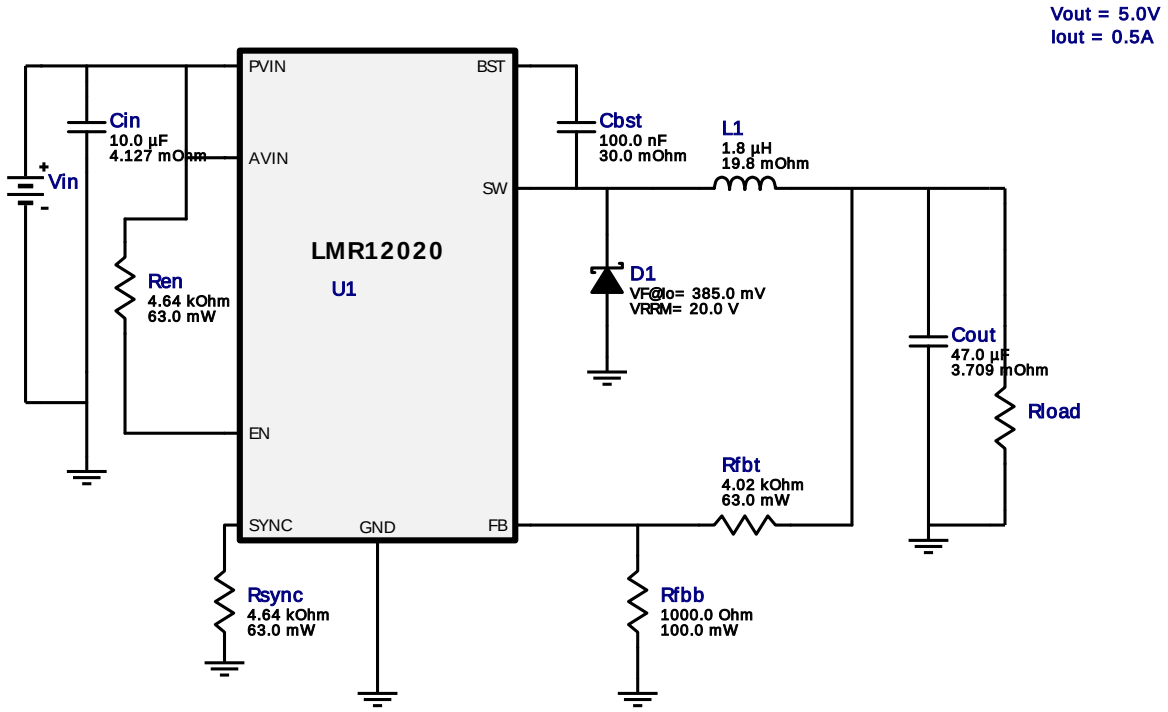
WEBENCH® Design Report

VinMin = 10.0V
VinMax = 12.0V
Vout = 5.0V
Iout = 0.5A

Device = LMR12020XSD/NOPB
Topology = Buck
Created = 7/21/16 2:13:51 AM
BOM Cost = $1.40
BOM Count = 10
Total Pd = 0.41W

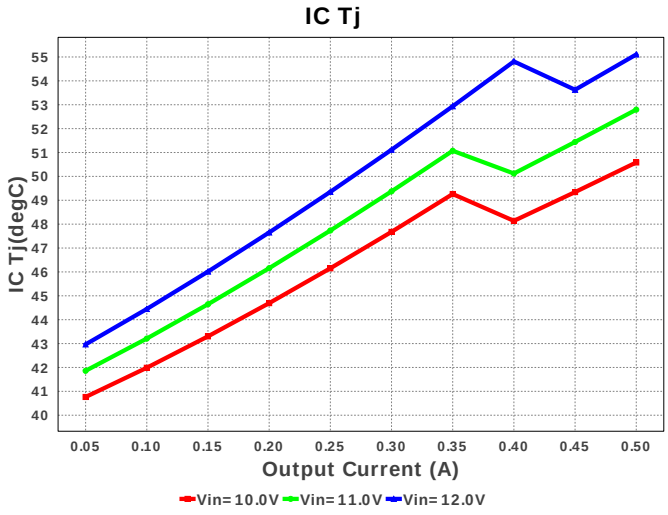
Design : 4742013/226 LMR12020XSD/NOPB
LMR12020XSD/NOPB 10.0V-12.0V to 5.00V @ 0.5A

