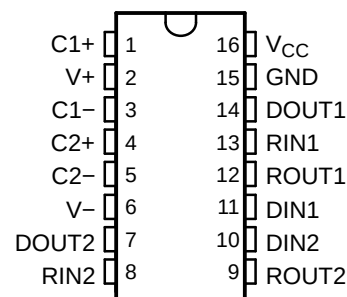


FEATURES

- Operate With 3-V to 5.5-V V_{CC} Supply
- Operate up to 1 Mbit/s
- Low Supply Current . . . 300 μ A Typ
- External Capacitors . . . $4 \times 0.1 \mu$ F
- Accept 5-V Logic Input With 3.3-V Supply
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection for RS-232 Pins
 - ± 15 -kV Human-Body Model (HBM)
 - ± 15 -kV IEC 61000-4-2 Air-Gap Discharge
 - ± 8 -kV IEC 61000-4-2 Contact Discharge

D, DB, DW, OR PW PACKAGE
(TOP VIEW)



APPLICATIONS

- Battery-Powered Systems
- PDAs
- Notebooks
- Laptops
- Palmtop PCs
- Hand-Held Equipment

DESCRIPTION/ORDERING INFORMATION

The SN65C3232E and SN75C3232E consist of two line drivers, two line receivers, and a dual charge-pump circuit with ± 15 -kV ESD protection pin to pin (serial-port connection pins, including GND). These devices provide the electrical interface between an asynchronous communication controller and the serial-port connector. The charge pump and four small external capacitors allow operation from a single 3-V to 5.5-V supply. The devices operate at data signaling rates up to 1 Mbit/s and a driver output slew rate of 14 V/ μ s to 150 V/ μ s.

ORDERING INFORMATION

T_A	PACKAGE ⁽¹⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SOIC – D	Tube of 40	SN65C3232ED	65C3232
		Reel of 2500	SN65C3232EDR	65C3232
	SOIC – DW	Tube of 40	SN65C3232EDW	
		Reel of 2000	SN65C3232EDWR	65C3232
	SSOP – DB	Reel of 2000	SN65C3232EDBR	CB3232
0°C to 70°C	TSSOP – PW	Tube of 90	SN65C3232EPW	75C3232
		Reel of 2000	SN65C3232EPWR	
	SOIC – D	Tube of 40	SN75C3232ED	75C3232
		Reel of 2500	SN75C3232EDR	
	SOIC – DW	Tube of 40	SN75C3232EDW	75C3232
		Reel of 2000	SN75C3232EDWR	
	SSOP – DB	Reel of 2000	SN75C3232EDBR	75C3232
	TSSOP – PW	Tube of 90	SN75C3232EPW	CA3232
		Reel of 2000	SN75C3232EPWR	

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



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.

SN65C3232E, SN75C3232E
3-V TO 5.5-V TWO-CHANNEL RS-232 1-MBIT/S LINE DRIVERS/RECEIVERS
WITH ± 15 -kV IEC ESD PROTECTION

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Table 1. 1-Mbit/s RS-232 Parts

