



Soft Switching  
PFC  
&  
Soft Switching  
PWM

$96\% \times 96\% = 92.16\%$

Noise Free

90+

for  
LCD TV  
AC Adapter  
Desk Top

96+ LLC/SRC + SR CM6900/1

96+ Interleaved CRM PFC CM6565

Low Cost PFC + Stand By CM6807

96+ LLC/SRC + SR **CM6900/1**

96+ Interleaved CRM PFC **CM6565**

Low Cost PFC + Stand By **CM6807**



**96% x 96% = 92.16%**

96+ LLC/SRC + SR **CM6900/1**  
96+ Interleaved CRM PFC **CM6565**



**92% x 96% = 88.32%**

96+ LLC/SRC + SR **CM6900/1**  
Low Cost PFC + Stand By **CM6807**

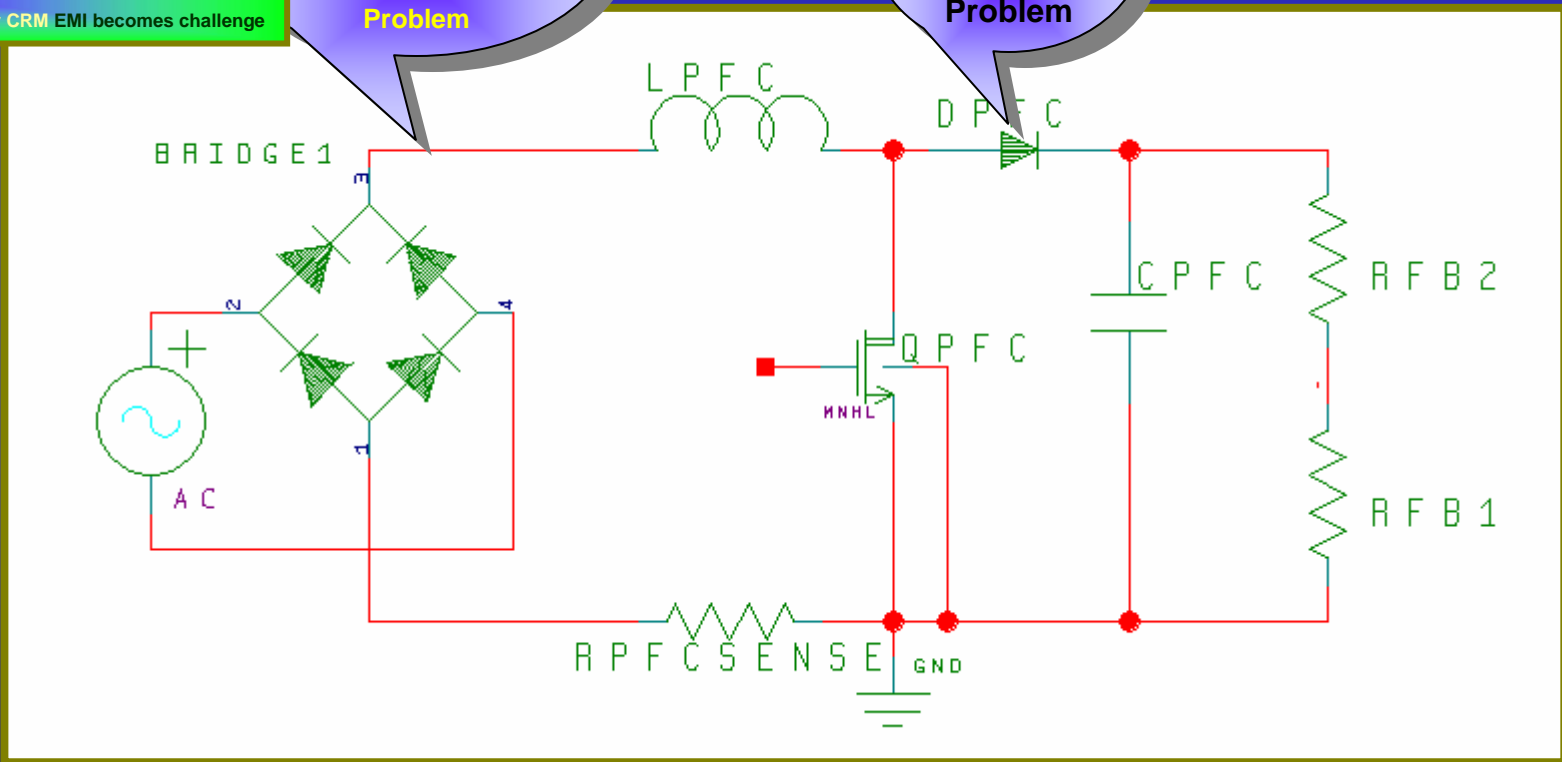
**96+ Interleaved CRM PFC CM6565**  
Idea Invented by Tom Li and Jeffrey H. Hwang around mid 1996

High Switching Loss at turn on, it limits the efficiency performance and it limits PFC switching frequency.

