

Project Report

Project : 4387439/1 : Project ID 1
 Created : 2015-06-09 17:51:19.279
 LED Architect with light output=1000.0

Launch WEBENCH LED Architect.

Project Summary

Total BOM Cost : \$18.05
 Total Footprint : 4,266 mm²
 Total BOM Count : 25
 Total Efficiency : 28.66%
 Total Efficacy : 96.5 lumens / Watt
 Total Power Dissipation (loss) : 1.1 Watts

Design Input Specifications :

- | | | |
|----------------------|------------|---|
| 1. VinMax | 22.0 | Maximum input voltage |
| 2. VinMin | 14.0 | Minimum input voltage |
| 3. color | cool 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 | 50.0 | Ambient temperature |

Regulators

Main Driver NSID : LM3401MM/NOPB Hysteretic controller; Driver Efficiency = 89.57%

Drivers Electrical BOM

Manufacturer	Part Number	Quantity	Budgetary Price	Footprint (mm ²)
TDK	C2012X7R1H224K	2	\$0.04	14
Panasonic	ERJ-6ENF1302V	2	\$0.02	14
Panasonic	ERJ-6ENF2742V	2	\$0.02	14
Panasonic	ERJ-8RQFR39V	2	\$0.08	22
MuRata	GRM31CR71H475KA12L	2	\$0.14	22
Texas Instruments	LM3401MM/NOPB	2	\$1.20	47
ON Semiconductor	MBR0540T1G	2	\$0.12	26
Bourns	SDR0403-180ML	2	\$0.36	55
Vishay-Siliconix	SI2319DS-T1-E3	2	\$0.56	28
Total		18	\$2.54	241

LED Array Solution BOM = LEDs + Heatsink

Manufacturer	Part Number	Quantity	Cost	Footprint (cm ²)
Cree	XPGWHT-L1-0000-00H51	6	\$13.74	-
Aavid	66365	1	\$1.77	40
Total			\$15.51	40

LED Array Solution

LED Array

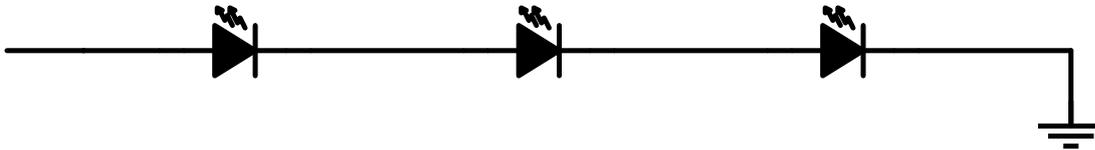
Light Output : 1000 lumens
 Color : cool white
 LED quantity : 6Series = 3Parallel = 2
 Total Vout : 8.9 Volts
 Total Iload : 0.5 Amps
 Total Light Output : 1000 lumens
 Flux : 167 lumens
 ThetaSA : 5.59 C / Watt
 Junction Temp : 100 degrees
 Operating Vf : 2.973 Volts
 Operating Io : 0.519 Amps
 Efficiency : 32%
 Efficacy : 108 lumens / Watt
 Total Footprint : 4025.6 mm²
 Total LED Cost : \$15.51
 Max LED Vout : 60.0 Volts

Selected LED



Manufacturer : Cree
 Part Number : XPGWHT-L1-0000-00H51
 Vf : 3.0 V
 Io : 0.35 A
 Angle : 125.0 degree
 PhiV : 139.0
 Color Temperature : 6650.0 K
 Color : cool white
 Tj : 150.0 deg C
 IfMin : 0.1 Amps
 IfMax : 1.5 Amps
 RJC : 6.0 deg C/Ohm
 Isat : 0.0 Amps
 Package mount : SMT
 Footprint : 19.8 mm²

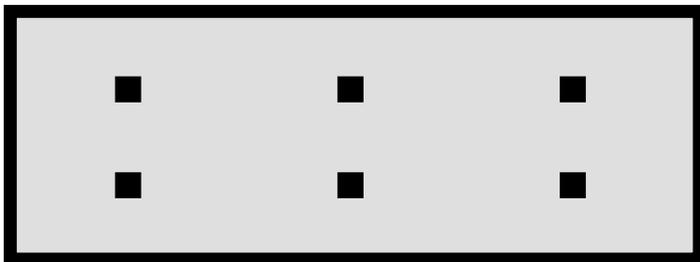
LED Load Array : For each Driver : series = 3, parallel = 1. LED Quantity = 3
Total Driver Quantity = 2 Total LED Quantity = 6



Heatsink

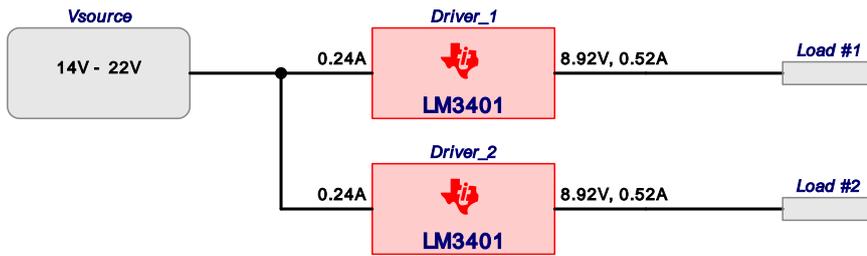
Length : 105.66 mm
 Width : 38.1 mm
 Height : 16.0 mm
 Total Heatsink Footprint : 4026 mm²
 Total Heatsink Cost : \$1.77

Manufacturer : Aavid
 Part Number : 66365
 ThetaSA : 6.07 C/W



Project Diagram

WEBENCH® LED Architect Project ID : 1 Project ID 1 LED Architect 2015-06-09 17:51:19.279



