GD65232, GD75232 Multiple RS-232 Drivers and Receivers

1 Features

- Single chip with easy interface between UART and serial-port connector of IBM PC/AT and compatibles
- Meet or exceed the requirements of TIA/EIA-232-F and ITU v.28 standards
- Designed to support data rates up to 120kbits
- Pinout compatible with SN75C185 and SN75185
- ESD performance tested per JESD 22: HBM; 1500V, CDM: 500V, MM; 200V

2 Applications

- Terminals
- Modems
- Computers
- Wired networking
- Data center and enterprise computing
- Hand-held equipment

3 Description

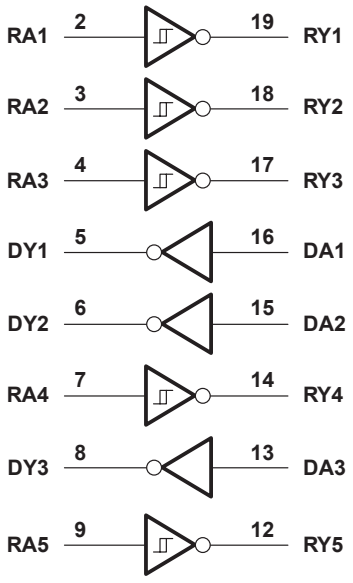
The GD65232 and GD75232 combine three drivers and five receivers from the Texas Instruments trade-standard SN75188 and SN75189 bipolar quadruple drivers and receivers, respectively. The pinout matches the flow-through design of the SN75C185 to decrease the part count, reduce the board space required, and allow easy interconnection of the UART and serial-port connector of an IBM™ PC/AT and compatibles. The bipolar circuits and processing of the GD65232 and GD75232 provide a rugged, low-cost solution for this function at the expense of quiescent power and external passive components relative to the SN75C185.

The GD65232 and GD75232 comply with the requirements of the TIA/EIA-232-F and ITU (formerly CCITT) V.28 standards. These standards are for data interchange between a host computer and a peripheral at signaling rates up to 20kbits. The switching speeds of these devices are fast enough to support rates up to 120kbits with lower capacitive loads (shorter cables). Interoperability at the higher signaling rates cannot be expected unless the designer has design control of the cable and the interface circuits at both ends. For interoperability at signaling rates up to 120kbits, use of TIA/EIA-423-B (ITU V.10) and TIA/EIA-422-B (ITU V.11) standards is recommended.

Package Information

PART NUMBER	PACKAGE(1)	PACKAGE SIZE(2)
GD65232 GD75232	SSOP (DB, 20)	7.2mm x 7.8mm
	SOIC (DW, 20)	12.8mm x 10.3mm
	PDIP (N, 20)	24.33mm x 9.4mm
	TSSOP (PW, 20)	6.5mm x 6.4mm

(1) For more information, see Section 10.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.



Logic Diagram (positive logic)

Table of Contents

4 Pin Configuration and Functions

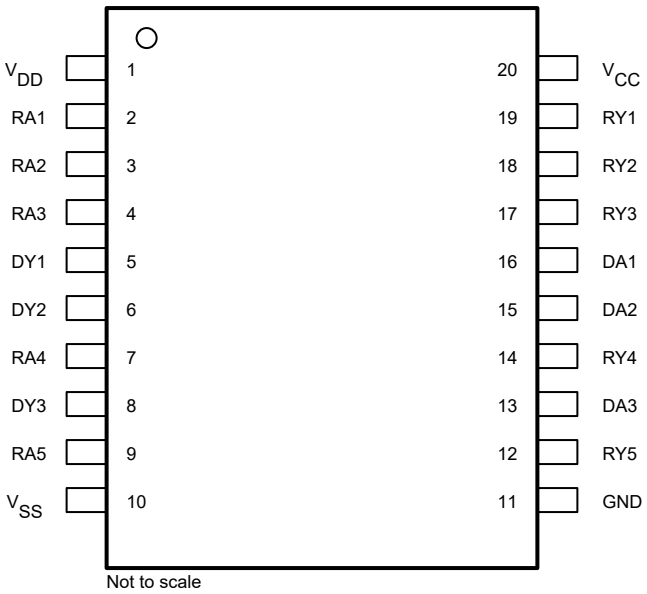


Figure 4-1. DB, DW, N, OR PW Package (Top View)

Table 4-1. Pin Functions

PIN		TYPE(1)	DESCRIPTION
NAME	NO.		
V_{DD}	1	–	Positive RS232 Power Supply
RA1	2	I	RS232 Input
RA2	3	I	RS232 Input
RA3	4	I	RS232 Input
DY1	5	O	RS232 Output
DY2	6	O	RS232 Output
RA4	7	I	RS232 Input
DY3	8	O	RS232 Output
RA5	9	I	RS232 Input
V_{SS}	10	–	Negative RS232 Power Supply
GND	11	–	Ground
RY5	12	O	TTL Output
DA3	13	I	TTL Input
RY4	14	O	TTL Output
DA2	15	I	TTL Input
DA1	16	I	TTL Input
RY3	17	O	TTL Output
RY2	18	O	TTL Output
RY1	19	O	TTL Output
V_{CC}	20	–	Device Power Supply for TTL

(1) Signal Types: I = Input, O = Output, I/O = Input or Output.

5 Specifications

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) (1)

		MIN	MAX	UNIT
V_{CC}	Supply voltage (see (2))		10	V
V_{DD}			15	V
V_{SS}			−15	V
V_I	Input voltage range, Driver	−15	7	V
	Input voltage range, Receiver	−30	30	V
V_O	Driver output voltage range	−15	15	V
I_{OL}	Receiver low-level output current		20	mA
T_J	Operating virtual junction temperature		150	°C
T_{stg}	Storage temperature range	−65	150	°C

(1) 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.
(2) All voltages are with respect to the network ground terminal

5.2 Recommended Operating Conditions

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

			MIN	NOM	MAX	UNIT
VDD	Supply voltage (see (1))		7.5	9	15	V
VSS	Supply voltage (see (1))		−7.5	−9	−15	V
V_{CC}	Supply voltage (see (1))		4.5	5	5.5	V
V_{IH}	High-level input voltage (driver only)		1.9			V
V_{IL}	Low-level input voltage (driver only)				0.8	V
I_{OH}	High-level output current	Driver			−6	mA
		Receiver			−0.5	
I_{OL}	Low-level output current	Driver			6	mA
		Receiver			16	
T_A	Operating free-air temperature	GD65232	−40		85	°C
		GD75232	0		70	

(1) When powering up the GD65232 and GD75232, the following sequence should be used:

- V_{SS}, V_{DD}, V_{CC}, I/Os

Applying V_{CC} before V_{DD} may allow large currents to flow, causing damage to the device. When powering down the GD65232 and GD75232, the reverse sequence should be used

5.3 Thermal Information

THERMAL METRIC(1)		DB (SSOP)	DW (SOIC)	N (PDIP)	PW (TSSOP)	UNIT
		20 PINS	20 PINS	20 PINS	20 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	92.0	73.0	59.8	97.5	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	54.3	40.2	39.1	41.3	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	57.0	45.7	36.1	59.2	°C/W
ψ_{JT}	Junction-to-top characterization parameter	14.7	12.8	18.3	4.1	°C/W
ψ_{JB}	Junction-to-board characterization parameter	56.3	45.0	35.7	58.6	°C/W

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC package thermal metrics* application report.

5.4 Supply Currents over Recommended Operating Free-air Temperature Range

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

	PARAMETER	TEST CONDITIONS				MIN	MAX	UNIT
I_{DD}	Supply current from V_{DD}	All inputs at 1.9V	No load	V_{DD} = 9V	V_{SS} = −9V		15	mA
				V_{DD} = 12V	V_{SS} = −12V		19	
				V_{DD} = 15V	V_{SS} = −15V		25	
		All inputs at 0.8V	No load	V_{DD} = 9V	V_{SS} = −9V		4.5	
				V_{DD} = 12V	V_{SS} = −12V		5.5	
				V_{DD} = 15V	V_{SS} = −15V		9	
I_{SS}	Supply current from V_{SS}	All inputs at 1.9V	No load	V_{DD} = 9V	V_{SS} = −9V		−15	mA
				V_{DD} = 12V	V_{SS} = −12V		−19	
				V_{DD} = 15V	V_{SS} = −15V		−25	
		All inputs at 0.8V	No load	V_{DD} = 9V	V_{SS} = −9V		−3.2	
				V_{DD} = 12V	V_{SS} = −12V		−3.2	
				V_{DD} = 15V	V_{SS} = −15V		−3.2	
I_{CC}	Supply current from V_{CC}	All inputs at 5V	No load, V_{CC} = 5V		GD65232		38	mA
					GD75232		30	

5.5 Electrical Characteristics, Driver

over operating free-air temperature range V_{DD} = 9V, V_{SS} = −9V, V_{CC} = 5V (unless otherwise noted)

	PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
V_{OH}	High-level output voltage	V_{IL} = 0.8V,	R_L = 3kΩ,	See Figure 6-1	6	7.5		V
V_{OL}	Low-level output voltage (see (1))	V_{IH} = 1.9V,	R_L = 3kΩ,	See Figure 6-1		−7.5	−6	V
I_{IH}	High-level input current	V_I = 5V,	See Figure 6-2				10	µA
I_{IL}	Low-level input current	V_I = 0,	See Figure 6-2				−1.6	mA
$I_{OS(H)}$	High-level short-circuit output current (see (2))	V_{IL} = 0.8V,	V_O = 0,	See Figure 1	−4.5	−12	−19.5	mA
$I_{OS(L)}$	Low-level short-circuit output current	V_{IH} = 2V,	V_O = 0,	See Figure 6-1	4.5	12	19.5	mA
r_o	Output resistance (see (3))	V_{CC} = V_{DD} = V_{SS} = 0,		V_O = −2V to 2V	300			Ω

(1) The algebraic convention, where the more positive (less negative) limit is designated as maximum, is used in this data sheet for logic levels only (that is, if −10V is maximum, the typical value is a more negative voltage).
(2) Output short-circuit conditions must maintain the total power dissipation below absolute maximum ratings,
(3) Test conditions are those specified by TIA/EIA-232-F and as listed above

5.6 Switching Characteristics, Driver

over operating free-air temperature range V_{CC} = 5V, V_{DD} = 12V, V_{SS} = −12V, T_A = 25°C (unless otherwise noted)

	PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low- to high-level output	R_L = 3kΩ to 7kΩ,	C_L = 15pF,	SeeFigure 6-3		315	500	ns
t_{PHL}	Propagation delay time, high- to low-level output	R_L = 3kΩ to 7kΩ,	C_L = 15pF,	See Figure 6-3		75	175	ns
t_{TLH}	Transition time, low- to high-level output	R_L = 3kΩ to 7kΩ	C_L = 15pF,	See Figure 6-3		60	100	ns
			C = 2500 pF,	See Figure 6-3 and (1)		1.7	2.5	µs
t_{THL}	Transition time, high- to low-level output	R_L = 3kΩ to 7kΩ	C_L = 15pF,	See Figure 6-3		40	75	ns
			C_L = 2500pF,	See Figure 6-3 and (1)		1.5	2.5	µs

(1) Measured between ±3V and ±3V points of the output waveform (TIA/EIA-232-F conditions); all unused inputs are tied either high or low.

5.7 Electrical Characteristics, Receiver

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

	PARAMETER	TEST CONDITIONS			MIN	TYP(1)	MAX	UNIT
V_{IT+}	Positive-going input threshold voltage	T_A = 25°C, See Figure 6-5			1.75	1.9	2.3	V
		T_A = 0°C to 70°C, See Figure 6-5			1.55		2.3	
V_{IT-}	Negative-going input threshold voltage				0.75	0.97	1.25	V
V_{hys}	Input hysteresis voltage (VIT+ − VIT−)				0.5			V
V_{OH}	High-level output voltage	I_{OH} = −0.5mA	V_{IH} = 0.75V		2.6	4	5	V
			Inputs open		2.6			
V_{OL}	Low-level output voltage	I_{OL} = 10mA, V_I = 3V				0.2	0.45	V
I_{IH}	High-level input current	V_I = 25V, See Figure 6-5		GD65232	3.6		11	mA
				GD75232	3.6		8.3	
		V_I = 3V, See Figure 6-5			0.43			
I_{IL}	Low-level input current	V_I = −25V, Figure 6-5		GD65232	−3.6		−11	mA
				GD75232	−3.6		−8.3	
		V_I = −3V, See Figure 6-5			−0.43			
I_{OS}	Short-circuit output current	See Figure 6-4				−3.4	−12	mA

(1) All typical values are at T_A = 25°C, V_{CC} = 5 V, V_{DD} = 9 V, and V_{SS} = −9 V.

5.8 Switching Characteristics, Receiver

over operating free-air temperature range V_{CC} = 5V, V_{DD} = 12V, V_{SS} = −12V, T_A = 25°C (unless otherwise noted)

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low- to high-level output	C_L = 50pF, RL = 5kΩ, See Figure 6-6		107	250	ns
t_{PHL}	Propagation delay time, high- to low-level output			42	150	ns
t_{TLH}	Transition time, low- to high-level output			175	350	ns
t_{THL}	Transition time, high- to low-level output			16	60	ns
t_{PLH}	Propagation delay time, low- to high-level output	C_L = 15pF, RL = 1.5kΩ, See Figure 6-6		100	160	ns
t_{PHL}	Propagation delay time, high- to low-level output			60	100	ns
t_{TLH}	Transition time, low- to high-level output			90	175	ns
t_{THL}	Transition time, high- to low-level output			15	50	ns

