

WEBENCH® Power Architect

Project Report

Project : 4109962/2 : PA_Project_302 (modified from 301)

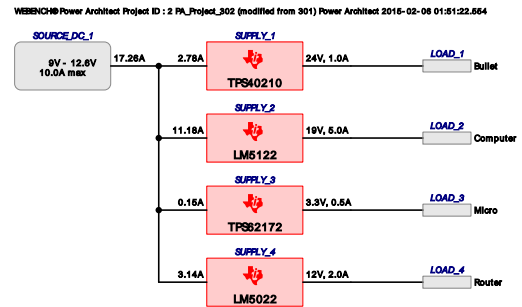
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Optimize project optFactor=3

Project Summary

1. Total System Efficiency	92.808 %
2. Total System BOM Count	73.0
3. Total System Footprint	1.661 kmm2
4. Total System BOM Cost	\$15.14
5. Total System Power Dissipation	11.209 W

--> Launch WEBENCH Power Architect.



Power Supplies

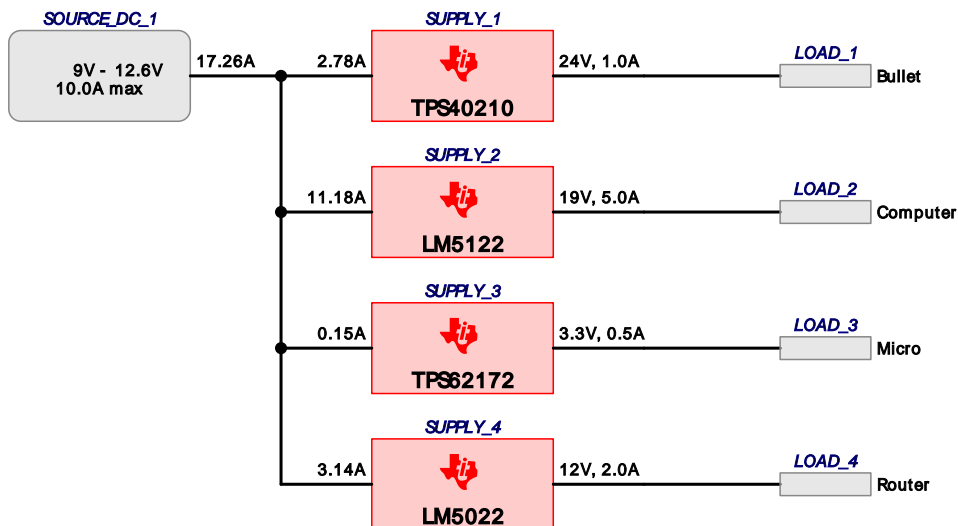
#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
1.	SUPPLY_1	TPS40210	Switcher : Current Mode Boost Controller,10pin DCQ-PowerPAD	24 V	1.0 A	95.8%	513	\$2.67	5	4
2.	SUPPLY_2	LM5122	Switcher : 100V Synchronous Boost Controller	19 V	5.0 A	94.4%	696	\$7.39	6	13
3.	SUPPLY_3	TPS62172	Switcher : 17V,3.3Vout,0.5A,Buck Converter with Power Good	3.3 V	0.5 A	86.6%	42	\$1.41	7	22
4.	SUPPLY_4	LM5022	Switcher : Coupled inductors SEPIC	12 V	2.0 A	84.8%	410	\$3.67	8	27

Power Loads

#	Name	VLoad	ILoad	Description
1.	Bullet	24 V	1 A	VoutRipple=5%
2.	Computer	19 V	5 A	VoutRipple=5%
3.	Micro	3.3 V	0.5 A	VoutRipple=10%
4.	Router	12 V	2 A	VoutRipple=10%

Project Diagram

WEBENCH® Power Architect Project ID : 2_PA_Project_302 (modified from 301) Power Architect 2015-02-06 01:51:22.554



Electrical Procurement BOM

Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm ²)
Panasonic	20SVPF390M	CAPSMT_62_E12	1	\$0.63	106
Panasonic	25SVPF180M	CAPSMT_62_E12	2	\$0.61	106
Panasonic	35SVPF82M	CAPSMT_62_E12	1	\$0.61	106
Diodes Inc.	B240A-13-F	SMA	1	\$0.09	37
Infineon Technologies	BSZ035N03MS G	PG-TSDSON-8	1	\$0.39	19
TDK	C0603C0G1E110G	0201	1	\$0.01	2
Kemet	C0805C224K5RACTU	0805	1	\$0.02	7
TDK	C1608X5R1C105K	0603	1	\$0.01	5
TDK	C3216JB1E476M	1206	1	\$0.35	11
Yageo America	CC0805JRNPO9BN101	0805	2	\$0.01	14
Yageo America	CC0805JRNPO9BN151	0805	1	\$0.01	7
Yageo America	CC0805KRX7R9BB272	0805	1	\$0.01	7
Yageo America	CC0805KRX7R9BB561	0805	1	\$0.01	7
Samsung Electro-Mechanics	CL21C431JBANNNC	0805	1	\$0.01	7
Vishay-Dale	CRCW0402100KFKED	0402	1	\$0.01	3
Vishay-Dale	CRCW0402100RFKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040210K0FKED	0402	2	\$0.01	6
Vishay-Dale	CRCW040213K3FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040215K0FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040217R8FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040219K6FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04021K00FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04021K40FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04022K21FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04022K37FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW0402316KFKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040239K2FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04023K16FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040249K9FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040256K2FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040273K2FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040286K6FKED	0402	2	\$0.01	6
Vishay-Dale	CRCW08053R01FKEA	0805	1	\$0.01	7
Texas Instruments	CSD16340Q3	TRANS_NexFET_Q3	1	\$0.44	19
Texas Instruments	CSD17551Q5A	TRANS_NexFET_Q5A	1	\$0.32	55
Stackpole Electronics Inc	CSR1206FK25L0	1206	1	\$0.10	11
Stackpole Electronics Inc	CSRN2010FK50L0	2010	1	\$0.15	32
Coiltronics	DRQ127-3R3-R	DRQ127	1	\$0.93	210
Taiyo Yuden	EMK212B7474KD-T	0805	1	\$0.02	7
Taiyo Yuden	GMK212B7105KG-T	0805	1	\$0.05	7
MuRata	GRM1555C1E301JA01D	0402	1	\$0.01	3
MuRata	GRM155R61A154KE19D	0402	1	\$0.01	3
MuRata	GRM155R61A683KA01D	0402	1	\$0.01	3
MuRata	GRM155R61C104KA88D	0402	1	\$0.01	3
MuRata	GRM155R71C224KA12D	0402	1	\$0.01	3
MuRata	GRM188R71C474KA88D	0603	1	\$0.02	5
MuRata	GRM216R71H103KA01D	0805	1	\$0.01	7
MuRata	GRM219R61E106KA12	0805	1	\$0.05	7
MuRata	GRM21BC81E475KA12L	0805	1	\$0.04	7
MuRata	GRM21BR61E475MA12L	0805	4	\$0.06	14
MuRata	GRM31CR70J226KE19L	1206	1	\$0.30	11
MuRata	GRM32ER61C226KE20L	1210	1	\$0.35	15
Texas Instruments	LM5022MM/NOPB	MUB10A	1	\$0.90	24
Texas Instruments	LM5122MH/NOPB	MXA20A	1	\$2.16	71
ON Semiconductor	MBR130T1G	SOD-123	1	\$0.09	13
Diodes Inc.	PDS760-13	PowerDI5	1	\$0.60	50
Susumu Co Ltd	PRL1632-R005-F-T1	1206	1	\$0.19	11
Susumu Co Ltd	RR1220P-473-D	0805	2	\$0.01	14
Vishay-Siliconix	SI2316BDS-T1-E3	SOT-23	1	\$0.22	14
Bourns	SRR1210-220M	SRR1210	1	\$0.44	196
Taiyo Yuden	TMK212BJ474KD-T	0805	1	\$0.02	7
Texas Instruments	TPS40210DGQR	S-PDSO-G10	1	\$0.80	24
Texas Instruments	TPS62172DSGR	S-PWSON-N8	1	\$0.60	10
AVX	TPSB226K020R0400	3528-21	1	\$0.33	17
TDK	VLF252015MT-2R2M	VLF252015MT	1	\$0.45	12
Coilcraft	XAL1010-682MEB	XAL1010	1	\$1.71	160
Total			73	\$15.14	1,548

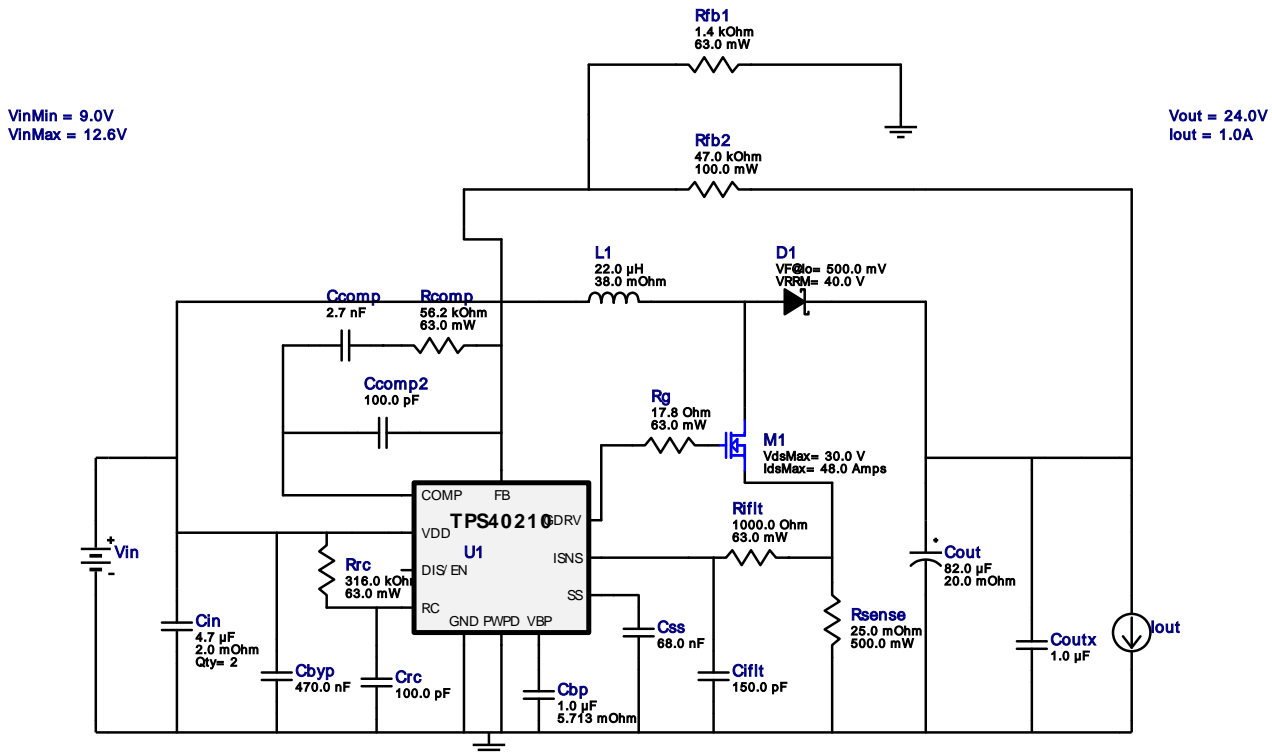


VinMin = 9.0V
 VinMax = 12.6V
 Vout = 24.0V
 Iout = 1.0A

Device = TPS40210DGQR
 Topology = Boost
 Created = 2/6/15 1:51:09 AM
 BOM Cost = \$2.67
 Footprint = 513.0 mm²
 BOM Count = 22
 Total Pd = 1.06W

WEBENCH® Design Report

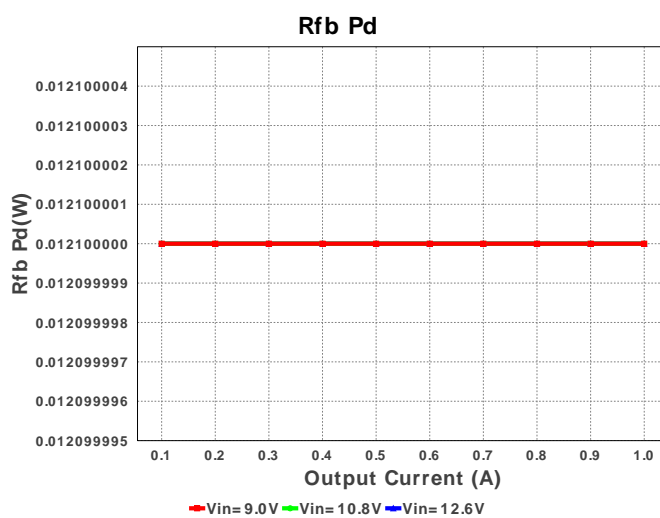
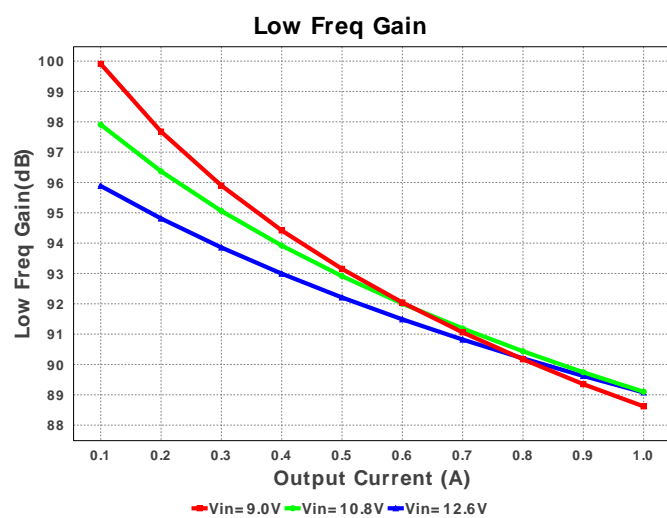
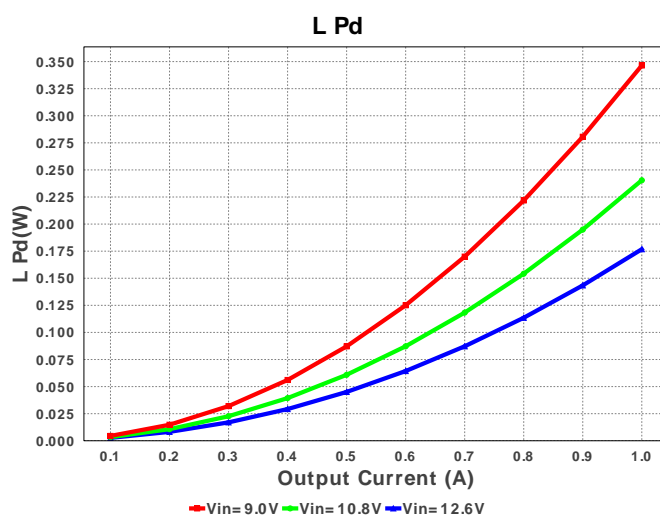
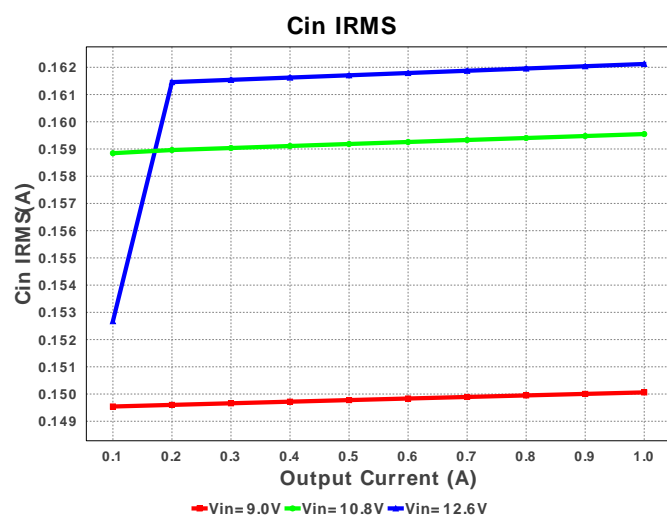
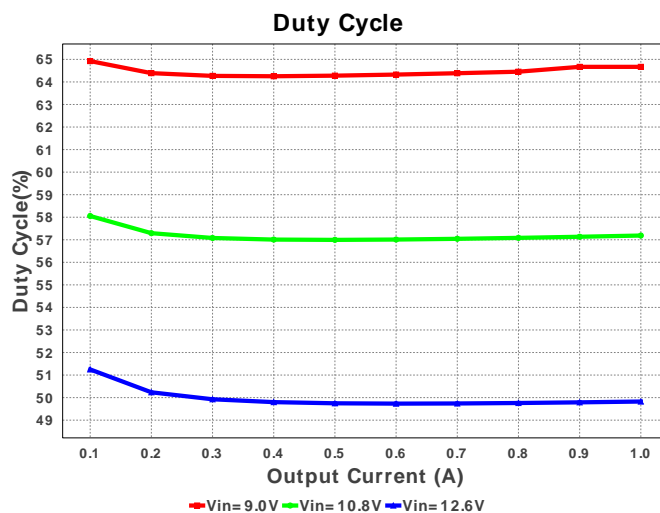
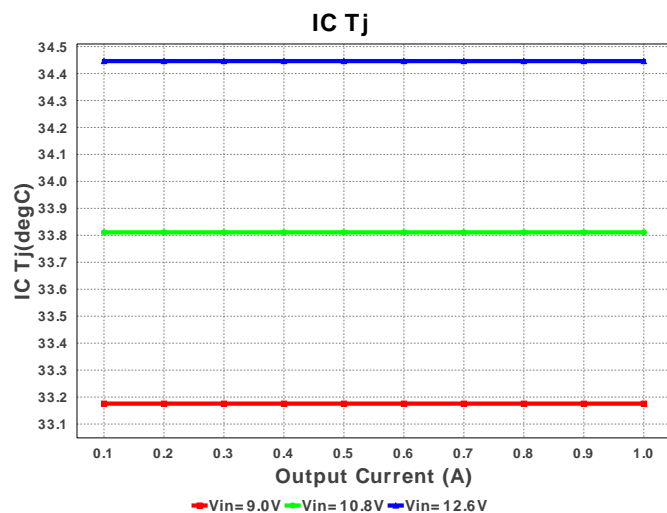
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 TPS40210DGQR 9.0V-12.6V to 24.20V @ 1.0A

