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<u>Texas Instruments</u> <u>SN74LVC1G02MDCKREP</u>

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Datasheet of SN74LVC1G02MDCKREP - IC GATE NOR 1CH 2-INP SC-70-5

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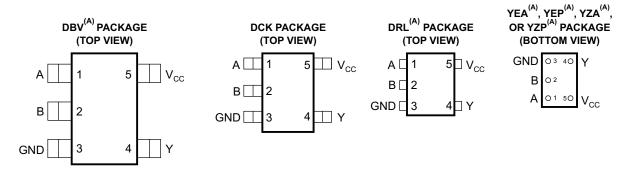
# SN74LVC1G02-EP SINGLE 2-INPUT POSITIVE-NOR GATE

SGLS370-AUGUST 2006

### **FEATURES**

- Controlled Baseline
  - One Assembly
  - One Test Site
  - One Fabrication Site
- Extended Temperature Performance of –55°C to 125°C
- Enhanced Diminishing Manufacturing Sources (DMS) Support
- Enhanced Product-Change Notification
- Qualification Pedigree (1)
- Available in the Texas Instruments
   NanoStar<sup>™</sup> and NanoFree<sup>™</sup> Packages
- (1) Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.

- Supports 5-V V<sub>CC</sub> Operation
- Inputs Accept Voltages to 5.5 V
- Max t<sub>pd</sub> of 3.6 ns at 3.3 V
- Low Power Consumption, 10-μA Max I<sub>CC</sub>
- ±24-mA Output Drive at 3.3 V
- I<sub>off</sub> Supports Partial-Power-Down Mode Operation
- 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)



See mechanical drawings for dimensions.

A. Product Preview

### **DESCRIPTION/ORDERING INFORMATION**

This single 2-input positive-NOR gate is designed for 1.65-V to 5.5-V V<sub>CC</sub> operation.

The SN74LVC1G02 performs the Boolean function  $Y = \overline{A} + \overline{B}$  or  $Y = \overline{A} \times \overline{B}$  in positive logic.

NanoStar<sup>™</sup> and NanoFree<sup>™</sup> package technology is a major breakthrough in IC packaging concepts, using the die as the package.

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



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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## SN74LVC1G02-EP SINGLE 2-INPUT POSITIVE-NOR GATE



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### **ORDERING INFORMATION**

T <sub>A</sub>	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(2)</sup>	
	NanoStar™ – WCSP (DSBGA) 0,17-mm Small Bump – YEA		SN74LVC1G02NYEAREP <sup>(3)</sup>		
Reel of 3000	SN74LVC1G02NYZAREP <sup>(3)</sup>	CB			
–55°C to 125°C	NanoStar™ – WCSP (DSBGA) 0,23-mm Large Bump – YEP	Reel of 3000	SN74LVC1G02MYEPREP <sup>(3)</sup>	0_	
00 0 10 120 0	NanoFree™ – WCSP (DSBGA) 0,23-mm Large Bump – YZP (Pb-free)		SN74LVC1G02MYZPREP <sup>(3)</sup>	CB_ _	
	SOT (SOT-23) - DBV	Reel of 3000	SN74LVC1G02MDBVREP <sup>(3)</sup>	C02_	
	SOT (SC-70) – DCK	Reel of 3000	SN74LVC1G02MDCKREP	BUF	
	SOT (SOT-553) – DRL	Reel of 4000	SN74LVC1G02MDRLREP <sup>(3)</sup>	CB_	

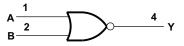
- (1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.
- DBV/DCK/DRL: The actual top-side marking has one additional character that designates the assembly/test site.
  YEA/YZA,YEP/YZP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the assembly/test site. Pin 1 identifier indicates solder-bump composition(1 = SnPb, • = Pb-free).

  (3) Product Preview

### **FUNCTION TABLE**

INP	UTS	OUTPUT
Α	В	Y
Н	Χ	L
X	Н	L
L	L	Н

### **LOGIC DIAGRAM (POSITIVE LOGIC)**





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## Absolute Maximum Ratings<sup>(1)</sup>

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

			MIN	MAX	UNIT	
$V_{CC}$	Supply voltage range		-0.5	6.5	V	
$V_{I}$	Input voltage range <sup>(2)</sup>		-0.5	6.5	V	
Vo	Voltage range applied to any output in the high-im	-0.5	6.5	V		
Vo	Voltage range applied to any output in the high or low state <sup>(2)(3)</sup>		-0.5	V <sub>CC</sub> + 0.5	V	
I <sub>IK</sub>	Input clamp current	V <sub>I</sub> < 0		-50	mA	
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> < 0		-50	mA	
Io	Continuous output current		±50	mA		
	Continuous current through V <sub>CC</sub> or GND			±100	mA	
		DBV package		206		
		DCK package		252		
$\theta_{JA}$	Package thermal impedance <sup>(4)</sup>	DRL package		142	°C/W	
		YEA/YZA package		154		
		YEP/YZP package		132		
T <sub>stg</sub>	Storage temperature range		-65	150	°C	

<sup>(1)</sup> 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.

