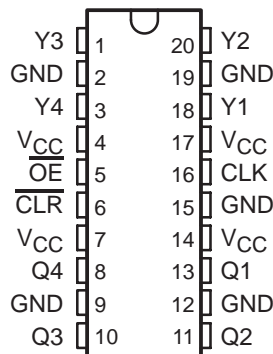


# CDC339 CLOCK DRIVER WITH 3-STATE OUTPUTS

SCAS331 – DECEMBER 1992 – REVISED MARCH 1994

- Low Output Skew, Low Pulse Skew for Clock-Distribution and Clock-Generation Applications
- TTL-Compatible Inputs and Outputs
- Distributes One Clock Input to Eight Outputs
  - Four Same-Frequency Outputs
  - Four Half-Frequency Outputs
- Distributed  $V_{CC}$  and Ground Pins Reduce Switching Noise
- High-Drive Outputs ( $-48\text{-mA } I_{OH}$ ,  $48\text{-mA } I_{OL}$ )
- State-of-the-Art EPIC-II B™ BiCMOS Design Significantly Reduces Power Dissipation
- Package Options Include Plastic Small-Outline (DW) and Shrink Small-Outline (DB) Packages

DB OR DW PACKAGE  
(TOP VIEW)



## description

The CDC339 is a high-performance, low-skew clock driver. It is specifically designed for applications requiring synchronized output signals at both the primary clock frequency and one-half the primary clock frequency. The four Y outputs switch in phase and at the same frequency as the clock (CLK) input. The four Q outputs switch at one-half the frequency of CLK.

When the output-enable ( $\overline{OE}$ ) input is low and the clear ( $\overline{CLR}$ ) input is high, the Y outputs follow CLK and the Q outputs toggle on low-to-high transitions of CLK. Taking CLR low asynchronously resets the Q outputs to the low level. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

The CDC339 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

FUNCTION TABLE

INPUTS			OUTPUTS	
$\overline{OE}$	$\overline{CLR}$	CLK	Y1–Y4	Q1–Q4
H	X	X	Z	Z
L	L	L	L	L
L	L	H	H	L
L	H	L	L	$Q_0^{\dagger}$
L	H	$\uparrow$	H	$\overline{Q}_0^{\dagger}$

$\dagger$  The level of the Q outputs before the indicated steady-state input conditions were established.



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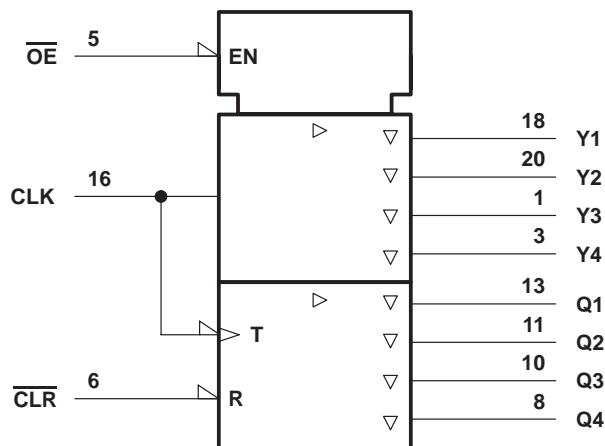
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# CDC339 CLOCK DRIVER WITH 3-STATE OUTPUTS

