

SN74AUC16240 16-BIT BUFFER/DRIVER WITH 3-STATE OUTPUTS

SCES390E – MARCH 2002 – REVISED DECEMBER 2002

- Member of the Texas Instruments Widebus™ Family
- Optimized for 1.8-V Operation and is 3.6-V I/O Tolerant to Support Mixed-Mode Signal Operation
- I_{off} Supports Partial-Power-Down Mode Operation
- Sub 1-V Operable
- Max t_{pd} of 2 ns at 1.8 V
- Low Power Consumption, 20- μ A Max I_{CC}
- \pm 8-mA Output Drive at 1.8 V
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

description/ordering information

This 16-bit buffer/driver is operational at 0.8-V to 2.7-V V_{CC} , but is designed specifically for 1.65-V to 1.95-V V_{CC} operation.

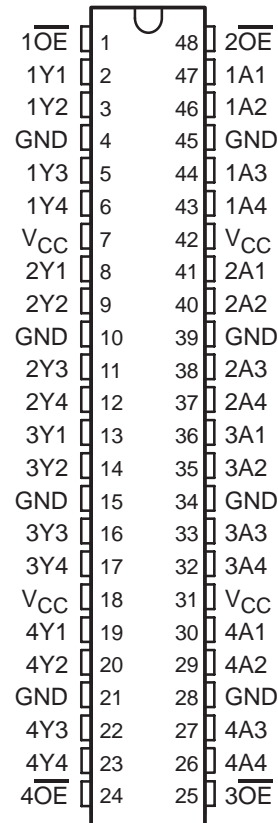
The SN74AUC16240 is designed specifically to improve the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

The device can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer. It provides inverting outputs and symmetrical active-low output-enable (\overline{OE}) inputs.

To ensure the high-impedance state during power up or power down, \overline{OE} should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

This device is fully specified for partial-power-down applications using I_{off} . The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

DGG OR DGV PACKAGE (TOP VIEW)



ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	TSSOP – DGG	Tape and reel	SN74AUC16240DGGR	AUC16240
	TVSOP – DGV	Tape and reel	SN74AUC16240DGVR	MH240
	VFBGA – GQL	Tape and reel	SN74AUC16240GQLR	MH240

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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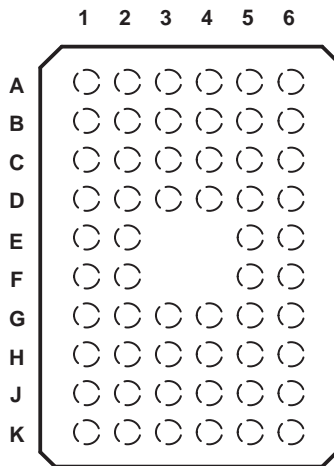
SN74AUC16240

16-BIT BUFFER/DRIVER

WITH 3-STATE OUTPUTS

SCES390E – MARCH 2002 – REVISED DECEMBER 2002

GQL PACKAGE (TOP VIEW)



