

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TMPN3120E1M

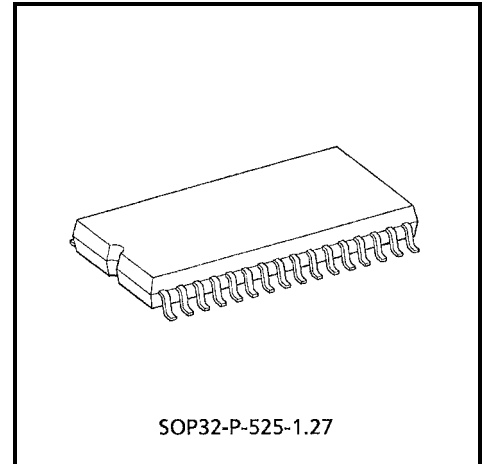
Neuron<sup>®</sup> Chip

For Distributed Intelligent Control Networks (LONWORKS<sup>®</sup>)

The TMPN3120E1M is a Neuron Chip which configures LONWORKS nodes on a single chip. Neuron Chips have all the built-in communications and control functions required to implement LONWORKS nodes. These nodes may then be easily integrated into highly-reliable distributed intelligent control networks. The typical functions for this chip are explained below.

## FEATURES

- I / O Functions
  - Eleven programmable I / O pins.
  - Two programmable 16-bit timers and counters built in.
  - 34 different types of I / O functions to handle a wide range of input and output.
  - ROM firmware image containing pre-programmed I / O drivers, greatly simplifying application programs.
- Network functions
  - Two CPUs for communication protocol processing built in. The communications and application CPUs execute in parallel.
  - Equipped with a built-in LonTalk protocol which supports all seven levels of the OSI reference model with ISO.
  - The ROM firmware image contains a complete network operating system, greatly simplifying application programs.
  - Built-in twisted-pair wire transceiver
  - Equipped with communications modes and communication speeds which support various types of external transceivers. Supports twisted-pair wire, power line, radio ( RF ), infrared, coaxial cables, and fiber optics.
  - Communication port transceiver modes and logical addresses stored within the EEPROM. Can be amended via the network.



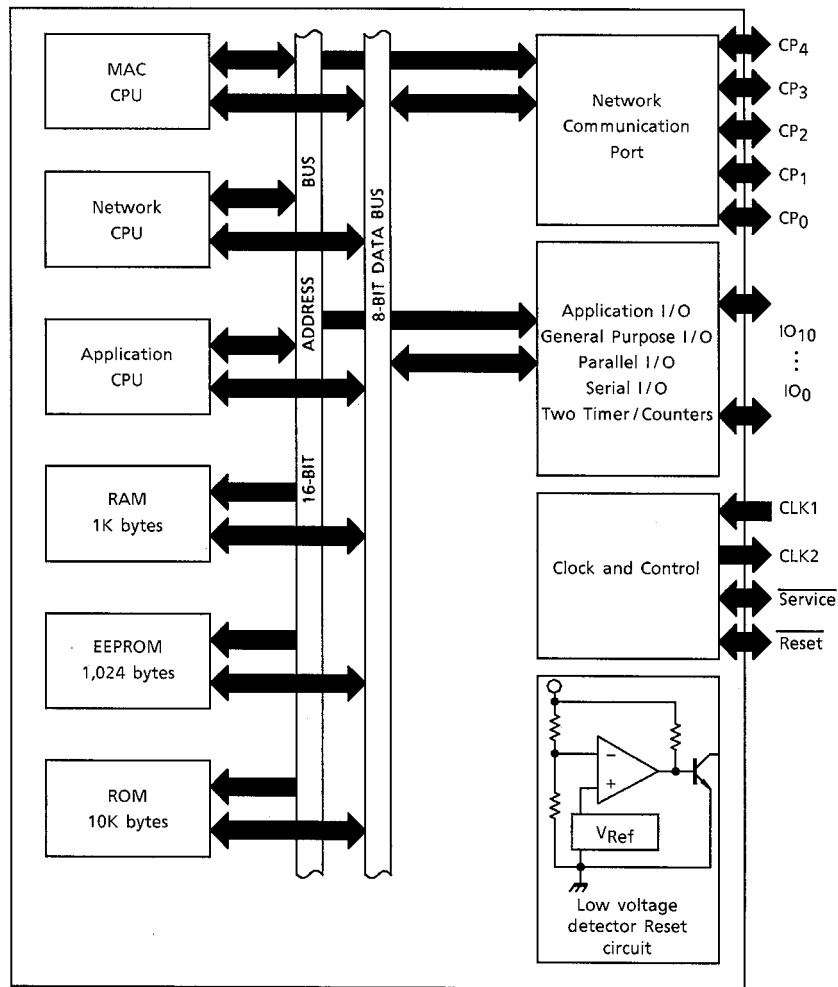
Weight : 1.1g (Typ.)

