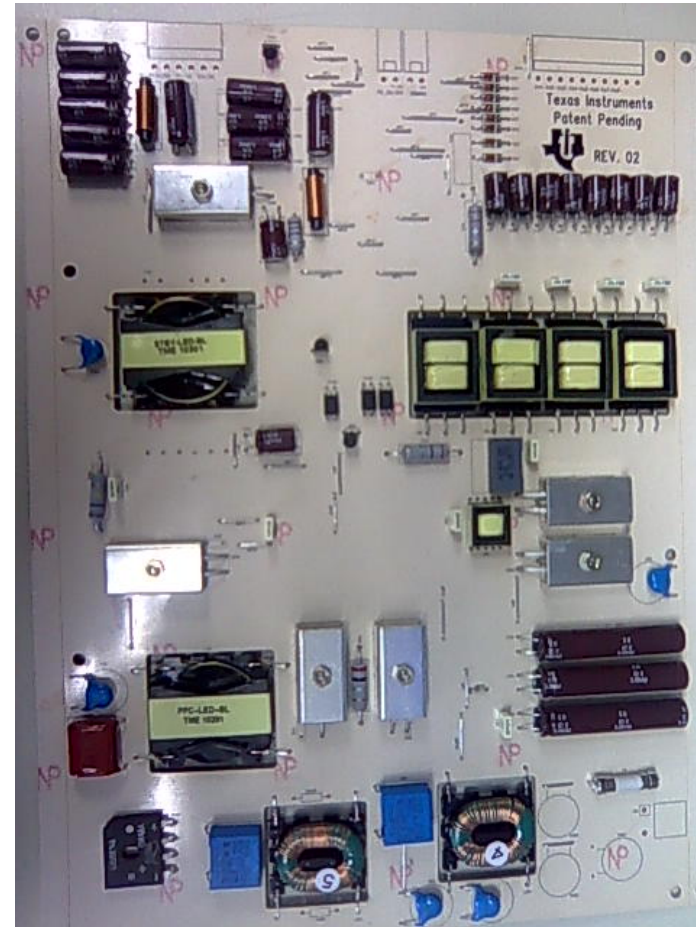


# Performance

## Specification:

- Support to universal 90~264Vac range
- LED 8 outputs @120mA, 70V~88V, 5Vsb@1A, 5V@4A, 12V@3A
- Eff 86.1%@90Vac, 89.6%@264Vac
- Secondary side 160Hz blanking control for dimming
- 8mm height and 6mm height for LED magnetic components
- Board dimension 300mm(L) \* 210mm(W) \* 8mm(H)
- LED output common + and LED OVP and UVP



# Cross Regulation

Cross Regulation					
Load Condition			Output Voltage		
5Vsb	5V	12V	5Vsb	5V	12V
20mA	0.5A	0.1A	4.88V	4.88V	13.74V
20mA	0.5A	3A	4.88V	4.88V	11.46V
20mA	4A	0.1A	4.86V	4.84V	13.75V
20mA	4A	3A	4.85V	4.83V	12.5V
1A	0.5A	0.1A	4.87V	4.87V	13.75V
1A	0.5A	3A	4.87V	4.87V	12.05V
1A	4A	0.1A	4.84V	4.83V	13.75V
1A	4A	3A	4.84V	4.83V	12.64V

