- **2-V to 5.5-V V_{CC} Operation**
- **Max t_{pd} of 9.5 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**
- **Internal Look Ahead for Fast Counting**
- **Carry Output for n-Bit Cascading**

- **Synchronous Counting**
- **Synchronously Programmable**
- **I_{off} Supports Partial-Power-Down Mode Operation**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **ESD Protection Exceeds JESD 22**
  - **2000-V Human-Body Model (A114-A)**
  - **200-V Machine Model (A115-A)**
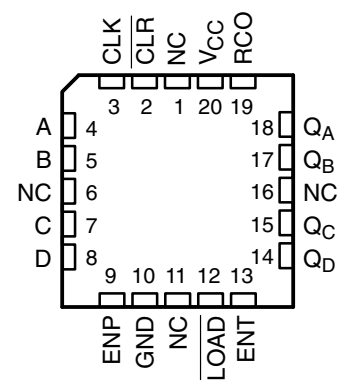 - **1000-V Charged-Device Model (C101)**

SN54LV163A . . . J OR W PACKAGE
SN74LV163A . . . D, DB, DGV, NS,
OR PW PACKAGE
(TOP VIEW)
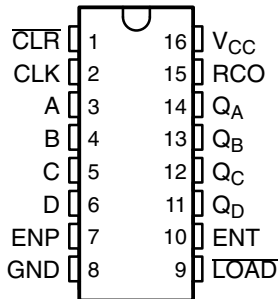
SN74LV163A . . . RGY PACKAGE
(TOP VIEW)
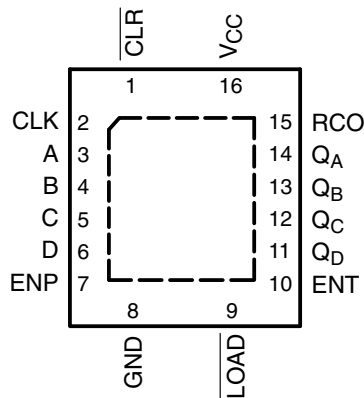
SN54LV163A . . . FK PACKAGE
(TOP VIEW)

NC – No internal connection

description/ordering information

ORDERING INFORMATION

T_A	PACKAGE[†]		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 85°C	QFN – RGY	Reel of 1000	SN74LV163ARGYR	LV163A
	SOIC – D	Tube of 40	SN74LV163AD	LV163A
		Reel of 2500	SN74LV163ADR	
	SOP – NS	Reel of 2000	SN74LV163ANSR	74LV163A
	SSOP – DB	Reel of 2000	SN74LV163ADBR	LV163A
	TSSOP – PW	Tube of 90	SN74LV163APW	LV163A
		Reel of 2000	SN74LV163APWR	
		Reel of 250	SN74LV163APWT	
	TVSOP – DGV	Reel of 2000	SN74LV163ADGVR	LV163A
−55°C to 125°C	CDIP – J	Tube of 25	SNJ54LV163AJ	SNJ54LV163AJ
	CFP – W	Tube of 150	SNJ54LV163AW	SNJ54LV163AW
	LCCC – FK	Tube of 55	SNJ54LV163AFK	SNJ54LV163AFK

[†] 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)

The 'LV163A devices are 4-bit synchronous binary counters designed for 2-V to 5.5-V V_{CC} operation.

These synchronous, presettable counters feature an internal carry look ahead for application in high-speed counting designs. The 'LV163A devices are 4-bit binary counters. Synchronous operation is provided by having all flip-flops clocked simultaneously so that the outputs change coincident with each other when instructed by the count-enable (ENP, ENT) inputs and internal gating. This mode of operation eliminates the output counting spikes normally associated with synchronous (ripple-clock) counters. A buffered clock (CLK) input triggers the four flip-flops on the rising (positive-going) edge of the clock waveform.

These counters are fully programmable; that is, they can be preset to any number between 0 and 9 or 15. As presetting is synchronous, setting up a low level at the load input disables the counter and causes the outputs to agree with the setup data after the next clock pulse, regardless of the levels of the enable inputs.