terminal assignments

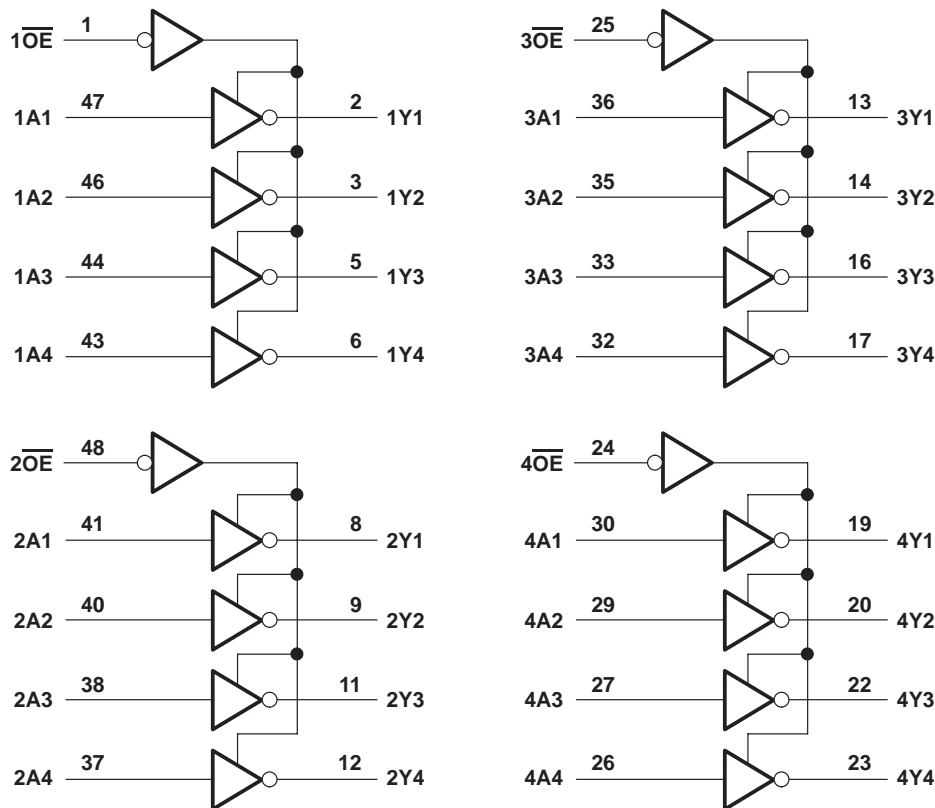
	1	2	3	4	5	6
A	$\overline{1OE}$	NC	NC	NC	NC	$\overline{2OE}$
B	1Y2	1Y1	GND	GND	1A1	1A2
C	1Y4	1Y3	V _{CC}	V _{CC}	1A3	1A4
D	2Y2	2Y1	GND	GND	2A1	2A2
E	2Y4	2Y3			2A3	2A4
F	3Y1	3Y2			3A2	3A1
G	3Y3	3Y4	GND	GND	3A4	3A3
H	4Y1	4Y2	V _{CC}	V _{CC}	4A2	4A1
J	4Y3	4Y4	GND	GND	4A4	4A3
K	$\overline{4OE}$	NC	NC	NC	NC	$\overline{3OE}$

NC – No internal connection

FUNCTION TABLE (each 4-bit buffer)

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

logic diagram (positive logic)



Pin numbers shown are for the DGG and DGV packages.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC}	-0.5 V to 3.6 V
Input voltage range, V_I (see Note 1)	-0.5 V to 3.6 V
Voltage range applied to any output in the high-impedance or power-off state, V_O (see Note 1)	-0.5 V to 3.6 V
Output voltage range, V_O (see Note 1)	-0.5 V to $V_{CC} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$)	-50 mA
Output clamp current, I_{OK} ($V_O < 0$)	-50 mA
Continuous output current, I_O	± 20 mA
Continuous current through V_{CC} or GND	± 100 mA
Package thermal impedance, θ_{JA} (see Note 2): DGG package	70°C/W
DGV package	58°C/W
GQL package	42°C/W
Storage temperature range, T_{stg}	-65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
 2. The package thermal impedance is calculated in accordance with JESD 51-7.

SN74AUC16240
16-BIT BUFFER/DRIVER
WITH 3-STATE OUTPUTS

SCES390E – MARCH 2002 – REVISED DECEMBER 2002

recommended operating conditions (see Note 3)

