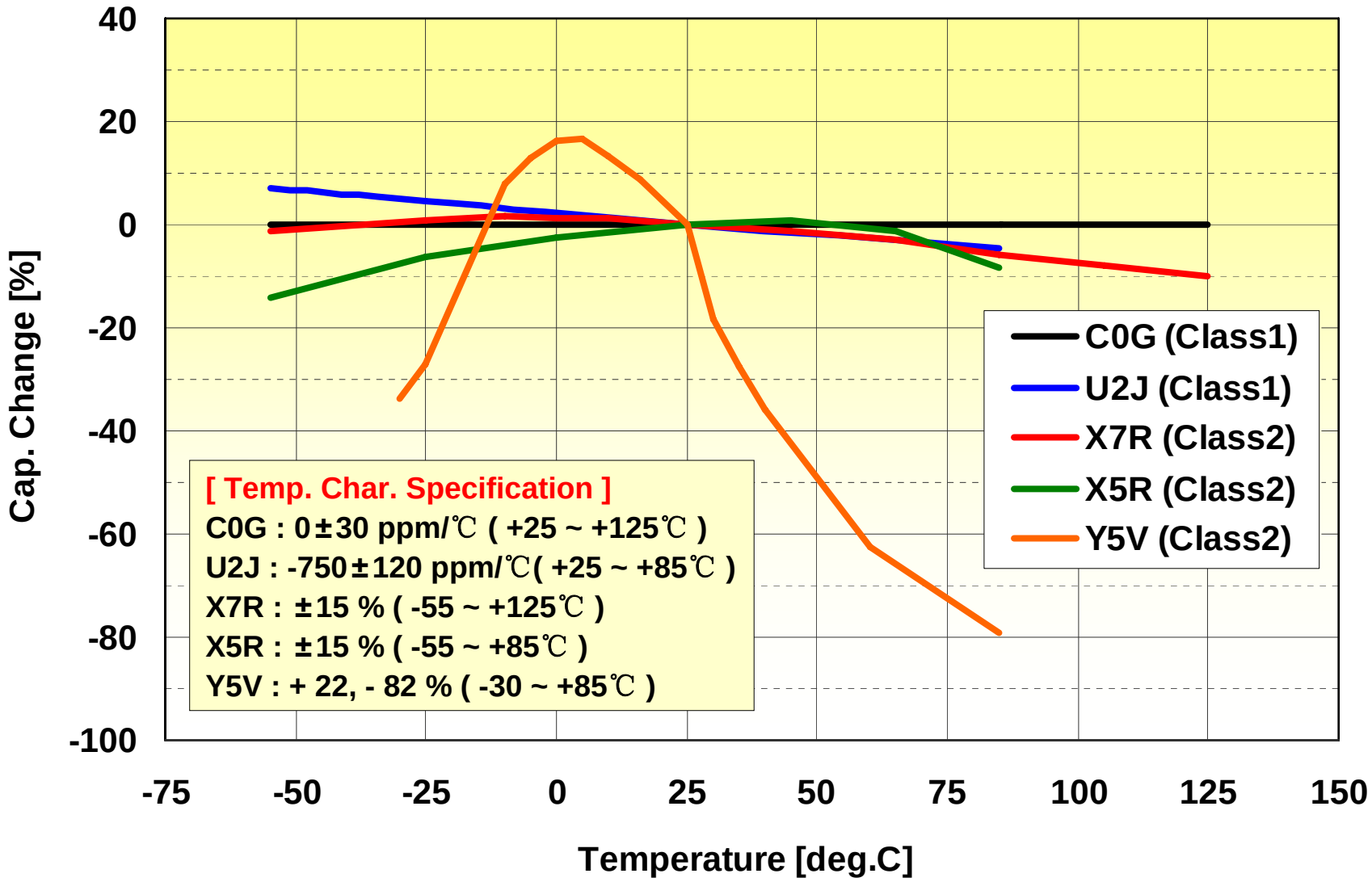
Class 分类	Ceramic Material 陶瓷材料	Ceramic Character 陶瓷特性	Temp. Char. 温度特性	Capacitance Range 容量範围	Recommended Circuit 推荐电路
Class 1 分类1	Temperature Compensation 温度補償用 (TC系)	Capacitance Accuracy for temperature 対温度容量値精度大	<EIA> C0G,U2J <EIA-J> CH,UJ,SL	CHIP 片状独石 0.1pF - 0.1uF (0R1 - 104) LEAD 插脚 1pF - 680nF (010 - 683)	In Band Pass Filter Circuit 带通滤波电路 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 片状独石 100pF - 100uF (101 - 107) LEAD 插脚 220pF - 4.7uF (221 - 475)	In By-Pass Circuit 旁路电路 In Decoupling Circuit 去耦电路 In Resonance Circuit 振荡电路

[Classification by Temperature Characteristic]

