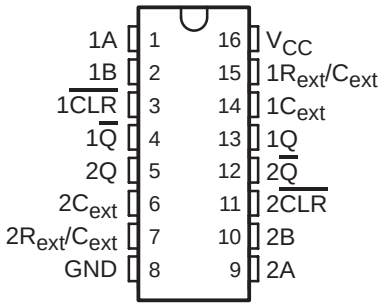
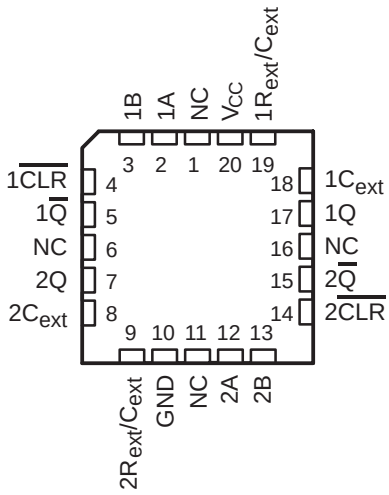
- **Dual Versions of Highly Stable SN54121 and SN74121 One Shots**
- **SN54221 and SN74221 Demonstrate Electrical and Switching Characteristics That Are Virtually Identical to the SN54121 and SN74121 One Shots**
- **Pinout Is Identical to the SN54123, SN74123, SN54LS123, and SN74LS123**
- **Overriding Clear Terminates Output Pulse**

TYPE	MAXIMUM OUTPUT PULSE LENGTH(S)
SN54221	21
SN74221	28
SN54LS221	49
SN74LS221	70

SN54221, SN54LS221 . . . J PACKAGE
SN74221 . . . N PACKAGE
SN74LS221 . . . D, DB, N, OR NS PACKAGE
(TOP VIEW)



SN54LS221 . . . FK PACKAGE
(TOP VIEW)



NC − No internal connection

description/ordering information

The ’221 and ’LS221 devices are dual multivibrators with performance characteristics virtually identical to those of the ’121 devices. Each multivibrator features a negative-transition-triggered input and a positive-transition-triggered input, either of which can be used as an inhibit input.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP − N	Tube	SN74221N	SN74221N
			SN74LS221N	SN74LS221N
	SOIC − D	Tube	SN74LS221D	LS221
		Tape and reel	SN74LS221DR	
	SOP − NS	Tape and reel	SN74LS221NSR	74LS221
	SSOP − DB	Tape and reel	SN74LS221DBR	LS221
−55°C to 125°C	CDIP − J	Tube	SNJ54221J	SNJ54221J
			SNJ54LS221J	SNJ54LS221J
	LCCC − FK	Tube	SNJ54LS221FK	SNJ54LS221FK

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

description/ordering information (continued)

Pulse triggering occurs at a particular voltage level and is not directly related to the transition time of the input pulse. Schmitt-trigger input circuitry (TTL hysteresis) for B input allows jitter-free triggering from inputs with transition at rates as slow as 1 V/s, providing the circuit with excellent noise immunity, typically of 1.2 V. A high immunity to V_{CC} noise, typically of 1.5 V, also is provided by internal latching circuitry.

Once fired, the outputs are independent of further transitions of the A and B inputs and are a function of the timing components, or the output pulses can be terminated by the overriding clear. Input pulses can be of any duration relative to the output pulse. Output pulse length can be varied from 35 ns to the maximum by choosing appropriate timing components. With R_{ext} = 2 kΩ and C_{ext} = 0, an output pulse typically of 30 ns is achieved that can be used as a dc-triggered reset signal. Output rise and fall times are TTL compatible and independent of pulse length. Typical triggering and clearing sequences are shown as a part of the switching characteristics waveforms.

Pulse-width stability is achieved through internal compensation and is virtually independent of V_{CC} and temperature. In most applications, pulse stability is limited only by the accuracy of external timing components.

Jitter-free operation is maintained over the full temperature and V_{CC} ranges for more than six decades of timing capacitance (10 pF to 10 μF) and more than one decade of timing resistance (2 kΩ to 30 kΩ for the SN54221, 2 kΩ to 40 kΩ for the SN74221, 2 kΩ to 70 kΩ for the SN54LS221, and 2 kΩ to 100 kΩ for the SN74LS221). Throughout these ranges, pulse width is defined by the relationship: $t_w(out) = C_{ext}R_{ext}\ ln2 \approx 0.7\ C_{ext}R_{ext}$. In circuits where pulse cutoff is not critical, timing capacitance up to 1000 μF and timing resistance as low as 1.4 kΩ can be used. Also, the range of jitter-free output pulse widths is extended if V_{CC} is held to 5 V and free-air temperature is 25°C. Duty cycles as high as 90% are achieved when using maximum recommended R_T. Higher duty cycles are available if a certain amount of pulse-width jitter is allowed.

The variance in output pulse width from device to device typically is less than ±0.5% for given external timing components. An example of this distribution for the ’221 is shown in Figure 3. Variations in output pulse width versus supply voltage and temperature for the ’221 are shown in Figures 4 and 5, respectively.

Pin assignments for these devices are identical to those of the SN54123/SN74123 or SN54LS123/SN74LS123 so that the ’221 or ’LS221 devices can be substituted for those products in systems not using the retrigger by merely changing the value of R_{ext} and/or C_{ext}; however, the polarity of the capacitor must be changed.

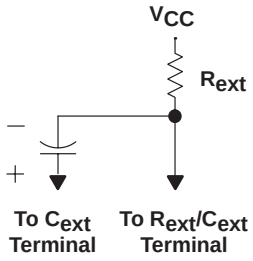
FUNCTION TABLE
(each monostable multivibrator)

INPUTS			OUTPUTS	
$\overline{CLR}$	A	B	Q	$\overline{Q}$
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↑	⎍†	⎎†
H	↓	H	⎍†	⎎†
↑‡	L	H	⎍†	⎎†

† Pulsed-output patterns are tested during AC switching at 25°C with R_{ext} = 2 kΩ, and C_{ext} = 80 pF.

‡ This condition is true only if the output of the latch formed by the two NAND gates has been conditioned to the logic 1 state prior to $\overline{CLR}$ going high. This latch is conditioned by taking either A high or B low while $\overline{CLR}$ is inactive (high).

timing component connections

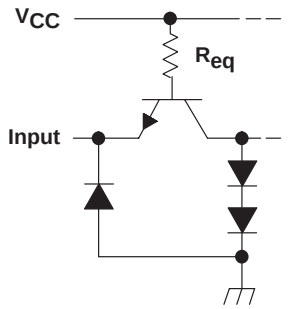


NOTE: Due to the internal circuit, the R_{ext}/C_{ext} terminal never is more positive than the C_{ext} terminal.

schematics of inputs and outputs

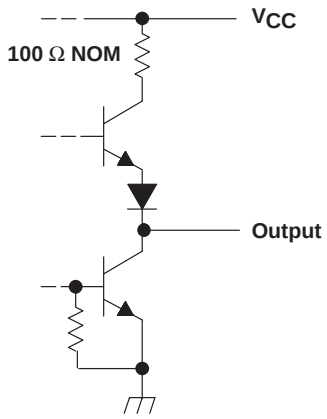
SN54/74221

EQUIVALENT OF EACH INPUT



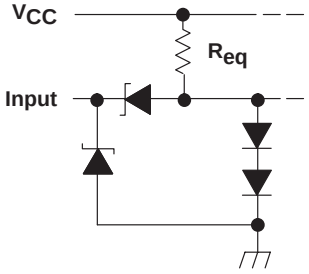
A Input: R_{eq} = 4 kΩ NOM
B, $\overline{CLR}$ Input: R_{eq} = 2 kΩ NOM

