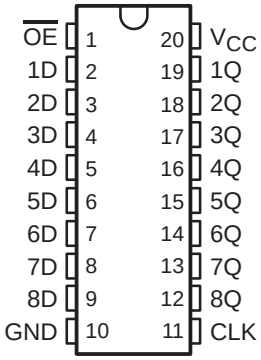
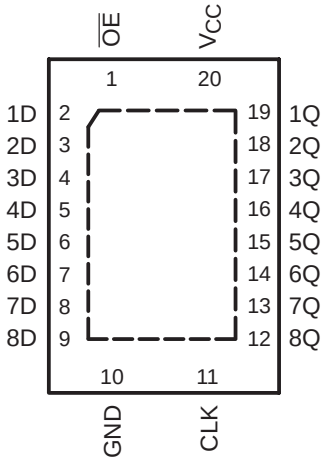
- **Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V V_{CC})**
- **Support Unregulated Battery Operation Down to 2.7 V**
- **Typical V_{OLP} (Output Ground Bounce) <0.8 V at V_{CC} = 3.3 V, T_A = 25°C**
- **I_{off} and Power-Up 3-State Support Hot Insertion**
- **Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors**
- **Latch-Up Performance Exceeds 500 mA Per JESD 17**
- **ESD Protection Exceeds JESD 22**
  - **2000-V Human-Body Model (A114-A)**
  - **200-V Machine Model (A115-A)**

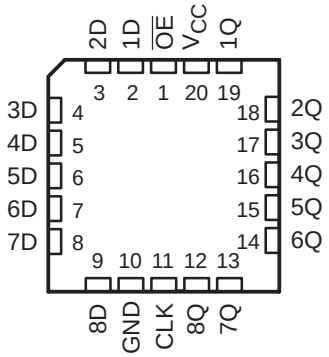
SN54LVTH574 . . . J OR W PACKAGE
SN74LVTH574 . . . DB, DW, NS, OR PW PACKAGE
(TOP VIEW)



SN74LVTH574 . . . RGY PACKAGE
(TOP VIEW)



SN54LVTH574 . . . FK PACKAGE
(TOP VIEW)



description/ordering information

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.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 85°C	QFN − RGY	Tape and reel	SN74LVTH574RGYR	LXH574
	SOIC − DW	Tube	SN74LVTH574DW	LVTH574
		Tape and reel	SN74LVTH574DWR	
	SOP − NS	Tape and reel	SN74LVTH574NSR	LVTH574
	SSOP − DB	Tape and reel	SN74LVTH574DBR	LXH574
	TSSOP − PW	Tube	SN74LVTH574PW	LXH574
		Tape and reel	SN74LVTH574PWR	
	VFBGA − GQN	Tape and reel	SN74LVTH574GQNR	LXH574
	VFBGA − ZQN (Pb-free)		SN74LVTH574ZQNR	
−55°C to 125°C	CDIP − J	Tube	SNJ54LVTH574J	SNJ54LVTH574J
	CFP − W	Tube	SNJ54LVTH574W	SNJ54LVTH574W
	LCCC − FK	Tube	SNJ54LVTH574FK	SNJ54LVTH574FK

† 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.

description/ordering information (continued)

The eight flip-flops of the 'LVTH574 devices 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.

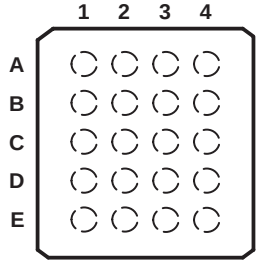
$\overline{OE}$ does not affect the internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

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.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level. Use of pullup or pulldown resistors with the bus-hold circuitry is not recommended.

These devices are fully specified for hot-insertion applications using I_{off} and power-up 3-state. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down. The power-up 3-state circuitry places the outputs in the high-impedance state during power up and power down, which prevents driver conflict.

SN74LVTH574 . . . GQN OR ZQN PACKAGE
(TOP VIEW)



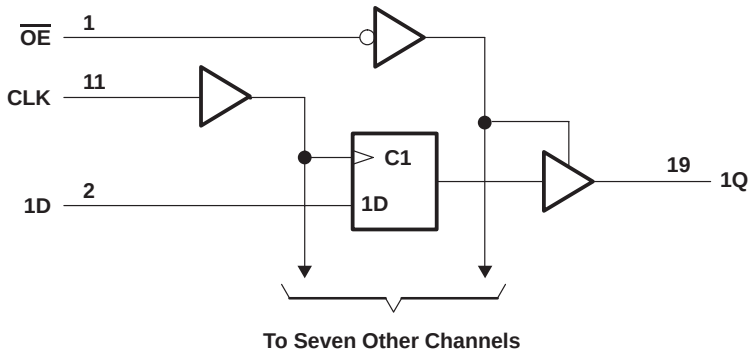
terminal assignments

	1	2	3	4
A	1D	$\overline{OE}$	V_{CC}	1Q
B	3D	3Q	2D	2Q
C	5D	4D	5Q	4Q
D	7D	7Q	6D	6Q
E	GND	8D	CLK	8Q

FUNCTION TABLE
(each flip-flop)

INPUTS			OUTPUT
$\overline{OE}$	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	H or L	X	Q_0
H	X	X	Z

logic diagram (positive logic)



Pin numbers shown are for the DB, DW, FK, J, NS, PW, RGY, and W packages.

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-impedance or power-off state, V_O (see Note 1) . . . . . −0.5 V to 7 V
Voltage range applied to any output in the high state, V_O (see Note 1) . . . . . −0.5 V to V_{CC} + 0.5 V
Current into any output in the low state, I_O: SN54LVTH574 . . . . . 96 mA
SN74LVTH574 . . . . . 128 mA
Current into any output in the high state, I_O (see Note 2): SN54LVTH574 . . . . . 48 mA
SN74LVTH574 . . . . . 64 mA
Input clamp current, I_{IK} (V_I < 0) . . . . . −50 mA
Output clamp current, I_{OK} (V_O < 0) . . . . . −50 mA
Package thermal impedance, θ_{JA} (see Note 3): DB package . . . . . 70°C/W
(see Note 3): DW package . . . . . 58°C/W
(see Note 3): GQN/ZQN package . . . . . 78°C/W
(see Note 3): NS package . . . . . 60°C/W
(see Note 3): PW package . . . . . 83°C/W
(see Note 4): RGY package . . . . . 37°C/W
Storage temperature range, T_{stg} . . . . . −65°C to 150°C

