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## **Uninterruptible Power Supply Systems**



# Overview

## MITSUBISHI

### UPS Product

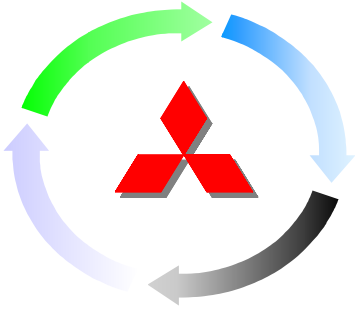
- ◆ Complete UPS Line-Up for Small, Medium and Large Scale Systems.
- ◆ Broad range of kVA capacity
- ◆ High Performance & Reliability using the latest state of the art technology
- ◆ Mitsubishi UPS Series Specifications

### Knowledge and Experience

- ◆ Worlds Top Manufacturer of IGBT Power Devices
- ◆ Extensive References for UPS throughout a broad range of business sectors
- ◆ Leading Japanese UPS Market Share
- ◆ Total Quality Control Cycle

### Introduction to Mitsubishi Electric

- ◆ Mitsubishi Electric Corporation Kobe works established 1921
- ◆ The Energy and Industrial Systems Center
- ◆ Mitsubishi Electric Automation, Inc.
- ◆ Global UPS Business Overview



### System Application

- ◆ System Configuration
- ◆ Mitsubishi MMS Features

### State of the Art Technology

- ◆ Advanced PWM technology
- ◆ Advanced IGBT Application
- ◆ Optimum Control and High Reliability Technology
- ◆ Superior Characteristics, Performance and benefits

### MELCO & MEAU Relationship and Support

- ◆ UPS Engineering and Business organization
- ◆ Direct Engineering and Technical Support





## Mitsubishi UPS Technology

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### **Unique UPS Characteristics and Features:**

- ◆ Advanced PWM technology with advanced IGBT switching application
- ◆ Utilize 4<sup>th</sup> Generation Mitsubishi IGBT
- ◆ IGBT Converter and Inverter
- ◆ Unique Optimum Control and High Reliability Technology
- ◆ Flexible MMS Configuration



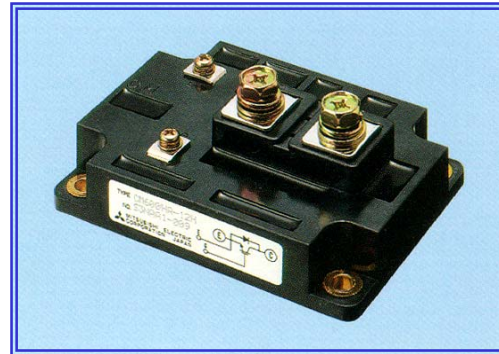
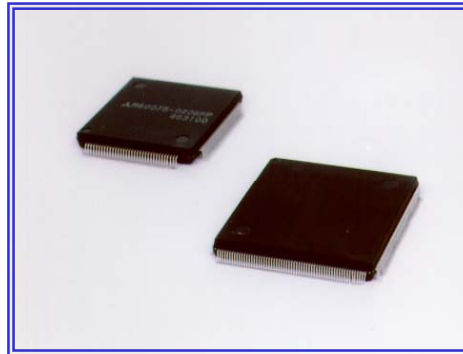
# Mitsubishi UPS Technology

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## Typical UPS Characteristics and Features:

- ◆ Advanced PWM technology with advanced IGBT switching application
- ◆ Energy Saving and Clean Power Supply Environment
- ◆ Superior Input and Output Performance, Characteristics and benefits
- ◆ Unique Optimum Control and High Reliability Technology
- ◆ DSP applied DDC Control
- ◆ Special Development ASIC Chips

DDC: Direct Digital Control  
DSP: Digital Signal Processor  
ASIC: Application Specified IC



Mitsubishi Electric Corporation:  
IC Chips and 4<sup>th</sup> Generation IGBT Power module



# 4<sup>th</sup> Generation Mitsubishi IGBT

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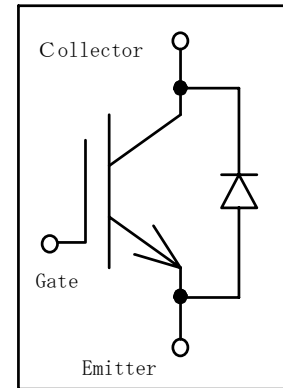
## Features:

