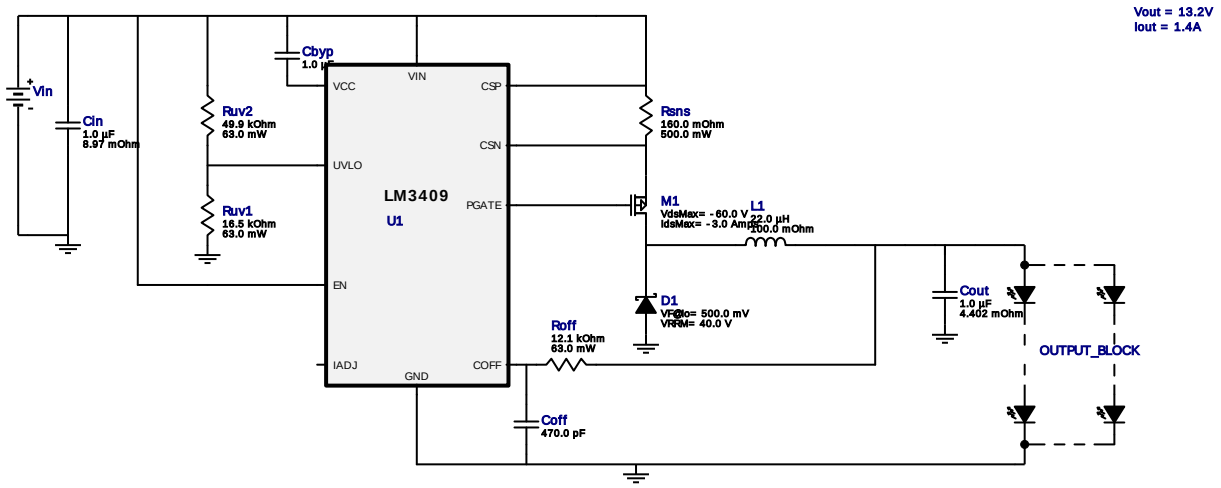
WEBENCH® Design Report

VinMin = 24.0V
VinMax = 32.0V
Vout = 13.2V
Iout = 1.4A

Device = LM3409MY/NOPB
Topology = Buck
Created = 7/25/16 7:21:24 AM
BOM Cost = $69.88
BOM Count = 28
Total Pd = 1.86W

Design : 1194016/2206 LM3409MY/NOPB
LM3409MY/NOPB 24.0V-32.0V to 13.20V @ 1.4A



1. Bypass Capacitor Connection : WEBENCH schematic configured for the selected PFET's total gate charge (Qg). If the Qg value is > 30 nC, the Bypass Capacitor(Cbyp or CF) is connected from the VCC pin to CSN pin instead of the typically connected from VCC to Vin when Qg < 30nC.