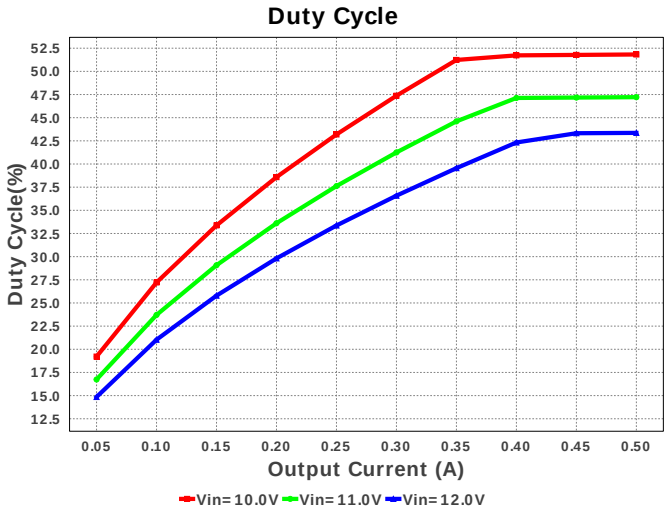


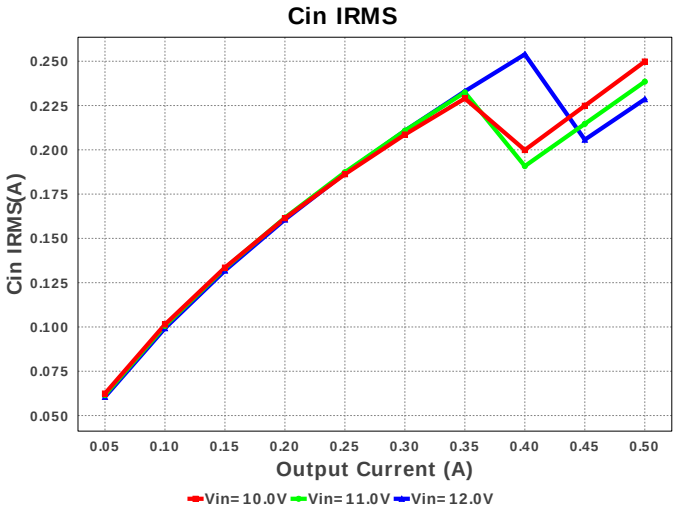
Electrical BOM

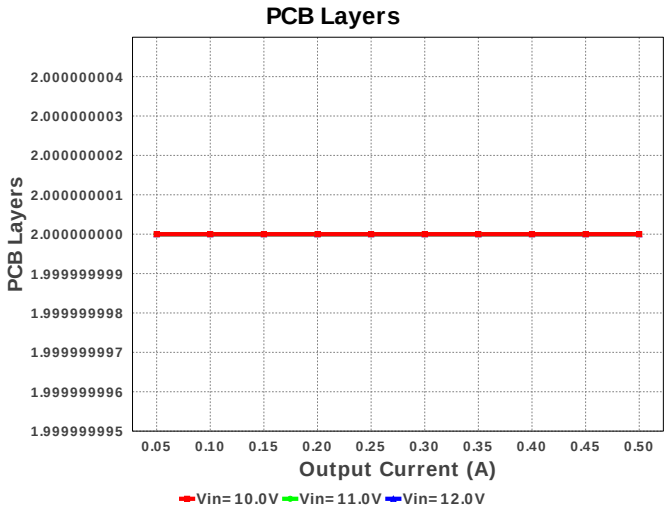
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	MuRata	GRM188R71C104KA01D Series= X7R	Cap= 100.0 nF ESR= 30.0 mOhm VDC= 16.0 V IRMS= 1.7 A	1	$0.01	0603 5 mm²
2.	Cin	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	1	$0.03	0805 7 mm²
3.	Cout	MuRata	GRM31CR61A476KE15L Series= X5R	Cap= 47.0 uF ESR= 3.709 mOhm VDC= 10.0 V IRMS= 4.2862 A	1	$0.15	1206_190 11 mm²
4.	D1	ON Semiconductor	MBR0520LT1G	VF@Io= 385.0 mV VRRM= 20.0 V	1	$0.06	SOD-123 13 mm²
5.	L1	Bourns	SRN6045-1R8Y	L= 1.8 µH DCR= 19.8 mOhm	1	$0.16	SRN6045 64 mm²
6.	Ren	Vishay-Dale	CRCW04024K64FKED Series= CRCW..e3	Res= 4.64 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
7.	Rfbb	Vishay-Dale	CRCW06031K00FKEA Series= CRCW..e3	Res= 1000.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²