TYPICAL OF ALL OUTPUTS



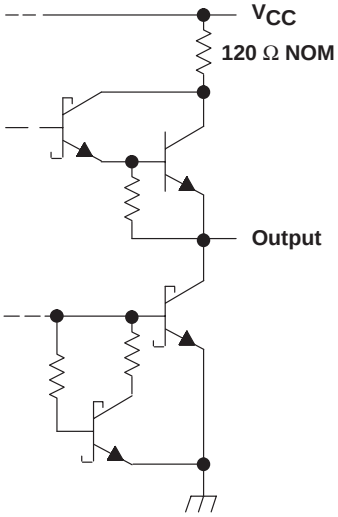
SN54/74LS221

EQUIVALENT OF EACH INPUT



A Input: R_{eq} = 25 kΩ NOM
B $\overline{Input}$: R_{eq} = 15.4 kΩ NOM
$\overline{CLR}$: R_{eq} = 12.5 kΩ NOM

TYPICAL OF ALL OUTPUTS



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

Supply voltage range, V_{CC} . . . . . 7 V
Input voltage range, V_I (see Note 1): 'LS221 . . . . . 7 V
'221 . . . . . 5.5 V
Package thermal impedance, θ_{JA} (see Note 2): D package . . . . . 73°C/W
DB package . . . . . 82°C/W
N package . . . . . 67°C/W
NS package . . . . . 64°C/W
Storage temperature range, T_{stg} . . . . . −65°C to 150°C

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

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

recommended operating conditions (see Note 3)

			SN54221			SN74221			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage		4.5	5	5.5	4.75	5	5.25	V
I_{OH}	High-level output current				−800			−800	μA
I_{OL}	Low-level output current				16			16	mA
$\Delta v/\Delta t$	Rise or fall of input pulse rate	B input	1*			1			V/s
		A input	1*			1			V/μs
T_A	Operating free-air temperature		−55		125	0		70	°C

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

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

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

PARAMETER		TEST CONDITIONS†		SN54221			SN74221			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{T+}	Positive-going threshold voltage, B input	V_{CC} = MIN			1.55	2*		1.55	2	V
V_{T-}	Negative-going threshold voltage, B input	V_{CC} = MIN		0.8*	1.35		0.8	1.35		V
V_{IK}		V_{CC} = MIN,	I_I = −12 mA			−1.5			−1.5	V
V_{OH}		V_{CC} = MIN,	I_{OH} = −800 μA	2.4	3.4		2.4	3.4		V
V_{OL}		V_{CC} = MIN,	I_{OL} = 16 mA		0.2	0.4		0.2	0.4	V
I_I		V_{CC} = MAX,	V_I = 5.5 V			1			1	mA
I_{IH}	A input	V_{CC} = MAX,	V_I = 2.4 V			40			40	μA
	$\overline{CLR}$, B input					80			80	
I_{IL}	A input	V_{CC} = MAX,	V_I = 0.4 V			−1.6			−1.6	mA
	$\overline{CLR}$, B input					−3.2			−3.2	
I_{OS}§		V_{CC} = MAX		−20		−55	−18		−55	mA
I_{CC}	Quiescent	V_{CC} = MAX			26	50*		26	50	mA
	Triggered				46	80*		46	80	

∗ On products compliant to MIL-PRF-38535, this parameter is not production tested.
† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

timing requirements over recommended ranges of supply voltage and operating free-air temperature

			SN54221		SN74221		UNIT
			MIN	MAX	MIN	MAX	
t_w	Pulse duration	A or B input	50		50		ns
		$\overline{CLR}$	20		20		
t_{su}	Setup time, inactive-state¶	$\overline{CLR}$	15		15		ns
R_{ext}	External timing resistance		1.4*	30*	1.4	40	kΩ
C_{ext}	External timing capacitance		0*	1000*	0	1000	μF
	Output duty cycle	R_{ext} = 2 kΩ		67%		67%	
		R_{ext} = MAX R_{ext}		90%		90%	

∗ On products compliant to MIL-PRF-38535, this parameter is not production tested.
¶ Inactive-state setup time also is referred to as recovery time.

switching characteristics V_{CC} = 5 V, R_L = 400 Ω, T_A = 25°C (see Figures 1 and 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	SN54221			SN74221			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH}	A	Q	C_{ext} = 80 pF, R_{ext} = 2 kΩ		45	70		45	70	ns
	B				35	55		35	55	
t_{PHL}	A	$\overline{Q}$			50	80		50	80	
	B				40	65		40	65	
t_{PHL}	$\overline{CLR}$	Q	C_{ext} = 80 pF, R_{ext} = 2 kΩ			27			27	ns
t_{PLH}		$\overline{Q}$				40			40	
t_w	A or B	Q or $\overline{Q}$	C_{ext} = 80 pF, R_{ext} = 2 kΩ	70	110	150	70	110	150	ns
			C_{ext} = 0, R_{ext} = 2 kΩ	17	30	50	17	30	50	
			C_{ext} = 100 pF, R_{ext} = 10 kΩ	650	700	750	650	700	750	
			C_{ext} = 1 µF, R_{ext} = 10 kΩ	6.5*	7	7.5*	6.5	7	7.5	ms

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

recommended operating conditions (see Note 4)

			SN54LS221			SN74LS221			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage		4.5	5	5.5	4.75	5	5.25	V
I_{OH}	High-level output current				−400			−400	µA
I_{OL}	Low-level output current				4			8	mA
Δv/Δt	Rise or fall of input pulse rate	B input	1*			1			V/s
		A input	1*			1			V/µs
T_A	Operating free-air temperature		−55		125	0		70	°C

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

NOTE 4: 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.

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

PARAMETER		TEST CONDITIONS†		SN54LS221			SN74LS221			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{T+}	Positive-going threshold voltage, B input	V_{CC} = MIN			1	2*		1	2	V
V_{T-}	Negative-going threshold voltage, B input	V_{CC} = MIN		0.7*	0.9		0.8	0.9		V
V_{IK}		V_{CC} = MIN,	I_I = −18 mA			−1.5			−1.5	V
V_{OH}		V_{CC} = MIN,	I_{OH} = −400 μA	2.5	3.4		2.7	3.4		V
V_{OL}		V_{CC} = MIN	I_{OL} = 4 mA		0.25	0.4		0.25	0.4	V
			I_{OL} = 8 mA					0.35	0.5	
I_I		V_{CC} = MAX,	V_I = 7 V			0.1			0.1	mA
I_{IH}		V_{CC} = MAX,	V_I = 2.7 V			20			20	μA
I_{IL}	A input	V_{CC} = MAX,	V_I = 0.4 V			−0.4			−0.4	mA
	$\overline{CLR}$, B input					−0.8			−0.8	
I_{OS}§		V_{CC} = MAX		−20		−100	−20		−100	mA
I_{CC}	Quiescent	V_{CC} = MAX			4.7	11		4.7	11	mA
	Triggered				19	27*		19	27	

∗ On products compliant to MIL-PRF-38535, this parameter is not production tested.
† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

timing requirements over recommended ranges of supply voltage and operating free-air temperature

			SN54LS221		SN74LS221		UNIT
			MIN	MAX	MIN	MAX	
t_w	Pulse duration	A or B	50		50		ns
		$\overline{CLR}$	40		40		
t_{su}	Setup time, inactive state¶	$\overline{CLR}$	15		15		ns
R_{ext}	External timing resistance		1.4*	70*	1.4	100	kΩ
C_{ext}	External timing capacitance		0*	1000*	0	1000	μF
	Output duty cycle	R_T = 2 kΩ		50%		50%	
		R_T = MAX R_{ext}		90%		90%	

