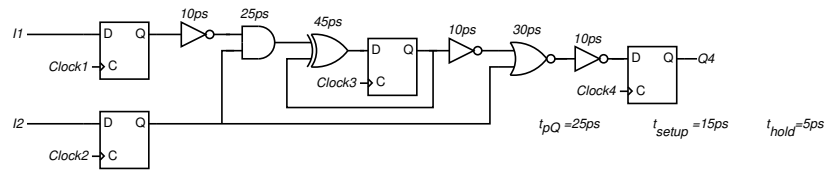


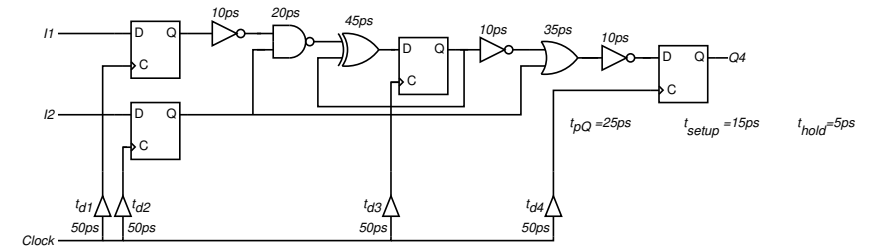
Synchronous Systems - Static Timing Analysis (inc. clock skew)



- Calculate f_{max} in the presence of intentional clock skew.

20101

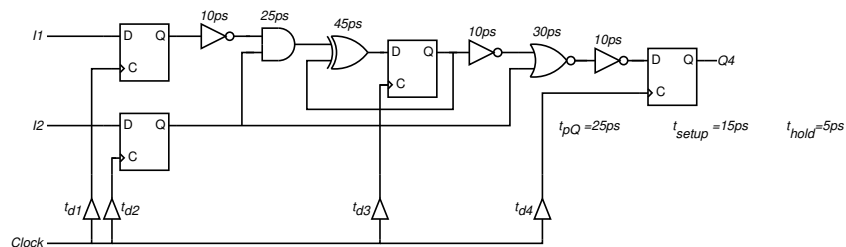
Synchronous Systems - Static Timing Analysis (inc. clock skew)



- Calculate f_{max} in the presence of intentional clock skew.
- Suggest suitable values for t_{d1} , t_{d2} , t_{d3} , t_{d4}
Initially set all to a minimum value (in this case 50ps)

20103

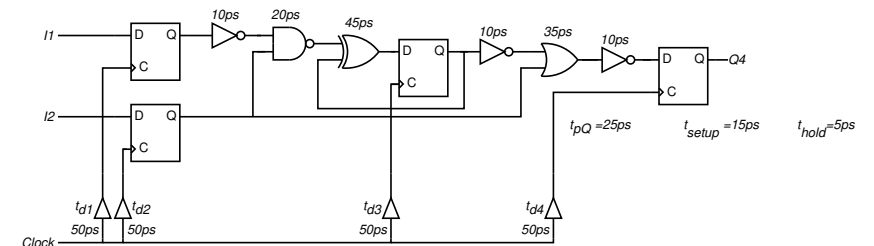
Synchronous Systems - Static Timing Analysis (inc. clock skew)



- Calculate f_{max} in the presence of intentional clock skew.
- Suggest suitable values for t_{d1} , t_{d2} , t_{d3} , t_{d4}

20102

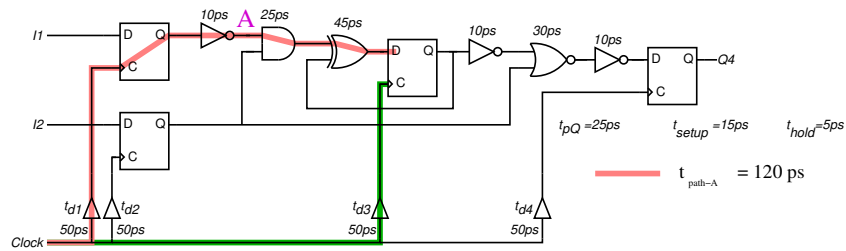
Synchronous Systems - Static Timing Analysis (inc. clock skew)



