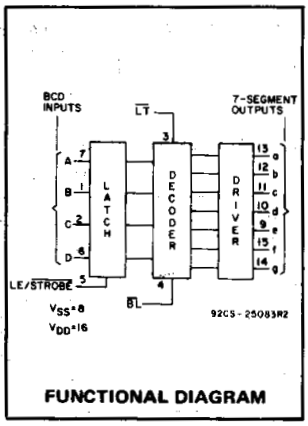
TEXAS INSTRUMENTS
Data sheet acquired from Harris Semiconductor
SCHS072B – Revised July 2003

CD4511B Types

CMOS BCD-to-7-Segment Latch Decoder Drivers

High-Voltage Types (20-Volt Rating)



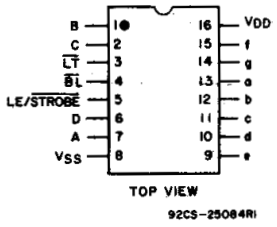
FUNCTIONAL DIAGRAM

■ CD4511B types are BCD-to-7-segment latch decoder drivers constructed with CMOS logic and n-p-n bipolar transistor output devices on a single monolithic structure. These devices combine the low quiescent power dissipation and high noise immunity features of RCA CMOS with n-p-n bipolar output transistors capable of sourcing up to 25 mA. This capability allows the CD4511B types to drive LED's and other displays directly.

Lamp Test ($\overline{LT}$), Blanking ($\overline{BL}$), and Latch Enable or Strobe inputs are provided to test the display, shut off or intensity-modulate it, and store or strobe a BCD code, respectively. Several different signals may be multiplexed and displayed when external multiplexing circuitry is used.

The CD4511B types are supplied in 16-lead hermetic dual-in-line ceramic packages (F3A suffix), 16-lead dual-in-line plastic packages (E suffix), 16-lead small-outline packages (NSR suffix), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).

These devices are similar to the type MC14511.



CD4511B
TERMINAL ASSIGNMENT

Features:

- High-output-sourcing capability . . . . . up to 25 mA
- Input latches for BCD Code storage
- Lamp Test and Blanking capability
- 7-segment outputs blanked for BCD input codes > 1001
- 100% tested for quiescent current at 20 V
- Max. input current of 1 μA at 18 V, over full package-temperature range, 100 nA at 18 V and 25°C
- 5-V, 10-V, and 15-V parametric ratings

Applications:

- Driving common-cathode LED displays
- Multiplexing with common-cathode LED displays
- Driving incandescent displays
- Driving low-voltage fluorescent displays

MAXIMUM RATINGS, *Absolute-Maximum Values:*

DC SUPPLY-VOLTAGE RANGE, (V_{DD})
Voltages referenced to V_{SS} Terminal) . . . . . -0.5V to +20V
INPUT VOLTAGE RANGE, ALL INPUTS . . . . . -0.5V to V_{DD} +0.5V
DC INPUT CURRENT, ANY ONE INPUT . . . . . ±10mA
POWER DISSIPATION PER PACKAGE (P_D):
For T_A = -55°C to +100°C 500mW
For T_A = +100°C to +125°C. . . . . Derate Linearity at 12mW/°C to 200mW
DEVICE DISSIPATION PER OUTPUT TRANSISTOR
FOR T_A = FULL PACKAGE-TEMPERATURE RANGE (All Package Types) 100mW
OPERATING-TEMPERATURE RANGE (T_A) . . . . . -55°C to +125°C
STORAGE TEMPERATURE RANGE (T_{stg}) . . . . . -65°C to +150°C
LEAD TEMPERATURE (DURING SOLDERING):
At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10s max . . . . . +265°C

OPERATING CONDITIONS AT T_A = 25°C Unless Otherwise Specified

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges

Characteristic	V_{DD}	Min.	Max.	Units
Supply-Voltage Range (T_A): (Full Package-Temperature Range)	–	3	18	V
Set-Up Time (t_S)	5	150	–	ns
	10	70	–	ns
	15	40	–	ns
Hold Time (t_H)	5	0	–	ns
	10	0	–	ns
	15	0	–	ns
Strobe Pulse Width (t_W)	5	400	–	ns
	10	160	–	ns
	15	100	–	ns