DCM  
Has too much  
input ripple  
current  
Problem

CCM  
Qrr  
Problem

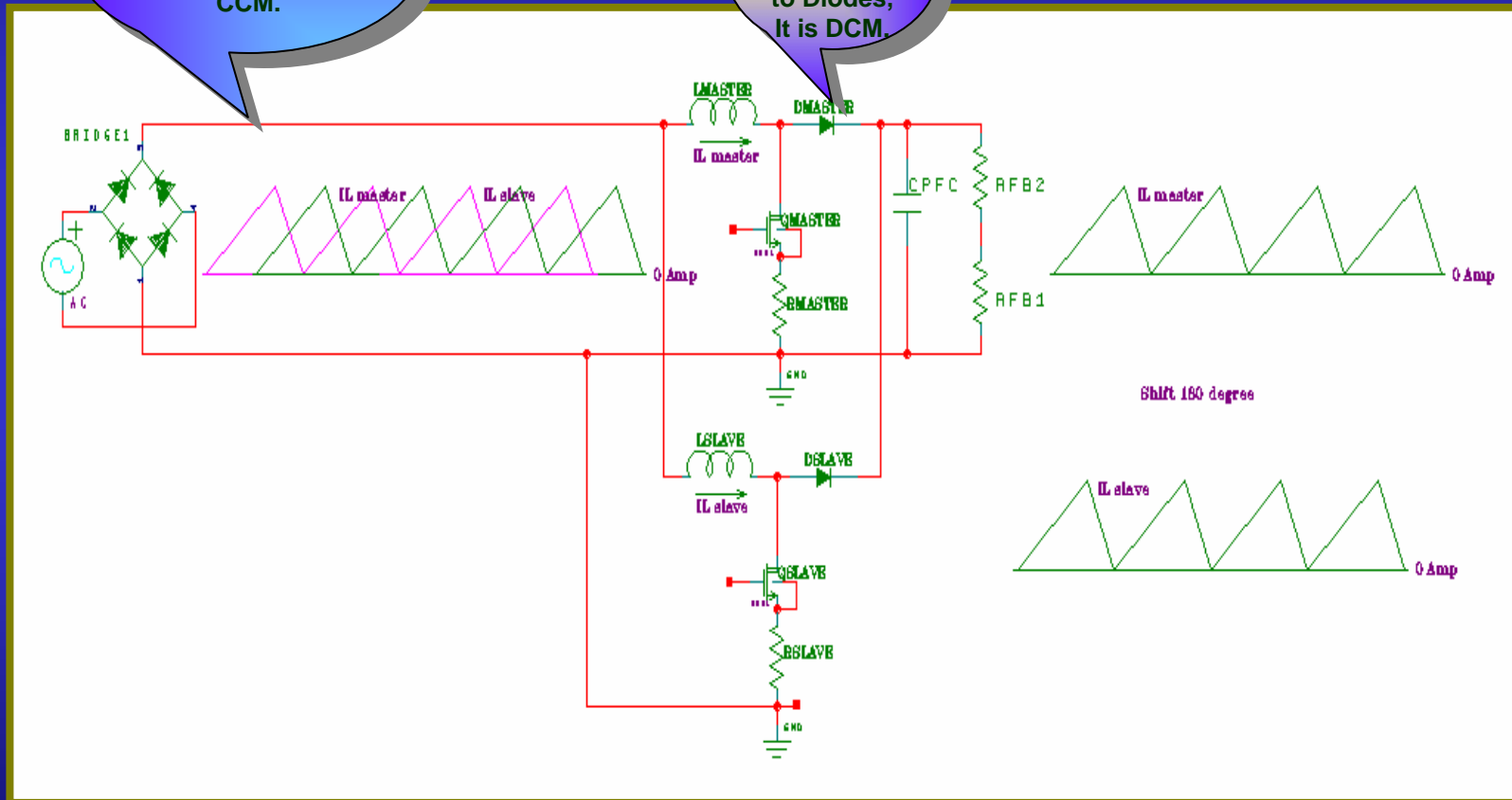
DCM or CRM EMI becomes challenge



**96+ Interleaved CRM PFC CM6565**  
Idea Invented by Tom Li and Jeffrey H. Hwang around mid 1996

No High Ripple Current Issues to EMI filter, It is CCM.

No Qrr Issues, to Diodes, It is DCM.



