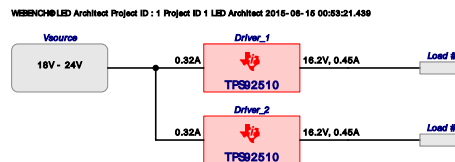


# WEBENCH® LED Architect



## Project Report

Project : 4325536/1 : Project ID 1

Created : 2015-06-15 00:53:21.439

LED Architect with light output=1000.0

Launch WEBENCH LED Architect.

### Project Summary

Total BOM Cost : \$18.87

Total Footprint : 3,617 mm<sup>2</sup>

Total BOM Count : 43

Total Efficiency : 20.02%

Total Efficacy : 65.6 lumens / Watt

Total Power Dissipation (loss) : 0.72 Watts

### Design Input Specifications :

1. VinMax	24.0	Maximum input voltage
2. VinMin	18.0	Minimum input voltage
3. color	warm white	LED Color
4. inputSource	DC	Input Source Type
5. lightOutput	1000.0	Light Output in Lumen
6. maxHeatSinkLength	200.0	Max Heat Sink Length
7. maxHeatSinkWidth	50.0	Max Heat Sink Width
8. maxJunctionTemp	150.0	Max LED Junction Temperature
9. maxLEDStringVout	60.0	Max LED String Voltage
10. optfactor	3	Optimization factor to tune up the design
11. pricefactor	0	Price factor to tune up the design cost
12. ta	30.0	Ambient temperature

### Regulators

Main Driver NSID : TPS92510DGQR 1.5A,Buck for HB LEDs with Integrated Thermal Foldback; Driver Efficiency = 95.32%

### Drivers Electrical BOM

Manufacturer	Part Number	Quantity	Budgetary Price	Footprint (mm <sup>2</sup> )
AVX	08053C104KAT2A	2	\$0.02	14
TDK	C3216JB1H106K	2	\$0.52	22
TDK	C3216JB1V106K	4	\$0.36	22
Yageo America	CC0805KRX7R9BB183	2	\$0.02	14
Bourns	CD0603-B0230	2	\$0.20	10
Vishay-Dale	CRCW0402294RFKED	2	\$0.02	6
Vishay-Dale	CRCW0402348KFKED	2	\$0.02	6
Vishay-Dale	CRCW040243K2FKED	2	\$0.02	6
Vishay-Dale	CRCW0402549KFKED	2	\$0.02	6
MuRata	GRM033R61A103KA01D	2	\$0.02	4
MuRata	GRM155R71H182KA01D	2	\$0.02	6
Rohm	MCR25JZHFLR430	2	\$0.06	29
MuRata	NCP15WF104E03RC	2	\$0.06	6
Texas Instruments	TPS92510DGQR	2	\$2.10	47
TDK	VLCF4028T-220MR72-2	2	\$0.72	50
Total		32	\$4.18	248

### LED Array Solution BOM = LEDs + Heatsink

Manufacturer	Part Number	Quantity	Cost	Footprint (cm <sup>2</sup> )
Nichia	NS6L183-H3	10	\$12.00	-
Aavid	64800	1	\$2.33	33
Total			\$14.33	33

## LED Array Solution

### LED Array

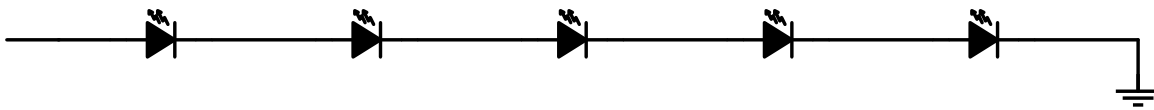
Light Output : 1000 lumens  
 Color : warm white  
 LED quantity : 10 Series = 5 Parallel = 2  
 Total Vout : 16.2 Volts  
 Total Iload : 0.4 Amps  
 Total Light Output : 1000 lumens  
 Flux : 100 lumens  
 ThetaSA : 4.37 C / Watt  
 Junction Temp : 90 degrees  
 Operating Vf : 3.24 Volts  
 Operating Io : 0.448 Amps  
 Efficiency : 21%  
 Efficacy : 68.9 lumens / Watt  
 Total Footprint : 3347.3 mm<sup>2</sup>  
 Total LED Cost : \$14.33  
 Max LED Vout : 60.0 Volts

### Selected LED



Manufacturer : Nichia  
 Part Number : NS6L183-H3  
 Vf : 3.5 V  
 Io : 0.7 A  
 Angle : 120.0 degree  
 PhiV : 175.0  
 Color Temperature : 3400.0 K  
 Color : warm white  
 Tj : 135.0 deg C  
 IfMin : 0.02 Amps  
 IfMax : 0.8 Amps  
 RJC : 0.0 deg C/Ohm  
 Isat : 0.0 Amps  
 Package mount : SMT  
 Footprint : 59.5 mm<sup>2</sup>

