File: Calculating Adaptive Delays.xmcd
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The delays are given by eq (3) and (4) in the UCC28950 datasheet, slusa16d

$$T_{ABSET} = \left(\frac{5R_{AB}}{0.26 + CS \cdot K_A \cdot 1.3} \right) ns$$ And $$T_{CDSET} = \left(\frac{5R_{CD}}{0.26 + CS \cdot K_A \cdot 1.3} \right) ns$$

R_{AB} and R_{CD} are in kOhm, CS is the voltage at the CS pin in Volts

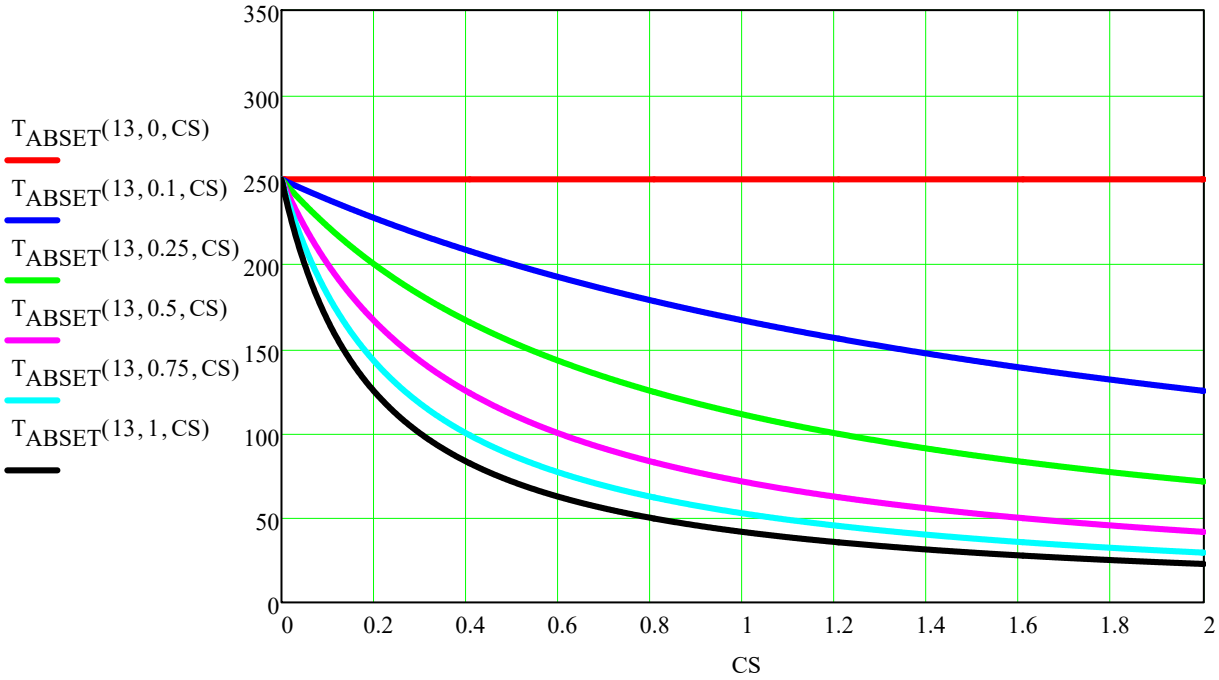
The same formula is used for T_{ABSET} and T_{CDSET}. Normally the optimum delay times are different so R_{AB} may differ from R_{CD}

