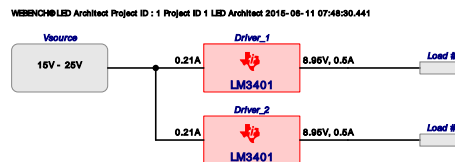


# WEBENCH® LED Architect



## Project Report

Project : 4085740/1 : Project ID 1

Created : 2015-06-11 07:48:30.441

LED Architect with light output=1000.0

Launch WEBENCH LED Architect.

### Project Summary

Total BOM Cost : \$17.70

Total Footprint : 2,456 mm<sup>2</sup>

Total BOM Count : 25

Total Efficiency : 29.4%

Total Efficacy : 98.9 lumens / Watt

Total Power Dissipation (loss) : 1.12 Watts

### Design Input Specifications :

1. VinMax	25.0	Maximum input voltage
2. VinMin	15.0	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	30.0	Ambient temperature

### Regulators

Main Driver NSID : LM3401MM/NOPB Hysteretic controller; Driver Efficiency = 89.1%

### Drivers Electrical BOM

Manufacturer	Part Number	Quantity	Budgetary Price	Footprint (mm <sup>2</sup> )
TDK	C2012X7R1H224K	2	\$0.04	14
Panasonic	ERJ-6ENF1432V	2	\$0.02	14
Panasonic	ERJ-6ENF2802V	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 <sup>2</sup> )
Cree	XPGWHT-L1-0000-00H51	6	\$13.74	-
Aavid	66365	1	\$1.42	22
Total			\$15.16	22

## LED Array Solution

### LED Array

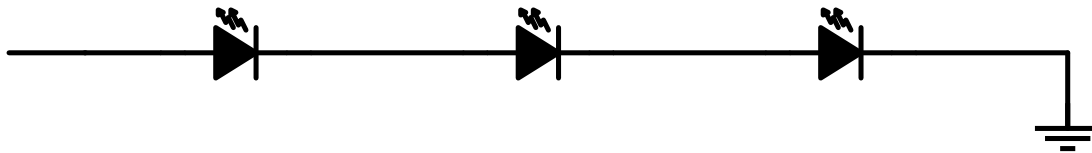
Light Output : 1000 lumens  
 Color : cool white  
 LED quantity : 6 Series = 3 Parallel = 2  
 Total Vout : 8.9 Volts  
 Total Iload : 0.5 Amps  
 Total Light Output : 1000 lumens  
 Flux : 167 lumens  
 ThetaSA : 7.46 C / Watt  
 Junction Temp : 89 degrees  
 Operating Vf : 2.983 Volts  
 Operating Io : 0.502 Amps  
 Efficiency : 33%  
 Efficacy : 111.2 lumens / Watt  
 Total Footprint : 2215.8 mm<sup>2</sup>  
 Total LED Cost : \$15.16  
 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 mm<sup>2</sup>

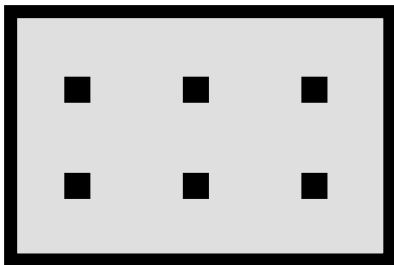
**LED Load Array : For each Driver : series = 3, parallel = 1. LED Quantity = 3**  
**Total Driver Quantity = 2 Total LED Quantity = 6**



### Heatsink

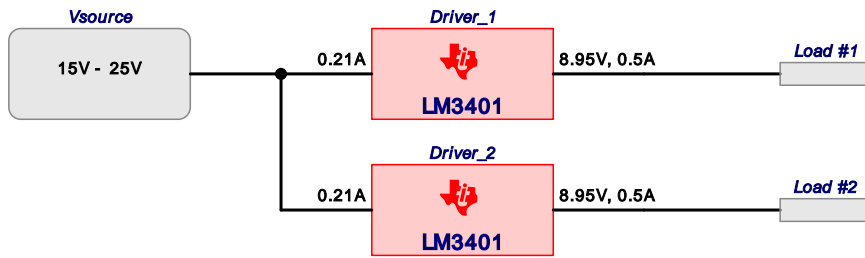
Length : 58.16 mm  
 Width : 38.1 mm  
 Height : 16.0 mm  
 Total Heatsink Footprint : 2216 mm<sup>2</sup>  
 Total Heatsink Cost : \$1.42

Manufacturer : Aavid  
 Part Number : 66365  
 ThetaSA : 8.16 C/W



## Project Diagram

WEBENCH® LED Architect Project ID : 1 Project ID 1 LED Architect 2015-06-11 07:48:30.441



