

Dual Schmitt-Trigger Inverter

Check for Samples: SN74LVC2G14

FEATURES

- Available in the Texas Instruments NanoFree™ **Package**
- Supports 5-V V_{CC} Operation
- Inputs Accept Voltages to 5.5 V
- Max t_{pd} of 5.4 ns at 3.3 V
- Low Power Consumption, 10-µA Max I_{CC}
- ±24-mA Output Drive at 3.3 V
- Typical V_{OLP} (Output Ground Bounce) $<0.8 \text{ V at V}_{CC} = 3.3 \text{ V}, T_A = 25^{\circ}\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot) >2 V at V_{CC} = 3.3 V, T_A = 25°C
- I_{off} Supports Live Insertion, Partial Power Down Mode, and Back Drive Protection
- Support Translation Down (5V to 3.3V; 3.3V to 1.8V)
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- **ESD Protection Exceeds JESD 22**
 - 2000-V Human-Body Model (A114-A)
 - 1000-V Charged-Device Model (C101)

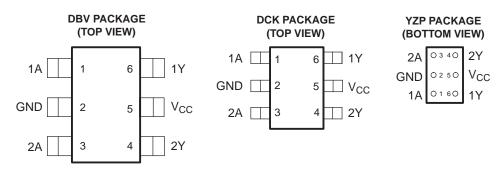
DESCRIPTION

This dual Schmitt-trigger inverter is designed for 1.65-V to 5.5-V V_{CC} operation.

NanoFree™ package technology is a major breakthrough in IC packaging concepts, using the die as the package.

The SN74LVC2G14 contains two inverters and performs the Boolean function $Y = \overline{A}$. The device functions as two independent inverters, but because of Schmitt action, it may have different input threshold levels for positive-going (V_{T+}) and negative-going $(V_{T_{-}})$ signals.

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.



See mechanical drawings for dimensions.

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. NanoFree is a trademark of Texas Instruments.



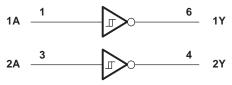


These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Function Table (Each Inverter)

INPUT A	OUTPUT Y
Н	L
L	Н

Logic Diagram (Positive Logic)



Absolute Maximum Ratings⁽¹⁾

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

			MIN	MAX	UNIT
V _{CC}	Supply voltage range		-0.5	6.5	V
VI	Input voltage range ⁽²⁾		-0.5	6.5	V
Vo	Voltage range applied to any output in t	he high-impedance or power-off state (2)	-0.5	6.5	V
Vo	Voltage range applied to any output in t	he high or low state ⁽²⁾ (3)	-0.5	V _{CC} + 0.5	V
I _{IK}	Input clamp current	V _I < 0		-50	mA
I _{OK}	Output clamp current	V _O < 0		–50	
lo	Continuous output current			±50	mA
	Continuous current through V _{CC} or GNI)		±100	mA
		DBV package		165	
θ_{JA}	Package thermal impedance (4)	DCK package		259	°C/W
		YZP package		123	•
T _{stg}	Storage temperature range		-65	150	°C

- (1) 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.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (3) The value of V_{CC} is provided in the recommended operating conditions table.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

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Recommended Operating Conditions⁽¹⁾

			MIN	MAX	UNIT	
\/	Cupality voltage	Operating	1.65	5.5	W	
V_{CC}	Supply voltage	Data retention only	1.5		V	
V_{I}	Input voltage	·	0	5.5	V	
Vo	Output voltage		0	V_{CC}	V	
		V _{CC} = 1.65 V		-4		
I _{OH}	$V_{CC} = 2.3 \text{ V}$ High-level output current	V _{CC} = 2.3 V		-8		
		V 2V		-16	mA	
	$V_{CC} = 3 V$			-24		
		V _{CC} = 4.5 V		-32		
		V _{CC} = 1.65 V		4		
		V _{CC} = 2.3 V		8		
I_{OL}	Low-level output current	V 2V		16	mA	
		$V_{CC} = 3 V$		24	İ	
		V _{CC} = 4.5 V				
T _A	Operating free-air temperature		-40	125	°C	

⁽¹⁾ 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.

