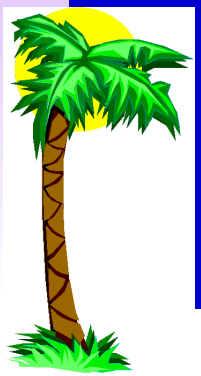
SBS IF Developer's Conference '98

MITSUBISHI

Smart Charger & Selector Safety Presentation

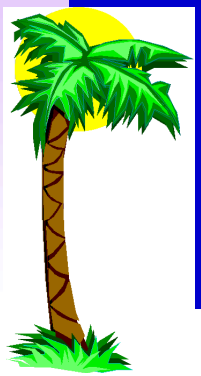
PlugFest VI in Kauai

MITSUBISHI ELECTRIC CORPORATION AND
MITSUBISHI ELECTRIC SYSTEM LSI DESIGN CORPORATION



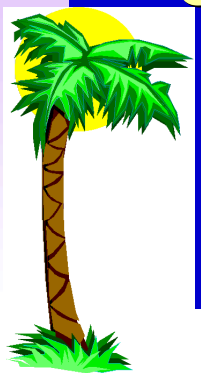
TOPIC

- SBS SYSTEM BLOCK DIAGRAM
- SAFETY ISSUE WITH SMBus DATA
- SAFETY ISSUE WITHOUT SMBus DATA
- CONCLUSION

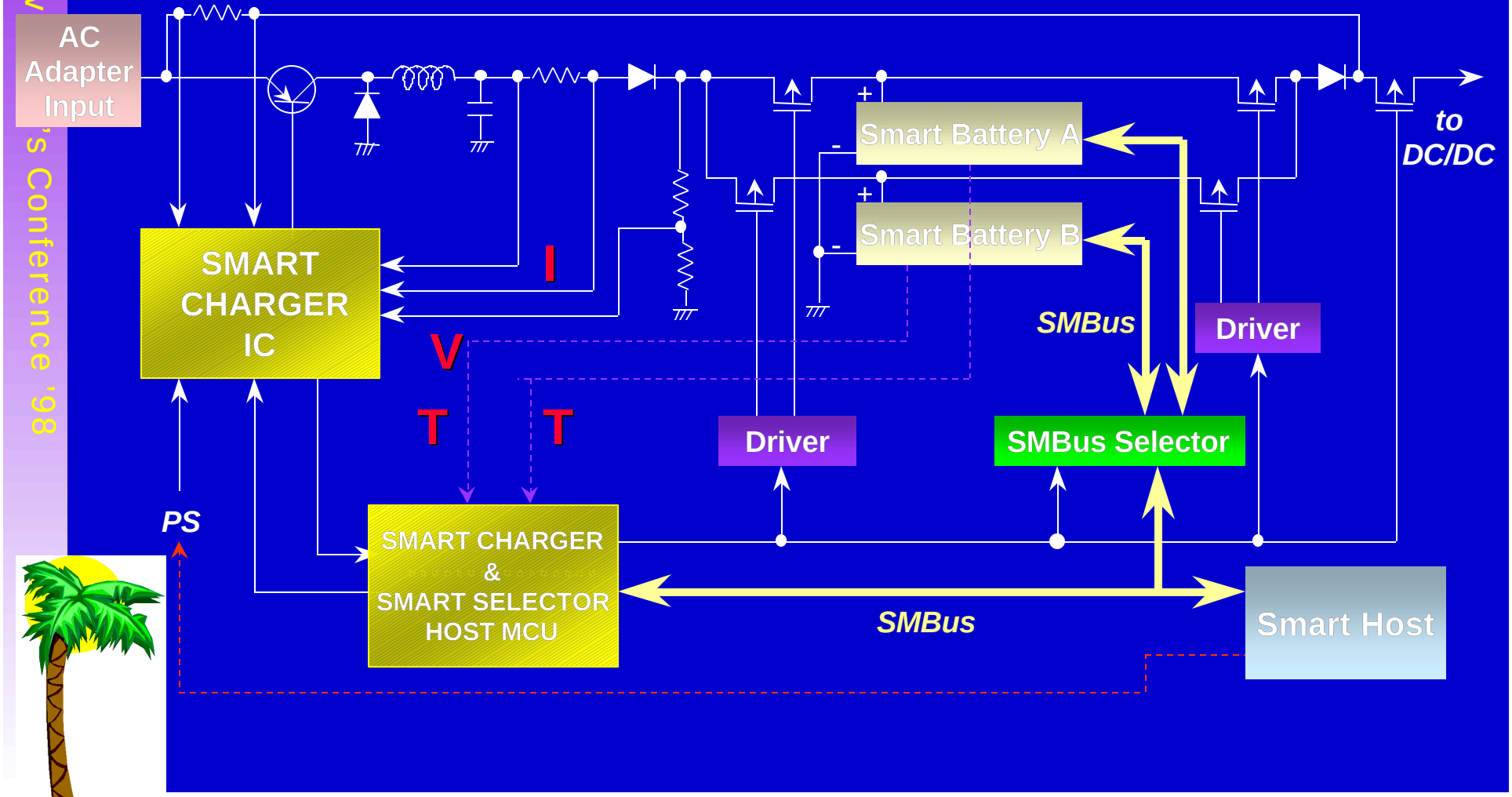


Basic Functions

- initial stage management
  - –AC power supply detect
  - –PC ON/OFF detect
  - –Battery detect
  - –Check battery status
  - –Decide target battery
  - –Detect battery chemistry
  - –Charge initiation
- Periodic management
  - –Polling battery information
  - –LED indicate
  - –Adjust charging current & voltage
  - –Select charging method
  - –Charge termination
  - –Power save mode
  - –On-Line Charging



