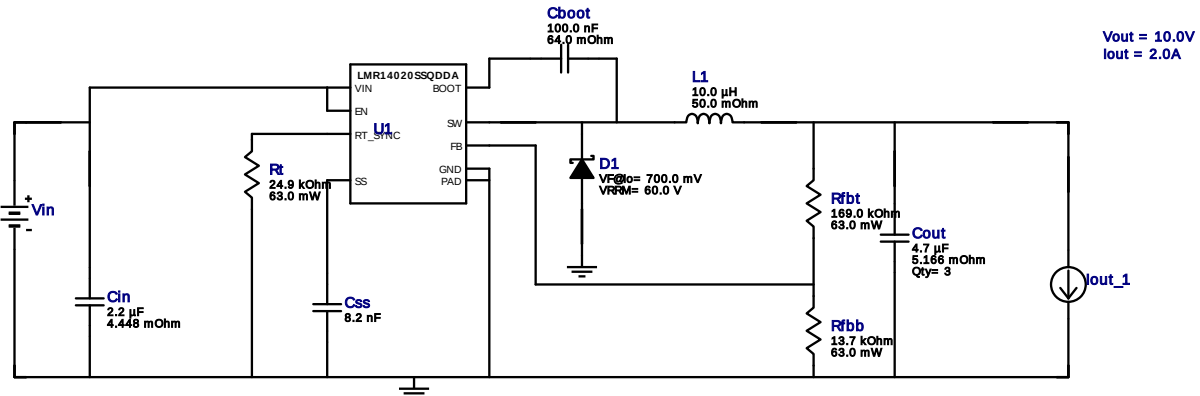


WEBENCH® Design Report

Design : 4352199/50 LMR14020SSQDDARQ1
LMR14020SSQDDARQ1 22.0V-30.0V to 10.00V @ 2.000164203612479A

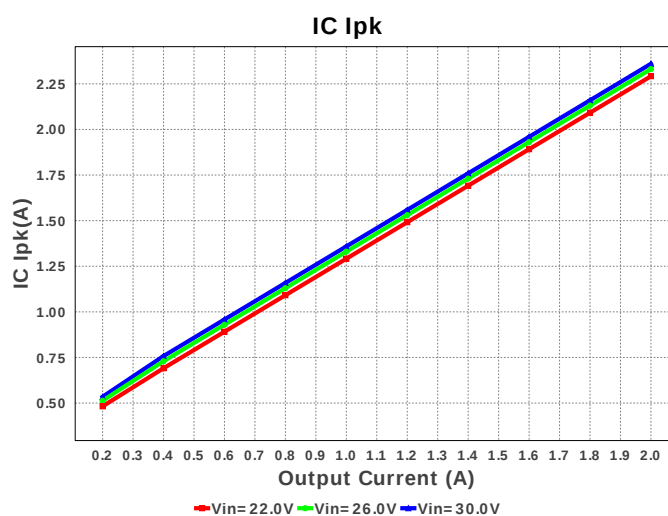