# LED Current

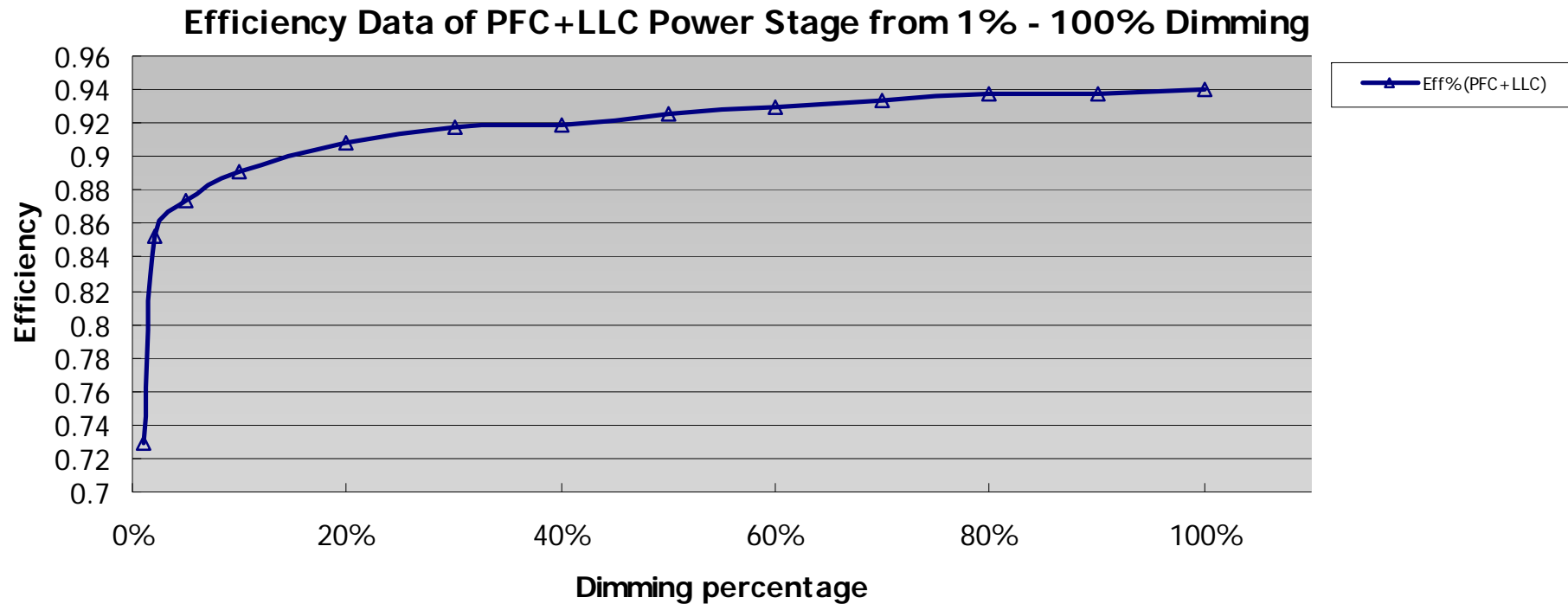
	LED1	LED2	LED3	LED4	LED5	LED6	LED7	LED8	AVG
Voltage	83.6	84.4	85.8	84.2	84.2	80.3	80.6	84.7	
100%	122.11	122.04	121.92	122.02	125.55	125.52	123.12	123.09	123.171
90%	109.52	109.44	109.88	109.63	112.86	112.96	110.14	110.12	110.569
80%	97.01	96.93	97.54	97.37	100.18	100.36	97.37	97.41	98.0213
70%	84.63	84.47	85.05	85.19	87.45	87.66	84.6	84.52	85.4463
60%	72.17	72.11	72.66	73.03	74.98	75.08	71.78	71.62	72.9288
50%	59.81	59.68	60.47	61.18	62.37	62.38	59.81	59.81	60.6888
40%	47.48	47.44	48.18	48.86	49.56	49.55	47.24	47.26	48.1963
30%	36.19	36.02	35.92	36.45	37.17	37.21	36.82	36.82	36.575
20%	23.92	23.75	23.58	23.86	24.3	24.4	23.85	23.84	23.9375
10%	10.77	10.82	10.77	11.18	11.3	11.38	11.21	11.24	11.0838
5%	4.92	4.94	5.04	5.03	5.11	5.08	4.84	4.84	4.975
2%	1.78	1.77	1.77	1.77	1.82	1.82	1.78	1.78	1.78625
1%	0.66	0.66	0.65	0.65	0.67	0.67	0.64	0.64	0.655

