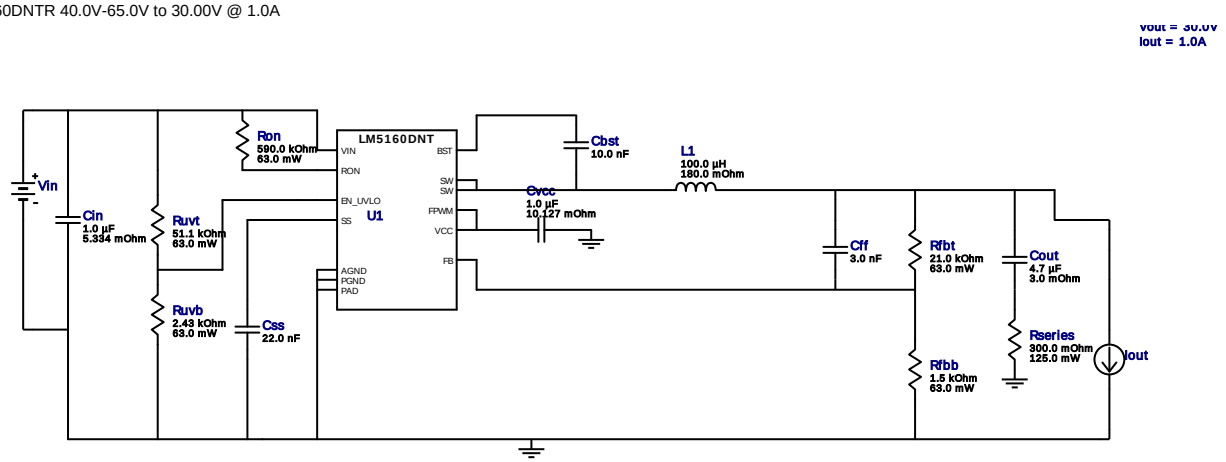
TEXAS INSTRUMENTS

WEBENCH® Design Report

VinMin = 40.0V
VinMax = 65.0V
Vout = 30.0V
Iout = 1.0A

Device = LM5160DNTR
Topology = Buck
Created = 7/9/16 12:50:31 AM
BOM Cost = $2.54
BOM Count = 14
Total Pd = 2.21W

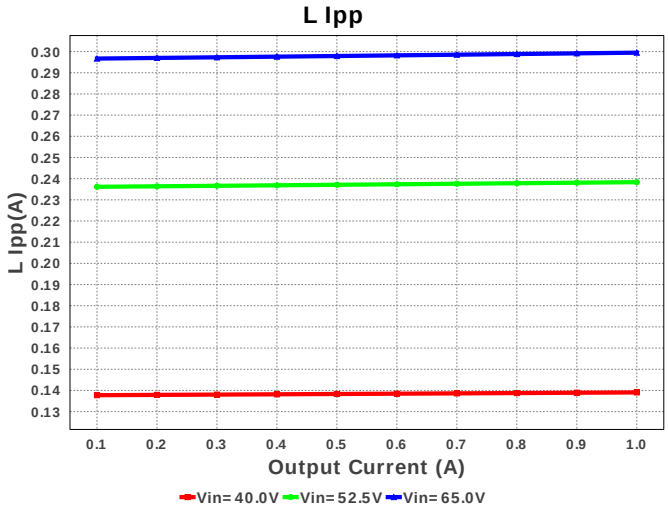
Design : 3735680/9 LM5160DNTR
LM5160DNTR 40.0V-65.0V to 30.00V @ 1.0A