TEMPERATURE RANGE	PART NO.	NO. OF DRIVERS	NO. OF RECEIVERS	ESD	SUPPLY V_{CC} (V)	FEATURE	PIN/PACKAGE
-40°C to 85°C	SN65C3221E	1	1	± 15 -kV Air-Gap, ± 8 -kV Contact, ± 15 -kV HBM	3.3 or 5	Auto powerdown	16-pin SOIC, SSOP, TSSOP
	SN65C3232E	2	2	± 15 -kV Air-Gap, ± 8 -kV Contact, ± 15 -kV HBM	3.3 or 5	Low pin count	16-pin SOIC, SSOP, TSSOP
	MAX3227I	1	1	± 8 -kV Air-Gap, ± 8 -kV Contact, ± 15 -kV HBM	3.3 or 5	Auto powerdown plus, ready signal	16-pin SSOP
	SN65C3221	1	1	± 15 -kV HBM	3.3 or 5	Auto powerdown	16-pin SOIC, SSOP, TSSOP
	SN65C3223	2	2	± 15 -kV HBM	3.3 or 5	Auto powerdown, enable signal	20-pin SOIC, SSOP, TSSOP
	SN65C3222	2	2	± 15 -kV HBM	3.3 or 5	Enable, powerdown signal	20-pin SOIC, SSOP, TSSOP
	SN65C3232	2	2	± 15 -kV HBM	3.3 or 5	Low pin count	16-pin SOIC, SSOP, TSSOP
	SN65C3238	5	3	± 15 -kV HBM	3.3 or 5	Auto powerdown plus	28-pin SOIC, SSOP, TSSOP
	SN65C3243	3	5	± 15 -kV HBM	3.3 or 5	Auto powerdown	28-pin SOIC, SSOP, TSSOP
0°C to 70°C	SN75C3221E	1	1	± 15 -kV Air-Gap, ± 8 -kV Contact, ± 15 -kV HBM	3.3 or 5	Auto powerdown	16-pin SOIC, SSOP, TSSOP
	SN75C3232E	2	2	± 15 -kV Air-Gap, ± 8 -kV Contact, ± 15 -kV HBM	3.3 or 5	Low pin count	16-pin SOIC, SSOP, TSSOP
	MAX3227C	1	1	± 8 -kV Air-Gap, ± 8 -kV Contact, ± 15 -kV HBM	3.3 or 5	Auto powerdown plus, ready signal	16-pin SSOP
	SN75C3221	1	1	± 15 -kV HBM	3.3 or 5	Auto powerdown	16-pin SOIC, SSOP, TSSOP
	SN75C3223	2	2	± 15 -kV HBM	3.5 or 5	Auto powerdown, enable signal	20-pin SOIC, SSOP, TSSOP
	SN75C3222	2	2	± 15 -kV HBM	3.3 or 5	Enable, powerdown signal	20-pin SOIC, SSOP, TSSOP
	SN75C3232	2	2	± 15 -kV HBM	3.3 or 5	Low pin count	16-pin SOIC, SSOP, TSSOP
	SN75C3238	5	3	± 15 -kV HBM	3.3 or 5	Auto powerdown plus	28-pin SOIC, SSOP, TSSOP
	SN75C3243	3	5	± 15 -kV HBM	3.3 or 5	Auto powerdown	28-pin SOIC, SSOP, TSSOP

FUNCTION TABLES

EACH DRIVER⁽¹⁾

INPUT DIN	OUTPUT DOUT
L	H
H	L

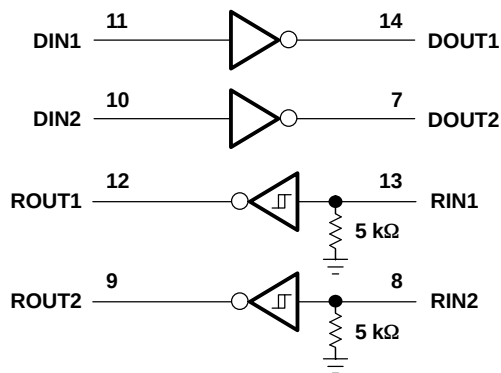
(1) H = high level, L = low level

EACH RECEIVER⁽¹⁾

INPUT RIN	OUTPUT ROUT
L	H
H	L
Open	H

(1) H = high level, L = low level,
Open = input disconnected or
connected driver off

LOGIC DIAGRAM (POSITIVE LOGIC)



SN65C3232E, SN75C3232E

3-V TO 5.5-V TWO-CHANNEL RS-232 1-MBIT/S LINE DRIVERS/RECEIVERS

WITH ± 15 -kV IEC ESD PROTECTION

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Absolute Maximum Ratings⁽¹⁾

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage range ⁽²⁾		–0.3	6	V
V_+	Positive output supply voltage range ⁽²⁾		–0.3	7	V
V_-	Negative output supply voltage range ⁽²⁾		0.3	–7	V
$V_+ - V_-$	Supply voltage difference ⁽²⁾			13	V
V_I	Input voltage range	Drivers	–0.3	6	V
		Receivers	–25	25	
V_O	Output voltage range	Drivers	–13.2	13.2	V
		Receivers	–0.3	$V_{CC} + 0.3$	
θ_{JA}	Package thermal impedance ⁽³⁾⁽⁴⁾	D package		82	°C/W
		DB package		46	
		DW package		57	
		PW package		108	
T_J	Operating virtual junction temperature			150	°C
T_{stg}	Storage temperature range		–65	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.
- All voltages are with respect to network GND.
- Maximum power dissipation is a function of $T_J(\text{max})$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
- The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions⁽¹⁾