# LED Current Tolerance

	Tolerance1	Tolerance2	Tolerance3	Tolerance4	Tolerance5	Tolerance6	Tolerance7	Tolerance8
100%	-0.8616 %	-0.9184 %	-1.0159 %	-0.9347 %	1.93125 %	1.9069 %	-0.0416 %	-0.06597 %
90%	-0.9485 %	-1.0209 %	-0.6229 %	-0.849 %	2.07224 %	2.16268 %	-0.3878 %	-0.40586 %
80%	-1.0317 %	-1.1133 %	-0.491 %	-0.6644 %	2.20233 %	2.38596 %	-0.6644 %	-0.62359 %
70%	-0.9553 %	-1.1425 %	-0.4637 %	-0.2999 %	2.34504 %	2.59081 %	-0.9904 %	-1.08401 %
60%	-1.0404 %	-1.1227 %	-0.3685 %	0.13883 %	2.81268 %	2.9498 %	-1.5752 %	-1.79456 %
50%	-1.448 %	-1.6622 %	-0.3604 %	0.80946 %	2.77028 %	2.78676 %	-1.448 %	-1.44796 %
40%	-1.4861 %	-1.5691 %	-0.0337 %	1.37718 %	2.82958 %	2.80883 %	-1.9841 %	-1.94258 %
30%	-1.0526 %	-1.5174 %	-1.7908 %	-0.3418 %	1.62679 %	1.73616 %	0.66986 %	0.669856 %
20%	-0.0731 %	-0.7833 %	-1.4935 %	-0.3238 %	1.51436 %	1.93211 %	-0.3655 %	-0.40731 %
10%	-2.8307 %	-2.3796 %	-2.8307 %	0.86839 %	1.95105 %	2.67283 %	1.13905 %	1.409721 %
5%	-1.1055 %	-0.7035 %	1.30653 %	1.10553 %	2.71357 %	2.11055 %	-2.7136 %	-2.71357 %
2%	-0.3499 %	-0.9097 %	-0.9097 %	-0.9097 %	1.88943 %	1.88943 %	-0.3499 %	-0.3499 %
1%	0.76336 %	0.76336 %	-0.7634 %	-0.7634 %	2.29008 %	2.29008 %	-2.2901 %	-2.29008 %