<sup>(2)</sup> The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed

<sup>3)</sup> The value of V<sub>CC</sub> is provided in the recommended operating conditions table.

<sup>(4)</sup> The package thermal impedance is calculated in accordance with JESD 51-7.

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## SN74LVC1G02-EP SINGLE 2-INPUT POSITIVE-NOR GATE



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# Recommended Operating Conditions<sup>(1)</sup>

			MIN	MAX	UNIT
V	Cumply yellogo	Operating	1.65	5.5	V
$V_{CC}$	Supply voltage	Data retention only	1.5		V
		V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 × V <sub>CC</sub>		
\/	High-level input voltage	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.7		V
$V_{IH}$	nigh-level input voltage	V <sub>CC</sub> = 3 V to 3.6 V			V
		V <sub>CC</sub> = 4.5 V to 5.5 V	$0.7 \times V_{CC}$		
		V <sub>CC</sub> = 1.65 V to 1.95 V		$0.35 \times V_{CC}$	
\/	Low lovel input valtage	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0.7	V
$V_{IL}$	Low-level input voltage	V <sub>CC</sub> = 3 V to 3.6 V		0.8	V
		V <sub>CC</sub> = 4.5 V to 5.5 V		$0.3 \times V_{CC}$	
V <sub>I</sub>	Input voltage		0	5.5	V
Vo	Output voltage		0	$V_{CC}$	V
		V <sub>CC</sub> = 1.65 V		-4	
		V <sub>CC</sub> = 2.3 V		-8	
$I_{OH}$	High-level output current	V <sub>CC</sub> = 3 V		-16	mA
		v <sub>CC</sub> = 3 v		-8 -16 -24	
		V <sub>CC</sub> = 4.5 V		-32	
		V <sub>CC</sub> = 1.65 V		4	
		V <sub>CC</sub> = 2.3 V		8	
$I_{OL}$	Low-level output current	V 2V		16	mA
		V <sub>CC</sub> = 3 V		24	
		V <sub>CC</sub> = 4.5 V			
		$V_{CC}$ = 1.8 V ± 0.15 V, 2.5 V ± 0.2 V		20	
$\Delta t/\Delta v$	Input transition rise or fall rate	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$		10	ns/V
		$V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$		5	
T <sub>A</sub>	Operating free-air temperature		-55	125	°C

<sup>(1)</sup> All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. See the TI application report, Implications of Slow or Floating CMOS Inputs, literature number SCBA004.

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# SN74LVC1G02-EP SINGLE 2-INPUT POSITIVE-NOR GATE

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#### **Electrical Characteristics**

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	MIN TYP	O(1) MAX	UNIT
	$I_{OH} = -100 \mu A$	1.65 V to 5.5 V	V <sub>CC</sub> - 0.1		
	$I_{OH} = -4 \text{ mA}$	1.65 V	1.2		
V	$I_{OH} = -8 \text{ mA}$	2.3 V			
V <sub>OH</sub>	$I_{OH} = -16 \text{ mA}$	3 V	2.4		V
	$I_{OH} = -24 \text{ mA}$		2.3		
	$I_{OH} = -32 \text{ mA}$	4.5 V	3.8		1
	$I_{OL} = 100 \mu A$	1.65 V to 5.5 V		0.1	
	$I_{OL} = 4 \text{ mA}$	1.65 V		0.45	
M	$I_{OL} = 8 \text{ mA}$	2.3 V		0.3	V
V <sub>OL</sub>	$I_{OL} = 16 \text{ mA}$	3 V		0.4	V
	$I_{OL} = 24 \text{ mA}$			0.55	
	$I_{OL} = 32 \text{ mA}$	4.5 V		0.6	
I <sub>I</sub> A or B inputs	$V_I = 5.5 \text{ V or GND}$	0 to 5.5 V		±5	μΑ
I <sub>off</sub>	$V_I$ or $V_O = 5.5 \text{ V}$		±10	μΑ	
I <sub>cc</sub>	$V_I = 5.5 \text{ V or GND}, I_O = 0$	1.65 V to 5.5 V		10	μΑ
$\Delta I_{CC}$	One input at $V_{CC}$ – 0.6 V, Other inputs at $V_{CC}$ or GND	3 V to 5.5 V		500	μΑ
C <sub>i</sub>	$V_1 = V_{CC}$ or GND 3.3 V 4			4	pF