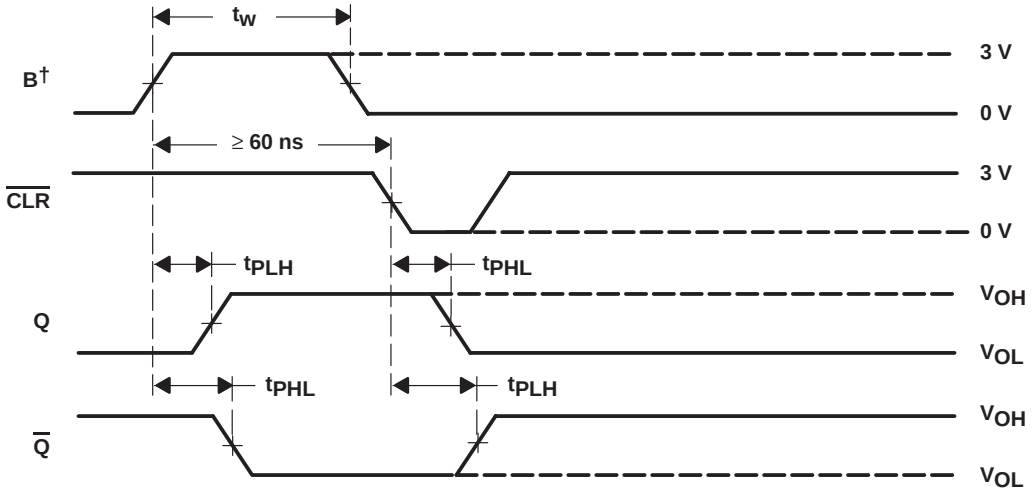
∗ On products compliant to MIL-PRF-38535, this parameter is not production tested.
¶ Inactive-state setup time also is referred to as recovery time.

switching characteristics V_{CC} = 5 V, R_L = 2 kΩ, T_A = 25°C (see Figures 1 and 2)

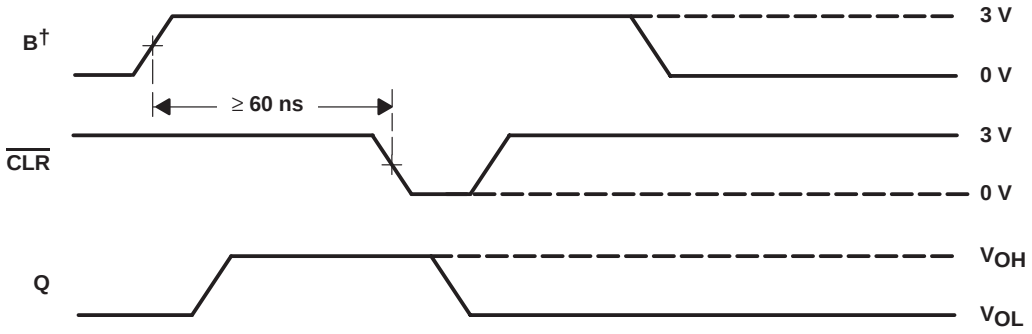
PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	SN54LS221			SN74LS221			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH}	A	Q	C_{ext} = 80 pF, R_{ext} = 2 kΩ		45	70		45	70	ns
	B				35	55		35	55	
t_{PHL}	A	$\overline{Q}$			50	80		50	80	
	B				40	65		40	65	
t_{PHL}	$\overline{CLR}$	Q	C_{ext} = 80 pF, R_{ext} = 2 kΩ		35	55		35	55	ns
t_{PLH}		$\overline{Q}$			44	65		44	65	
t_w	A or B	Q or $\overline{Q}$	C_{ext} = 80 pF, R_{ext} = 2 kΩ	70	120	150	70	120	150	ns
			C_{ext} = 0, R_{ext} = 2 kΩ	20	47	70	20	47	70	
			C_{ext} = 100 pF, R_{ext} = 10 kΩ	670	740	810	670	740	810	
			C_{ext} = 1 µF, R_{ext} = 10 kΩ	6*	6.9	7.5*	6	6.9	7.5	ms

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

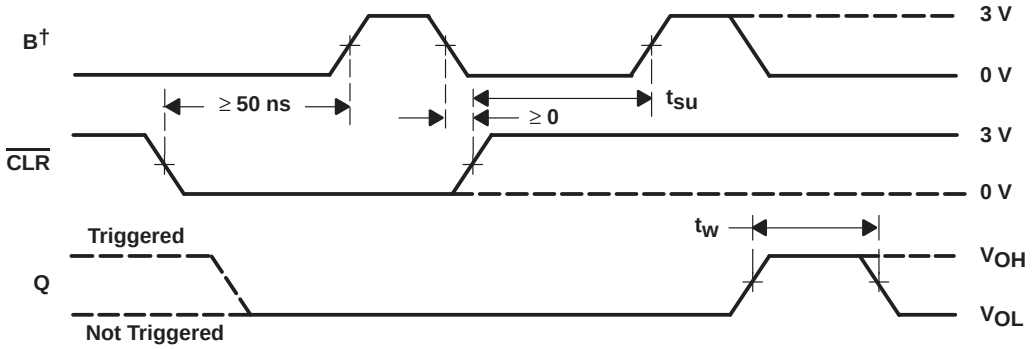
PARAMETER MEASUREMENT INFORMATION



CONDITION 1: TRIGGER FROM B, THEN $\overline{CLR}$



CONDITION 2: TRIGGER FROM B, THEN $\overline{CLR}$

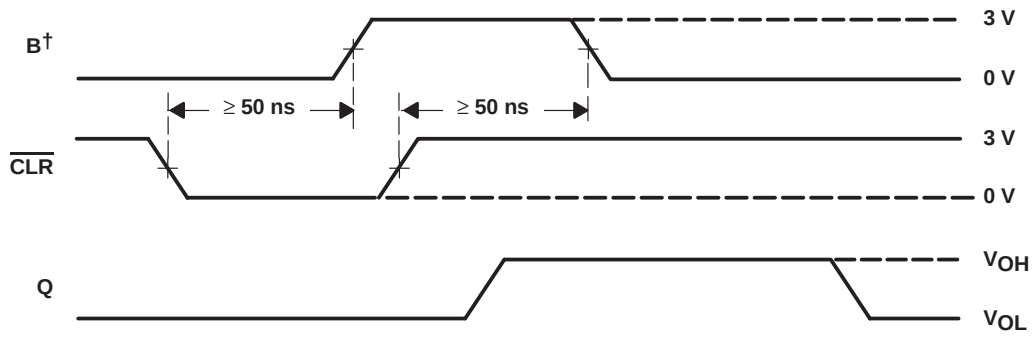


CONDITION 3: $\overline{CLR}$ OVERRIDING B, THEN TRIGGER FROM B

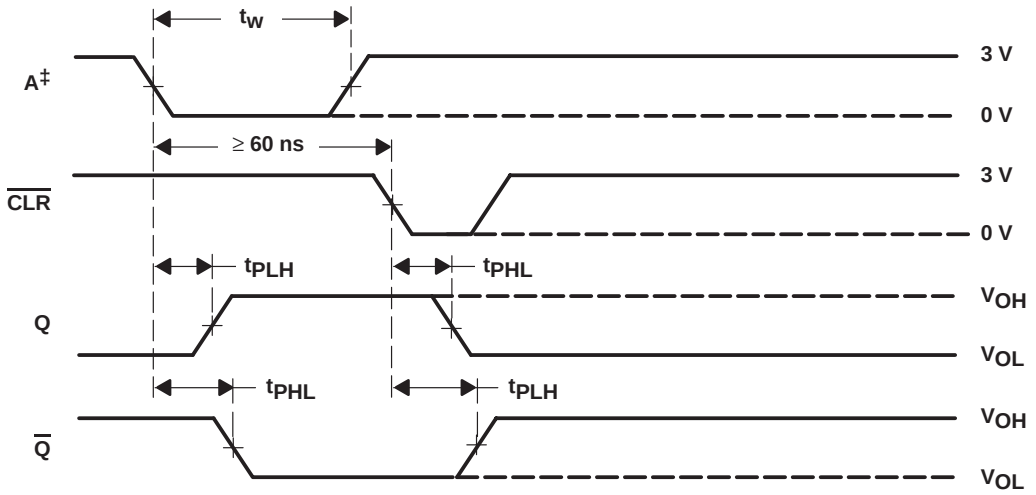
† A is low.

