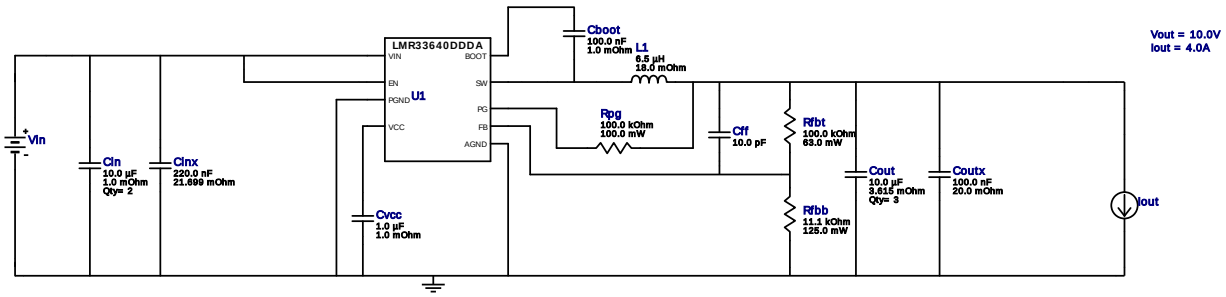
WEBENCH® Design Report

LMR33640DDDAR 11V-20V to 10.00V @ 4A

VinMin = 11.0V
VinMax = 20.0V
Vout = 10.0V
Iout = 4.0A

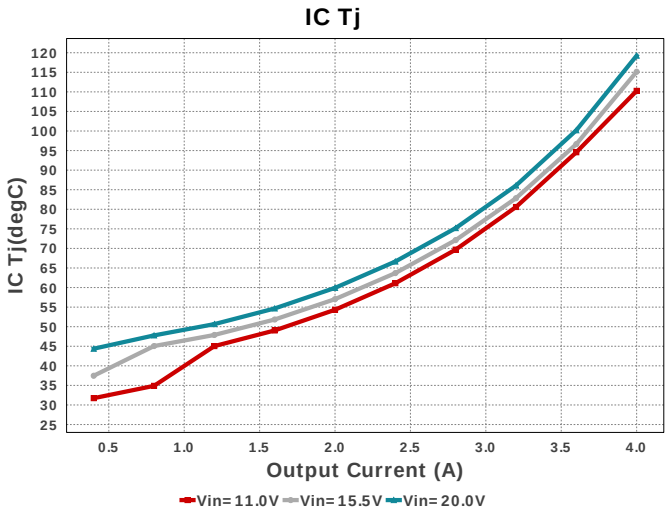
Device = LMR33640DDDAR
Topology = Buck
Created = 2020-10-21 06:12:15.994
BOM Cost = $2.26
BOM Count = 15
Total Pd = 3.0W