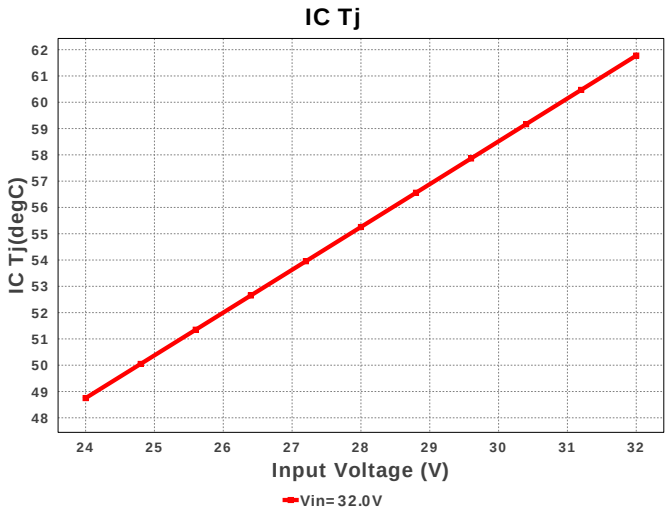
My Comments

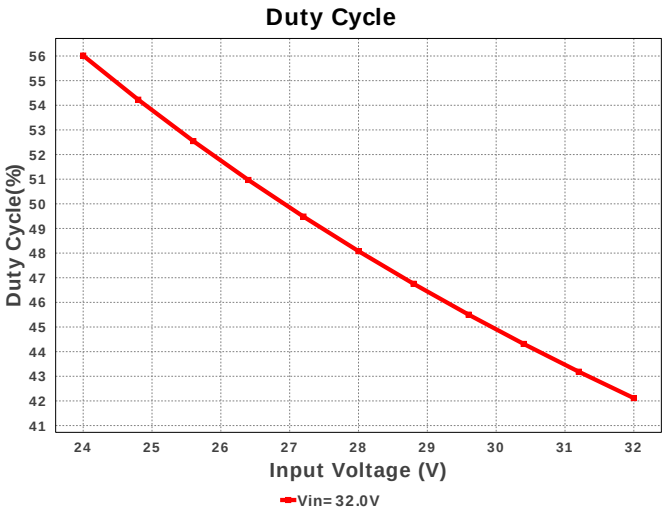
No comments

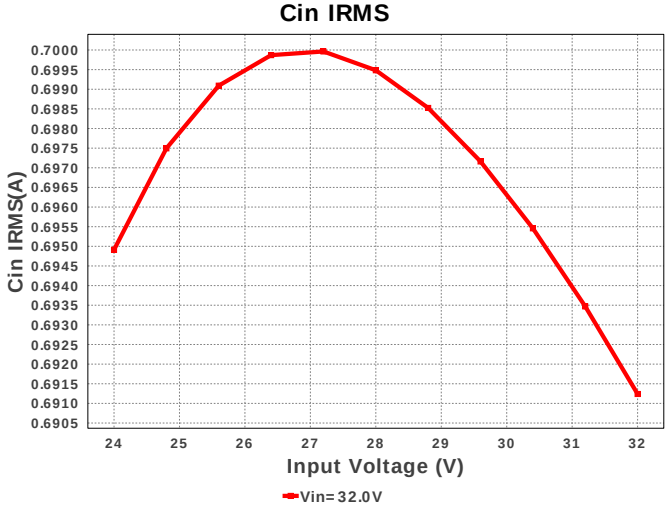
Electrical BOM

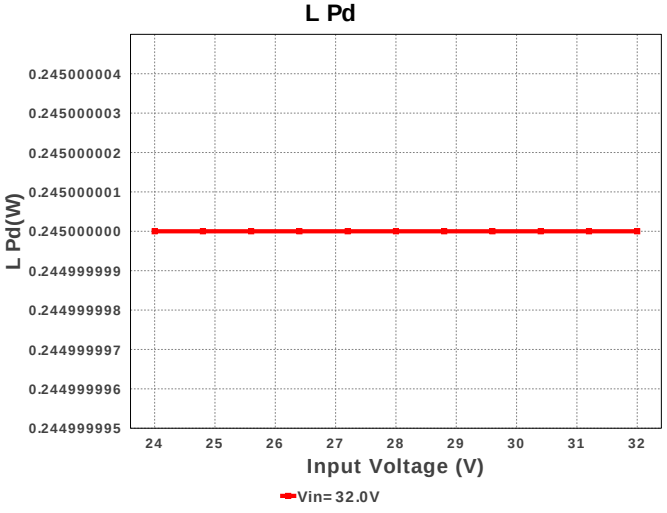
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbyp	Taiyo Yuden	EMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 16.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
2.	Cin	TDK	C3216X5R1H105K Series= X5R	Cap= 1.0 uF ESR= 8.97 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.02	1206 11 mm²
3.	Coff	Yageo America	CC0805KRX7R9BB471 Series= X7R	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cout	MuRata	GRM21BR71H105KA12L Series= X7R	Cap= 1.0 uF ESR= 4.402 mOhm VDC= 50.0 V IRMS= 1.677 A	1	$0.05	0805 7 mm²
5.	D1	Diodes Inc.	B240A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.09	SMA 37 mm²
6.	D_LED	Cree	XREBLU-L1-R250-00K01	LED	16	$4.28	xlampxre 99 mm²
7.	L1	Bourns	SRN8040-220M	L= 22.0 µH DCR= 100.0 mOhm	1	$0.22	SRN8040 100 mm²

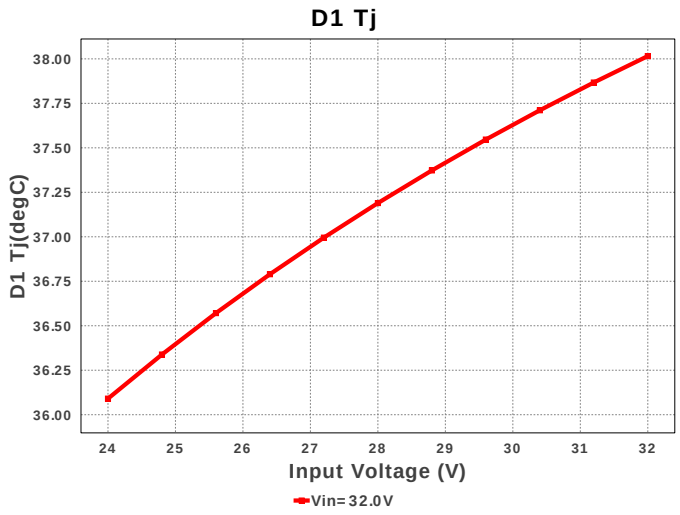
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	M1	Fairchild Semiconductor	FDC5614P	VdsMax= -60.0 V IdsMax= -3.0 Amps	1	$0.23	SOT-23-6 15 mm^2
9.	Roff	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
10.	Rsns	Rohm	MCR25JZHFLR160 Series= MCR25	Res= 160.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.03	1210 15 mm^2
11.	Ruv1	Vishay-Dale	CRCW040216K5FKED Series= CRCW..e3	Res= 16.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
12.	Ruv2	Vishay-Dale	CRCW040249K9FKED Series= CRCW..e3	Res= 49.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
13.	U1	Texas Instruments	LM3409MY/NOPB	Switcher	1	$0.70	MUC10A 24 mm^2

