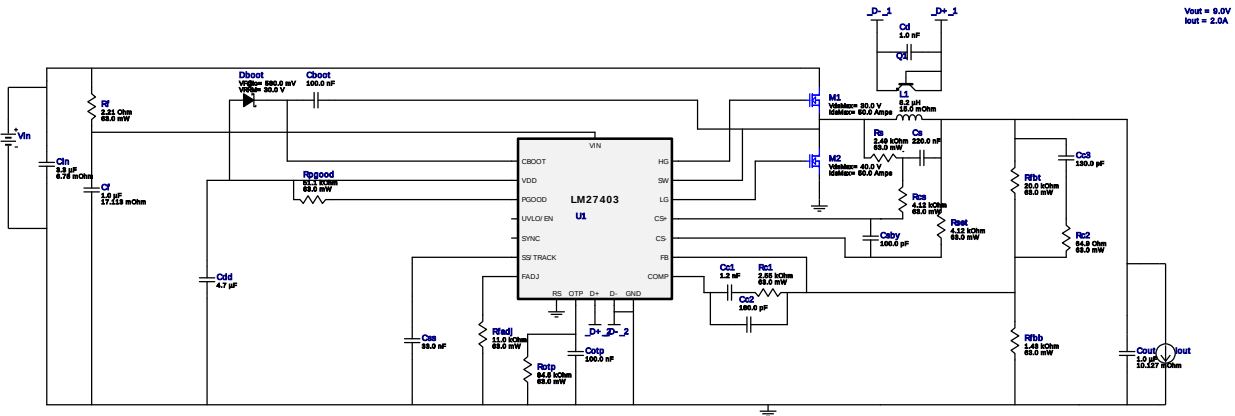


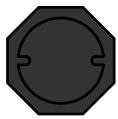
WEBENCH® Design Report

Design : 4801973/6 LM27403SQ/NOPB
LM27403SQ/NOPB 15.0V-18.0V to 9.00V @ 2.0A

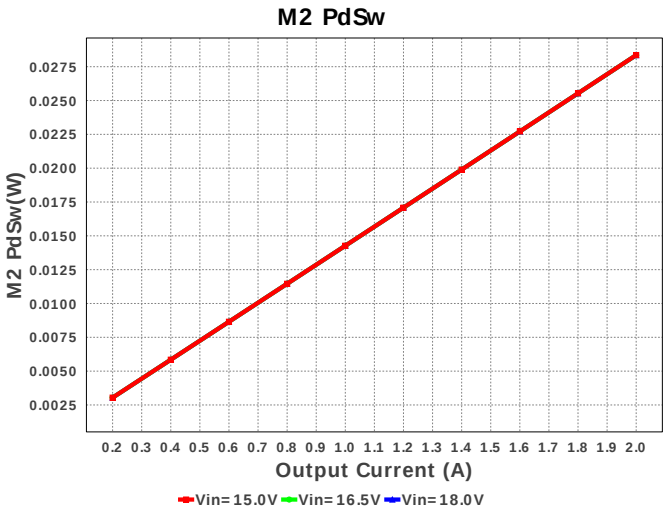
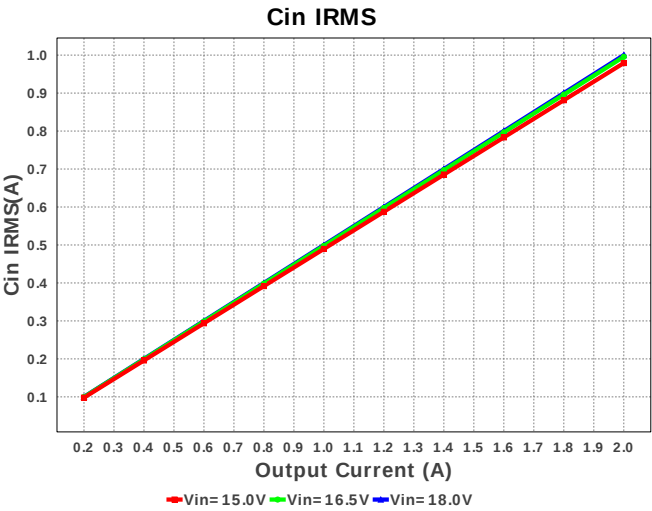
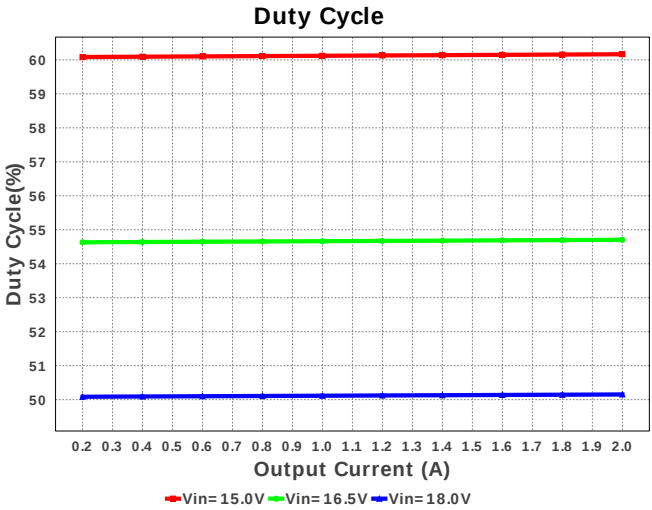
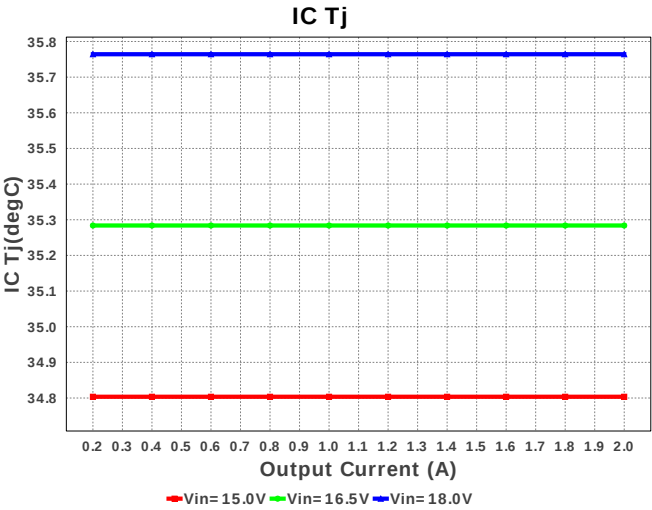


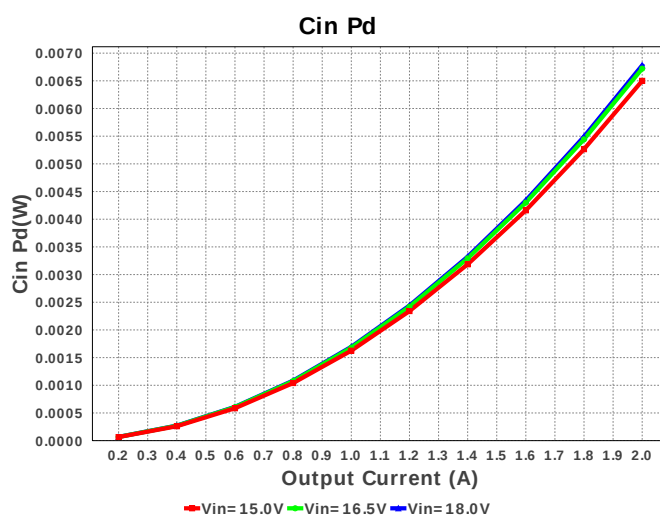
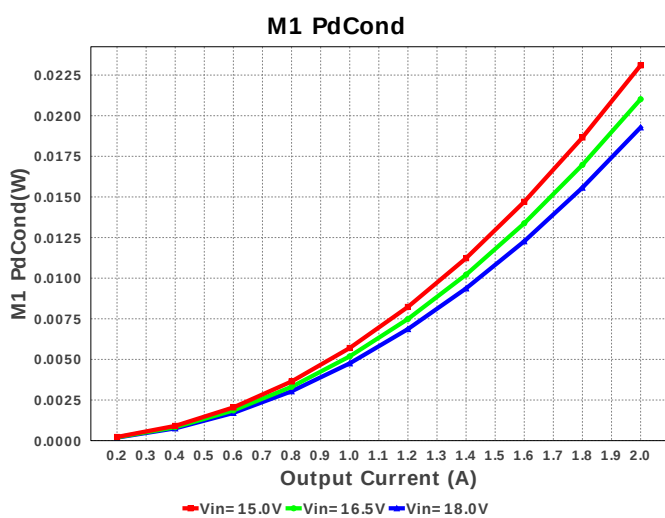
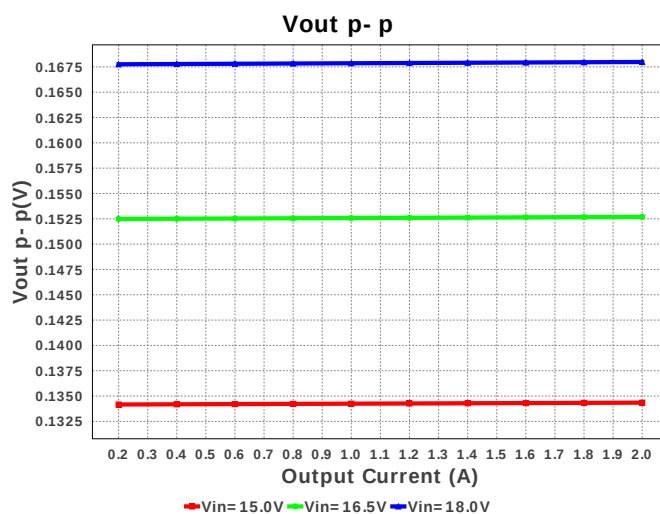
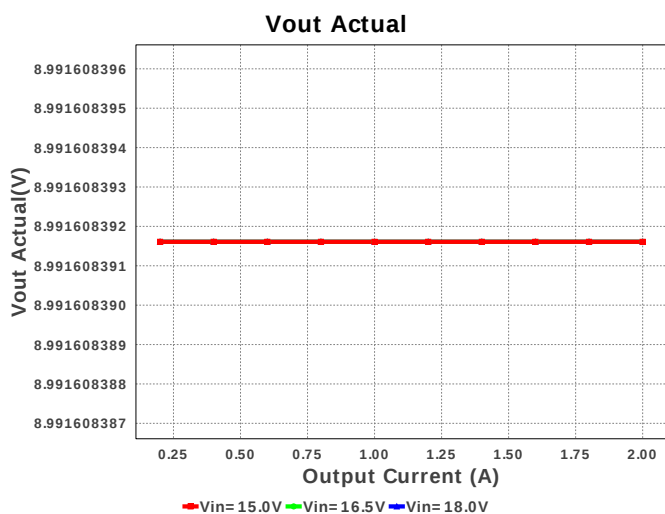
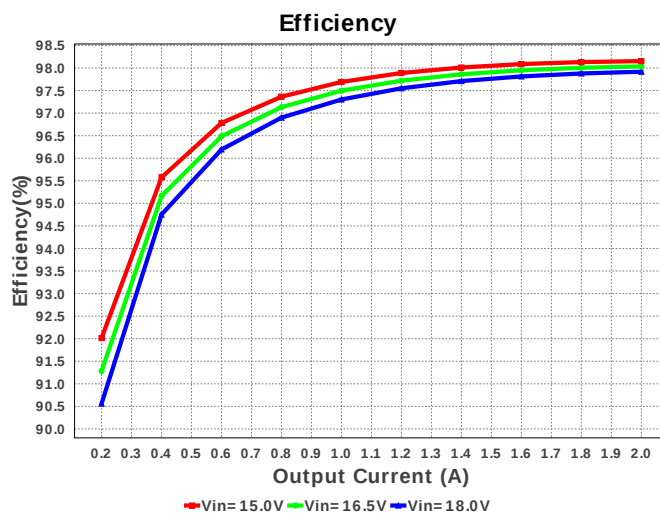
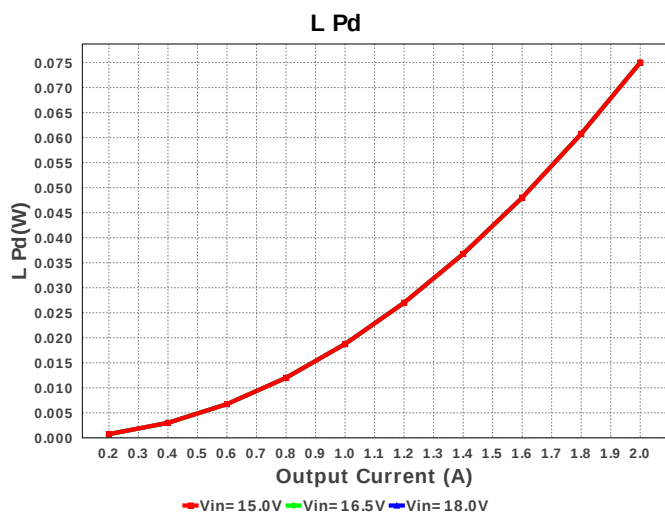
Electrical BOM

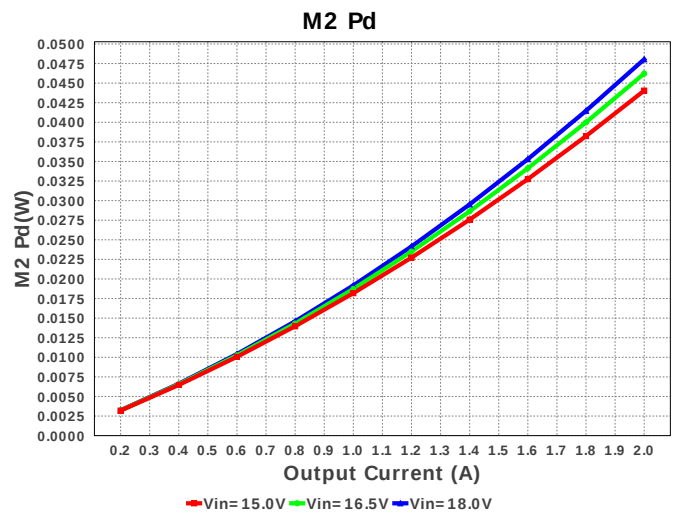
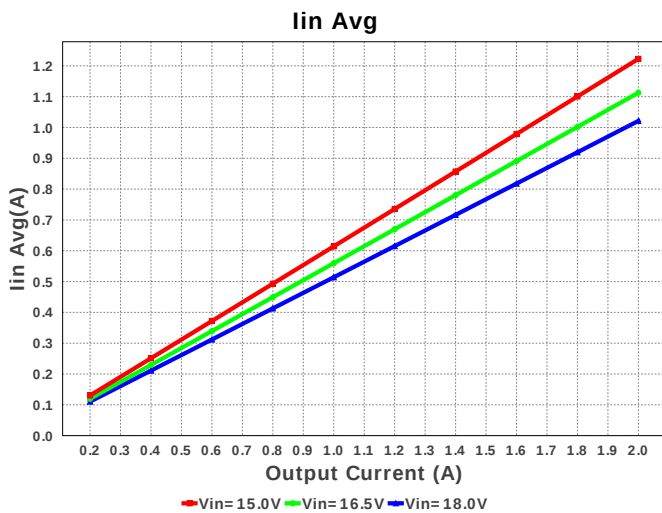
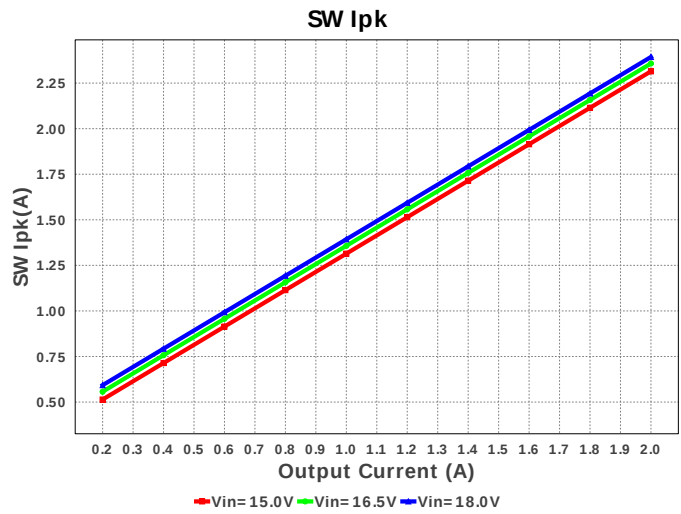
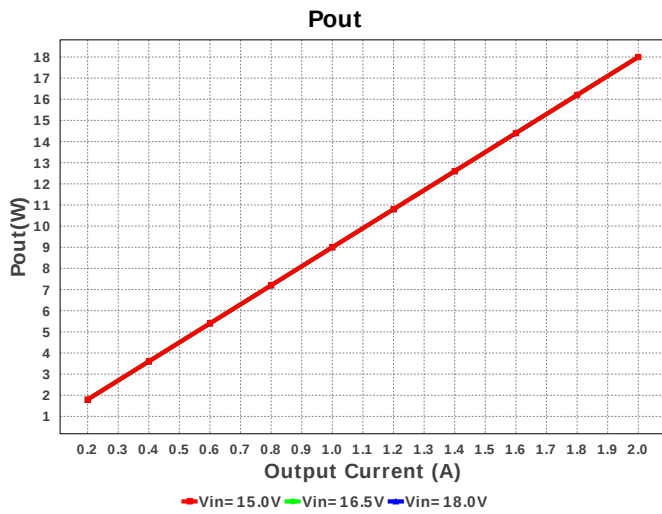
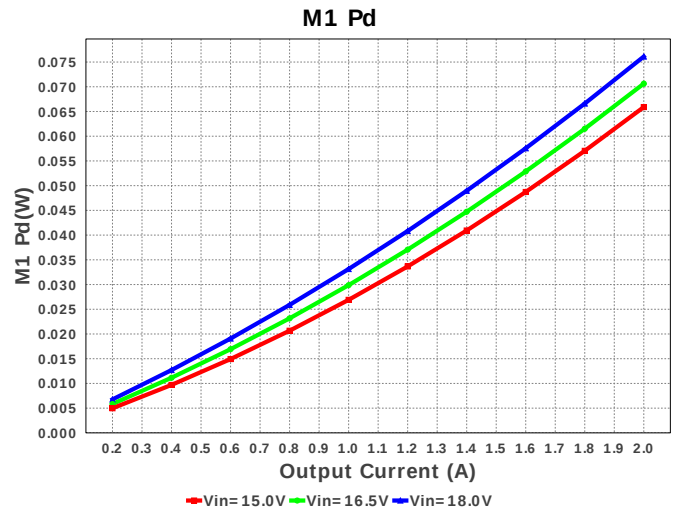
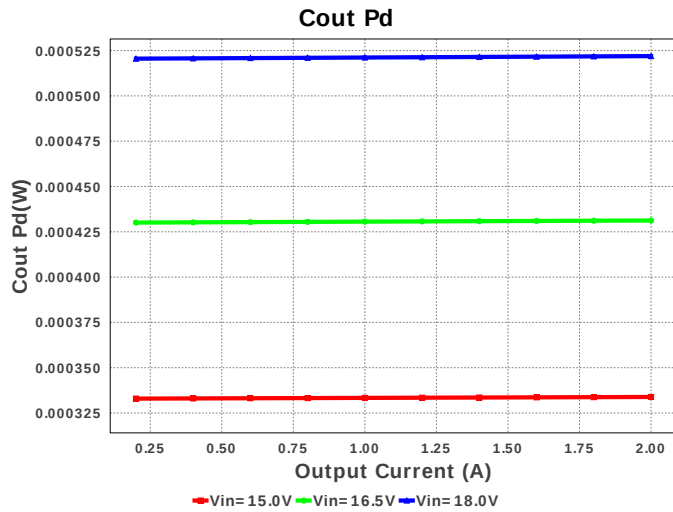
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155R61C104KA88D Series= X5R	Cap= 100.0 nF VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