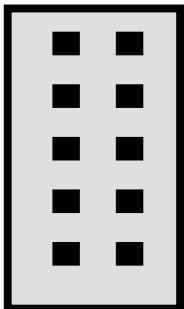
**LED Load Array : For each Driver : series = 5, parallel = 1. LED Quantity = 5**  
**Total Driver Quantity = 2 Total LED Quantity = 10**



### Heatsink

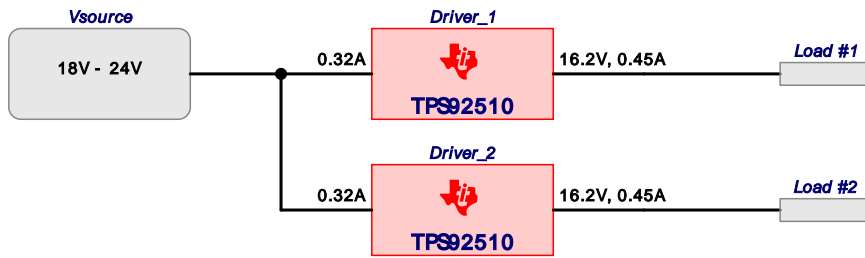
Length : 43.93 mm  
 Width : 76.2 mm  
 Height : 38.1 mm  
 Total Heatsink Footprint : 3347 mm<sup>2</sup>  
 Total Heatsink Cost : \$2.33

Manufacturer : Aavid  
 Part Number : 64800  
 ThetaSA : 4.37 C/W



## Project Diagram

WEBENCH® LED Architect Project ID : 1 Project ID 1 LED Architect 2015-06-15 00:53:21.439

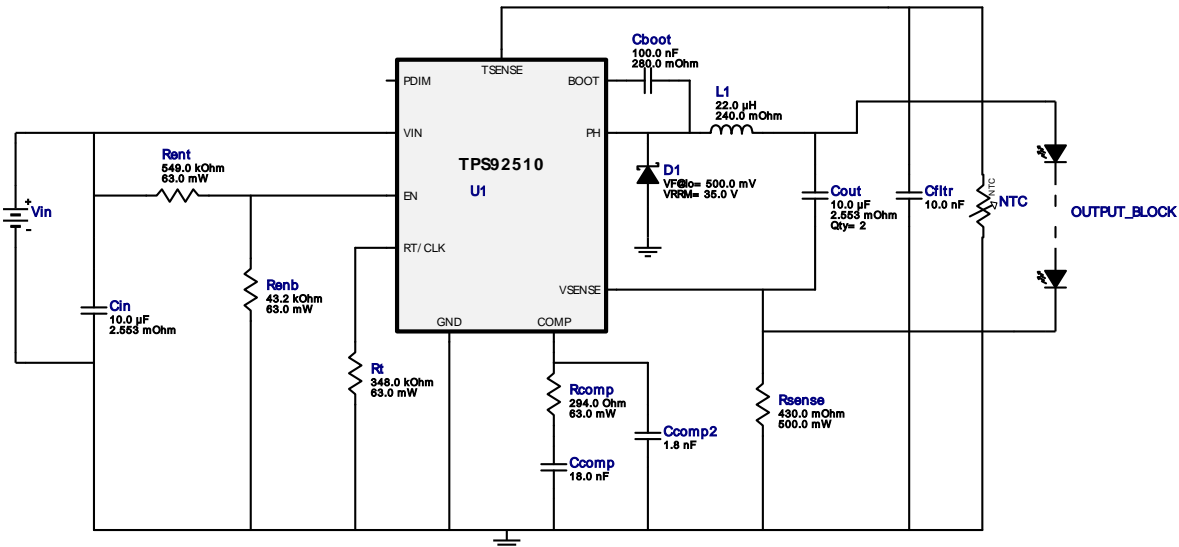


Device = TPS92510DGQR  
Topology = Buck  
Created = 6/15/15 12:53:21 AM  
BOM Cost = \$2.27  
Footprint = 135.0 mm<sup>2</sup>  
BOM Count = 21  
Total Pd = 0.36W

