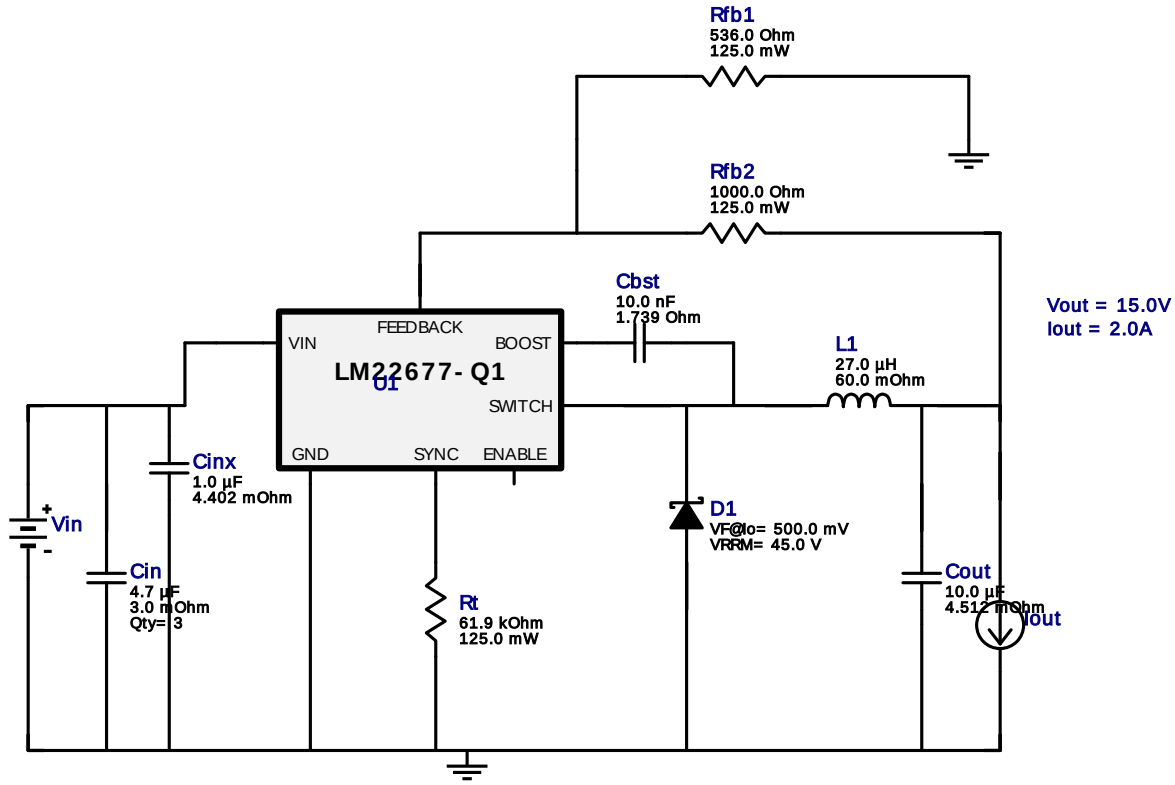
WEBENCH® Design Report

VinMin = 22.0V
VinMax = 30.0V
Vout = 15.0V
Iout = 2.0A

Device = LM22677QTJE-5.0/NOPB
Topology = Buck
Created = 7/17/16 8:21:46 AM
BOM Cost = $3.85
BOM Count = 12
Total Pd = 1.78W

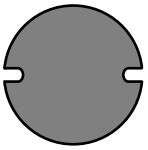
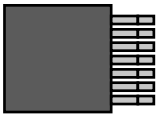
Design : 4352199/42 LM22677QTJE-5.0/NOPB
LM22677QTJE-5.0/NOPB 22.0V-30.0V to 15.00V @ 2.0A