3 COMMERCIAL CMOS HIGH VOLTAGE ICs

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	TEST CONDITIONS				LIMITS AT INDICATED TEMPERATURES (°C)							Units
	I_{OH} (mA)	V_O (V)	V_{IN} (V)	V_{DD} (V)	−55	−40	+85	+125	+25 Min.	+25 Typ.	+25 Max.	
Quiescent Device Current: I_{DD} Max.	–	–	–	5	5	5	150	150	–	0.04	5	μA
	–	–	–	10	10	10	300	300	–	0.04	10	
	–	–	–	15	20	20	600	600	–	0.04	20	
	–	–	–	20	100	100	3000	3000	–	0.08	100	
Output Voltage: Low-Level V_{OL} Max.	–	–	0,5	5	0.05				–	0	0.05	V
	–	–	0,10	10	0.05				–	0	0.05	
	–	–	0,15	15	0.05				–	0	0.05	
High-Level V_{OH} Min.	–	–	0,5	5	4	4	4.2	4.2	4.1	4.55	–	V
	–	–	0,10	10	9	9	9.2	9.2	9.1	9.55	–	
	–	–	0,15	15	14	14	14.2	14.2	14.1	14.55	–	
Input Low Voltage, V_{IL} Max.	–	0.5,3.8		5	1.5				–	–	1.5	V
	–	1,8.8	–	10	3				–	–	3	
	–	1.5,13.8		15	4				–	–	4	
Input High Voltage, V_{IH} Min.	–	0.5,3.8		5	3.5				3.5	–	–	V
	–	1,8.8		10	7				7	–	–	
	–	1.5,13.8		15	11				11	–	–	
Output Drive Voltage: High Level V_{OH} Min.	0			5	4.0	4.0	4.20	4.20	4.10	4.55	–	V
	5						–	–	–	4.25	–	
	10				3.80	3.80	3.90	3.90	3.90	4.10	–	
	15					–	3.50	3.50	–	3.95	–	
	20				3.55	3.55	3.30	–	3.40	3.75	–	
	25				3.40	3.40	–	–	3.10	3.55	–	
	0			10	9.0	9.0	9.20	9.20	9.10	9.55	–	V
	5					–	–	–	–	9.25	–	
	10	–	–		8.85	8.85	9.00	9.00	9.00	9.15	–	
	15	–	–		–	–	–	–	–	9.05	–	
	20	–	–		8.70	8.70	8.40	8.40	8.60	8.90	–	
	25	–	–		8.60	8.60	–	–	8.30	8.75	–	
	0	–	–	15	14.0	14.0	14.20	14.20	14.10	14.55	–	V
	5	–	–		–	–	–	–	–	14.30	–	
	10	–	–		13.90	13.90	14.0	14.0	14.0	14.20	–	
	15	–	–		–	–	–	–	–	14.10	–	
	20	–	–		13.75	13.75	13.50	13.50	13.70	13.95	–	
	25	–	–		13.65	13.65	–	–	13.50	13.80	–	
Output Low (Sink) Current, I_{OL} Min.	–	0.4	0,5	5	0.64	0.61	0.42	0.36	0.51	1	–	mA
	–	0.5	0,10	10	1.6	1.5	1.1	0.9	1.3	2.6	–	
	–	1.5	0,15	15	4.2	4	2.8	2.4	3.4	6.8	–	
Input Current, I_{IN} Max.	–	0,18	0,18	18	±0.1	±0.1	±1	±1	–	$±10^{-5}$	±0.1	μA

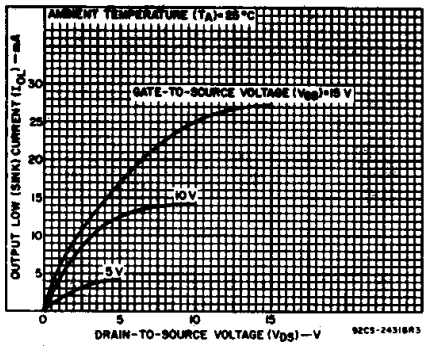


Fig. 1 – Typical output low (sink) current characteristics.

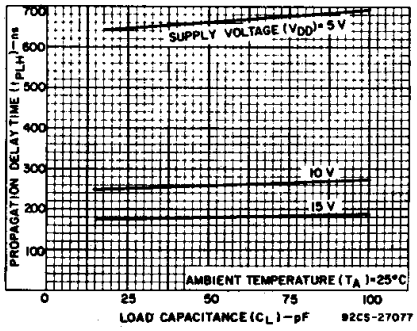


Fig. 2 – Typical data-to-output, low-to-high-level propagation delay time as a function of load capacitance.

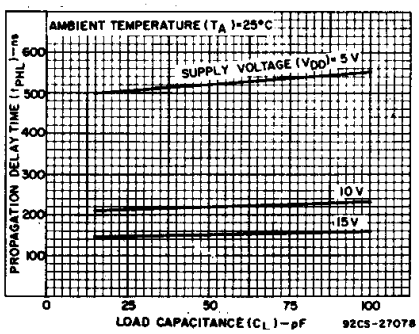


Fig. 3 – Typical data-to-output, high-to-low-level propagation delay time as a function of load capacitance.

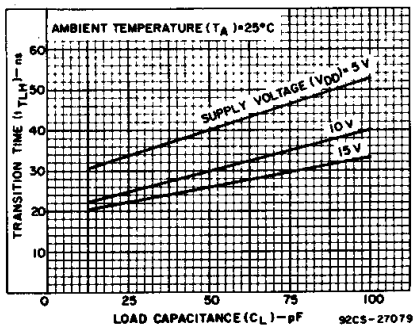


Fig. 4 – Typical low-to-high-level transition time as a function of load capacitance.

