

## uPD1719G

Internal Prescaler, PLL Synthesizer, and LCD driver  
Microcontroller

The uPD1719G is a 4-bit CMOS microcontroller with prescaler that can input up to 150 MHz, PLL synthesizer, and 1/2 duty, 1/2 bias LCD driver.

The 4-bit CPU execute arithmetic operations (AD and SU), boolean operations (EXL), bit test (TMT), carry flag set reset instruction (STC), and timer function.

The 24 I/O ports are controlled by IN and OUT instructions. The serial I/O, 6 bit A/D converter, and clock generator port are controlled by special instructions.

The 16-bit IF counter can input FM/AM IF to detect a valid station during auto tuning.

## Features:

1. 4-bit microcontroller for digital tuning
2. Two modulus prescaler : 150 MHz max.
3. Power supply 5 V +/- 10%
4. CMOS process
5. Power down mode (by CE terminal)
6. Program memory (ROM) 16-bit X 2040 steps
7. Data memory (RAM) 4-bit X 256 word
8. Instruction set : 93
9. Instruction cycle time : 33.3 us ( 4.5 MHz crystal)
10. Arithmetic intructions (12 addition and 12 subtraction)
11. Conditional instruction (AIS <- -> AIN)
12. Data transfer within the same row
13. Data transfer with the registers. (MVRD, MVRS)
14. 16 general purpose registers.
15. Stack level : 3 levels

16. LCD driver (1/2 duty, 1/2 bias, frame frequency : 100 Hz)
17. User programmable PLA for LCD display pattern
18. Power down mode by stopping the clock. (CKSTP)
19. 8 I/O port (PA3 - PA0 : individual pin can be selected  
PC3 - PC0 : 4 bits can be selected either input or output)
20. 12 output ports (PB3 - PB0, PD3 - PD1, CGP, PL3 - PL0  
PL3 - PL0 share pins with LCD segment drivers)
21. Internal serial interface (PA3/SCK : shift clock,  
PA2/SI, serial in, PB0/SO : serial output)
22. 6 bit A/D converter (Vref = VDD : conversion is  
executed in software by TADT and TADF instructions)
23. Clock generator port (Signal Generator (SG) : 180 KHz  
or 18 KHz are divided in 64 steps. Variable Duty Port  
(VDP) : the duty of 2.69 KHz is changed in 64 steps)
24. LCD segment driver and key matrix signal source share  
common ports.
25. Key input port (K3 - K0)
26. I/O instructions (IN and OUT)
27. Port status test (TPT and TPF)
28. External edge triggered interrupt
29. IF counter (Gate duration : 1 ms, 4 ms, 8 ms, infinity  
Maximum input freq. : FMIF = 12 MHz, AMIF = 1 MHz)
30. 125 ms interval timer and timer F/F
31. Internal 5 ms 60 % duty clock
32. PLL lock status test (TUL)
33. PLL dividing number loaded and the PLL method selected  
by one instruction (PLL)
34. Direct connection of FM and AM signals from VCO  
( max : AM = 15 MHz, FM = 150 MHz)
35. Pulse swallowing method and direct method can be  
software selected.
36. Two error out terminal (EO1, EO2)
37. 7 reference frequencies (1 KHz, 5 KHz, 6.25 KHz, 9 KHz,  
10 KHz, 12.5 KHz, 25 KHz)

38. Hardware support :

EVAKIT \*\*\* EVAKIT-1700 + EV-1714  
SE board \*\*\* SE-1700 + EV1714

39. software support : MP/M-86, CP/M base cross assembler  
\*1  
(uS281AS1700, uS171AS1700)

\*1 MP/M-86, CP/M are trademark of Digital Research

**Absolute Maximum Ratings**

parameter	symbol	rating	units
Supply Voltage	VDD	-0.3 to +6.0	V
Input Voltage	VI	-0.3 to +VDD	V
Output Voltage	VO	-0.3 to +VDD	V
Output absorbing current	IO	10	mA
Storage temperature	Tstg	-55 to +125	C
Operating temperature	Topt	-40 to +85	C

**Recommended Operating Conditions**

parameter	symbol	conditions	MIN	TYP	MAX	units
PLL operating	VDDP	VDD1	4.5	5	5.5	V
CPU operating	VDDC	PLL stopped	3.8	5	5.5	V
Data retention	VDDR	crystal stopped	2.5		5.5	V

