1024 WORD X 4BIT CMOS RAM

SILICON GATE CMOS

TC5047AP-1
TC5047AP-2

DESCRIPTION

The TC5047AP is a static read write memory organized as 1024 words by 4 bits using CMOS technology. Because of ultra low power dissipation, the TC5047AP can be used as battery operated portable memory system and also as a nonvolatile memory with battery back up. The TC5047AP operates from a single 5V power supply with a static operation, so that the no refresh periods are required. This simplifies the power supply circuit design.

The three state outputs simplify the memory expansion making the TC5047AP suitable for use in a microprocessor peripheral memory. Since the minimum data retention voltage is 2V, the battery back up system needs only simple circuit. By using Toshiba's original C^2MOS technology, the device circuitry is not only simplified but wide operating margin and noise margin are also realized.

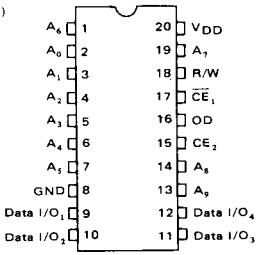
The TC5047AP family is moulded in a dual-in-line 20 pin plastic package, 0.4 inch in width.

FEATURES

- Low Power Dissipation
  110 μW (MAX.) STANDBY
  110mW (MAX.) OPERATING
- Single 5V Power Supply
- Data Retention Voltage; 2.0~5.5V
- 20 PIN Plastic Package
- Static Operation
- Three State Outputs
- Input/Output; TTL Compatible
- Access Time
  TC5047AP-1; $t_{ACC} \leqq 550$ns (MAX.)
  TC5047AP-2; $t_{ACC} \leqq 800$ns (MAX.)

PIN CONNECTION

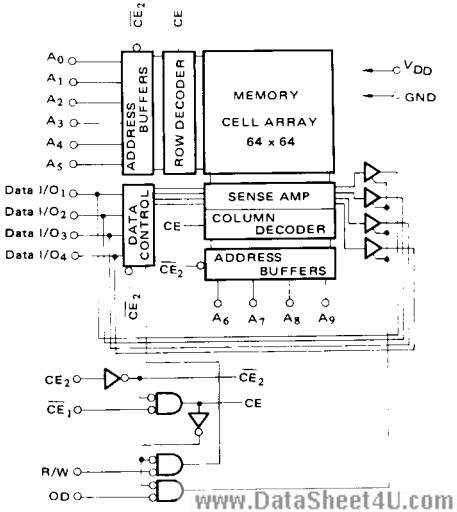
(TOP VIEW)



PIN NAMES

$A_0 \sim A_9$	Address Inputs
R/W	Read Write Input
$\overline{CE}_1$, CE_2	Chip Enable Inputs
Data $I/O_{1\sim4}$	Data Input/Output
OD	Output Disable Input
V_{DD}/GND	Power Supply Terminals

BLOCK DIAGRAM



MAXIMUM RATINGS

SYMBOL	ITEM	RATING	UNIT
V_{DD}	Power Supply Voltage	−0.3 ~ 7.0	V
V_{IN}	Input Voltage	−0.3 ~ V_{DD} + 0.3	V
V_{OUT}	Output Voltage	0 ~ V_{DD}	V
P_D	Power Dissipation (Ta = 85°C)	700	mW
T_{SOLDER}	Soldering Temperature · Time	260 · 10	°C · sec
T_{STG}	Storage Temperature	−55 ~ 150	°C
T_{OPR}	Operating Temperature	−30 ~ 85	°C

DC RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{DD}	Power Supply Voltage	4.5	5.0	5.5	V
V_{IH}	Input High Level Voltage	V_{DD}−1.5	–	V_{DD}+0.3	V
V_{IL}	Input Low Level Voltage	−0.3	–	0.6	V
V_{DH}	Data Retention Voltage	2.0	–	5.5	V