One High Voltage resistor,

Rac resistor to provide lac, Vrms1 and Vrms2

&  
Constant Power

Interleaved GRM PFC **CM6565**  
Simplified Block Diagram

96+ Interleaved GRM PFC **CM6565**

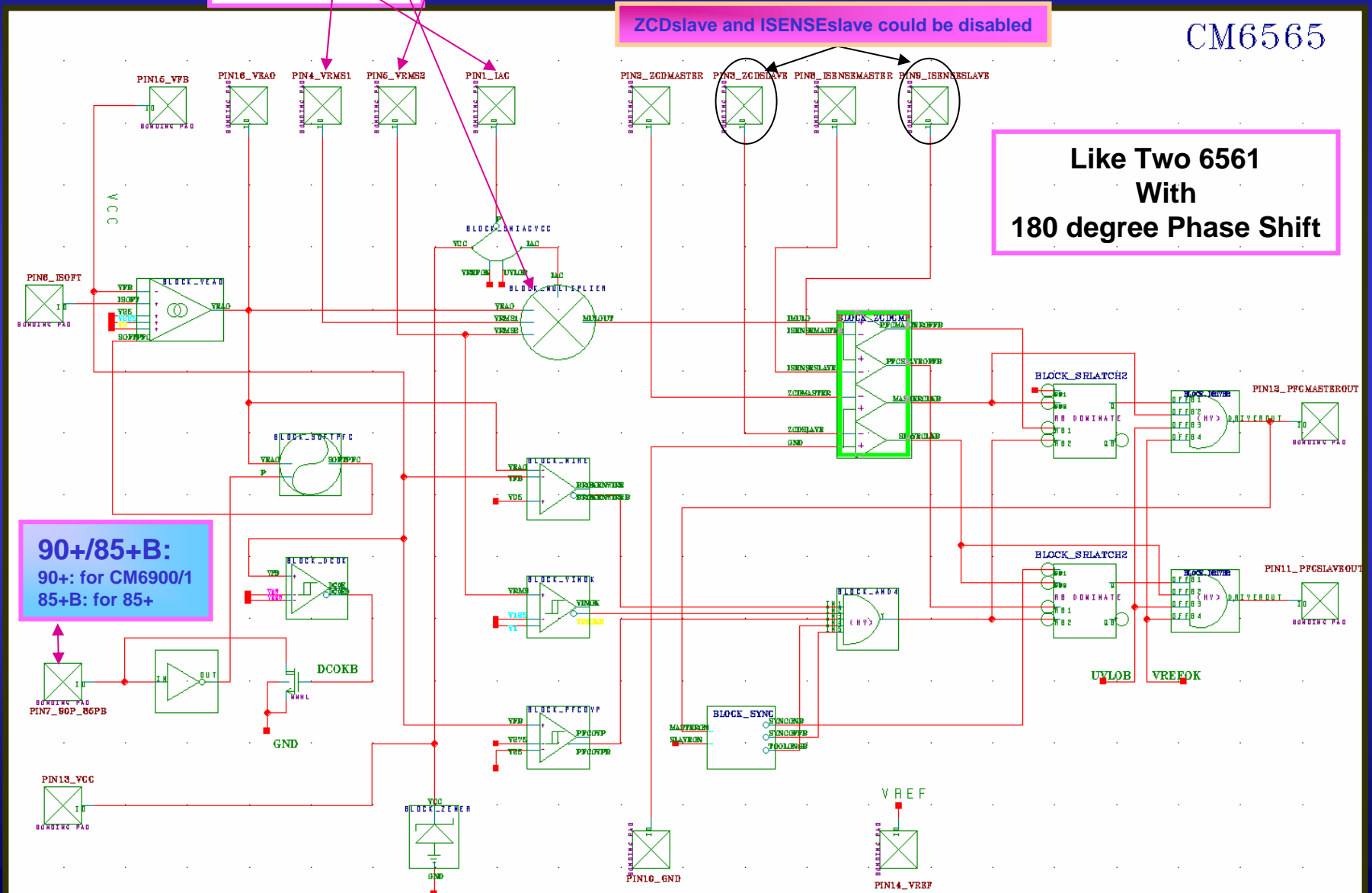
Low Cost PFC + Stand By **CM6807**

ZCDslave and ISENSEslave could be disabled

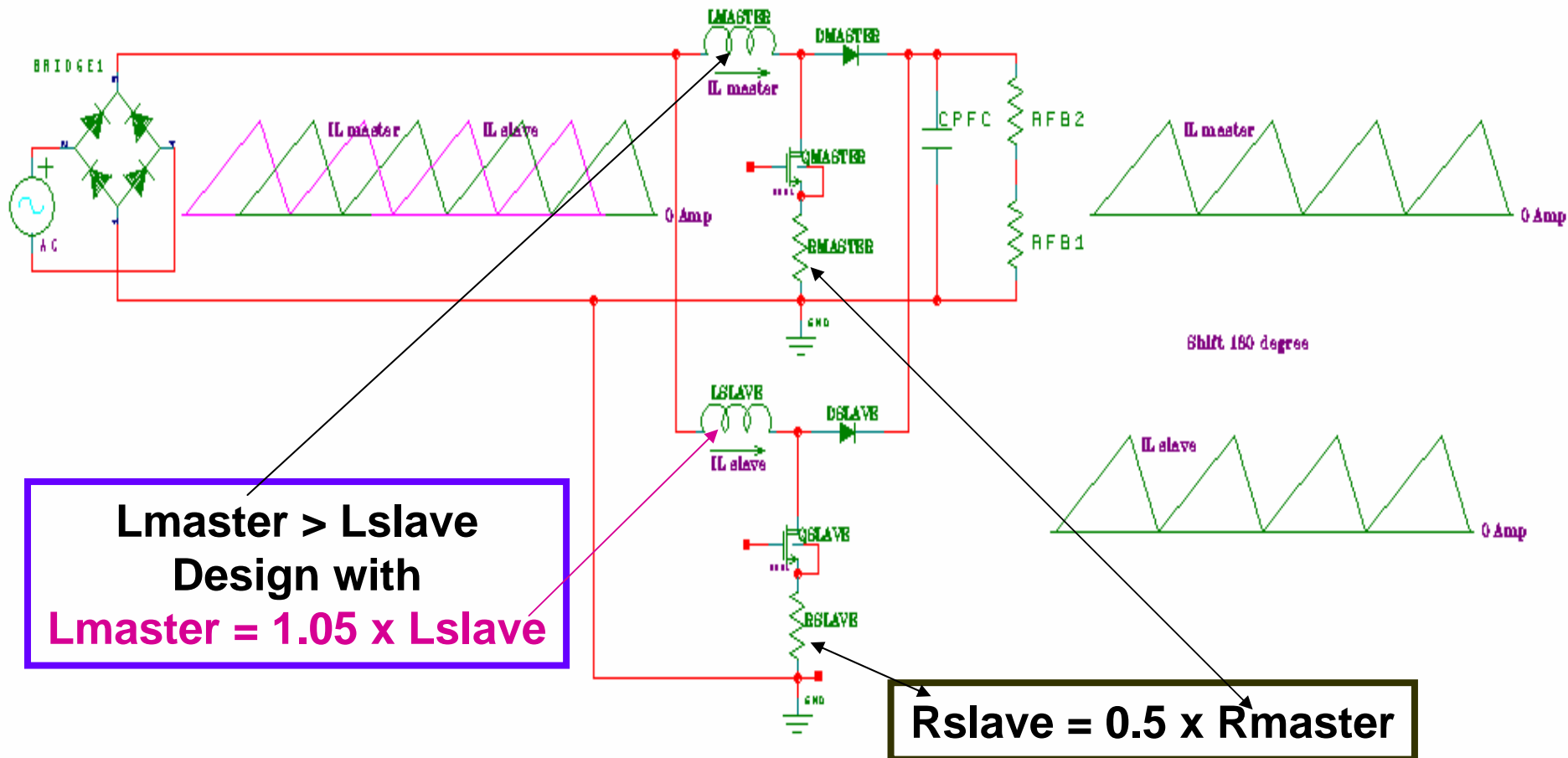
CM6565

Like Two 6561  
With  
180 degree Phase Shift

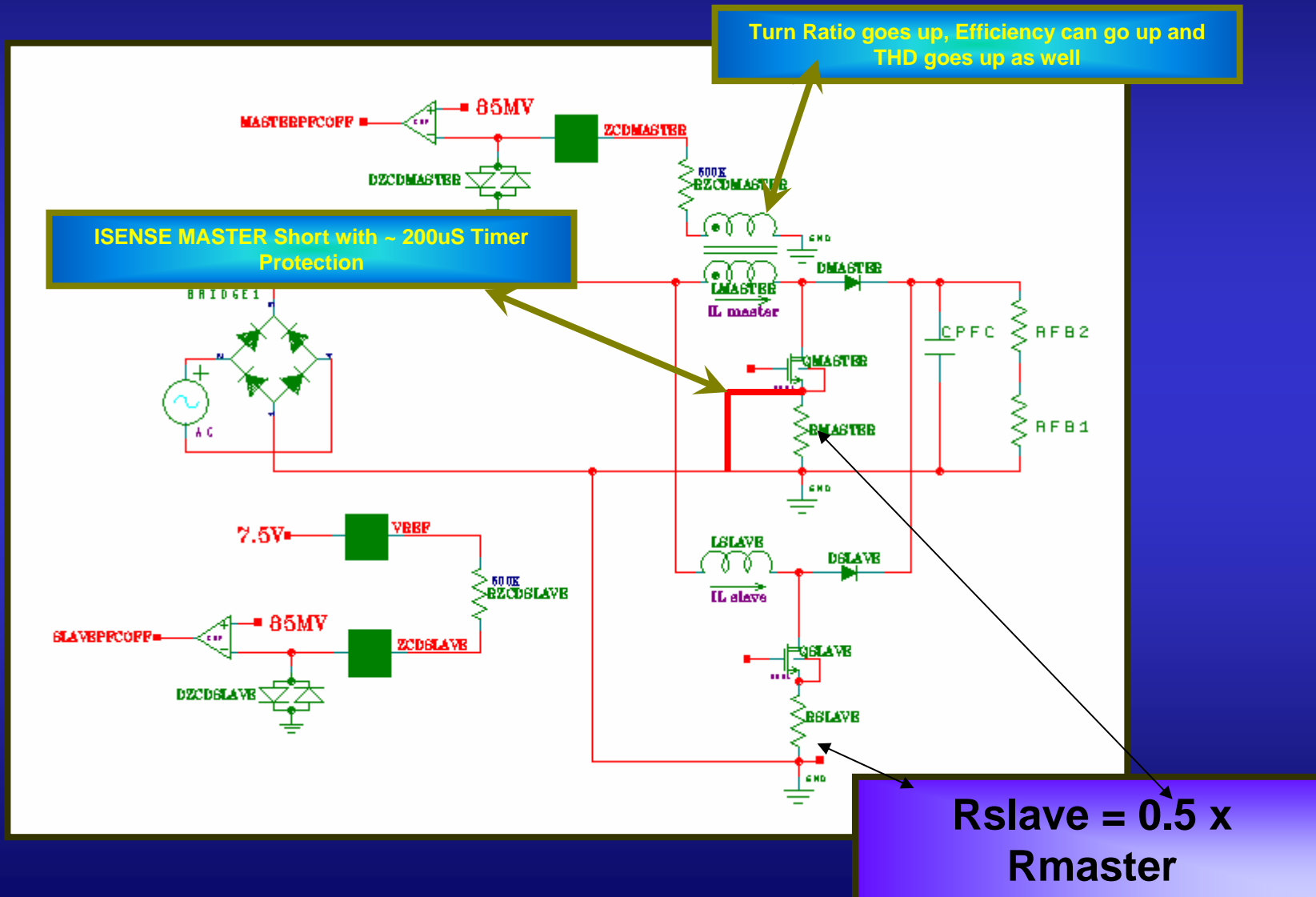