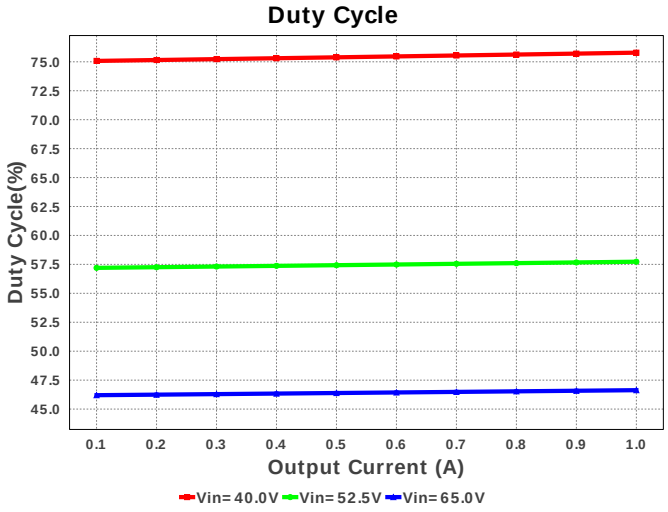


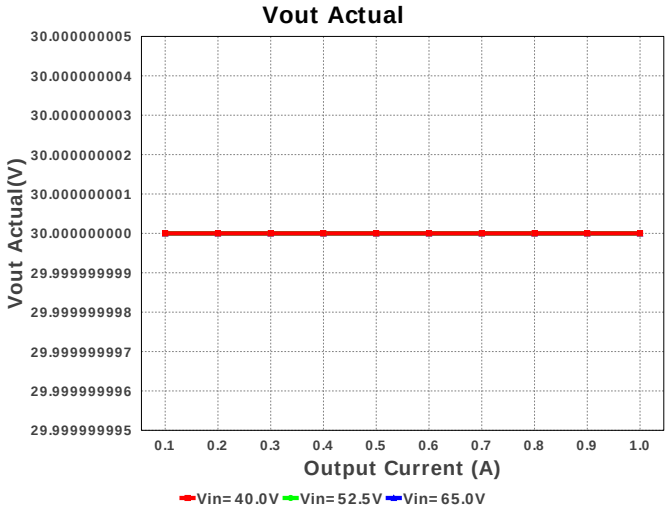
Electrical BOM

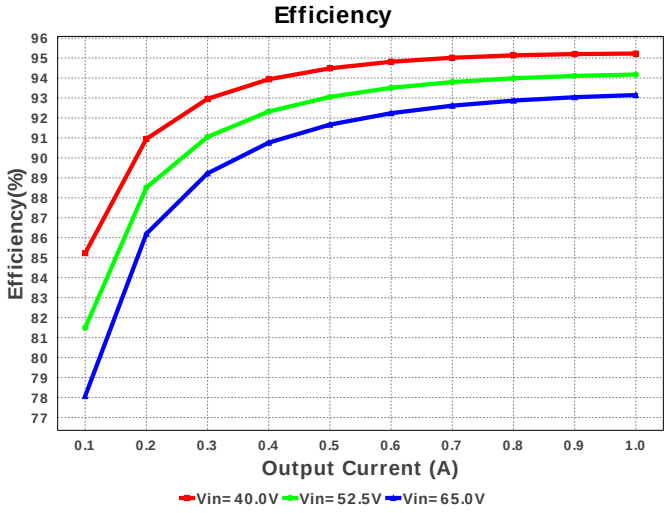
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	MuRata	GRM155R61C103KA01D Series= X5R	Cap= 10.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Cff	Kemet	C0603C302K5GACTU Series= C0G/NP0	Cap= 3.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.07	0603 5 mm²
3.	Cin	MuRata	GRM31CR72A105KA01L Series= X7R	Cap= 1.0 uF ESR= 5.334 mOhm VDC= 100.0 V IRMS= 1.55432 A	1	$0.11	1206_190 11 mm²
4.	Cout	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	1	$0.07	1206 11 mm²
5.	Css	MuRata	GRM155R61C223KA01D Series= X5R	Cap= 22.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
6.	Cvcc	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 mm²
7.	L1	Bourns	SDR1307-101KL	L= 100.0 µH DCR= 180.0 mOhm	1	$0.35	SDR1307 227 mm²
8.	Rfbb	Vishay-Dale	CRCW04021K50FKED Series= CRCW..e3	Res= 1.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
9.	Rfbt	Vishay-Dale	CRCW040221K0FKED Series= CRCW..e3	Res= 21.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
10.	Ron	Vishay-Dale	CRCW0402590KFKED Series= CRCW..e3	Res= 590.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

