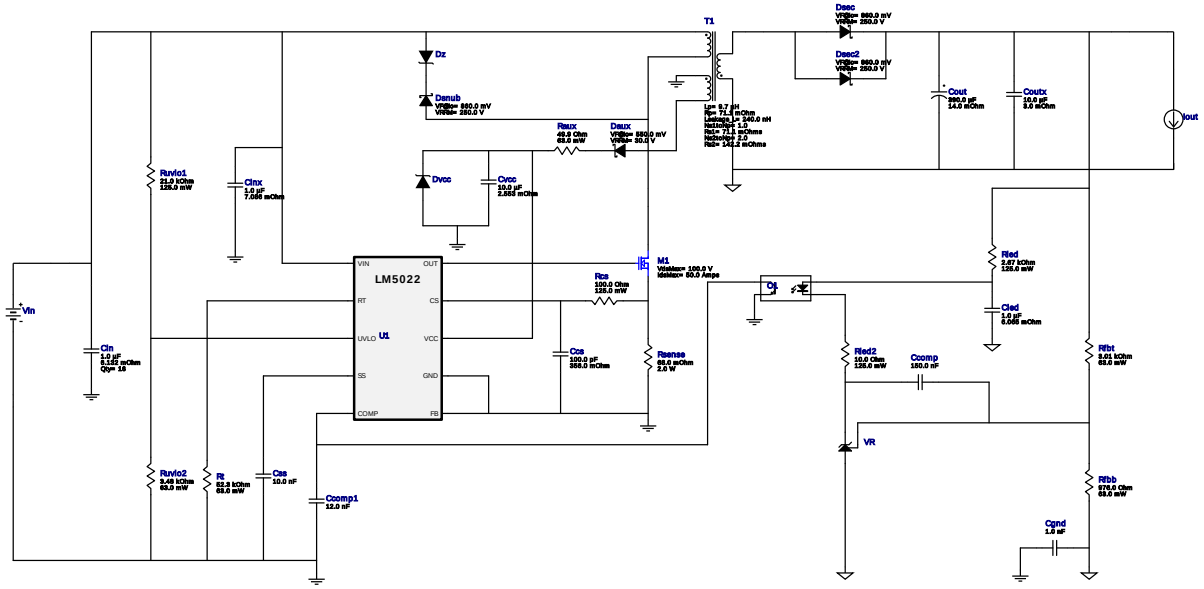
VinMin = 9.0V
VinMax = 60.0V
Vout = 5.0V
Iout = 3.0A

Device = LM5022MM/NOPB
Topology = Flyback
Created = 5/8/17 9:45:21 PM
BOM Cost = $15.38
BOM Count = 47
Total Pd = 4.56W

WEBENCH® Design Report

Design : 4812076/19 LM5022MM/NOPB
LM5022MM/NOPB 9.0V-60.0V to 5.00V @ 3.0A

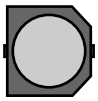
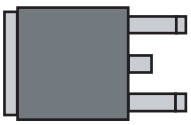
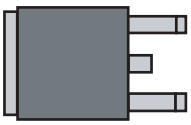
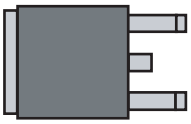