5.9 Typical Characteristics Driver

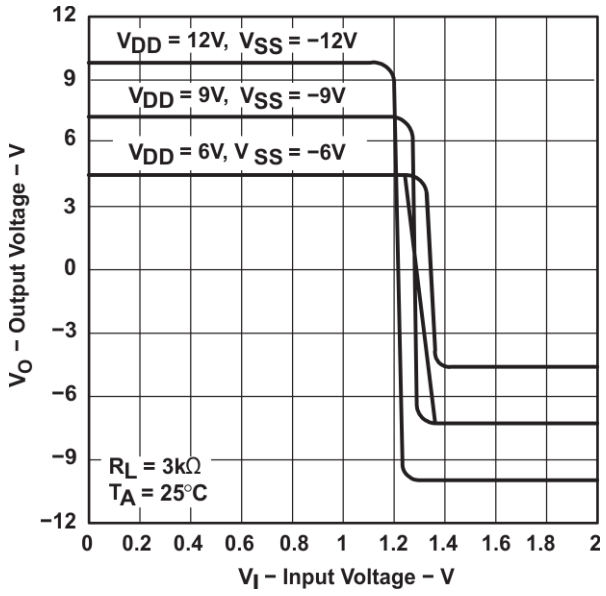


Figure 5-1. Voltage Transfer Characteristics

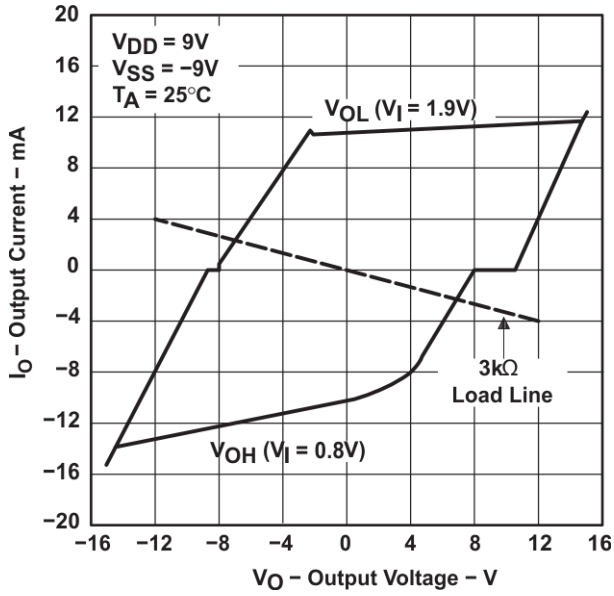


Figure 5-2. Output Current vs Output Voltage

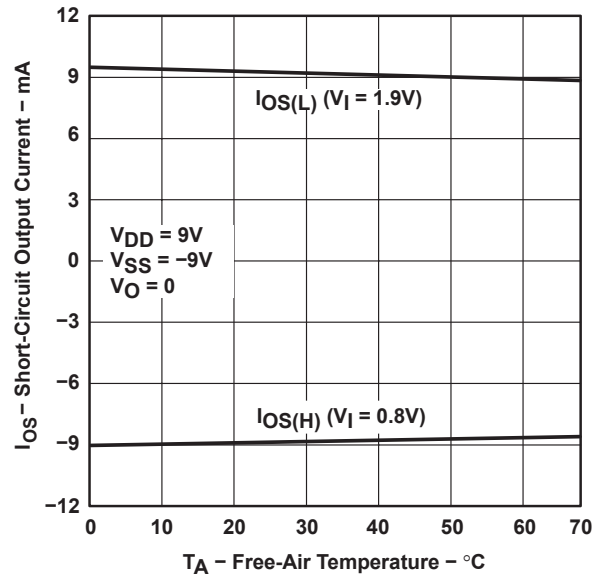


Figure 5-3. Short-Circuit Output Current vs Free-Air Temperature

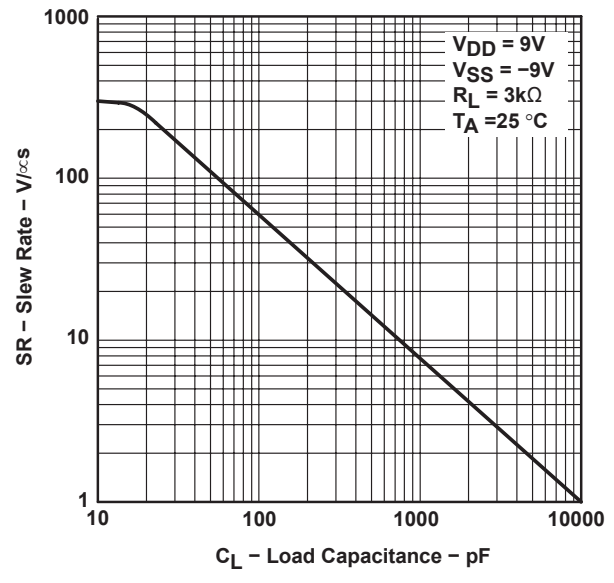


Figure 5-4. Slew Rate vs Load Capacitance

5.10 Typical Characteristics Receiver

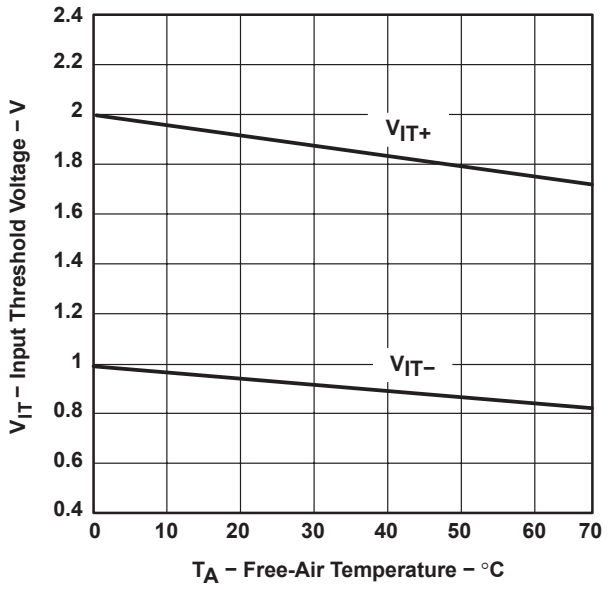


Figure 5-5. Input Threshold Voltage vs Free-Air Temperature

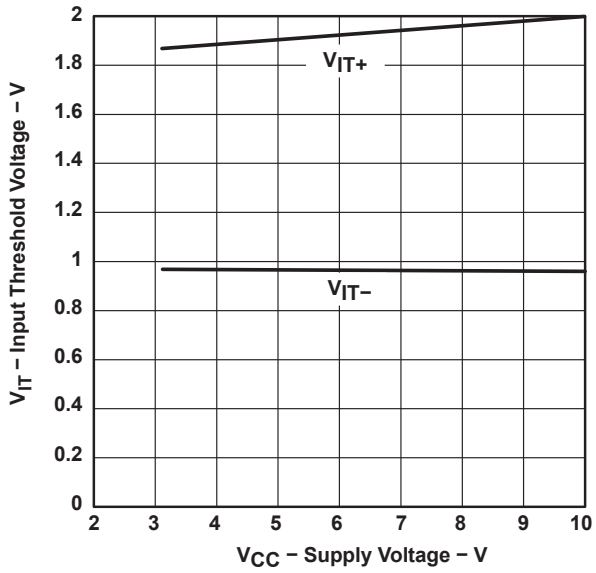
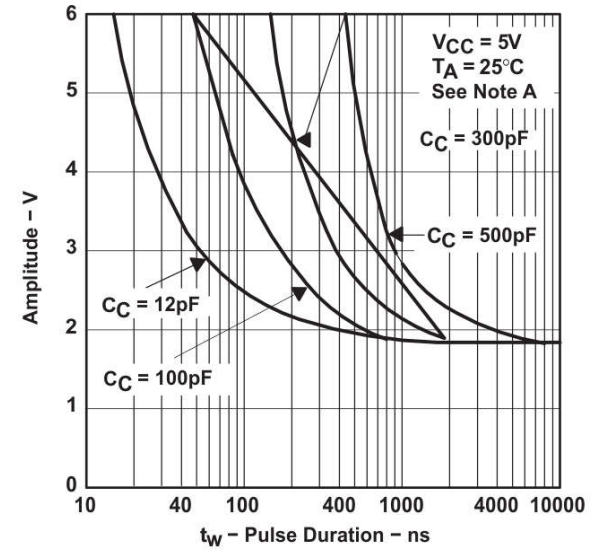


Figure 5-6. Input Threshold Voltage vs Supply Voltage



NOTE A: This figure shows the maximum amplitude of a positive-going pulse that, starting from 0V, does not cause a change of the output level.

Figure 5-7. Noise Rejection

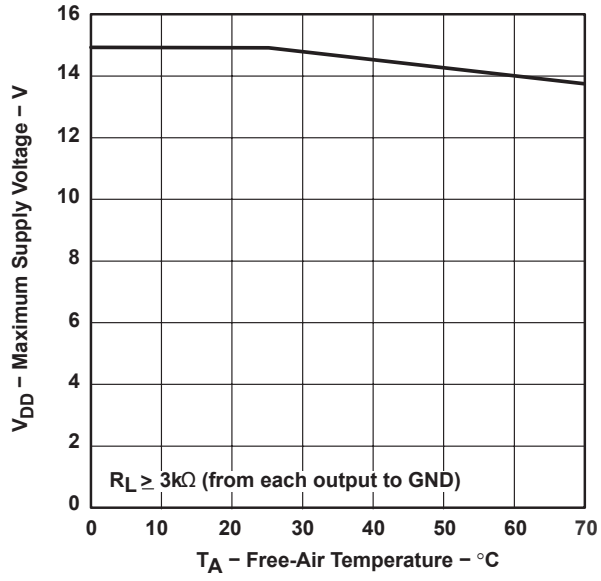


Figure 5-8. Maximum Supply Voltage vs Free-Air Temperature

6 Parameter Measurement Information

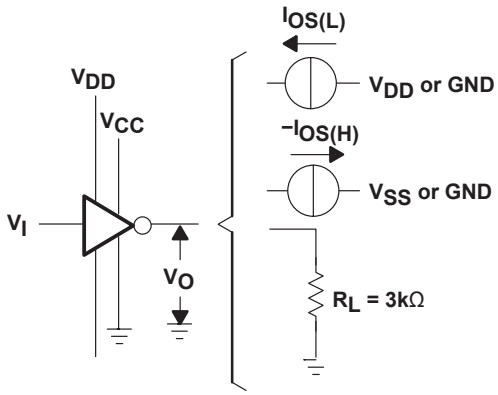


Figure 6-1. Driver Test Circuit for V_{OH}, V_{OL}, $I_{OS(H)}$, and $I_{OS(L)}$

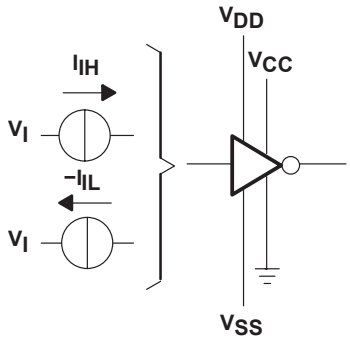
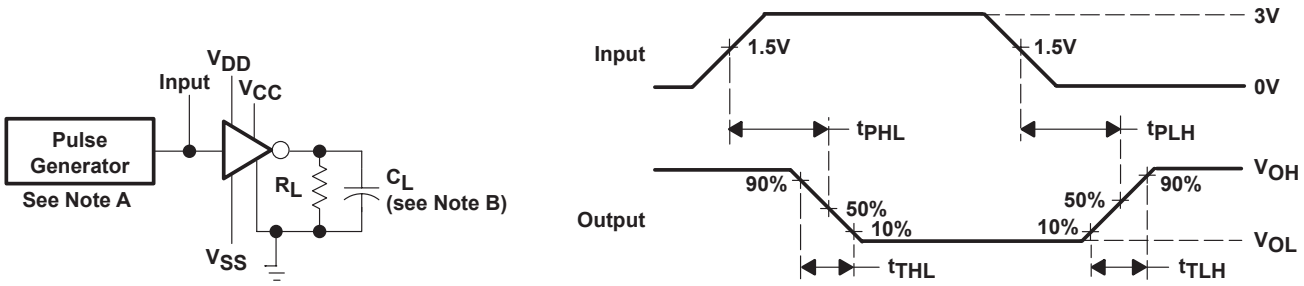


Figure 6-2. Driver Test Circuit for I_{IH} and I_{IL}



NOTES: A. The pulse generator has the following characteristics: t_W = 25µs, PRR = 20kHz, Z_O = 50Ω , t_r = t_f < 50ns.
B. C_L includes probe and jig capacitance.