		MIN	MAX	UNIT
V_{CC}	Supply voltage	0.8	2.7	V
V_{IH}	High-level input voltage	$V_{CC} = 0.8\text{ V}$	V_{CC}	V
		$V_{CC} = 1.1\text{ V to }1.95\text{ V}$	$0.65 \times V_{CC}$	
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.7	
V_{IL}	Low-level input voltage	$V_{CC} = 0.8\text{ V}$	0	V
		$V_{CC} = 1.1\text{ V to }1.95\text{ V}$	$0.35 \times V_{CC}$	
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	0.7	
V_I	Input voltage	0	3.6	V
V_O	Output voltage	0	V_{CC}	V
I_{OH}	High-level output current	$V_{CC} = 0.8\text{ V}$	-0.7	mA
		$V_{CC} = 1.1\text{ V}$	-3	
		$V_{CC} = 1.4\text{ V}$	-5	
		$V_{CC} = 1.65\text{ V}$	-8	
		$V_{CC} = 2.3\text{ V}$	-9	
I_{OL}	Low-level output current	$V_{CC} = 0.8\text{ V}$	0.7	mA
		$V_{CC} = 1.1\text{ V}$	3	
		$V_{CC} = 1.4\text{ V}$	5	
		$V_{CC} = 1.65\text{ V}$	8	
		$V_{CC} = 2.3\text{ V}$	9	
$\Delta t/\Delta v$	Input transition rise or fall rate	$V_{CC} = 0.8\text{ V, }1.3\text{ V}$	20	ns/V
		$V_{CC} = 1.6\text{ V, }1.95\text{ V}$	10	
		$V_{CC} = 2.7\text{ V}$	5	
T_A	Operating free-air temperature	-40	85	°C

NOTE 3: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



SN74AUC16240
16-BIT BUFFER/DRIVER
WITH 3-STATE OUTPUTS

SCES390E – MARCH 2002 – REVISED DECEMBER 2002

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	V _{CC}	MIN	TYP†	MAX	UNIT
V _{OH}		I _{OH} = -100 μA	0.8 V to 2.7 V	V _{CC} -0.1			V
		I _{OH} = -0.7 mA	0.8 V	0.55			
		I _{OH} = -3 mA	1.1 V	0.8			
		I _{OH} = -5 mA	1.4 V	1			
		I _{OH} = -8 mA	1.65 V	1.2			
		I _{OH} = -9 mA	2.3 V	1.8			
V _{OL}		I _{OL} = 100 μA	0.8 V to 2.7 V			0.2	V
		I _{OL} = 0.7 mA	0.8 V	0.25			
		I _{OL} = 3 mA	1.1 V			0.3	
		I _{OL} = 5 mA	1.4 V			0.4	
		I _{OL} = 8 mA	1.65 V			0.45	
		I _{OL} = 9 mA	2.3 V			0.6	
I _I	A or \overline{OE} inputs	V _I = V _{CC} or GND	0 to 2.7 V			±5	μA
I _{off}		V _I or V _O = 2.7 V	0			±10	μA
I _{OZ}		V _O = V _{CC} or GND	2.7 V			±10	μA
I _{CC}		V _I = V _{CC} or GND, I _O = 0	0.8 V to 2.7 V			20	μA
C _i		V _I = V _{CC} or GND	2.5 V	3		4	pF
C _o		V _O = V _{CC} or GND	2.5 V	5.5		6	pF

† All typical values are at T_A = 25°C.

switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 0.8 V	V _{CC} = 1.2 V ± 0.1 V		V _{CC} = 1.5 V ± 0.1 V		V _{CC} = 1.8 V ± 0.15 V			V _{CC} = 2.5 V ± 0.2 V		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	TYP	MAX	MIN	MAX	
t _{pd}	A	Y	5.9	0.9	2.6	0.7	1.8	0.6	1.4	2	0.4	1.6	ns
t _{en}	\overline{OE}	Y	7.9	1.2	3.8	0.8	2.5	0.7	1.5	2.5	0.7	2	ns
t _{dis}	\overline{OE}	Y	9.3	2.1	6	1.5	4.8	1.8	2.7	4.5	0.6	2.3	ns

operating characteristics, T_A = 25°C

PARAMETER		TEST CONDITIONS	V _{CC} = 0.8 V	V _{CC} = 1.2 V	V _{CC} = 1.5 V	V _{CC} = 1.8 V	V _{CC} = 2.5 V	UNIT
			TYP	TYP	TYP	TYP	TYP	
C _{pd}	Power dissipation capacitance	f = 10 MHz	24	24	25	26	30	pF
	Outputs enabled							
	Outputs disabled		2	2	2	3	4	



