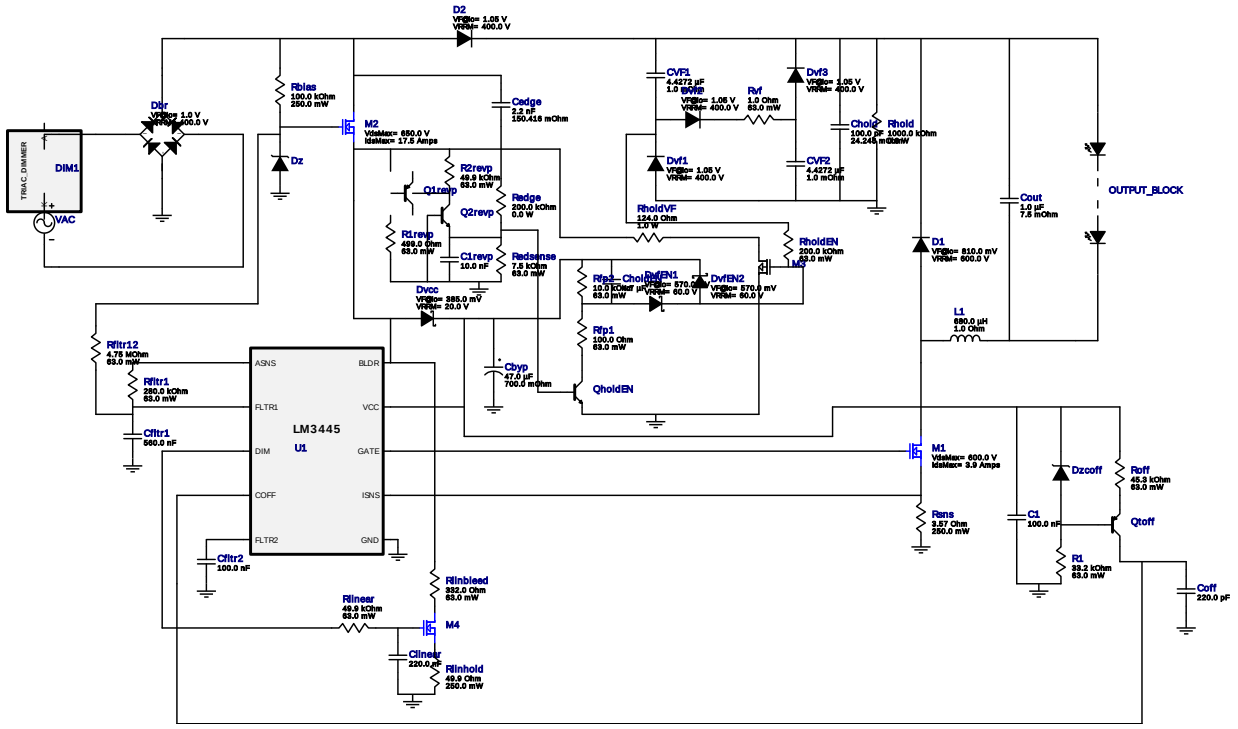
WEBENCH® Design Report

VinMin = 185.0V
VinMax = 250.0V
Vout = 46.0V
Iout = 0.2A

Device = LM3445MM/NOPB
Topology = Buck
Created = 7/31/15 9:05:18 PM
BOM Cost = $0.00
Footprint = 1,148.0 mm²
BOM Count = 63
Total Pd = 0.0W

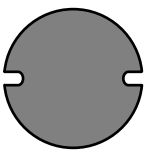
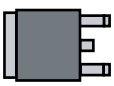
Design : 4045121/77 LM3445MM/NOPB
LM3445MM/NOPB 185.0V-250.0V to 46.00V @ 0.2A



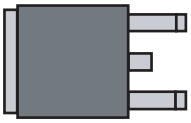
Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C1	MuRata	GRM21BR71E104KA01L Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	C1revp	MuRata	GRM216R71H103KA01D Series= X7R	Cap= 10.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	CVF1	CUSTOM	CUSTOM Series= ?	Cap= 4.4272 uF ESR= 1.0 mOhm VDC= 282.843 V IRMS= 355.1 mA	1	NA	CUSTOM 0 mm²
4.	CVF2	CUSTOM	CUSTOM Series= ?	Cap= 4.4272 uF ESR= 1.0 mOhm VDC= 282.843 V IRMS= 355.1 mA	1	NA	CUSTOM 0 mm²
5.	Cbyp	Panasonic	EEE-FK1C470UR Series= FK	Cap= 47.0 uF ESR= 700.0 mOhm VDC= 16.0 V IRMS= 160.0 mA	1	$0.11	SM_RADIAL_C 62 mm²
6.	Cedge	TDK	C3216JB2J222K Series= JB	Cap= 2.2 nF ESR= 150.416 mOhm VDC= 630.0 V IRMS= 0.0 A	1	$0.05	1206 11 mm²
7.	Cfltr1	MuRata	GRM155R61A564KE15D Series= X5R	Cap= 560.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.02	0402 3 mm²

