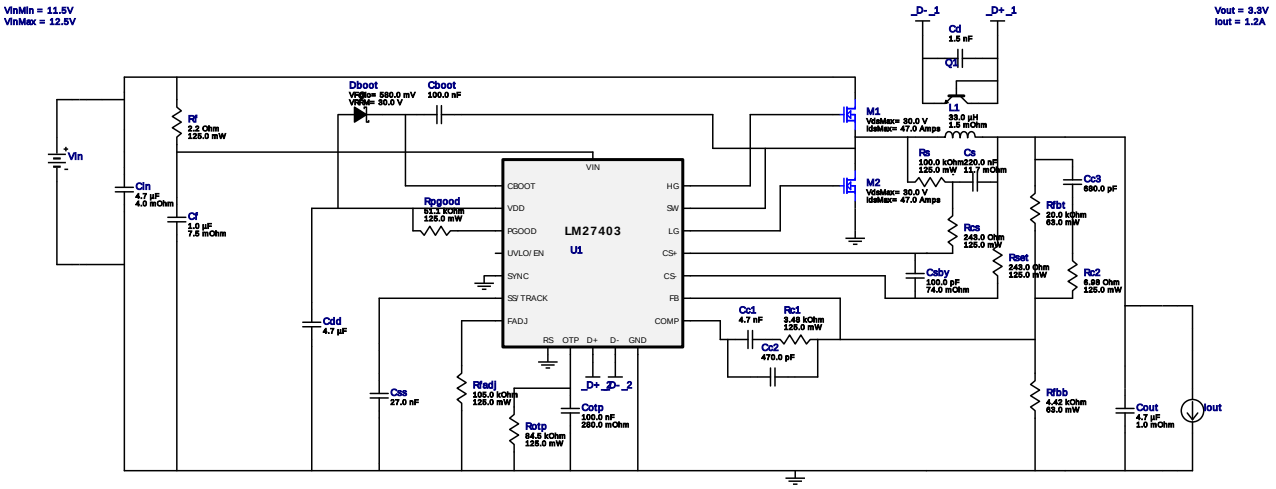
WEBENCH® Design Report

VinMin = 11.5V
VinMax = 12.5V
Vout = 3.3V
Iout = 1.2A

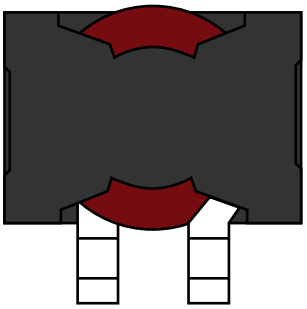
Device = LM27403SQ/NOPB
Topology = Buck
Created = 4/15/14 2:49:28 AM
BOM Cost = $4.28
Footprint = 1,111.0mm2
BOM Count = 30
Total Pd = 0.06W

