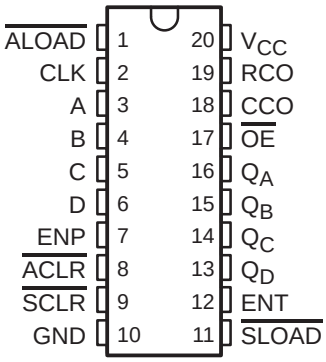
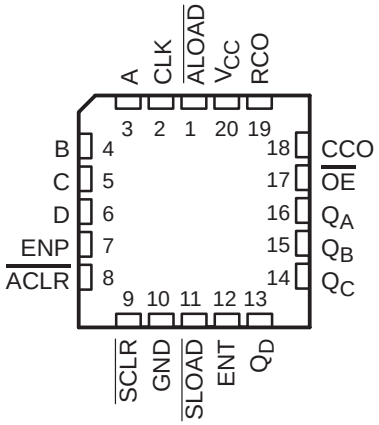
- **Carry Output for n-Bit Cascading**
- **Buffer-Type Outputs Drive Bus Lines Directly**
- **Choice of Asynchronous or Synchronous Clearing and Loading**
- **Internal Look-Ahead Circuitry for Fast Cascading**
- **Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs**

SN54ALS561A . . . J PACKAGE
SN74ALS561A . . . DW OR N PACKAGE
(TOP VIEW)



SN54ALS561A . . . FK PACKAGE
(TOP VIEW)



description

These binary counters are programmable and offer synchronous and asynchronous clearing as well as synchronous and asynchronous loading. All synchronous functions are executed on the positive-going edge of the clock.

The clear function is initiated by applying a low level to either asynchronous clear ($\overline{\text{ACLR}}$) or synchronous clear ($\overline{\text{SCLR}}$). $\overline{\text{ACLR}}$ (direct clear) overrides all other functions of the device, while $\overline{\text{SCLR}}$ overrides only the other synchronous functions. Data is loaded from the A, B, C, and D inputs by applying a low level to asynchronous load ($\overline{\text{ALOAD}}$) or by the combination of a low level at synchronous load ($\overline{\text{SLOAD}}$) and a positive-going clock transition. The counting function is enabled only when enable P (ENP), enable T (ENT), $\overline{\text{ACLR}}$, $\overline{\text{ALOAD}}$, $\overline{\text{SCLR}}$, and $\overline{\text{SLOAD}}$ are all high.

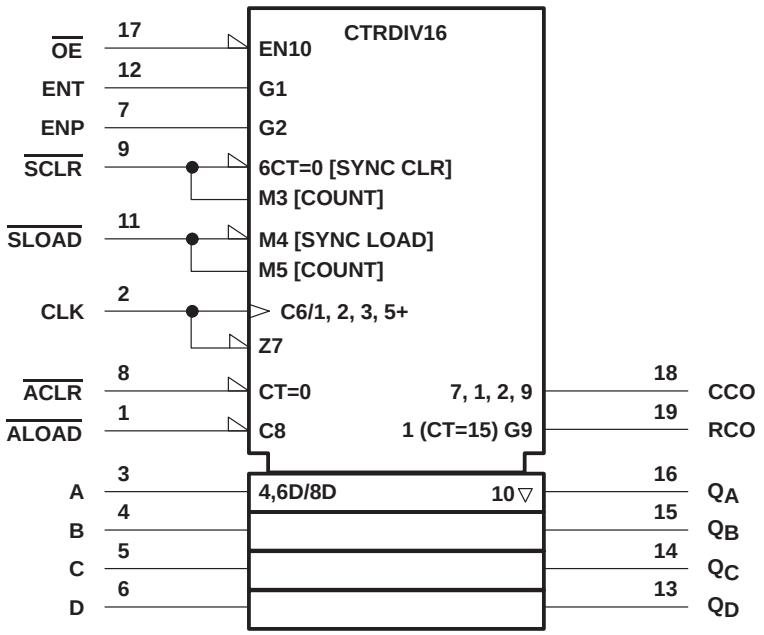
A high level at the output-enable ($\overline{\text{OE}}$) input forces the Q outputs into the high-impedance state, and a low level enables those outputs. Counting is independent of $\overline{\text{OE}}$. ENT is fed forward to enable the ripple-carry output (RCO) to produce a high-level pulse while the count is maximum (15). The clocked carry output (CCO) produces a high-level pulse for a duration equal to that of the low level of the clock when RCO is high and the counter is enabled (ENP and ENT are high); otherwise, CCO is low. CCO does not have the glitches commonly associated with a ripple-carry output. Cascading is normally accomplished by connecting RCO or CCO of the first counter to ENT of the next counter. However, for very high-speed counting, RCO should be used for cascading because CCO does not become active until the clock returns to the low level.