Figure 6-3. Driver Test Circuit and Voltage Waveforms

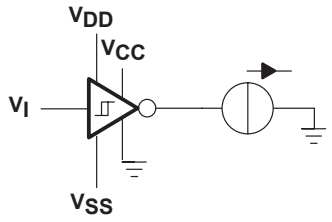


Figure 6-4. Receiver Test Circuit for I_{OS}

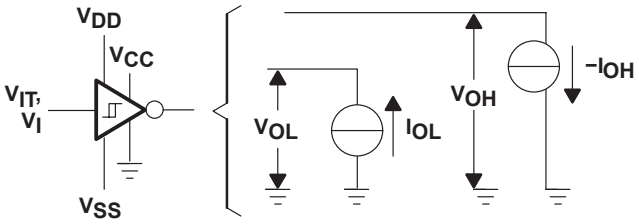
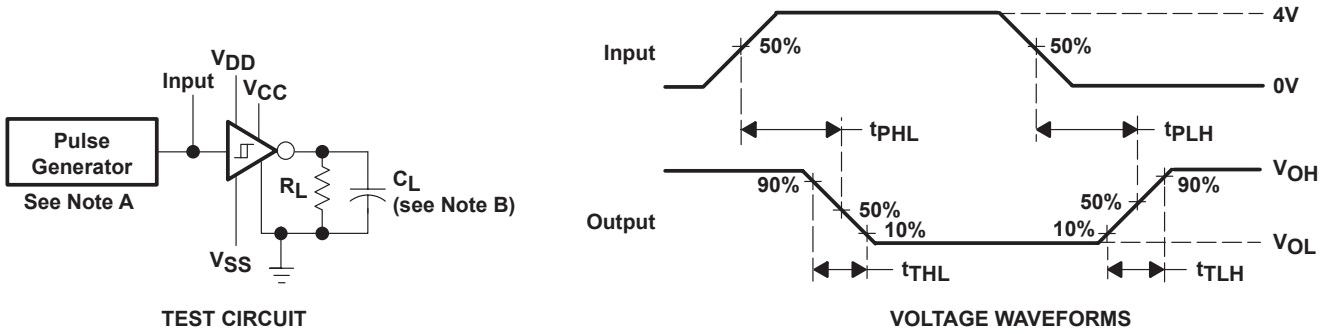


Figure 6-5. Receiver Test Circuit for V_{IT}, V_{OH}, and V_{OL}



NOTES: A. The pulse generator has the following characteristics: t_W = 25µs, PRR = 20kHz, Z_O = 50Ω, t_r = t_f < 50ns.
B. C_L includes probe and jig capacitance.

Figure 6-6. Receiver Propagation and Transition Times

7 Application and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

7.1 Application Information

Diodes placed in series with the VDD and VSS leads protect the GD65232 and GD75232 in the fault condition in which the device outputs are shorted to ±15V and the power supplies are at low and provide low-impedance paths to ground, see Figure 7-1.

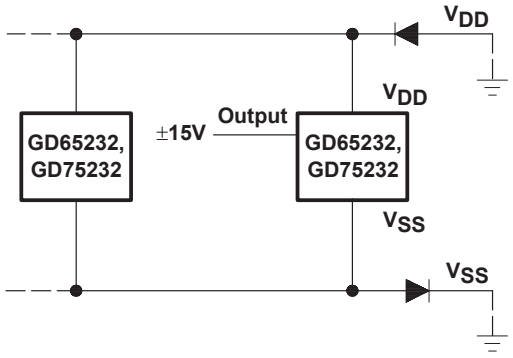


Figure 7-1. Power-Supply Protection to Meet Power-Off Fault Conditions of TIA/EIA-232-F

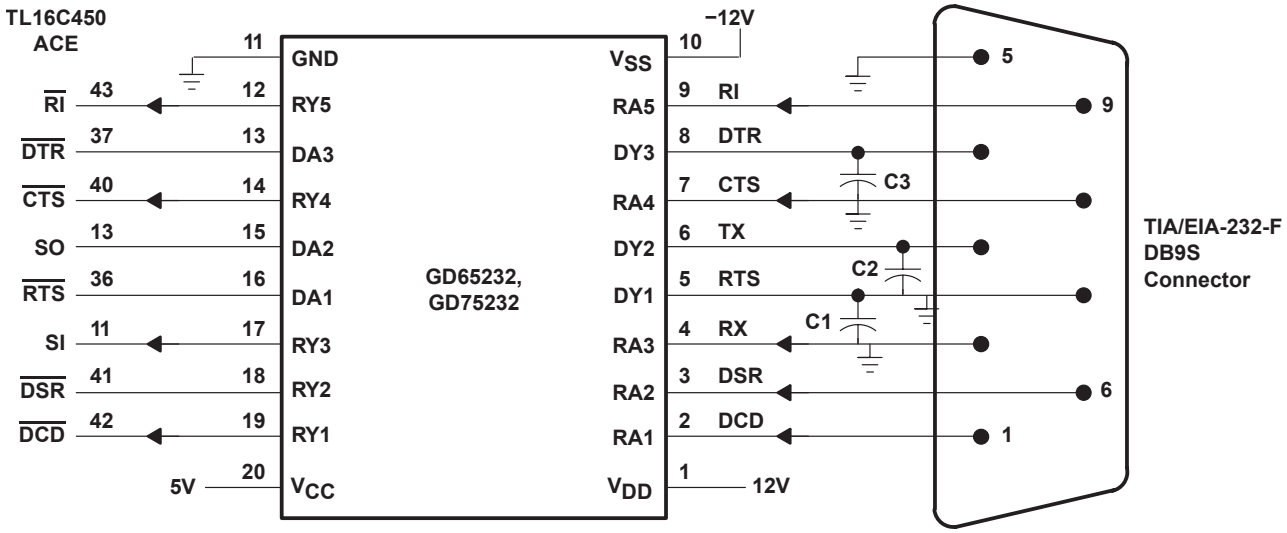
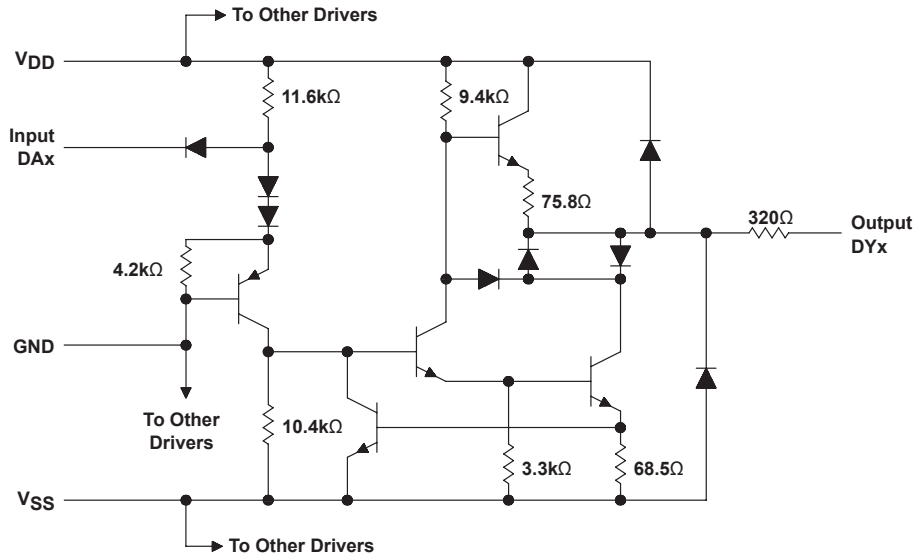


Figure 7-2. Typical Connection

7.2 Schematic



Resistor values shown are nominal.

Figure 7-3. Schematic (each driver)

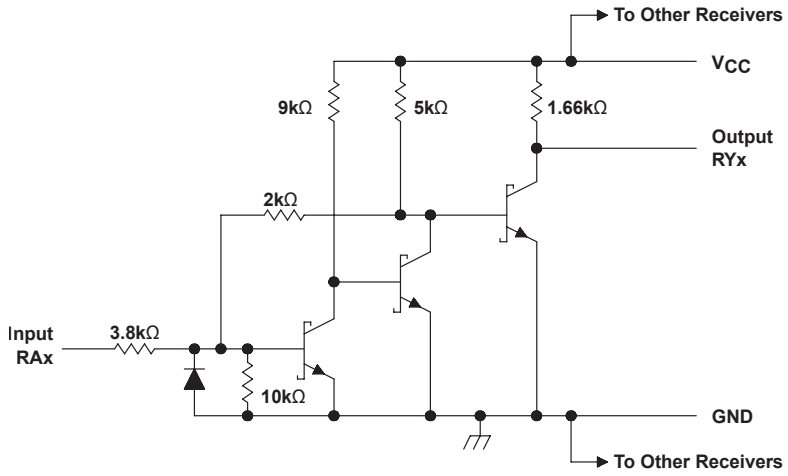


Figure 7-4. Schematic (each receiver)

8 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

8.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

8.2 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

8.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.
All trademarks are the property of their respective owners.

8.4 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

8.5 Glossary

TI Glossary	This glossary lists and explains terms, acronyms, and definitions.

9 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision K (August 2012) to Revision L (August 2024)	Page
• Changed the numbering format for tables, figures, and cross-references throughout the document	1
• Added the *Thermal Information* table	5

10 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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
GD65232DW	ACTIVE	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	GD65232	Samples
GD65232DWR	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	GD65232	Samples
GD65232PWR	ACTIVE	TSSOP	PW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	GD65232	Samples
GD75232DBR	ACTIVE	SSOP	DB	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	GD75232	Samples
GD75232DW	ACTIVE	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	GD75232	Samples
GD75232DWR	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	GD75232	Samples
GD75232DWRG4	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	GD75232	Samples
GD75232N	ACTIVE	PDIP	N	20	20	RoHS & Non-Green	NIPDAU	N / A for Pkg Type	0 to 70	GD75232N	Samples
GD75232PWR	ACTIVE	TSSOP	PW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	GD75232	Samples
GD75232PWRG4	OBSOLETE	TSSOP	PW	20		TBD	Call TI	Call TI	0 to 70	GD75232	

(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.

