56800/E Hybrid Controllers in Connectivity Applications
Introduction

- Covers connectivity peripherals available in the 56800E Hybrid Controller portfolio (SCI, SPI, CAN, SSI, Host Interface, I²C).

- Application Reference Designs

- Provides a general overview of the hardware and software support available for the 56800E Hybrid Controller product line.

- Hands-on exercises demonstrate application development using CodeWarrior™ tools with Processor Expert™ technology.
Connectivity Peripherals
56800E Hybrid Controller Roadmap

- **56850 Series**
  - Telecom/voice, RAM-based, 120 MMACS, 81–144 pins

- **56F8400 Series**
  - Automotive, industrial, Flash-based, 120 MMACS, FlexRay, 2xCan, Improved PWM & ADC, low power, 48–160 pins

- **56F8500 Series**
  - Automotive, industrial, Flash-based, 150 MMACS, FlexRay, 2xCan, Improved PWM & ADC, low power, 48–160 pins

- **56F8300 Series**
  - Automotive & Industrial, Flash-based, 60 MMACS, 16–512KB PFlash, 48–160 pins

- **56F8100 Family**
  - Mid-Range Industrial and General Purpose, Flash Based, 40MMACs 48-144 pins

- **56F8000 Series**
  - Low end industrial and automotive control, Flash-based, 32 MMACS, 28-32 pins

- **56F820 Series**
  - General Purpose, Flash-based, 40 MMACS, 100–128 pins

- **56F80x Series**
  - Industrial controllers, Flash-based, 40 MMACS, 32–160 pins

Specifications:
- **56F801 Series**
  - 0.18µ, 56800E, 120 MMACS
  - 0.1Xµ, 56F8500, 150 MMACS
  - 0.18µ, 56800E, 60 MMACS
  - 0.25µ, 56800E, 40 MMACS
  - 0.25µ, 56800E, 30/40 MMACS
  - 0.25µ, 56800E, 32 MMACS

Motorola Launches the 5680x Family
56F80x MSCAN Features

- Version 2.0B compliant
- Standard and extended data frames
- 0-8 bytes data length
- Programmable bit rate up to 1 Mbps
- Support for remote frames
- Double-buffered receive storage scheme
- Triple-buffered transmit storage scheme
- Flexible maskable identifier filter
- Programmable wake-up functionality with integrated low-pass filter
- Separate signaling and interrupt capabilities for all CAN Rx/Tx error states
- Three low power modes
- Based on the Motorola Scalable Controller Area Network (MSCAN12) definition as implemented on the MC68HC12
56F83xx FlexCAN Features

- Version 2.0B compliant
- Standard and extended data frames
- 0-8 bytes data length
- Programmable bit rate up to 1Mbps
- Support for remote frames
- Double-buffered receive storage scheme
- Flexible maskable identifier filter
- Programmable wake-up functionality
- Separate signaling and interrupt capabilities for all CAN Rx/Tx error states
- Three low power modes
- Programmable first transmit scheme: Lowest ID or Lowest Message Buffer
- “Time Stamp”, based on 16-bit free-running timer with Global Network Synchronization
- Sixteen Flexible Message Buffers of 0-8 bytes Data Length, each configurable as Rx or Tx, all support Standard and Extended Messages
CAN Applications: Vehicles and Transportation

- 80% of an annual 100-million-unit market with perhaps 20 distinct applications.

- CAN is the in-vehicle network (IVN)
  - engine management
  - body electronics (e.g. door and roof control)
  - air conditioning
  - lighting
  - entertainment control

- Majority of the European carmakers use CAN-based IVNs. American and Far East manufacturers started implementing CAN-based IVNs.
CAN Applications: Other Segments

The 20% of the market shared by all the other segments combined, however, represents thousands of applications most of which do not reach high volume.

Factory automation: Control of assembly line manufacturing machinery enables automation. Typical applications include conveyors, production data recording, and other end-user configurable systems.