The SN54ALS561A is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74ALS561A is characterized for operation from 0°C to 70°C.

FUNCTION TABLE

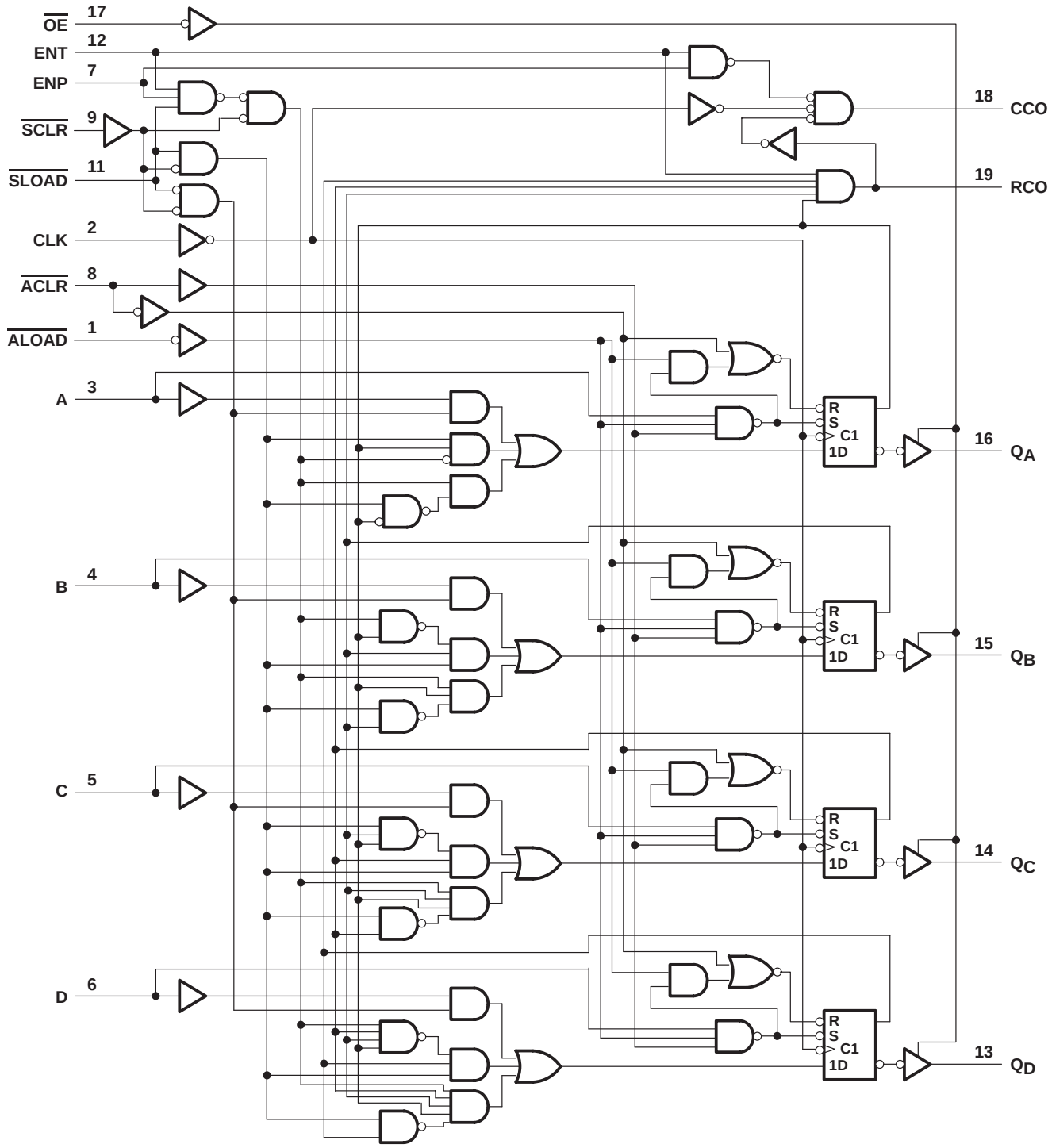
INPUTS								OPERATION
$\overline{OE}$	$\overline{ACLR}$	$\overline{ALOAD}$	$\overline{SCLR}$	$\overline{SLOAD}$	ENT	ENP	CLK	
H	X	X	X	X	X	X	X	Q outputs disabled
L	L	X	X	X	X	X	X	Asynchronous clear
L	H	L	X	X	X	X	X	Asynchronous load
L	H	H	L	X	X	X	↑	Synchronous clear
L	H	H	H	L	X	X	↑	Synchronous load
L	H	H	H	H	H	H	↑	Count
L	H	H	H	H	L	X	X	Inhibit counting
L	H	H	H	H	X	L	X	Inhibit counting

