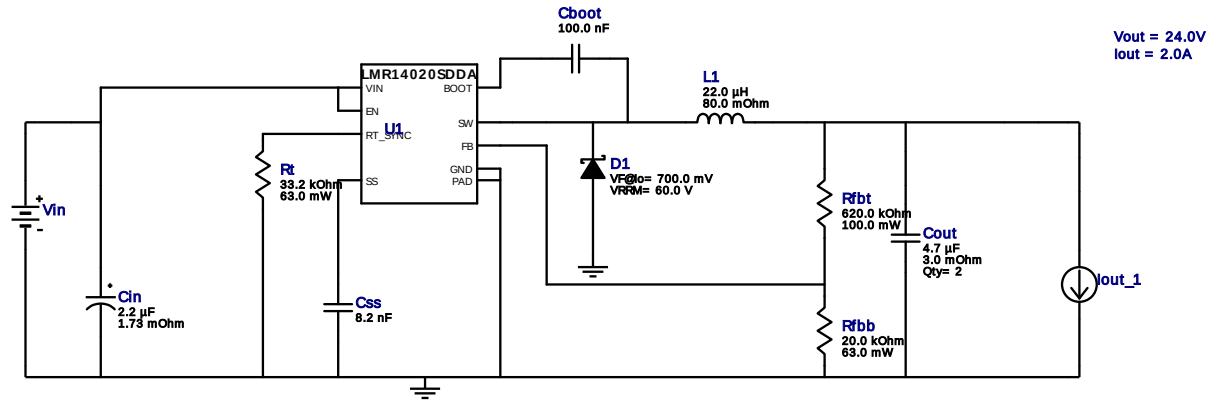
WEBENCH® Design Report

VinMin = 33.0V
VinMax = 38.0V
Vout = 24.0V
Iout = 2.0A

Device = LMR14020SDDAR
Topology = Buck
Created = 9/23/16 1:44:43 AM
BOM Cost = $2.20
BOM Count = 11
Total Pd = 1.87W

Design : 4800957/10 LMR14020SDDAR
LMR14020SDDAR 33.0V-38.0V to 24.00V @ 2.0001124999999997A



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	Taiyo Yuden	HMK212B7104KG-T Series= X7R	Cap= 100.0 nF VDC= 100.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm²
2.	Cin	TDK	C3225X7R2A225K230AB Series= X7R	Cap= 2.2 uF ESR= 1.73 mOhm VDC= 100.0 V IRMS= 5.5932 A	1	$0.19	1210_250 15 mm²
3.	Cout	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	2	$0.07	1206 11 mm²
4.	Css	MuRata	GRM155R71C822KA01D Series= X7R	Cap= 8.2 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
5.	D1	Diodes Inc.	B160-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	$0.05	SMA 37 mm²
6.	L1	Bourns	SDR1105-220ML	L= 22.0 µH DCR= 80.0 mOhm	1	$0.29	SDR1105 157 mm²
7.	Rfbb	Vishay-Dale	CRCW040220K0FKED Series= CRCW..e3	Res= 20.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
8.	Rfbt	Yageo America	RC0603FR-07620KL Series= ?	Res= 620.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
9.	Rt	Vishay-Dale	CRCW040233K2FKED Series= CRCW..e3	Res= 33.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

