

32K x 18 Fast CMOS Synchronous Static SRAM with Linear Burst Counter

Features

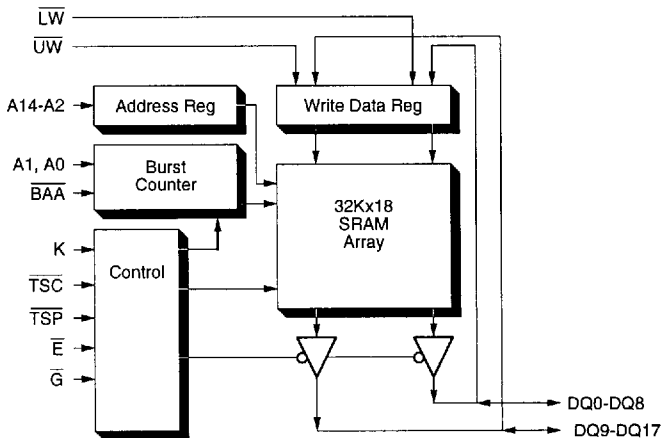
- Interfaces directly with the Motorola 680x0 and PowerPC™ processors (80, 66, 60, 50, 40 MHz)
- High Speed Access Times
 - Clock to data valid times: 8, 9, 10, 12, 14 ns
 - Cycle Times: 12.5, 15, 20, 25 ns
- High Density 32K x 18 Architecture
- Choice of 5V or 3V ±10% Output Vcc for output level compatibility
- High Output Drive: 30 pF at Rated Taa
- Asynchronous Output Enable
- Self Timed Write Cycle
- Byte Writeable via Dual Write Strokes
- Internal linear burst read/write address counter
- Internal registers for Address, Data, Controls
- Packages: 52-pin PLCC

Description

The PDM44528 is a 589,824 bit synchronous random access memory organized as 32,768 words by 18 bits. It has burst mode capability and interface controls designed to provide high performance in secondary cache designs for 680X0 and Power PC™ microprocessors. Addresses, write data and all control signals except output enable are controlled through positive edge triggered registers. Write cycles are self timed and are also initiated by the rising edge of the clock. Controls are provided to allow burst reads and writes of up to four words in length. A two-bit burst address counter controls the two least significant bits of the address during burst reads and writes. The linear burst address counter uses the 2-bit binary counting scheme required by the 680X0 and Power PC™ microprocessors. Individual write strobes provide byte write for the upper and lower 9-bit bytes of data. An asynchronous output enable simplifies interface to high speed buses. Separate output Vcc pins provide user controlled output levels of 5V or 3.3V, for 3.3V TTL compatibility.

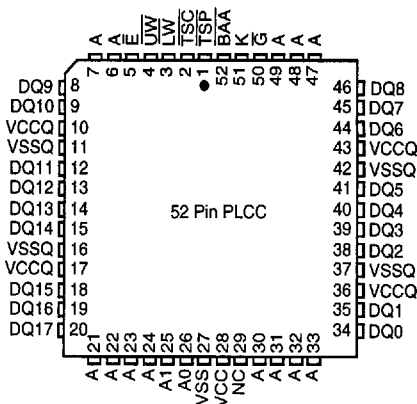
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Functional Block Diagram



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Pin Assignment



Pinout

Name	I/O	Description	Name	I/O	Description
A	I	Address Inputs A14-A2	LW	I	Low Byte Write Enable, DQ0-DQ8
A1, A0	I	Address Inputs A1 & A0	UW	I	Upper Byte Write Enable, DQ8-DQ17
DQ0-DQ17	I/O	Read/Write Data	G	I	Output Enable
K	I	Clock	VCC	—	Array Power (+5V)
BAA	I	Burst Counter Advance	VCCQ	—	Output Power for DQ's (+3.3V or +5V)
TSC	I	Controller Address Status	VSS	—	Array Ground
TSP	I	Processor Address Status	VSSQ	—	Output Ground for DQ's
E	I	Chip Enable			

