- **2-V to 5.5-V V_{CC} Operation**
- **Max t_{pd} of 7.1 ns at 5 V**
- **Typical V_{OLP} (Output Ground Bounce) <0.8 V at V_{CC} = 3.3 V, T_A = 25°C**
- **Typical V_{OHV} (Output V_{OH} Undershoot) >2.3 V at V_{CC} = 3.3 V, T_A = 25°C**
- **Support Mixed-Mode Voltage Operation on All Ports**
- **8-Bit Serial-In, Parallel-Out Shift**

- **I_{off} Supports Partial-Power-Down Mode Operation**
- **Shift Register Has Direct Clear**
- **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)**
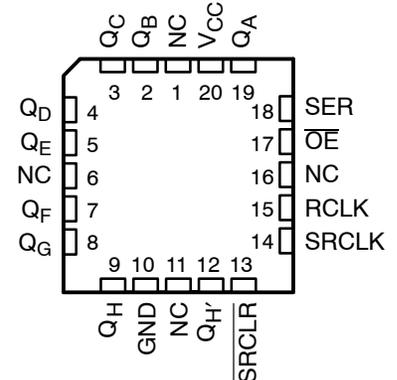 - **1000-V Charged-Device Model (C101)**

SN54LV595A . . . J OR W PACKAGE
SN74LV595A . . . D, DB, NS, OR PW PACKAGE
(TOP VIEW)

```
        ___ ___
 Q_B [ 1     16 ] V_CC
 Q_C [ 2     15 ] Q_A
 Q_D [ 3     14 ] SER
 Q_E [ 4     13 ] OE̅
 Q_F [ 5     12 ] RCLK
 Q_G [ 6     11 ] SRCLK
 Q_H [ 7     10 ] SRCLR̅
 GND [ 8      9 ] Q_H'
```
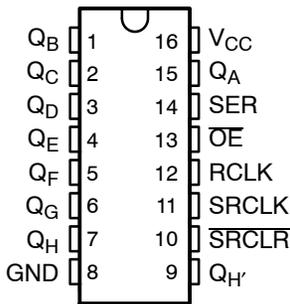
SN74LV595A . . . RGY PACKAGE
(TOP VIEW)

```
         Q_B   V_CC
          1     16
 Q_C [ 2         15 ] Q_A
 Q_D [ 3         14 ] SER
 Q_E [ 4         13 ] OE̅
 Q_F [ 5         12 ] RCLK
 Q_G [ 6         11 ] SRCLK
 Q_H [ 7         10 ] SRCLR̅
          8      9
         GND   Q_H'
```
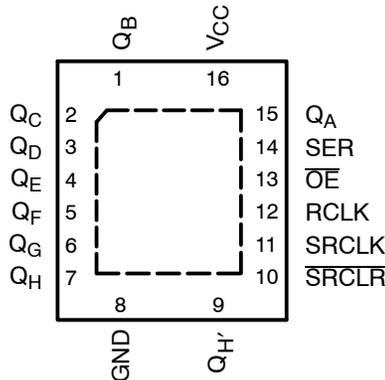
SN54LV595A . . . FK PACKAGE
(TOP VIEW)

```
          Q_C Q_B NC V_CC Q_A
           3   2   1  20  19
 Q_D [ 4              18 ] SER
 Q_E [ 5              17 ] OE̅
 NC  [ 6              16 ] NC
 Q_F [ 7              15 ] RCLK
 Q_G [ 8              14 ] SRCLK
           9  10  11  12  13
          Q_H GND NC Q_H' SRCLR̅
```

NC – No internal connection

description/ordering information

The 'LV595A devices are 8-bit shift registers designed for 2-V to 5.5-V V_{CC} operation.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 85°C	QFN – RGY	Reel of 1000	SN74LV595ARGYR	LV595A
	SOIC – D	Tube of 40	SN74LV595ADG3	LV595A
		Reel of 2500	SN74LV595ADR	
	SOP – NS	Reel of 2000	SN74LV595ANSR	74LV595A
	SSOP – DB	Reel of 2000	SN74LV595ADBR	LV595A
	TSSOP – PW	Tube of 90	SN74LV595APW	LV595A
		Reel of 2000	SN74LV595APWRG3	
		Reel of 250	SN74LV595APWT	
−55°C to 125°C	CDIP – J	Tube of 25	SNJ54LV595AJ	SNJ54LV595AJ
	CFP – W	Tube of 150	SNJ54LV595AW	SNJ54LV595AW
	LCCC – FK	Tube of 55	SNJ54LV595AFK	SNJ54LV595AFK

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

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TEXAS INSTRUMENTS

description/ordering information (continued)

These devices contain an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. The storage register has parallel 3-state outputs. Separate clocks are provided for both the shift and storage register. The shift register has a direct overriding clear ($\overline{\text{SRCLR}}$) input, serial (SER) input, and a serial output for cascading. When the output-enable ($\overline{\text{OE}}$) input is high, all outputs except $Q_{H'}$ are in the high-impedance state.

Both the shift register clock (SRCLK) and storage register clock (RCLK) are positive-edge triggered. If both clocks are connected together, the shift register always is one clock pulse ahead of the storage register.

To ensure the high-impedance state during power up or power down, $\overline{\text{OE}}$ 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.

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.
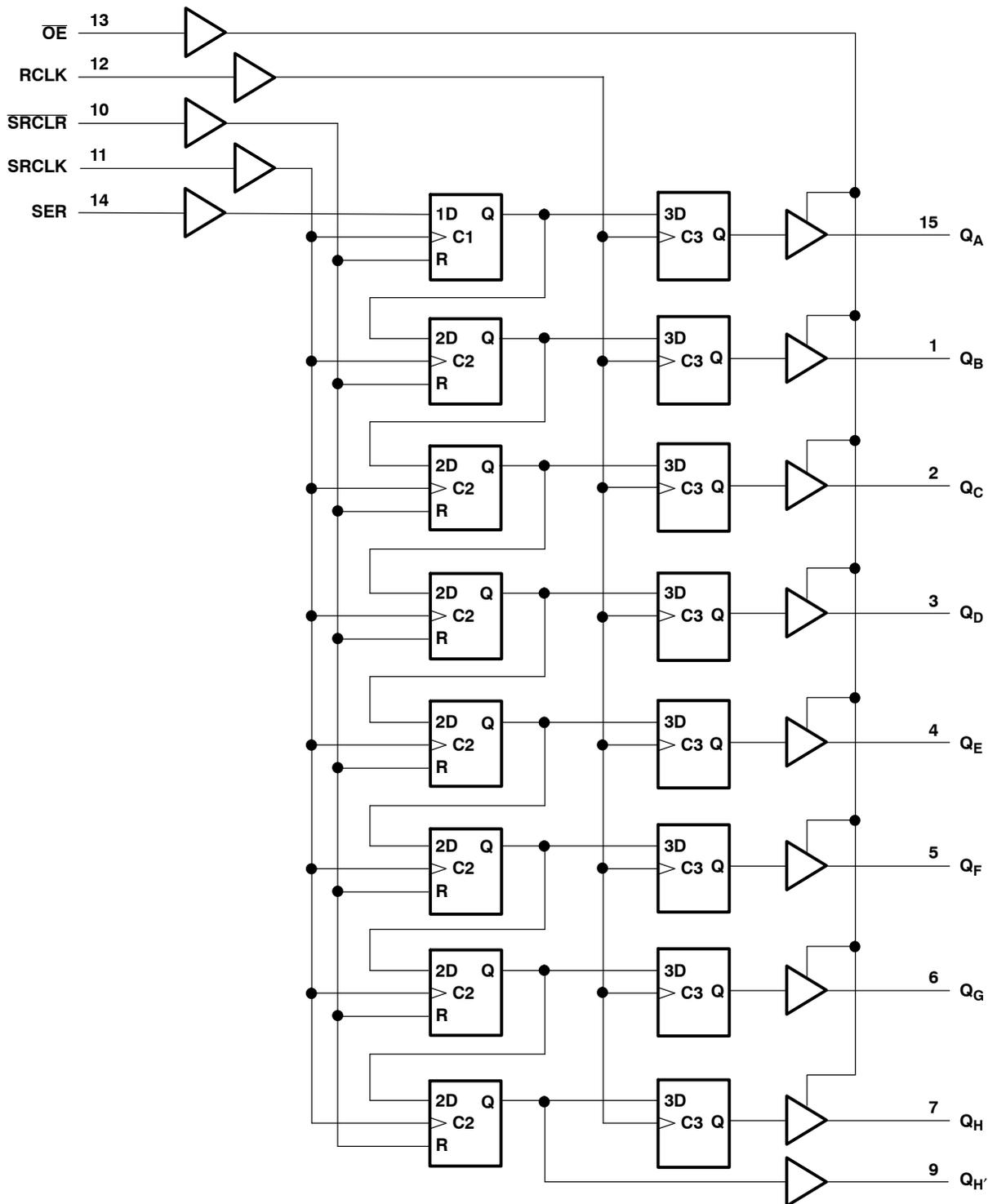
FUNCTION TABLE

