EM78F564N/F664N

8-Bit Microcontroller

Product Specification

DOC. VERSION 2.3

ELAN MICROELECTRONICS CORP.

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APPENDIX

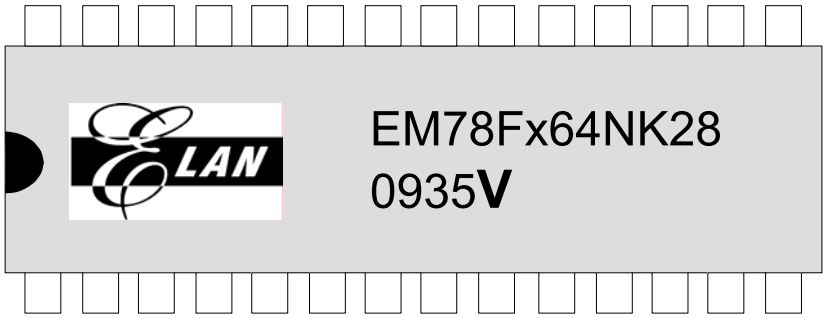
Specification Revision History

Doc. Version	Revision Description	Date
1.0	Initial release version	2009/01/08
1.1	1. Showed the difference between EM78F664N and ICE652N, particularly on the TCC function. 2. Modified the DC Electrical Characteristics.	2009/06/03
2.0	1. Deleted ICE652N information and PAGE instruction. 2. Added CPU operation with Green/Idle mode, LCALL/LJMP/TBRD instructions. 3. Indicated the use of ICE660N to simulate EM78F664N.	2009/09/08
2.1	1. Redefined CPU Operation Mode information. 2. Added IRC mode selection information on Bank1 R8<7,6> and Word1<12>. 3. Added Comparison between V/U-Package Versions.	2009/11/20
2.2	1. Revised the format of the Pin Description and Wake-up signal table. 2. Added Device Characteristics. 3. Combined the Specs of EM78F564N and EM78F664N.	2010/04/07
2.3	1. Modified the maximum supportable baud rate of the SPI function. 2. Added LVR specifications.	2013/05/07

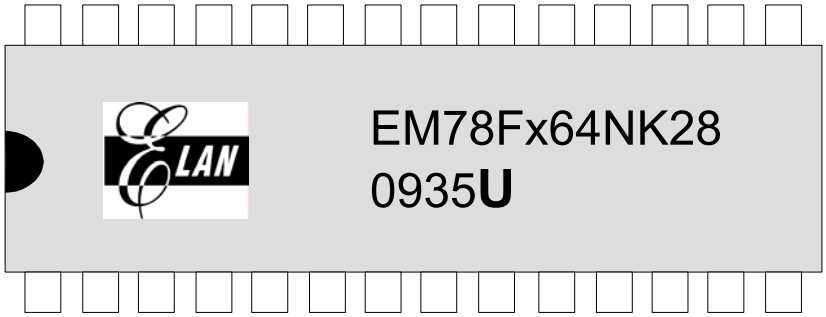
Comparison between V/U-Package Versions

Item	EM78Fx64N-V	EM78Fx64N-U
Version	Older	Newer
16 MHz Operating Temperature @ VDD = 5V	-40°C ~ 50°C	-40°C ~ 85°C
85°C Operating Frequency @ VDD = 5V	14.318 MHz	16 MHz
Register Changes IRC Frequency	×	O

Note: "O" = function is available if enabled "×" = function is not available



EM78Fx64N-V Package



EM78Fx64N-U Package

1 General Description

The EM78Fx64N are 8-bit microprocessors designed and developed with low-power, high-speed CMOS technology and high noise immunity. They have on-chip 4K×13-bit Electrical Flash Memory and the EM78F664N has 256×8-bit In-System Programmable EEPROM. It provides three protection bits to prevent intrusion of user's Flash memory code. Twelve Code option bits are also available to meet user's requirements.

With its enhanced Flash-ROM features, the EM78Fx64N provide a convenient way of developing and verifying user's programs. Moreover, this Flash-ROM device offers the advantages of easy and effective program updates, using development and programming tools. Users can avail of the ELAN Writer to easily program his development code.