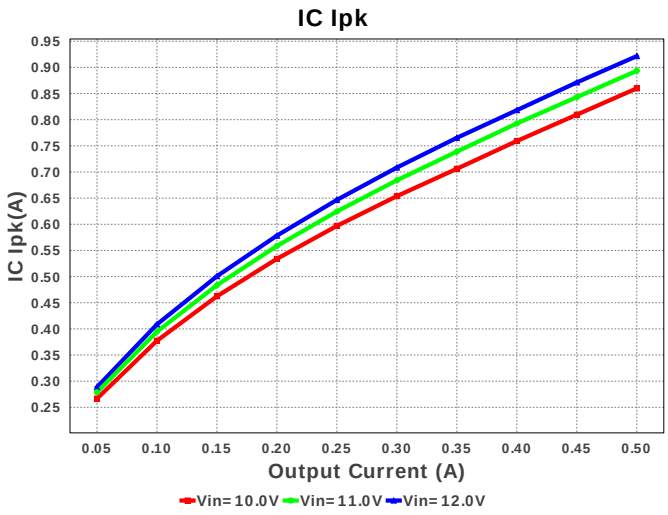
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	Rfbt	Vishay-Dale	CRCW04024K02FKED Series= CRCW..e3	Res= 4.02 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
9.	Rsync	Vishay-Dale	CRCW04024K64FKED Series= CRCW..e3	Res= 4.64 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
10.	U1	Texas Instruments	LMR12020XSD/NOPB	Switcher	1	$0.95	SDA10A 16 mm^2

