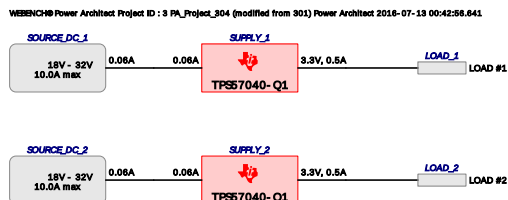


WEBENCH® Power Architect



Project Report

Project : 1165565/3 : PA_Project_304 (modified from 301)

Created : 2016-07-13 00:42:56.641

Optimize project optFactor=3

Project Summary

1. Total System Efficiency	79.339 %
2. Total System BOM Count	30.0
3. Total System Footprint	368.0 mm2
4. Total System BOM Cost	\$3.38
5. Total System Power Dissipation	859.4 mW

--> Launch WEBENCH Power Architect.

Sequencer Flag Table

Supply	Sequencer Flag	Load	Load Name
SUPPLY_1	0	LOAD_1	LOAD #1
SUPPLY_2	0	LOAD_2	LOAD #2

Power Supplies

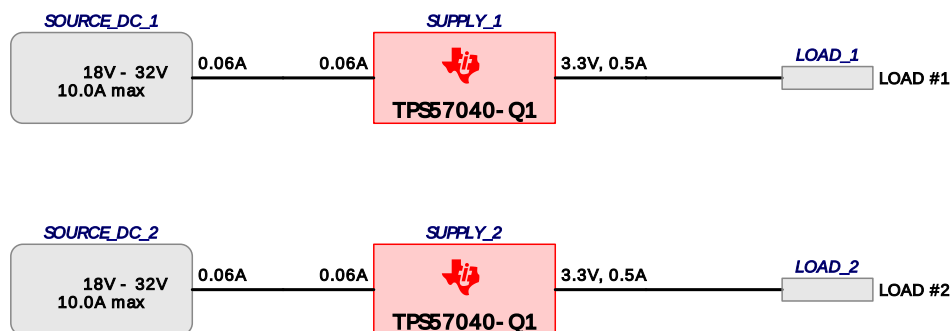
#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
1.	SUPPLY_1	TPS57040-Q1	Switcher : Automotive Catalog Step Down Converter with Eco-Mode	3.3 V	0.5 A	79.3%	184	\$1.69	12	4
2.	SUPPLY_2	TPS57040-Q1	Switcher : Automotive Catalog Step Down Converter with Eco-Mode	3.3 V	0.5 A	79.3%	184	\$1.69	13	10

Power Loads

#	Name	VLoad	ILoad	Description
1.	LOAD #1	3.3 V	0.5 A	VoutRipple=10%
2.	LOAD #2	3.3 V	0.5 A	VoutRipple=10%

Project Diagram

WEBENCH® Power Architect Project ID : 3 PA_Project_304 (modified from 301) Power Architect 2016-07-13 00:42:56.641



Electrical Procurement BOM

Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm ²)
Diodes Inc.	B160-13-F	SMA	2	\$0.06	75
Yageo America	CC0805KRX7R9BB682	0805	2	\$0.01	14
Vishay-Dale	CRCW0402105KFKED	0402	2	\$0.01	6
Vishay-Dale	CRCW040210K0FKED	0402	2	\$0.01	6
Vishay-Dale	CRCW0402150KFKED	0402	2	\$0.01	6
Vishay-Dale	CRCW0402249KFKED	0402	2	\$0.01	6
Vishay-Dale	CRCW040231K6FKED	0402	2	\$0.01	6
Vishay-Dale	CRCW04028K87FKED	0402	2	\$0.01	6
MuRata	GRM1555C1H1R0CA01D	0402	2	\$0.01	6
MuRata	GRM155R61A104KA01D	0402	2	\$0.01	6
MuRata	GRM2165C2A132JA01D	0805	2	\$0.03	14
MuRata	GRM31CC80J476KE18L	1206_190	2	\$0.10	22
MuRata	GRM31CR71H225KA88L	1206_190	2	\$0.05	22
Bourns	SRN6045-470M	SRN6045	2	\$0.16	128
Texas Instruments	TPS57040QDGQRQ1	S-PDSO-G10	2	\$1.20	47
Total			30	\$3.68	5559999999996

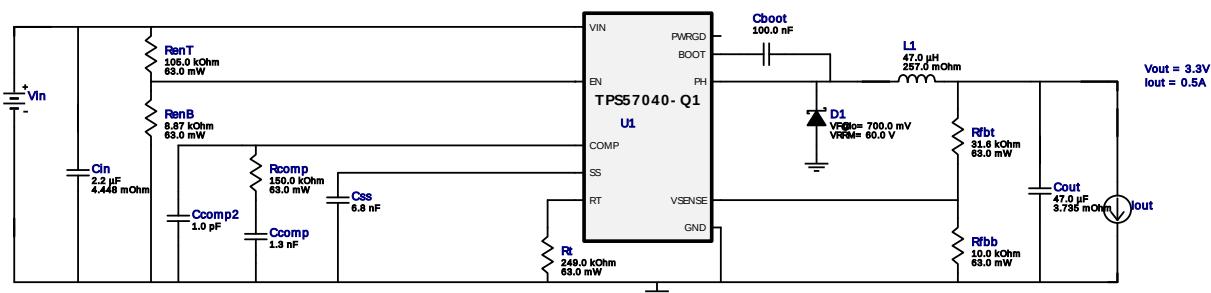


Vout = 3.3V
Iout = 0.5A

Device = TPS57040QDGQRQ1
Topology = Buck
Created = 7/13/16 12:42:55 AM
BOM Cost = \$1.69
BOM Count = 15
Total Pd = 0.43W

