

August 1998

100353 Low Power 8-Bit Register

General Description

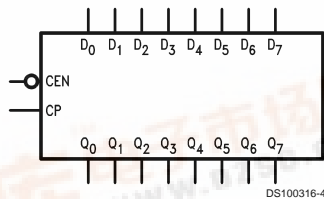
The 100353 contains eight D-type edge triggered, master/slave flip-flops with individual inputs (D_n), true outputs (Q_n), a clock input (CP), and a common clock enable pin (\overline{CEN}). Data enters the master when CP is LOW and transfers to the slave when CP goes HIGH. When the \overline{CEN} input 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 50Ω termination to -2.0V. All inputs have 50 kΩ 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

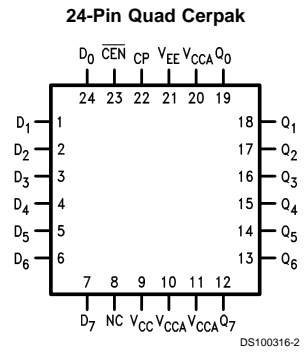
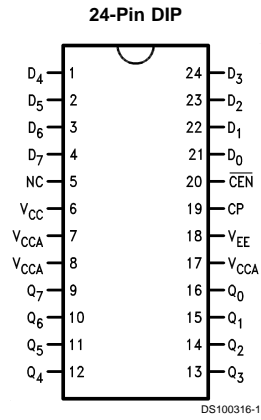


| Pin Names | Description |
|------------------|----------------------------------|
| D_0 - D_7 | Data Inputs |
| \overline{CEN} | Clock Enable Input |
| CP | Clock Input (Active Rising Edge) |
| Q_0 - Q_7 | Data Outputs |
| NC | No Connect |

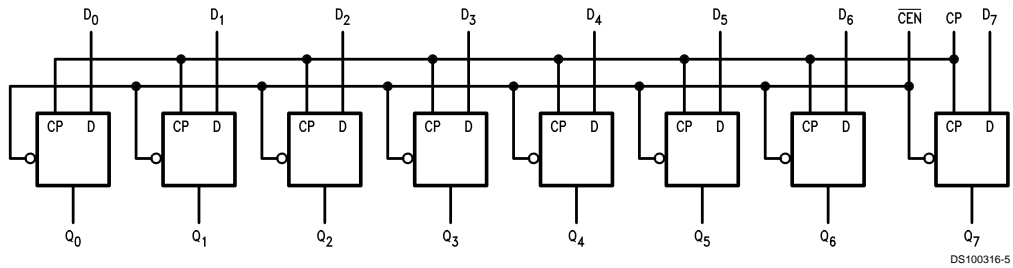
100353 Low Power 8-Bit Register



Connection Diagrams



Logic Diagram



Truth Table

| Inputs | | | Outputs |
|----------------|-------------------------|----|----------------|
| D _n | $\overline{\text{CEN}}$ | 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 _{STG}) | -65°C to +150°C |
| Maximum Junction Temperature (T _J) | |
| Ceramic | +175°C |
| V _{EE} Pin Potential to Ground Pin | -7.0V to +0.5V |
| Input Voltage (DC) | V _{EE} to + 0.5V |
| Output Current (DC Output HIGH) | -50 mA |

ESD (Note 2)

≥2000V

Recommended Operating Conditions

| | |
|------------------------------------|-----------------|
| Case Temperature (T _C) | |
| Military | -55°C to +125°C |
| Supply Voltage (V _{EE}) | -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_{EE} = -4.2V to -5.7V, V_{CC} = V_{CCA} = GND, T_C = -55°C to +125°C

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

AC Electrical Characteristics

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

| Symbol | Parameter | T _C = -55°C | | T _C = +25°C | | T _C = +125°C | | Units | Conditions | Notes |
|------------------|------------------|------------------------|-----|------------------------|-----|-------------------------|-----|-------|--------------|-----------|
| | | Min | Max | Min | Max | Min | Max | | | |
| f _{max} | 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 | | |
| t_{THL} | 20% to 80%, 80% to 20% | | | | | | | | | (Note 10) |
| t_s | Setup Time | | | | | | | | Figures 1, 3 | (Note 10) |
| | D_n | 0.30 | | 0.30 | | 0.30 | | ns | | |
| | \overline{CEN} (Disable Time) | 0.60 | | 0.60 | | 0.60 | | ns | | |
| | \overline{CEN} (Release Time) | 1.40 | | 1.40 | | 1.40 | | ns | | |
| t_h | Hold Time D_n | 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 | | 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.

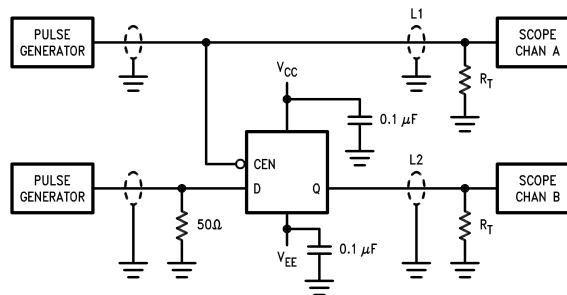
Note 8: Screen tested 100% on each device at $+25^\circ C$ temperature only, Subgroup A9.

