

## 100353 Low Power 8-Bit Register

### General Description

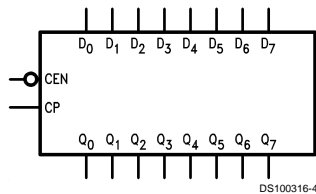
The 100353 contains eight D-type edge triggered, master/slave flip-flops with individual inputs ( $D_n$ ), true outputs ( $Q_n$ ), a clock input (CP), and a common clock enable pin ( $\overline{CEN}$ ). Data enters the master when CP is LOW and transfers to the slave when CP goes HIGH. When the  $\overline{CEN}$  input goes HIGH it overrides all other inputs, disables the clock, and the Q outputs maintain the last state.

The 100353 output drivers are designed to drive 50 $\Omega$  termination to -2.0V. All inputs have 50 k $\Omega$  pull-down resistors.

### Features

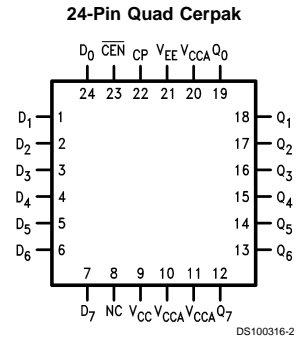
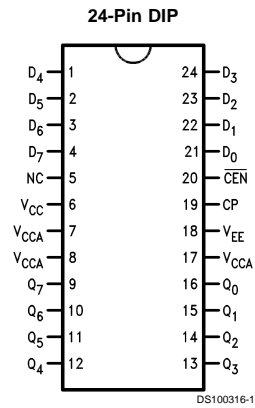
- Low power operation
- 2000V ESD protection
- Voltage compensated operating range = -4.2V to -5.7V
- Available to MIL-STD-883

### Logic Symbol

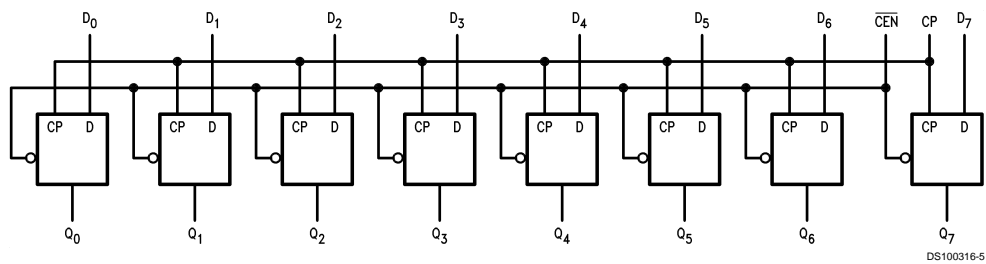


Pin Names	Description
$D_0$ - $D_7$	Data Inputs
$\overline{CEN}$	Clock Enable Input
CP	Clock Input (Active Rising Edge)
$Q_0$ - $Q_7$	Data Outputs
NC	No Connect

## Connection Diagrams



## Logic Diagram



## Truth Table

Inputs			Outputs
$D_n$	$\overline{CEN}$	CP	$Q_n$
L	L	↗	L
H	L	↗	H
X	X	L	NC
X	X	H	NC
X	H	X	NC

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Don't Care  
 NC = No Change  
 ↗ = LOW to HIGH Transition

## Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Above which the useful life may be impaired

Storage Temperature (T <sub>STG</sub> )	-65°C to +150°C
Maximum Junction Temperature (T <sub>J</sub> )	
Ceramic	+175°C
V <sub>EE</sub> Pin Potential to Ground Pin	-7.0V to +0.5V
Input Voltage (DC)	V <sub>EE</sub> to + 0.5V
Output Current (DC Output HIGH)	-50 mA

ESD (Note 2)

≥2000V

## Recommended Operating Conditions

Case Temperature (T<sub>C</sub>)

Military -55°C to +125°C

Supply Voltage (V<sub>EE</sub>)

-5.7V to -4.2V

**Note 1:** Absolute maximum ratings are those values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

**Note 2:** ESD testing conforms to MIL-STD-883, Method 3015.

## Military Version

### DC Electrical Characteristics

V<sub>EE</sub> = -4.2V to -5.7V, V<sub>CC</sub> = V<sub>CCA</sub> = GND, T<sub>C</sub> = -55°C to +125°C

