

100311

Low Skew 1:9 Differential Clock Driver

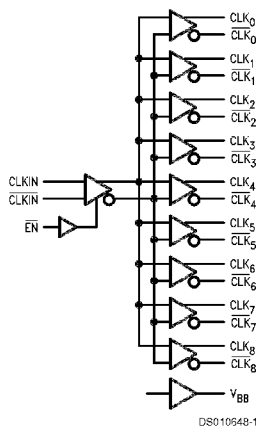
General Description

The 100311 contains nine low skew differential drivers, designed for generation of multiple, minimum skew differential clocks from a single differential input (CLKIN, $\overline{\text{CLKIN}}$). If a single-ended input is desired, the V_{BB} output pin may be used to drive the remaining input line. A HIGH on the enable pin ($\overline{\text{EN}}$) will force a LOW on all of the CLK_n outputs and a HIGH on all of the $\overline{\text{CLK}}_n$ output pins. The 100311 is ideal for distributing a signal throughout a system without worrying about the original signal becoming too corrupted by undesirable delays and skew. The 100311 is pin-for-pin compatible with the Motorola 100E111.

Features

- Low output to output skew
- 2000V ESD protection
- 1:9 low skew clock driver
- Differential inputs and outputs

Ordering Code: Logic Symbol

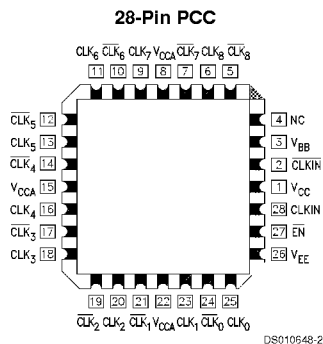


| Pin Names | Description |
|--|----------------------------|
| CLKIN, $\overline{\text{CLKIN}}$ | Differential Clock Inputs |
| $\overline{\text{EN}}$ | Enable |
| CLK ₀₋₈ , $\overline{\text{CLK}}_{0-8}$ | Differential Clock Outputs |
| V_{BB} | V_{BB} Output |
| NC | No Connect |

Truth Table

| CLKIN | $\overline{\text{CLKIN}}$ | $\overline{\text{EN}}$ | CLK _n | $\overline{\text{CLK}}_n$ |
|-------|---------------------------|------------------------|------------------|---------------------------|
| L | H | L | L | H |
| H | L | L | H | L |
| X | X | H | L | H |

Connection Diagram



Absolute Maximum Ratings (Note 1)

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 |
| Plastic | +150°C |
| Pin Potential to Ground Pin (V_{EE}) | -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) | |
| Commercial | 0°C to +85°C |
| Industrial | -40°C to +85°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.

Commercial Version DC Electrical Characteristics

$V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$, $T_C = 0^\circ C$ to $+85^\circ C$ (Note 3)

| Symbol | Parameter | Min | Typ | Max | Units | Conditions | |
|------------|---|----------------|-------|----------------|---------|--|--|
| V_{OH} | Output HIGH Voltage | -1025 | -955 | -870 | mV | $V_{IN} = V_{IH}$ (Max) or V_{IL} (Min) | Loading with 50Ω to -2.0V |
| V_{OL} | Output LOW Voltage | -1830 | -1705 | -1620 | mV | | $V_{IN} = V_{IH}$ or V_{IL} (Max) |
| V_{OHC} | Output HIGH Voltage | -1035 | | | mV | $V_{IN} = V_{IH}$ or V_{IL} (Max) | |
| V_{OLC} | Output LOW Voltage | | | -1610 | mV | | $I_{VBB} = -300 \mu A$ |
| V_{BB} | Output Reference Voltage | -1380 | -1320 | -1260 | mV | Required for Full Output Swing | |
| V_{DIFF} | Input Voltage Differential | 150 | | | mV | | |
| V_{CM} | Common Mode Voltage | $V_{CC} - 2.0$ | | $V_{CC} - 0.5$ | V | | |
| V_{IH} | Input High Voltage | -1165 | | -870 | mV | Guaranteed HIGH Signal for All Inputs | |
| V_{IL} | Input Low Voltage | -1830 | | -1475 | mV | Guaranteed LOW Signal for All Inputs | |
| I_{IL} | Input LOW Current | 0.50 | | | μA | $V_{IN} = V_{IL}$ (Min) | |
| I_{IH} | Input HIGH Current CLKIN, \overline{CLKIN} EN | | | 100 250 | μA | $V_{IN} = V_{IH}$ (Max) | |
| I_{CBO} | Input Leakage Current | -10 | | | μA | $V_{IN} = V_{EE}$ | |
| I_{EE} | Power Supply Current | -115 | | -57 | mA | Inputs Open | |