Medical: Hospitals control vital operating room components such as OR lights and tables, endoscope lights and cameras, insufflators, X-ray and ultrasound machines, video recorders, and video printers.

Aviation: CAN is used as a backbone network in aircrafts for flight state sensors, navigation systems and research PCs driving displays installed in the cockpit.
SCI Features

- Full duplex operation provides simultaneous data transmit and receive
- Half duplex operation allows data transmit and receive via single wire.
- Separately enabled transmitter and receiver
- 13-bit baud rate selection
- Standard mark/space non-return-to-zero (NRZ) format:
  - Programmable 8-bit or 9-bit data format
- Separate receiver & transmitter CPU interrupts
- Programmable polarity for transmitter and receiver
- Two receiver wakeup methods:
  - Idle Line
  - Address Mark
- Interrupt-driven operation with eight flags
- Receiver framing error detection
- Hardware parity checking
- 1/16 bit-time noise detection
Sci Applications

- Inter-Processor Communication, PC serial port communications, Modems
- Operates as a Universal Asynchronous Receiver/Transmitter (UART)
- Highly accurate baud rates provide reliable communication

### Table 13-3. Example Baud Rates (Module Clock = 60MHz)

<table>
<thead>
<tr>
<th>SBR Bits</th>
<th>Receiver Clock (Hz)</th>
<th>Transmitter Clock (Hz)</th>
<th>Target Baud Rate</th>
<th>Error (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>98</td>
<td>612,245</td>
<td>38,265</td>
<td>38,400</td>
<td>-0.35</td>
</tr>
<tr>
<td>195</td>
<td>307,692</td>
<td>19,231</td>
<td>19,200</td>
<td>0.16</td>
</tr>
<tr>
<td>391</td>
<td>153,453</td>
<td>9,591</td>
<td>9,600</td>
<td>-0.10</td>
</tr>
<tr>
<td>781</td>
<td>76,825</td>
<td>4,802</td>
<td>4,800</td>
<td>0.03</td>
</tr>
<tr>
<td>1563</td>
<td>38,388</td>
<td>2,399</td>
<td>2,400</td>
<td>-0.03</td>
</tr>
<tr>
<td>3125</td>
<td>19,200</td>
<td>1,200</td>
<td>1,200</td>
<td>0.00</td>
</tr>
<tr>
<td>6250</td>
<td>9,600</td>
<td>600</td>
<td>600</td>
<td>0.00</td>
</tr>
</tbody>
</table>
SPI Features

- Supports demand-driven master or slave devices with high data rates
- Full-Duplex Operation
- Double-buffered Operation with separate transmit and receive registers
- Programmable length transmissions, 2 to 16 bits
- Programmable transmit and receive shift order, MSB or last bit transmitted
- Eight master mode frequencies (maximum = bus frequency/2)
- Maximum slave mode frequency = bus frequency
- Serial clock with programmable polarity and phase
- Two separately enabled interrupts
- Receiver Full
- Transmitter Empty
- Mode Fault and overflow error flag with interrupt capability
SPI Applications

- Invented by Motorola
- Easy interface to Freescale MCUs, Analog, and Sensor Products
- Supports LCD drivers, A/D subsystems, Serial Data Flash
IIC Features

- Compatible with I²C Bus standard
- Multi-master operation
- Software programmable for one of 256 different serial clock frequencies
- Arbitration lost interrupt with automatic mode switching from master to slave
- Calling address identification interrupt
- Start and stop signal generation/detection
- Repeated start signal generation
- Bus busy detection
**Host Interface Features**

- Byte-wide, full-duplex, double buffered, parallel port
- Operate asynchronously to the DSP core clock
- Data transfers are manageable
  - The host side registers are accessible to the external host processor
  - The DSP side registers are accessible to the DSP core

**DSP Side.**
- Registers are directly mapped into four X data memory locations.
- 16-bit data wide
- Transfer mode
  - DSP to host
  - Host to DSP
  - Host Command
- Handshaking protocol
  - Software Polled
  - Interrupt driven
- DMA accesses
- Instructions
  - Memory-mapped registers allow the standard MOVE instruction to be used
  - Bit manipulation instructions simplify I/O service routines

