## STANDARD AND LOW POWER PROGRAMMABLE READ-ONLY MEMORIES

SEPTEMBER 1979-REVISED AUGUST 1984

- Expanded Family of Standard and Low Power PROMs
- Titanium-Tungsten (Ti-W) Fuse Links for Reliable Low-Voltage Full-Family-Compatible Programming
- Full Decoding and Fast Chip Select Simplify System Design
- P-N-P Inputs for Reduced Loading On System Buffers/Drivers
- Each PROM Supplied With a High Logic Level Stored at Each Bit Location
- Applications Include:
   Microprogramming/Firmware Loaders
   Code Converters/Character Generators
   Translators/Emulators
   Address Mapping/Look-Up Tables

#### description

The 24 and 28 Series of monolithic TTL programmable read-only memories (PROMs) feature an expanded selection of standard and low-power PROMs. This expanded PROM family provides the system designer with considerable flexibility in upgrading existing designs or optimizing new designs. Featuring proven titanium-tungsten (Ti-W) fuse links with low-current MOS-compatible p-n-p inputs, all family members utilize a common programming technique designed to program each link with a 20-microsecond pulse.

The 4096-bit and 8192-bit PROMs are offered in a wide variety of packages ranging from 18-pin 300 milwide thru 24 pin 600 mil-wide. The 16,384-bit PROMs provide twice the bit density of the 8192-bit PROMs and are provided in a 24 pin 600 mil-wide package.

All PROMs are supplied with a logic-high output level stored at each bit location. The programming procedure will produce open-circuits in the Ti-W metal links, which reverses the stored logic level at the selected location. The procedure is irreversible; once altered, the output for that bit location is permanently programmed. Outputs that have never been altered may later be programmed to supply the opposite output level. Operation of the unit within the recommended operating conditions will not alter the memory content.

Active level(s) at the chip-select input(s) (S or  $\overline{S}$ ) enables all of the outputs. An inactive level at any chip-select input causes all outputs to be in the three-state, or off condition.

#### standard PROMs

The standard PROM members of Series 24 and 28 offer high performance for applications which require the uncompromised speed of Schottky technology. The fast chip-select access times allow additional decoding delays to occur without degrading speed performance.

TV-7	PACKAGE <sup>†</sup> AND	OUTPUT	BIT SIZE	TYP	ICAL PERF	ORMANCE
TYPE NUMBER	TEMPERATURE RANGE DESIGNATORS	CONFIGURATION <sup>‡</sup>	(ORGANIZATION)		TIMES	POWER
TBP24S10				ADDRESS	SELECT	DISSIPATION
	MJ, J, N	$\nabla$	1024 Bits			
TBP24SA10	MJ, J, N	$\Diamond$	$(256W \times 4B)$	35 ns	20 ns	375 mW
TBP28S42	MJ, J, N	$\nabla$				
TBP28SA42	MJ, J, N	$\Diamond$	4096 Bits			
TBP28S46	MJW, JW, NW	$\nabla$	(512W × 8B)	35 ns	20 ns	500 mW
TBP28SA46	MJW, JW, NW	Ω	(0.217 × 00)			
TBP24S41	MJ, J, N	$\nabla$	4096 Bits			
TBP24SA41	MJ, J, N	Φ	(1024 × 4B)	40 ns	20 ns	475 mW
TBP24S81	MJ, J, N	$\nabla$	8192 Bits			
TBP24SA81	MJ, J, N	Ω	(2048 × 4B)	45 ns	20 ns	625 mW
TBP28S86A	WN ,WL ,WLM	$\nabla$				
TBP28SA86A	WN ,WL ,WLM	Ω	8192 Bits	45 ns	20 ns	605\44
TBP28S2708A	NW	$\overline{\nabla}$	$(1024 \times 8B)$	75 115	20 IIS	625 mW
TBP28S166	NW	▽	16,384 Bits (2048W × 8B)	35 ns	15 ns	650 mW

<sup>&</sup>lt;sup>†</sup>MJ and MJW designates full-temperature-range circuits (formerly 54 Family), J, JW, N, and NW designates commercial-temperature-range circuits (formerly 74 Family).

 $^{\ddagger}$   $\nabla$  = three state,  $\triangle$  = open collector.



# SERIES 24 AND 28 STANDARD AND LOW-POWER PROGRAMMABLE READ-ONLY MEMORIES

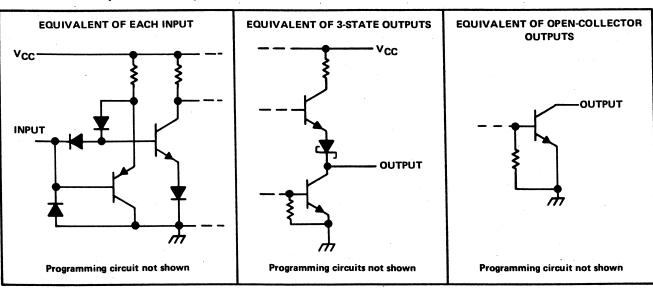
#### low power PROMs

To upgrade systems utilizing MOS EPROMs or MOS PROMs, or when designing new systems which do not require maximum speed, the low-power PROM family offers the output drive and speed performance of bipolar technology, plus reduced power dissipation.

	PACKAGE <sup>†</sup> AND	OUTDUT	DIT OUT	TYPI	TYPICAL PERFORMANCE					
TYPE NUMBER	TEMPERATURE RANGE	OUTPUT	BIT SIZE	ACCESS	TIMES	POWER				
	DESIGNATORS	CONFIGURATION <sup>‡</sup>	(ORGANIZATION)	ADDRESS	SELECT	DISSIPATION				
TBP28L22	MJ, J,N	$\nabla$	2048 Bits	45 ns	20 ns	375 mW				
TBP28LA22	MJ, J, N	$\Diamond$	(256W × 8B)	45 118	20 HS	375 11144				
TBP28L42	MJ, J, N	$\nabla$	4096 Bits	60 ns	30 ns	250 mW				
TBP28L46	MJW, JW, NW	$\nabla$	(512W × 8B)	OU IIS	30 115	250 11100				
TBP28L86A	MJW, JW, NW	▽	8192 Bits (1024W × 8B)	80 ns	35 ns	350 mW				
TBP28L166	NW	▽	16,384 Bits (2084W × 8B)	65 ns	30 ns	350 mW				

<sup>&</sup>lt;sup>†</sup>MJ and MJW designates full-temperature-range circuits (formerly 54 Family), J, JW, N, and NW designates commercial-temperature-range circuits (formerly 74 Family).

#### schematics of inputs and outputs



#### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage (see Note 1) 7 V
Input voltage
Chip-select peak input voltage (S, S1, S2) (see Note 2)
Off-state output voltage
Off-state peak output voltage (see Note 2)
Operating free-air temperature range: Full-temperature-range circuits (M suffix)55°C to 125°C
Commercial-temperature-range circuits 0 °C to 70 °C
Storage temperature range65°C to 150°C

NOTES: 1. Voltage values are with respect to network ground terminal.

2. These ratings apply only under the conditions described in the programming procedure.



 $<sup>^{\</sup>ddagger}$  ∇ = three state, Ω = open collector.

## TBP24S10 1024 BIT (256 WORDS BY 4 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH 3-STATE OUTPUTS

#### logic symbol pin assignment **TBP24S10** TBP24S10 J or N PACKAGE PROM 256 X 4 (TOP VIEW) (5) A0 A6 ∏1 U<sub>16</sub> V<sub>CC</sub> (6)15 A7 A5 (7) (12)A4 🔲 3 14 🔲 🔂 2 (4) (11) $A \nabla$ Q1 АЗ [ 13 🔲 🔁 T (3) (10)255 $A \nabla$ A4 Ω2 A0 ∏5 12 Q0 (2) (9) A5 - $A \nabla$ 03 A1 🛮 6 11 Q Q1 (1) A6 (15) A2 🛮 7 10 Q2 A7 (14) GND □8 9 Q3 Ğ2 EN (13)

#### recommended operating conditions

	PARAMETER		MJ			J OR N			
	PANAIVIETEN	MIN	NOM	MAX	MIN	NOM	MAX	UNIT	
VCC	Supply voltage	4.5	5	5.5	4.75	5	5.25	V	
VIH	High-level input voltage	2			2			Ņ	
٧ <sub>IL</sub>	Low-level input voltage			0.8			0.8	V	
ЮН	High-level output current			-2			-6.5	mA	
loL	Low-level output current			16			16	mA	
TA	Operating free-air temperature range	-55		125	0		70	°C	