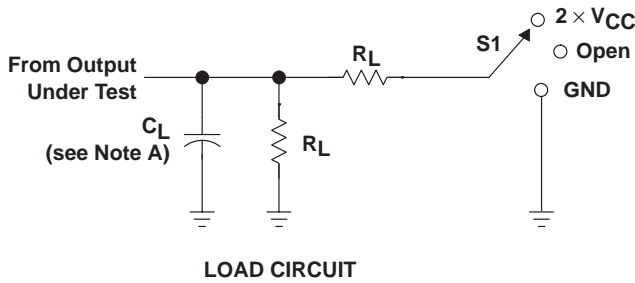
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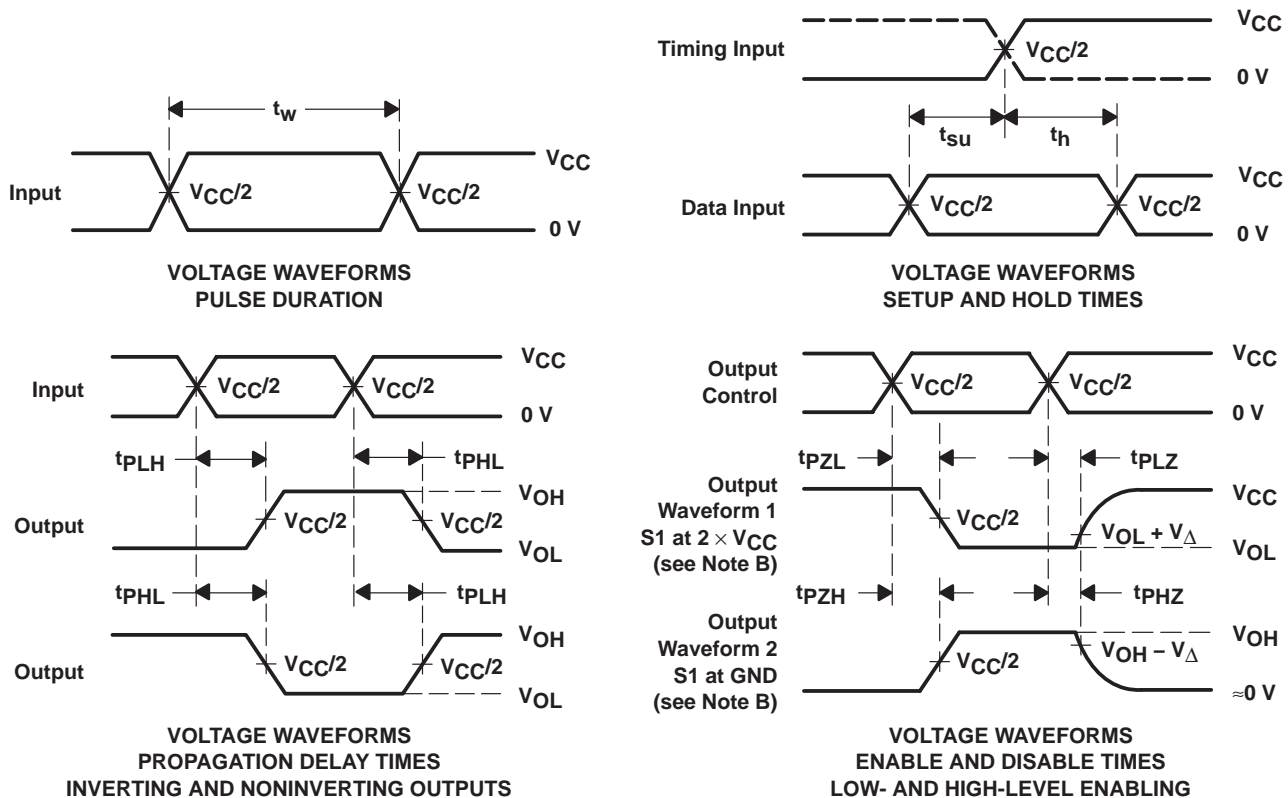
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PARAMETER MEASUREMENT INFORMATION



TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$
t_{PHZ}/t_{PZH}	GND

V_{CC}	C_L	R_L	V_{Δ}
0.8 V	15 pF	2 k Ω	0.1 V
1.2 V \pm 0.1 V	15 pF	2 k Ω	0.1 V
1.5 V \pm 0.1 V	15 pF	2 k Ω	0.1 V
1.8 V \pm 0.15 V	30 pF	1 k Ω	0.15 V
2.5 V \pm 0.2 V	30 pF	500 Ω	0.15 V



- NOTES:
- C_L includes probe and jig capacitance.
 - 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.
 - All input pulses are supplied by generators having the following characteristics: $PRR \leq 10$ MHz, $Z_O = 50 \Omega$, slew rate ≥ 1 V/ns.
 - The outputs are measured one at a time with one transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - t_{PLH} and t_{PHL} are the same as t_{pd} .
 - All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AUC16240DGGR	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AUC16240	Samples
SN74AUC16240DGVR	ACTIVE	TVSOP	DGV	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MH240	Samples

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSELETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

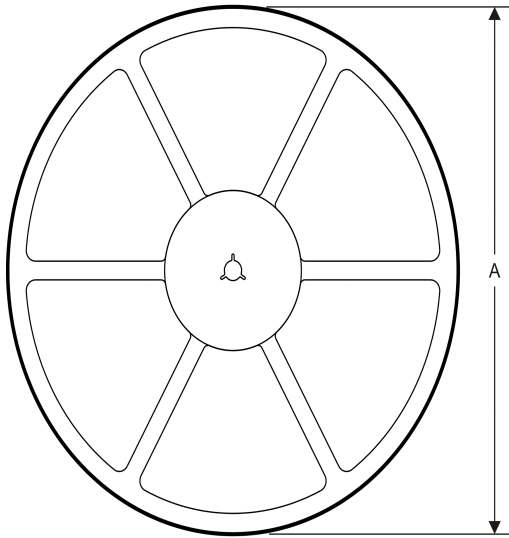
(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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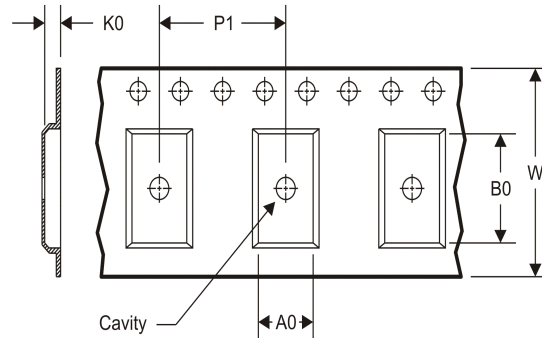
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TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

TAPE AND REEL INFORMATION

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74AUC16240DGGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	15.8	1.8	12.0	24.0	Q1
SN74AUC16240DGVR	TVSOP	DGV	48	2000	330.0	16.4	7.1	10.2	1.6	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AUC16240DGGR	TSSOP	DGG	48	2000	367.0	367.0	45.0
SN74AUC16240DGVR	TVSOP	DGV	48	2000	367.0	367.0	38.0

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
 D. Falls within JEDEC: 24/48 Pins – MO-153
 14/16/20/56 Pins – MO-194

DGG (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

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