<sup>(1)</sup> All typical values are at  $V_{CC}$  3.3 V,  $T_A$  = 25°C.

### **Switching Characteristics**

over recommended operating free-air temperature range,  $C_L = 30 \text{ pF}$  or 50 pF (unless otherwise noted) (see Figure 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = ± 0.1		V <sub>CC</sub> = ± 0.2		V <sub>CC</sub> = ± 0.3		V <sub>CC</sub> =		UNIT
	(INFOT)	(001F01)	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	A or B	Υ	2.8	10.7	1.2	7.3	1	6	1	5	ns

### **Operating Characteristics**

 $T_A = 25^{\circ}C$ 

	PARAMETER	TEST CONDITIONS	V <sub>CC</sub> = 1.8 V	V <sub>CC</sub> = 2.5 V	V <sub>CC</sub> = 3.3 V	V <sub>CC</sub> = 5 V	UNIT
	PARAMETER	TEST CONDITIONS	TYP	TYP	TYP	TYP	UNII
$C_{pd}$	Power dissipation capacitance	f = 10 MHz	23	23	23	25	pF

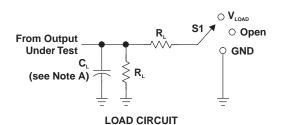
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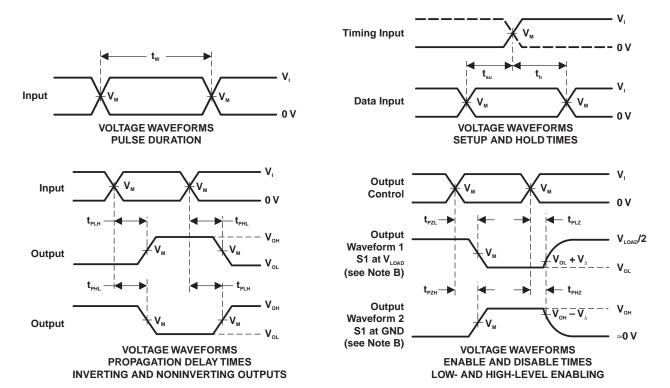
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#### PARAMETER MEASUREMENT INFORMATION



TEST	S1
t <sub>PLH</sub> /t <sub>PHL</sub>	Open
t <sub>PLZ</sub> /t <sub>PZL</sub>	V <sub>LOAD</sub>
t <sub>PHZ</sub> /t <sub>PZH</sub>	GND

V <sub>cc</sub>	INI	PUTS		V		1	.,
	V,	t,/t,	V <sub>M</sub>	V <sub>LOAD</sub>	C <sup>∟</sup>	$R_{\scriptscriptstyle L}$	V <sub>Δ</sub>
$\textbf{1.8 V} \pm \textbf{0.15 V}$	V <sub>cc</sub>	≤2 ns	V <sub>cc</sub> /2	2 × V <sub>cc</sub>	15 pF	<b>1 M</b> Ω	0.15 V
$\textbf{2.5 V} \pm \textbf{0.2 V}$	$V_{cc}$	≤2 ns	V <sub>cc</sub> /2	2 × V <sub>cc</sub>	15 pF	<b>1 M</b> Ω	0.15 V
3.3 V $\pm$ 0.3 V	3 V	≤2.5 ns	1.5 V	6 V	15 pF	<b>1 M</b> Ω	0.3 V
5 V $\pm$ 0.5 V	$V_{cc}$	≤2.5 ns	V <sub>cc</sub> /2	2 × V <sub>cc</sub>	15 pF	1 M $\Omega$	0.3 V



NOTES: A. C<sub>L</sub> includes probe and jig capacitance.