Figure 1. Switching Characteristics

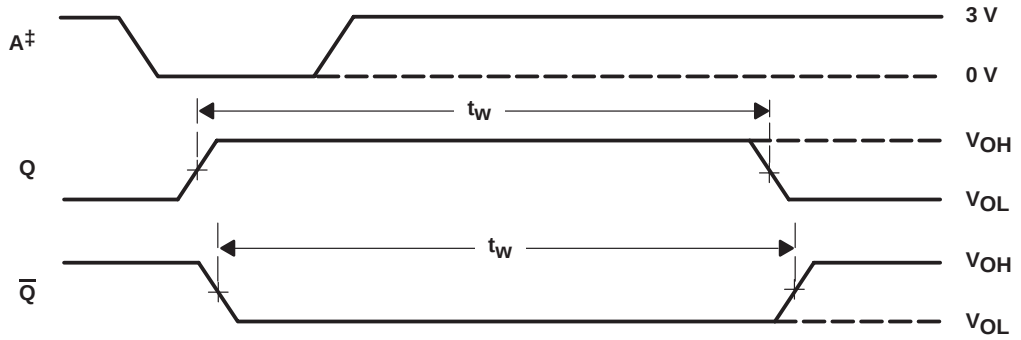
PARAMETER MEASUREMENT INFORMATION



CONDITION 4: TRIGGERING FROM POSITIVE TRANSITION OF $\overline{CLR}$



CONDITION 5: TRIGGER FROM A, THEN $\overline{CLR}$



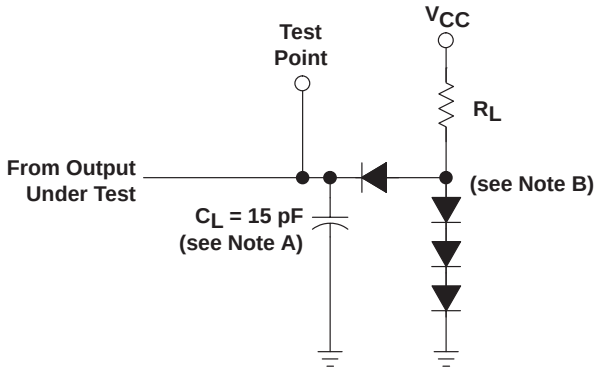
CONDITION 6: TRIGGER FROM A

† A is low.
‡ B and $\overline{CLR}$ are high.

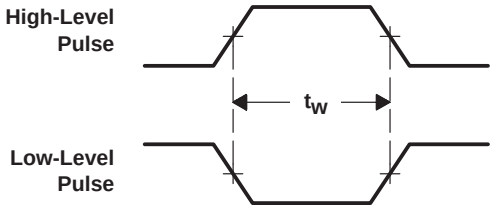
NOTES: A. Input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, $Z_O \approx 50\Omega$; for SN54/74221, $t_r \le 7$ ns, $t_f \le 7$ ns, for SN54/74LS221, $t_r \le 15$ ns, $t_f \le 6$ ns.
B. All measurements are made between the 1.5-V points of the indicated transitions for the SN54/74221 or between the 1.3-V points for the SN54/74LS221.

Figure 1. Switching Characteristics (Continued)

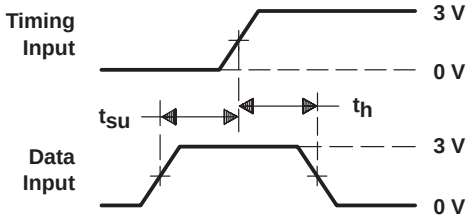
PARAMETER MEASUREMENT INFORMATION



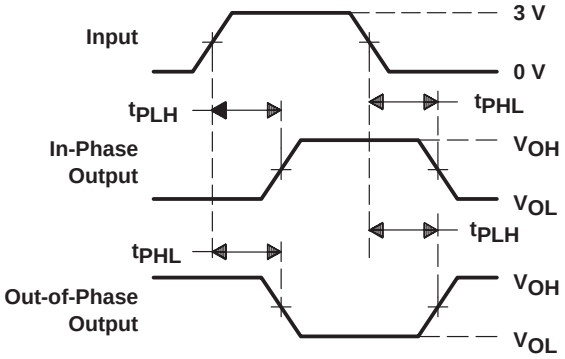
LOAD CIRCUIT FOR
BI-STATE
TOTEM-POLE OUTPUTS



VOLTAGE WAVEFORMS
PULSE DURATIONS



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

NOTES: A. C_L includes probe and jig capacitance.
B. All diodes are 1N3064 or equivalent.
C. In the examples above, the phase relationships between inputs and outputs have been chosen arbitrarily.
D. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, $Z_O \approx 50\ \Omega$ and, for SN54/74221, $t_r \le 7$ ns, $t_f \le 7$ ns, for SN54/74LS221, $t_r \le 15$ ns, $t_f \le 6$ ns.
E. All measurements are made between the 1.5-V points of the indicated transitions for the SN54/74221 or between the 1.3-V points for the SN54/74LS221.