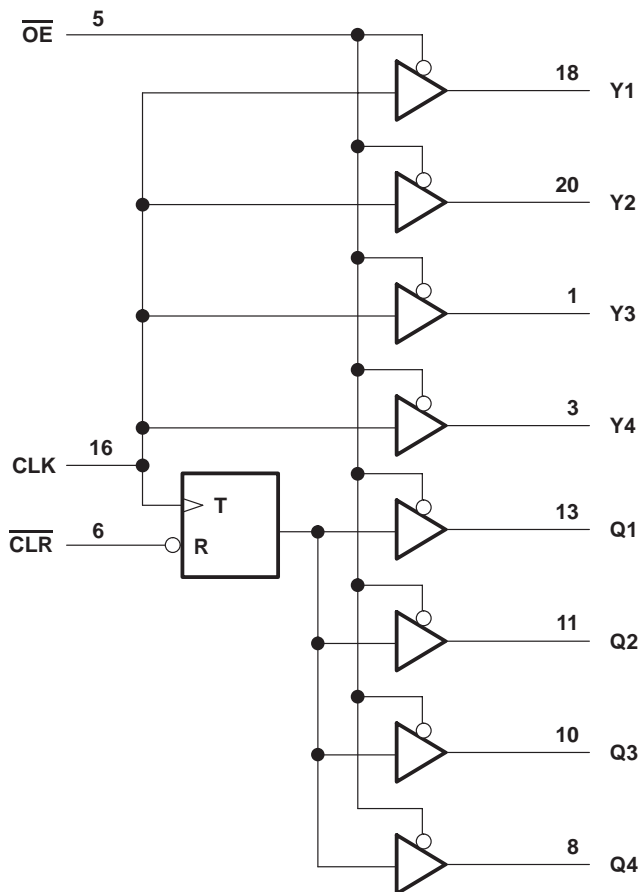
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## logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

## logic diagram (positive logic)



## 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 disabled or power-off state, $V_O$	–0.5 V to 5.5 V
Current into any output in the low state, $I_O$	96 mA
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	–18 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ )	–50 mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2): DB package	0.6 W
DW package	1.6 W
Storage temperature range, $T_{stg}$	–65°C to 150°C

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

NOTES: 1. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.  
2. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

# CDC339 CLOCK DRIVER WITH 3-STATE OUTPUTS

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## recommended operating conditions (see Note 3)

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage	4.75	5.25	V
$V_{IH}$	High-level input voltage	2		V
$V_{IL}$	Low-level input voltage		0.8	V
$V_I$	Input voltage	0	$V_{CC}$	V
$I_{OH}$	High-level output current		-48	mA
$I_{OL}$	Low-level output current		48	mA
$f_{clock}$	Input clock frequency		80	MHz
$T_A$	Operating free-air temperature	-40	85	°C

NOTE 3: Unused pins (input or I/O) must be held high or low.

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

PARAMETER	TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V <sub>IK</sub>	V <sub>CC</sub> = 4.75 V,	I <sub>I</sub> = −18 mA			−1.2	V
V <sub>OH</sub>	V <sub>CC</sub> = 4.75 V,	I <sub>OH</sub> = − 48 mA	2			V
V <sub>OL</sub>	V <sub>CC</sub> = 4.75 V,	I <sub>OL</sub> = 48 mA			0.5	V
I <sub>IH</sub>	V <sub>CC</sub> = 5.25 V,	V <sub>I</sub> = 2.7 V			50	μA
I <sub>IL</sub>	V <sub>CC</sub> = 5.25 V,	V <sub>I</sub> = 0.5 V			−50	μA
I <sub>OZ</sub>	V <sub>CC</sub> = 5.25 V,	V <sub>O</sub> = 2.7 V or 0.5 V			±50	μA
I <sub>O‡</sub>	V <sub>CC</sub> = 5.25 V,	V <sub>O</sub> = 2.5 V	−50		−180	mA
I <sub>CC</sub>	V <sub>CC</sub> = 5.25 V, V <sub>I</sub> = V <sub>CC</sub> or GND	I <sub>O</sub> = 0,	Outputs high		70	mA
			Outputs low		85	
			Outputs disabled		70	
C <sub>i</sub>	V <sub>I</sub> = 2.5 V or 0.5 V			3		pF
C <sub>o</sub>	V <sub>O</sub> = 2.5 V or 0.5 V			8		pF

† All typical values are at  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$ .

