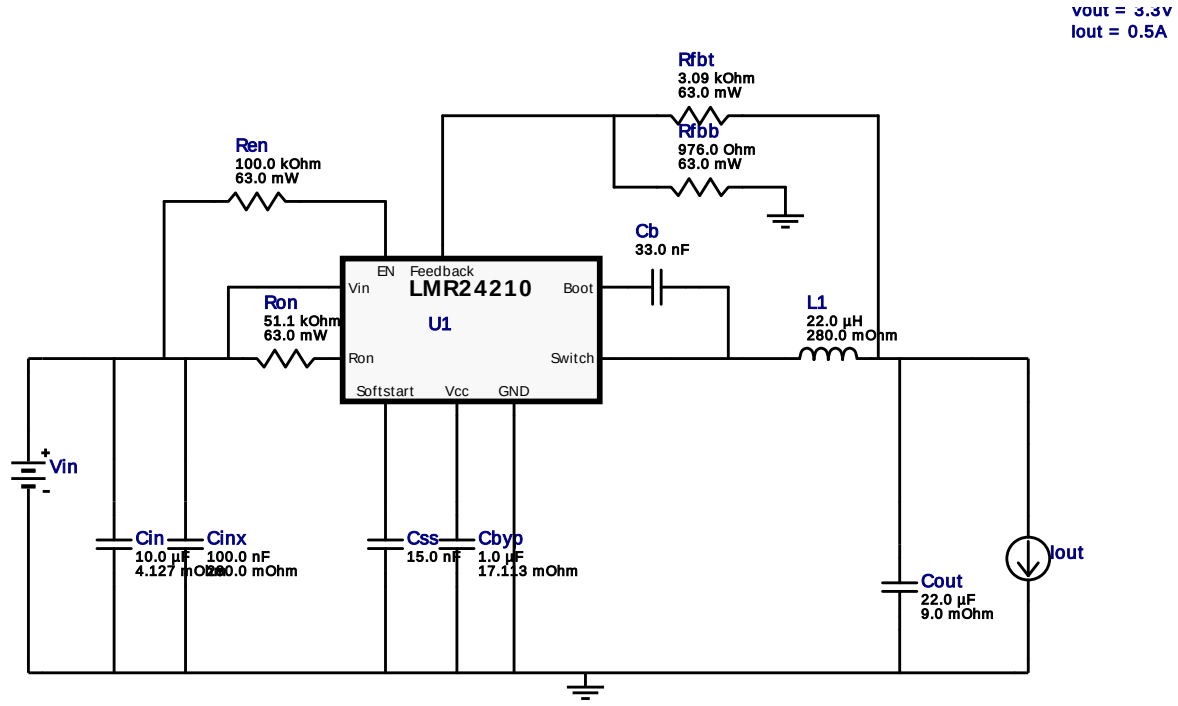
WEBENCH® Design Report

VinMin = 5.0V
VinMax = 9.0V
Vout = 3.3V
Iout = 0.5A

Device = LMR24210TL/NOPB
Topology = Buck
Created = 7/21/16 4:06:08 AM
BOM Cost = $2.07
BOM Count = 12
Total Pd = 0.25W