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



DS100316-6

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 μF from GND to V_{CC} and V_{EE} All unused outputs are loaded with 50Ω to GND $C_L =$ Fixture and stray capacitance ≤ 3 pF

FIGURE 1. AC, Toggle Frequency Test Circuit

Switching Waveforms

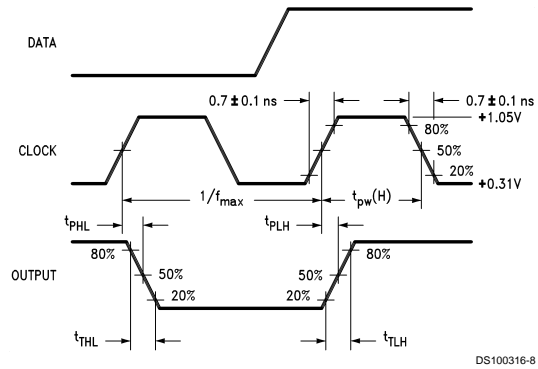


FIGURE 2. Propagation Delay (Clock) and Transition Times

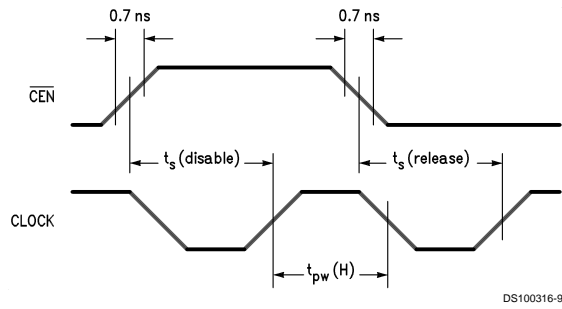
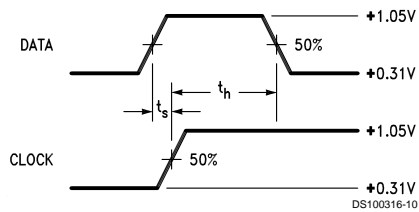