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

NOTES: 1. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This current flows only when the output is in the high state and $V_O > V_{CC}$.
3. The package thermal impedance is calculated in accordance with JESD 51-7.
4. The package thermal impedance is calculated in accordance with JESD 51-5.

recommended operating conditions (see Note 5)

			SN54LVTH574		SN74LVTH574		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
$\Delta t/\Delta V_{CC}$	Power-up ramp rate		200		200		μs/V
T_A	Operating free-air temperature		−55	125	−40	85	°C

NOTE 5: All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

PARAMETER		TEST CONDITIONS		SN54LVTH574			SN74LVTH574			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}		V_{CC} = 2.7 V,	I_I = −18 mA			−1.2			−1.2	V
V_{OH}		V_{CC} = 2.7 V to 3.6 V,	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	Control inputs	V_{CC} = 0 or 3.6 V,	V_I = 5.5 V			10			10	µA
		V_{CC} = 3.6 V,	V_I = V_{CC} or GND			±1			±1	
	Data inputs	V_{CC} = 3.6 V	V_I = V_{CC}			1			1	
			V_I = 0			−5			−5	
I_{off}		V_{CC} = 0,	V_I or V_O = 0 to 4.5 V						±100	µA
$I_{I(hold)}$	Data inputs	V_{CC} = 3 V	V_I = 0.8 V	75			75			µA
			V_I = 2 V	−75			−75			
		V_{CC} = 3.6 V‡,	V_I = 0 to 3.6 V						±500	
I_{OZH}		V_{CC} = 3.6 V,	V_O = 3 V			5			5	µA
I_{OZL}		V_{CC} = 3.6 V,	V_O = 0.5 V			−5			−5	µA
I_{OZPU}		V_{CC} = 0 to 1.5 V, V_O = 0.5 V to 3 V, $\overline{OE}$ = don't care				±100*			±100	µA
I_{OZPD}		V_{CC} = 1.5 V to 0, V_O = 0.5 V to 3 V, $\overline{OE}$ = don't care				±100*			±100	µA
I_{CC}		V_{CC} = 3.6 V, I_O = 0, V_I = V_{CC} or GND	Outputs high			0.19			0.19	mA
			Outputs low			5			5	
			Outputs disabled			0.19			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				0.2			0.2	mA
C_i		V_I = 3 V or 0			3			3		pF
C_o		V_O = 3 V or 0			7			7		pF

* On products compliant to MIL-PRF-38535, this parameter is not production tested.
† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.
‡ This is the bus-hold maximum dynamic current. It is the minimum overdrive current required to switch the input from one state to another.
§ 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)

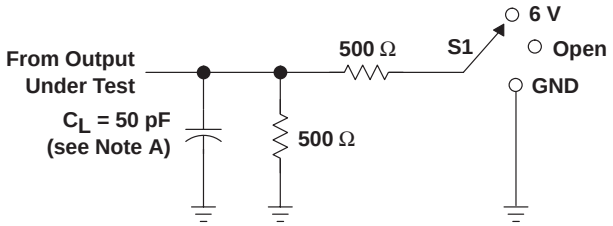
		SN54LVTH574				SN74LVTH574				UNIT
		V_{CC} = 3.3 V ± 0.3 V		V_{CC} = 2.7 V		V_{CC} = 3.3 V ± 0.3 V		V_{CC} = 2.7 V		
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		150		150		150		150	MHz
t_w	Pulse duration, CLK high or low	3.3		3.3		3.3		3.3		ns
t_{su}	Setup time, data before CLK↑	2		2.4		2		2.4		ns
t_h	Hold time, data after CLK↑	0.9		0.9		0.3		0		ns

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVTH574				SN74LVTH574					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	1.7	4.9		5.9	1.8	3	4.5		5.3	ns
t_{PHL}			1.7	4.9		5.5	1.8	3	4.5		5.3	
t_{PZH}	$\overline{OE}$	Q	1.4	5.1		6.5	1.5	3.2	4.8		5.9	ns
t_{PZL}			1.4	5.1		6.1	1.5	3.5	4.8		5.9	
t_{PHZ}	$\overline{OE}$	Q	1	5.9		6.4	2	3.5	4.8		5.1	ns
t_{PLZ}			0.8	4.8		5.3	2	3.2	4.4		4.4	

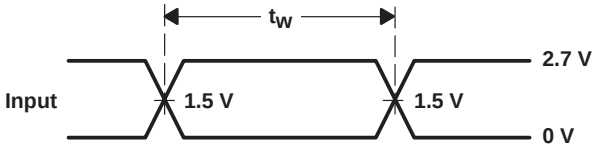
† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

PARAMETER MEASUREMENT INFORMATION

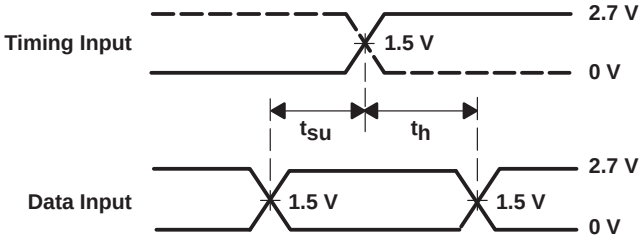


LOAD CIRCUIT

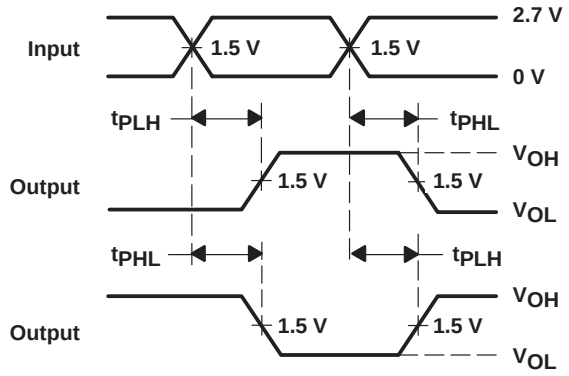
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND



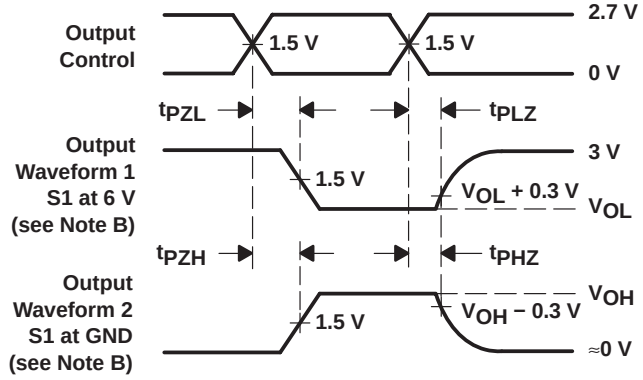
VOLTAGE WAVEFORMS
PULSE DURATION



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 ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 ns.
D. The outputs are measured one at a time with one transition per measurement.
E. All parameters and waveforms are not applicable to all devices.