**Host Side.**
- 16 signal pins are provided to support non-multiplexed data bus
- 8-bit data wide
- Transfer mode
  - DSP to Host: 8-bit or 16-bit
  - Host to DSP: 8-bit or 16-bit
  - Host Command
- Handshaking protocols
  - Software Polled
  - Interrupt driven
- DMA accesses
- Separate interrupt lines for each interrupt source
- Special host commands force the host command associated DSP core interrupts under host processor control, which are useful for:
  - Real-time production diagnostics
  - Debugging window for program development
Synchronous Serial Interface (56F826/827)

- Sophisticated programmable clocking
  - Completely separate clock and frame sync selections for receive and transmit sections
  - Independent or shared transmit and receive
  - Normal mode operation using frame sync
  - Gated Clock mode operation requiring no frame sync
  - Programmable internal clock divider
  - Program options for frame sync and clock generation

- Programmable word length (8, 10, 12, or 16 bits)
- SSI power-down feature
- Network Mode
Improved Synchronous Interface (56852)

- Sophisticated programmable clocking
  - Completely separate clock and frame sync selections for receive and transmit sections
  - Independent or shared transmit and receive
  - Normal mode operation using frame sync
  - Gated Clock mode operation requiring no frame sync
  - Programmable internal clock divider
  - Program options for frame sync and clock generation
- Programmable word length (8, 10, 12, or 16 bits)
- ISSI power-down feature
- Network Mode
Enhanced Synchronous Serial Interface (56853/4/5/7/8)

- Independent (asynchronous) or shared (synchronous) transmit and receive sections with separate or shared internal/external clocks and frame syncs
- Normal mode operation using frame sync
- Network mode operation allowing multiple devices to share the port with as many as thirty-two time slots
- Network mode enhancements
  - Time slot mask registers (receive and transmit)
  - End of Frame Interrupt
- Gated Clock mode operation requiring no frame sync
- Programmable internal clock divider
- Programmable word length (8, 10, 12, or 16 bits)
- Program options for frame sync and clock generation
- ESSI power down feature
- Completely separate clock and frame sync selections for receive and transmit sections
- Audio enhancements
- Three transmitters per ESSI (allowing 6 channel surround sound)
Application Reference Designs
56F800 Design Opportunities by Market

**General**
- Medical Scanners
- Remote Monitoring
- Cable Test Equipment
- Noise Cancellation
- ID Tag Readers
- Traffic Light Control
- Underwater Acoustics

**Appliance**
- Compressors
- Smart Appliances
- General Purpose Drives

**Industrial**
- HVAC Blowers & Fans
- Lifts / Elevators / Cranes
- Frequency Inverters
- Variable Speeds Pumps
- Uninterruptible Power Supplies

**Office / Home**
- Printers / Fax / Scanners
- Exercise Equipment
- Electric Lawn Equipment
- Temperature Control
General Embedded Application

DSP56F80x

- Sensors
- Battery/Voltage
- Audio/Mic/Line
- IF/Baseband
- Speaker/Line
- Waveform etc.

Optional SPI Peripherals

- * DSP56803/5/7 only

Optional External Memory or Peripherals

JTAG/OnCE Debug

Xcvr

CAN*

SCI

56800 CPU

Boot Flash™

Flash

RAM

PWM

Quad Timer

Quadrateure Decoder*

GPIO

External Bus*

A/D

A/D

Flash™

Memory or

Peripherals

56800 CPU

DSP56F80x

JTAG/OnCE Debug

Xcvr

A/D

A/D

PWM

Quad Timer

Quadrateure Decoder*

GPIO

External Bus*

* DSP56803/5/7 only
Remote Monitoring System
With Local Readout and Control Inputs Using **DSP56F803**
Tag Reader System
With Control Inputs Using **DSP56F803**