2.	Cc1	Samsung Electro-Mechanics	CL21C122JBFNNWE Series= C0G/NP0	Cap= 1.2 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
3.	Cc2	Kemet	C0805C181K5GACTU Series= C0G/NP0	Cap= 180.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
4.	Cc3	Samsung Electro-Mechanics	CL21C131JBANNNC Series= C0G/NP0	Cap= 130.0 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	MuRata	GRM21BR71E335KA73L Series= X7R	Cap= 3.3 uF ESR= 6.78 mOhm VDC= 25.0 V IRMS= 1.4 A	1	\$0.06	0805 7 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	GRM188R61C105KA93D Series= X5R	Cap= 1.0 uF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.63 mA	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

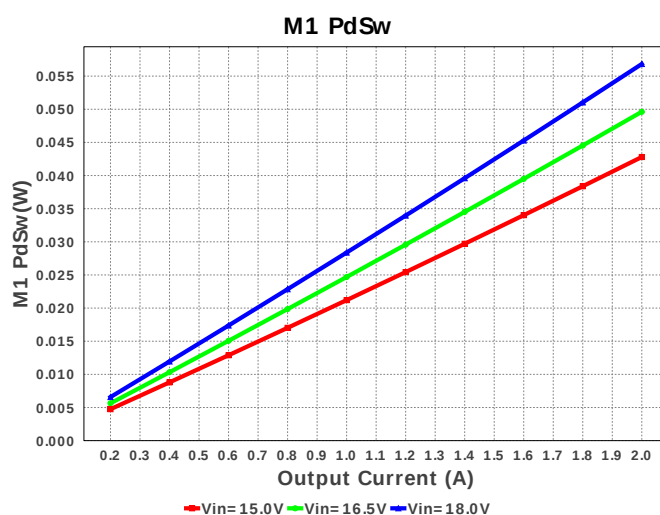
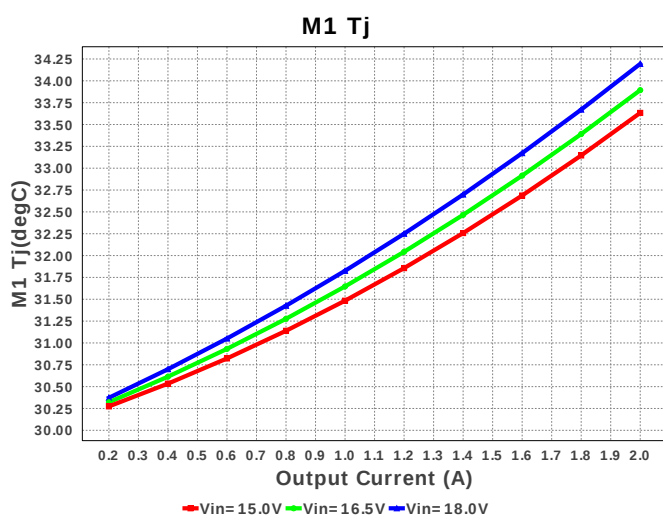
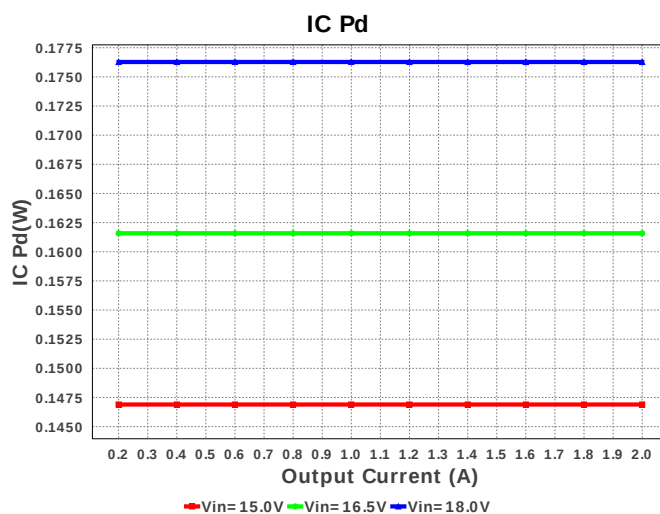
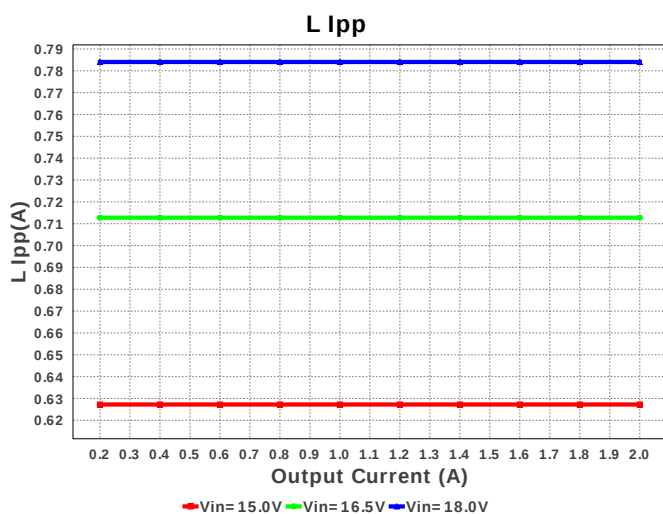