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)
5962-9583201Q2A	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
5962-9583201QRA	ACTIVE	CDIP	J	20	1	None	Call TI	Level-NC-NC-NC
5962-9583201QSA	ACTIVE	CFP	W	20	1	None	Call TI	Level-NC-NC-NC
5962-9583201VRA	ACTIVE	CDIP	J	20	1	None	Call TI	Level-NC-NC-NC
5962-9583201VSA	ACTIVE	CFP	W	20	1	None	Call TI	Level-NC-NC-NC
SN74LVTH574DBLE	OBSOLETE	SSOP	DB	20		None	Call TI	Call TI
SN74LVTH574DBR	ACTIVE	SSOP	DB	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LVTH574DW	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
SN74LVTH574DWR	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
SN74LVTH574GQNR	ACTIVE	VFBGA	GQN	20	1000	None	SNPB	Level-1-240C-UNLIM
SN74LVTH574NSR	ACTIVE	SO	NS	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LVTH574PW	ACTIVE	TSSOP	PW	20	70	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LVTH574PWLE	OBSOLETE	TSSOP	PW	20		None	Call TI	Call TI
SN74LVTH574PWR	ACTIVE	TSSOP	PW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LVTH574RGYR	ACTIVE	QFN	RGY	20	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
SN74LVTH574ZQNR	ACTIVE	VFBGA	ZQN	20	1000	Pb-Free (RoHS)	SNAGCU	Level-1-260C-UNLIM
SNJ54LVTH574FK	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
SNJ54LVTH574J	ACTIVE	CDIP	J	20	1	None	Call TI	Level-NC-NC-NC
SNJ54LVTH574W	ACTIVE	CFP	W	20	1	None	Call TI	Level-NC-NC-NC

(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 - May not be currently available - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
None: Not yet available Lead (Pb-Free).
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.
Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

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

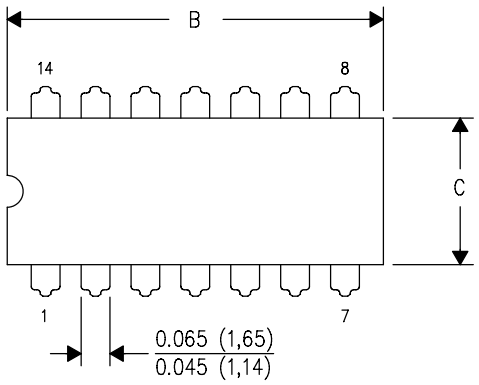
reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be 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.

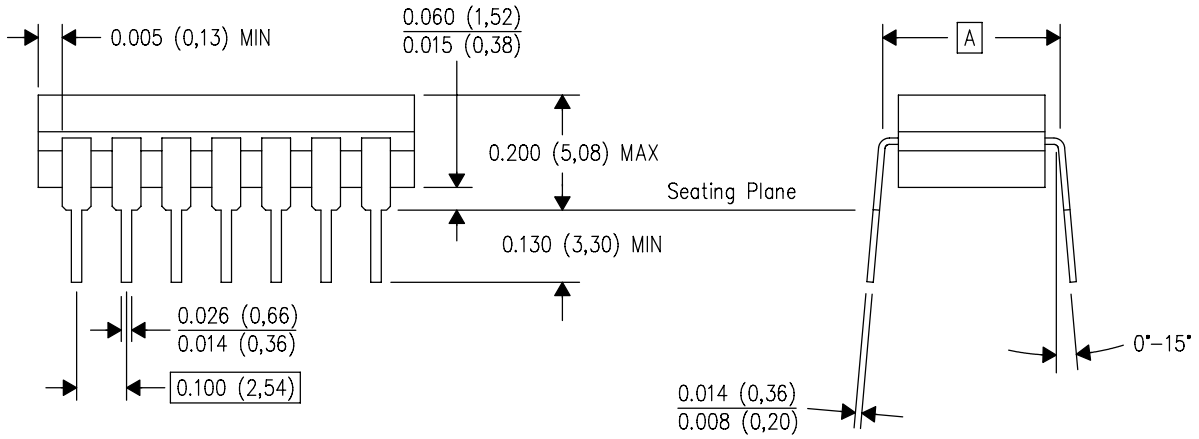
J (R–GDIP–T**)

