- **Single-Chip and Single-Supply Interface for IBM PC/AT™ Serial Port**
- **Meets or Exceeds the Requirements of TIA/EIA-232-F and ITU v.11 Standards**
- **Operates With 3.3-V or 5-V Supplies**
- **One Receiver Remains Active During Standby (Wake-up Mode)**
- **Designed to Operate at 128 kbit/s Over a 3-m Cable**
- **Low Standby Current . . . 5 µA Max**
- **ESD Protection on RS-232 Pins Meets or Exceeds 4 kV (HBM) and 1.5 kV (HBM) on All Pins Per MIL-STD-883, Method 3015**
- **External Capacitors . . . 0.1 µF (V_{CC} = 3.3 V . . . Five External Capacitors) (V_{CC} = 5 V . . . Four External Capacitors)**
- **Accepts 5-V Logic Input With 3.3-V Supply**
- **Applications**
  - **RS-232 Interface**
  - **Battery-Powered Systems, PDAs**
  - **Notebook, Laptop, and Palmtop PCs**
  - **External Modems and Hand-Held Terminals**
- **Packaged in Shrink Small-Outline Package**

DB PACKAGE†
(TOP VIEW)

V_{DD}	1	28	C3+
C2+	2	27	GND
V_{CC}	3	26	C3–
C2–	4	25	V_{SS}
$\overline{EN}$	5	24	C1–
C1+	6	23	STBY
DIN1	7	22	DOUT1
DIN2	8	21	DOUT2
DIN3	9	20	DOUT3
ROUT1	10	19	RIN1
ROUT2	11	18	RIN2
ROUT3	12	17	RIN3
ROUT4	13	16	RIN4
ROUT5	14	15	RIN5
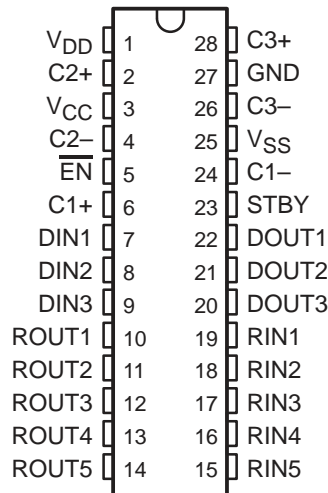
† The DB package is only available in left-ended tape and reel (order part number SN75LV4737ADBR).

description

The SN75LV4737A‡ consists of three line drivers, five line receivers, and a charge-pump circuit. It provides the electrical interface between an asynchronous communication controller and the serial-port connector, and meets the requirements of TIA/EIA-232-F. This combination of drivers and receivers matches those needed for the typical serial port used in an IBM PC/AT or compatibles. The charge pump and five small external capacitors allow operation from a single 3.3-V supply, and four capacitors allow operation from a 5-V supply.

The device has flexible control options for power management when the serial port is inactive. A common disable for all of the drivers and receivers is provided with the active-high STBY input. The active-low $\overline{EN}$ input is an enable for one receiver to implement a wake-up feature for the serial port. All the logic inputs can accept signals from controllers operating from a 5-V supply, even though the SN75LV4737A is operating from 3.3 V.

The SN75LV4737A is characterized for operation over the temperature range of 0°C to 70°C.

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.

‡ Patent-pending design
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TEXAS INSTRUMENTS

Function Tables

EACH DRIVER

INPUTS		OUTPUT
DIN	STBY	DOUT
X	H	Z
L	L	H
H	L	L
Open	L	L

H = high level, L = low level, X = irrelevant, Z = high impedance

EACH RECEIVER

INPUTS				OUTPUTS	
STBY	$\overline{EN}$	RIN5	RIN1–RIN4	ROUT5	ROUT1–ROUT4
H	H	X	X	Z	Z
H	L	H	X	L	Z
H	L	L	X	H	Z
L	X	L	L	H	H
L	X	H	H	L	L

H = high level, L = low level, X = irrelevant, Z = high impedance

logic diagram (positive logic)
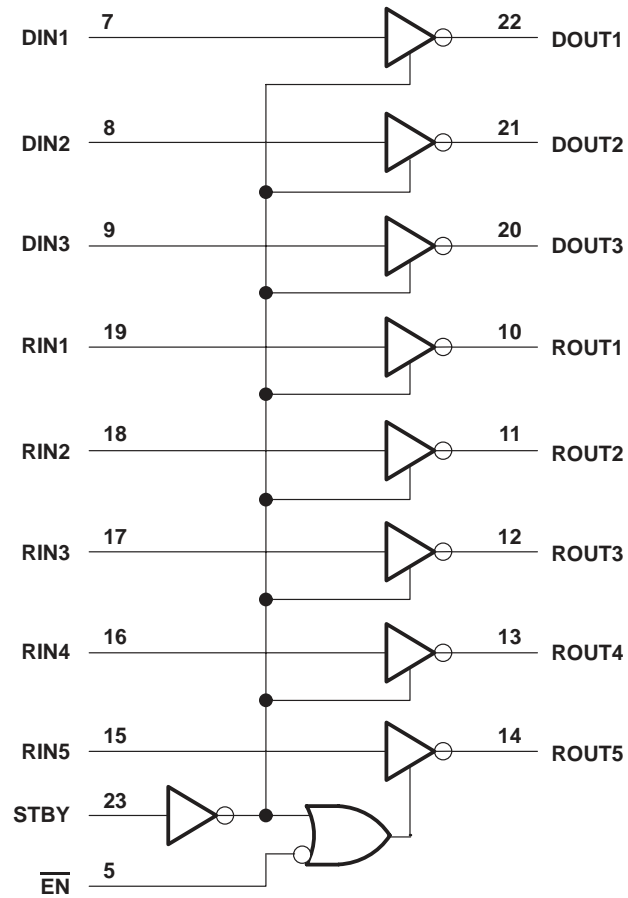
DIN1	7	22 DOUT1
DIN2	8	21 DOUT2
DIN3	9	20 DOUT3
RIN1	19	10 ROUT1
RIN2	18	11 ROUT2
RIN3	17	12 ROUT3
RIN4	16	13 ROUT4
RIN5	15	14 ROUT5
STBY	23	
$\overline{\text{EN}}$	5	