DYNAMIC ELECTRICAL CHARACTERISTICS at T_A = 25°C, Input t_r, t_f = 20 ns, C_L = 50 pF, R_L = 200 kΩ

CHARACTERISTIC	Test Conditions	LIMITS All Packages			UNITS
	V_{DD} Volts	Min.	Typ.	Max.	
Propagation Delay Time: (Data) High-to-Low Level, t_{PHL}	5	–	520	1040	ns
	10	–	210	420	
	15	–	150	300	
Low-to-High Level, t_{PLH}	5	–	660	1320	ns
	10	–	260	520	
	15	–	180	360	
Propagation Delay Time: ($\overline{BL}$) High-to-Low Level, t_{PHL}	5	–	350	700	ns
	10	–	175	350	
	15	–	125	250	
Low-to-High Level, t_{PLH}	5	–	400	800	ns
	10	–	175	350	
	15	–	150	300	
Propagation Delay Time: ($\overline{LT}$) High-to-Low Level, t_{PHL}	5	–	250	500	ns
	10	–	125	250	
	15	–	85	170	
Low-to-High Level, t_{PLH}	5	–	150	300	ns
	10	–	75	150	
	15	–	50	100	
Transition Time: Low-to-High Level, t_{TLH}	5	–	40	80	ns
	10	–	30	60	
	15	–	25	50	
High-to-Low Level, t_{THL}	5	–	125	310	ns
	10	–	75	185	
	15	–	65	160	
Minimum Set-Up Time, t_S	5	150	75	–	ns
	10	70	35	–	
	15	40	20	–	
Minimum Hold Time, t_H	5	0	−75	–	ns
	10	0	−35	–	
	15	0	−20	–	
Strobe Pulse Width, t_W	5	400	200	–	ns
	10	160	80	–	
	15	100	50		
Input Capacitance, C_{IN}		–	5	7.5	pF

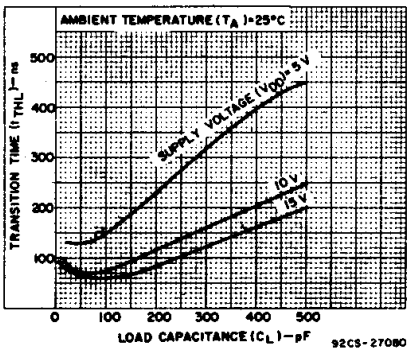


Fig. 5 – Typical high-to-low transition time as a function of load capacitance.

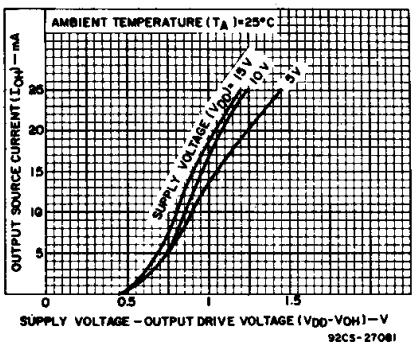


Fig. 6 – Typical voltage drop (V_{DD} to output) vs. output source current as a function of supply.

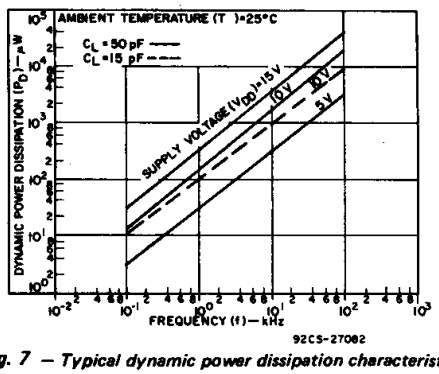


Fig. 7 – Typical dynamic power dissipation characteristics.

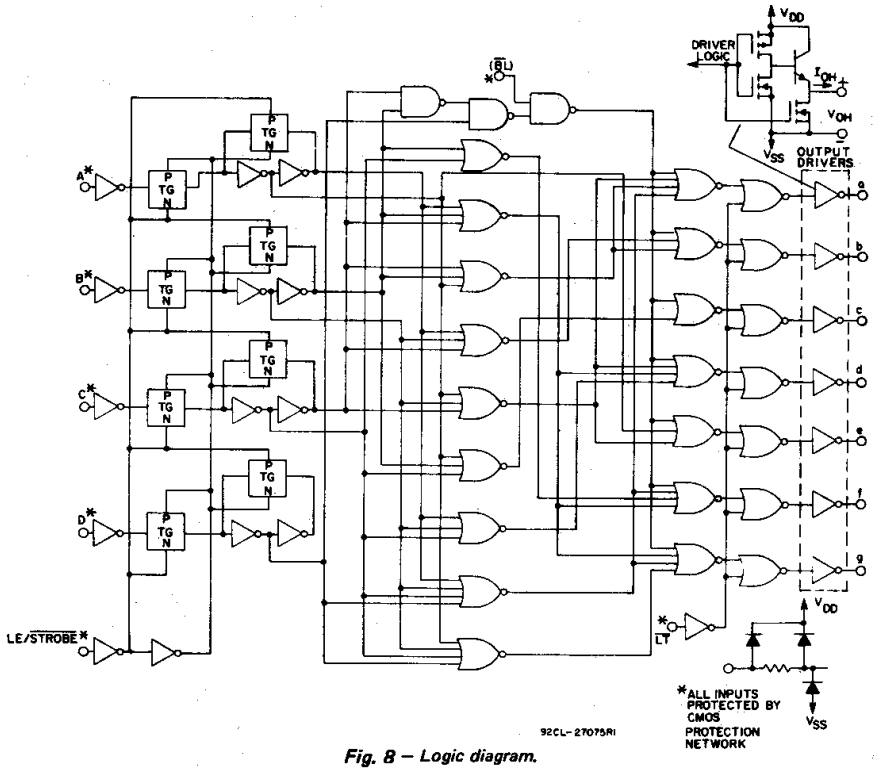


Fig. 8 – Logic diagram.