‡ Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

## timing requirements over recommended ranges of supply voltage and operating free-air temperature

			MIN	MAX	UNIT
f <sub>clock</sub>	Clock frequency		80		MHz
t <sub>w</sub>	Pulse duration	CL $\overline{\text{R}}$ low	4		ns
		CLK low	4		
		CLK high	4		
t <sub>su</sub>	Setup time	CL $\overline{\text{R}}$ inactive before CLK↑	2		ns
Clock duty cycle			40%	60%	



# CDC339

## CLOCK DRIVER

### WITH 3-STATE OUTPUTS

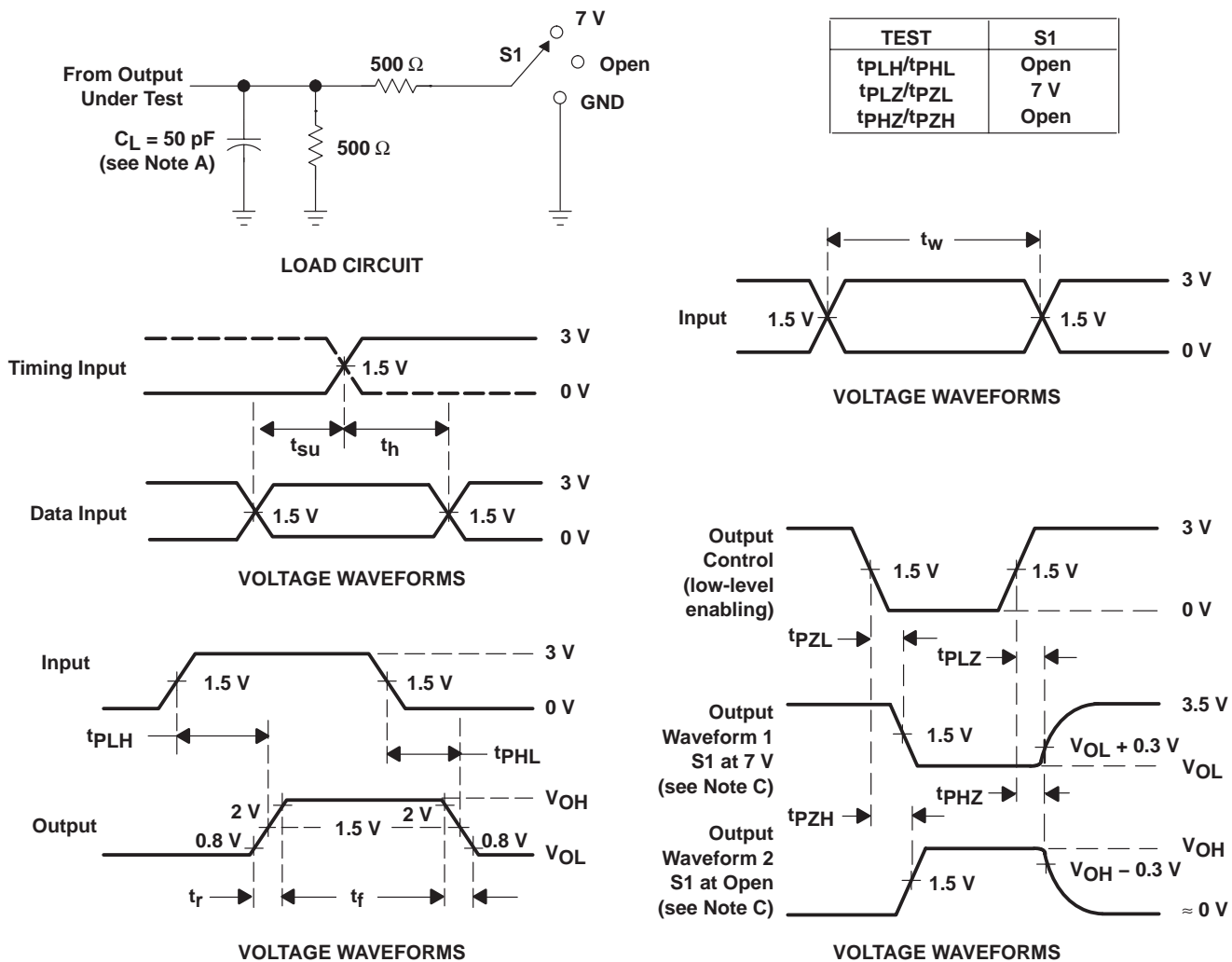
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switching characteristics over recommended ranges of supply voltage and operating free-air temperature (see Figures 1 and 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	MIN	TYP†	MAX	UNIT
$f_{\max}$			80			MHz
$t_{PLH}$	CLK	Any Y or Q	3		9	ns
$t_{PHL}$			3		9	
$t_{PHL}$	$\overline{CLR}$	Any Q	4		9	ns
$t_{PZH}$	$\overline{OE}$	Any Y or Q	2		7	ns
$t_{PZL}$			3		7	
$t_{PHZ}$	$\overline{OE}$	Any Y or Q	2		7	ns
$t_{PLZ}$			2		7	
$t_{sk(o)}$	CLK↑	Y↑			0.75	ns
		Q↑			0.9	
		Y↑ and Q↑			0.9	
$t_r$				0.9		ns
$t_f$				0.7		ns

