SERIES 24 AND 28
STANDARD PROGRAMMABLE READ-ONLY MEMORIES
WITH OPEN-COLLECTOR OUTPUTS

recommended operating conditions

PARAMETER		TBP28SA86			TBP24SA81, TBP24SA41			TBP24SA10*			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	MJ	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5	V
	J, N	4.75	5	5.25	4.75	5	5.25	4.75	5	5.25	
High-level output voltage, V_{OH}				5.5			5.5			5.5	V
Low-level output current, I_{OL}	MJ			12			16			16	mA
	J, N			12			16			16	
Operating free-air temperature range	MJ	−55		125	−55		125	−55		125	°C
	J, N	0		70	0		70	0		70	

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

PARAMETER		TEST CONDITIONS†		TBP24SA81 TBP28SA86			TBP24SA41			TBP24SA10*			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage			2			2			2			V
V_{IL}	Low-level input voltage					0.8			0.8			0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = −18 mA				−1.2			−1.2			−1.2	V
I_{OH}	High-level output current	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V	V_O = 2.4 V			50			50			50	µA
			V_O = 5.5 V			100			100			100	
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = MAX	MJ			0.5			0.5			0.5	V
			J, N			0.5			0.5			0.45	
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V				1			1			1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7 V				25			25			25	µA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.5 V				−250			−250			−250	µA
I_{CC}	Supply current	V_{CC} = MAX	MJ		125			95	140		75		mA
			J, N		125	175		95	140		75		

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

switching characteristics over recommended ranges of T_A and V_{CC} (unless otherwise noted)

TYPE		TEST CONDITIONS	$t_{a(A)}$ Access time from address			$t_{a(S)}$ Access time from chip select (enable time)			t_{PLH} Propagation delay time, low-to-high-level output from chip select			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
TBP24SA10*	MJ	C_L = 30 pF, See Page 1-14		35			20	40		15	40	ns
	J, N			35			20	30		15	30	
TBP24SA81				45	70		20	40		20	40	ns
TBP24SA41	MJ			40	75		20	40		20	40	ns
	J, N			40	60		20	30		20	30	
TBP24SA86				45	70		20	40		20	40	ns

* Electrical parameters for these devices are design goals only.

NOTE: MJ designates full-temperature-range circuits (formerly 54 Family), J and N designate commercial-temperature-range circuits (formerly 74 Family).

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 225012 • DALLAS, TEXAS 75265

SERIES 24 AND 28
STANDARD PROGRAMMABLE READ-ONLY MEMORIES
WITH 3-STATE OUTPUTS

recommended operating conditions

PARAMETER		TBP24S10*			TBP28S86, TBP28S2708			TBP24S81, TBP24S41			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	MJ	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5	V
	J, N	4.75	5	5.25	4.75	5	5.25	4.75	5	5.25	
High-level output current, I_{OH}	MJ			−2			−2			−2	mA
	J, N			−3.2			−3.2			−3.2	
Low-level output current, I_{OL}	MJ			16			12			16	mA
	J, N			16			12			16	
Operating free-air temperature range	MJ	−55		125	−55		125	−55		125	°C
	J, N	0		70	0		70	0		70	

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

PARAMETER		TEST CONDITIONS†		TBP24S10*			TBP24S81, TBP24S86, TBP28S2708			TBP24S41			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage			2			2			2			V
V_{IL}	Low-level input voltage					0.8			0.8			0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = −18 mA				−1.2			−1.2			−1.2	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = MAX		2.4	3.1		2.4	3.1		2.4	3.1		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = MAX				0.5			0.5			0.5	V
I_{OZH}	Off-state output current, high-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_O = 2.4 V				50			50			50	µA
I_{OZL}	Off-state output current, low-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_O = 0.5 V				−50			−50			−50	µA
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V				1			1			1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7 V				25			25			25	µA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.5 V				−250			−250			−250	µA
I_{OS}	Short-circuit output current§	V_{CC} = MAX	MJ	−15		−100	−15		−100	−15		−100	mA
			J, N	−20		−100	−20		−100	−20		−100	
I_{CC}	Supply current	V_{CC} = MAX	MJ					125	175		95	140	mA
			J, N		75			125	175		95	140	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C

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

switching characteristics over recommended ranges of T_A and V_{CC} (unless otherwise noted)

TYPE		TEST CONDITIONS		$t_{a(A)}$ Access time from address			$t_{a(S)}$ Access time from chip select (enable time)			t_{PXZ} Disable time			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
TBP24S10*	MJ	C_L = 30 pF for $t_{a(A)}$ and $t_{a(S)}$, C_L = 5 pF for t_{PXZ}	R_L = 300 Ω, See Page 1-14		35			20	35		15	35	ns
	J, N				35			20	40		15	30	ns
TBP24S81					45	70		20	40		20	40	ns
TBP24S41	MJ				40	75		20	40		20	40	ns
	J, N				40	60		20	30		20	30	ns
TBP28S86					45	70		20	40		20	40	ns
TBP28S2708													

* Electrical parameters for these devices are design goals only.