TRUTH TABLE

LE	$\overline{BI}$	$\overline{LT}$	D	C	B	A	a	b	c	d	e	f	g	Display
X	X	0	X	X	X	X	1	1	1	1	1	1	1	8
X	0	1	X	X	X	X	0	0	0	0	0	0	0	Blank
0	1	1	0	0	0	0	1	1	1	1	1	1	0	0
0	1	1	0	0	0	1	0	1	1	0	0	0	0	1
0	1	1	0	0	1	0	1	1	0	1	1	0	1	2
0	1	1	0	0	1	1	1	1	1	1	0	0	1	3
0	1	1	0	1	0	0	0	1	1	0	0	1	1	4
0	1	1	0	1	0	1	1	0	1	1	0	1	1	5
0	1	1	0	1	1	0	0	0	1	1	1	1	1	6
0	1	1	0	1	1	1	1	1	1	0	0	0	0	7
0	1	1	1	0	0	0	1	1	1	1	1	1	1	8
0	1	1	1	0	0	1	1	1	1	0	0	1	1	9
0	1	1	1	0	1	0	0	0	0	0	0	0	0	Blank
0	1	1	1	0	1	1	0	0	0	0	0	0	0	Blank
0	1	1	1	1	0	0	0	0	0	0	0	0	0	Blank
0	1	1	1	1	0	1	0	0	0	0	0	0	0	Blank
0	1	1	1	1	1	0	0	0	0	0	0	0	0	Blank
0	1	1	1	1	1	1	0	0	0	0	0	0	0	Blank
1	↑	1	X	X	X	X				*				*

X ≡ Don't Care * Depends on BCD code previously applied when LE = 0

Note: Display is blank for all illegal input codes (BCD > 1001).

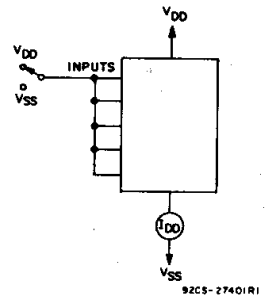


Fig. 9 – Quiescent device current.

TEST CIRCUITS

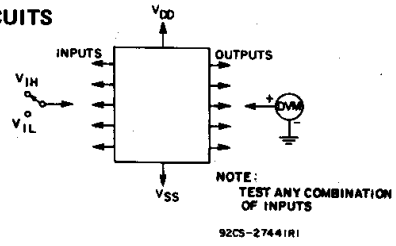


Fig. 10 – Input voltage.

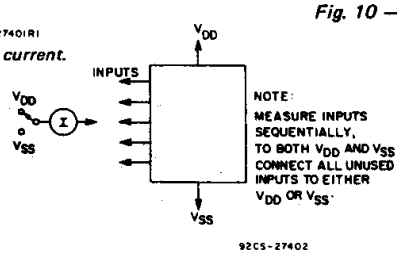
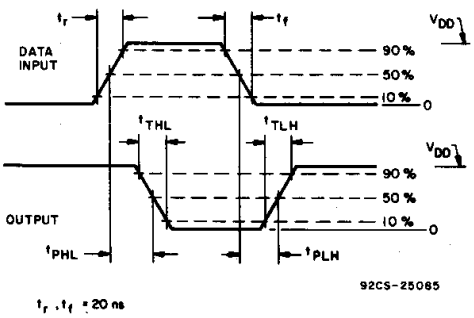


Fig.11 – Input current.



t_r, t_f = 20 ns

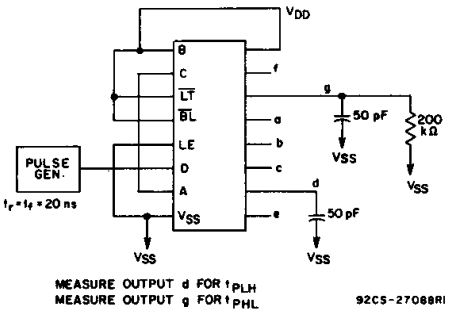


Fig.12 – Data propagation delay.

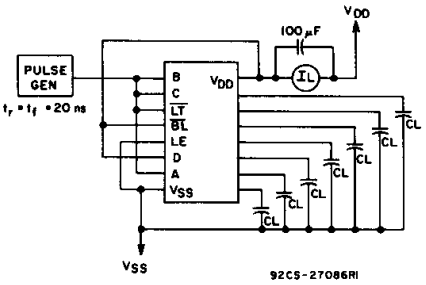
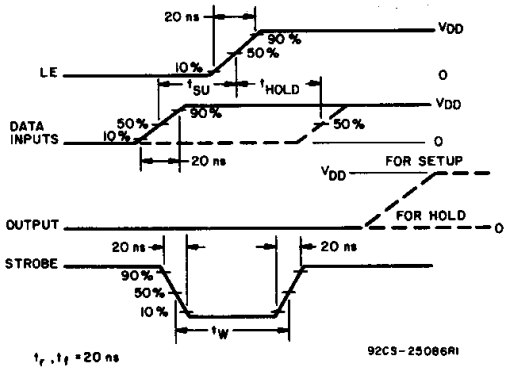


Fig. 13 – Dynamic power dissipation.

