

Example source using GMS37112

NEC format (uDP6121G)

INTRODUCTION

The GMS37112 are an advanced CMOS 4-bit microcontroller with 1K bytes of ROM which provides a highly flexible and cost effective solution to many remote control transmitter such as TV, VCR, CATV, DVD etc. It offers 32 nibbles of on-chip data memory, 43 types of instruction set, 3 levels of subroutine nesting, 1 bit output port for a large current, built-in capacitor for ceramic oscillation circuit, built-in a watchdog timer, built-in power-on reset circuit, built-in low voltage detection circuit. In addition, it supports power saving mode (stop mode) to reduce power consumption. Package types are provided with 16, 20, 24 DIP/SOP, 20SSOP. The OTP (one time programmable ROM) device has the program memory locking function to prevent illegal copy and devices name are provided as a GMS37112TK or GMS37112TM.

FEATURES

- 1024 bytes on-chip program memory
- 32 nibbles of on-chip data memory
- 43 types of instruction set
- 3 levels of subroutine nesting
- 1 bit output port for a large current (REMOUT signal)
- Operating frequency : 300~ 1MHz at kHz version, 2.4MHz~4Mhz at MHz version
- Minimum instruction execution time : fosc/6 at kHz version, fosc/48 at MHz version
- Stop mode (through internal instruction)
- Released stop mode by key input (Masked option)
- Built-in power-on reset circuit
- Built-in low voltage detection circuit
- Built-in capacitor for ceramic oscillation circuit (Masked option)
- Built-in a watchdog timer (WDT)
- Low operating voltage
- Mask: 2.0~3.6 V (at 300kHz~4Mhz)
- OTP : 2.2~3.6 V (at 300kHz~4Mhz)

KEY NO.	DATA(H)	KEY NO.	DATA(H)
K01	00	K29	1C

Table 1: Truth table for example program

KEY NO.	DATA(H)	KEY NO.	DATA(H)
K02	01	K30	1D
K03	02	K31	1E
K04	03	K32	1F
K05	04	K33	20
K06	05	K34	21
K07	06	K35	22
K08	07	K36	23
K09	08	K37	24
K10	09	K38	25
K11	0A	K39	26
K12	0B	K40	27
K13	0C	K41	28
K14	0D	K42	29
K15	0E	K43	2A
K16	0F	K44	2B
K17	10	K45	2C
K18	11	K46	2D
K19	12	K47	2E
K20	13	K48	2F
K21	14	K49	30
K22	15	K50	31
K23	16	K51	32
K24	17	K52	33
K25	18	K53	34
K26	19	K54	35
K27	1A	K55	36
K28	1B	K56	37

