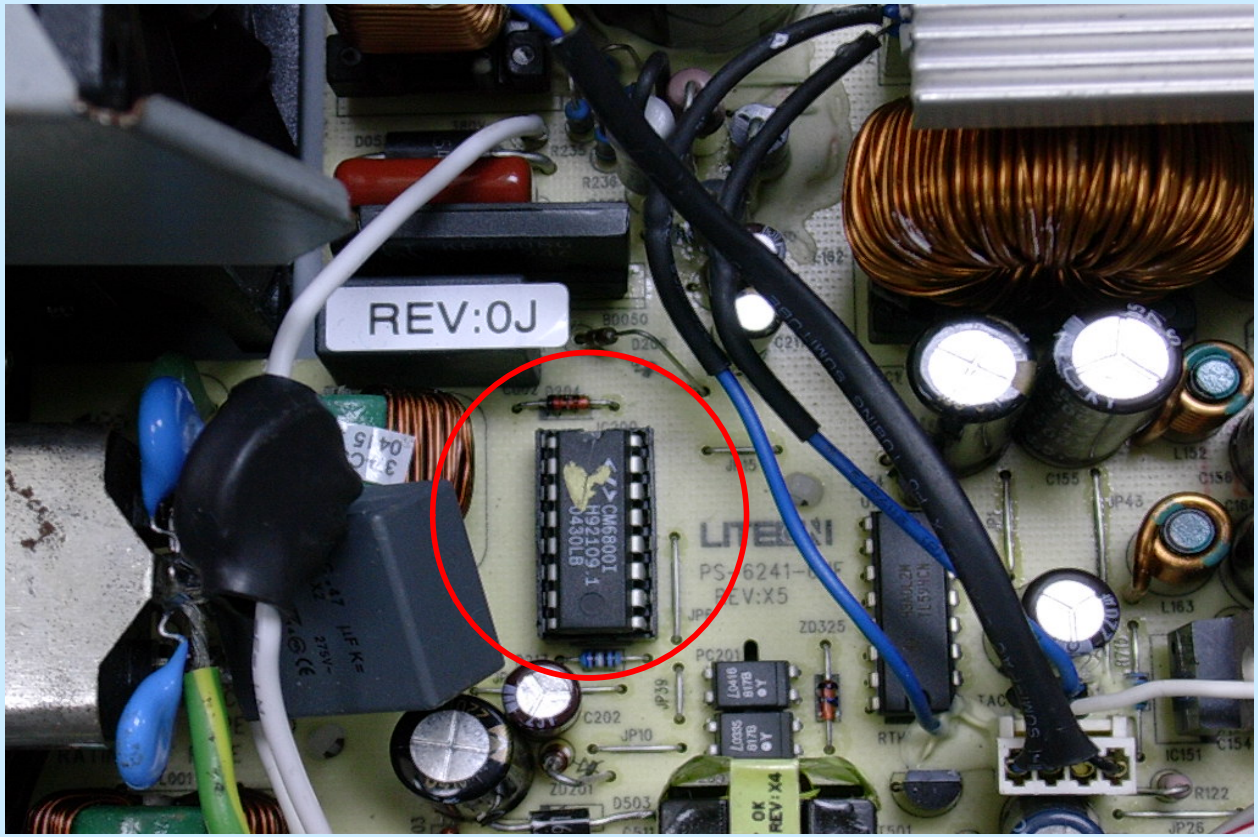
Championmicro

CM6800 PFC/PWM combo controller



AE/Elvis

Goal:

Input current shaping(PFC stage)

Output voltage regulation(PWM stage)

Application product:

ATX power

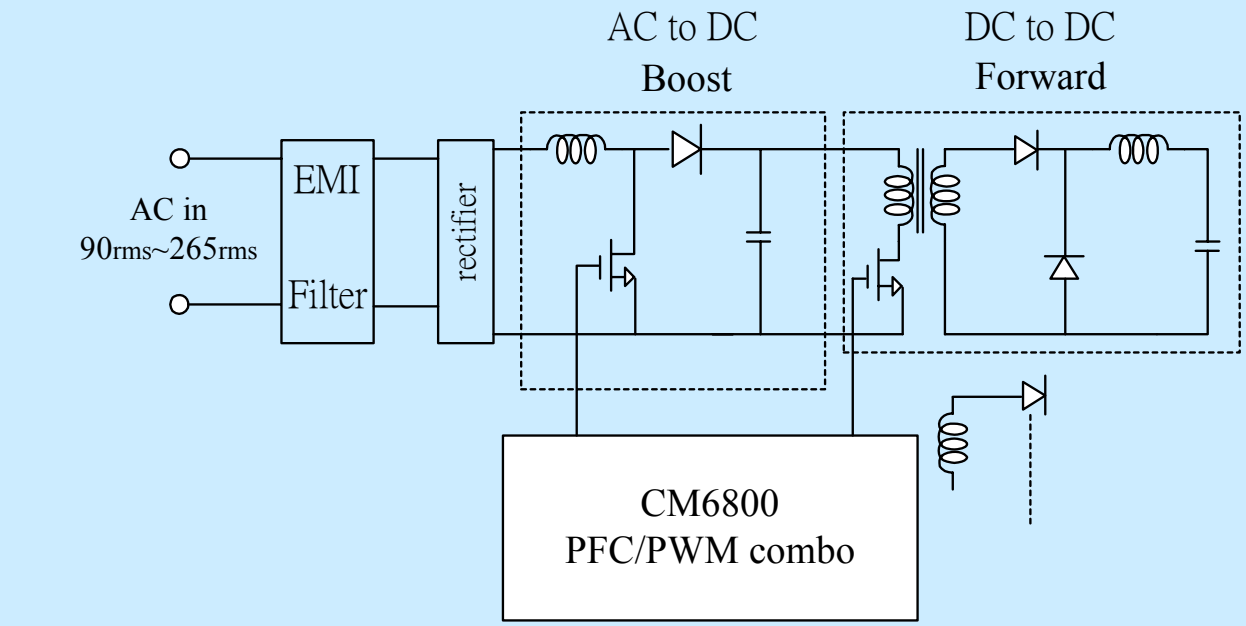
LCD TV

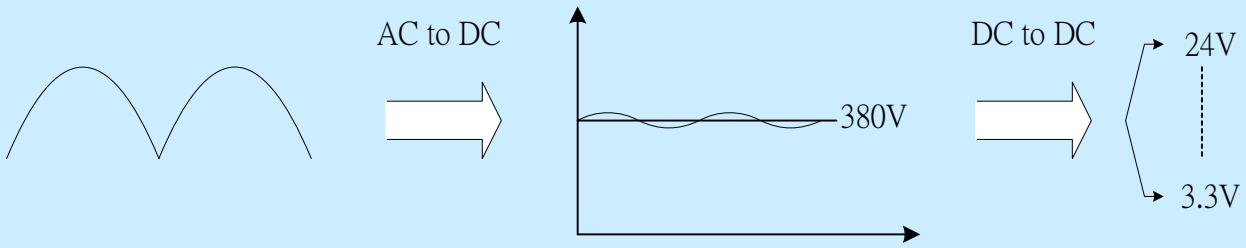
PDP

IPC

:

Active PFC Power Supply





Functions

PFC :**PFC O.V.P**

vin-ok (PFC/O.K)

