Glosario

A

ACK *Acknowledge.* En una comunicación I²C es usado por el receptor para indicarle al transmisor que éste puede continuar con la comunicación.

B

Bus Canal eléctrico para transferir datos entre diferentes dispositivos.

C

Clase En una programación orientada a objetos, es un tipo de dato que define la implementación de un objeto en particular.

Compilador Programa informático que traduce un programa escrito en un lenguaje de programación a otro ejecutable por un procesador.

E

EEPROM Tipo de memoria no volátil que puede ser borrada usando medios electrónicos.

Erosividad Erosión causada por la lluvia.

Estampa de tiempo Tiempo en el que un evento es registrado.

F

FGMOSFET *Floating Gate* MOSFET, MOSFET's que poseen una compuerta aislada y es usado para almacenar un bit de información en las memorias EEPROM y flash.

Firmware Programa que se encuentra embebido en el hardware de un dispositivo, por ejemplo un microcontrolador.

H

Hardware Componentes físicos de un sistema.

Host Dispositivo anfitrión que provee servicios otros dispositivos.

Hub Punto de conexión común entre dispostivos de una red.

I

I²C *Inter-Integrated Circuit* tambien llamado TWI. es un tipo de comunicación serie utilizado para conectar dispostivos con sólo dos lineas de comunicación.

Intercambiabilidad Error de. Diferencia entre el valor nominal de determinado termistor y la curva de Steinhart-Hart que caracteriza el modelo al que pertenece dicho termistor.

N

NACK *Negative Acknowledge.* En una comunicación I²C es usada por el receptor para indicarle al transmisor que no puede continuar con la comunicación.

NRZI *Non-Return-to-Zero Inverted.* Tipo de codificación que representa un 0 con un cambio de nivel y un 1 sin cambio.

NTC *Negative Temperature Coefficient.* Tipo de termistor que decrementa su resistencia conforme su temperatura se incrementa.

O

Objeto En una programación orientada a objetos, es una realización concreta de una clase que consiste en información y las operaciones asociadas con dicha información.

P

Pluviómetro Dispositivo usado para medir la cantidad de precipitación pluvial.

Pull-up Resistencia. Resistencia que se conecta entre Vcc y una entrada para mantener la entrada en un valor alto.

R

RS-232 Norma que designa una interfaz de intercambio de datos binarios serie.

S

SCL En una comunicación I^2C es la línea que lleva la señal de reloj generada por el dispositivo maestro.

SDA En una comunicación I^2C es la línea donde se trasmiten datos entre el transmisor y el receptor.

Software Colección de programas de computadora que realizan una tarea sobre un sistema computacional.

Steinhart-Hart Ecuación. Ecuación que relaciona la resistencia de un termistor con su temperatura.

T

Termistor Semiconductor que varía el valor de su resistencia eléctrica en función de su temperatura.

TWI *Two-wire interface,* ver I^2C.

U

USART *Universal Synchronous/Asynchronous Receiver/Trasmitter.* Dispositivo que permite establecer una comunicación síncrona o asíncrona serie.

USB *Universal Serial Bus.* Estándar de comunicación serie que es usado para conectar dispositivos incluyendo teléfonos, computadoras, etc.

Apéndice 1

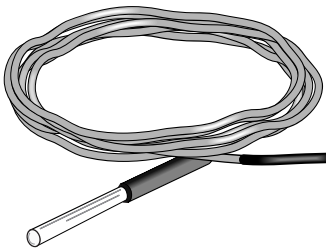
Portada de las hojas de especificaciones de los componentes usados

- Sonda de temperatura 107
- Micocontrolador ATMega16
- Memoria EEPROM 24LC1025
- Reloj en tiempo real DS1337
- Transceptor RS-232 MAX3233
- Transceptor RS-232 a USB FT232
- Compuerta inversora con Schmit Trigger NC7SZ14
- Amplificadores operacionales MAX4166 y MAX4168
- Convertidor de DC-DC de subida MAX1676