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST COL	NDITIONS†		MJ			J OR N		
PANAIVIETEN	TEST COI	ADITIONS ·	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
V <sub>IK</sub>	V <sub>CC</sub> = MIN,	ij = -18 mA			-1.2			-1.2	٧
Voн	V <sub>CC</sub> = MIN,	IOH = MAX	2.4	3.1		2.4	3.1		V
VOL	V <sub>CC</sub> = MIN,	I <sub>OL</sub> = 16 mA			0.5			0.5	V
lozh	V <sub>CC</sub> = MAX,	$V_0 = 2.4 \text{ V}$			50			50	μΑ
IOZL	V <sub>CC</sub> = MAX,	$V_0 = 0.5 V$			- 50			- 50	μΑ
. 1	V <sub>CC</sub> = MAX,	$V_{  } = 5.5 \text{ V}$			1			1	mA
۱н	V <sub>CC</sub> = MAX,	$V_I = 2.7 V$			25			25	μΑ
կլ .	V <sub>CC</sub> = MAX,	$V_{  } = 0.5 \text{ V}$		* :	-0.25			-0.25	mA
los§	V <sub>CC</sub> = MAX		-30		-100	-30		-100	mA
lcc	V <sub>CC</sub> = MAX			75	100		75	100	mA

	PARAMETER	TEST	MJ			J OR N		
	PANAMETER	CONDITIONS	MIN TYP‡	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
ta(A)	Access time from address	CL = 30 pF	35	75		35	55	ns
ta(S)	Access time from chip select (enable time)	See Note 3	20	40		20	35	ns
<sup>t</sup> dis	Disable time	C <sub>L</sub> = 5 pF See Note 3	15	. 40		15	35	ns

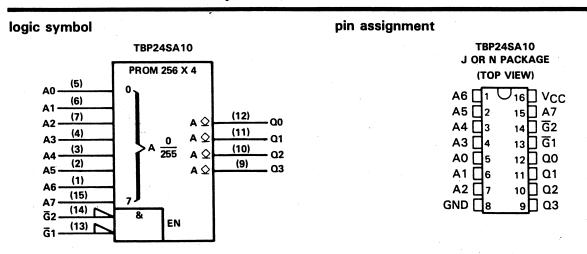
<sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.

<sup>&</sup>lt;sup>§</sup>Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second. NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



 $<sup>^{\</sup>ddagger}$ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25 °C.

## TBP24SA10 1024 BITS (256 WORDS BY 4 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH OPEN-COLLECTOR OUTPUTS



### recommended operating conditions

	PARAMETER		MJ			J OR N		UNIT
	PARAMETER	MIN	NOM	MAX	MIN	NOM	MAX	ONIT
Vcc	Supply voltage	4.5	5	5.5	4.75	. 5	5.25	٧
VIH	High-level input voltage	2			2			٧
VIL	Low-level input voltage			0.8			0.8	V
∨он	High-level output voltage		• .	5.5			5.5	٧
lOL	Low-level output current			16			16	mA
TA	Operating free-air temperature range	- 55		125	0		70	°C

#### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

	7507.00	NOTION OF	MJ			OR N		
PARAMETER	IEST CO	NDITIONS <sup>†</sup>	MIN TYP‡	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
VIK	V <sub>CC</sub> = MIN,	I <sub>I</sub> = -18 mA		-1.2			-1.2	٧
1	Man - MIN	V <sub>OH</sub> = 2.4 V		0.05			0.05	
ЮН	$V_{CC} = MIN,$	V <sub>OH</sub> = 5.5 V		0.1			0.1	mA
V <sub>OL</sub>	V <sub>CC</sub> = MIN,	I <sub>OL</sub> = 16 mA		0.5			0.45	٧
l <sub>l</sub>	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 5.5 V		1			1	mA
IIH	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 2.7 V		. 25			25	μΑ
l <sub>IL</sub>	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 0.5 V		-0.25			-0.25	mA
lcc	V <sub>CC</sub> = MAX		75	100		75	100	mA

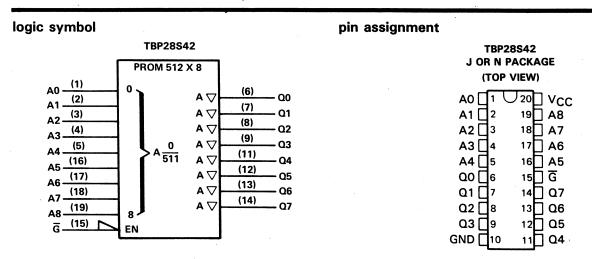
	PARAMETER	TEST		MJ			J OR N		UNIT
	PARAMETER	CONDITIONS	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
ta(A)	Access time from address	C <sub>L</sub> = 30 pF		35	75		35	65	ns
ta(S)	Access time from chip select (enable time)	$R_{L1} = 300 \Omega$		20	40		20	35	ns
	Propagation delay time low-to-high-level	$R_{L2} = 600 \Omega$		15	40		20	35	
<sup>t</sup> PLH	output from chip select	See Note 3		15	40		20	35	ns

<sup>&</sup>lt;sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.

 $<sup>^{\</sup>ddagger}$ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25 °C.

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

## TBP28S42 4096 BITS (512 WORDS BY 8 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH 3-STATE OUTPUTS



#### recommended operating conditions

	PARAMETER			MJ			UNIT		
	FARAMETER		MIN	NOM	MAX	MIN	NOM	MAX	ONII
Vcc	Supply voltage		4.5	5	5.5	4.75	5	5.25	V
VIH	High-level input voltage		2			2			V
VIL	Low-level input voltage	4.1			0.8		:	0.8	V
Іон	High-level output current				-2			-6.5	mA
loL	Low-level output current				16			16	mÁ
TA	Operating free-air temperature range		- 55		125	0		70	°C

#### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CO	NDITIONS†		MJ			J OR N		UNIT
PANAMETEN	TEST CO	NDITIONS	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNII
VIK	V <sub>CC</sub> = MIN,	l <sub>l</sub> = -18 mA			-1.2			-1.2	٧
Voн	V <sub>CC</sub> = MIN,	I <sub>OH</sub> = MAX	2.4	3.1		2.4	3.1		٧
VoL	V <sub>CC</sub> = MIN,	I <sub>OL</sub> = 16 mA			0.5			0.5	٧
lozh	V <sub>CC</sub> = MAX,	$V_0 = 2.4 V$			50			50	μА
lozL .	V <sub>CC</sub> = MAX,	$V_0 = 0.5 V$			- 50			- 50	μА
lj .	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 5.5 V			1			1	mA
liH .	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 2.7 V			25			25	μΑ
IIL	$V_{CC} = MAX$ ,	V <sub>I</sub> = 0.5 V		-	-0.25			-0.25	mA
los§	V <sub>CC</sub> = MAX		-30		-100	-30		-100	mA
Icc	V <sub>CC</sub> = MAX	· · · · · · · · · · · · · · · · · · ·		100	135		100	135	mA

## switching characteristics over recommended ranges of TA and VCC (unless otherwise noted)

	PARAMETER	TEST		MJ			J OR N		
	FANAMETEN	CONDITIONS	MIN	TYP‡	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
t <sub>a(A)</sub>	Access time from address	C <sub>L</sub> = 30 pF		35	70		35	60	ns
ta(S)	Access time from chip select (enable time)	See Note 3		20	45		20	45	ns
<sup>t</sup> dis	Disable time	C <sub>L</sub> = 5 pF See Note 3		15	45	- 1 i	15	40	ns

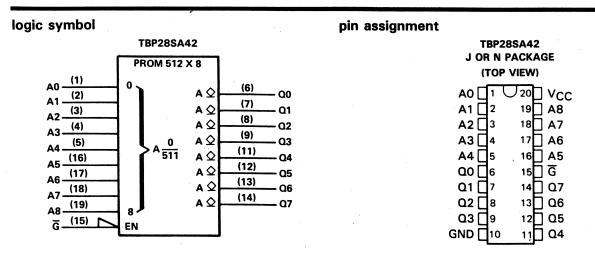
<sup>&</sup>lt;sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.



 $<sup>^{\</sup>ddagger}$ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25 °C.

<sup>§</sup>Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

## TBP28SA42 4096 BITS (512 WORDS BY 8 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH OPEN-COLLECTOR OUTPUTS



#### recommended operating conditions

	PARAMETER		MJ			J OR N	]	
	TANAMETER	MIN	NOM	MAX	MIN	NOM	MAX	UNIT
VCC	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
VIH	High-level input voltage	2			2			V
VIL	Low-level input voltage			0.8			0.8	V
Vон	High-level output voltage			5.5			5.5	V
lOL	Low-level output current			16			16	mA
TA	Operating free-air temperature range	- 55		125	0		70	°C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST COL	NDITIONS†	MJ J OR N						
T ANAMETER	1231 001	4DITIONS	MIN	TYP <sup>‡</sup>	.MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
VIK	$V_{CC} = MIN,$	I <sub>I</sub> = -18 mA			-1.2			-1.2	V
ЮН	V <sub>CC</sub> = MIN,	$V_{OH} = 2.4 V$		•	0.05			0.05	
'OH	VCC - 141114,	$V_{OH} = 5.5 V$			0.1			0.1	mA
V <sub>OL</sub>	$V_{CC} = MIN,$	IOL = 16 mA			0.5			0.5	V
l <sub>l</sub>	$V_{CC} = MAX$ ,	V <sub>I</sub> = 5.5 V			1			1	mA
t <sub>IH</sub>	$V_{CC} = MAX$ ,	V <sub>I</sub> = 2.7 V			25			25	μΑ
IIL	$V_{CC} = MAX$ ,	V <sub>I</sub> = 0.5 V			-0.25			-0.25	mA
lcc	V <sub>CC</sub> = MAX			105	135		105	135	mA

	PARAMETER	TEST		MJ	-	J OR N	UNIT	
	FARAMEIER	CONDITIONS	MIN	TYP <sup>‡</sup>	MAX	MIN TYP‡	MAX	UNII
t <sub>a(A)</sub>	Access time from address	C <sub>L</sub> = 30 pF		35	75	35	65	ns
ta(S)	Access time from chip select (enable time)	$R_{L1} = 300 \Omega$		20	45	20	35	ns
*****	Propagation delay time low-to-high-level	$R_{L2} = 600 \Omega$		4.5		4=	0.5	
<sup>t</sup> PLH	output from chip select	See Note 3		15	45	15	35	ns

<sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.