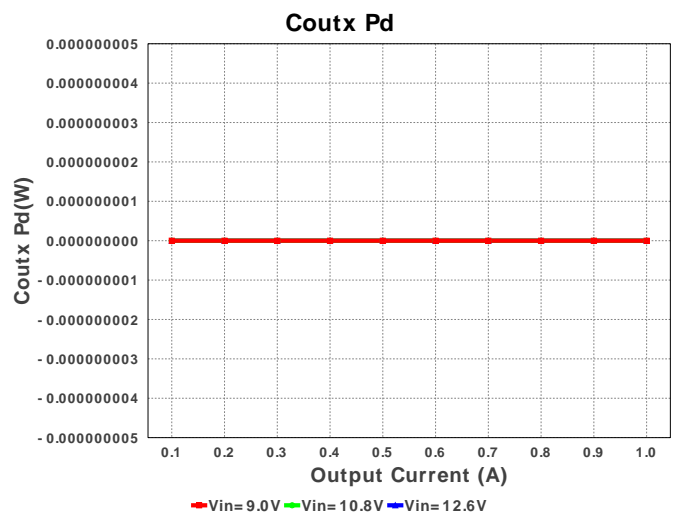
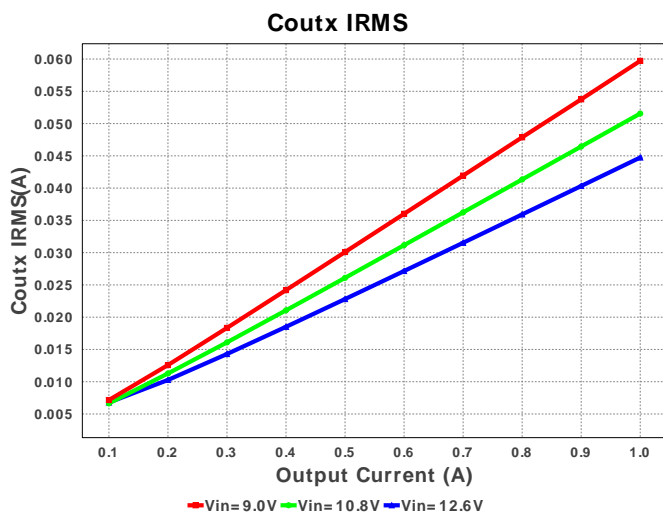
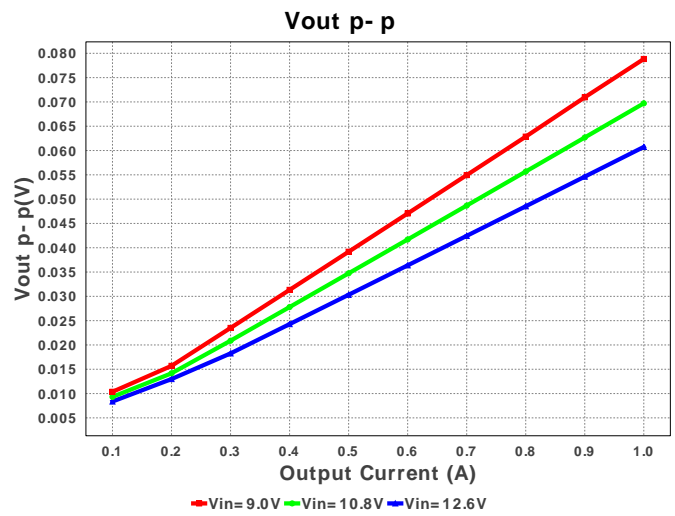
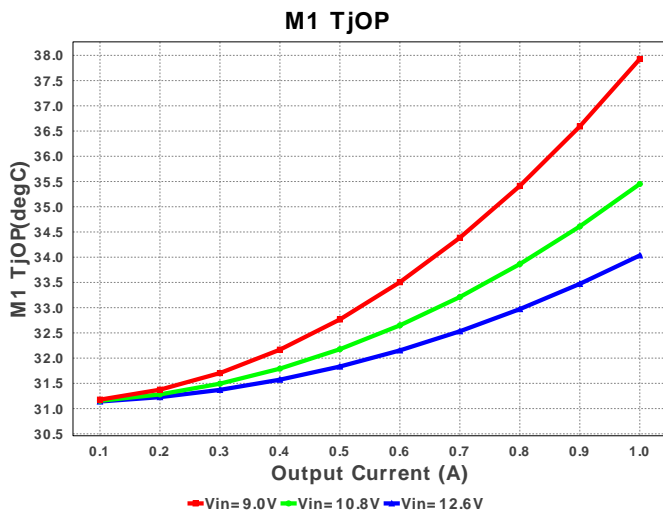
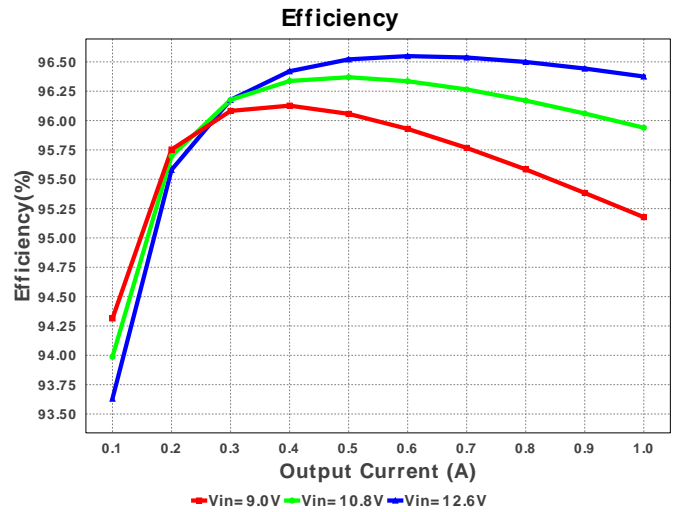
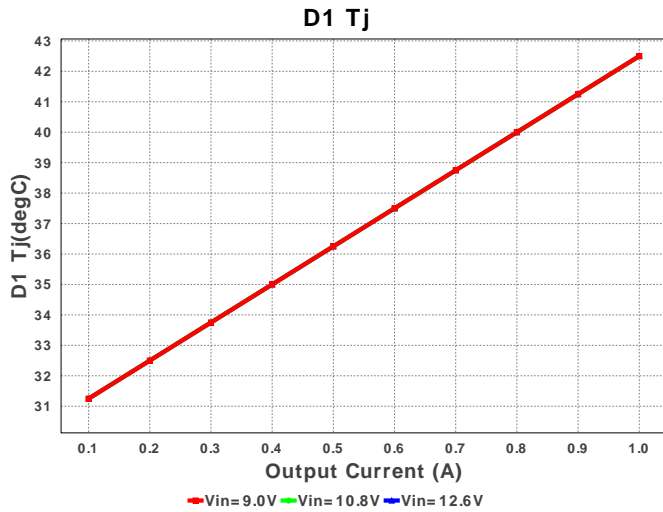


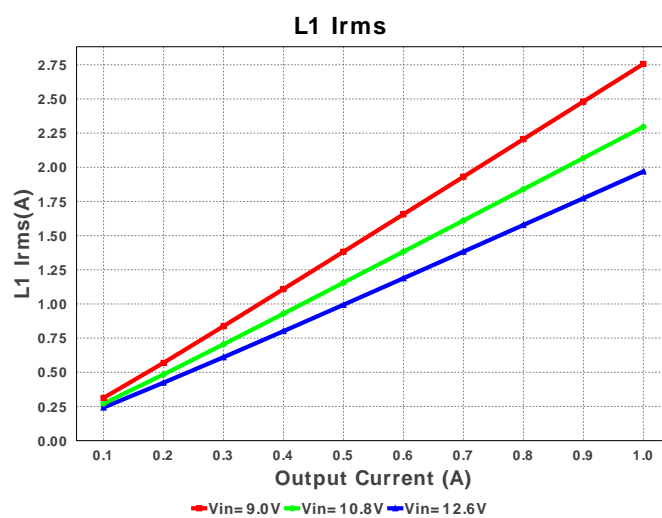
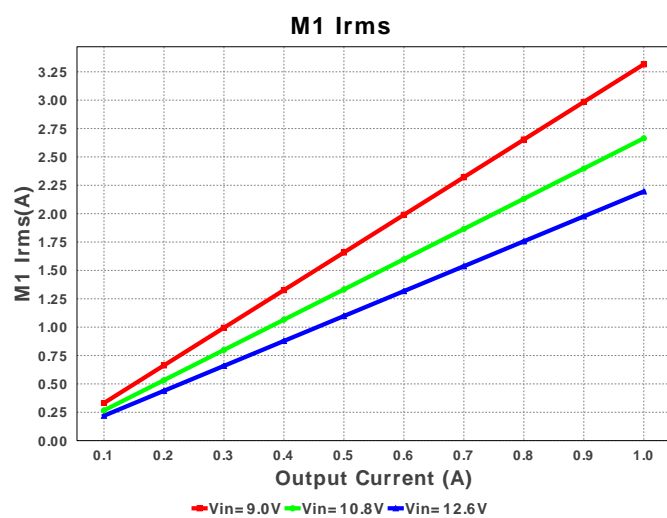
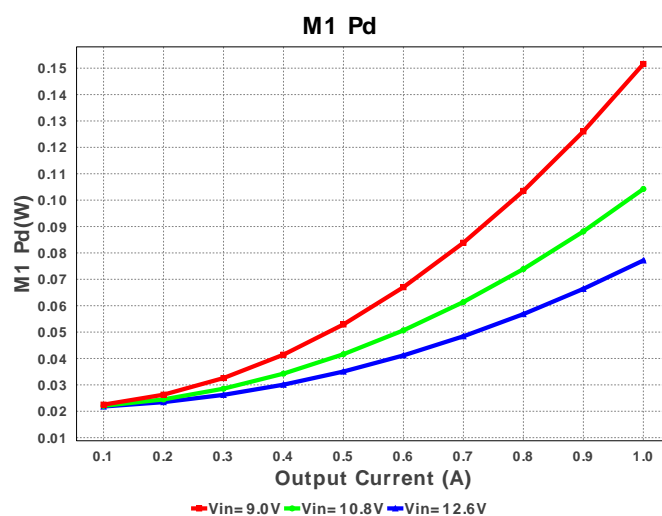
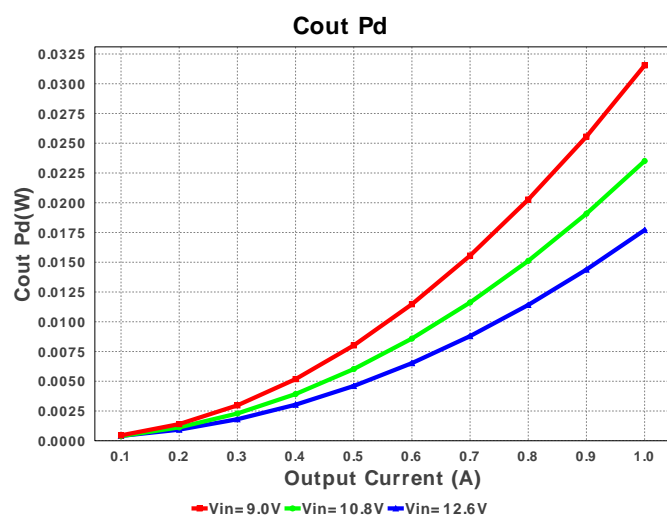
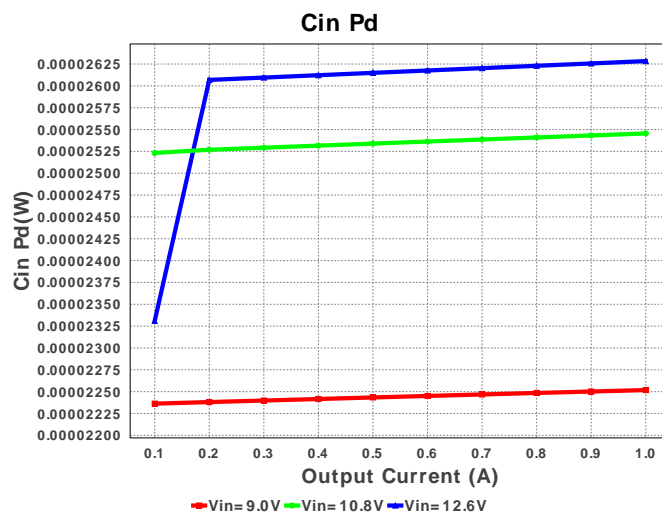
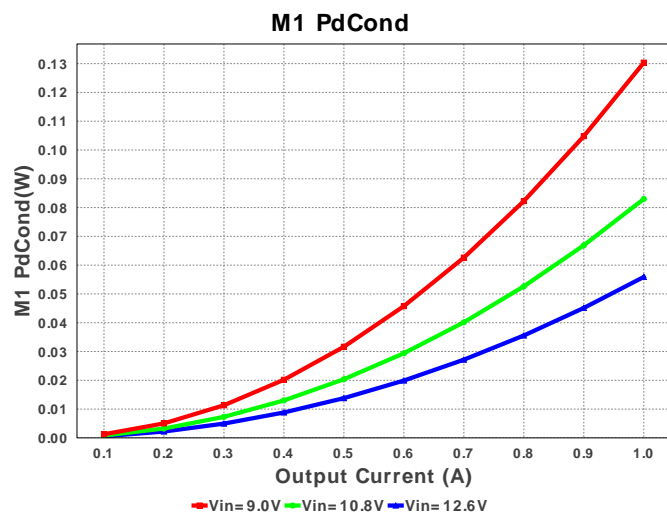
Electrical BOM

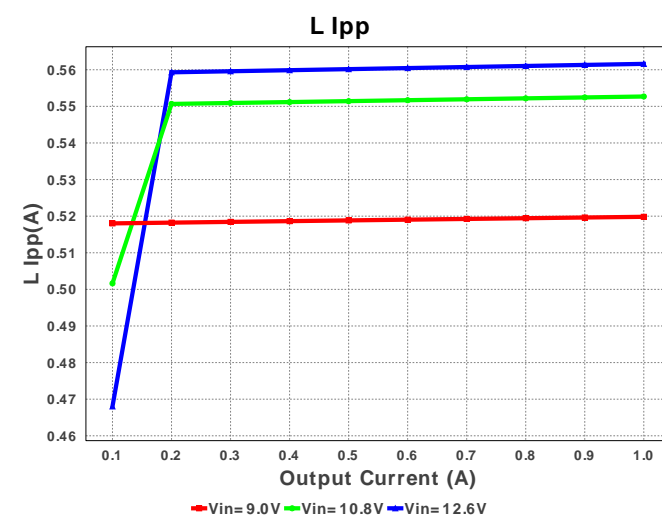
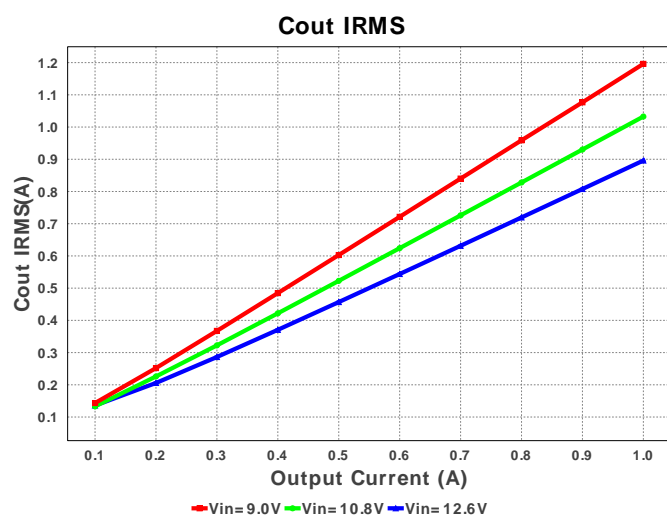
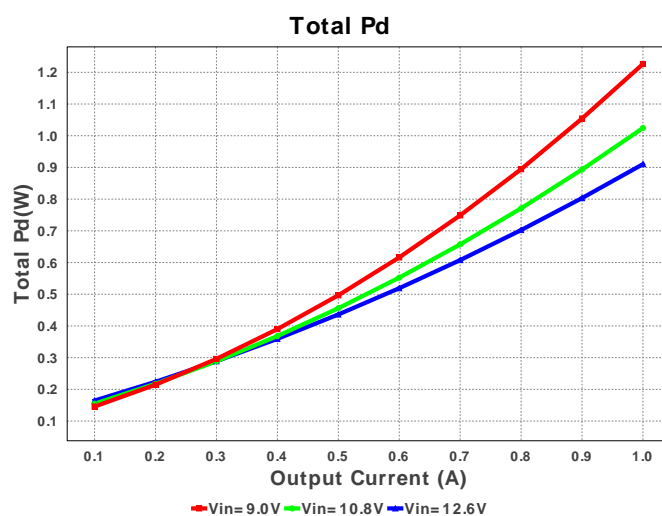
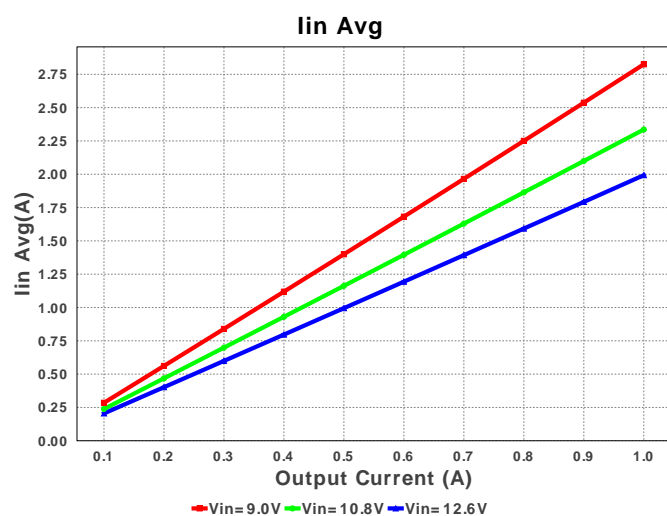
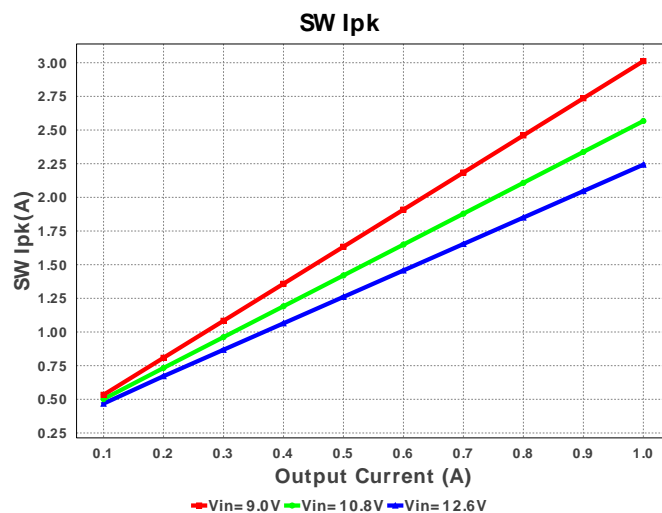
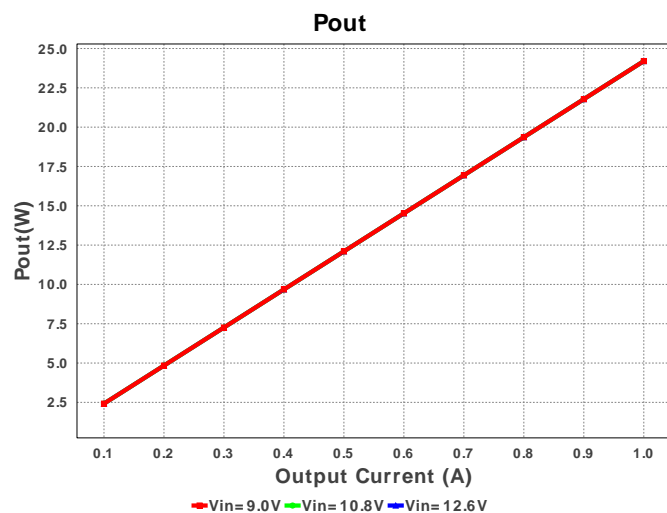
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbp	TDK	C1608X5R1C105K Series= 285	Cap= 1.0 uF ESR= 5.713 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
2.	Cbyp	Taiyo Yuden	EMK212B7474KD-T Series= X7R	Cap= 470.0 nF VDC= 16.0 V IRMS= 0.0 A	1	\$0.02	0805 7 mm ²
3.	Ccomp	Yageo America	CC0805KRX7R9BB272 Series= X7R	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
4.	Ccomp2	Yageo America	CC0805JRNPO9BN101 Series= C0G	Cap= 100.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
5.	Cfilt	Yageo America	CC0805JRNPO9BN151 Series= C0G	Cap= 150.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
6.	Cin	MuRata	GRM21BR61E475MA12L Series= X5R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 7.29 A	2	\$0.06	0805 7 mm ²

