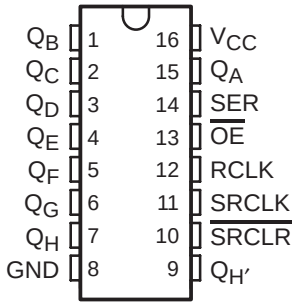
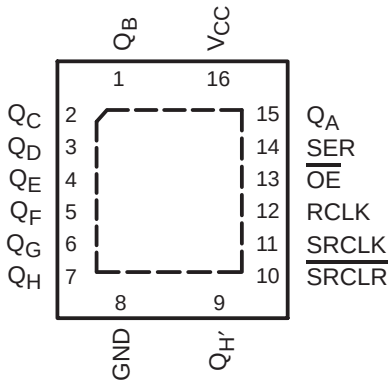
- **2-V to 5.5-V V_{CC} Operation**
- **Max t_{pd} of 7.1 ns at 5 V**
- **Typical V_{OLP} (Output Ground Bounce) <0.8 V at V_{CC} = 3.3 V, T_A = 25°C**
- **Typical V_{OHV} (Output V_{OH} Undershoot) >2.3 V at V_{CC} = 3.3 V, T_A = 25°C**
- **Support Mixed-Mode Voltage Operation on All Ports**
- **8-Bit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

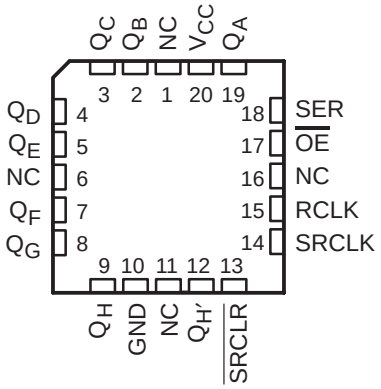
SN54LV595A . . . J OR W PACKAGE
SN74LV595A . . . D, DB, NS, OR PW PACKAGE
(TOP VIEW)



SN74LV595A . . . RGY PACKAGE
(TOP VIEW)



SN54LV595A . . . FK PACKAGE
(TOP VIEW)



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	SN74LV595AD	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	SN74LV595APWR	
		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.

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 ($\overline{SRCLR}$) input, serial (SER) input, and a serial output for cascading. When the output-enable ($\overline{OE}$) 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.

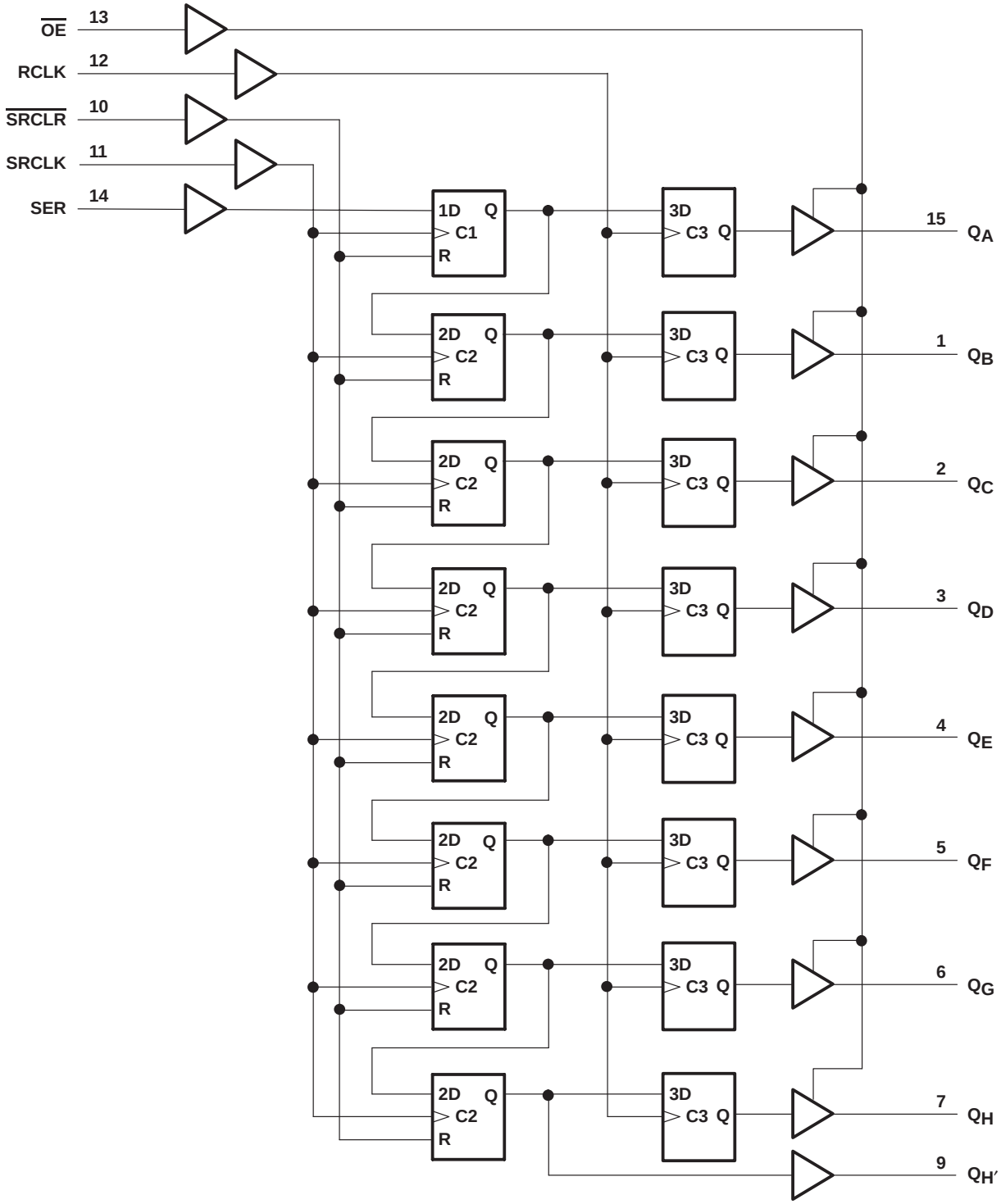
To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