- **SERIAL INTERFACE**
- **SERIAL PORT**
- **PWM STAGE**
- **EXTERNAL ADDRESS BUS A[06:15]**
- **ANALOG TO DIGITAL CONVERTER**
- **SERIAL INTERFACE TO MASTER CONTROL UNIT**
- **TRANSMIT ANTENNA**
- **RECEIVE ANTENNA**
- **KEYPAD**
- **ANALOG CONDITIONING**

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Embedded Connectivity Summit

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Automatic Meter Reader (AMR) System
3-Phase Unit With Local Readout Using DSP56F807
Identifying 56F80x opportunities/Key Peripherals

- All types of Industrial 3 phase Motor Control
  - High speed sophisticated PWMs can replace what had previously been performed in external PWM generation chip
  - High speed/performance 1.2 μs/12-bit ADC
  - Quadrature decoders for direct interface to Hall Effect sensors or Optical encoders
  - High 30/40 MIPS MCU/DSP performance required for advanced Motor Control Algorithms
  - Integration of support and communication peripherals

- Metering and Industrial Control
  - High speed/performance 1.2 μs/12-bit ADC
  - High 30/40 MIPS MCU/DSP performance required for advanced Control Algorithms
  - Use of PWMs to generate output waveforms
  - Integration of support and communication peripherals
Identifying 56F80x opportunities/Key Peripherals

Medical

- High speed sophisticated PWMs can replace what had previously been performed in external PWM generation chip
- High speed/ performance 1.2 $\mu$s/12-bit ADC
- High 30/40 MIPs MCU/DSP performance required for advanced Control Algorithms
- Integration of support and communication peripherals

Power Supplies/Inverters

- High speed sophisticated PWMs can replace what had previously been performed in external PWM generation chip
- High speed/ performance 1.2 $\mu$s/12-bit ADC
- High 30/40 MIPs MCU/DSP performance required for advanced Control Algorithms
- Integration of support and communication peripherals
Single Programmable DSP Remote Metering

- Flexible PLL w/TOD
  Solutions provide for various crystals and/or oscillators, reducing system cost.
- Programmable DSP
  Programmability of flash based DSP56826 allows DSP to act as an MCU as well, reducing system cost.
Digital Answering Device

- **External Memory (Option)**
- **DSP 56826**
- **Keypad**
- **LCD Display**
- **GPIO**
- **SPI or SCIs**
- **SSI**
- **Codec**
- **Line I/F**
- **Telco**
- **Codec**
- **Audio AMPs**
- **Mic**

**Flexible PLL**

Solutions provide for various crystals and/or oscillators, reducing system cost.

**Internal TOD**

Internal Time of Day module eliminates need for external real time clock reducing system cost.
• **Flexible PLL**
  Solutions provide for various crystals and/or oscillators, reducing system cost.

• **Internal TOD**
  Internal Time of Day module eliminates need for external real time clock reducing system cost.

**POS Terminal**

- **DSP 56826**
- **Codec**
- **SSI**
- **GPIO**
- **TOD Timer**
- **EAB/EDB**
- **SPI**
- **Keypad**
- **Mag card reader**
- **LCD Display**
- **External Memory (Option)**
Identifying 56F82x Opportunities/Key Peripherals

**Telephony**
- SSI enables connection to external High performance Codecs
- Time-of-Day peripheral enables time aware applications requiring time stamps
- High 40 MIPs MCU/DSP performance required for telephony Algorithms
- Internal Flash memory enables lower system cost
- Integration of support and communication peripherals

**Voice Applications**
- SSI enables connection to external high performance Codecs
- Time-of-Day peripheral enables time aware applications requiring time stamps
- Internal Flash memory enables lower system cost
- High 40 MIPs MCU/DSP performance required for telephony Algorithms
- Internal ADC and timer peripheral can be used to create low cost Codec
- Integration of support and communication peripherals
Identifying 56F82x opportunities/Key Peripherals

