

SN54LVT574, SN74LVT574

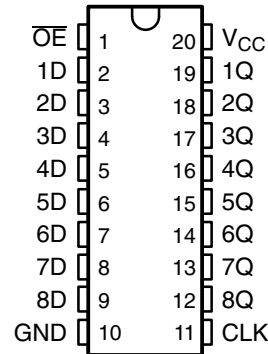
3.3-V ABT OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

WITH 3-STATE OUTPUTS

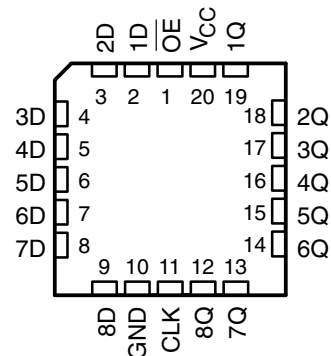
SCBS139D – MAY 1992 – REVISED JULY 1995

- State-of-the-Art Advanced BiCMOS Technology (ABT) Design for 3.3-V Operation and Low Static Power Dissipation
- Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V V_{CC})
- Support Unregulated Battery Operation Down to 2.7 V
- Typical V_{OLP} (Output Ground Bounce) < 0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model ($C = 200$ pF, $R = 0$)
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- Bus-Hold Data Inputs Eliminate the Need for External Pullup Resistors
- Support Live Insertion
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), and Thin Shrink Small-Outline (PW) Packages, Ceramic Chip Carriers (FK), Ceramic Flat (W) Packages, and Ceramic (J) DIPs

SN54LVT574 . . . J OR W PACKAGE
SN74LVT574 . . . DB, DW, OR PW PACKAGE
(TOP VIEW)



SN54LVT574 . . . FK PACKAGE
(TOP VIEW)



description

These octal flip-flops are designed specifically for low-voltage (3.3-V) V_{CC} operation, but with the capability to provide a TTL interface to a 5-V system environment.

The eight flip-flops of the 'LVT574 are edge-triggered D-type flip-flops. On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels set up at the data (D) inputs.

A buffered output-enable ($\overline{OE}$) input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or a high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without need for interface or pullup components. $\overline{OE}$ does not affect the internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

The SN74LVT574 is available in TI's shrink small-outline package (DB), which provides the same I/O pin count and functionality of standard small-outline packages in less than half the printed-circuit-board area.

The SN54LVT574 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74LVT574 is characterized for operation from -40°C to 85°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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1995, Texas Instruments Incorporated

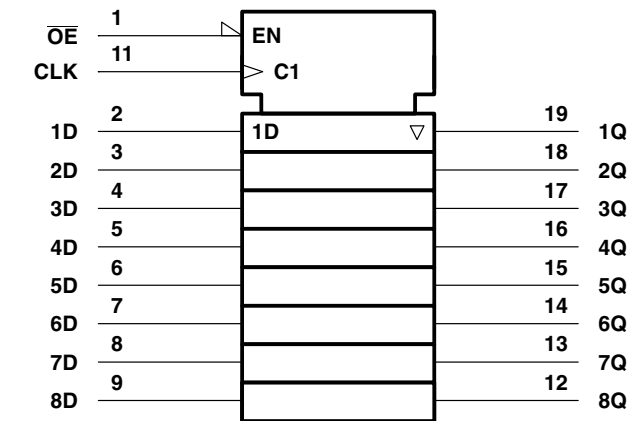
SN54LVT574, SN74LVT574 3.3-V ABT OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

SCBS139D – MAY 1992 – REVISED JULY 1995

FUNCTION TABLE
(each flip-flop)

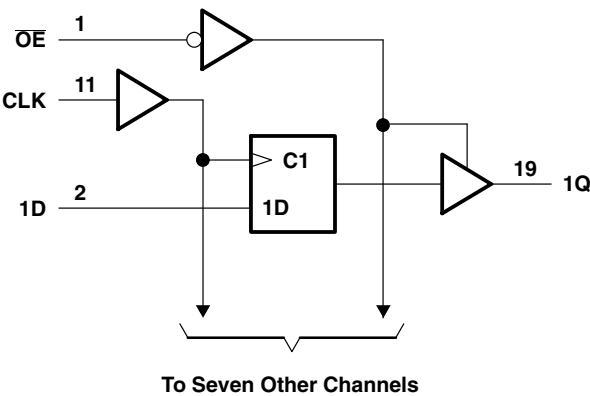
INPUTS			OUTPUT Q
OE	CLK	D	
L	↑	H	H
L	↑	L	L
L	H or L	X	Q ₀
H	X	X	Z

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



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

Supply voltage range, V_{CC}	–0.5 V to 4.6 V
Input voltage range, V_I (see Note 1)	–0.5 V to 7 V
Voltage range applied to any output in the high state or power-off state, V_O (see Note 1)	–0.5 V to 7 V
Current into any output in the low state, I_O : SN54LVT574	96 mA
SN74LVT574	128 mA
Current into any output in the high state, I_O (see Note 2): SN54LVT574	48 mA
SN74LVT574	64 mA
Input clamp current, I_{IK} ($V_I < 0$)	–50 mA
Output clamp current, I_{OK} ($V_O < 0$)	–50 mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 3): DB package	0.6 W
DW package	1.6 W
PW package	0.7 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. This current flows only when the output is in the high state and $V_O > V_{CC}$.
3. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