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

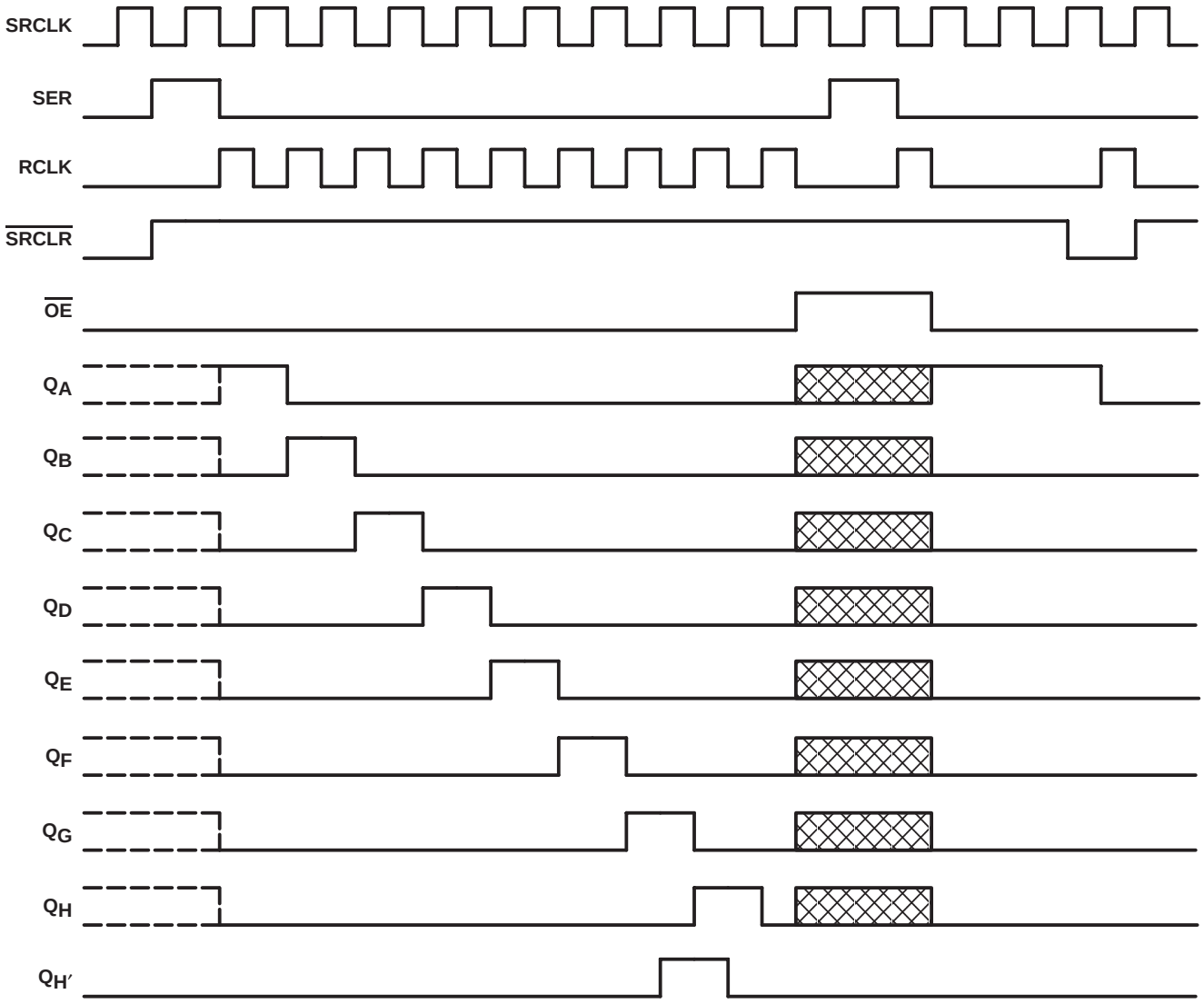
INPUTS					FUNCTION
SER	SRCLK	$\overline{SRCLR}$	RCLK	$\overline{OE}$	
X	X	X	X	H	Outputs Q_A–Q_H are disabled.
X	X	X	X	L	Outputs Q_A–Q_H are enabled.
X	X	L	X	X	Shift register is cleared.
L	↑	H	X	X	First stage of the shift register goes low. Other stages store the data of previous stage, respectively.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

recommended operating conditions (see Note 5)

			SN54LV595A		SN74LV595A		UNIT
			MIN	MAX	MIN	MAX	
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.