The clear function for the 'LV163A devices is synchronous. A low level at the clear ($\overline{CLR}$) input sets all four of the flip-flop outputs low after the next low-to-high transition of CLK, regardless of the levels of the enable inputs. This synchronous clear allows the count length to be modified easily by decoding the Q outputs for the maximum count desired. The active-low output of the gate used for decoding is connected to $\overline{CLR}$ to synchronously clear the counter to 0000 (LLLL).

The carry look-ahead circuitry provides for cascading counters for n-bit synchronous applications without additional gating. ENP, ENT, and a ripple-carry output (RCO) are instrumental in accomplishing this function. Both ENP and ENT must be high to count, and ENT is fed forward to enable RCO. Enabling RCO produces a high-level pulse while the count is maximum (9 or 15 with Q_A high). This high-level overflow ripple-carry pulse can be used to enable successive cascaded stages. Transitions at ENP or ENT are allowed, regardless of the level of CLK.

These counters feature a fully independent clock circuit. Changes at control inputs (ENP, ENT, or $\overline{LOAD}$) that modify the operating mode have no effect on the contents of the counter until clocking occurs. The function of the counter (whether enabled, disabled, loading, or counting) is dictated solely by the conditions meeting the stable setup and hold times.

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					OUTPUTS				FUNCTION
$\overline{CLR}$	$\overline{LOAD}$	ENP	ENT	CLK	$\overline{QA}$	QB	QC	QD	
L	X	X	X	X	L	L	L	L	Reset to "0"
H	L	X	X		A	B	C	D	Preset data
H	H	X	L		No change				No count
H	H	L	X		No change				No count
H	H	H	H		Count up				Count
H	X	X	X		No change				No count

TEXAS INSTRUMENTS

POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265

logic diagram (positive logic)
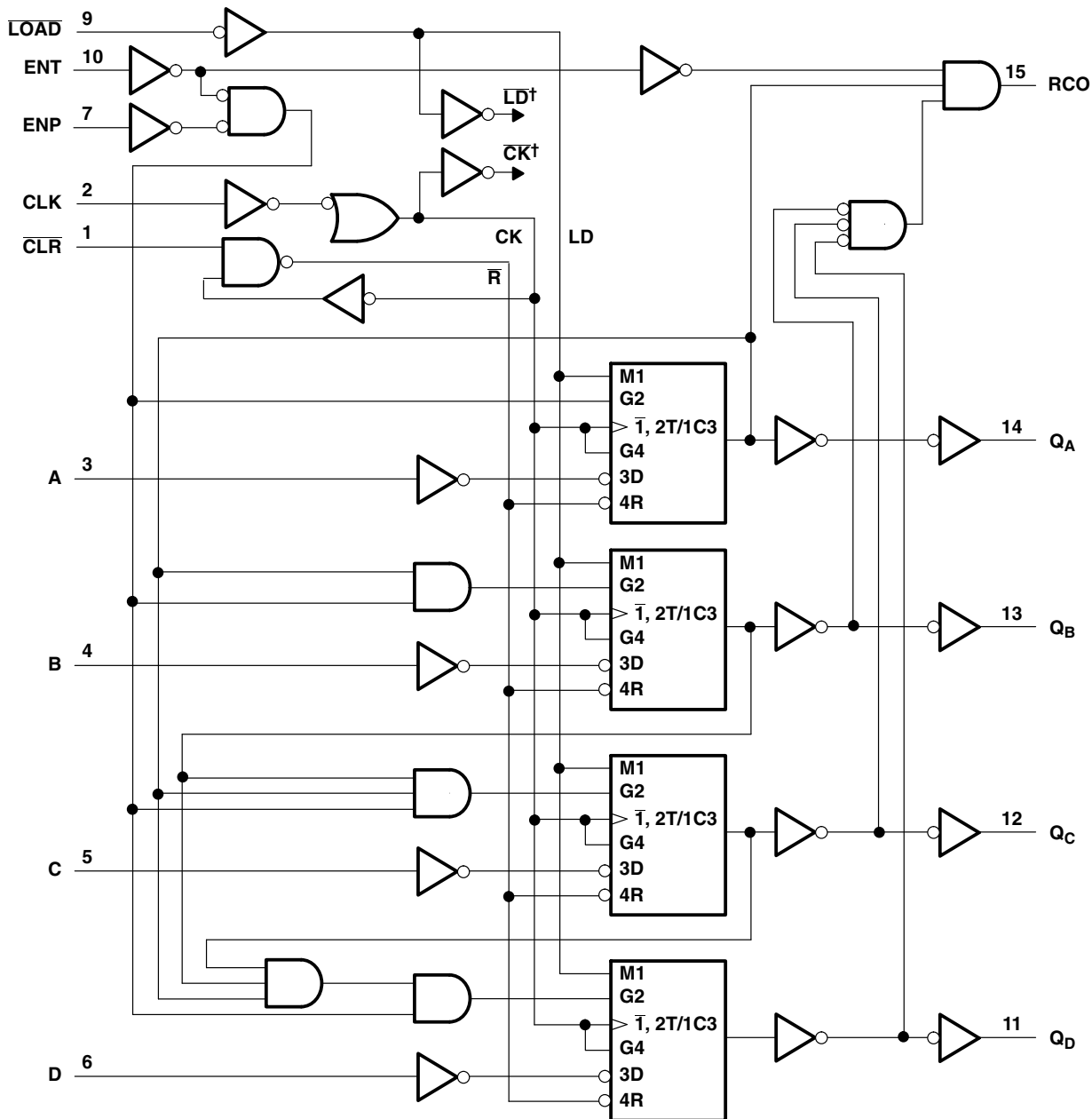
† For simplicity, routing of complementary signals $\overline{LD}$ and $\overline{CK}$ is not shown on this overall logic diagram. The uses of these signals are shown on the logic diagram of the D/T flip-flops.

