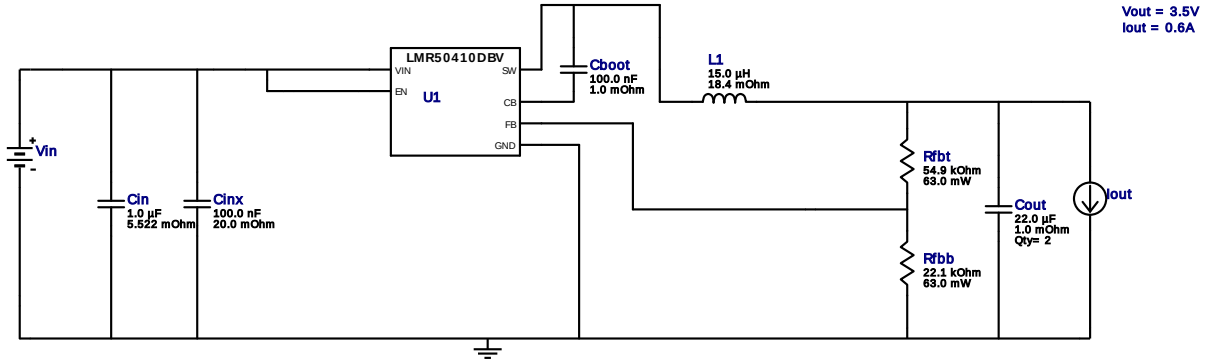
WEBENCH® Design Report

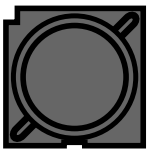
LMR50410XDBVR 10V-32V to 3.50V @ 0.6A

VinMin = 10.0V
VinMax = 32.0V
Vout = 3.5V
Iout = 0.6A

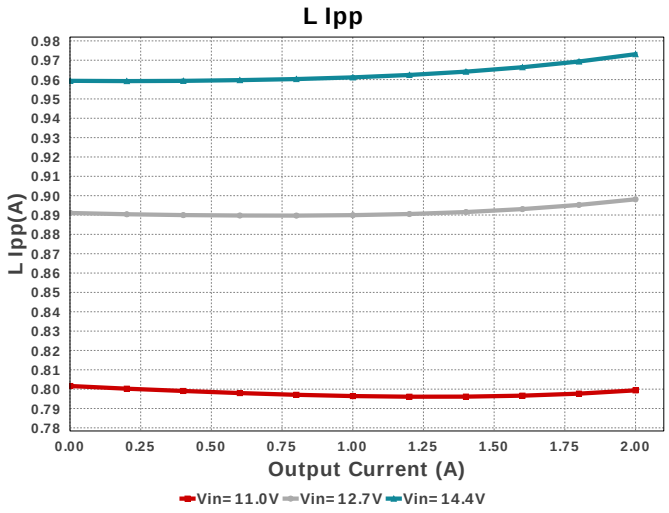
Device = LMR50410XDBVR
Topology = Buck
Created = 2020-06-09 06:46:03.053
BOM Cost = $1.76
BOM Count = 9
Total Pd = 0.27W

