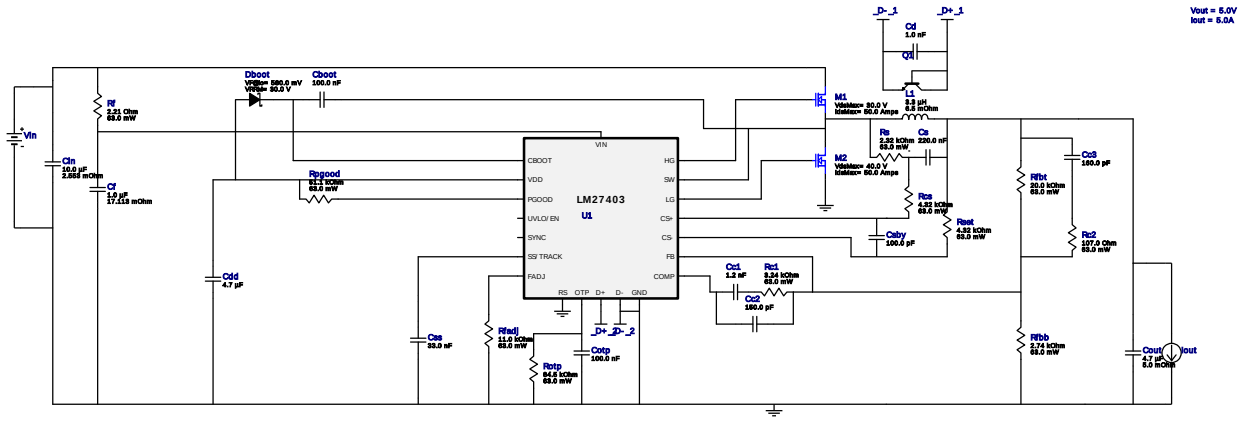
WEBENCH® Design Report

VinMin = 12.0V
VinMax = 18.0V
Vout = 5.0V
Iout = 5.0A

Device = LM27403SQ/NOPB
Topology = Buck
Created = 8/10/16 5:45:58 PM
BOM Cost = $3.91
BOM Count = 30
Total Pd = 0.83W

