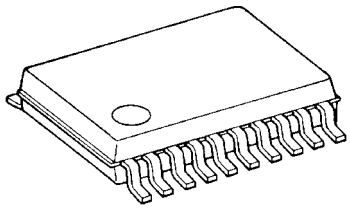
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7MET540AFK,TC7MET541AFK

Octal Bus Buffer

TC7MET540AFK Inverted, 3-State Outputs

TC7MET541AFK Non-Inverted, 3-State Outputs



VSSOP20-P-0030-0.50

Weight: 0.03 g (typ.)

The TC7MET540AFK and 541AFK are advanced high speed CMOS octal bus buffers fabricated with silicon gate C^2MOS technology. They achieve the high speed operation similar to equivalent bipolar schottky TTL while maintaining the CMOS low power dissipation.

The TC7MET540AFK is an inverting type and, the TC7MET541AFK is a non-inverting type.

When either $\overline{G}1$ or $\overline{G}2$ are high , the terminal outputs are in the high-impedance state.

The input voltage are compatible with TTL output voltage.

These devices may be used as a level converter for interfacing 3.3 V to 5 V system.

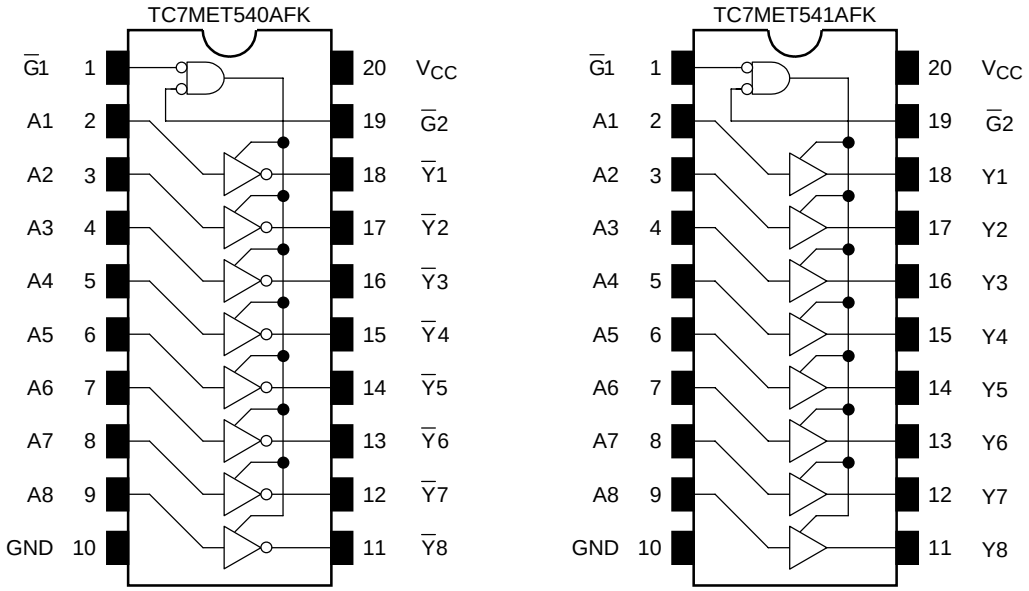
Input protection and output circuit ensure that 0 to 5.5 V can be applied to the input and output (*) pins without regard to the supply voltage. These structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, hot board insertion, etc.