Figure 2. Load Circuits and Voltage Waveforms

TYPICAL CHARACTERISTICS (SN54/74221 ONLY)†

DISTRIBUTION OF UNITS FOR OUTPUT PULSE

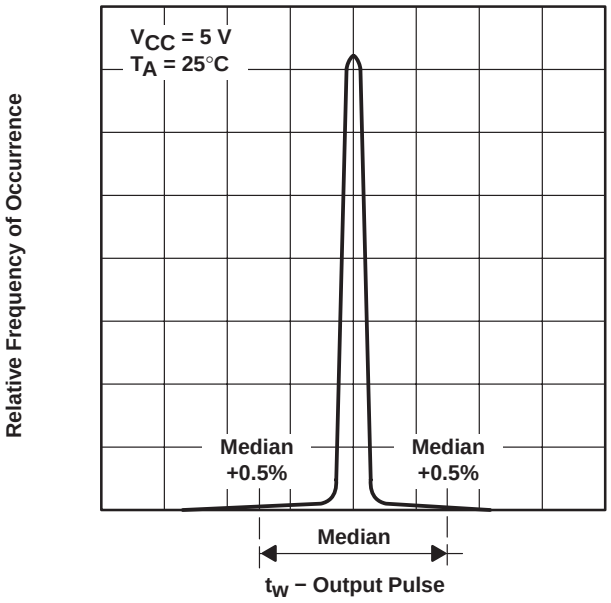


Figure 3

VARIATION IN OUTPUT PULSE vs SUPPLY VOLTAGE

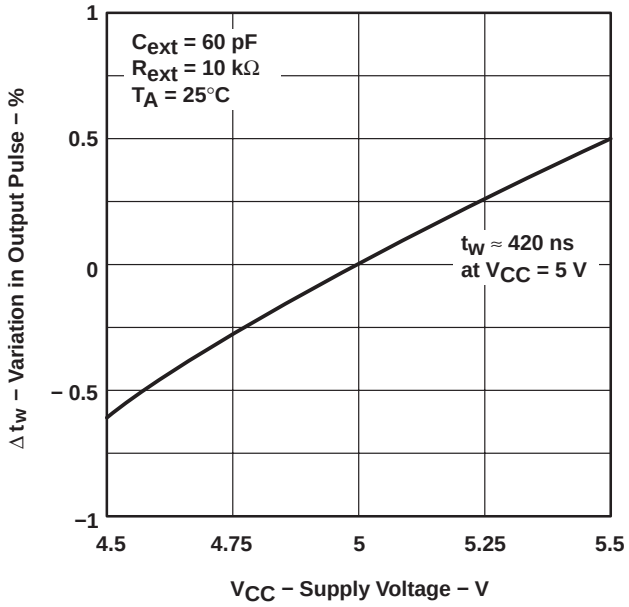


Figure 4

VARIATION IN OUTPUT PULSE vs FREE-AIR TEMPERATURE

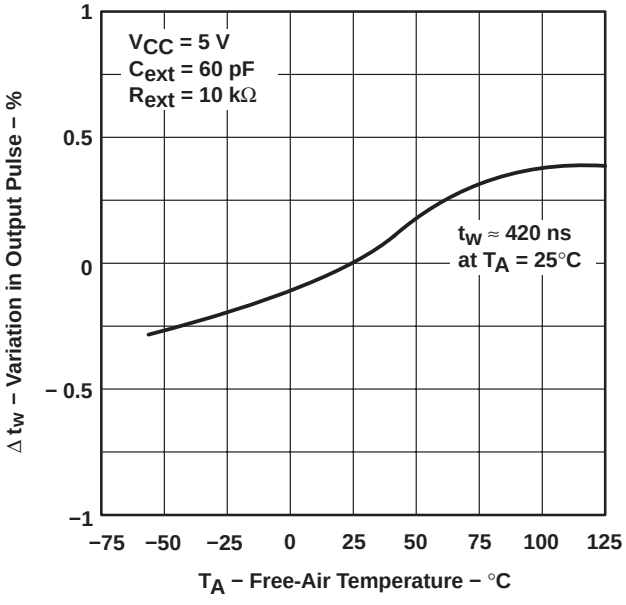


Figure 5

OUTPUT PULSE vs TIMING RESISTOR VALUE

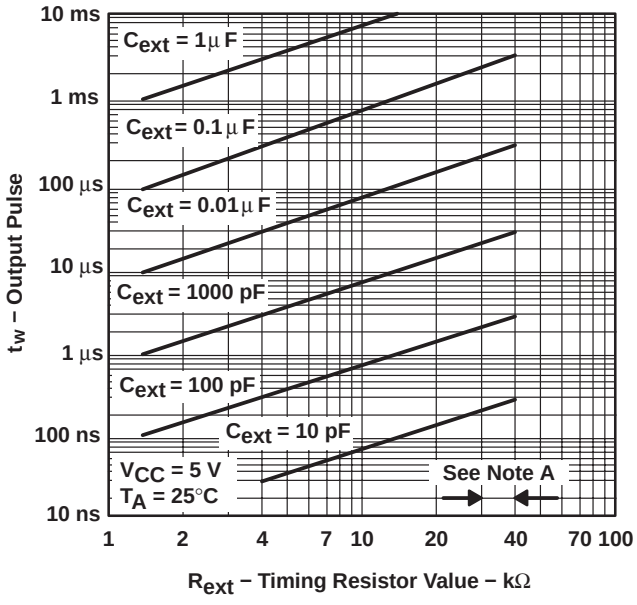


Figure 6

† Data for temperatures below 0°C and above 70°C, and for supply voltages below 4.75 V and above 5.25 V are applicable for the SN54221 only.
NOTE A: These values of resistance exceed the maximum recommended for use over the full military temperature range of the SN54221.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
5962-8771101EA	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
76042012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
7604201EA	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
7604201FA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type
JM38510/31402B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
JM38510/31402BEA	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
JM38510/31402BFA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type
SN54221J	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
SN54LS221J	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
SN74221N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74221NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS221D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS221DBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS221DBRE4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS221DBRG4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS221DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS221DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS221DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS221DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS221DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS221N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS221N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS221NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS221NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS221NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS221NSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54221J	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54LS221FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54LS221J	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54LS221W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type

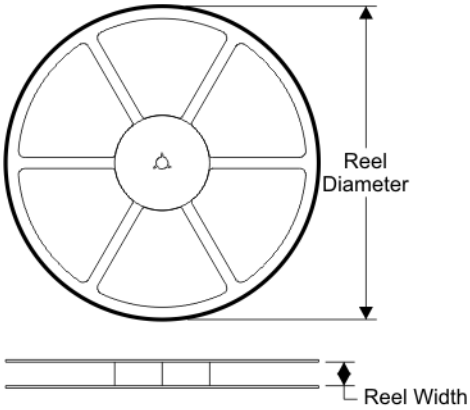
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers,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

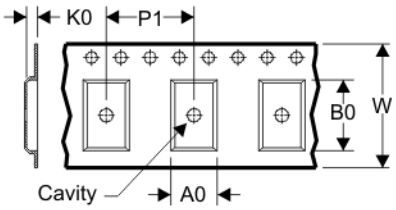
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL BOX INFORMATION

REEL DIMENSIONS

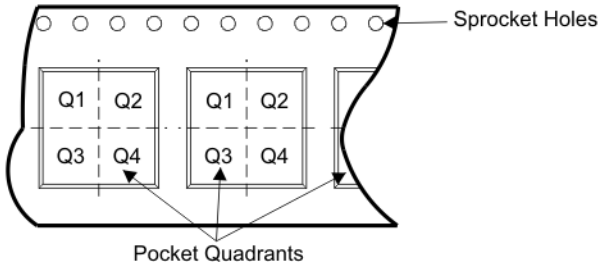


TAPE DIMENSIONS



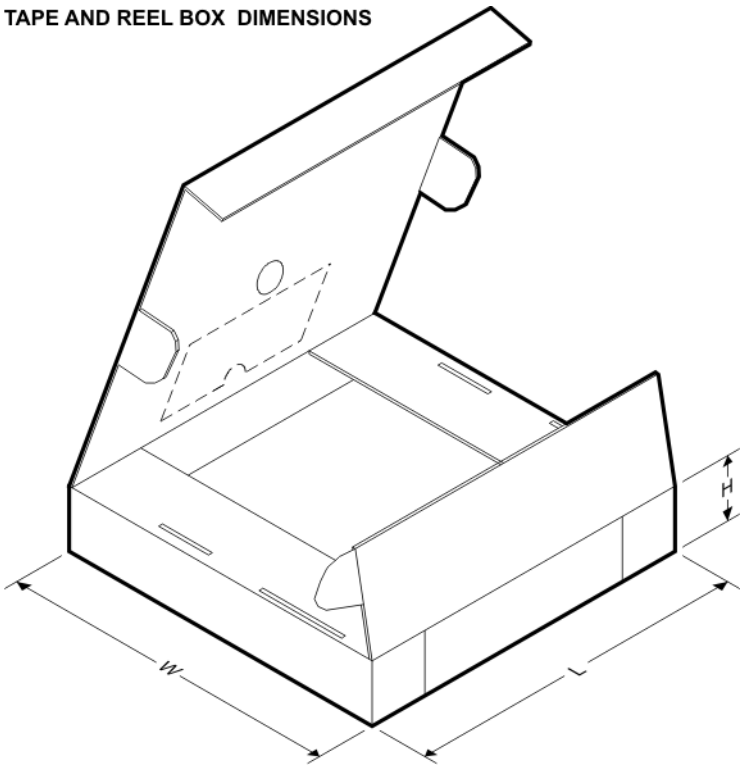
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Device	Package	Pins	Site	Reel Diameter (mm)	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LS221DBR	DB	16	SITE 41	330	16	8.2	6.6	2.5	12	16	Q1
SN74LS221DR	D	16	SITE 27	330	16	6.5	10.3	2.1	8	16	Q1
SN74LS221NSR	NS	16	SITE 41	330	16	8.2	10.5	2.5	12	16	Q1

TAPE AND REEL BOX DIMENSIONS

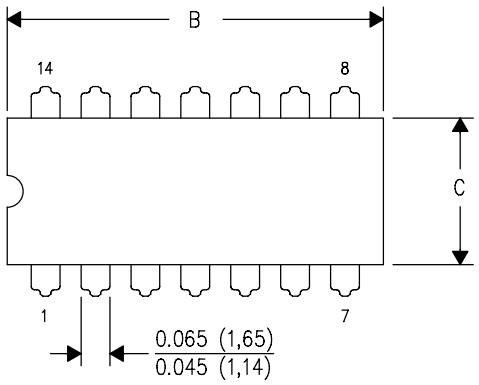


Device	Package	Pins	Site	Length (mm)	Width (mm)	Height (mm)
SN74LS221DBR	DB	16	SITE 41	346.0	346.0	33.0
SN74LS221DR	D	16	SITE 27	342.9	336.6	28.58
SN74LS221NSR	NS	16	SITE 41	346.0	346.0	33.0