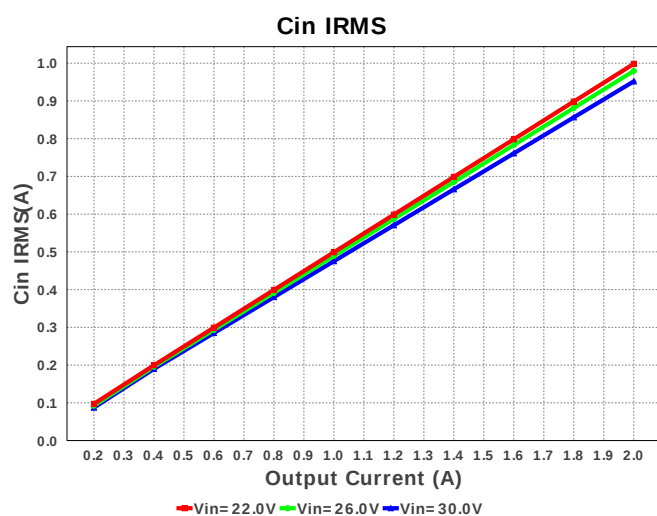
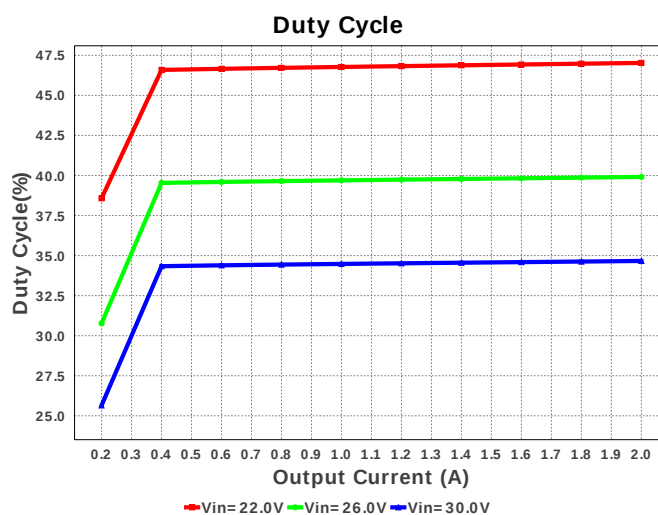
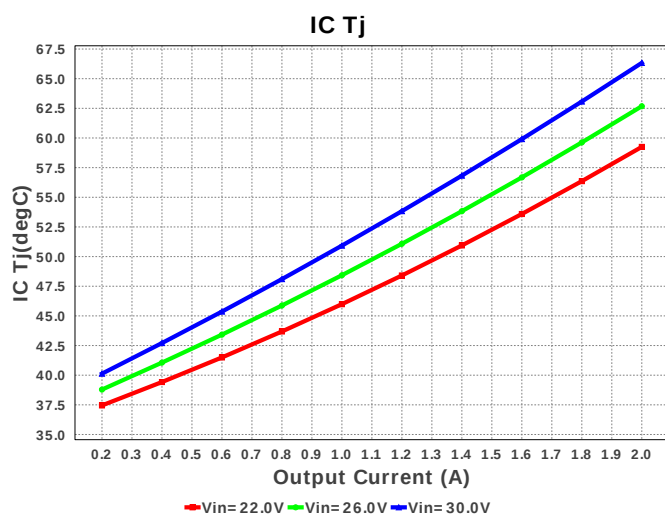


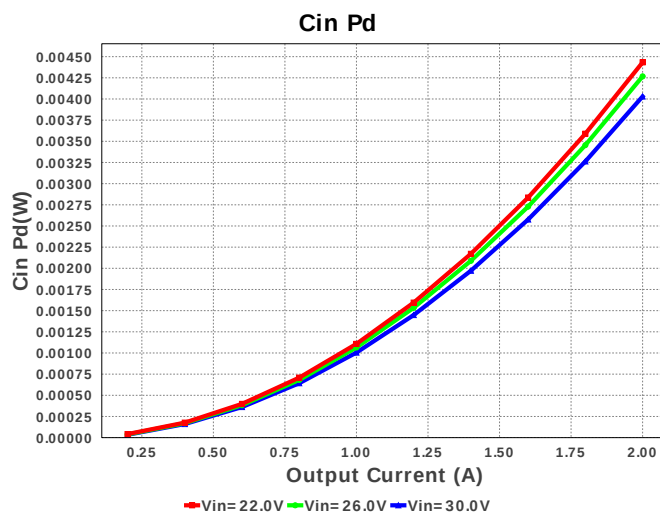
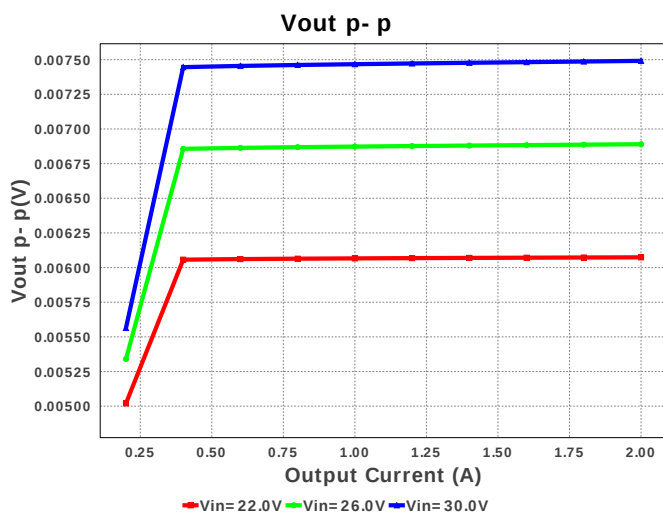
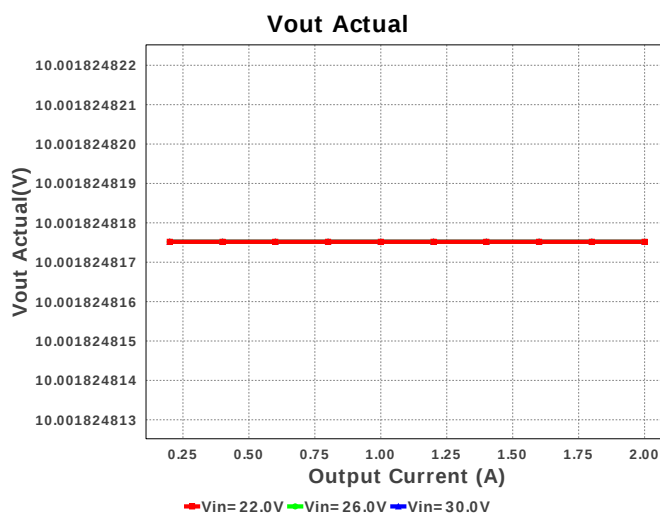