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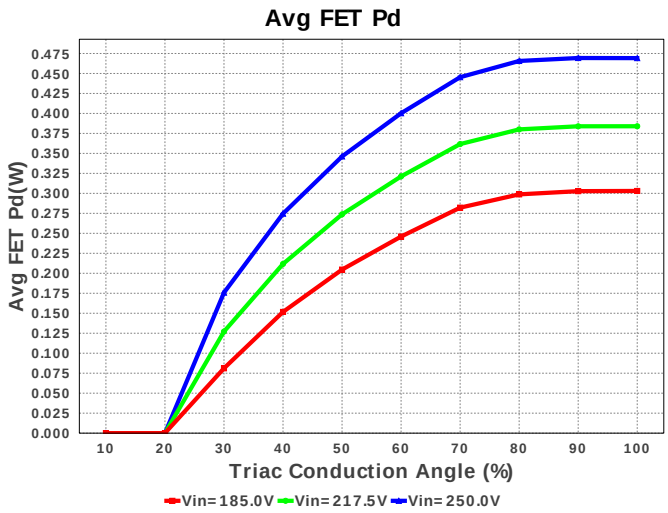
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	Cfltr2	MuRata	GRM21BR71E104KA01L Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm²
9.	Chold	TDK	C3216X7T2W104M Series= X7T	Cap= 100.0 nF ESR= 24.248 mOhm VDC= 400.0 V IRMS= 0.0 A	1	$0.09	 1206 11 mm²
10.	CholdEN	MuRata	GRM219R61C475KE15D Series= X5R	Cap= 4.7 uF VDC= 16.0 V IRMS= 0.0 A	1	$0.03	 0805 7 mm²
11.	Clinear	MuRata	GRM155C80G224KE01D Series= X6S	Cap= 220.0 nF VDC= 4.0 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
12.	Coff	Yageo America	CC0805JRNPO9BN221 Series= C0G/NP0	Cap= 220.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm²
13.	Cout	TDK	C3216X7R2A105M160AA Series= X7R	Cap= 1.0 uF ESR= 7.5 mOhm VDC= 100.0 V IRMS= 5.9235 A	1	$0.11	 1206 11 mm²
14.	D1	ON Semiconductor	MURS360T3	VF@Io= 810.0 mV VRRM= 600.0 V	1	$0.24	 SMC 83 mm²
15.	D2	Bourns	CD1408-FU1400	VF@Io= 1.05 V VRRM= 400.0 V	1	$0.13	 Diode_1408 13 mm²
16.	D_LED	CUSTOM	CUSTOM	LED	10	NA	CUSTOM 0 mm²
17.	Dbr	Diodes Inc.	HD04-T	VF@Io= 1.0 V VRRM= 400.0 V	1	$0.12	 MiniDIP 62 mm²
18.	Dvcc	ON Semiconductor	MBR0520LT1G	VF@Io= 385.0 mV VRRM= 20.0 V	1	$0.06	 SOD-123 13 mm²
19.	Dvf1	Bourns	CD1408-FU1400	VF@Io= 1.05 V VRRM= 400.0 V	1	$0.13	 Diode_1408 13 mm²
20.	Dvf2	Bourns	CD1408-FU1400	VF@Io= 1.05 V VRRM= 400.0 V	1	$0.13	 Diode_1408 13 mm²
21.	Dvf3	Bourns	CD1408-FU1400	VF@Io= 1.05 V VRRM= 400.0 V	1	$0.13	 Diode_1408 13 mm²
22.	DvfEN1	NXP Semiconductor	PMEG6010CEH,115	VF@Io= 570.0 mV VRRM= 60.0 V	1	$0.11	 SOD-123F 12 mm²
23.	DvfEN2	NXP Semiconductor	PMEG6010CEH,115	VF@Io= 570.0 mV VRRM= 60.0 V	1	$0.11	 SOD-123F 12 mm²
24.	Dz	ON Semiconductor	BZX84C15LT1G	Zener	1	$0.02	 SOT-23 14 mm²
25.	Dzcoff	ON Semiconductor	BZX84C5V1LT1G	Zener	1	$0.02	 SOT-23 14 mm²
26.	L1	Bourns	SDR1307-681KL	L= 680.0 µH DCR= 1.0 Ohm	1	$0.35	 SDR1307 227 mm²
27.	M1	Fairchild Semiconductor	FCD4N60TM	VdsMax= 600.0 V IdsMax= 3.9 Amps	1	$0.49	 DPAK 102 mm²