14 LEADS SHOWN

CERAMIC DUAL IN–LINE PACKAGE



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

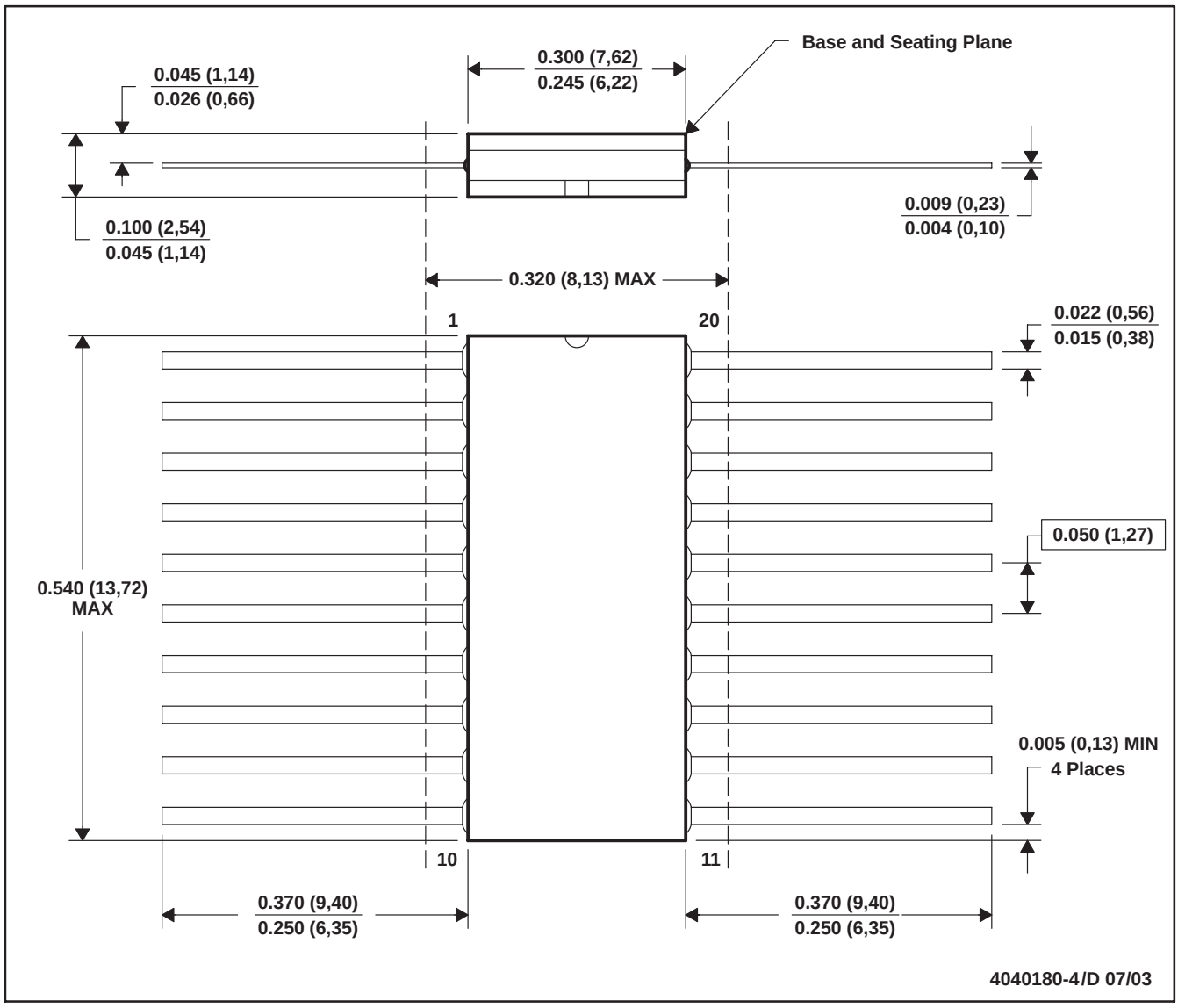


4040083/F 03/03

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
E. Falls within MIL STD 1835 GDIP1–T14, GDIP1–T16, GDIP1–T18 and GDIP1–T20.

MCFP006B − JANUARY 1995 − REVISED JULY 2003

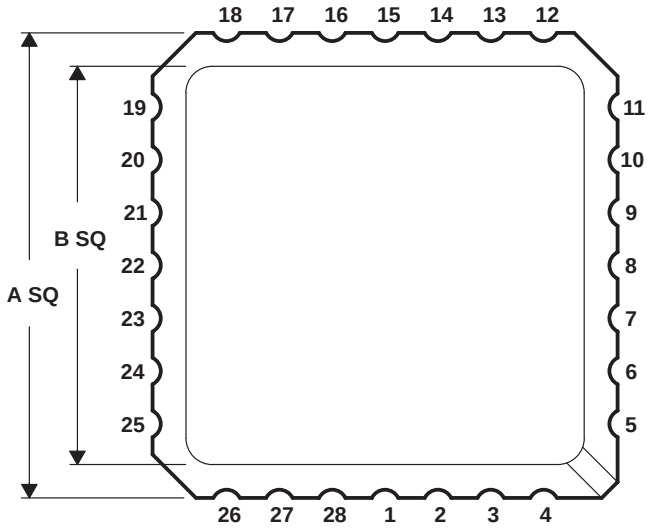
W (R-GDFP-F20) **CERAMIC DUAL FLATPACK**



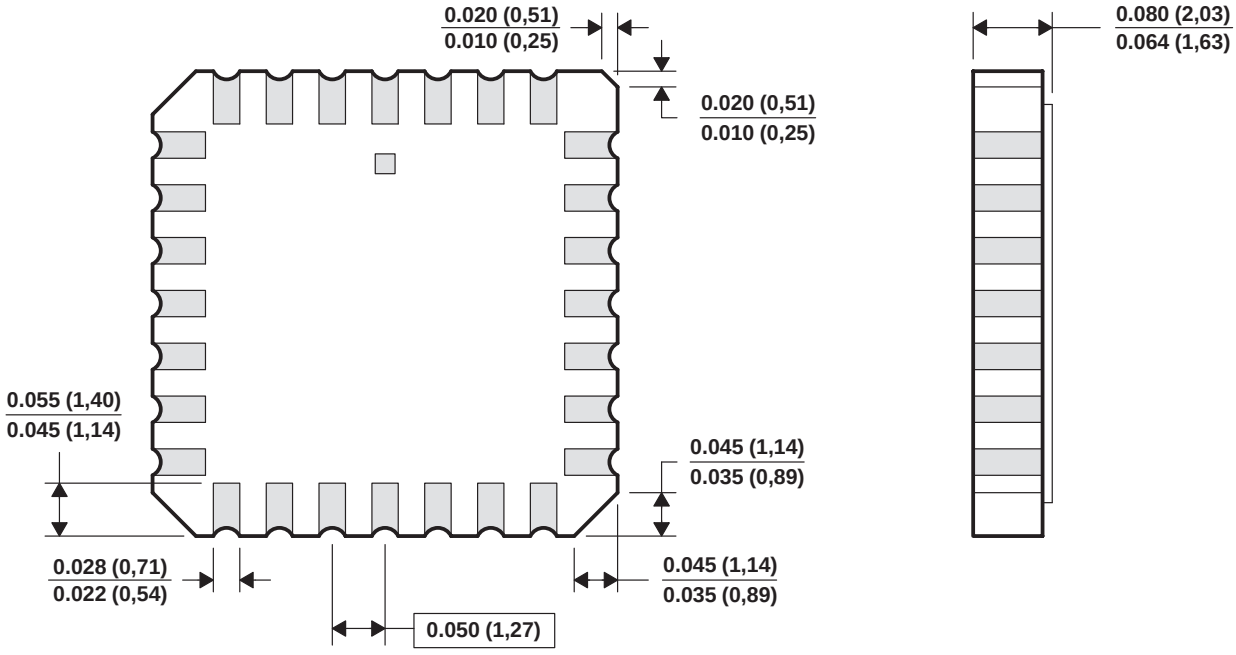
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only.
E. Falls within Mil-Std 1835 GDFP2-F20

