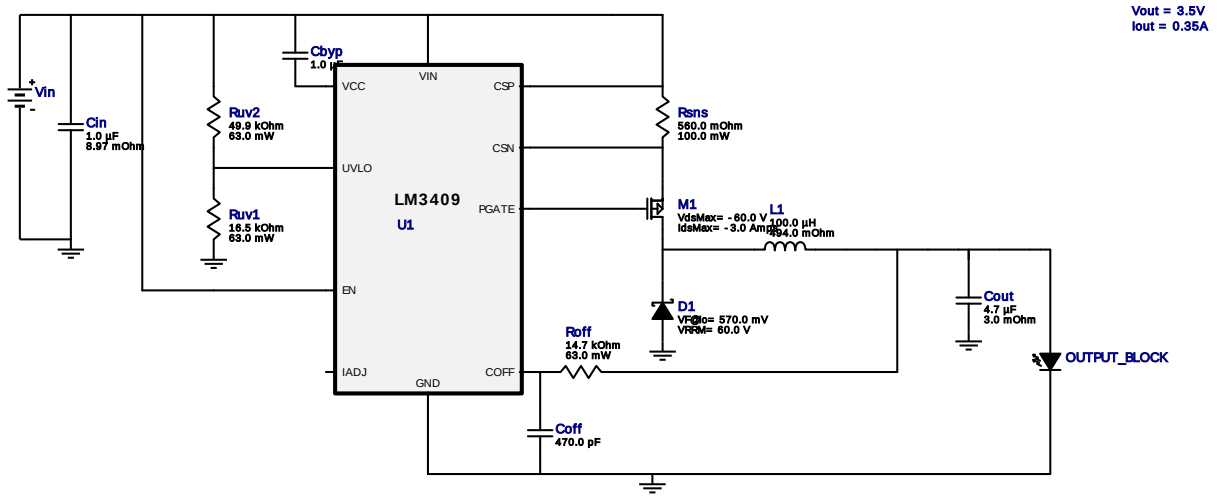
WEBENCH® Design Report

VinMin = 24.0V
VinMax = 32.0V
Vout = 3.5V
Iout = 0.35A

Device = LM3409MY/NOPB
Topology = Buck
Created = 8/11/16 11:43:19 PM
BOM Cost = $0.00
BOM Count = 13
Total Pd = 0.5W

Design : 4766016/2 LM3409MY/NOPB
LM3409MY/NOPB 24.0V-32.0V to 3.50V @ 0.35A

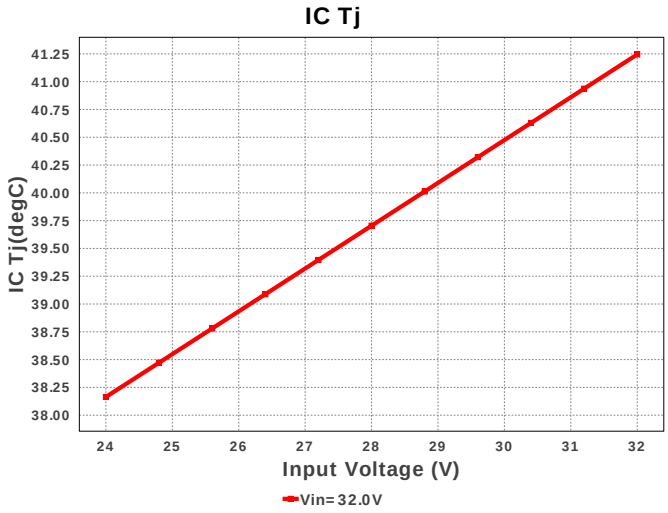


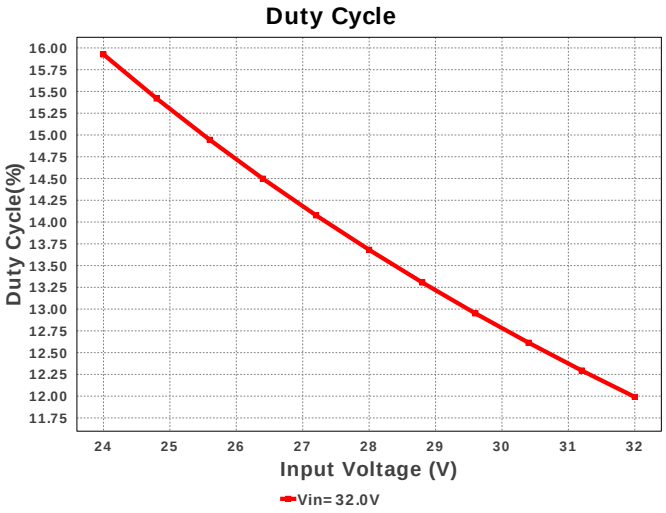
1. Bypass Capacitor Connection : WEBENCH schematic configured for the selected PFET's total gate charge (Qg). If the Qg value is > 30 nC, the Bypass Capacitor(Cbyp or CF) is connected from the VCC pin to CSN pin instead of the typically connected from VCC to Vin when Qg < 30nC.

