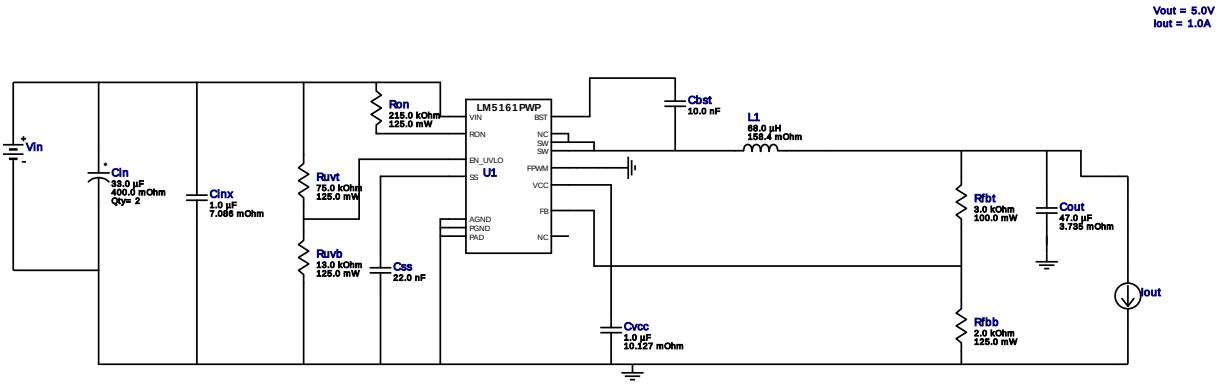
TEXAS INSTRUMENTS

WEBENCH® Design Report

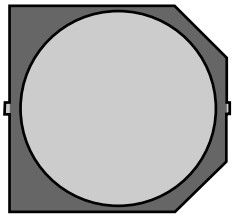
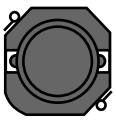
VinMin = 10.0V
VinMax = 80.0V
Vout = 5.0V
Iout = 1.0A

Device = LM5161PWPR
Topology = Buck
Created = 8/24/16 8:27:12 PM
BOM Cost = $5.30
BOM Count = 14
Total Pd = 1.39W

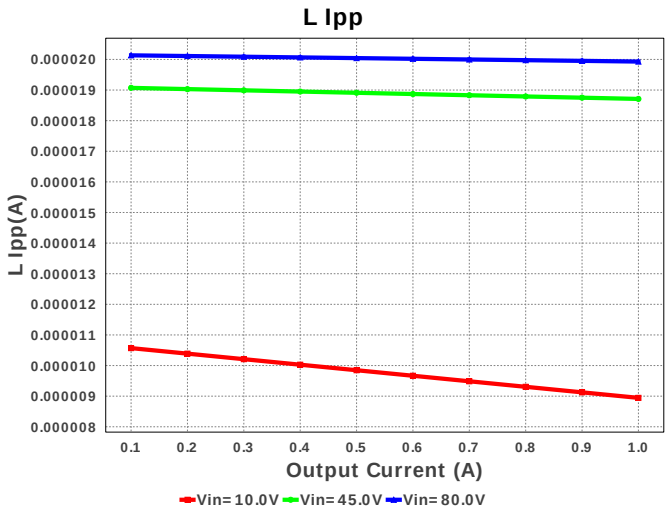
Design : 4755249/4 LM5161PWPR
LM5161PWPR 10.0V-80.0V to 5.00V @ 1.0A