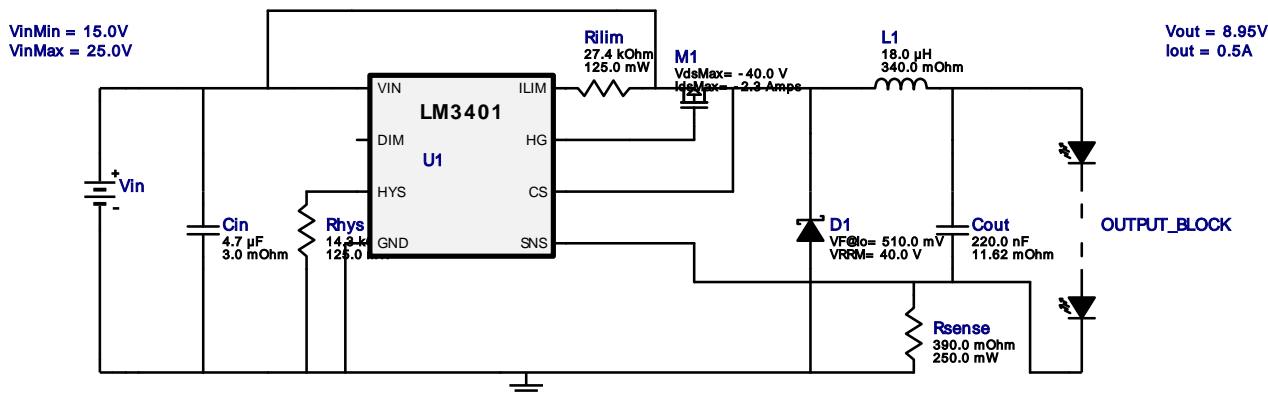


## WEBENCH® Design Report











Design : 4085740/5 LM3401MM/NOPB  
LM3401MM/NOPB 15.0V-25.0V to 9.15V @ 0.502A

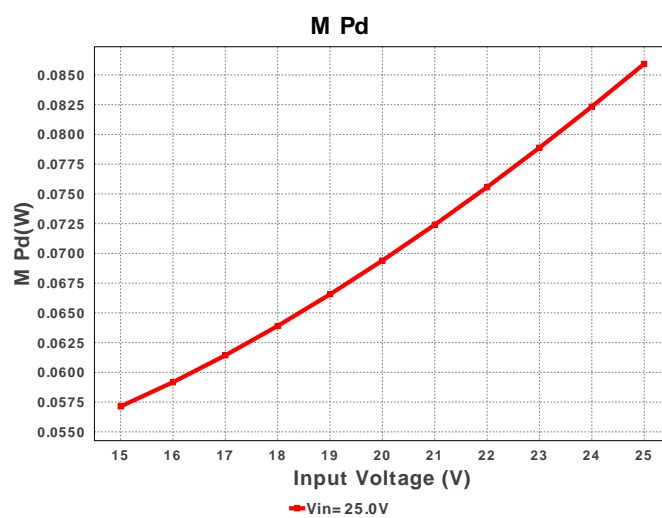
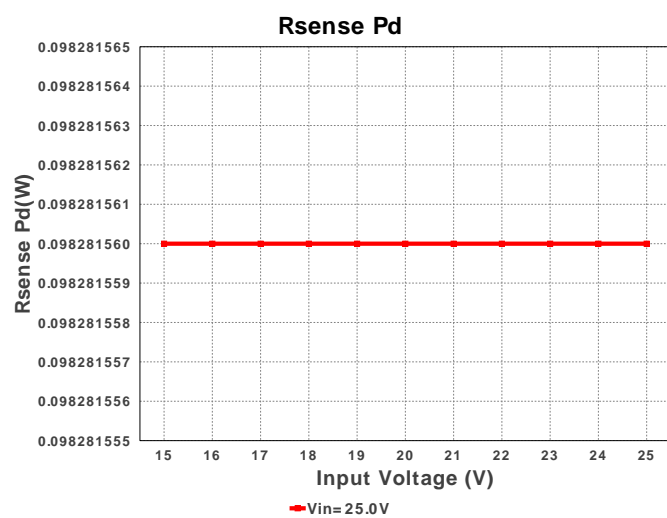
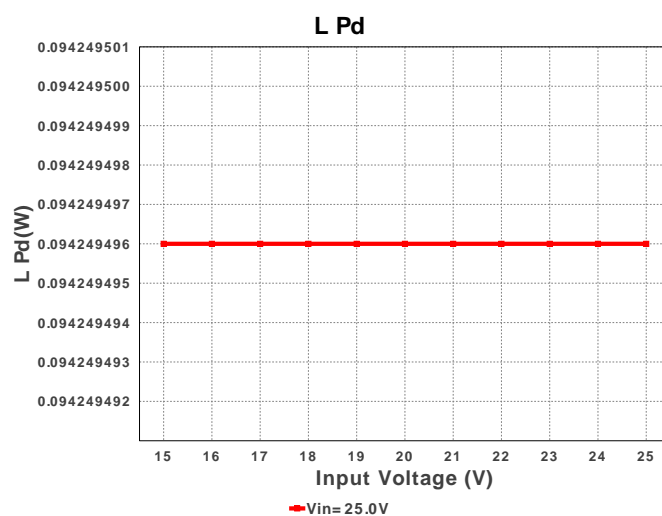
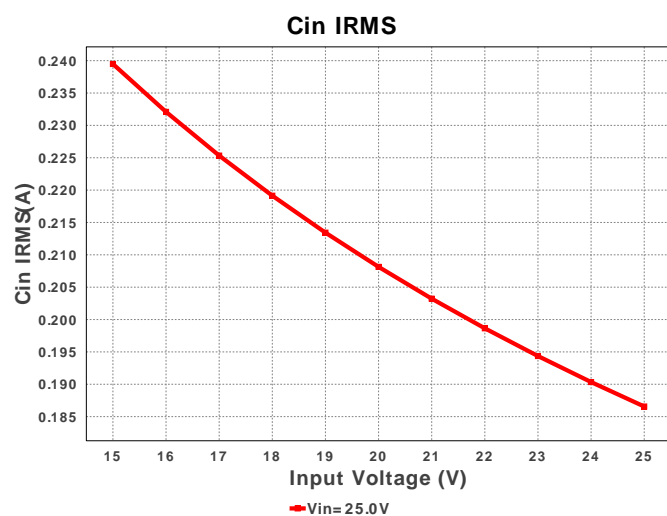
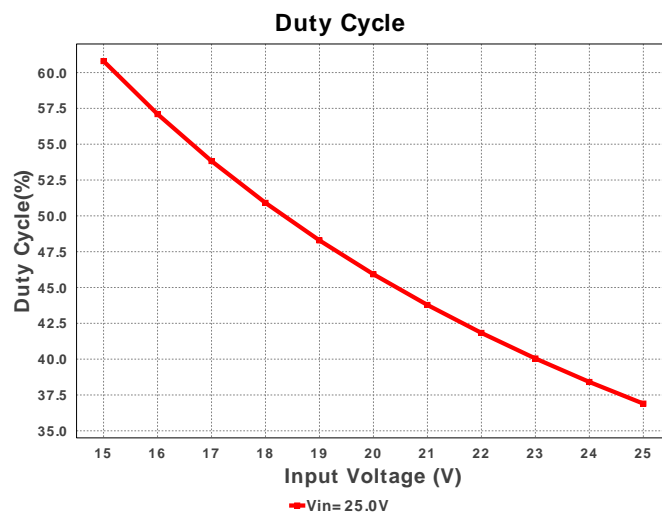
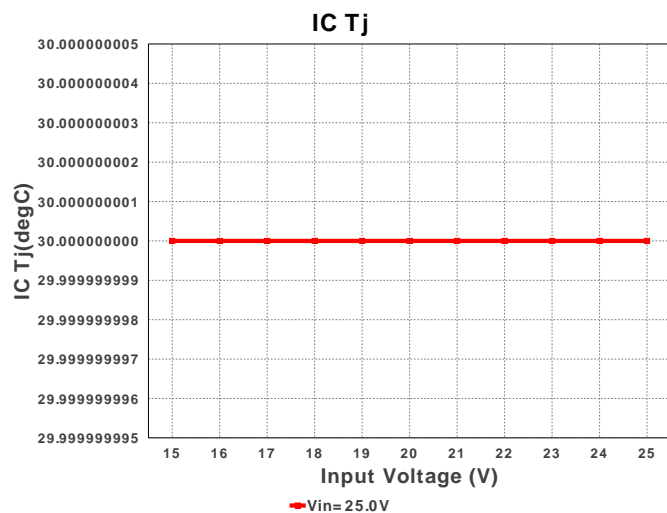
VinMin = 15.0V  
VinMax = 25.0V  
Vout = 8.95V  
Iout = 0.5A