INSTRUCTION MANUAL

Model 107 Temperature Probe

Revision: 10/08



Features

- High-performance, Low-power AVR® 8-bit Microcontroller
- Advanced RISC Architecture
  - 131 Powerful Instructions – Most Single-clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 16 MIPS Throughput at 16 MHz
  - On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory segments
  - 16K Bytes of In-System Self-programmable Flash program memory
  - 512 Bytes EEPROM
  - 1K Byte Internal SRAM
  - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
  - Data retention: 20 years at 85°C/100 years at 25°C(1)
  - Optional Boot Code Section with Independent Lock Bits
    In-System Programming by On-chip Boot Program
    True Read-While-Write Operation
  - Programming Lock for Software Security
- JTAG (IEEE std. 1149.1 Compliant) Interface
  - Boundary-scan Capabilities According to the JTAG Standard
  - Extensive On-chip Debug Support
  - Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes
  - One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
  - Real Time Counter with Separate Oscillator
  - Four PWM Channels
  - 8-channel, 10-bit ADC
    8 Single-ended Channels
    7 Differential Channels in TQFP Package Only
    2 Differential Channels with Programmable Gain at 1x, 10x, or 200x
  - Byte-oriented Two-wire Serial Interface
  - Programmable Serial USART
  - Master/Slave SPI Serial Interface
  - Programmable Watchdog Timer with Separate On-chip Oscillator
  - On-chip Analog Comparator
- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated RC Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby
- I/O and Packages
  - 32 Programmable I/O Lines
  - 40-pin PDIP, 44-lead TQFP, and 44-pad QFN/MLF
- Operating Voltages
  - 2.7 - 5.5V for ATmega16L
  - 4.5 - 5.5V for ATmega16
- Speed Grades
  - 0 - 8 MHz for ATmega16L
  - 0 - 16 MHz for ATmega16
- Power Consumption @ 1 MHz, 3V, and 25·C for ATmega16L
  - Active: 1.1 mA
  - Idle Mode: 0.35 mA
  - Power-down Mode: < 1 µA

8-bit Microcontroller with 16K Bytes In-System Programmable Flash

ATmega16
ATmega16L

Rev. 2466S–AVR–05/09

24AA1025/24LC1025/24FC1025

1024K I²C™ CMOS Serial EEPROM

Device Selection Table:

Part Number	Vcc Range	Max Clock Frequency	Temp Ranges
24AA1025	1.8-5.5V	400 kHz†	I
24LC1025	2.5-5.5V	400 kHz	I
24FC1025	2.5-5.5V	1 MHz	I

†100 kHz for VCC < 2.5V.

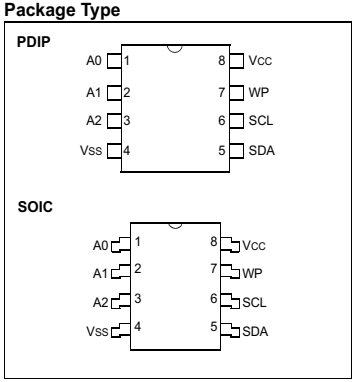
Features:

- Low-power CMOS technology:
  - Maximum write current 5 mA at 5.5V
  - Maximum read current 500 µA at 5.5V
  - Standby current 100 nA, typical at 5.5V
- 2-wire serial interface bus, I²C™ compatible
- Cascadable for up to four devices
- Self-timed erase/write cycle
- 128-byte Page Write mode available
- 5 ms max. write cycle time
- Hardware write-protect for entire array
- Output slope control to eliminate ground bounce
- Schmitt Trigger inputs for noise suppression
- 1,000,000 erase/write cycles
- Electrostatic discharge protection > 4000V
- Data retention > 200 years
- 8-pin PDIP, SOIC packages
- Temperature ranges:
  - Industrial (I): -40°C to +85°C

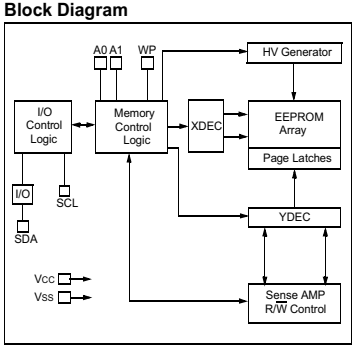
Description:

The Microchip Technology Inc. 24AA1025/24LC1025/24FC1025 (24XX1025*) is a 128K x 8 (1024K bit) Serial Electrically Erasable PROM, capable of operation across a broad voltage range (1.8V to 5.5V). It has been developed for advanced, low power applications such as personal communications or data acquisition. This device has both byte write and page write capability of up to 128 bytes of data. This device is capable of both random and sequential reads. Reads may be sequential within address boundaries 0000h to FFFFh and 10000h to 1FFFFh. Functional address lines allow up to four devices on the same data bus. This allows for up to 4 Mbits total system EEPROM memory. This device is available in the standard 8-pin plastic DIP and SOIC packages.

Package Type



Block Diagram



*24XX1025 is used in this document as a generic part number for the 24AA1025/24LC1025/24FC1025 devices.