			MIN	NOM	MAX	UNIT
Supply voltage		$V_{CC} = 3.3 \text{ V}$	3	3.3	3.6	V
		$V_{CC} = 5 \text{ V}$	4.5	5	5.5	
V_{IH}	Driver high-level input voltage	DIN	$V_{CC} = 3.3 \text{ V}$		2	V
			$V_{CC} = 5 \text{ V}$		2.4	
V_{IL}	Driver low-level input voltage	DIN			0.8	V
V_I	Driver input voltage	DIN	0		5.5	V
	Receiver input voltage		–25		25	
T_A	Operating free-air temperature	SN65C3232E	–40		85	°C
		SN75C3232E	0		70	

- Test conditions are C1–C4 = 0.1 μF at $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$; C1 = 0.047 μF , C2–C4 = 0.33 μF at $V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$ (see [Figure 4](#)).

Electrical Characteristics⁽¹⁾

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
I_{CC}	Supply current	No load, $V_{CC} = 3.3 \text{ V}$ or 5 V	0.3	1	mA

- Test conditions are C1–C4 = 0.1 μF at $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$; C1 = 0.047 μF , C2–C4 = 0.33 μF at $V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$ (see [Figure 4](#)).
- All typical values are at $V_{CC} = 3.3 \text{ V}$ or $V_{CC} = 5 \text{ V}$, and $T_A = 25^\circ\text{C}$.

DRIVER SECTION

Electrical Characteristics⁽¹⁾

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
V _{OH} High-level output voltage	DOUT at R _L = 3 k Ω to GND, DIN = GND	5	5.5		V
V _{OL} Low-level output voltage	DOUT at R _L = 3 k Ω to GND, DIN = V _{CC}	–5	–5.4		V
I _{IH} High-level input current	V _I = V _{CC}		± 0.01	± 1	μ A
I _{IL} Low-level input current	V _I at GND		± 0.01	± 1	μ A
I _{OS} ⁽³⁾ Short-circuit output current	V _{CC} = 3.6 V, V _O = 0 V		± 35	± 60	mA
	V _{CC} = 5.5 V, V _O = 0 V		± 35	± 90	
r _o Output resistance	V _{CC} , V ₊ , and V _– = 0 V, V _O = ± 2 V	300	10M		Ω

(1) Test conditions are C1–C4 = 0.1 μ F at V_{CC} = 3.3 V $\pm$ 0.3 V; C1 = 0.047 μ F, C2–C4 = 0.33 μ F at V_{CC} = 5 V $\pm$ 0.5 V (see [Figure 4](#)).

(2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

(3) Short-circuit durations should be controlled to prevent exceeding the device absolute power dissipation ratings, and not more than one output should be shorted at a time.

Switching Characteristics⁽¹⁾

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
Maximum data rate (see Figure 1)	R _L = 3 k Ω , One DOUT switching		C _L = 250 pF, V _{CC} = 3 V to 4.5 V	1000	kbit/s
			C _L = 1000 pF, V _{CC} = 3.5 V to 5.5 V	1000	
t _{sk(p)} Pulse skew ⁽³⁾	C _L = 150 pF to 2500 pF, R _L = 3 k Ω to 7 k Ω , See Figure 2		300		ns
SR(tr) Slew rate, transition region (see Figure 1)	R _L = 3 k Ω to 7 k Ω , C _L = 150 pF to 1000 pF, V _{CC} = 3.3 V		14	150	V/ μ s

(1) Test conditions are C1–C4 = 0.1 μ F at V_{CC} = 3.3 V $\pm$ 0.3 V; C1 = 0.047 μ F, C2–C4 = 0.33 μ F at V_{CC} = 5 V $\pm$ 0.5 V (see [Figure 4](#)).

(2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

(3) Pulse skew is defined as |t_{PLH} – t_{PHL}| of each channel of the same device.