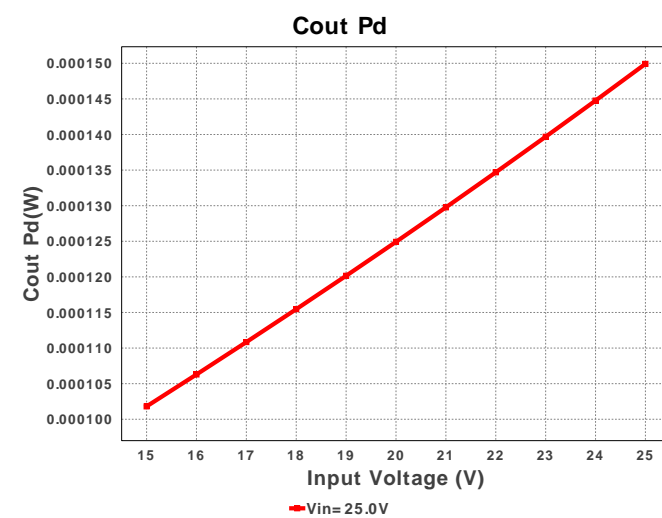
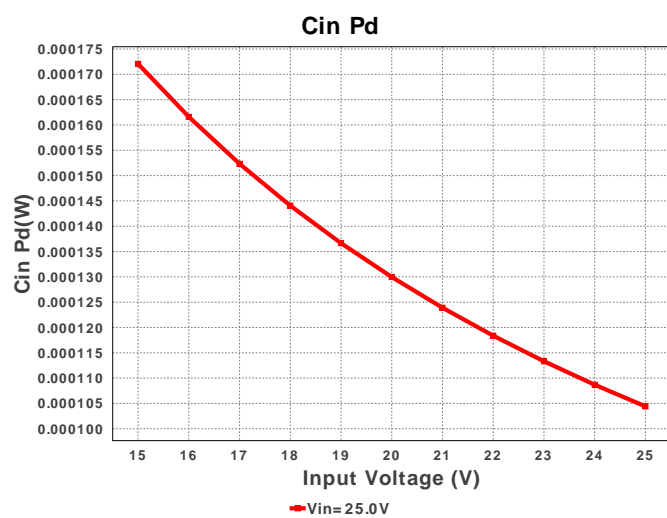
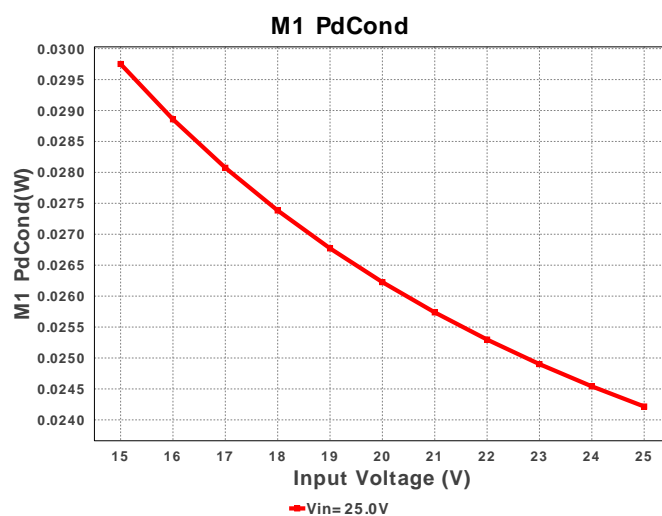
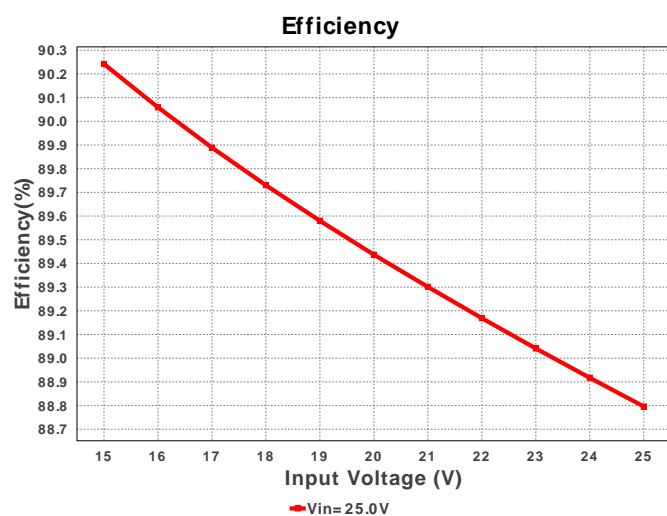
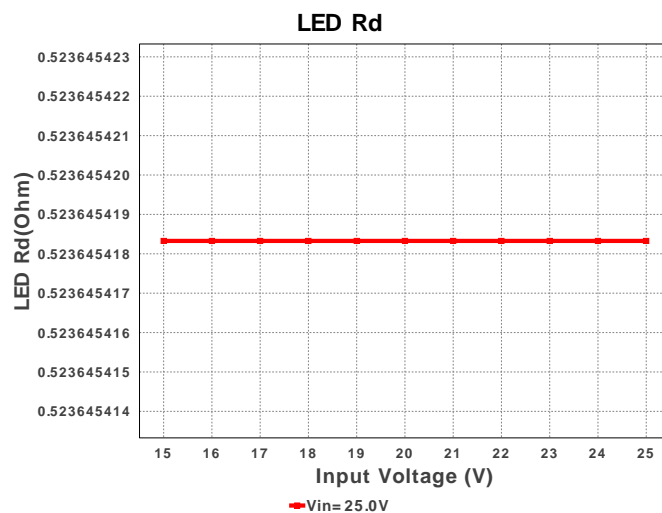
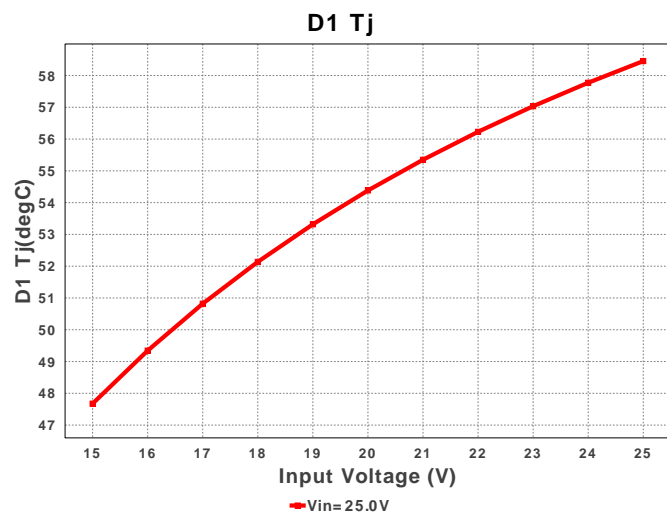
Device = LM3401MM/NOPB  
Topology = Buck  
Created = 6/11/15 7:48:30 AM  
BOM Cost = \$1.27  
Footprint = 120.0 mm<sup>2</sup>  
BOM Count = 12  
Total Pd = 0.56W