- General Purpose
  - Low noise linear High performance 2.4 $\mu$s/12-bit ADC
  - High 40 MIPS MCU/DSP performance
  - Integration of support and communication peripherals
  - Lower power consumption than 56F80x devices
5650 Design Opportunities by Market

**Telecommunications**
- VoIP
- Low end Networking

**Consumer**
- Feature Phones
- IP Phones
- Karaoke
- Toys

**Automotive**
- Hands-free
- Embedded Video

**General**
- Medical applications
- Security
- Voice recognition systems
Client Side IP Phone

With MCU functionality and DSP processing power combined with a large number of peripherals and I/O, the enhanced 5685x chips offer a single-chip solution for Client-Side IP Phones. The 5685x devices can support all the necessary system components required for an IP phone, including voice-band codec, keypad, and optional LCD. The device can connect via Ethernet or USB transceiver chips to LAN, DAA to Telco, or RF to wireless LAN.

The 56800E family provides speech and message processing required by everything from digital telephony answering devices to feature phones, type 1, 2 and 3. The synchronous serial interfaces on the DSP56800E devices provide glueless interface to industry-standard CODEC, required by all telephony applications.
DSP56858 Feature Phone

Four Line/80 Character LCD Display

- DSP56858
- Logic
- EMI
- GPIO
- SSI

Codec
- CH 1
- CH 2
- Hook Control
- Ring Detection Line Sense

Audio Circuit

DAA

Tip & Ring

Microphone

Speaker

Legend
- EVM
- TDC

Keypad

Internal Memory

Launched by Motorola

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Feature Phone – Our Solution

- Includes the DSP5685x silicon and implements the following features for a single or multi-line application in compliance with the caller ID telecommunications standard **SR-3004**:
  - Type 1 Caller ID and Visual Message Waiting Indicator
  - Type 2 Call Waiting ID
  - Type 2.5 Call Waiting Deluxe Options
  - Full Duplex Speakerphone with System Optimization Diagnostic Tools
  - Multi-line/VoIP Conference Bridge
  - Adaptive Line and Acoustic Echo Cancellers
  - Extension in Use Detection
  - DTMF Detection/Generation
  - EIA-470B DTMF Dialer
  - Voice Activity Detection -- Call Progress Signal Detection
  - Volume/Gain Control
  - Tonal Ringing Generator
  - AT Command/Keypad/LCD Control Interface

- All Drivers for DSP5685x peripherals, Codec and DAA
Voice-Controlled Digital Answering Machine

Several of Motorola's DSP56800E devices are appropriate for a DTAD application. For example, as shown in Figure 1, the DSP56858 provides the following interfaces:

- Flexible PLL clock source provides various crystals and/or oscillators that help to reduce system cost
- SSI or ESSI peripherals for seamless connection to Codecs (for user interface and telco interface)
- An SPI for connection to a Flash card device
- An integrated time-of-day peripheral providing real-time clock
- Additional general purpose input/output (GPIO) ports for LCD and keypad support

Included in Processor Expert are:

- VRLite-1 for memory-optimized, isolated-word, speaker-dependent speech recognition system
- A wide variety of vocoder algorithms for voice compression
- A comprehensive set of drivers and framework code, enabling quick completion of the software application
- The out-of-the-box software components for all on-chip peripherals, in combination with software libraries for motor control, communication, and signal processing, make it easier to develop the most demanding real-time embedded applications
Hands Free Cell Phone Operation

Features:
- Bluetooth connection replaces earphone cable
- Platform into Car Radio System
- Headset & Handsfree profile
  - Noise suppression
  - Echo cancellation
- Full-Duplex communication quality
In the above example the DSP is running the voice processing, echo cancellation, jitter buffer, and other signal processing type tasks. The RISC or CISC processor, the MPC857DSL in this case, is running the protocol stacks and other tasks required to perform the entire VoIP function.
High Tech Toys

Wabi shares the home phone line.
Wabi periodically dials out to a toll-free number to check for new messages. Wabi then communicates wirelessly with the base station. The bear itself has no wires (other than when he is recharging).