ESD Protection

TERMINAL		TEST CONDITIONS	TYP	UNIT
NAME	NO.			
DOUT	7, 14	HBM	± 15	kV
		IEC 61000-4-2 Air-Gap Discharge	± 15	
		IEC 61000-4-2 Contact Discharge	± 8	

SN65C3232E, SN75C3232E

3-V TO 5.5-V TWO-CHANNEL RS-232 1-MBIT/S LINE DRIVERS/RECEIVERS

WITH ± 15 -kV IEC ESD PROTECTION

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RECEIVER SECTION

Electrical Characteristics⁽¹⁾

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
V _{OH} High-level output voltage	I _{OH} = -1 mA	V _{CC} - 0.6	V _{CC} - 0.1		V
V _{OL} Low-level output voltage	I _{OL} = 1.6 mA			0.4	V
V _{IT+} Positive-going input threshold voltage	V _{CC} = 3.3 V		1.5	2.4	V
	V _{CC} = 5 V		1.8	2.4	
V _{IT-} Negative-going input threshold voltage	V _{CC} = 3.3 V	0.6	1.2		V
	V _{CC} = 5 V	0.8	1.5		
V _{hys} Input hysteresis (V _{IT+} - V _{IT-})			0.3		V
r _i Input resistance	V _I = ± 3 V to ± 25 V	3	5	7	k Ω

(1) Test conditions are C1–C4 = 0.1 μ F at V_{CC} = 3.3 V $\pm$ 0.3 V; C1 = 0.047 μ F, C2–C4 = 0.33 μ F at V_{CC} = 5 V $\pm$ 0.5 V (see [Figure 4](#)).

(2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

Switching Characteristics⁽¹⁾

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TYP ⁽²⁾	UNIT
t _{PLH} Propagation delay time, low- to high-level output	C _L = 150 pF	300	ns
t _{PHL} Propagation delay time, high- to low-level output		300	ns
t _{sk(p)} Pulse skew ⁽³⁾		300	ns

(1) Test conditions are C1–C4 = 0.1 μ F at V_{CC} = 3.3 V $\pm$ 0.3 V; C1 = 0.047 μ F, C2–C4 = 0.33 μ F at V_{CC} = 5 V $\pm$ 0.5 V (see [Figure 4](#)).

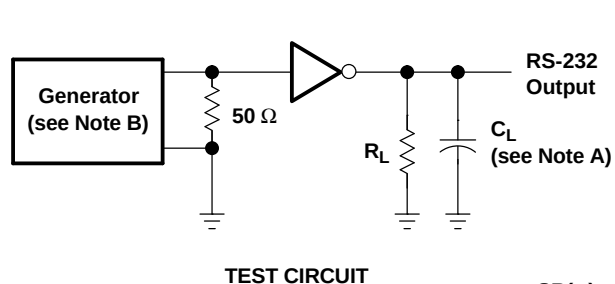
(2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

(3) Pulse skew is defined as |t_{PLH} - t_{PHL}| of each channel of the same device.

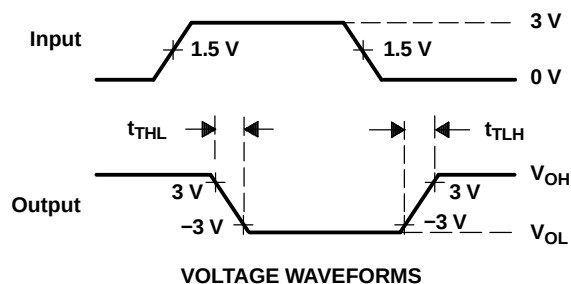
ESD Protection

TERMINAL		TEST CONDITIONS	TYP	UNIT
NAME	NO.			
RIN	8, 13	HBM	± 15	kV
		IEC 61000-4-2 Air-Gap Discharge	± 15	
		IEC 61000-4-2 Contact Discharge	± 8	

PARAMETER MEASUREMENT INFORMATION



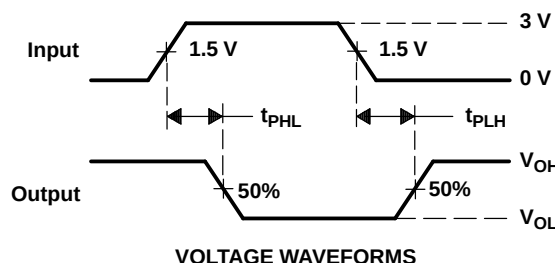
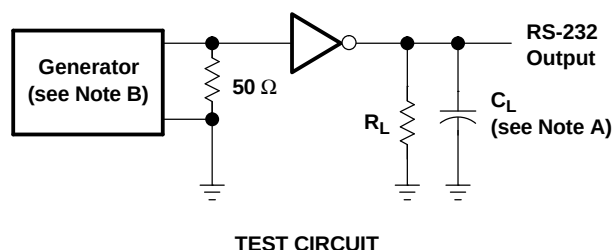
$$SR(tr) = \frac{6\text{ V}}{t_{THL} \text{ or } t_{TLH}}$$



NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: PRR = 250 kbit/s, $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.