2 Features

- CPU configuration
  - 4K×13 bits on-chip Flash memory
  - 144×8 bits on-chip registers (SRAM)
  - 256 bytes in-system programmable EEPROM (Only for EM78F664N)
    *Endurance: 1,000,000 write/erase cycles
  - More than 10 years data retention
  - 8-level stacks for subroutine nesting
  - 3 programmable Level Voltage Reset LVR : 4.1V, 3.7V, 2.7V
  - Less than 1.5 mA at 5V / 4 MHz
  - Typically 20 μA, at 3V / 32kHz
  - Typically 1.5 μA, during sleep mode
- I/O port configuration
  - 4 bidirectional I/O ports: P5, P6, P7 and P8
  - 25 I/O pins
  - Wake-up port : P6
  - High sink port : P6
  - 14 programmable pull-high I/O pins
  - 14 programmable pull-down I/O pins
  - 8 programmable open-drain I/O pins
  - External interrupt with Wake-up : P60
- Operating voltage range
  - 2.5V~5.5V at -40°C~85°C (Industrial)
  - 2.3V~5.5V at 0°C~70°C (Commercial)
- Operating frequency range (base on two clocks)
  - Crystal mode : DC~16MHz @ 4.5V~5.5V; DC~8MHz @ 3V~5.5V ; DC~4MHz @ 2.3V~5.5V
  - ERC mode : DC~16MHz @ 4.5V~5.5V ; DC~8MHz @ 3V~5.5V ; DC~4MHz @ 2.3V~5.5V
  - IRC mode : DC~16MHz @ 4.5V~5.5V ; DC~4MHz @ 2.3V~5.5V

Internal RC Frequency	Drift Rate			
	Temperature (-40℃~85℃)	Voltage (2.5V~5.5V)	Process	Total
4 MHz	± 3%	± 5%	± 2.5%	± 10.5%
16 MHz	± 3%	± 5%	± 2.5%	± 10.5%
8 MHz	± 3%	± 5%	± 2.5%	± 10.5%
455kHz	± 3%	± 5%	± 2.5%	± 10.5%

- Fourteen available interrupts
  - Internal interrupt : 11
  - External interrupt : 3
- 8 channels Analog-to-Digital Converter with 10-bit resolution
- One set of comparator (offset voltage: smaller than 10 mV)
- Two channels Pulse Width Modulation (PWM) with 10-bit resolution
- Two 8-bit Timer/Counter
  - TC1 : Timer/Counter/Capture
  - TC3 : Timer/Counter/PDO (Programmable Divider Output)/PWM (Pulse Width Modulation)
- One 16-bit Timer/Counter
  - TC2 : Timer/Counter/Window
- Serial transmitter/receiver interface
  - Serial Peripheral Interface (SPI): Three-wire synchronous communication
  - Universal Asynchronous Receiver/Transmitter (UART)
- Peripheral configuration
  - 8-bit Real Time Clock/Counter (TCC) with selective signal sources, trigger edges, and overflow interrupt
  - External interrupt input pin
  - 2/4/8/16 clocks per instruction cycle selected by code option
  - Power down (Sleep) mode
  - High EFT immunity
- Single instruction cycle commands
- Special Features
  - Programmable free running Watchdog Timer
  - Power-on voltage detector available (2.0V ~ 2.2V)
- Package Type:
  - 24-pin skinny DIP 300 mil : EM78Fx64NK24J/S
  - 24-pin SOP 300 mil : EM78Fx64NSO24J/S
  - 28-pin skinny DIP 300 mil : EM78Fx64NK28J/S
  - 28-pin SOP 300 mil : EM78Fx64NSO28J/S
  - 32-pin QFN 5×5 mm : EM78Fx64NQN32J/S