Design : 3953918/7 LM27403SQ/NOPB
LM27403SQ/NOPB 11.5V-12.5V to 3.3V @ 1.2A

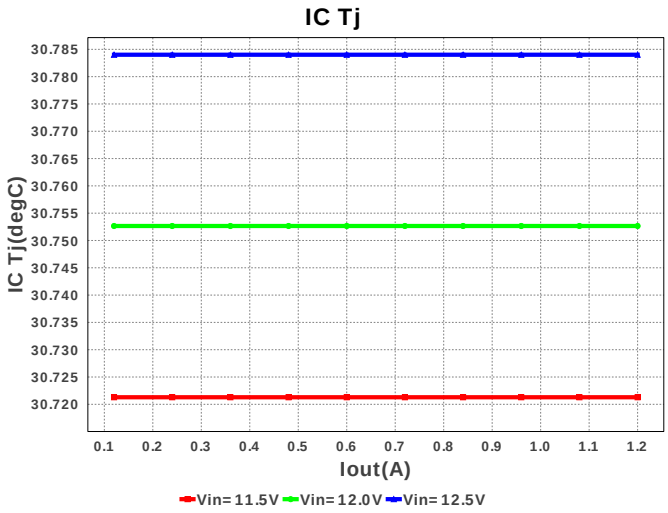


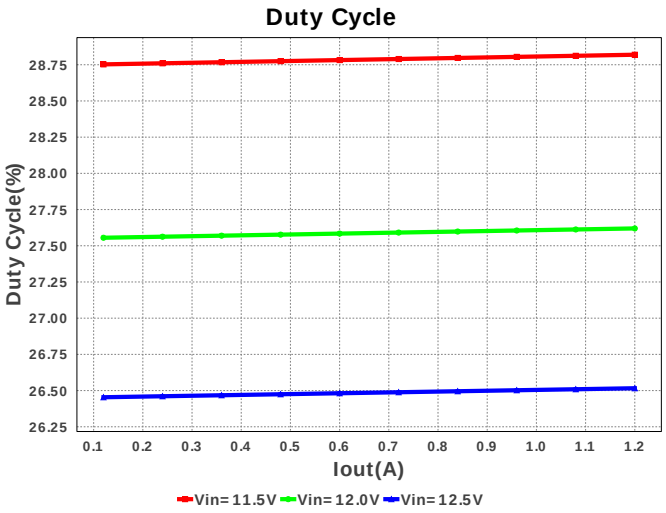
Electrical BOM

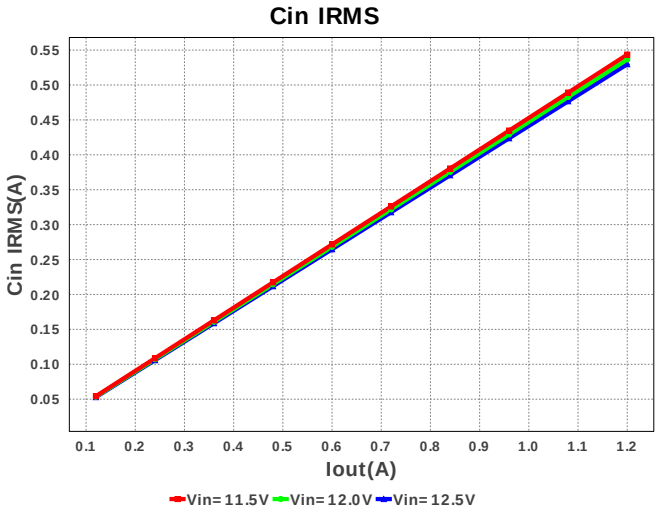
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155R61C104KA88D Series= X5R	Cap= 100.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3mm2
2.	Cc1	Yageo America	CC0805KRX7R9BB472 Series= X7R	Cap= 4.7 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
3.	Cc2	Yageo America	CC0805KRX7R9BB471 Series= X7R	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
4.	Cc3	Yageo America	CC0805KRX7R9BB681 Series= X7R	Cap= 680.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
5.	Cd	MuRata	GRM033R61A152KA01D Series= X5R	Cap= 1.5 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0201 2mm2
6.	Cdd	MuRata	GRM21BR71A475KA73L Series= X7R	Cap= 4.7 µF VDC= 10.0 V IRMS= 0.0 A	1	$0.03	0805 7mm2
7.	Cf	TDK	C2012X5R1E105K Series= X5R	Cap= 1.0 µF ESR= 7.5 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.03	0805 7mm2
8.	Cin	MuRata	GRM21BR61E475KA12L Series= X5R	Cap= 4.7 µF ESR= 4.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.05	0805 7mm2
9.	Cotp	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
10.	Cout	MuRata	GRM188R60J475ME19D Series= X5R	Cap= 4.7 µF ESR= 1.0 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.02	0603 5mm2

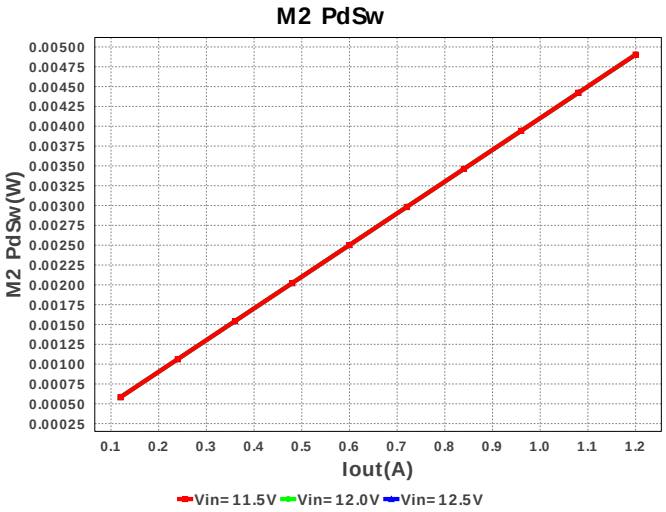
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	Cs	TDK	C2012X7R1C224K Series= X7R	Cap= 220.0 nF ESR= 11.7 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.02	0805 7mm2
12.	Csby	Kemet	C0805C101J5GACTU Series= C0G/NP0	Cap= 100.0 pF ESR= 74.0 mOhm VDC= 50.0 V IRMS= 524.0 mA	1	$0.01	0805 7mm2
13.	Css	MuRata	GRM155R71C273KA01D Series= X7R	Cap= 27.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3mm2
14.	Dboot	Diodes Inc.	SBR0230T5-7-F	VF@Io= 580.0 mV VRRM= 30.0 V	1	$0.09	SOD-523 5mm2
15.	L1	Coilcraft	SER2915L-333KL	L= 33.0 µH DCR= 1.5 mOhm	1	$1.93	 SER2915 895mm2
16.	M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 47.0 Amps	1	$0.34	TRANS_NexFET_Q3 19mm2
17.	M2	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 47.0 Amps	1	$0.34	TRANS_NexFET_Q3 19mm2
18.	Q1	Diodes Inc.	MMBT3904T	Bipolar Transistor	1	$0.04	SOT-523 7mm2
19.	Rc1	Panasonic	ERJ-6ENF3481V Series= 225	Res= 3.48 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7mm2
20.	Rc2	Vishay-Dale	CRCW08056R98FKEA Series= CRCW..e3	Res= 6.98 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7mm2
21.	Rcs	Vishay-Dale	CRCW0805243RFKEA Series= CRCW..e3	Res= 243.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7mm2
22.	Rf	Yageo America	RC0805FR-072R2L Series= 234	Res= 2.2 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7mm2
23.	Rfadj	Panasonic	ERJ-6ENF1053V Series= 225	Res= 105.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7mm2
24.	Rfbb	Vishay-Dale	CRCW04024K42FKED Series= CRCW..e3	Res= 4.42 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
25.	Rfbt	Vishay-Dale	CRCW040220K0FKED Series= CRCW..e3	Res= 20.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
26.	Rotp	Panasonic	ERJ-6ENF8452V Series= 225	Res= 84.5 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7mm2
27.	Rpgood	Panasonic	ERJ-6ENF5112V Series= 225	Res= 51.1 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7mm2