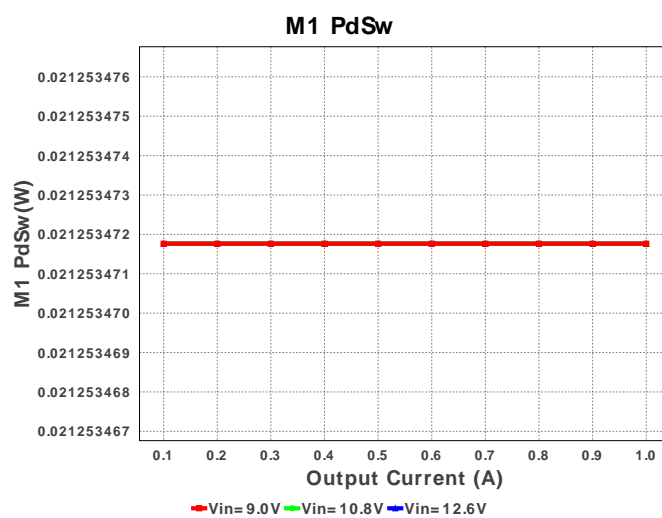
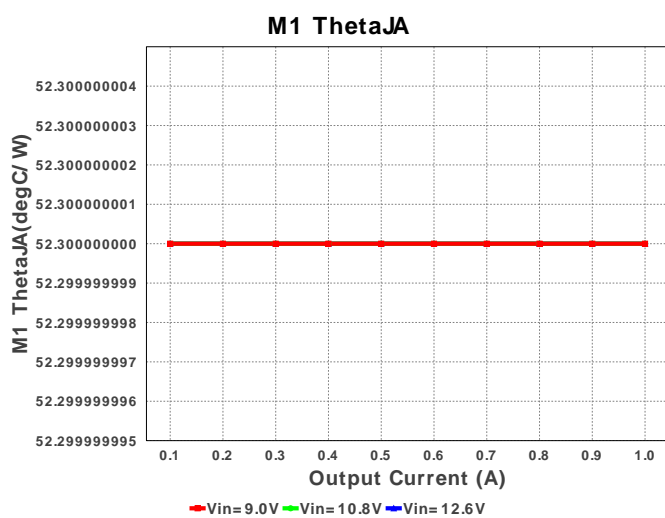
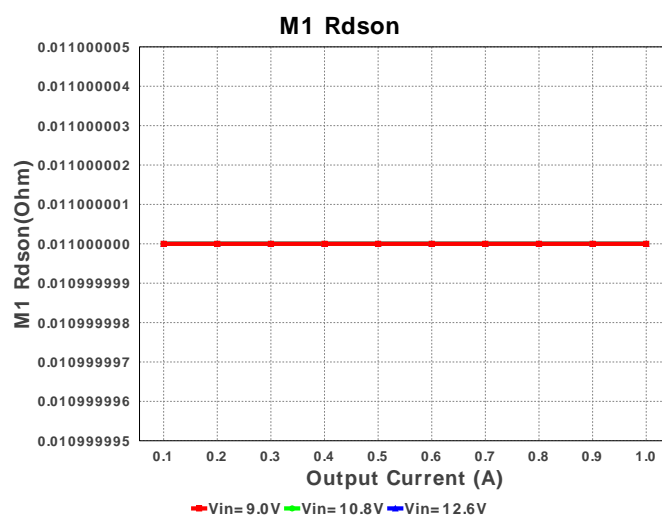
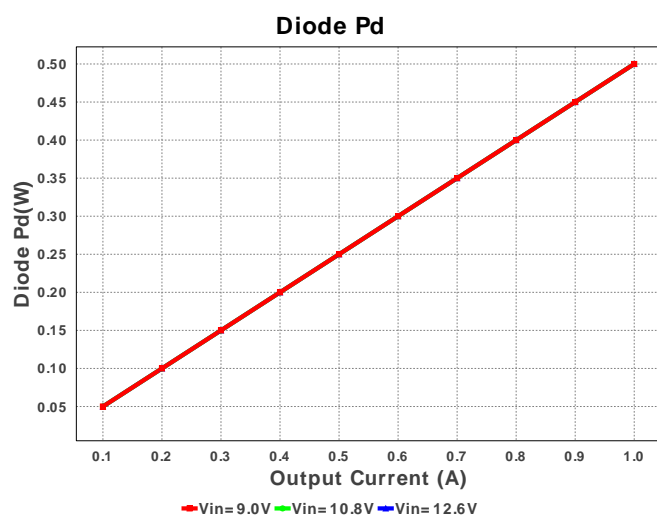
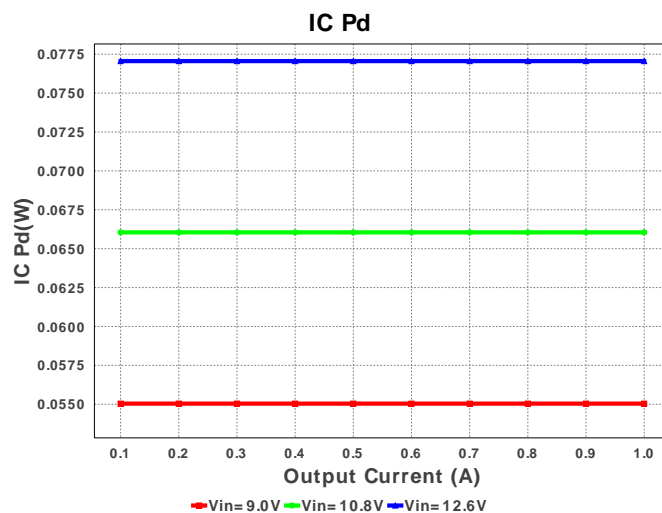
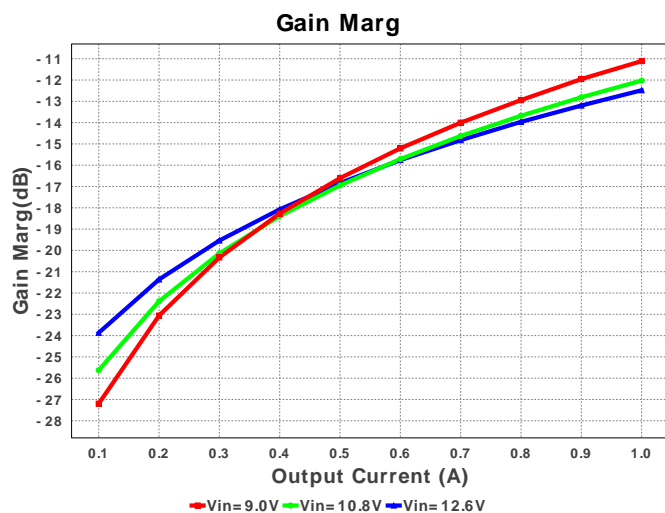
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7.	Cout	Panasonic	35SVPF82M Series= 1273	Cap= 82.0 uF ESR= 20.0 mOhm VDC= 35.0 V IRMS= 4.0 A	1	\$0.61	 CAPSMT_62_E12 106 mm ²
8.	Coutx	Taiyo Yuden	GMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 35.0 V IRMS= 0.0 A	1	\$0.05	 0805 7 mm ²
9.	Crc	Yageo America	CC0805JRNPO9BN101 Series= C0G	Cap= 100.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
10.	Css	MuRata	GRM155R61A683KA01D Series= X5R	Cap= 68.0 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
11.	D1	Diodes Inc.	B240A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	\$0.09	 SMA 37 mm ²
12.	L1	Bourns	SRR1210-220M	L= 22.0 uH DCR= 38.0 mOhm	1	\$0.44	 SRR1210 196 mm ²
13.	M1	Texas Instruments	CSD17551Q5A	VdsMax= 30.0 V IdsMax= 48.0 Amps	1	\$0.32	 TRANS_NexFET_Q5A 55 mm ²
14.	Rcomp	Vishay-Dale	CRCW040256K2FKED Series= CRCW..e3	Res= 56.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
15.	Rfb1	Vishay-Dale	CRCW04021K40FKED Series= CRCW..e3	Res= 1.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
16.	Rfb2	Susumu Co Ltd	RR1220P-473-D Series= 264	Res= 47.0 kOhm Power= 100.0 mW Tolerance= 0.5%	1	\$0.01	 0805 7 mm ²
17.	Rg	Vishay-Dale	CRCW040217R8FKED Series= CRCW..e3	Res= 17.8 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
18.	Riflt	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
19.	Rrc	Vishay-Dale	CRCW0402316KFKED Series= CRCW..e3	Res= 316.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
20.	Rsense	Stackpole Electronics Inc	CSR1206FK25L0 Series= ?	Res= 25.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	\$0.10	 1206 11 mm ²
21.	U1	Texas Instruments	TPS40210DGQR	Switcher	1	\$0.80	 S-PDSO-G10 24 mm ²

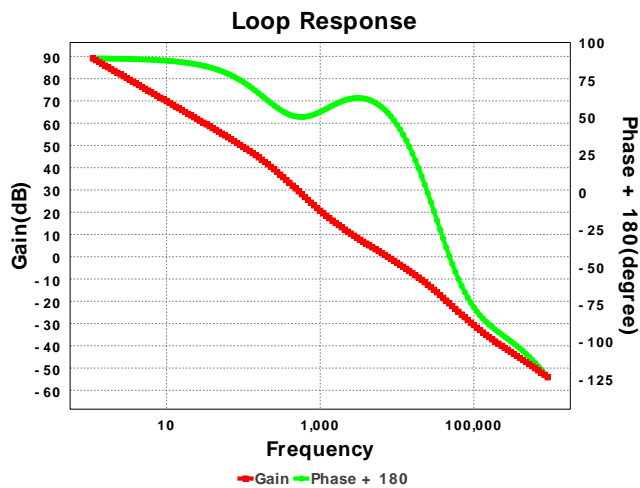












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	149.776 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.187 A	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	59.482 mA	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	2.785 A	Current	Average input current
5.	L Ipp	518.84 mA	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	2.726 A	Current	Inductor ripple current
7.	M1 Irms	3.277 A	Current	M1 MOSFET Irms
8.	SW Ipk	2.982 A	Current	Peak switch current
9.	BOM Count	22	General	Total Design BOM count
10.	FootPrint	513.0 mm ²	General	Total Foot Print Area of BOM components
11.	Frequency	502.159 kHz	General	Switching frequency
12.	IC Tolerance	10.0 mV	General	IC Feedback Tolerance
13.	M1 Rdson	11.0 mOhm	General	Drain-Source On-resistance
14.	M1 ThetaJA	52.3 degC/W	General	MOSFET junction-to-ambient thermal resistance
15.	Pout	24.0 W	General	Total output power
16.	Total BOM	\$2.67	General	Total BOM Cost
17.	D1 Tj	42.5 degC	Op_Point	D1 junction temperature
18.	Vout OP	24.2 V	Op_Point	Operational Output Voltage
19.	Cross Freq	5.669 kHz	Op_point	Bode plot crossover frequency
20.	Duty Cycle	64.091 %	Op_point	Duty cycle
21.	Efficiency	95.766 %	Op_point	Steady state efficiency
22.	Gain Marg	-11.234 dB	Op_point	Bode Plot Gain Margin
23.	IC Tj	33.172 degC	Op_point	IC junction temperature
24.	ICThetaJA	57.7 degC/W	Op_point	IC junction-to-ambient thermal resistance
25.	IOUT_OP	1.0 A	Op_point	Iout operating point
26.	M1 TjOP	37.751 degC	Op_point	M1 MOSFET junction temperature
27.	Phase Marg	54.532 deg	Op_point	Bode Plot Phase Margin
28.	VIN_OP	9.0 V	Op_point	Vin operating point
29.	Vout p-p	78.116 mV	Op_point	Peak-to-peak output ripple voltage
30.	Cin Pd	22.433 μW	Power	Input capacitor power dissipation
31.	Cout Pd	31.078 mW	Power	Output capacitor power dissipation
32.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
33.	Diode Pd	500.0 mW	Power	Diode power dissipation
34.	IC Pd	54.972 mW	Power	IC power dissipation
35.	L Pd	338.941 mW	Power	Inductor power dissipation
36.	M1 Pd	148.204 mW	Power	M1 MOSFET total power dissipation
37.	M1 PdCond	127.162 mW	Power	M1 MOSFET conduction losses
38.	M1 PdSw	21.042 mW	Power	M1 MOSFET switching losses
39.	Rfb Pd	11.901 mW	Power	Rfb Power Dissipation
40.	Total Pd	1.061 W	Power	Total Power Dissipation
41.	Low Freq Gain	88.676 dB	Unknown	Gain at 10Hz

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	Maximum Output Current
2.	Iout1	1.0	Output Current #1
3.	VinMax	12.6	Maximum input voltage
4.	VinMin	9.0	Minimum input voltage
5.	Vout	24.0	Output Voltage
6.	Vout1	24.0	Output Voltage #1
7.	base_pn	TPS40210	Base Product Number

#	Name	Value	Description
8.	source	DC	Input Source Type
9.	Ta	30.0	Ambient temperature

Design Assistance


1. **TPS40210** Product Folder : <http://www.ti.com/product/tps40210> : contains the data sheet and other resources.

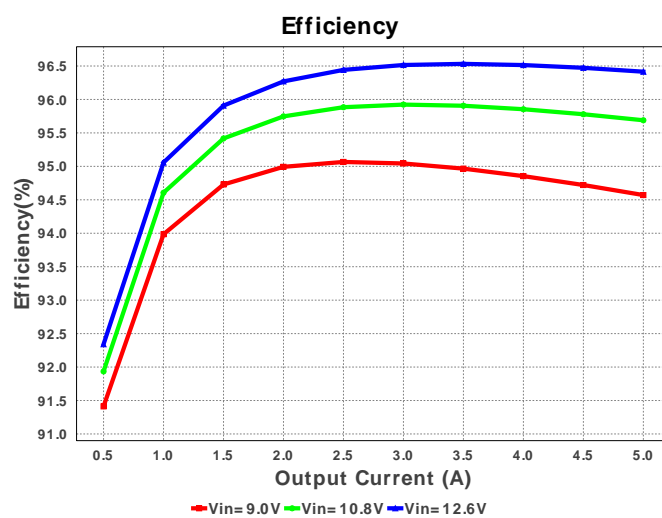
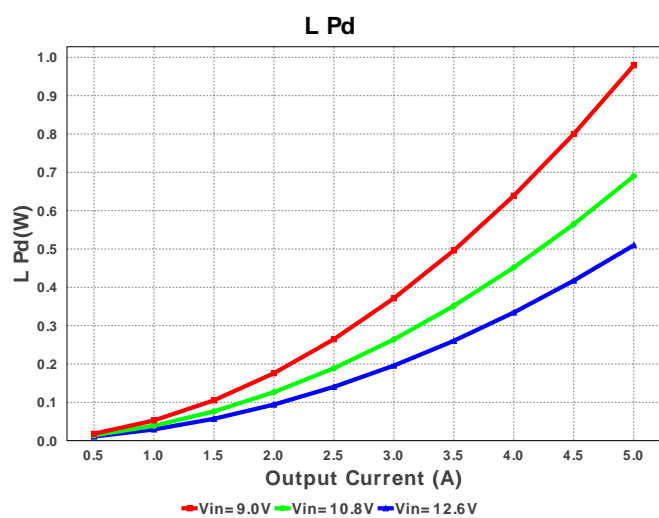
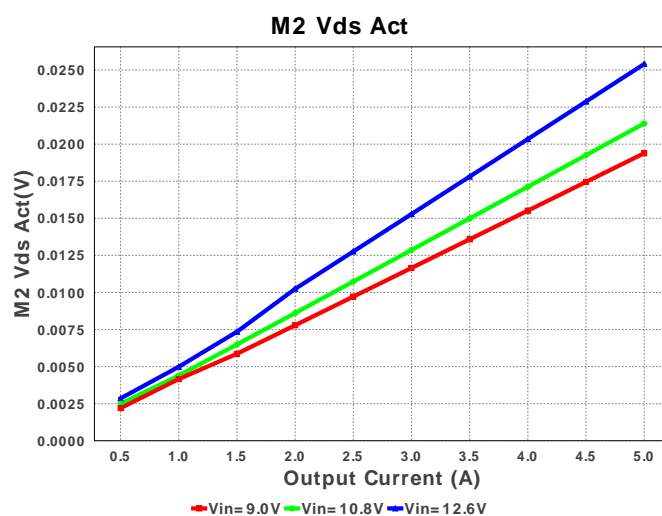
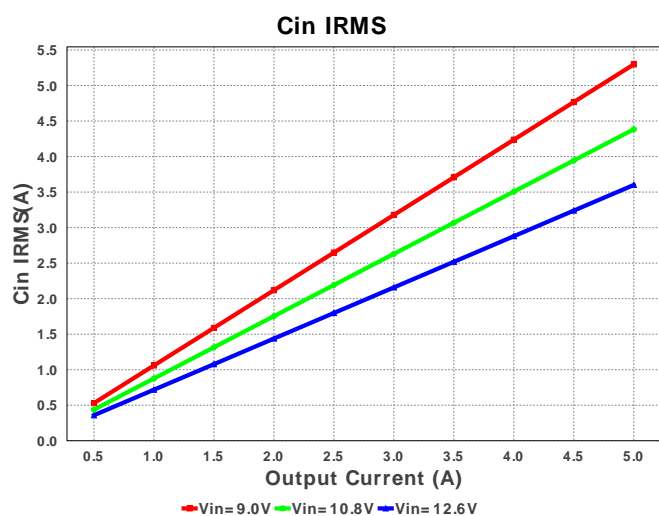
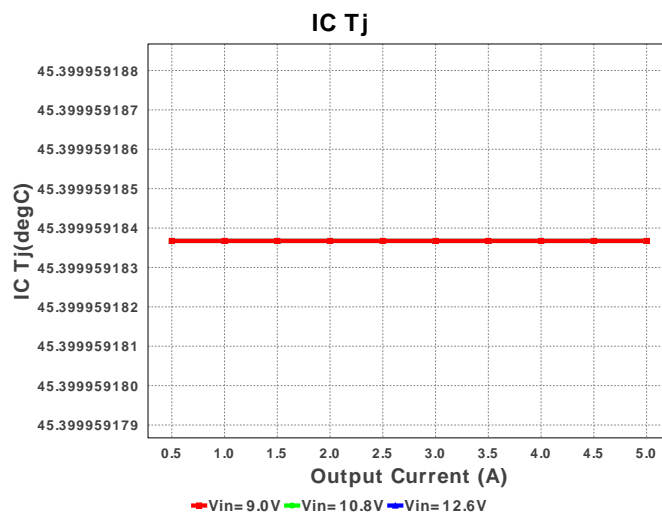
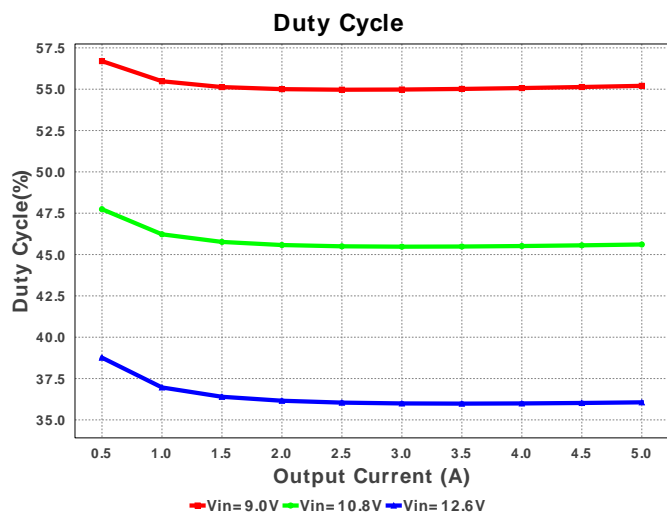
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Footprint = 696.0 mm²
BOM Count = 25
Total Pd = 5.61W

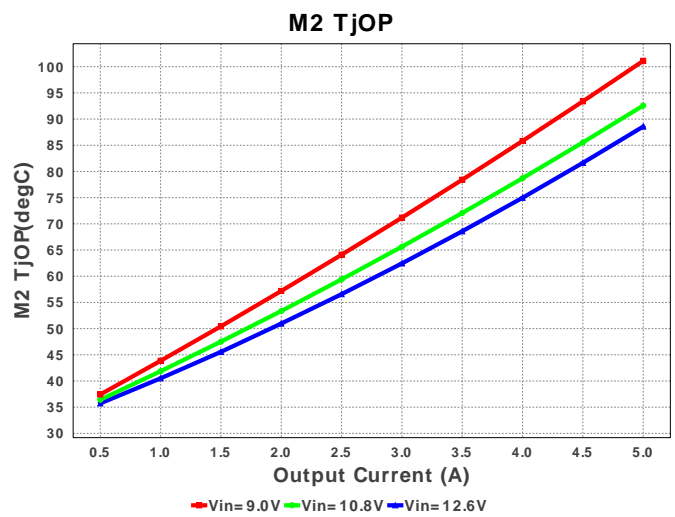
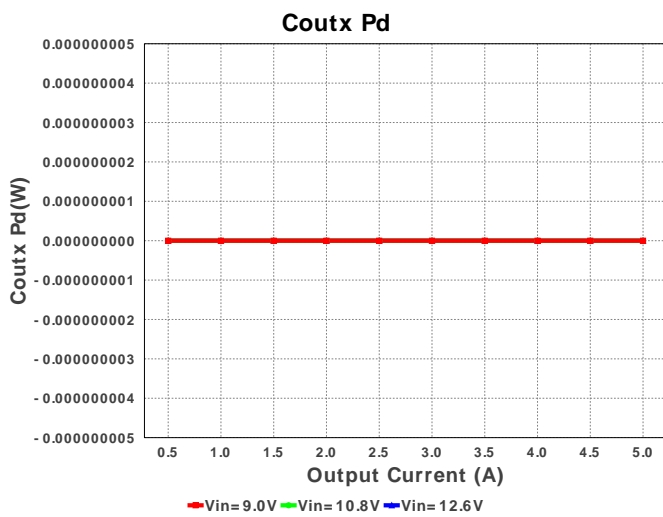
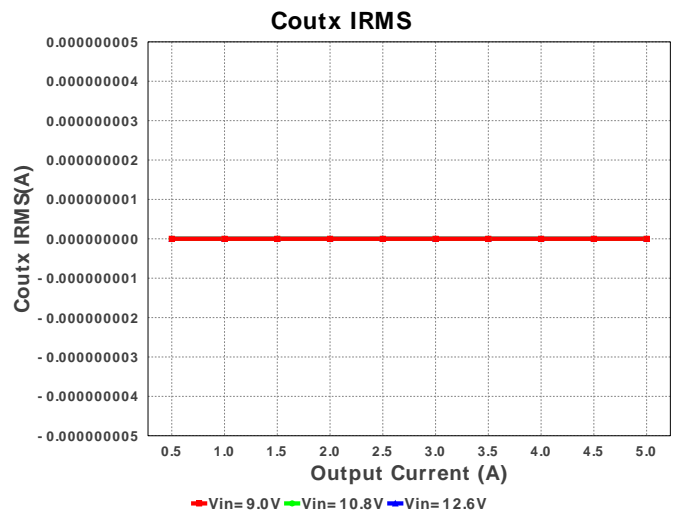
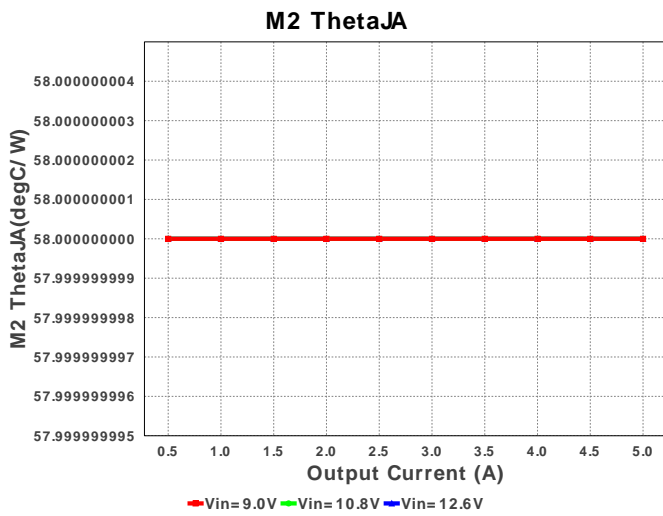
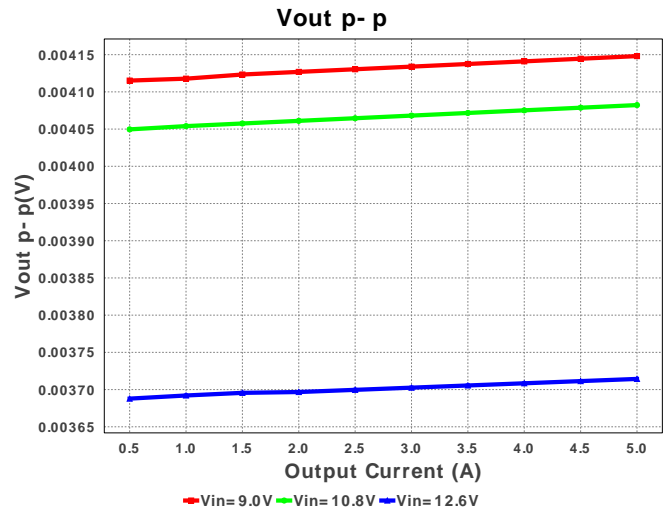
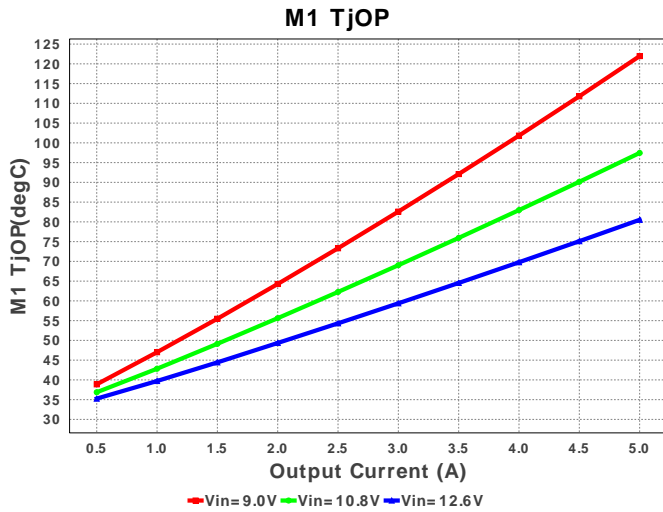
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LM5122MH/NOPB 9.0V-12.6V to 19.00V @ 5.0A