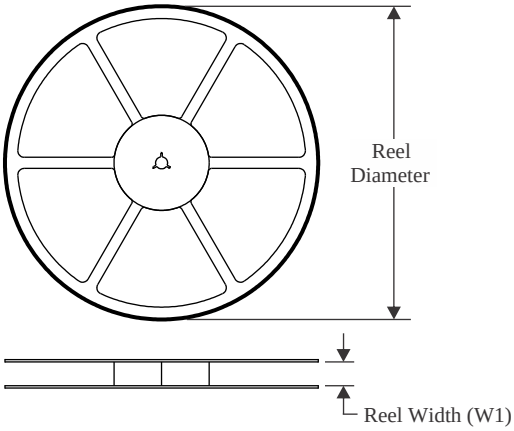
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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.

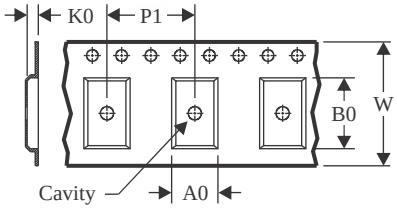
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

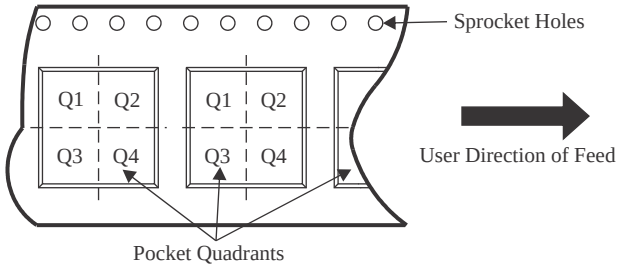


TAPE DIMENSIONS



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

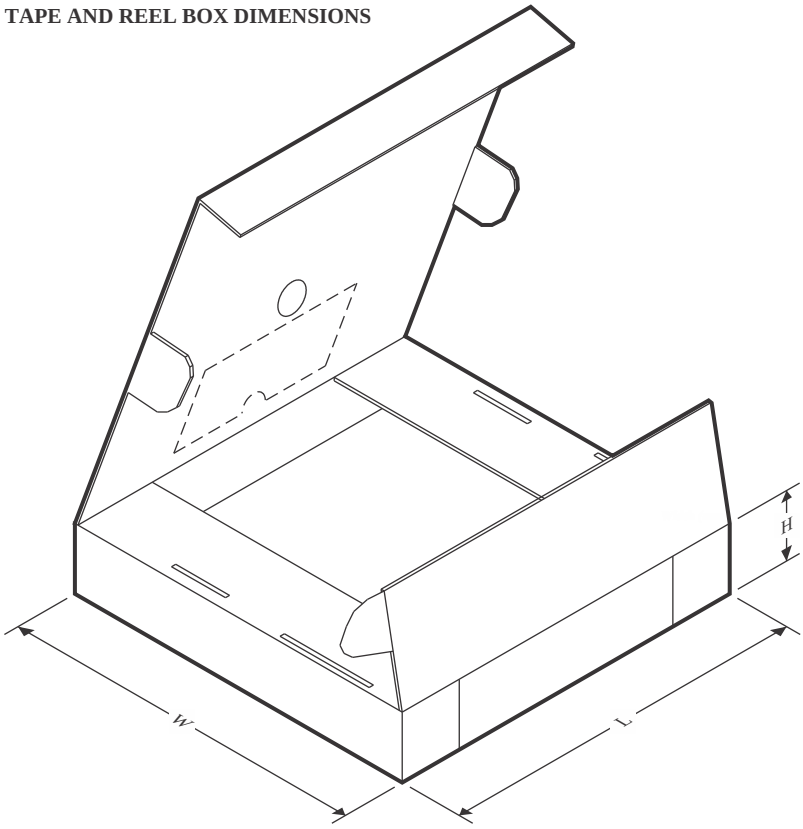
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
GD65232DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
GD65232PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	16.0	Q1
GD65232PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	16.0	Q1
GD75232DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
GD75232DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
GD75232PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	16.0	Q1
GD75232PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	16.0	Q1

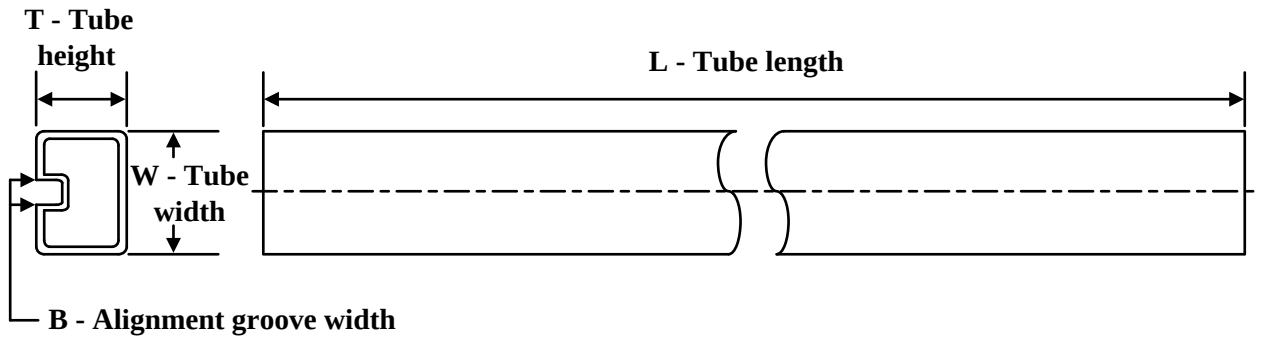
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
GD65232DWR	SOIC	DW	20	2000	367.0	367.0	45.0
GD65232PWR	TSSOP	PW	20	2000	353.0	353.0	32.0
GD65232PWR	TSSOP	PW	20	2000	356.0	356.0	35.0
GD75232DBR	SSOP	DB	20	2000	356.0	356.0	35.0
GD75232DWR	SOIC	DW	20	2000	367.0	367.0	45.0
GD75232PWR	TSSOP	PW	20	2000	353.0	353.0	32.0
GD75232PWR	TSSOP	PW	20	2000	356.0	356.0	35.0

TUBE



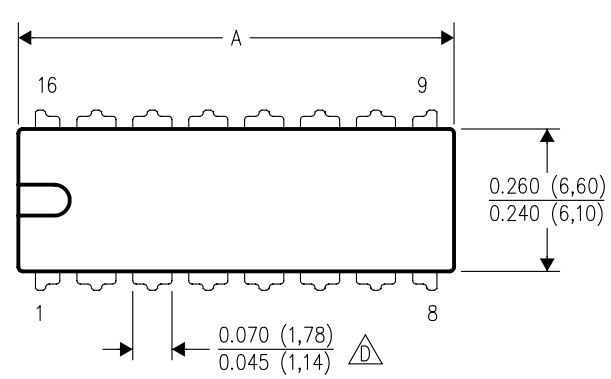
*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
GD65232DW	DW	SOIC	20	25	507	12.83	5080	6.6
GD75232DW	DW	SOIC	20	25	506.98	12.7	4826	6.6
GD75232DW	DW	SOIC	20	25	507	12.83	5080	6.6
GD75232N	N	PDIP	20	20	506	13.97	11230	4.32

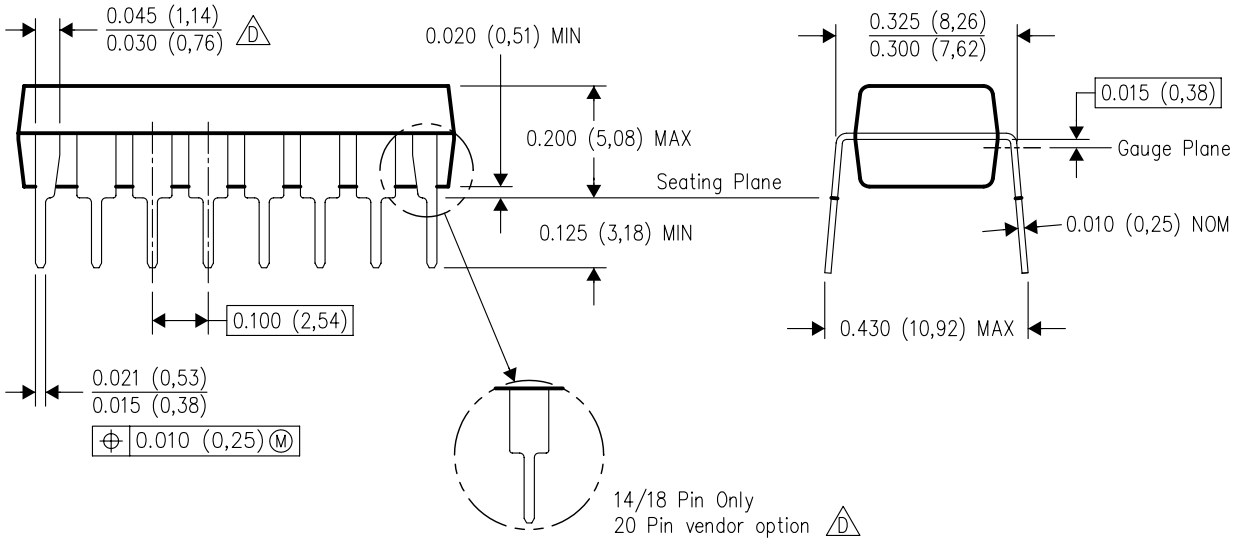
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN

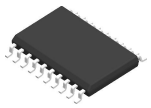


DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



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.