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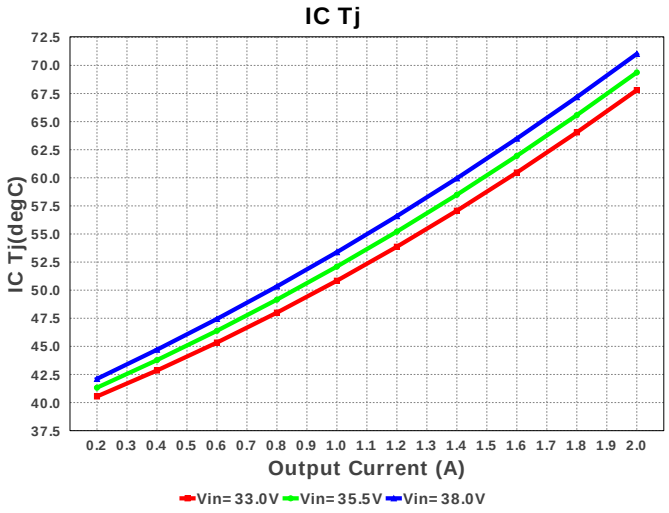
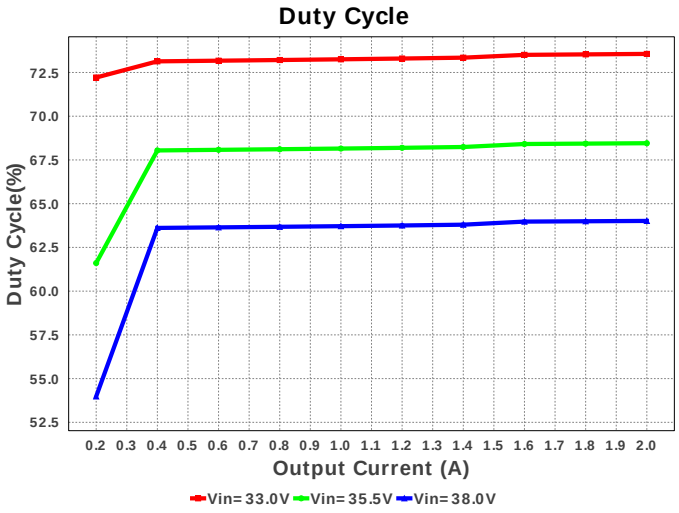
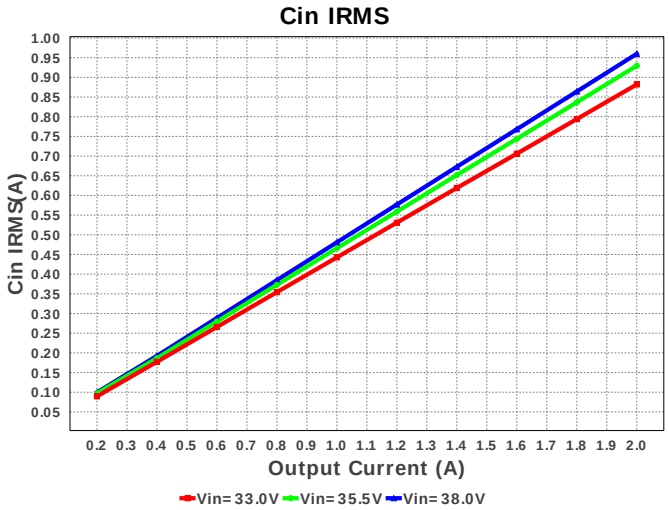
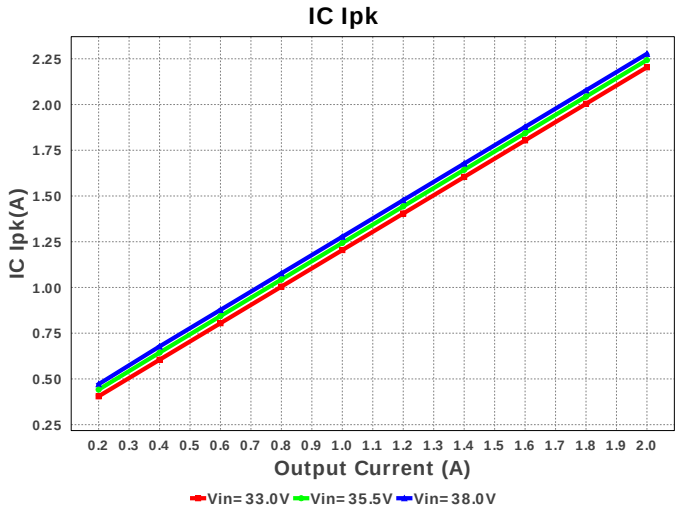
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	U1	Texas Instruments	LMR14020SDDAR	Switcher	1	$1.46	DDA0008E_N 57 mm²