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

logic diagram, each D/T flip-flop (positive logic)
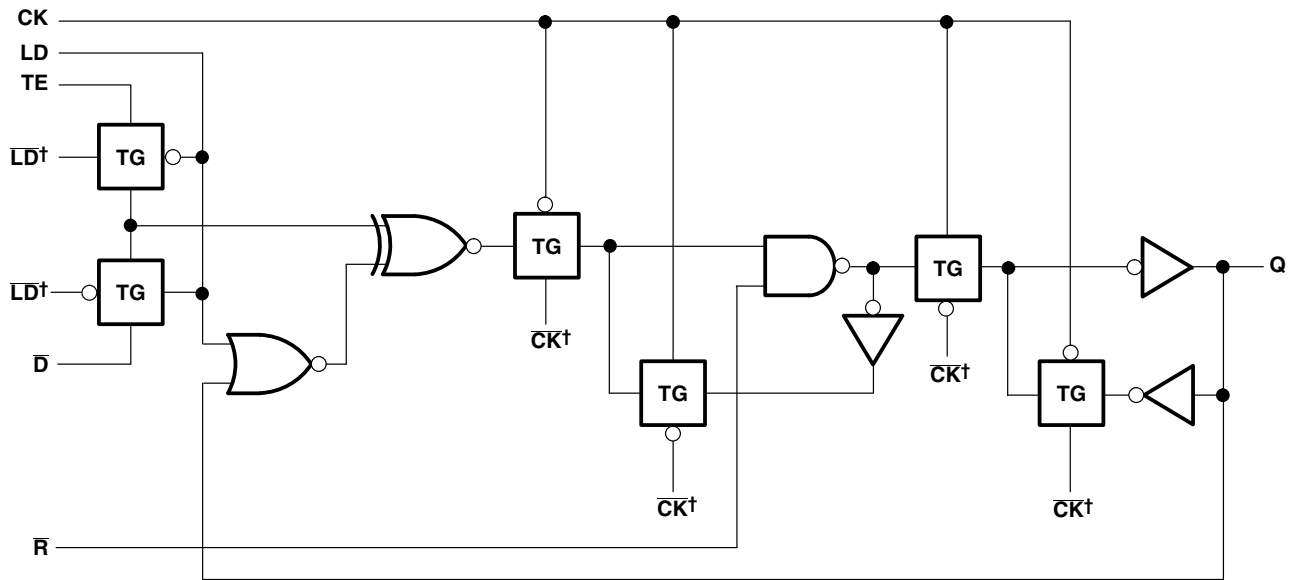
† The origins of $\overline{LD}$ and $\overline{CK}$ are shown in the overall logic diagram of the device.