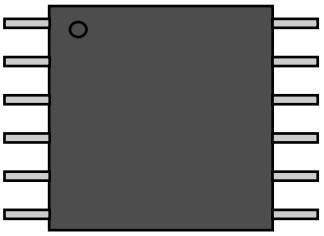
My Comments

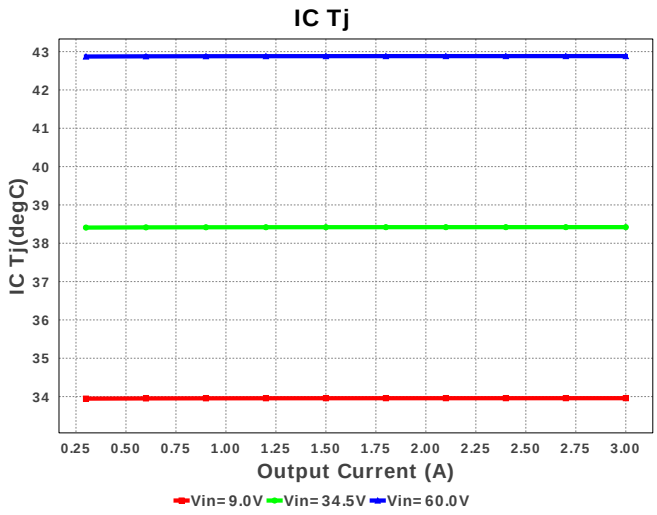
No comments

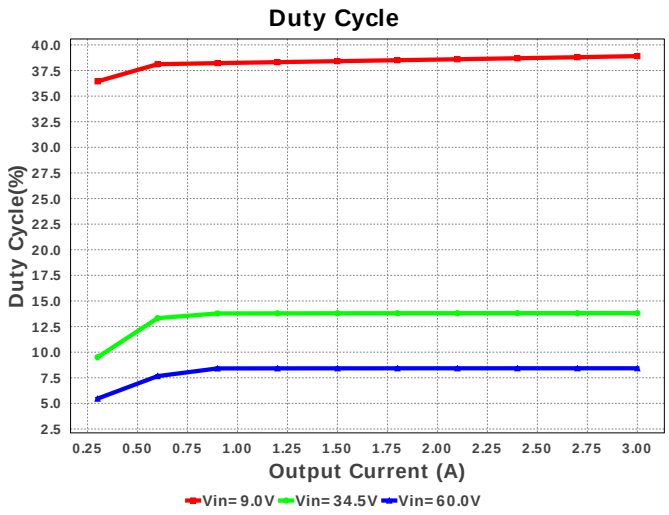
Electrical BOM

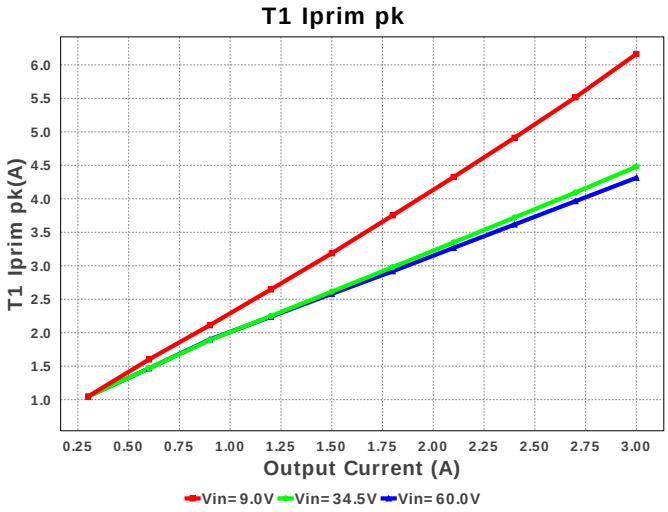
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Ccomp	MuRata	GRM155R60J154KE01D Series= X5R	Cap= 150.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.02	0402 3 mm²
2.	Ccomp1	MuRata	GRM033C80J123KE01D Series= X6S	Cap= 12.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
3.	Ccs	AVX	08055A101JAT2A Series= C0G/NP0	Cap= 100.0 pF ESR= 356.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cgnd	MuRata	GRM21AR72E102KW01D Series= X7R	Cap= 1.0 nF VDC= 250.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
5.	Cin	TDK	C4532X7T2E105K Series= X7T	Cap= 1.0 uF ESR= 6.132 mOhm VDC= 250.0 V IRMS= 0.0 A	16	$0.27	1812 23 mm²

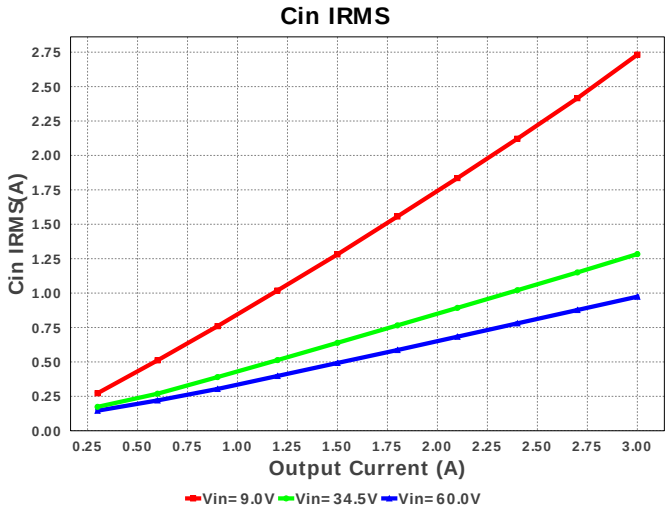
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
6.	Cinx	MuRata	GRM55DR72E105KW01L Series= X7R	Cap= 1.0 uF ESR= 7.086 mOhm VDC= 250.0 V IRMS= 2.0605 A	1	$0.28	 2220_200 54 mm²
7.	Cled	MuRata	GRM188R61A105KA61D Series= X5R	Cap= 1.0 uF ESR= 6.065 mOhm VDC= 10.0 V IRMS= 1.30675 A	1	$0.01	 0603 5 mm²
8.	Cout	Panasonic	20SVPF390M Series= SVPF	Cap= 390.0 uF ESR= 14.0 mOhm VDC= 20.0 V IRMS= 4.95 A	1	$0.66	 CAPSMT_62_E12 106 mm²
9.	Coutx	Kemet	C0805C106K8PACTU Series= X5R	Cap= 10.0 uF ESR= 3.0 mOhm VDC= 10.0 V IRMS= 11.43 A	1	$0.02	 0805 7 mm²
10.	Css	MuRata	GRM155R71E103KA01D Series= X7R	Cap= 10.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
11.	Cvcc	TDK	C3216X6S1E106K Series= X6S	Cap= 10.0 uF ESR= 2.553 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.12	 1206 11 mm²
12.	Daux	Panasonic	DB2S31600L	VF@Io= 550.0 mV VRRM= 30.0 V	1	$0.04	 SOD-523 5 mm²
13.	Dsec	ON Semiconductor	MBRB40250TG	VF@Io= 860.0 mV VRRM= 250.0 V	1	$0.99	 DDPAK 210 mm²
14.	Dsec2	ON Semiconductor	MBRB40250TG	VF@Io= 860.0 mV VRRM= 250.0 V	1	$0.99	 DDPAK 210 mm²
15.	Dsnub	ON Semiconductor	MBRB40250TG	VF@Io= 860.0 mV VRRM= 250.0 V	1	$0.99	 DDPAK 210 mm²
16.	Dvcc	Diodes Inc.	DFLZ12-7	Zener	1	$0.15	 PowerDI123 13 mm²
17.	Dz	Diodes Inc.	DFLZ9V1-7	Zener	1	$0.15	 PowerDI123 13 mm²
18.	M1	Texas Instruments	CSD19534Q5A	VdsMax= 100.0 V IdsMax= 50.0 Amps	1	$0.34	 TRANS_NexFET_Q5A 55 mm²
19.	O1	California Eastern Laboratories	PS2501L-1-A	Optocoupler	1	$0.23	 PS2501L 77 mm²
20.	Raux	Vishay-Dale	CRCW040249R9FKED Series= CRCW..e3	Res= 49.9 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
21.	Rcs	Vishay-Dale	CRCW0805100RFKEA Series= CRCW..e3	Res= 100.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²