Design : 4372614/31 LMR24210TL/NOPB
LMR24210TL/NOPB 5.0V-9.0V to 3.30V @ 0.5A

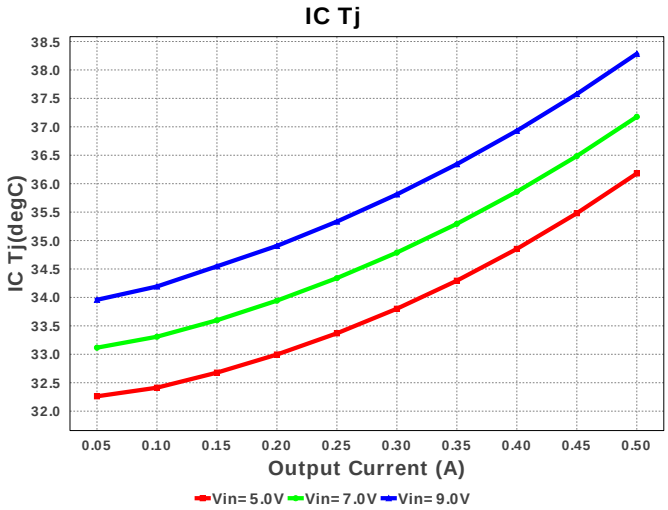


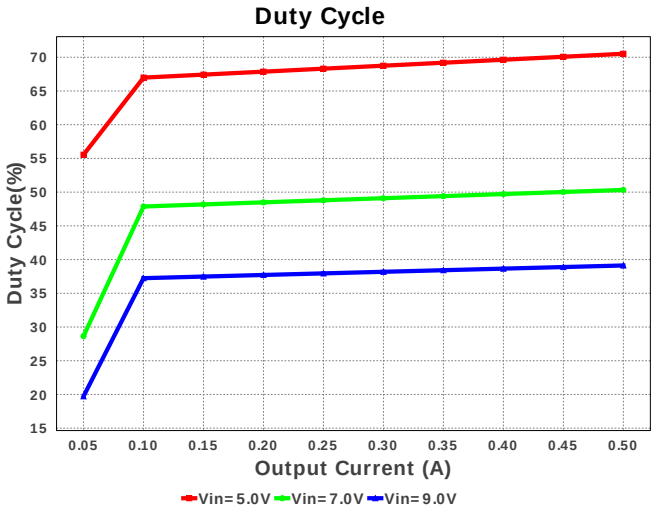
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application.View WEBENCH(R) Disclaimer.

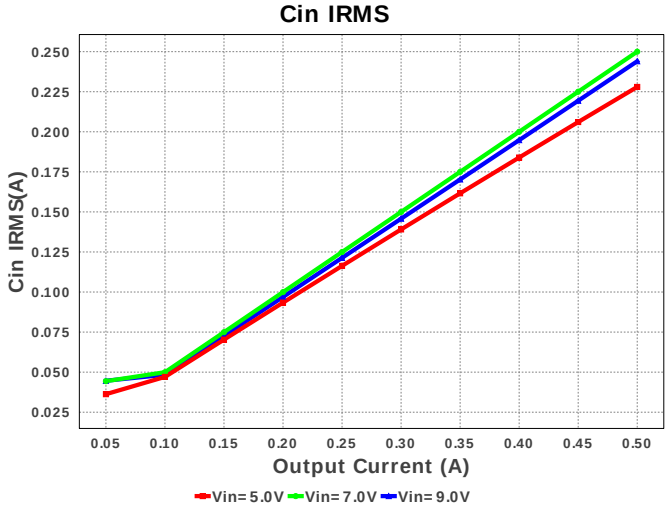
Electrical BOM

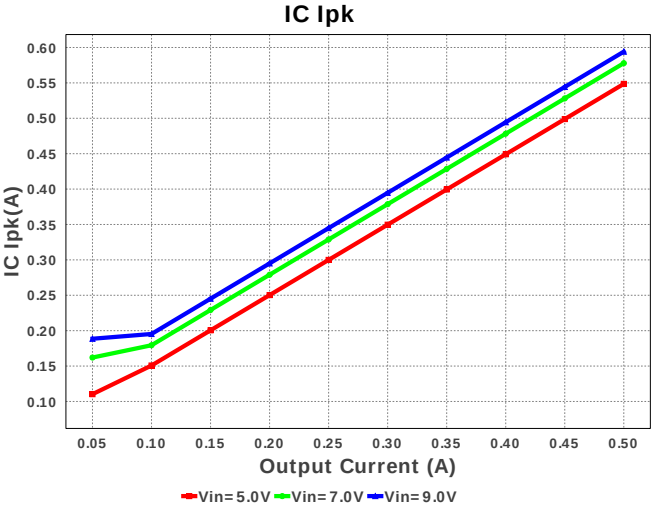
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cb	MuRata	GRM155R71E333KA88D Series= X7R	Cap= 33.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Cbyp	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 uF ESR= 17.113 mOhm VDC= 25.0 V IRMS= 979.39 mA	1	$0.01	0603 5 mm²
3.	Cin	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	1	$0.03	0805 7 mm²
4.	Cinx	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
5.	Cout	MuRata	GRM21BR60J226ME39L Series= X5R	Cap= 22.0 uF ESR= 9.0 mOhm VDC= 6.3 V IRMS= 3.5 A	1	$0.04	0805 7 mm²
6.	Css	MuRata	GRM155R71E153KA61D Series= X7R	Cap= 15.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
7.	L1	Bourns	SDR0503-220ML	L= 22.0 µH DCR= 280.0 mOhm	1	$0.19	SDR0503 48 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	Ren	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
9.	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
10.	Rfbt	Vishay-Dale	CRCW04023K09FKED Series= CRCW..e3	Res= 3.09 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
11.	Ron	Vishay-Dale	CRCW040251K1FKED Series= CRCW..e3	Res= 51.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
12.	U1	Texas Instruments	LMR24210TL/NOPB	Switcher	1	$1.73	TLC28VFA 16 mm^2