WEBENCH® Design Report

Design : 1165565/12 TPS57040QDGQRQ1
TPS57040QDGQRQ1 18.0V-32.0V to 3.30V @ 0.5A

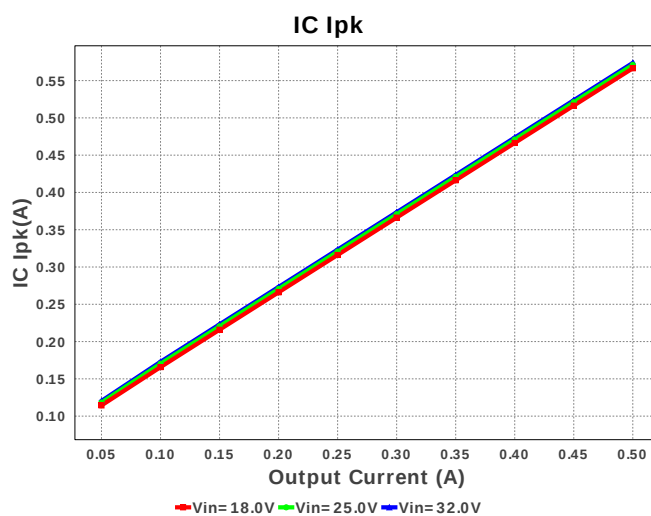
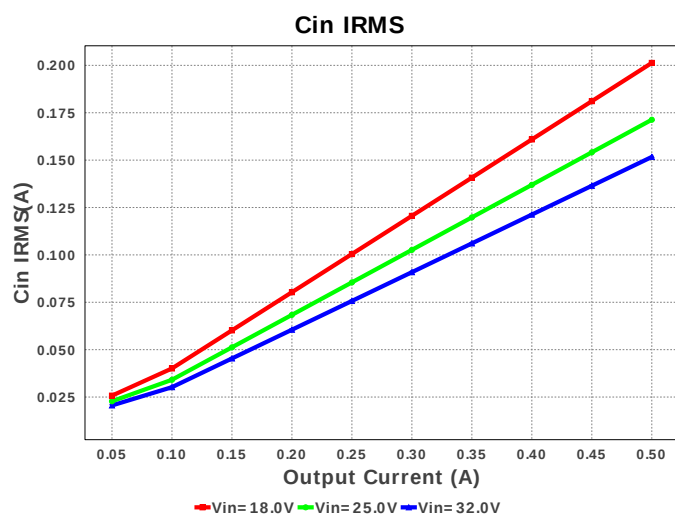
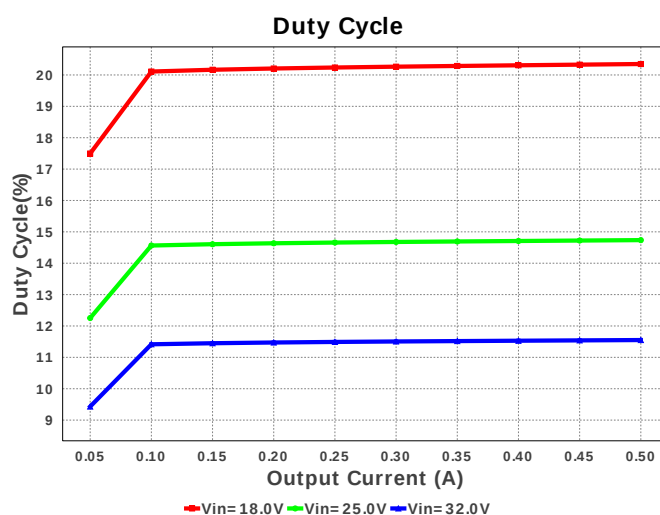
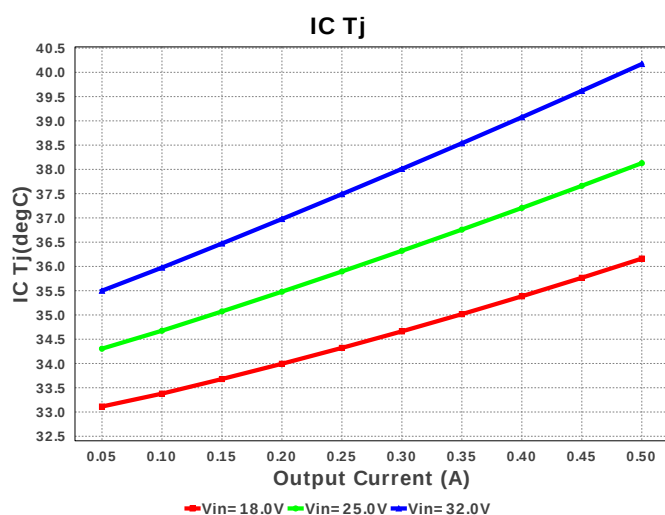


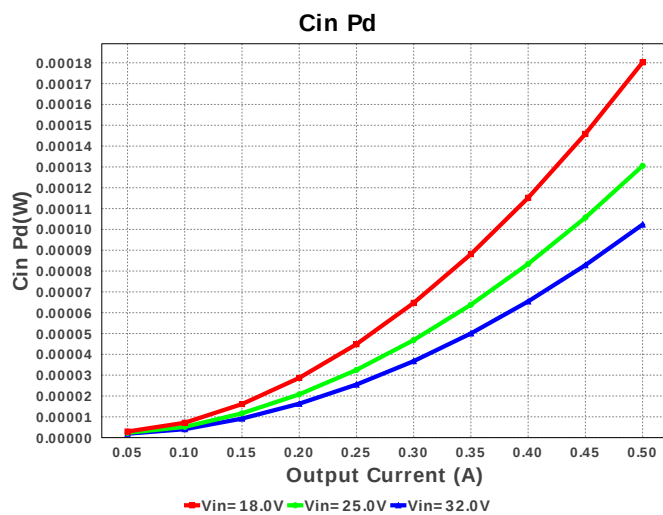
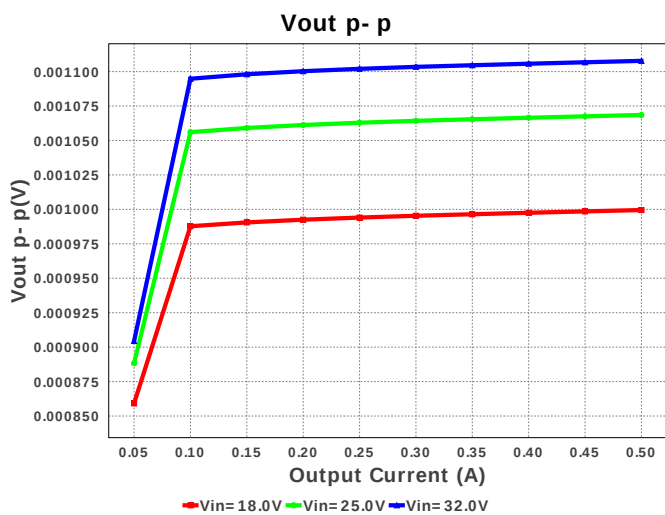
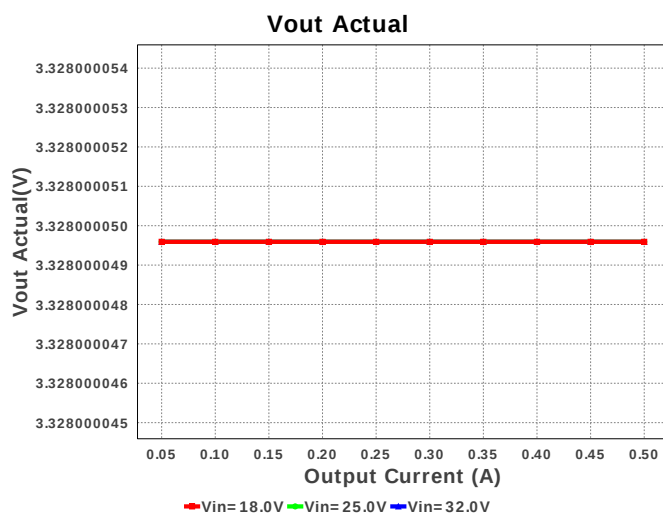
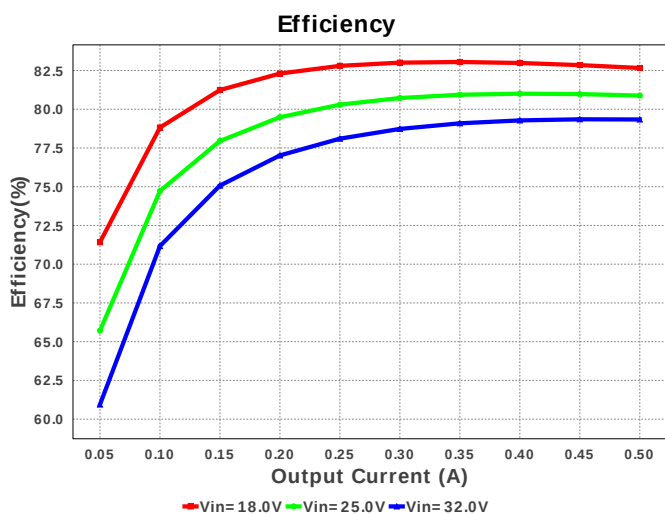
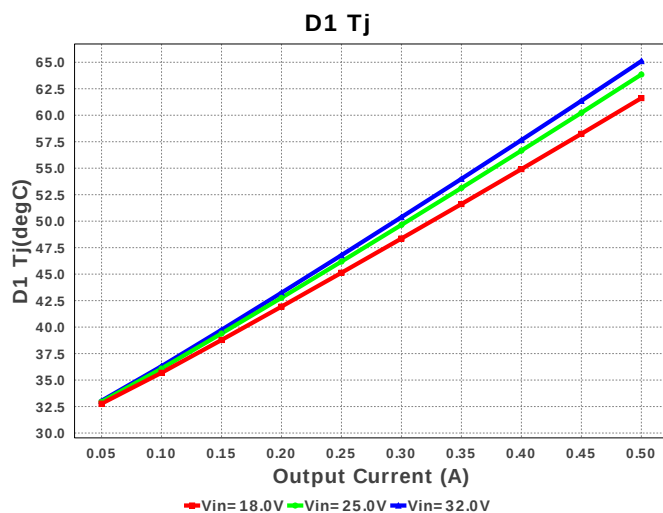
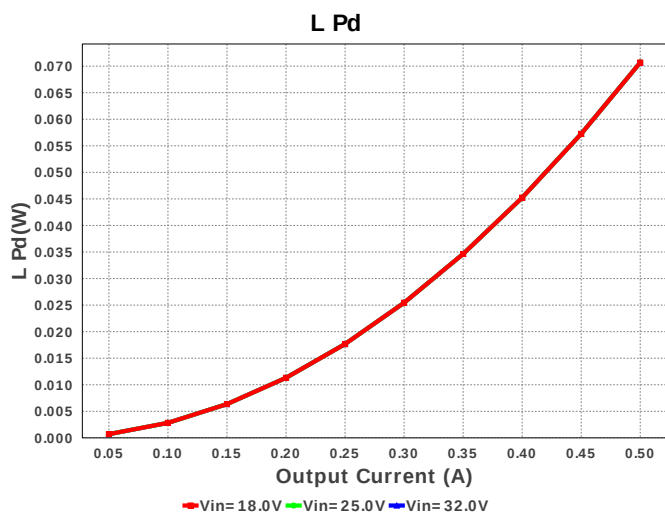
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific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