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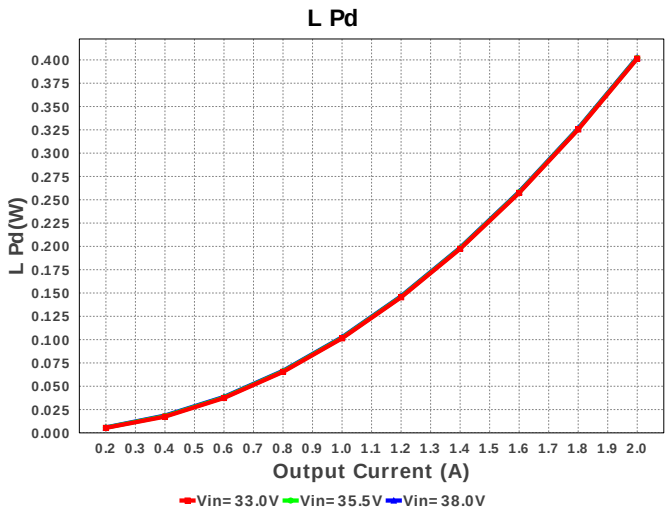

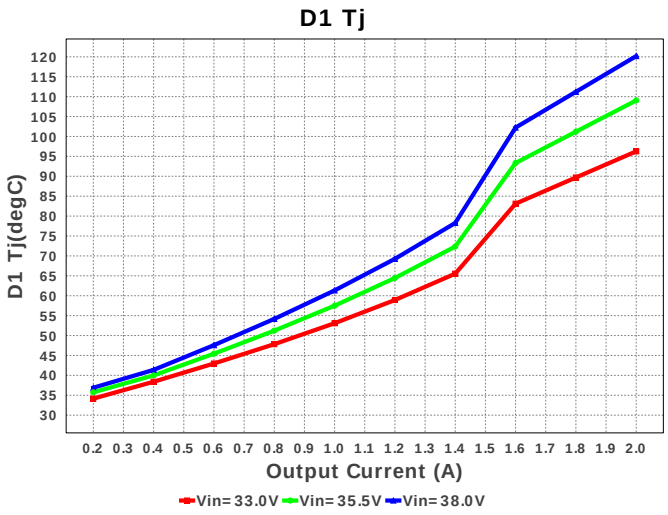

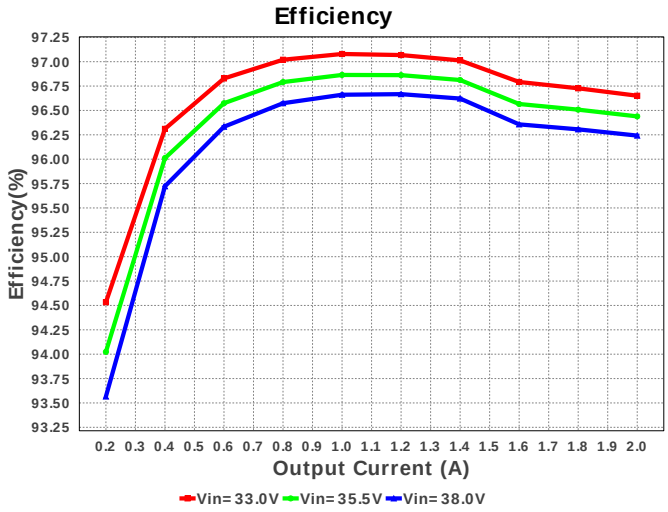