schematics of inputs and outputs

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

Supply voltage, V_{CC} .... 7 V

Positive output supply voltage, V_{DD} (see Note 1) .... 15 V

Negative output supply voltage, V_{SS} .... −15 V

Input voltage range, V_I: Driver .... −3 V to 7 V

Receiver .... −30 V to 30 V

Output voltage range, V_O: Driver .... V_{SS} − 0.3 V to V_{DD} + 0.3 V

Receiver .... −0.3 V to 7 V

Package thermal impedance, θ_{JA} (see Note 2) .... 62°C/W

Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds .... 260°C

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. All voltages are with respect to network GND.
2. The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions

				MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage		V_{CC} = 3.3 V	3	3.3	3.6	V
			V_{CC} = 5 V	4.5	5	5.5	V
V_{IH}	Driver high-level input voltage	DIN, $\overline{EN}$, STBY	V_{CC} = 3.3 V	2			V
		DIN	V_{CC} = 5 V	2			
		$\overline{EN}$, STBY		2.5			
V_{IL}	Driver low-level input voltage	DIN, $\overline{EN}$, STBY				0.8	V
V_I	Receiver input voltage					±30	V
	External capacitor	3.3-V operation (C1, C2, C3, C4, C5), 5-V operation (C1, C3, C4, C5), See Note 3 and Figures 6 and 7		0.1			μF
T_A	Operating free-air temperature			0		70	°C

NOTE 3:   C2 is needed only for 3.3-V operation.

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (see Figures 6 and 7) (unless otherwise noted)

PARAMETER		TEST CONDITIONS		V_{CC} = 3.3 V			V_{CC} = 5 V			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{DD}	Positive supply voltage	No load		8	10		7	8.7		V
V_{SS}	Negative supply voltage	No load			−9.5	−7		−8	−6	V
I_I	Input current ($\overline{EN}$, STBY)	See Notes 4 and 5				±2			±2	μA
I_{CC}	Supply current	No load, Inputs open	STBY at GND, $\overline{EN}$ at V_{CC} or GND	8.4	10	18	10	12	20.7	mA
	Supply current (standby mode) (see Note 4)		$\overline{EN}$, STBY at V_{CC}			5			5	μA
	Supply current (wake-up mode) (see Note 5)		$\overline{EN}$ at GND, STBY at V_{CC}			10			10	

† All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.
NOTES: 4.   When standby mode is not used, STBY input must be taken low.
         5.   When wake-up mode is not used, $\overline{EN}$ input must be taken high.

DRIVER SECTION

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

	PARAMETER	TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{OH}	High-level output voltage	$R_L = 3\ k\Omega$		5.5	7		V
V_{OL}	Low-level output voltage	$R_L = 3\ k\Omega$			−6	−5	V
I_{IH}	High-level input current	$V_I = V_{CC}$				1	μA
I_{IL}	Low-level input current	V_I at GND				−10	μA
I_{OS}	Short-circuit output current (see Note 6)	$V_{CC} = 3.6\ V,$	$V_O = 0\ V$		±15	±40	mA
		$V_{CC} = 5.5\ V,$	$V_O = 0\ V$				
r_o	Output resistance	$V_{CC} = V_{DD} = V_{SS} = 0\ V,$	$V_O = \pm2\ V$	300	500		Ω

† All typical values are at $V_{CC} = 3.3\ V$ or $V_{CC} = 5\ V$, and $T_A = 25°C$.
NOTE 6:   Short-circuit durations should be controlled to prevent exceeding the device absolute maximum power dissipation ratings, and not more than one output should be shorted at a time.

