

CONFIG Register Programming for EEPROM-based M68HC11 Microcontrollers

Introduction

To guarantee proper operation of EEPROM-based M68HC11 devices, the CONFIG register must be correctly programmed. A CONFIG register verification and reprogramming routine should be included at the beginning of critical M68HC11 programs.

Code Listing

The following example code shows how to verify and reprogram the EEPROM CONFIG register to ensure proper operation. The same results can be accomplished with less generic, user-specified code. **Table 1** shows M68HC11 devices with EEPROM-based CONFIG registers. Use **Table 1** when customizing the source code. Refer to the appropriate M68HC11 Technical Data Book or Technical Summary for CONFIG register control bit definitions

The code will execute properly in single-chip or expanded operating modes on all EEPROM-based M68HC11 microcontrollers except for devices in the A Series. The CONFIG register in A Series devices can only be programmed in special test or bootstrap operating modes. Users devices in the A Series may choose to provide hardware support for special test or bootstrap mode operation. The code can be used as written in these modes if a proper starting address is selected. See **SECTION 3 CONFIGURATION AND MODES OF OPERATION** of the *M68HC11 Reference Manual* (M68HC11RM/AD) for more information.

```
* FILENAME: config.asm
*
* DESCRIPTION: This code checks the CONFIG register on an EEPROM-based
* HC11 device and reprograms it with the proper value if necessary.
*
```

Refer to Table 1. Fill in the blank that follows with the register base address for the device being used.

```
REGBASE    equ    $____    ;beginning of HC11 registers
* Offsets from the beginning of the register block.
TCNT       equ    $0E
TOC4       equ    $1C
TFLG1      equ    $23
BPROT      equ    $35
OPTION     equ    $39
PPROG      equ    $3B
CONFIG     equ    $3F
CSCSTR     equ    $5A
* The following register bit constants are needed.
OC4F       equ    $10
PTCON      equ    $10
CME        equ    $08
BYTE       equ    $10
ERASE      equ    $04
EELAT      equ    $02
EEPGM      equ    $01
```



Freescale Semiconductor, Inc.

Fill in the blank that follows with the desired CONFIG register value.

* Other user constants should follow, including:

```
MY_CONFIG equ    $__
```

Fill in the program starting address in the following blank.

```
START    org    $____    ;program starts here
```

The next line is only needed for derivatives in the K Series that are running in expanded mode.

```
    clr    CSCSTR    ;disable clock stretching on K-series
    lds    #$00FF    ;set a valid stack pointer
    ldx    #REGBASE    ;set beginning of register block
    ldaa   CONFIG,X    ;read CONFIG
    cmpa   #MY_CONFIG    ;check for valid CONFIG
    beq    NORMAL    ;if CONFIG is OK, go on as usual
```

At this point, 49 cycles remain for modifications to be made to the time protected registers on all HC11 devices except for devices in the K Series that are running in expanded mode. On these devices, 37 cycles remain because program chip-select clock stretching is enabled in expanded mode, effectively doubling the execution time of all instructions until stretching is disabled.

```
    bclr   BPROT,X,PTCON    ;clear CONFIG protect bit
```

* CONFIG erase sequence.

```
    ldaa   #{BYTE + ERASE + EELAT}
    staa   PPROG,X
```

The EEPROM erase sequence requires that some data be stored to the byte being erased. The actual data stored and instructions used are irrelevant; it is only necessary to complete a memory write cycle to the location in question.

```
    staa   CONFIG,X    ;store something to CONFIG
    ldaa   #{BYTE + ERASE + EELAT + EEPGM}
    staa   PPROG,X
    jsr    EEDELAY    ;wait 10 ms
    clr    PPROG,X    ;finish erase sequence
```

* CONFIG program sequence.

```
    ldaa   #EELAT
    staa   PPROG,X
    ldaa   #MY_CONFIG    ;desired CONFIG value
    staa   CONFIG,X
    ldaa   #{EELAT + EEPGM}
    staa   PPROG,X
    jsr    EEDELAY    ;wait 10 ms
    clr    PPROG,X    ;finish program sequence
```

* Now allow clock monitor to reset the HC11 and latch the new CONFIG register value.

```
    bset   OPTION,X,CME    ;enable clock monitor reset
    tpa    ;get condition code register
    anda   #$7F    ;enable STOP mode
    tap
    nop
    stop    ;enter STOP mode and allow reset
```

* User program resumes here if CONFIG does not need to be reprogrammed.

NORMAL etc.

* This delay subroutine may be used for any EEPROM programming/erase operation.

```
EEDELAY    ldd    TCNT,X    ;get current time
```

Fill in the following blank with the delay term used for program and erase operations. DELAY = ECLK/100, and typical values are 40000 at 4 MHz, 20000 at 2 MHz, and 10000 at 1 MHz.

```
    addd   #____    ;add delay
    std    TOC4,X    ;allow match at end of delay
    ldaa   #OC4F    ;clear last output compare match
    staa   TFLG1,X
```

* Wait for OC4 match (end of 10 ms delay) to occur.

```
DELAYLOOP brclr  TFLG1,X,OC4F,DELAYLOOP
          rts    ;end of delay loop
```

Freescale Semiconductor, Inc.


Table 1 M68HC11 Devices with EEPROM-Based CONFIG Registers

Device	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Register Base
MC68HC11A0	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11A1	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11A7	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11A8	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11A0	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11A1	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11A7	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11A8	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11E0	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11E1	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11E8	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11E9	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11E0	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11E1	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11E8	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11E9	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC711E9	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68S711E9	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11E20	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC711E20	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC811E2	EE3	EE2	EE1	EE0	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11EA9	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC711EA9	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11F1	EE3	EE2	EE1	EE0	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11F1	EE3	EE2	EE1	EE0	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11K0	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11K1	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11K3	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11K4	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68L11K0	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68L11K1	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68L11K3	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68L11K4	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC711K4	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11KA0	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11KA1	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11KA3	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11KA4	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC711KA4	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11KA2	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC711KA2	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11L0	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11L1	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11L5	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000

Freescale Semiconductor, Inc.

Table 1 M68HC11 Devices with EEPROM-Based CONFIG Registers (Continued)

Device	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Register Base
MC68HC11L6	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11L0	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11L1	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11L5	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11L6	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC711L6	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11P2	ROMAD	—	—	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC711P2	ROMAD	—	—	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

Mfax is a trademark of Motorola, Inc.

How to reach us:

USA/EUROPE/Locations Not Listed: Motorola Literature Distribution;
P.O. Box 5405, Denver, Colorado 80217. 303-675-2140 or 1-800-441-2447

JAPAN: Nippon Motorola Ltd.: SPD, Strategic Planning Office, 4-32-1,
Nishi-Gotanda, Shinagawa-ku, Tokyo 141, Japan. 81-3-5487-8488

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 602-244-6609
– US & Canada ONLY 1-800-774-1848

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

INTERNET: <http://motorola.com/sps>



MOTOROLA

For More Information On This Product
Go to: www.freescale.com

1ATX35025-2 PRINTED IN USA 597 IMPERIAL LITHO 30073 2.500 LITAMCU

M68HC11CFG/D