Design : 4325536/3 TPS92510DGQR  
TPS92510DGQR 18.0V-24.0V to 16.64V @ 0.448A







**VinMin = 18.0V**  
**VinMax = 24.0V**

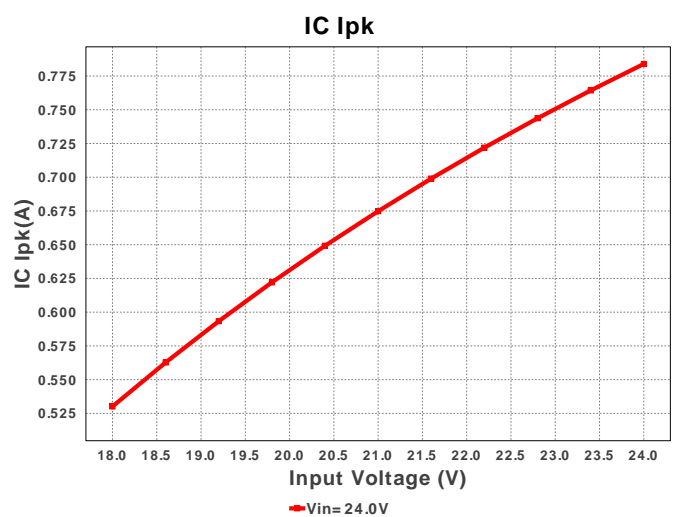
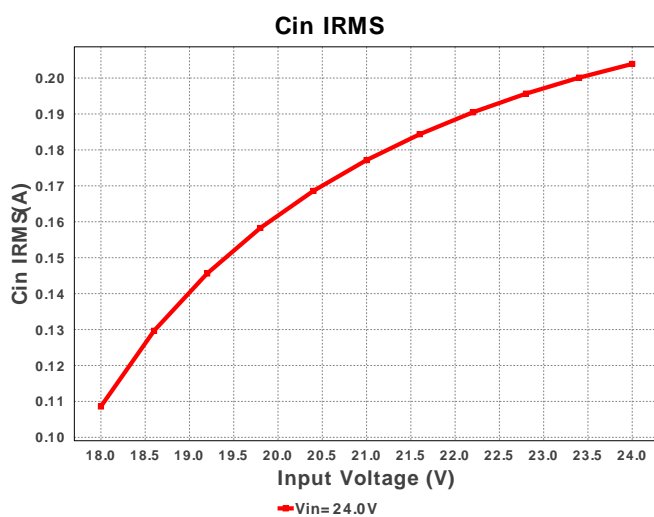
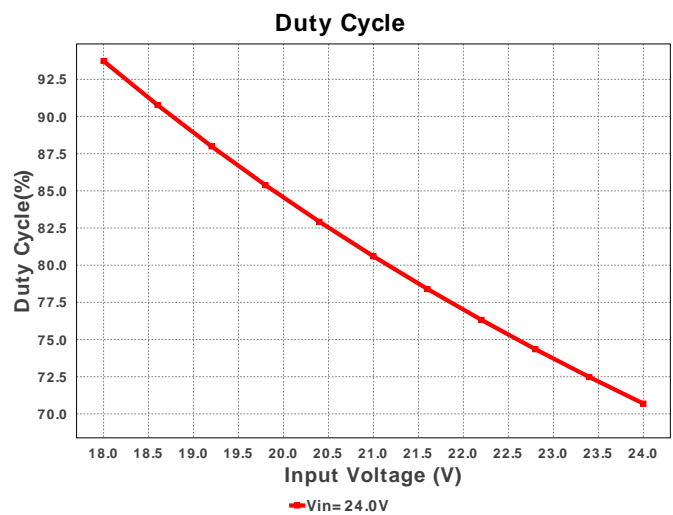
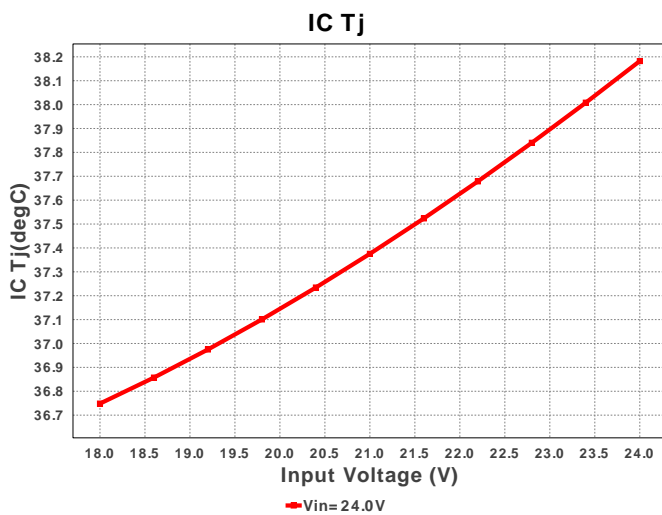
**Vout = 16.2V**  
**Iout = 0.45A**