VCC O.V.P

VCC U.V.L.O

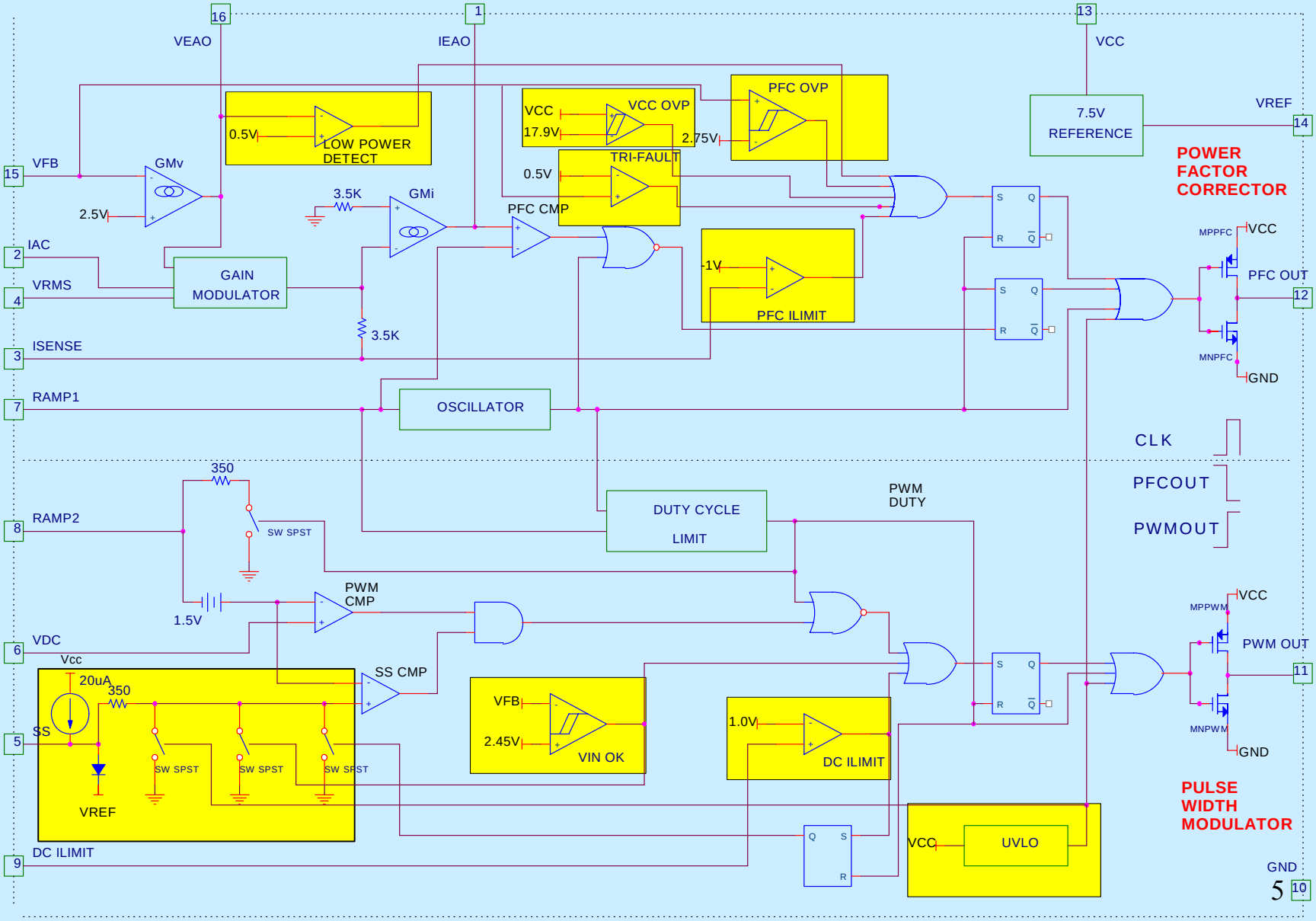
Input current limit

PFC low power detect

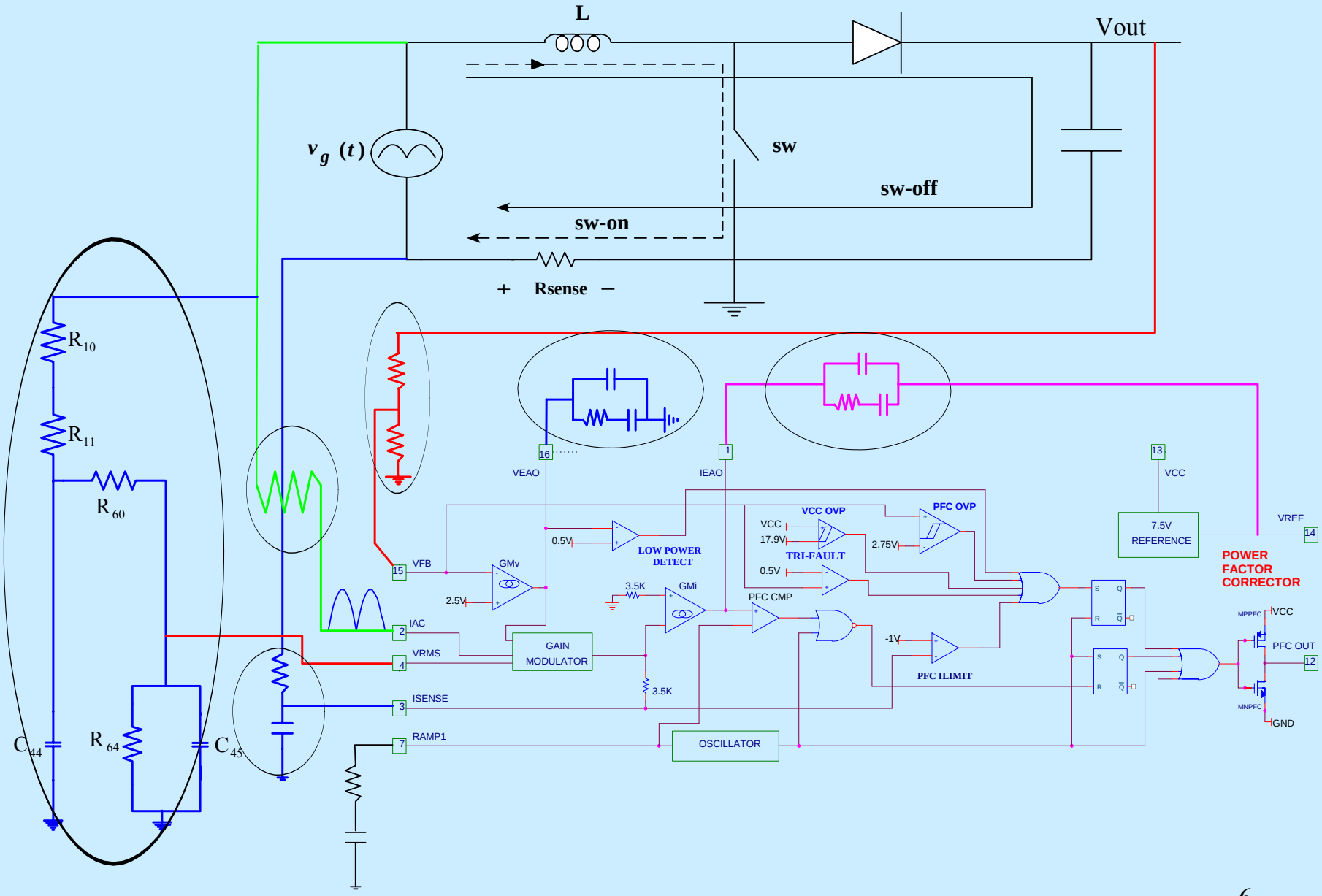
PWM :**Soft-start**

PWM current limit

CM6800 Block



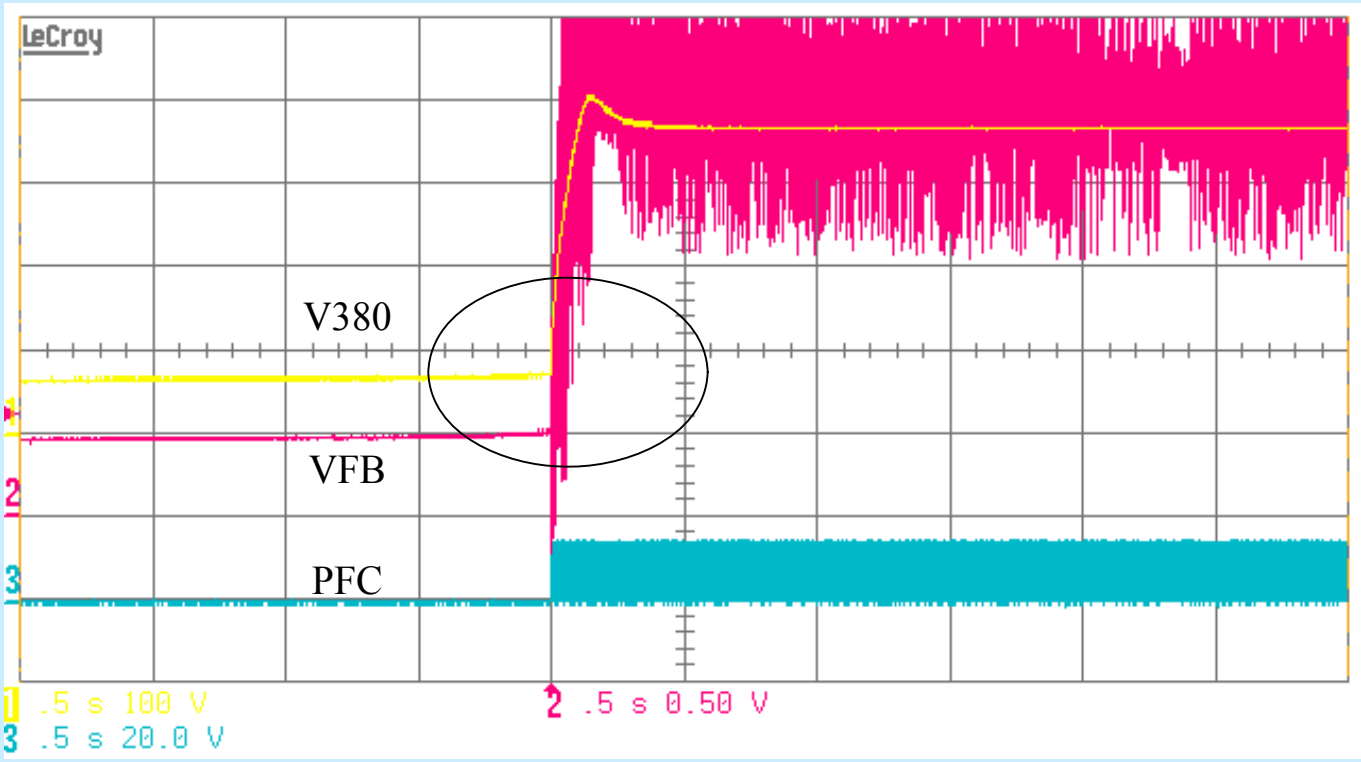
PFC block


L
Vout
v_g (t)
sw
sw-off
sw-on
+ Rsense −
R_{10}
R_{11}
R_{60}
C_{44}
R_{64}
C_{45}
16 VEAO
1 IEAO
13 VCC
7.5V REFERENCE
VREF
14
POWER FACTOR CORRECTOR
VCC OVP
VCC
17.9V
TRI-FAULT
PFC OVP
2.75V
0.5V
LOW POWER DETECT
15 VFB
GMv
2.5V
3.5K
GMi
PFC CMP
2 IAC
4 VRMS
GAIN MODULATOR
-1V
PFC ILIMIT
3.5K
3 ISENSE
7 RAMP1
OSCILLATOR
MPPFC
VCC
PFC OUT
12
MNPFC
GND

Topics

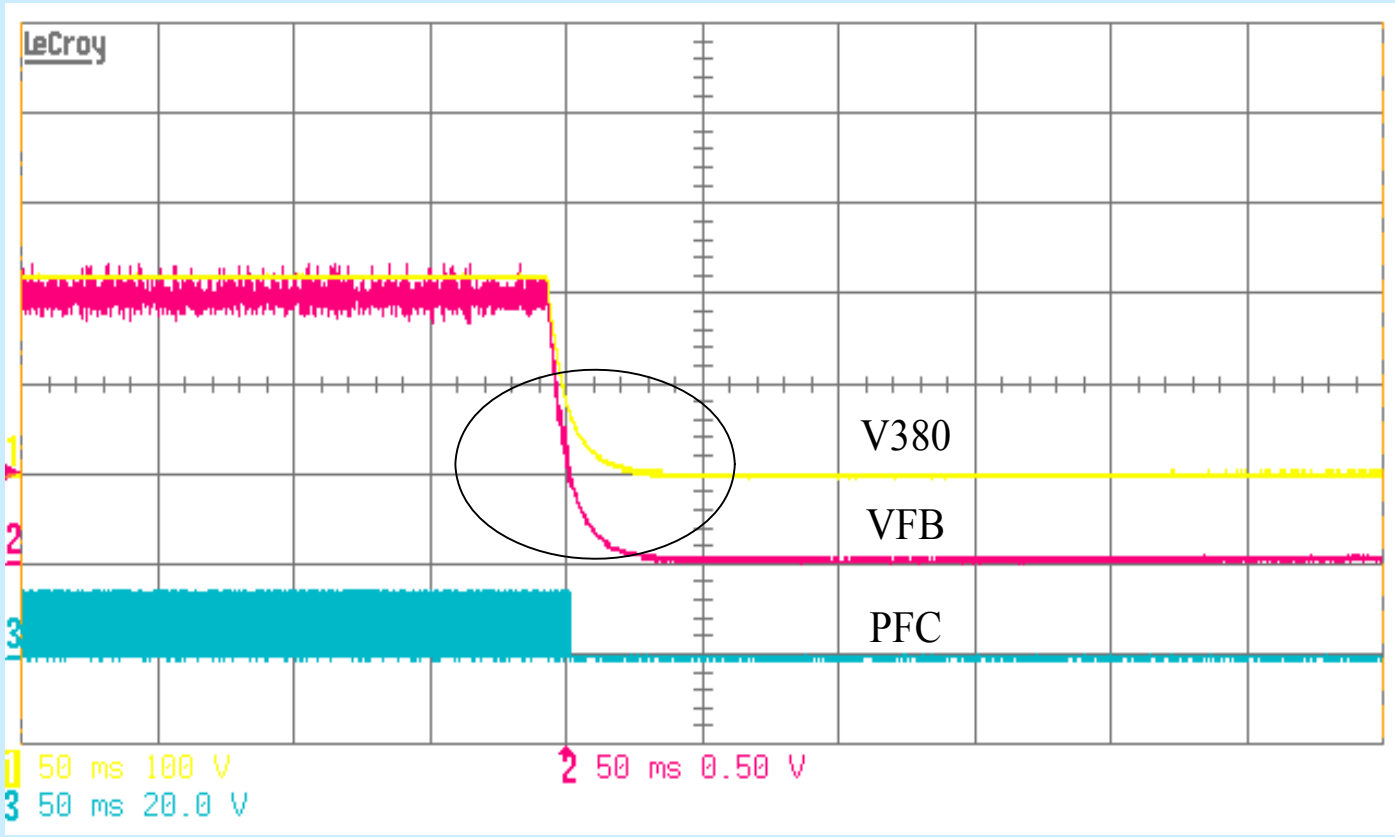
- PFC turn-on-off
- PFC O.V.P
- VFB
- Input current limit
- PFC low power detect
- PWM turn-on-off
- PFC-PWM timing
- VCC O.V.P
- VCC U.V.L.O
- PWM current limit
- Control
- Compensation

PFC turn-on



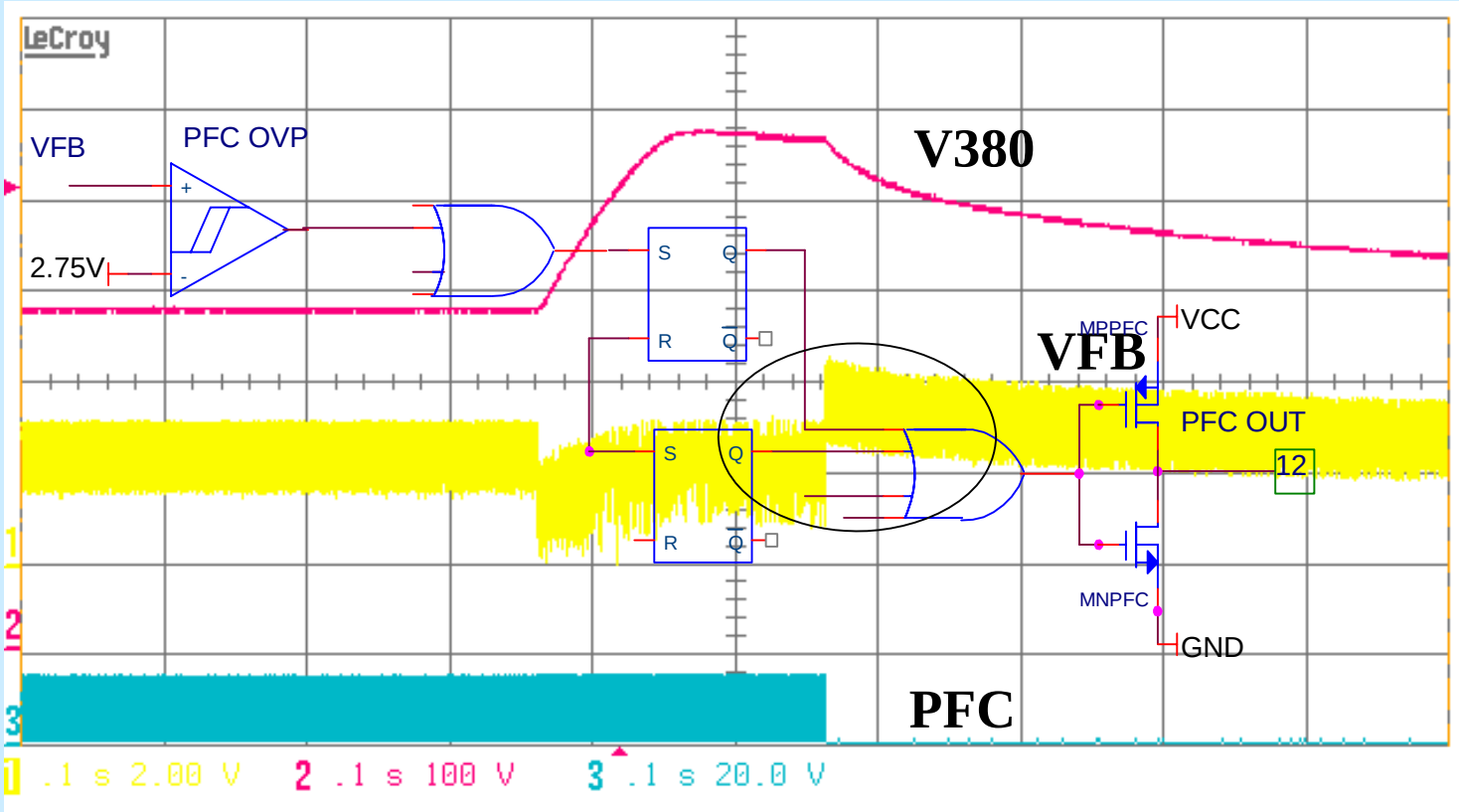
- VFB>0.5V→PFC turn-on
- VFB=2.5V→PFC stage OK(vin O.K)