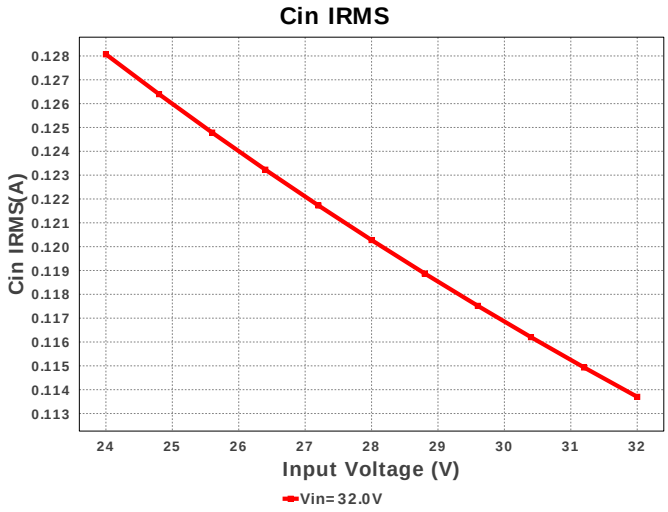
Electrical BOM

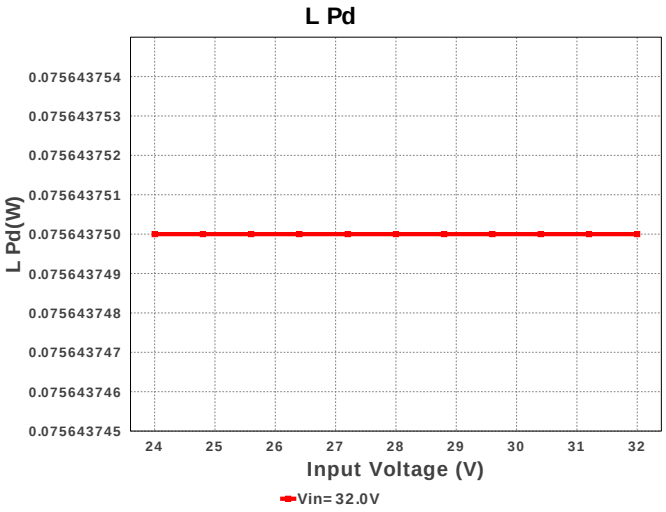
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbyp	Taiyo Yuden	EMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 16.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
2.	Cin	TDK	C3216X5R1H105K Series= X5R	Cap= 1.0 uF ESR= 8.97 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.02	1206 11 mm²
3.	Coff	Yageo America	CC0805KRX7R9BB471 Series= X7R	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cout	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	1	$0.07	1206 11 mm²
5.	D1	NXP Semiconductor	PMEG6010CEH,115	VF@Io= 570.0 mV VRRM= 60.0 V	1	$0.04	SOD-123F 12 mm²
6.	D_LED	CUSTOM	CUSTOM	LED	1	NA	CUSTOM 0 mm²
7.	L1	Bourns	SRN6045-101M	L= 100.0 µH DCR= 494.0 mOhm	1	$0.16	SRN6045 64 mm²
8.	M1	Fairchild Semiconductor	FDC5614P	VdsMax= -60.0 V IdsMax= -3.0 Amps	1	$0.23	SOT-23-6 15 mm²
9.	Roff	Vishay-Dale	CRCW040214K7FKED Series= CRCW..e3	Res= 14.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