All registers are positive-edge triggered. The state of *W* determines whether the next cycle will be a read or write cycle. The state of *W* is sampled at each clock rising edge. If sampled active (low), a write cycle begins; if sampled inactive (high), a read cycle begins. Read and write cycles begin at the current address, which is the base address loaded by *TSP* or *TSC* and modified by *BAA*. *TSP* overrides *W*. If *TSP* is active, *W* is internally forced inactive. Therefore, the first cycle following *TSP* is always a read cycle. The *TSC* or *TSP* signals control the duration of the burst and the start of the next burst. When *TSP* is sampled low, any ongoing burst is interrupted and a read (independent of *W* and *TSC*) is performed using the new external address. When *TSC* is sampled low (and *TSP* is sampled high), any ongoing burst is interrupted and a read or write (dependent on *W*) is performed using the new external address. chip selects (*S0*, *S1*) are sampled only when a new base address is loaded. After the first cycle of the burst, *W* determines whether the next cycle is a read or write cycle, and *BAA* controls the advance of the address counter. When *BAA* is sampled low, the internal address is advanced prior to the operation. When *BAA* is sampled high, the internal address is not advanced, thus inserting a wait state into the burst sequence accesses. Upon completion of a burst, the address will wrap around to its initial state. See BURST SEQUENCE FIGURE.

Synchronous Truth Table (See Notes 1 through 4)

\bar{G}	TSP	TSC	BAA	UW or LW	K	Address	Operation
H	X	L	X	X	↑	N/A	Deselected
L	L	X	X	X	↑	External	Read Cycle, Begin Burst
L	H	L	X	L	↑	External	Write Cycle, Begin Burst
L	H	L	X	H	↑	External	Read Cycle, Begin Burst
X	H	H	L	L	↑	Next	Write Cycle, Continue Burst
X	H	H	L	H	↑	Next	Read Cycle, Continue Burst
X	H	H	H	L	↑	Current	Write Cycle, Suspend Burst
X	H	H	H	H	↑	Current	Read Cycle, Suspend Burst
X	X	H	L	L	↑	Next	Write Cycle, Continue Burst
X	X	H	L	H	↑	Next	Read Cycle, Continue Burst
X	X	H	H	L	↑	Current	Write Cycle, Suspend Burst
X	X	H	H	H	↑	Current	Read Cycle, Suspend Burst

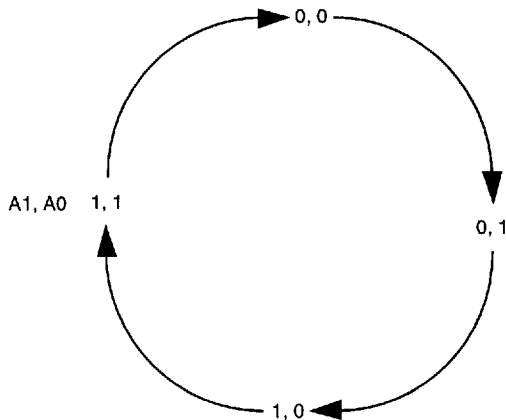
- NOTE:
1. X means Don't Care.
 2. All inputs except \bar{G} must meet setup and hold times relative low-to-high transition of clock, K.
 3. Wait states are inserted by suspending burst.

Asynchronous Truth Table

Operation	\bar{G}	I/O Status
Read	L	Data Out
Read	H	High-Z
Write	X	High-Z: Write Data In
Deselected	X	High-Z

- NOTE:
1. X means Don't Care.
 2. For a write operation following a read operation, \bar{G} must be high before the input data required setup

Burst Sequence



Base address provided with TSP or TSC. The external two values for A1 and A0 provides the starting point for the burst sequence graph. The burst logic advances A1 and A0 as shown above.

Absolute Maximum Ratings

Symbol	Rating	Com'l.	Unit
V _{TERM}	Terminal Voltage with Respect to GND	-0.5 to +7.0	V
T _A	Operating Temperature	0 to +70	°C
T _{BIAS}	Temperature Under Bias	-55 to +125	°C
T _{STG}	Storage Temperature	-55 to +125	°C
I _{OUT}	DC Output Current	50	mA

NOTE: 1. Stresses greater than 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 reliability.

