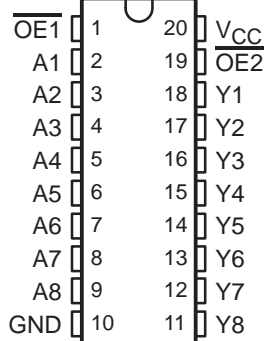


# SN54LVC541A, SN74LVC541A OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

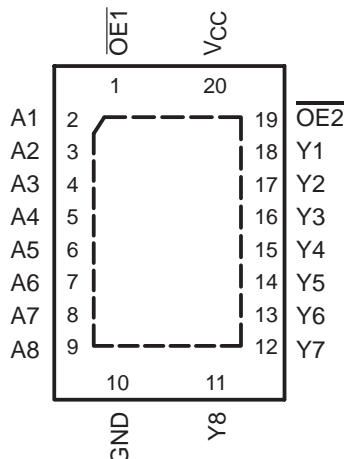
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- Operate From 1.65 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max  $t_{pd}$  of 5.1 ns at 3.3 V
- Typical  $V_{OLP}$  (Output Ground Bounce)  $<0.8$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot)  $>2$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Support Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V  $V_{CC}$ )
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

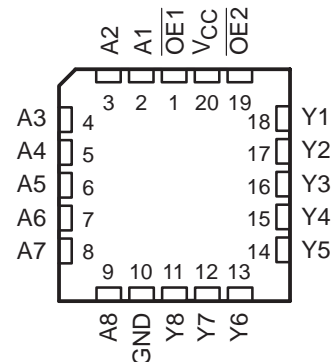
SN54LVC541A . . . J OR W PACKAGE  
SN74LVC541A . . . DB, DGV, DW, NS,  
OR PW PACKAGE  
(TOP VIEW)



SN74LVC541A . . . RGY PACKAGE  
(TOP VIEW)



SN54LVC541A . . . FK PACKAGE  
(TOP VIEW)



## description/ordering information

### ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QFN – RGY	Reel of 1000	SN74LVC541ARGYR	LC541A
	SOIC – DW	Tube of 25	SN74LVC541ADW	LVC541A
		Reel of 2000	SN74LVC541ADWR	
	SOP – NS	Reel of 2000	SN74LVC541ANSR	LVC541A
	SSOP – DB	Reel of 2000	SN74LVC541ADBR	LC541A
	TSSOP – PW	Tube of 70	SN74LVC541APW	LC541A
		Reel of 2000	SN74LVC541APWR	
		Reel of 250	SN74LVC541APWT	
–55°C to 125°C	TVSOP – DGV	Reel of 2000	SN74LVC541ADGVR	LC541A
	CDIP – J	Tube of 20	SNJ54LVC541AJ	SNJ54LVC541AJ
	CFP – W	Tube of 85	SNJ54LVC541AW	SNJ54LVC541AW
	LCCC – FK	Tube of 55	SNJ54LVC541AFK	SNJ54LVC541AFK

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



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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**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

description/ordering information (continued)

The SN54LVC541A octal buffer/driver is designed for 2.7-V to 3.6-V  $V_{CC}$  operation, and the SN74LVC541A octal buffer/driver is designed for 1.65-V to 3.6-V  $V_{CC}$  operation.

The 'LVC541A devices are ideal for driving bus lines or buffering memory address registers.

These devices feature inputs and outputs on opposite sides of the package to facilitate printed circuit board layout.

The 3-state control gate is a 2-input AND gate with active-low inputs so that, if either output enable ( $\overline{OE1}$  or  $\overline{OE2}$ ) input is high, all eight outputs are in the high-impedance state.

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of these devices as translators in a mixed 3.3-V/5-V system environment.

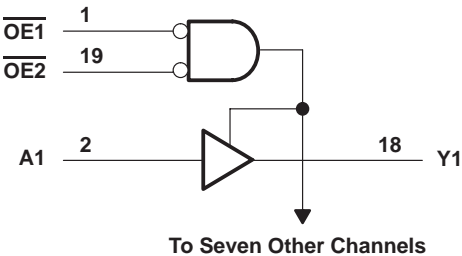
These devices are fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down.

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.