 $<sup>^{\</sup>ddagger}$ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25 °C.

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

## TBP28S46 4096 BITS (512 WORDS BY 8 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH 3-STATE OUTPUTS

logic symbol	TBP28S46		pin assignment	TBP28	
A0 (8) (7) A2 (6) (5) A3 (2) A5 (2) A6 (1) A7 (23) G4 (21) G3 (18) G1 (20)	PROM 512 X 8   A   A   A   A   A   A   A   A   A	(9) (10) (11) (11) (13) (14) (15) (16) (16) (17) Q0 Q1 Q2 (15) Q5 (16) Q6 (17)		A7   1   1   A6   2   A5   3   A4   4   A3   5   A2   6   A1   7   A0   8   Q0   9   Q1   10   Q2   11   GND   12	

## recommended operating conditions

	DADAMETED		MJW		JW OR NW			UNIT
	PARAMETER	MIN	NOM	MAX	MIN	NOM	MAX	ONL
Vcc	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
VIH	High-level input voltage	2			2			٧
VIL	Low-level input voltage			0.8			0.8	V
IOH	High-level output current			-2		3 - 21 A	-6.5	mA
lOL	Low-level output current		-	16			16	mA
TA	Operating free-air temperature range	-55		125	0		70	°C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

	7507.00	NOITIONO†		MJW		J	W OR N	W .	UNIT
PARAMETER	TEST CO	NDITIONS <sup>†</sup>	MIN	TYP‡	MAX	MIN	TYP <sup>‡</sup>	0.5 50 -50 1 25 -0.25	UNII
VIK	V <sub>CC</sub> = MIN,	I <sub>I</sub> = -18 mA			-1.2			-1.2	٧
Voн	V <sub>CC</sub> = MIN,	IOH = MAX	2.4	3.1		2.4	3.1		٠٧
V <sub>OL</sub>	V <sub>CC</sub> = MIN,	I <sub>OL</sub> = 16 mA			0.5		*	0.5	٧
lozн	V <sub>CC</sub> = MAX,	$V_0 = 2.4 \text{ V}$			50			50	μΑ
<sup>I</sup> OZL	V <sub>CC</sub> = MAX,	$V_0 = 0.5 V$			- 50	1.0		- 50	μΑ
li l	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 5.5 V			1			1	mA
ΊΗ	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 2.7 V			25			25	μΑ
116	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 0.5 V			-0.25			-0.25	mA
los§	V <sub>CC</sub> = MAX		-15		- 100	-20		- 100	mA
lcc	V <sub>CC</sub> = MAX			100	135		100	135	mA

	0.00.00	TEST	MJW			J	UNIT		
	PARAMETER	CONDITIONS	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	ONT
ta(A)	Access time from address	$C_L = 30 pF$		35	70		35	60	ns
ta(S)	Access time from chip select (enable time)	See Note 3		20	45		20	35	ns
	Disable time	C <sub>L</sub> = 5 pF		15	40		15	35	ns
<sup>t</sup> dis	Disable time	See Note 3			70	1.5		00	'''

<sup>&</sup>lt;sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.

<sup>§</sup>Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second. NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



 $<sup>^{\</sup>ddagger}$ All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25 \,^{\circ}\text{C}$ .

# TBP28SA46 4096 BITS (512 WORDS BY 8 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH OPEN-COLLECTOR OUTPUTS

#### logic symbol pin assignment **TBP28SA46 TBP28SA46** JW OR NW PACKAGE **PROM 512 X 8** (TOP VIEW) (8) A0 (9) (7)A7 [1 U24] VCC A1 Q0 (6)(10)A6 **□**2 23 A8 **A5** □3 22 NC (5) (11)**A ♦** Q2 A4 🗌 21 G4 (4)(13)A 511 A **☆** Q3 A3 **□**5 20 G1 (3) (14)**A5 A ♦** 04 A2 □6 19∏ G3 (2) (15)A6 ΑQ Q5 A1 🛛 7 18 G2 (1) (16)**A7** ΑQ Q6 A0 □8 (23)17 Q7 (17)**8**A **A ♦ G**0 □a 16∏ Q6 (21)15 Q5 Q1 []10 (19)G3 ΕN Q2 []11 14 Q4 (18)GND ∏12 13 \ Q3 (20)

#### recommended operating conditions

	DADAMETED	PARAMETER				W OR N	W	LIBUT
	PANAIVIE I EN	MIN	NOM	MAX	MIN	NOM	MAX	UNIT
Vcc	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
VIH	High-level input voltage	2			2			V
VIL	Low-level input voltage			0.8			0.8	V
∨он	High-level output voltage			5.5			5.5	V
lOL	Low-level output current	-	- 1	16	· ·		16	mA
TA	Operating free-air temperature range	- 55		125	0		70	°C

#### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CO	NDITIONS†	MJW	JW OR NW	
PANAIVIETEN	TEST CO	NUTTONS	MIN TYP <sup>‡</sup> MAX	MIN TYP# MAX	UNIT
V <sub>IK</sub>	V <sub>CC</sub> = MIN,	I <sub>I</sub> = -18 mA	-1.2	-1.2	V
lou	V <sub>CC</sub> = MIN,	V <sub>OH</sub> = 2.4 V	0.05	0.05	
ЮН	ACC - 141114)	$V_{OH} = 5.5 V$	0.1	0.1	mA
V <sub>OL</sub>	V <sub>CC</sub> = MIN,	I <sub>OL</sub> = 16 mA	0.5	0.5	V
l <sub>l</sub>	$V_{CC} = MAX$ ,	$V_1 = 5.5 V$	1	1	mA
IIH	$V_{CC} = MAX$ ,	$V_{  } = 2.7 V$	25	25	μΑ
IIL	V <sub>CC</sub> = MAX,	$V_{  } = 0.5 V$	-0.25	-0.25	mA
ICC	V <sub>CC</sub> = MAX		100 135	100 135	mA

	PARAMETER	TEST	MJW		J	JW OR NW		
	PANAMETER	CONDITIONS	MIN TYP‡	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
ta(A)	Access time from address	C <sub>L</sub> = 30 pF	35	75		35	65	ns
ta(S)	Access time from chip select (enable time)	$R_{L1} = 300 \Omega$	20	45		20	35	ns
<sup>t</sup> PLH	Propagation delay time low-to-high-level output from chip select	$R_{L2} = 600 \Omega$ See Note 3	15	40	-	15	35	ns

<sup>&</sup>lt;sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



 $<sup>^{\</sup>ddagger}$ All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_{A} = 25 ^{\circ}\text{C}$ .

## TBP24S41 4096 BITS (1024 WORDS BY 4 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH 3-STATE OUTPUTS

#### pin assignment logic symbol TBP24S41 **TBP24S41** J OR N PACKAGE **PROM 1024 X 4** (TOP VIEW) (5) ΔO J18□ VCC (6) A5 **□**2 17 A7 (7) A2 A4 □3 16 🛮 A8 (4) A3 🛮 4 15 A9 ററ (3) (13) A0 🛮 5 14 Q0 $A \nabla$ (2) (12)1023 A1 **□**6 13 01 $A \nabla$ Q2 (1) (11)**A6** A2 🗌 12 Q2 $A \nabla$ Q3 (17)**G**1 ∏8 11 Q3 (16)**8**A GND []9 (15)A9 (10)G2 ΕN (8) Ğ1

#### recommended operating conditions

	DADAMETED		MJ			UNIT		
	PARAMETER	MIN	NOM	MAX	MIN	NOM	MAX	ONI
Vcc	Supply voltage	4.5	5	5.5	4.75	5	5.25	٧
VIH	High-level input voltage	2	-		2			V
VIL	Low-level input voltage			0.8			0.8	V
ЮН	High-level output current			-2			-3.2	mA
lOL	Low-level output current			16			16	mA
TA	Operating free-air temperature range	- 55		125	0		70	°C

#### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

	TF0T 001	uniziono†		MJ			J OR N		UNIT
PARAMETER	TEST CO	NDITIONS <sup>†</sup>	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX -1.2  0.5 50 -50 1 25 -0.25 -100	UNII
VIK	V <sub>CC</sub> = MIN,	I <sub>I</sub> = -18 mA			-1.2			-1.2	٧
Voн	V <sub>CC</sub> = MIN,	I <sub>OH</sub> = MAX	2.4	3.1		2.4	3.1		٧
V <sub>OL</sub>	V <sub>CC</sub> = MIN,	IOL = 16 mA			0.5	1.5		0.5	V
lozh	V <sub>CC</sub> = MAX,	$V_0 = 2.4 V$			50			50	. μΑ
lozL	V <sub>CC</sub> = MAX,	$V_0 = 0.5 V$			- 50			- 50	μΑ
l <sub>l</sub>	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 5.5 V			1			1	mA
I <sub>I</sub> H	V <sub>CC</sub> = MAX,	$V_1 = 2.7 V$			25			25	μΑ
IIL	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 0.5 V			-0.25			-0.25	mA
los§	V <sub>CC</sub> = MAX		-15		-100	-20	A	- 100	mA
Icc	V <sub>CC</sub> = MAX			95	140		95	140	mA