DC CHARACTERISTICS (Ta = −30 ~ 85°C)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP. (1)	MAX.	UNIT
I_{IN}	Input Current	$0V \leqq V_{IN} \leqq V_{DD}$	0	±0.05	±1.0	μA
I_{DDS}	Standby Current	V_{DD} = 2 ~ 5.5V CE_2 = 0.2V, Output Open	0	0.2	20	μA
I_{DDO}	Operating Current	V_{DD}=5.5V, t_{CYC}=1μs	0	10	20	mA
I_{LO}	Output Leakage Current	$0V \leqq V_{OUT} \leqq V_{DD}$	0	±0.1	±5.0	μA
I_{OH}	Output High Current	V_{DD}=4.5V, V_{OH} = 2.4V	−1.0	−2.0	–	mA
I_{OL}	Output Low Current	V_{DD} = 4.5V, V_{OL} = 0.4V	1.6	2.0	–	mA
C_i (2)	Input Capacitance	f = 1MHz	–	5	10	pF
C_o (2)	Output Capacitance	f = 1MHz	–	7	15	pF

Note (1) Ta = 25°C, V_{DD} = 5V

Note (2) This parameter is periodically sampled and is not 100% tested.

A.C. RECOMMENDED OPERATING CONDITIONS

- **TC5047AP-1**

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
T_{RC}	Read Cycle Time	V_{DD} = 4.5 ~ 5.5V C_L = 100 pF V_{IH} = V_{DD} − 1.5V ~ V_{DD} + 0.3V V_{IL} = −0.3 ~ 0.6V Ta = −30 ~ 85°C	650	–	ns
t_{WC}	Write Cycle Time		650	–	ns
t_{CES}	CE Setup Time		20(3)	–	ns
t_{CEH}	CE Hold Time		20(3)	–	ns
t_{PC}	Precharge Time		100	–	ns
$t_{\overline{CE}}$	$\overline{CE}$ Pulse Width		550	–	ns
t_{WP}	Write Pulse Width		300	–	ns
t_{DS}	Data Setup Time		300	–	ns
t_{DH}	Data Hold Time		0	–	ns
t_{CW}	Write Setup Time		350	–	ns
t_{RS}	Read Setup Time		0	–	ns
t_{RH}	Read Hold Time		0	–	ns

Note (3) $t_{CES} + t_{CEH} \geqq 100$ ns

- **TC5047AP-2**

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
t_{RC}	Read Cycle Time	V_{DD} = 4.5 ~ 5.5V C_L = 100 pF V_{IH} = V_{DD} − 1.5V ~ V_{DD} + 0.3V V_{IL} = −0.3 ~ 0.6V Ta = −30 ~ 85°C	1000	–	ns
t_{WC}	Write Cycle Time		1000	–	ns
t_{CES}	CE Setup Time		20(4)	–	ns
t_{CEH}	CE Hold Time		20(4)	–	ns
t_{PC}	Precharge Time		200	–	ns
$t_{\overline{CE}}$	$\overline{CE}$ Pulse Width		800	–	ns
t_{WP}	Write Pulse Width		500	–	ns
t_{DS}	Data Setup Time		500	–	ns
t_{DH}	Data Hold Time		0	–	ns
t_{CW}	Write Setup Time		550	–	ns
t_{RS}	Read Setup Time		0	–	ns
t_{RH}	Read Hold Time		0	–	ns

Note (4) $t_{CES} + t_{CEH} \geqq 200$ ns.