Listen for Wabi’s giggle
When Wabi receives a new message he giggles and lights up an LED to let the child know there is a new message. If Wabi hasn’t been played with for a while only the light illuminates to avoid waking sleeping children.

Children can play messages over and over again.
Pressing the buttons on Wabi’s chest will loop through all the stored messages.
Messages are stored until newer ones replace the oldest ones.
Telephony & Voice Applications

- ESSI enables connection to external high performance Codecs
- Time Of Day peripheral enables time aware applications requiring time stamps
- High 120 MIPs MCU/DSP performance required for telephony Algorithms
- Internal timer peripheral can be used to create low cost DAC
- Integration of support and communication peripherals
- Full complement of Telephony software
- Very Cost Effective
Identifying 5685x opportunities/Key Peripherals

- **Voice over IP (VoIP)**
  - ESSI enables connection to external High performance Codecs
  - High 120 MIPs MCU/DSP performance supports multiple channel operation
  - Integration of support and communication peripherals
  - VoIP software components
  - Networking software available from third party for single chip implementations
  - High performance Host Port Interface for simple connection to Power PC or ColdFire network processors for multi-chip systems
  - Very Cost Effective
56F8300 Target Markets

**Industrial**
- UPS
- Power supplies
- Frequency inverters
- Protection relay
- Sensorless control
- Valve actuators

**Automotive**
- EPAS
- Braking
- Transmission
- Active suspension
- Valve actuators
- Engine performance modules

**General**
- Bill validators
- Medical instrumentation
- Intelligent toys
- Metering
- Retail scanners

- Exercise equipment
- Security and safety systems
- Vending machines
- Home automation
Field Oriented Motor Control Application

- **PWM module A**
- **PWM module B**
- **ADC**
- **FaultA0-3**
- **FaultB0-3**
- **ADC**
- **Isa0-2**
- **Isb0-2**
- **Quadrature Decoder**

- **MC56F8346**

- **Command**
- **Speed Controller**
- **Torque Controller**
- **Torque Model**
- **Flux Controller**
- **Decoupling Flux Controller**
- **Flux Current Controller**
- **Torque Current Controller**

- **Input Voltage Generators**
- **Zero Crossing Detector**

- **GPIO-D**

- **CAN 2.0A/B**
- **SPI**
- **SCI0**
- **SCI1**
- **RS232**

- **Coordinate Transformation**

- **Current Mode Control**
Combining today’s low-cost, high-performance sensor technology with the processing capability of the 56F8300 makes traditionally high-cost intelligent sensor systems much more affordable. With the greatly reduced cost and increased performance these systems can be applied to many new markets.

One such system is the Inertial Sensor, which can be used to determine the angular and linear motion of an object. Traditionally, the inertial sensors have been used for active stabilization and navigation applications. But in the past, the intelligent inertial sensor systems were quite expensive because of the cost of mechanical accelerometers and gyros, and the cost of the high-performance processors required in the system. This made their use practical only for expensive and complex systems, such as military submarines and commercial aircraft. Now, with the introduction of low-cost MEMs sensor technology and the low-cost 56F8300 hybrid processors, much more economical inertial sensors can now be produced.
Connected Alarm Systems

Keypad Unit performing: Human Interface, speaker phone, voice compression, and voice prompt message replay.

Panel Unit performing: Caller ID, v.22bis soft modem, speaker phone, voice compression and security control.

Analog inputs from various zone sensors.