*: output in off-state

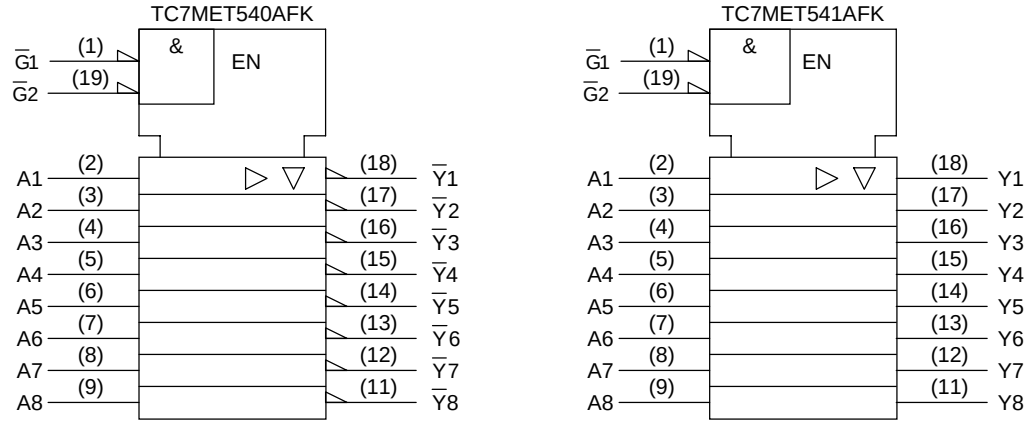
Features

- High speed: t_{pd} = 5.4 ns (typ.) (V_{CC} = 5 V)
- Low power dissipation: I_{CC} = 4 μA (max) (Ta = 25°C)
- Compatible with TTL outputs: V_{IL} = 0.8 V (max)
  V_{IH} = 2.0 V (min)
- Power down protection is provided on all inputs and outputs.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Low noise: V_{OLP} = 1.5 V (max)
- Pin and function compatible with the 74 series (74AC/HC/F/ALS/LS etc.) 540/541 type.

Pin Assignment (top view)



IEC Logic Symbol



Truth Table

Inputs			Outputs	
$\overline{G}1$	$\overline{G}2$	A_n	Y_n	$\overline{Y}_n$
H	X	X	Z	Z
X	H	X	Z	Z
L	L	H	H	L
L	L	L	L	H

X: Don't care

Z: High impedance

Y_n: TC7MET541AFK

$\overline{Y}_n$: TC7MET540AFK

Maximum Ratings

Characteristics	Symbol	Rating		Unit
Supply voltage range	V_{CC}	−0.5~7.0		V
DC input voltage	V_{IN}	−0.5~7.0		V
DC output voltage	V_{OUT}	−0.5~7.0	(Note1)	V
		−0.5~V_{CC} + 0.5	(Note2)	
Input diode current	I_{IK}	−20		mA
Output diode current	I_{OK}	±20	(Note3)	mA
DC output current	I_{OUT}	±25		mA
DC V_{CC}/ground current	I_{CC}	±75		mA
Power dissipation	P_D	180		mW
Storage temperature	T_{stg}	−65~150		°C

Note1: Output in off-state

Note2: High or low state. I_{OUT} absolute maximum rating must be observed.

Note3: $V_{OUT} < GND$, $V_{OUT} > V_{CC}$

Recommended Operating Conditions

Characteristics	Symbol	Rating		Unit
Supply voltage	V_{CC}	4.5~5.5		V
Input voltage	V_{IN}	0~5.5		V
Output voltage	V_{OUT}	0~5.5	(Note4)	V
		0~V_{CC}	(Note5)	
Operating temperature	T_{opr}	−40~85		°C
Input rise and fall time	dt/dv	0~20		ns/V

Note4: Output in off-state

Note5: High or low state

Electrical Characteristics

DC Characteristics

Characteristics		Symbol	Test Condition		V_{CC} (V)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = −40~85°C Min	Ta = −40~85°C Max	Unit
Input voltage	High level	V_{IH}	—		4.5~5.5	2.0	—	—	2.0	—	V
	low level	V_{IL}	—		4.5~5.5	—	—	0.8	—	0.8	
Output voltage	High level	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = −50 μA	4.5	4.4	4.5	—	4.4	—	V
				I_{OH} = −8 mA	4.5	3.94	—	—	3.80	—	
	low level	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 50 μA	4.5	—	0	0.1	—	0.1	
				I_{OL} = 8 mA	4.5	—	—	0.36	—	0.44	
3-state output off-state current		I_{OZ}	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND		5.5	—	—	±0.25	—	±2.50	μA
Input leakage current		I_{IN}	V_{IN} = 5.5 V or GND		0~5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current		I_{CC}	V_{IN} = V_{CC} or GND		5.5	—	—	4.0	—	40.0	μA
		I_{CCT}	Per input: V_{IN} = 3.4 V Other input: V_{CC} or GND		5.5	—	—	1.35	—	1.50	mA
Output leakage current		I_{OPD}	V_{OUT} = 5.5 V		0	—	—	0.5	—	5.0	μA

AC Electrical Characteristics (Input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition	V_{CC} (V)	C_L (pF)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = −40~85°C Min	Ta = −40~85°C Max	Unit
Propagation delay time (TC7MET540AFK)	t_{pLH} t_{pHL}	—	5.0 ± 0.5	15	—	5.4	7.4	1.0	8.5	ns
				50	—	5.9	8.4	1.0	9.5	
Propagation delay time (TC7MET541AFK)	t_{pLH} t_{pHL}	—	5.0 ± 0.5	15	—	5.0	6.9	1.0	8.0	ns
				50	—	5.5	7.9	1.0	9.0	
3-state output enable time	t_{pZL} t_{pZH}	R_L = 1 kΩ	5.0 ± 0.5	15	—	8.3	11.3	1.0	13.0	ns
				50	—	8.8	12.3	1.0	14.0	
3-state output disable time	t_{pLZ} t_{pHZ}	R_L = 1 kΩ	5.0 ± 0.5	50	—	9.4	11.9	1.0	13.5	ns
Output to output skew	t_{osLH} t_{osHL}	(Note6)	5.0 ± 0.5	50	—	—	1.0	—	1.0	ns
Input capacitance	C_{IN}	—			—	4	10	—	10	pF
Output capacitance	C_{OUT}	—			—	9	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note7)			—	19	—	—	—	pF