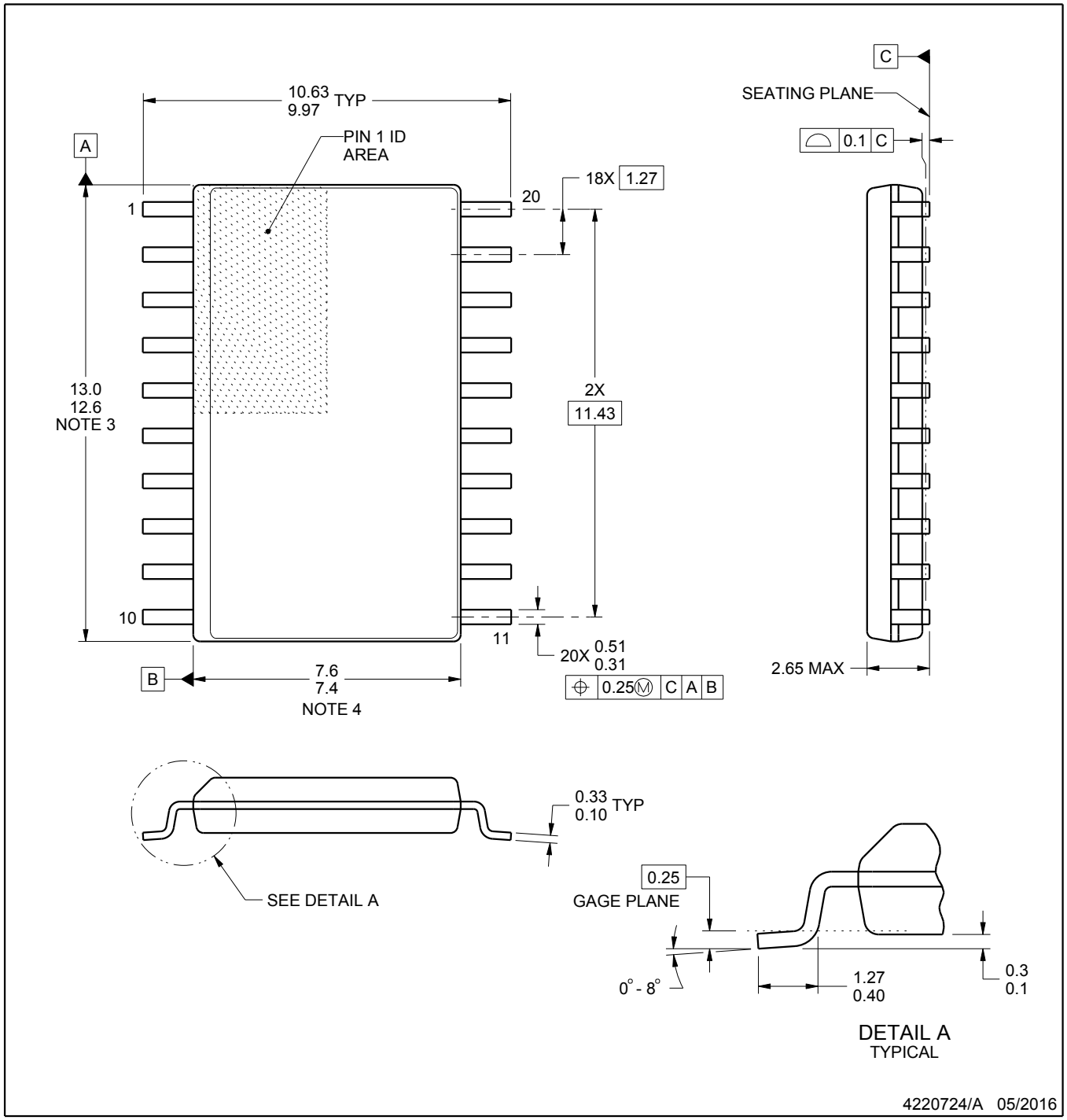


PACKAGE OUTLINE

DW0020A

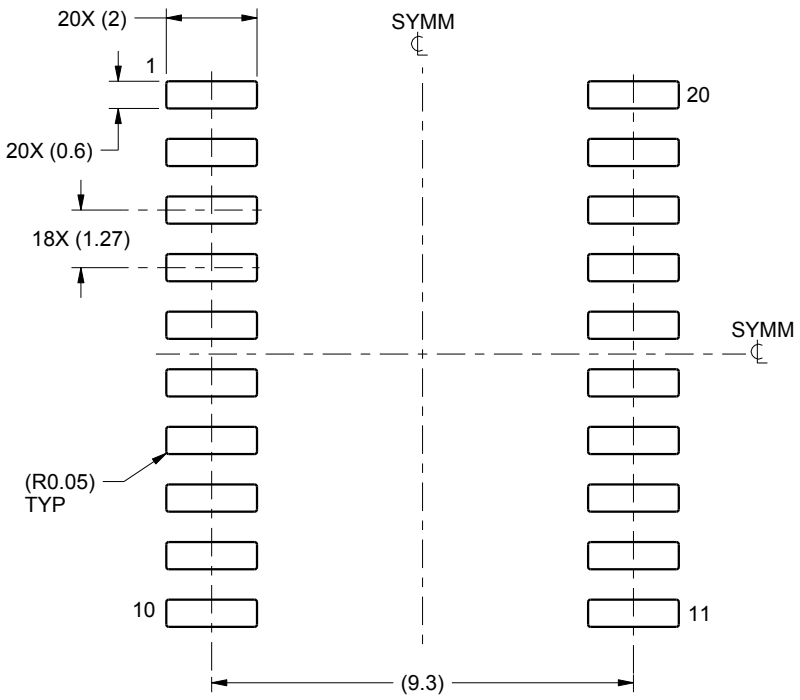
SOIC - 2.65 mm max height

SOIC

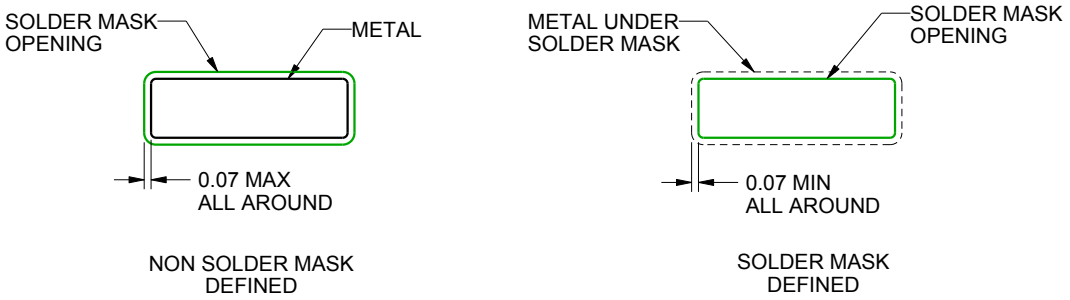


NOTES:

1. All linear dimensions are in millimeters. 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 0.43 mm per side.
5. Reference JEDEC registration MS-013.