NOTE: MJ designates full-temperature-range circuits (formerly 54 Family), J and N designate commercial-temperature-range circuits (formerly 74 Family).

5

SERIES 24 AND 28
STANDARD PROGRAMMABLE READ-ONLY MEMORIES
WITH 3-STATE OUTPUTS

recommended operating conditions

PARAMETER		TBP28S42*, TBP28S45*			TBP28S85*			TBP28S166*			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	MJ	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5	V
	J, N	4.75	5	5.25	4.75	5	5.25	4.75	5	5.25	
High-level output current, I_{OH}	MJ			−2			−2			−2	mA
	J, N			−3.2			−3.2			−3.2	
Low-level output current, I_{OL}	MJ			16			16			16	mA
	J, N			16			16			16	
Operating free-air temperature range	MJ	−55		125	−55		125	−55		125	°C
	J, N	0		70	0		70	0		70	

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

PARAMETER		TEST CONDITIONS†		TBP28S42*, TBP28S45*			TBP28S85*			TBP28S166*			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage			2			2			2			V
V_{IL}	Low-level input voltage					0.8			0.8			0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = −18 mA				−1.2			−1.2			−1.2	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = MAX		2.4	3.1		2.4	3.1		2.4	3.1		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = MAX				0.5			0.5			0.5	V
I_{OZH}	Off-state output current, high-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_O = 2.4 V				50			50			50	μA
I_{OZL}	Off-state output current, low-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_O = 0.5 V				−50			−50			−50	μA
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V				1			1			1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7 V				25			25			25	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.5 V				−250			−250			−250	μA
I_{OS}	Short-circuit output current§	V_{CC} = MAX	MJ	−15		−100	−15		−100	−15		−100	mA
			J, N	−20		−100	−20		−100	−20		−100	
I_{CC}	Supply current	V_{CC} = MAX	MJ		105			110			100		mA
			J, N		105			110			100		

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

switching characteristics over recommended ranges of T_A and V_{CC} (unless otherwise noted)

TYPE	TEST CONDITIONS		$t_{a(A)}$ Access time from address			$t_{a(S)}$ Access time from chip select (enable time)			t_{PXZ} Disable time			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
TBP28S42* TBP28S45*	C_L = 30 pF for $t_{a(A)}$ and $t_{a(S)}$, C_L = 5 pF for t_{PXZ}	R_L = 300 Ω, See Page 1-14		35			15			12		ns
TBP28S85*				35			15			12		ns
TBP28S166*				35			15			12		ns

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SERIES 24 AND 28
LOW-POWER PROGRAMMABLE READ-ONLY MEMORIES
WITH 3-STATE OUTPUTS

recommended operating conditions

PARAMETER		TBP28L22*			TBP28L42*, TBP28L45*			TBP28L86			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	MJ	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5	V
	J, N	4.75	5	5.25	4.75	5	5.25	4.75	5	5.25	
High-level output current, I_{OH}	MJ			−1			−1			−1	mA
	J, N			−1.6			−1.6			−1.6	
Low-level output current, I_{OL}	MJ			8			8			4	mA
	J, N			8			8			8	
Operating free-air temperature range	MJ	−55		125	−55		125	−55		125	°C
	J, N	0		70	0		70	0		70	

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

PARAMETER		TEST CONDITIONS†		TBP28L22*			TBP28L42* TBP28L42*			TBP28L86			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage			2			2			2			V
V_{IL}	Low-level input voltage					0.8			0.8			0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = −18 mA				−1.2			−1.2			−1.2	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = MAX		2.4	3.1		2.4	3.1		2.4	3.1		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = MAX				0.5			0.5			0.5	V
I_{OZH}	Off-state output current, high-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_O = 2.4 V				50			50			50	μA
I_{OZL}	Off-state output current, low-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_O = 0.5 V				−50			−50			−50	μA
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V				1			1			1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7 V				25			25			25	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.5 V				−250			−250			−250	μA
I_{OS}	Short-circuit output current§	V_{CC} = MAX	MJ	−10		−100	−10		−100	−10		−100	mA
			J, N	−10		−100	−10		−100	−10		−100	
I_{CC}	Supply current	V_{CC} = MAX	MJ								60	100	mA
			J, N		60	85		50			60	100	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

switching characteristics over recommended ranges of T_A and V_{CC} (unless otherwise noted)

