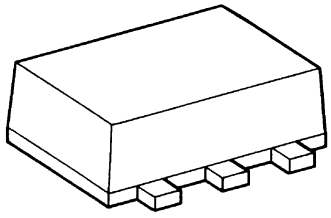
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7PA19AFE

Chip Select Decoder

## Features

- Operating voltage range: $V_{CC}$ = 1.4~3.6 V
- High-speed operation: $t_{pd}$ = 3.3 ns (max) at $V_{CC}$ = 3.0~3.6 V
  $t_{pd}$ = 3.9 ns (max) at $V_{CC}$ = 2.3~2.7 V
  $t_{pd}$ = 8.0 ns (max) at $V_{CC}$ = 1.65~1.95 V
  $t_{pd}$ = 10.0 ns (max) at $V_{CC}$ = 1.4~1.6 V
- High-level output current:
  $I_{OH}/I_{OL}$ = ±24 mA (min) at $V_{CC}$ = 3.0 V
  $I_{OH}/I_{OL}$ = ±18 mA (min) at $V_{CC}$ = 2.3 V
  $I_{OH}/I_{OL}$ = ±4 mA (min) at $V_{CC}$ = 1.4 V
- 3.6 V tolerant inputs



SON6-P-0.50 (ES6)

Weight: 0.003 g (typ.)

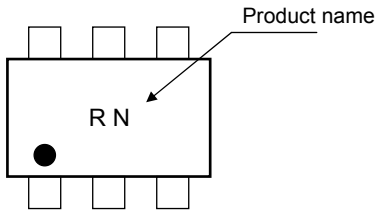
## Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Value | Unit |
|---|---|---|---|
| Power supply voltage | $V_{CC}$ | −0.5~4.6 | V |
| DC input voltage | $V_{IN}$ | −0.5~4.6 | V |
| DC output voltage | $V_{OUT}$ | −0.5~$V_{CC}$ + 0.5 (Note 1) | V |
| Input diode current | $I_{IK}$ | −50 | mA |
| Output diode current | $I_{OK}$ | ±50 (Note 2) | mA |
| DC output current | $I_{OUT}$ | +50 | mA |
| Power dissipation | $P_D$ | 150 | mW |
| DC $V_{CC}$/ground current | $I_{CC}$ | ±100 | mA |
| Storage temperature | $T_{stg}$ | −65~150 | °C |

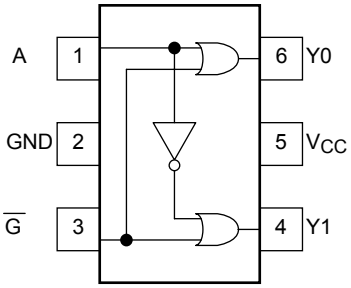
Note 1: High or Low state. The $I_{OUT}$ maximum rating must be adhere to.

Note 2: $V_{OUT}$ < GND, $V_{OUT}$ > $V_{CC}$

## Marking




## Pin Assignment (top view)



## Truth Table

| Inputs | | Outputs | | Selected Output |
|---|---|---|---|---|
| Enable | Select | Y0 | Y1 | |
| $\overline{G}$ | A | | | |
| H | X | H | H | None |
| L | L | L | H | Y0 |
| L | H | H | L | Y1 |

## Recommended Operating Conditions

| Characteristics | Symbol | Value | | Unit |
|---|---|---|---|---|
| Power supply voltage | $V_{CC}$ | 1.4~3.6 | | V |
| | | 1.2~3.6 | (Note 3) | |
| Input voltage | $V_{IN}$ | −0.3~3.6 | | V |
| Output voltage | $V_{OUT}$ | 0~$V_{CC}$ | (Note 4) | V |
| Output Current | $I_{OH}/I_{OL}$ | ±24 | (Note 5) | mA |
| | | ±18 | (Note 6) | |
| | | ±4 | (Note 7) | |
| Operating temperature | $T_{opr}$ | −40~85 | | °C |
| Input rise and fall time | $d_t/d_v$ | 0~10 | (Note 8) | ns/V |