Table 1: Truth table for example program

OUTPUT WAVEFORM FOR uPD6121G

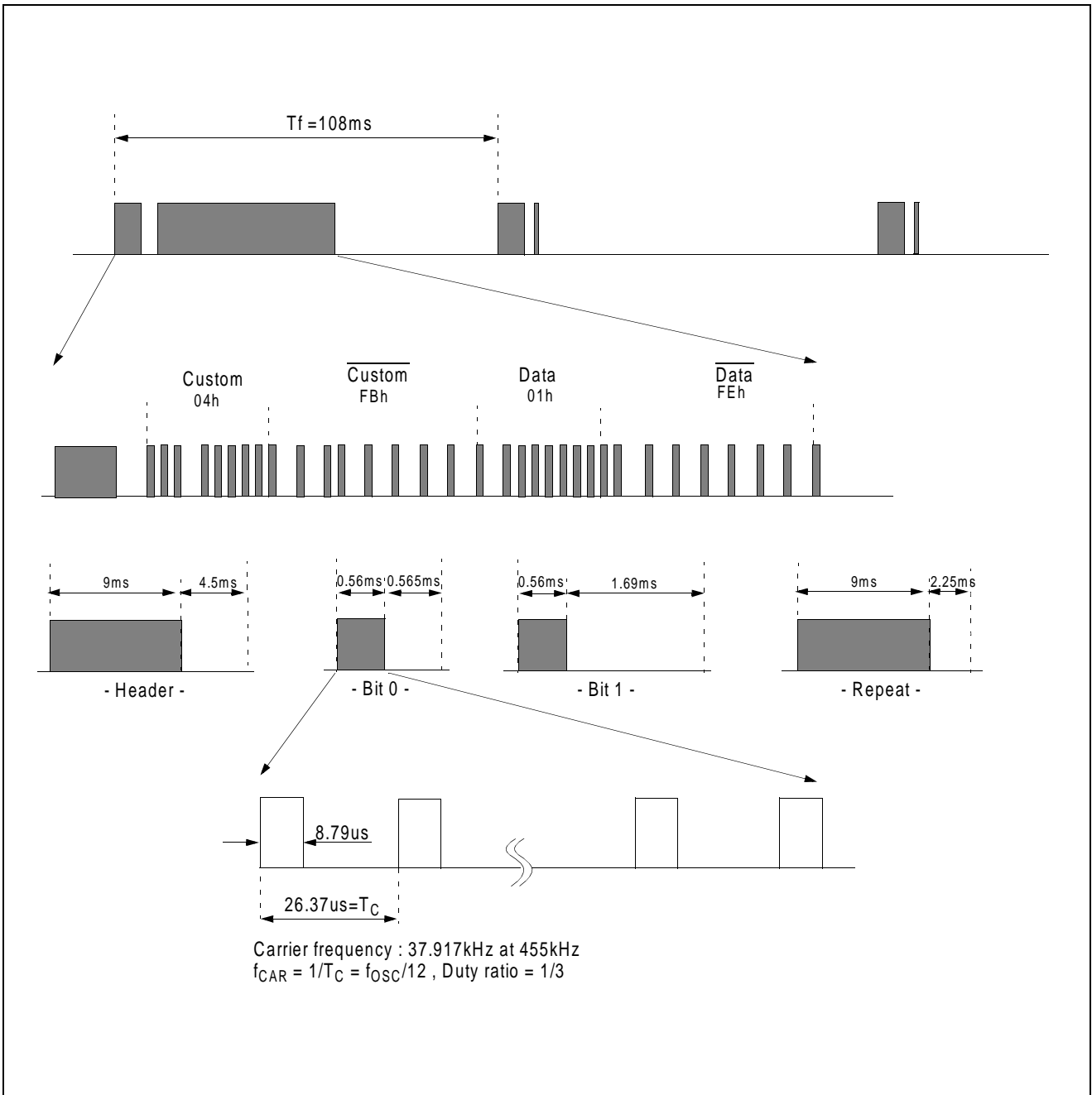
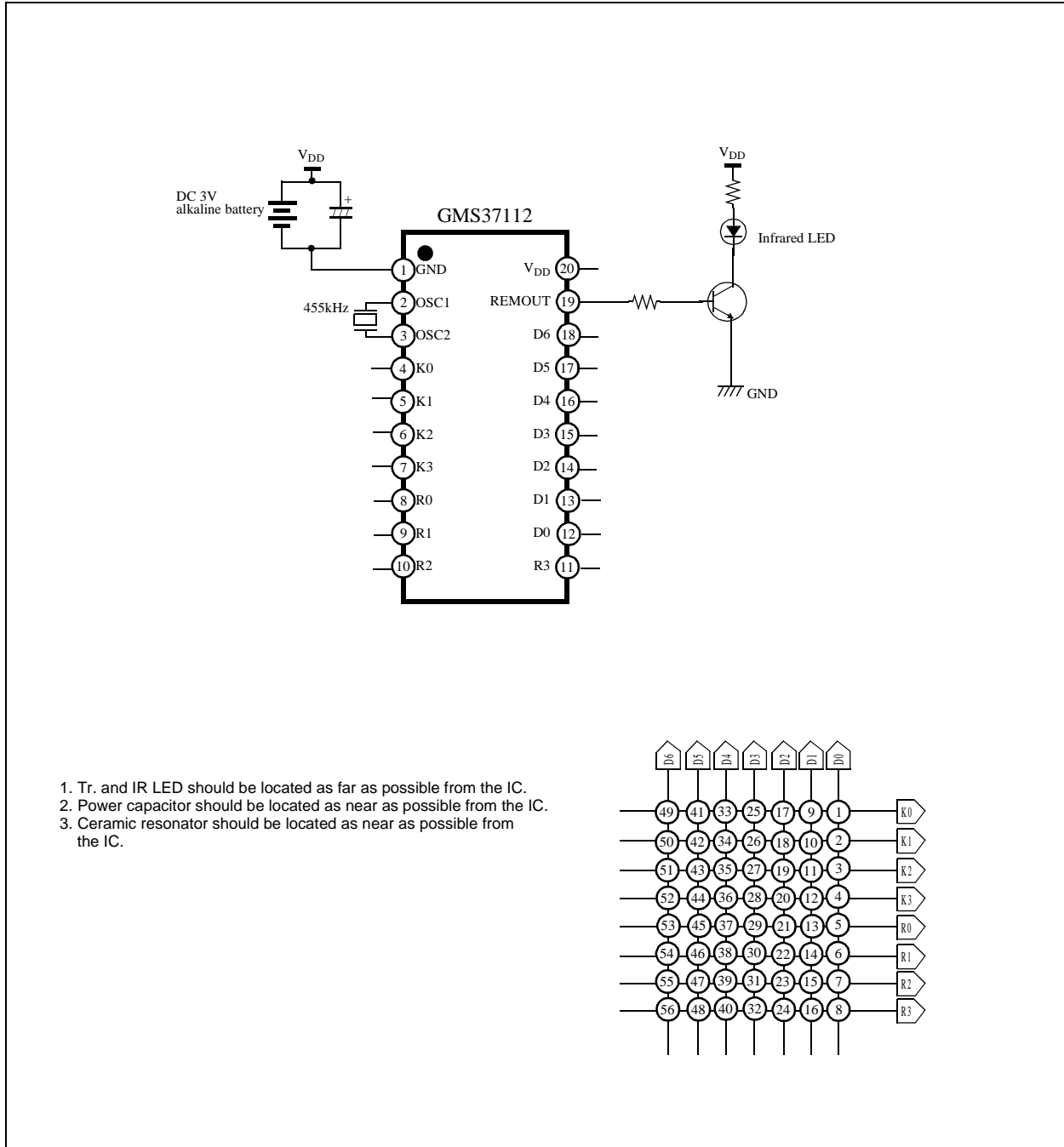