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		
		$\overline{\text{SRCLR}}$ 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		
		$\overline{\text{SRCLR}}$ low before RCLK↑	8.5		9.5		9.5		
		$\overline{\text{SRCLR}}$ 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.

timing requirements over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 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		
		$\overline{\text{SRCLR}}$ 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		
		$\overline{\text{SRCLR}}$ low before RCLK↑	8		9		9		
		$\overline{\text{SRCLR}}$ 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 ± 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		
		$\overline{\text{SRCLR}}$ low	5.2		5.2		5.2		
t_{su}	Setup time	SER before SRCLK↑	3		3		3		ns
		SRCLK↑ before RCLK↑†	5		5		5		
		$\overline{\text{SRCLR}}$ low before RCLK↑	5		5		5		
		$\overline{\text{SRCLR}}$ 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.

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	C_L = 15 pF		8.4*	14.2*	1*	15.8*	1	15.8	ns
t_{PHL}					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}					9.4*	19.6*	1*	22.2*	1	22.2	
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$			8.7*	14.6*	1*	16.3*	1	16.3	
t_{PZH}	$\overline{OE}$	Q_A–Q_H			8.2*	13.9*	1*	15*	1	15	
t_{PZL}					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}					9.2*	15.2*	1*	16.7*	1	16.7	
t_{PLH}	RCLK	Q_A–Q_H	C_L = 50 pF		11.2	17.2	1	19.3	1	19.3	ns
t_{PHL}					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}					13.1	22.5	1	25.5	1	25.5	
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$			12.4	18.8	1	21.1	1	21.1	
t_{PZH}	$\overline{OE}$	Q_A–Q_H			10.8	17	1	18.3	1	18.3	
t_{PZL}					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}					14	20.9	1	22.6	1	22.6	

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

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 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	80*	120*		70*		70		MHz
			C_L = 50 pF	55	105		50		50		
t_{PLH}	RCLK	Q_A–Q_H	C_L = 15 pF		6*	11.9*	1*	13.5*	1	13.5	ns
t_{PHL}					6*	11.9*	1*	13.5*	1	13.5	
t_{PLH}	SRCLK	$Q_{H'}$			6.6*	13*	1*	15*	1	15	
t_{PHL}					6.6*	13*	1*	15*	1	15	
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$			6.2*	12.8*	1*	13.7*	1	13.7	
t_{PZH}	$\overline{OE}$	Q_A–Q_H			6*	11.5*	1*	13.5*	1	13.5	
t_{PZL}					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}					6.3*	14.7*	1*	15.2*	1	15.2	
t_{PLH}	RCLK	Q_A–Q_H	C_L = 50 pF		7.9	15.4	1	17	1	17	ns
t_{PHL}					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}					9.2	16.5	1	18.5	1	18.5	
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$			9	16.3	1	17.2	1	17.2	
t_{PZH}	$\overline{OE}$	Q_A–Q_H			7.8	15	1	17	1	17	
t_{PZL}					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}					9.3	15.7	1	16.2	1	16.2	

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

switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 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	135*	170*		115*		115		MHz
			C_L = 50 pF	120	140		95		95		
t_{PLH}	RCLK	Q_A–Q_H	C_L = 15 pF		4.3*	7.4*	1*	8.5*	1	8.5	ns
t_{PHL}					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}					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}					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}					2.7*	5.1*	1*	7.2*	1	7.2	
t_{PLH}	RCLK	Q_A–Q_H	C_L = 50 pF		5.6	9.4	1	10.5	1	10.5	ns
t_{PHL}					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}					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}					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}					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)

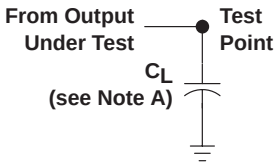
PARAMETER		SN74LV595A			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.3		V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		−0.2		V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		2.8		V
$V_{IH(D)}$	High-level dynamic input voltage	2.31			V
$V_{IL(D)}$	Low-level dynamic input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