logic symbol†

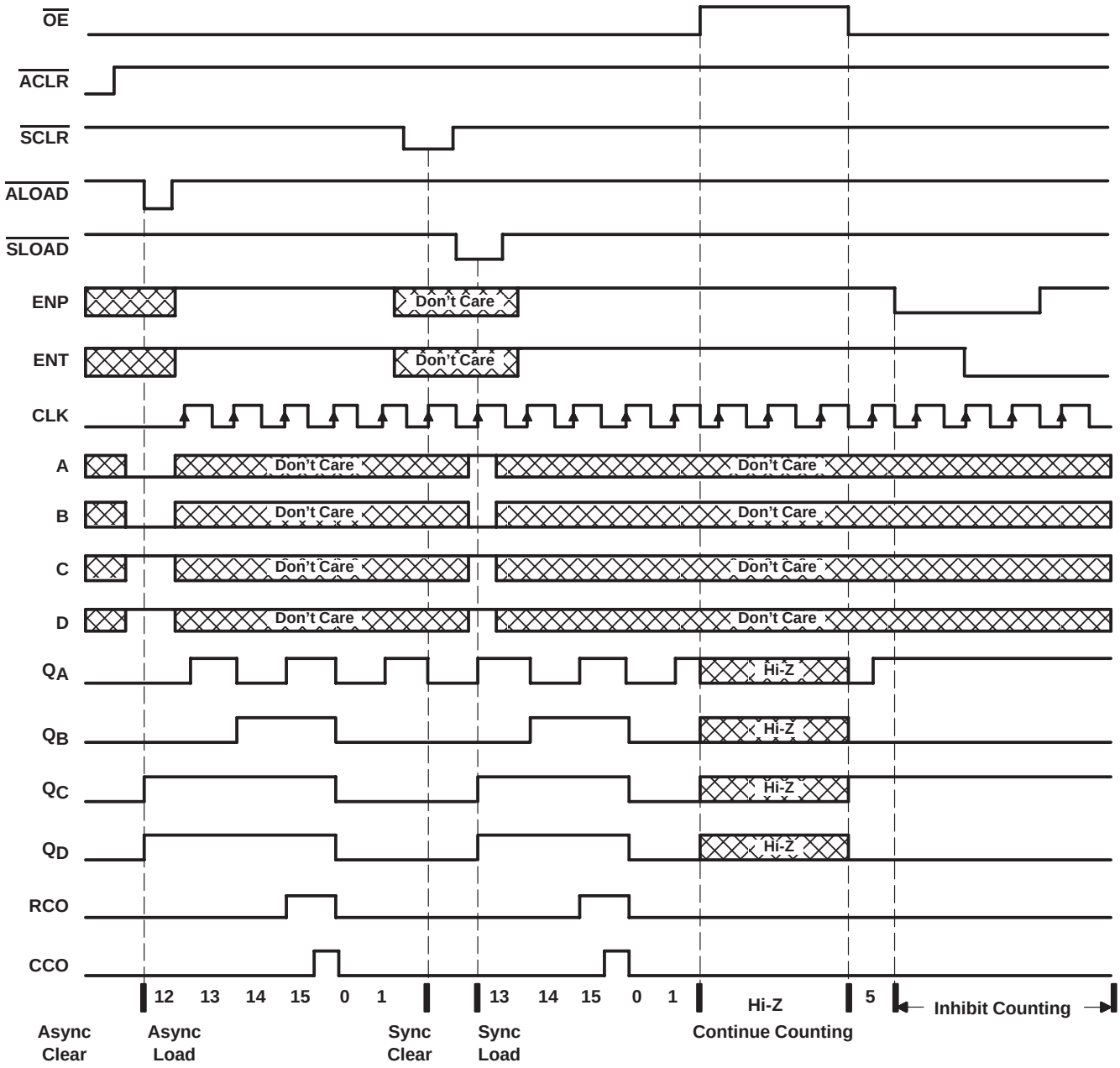


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



typical load, count, and inhibit sequences



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

Supply voltage, V_{CC} . . . . . 7 V
Input voltage, V_I . . . . . 7 V
Operating free-air temperature range, T_A: SN54ALS561A . . . . . –55°C to 125°C
SN74ALS561A . . . . . 0°C to 70°C
Storage temperature range . . . . . –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.