Inductance tolerance 3% might cause current tolerance 1%

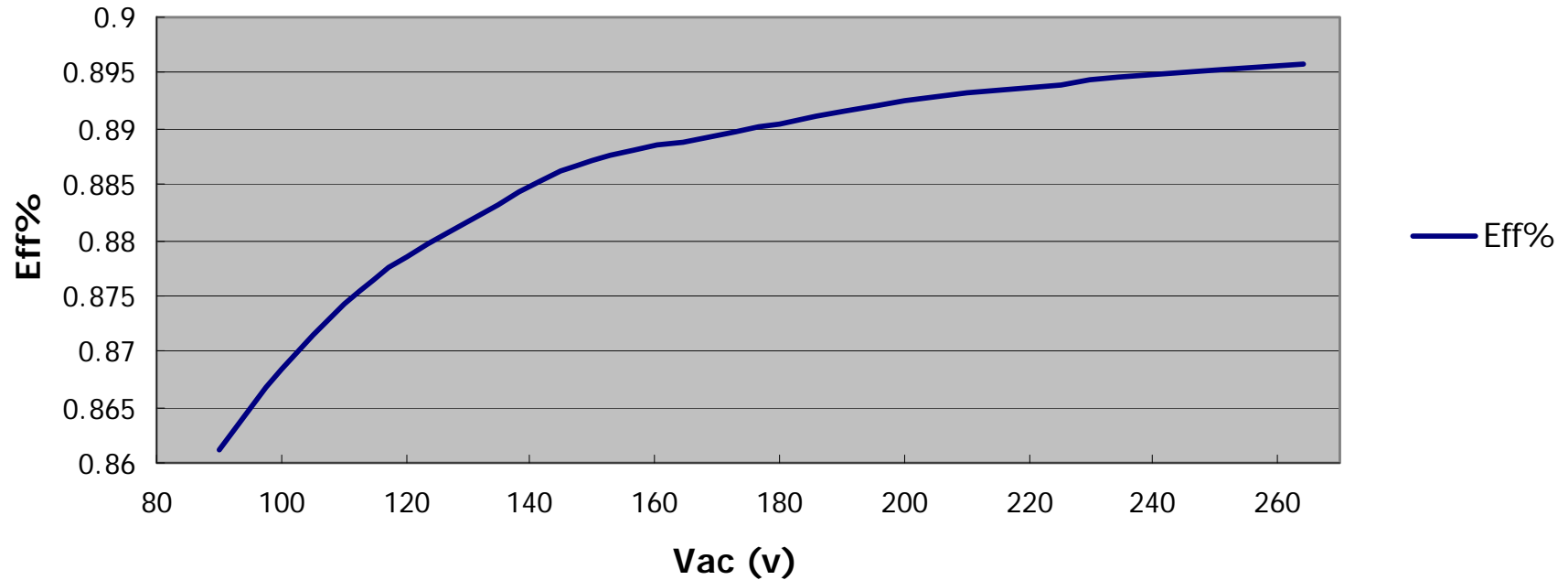
# LLC Efficiency



Efficiency exclude Stby Power Converter at full load condition ~ 94%

# Efficiency

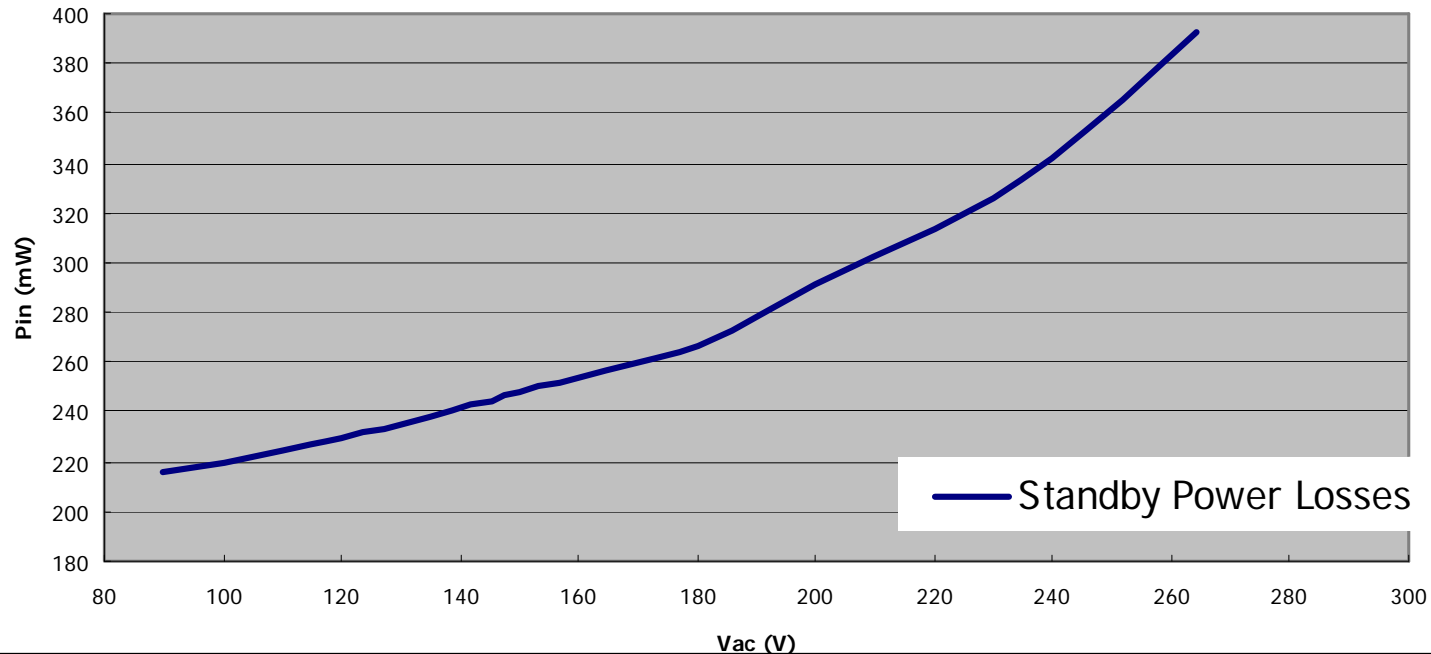
Efficiency Curve of 150Watt LED TV Back Light Reference Design



Vin	90	100	110	120	135	150	180	200	220	240	264
Pin	167.6	166.2	165.1	164.3	163.4	162.7	162.1	161.7	161.5	161.3	161.1
Eff	0.86112	0.86837	0.87416	0.87841	0.88325	0.88705	0.89033	0.89254	0.89364	0.89475	0.89586

# Standby Mode Power Consumption Performance – @5V/ 0.02A

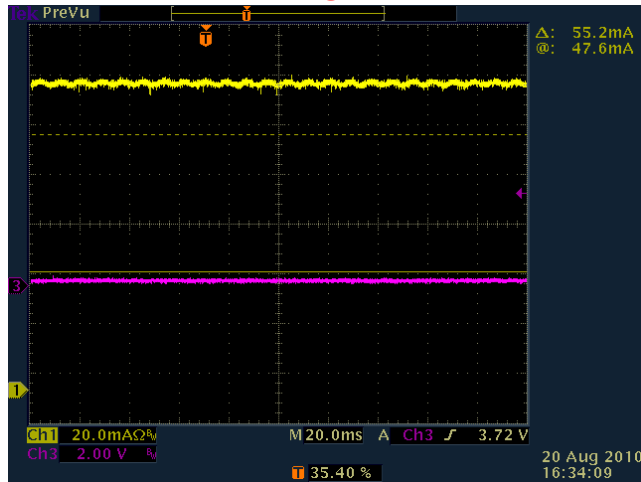
Standby Power Losses at 5V/0.02A with universal AC input