Figure 1 OUTPUT WAVEFORM FOR uPD6121G

CIRCUIT DIAGRAM OF GMS37112



Appendix A listing: example program code

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Example source using GMS37112

APPENDIX A

```

1  0000          INCLUDE GMS30K.LIB
2  0000          list
3  0000          ;-----
4  0000          ;    02.6.12
5  0000          ;    This program is example program for GMS37112 by Heejin Ryu.
6  0000          ;    The format is NEC format (uPD6121G)
7  0000          ;
8  0000          ;-----
9  0000          ;-----
10 0000         ;    RAM DEFINE
11 0000         ;    X=0
12 0000
13 0000         COUNT    EQU    00    ;STATUS RAM
14 0000         NONE    EQU    00    ;FLAG FOR NOKEY CHKCK
15 0001         FIRST   EQU    01    ;FLAG FOR KEY SCAN TWO TIMES
16 0002         REPEAT  EQU    02    ;FLAG FOR REPEAT CHECK
17 0000
18 0001         INDAT   EQU    01    ;INPUT K or R DATA
19 0002         TOTLKY  EQU    02    ;THE NUMBER OF PRESSED KEY
20 0003         POINT   EQU    03    ;RAM FOR KEYSKAN LOOPING or TRANSMIT LOOPING
21 0004         STROBE  EQU    04    ;PRESSED OUTPUT DATA
22 0000
23 0006         CC6L    EQU    06    ;CUSTOM CODE LOW
24 0007         CC6H    EQU    07    ;CUSTOM CODE HIGH
25 0008         CC7L    EQU    08    ;CUSTOM CODE LOW BAR
26 0009         CC7H    EQU    09    ;CUSTOM CODE HIGH BAR
27 000A         NEWDTL  EQU    10    ;DATA CODE LOW
28 000B         NEWDTH  EQU    11    ;DATA CODE HIGH
29 000C         KEYDTL  EQU    12    ;DATA CODE LOW BAR
30 000D         KEYDTH  EQU    13    ;DATA CODE HIGH BAR
31 000E         OLDL    EQU    14    ;DATA CODE LOW FOR SAVING POSITION
32 000F         OLDH    EQU    15    ;DATA CODE HIGH FOR SAVING POSITION
33 0000
34 0000         ;-----
35 0000         ;    PG    00
36 0000         ;-----
37 0000 3c      +RST    LXI    0      ;DEFINE X0 RAM
38 0001 40      +      LYI    0      ;RAM CLEAR
39 0003 60      +CLA    LMIY   0
40 0007 50      +      YNEI   0
41 000f 83      +      BR     CLA
42 001f
43 001f 4f      +      LYI    15     ;ALL PORT HIGH
44 003f 0d      +      SO
45 003e 46      +      LYI    6     ;MAKE STROBE PORT LOW BEFORE STOP MODE
46 003d 0c      +TORO   RO
47 003b 2c      +      DY
48 0037 bd      +      BR     TORO
49 002f 1a      +      CALL   TIM10  ;FOR STABLIZATION PORT
50 001e e5      +
51 003c
52 003c 06      +      STOP    ;STOP MODE
53 0039
54 0039         ;KEY INPUT --> WAKE UP STOP MODE
55 0039 3c      +MAIN   LXI    0
56 0033 4f      +      LYI    15     ;ALL PORT HIGH FOR DECREASING CURRENT CONSUMPTION
57 0027 0d      +      SO
58 000e
59 000e 40      +      LYI    COUNT  ;STATUS RAM CLEAR
60 001d 60      +      LMIY   0
61 003a 48      +KEY    LYI    1     ;PMR SETTING, fosc/12, duty ratio 1/3

```

Example source using GMS37112

```

62 0035 04      +      LPY
63 002b 40      +      LYI      COUNT      ;FLAG CLEAR FOR KEY SCAN
64 0016 36      +      REM      FIRST
65 002c 34      +      REM      NONE
66 0018
67 0018 48      +SCAN   LYI      INDAT      ;RAM CLEAR FOR KEY SCAN
68 0030 6f      +      LMIIY     15
69 0021 60      +CLR    LMIIY     0
70 0002 53      +      YNEI     KEYDTL
71 0005 a1      +      BR       CLR
72 000b
73 000b 18      +      CALL     SCAN1     ;KEY SCAN
74 0017 c1      +
75 002e 05      +      WDTR                      ;DON'T USE WDTR IN SUBROUTINE
76 001c
77 001c 44      +      LYI      TOTLKY
78 0038 26      +      MNEZ
79 0031 ad      +      BR       KEY11
80 0023
81 0023 40      +      LYI      COUNT      ;NO KEY PRESSED
82 0006 38      +      TM       NONE
83 000d 80      +      BR       RST
84 001b 30      +      SEM      NONE
85 0036 98      +      BR       SCAN
86 002d
87 002d 22      +KEY11  LYM
88 001a 58      +      YNEI     1
89 0034 b9      +      BR       MAIN      ;DOUBLE KEY(MORE THAN TWO) PRESSED
90 0029 14      +      BL       KEY12     ;ONE KEY PRESSED
91 0012 81      +
92 0024
93 0024
94 0024
95 0024 ca      +DTCOM  CAL      COMPARE1   ;DATA COMPARE SUB ROUTINE
96 0008 70      +      ALEI     0
97 0011
98 0011 89      +      BR       DTCOM1
99 0022 1a      +      BL       TIM11
100 0004 b2     +
101 0009 2c     +DTCOM1  DY
102 0013 ca     +      CAL      COMPARE1
103 0026 70     +      ALEI     0
104 000c b2     +      BR       DATAC
105 0019 a8     +      BR       RRTN
106 0032 40     +DATAC  LYI      0
107 0025 0f     +      RTN
108 000a 21     +COMPARE1 LAM
109 0015 2b     +      IY
110 002a 2b     +      IY
111 0014 01     +      EORM
112 0028 0f     +RRTN   RTN
113 0010
114 0010
115 0010 00     +      NOP
116 0020 a0     +      BR       $          ; END ADDRESS
117 0100
118 0100        ;-----
119 0100        ;          PG          01
120 0100 80     +      BR       $          ;START ADDRESS
121 0101
122 0101
123 0101 4c     +SCAN1  LYI      POINT     ;KEY SCAN START