FUNCTION TABLE

INPUTS			OUTPUT Y
$\overline{OE1}$	$\overline{OE2}$	A	
L	L	L	L
L	L	H	H
H	X	X	Z
X	H	X	Z

logic diagram (positive logic)



# SN54LVC541A, SN74LVC541A

## OCTAL BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

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#### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

Supply voltage range, $V_{CC}$	–0.5 V to 6.5 V
Input voltage range, $V_I$ (see Note 1)	–0.5 V to 6.5 V
Voltage range applied to any output in the high-impedance or power-off state, $V_O$ (see Note 1)	–0.5 V to 6.5 V
Voltage range applied to any output in the high or low state, $V_O$ (see Notes 1 and 2)	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	–50 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ )	–50 mA
Continuous output current, $I_O$	±50 mA
Continuous current through $V_{CC}$ or GND	±100 mA
Package thermal impedance, $\theta_{JA}$ (see Note 3): DB package	70°C/W
(see Note 3): DGV package	92°C/W
(see Note 3): DW package	58°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

<sup>†</sup> 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 negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
  2. The value of  $V_{CC}$  is provided in the recommended operating conditions table.
  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.



# SN54LVC541A, SN74LVC541A

## OCTAL BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

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#### recommended operating conditions (see Note 5)

			SN54LVC541A		SN74LVC541A		UNIT
			MIN	MAX	MIN	MAX	
V <sub>CC</sub>	Supply voltage	Operating	2	3.6	1.65	3.6	V
		Data retention only	1.5		1.5		
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V			0.65 × V <sub>CC</sub>		V
		V <sub>CC</sub> = 2.3 V to 2.7 V			1.7		
		V <sub>CC</sub> = 2.7 V to 3.6 V	2		2		
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V			0.35 × V <sub>CC</sub>		V
		V <sub>CC</sub> = 2.3 V to 2.7 V			0.7		
		V <sub>CC</sub> = 2.7 V to 3.6 V	0.8		0.8		
V <sub>I</sub>	Input voltage		0	5.5	0	5.5	V
V <sub>O</sub>	Output voltage	High or low state	0	V <sub>CC</sub>	0	V <sub>CC</sub>	V
		3-state	0	5.5	0	5.5	
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 1.65 V			−4		mA
		V <sub>CC</sub> = 2.3 V			−8		
		V <sub>CC</sub> = 2.7 V	−12		−12		
		V <sub>CC</sub> = 3 V	−24		−24		
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 1.65 V			4		mA
		V <sub>CC</sub> = 2.3 V			8		
		V <sub>CC</sub> = 2.7 V	12		12		
		V <sub>CC</sub> = 3 V	24		24		
T <sub>A</sub>	Operating free-air temperature		−55	125	−40	85	°C

NOTE 5: All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

# SN54LVC541A, SN74LVC541A OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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

PARAMETER	TEST CONDITIONS		V <sub>CC</sub>	SN54LVC541A			SN74LVC541A			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = –100 μA		1.65 V to 3.6 V				V <sub>CC</sub> –0.2			V
			2.7 V to 3.6 V	V <sub>CC</sub> –0.2						
	I <sub>OH</sub> = –4 mA		1.65 V				1.2			
	I <sub>OH</sub> = –8 mA		2.3 V				1.7			
	I <sub>OH</sub> = –12 mA		2.7 V	2.2			2.2			
			3 V	2.4			2.4			
	I <sub>OH</sub> = –24 mA		3 V	2.2			2.2			
V <sub>OL</sub>	I <sub>OL</sub> = 100 μA		1.65 V to 3.6 V				0.2			V
			2.7 V to 3.6 V	0.2						
	I <sub>OL</sub> = 4 mA		1.65 V				0.45			
	I <sub>OL</sub> = 8 mA		2.3 V				0.7			
	I <sub>OL</sub> = 12 mA		2.7 V	0.4			0.4			
	I <sub>OL</sub> = 24 mA		3 V	0.55			0.55			
	I <sub>I</sub>	V <sub>I</sub> = 0 to 5.5 V	3.6 V	±5			±5			
I <sub>off</sub>	V <sub>I</sub> or V <sub>O</sub> = 5.5 V		0				±10			μA
I <sub>OZ</sub>	V <sub>O</sub> = 0 to 5.5 V		3.6 V	±15			±10			μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	I <sub>O</sub> = 0	3.6 V	10			10			μA
	3.6 V ≤ V <sub>I</sub> ≤ 5.5 V‡			10			10			
ΔI <sub>CC</sub>	One input at V <sub>CC</sub> – 0.6 V, Other inputs at V <sub>CC</sub> or GND		2.7 V to 3.6 V	500			500			μA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND		3.3 V	4			4			pF
C <sub>O</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND		3.3 V	5.5			5.5			pF

† All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.