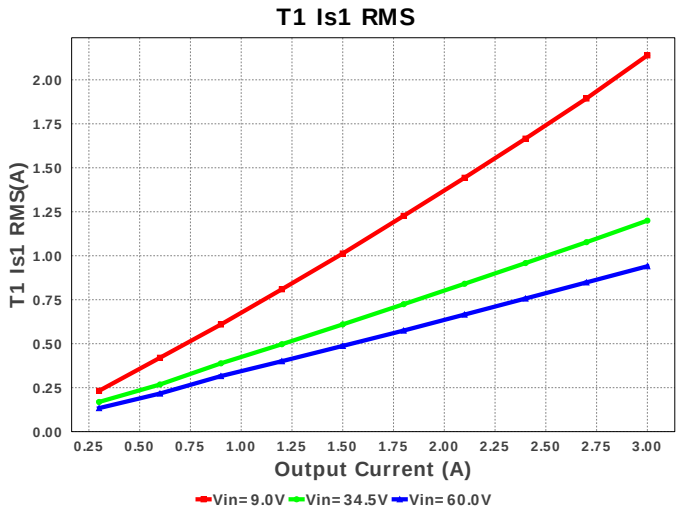
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
22.	Rfbb	Vishay-Dale	CRCW0402976RFKED Series= CRCW..e3	Res= 976.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
23.	Rfbt	Vishay-Dale	CRCW04023K01FKED Series= CRCW..e3	Res= 3.01 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
24.	Rled	Panasonic	ERJ-6ENF2671V Series= ERJ-6E	Res= 2.67 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
25.	Rled2	Yageo America	RC0805FR-0710RL Series= ?	Res= 10.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
26.	Rsense	Stackpole Electronics Inc	CSRN2512FK68L0 Series= ?	Res= 68.0 mOhm Power= 2.0 W Tolerance= 1.0%	1	$0.14	 2512 43 mm^2
27.	Rt	Vishay-Dale	CRCW040252K3FKED Series= CRCW..e3	Res= 52.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
28.	Ruvlo1	Panasonic	ERJ-6ENF2102V Series= ERJ-6E	Res= 21.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
29.	Ruvlo2	Vishay-Dale	CRCW04023K48FKED Series= CRCW..e3	Res= 3.48 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
30.	T1	Wurth Elektronik	749196531	Lp= 9.7 µH Rp= 71.1 mOhm Leakage_L= 240.0 nH Ns1toNp= 1.0 Rs1= 71.1 mOhms Ns2toNp= 2.0 Rs2= 142.2 mOhms	1	$4.71	 EFD20 724 mm^2
31.	U1	Texas Instruments	LM5022MM/NOPB	Switcher	1	$0.90	 MUB10A 24 mm^2
32.	VR	Texas Instruments	LMV431CM5/NOPB	Voltage References	1	$0.16	 R-PDSO-G3 16 mm^2