- ◆ Trench structure
- ◆ Wide SOA (Safe Operating Area)
- ◆ High Power Switching
- ◆ High Frequency Switching
- ◆ Less Power Losses
- ◆ Soft Switching
- ◆ Small Drive Power

## Energy Saving

- ◆ Promotes an energy saving and clean power supply environment.
- ◆ Low Loss & Low Noise performance

## Device Configuration



## IGBT Power Module



## Benefits

- ◆ High Reliability
- ◆ Superior Performance
- ◆ High Efficiency
- ◆ Low noise



# Optimum Control and High Reliability Technology

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## Features of UPS Control:

### Unique Control Scheme

- ◆ Instantaneous Wave Form Control both of Input Current and Output Voltage
- ◆ Three Phase Independent Control
- ◆ Feedback Control with Characteristic Current Minor Loop plus Feed Forward Control

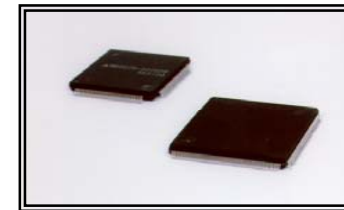


### **Performance**

- ◆ Reduced Output Voltage Fluctuation
- ◆ Reduced Output Voltage Distortion
- ◆ Unbalanced Load Capability
- ◆ Eliminate Input Current Harmonics
- ◆ Self Diagnostic Function

### Advanced Control Chip

Full DDC Control using High Speed DSP and Specially Developed ASIC Chips



IC Chips



**Superior Performance and High Reliability**

**DDC: Direct Digital Control**  
**DSP: Digital Signal Processor**  
**ASIC: Application Specified IC**

Why DDC ? ----- for software control with reduced components

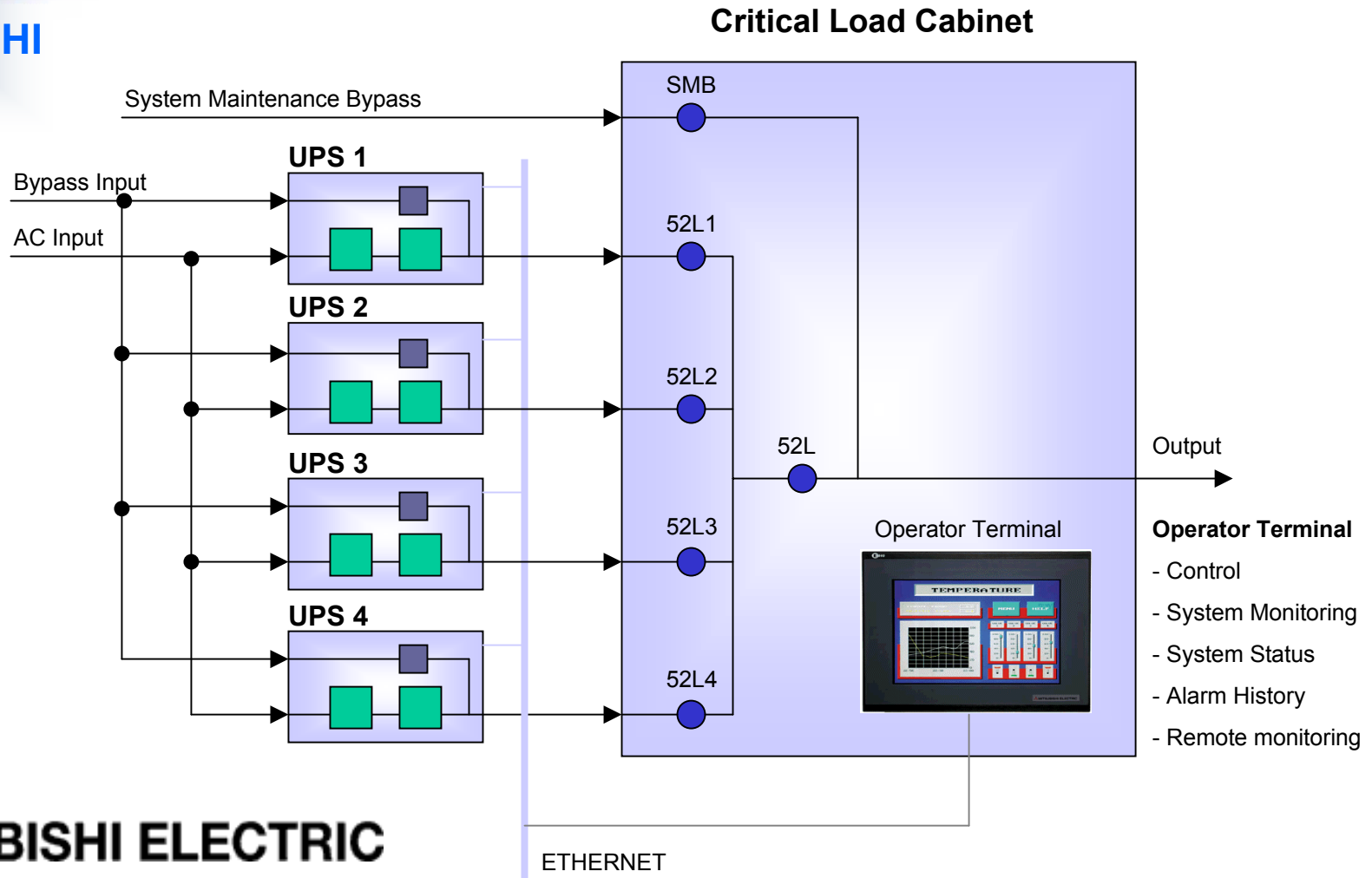
Why DSP ? ----- high speed calculation for Full DDC