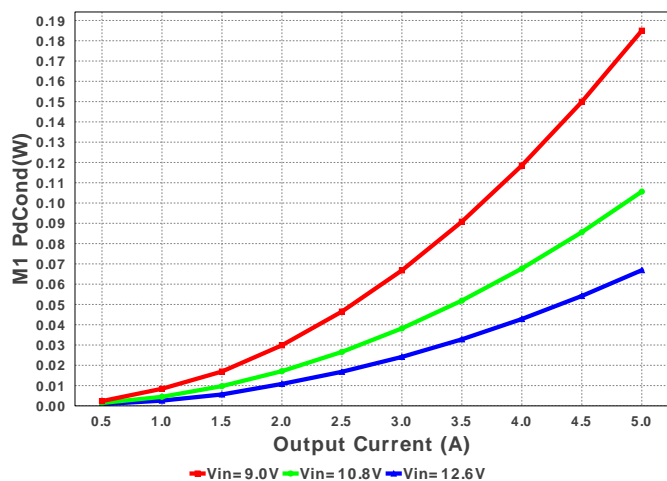
tj.com/webench

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Cvin	MuRata	GRM188R71C474KA88D Series= X7R	Cap= 470.0 nF ESR= 10.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.02	 0603 5 mm ²
11.	Dbst	ON Semiconductor	MBR130T1G	VF@Io= 470.0 mV VRRM= 30.0 V	1	\$0.09	 SOD-123 13 mm ²
12.	L1	Coilcraft	XAL1010-682MEB	L= 6.8 µH DCR= 8.1 mOhm	1	\$1.71	 XAL1010 160 mm ²
13.	M1	Infineon Technologies	BSZ035N03MS G	VdsMax= 30.0 V IdsMax= 40.0 Amps	1	\$0.39	 PG-TSDSON-8 19 mm ²
14.	M2	Texas Instruments	CSD16340Q3	VdsMax= 25.0 V IdsMax= 60.0 Amps	1	\$0.44	 TRANS_NexFET_Q3 19 mm ²
15.	Rcomp	Vishay-Dale	CRCW040239K2FKED Series= CRCW..e3	Res= 39.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
16.	Rfbb	Vishay-Dale	CRCW04023K16FKED Series= CRCW..e3	Res= 3.16 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
17.	Rfbt	Susumu Co Ltd	RR1220P-473-D Series= 264	Res= 47.0 kOhm Power= 100.0 mW Tolerance= 0.5%	1	\$0.01	 0805 7 mm ²
18.	Rs	Susumu Co Ltd	PRL1632-R005-F-T1 Series= 237	Res= 5.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	\$0.19	 1206 11 mm ²
19.	Rslope	Vishay-Dale	CRCW040286K6FKED Series= CRCW..e3	Res= 86.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
20.	Rt	Vishay-Dale	CRCW040219K6FKED Series= CRCW..e3	Res= 19.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
21.	Ruvb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
22.	Rvvt	Vishay-Dale	CRCW040249K9FKED Series= CRCW..e3	Res= 49.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
23.	Rvin	Vishay-Dale	CRCW08053R01FKEA Series= CRCW..e3	Res= 3.01 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
24.	U1	Texas Instruments	LM5122MH/NOPB	Switcher	1	\$2.16	 MXA20A 71 mm ²

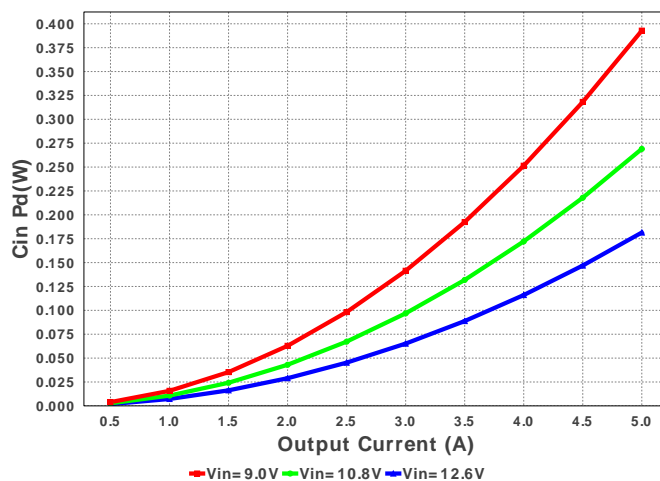




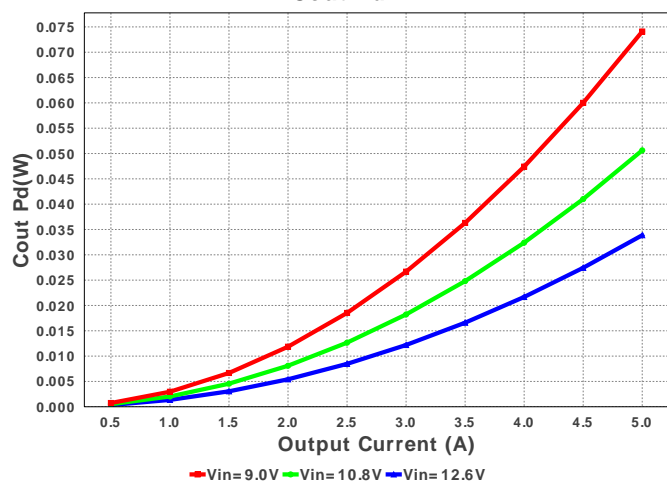
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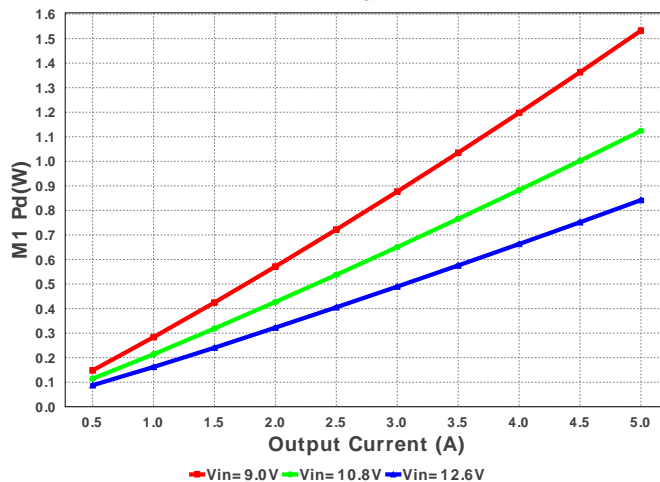
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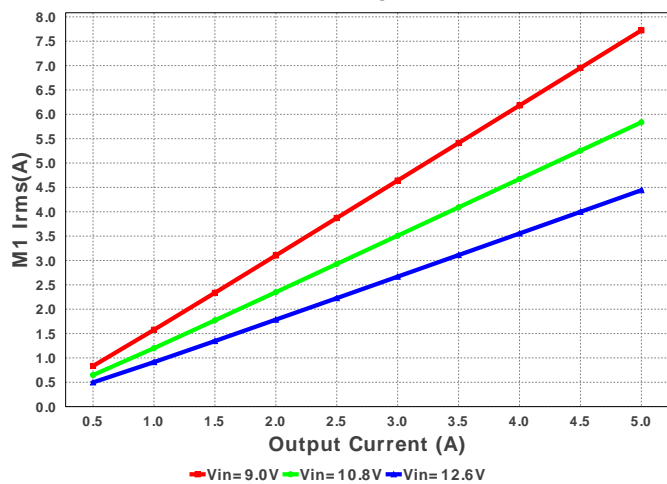
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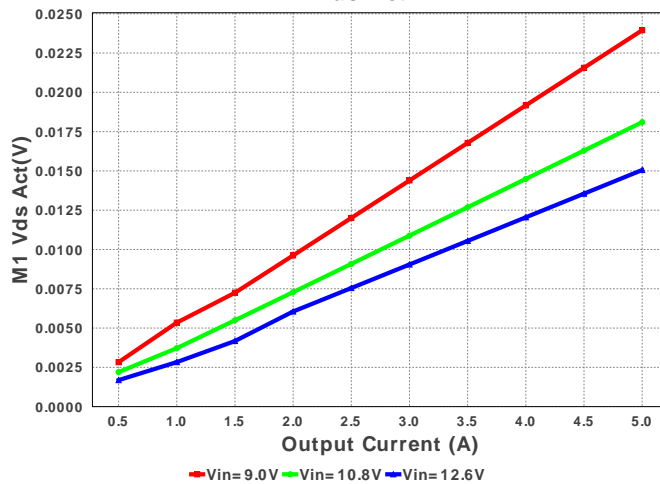
M1 Pd

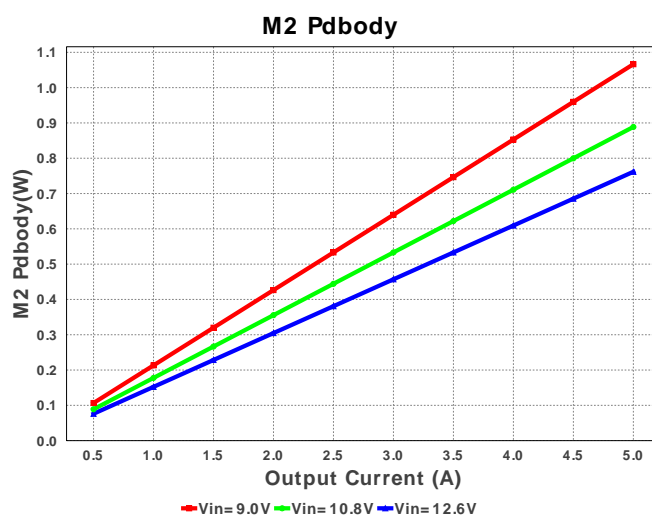
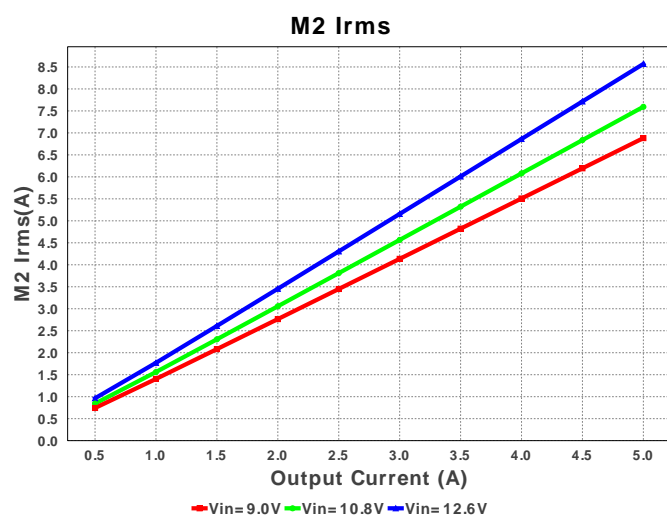
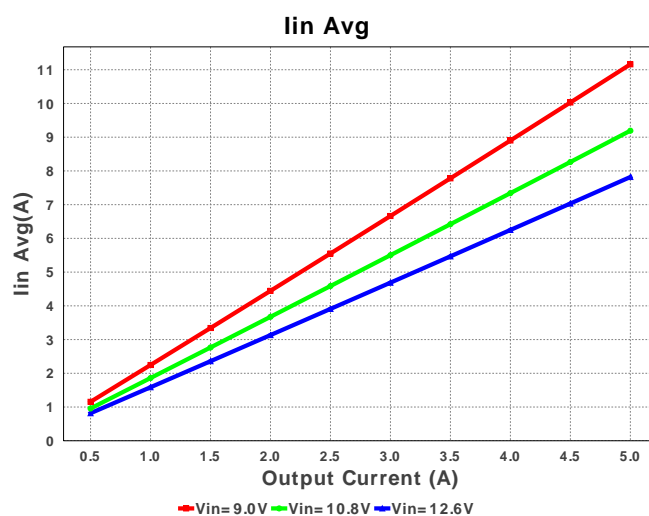
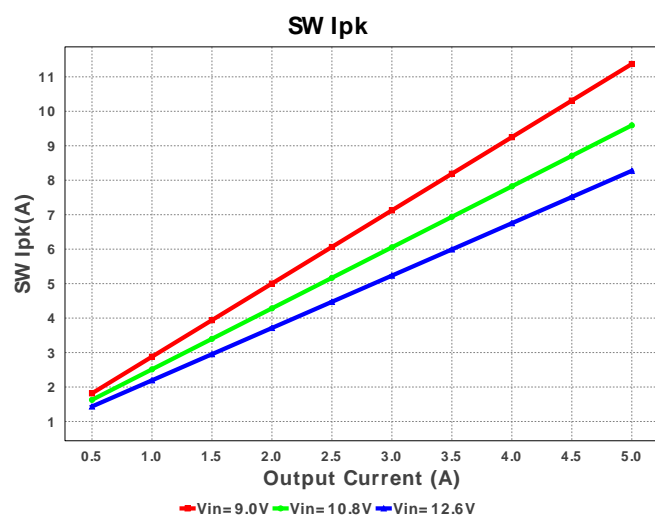
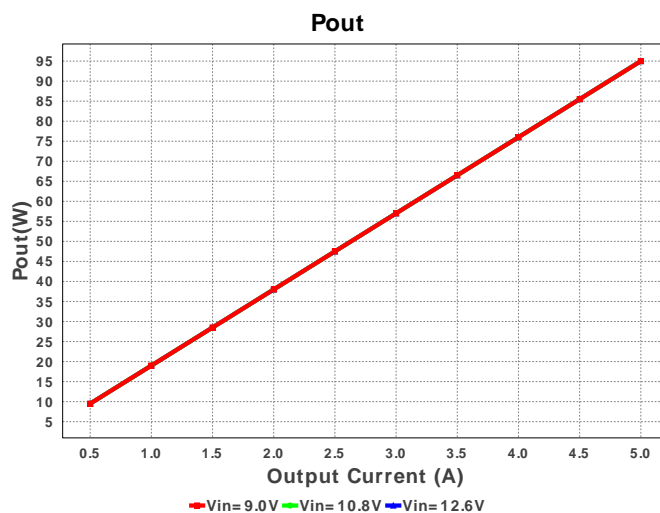
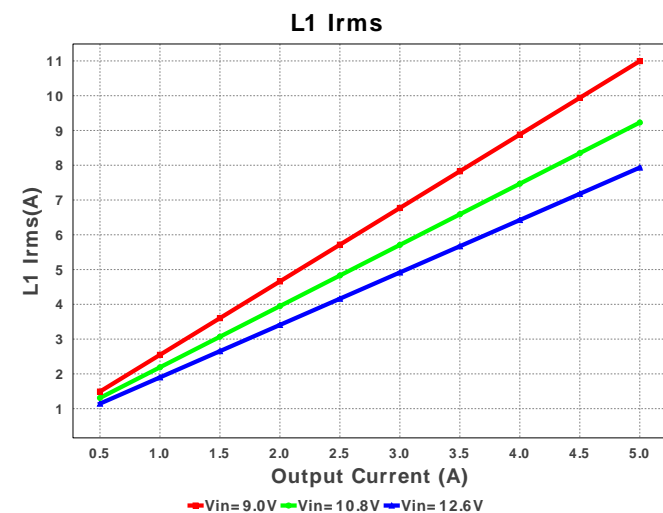