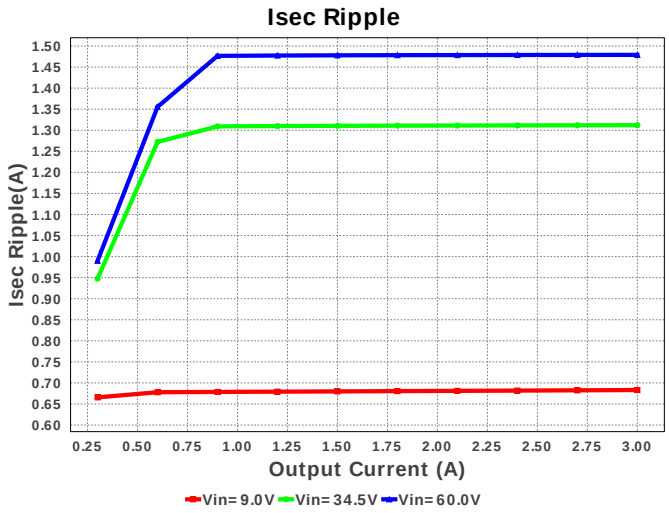




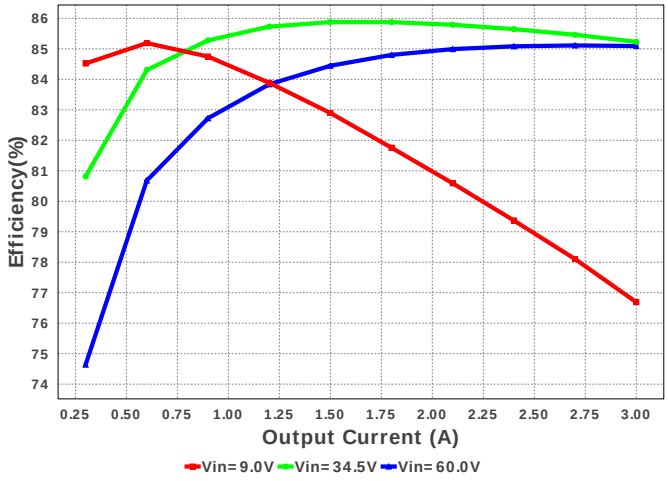




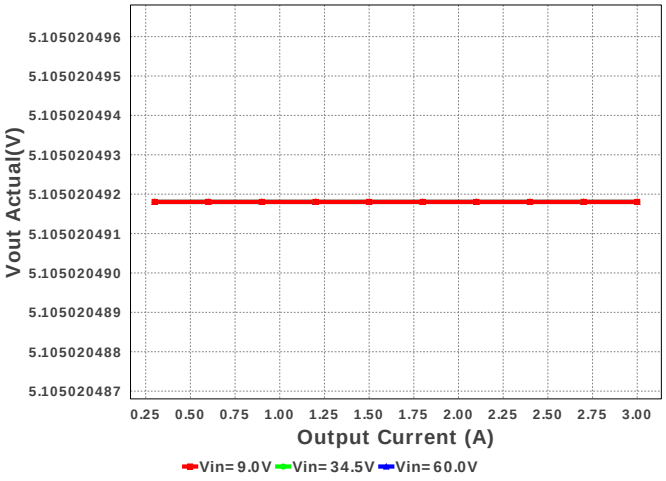




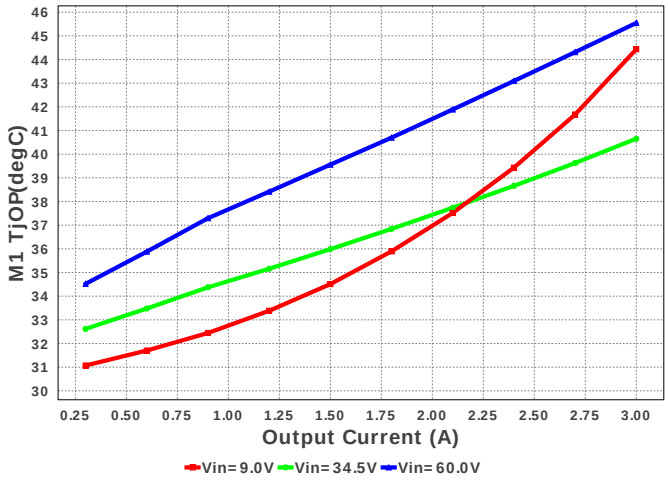
Efficiency



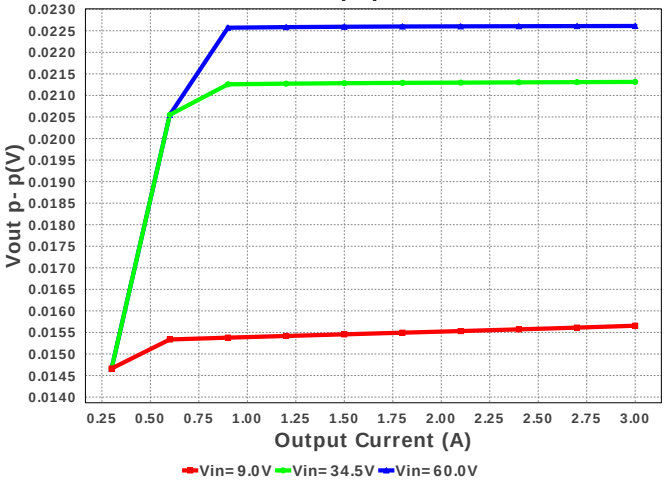
Vout Actual



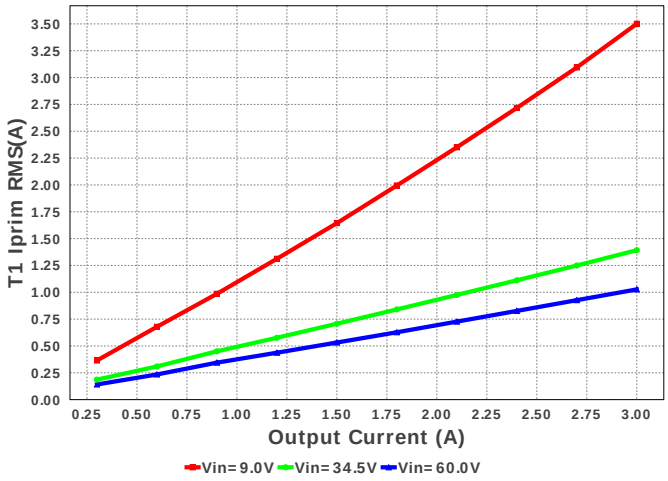
M1 TjOP



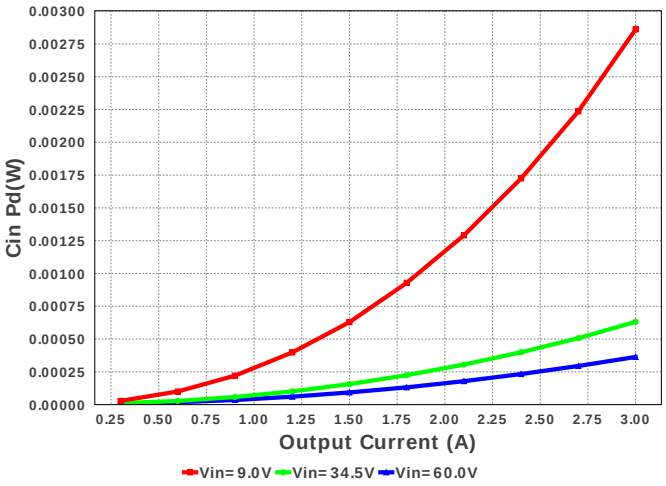
Vout p- p

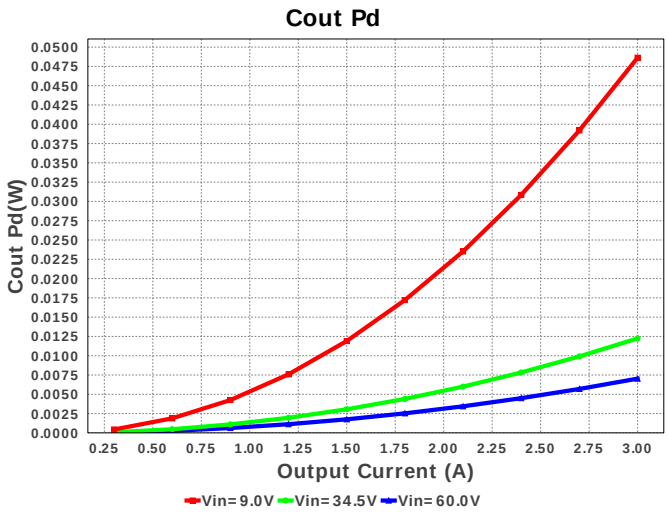


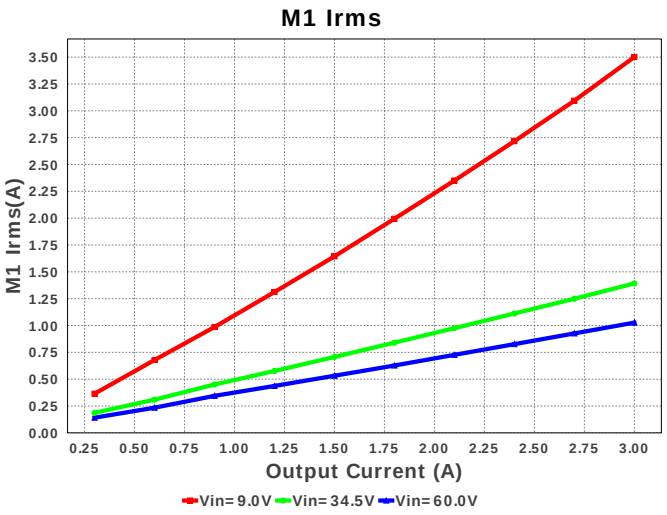
T1 Iprim RMS

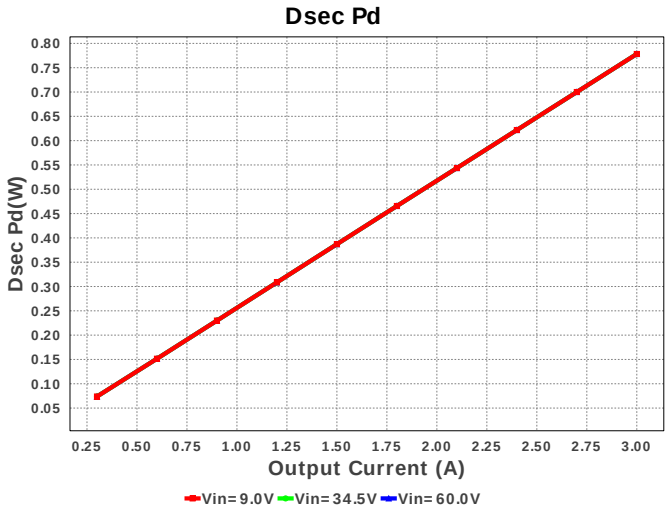


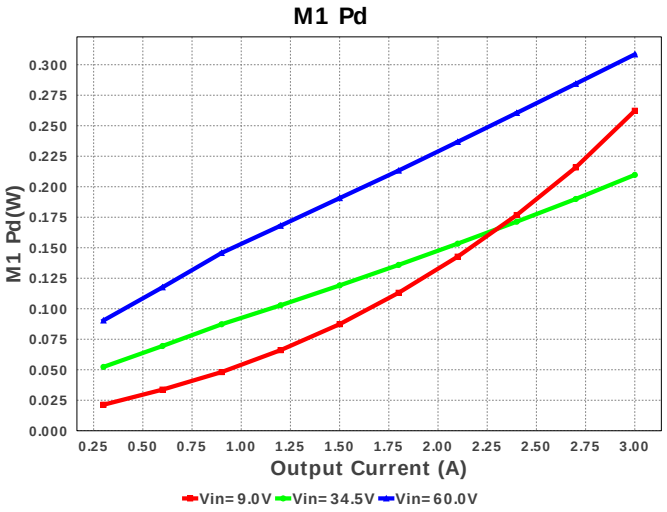
Cin Pd

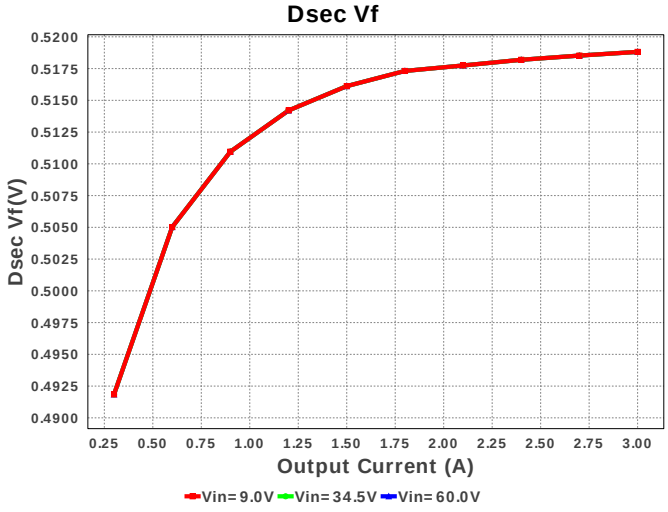


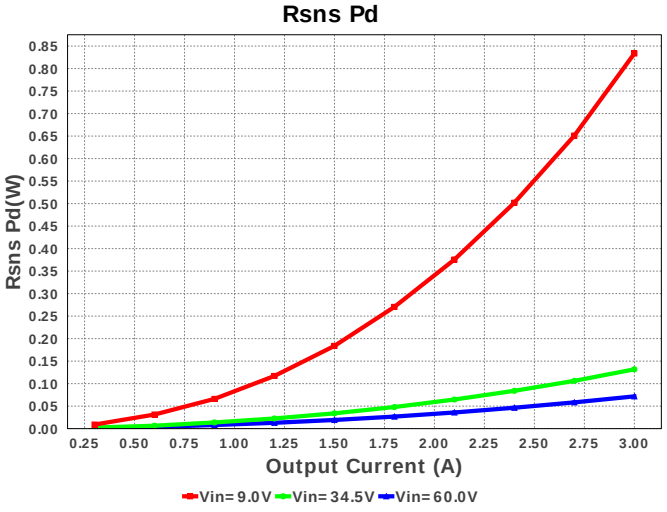


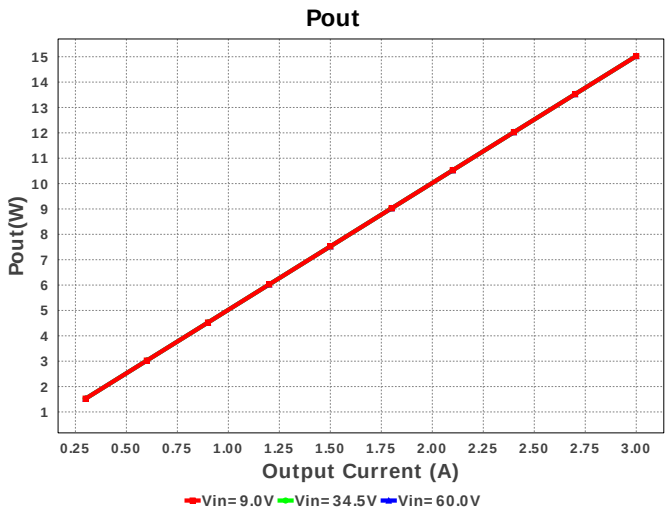


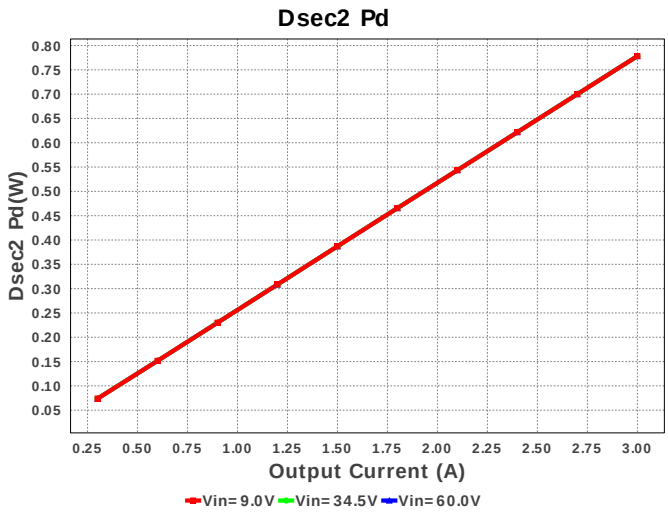


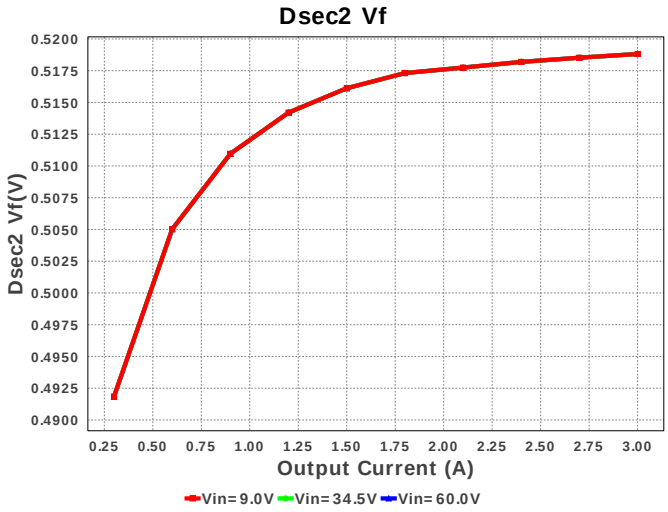