PFC turn-off



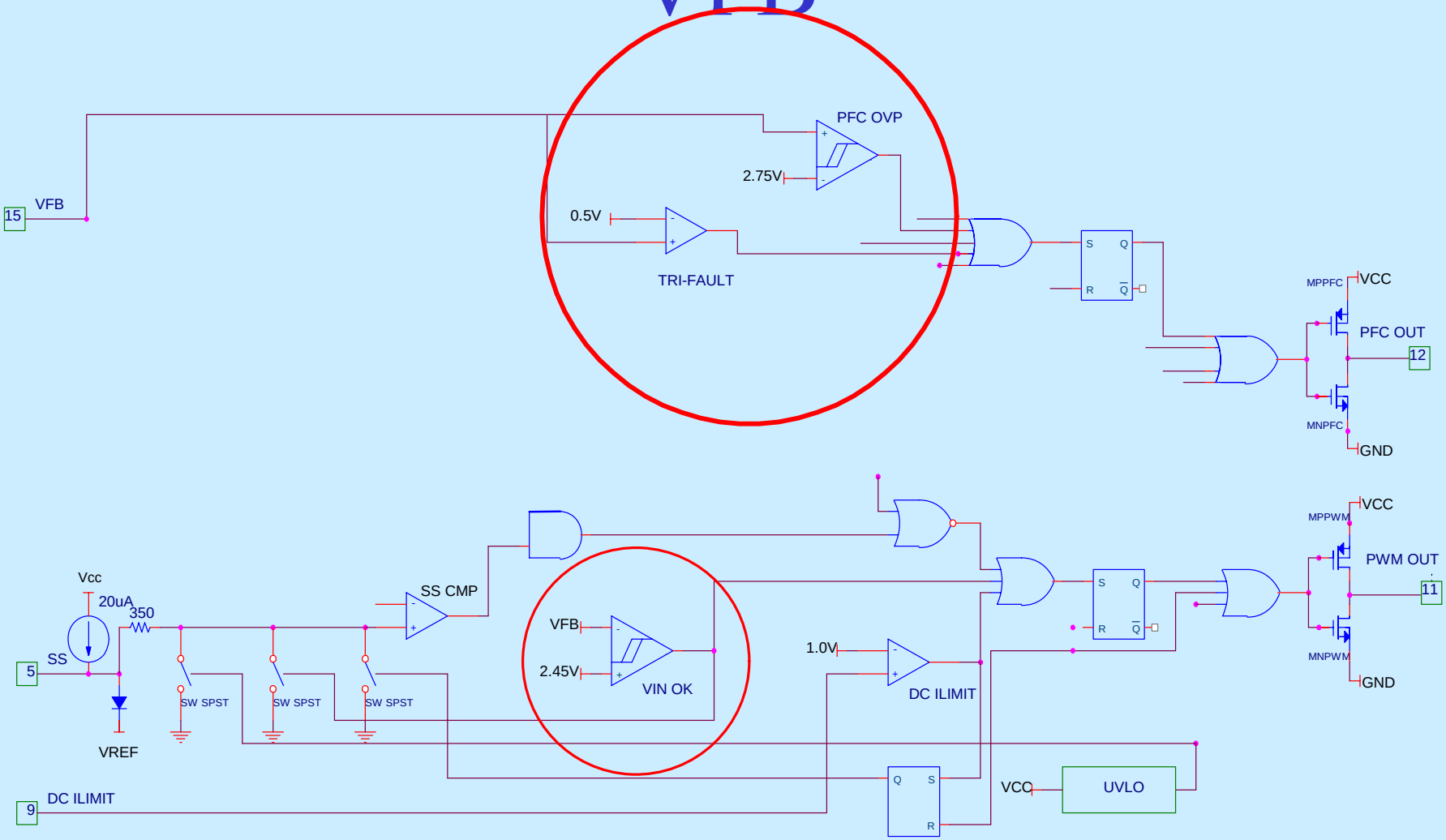
- VFB<0.5V→PFC turn-off

PFC O.V.P

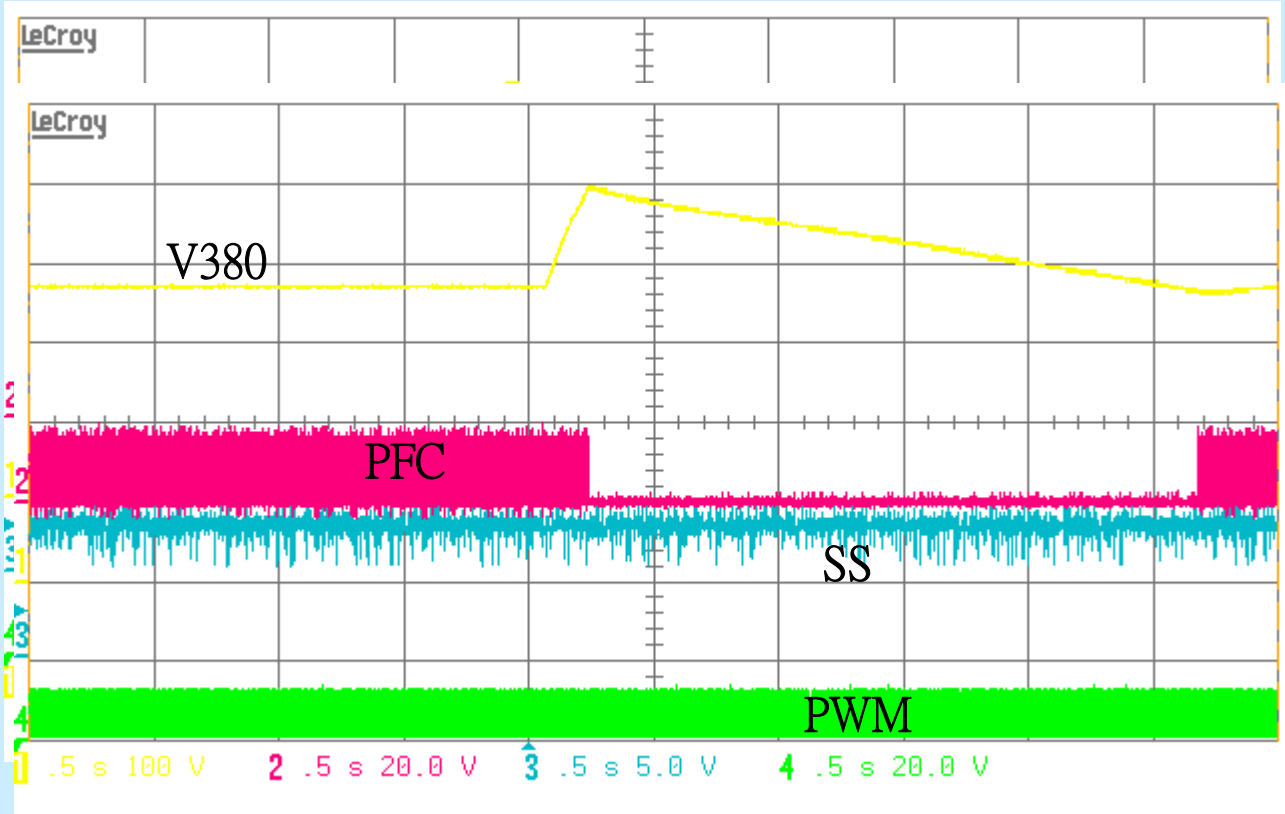


VFB>2.75V→PFC turn-off

VFB


VFB
15
PFC OVP
2.75V
0.5V
TRI-FAULT
S
Q
R
Q
MPPFC
VCC
PFC OUT
12
MNPFC
GND
Vcc
20uA
350
SS
5
SW SPST
SW SPST
SW SPST
VREF
SS CMP
VFB
2.45V
VIN OK
1.0V
DC ILIMIT
MPPWM
VCC
PWM OUT
11
MNPWM
GND
9
DC ILIMIT
VCC
UVLO