recommended operating conditions

				SN54ALS561A			SN74ALS561A			UNIT
				MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage			4.5	5	5.5	4.5	5	5.5	V
V_{IH}	High-level input voltage			2			2			V
V_{IL}	Low-level input voltage					0.7			0.8	V
I_{OH}	High-level output current	Q outputs				–1			–2.6	mA
		CCO and RCO				–0.4			–0.4	
I_{OL}	Low-level output current	Q outputs				12			24	mA
		CCO and RCO				4			8	
f_{clock}	Clock frequency			0		20	0		30	MHz
t_w	Pulse duration	$\overline{ACLR}$ or $\overline{ALOAD}$ low		20			15			ns
		CLK high		20			16.5			
		CLK low		25			16.5			
t_{su}	Setup time before CLK↑	ENP, ENT	High	25			20			ns
			Low	25			20			
		Data at A, B, C, D		25			20			
		$\overline{SCLR}$	Low	21			15			
			High (inactive)	35			30			
		$\overline{SLOAD}$	Low	20			15			
			High (inactive)	35			30			
		$\overline{ACLR}$ or $\overline{ALOAD}$ inactive		12			10			
t_h	Hold time after CLK↑ for data, ENP, ENT, $\overline{SCLR}$, or $\overline{SLOAD}$			0			0			ns
T_A	Operating free-air temperature			–55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS		SN54ALS561A			SN74ALS561A			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}		V_{CC} = 4.5 V,	I_I = –18 mA			–1.5			–1.5	V
V_{OH}	All outputs	V_{CC} = 4.5 V to 5.5 V,	I_{OH} = –0.4 mA	V_{CC} –2			V_{CC} –2			V
	Q outputs	V_{CC} = 4.5 V	I_{OH} = –1 mA	2.4	3.3					
			I_{OH} = –2.6 mA				2.4	3.2		
V_{OL}	Q outputs	V_{CC} = 4.5 V	I_{OL} = 12 mA		0.25	0.4		0.25	0.4	V
			I_{OL} = 24 mA					0.35	0.5	
	CCO and RCO	V_{CC} = 4.5 V	I_{OL} = 4 mA		0.25	0.4		0.25	0.4	
			I_{OL} = 8 mA					0.35	0.5	
I_{OZH}		V_{CC} = 5.5 V,	V_O = 2.7 V			20			20	µA
I_{OZL}		V_{CC} = 5.5 V,	V_O = 0.4 V			–20			–20	µA
I_I	ENP and ENT	V_{CC} = 5.5 V,	V_I = 7 V			0.2			0.2	mA
	Other inputs					0.1			0.1	
I_{IH}	ENP and ENT	V_{CC} = 5.5 V,	V_I = 2.7 V			40			40	µA
	Other inputs					20			20	
I_{IL}		V_{CC} = 5.5 V,	V_I = 0.4 V			–0.2			–0.2	mA
I_O‡	CCO and RCO	V_{CC} = 5.5 V,	V_O = 2.25 V	–15		–70	–15		–70	mA
	Q			–20		–112	–30		–112	
I_{CC}		V_{CC} = 5.5 V	Outputs high		17	27		17	27	mA
			Outputs low		21	33		21	33	
			Outputs disabled		22	36		22	36	

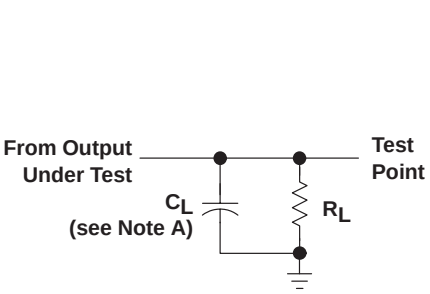
† All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS}.

switching characteristics (see Figure 1)

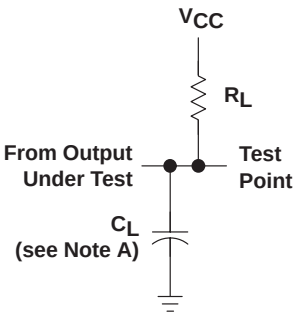
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 4.5 V to 5.5 V, C_L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T_A = MIN to MAX†				UNIT
			SN54ALS561A		SN74ALS561A		
			MIN	MAX	MIN	MAX	
f_{max}			20		30		MHz
t_{PLH}	CLK	Any Q	4	15	4	12	ns
t_{PHL}			5	21	5	18	
t_{PLH}	CLK	RCO	9	35	9	29	ns
t_{PHL}			8	29	8	24	
t_{PLH}	CLK	CCO	8	35	8	26	ns
t_{PHL}			5	20	5	16	
t_{PLH}	$\overline{\text{ALOAD}}$	Any Q	10	38	10	35	ns
t_{PHL}			7	27	7	23	
t_{PLH}	$\overline{\text{ALOAD}}$	RCO	15	50	15	40	ns
t_{PHL}			12	35	12	30	
t_{PLH}	$\overline{\text{ALOAD}}$	CCO	25	65	25	55	ns
t_{PHL}			12	42	12	33	
t_{PLH}	A, B, C, or D	Any Q	8	35	8	30	ns
t_{PHL}			7	27	7	22	
t_{PLH}	ENT	RCO	5	20	5	16	ns
t_{PHL}			4	18	4	14	
t_{PLH}	ENT	CCO	12	35	12	32	ns
t_{PHL}			4	15	4	12	
t_{PLH}	ENP	CCO	5	22	5	18	ns
t_{PHL}			4	14	4	12	
t_{PHL}	$\overline{\text{ACLR}}$	Any Q	7	28	7	22	ns
t_{PZH}	$\overline{\text{OE}}$	Any Q	5	24	5	19	ns
t_{PZL}			8	28	8	23	
t_{PHZ}	$\overline{\text{OE}}$	Any Q	2	12	2	10	ns
t_{PLZ}			2	20	4	15	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

