54ACQ244,54ACTQ244

54ACQ244, 54ACTQ244 Quiet Series Octal Buffer/Line Driver with TRI-STATE Outputs

TEXAS INSTRUMENTS

Literature Number: SNOS059A

National Semiconductor

54ACQ244 • 54ACTQ244

Quiet Series Octal Buffer/Line Driver with TRI-STATE® Outputs

General Description

The 'ACQ/'ACTQ244 is an octal buffer and line driver designed to be employed as a memory address driver, clock driver and bus oriented transmitter or receiver which provides improved PC board density. The ACQ/ACTQ utilizes NSC Quiet Series technology to guarantee quiet output switching and improved dynamic threshold performance. FACT Quiet Series™ features GTO™ output control and undershoot corrector in addition to a split ground bus for superior performance.

Features

- I_{CC} and I_{OZ} reduced by 50%
- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Improved latch-up immunity
- TRI-STATE outputs drive bus lines or buffer memory address registers
- Outputs source/sink 24 mA
- Faster prop delays than the standard 'AC/'ACT244
- 4 kV minimum ESD immunity
- Standard Microcircuit Drawing (SMD)
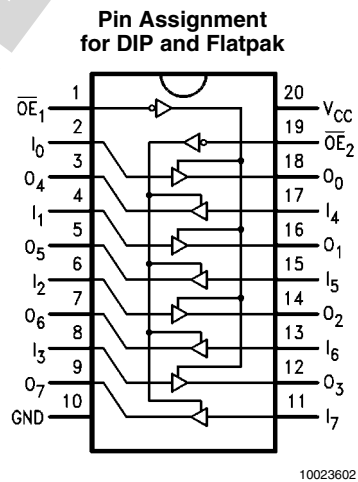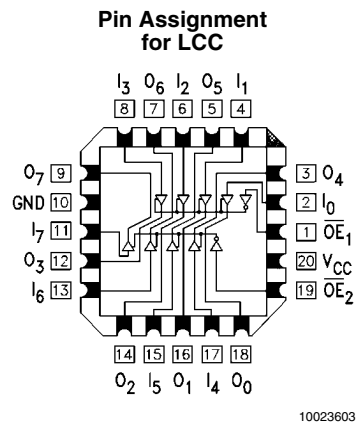 — 'ACTQ244: 5962-92186
  — 'ACQ244: 5962-92176

Logic Symbol

IEE/IEC
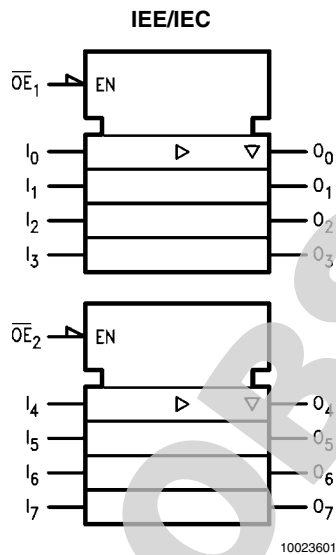
10023601

Pin Names	Description
$\overline{OE}_1$, $\overline{OE}_2$	TRI-STATE Output Enable Inputs
I_0–I_7	Inputs
O_0–O_7	Outputs

Connection Diagrams

Pin Assignment for DIP and Flatpak

10023602

Pin Assignment for LCC

10023603

Truth Table

Inputs		Outputs
$\overline{OE}_1$	I_n	(Pins 12, 14, 16, 18)
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_2$	I_n	(Pins 3, 5, 7, 9)
L	L	L
L	H	H
H	X	Z

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
Z = High Impedance

OBSOLETE

Absolute Maximum Ratings (*Note 1*)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Supply Voltage (V_{CC})	−0.5V to +7.0V
DC Input Diode Current (I_{IK})	
$V_I = −0.5V$	−20 mA
$V_I = V_{CC} + 0.5V$	+20 mA
DC Input Voltage (V_I)	−0.5V to V_{CC} + 0.5V
DC Output Diode Current (I_{OK})	
$V_O = −0.5V$	−20 mA
$V_O = V_{CC} + 0.5V$	+20 mA
DC Output Voltage (V_O)	−0.5V to V_{CC} + 0.5V
DC Output Source	
or Sink Current (I_O)	±50 mA
DC V_{CC} or Ground Current	
per Output Pin (I_{CC} or I_{GND})	±50 mA
Storage Temperature (T_{STG})	−65°C to +150°C
DC Latch-Up Source or	
Sink Current	±300 mA
Junction Temperature (T_J)	
CDIP	175°C