**Electrical Characteristics (Ta = -40 to +85 C, VDD 4.5 to 5.5V)**

parameter	symbol	conditions	MIN	TYP	MAX	units
High level input voltage	VIH1	PORT A, C	0.7*VDD			V
High level input voltage	VIH2	CE, INT	0.8*VDD			V
High level input voltage	VIH3	K3 - K0	0.6*VDD			V
Low level input voltage	VIL1	PORT A, C			0.2*VDD	V
Low level input voltage	VIL2	K3 - K0, CE, INT			0.2*VDD	V
High level output current	-IOH1	Port A, B, C, D VOH = VDD - 0.4 v	0.4			mA
High level output current	-IOH2	EO1,EO2,CGP,PL3-PL0 VOH = VDD - 1 V	0.5			mA
High level output current	-IOH3	S0 - S23 VOH = VDD - 1V	10	18		uA
Low level output current	IOL1	PORT A, B, C, D, CGP PL3-PL0 VOL = 0.4 V	0.6			mA

parameter	symbol	conditions	MIN	TYP	MAX	UNIT
Low level output current	IOL2	EO1, EO2 VOL = 1 V	0.5			mA
Low level output current	IOL3	S0 - S23 VOL = 1 V	10	30		uA
High level input current	IIH1	K3 - K0 VI = VDD = 4.5 V	15		150	uA
High level input current	IIH2	VCOH, VCOL, XI VI = VDD = 4.5 V	100			uA
Output voltage	VCOM1	COM0, COM1 VDD = 5 V, output open	4.8	5.0		V
Output voltage	VCOM2	COM0, COM1 VDD = 5 V, output open	2.3	2.5	2.7	V
Output voltage	VCOM3	COM0, COM1 VDD = 5 V, output open	0	0.2		V
Output off leak current	IL	EO1, EO2 VO = VDD, TA = 25 C		1 nA	1uA	A
Input frequency	FIN1	VCOH Vi = 0.5 Vp-p	15		150	MHz
Input frequency	FIN2	VCOH Vi = 0.3 Vp-p	15		130	MHz
Input frequency	FIN3	VCOL Vi = 0.5 Vp-p	0.6		15	MHz
Input frequency	FIN4	PAL/FMIF Vi = 0.5 Vp-p			12	MHz
Input frequency	FIN5	PA0/AMIF Vi = 0.5 Vp-p			1	MHz
A/D resolution					6	bit
A/D error		Topt = -10 to +50 C		1	1.5	bit
PLL operating current	IDDP	CPU and PLL operating FIN = 150 MHz VDD = 5 V, Ta = 25 C		15		mA
CPU operating current	IDDC	PLL disabled CPU oper. VDD = 5 V, Ta = 25 C		0.5		mA
Data retention current	IDDR	Xtal off, Ta = 25 C, VDD=5V		10	150	nA

**Pin Description**

PIN #	Symbol	Pin Name	Description
1	NC	No-Connection	
2 3	EO1 EO2	Error Outputs	This is the PLL error out terminals. If the freq. of divided VCO is greater than the reference a high level is output. If lower then a low level is output. The EO pin will float if both are equal.
26,58	GND	Ground	The ground terminal of the device
5	VCOL	local osc signal input low	This terminal receives the local osc outputs (VCO output) from 0.6 to 15 MHz (0.3 Vp-p MIN). Using the direct method 16 to $(2 \text{ exp}12 - 1)$ division can be made. During pulse swallowing method this pin is pulled down to ground
6	VCOH	local osc signal input	This terminal receives the local osc outputs (VCO output) from 15 to 150 MHz (0.5 Vp-p MIN). Using the pulse swallowing method 1024 to $(2 \text{ exp}12 - 1)$ division can be made.
7	CE	Chip enable	This is the device select terminal. When this pin is high level, the device operates normally, PLL operational. When this pin is low level, the CPU is operational but the PLL is disabled. Any input less than 134 uS will not be acceptable. If CKSTP instruction is executed when CE is in low state, the CPU stops and the device will enter the data retention mode. During this power down mode (10 uA typical) the LCD driver is disabled. If CE is in high state then the CKSTP instruction will be treated as a NOP. During the low to high transition of CE line the device is reset and the PC is reset to 0. PORT A, C are set to input.
9   11	PD1   PD3	PORT D	3 bit output port *note 1, 3