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

	PARAMETER	TEST CONDITIONS		MIN	TYP†	MAX	UNIT
t_{PLH}	Propagation delay time, low- to high-level output	$C_L = 50\ pF,$ $R_L = 3\ k\Omega$ to $7\ k\Omega,$ See Figure 1	$V_{CC} = 3.3\ V$	100	500	850	ns
			$V_{CC} = 5\ V$	100	500	850	
t_{PHL}	Propagation delay time, high- to low-level output		$V_{CC} = 3.3\ V$	100	500	850	ns
			$V_{CC} = 5\ V$	100	500	850	
t_{PZH}	Output enable time to high level	$C_L = 50\ pF,$ See Figure 2	$R_L = 3\ k\Omega$ to $7\ k\Omega,$		1	5	ms
t_{PZL}	Output enable time to low level				3	7	ms
t_{PHZ}	Output disable time from high level	$C_L = 50\ pF,$ $R_L = 3\ k\Omega$ to $7\ k\Omega,$ See Figure 2	$V_{CC} = 3.3\ V$		0.9	3	μs
			$V_{CC} = 5\ V$		0.6	3	
t_{PLZ}	Output disable time from low level		$V_{CC} = 3.3\ V$		0.5	3	μs
			$V_{CC} = 5\ V$		0.3	3	
SR	Slew rate	$C_L = 50\ pF,$ See Figure 1	$R_L = 3\ k\Omega$ to $7\ k\Omega,$	4		30	V/μs
SR(tr)	Slew rate, transition region	$C_L = 2500\ pF,$ See Figure 3	$R_L = 3\ k\Omega$ to $7\ k\Omega,$	3		30	V/μs

† All typical values are at $V_{CC} = 3.3\ V$ or $V_{CC} = 5\ V$, and $T_A = 25°C$.

![Texas Instruments logo]

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RECEIVER SECTION

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

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{OH}	High-level output voltage	$I_{OH} = -2$ mA	$V_{CC} = 3.3$ V	2.4	3		V
			$V_{CC} = 5$ V	3.5	5		
V_{OL}	Low-level output voltage	$I_{OL} = 2$ mA			0.2	0.4	V
V_{IT+}	Positive-going input threshold voltage				2.2	2.6	V
V_{IT-}	Negative-going input threshold voltage			0.6	1		V
V_{hys}	Input hysteresis ($V_{IT+} - V_{IT-}$)			0.5	1.2	1.8	V
r_i	Input resistance	$V_I = \pm3$ V to ±25 V		3	5	7	kΩ

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

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50$ pF, $R_L = 3$ kΩ to GND

PARAMETER		TEST CONDITIONS	$V_{CC} = 3.3$ V			$V_{CC} = 5$ V			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH}	Propagation delay time, low- to high-level output	See Figure 4	10	70	200	10	70	200	ns
t_{PHL}	Propagation delay time, high- to low-level output		10	60	200	10	55	200	ns
t_{PLH}	Propagation delay time, low- to high-level output (wake-up mode)			40	200		40	200	μs
t_{PHL}	Propagation delay time, high- to low-level output (wake-up mode)			90	500		70	500	ns
t_{PZH}	Output enable time to high level	See Figure 5		3	10		1.2	10	μs
t_{PZL}	Output enable time to low level			100	250		60	250	ns
t_{PHZ}	Output disable time from high level		100	200	600	100	150	600	ns
t_{PLZ}	Output disable time from low level			130	250		60	250	ns