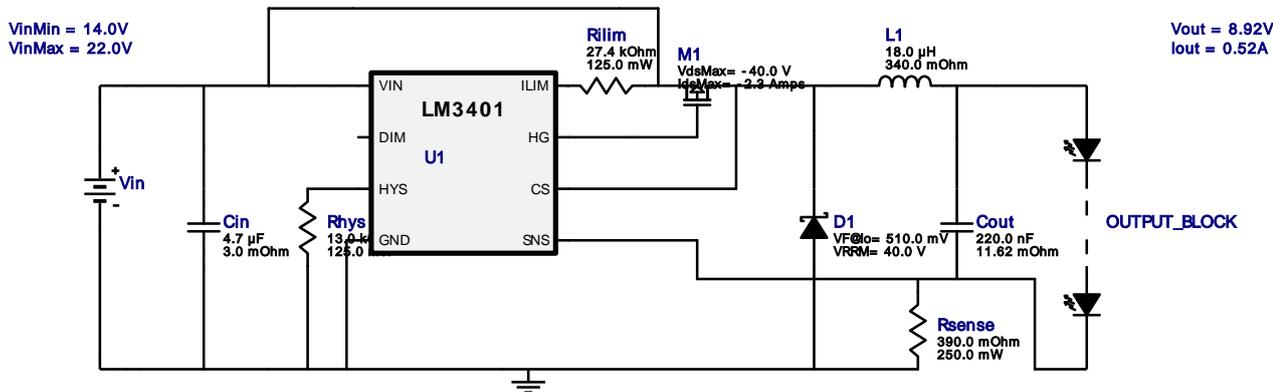


VinMin = 14.0V
 VinMax = 22.0V
 Vout = 8.92V
 Iout = 0.52A

Device = LM3401MM/NOPB
 Topology = Buck
 Created = 6/9/15 5:51:18 PM
 BOM Cost = \$1.27
 Footprint = 120.0 mm²
 BOM Count = 12
 Total Pd = 0.55W