A.C. CHARACTERISTICS (Ta = −30~85°C)

- **TC5047AP-1**

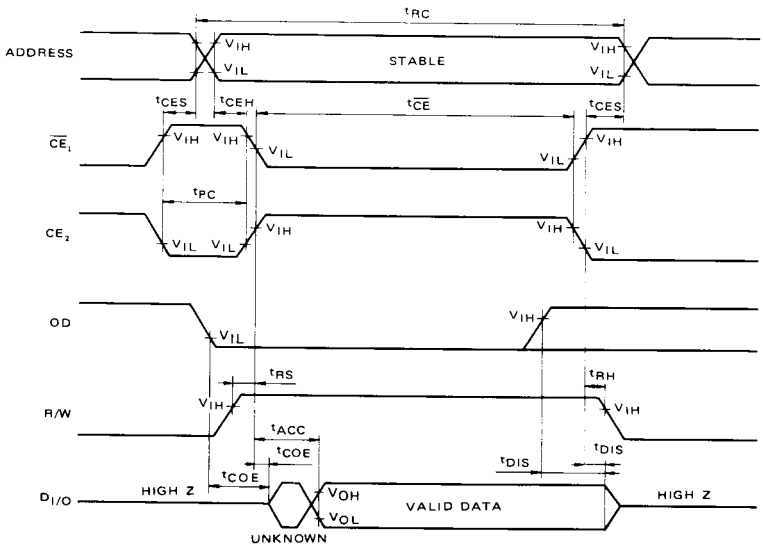
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
t_{ACC}	Access Time	V_{DD} = 4.5 ~ 5.5V C_L = 100 pF V_{OH} =2.4V, V_{OL}=0.6V	–	–	550	ns
t_{DIS}	Output Disable Time		–	–	100	ns
t_{COE}	Output Enable Time		–	100	–	ns

- **TC5047AP-2**

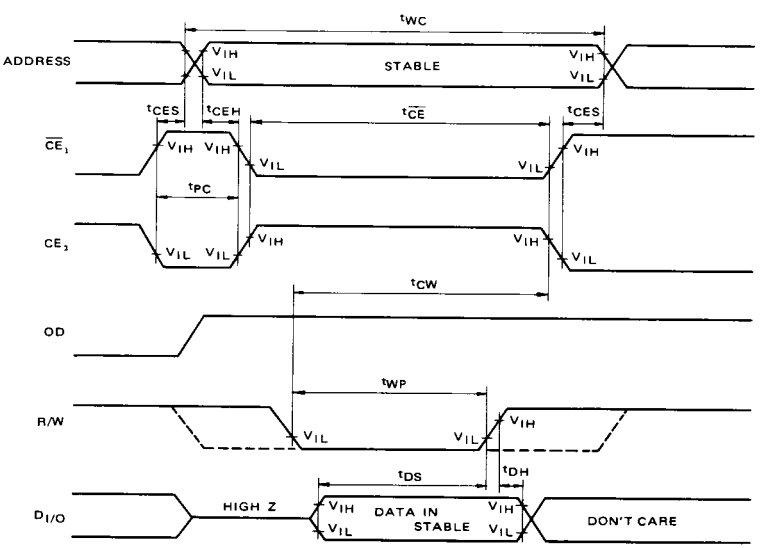
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
t_{ACC}	Access Time	V_{DD} = 4.5 ~ 5.5V C_L = 100 pF V_{OH} =2.4V, V_{OL} = 0.6V	–	–	800	ns
t_{DIS}	Output Disable Time		–	–	200	ns
t_{COE}	Output Enable Time		–	200	–	ns