Recommended DC Operating Conditions

Symbol	Description	Min.	Typ.	Max.	Unit
V _{CC}	Supply Voltage	4.75	5.0	5.25	V
V _{CCQ}		5V	4.5	5.0	V
		3.3V	3.0	3.3	V
GND	Supply Voltage	0	0	0	V
Industrial	Ambient Temperature	-40	25	85	°C
Commercial	Ambient Temperature	-0	25	70	°C

DC Electrical Characteristics ($V_{CC} = 5.0V \pm 5\%$, All Temperature Ranges)

Symbol	Description	Test Conditions	Min.	Max.	Unit
$ I_{LI} $	Input Leakage Current	$V_{CC} = \text{MAX.}, V_{IN} = \text{GND to } V_{CC}$	—	1	μA
$ I_{LO} $	Output Leakage Current	$V_{CC} = \text{MAX.}, V_{OUT} = \text{GND to } V_{CC}$	—	1	μA
V_{OL}	Output Low Voltage	$V_{CC} = \text{Min.}, I_{OL} = 8 \text{ mA}$	0	0.4	V
V_{OH}	Output High Voltage	$V_{CC} = \text{Min.}, I_{OH} = -4 \text{ mA}$	2.4	V_{CCQ}	V
V_{IH}	Input HIGH Voltage		2.2	6	V
V_{IL}	Input LOW Voltage (1)		-0.5	0.8	V

NOTE: 1. Undershoots to -1.5 for 10 ns are allowed once per cycle.

Power Supply Characteristics

Symbol	Description	Test Conditions	-8 ns	-9 ns	-10 ns	-12 ns	-14 ns	Unit
I_{CC1}	Active Supply Current: Outputs Open	$V_{CC} = \text{Max.},$ Inputs @ 0.0V or 3.0V $F = 1/T_{CYC}$ on Rclk & Wclk	Com'l 380	360	360	340	320	mA
I_{SB}	Standby Current: Outputs Open	$V_{CC} = \text{Max.},$ Inputs @ 0.0V or 3.0V $F = 1/T_{CYC}, E = V_{IH}$	Com'l 130	120	120	110	100	mA

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Capacitance ($T_A = +25^\circ C, f = 1.0 \text{ MHz}$)

Symbol	Parameter	Conditions	Max.	Unit
C_{IN}	Input Capacitance	$V_{IN} = 0V$	6	pF
C_{OUT}	Output Leakage Current	$V_{OUT} = 0V$	8	pF

NOTES: 1. Characterized values, not currently tested.
2. With output deselected.

AC Test Conditions

Input Pulse Levels	GND to 3.0V
Input rise and fall times	3 ns
Input timing reference levels	1.5V
Output reference levels	1.5V
Output Load	See Figures 1 and 2