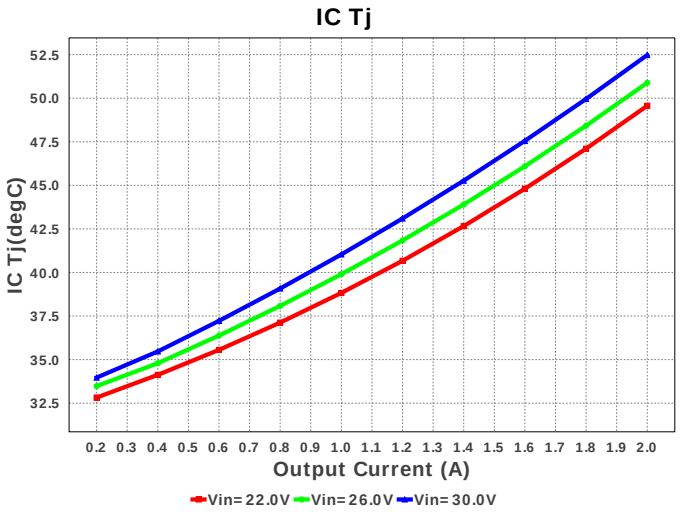


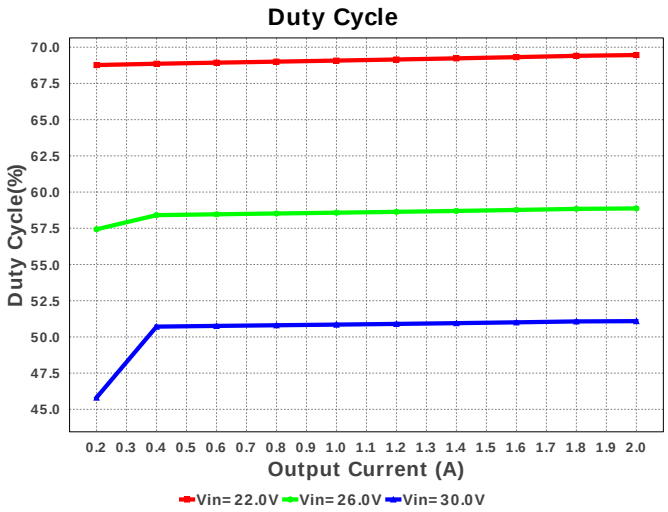
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific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

