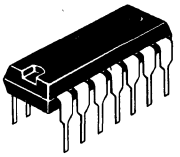
M58653P



700-BIT (50-WORD BY 14-BIT) ELECTRICALLY ALTERABLE ROM

DESCRIPTION

The M58653P is a serial input/output 700 bit electrically erasable and reprogrammable ROM organized as 50 words of 14 bits, and fabricated using MNOS technology. Data and addresses are transferred serially via a one-bit bidirectional bus.

FEATURES

- Word-by-word electrically alterable
- Non-volatile data storage . . . . . 10 years (min)
- Write/erase time 20ms/word
- Typical power supply voltages . . . . . -30V, +5V
- Number of erase-write cycles . . . . . 10^5 times (min)
- Number of read access unrefreshed. . . 10^9 times (min)
- 5V I/O interface

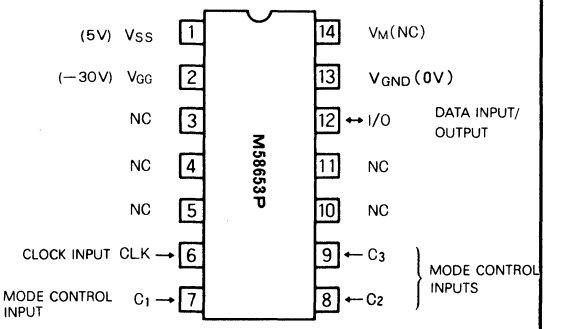
APPLICATION

- Non-volatile channel memories for electronic tuning systems and field-reprogrammable read-only memory systems

FUNCTION

The address is designated by two consecutive one-of-ten-coded digits. Seven modes—accept address, accept data, shift data output, erase, write, read, and standby—are all selected by a 3-bit code applied to C_1, C_2, and C_3. Data is stored by internal negative writing pulses that selectively tunnel charges into the SiO_2—Si_3N_4 interface of the gate insulators of the MNOS memory transistors.

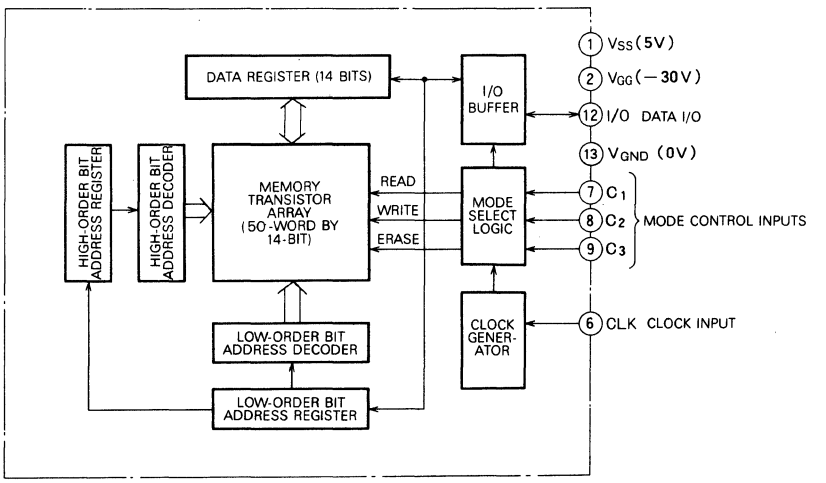
PIN CONFIGURATION (TOP VIEW)



Outline 14P4

NC: NO CONNECTION

BLOCK DIAGRAM



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PIN DESCRIPTION

Pin	Name	Functions
I/O	I/O	In the accept address and accept data modes, used for input. In the shift data output mode, used for output. In the standby, read, erase and write modes, this pin is in a floating state.
V_M	Test	Used for testing purposes only. It should be left unconnected during normal operation.
V_{SS}	Chip substrate voltage	Normally connected to +5V.
V_{GG}	Power supply voltage	Normally connected to −30V.
CLK	Clock input	14kHz timing reference. Required for all operating modes. High-level input is possible during standby mode.
$C_1 \sim C_3$	Mode control input	Used to select the operation mode.
V_{GND}	Ground voltage	Connected to ground (0V)

OPERATION MODES

C_1	C_2	C_3	Functions
H	H	H	Standby mode: The contents of the address registers and the data register remain unchanged. The output buffer is held in the floating state.
H	H	L	Not used.
H	L	H	Erase mode: The word stored at the addressed location is erased. The data bits after erasing are all low-level.
H	L	L	Accept address mode: Data presented at the I/O pin is shifted into the address registers one bit with each clock pulse. The address is designated by two one-of-ten-coded digits.
L	H	H	Read mode: The addressed word is read from the memory into the data register.
L	H	L	Shift data output mode: The output driver is enabled and the contents of the data register are shifted to the I/O pin one bit with each clock pulse.
L	L	H	Write mode: The data contained in the data register is written into the location designated by the address registers.
L	L	L	Accept data mode: The data register accepts serial data from the I/O pin one bit with each clock pulse. The address registers remain unchanged.