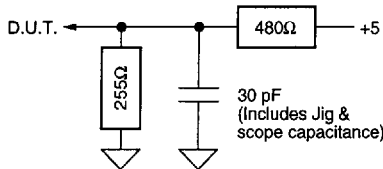


Figure 1a. Output Load

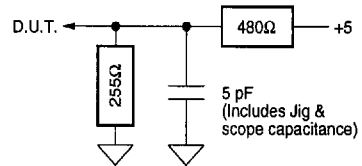


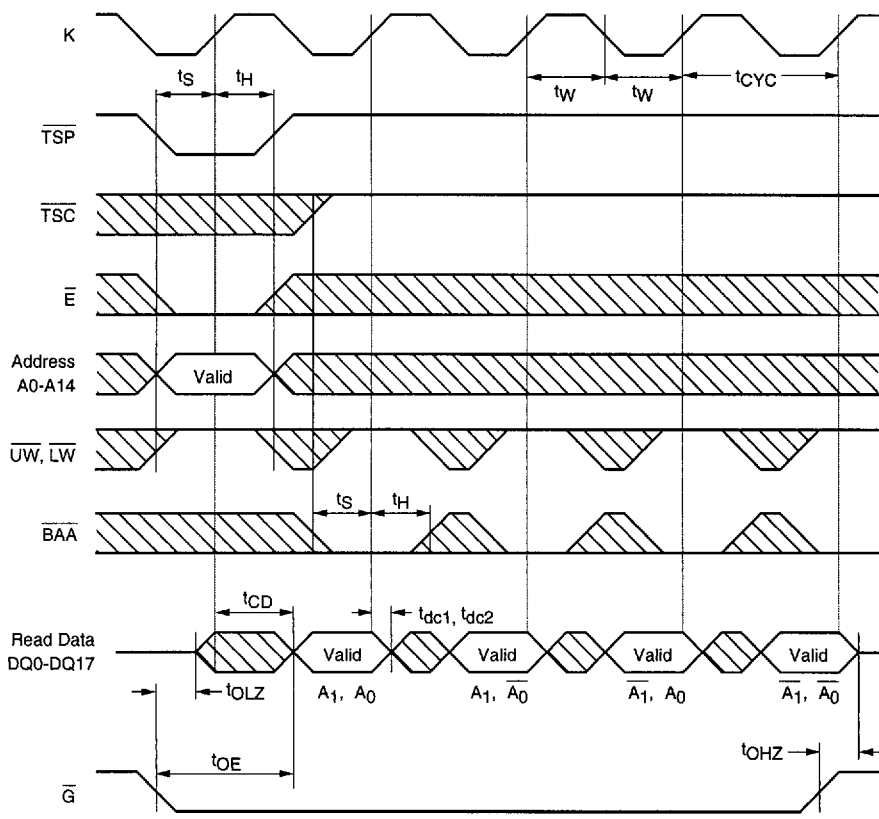
Figure 1b. Output Disable Timing Load

AC Electrical Characteristics ($V_{CC} = 5V \pm 5\%$, All Temperature Ranges)

Parameter	Symbol	-8	-9	-10	-12	-14	Type	Units	Notes
Clock Cycle time	t_{CYC}	13	15	15	20	25	Min.	ns	
Clock to Data Valid (Std Load)	t_{CD}	8	9	10	12	14	Max.	ns	5
Clock to Data Valid (0 pF Load)	t_{CD0}	7	8	9	11	13	Min.	ns	
Output Enable	t_{OE}	5	5	5	6	7	Max.	ns	
Clock to Data Low-Z	t_{dc1}	3	3	3	3	3	Min.	ns	
Clock to Data Hold Time	t_{dc2}	3	3	3	3	3	Min.	ns	
OE to Output Low-Z ⁽¹⁾	t_{OLZ}	0	0	0	0	0	Min.	ns	1
OE to Output High-Z ⁽¹⁾	t_{OHZ}	2	2	2	2	2	Min.	ns	1, 6
		5	5	5	6	7	Max.	ns	1, 6
Clock to Data High-Z	t_{CZ}	6	6	6	7	8	Max.	ns	1, 6
Clock High/Low	t_W	4	4	5	6	7	Min.	ns	
Setup Time	t_S	2.5	2.5	2.5	3	3	Min.	ns	7
Hold Time	t_H	0.5	0.5	0.5	0.5	0.5	Min.	ns	7