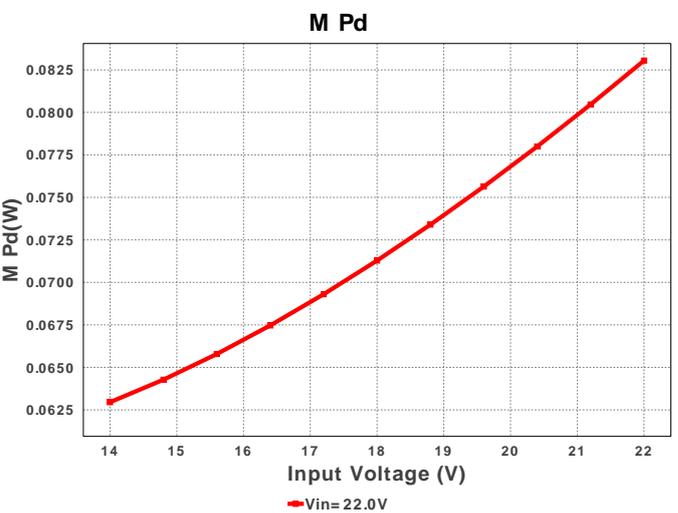
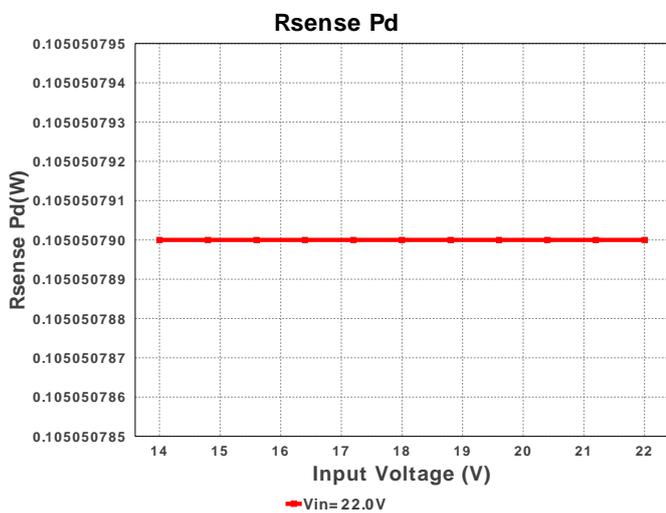
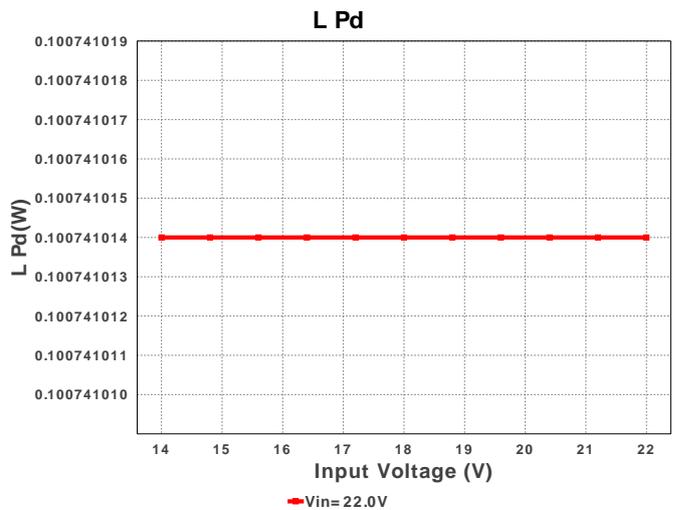
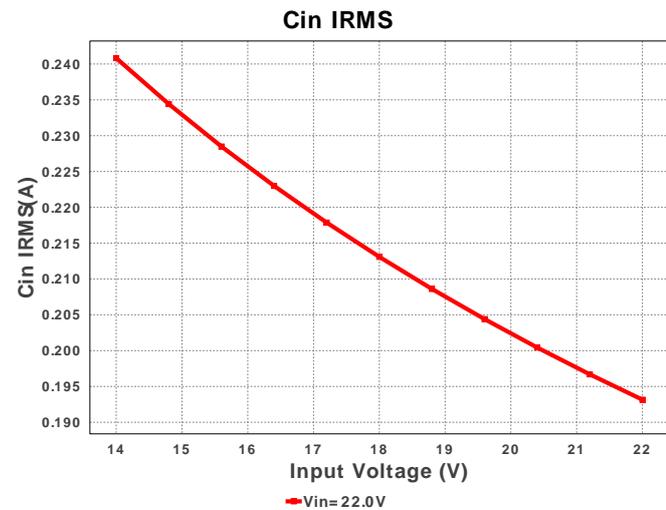
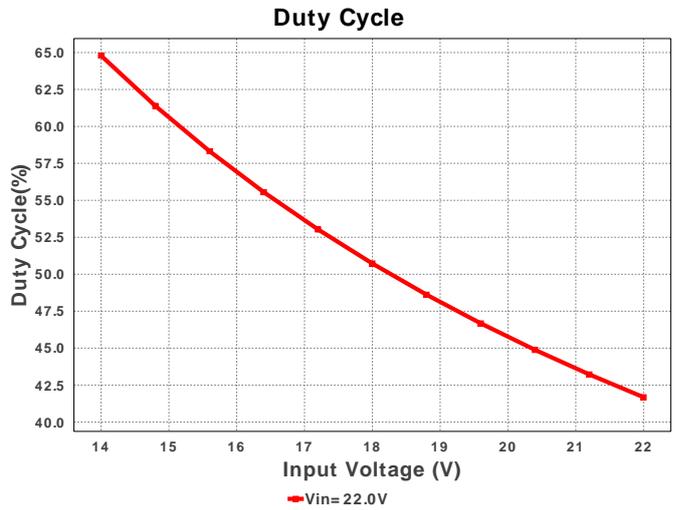
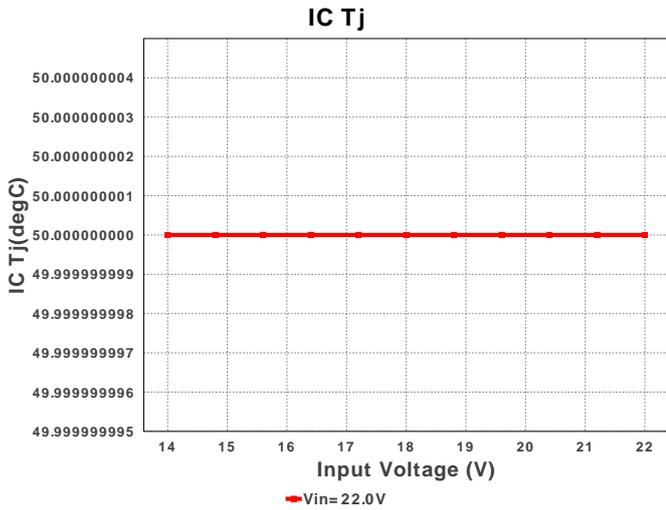
WEBENCH® Design Report