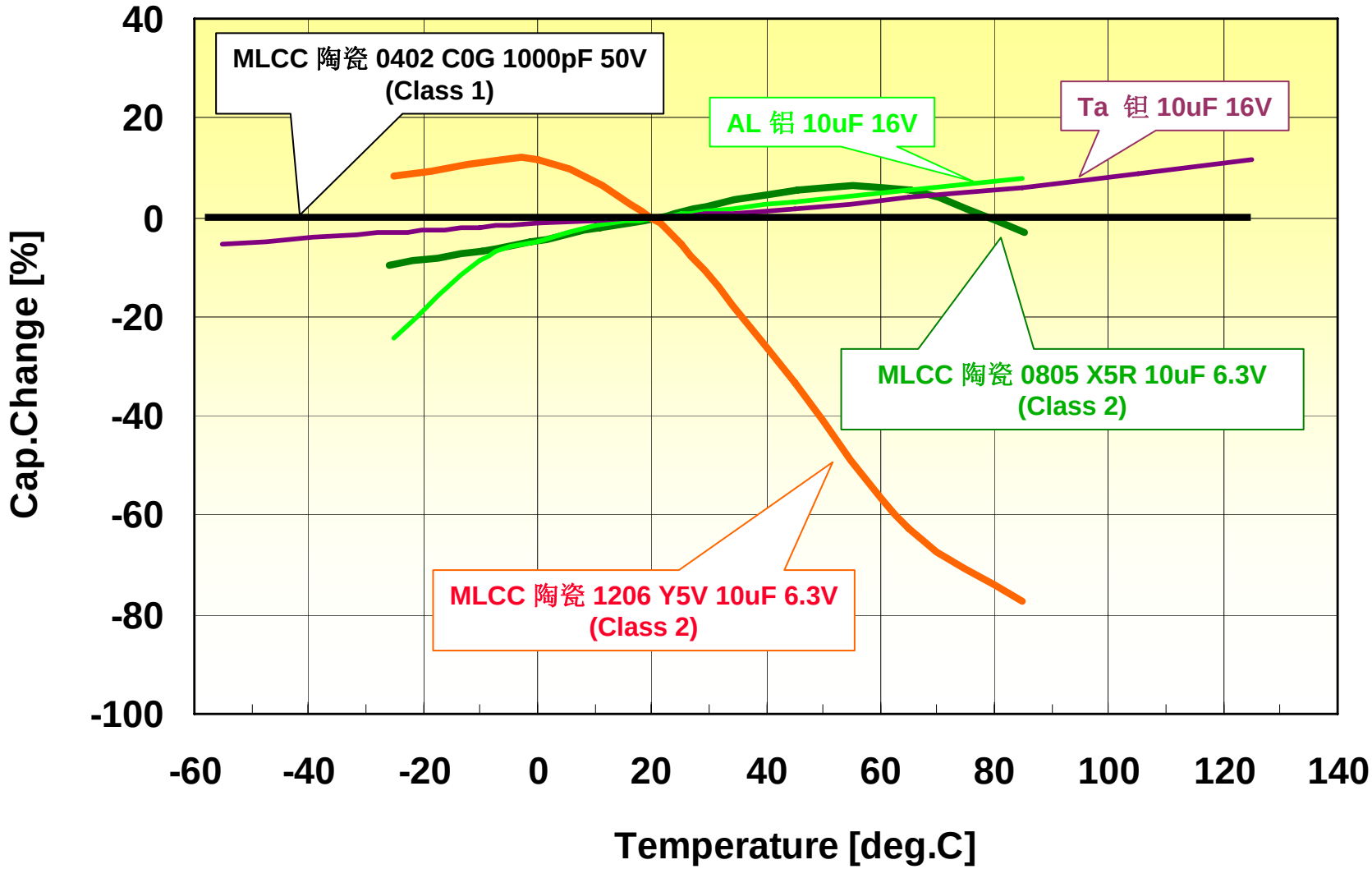
Class 1 : C0G, U2J

Class 2 : X7R, X5R, Y5V

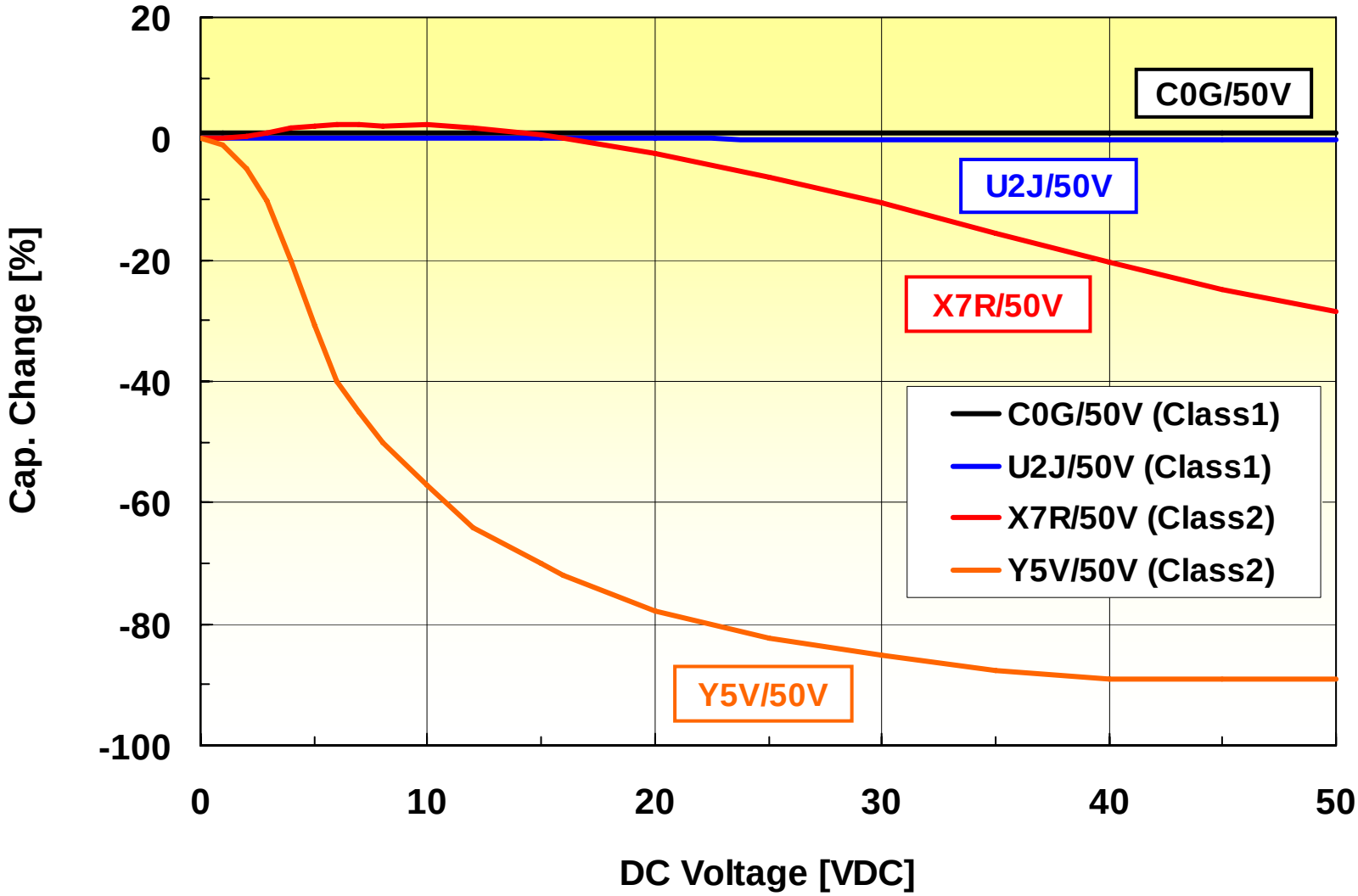
Temp. Characteristic (Class 1 & Class 2)
温度特性（例）



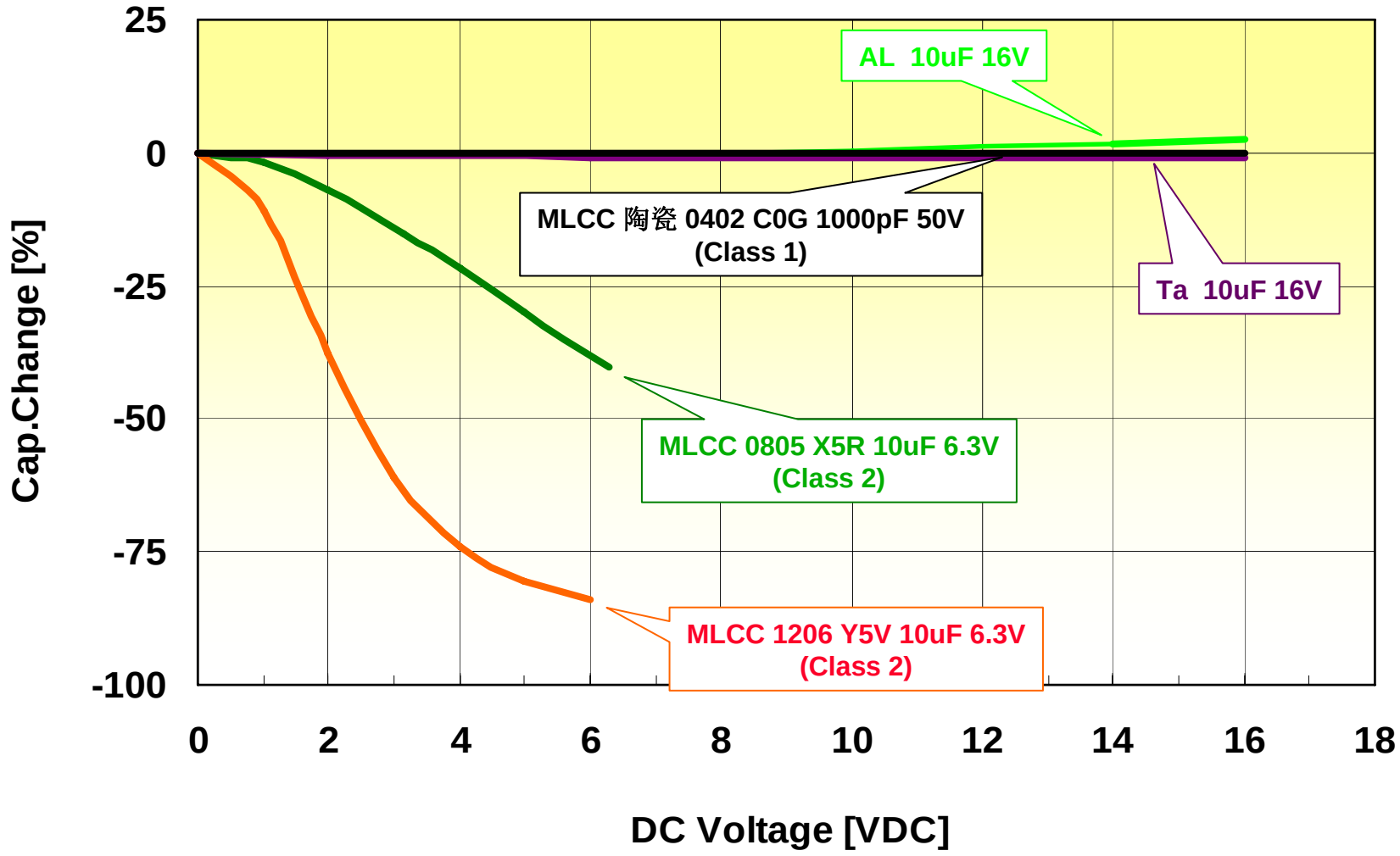
Temp. Characteristic (AL/TAN-CAP Comparison)
温度特性（例）