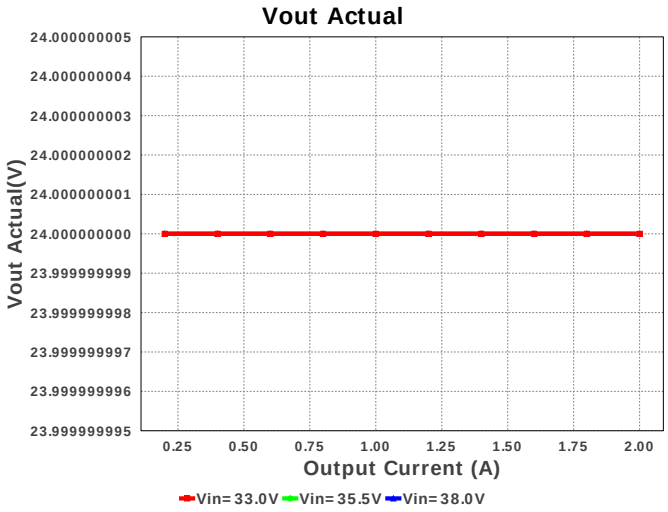

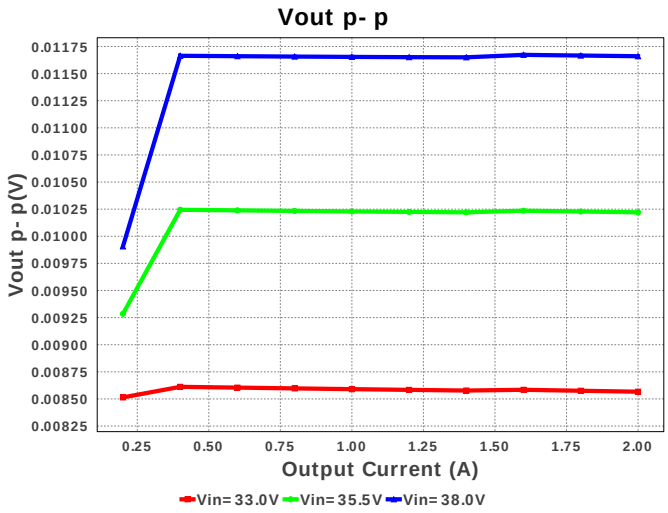

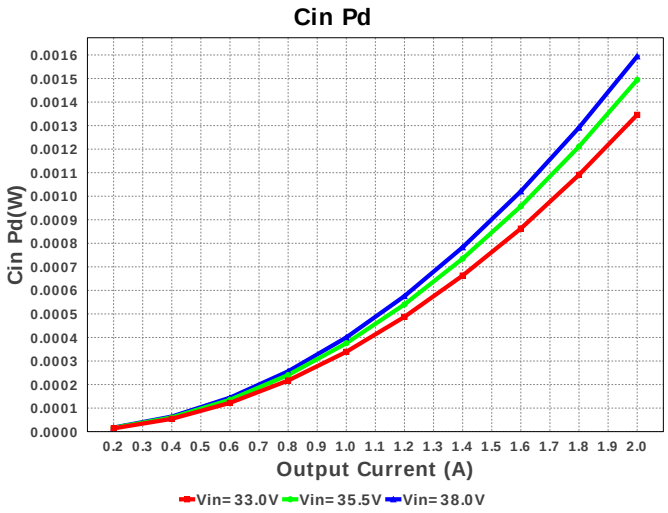

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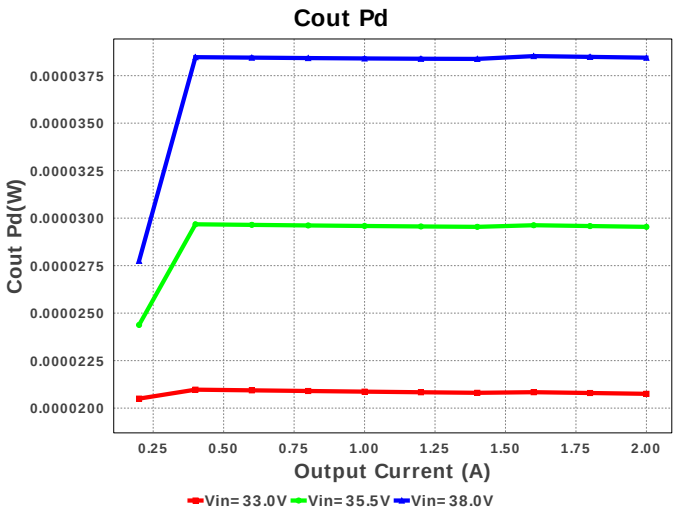