typical clear, preset, count, and inhibit sequence

The following sequence is illustrated below:

1. Clear outputs to zero (synchronous)
2. Preset to binary 12
3. Count to 13, 14, 15, 0, 1, and 2
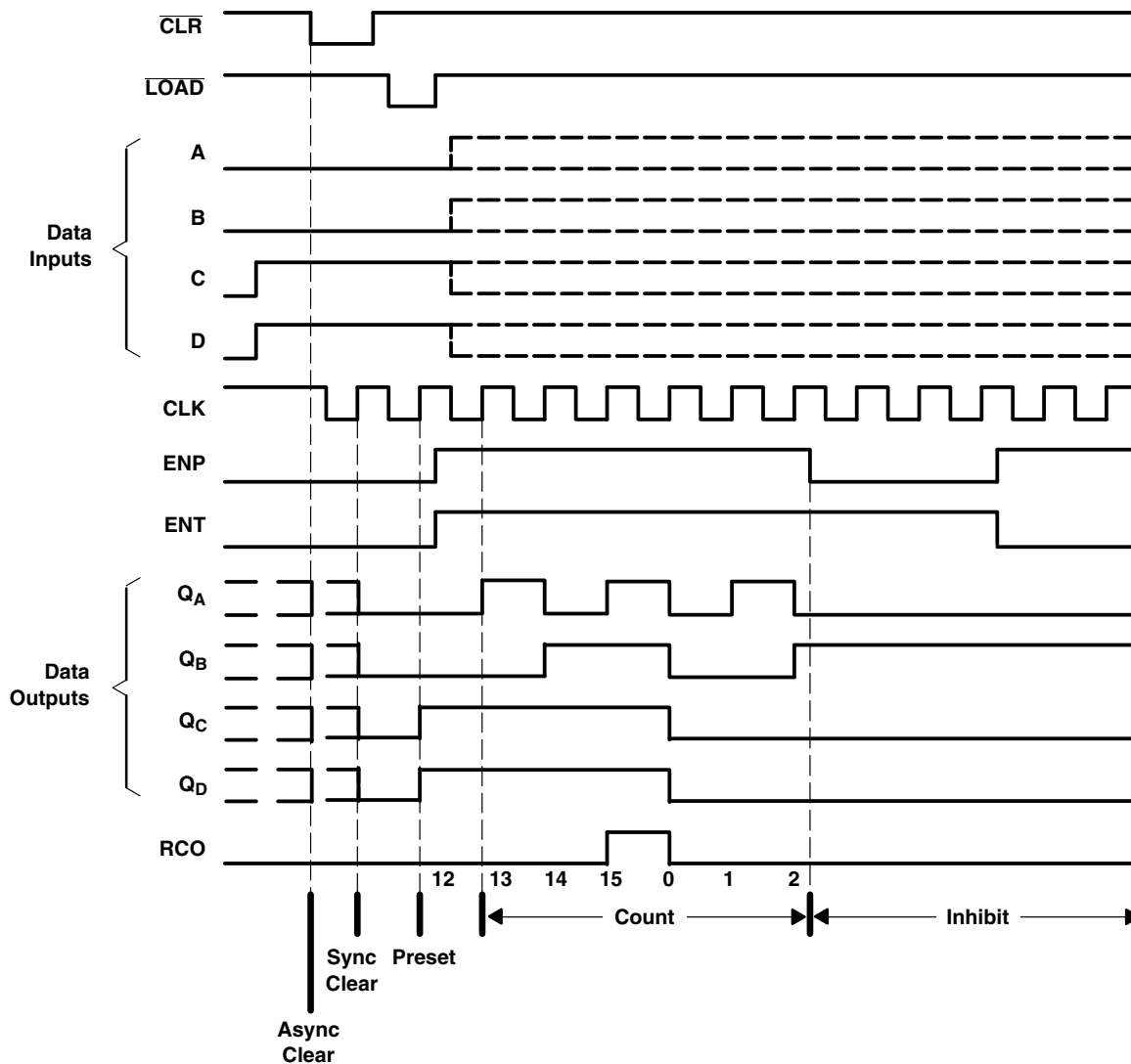4. Inhibit