SN54LVT574, SN74LVT574

3.3-V ABT OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

WITH 3-STATE OUTPUTS

SCBS139D – MAY 1992 – REVISED JULY 1995

recommended operating conditions (see Note 4)

			SN54LVT574		SN74LVT574		UNIT
			MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage		2.7	3.6	2.7	3.6	V
V_{IH}	High-level input voltage		2		2		V
V_{IL}	Low-level input voltage			0.8		0.8	V
V_I	Input voltage			5.5		5.5	V
I_{OH}	High-level output current			–24		–32	mA
I_{OL}	Low-level output current			48		64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	Outputs enabled		10		10	ns/V
T_A	Operating free-air temperature		–55	125	–40	85	°C

NOTE 4: Unused control inputs must be held high or low to prevent them from floating.

SN54LVT574, SN74LVT574

3.3-V ABT OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

WITH 3-STATE OUTPUTS

SCBS139D – MAY 1992 – REVISED JULY 1995

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

PARAMETER	TEST CONDITIONS			SN54LVT574		SN74LVT574		UNIT
				MIN	TYP†	MAX	MIN	
V _{IK}	V _{CC} = 2.7 V, I _I = −18 mA			−1.2		−1.2		V
V _{OH}	V _{CC} = MIN to MAX‡, I _{OH} = −100 μA			V _{CC} − 0.2		V _{CC} − 0.2		V
	V _{CC} = 2.7 V, I _{OH} = − 8 mA			2.4		2.4		
	V _{CC} = 3 V	I _{OH} = − 24 mA		2				
		I _{OH} = − 32 mA				2		
V _{OL}	V _{CC} = 2.7 V	I _{OL} = 100 μA		0.2		0.2		V
		I _{OL} = 24 mA		0.5		0.5		
	V _{CC} = 3 V	I _{OL} = 16 mA		0.4		0.4		
		I _{OL} = 32 mA		0.5		0.5		
		I _{OL} = 48 mA		0.55				
		I _{OL} = 64 mA				0.55		
I _I	V _{CC} = 0 or MAX‡, V _I = 5.5 V			50		10		μA
	V _{CC} = 3.6 V	V _I = V _{CC} or GND	Control inputs	±1		±1		
		V _I = V _{CC}	Data inputs	1		1		
		V _I = 0		−5		−5		
I _{off}	V _{CC} = 0, V _I or V _O = 0 to 4.5 V					±100		μA
I _{I(hold)}	V _{CC} = 3 V	V _I = 0.8 V	Data inputs	75		75		μA
		V _I = 2 V		−75		−75		
I _{OZH}	V _{CC} = 3.6 V, V _O = 3 V			1		1		μA
I _{OZL}	V _{CC} = 3.6 V, V _O = 0.5 V			−1		−1		μA
I _{CC}	V _{CC} = 3.6 V, I _O = 0, V _I = V _{CC} or GND		Outputs high	0.13	0.39	0.13	0.19	mA
			Outputs low	8.7	14	8.7	12	
			Outputs disabled	0.13	0.39	0.13	0.19	
ΔI _{CC} §	V _{CC} = 3 V to 3.6 V, One input at V _{CC} − 0.6 V, Other inputs at V _{CC} or GND			0.3		0.2		mA
C _i	V _I = 3 V or 0			4		4		pF
C _o	V _O = 3 V or 0			8		8		pF

† All typical values are at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$.

‡ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

§ This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.

timing requirements over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

		SN54LVT574				SN74LVT574				UNIT
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$		$V_{CC} = 2.7\text{ V}$		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$		$V_{CC} = 2.7\text{ V}$		
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency	0	150	0	150	0	150	0	150	MHz
t_w	Pulse duration, CLK high or low	3.3		3.3		3.3		3.3		ns
t_{su}	Setup time, data before CLK↑	2		2.4		2		2.4		ns
t_h	Hold time, data after CLK↑	0.9		0.9		0.3		0		ns



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

SN54LVT574, SN74LVT574

3.3-V ABT OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

WITH 3-STATE OUTPUTS

SCBS139D – MAY 1992 – REVISED JULY 1995

switching characteristics over recommended operating free-air temperature range, $C_L = 50$ pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVT574				SN74LVT574				UNIT	
			V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 2.7 V		V _{CC} = 3.3 V ± 0.3 V			V _{CC} = 2.7 V		
			MIN	MAX	MIN	MAX	MIN	TYP†	MAX	MIN		MAX
f _{max}			150		150		150		150		MHz	
t _{PLH}	CLK	Q	1	5.9		6.6	1.7	3.6	5.4		6.2	ns
t _{PHL}			1	6.1		6.8	2.4	4.3	5.9		6.6	
t _{PZH}	OE	Q	0.5	5.9		7.1	1	2.9	4.8		5.9	ns
t _{PZL}			0.5	5.3		6.4	1.3	3.4	5.1		6.2	
t _{PHZ}	OE	Q	0.7	5.9		6.6	1.9	4	5.5		5.9	ns
t _{PLZ}			0.5	5.1		5.1	1.7	3.2	4.5		4.5	

† All typical values are at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$.