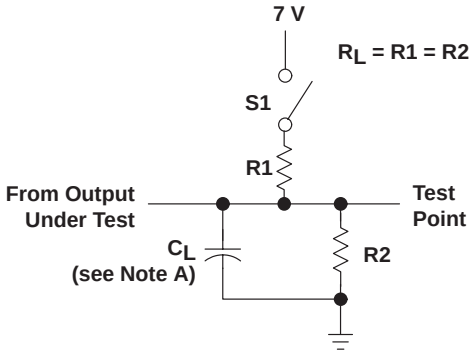
PARAMETER MEASUREMENT INFORMATION
SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



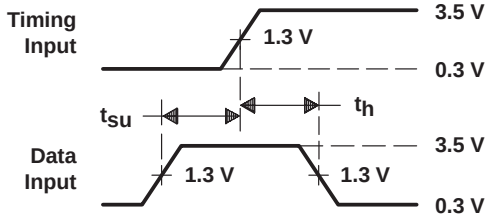
LOAD CIRCUIT FOR
BI-STATE
TOTEM-POLE OUTPUTS



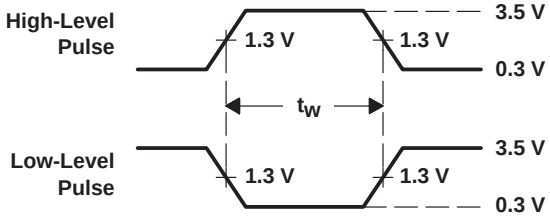
LOAD CIRCUIT
FOR OPEN-COLLECTOR OUTPUTS



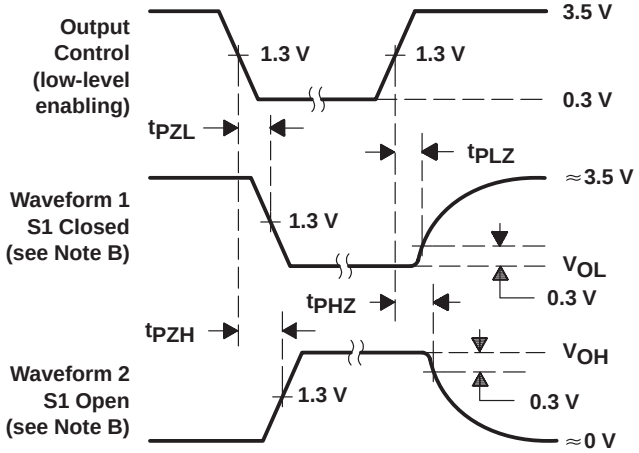
LOAD CIRCUIT
FOR 3-STATE OUTPUTS



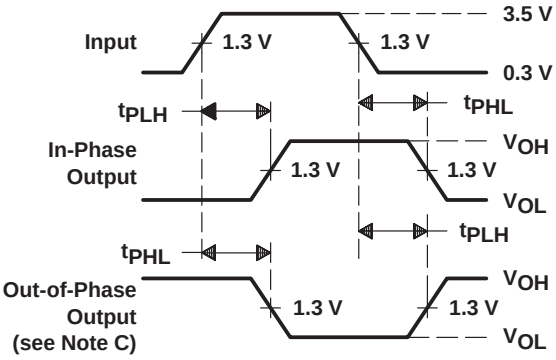
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PULSE DURATIONS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

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. When measuring propagation delay items of 3-state outputs, switch S1 is open.
D. All input pulses have the following characteristics: PRR ≤ 1 MHz, $t_r = t_f = 2$ ns, duty cycle = 50%.
E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
SN74ALS561ADWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS561ADWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS561ADWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS561AN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS561ANE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SNJ54ALS561AJ	OBSOLETE	CDIP	J	20		TBD	Call TI	Call TI