Note 3: Data retention only

Note 4: High or Low state

Note 5: $V_{CC}$ = 3.0~3.6 V

Note 6: $V_{CC}$ = 2.3~2.7 V

Note 7: $V_{CC}$ = 1.4~1.9 V

Note 8: $V_{IN}$ = 0.8~2.0 V, $V_{CC}$ = 3.0 V

## DC Electrical Characteristics (Ta = −40~85°C, 2.7 V < $V_{CC}$ ≦ 3.6 V)

| Characteristics | Symbol | Test Condition | | $V_{CC}$ (V) | Min | Max | Unit |
|---|---|---|---|---|---|---|---|
| High-Level Input Voltage | $V_{IH}$ | — | | 2.7~3.6 | 2.0 | — | V |
| Low-Level Input Voltage | $V_{IL}$ | — | | 2.7~3.6 | — | 0.8 | V |
| High-Level Output Voltage | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = −100 μA | 2.7~3.6 | $V_{CC}$ − 0.2 | — | V |
| | | | $I_{OH}$ = −12 mA | 2.7 | 2.2 | — | |
| | | | $I_{OH}$ = −18 mA | 3.0 | 2.4 | — | |
| | | | $I_{OH}$ = −24 mA | 3.0 | 2.2 | — | |
| Low-Level Output Voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 100 μA | 2.7~3.6 | — | 0.2 | V |
| | | | $I_{OL}$ = 12 mA | 2.7 | — | 0.4 | |
| | | | $I_{OL}$ = 18 mA | 3.0 | — | 0.4 | |
| | | | $I_{OL}$ = 24 mA | 3.0 | — | 0.55 | |
| Input Leakage Current | $I_{IN}$ | $V_{IN}$ = 0~3.6 V | | 2.7~3.6 | — | ±10.0 | μA |
| Quiescent Supply Current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | 2.7~3.6 | — | 20.0 | μA |
| | | $V_{CC}$ ≦ $V_{IN}$ ≦ 3.6 V | | 2.7~3.6 | — | ±20.0 | |
| Increase in $I_{CC}$ per Input | $\Delta I_{CC}$ | $V_{IH}$ = $V_{CC}$ − 0.6 V | | 2.7~3.6 | — | 750 | |

## DC Electrical Characteristics (Ta = −40~85°C, 2.3 V ≦ $V_{CC}$ ≦ 2.7 V)

| Characteristics | Symbol | Test Condition | | $V_{CC}$ (V) | Min | Max | Unit |
|---|---|---|---|---|---|---|---|
| High-Level Input Voltage | $V_{IH}$ | — | | 2.3~2.7 | 1.6 | — | V |
| Low-Level Input Voltage | $V_{IL}$ | — | | 2.3~2.7 | — | 0.7 | V |
| High-Level Output Voltage | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = −100 μA | 2.3~2.7 | $V_{CC}$ − 0.2 | — | V |
| | | | $I_{OH}$ = −6 mA | 2.3 | 2.0 | — | |
| | | | $I_{OH}$ = −12 mA | 2.3 | 1.8 | — | |
| | | | $I_{OH}$ = −18 mA | 2.3 | 1.7 | — | V |
| Low-Level Output Voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 100 μA | 2.3~2.7 | — | 0.2 | |
| | | | $I_{OL}$ = 12 mA | 2.3 | — | 0.4 | |
| | | | $I_{OL}$ = 18 mA | 2.3 | — | 0.6 | |
| Input Leakage Current | $I_{IN}$ | $V_{IN}$ = 0~3.6 V | | 2.3~2.7 | — | ±10.0 | μA |
| Quiescent Supply Current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | 2.3~2.7 | — | 20.0 | μA |
| | | $V_{CC}$ ≦ $V_{IN}$ ≦ 3.6 V | | 2.3~2.7 | — | ±20.0 | |

## DC Electrical Characteristics (Ta = −40~85°C, 1.4 V ≦ $V_{CC}$ < 2.3 V)

| Characteristics | Symbol | Test Condition | | $V_{CC}$ (V) | Min | Max | Unit |
|---|---|---|---|---|---|---|---|
| High-Level Input Voltage | $V_{IH}$ | — | | 1.4~2.3 | $V_{CC}$ × 0.7 | — | V |
| Low-Level Input Voltage | $V_{IL}$ | — | | 1.4~2.3 | — | $V_{CC}$ × 0.13 | V |
| High-Level Output Voltage | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = −100 μA | 1.4 | $V_{CC}$ − 0.2 | — | V |
| | | | $I_{OH}$ = −4 mA | 1.4 | 1.0 | — | |
| Low-Level Output Voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 100 μA | 1.4 | — | 0.2 | V |
| | | | $I_{OL}$ = 4 mA | 1.4 | — | 0.3 | |
| Input Leakage Current | $I_{IN}$ | $V_{IN}$ = 0~3.6 V | | 1.4 | — | ±10.0 | μA |
| Quiescent Supply Current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | 1.4 | — | 20.0 | μA |
| | | $V_{CC}$ ≦ $V_{IN}$ ≦ 3.6 V | | 1.4 | — | ±20.0 | |

## AC Electrical Characteristics (Ta = −40~85°C, input $t_r$ = $t_f$ = 2.0 ns)

| Characteristics | Symbol | Test Condition | | $V_{CC}$ (V) | Min | Max | Unit |
|---|---|---|---|---|---|---|---|
| Propagation delay time (A or $\overline{G}$ – Y0 or Y1) | $t_{pLH}$ $t_{pHL}$ | (Figure 1 and 2) | $C_L$=15pF, $R_L$=1MΩ | 1.5 ± 0.1 | 1.8 | 10.0 | ns |
| | | | | 1.8 ± 0.15 | 1.5 | 8.0 | |
| | | | | 2.5 ± 0.2 | 0.8 | 3.9 | |
| | | | | 3.3 ± 0.3 | 0.6 | 3.3 | |
| | | | $C_L$=30pF, $R_L$=500Ω | 1.5 ± 0.1 | 2.0 | 13.0 | ns |
| | | | | 1.8 ± 0.15 | 1.8 | 9.5 | |
| | | | | 2.5 ± 0.2 | 1.2 | 5.0 | |
| | | | | 3.3 ± 0.3 | 1.0 | 4.0 | |