- B. 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.
- C. All input pulses are supplied by generators have the following characteristics: PRR  $\leq$  10 MHz,  $Z_0 = 50 \Omega$ .
- D. The outputs are measured one at a time, with one transition per measurement.
- E.  $t_{\mbox{\tiny PLZ}}$  and  $t_{\mbox{\tiny PHZ}}$  are the same as  $t_{\mbox{\tiny dis}}.$
- F.  $t_{\mbox{\tiny PZL}}$  and  $t_{\mbox{\tiny PZH}}$  are the same as  $t_{\mbox{\tiny en}}.$
- G.  $t_{\mbox{\tiny PLH}}$  and  $t_{\mbox{\tiny PHL}}$  are the same as  $t_{\mbox{\tiny pd}}.$
- H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

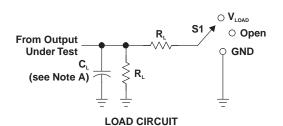




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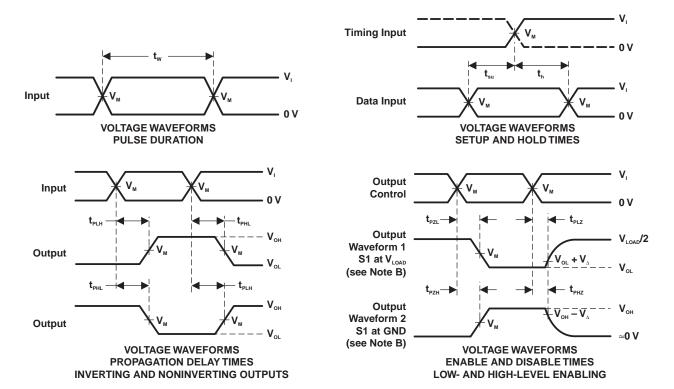
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### PARAMETER MEASUREMENT INFORMATION (continued)



TEST	S1
t <sub>PLH</sub> /t <sub>PHL</sub>	Open
t <sub>PLZ</sub> /t <sub>PZL</sub>	V <sub>LOAD</sub>
t <sub>PHZ</sub> /t <sub>PZH</sub>	GND

V	INI	PUTS		V		Б	V
V <sub>cc</sub>	V,	t,/t,	V <sub>M</sub>	V <sub>LOAD</sub>	C <sub>r</sub>	R <sub>L</sub>	V <sub>Δ</sub>
1.8 V $\pm$ 0.15 V	V <sub>cc</sub>	≤2 ns	V <sub>cc</sub> /2	2 × V <sub>cc</sub>	30 pF	<b>1 k</b> Ω	0.15 V
$\textbf{2.5 V} \pm \textbf{0.2 V}$	V <sub>cc</sub>	≤2 ns	V <sub>cc</sub> /2	2 × V <sub>cc</sub>	30 pF	<b>500</b> Ω	0.15 V
3.3 V $\pm$ 0.3 V	3 V	≤2.5 ns	1.5 V	6 V	50 pF	<b>500</b> Ω	0.3 V
5 V $\pm$ 0.5 V	V <sub>cc</sub>	≤2.5 ns	V <sub>cc</sub> /2	2 × V <sub>cc</sub>	50 pF	<b>500</b> Ω	0.3 V



NOTES: A. C<sub>L</sub> includes probe and jig capacitance.

- B. 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.
- C. All input pulses are supplied by generators have the following characteristics: PRR  $\leq$  10 MHz,  $Z_o$  = 50  $\Omega$ . D. The outputs are measured one at a time, with one transition per measurement.
- E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
- F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
- G.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
- H. All parameters and waveforms are not applicable to all devices.

Figure 2. Load Circuit and Voltage Waveforms



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PACKAGE OPTION ADDENDUM

24-Jun-2014

#### PACKAGING INFORMATION

Orderable Device	Status	Package Type	Package Drawing	Pins	•		Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Device Marking	Samples
	(1)		Drawing		Qty	(2)	(6)	(3)		(4/5)	
SN74LVC1G02MDCKREP	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	BUF	Samples
V62/06631-01XE	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	BUF	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.