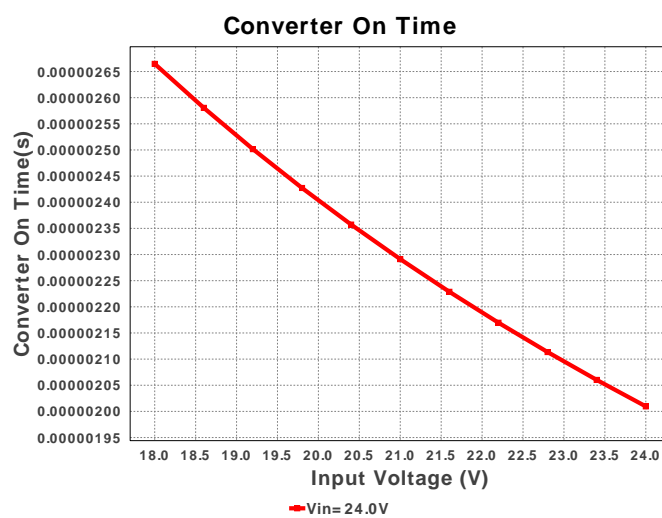
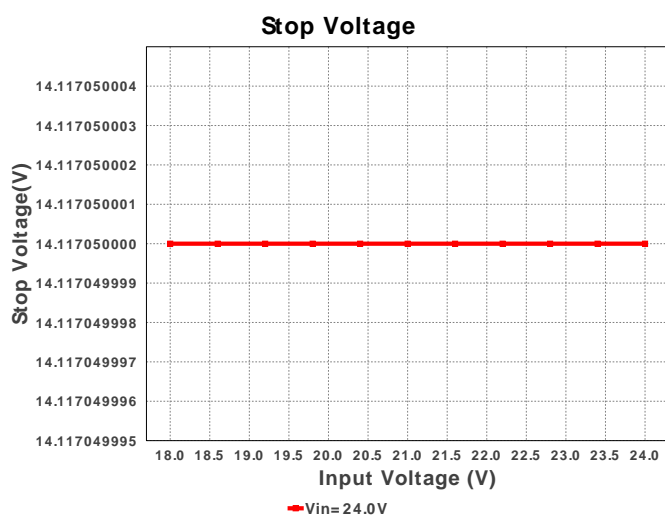
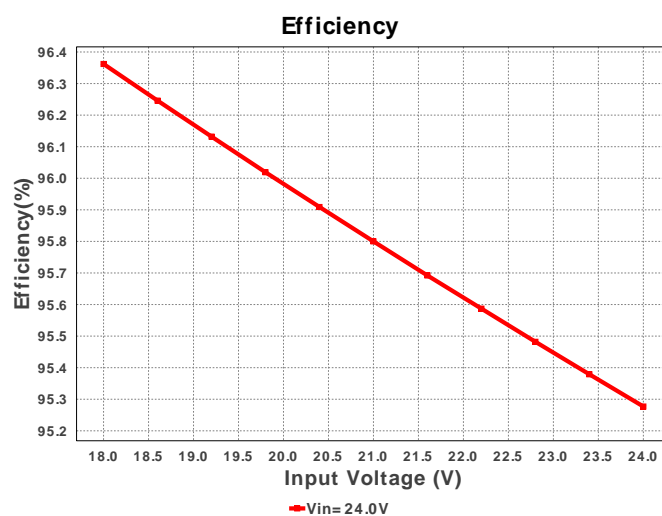
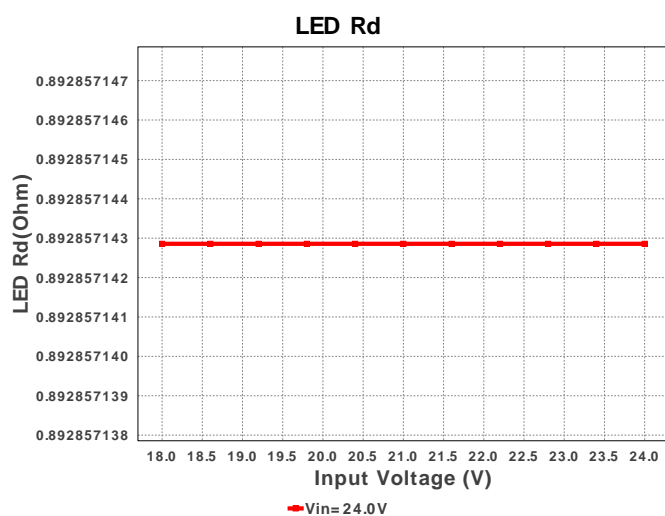
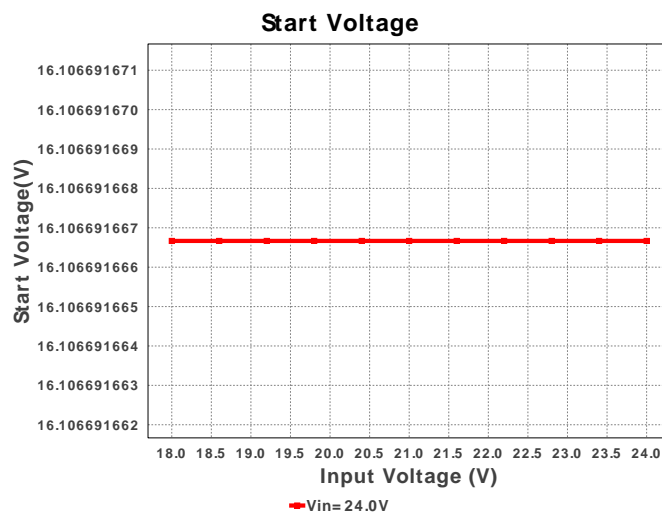
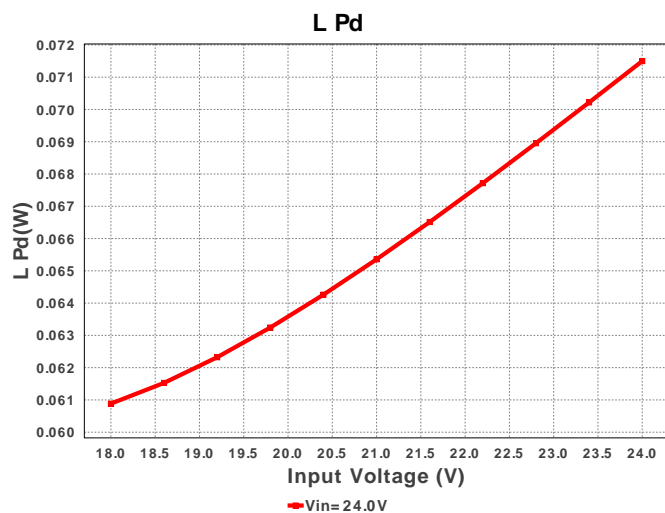