Product Folder Links: SN74LVC2G14



Electrical Characteristics

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

DADAMETED	TEST CONDITIONS	V	-40°0	C to 85°C	-40°C	to 125°C	UNIT		
PARAMETER	TEST CONDITIONS	V _{cc}	MIN	TYP ⁽¹⁾ MAX	MIN	TYP ⁽¹⁾ MAX	UNII		
		1.65 V	0.7	1.4	0.7	1.4			
V _{T+}		2.3 V	1	1.7	1	1.7			
Positive-going input		3 V	1.3	2.2	1.3	2.2	V		
threshold voltage		4.5 V	1.9	3.1	1.9	3.1			
		5.5 V	2.2	3.7	2.2	3.7			
		1.65 V	0.3	0.7	0.3	0.7			
V _{T-}		2.3 V	0.4	1	0.4	1			
Negative-going input threshold		3 V	0.6	1.3	0.6	1.3	V		
voltage		4.5 V	1.1	2	1.1	2			
		5.5 V	1.4	2.5	1.4	2.5			
		1.65 V	0.3	0.8	0.3	0.8			
ΔV_{T}		2.3 V	0.4	0.9	0.4	0.9			
Hysteresis		3 V	0.4	1.1	0.4	1.1	V		
$(V_{T+} - V_{T-})$		4.5 V	0.6	1.3	0.6	1.3			
		5.5 V	0.7	1.4	0.7	1.4			
	I _{OH} = -100 μA	1.65 V to 4.5 V	V _{CC} - 0.1		V _{CC} - 0.1				
	$I_{OH} = -4 \text{ mA}$	1.65 V	1.2		1.2				
V _{OH}	I _{OH} = -8 mA	2.3 V	1.9		1.9		V		
	I _{OH} = -16 mA	3 V	2.4		2.4				
	I _{OH} = -24 mA	3 V	2.3		2.3				
	I _{OH} = -32 mA	4.5 V	3.8		3.8				
	Ι _{ΟL} = 100 μΑ	1.65 V to 4.5 V		0.1		0.1			
	I _{OL} = 4 mA	1.65 V		0.45		0.45			
V _{OL}	I _{OL} = 8 mA	2.3 V		0.3		0.3	V		
01	I _{OL} = 16 mA	3 V		0.4		0.4			
	I _{OL} = 24 mA	3 V		0.55		0.55			
	I _{OL} = 32 mA	4.5 V		0.55		0.55			
I _I A input	V _I = 5.5 V or GND	0 to 5.5 V		±5		±5	μA		
I _{off}	V_I or $V_O = 5.5 \text{ V}$	0		±10		±10	μA		
Icc	$V_I = 5.5 \text{ V or GND}, \qquad I_O = 0$	1.65 V to 5.5 V		10		10	μA		
Δl _{CC}	One input at V_{CC} – 0.6 Other inputs at V_{CC} or V , V_{CC} Other inputs at V_{CC} Or V	3 V to 5.5 V		500		500	μA		
Cı	V _I = V _{CC} or GND	3.3 V		4			pF		

Product Folder Links: SN74LVC2G14

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



Switching Characteristics

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

						SN74LV -40°C t					
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 1.8 V ± 0.15 V		V _{CC} = 2.5 V ± 0.2 V		V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	1
t _{pd}	Α	Υ	3.9	9.5	1.9	5.7	2	5.4	1.5	4.3	ns

Switching Characteristics

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

			SN74LVC2G14 -40°C to 125°C								
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 1.8 V ± 0.15 V		V _{CC} = 2.5 V ± 0.2 V		V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t _{pd}	Α	Y	3.9	10.5	1.9	6.5	2	6.0	1.5	4.7	ns