## switching characteristics over recommended ranges of TA and VCC (unless otherwise noted)

		TEST		MJ			J OR N			
	PARAMETER	CONDITIONS		MIN TYP‡		MIN TYP‡		MAX	UNIT	
ta(A)	Access time from address	C <sub>L</sub> = 30 pF		40	75		40	60	ns	
ta(S)	Access time from chip select (enable time)	See Note 3		20	40		20	30	ns	
<sup>t</sup> dis	Disable time	C <sub>L</sub> = 5 pF See Note 3		20	40		20	30	ns	

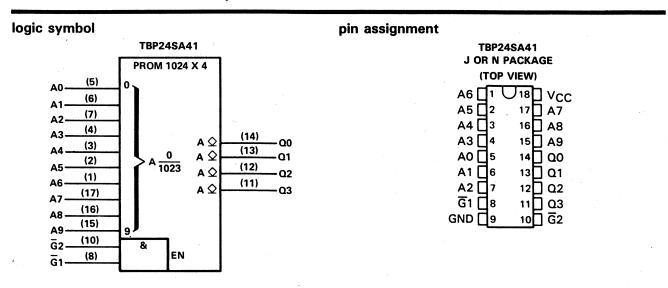
<sup>&</sup>lt;sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.



<sup>&</sup>lt;sup>‡</sup>All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25 °C.

<sup>§</sup>Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

## TBP24SA41 4096 BITS (1024 WORDS BY 4 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH OPEN-COLLECTOR OUTPUTS



#### recommended operating conditions

	PARAMETER		MJ			J OR N			
	PARAIVIETER	MIN	NOM	MAX	MIN	NOM	MAX	UNIT	
Vcc	Supply voltage	4.5	5	5.5	4.75	5	5.25	V	
VIH	High-level input voltage	2			2			V	
VIL	Low-level input voltage			0.8			0.8	V	
Voн	High-level output voltage			5.5			5.5	V	
loL	Low-level output current			16		<del></del>	16	mA	
TA	Operating free-air temperature range	- 55		125	0		70	°C	

### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CO	NDITIONS†		MJ			J OR N		
PANAMETER	TEST CO	NDITIONS :	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
V <sub>IK</sub>	$V_{CC} = MIN,$	l <sub>l</sub> = -18 mA			-1.2			-1.2	٧
ЮН	V <sub>CC</sub> = MIN,	V <sub>OH</sub> = 2.4 V		1.00	0.05			0.05	^
'OH	VCC - 141114,	$V_{OH} = 5.5 V$			0.1	-		0.1	mA
V <sub>OL</sub>	V <sub>CC</sub> = MIN,	I <sub>OL</sub> = 16 mA			0.5			0.5	V
lį	$V_{CC} = MAX$ ,	$V_{ } = 5.5 V$			1			1	mA
lін	V <sub>CC</sub> = MAX,	$V_{\parallel} = 2.7 \text{ V}$			25			25	μА
I <sub>I</sub> L	$V_{CC} = MAX$ ,	$V_{  } = 0.5 V$			-0.25			-0.25	mA
Icc	V <sub>CC</sub> = MAX			95	140		95	140	mA

	PARAMETER	TEST	MJ				UNIT		
	PANAMETEN	CONDITIONS	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNII
ta(A)	Access time from address	$C_L = 30 pF$		40	75		40	60	ns
ta(S)	Access time from chip select (enable time)	$R_{L1} = 300 \Omega$		20	40		20	30	ns
<b>†</b> D	Propagation delay time low-to-high-level	$R_{L2} = 600 \Omega$		20	40				
<sup>t</sup> PLH	output from chip select	See Note 3		20	40	100	20	30	ns

<sup>&</sup>lt;sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



 $<sup>^{\</sup>ddagger}$ All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_{A} = 25 ^{\circ}\text{C}$ .

## TBP24S81 8192 BITS (2048 WORDS BY 4 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH 3-STATE OUTPUTS

#### pin assignment logic symbol **TBP24S81 TBP24S81** J OR N PACKAGE **PROM 2048 X 4** (TOP VIEW) (5) A0 U18∐ Vcc (6) A5 🛮 2 17 A7 (7)A4 ∏3 16 🛮 A8 (4)A3 🛮 4 15 A9 (3) QO A0 ∏5 14 Q0 (13)(2) Q1 A5 A1 🛮 6 13 Q1 2047 (12)(1) Q2 $A\nabla$ A6 A2 🗌 (11) 12 Q2 (17)Q3 11 Q3 A10 🛮 8 (16)**A8** GND ∏9 10 ☐ G (15)(8) A10-(10)G. ΕN

#### recommended operating conditions

	DADAMETED	MJ				UNIT		
	PARAMETER	MIN	NOM	MAX	MIN	NOM	MAX	ONIT
Vcc	Supply voltage	4.5	5	5.5	4.75	5	5.25	٧
VIH	High-level input voltage	2			2			٧
VIL	Low-level input voltage			0.8			0.8	V
ЮН	High-level output current			-2			-3.2	mA
lOL	Low-level output current			16			16	mA
TA	Operating free-air temperature range	- 55		125	0		70	°C

### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

	TF07.00	unitions†		MJ			UNIT		
PARAMETER	TEST CONDITIONS <sup>†</sup>		MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
VIK	V <sub>CC</sub> = MIN,	I <sub>I</sub> = -18 mA		- 1	-1.2			-1.2	٧
V <sub>OH</sub>	V <sub>CC</sub> = MIN,	I <sub>OH</sub> = MAX	2.4	3.1		2.4	3.1		٧
VoL	V <sub>CC</sub> = MiN,	I <sub>OL</sub> = 16 mA			0.5			0.5	٧
lozh	$V_{CC} = MAX$ ,	$V_0 = 2.4 \text{ V}$		· · · · · · · · · · · · · · · · · · ·	50			50	μΑ
lozL	$V_{CC} = MAX$ ,	$V_0 = 0.5 V$			- 50			- 50	μА
l <sub>l</sub>	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 5.5 V			1			1	mA
lін	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 2.7 V			25			25	μΑ
IIL .	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 0.5 V			-0.25			-0.25	mA
los§	V <sub>CC</sub> = MAX		-15	-	- 100	-20		- 100	mA
<sup>I</sup> cc	V <sub>CC</sub> = MAX			125	175		125	175	mA

## switching characteristics over recommended ranges of TA and VCC (unless otherwise noted)

	DADAMETER	TEST		MJ			J OR N		
	PARAMETER	CONDITIONS	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
t <sub>a(A)</sub>	Access time from address	C <sub>L</sub> = 30 pF	· .	45	85		45	70	ns
ta(S)	Access time from chip select (enable time)	See Note 3		20	50		20	40	ns
	Disable disas	C <sub>L</sub> = 5 pF		20	50		20	40	ns
<sup>t</sup> dis	Disable time	See Note 3	-	20	30		20	40	115

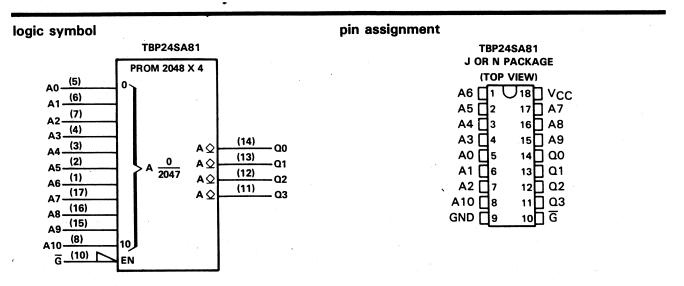
<sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.



 $<sup>^{\</sup>ddagger}$ All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_{A} = 25 ^{\circ}\text{C}$ .