90+/85+B:  
90+: for CM6900/1  
85+B: for 85+



To Design 96+ Interleaved CRM PFC **CM6565**

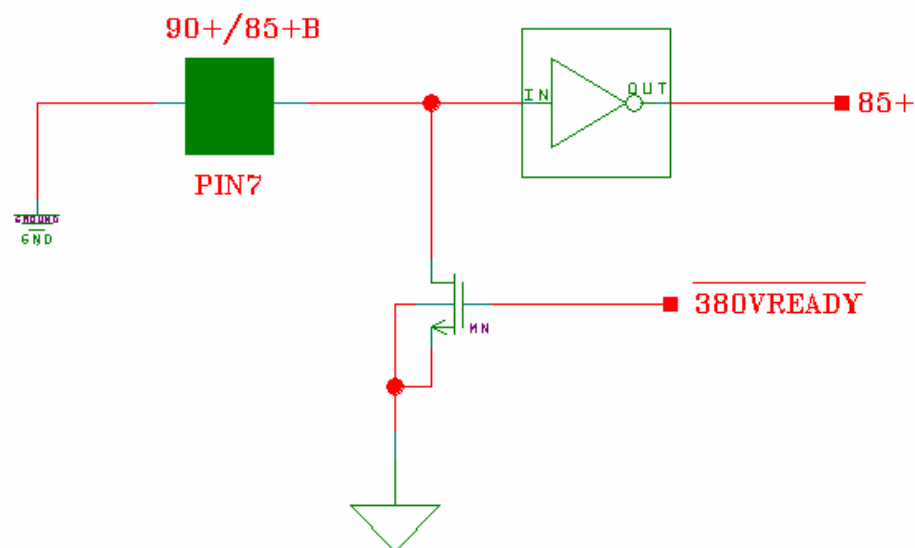


To Design 96+ Interleaved CRM PFC **CM6565**



To Design 96+ Interleaved CRM PFC **CM6565**

## 85+ Applications



1. 85+, Dual Forward Waveform can be recognized by the secondary housekeeping IC.
2. At Light Load and Low Line, PFC boost output 380V will drop to 304V. It boosts the light load efficiency further.