19-4652; 7/09

DS1337
I²C Serial Real-Time Clock

www.maxim-ic.com

GENERAL DESCRIPTION

The DS1337 serial real-time clock is a low-power clock/calendar with two programmable time-of-day alarms and a programmable square-wave output. Address and data are transferred serially through an I^2C bus. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The date at the end of the month is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with AM/PM indicator.

The device is fully accessible through the serial interface while V_{CC} is between 1.8V and 5.5V. I^2C operation is not guaranteed below 1.8V. Timekeeping operation is maintained with V_{CC} as low as 1.3V.

APPLICATIONS

Handhelds (GPS, POS Terminal, MP3 Player)

Consumer Electronics (Set-Top Box, VCR/Digital Recording)

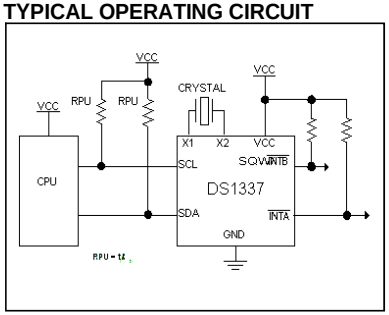
Office Equipment (Fax/Printer, Copier)

Medical (Glucometer, Medicine Dispenser)

Telecommunications (Router, Switch, Server)

Other (Utility Meter, Vending Machine, Thermostat, Modem)

TYPICAL OPERATING CIRCUIT



FEATURES

- **Real-Time Clock (RTC) Counts Seconds, Minutes, Hours, Day, Date, Month, and Year with Leap-Year Compensation Valid Up to 2100**
- **Available in a Surface-Mount Package with an Integrated Crystal (DS1337C)**
- **I^2C Serial Interface**
- **Two Time-of-Day Alarms**
- **Oscillator Stop Flag**
- **Programmable Square-Wave Output Defaults to 32kHz on Power-Up**
- **Available in 8-Pin DIP, SO, or µSOP**
- **-40°C to +85°C Operating Temperature Range**

ORDERING INFORMATION

PART	TEMP RANGE	PIN-PACKAGE	TOP MARK†
DS1337+	-40°C to +85°C	8 DIP (300 mils)	DS1337
DS1337S+	-40°C to +85°C	8 SO (150 mils)	DS1337
DS1337U+	-40°C to +85°C	8 µSOP	1337
DS1337C#	-40°C to +85°C	16 SO (300 mils)	DS1337C

+ Denotes a lead(Pb)-free/RoHS-compliant device.
 # Denotes a RoHS-compliant device that may include lead that is exempt under the RoHS requirements. The lead finish is JESD97 category e3, and is compatible with both lead-based and lead-free soldering processes.
† A "+" anywhere on the top mark denotes a lead-free device. A "#" denotes a RoHS-compliant device.

Pin Configurations appear at end of data sheet.

***Note:** Some revisions of this device may incorporate deviations from published specifications known as errata. Multiple revisions of any device may be simultaneously available through various sales channels. For information about device errata, go to: www.maxim-ic.com/errata.*

19-1473; Rev 2; 8/04

MAXIM

±15kV ESD-Protected, 1µA, 250kbps, 3.3V/5V, Dual RS-232 Transceivers with Internal Capacitors

General Description

The MAX3233E/MAX3235E are EIA/TIA-232 and V.28/V.24 communications interfaces with automatic shutdown/wake-up features, high data-rate capabilities, and enhanced electrostatic discharge (ESD) protection. All transmitter outputs and receiver inputs are protected to ±15kV using IEC 1000-4-2 Air-Gap Discharge, to ±8kV using IEC 1000-4-2 Contact Discharge, and to ±15kV using the Human Body Model. The MAX3233E operates from a +3.3V supply; the MAX3235E operates from +5.0V.

All devices achieve a 1µA supply current using Maxim's revolutionary AutoShutdown Plus™ feature. These devices automatically enter a low-power shutdown mode when the following two conditions occur: either the RS-232 cable is disconnected or the transmitters of the connected peripherals are inactive, and the UART driving the transmitter inputs is inactive for more than 30 seconds. They turn on again when they sense a valid transition at any transmitter or receiver input. AutoShutdown Plus saves power without changes to the existing BIOS or operating system.

The MAX3233E/MAX3235E have internal dual charge pumps requiring no external capacitors. Both transceivers have a proprietary low-dropout transmitter output stage that enables true RS-232 performance from a +3.0V to +3.6V supply for the MAX3233E or a +4.5V to +5.5V supply for the MAX3235E. These devices are guaranteed to operate up to 250kbps. Both are available in space-saving 20-pin wide SO or plastic DIP packages.