‡ This applies in the disabled state only.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVC541A				UNIT
			V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		
			MIN	MAX	MIN	MAX	
t <sub>pd</sub>	A	Y	5.6		1	5.1	ns
t <sub>en</sub>	$\overline{\text{OE}}$	Y	7.5		1	7	ns
t <sub>dis</sub>	$\overline{\text{OE}}$	Y	7.7		1	7	ns



# SN54LVC541A, SN74LVC541A

## OCTAL BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

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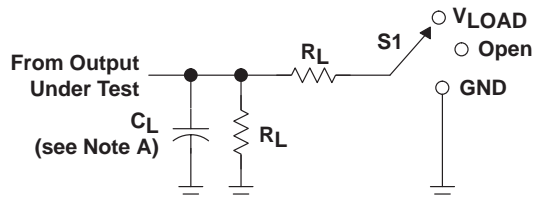
switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74LVC541A								UNIT
			V <sub>CC</sub> = 1.8 V ± 0.15 V		V <sub>CC</sub> = 2.5 V ± 0.2 V		V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	A	Y	1	15.7	1	7.8	1	5.6	1.5	5.1	ns
t <sub>en</sub>	$\overline{OE}$	Y	1	17.5	1	10.5	1	7.5	1.5	7	ns
t <sub>dis</sub>	$\overline{OE}$	Y	1	16.5	1	9	1	7.7	1.5	7	ns
t <sub>sk(o)</sub>									1		ns

operating characteristics,  $T_A = 25^\circ\text{C}$

PARAMETER			TEST CONDITIONS	$V_{CC} = 1.8\text{ V}$	$V_{CC} = 2.5\text{ V}$	$V_{CC} = 3.3\text{ V}$	UNIT
				TYP	TYP	TYP	
$C_{pd}$	Power dissipation capacitance per buffer/driver	Outputs enabled	$f = 10\text{ MHz}$	65	58	33	pF
		Outputs disabled		2	2	2	

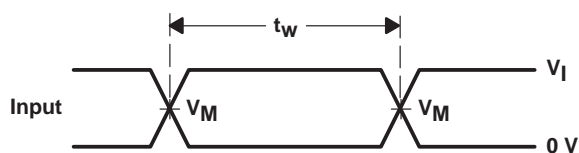
## PARAMETER MEASUREMENT INFORMATION



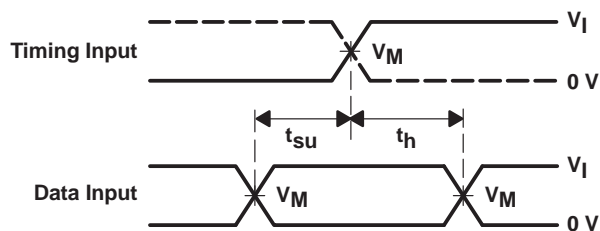
LOAD CIRCUIT

TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$V_{LOAD}$
$t_{PHZ}/t_{PZH}$	GND

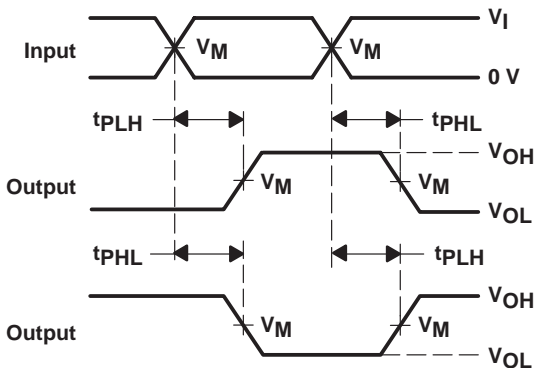
$V_{CC}$	INPUTS		$V_M$	$V_{LOAD}$	$C_L$	$R_L$	$V_{\Delta}$
	$V_I$	$t_r/t_f$					
$1.8\text{ V} \pm 0.15\text{ V}$	$V_{CC}$	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 k $\Omega$	0.15 V
$2.5\text{ V} \pm 0.2\text{ V}$	$V_{CC}$	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 $\Omega$	0.15 V
2.7 V	2.7 V	$\leq 2.5\text{ ns}$	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V
$3.3\text{ V} \pm 0.3\text{ V}$	2.7 V	$\leq 2.5\text{ ns}$	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V



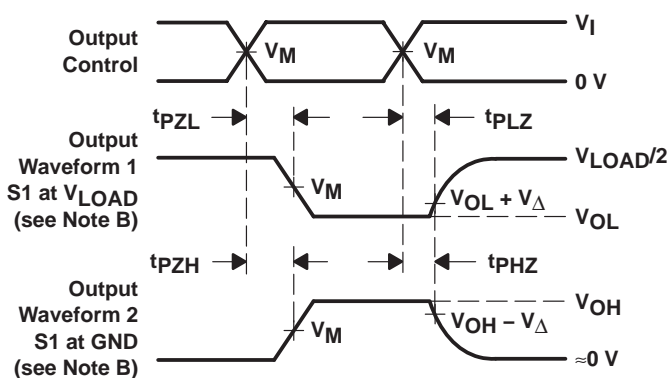
VOLTAGE WAVEFORMS  
PULSE DURATION



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:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ .
  - The outputs are measured one at a time with one transition per measurement.
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