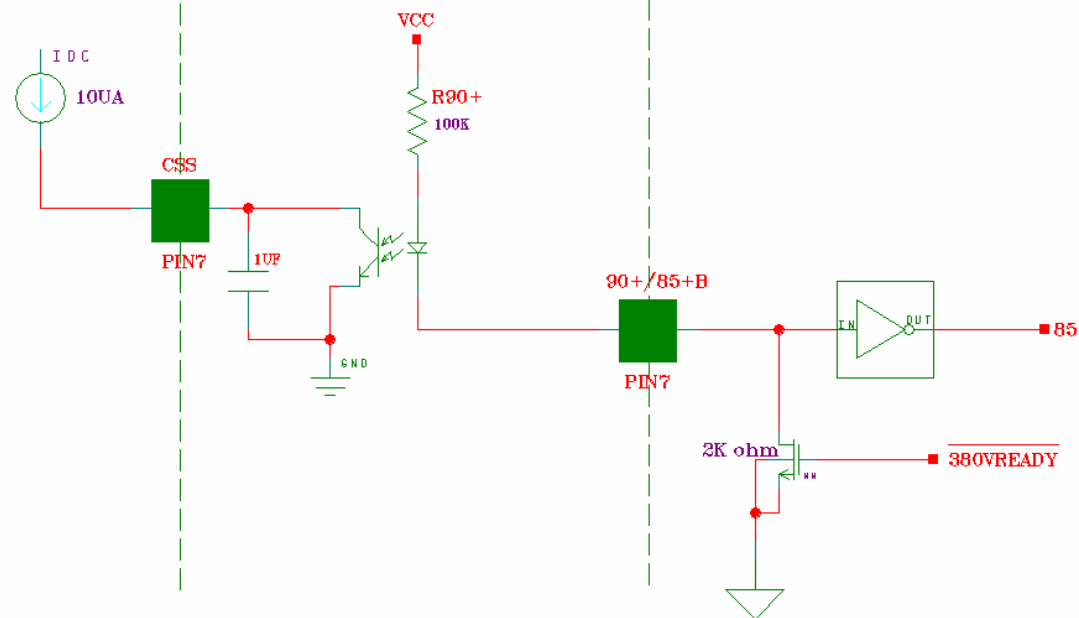


To Design 96+ Interleaved CRM PFC **CM6565**

## 90+ Applications

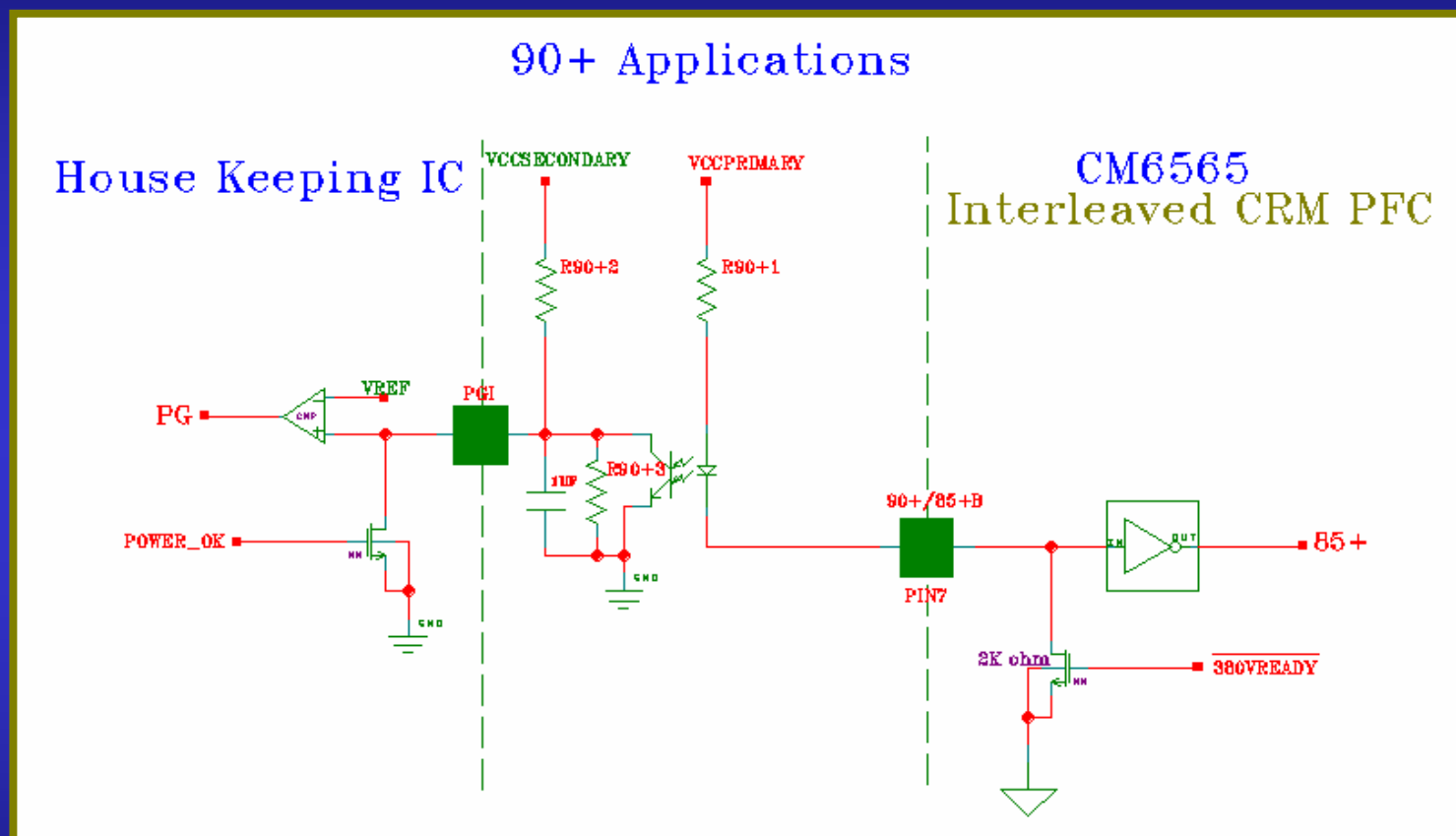
CM6900/1  
LLC/SRC + SR

CM6565  
Interleaved CRM PFC



1. 90+, LLC/SRC sine wave output cannot be recognized by the secondary housekeeping IC. A Photo Couple with CM6565 can send the 380V ready signal to interface the regular house keeping IC.
2. At Light Load, PFC boost output 380V will drop to 342V. It boosts the light load efficiency further.