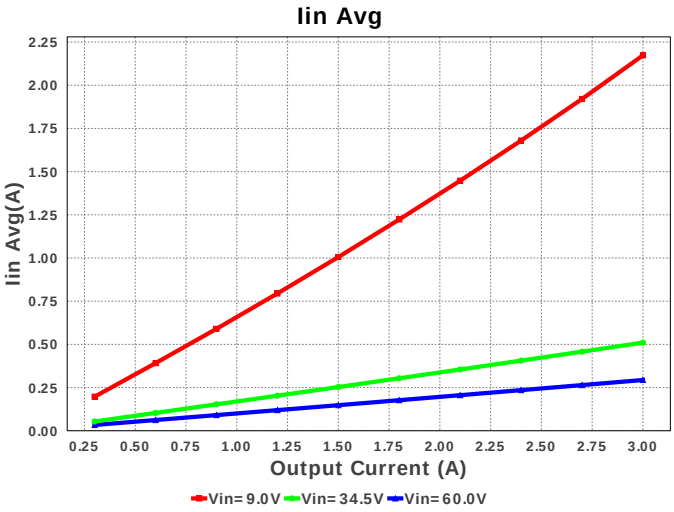


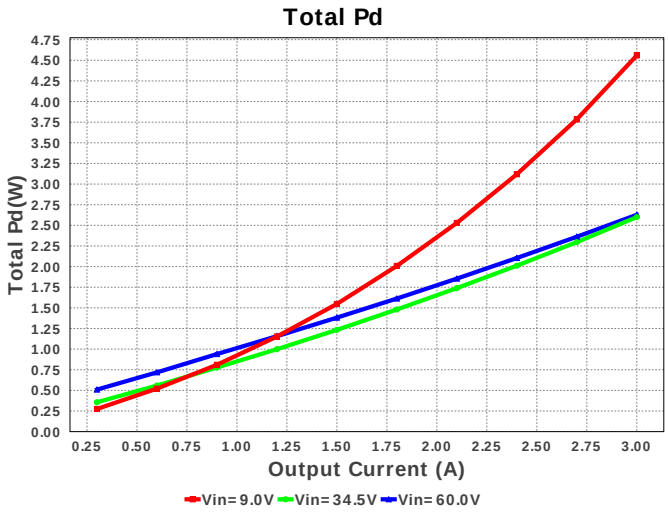


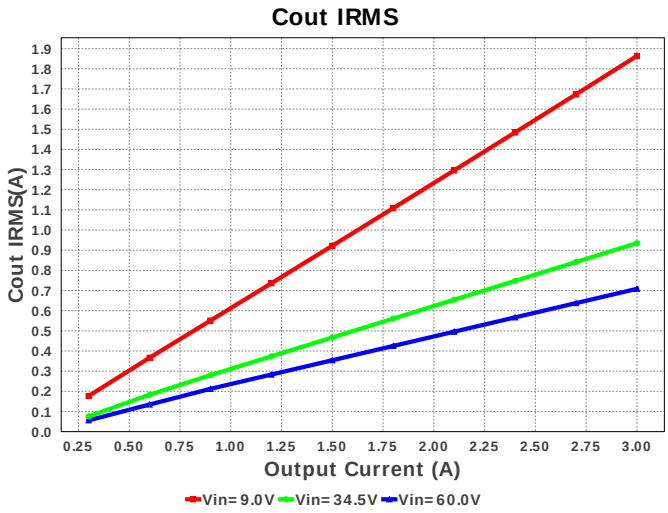


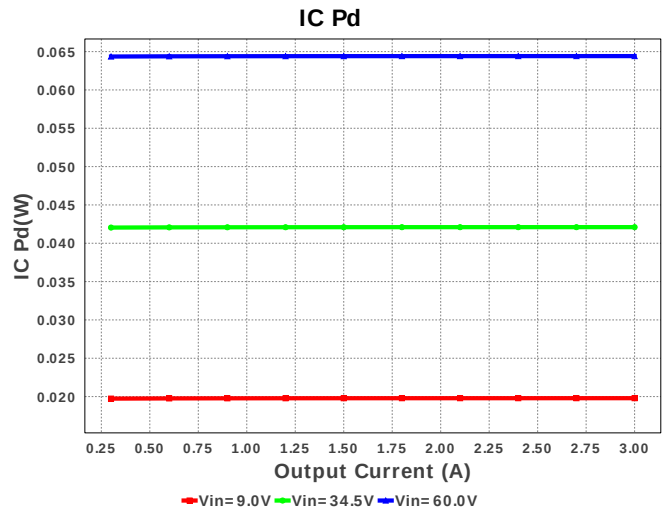


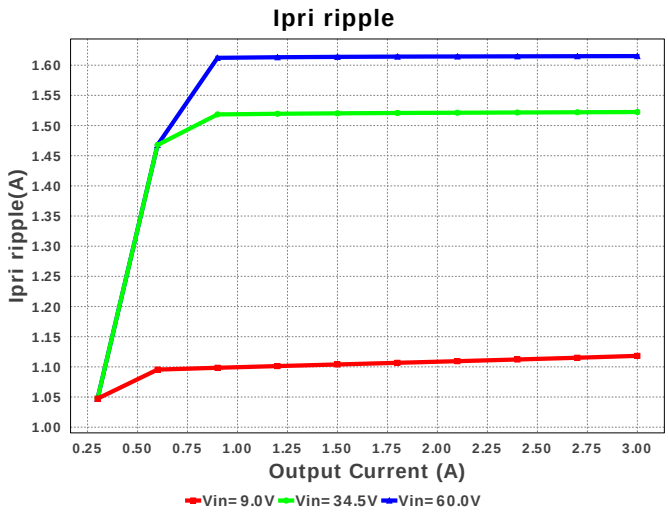


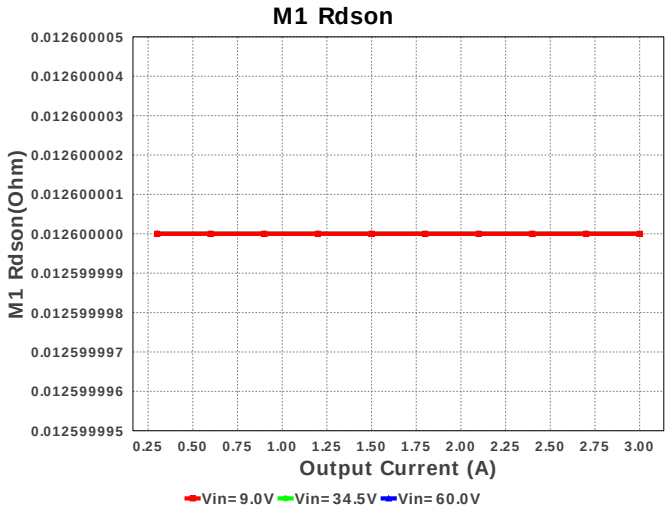


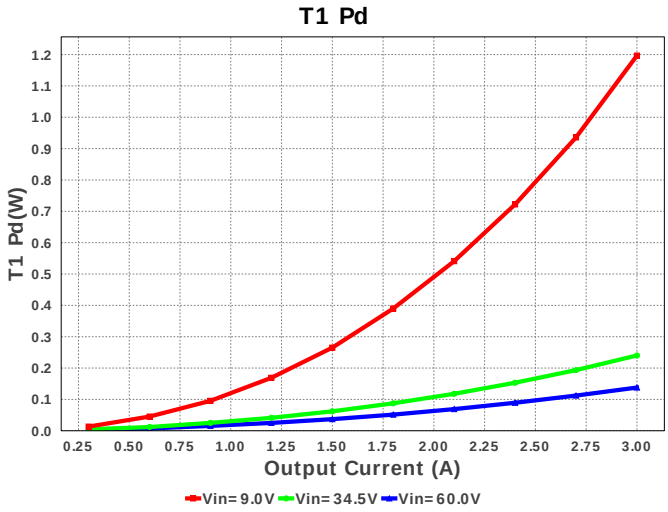












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.732 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.864 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	2.173 A	Current	Average input current
4.	Ipri ripple	1.118 A	Current	Ripple Current in the Primary Winding
5.	Isec Ripple	683.17 mA	Current	Ripple Current in the Secondary Winding
6.	M1 Irms	3.501 A	Current	MOSFET RMS current
7.	T1 Iprim RMS	3.501 A	Current	Transformer Primary RMS Current