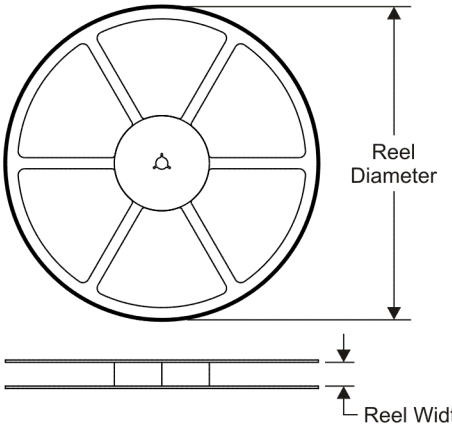
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, 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): 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)

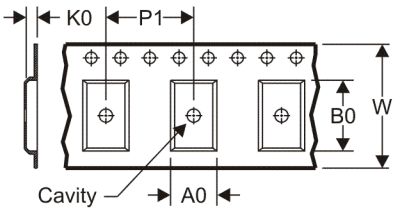
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

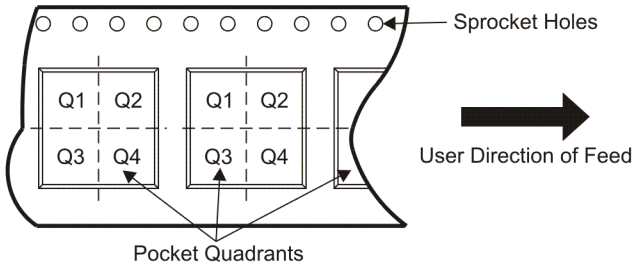


TAPE DIMENSIONS



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

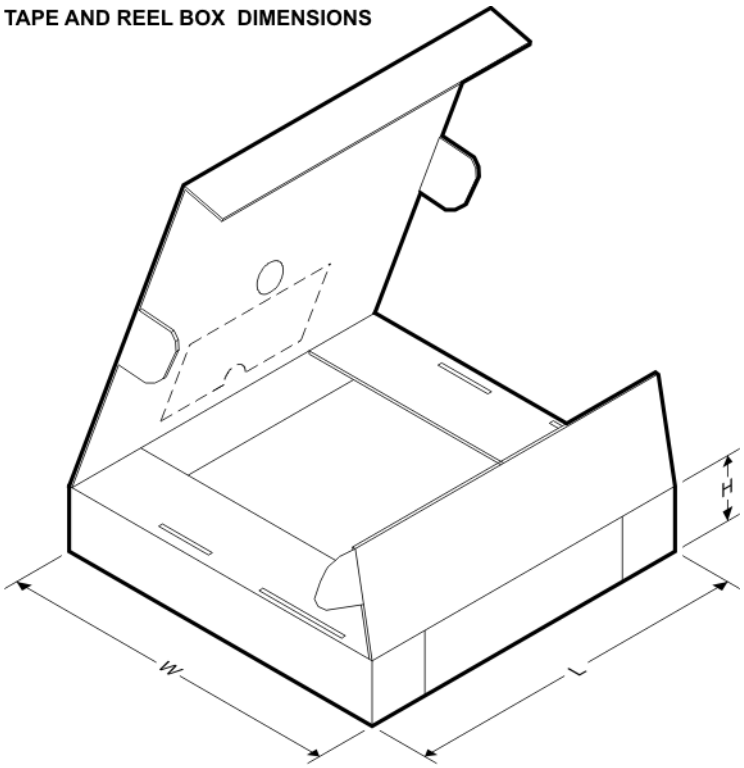
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN74ALS561ADWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS



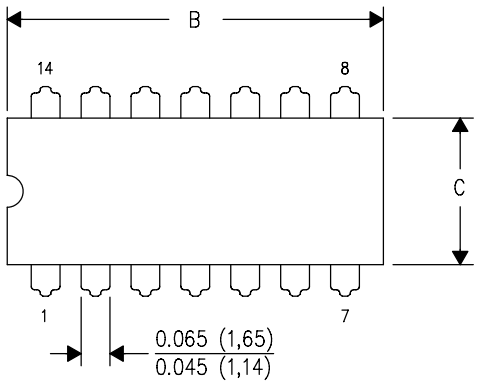
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALS561ADWR	SOIC	DW	20	2000	346.0	346.0	41.0