```

Example source using GMS37112

```

124 0103 22      +      LYM
125 0107 0c      +      RO
126 010f 1a      +      CALL      TIM30      ;DELAY FOR KEY SCAN
127 011f c6      +
128 013f 08      +      LAK              ;READ KPORT
129 013e 77      +      ALEI      14
130 013d f5      +      CAL      KSAVE      ;KPORT PRESSED
131 013b 0a      +      LAR              ;READ RPORT
132 0137 77      +      ALEI      14
133 012f d6      +      CAL      RSAVE      ;RPORT PRESSED
134 011e 4f      +      LYI      15
135 013c 0d      +      SO
136 0139 4c      +      LYI      POINT      ;KEY STROBE INCREASE
137 0133 28      +      IM
138 0127 03      +      LMA
139 010e 76      +      ALEI      6
140 011d 81      +      BR      SCAN1
141 013a 0f      +      RTN
142 0135
143 0135 00      +KSAVE  NOP
144 012b 98      +      BR      SAVE
145 0116 45      +RSAVE  LYI      NEWDTL      ;NEWDTL+4
146 012c 31      +      SEM      2
147 0118 48      +SAVE   LYI      INDAT
148 0130 20      +      LMAIY              ;K or R VALUE --> INDAT
149 0121 28      +      IM              ;TOTLKY++
150 0102 20      +      LMAIY
151 0105 21      +      LAM
152 010b 42      +      LYI      STROBE      ;POINT --> STROBE
153 0117 03      +      LMA
154 012e 0f      +      RTN
155 011c
156 011c
157 011c 40      +COUN  LYI      COUNT
158 0138 3a      +      TM      FIRST      ;FIRST OR NOT
159 0131 92      +      BR      KEY25      ;SECOND
160 0123 32      +      SEM      FIRST      ;FIRST
161 0106
162 0106 45      +KEY26 LYI      NEWDTL
163 010d 12      +      CALL     DTMOVE      ;NEWDTL,NEWDTL --> KEYDTL,KEYDTH
164 011b ea      +
165 0136 44      +      LYI      2
166 012d 1c      +      CALL     DLY65M      ;DELAY TIME
167 011a e2      +
168 0134 10      +      BL      SCAN
169 0129 98      +
170 0112
171 0112 45      +KEY25 LYI      NEWDTL      ;NEWDTL,NEWDTL COMPARE KEYDTL,KEYDTH
172 0124 10      +      CALL     DTCOM
173 0108 e4      +
174 0111 50      +      YNEI     0
175 0122 86      +      BR      KEY26      ;DIFFERENT
176 0104
177 0104 43      +      LYI      KEYDTL      ;KEYDTL,KEYDTH COMPARE OLDL,OLDH
178 0109 10      +      CALL     DTCOM
179 0113 e4      +
180 0126 50      +      YNEI     0
181 010c aa      +      BR      KEY31      ;DIFFERENT
182 0119
183 0119 43      +KEY32 LYI      KEYDTL      ;KEYDTL,KEYDTH --> OLDL,OLDH
184 0132 12      +      CALL     DTMOVE
185 0125 ea      +