Design : 4759963/13 LM27403SQ/NOPB
LM27403SQ/NOPB 12.0V-18.0V to 5.00V @ 5.0A

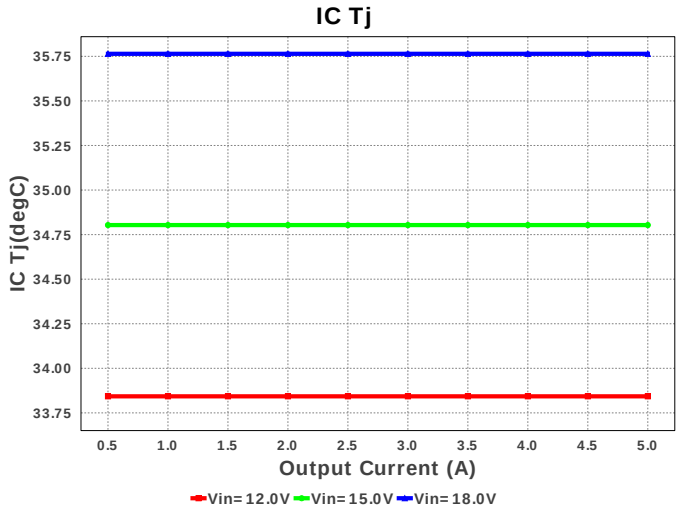


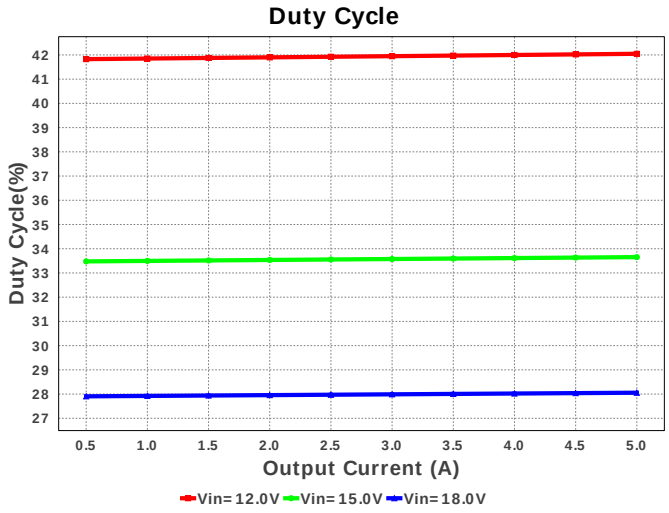
Electrical BOM

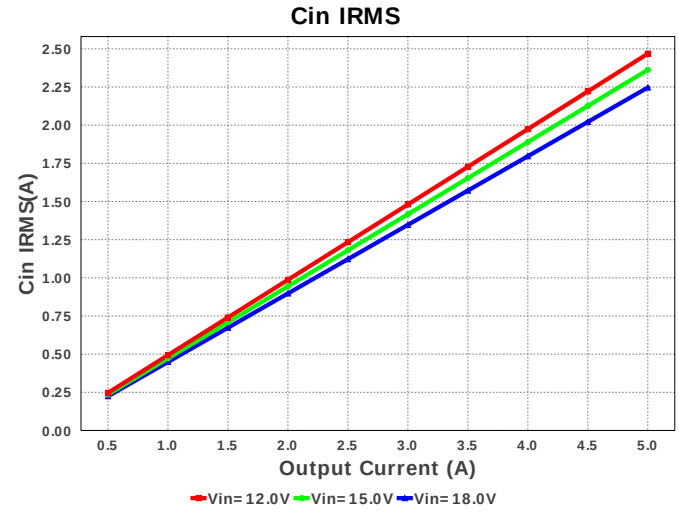
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155R61C104KA88D Series= X5R	Cap= 100.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
2.	Cc1	MuRata	GRM033R71C122KA01D Series= X7R	Cap= 1.2 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm^2
3.	Cc2	TDK	C2012C0G1H151J Series= C0G/NP0	Cap= 150.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
4.	Cc3	Samsung Electro-Mechanics	CL21C161JBANNNC Series= C0G/NP0	Cap= 160.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
5.	Cd	MuRata	GRM033R71C102KA01D Series= X7R	Cap= 1.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm^2
6.	Cdd	Taiyo Yuden	LMK212BJ475KD-T Series= X5R	Cap= 4.7 uF VDC= 10.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm^2
7.	Cf	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 mm^2
8.	Cin	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 mm^2
9.	Cotp	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
10.	Cout	MuRata	GRM188R60J475KE19D Series= X5R	Cap= 4.7 uF ESR= 5.0 mOhm VDC= 6.3 V IRMS= 2.0 A	1	$0.01	0603 5 mm^2
11.	Cs	MuRata	GRM155R71C224KA12D Series= X7R	Cap= 220.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2

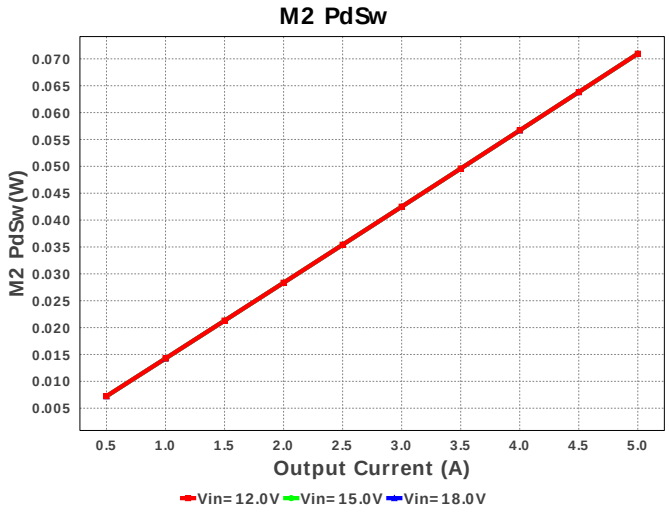
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
12.	Csby	MuRata	GRM0335C1E101JA01D Series= C0G/NP0	Cap= 100.0 pF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
13.	Css	MuRata	GRM033R60J333KE01D Series= X5R	Cap= 33.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
14.	Dboot	Diodes Inc.	SBR0230T5-7-F	VF@Io= 580.0 mV VRRM= 30.0 V	1	$0.10	SOD-523 5 mm²
15.	L1	Wurth Elektronik	7443340330	L= 3.3 µH DCR= 6.5 mOhm	1	$1.79	 WE-HCC-8X7 103 mm²
16.	M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	$0.28	 TRANS_NexFET_Q3 18 mm²
17.	M2	Texas Instruments	CSD18504Q5A	VdsMax= 40.0 V IdsMax= 50.0 Amps	1	$0.37	 TRANS_NexFET_Q5A 55 mm²
18.	Q1	Diodes Inc.	MMBT3904T	Bipolar Transistor	1	$0.04	 SOT-523 7 mm²
19.	Rc1	Vishay-Dale	CRCW04023K24FKED Series= CRCW..e3	Res= 3.24 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
20.	Rc2	Vishay-Dale	CRCW0402107RFKED Series= CRCW..e3	Res= 107.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
21.	Rcs	Vishay-Dale	CRCW04024K32FKED Series= CRCW..e3	Res= 4.32 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
22.	Rf	Vishay-Dale	CRCW04022R21FKED Series= CRCW..e3	Res= 2.21 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
23.	Rfadj	Vishay-Dale	CRCW040211K0FKED Series= CRCW..e3	Res= 11.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
24.	Rfbb	Vishay-Dale	CRCW04022K74FKED Series= CRCW..e3	Res= 2.74 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
25.	Rfbt	Vishay-Dale	CRCW040220K0FKED Series= CRCW..e3	Res= 20.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
26.	Rotp	Vishay-Dale	CRCW040284K5FKED Series= CRCW..e3	Res= 84.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
27.	Rpgood	Vishay-Dale	CRCW040251K1FKED Series= CRCW..e3	Res= 51.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
28.	Rs	Vishay-Dale	CRCW04022K32FKED Series= CRCW..e3	Res= 2.32 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
29.	Rset	Vishay-Dale	CRCW04024K32FKED Series= CRCW..e3	Res= 4.32 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