Keypad Unit:
- MC56F8346
- Mic
- Speaker

Panel Unit:
- MC56F8346
- Phone Line
- Zones

230kbps serial connection between Keypad and Panel Units.
Identifying 56F8300 Opportunities/Key Peripherals

- All types of Industrial 3 phase Motor Control
  - High speed sophisticated (60 MHz) PWMs can replace what had previously been performed in external PWM generation chip
  - High speed/performance 1.2 μs/12-bit ADC
  - Quadrature decoders for direct interface to Hall Effect sensors or Optical encoders
  - High 60 MIPs MCU/DSP performance required for advanced Motor Control Algorithms
  - Integration of support and communication peripherals
  - Flash Security

- Metering and Industrial Control
  - High speed/performance 1.2 μs/12-bit ADC
  - High 60 MIPs MCU/DSP performance required for advanced Control Algorithms
  - Use of (60 MHz) PWMs to generate output waveforms
  - Integration of support and communication peripherals
  - Flash Security
Identifying 56F8300 opportunities/Key Peripherals

- **Medical**
  - High speed sophisticated (60 MHz) PWMs can replace what had previously been performed in external PWM generation chip
  - High speed/ performance 1.2 µs/12-bit ADC
  - High 60 MIPs MCU/DSP performance required for advanced Control Algorithms
  - Integration of support and communication peripherals
  - Flash Security

- **Power Supplies/Inverters**
  - High speed sophisticated (60 MHz) PWMs can replace what had previously been performed in external PWM generation chip
  - High speed/ performance 1.2 µs/12-bit ADC
  - High 60 MIPs MCU/DSP performance required for advanced Control Algorithms
  - Integration of support and communication peripherals
  - Flash Security
Identifying 56F8300 opportunities/Key Peripherals

❖ **Automotive**
- High speed sophisticated (60 MHz) PWMs can replace what had previously been performed in external PWM generation chip
- High speed/performance 1.2 μs/12-bit ADC
- Quadrature decoders for direct interface to Hall Effect sensors or Optical encoders
- High 60 MIPs MCU/DSP performance required for advanced Control Algorithms
- Integration of support and communication peripherals
- Flash Security
- Integrated safety features
- Full Auto temp range and test coverage
Hardware & Software Development Tools
**The Complete Development Environment**

**CodeWarrior™ for 56800/E**
CodeWarrior for Freescale 56800/E is a windows based visual IDE that includes an optimizing C compiler, assembler and linker, project management system, editor and code navigation system, debugger, simulator, scripting, source control, and third party plug in interface.

**Processor Expert™**
Processor Expert (PE) provides a Rapid Application Design (RAD) tool that combines easy-to-use component-based software application creation with an expert knowledge system. PE is fully integrated with the CodeWarrior for 56800/E.

**Hardware Tools**
The 56800/E solutions are supported with a complete set of evaluation modules which supply all required items for rapid evaluation and software and hardware development. In addition several command converter options exist for customer target system debugger connection.
56800/E Evaluation Board (EVB)

Evaluation Board (EVB) Kit
The EVB kit includes everything required to start developing code immediately. It includes the evaluation board, all documentation, required cabling, power supply, CodeWarrior IDE, Processor Expert, and the training CD.

Standard Features:
- Parallel port Connection to Host PC
- Non intrusive debug via OnCE/EOnCE port
- JTAG Connector
- RS232 Serial connector
- Expansion Memory
- Standard daughter card connection
- CAN PHY layer
- Universal Power Supply
- Code Warrior CD w/30 day evaluation license
- Processor Expert
- Hands on training CD

Windows Host System

Parallel cable
56F800 Demonstration Kit

- Demo Board
- Complimentary CodeWarrior™ License
  - 16K bytes Program Memory Limit
- Parallel Cable
- Directions for Kit
- Training CD
- Ordering Part Number and Price:
  - DSP56F800DEMO
    - --$49.95 (US power supply) suggested resale
  - DSP56F800DEMO-E
    - --$64.95 (International power supply) suggested resale
56F8300 Developer’s Starter Kit

- Everything required to start developing code immediately
- All documentation, required cabling, power supply and more
- Parallel port connection to host PC
- JTAG connector
- CAN PHY layer
- Non-intrusive debug via EOnCE port
- On-board MC33794 E-Field sensor
- Universal power supply
- CodeWarrior CD with Processor Expert
56800/E Demos and Reference Designs

**Vehicle**
- Electronic Power Assisted Steering (EPAS) Demo
  - 56F805 Version and 56F8345 Version
- Hybrid Braking Demo in Definition