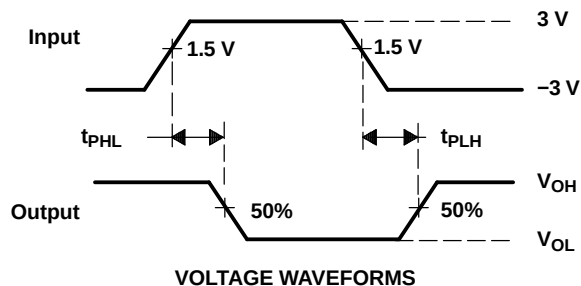
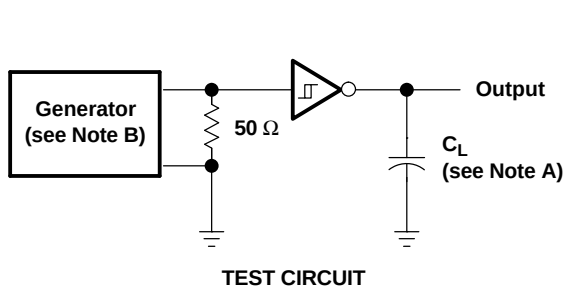
Figure 1. Driver Slew Rate



NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: PRR = 250 kbit/s, $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.

Figure 2. Driver Pulse Skew

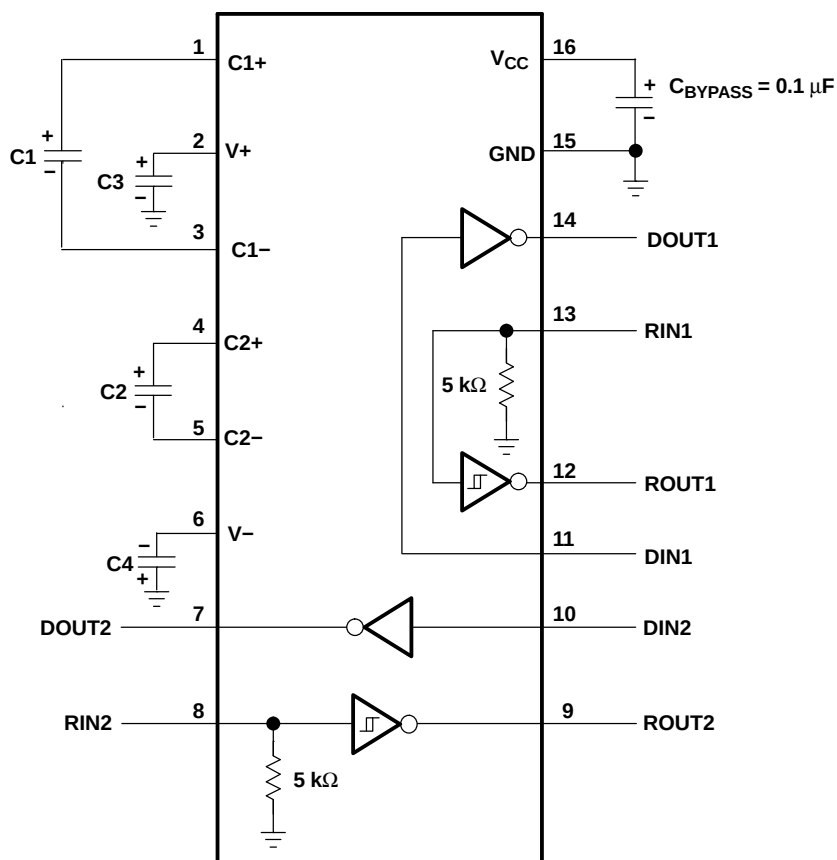


NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.