12	PC3	PORT C	4-bit input output port. If OUT, SPB, or RPB instruction is used it will be output port. If IN instruction is used then it will be input port. *note 1, 2, 3
15	PC0		
-----			
16	PA0/AMIF	PORT A	4-bit input port. The direction of individual pin is determined by the content of 1FH of BANK0. When the device is reset this port becomes input port. PORT A shares pins with serial I/O. The serial data in and shift clock are common with PA2 and PA3. PA0 and PA1 can be used for IF counters. The AMIF can input up to 1 MHz and the FMIF can input up to 12 MHz. The AMIF is directly fed to the IF counter FMIF is divided by 2 before the signal is fed to the IF counter. * note 1, 2
17	PA1/FMIF		
18	PA2/SI		
19	PA3/SCK		
-----			
20	PB3	PORT B	4 bit output port PB0 is used as serial data out pin when SIO instruction is executed. * note 1, 3
23	PB0/SO		
-----			
24	XO	Crystal	4.5 MHz crystal is connected to this terminal.
25	XI		
-----			
4	VDD	Power Supply	This is the device power supply. (5 V +/- 10 %) During the data retention mode (CE low and CKSTP executed) VDD can be lowered to 2.5 V. When this terminal's voltage is raised from 0 V to 4.5 V the device is reset and the PC is reset to 0. Pin 26 and pin 58 are internally connected, therefore it is not necessary to apply power to both pins.
8			
-----			
27	CGP	Clock Generator port	This terminal is the clock generator port or 1 bit output port selected in software. If this pin is used as CGP it can be used as a variable duty port or signal generator port. The duty of 2.69 KHz is changed by 64 steps during the VDP mode. If SG mode is selected the frequency can be changed 64 steps using 18 KHz or 180 KHz as the reference. When the device is reset the CGP pin is low level. * note 1
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28      S27      LCD  
|      |      segment  
55      S0      outputs

56 dots can be displayed and controlled by the segments and COM0 COM1 matrix.  
S27/PL3 - S24/PL0 can be used as 4 bit output port when not used for LCD segment driver.  
S15/KS15 - S0/KS0 can be used for key matrix source signal.  
\* note when device is reset display will be off mode.

56      COM0      LCD  
57      COM1      Common  
                 Outputs

100 Hz 1/2 duty signal is output via this terminal

59      K3      Key Return  
|      |      signal input  
62      K0

This is the 4 bit key input port. When KIN or KI instruction is executed the key data is stored in specified RAM location.

63      AD      Analog  
                 Digital  
                 Input

A/D converter input. The conversion is made in software so that you have the option of 6-bit to 1-bit resolution.

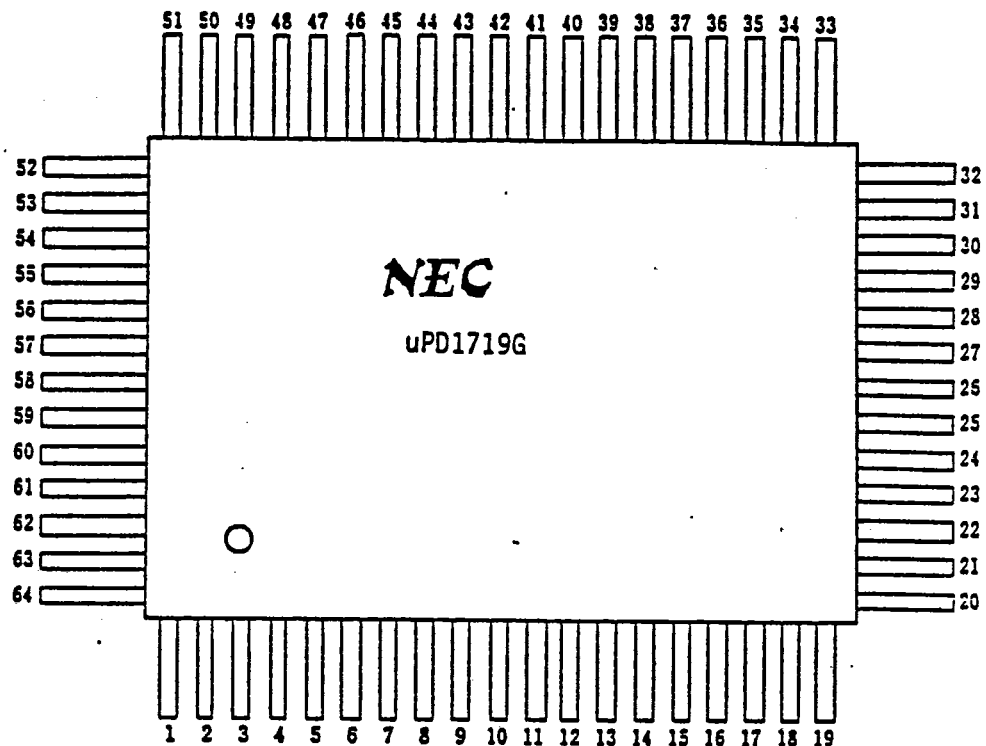
64      INT      Interrupt

When falling edge is detected the program counter is set to location 1.