SN75LV4737A
3.3-V/5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

PARAMETER MEASUREMENT INFORMATION

$$SR = \frac{0.8\ V(V_{OH} - V_{OL})}{t_{TLH}} \quad or \quad \frac{0.8\ V(V_{OL} - V_{OH})}{t_{THL}}$$
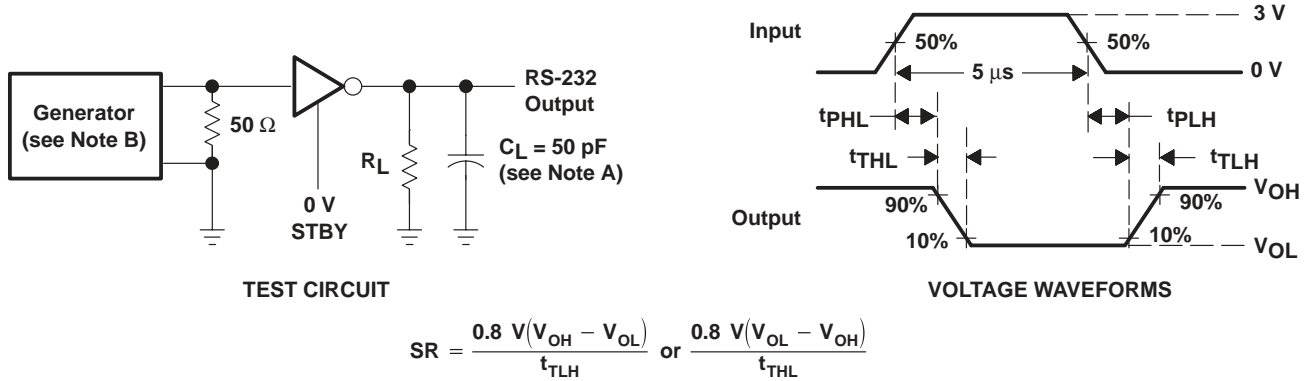
NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.
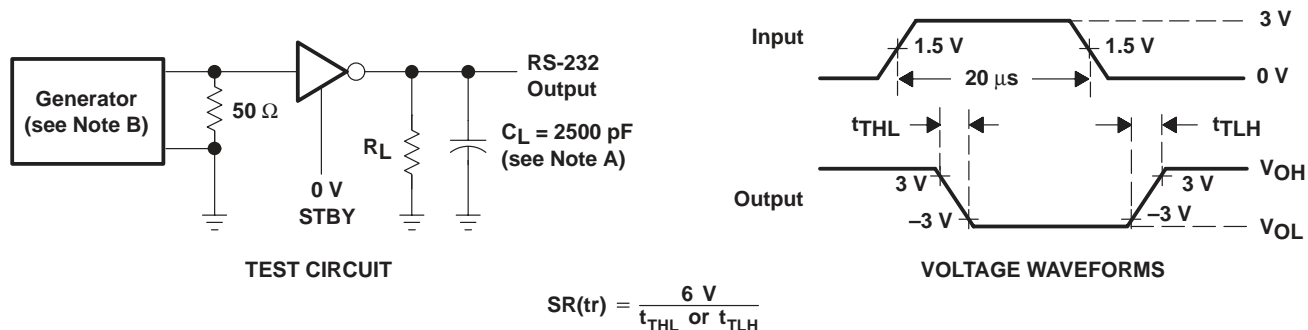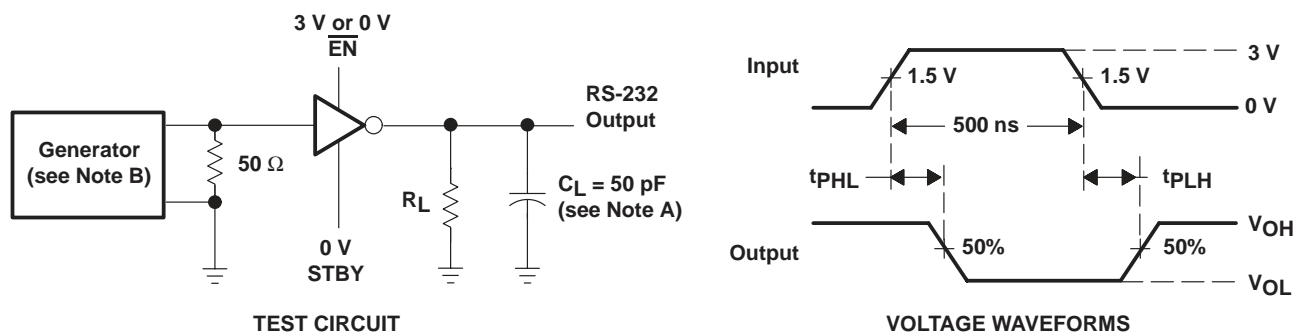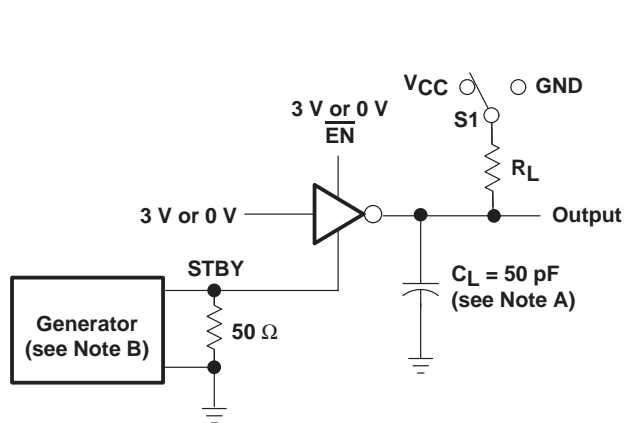
Figure 1. Driver Propagation Delay Times and Slew Rate (5-μs Input)
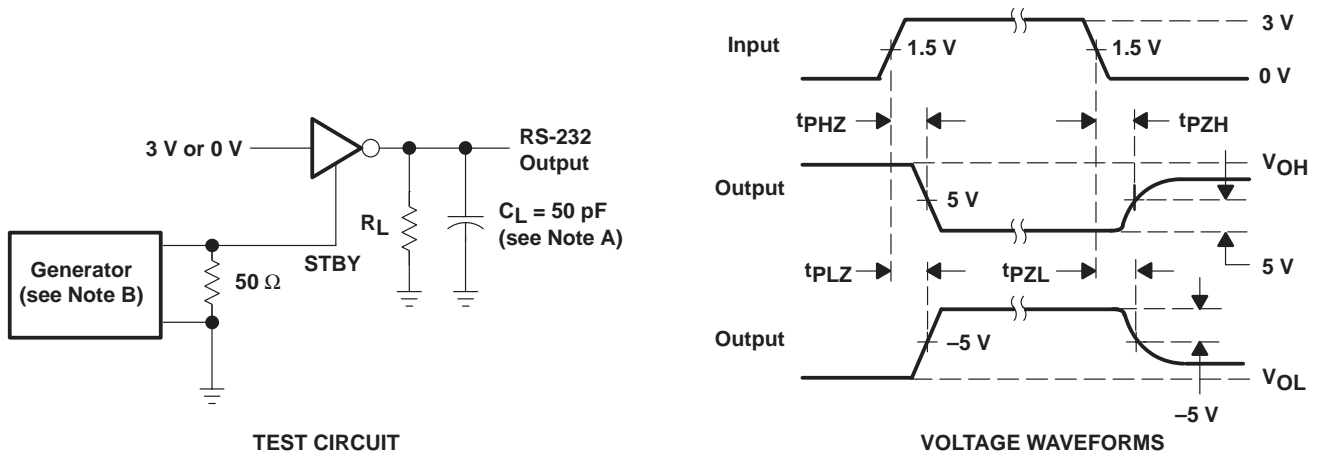
NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

Figure 2. Driver Enable and Disable Test Times

PARAMETER MEASUREMENT INFORMATION

TEST CIRCUIT

VOLTAGE WAVEFORMS

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

NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: Z_O = 50 Ω, 50% duty cycle, t_r ≤ 10 ns, t_f ≤ 10 ns.