FIGURE 3. Setup and Pulse Width Times

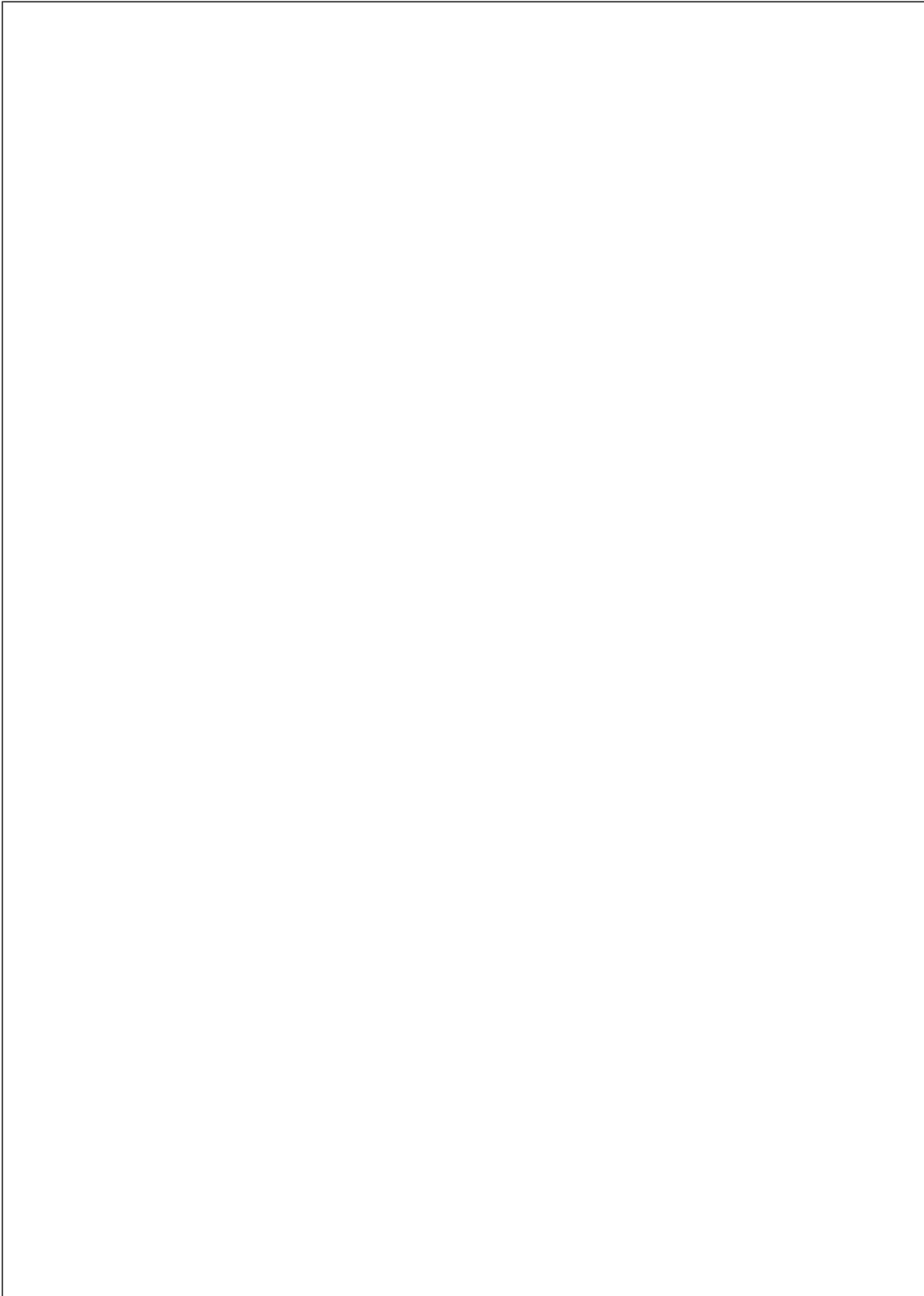


Note 12: t_s is the minimum time before the transition of the clock that information must be present at the data input.

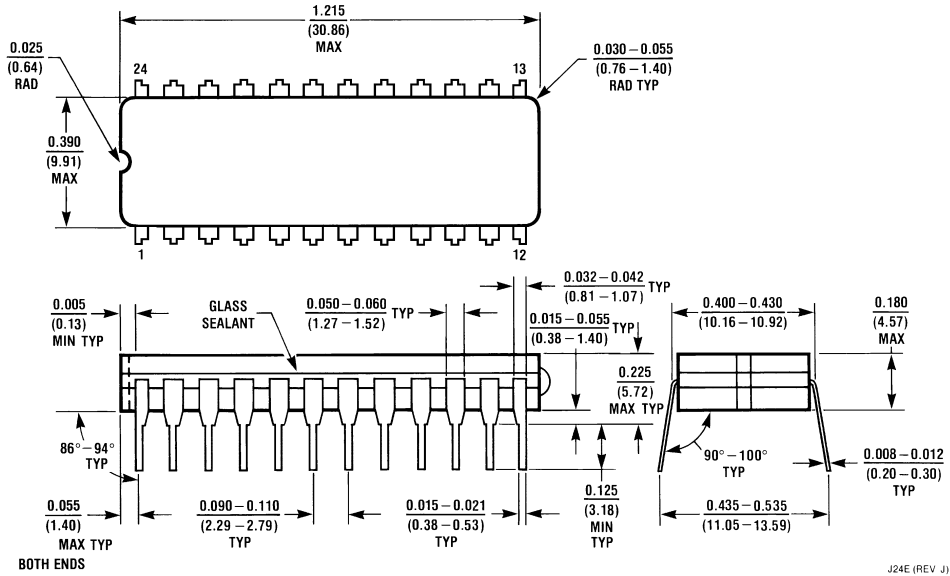
Note 13: t_h is the minimum time after the transition of the clock that information must remain unchanged at the data input.

FIGURE 4. Data Setup and Hold Time

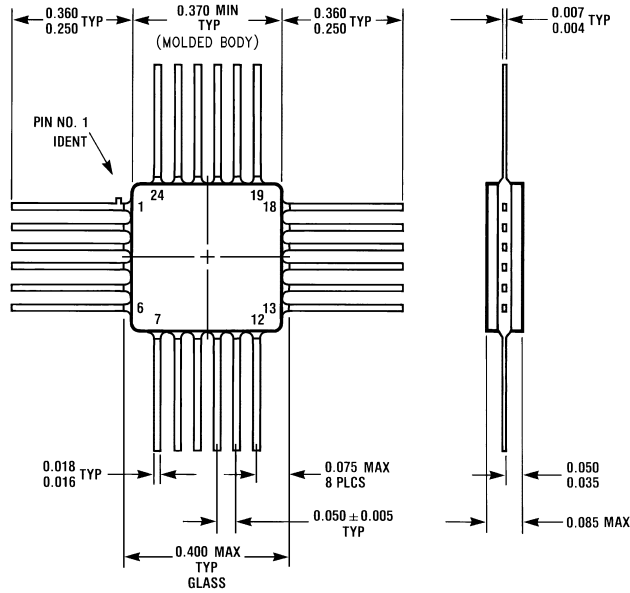
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Physical Dimensions inches (millimeters) unless otherwise noted



24-Lead Ceramic Dual-In-Line Package (0.400" Wide) (D)
NS Package Number J24E



24 Lead Quad Cerpak (F)
NS Package Number W24B

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