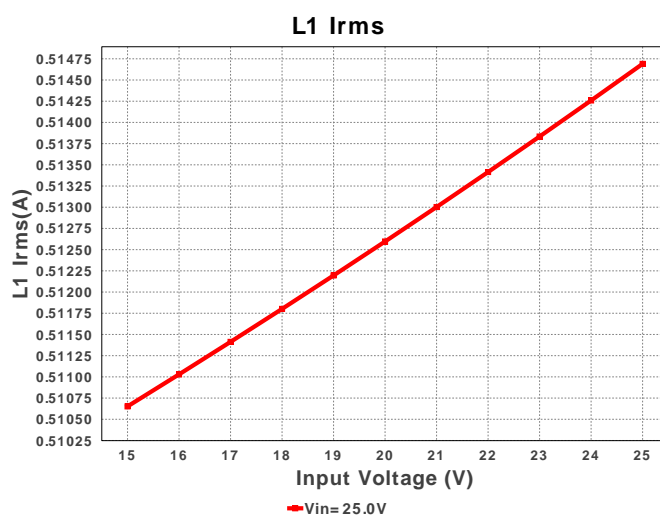
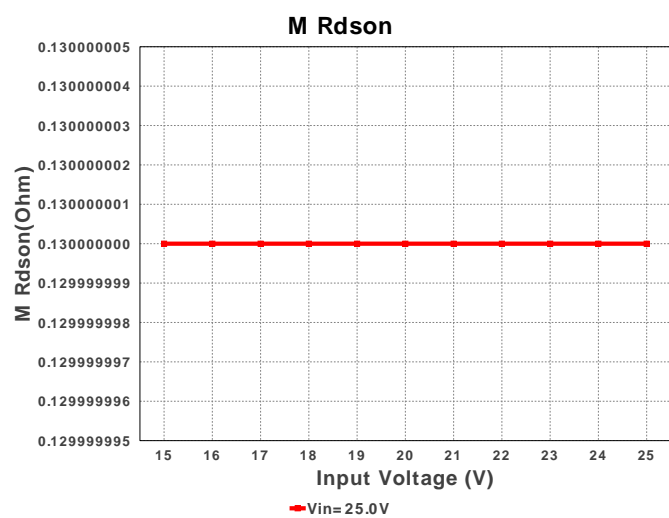
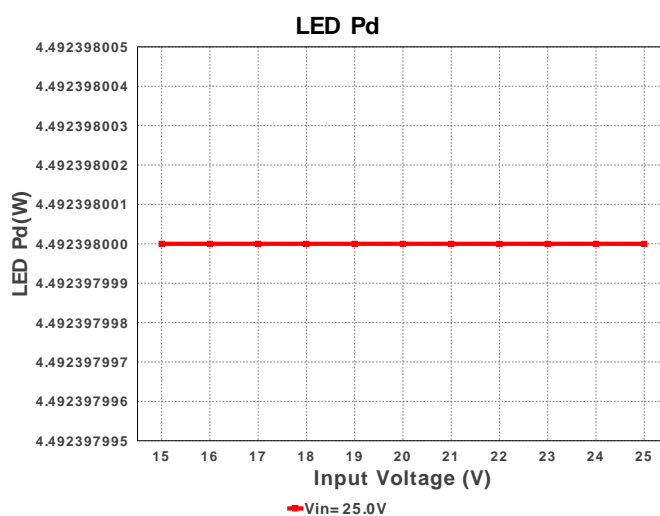
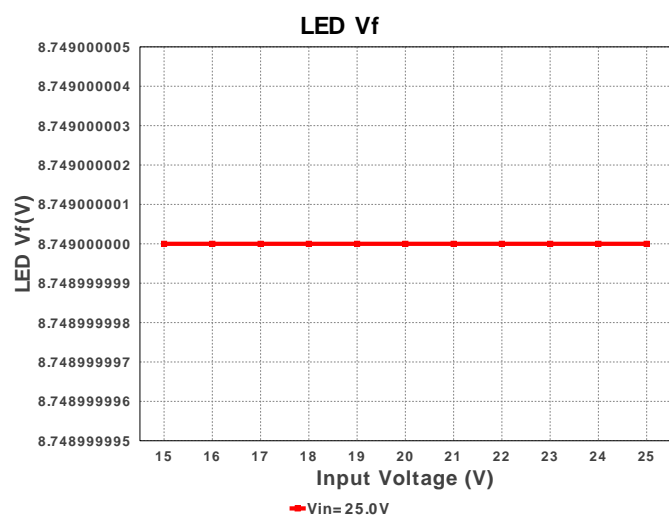
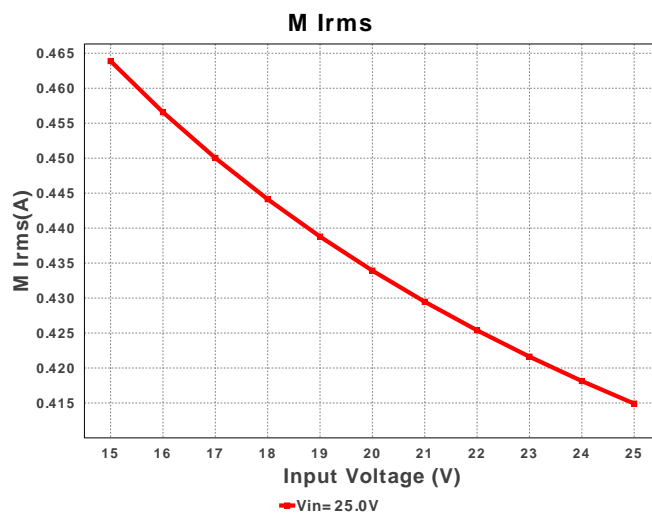
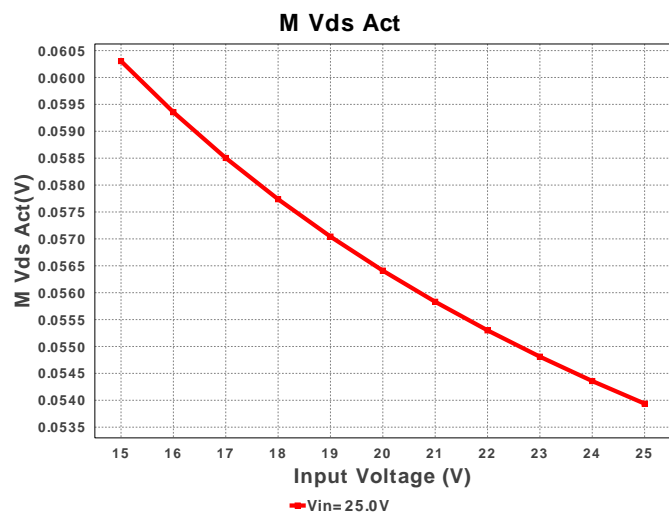