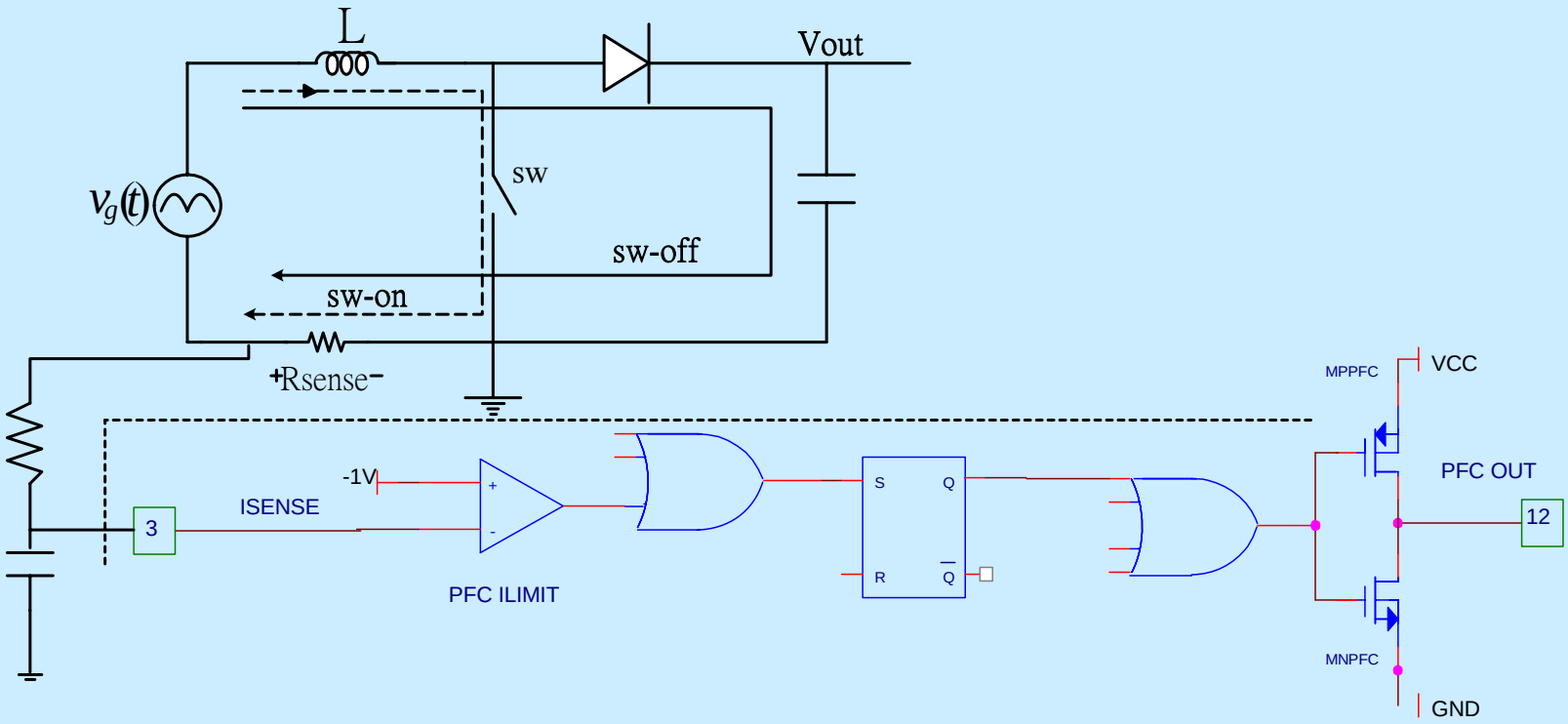
VFB



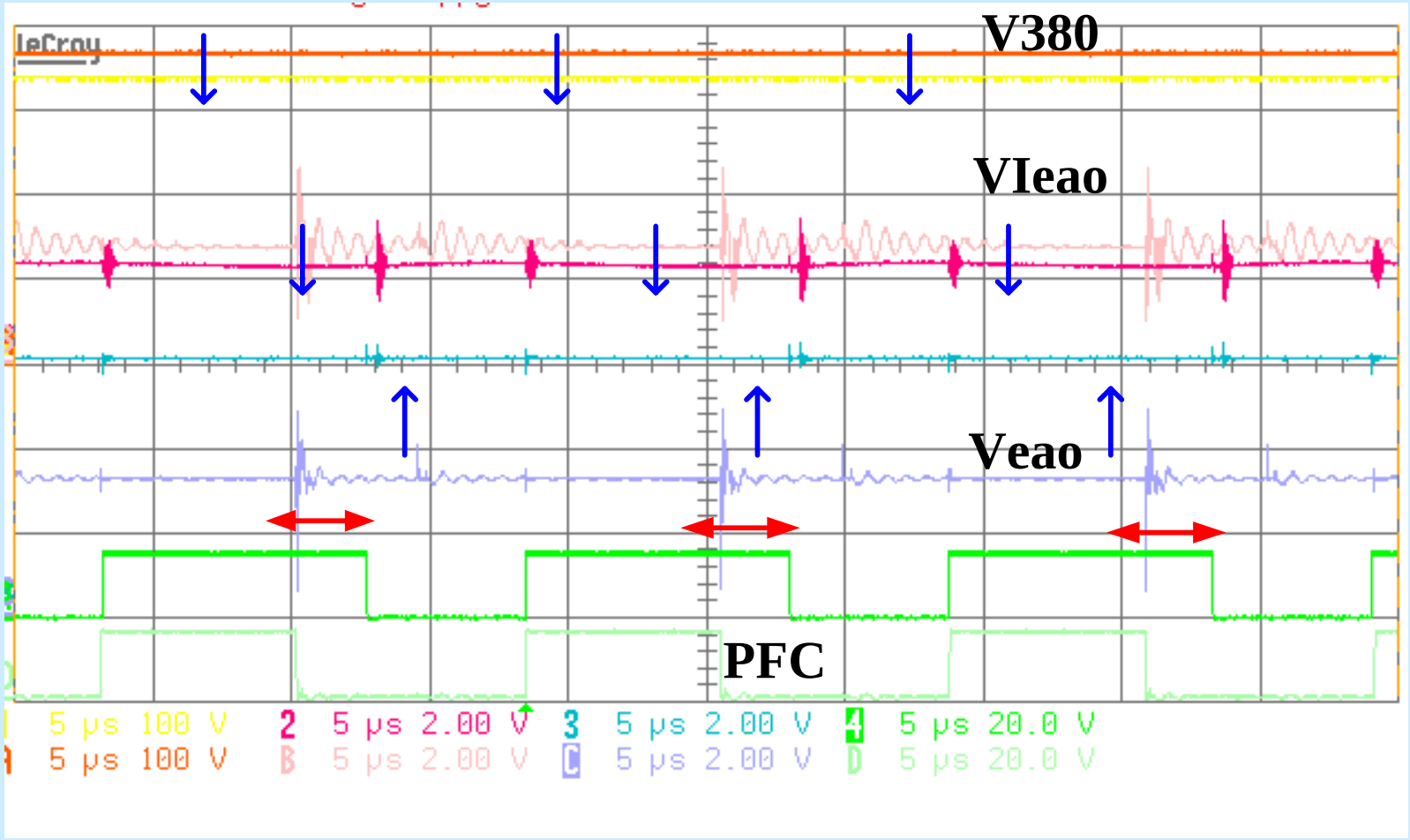
VFB>2.75V PFC turn-off

VFB<2. 5V PWM turn-off

input current limit

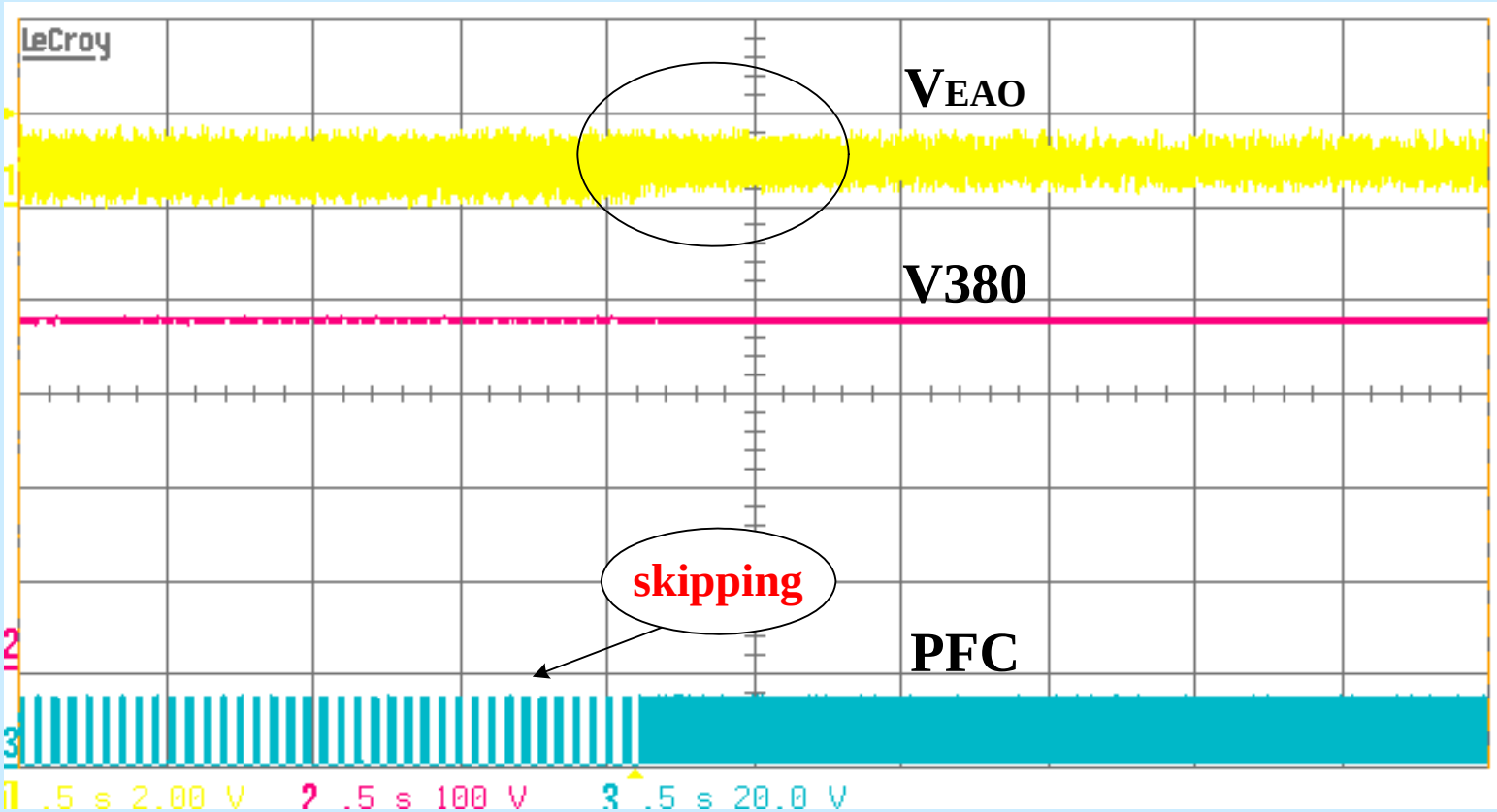


Current waveform



PFC duty cycle by cycle reduce

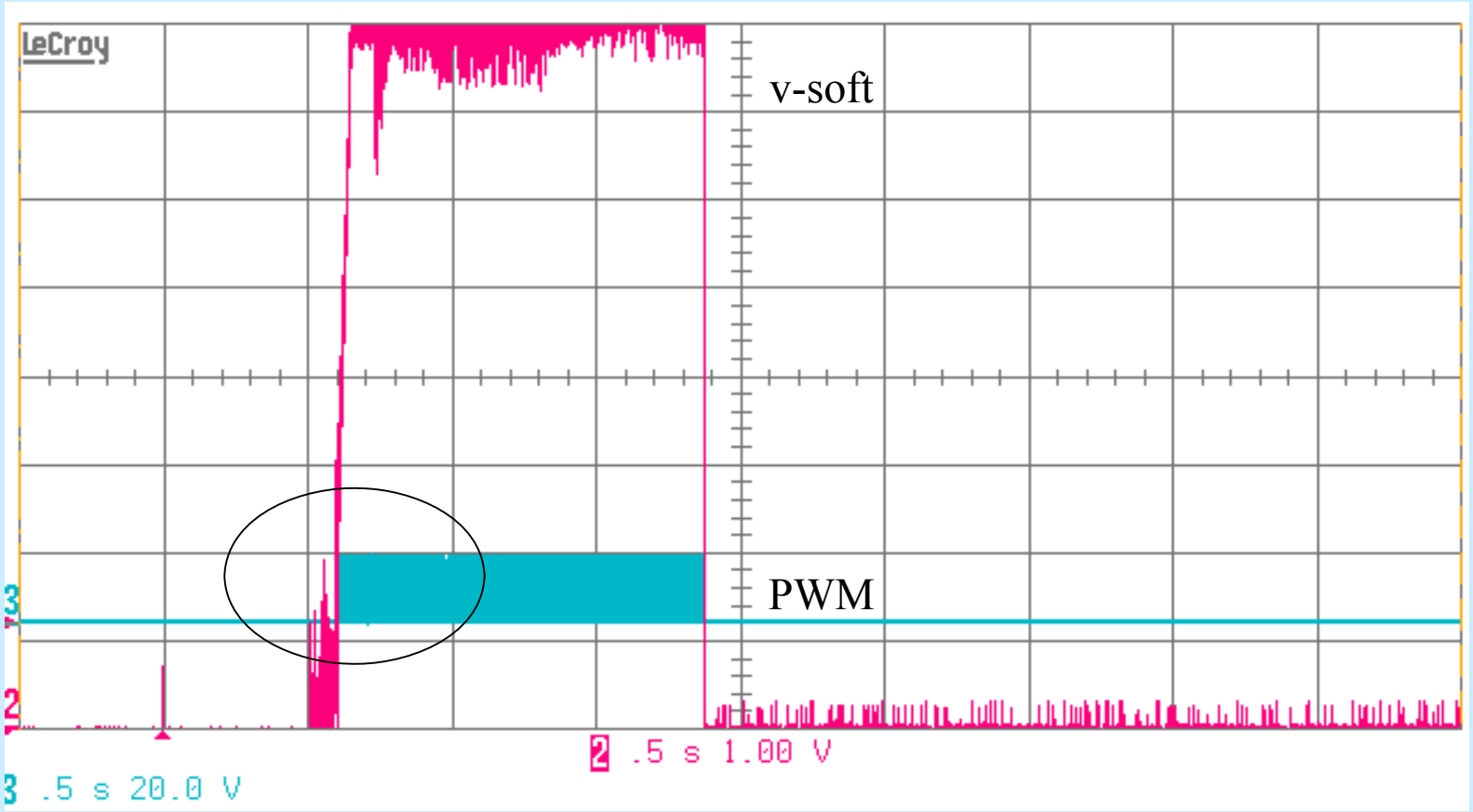
PFC low power detect



VEAO

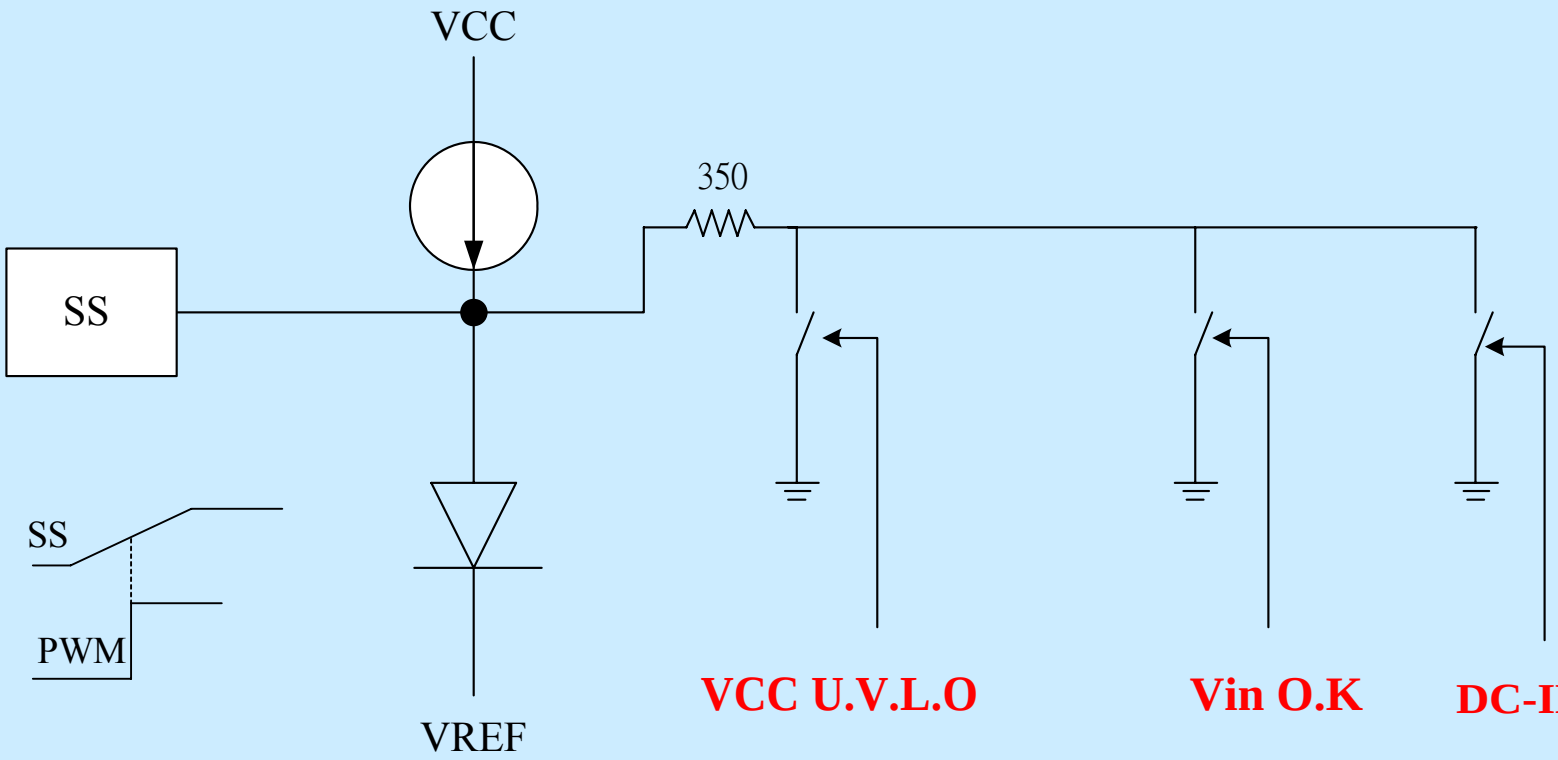
If V_{EAO}<0.3 PFC pulse skipping

PWM turn-on-off