Why ASIC ? ----- to reduce components



# Mitsubishi MMS Configuration

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# Mitsubishi MMS Features

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## **Features**

- ◆ Individual UPS Bypass circuitry - No System Control Cabinet (SCC)
- ◆ Independent UPS Control – No Common Controller
- ◆ Instantaneous Load Sharing Control

(Each Individual UPS Module incorporates a Control Function that controls its output current so that total load current is equally shared between all system UPS)

- ◆ Critical Load Cabinet Monitoring System (Ethernet/Operator Terminal)

## **Benefits**

- ◆ Flexibility (System expansion is easy – Initial cost of SCC de-rating unnecessary)
- ◆ High Reliability
- ◆ No Single Point of Failure
- ◆ Stable Operation, Sharing of required Transient Load Current
- ◆ Individual UPS Module or System Maintenance Possible





# Mitsubishi UPS Technology

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## **Unique UPS Operational Features:**

- ◆ Superior Performance
- ◆ Low THD
- ◆ Excellent Generator Compatibility, 1:1 (kWg : kVAups) typical
- ◆ MMS Configuration allows ease in system expansion and eliminates single point failure (STS)



## Typical Mitsubishi UPS Specifications

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Items	9800A
Rated Output Capacity	100kVA up to 750kVA
System Configuration	Single or Multi Module System
<u>AC Input</u>	
Voltage	480V +15% -15%
Frequency	60Hz +/- 5%
Power Factor	0.99
Current Distortion	6% THD Typical at 100% Load
<u>AC Output</u>	
Voltage	480V
Frequency	60Hz
Power Factor	0.8 Lagging (100, 150, 225kVA) 0.9 Lagging (300, 375, 500,750 kVA)
Voltage Regulation: Steady State	+/- 1%
Transient Voltage Fluctuation	+/- 2% or less at 100% Step Load Change
Voltage Distortion Factor	5% max. THD at 100% non-Linear load
Efficiency	<p>The graph shows Efficiency (Eff) on the vertical axis and Load on the horizontal axis. A curve starts at a lower efficiency at low loads and rises to reach 94% efficiency at a high load level.</p>



