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# Migrating from Atmel C51/CAN: T89C51CC01, AT89C51CC03 To Atmel AVR/CAN: AT90CAN128, AT90CAN64, AT90CAN32

## Introduction

This application note is a guide, on the CAN controller, to help current T89C51CC01, AT89C51CC03 users convert existing designs to AT90CAN128, AT90CAN64, AT90CAN32. The CAN controller used in T89C51CC01/AT89C51CC03 and the CAN controller used in AT90CAN128 are almost identical. This application note presents their differences and helps users take advantage of additional features.

Check the datasheets of these products for detailed information.

## Same CAN controller

The CAN controller implemented into AT89C51CC01, AT89C51CC03, AT90CAN128, AT90CAN64, AT90CAN32 offers V2.0B Active. This full-CAN controller provides the whole hardware for convenient acceptance filtering and message management. For each message to be transmitted or received this module contains one so called message object in which all information regarding the message (e.g. identifier, data bytes etc.) is stored.

During the initialization of the peripheral, the application defines which messages are to be sent and which are to be received. When the CAN controller receives a message whose identifier matches the identifiers of the programmed message objects, the message is stored and an interrupt occurs.

Another advantage is that incoming remote frames can be answered automatically by the full-CAN controller with the corresponding data frame. In this way, CPU load is strongly reduced compared to a basic-CAN solution. Using full-CAN controller, high baudrates and high bus loads with many messages can be handled.

The CNHPMOB and BOFF registers have been added to the following products  
**AT90CAN128, AT90CAN64, AT90CAN32**

### BOFF (Bus OFF Mode)

BOFF gives the information of the state of the CAN channel. Only entering in bus Off mode generates the BOFFIT interrupt.

### CANHPMOB (CAN Highest Priority MOB Register)

This register offers the possibility to quickly manage the MOB having the highest priority in CANSIT registers.

**AVR/CAN controller = C51/CAN controller + BOFFIT + CANHPMOB**



**CAN, 80C51,  
AVR,  
Microcontroller**

**Application Note**



## Error Management

The Bus Off Interrupt Flag (BOFFIT) in the AT90CAN128, AT90CAN64, AT90CAN32 provides functionality concerning error management not available in the AT89C51CC01 and AT89C51CC03 as illustrated in the following diagrams.