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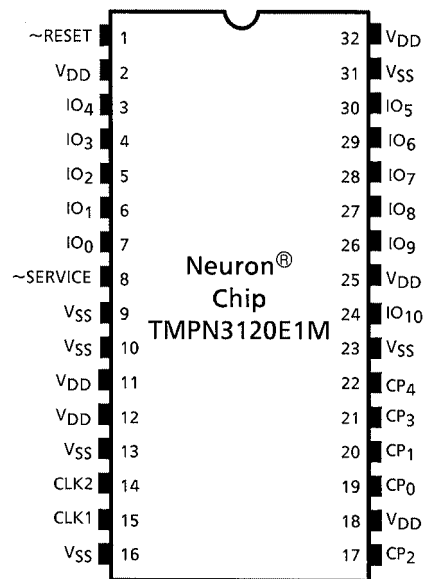
- Other functions
  - Application programs are also stored within the EEPROM.  
Can be updated by downloading over the network. Up to 900-byte applications can be stored.
  - Built-in watch-dog timer.
  - Each chip has a unique ID number.  
Effective during the logical installation of networks.
  - Low electrical consumption mode supported with a sleep mode.
  - Built-in low-voltage detection circuit.  
Prevents incorrect operations and writing errors in the EEPROM during drops in power voltage.
  - The package is SOP32-P-525-1.27.

**BLOCK DIAGRAM**



ITEM	TMPN3120E1M
CPU	8-bit CPU×3
RAM	1,024 bytes
ROM	10,240 bytes
EEPROM	1,024 bytes
16-bit Timer / Counter	2 channels
External Memory Interface	Not available
Package	32-pin SOP

## PIN ASSIGNMENT



## PIN FUNCTION

PIN No.	PIN NAME	I / O	PIN FUNCTION
15	CLK1	Input	Oscillator connection, or external clock input.
14	CLK2	Output	Oscillator connection. Leave open when external clock is input to CLK1.
1	~RESET	I / O (built-in configurable pull-up)	Reset pin. (Active low)
8	~SERVICE	I / O (built-in configurable pull-up)	Service pin. Indicator output during operation.
7~4	IO <sub>0</sub> ~IO <sub>3</sub>	I / O	Large current sink capacity (20mA). General I / O port.
3, 30~28	IO <sub>4</sub> ~IO <sub>7</sub>	I / O (built-in configurable pull-up)	General I / O port. One of IO <sub>4</sub> to IO <sub>7</sub> can be specified as No.1 timer / counter input. Output signal can be output to IO <sub>0</sub> . IO <sub>4</sub> can be used as the No.2 timer / counter input with IO <sub>1</sub> as output.
27, 26, 24	IO <sub>8</sub> ~IO <sub>10</sub>	I / O	General I / O port. Can be used for serial communication with other device.
2, 11, 12, 18, 25, 32	V <sub>DD</sub>	Input	Power input (5.0V Typ.)
9, 10, 13, 16, 23, 31	V <sub>SS</sub>	Input	Power input (0V GND)
19, 20, 17, 21, 22	CP <sub>0</sub> ~CP <sub>4</sub>	I / O	Bidirectional port for communications. Supports several communications protocols by specifying mode.