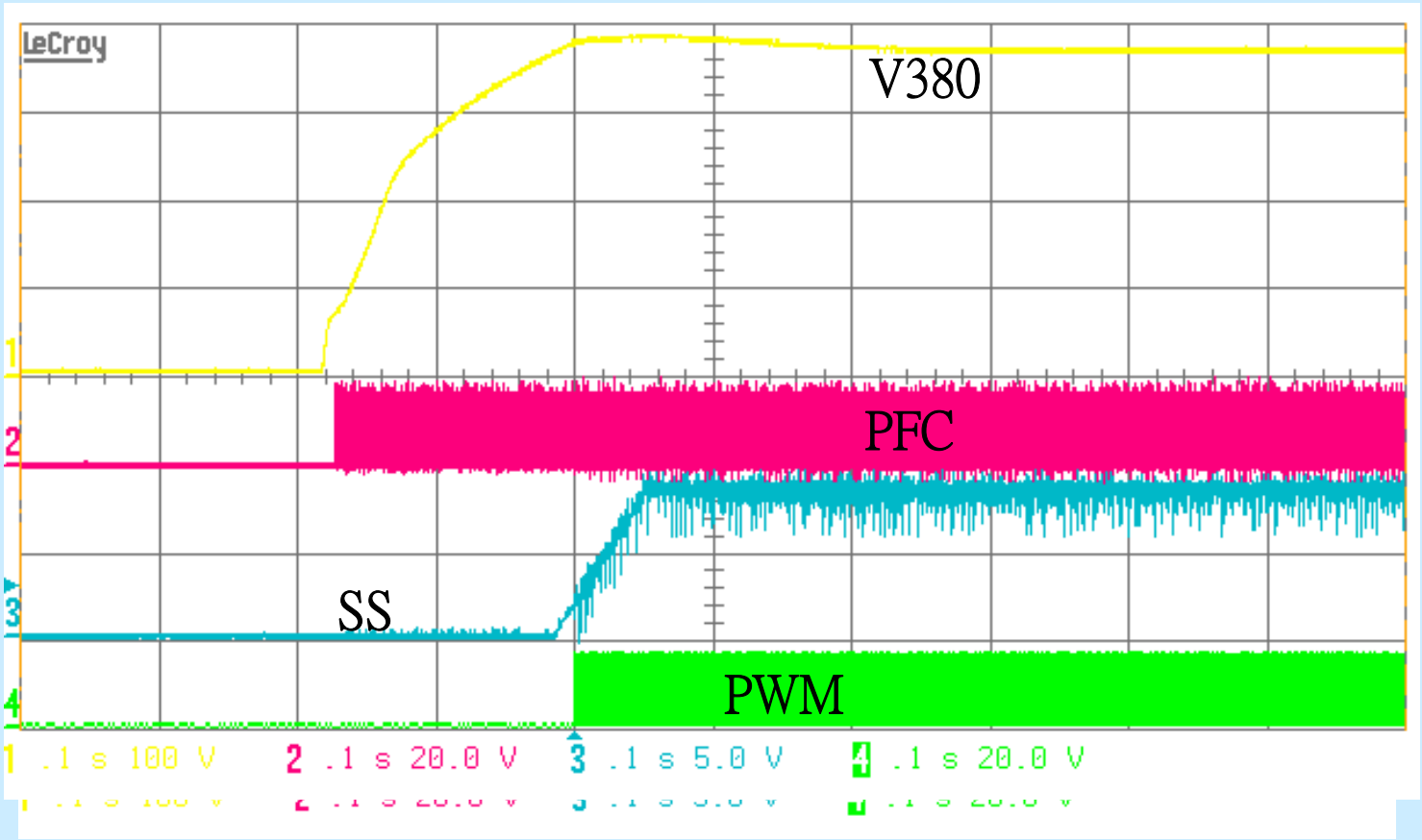


- Vsoft>1.25V→PWM turn-on
- Vsoft<1.25V→PWM turn-off

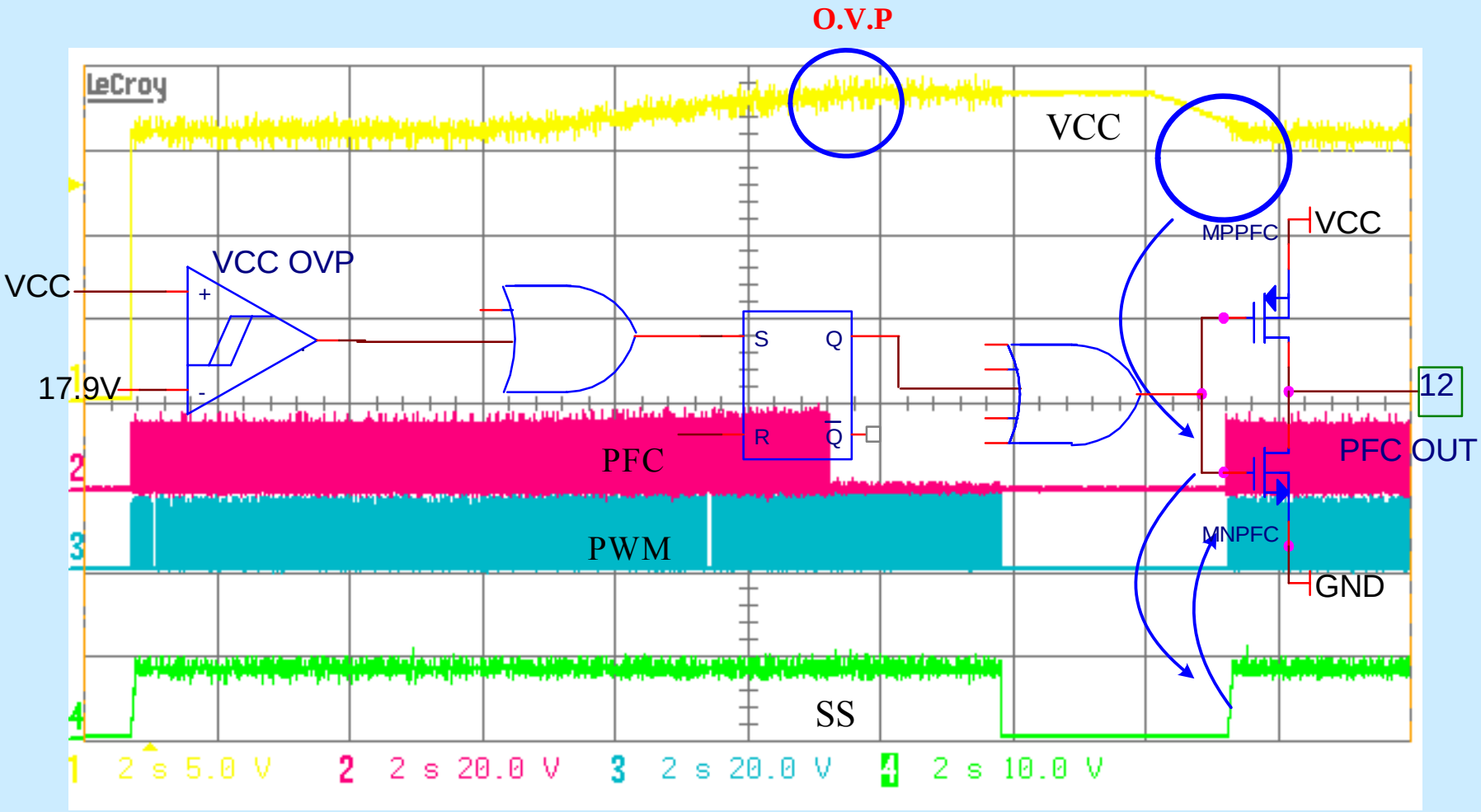
PFC-PWM timing



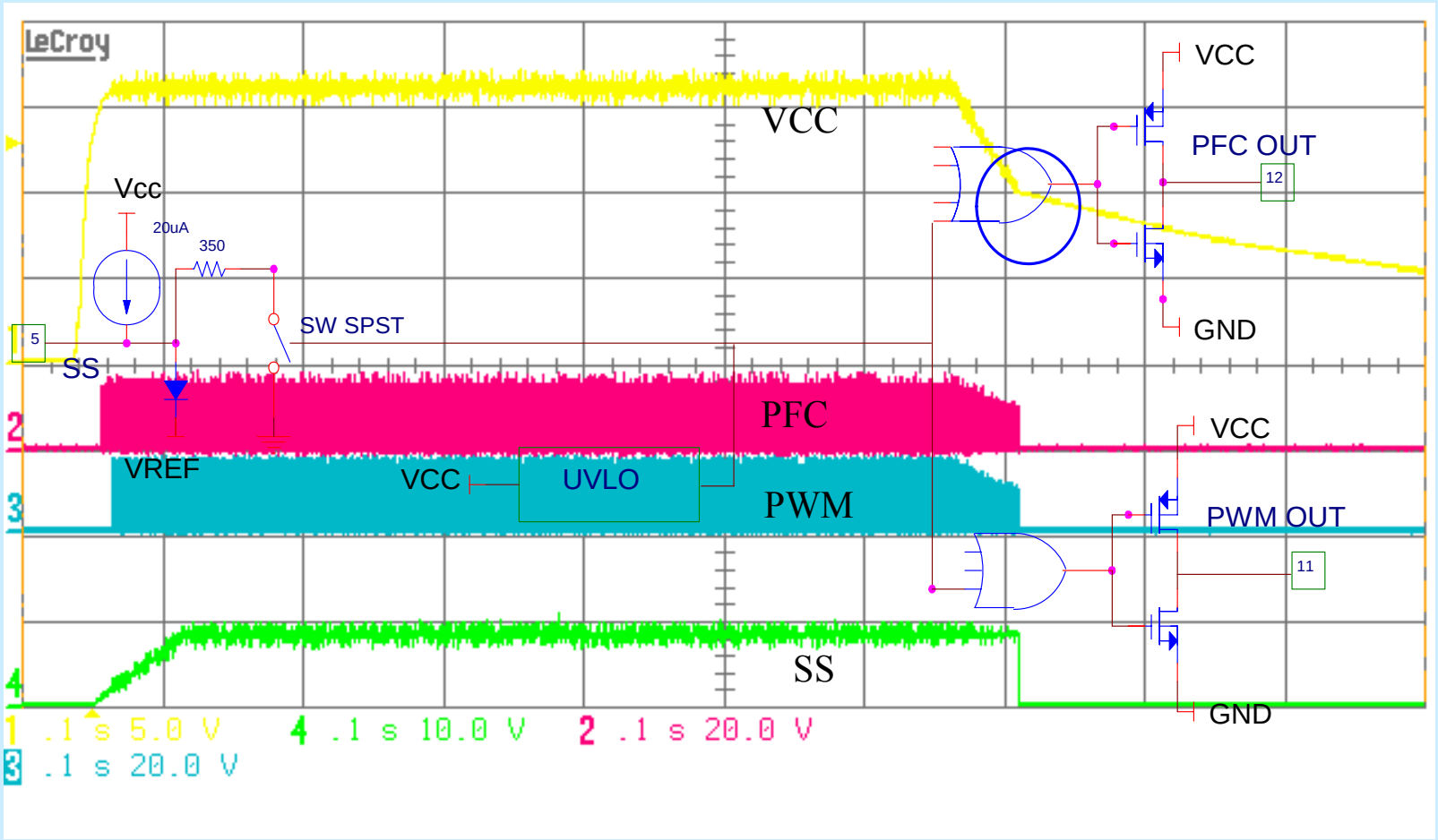
PFC-PWM timing waveform



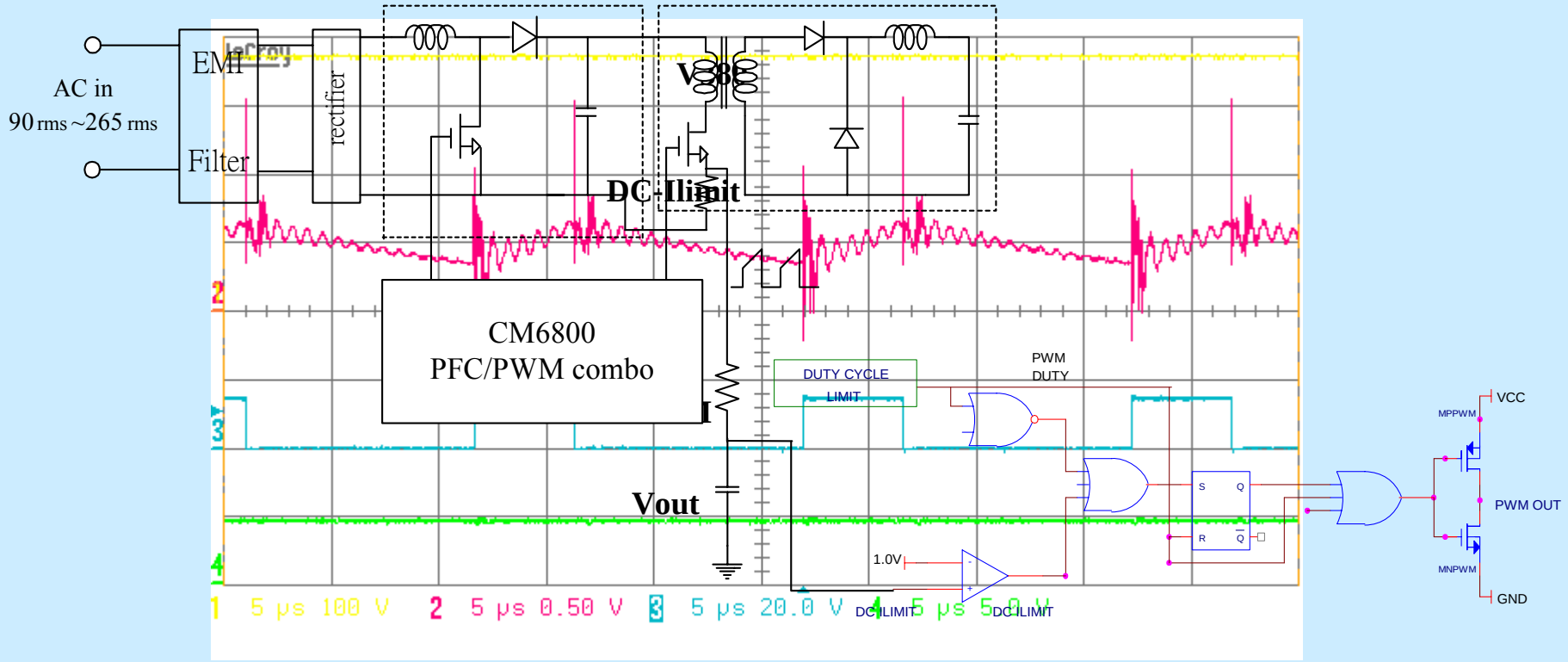
VCC O.V.P


O.V.P
LeCroy
VCC
VCC OVP
VCC
17.9V
+
-
S
Q
R
Q
MPPFC
VCC
12
PFC OUT
PFC
PWM
MNPFC
GND
SS
1 2 s 5.0 V
2 2 s 20.0 V
3 2 s 20.0 V
4 2 s 10.0 V