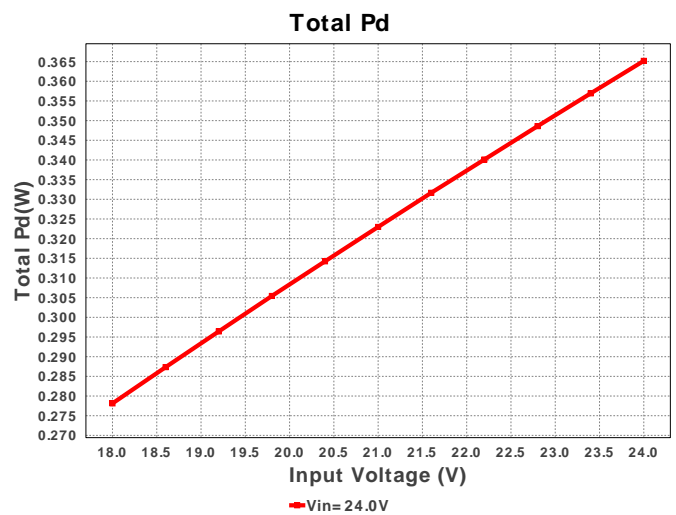
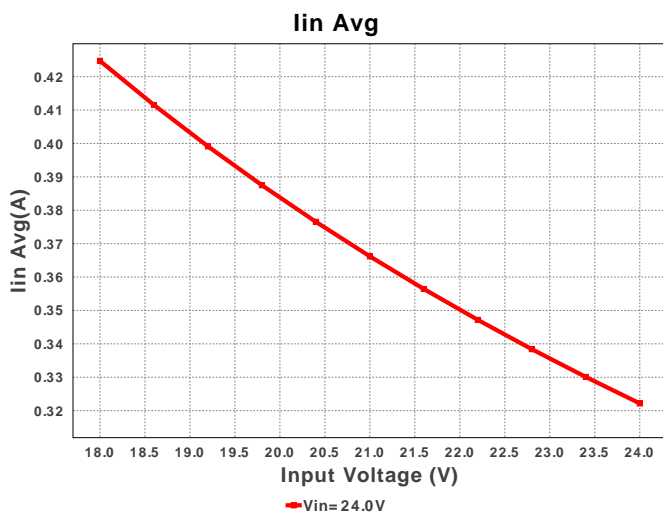
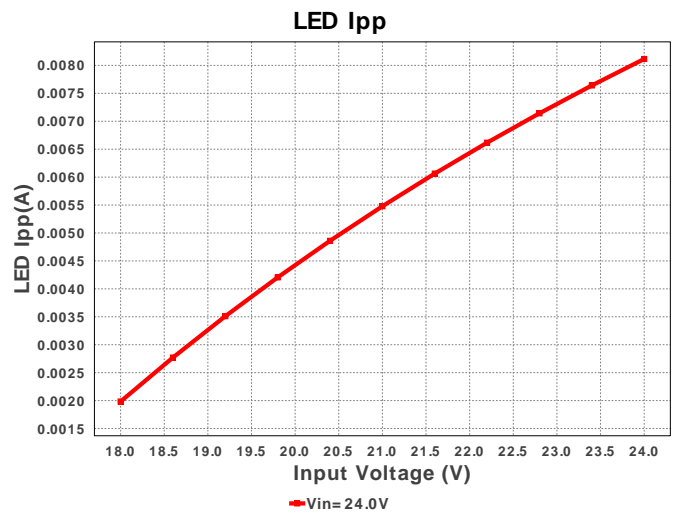
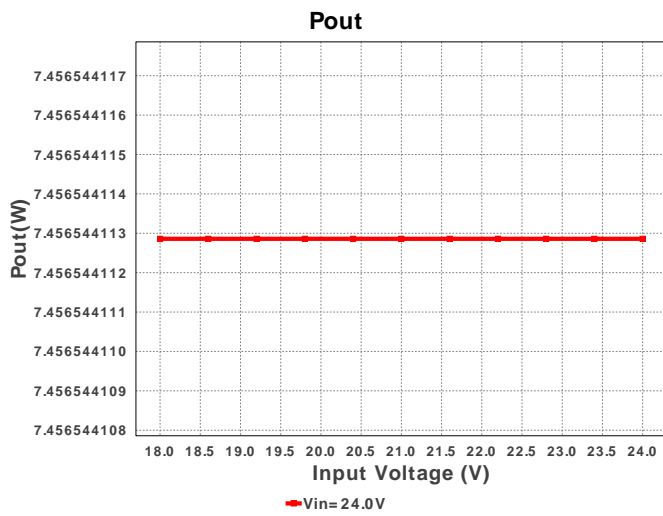
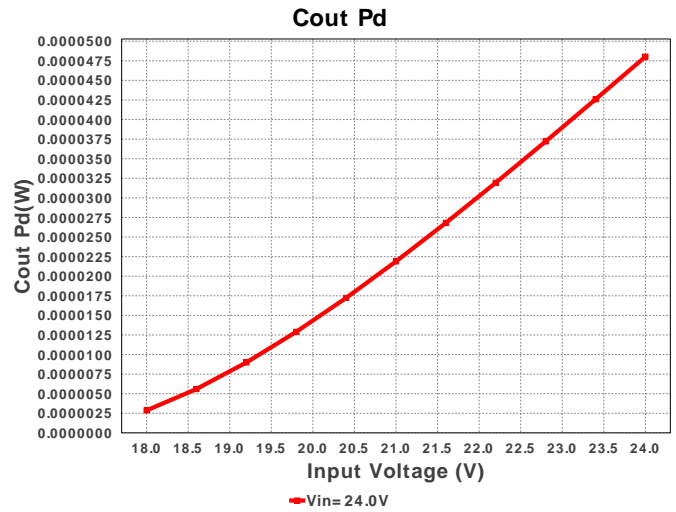
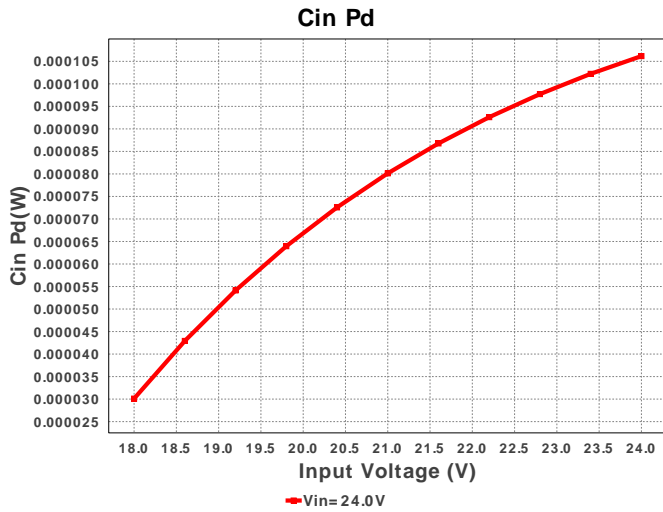
## Electrical BOM