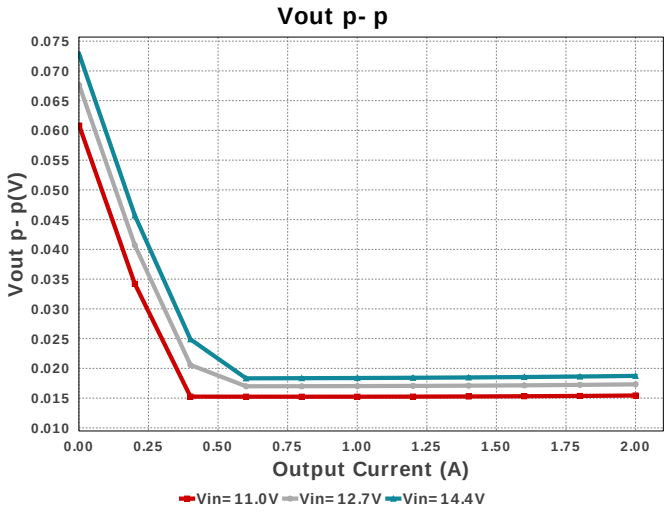


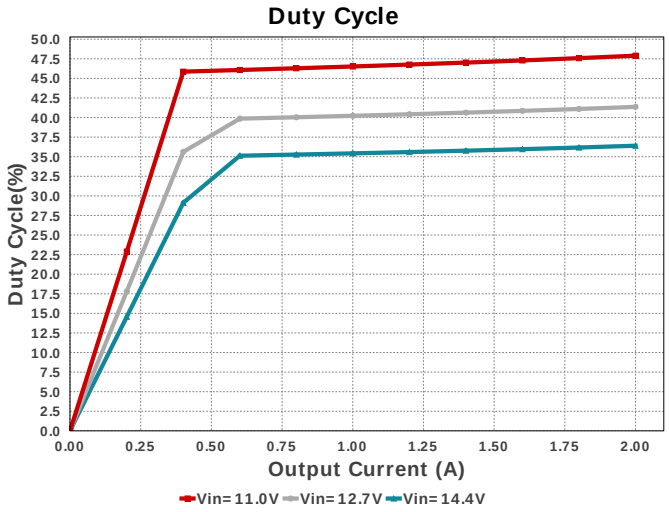
Electrical BOM

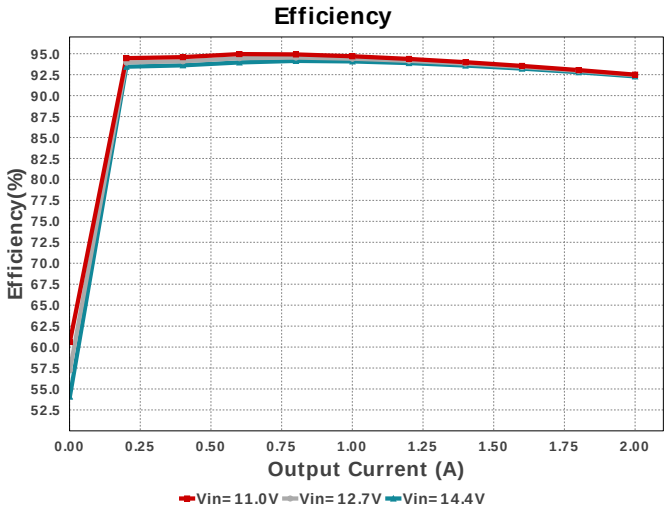
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155R71C104KA88D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Cin	TDK	C1608X5R1H105K080AB Series= X5R	Cap= 1.0 uF ESR= 5.522 mOhm VDC= 50.0 V IRMS= 2.2162 A	1	$0.04	0603 5 mm²
3.	Cinx	MuRata	GRM188R71H104KA93D Series= X7R	Cap= 100.0 nF ESR= 20.0 mOhm VDC= 50.0 V IRMS= 3.8 A	1	$0.02	0603 5 mm²
4.	Cout	MuRata	GRM21BD70J226ME44L Series= X7T	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 6.3 V IRMS= 6.0 A	2	$0.10	0805 7 mm²
5.	L1	TDK	SLF12575T-150M4R7-PF	L= 15.0 µH DCR= 18.4 mOhm	1	$0.77	 SLF12575 210 mm²
6.	Rfbb	Vishay-Dale	CRCW040222K1FKED Series= CRCW..e3	Res= 22100.0Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
7.	Rfbt	Vishay-Dale	CRCW040254K9FKED Series= CRCW..e3	Res= 54900.0Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	U1	Texas Instruments	LMR50410XDBVR	Switcher	1	$0.70	DBV0006A 15 mm²