Recommended Operating Conditions

Supply Voltage (V_{CC})	
'ACQ	2.0V to 6.0V
'ACTQ	4.5V to 5.5V
Input Voltage (V_I)	0V to V_{CC}
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A)	
54ACQ/ACTQ	−55°C to +125°C
Minimum Input Edge Rate ΔV/Δt	
'ACQ Devices	
V_{IN} from 30% to 70% of V_{CC}	
V_{CC} @ 3.0V, 4.5V, 5.5V	125 mV/ns
Minimum Input Edge Rate ΔV/Δt	
'ACTQ Devices	
V_{IN} from 0.8V to 2.0V	
V_{CC} @ 4.5V, 5.5V	125 mV/ns

Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT™ circuits outside databook specifications.

Note 2: All commercial packaging is not recommended for applications requiring greater than 2000 temperature cycles from −40°C to +125°C.

DC Electrical Characteristics for 'ACQ Family Devices

Symbol	Parameter	V_{CC} (V)	54ACQ $T_A = −55°C$ to $+125°C$ Guaranteed Limits	Units	Conditions
V_{IH}	Minimum High Level Input Voltage	3.0	2.1		$V_{OUT} = 0.1V$ or $V_{CC} − 0.1V$
		4.5	3.15	V	
		5.5	3.85		
V_{IL}	Maximum Low Level Input Voltage	3.0	0.9		$V_{OUT} = 0.1V$ or $V_{CC} − 0.1V$
		4.5	1.35	V	
		5.5	1.65		
V_{OH}	Minimum High Level Output Voltage	3.0	2.9		$I_{OUT} = −50$ μA
		4.5	4.4	V	
		5.5	5.4		
		3.0	2.4		(*Note 3*) $V_{IN} = V_{IL}$ or V_{IH} $I_{OH} = −12$ mA
		4.5	3.7	V	$I_{OH} = −24$ mA
		5.5	4.7		$I_{OH} = −24$ mA
V_{OL}	Maximum Low Level Output Voltage	3.0	0.1		$I_{OUT} = 50$ μA
		4.5	0.1	V	
		5.5	0.1		
		3.0	0.50		(*Note 3*) $V_{IN} = V_{IL}$ or V_{IH} $I_{OL} = 12$ mA
		4.5	0.50	V	$I_{OL} = 24$ mA
		5.5	0.50		$I_{OL} = 24$ mA
I_{IN}	Maximum Input Leakage Current	5.5	±1.0	μA	$V_I = V_{CC}$, GND (*Note 5*)

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Symbol	Parameter	V_{CC} (V)	54ACQ T_A = −55°C to +125°C Guaranteed Limits	Units	Conditions
I_{OLD}	Minimum Dynamic (*Note 4*)	5.5	50	mA	V_{OLD} = 1.65V Max
I_{OHD}	Output Current	5.5	−50	mA	V_{OHD} = 3.85V Min
I_{CC}	Maximum Quiescent Supply Current	5.5	80.0	µA	$V_{IN} = V_{CC}$ or GND (*Note 5*)
I_{OZ}	Maximum TRI-STATE Leakage Current	5.5	±5.0	µA	$V_I(OE) = V_{IL}, V_{IH}$ $V_I = V_{CC}$, GND $V_O = V_{CC}$, GND
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	5.0	1.5	V	(*Note 6*, *Note 7*)
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	5.0	−1.2	V	(*Note 6*, *Note 7*)

Note 3: All outputs loaded thresholds on input associated with output under test.

Note 4: Maximum test duration 2.0 ms, one output loaded at a time.

Note 5: I_{IN} and I_{CC} @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V_{CC}. I_{CC} for 54ACQ @ 25°C is identical to 74ACQ @ 25°C.

Note 6: Plastic DIP package.

Note 7: Max number of outputs defined as (n). Data Inputs are driven 0V to 5V. One output @ GND.

Note 8: Max number of Data Inputs (n) switching. (n − 1) Inputs switching 0V to 5V ('ACQ). Input-under-test switching: 5V to threshold (V_{ILD}), 0V to threshold (V_{IHD}), f = 1 MHz.