Note 3: The specified limits represent the "worst case" value for the parameter. Since these values normally occur at the temperature extremes, additional noise immunity and guardbanding can be achieved by decreasing the allowable system operating ranges. Conditions for testing shown in the tables are chosen to guarantee operation under "worst case" conditions.

AC Electrical Characteristics

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

| Symbol | Parameter | $T_C = 0^\circ C$ | | | $T_C = +25^\circ C$ | | | $T_C = +85^\circ C$ | | | Units | Conditions |
|------------------------|--|-------------------|------|------|---------------------|------|------|---------------------|------|------|-------|--------------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | | |
| f_{max} | Max Toggle Frequency CLKIN to Q_n | 750 | | | 750 | | | 750 | | | MHz | |
| t_{PLH} t_{PHL} | Propagation Delay, CLKIN _n to CLK _n | | | | | | | | | | | Figure 3 |
| | Differential | 0.75 | 0.84 | 0.95 | 0.75 | 0.86 | 0.95 | 0.84 | 0.93 | 1.04 | ns | |
| | Single-Ended | 0.65 | 0.90 | 1.05 | 0.67 | 0.93 | 1.17 | 0.74 | 1.06 | 1.24 | ns | |
| t_{PLH} t_{PHL} | Propagation Delay SEL to Output | 0.75 | 1.03 | 1.20 | 0.80 | 1.05 | 1.25 | 0.85 | 1.12 | 1.35 | ns | Figure 2 |
| t_{PS} | LH-HL Skew | | 10 | 30 | | 10 | 30 | | 10 | 30 | ps | (Notes 4, 7) |
| t_{OSLH} | Gate-Gate Skew LH | | 20 | 50 | | 20 | 50 | | 20 | 50 | ps | (Notes 5, 7) |
| t_{OSHL} | Gate-Gate Skew HL | | 20 | 50 | | 20 | 50 | | 20 | 50 | ps | (Notes 5, 7) |
| t_{OST} | Gate-Gate LH-HL Skew | | 30 | 60 | | 30 | 60 | | 30 | 60 | ps | (Notes 6, 7) |

AC Electrical Characteristics (Continued)

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

| Symbol | Parameter | $T_C = 0^\circ C$ | | | $T_C = +25^\circ C$ | | | $T_C = +85^\circ C$ | | | Units | Conditions |
|------------------------|---|-------------------|-----|-----|---------------------|-----|-----|---------------------|-----|-----|-------|------------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | | |
| t_S | Setup Time EN _n to CLKIN _n | 250 | | | 250 | | | 300 | | | ps | |
| t_H | Hold Time EN _n to CLKIN _n | 0 | | | 0 | | | 0 | | | ps | |
| t_R | Release Time EN _n to CLKIN _n | 300 | | | 300 | | | 300 | | | ps | |
| t_{TLH} t_{THL} | Transition Time 20% to 80%, 80% to 20% | 275 | 500 | 750 | 275 | 480 | 750 | 275 | 460 | 750 | ps | Figure 4 |

Note 4: t_{PS} describes opposite edge skews, i.e. the difference between the delay of a differential output signal pair's low to high and high to low propagation delays. With differential signal pairs, a low to high or high to low transition is defined as the transition of the true output or input pin.

Note 5: t_{OSLH} describes in-phase gate-to-gate differential propagation skews with all differential outputs going low to high; t_{OSHL} describes the same conditions except with the outputs going high to low.

Note 6: t_{OST} describes the maximum worst case difference in any of the t_{PS} , t_{OSLH} or t_{OST} delay paths combined.