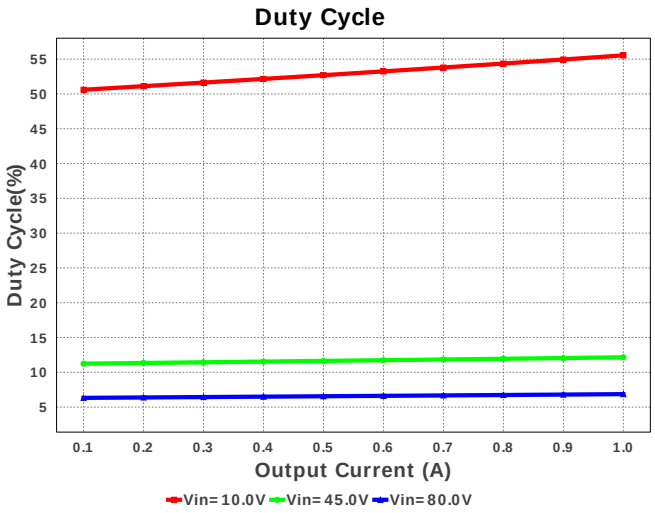


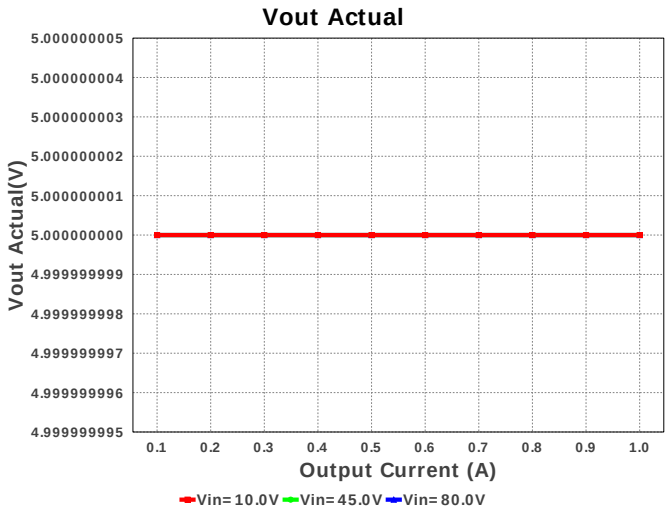
Electrical BOM

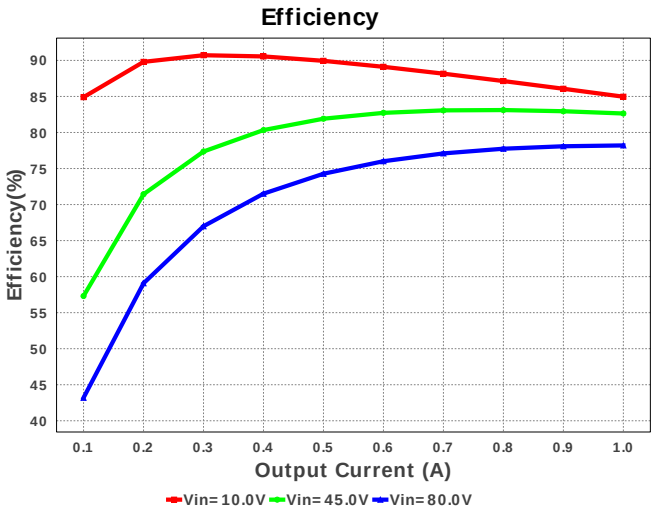
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	MuRata	GRM188R71C103KA01D Series= X7R	Cap= 10.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	 0603 5 mm²
2.	Cin	Panasonic	EEV-EB2E330SM Series= ?	Cap= 33.0 uF ESR= 400.0 mOhm VDC= 250.0 V IRMS= 560.0 mA	2	$1.25	 EB_K16 483 mm²
3.	Cinx	MuRata	GRM55DR72E105KW01L Series= X7R	Cap= 1.0 uF ESR= 7.086 mOhm VDC= 250.0 V IRMS= 2.0605 A	1	$0.26	 2220_200 54 mm²
4.	Cout	MuRata	GRM31CC80J476KE18L Series= X6S	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 6.3 V IRMS= 4.0522 A	1	$0.10	 1206_190 11 mm²
5.	Css	Kemet	C0603C223K4RACTU Series= X7R	Cap= 22.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	 0603 5 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	Coilcraft	MSS1048-683MLB	L= 68.0 µH DCR= 158.4 mOhm	1	$0.56	 MSS1048 146 mm²
8.	Rfbb	Panasonic	ERJ-6ENF2001V Series= ERJ-6E	Res= 2.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²
9.	Rfbt	Yageo America	RC0603FR-073KL Series= ?	Res= 3.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm²

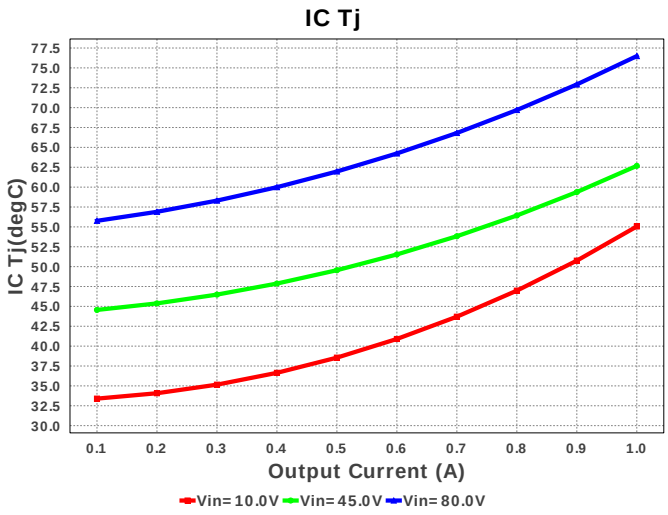
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Ron	Panasonic	ERJ-6ENF2153V Series= ERJ-6E	Res= 215.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
11.	Ruvb	Panasonic	ERJ-6ENF1302V Series= ERJ-6E	Res= 13.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
12.	Ruvt	Panasonic	ERJ-6ENF7502V Series= ERJ-6E	Res= 75.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
13.	U1	Texas Instruments	LM5161PWPR	Switcher	1	$1.80	PWP0014A_N 59 mm^2