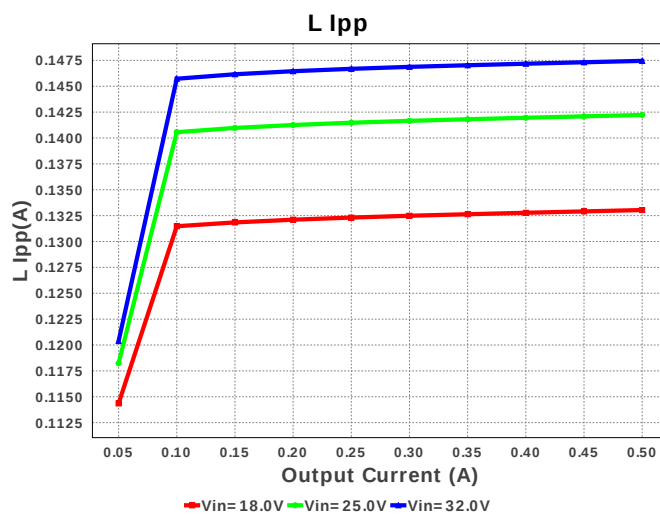
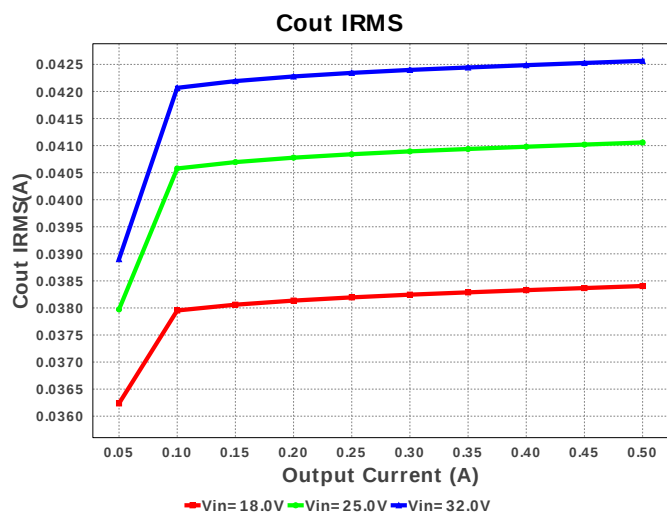
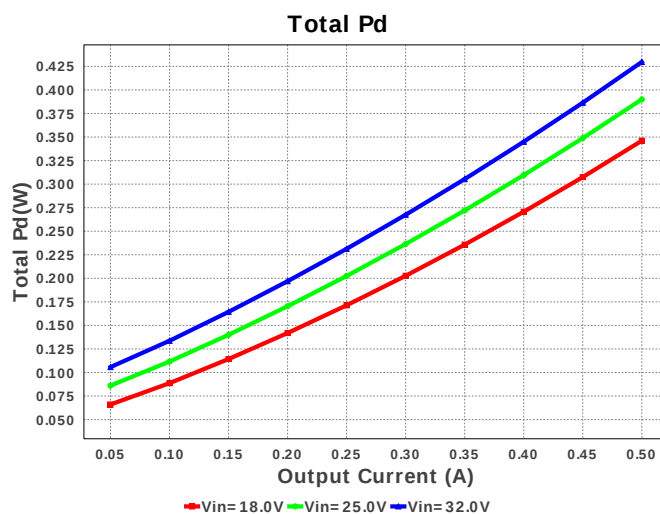
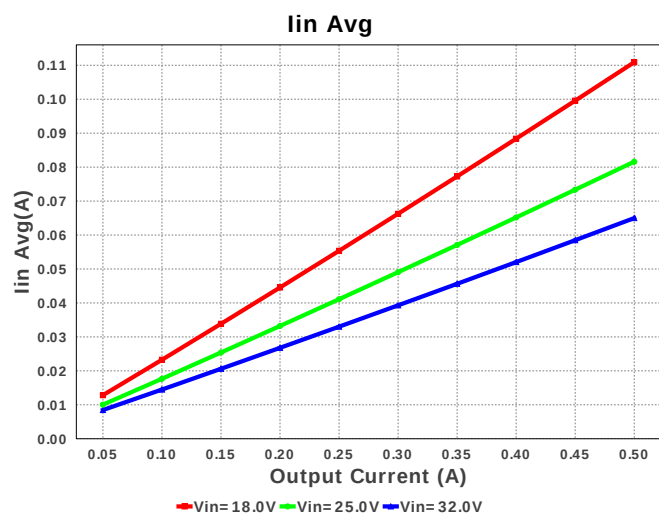
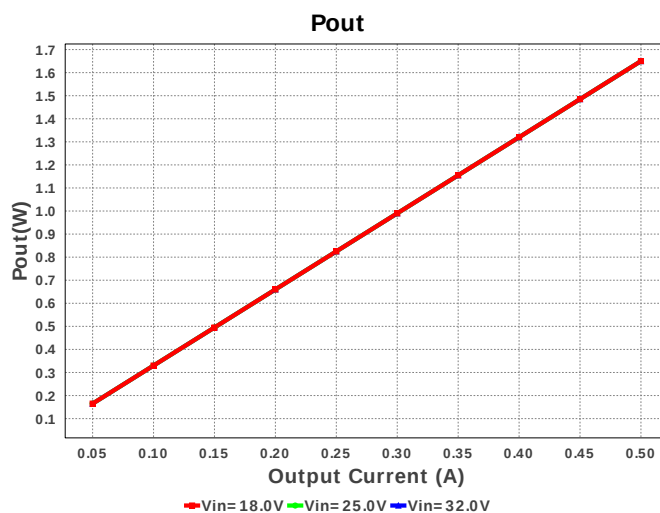
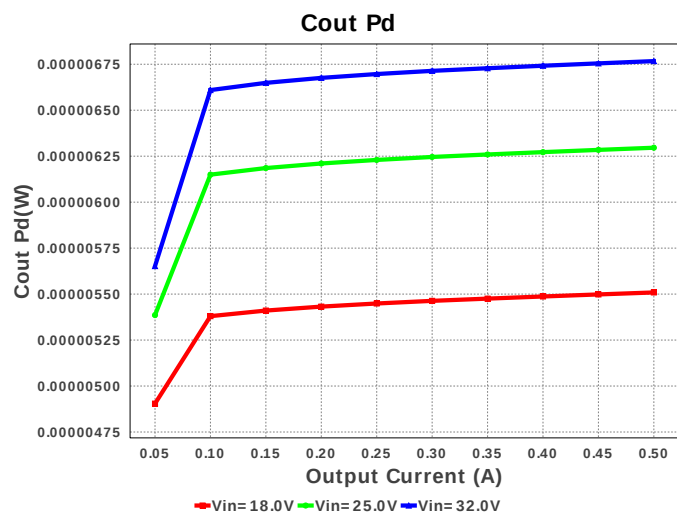
Electrical BOM

