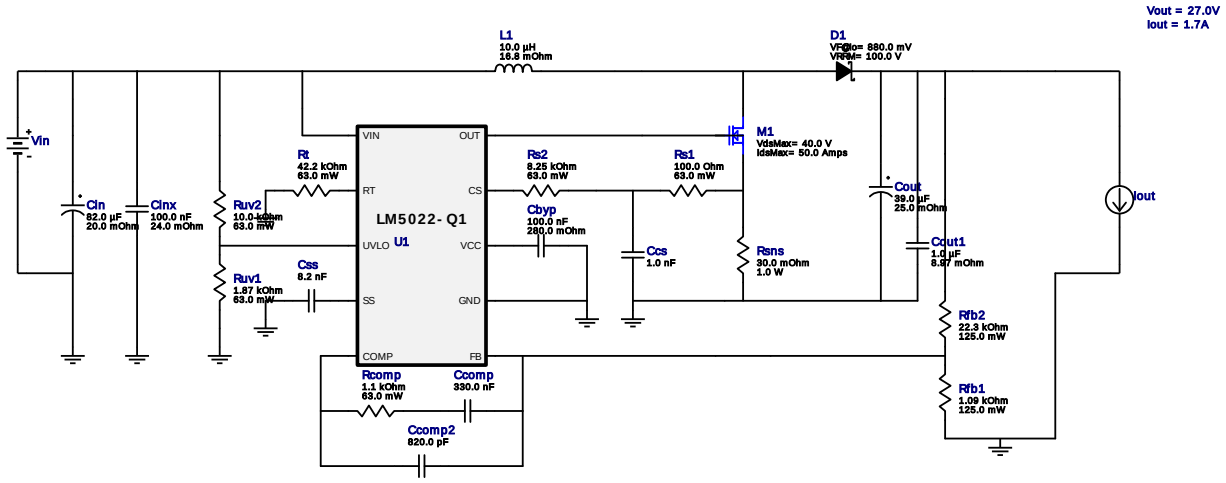
WEBENCH® Design Report

VinMin = 10.0V
VinMax = 22.0V
Vout = 27.0V
Iout = 1.7A

Device = LM5022QDGSTQ1
Topology = Boost
Created = 11/5/16 6:25:30 AM
BOM Cost = $3.98
BOM Count = 22
Total Pd = 3.31W

Design : 4494754/12 LM5022QDGSTQ1
LM5022QDGSTQ1 10.0V-22.0V to 27.00V @ 1.7A



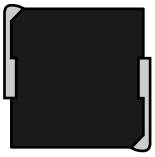
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific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