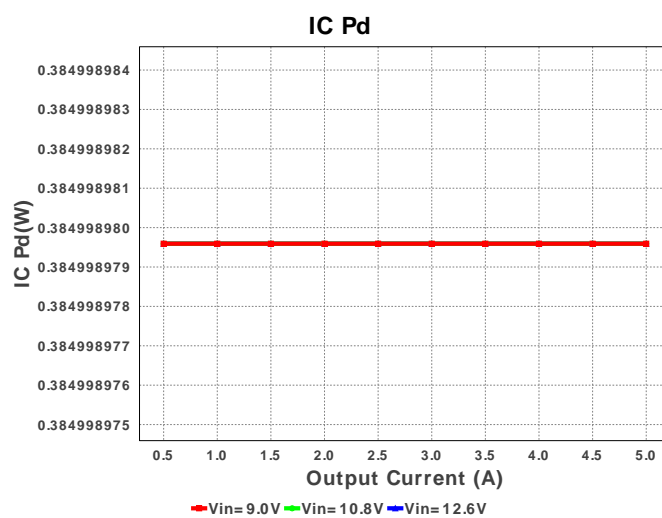
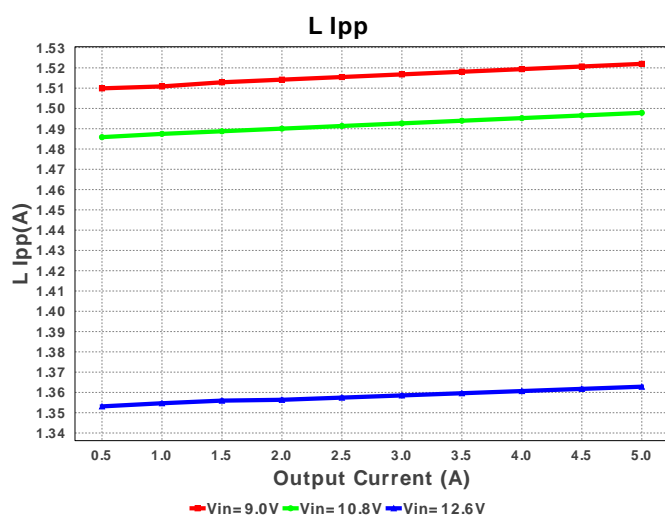
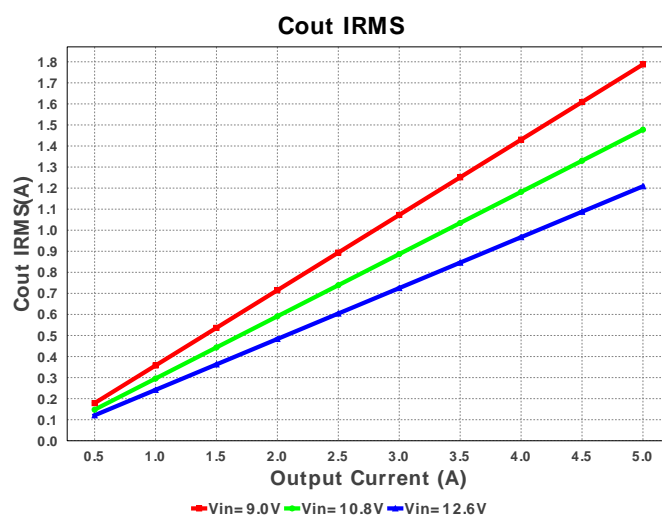
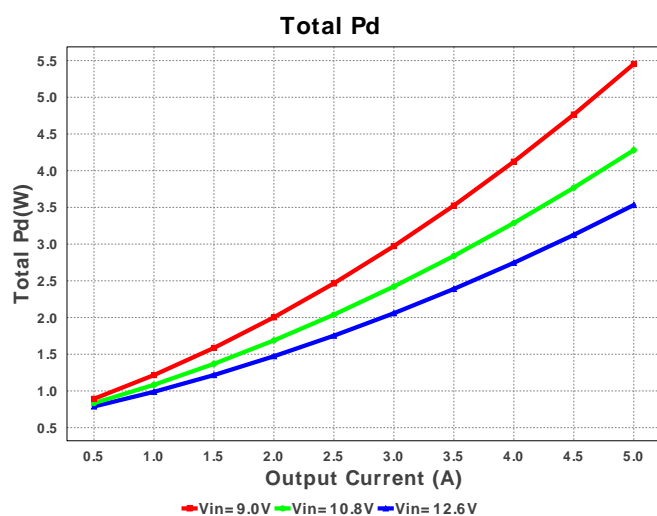
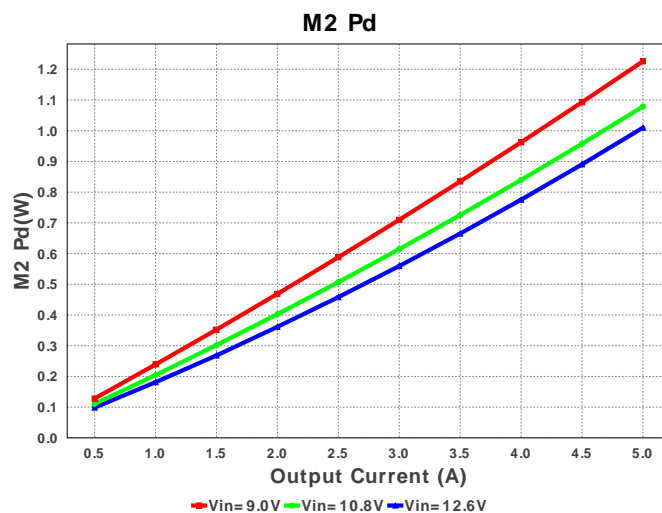
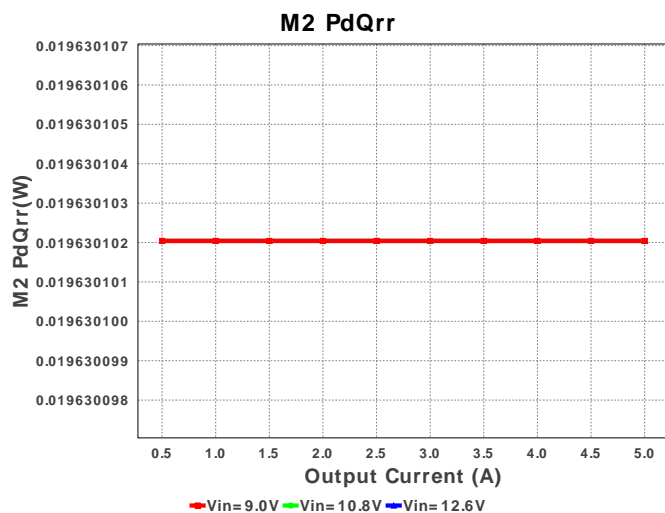
M1 Irms

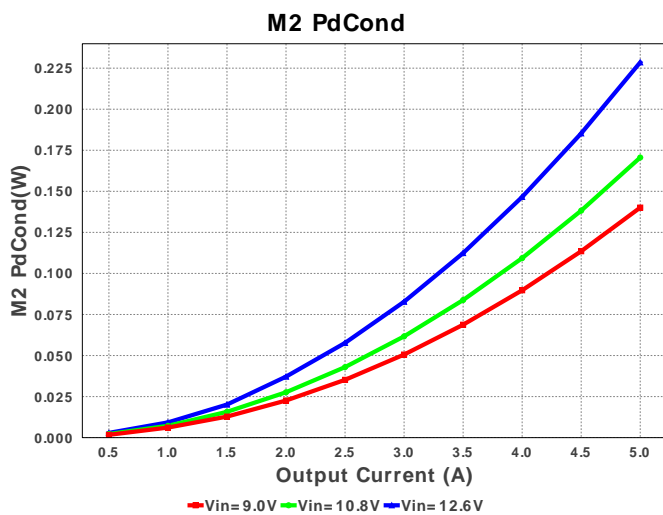
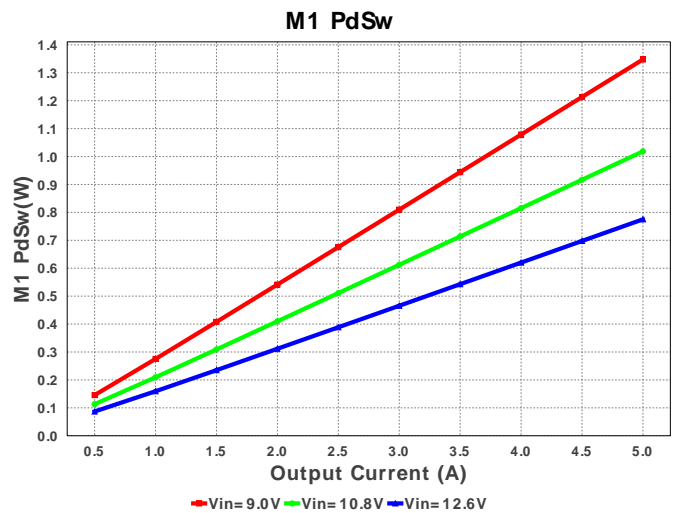
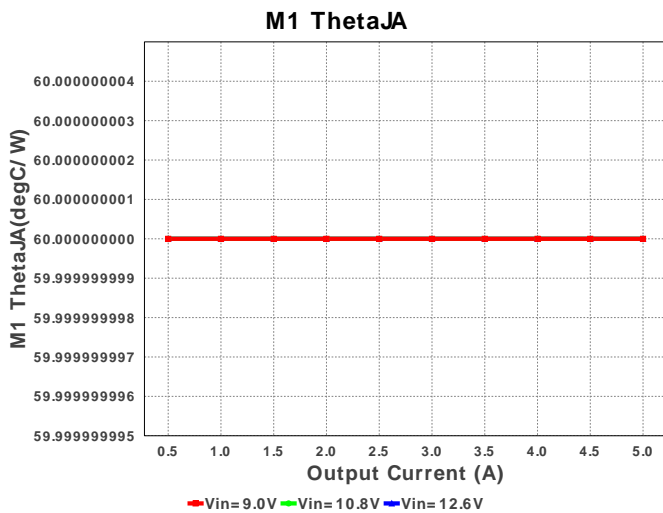
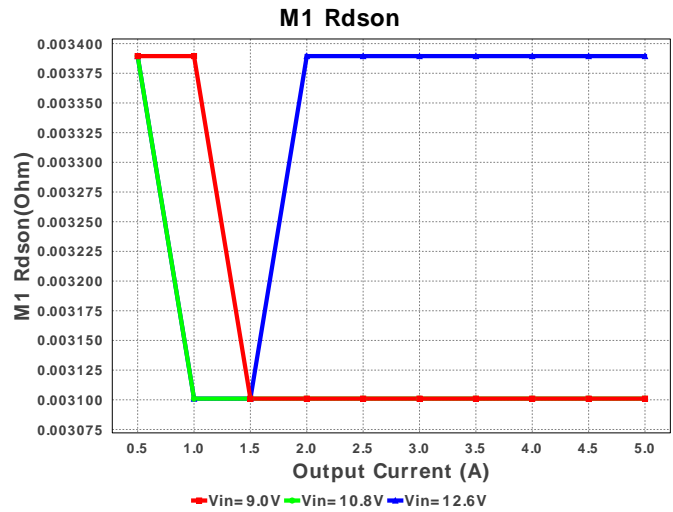
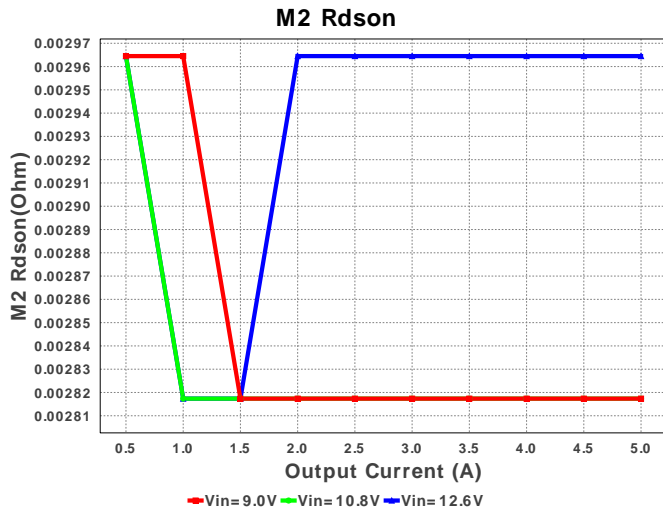


M1 Vds Act









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	5.31 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	2.756 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	11.178 A	Current	Average input current
4.	L Ipp	1.518 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	10.994 A	Current	Inductor ripple current
6.	M1 Irms	7.753 A	Current	MOSFET RMS ripple current
7.	M2 Irms	6.873 A	Current	MOSFET RMS ripple current
8.	SW Ipk	11.399 A	Current	Peak switch current
9.	BOM Count	25	General	Total Design BOM count
10.	FootPrint	696.0 mm ²	General	Total Foot Print Area of BOM components
11.	Frequency	459.184 kHz	General	Switching frequency

#	Name	Value	Category	Description
12.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
13.	M1 Rdson	3.101 mOhm	General	Drain-Source On-resistance
14.	M1 ThetaJA	60.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
15.	M2 Rdson	2.817 mOhm	General	Drain-Source On-resistance
16.	M2 ThetaJA	58.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
17.	M2 Vds Act	19.365 mV	General	M Vds
18.	Pout	95.0 W	General	Total output power
19.	Total BOM	\$7.39	General	Total BOM Cost
20.	Vout OP	19.0 V	Op_Point	Operational Output Voltage
21.	Duty Cycle	55.271 %	Op_point	Duty cycle
22.	Efficiency	94.428 %	Op_point	Steady state efficiency
23.	IC Tj	51.285 degC	Op_point	IC junction temperature
24.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
25.	IOUT_OP	5.0 A	Op_point	Iout operating point
26.	M1 TjOP	122.357 degC	Op_point	M1 MOSFET junction temperature
27.	M2 TjOP	101.091 degC	Op_point	MOSFET junction temperature
28.	VIN_OP	9.0 V	Op_point	Vin operating point
29.	Vout p-p	6.379 mV	Op_point	Peak-to-peak output ripple voltage
30.	Cin Pd	394.809 mW	Power	Input capacitor power dissipation
31.	Cout Pd	71.63 mW	Power	Output capacitor power dissipation
32.	IC Pd	532.119 mW	Power	IC power dissipation
33.	L Pd	978.986 mW	Power	Inductor power dissipation
34.	M1 Pd	1.539 W	Power	MOSFET power dissipation
35.	M1 Pd	1.539 W	Power	MOSFET power dissipation
36.	M1 PdCond	186.412 mW	Power	M1 MOSFET conduction losses
37.	M1 PdSw	1.353 W	Power	M1 MOSFET switching losses
38.	M2 Pd	1.226 W	Power	MOSFET power dissipation
39.	M2 PdCond	139.754 mW	Power	M2 MOSFET conduction losses
40.	M2 PdQrr	19.63 mW	Power	Synchronous Boost High Side Reverse Recovery
41.	M2 Pdbody	1.066 W	Power	Power dissipation through lower FET
42.	Total Pd	5.606 W	Power	Total Power Dissipation
43.	M1 Vds Act	24.043 mV	Unknown	M Vds

Design Inputs

#	Name	Value	Description
1.	Iout	5.0	Maximum Output Current
2.	Iout1	5.0	Output Current #1
3.	VinMax	12.6	Maximum input voltage
4.	VinMin	9.0	Minimum input voltage
5.	Vout	19.0	Output Voltage
6.	Vout1	19.0	Output Voltage #1
7.	base_pn	LM5122	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	30.0	Ambient temperature

Design Assistance

1. The LM5122 is a wide range boost controller which is operable in an ultra wide input range of 4.5 to 65V. A boost regulator can maintain regulation for input voltages lower than the output voltage.

2. **LM5122** Product Folder : <http://www.ti.com/product/lm5122> : contains the data sheet and other resources.

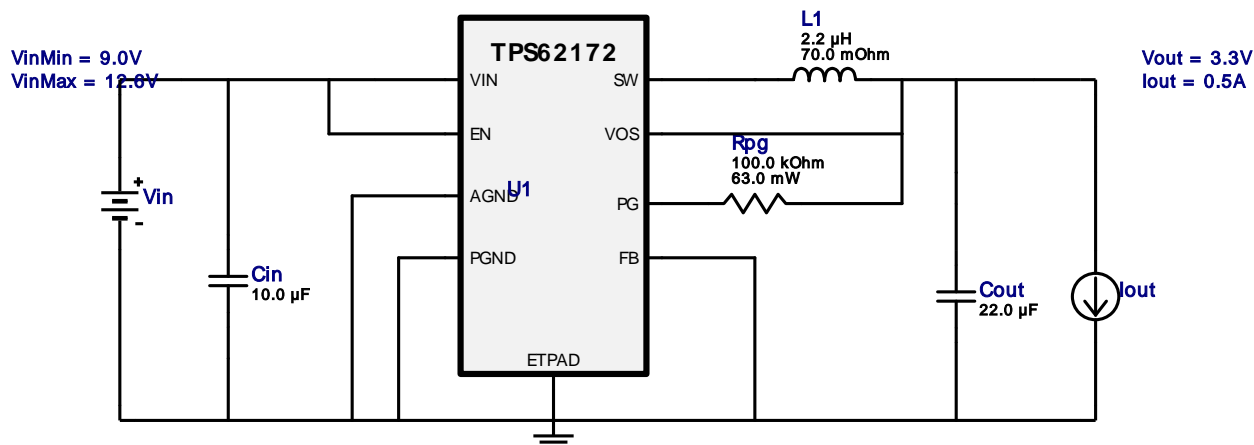


VinMin = 9.0V
 VinMax = 12.6V
 Vout = 3.3V
 Iout = 0.5A






Device = TPS62172DSGR
 Topology = Buck
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 BOM Cost = \$1.41
 Footprint = 42.0 mm²
 BOM Count = 5
 Total Pd = 0.26W

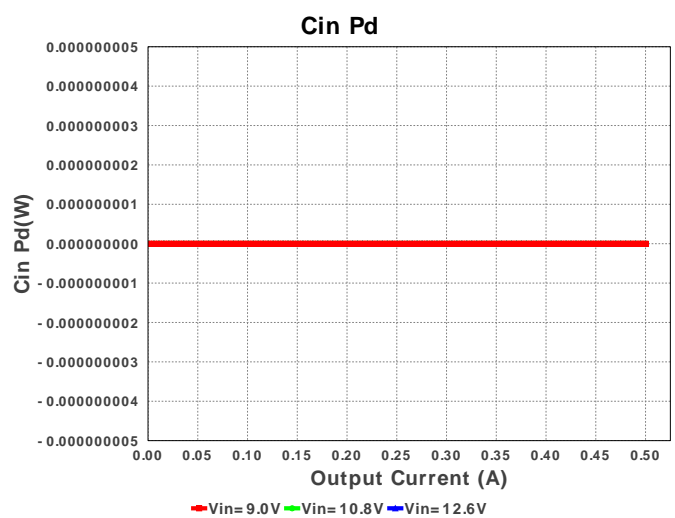
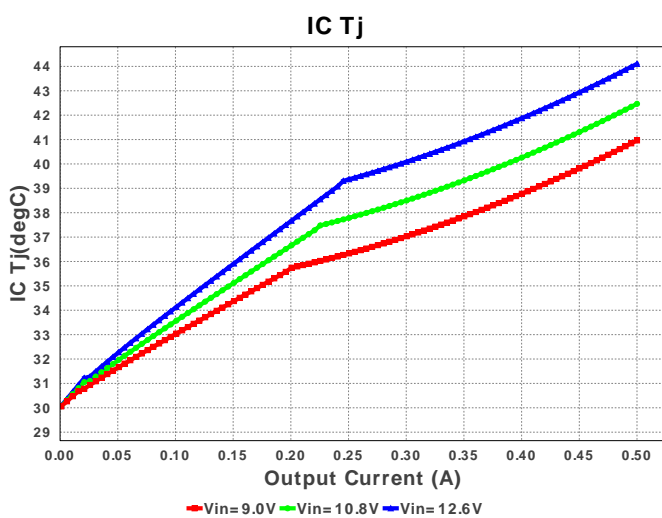
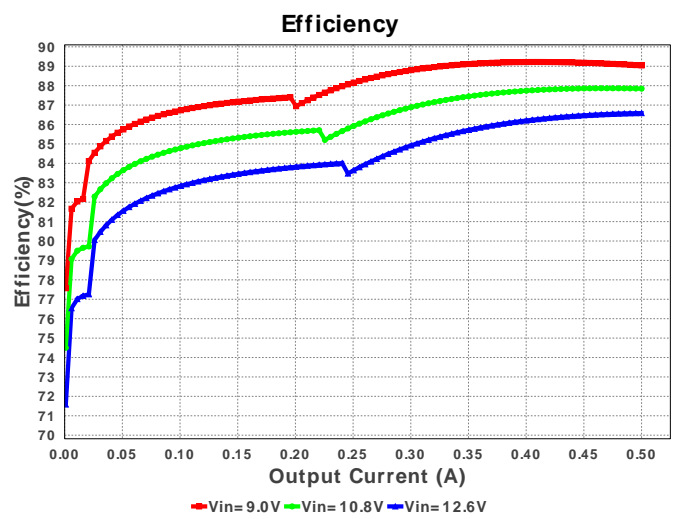
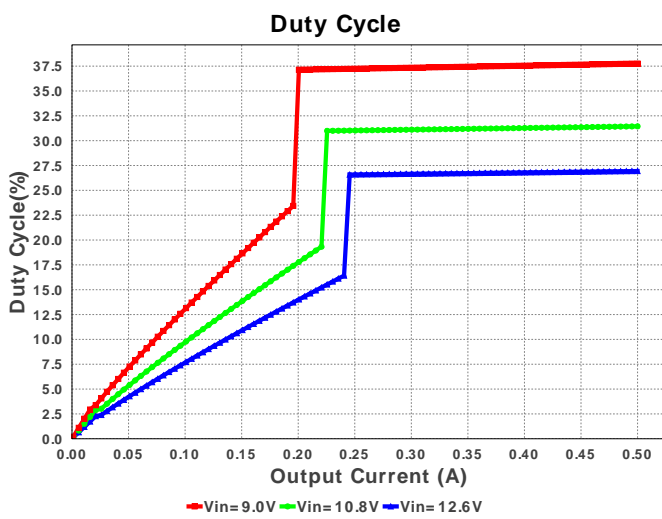
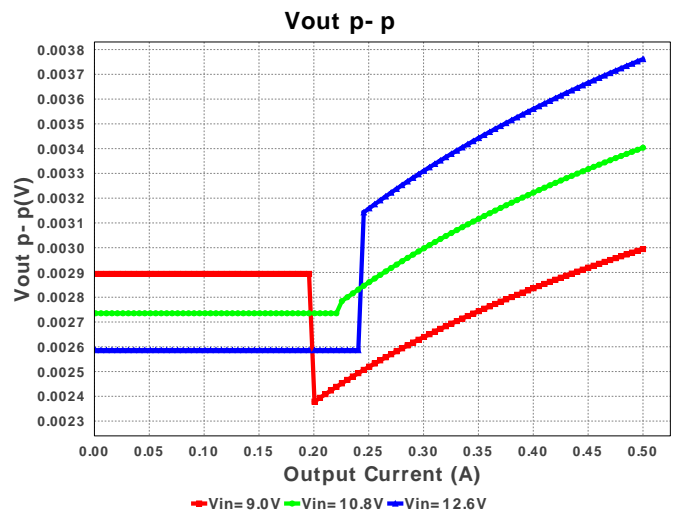
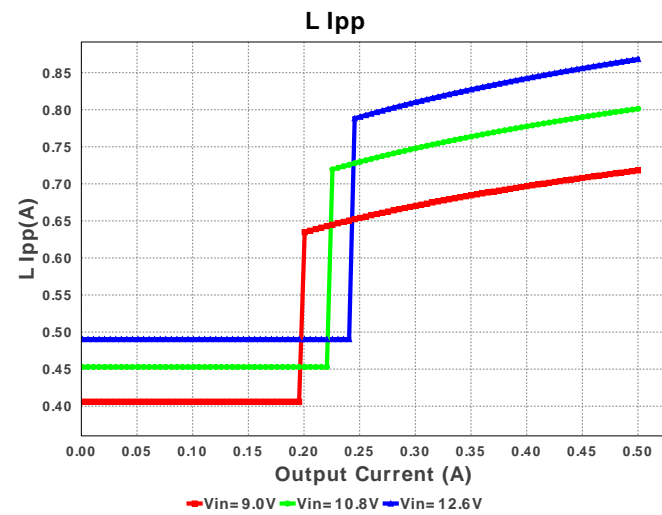
WEBENCH® Design Report