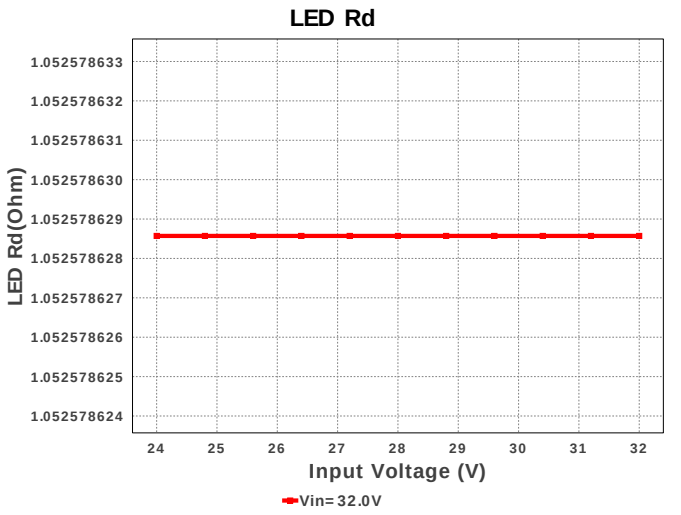


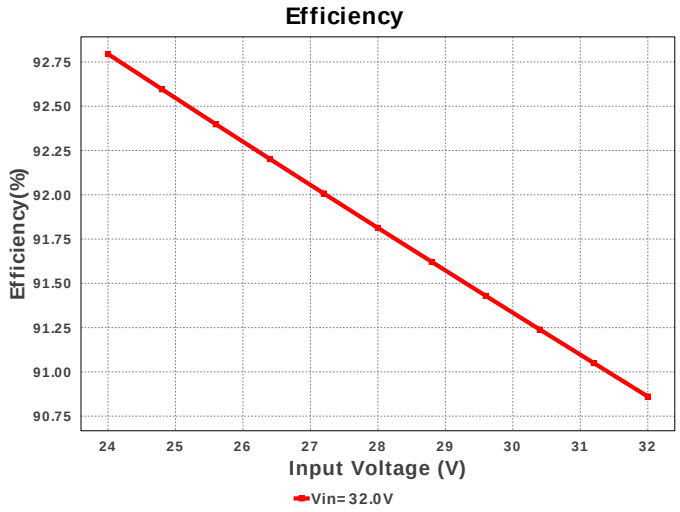


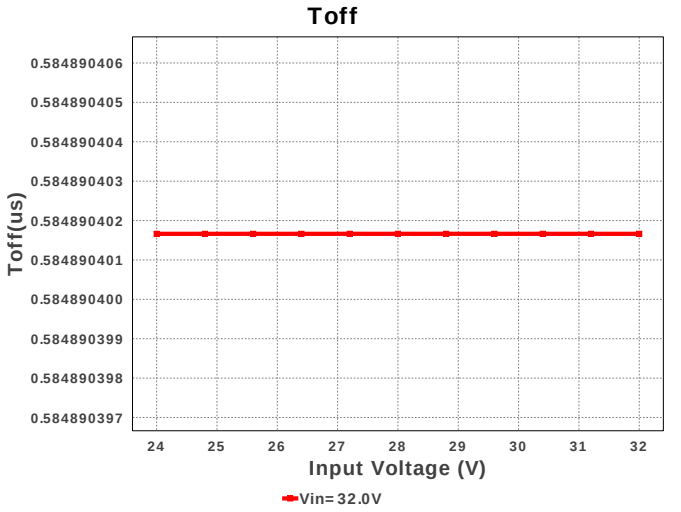


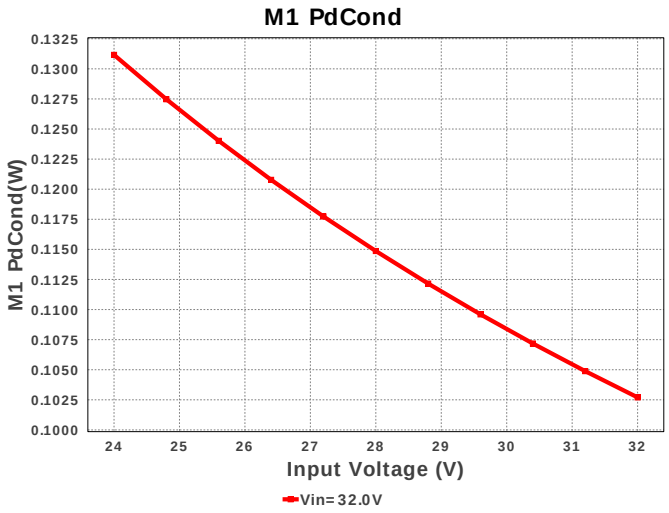


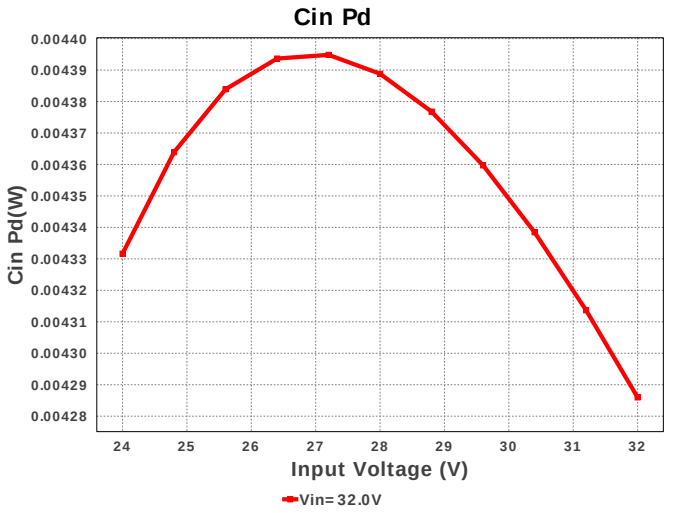


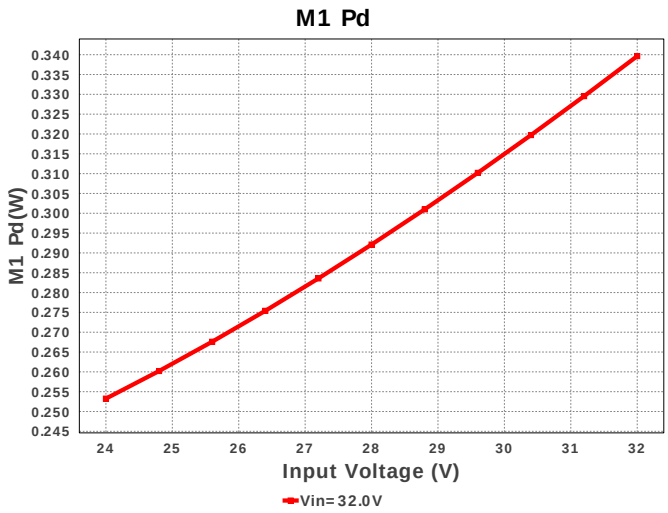


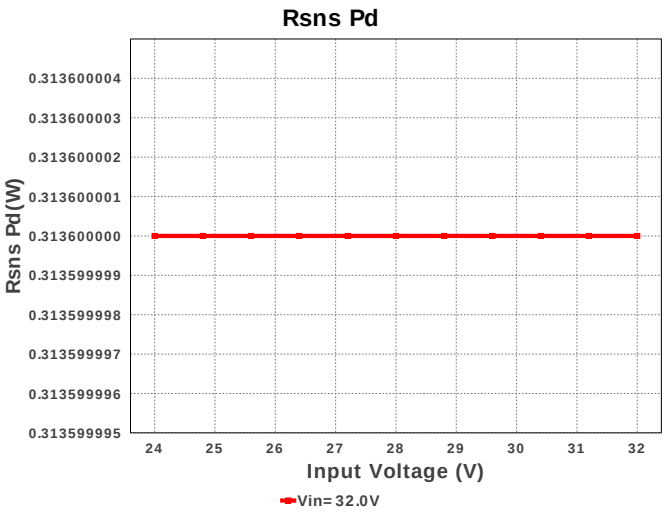


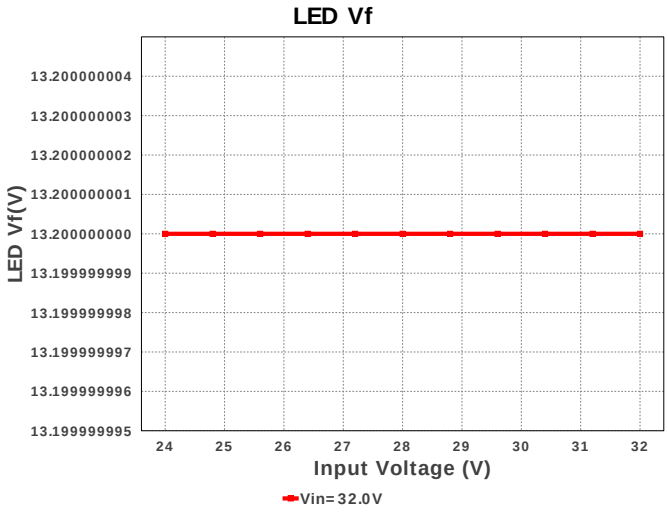


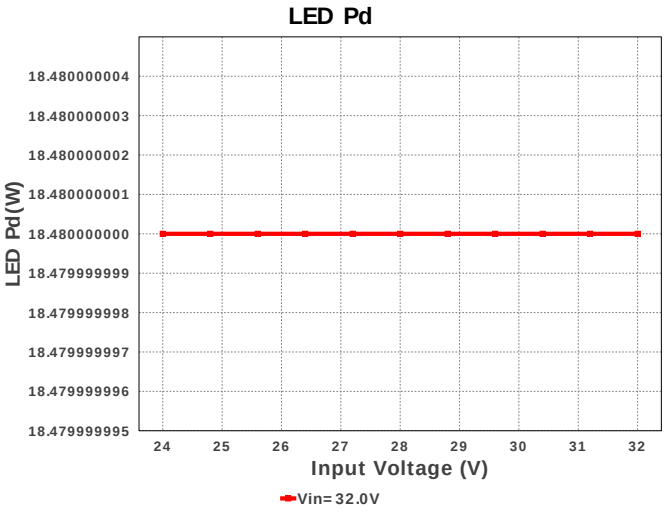


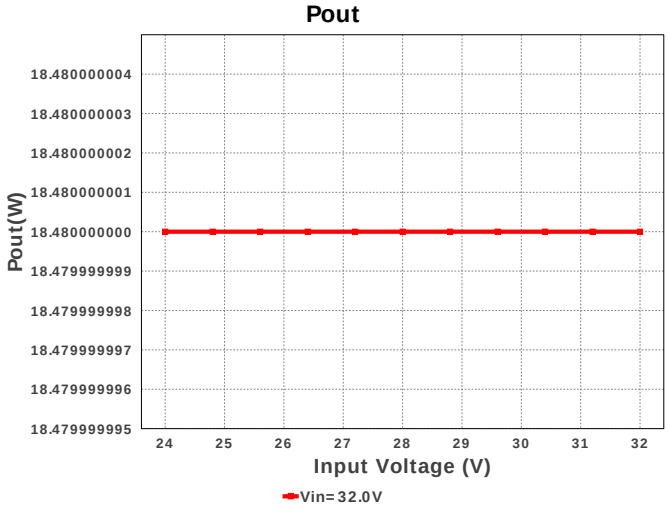


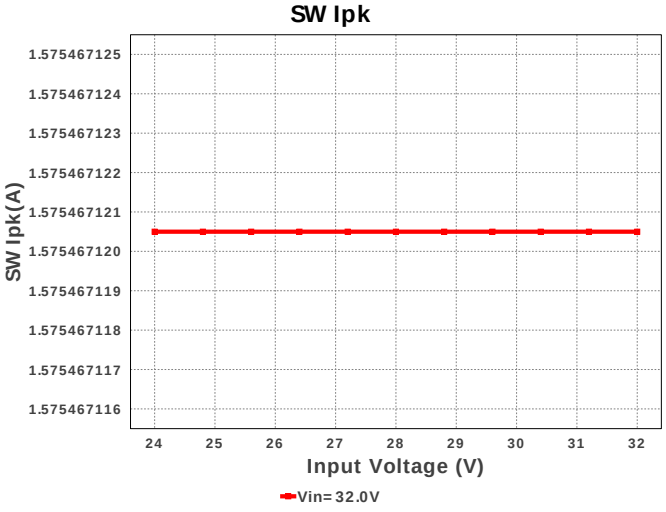


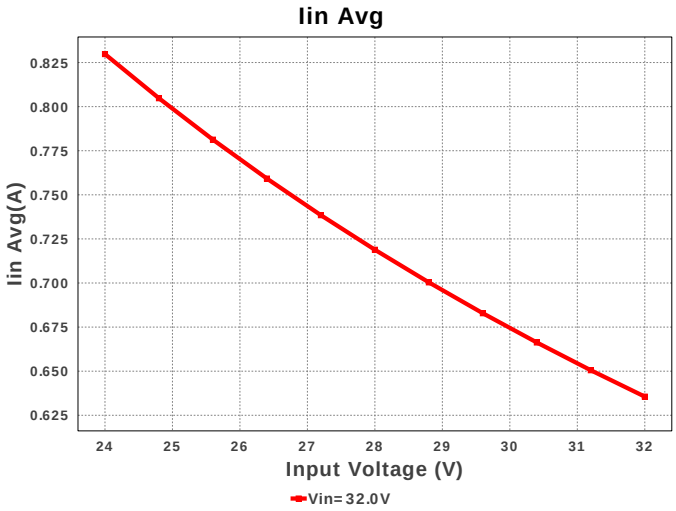


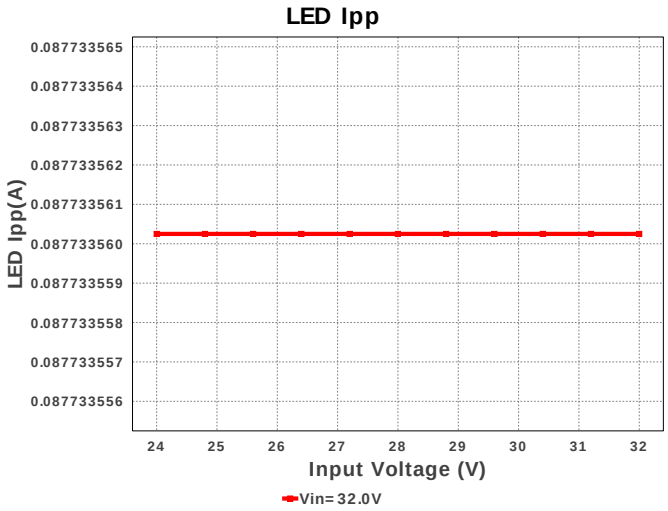


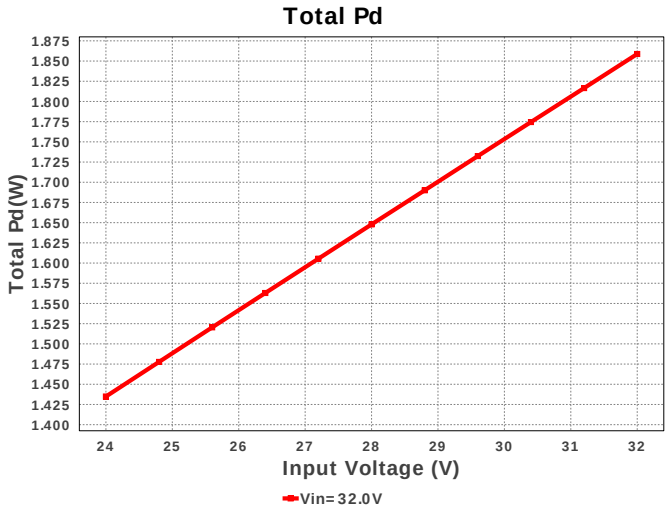


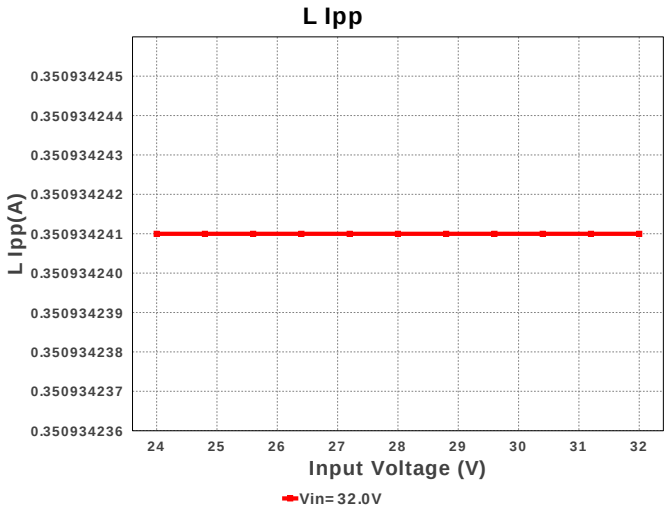