My Comments

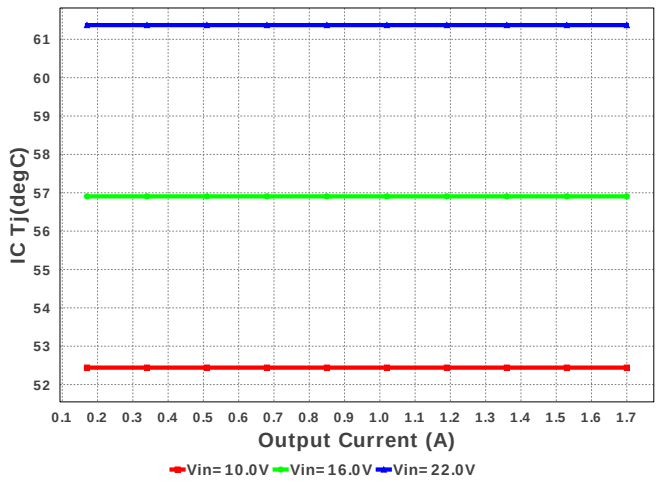
No comments

Electrical BOM

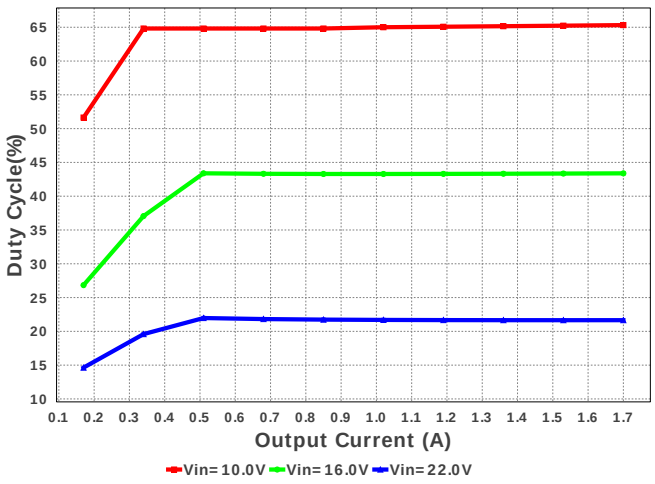
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbyp	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp	MuRata	GRM155R60J334KE01D Series= X5R	Cap= 330.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
3.	Ccomp2	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Ccs	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
5.	Cin	Panasonic	35SVPF82M Series= ?	Cap= 82.0 uF ESR= 20.0 mOhm VDC= 35.0 V IRMS= 4.0 A	1	$0.61	CAPSMT_62_E12 106 mm²
6.	Cinx	AVX	08055C104JAT2A Series= X7R	Cap= 100.0 nF ESR= 24.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
7.	Cout	Panasonic	50SVPF39M Series= ?	Cap= 39.0 uF ESR= 25.0 mOhm VDC= 50.0 V IRMS= 3.8 A	1	$0.72	CAPSMT_62_E12 106 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	Cout1	TDK	C3216X5R1H105K Series= X5R	Cap= 1.0 uF ESR= 8.97 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.02	 1206 11 mm²
9.	Css	MuRata	GRM155R71E822KA01D Series= X7R	Cap= 8.2 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
10.	D1	Vishay-Semiconductor	SS10PH10-M3/86A	VF@Io= 880.0 mV VRRM= 100.0 V	1	$0.29	 TO-277A 57 mm²
11.	L1	Bourns	SRP1270-100M	L= 10.0 µH DCR= 16.8 mOhm	1	$0.60	 SRP1270 246 mm²
12.	M1	Texas Instruments	CSD18504Q5A	VdsMax= 40.0 V IdsMax= 50.0 Amps	1	$0.33	 TRANS_NexFET_Q5A 55 mm²
13.	Rcomp	Vishay-Dale	CRCW04021K10FKED Series= CRCW..e3	Res= 1.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
14.	Rfb1	Yageo America	RT0805BRD071K09L Series= RT0805	Res= 1.09 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.05	 0805 7 mm²
15.	Rfb2	Yageo America	RT0805BRD0722K3L Series= RT0805	Res= 22.3 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.05	 0805 7 mm²
16.	Rs1	Vishay-Dale	CRCW0402100RFKED Series= CRCW..e3	Res= 100.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
17.	Rs2	Vishay-Dale	CRCW04028K25FKED Series= CRCW..e3	Res= 8.25 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
18.	Rsns	Stackpole Electronics Inc	CSRN2010FK30L0 Series= ?	Res= 30.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.15	 2010 32 mm²
19.	Rt	Vishay-Dale	CRCW040242K2FKED Series= CRCW..e3	Res= 42.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
20.	Ruv1	Vishay-Dale	CRCW04021K87FKED Series= CRCW..e3	Res= 1.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
21.	Ruv2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
22.	U1	Texas Instruments	LM5022QDGSTQ1	Switcher	1	$1.04	 MUB10A 24 mm²