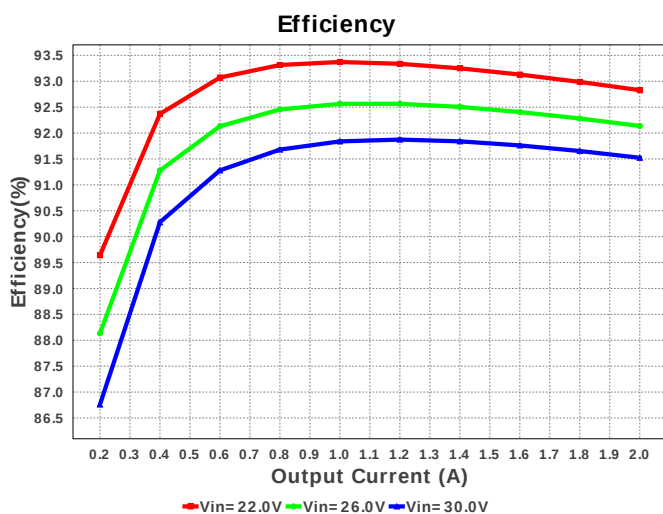
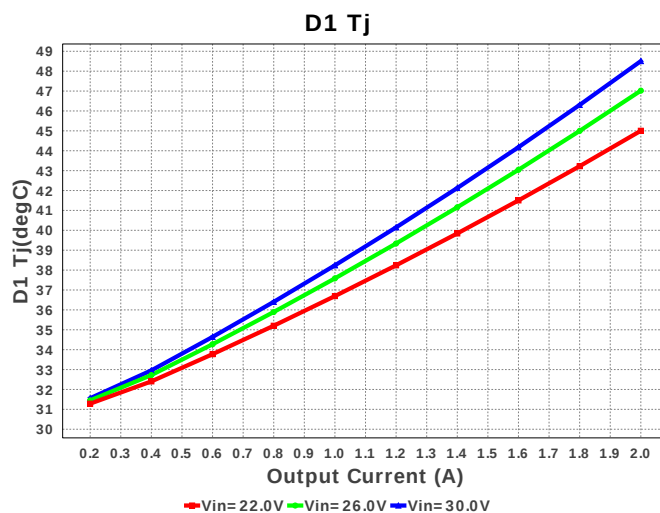
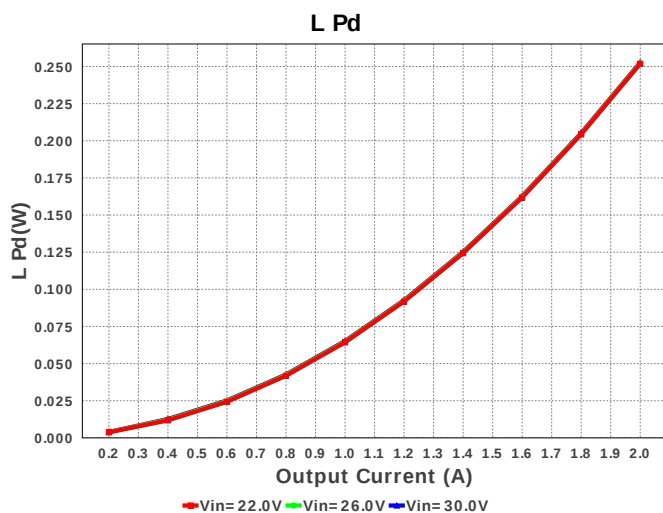
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application. View WEBENCH(R) Disclaimer.