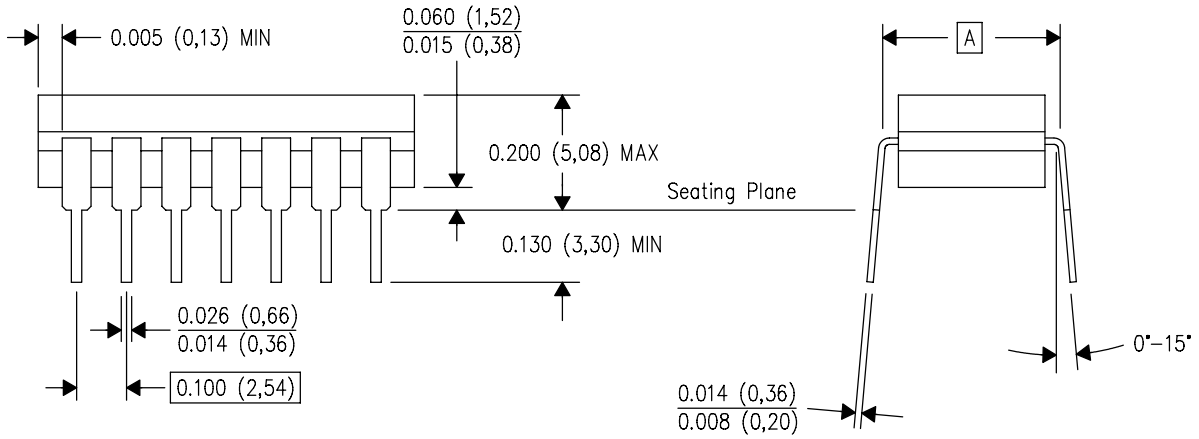
J (R–GDIP–T**)

14 LEADS SHOWN

CERAMIC DUAL IN–LINE PACKAGE



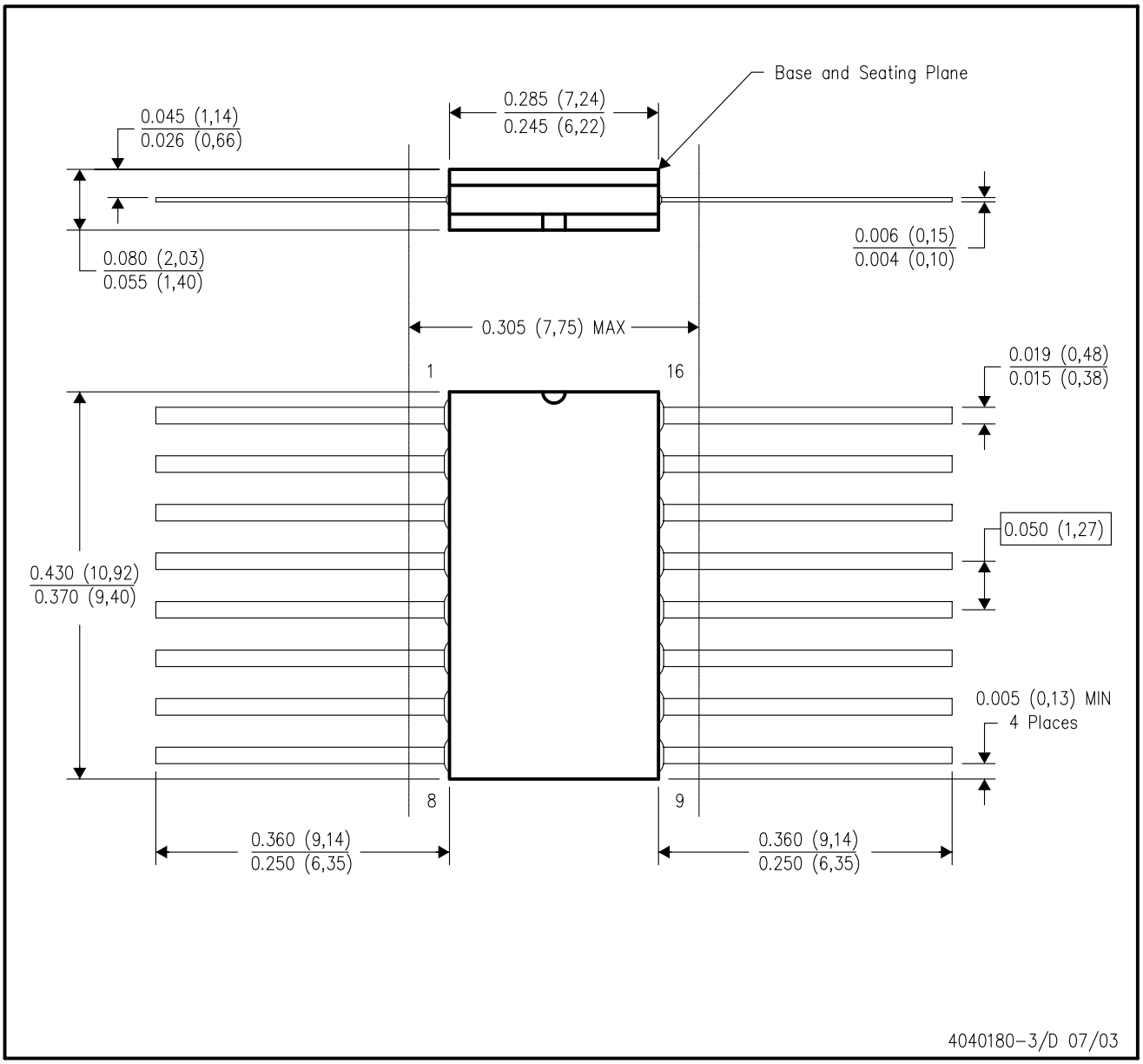
DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



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.