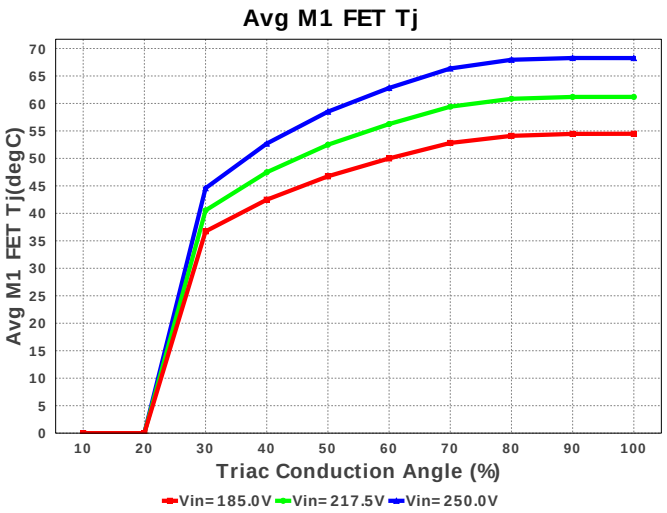
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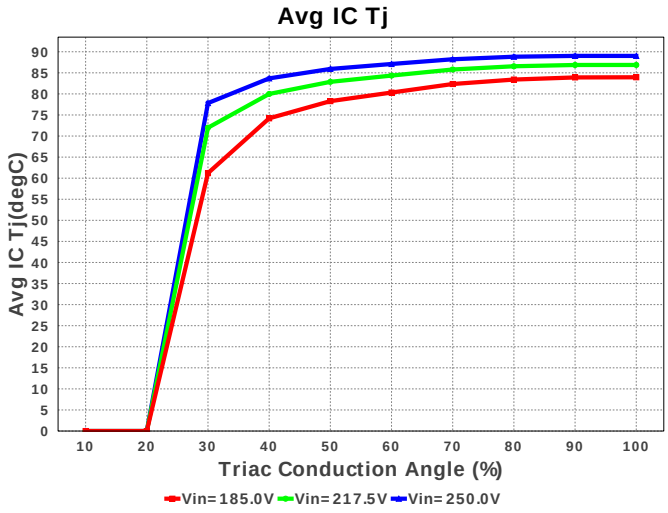
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
28.	M2	Infineon Technologies	IPP65R190CFD	VdsMax= 650.0 V IdsMax= 17.5 Amps	1	$1.49	 DDPAK 210 mm^2
29.	M3	unknown		unknown		NA	NaN
30.	M4	unknown		unknown		NA	NaN
31.	Q1revp	Diodes Inc.	BC858C-7-F	Bipolar Transistor	1	$0.03	 SOT-23 14 mm^2
32.	Q2revp	Diodes Inc.	MMBT4401-7-F	Bipolar Transistor	1	$0.02	 SOT-23 14 mm^2
33.	QholdEN	Diodes Inc.	MMBT4401-7-F	Bipolar Transistor	1	$0.02	 SOT-23 14 mm^2
34.	Qtoff	Fairchild Semiconductor	MMBT4403	Bipolar Transistor	1	$0.03	 SOT-23 14 mm^2
35.	R1	Vishay-Dale	CRCW040233K2FKED Series= CRCW..e3	Res= 33.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
36.	R1revp	Vishay-Dale	CRCW0402499RFKED Series= CRCW..e3	Res= 499.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
37.	R2revp	Vishay-Dale	CRCW040249K9FKED Series= CRCW..e3	Res= 49.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
38.	Rbias	Panasonic	ERJ-8ENF1003V Series= ERJ-8E	Res= 100.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm^2
39.	Redge	CUSTOM	CUSTOM Series= ?	Res= 200.0 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
40.	Redsense	Vishay-Dale	CRCW04027K50FKED Series= CRCW..e3	Res= 7.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
41.	Rfltr1	Vishay-Dale	CRCW0402280KFKED Series= CRCW..e3	Res= 280.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
42.	Rfltr12	Vishay-Dale	CRCW04024M75FKED Series= CRCW..e3	Res= 4.75 MOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
43.	Rfp1	Vishay-Dale	CRCW0402100RFKED Series= CRCW..e3	Res= 100.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
44.	Rfp2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
45.	Rhold	CUSTOM	CUSTOM Series= ?	Res= 1000.0 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
46.	RholdEN	Vishay-Dale	CRCW0402200KFKED Series= CRCW..e3	Res= 200.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
47.	RholdVF	Panasonic	ERJ-1TNF1240U Series= ERJ-1T	Res= 124.0 Ohm Power= 1.0 W Tolerance= 1.0%	1	$0.13	 2512 43 mm^2

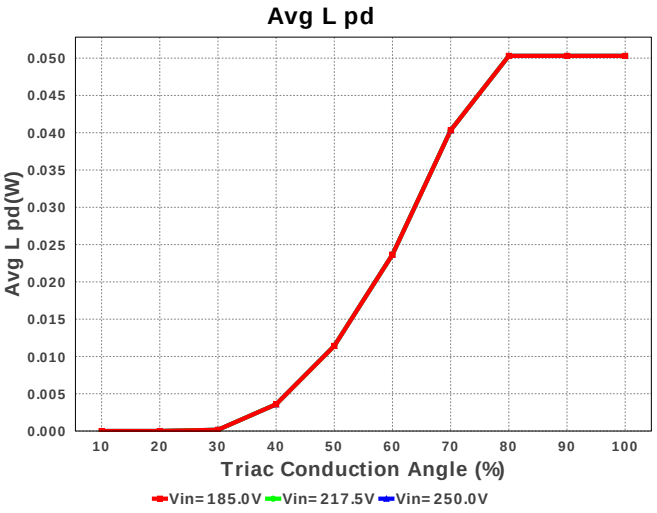
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#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
48.	Rlinbleed	Vishay-Dale	CRCW0402332RFKED Series= CRCW..e3	Res= 332.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
49.	Rlinear	Vishay-Dale	CRCW040249K9FKED Series= CRCW..e3	Res= 49.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
50.	Rlinhold	Panasonic	ERJ-8ENF49R9V Series= ERJ-8E	Res= 49.9 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	1206 11 mm^2
51.	Roff	Vishay-Dale	CRCW040245K3FKED Series= CRCW..e3	Res= 45.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
52.	Rsns	Vishay-Dale	CRCW12063R57FKEA Series= CRCW..e3	Res= 3.57 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	1206 11 mm^2
53.	Rvf	Vishay-Dale	CRCW04021R00FKED Series= CRCW..e3	Res= 1.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
54.	U1	Texas Instruments	LM3445MM/NOPB	Switcher	1	$0.60	MUB10A 24 mm^2