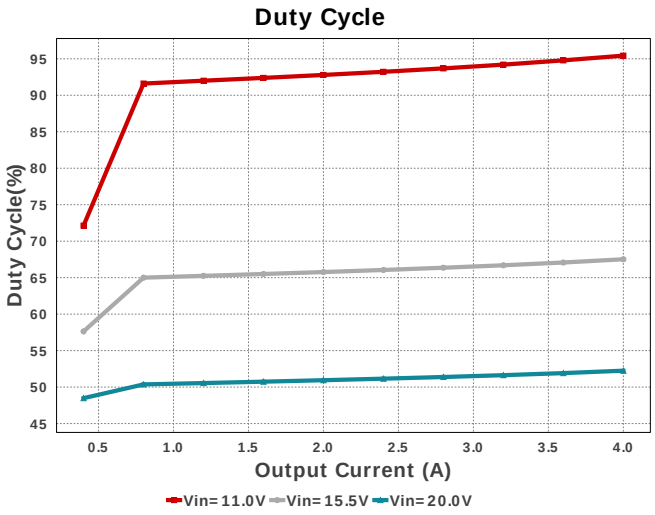


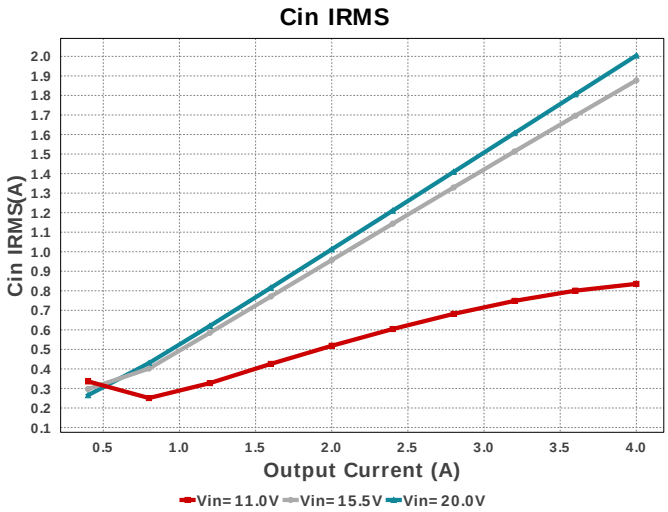
Electrical BOM

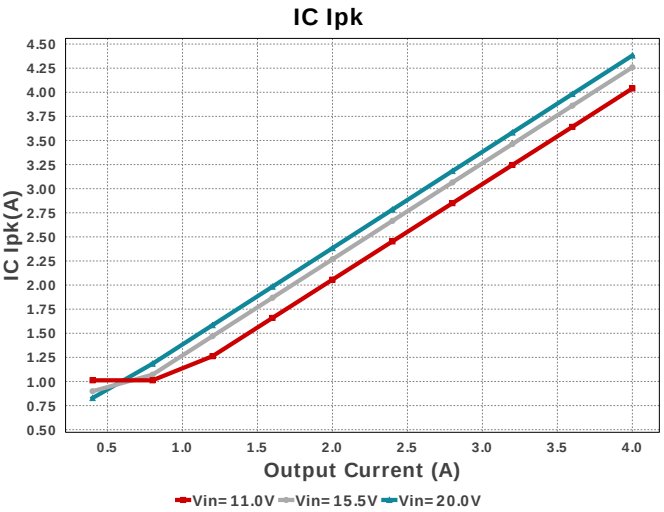
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155R71A104KA01D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Cff	Kemet	C0402C100J3GACTU Series= C0G/NP0	Cap= 10.0 pF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
3.	Cin	TDK	C3225X7R1H106M250AC Series= X7R	Cap= 10.0 uF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 5.0 A	2	$0.28	1210 15 mm²
4.	Cinx	TDK	C1608X5R1H224K080AB Series= X5R	Cap= 220.0 nF ESR= 21.699 mOhm VDC= 50.0 V IRMS= 1.125 A	1	$0.03	0603 5 mm²
5.	Cout	MuRata	GRM31CR61C106KA88L Series= X5R	Cap= 10.0 uF ESR= 3.615 mOhm VDC= 16.0 V IRMS= 3.8281 A	3	$0.08	1206_190 11 mm²
6.	Coutx	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
7.	Cvcc	Kemet	C0603C105Z8VACTU Series= Y5V	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
8.	L1	Bourns	SRR1208-6R5ML	L= 6.5 µH DCR= 18.0 mOhm	1	$0.45	SRR1208 216 mm²
9.	Rfbb	Yageo	RT0805BRD0711K1L Series= ?	Res= 11100.0Ohm Power= 125.0 mW Tolerance= 0.1%	1	$0.06	0805 7 mm²
10.	Rfbt	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100000.0Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	Rpg	Vishay-Dale	CRCW0603100KFKEA Series= CRCW..e3	Res= 100000.0Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
12.	U1	Texas Instruments	LMR33640DDDAR	Switcher	1	$0.85	 DDA0008J 55 mm^2