```

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```

186 010a 1c + BL CUSREAD
187 0115 81 +
188 012a
189 012a 40 +KEY31 LYI COUNT ;REPEAT FLAG CLEAR
190 0114 35 + REM REPEAT
191 0128 99 + BR KEY32
192 0110
193 0110 00 + NOP
194 0120 a0 + BR $
195 0200 ;-----
196 0200 PG 02
197 0200 ;-----
198 0200 80 + BR $
199 0201
200 0201 42 +KEY12 LYI STROBE
201 0203 38 + TM 0
202 0207 bf + BR LOOPA
203 020f 00 + NOP
204 021f bd + BR LOOPB
205 023f 45 +LOOPA LYI NEWDTL ;NEWDTL+8
206 023e 33 + SEM 3
207 023d 42 +LOOPB LYI STROBE
208 023b 21 + LAM
209 0237 4d + LYI NEWDTH
210 022f
211 022f 78 + ALEI 1 ;STROBE 0,1
212 021e ba + BR NT0
213 023c 7c + ALEI 3 ;STROBE 2,3
214 0239 ac + BR NT1
215 0233 7a + ALEI 5 ;STROBE 4,5
216 0227 82 + BR NT2
217 020e ;STROBE 6
218 020e 6c + LMIIY 3
219 021d 8b + BR CNVE
220 023a
221 023a 60 +NT0 LMIIY 0
222 0235 1a + CALL TIM04
223 022b d0 +
224 0216 8b + BR CNVE
225 022c
226 022c 68 +NT1 LMIIY 1
227 0218 00 + NOP
228 0230 00 + NOP
229 0221 8b + BR CNVE
230 0202
231 0202 64 +NT2 LMIIY 2
232 0205 00 + NOP
233 020b
234 020b 48 +CNVE LYI INDAT
235 0217 21 + LAM
236 022e 40 + LYI 0 ;K3 K2 K1 K0 CONVERSION NEWDTL
237 021c 76 + ALEI 6 ;R3 R2 R1 R0
238 0238 88 + BR DWKEY ;0 1 1 1 (7) -->3
239 0231 7e + ALEI 7 ;1 0 1 1 (11) -->2
240 0223 a2 + BR CON4 ;1 1 0 1 (13) -->1
241 0206 75 + ALEI 10 ;1 1 1 0 (14) -->0
242 020d 88 + BR DWKEY
243 021b 7d + ALEI 11 ;EXCEPT 7,11,13,14, THE OTHER VALUES ARE DOUBLE KEYS.
244 0236 93 + BR CON3
245 022d 73 + ALEI 12
246 021a 88 + BR DWKEY
247 0234 7b + ALEI 13

```

Example source using GMS37112

```

248 0229 99      +      BR      CON2
249 0212 77      +      ALEI     14
250 0224 a5      +      BR      CONV
251 0208 10      +DWKEY  BL      MAIN
252 0211 b9      +
253 0222 2b      +CON4   IY
254 0204 1a      +      CALL     TIM03
255 0209 e0      +
256 0213 2b      +CON3   IY
257 0226 1a      +      CALL     TIM03
258 020c e0      +
259 0219 2b      +CON2   IY
260 0232 00      +      NOP
261 0225 23      +CONV   LAY
262 020a 45      +      LYI     NEWDTL ;A + NEWDTL --> NEWDTL
263 0215 25      +      AM
264 022a 03      +      LMA
265 0214 18      +      BL      COUN
266 0228 9c      +
267 0210
268 0210 00      +      NOP
269 0220 a0      +      BR      $
270 0300
271 0300          ;-----
272 0300          PG      03
273 0300          ;-----
274 0300 80      +      BR      $
275 0301
276 0301 46      +CUSREAD LYI     CC6L   ;CUSTOM VALUE 04FBh
277 0303 62      +      LMIIY    4
278 0307 60      +      LMIIY    0
279 030f 6d      +      LMIIY    11
280 031f 6f      +      LMIIY    15
281 033f
282 033f 45      +CUSCOM  LYI     NEWDTL
283 033e 12      +      CALL     BAR      ;MAKE NEWDTL BAR AND NEWDTL BAR
284 033d d3      +
285 033b
286 033b 41      +      LYI     8      ;HEAD HIGH TIME DELAY
287 0337 0d      +      SO          ;9MS (683 STEP)
288 032f 49      +      LYI     9
289 031e 1c      +      CALL     DLY65M
290 033c e2      +
291 0339 1a      +      CALL     TIM27
292 0333 f6      +
293 0327 41      +      LYI     8
294 030e 0c      +      RO          ;HEAD LWO TIME DELAY
295 031d 48      +      LYI     1      ;2.25MS
296 033a 1c      +      CALL     DLY65M
297 0335 e2      +
298 032b 1a      +      CALL     TIM29
299 0316 cd      +
300 032c 40      +      LYI     COUNT  ;REPEAT CHK
301 0318 39      +      TM      REPEAT ;REPEAT CODE
302 0330 a3      +      BR      HD1   ;FULL CODE
303 0321
304 0321 48      +FULCOD  LYI     1      ;2.25MS MORE DELAY , TOTALLY 4.5MS
305 0302 1c      +      CALL     DLY65M
306 0305 e2      +
307 030b 1a      +      CALL     TIM34
308 0317 dc      +
309 032e

```

Example source using GMS37112