Note 7: The skew specifications pertain to differential I/O paths.

Note 8: f_{max} = the highest frequency at which output V_{OL}/V_{OH} levels still meet V_{IN} specifications. The F311 will function @ 1 GHz.

Industrial Version DC Electrical Characteristics

$V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$ (Note 9)

| Symbol | Parameter | $T_C = -40^\circ C$ | | $T_C = 0^\circ C$ to $+85^\circ C$ | | Units | Conditions | |
|------------|----------------------------|---------------------|----------------|------------------------------------|----------------|-------|--|------------------------------|
| | | Min | Max | Min | Max | | | |
| V_{OH} | Output HIGH Voltage | -1085 | -870 | -1025 | -870 | mV | $V_{IN} = V_{IH}$ (Max) | Loading with 50Ω to -2.0V |
| V_{OL} | Output LOW Voltage | -1830 | -1575 | -1830 | -1620 | mV | or V_{IL} (Min) | |
| V_{OHC} | Output HIGH Voltage | -1095 | | -1035 | | mV | $V_{IN} = V_{IH}$ | Loading with 50Ω to -2.0V |
| V_{OLC} | Output LOW Voltage | | -1565 | | -1610 | mV | or V_{IL} (Min) | |
| V_{BB} | Output Reference Voltage | -1395 | -1255 | -1380 | -1260 | mV | $I_{VBB} = -300 \mu A$ | |
| V_{DIFF} | Input Voltage Differential | 150 | | 150 | | mV | Required for Full Output Swing | |
| V_{CM} | Common Mode Voltage | $V_{CC} - 2.0$ | $V_{CC} - 0.5$ | $V_{CC} - 2.0$ | $V_{CC} - 0.5$ | V | | |
| V_{IH} | Input High Voltage | -1170 | -870 | -1165 | -870 | mV | Guaranteed HIGH Signal for All Inputs | |

DC Electrical Characteristics

$V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$ (Note 9)

| Symbol | Parameter | $T_C = -40^\circ C$ | | $T_C = 0^\circ C$ to $+85^\circ C$ | | Units | Conditions | |
|-----------|---|---------------------|----------------|------------------------------------|----------------|---------|---|--|
| | | Min | Max | Min | Max | | | |
| V_{IL} | Input Low Voltage | -1830 | -1480 | -1830 | -1475 | mV | Guaranteed LOW Signal for All Inputs | |
| I_{IL} | Input LOW Current | 0.50 | | 0.50 | | μA | $V_{IN} = V_{IL}$ (Min) | |
| I_{IH} | Input HIGH Current CLKIN, \overline{CLKIN} EN | | 100 250 | | 100 250 | μA | $V_{IN} = V_{IH}$ (Max) | |
| I_{CBO} | Input Leakage Current | -10 | | -10 | | μA | $V_{IN} = V_{EE}$ | |
| I_{EE} | Power Supply Current | -115 | -57 | -115 | -57 | mA | Inputs Open | |
| V_{PP} | Minimum Input Swing | 150 | | 150 | | mV | | |
| V_{CMR} | Common Mode Range | $V_{CC} - 2.0$ | $V_{CC} - 0.5$ | $V_{CC} - 2.0$ | $V_{CC} - 0.5$ | V | | |

Note 9: The specified limits represent the "worst case" value for the parameter. Since these values normally occur at the temperature extremes, additional noise immunity and guardbanding can be achieved by decreasing the allowable system operating ranges. Conditions for testing shown in the tables are chosen to guarantee operation under "worst case" conditions.