Figure 1. Line Error Mode on AT89C51CC01, AT89C51CC03

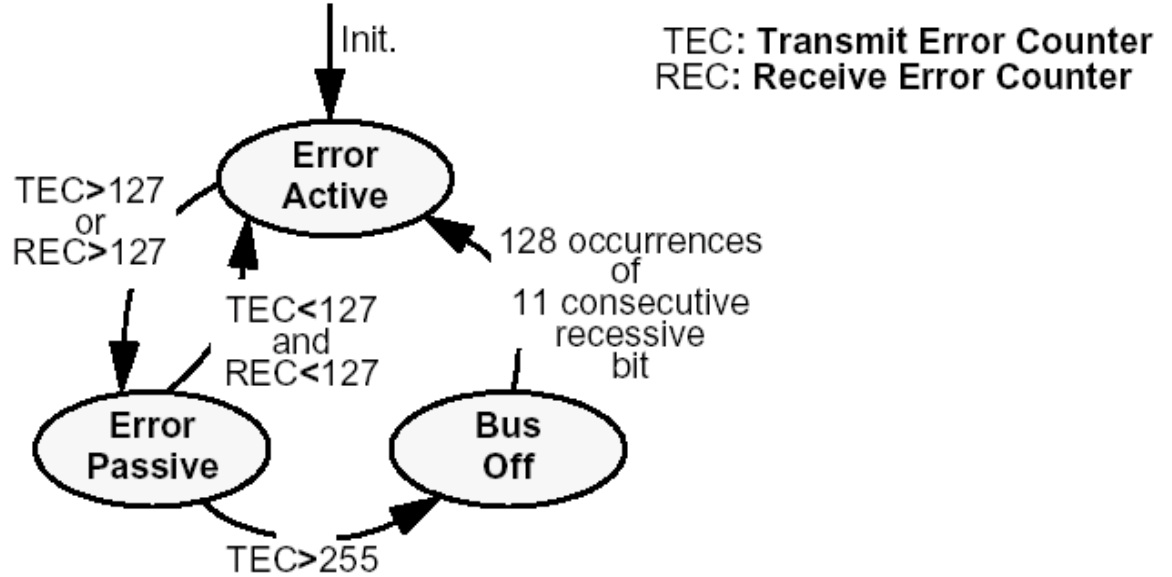
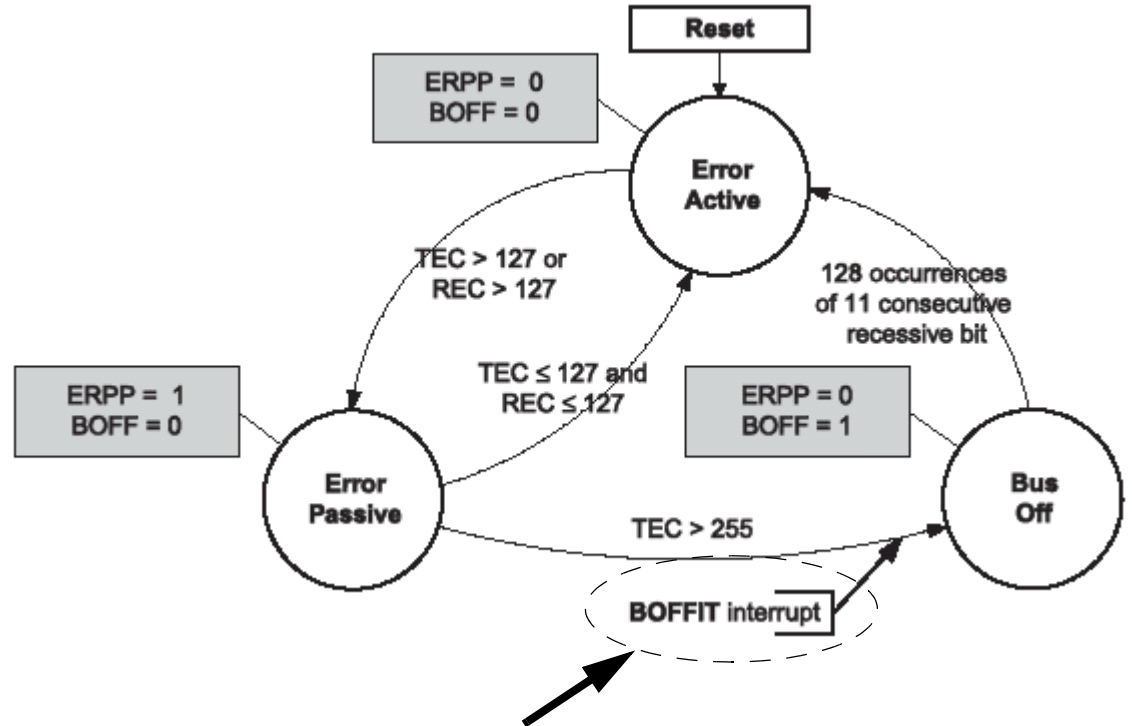


Figure 2. Line Error Mode on AT90CAN128, AT90CAN64, AT90CAN32



## CAN General Interrupt Register - CANGIT

This register serves **exactly the same function** between T89C51CC01, AT89C51CC03 and AT90CAN128, AT90CAN64, AT90CAN32.

The only difference is bit 6, which exists only on AT90CAN128, AT90CAN64, AT90CAN32:

Bit 6 – BOFFIT: Bus Off Interrupt Flag

Writing a logical 1 resets this interrupt flag. BOFFIT flag is only set when the CAN enters in bus off mode coming from error passive mode.

- 0 - no interrupt.
- 1 - bus off interrupt when the CAN enters in bus off mode.

In order to RESET the Interrupt, you have to write a level 0 on CANGIT for the T89C51CC01, AT89C51CC03.

In order to RESET the Interrupt, you have to write a level 1 on CANGIT for the AT90CAN128, AT90CAN64, AT90CAN32.

## CAN Highest Priority Mob Register – CANHPMOB

This register **only exists on AT90CAN128, AT90CAN64, AT90CAN32.**

This register offers the possibility to quickly manage the MOB having the highest priority in CAN-SIT registers.

## CAN General Interrupt Enable Register - CANGIE

This register has **exactly the same function** between T89C51CC01, AT89C51CC03 and AT90CAN128, AT90CAN64, AT90CAN32.