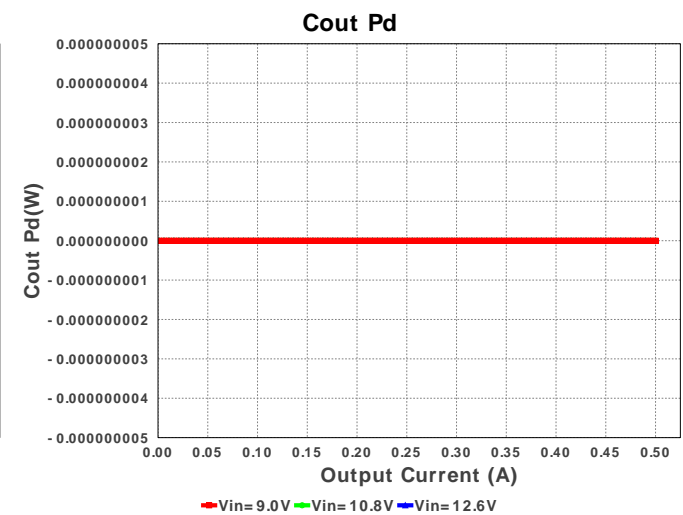
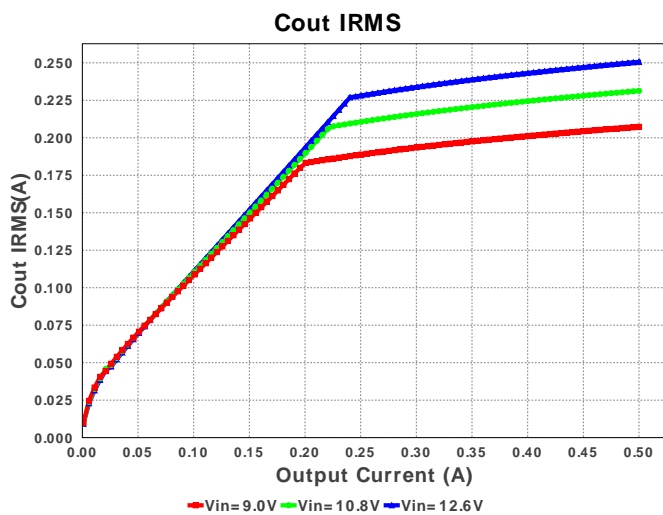
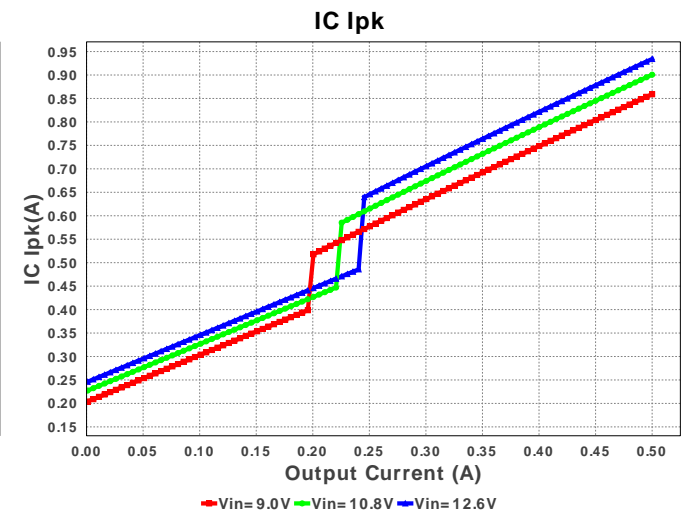
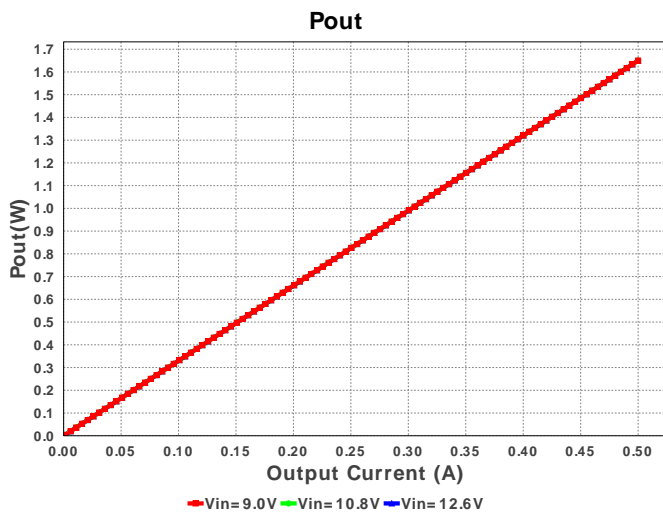
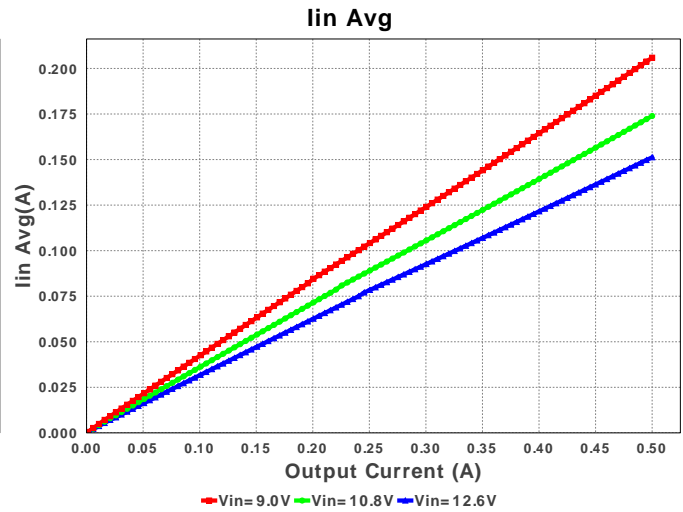
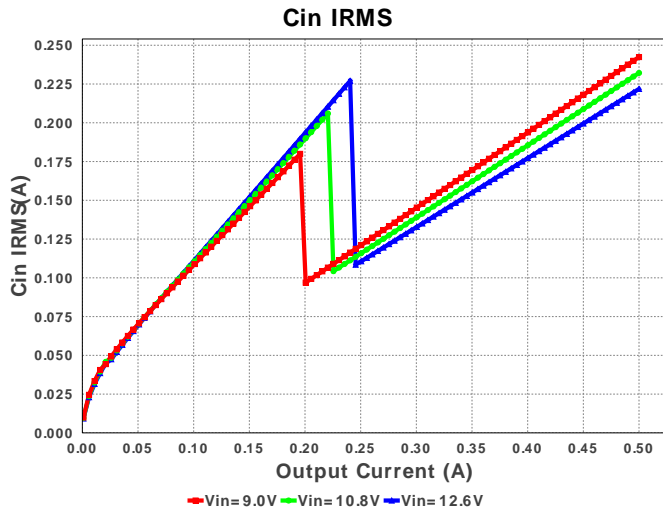
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 TPS62172DSGR 9.0V-12.6V to 3.30V @ 0.5A

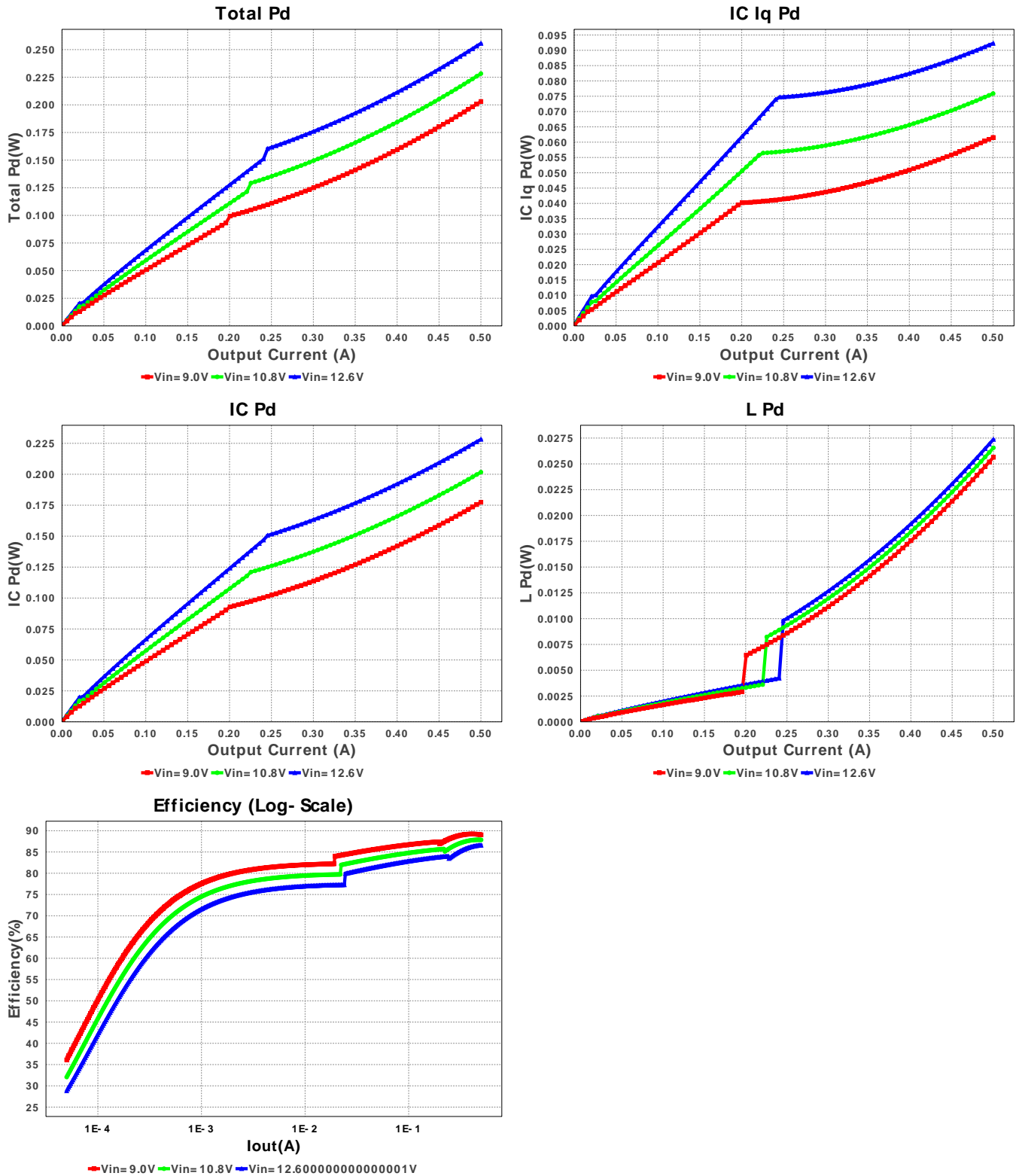


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	MuRata	GRM219R61E106KA12 Series= ?	Cap= 10.0 uF VDC= 25.0 V IRMS= 0.0 A	1	\$0.05	 0805 7 mm ²
2.	Cout	MuRata	GRM31CR70J226KE19L Series= X7R	Cap= 22.0 uF VDC= 6.3 V IRMS= 0.0 A	1	\$0.30	 1206 11 mm ²
3.	L1	TDK	VLF252015MT-2R2M	L= 2.2 uH DCR= 70.0 mOhm	1	\$0.45	 VLF252015MT 12 mm ²
4.	Rpg	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
5.	U1	Texas Instruments	TPS62172DSGR	Switcher	1	\$0.60	 S-PWSON-N8 10 mm ²







Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	221.829 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	250.662 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	934.159 mA	Current	Peak switch current in IC
4.	Iin Avg	151.24 mA	Current	Average input current
5.	L Ipp	868.32 mA	Current	Peak-to-peak inductor ripple current
6.	BOM Count	5	General	Total Design BOM count
7.	FootPrint	42.0 mm ²	General	Total Foot Print Area of BOM components
8.	Frequency	2.327 MHz	General	Switching frequency
9.	Pout	1.65 W	General	Total output power
10.	Total BOM	\$1.41	General	Total BOM Cost
11.	Vout OP	3.3 V	Op_Point	Operational Output Voltage

#	Name	Value	Category	Description
12.	Duty Cycle	26.942 %	Op_point	Duty cycle
13.	Efficiency	86.587 %	Op_point	Steady state efficiency
14.	IC Tj	44.104 degC	Op_point	IC junction temperature
15.	ICThetaJA	61.8 degC/W	Op_point	IC junction-to-ambient thermal resistance
16.	IOUT_OP	500.0 mA	Op_point	Iout operating point
17.	VIN_OP	12.6 V	Op_point	Vin operating point
18.	Vout p-p	3.761 mV	Op_point	Peak-to-peak output ripple voltage
19.	Cin Pd	0.0 W	Power	Input capacitor power dissipation
20.	Cout Pd	0.0 W	Power	Output capacitor power dissipation
21.	IC Iq Pd	92.257 mW	Power	IC Iq Pd
22.	IC Pd	228.216 mW	Power	IC power dissipation
23.	L Pd	27.373 mW	Power	Inductor power dissipation
24.	Total Pd	255.601 mW	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	500.0 m	Maximum Output Current
2.	Iout1	500.0 m	Output Current #1
3.	VinMax	12.6	Maximum input voltage
4.	VinMin	9.0	Minimum input voltage
5.	Vout	3.3	Output Voltage
6.	Vout1	3.3	Output Voltage #1
7.	base_pn	TPS62172	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	30.0	Ambient temperature

Design Assistance

1. Feature Highlights: DCS-Control(TM) Architecture with upto 0.5A output current, 3V to 17V Input Voltage Range, 3.3V Fixed Output voltage, Seamless Power Save Mode for Light Load Efficiency, Power Good Output, 100% Duty Cycle mode, Short Circuit Protection, Thermal Shutdown

2. **TPS62172** Product Folder : <http://www.ti.com/product/tps62172> : contains the data sheet and other resources.



VinMin = 9.0V
 VinMax = 12.6V
 Vout = 12.0V
 Iout = 2.0A

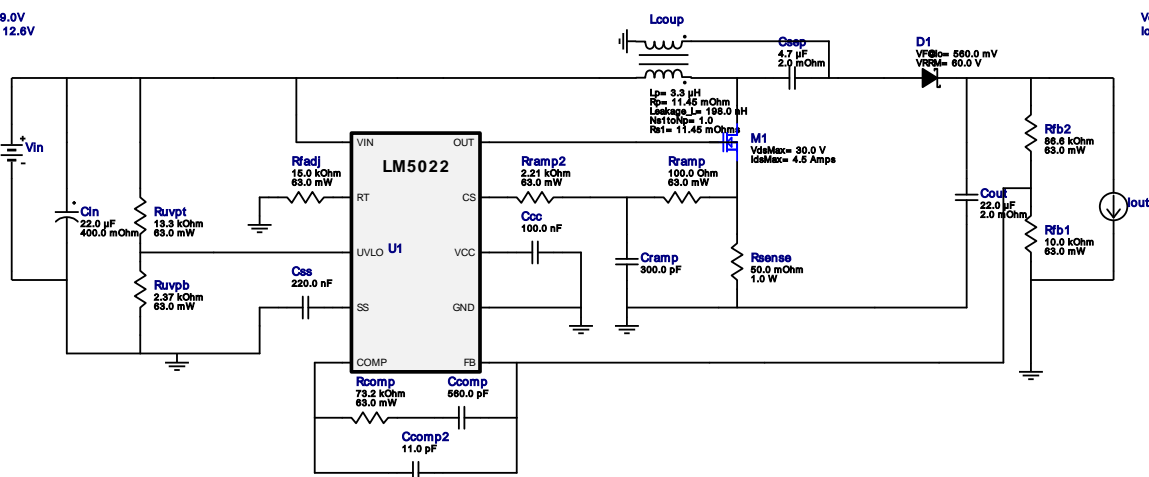
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 Topology = SEPIC
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 Footprint = 410.0 mm²
 BOM Count = 21
 Total Pd = 4.29W

WEBENCH® Design Report

Design : 4109962/8 LM5022MM/NOPB
 LM5022MM/NOPB 9.0V-12.6V to 12.00V @ 2.0A

VinMin = 9.0V
 VinMax = 12.6V

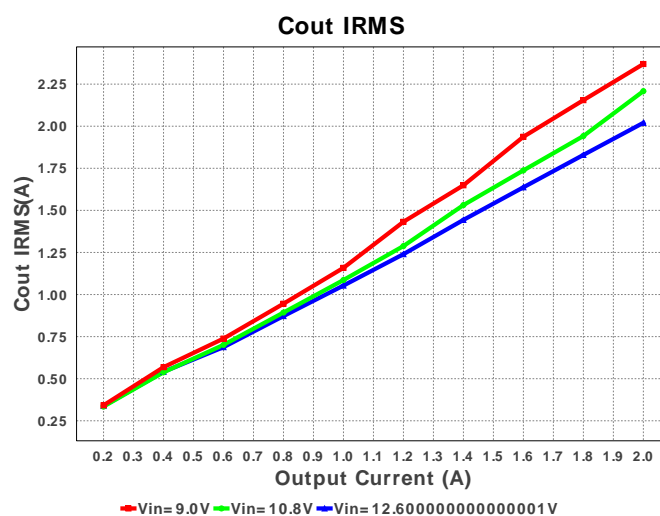
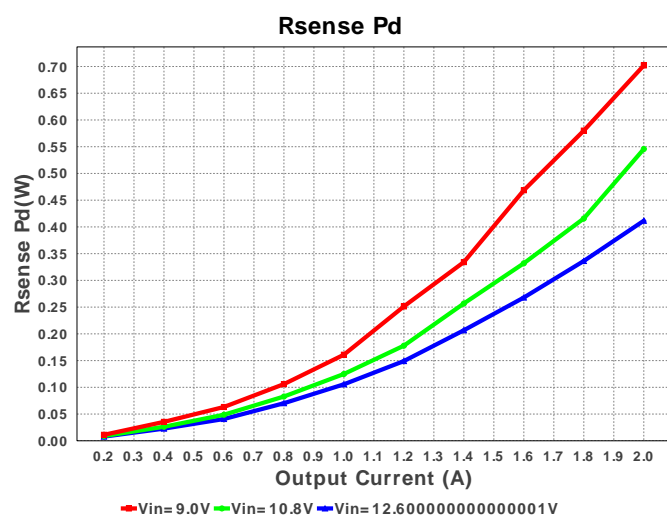
Vout = 12.0V
 Iout = 2.0A