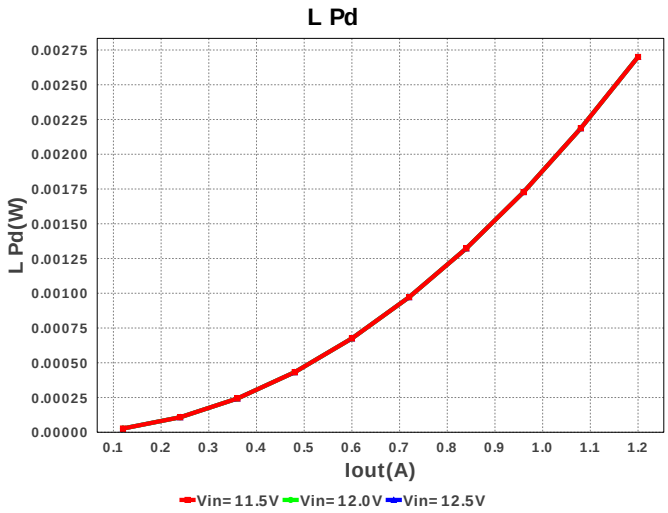
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
28.	Rs	Panasonic	ERJ-6ENF1003V Series= 225	Res= 100.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7mm2
29.	Rset	Vishay-Dale	CRCW0805243RFKEA Series= CRCW..e3	Res= 243.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7mm2
30.	U1	Texas Instruments	LM27403SQ/NOPB	Switcher	1	$1.20	WQFN-24 25mm2