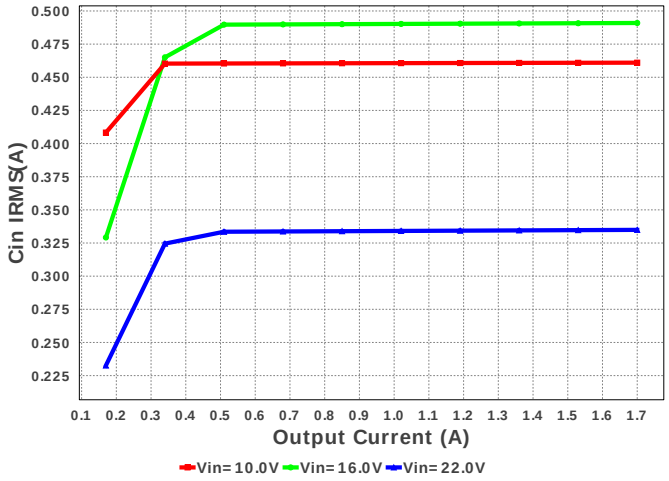
IC Tj



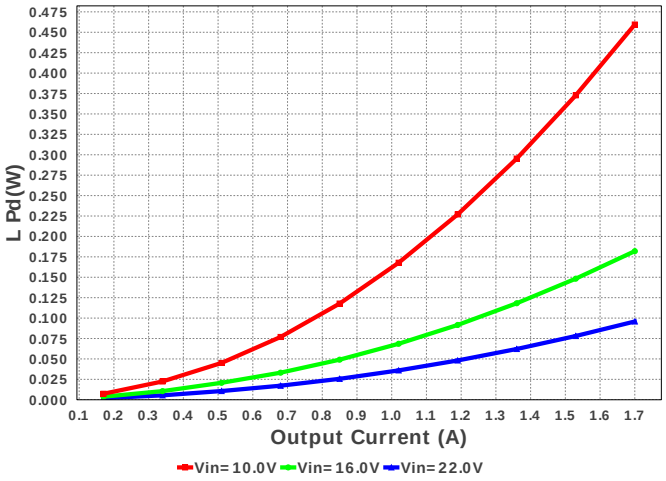
Duty Cycle



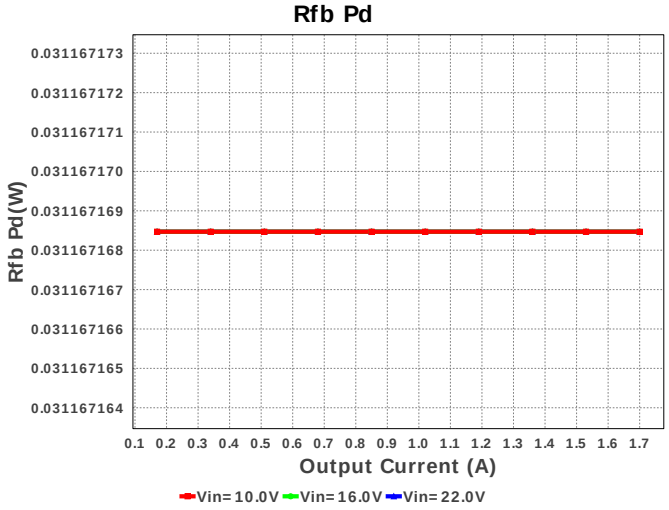
Cin IRMS



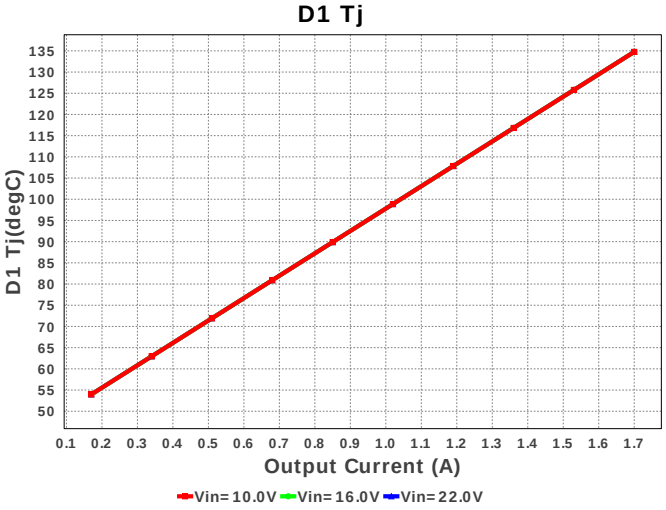
L Pd

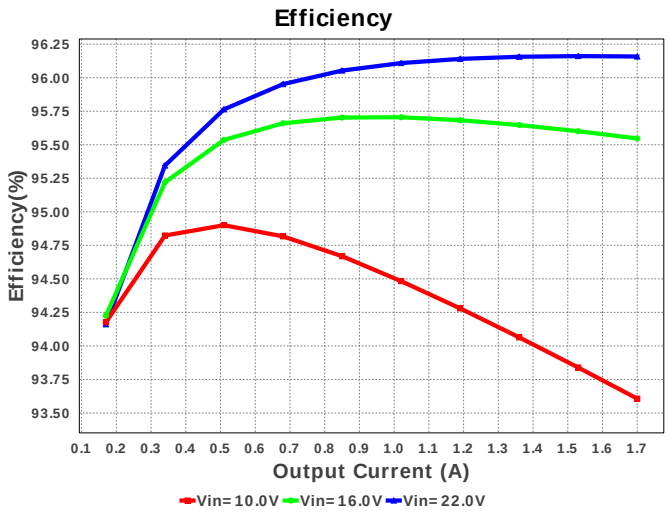


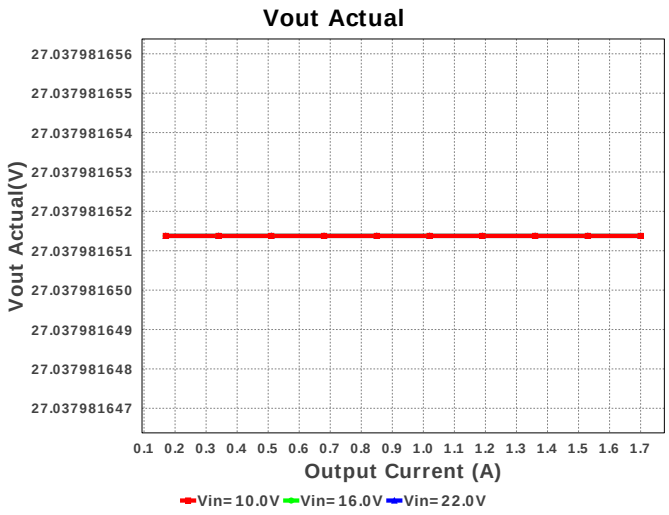
Rfb Pd

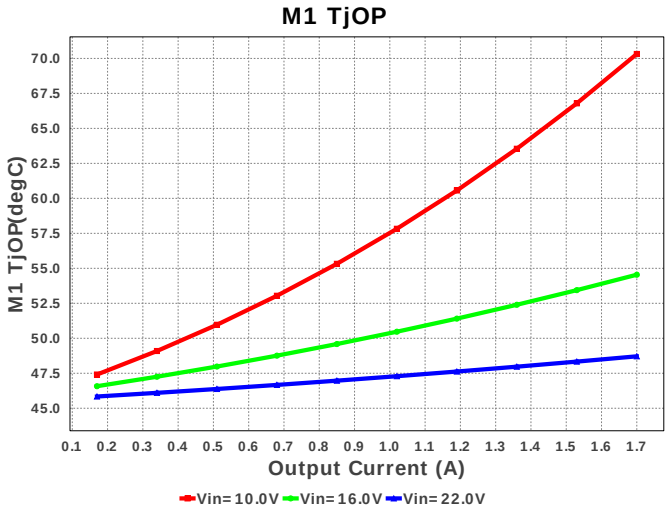


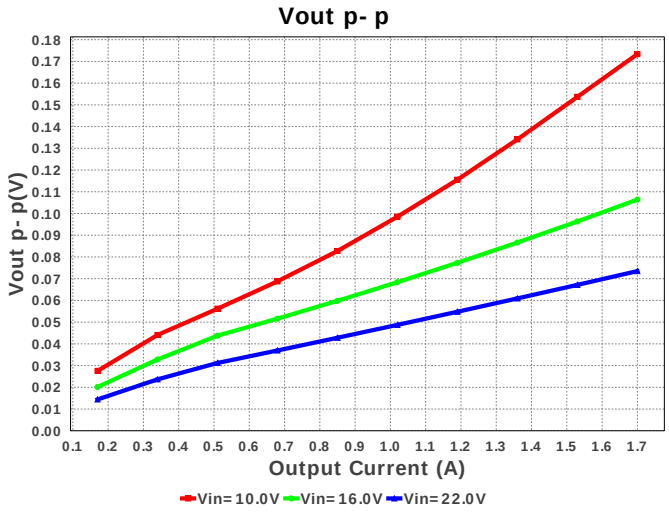
D1 Tj

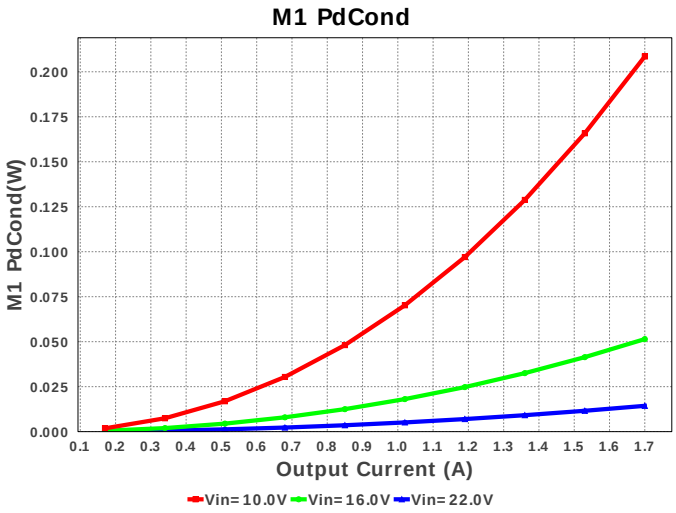


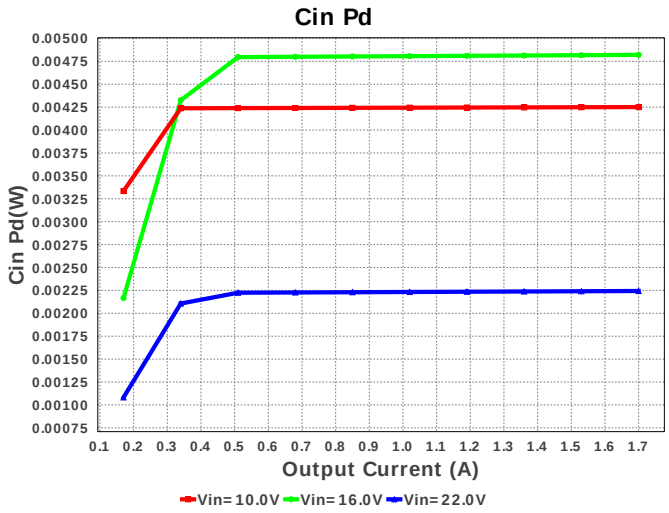


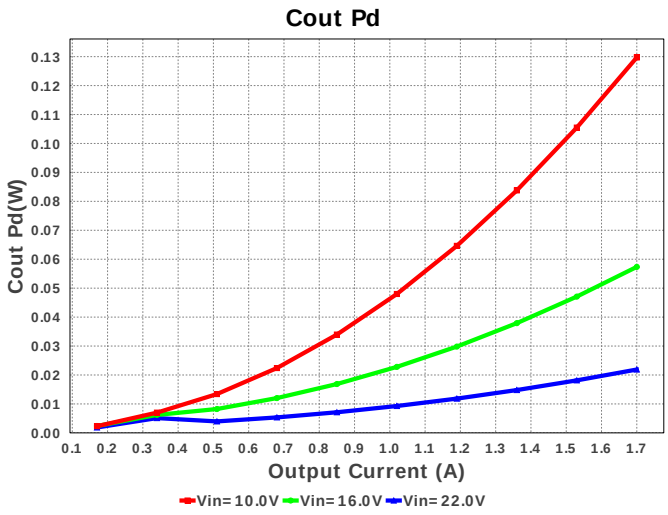


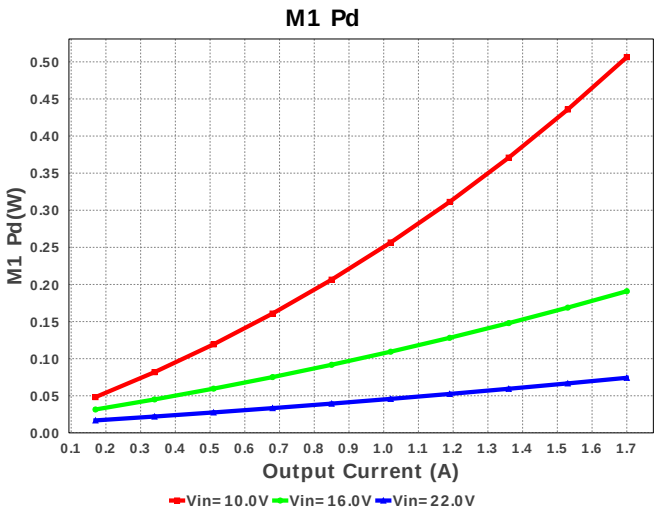


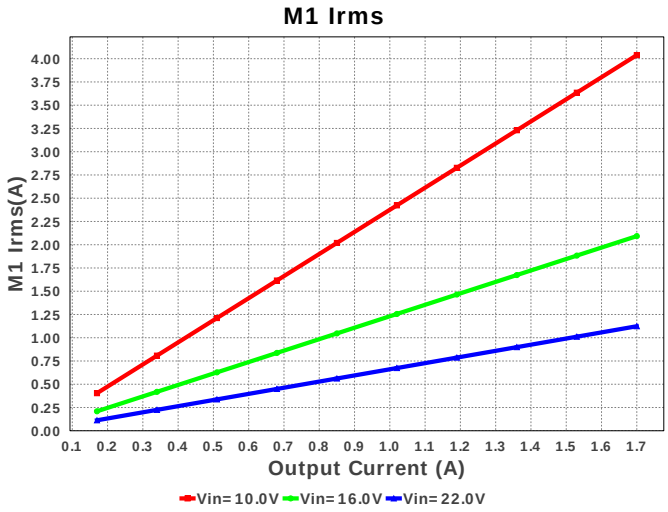


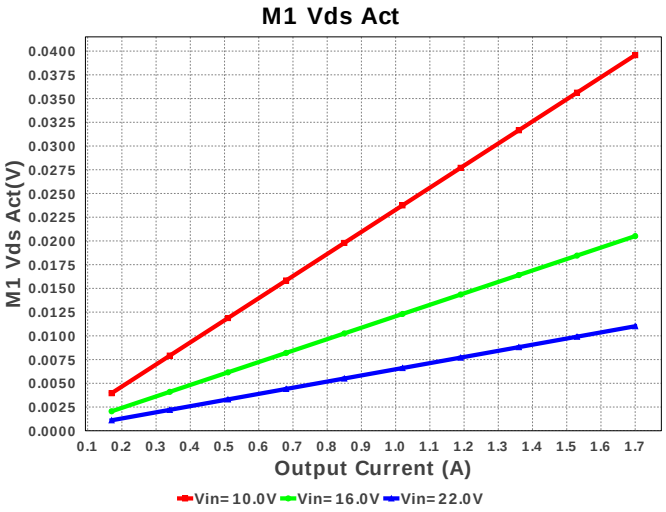


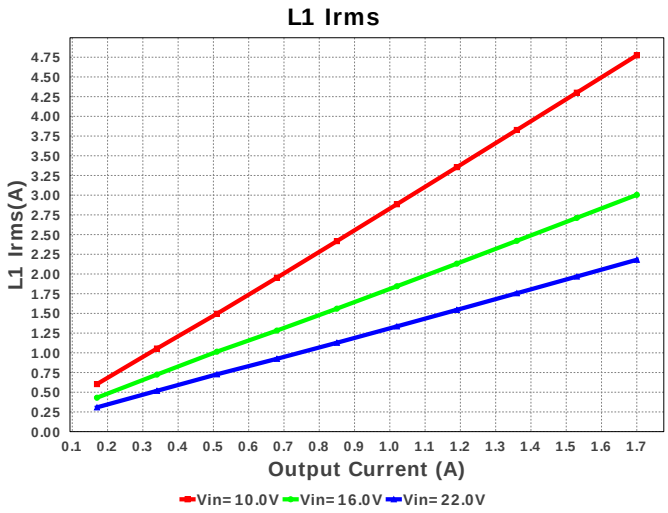