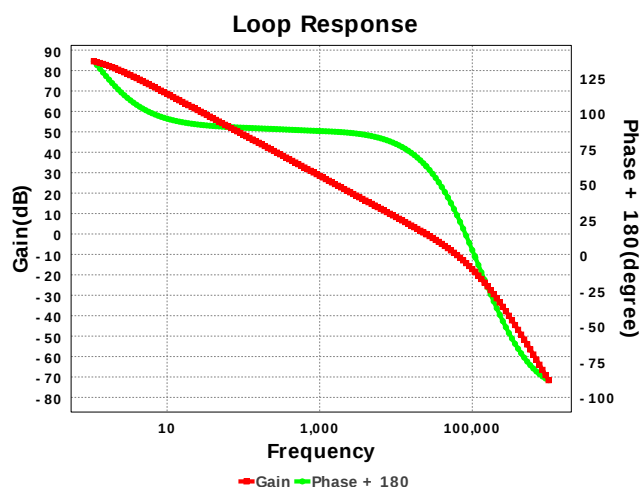
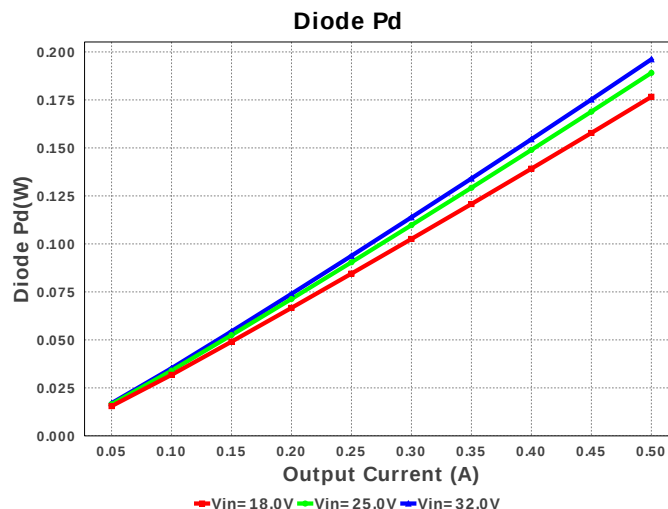
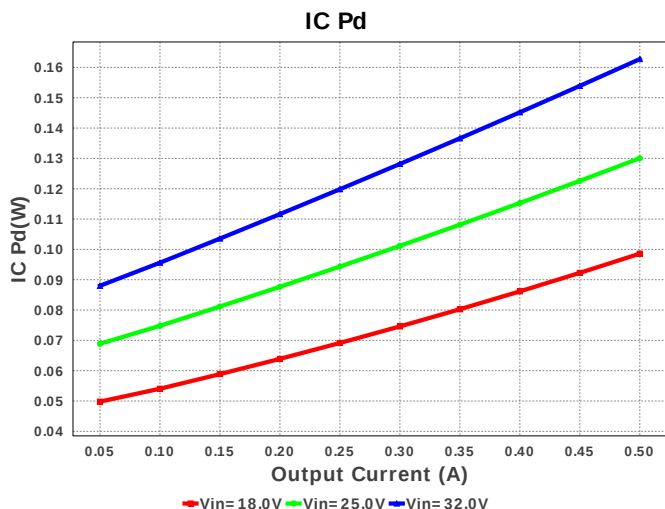
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
2.	Ccomp	MuRata	GRM2165C2A132JA01D Series= C0G/NP0	Cap= 1.3 nF VDC= 100.0 V IRMS= 0.0 A	1	\$0.03	0805 7 mm ²
3.	Ccomp2	MuRata	GRM1555C1H1R0CA01D Series= C0G/NP0	Cap= 1.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
4.	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
5.	Cout	MuRata	GRM31CC80J476KE18L Series= X6S	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 6.3 V IRMS= 4.0522 A	1	\$0.10	1206_190 11 mm ²
6.	Css	Yageo America	CC0805KRX7R9BB682 Series= X7R	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
7.	D1	Diodes Inc.	B160-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	\$0.06	SMA 37 mm ²
8.	L1	Bourns	SRN6045-470M	L= 47.0 uH DCR= 257.0 mOhm	1	\$0.16	SRN6045 64 mm ²
9.	Rcomp	Vishay-Dale	CRCW0402150KFKED Series= CRCW..e3	Res= 150.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
10.	RenB	Vishay-Dale	CRCW04028K87FKED Series= CRCW..e3	Res= 8.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	RenT	Vishay-Dale	CRCW0402105KFKED Series= CRCW..e3	Res= 105.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
12.	Rfbb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
13.	Rfbt	Vishay-Dale	CRCW040231K6FKED Series= CRCW..e3	Res= 31.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
14.	Rt	Vishay-Dale	CRCW0402249KFKED Series= CRCW..e3	Res= 249.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
15.	U1	Texas Instruments	TPS57040QDGRQ1	Switcher	1	\$1.20	 S-PDSO-G10 24 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	151.676 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	42.565 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	500.0 mA	Current	Peak switch current in IC
4.	Iin Avg	64.99 mA	Current	Average input current
5.	L Ipp	147.45 mA	Current	Peak-to-peak inductor ripple current
6.	BOM Count	15	General	Total Design BOM count
7.	FootPrint	184.0 mm ²	General	Total Foot Print Area of BOM components
8.	Frequency	478.381 kHz	General	Switching frequency
9.	Pout	1.65 W	General	Total output power
10.	Total BOM	\$1.69	General	Total BOM Cost
11.	D1 Tj	65.11 degC	Op_Point	D1 junction temperature
12.	Low Freq Gain	84.478 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	3.328 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
15.	Cross Freq	24.686 kHz	Op_point	Bode plot crossover frequency
16.	Duty Cycle	11.551 %	Op_point	Duty cycle
17.	Efficiency	79.339 %	Op_point	Steady state efficiency
18.	Gain Marg	-18.409 dB	Op_point	Bode Plot Gain Margin
19.	IC Tj	40.171 degC	Op_point	IC junction temperature
20.	ICThetaJA	62.5 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	500.0 mA	Op_point	Iout operating point
22.	Phase Marg	63.089 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	32.0 V	Op_point	Vin operating point
24.	Vout p-p	1.108 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	102.329 μ W	Power	Input capacitor power dissipation
26.	Cout Pd	6.767 μ W	Power	Output capacitor power dissipation
27.	Diode Pd	196.148 mW	Power	Diode power dissipation
28.	IC Pd	162.741 mW	Power	IC power dissipation
29.	L Pd	70.675 mW	Power	Inductor power dissipation
30.	Total Pd	429.683 mW	Power	Total Power Dissipation