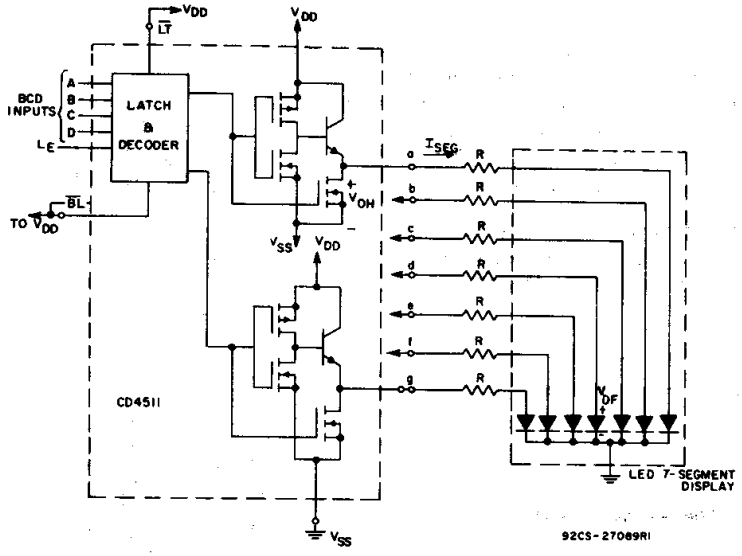


t_r, t_f = 20 ns

Fig. 14 – Dynamic waveforms.

APPLICATIONS

Interfacing with Various Displays

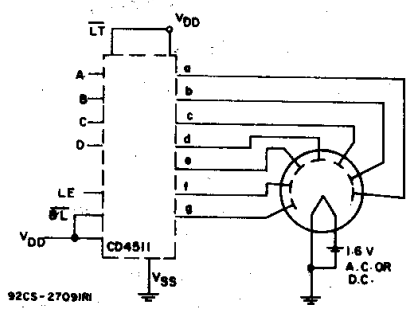


Duty Cycle = 100%

$I_{SEG} = I_{DIODE_{AVG.}}$ = 20 mA at Luminous Intensity/Segment = 250 microcandles

$$R = \frac{V_{OH} - V_{DF}}{I_{SEG}}$$

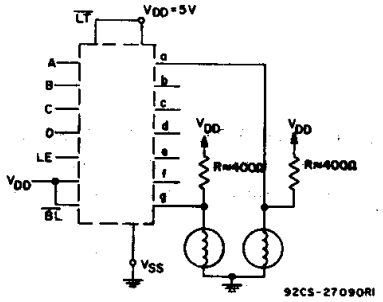
Fig. 15 - Driving common-cathode 7-segment LED displays (example Hewlet-Packard 5082-7740).



A medium-brightness intensity display can be obtained with low-voltage fluorescent displays such as the Tung-Sol Digivac S/G** Series.

**Trademark Tung-Sol Division Wagner Electric Co.

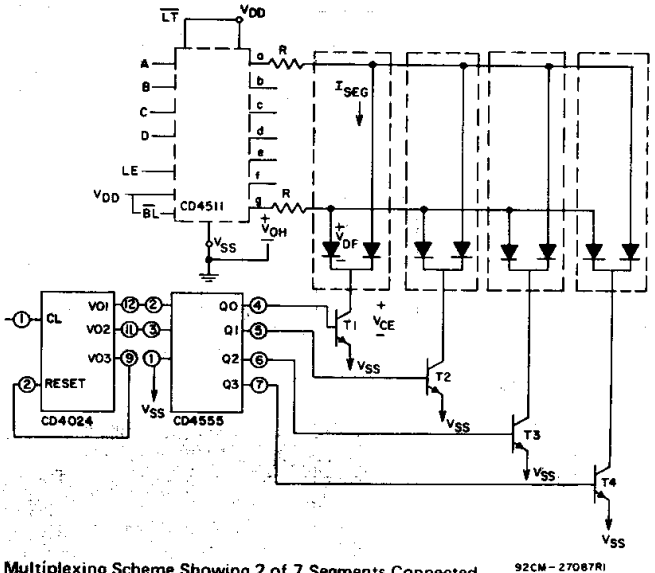
Fig. 16 – Driving low-voltage fluorescent displays.



2 of 7 Segments Shown Connected

Resistors R from V_{DD} to each 7-segment driver output are chosen to keep all Numitron segments slightly on and warm.

Fig. 17 – Driving incandescent displays (RCA Numitron DR2000 series displays).



Multiplexing Scheme Showing 2 of 7 Segments Connected

Transistors T_1–T_4 (RCA-2N3053 or 2N2102) have I_C Max. rating > 7xI_{SEG}

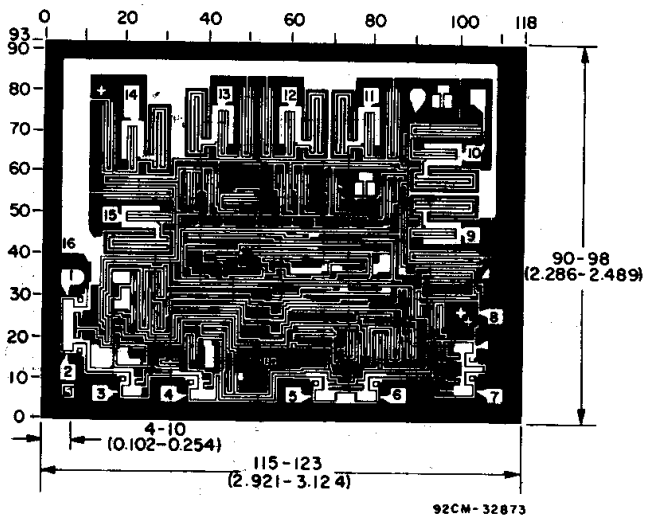
Duty Cycle = 25%

$I_{SEG} = (I_{DIODE_{AVG}}) \times 4$

$$R = \frac{(V_{OH} - V_{DF} - V_{CE})}{I_{SEG}}$$

All unused inputs on CD4555 are connected to V_{DD} or V_{SS}.