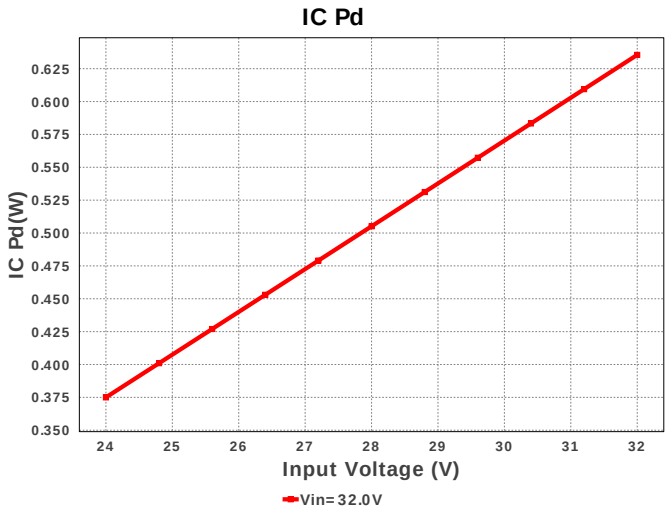


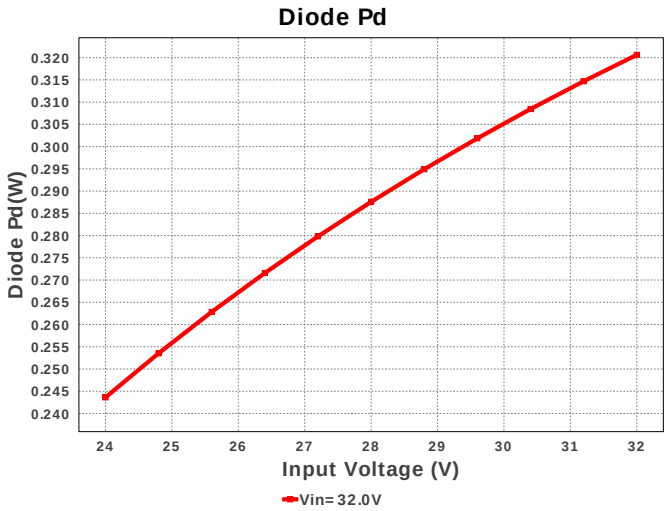


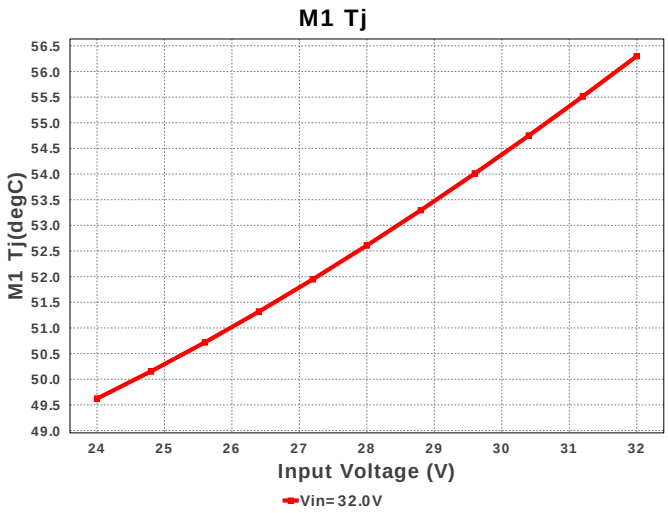


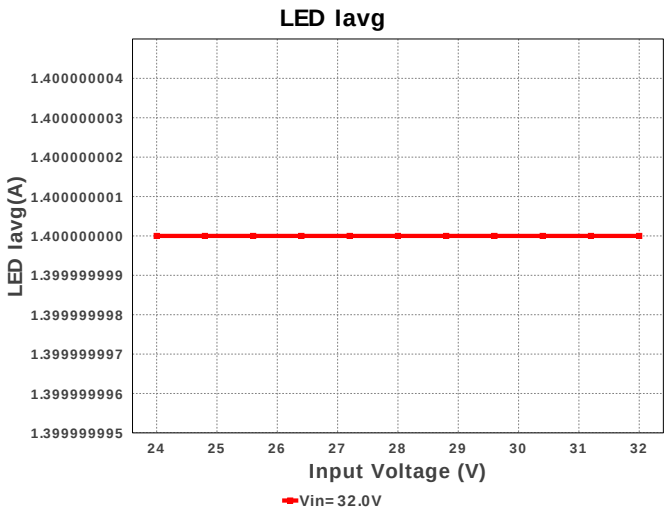


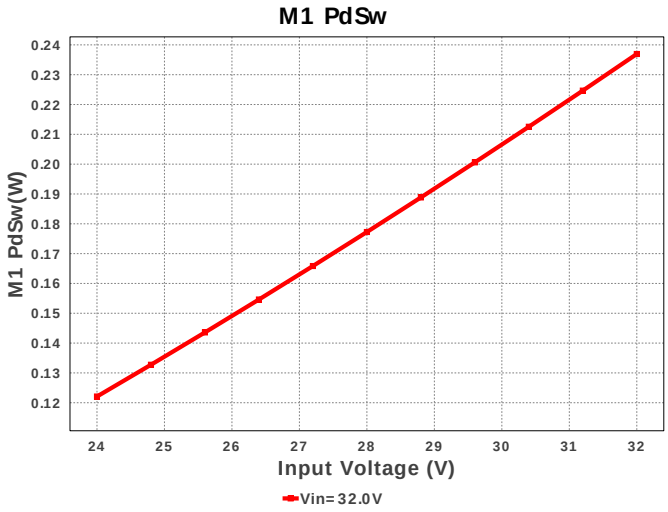












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	691.24 mA	Current	Input capacitor RMS ripple current
2.	Iin Avg	635.56 mA	Current	Average input current
3.	L Ipp	350.93 mA	Current	Peak-to-peak inductor ripple current
4.	LED Iavg	1.4 A	Current	LED Average Current
5.	LED Ipp	11.891 mA	Current	LED Ripple Current
6.	SW Ipk	1.575 A	Current	Peak switch current
7.	BOM Count	28	General	Total Design BOM count