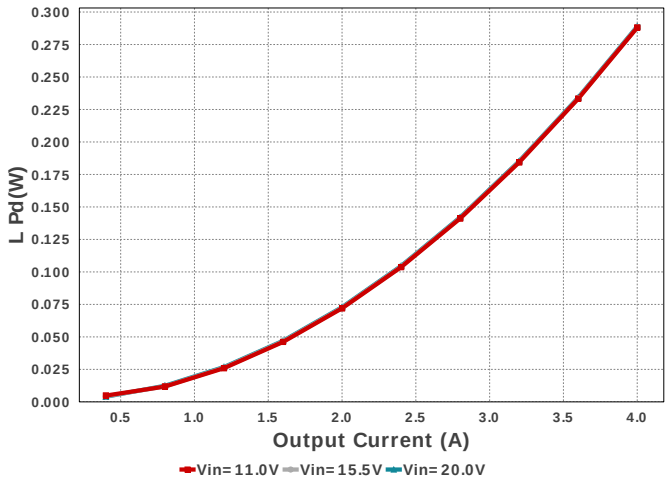




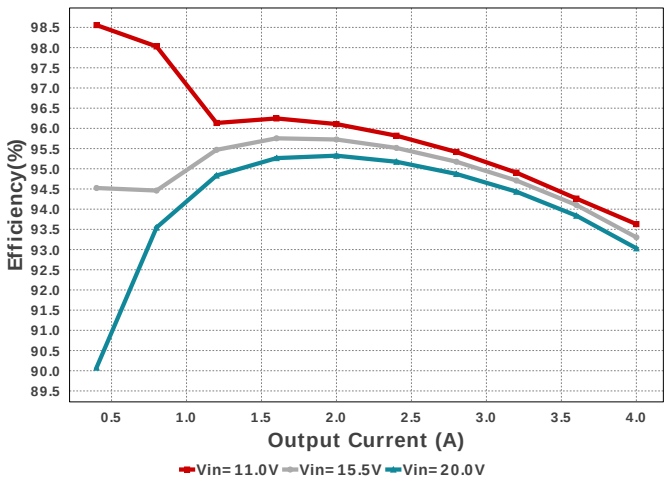




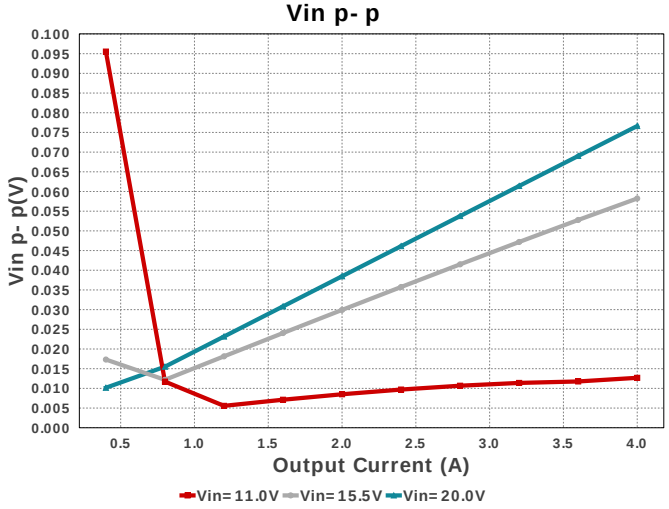
L Pd



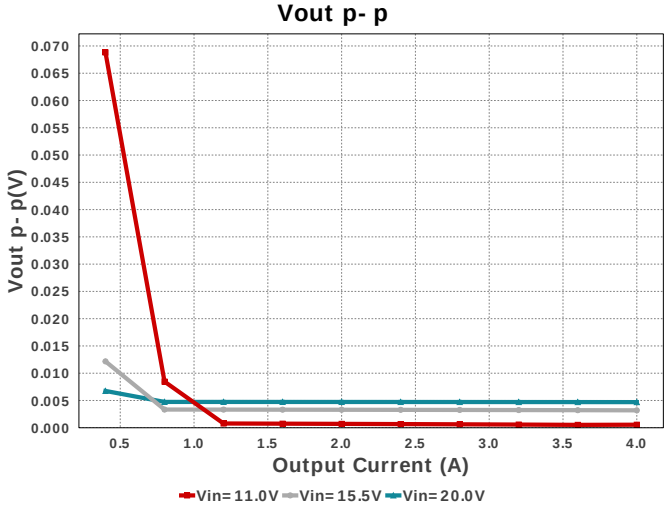
Efficiency



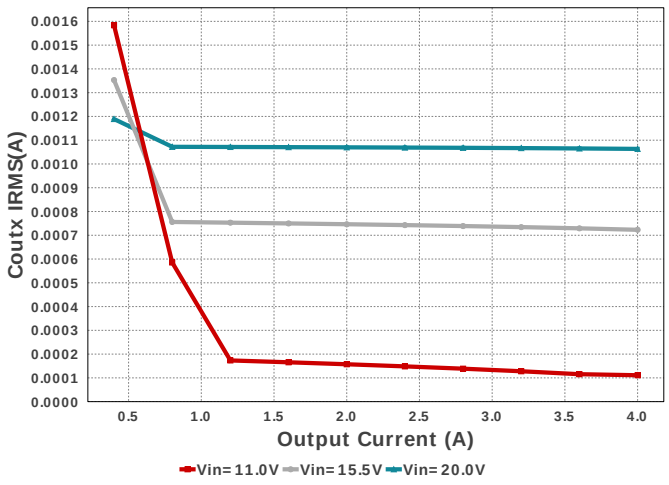
Vin p- p



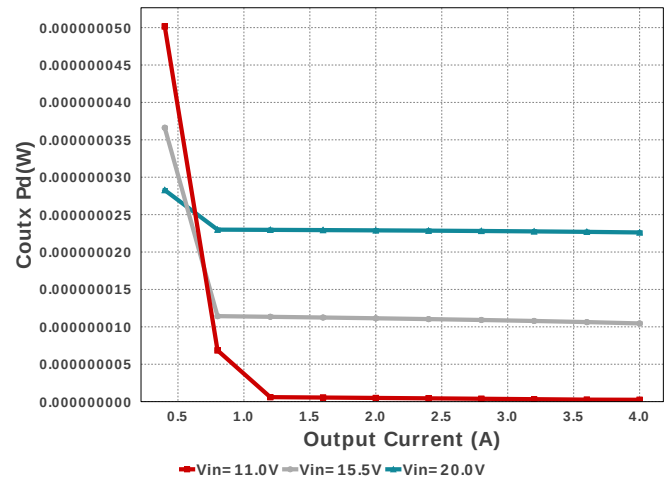
Vout p- p

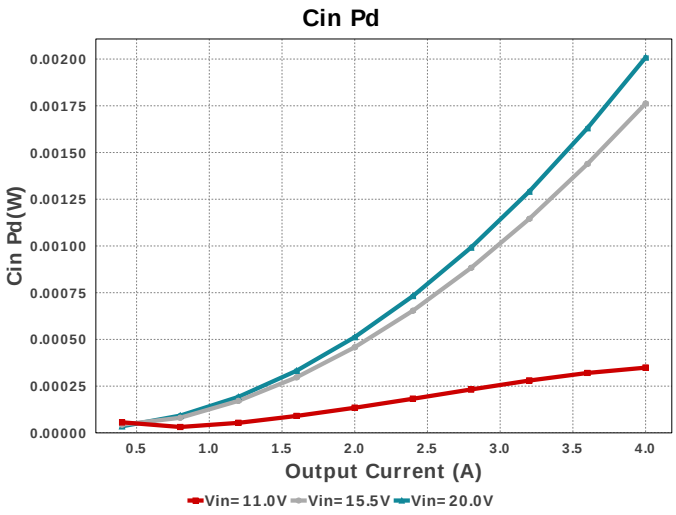


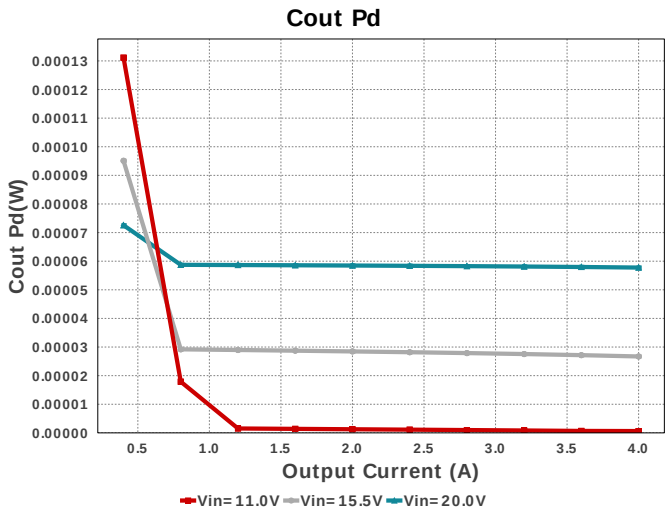
Coutx IRMS

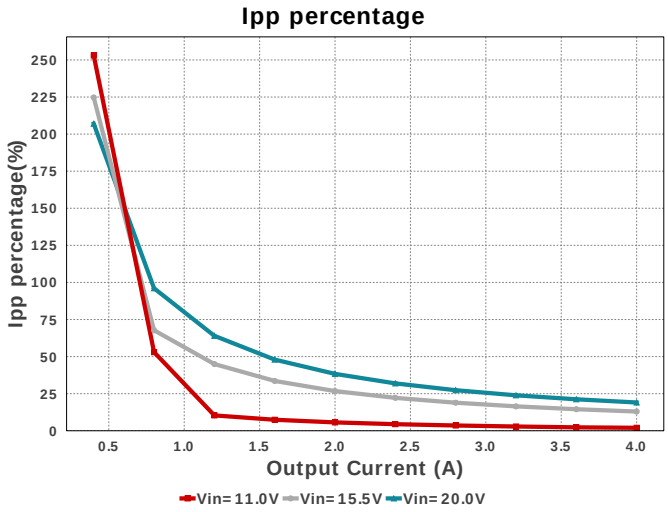


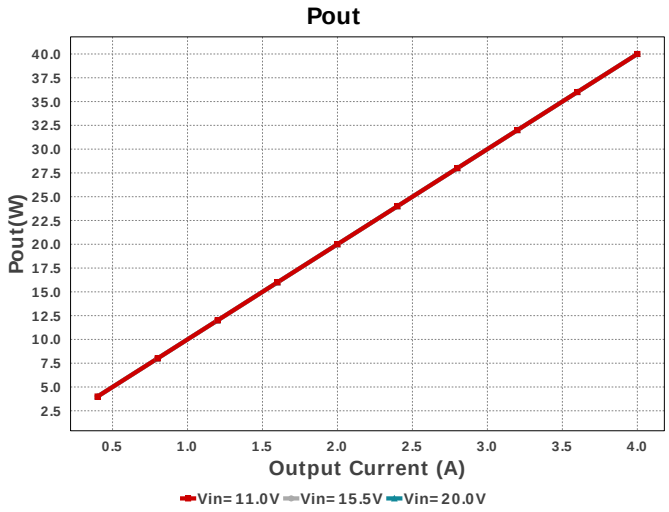
Coutx Pd

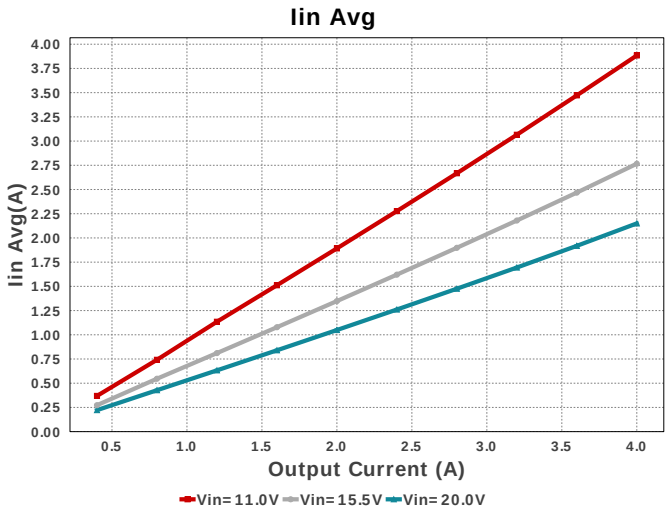


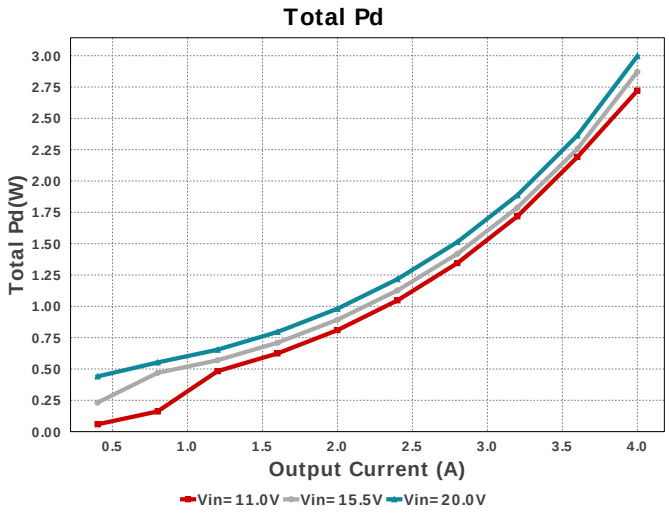


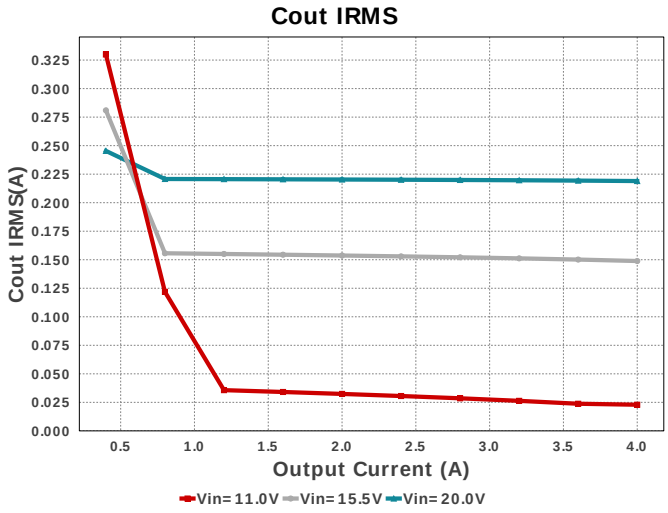


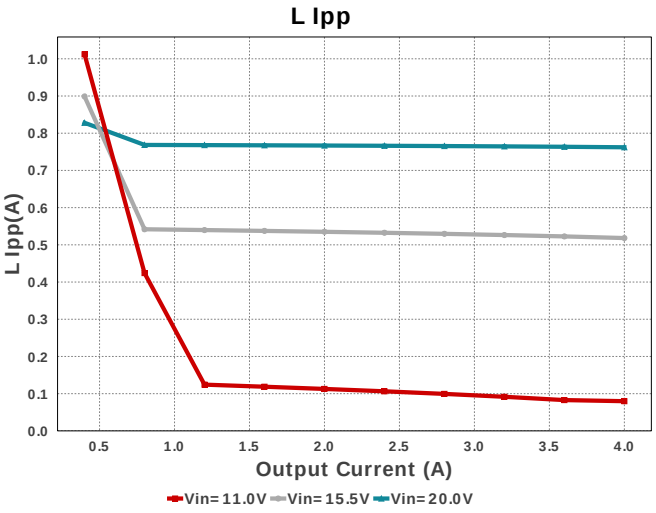


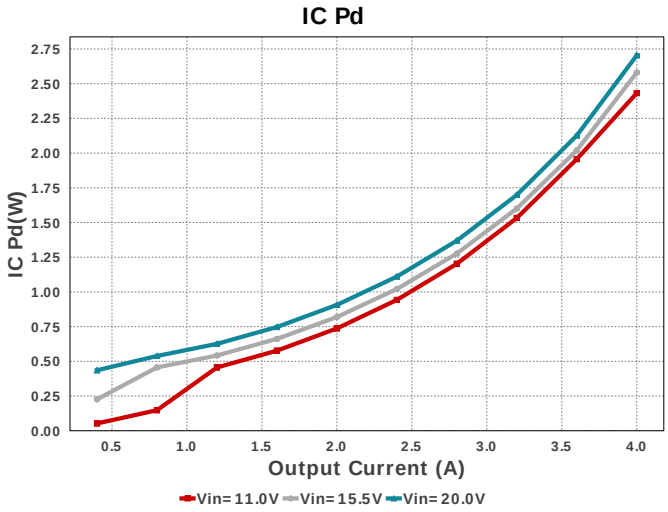


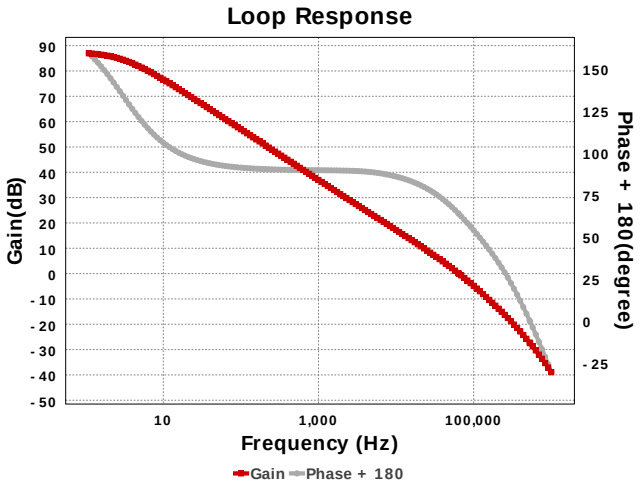