INPUTS					FUNCTION
SER	SRCLK	$\overline{\text{SRCLR}}$	RCLK	$\overline{\text{OE}}$	
X	X	X	X	H	Outputs Q_A–Q_H are disabled.
X	X	X	X	L	Outputs Q_A–Q_H are enabled.
X	X	L	X	X	Shift register is cleared.
L	↑	H	X	X	First stage of the shift register goes low. Other stages store the data of previous stage, respectively.
H	↑	H	X	X	First stage of the shift register goes high. Other stages store the data of previous stage, respectively.
X	X	X	↑	X	Shift-register data is stored in the storage register.

logic diagram (positive logic)

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

timing diagram

NOTE: ⬚⬚⬚⬚ implies that the output is in 3-State mode.

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

Supply voltage range, V_{CC} .... −0.5 V to 7 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
Output voltage range applied 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) .... −20 mA
Output clamp current, I_{OK} (V_O < 0) .... −50 mA
Continuous output current, I_O (V_O = 0 to V_{CC}) .... ±35 mA
Continuous current through V_{CC} or GND .... ±70 mA
Package thermal impedance, θ_{JA} (see Note 3): D package .... 73°C/W
                               (see Note 3): DB package .... 82°C/W
                                (see Note 3): NS package .... 64°C/W
                                (see Note 3): PW package .... 108°C/W
                                (see Note 4): RGY package .... 39°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 current ratings are observed.
          2. This value is limited to 5.5 V maximum.
          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.

TEXAS
INSTRUMENTS

recommended operating conditions (see Note 5)

			SN54LV595A MIN	SN54LV595A MAX	SN74LV595A MIN	SN74LV595A MAX	UNIT
V_{CC}	Supply voltage		2	5.5	2	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.5		1.5		V
		V_{CC} = 2.3 V to 2.7 V	$V_{CC} \times 0.7$		$V_{CC} \times 0.7$		
		V_{CC} = 3 V to 3.6 V	$V_{CC} \times 0.7$		$V_{CC} \times 0.7$		
		V_{CC} = 4.5 V to 5.5 V	$V_{CC} \times 0.7$		$V_{CC} \times 0.7$		
V_{IL}	Low-level input voltage	V_{CC} = 2 V		0.5		0.5	V
		V_{CC} = 2.3 V to 2.7 V		$V_{CC} \times 0.3$		$V_{CC} \times 0.3$	
		V_{CC} = 3 V to 3.6 V		$V_{CC} \times 0.3$		$V_{CC} \times 0.3$	
		V_{CC} = 4.5 V to 5.5 V		$V_{CC} \times 0.3$		$V_{CC} \times 0.3$	
V_I	Input voltage		0	5.5	0	5.5	V
V_O	Output voltage	High or low state	0	V_{CC}	0	V_{CC}	V
		3-state	0	5.5	0	5.5	
I_{OH}	High-level output current	V_{CC} = 2 V		−50		−50	µA
		V_{CC} = 2.3 V to 2.7 V		−2		−2	mA
		V_{CC} = 3 V to 3.6 V		−8		−8	
		V_{CC} = 4.5 V to 5.5 V		−16		−16	
I_{OL}	Low-level output current	V_{CC} = 2 V		50		50	µA
		V_{CC} = 2.3 V to 2.7 V		2		2	mA
		V_{CC} = 3 V to 3.6 V		8		8	
		V_{CC} = 4.5 V to 5.5 V		16		16	
$\Delta t/\Delta v$	Input transition rise or fall rate	V_{CC} = 2.3 V to 2.7 V		200		200	ns/V
		V_{CC} = 3 V to 3.6 V		100		100	
		V_{CC} = 4.5 V to 5.5 V		20		20	
T_A	Operating free-air temperature		−55	125	−40	85	°C

NOTE 5: All unused 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.

TEXAS INSTRUMENTS

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

PARAMETER		TEST CONDITIONS	V_{CC}	SN54LV595A			SN74LV595A			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{OH}		I_{OH} = −50 µA	2 V to 5.5 V	V_{CC}−0.1			V_{CC}−0.1			V
		I_{OH} = −2 mA	2.3 V	2			2			
	$Q_{H'}$	I_{OH} = −6 mA	3 V	2.48			2.48			
	Q_A–Q_H	I_{OH} = −8 mA		2.48			2.48			
	$Q_{H'}$	I_{OH} = −12 mA	4.5 V	3.8			3.8			
	Q_A–Q_H	I_{OH} = −16 mA		3.8			3.8			
V_{OL}		I_{OL} = 50 µA	2 V to 5.5 V			0.1			0.1	V
		I_{OL} = 2 mA	2.3 V			0.4			0.4	
	$Q_{H'}$	I_{OL} = 6 mA	3 V			0.44			0.44	
	Q_A–Q_H	I_{OL} = 8 mA				0.44			0.44	
	$Q_{H'}$	I_{OL} = 12 mA	4.5 V			0.55			0.55	
	Q_A–Q_H	I_{OL} = 16 mA				0.55			0.55	
I_I		V_I = 5.5 V or GND	0 to 5.5 V			±1			±1	µA
I_{OZ}		V_O = V_{CC} or GND, Q_A–Q_H	5.5 V			±5			±5	µA
I_{CC}		V_I = V_{CC} or GND, I_O = 0	5.5 V			20			20	µA
I_{off}		V_I or V_O = 0 to 5.5 V	0			5			5	µA
C_i		V_I = V_{CC} or GND	3.3 V		3.5			3.5		pF

timing requirements over recommended operating free-air temperature range, V_{CC} = 2.5 V ± 0.2 V (unless otherwise noted) (see Figure 1)

			T_A = 25°C		SN54LV595A		SN74LV595A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration	SRCLK high or low	7		7.5		7.5		ns
		RCLK high or low	7		7.5		7.5		
		$\overline{SRCLR}$ low	6		6.5		6.5		
t_{su}	Setup time	SER before SRCLK↑	5.5		5.5		5.5		ns
		SRCLK↑ before RCLK↑†	8		9		9		
		$\overline{SRCLR}$ low before RCLK↑	8.5		9.5		9.5		
		$\overline{SRCLR}$ high (inactive) before SRCLK↑	4		4		4		
t_h	Hold time	SER after SRCLK↑	1.5		1.5		1.5		ns

† This setup time allows the storage register to receive stable data from the shift register. The clocks can be tied together, in which case the shift register is one clock pulse ahead of the storage register.

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TEXAS INSTRUMENTS

timing requirements over recommended operating free-air temperature range, V_{CC} = 3.3 V $\pm$ 0.3 V (unless otherwise noted) (see Figure 1)

			T_A = 25°C		SN54LV595A		SN74LV595A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration	SRCLK high or low	5.5		5.5		5.5		ns
		RCLK high or low	5.5		5.5		5.5		
		$\overline{SRCLR}$ low	5		5		5		
t_{su}	Setup time	SER before SRCLK↑	3.5		3.5		3.5		ns
		SRCLK↑ before RCLK↑†	8		8.5		8.5		
		$\overline{SRCLR}$ low before RCLK↑	8		9		9		
		$\overline{SRCLR}$ high (inactive) before SRCLK↑	3		3		3		
t_h	Hold time	SER after SRCLK↑	1.5		1.5		1.5		ns

† This setup time allows the storage register to receive stable data from the shift register. The clocks can be tied together, in which case the shift register is one clock pulse ahead of the storage register.

timing requirements over recommended operating free-air temperature range, V_{CC} = 5 V $\pm$ 0.5 V (unless otherwise noted) (see Figure 1)

			T_A = 25°C		SN54LV595A		SN74LV595A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration	SRCLK high or low	5		5		5		ns
		RCLK high or low	5		5		5		
		$\overline{SRCLR}$ low	5.2		5.2		5.2		
t_{su}	Setup time	SER before SRCLK↑	3		3		3		ns
		SRCLK↑ before RCLK↑†	5		5		5		
		$\overline{SRCLR}$ low before RCLK↑	5		5		5		
		$\overline{SRCLR}$ high (inactive) before SRCLK↑	2.5		2.5		2.5		
t_h	Hold time	SER after SRCLK↑	2		2		2		ns

† This setup time allows the storage register to receive stable data from the shift register. The clocks can be tied together, in which case the shift register is one clock pulse ahead of the storage register.