8.	FootPrint	1.815 k mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	990.849 kHz	General	Switching frequency
10.	IC Tolerance	54.0 mV	General	IC Feedback Tolerance
11.	Pout	18.48 W	General	Total output power
12.	Toff	584.89 mus	General	Fixed Off Time
13.	Total BOM	$69.88	General	Total BOM Cost
14.	D1 Tj	38.016 degC	Op_Point	D1 junction temperature
15.	Vout OP	13.2 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	42.115 %	Op_point	Duty cycle
17.	Efficiency	90.865 %	Op_point	Steady state efficiency
18.	IC Tj	61.736 degC	Op_point	IC junction temperature
19.	ICThetaJA	50.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	1.4 A	Op_point	Iout operating point
21.	LED Rd	1.053 Ohm	Op_point	LED DynamicResistance
22.	LED Vf	13.2 V	Op_point	Total LED Forward Calculated Voltage
23.	M1 Tj	56.289 degC	Op_point	MOSFET junction temperature
24.	M1 Tj	56.289 degC	Op_point	MOSFET junction temperature
25.	VIN_OP	32.0 V	Op_point	Vin operating point
26.	Cin Pd	4.286 mW	Power	Input capacitor power dissipation
27.	Diode Pd	320.622 mW	Power	Diode power dissipation
28.	IC Pd	634.729 mW	Power	IC power dissipation
29.	L Pd	245.0 mW	Power	Inductor power dissipation
30.	LED Pd	18.48 W	Power	LED Power Dissipation
31.	M1 Pd	339.625 mW	Power	M1 MOSFET total power dissipation