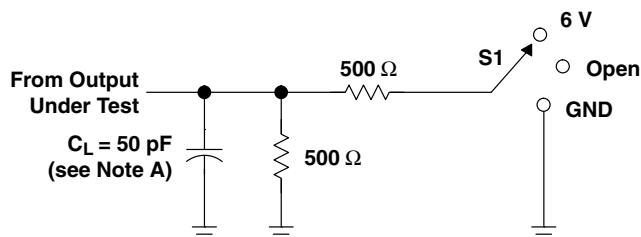
SN54LVT574, SN74LVT574

3.3-V ABT OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

WITH 3-STATE OUTPUTS

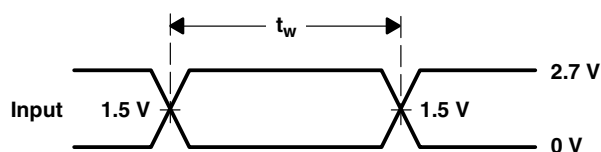
SCBS139D – MAY 1992 – REVISED JULY 1995

PARAMETER MEASUREMENT INFORMATION

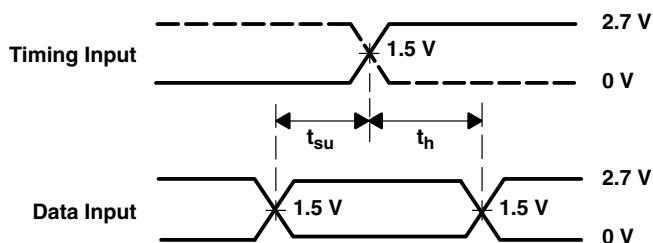


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND

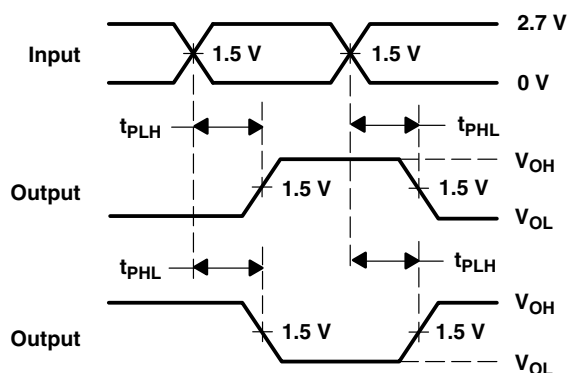
LOAD CIRCUIT FOR OUTPUTS



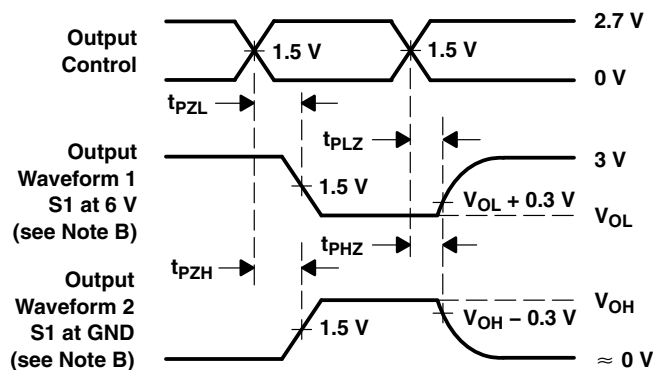
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- NOTES: A. C_L includes probe and jig capacitance.
- B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
- D. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
SN74LVT574DBLE	OBSOLETE	SSOP	DB	20		TBD	Call TI	Call TI	
SN74LVT574DBR	OBSOLETE	SSOP	DB	20		TBD	Call TI	Call TI	
SN74LVT574DW	NRND	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LVT574DWR	NRND	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LVT574NSR	OBSOLETE	SO	NS	20		TBD	Call TI	Call TI	
SN74LVT574PWLE	OBSOLETE	TSSOP	PW	20		TBD	Call TI	Call TI	
SN74LVT574PWR	NRND	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SNJ54LVT574FK	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI	
SNJ54LVT574J	OBSOLETE	CDIP	J	20		TBD	Call TI	Call TI	
SNJ54LVT574W	OBSOLETE	CFP	W	20		TBD	Call TI	Call TI	

(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.

OTHER QUALIFIED VERSIONS OF SN54LVT574, SN74LVT574 :

- Catalog: [SN74LVT574](#)
- Military: [SN54LVT574](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

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

TAPE AND REEL INFORMATION

*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
SN74LVT574DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
SN74LVT574PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



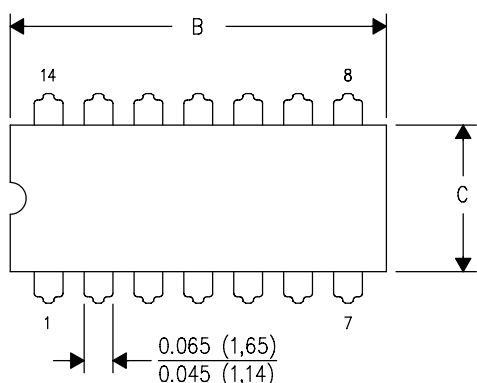
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVT574DWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74LVT574PWR	TSSOP	PW	20	2000	367.0	367.0	38.0