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INSTRUMENTS

switching characteristics over recommended operating free-air temperature range, V_{CC} = 2.5 V ± 0.2 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			SN54LV595A		SN74LV595A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			C_L = 15 pF	65*	80*		45*		45		MHz
			C_L = 50 pF	60	70		40		40		
t_{PLH}	RCLK	Q_A–Q_H			8.4*	14.2*	1*	15.8*	1	15.8	
t_{PHL}	RCLK	Q_A–Q_H			8.4*	14.2*	1*	15.8*	1	15.8	
t_{PLH}	SRCLK	$Q_{H'}$			9.4*	19.6*	1*	22.2*	1	22.2	
t_{PHL}	SRCLK	$Q_{H'}$			9.4*	19.6*	1*	22.2*	1	22.2	
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$	C_L = 15 pF		8.7*	14.6*	1*	16.3*	1	16.3	ns
t_{PZH}	$\overline{OE}$	Q_A–Q_H			8.2*	13.9*	1*	15*	1	15	
t_{PZL}	$\overline{OE}$	Q_A–Q_H			10.9*	18.1*	1*	20.3*	1	20.3	
t_{PHZ}	$\overline{OE}$	Q_A–Q_H			8.3*	13.7*	1*	15.6*	1	15.6	
t_{PLZ}	$\overline{OE}$	Q_A–Q_H			9.2*	15.2*	1*	16.7*	1	16.7	
t_{PLH}	RCLK	Q_A–Q_H			11.2	17.2	1	19.3	1	19.3	
t_{PHL}	RCLK	Q_A–Q_H			11.2	17.2	1	19.3	1	19.3	
t_{PLH}	SRCLK	$Q_{H'}$			13.1	22.5	1	25.5	1	25.5	
t_{PHL}	SRCLK	$Q_{H'}$			13.1	22.5	1	25.5	1	25.5	
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$	C_L = 50 pF		12.4	18.8	1	21.1	1	21.1	ns
t_{PZH}	$\overline{OE}$	Q_A–Q_H			10.8	17	1	18.3	1	18.3	
t_{PZL}	$\overline{OE}$	Q_A–Q_H			13.4	21	1	23	1	23	
t_{PHZ}	$\overline{OE}$	Q_A–Q_H			12.2	18.3	1	19.5	1	19.5	
t_{PLZ}	$\overline{OE}$	Q_A–Q_H			14	20.9	1	22.6	1	22.6	

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

TEXAS INSTRUMENTS

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V $\pm$ 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C MIN	TYP	MAX	SN54LV595A MIN	MAX	SN74LV595A MIN	MAX	UNIT
f_{max}			C_L = 15 pF	80*	120*		70*		70		MHz
			C_L = 50 pF	55	105		50		50		
t_{PLH}	RCLK	Q_A–Q_H			6*	11.9*	1*	13.5*	1	13.5	
t_{PHL}	RCLK				6*	11.9*	1*	13.5*	1	13.5	
t_{PLH}	SRCLK	$Q_{H'}$			6.6*	13*	1*	15*	1	15	
t_{PHL}	SRCLK				6.6*	13*	1*	15*	1	15	
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$	C_L = 15 pF		6.2*	12.8*	1*	13.7*	1	13.7	ns
t_{PZH}	$\overline{OE}$	Q_A–Q_H			6*	11.5*	1*	13.5*	1	13.5	
t_{PZL}	$\overline{OE}$				7.8*	11.5*	1*	13.5*	1	13.5	
t_{PHZ}	$\overline{OE}$	Q_A–Q_H			6.1*	14.7*	1*	15.2*	1	15.2	
t_{PLZ}	$\overline{OE}$				6.3*	14.7*	1*	15.2*	1	15.2	
t_{PLH}	RCLK	Q_A–Q_H			7.9	15.4	1	17	1	17	
t_{PHL}	RCLK				7.9	15.4	1	17	1	17	
t_{PLH}	SRCLK	$Q_{H'}$			9.2	16.5	1	18.5	1	18.5	
t_{PHL}	SRCLK				9.2	16.5	1	18.5	1	18.5	
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$	C_L = 50 pF		9	16.3	1	17.2	1	17.2	ns
t_{PZH}	$\overline{OE}$	Q_A–Q_H			7.8	15	1	17	1	17	
t_{PZL}	$\overline{OE}$				9.6	15	1	17	1	17	
t_{PHZ}	$\overline{OE}$	Q_A–Q_H			8.1	15.7	1	16.2	1	16.2	
t_{PLZ}	$\overline{OE}$				9.3	15.7	1	16.2	1	16.2	

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

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SN54LV595A, SN74LV595A
8-BIT SHIFT REGISTERS
WITH 3-STATE OUTPUT REGISTERS

SCLS414O – APRIL 1998 – REVISED JANUARY 2011

switching characteristics over recommended operating free-air temperature range, $V_{CC} = 5\ V \pm 0.5\ V$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25°C$ MIN	TYP	MAX	SN54LV595A MIN	MAX	SN74LV595A MIN	MAX	UNIT
f_{max}			C_L = 15 pF	135*	170*		115*		115		MHz
			C_L = 50 pF	120	140		95		95		
t_{PLH}	RCLK	Q_A–Q_H			4.3*	7.4*	1*	8.5*	1	8.5	ns
t_{PHL}	RCLK	Q_A–Q_H			4.3*	7.4*	1*	8.5*	1	8.5	
t_{PLH}	SRCLK	$Q_{H'}$			4.5*	8.2*	1*	9.4*	1	9.4	
t_{PHL}	SRCLK	$Q_{H'}$	C_L = 15 pF		4.5*	8.2*	1*	9.4*	1	9.4	
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$			4.5*	8*	1*	9.1*	1	9.1	
t_{PZH}	$\overline{OE}$	Q_A–Q_H			4.3*	8.6*	1*	10*	1	10	
t_{PZL}	$\overline{OE}$	Q_A–Q_H			5.4*	8.6*	1*	10*	1	10	
t_{PHZ}	$\overline{OE}$	Q_A–Q_H			2.4*	6*	1*	7.1*	1	7.1	
t_{PLZ}	$\overline{OE}$	Q_A–Q_H			2.7*	5.1*	1*	7.2*	1	7.2	
t_{PLH}	RCLK	Q_A–Q_H			5.6	9.4	1	10.5	1	10.5	ns
t_{PHL}	RCLK	Q_A–Q_H			5.6	9.4	1	10.5	1	10.5	
t_{PLH}	SRCLK	$Q_{H'}$			6.4	10.2	1	11.4	1	11.4	
t_{PHL}	SRCLK	$Q_{H'}$	C_L = 50 pF		6.4	10.2	1	11.4	1	11.4	
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$			6.4	10	1	11.1	1	11.1	
t_{PZH}	$\overline{OE}$	Q_A–Q_H			5.7	10.6	1	12	1	12	
t_{PZL}	$\overline{OE}$	Q_A–Q_H			6.8	10.6	1	12	1	12	
t_{PHZ}	$\overline{OE}$	Q_A–Q_H			3.5	10.3	1	11	1	11	
t_{PLZ}	$\overline{OE}$	Q_A–Q_H			3.4	10.3	1	11	1	11	

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

noise characteristics, V_{CC} = 3.3 V, C_L = 50 pF, T_A = 25°C (see Note 6)

