

### FEATURES:

- 3-state outputs drive bus lines or buffer memory address registers
- RAD-PAK® radiation-hardened against natural space radiation
- Total dose hardness:
  - >100 krad (Si), depending upon space mission
- Package:
  - 20-pin RAD-PAK® flat package
- Operating temperature range:
  - 55 to 125°C
- P-N-P inputs reduce DC loading
- Typical  $V_{OLP}$  (output ground bounce)
  - < 0.8 V at  $V_{CC}=3.3$  V,  $T_A=25^\circ\text{C}$
- ESD protection exceeds 2000 V

### DESCRIPTION:

Maxwell Technologies' 54BCT244 octal buffers and line drivers features a greater than 100 krad (Si) total dose tolerance; depending upon space mission. The 54BCT244 is organized as two 4-bit drivers with separate output enable (OE) inputs. When OE is low, the device passes data from the A inputs to the Y outputs. When OE is high, the outputs are in the high impedance state.

Maxwell Technologies' patented RAD-PAK® packaging technology incorporates radiation shielding in the microcircuit package. It eliminates the need for box shielding while providing the required radiation shielding for a lifetime in orbit or a space mission. In a GEO orbit, RAD-PAK provides true greater than 100 krad (Si) total radiation dose tolerance, dependent upon space mission. This product is available with packaging and screening up to Class S.

TABLE 1. PINOUT DESCRIPTION

PIN	SYMBOL	DESCRIPTION
1, 19	$\overline{1OE-2OE}$	Output Enables
2, 4, 6, 8	1A1-1A4	Input
3, 5, 7, 9	2Y4-2Y1	Output
10	GND	Ground
11, 13, 15, 17	2A1-2A4	Input
12, 14, 16, 18	1Y4-1Y1	Output
20	$V_{CC}$	Power Supply

TABLE 2. 54BCT244 ABSOLUTE MAXIMUM RATINGS <sup>1</sup>

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage Range	$V_{CC}$	-0.5	7.0	V
Input Voltage Range <sup>2</sup>	$V_I$	-0.5	7.0	V
Voltage Range Applied to any Output in the Disable or Power-Off State <sup>2</sup>	$V_O$	-0.5	5.5	V
Voltage Range Applied to any Output in High State <sup>2</sup>	$V_O$	-0.5	$V_{CC}$	V
Current Into Any Output in the Low State	$I_O$	--	96	mA
Total Power Dissipation @ $T_A = +55\text{ }^\circ\text{C}$ <sup>3</sup>	$P_D$	--	651	mW
Operating Temperature Range	$T_A$	-55	125	$^\circ\text{C}$
Storage Temperature Range	$T_S$	-65	150	$^\circ\text{C}$

1. Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability.
2. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
3. Must be able to withstand the additional  $P_D$  due to short circuit test, e.g.  $I_{DS}$ . The  $P_D$  number is based upon dc values.

TABLE 3. DELTA LIMITS

PARAMETER	VARIATION
$I_{CC(OP)}$	$\pm 10\%$ of specified value on Table 5
$I_{OZH}$	$\pm 10\%$ of specified value on Table 5
$I_{OZL}$	$\pm 10\%$ of specified value on Table 5

TABLE 4. 54BCT244 RECOMMENDED OPERATING CONDITIONS<sup>1</sup>

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage	$V_{CC}$	4.5	5.5	V
High-Level Input Voltage	$V_{IH}$	2.0	--	V
Low-Level Input Voltage	$V_{IL}$	--	0.8	V
High-Level Output Current	$I_{OH}$	--	-12	mA
Low-Level Output Current	$I_{OL}$	--	48	mA
Input Clamp Current	$I_{IK}$	--	-18	mA
Thermal Impedance — Flat Package	$\Theta_{JC}$	--	5.56	°C/W
Operating Temperature	$T_A$	-55	125	°C