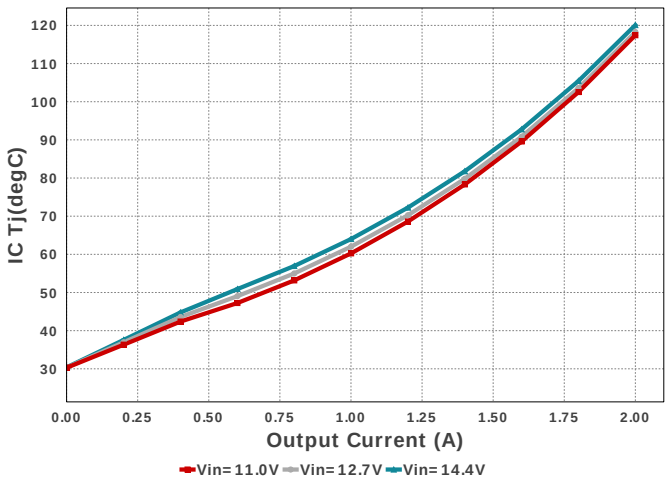




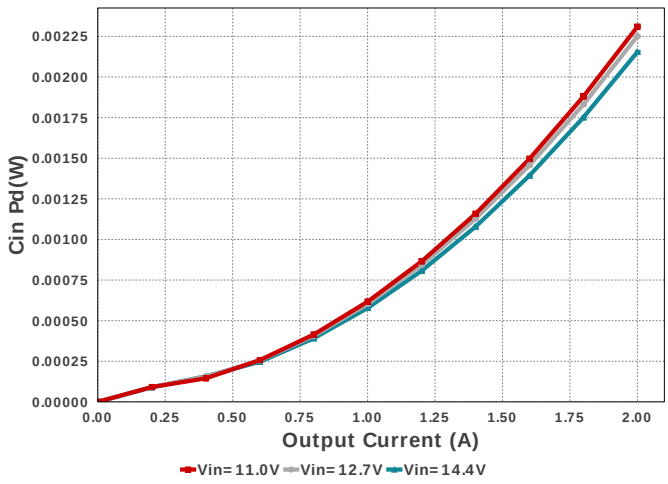




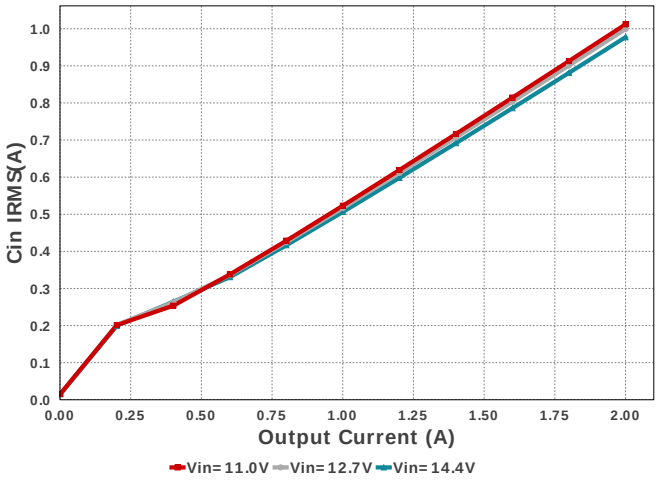
IC Tj



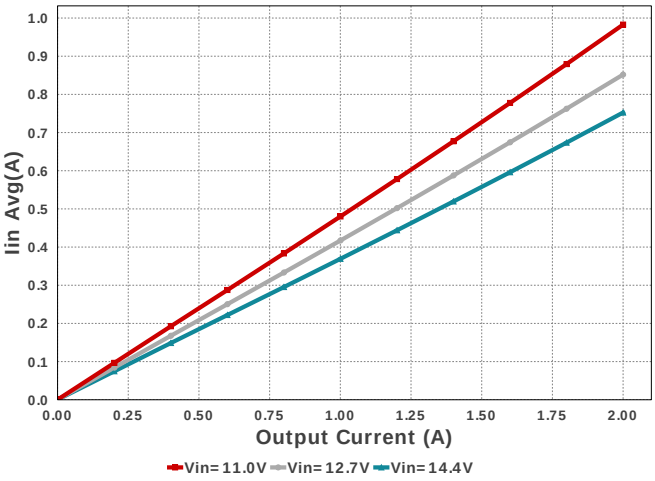
Cin Pd



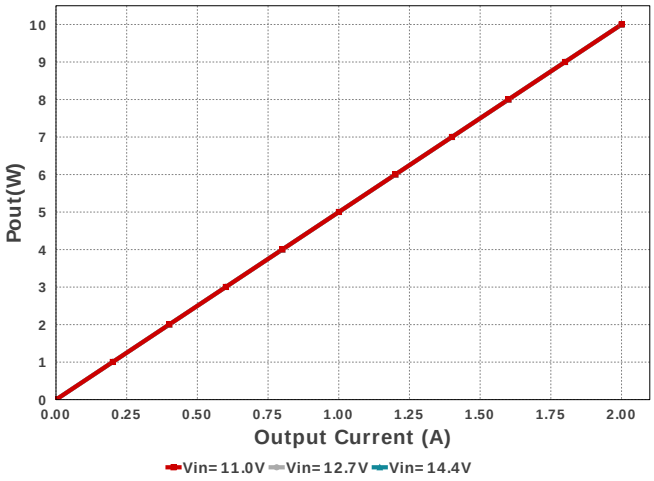
Cin IRMS



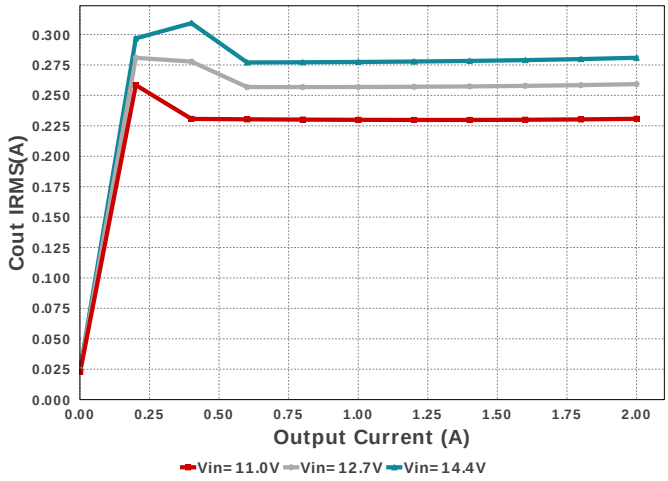
Iin Avg

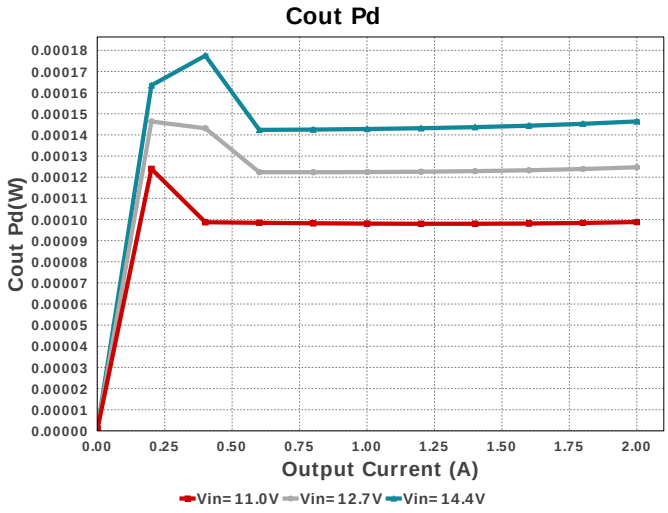


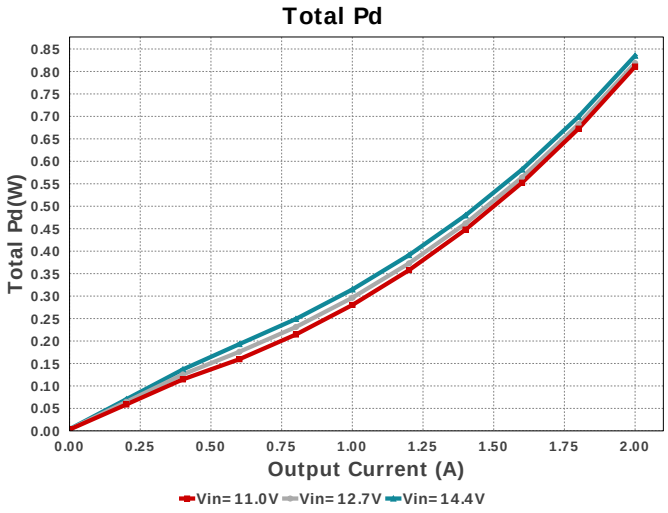
Pout

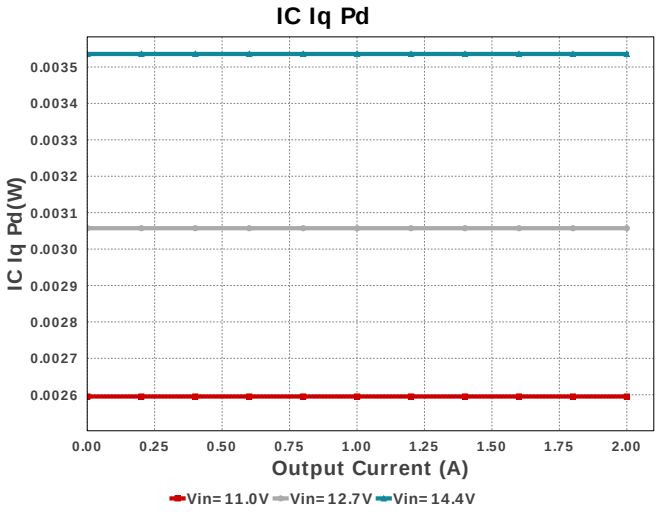


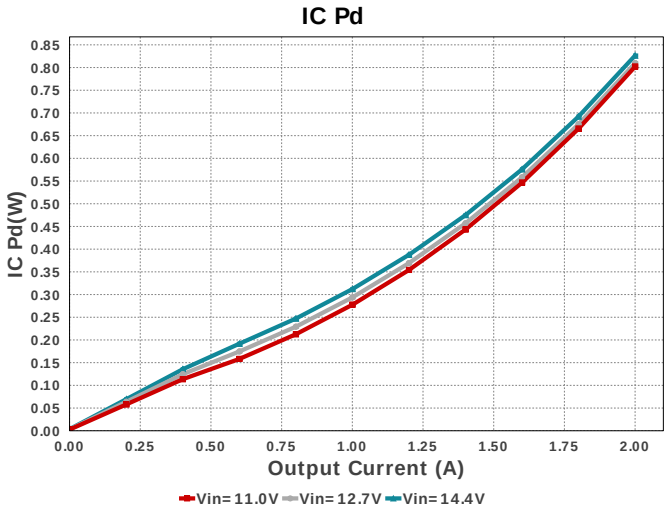
Cout IRMS

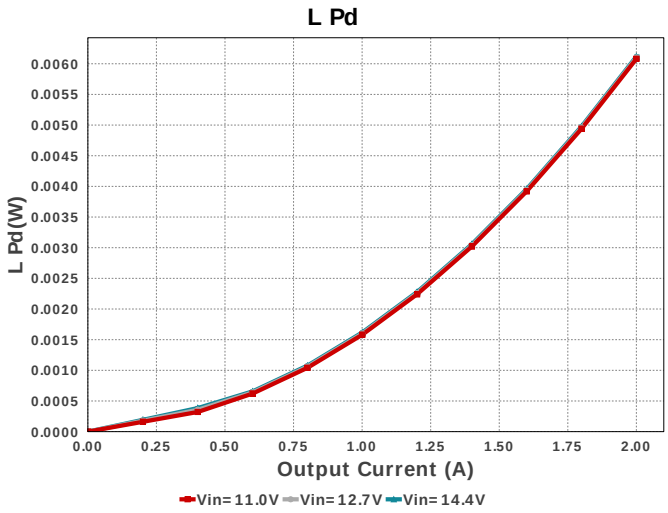


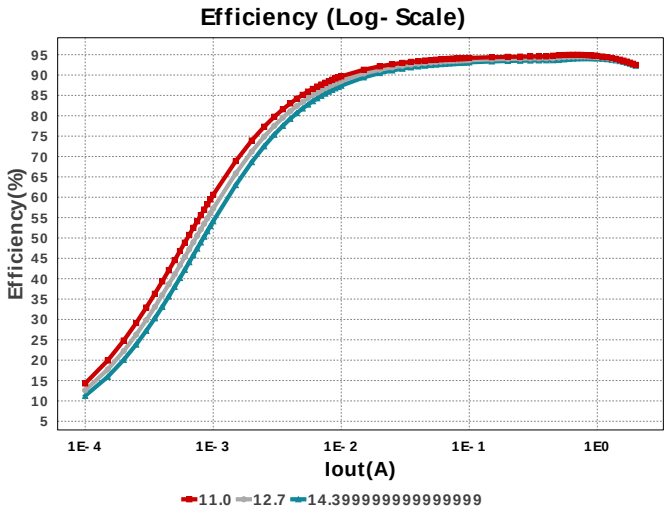












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	181.9 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	182.71 µW	Capacitor	Input capacitor power dissipation
3.	Cinx IRMS	13.404 mA	Capacitor	Bulk capacitor RMS ripple current
4.	Cinx Pd	3.594 µW	Capacitor	Bulk capacitor power dissipation
