FULLY DECODED 2048 BIT ELECTRICALLY ERASABLE AND PROGRAMMABLE READ ONLY MEMORY

DESCRIPTION

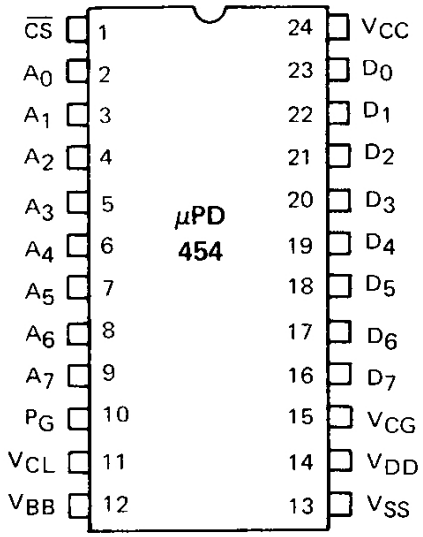
The μPD454 EEPROM, a 256 Words x 8 Bits Read Only Memory, is designed for rapid development of microcomputer systems. The ability to electrically program, erase, and reprogram the μPD454 provides a fast and convenient means of debugging both hardware and software designs.

The μPD454 is pin for pin compatible with NEC's μPD464 mask programmed ROM.

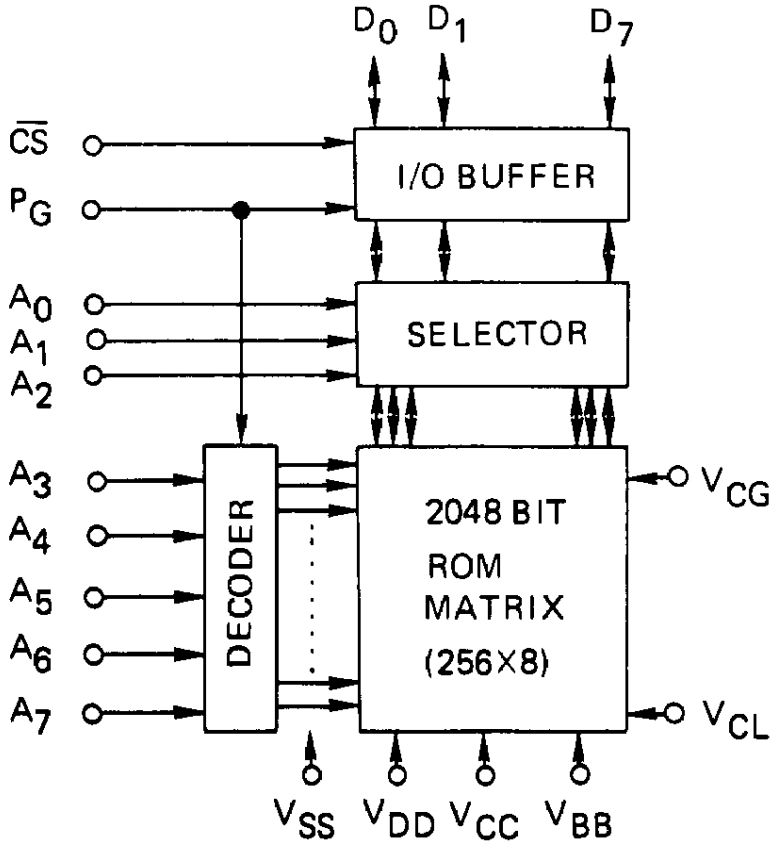
FEATURES

- Electrically Erasable and Programmable
- Fully Decoded, 256 Words x 8 Bits Organization
- Access Time 800 ns Max
- Low Power: 245 mW (Typ.) in Read Operation
  670 mW (Typ.) in Programming Operation
- Fast Programming and Erasure Speed
- Low Power for Programming and Erasure
- Static, No Clock Required
- Input/Output TTL Compatible for Read and Programming Operation
- Three-State Output, OR-Tie Capability
- N-Channel MOS Fabrication
- Two Power Supplies, +12V and +5V for Read Operation
- 24 Pin Ceramic DIP