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ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Conditions	Limits	Unit
V_{GG}	Supply voltage	With respect to V_{SS}	0.3 ~ −40	V
V_I	Input voltage		0.3 ~ −20	V
V_O	Output voltage		0.3 ~ −20	V
Tstg	Storage temperature range		−40 ~ 125	℃
Topr	Operating free-air temperature range		−10 ~ 70	℃

RECOMMENDED OPERATING CONDITIONS (Ta = −10 ~ 70℃, unless otherwise noted.)

Symbol	Parameter	Limits			Unit
		Min	Nom	Max	
V_{GG}-V_{SS}	Supply voltage	−32.2	−35	−37.8	V
V_{SS}-V_{GND}	Supply voltage	4.75	5	6	V
V_{IH}	High-level input voltage	V_{SS}−1		V_{SS}+0.3	V
V_{IL}	Low-level input voltage	V_{SS}-6.5		V_{SS}-4.25	V

Note 1:
The order of V_{SS} V_{GG} with on or off.
With on, V_{GG} is turned on after V_{SS} is done.
With off, V_{SS} is turned off after V_{GG} is done.

ELECTRICAL CHARACTERISTICS (Ta = −10 ~ 70℃, V_{GG}-V_{SS} = −35V ± 8%, V_{SS}-V_{GND} = 5V $^{+20\%}_{-5\%}$, unless otherwise noted.)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{IH}	High-level input voltage		V_{SS}−1		V_{SS}+0.3	V
V_{IL}	Low-level input voltage		V_{SS}-6.5		V_{SS}-4.25	V
I_{IL}	Low-level input current	V_I-V_{SS} = −6.5V			±10	μA
I_{OZL}	Off-state output current, low-level voltage applied	V_O-V_{SS} = −6.5V			±10	μA
V_{OH}	High-level output voltage	I_{OH} = −200μA	V_{SS}−1			V
V_{OL}	Low-level output voltage	I_{OL} = 10μA			V_{GND}+0.5	V
I_{GG}	Supply current from V_{GG}	I_O = 0μA		5.5	8.8	mA

Note 2: Typical values are at Ta=25°C and nominal supply voltage.

TIMING REQUIREMENTS (Ta = −10 ~ 70℃, V_{GG}-V_{SS} = −35V ± 8%, V_{SS}-V_{GND} = 5V $^{+20\%}_{-5\%}$, unless otherwise noted.)

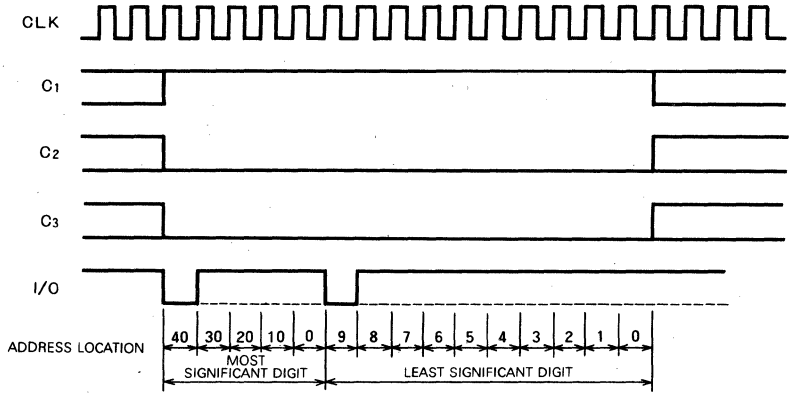
Symbol	Parameter	Alternative symbols	Test conditions	Limits			Unit
				Min	Typ	Max	
f(φ)	Clock frequency	fφ		11.2	14	16.8	kHz
D(φ)	Clock duty cycle	Dφ		30	50	55	%
tw(w)	Write time	tw		16	20	24	ms
tw(E)	Erase time	te		16	20	24	ms
tr, tf	Risetime, falltime	tr, tf				1	μs
tsu(c−φ)	Control setup time before the fall of the clock pulse	tCS		0			ns
th(φ−c)	Control hold time after the rise of the clock pulse	tCH		0			ns

SWITCHING CHARACTERISTICS (Ta = −10 ~ 70℃, V_{GG} = −35V ± 8%, unless otherwise noted.)

Symbol	Parameter	Alternative symbols	Test conditions	Limits			Unit
				Min	Typ	Max	
ta(c)	Read access time	tPW	C_L = 100PF, V_{OH} = V_{SS} − 2V, V_{OL} = V_{GND} + 1.5V			20	μs
ts	Unpowered nonvolatile data retention time	Ts	N_{EW} = 10^4, tw(w) = 20ms, tw(E) = 20ms	10			Year
		Ts	N_{EW} = 10^5, tw(w) = 20ms, tw(E) = 20ms	1			Year
N_{EW}	Number of erase/write cycles	Nw		10^5			Times
N_{RA}	Number of read access unrefreshed	N_{RA}		10^9			Times
tdv	Data valid time	tPW				20	μs

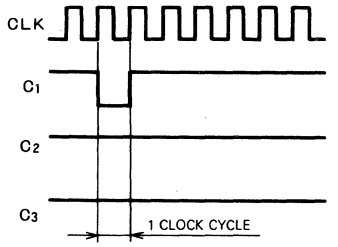
TIMING DIAGRAM

Accept Address Mode

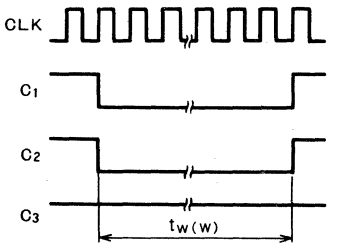


Note 3: The address is designated by two one-of-ten-coded digits. The figure shows designation of the address 49.