The only differences are bit 6 and bit 7, which exist only on AT90CAN128, AT90CAN64, AT90CAN32:

Bit 7 – ENIT: Enable all Interrupts (Except for CAN Timer Overrun Interrupt)

- 0 - interrupt disabled.
- 1- CANIT interrupt enabled.

Bit 6 – ENBOFF: Enable Bus Off Interrupt

- 0 - interrupt disabled.
- 1- bus off interrupt enabled.



## Register Name Differences and Bit Name Differences

These registers have **exactly the same function** between AT89C51CC01, AT89C51CC03 and AT90CAN128, AT90CAN64, AT90CAN32.

Only some bits do not have the same name and some registers do not have exactly the same name (but the function is exactly the same).

	<b>T89C51CC01 AT89C51CC03</b>	<b>AT90CAN128 AT90CAN64 AT90CAN32</b>
CAN General Control Register – CANGCON bit 3	AUTOBAUD	LISTEN
CAN General Status Register – CANGSTA bit 3	RBSY	RXBSY
CAN General Status Register – CANGSTA bit 4	TBSY	TXBSY
CAN Enable Mob Registers – CANEN1 & CANEN2	ENCHx	ENMOBx
CAN Enable Interrupt Mob Registers – CANIE1 & CANIE2	IECHx	IENMOBx
CAN Timer Control Register – CANTCON	TPRESCx	TPRSCx
CAN Page Mob register - CANPAGE	CHNBx	MOBNBx
CAN Message Object Control and DLC register name difference	CANCONCH	CANCDMOB
CAN Time Stamp Registers name difference	CANSTMPx	CANSTM

## CAN Timer

A programmable 16-bit timer is used for message stamping and time trigger communication (TTC).

Before the CANTCON the AT89C51CC01, AT89C51CC03 we have a clock frequency divider of 6. For the AT90CAN128, AT90CAN64, AT90CAN32 we have a clock frequency divider of 8.