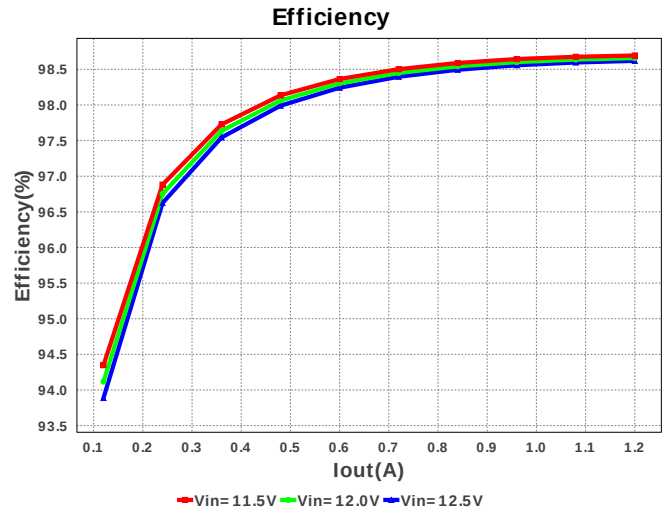


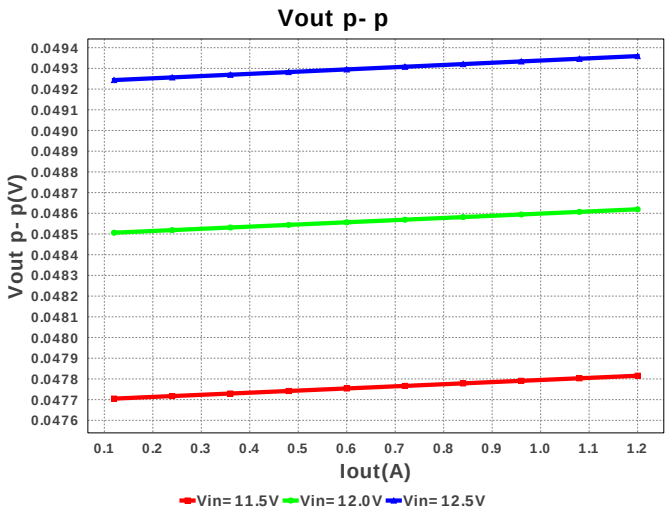


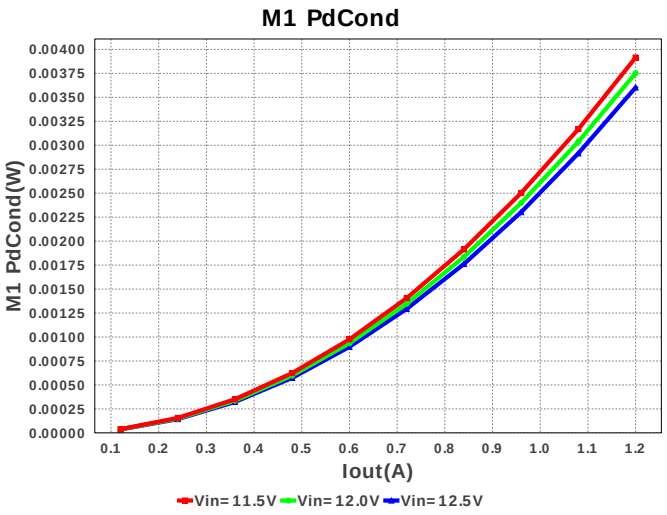


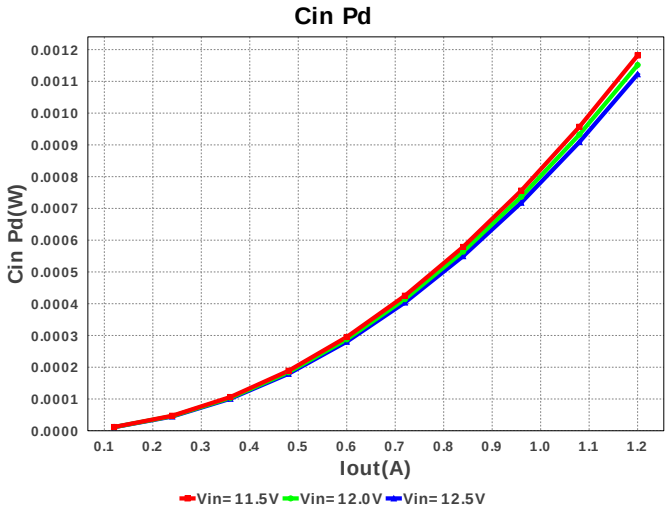


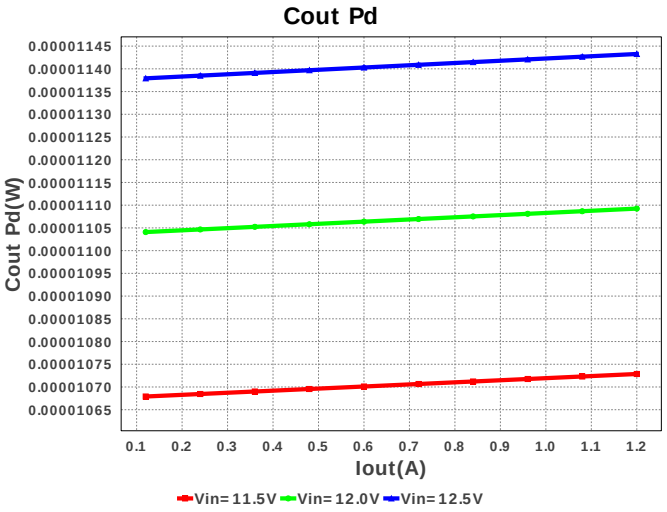


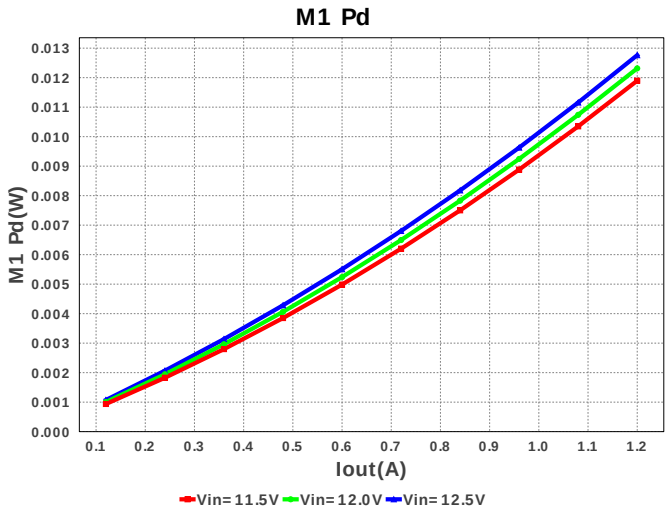


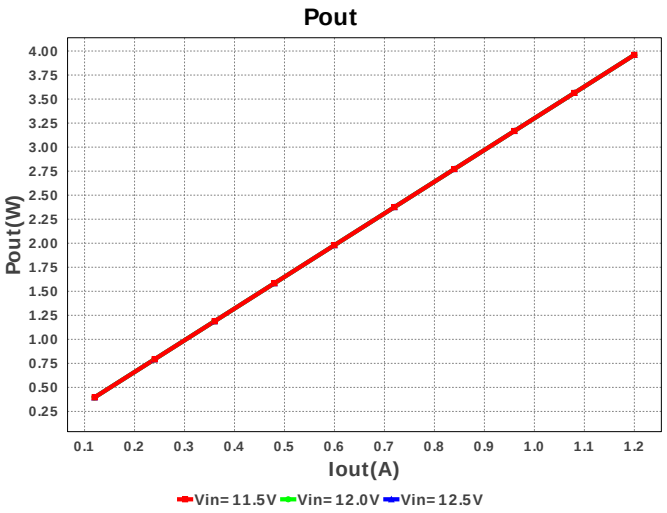


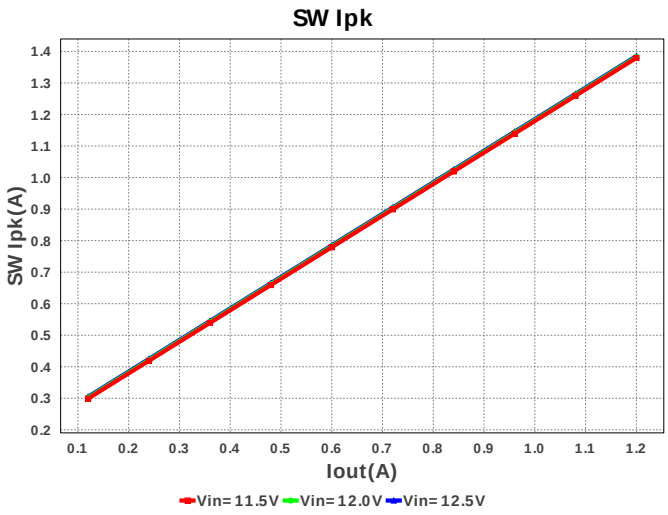


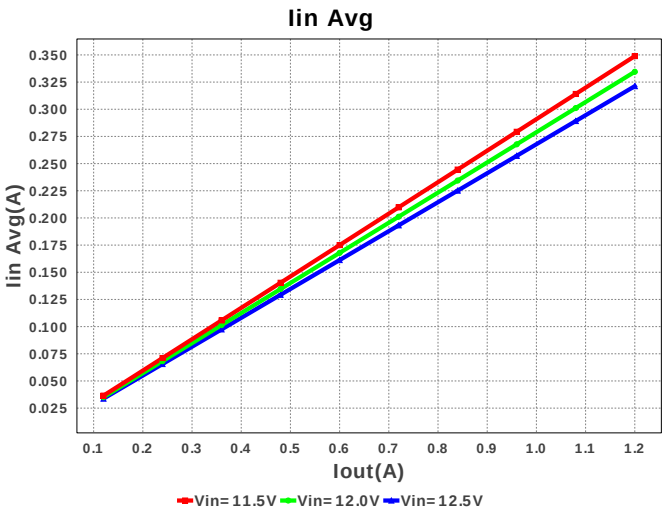


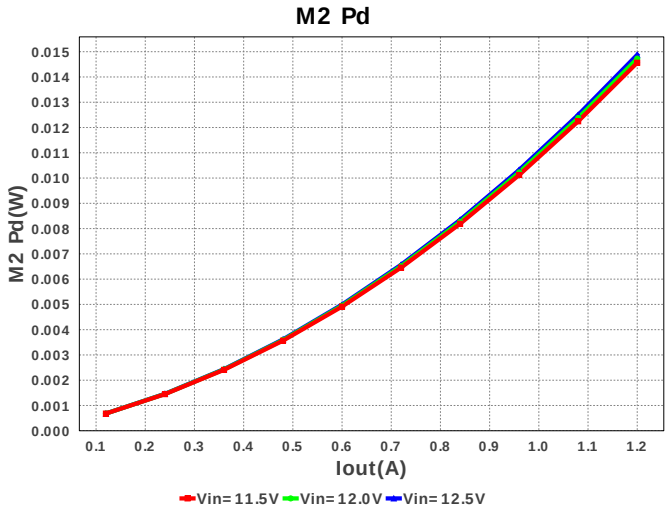


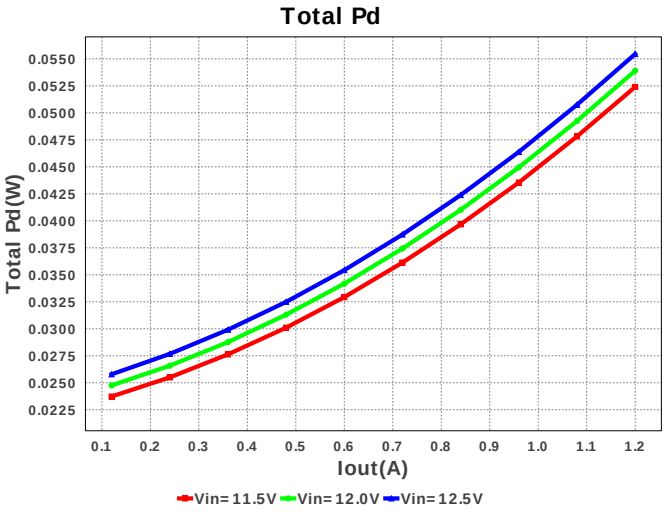


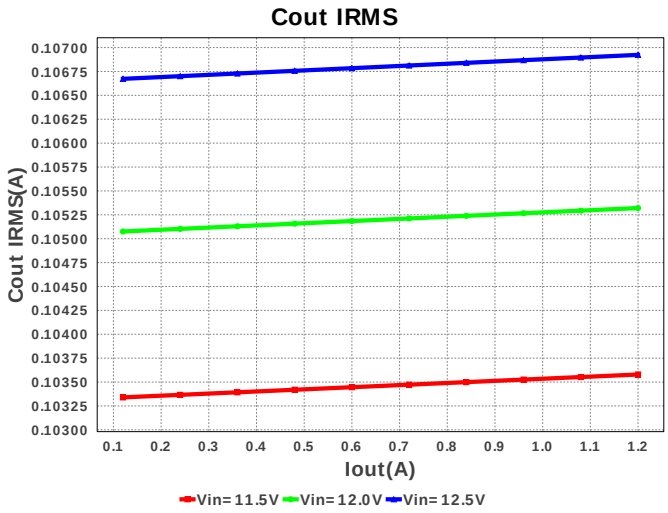


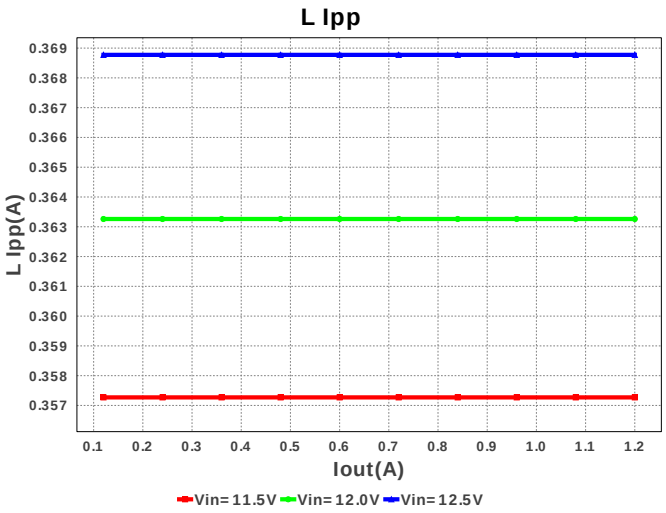


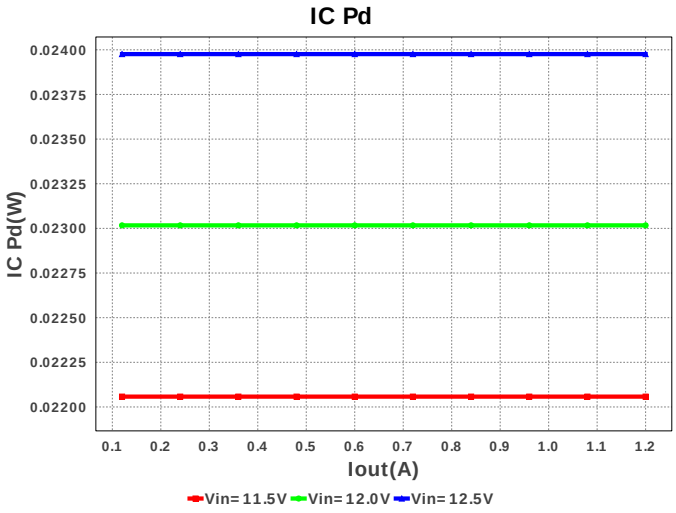


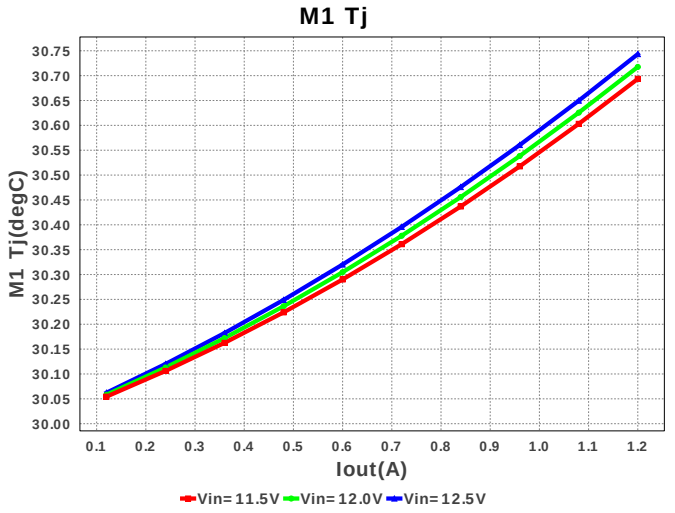


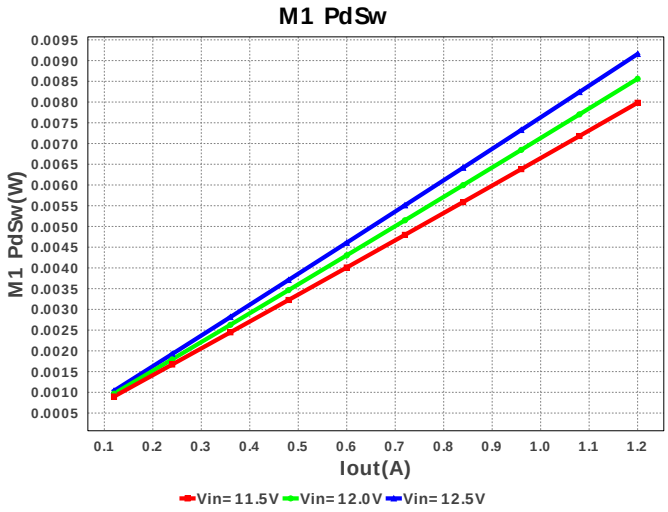


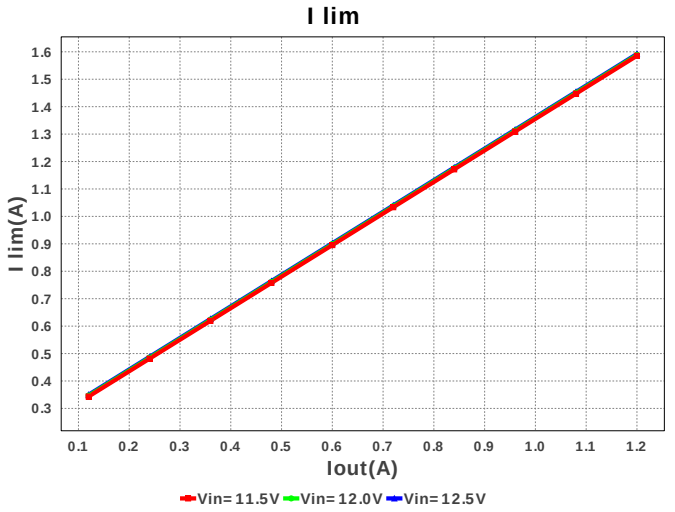


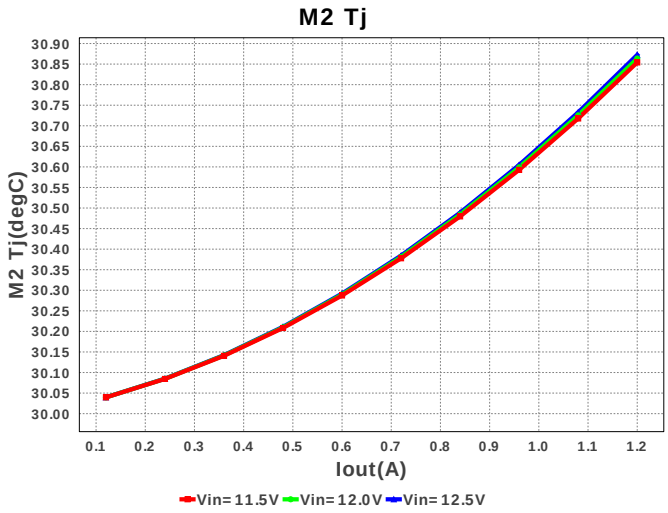


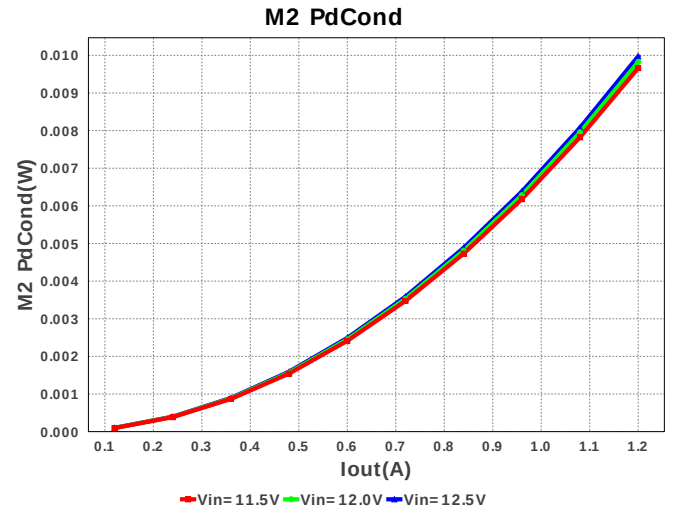












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	529.703 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	106.924 mA	Current	Output capacitor RMS ripple current