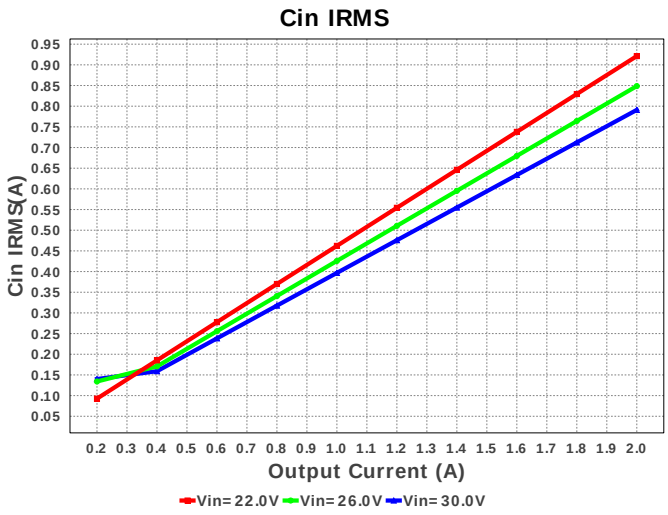
Electrical BOM

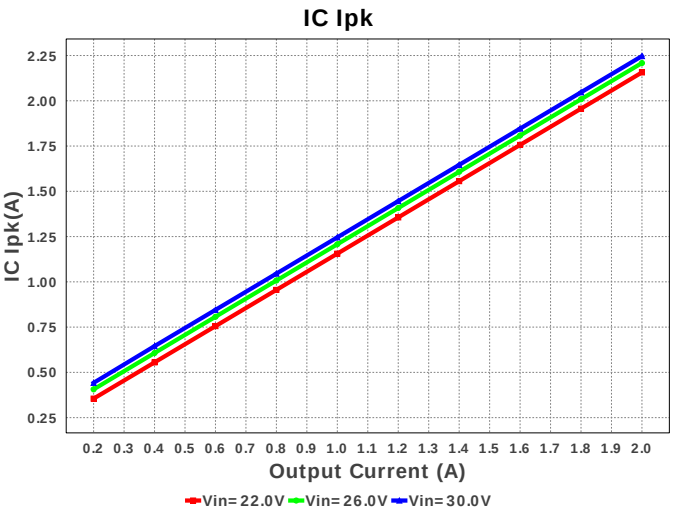
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	Kemet	C0805C103K5RACTU Series= X7R	Cap= 10.0 nF ESR= 1.739 Ohm VDC= 50.0 V IRMS= 411.0 mA	1	$0.01	0805 7 mm²
2.	Cin	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	3	$0.07	1206 11 mm²
3.	Cinx	MuRata	GRM21BR71H105KA12L Series= X7R	Cap= 1.0 uF ESR= 4.402 mOhm VDC= 50.0 V IRMS= 1.677 A	1	$0.05	0805 7 mm²
4.	Cout	MuRata	GRM31CR61E106KA12L Series= X5R	Cap= 10.0 uF ESR= 4.512 mOhm VDC= 25.0 V IRMS= 2.447 A	1	$0.05	1206_190 11 mm²
5.	D1	Vishay-Semiconductor	BYS10-45-E3/TR	VF@Io= 500.0 mV VRRM= 45.0 V	1	$0.10	SMA 37 mm²

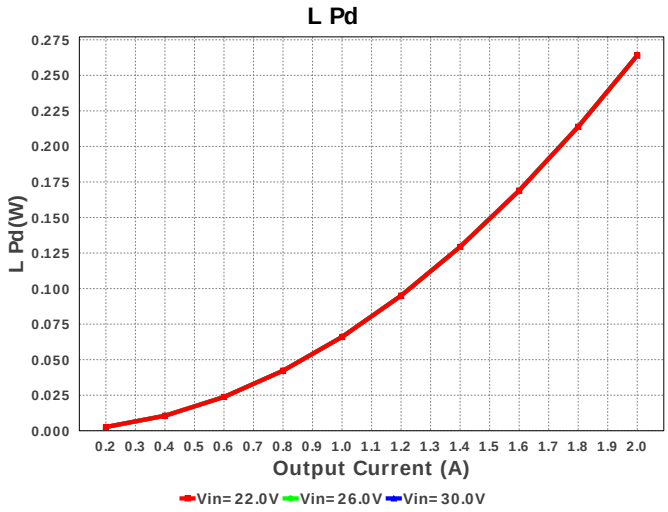
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
6.	L1	Bourns	SDR1307-270ML	L= 27.0 µH DCR= 60.0 mOhm	1	$0.35	 SDR1307 227 mm²
7.	Rfb1	Vishay-Dale	CRCW0805536RFKEA Series= CRCW..e3	Res= 536.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²
8.	Rfb2	Panasonic	ERJ-6ENF1001V Series= ERJ-6E	Res= 1000.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²
9.	Rt	Panasonic	ERJ-6ENF6192V Series= ERJ-6E	Res= 61.9 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²
10.	U1	Texas Instruments	LM22677QTJE-5.0/NOPB	Switcher	1	$3.05	 TJ7A 199 mm²

