UCC28950 questions

Please refer to TI SLUA560C UCC28950 600W, Phase-Shifted, Full-Bridge Application Report for the following discussions

1. Page 7, formula (34)

$$C_{OSS\_QA\_AVG} = C_{OSS\_QA\_SPEC}\sqrt{\frac{V_{dsQA}}{V_{INMAX}}} \approx 193\,pF \quad (34)$$

According to slup 169, Design And Application Guide for High Speed MOSFET Gate Drive Circuits, page 2-4, cited below.

$$C_{OSS,ave} = 2 \cdot C_{OSS,spec} \cdot \sqrt{\frac{V_{DS,spec}}{V_{DS,off}}}$$

We do not know why the multiplier "2" is missing in formula (34)

- I think you are correct that the 2 should be in the equation.
- This is just an estimate to get you close to give you an estimate to where to set your delay.
- The application note will have you fine tune the delays at 10% load if I remember correctly.
- The newer FETs have Coss(tr) the average Coss switch capacitance during transients so you don't have to calculate it anymore.

- Acknowledged with thanks.

2. Page 8, formula (39)

$$L_S \geq \left(2 \times C_{OSS\_QA\_AVG}\right)\frac{V_{INMAX}^{\,2}}{\left(\frac{I_{PP}}{2} - \frac{\Delta I_{LOUT}}{2 \times a1}\right)^2} - L_{LK} \approx 26\,\mu H \quad (39)$$

Ls is selected to achieve ZVS at 100% load down to 50% load based on the primary FET's average total Coss at the switch node.

We would like to know if the multiplier "2" before $C_{OSS\_QA\_AVG}$ is for the requirement of achieving ZVS at 100% load down to 50% load.

> This equation is based on (1/2) LI^2 = 1/2CV^2

> The total capacitance as the switch node should be 2*Coss_QA_AVG because the capacitors across the FETs will appear to be in parallel to the switch node. The 1/2s cancel out.

- Understand that the total capacitance at the switch node should be 2*$C_{oss\_QA\_AVG}$ because the capacitors across the two FETs will appear in parallel to the switch node. We know the multiplier is for achieving ZVS at 100% load down to 50% load. By the way, if we want to achieve ZVS at 100% load down to 25% load, then what we need to do is to change the multiplier "2" before $C_{OSS\_QA\_AVG}$ to "4". Is it correct?

3. Page 11, formula (62)

$$V_{dsQE} = \frac{V_{INMAX}}{a1} \approx 19.5\,V \quad (62)$$

We believe that V_{dsQE} should be two times the value obtained above because it is a center tapped secondary.

>The FETs source is tied to ground so the formula is correct.

- Refer to UCC28950 Excel Design Tool: SLUC222D dated 2018/7/27, V_{dsQE} has been changed from 19.5V to 39.05V and there is a multiplier "2" in the equation. We believe UCC28950 Excel Design Tool: SLUC222D dated 2018/7/27 is correct.

4. Page 11, formula (65)

$$C_{OSS\_QE\_AVG} = C_{OSS\_SPEC}\sqrt{\frac{V_{dsQE}}{V_{ds\_spec}}} \approx 1.6\,nF \quad (65)$$

We thought that there was a typo, V_{ds_spec} should be in the numerator and V_{dsQE} should be in the denominator. And we need multiplier "2" in formula (65), too.

> I believe you are correct and I will notify the applications team to fix this in the application note when they have a

chance.

- Acknowledged with thanks.

5. Page 19, formula (120)

$$2\pi \times f_R L_S = \frac{1}{2\pi \times f_R \times (2 \times C_{OSS\_QA\_AVG})} \quad (120)$$

We believe that the multiplier "2" before $C_{OSS\_QA\_AVG}$ is also for the requirement of achieving ZVS at 100% load down to 50% load. Is that correct?

- The 2*Coss_QA_AVG is correct.

- If we want to achieve ZVS at 100% load down to 25% load, then what we need to do is to change the multiplier "2" before $C_{OSS\_QA\_AVG}$ to "4". Is it correct?

6. Page 22, formula (137)

$$R_{DELEF} = \frac{(t_{AFSET} \times 0.5 - 4ns)}{ns} \times \frac{(2.65V - V_{ADELEF} \times 1.32) \times 10^3}{5} \times \frac{1}{1A} \approx 14.1k\Omega \quad (137)$$

We believe that the multiplier "0.5" after t_{AFSET} is a typo. The multiplier "0.5" is not needed.

- This equation came from the systems engineer and is the same as equation 161 in the data sheet. So I believe it is correct.

- Refer to UCC28950 Excel Design Tool: SLUC222D dated 2018/7/27, there is no multiplier "0.5" after t_{AFSET} in the equation. We believe UCC28950 Excel Design Tool: SLUC222D dated 2018/7/27 is correct.