- \* note 1 When IN, OUT, SPB, RPB instructions are executed PA0 is LSB and PA3 is MSB. PORT B and PORT C are also same as PORT A.
- \* note 2 When the device is reset (VDD low -> high) or CKSTP is executed, PORT A and PORT C are set to input mode.
- \* note 3 PORT B and PORT D data will be indeterminate when device is reset (VDD low -> high). Therefore they must be initialized by the program. When CS low -> high or during CKSTP the output data will not change.



(Top View)

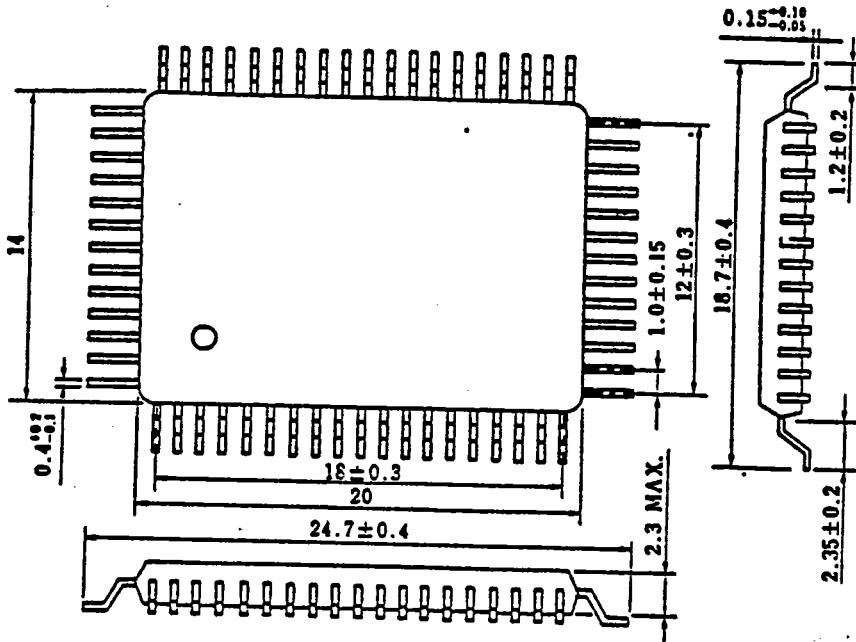


pin#	Symbol	pin#	symbol	pin#	symbol	pin#	symbol
1	NC	17	PA1/FMIF	33	S22	48	S8/KS8
2	EO1	18	PA2/SI	34	S21	50	S5/KS5
3	EO2	19	PA3/SCK	35	S20	51	S4/KS4
4	VDD	20	PB0/SO	36	S19	52	S3/KS3
5	VCOL	21	PB1	37	S18	53	S2/KS2
6	VCOH	22	PB2	38	S17	54	S1/KS1
7	CE	23	PB3	39	S16	55	S0/KS0
8	VDD	24	XO	40	S15/KS15	56	COM0
9	PD1	25	XI	41	S14/KS14	57	COM1
10	PD2	26	GND	42	S13/KS13	58	GND
11	PD3	27	CGP	43	S12/KS12	59	K3
12	PC0	28	S27/PL3	44	S11/KS11	60	K2
13	PC1	29	S26/PL2	45	S10/KS10	61	K1
14	PC2	30	S25/PL1	46	S9/KS9	62	K0
15	PC3	31	S24/PLO	47	S8/KS8	63	AD
16	PA0/AMIF	32	S23	48	S7/KS7	64	INT

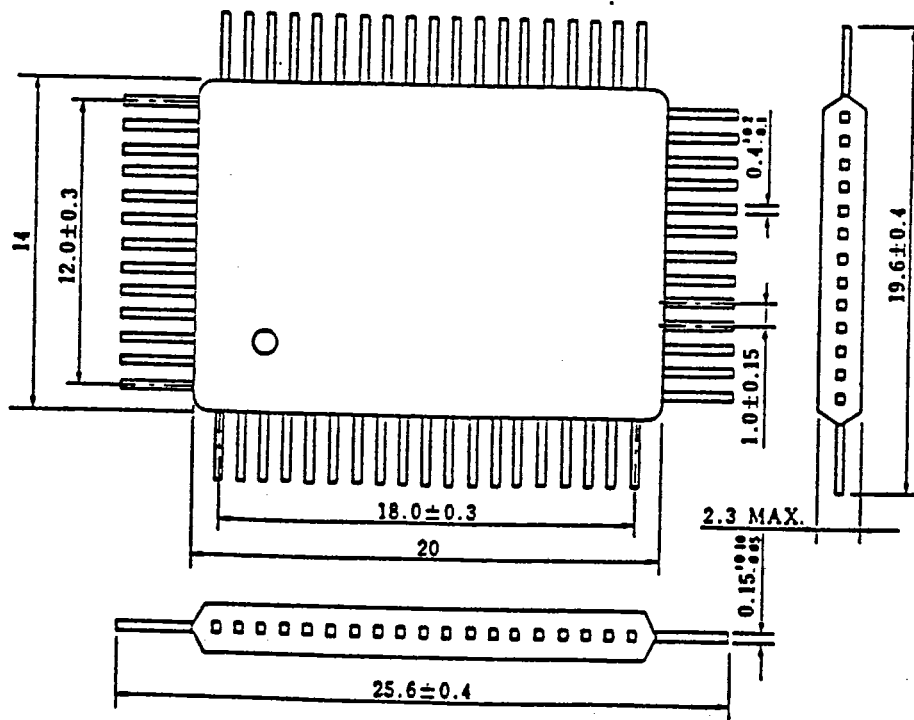
(NC : No Connection)