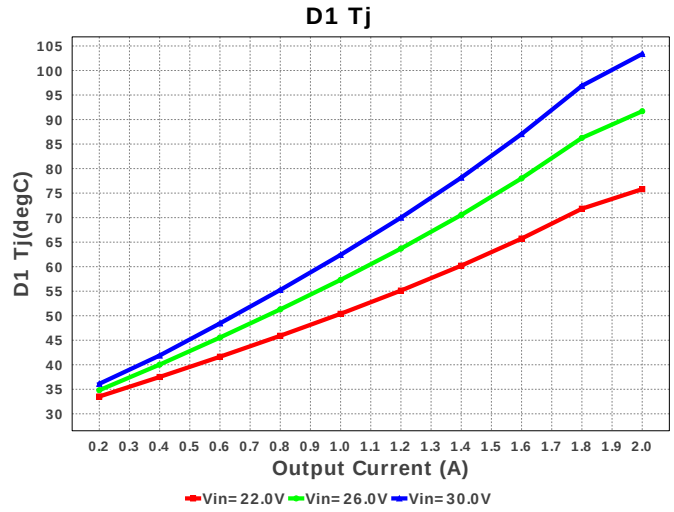


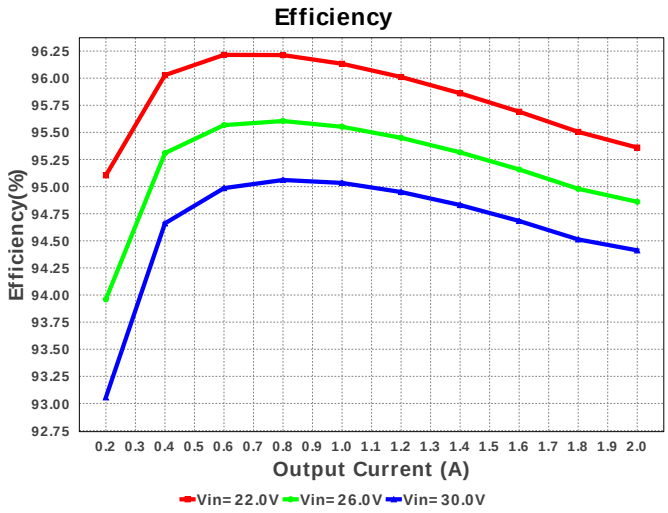


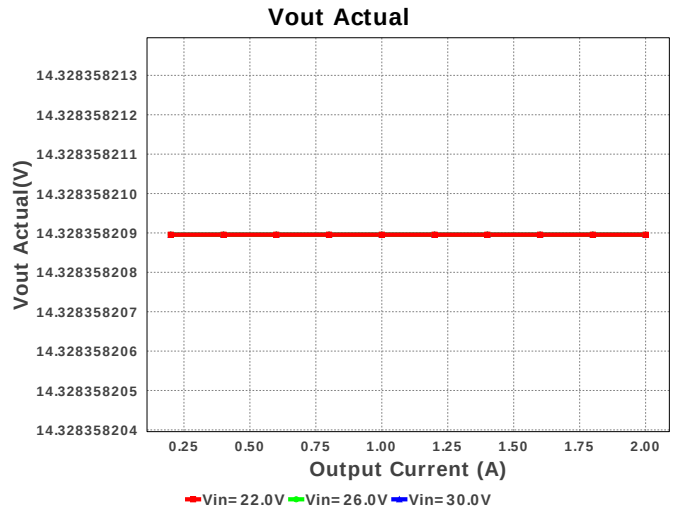

Cin IRMS
Cin IRMS(A)
0.95 0.90 0.85 0.80 0.75 0.70 0.65 0.60 0.55 0.50 0.45 0.40 0.35 0.30 0.25 0.20 0.15 0.10 0.05
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin= 22.0V Vin= 26.0V Vin= 30.0V

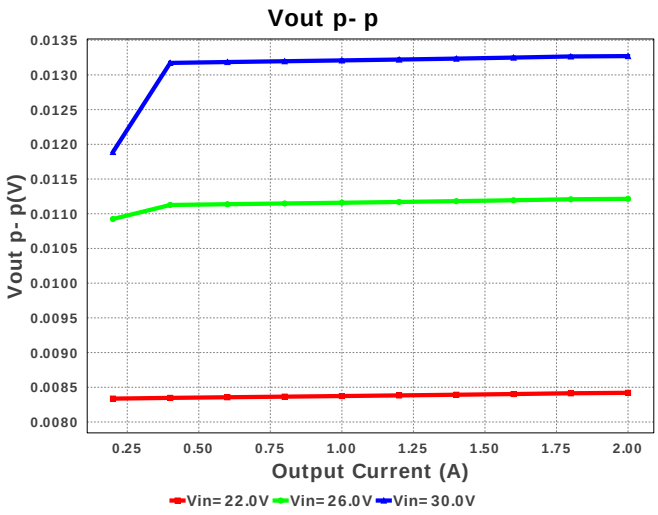

IC Ipk
IC Ipk(A)
2.25 2.00 1.75 1.50 1.25 1.00 0.75 0.50 0.25
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin= 22.0V Vin= 26.0V Vin= 30.0V