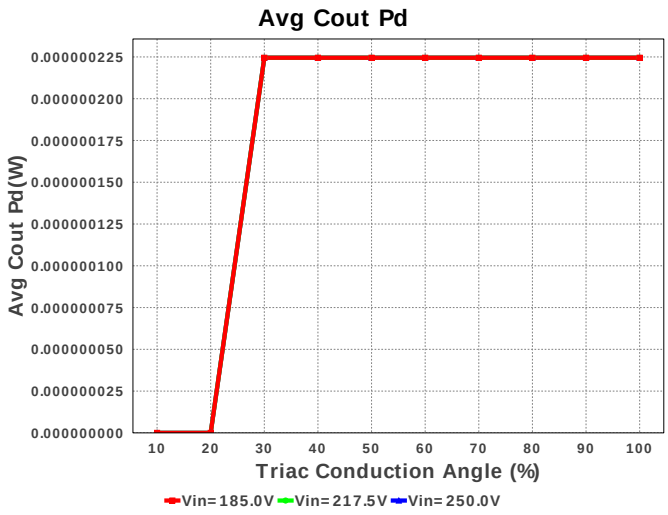


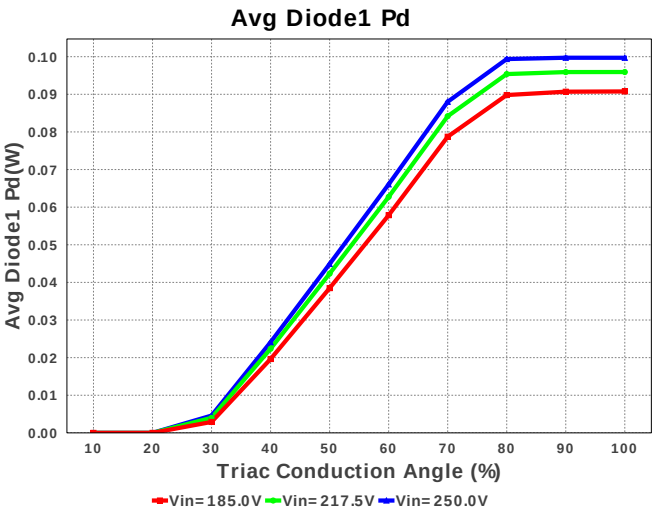


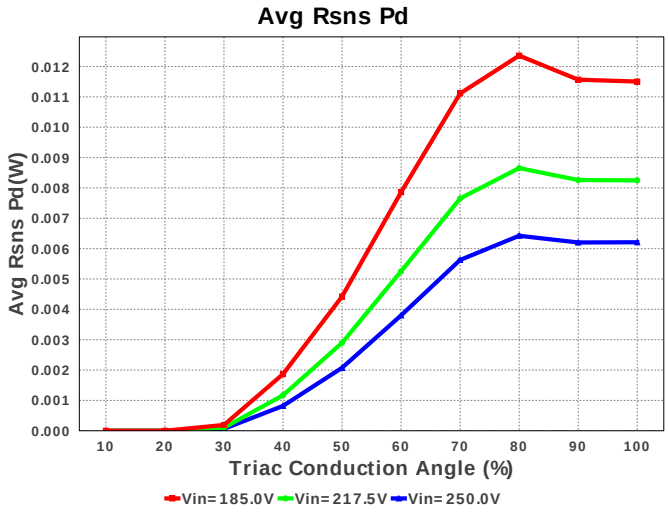


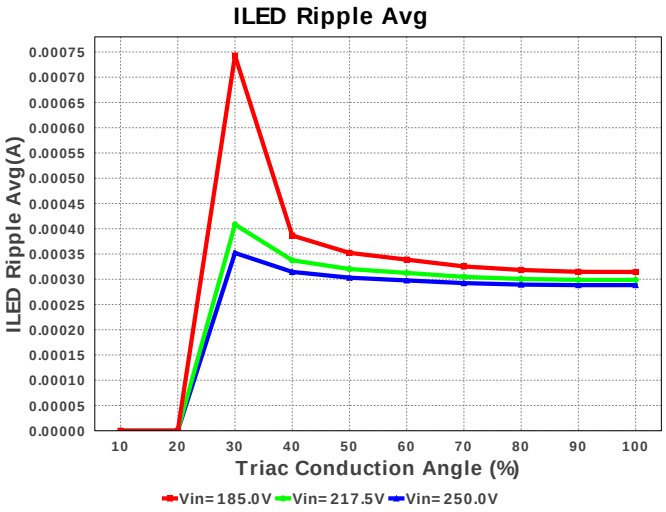