TIMING WAVEFORMS

- Read Cycle

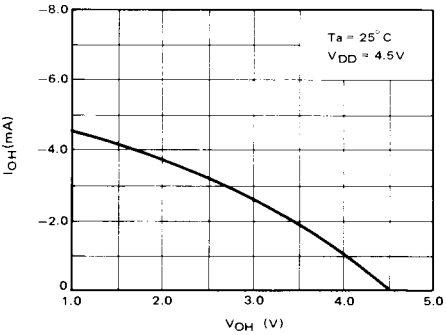


- Write Cycle

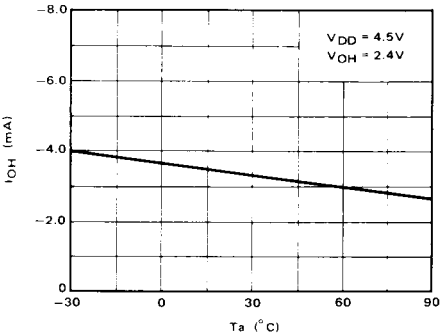


TYPICAL CHARACTERISTICS

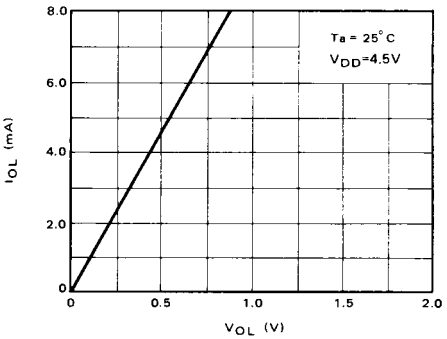
V_{OH} – I_{OH}



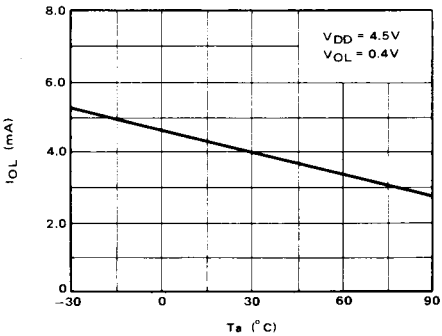
I_{OH} – Ta



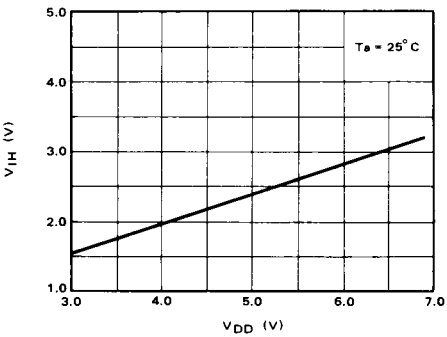
I_{OL} – V_{OL}



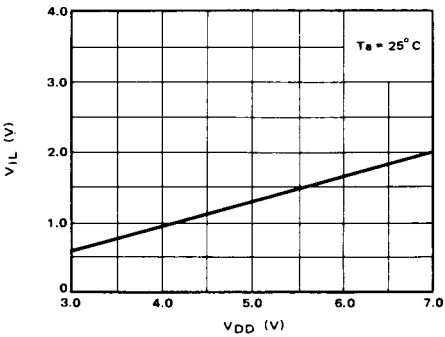
I_{OL} – Ta



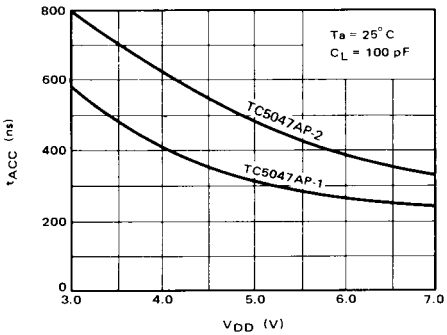
V_{IH} – V_{DD}



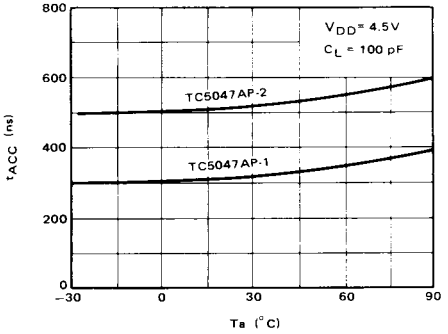