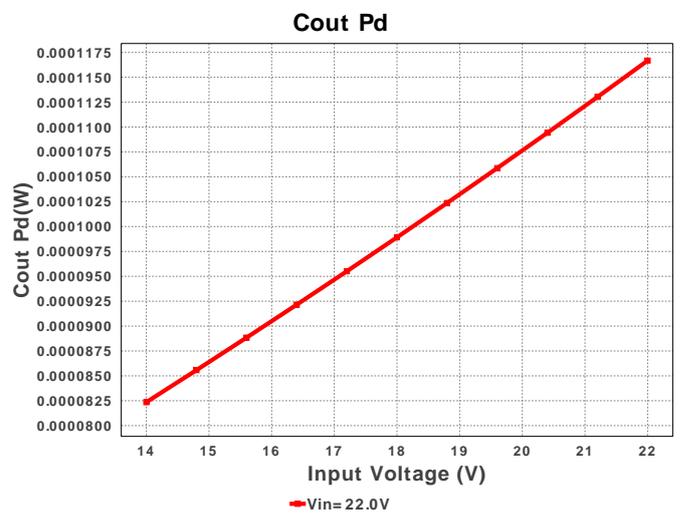
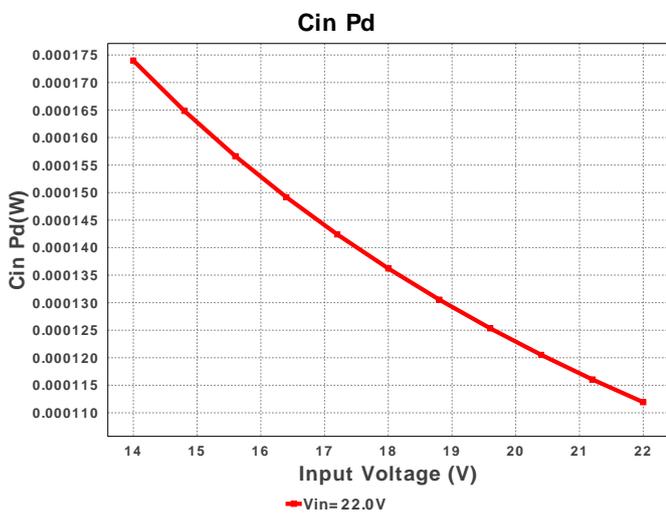
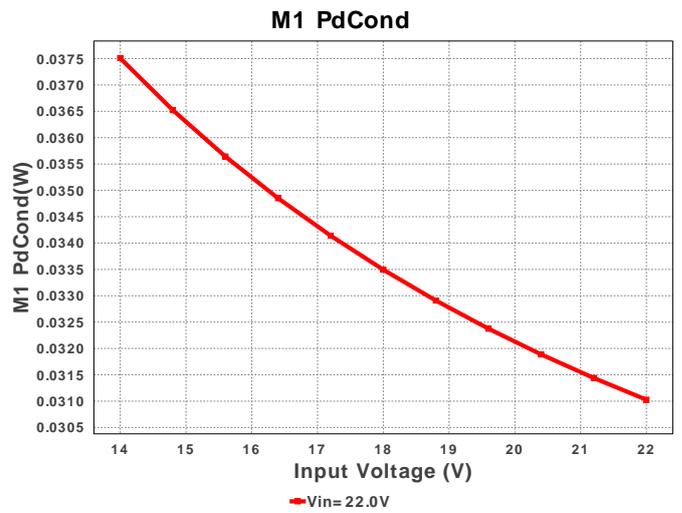
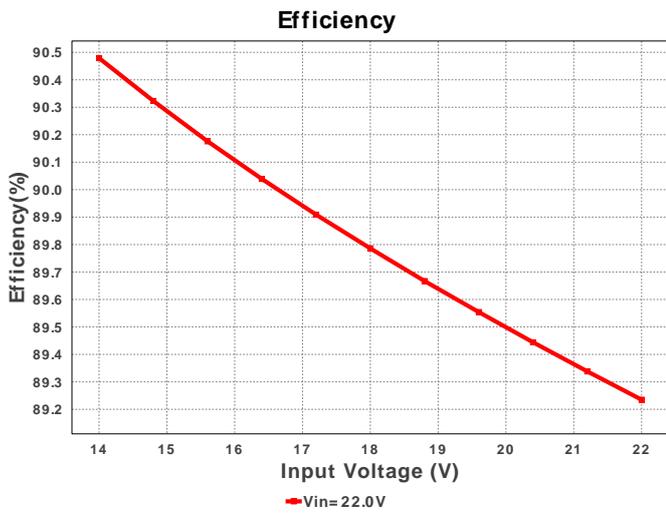
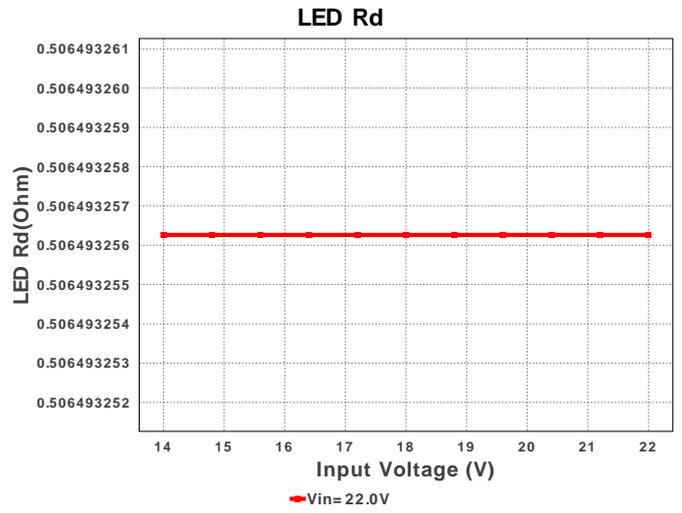
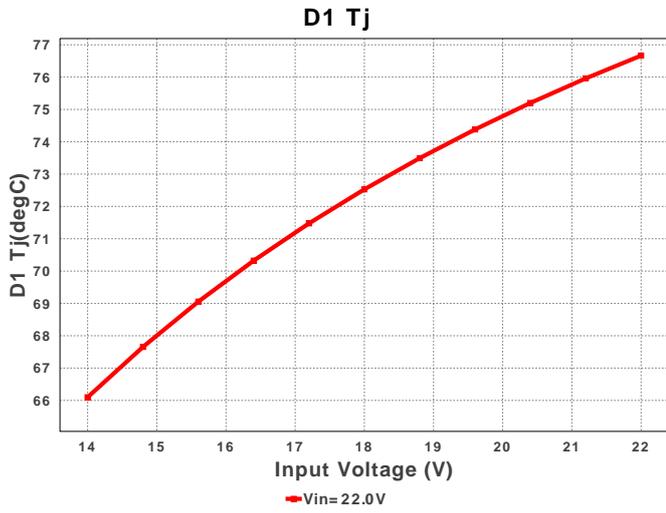
Design : 4387439/2 LM3401MM/NOPB
 LM3401MM/NOPB 14.0V-22.0V to 9.12V @ 0.519A