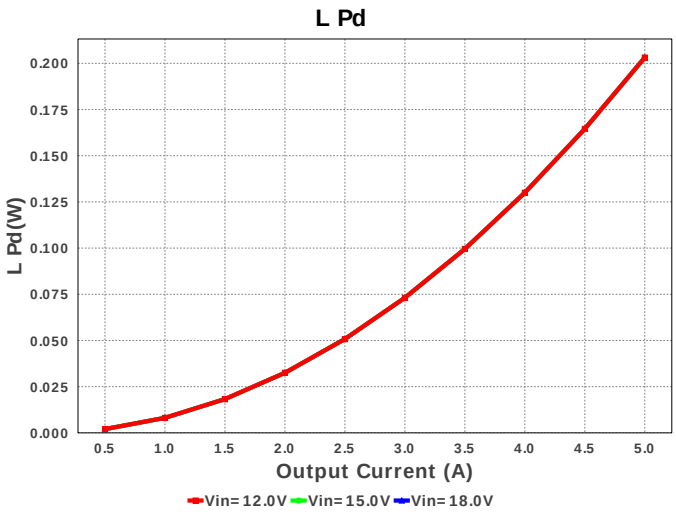
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
30.	U1	Texas Instruments	LM27403SQ/NOPB	Switcher	1	$0.95	 WQFN-24 25 mm^2