TYPE		TEST CONDITIONS		$t_{a(A)}$ Access time from address			$t_{a(S)}$ Access time from chip select (enable time)			t_{PXZ} Disable time			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
TBP28L22*	MJ	C_L = 30 pF for $t_{a(A)}$ and $t_{a(S)}$, C_L = 5 pF for t_{PXZ}	R_L = 600 Ω, See Page 1-15		45			20			15		ns
	J, N				45			20			15		ns
TBP28L42* TBP28L45*					60			30			25		ns
TBP28L86	MJ				85	175		55	135		50	90	ns
	J, N				85	130		55	90		50	75	

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NOTE: MJ designates full-temperature-range circuits (formerly 54 Family), J and N designate commercial-temperature-range circuits (formerly 74 Family).

SERIES 24 AND 28
LOW-POWER PROGRAMMABLE READ-ONLY MEMORIES
WITH 3-STATE OUTPUTS

recommended operating conditions

PARAMETER		TBP28L85*			TBP28L166*			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	MJ	4.5	5	5.5	4.5	5	5.5	V
	J, N	4.75	5	5.25	4.75	5	5.25	
High-level output current, I_{OH}	MJ			−1			−1	mA
	J, N			−1.6			−1.2	
Low-level output current, I_{OL}	MJ			8			8	mA
	J, N			8			8	
Operating free-air temperature range	MJ	−55		125	−55		125	°C
	J, N	0		70	0		70	

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

PARAMETER		TEST CONDITIONS†		TBP28L85*			TBP28L166*			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage			2			2			V
V_{IL}	Low-level input voltage					0.8			0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = −18 mA				−1.2			−1.2	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = MAX		2.4	3.1		2.4	3.1		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = MAX				0.5			0.5	V
I_{OZH}	Off-state output current, high-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_O = 2.4 V				50			50	μA
I_{OZL}	Off-state output current, low-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_O = 0.5 V				−50			−50	μA
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V				1			1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7 V				25			25	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.5 V				−250			−250	μA
I_{OS}	Short-circuit output current§	V_{CC} = MAX	MJ	−10		−100	−10		−100	mA
			J, N	−10		−100	−10		−100	
I_{CC}	Supply current	V_{CC} = MAX	MJ		55			50		mA
			J, N		55			50		

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

switching characteristics over recommended ranges of T_A and V_{CC} (unless otherwise noted)

TYPE	TEST CONDITIONS		$t_{a(A)}$ Access time from address			$t_{a(S)}$ Access time from chip select (enable time)			t_{PXZ} Disable time			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
TBP28L85*	C_L = 30 pF for $t_{a(A)}$ and $t_{a(S)}$, C_L = 5 pF for t_{PXZ}	R_L = 600 Ω, See Page 1-15		65			30			25		ns
TBP28L166*				65			30			25		ns

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TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 225012 • DALLAS TEXAS 75265

recommended operating conditions

PARAMETER		TBP28P42*, TBP28P45*			TBP28P85*			TBP28P166*			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	MJ	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5	V
	J, N	4.75	5	5.25	4.75	5	5.25	4.75	5	5.25	
High-level output current, I_{OH}	MJ			−2			−2			−2	mA
	J, N			−3.2			−3.2			−3.2	
Low-level output current, I_{OL}	MJ			16			16			16	mA
	J, N			16			16			16	
Operating free-air temperature range	MJ	−55		125	−55		125	−55		125	°C
	J, N	0		70	0		70	0		70	

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

PARAMETER		TEST CONDITIONS†		TBP28P42*, TBP28P45*			TBP28P85*			TBP28P166*			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage			2			2			2			V
V_{IL}	Low-level input voltage					0.8			0.8			0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = −18 mA				−1.2			−1.2			−1.2	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = MAX		2.4	3.1		2.4	3.1		2.4	3.1		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = MAX				0.5			0.5			0.5	V
I_{OZH}	Off-state output current, high-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_O = 2.4 V				50			50			50	μA
I_{OZL}	Off-state output current, low-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_O = 0.5 V				−50			−50			−50	μA
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V				1			1			1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7 V				25			25			25	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.5 V				−250			−250			−250	μA
I_{OS}	Short-circuit output current§	V_{CC} = MAX	MJ	−15	−100		−15	−100		−15	−100		mA
			J, N	−20	−100		−20	−100		−20	−100		
I_{CC}	Supply current, Power Up	V_{CC} = MAX			100			110			100		mA
	Supply current, Power Down				12			12			15		