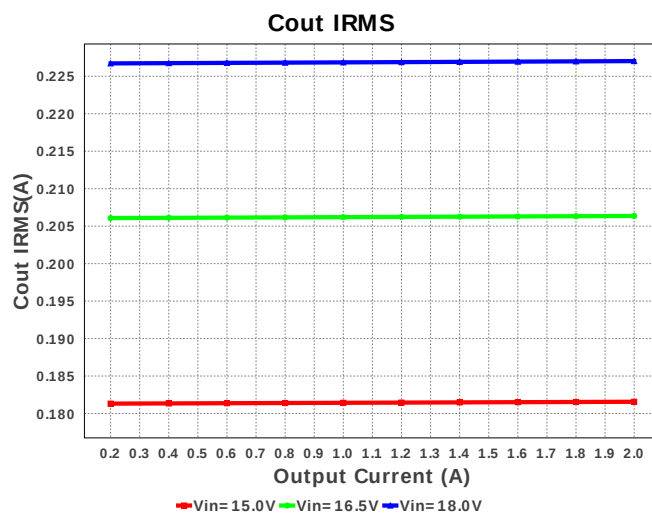
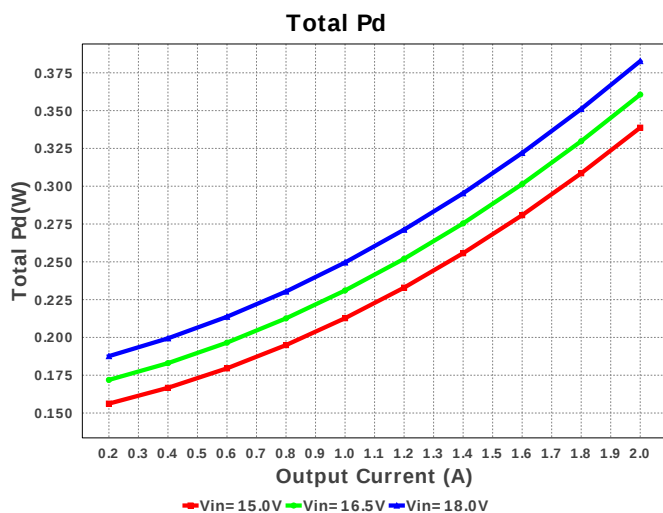
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12.	Csby	MuRata	GRM0335C1E101JA01D Series= C0G/NP0	Cap= 100.0 pF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0201 2 mm ²
13.	Css	MuRata	GRM033R60J333KE01D Series= X5R	Cap= 33.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	 0201 2 mm ²
14.	Dboot	Diodes Inc.	SBR0230T5-7-F	VF@Io= 580.0 mV VRRM= 30.0 V	1	\$0.10	 SOD-523 5 mm ²
15.	L1	Bourns	SRU1048-8R2Y	L= 8.2 µH DCR= 15.0 mOhm	1	\$0.33	 SRU1048 144 mm ²
16.	M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	\$0.28	 DQG0008A 18 mm ²
17.	M2	Texas Instruments	CSD18504Q5A	VdsMax= 40.0 V IdsMax= 50.0 Amps	1	\$0.37	 TRANS_NexFET_Q5A 55 mm ²
18.	Q1	Diodes Inc.	MMBT3904T	Bipolar Transistor	1	\$0.04	 SOT-523 7 mm ²
19.	Rc1	Vishay-Dale	CRCW04022K55FKED Series= CRCW..e3	Res= 2.55 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