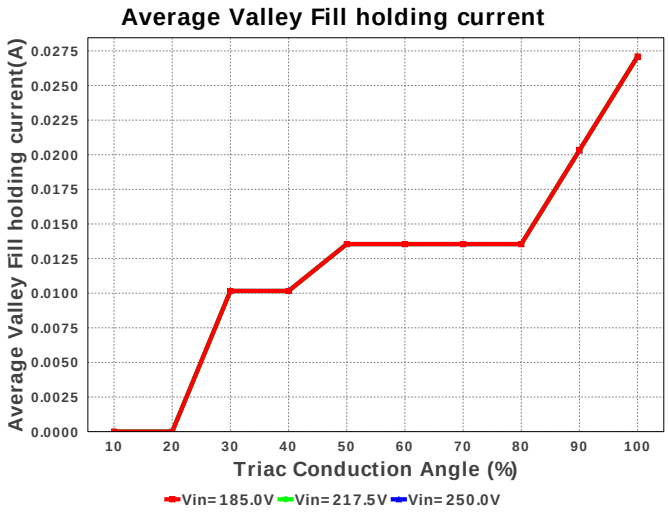
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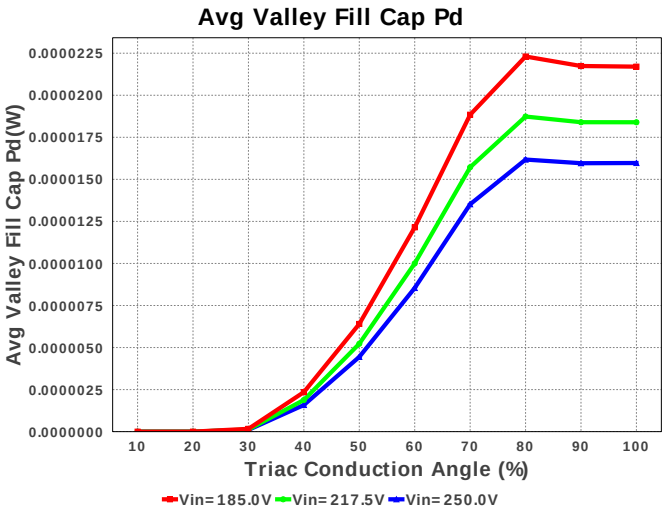