PIN CONFIGURATION



BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS*

Operating Temperature	−10°C to +70°C
Storage Temperature	−40°C to +125°C
All Output Voltages	−0.3 to +11 Volts①
All Input Voltages	−0.3 to +11 Volts①
Supply Voltage V_{DD}	−0.3 to +15 Volts①
Supply Voltage V_{CC}	−0.3 to +7 Volts①
Supply Voltage V_{BB}	V_{SS} to −7 Volts②
Supply Voltage P_G	−0.3 to +30 Volts①②
Supply Voltage V_{CL}	−0.3 to +43 Volts①②
Supply Voltage V_{CG}	−44 to +30 Volts①②

Notes: ① Relative to V_{BB}.

② Data in the memory cell is not guaranteed to be preserved.

Specifies ratings which will not cause permanent damage to the device.

COMMENT: Stress above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

*T_a = 25°C

CAPACITANCE

PARAMETER	SYMBOL	LIMITS			UNIT	TEST CONDITIONS
		MIN	TYP	MAX		
Input Capacitance	C_{IN}			10	pF	f = 1 MHz
Output Capacitance	C_{OUT}			15	pF	f = 1 MHz

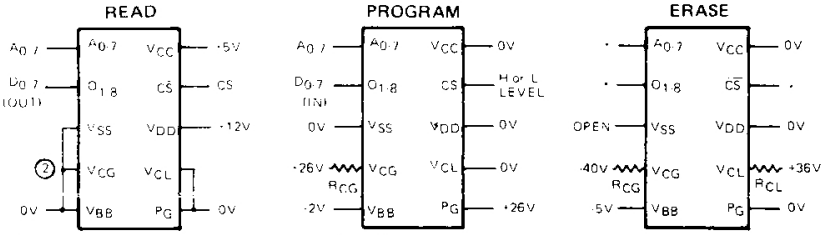
PIN DEFINITION

PIN NO.	PIN SYMBOL	PIN NAME	FUNCTION
1	$\overline{CS}$	CHIP SELECT	Chip selection, active low
2-9	A_0–A_7	ADDRESS BUS	Memory address
10	P_G	+26V (TYP) Power Supply	Power supply for programming operation
11	V_{CL}	+36V (TYP) Power Supply	Power supply for erasing operations
12	V_{BB}	Substrate Power Supply	Power supply
13	V_{SS}	GROUND	Ground Reference
14	V_{DD}	+12V Power Supply	Power supply for read operations
15	V_{CG}	−44 to +30 Power Supply	Power supply for control of programming and erasure operations
16-23	D_7–D_0	Data Input/Output	Data In for programming operations. Data Output for read operations.
24	V_{CC}	+5V Power Supply	Power supply for read operations

SUPPLY VOLTAGES

Typical values. Unit: Voltage.

MODE \ PIN	V_{DD}(14)	V_{CC}(24)	V_{BB}(14)	P_G(10)	V_{CL}(11)	V_{CG}(15)	V_{SS}(13)
Read	+12	+5	0	0	0	0	0
Program	0	0	2	+26	0	+26	0
Erase	0	0	5	0	+36	40	Open
Verify "0"	+12	+5		0	0	+3	0
Verify "1"	+12	+5		0	0	−3	0

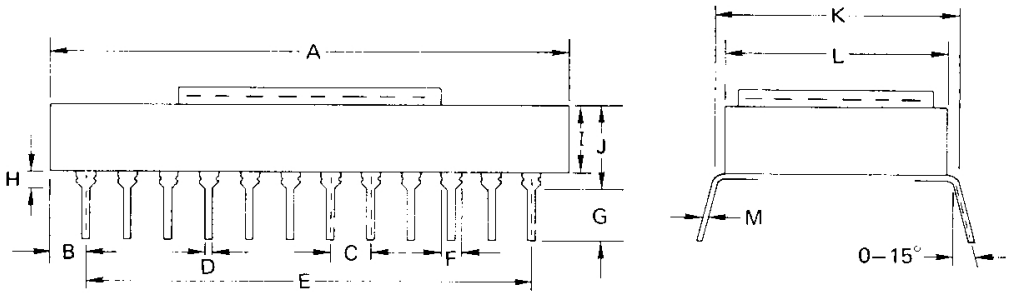


Notes: * = Either High or Low Level, or Open.