LAND PATTERN EXAMPLE
SCALE:6X

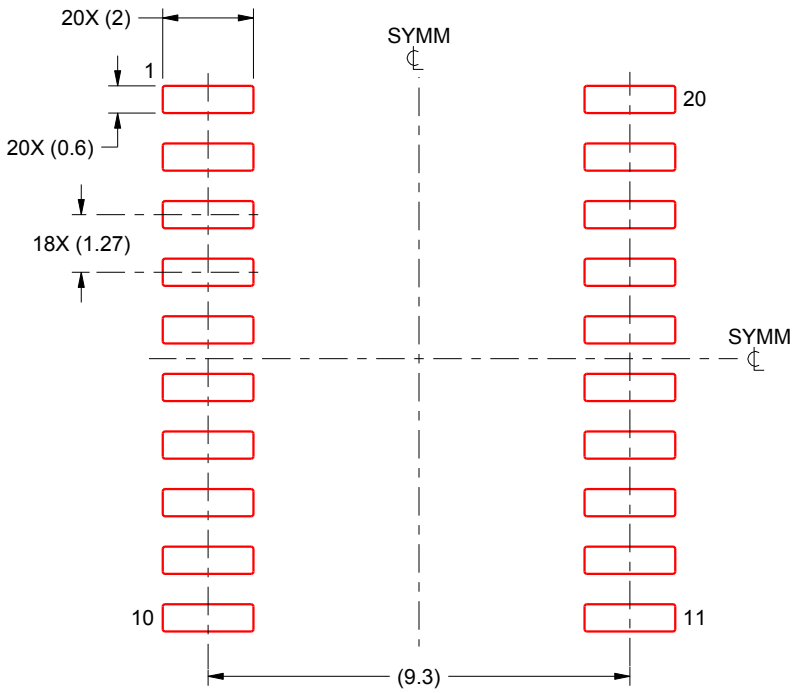


SOLDER MASK DETAILS

4220724/A 05/2016

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.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

4220724/A 05/2016

NOTES: (continued)

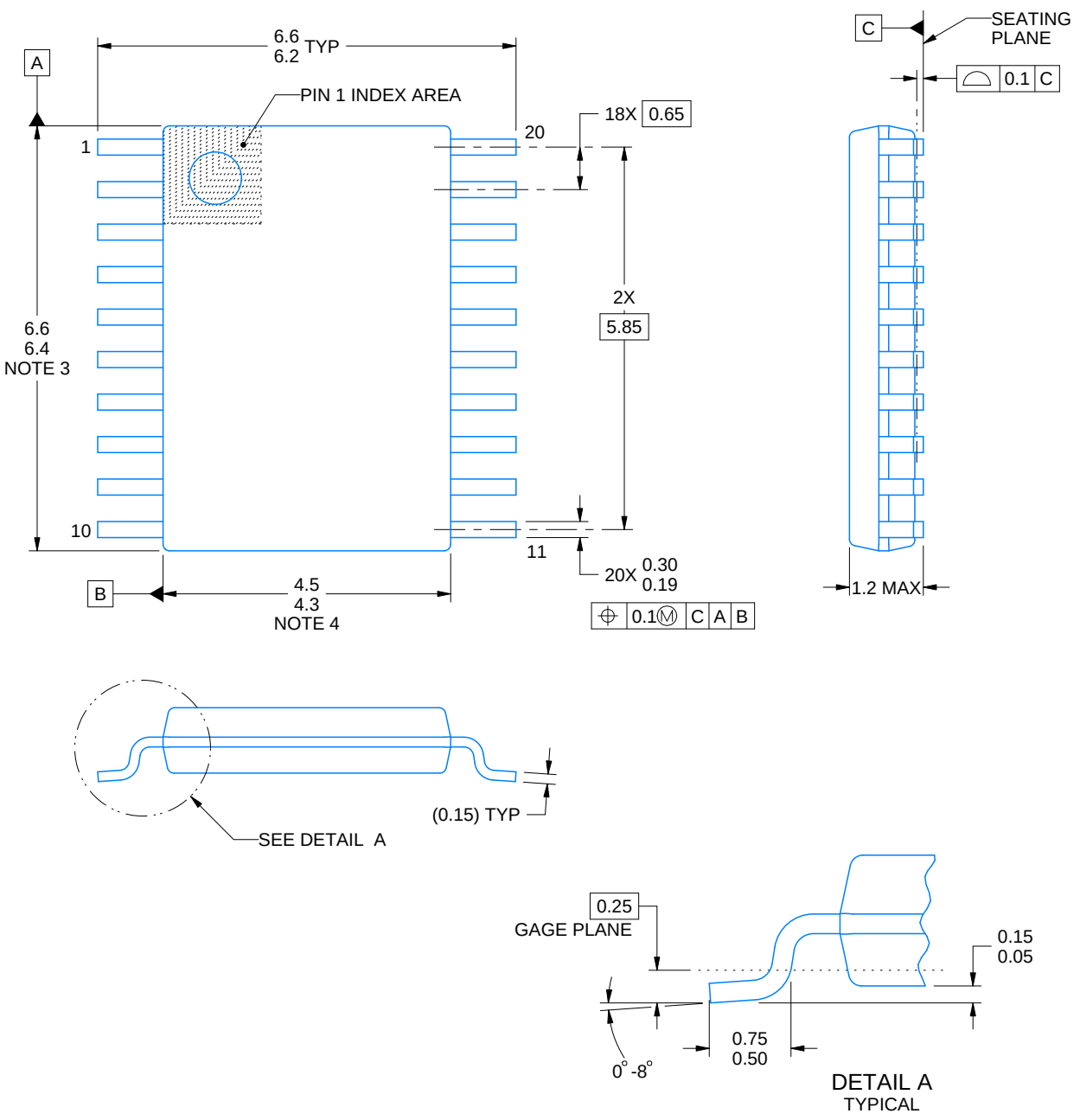
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

PACKAGE OUTLINE

PW0020A

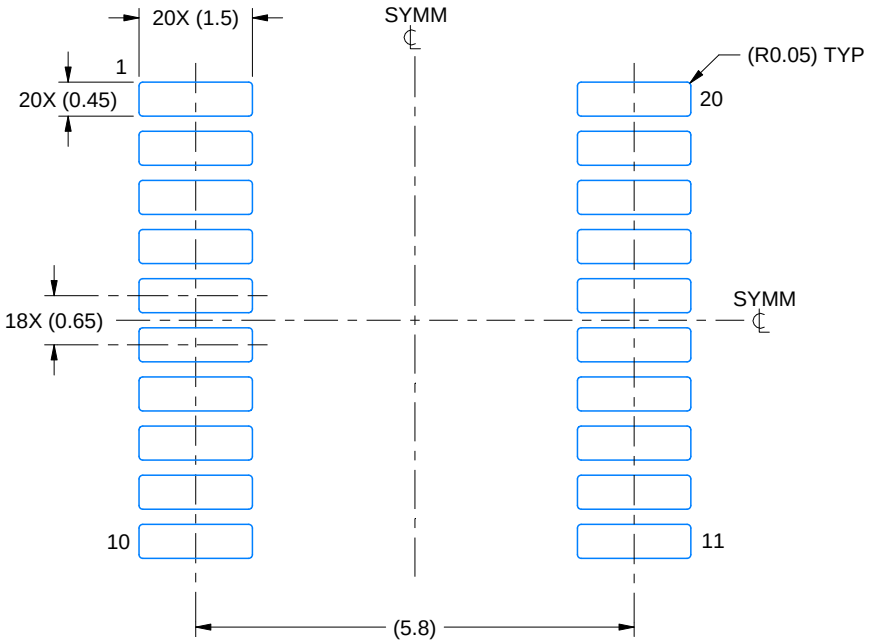
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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-153.



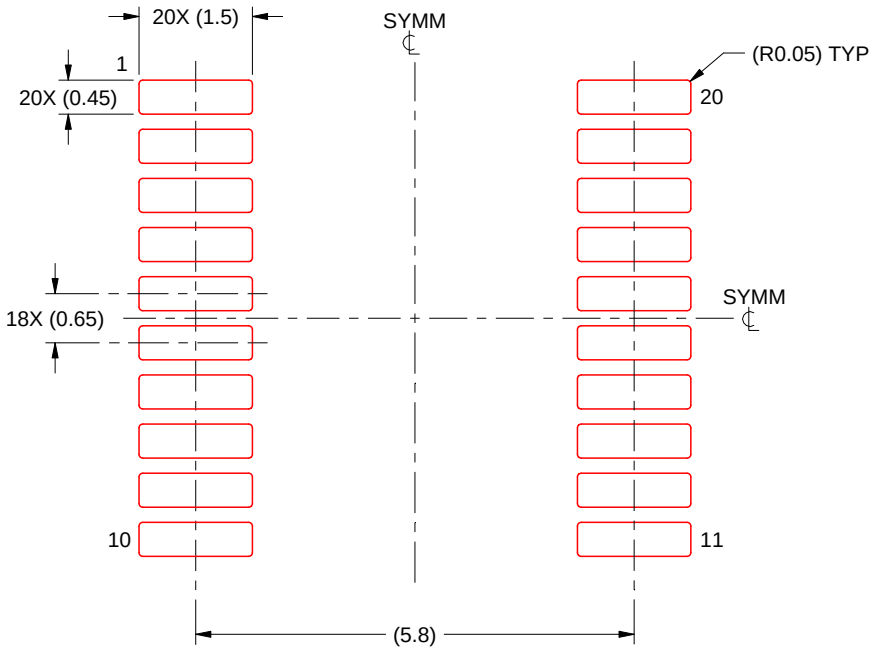
LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

SOLDER MASK DETAILS

4220206/A 02/2017

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.