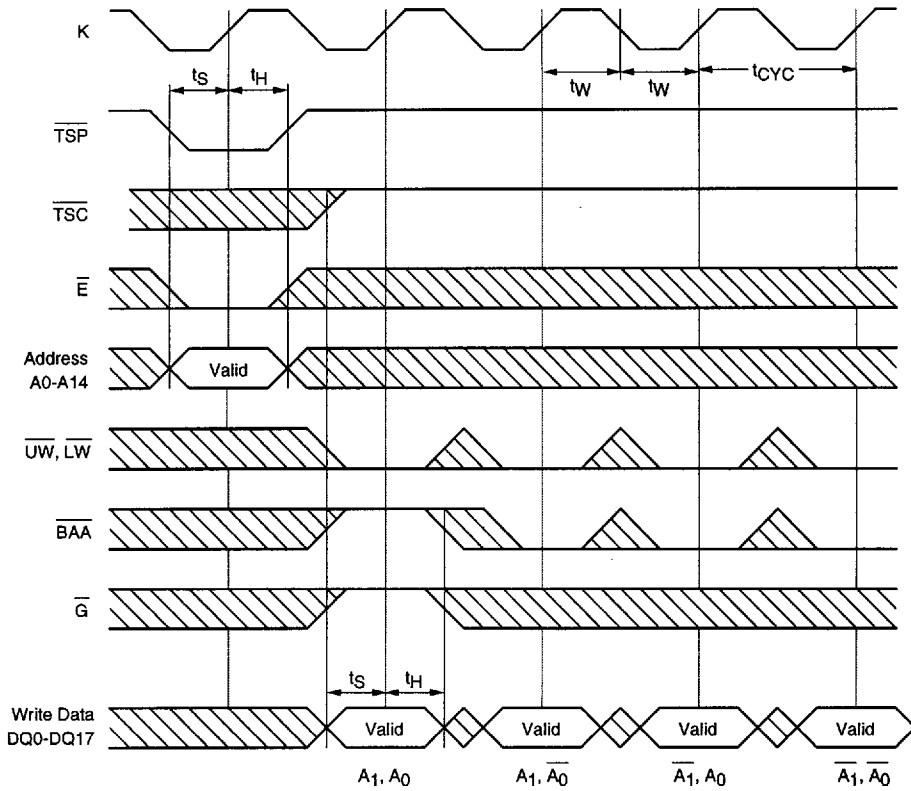
- NOTES: 1. Values characterized and guaranteed by design, not currently tested.
 2. A read cycle is defined by \overline{UW} and \overline{LW} high or \overline{TSP} low for the setup and hold times. A write cycle is defined by \overline{LW} or \overline{UW} low and \overline{TSP} high for the set up and hold times.
 3. All read and write cycle timings are referenced from \overline{K} or \overline{G} .
 4. \overline{G} is a don't care when \overline{UW} or \overline{LW} is sampled low.
 5. Maximum access times are guaranteed for all possible i486 external bus cycles.
 6. Transition is measured $\pm 500mV$ from steady-state voltage with load of Figure 1B. This parameter is sampled rather than 100% tested. At any given voltage and temperature, t_{CHZ} max is less than t_{CLZ} min for a given device and from device to device.
 7. This is a synchronous device. All addresses must meet the specified setup and hold times for ALL rising edges of \overline{K} whenever \overline{TSP} or \overline{TSC} is low, and the chip is enabled. Chip enable must be valid at each rising edge of clock for the device (when \overline{TSP} or \overline{TSC} is low) to remain enabled.

TSP Read Timing Diagram



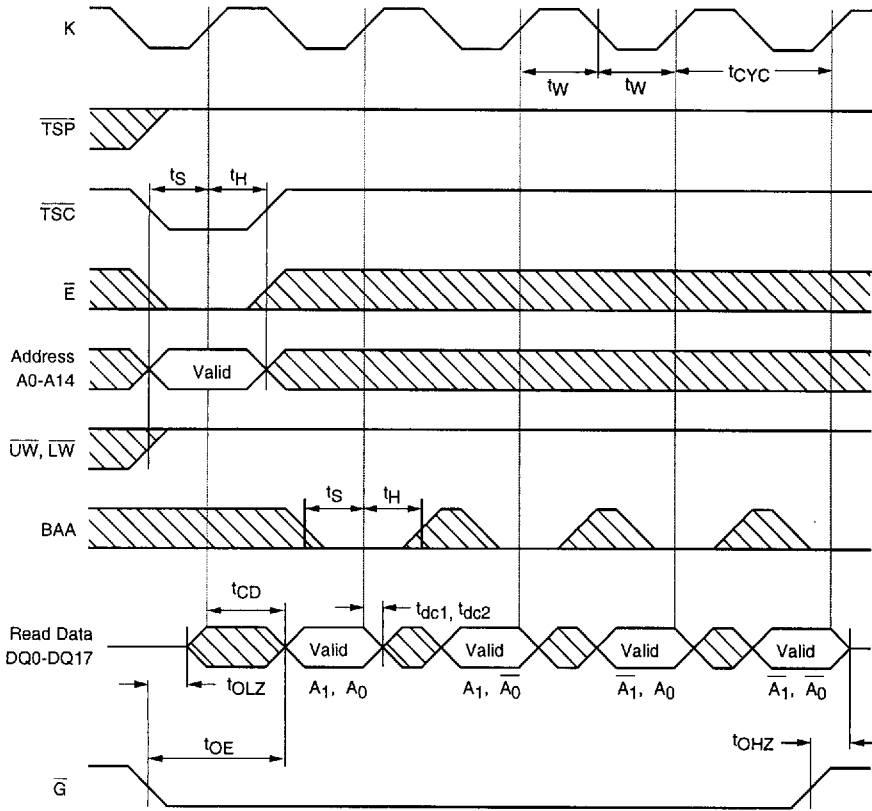
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TSP Write Timing Diagram