① R_{CG} and R_{CL} are Protection Resistors
R_{CG} = 10 kΩ ± 10%, 1/4W
R_{CL} = 200Ω ± 10%, 10W

② R_{CG} may be left connected in Read Mode

PACKAGE OUTLINE μPD454D



ITEM	MILLIMETERS	INCHES
A	32.5 MAX	1.28 MAX
B	2.28	0.09
C	2.54	0.1
D	0.5 ± 0.1	0.02 ± 0.004
E	27.94	1.1
F	1.20 MIN	0.047 MIN
G	3.2 MIN	0.126 MIN
H	1.0 MIN	0.04 MIN
I	4.2 MAX	0.165 MAX
J	5.2 MAX	0.205 MAX
K	15.24	0.6
L	13.9	0.55
M	0.30 ± 0.1	0.012 ± 0.004

READ OPERATION

DC CHARACTERISTICS

T_a = −10 to +70°C, V_{DD} = +12V ± 5%, V_{CC} = +5V ± 5%,
V_{BB} = P_G = V_{CL} = V_{CG} = V_{SS} = 0V

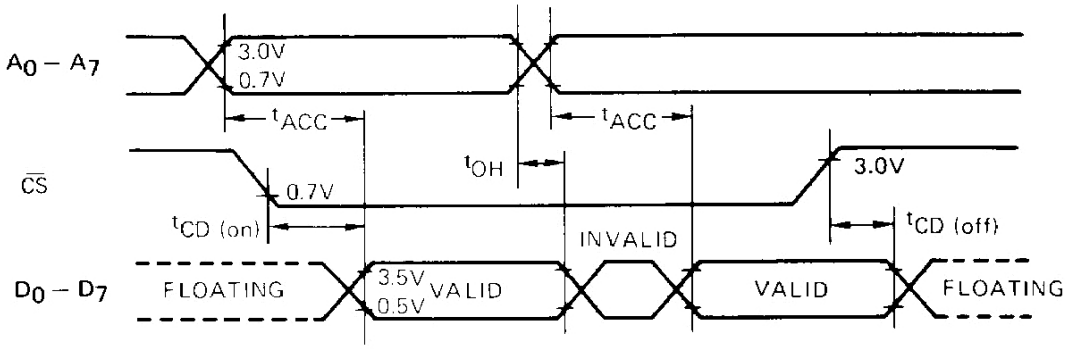
PARAMETER	SYMBOL	LIMITS			UNIT	TEST CONDITIONS
		MIN	TYP	MAX		
Input High Voltage	V_{IH}	3.0		V_{CC}	V	
Input Low Voltage	V_{IL}	0		0.7	V	
Output High Voltage	V_{OH}	3.5			V	I_{OH} = −2.0 mA
Output Low Voltage	V_{OL}			0.5	V	I_{OL} = 1.7 mA
Input Leakage Current High	I_{LIH}			+10	μA	V_I = +3.0V
Input Leakage Current Low	I_{LIL}			-10	μA	V_I = +0.7V
Output Leakage Current High	I_{LOH}			+100	μA	$\overline{CS}$ = "1" V_O = 3.5V
Output Leakage Current Low	I_{LOL}			-10	μA	$\overline{CS}$ = "1" V_O = 0.4V
V_{DD} Supply Current	I_{DD}		20		mA	
V_{CC} Supply Current	I_{CC}			0.3	mA	with no load