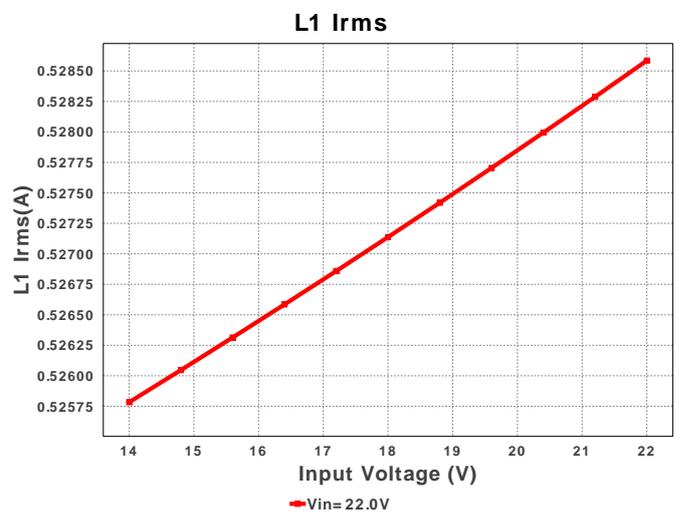
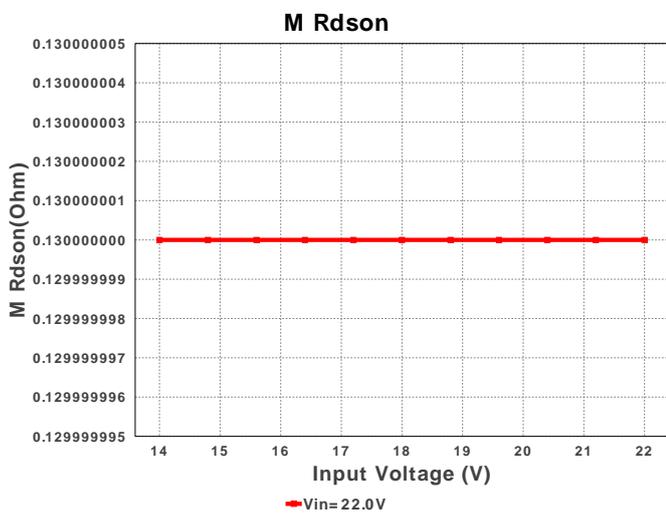
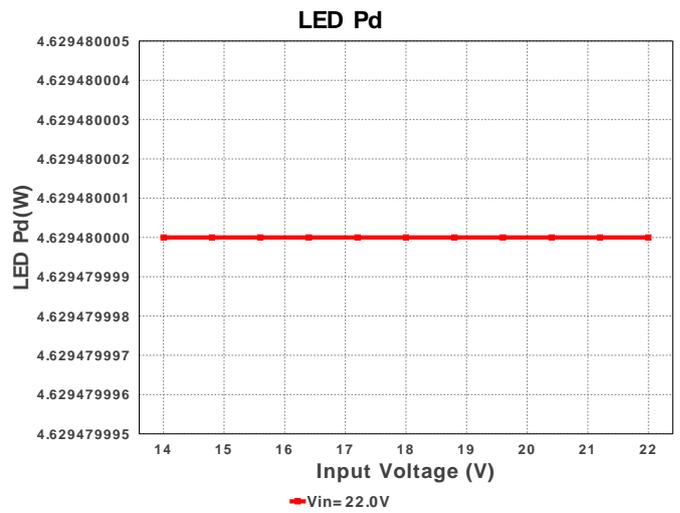
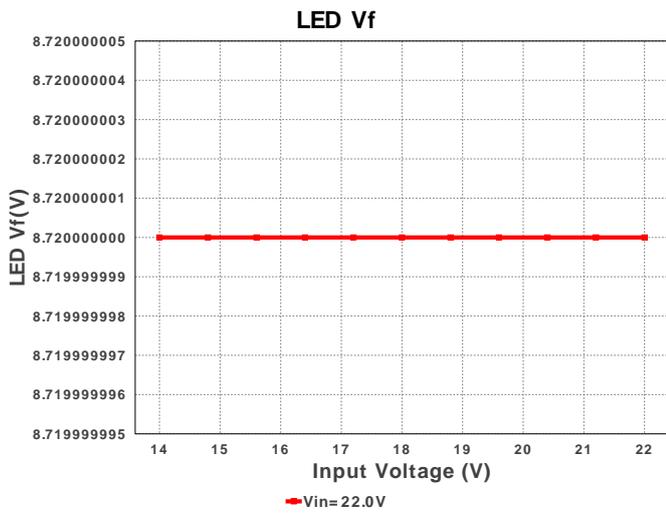
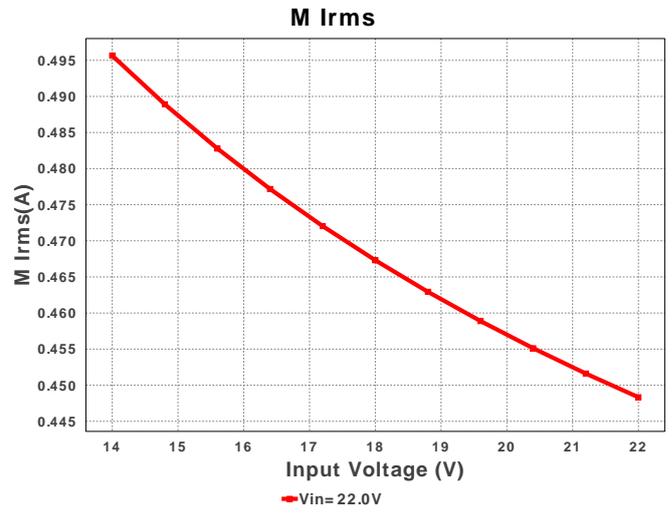
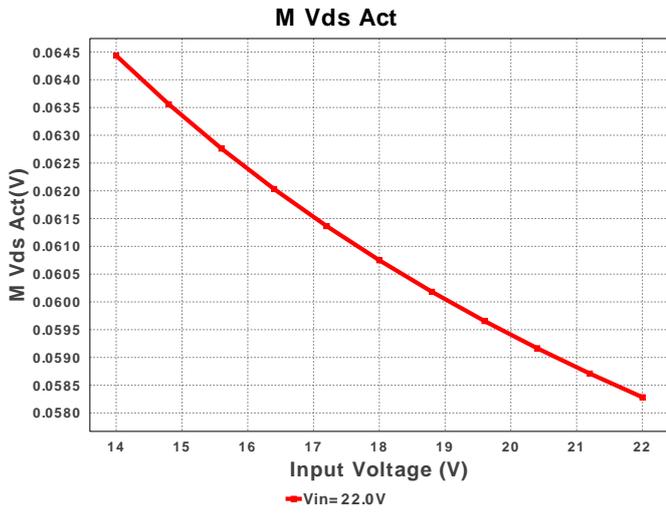