- Calculate f_{max} in the presence of intentional clock skew.
- Suggest suitable values for t_{d1} , t_{d2} , t_{d3} , t_{d4}
⇒ Identify longest timing paths

20104

Synchronous Systems - Static Timing Analysis (inc. clock skew)

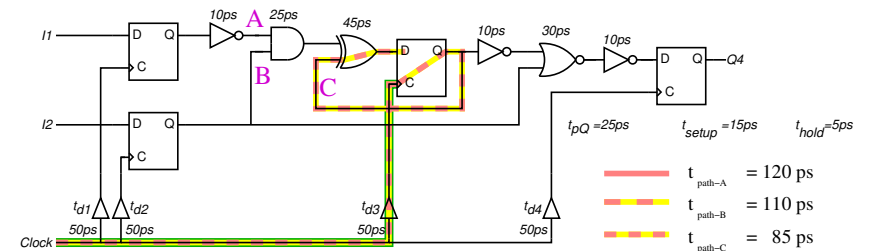


- Calculate f_{max} in the presence of intentional clock skew.
 - Suggest suitable values for t_{d1} , t_{d2} , t_{d3} , t_{d4}
- ⇒ Identify longest timing paths

$$t_{path-A} = t_{pQ} + t_{comb-A} + t_{setup} + (t_{d1} - t_{d3})$$

20105

Synchronous Systems - Static Timing Analysis (inc. clock skew)

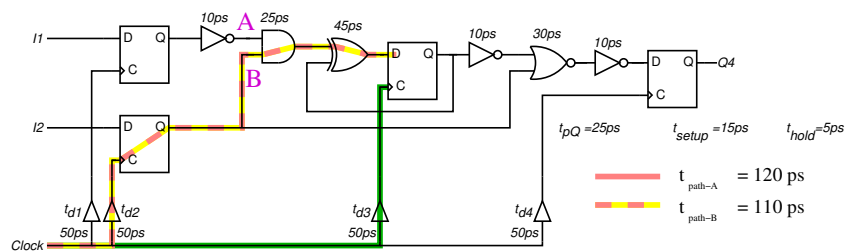


- Calculate f_{max} in the presence of intentional clock skew.
 - Suggest suitable values for t_{d1} , t_{d2} , t_{d3} , t_{d4}
- ⇒ Identify longest timing paths

$$t_{path-C} = t_{pQ} + t_{comb-C} + t_{setup} + (t_{d3} - t_{d3})$$

20105

Synchronous Systems - Static Timing Analysis (inc. clock skew)

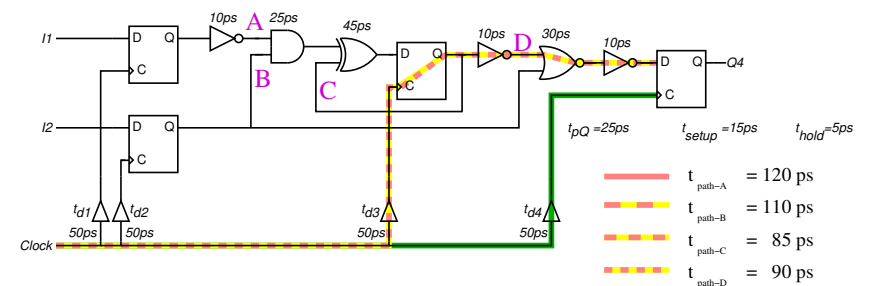


- Calculate f_{max} in the presence of intentional clock skew.
 - Suggest suitable values for t_{d1} , t_{d2} , t_{d3} , t_{d4}
- ⇒ Identify longest timing paths

$$t_{path-B} = t_{pQ} + t_{comb-B} + t_{setup} + (t_{d2} - t_{d3})$$

20105

Synchronous Systems - Static Timing Analysis (inc. clock skew)