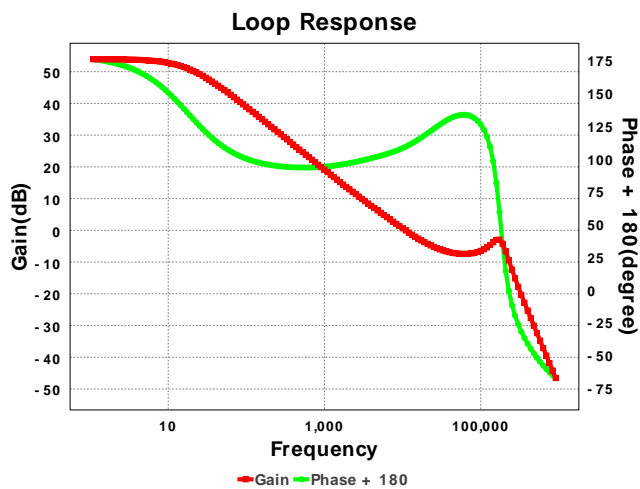
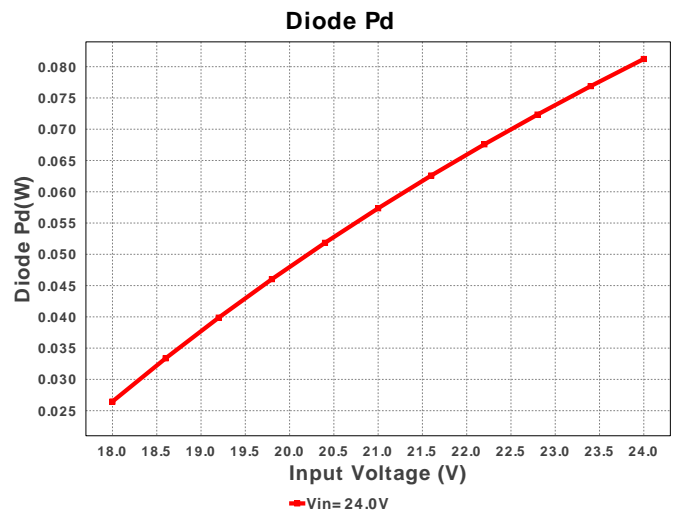
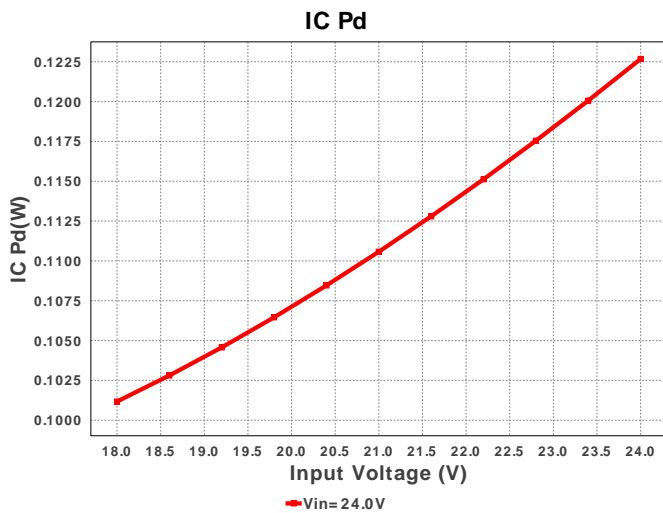
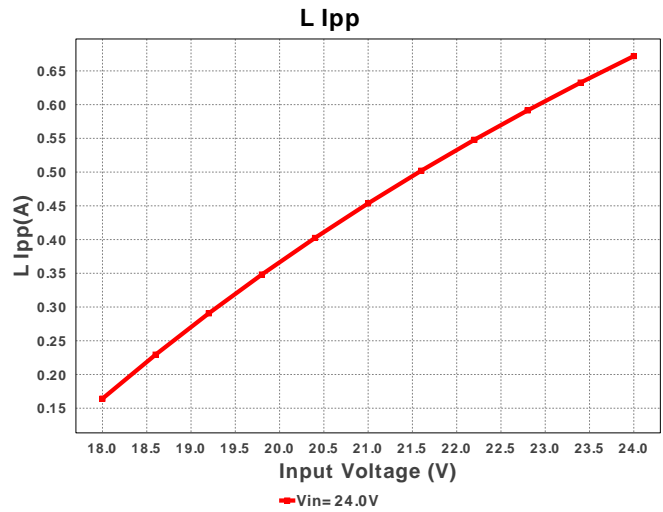
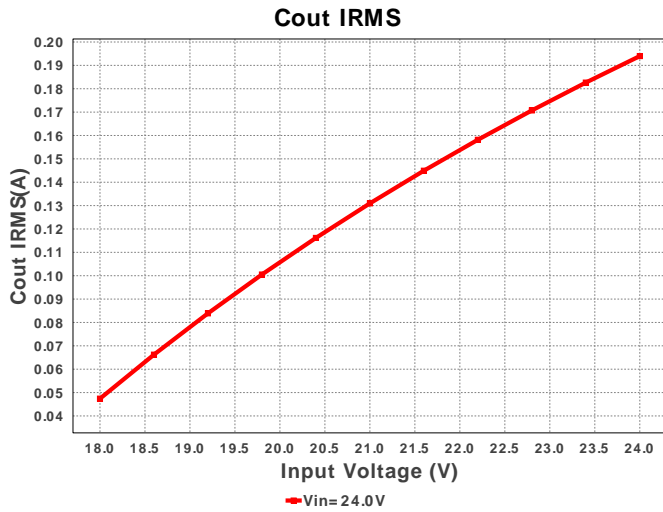
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm <sup>2</sup>
2.	Ccomp	Yageo America	CC0805KRX7R9BB183 Series= X7R	Cap= 18.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm <sup>2</sup>
3.	Ccomp2	MuRata	GRM155R71H182KA01D Series= X7R	Cap= 1.8 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm <sup>2</sup>
4.	Cftr	MuRata	GRM033R61A103KA01D Series= X5R	Cap= 10.0 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	 0201 2 mm <sup>2</sup>
5.	Cin	TDK	C3216JB1H106K Series= 274	Cap= 10.0 uF ESR= 2.553 mOhm VDC= 50.0 V IRMS= 0.0 A	1	\$0.26	 1206 11 mm <sup>2</sup>
6.	Cout	TDK	C3216JB1V106K Series= 274	Cap= 10.0 uF ESR= 2.553 mOhm VDC= 35.0 V IRMS= 0.0 A	2	\$0.18	 1206 11 mm <sup>2</sup>
7.	D1	Bourns	CD0603-B0230	VF@Io= 500.0 mV VRRM= 35.0 V	1	\$0.10	 Diode_0603 5 mm <sup>2</sup>
8.	D_LED	Nichia	NS6L183-H3	LED	5	\$1.20	 NS6x083 60 mm <sup>2</sup>
9.	L1	TDK	VLCF4028T-220MR72-2	L= 22.0 uH DCR= 240.0 mOhm	1	\$0.36	 VLCF4028 25 mm <sup>2</sup>