#	Name	Value	Category	Description
31.	Vout Tolerance	2.55 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	500.0 m	Maximum Output Current
2.	VinMax	32.0	Maximum input voltage
3.	VinMin	18.0	Minimum input voltage
4.	Vout	3.3	Output Voltage
5.	base_pn	TPS57040-Q1	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. The TPS57040-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

2. TPS57040-Q1 Product Folder : <http://www.ti.com/product/TPS57040%2DQ1> : contains the data sheet and other resources.

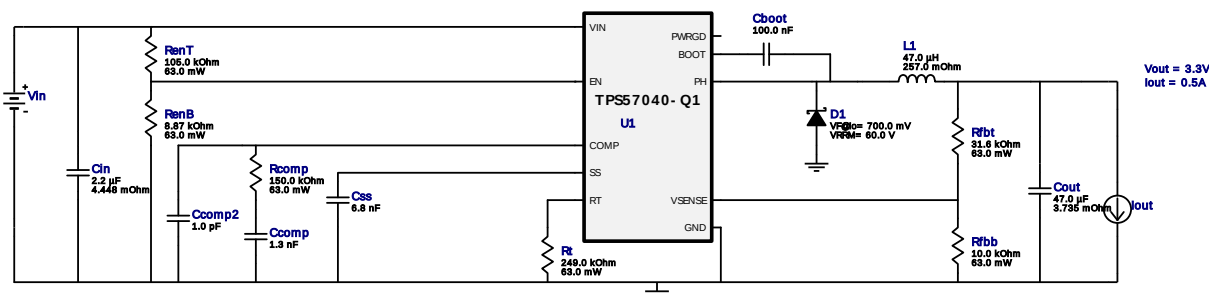


Vout = 3.3V
Iout = 0.5A

Device = TPS57040QDGQRQ1
Topology = Buck
Created = 7/13/16 12:42:56 AM
BOM Cost = \$1.69
BOM Count = 15
Total Pd = 0.43W

WEBENCH® Design Report

Design : 1165565/13 TPS57040QDGQRQ1
TPS57040QDGQRQ1 18.0V-32.0V to 3.30V @ 0.5A

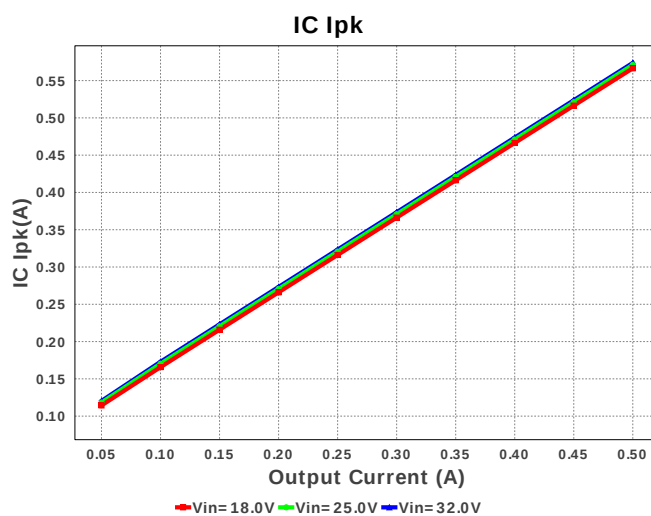
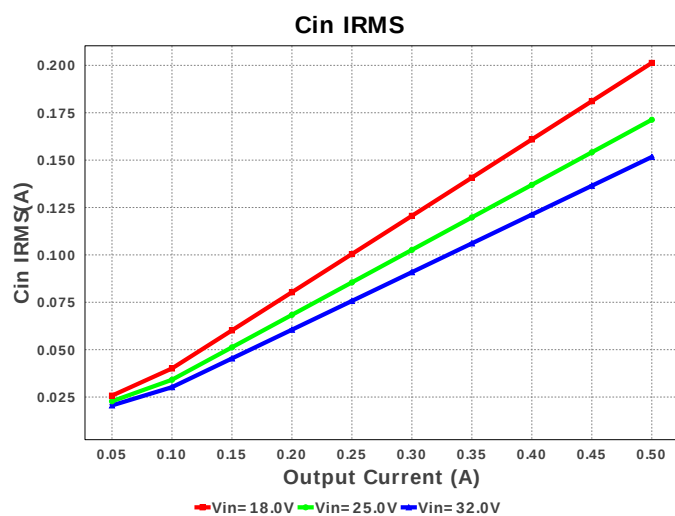
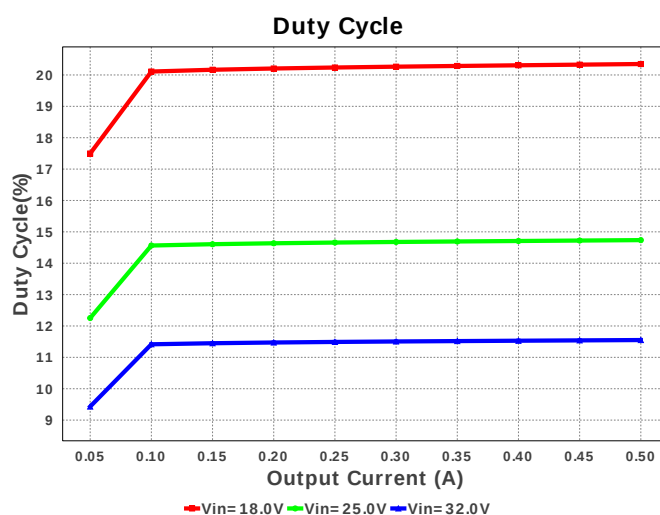
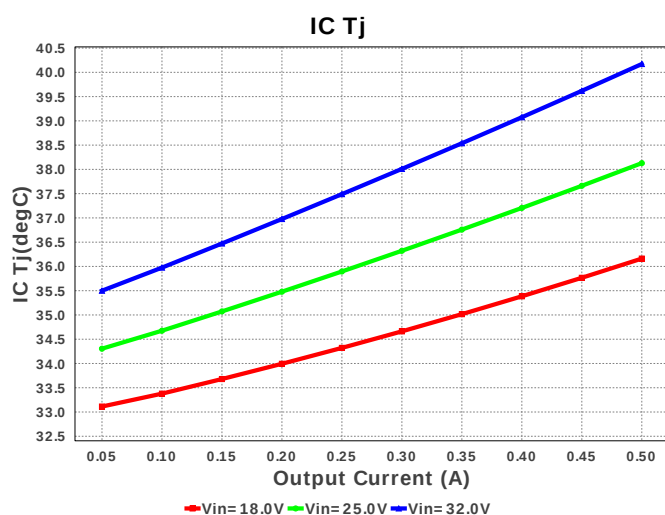