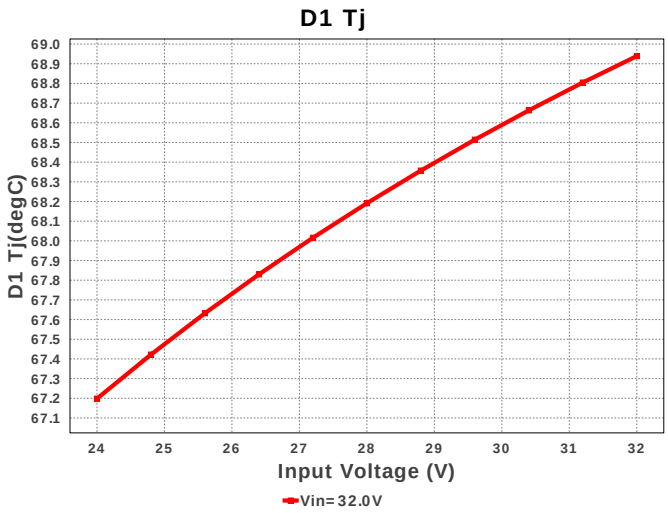
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Rsns	Panasonic	ERJ-3RQFR56V Series= ERJ-3R	Res= 560.0 mOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.02	0603 5 mm^2
11.	Ruv1	Vishay-Dale	CRCW040216K5FKED Series= CRCW..e3	Res= 16.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
12.	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