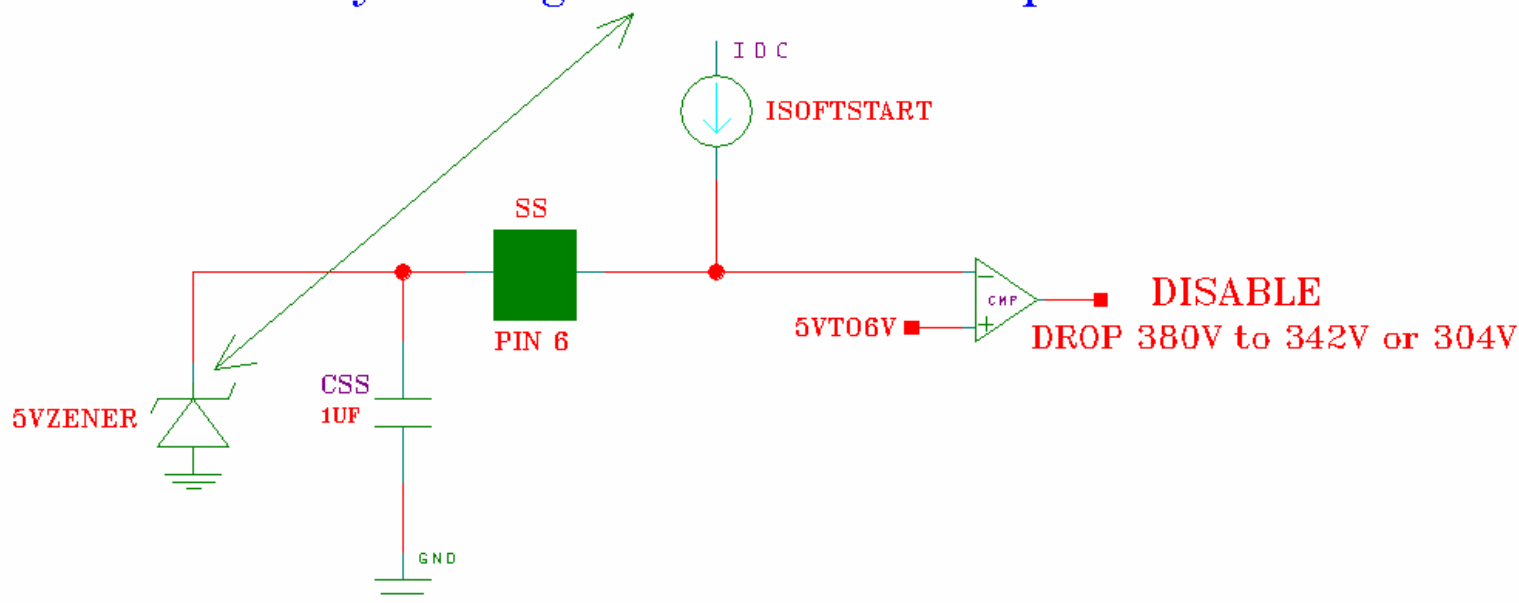
To Design 96+ Interleaved CRM PFC **CM6565**



1. 90+, LLC/SRC sine wave output cannot be recognized by the secondary housekeeping IC. A Photo Couple with CM6565 can send the 380V ready signal to interface the regular house keeping IC.
2. At Light Load, PFC boost output 380V will drop to 342V. It boosts the light load efficiency further.

To Design 96+ Interleaved CRM PFC **CM6565**

To DISABLE 380V DROPS to 342V or 304V  
By Adding a 5V Zener at SS pin.



1. To Disable 380V drops to 342V or 304V, a 4V or 5V zener diode can be added to disable the function.

96+ LLC/SRC + SR **CM6900/1**

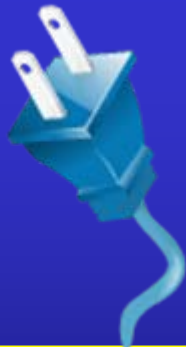
96+ Interleaved CRM PFC **CM6565**

Low Cost PFC + Stand By **CM6807**



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96+ LLC/SRC + SR **CM6900/1**  
96+ Interleaved CRM PFC **CM6565**

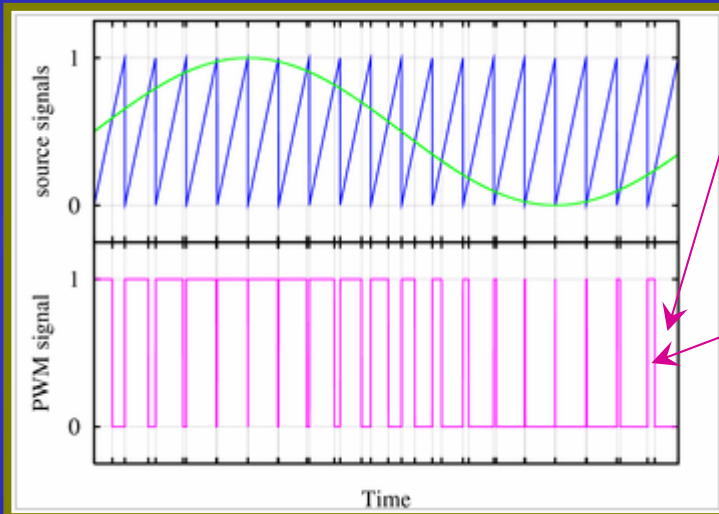


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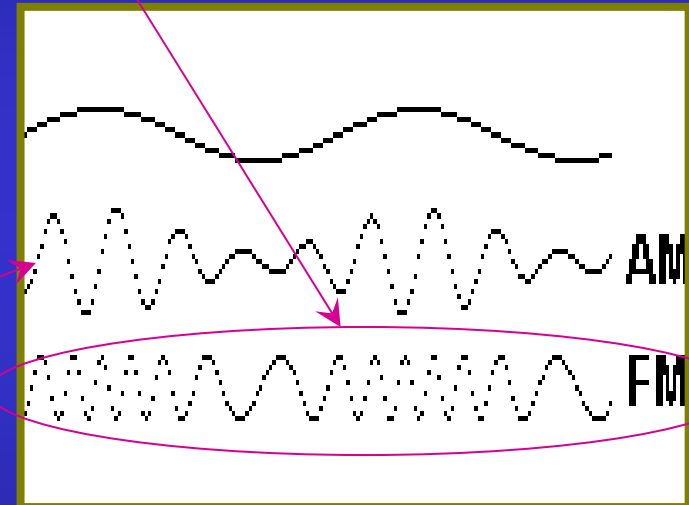
96+ LLC/SRC + SR **CM6900/1**  
Low Cost PFC + Stand By **CM6807**