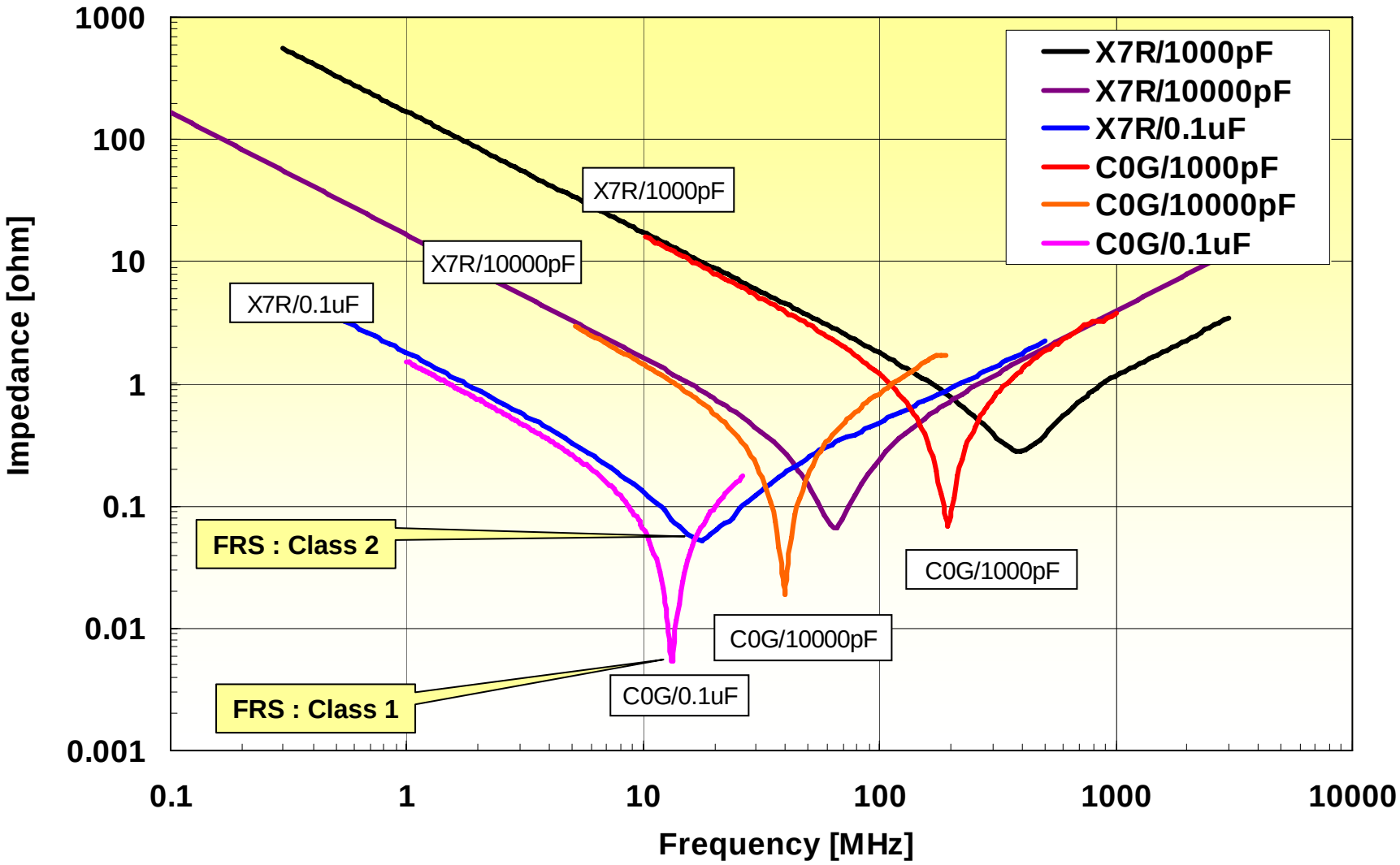
Bias Characteristic (Class 1 & Class 2)
电压特性（例）



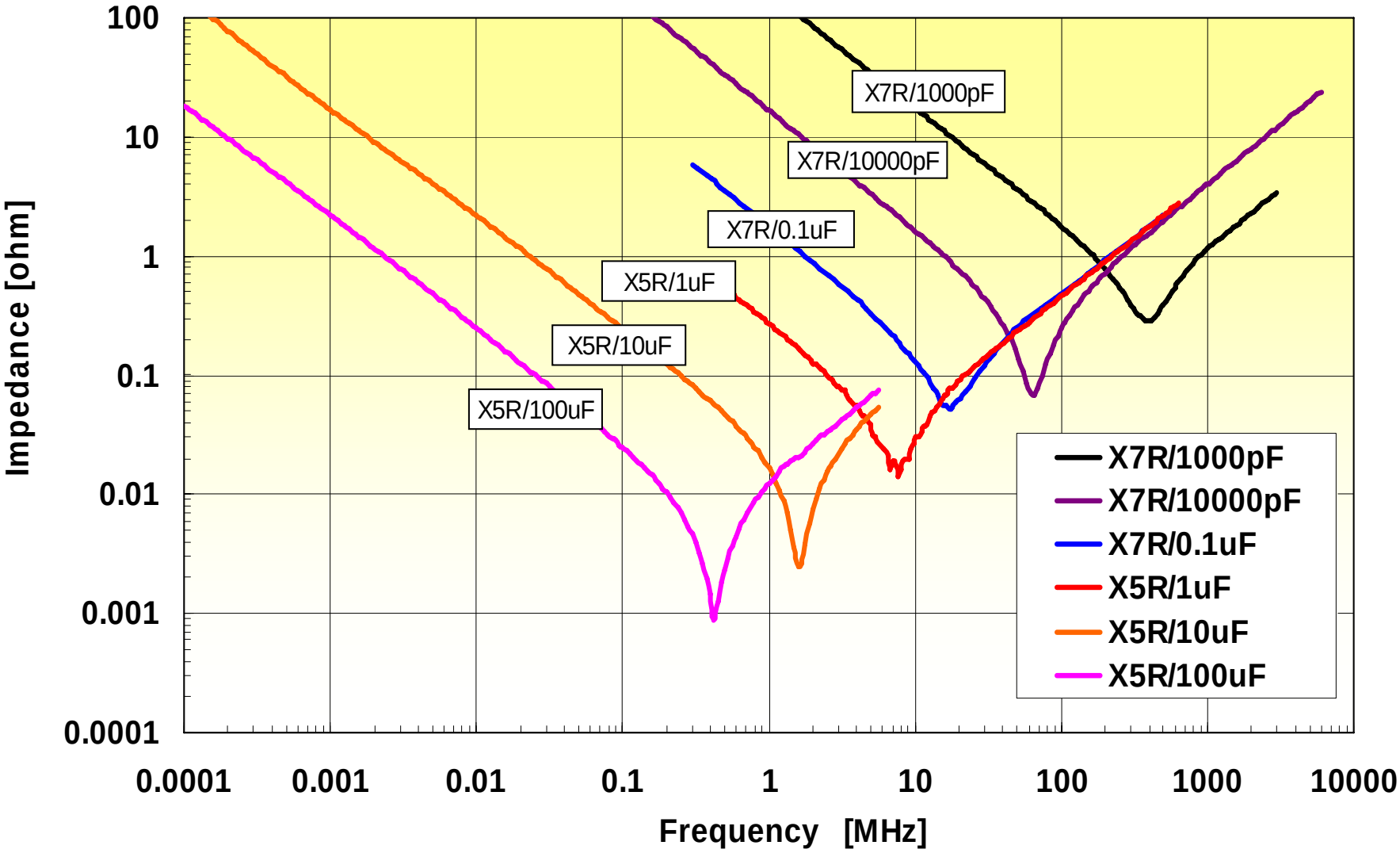
Bias Characteristic (AL/TAN-CAP Comparison)
电压特性（例）