Symbol	Parameter	Min	Max	Units	T <sub>C</sub>	Conditions	Notes
V <sub>OH</sub>	Output HIGH Voltage	-1025	-870	mV	0°C to +125°C	V <sub>IN</sub> = V <sub>IH</sub> (Max) Loading with 50Ω to -2.0V	(Notes 3, 4, 5)
		-1085	-870	mV	-55°C		
V <sub>OL</sub>	Output LOW Voltage	-1830	-1620	mV	0°C to +125°C	V <sub>IN</sub> = V <sub>IH</sub> (Max) Loading with 50Ω to -2.0V	(Notes 3, 4, 5)
		-1830	-1555	mV	-55°C		
V <sub>OHC</sub>	Output HIGH Voltage	-1035		mV	0°C to +125°C	V <sub>IN</sub> = V <sub>IH</sub> (Min) Loading with 50Ω to -2.0V	(Notes 3, 4, 5)
		-1085		mV	-55°C		
V <sub>OLC</sub>	Output LOW Voltage		-1610	mV	0°C to +125°C	V <sub>IN</sub> = V <sub>IH</sub> (Max) Loading with 50Ω to -2.0V	(Notes 3, 4, 5)
			-1555	mV	-55°C		
V <sub>IH</sub>	Input HIGH Voltage	-1165	-870	mV	-55°C to +125°C	Guaranteed HIGH Signal for all Inputs	(Notes 3, 4, 5, 6)
V <sub>IL</sub>	Input LOW Voltage	-1830	-1475	mV	-55°C to +125°C	Guaranteed LOW Signal for all Inputs	(Notes 3, 4, 5, 6)
I <sub>IL</sub>	Input LOW Current	0.50		μA	-55°C to +125°C	V <sub>EE</sub> = -4.2V V <sub>IN</sub> = V <sub>IL</sub> (Min)	(Notes 3, 4, 5)
I <sub>IH</sub>	Input HIGH Current		240	μA	0°C to +125°C	V <sub>EE</sub> = -5.7V V <sub>IN</sub> = V <sub>IH</sub> (Max)	(Notes 3, 4, 5)
			340	μA	-55°C		
I <sub>EE</sub>	Power Supply Current	-132	-42	mA	-55°C to +125°C	Inputs Open V <sub>EE</sub> = -4.2V to -5.7V	(Notes 3, 4, 5)

**Note 3:** F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals -55°C), then testing immediately without allowing for the junction temperature to stabilize due to heat dissipation after power-up. This provides "cold start" specs which can be considered a worst case condition at cold temperatures.

**Note 4:** Screen tested 100% on each device at -55°C, +25°C, and +125°C, Subgroups 1, 2, 3, 7, and 8.

**Note 5:** Sample tested (Method 5005, Table I) on each manufactured lot at -55°C, +25°C, and +125°C, Subgroups A1, 2, 3, 7, and 8.

**Note 6:** Guaranteed by applying specified input condition and testing V<sub>OH</sub>/V<sub>OL</sub>.

### AC Electrical Characteristics

V<sub>EE</sub> = -4.2V to -5.7V, V<sub>CC</sub> = V<sub>CCA</sub> = GND

Symbol	Parameter	T <sub>C</sub> = -55°C		T <sub>C</sub> = +25°C		T <sub>C</sub> = +125°C		Units	Conditions	Notes
		Min	Max	Min	Max	Min	Max			
f <sub>max</sub>	Toggle Frequency	400		400		400		MHz	Figures 1, 2	(Note 10)