Fig. 18 – Multiplexing with common-cathode 7-segment LED displays (example Hewlet-Packard 5082-7404 4 character display or 4 discrete Monosanto Man 3 displays).



Dimensions and pad layout for CD4511B chip.

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10^{-3} inch).

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
CD4511BE	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CD4511BEE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CD4511BF	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
CD4511BF3A	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
CD4511BNSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD4511BNSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD4511BNSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD4511BPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD4511BPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD4511BPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD4511BPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD4511BPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD4511BPWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

(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.

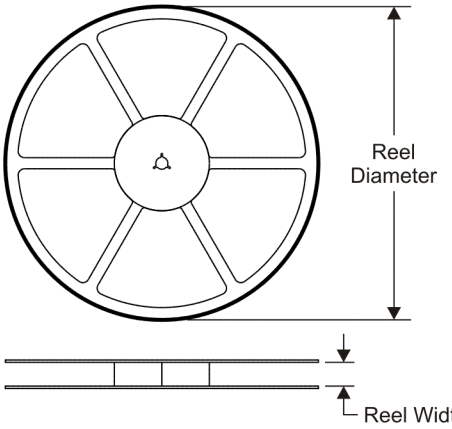
(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been 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.

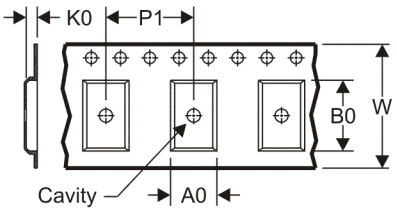
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

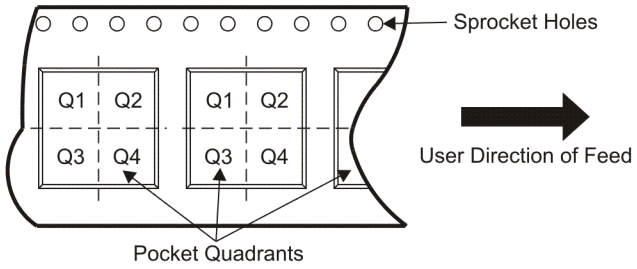


TAPE DIMENSIONS



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

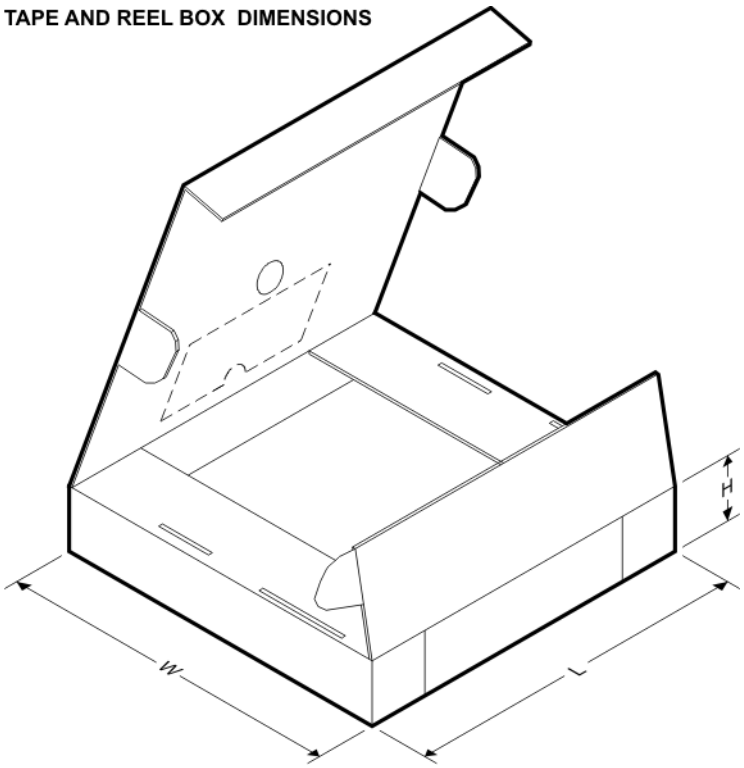
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
CD4511BNSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
CD4511BPWR	TSSOP	PW	16	2000	330.0	12.4	7.0	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