DC Electrical Characteristics for 'ACTQ Family Devices

Symbol	Parameter	V_{CC} (V)	54ACTQ −55°C to +125°C Guaranteed Limits	Units	Conditions
V_{IH}	Minimum High Level Input Voltage	4.5	2.0	V	V_{OUT} = 0.1V or V_{CC} − 0.1V
		5.5	2.0		
V_{IL}	Maximum Low Level Input Voltage	4.5	0.8	V	V_{OUT} = 0.1V or V_{CC} − 0.1V
		5.5	0.8		
V_{OH}	Minimum High Level Output Voltage	4.5	4.4	V	I_{OUT} = −50 µA
		5.5	5.4		
		4.5	3.70	V	(*Note 9*) $V_{IN} = V_{IL}$ or V_{IH} I_{OH} = −24 mA
		5.5	4.70		I_{OH} = −24 mA
V_{OL}	Maximum Low Level Output Voltage	4.5	0.1	V	I_{OUT} = 50 µA
		5.5	0.1		
		4.5	0.50	V	(*Note 9*) $V_{IN} = V_{IL}$ or V_{IH} I_{OL} = 24 mA
		5.5	0.50		I_{OL} = 24 mA
I_{IN}	Maximum Input Leakage Current	5.5	±1.0	µA	$V_I = V_{CC}$, GND
I_{OZ}	Maximum TRI-STATE Leakage Current	5.5	±5.0	µA	$V_I = V_{IL}, V_{IH}$ $V_O = V_{CC}$, GND
I_{CCT}	Maximum I_{CC}/Input	5.5	1.6	mA	$V_I = V_{CC}$ − 2.1V
I_{OLD}	Minimum Dynamic (*Note 10*)	5.5	50	mA	V_{OLD} = 1.65V Max
I_{OHD}	Output Current	5.5	−50	mA	V_{OHD} = 3.85V Min
I_{CC}	Maximum Quiescent Supply Current	5.5	80.0	µA	$V_{IN} = V_{CC}$ or GND (*Note 11*)

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Symbol	Parameter	V$_{CC}$ (V)	54ACTQ −55°C to +125°C Guaranteed Limits	Units	Conditions
V$_{OLP}$	Quiet Output Maximum Dynamic V$_{OL}$	5.0	1.5	V	(*Note 12*, *Note 13*)
V$_{OLV}$	Quiet Output Minimum Dynamic V$_{OL}$	5.0	−1.2	V	(*Note 12*, *Note 13*)

Note 9: All outputs loaded thresholds on input associated with output under test.

Note 10: Maximum test duration 2.0 ms, one output loaded at a time.

Note 11: I$_{CC}$ for 54ACTQ @ 25°C is identical to 74ACTQ @ 25°C.

Note 12: Plastic DIP package.

Note 13: Max number of outputs defined as (n). Data Inputs are driven 0V to 3V. One output @ GND.

AC Electrical Characteristics

Symbol	Parameter	V$_{CC}$ (V) (*Note 14*)	54ACQ T$_A$ = −55°C to +125°C C$_L$ = 50 pF		Units	Fig. No.
			Min	Max		
t$_{PHL}$, t$_{PLH}$	Propagation Delay Data to Output	3.3	1.0	12.5	ns	
		5.0	1.0	9.0		
t$_{PZL}$, t$_{PZH}$	Output Enable Time	3.3	1.0	12.0	ns	
		5.0	1.0	10.0		
t$_{PHZ}$, t$_{PLZ}$	Output Disable Time	3.3	1.0	11.5	ns	
		5.0	1.0	10.0		

Note 14: Voltage Range 5.0 is 5.0V ±0.5V.

Voltage Range 3.3 is 3.3V ±0.3V.

Note 15: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH to LOW (t$_{OSHL}$) or LOW to HIGH (t$_{OSLH}$). Parameter guaranteed by design.

AC Electrical Characteristics

Symbol	Parameter	V$_{CC}$ (V) (*Note 16*)	54ACTQ T$_A$ = −55°C to +125°C C$_L$ = 50 pF		Units	Fig. No.
			Min	Max		
t$_{PHL}$, t$_{PLH}$	Propagation Delay Data to Output	5.0	1.5	9.0	ns	
t$_{PZL}$, t$_{PZH}$	Output Enable Time	5.0	1.5	10.5	ns	
t$_{PHZ}$, t$_{PLZ}$	Output Disable Time	5.0	1.5	10.5	ns	

Note 16: Voltage Range 5.0 is 5.0V ±0.5V.

Note 17: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH to LOW (t$_{OSHL}$) or LOW to HIGH (t$_{OSLH}$). Parameter guaranteed by design.