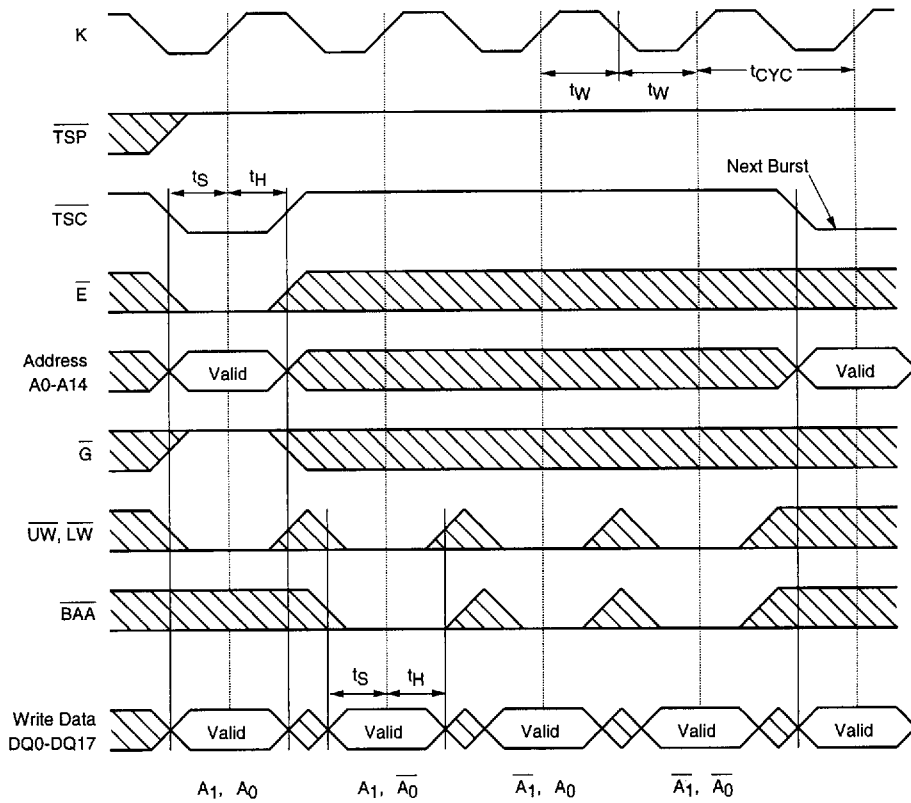
NOTE: \overline{UW} and \overline{LW} are ignored for the first cycle when \overline{TSP} initiates the burst. \overline{TSP} active loads a new address into the address counter and forces the first cycle to be a read cycle.

TSC Read Timing Diagrams

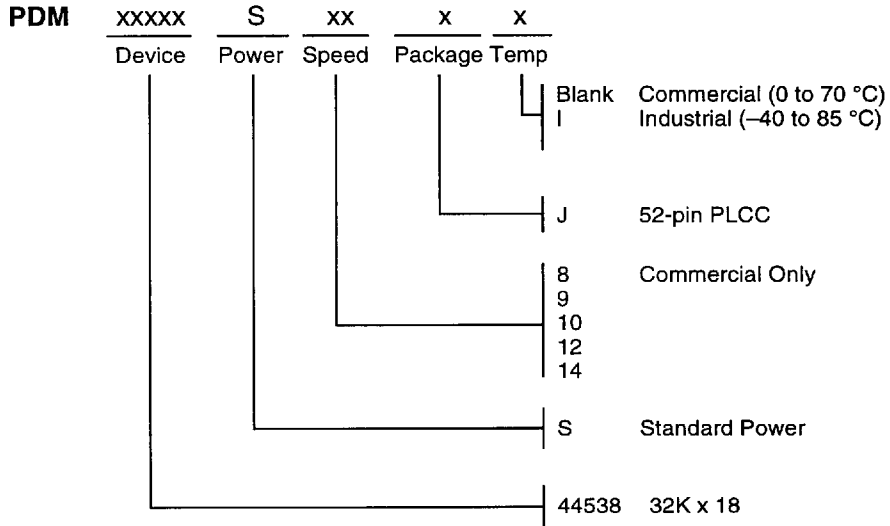


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TSC Write Timing Diagrams



Ordering Information



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Chip	Description
PDM44538	52-pin PLCC