## AC Electrical Characteristics (Continued)

$V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$

Symbol	Parameter	$T_C = -55^\circ C$		$T_C = +25^\circ C$		$T_C = +125^\circ C$		Units	Conditions	Notes
		Min	Max	Min	Max	Min	Max			
$t_{PLH}$	Propagation Delay	0.70	3.30	0.80	3.10	0.80	3.50	ns	Figures 1, 2	(Notes 7, 8, 9, 11)
$t_{PHL}$	CP to Output									
$t_{TLH}$	Transition Time	0.40	2.20	0.40	2.20	0.40	2.20	ns		(Note 10)
$t_{THL}$	20% to 80%, 80% to 20%									
$t_s$	Setup Time									
	$D_n$	0.30		0.30		0.30			Figures 1, 3	(Note 10)
	$\overline{CEN}$ (Disable Time)	0.60		0.60		0.60		ns		
	$\overline{CEN}$ (Release Time)	1.40		1.40		1.40				
$t_h$	Hold Time	$D_n$	1.50	1.50	1.50	1.50		ns	Figures 1, 4	(Note 10)
$t_{pw(H)}$	Pulse Width HIGH	CP	2.00	2.00	2.00	2.00		ns	Figures 1, 2	(Note 10)

**Note 7:** F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals  $-55^\circ C$ ), then testing immediately after power-up. This provides "cold start" specs which can be considered a worst case condition at cold temperatures.

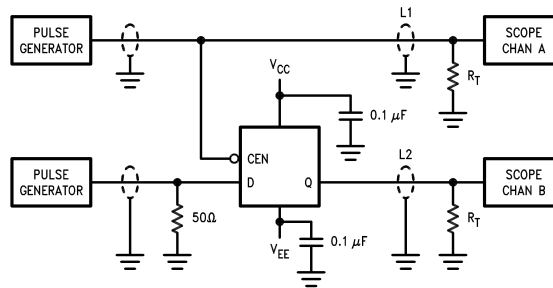
**Note 8:** Screen tested 100% on each device at  $+25^\circ C$  temperature only, Subgroup A9.

**Note 9:** Sample tested (Method 5005, Table I) on each manufactured lot at  $+25^\circ C$ , Subgroup A9, and at  $+125^\circ C$  and  $-55^\circ C$ , temperatures, Subgroups A10 and A11.

**Note 10:** Not tested at  $+25^\circ C$ ,  $+125^\circ C$ , and  $-55^\circ C$  temperature (design characterization data).

**Note 11:** The propagation delay specified is for single output switching. Delays may vary up to 300 ps with multiple outputs switching.

## Test Circuitry



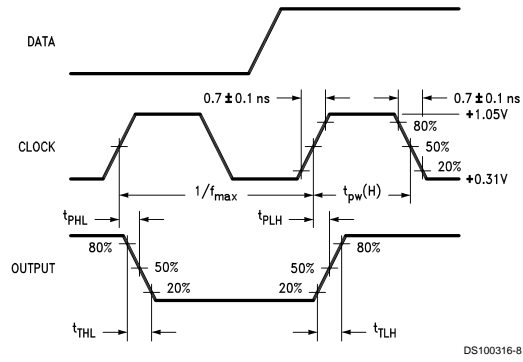
### Notes:

$V_{CC}$ ,  $V_{CCA} = +2V$ ,  $V_{EE} = -2.5V$

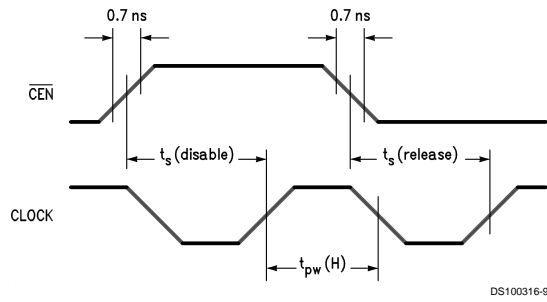
L1 and L2 = equal length 50Ω impedance lines  $R_T = 50\Omega$  terminator internal to scope Decoupling 0.1  $\mu F$  from GND to  $V_{CC}$  and  $V_{EE}$  All unused outputs are loaded with 50Ω to GND  $C_L$  = Fixture and stray capacitance  $\leq 3$  pF