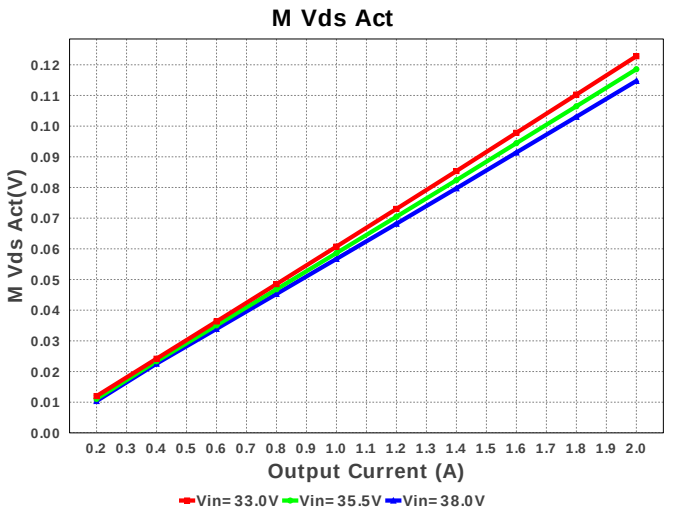

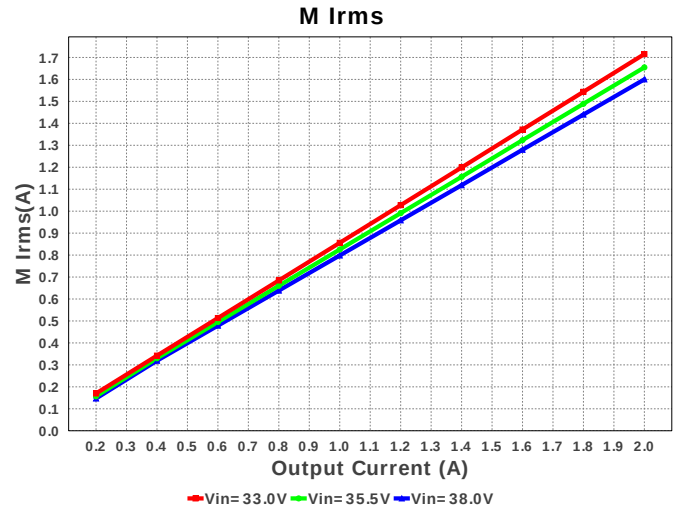

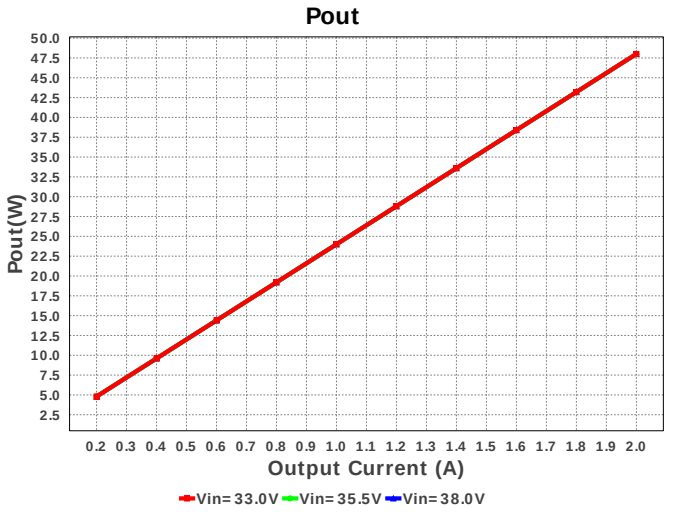

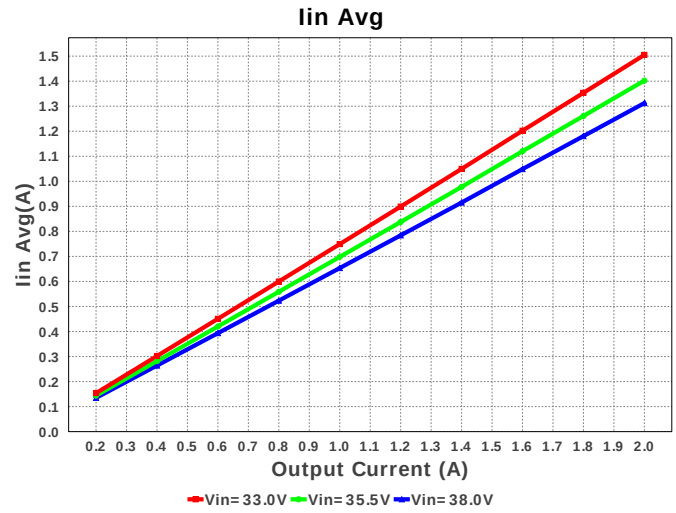