VCC U.V.L.O

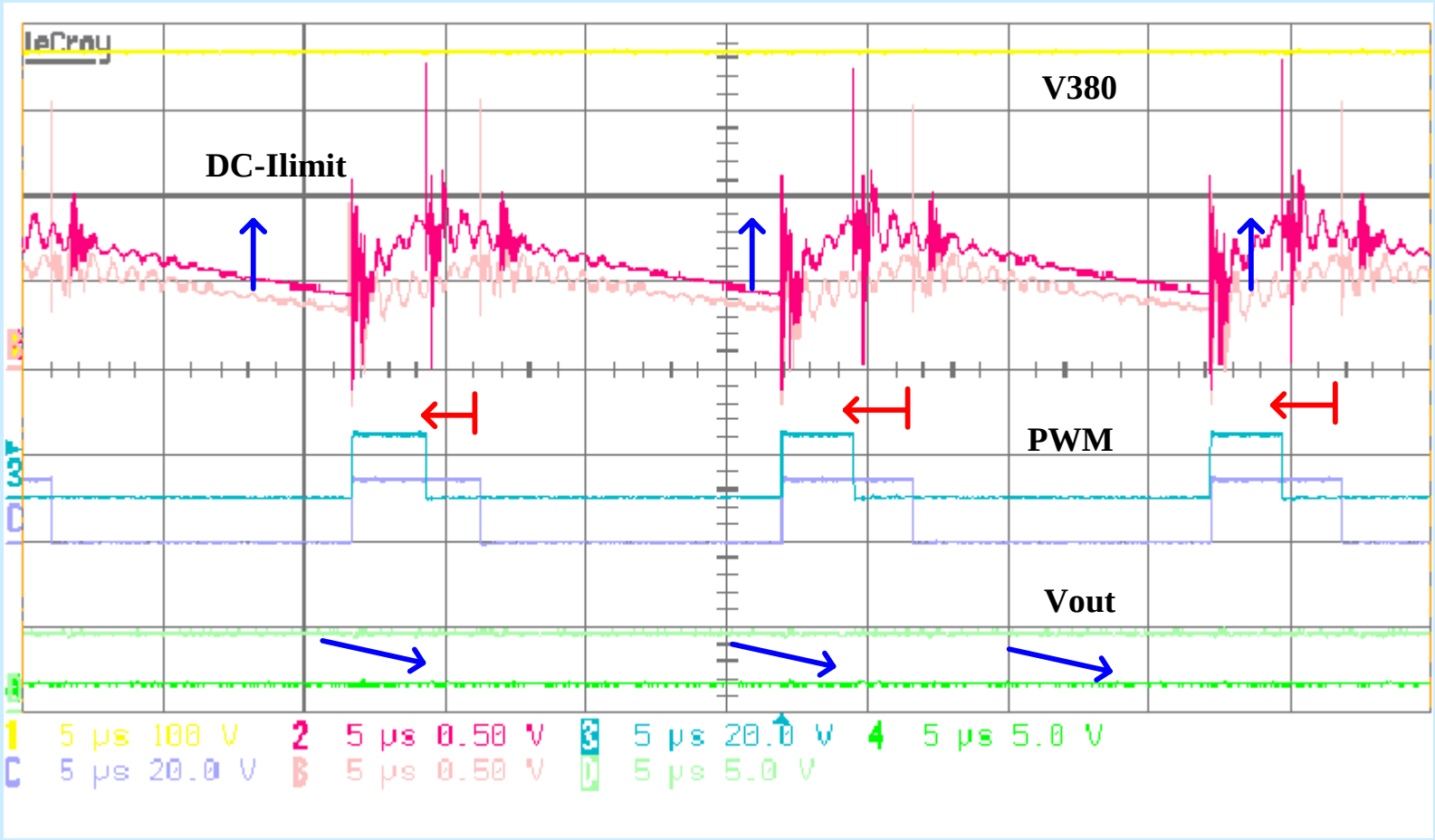

LeCroy
VCC
Vcc
20uA
350
SW SPST
5
SS
PFC
VREF
VCC
UVLO
PWM
SS
VCC
PFC OUT
12
GND
VCC
PWM OUT
11
GND
1 .1 s 5.0 V
4 .1 s 10.0 V
2 .1 s 20.0 V
3 .1 s 20.0 V

PWM current limit



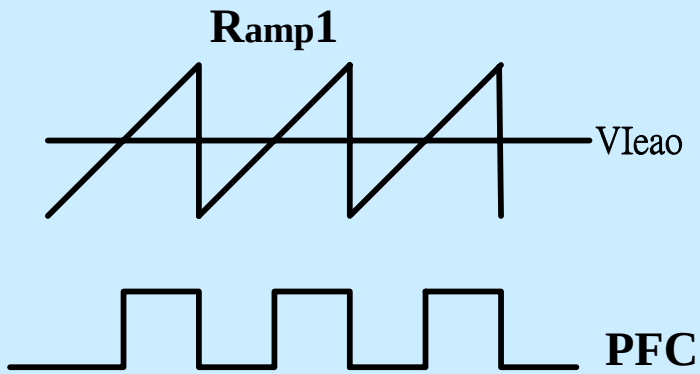
PWM duty cycle by cycle reduce

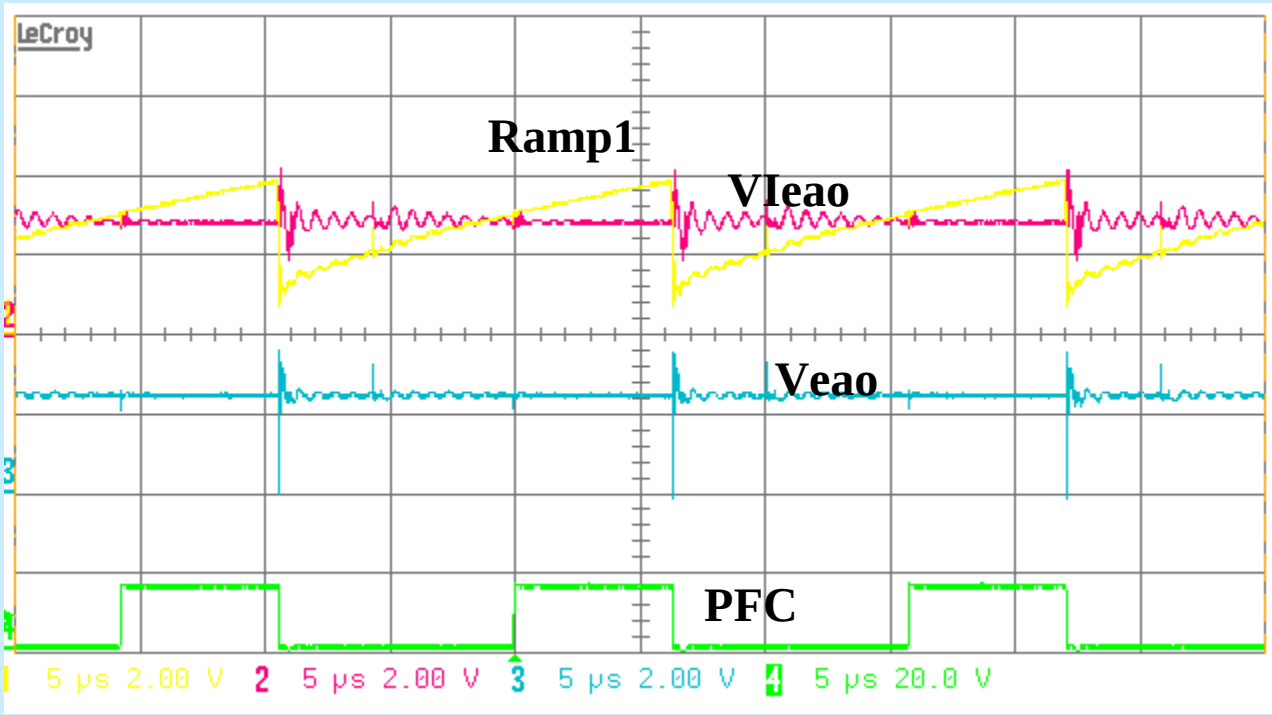
DC-Ilimit current waveform



Waveform discuss

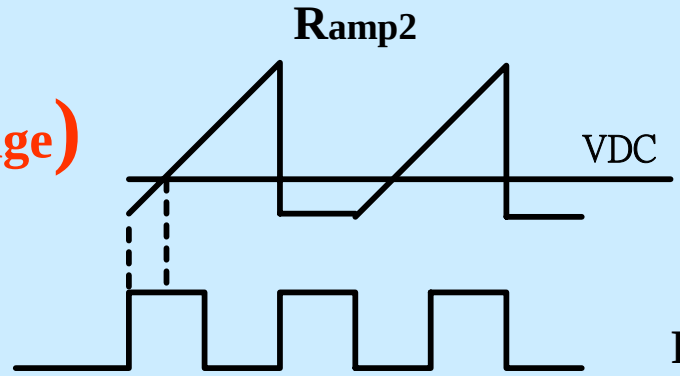
PFC(leading-edge)

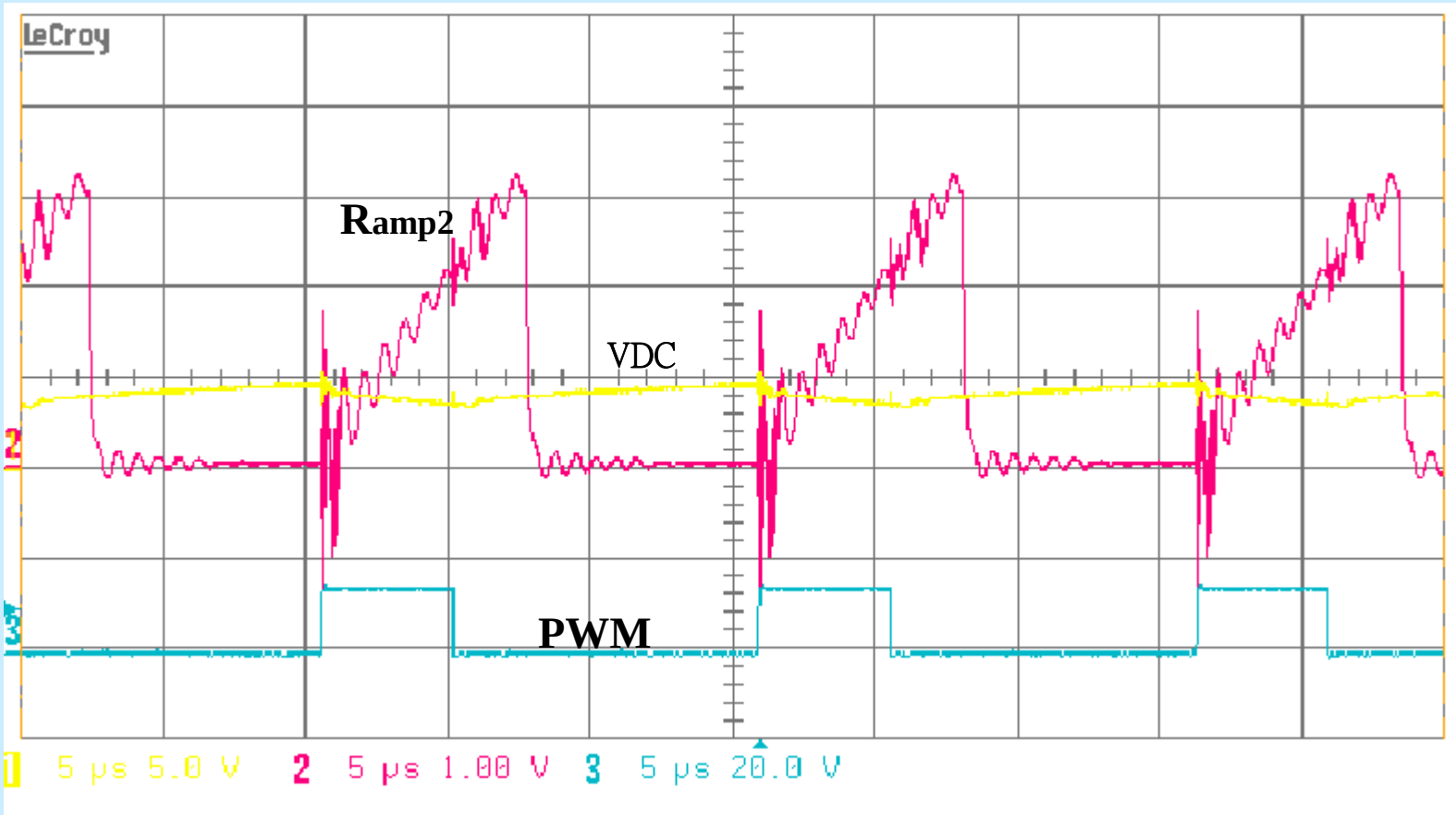




Waveform discuss

PWM(trailing-edge)