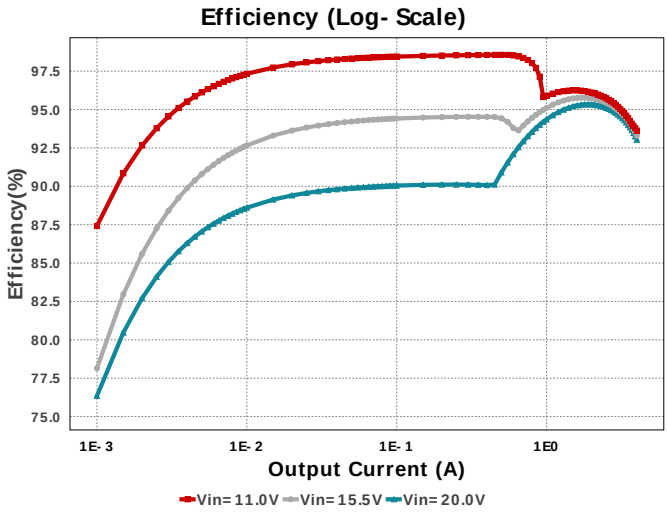












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.004 A	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	2.009 mW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	218.965 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	57.775 µW	Capacitor	Output capacitor power dissipation
5.	Coutx IRMS	1.063 mA	Capacitor	Output capacitor_x RMS ripple current
6.	Coutx Pd	22.617 nW	Capacitor	Output capacitor_x power loss
7.	IC Ipk	4.381 A	IC	Peak switch current in IC
8.	IC Pd	2.705 W	IC	IC power dissipation
9.	IC Tj	119.256 degC	IC	IC junction temperature
10.	IC Tolerance	15.0 mV	IC	IC Feedback Tolerance
11.	ICThetaJA	33.0 degC/W	IC	IC junction-to-ambient thermal resistance