Note6: Parameter guaranteed by design.

$t_{osLH} = |t_{pLHm} - t_{pLHn}|$, $t_{osHL} = |t_{pHLm} - t_{pHLn}|$

Note7: 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:

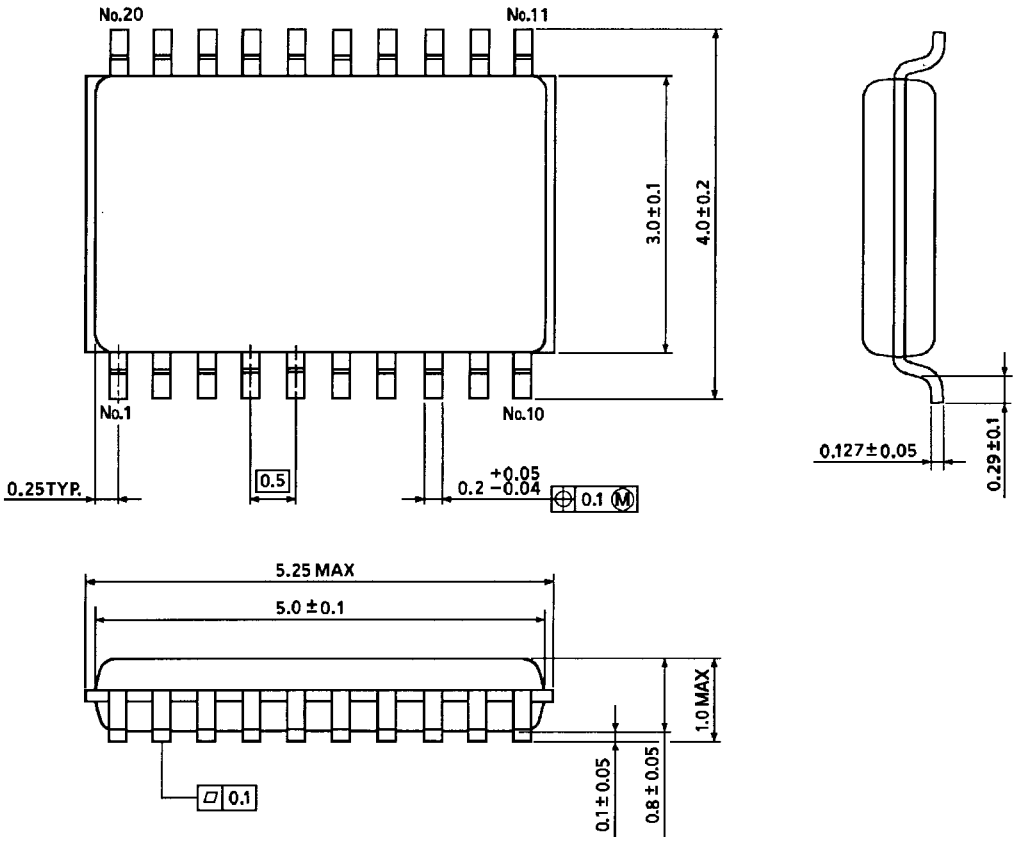
$I_{CC\ (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8$ (per bit)

Noise Characteristics (Input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition	Ta = 25°C			Unit
			V_{CC} (V)	Typ.	Limit	
Quiet output maximum dynamic V_{OL}	V_{OLP}	C_L = 50 pF	5.0	1.1	1.5	V
Quiet output minimum dynamic V_{OL}	V_{OLV}	C_L = 50 pF	5.0	−1.1	−1.5	V
Minimum high level dynamic input voltage V_{IH}	V_{IHD}	C_L = 50 pF	5.0	—	2.0	V
Maximum low level dynamic input voltage V_{IL}	V_{ILD}	C_L = 50 pF	5.0	—	0.8	V

Package Dimensions

VSSOP20-P-0030-0.50 Unit : mm



Weight: 0.03 g (typ.)

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