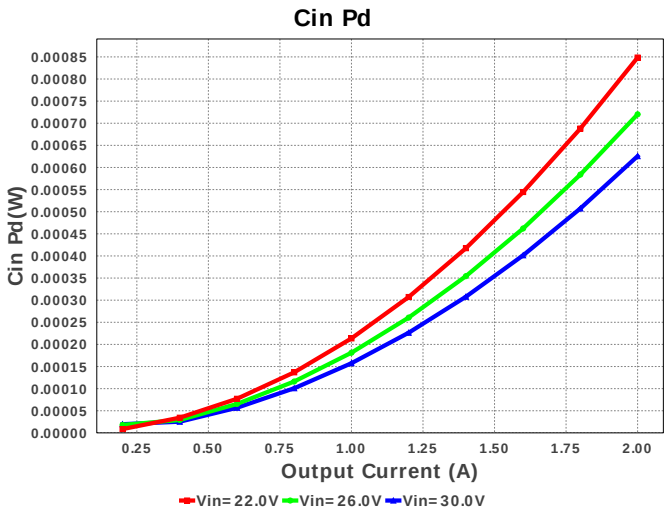

L Pd
L Pd(W)
0.275 0.250 0.225 0.200 0.175 0.150 0.125 0.100 0.075 0.050 0.025 0.000
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin= 22.0V Vin= 26.0V Vin= 30.0V

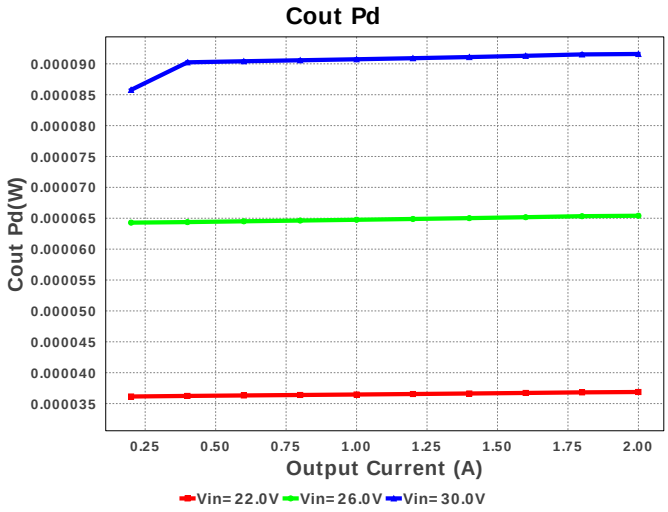

D1 Tj
D1 Tj(degC)
105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin= 22.0V Vin= 26.0V Vin= 30.0V

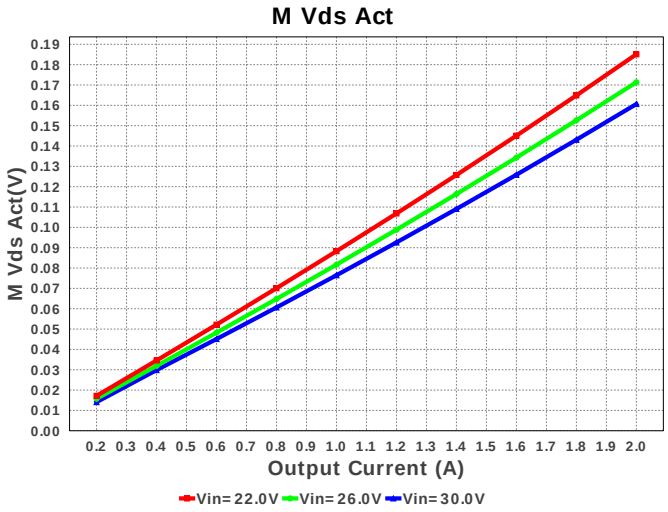

Efficiency
Efficiency(%)
96.25 96.00 95.75 95.50 95.25 95.00 94.75 94.50 94.25 94.00 93.75 93.50 93.25 93.00 92.75
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin= 22.0V Vin= 26.0V Vin= 30.0V