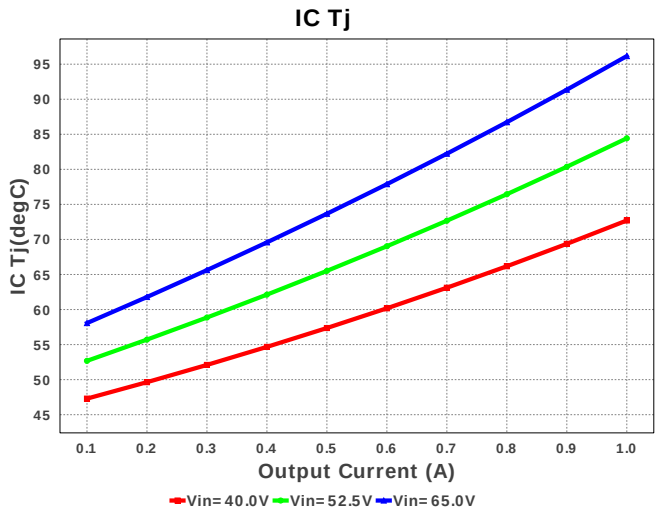
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	Rseries	Panasonic	ERJ-2BQFR30X Series= ERJ-2B	Res= 300.0 mOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.06	0402 3 mm^2
12.	Ruvb	Vishay-Dale	CRCW04022K43FKED Series= CRCW..e3	Res= 2.43 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
13.	Ruvt	Vishay-Dale	CRCW040251K1FKED Series= CRCW..e3	Res= 51.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
14.	U1	Texas Instruments	LM5160DNTR	Switcher	1	$1.80	DNT0012B 25 mm^2