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

switching characteristics over recommended ranges of T_A and V_{CC} (unless otherwise noted)

TYPE	TEST CONDITIONS		$t_{a(A)}$ Access time from address			$t_{a(E)}$ Access time from chip enable (enable time)			t_{PXZ} Disable time			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
TBP28P42* TBP28P45*	C_L = 30 pF for $t_{a(A)}$ and $t_{a(E)}$, C_L = 5 pF for t_{PXZ}	R_L = 300 Ω, See Page 1-14		35			35			12		ns
TBP28P85*				35			35			12		ns
TBP28P166*				35			35			12		ns

* Electrical parameters for these devices are design goals only.

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SERIES 24 AND 28
REGISTERED PROGRAMMABLE READ-ONLY MEMORIES
WITH 3-STATE OUTPUTS

recommended operating conditions

PARAMETER		TBP28R45*			TBP28R85*			TBP28R166*			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	MJ	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5	V
	J, N	4.75	5	5.25	4.75	5	5.25	4.75	5	5.25	
High-level output current, I_{OH}	MJ			−2			−2			−2	mA
	J, N			−3.2			−3.2			−3.2	
Low-level output current, I_{OL}	MJ			16			16			16	mA
	J, N			16			16			16	
Clock pulse width high, $t_{w(CH)}$		20			20			20			ns
Clock pulse width low, $t_{w(CL)}$		20			20			20			ns
Address setup time, $t_{su(A)}$		20			20			20			ns
Chip select setup time, $t_{su(S)}$		0			0			0			ns
Address hold time, $t_{h(A)}$		0			0			0			ns
Chip select hold time, $t_{h(S)}$		5			5			5			ns
Operating free-air temperature range	MJ	−55		125	−55		125	−55		125	°C
	J, N	0		70	0		70	0		70	

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

PARAMETER		TEST CONDITIONS†		TBP28R45*			TBP28R85*			TBP28R166*			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage			2			2			2			V
V_{IL}	Low-level input voltage					0.8			0.8			0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = −18 mA				−1.2			−1.2			−1.2	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = MAX		2.4	3.1		2.4	3.1		2.4	3.1		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = MAX	MJ			0.5			0.5			0.5	V
			J, N			0.5			0.5			0.5	
I_{OZH}	Off-state output current, high-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_O = 2.4 V				50			50			50	μA
I_{OZL}	Off-state output current, low-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_O = 0.5 V				−50			−50			−50	μA
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V				1			1			1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7 V				25			25			25	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.5 V				−250			−250			−250	μA
I_{OS}	Short-circuit output current§	V_{CC} = MAX	MJ	−15		−100	−15		−100	−15		−100	mA
			J, N	−20		−100	−20		−100	−20		−100	
I_{CC}	Supply current	V_{CC} = MAX	MJ		110			120			110		mA
			J, N		110			120			110		

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.
* Electrical and switching parameters for these devices are design goals only.
NOTE: MJ designates full-temperature-range circuits (formerly 54 Family), J and N designate commercial-temperature-range circuits (formerly 74 Family).

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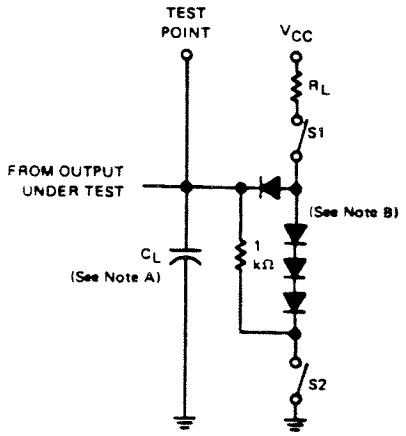
switching characteristics over recommended ranges of T_A and V_{CC} (unless otherwise noted)

types TBP28R45*, TBP28R85*, TBP28R166*

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{a(C)}$	Access time from clock	R_L = 300 Ω, C_L = 30 pF, See Figure 1		20		ns
$t_{PXZ(C)}$	Output disable time from clock			20		ns
$t_{PZX(C)}$	Output enable time from clock			20		ns
$t_{PXZ(G)}$	Output disable time from $\overline{G}$			12		ns
$t_{PZX(G)}$	Output enable time from $\overline{G}$			15		ns

* Electrical and switching parameters for these devices are design goals only.