Figure 3. Receiver Propagation Delay Times

APPLICATION INFORMATION



V_{CC} vs CAPACITOR VALUES

V _{CC}	C1	C2, C3, C4
3.3 V $\pm$ 0.3 V	0.1 μ F	0.1 μ F
5 V $\pm$ 0.5 V	0.047 μ F	0.33 μ F
3 V to 5.5 V	0.1 μ F	0.47 μ F

A. C3 can be connected to V_{CC} or GND.

Figure 4. Typical Operating Circuit and Capacitor Values

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN65C3232ED	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65C3232EDB	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65C3232EDBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65C3232EDE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65C3232EDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65C3232EDRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65C3232EDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65C3232EDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65C3232EPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65C3232EPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65C3232EPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65C3232EPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75C3232ED	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75C3232EDB	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75C3232EDBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75C3232EDE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75C3232EDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75C3232EDRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75C3232EDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75C3232EDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75C3232EPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75C3232EPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75C3232EPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75C3232EPWRE4	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.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

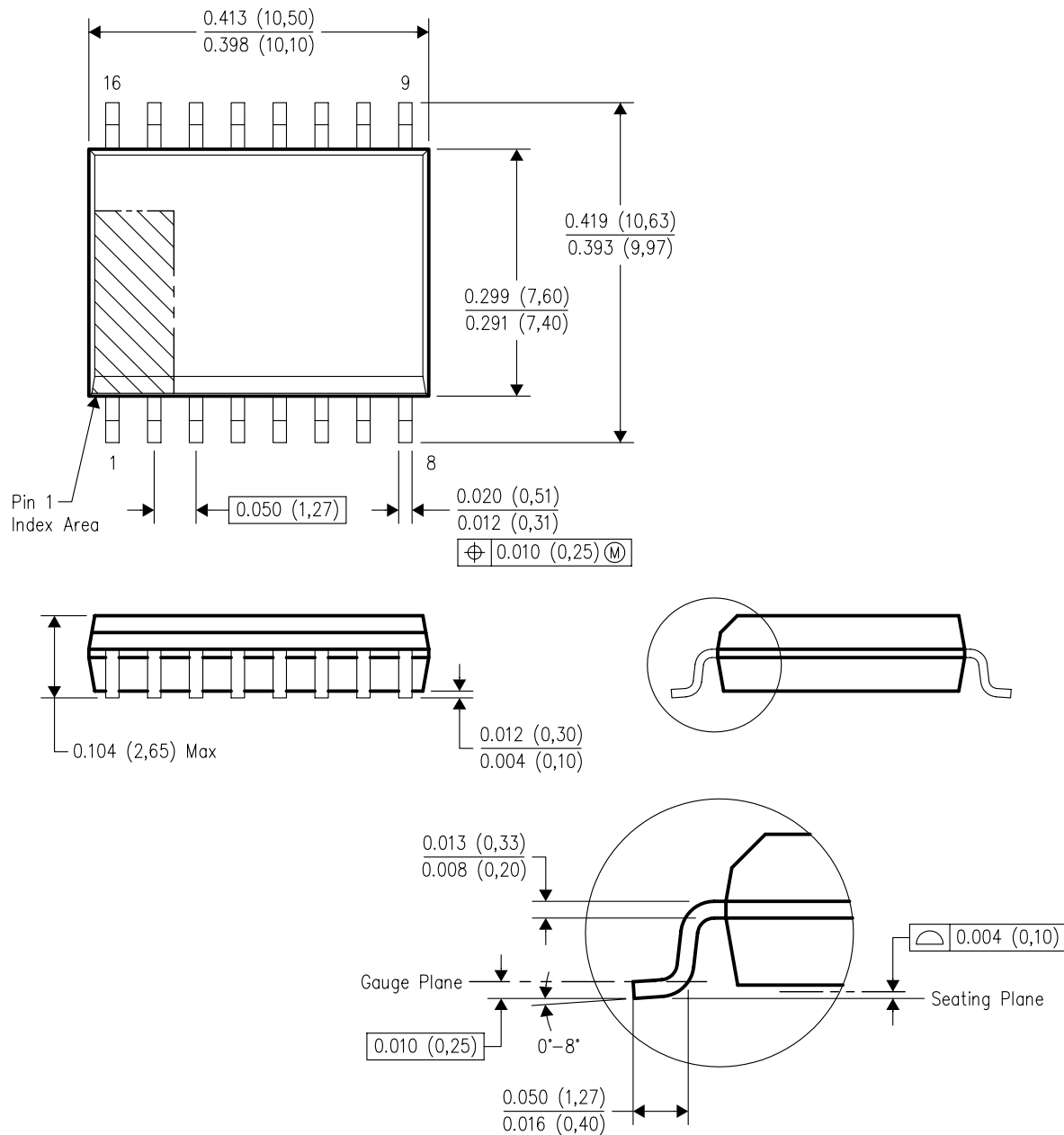
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

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.