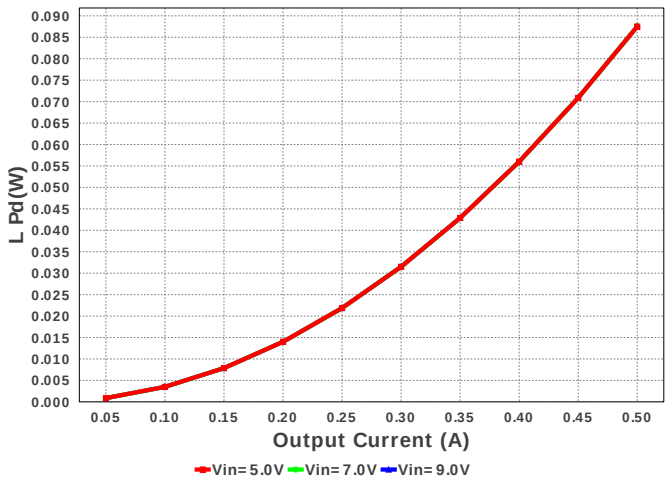




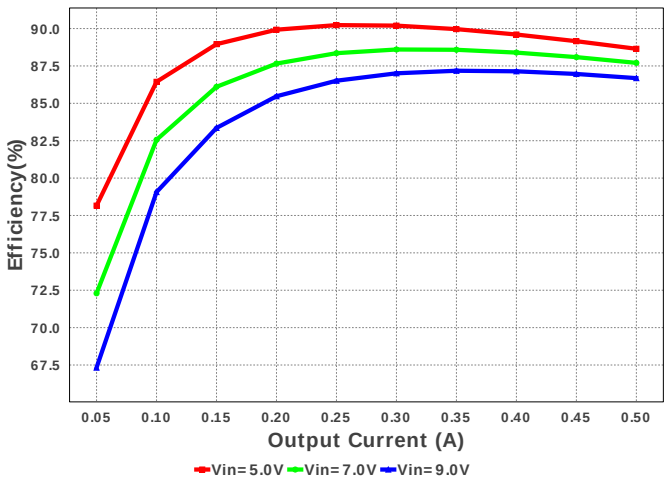




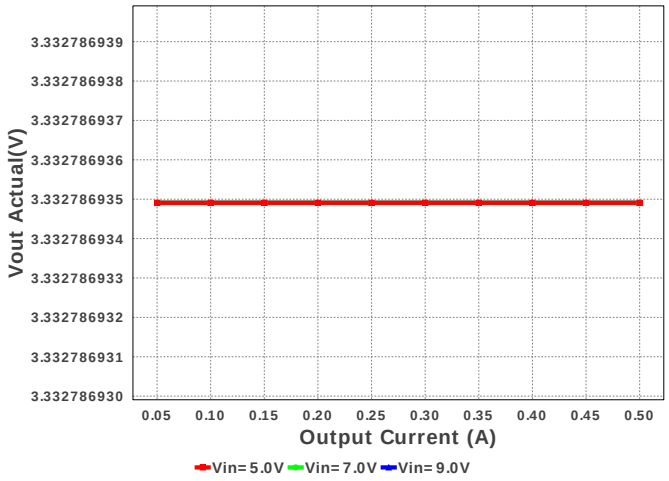
L Pd



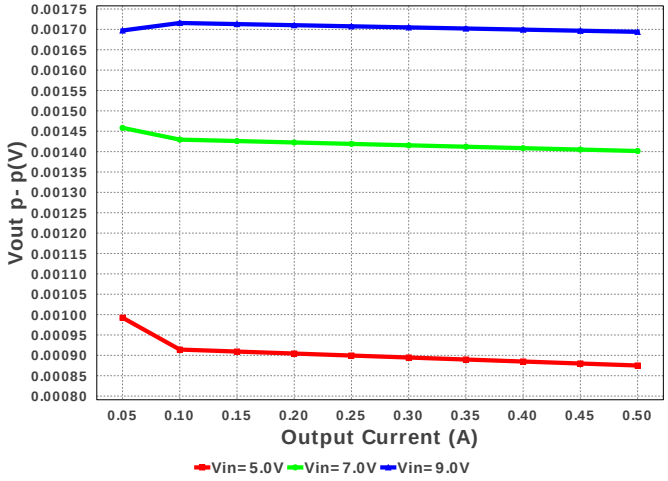
Efficiency



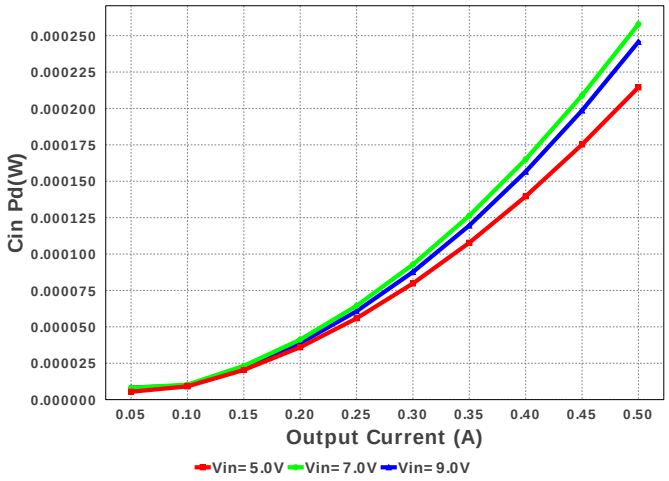
Vout Actual



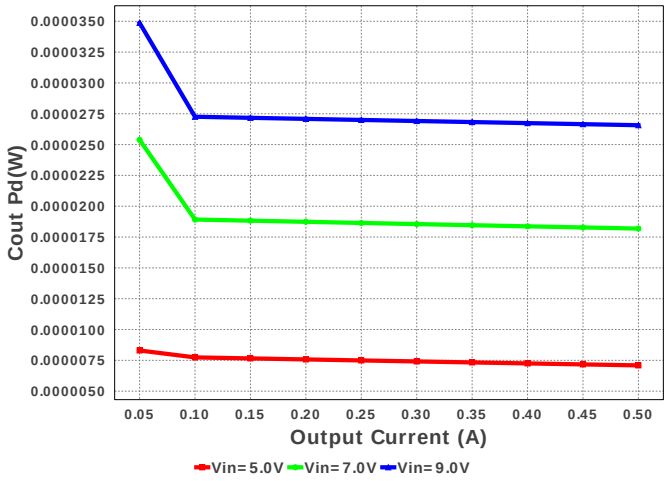
Vout p- p

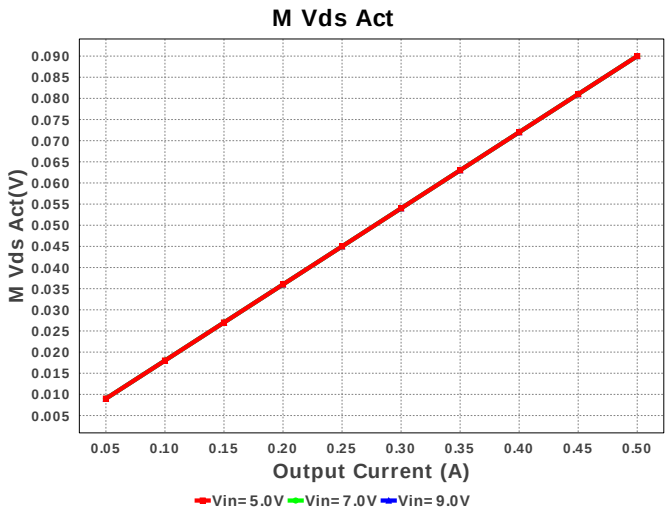


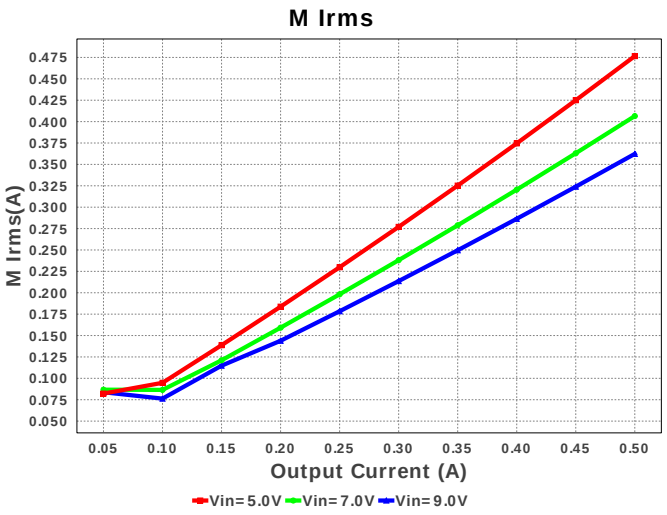
Cin Pd

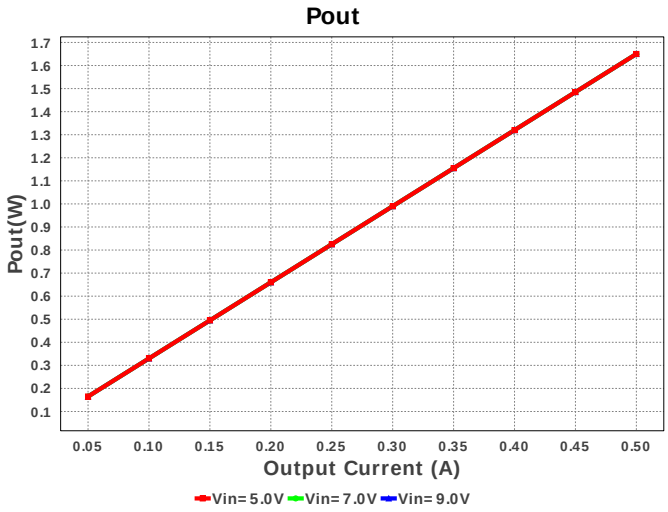


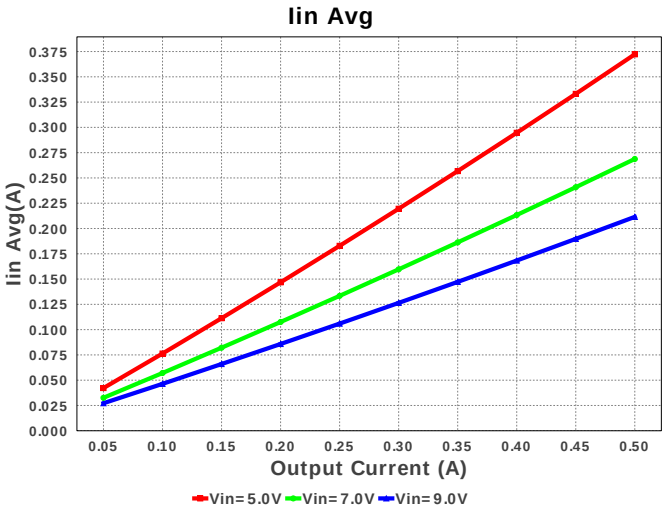
Cout Pd

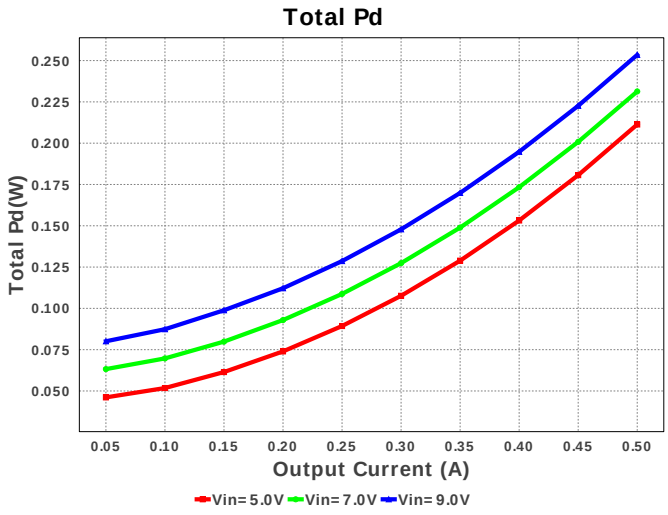


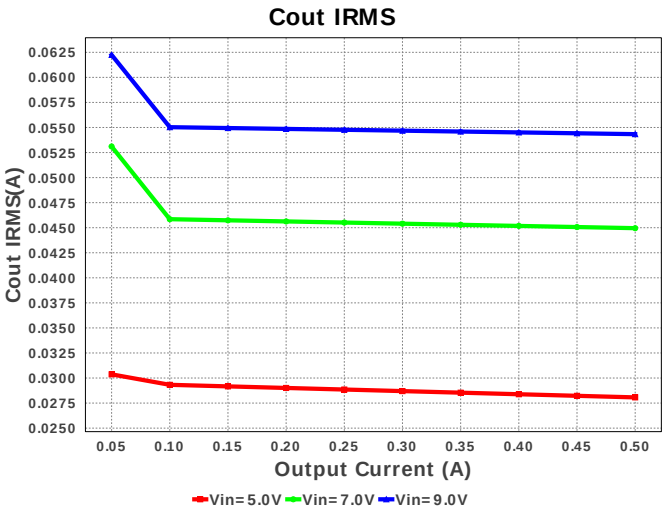


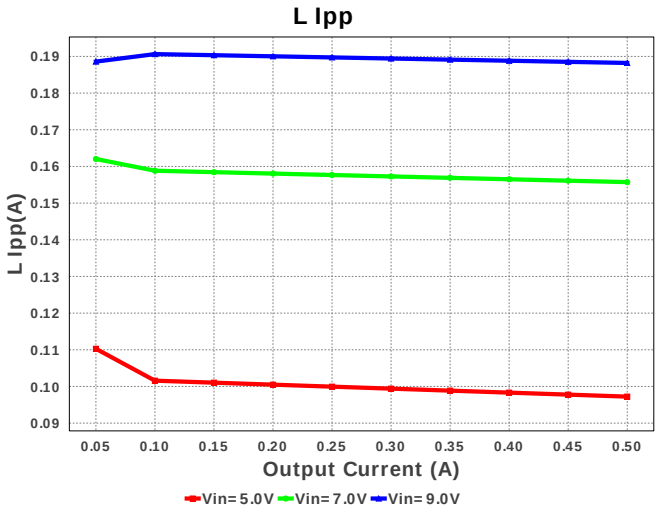