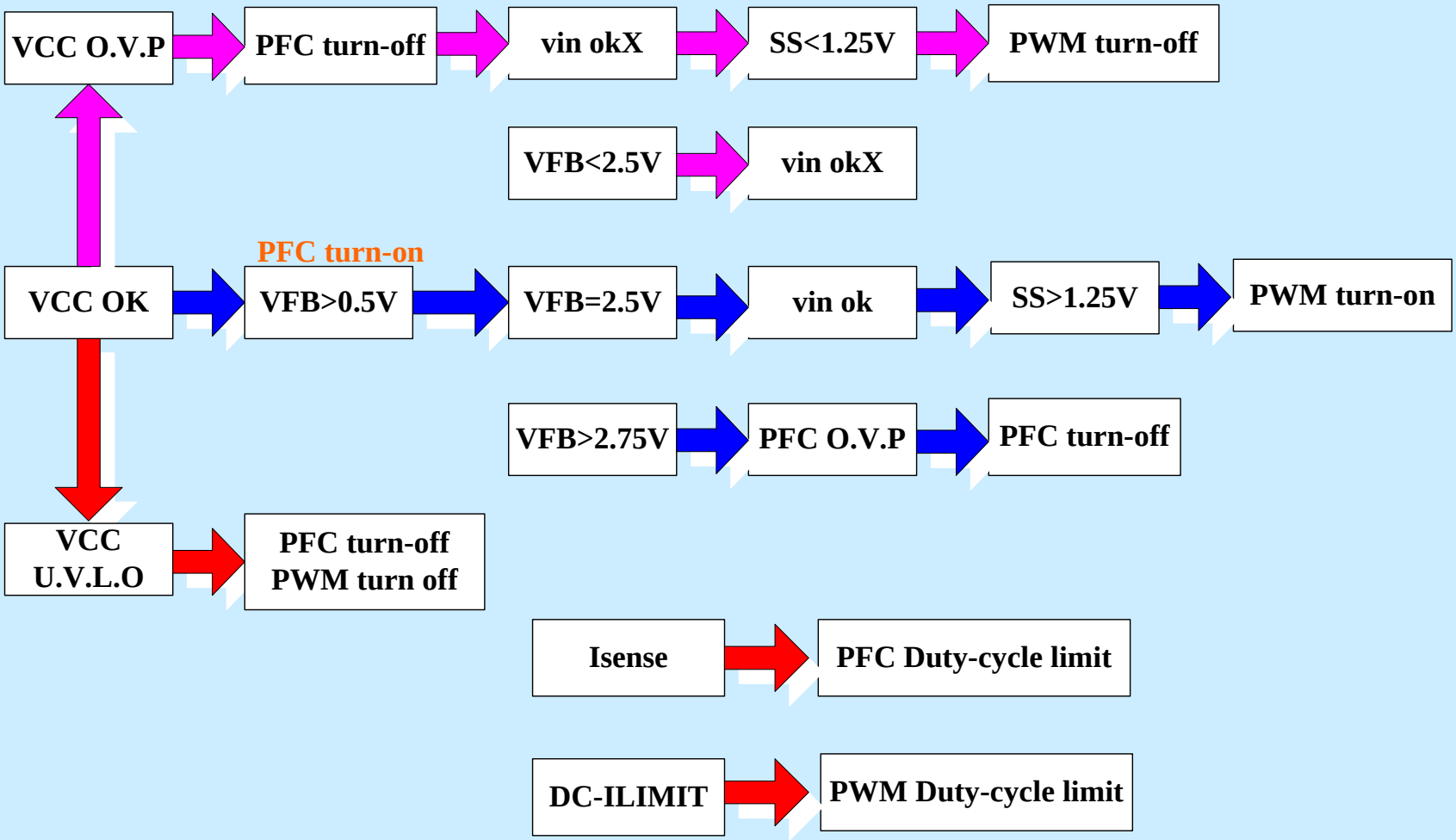


Disable CM6800

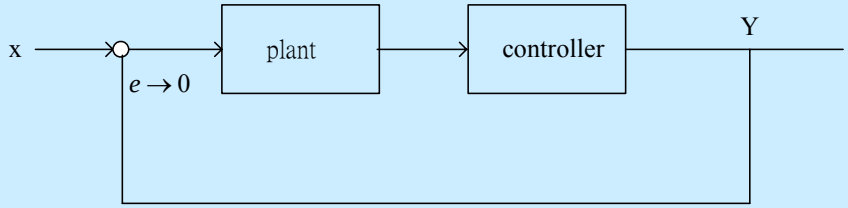
PFC:Veao pull-low

PWM:Soft-start pull-low

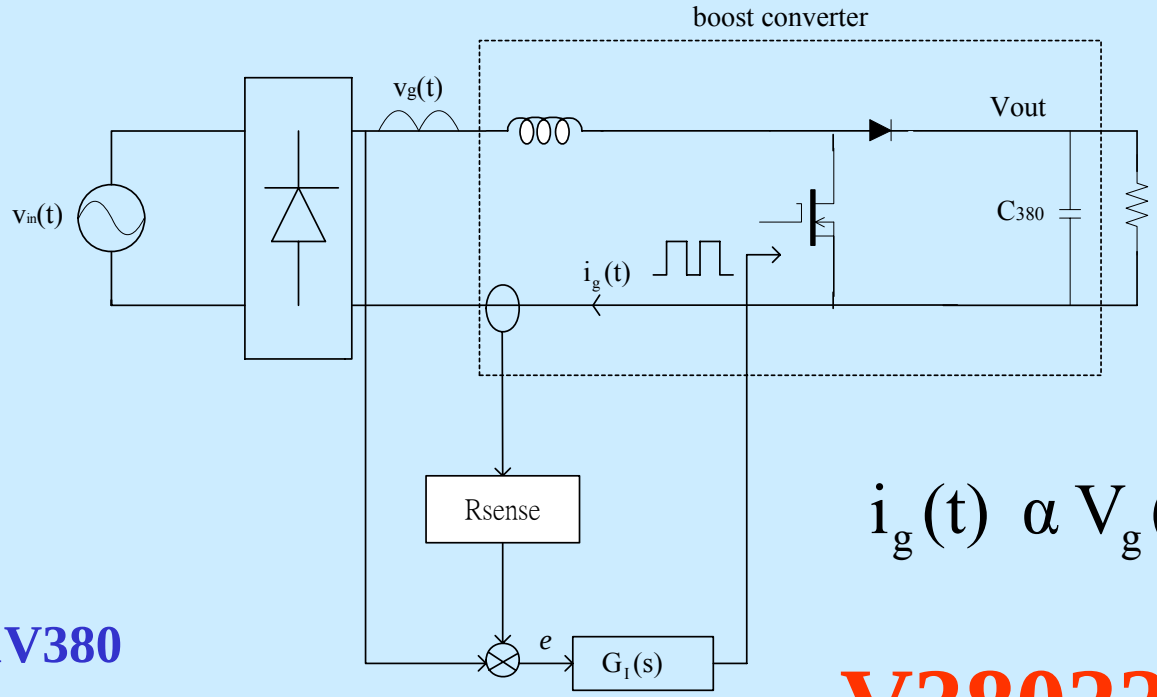
Summary


VCC O.V.P
PFC turn-off
vin okX
SS<1.25V
PWM turn-off
VFB<2.5V
vin okX
PFC turn-on
VCC OK
VFB>0.5V
VFB=2.5V
vin ok
SS>1.25V
PWM turn-on
VFB>2.75V
PFC O.V.P
PFC turn-off
VCC
U.V.L.O
PFC turn-off
PWM turn off
Isense
PFC Duty-cycle limit
DC-ILIMIT
PWM Duty-cycle limit

Control 1



Control 2

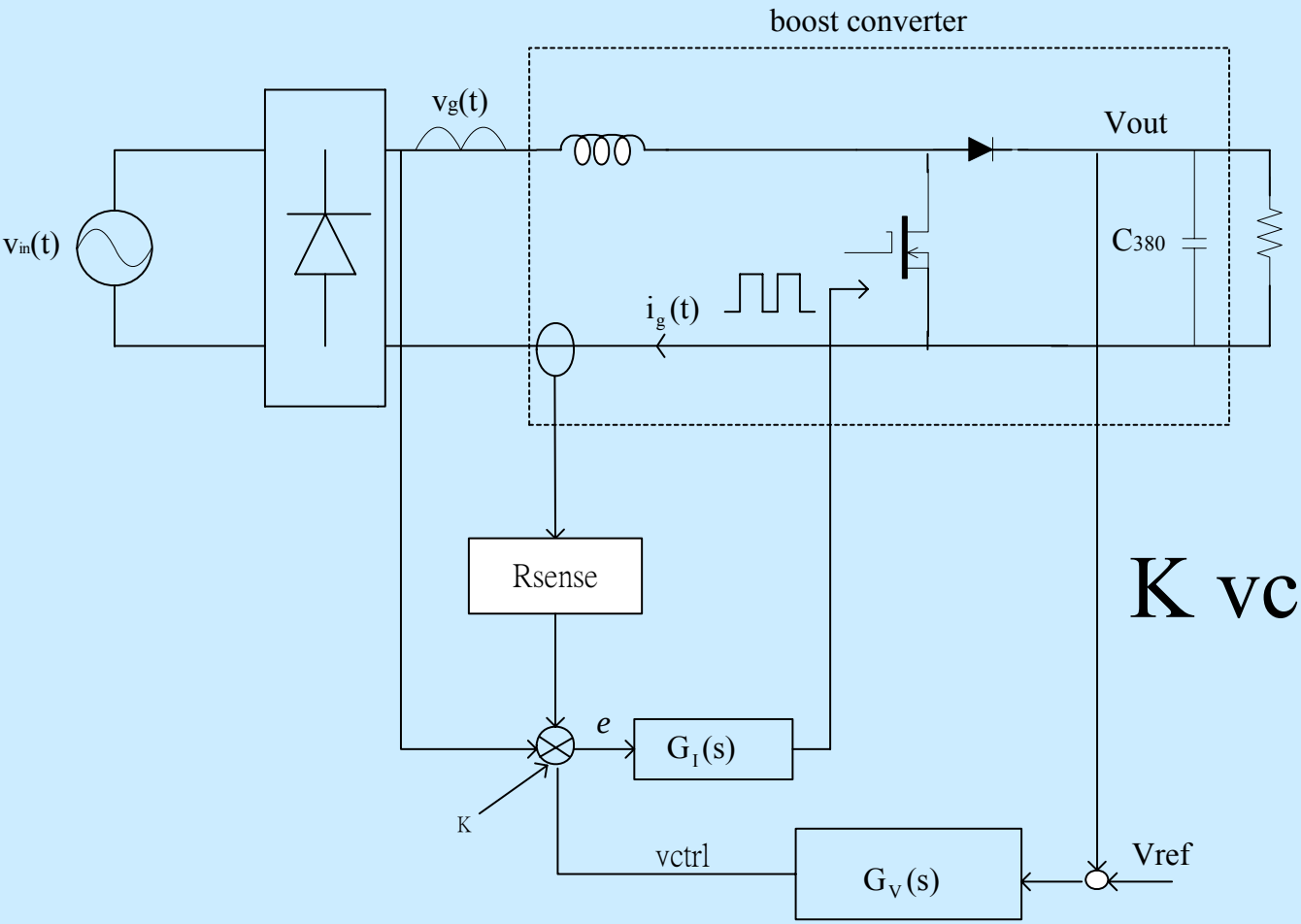


$$i_g(t) \ \alpha \ V_g(t)$$

Goal:P.F&V380

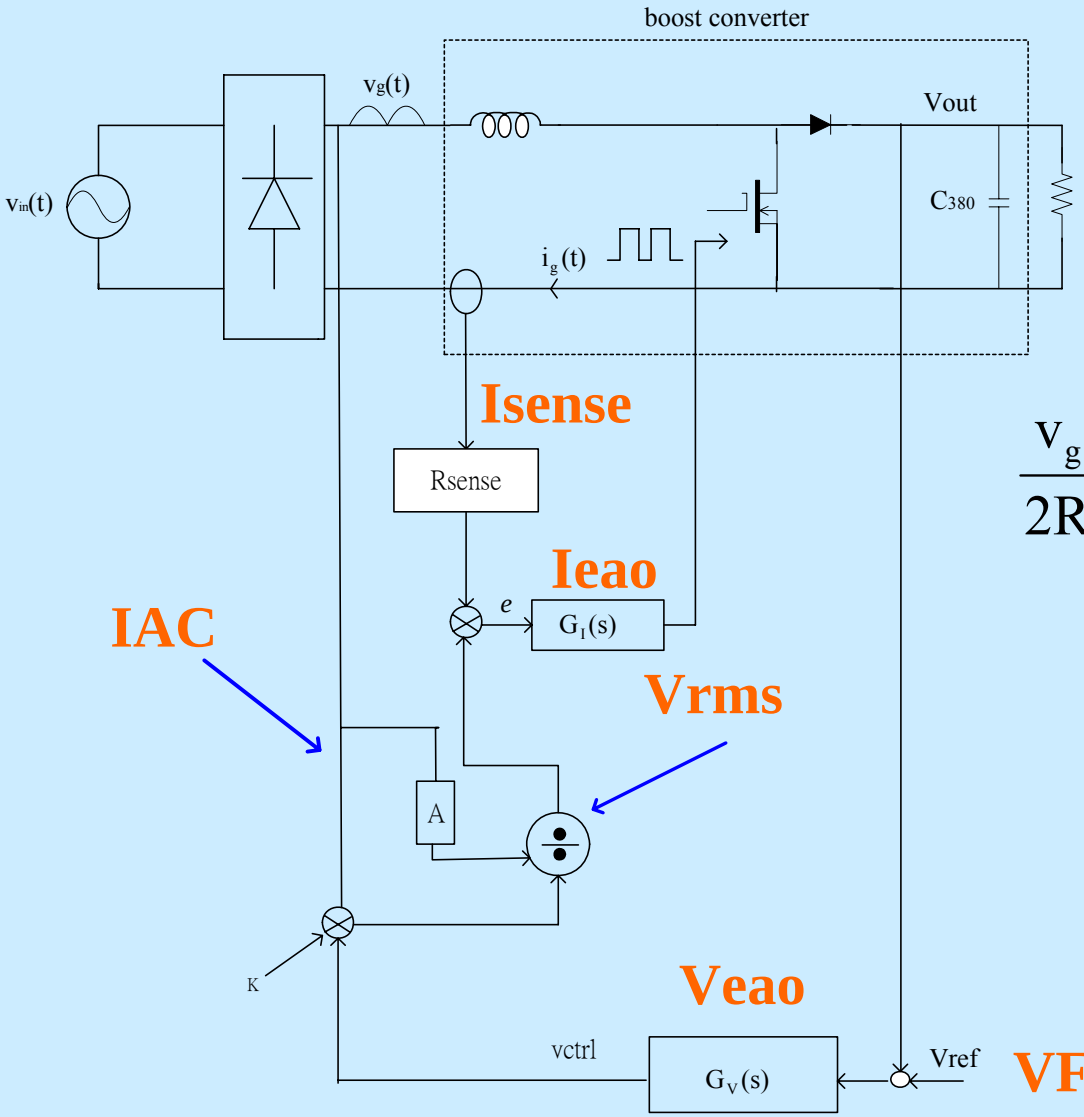
V380???

PFC&regulation



$$K\ vctrl\ v_g(t)\ \alpha\ i_g(t)$$

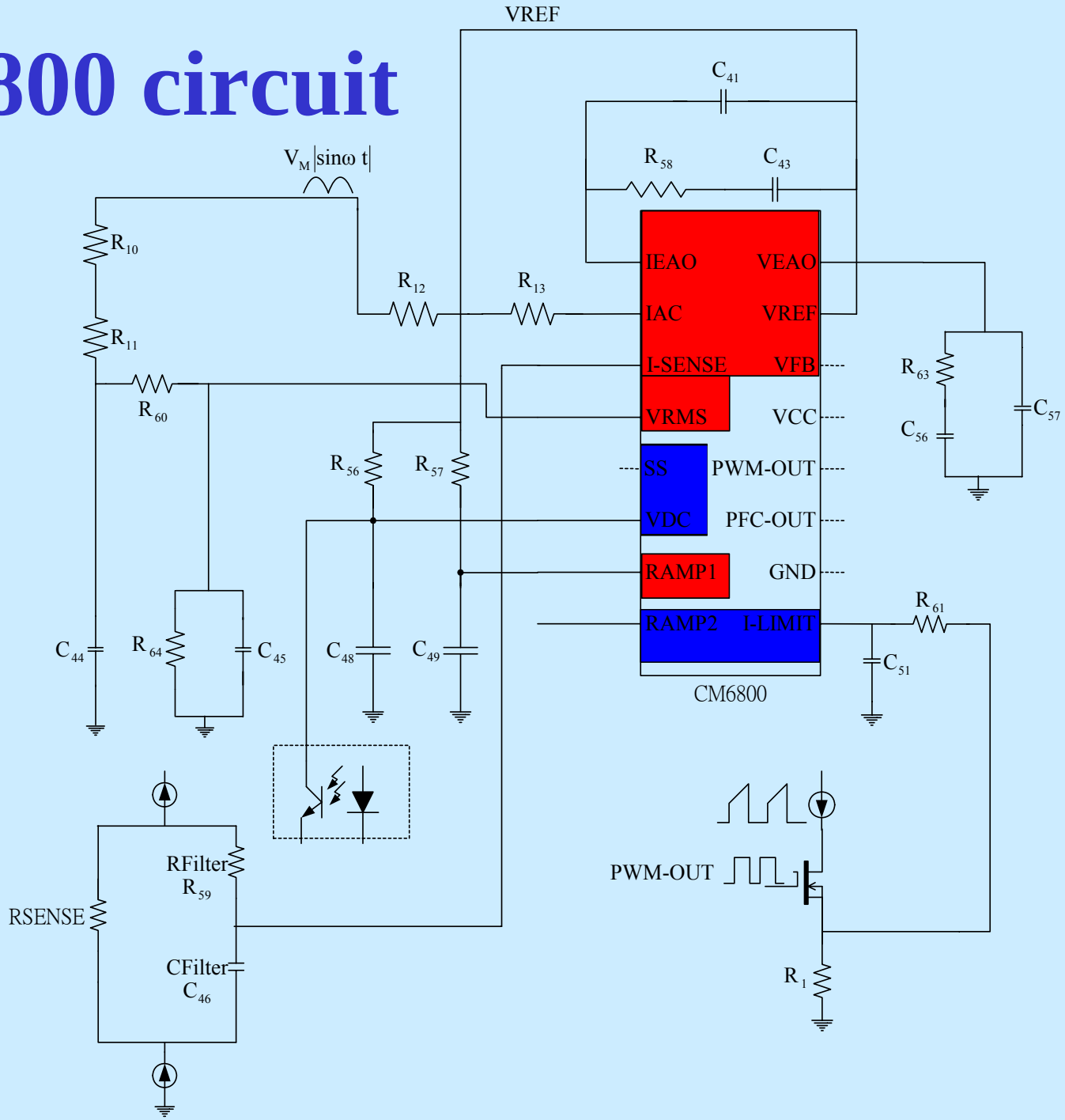
PFC&regulation



$$\frac{v_g^2}{2Re} = \frac{V_{380}^2}{R_L} \xrightarrow{A} \frac{v_g^2}{2ARe} = \frac{V_{380}^2}{R_L}$$