DW (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



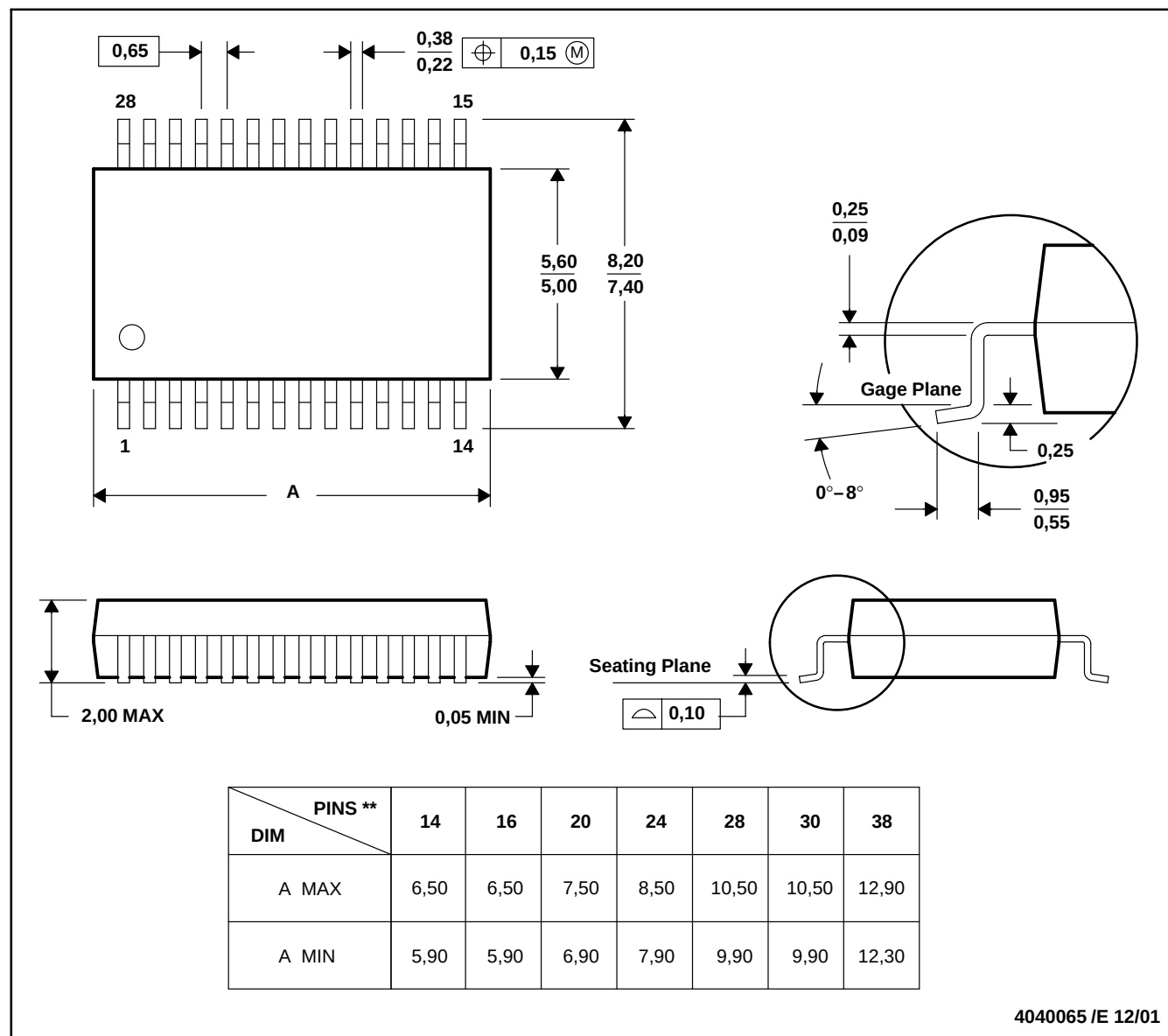
4040000-2/F 06/2004

- 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 AA.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN

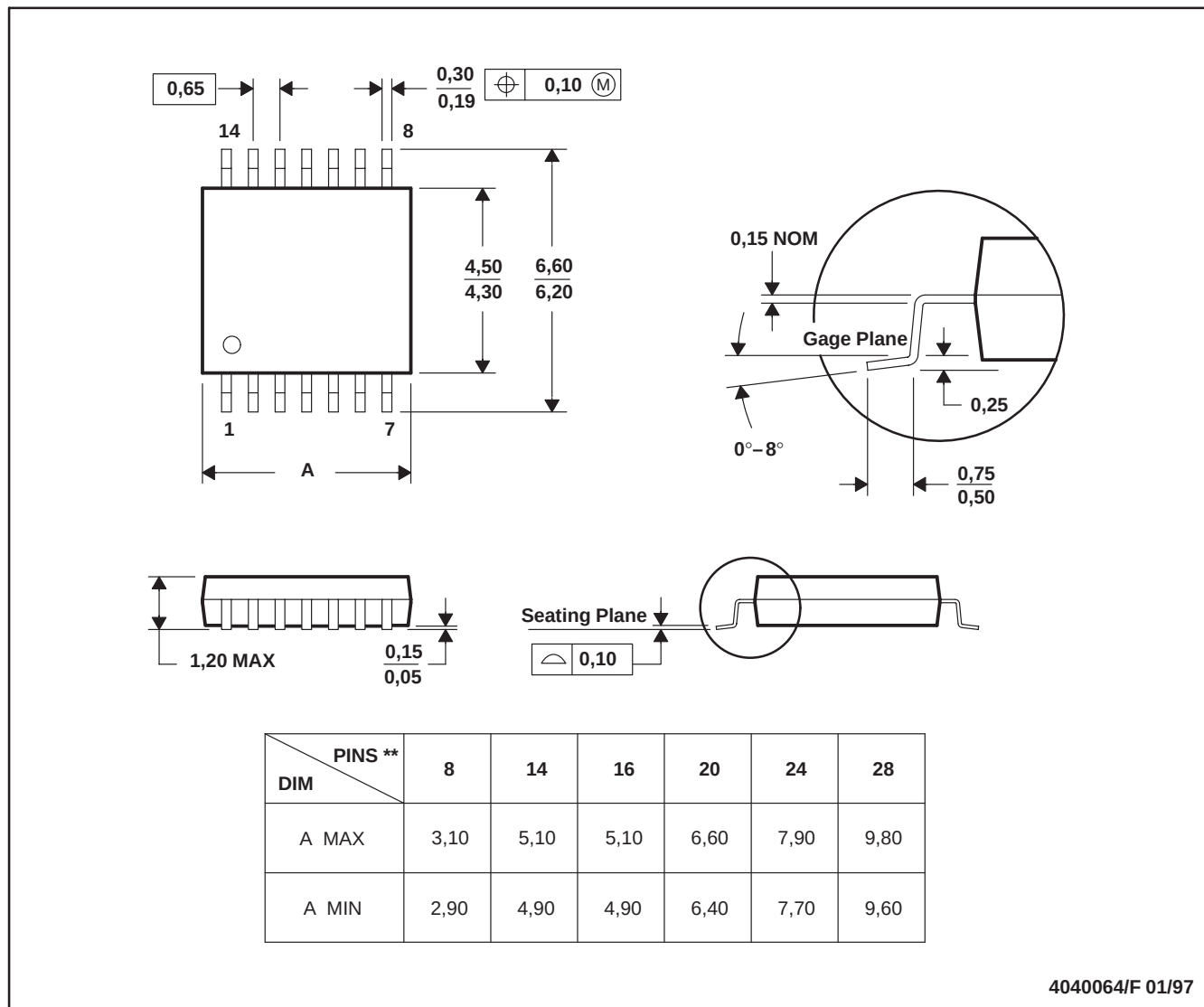


- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-150

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 - Falls within JEDEC MO-153

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