Figure 3. CAN Timer Block Diagram on AT89C51CC01, AT89C51CC03

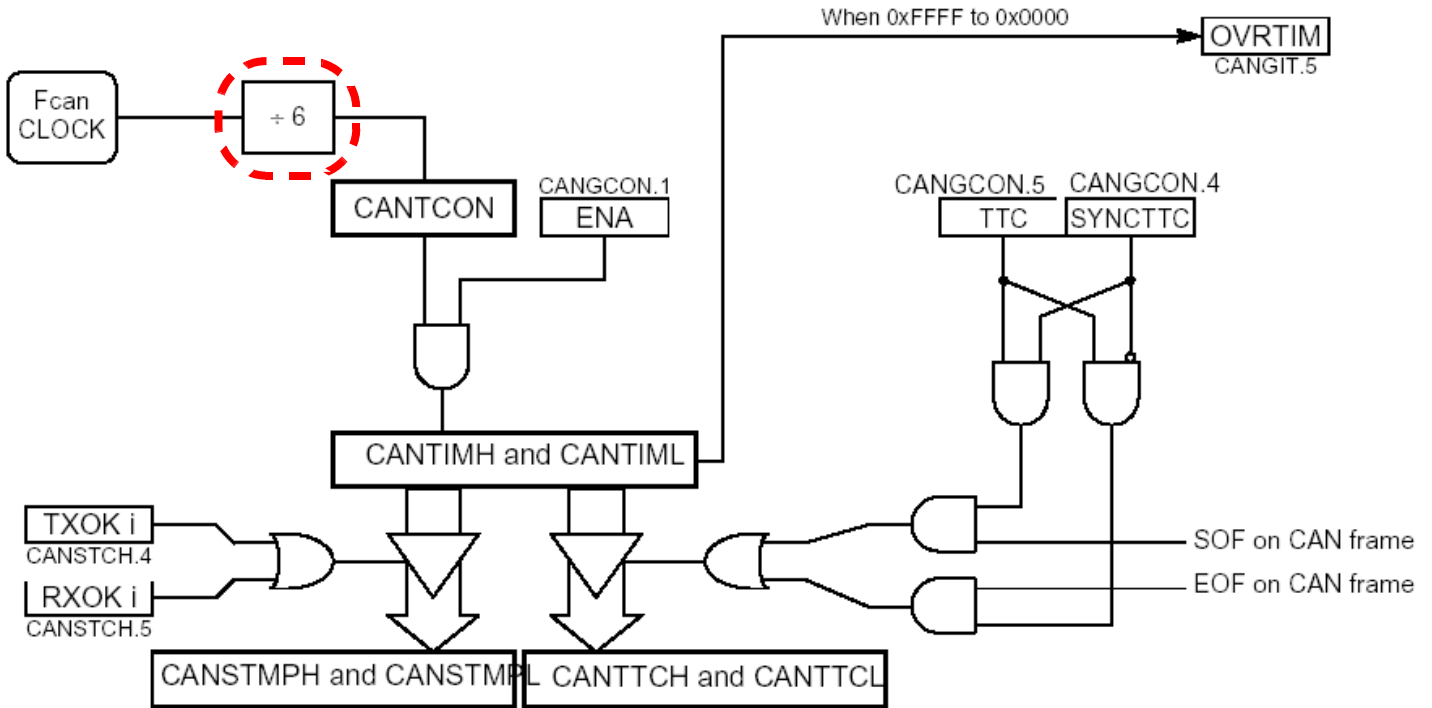
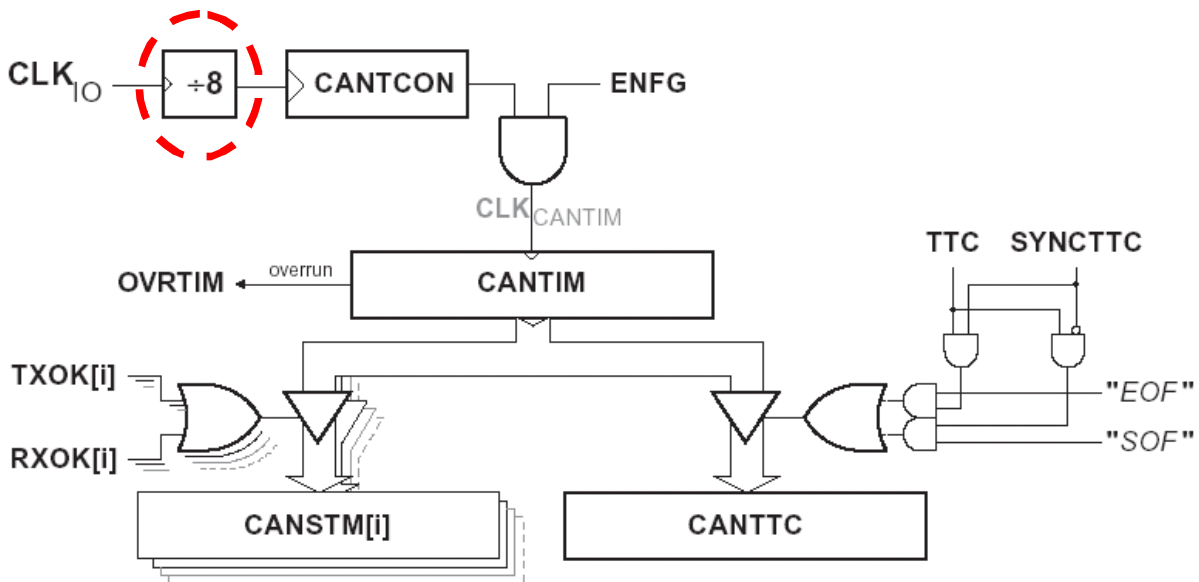


Figure 4. CAN Timer Block Diagram on AT90CAN128, AT90CAN64, AT90CAN32



## Performance Comparison AVR versus C51 Atmel with CANopen Software

Here are some figures of IXXAT CANopen software for a performance comparison:

### On the T89C51CC01 / AT89C51CC03

- the CANISR runs about 80µs
- an RX PDO is processed in about 200µs
- an TX PDO is processed in about 440µs

### On the AT90CAN128

- the CANISR runs about 14µs
- an RX PDO is processed in about 40µs
- an TX PDO is processed in about 100µs

Depending on the application that is to be implemented, the on-chip RAM of a T89C51CC01 / AT89C51CC03 can also be a restriction with CANopen.



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## Literature Requests

[www.atmel.com/literature](http://www.atmel.com/literature)

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