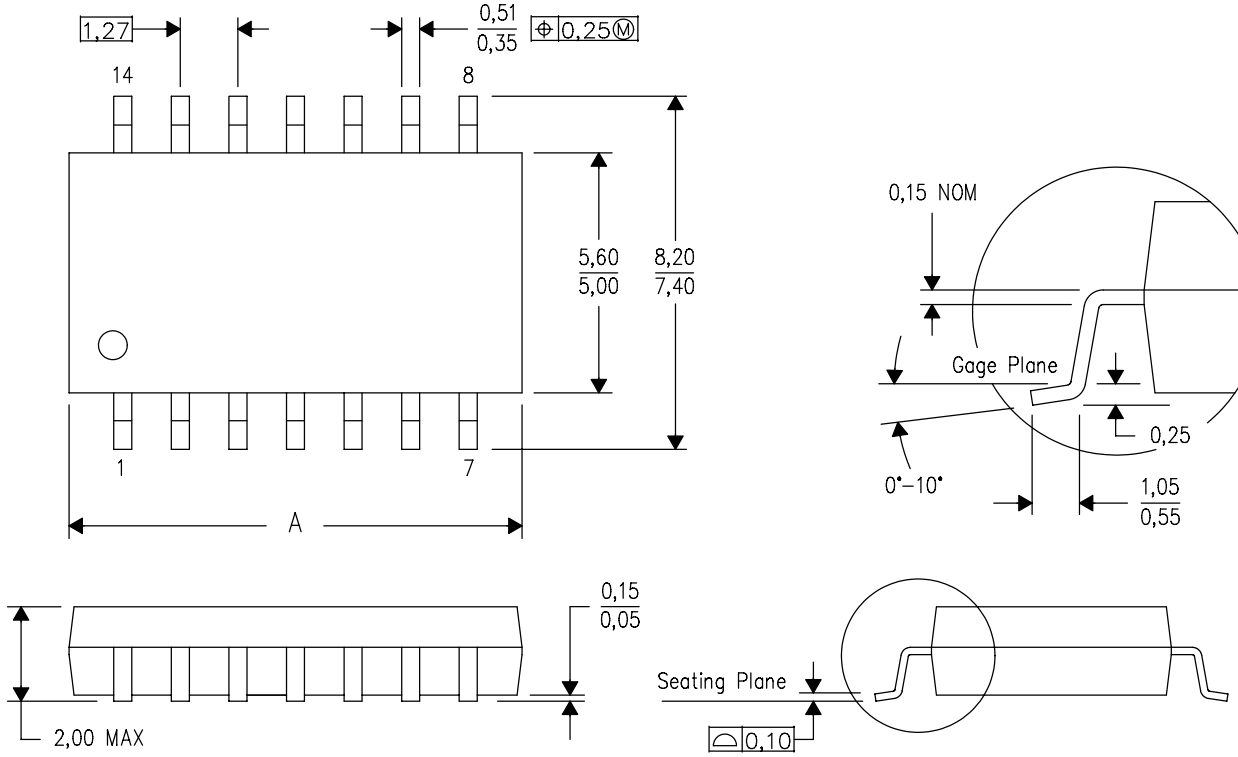
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD4511BNSR	SO	NS	16	2000	346.0	346.0	33.0
CD4511BPWR	TSSOP	PW	16	2000	346.0	346.0	29.0

MECHANICAL DATA

NS (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14-PINS SHOWN



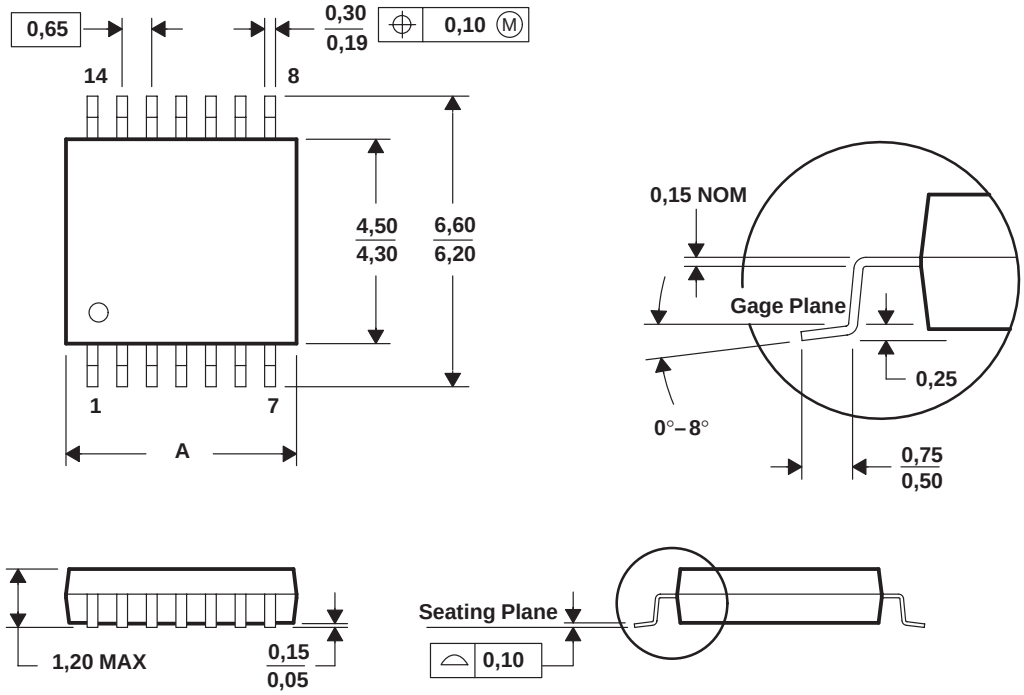
DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

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.