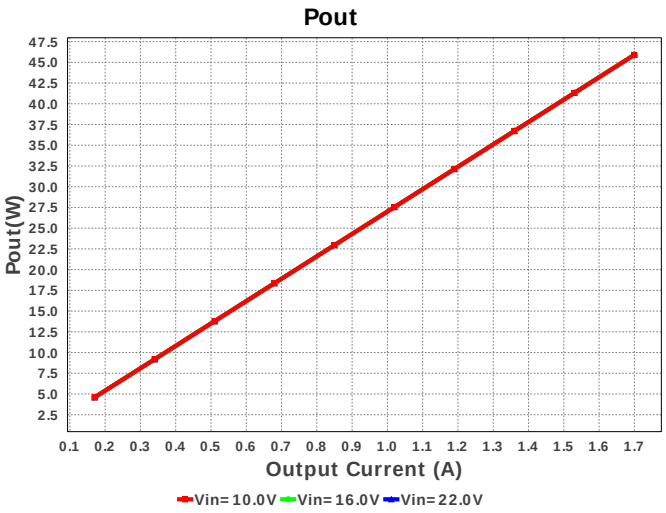


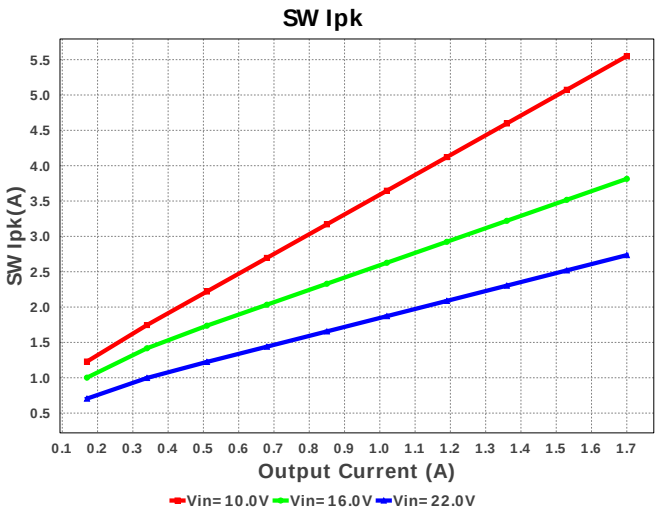


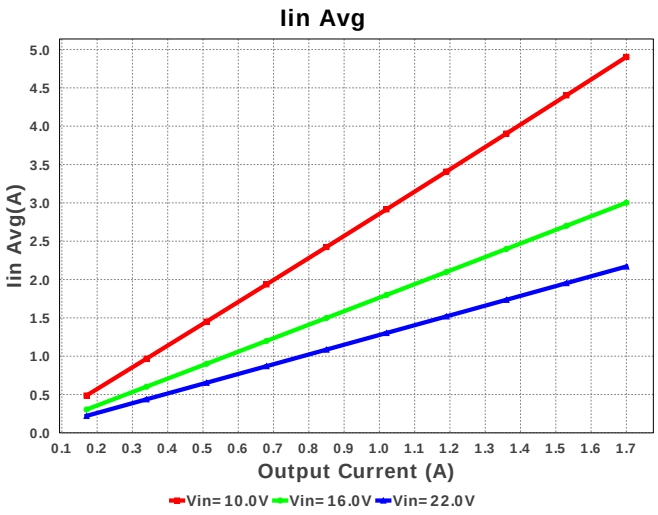


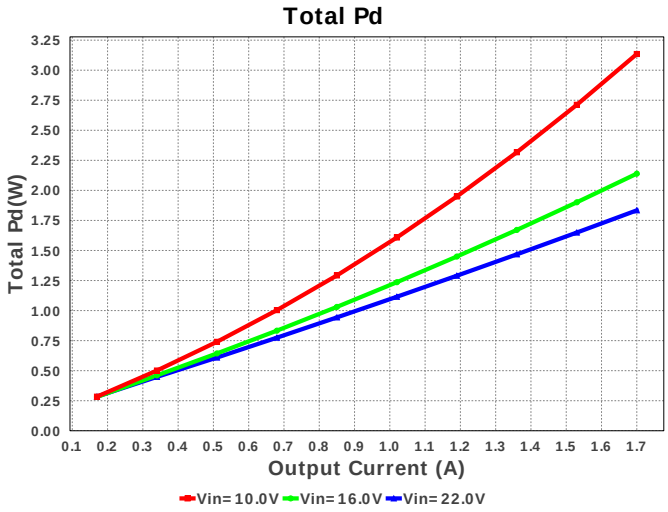


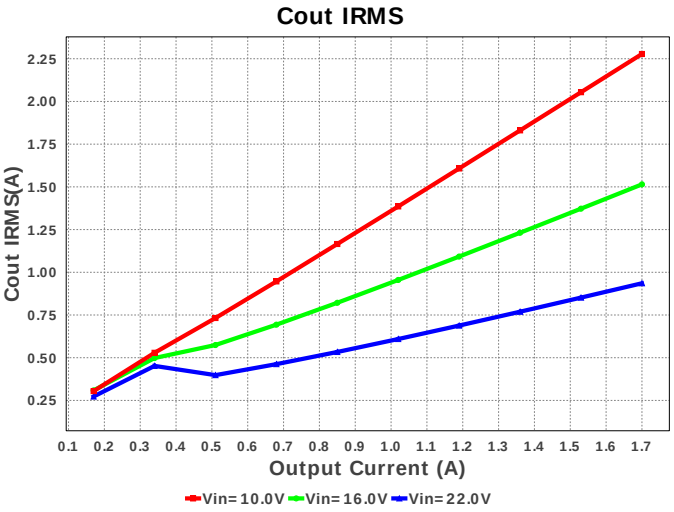


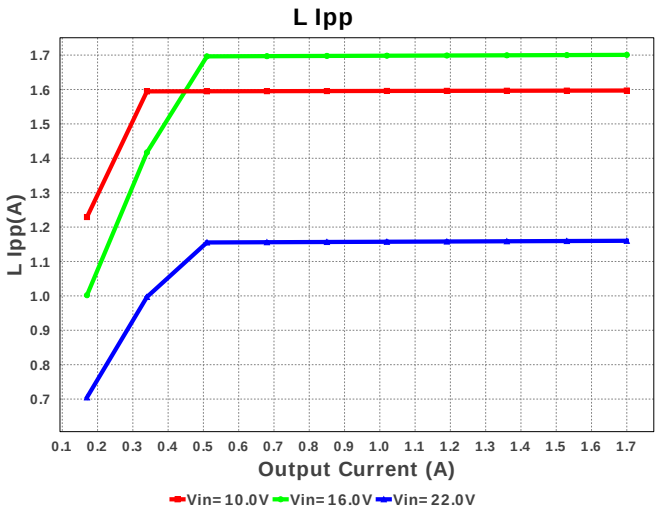


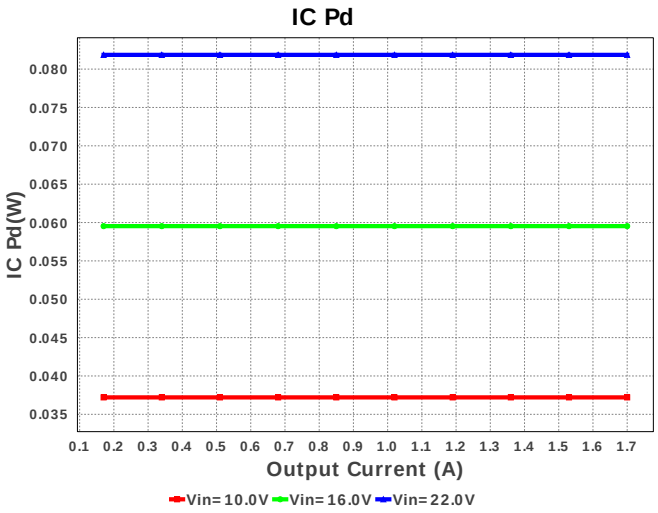


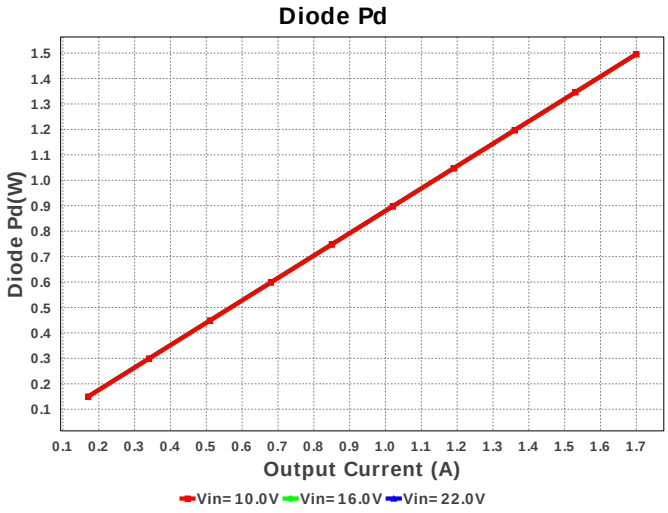


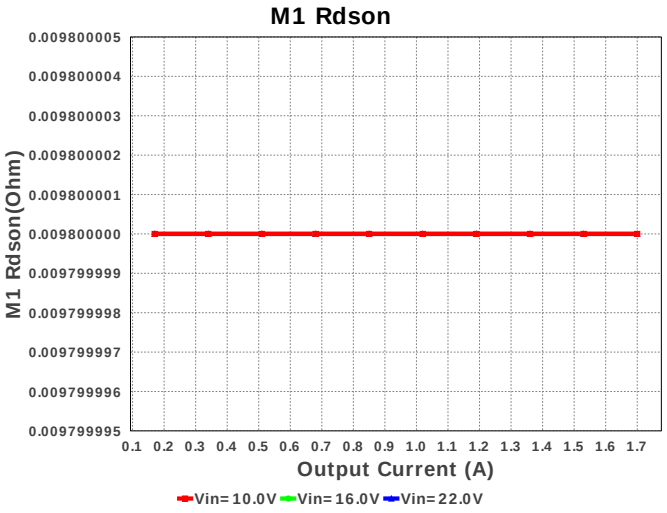


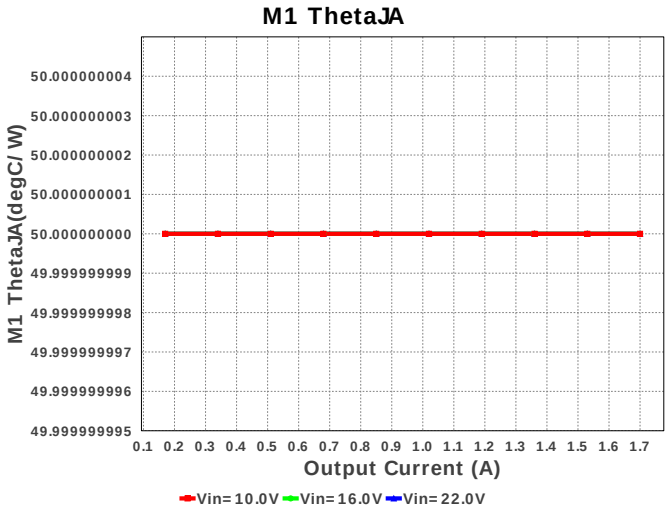


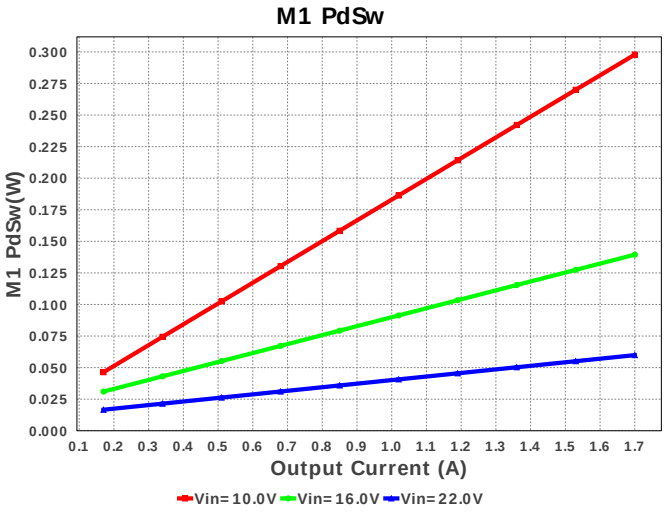


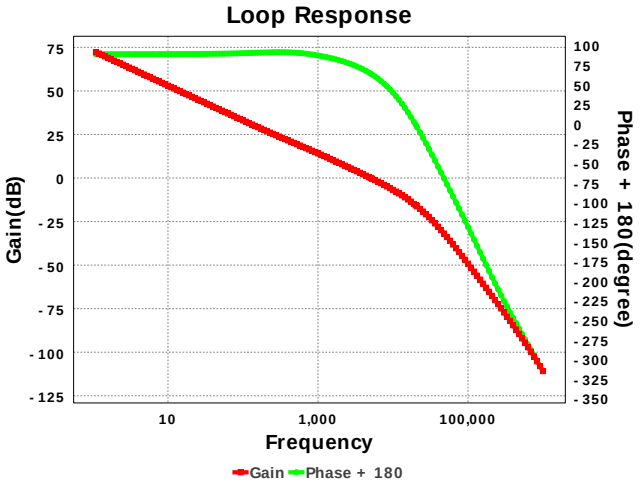












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	463.72 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	2.276 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	4.921 A	Current	Average input current