FIGURE 1. AC, Toggle Frequency Test Circuit

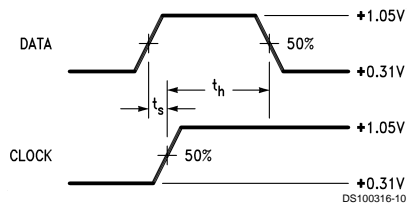
## Switching Waveforms



**FIGURE 2. Propagation Delay (Clock) and Transition Times**



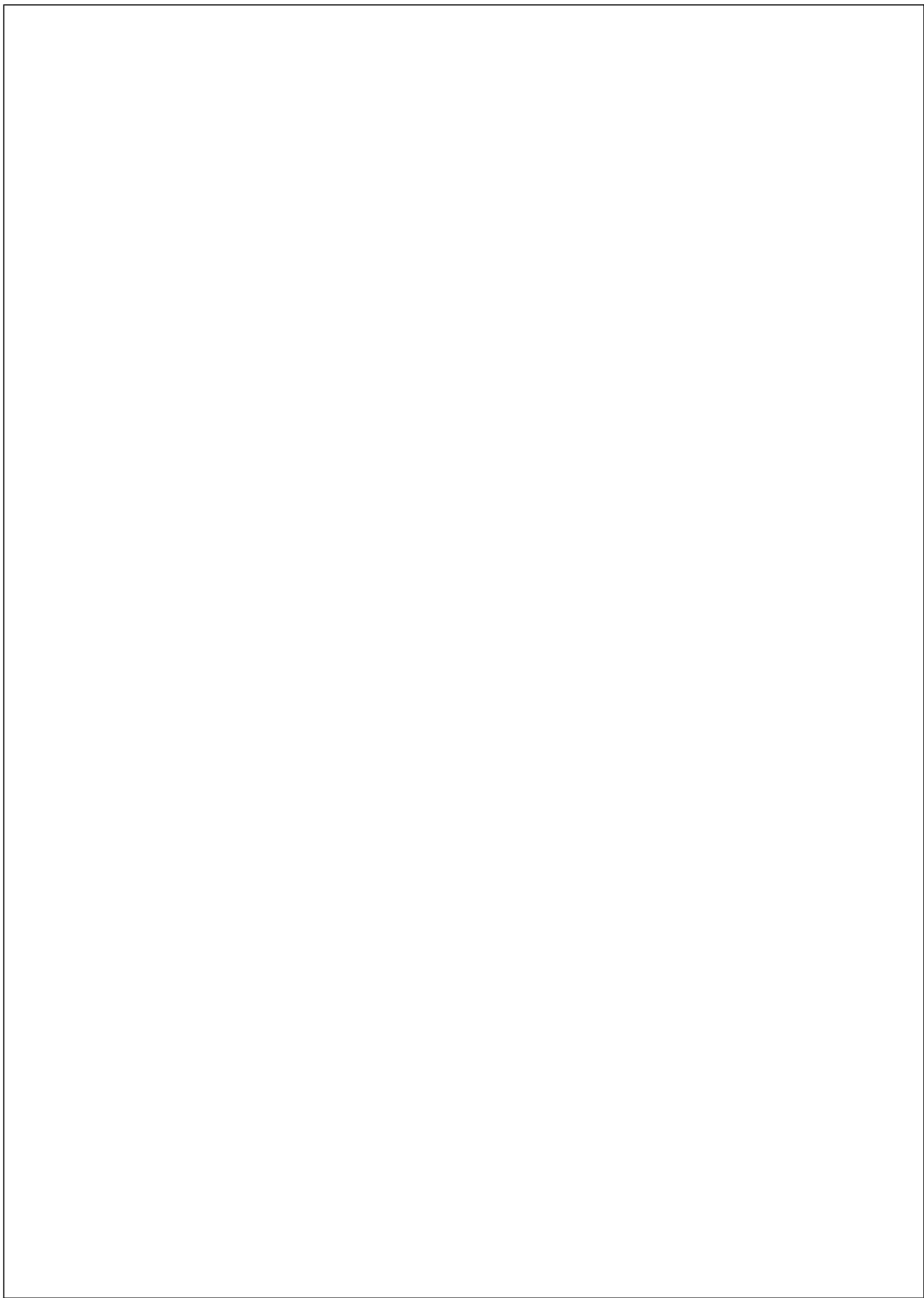
**FIGURE 3. Setup and Pulse Width Times**



**Note 12:**  $t_s$  is the minimum time before the transition of the clock that information must be present at the data input.

**Note 13:**  $t_h$  is the minimum time after the transition of the clock that information must remain unchanged at the data input.

**FIGURE 4. Data Setup and Hold Time**





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