5.	Cout IRMS	90.656 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	4.109 µW	Capacitor	Output capacitor power dissipation
7.	IC Ipk	757.021 mA	IC	Peak switch current in IC
8.	IC Pd	265.13 mW	IC	IC power dissipation
9.	IC Tj	51.211 degC	IC	IC junction temperature
10.	IC Tolerance	15.0 mV	IC	IC Feedback Tolerance
11.	ICThetaJA Effective	80.0 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance

#	Name	Value	Category	Description
12.	Iin Avg	74.133 mA	IC	Average input current
13.	Ipp percentage	52.34 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
14.	L Ipp	314.04 mA	Inductor	Peak-to-peak inductor ripple current
15.	L Pd	6.775 mW	Inductor	Inductor power dissipation
16.	Cin Pd	182.71 µW	Power	Input capacitor power dissipation
17.	Cinx Pd	3.594 µW	Power	Bulk capacitor power dissipation
18.	Cout Pd	4.109 µW	Power	Output capacitor power dissipation
19.	IC Pd	265.13 mW	Power	IC power dissipation
20.	L Pd	6.775 mW	Power	Inductor power dissipation
21.	Total Pd	272.264 mW	Power	Total Power Dissipation
22.	BOM Count	9	System Information	Total Design BOM count
23.	Cross Freq	38.385 kHz	System Information	Bode plot crossover frequency
24.	Duty Cycle	11.697 %	System Information	Duty cycle
25.	Efficiency	88.523 %	System Information	Steady state efficiency
26.	FootPrint	257.0 mm^2	System Information	Total Foot Print Area of BOM components
27.	Frequency	700.0 kHz	System Information	Switching frequency
28.	Gain Marg	-22.329 dB	System Information	Bode Plot Gain Margin
29.	Iout	600.0 mA	System Information	Iout operating point
30.	Low Freq Gain	69.42 dB	System Information	Gain at 1Hz
31.	Mode	CCM	System Information	Conduction Mode
32.	Phase Marg	73.678 deg	System Information	Bode Plot Phase Margin
33.	Pout	2.1 W	System Information	Total output power
34.	Total BOM	$1.76	System Information	Total BOM Cost
35.	Vin	32.0 V	System Information	Vin operating point
36.	Vin p-p	86.347 mV	System Information	Peak-to-peak input voltage
37.	Vout	3.5 V	System Information	Operational Output Voltage
38.	Vout Actual	3.484 V	System Information	Vout Actual calculated based on selected voltage divider resistors
39.	Vout Tolerance	2.962 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
40.	Vout p-p	1.971 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

#	Name	Value	Description
1.	Iout	600.0 m	Maximum Output Current
2.	VinMax	32.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	3.5	Output Voltage
5.	acFrequency	60.0	AC Frequency
6.	base_pn	LMR50410X	Base Product Number
7.	source	DC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

1. **LMR50410X** Product Folder : http://www.ti.com/product/LMR50410 : contains the data sheet and other resources.