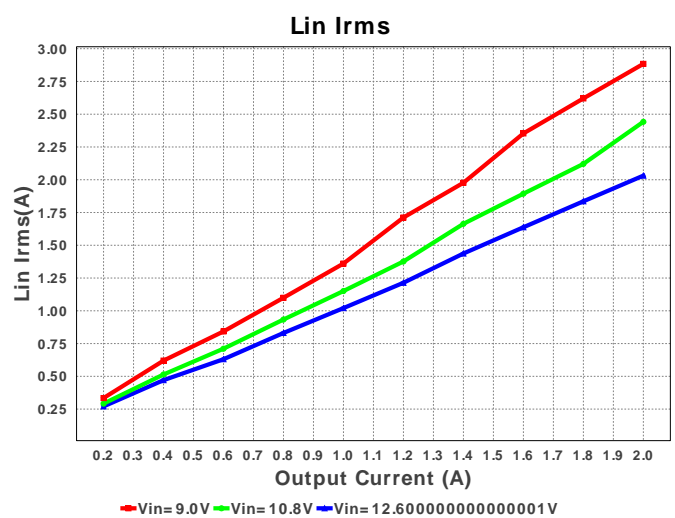
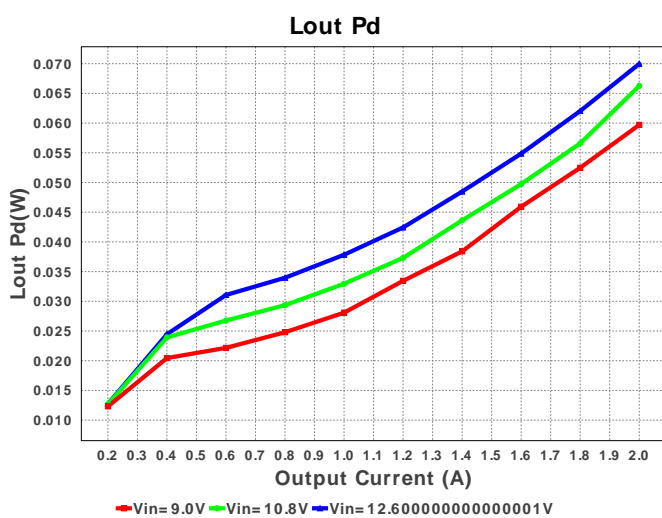
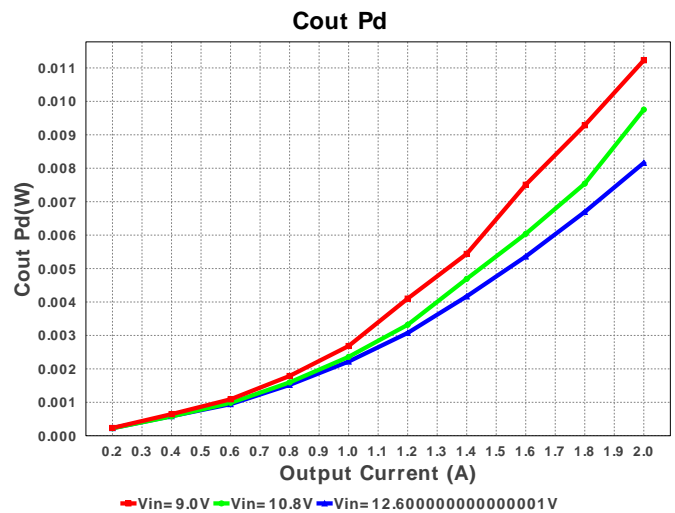
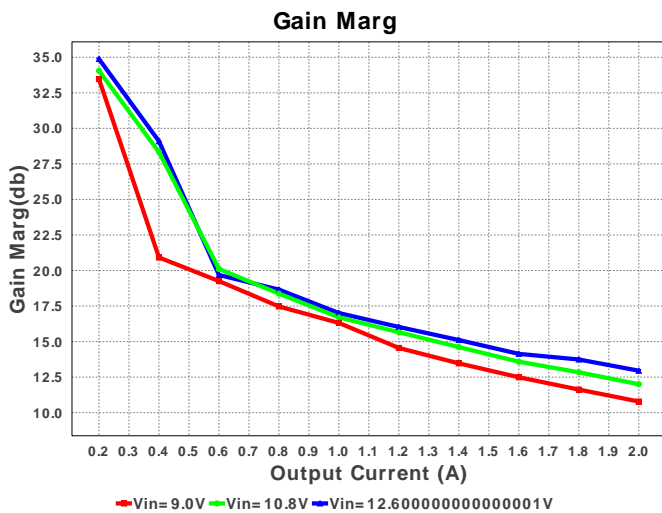
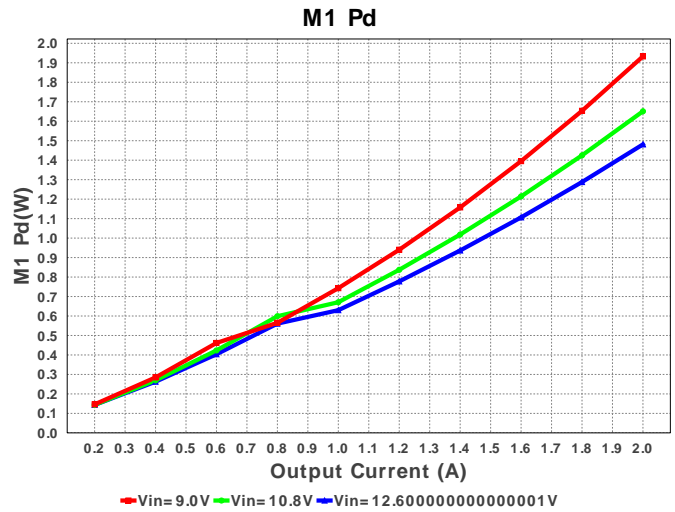
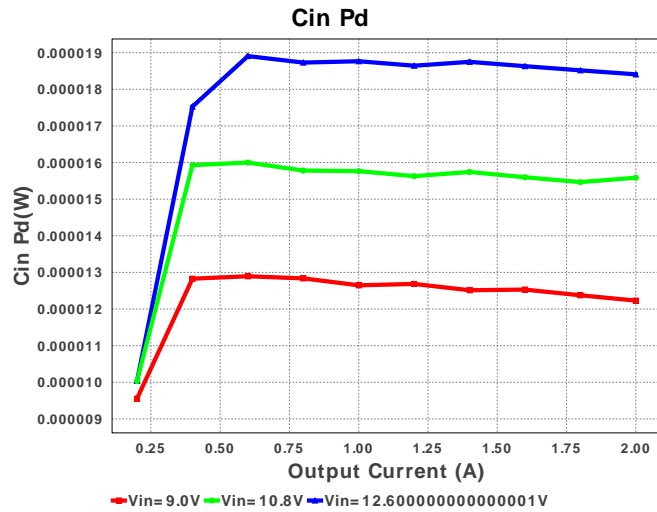


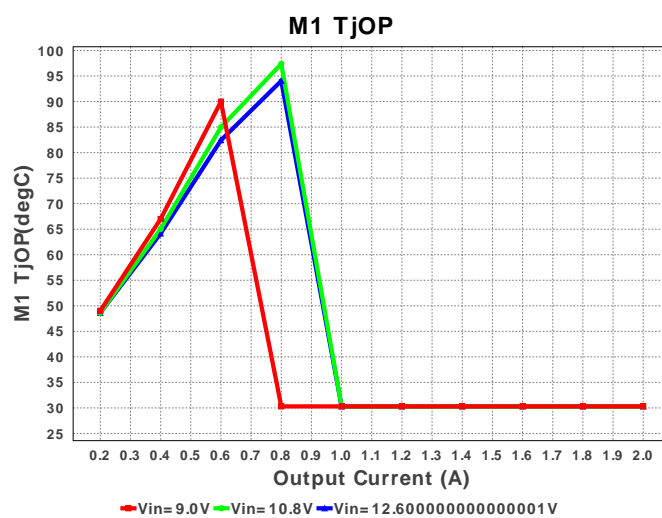
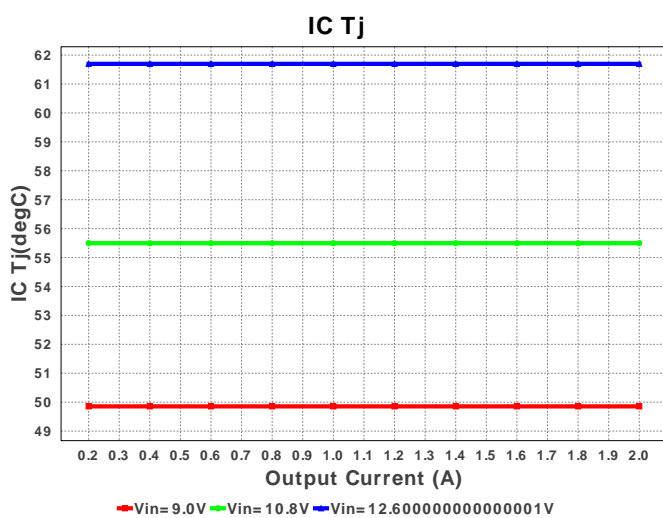
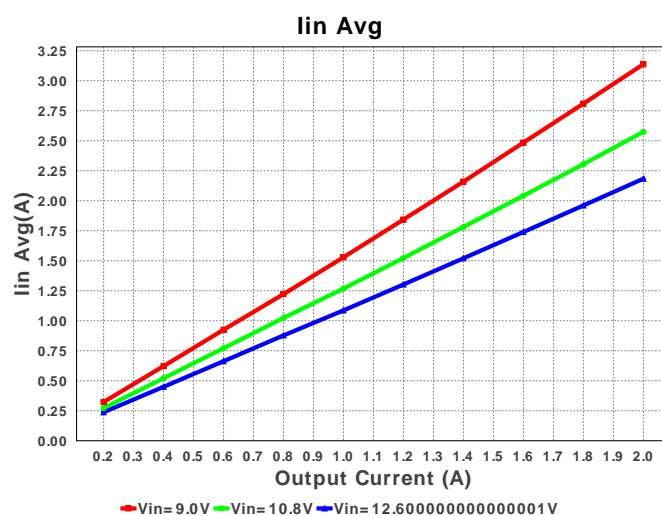
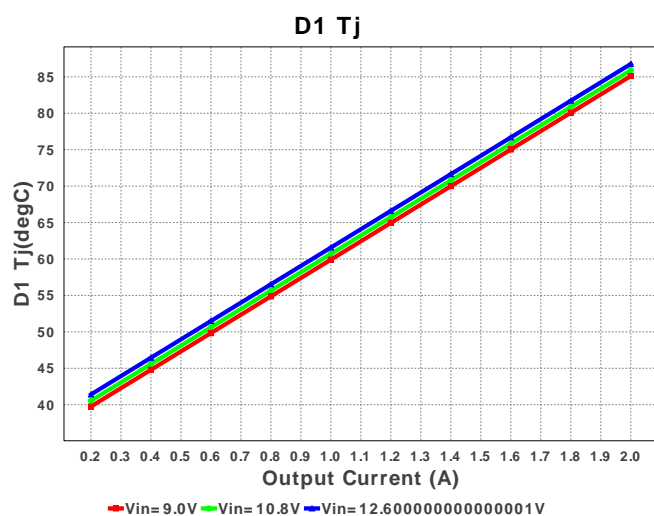
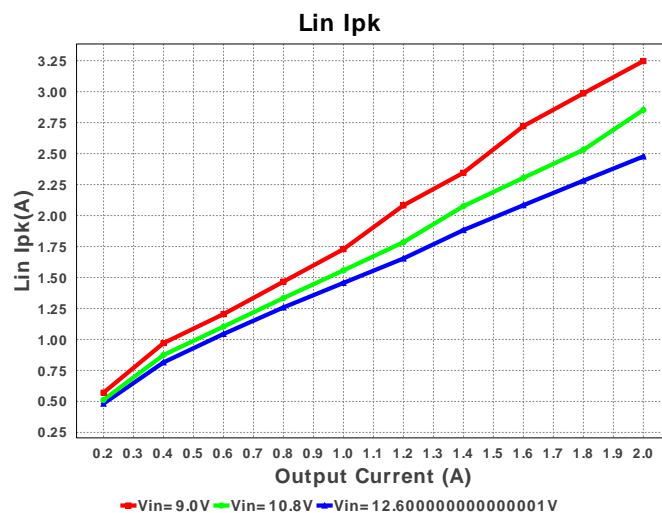
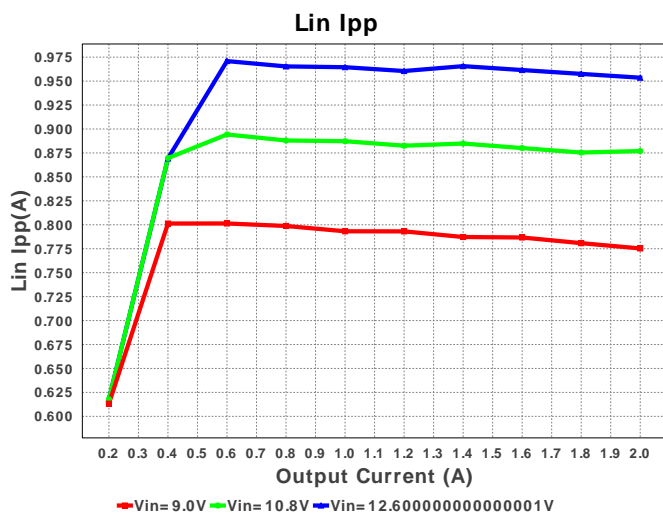
Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Ccc	MuRata	GRM155R61C104KA88D Series= X5R	Cap= 100.0 nF VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
2.	Ccomp	Yageo America	CC0805KRX7R9BB561 Series= X7R	Cap= 560.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
3.	Ccomp2	TDK	C0603C0G1E110G Series= C0G	Cap= 11.0 pF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0201 2 mm ²
4.	Cin	AVX	TPSB226K020R0400 Series= TPS	Cap= 22.0 uF ESR= 400.0 mOhm VDC= 20.0 V IRMS= 415.0 mA	1	\$0.33	3528-21 17 mm ²
5.	Cout	MuRata	GRM32ER61C226KE20L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 16.0 V IRMS= 3.68 A	1	\$0.35	1210 15 mm ²
6.	Cramp	MuRata	GRM1555C1E301JA01D Series= C0G/NP0	Cap= 300.0 pF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
7.	Csep	MuRata	GRM21BR61E475MA12L Series= X5R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 7.29 A	1	\$0.06	0805 7 mm ²
8.	Css	MuRata	GRM155R71C224KA12D Series= X7R	Cap= 220.0 nF VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
9.	D1	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	\$0.60	PowerDI5 50 mm ²

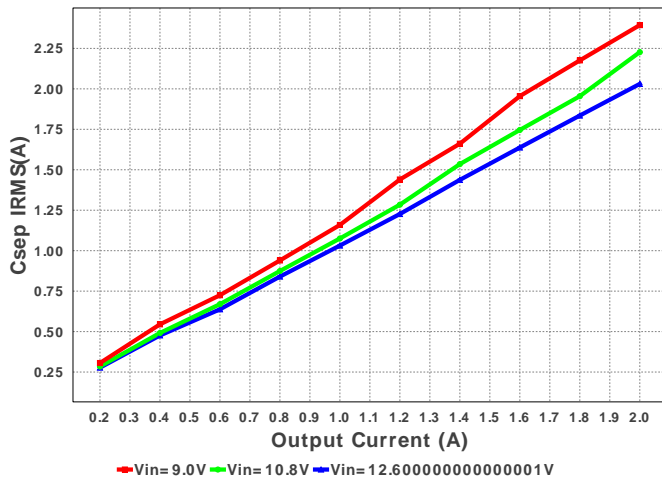
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Lcoup	Coiltronics	DRQ127-3R3-R	Lp= 3.3 µH Rp= 11.45 mOhm Leakage_L= 198.0 nH Ns1toNp= 1.0 Rs1= 11.45 mOhms	1	\$0.93	 DRQ127 210 mm²
11.	M1	Vishay-Siliconix	SI2316BDS-T1-E3	VdsMax= 30.0 V IdsMax= 4.5 Amps	1	\$0.22	 SOT-23 14 mm²
12.	Rcomp	Vishay-Dale	CRCW040273K2FKED Series= CRCW..e3	Res= 73.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
13.	Rfadj	Vishay-Dale	CRCW040215K0FKED Series= CRCW..e3	Res= 15.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
14.	Rfb1	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
15.	Rfb2	Vishay-Dale	CRCW040286K6FKED Series= CRCW..e3	Res= 86.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
16.	Rramp	Vishay-Dale	CRCW0402100RFBED Series= CRCW..e3	Res= 100.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
17.	Rramp2	Vishay-Dale	CRCW04022K21FKED Series= CRCW..e3	Res= 2.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
18.	Rsense	Stackpole Electronics Inc	CSRN2010FK50L0 Series= ?	Res= 50.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	\$0.15	 2010 32 mm²
19.	Ruvpb	Vishay-Dale	CRCW04022K37FKED Series= CRCW..e3	Res= 2.37 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
20.	Ruvpt	Vishay-Dale	CRCW040213K3FKED Series= CRCW..e3	Res= 13.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
21.	U1	Texas Instruments	LM5022MM/NOPB	Switcher	1	\$0.90	 MUB10A 24 mm²



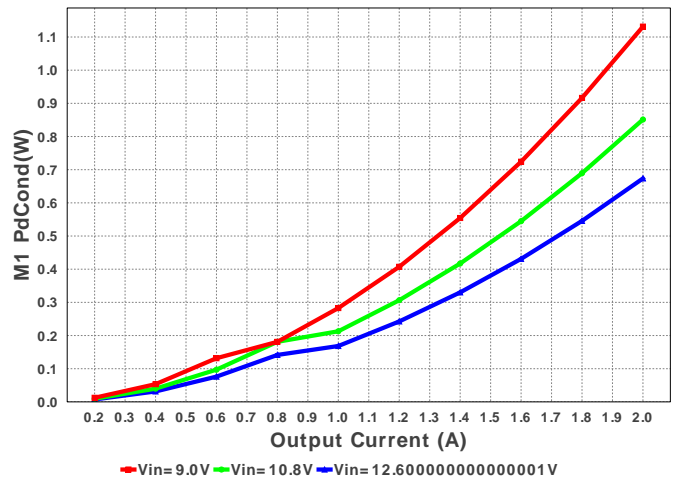




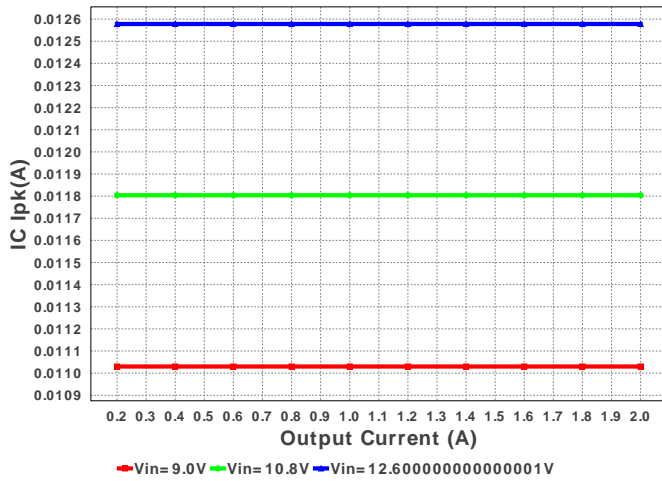
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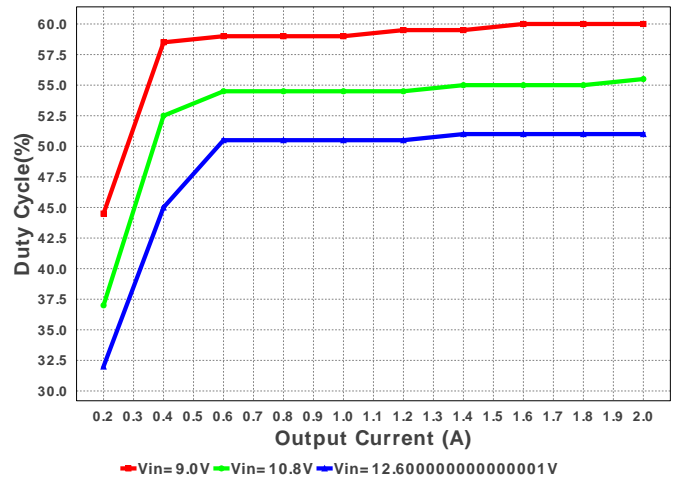
M1 PdCond