Applications

Subnotebook and Palmtop Computers
Cellular Phones
Battery-Powered Equipment
Handheld Equipment
Peripherals
Embedded Systems

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX3233ECWP	0°C to +70°C	20 SO
MAX3233ECPP	0°C to +70°C	20 Plastic DIP
MAX3233EEWP	-40°C to +85°C	20 SO
MAX3233EEPP	-40°C to +85°C	20 Plastic DIP

Ordering Information continued at end of data sheet.

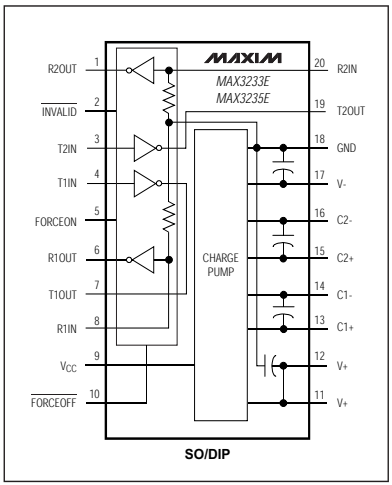
AutoShutdown Plus is a trademark of Maxim Integrated Products, Inc.

†Covered by U.S. Patent numbers 4,636,930; 4,679,134; 4,777,577; 4,797,899; 4,809,152; 4,897,774; 4,999,761; 5,649,210; and other patents pending.

Features

- **ESD Protection for RS-232 I/O Pins**
  ±15kV—Human Body Model
  ±8kV—IEC 1000-4-2, Contact Discharge
  ±15kV—IEC 1000-4-2, Air-Gap Discharge
- **Latchup Free**
- **1µA Supply Current**
- **AutoShutdown Plus—1997 EDN Magazine Innovation of the Year**
- **Single-Supply Operation**
  +3.0V to +3.6V (MAX3233E)
  +4.5V to +5.5V (MAX3235E)
- **250kbps Guaranteed Data Rate**
- **6V/µs Guaranteed Slew Rate**
- **Meets EIA/TIA-232 Specifications Down to 3.0V (MAX3233E)**
- **Internal Charge-Pump Capacitors**

Pin Configuration/ Functional Diagram

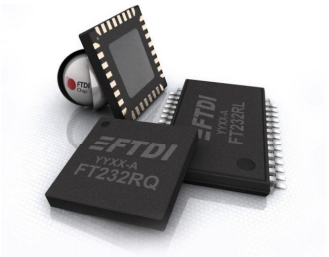


Typical Operating Circuit appears at end of data sheet.

Document No.: FT_000053
FT232R USB UART IC Datasheet Version 2.04
Clearance No.: FTDI# 38

Future Technology Devices International Ltd.

FT232R USB UART IC



The FT232R is a USB to serial UART interface with the following advanced features:

- Single chip USB to asynchronous serial data transfer interface.
- Entire USB protocol handled on the chip. No USB specific firmware programming required.
- Fully integrated 1024 bit EEPROM storing device descriptors and CBUS I/O configuration.
- Fully integrated USB termination resistors.
- Fully integrated clock generation with no external crystal required plus optional clock output selection enabling a glue-less interface to external MCU or FPGA.
- Data transfer rates from 300 baud to 3 Mbaud (RS422, RS485, RS232) at TTL levels.
- 128 byte receive buffer and 256 byte transmit buffer utilising buffer smoothing technology to allow for high data throughput.
- FTDI's royalty-free Virtual Com Port (VCP) and Direct (D2XX) drivers eliminate the requirement for USB driver development in most cases.
- Unique USB FTDIChip-ID™ feature.
- Configurable CBUS I/O pins.
- Transmit and receive LED drive signals.
- UART interface support for 7 or 8 data bits, 1 or 2 stop bits and odd / even / mark / space / no parity
- FIFO receive and transmit buffers for high data throughput.
- Synchronous and asynchronous bit bang interface options with RD# and WR# strobes.
- Device supplied pre-programmed with unique USB serial number.
- Supports bus powered, self powered and high-power bus powered USB configurations.
- Integrated +3.3V level converter for USB I/O.
- Integrated level converter on UART and CBUS for interfacing to between +1.8V and +5V logic.
- True 5V/3.3V/2.8V/1.8V CMOS drive output and TTL input.
- Configurable I/O pin output drive strength.
- Integrated power-on-reset circuit.
- Fully integrated AVCC supply filtering - no external filtering required.
- UART signal inversion option.
- +3.3V (using external oscillator) to +5.25V (internal oscillator) Single Supply Operation.
- Low operating and USB suspend current.
- Low USB bandwidth consumption.
- UHCI/OHCI/EHCI host controller compatible.
- USB 2.0 Full Speed compatible.
- -40°C to 85°C extended operating temperature range.
- Available in compact Pb-free 28 Pin SSOP and QFN-32 packages (both RoHS compliant).