20.	Rc2	Vishay-Dale	CRCW040264R9FKED Series= CRCW..e3	Res= 64.9 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
21.	Rcs	Vishay-Dale	CRCW04024K12FKED Series= CRCW..e3	Res= 4.12 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
22.	Rf	Vishay-Dale	CRCW04022R21FKED Series= CRCW..e3	Res= 2.21 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
23.	Rfadj	Vishay-Dale	CRCW040211K0FKED Series= CRCW..e3	Res= 11.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
24.	Rfbb	Vishay-Dale	CRCW04021K43FKED Series= CRCW..e3	Res= 1.43 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
25.	Rfbt	Vishay-Dale	CRCW040220K0FKED Series= CRCW..e3	Res= 20.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
26.	Rotp	Vishay-Dale	CRCW040284K5FKED Series= CRCW..e3	Res= 84.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
27.	Rpgood	Vishay-Dale	CRCW040251K1FKED Series= CRCW..e3	Res= 51.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
28.	Rs	Vishay-Dale	CRCW04022K49FKED Series= CRCW..e3	Res= 2.49 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
29.	Rset	Vishay-Dale	CRCW04024K12FKED Series= CRCW..e3	Res= 4.12 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

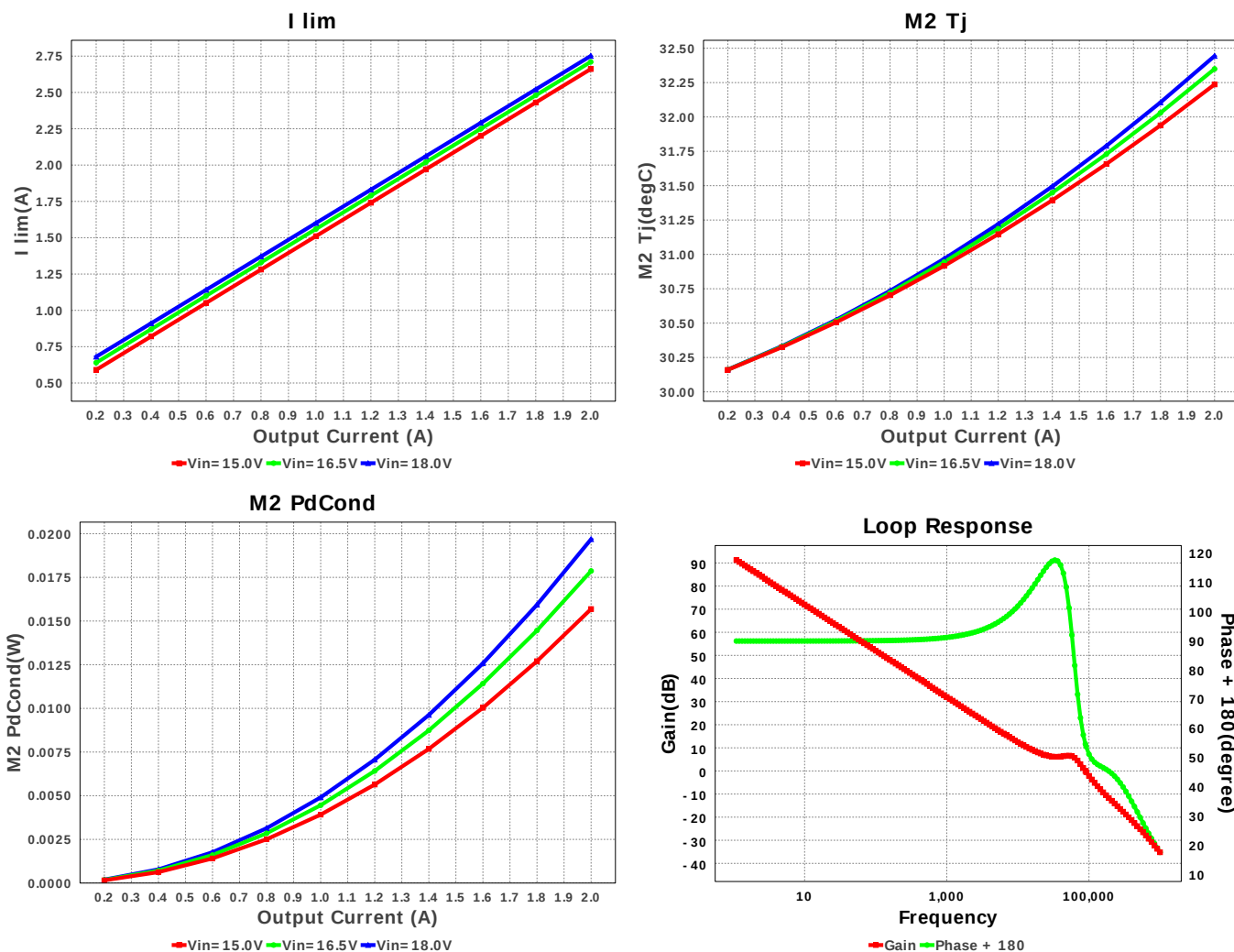
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
30.	U1	Texas Instruments	LM27403SQ/NOPB	Switcher	1	\$0.95	 WQFN-24 25 mm²











Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	999.995 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	227.025 mA	Current	Output capacitor RMS ripple current
3.	I lim	2.751 A	Current	Current limit threshold
4.	Iin Avg	1.021 A	Current	Average input current
5.	L Ipp	786.44 mA	Current	Peak-to-peak inductor ripple current
6.	SW Ipk	2.393 A	Current	Peak switch current
7.	BOM Count	30	General	Total Design BOM count
8.	FootPrint	346.0 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	18.0 W	General	Total output power