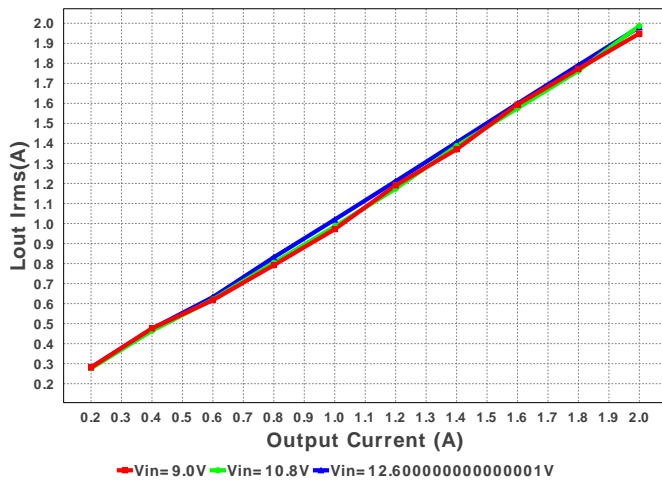
IC Ipk



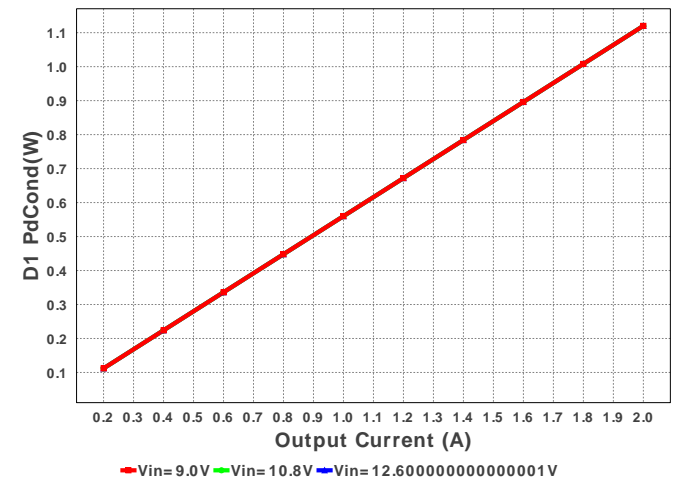
Duty Cycle

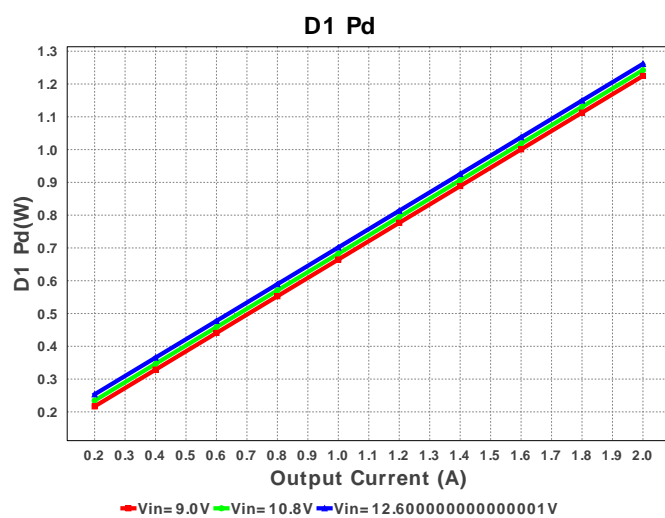
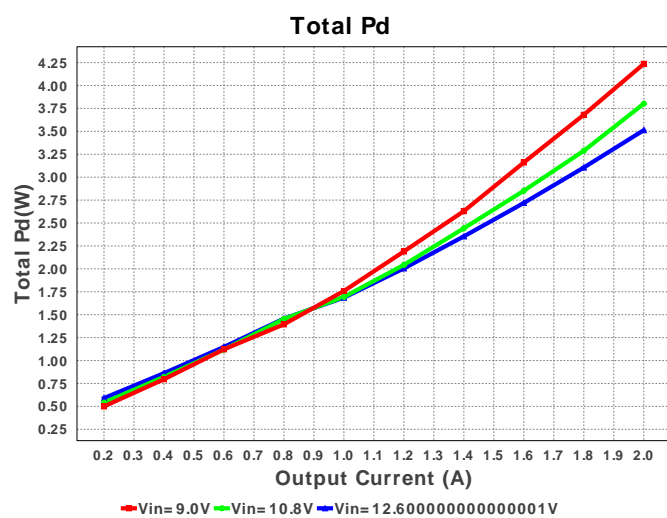
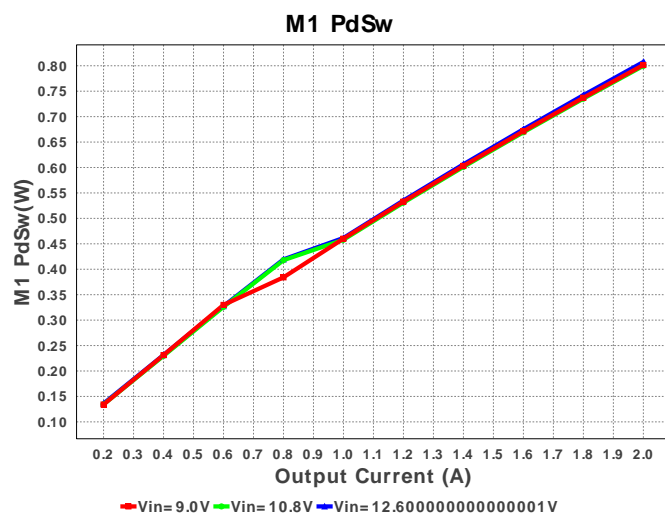
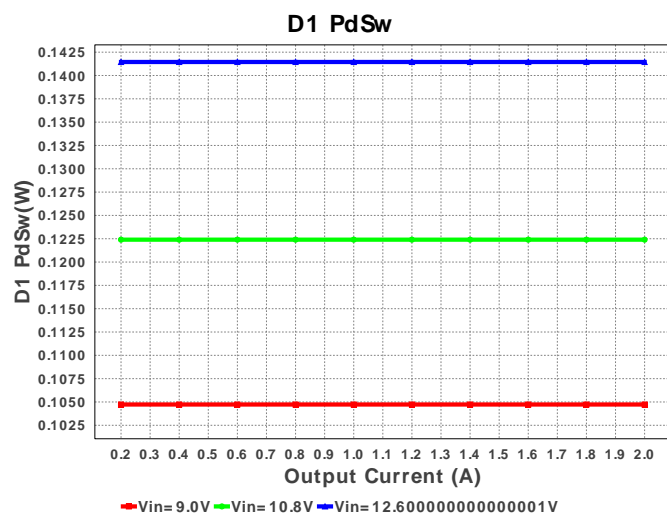
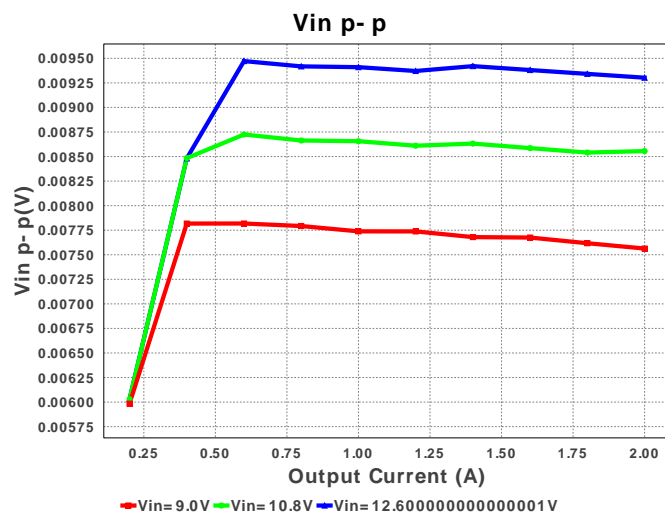
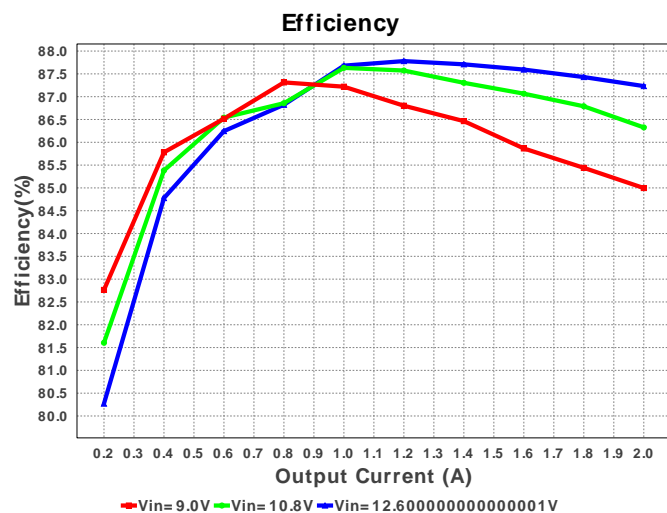


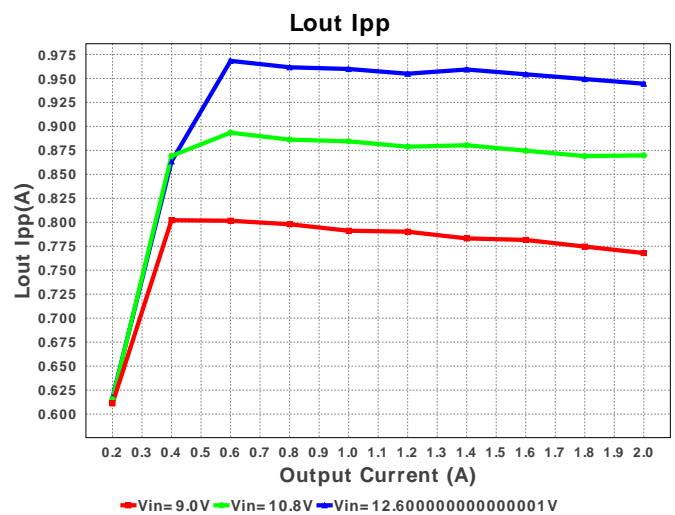
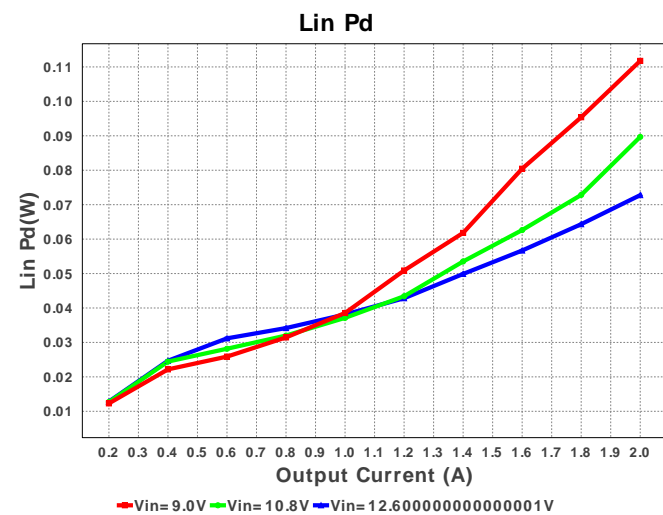
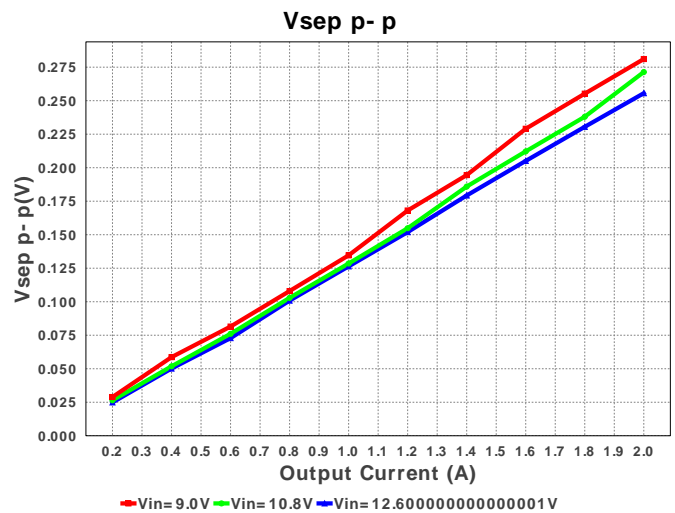
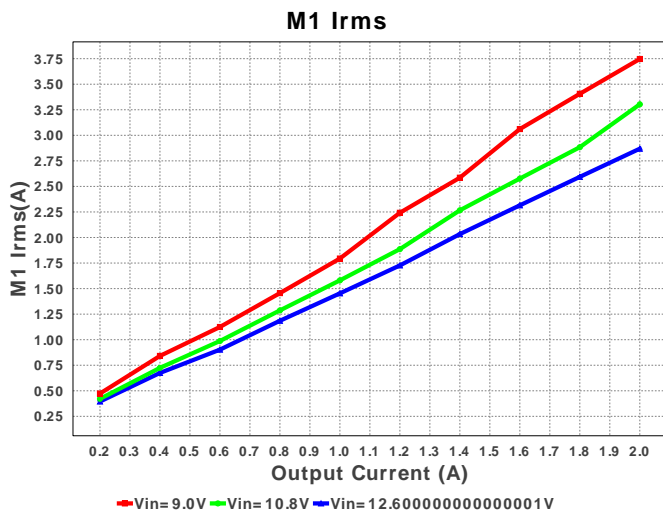
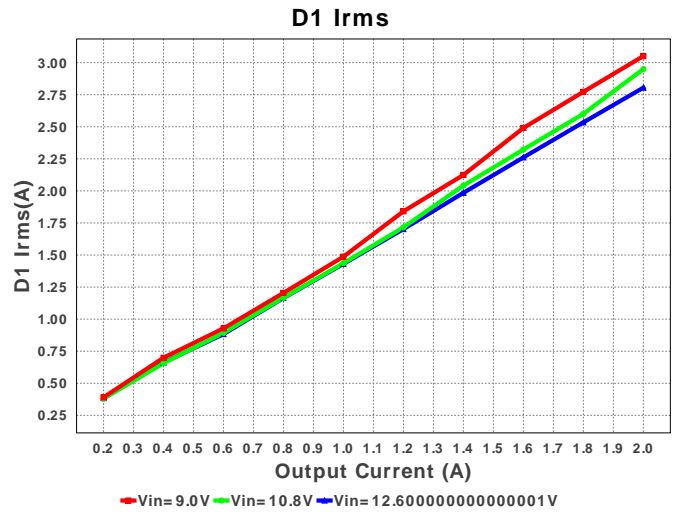
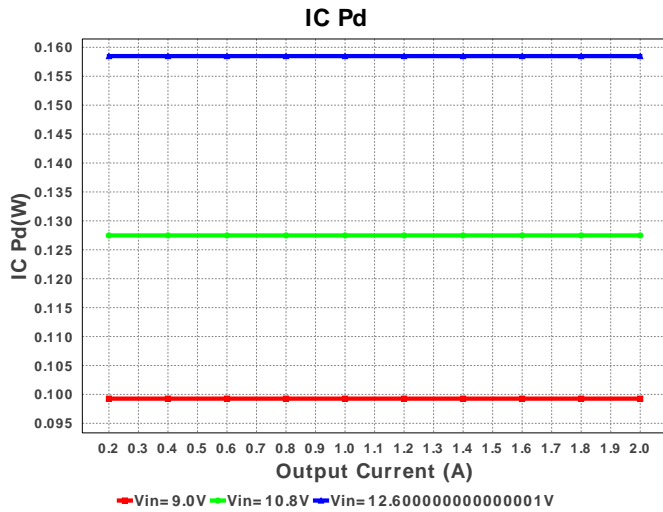
Lout Irms

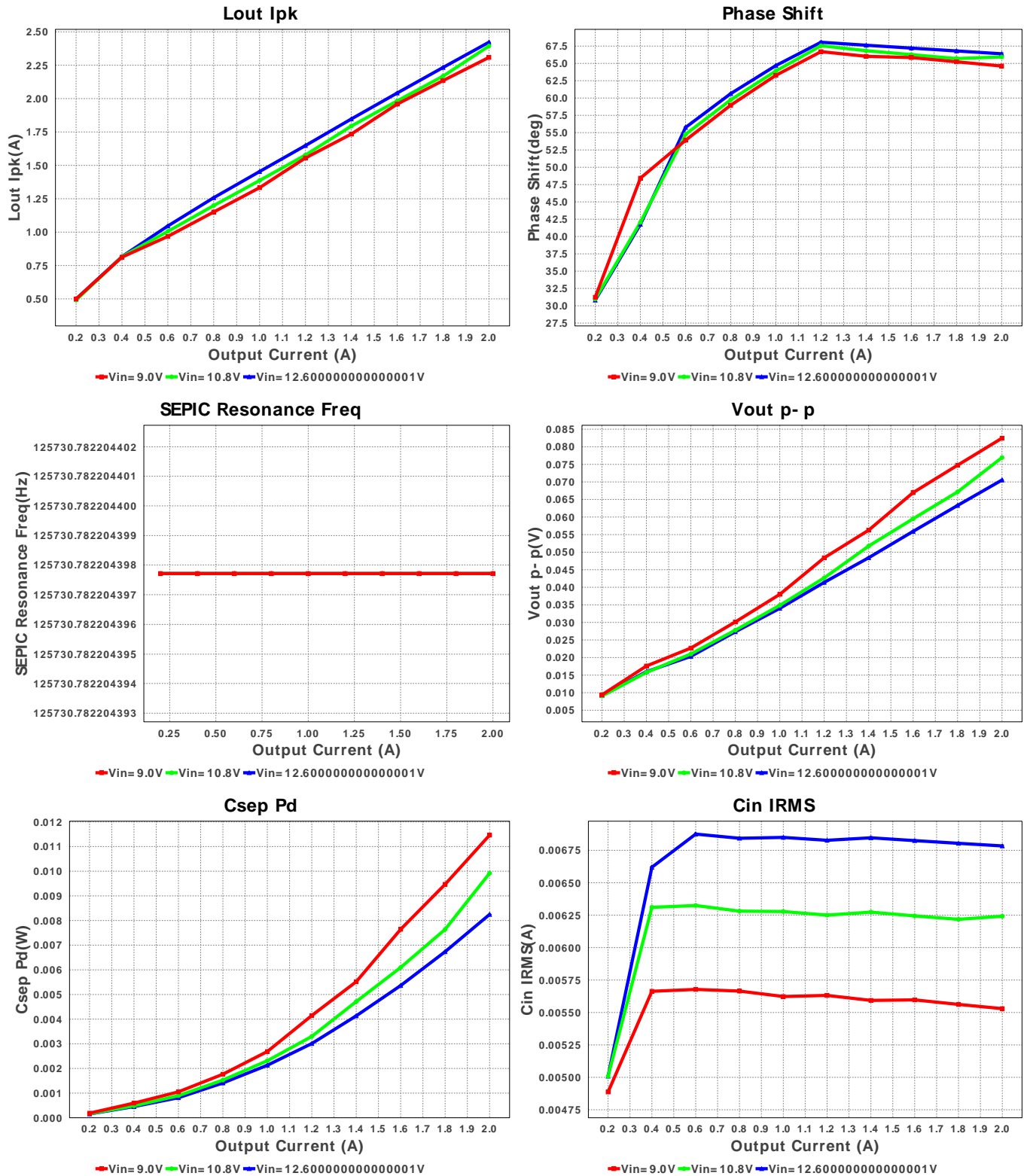


D1 PdCond









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	5.248 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	2.37 A	Current	Output capacitor RMS ripple current
3.	Csep IRMS	2.393 A	Current	SEPIC capacitor RMS ripple current
4.	D1 Irms	3.053 A	Current	D1 Irms
5.	IC IpK	12.752 mA	Current	Peak switch current in IC
6.	Iin Avg	3.143 A	Current	Average input current
7.	Iin IpK	3.23 A	Current	Iin peak current
8.	Iin Ipp	735.47 mA	Current	Peak-to-peak input inductor ripple current
9.	Iin Irms	2.887 A	Current	Iin ripple current
10.	Iout IpK	2.29 A	Current	Iout peak current
11.	Iout Ipp	728.16 mA	Current	Peak-to-peak output inductor ripple current

#	Name	Value	Category	Description
12.	Lout Irms	1.949 A	Current	Lout ripple current
13.	M1 Irms	3.749 A	Current	M1 MOSFET Irms
14.	BOM Count	21	General	Total Design BOM count
15.	FootPrint	410.0 mm ²	General	Total Foot Print Area of BOM components
16.	Frequency	1.055 MHz	General	Switching frequency
17.	IC Tolerance	25.0 mV	General	IC Feedback Tolerance
18.	Total BOM	\$3.67	General	Total BOM Cost
19.	D1 Tj	85.372 degC	Op_Point	D1 junction temperature
20.	SEPIC Resonance Freq	125.731 kHz	Op_Point	SEPIC Resonance Frequency
21.	Vin p-p	7.175 mV	Op_Point	Peak-to-peak input voltage
22.	Vsep p-p	266.892 mV	Op_Point	Peak-to-peak sepic voltage
23.	Cross Freq	20.729 kHz	Op_point	Bode plot crossover frequency
24.	Duty Cycle	60.0 %	Op_point	Duty cycle
25.	Efficiency	84.844 %	Op_point	Steady state efficiency
26.	Gain Marg	10.075 db	Op_point	Bode Plot Gain Margin
27.	IC Tj	62.135 degC	Op_point	IC junction temperature
28.	IOUT_OP	2.0 A	Op_point	lout operating point
29.	M1 TjOP	30.3 degC	Op_point	M1 MOSFET junction temperature
30.	Phase Marg	61.517 deg	Op_point	Bode Plot Phase Margin
31.	Phase Shift	63.1 deg	Op_point	Bode Plot Phase Shift
32.	VIN_OP	9.0 V	Op_point	Vin operating point
33.	Vout p-p	78.729 mV	Op_point	Peak-to-peak output ripple voltage
34.	Cin Pd	11.015 μ W	Power	Input capacitor power dissipation
35.	Cout Pd	11.237 mW	Power	Output capacitor power dissipation
36.	Csep Pd	11.448 mW	Power	SEPIC capacitor power dissipation
37.	D1 Pd	1.23 W	Power	Diode power dissipation
38.	D1 PdCond	1.12 W	Power	Diode conduction losses
39.	D1 PdSw	110.489 mW	Power	Diode switching losses
40.	IC Pd	160.673 mW	Power	IC power dissipation
41.	Lin Pd	111.169 mW	Power	Lin power dissipation
42.	Lout Pd	58.947 mW	Power	Lout power dissipation
43.	M1 Pd	1.977 W	Power	M1 MOSFET total power dissipation
44.	M1 PdCond	1.131 W	Power	M1 MOSFET conduction losses
45.	M1 PdSw	845.589 mW	Power	M1 MOSFET switching losses
46.	Rsense Pd	702.758 mW	Power	LED Current Rsns Power Dissipation
47.	Total Pd	4.287 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	Iout1	2.0	Output Current #1
3.	VinMax	12.6	Maximum input voltage
4.	VinMin	9.0	Minimum input voltage
5.	Vout	12.0	Output Voltage
6.	Vout1	12.0	Output Voltage #1
7.	base_pn	LM5022	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	30.0	Ambient temperature

Design Assistance

1. **LM5022** Product Folder : <http://www.ti.com/product/lm5022> : contains the data sheet and other resources.

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