#	Name	Value	Category	Description
12.	Iin Avg	2.15 A	IC	Average input current
13.	Ipp percentage	19.055 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
14.	L Ipp	762.2 mA	Inductor	Peak-to-peak inductor ripple current
15.	L Pd	288.87 mW	Inductor	Inductor power dissipation
16.	Cin Pd	2.009 mW	Power	Input capacitor power dissipation
17.	Cout Pd	57.775 µW	Power	Output capacitor power dissipation
18.	Coutx Pd	22.617 nW	Power	Output capacitor_x power loss
19.	IC Pd	2.705 W	Power	IC power dissipation
20.	L Pd	288.87 mW	Power	Inductor power dissipation
21.	Total Pd	2.996 W	Power	Total Power Dissipation
22.	BOM Count	15	System Information	Total Design BOM count
23.	Cross Freq	64.54 kHz	System Information	Bode plot crossover frequency
24.	Duty Cycle	52.246 %	System Information	Duty cycle
25.	Efficiency	93.031 %	System Information	Steady state efficiency
26.	FootPrint	368.0 mm^2	System Information	Total Foot Print Area of BOM components
27.	Frequency	1000.0 kHz	System Information	Switching frequency
28.	Gain Marg	-27.516 dB	System Information	Bode Plot Gain Margin
29.	Iout	4.0 A	System Information	Iout operating point
30.	Low Freq Gain	86.963 dB	System Information	Gain at 1Hz
31.	Mode	CCM	System Information	Conduction Mode
32.	Phase Marg	64.144 deg	System Information	Bode Plot Phase Margin
33.	Pout	40.0 W	System Information	Total output power
34.	Total BOM	$2.26	System Information	Total BOM Cost
35.	Vin	20.0 V	System Information	Vin operating point
36.	Vin p-p	76.628 mV	System Information	Peak-to-peak input voltage
37.	Vout	10.0 V	System Information	Operational Output Voltage
38.	Vout Actual	10.009 V	System Information	Vout Actual calculated based on selected voltage divider resistors
39.	Vout Tolerance	2.506 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
40.	Vout p-p	4.699 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

#	Name	Value	Description
1.	Iout	4.0	Maximum Output Current
2.	VinMax	20.0	Maximum input voltage
3.	VinMin	11.0	Minimum input voltage
4.	Vout	10.0	Output Voltage
5.	acFrequency	60.0	AC Frequency
6.	base_pn	LMR33640D-SOIC	Base Product Number
7.	source	DC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

1. **LMR33640D-SOIC** Product Folder : http://www.ti.com/product/LMR33640 : contains the data sheet and other resources.