<sup>§</sup>Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

## TBP24SA81 8192 BITS (2048 WORDS BY 4 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH OPEN-COLLECTOR OUTPUTS



#### recommended operating conditions

	DADAMETED		MJ			J OR N			
	PARAMETER	MIN	NOM	MAX	MIN	NOM	MAX	UNIT	
Vcc	Supply voltage	4.5	5	5.5	4.75	5	5.25	V	
VIH	High-level input voltage	2	* .		2			V	
VIL	Low-level input voltage			0.8			0.8	٧	
V <sub>OH</sub>	High-level output voltage			5.5			5.5	V	
loL	Low-level output current			16			16	mA	
TA	Operating free-air temperature range	- 55		125	0		70	°C	

#### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

	TEGT CON	TEST CONDITIONS†		MJ		J OR N		UNIT
PARAMETER	TEST CONDITIONS			TYP <sup>‡</sup> MA	X N	AIN TYP‡	MAX	UNIT
VIK	V <sub>CC</sub> = MIN,	l <sub>l</sub> = -18 mA		-1.	2		-1.2	V
	V MINI	V <sub>OH</sub> = 2.4 V		0.0	5		0.05	VmA
- Іон	V <sub>CC</sub> = MIN,	$V_{OH} = 5.5 V$		0.	1		0.1	1 ****
VOL	V <sub>CC</sub> = MIN,	I <sub>OL</sub> = 16 mA		0.	5	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	0.5	V
l <sub>l</sub>	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 5.5 V			1		1	mA
ЧΗ	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 2.7 V	* * * * * * * * * * * * * * * * * * * *	- 1 2	5		25	μΑ
ΊL	V <sub>CC</sub> = MAX,	$V_1 = 0.5 V$		-0.2	5		-0.25	mA
'cc	V <sub>CC</sub> = MAX			125 17	5	125	175	mA

#### switching characteristics over recommended ranges of TA and VCC (unless otherwise noted)

	OADAMETER	TEST	MJ					UNIT	
	PARAMETER	CONDITIONS	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
ta(A)	Access time from address	CL = 30 pF	- W 1	45	95		45	70	ns
t <sub>a(S)</sub>	Access time from chip select (enable time)	$R_{L1} = 300 \Omega$		20	50		20	40	ns
•	Propagation delay time low-to-high-level	$R_{L2} = 600 \Omega$		20	50		20	40	ns
<sup>t</sup> PLH	output from chip select	See Note 3	1	, 20	50		20	40	115

<sup>&</sup>lt;sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.



 $<sup>^{\</sup>ddagger}$ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25 °C.

## TBP28S86A 8192 BITS (1024 WORDS BY 8 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH 3-STATE OUTPUTS

logic symbol	TBP28S86A		pin assignment	TBP28S86A	
A0 (8)	PROM 1024 X 8	(9)		JW OR NW PACKAGE  (TOP VIEW)  A7 1 24 VCC	
A2 (6) A3 (5)	A ▽ A ▽ A ▽	(10) Q1 (11) Q2		A6	*.
A4 (4) A5 (3) A6 (2)	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	(13) (14) (15) Q4		A4	
A7 (1) A8 (23)	A ▽ A ▽ A ▽	(16) Q6 (17) Q7		A1	
$ \begin{array}{c} A9 - (22) \\ \hline G4 - (21) \Gamma \\ G3 - (19) \end{array} $	9 J 8			Q0	
$ \frac{G3}{G2} = \frac{(18)}{(20)} $	EN			Q2	

#### recommended operating conditions

·-	PARAMETER	MJW			J	UNIT		
	PARAIVIETER	MIN	NOM	MAX	MIN	NOM	MAX	UNIT
Vcc	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
ViH	High-level input voltage	2		10.	2			V.
VIL	Low-level input voltage			0.8			0.8	V
ЮН	High-level output current		-	-2			-3.2	mA
loL	Low-level output current			12			12	· mA
TA	Operating free-air temperature range	- 55		125	0		70	°C

#### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

DADAMETED	TEST CO	NDITIONS <sup>†</sup>		MJW		J	W OR N	W	
PARAMETER	IESI CO	יפאטוווטאי	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
VIK	V <sub>CC</sub> = MIN,	I <sub>I</sub> = -18 mA			-1.2			-1.2	٧
VOH	V <sub>CC</sub> = MIN,	I <sub>OH</sub> = MAX	2.4	3.1		2.4	3.1	-	٧
V <sub>OL</sub>	V <sub>CC</sub> = MIN,	I <sub>OL</sub> = 12 mA			0.5	1.1		0.5	V
lozh	V <sub>CC</sub> = MAX,	V <sub>O</sub> = 2.4 V			50		-1.5	50	μΑ
<sup>I</sup> OZL	V <sub>CC</sub> = MAX,	$V_0 = 0.5 V$			- 50			- 50	μΑ
l <sub>l</sub>	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 5.5 V			1			1	mA
lін	V <sub>CC</sub> = MAX,	$V_1 = 2.7 V$			25			25	μΑ
IL	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 0.5 V		4	-0.25		il na	-0.25	mA
los§	V <sub>CC</sub> = MAX		-15		-100	-20		- 100	mA
ICC	V <sub>CC</sub> = MAX			110	170		110	165	mA

DADAMETED		TEST	MJW		JW OR NW			UNIT	
	PARAMETER	CONDITIONS	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNII
taA)	Access time from address	C <sub>L</sub> = 30 pF	100	35	80		35	65	ns
ta(S)	Access time from chip select (enable time)	See Note 3		20	50		20	40	ns
	Disable time	C <sub>L</sub> = 5 pF		15	40		15	35	ns
<sup>t</sup> dis	Disable time	See Note 3		15	40		15	35	113

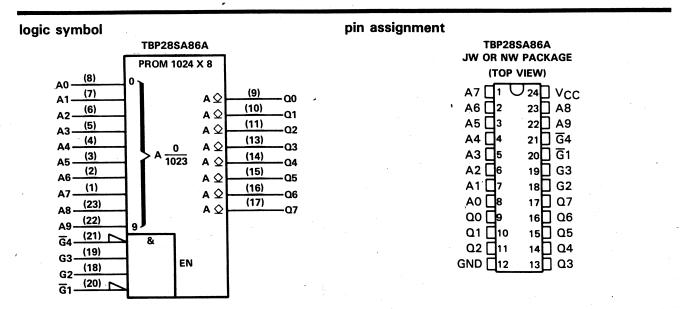
<sup>&</sup>lt;sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.

<sup>&</sup>lt;sup>‡</sup>All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25 ^{\circ}\text{C}$ .

<sup>§</sup>Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

## TBP28SA86A 8192 BITS (1024 WORDS BY 8 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH OPEN-COLLECTOR OUTPUTS



#### recommended operating conditions

		MJW		JW OR NW			UNIT	
	PARAMETER	MIN	NOM	MAX	MIN	NOM	MAX	CIVIT
Vcc	Supply voltage	4.5	5	5.5	4.75	5	5.25	٧
VIH	High-level input voltage	2			2			V
VIL	Low-level input voltage		- 1	0.8			0.8	V
Voн	High-level output voltage			5.5			5.5	V
lOL	Low-level output current			12			12	mA
TA	Operating free-air temperature range	- 55		125	0		70	°C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

				MJW		J	W OR N	W	
PARAMETER	TEST CO	NDITIONS†	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
ViK	V <sub>CC</sub> = MIN,	I <sub>I</sub> = -18 mA			-1.2			-1.2	>
	14 1411	V <sub>OH</sub> = 2.4 V			0.05			0.05	mA
ЮН	$V_{CC} = MIN,$	$V_{OH} = 5.5 V$			0.1			0.1	IIIA
VOL	V <sub>CC</sub> = MIN,	I <sub>OL</sub> = 12 mA			0.5			0.5	V .
l <sub>l</sub>	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 5.5 V			1			1	mA
IIH	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 2.7 V			25			25	μΑ
I <sub>I</sub> L	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 0.5 V			-,0.25			-0.25	mA
¹cc	V <sub>CC</sub> = MAX			125	175		125	175	mA

		TEST	- ·	MJW		J	W OR N	W	UNIT
	PARAMETER	CONDITIONS	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNII
ta(A)	Access time from address	C <sub>L</sub> = 30 pF		35	80	N 1	35	70	ns
t <sub>a</sub> (S)	Access time from chip select (enable time)	$R_{L1} = 300 \Omega$	14.1	20	50		20	40	ns
	Propagation delay time low-to-high-level	$R_{L2} = 600 \Omega$		15	40		15	35	ns
<sup>t</sup> PLH	output from chip select	See Note 3		1.5	40				

<sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



 $<sup>^{\</sup>ddagger}$ All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_{A} = 25 \,^{\circ}\text{C}$ .