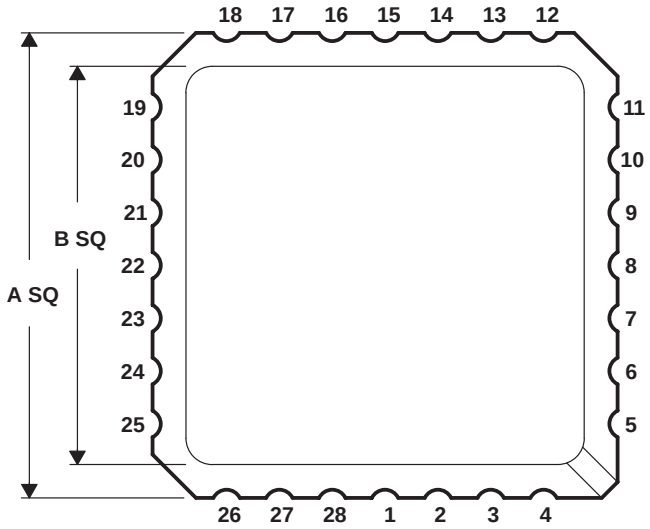
W (R–GDFP–F16) CERAMIC DUAL FLATPACK



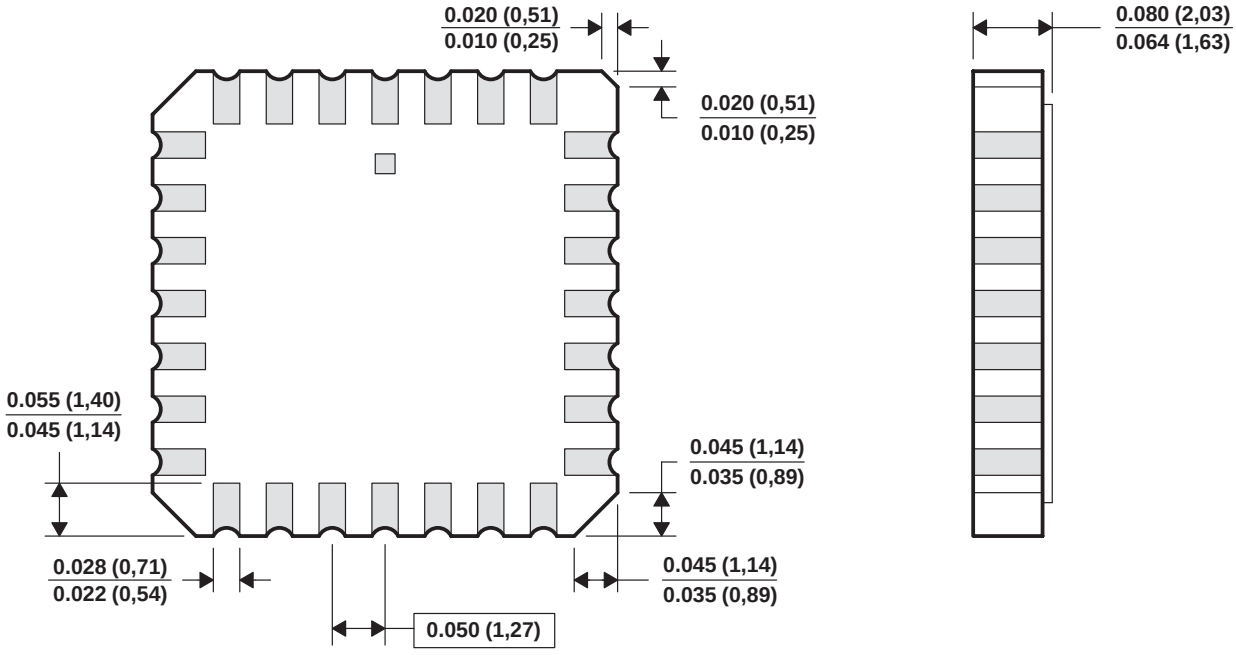
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only.
E. Falls within MIL STD 1835 GDFP1–F16 and JEDEC MO–092AC

FK (S-CQCC-N)** **LEADLESS CERAMIC CHIP CARRIER**

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.739 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



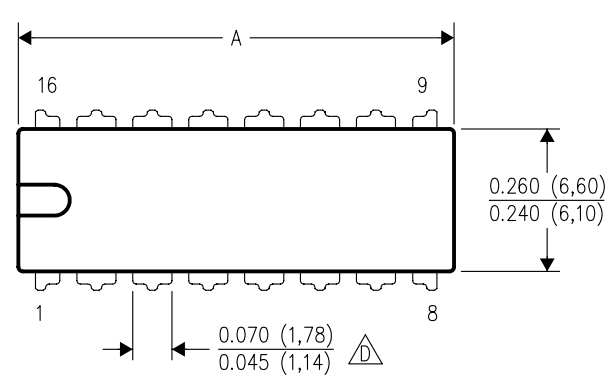
4040140/D 10/96

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MS-004

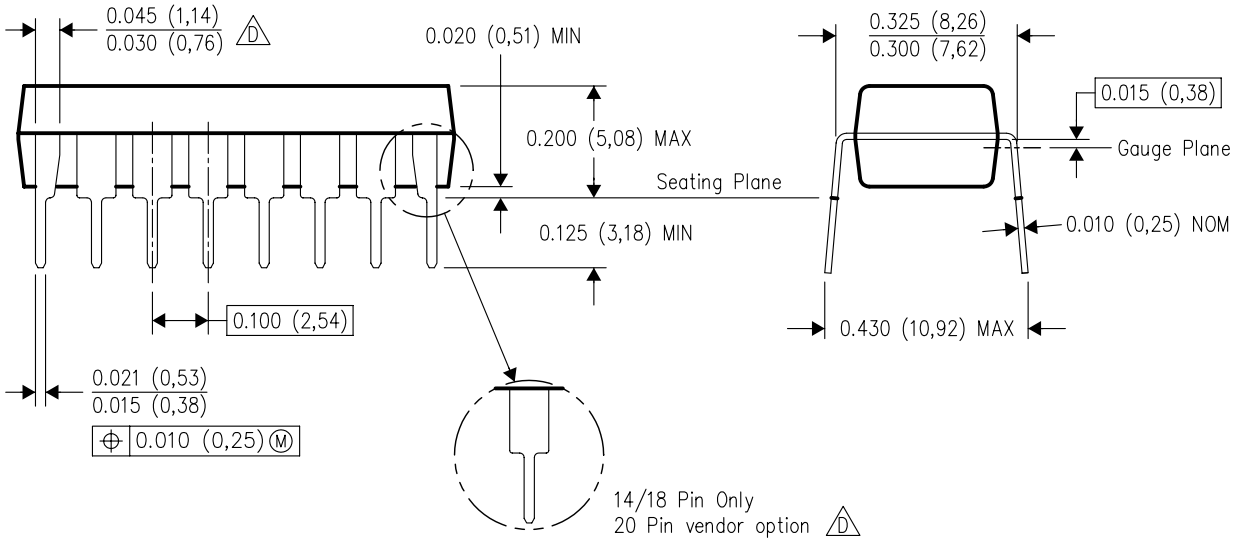
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



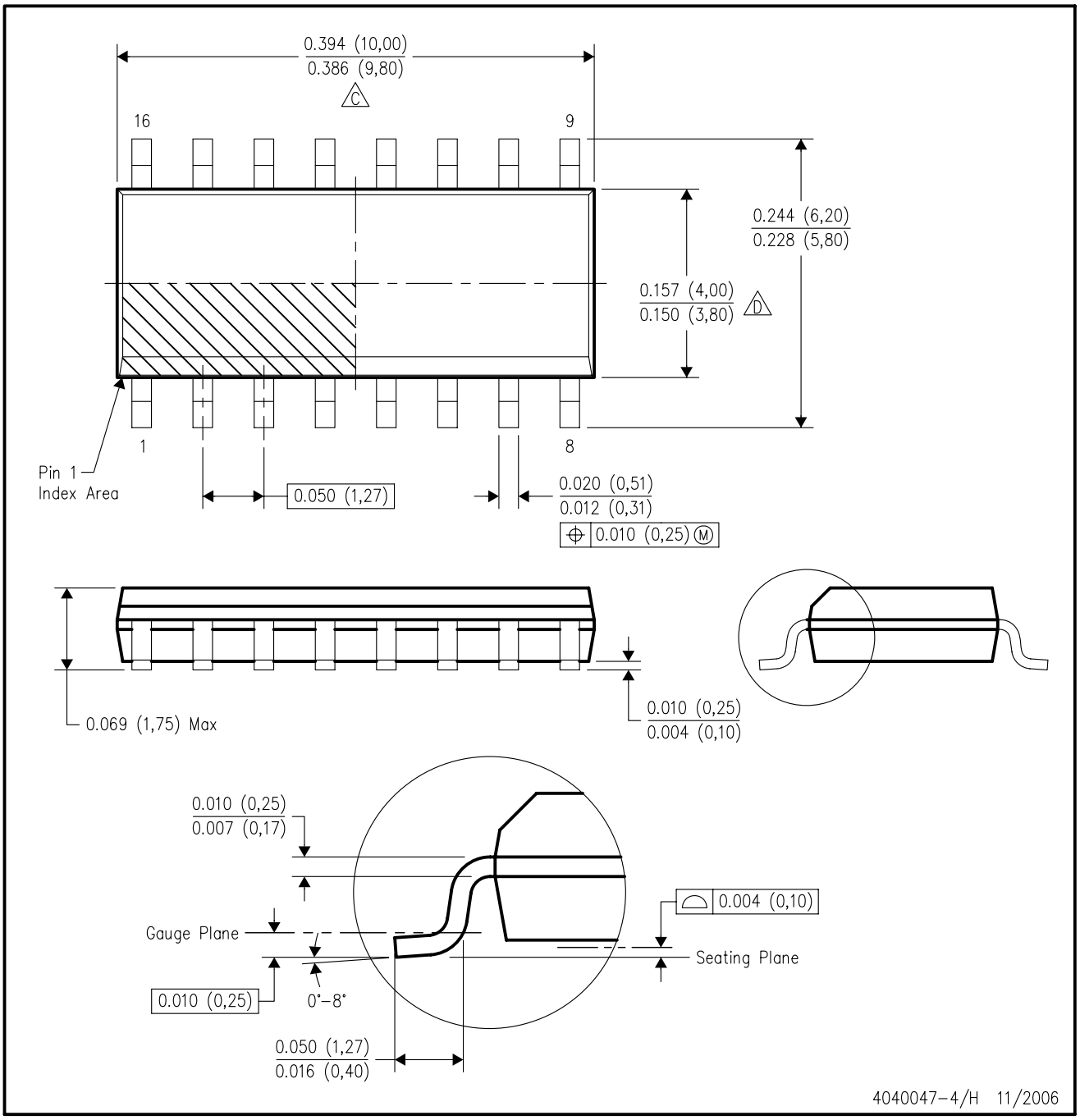
DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



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.