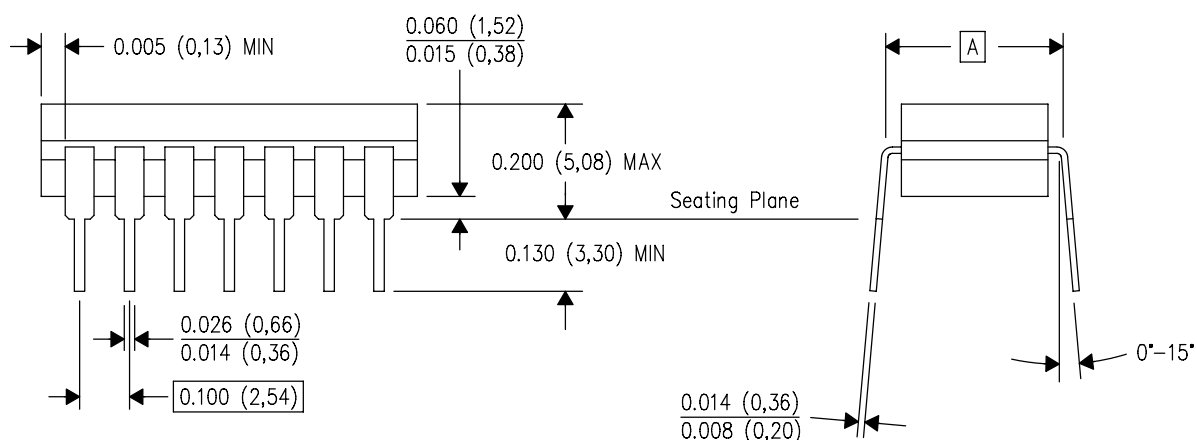
J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	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)

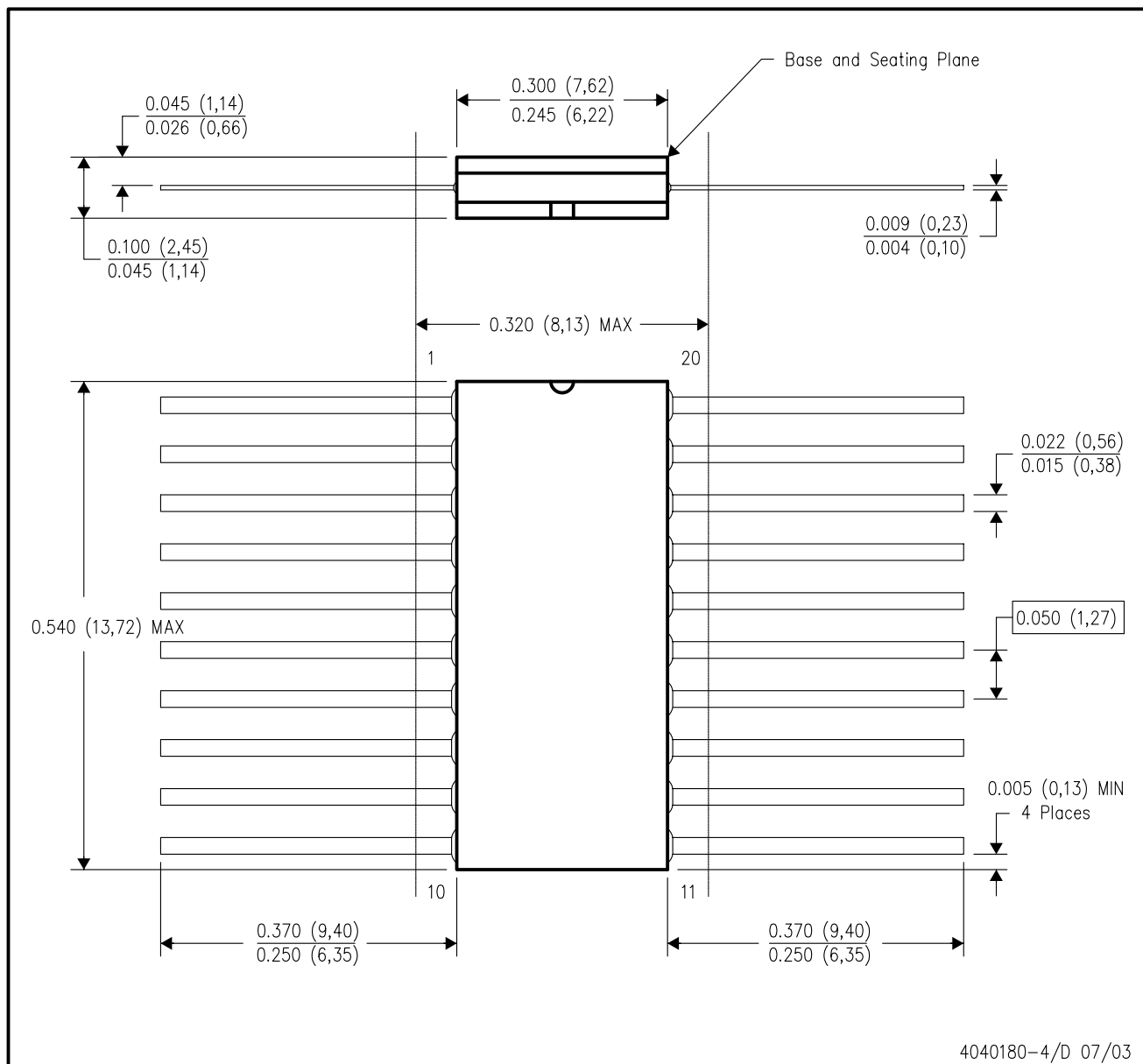


4040083/F 03/03

- 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-F20)