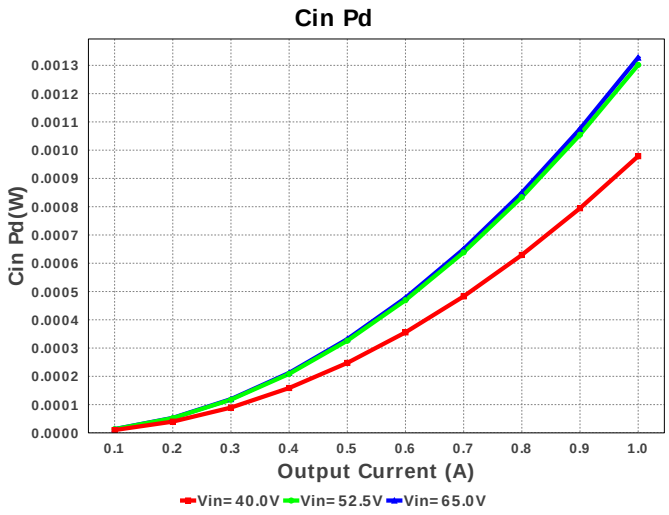


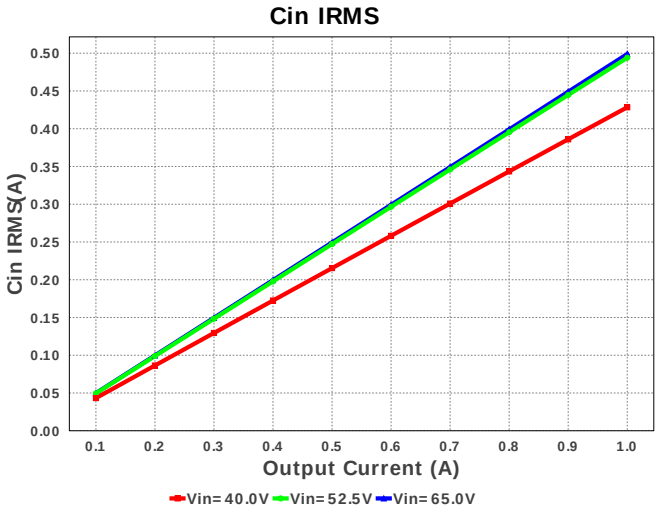


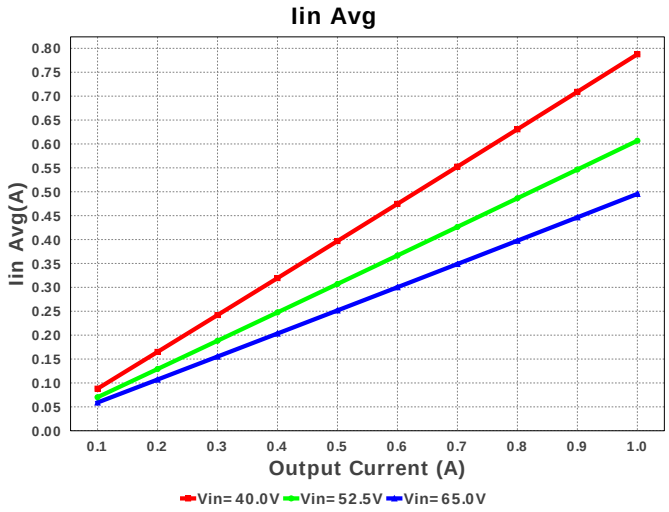


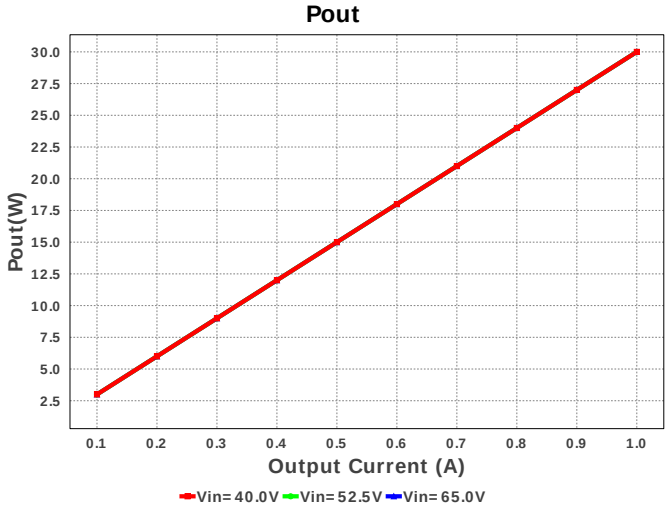


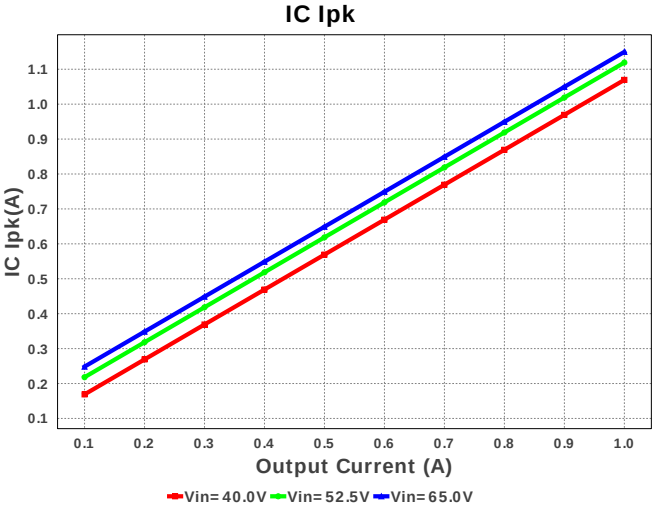


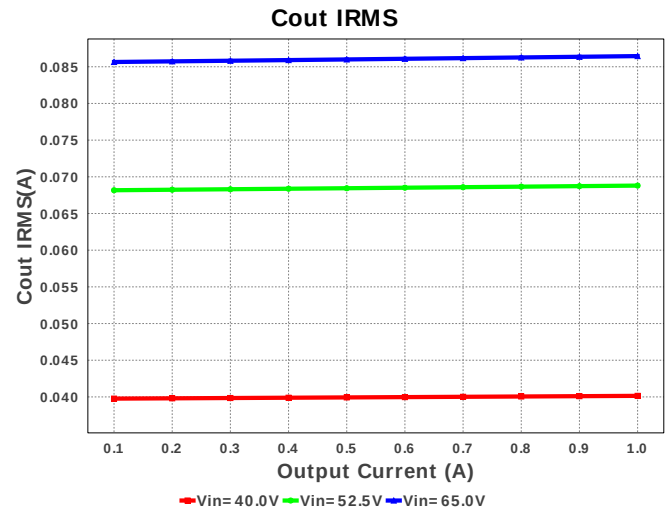


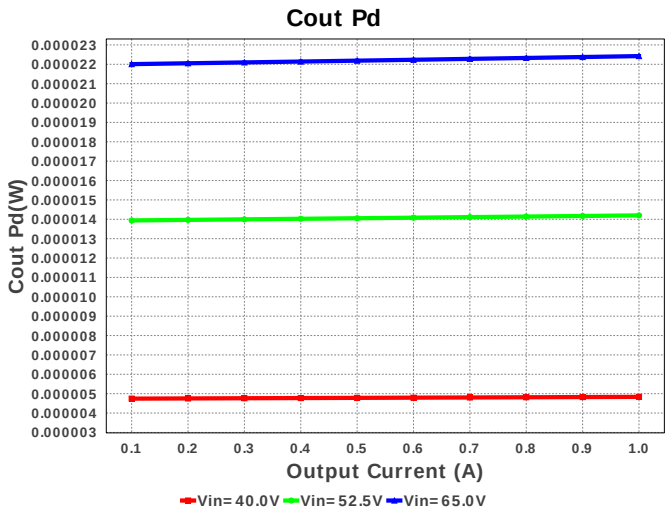


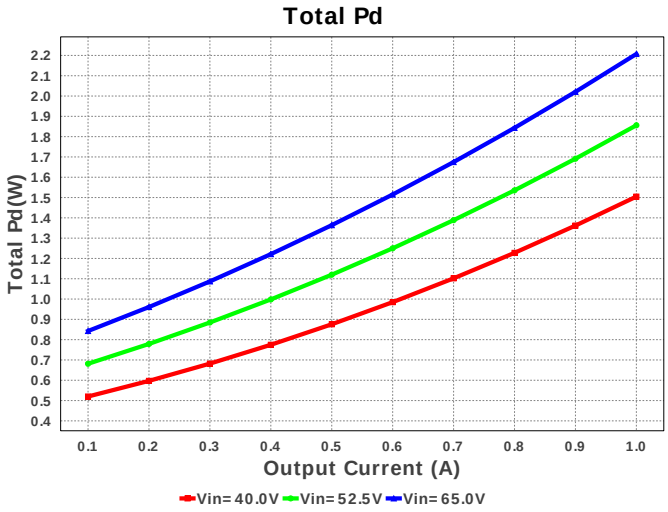


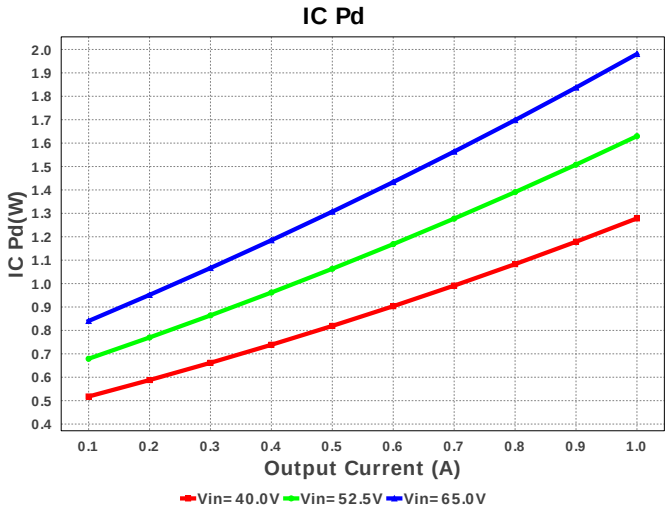


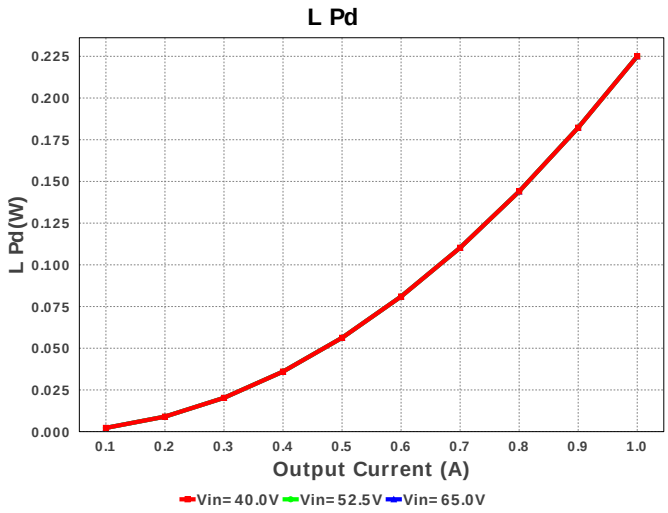












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	498.865 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	86.454 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	1.15 A	Current	Peak switch current in IC
4.	Iin Avg	495.49 mA	Current	Average input current
5.	L Ipp	299.48 mA	Current	Peak-to-peak inductor ripple current
6.	BOM Count	14	General	Total Design BOM count
7.	FootPrint	307.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	544.989 kHz	General	Switching frequency
9.	Pout	30.0 W	General	Total output power
10.	Total BOM	$2.54	General	Total BOM Cost