- \* :
- The ~SERVICE and IO<sub>4</sub> ~ IO<sub>7</sub> terminals are programmable pull-ups.
  - All V<sub>DD</sub> terminals must be externally connected.
  - All V<sub>SS</sub> terminals must be externally connected.

## MAXIMUM RATINGS ( $V_{SS} = 0V$ , $V_{SS}$ typ.)

CHARACTERISTICS	SYMBOL	RATING	UNIT
Power Supply Voltage	$V_{DD}$	-0.3~7.0	V
Input Voltage	$V_{IN}$	-0.3~ $V_{DD}+0.3$	V
Power Dissipation	PD	800	mW
Storage Temperature	$T_{stg}$	-65~150	°C

## OPERATING CONDITIONS

ITEM	SYMBOL	MIN	TYP.	MAX	UNIT
Operating Voltage	$V_{DD}$	4.5	5.0	5.5	V
Input Voltage ( TTL )	$V_{IH}$	2.0	—	$V_{DD}$	V
	$V_{IL}$	$V_{SS}$	—	0.8	V
Input Voltage ( CMOS )	$V_{IH}$	$V_{DD}-0.8$	—	$V_{DD}$	V
	$V_{IL}$	$V_{SS}$	—	0.8	V
Operating Frequency	$f_{osc}$	0.625	—	10	MHz
Operating Temperature	$T_{opr}$	-40	—	85	°C

## ELECTRICAL CHARACTERISTICS

DC characteristic ( $V_{DD} = 5.0 V \pm 10\%$ ,  $V_{SS} = 0 V$ ,  $T_a = -40\sim 85^\circ C$ )

(Above operating conditions apply unless otherwise states.)

CHARACTERISTICS	SYMBOL	PINS	TEST CONDITION	MIN	MAX	UNIT	
LOW Output Voltage (1)	$V_{OL}$ (1)	IO <sub>0</sub> ~IO <sub>3</sub>	$I_{OL}=20mA$	0	0.8	V	
			$I_{OL}=10mA$	0	0.4	V	
LOW Output Voltage (2)	$V_{OL}$ (2)	~SERVICE	Duty cycle=50%	$I_{OL}=20mA$	0	0.8	V
				$I_{OL}=10mA$	0	0.4	V
LOW Output Voltage (3)	$V_{OL}$ (3)	CP <sub>2</sub> , CP <sub>3</sub>	$I_{OL}=40mA$	0	1.0	V	
LOW Output Voltage (4)	$V_{OL}$ (4)	Others (Note 1)	$I_{OL}=1.4mA$	0	0.4	V	
HIGH Output Voltage (1)	$V_{OH}$ (1)	IO <sub>0</sub> ~IO <sub>3</sub>	$I_{OH}=-1.4mA$	$V_{DD}-0.4$	$V_{DD}$	V	
HIGH Output Voltage (2)	$V_{OH}$ (2)	~SERVICE	$I_{OH}=-1.4mA$	$V_{DD}-0.4$	$V_{DD}$	V	
HIGH Output Voltage (3)	$V_{OH}$ (3)	CP <sub>2</sub> , CP <sub>3</sub>	$I_{OH}=-40mA$	$V_{DD}-1.0$	$V_{DD}$	V	
HIGH Output Voltage (4)	$V_{OH}$ (4)	Others (Note 1)	$I_{OH}=-1.4mA$	$V_{DD}-0.4$	$V_{DD}$	V	
Input Current	$I_{IN}$	(Note 2)	$V_{IN}=V_{SS}\sim V_{DD}$	-10	+10	μA	
Pull-up Current	$I_{PU}$	IO <sub>4</sub> ~IO <sub>7</sub> ~SERVICE, ~RESET (Note 3)	$V_{IN}=0V$	-30	-300	μA	
Low-voltage Detection Level	$V_{LVD}$	$V_{DD}$	—	3.8	4.5	V	

Note1 : Output voltage characteristics exclude the ~RESET pin and CLK2 pin.