Package Dimensions (Unit : mm)

bent leads (12)



(11) straight leads





List of  $\mu$ PD1719G instructions

NOTE:  $D_H$ : Data memory address high (row address) (2 bits)  
 $D_L$ : Data memory address low (column address) (4 bits)  
 $R_n$ : Register number (4 bits)  
 $I$ : Immediate data (4 bits)  
 $N$ : Bit position (4 bits)  
**ADDR**: Program memory address (10 bits)  
 —: All "1"  
 $r$ : General register  
 One of addresses 00-0FH of BANK0  
 $M$ : Data memory address  
 One of 00-3FH of BANK0 and 00-3FH of BANK1  
 $P$ : Port 0 ≤ P ≤ 3

$N_1$ : Bit position of status word 1 0 ≤  $N_1$  ≤ 0FH  
 $N_2$ : Bit position of status word 2 0 ≤  $N_2$  ≤ 0FH  
 $( )$ : Contents of register of memory  
 $c$ : Carry  
 $b$ : Borrow  
 $s$ : Data to S.M.R. 0 ≤  $s$  ≤ 0FH  
 $w$ : Data to IF Control Word 0 ≤  $w$  ≤ 0FH  
 $t$ : Trigger conditions 0 ≤  $t$  ≤ 3  
 $h$ : Halt release conditions 0 ≤  $h$  ≤ 0FH

	Mnemonic	Operand		Function	Operation	Machine code			
		1ST	2ND			Operation code			
Addition	AD	r	M	Add memory to register	$r ← (r) + (M)$	110100	$D_H$	$D_L$	$R_n$
	ADS	r	M	Add memory to register, then skip if carry	$r ← (r) + (M)$ skip if carry	111100	$D_H$	$D_L$	$R_n$
	ADN	r	M	Add memory to register, then skip if not carry	$r ← (r) + (M)$ skip if not carry	111000	$D_H$	$D_L$	$R_n$
	AC	r	M	Add memory to register with carry	$r ← (r) + (M) + c$	110110	$D_H$	$D_L$	$R_n$
	ACS	r	M	Add memory to register with carry, then skip if carry	$r ← (r) + (M) + c$ skip if carry	111110	$D_H$	$D_L$	$R_n$
	ACN	r	M	Add memory to register with carry, then skip if not carry	$r ← (r) + (M) + c$ skip if not carry	111010	$D_H$	$D_L$	$R_n$
	AI	M	I	Add immediate data to memory	$M ← (M) + I$	010100	$D_H$	$D_L$	I
	AIS	M	I	Add immediate data to memory, then skip if carry	$M ← (M) + I$ skip if carry	011100	$D_H$	$D_L$	I
	AIN	M	I	Add immediate data to memory, then skip if not carry	$M ← (M) + I$ skip if not carry	011000	$D_H$	$D_L$	I
	AIC	M	I	Add immediate data to memory with carry	$M ← (M) + I + c$	010110	$D_H$	$D_L$	I
	AICS	M	I	Add immediate data to memory with carry, then skip if carry	$M ← (M) + I + c$ skip if carry	011110	$D_H$	$D_L$	I
	AICN	M	I	Add immediate data to memory with carry, then skip if not carry	$M ← (M) + I + c$ skip if not carry	011010	$D_H$	$D_L$	I
Subtraction	SU	r	M	Subtract memory from register	$r ← (r) - (M)$	110101	$D_H$	$D_L$	$R_n$
	SUS	r	M	Subtract memory from register, then skip if borrow	$r ← (r) - (M)$ skip if borrow	111101	$D_H$	$D_L$	$R_n$
	SUN	r	M	Subtract memory from register, then skip if not borrow	$r ← (r) - (M)$ skip if not borrow	111001	$D_H$	$D_L$	$R_n$
	SB	r	M	Subtract memory from register with borrow	$r ← (r) - (M) - b$	110111	$D_H$	$D_L$	$R_n$
	SBS	r	M	Subtract memory from register with borrow, then skip if borrow	$r ← (r) - (M) - b$ skip if borrow	111111	$D_H$	$D_L$	$R_n$
	SBN	r	M	Subtract memory from register with borrow, then skip if not borrow	$r ← (r) - (M) - b$ skip if not borrow	111011	$D_H$	$D_L$	$R_n$
	SI	M	I	Subtract immediate data from memory	$M ← (M) - I$	010101	$D_H$	$D_L$	I
	SIS	M	I	Subtract immediate data from memory, then skip if borrow	$M ← (M) - I$ skip if borrow	011101	$D_H$	$D_L$	I
	SIN	M	I	Subtract immediate data from memory, then skip if not borrow	$M ← (M) - I$ skip if not borrow	011001	$D_H$	$D_L$	I
	SIB	M	I	Subtract immediate data from memory with borrow	$M ← (M) - I - b$	010111	$D_H$	$D_L$	I
	SIBS	M	I	Subtract immediate data from memory with borrow, then skip if borrow	$M ← (M) - I - b$ skip if borrow	011111	$D_H$	$D_L$	I
	SIBN	M	I	Subtract immediate data from memory with borrow, then skip if not borrow	$M ← (M) - I - b$ skip if not borrow	011011	$D_H$	$D_L$	I