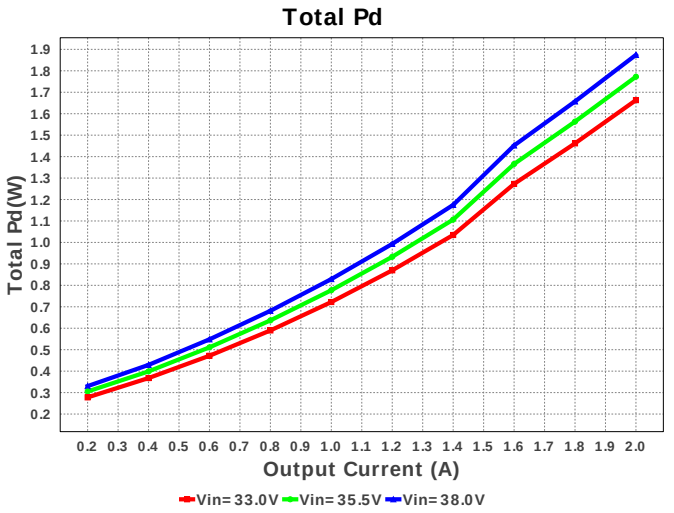

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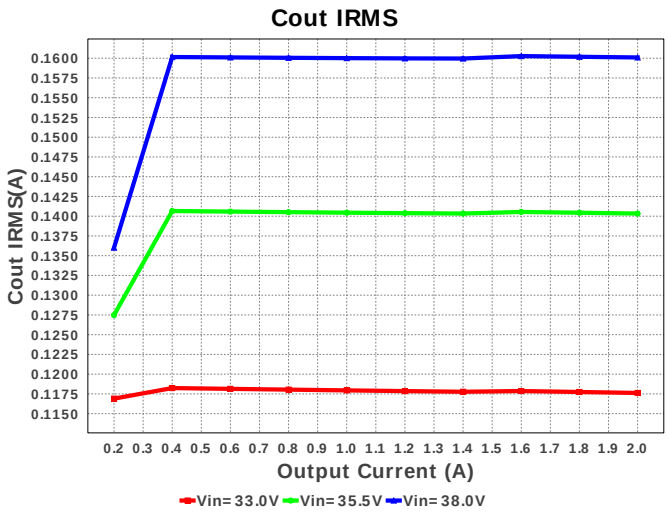