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

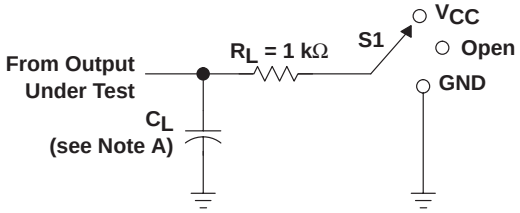
operating characteristics, T_A = 25°C

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	

PARAMETER MEASUREMENT INFORMATION

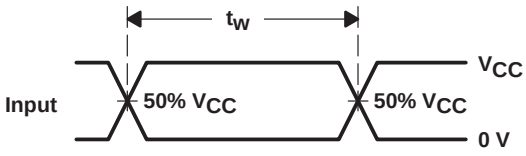


LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

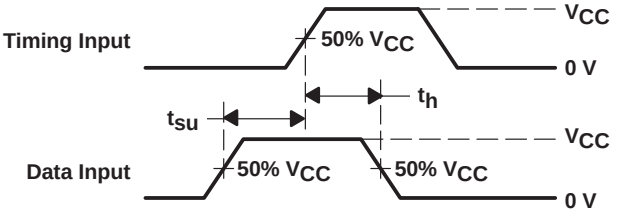


LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN OUTPUTS

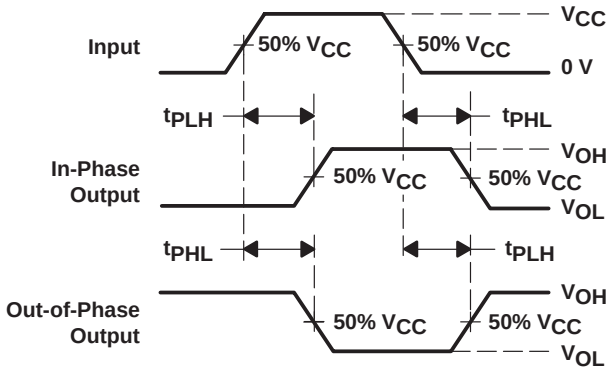
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND
Open Drain	V_{CC}



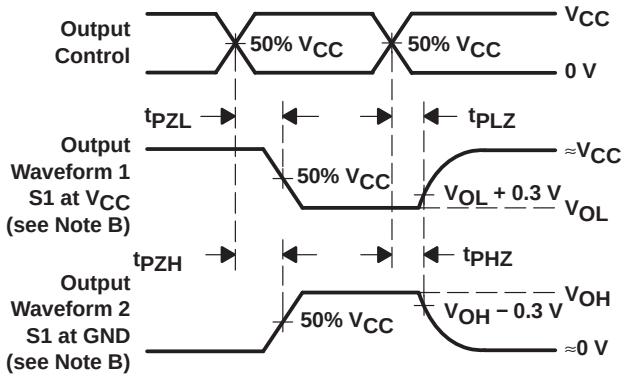
VOLTAGE WAVEFORMS
PULSE DURATION



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

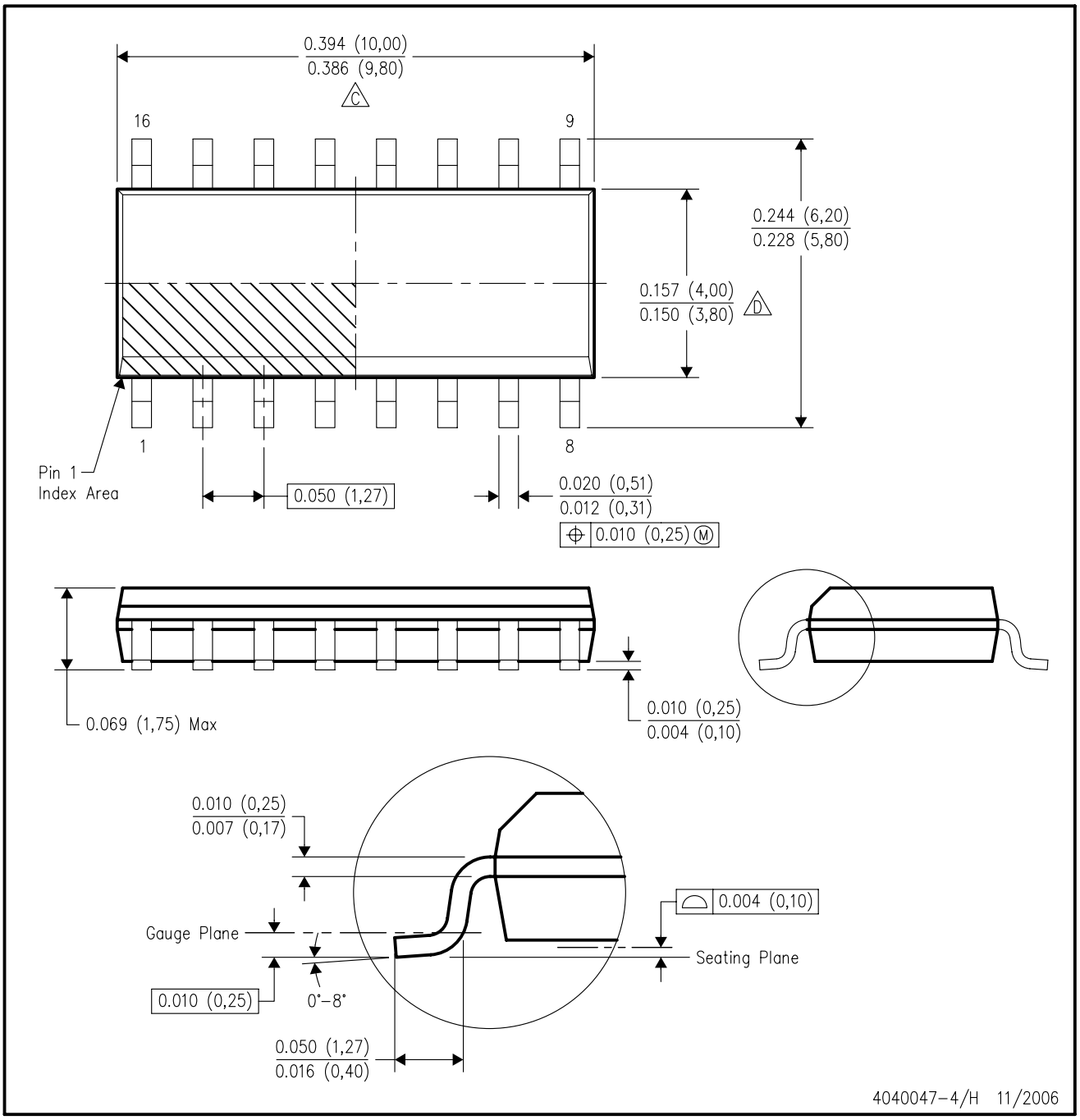
Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
SN74LV595AD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV595ADBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV595ADBRE4	ACTIVE	SSOP	DB	16	2000	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
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
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
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
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
SN74LV595ARGYR	ACTIVE	QFN	RGY	16	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
SN74LV595ARGYRG4	ACTIVE	QFN	RGY	16	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR