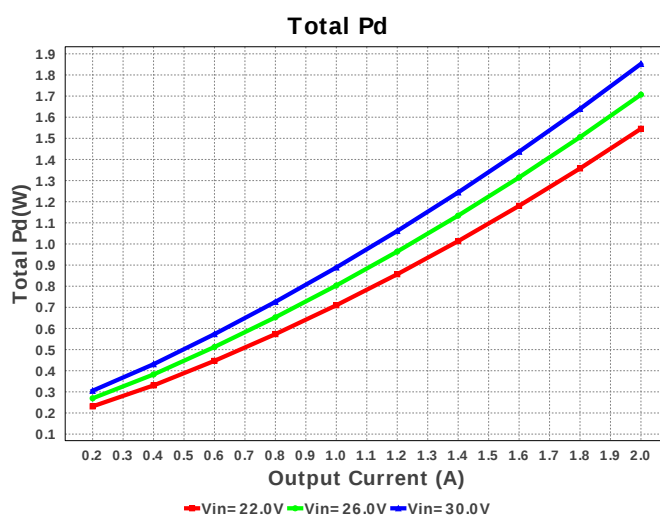
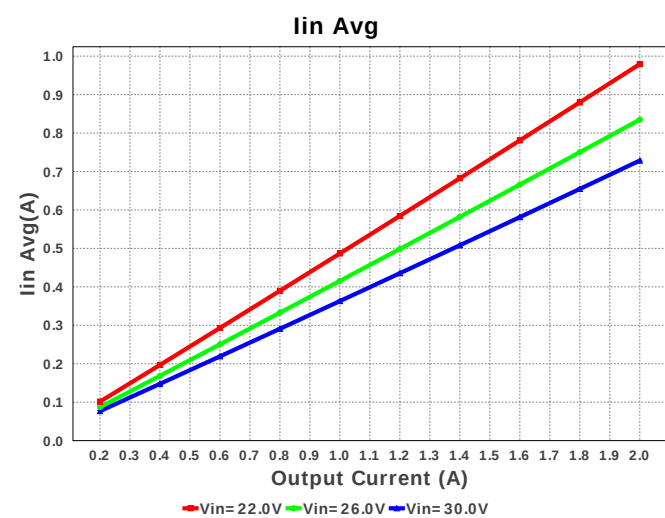
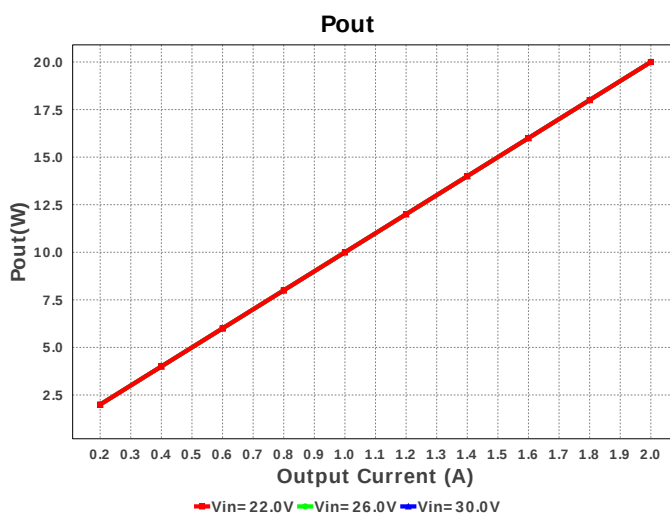
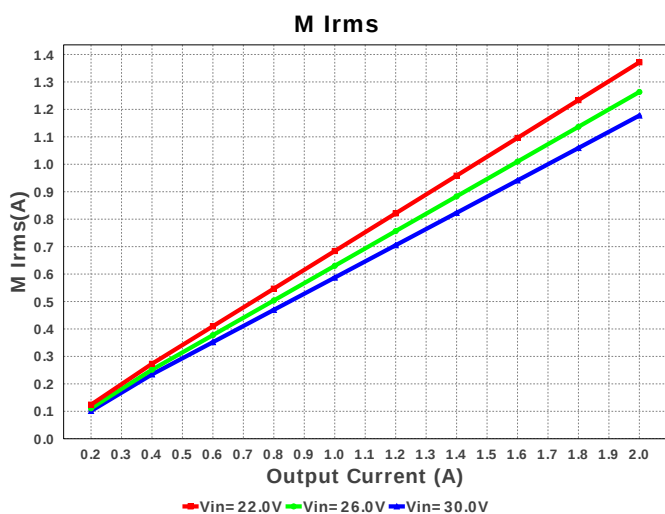
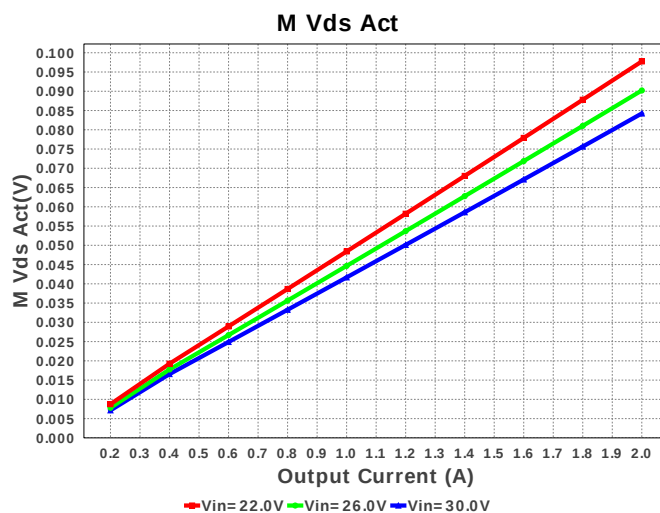
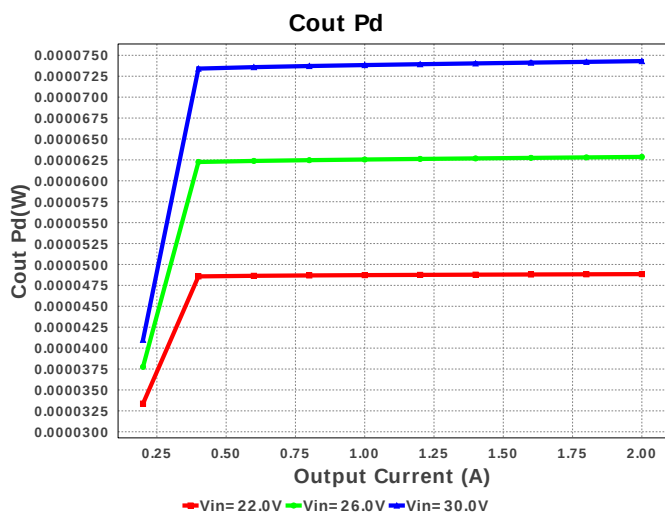
Electrical BOM

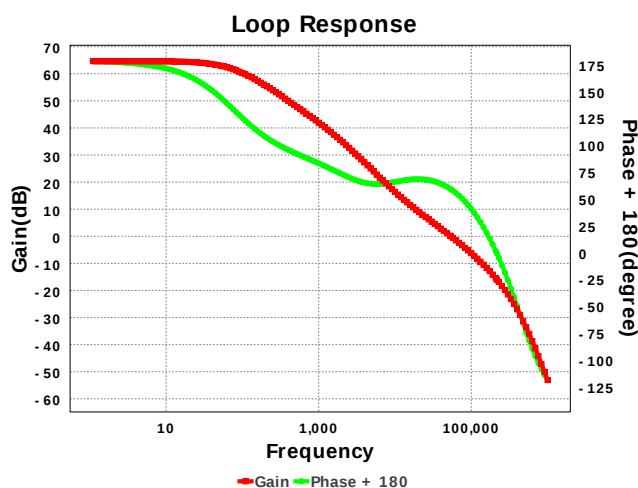
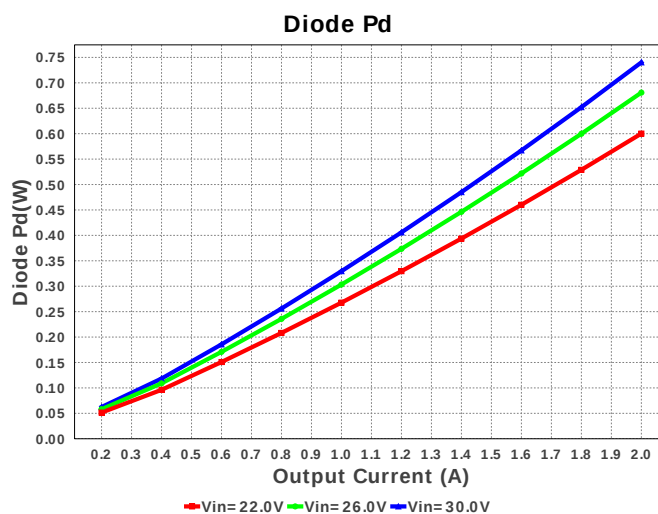
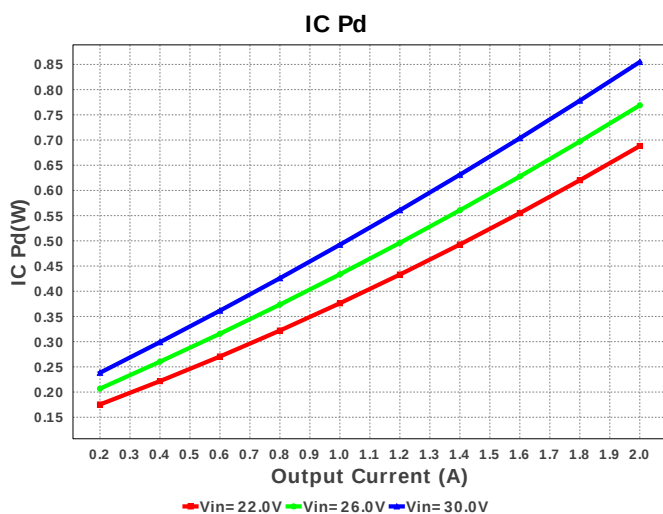
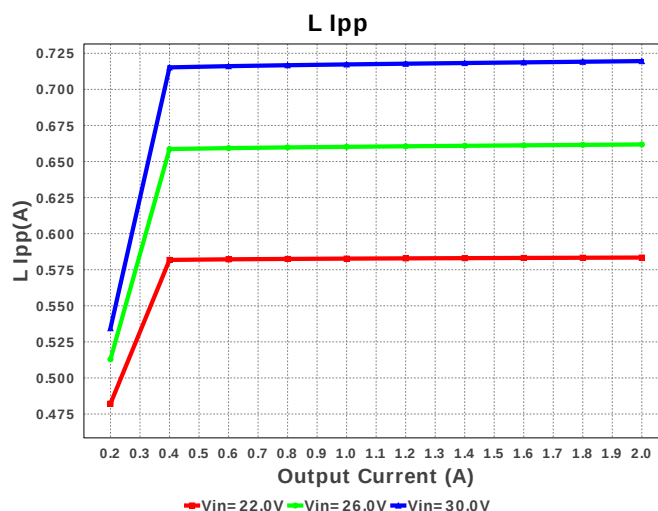
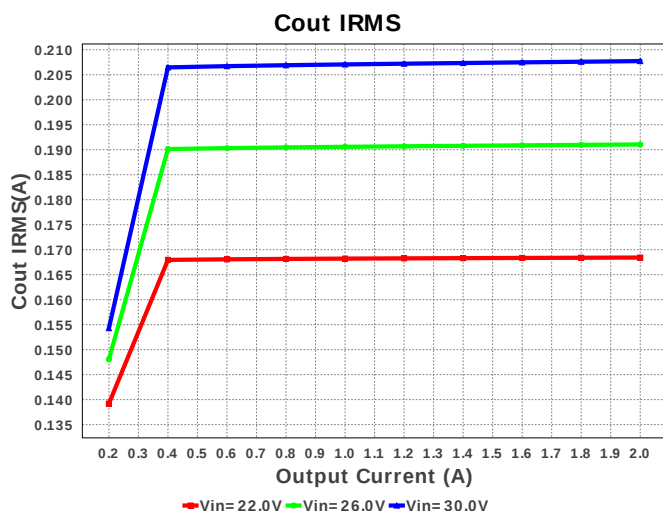
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	\$0.01	0805 7 mm ²
2.	Cin	MuRata	GRM31CR71H225KA88L Series= X7R	Cap= 2.2 uF ESR= 4.448 mOhm VDC= 50.0 V IRMS= 2.2252 A	1	\$0.05	1206_190 11 mm ²
3.	Cout	MuRata	GRM21BC81E475KA12L Series= X6S	Cap= 4.7 uF ESR= 5.166 mOhm VDC= 25.0 V IRMS= 2.03531 A	3	\$0.02	0805 7 mm ²
4.	Css	MuRata	GRM155R71C822KA01D Series= X7R	Cap= 8.2 nF VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
5.	D1	Diodes Inc.	B260A-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	\$0.09	SMA 37 mm ²
6.	L1	Bourns	SRN8040-100M	L= 10.0 uH DCR= 50.0 mOhm	1	\$0.22	SRN8040 100 mm ²
7.	Rfbb	Vishay-Dale	CRCW040213K7FKED Series= CRCW..e3	Res= 13.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
8.	Rfbbt	Vishay-Dale	CRCW0402169KFKED Series= CRCW..e3	Res= 169.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