8.	T1 Iprim pk	6.163 A	Current	Transformer Primary Peak Current
9.	T1 Is1 RMS	2.139 A	Current	Transformer Secondary1 RMS Current
10.	BOM Count	47	General	Total Design BOM count
11.	Dsec Vf	518.816 mV	General	Effective Forward Voltage Drop at the Operating Current
12.	Dsec2 Vf	518.816 mV	General	Effective Forward Voltage Drop at the Operating Current
13.	FootPrint	2.215 k mm^2	General	Total Foot Print Area of BOM components
14.	Frequency	322.82 kHz	General	Switching frequency
15.	M1 Rdson	12.6 mOhm	General	Drain-Source On-resistance
16.	Mode	CCM	General	Conduction Mode
17.	Pout	15.025 W	General	Total output power
18.	Total BOM	$15.38	General	Total BOM Cost
19.	Vout Actual	5.105 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
20.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
21.	Duty Cycle	38.907 %	Op_point	Duty cycle
22.	Efficiency	76.691 %	Op_point	Steady state efficiency
23.	IC Tj	33.958 degC	Op_point	IC junction temperature
24.	ICThetaJA	200.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
25.	IOUT_OP	3.0 A	Op_point	Iout operating point
26.	M1 TjOP	44.432 degC	Op_point	M1 MOSFET junction temperature
27.	VIN_OP	9.0 V	Op_point	Vin operating point
28.	Vout p-p	15.655 mV	Op_point	Peak-to-peak output ripple voltage
29.	Cin Pd	2.861 mW	Power	Input capacitor power dissipation
30.	Cout Pd	48.626 mW	Power	Output capacitor power dissipation
31.	Dsec Pd	778.224 mW	Power	Secondary Diode Power Dissipation

#	Name	Value	Category	Description
32.	Dsec2 Pd	778.224 mW	Power	Secondary Diode Power Dissipation
33.	IC Pd	19.789 mW	Power	IC power dissipation
34.	M1 Pd	262.28 mW	Power	MOSFET power dissipation
35.	Rsns Pd	833.518 mW	Power	Current Limit Sense Resistor Power Dissipation
36.	T1 Pd	1.197 W	Power	Estimated Losses in Transformer
37.	Total Pd	4.559 W	Power	Total Power Dissipation
38.	Vout Tolerance	3.556 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	3.0	Maximum Output Current
2.	VinMax	60.0	Maximum input voltage
3.	VinMin	9.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	LM5022	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. Isolated feedback, DC-DC Flyback controller with wide Vin range

2. LM5022 Product Folder : http://www.ti.com/product/LM5022 : contains the data sheet and other resources.