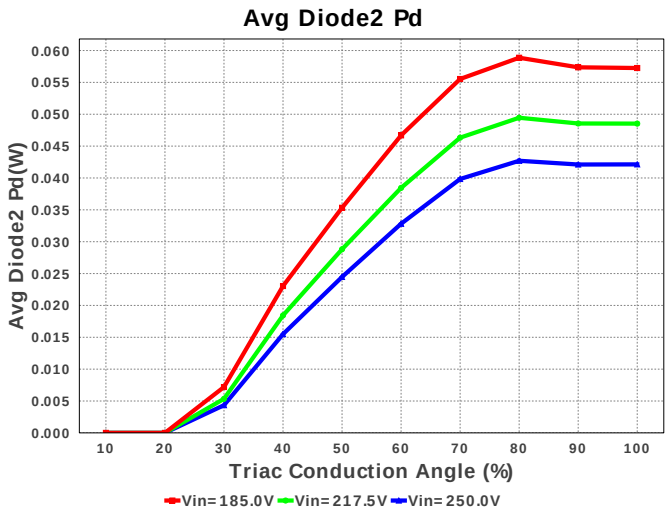


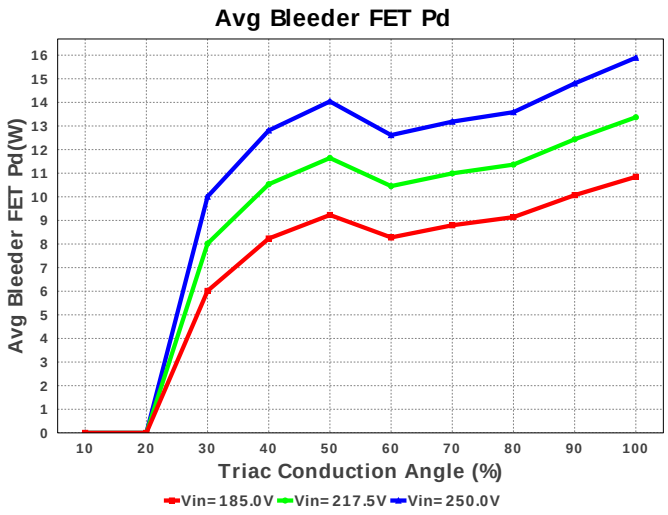


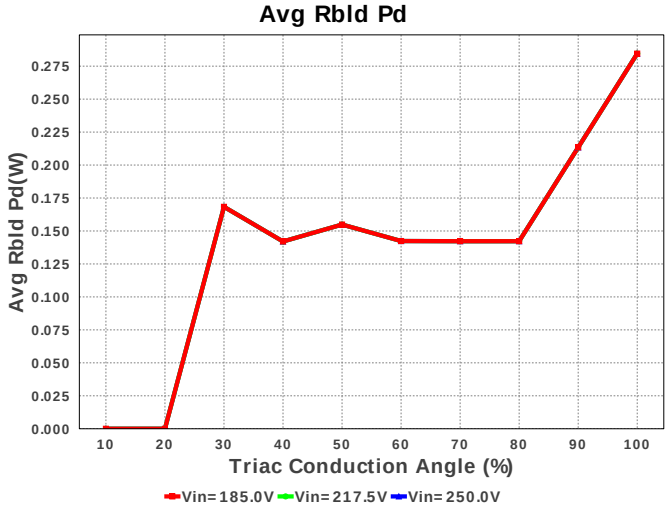


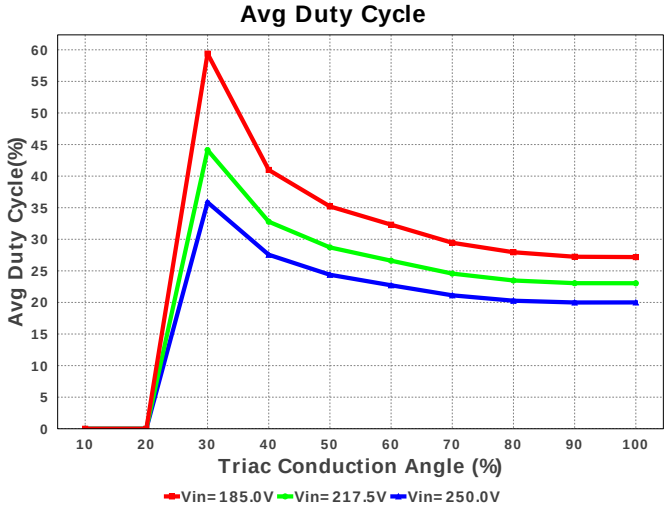


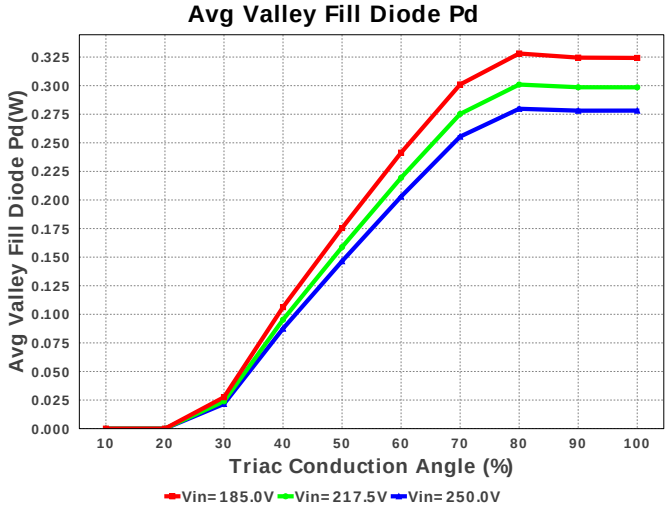
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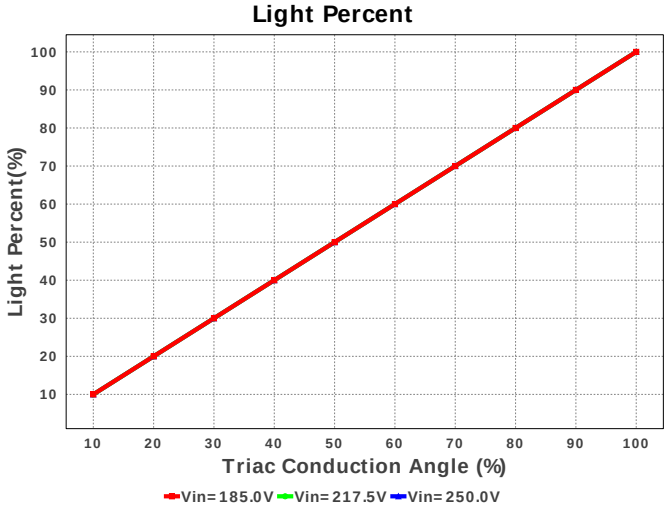