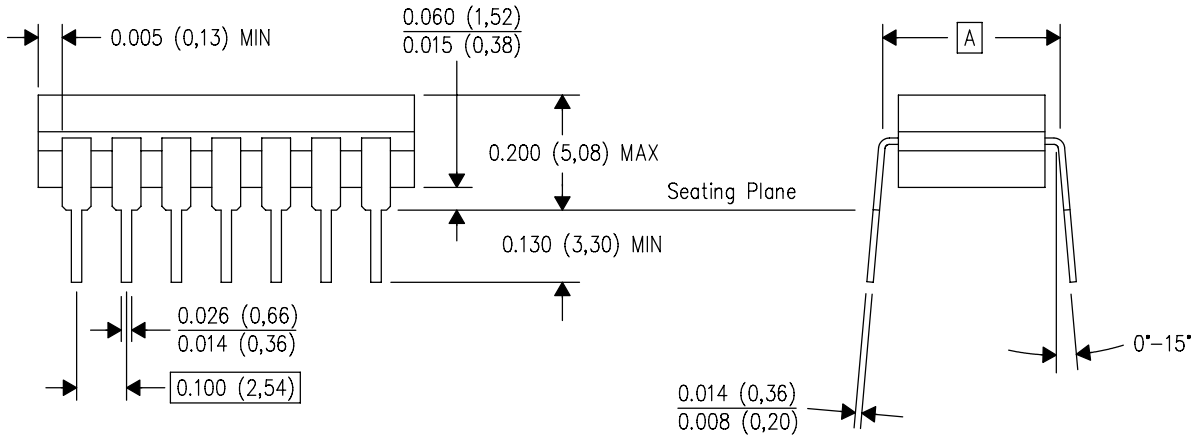
J (R–GDIP–T**)

14 LEADS SHOWN

CERAMIC DUAL IN–LINE PACKAGE



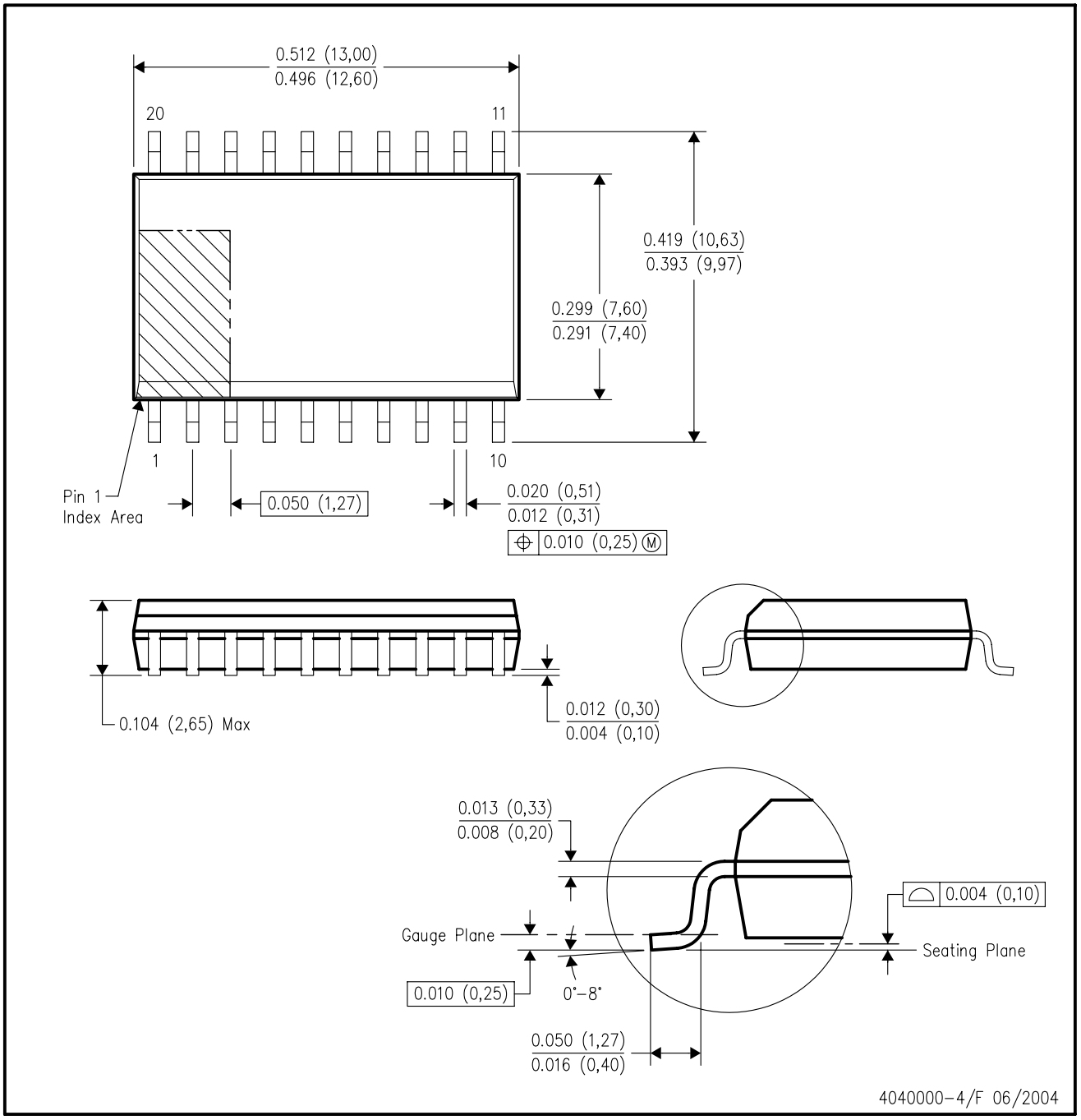
DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
E. Falls within MIL STD 1835 GDIP1–T14, GDIP1–T16, GDIP1–T18 and GDIP1–T20.