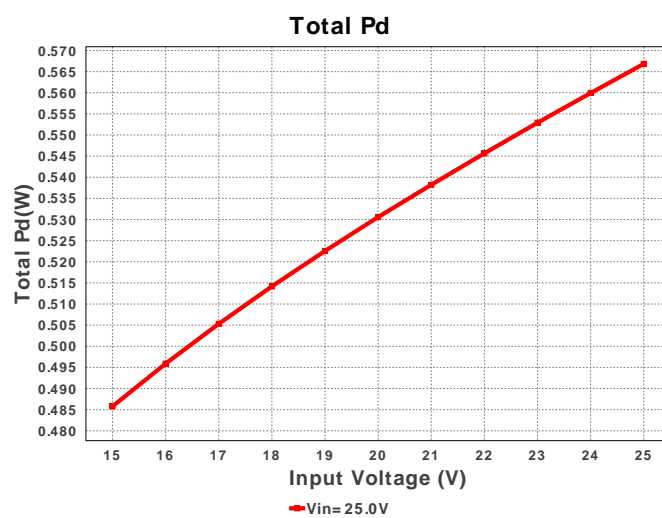
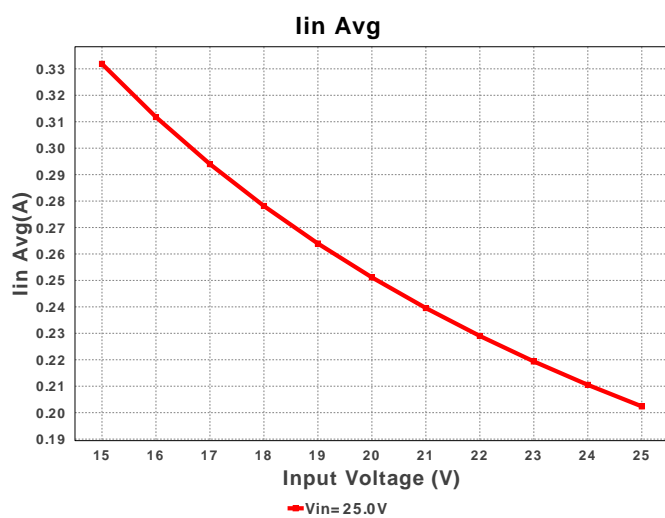
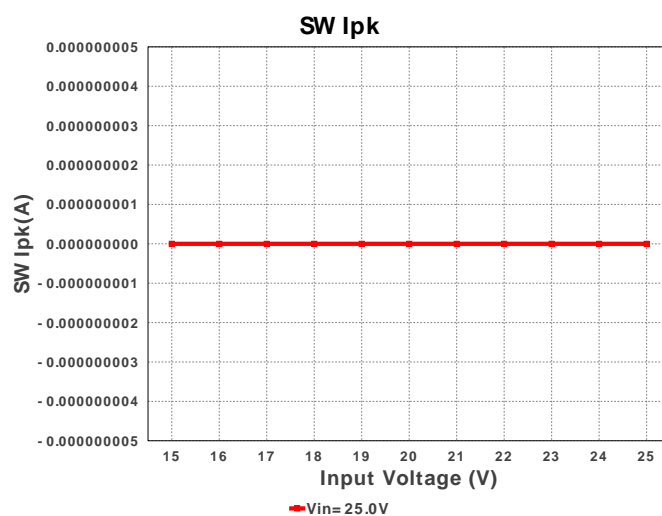
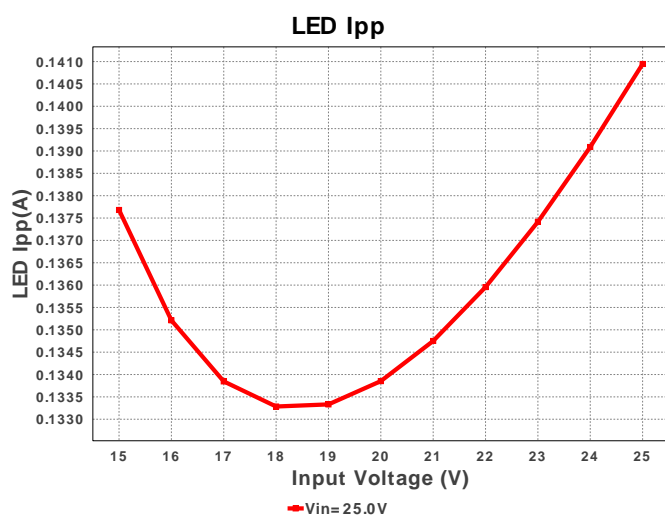
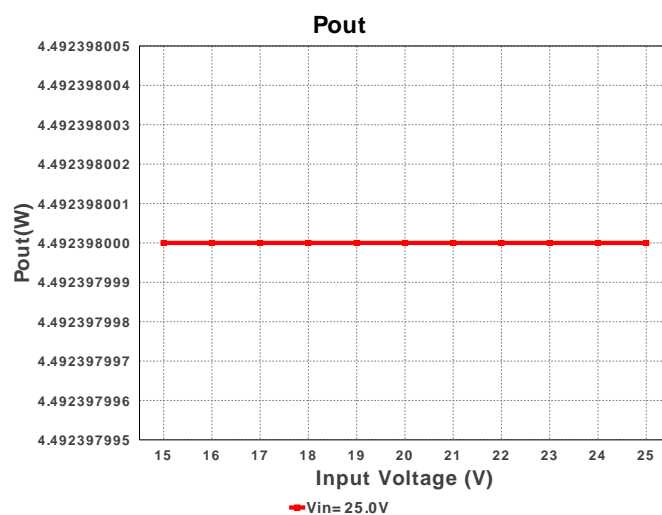
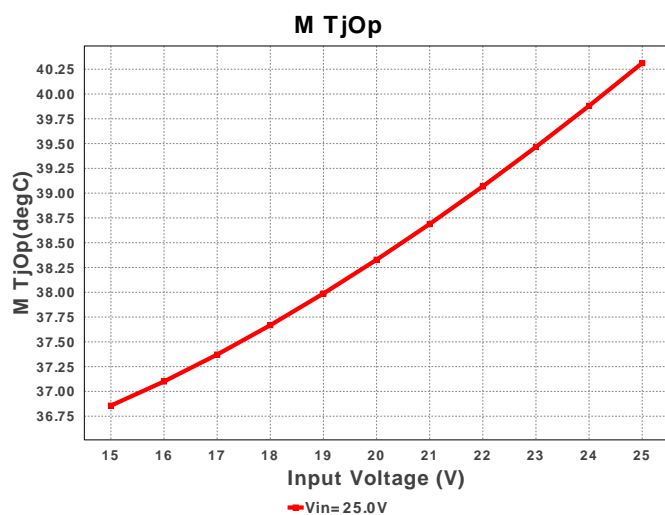
## Electrical BOM