† All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

## PARAMETER MEASUREMENT INFORMATION



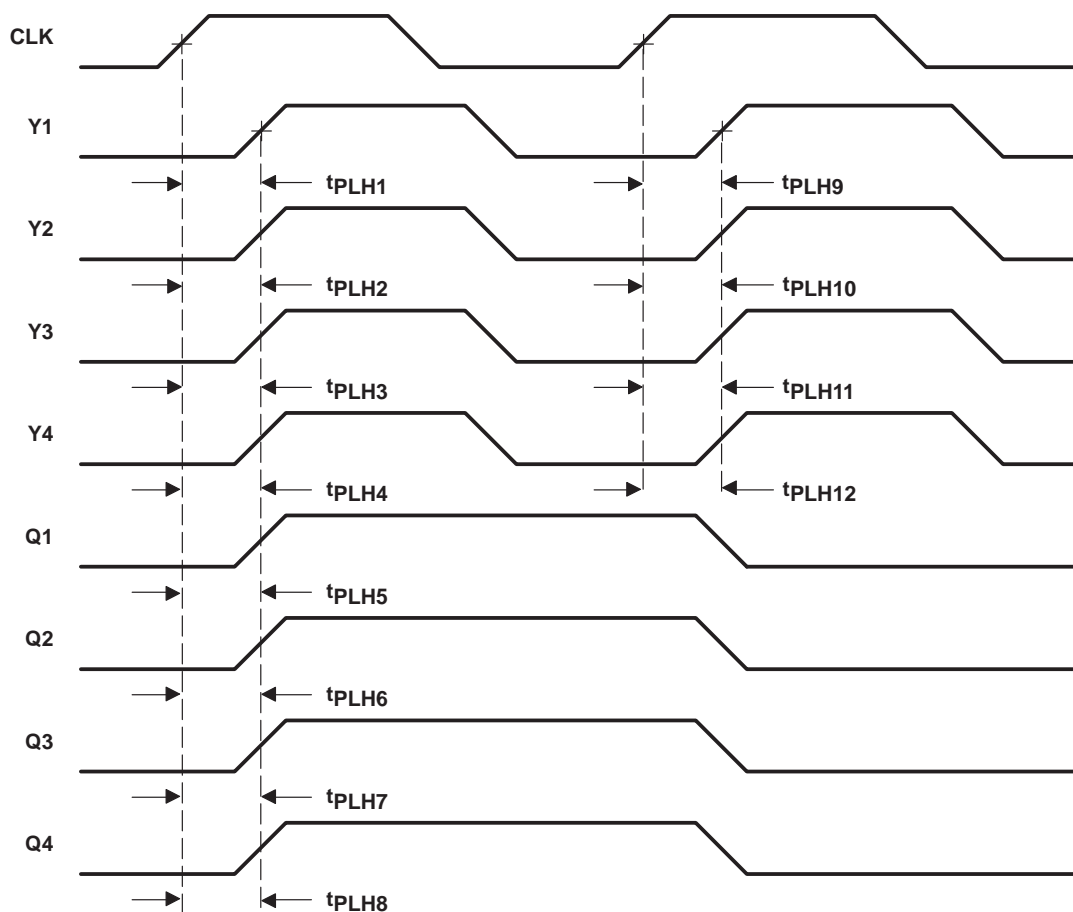
- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .
  - C. Waveform 1 is for an output with internal 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.
  - D. The outputs are measured one at a time with one transition per measurement.