4.	L Ipp	1.606 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	4.774 A	Current	Inductor ripple current
6.	M1 Irms	4.03 A	Current	M1 MOSFET Irms
7.	SW Ipk	5.555 A	Current	Peak switch current
8.	BOM Count	22	General	Total Design BOM count
9.	FootPrint	702.0 mm^2	General	Total Foot Print Area of BOM components
10.	Frequency	400.0 kHz	General	Switching frequency
11.	IC Tolerance	25.0 mV	General	IC Feedback Tolerance

#	Name	Value	Category	Description
12.	M1 Rdson	9.8 mOhm	General	Drain-Source On-resistance
13.	M1 ThetaJA	50.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
14.	Mode	CCM	General	Conduction Mode
15.	Pout	45.9 W	General	Total output power
16.	Total BOM	$3.98	General	Total BOM Cost
17.	D1 Tj	134.76 degC	Op_Point	D1 junction temperature
18.	Low Freq Gain	65.105 dB	Op_Point	Gain at 10Hz
19.	Vout Actual	27.038 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
20.	Vout OP	27.0 V	Op_Point	Operational Output Voltage
21.	Cross Freq	2.293 kHz	Op_point	Bode plot crossover frequency
22.	Duty Cycle	65.441 %	Op_point	Duty cycle
23.	Efficiency	93.272 %	Op_point	Steady state efficiency
24.	Gain Marg	-18.314 dB	Op_point	Bode Plot Gain Margin
25.	IC Tj	56.094 degC	Op_point	IC junction temperature
26.	ICThetaJA	200.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
27.	IOUT_OP	1.7 A	Op_point	Iout operating point