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)

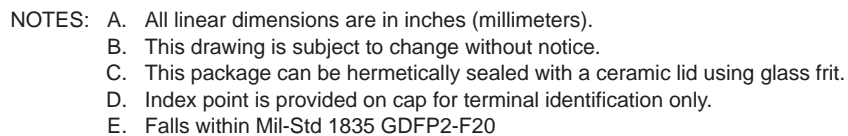


4040083/F 03/03

- 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.



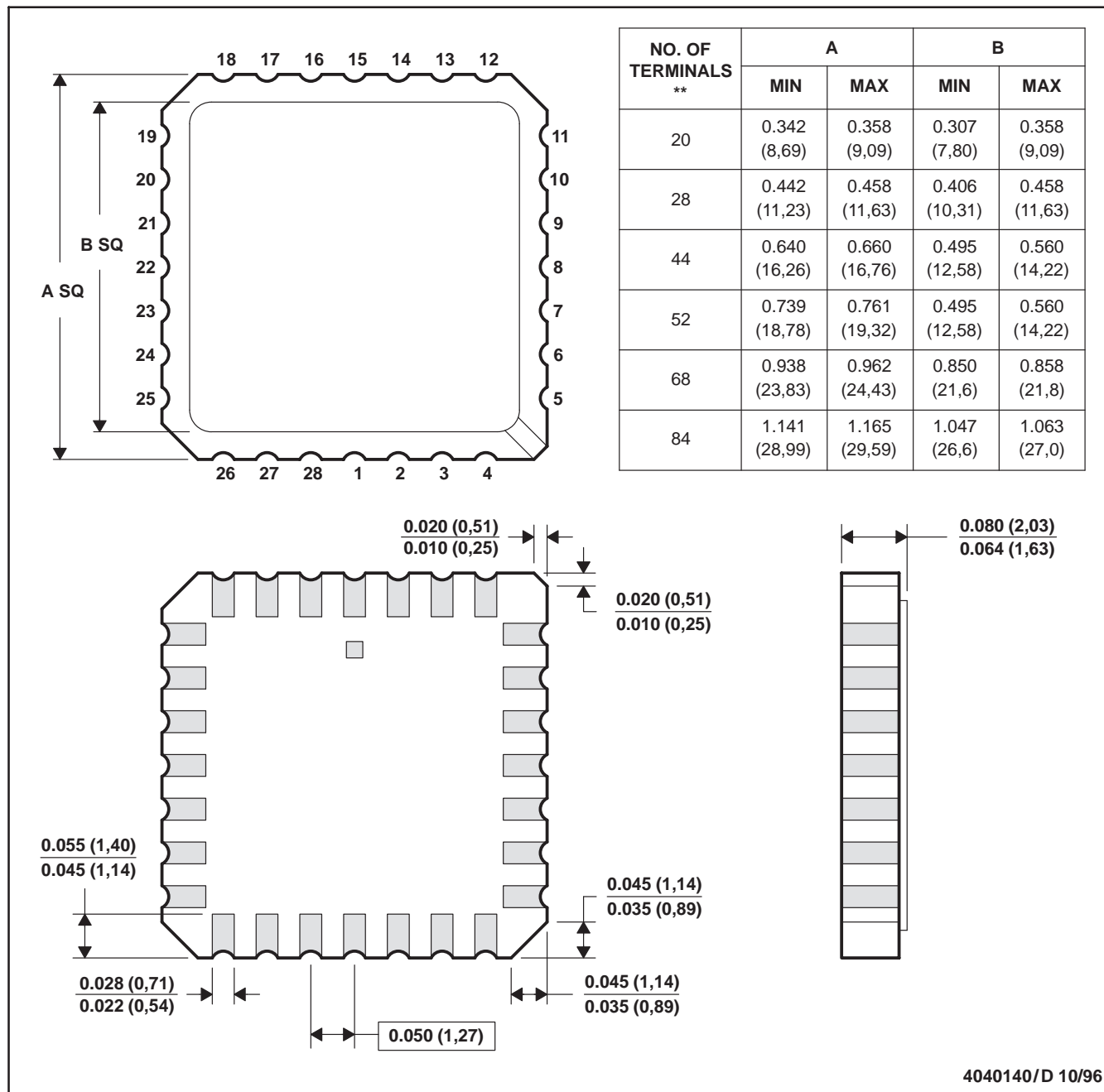
## CERAMIC DUAL FLATPACK



## FK (S-CQCC-N\*\*)

## LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- 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.
  - The terminals are gold plated.
  - Falls within JEDEC MS-004