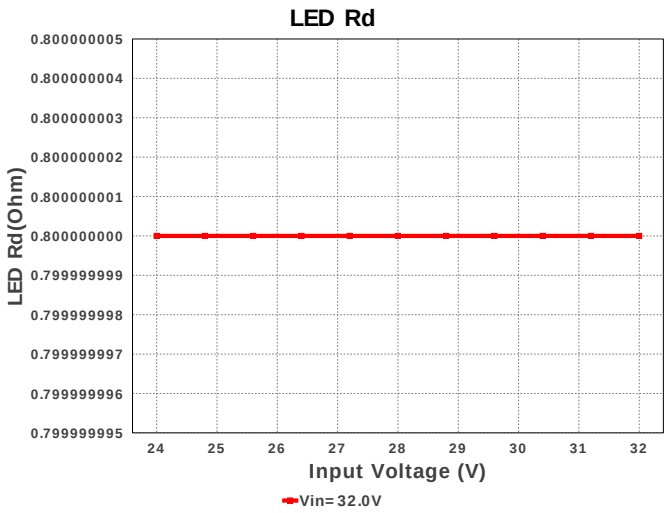


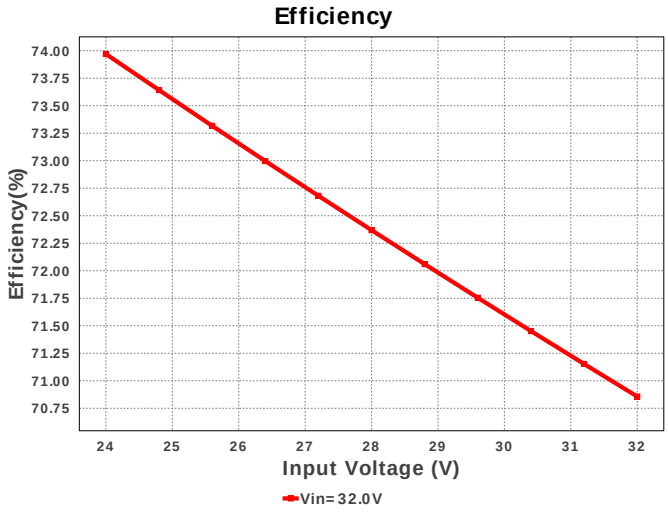


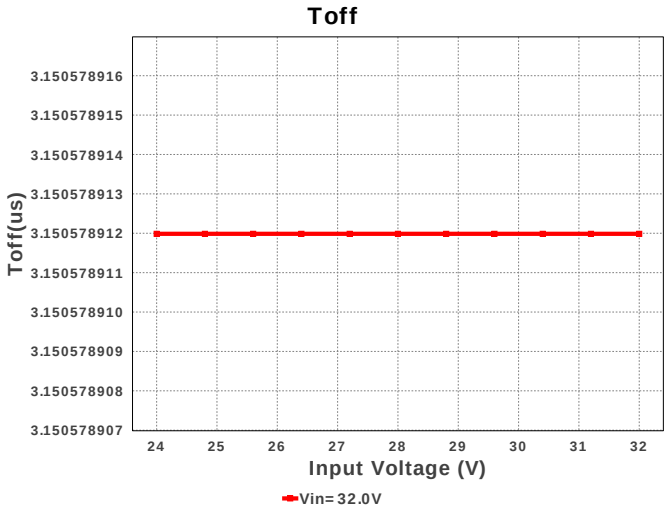


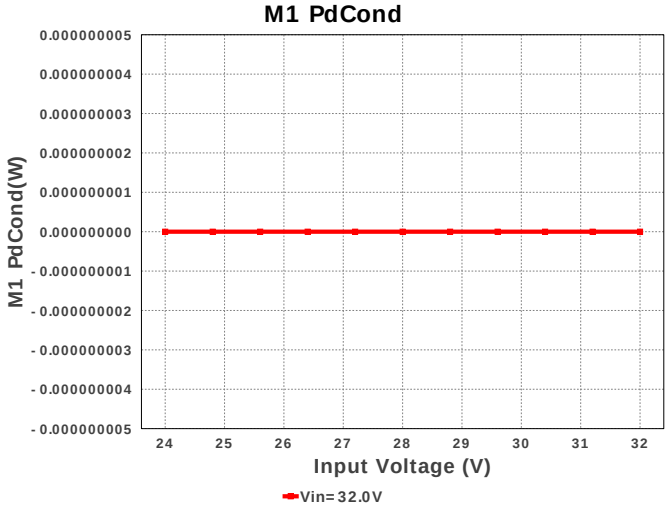


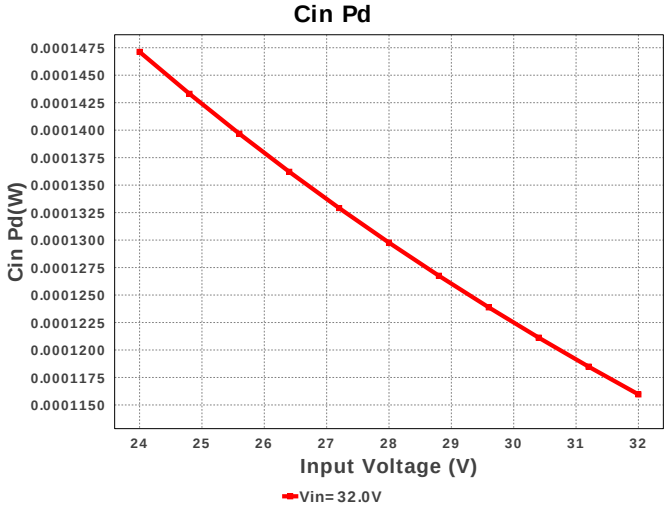


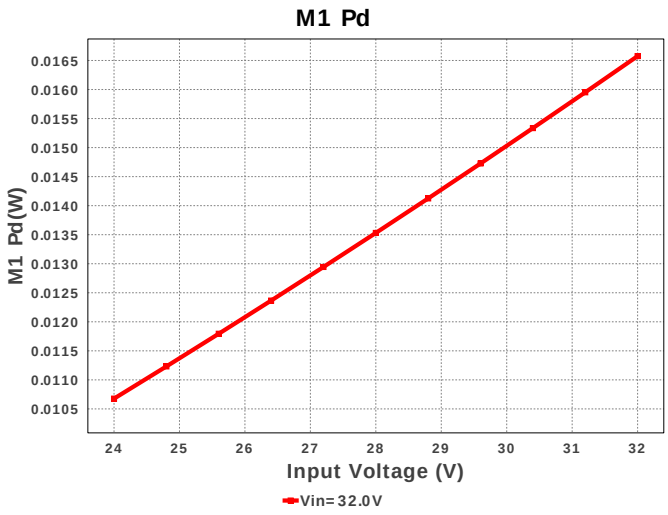


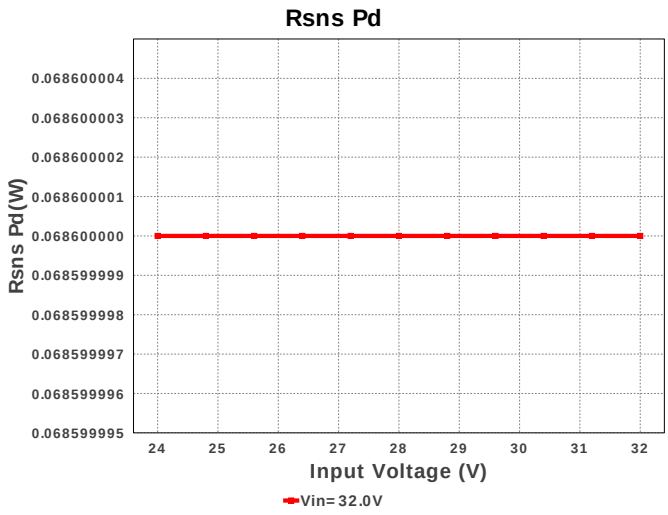


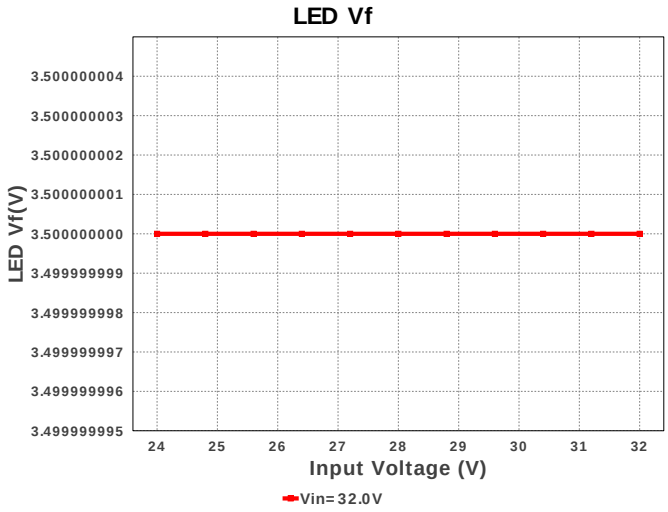


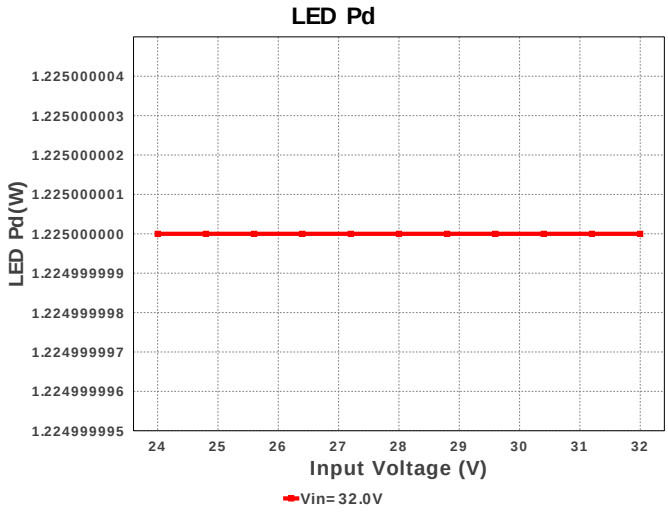


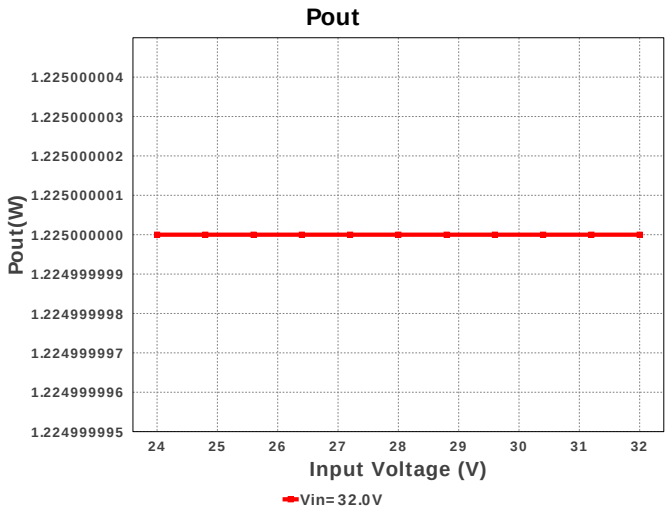


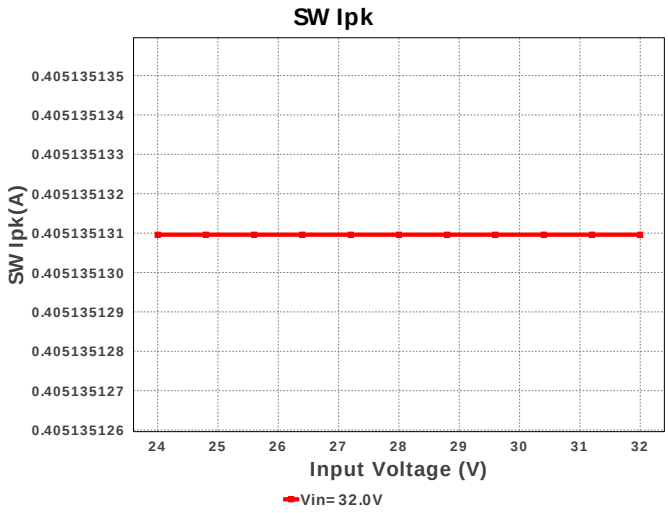


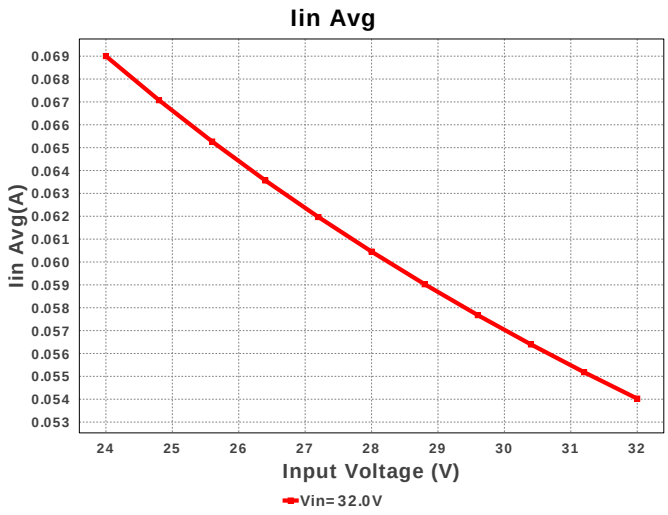


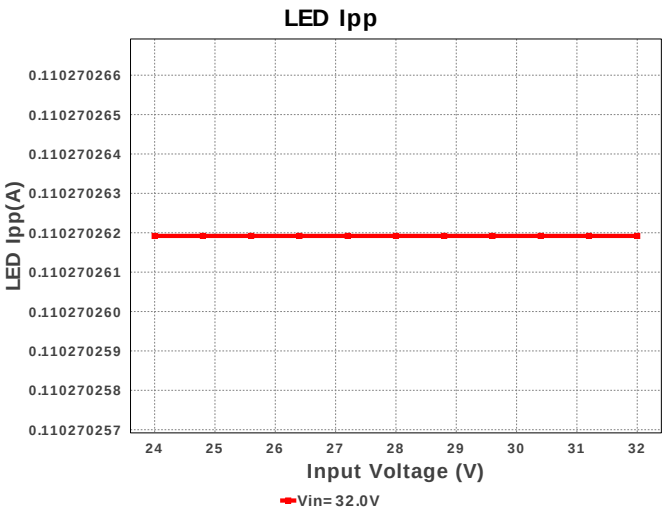


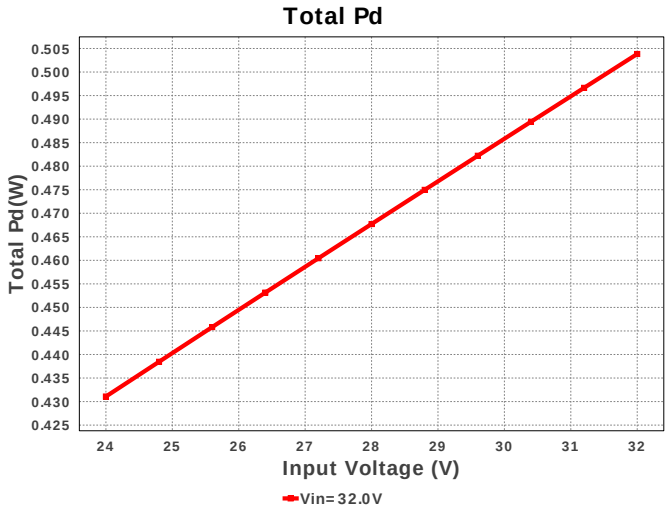


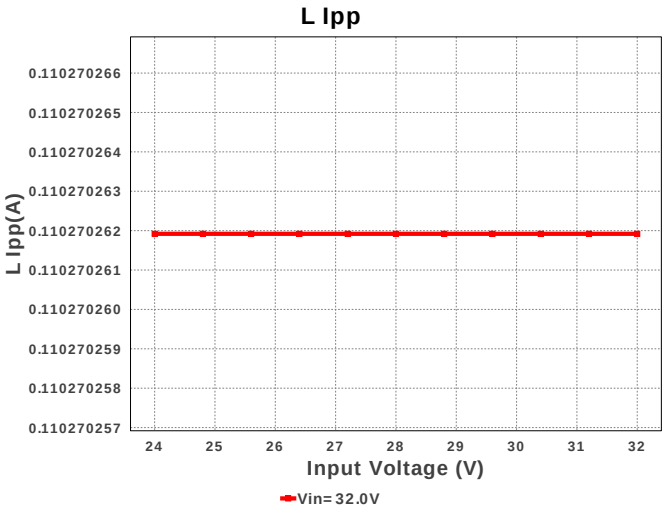