Note2 : Excludes pull-up input pins.

Note3 : The IO<sub>4</sub> to IO<sub>7</sub> and ~SERVICE pins have programmable pull-ups. ~RESET has a fixed pull-up.

ITEM		SYMBOL	TYP.	MAX	UNIT
Operating Mode Current Consumption	10 MHz Clock	$I_{DD} (OP)$	17	30	mA
	5 MHz Clock		9	15	
	2.5 MHz Clock		6	8	
	1.25 MHz Clock		4	5	
	0.625 MHz Clock		2	3	
Sleep Mode Current Consumption		$I_{DD} (SLP)$	16	100	$\mu A$

Note: Test conditions for current dissipation

$V_{DD}=5V$ , all output=with no load, all input=0.2V or below or  $V_{DD}-0.2V$ , programmable pull-up=off, crystal oscillator clock input, differential receiver disabled.

The current value ( typ. ) is a typical value when  $T_a=25^{\circ}C$ .

The current value ( max ) applies to the rated temperature range at  $V_{DD}=5.5V$ .

200 $\mu A$  ( typ. ) to 600 $\mu A$  ( max ) is added to the current of the differential receiver when the receiver is enabled.

The differential receiver is enabled by either of the following conditions :

- When the Neuron chip is in Run mode and the communication ports are in Differential mode.
- When the Neuron chip is in Sleep mode, the communication ports are in Differential mode, and the Comm Port Wakeup is not masked.

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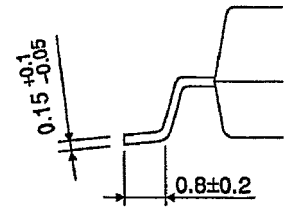
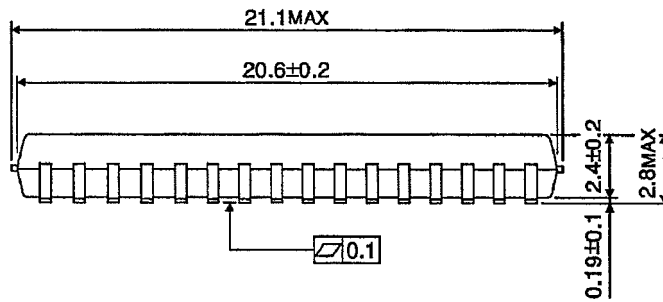
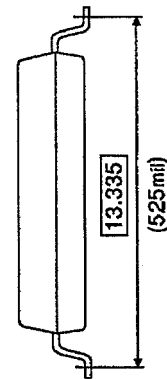
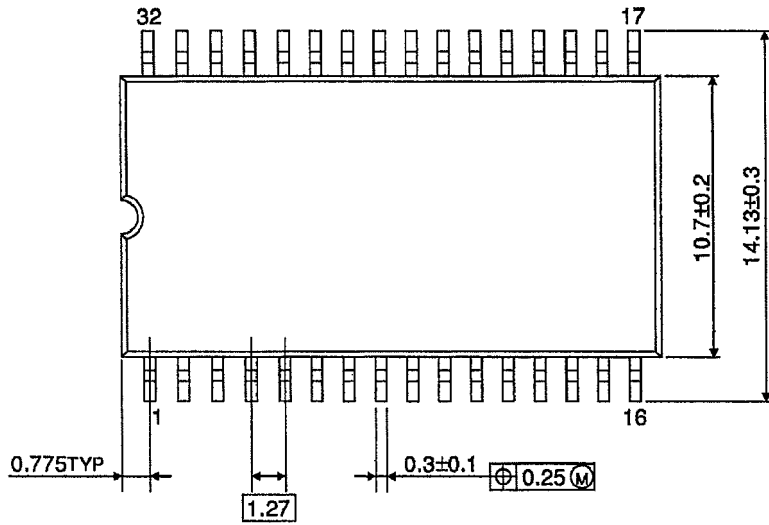
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## PACKAGE DIMENSIONS

SOP32-P-525-1.27

Unit : mm



Weight : 1.1g (Typ.)



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