FAIRCHILD SEMICONDUCTOR™

October 1996
Revised August 2004

NC7SZ14
TinyLogic® UHS Inverter with Schmitt Trigger Input

General Description

The NC7SZ14 is a single Inverter with Schmitt Trigger input from Fairchild's Ultra High Speed Series of TinyLogic®. The device is fabricated with advanced CMOS technology to achieve ultra high speed with high output drive while maintaining low static power dissipation over a very broad V_{CC} operating range. The device is specified to operate over the 1.65V to 5.5V V_{CC} range. The input and output are high impedance when V_{CC} is 0V. Inputs tolerate voltages up to 6V independent of V_{CC} operating voltage.

Features

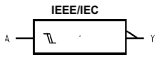
- Space saving SOT23 or SC70 5-lead package
- Ultra small MicroPak™ leadless package
- Ultra High Speed; t_{PD} 3.7 ns Typ into 50 pF at 5V V_{CC}
- High Output Drive; ±24 mA at 3V V_{CC}
- Broad V_{CC} Operating Range; 1.65V to 5.5V
- Matches the performance of LCX when operated at 3.3V V_{CC}
- Power down high impedance inputs/output
- Overvoltage Tolerant inputs facilitate 5V to 3V translation
- Patented noise/EMI reduction circuitry implemented

Ordering Code:

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
NC7SZ14M5X	MA05B	7Z14	5-Lead SOT23, JEDEC MO-178, 1.6mm	3k Units on Tape and Reel
NC7SZ14P5X	MAA05A	Z14	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3k Units on Tape and Reel
NC7SZ14L6X	MAC06A	B6	6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel

Logic Symbol

IEEE/IEC



Pin Descriptions

Pin Names	Description
A	Input
Y	Output
NC	No Connect

Function Table

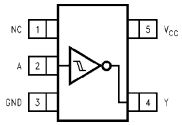
$Y = \overline{A}$

Input	Output
A	Y
L	H
H	L

H = HIGH Logic Level
L = LOW Logic Level

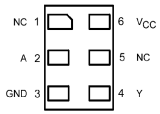
Connection Diagrams

Pin Assignments for SOT23 and SC70



(Top View)

Pad Assignments for MicroPak



(Top Thru View)

TinyLogic® is a registered trademark of Fairchild Semiconductor Corporation.
MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

 DS012176

19-1224; Rev 3; 1/07

MAXIM

High-Output-Drive, Precision, Low-Power, Single-Supply, Rail-to-Rail I/O Op Amps with Shutdown

General Description

The MAX4165–MAX4169 family of operational amplifiers combines excellent DC accuracy with high output current drive, single-supply operation, and rail-to-rail inputs and outputs. These devices operate from a single +2.7V to +6.5V supply, or from dual ±1.35V to ±3.25V supplies. They typically draw 1.2mA supply current, and are guaranteed to deliver 80mA output current.

The MAX4166/MAX4168 have a shutdown mode that reduces supply current to 38µA per amplifier and places the outputs into a high-impedance state. The MAX4165–MAX4169's precision performance combined with high output current, wide input/output dynamic range, single-supply operation, and low power consumption makes them ideal for portable audio applications and other low-voltage, battery-powered systems. The MAX4165 is available in the space-saving 5-pin SOT23 package and the MAX4166 is available in a tiny 2mm x 2mm x 0.8mm µDFN package.

Selector Guide

PART	AMPS PER PACKAGE	SHUTDOWN MODE
MAX4165	Single	—
MAX4166	Single	Yes
MAX4167	Dual	—
MAX4168	Dual	Yes
MAX4169	Quad	—

Applications

Portable/Battery-Powered Audio Applications
Portable Headphone Speaker Drivers
Laptop/Notebook Computers
Sound Ports/Cards
Set-Top Boxes
Cell Phones
Hands-Free Car Phones (kits)
Signal Conditioning
Digital-to-Analog Converter Buffers
Transformer/Line Drivers
Motor Drivers

Typical Operating Circuit appears at end of data sheet.