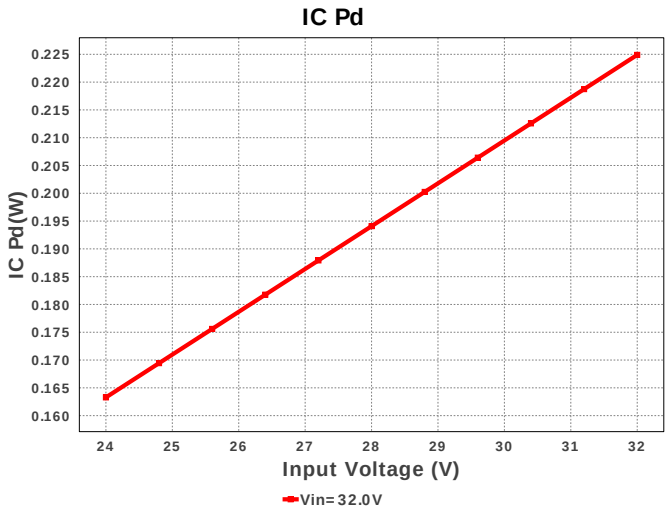


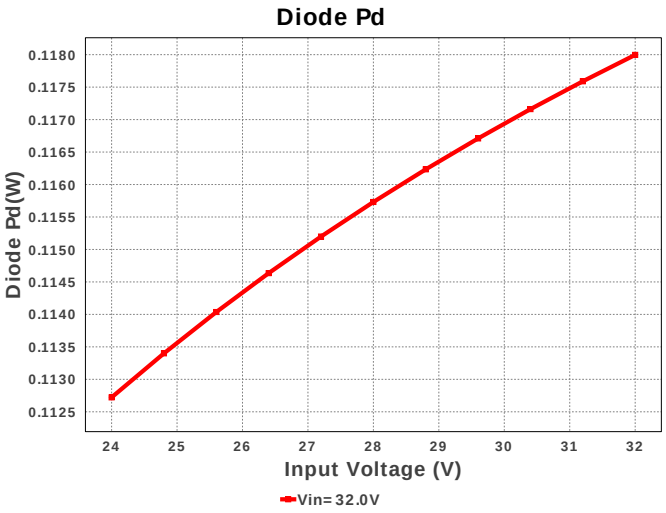


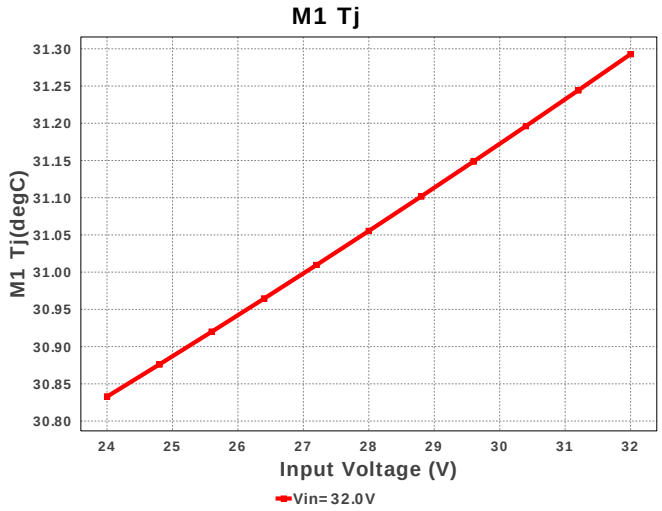


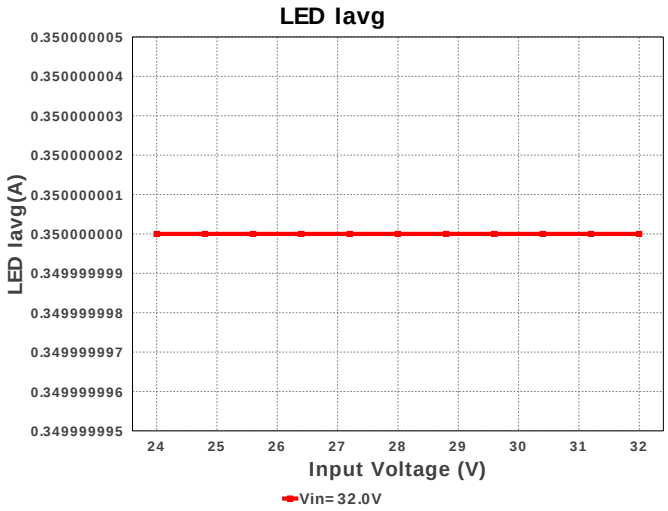


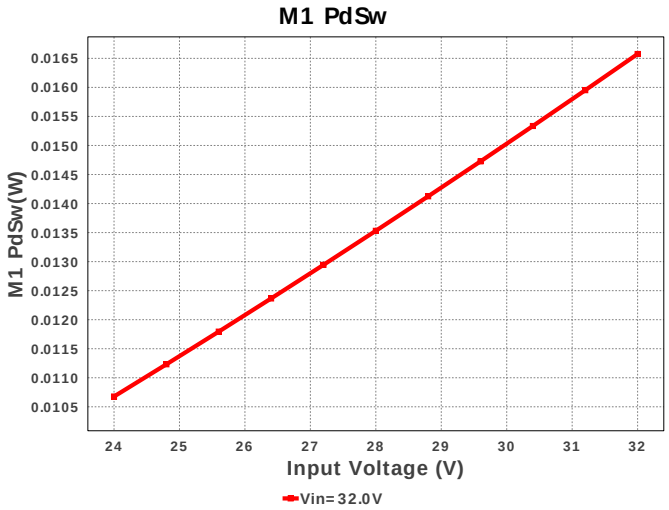












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	113.7 mA	Current	Input capacitor RMS ripple current
2.	Iin Avg	54.027 mA	Current	Average input current
3.	L Ipp	110.27 mA	Current	Peak-to-peak inductor ripple current
4.	LED Iavg	350.0 mA	Current	LED Average Current
5.	LED Ipp	14.821 mA	Current	LED Ripple Current
6.	SW Ipk	405.135 mA	Current	Peak switch current
7.	BOM Count	13	General	Total Design BOM count