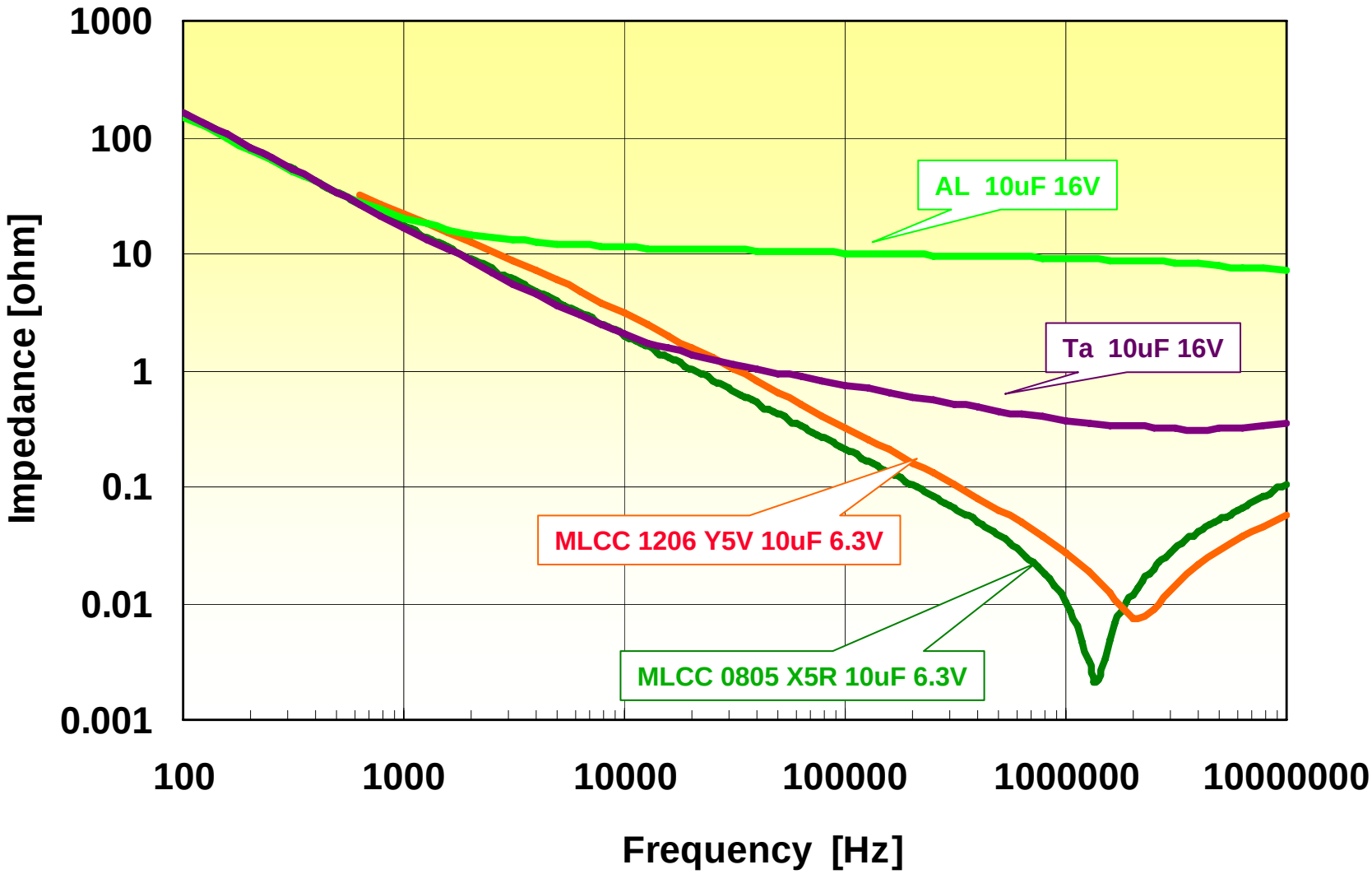
Freq. Characteristic (Class 1 & Class 2)
频率特性（例）



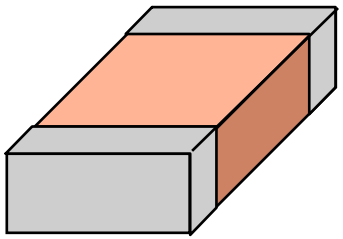
Freq. Characteristic (Capacitance Value)
频率特性（例）



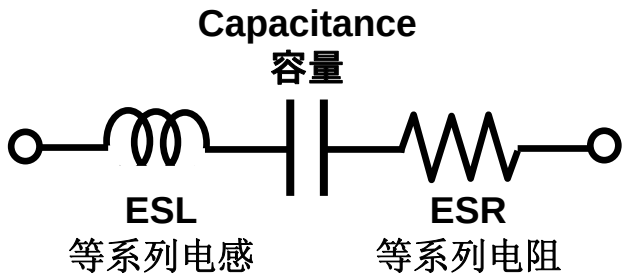
Freq. Characteristic (AL/TAN-CAP Comparison)
频率特性（例）



Freq. Characteristic Explanation
频率特性说明



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 (⇒ loss tangent)

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

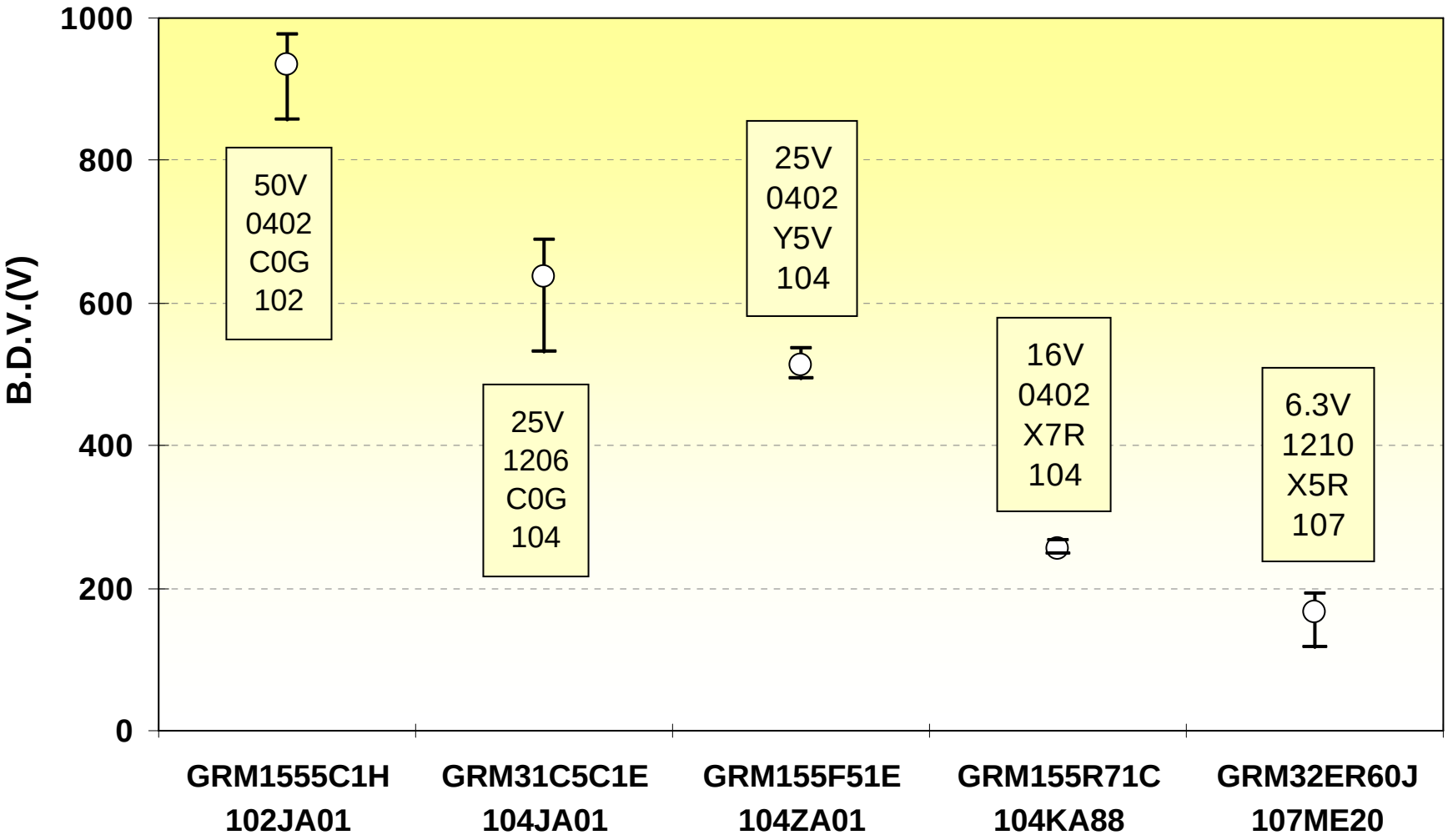
(微量) (微量)

