```
001    ;-------------------------------------------------------------
002    ;   Programa : EEPROM.asm
003    ;   Autor    : Prof. Vargas
004    ;   Data     : 21/01/2019
005    ;
006    ;   Descrição:
007    ;   Testa o uso da EEPROM Interna do PIC que inicia em 0x00 e vai até 0x7F.
008    ;   Este programa apresenta no display de 7 segmentos o valor contido nos
009    ;   endereços de RAM de usuário de 0x70 até 0x79 (respectivamente a0 a a9).
010    ;   Uma sequencia de dados consecutivos de 0 a 9 são gravados na EEPROM nos
011    ;   endereços de 0x00 a 0x09 (coincidentemente).  Após isto a memória é
012    ;   preenchida com dados aleatórios para que se possa ter a percepção da
013    ;   alteração ao se LER os dados da EEPROM.
014    ;   Ao pressionar o botão LE, o PIC recolhe os dados da EEPROM e os coloca
015    ;   na RAM de 0x70 a 0x79.
016    ;   O botão GRAVA preenche a EEPROM com 0s e 1s alternadamente, que podemos
017    ;   ler com o botão LE.
018    ;-------------------------------------------------------------
019
020        include   "P16F628a.inc"
021        __config    0x3F29
022
023    BANK0   MACRO
024            bcf STATUS,RP0
025            bcf STATUS,RP1
026        ENDM
027    BANK1   MACRO
028            bsf STATUS,RP0
029            bcf STATUS,RP1
030        ENDM
031
```

```asm
032   #DEFINE GRAVA    PORTB,6
033   #DEFINE LE  PORTB,7
034
035       cblock  0x70
036           a0   ;valor de 0x70
037           a1   ;valor de 0x71
038           a2   ;valor de 0x72
039           a3   ;valor de 0x73
040           a4   ;valor de 0x74
041           a5   ;valor de 0x75
042           a6   ;valor de 0x76
043           a7   ;valor de 0x77
044           a8   ;valor de 0x78
045           a9   ;valor de 0x79
046           counta
047           countb
048           countc
049           contdec ; contador de dados
050           EEPROM_Addr ; Endereço da EEPROM
051           EEPROM_data ; Dado da EEPROM
052       endc
053
054       org     0x000    ; Reset vector
055       goto    inicio
056
057       org     0x004    ; Interrupt vector
058       retfie
059
060   inicio:
061       clrf    PORTB
062       clrf    PORTA
```

```
063        movlw    0x07
064        movwf    CMCON          ; Libera PORTA
065        BANK1
066        movlw    b'11110000'
067        movwf    TRISA          ; PORTA all Input
068        movlw    b'11100000'
069        movwf    TRISB          ; PORTB all Output
070        BANK0
071        ;carrega dados na EEPROM
072        movlw    d'00'
073        movwf    contdec
074   continua:
075        movf     contdec,W
076        movwf    EEPROM_data
077        movwf    EEPROM_Addr
078        call     EP_Write
079        incf     contdec
080        movlw    d'10'
081        xorwf    contdec,W
082        btfss    STATUS,Z
083        goto     continua
084        ;preenche dados aleatórios
085        movlw    d'1'
086        movwf    a0
087        movlw    d'7'
088        movwf    a1
089        movlw    d'3'
090        movwf    a2
091        movlw    d'8'
092        movwf    a3
093        movlw    d'4'
```

```
094        movwf    a4
095        movlw    d'7'
096        movwf    a5
097        movlw    d'5'
098        movwf    a6
099        movlw    d'1'
100        movwf    a7
101        movlw    d'6'
102        movwf    a8
103        movlw    d'2'
104        movwf    a9
105
106   denovo:
107        movf     a0,W
108        movwf    PORTA     ;apresenta no display
109        call     Delay
110        call     teclado
111        movf     a1,W
112        movwf    PORTA     ;apresenta no display
113        call     Delay
114        call     teclado
115        movf     a2,W
116        movwf    PORTA     ;apresenta no display
117        call     Delay
118        call     teclado
119        movf     a3,W
120        movwf    PORTA     ;apresenta no display
121        call     Delay
122        call     teclado
123        movf     a4,0
124        movwf    PORTA     ;apresenta no display
```

```
125        call       Delay
126        call       teclado
127        movf       a5,0
128        movwf      PORTA     ;apresenta no display
129        call       Delay
130        call       teclado
131        movf       a6,0
132        movwf      PORTA     ;apresenta no display
133        call       Delay
134        call       teclado
135        movf       a7,0
136        movwf      PORTA     ;apresenta no display
137        call       Delay
138        call       teclado
139        movf       a8,0
140        movwf      PORTA     ;apresenta no display
141        call       Delay
142        call       teclado
143        movf       a9,0
144        movwf      PORTA     ;apresenta no display
145        call       Delay
146        call       teclado
147        goto       denovo
148
149    EP_Write:
150        BANK1
151        bsf        EECON1,WREN ; Enable write
152        movf       EEPROM_data,0
153        movwf      EEDATA       ; set EEPROM data
154        movf       EEPROM_Addr,0
155        movwf      EEADR        ; set EEPROM address
```

```
156      movlw    0x55
157      movwf    EECON2        ; Write 55h
158      movlw    0xAA
159      movwf    EECON2        ; Write AAh
160      bsf      EECON1,WR     ; Set WR bit
161
162      ; inicia processo de escrita
163
164      BANK0
165      btfss    PIR1,EEIF     ; wait for write to complete.