STBY power 5Vsb 0.02A											
Vin	90V	100V	110V	120V	135V	150V	180V	200V	220V	240V	264V
Pin	216mW	219mW	224mW	229mW	238mW	248mW	267mW	291mW	313mW	342mW	393mW

# Dimming Waveforms

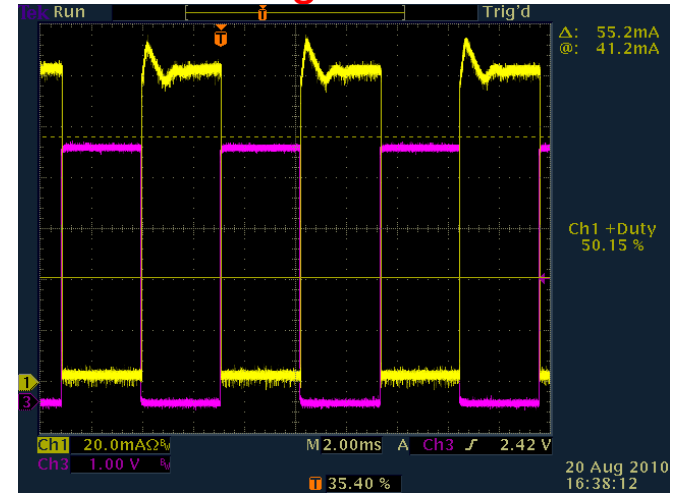
## 100% Dimming



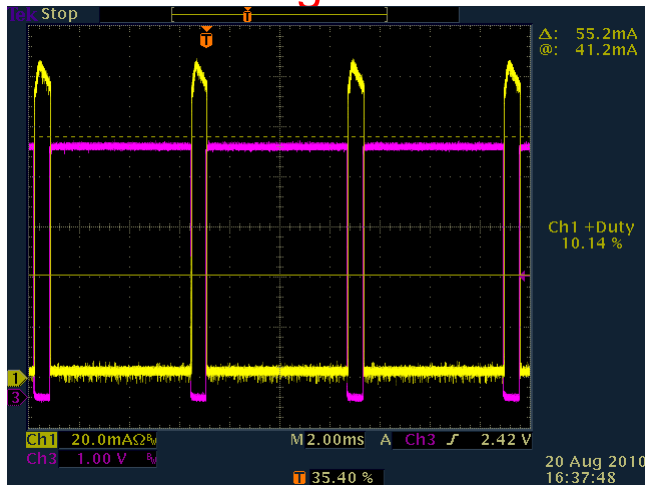
Current

Voltage

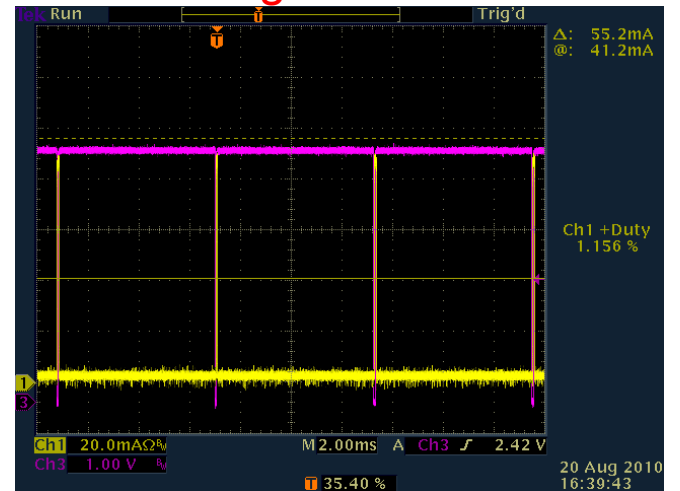
## 50% Dimming



## 10% Dimming



## 1% Dimming





# Summary

- Two stage will be a market trend for LED-TV back light power architecture base on cost & performance point of view.
- Simple design concept- cascading the Ls of transformer at primary side (Multi-Transformers Architecture) to implement the current balancing at secondary side for each channel ideally– Achieving <1% tolerance dimming range in reality.
- Fully utilize the transformer – Two-channels common anode LED driven by single transformer.
- Higher efficiency ~89.6%@ 220Vac/ ~86%@90Vac compare to the traditional 3-stages scheme. (<85%)
- Exclude the standby converter, the efficiency of PFC +LLC power stage ~94%.
- Dimming voltage range can work from 1% - 100% and the tolerance of current between each strings less than 1%.
- Saving the heat sinks for MOSFETs of linear regulators at secondary side. – more thinness, cost-saving.

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