Note: *These are all Green products which do not contain hazardous substances.*

3 Pin Assignment

(1) 24-Pin SKDIP/SOP

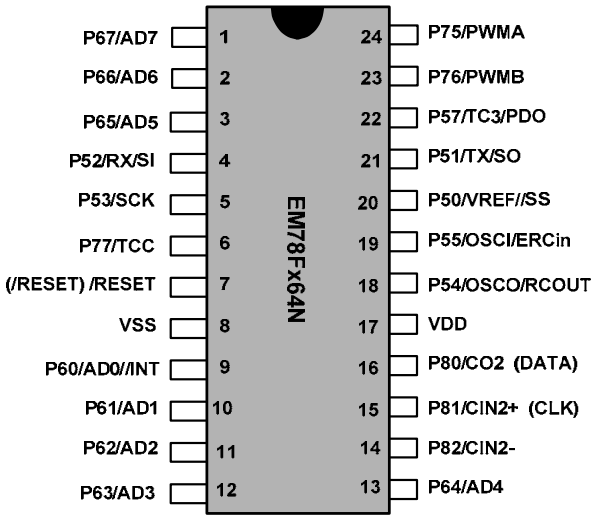


Figure 3-1 24-pin EM78Fx64N

(2) 28-Pin SKDIP/SOP

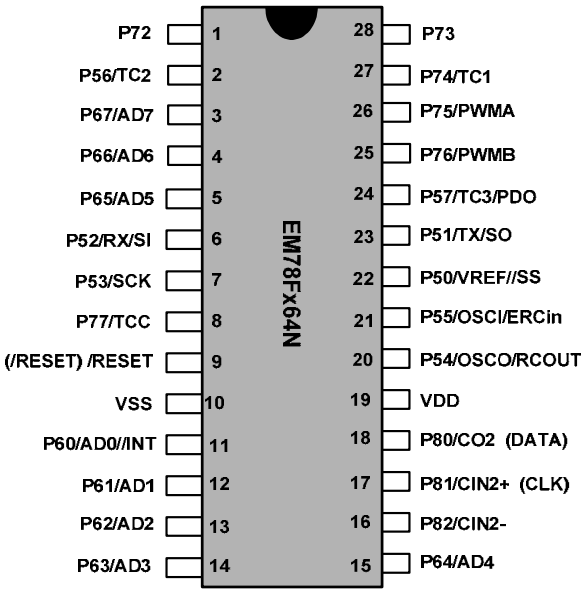


Figure 3-2 28-pin EM78Fx64N

(3) 32-Pin QFN

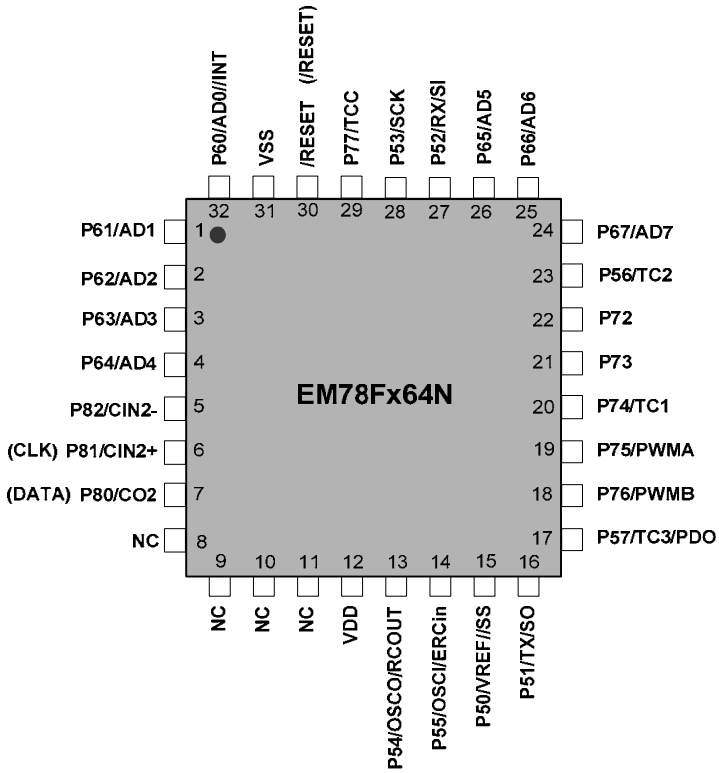


Figure 3-3 32-pin EM78Fx64N

4 Pin Description

Name	Function	Input Type	Output Type	Description
P50/VREF//SS	P50	ST	CMOS	Bidirectional I/O pin with programmable pull-down
	VREF	AN	–	ADC external voltage reference
	/SS	ST	–	SPI slave select pin
P51/TX/SO	P51	ST	CMOS	Bidirectional I/O pin with programmable pull-down
	TX	–	CMOS	UART TX output
	SO	–	CMOS	SPI serial data output
P52/RX/SI	P52	ST	CMOS	Bidirectional I/O pin with programmable pull-down
	RX	ST	–	UART RX input
	SI	ST	–	SPI serial data input
P53/SCK	P53	ST	CMOS	Bidirectional I/O pin with programmable pull-down
	SCK	ST	CMOS	SPI serial clock input/output
P54/OSCO/RCOUT	P54	ST	CMOS	Bidirectional I/O pin
	OSCO	–	XTAL	Clock output of crystal/resonator oscillator
	RCOUT	–	CMOS	Clock output of internal RC oscillator Clock output of external RC oscillator (open-drain)
P55/OSCI/ERCin	P55	ST	CMOS	Bidirectional I/O pin
	OSCI	XTAL	–	Clock input of crystal/resonator oscillator
	ERCin	AN	–	External RC input pin
P56/TC2	P56	ST	CMOS	Bidirectional I/O pin
	TC2	ST	–	Timer 2 clock input
P57/TC3/PDO	P57	ST	CMOS	Bidirectional I/O pin
	TC3	ST	–	Timer 3 clock input
	PDO	–	CMOS	Programmable Divider Output
P60/AD0//INT	P60	ST	CMOS	Bidirectional I/O pin with programmable pull-down, pull-high, open-drain, and pin change wake-up
	AD0	AN	–	ADC Input 0
	/INT	ST	–	External interrupt pin
P61/AD1	P61	ST	CMOS	Bidirectional I/O pin with programmable pull-down, pull-high, open-drain, and pin change wake-up
	AD1	AN	–	ADC Input 1
P62/AD2	P62	ST	CMOS	Bidirectional I/O pin with programmable pull-down, pull-high, open-drain, and pin change wake-up
	AD2	AN	–	ADC Input 2