166      goto     $-1
167      bcf      PIR1,EEIF     ; and clear the 'write complete' flag
168      bsf      STATUS,RP0    ; Bank 1
169      bcf      EECON1,WREN   ; Disable write
170      bcf      STATUS,RP0    ; Bank 0
171      return
172
173  EP_READ:
174      BANK1
175      movf     EEPROM_Addr,W
176      movwf    EEADR         ; Address to read
177      bsf      EECON1,RD     ; EE Read
178      movf     EEDATA,W      ; W = EEDATA
179      movwf    EEPROM_data
180      BANK0
181      return
182
183  ;~~~~~~~~~~~~~~~~
184  ; Rotina de Delay
185  ;~~~~~~~~~~~~~~~~
186  Delay:
```

```
187         movlw    d'250'
188         movwf    countc
189  d1:
190         movlw    0xC7
191         movwf    counta
192         movlw    0x01
193         movwf    countb
194  Delay_0:
195         decfsz   counta,f
196         goto     $+2
197         decfsz   countb,f
198         goto     Delay_0
199         decfsz   countc,f
200         goto     d1
201         retlw    0x00
202
203  teclado:
204         btfss    GRAVA
205         goto     record
206         btfss    LE
207         goto     reader
208         goto     final
209  record:
210         ;carrega dados na EEPROM
211         btfss    GRAVA
212         goto     $-1
213         clrf     contdec
214         movlw    d'0'
215         movwf    EEPROM_data
216         movf     contdec,0
217         movwf    EEPROM_Addr
```

```
218        call     EP_Write
219        incf     contdec
220        movlw    d'1'
221        movwf    EEPROM_data
222        movf     contdec,0
223        movwf    EEPROM_Addr
224        call     EP_Write
225        incf     contdec
226        movlw    d'1'
227        movwf    EEPROM_data
228        movf     contdec,0
229        movwf    EEPROM_Addr
230        call     EP_Write
231        incf     contdec
232        movlw    d'0'
233        movwf    EEPROM_data
234        movf     contdec,0
235        movwf    EEPROM_Addr
236        call     EP_Write
237        incf     contdec
238        movlw    d'1'
239        movwf    EEPROM_data
240        movf     contdec,W
241        movwf    EEPROM_Addr
242        call     EP_Write
243        incf     contdec
244        movlw    d'1'
245        movwf    EEPROM_data
246        movf     contdec,W
247        movwf    EEPROM_Addr
248        call     EP_Write
```

```
249        incf     contdec
250        movlw    d'1'
251        movwf    EEPROM_data
252        movf     contdec,W
253        movwf    EEPROM_Addr
254        call     EP_Write
255        incf     contdec
256        movlw    d'0'
257        movwf    EEPROM_data
258        movf     contdec,W
259        movwf    EEPROM_Addr
260        call     EP_Write
261        incf     contdec
262        movlw    d'1'
263        movwf    EEPROM_data
264        movf     contdec,W
265        movwf    EEPROM_Addr
266        call     EP_Write
267        incf     contdec
268        movlw    d'0'
269        movwf    EEPROM_data
270        movf     contdec,W
271        movwf    EEPROM_Addr
272        call     EP_Write
273        goto     final
274   reader:
275        ; Traz os dados da EEPROM
276        btfss    LE
277        goto     $-1
278        clrf     contdec
279        movf     contdec,W
```

```
280        movwf    EEPROM_Addr
281        call     EP_READ
282        movf     EEPROM_data,W
283        movwf    a0
284        incf     contdec
285        movf     contdec,W
286        movwf    EEPROM_Addr
287        call     EP_READ
288        movf     EEPROM_data,W
289        movwf    a1
290        incf     contdec
291        movf     contdec,W
292        movwf    EEPROM_Addr
293        call     EP_READ
294        movf     EEPROM_data,W
295        movwf    a2
296        incf     contdec
297        movf     contdec,W
298        movwf    EEPROM_Addr
299        call     EP_READ
300        movf     EEPROM_data,W
301        movwf    a3
302        incf     contdec
303        movf     contdec,W
304        movwf    EEPROM_Addr
305        call     EP_READ
306        movf     EEPROM_data,W
307        movwf    a4
308        incf     contdec
309        movf     contdec,W
310        movwf    EEPROM_Addr
```

```
311        call       EP_READ
312        movf       EEPROM_data,W
313        movwf      a5
314        incf       contdec
315        movf       contdec,W
316        movwf      EEPROM_Addr
317        call       EP_READ
318        movf       EEPROM_data,W
319        movwf      a6
320        incf       contdec
321        movf       contdec,W
322        movwf      EEPROM_Addr
323        call       EP_READ
324        movf       EEPROM_data,W
325        movwf      a7
326        incf       contdec
327        movf       contdec,W
328        movwf      EEPROM_Addr
329        call       EP_READ
330        movf       EEPROM_data,W
331        movwf      a8
332        incf       contdec
333        movf       contdec,W
334        movwf      EEPROM_Addr
335        call       EP_READ
336        movf       EEPROM_data,W
337        movwf      a9
338    final:
339        return
340        end
341
```