96+ LLC/SRC + SR **CM6900/1**

Majority of Switching Converter is a fixed frequency PWM converter



+

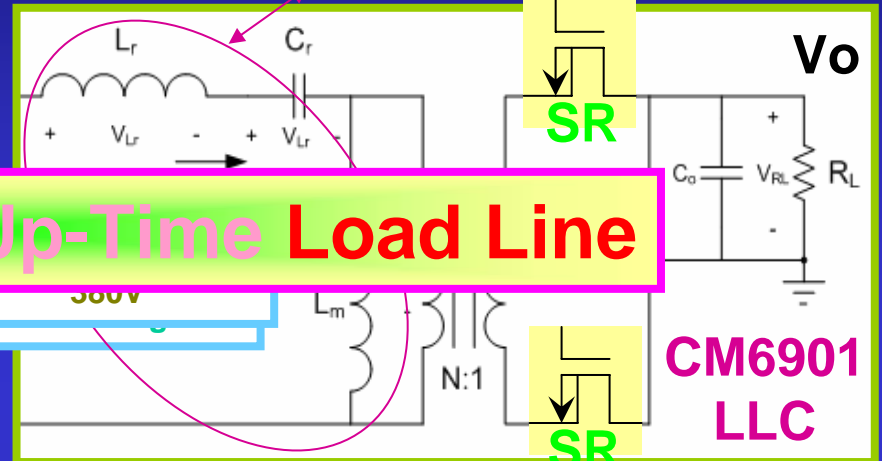
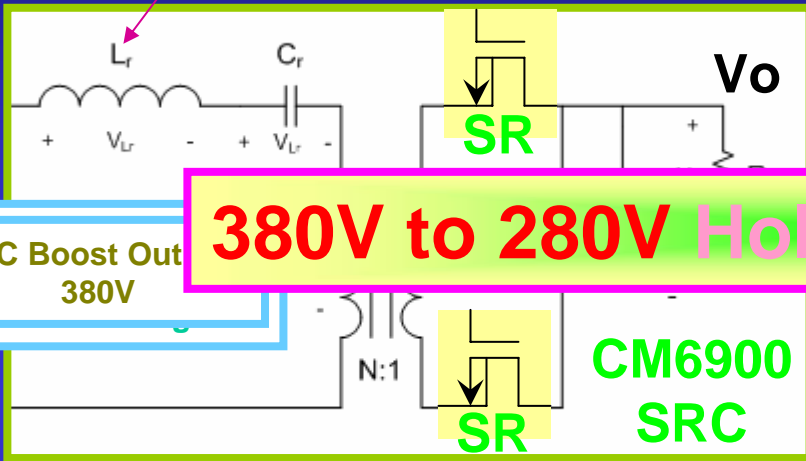


96+ SRC + SR **CM6900**:  
FM at Full Load  
&  
PWM at Light Load

96+ LLC + SR **CM6901**:  
FM around  $f_{r1}$   
&  
PWM SR below  $f_{r1}$   
&  
PWM at Light Load

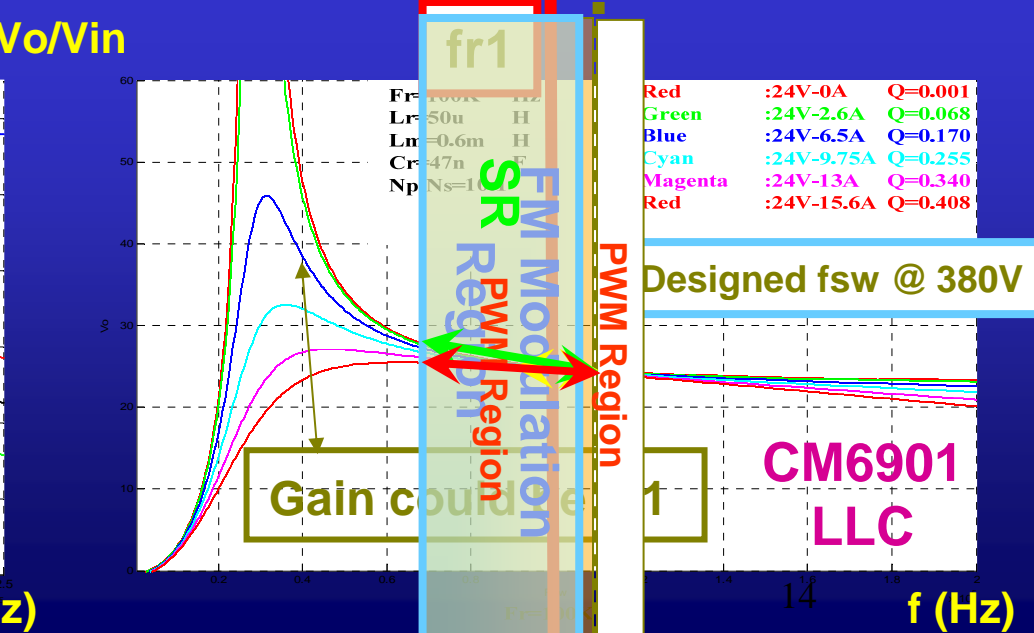
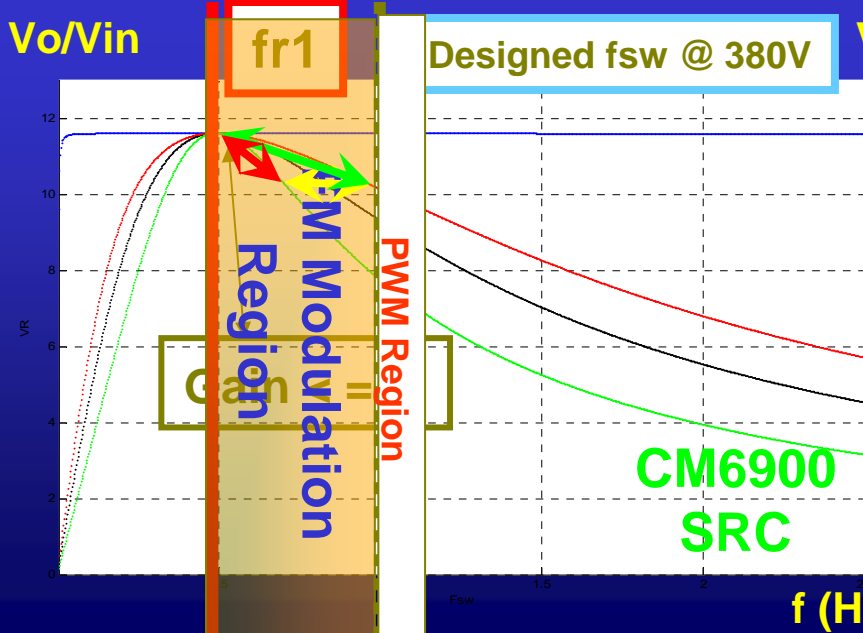
**Real Inductor,  $L_r$**