Features

- **80mA (min) Output Drive Capability**
- **Rail-to-Rail Input Common-Mode Voltage Range**
- **Rail-to-Rail Output Voltage Swing**
- **1.2mA Supply Current per Amplifier**
- **+2.7V to +6.5V Single-Supply Operation**
- **5MHz Gain-Bandwidth Product**
- **250µV Offset Voltage**
- **120dB Voltage Gain (R_L = 100kΩ)**
- **88dB Power-Supply Rejection Ratio**
- **No Phase Reversal for Overdriven Inputs**
- **Unity-Gain Stable for Capacitive Loads to 250pF**
- **Low-Power Shutdown Mode: Reduces Supply Current to 38µA Places Outputs in High-Impedance State**
- **Available in 5-Pin SOT23 Package (MAX4165) or 2mm x 2mm x 0.8mm µDFN (MAX4166)**

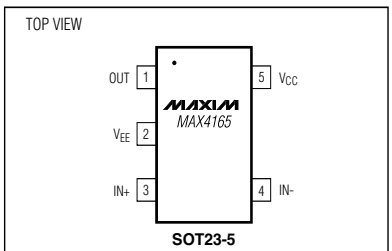
Ordering Information

PART	TEMP RANGE	PIN-PACKAGE	TOP MARK
MAX4165EUK-T	-40°C to +85°C	5 SOT23-5	AABY
MAX4166EPA	-40°C to +85°C	8 Plastic DIP	—
MAX4166ESA	-40°C to +85°C	8 SO	—
MAX4166EUA	-40°C to +85°C	8 µMAX	—
MAX4166ELA+T	-40°C to +85°C	8 µDFN-8	AAG

+Denotes lead-free package.

Ordering Information continued on last page.

Pin Configurations



Pin Configurations continued at end of data sheet.

19-1360; Rev 3; 3/00

EVALUATION KIT MANUAL FOLLOWS DATA SHEET

MAXIM

High-Efficiency, Low-Supply-Current, Compact, Step-Up DC-DC Converters

General Description

The MAX1674/MAX1675/MAX1676 compact, high-efficiency, step-up DC-DC converters fit in small µMAX packages. They feature a built-in synchronous rectifier, which improves efficiency and reduces size and cost by eliminating the need for an external Schottky diode. Quiescent supply current is only 16µA.

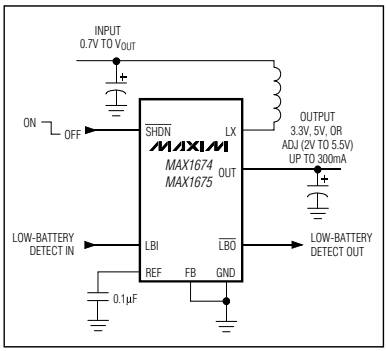
The input voltage ranges from 0.7V to V_{OUT}, where V_{OUT} can be set from 2V to 5.5V. Start-up is guaranteed from 1.1V inputs. The MAX1674/MAX1675/MAX1676 have a preset, pin-selectable output for 5V or 3.3V. The outputs can also be adjusted to other voltages using two external resistors.

All three devices have a 0.3Ω N-channel MOSFET power switch. The MAX1674 has a 1A current limit. The MAX1675 has a 0.5A current limit, which permits the use of a smaller inductor. The MAX1676 comes in a 10-pin µMAX package and features an adjustable current limit and circuitry to reduce inductor ringing.

Applications

Pagers
Wireless Phones
Medical Devices
Hand-Held Computers
PDAs
RF Tags
1 to 3-Cell Hand-Held Devices

Typical Operating Circuit



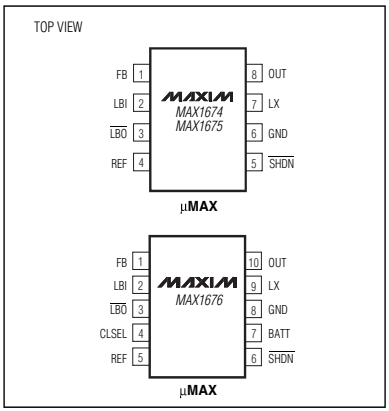
Features

- **94% Efficient at 200mA Output Current**
- **16µA Quiescent Supply Current**
- **Internal Synchronous Rectifier (no external diode)**
- **0.1µA Logic-Controlled Shutdown**
- **LBI/LBO Low-Battery Detector**
- **Selectable Current Limit for Reduced Ripple**
- **Low-Noise, Anti-Ringing Feature (MAX1676)**
- **8-Pin and 10-Pin µMAX Packages**
- **Preassembled Evaluation Kit (MAX1676EVKIT)**

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX1674EUA	-40°C to +85°C	8 µMAX
MAX1675EUA	-40°C to +85°C	8 µMAX
MAX1676EUB	-40°C to +85°C	10 µMAX