(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)

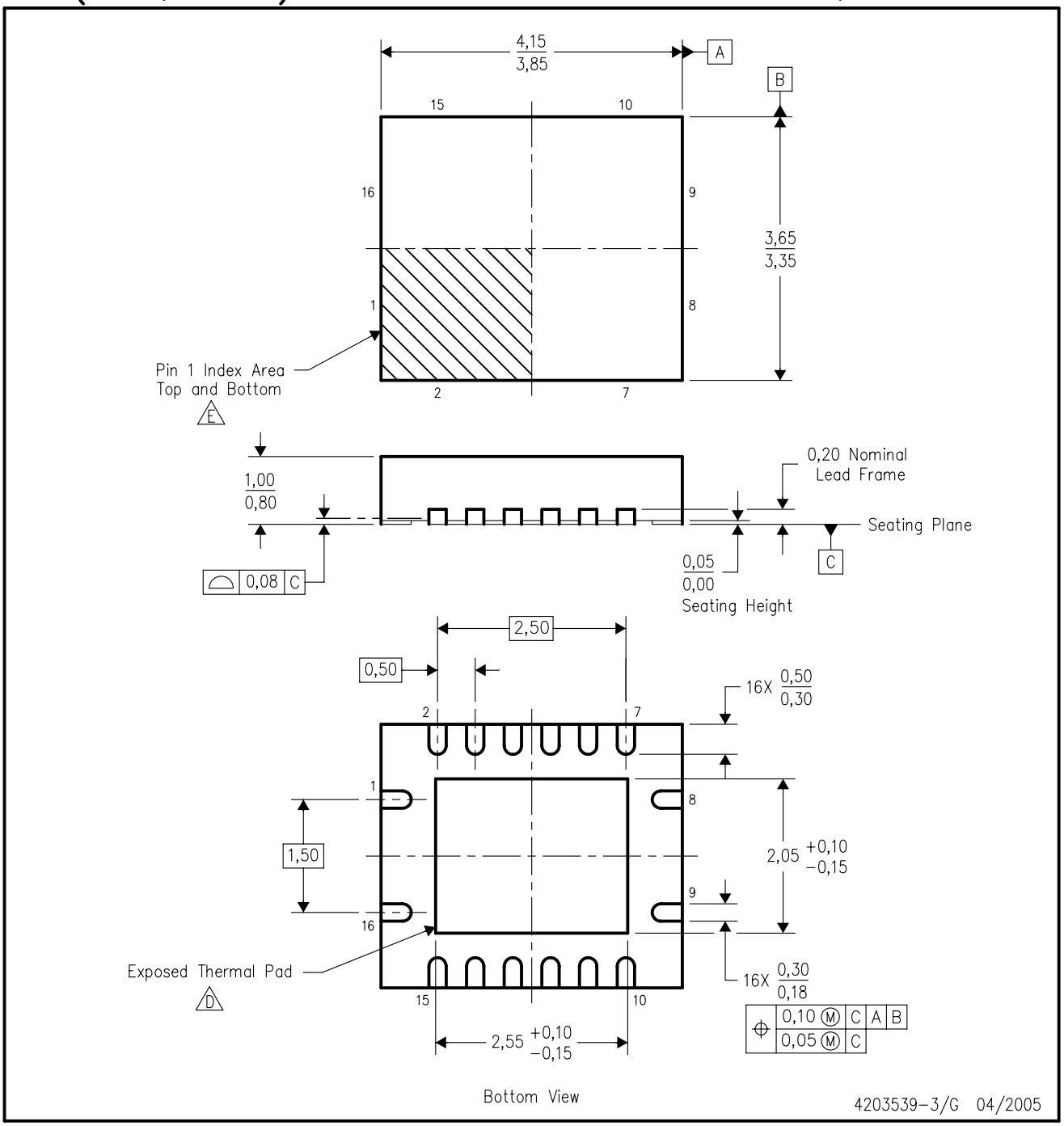
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

D (R–PDSO–G16) PLASTIC SMALL–OUTLINE PACKAGE



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 .006 (0,15) per end.
D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
E. Reference JEDEC MS–012 variation AC.