PARAMETER		SN74LV595A MIN	TYP	MAX	UNIT
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.3		V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		−0.2		V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		2.8		V
$V_{IH(D)}$	High-level dynamic input voltage	2.31			V
$V_{IL(D)}$	Low-level dynamic input voltage			0.99	V

NOTE 6: Characteristics are for surface-mount packages only.

operating characteristics, T_A = 25°C

PARAMETER		TEST CONDITIONS	V_{CC}	TYP	UNIT
C_{pd}	Power dissipation capacitance	C_L = 50 pF, f = 10 MHz	3.3 V	111	pF
			5 V	114	

TEXAS INSTRUMENTS

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PARAMETER MEASUREMENT INFORMATION

TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND
Open Drain	V_{CC}

**LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS**

**LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN 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 ≤ 1 MHz, Z_O = 50 Ω, t_r ≤ 3 ns, t_f ≤ 3 ns.
   D. The outputs are measured one at a time, with one input transition per measurement.
   E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
   F. t_{PZL} and t_{PZH} are the same as t_{en}.
   G. t_{PHL} and t_{PLH} are the same as t_{pd}.
   H. 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)	Samples (Requires Login)
SN74LV595AD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595ADE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595ADG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595ADR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595ADRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595ADRG3	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	
SN74LV595ADRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595ANSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595ANSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595ANSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595APWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595APWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595APWRG3	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	
SN74LV595APWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595APWT	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595APWTE4	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LV595APWTG4	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/ Ball Finish	MSL Peak Temp [3]	Samples (Requires Login)
SN74LV595ARGYR	ACTIVE	VQFN	RGY	16	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
SN74LV595ARGYRG4	ACTIVE	VQFN	RGY	16	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	

[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.

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OTHER QUALIFIED VERSIONS OF SN74LV595A :

• Automotive: SN74LV595A-Q1

• Enhanced Product: SN74LV595A-EP

NOTE: Qualified Version Definitions:

● Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

● Enhanced Product - Supports Defense, Aerospace and Medical Applications

PACKAGE MATERIALS INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS
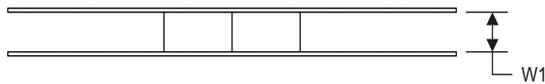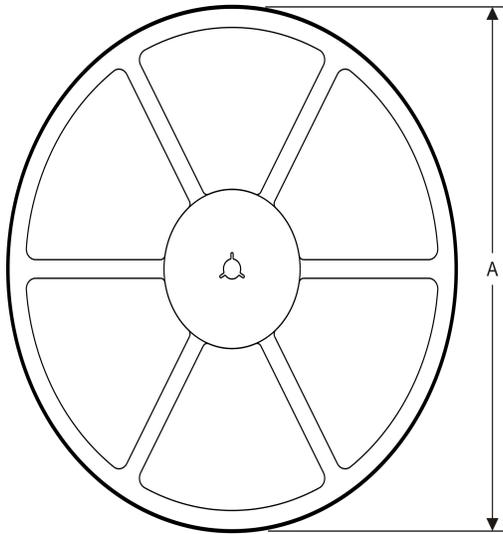
TAPE DIMENSIONS
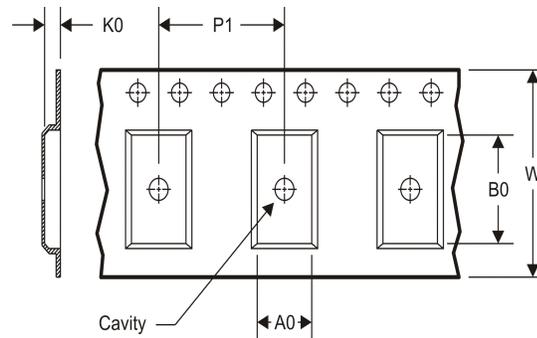
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
SN74LV595ADRG4	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74LV595ANSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74LV595APWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV595APWR	TSSOP	PW	16	2000	330.0	12.4	7.0	5.6	1.6	8.0	12.0	Q1
SN74LV595APWRG3	TSSOP	PW	16	2000	330.0	12.4	7.0	5.6	1.6	8.0	12.0	Q1
SN74LV595APWRG4	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV595APWT	TSSOP	PW	16	250	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV595ARGYR	VQFN	RGY	16	3000	330.0	12.4	3.8	4.3	1.5	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS
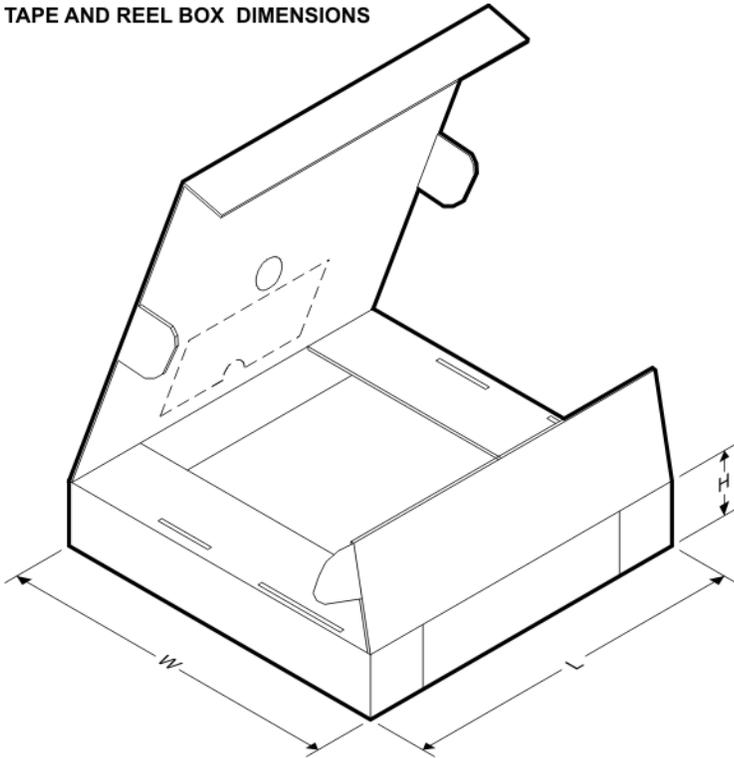
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LV595ADRG4	SOIC	D	16	2500	333.2	345.9	28.6
SN74LV595ANSR	SO	NS	16	2000	367.0	367.0	38.0
SN74LV595APWR	TSSOP	PW	16	2000	367.0	367.0	35.0
SN74LV595APWR	TSSOP	PW	16	2000	364.0	364.0	27.0
SN74LV595APWRG3	TSSOP	PW	16	2000	364.0	364.0	27.0
SN74LV595APWRG4	TSSOP	PW	16	2000	367.0	367.0	35.0
SN74LV595APWT	TSSOP	PW	16	250	367.0	367.0	35.0
SN74LV595ARGYR	VQFN	RGY	16	3000	367.0	367.0	35.0

D (R−PDSO−G16)   PLASTIC SMALL OUTLINE

0.394 (10,00)
0.386 (9,80)
⟋C⟍

16   9

0.244 (6,20)
0.228 (5,80)

0.157 (4,00)
0.150 (3,80) ⟋D⟍

1   8

Pin 1
Index Area

0.050 (1,27)

0.020 (0,51)
0.012 (0,31)

⊕ | 0.010 (0,25) Ⓜ

0.069 (1,75) Max

0.010 (0,25)
0.004 (0,10)

0.010 (0,25)
0.005 (0,13)

△ | 0.004 (0,10)