1. All unused control inputs must be held high or low to ensure proper device operation.

TABLE 5. 54BCT244 DC ELECTRICAL CHARACTERISTICS

( $V_{CC} = 5V \pm 10\%$ ,  $T_A = -55\text{ }^\circ\text{C}$  TO  $125\text{ }^\circ\text{C}$ , UNLESS OTHERWISE SPECIFIED)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	MAX	UNIT
Input Clamp Voltage	$V_{IK}$	$V_{CC} = 4.5\text{ V}$	$I_I = -18\text{ mA}$	--	-1.2	V
High-Level Output Voltage	$V_{OH}$	$V_{CC} = 4.5\text{ V}$	$I_{OH} = -3\text{ mA}$	2.4	--	V
			$I_{OH} = -12\text{ mA}$	2	--	
Low-Level Output Voltage	$V_{OL}$	$V_{CC} = 4.5\text{ V}$	$I_{OL} = 48\text{ mA}$	--	0.55	V
Input Current	$I_I$	$V_{CC} = 5.5\text{ V}$	$V_I = 7\text{ V}$		0.1	mA
Off-State Output Current High-Level Voltage Applied	$I_{OZH}$	$V_{CC} = 5.5\text{ V}$	$V_I = 2.7\text{ V}$	--	50	$\mu\text{A}$
Off-State Output Current Low-Level Voltage Applied	$I_{OZL}$	$V_{CC} = 5.5\text{ V}$	$V_O = 0.5\text{ V}$	--	-50	$\mu\text{A}$
High Level Input Current	$I_{IH1}$	$V_{CC} = 5.5\text{ V}$	$V_I = 7\text{ V}$	--	0.1	mA
	$I_{IH2}$	$V_{CC} = 5.5\text{ V}$	$V_I = 2.7\text{ V}$	--	20	$\mu\text{A}$
Low Level Input Current	$I_{IL}$	$V_{CC} = 5.5\text{ V}$	$V_I = 0.5\text{ V}$	--	-1.0	mA
Short-circuit Output Current <sup>1</sup>	$I_{OS}$	$V_{CC} = 5.5\text{ V}$	$V_O = 0.0\text{ V}$	-100	-225	mA
Supply Current, Outputs High	$I_{CCH}$	$V_{CC} = 5.5\text{ V}$	Outputs Open	--	40	mA
Supply Current, Outputs Low	$I_{CCL}$	$V_{CC} = 5.5\text{ V}$	Outputs Open	--	80	mA
Supply Current, Outputs Disabled to High Impedance State	$I_{CCZ}$	$V_{CC} = 5.5\text{ V}$	Outputs Open	--	10	mA

1. Not more than one output should be shorted at one time and the duration of test shall not exceed one second.

TABLE 6. 54BCT244 AC ELECTRICAL CHARACTERISTICS

(V<sub>CC</sub> = 5V ±10%, T<sub>A</sub> = -55 °C TO 125 °C, UNLESS OTHERWISE SPECIFIED)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Propagation Delay Time An to Yn	t <sub>PLH</sub>	V <sub>CC</sub> = 4.5 to 5.5 V C <sub>L</sub> = 50 pF R <sub>1</sub> = 500 Ω R <sub>2</sub> = 500 Ω	0.9	5.3	ns
	t <sub>PHL</sub>	T <sub>A</sub> = -55 to +125 °C	1.4	6	
	t <sub>PLH</sub>	V <sub>CC</sub> = 5.0 V C <sub>L</sub> = 50 pF R <sub>1</sub> = 500 Ω R <sub>2</sub> = 500 Ω	1.2	4.4	
	t <sub>PHL</sub>	T <sub>A</sub> = +25 °C	1.7	5	
Output Enable Time OE to Yn	t <sub>PZH</sub>	V <sub>CC</sub> = 4.5 to 5.5 V C <sub>L</sub> = 50 pF R <sub>1</sub> = 500 Ω R <sub>2</sub> = 500 Ω	2	9	ns
	t <sub>PZL</sub>	T <sub>A</sub> = -55 to +125 °C	2	9.4	
	t <sub>PZH</sub>	V <sub>CC</sub> = 5.0 V C <sub>L</sub> = 50 pF R <sub>1</sub> = 500 Ω R <sub>2</sub> = 500 Ω	2	7.8	
	t <sub>PZL</sub>	T <sub>A</sub> = +25 °C	2	8.1	
Output Disable Time OE to Yn	t <sub>PHZ</sub>	V <sub>CC</sub> = 4.5 to 5.5 V C <sub>L</sub> = 50 pF R <sub>1</sub> = 500 Ω R <sub>2</sub> = 500 Ω	2	8	ns
	t <sub>PLZ</sub>	T <sub>A</sub> = -55 to +125 °C	2	9.8	
	t <sub>PHZ</sub>	V <sub>CC</sub> = 5.0 V C <sub>L</sub> = 50 pF R <sub>1</sub> = 500 Ω R <sub>2</sub> = 500 Ω	2	6.7	
	t <sub>PLZ</sub>	T <sub>A</sub> = +25 °C	2	7.6	