D (R–PDSO–G16) PLASTIC SMALL–OUTLINE PACKAGE

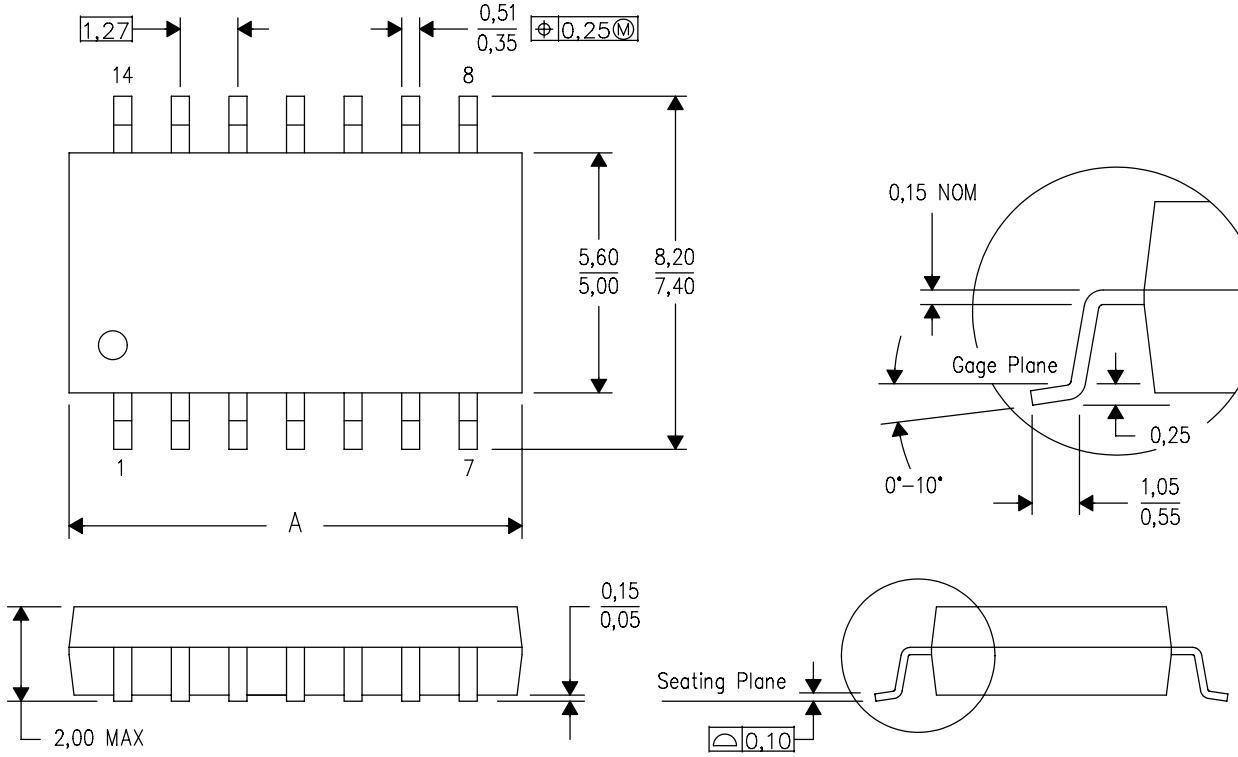


NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
E. Reference JEDEC MS–012 variation AC.

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

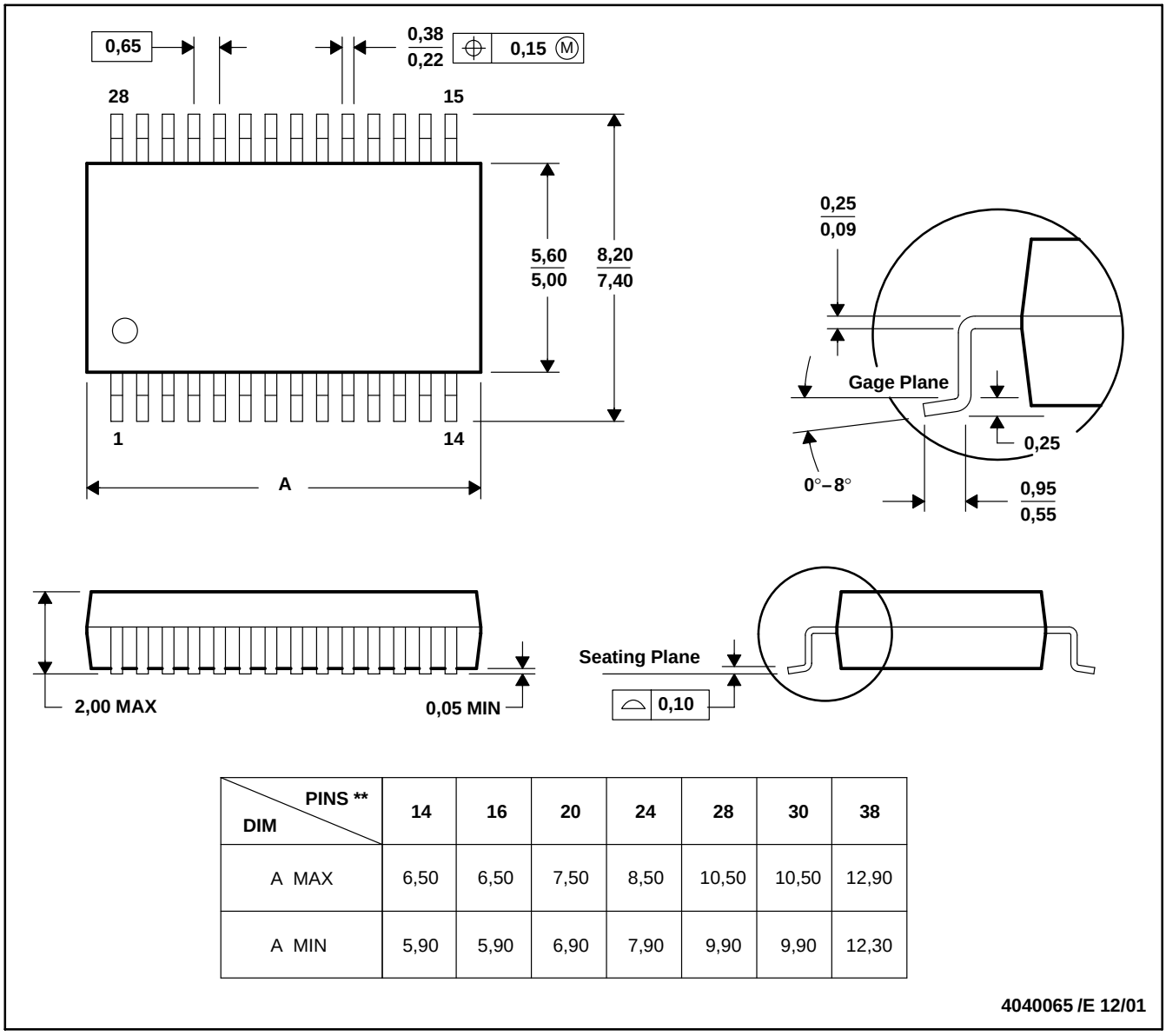
4040062/C 03/03

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.

MSSO002E – JANUARY 1995 – REVISED DECEMBER 2001

DB (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

28 PINS SHOWN



DIM \ PINS **	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 /E 12/01

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-150

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