PARAMETER MEASUREMENT INFORMATION



NOTES: A. C_L includes probe and jig capacitance.
B. All diodes are 1N916 or 1N3064.

LOAD CIRCUIT

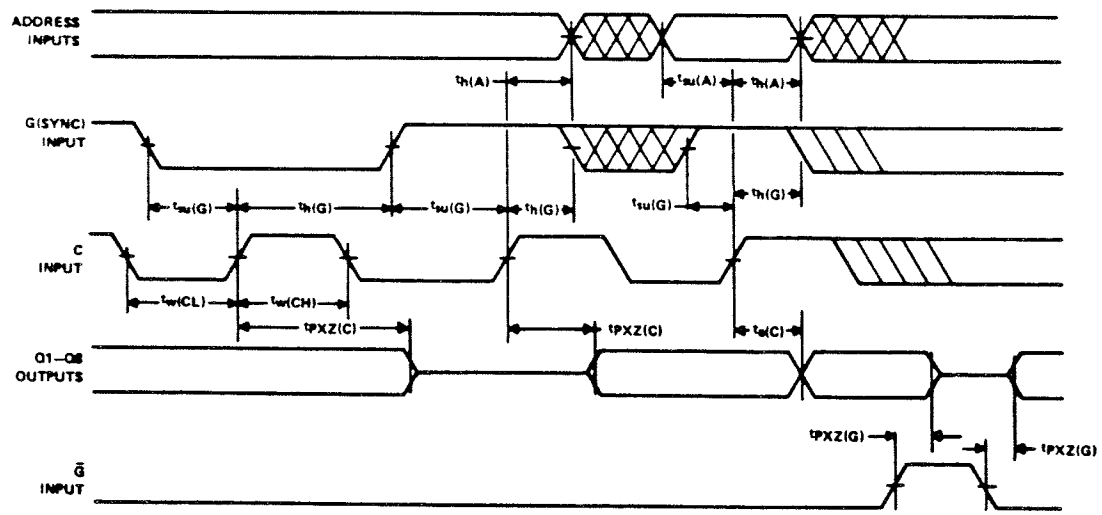


FIGURE 1 – SWITCHING WAVEFORMS FOR TYPES TBP28R45, TBP28R85, AND TBP28R166

5

SERIES 24 AND 28
PROGRAMMABLE READ-ONLY MEMORIES

recommended conditions for programming

PARAMETER		MIN	TYP	MAX	UNIT
Steady-state supply voltage, V_{CC}		4.5	5	5.5	V
Address input voltage	V_{IH}	2.4		5	V
	V_{IL}	0		0.5	
E3 and E4 input voltage (where appropriate)	V_{IH}	2.4		5	V
Voltage at all outputs except the one to be programmed		0		0.5	V
Supply voltage programming pulse (see Figure 2)	Voltage, $V_{CC(pr)}$	5.75	6	6.25	V
	Pulse width, t_w	1000		2000	μs
	Duty cycle		25	35	%
Select or enable programming pulse (see Figure 2)	Voltage, $V_{S(pr)}$	9.75	10	11	V
	V_{IL}				
Output programming pulse (see Figure 2)	Voltage, $V_{O(pr)}$	16.75	17	17.25	V
	Rise time, t_r	10		50	μs
	Pulse width, t_w	98	100	1000	μs
	V_{IL}	0		0.5	
Registered PROM verify clock pulse width	$t_{w(CH)}$		20		ns
Free-air temperature, T_A		0		55	°C

step-by-step programming instructions (see Figure 2)

1. Address the word to be programmed, apply 5V ± 10% to V_{CC} and active levels to all chip select (S and $\overline{S}$) or chip enable (E and $\overline{E}$) inputs.
2. Verify the status of a bit location by checking the output level. For registered PROMs a clock must be applied to the clock pin to verify the output level.
3. Increase V_{CC} to $V_{CC(pr)}$ with a minimum current capability of 200 milliamperes.
4. Apply $V_{S(pr)}$ to all the $\overline{S}$, $\overline{E}$ or $\overline{G}$ inputs. $I_I \leqslant 15$ mA.
5. Connect all outputs, except the one to be programmed, to a logic low level ($0 \leqslant V_{IL} \leqslant 0.5$ V). Only one bit is programmed at a time.
6. Apply the output programming pulse for at least 98 microseconds. Minimum current capability of the programming supply should be 200 milliamperes.
7. After terminating the output pulse, disconnect all outputs from V_{IL} conditions.
8. Reduce the voltage at $\overline{S}$, $\overline{E}$ or $\overline{G}$ inputs to V_{IL}.
9. Reduce V_{CC} to steady-state voltage and verify output status. Note that for registered PROMs, a clock must be applied to the clock input pin to verify output status.
10. Repeat steps 3 through 9 for each bit location that requires programming.
11. Verify accurate programming of every word after all words have been programmed using V_{CC} values of 4.5 and 5.5 volts. Note that registered PROMs must be clocked to verify the output condition.