TABLE 7. FUNCTION TABLE

(EACH BUFFER)

INPUTS		OUTPUT
$\overline{\text{OE}}$	A	Y
I	H	H
L	L	L
H	X	Z

FIGURE 1. LOAD CIRCUIT FOR OUTPUTS

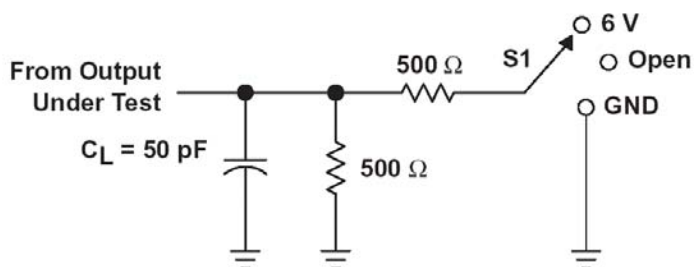


FIGURE NOTE:

1.  $C_L$  INCLUDES PROBE AND JOG CAPACITANCE

### PARAMETER MEASUREMENT INFORMATION

TEST	S1
$T_{PLH}/T_{PHL}$	Open
$T_{PLZ}/T_{PZL}$	6V
$T_{PHZ}/T_{PZH}$	GND

FIGURE 2. VOLTAGE WAVEFORMS PULSE DURATION

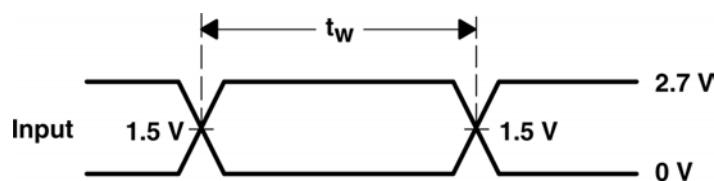


FIGURE 3. OUTPUT ENABLE TIMING

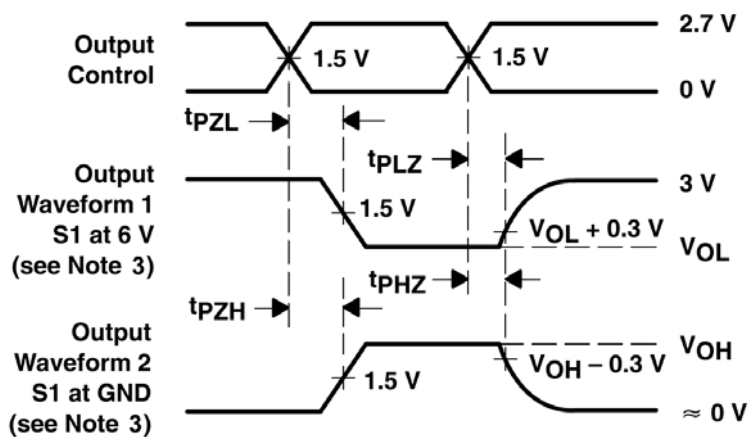


FIGURE 4. VOLTAGE SETUP AND HOLD TIMES

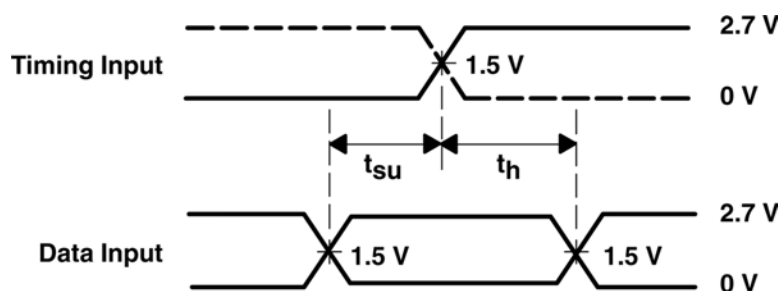


FIGURE 5. PROPAGATION DELAY TIMES INVERTING AND NON-INVERTING OUTPUTS

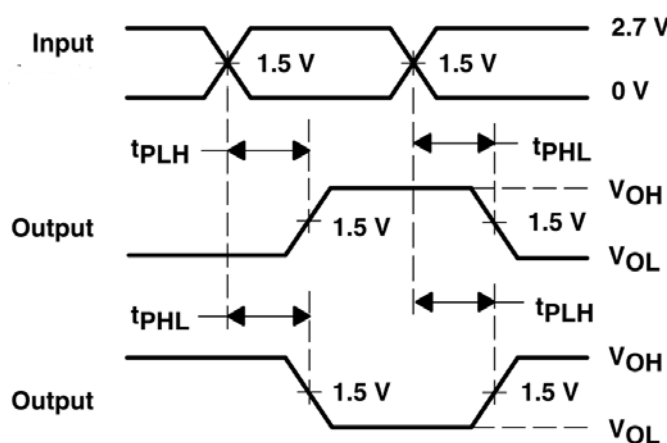