CERAMIC DUAL FLATPACK

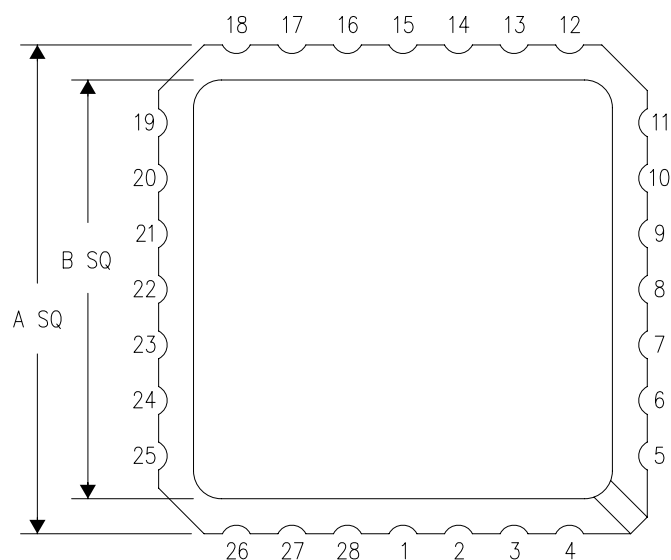


- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only.
 - Falls within Mil-Std 1835 GDFP2-F20

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	0.740 (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)

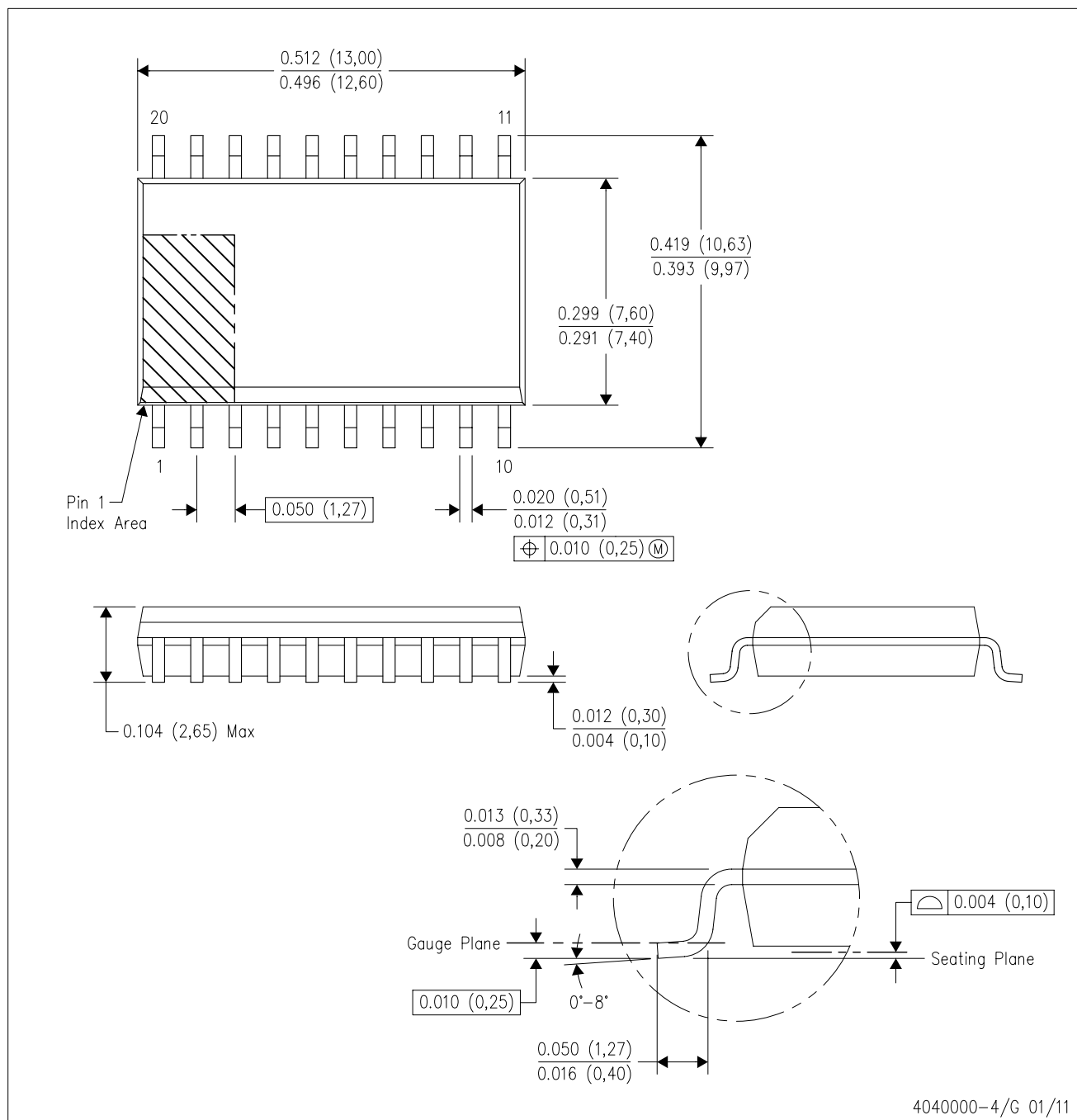


4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - Falls within JEDEC MS-004