**Parasitic Inductors,  $L_r$  &  $L_m$**

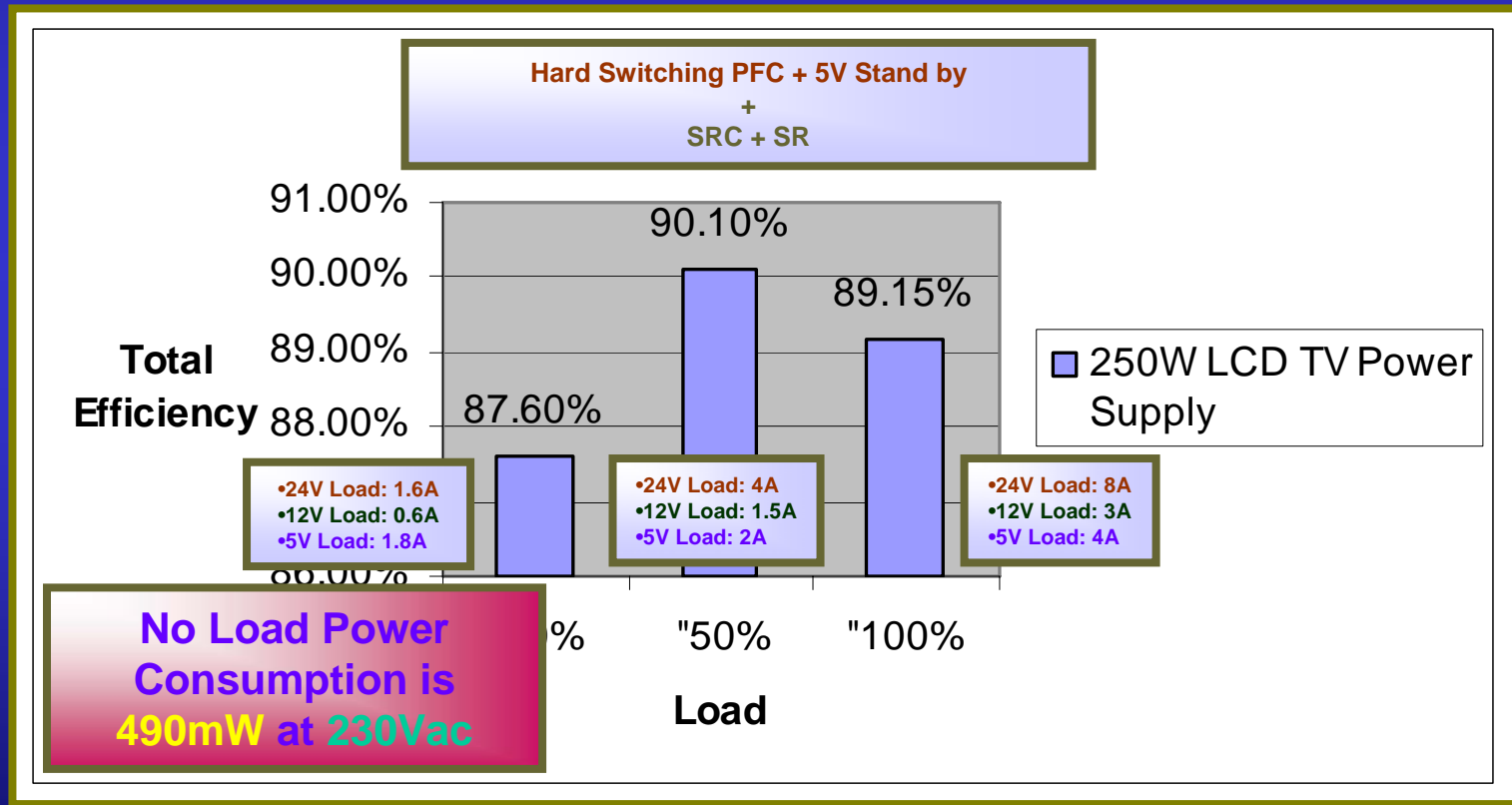


**380V to 280V Hold-Up-Time Load Line**

PFC Boost Out 380V



With  
**CM6807**  
 &  
**CM6900**



# Summary & Future Works

## 90+ Summary:

1. **CM6807 + CM6900/1:**
  - Full Load Efficiency ~ 89.15%
  - Light Load Efficiency ~ 87.60%
  - No Load Consumption < 500mW
  - Hold Up time is sufficient

## Future Works:

1. Get the **CM6565 + CM6900/1** lab data
2. Reduce Cost by reducing 450V Bulk Cap
3. Cross Regulation
4. Improve Light Load Efficiency further