8.	FootPrint	163.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	279.342 kHz	General	Switching frequency
10.	IC Tolerance	54.0 mV	General	IC Feedback Tolerance
11.	Mode	CCM	General	Conduction Mode
12.	Pout	1.225 W	General	Total output power
13.	Toff	3.151 us	General	Fixed Off Time
14.	Total BOM	$0.0	General	Total BOM Cost
15.	D1 Tj	68.939 degC	Op_Point	D1 junction temperature
16.	Vout OP	3.5 V	Op_Point	Operational Output Voltage
17.	Duty Cycle	11.991 %	Op_point	Duty cycle
18.	Efficiency	70.856 %	Op_point	Steady state efficiency
19.	IC Tj	41.245 degC	Op_point	IC junction temperature
20.	ICThetaJA	50.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	350.0 mA	Op_point	Iout operating point
22.	LED Rd	800.0 mOhm	Op_point	LED DynamicResistance
23.	LED Vf	3.5 V	Op_point	Total LED Forward Calculated Voltage
24.	M1 Tj	31.294 degC	Op_point	MOSFET junction temperature
25.	M1 Tj	31.294 degC	Op_point	MOSFET junction temperature
26.	VIN_OP	32.0 V	Op_point	Vin operating point
27.	Cin Pd	115.961 µW	Power	Input capacitor power dissipation
28.	Diode Pd	117.997 mW	Power	Diode power dissipation
29.	IC Pd	224.901 mW	Power	IC power dissipation
30.	L Pd	75.644 mW	Power	Inductor power dissipation
31.	LED Pd	1.225 W	Power	LED Power Dissipation

#	Name	Value	Category	Description
32.	M1 Pd	16.595 mW	Power	M1 MOSFET total power dissipation
33.	M1 PdCond	0.0 W	Power	M1 MOSFET conduction losses
34.	M1 PdSw	16.595 mW	Power	M1 MOSFET switching losses
35.	Rsns Pd	68.6 mW	Power	LED Power Dissipation
36.	Total Pd	503.86 mW	Power	Total Power Dissipation
37.	Vout Tolerance	1.543 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	350.0 m	Maximum Output Current
2.	VinMax	32.0	Maximum input voltage
3.	VinMin	24.0	Minimum input voltage
4.	Vout	3.5	Output Voltage
5.	application	LED_DRIVER	LED Application
6.	base_pn	LM3409	Base Product Number
7.	LED_Architect	N	LED Architect Project
8.	ledparallel	1.0	Number of LED in parallel
9.	ledpartnumber	Custom	LED Part number
10.	ledseries	1.0	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.