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
Output voltage range applied in high or low state, V_O (see Notes 1 and 2) . . . . −0.5 V to V_{CC} + 0.5 V
Voltage range applied to any output in the power-off state, V_O (see Note 1) . . . . −0.5 V to 7 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}) . . . . ±25 mA
Continuous current through V_{CC} or GND . . . . ±50 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): DGV package . . . . 120°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

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

recommended operating conditions (see Note 5)

			SN54LV163A		SN74LV163A		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		0	V_{CC}	0	V_{CC}	V
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		−6		−6	
		V_{CC} = 4.5 V to 5.5 V		−12		−12	
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		6		6	
		V_{CC} = 4.5 V to 5.5 V		12		12	
$\Delta t/\Delta v$	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}	SN54LV163A			SN74LV163A			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			
	I_{OH} = −6 mA	3 V	2.48			2.48			
	I_{OH} = −12 mA	4.5 V	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	
	I_{OL} = 6 mA	3 V			0.44			0.44	
	I_{OL} = 12 mA	4.5 V			0.55			0.55	
I_I	V_I = 5.5 V or GND	0 to 5.5 V			±1			±1	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		1.8			1.8		pF

TEXAS INSTRUMENTS

SN54LV163A, SN74LV163A
4-BIT SYNCHRONOUS BINARY COUNTERS

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

			T_A = 25°C		SN54LV163A		SN74LV163A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration, CLK high or low		7		7		7		ns
t_{su}	Setup time before CLK↑	CLR	6		6		6		ns
		Data (A, B, C, and D)	7.5		8.5		8.5		
		ENP, ENT	9.5		11		11		
		LOAD low	10		11.5		11.5		
t_h	Hold time, all synchronous inputs after CLK↑		1.5		1.5		1.5		ns

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		SN54LV163A		SN74LV163A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration, CLK high or low		5		5		5		ns
t_{su}	Setup time before CLK↑	CLR	4		4		4		ns
		Data (A, B, C, and D)	5.5		6.5		6.5		
		ENP, ENT	7.5		9		9		
		LOAD low	8		9.5		9.5		
t_h	Hold time, all synchronous inputs after CLK↑		1		1		1		ns

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		SN54LV163A		SN74LV163A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration, CLK high or low		5		5		5		ns
t_{su}	Setup time before CLK↑	CLR	3.5		3.5		3.5		ns
		Data (A, B, C, and D)	4.5		4.5		4.5		
		ENP, ENT	5		6		6		
		LOAD low	5		6		6		
t_h	Hold time, all synchronous inputs after CLK↑		1		1		1		ns

TEXAS INSTRUMENTS

POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265

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	$T_A = 25°C$			SN54LV163A		SN74LV163A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			C_L = 15 pF	50*	115*		40*		40		MHz
			C_L = 50 pF	30	90		25		25		
t_{pd}	CLK	Q	C_L = 15 pF		8.5*	16.2*	1*	19.5*	1	19.5	ns
		RCO (count mode)			9.1*	17*	1*	20.5*	1	20.5	
		RCO (preset mode)			12.1*	20.6*	1*	24.5*	1	24.5	
	ENT	RCO			8.7*	15.7*	1*	19*	1	19	
t_{pd}	CLK	Q	C_L = 50 pF		11	19.2	1	22.5	1	22.5	ns
		RCO (count mode)			11.9	20	1	23.5	1	23.5	
		RCO (preset mode)			14.6	23.6	1	27.5	1	27.5	
	ENT	RCO			11.7	18.7	1	22	1	22	