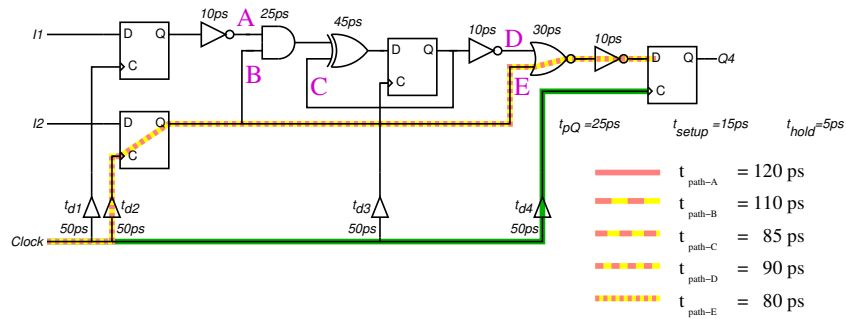


- Calculate f_{max} in the presence of intentional clock skew.
 - Suggest suitable values for t_{d1} , t_{d2} , t_{d3} , t_{d4}
- ⇒ Identify longest timing paths

$$t_{path-D} = t_{pQ} + t_{comb-D} + t_{setup} + (t_{d3} - t_{d4})$$

20105

Synchronous Systems - Static Timing Analysis (inc. clock skew)

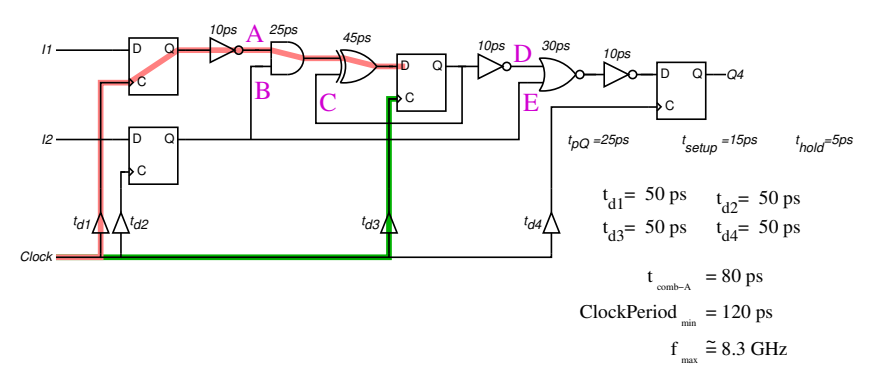


- Calculate f_{max} in the presence of intentional clock skew.
- Suggest suitable values for t_{d1} , t_{d2} , t_{d3} , t_{d4}
- ⇒ Identify longest timing paths

$$t_{path-D} = t_{pQ} + t_{comb-E} + t_{setup} + (t_{d2} - t_{d4})$$

20105

Synchronous Systems - Static Timing Analysis (inc. clock skew)

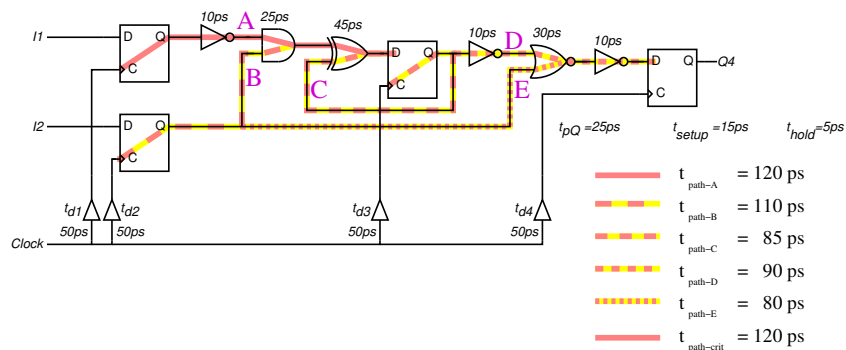


$$ClockPeriod > t_{pQ} + t_{comb-A} + t_{setup} + (t_{d1} - t_{d4})$$

$$f_{max} = \frac{1}{t_{pQ} + t_{comb-A} + t_{setup} + (t_{d1} - t_{d4})}$$

20106

Synchronous Systems - Static Timing Analysis (inc. clock skew)