Operating Characteristics

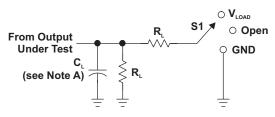
 $T_A = 25$ °C

PARAMETER		TEST CONDITIONS	V _{CC} = 1.8 V TYP	V _{CC} = 2.5 V TYP	V _{CC} = 3.3 V TYP	V _{CC} = 5 V TYP	UNIT
C_{pd}	Power dissipation capacitance	f = 10 MHz	16	17	18	21	pF

Product Folder Links: SN74LVC2G14



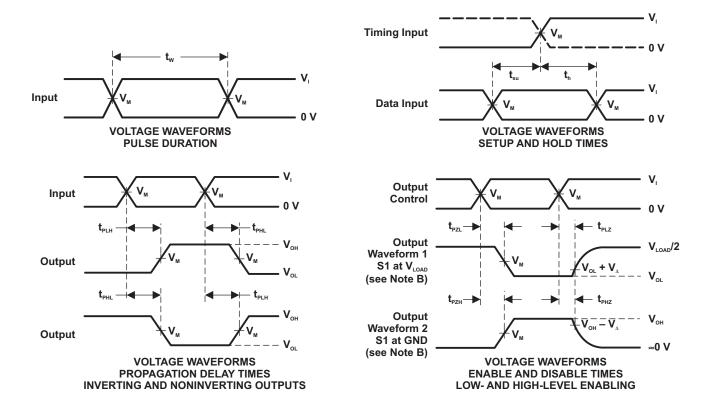
Parameter Measurement Information



TEST	S1
t _{PLH} /t _{PHL}	Open
t _{PLZ} /t _{PZL}	V _{LOAD}
t _{PHZ} /t _{PZH}	GND

п	0	Δ	n	CI	R	CI	П	IT
-	·	М	u	V.	\mathbf{r}	u	•	

V	INI	PUTS	V	V			\ \ \
V _{cc}	V,	t,/t,	V _M	V _{LOAD}	C _L	R _∟	V _A
1.8 V ± 0.15 V	V _{cc}	≤2 ns	V _{cc} /2	2 × V _{cc}	30 pF	1 k Ω	0.15 V
2.5 V ± 0.2 V	V_{cc}	≤2 ns	V _{cc} /2	2 × V _{cc}	30 pF	500 Ω	0.15 V
3.3 V ± 0.3 V	3 V	≤2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V
5 V ± 0.5 V	V_{cc}	≤2.5 ns	V _{cc} /2	2 × V _{cc}	50 pF	500 Ω	0.3 V



NOTES: A. C_L 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 having the following characteristics: PRR \leq 10 MHz, Z_o = 50 Ω .
- D. The outputs are measured one at a time, with one transition per measurement.
- E. $t_{\mbox{\tiny PLZ}}$ and $\dot{t}_{\mbox{\tiny PHZ}}$ 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_{PLH} and t_{PHL} are the same as t_{pd} .
- H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

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REVISION HISTORY

CI	hanges from Revision L (January 2007) to Revision M	Page
•	Updated document to new TI data sheet format.	1
•	Added ESD warning.	2
•	Updated operating temperature range.	3