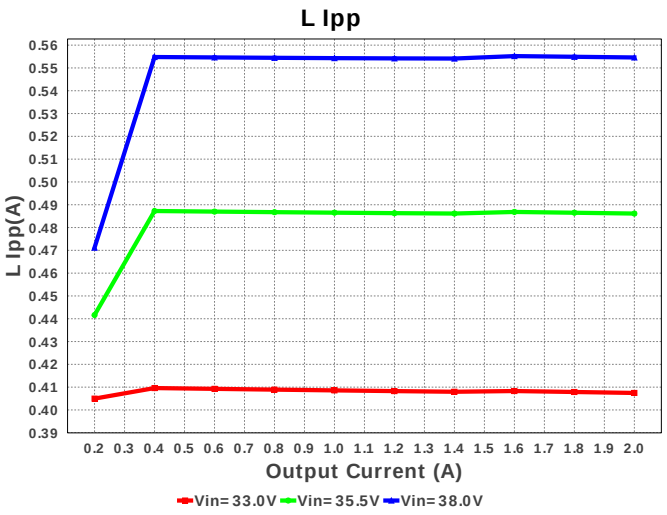

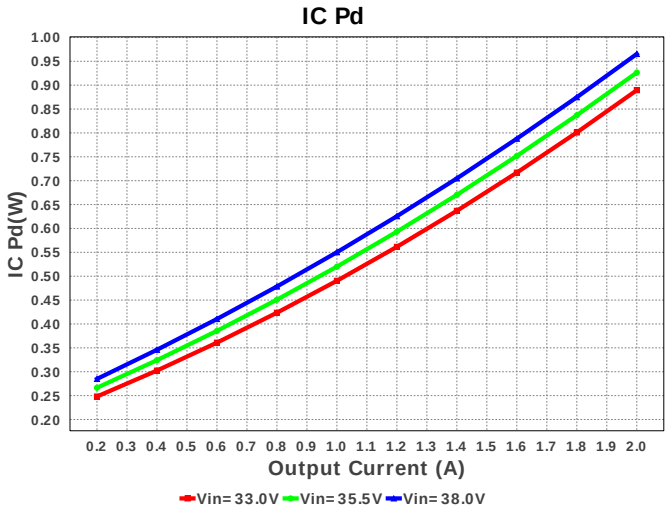

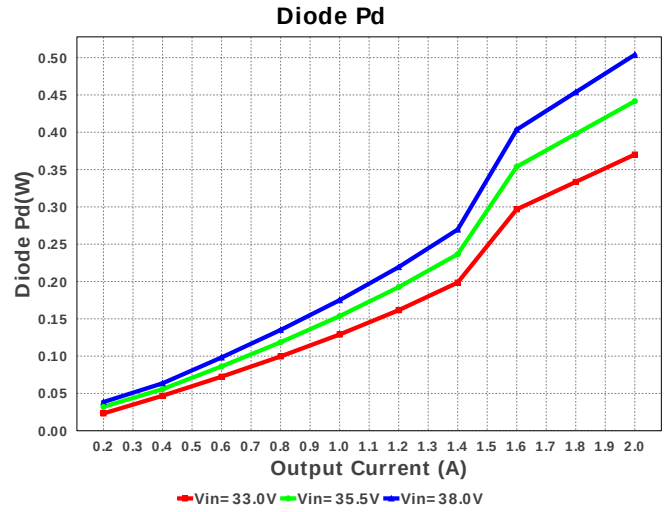

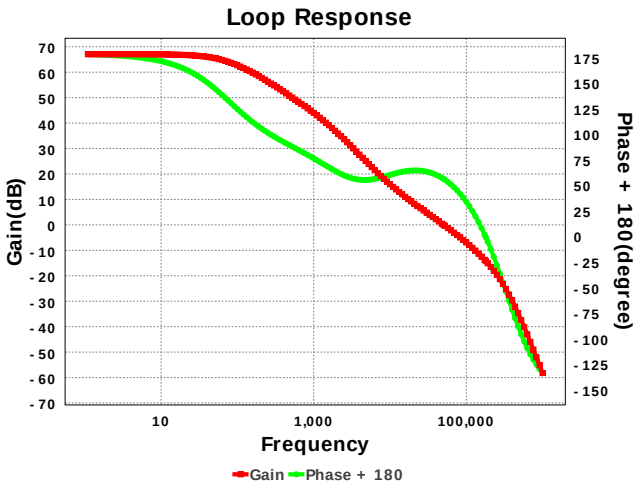

Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	959.936 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	160.098 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	2.277 A	Current	Peak switch current in IC
4.	Iin Avg	1.312 A	Current	Average input current
5.	L Ipp	554.6 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	1.6 A	Current	Q Iavg
7.	BOM Count	11	General	Total Design BOM count
8.	FootPrint	309.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	728.501 kHz	General	Switching frequency
10.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	114.711 mV	General	Voltage drop across the MosFET

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#	Name	Value	Category	Description
12.	Mode	CCM	General	Conduction Mode
13.	Pout	48.0 W	General	Total output power
14.	Total BOM	$2.2	General	Total BOM Cost
15.	D1 Tj	120.183 degC	Op_Point	D1 junction temperature
16.	Vout Actual	24.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
17.	Vout OP	24.0 V	Op_Point	Operational Output Voltage
18.	Cross Freq	50.456 kHz	Op_point	Bode plot crossover frequency
19.	Duty Cycle	64.014 %	Op_point	Duty cycle
20.	Efficiency	96.242 %	Op_point	Steady state efficiency
21.	IC Tj	70.54 degC	Op_point	IC junction temperature
22.	ICThetaJA	42.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
23.	IOUT_OP	2.0 A	Op_point	Iout operating point
24.	Phase Marg	57.161 deg	Op_point	Bode Plot Phase Margin
25.	VIN_OP	38.0 V	Op_point	Vin operating point
26.	Vout p-p	11.66 mV	Op_point	Peak-to-peak output ripple voltage
27.	Cin Pd	1.594 mW	Power	Input capacitor power dissipation
28.	Cout Pd	38.447 µW	Power	Output capacitor power dissipation
29.	Diode Pd	503.813 mW	Power	Diode power dissipation
30.	IC Pd	965.232 mW	Power	IC power dissipation
31.	L Pd	402.578 mW	Power	Inductor power dissipation
32.	Total Pd	1.874 W	Power	Total Power Dissipation
33.	Vout Tolerance	4.404 %		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	38.0	Maximum input voltage
3.	VinMin	33.0	Minimum input voltage
4.	Vout	24.0	Output Voltage
5.	base_pn	LMR14020S	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **LMR14020S** Product Folder : http://www.ti.com/product/LMR14020 : contains the data sheet and other resources.

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