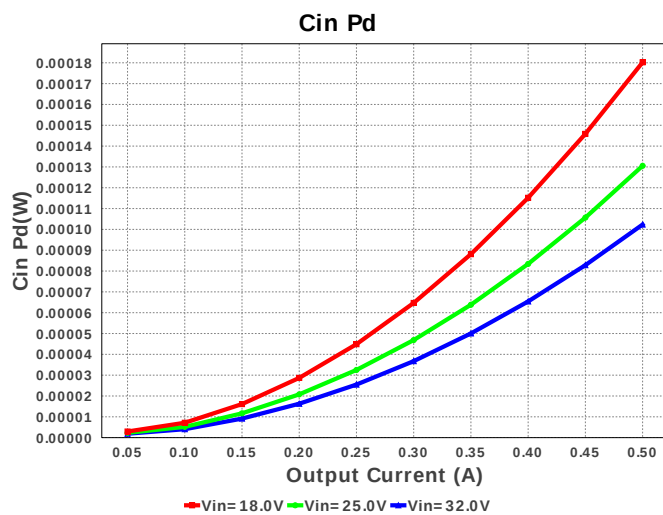
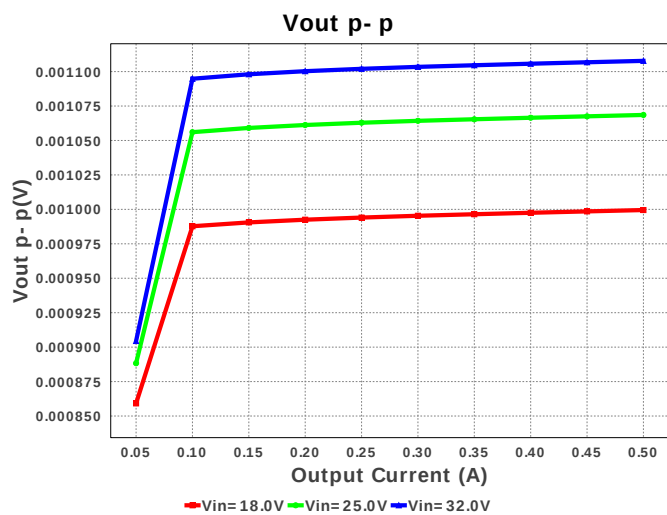
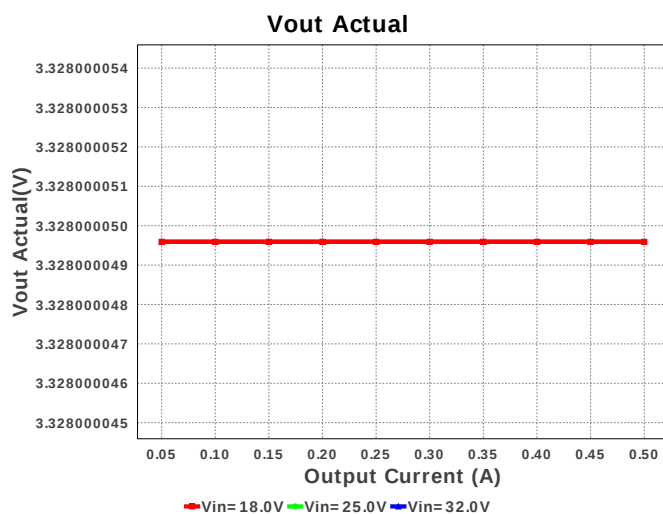
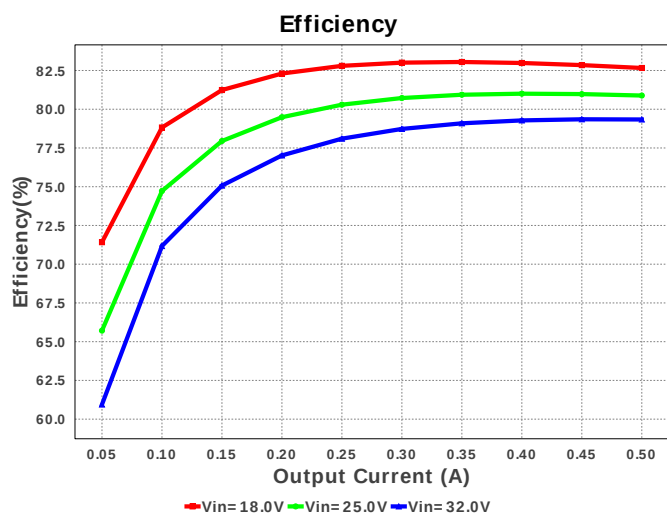
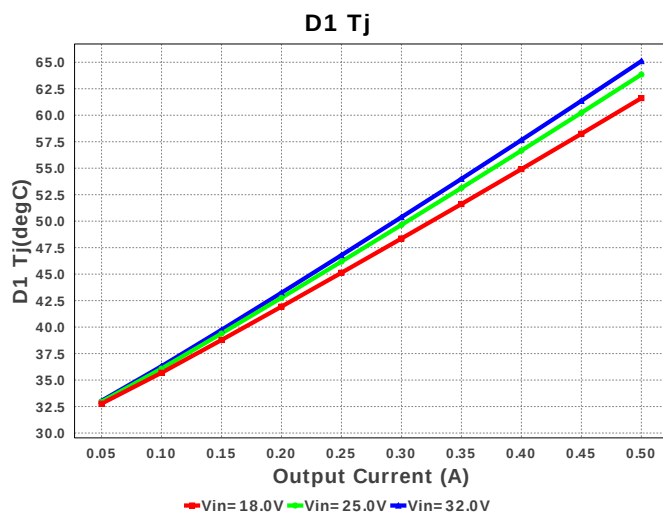
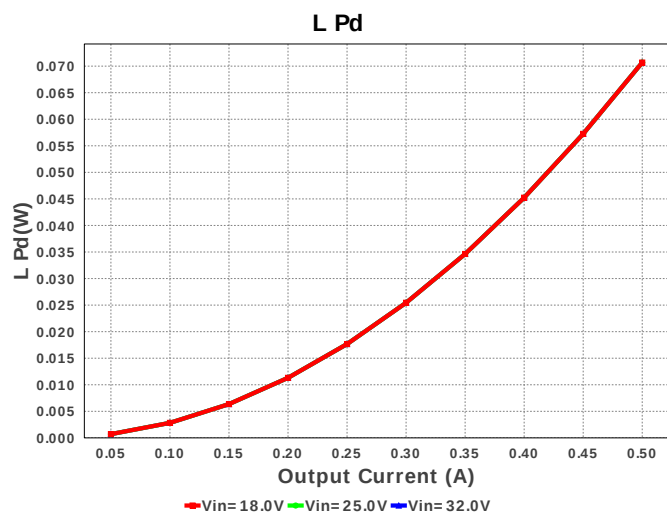
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific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