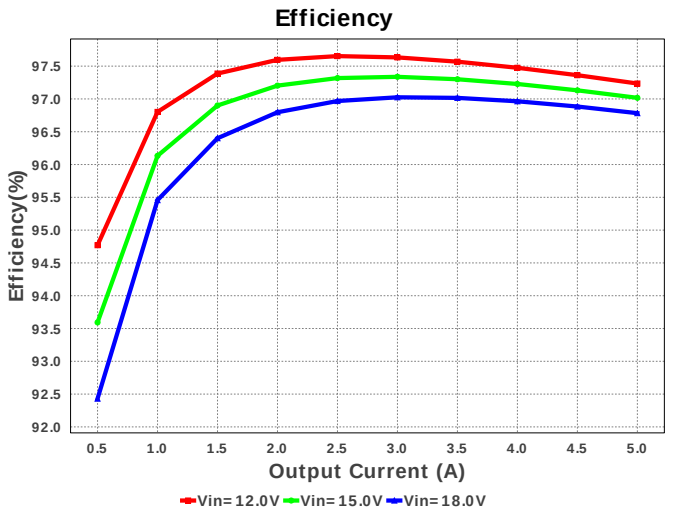


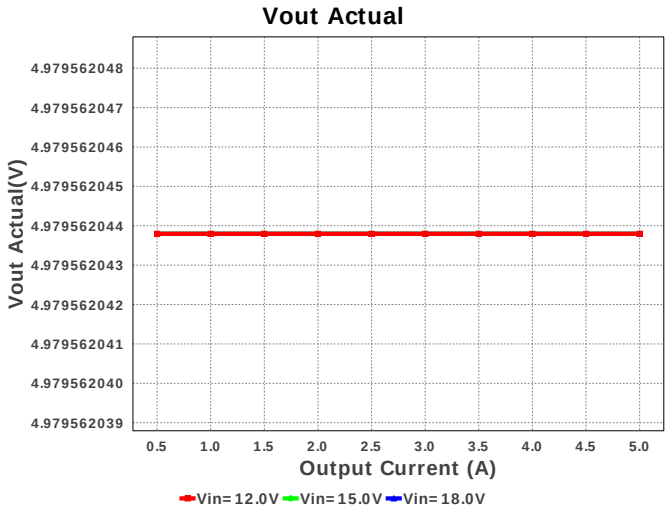


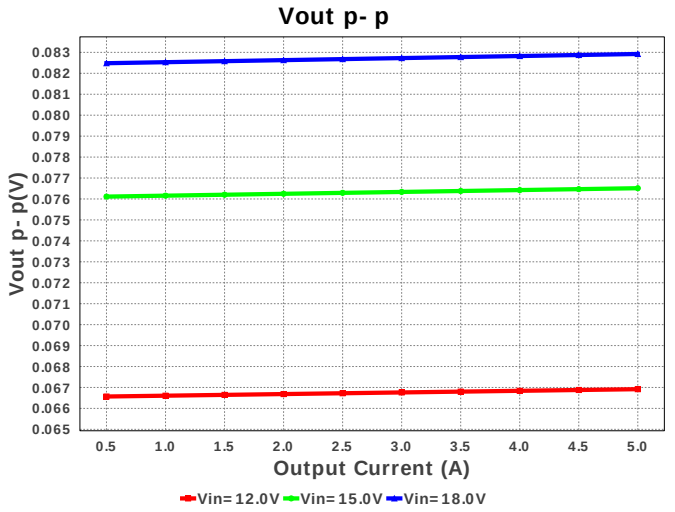


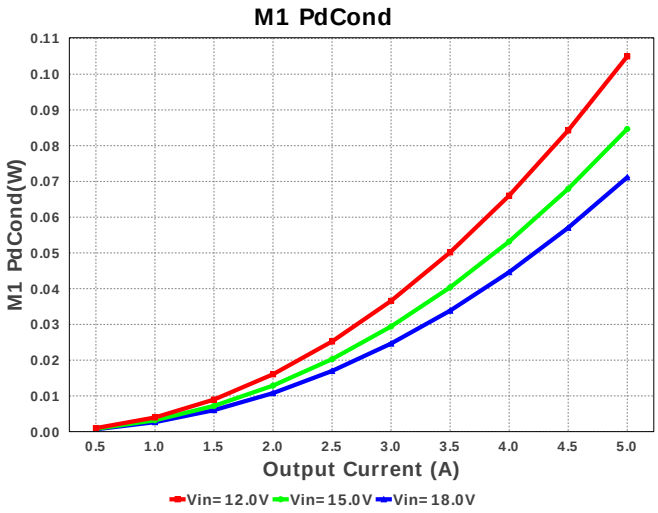


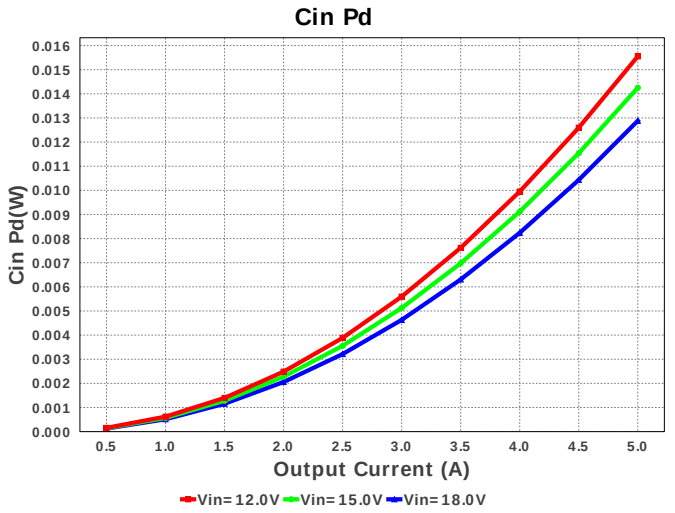


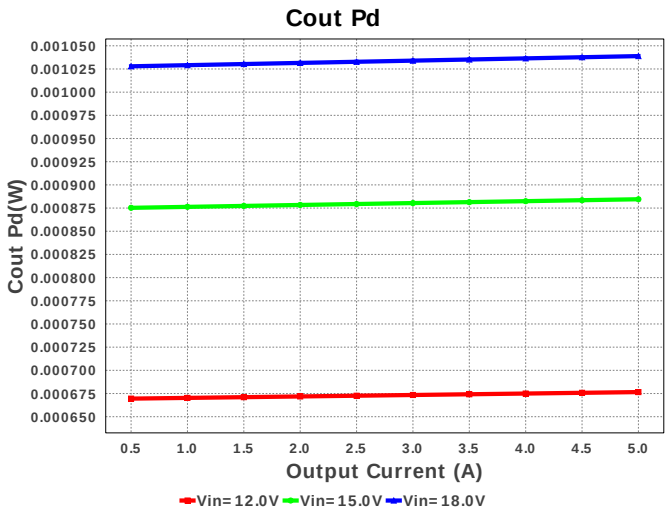


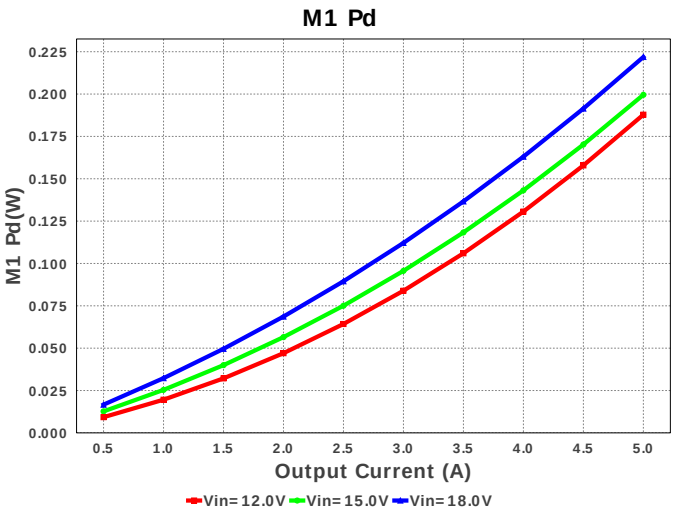


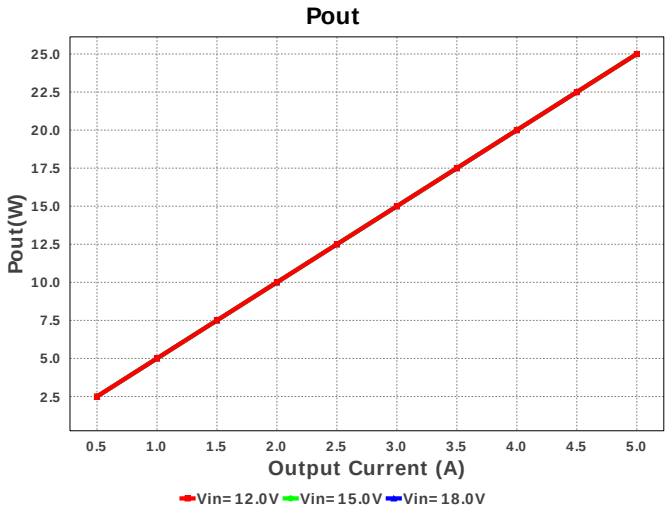


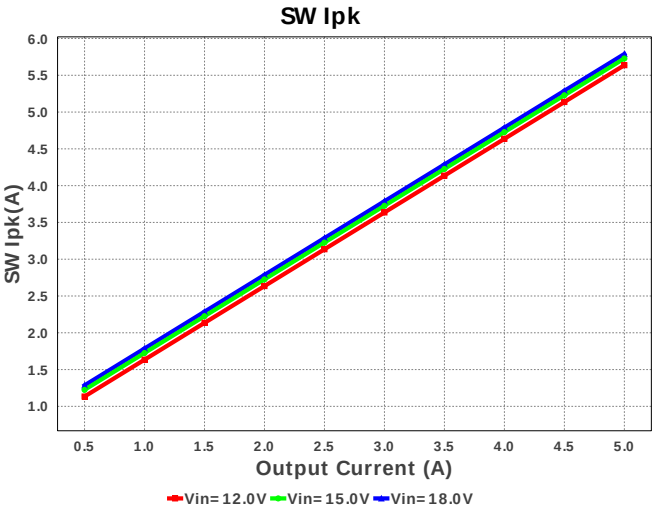


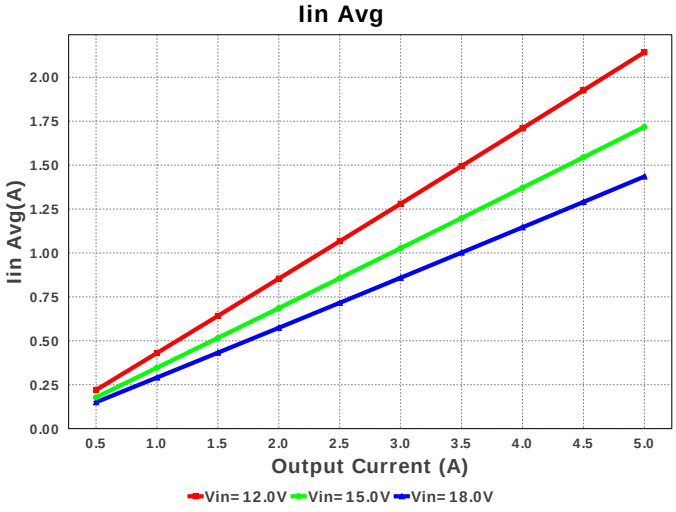


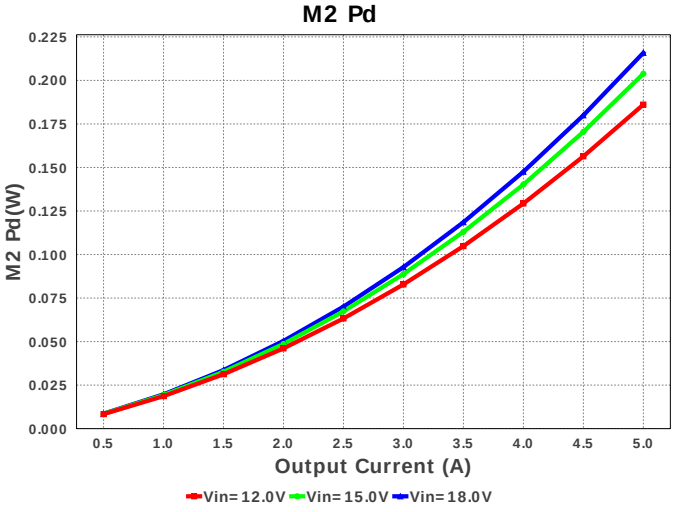


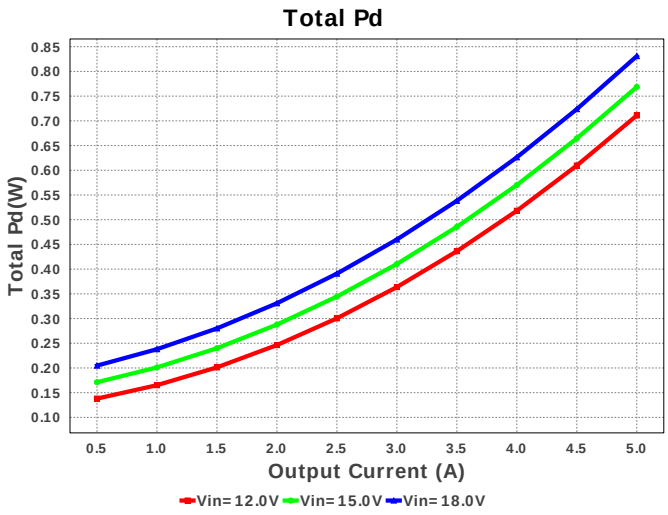


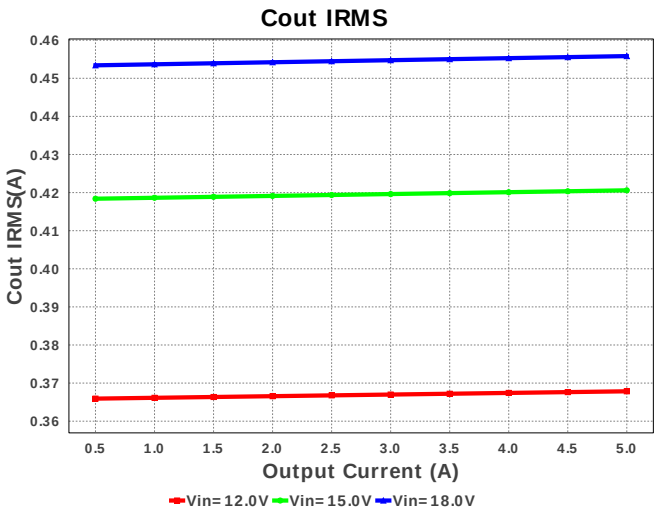


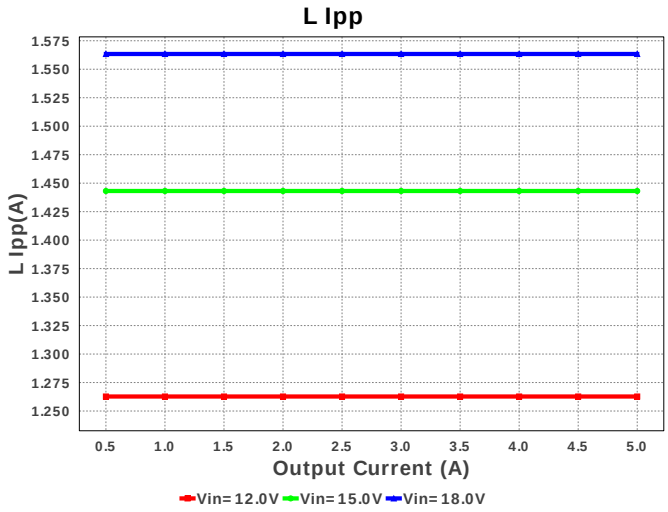


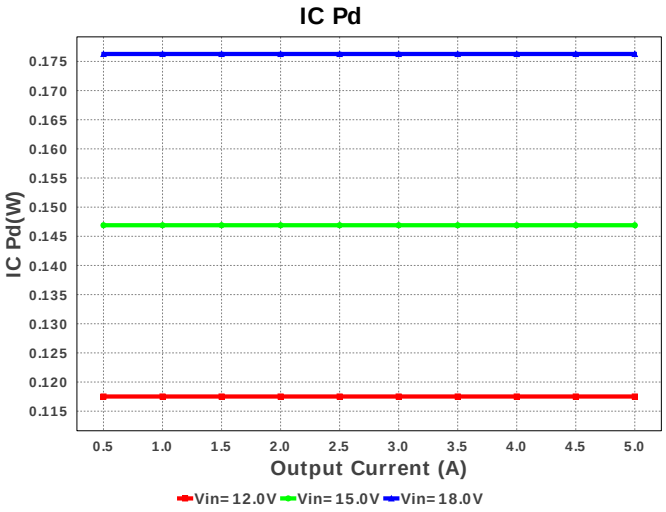


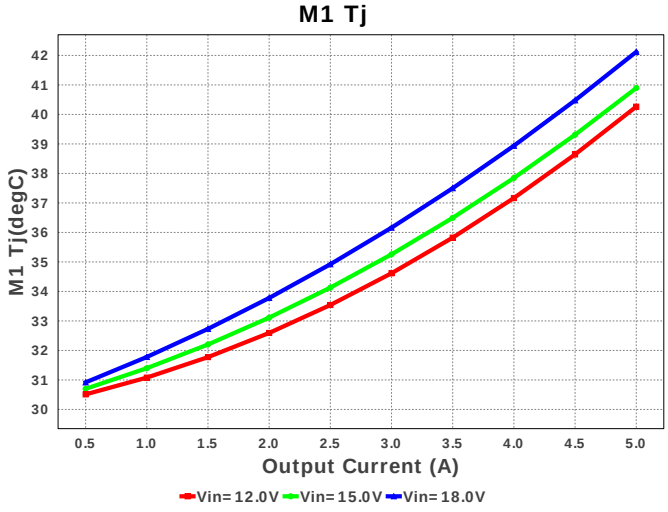