Gauge Plane

Seating Plane

0.010 (0,25)   0°−8°
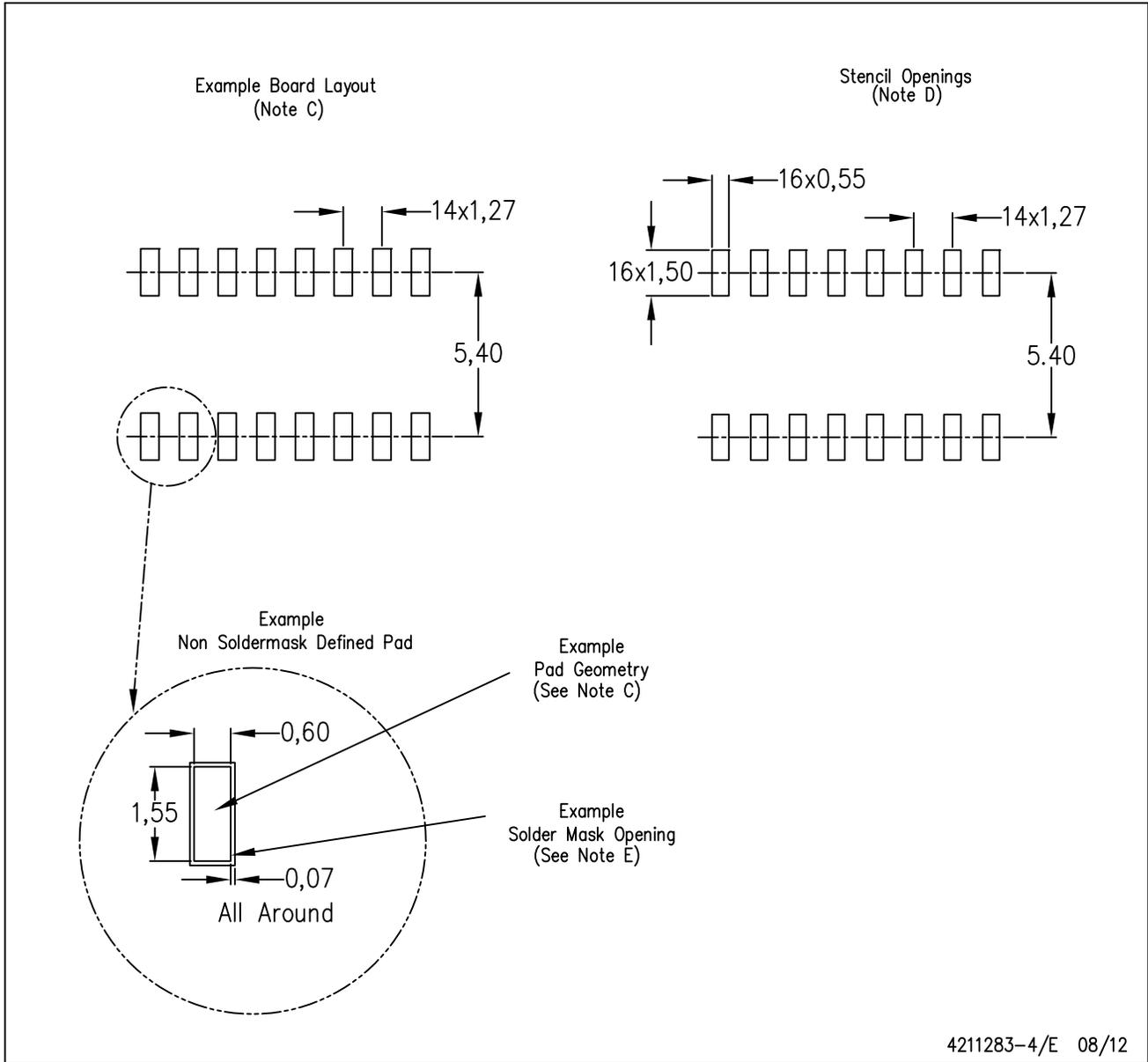
0.050 (1,27)
0.016 (0,40)
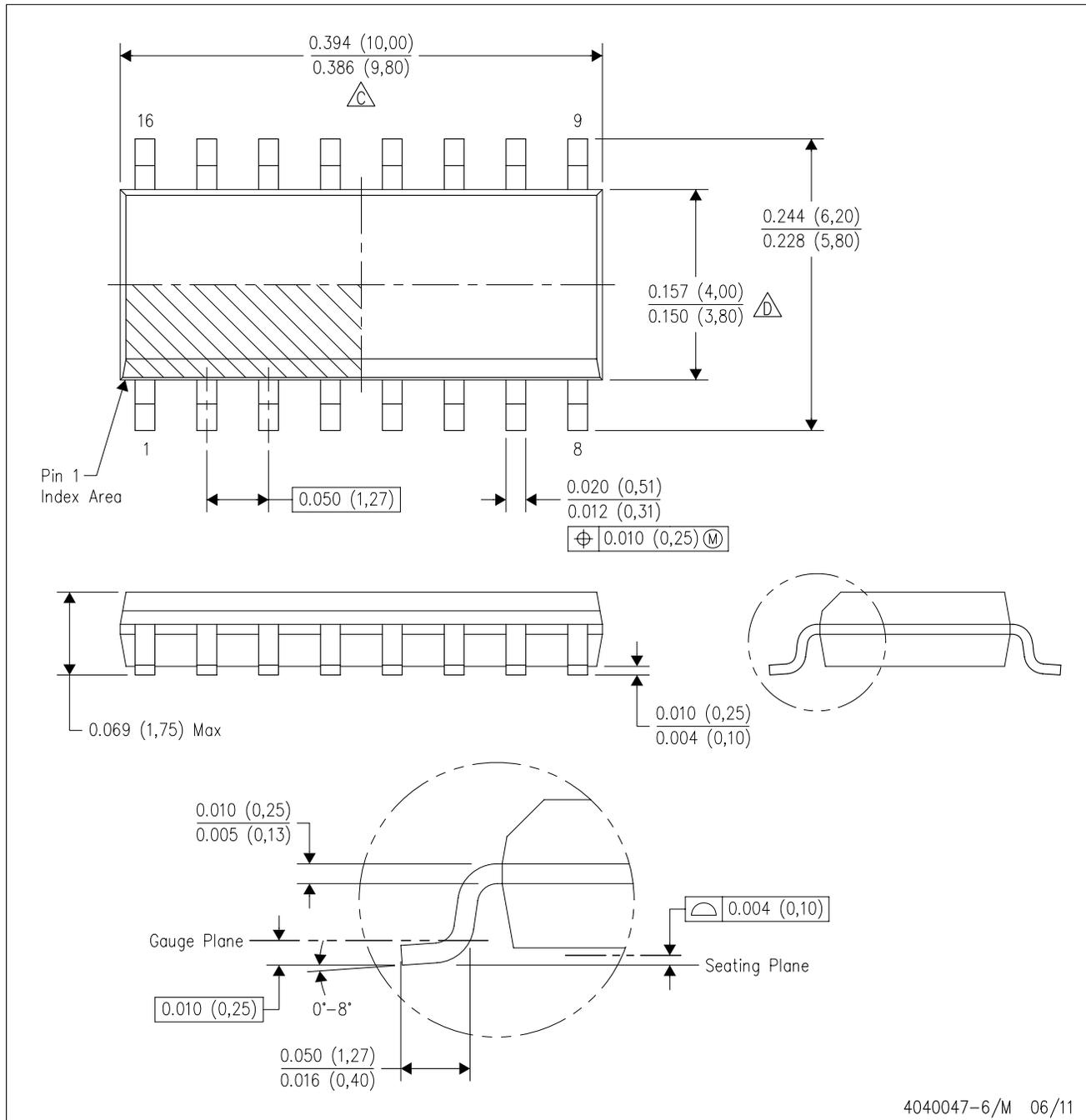
4040047−6/M   06/11