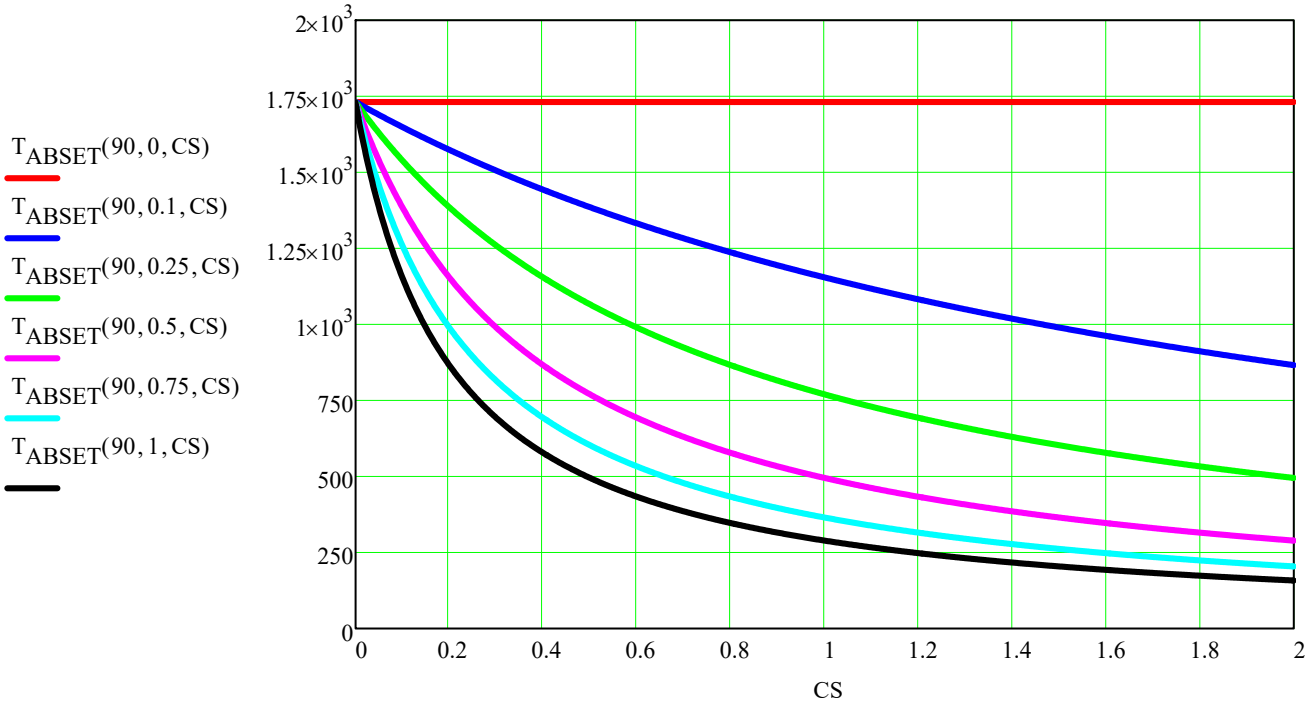
$$K_A = \frac{R_A}{R_A + R_B}$$

K_A is the ratio of the resistor potential divider between the CS pin and the ADEL pin

We can use these equations to reproduce the graphs in Fig 29 and Fig 30 of the datasheet by setting R_{AB} = 13 for Fig 29 and R_{AB} = 90 for Fig 30
KA is varied from 0 to 1 and the result is graphed from CS = 0 to CS = 2

$$T_{ABSET}(R_{AB}, K_A, CS) := \left(\frac{5R_{AB}}{0.26 + CS \cdot K_A \cdot 1.3} \right)$$


$T_{ABSET}(13, 0, CS)$
$T_{ABSET}(13, 0.1, CS)$
$T_{ABSET}(13, 0.25, CS)$
$T_{ABSET}(13, 0.5, CS)$
$T_{ABSET}(13, 0.75, CS)$
$T_{ABSET}(13, 1, CS)$
350
300
250
200
150
100
50
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
CS



ADAPTIVE Delays:

The graphs and equations above allow us to set a baseline delay with RAB or RCD and then to tailor the way in which the delays are modified as a function of the CS signal by choosing the appropriate value of KA. Note that the total resistance of the potential divider between the CS pin and GND should be in the range 10k to 20k.