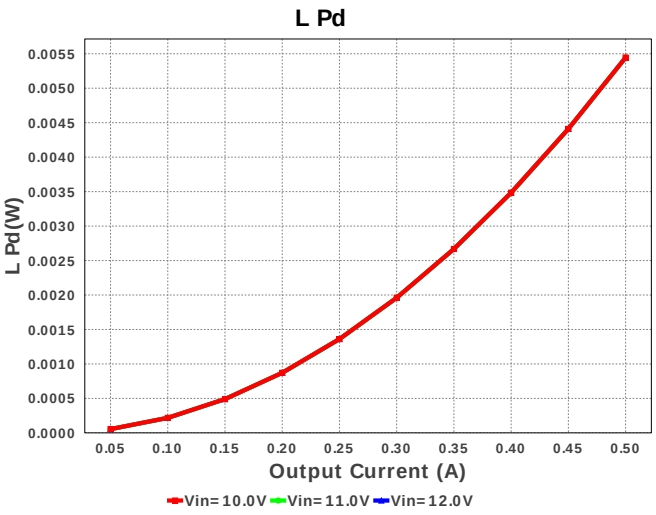


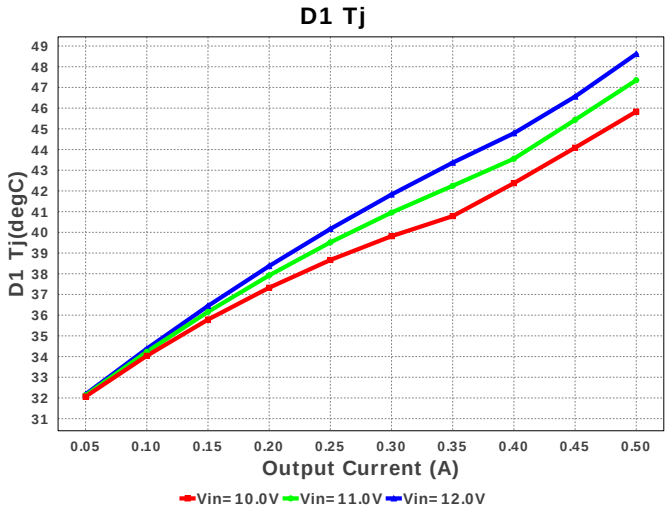


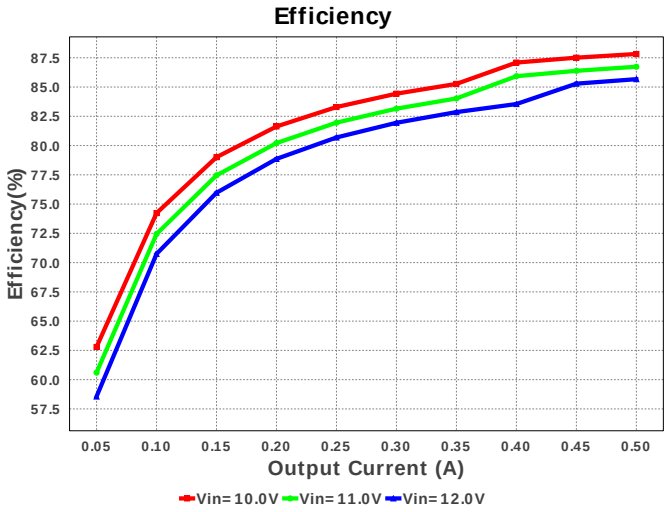


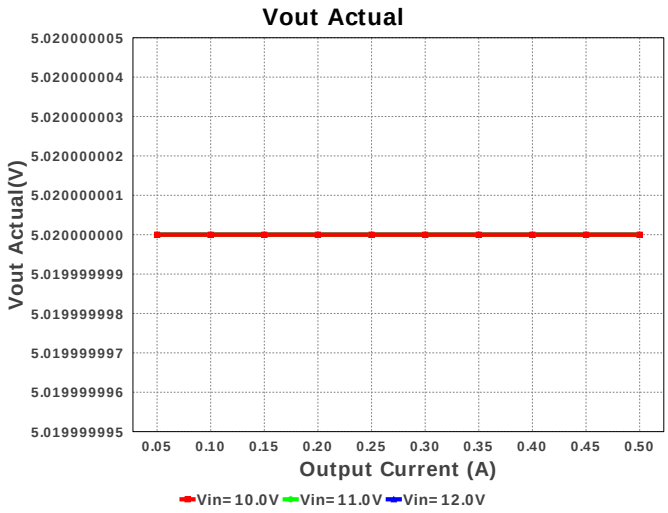


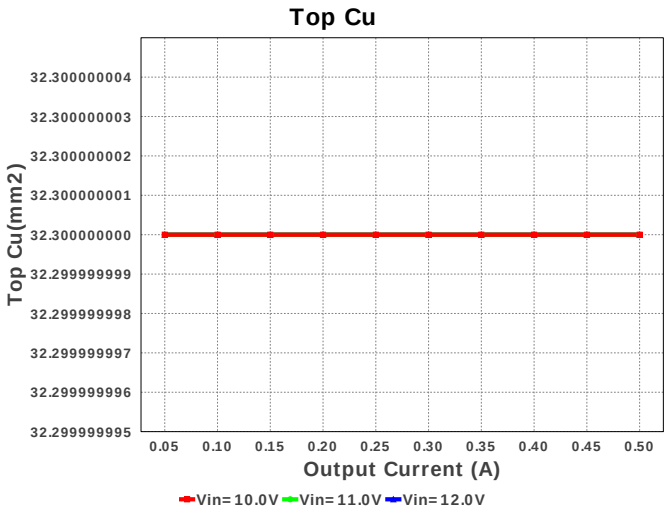


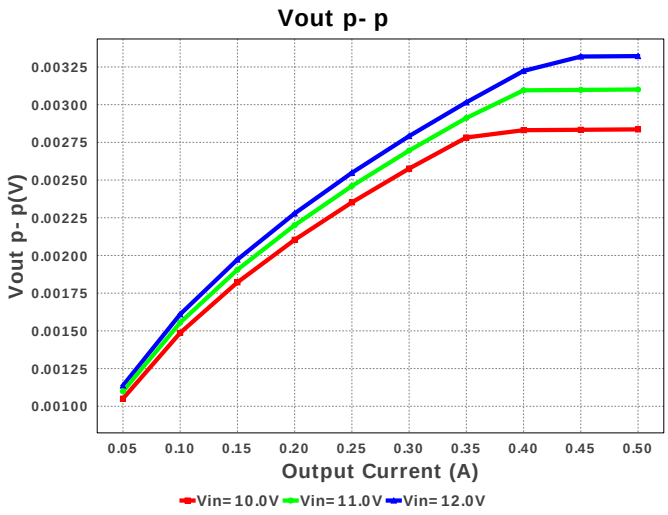


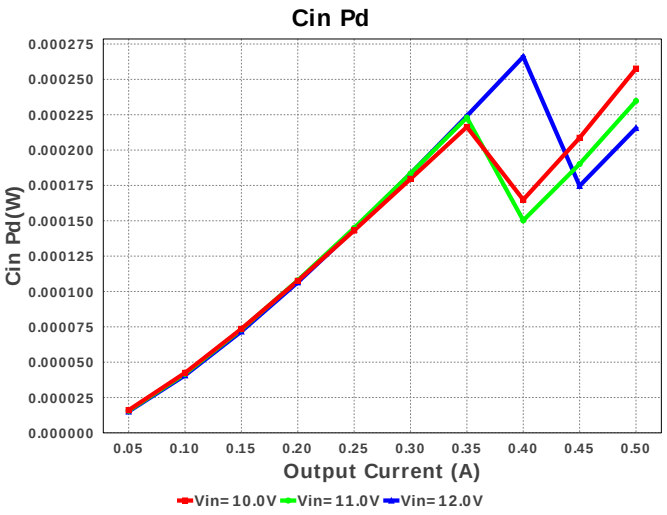


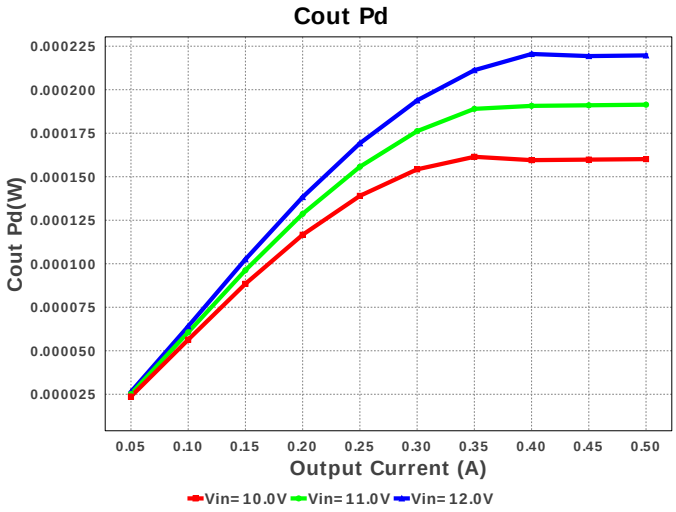


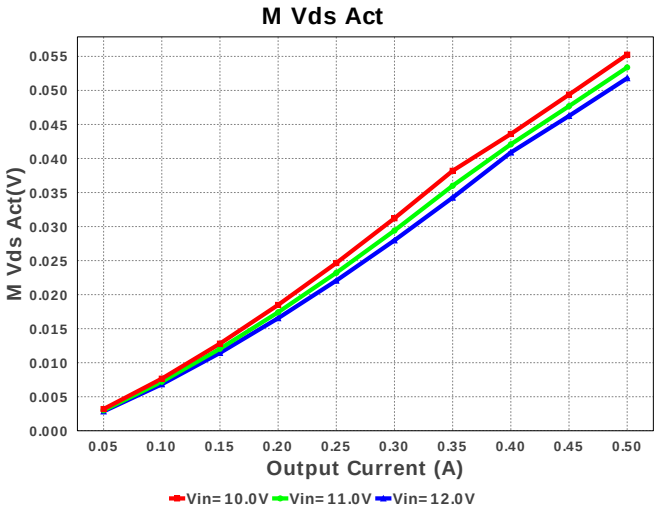


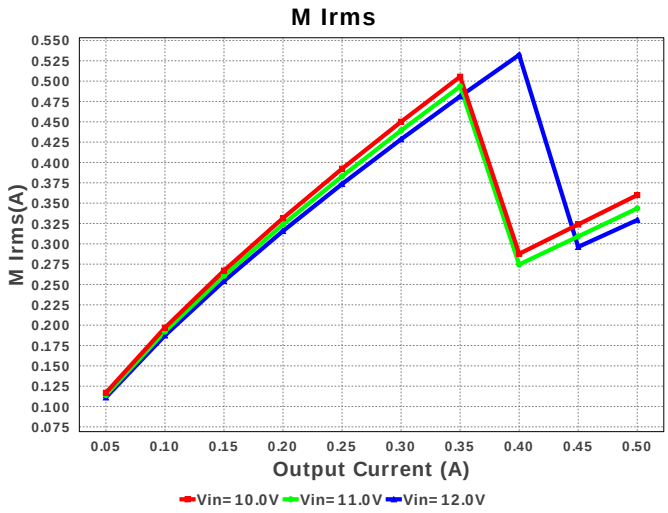


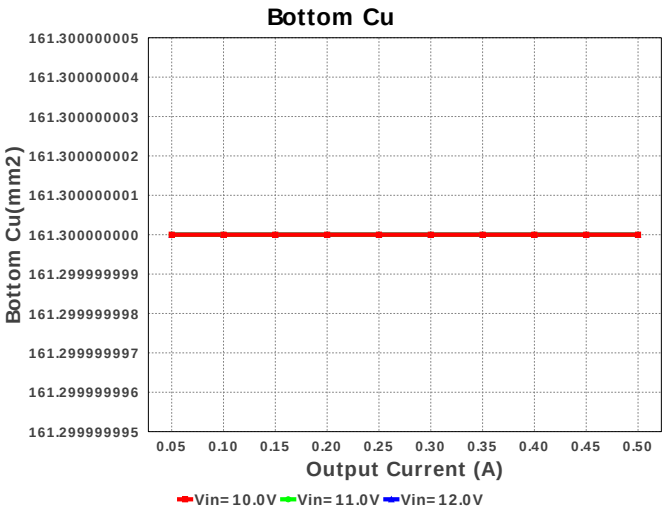


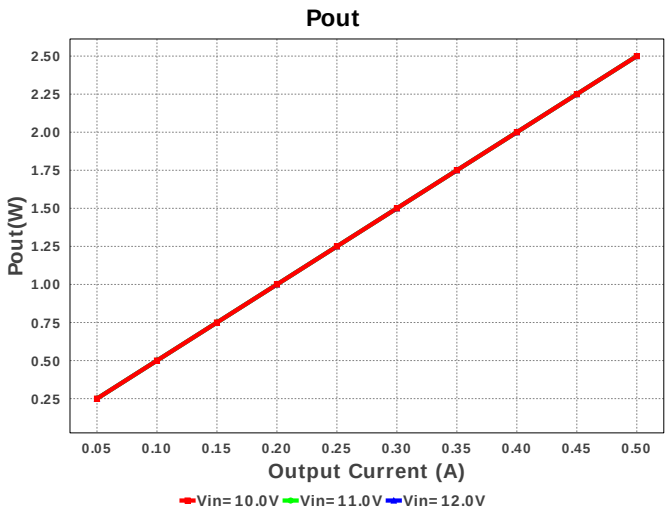


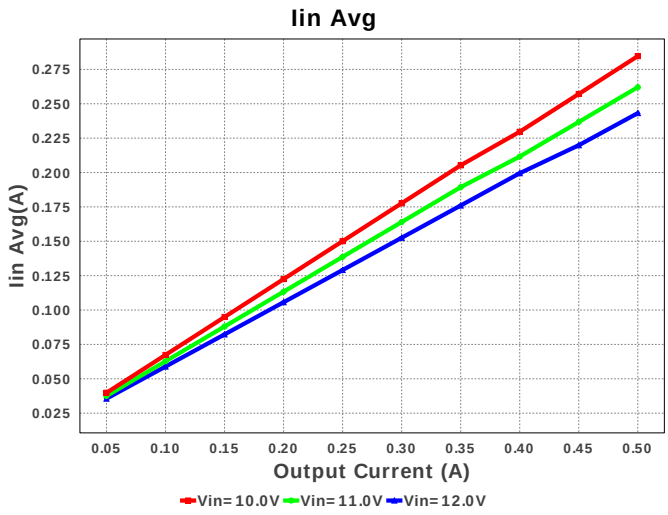


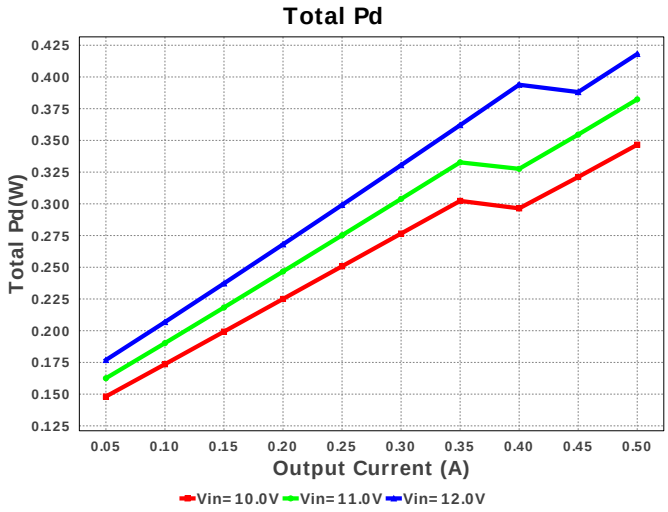


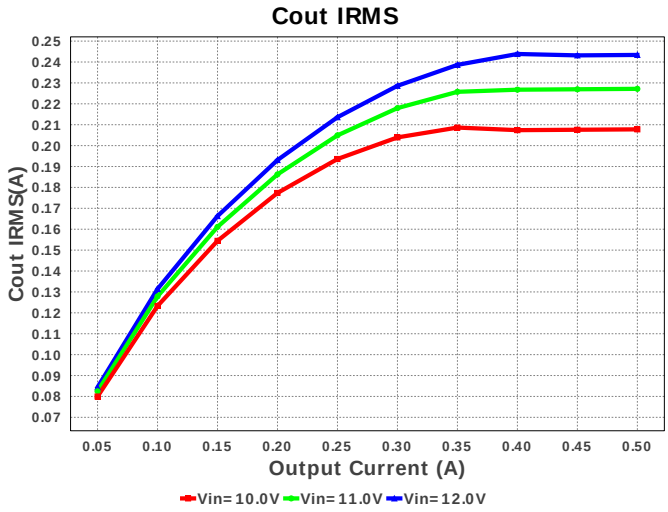