NOTES: A.   All linear dimensions are in inches (millimeters).
         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 0.006 (0,15) each side.
      ⟋D⟍   Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
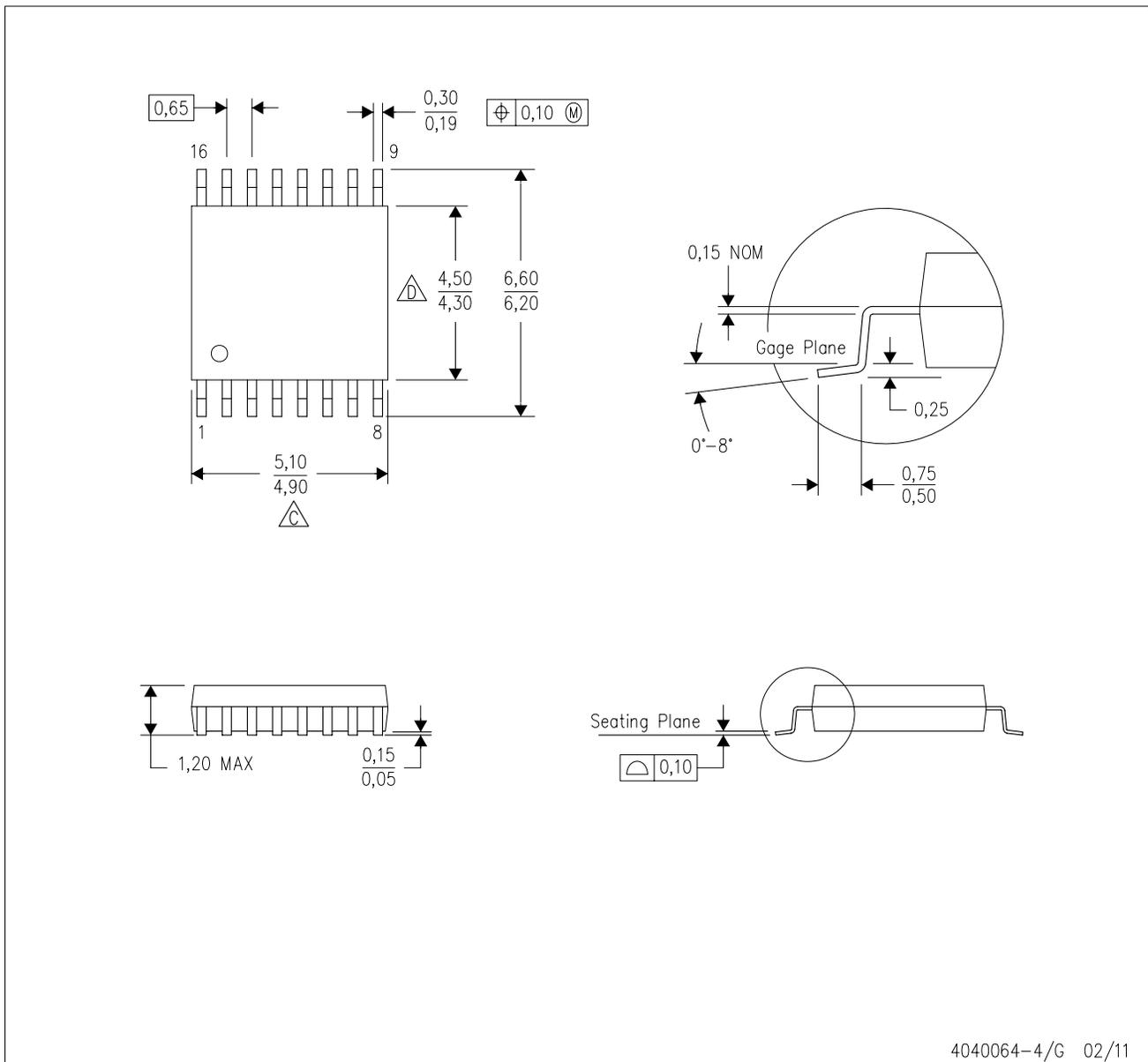   E.   Reference JEDEC MS−012 variation AC.

D (R-PDSO-G16)   PLASTIC SMALL OUTLINE

Example Board Layout
(Note C)

Stencil Openings
(Note D)

←14x1,27

16x0,55

14x1,27

16x1,50

5,40

5.40

Example
Non Soldermask Defined Pad

Example
Pad Geometry
(See Note C)

0,60

1,55

Example
Solder Mask Opening
(See Note E)

0,07

All Around

4211283-4/E 08/12

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 designs.
          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.

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PW (R−PDSO−G16)   PLASTIC SMALL OUTLINE