## DGV (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

24 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 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

## DW (R-PDSO-G20)

## PLASTIC SMALL-OUTLINE PACKAGE

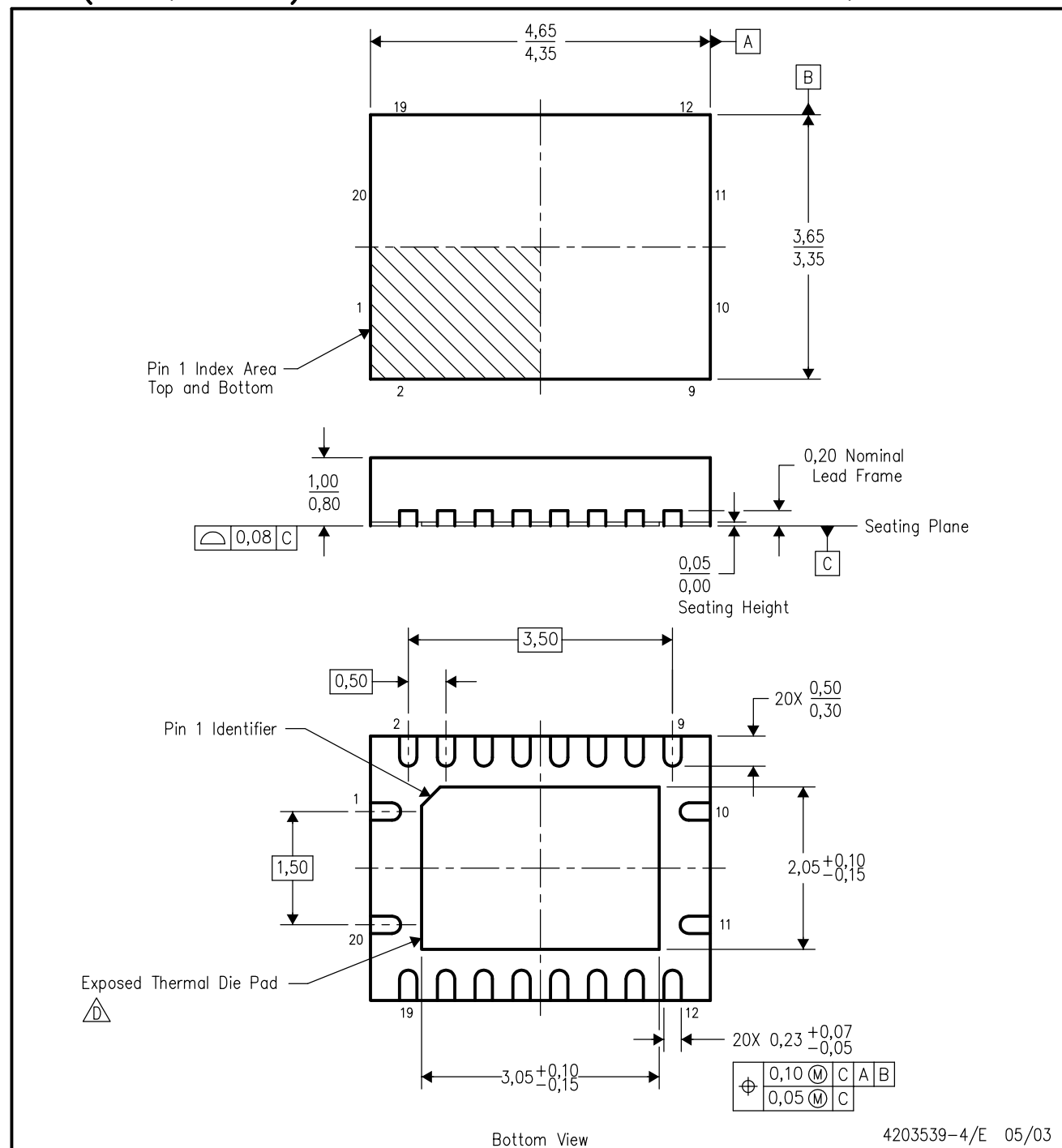



4040000-4/F 06/2004

- NOTES:
- All linear dimensions are in inches (millimeters).
  - 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.

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.
  -  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.

## DB (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

28 PINS SHOWN



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

## PW (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



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



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