RGY (R–PQFP–N16) PLASTIC QUAD FLATPACK



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. 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.
F. Package complies to JEDEC MO–241 variation BB.

THERMAL PAD MECHANICAL DATA

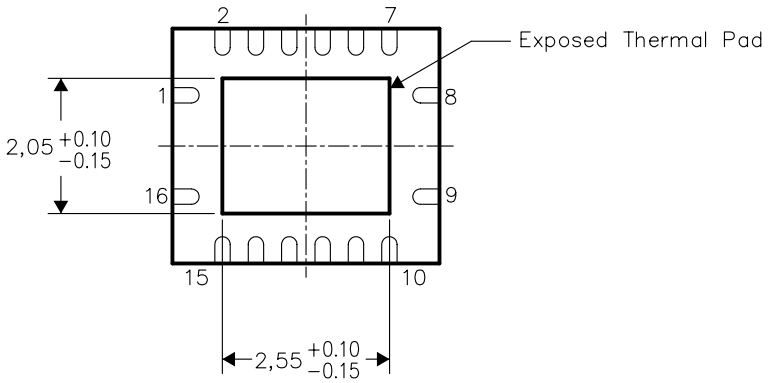
RGY (R–PQFP–N16)

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), the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to a ground plane or 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, Quad Flatpack No–Lead Logic Packages, Texas Instruments Literature No. SCBA017. This document is available at www.ti.com.

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

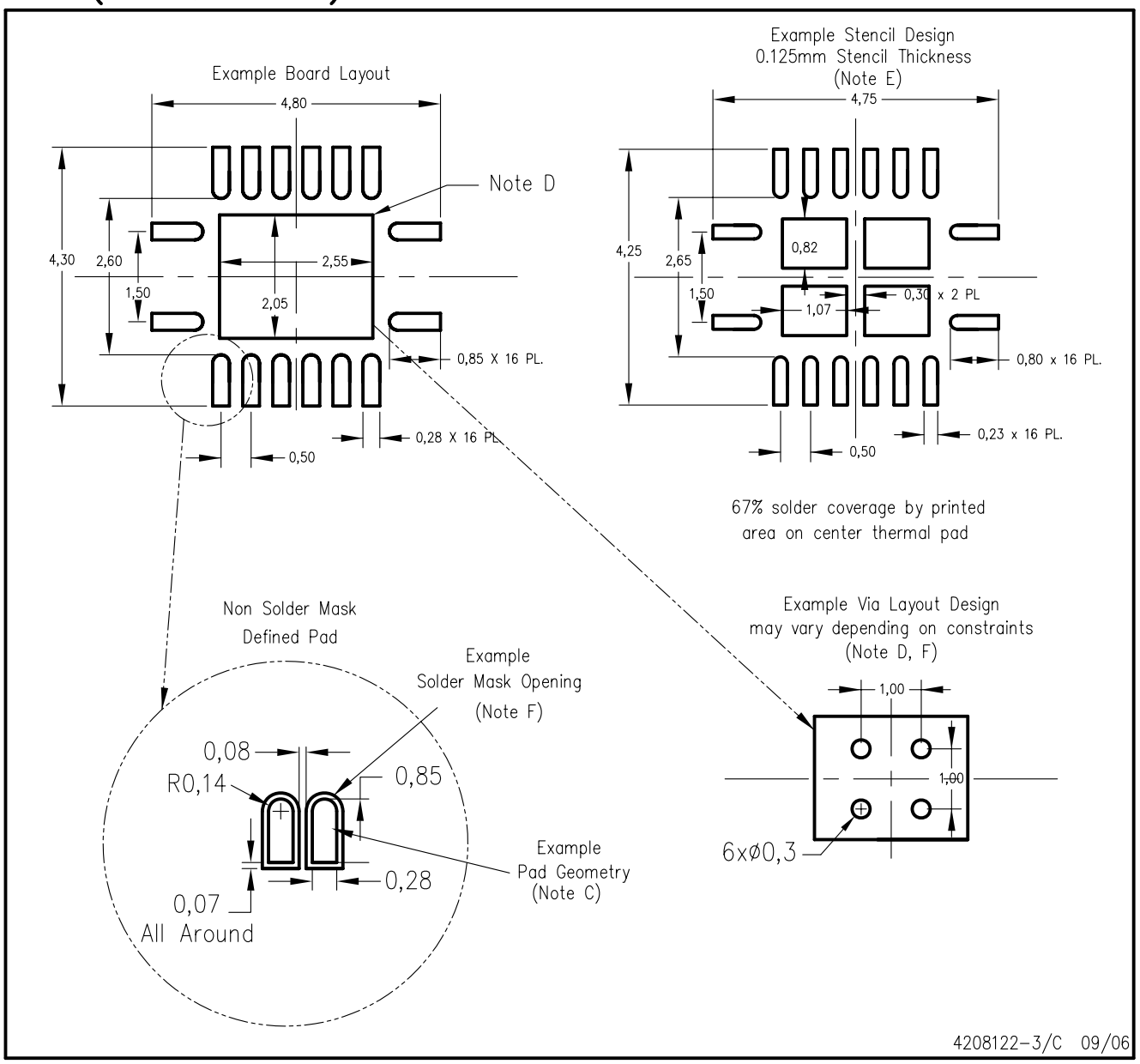


Bottom View

NOTE: All linear dimensions are in millimeters

Exposed Thermal Pad Dimensions

RGY (R–PQFP–N16)