9.	Rt	Vishay-Dale	CRCW040224K9FKED Series= CRCW..e3	Res= 24.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	U1	Texas Instruments	LMR14020SSQDDARQ1	Switcher	1	\$1.87	 DDA0008E_N 57 mm²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	951.828 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	207.731 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	2.36 A	Current	Peak switch current in IC
4.	Iin Avg	728.43 mA	Current	Average input current
5.	L Ipp	719.6 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	1.178 A	Current	Q lavg
7.	BOM Count	12	General	Total Design BOM count
8.	FootPrint	245.0 mm ²	General	Total Foot Print Area of BOM components
9.	Frequency	959.376 kHz	General	Switching frequency
10.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	84.211 mV	General	Voltage drop across the MosFET

#	Name	Value	Category	Description
12.	Pout	20.0 W	General	Total output power
13.	Total BOM	\$2.34	General	Total BOM Cost
14.	D1 Tj	48.506 degC	Op_Point	D1 junction temperature
15.	Vout Actual	10.002 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
16.	Vout OP	10.0 V	Op_Point	Operational Output Voltage
17.	Cross Freq	53.962 kHz	Op_point	Bode plot crossover frequency
18.	Duty Cycle	34.664 %	Op_point	Duty cycle
19.	Efficiency	91.523 %	Op_point	Steady state efficiency
20.	IC Tj	65.902 degC	Op_point	IC junction temperature
21.	ICThetaJA	42.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
22.	IOUT_OP	2.0 A	Op_point	Iout operating point
23.	Phase Marg	59.907 deg	Op_point	Bode Plot Phase Margin
24.	VIN_OP	30.0 V	Op_point	Vin operating point
25.	Vout p-p	7.491 mV	Op_point	Peak-to-peak output ripple voltage
26.	Cin Pd	4.03 mW	Power	Input capacitor power dissipation
27.	Cout Pd	74.308 µW	Power	Output capacitor power dissipation
28.	Diode Pd	740.25 mW	Power	Diode power dissipation
29.	IC Pd	854.805 mW	Power	IC power dissipation
30.	L Pd	252.711 mW	Power	Inductor power dissipation
31.	Total Pd	1.852 W	Power	Total Power Dissipation
32.	Vout Tolerance	4.314 %		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	30.0	Maximum input voltage
3.	VinMin	22.0	Minimum input voltage
4.	Vout	10.0	Output Voltage
5.	base_pn	LMR14020SS-Q1	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **LMR14020SS-Q1** Product Folder : <http://www.ti.com/product/LMR14020%2DQ1> : contains the data sheet and other resources.

Texas Instruments' WEBENCH simulation tools attempt to recreate the performance of a substantially equivalent physical implementation of the design. Simulations are created using Texas Instruments' published specifications as well as the published specifications of other device manufacturers. While Texas Instruments does update this information periodically, this information may not be current at the time the simulation is built. Texas Instruments does not warrant the accuracy or completeness of the specifications or any information contained therein. Texas Instruments does not warrant that any designs or recommended parts will meet the specifications you entered, will be suitable for your application or fit for any particular purpose, or will operate as shown in the simulation in a physical implementation. Texas Instruments does not warrant that the designs are production worthy.

You should completely validate and test your design implementation to confirm the system functionality for your application prior to production.

Use of Texas Instruments' WEBENCH simulation tools is subject to [Texas Instruments' Site Terms and Conditions of Use](#). Prototype boards based on WEBENCH created designs are provided AS IS without warranty of any kind for evaluation and testing purposes and are subject to the terms of the [Evaluation License Agreement](#).