DW (R-PDSO-G20)

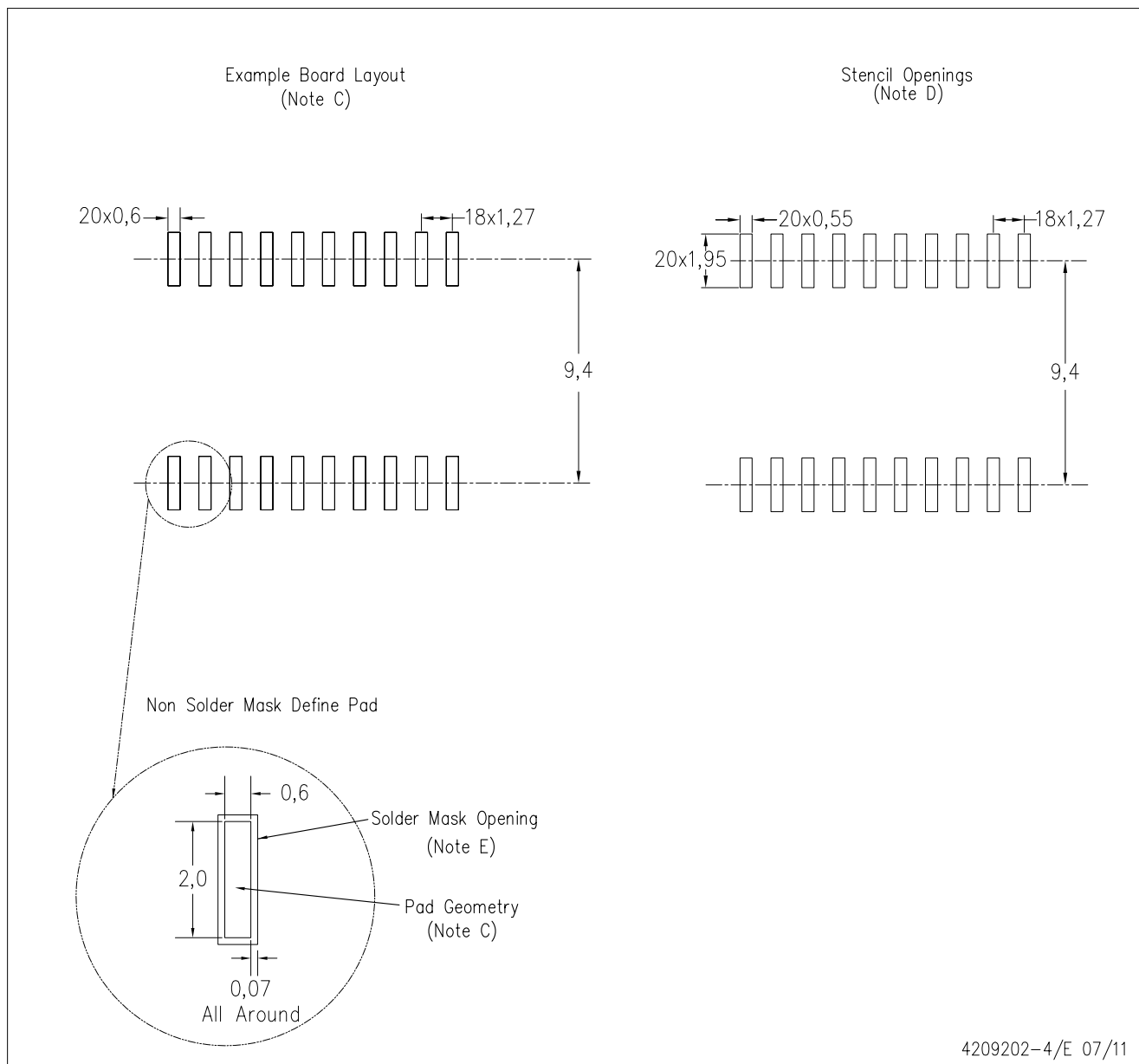
PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - Falls within JEDEC MS-013 variation AC.

DW (R-PDSO-G20)