* 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	$T_A = 25°C$			SN54LV163A		SN74LV163A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			C_L = 15 pF	80*	160*		70*		70		MHz
			C_L = 50 pF	55	125		50		50		
t_{pd}	CLK	Q	C_L = 15 pF		6.2*	12.8*	1*	15*	1	15	ns
		RCO (count mode)			6.8*	13.6*	1*	16*	1	16	
		RCO (preset mode)			8.8*	17.2*	1*	20*	1	20	
	ENT	RCO			6.5*	12.3*	1*	14.5*	1	14.5	
t_{pd}	CLK	Q	C_L = 50 pF		8	16.3	1	18.5	1	18.5	ns
		RCO (count mode)			8.8	17.1	1	19.5	1	19.5	
		RCO (preset mode)			10.7	20.7	1	23.5	1	23.5	
	ENT	RCO			8.2	15.8	1	18	1	18	

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

TEXAS INSTRUMENTS

POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265

9

SN54LV163A, SN74LV163A
4-BIT SYNCHRONOUS BINARY COUNTERS

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			SN54LV163A		SN74LV163A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			C_L = 15 pF	135*	210*		115*		115		MHz
			C_L = 50 pF	95	160		85		85		
t_{pd}	CLK	Q	C_L = 15 pF		4.7*	8.1*	1*	9.5*	1	9.5	ns
		RCO (count mode)			5.2*	8.1*	1*	9.5*	1	9.5	
		RCO (preset mode)			6.4*	10.3*	1*	12*	1	12	
	ENT	RCO			4.9*	8.1*	1*	9.5*	1	9.5	
t_{pd}	CLK	Q	C_L = 50 pF		6.1	10.1	1	11.5	1	11.5	ns
		RCO (count mode)			6.6	10.1	1	11.5	1	11.5	
		RCO (preset mode)			7.8	12.3	1	14	1	14	
	ENT	RCO			6.3	10.1	1	11.5	1	11.5	

* 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		SN74LV163A			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.3	0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		−0.2	−0.8	V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		3		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	23.8	pF
			5 V	26	

TEXAS INSTRUMENTS

POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265

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 finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LV163AD	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI	-40 to 85	LV163A	
SN74LV163ADBR	ACTIVE	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV163A	Samples
SN74LV163ADGVR	ACTIVE	TVSOP	DGV	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV163A	Samples
SN74LV163ADR	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV163A	Samples
SN74LV163ANSR	ACTIVE	SO	NS	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	74LV163A	Samples
SN74LV163APW	OBSOLETE	TSSOP	PW	16		TBD	Call TI	Call TI	-40 to 85	LV163A	
SN74LV163APWR	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	LV163A	Samples
SN74LV163APWRG4	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV163A	Samples
SN74LV163ARGYR	ACTIVE	VQFN	RGY	16	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV163A	Samples

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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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

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

*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
SN74LV163ADBR	SSOP	DB	16	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN74LV163ADGVR	TVSOP	DGV	16	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
SN74LV163ADR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74LV163ANSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74LV163APWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV163APWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV163APWRG4	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV163APWRG4	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV163ARGYR	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)
SN74LV163ADBR	SSOP	DB	16	2000	356.0	356.0	35.0
SN74LV163ADGVR	TVSOP	DGV	16	2000	356.0	356.0	35.0
SN74LV163ADR	SOIC	D	16	2500	353.0	353.0	32.0
SN74LV163ANSR	SO	NS	16	2000	356.0	356.0	35.0
SN74LV163APWR	TSSOP	PW	16	2000	356.0	356.0	35.0
SN74LV163APWR	TSSOP	PW	16	2000	356.0	356.0	35.0
SN74LV163APWRG4	TSSOP	PW	16	2000	356.0	356.0	35.0
SN74LV163APWRG4	TSSOP	PW	16	2000	356.0	356.0	35.0
SN74LV163ARGYR	VQFN	RGY	16	3000	360.0	360.0	36.0

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.