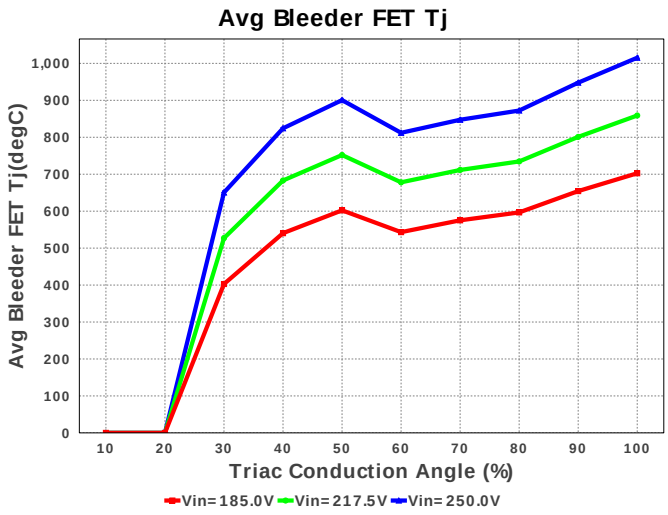


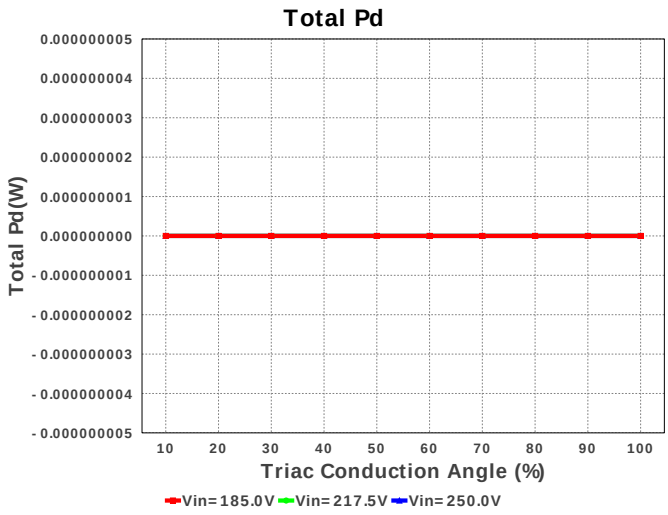


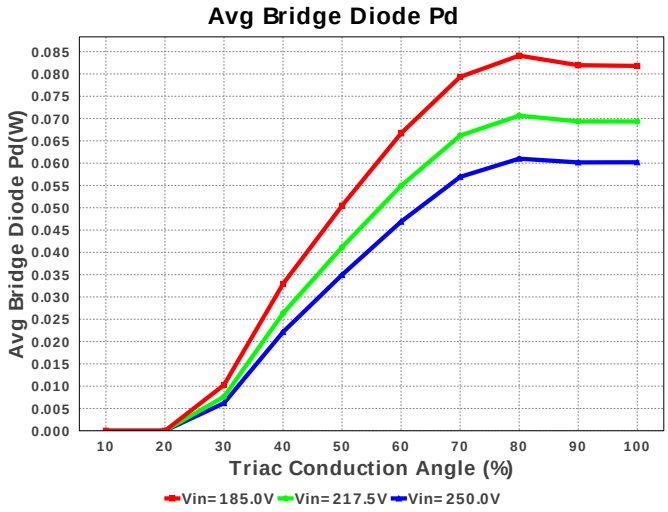


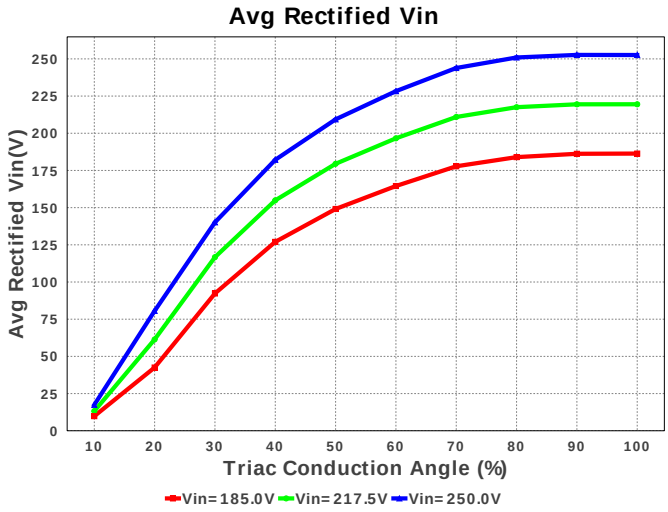


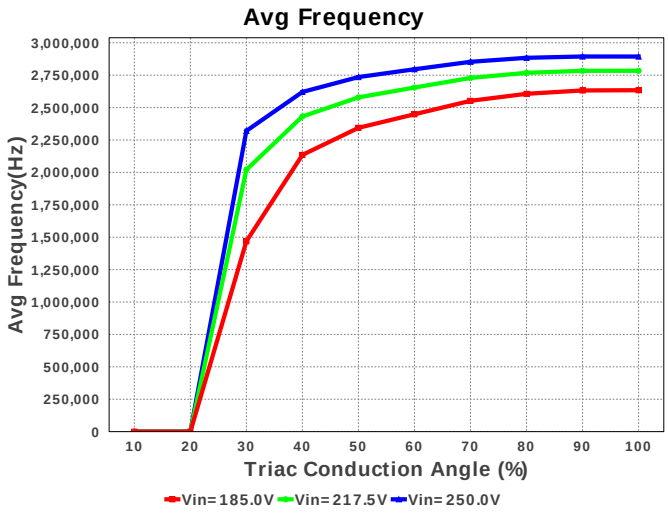
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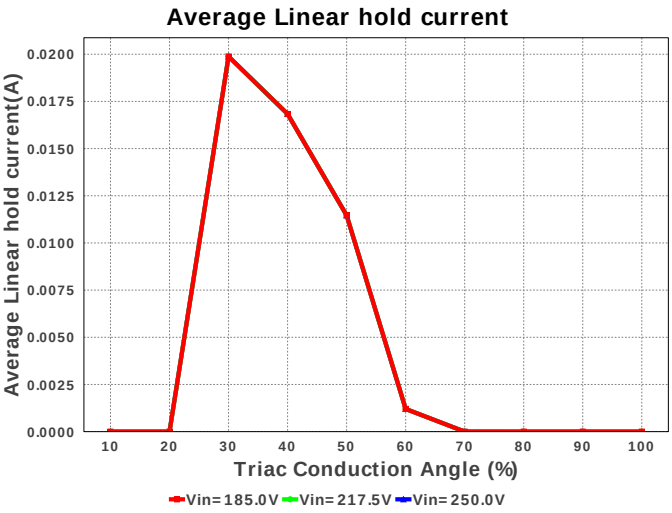