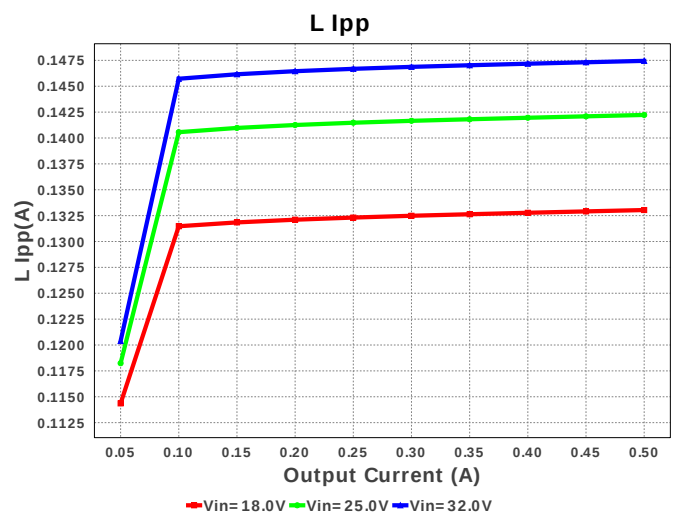
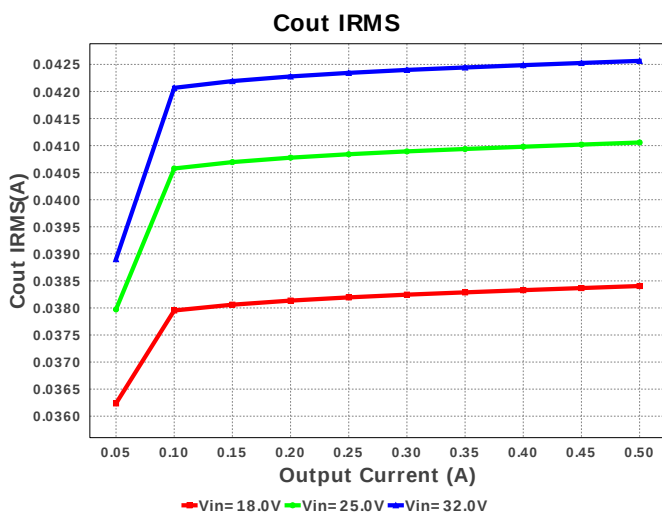
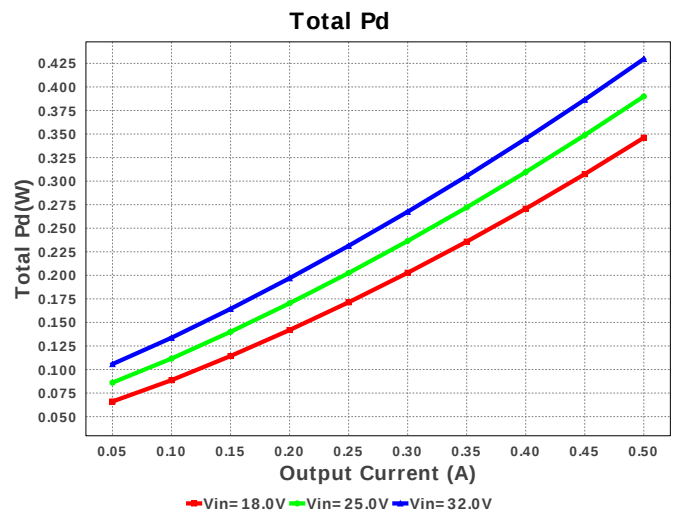
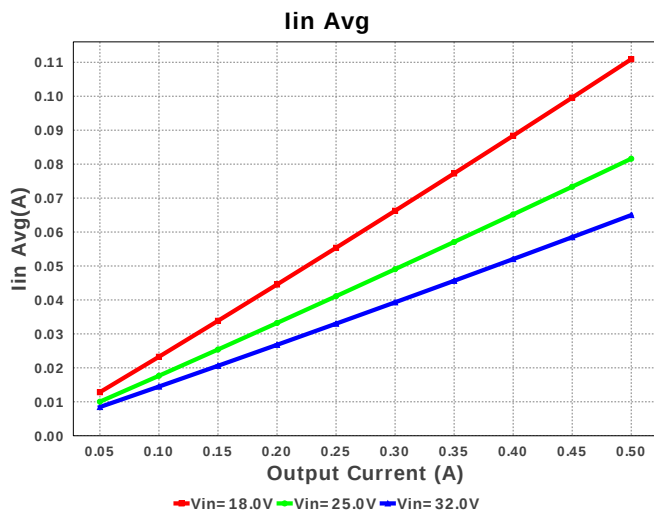
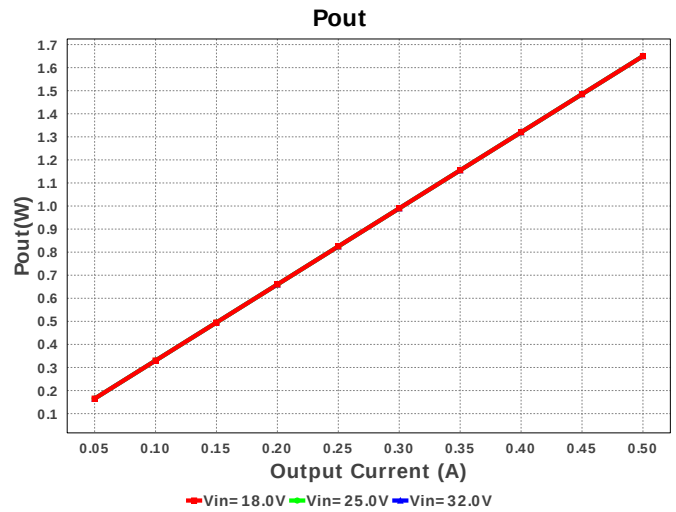
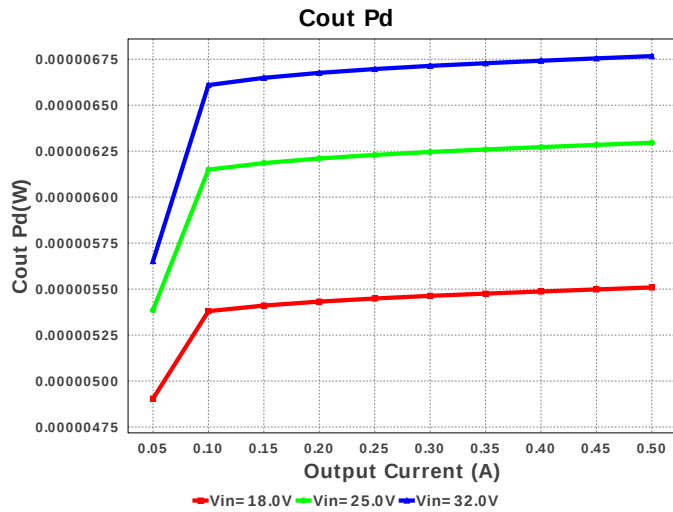
Electrical BOM