AC Electrical Characteristics

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

| Symbol | Parameter | $T_C = -40^\circ C$ | | | $T_C = +25^\circ C$ | | | $T_C = +85^\circ C$ | | | Units | Conditions |
|------------------------|--|---------------------|------|------|---------------------|------|------|---------------------|------|------|-------|----------------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | | |
| f_{max} | Max Toggle Frequency CLKIN to Q_n | 750 | | | 750 | | | 750 | | | MHz | |
| t_{PLH} t_{PHL} | Propagation Delay, CLKIN _n to CLK _n | | | | | | | | | | | |
| | Differential | 0.72 | 0.81 | 0.92 | 0.77 | 0.86 | 0.95 | 0.84 | 0.93 | 1.04 | ns | Figure 3 |
| | Single-Ended | 0.62 | 0.89 | 1.02 | 0.67 | 0.93 | 1.17 | 0.74 | 1.06 | 1.24 | | |
| t_{PLH} t_{PHL} | Propagation Delay SEL to Output | 0.70 | 0.97 | 1.20 | 0.80 | 1.05 | 1.25 | 0.85 | 1.12 | 1.35 | ns | Figure 2 |
| t_{PS} | LH–HL Skew | | 10 | 30 | | 10 | 30 | | 10 | 30 | ps | (Notes 10, 13) |
| t_{OSLH} | Gate–Gate Skew LH | | 20 | 50 | | 20 | 50 | | 20 | 50 | ps | (Notes 11, 13) |
| t_{OSHL} | Gate–Gate Skew HL | | 20 | 50 | | 20 | 50 | | 20 | 50 | ps | (Notes 11, 13) |
| t_{OST} | Gate–Gate LH–HL Skew | | 30 | 60 | | 30 | 60 | | 30 | 60 | ps | (Notes 12, 13) |
| t_S | Setup Time EN _n to CLKIN _n | 250 | | | 250 | | | 300 | | | ps | |
| t_H | Hold Time EN _n to CLKIN _n | 0 | | | 0 | | | 0 | | | ps | |
| t_R | Release Time EN _n to CLKIN _n | 300 | | | 300 | | | 300 | | | ps | |
| t_{TLH} t_{THL} | Transition Time 20% to 80%, 80% to 20% | 275 | 500 | 750 | 275 | 480 | 750 | 275 | 460 | 750 | ps | Figure 4 |

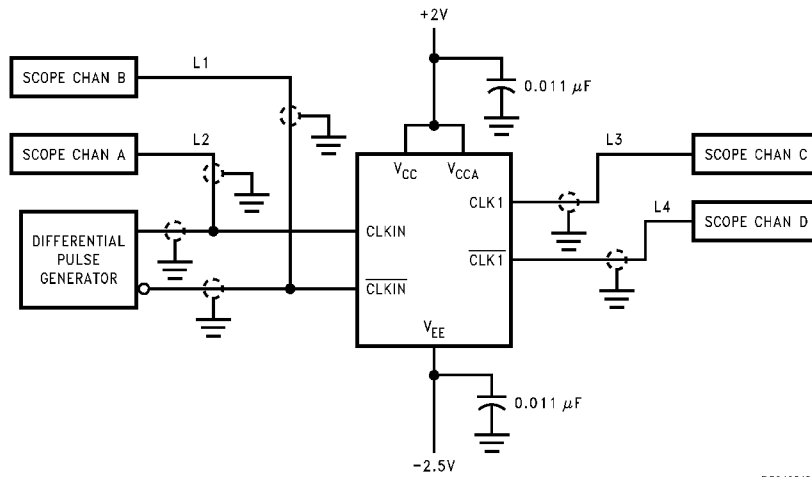
Note 10: t_{PS} describes opposite edge skews, i.e. the difference between the delay of a differential output signal pair's low to high and high to low propagation delays. With differential signal pairs, a low to high or high to low transition is defined as the transition of the true output or input pin.

Note 11: t_{OSLH} describes in-phase gate differential propagation skews with all differential outputs going low to high; t_{OSHL} describes the same conditions except with the outputs going high to low.

Note 12: t_{OST} describes the maximum worst case difference in any of the t_{PS} , t_{OSLH} or t_{OST} delay paths combined.

Note 13: The skew specifications pertain to differential I/O paths.

Test Circuit



DS010548-3

Note 14: Shown for testing CLKIN to CLK1 in the differential mode.