Product Folder Links: SN74LVC2G14





10-Jun-2014

PACKAGING INFORMATION

Orderable Device	Status	Package Type		Pins	Package	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Device Marking	Samples
	(1)		Drawing		Qty	(2)	(6)	(3)		(4/5)	
SN74LVC2G14DBVR	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(C142 ~ C145 ~ C14F ~ C14K ~ C14R)	Samples
SN74LVC2G14DBVRE4	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(C142 ~ C145 ~ C14F ~ C14K ~ C14R)	Samples
SN74LVC2G14DBVRG4	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(C142 ~ C145 ~ C14F ~ C14K ~ C14R)	Samples
SN74LVC2G14DBVT	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(C142 ~ C145 ~ C14F ~ C14K ~ C14R)	Samples
SN74LVC2G14DBVTG4	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(C142 ~ C145 ~ C14F ~ C14K ~ C14R)	Samples
SN74LVC2G14DCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(CF5 ~ CFF ~ CFK ~ CFR)	Samples
SN74LVC2G14DCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(CF5 ~ CFF ~ CFK ~ CFR)	Samples
SN74LVC2G14DCKRG4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(CF5 ~ CFF ~ CFK ~ CFR)	Samples
SN74LVC2G14DCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(CF5 ~ CFF ~ CFK ~ CFR)	Samples
SN74LVC2G14DCKTG4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(CF5 ~ CFF ~ CFK ~ CFR)	Samples
SN74LVC2G14YZPR	ACTIVE	DSBGA	YZP	6	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	(CF7 ~ CFN)	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.



PACKAGE OPTION ADDENDUM

10-Jun-2014

(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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OTHER QUALIFIED VERSIONS OF SN74LVC2G14:

Automotive: SN74LVC2G14-Q1

NOTE: Qualified Version Definitions:

Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

PACKAGE MATERIALS INFORMATION

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TAPE AND REEL INFORMATION





Α0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
	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 Device	Package Type	Package Drawing		SPQ	Reel Diameter	Reel Width	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
					(mm)	W1 (mm)						
SN74LVC2G14DBVR	SOT-23	DBV	6	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
SN74LVC2G14DCKR	SC70	DCK	6	3000	178.0	9.0	2.4	2.5	1.2	4.0	8.0	Q3
SN74LVC2G14YZPR	DSBGA	YZP	6	3000	178.0	9.2	1.02	1.52	0.63	4.0	8.0	Q1

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*All dimensions are nominal

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Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)	
SN74LVC2G14DBVR	SOT-23	DBV	6	3000	180.0	180.0	18.0	
SN74LVC2G14DCKR	SC70	DCK	6	3000	180.0	180.0	18.0	
SN74LVC2G14YZPR	DSBGA	YZP	6	3000	220.0	220.0	35.0	

DBV (R-PDSO-G6)

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. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
- Falls within JEDEC MO-178 Variation AB, except minimum lead width.



DBV (R-PDSO-G6)

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.



DCK (R-PDSO-G6)

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 AB.



DCK (R-PDSO-G6)

PLASTIC SMALL OUTLINE



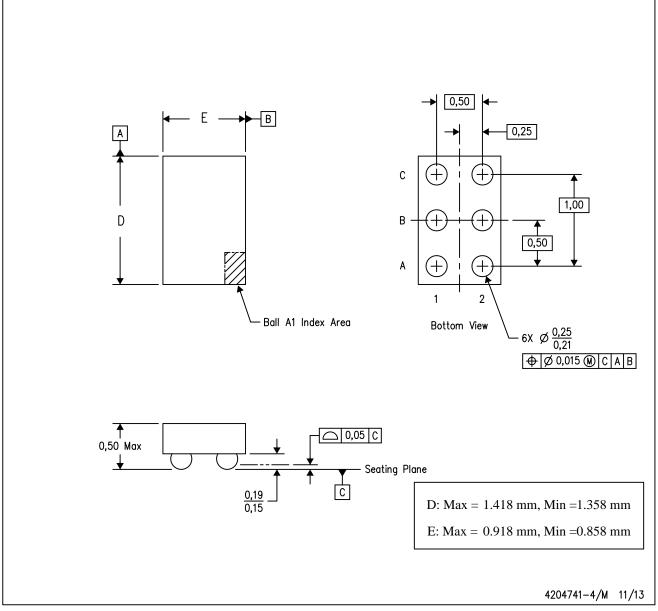
NOTES:

- 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.



YZP (R-XBGA-N6)

DIE-SIZE BALL GRID ARRAY



NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.

- B. This drawing is subject to change without notice.
- C. NanoFree \mathbf{M} package configuration.

NanoFree is a trademark of Texas Instruments.



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Products Applications

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