Figure 3. Driver Transition Times and Slew Rate (20-μs Input)

TEST CIRCUIT

VOLTAGE WAVEFORMS

NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: PRR = 1 MHz, Z_O = 50 Ω, 50% duty cycle, t_r ≤ 10 ns, t_f ≤ 10 ns.

Figure 4. Receiver Propagation Delay Times

PARAMETER MEASUREMENT INFORMATION

TEST CIRCUIT

VOLTAGE WAVEFORMS

NOTES: A. C_L includes probe and jig capacitance.
 B. The pulse generator has the following characteristics: PRR = 1 MHz, Z_O = 50 Ω, 50% duty cycle, t_r ≤ 10 ns, t_f ≤ 10 ns.

Figure 5. Receiver Enable and Disable Times

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APPLICATION INFORMATION
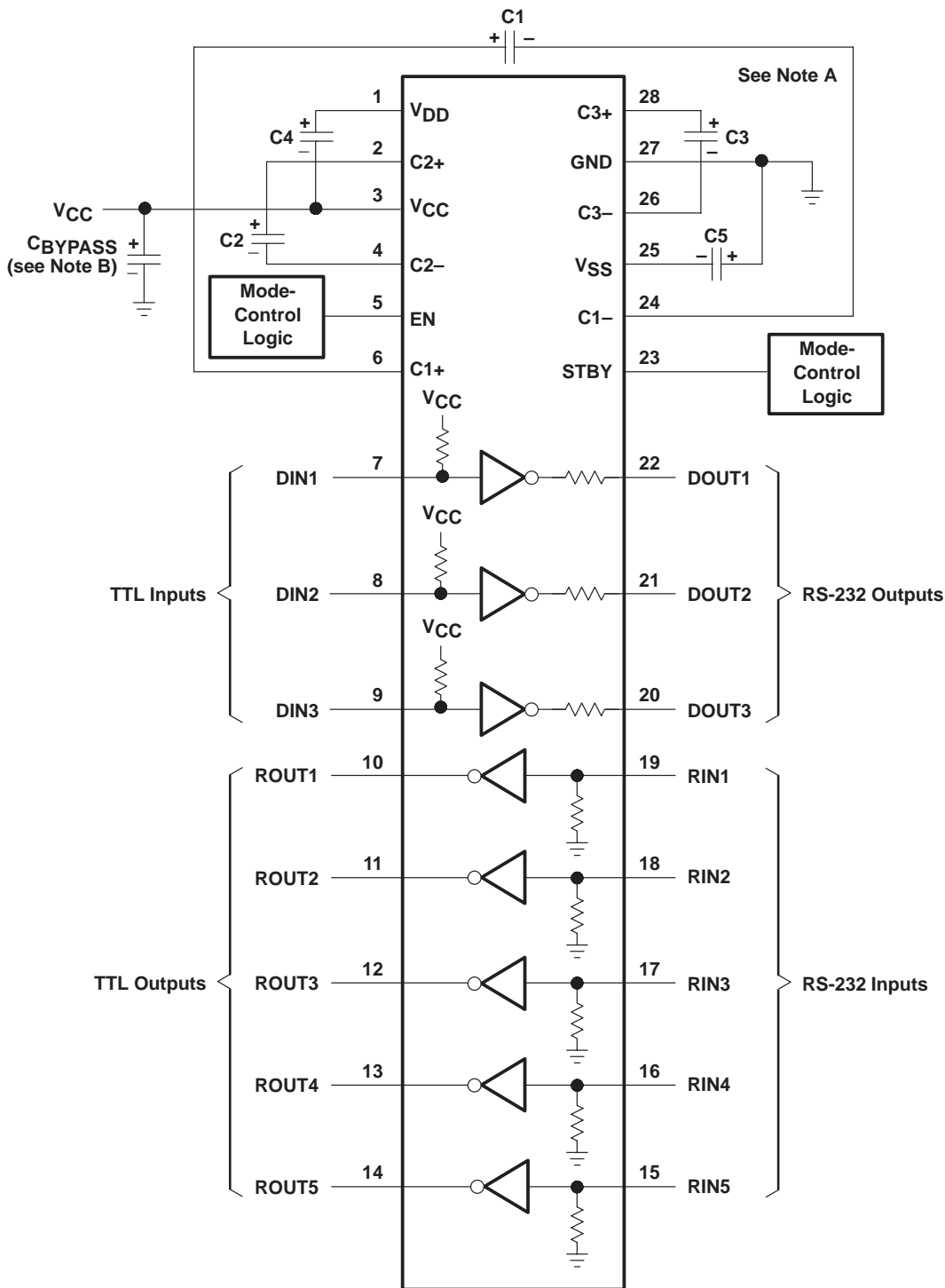
NOTES: A. C1 = C2 = C3 = C4 = C5 = C$_{BYPASS}$ = 0.1 µF
B. C$_{BYPASS}$ is used as a decoupling capacitor.