System Block Diagram

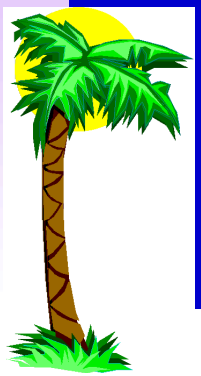


Check Battery Status

After the smart charger founds the battery, the smart charger sends following 2 SMBus commands to the battery.

- Battery Mode:
- @- To identify connected battery is the Smart Battery.

- Battery Status:
- @- To get current status of the Smart Battery.



Detect Battery Chemistry

After the smart charger detected battery exist, the smart charger issues "Device Chemistry" command to SB, and decide charging method by return value.

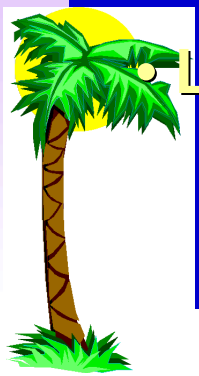
The smart charger has to supports following battery types
with correct charging method.

- **NiCd / NiMh Smart Battery :**

  Charge w/ constant current

- **Lilon Smart Battery :**

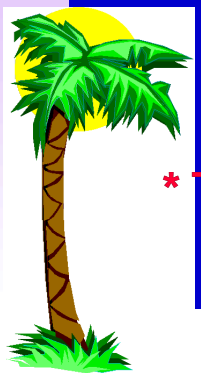
  Charge w/ constant current and constant voltage



Charge Initiation

The smart charger initiates charging at following situations:

- **Upon insertion of a battery**
- **When charge power becomes available**
- * **When Charging Current & Voltage are set to non-zero value**
- * **When the Alarm Warning is written without critical error bits set**
- * **When the system could get response from SB**
- * **When battery pack temperature is under temperature limitation**



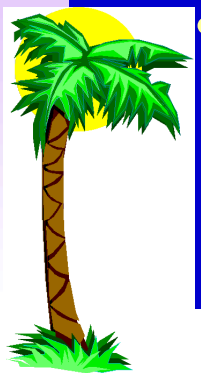
*** Through SMBus**

Polling Battery Status

SMBus Master Functions

The smart battery issues following SMBus commands every 1 sec period* to check battery status. It is better for safety issue battery charging.

- **Battery Status**
- **Battery Mode**
- **Charging Current**
- **Charging Voltage**
- **Current**
- **Voltage**
- **Temperature**



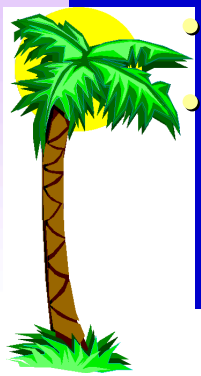
*** Failure data or communcation in 5 times, SC should terminate charging**

Polling Battery Status

SMBus Slave Functions

keeping smart host knows battery system status. Smart charger has better to support following command in slave mode.

- *Battery Status*
- *Charging Current*
- *Charging Voltage*
- *Charging Mode*
- *Charger Status*
- *Charger Info*
- *Selector Status*
- *Selector Preset*
- *Selector Info*

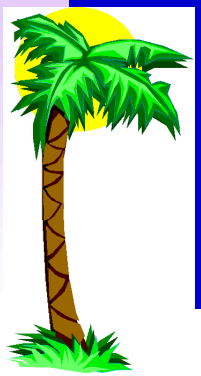


Charge Termination

The smart charger discontinues charging at following situations:

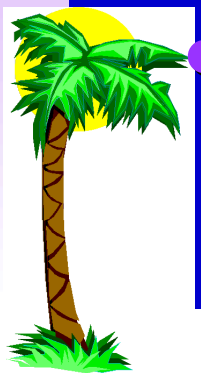
- **When Alarm Warning is written with critical error bits set.**
- **If either Charging Current or Charging Voltage are set to zero.**
- **When the smart host couldn't get response from SB.***
- **When temperature of battery pack over temperature limitation.**

***Trying in 5 times**



DIRECTLY MONITOR BATTERY STATUS

- **Directly monitor battery voltage, current and temperature via SC analog pin**
- **Battery will be stopped charged, if value of battery voltage, current or temperature is abnormal**
- **Guarantee SBS is safety**



CONCLUSION

- **The charge method should be followed SBS specification**
- **The charging voltage and current should be followed smart battery broadcast value**
- **Don’t over supply charging voltage to charge Li-Ion battery**
- **Implement hardware pin to monitor battery status**