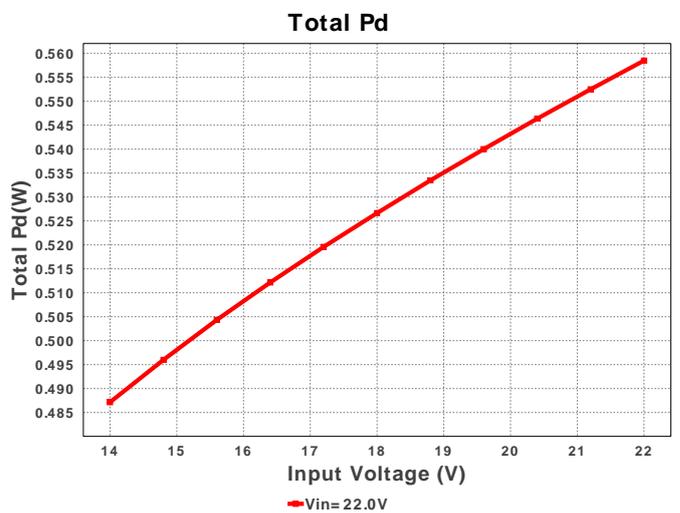
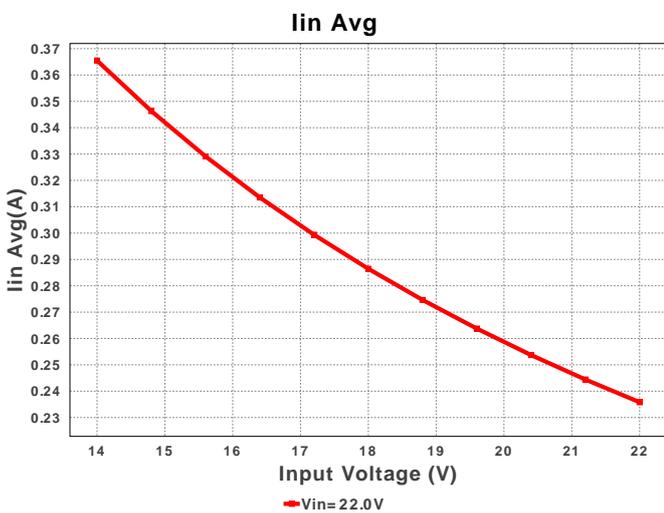
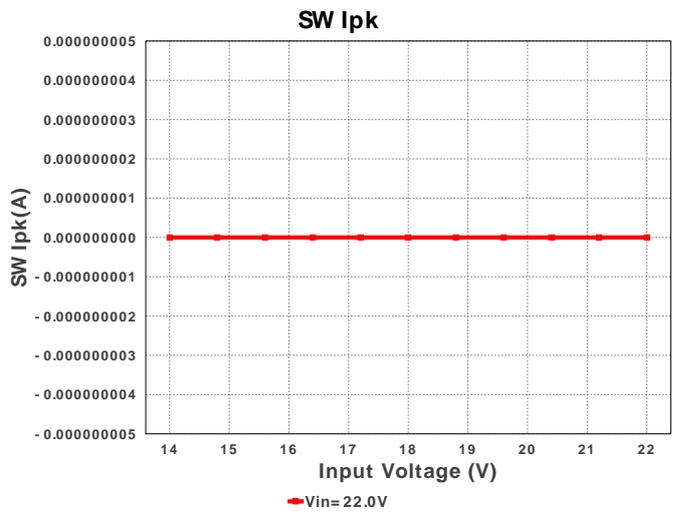
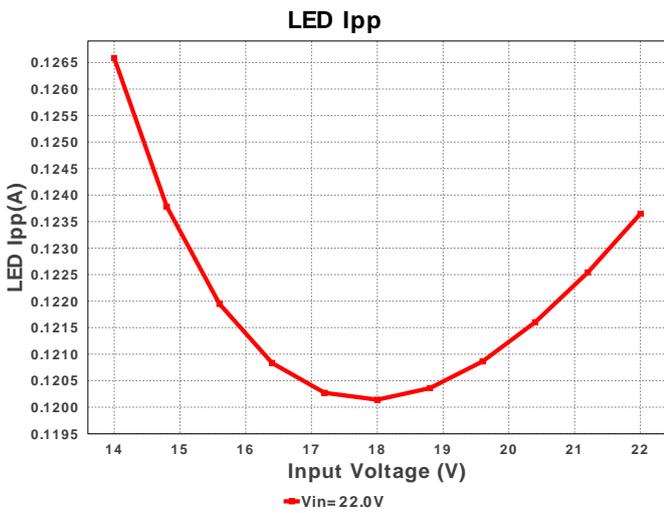
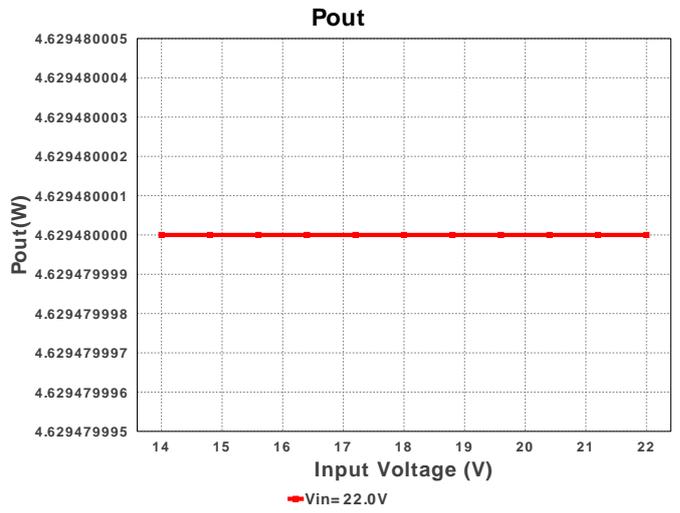
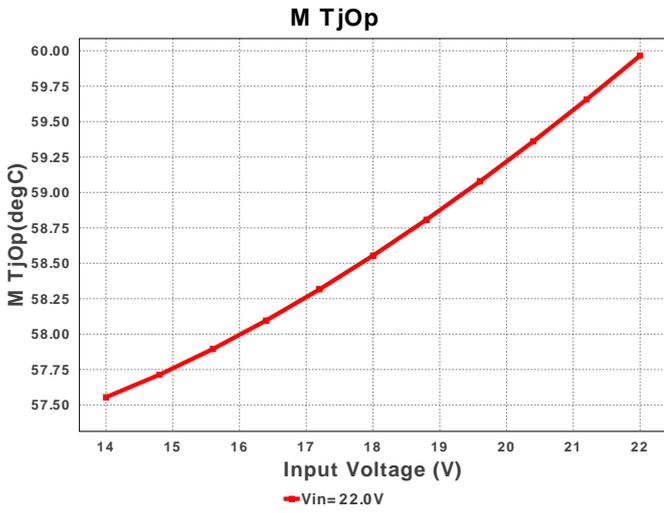
Electrical BOM