Pin Configurations



Apéndice 2

Extracto del código del microcontrolador

- Main
- Inicio de la adquisición
- Interrupción de temperatura
- Registro de temperatura
- Interrupción del pluviómetro

```
/************MAIN****************/
 int main(void)
{

    DDRD|=(1<<DDD6); //LED's pin as an output
    PORTB |= (1<<PB0)|(1<<PB1)|(1<<PB3); //PB1, PB1 and PB3 are
the dip switch inputs

    if ((!(PINB & 0x02))|(!(PINB & 0x01))) { //check the pinB4
and pinB1, the statement is executed if PINDB4 or PINDB1 Swit-
ches are closed
        PORTD |= (1<<PD6);

        if (!(PINB & 0x02)) //PB0 int 1
        {

            format_directory (); //format the external EEPROM
memory (24LC1025)

        }
        if(!(PINB & 0x01)) //PB1 int 2
        {
            format_eeprom(); //format the internal EEPROM

        }
            while(1) //infinite loop, the programs start again
until is reset and the switches are placed off again
            asm volatile ("nop");
    }

// If no  format is needed, the execution continues

    USART_Init (MYUBRR); //configure and start USART

    conf_default(); //default time in the RTC

    GICR|=(1<<INT1); //enable external interrupt 1

    lesen_verz( &mut_byte_ad,&mut_chip_ad);//initialize the
pointer in case the user wants to download data
    //save the initial addresses for ring mode configuration
```

```
    start_chip_address = mut_chip_ad;
    start_byte_address = mut_byte_ad;

    sei(); //enable external interrupts
    set_sleep_mode(SLEEP_MODE_PWR_DOWN );// define power save
mode: Power down
    sleep_enable(); //enable power save mode
    PORTD |= (1<<PD3);  //PD3 is configured as an output
    PORTB |= (1<<PB4); //PB4 is configured as an output

    while(1)
    {
    GICR|=(1<<INT1); //enable external interrupt 1 this will be
raised when the main sw is pressed
    sleep_cpu(); //sleep the microcontroller, the program conti-
nues only by interruptions
    asm volatile("nop"); //dummy nop
    }
    return 0;

}
/************ACQUISITION START***************/
unsigned char Start_Sys (void)
/* This function enables the acquisition interrupts according
with the established configuration*/
{

    read_adqtype(&acc_type); //read from memory what kind of ac-
quisition
    //will be performed: temperature, rainfall or both
    blink(); //blink LED to indicate start of acquisition
    oper=1; //the system is operating

    read_memorybeh(&memory_mode); //stores the mode in which the
memory is going to behave

    if (acc_type=='a') //record temperature
    {

        reg_rate = eeprom_read_word(reg_rate_EEPROM); //read
from EEPROM the rate in minutes
```

```
        //get the rate of measurement
        //this is defined as the minimum value of samples that
can be made
        //in the register interval without bypassing 30 measure-
ments
        while(1)
        {
             if(30*rate_min >= reg_rate)
             break;
             else
             rate_min++;
        }

        lesen_verz(&byte_ad_temp, &chip_ad_temp); //initialize
the recording pointers by reading the memory 24Lxx

        mut_byte_ad = byte_ad_temp; //the last available address
is in the rain gauge pointers
        mut_chip_ad = chip_ad_temp;

        config_ADC(); //configure the ADC
        set_conf (1); //enable one minute alarm
        clear_flag(); //clear the interrupt flag of the RTC
        _delay_ms(50); //this delay is to giving change to the
signal to get enough low to
                       // prevent a interrupt
        GICR |= (1<<INT0); //enable external interrupt 0

    }

    if (acc_type=='b') //record rainfall
    {

        lesen_verz(&byte_ad, &chip_ad); //initialize the recor-
ding pointers by reading the memory 24Lxx

        mut_byte_ad = byte_ad; //the last available address is
in the rain gauge pointers
        mut_chip_ad = chip_ad;
```

```
        MCUCSR|=(1<<ISC2); //interrupt on rising edge
        GIFR=(1<<INTF2); //clear the flag that could be set
        GICR|=(1<<INT2); //enable external interrupt 2 connected
to the rain gauge
    }

    if (acc_type=='c') //record both
    {
        reg_rate = eeprom_read_word(reg_rate_EEPROM); //read
from EEPROM the rate in minutes

        MCUCSR|=(1<<ISC2); //interrupt on rising edge
        GIFR=(1<<INTF2); //clear the flag that could be set
        GICR|=(1<<INT2); //enable external interrupt 2 connected
to the rain gauge

        while(1)  //get the rate of measurement
        {
             if(30*rate_min >= reg_rate)
             break;
             else
             rate_min++;
        }

        lesen_verz(&byte_ad, &chip_ad); //initialize the recor-
ding pointers by reading the memory 24Lxx