## Typical Mitsubishi UPS Specifications

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Items	9700 Series	2033A Series
Rated Output Capacity	100, 150, 225 kVA	30, 40, 50, 75 kVA
System Configuration	Single Module System	Single Module System
<u>AC Input</u>		
Voltage	208VAC +10% -15%	208/480/600VAC +10% -15%
Frequency	60Hz +/- 5%	60Hz +/- 5%
Power Factor	0.99	Unity
Current Distortion	3% THD Max at 100% Load	3% THD Max at 100% Load
<u>AC Output</u>		
Voltage	208/480V	208/480/600V
Frequency	60Hz	60Hz
Power Factor	0.8 Lagging	0.8 Lagging
Volt. Reg.: Steady State	+/- 1%	+/- 1%
Trans. Volt. Fluctuation	+/- 2% or less at 100% SLC	+/- 3% or less at 100% SLC
Volt. Dist. Factor	5% max. THD at 100% NLL	4% max. THD at 100% NLL

SLC: Step Load Change

NLL: Non Linear Load



# Mitsubishi UPS Technology

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## **Environmental Requirements:**

- ◆ Temperature 0 – 40 deg C
- ◆ Relative Humidity 0 -95% non-condensing
- ◆ up to 9000 ft without de-rating
- ◆ Low Acoustic Noise



## Mitsubishi UPS Technology

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### **Five Reasons To Choose Mitsubishi UPS:**

- ◆ Excellent Quality
- ◆ Worldwide Leader In Power Semiconductor Devices
- ◆ Superior Performance
- ◆ Knowledge and Experience
- ◆ MMS System Flexibility



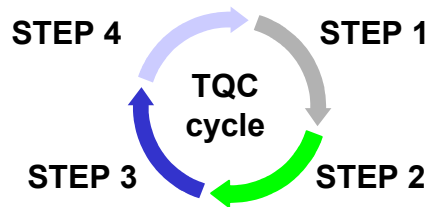
# Total Quality Control

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**ISO9001 certified**

## TQC (Total Quality Control) cycle



- STEP 1:** Product research and development
- STEP 2:** System design; satisfying customer's requirements
- STEP 3:** Production & quality assurance (factory)
- STEP 4:** Field service (operation & maintenance)

**TQC (Total Quality Control) cycle assures High Reliability**



## Mitsubishi IGBT Market Share

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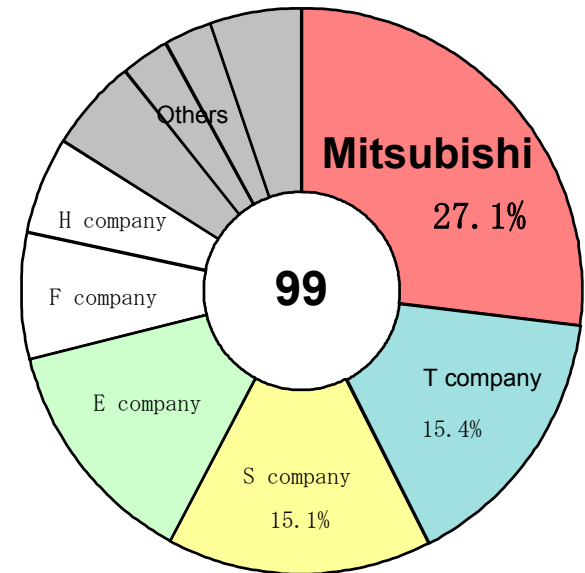
**Mitsubishi Electric is the**  
**Worlds Top Manufacturer of IGBT**  
**power devices.**

Mitsubishi IGBT enables high frequency PWM power switching with **Improved efficiency and low noise.**

Mitsubishi Electric UPS utilize the Mitsubishi Electric 4<sup>th</sup> Generation IGBT, supporting **Complete Integration** for UPS components and assembly.

Mitsubishi Electric **Total Quality** is achieved by controlling the major aspects of system assembly.

Utilizing Mitsubishi IGBT devices **Optimizes the UPS performance**, while delivering superior quality UPS within stringent lead times.





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## Introduction to Mitsubishi Electric Corporation and Kobe City

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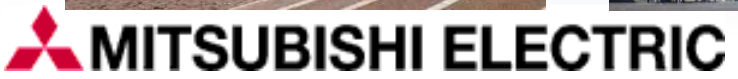
### **Mitsubishi Electric Corporation:**

Is a Core Company in the Mitsubishi Group. Head Office being located in Tokyo, with a vast amount of Laboratory and manufacturing Facilities throughout Japan. Mitsubishi Electric Corporation Uninterruptible Power Supply Systems are manufactured in Kobe and Nagoya works.