13.	Total BOM	\$2.38	General	Total BOM Cost
14.	Low Freq Gain	91.226 dB	Op_Point	Gain at 10Hz
15.	Vout Actual	8.992 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
16.	Cross Freq	89.087 kHz	Op_point	Bode plot crossover frequency
17.	Duty Cycle	50.153 %	Op_point	Duty cycle
18.	Efficiency	97.918 %	Op_point	Steady state efficiency
19.	Gain Marg	-47.207 dB	Op_point	Bode Plot Gain Margin
20.	IC Tj	35.764 degC	Op_point	IC junction temperature
21.	IOUT_OP	2.0 A	Op_point	Iout operating point
22.	M1 Tj	34.194 degC	Op_point	M1 MOSFET junction temperature
23.	M2 Tj	32.444 degC	Op_point	M2 MOSFET junction temperature
24.	Phase Marg	54.774 deg	Op_point	Bode Plot Phase Margin
25.	VIN_OP	18.0 V	Op_point	Vin operating point
26.	Vout p-p	167.983 mV	Op_point	Peak-to-peak output ripple voltage
27.	Cin Pd	6.78 mW	Power	Input capacitor power dissipation
28.	Cout Pd	521.951 μW	Power	Output capacitor power dissipation
29.	IC Pd	176.277 mW	Power	IC power dissipation
30.	L Pd	75.0 mW	Power	Inductor power dissipation
31.	M1 Pd	76.11 mW	Power	M1 MOSFET total power dissipation

#	Name	Value	Category	Description
32.	M1 PdCond	19.281 mW	Power	M1 MOSFET conduction losses
33.	M1 PdSw	56.829 mW	Power	M1 MOSFET switching losses
34.	M2 Pd	48.04 mW	Power	M2 MOSFET total power dissipation
35.	M2 PdCond	19.685 mW	Power	M2 MOSFET conduction losses
36.	M2 PdSw	28.355 mW	Power	M2 MOSFET switching losses
37.	Total Pd	382.742 mW	Power	Total Power Dissipation
38.	Vout Tolerance	2.904 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	18.0	Maximum input voltage
3.	VinMin	15.0	Minimum input voltage
4.	Vout	9.0	Output Voltage
5.	base_pn	LM27403	Base Product 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.

Texas Instruments' WEBENCH simulation tools attempt to recreate the performance of a substantially equivalent physical implementation of the design. Simulations are created using Texas Instruments' published specifications as well as the published specifications of other device manufacturers. While Texas Instruments does update this information periodically, this information may not be current at the time the simulation is built. Texas Instruments does not warrant the accuracy or completeness of the specifications or any information contained therein. Texas Instruments does not warrant that any designs or recommended parts will meet the specifications you entered, will be suitable for your application or fit for any particular purpose, or will operate as shown in the simulation in a physical implementation. Texas Instruments does not warrant that the designs are production worthy.

You should completely validate and test your design implementation to confirm the system functionality for your application prior to production.

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