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

4220206/A 02/2017

NOTES: (continued)

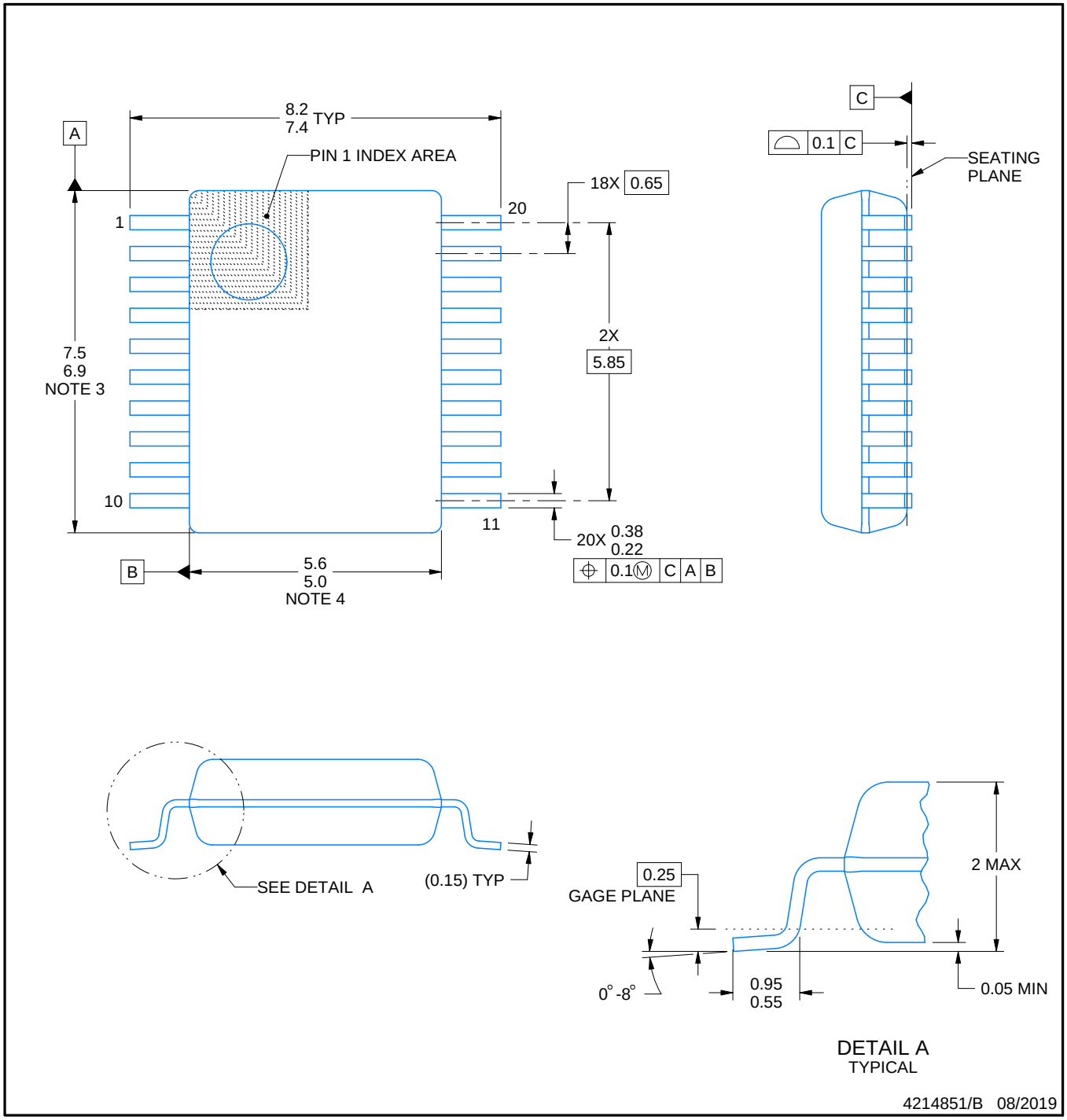
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

PACKAGE OUTLINE

DB0020A

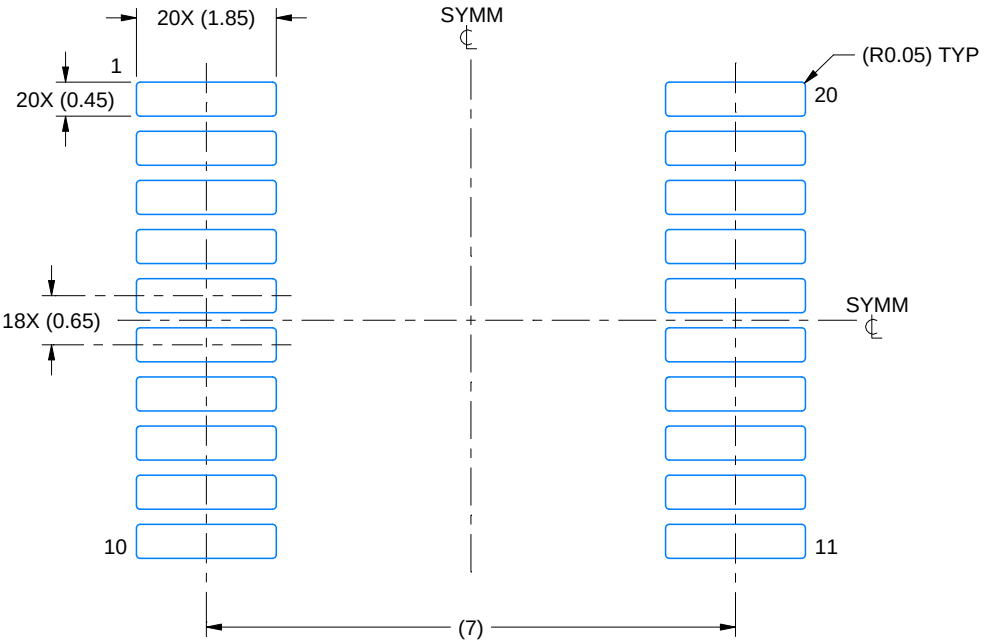
SSOP - 2 mm max height

SMALL OUTLINE PACKAGE

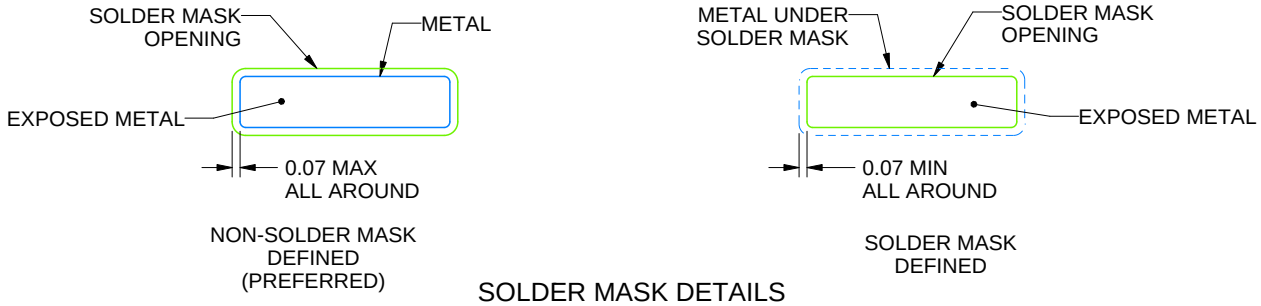


NOTES:

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.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4214851/B 08/2019

NOTES: (continued)

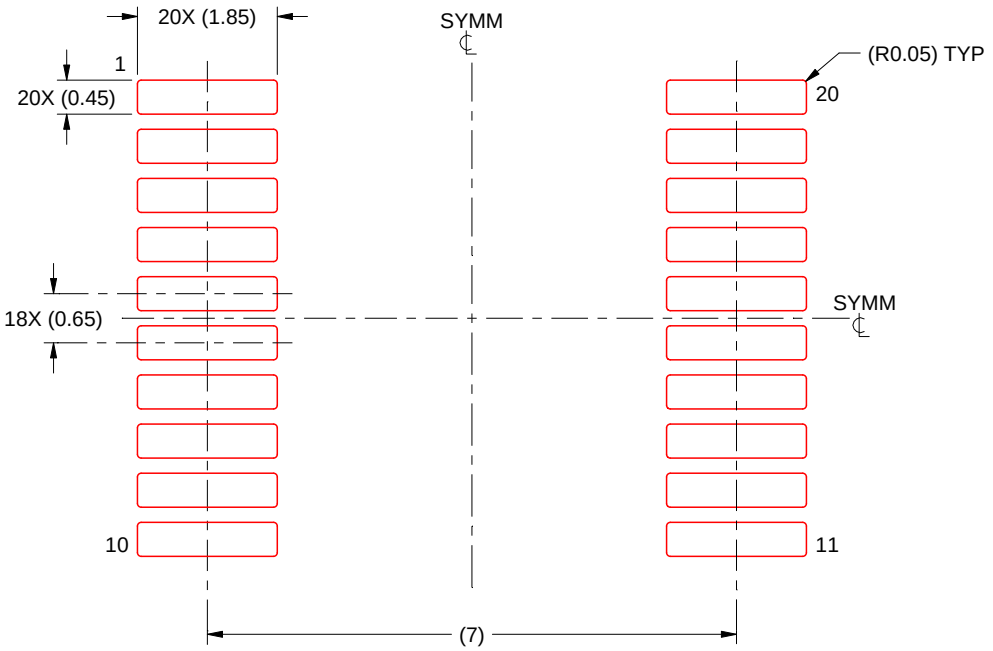
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



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

4214851/B 08/2019

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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