Figure 6. Typical 3.3-V Operating Circuit

TEXAS
INSTRUMENTS

APPLICATION INFORMATION

NOTES: A. C2 is not used. C1 = C3 = C4 = C5 = C$_{BYPASS}$ = 0.1 µF
B. C$_{BYPASS}$ is used as a decoupling capacitor.

Figure 7. Typical 5-V Operating Circuit

PACKAGE OPTION ADDENDUM

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN75LV4737ADB	ACTIVE	SSOP	DB	28	50	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	75LV4737A	Samples
SN75LV4737ADBR	ACTIVE	SSOP	DB	28	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	75LV4737A	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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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.

PACKAGE MATERIALS INFORMATION

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

User Direction of Feed

*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
SN75LV4737ADBR	SSOP	DB	28	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75LV4737ADBR	SSOP	DB	28	2000	356.0	356.0	35.0

PACKAGE MATERIALS INFORMATION

TUBE
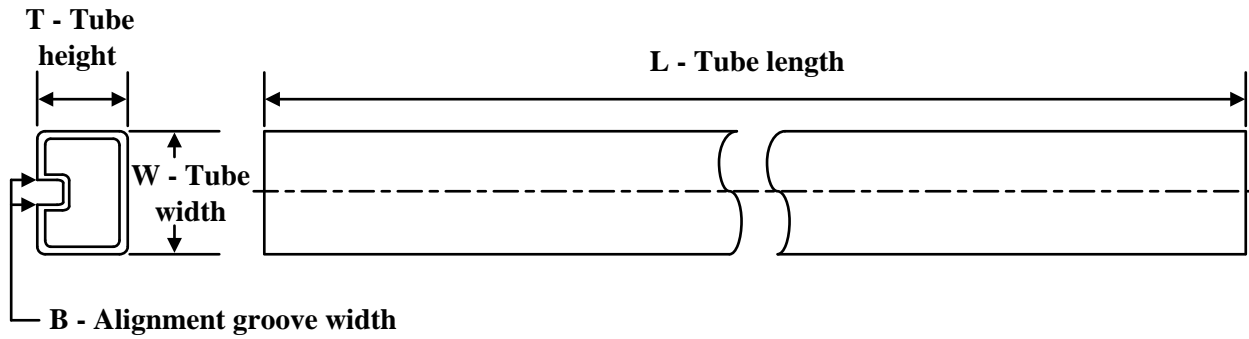
*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
SN75LV4737ADB	DB	SSOP	28	50	530	10.5	4000	4.1