28.	M1 TjOP	77.999 degC	Op_point	M1 MOSFET junction temperature
29.	Phase Marg	78.723 deg	Op_point	Bode Plot Phase Margin
30.	VIN_OP	10.0 V	Op_point	Vin operating point
31.	Vout p-p	174.211 mV	Op_point	Peak-to-peak output ripple voltage
32.	Cin Pd	4.301 mW	Power	Input capacitor power dissipation
33.	Cout Pd	129.514 mW	Power	Output capacitor power dissipation
34.	Diode Pd	1.496 W	Power	Diode power dissipation
35.	IC Pd	55.47 mW	Power	IC power dissipation
36.	L Pd	459.512 mW	Power	Inductor power dissipation
37.	M1 Pd	659.978 mW	Power	M1 MOSFET total power dissipation
38.	M1 PdCond	215.852 mW	Power	M1 MOSFET conduction losses
39.	M1 PdSw	444.126 mW	Power	M1 MOSFET switching losses
40.	Rfb Pd	31.167 mW	Power	Rfb Power Dissipation
41.	Total Pd	3.311 W	Power	Total Power Dissipation
42.	M1 Vds Act	39.495 mV		M Vds
43.	Vout Tolerance	2.179 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.7	Maximum Output Current
2.	VinMax	22.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	27.0	Output Voltage
5.	base_pn	LM5022-Q1	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	45.0	Ambient temperature

Design Assistance

1. Feature Highlights: Automotive Qualified Synchronous Boost Controller

2. The LM5022-Q1 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

3. **LM5022-Q1** Product Folder : http://www.ti.com/product/LM5022%2Dq1 : contains the data sheet and other resources.