0,65

0,30
0,19

⊕ 0,10 Ⓜ

16   9

D   4,50
      4,30

6,60
6,20

1   8

5,10
4,90

C

0,15 NOM

Gage Plane

0,25

0°–8°

0,75
0,50

1,20 MAX

0,15
0,05

Seating Plane

⌒ 0,10
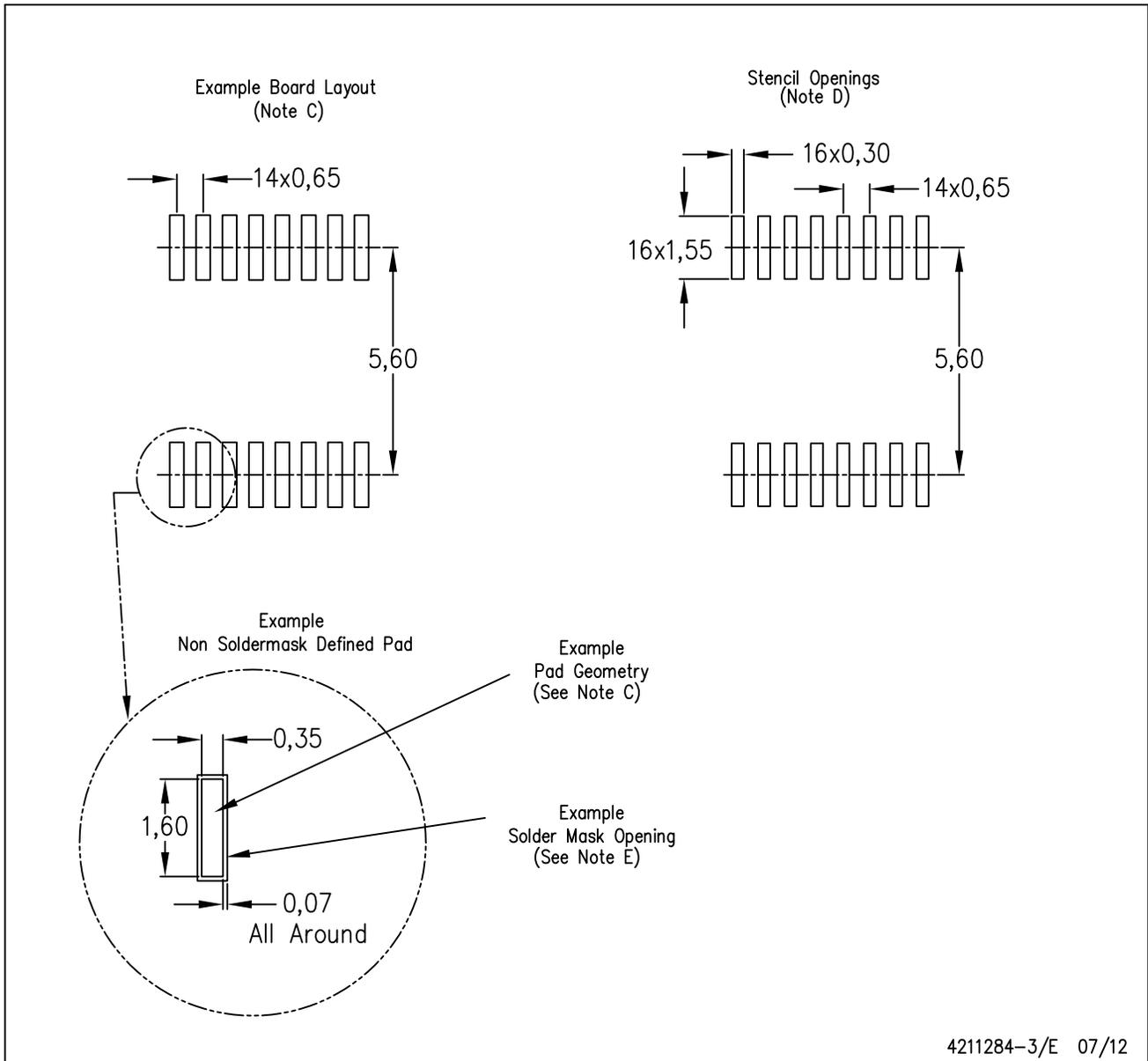
4040064−4/G 02/11

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
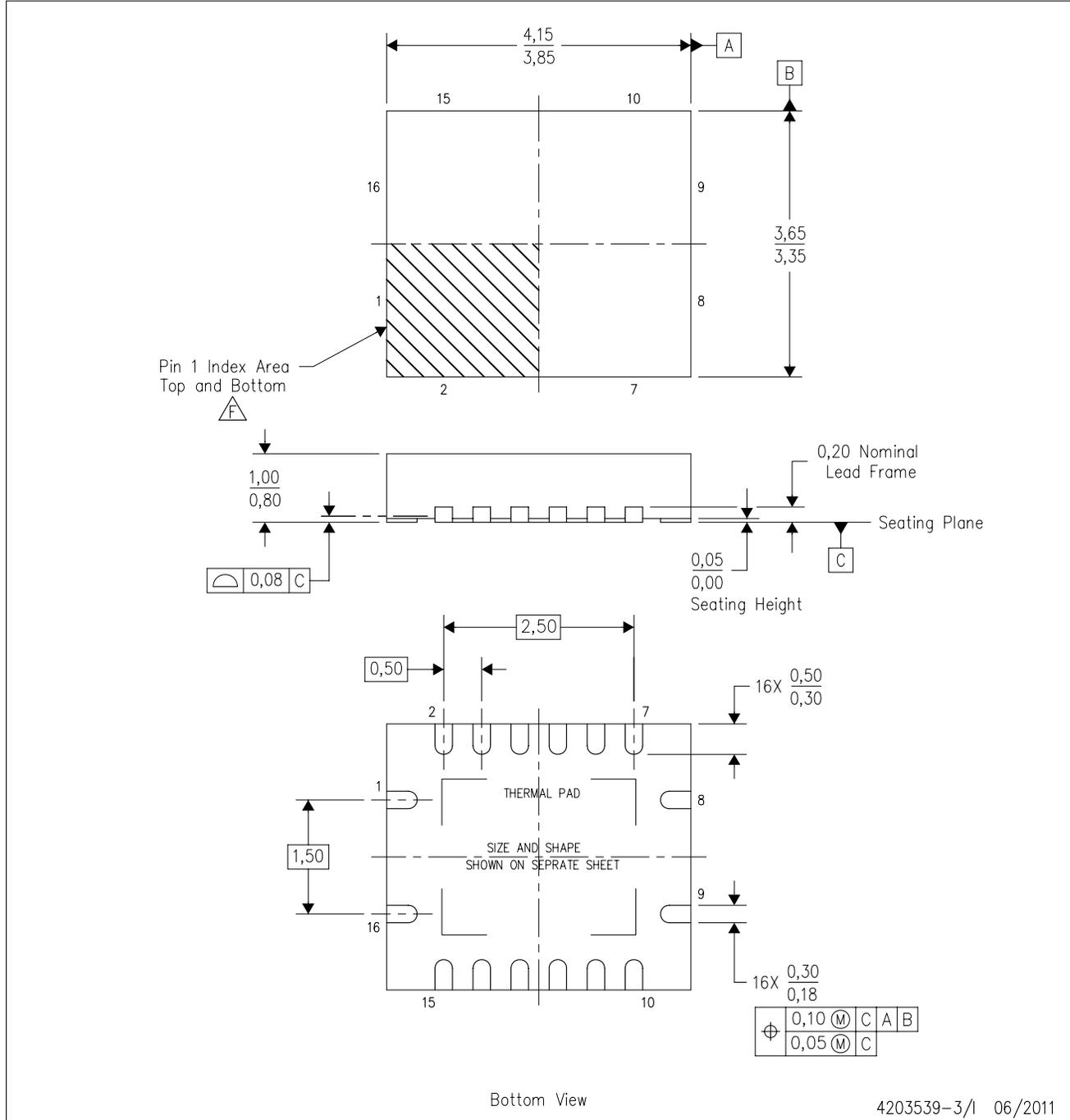
TEXAS INSTRUMENTS
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PW (R−PDSO−G16)   PLASTIC SMALL OUTLINE

Example Board Layout
(Note C)

→| |←—14x0,65

5,60

Example
Non Soldermask Defined Pad

Example
Pad Geometry
(See Note C)

→| |←—0,35

1,60

Example
Solder Mask Opening
(See Note E)

←—0,07
All Around

Stencil Openings
(Note D)

→| |←—16x0,30

→| |←—14x0,65

16x1,55

5,60

4211284−3/E 07/12

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 designs.
         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.

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RGY (R-PVQFN-N16)   PLASTIC QUAD FLATPACK NO-LEAD

$\frac{4,15}{3,85}$ A

B

15   10

16   9

$\frac{3,65}{3,35}$

1   8

2   7

Pin 1 Index Area
Top and Bottom
F

0,20 Nominal
Lead Frame

$\frac{1,00}{0,80}$

Seating Plane

0,08 C

$\frac{0,05}{0,00}$
Seating Height

C

2,50

0,50

16X $\frac{0,50}{0,30}$

2   7

1   THERMAL PAD   8

1,50   SIZE AND SHAPE
SHOWN ON SEPRATE SHEET

16   9

15   10

16X $\frac{0,30}{0,18}$

⊕ | 0,10 (M) | C | A | B |
     | 0,05 (M) | C |

Bottom View

4203539-3/I 06/2011

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. QFN (Quad Flatpack No-Lead) package configuration.
         D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
         E. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
         F. Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated.
             The Pin 1 identifiers are either a molded, marked, or metal feature.
         G. Package complies to JEDEC MO-241 variation BA.

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RGY (R−PVQFN−N16)   PLASTIC QUAD FLATPACK NO−LEAD

THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No−Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at www.ti.com.

The exposed thermal pad dimensions for this package are shown in the following illustration.