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

28 TERMINAL SHOWN



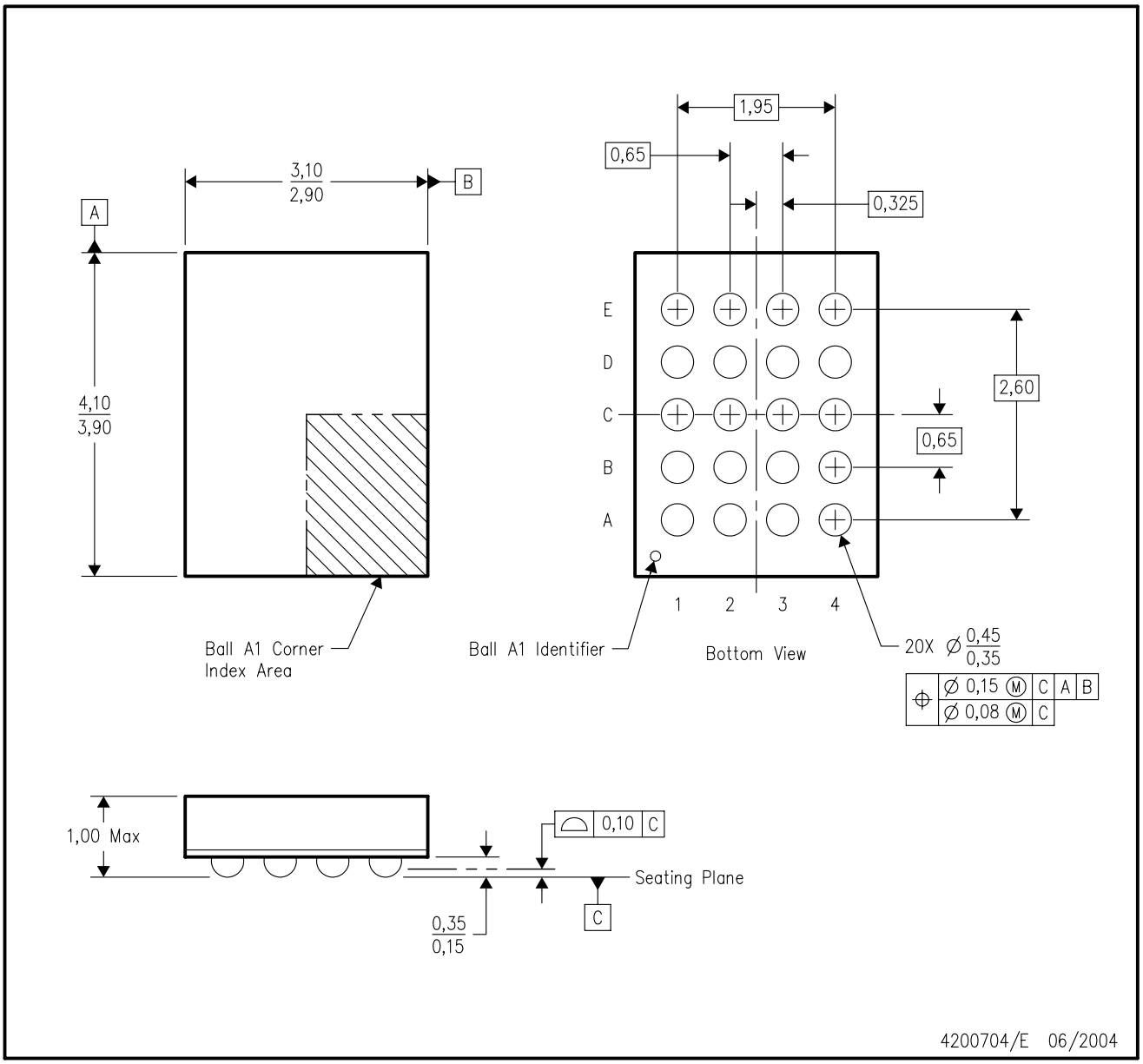
NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.739 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)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



4040140/D 10/96

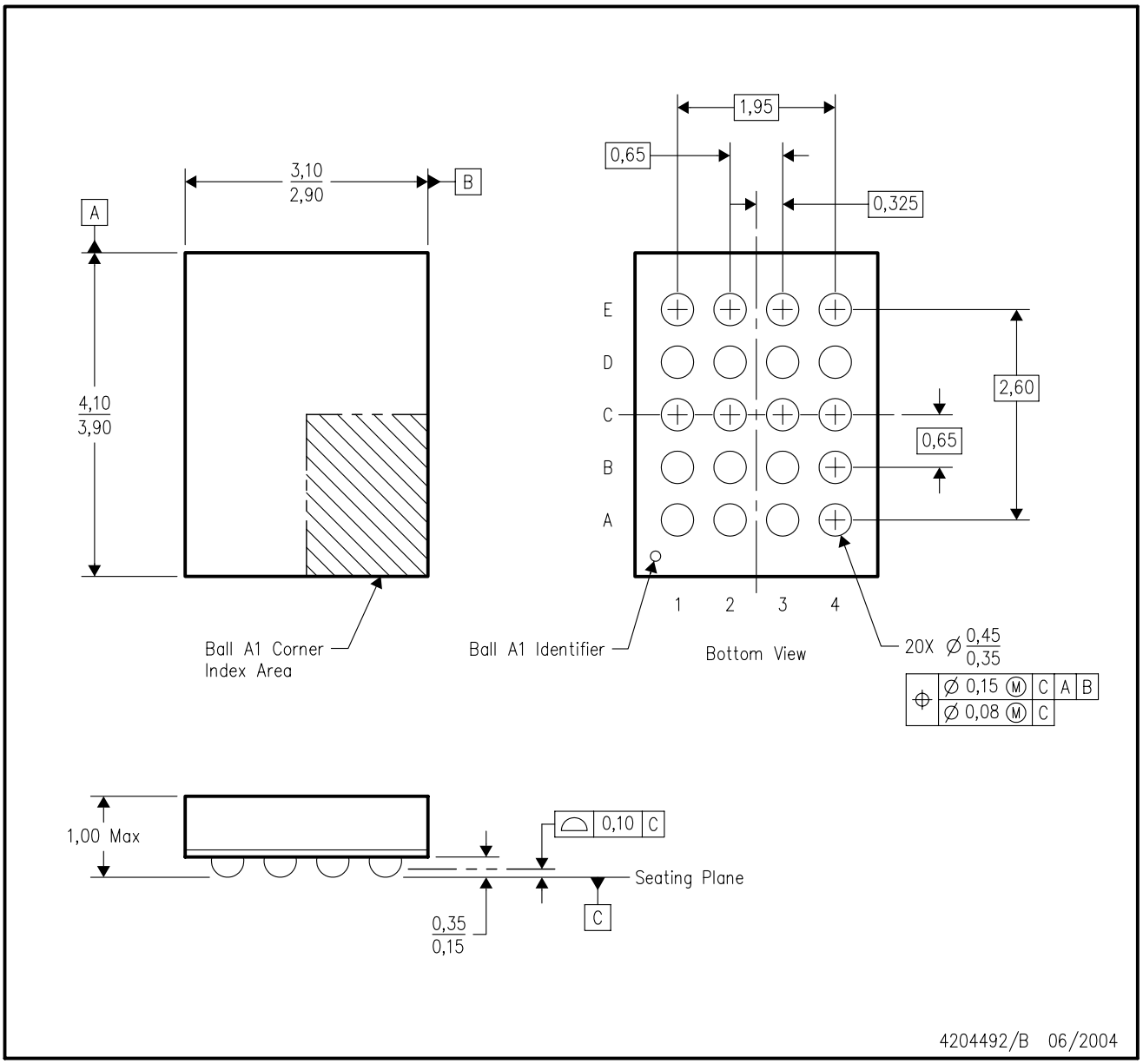
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MS-004