**Figure 1. Load Circuit and Voltage Waveforms**

# CDC339 CLOCK DRIVER WITH 3-STATE OUTPUTS

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## PARAMETER MEASUREMENT INFORMATION



- NOTES: A. Output skew,  $t_{sk(o)}$ , from  $CLK\uparrow$  to  $Y\uparrow$ , is calculated as the greater of the difference between the fastest and slowest of  $t_{PLHn}$  ( $n = 1, 2, 3, 4$ ) or  $t_{PLHn}$  ( $n = 9, 10, 11, 12$ ).
- B. Output skew,  $t_{sk(o)}$ , from  $CLK\uparrow$  to  $Q\uparrow$ , is calculated as the greater of the difference between the fastest and slowest of  $t_{PLHn}$  ( $n = 5, 6, 7, 8$ ).
- C. Output skew,  $t_{sk(o)}$ , from  $CLK\uparrow$  to  $Y\uparrow$  and  $Q\uparrow$ , is calculated as the greater of the difference between the fastest and slowest of  $t_{PLHn}$  ( $n = 1, 2, \dots, 8$ ).

Figure 2. Skew Waveforms and Calculations

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
CDC339DB	ACTIVE	SSOP	DB	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DBG4	ACTIVE	SSOP	DB	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DBG4	ACTIVE	SSOP	DB	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DBLE	OBSOLETE	SSOP	DB	20		TBD	Call TI	Call TI
CDC339DBLE	OBSOLETE	SSOP	DB	20		TBD	Call TI	Call TI
CDC339DBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DBRG4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DBRG4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CDC339DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> 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.

<sup>(2)</sup> 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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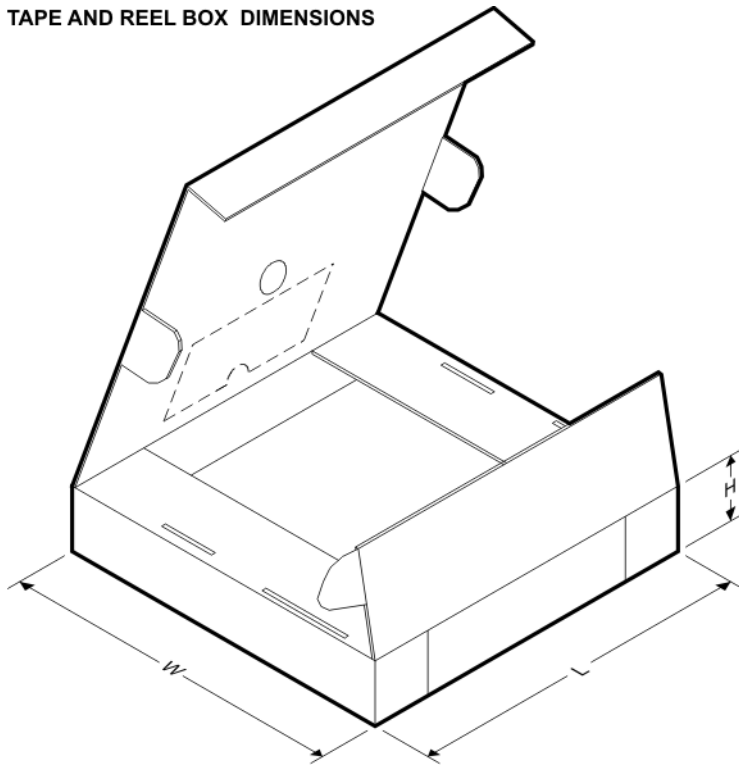
**TAPE AND REEL INFORMATION**



\*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
CDC339DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
CDC339DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CDC339DBR	SSOP	DB	20	2000	346.0	346.0	33.0
CDC339DWR	SOIC	DW	20	2000	346.0	346.0	41.0

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

## PLASTIC SMALL-OUTLINE

28 PINS SHOWN



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

## DW (R-PDSO-G20)

## PLASTIC SMALL-OUTLINE PACKAGE



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- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MS-013 variation AC.

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