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

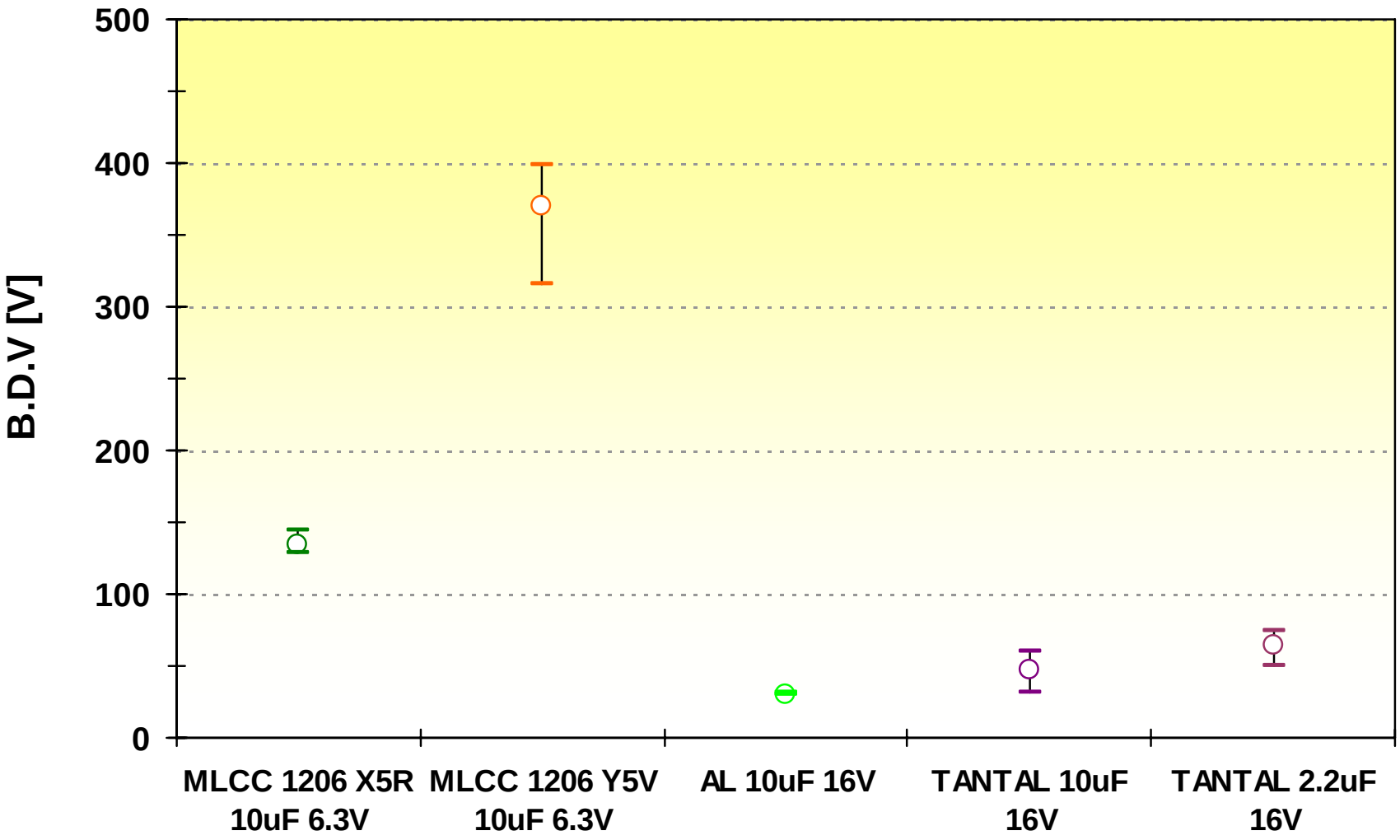
(频率 f →大) : (2πfL → 大) (1/(2πfC) → 少)

(容量C→大) (1/(2πfC) → 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）



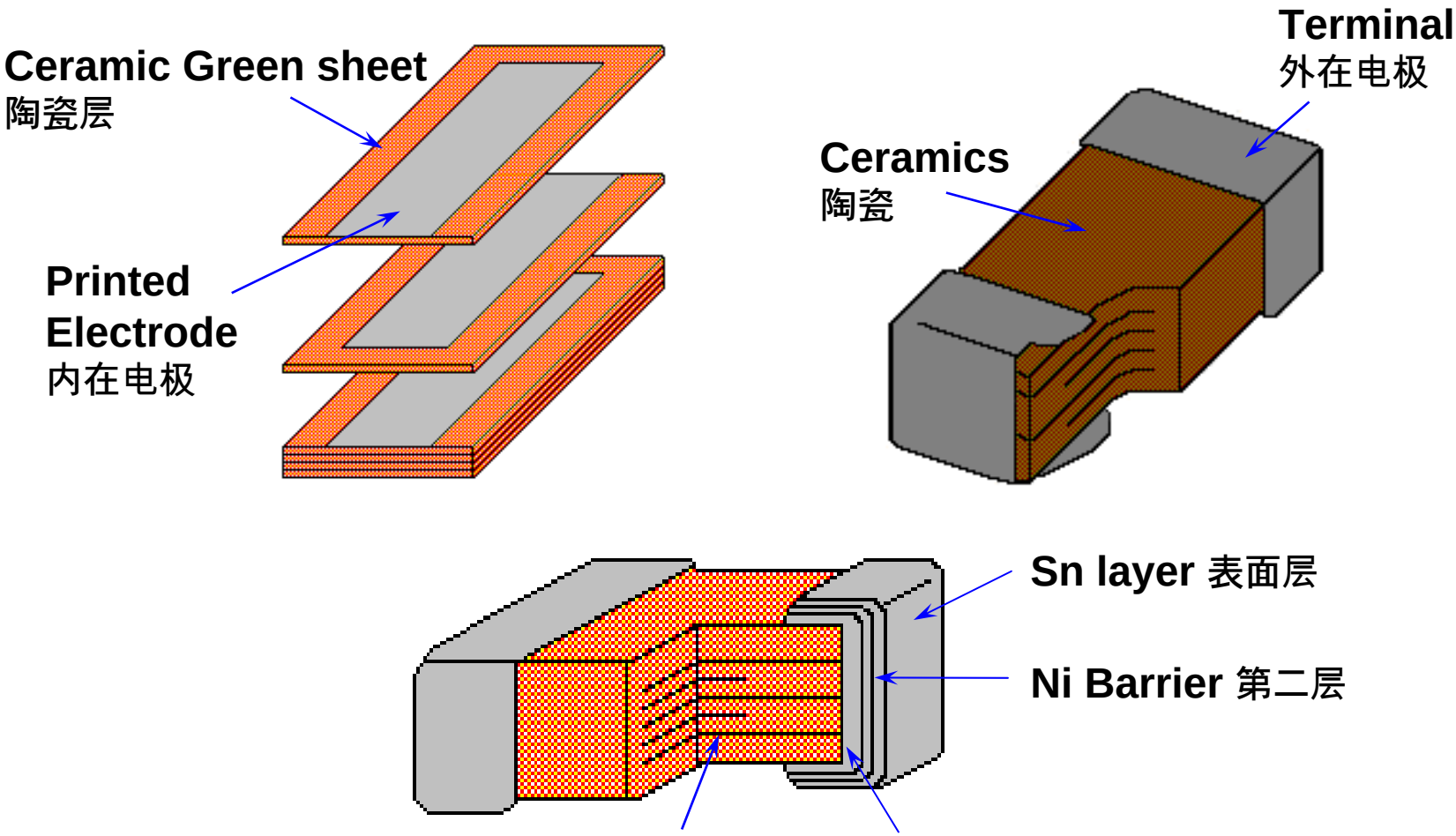
Comparison of Various Capacitors
各类电容器的比较

		Cap	Freq. Char.	Temp. Char.	High Voltage	High Temp.	Size	Life	Cost
MLCC		Good	Excellent	Fair	Excellent	Excellent	Good	Excellent	Good
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

Contents
内容

MLCC Structure
MLCC 结构

Monolithic Structure 独石结构



MLCC Production Process
片状独石陶瓷电容器的工序

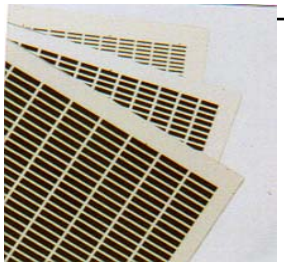
INCOMING INSP. OF CERAMIC MATERIAL
引入陶瓷材料