AC CHARACTERISTICS

T_a = −10 to +70°C, V_{DD} = +12V + 5%, V_{CC} = +5V + 5%,
V_{BB} = P_G = V_{CL} = V_{CG} = V_{SS} = 0V

PARAMETER	SYMBOL	LIMITS			UNIT	TEST CONDITIONS
		MIN	TYP	MAX		
Access Time	t_{ACC}			800	ns	1 TTL + 100 pF
$\overline{CS}$ to Output On Delay	$t_{CD(on)}$			200	ns	
$\overline{CS}$ to Output Off Delay	$t_{CD(off)}$	0		200	ns	
Output Hold Time	t_{OH}	0			ns	

TIMING WAVEFORMS



PROGRAMMING OPERATION

Before the μPD454 is programmed the device must be erased. All bit locations must contain a zero (0). The μPD454 programming procedure is word by word one word at a time.

DC CHARACTERISTICS

$T_a = 25°C \pm 2°C$, $V_{DD} = V_{CC} = V_{SS} = V_{CL} = 0V$. $\overline{CS}$ = Either HIGH or LOW level.

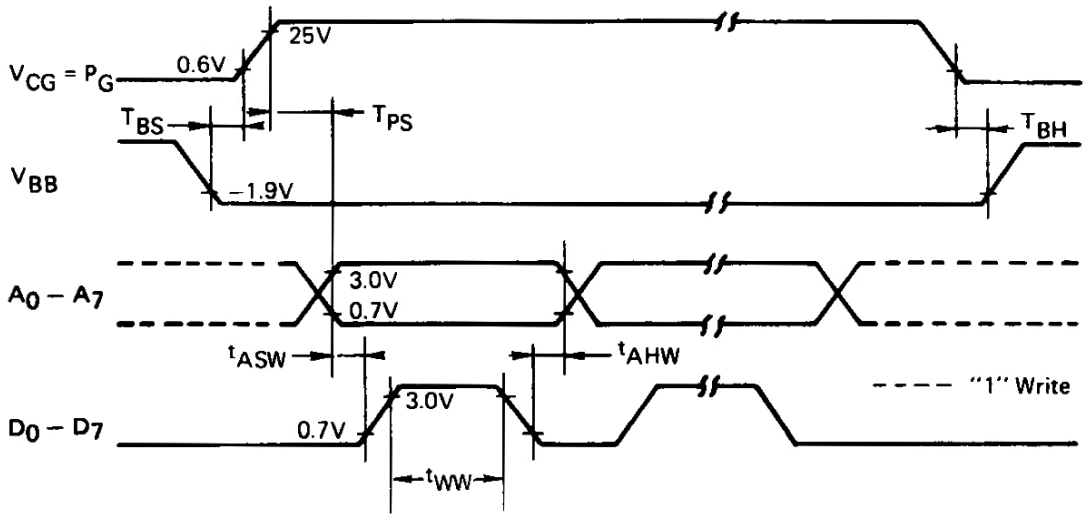
PARAMETER	SYMBOL	LIMITS			UNIT	TEST CONDITIONS
		MIN	TYP	MAX		
Input High Voltage	V_{IH}	3.0		V_{CC}	V	
Input Low Voltage	V_{IL}	0		0.7	V	
Supply Voltage	V_{BB}	−1.9	−2.0	−2.1	V	
Supply Voltage	P_G	25	26	27	V	
Supply Voltage	V_{CG}	25	26	27	V	through R_{CG}
Supply Current (V_{BB})	I_{BB}		−8		mA	
Supply Current (P_G)	I_G		+25		mA	
Supply Current (V_{CG})	I_{CG}			+10	μA	

AC CHARACTERISTICS

$T_a = 25°C \pm 2°C$, $V_{DD} = V_{CC} = V_{SS} = V_{CL} = 0V$. $\overline{CS}$ = Either HIGH or LOW level.