#	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 <sup>2</sup>
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 <sup>2</sup>
3.	D1	ON Semiconductor	MBR0540T1G	Vf@Io= 510.0 mV VRRM= 40.0 V	1	\$0.06	 SOD-123 13 mm <sup>2</sup>
4.	D_LED	Cree	XPGWHT-L1-0000-00H51	LED	3	\$2.29	 xlampxpg 20 mm <sup>2</sup>
5.	L1	Bourns	SDR0403-180ML	L= 18.0 uH DCR= 340.0 mOhm	1	\$0.18	 SDR0403 28 mm <sup>2</sup>
6.	M1	Vishay-Siliconix	SI2319DS-T1-E3	VdsMax= -40.0 V IdsMax= -2.3 Amps	1	\$0.28	 SOT-23 14 mm <sup>2</sup>
7.	Rhys	Panasonic	ERJ-6ENF1432V Series= 225	Res= 14.3 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>
8.	Rilim	Panasonic	ERJ-6ENF2742V Series= 225	Res= 27.4 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>
9.	Rsense	Panasonic	ERJ-8RQFR39V Series= 229	Res= 390.0 mOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.04	 1206 11 mm <sup>2</sup>
10.	U1	Texas Instruments	LM3401MM/NOPB	Switcher	1	\$0.60	 MUA08A 24 mm <sup>2</sup>