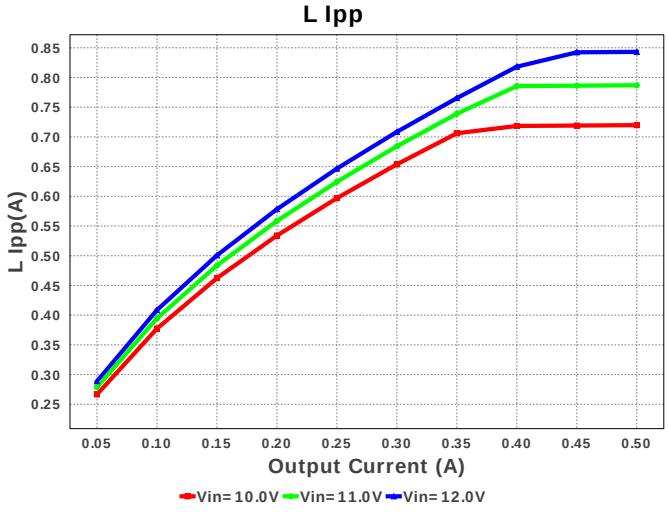


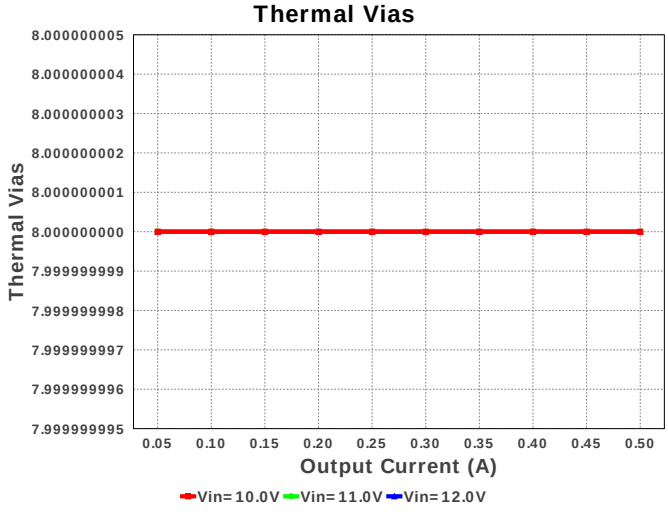


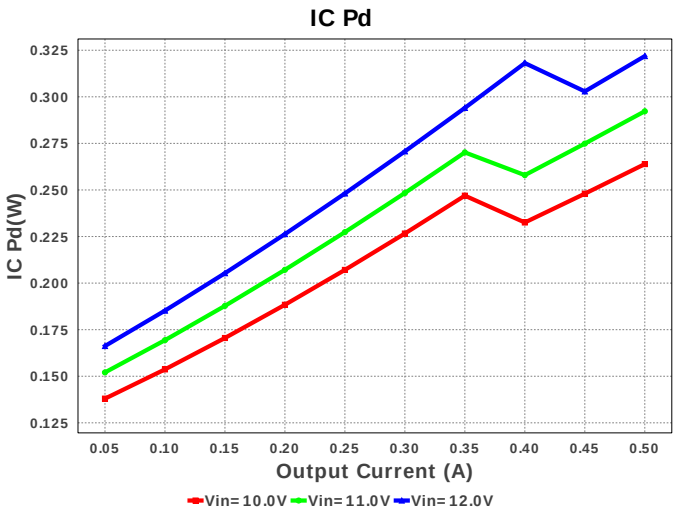


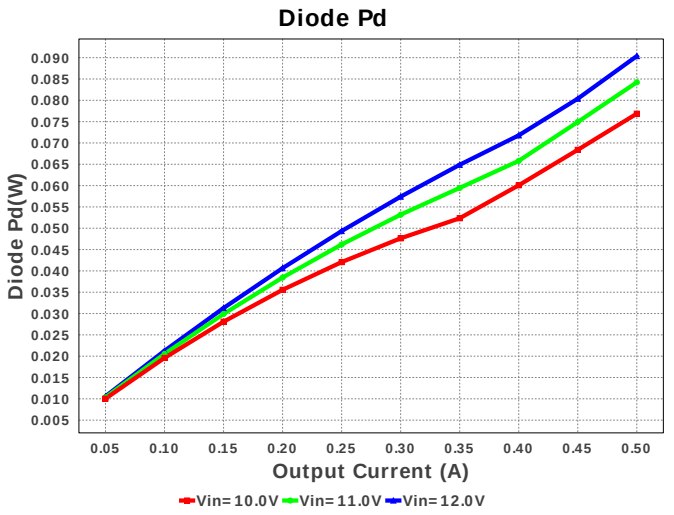












Operating Values

#	Name	Value	Category	Description
1.	Bottom Cu	161.3 mm^2	Board_Layout	Recommended minimum area of bottom layer copper connected to DAP
2.	PCB Layers	2.0	Board_Layout	Recommended number of PCB layers for the necessary IC Thermal Resistance
3.	Thermal Vias	8.0	Board_Layout	Recommended number of 10 mil thermal vias under the IC
4.	Top Cu	32.3 mm^2	Board_Layout	Recommended minimum area of top layer copper connected to DAP