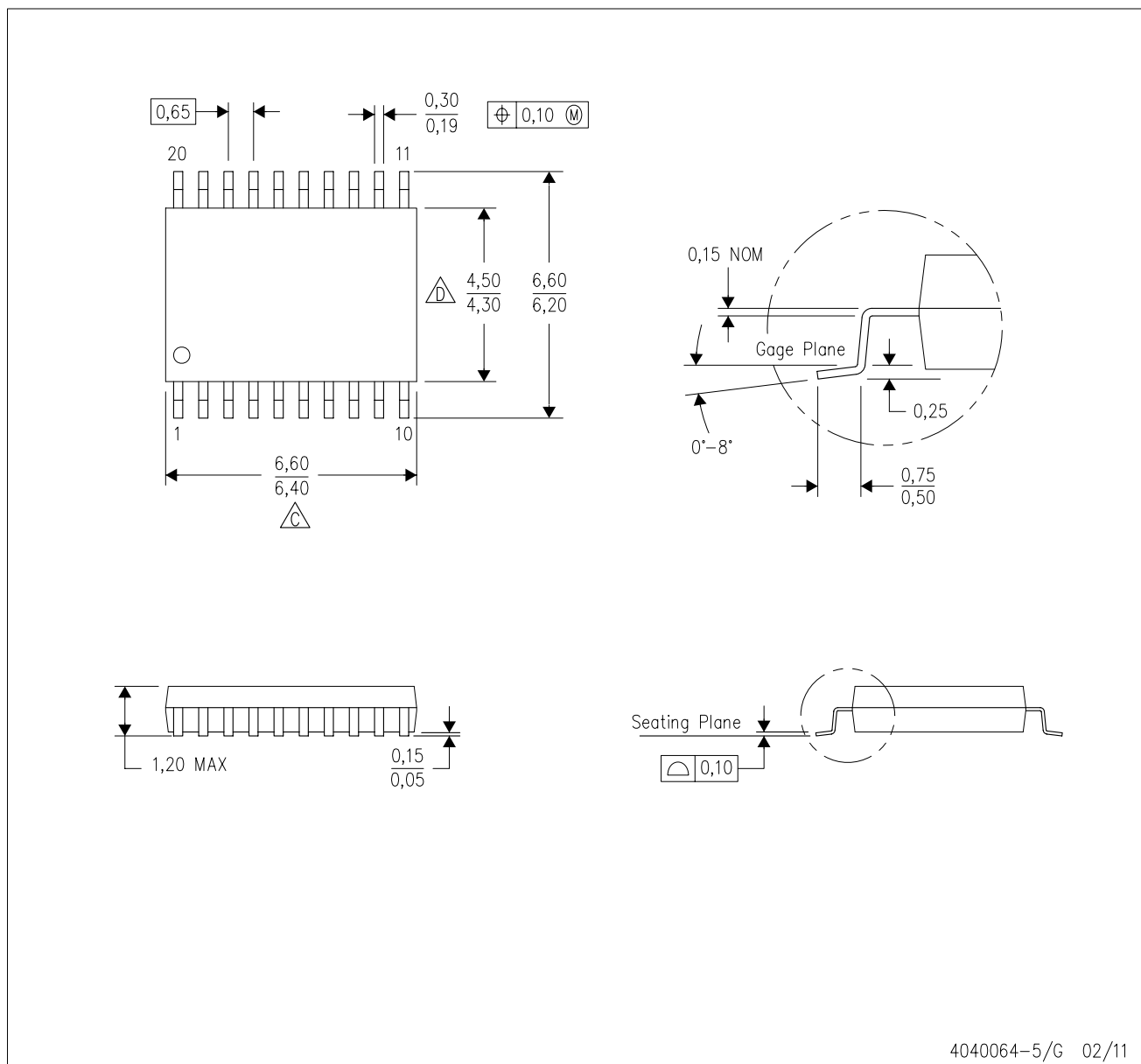
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Refer to IPC7351 for alternate board design.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



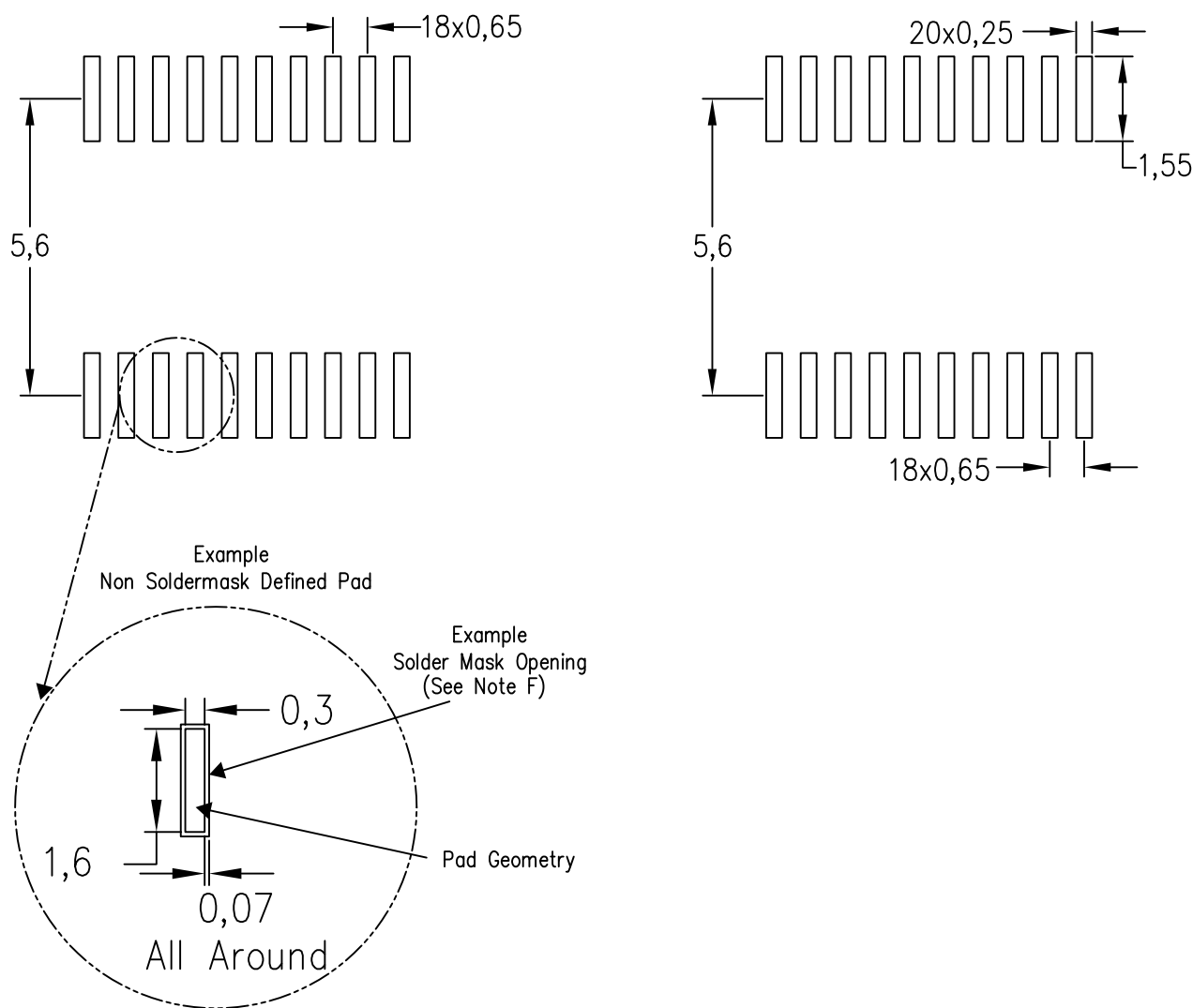
- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
 - E. Falls within JEDEC MO-153

PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE

Example Board Layout

Based on a stencil thickness
of .127mm (.005inch).



4211284-5/F 12/12

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate design.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

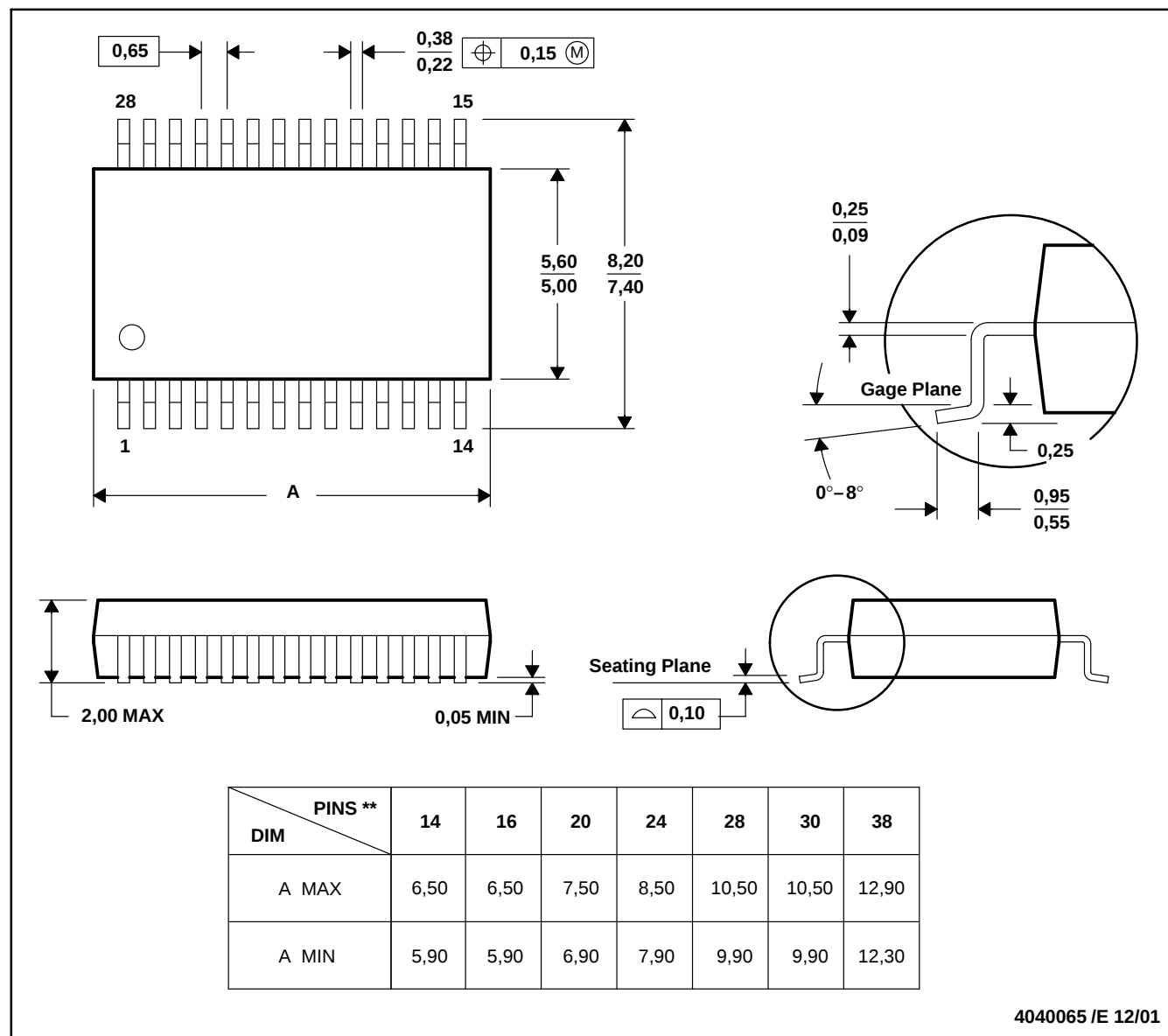


- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com