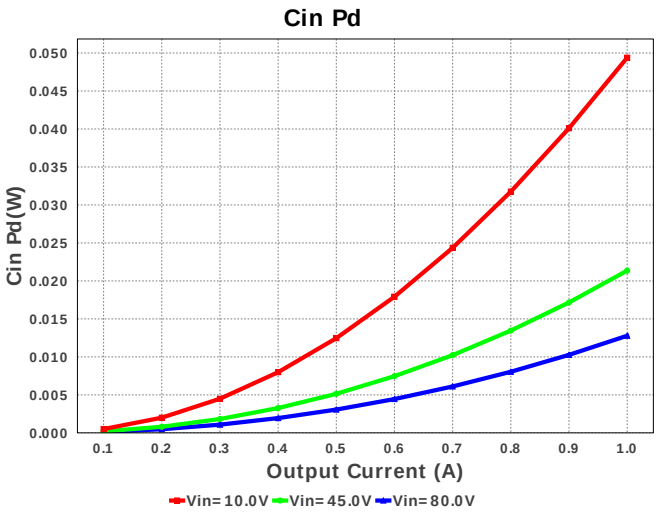


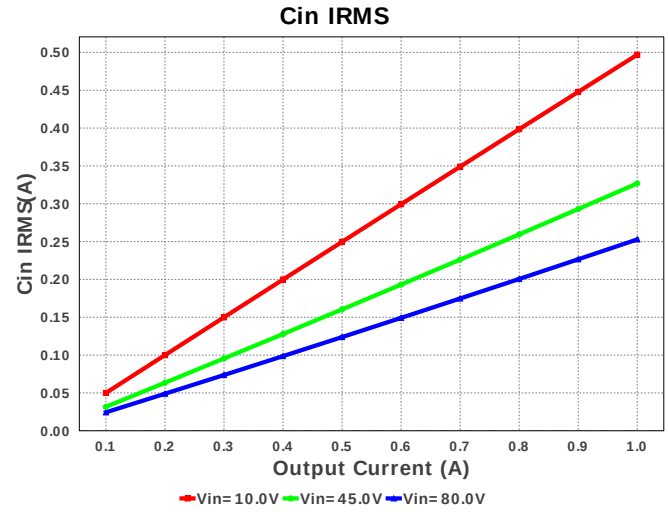


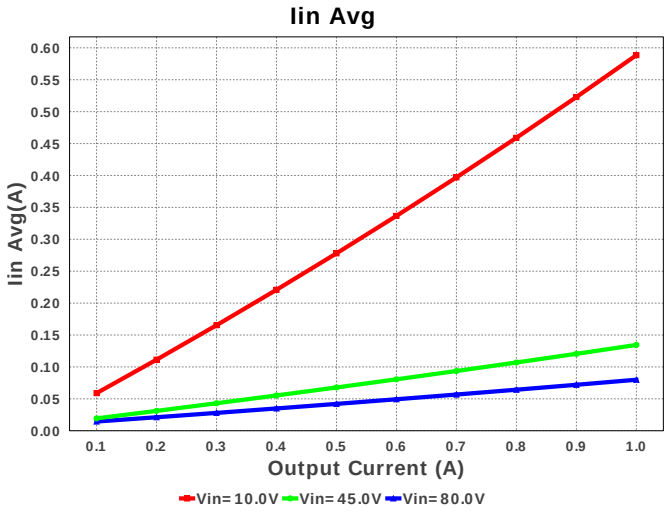


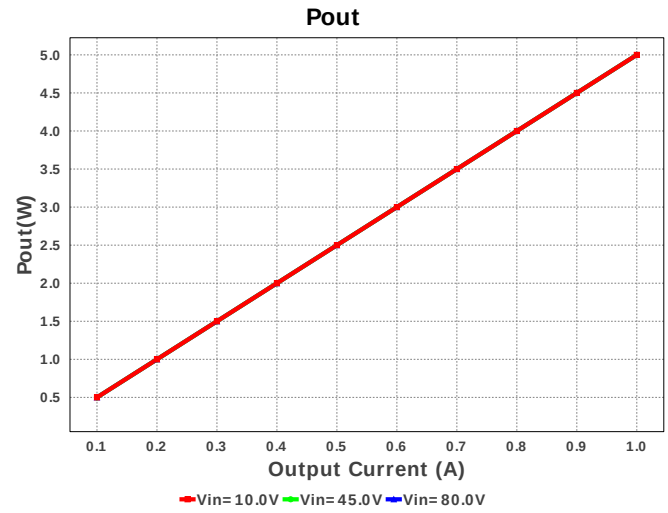


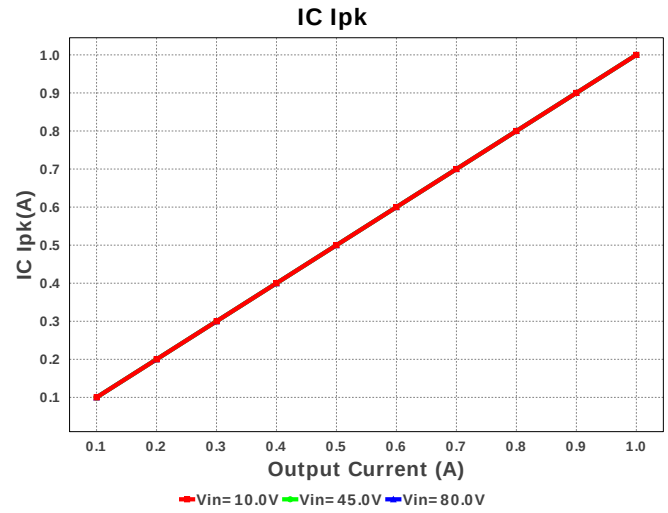


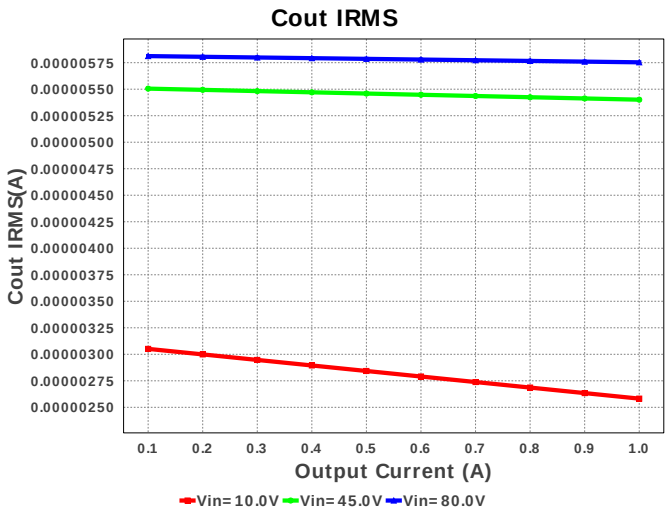


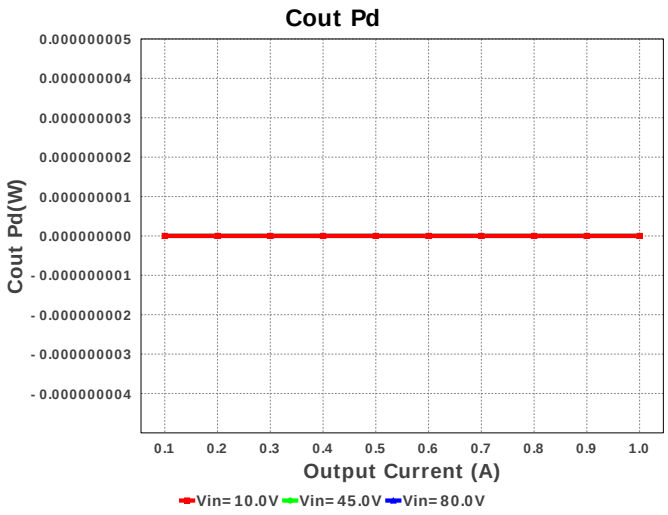


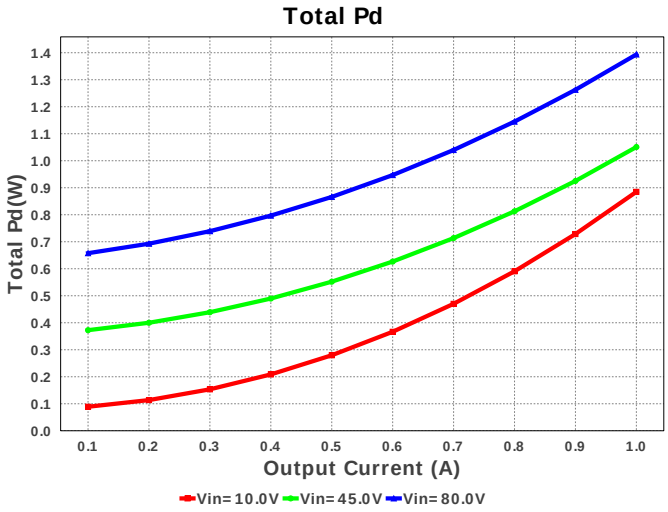


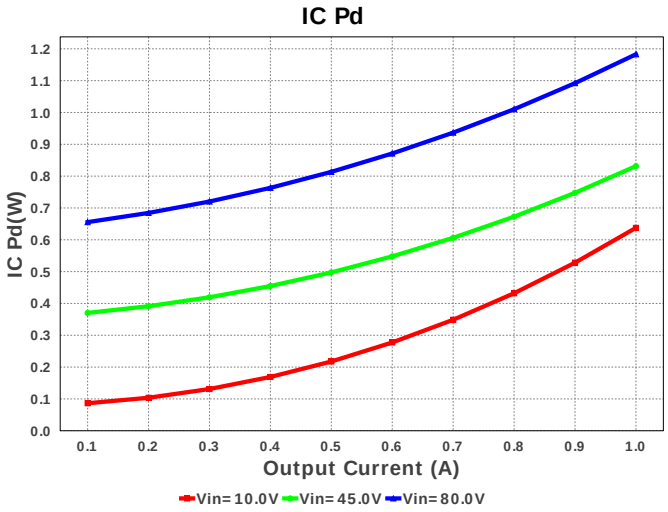


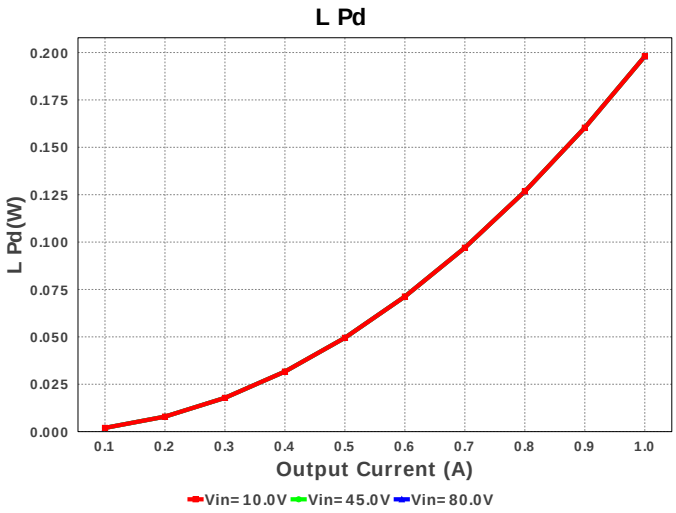












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	252.835 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	5.753 µA	Current	Output capacitor RMS ripple current
3.	IC Ipk	1.0 A	Current	Peak switch current in IC
4.	Iin Avg	79.919 mA	Current	Average input current