GQN (R–PBGA–N20) PLASTIC BALL GRID ARRAY



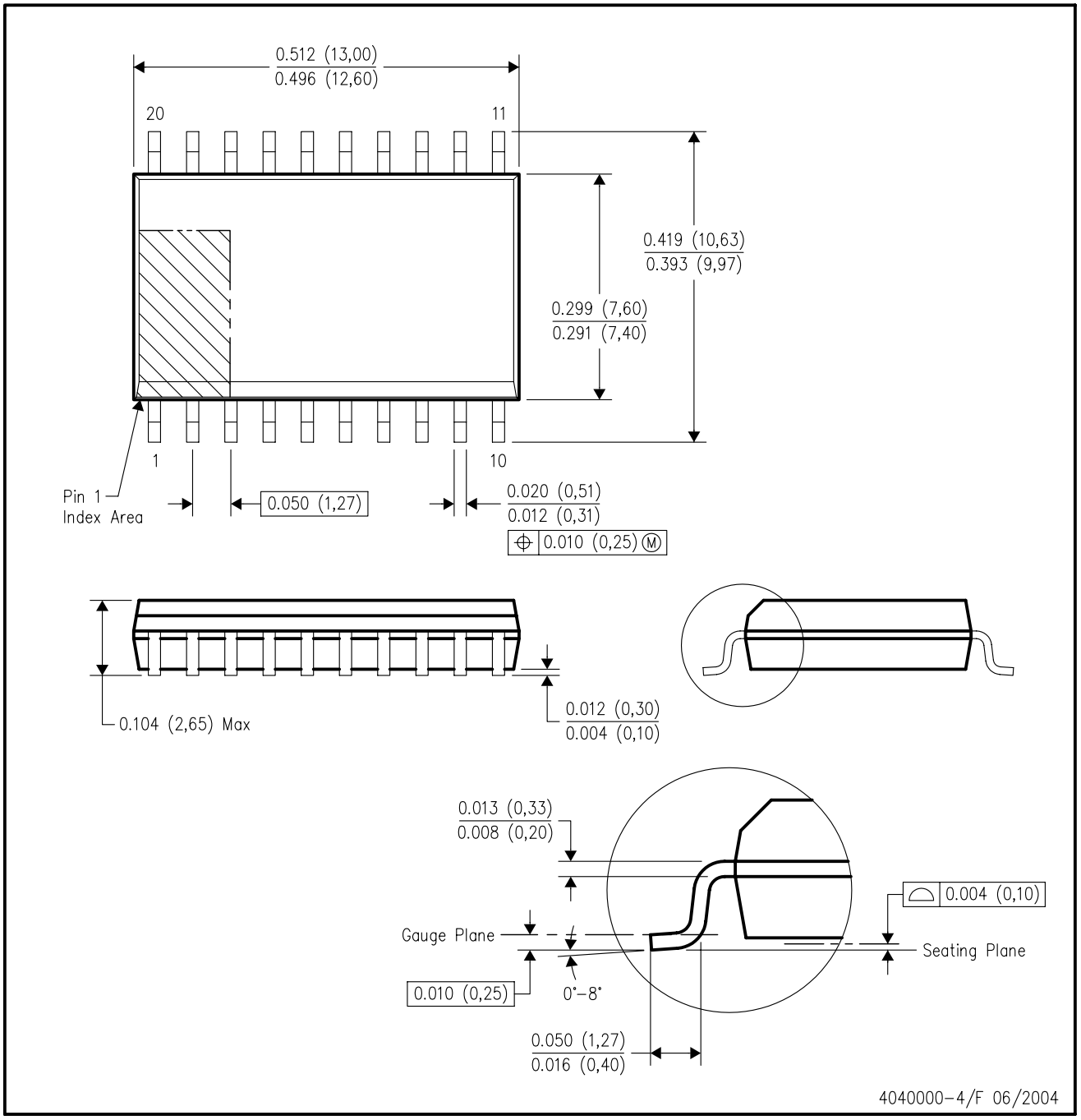
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO–225 variation BC.
D. This package is tin–lead (SnPb). Refer to the 20 ZQN package (drawing 4204492) for lead–free.