### **Kobe City:**

Located roughly in the center of Honshu, Japan's main island, Kobe is easily accessible by land, sea, and air.

Together with Osaka and Kyoto, it forms the focal point for the economy of western Japan. Since 1921, Kobe City has been the home of the Mitsubishi Electric Corporation Energy and Industrial Systems Center (EISC)





# Introduction to Kobe Works and The Energy and Industrial Systems Center

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## **Mitsubishi Electric Corporation History:**

Kobe Works Established 1921

The Energy and Industrial Systems Center (EISC)

Power Electronics Systems Department

ISO 9001 Approved 1994

Utilizing the latest technology, the  
Energy and Industrial Systems Center  
of Mitsubishi Electric Corporation  
Designs a variety of large Infrastructure Systems and Products.  
Mitsubishi Electric Corporation develops and manufactures the  
electronic equipment used in these systems.



## Introduction to Mitsubishi Electric Automation, Inc.

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### **Mitsubishi Electric Automation, Inc.:**

Is a directly wholly owned subsidiary of Mitsubishi Electric Corporation.

Since 1985 Uninterruptible Power Supply products have been part of Mitsubishi Electric Automation, Inc. business located in Vernon Hills, Illinois. This location houses all the management, order services, direct product services, and retains the base inventory of UPS products.

Offers an abundance of strategically located sales and service offices in North, South and Latin America to provide customers with commercial and technical services.

Is dedicated to the global market as well. Through teamwork and perseverance, joining Mitsubishi automation affiliates around the world in the quest to be the premier, single source provider of automation solutions for the global marketplace in the 21st century



**Mitsubishi Electric Automation, Inc.  
- Vernon Hills, IL**



## Global UPS Business Overview

### **mitsubishi** **Global** **Solutions**

#### **Mitsubishi Electric:**

Is a recognized world leader in the Manufacture, Marketing and Sales of Uninterruptible Power Supply Systems.

Holds extensive UPS Installation References throughout a broad range of business sectors.

Owens the top share in the Japanese UPS marketplace.

One of the premier UPS companies in the North and Latin America Marketplace.

One of the premier UPS companies in the Asian Marketplace





# Summary

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**UPS Product**

**State of the Art Technology**



**Relationship and Technical Support**

**Knowledge and Experience**

**System Application**



**Mitsubishi Electric**

**High Quality and Performance**

**Reliability**

**Partnership**

**Cooperation**

 **MITSUBISHI ELECTRIC**



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**Questions?**





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**UPS Product  
(Additional slides provided FYI)**





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## Product Range

### **Mitsubishi Electric:**

Offers a complete UPS Line-Up for Small, Medium and Large Scale Systems.

Utilizes Three Phase UPS in either Single Module or Parallel Module configuration

Offers a broad range of UPS system kVA capacity.

Offers product specifications to satisfy any local regulations and standards: North and Latin America standards - UL certified and stamped, Japanese and Asia Standards.

TQC (Total Quality Control) cycle assures High Reliability and Quality: ISO 9001












# Mitsubishi Kobe Works UPS Line-Up

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UPS SYSTEM SCALE	OUTPUT PHASE	MODEL NAME (KVA CAPACITY)	TYPICAL LOAD	
<b>LARGE</b> Applicable for <b>PARALLEL OPERATION (MMS)</b>	3	9800A Series  100~750 kVA, 9700 Series  100~225 kVA (SMS Only)	INTERNET DATA CENTER  MAIN FRAME COMPUTER	
		<b>MEDIUM</b>	3	2033AD Series  30~75 kVA 2033D Series  30~80 kVA 2033C Series  10~50 kVA
1	7011A Series (1 ~12kVA) Tower Type 7011A Series (1.5/3 kVA) Rackmount Type			TELECOMMS

■ 5kVA and below Single Phase UPS manufactured at Mitsubishi Electric Corporation, Fukiyama Works