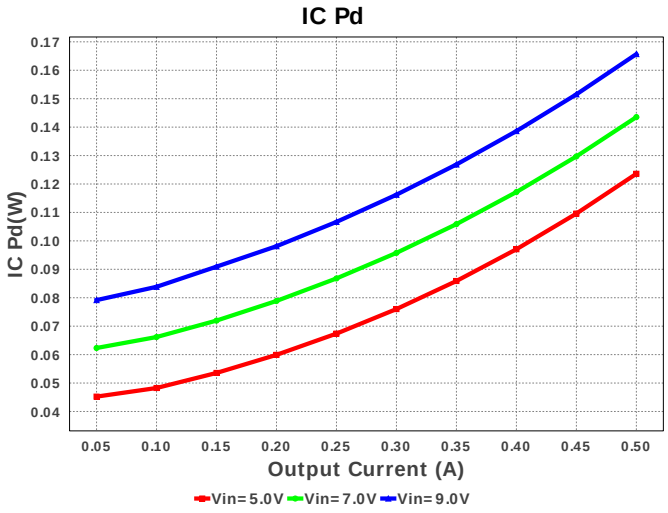












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	244.016 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	54.334 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	594.109 mA	Current	Peak switch current in IC
4.	Iin Avg	211.49 mA	Current	Average input current
5.	L Ipp	188.22 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	362.304 mA	Current	Q Iavg
7.	BOM Count	12	General	Total Design BOM count
8.	FootPrint	107.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	496.764 kHz	General	Switching frequency