3.	I lim	1.592 A	Current	Current limit threshold
4.	Iin Avg	321.24 mA	Current	Average input current
5.	L Ipp	370.394 mA	Current	Peak-to-peak inductor ripple current
6.	SW Ipk	1.385 A	Current	Peak switch current
7.	BOM Count	30	General	Total Design BOM count
8.	FootPrint	1.111 kmm2	General	Total Foot Print Area of BOM components
9.	Frequency	199.581 kHz	General	Switching frequency
10.	IC Tolerance	6.0 mV	General	IC Feedback Tolerance
11.	Pout	3.96 W	General	Total output power

#	Name	Value	Category	Description
12.	Total BOM	$4.28	General	Total BOM Cost
13.	Cross Freq	21.72 kHz	Op_point	Bode plot crossover frequency
14.	Duty Cycle	26.516 %	Op_point	Duty cycle
15.	Efficiency	98.619 %	Op_point	Steady state efficiency
16.	IC Tj	30.784 degC	Op_point	IC junction temperature
17.	IOUT_OP	1.2 A	Op_point	Iout operating point
18.	M1 Tj	30.743 degC	Op_point	M1 MOSFET junction temperature
19.	M2 Tj	30.872 degC	Op_point	M2 MOSFET junction temperature
20.	Phase Marg	67.194 deg	Op_point	Bode Plot Phase Margin
21.	VIN_OP	12.5 V	Op_point	Vin operating point
22.	Vout p-p	49.359 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	1.122 mW	Power	Input capacitor power dissipation
24.	Cout Pd	11.433 µW	Power	Output capacitor power dissipation
25.	IC Pd	23.976 mW	Power	IC power dissipation
26.	L Pd	2.7 mW	Power	Inductor power dissipation
27.	M1 Pd	12.762 mW	Power	M1 MOSFET total power dissipation
28.	M1 PdCond	3.603 mW	Power	M1 MOSFET conduction losses
29.	M1 PdSw	9.159 mW	Power	M1 MOSFET switching losses
30.	M2 Pd	14.877 mW	Power	M2 MOSFET total power dissipation
31.	M2 PdCond	9.974 mW	Power	M2 MOSFET conduction losses
32.	M2 PdSw	4.903 mW	Power	M2 MOSFET switching losses
33.	Total Pd	55.454 mW	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	1.2 A	Maximum Output Current
2.	Iout1	1.2 Amps	Output Current #1
3.	VinMax	12.5 V	Maximum input voltage
4.	VinMin	11.5 V	Minimum input voltage