```

310 032e 4c + LYI POINT
311 031c 66 + LMIIY CC6L ;TX INITIAL POINT
312 0338 12 + BL TX
313 0331 a7 +
314 0323
315 0323 12 +HD1 CALL PULSE0 ;REPEAT CODE GENERATION
316 0306 c7 +
317 030d 45 + LYI 10 ;REPEAT DELAY
318 031b e2 + CAL DLY65M
319 0336 e2 + CAL DLY65M
320 032d e2 + CAL DLY65M
321 031a 05 + WDTR
322 0334 e2 + CAL DLY65M
323 0329 e2 + CAL DLY65M
324 0312 1a + CALL TIM52
325 0324 f9 +
326 0308 12 + BL DDLY1
327 0311 b4 +
328 0322
329 0322 1a +DLY65M CALL TIM63 ;DELAY ROUTINE
330 0304 c7 +
331 0309 2c +DLY65M1 DY
332 0313 a2 + BR DLY65M
333 0326 0f + RTN
334 030c
335 030c
336 030c 0e + IA ;UNUSED INSTRUCTION IS WRITTEN IN BLANK AREA
337 0319 07 + DA
338 0332 23 + LAY
339 0325 24 + LYA
340 030a 2f + LAZ
341 0315 2e + XMA
342 032a 09 + KNEZ
343 0314 0b + RNEZ
344 0328 29 + ALEM
345 0310 00 + NOP
346 0320
347 0320 a0 + BR $
348 0400
349 0400 ;-----
350 0400 PG 04
351 0400 ;-----
352 0400
353 0400 80 + BR $
354 0401
355 0401 1a +PULSE CALL TIM05
356 0403 e8 +
357 0407 41 +PULSE0 LYI 8 ;0.6MS HIGH PULSE TIME
358 040f 0d + SO
359 041f 1a + CALL TIM41
360 043f f0 +
361 043e 0c + RO
362 043d 4c + LYI POINT
363 043b 22 + LYM
364 0437 1a + BL TIM31
365 042f a3 +
366 041e
367 041e 1a +HGHOUT CALL TIM60 ;1.125 HIGH BIT DELAY TIME
368 043c ff +
369 0439 1a + BL TIM25
370 0433 9a +
371 0427

```

Example source using GMS37112