	Mnemonic	Operand		Function	Operation	Machine code			
		1ST	2ND			Operation code			
Comparison	SEQ	r	M	Skip if register equals memory	r-M skip if zero	1 0 1 1 1 0	D <sub>H</sub>	D <sub>L</sub>	R <sub>n</sub>
	SNE	r	M	Skip if register not equals memory	r-M skip if not zero	1 0 1 1 1 1	D <sub>H</sub>	D <sub>L</sub>	R <sub>n</sub>
	SGE	r	M	Skip if register is greater than or equal to memory	r-M skip if not borrow (r) ≥ (M)	1 0 1 1 0 1	D <sub>H</sub>	D <sub>L</sub>	R <sub>n</sub>
	SLT	r	M	Skip if register is less than memory	r-M skip if borrow (r) < (M)	1 0 1 1 0 0	D <sub>H</sub>	D <sub>L</sub>	R <sub>n</sub>
	SEQI	M	I	Skip if memory equals immediate data	M-I skip if zero	0 0 1 1 1 0	D <sub>H</sub>	D <sub>L</sub>	I
	SNEI	M	I	Skip if memory not equals immediate data	M-I skip if not zero	0 0 1 1 1 1	D <sub>H</sub>	D <sub>L</sub>	I
	SGEI	M	I	Skip if memory is greater than or equal to immediate data	M-I skip if not borrow (M) ≥ I	0 0 1 1 0 1	D <sub>H</sub>	D <sub>L</sub>	I
	SLTI	M	I	Skip if memory is less than immediate data	M-I skip if borrow (M) < I	0 0 1 1 0 0	D <sub>H</sub>	D <sub>L</sub>	I
Logical operation	ANI	M	I	Logic AND of memory and immediate data	M-(M) ∧ I	0 1 0 0 1 1	D <sub>H</sub>	D <sub>L</sub>	I
	ORI	M	I	Logic OR of memory and immediate data	M-(M) ∨ I	0 1 0 0 0 1	D <sub>H</sub>	D <sub>L</sub>	I
	EXL	r	M	Exclusive OR Logic of memory and register	r-(r) ⊕ (M)	1 0 0 1 0 1	D <sub>H</sub>	D <sub>L</sub>	R <sub>n</sub>
Transfer	LD	r	M	Load memory to register	r←(M)	1 0 0 1 1 0	D <sub>H</sub>	D <sub>L</sub>	R <sub>n</sub>
	ST	M	r	Store register to memory	M←(r)	1 1 0 0 0 0	D <sub>H</sub>	D <sub>L</sub>	R <sub>n</sub>
	MVRD	r	M	Move memory to destination memory referring to register in the same row	(D <sub>H</sub> , R <sub>n</sub> )←(M)	1 1 0 0 1 1	D <sub>H</sub>	D <sub>L</sub>	R <sub>n</sub>
	MVRS	M	r	Move source memory referring to register to memory in the same row	M←(D <sub>H</sub> , R <sub>n</sub> )	1 1 0 0 0 1	D <sub>H</sub>	D <sub>L</sub>	R <sub>n</sub>
	MVSR	M <sub>1</sub>	M <sub>2</sub>	Move memory to memory in the same row	(D <sub>H</sub> , D <sub>L1</sub> )←(D <sub>H</sub> , D <sub>L2</sub> )	1 0 0 1 0 0	D <sub>H</sub>	D <sub>L1</sub>	D <sub>L2</sub>