ZQN (R–PBGA–N20) PLASTIC BALL GRID ARRAY



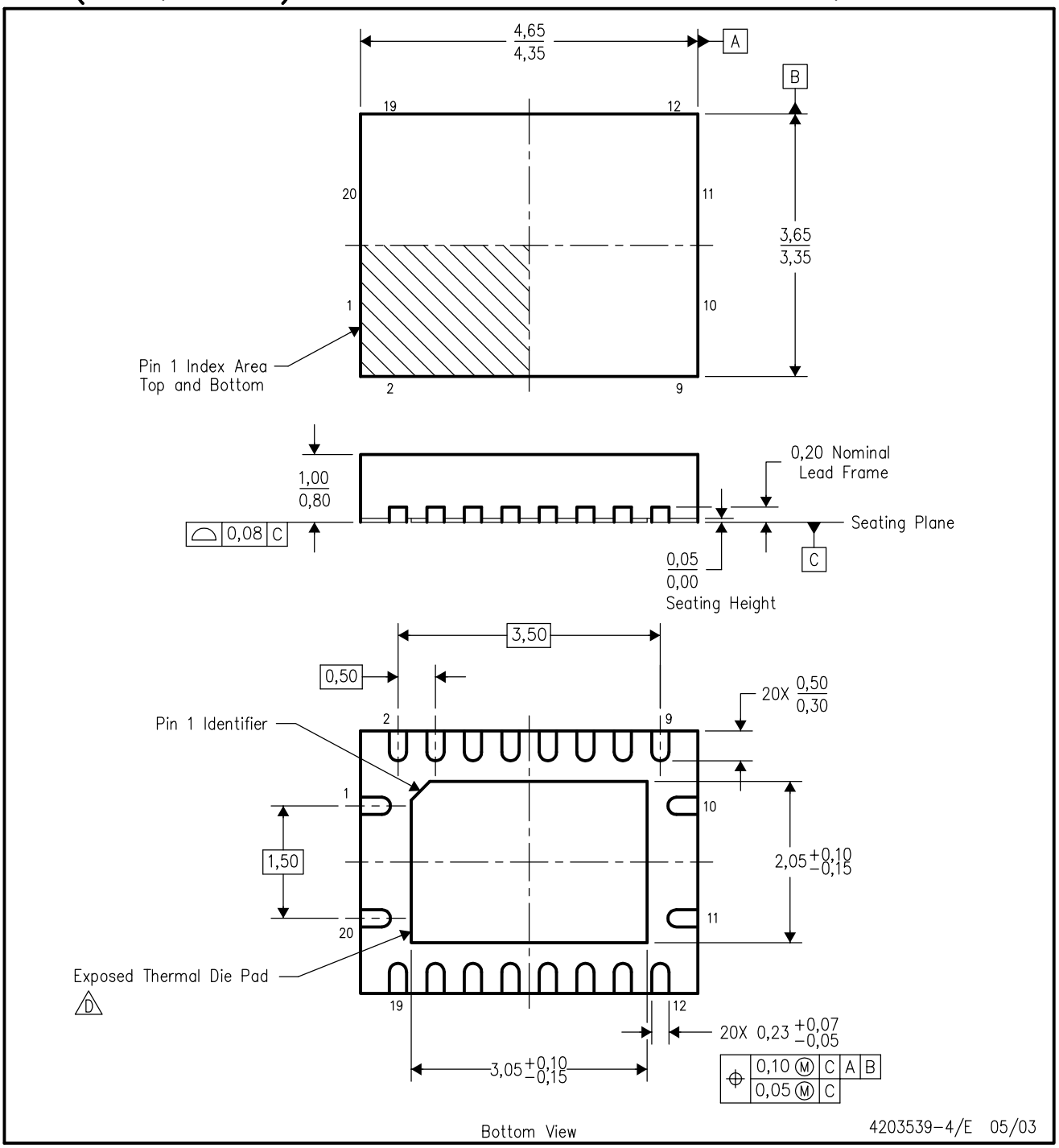
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO–225 variation BC.
D. This package is lead–free. Refer to the 20 GQN package (drawing 4200704) for tin–lead (SnPb).

DW (R–PDSO–G20) PLASTIC SMALL–OUTLINE PACKAGE



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 AC.

RGY (R–PQFP–N20) PLASTIC QUAD FLATPACK

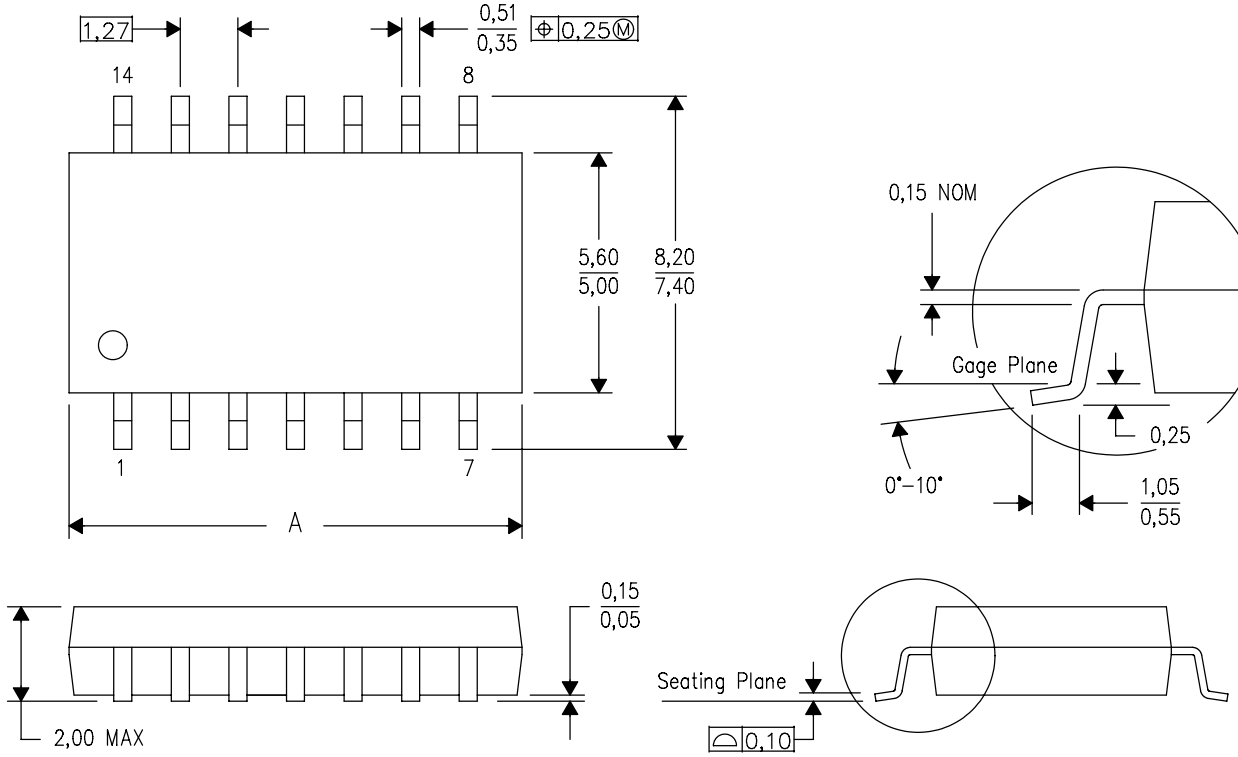


NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. QFN (Quad Flatpack No–Lead) package configuration.
D. The package thermal performance may be enhanced by bonding the thermal die pad to an external thermal plane. This pad is electrically and thermally connected to the backside of the die and possibly selected ground leads.
E. Package complies to JEDEC MO–241 variation BC.