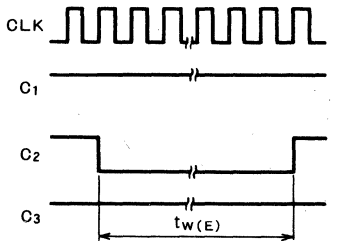
Read Mode



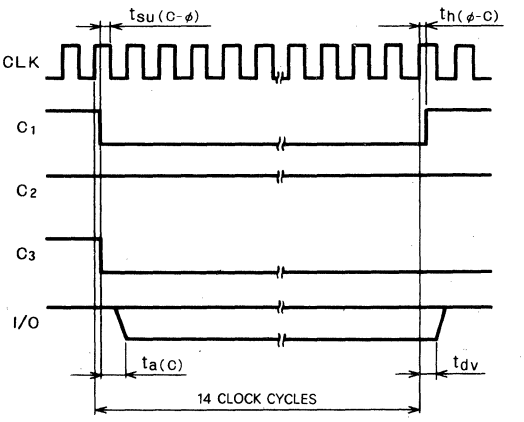
Write Mode



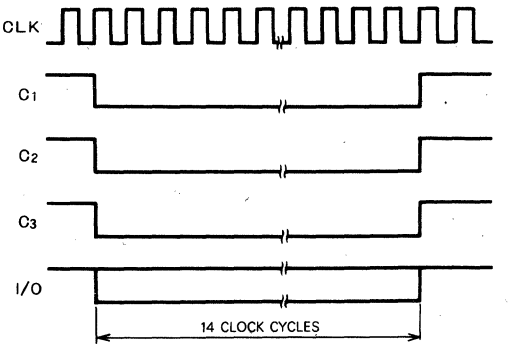
Erase Mode



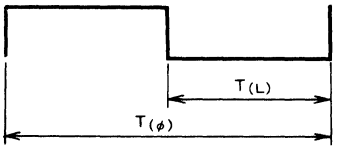
Shift Data Output Mode



Accept Data Mode



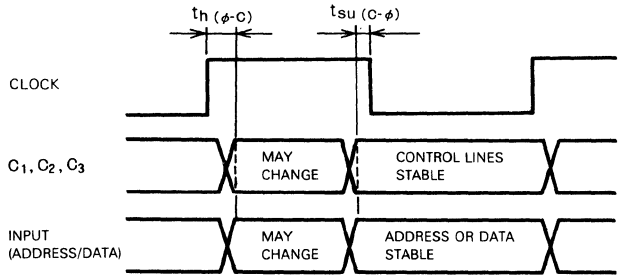
- **The difinition of clock duty cycle, D (ϕ)**



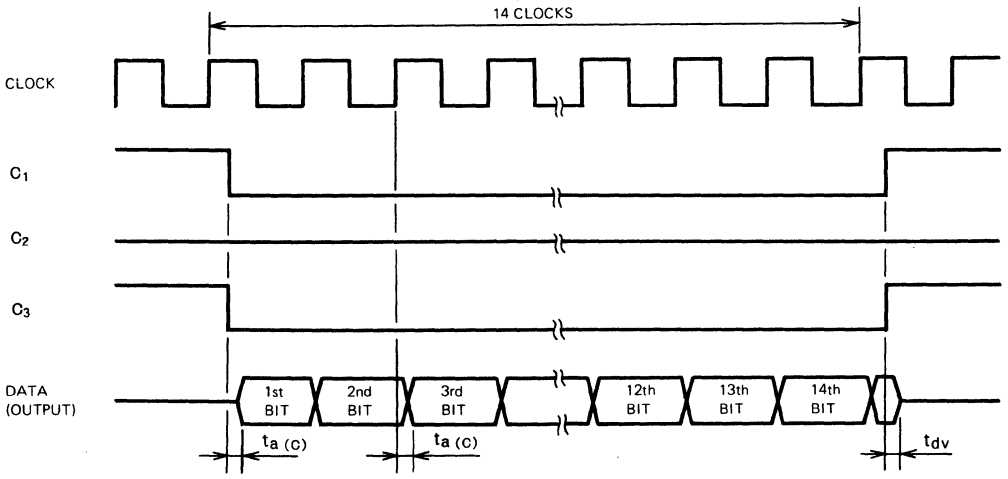
$D(\phi) = T(L)/T(\phi)$

- **Timing of data input and mode control inputs**

Mode control inputs, C_1, C_2, C_3 and input signal my change, when clock is 'H' level.



- **Timing of data output**



The 1st bit of output data is output after access time of $t_{a(C)}$ from the mode control transition. And other bits are output after $t_{a(C)}$ from positive edge of clock.

• Operating sequential flow