        byte_ad_temp = byte_ad;
        chip_ad_temp = chip_ad;
        mutual_pointer_inc (& byte_ad_temp, & chip_ad_temp); //
the temperature pointer will have the next page

        mut_byte_ad = byte_ad_temp; //the last available address
is in the temperature pointers
        mut_chip_ad = chip_ad_temp;

        config_ADC();
        set_conf (1); //enable 1 minute alarm
        clear_flag();
        _delay_ms(50);
        GICR |= (1<<INT0); //enable external interrupt 0
```

```
    }

}

/************THERMISTOR ACQUISITION INTERRUPT***************/
ISR(INT0_vect) //External Interrupt 0 code: Thermistor alarm A
from RTC

{
    clear_flag(); //clear the signal interrupt from the RTC

    add_count++; //increment the counters
    reg_count++;

    if(add_count==rate_min) //if it's time to acquire data from
the thermistor
    {

        data_mean[index]=ADC_mean(); // in the vector of tempe-
rature measures add one more
        add_count=0; // the add_count counter is reset
        index++; //the index is increment by one, this will help
us in other
                 //part of the code (regist()) to generate the
mean from all the measurements

    }

    if(reg_count==reg_rate) //if it's time to register a value
in memory execute the code
    {

        regist(); // register the temperature value in memory
        reg_count=0; //reset the counter for a new loop
        index = 0; //reset the index

    }

}
```

```
/************TEMPERATURE REGISTER****************/
void regist() //temperature register in EEPROM
{
    unsigned char i;
    unsigned int mean=0;
    unsigned char eql; //the comparison is true calculate the
mean of all the measurements made
    for (i=0;i<index;i++)
    {
        mean = mean+data_mean[i];

    }
    mean = mean/index;

    st = 0; // the system had recorded dates for first time

    if (!(byte_ad_temp % 128)) //if the data is multiple from
128 we need to write in another page but before we need to pre-
pare it
    {

        schreibt_verz();
        lesen_verz(&byte_ad_temp, &chip_ad_temp);
        reinigen_Speicher (&byte_ad_temp,&chip_ad_temp);
        header_temp (reg_rate, &byte_ad_temp,&chip_ad_temp);
        mutual_pointer_inc(&mut_byte_ad,&mut_chip_ad);
        eql = Compare_Addresses (&mut_chip_ad,&mut_byte_ad,
                    &start_chip_address,&start_byte_address);
        if(eql==0x01)
            if (memory_mode == 'a')
            {
                Stop_Sys(); //if the mode was set to stop when
the memory is full
                return; //exit the function no other acquisition
has to be made
            }
            if (memory_mode == 'b')
            {
                set_memoryendreached(); //the memory ended and
now the registers are been overwritten
```

```
            }
    }

        //write the temperature on memory

        write_temp (&byte_ad_temp,&chip_ad_temp,mean);

        if (!(PINB & 0x04))
        {
            blink_2//blink the LED to acknowledge that a measu-
rement has been recorded
        }
}

/************RAINGAUGE ACQUISITION INTERRUPT***************/
ISR(INT2_vect) //rain gauge interrupt
{
    unsigned char eql;

    if (test_mode) //if test_mode was set
    {
        USART_Trasmit(0xFF);
        USART_Trasmit(0x01); //transmit a token to the computer
    }
    else
    {
        asm volatile ("nop"); //dummy nop

        st = 0; //the system has started

        _delay_ms(5); //delay for avoiding a possible rebound

        if (!(byte_ad % 128)) { // if the current page is full
record the change and jump to another one

            schreibt_verz();
            lesen_verz(&byte_ad, &chip_ad);
            reinigen_Speicher (&byte_ad,&chip_ad);
            header_otemp (&byte_ad, &chip_ad);
            mutual_pointer_inc(&mut_byte_ad,&mut_chip_ad);
```

```
            eql = Compare_Addresses (&mut_chip_ad,&mut_byte_ad,
                        &start_chip_address,&start_byte_address);

            if(eql==0x01)
            {
                if (memory_mode == 'a')
                {
                    Stop_Sys(); //if the mode was set to stop
when the memory is full
                    return; //exit the function no other acqui-
sition needs to be made
                }
            if (memory_mode == 'b')
                {
                    set_memoryendreached(); //the memory ended
and now the registers are been overwritten
                }
            }
        }

        write_pluv_otemp (&byte_ad,&chip_ad); //write the vale
in memory

        if (!(PINB & 0x04)) //blink if the switch is set
        {
            blink_2();//blink the LED to acknowledge that a mea-
surement has been recorded
        }
    }
}
```