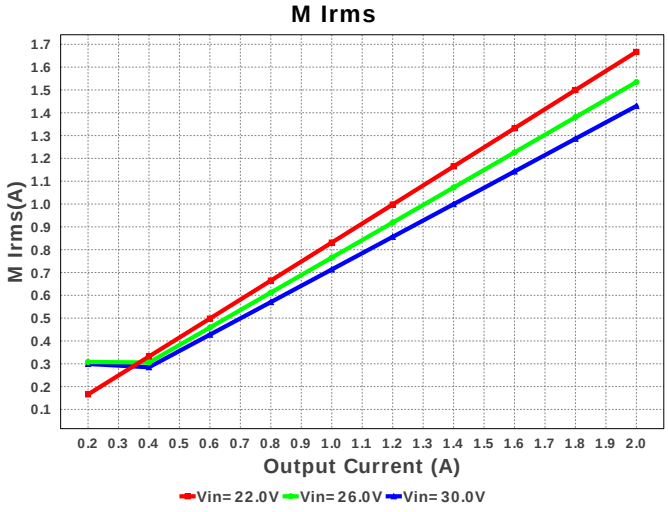

Vout Actual
Vout Actual(V)
14.328358213 14.328358212 14.328358211 14.328358210 14.328358209 14.328358208 14.328358207 14.328358206 14.328358205 14.328358204
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00
Output Current (A)
Vin= 22.0V Vin= 26.0V Vin= 30.0V