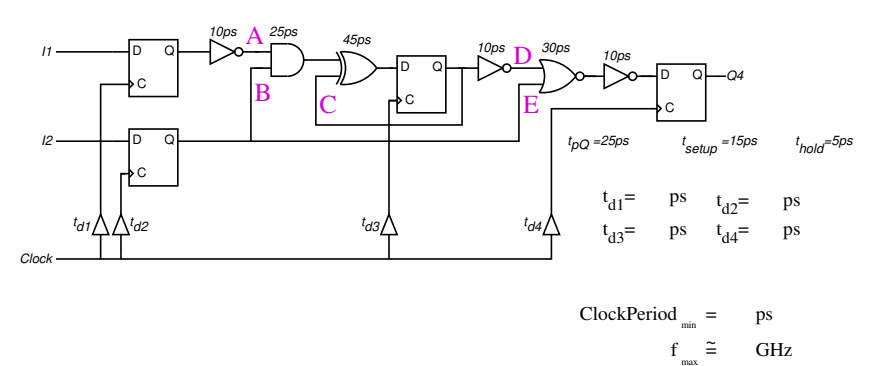


- Calculate f_{max} in the presence of intentional clock skew.
- Suggest suitable values for t_{d1} , t_{d2} , t_{d3} , t_{d4}
- ⇒ Identify longest timing paths

$$t_{path} = t_{pQ} + t_{comb} + t_{setup} + (t_{d_{launch}} - t_{d_{capture}})$$

20105

Synchronous Systems - Static Timing Analysis (inc. clock skew)

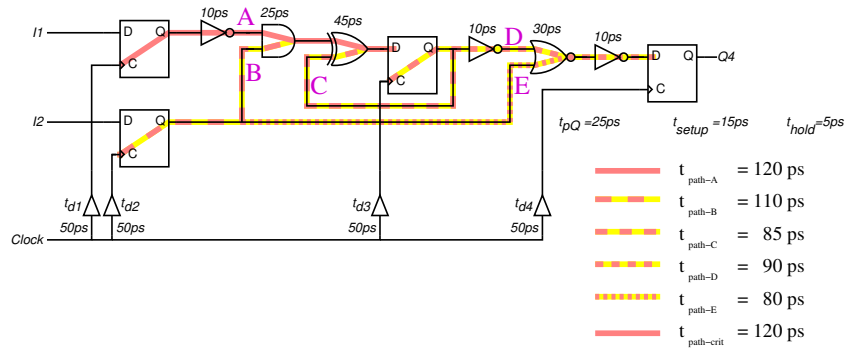


$$ClockPeriod > t_{pQ} + t_{comb-crit} + t_{setup} + (t_{d_{launch}} - t_{d_{capture}})$$

$$f_{max} = \frac{1}{t_{pQ} + t_{comb-crit} + t_{setup} + (t_{d_{launch}} - t_{d_{capture}})}$$

20107

Synchronous Systems - Static Timing Analysis (inc. clock skew)

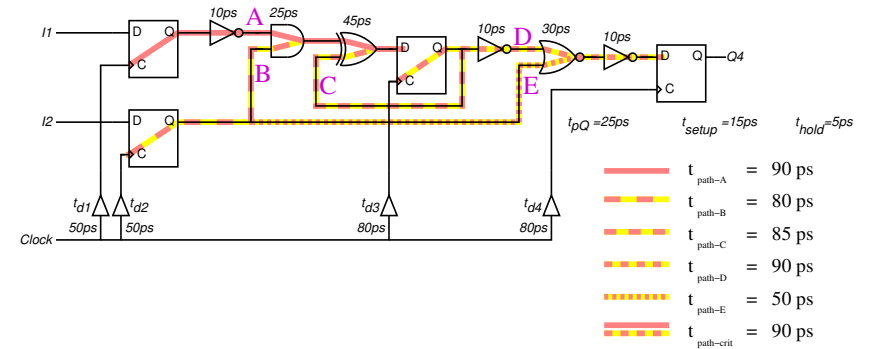


⇒ Initially try increasing t_{d3} by $30ps^1$

¹to ease the timing on paths A and B

20108

Synchronous Systems - Static Timing Analysis (inc. clock skew)