MIXING 混合

DE-AIRING 不风干

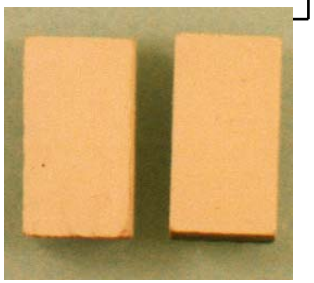
SHEET CASTING
薄片铸造

ELECTRODE PRINTING / STACKING
电极印刷和堆叠

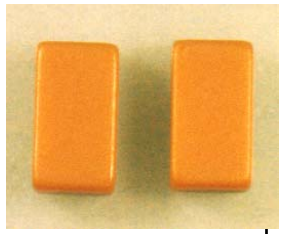


PRESSING
印刷

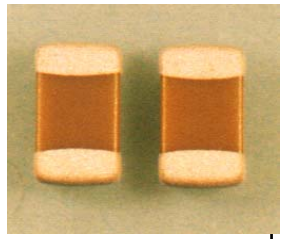
CUTTING 切片



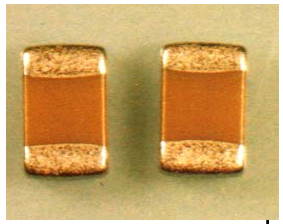
FIRING
烧窑



TERMINATION 终端



TERMINATION FIRING
终端烧窑



TERMINATION PLANTING 装备终端

ELECTRICAL SORTING
电资料排架

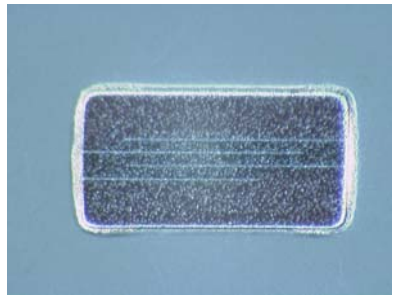
OUTGOING INSPCTION
引出来源

PACKAGING 包装

TAPING
包装

EIA-J BULK CASE 散装

SHIPMENT
装运



Contents
内容

MLCC Application
MLCC 应用

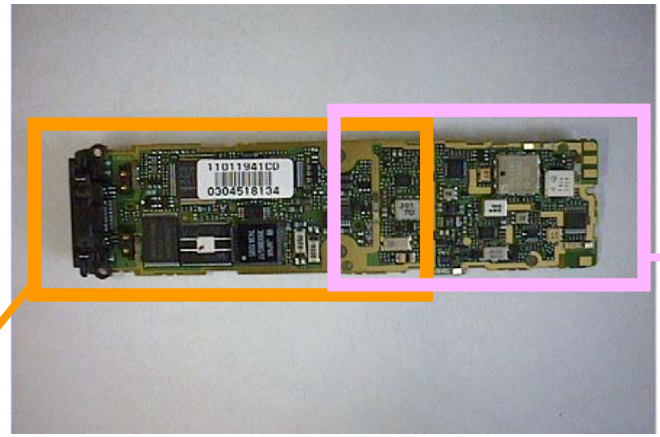
Application	Q'ty [pcs/set]	
	SMD Type	Lead Type
LCD-TV	500 - 700	10 - 50
PDP-TV	500 - 700	5 - 15
VDR(DVD/HDD)	400 - 500	- 10
DVC	200 - 500	—
DSC	100 - 200	—
Mobile phone	100 - 200	—
FAX	100 - 200	- 10
PDA	150 - 400	—
Desk Top PC	400 - 800	400 - 800
Note PC	600 - 900	—
Automotive	300 -	- 10
Navigation System	200 - 300	—
TV Game	400 - 1500	- 10
Refrigerator	- 50	- 10
Lighting	- 50	- 10

MLCC Application (Cellular phone)
MLCC 应用 （ 移动电话 ）

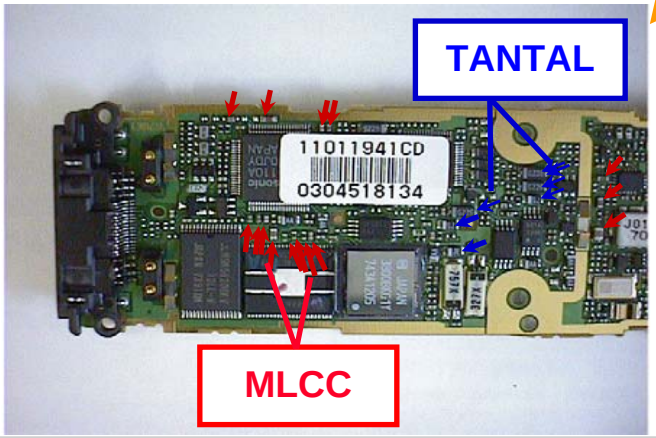
Cellular Phone 移动电话

<Appearance> 外貌

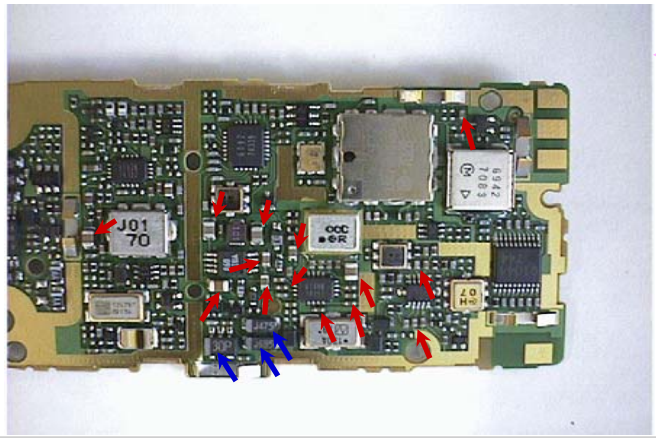
<PCB> 电脑底板



<Base Band> 基频带



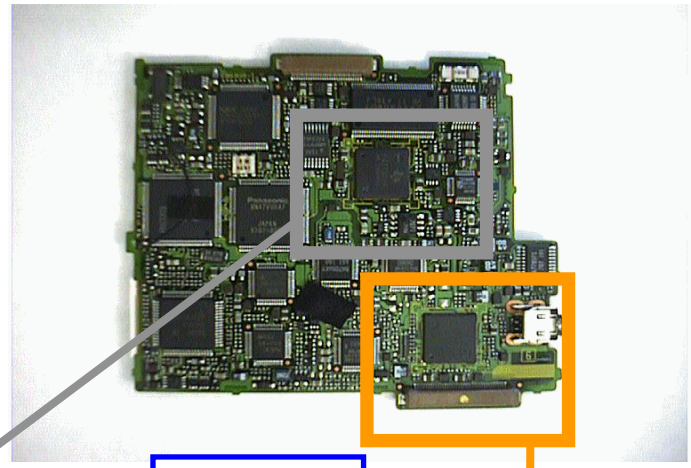
<RF> 无线电频率



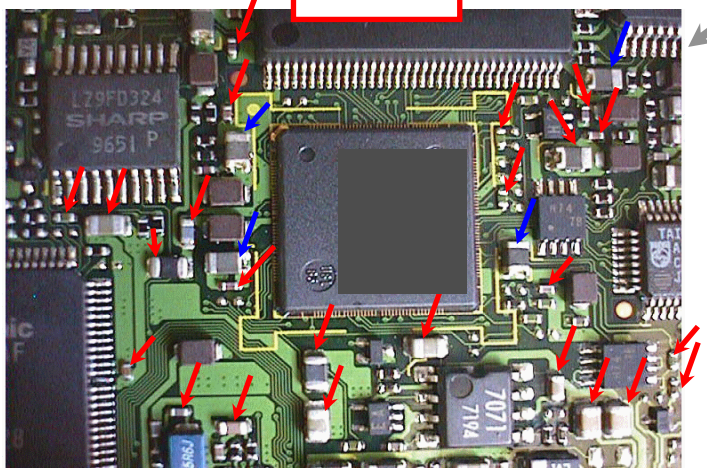
MLCC Application (Digital Camera)
MLCC 应用 （ 数码相机 ）