V_{IL} – V_{DD}



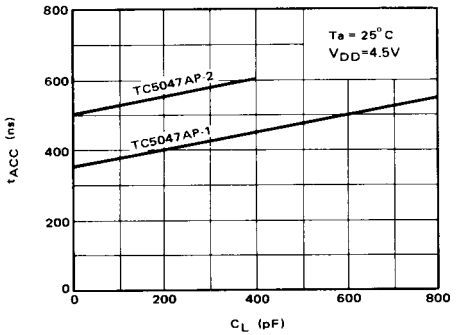
$t_{ACC} - V_{DD}$



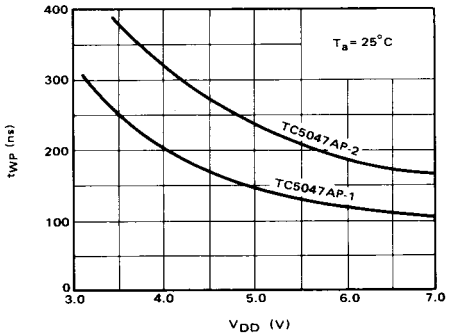
$t_{ACC} - T_a$



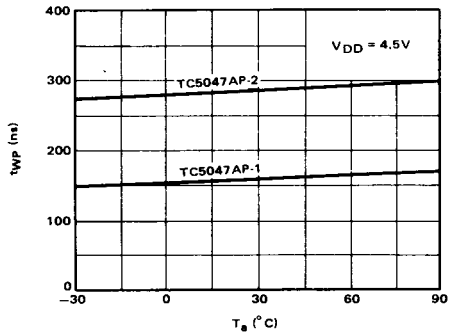
$t_{ACC} - C_L$



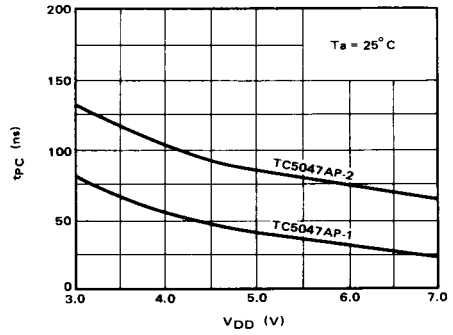
$t_{WP} - V_{DD}$



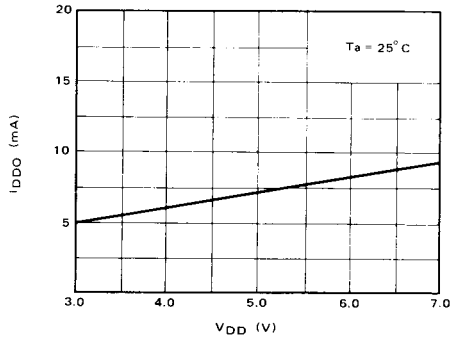
$t_{WP} - T_a$



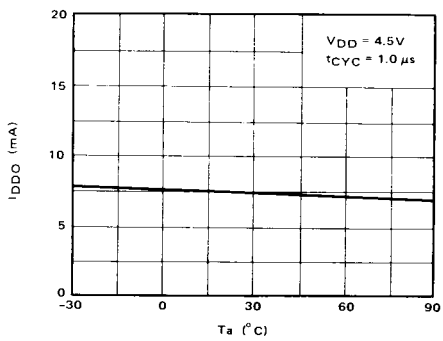
$t_{PC} - V_{DD}$



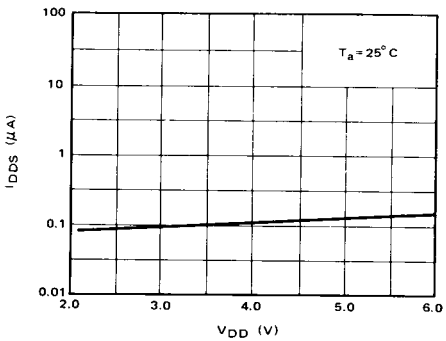
I_{DDO} – V_{DD}



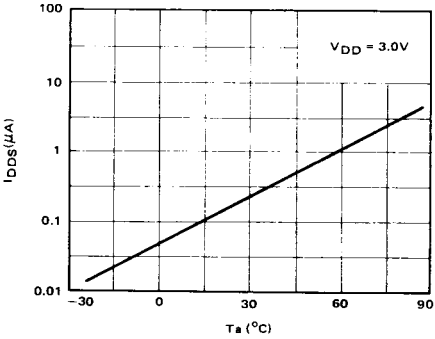