DW (R–PDSO–G20) PLASTIC SMALL–OUTLINE PACKAGE

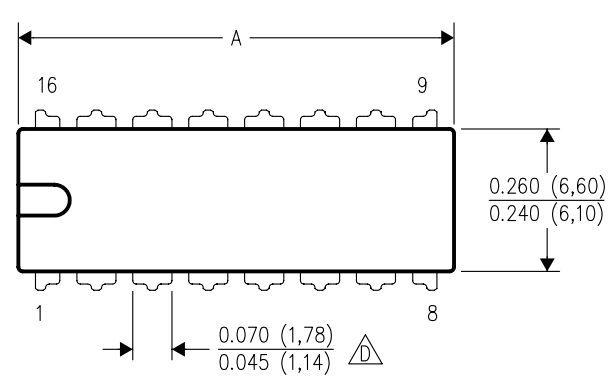


NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS–013 variation AC.

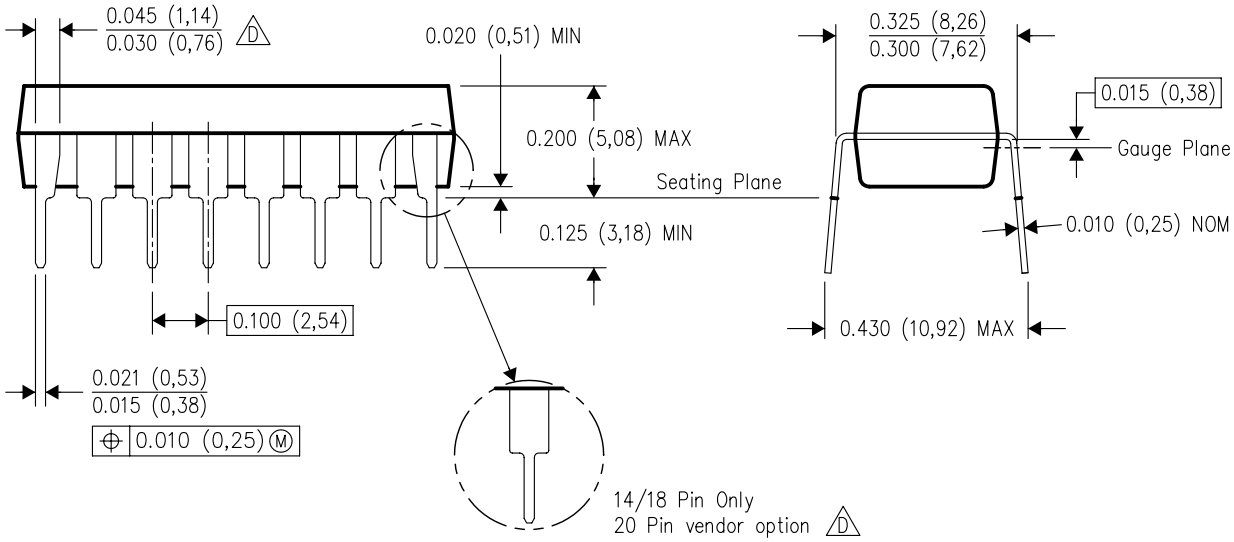
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



4040049/E 12/2002

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Broadband	www.ti.com/broadband
DSP	dsp.ti.com	Digital Control	www.ti.com/digitalcontrol
Clocks and Timers	www.ti.com/clocks	Medical	www.ti.com/medical
Interface	interface.ti.com	Military	www.ti.com/military
Logic	logic.ti.com	Optical Networking	www.ti.com/opticalnetwork
Power Mgmt	power.ti.com	Security	www.ti.com/security
Microcontrollers	microcontroller.ti.com	Telephony	www.ti.com/telephony
RFID	www.ti-rfid.com	Video & Imaging	www.ti.com/video
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265