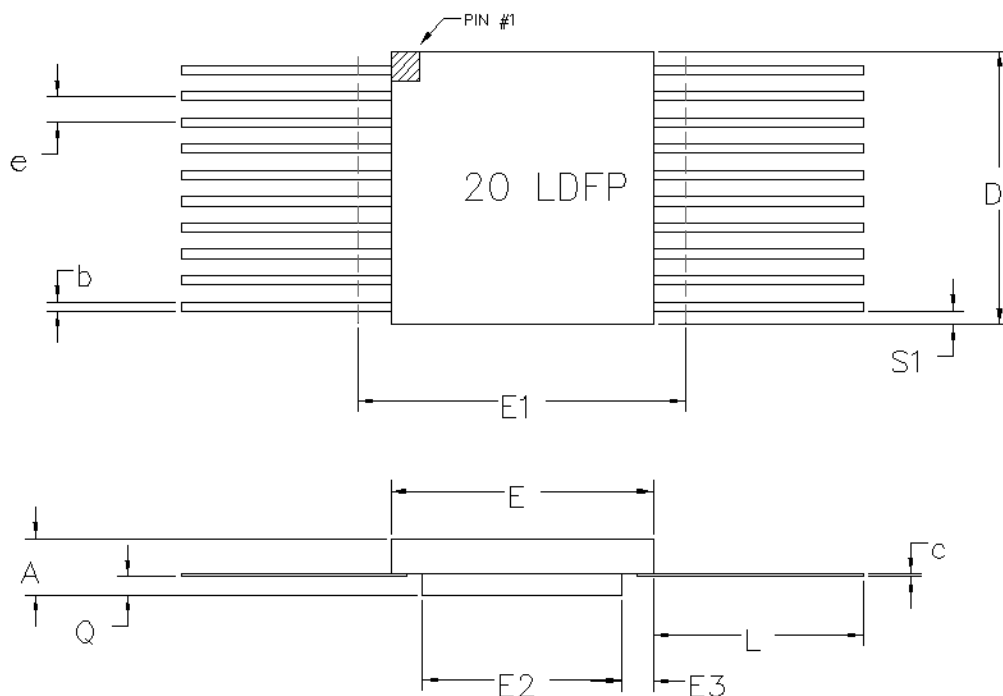


Figure Notes:

- All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_o = 50\Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .
- Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- The outputs are measured one at a time with one transition per measurement.



20 PIN RAD-PAK® FLAT PACKAGE

SYMBOL	DIMENSION		
	MIN	NOM	MAX
A	0.128	0.141	0.154
b	0.015	0.017	0.022
c	0.003	0.005	0.009
D	0.470	0.480	0.490
E	0.287	0.295	0.303
E1	--	--	0.333
E2	0.155	0.160	--
E3	0.030	0.068	--
e	0.050BSC		
L	0.370	0.380	0.390
Q	0.035	0.039	0.042
S1	0.005	0.007	--
N	20		

F20-01

Note: All dimensions in inches

## Important Notice:

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