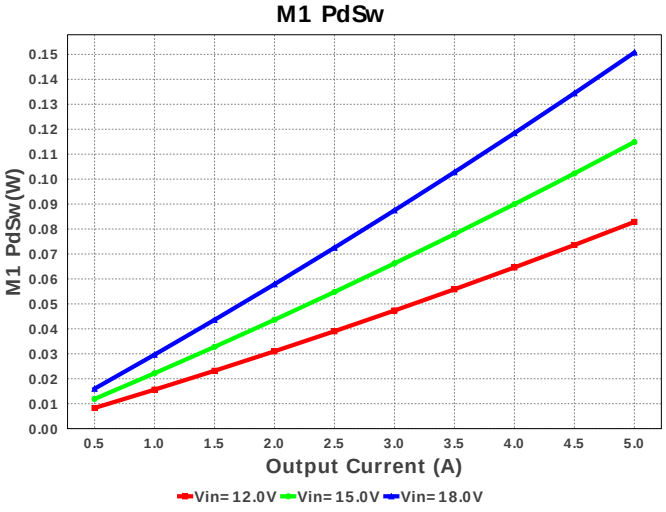


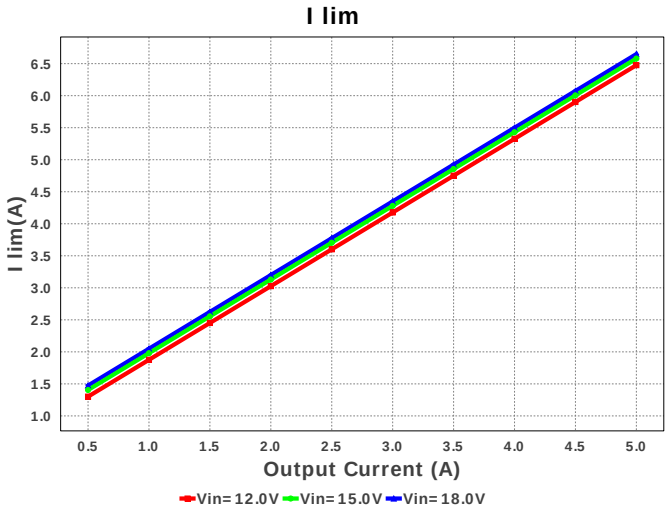


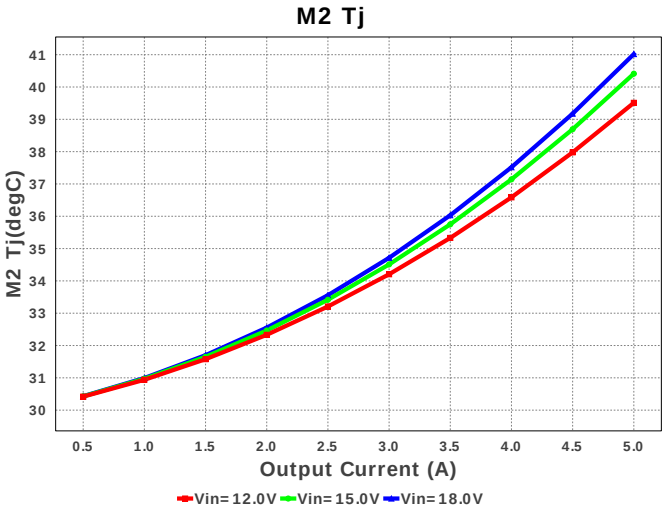


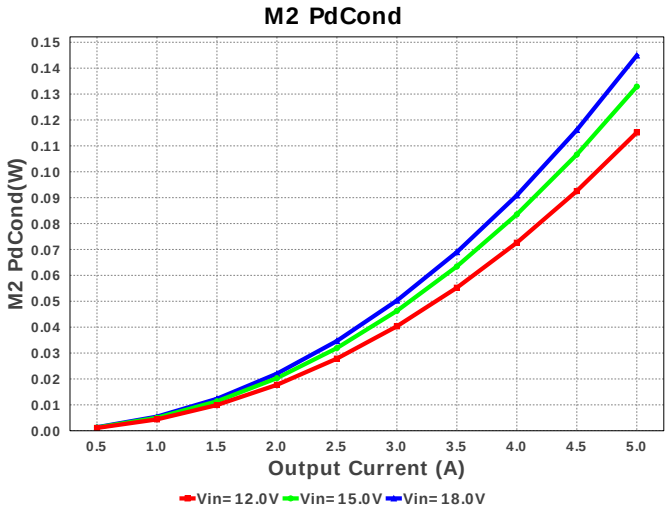


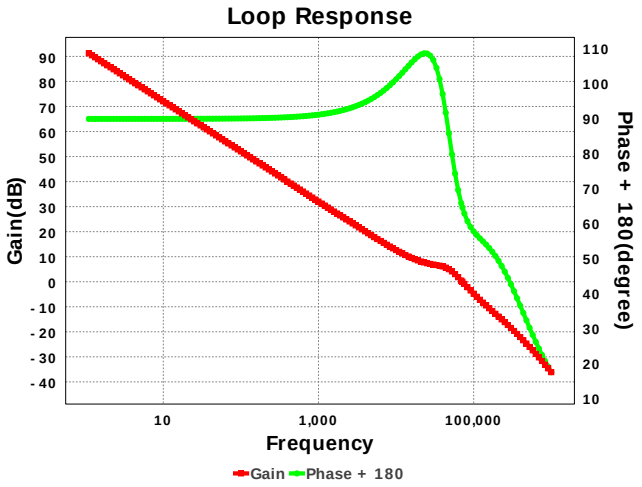












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.246 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	455.825 mA	Current	Output capacitor RMS ripple current
3.	I lim	6.649 A	Current	Current limit threshold
4.	Iin Avg	1.435 A	Current	Average input current
5.	L Ipp	1.579 A	Current	Peak-to-peak inductor ripple current
6.	SW Ipk	5.79 A	Current	Peak switch current
7.	BOM Count	30	General	Total Design BOM count