	MVI	M	I	Move immediate data to memory	M← I	0 1 0 0 1 0	D <sub>H</sub>	D <sub>L</sub>	I
	PLL	M	r	Load N0-N3, N <sub>r</sub> & memory to PLL registers	PLL <sub>r</sub> ←(N0-N3), N <sub>r</sub> & (M)	1 0 1 0 1 1	D <sub>H</sub>	D <sub>L</sub>	R <sub>n</sub>
Bit test	TMT	M	N	Test memory bits, then skip if all bits specified are true	if M(N)=all "1", then skip	0 0 1 0 1 1	D <sub>H</sub>	D <sub>L</sub>	N
	TMF	M	N	Test memory bits, then skip if all bits specified are false	if M(N)=all "0", then skip	0 0 1 0 1 0	D <sub>H</sub>	D <sub>L</sub>	N
Jump	JMP	ADDR		Jump to the address specified in page 0	PC←ADDR, PAGE←0	0 0 0 1 1 0	ADDR(10 bits)		
				Jump to the address specified in page 1	PC←ADDR, PAGE←1	0 0 0 0 1 0	ADDR(10 bits)		
Subroutine	CAL	ADDR		Call subroutine in page 0	Stack←((PC)+1, PAGE), PC←ADDR, PAGE←0	0 0 0 1 1 1	ADDR(10 bits)		
	RT			Return to main routine	PC←(stack)	0 0 0 1 0 0	-	-	-
	RTS			Return to main routine, then skip unconditional	PC←(stack), and skip	0 0 0 1 0 1	-	-	-
Interrupt	EI			Enable interrupt	INTE F/F←1	0 0 0 0 0 1	-	0 0 0 1	-
	DI			Disable interrupt	INTE F/F←0	0 0 0 0 1 1	-	0 0 0 1	-
F/F test	TTM			Test and reset timer F/F, then skip if it has not been set	if Timer F/F=1, then Timer F/F←0 if Timer F/F=0, then skip	1 0 1 0 0 1	-	-	-
	TUL			Test and reset unlock F/F, then skip if it has not been set	if UL F/F=1, then UL F/F←0 if UL F/F=0, then skip	1 0 1 0 1 0	-	-	-
	TKLT			Test then reset Key Latch F/F, then skip if true	if KL F/F=1, then skip and KL F/F←0	1 0 1 0 0 0	-	0 0 0 1	-
	TKLF			Test then reset Key Latch F/F, then skip if false	if KL F/F=1, then KL F/F←0 if KL F/F=0, then skip	1 0 1 0 0 0	0 1	0 0 0 1	-
Test timer	TIP			Test interval pulse, then skip if low	if IPG=0, then skip	1 0 1 0 0 1	-	0 0 0 0	0 0 0 0
IF counter	IFCW	w		Set immediate data to IFCW	IFCW←w	0 0 0 0 0 0	1 0	0 0 0 0	w
	IFC	t		Trigger and/or reset IF counter	Trigger←t <sub>1</sub> , Reset←t <sub>2</sub>	0 0 0 0 0 0	0 1	0 0 0 0	0 0 t
	TGC			Test IF counter gate, skip if close	if IFC gate=close, then skip	1 0 1 0 0 1	0 0	-	-