I_{DDO} – Ta



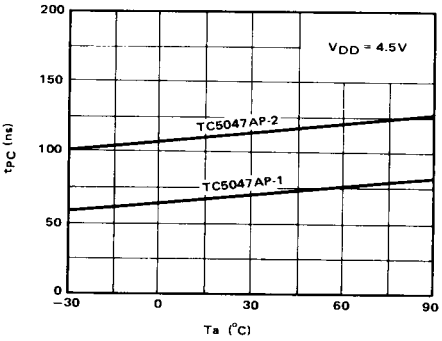
I_{DDS} – V_{DD}



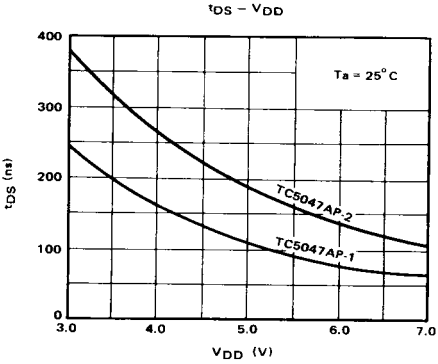
I_{DDS} – Ta



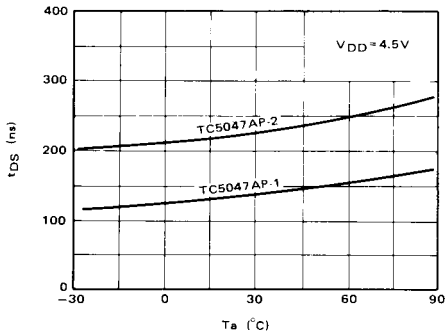
t_{PC} – Ta



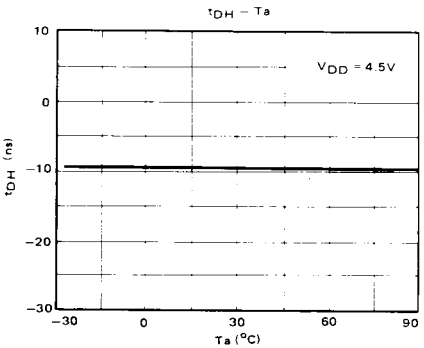
t_{DS} – V_{DD}



t_{DS} – Ta

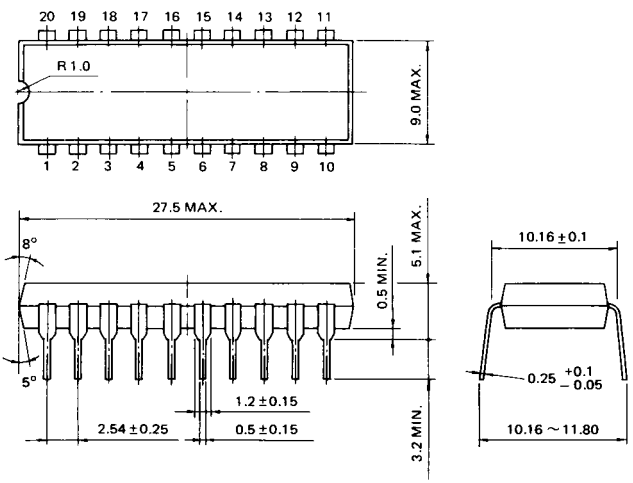


t_{DH} – Ta



OUTLINE DRAWINGS

Unit in mm



Note: Each lead pitch is 2.54mm. All leads are located within 0.25 mm of their true longitudinal position with respect to No. 1 and No. 20 leads.