#	Name	Value	Category	Description
32.	M1 PdCond	102.821 mW	Power	M1 MOSFET conduction losses
33.	M1 PdSw	236.805 mW	Power	M1 MOSFET switching losses
34.	Rsns Pd	313.6 mW	Power	LED Power Dissipation
35.	Total Pd	1.858 W	Power	Total Power Dissipation
36.	Vout Tolerance	409.091 m%		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.4	Maximum Output Current
2.	VinMax	32.0	Maximum input voltage
3.	VinMin	24.0	Minimum input voltage
4.	Vout	13.2	Output Voltage
5.	application	LED_DRIVER	LED Application
6.	base_pn	LM3409	Base Product Number
7.	LED_Architect	N	LED Architect Project
8.	ledparallel	4.0	Number of LED in parallel
9.	ledpartnumber	XREBLU-L1-R250-00K01	LED Part number
10.	ledseries	4.0	Number of LED in series
11.	line_fsw	60.0	AC Line Frequency
12.	source	DC	Input Source Type
13.	Ta	30.0	Ambient temperature

Design Assistance

1. Application Hints Bypass Capacitor Connection WEBENCH schematic configured for the selected PFET's total gate charge (Qg)If the Qg value is > 30 nC, the Bypass Capacitor(Cbyp or CF) is connected from the VCC pin to CSN pin instead of typically connected from VCC to Vin when Qg < 30nC. Please see the datasheet for further design guidance. http://www.ti.com/lit/ds/symlink/LM3409HV.pdf

2. **LM3409** Product Folder : http://www.ti.com/product/LM3409 : contains the data sheet and other resources.