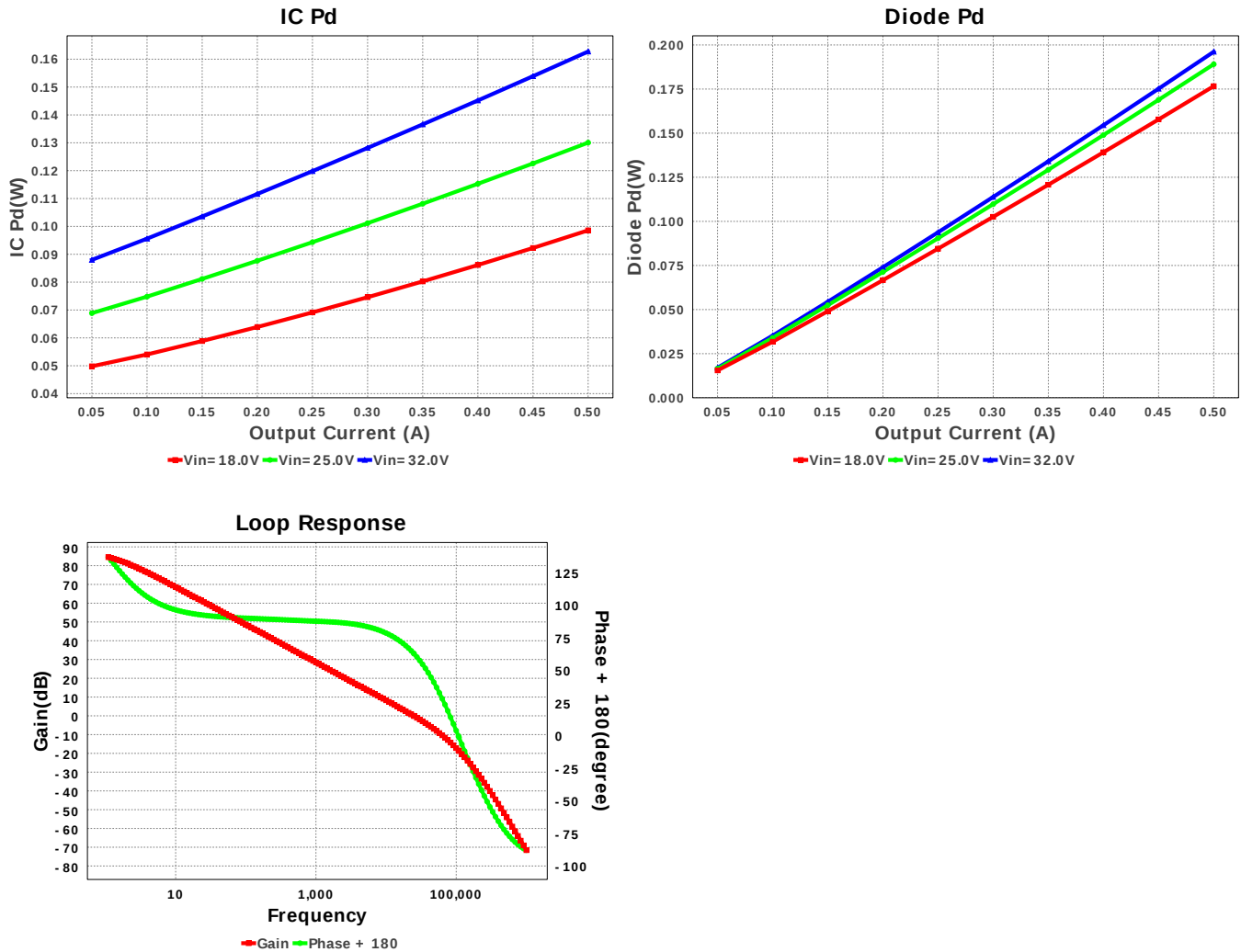
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm²
2.	Ccomp	MuRata	GRM2165C2A132JA01D Series= C0G/NP0	Cap= 1.3 nF VDC= 100.0 V IRMS= 0.0 A	1	\$0.03	 0805 7 mm²
3.	Ccomp2	MuRata	GRM1555C1H1R0CA01D Series= C0G/NP0	Cap= 1.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm²
4.	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 mm²
5.	Cout	MuRata	GRM31CC80J476KE18L Series= X6S	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 6.3 V IRMS= 4.0522 A	1	\$0.10	 1206_190 11 mm²
6.	Css	Yageo America	CC0805KRX7R9BB682 Series= X7R	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm²
7.	D1	Diodes Inc.	B160-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	\$0.06	 SMA 37 mm²
8.	L1	Bourns	SRN6045-470M	L= 47.0 uH DCR= 257.0 mOhm	1	\$0.16	 SRN6045 64 mm²
9.	Rcomp	Vishay-Dale	CRCW0402150KFKED Series= CRCW..e3	Res= 150.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
10.	RenB	Vishay-Dale	CRCW04028K87FKED Series= CRCW..e3	Res= 8.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	RenT	Vishay-Dale	CRCW0402105KFKED Series= CRCW..e3	Res= 105.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
12.	Rfbb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
13.	Rfbt	Vishay-Dale	CRCW040231K6FKED Series= CRCW..e3	Res= 31.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
14.	Rt	Vishay-Dale	CRCW0402249KFKED Series= CRCW..e3	Res= 249.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
15.	U1	Texas Instruments	TPS57040QDGRQ1	Switcher	1	\$1.20	 S-PDSO-G10 24 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	151.676 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	42.565 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	500.0 mA	Current	Peak switch current in IC
4.	Iin Avg	64.99 mA	Current	Average input current
5.	L Ipp	147.45 mA	Current	Peak-to-peak inductor ripple current
6.	BOM Count	15	General	Total Design BOM count
7.	FootPrint	184.0 mm ²	General	Total Foot Print Area of BOM components
8.	Frequency	478.381 kHz	General	Switching frequency
9.	Pout	1.65 W	General	Total output power
10.	Total BOM	\$1.69	General	Total BOM Cost
11.	D1 Tj	65.11 degC	Op_Point	D1 junction temperature
12.	Low Freq Gain	84.478 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	3.328 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
15.	Cross Freq	24.686 kHz	Op_point	Bode plot crossover frequency
16.	Duty Cycle	11.551 %	Op_point	Duty cycle
17.	Efficiency	79.339 %	Op_point	Steady state efficiency
18.	Gain Marg	-18.409 dB	Op_point	Bode Plot Gain Margin
19.	IC Tj	40.171 degC	Op_point	IC junction temperature
20.	ICThetaJA	62.5 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	500.0 mA	Op_point	Iout operating point
22.	Phase Marg	63.089 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	32.0 V	Op_point	Vin operating point
24.	Vout p-p	1.108 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	102.329 μW	Power	Input capacitor power dissipation
26.	Cout Pd	6.767 μW	Power	Output capacitor power dissipation
27.	Diode Pd	196.148 mW	Power	Diode power dissipation
28.	IC Pd	162.741 mW	Power	IC power dissipation
29.	L Pd	70.675 mW	Power	Inductor power dissipation
30.	Total Pd	429.683 mW	Power	Total Power Dissipation

#	Name	Value	Category	Description
31.	Vout Tolerance	2.55 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	500.0 m	Maximum Output Current
2.	VinMax	32.0	Maximum input voltage
3.	VinMin	18.0	Minimum input voltage
4.	Vout	3.3	Output Voltage
5.	base_pn	TPS57040-Q1	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. The TPS57040-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

2. TPS57040-Q1 Product Folder : <http://www.ti.com/product/TPS57040%2DQ1> : contains the data sheet and other resources.

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