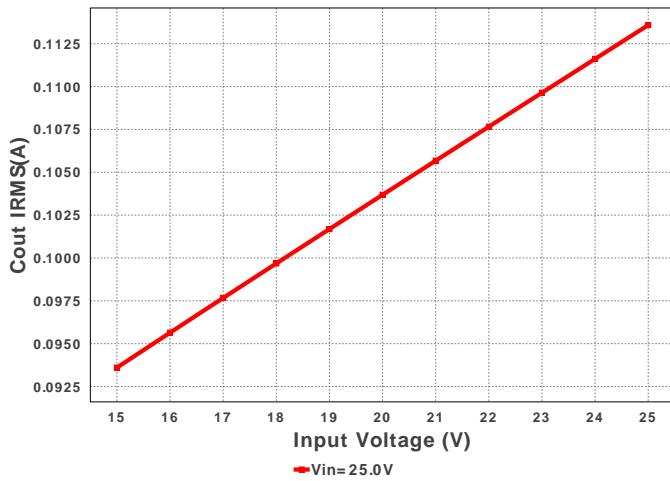




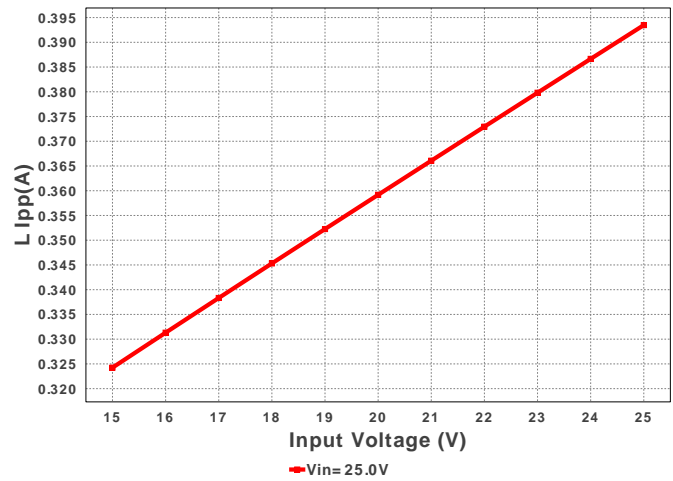




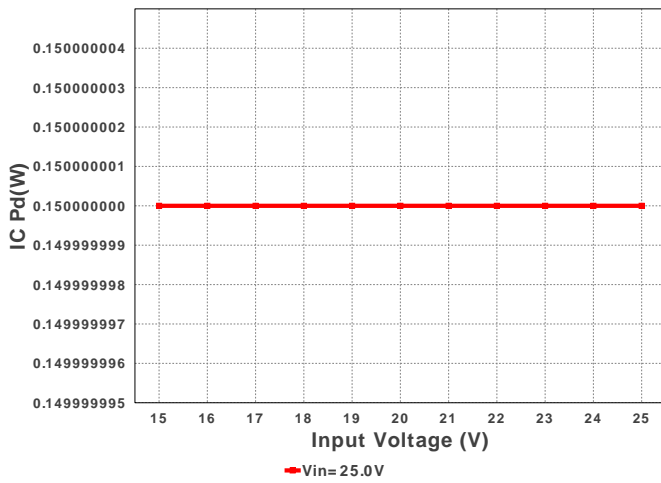
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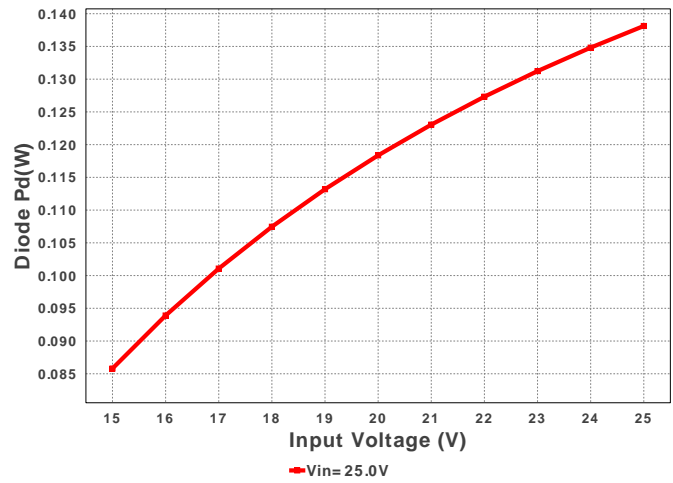
L Ipp