PARAMETER	SYMBOL	LIMITS			UNIT	TEST CONDITIONS
		MIN	TYP	MAX		
Address Setup Time	t_{ASW}	10			μs	
Address Hold Time	t_{AHW}	10			μs	
Write Data Width	t_{WW}	20		100	ms	per one word
V_{BB} Setup Time	T_{BS}	1.0			μs	
V_{BB} Hold Time	T_{BH}	1.0			μs	
P_G, V_{CG} Setup Time	T_{PS}	10			μs	

TIMING WAVEFORMS



ERASURE OPERATION*

DC CHARACTERISTICS

$T_a = 25°C \pm 2°C$, $V_{DD} = V_{CC} = P_G = 0V$, $V_{SS} = 0V$
$\overline{CS}$, $A_0 - A_7$ and $D_0 - D_7$ = Either HIGH or LOW level, or non-connected

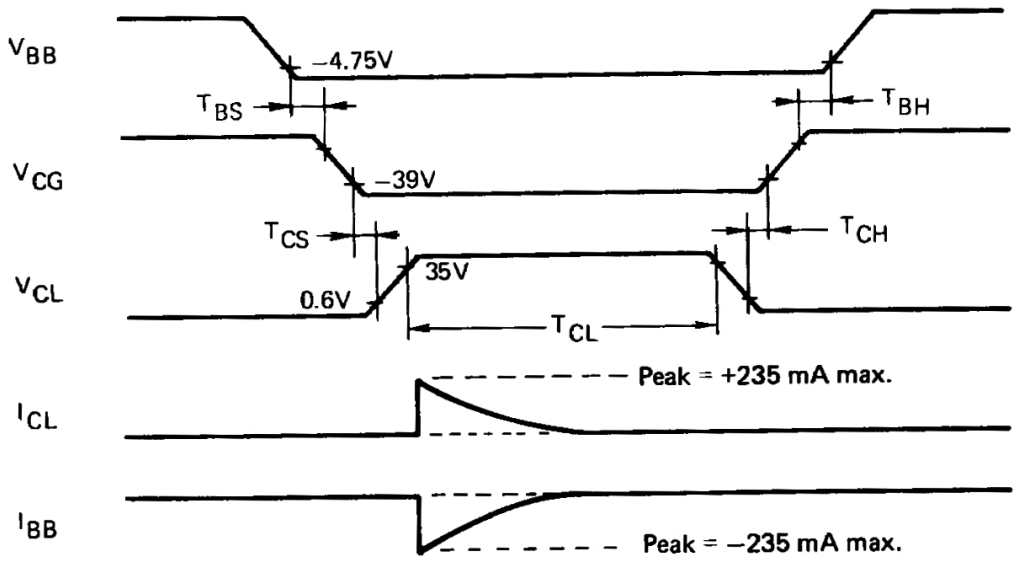
PARAMETER	SYMBOL	LIMITS			UNIT	TEST CONDITIONS
		MIN	TYP	MAX		
Supply Voltage	V_{BB}	-4.75	-5.0	-5.25	V	
Supply Voltage	V_{CL}	+35	+36	+37	V	through R_{CL}
Supply Voltage	V_{CG}	-39	-40	-41	V	through R_{CG}
Supply Current (V_{BB})	I_{BB}			-235	mA	Initial peak current. See timing chart.
Supply Current (V_{CL})	I_{CL}			-235	mA	
Supply Current (V_{CG})	I_{CG}			-20	μA	

AC CHARACTERISTICS

$T_a = 25°C \pm 2°C$, $V_{DD} = V_{CC} = P_G = 0V$, $V_{SS} = 0V$
$\overline{CS}$, $A_0 - A_7$ and $D_0 - D_7$ = Either HIGH or LOW level, or non-connected

PARAMETER	SYMBOL	LIMITS			UNIT	TEST CONDITIONS
		MIN	TYP	MAX		
Clear Time	T_{CL}			60	sec	
V_{BB} Setup Time	T_{BS}	0			μs	
V_{BB} Hold Time	T_{BH}	0			μs	
V_{CG} Setup Time	T_{CS}	1.0			μs	
V_{CG} Hold Time	T_{CH}	1.0			μs	

TIMING WAVEFORMS



Note: The supply currents I_{BB} and I_{CL} diminish to almost zero within T_{CL}

*Erasure operation clears all 2048 bits to Logic "0" simultaneously.