## TBP28S2708A 8192 BITS (1024 WORDS BY 8 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH 3-STATE OUTPUTS

logic symbol			pin assignment		
	TBP28S2708A				2708A
	PROM 1024 X 8			NW PA	
A0 (8) A1 (7) A2 (6) A3 (4) A4 (4) A5 (2) A6 (1) A8 (22) A9 (22)	0	(9) — Q0 (10) — Q1 (11) — Q2 (13) — Q3 (14) — Q4 (15) — Q5 (16) — Q6 (17) — Q7		A7	24 VCC 23 A8 22 A9 21 NC 20 G 19 NC 18 NC 17 Q7 16 Q6 15 Q5 14 Q4 13 Q3

#### recommended operating conditions

	DADAMETED		NW		UNIT
	PARAMETER	MIN	NOM	MAX	UNIT
Vcc	Supply voltage	4.75	5	5.25	٧
VIH	High-level input voltage	2			٧
VIL	Low-level input voltage			0.8	V
ЮН	High-level output current			-3.2	mA
lOL	Low-level output current			12	mA
TA	Operating free-air temperature range	0		70	°C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

					NW		
PARAMETER	TEST CO	NDITIONS		MIN	TYP <sup>†</sup>	MAX	UNIT
VIK	$V_{CC} = 4.75,$	I <sub>I</sub> = -18 mA				-1.2	٧
Voн	$V_{CC} = 4.75,$	I <sub>OH</sub> = -3.2 mA		2.4	3.1		٧
V <sub>OL</sub>	$V_{CC} = 4.75,$	I <sub>OL</sub> = 12 mA				0.5	V
lоzн	$V_{CC} = 5.25,$	$V_0 = 2.4 \text{ V}$			100	50	μΑ
<sup>I</sup> OZL	$V_{CC} = 5.25,$	$V_0 = 0.5 V$				- 50	μΑ
1	$V_{CC} = 5.25,$	$V_1 = 5.5 V$	•			1	mA
lін	$V_{CC} = 5.25,$	$V_1 = 2.7 V$				25	μΑ
Ι <sub>Ι</sub> L	$V_{CC} = 5.25,$	V <sub>I</sub> = 0.5 V				-0.25	mA
los <sup>‡</sup>	V <sub>CC</sub> = 5.25			- 20		- 100	mA
Icc	$V_{CC} = 5.25$				110	165	mA

	0.0445770	TEST		NW		1 10117
	PARAMETER	CONDITIONS	MIN	TYP <sup>†</sup>	MAX	UNIT
ta(A)	Access time from address	C <sub>L</sub> = 30 pF		45	70	ns
ta(S)	Access time from chip select (enable time)	See Note 3		20	40	ns
	Disable time	C <sub>L</sub> = 5 pF	1.00	20	40	ns
<sup>t</sup> dis	Disable time	See Note 3				1

 $<sup>^{\</sup>dagger}$ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25 °C.

<sup>&</sup>lt;sup>‡</sup>Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second. NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



## TBP28S166 16,384 BITS (2084 WORDS BY 8 BITS) STANDARD PROGRAMMABLE READ-ONLY MEMORIES WITH 3-STATE OUTPUTS

	P28S166	pin assignment	TBP28S166	
A0 (8) A1 (7) A2 (6) A3 (5) A4 (4) A5 (3)	M 2048 X 8  A ♥ (9) Q0 (10) Q1 A ♥ (11) Q2 (13) Q3 (14) Q4 A ♥ (15) Q5 A ♥ (16) Q6 A ♥ (17) Q7		NW PACKAGE (TOP VIEW)  A7	

## recommended operating conditions

	PARAMETER		NW		
		MIN	NOM	MAX	UNIT
VCC	Supply voltage	4.75	5	5.25	V
VIH	High-level input voltage	2			V
VIL	Low-level input voltage			0.8	<del>l v</del>
ЮН	High-level output current			-3.2	mA
lOL	Low-level output current			16	mA
TA	Operating free-air temperature range	0		70	°C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CO	NDITIONS		NW		
	.10. 00		MIN	TYP	MAX	UNIT
VIK	$V_{CC} = 4.75,$	l <sub>l</sub> = -18 mA			-1.2	V
Voн	$V_{CC} = 4.75,$	$I_{OH} = -3.2 \text{ mA}$	2.4	3.1		V
VOL	$V_{CC} = 4.75,$	I <sub>OL</sub> = 16 mA	 1		0.5	V
<sup>I</sup> OZH	$V_{CC} = 5.25,$	V <sub>O</sub> = 2.4 V	<u> </u>		50	μА
lozl	$V_{CC} = 5.25,$	$V_0 = 0.5 V$	1	en e	- 50	μΑ
11	$V_{CC} = 5.25,$	V <sub>I</sub> = 5.5 V			1	mA
lін	$V_{CC} = 5.25,$	V <sub>I</sub> = 2.7 V			25	μΑ
կլ	$V_{CC} = 5.25,$	$V_1 = 0.5 V$		<u> </u>	-0.25	mA
los‡	$V_{CC} = 5.25$		- 20		- 100	mA
ICC	V <sub>CC</sub> = 5.25		1	130	175	mA

	PARAMETER	TEST		NW			
		CONDITIONS	MIN	TYP	MAX	UNIT	
ta(A)	Access time from address	$C_l = 30 pF$		35	75	ns	
t <sub>a(S)</sub>	Access time from chip select (enable time)	See Note 3		15	40	ns	
<sup>t</sup> dis	Disable time	C <sub>L</sub> = 5 pF See Note 3		15	40	ns	

<sup>&</sup>lt;sup>†</sup>All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25 ^{\circ}\text{C}$ .

<sup>\*</sup>Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second. NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



## TBP28L22 2048 BITS (256 WORDS BY 8 BITS) LOW-POWER PROGRAMMABLE READ-ONLY MEMORIES WITH 3-STATE OUTPUTS

#### pin assignment logic symbol **TBP28L22 TBP28L22** J OR N PACKAGE PROM 256 X 8 (TOP VIEW) A0 (6)Ω0 (7)A1 □2 19 A 7 (3) Q1 A2 (8) 18 A6 A2 ∏3 (4) 02 (9) 17 A5 A3 🗌 Q3 (5) (11)A4 🗍 5 16 G2 (17) $A \nabla$ Q4 A5 (12)Q0 ∏6 15 G1 $A\nabla$ **Q5** (18)**A6** (13)Q1 []7 14 07 (19)Q6 $A\nabla$ (14)02 8 13 06 **Q7** $A \nabla$ (16)Q3 [ 12 Q5 (15) Ğ1 GND ☐10 11 Q4

#### recommended operating conditions

			MJ			J OR N		UNIT
	PARAMETER	MIN	NOM	MAX	MIN	NOM	MAX	ONT
VCC	Supply voltage	4.5	5	5.5	4.75	5	5.25	٧
VIH	High-level input voltage	2			2		1.0	٧
VIL	Low-level input voltage			0.8			0.8	V
ЮН	High-level output current			-2			-6.5	mA
IOL	Low-level output current			16			16	mA
TA	Operating free-air temperature range	-55		125	0		70	°C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

				MJ		-	UNIT		
PARAMETER	TEST CONDITIONS†		MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
VIK	V <sub>CC</sub> = MIN,	I <sub>I</sub> = -18 mA			-1.2			-1.2	٧
Voн	V <sub>CC</sub> = MIN,	. I <sub>OH</sub> = MAX	2.4	3.1		2.4	3.1		٧
V <sub>OL</sub>	V <sub>CC</sub> = MIN,	I <sub>OL</sub> = 16 mA			0.5			0.5	٧
IOZH	V <sub>CC</sub> = MAX,	$V_0 = 2.4 \text{ V}$			50			50	μΑ
IOZL	V <sub>CC</sub> = MAX,	$V_0 = 0.5 V$			- 50			- 50	μΑ
11	V <sub>CC</sub> = MAX,	$V_1 = 5.5 \text{ V}$			1			1	mA
IIH	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 2.7 V	-		25			25	μΑ
IIL .	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 0.5 V			-0.25			-0.25	mA
los§	V <sub>CC</sub> = MAX		- 25		- 100	-30		- 100	mA
Icc	• V <sub>CC</sub> = MAX			75	100		75	100	mA

## switching characteristics over recommended ranges of TA and VCC (unless otherwise noted)

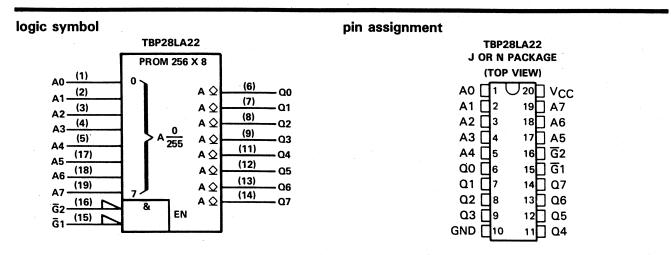
		TEST		MJ			J OR N			
	PARAMETER	CONDITIONS	MIN	TYP‡	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT	
taA)	Access time from address	C <sub>L</sub> = 30 pF	٠.	45	75		45	70	ns	
ta(S)	Access time from chip select (enable time)	See Note 3	1	20	40		20	35	ns	
	8: 11 4:	C <sub>L</sub> = 5 pF		15	35		15	30	ns	
<sup>t</sup> dis	Disable time	See Note 3		15	33				,,,,	

<sup>&</sup>lt;sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.

 $<sup>^{\</sup>ddagger}$ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25 °C.