**Industrial**
- UPS Reference Design in Development
- Powerline Modem
  - Switch Mode Power Supply in Definition
  - Low Cost 56F800
- Motor Control Demos
  - BLDC
  - Switch Reluctance
  - Sensorless ACIM
  - Stepper Motors

**Voice**
- Speaker Feature Phone
- Hands-free (AEC/NS)
- Voice Recognition
8 and 16-Bit Products Division Software Development Tools

- **56800/E**
  - PC Master
  - MDS Filter Design

- **CodeWarrior**

- **S12**
  - Cosmic
  - Imagecraft
  - IAR
  - GNU

- **HC08**
  - Cosmic
  - Imagecraft
  - Bytecraft

- Processor Expert
## 8/16-Products Compiler Offerings

<table>
<thead>
<tr>
<th>Product</th>
<th>FREE</th>
<th>$495</th>
<th>$995</th>
<th>Unlimited</th>
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</thead>
<tbody>
<tr>
<td>HC(S)08</td>
<td>4K bytes</td>
<td>32K bytes</td>
<td>64K bytes</td>
<td>$1995</td>
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<td>HCS12</td>
<td>12K bytes</td>
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<td>64K bytes</td>
<td>$2495</td>
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<td>56800/E</td>
<td>16K bytes</td>
<td>64K bytes</td>
<td>128K bytes</td>
<td>$1495</td>
</tr>
</tbody>
</table>
Third Party Hybrid Controller Support

- **Domain Technologies:** www.domaintec.com
  - Development systems: Emulators, debuggers, interfaces and libraries.

- **Lauterbach:** www.lauterbach.com
  - Modular development tools ranging from In-Circuit Emulators and Logic Analyzers to Pattern and Stimulus Generators

- **Macraigor:** www.macraigor.com
  - Host to target connections including parallel port, ISA bus, PCI bus, Serial and Ethernet.

- **P & E Micro:**
  - In-Circuit Debugger (ICD) Software, Parallel-Port Interface, Cable (DSP Cable), Flash Programmer (PROG) Software and Register File Viewer/Editor

- **System General:** www.sg.com.tw
  - Manual and Automated Device Flash Programmers
Third Party Hybrid Controller Support

Motor Boards & Development Systems
- **Micromint:** [www.micromint.com](http://www.micromint.com)
  - Motorman GUI Configured Embedded Motion Control Module
- **New Micros:** [www.newmicros.com](http://www.newmicros.com)
  - NMIN-0803 & IsoPod Single Board Motion Controllers

RTOS/Network Stacks
- **Unicoi (DSP OS):** [www.unicoi.com](http://www.unicoi.com)
  - DSPOS RTOS; Ethernet Daughtercards; Softworks Fusion Internet (TCP/IP stack), LAN, network management, Web software
- **Micrium:** [www.micrium.com](http://www.micrium.com)
  - uCOS RTOS
- **Quadros:** [www.quadros.com](http://www.quadros.com)
  - RTXC Quadros RTOS

Voice Solutions
- **Clarity:** [www.clarityco.com](http://www.clarityco.com)
  - CVC ClearVoice Capture Noise Suppression Solutions
Hands-On Exercise
Task Description

Develop a “Chat Room” application that uses the Serial Peripheral Interface (SPI) as the interprocessor communication channel.
Approach

- Design a communication system that exchanges key-press data from the PC between two EVMs connected by the SPI.

- Use Processor Expert Beans to implement application
  - SynchroMaster
  - SynchroSlave
  - Term

- Download and Execute on 56F8357 EVM
Summary
Summary

- Understand the available connectivity peripherals in the 56800E Hybrid Controller portfolio (SCI, SPI, CAN, SSI, Host Interface, I²C).
- Exposed to the target markets and available Application Reference Designs.
- Understand the hardware and software support available for the 56800E Hybrid Controller product line.
- Demonstrated the ease of developing applications using CodeWarrior™ development tools with Processor Expert™ technology.
Thank You!!!