Capacitance

Symbol	Parameter	Typ	Units	Conditions
C$_{IN}$	Input Capacitance	4.5	pF	V$_{CC}$ = OPEN
C$_{PD}$	Power Dissipation Capacitance	70	pF	V$_{CC}$ = 5.0V

Physical Dimensions inches (millimeters) unless otherwise noted

0.350 ± 0.008
(8.890 ± 0.203)

Top View

0.063 − 0.075
(1.600 − 1.905)

DETAIL A

Side View

0.200 ± 0.005
(5.080 ± 0.127)
TYP

45° × 0.015 ± 0.010
(0.381 ± 0.254)

0.015
(0.381)
MIN TYP

0.007 − 0.011
(0.178 − 0.279)
R TYP

0.022 − 0.028
(0.559 − 0.711)
TYP

0.077 − 0.093
(1.959 − 2.362)

PIN #1
INDEX

0.045 − 0.055
(1.143 − 1.397)
TYP

0.067 − 0.083
(1.702 − 2.108)
TYP

0.045 − 0.055
(1.143 − 1.397)
TYP

45° × 0.040 ± 0.010
(1.016 ± 0.254)
3 PLCS

Bottom View

0.003
(0.076)
MIN TYP

0.015
(0.381)
MAX TYP

0.022
(0.559)
MAX TYP

0.006
(0.152)
MIN TYP
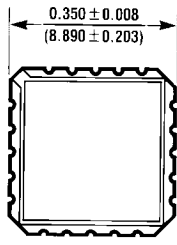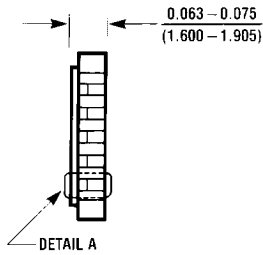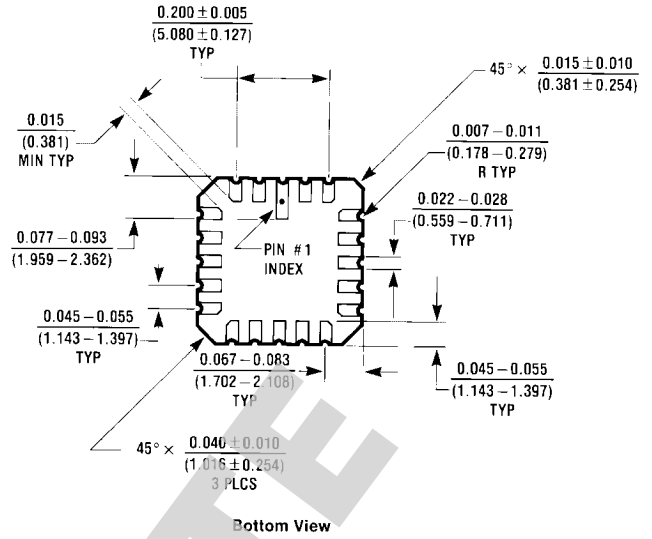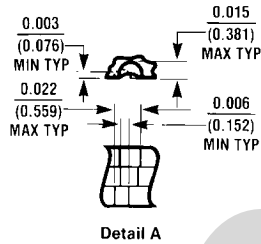
Detail A

L20A (REV D)