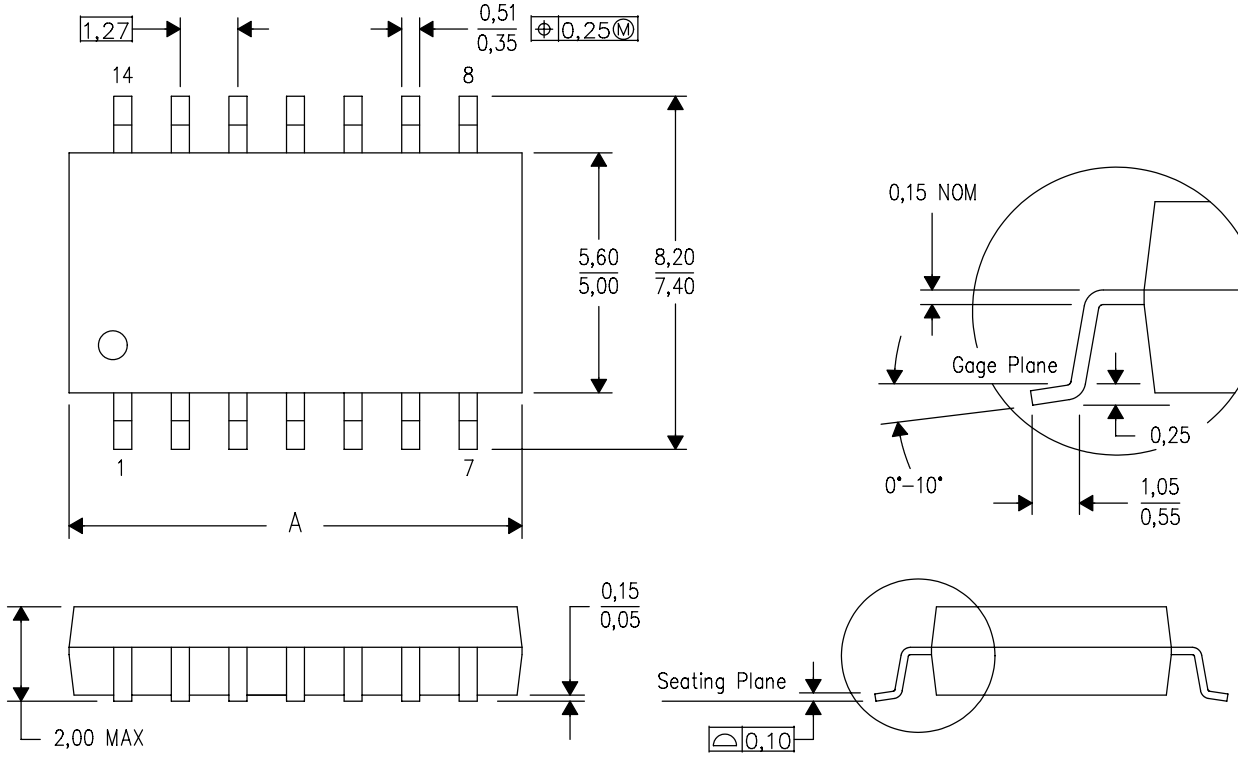


NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat–Pack Packages, Texas Instruments Literature No. SCBA017, 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.