5.	L Ipp	19.931 µA	Current	Peak-to-peak inductor ripple current
6.	BOM Count	14	General	Total Design BOM count
7.	FootPrint	1.282 k mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	232.558 kHz	General	Switching frequency
9.	Mode	CCM	General	Conduction Mode
10.	Pout	5.0 W	General	Total output power
11.	Total BOM	$5.3	General	Total BOM Cost

#	Name	Value	Category	Description
12.	Vout Actual	5.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
13.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
14.	Duty Cycle	6.864 %	Op_point	Duty cycle
15.	Efficiency	78.204 %	Op_point	Steady state efficiency
16.	IC Tj	76.482 degC	Op_point	IC junction temperature
17.	ICThetaJA	39.3 degC/W	Op_point	IC junction-to-ambient thermal resistance
18.	IOUT_OP	1.0 A	Op_point	Iout operating point
19.	VIN_OP	80.0 V	Op_point	Vin operating point
20.	Cin Pd	12.785 mW	Power	Input capacitor power dissipation
21.	Cout Pd	123.637 fW	Power	Output capacitor power dissipation
22.	IC Pd	1.183 W	Power	IC power dissipation
23.	L Pd	198.0 mW	Power	Inductor power dissipation
24.	Total Pd	1.394 W	Power	Total Power Dissipation
25.	Vout Tolerance	2.477 %		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	80.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	LM5161	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. LM5161 Product Folder : http://www.ti.com/product/LM5161 : contains the data sheet and other resources.