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A

6.6
6.2 TYP

PIN 1 INDEX AREA

14X 0.65

16

2X

4.55

1

5.1
4.9
NOTE 3

8

9

16X 0.30
0.19

⊕ 0.1 Ⓜ C A B

B

4.5
4.3
NOTE 4

SEATING
PLANE

C

◯ 0.1 C

1.2 MAX

SEE DETAIL A

(0.15) TYP

0.25
GAGE PLANE

0.15
0.05

0.75
0.50

0° -8°

DETAIL A
TYPICAL

4220204/A   02/2017

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

16X (1.5)

SYMM

1

16X (0.45)

(R0.05) TYP

16

SYMM

14X (0.65)

8

9

(5.8)

LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

SOLDER MASK
OPENING

METAL

EXPOSED METAL

0.05 MAX
ALL AROUND

NON-SOLDER MASK
DEFINED
(PREFERRED)

METAL UNDER
SOLDER MASK

SOLDER MASK
OPENING

EXPOSED METAL

0.05 MIN
ALL AROUND

SOLDER MASK
DEFINED

SOLDER MASK DETAILS

4220204/A   02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
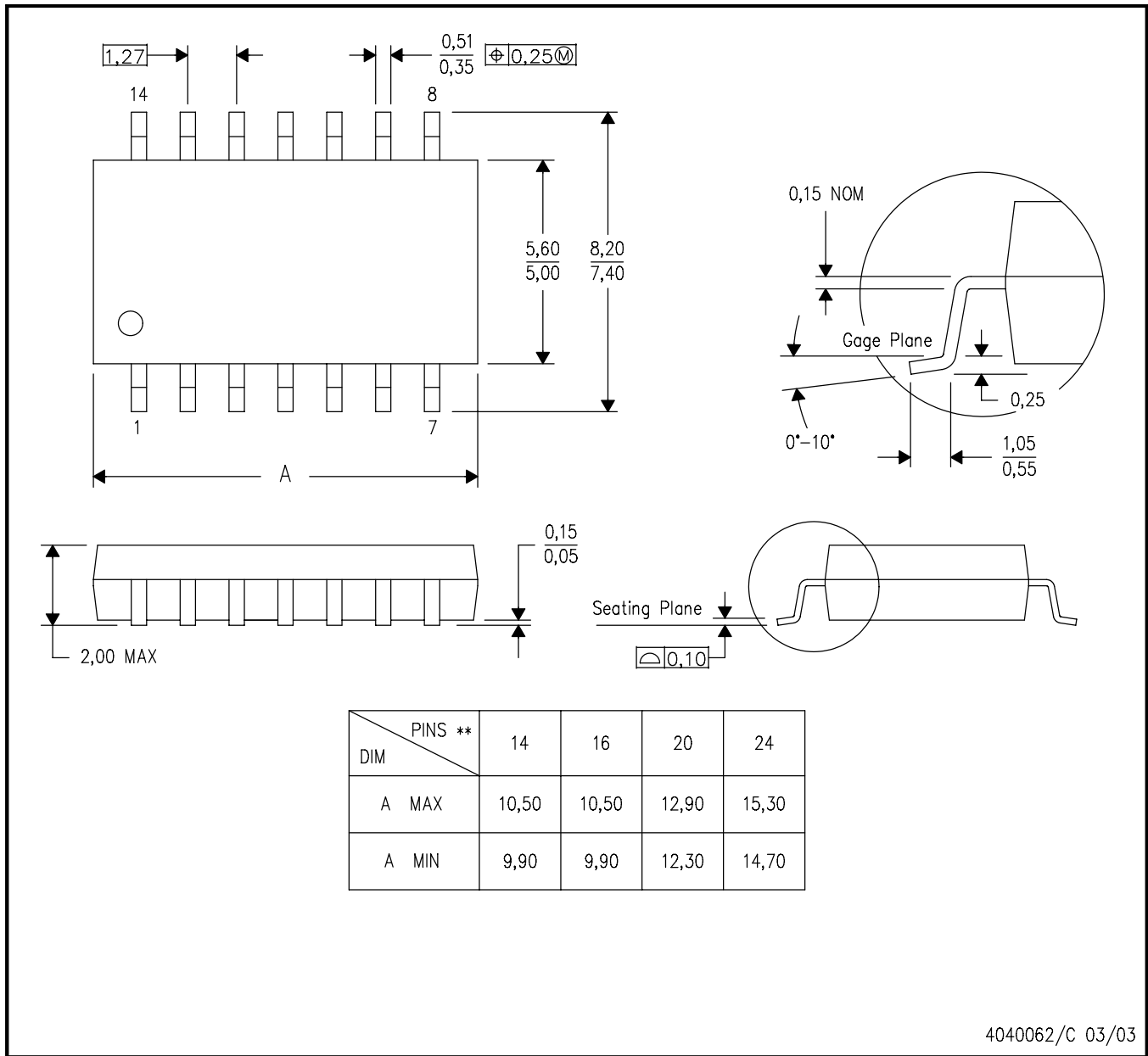SCALE: 10X