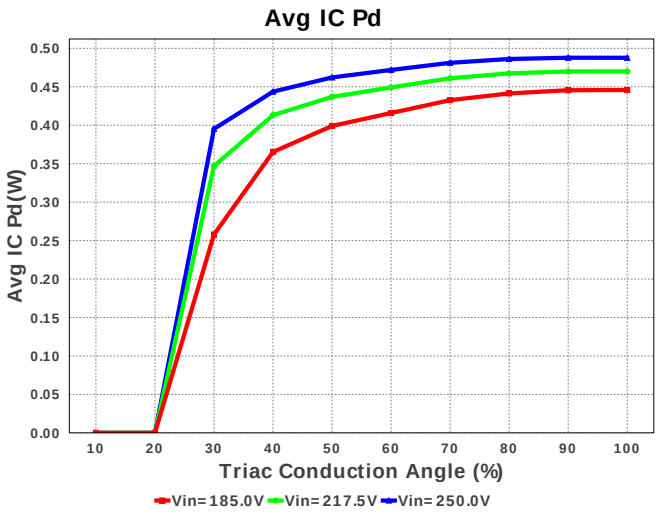




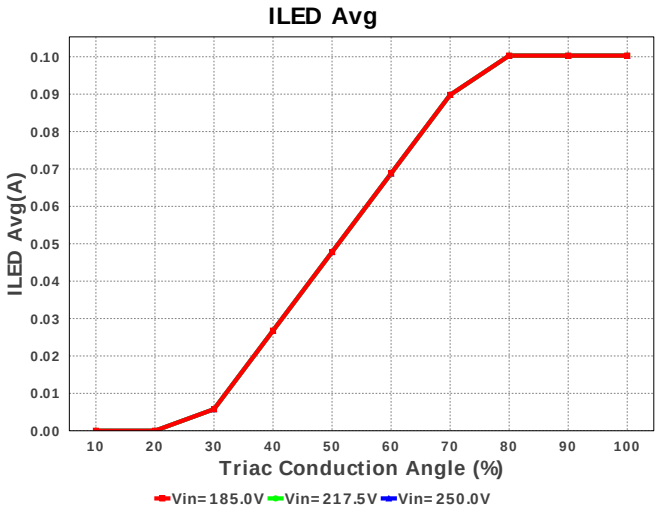




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Operating Values

#	Name	Value	Category	Description
1.	ILED Avg	100.303 mA	Current	Average Current per LED for the AC line period
2.	ILED Ripple Avg	290.445 µA	Current	Average LED Ripple Current for the AC line period
3.	Avg Rectified Vin	248.538 V	General	Average Rectified Voltage for the AC Line Period
4.	BOM Count	63	General	Total Design BOM count
5.	FootPrint	1.148 k mm^2	General	Total Foot Print Area of BOM components
6.	Total BOM	$0.0	General	Total BOM Cost
7.	Avg Bleeder FET Tj	863.912 degC	Op_Point	Bleeder MOSFET average junction temperature over the AC Line Period
8.	Avg M1 FET Tj	67.483 degC	Op_Point	M1 MOSFET average junction temperature over the AC Line Period
9.	Avg Duty Cycle	20.583 %	Op_point	Average Duty Cycle over the AC Line Period
10.	Avg Efficiency	39.999 %	Op_point	Average Efficiency over the AC Line Period
11.	Avg Frequency	2.873 MHz	Op_point	Average Switching Frequency over the AC Line Period
12.	Avg IC Tj	88.602 degC	Op_point	Average IC junction temperature for the AC line period
13.	VIN_OP	250.0 V	Op_point	AC Input RMS Voltage
14.	Avg Bleeder FET Pd	13.45 W	Power	Average power dissipation in the bleeder FET over the AC line period
15.	Avg Bridge Diode Pd	56.93 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
16.	Avg Cout Pd	224.461 nW	Power	Average Power Dissipation in the Output Capacitor over the AC Line Period
17.	Avg Diode1 Pd	97.975 mW	Power	Average Power Dissipation in D1 over the AC Line Period
18.	Avg Diode2 Pd	43.356 mW	Power	Average Power Dissipation in D1 over the AC Line Period
19.	Avg FET Pd	450.684 mW	Power	Average power dissipation in the switching FET over the AC line period
20.	Avg IC Pd	484.318 mW	Power	Average Power Dissipation in the IC over the AC line period
21.	Avg L pd	50.304 mW	Power	Average Inductor power disspation over the AC line period
22.	Avg Rbld Pd	142.258 mW	Power	Average power dissipation in the bleeder resistor over the AC line period
23.	Avg Rsns Pd	6.65 mW	Power	Average power dissipation in the Current limit resistor over the AC line period
24.	Avg Valley Fill Cap Pd	16.436 µW	Power	Average Power Dissipation in the Valley Fill Capacitors over the AC Line Period
25.	Avg Valley Fill Diode Pd	281.816 mW	Power	Average Power Dissipation in the Valley Fill Diodes over the AC Line Period

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#	Name	Value	Category	Description
26.	Total Pd	0.0 W	Power	Total Power Dissipation
27.	Average Linear hold current	0.0 A	Unknown	Average Linear hold current over the AC Line Period
28.	Average Valley Fill holding current	13.548 mA	Unknown	Average Valley Fill holding current over the AC Line Period
29.	Light Percent	75.0 %	Unknown	Percentage light from dimming

Design Inputs

#	Name	Value	Description
1.	Iout	200.0 m	Maximum Output Current
2.	Iout1	200.0 m	Output Current #1
3.	VinMax	250.0	Maximum input voltage
4.	VinMin	185.0	Minimum input voltage
5.	Vout	46.0	Output Voltage
6.	Vout1	46.0	Output Voltage #1
7.	line_fsw	60.0	Light Output in Lumen
8.	application	LED_DRIVER	LED Application
9.	base_pn	LM3445	Base Product Number
10.	LED_Architect	N	LED Architect Project
11.	ledparallel	2.0	Number of LED in parallel
12.	ledpartnumber	Custom	LED Part number
13.	ledseries	5.0	Number of LED in series
14.	line_fsw	60.0	AC Line Frequency
15.	source	AC	Input Source Type
16.	Ta	30.0	Ambient temperature

Design Assistance

1. **LM3445** Product Folder : http://www.ti.com/product/LM3445 : contains the data sheet and other resources.

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