	Mnemonic	Operand		Function	Operation	Machine code			
		1ST	2ND			Operation code			
Status word and terminal test	SS	N <sub>1</sub>		Set status word 1	(STATUS WORD 1) <sub>N</sub> -1	0 0 0 0 0 1	-	N <sub>1</sub>	-
	RS	N <sub>1</sub>		Reset status word 1	(STATUS WORD 1) <sub>N</sub> -0	0 0 0 0 1 1	-	N <sub>1</sub>	-
	TST	N <sub>2</sub>		Test status word 2 true	if (STATUS WORD 2) <sub>N</sub> =all 1s, then skip	0 0 1 0 0 1	-	N <sub>2</sub>	-
	TSF	N <sub>2</sub>		Test status word 2 false	if (STATUS WORD 2) <sub>N</sub> =all 0s, then skip	0 0 1 0 0 0	-	N <sub>2</sub>	-
	STC			Set carry F/F	carry F/F-1	0 0 0 0 0 1	-	0 0 1 0	-
	RSC			Reset carry F/F	carry F/F-0	0 0 0 0 1 1	-	0 0 1 0	-
	BANK0			Select BANK0	BANK F/F0-0, BANK F/F1-0	0 0 0 0 1 1	-	1 1 0 0	-
	BANK1			Select BANK1	BANK F/F0-1, BANK F/F1-0	0 0 0 0 0 1	-	0 1 0 0	-
	BANK2			Select BANK2	BANK F/F0-0, BANK F/F1-1	0 0 0 0 0 1	-	1 0 0 0	-
	BANK3			Select BANK3	BANK F/F0-1, BANK F/F1-1	0 0 0 0 0 1	-	1 1 0 0	-
	TITT			Test INT, skip if true	if INT=0, then skip	0 0 1 0 0 1	-	0 0 0 1	-
	TITF			Test INT, skip if false	if INT=1, then skip	0 0 1 0 0 0	-	0 0 0 1	-
	TCET			Test CE, skip if true	if CE=1, then skip	0 0 1 0 0 1	-	0 0 1 0	-
	TCEF			Test CE, skip if false	if CE=0, then skip	0 0 1 0 0 0	-	0 0 1 0	-
	SBK0			Skip if BANK0	if BANK F/F0=BANK F/F1=0, then skip	0 0 1 0 0 0	-	1 1 0 0	-
	TBOT			Test BANK F/F0, skip if true	if BANK F/F0=1, then skip	0 0 1 0 0 1	-	0 1 0 0	-
	TBOF			Test BANK F/F0, skip if false	if BANK F/F0=0, then skip	0 0 1 0 0 0	-	0 1 0 0	-
	TBIT			Test BANK F/F1, skip if true	if BANK F/F1=1, then skip	0 0 1 0 0 1	-	1 0 0 0	-
TBIF			Test BANK F/F1, skip if false	if BANK F/F1=0, then skip	0 0 1 0 0 0	-	1 0 0 0	-	
Input / output	LCDD	M	D	Output segment pattern to LCD digit 'D' based on memory, or output to LCD digit directly	LCD(D)-SEG PLA-(M), or LCD(D)-(M)	1 0 0 1 1 1	D <sub>H</sub>	D	D <sub>L</sub>
	KI	M		Input key data to memory	M-K <sub>n-1</sub>	0 1 0 0 0 0	D <sub>H</sub>	D <sub>L</sub>	0 0 0 0
	KIN	M		Input key data to memory, then skip if data are zero	M-K <sub>n-1</sub> , skip if (M)=0	0 1 0 0 0 0	D <sub>H</sub>	D <sub>L</sub>	-
	IN	r	P	Input data on port to register	r←(Port (P))	1 1 0 0 1 0	P	-	R <sub>n</sub>
	OUT	P	r	Output contents of register to port	(Port (P))←(r)	1 0 0 0 1 0	P	-	R <sub>n</sub>
	SPB	P	N	Set port bits	(Port (P)) <sub>N</sub> -1	0 0 0 0 0 1	P	0 0 0 0	N
	RPB	P	N	Reset port bits	(Port (P)) <sub>N</sub> -0	0 0 0 0 1 1	P	0 0 0 0	N
	TPT	P	N	Test port bits, then skip if all bits specified are true	if (Port (P)) <sub>N</sub> =all 1s, then skip	0 0 1 0 0 1	P	0 0 0 0	N
TPF	P	N	Test port bits, then skip if all bits specified are false	if (Port (P)) <sub>N</sub> =all 0s, then skip	0 0 1 0 0 0	P	0 0 0 0	N	
Serial I/O	SIO	s		Serial input/output	SMR (3.1.0)-s (3.1.0)	0 0 0 0 0 0	0 0	0 0 0 1	s
	TSET			Test shift end, then skip if true	if SCC=8/(2n+1), then skip (n≥0)	1 0 1 0 0 0	1 0	0 0 0 1	-
	TSEF			Test shift end, then skip if false	if SCC=8/(2n+1), then skip (n≥0)	1 0 1 0 0 0	0 0	0 0 0 1	-
Test A/D	TADT			Test A-D comparator, then skip if true	if V <sub>in</sub> > V <sub>comp</sub> , then skip	1 0 1 0 0 0	0 0	0 0 0 0	-
	TADF			Test A-D comparator, then skip if false	if V <sub>in</sub> ≤ V <sub>comp</sub> , then skip	1 0 1 0 0 0	1 0	0 0 0 0	-
Others	CKSTP			Clock stop by CE	stop clock if CE=0	1 0 0 0 1 1	-	1 1 1 0	1 1 1 0
	HALT	h		Halt the CPU. Restart by condition h	Halt	1 0 0 0 1 1	0 0	-	h
	NOP			No operation		0 0 0 0 0 0	-	-	-