Digital Camera 数码相机

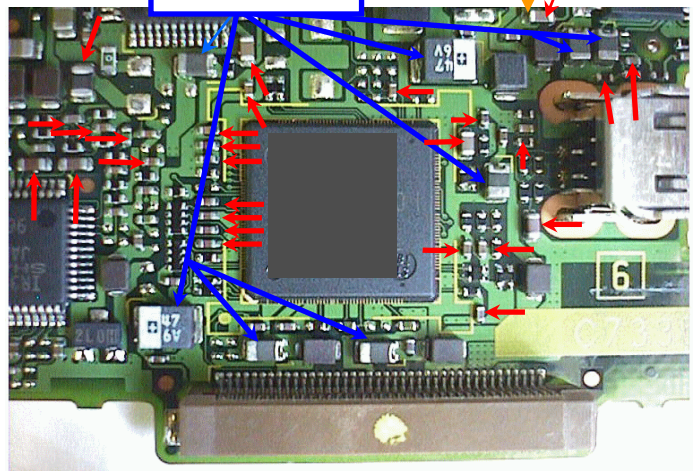
<PCB/Underside>



MLCC

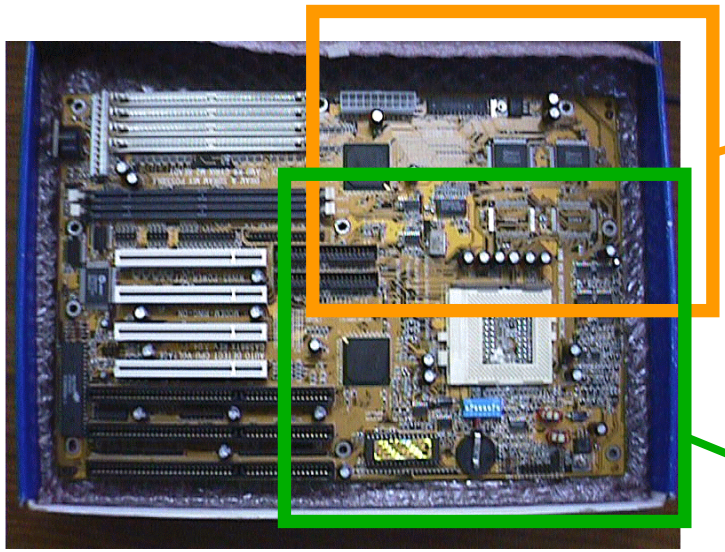


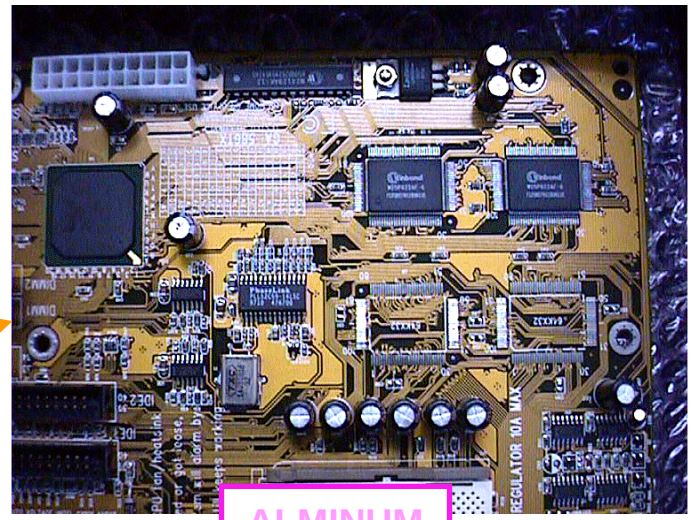
TANTAL



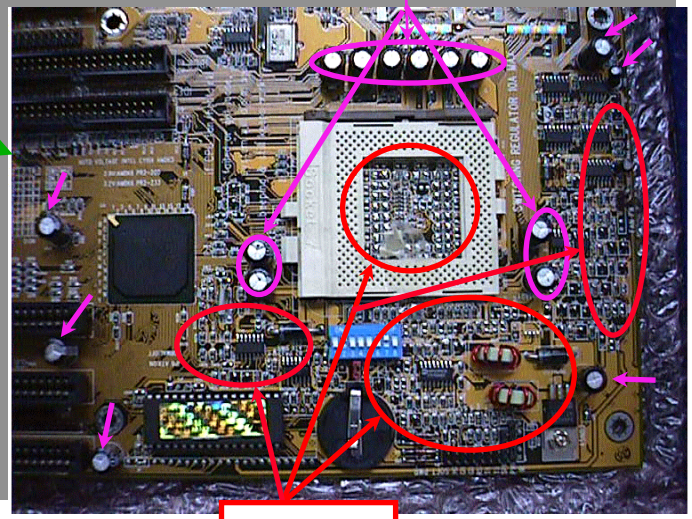
M/B(PC) Application
电脑底板应用

PC Mother Board 主要底板





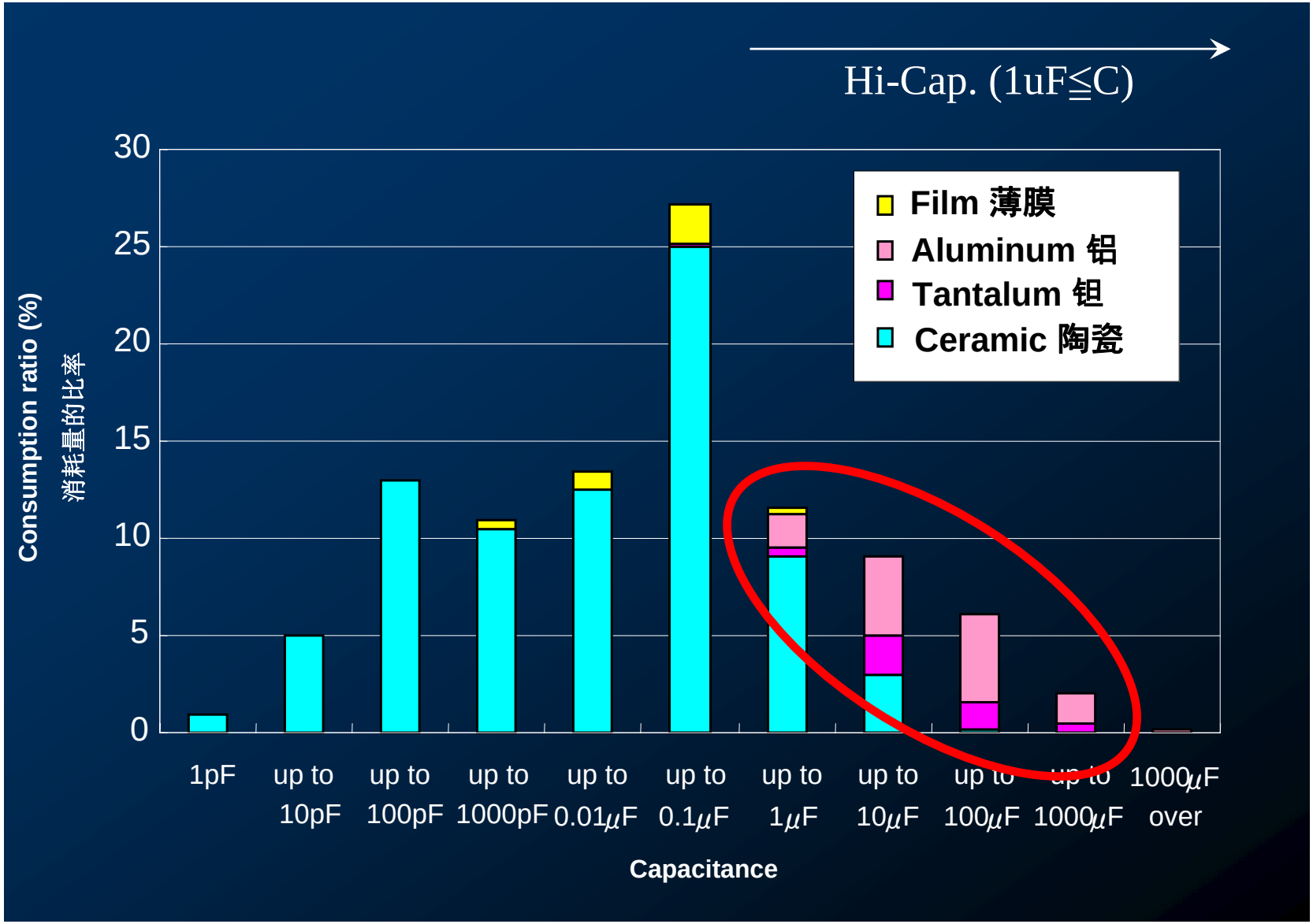
ALMINUM



MLCC

Contents
内容

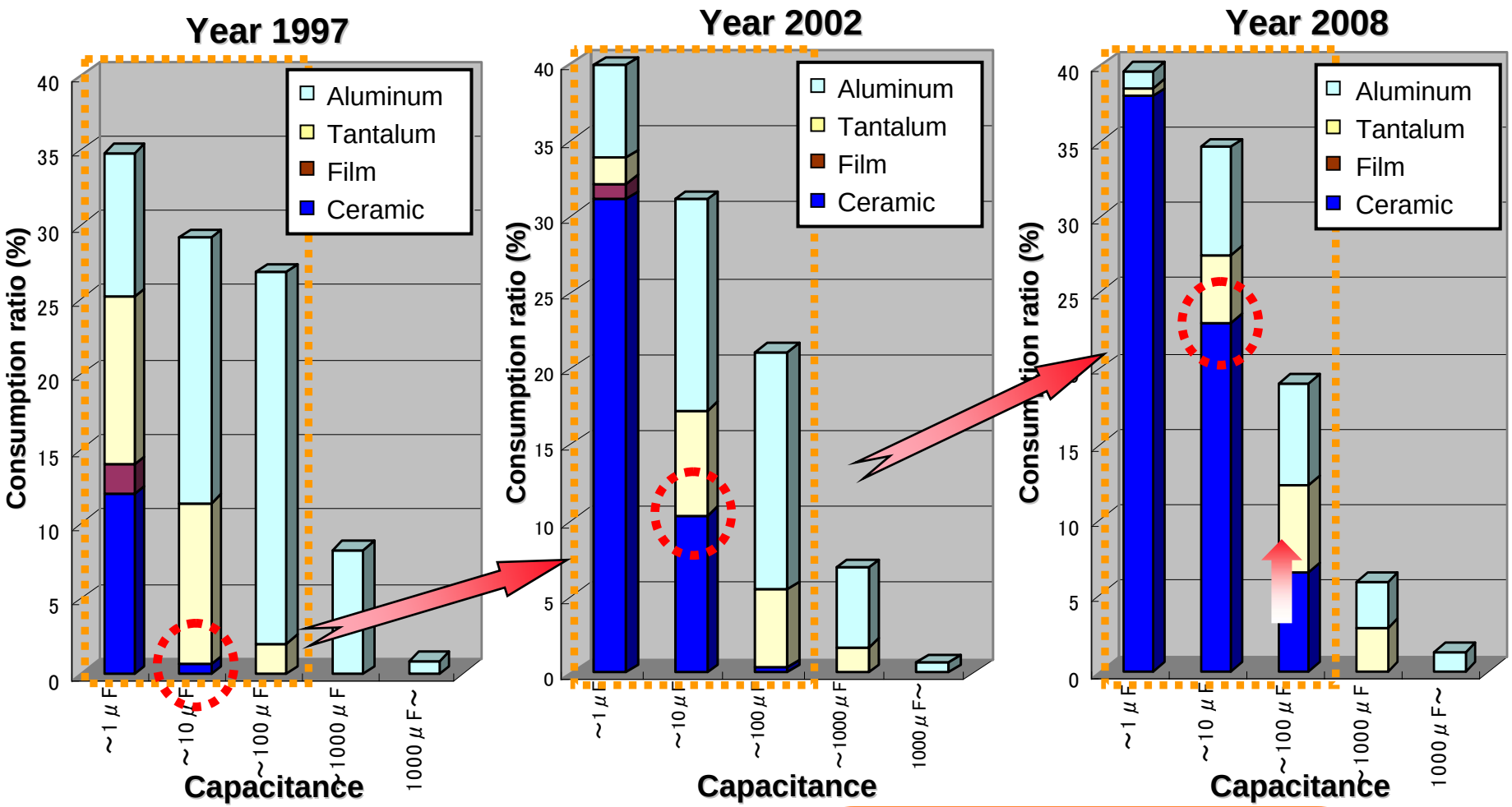
Capacitor Consumption by Cap. Range