20-Terminal Ceramic Leadless Chip Carrier (L)
NS Package Number E20A

20-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J20A
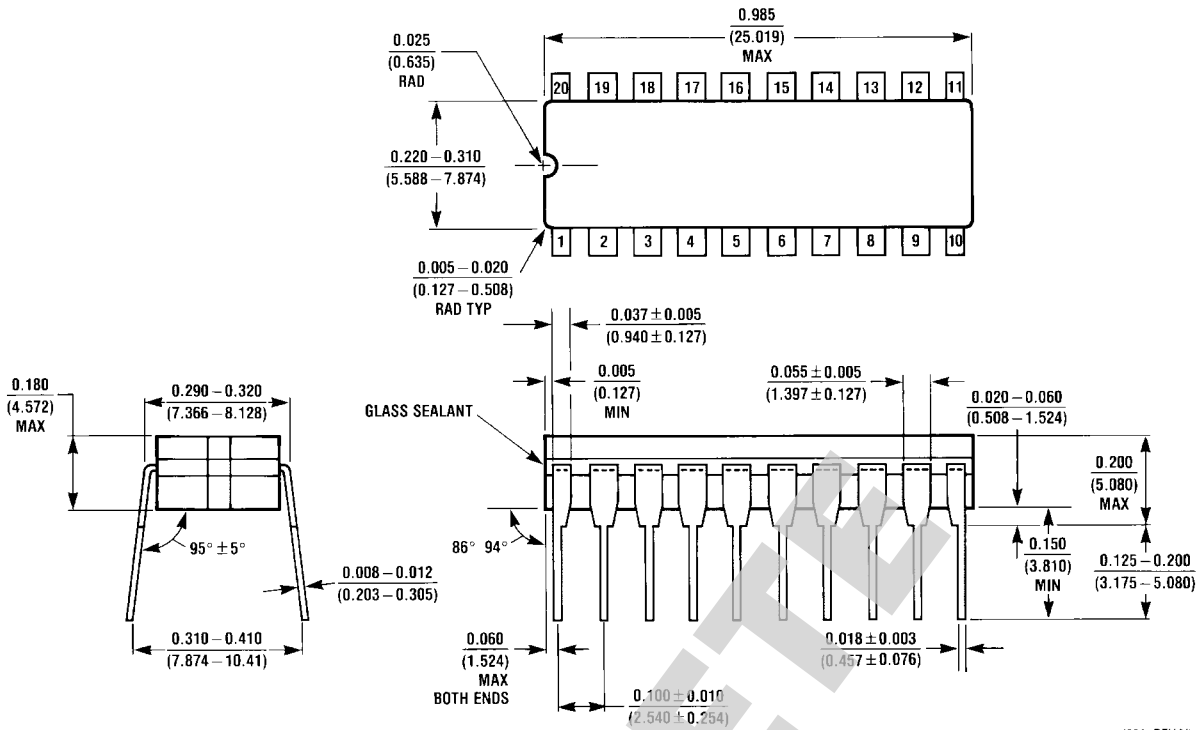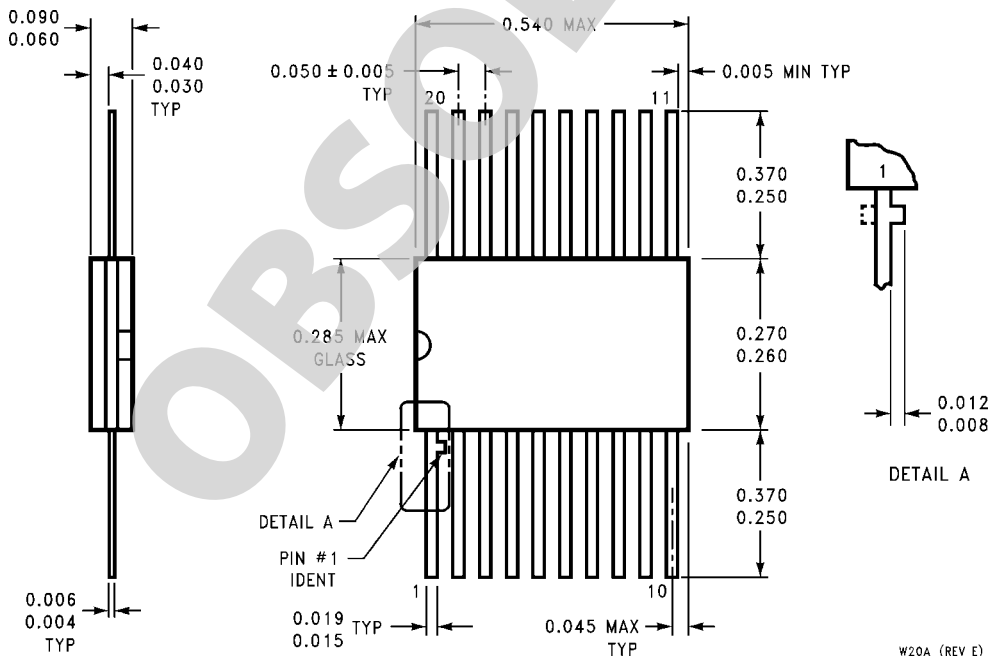
J20A (REV M)

20-Lead Ceramic Flatpak (F)
NS Package Number W20A

W20A (REV E)

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Notes

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Switching Regulators	www.national.com/switchers	Distributors	www.national.com/contacts
LDOs	www.national.com/ldo	Quality and Reliability	www.national.com/quality
LED Lighting	www.national.com/led	Feedback/Support	www.national.com/feedback
Voltage References	www.national.com/vref	Design Made Easy	www.national.com/easy
PowerWise® Solutions	www.national.com/powerwise	Applications & Markets	www.national.com/solutions
Serial Digital Interface (SDI)	www.national.com/sdi	Mil/Aero	www.national.com/milaero
Temperature Sensors	www.national.com/tempsensors	SolarMagic™	www.national.com/solarmagic
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