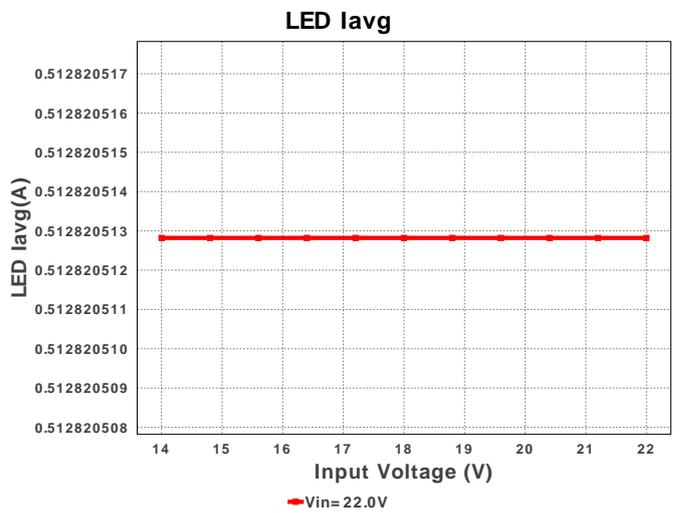
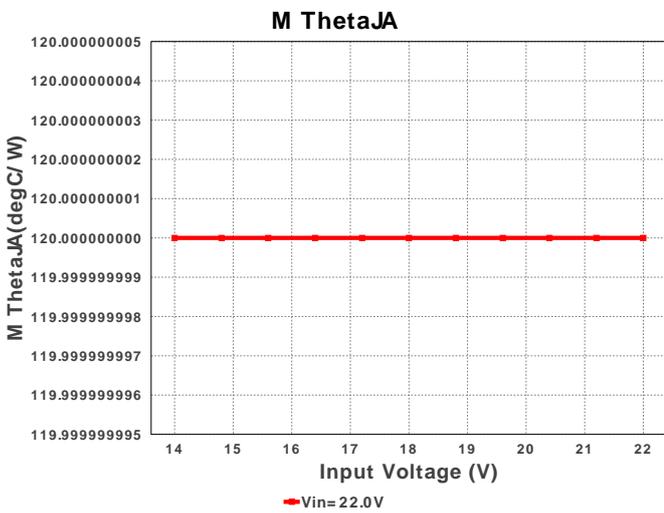
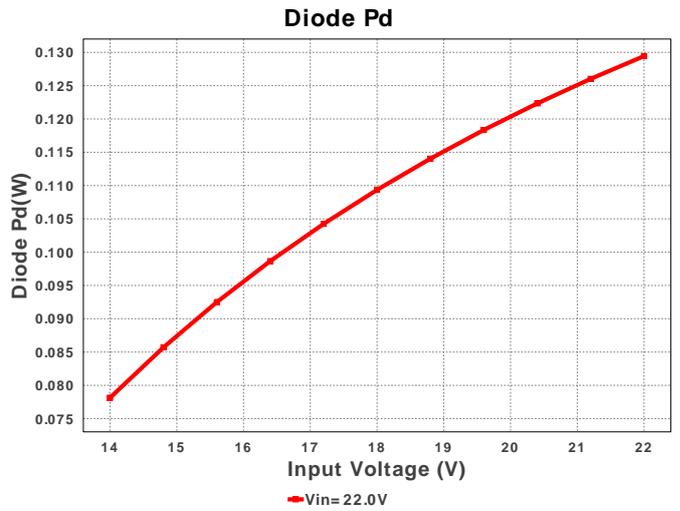
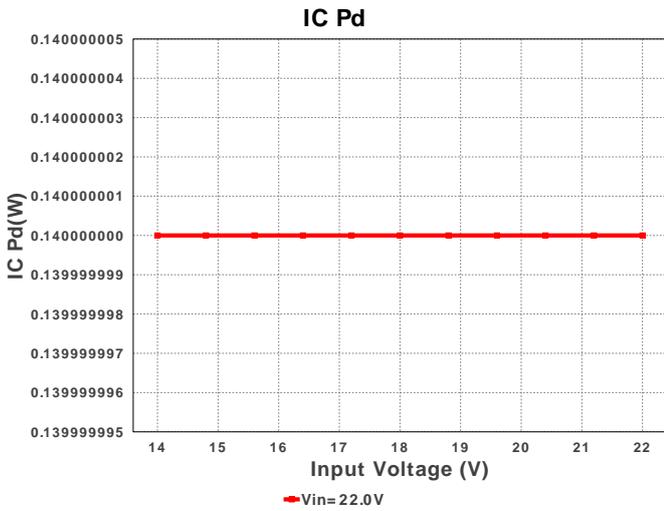
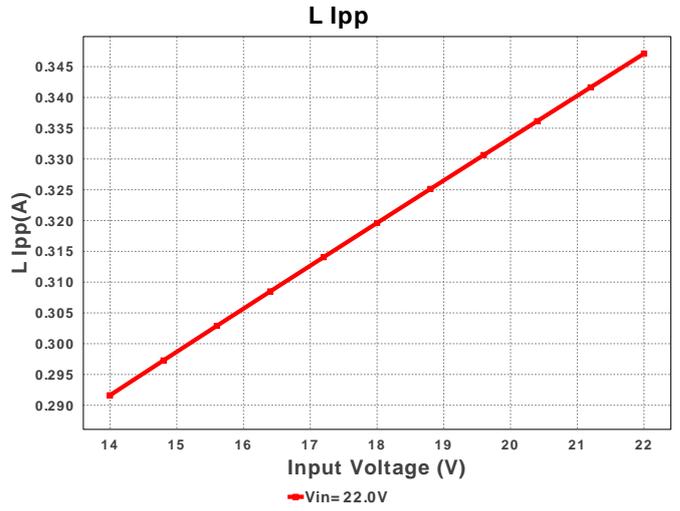
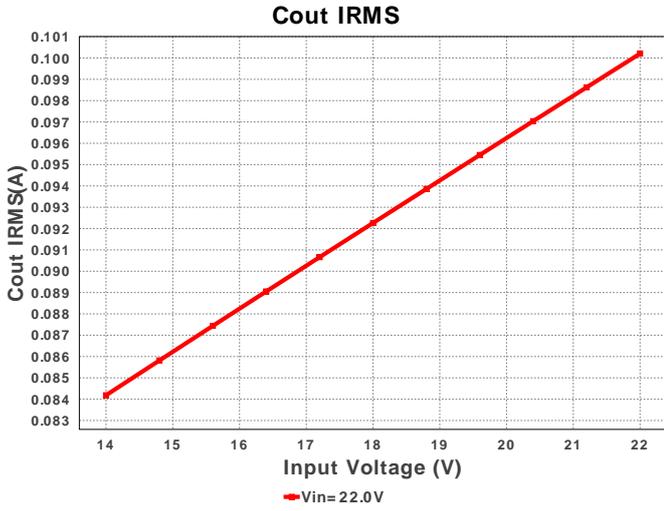
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	1	\$0.07	1206 11 mm ²
2.	Cout	TDK	C2012X7R1H224K Series= X7R	Cap= 220.0 nF ESR= 11.62 mOhm VDC= 50.0 V IRMS= 0.0 A	1	\$0.02	0805 7 mm ²
3.	D1	ON Semiconductor	MBR0540T1G	VF@Io= 510.0 mV VRRM= 40.0 V	1	\$0.06	SOD-123 13 mm ²
4.	D_LED	Cree	XPGWHT-L1-0000-00H51	LED	3	\$2.29	xlampxpg 20 mm ²
5.	L1	Bourns	SDR0403-180ML	L= 18.0 µH DCR= 340.0 mOhm	1	\$0.18	SDR0403 28 mm ²
6.	M1	Vishay-Siliconix	SI2319DS-T1-E3	VdsMax= -40.0 V IdsMax= -2.3 Amps	1	\$0.28	SOT-23 14 mm ²
7.	Rhys	Panasonic	ERJ-6ENF1302V Series= 225	Res= 13.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
8.	Rilim	Panasonic	ERJ-6ENF2742V Series= 225	Res= 27.4 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
9.	Rsense	Panasonic	ERJ-8RQFR39V Series= 229	Res= 390.0 mOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.04	1206 11 mm ²
10.	U1	Texas Instruments	LM3401MM/NOPB	Switcher	1	\$0.60	MUA08A 24 mm ²