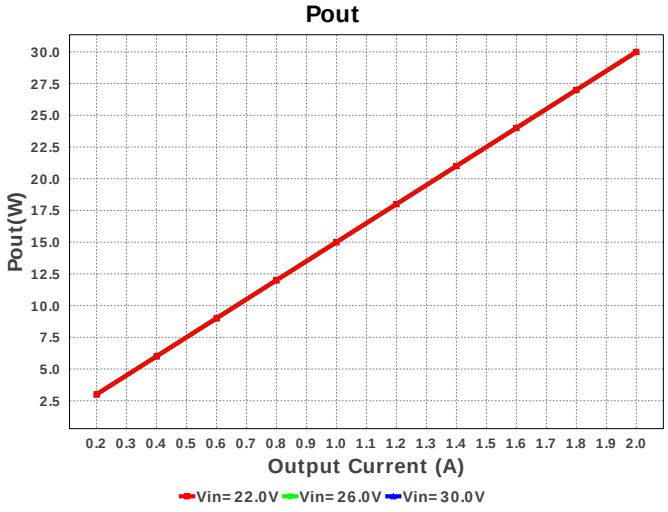


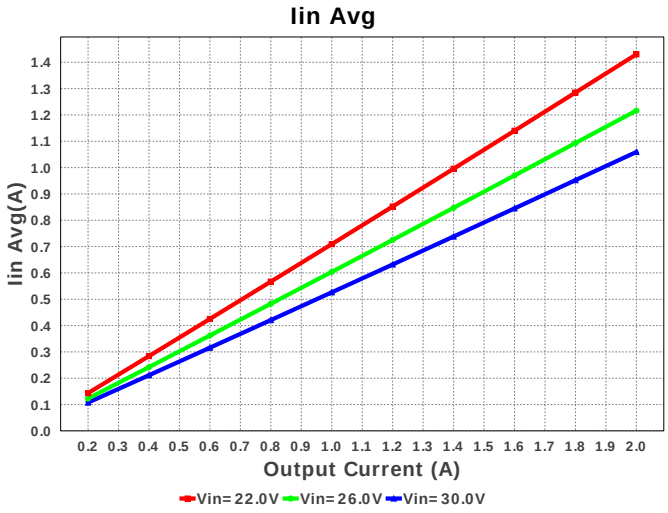


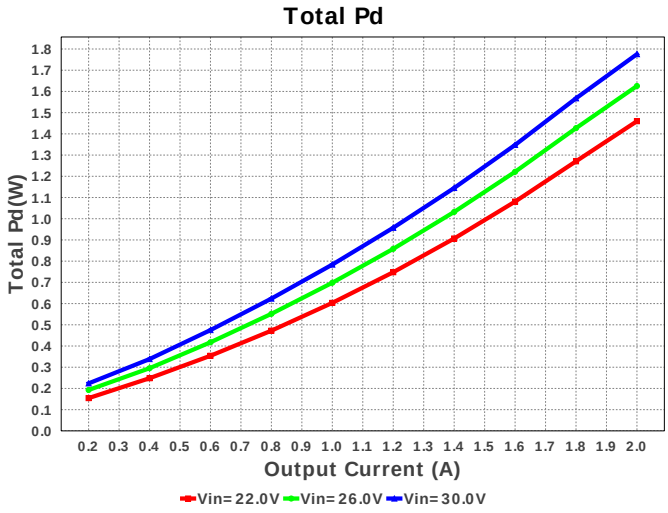


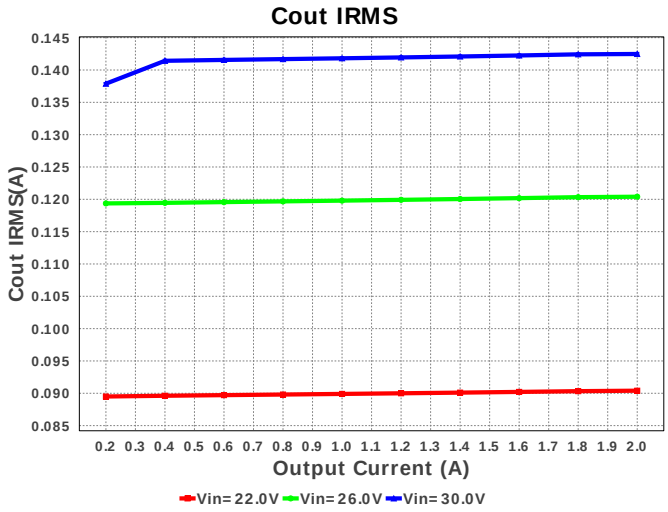


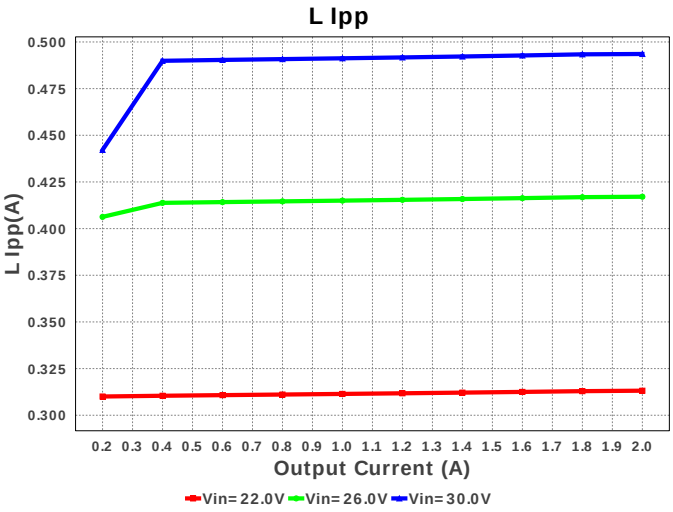


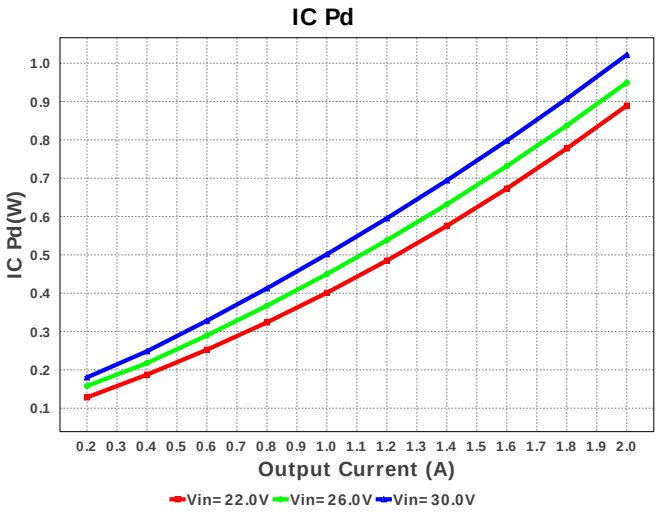


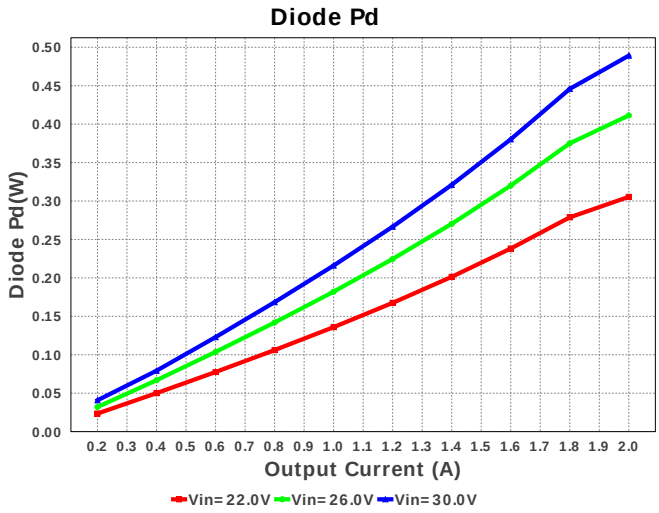












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	790.979 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	142.478 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	2.247 A	Current	Peak switch current in IC
4.	Iin Avg	1.059 A	Current	Average input current
5.	L Ipp	493.56 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	1.43 A	Current	Q Iavg
7.	BOM Count	12	General	Total Design BOM count
8.	FootPrint	540.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	575.061 kHz	General	Switching frequency
10.	IC Tolerance	75.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	160.629 mV	General	Voltage drop across the MosFET

#	Name	Value	Category	Description
12.	Pout	30.0 W	General	Total output power
13.	Total BOM	$3.85	General	Total BOM Cost
14.	D1 Tj	103.367 degC	Op_Point	D1 junction temperature
15.	Vout Actual	14.328 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
16.	Vout OP	15.0 V	Op_Point	Operational Output Voltage