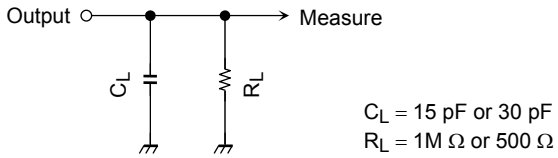
For $C_L$ = 50 pF, add approximately 300 ps to the AC maximum specification.

## Capacitive Characteristics (Ta = 25°C)

| Characteristics | Symbol | Test Condition | $V_{CC}$ (V) | TYP. | Unit |
|---|---|---|---|---|---|
| Input Capacitance | $C_{IN}$ | — | 1.8, 2.5, 3.3 | 6 | pF |
| Power Dissipation Capacitance | $C_{PD}$ | $f_{IN}$ = 10 MHz (Note 9) | 1.8, 2.5, 3.3 | 20 | pF |

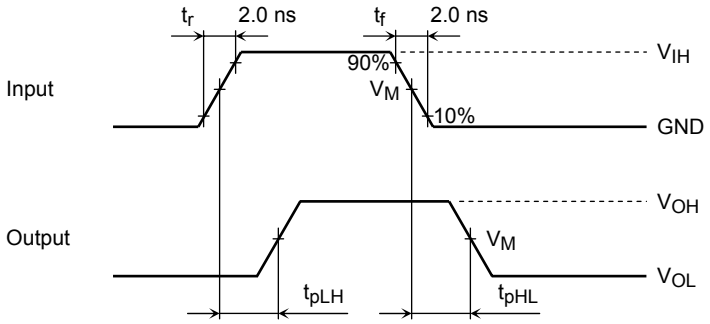
Note 9: $C_{PD}$ is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.
Average operating current can be obtained by the equation:
$I_{CC\ (opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$

**Figure 1 Test Circuit**




## AC Waveforms

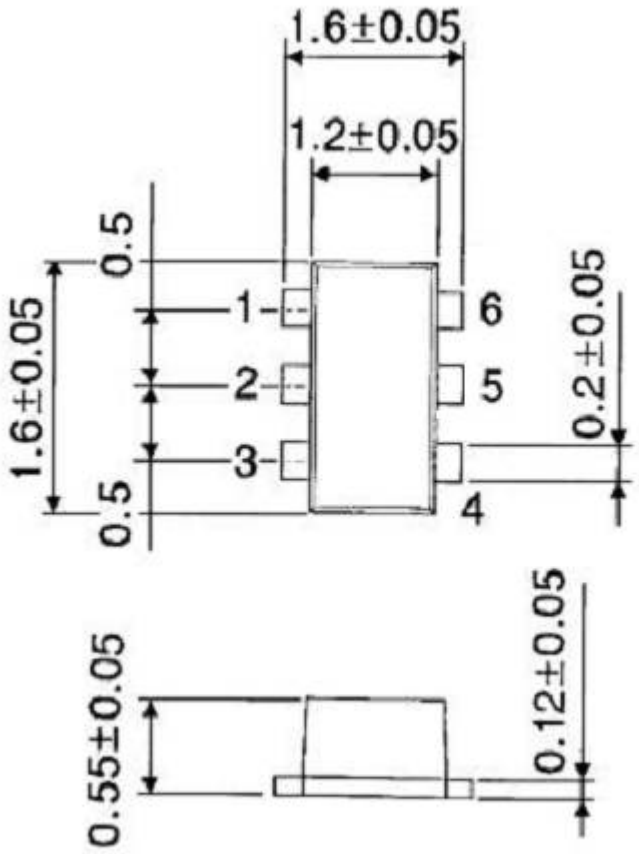
**Figure 2 $t_{pLH}$, $t_{pHL}$**




| Symbol | $V_{CC}$ | | | |
|---|---|---|---|---|
| | 3.3 ± 0.3 V | 2.5 ± 0.2 V | 1.8 ± 0.15 V | 1.5 ± 0.1 V |
| $V_{IH}$ | 2.7 V | $V_{CC}$ | $V_{CC}$ | $V_{CC}$ |
| $V_M$ | 1.5 V | $V_{CC}/2$ | $V_{CC}/2$ | $V_{CC}/2$ |

**Package Dimensions**

SON6-P-0.50 Unit : mm




Weight: 0.003 g (typ.)

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