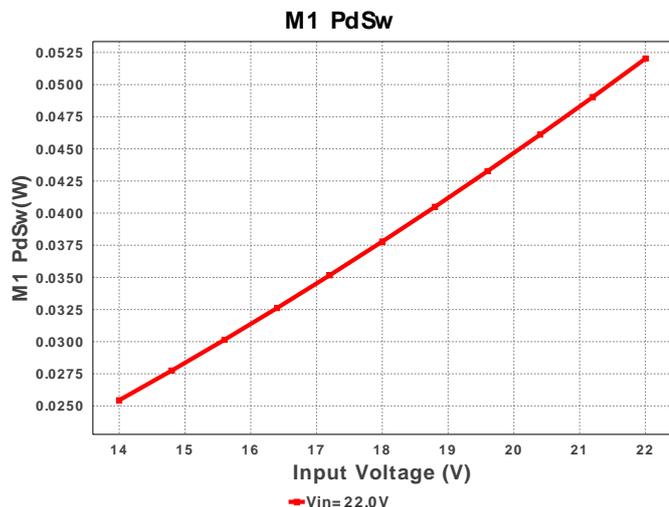












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	191.305 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	100.367 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	240.19 mA	Current	Average input current
4.	L Ipp	347.68 mA	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	528.616 mA	Current	Inductor ripple current
6.	LED Iavg	512.821 mA	Current	LED Average Current
7.	LED Ipp	123.626 mA	Current	LED Ripple Current
8.	M Irms	453.33 mA	Current	MOSFET RMS ripple current
9.	SW Ipk	0.0 A	Current	Peak switch current
10.	BOM Count	12	General	Total Design BOM count
11.	FootPrint	120.0 mm ²	General	Total Foot Print Area of BOM components
12.	Frequency	875.0 kHz	General	Switching frequency
13.	IC Tolerance	12.0 mV	General	IC Feedback Tolerance
14.	M Rdsn	130.0 mOhm	General	Drain-Source On-resistance
15.	M Vds Act	58.933 mV	General	M Vds
16.	Pout	4.733 W	General	Total output power
17.	Total BOM	\$1.27	General	Total BOM Cost
18.	D1 Tj	74.95 degC	Op_Point	D1 junction temperature
19.	Vout OP	9.12 V	Op_Point	Operational Output Voltage
20.	Duty Cycle	42.515 %	Op_point	Duty cycle
21.	Efficiency	89.575 %	Op_point	Steady state efficiency
22.	IC Tj	50.0 degC	Op_point	IC junction temperature
23.	ICThetaJA	151.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
24.	IOUT_OP	519.0 mA	Op_point	Iout operating point
25.	LED Rd	506.493 mOhm	Op_point	LED DynamicResistance
26.	LED Vf	8.92 V	Op_point	Total LED Forward Calculated Voltage
27.	M ThetaJA	120.0 degC/W	Op_point	MOSFET junction-to-ambient thermal resistance
28.	M TjOp	60.051 degC	Op_point	MOSFET junction temperature
29.	VIN_OP	22.0 V	Op_point	Vin operating point
30.	Cin Pd	109.793 μW	Power	Input capacitor power dissipation
31.	Cout Pd	117.054 μW	Power	Output capacitor power dissipation
32.	Diode Pd	121.115 mW	Power	Diode power dissipation
33.	IC Pd	140.0 mW	Power	IC power dissipation
34.	L Pd	100.741 mW	Power	Inductor power dissipation
35.	LED Pd	4.629 W	Power	LED Power Dissipation
36.	M Pd	83.756 mW	Power	MOSFET power dissipation
37.	M1 PdCond	31.735 mW	Power	M1 MOSFET conduction losses
38.	M1 PdSw	52.021 mW	Power	M1 MOSFET switching losses
39.	Rsense Pd	105.051 mW	Power	LED Current Rsns Power Dissipation
40.	Total Pd	550.876 mW	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	519.0 m	Maximum Output Current
2.	Iout1	519.0 m	Output Current #1
3.	VinMax	22.0	Maximum input voltage
4.	VinMin	14.0	Minimum input voltage
5.	Vout	8.92	Output Voltage
6.	Vout1	8.92	Output Voltage #1
7.	application	LED_DRIVER	LED Application
8.	base_pn	LM3401	Texas Instruments Base Part Number

#	Name	Value	Description
9.	isLEDArchitect	Y	LED Architect Project
10.	ledparallel	1.0	Number of LED in parallel
11.	ledpartnumber	XPGWHT- L1-0000-00H51	LED Part number
12.	ledseries	3.0	Number of LED in series
13.	line_fsw	NaN	AC Line Frequency
14.	source	DC	Input Source Type
15.	ta	50.0	Ambient temperature

Design Assistance

1. LM3401 Product Folder : <http://www.ti.com/product/LM3401> : contains the data sheet and other resources.

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