$$A = v_g^2$$

6800 circuit



PFC

PWM

Note

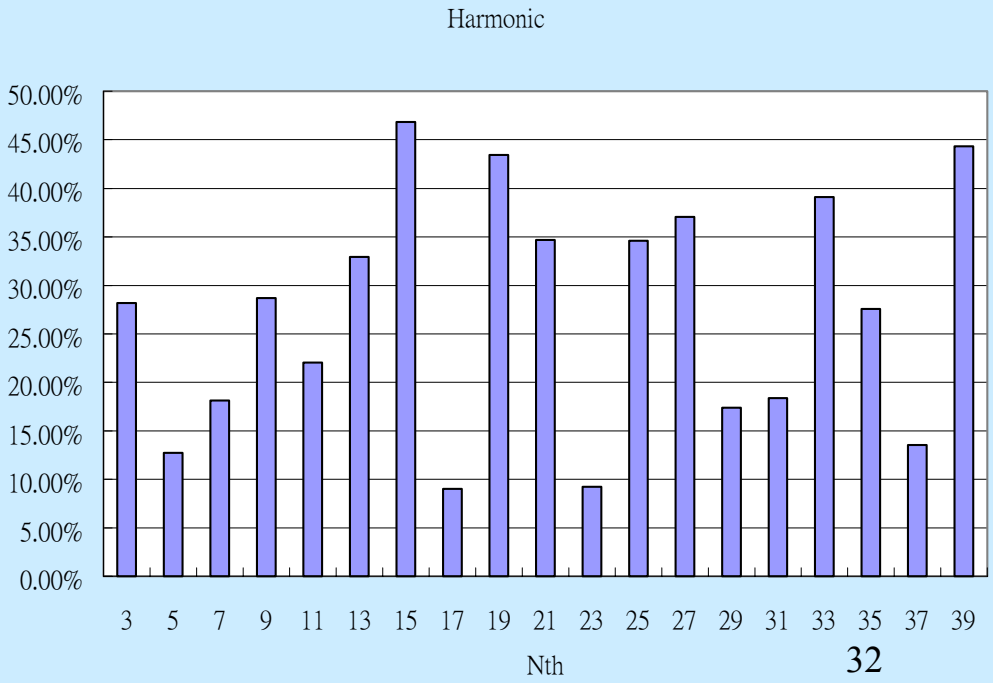
Note:AC to DC

Compensation rule

Reference CM6800 compensation word files

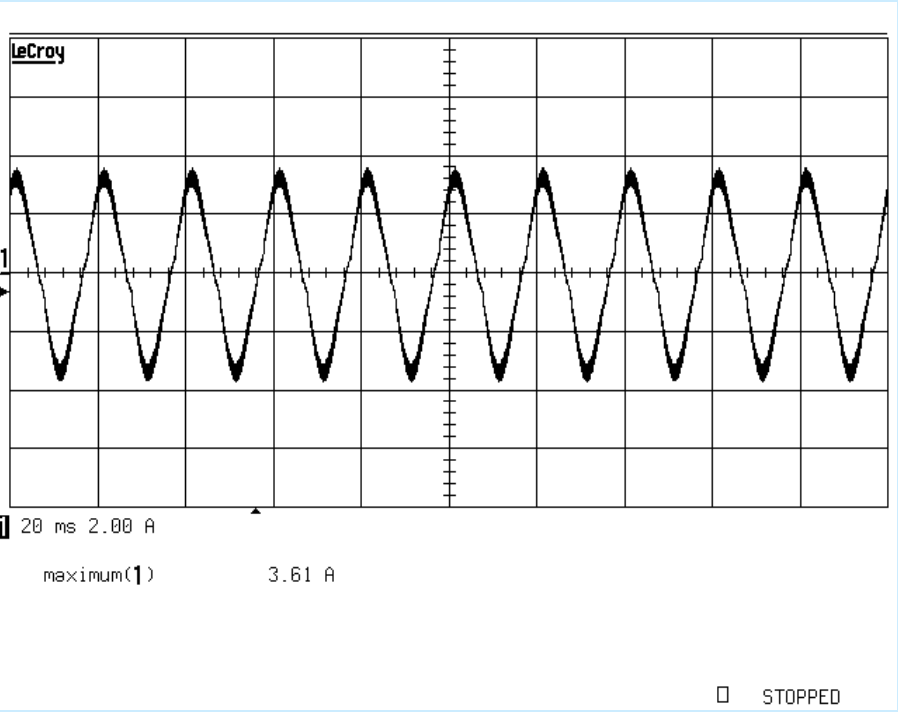
Hamonic

INPUT POWER	W		74.746	
PF	%		0.869	
INPUT AC VOLTAGE	V		230.66	
INPUT CURRENT	A		0.373	
FREQUENCY	Hz		50.061	
+5V LOADING	A			
+12V LOADING	A			
-5V LOADING	A			
-12V LOADING	A			
+3.3V LOADING	A			
+5Vaux LOADING	A			
Po			0	
EFFIENCY			0%	
N	A	READING	SPEC.	%
3	0.254136	0.07146	0.25	28.20%
5	0.142017	0.01806	0.14	12.75%
7	0.074746	0.01351	0.07	18.13%
9	0.037373	0.01069	0.04	28.69%
11	0.026161	0.00575	0.03	22.04%
13	0.022136	0.00727	0.02	32.94%
15	0.019185	0.00896	0.02	46.84%
17	0.016928	0.00152	0.02	9.01%
19	0.015146	0.00656	0.02	43.44%
21	0.013703	0.00474	0.01	34.69%
23	0.012512	0.00115	0.01	9.22%
25	0.011511	0.00397	0.01	34.59%
27	0.010658	0.00394	0.01	37.07%
29	0.009923	0.00172	0.01	17.38%
31	0.009283	0.0017	0.01	18.37%
33	0.00872	0.0034	0.01	39.10%
35	0.008222	0.00226	0.01	27.57%
37	0.007778	0.00105	0.01	13.54%
39	0.007379	0.00326	0.01	44.31%

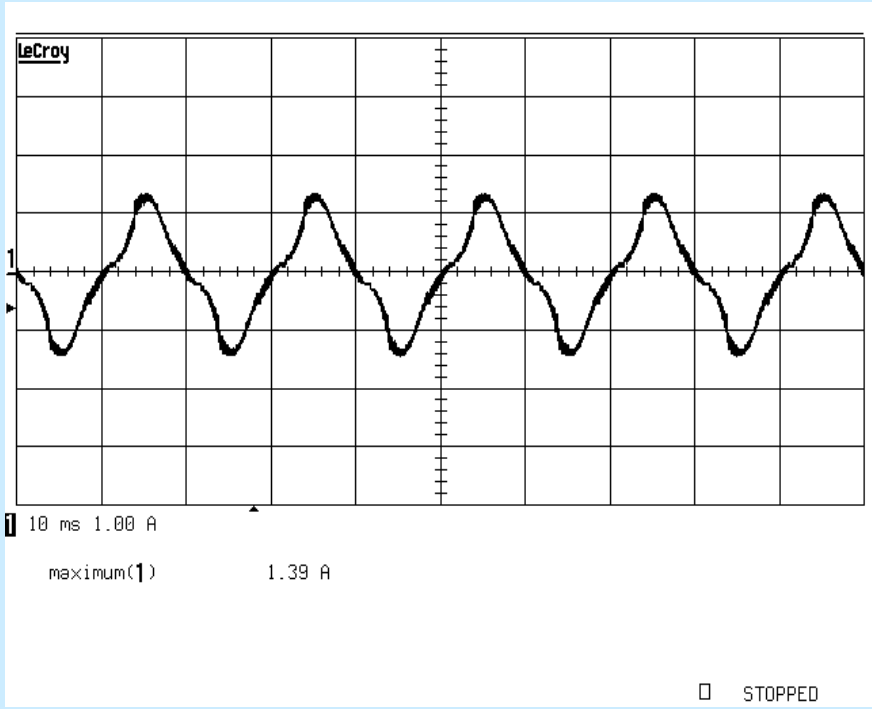


Power factor

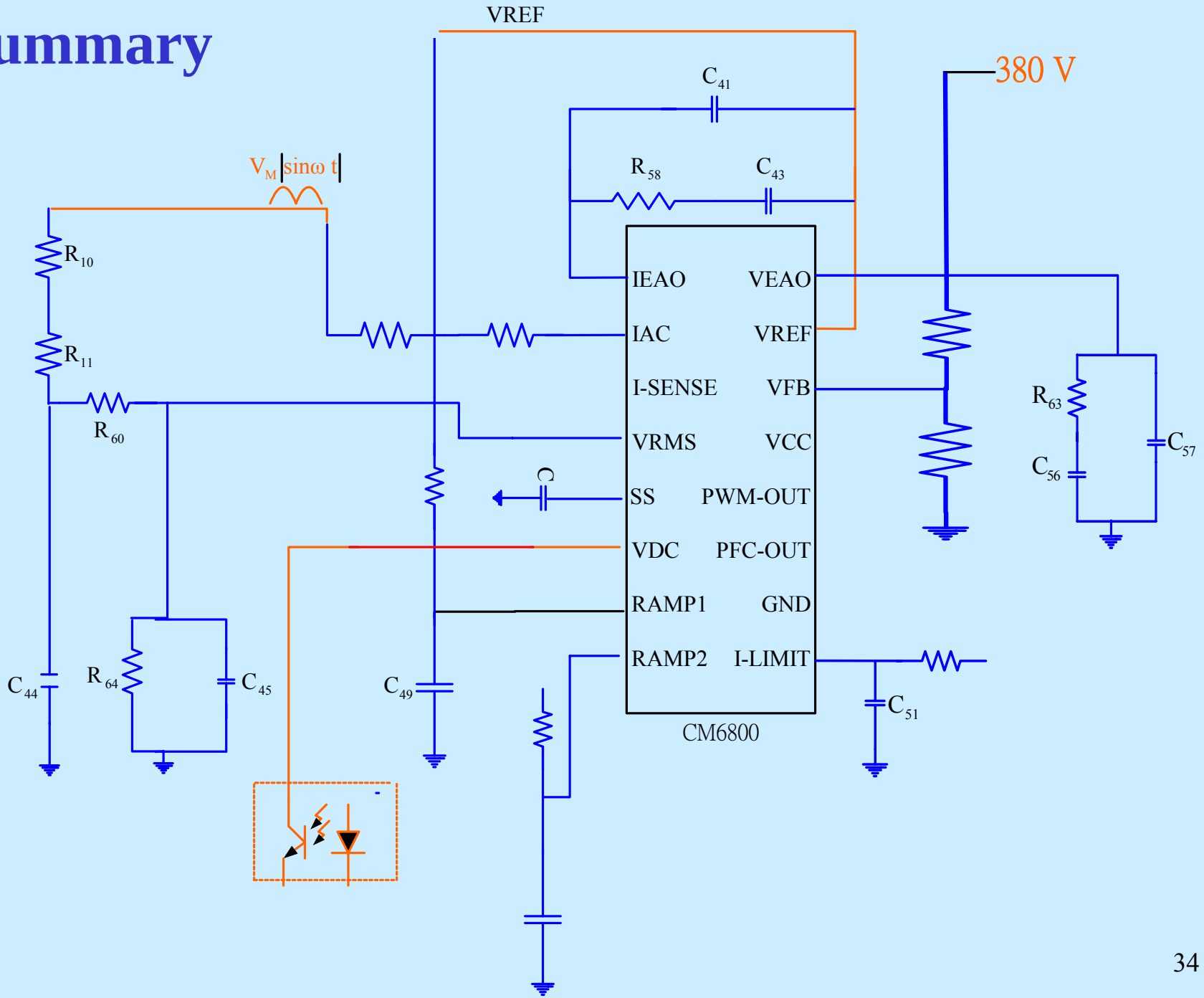
90VAC @ Max3.16A



264VAC @ Max3.16A



Summary


VREF
380 V
C_{41}
R_{58}
C_{43}
$V_M|\sin\omega t|$
R_{10}
R_{11}
R_{60}
IEAO
VEAO
IAC
VREF
I-SENSE
VFB
VRMS
VCC
SS
PWM-OUT
VDC
PFC-OUT
RAMP1
GND
RAMP2
I-LIMIT
CM6800
R_{63}
C_{56}
C_{57}
C_{44}
R_{64}
C_{45}
C_{49}
C_{51}