10.	IC Tolerance	16.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	90.0 mV	General	Voltage drop across the MosFET
12.	Pout	1.65 W	General	Total output power
13.	Total BOM	$2.07	General	Total BOM Cost
14.	Vout Actual	3.333 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	39.126 %	Op_point	Duty cycle
17.	Efficiency	86.684 %	Op_point	Steady state efficiency
18.	IC Tj	38.284 degC	Op_point	IC junction temperature
19.	ICThetaJA	50.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	500.0 mA	Op_point	Iout operating point
21.	VIN_OP	9.0 V	Op_point	Vin operating point
22.	Vout p-p	1.694 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	245.737 µW	Power	Input capacitor power dissipation
24.	Cout Pd	26.57 µW	Power	Output capacitor power dissipation
25.	IC Pd	165.682 mW	Power	IC power dissipation
26.	L Pd	87.5 mW	Power	Inductor power dissipation
27.	Total Pd	253.458 mW	Power	Total Power Dissipation
28.	Vout Tolerance	3.566 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	500.0 m	Maximum Output Current
2.	VinMax	9.0	Maximum input voltage
3.	VinMin	5.0	Minimum input voltage
4.	Vout	3.3	Output Voltage
5.	base_pn	LMR24210	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **LMR24210** Product Folder : http://www.ti.com/product/LMR24210 : contains the data sheet and other resources.