freescale™
Analog

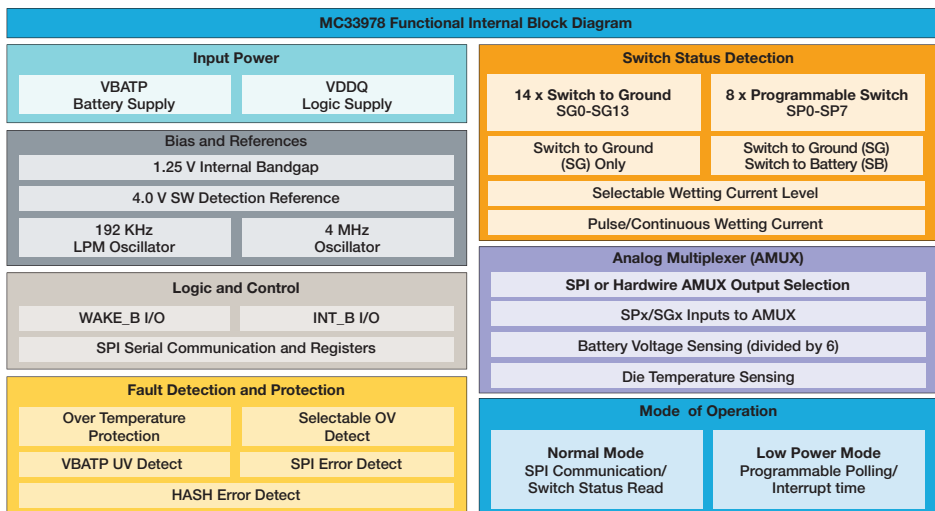Analog Solutions—Robust, Reliable Performance

MC33978 and MC34978

Configurable IO—Multiple Switch Detection Interface

Overview

The MC33978/MC34978 configurable I/O is an analog switch interface used to translate 22 I/Os onto a single MCU SPI bus, with low power auto-wake modes and programmable wetting currents. Package options are available in an SOIC 32-pin package and significant board reduction is achieved with a reduced footprint in a 5 mm x 5 mm QFN package. Best in class quiescent current at 30 uA typical reduces power consumption. The MC33978 and MC34978 can be set in sleep mode and wake-up automatically upon switch state change. Integrated wetting current that is individually selectable provides a flexible and easy solution for managing a large number of inputs or outputs across long distances.

MC33978 Functional Internal Block Diagram

MC33978 Functional Internal Block Diagram	
Input Power	**Switch Status Detection**
VBATP Battery Supply / VDDQ Logic Supply	14 x Switch to Ground SG0-SG13 / 8 x Programmable Switch SP0-SP7
Bias and References	Switch to Ground (SG) Only / Switch to Ground (SG) Switch to Battery (SB)
1.25 V Internal Bandgap	Selectable Wetting Current Level
4.0 V SW Detection Reference	Pulse/Continuous Wetting Current
192 KHz LPM Oscillator / 4 MHz Oscillator	**Analog Multiplexer (AMUX)**
Logic and Control	SPI or Hardwire AMUX Output Selection
WAKE_B I/O / INT_B I/O	SPx/SGx Inputs to AMUX
SPI Serial Communication and Registers	Battery Voltage Sensing (divided by 6)
Fault Detection and Protection	Die Temperature Sensing
Over Temperature Protection / Selectable OV Detect	**Mode of Operation**
VBATP UV Detect / SPI Error Detect	Normal Mode SPI Communication/ Switch Status Read / Low Power Mode Programmable Polling/ Interrupt time
HASH Error Detect	

Applications

- Multiple switch detect in body control modules
- Engine control modules
- Front-of-dash modules
- Communication Switch Detection
- I/O control
- Industrial automation
- Elevator control panel
- Programmable logic controller (PLC)

Product Longevity 10 15

Features

- Proven performance and robust I/O ESD above 15 kV

- Quiescent current of 30 uA

- Operating voltage range: 4.5 V–36 V to meet auto load dump

  - 48% better than competition

- Package options available with a 5 mm x 5 mm QFN and SOIC 32-pin

- Integrated battery sense

- 22 inputs:

  - 14 switch-to-ground

  - 8 programmable switch to battery or ground

- Wake-up upon signal detection

- 24-1 analog multiplexer

- Programmable wetting current from 2 mA to 20 mA

- Integrated temperature sensor

Product Longevity Program

These products are/or may be supported by Freescale's Product Longevity Program. For Terms and Conditions and to obtain a list of available products please see: **Freescale.com/productlongevity**

Freescale: A Leader in Analog Solutions

Expanding on more than 30 years of innovation, Freescale is a leading provider of high-performance products that use SMARTMOS technology combining digital, power and standard analog functions. Freescale supplies analog and power management ICs that are advancing the automotive, consumer, industrial and networking markets. Analog solutions interface with real world signals to control and drive for complete embedded systems.

## MC33978 and MC34978 Differentiators

Features	Benefits
SPI Aggregation	Reduces the necessary GPIO on the MCU
Advanced Wakeup Features	Power management—monitors for event, even if the system is powered down
Smallest integrated configurable I/O device	Significant space savings vs. discrete solutions
Robust EMC, 15 kV ESD	Operates even in the presence of significant transients
Analog multiplexer	Significantly increases the number of I/Os that can be interfaced with the MCU
Programmable high/low-side current sources	Supplies user defined current to the input pins for wetting current (e.g., switch) or sensor biasing. Can also be used to drive LEDs.
4.5 V to 36 V operation	Ensures performance during crank, load dump, 24 volt systems, etc.
Temperature sensor	Diagnostic capability and BOM reduction
Battery sense	Functional safety and BOM reduction

Documentation

Freescale Document Number	Title	Description
MC33978	Multiple Switch Detection Interface	Data Sheet
SG1002	Analog Product Selector Guide	Selector Guide
SG187	Automotive Product Selector Guide	Selector Guide
SG200	Industrial Product Selector Guide	Selector Guide

Development Tools and Software

Kit Number	Description
KIT33978EKEVB	MC33978 Evaluation board
KIT34978EKEVB	MC34978 Evaluation board
KITUSBSPIDGLEVME	USB SPI interface board
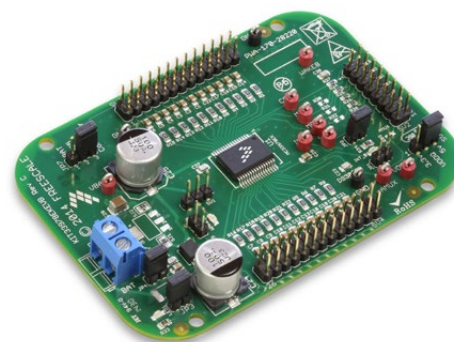
For more information visit freescale.com/analog