```

372 0427
373 0427 c7 +TX CAL PULSE0 ;BIT0 TX
374 040e 38 + TM 0
375 041d de + CAL HGHOUT
376 043a c1 + CAL PULSE ;BIT1 TX
377 0435 3a + TM 1
378 042b de + CAL HGHOUT
379 0416 c1 + CAL PULSE ;BIT2 TX
380 042c 39 + TM 2
381 0418 de + CAL HGHOUT
382 0430 c1 + CAL PULSE ;BIT3 TX
383 0421 3b + TM 3
384 0402 de + CAL HGHOUT
385 0405 4c + LYI POINT
386 040b 28 + IM
387 0417 03 + LMA
388 042e 7b + ALEI 13
389 041c a7 + BR TX
390 0438
391 0438 c7 +ENDTX CAL PULSE0 ;END BIT TX
392 0431 05 + WDTR
393 0423 40 + LYI COUNT;REPEAT FLAG SETTING
394 0406 31 + SEM REPEAT
395 040d
396 040d 49 + LYI 9 ;DELAY ROUTINE FOR WHOLE INTERVAL
397 041b 1c + CALL DLY65M
398 0436 e2 +
399 042d 1a + CALL TIM33
400 041a f8 +
401 0434
402 0434 40 +DDL1 LYI 0
403 0429 1c + CALL DLY65M
404 0412 e2 +
405 0424 1c + CALL DLY65M
406 0408 e2 +
407 0411 1a + CALL TIM54
408 0422 de +
409 0404 10 + BL KEY
410 0409 ba +
411 0413
412 0413 e6 +bar cal bar1 ;MAKE BAR SUBROUTINE
413 0426 28 +bar1 im
414 040c 2d + nega
415 0419 2b +COMPART IY
416 0432 2b + IY
417 0425 03 + LMA
418 040a 2c + DY
419 0415 0f + RTN
420 042a
421 042a d4 +DTMOVE CAL DTMOVE1 ;DATAMOVE SUBROUTINE
422 0414 21 +DTMOVE1 LAM
423 0428 99 + BR COMPART
424 0410
425 0410 00 + NOP
426 0420 a0 + BR $
427 0500
428 0500 ;-----
429 0500 PG 05
430 0500 ;-----
431 0500 80 + BR $
432 0501
433 0501 00 +TIM65 NOP ;TIME DELAY ROUTINE

```

Example source using GMS37112

```
434 0503 00      +TIM64      NOP
435 0507 00      +TIM63      NOP
436 050f 00      +TIM62      NOP
437 051f 00      +TIM61      NOP
438 053f 00      +TIM60      NOP
439 053e 00      +TIM59      NOP
440 053d 00      +TIM58      NOP
441 053b 00      +TIM57      NOP
442 0537 00      +TIM56      NOP
443 052f 00      +TIM55      NOP
444 051e 00      +TIM54      NOP
445 053c 00      +TIM53      NOP
446 0539 00      +TIM52      NOP
447 0533 00      +TIM51      NOP
448 0527 00      +TIM50      NOP
449 050e 00      +TIM49      NOP
450 051d 00      +TIM48      NOP
451 053a 00      +TIM47      NOP
452 0535 00      +TIM46      NOP
453 052b 00      +TIM45      NOP
454 0516 00      +TIM44      NOP
455 052c 00      +TIM43      NOP
456 0518 00      +TIM42      NOP
457 0530 00      +TIM41      NOP
458 0521 00      +TIM40      NOP
459 0502 00      +TIM39      NOP
460 0505 00      +TIM38      NOP
461 050b 00      +TIM37      NOP
462 0517 00      +TIM36      NOP
463 052e 00      +TIM35      NOP
464 051c 00      +TIM34      NOP
465 0538 00      +TIM33      NOP
466 0531 00      +TIM32      NOP
467 0523 00      +TIM31      NOP
468 0506 00      +TIM30      NOP
469 050d 00      +TIM29      NOP
470 051b 00      +TIM28      NOP
471 0536 00      +TIM27      NOP
472 052d 00      +TIM26      NOP
473 051a 00      +TIM25      NOP
474 0534 00      +TIM24      NOP
475 0529 00      +TIM23      NOP
476 0512 00      +TIM22      NOP
477 0524 00      +TIM21      NOP
478 0508 00      +TIM20      NOP
479 0511 00      +TIM19      NOP
480 0522 00      +TIM18      NOP
481 0504 00      +TIM17      NOP
482 0509 00      +TIM16      NOP
483 0513 00      +TIM15      NOP
484 0526 00      +TIM14      NOP
485 050c 00      +TIM13      NOP
486 0519 00      +TIM12      NOP
487 0532 00      +TIM11      NOP
488 0525 00      +TIM10      NOP
489 050a 00      +TIM09      NOP
490 0515 00      +TIM08      NOP
491 052a 00      +TIM07      NOP
492 0514 00      +TIM06      NOP
493 0528 00      +TIM05      NOP
494 0510 00      +TIM04      NOP
495 0520 0f      +TIM03      RTN
```