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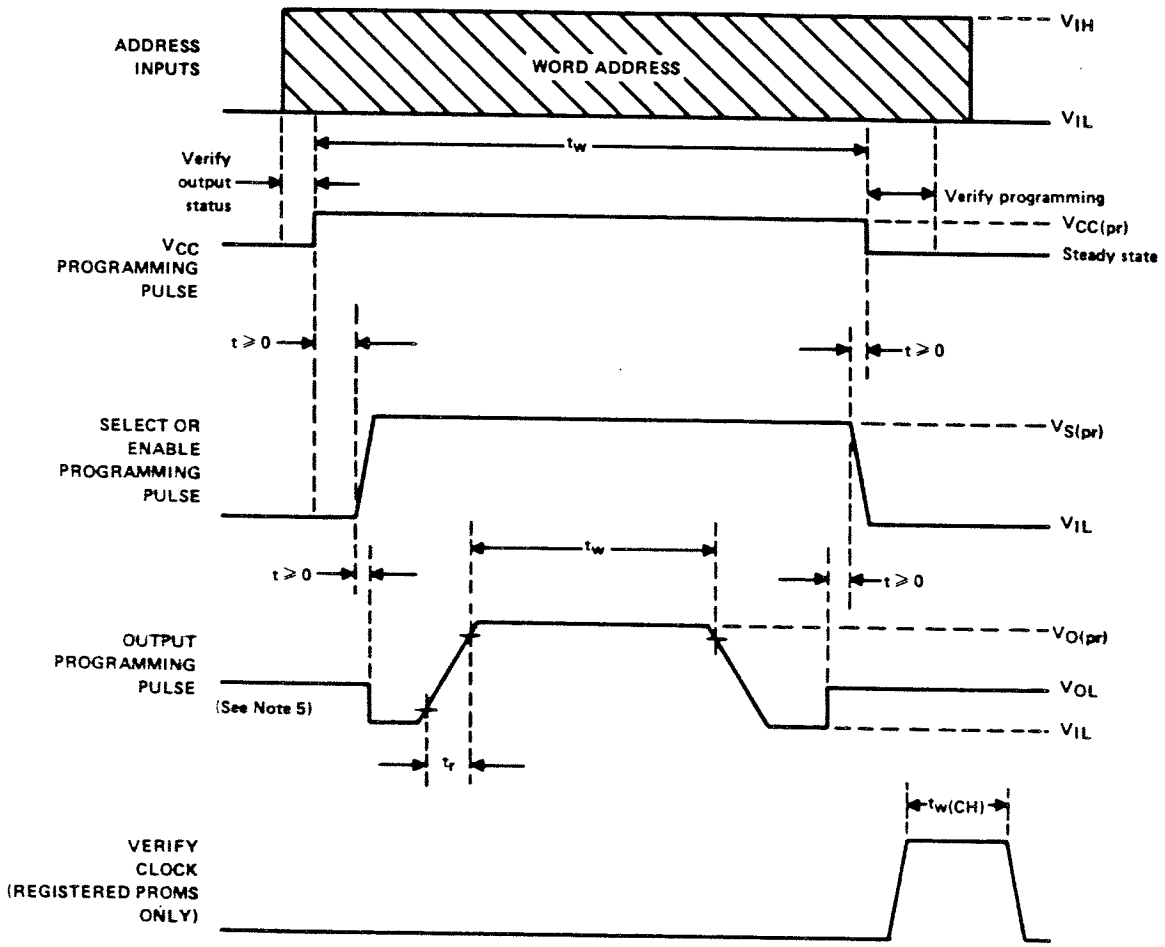

FIGURE 2 – TIMING DIAGRAM AND VOLTAGE WAVEFORMS FOR PROGRAMMING SEQUENCE

NOTE: The output to be programmed may be forced to zero volts after the transition to $V_{O(pr)}$ at the E input has begun.

5