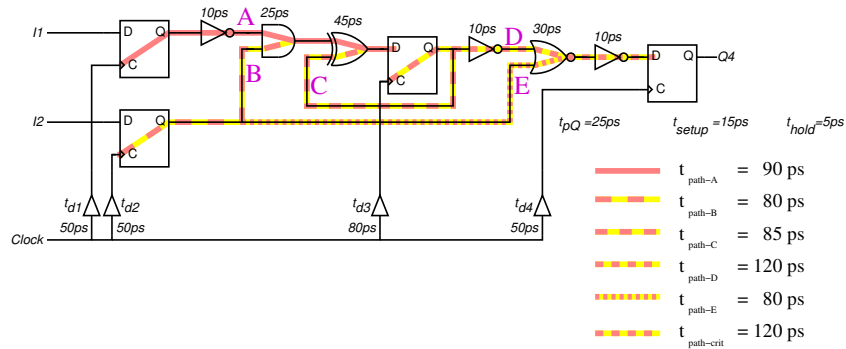


⇒ Increase t_{d3} by 5ps, t_{d4} by $10ps^3$

³to ease the timing on paths A, (B,) D (and E)

20110

Synchronous Systems - Static Timing Analysis (inc. clock skew)

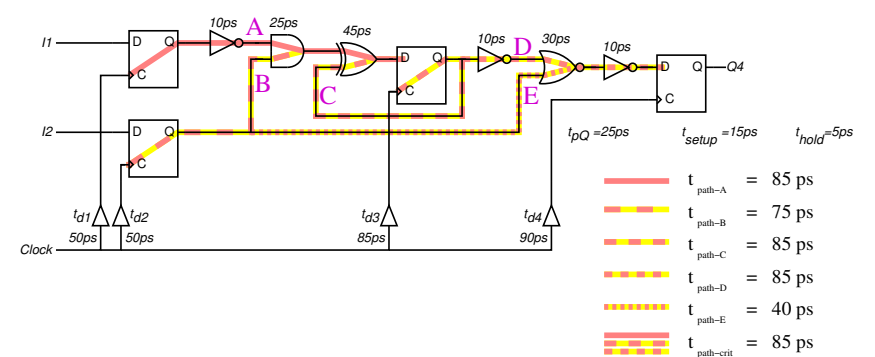


⇒ Increase t_{d4} by $30ps^2$

²to ease the timing on path D (and E)

20109

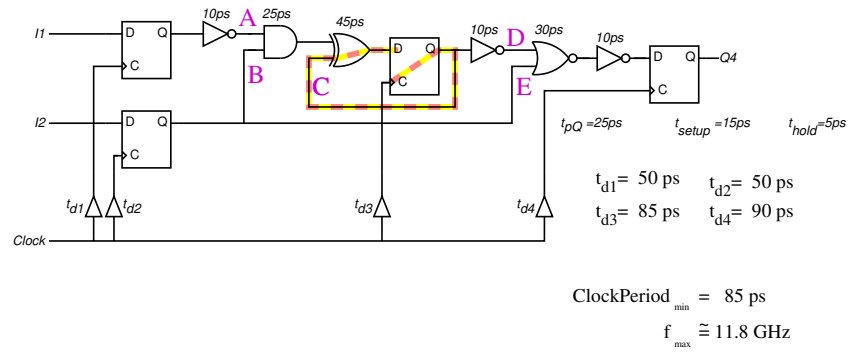
Synchronous Systems - Static Timing Analysis (inc. clock skew)



Can't now improve on t_{path-C}

20111

Synchronous Systems - Static Timing Analysis (inc. clock skew)



$$ClockPeriod > t_{pQ} + t_{comb-crit} + t_{setup} + (t_{d_{launch}} - t_{d_{capture}})$$

$$f_{max} = \frac{1}{t_{pQ} + t_{comb-crit} + t_{setup} + (t_{d_{launch}} - t_{d_{capture}})}$$

20112

Synchronous Systems - Static Timing Analysis (inc. clock skew)

Remember to check for hold violations

$$t_{pq} + t_{comb-A} > t_{hold} + (t_{d3} - t_{d1})$$

$$t_{pq} + t_{comb-B} > t_{hold} + (t_{d3} - t_{d2})$$

$$t_{pq} + t_{comb-C} > t_{hold}$$

$$t_{pq} + t_{comb-D} > t_{hold} + (t_{d4} - t_{d3})$$

$$t_{pq} + t_{comb-E} > t_{hold} + (t_{d4} - t_{d2})$$

In this example, path E is the worst case but even that one still has 20ps of slack before there would be a hold violation:

$$25ps + 40ps > 5ps + (90ps - 50ps)$$

20113