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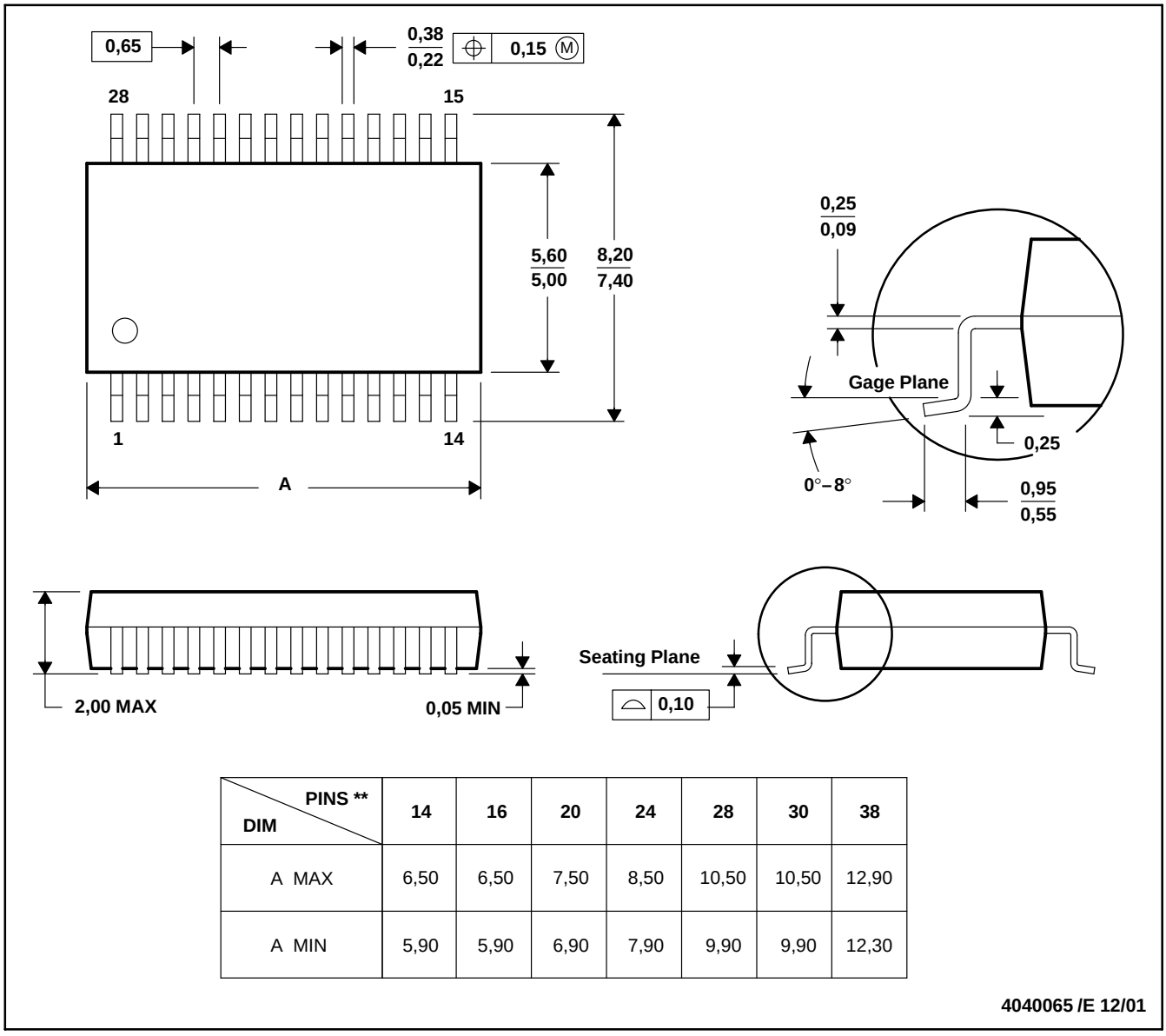
DB (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

28 PINS SHOWN



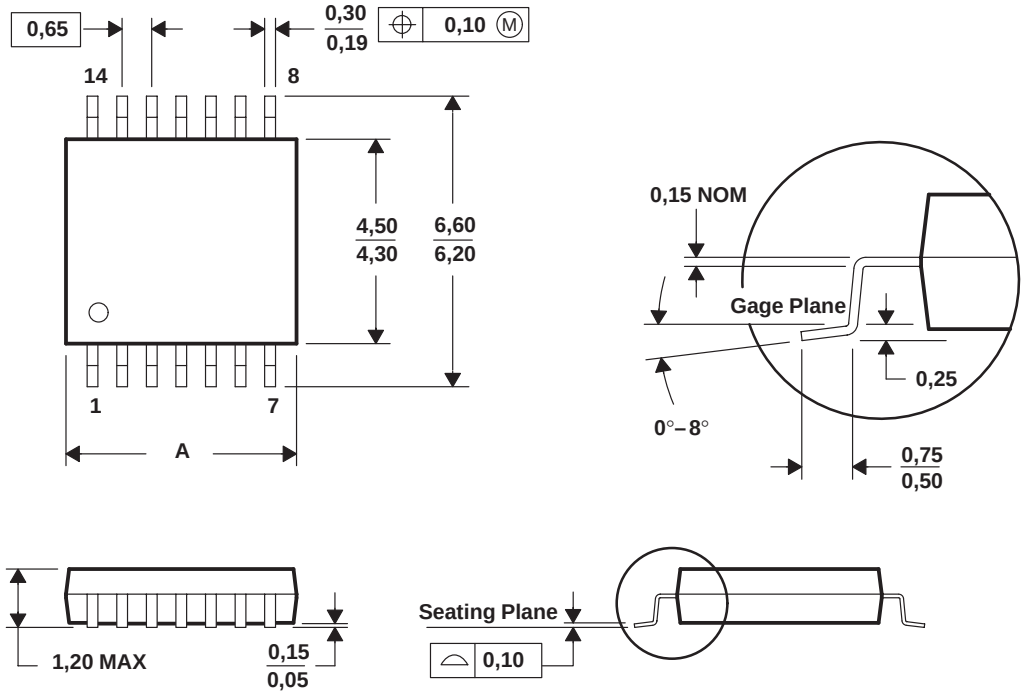
DIM \ PINS **	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

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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