4220204/A   02/2017

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

8.2 TYP
7.4

A

PIN 1 INDEX AREA

14X 0.65

16

1

2X

4.55

6.5
5.9
NOTE 3

8

9

16X 0.38
0.22

B

5.6
5.0
NOTE 4

⊕ 0.1Ⓜ C A B

C

⌒ 0.1 C

SEATING
PLANE

0.25
0.09

SEE DETAIL A

0.25

GAGE PLANE

2 MAX

0°-8°

0.95
0.55

0.05 MIN

DETAIL A
TYPICAL

4220763/A   05/2022

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-150.

16X (1.85)

16X (0.45)

14X (0.65)

SYMM

1

8

16

9

SYMM

(R0.05) TYP

(7)

LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

SOLDER MASK
OPENING

METAL

EXPOSED METAL

0.05 MAX
ALL AROUND

NON-SOLDER MASK
DEFINED
(PREFERRED)

METAL UNDER
SOLDER MASK

SOLDER MASK
OPENING

EXPOSED METAL

0.05 MIN
ALL AROUND

SOLDER MASK
DEFINED

SOLDER MASK DETAILS

4220763/A   05/2022

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

16X (1.85)

SYMM

1

16X (0.45)

(R0.05) TYP

16

SYMM

14X (0.65)

8

9

(7)

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220763/A   05/2022

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

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MECHANICAL DATA

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.

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

24 PINS SHOWN

PINS ** DIM	14	16	20	24	38	48	56
A MAX	3,70	3,70	5,10	5,10	7,90	9,80	11,40
A MIN	3,50	3,50	4,90	4,90	7,70	9,60	11,20

4073251/E 08/00

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

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POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265

C

SEATING PLANE

△ 0.1 C

8.2
7.4 TYP

A

PIN 1 ID
AREA

1

14X 1.27

16

10.4
10.0
NOTE 3

2X
8.89

2.00 MAX

8

9

B

5.4
5.2
NOTE 4

16X 0.51
0.35

⊕ 0.25Ⓜ C A B

SEE DETAIL A

0.15 TYP

0.25

GAGE PLANE

0.3
0.1

0° - 10°

1.05
0.55

(1.25)

DETAIL A
TYPICAL

4220735/A   12/2021

NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.

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16X (1.85)

SYMM

SEE DETAILS

1

16

16X (0.6)

SYMM

14X (1.27)

8

9

(R0.05) TYP

(7)

LAND PATTERN EXAMPLE
SCALE:7X

METAL

SOLDER MASK OPENING

SOLDER MASK OPENING

METAL

0.07 MAX
ALL AROUND

0.07 MIN
ALL AROUND

NON SOLDER MASK
DEFINED

SOLDER MASK
DEFINED

SOLDER MASK DETAILS

4220735/A   12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:7X

16X (1.85)

1

16X (0.6)

14X (1.27)

8

(R0.05) TYP

SYMM

SYMM

16

9

(7)

4220735/A   12/2021

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

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

4,15
3,85

A

B

15   10

16   9

3,65
3,35

1   8

2   7

Pin 1 Index Area
Top and Bottom

F

1,00
0,80

0,20 Nominal
Lead Frame

Seating Plane

0,08 C

0,05
0,00
Seating Height

C

2,50

0,50

16X 0,50
0,30

2   7

1   8

THERMAL PAD

1,50

SIZE AND SHAPE
SHOWN ON SEPRATE SHEET

16   9

15   10

16X 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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