8.2
7.4 TYP

A

PIN 1 INDEX AREA

1

10.5
9.9
NOTE 3

14

B

5.6
5.0
NOTE 4

26X 0.65

28

2X
8.45

15

28X 0.38
0.22

⊕ 0.15Ⓜ C A B

C

⌒ 0.1 C

SEATING
PLANE

SEE DETAIL A

(0.15) TYP

GAGE PLANE

0.25

0°-8°

0.95
0.55

2 MAX

0.05 MIN

DETAIL A
TYPICAL
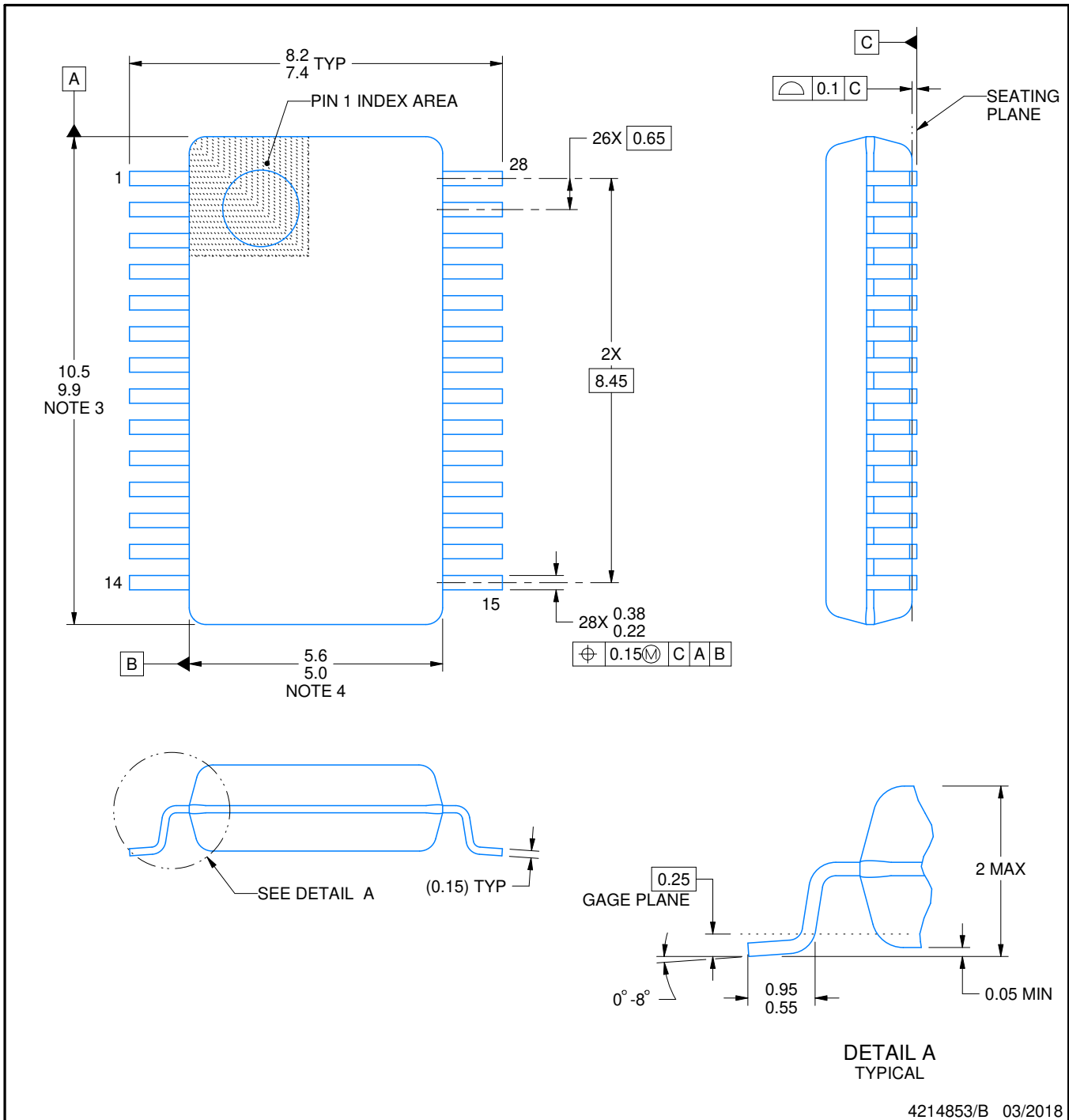
4214853/B   03/2018

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-150.

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28X (1.85)

1

28X (0.45)

26X (0.65)

SYMM

(R0.05) TYP

28

SYMM

14

15

(7)
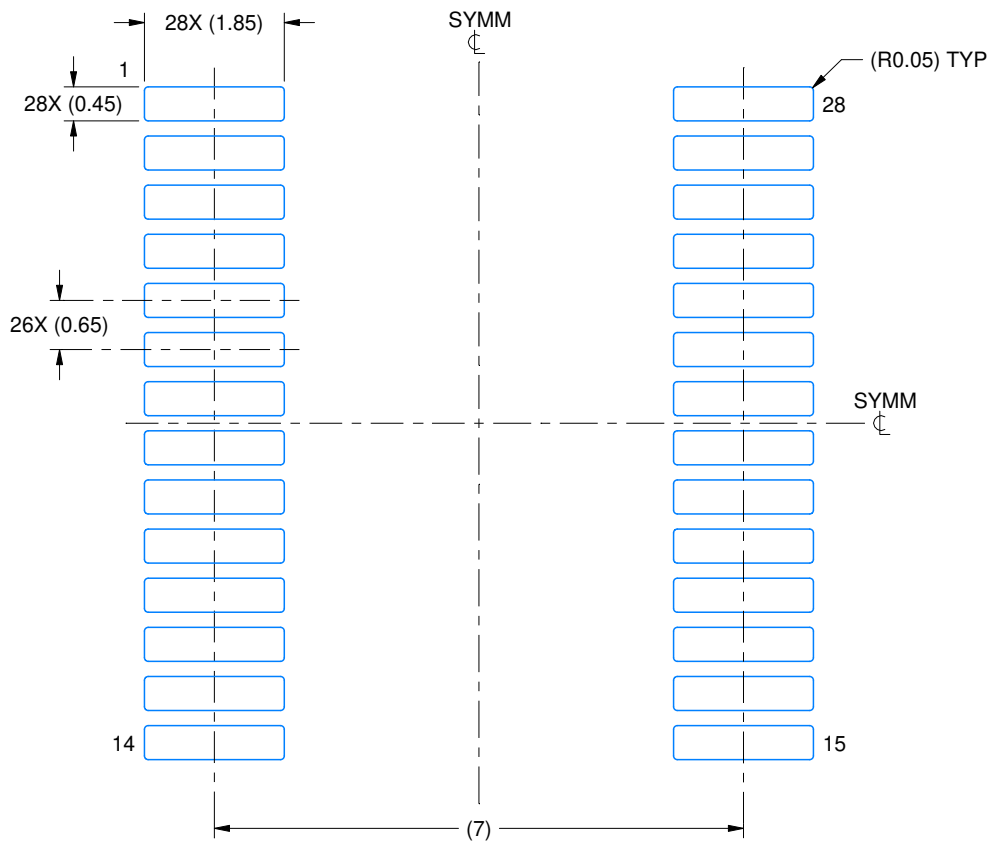
LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

SOLDER MASK
OPENING

METAL

EXPOSED METAL

0.07 MAX
ALL AROUND

NON-SOLDER MASK
DEFINED
(PREFERRED)