电容器消耗量（容量范围表）



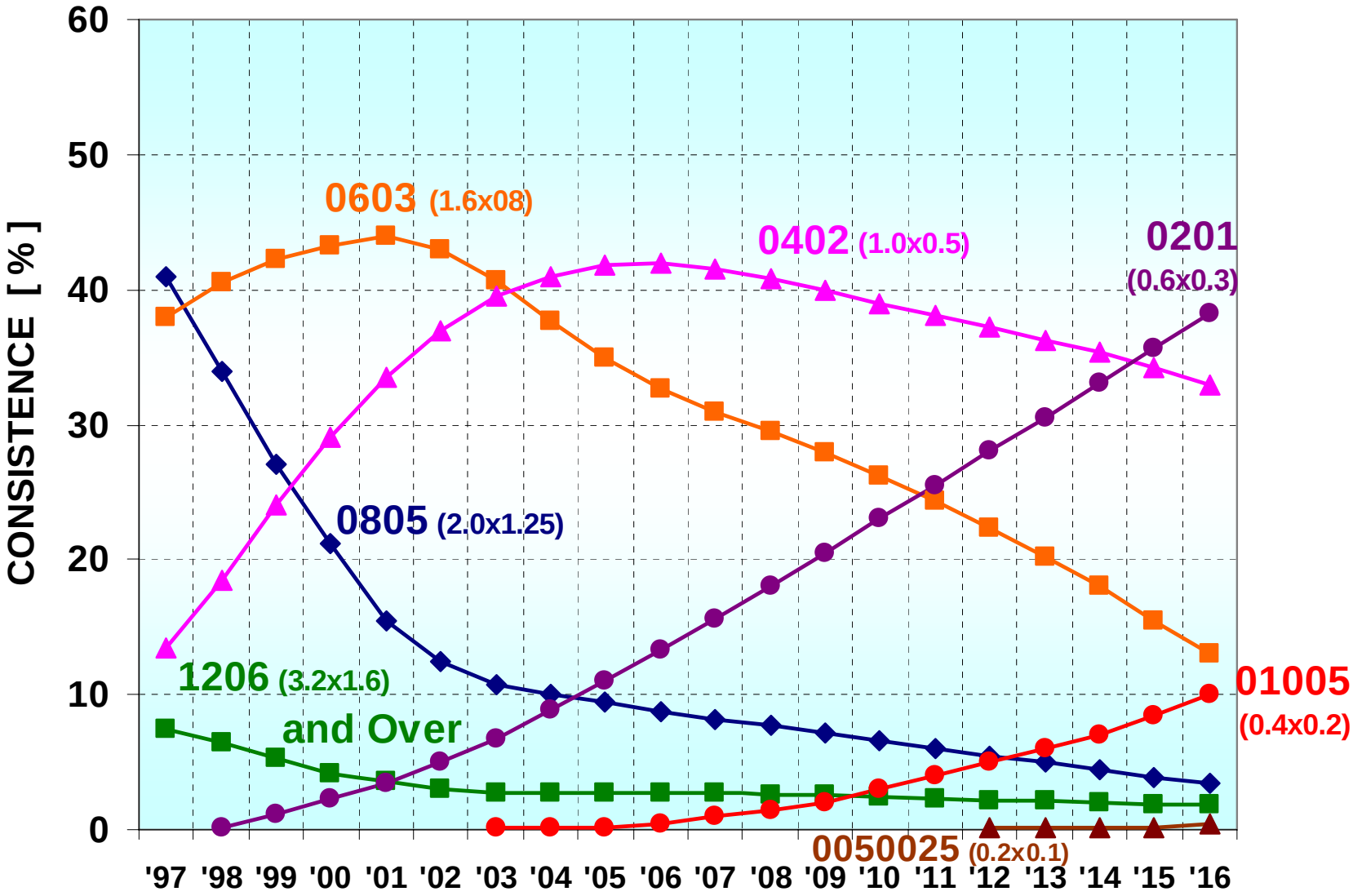
Capacitor Consumption by Material (1uF≦)

电容器按照材料消耗的比率

~100uF trend toward Ceramics in future



MLCC Size Trend (≦1uF)
MLCC的体积趋势



0201 will be main Size following 0402, 0603 size, in 2005. 01005 has also increase!

多谢观赏

Thank you for your attention

June 1, 2009

Component Business Unit
Murata Manufacturing Co.,Ltd.
株式会社 村田制作所　元件事业本部