17.	Cross Freq	61.361 kHz	Op_point	Bode plot crossover frequency
18.	Duty Cycle	51.089 %	Op_point	Duty cycle
19.	Efficiency	94.412 %	Op_point	Steady state efficiency
20.	IC Tj	52.477 degC	Op_point	IC junction temperature
21.	ICThetaJA	22.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
22.	IOUT_OP	2.0 A	Op_point	Iout operating point
23.	Phase Marg	42.931 deg	Op_point	Bode Plot Phase Margin
24.	VIN_OP	30.0 V	Op_point	Vin operating point
25.	Vout p-p	13.271 mV	Op_point	Peak-to-peak output ripple voltage
26.	Cin Pd	625.648 µW	Power	Input capacitor power dissipation
27.	Cout Pd	91.594 µW	Power	Output capacitor power dissipation
28.	Diode Pd	489.113 mW	Power	Diode power dissipation
29.	IC Pd	1.022 W	Power	IC power dissipation
30.	L Pd	264.0 mW	Power	Inductor power dissipation
31.	Total Pd	1.776 W	Power	Total Power Dissipation
32.	Vout Tolerance	2.835 %		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	15.0	Output Voltage
5.	base_pn	LM22677-Q1	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. Feature Highlights: Automotive Qualified 4.5V to 18V Vin, 3A Synchronous DCAP2 Mode Buck Converter

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4. **LM22677-Q1** Product Folder : http://www.ti.com/product/LM22677%2DQ1 : contains the data sheet and other resources.