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Rcomp	Vishay-Dale	CRCW0402294RFKED Series= CRCW..e3	Res= 294.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
11.	Renb	Vishay-Dale	CRCW040243K2FKED Series= CRCW..e3	Res= 43.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
12.	Rent	Vishay-Dale	CRCW0402549KFKED Series= CRCW..e3	Res= 549.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
13.	Rsense	Rohm	MCR25JZHFLR430 Series= 298	Res= 430.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	\$0.03	 1210 15 mm <sup>2</sup>
14.	Rt	Vishay-Dale	CRCW0402348KFKED Series= CRCW..e3	Res= 348.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
15.	U1	Texas Instruments	TPS92510DGQR	Switcher	1	\$1.05	 S-PDSO-G10 24 mm <sup>2</sup>









## Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	203.923 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	194.945 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	785.655 mA	Current	Peak switch current in IC
4.	Iin Avg	322.04 mA	Current	Average input current
5.	L Ipp	675.31 mA	Current	Peak-to-peak inductor ripple current
6.	LED Ipp	8.156 mA	Current	LED Ripple Current
7.	BOM Count	21	General	Total Design BOM count
8.	FootPrint	135.0 mm <sup>2</sup>	General	Total Foot Print Area of BOM components
9.	Frequency	351.763 kHz	General	Switching frequency
10.	IC Tolerance	10.0 mV	General	IC Feedback Tolerance
11.	Pout	7.457 W	General	Total output power



#	Name	Value	Category	Description
12.	Total BOM	\$2.27	General	Total BOM Cost
13.	Vout OP	16.644 V	Op_Point	Operational Output Voltage
14.	Cross Freq	9.885 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	70.69 %	Op_point	Duty cycle
16.	Efficiency	95.317 %	Op_point	Steady state efficiency
17.	IC Tj	38.182 degC	Op_point	IC junction temperature
18.	ICThetaJA	66.7 degC/W	Op_point	IC junction-to-ambient thermal resistance
19.	IOUT_OP	448.0 mA	Op_point	Iout operating point
20.	LED Rd	892.857 mOhm	Op_point	LED DynamicResistance
21.	Phase Marg	109.67 deg	Op_point	Bode Plot Phase Margin
22.	VIN_OP	24.0 V	Op_point	Vin operating point
23.	Cin Pd	106.165 $\mu$ W	Power	Input capacitor power dissipation
24.	Cout Pd	48.512 $\mu$ W	Power	Output capacitor power dissipation
25.	Diode Pd	81.229 mW	Power	Diode power dissipation
26.	IC Pd	122.673 mW	Power	IC power dissipation
27.	L Pd	71.612 mW	Power	Inductor power dissipation
28.	Total Pd	361.947 mW	Power	Total Power Dissipation
29.	Converter On Time	2.02 $\mu$ s	Unknown	Converter On Time
30.	Start Voltage	17.752 V	Unknown	Start Voltage with External UVLO Resistors
31.	Stop Voltage	15.762 V	Unknown	Stop Voltage with External UVLO Resistors

## Design Inputs

#	Name	Value	Description
1.	Iout	448.0 m	Maximum Output Current
2.	Iout1	448.0 m	Output Current #1
3.	VinMax	24.0	Maximum input voltage
4.	VinMin	18.0	Minimum input voltage
5.	Vout	16.2	Output Voltage
6.	Vout1	16.2	Output Voltage #1
7.	application	LED_DRIVER	LED Application
8.	base_pn	TPS92510	Texas Instruments Base Part Number
9.	isLEDArchitect	Y	LED Architect Project
10.	ledparallel	1.0	Number of LED in parallel
11.	ledpartnumber	NS6L183-H3	LED Part number
12.	ledseries	5.0	Number of LED in series
13.	line_fsw	NaN	AC Line Frequency
14.	source	DC	Input Source Type
15.	ta	30.0	Ambient temperature

## Design Assistance

1. Feature Highlights: 1.5A Constant Current Buck Converter, 3.5V to 60V Input Voltage Range, 200mV Internal Voltage Reference, +/-3% LED Current Accuracy, 100kHz to 2.5MHz Switching Frequency, Dedicated PWM Dimming Input, LED Thermal Foldback, Adjustable UVLO, Overcurrent Protection, Thermal Shutdown

2. TPS92510 Product Folder : <http://www.ti.com/product/TPS92510> : contains the data sheet and other resources.

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