MECHANICAL DATA

NS (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14-PINS SHOWN



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

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

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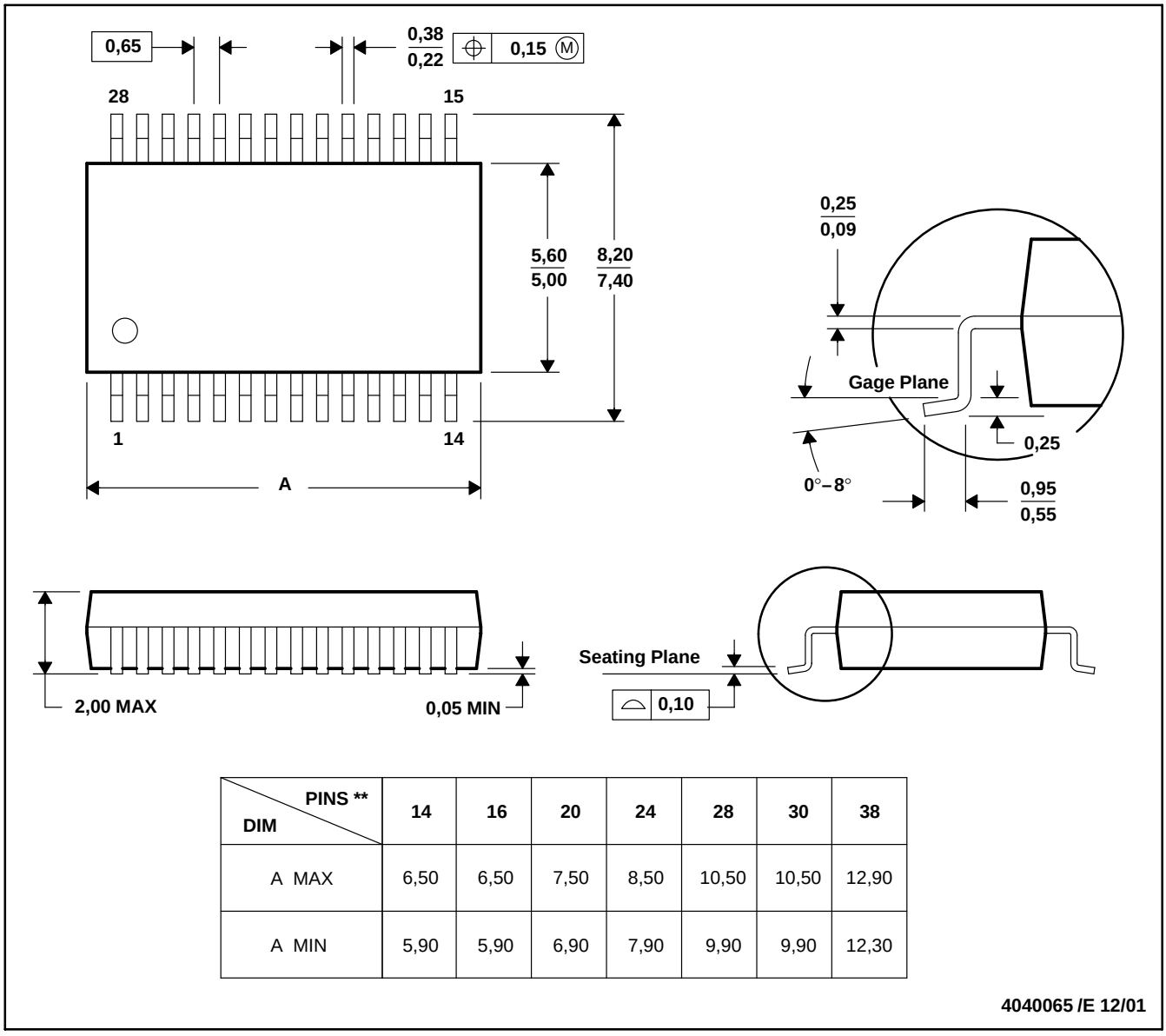
DB (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

28 PINS SHOWN



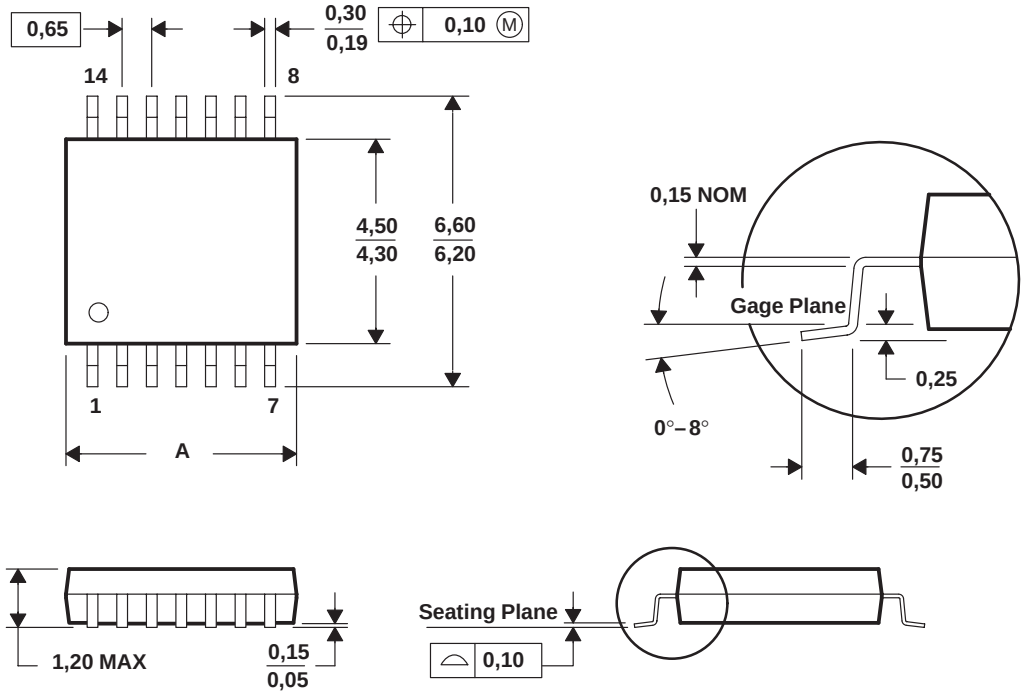
DIM \ PINS **	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 /E 12/01

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

PW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN



DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

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-153

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