<sup>§</sup>Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

# TBP28LA22 2048 BITS (256 WORDS BY 8 BITS) LOW-POWER PROGRAMMABLE READ-ONLY MEMORIES WITH OPEN-COLLECTOR OUTPUTS



### recommended operating conditions

	PARAMETER		MJ			J OR N			
· •	FANAMETEN	MIN	NOM	MAX	MIN	NOM	MAX	UNIT	
Vcc	Supply voltage	4.5	5	5.5	4.75	5	5.25	V	
VIH	High-level input voltage	2			2			·V	
VIL	Low-level input voltage	1		0.8			0.8	V	
Voн	High-level output voltage			5.5			5.5	V	
lOL	Low-level output current			16		-	16	mA	
TA	Operating free-air temperature range	-55		125	0		70	°C	

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†			MJ		J OR N			
FANAIVIETEN	lesi coi	4011049	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
VIK	V <sub>CC</sub> = MIN,	I <sub>I</sub> = -18 mA	1 1 1	176.4	-1.2			-1.2	V
ЮН	V <sub>CC</sub> = MIN,	V <sub>OH</sub> = 2.4 V			0.05			0.05	A
'OH		V <sub>OH</sub> = 5.5 V			0.1			0.1	mΑ
V <sub>OL</sub>	V <sub>CC</sub> = MIN,	I <sub>OL</sub> = 16 mA			0.5			0.5	V
11	$V_{CC} = MAX,$	V <sub>I</sub> = 5.5 V			1			1	mA
11H	$V_{CC} = MAX,$	V <sub>I</sub> = 2.7 V			25	7		25	μΑ
IIL	V <sub>CC</sub> = MAX,	$V_{I} = 0.5 V$			-0.25			-0.25	mA
Icc	V <sub>CC</sub> = MAX			75	100		75	100	mA

	PARAMETER	TEST	MJ		UNIT			
	PARAMETER	CONDITIONS	MIN TYP‡	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
t <sub>aA)</sub>	Access time from address	C <sub>L</sub> = 30 pF	40	80		45	75	ns
t <sub>a</sub> (S)	Access time from chip select (enable time)	$R_{L1} = 300 \Omega$	20	40		20	35	ns
*====	Propagation delay time low-to-high-level	$R_{L2} = 600 \Omega$	15	05		4-		
tPLH	output from chip select	See Note 3	15	35		15	30	ns

<sup>&</sup>lt;sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.

 $<sup>^{\</sup>ddagger}$ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25 °C.

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

## TBP28L42 4096 BITS (512 WORDS BY 8 BITS) LOW-POWER PROGRAMMABLE READ-ONLY MEMORIES WITH 3-STATE OUTPUTS

logic symbol	TBP28L42		pin assignment	TBP2	8L42
(4)	PROM 512 X 8			J OR N P	
A0 (1) (2) (3) (4) (4) (5) (16) (17) (48) (19) (19) (15)	$ \begin{array}{c c}  & A & \\  & A & \\  & A & \\  & A & \\  & \hline  & A & \\  & A &$	(6) Q0 (7) Q1 (8) Q2 (9) Q3 (11) Q4 (12) Q5 (13) Q6 (14) Q7		A0 1 2 A1 2 A2 3 A3 4 A4 5 Q0 6 Q1 7 Q2 8 Q3 9 GND 10	720 VCC 19 A8 18 A7 17 A6 16 A5 15 G 14 Q7 13 Q6 12 Q5 11 Q4

## recommended operating conditions

	DADAMETED		MJ			J OR N		UNIT
	PARAMETER	MIN	NOM	MAX	MIN	NOM	MAX	UNIT
Vcc	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
VIH	High-level input voltage	2			2	r .		٧
VIL	Low-level input voltage			0.8			0.8	V
ЮН	High-level output current			- 1			-1.6	mA
<sup>1</sup> OL	Low-level output current			8			8	mA
TA	Operating free-air temperature range	- 55		125.	0		70	°C

#### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

	TTOT 001	unitions t		MJ			J OR N		
PARAMETER	IEST COI	NDITIONS†	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
VIK	V <sub>CC</sub> = MIN,	l <sub>l</sub> = -18 mA			-1.2			-1.2	٧
Voн	V <sub>CC</sub> = MIN,	IOH = MAX	2.4	3.1		2.4	3.1		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN,	IOL = 8 mA			0.5			0.5	V
lozн	V <sub>CC</sub> = MAX,	V <sub>O</sub> = 2.4 V			50			50	μΑ
IOZL	V <sub>CC</sub> = MAX,	V <sub>O</sub> = 0.5 V			- 50			- 50	μА
l <sub>l</sub>	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 5.5 V			1			1	mA
IH	V <sub>CC</sub> = MAX,	$V_{  } = 2.7 V$			25			25	μΑ
IIL	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 0.5 V			-0.25			-0.25	mA
los§	V <sub>CC</sub> = MAX		- 10		- 100	-10		- 100	mA
lcc	V <sub>CC</sub> = MAX			50	85		50	85	mA

	DADAMETED	TEST	MJ				UNIT		
	PARAMETER	CONDITIONS	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP‡	MAX	UNIT
t <sub>a(A)</sub>	Access time from address	C <sub>L</sub> = 30 pF		55	110		55	95	ns
ta(S)	Access time from chip select (enable time)	See Note 3		25	60		25	60	ns
	Disable time	C <sub>L</sub> = 5 pF		25	50		25	40	
<sup>t</sup> dis	Disable time	See Note 3		25	50		25	40	ns

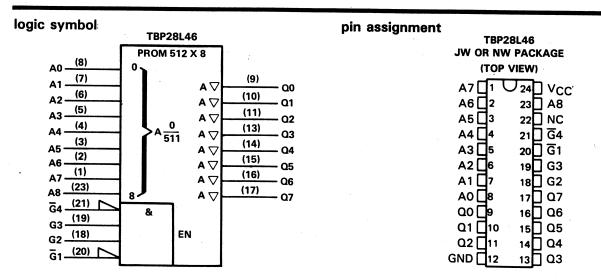
<sup>&</sup>lt;sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.

 $<sup>^{\</sup>ddagger}$ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25 °C.

<sup>§</sup>Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

# TBP28L46 4096 BITS (512 WORDS BY 8 BITS) LOW-POWER PROGRAMMABLE READ-ONLY MEMORIES WITH 3-STATE OUTPUTS



#### recommended operating conditions

	PARAMETER		MJW			JW OR NW			
		MIN	NOM	MAX	MIN	NOM	MAX	UNIT	
VCC	Supply voltage	4.5	5	5.5	4.75	5	5.25	V	
VIH	High-level input voltage	2			2			V	
VIL	Low-level input voltage			0.8			0.8	V	
ЮН	High-level output current			-1	<b>-</b>		-1.6	mA	
loL	Low-level output current			8		-	8	mA	
TA	Operating free-air temperature range	- 55		125	0		70	°C	

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CO	NDITIONS†		MJW		J	W OR N	W	T
	. 120. 00.		MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
VIK	$V_{CC} = MIN,$	l₁ = −18 mA			-1.2			-1.2	V
Voн	V <sub>CC</sub> = MIN,	IOH = MAX	2.4	3.1	-	2.4	3.1		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN,	IOL = 8 mA			0.5			0.5	V
<sup>l</sup> ozh	$V_{CC} = MAX$	V <sub>O</sub> = 2.4 V		· · · · · · · · · · · · · · · · · · ·	50			50	μΑ
<sup>I</sup> OZL	$V_{CC} = MAX,$	$V_0 = 0.5 V$			- 50			-50	μΑ
l <sub>l</sub>	$V_{CC} = MAX$	V <sub>I</sub> = 5.5 V			1		· · · · · · · · · · · · · · · · · · ·	1	mA
IH	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 2.7 V			25			25	μΑ
İL	V <sub>CC</sub> = MAX,	$V_1 = 0.5 V$			-0.25			-0.25	mA
los⁵	V <sub>CC</sub> = MAX		-10		-100	-10		- 100	mA
ICC	V <sub>CC</sub> = MAX			50	85		50	85	mA

## switching characteristics over recommended ranges of TA and VCC (unless otherwise noted)

	PARAMETER TEST		MJW			JW OR NW			T
		CONDITIONS	MIN TYP‡		MAX	MIN TYP‡		MAX	UNIT
ta(A)	Access time from address	C <sub>L</sub> = 30 pF		55	110	(	55	95	ns
ta(S)	Access time from chip select (enable time)	See Note 3		25	60		25	60	ns
tdis	Disable time	C <sub>L</sub> = 5 pF							
-uis	Diouble time	See Note 3		25	50		25	40	ns

<sup>&</sup>lt;sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.



 $<sup>^{\</sup>ddagger}$ All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_{A} = 25 ^{\circ}\text{C}$ .

Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

## TBP28L86A 8192 BITS (1024 WORDS BY 8 BITS) LOW-POWER PROGRAMMABLE READ-ONLY MEMORIES WITH 3-STATE OUTPUTS

logic symbol	TBP28L86A	pin assignment	TBP28L86A
A0 (8) A1 (7) A2 (6) A3 (5) A4 (4) A5 (3) A6 (2) A7 (1) A8 (23) A9 (22) G4 (19) G2 (18) G2 (20)	PROM 1024 X 8  A  A  A  A  A  A  A  A  A  A  A  A  A	(9) — Q0 (10) — Q1 (11) — Q2 (13) — Q3 (14) — Q4 (15) — Q5 (16) — Q6 (17) — Q7	JW OR NW PACKAGE       (TOP VIEW)       A7

#### recommended operating conditions

	242445752		MJW			JW OR NW			
	PARAMETER	MIN		MAX	MIN	NOM	MAX	UNIT	
Vcc	Supply voltage	4.5	5	5.5	4.75	5	5.25	٧	
VIH	High-level input voltage	2			2			٧	
VIL	Low-level input voltage			0.8			0.8	V	
ЮН	High-level output current	•		-1			- 1.6	mA	
lOL	Low-level output current			8			8	mA	
TA	Operating free-air temperature range	- 55		125	0		70	°C	

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

		TEST CONDITIONS†		MJW		J	W OR N	W	UNIT
PARAMETER	TEST CO	NDITIONS	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
ViK	V <sub>CC</sub> = MIN,	I <sub>I</sub> = -18 mA			-1.2			- 1.2	٧
Voн	V <sub>CC</sub> = MIN,	I <sub>OH</sub> = MAX	2.4	3.1		2.4	3.1		V
VOL	V <sub>CC</sub> = MIN,	I <sub>OL</sub> = 8 mA			0.5			0.5	٧
lozh	V <sub>CC</sub> = MAX,	$V_0 = 2.4 \text{ V}$			50		:	50	μΑ
lozL	$V_{CC} = MAX$ ,	V <sub>O</sub> = 0.5 V			- 50			- 50	μΑ
l <sub>l</sub>	$V_{CC} = MAX$	V <sub>I</sub> = 5.5 V			1			1	mA
IIH	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 2.7 V	.7		25			25	μΑ
1/1	$V_{CC} = MAX$ ,	$V_1 = 0.5 V$			-0.25			-0.25	mA
los§	V <sub>CC</sub> = MAX		-10		-100	-10		- 100	mA
<sup>1</sup> CC	V <sub>CC</sub> = MAX			55	95		55	80	mA

## switching characteristics over recommended ranges of TA and VCC (unless otherwise noted)

		TEST		MJW			JW OR NW		
	PARAMETER	CONDITIONS	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	UNIT
ta(A)	Access time from address	C <sub>L</sub> = 30 pF		65	200		65	110	ns
t <sub>a</sub> (S)	Access time from chip select (enable time)	See Note 3		40	125		40	80	ns
	Disable time	C <sub>L</sub> = 5 pF		25	100		25	60	ns
<sup>t</sup> dis	Disable time	See Note 3		20	100				"

<sup>†</sup>For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.



 $<sup>^{\</sup>ddagger}$ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25 °C.

<sup>§</sup>Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

# TBP28L166 16,384 BITS (2084 WORDS BY 8 BITS) LOW-POWER PROGRAMMABLE READ-ONLY MEMORIES WITH 3-STATE OUTPUTS

logic symbol			pin assignment			
	TBP28L166			TBP28	BL166	
	PROM 2048 X 8			NW PA	CKAGE	
A0 (8)	40	-		(TOP	VIEW)	
A1 (7) A2 (6)	- A ▽	(9) Q0		A7 [1]	724 VCC	
Δ3 (3)	A▽	(10) (11) Q1		A6 ∐2 A5 ∐3	23 A8 22 A9	
A4 (4) A5 (3)	$ \begin{array}{c c} A & \hline A $	(13) Q3 (14) Q3		A4	21 A10 20 G	
A6 (2) A7 (1)	-	(15) Q5		A2 []6	20∐ G 19∐ G3	
Ao (23)	A V	(16) (17) Q6		A1	18 G2 17 Q7	
A9 (22) A10 (21)	10	Q7			16 Q6	
G3 (19) G2 (18)	- &			Ω1 ∏10 Ω2 ∏11	15∏ Q5 14∏ Q4	
G2 (20) C	EN			GND 12	13 03	

#### recommended operating conditions

	PARAMETER		LINUT		
	- And the second of the second	MIN	NOM	MAX	UNIT
Vcc	Supply voltage	4.75	5	5.25	V
VIH	High-level input voltage	2			V
٧ <sub>IL</sub>	Low-level input voltage			0.8	V
ЮН	High-level output current			-1.6	mA
lOL	Low-level output current			8	mA
TA	Operating free-air temperature range	0		70	°C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CO	NDITIONS		NW				
			MIN	TYP	MAX	UNIT		
VIK	$V_{CC} = 4.75,$	I <sub>I</sub> = -18 mA			-1.2	V		
VOH	$V_{CC} = 4.75,$	I <sub>OH</sub> = -1.6 mA	2.4	3.1		V		
VOL	$V_{CC} = 4.75,$	I <sub>OL</sub> = 8 mA			0.5	V		
lozh	$V_{CC} = 5.25,$	V <sub>O</sub> = 2.4 V			50	μΑ		
lozL	$V_{CC} = 5.25,$	$V_0 = 0.5 V$			- 50	μΑ		
11	$V_{CC} = 5.25,$	V <sub>I</sub> = 5.5 V			1	mA		
IIH	$V_{CC} = 5.25,$	V <sub>I</sub> = 2.7 V			25	μА		
IIL	$V_{CC} = 5.25,$	$V_{I} = 0.5 \text{ V}$			-0.25	mA		
los <sup>‡</sup>	V <sub>CC</sub> = 5.25		- 10		-100	mA		
<sup>1</sup> CC	V <sub>CC</sub> = 5.25			75	110	mA		

	PARAMETER	TEST		ŇW		
		CONDITIONS		TYP	MAX	UNIT
ta(A)	Access time from address	$C_L = 30 pF$		80	125	ns
t <sub>a</sub> (S)	Access time from chip select (enable time)	See Note 3		40	65	ns
<sup>t</sup> dis	Disable time	C <sub>L</sub> = 5 pF				
-uis	Diodolo timo	See Note 3	1	30	65	ns

<sup>&</sup>lt;sup>†</sup>All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25 ^{\circ}\text{C}$ .

<sup>\*</sup>Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second. NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



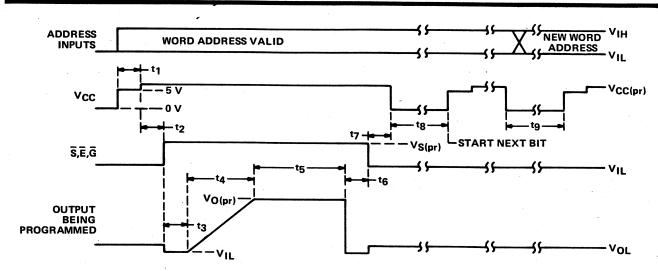
# SERIES 24 AND 28 PROGRAMMABLE READ-ONLY MEMORIES

## recommended operating condition's for programming (see Figure 1)

		MIN	NOM	MAX	UNIT
Steady-state supply voltage	Vcc	4.75	5	5.25	٧
	VIH	3	4	5	V
Input voltage	VIL	0	0	0.5	V
Voltage at all outputs except the one to be programmed		0	0	0.5	٧
Supply voltage level to program a bit	V <sub>CC(pr)</sub>	5.75	6	6.25	V
Select or enable level to program a bit	V <sub>S(pr)</sub>	9.75	10	11	V
Output level during interval t5	VO(pr)	15.75	16	16.25	V
	Low	4.4	4.5	4.6	v
Supply voltage during verification (see step 14)	High	5.4	5.5	5.6	]
Time from VCC to settle and to verify need to program	t <sub>1</sub>	0	5	10	μs
Time from V <sub>CC</sub> = 6 V until chip select (enable) is at 10 V-	t <sub>2</sub>	5	5	10	μs
Time from chip select (enable) high to start of program ramp	t3.	0.1	5	10	μs
Ramp time, output program pulse	t4	10	15	20	μs
Duration of output program pulse	t <sub>5</sub>	15	20	20	μs
Time from end of program pulse to chip select (enable) low	t <sub>6</sub>	5	5	10	μs
Time from chip select (enable) V <sub>CC</sub> = 0 V	t7	0.1	5	5	μs
Time for cooling between bits	tg t	30	50	100	μs
Time for cooling between words	tg	30	50		μs
Free-air temperature	TA	20	25	30	°C

## step-by-step programming instruction (see Figure 1)

- 1. Address the word to be programmed, apply 5 volts to VCC and active levels to all chip select (S and S) or chip enable (E and E) inputs.
- 2. Verify the status of a bit location by checking the output level.
- 3. Decreass VCC to 0 volts.
- 4. For bit locations that do not require programming, skip steps 5 through 11.
- 5. Increase V<sub>CC</sub> to V<sub>CC(pr)</sub> with a minimum current capability of 250 milliamperes.
- 6. Apply  $V_{S(pr)}$  to all the  $\overline{S}$ ,  $\overline{E}$  or  $\overline{G}$  inputs.  $I_I \leq 25$  milliamperes. Active-high enables may be left high.
- 7. Connect all outputs, except the one to be programmed, to VIL. Only one bit is to be programmed at a time.
- 8. Apply the output programming pulse for 20 microseconds. Minimum current capability of the programming supply should be 250 milliamperes.
- 9. After terminating the output pulse, disconnect all outputs from V<sub>IL</sub> conditions.
- 10. Reduce the voltage at \$\overline{S}\$, \$\overline{E}\$, or \$\overline{G}\$ inputs to \$V\_{||}\$.
- 11. Decrease VCC to 0 volts.
- 12. Return to step 4 until all outputs in the word have been programmed.
- 13. Repeat steps 2 through 11 for each word in memory.
- 14. Verify programming of every word after all words have been programmed using VCC values of 4.5 and 5.5 volts.



NOTE 4: Rise and fall times should be  $\leq$  1  $\mu$ s.

FIGURE 1. TIMING DIAGRAM AND VOLTAGE WAVEFORMS FOR PROGRAMMING SEQUENCE

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