11.	Vout Actual	30.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors

#	Name	Value	Category	Description
12.	Vout OP	30.0 V	Op_Point	Operational Output Voltage
13.	Duty Cycle	46.633 %	Op_point	Duty cycle
14.	Efficiency	93.147 %	Op_point	Steady state efficiency
15.	IC Tj	96.155 degC	Op_point	IC junction temperature
16.	ICThetaJA	33.4 degC/W	Op_point	IC junction-to-ambient thermal resistance
17.	IOUT_OP	1.0 A	Op_point	Iout operating point
18.	VIN_OP	65.0 V	Op_point	Vin operating point
19.	Cin Pd	1.327 mW	Power	Input capacitor power dissipation
20.	Cout Pd	22.423 µW	Power	Output capacitor power dissipation
21.	IC Pd	1.981 W	Power	IC power dissipation
22.	L Pd	225.0 mW	Power	Inductor power dissipation
23.	Total Pd	2.207 W	Power	Total Power Dissipation
24.	Vout Tolerance	3.159 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	Maximum Output Current
2.	VinMax	65.0	Maximum input voltage
3.	VinMin	40.0	Minimum input voltage
4.	Vout	30.0	Output Voltage
5.	base_pn	LM5160	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. For a Constant On Time device to be stable, we need to provide a ripple at the feedback comparator. There are various methods to implement the ripple. Depending on the circuit complexity vs. the allowable ripple, we have three options to choose from. The simplest option, 'Low Complexity', would require only a high ESR cap at the output. This means that the BOM count will be small, but the output voltage ripple will be quite large. The 'Optimal Solution' would require a feed-forward cap in parallel with the upper feedback resistor to AC couple the ripple to the feedback node. This increases the BOM count slightly, but now we have more control over the output voltage ripple. If the output voltage requirement is very tight, then the best option is to go for the 'Low Output Ripple' solution. In this option we can go with very low ESR output caps and have very good control over the output voltage ripple.

2. LM5160 Product Folder : http://www.ti.com/product/LM5160 : contains the data sheet and other resources.