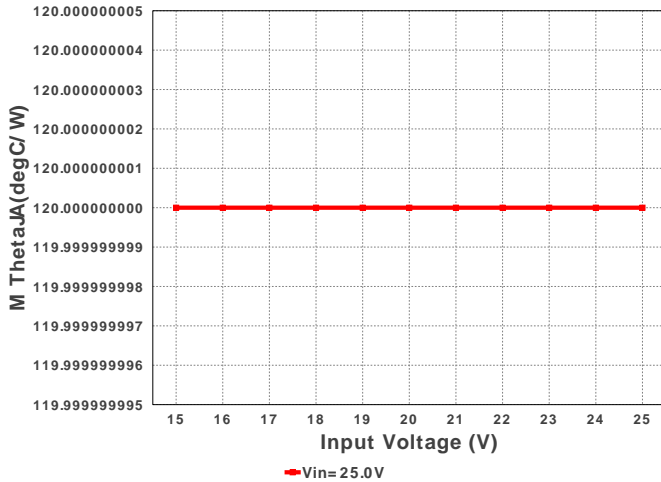
IC Pd



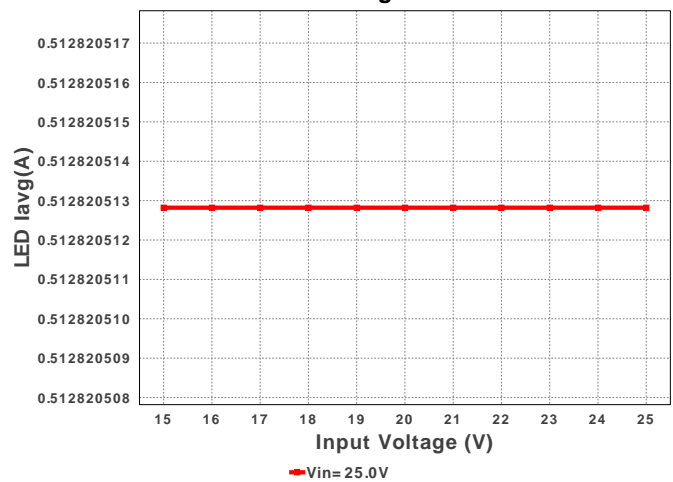
Diode Pd

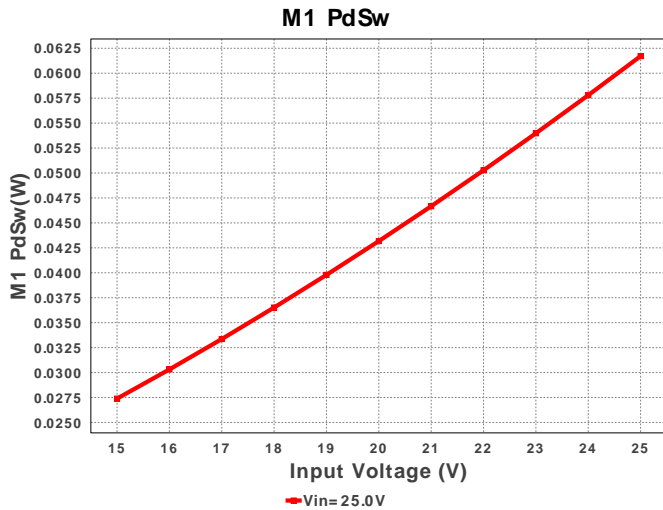


M ThetaJA



LED Iavg





## Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	185.291 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	113.822 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	206.18 mA	Current	Average input current
4.	L Ipp	394.29 mA	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	514.742 mA	Current	Inductor ripple current
6.	LED Iavg	512.821 mA	Current	LED Average Current
7.	LED Ipp	140.732 mA	Current	LED Ripple Current
8.	M Irms	419.518 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 <sup>2</sup>	General	Total Foot Print Area of BOM components
12.	Frequency	840.92 kHz	General	Switching frequency
13.	IC Tolerance	12.0 mV	General	IC Feedback Tolerance
14.	M Rdson	130.0 mOhm	General	Drain-Source On-resistance
15.	M Vds Act	54.537 mV	General	M Vds
16.	Pout	4.593 W	General	Total output power
17.	Total BOM	\$1.27	General	Total BOM Cost
18.	D1 Tj	57.303 degC	Op_Point	D1 junction temperature
19.	Vout OP	9.149 V	Op_Point	Operational Output Voltage
20.	Duty Cycle	37.652 %	Op_point	Duty cycle
21.	Efficiency	89.101 %	Op_point	Steady state efficiency
22.	IC Tj	30.0 degC	Op_point	IC junction temperature
23.	ICThetaJA	151.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
24.	IOUT_OP	502.0 mA	Op_point	Iout operating point
25.	LED Rd	523.645 mOhm	Op_point	LED DynamicResistance
26.	LED Vf	8.949 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	40.378 degC	Op_point	MOSFET junction temperature
29.	VIN_OP	25.0 V	Op_point	Vin operating point
30.	Cin Pd	102.998 μW	Power	Input capacitor power dissipation
31.	Cout Pd	150.543 μW	Power	Output capacitor power dissipation
32.	Diode Pd	132.538 mW	Power	Diode power dissipation
33.	IC Pd	150.0 mW	Power	IC power dissipation
34.	L Pd	94.249 mW	Power	Inductor power dissipation
35.	LED Pd	4.492 W	Power	LED Power Dissipation
36.	M Pd	86.481 mW	Power	MOSFET power dissipation
37.	M1 PdCond	24.765 mW	Power	M1 MOSFET conduction losses
38.	M1 PdSw	61.715 mW	Power	M1 MOSFET switching losses
39.	Rsense Pd	98.282 mW	Power	Rsense Power Dissipation
40.	Total Pd	561.789 mW	Power	Total Power Dissipation

## Design Inputs

#	Name	Value	Description
1.	Iout	502.0 m	Maximum Output Current
2.	Iout1	502.0 m	Output Current #1
3.	VinMax	25.0	Maximum input voltage
4.	VinMin	15.0	Minimum input voltage
5.	Vout	8.949	Output Voltage
6.	Vout1	8.949	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	30.0	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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