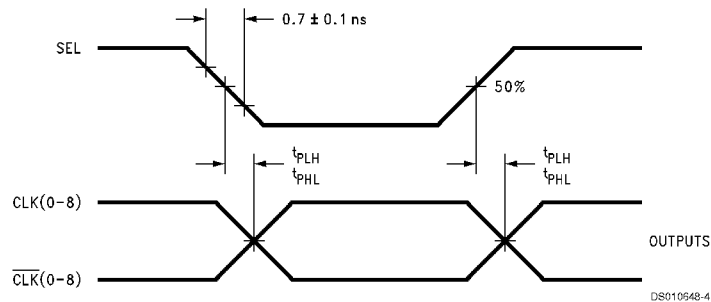
Note 15: L1, L2, L3 and L4 = equal length 50Ω impedance lines.

Note 16: All unused inputs and outputs are loaded with 50Ω in parallel with ≤ 3 pF to GND.

Note 17: Scope should have 50Ω input terminator internally.

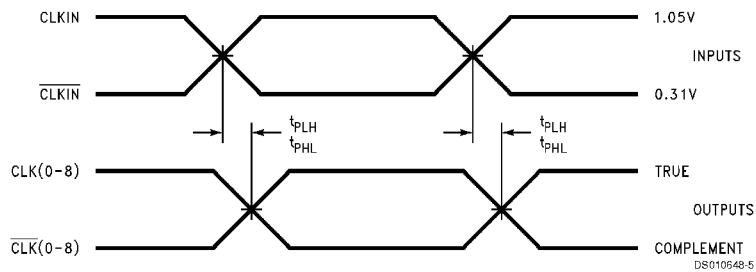
FIGURE 1. AC Test Circuit

Switching Waveforms



DS010548-4

FIGURE 2. Propagation Delay, \overline{EN} to Outputs



DS010548-5

FIGURE 3. Propagation Delay, CLKIN/CLKIN to Outputs

Switching Waveforms (Continued)

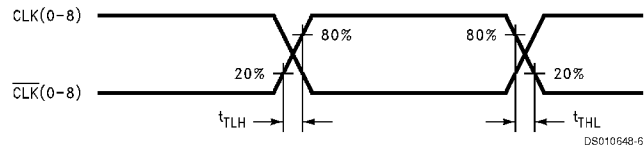
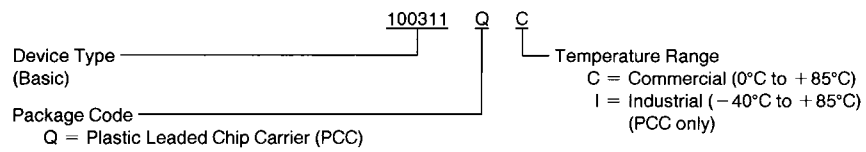