OBSOLETE: 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): Tl'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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Addendum-Page 1



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PACKAGE OPTION ADDENDUM

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN74LVC1G02-EP:

Catalog: SN74LVC1G02

NOTE: Qualified Version Definitions:

Catalog - TI's standard catalog product

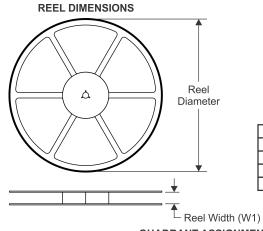
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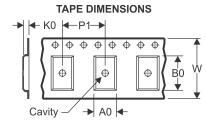


### PACKAGE MATERIALS INFORMATION

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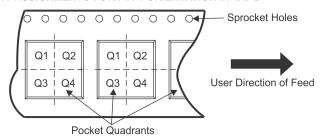
#### TAPE AND REEL INFORMATION





	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

### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



#### \*All dimensions are nominal

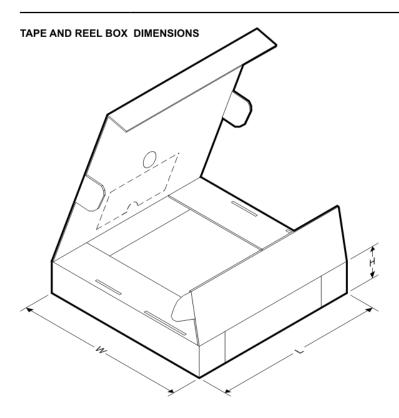
Device	Package Type	Package Drawing			Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LVC1G02MDCKREP	SC70	DCK	5	3000	180.0	8.4	2.41	2.41	1.2	4.0	8.0	Q3

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## **PACKAGE MATERIALS INFORMATION**

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### \*All dimensions are nominal

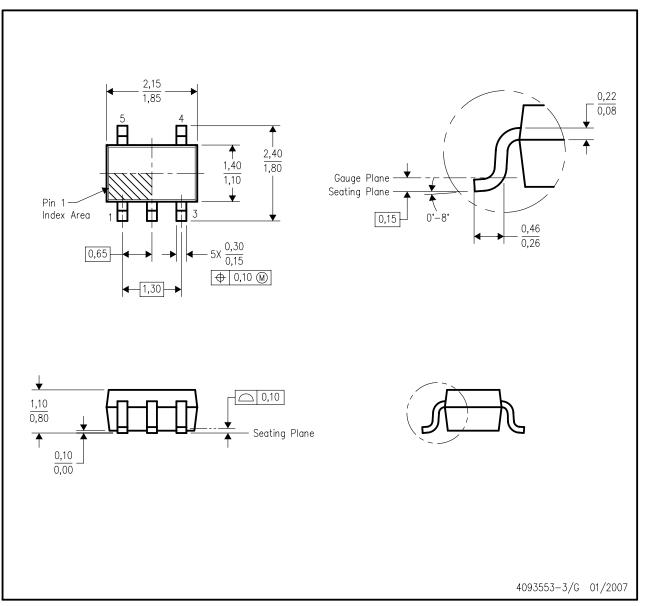
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVC1G02MDCKREP	SC70	DCK	5	3000	202.0	201.0	28.0



### **MECHANICAL DATA**

# DCK (R-PDSO-G5)

### PLASTIC SMALL-OUTLINE PACKAGE



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. Mold flash and protrusion shall not exceed 0.15 per side.
- D. Falls within JEDEC MO-203 variation AA.

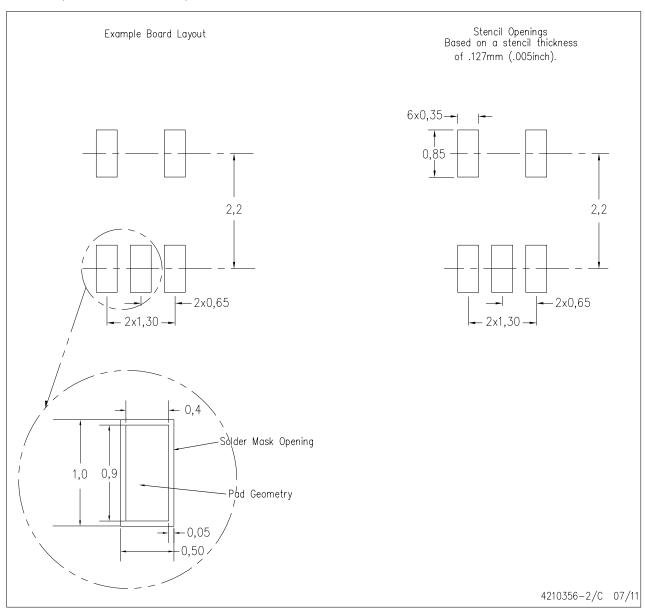




### **LAND PATTERN DATA**

# DCK (R-PDSO-G5)

## PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
- D. Publication IPC-7351 is recommended for alternate designs.
- E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.





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