FIXED Delays:

Fixed delays between 250ns and 1730ns can be programmed by choosing R_{AB} and R_{CD} in the range 13kOhm to 90kOhm. The ADEL pin is grounded so $K_A = 0$ and the T_{ABSET} equation above can be simplified to

$$T_{DEL\_fixed}(R_{DEL}) := \frac{5R_{DEL}}{0.26}$$

Where R_{DEL} is R_{AB} or R_{CD} depending on whether T_{ABSET} or T_{CDSET} is being programmed

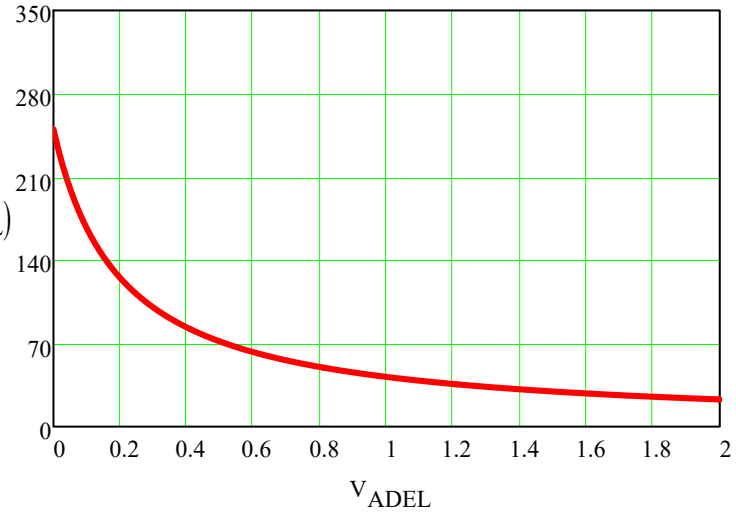
Short FIXED Delays:

To set a fixed delay time which is less than the 250ns we get when we set R_{AB} = 13 we put a fixed voltage on ADEL, this reduces the fixed baseline delay set by R_{AB} in a predictable way.
In this situation the voltage on the ADEL pin is fixed so we re-write the equation for the delay time in terms of V_{ADEL} rather than CS
V_{ADEL} is a fixed voltage and not a proportion of CS therefore KA = 1 so we can remove it from the equation.
We get this equation for T_{ABSET_fixed} The same equation can be used to calculate the T_{CDSET_fixed} delay

$$T_{ABSET\_fixed}(R_{AB}, V_{ADEL}) := \frac{5R_{AB}}{0.26 + V_{ADEL} \cdot 1.3}$$

This equation can be used to calculate the fixed delay produced by any given combination of R_{DELAB} and V_{ADEL}.

$T_{ABSET\_fixed}(13, V_{ADEL})$



This graph is essentially the same as the earlier one for T_{ABSET} with KA=1 and R_{AB}=13

The result gives the same result as the KA = 1 curves above, for example

$T_{ABSET\_fixed}(13,1) = 41.667$ Where $T_{ABSET\_fixed}(R_{AB}, V_{ADEL}) = \frac{5R_{AB}}{0.26 + V_{ADEL} \cdot 1.3}$

$T_{ABSET}(13,1,1) = 41.667$ Where $T_{ABSET}(R_{AB}, K_A, CS) = \frac{5R_{AB}}{0.26 + CS \cdot K_A \cdot 1.3}$

NOTES:
The delay setting resistor at the DELAB and DELCD pins must be in the range 13k to 90k
These resistors set a baseline delay which is then modified by the voltage on the ADEL pin
With the ADEL pin connected through a potential divider to the CS pin the voltage at the ADEL pin must be in the range 0 to 2V
IF the ADEL pin is used to modify the baseline delaygenerate a fixed delay then the voltage at the ADEL pin is fixed and can be in the range 0 to its AbsMax but it is recommended to keep V_{ADEL} below 2V.

This approach to calculating fixed delays is different to that shown in the UCC28950 datasheet (SLUSA16D) but it's equally valid.
All of these delay calculations are approximate because they cannot take account of external delays outside of the control of TI - for example propagation delays through the driver circuits and response times of the switches.