5.	Cin IRMS	228.562 mA	Current	Input capacitor RMS ripple current
6.	Cout IRMS	243.108 mA	Current	Output capacitor RMS ripple current
7.	IC Ipk	921.076 mA	Current	Peak switch current in IC
8.	Iin Avg	242.91 mA	Current	Average input current
9.	L Ipp	842.15 mA	Current	Peak-to-peak inductor ripple current
10.	M1 Irms	329.054 mA	Current	Q Iavg
11.	BOM Count	10	General	Total Design BOM count
12.	FootPrint	129.0 mm^2	General	Total Foot Print Area of BOM components
13.	Frequency	2.0 MHz	General	Switching frequency
14.	IC Tolerance	10.0 mV	General	IC Feedback Tolerance
15.	M Vds Act	49.505 mV	General	Voltage drop across the MosFET
16.	Pout	2.5 W	General	Total output power
17.	Total BOM	$1.4	General	Total BOM Cost
18.	D1 Tj	48.111 degC	Op_Point	D1 junction temperature
19.	Vout Actual	5.02 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	43.311 %	Op_point	Duty cycle
22.	Efficiency	85.767 %	Op_point	Steady state efficiency
23.	IC Tj	47.018 degC	Op_point	IC junction temperature
24.	ICThetaJA	53.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
25.	IOUT_OP	500.0 mA	Op_point	Iout operating point
26.	VIN_OP	12.0 V	Op_point	Vin operating point
27.	Vout Act	5.02 V	Op_point	Achieved Vout with feedback resistor pair
28.	Vout p-p	3.318 mV	Op_point	Peak-to-peak output ripple voltage
29.	Cin Pd	215.597 µW	Power	Input capacitor power dissipation
30.	Cout Pd	219.208 µW	Power	Output capacitor power dissipation
31.	Diode Pd	87.919 mW	Power	Diode power dissipation
32.	IC Pd	321.09 mW	Power	IC power dissipation
33.	L Pd	5.445 mW	Power	Inductor power dissipation
34.	Total Pd	414.881 mW	Power	Total Power Dissipation
35.	Vout Tolerance	2.634 %		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	12.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	LMR12020	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **LMR12020** Product Folder : http://www.ti.com/product/LMR12020 : contains the data sheet and other resources.