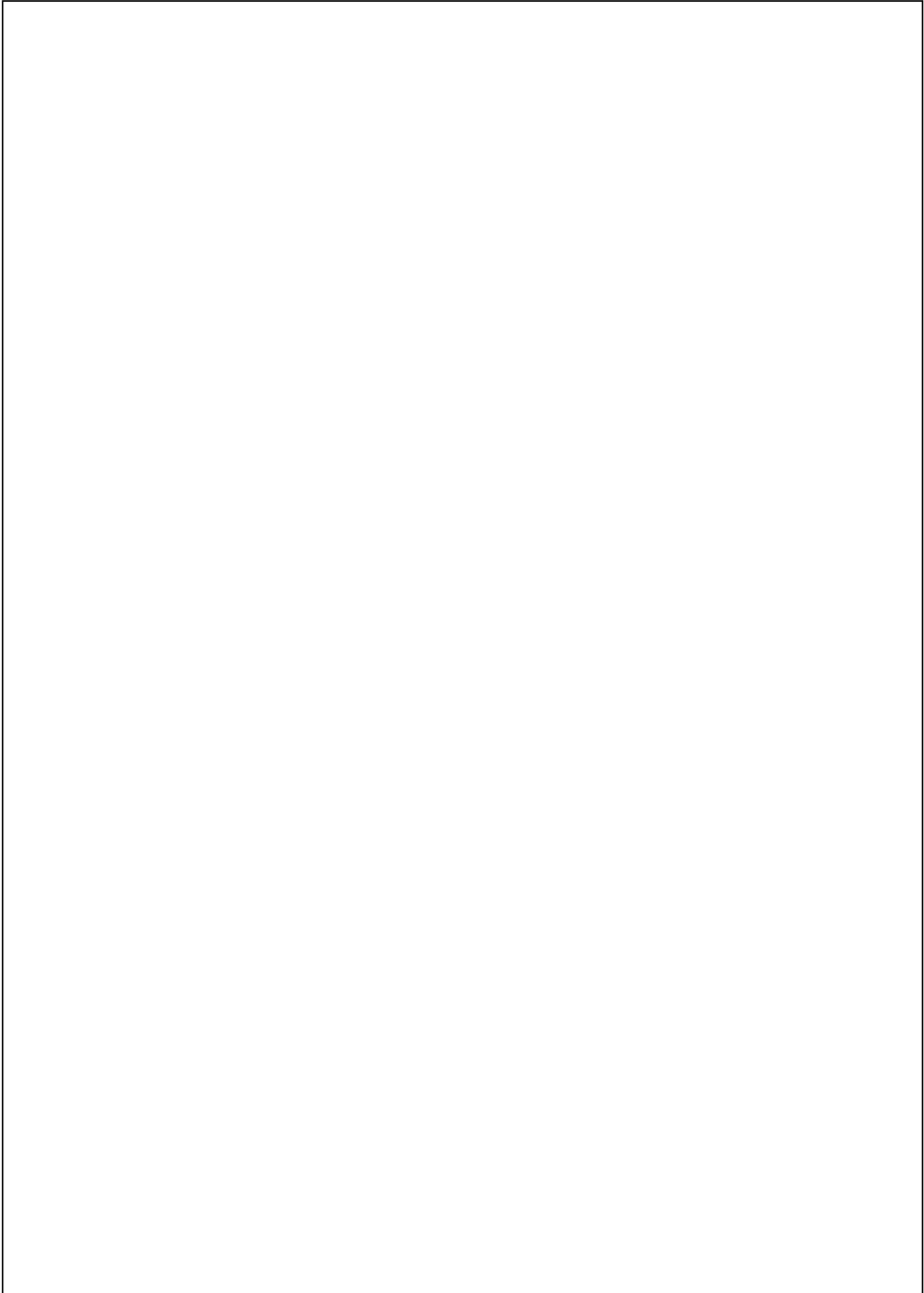
FIGURE 4. Transition Times

Ordering Information

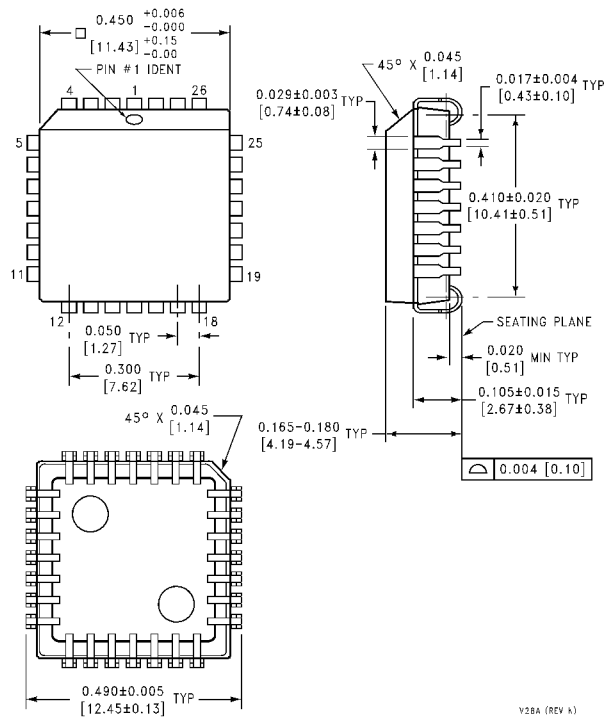
The device number is used to form part of a simplified purchasing code where a package type and temperature range are defined as follows:



DS010648-7



Physical Dimensions inches (millimeters) unless otherwise noted



**28-Lead Plastic Chip Carrier (Q)
 Package Number V28A**

V28A (REV A)

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