5.	Vout	3.3 V	Output Voltage
6.	Vout1	3.3 Volt	Output Voltage #1
7.	base_pn	LM27403	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	30.0 degC	Ambient temperature

Design Assistance

1. Tip: LM27403 High Current PCB Layout Design Guidance For higher current designs, please take care in designing the PCB layout. Consider good thermal management practices and proper routing of traces. Please see the following for more guidelines. Best Layout Practices for Switching Power Supplies http://sva.ti.com/assets/en/appnotes/national_power_designer114.pdf SIMPLE SWITCHER Layout Guidelines http://www.ti.com/lit/an/snva054c/snva054c.pdf Thermal Design by Insight, not Hindsight http://www.ti.com/lit/an/snva419c/snva419c.pdf

2. General Description: The LM27403 is a synchronous voltage mode buck controller with inductor DCR current sense capability. Sensing the inductor current eliminates the need to add resistive powertrain elements which increases overall efficiency and allows for accurate continuous current limit sensing. A 0.6V +/-1% voltage reference permits high accuracy and low voltage capability at the output. An operating voltage range of 3V to 20V makes the LM27403 suitable for a large variety of input rails. The LM27403 voltage mode control loop incorporates input voltage feed-forward to maintain stability throughout the entire input voltage range. The switching frequency is adjustable from 200 kHz to 1.2 MHz allowing a flexible design space. A power good indicator provides power rail sequencing capability and output fault detection. Programmable external softstart capability limits inrush current and provides monotonic output control at startup. Other features include external tracking of other power supplies, integrated LDO bias supply, and synchronization capability.

3. **LM27403** Product Folder : http://www.ti.com/product/lm27403 : contains the data sheet and other resources.