METAL UNDER
SOLDER MASK

SOLDER MASK
OPENING

EXPOSED METAL

0.07 MIN
ALL AROUND

SOLDER MASK
DEFINED

SOLDER MASK DETAILS
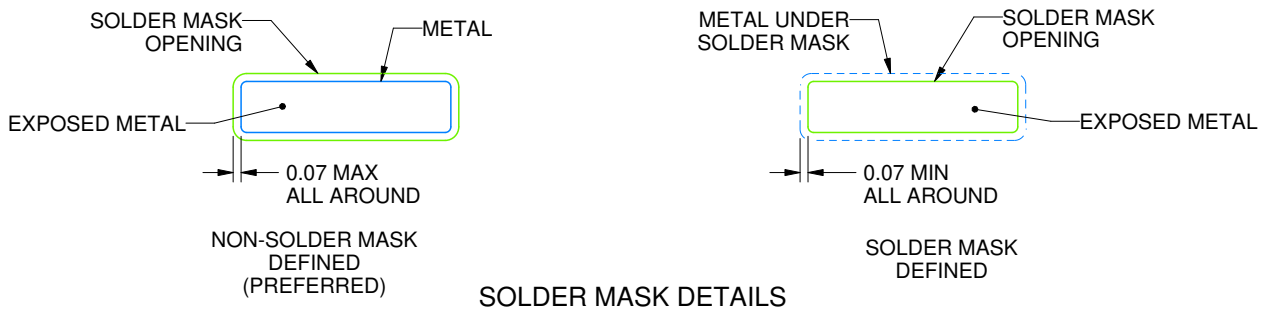
4214853/B   03/2018

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

28X (1.85)

SYMM

(R0.05) TYP

1

28

28X (0.45)

26X (0.65)

SYMM

14

15

(7)

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4214853/B   03/2018
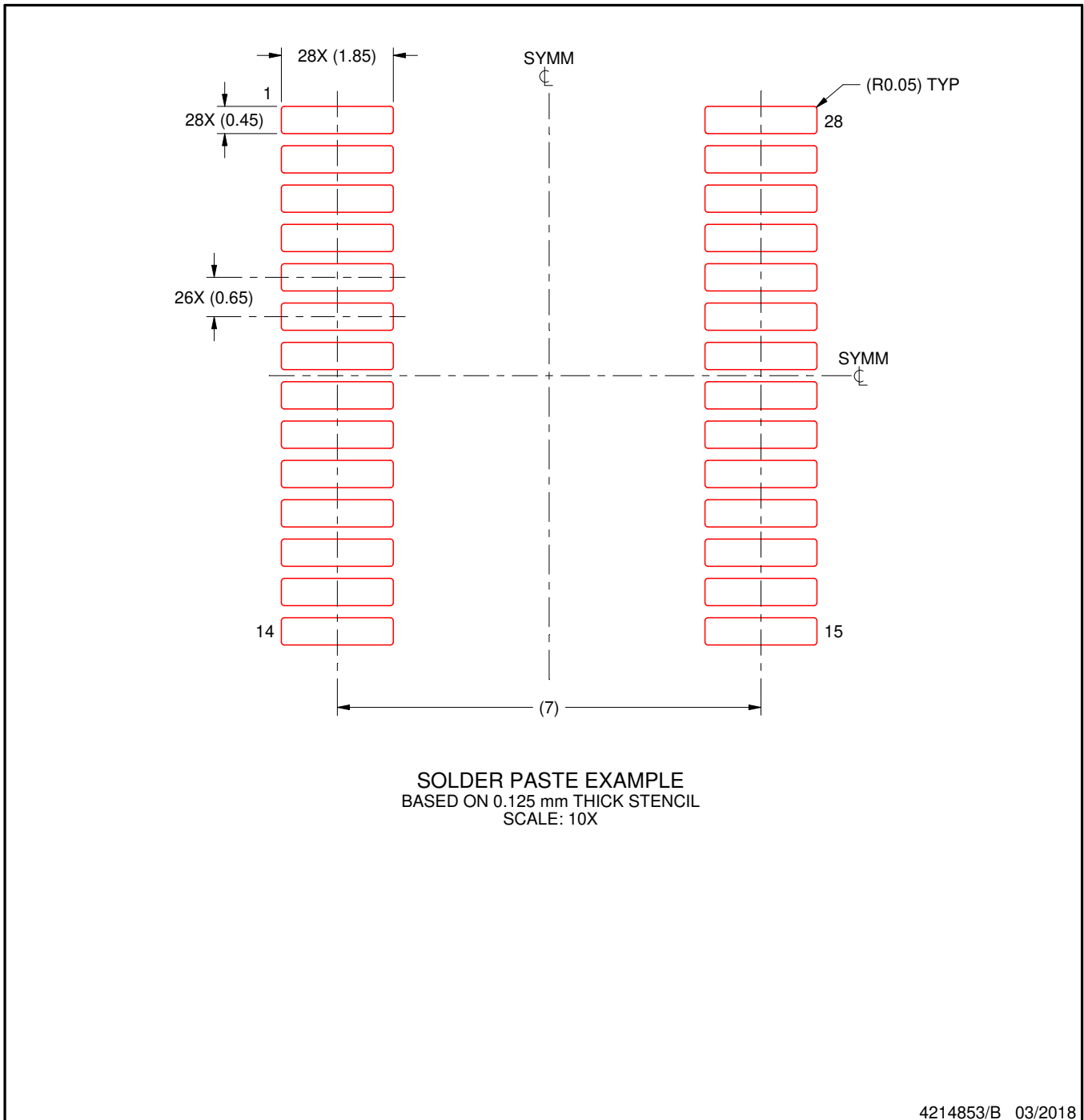
NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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