8.	FootPrint	304.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	699.939 kHz	General	Switching frequency
10.	IC Tolerance	6.0 mV	General	IC Feedback Tolerance
11.	Mode	CCM	General	Conduction Mode
12.	Pout	25.0 W	General	Total output power
13.	Total BOM	$3.91	General	Total BOM Cost
14.	Low Freq Gain	91.237 dB	Op_Point	Gain at 10Hz
15.	Vout Actual	4.98 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
16.	Cross Freq	71.614 kHz	Op_point	Bode plot crossover frequency
17.	Duty Cycle	28.056 %	Op_point	Duty cycle
18.	Efficiency	96.783 %	Op_point	Steady state efficiency
19.	Gain Marg	-47.888 dB	Op_point	Bode Plot Gain Margin
20.	IC Tj	35.764 degC	Op_point	IC junction temperature
21.	IOUT_OP	5.0 A	Op_point	Iout operating point
22.	M1 Tj	42.121 degC	Op_point	M1 MOSFET junction temperature
23.	M2 Tj	41.018 degC	Op_point	M2 MOSFET junction temperature
24.	Phase Marg	64.725 deg	Op_point	Bode Plot Phase Margin
25.	VIN_OP	18.0 V	Op_point	Vin operating point
26.	Vout p-p	82.923 mV	Op_point	Peak-to-peak output ripple voltage
27.	Cin Pd	12.883 mW	Power	Input capacitor power dissipation
28.	Cout Pd	1.039 mW	Power	Output capacitor power dissipation
29.	IC Pd	176.277 mW	Power	IC power dissipation
30.	L Pd	203.125 mW	Power	Inductor power dissipation
31.	M1 Pd	221.886 mW	Power	M1 MOSFET total power dissipation

#	Name	Value	Category	Description
32.	M1 PdCond	71.143 mW	Power	M1 MOSFET conduction losses
33.	M1 PdSw	150.743 mW	Power	M1 MOSFET switching losses
34.	M2 Pd	215.849 mW	Power	M2 MOSFET total power dissipation
35.	M2 PdCond	144.898 mW	Power	M2 MOSFET conduction losses
36.	M2 PdSw	70.951 mW	Power	M2 MOSFET switching losses
37.	Total Pd	831.009 mW	Power	Total Power Dissipation
38.	Vout Tolerance	2.795 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	5.0	Maximum Output Current
2.	VinMax	18.0	Maximum input voltage
3.	VinMin	12.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	LM27403	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	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.