PW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN



DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

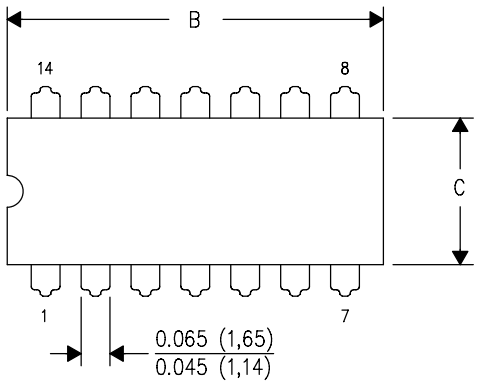
4040064/F 01/97

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.
D. Falls within JEDEC MO-153

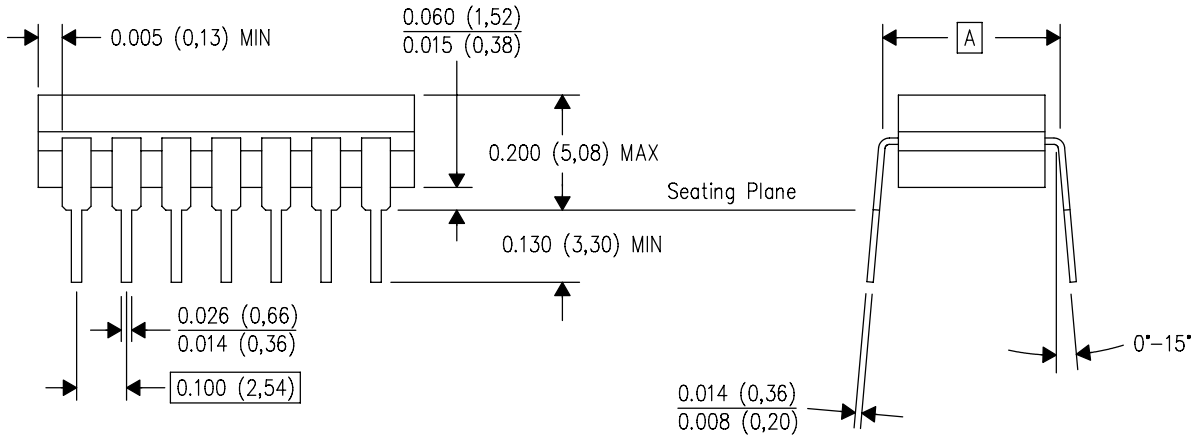
J (R–GDIP–T**)

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)



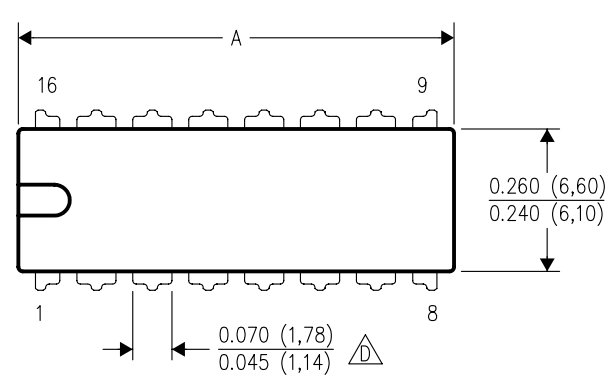
4040083/F 03/03

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.

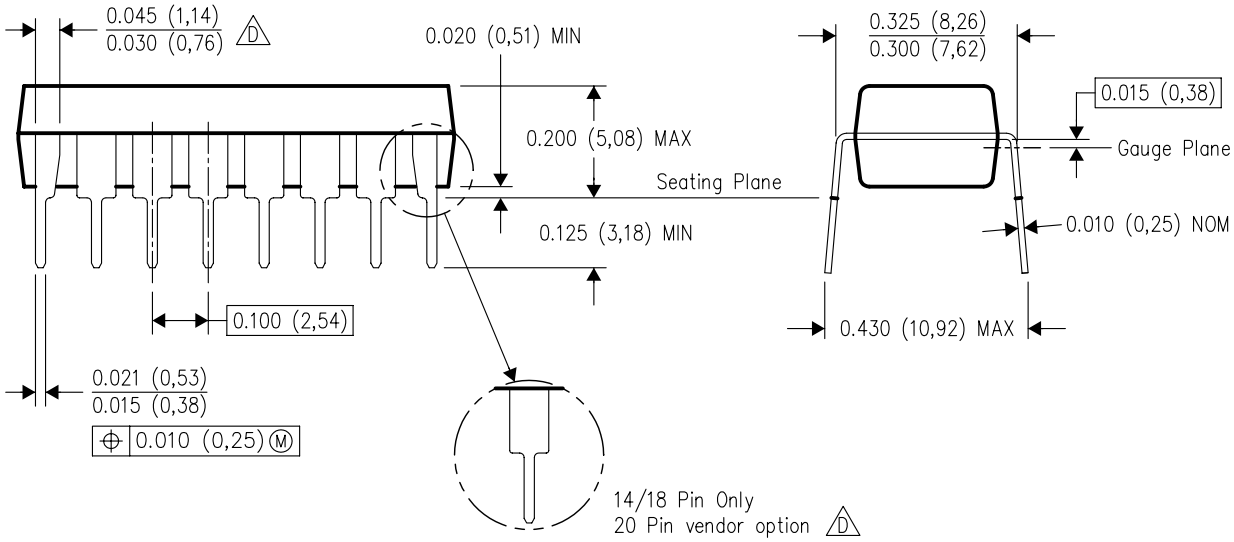
N (R–PDIP–T**)

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
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Clocks and Timers	www.ti.com/clocks	Digital Control	www.ti.com/digitalcontrol
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Telephony	www.ti.com/telephony
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

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