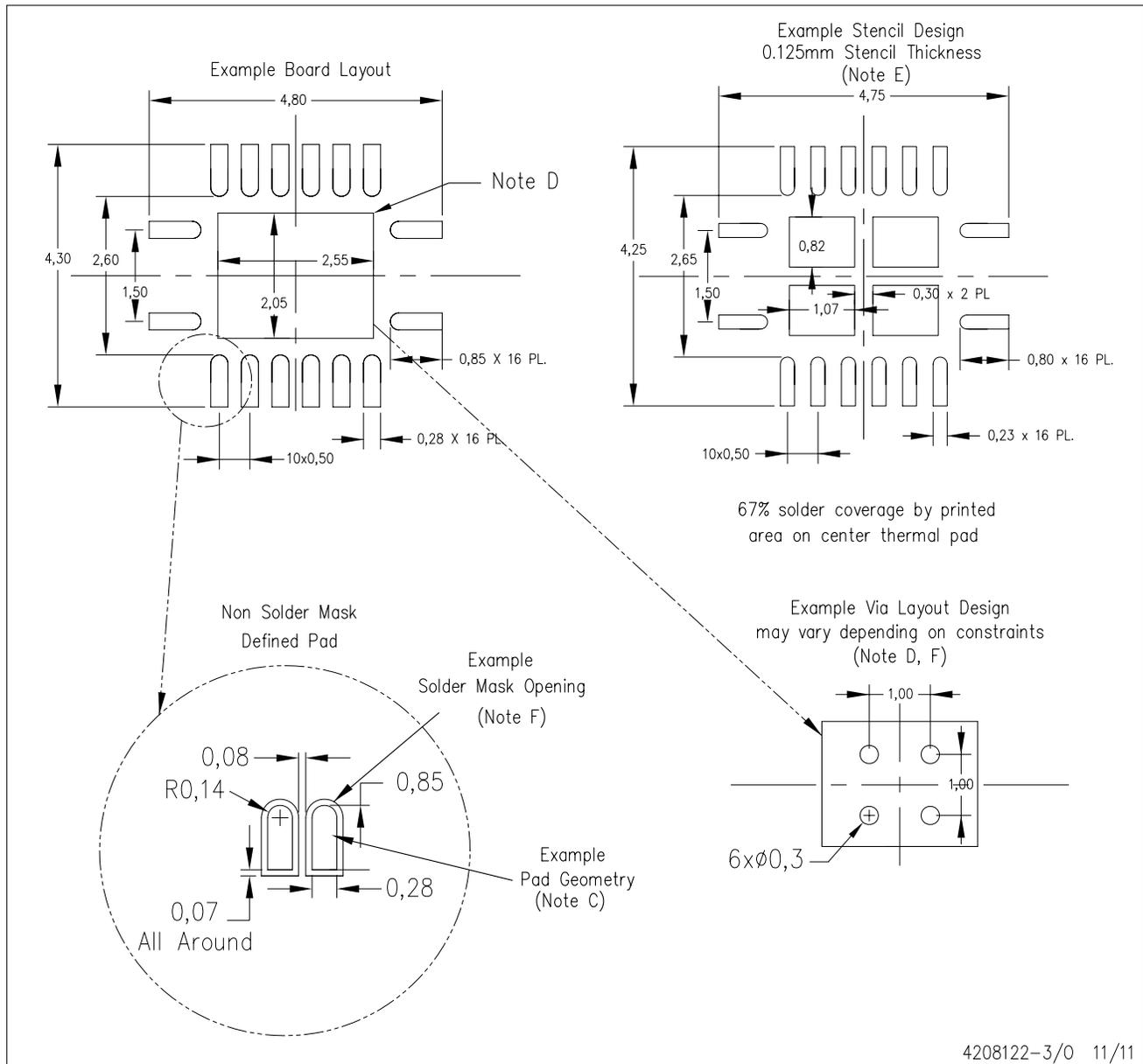Exposed Thermal Pad

2,05±0,10

2,55±0,10
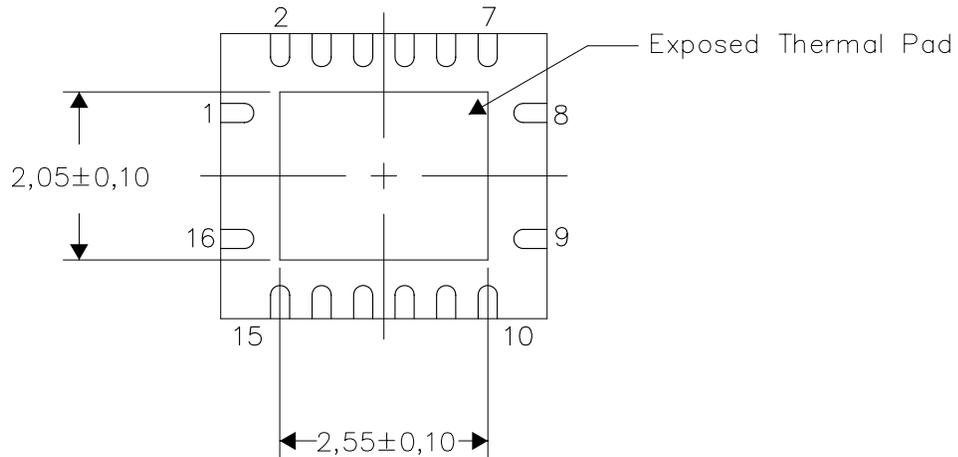
Bottom View

Exposed Thermal Pad Dimensions

4206353−3/0 11/11

NOTE: All linear dimensions are in millimeters

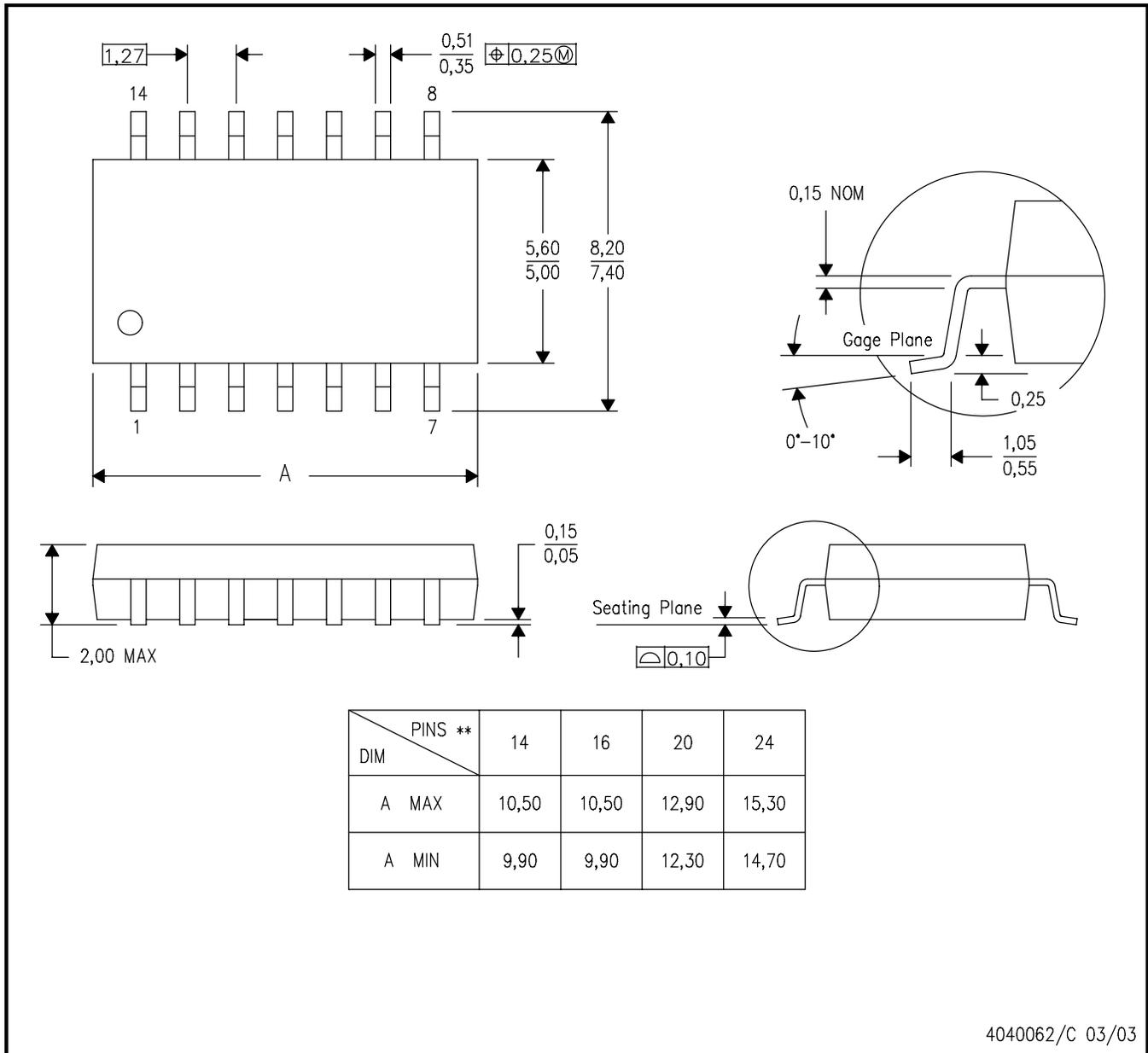RGY (R−PVQFN−N16)   PLASTIC QUAD FLATPACK NO−LEAD

Example Board Layout

4,80

Note D

4,30
2,60
1,50
2,55
2,05

0,85 X 16 PL.

0,28 X 16 PL.

10x0,50

Example Stencil Design
0.125mm Stencil Thickness
(Note E)

4,75

4,25
2,65
1,50
0,82
1,07
0,30 x 2 PL

0,80 x 16 PL.

0,23 x 16 PL.

10x0,50

67% solder coverage by printed
area on center thermal pad

Non Solder Mask
Defined Pad

Example
Solder Mask Opening
(Note F)

0,08
R0,14
0,85
0,28
0,07
All Around

Example
Pad Geometry
(Note C)

Example Via Layout Design
may vary depending on constraints
(Note D, F)

1,00
1,00

6x∅0,3

4208122−3/0 11/11

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 designs.
         D.   This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat−Pack
              QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets
              for specific thermal information, via requirements, and recommended board layout.
              These documents are available at www.ti.com <http://www.ti.com>.
         E.   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 stencil design considerations.
         F.   Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

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NS (R-PDSO-G**)
14-PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE

1,27

$\frac{0,51}{0,35}$ ⊕ 0,25Ⓜ

14

8

$\frac{5,60}{5,00}$ $\frac{8,20}{7,40}$

1

7

A

0,15 NOM

Gage Plane

0,25

0°–10°

$\frac{1,05}{0,55}$

$\frac{0,15}{0,05}$

2,00 MAX

Seating Plane

△ 0,10

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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TI has specifically designated certain components which meet ISO/TS16949 requirements, mainly for automotive use. Components which have not been so designated are neither designed nor intended for automotive use; and TI will not be responsible for any failure of such components to meet such requirements.

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