

WEBENCH[®] Power Architect

Project Report

Project : 4425714/6 : PA_Project_304 (modified from 301)
 Created : 2015-07-15 02:57:01.544
 Optimize project optFactor=3

Project Summary

- | | |
|-----------------------------------|-----------------------|
| 1. Total System Efficiency | 77.232 % |
| 2. Total System BOM Count | 17.0 |
| 3. Total System Footprint | 365.0 mm ² |
| 4. Total System BOM Cost | \$2.46 |
| 5. Total System Power Dissipation | 597.0 mW |

--> Launch WEBENCH Power Architect.

Power Supplies

| # | Name | NSID | Description | Vout | Iout | Efficiency | Foot-print | Cost | Design | Page |
|----|----------|-----------|--|-------|---------|------------|------------|--------|--------|------|
| 1. | SUPPLY_1 | TPS54336A | Switcher : 28V, 3A, Low Iq, Synchronous, monolithic buck converter with Eco-mode | 3.3 V | 0.631 A | 84.6% | 285 | \$1.48 | 41 | 8 |
| 2. | SUPPLY_2 | TPS62061 | Switcher : 3MHz, 1.6A, Buck Converter with Fixed Output Voltage | 1.8 V | 0.85 A | 87.6% | 80 | \$0.98 | 40 | 4 |

Power Loads

| # | Name | VLoad | Iload | Description |
|----|------------------------|-------|--------|----------------|
| 1. | TMS320C6201GJC200_DVDD | 3.3 V | 0.15 A | VoutRipple=9% |
| 2. | TMS320C6201GJC200_CVDD | 1.8 V | 0.85 A | VoutRipple=10% |

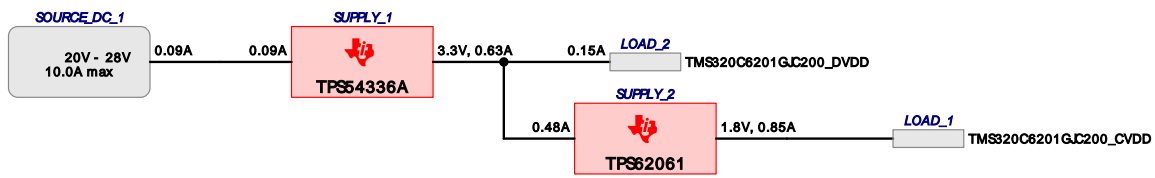
FPGAs, Processors

| # | Manufacturer | Part Number | Name | Series | Description |
|----|-------------------|-------------------|--------|-------------|--|
| 1. | Texas Instruments | TMS320C6201GJC200 | FPGA_1 | TMS320C62xx | FPGA Texas Instruments TMS320C62xx TMS320C6201GJC200 |

<http://focus.ti.com/lit/ds/symlink/tms320c6201.pdf>

Project Diagram

WEBENCH® Power Architect Project ID : 6 PA_Project_304 (modified from 301) FPGA Architect 2015-07-15 02:57:01.544



Electrical Procurement BOM

| Manufacturer | Part Number | Description | Quantity | Budgetary Price | Footprint (mm ²) |
|---------------------------|--------------------|---------------|----------|-----------------|------------------------------|
| Kemet | C0805C104K5RACTU | 0805 | 2 | \$0.01 | 14 |
| Samsung Electro-Mechanics | CL10A106MQ8NNNC | 0603 | 1 | \$0.02 | 5 |
| Vishay-Dale | CRCW0402100KFKED | 0402 | 1 | \$0.01 | 3 |
| Vishay-Dale | CRCW040232K4FKED | 0402 | 1 | \$0.01 | 3 |
| Vishay-Dale | CRCW0402787RFKED | 0402 | 1 | \$0.01 | 3 |
| MuRata | GRM033R61A103KA01D | 0201 | 1 | \$0.01 | 2 |
| MuRata | GRM188R60J475ME19D | 0603 | 1 | \$0.02 | 5 |
| MuRata | GRM188R61A124KA01D | 0603 | 1 | \$0.01 | 5 |
| MuRata | GRM2165C1H202JA01D | 0805 | 1 | \$0.03 | 7 |
| MuRata | GRM31CR60J476ME19L | 1206 | 1 | \$0.12 | 11 |
| Bourns | SRN3015-1R0Y | SRN3015 | 1 | \$0.14 | 16 |
| Bourns | SRN6045-470M | SRN6045 | 1 | \$0.16 | 64 |
| Texas Instruments | TPS54336ADDAR | R-PDSO-G8 | 1 | \$0.90 | 57 |
| Texas Instruments | TPS62061DSGR | DSG0008A | 1 | \$0.80 | 55 |
| Nichicon | UUD1V100MCL1GS | SM_RADIAL_5MM | 2 | \$0.10 | 58 |
| Total | | | 17 | \$2.46 | 308 |

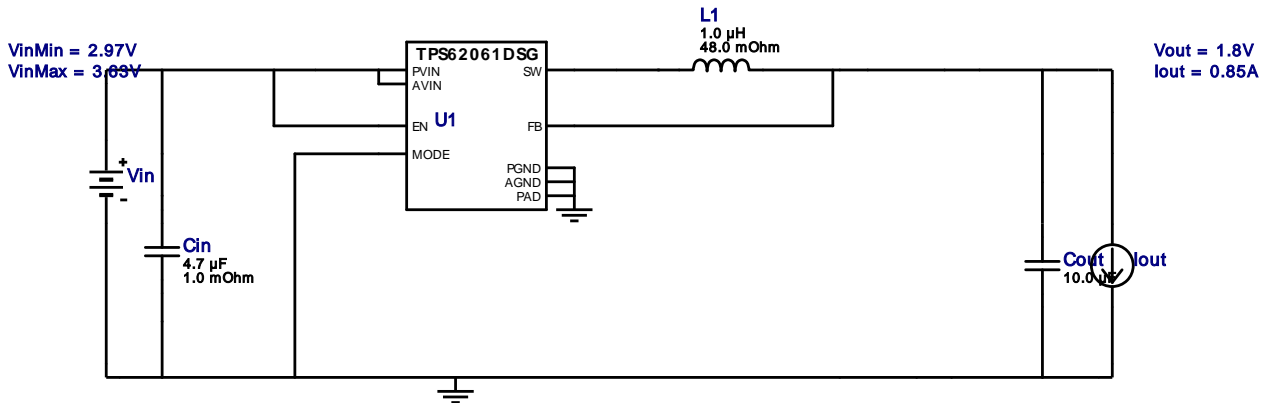


VinMin = 2.97V
 VinMax = 3.63V
 Vout = 1.8V
 Iout = 0.85A

Device = TPS62061DSGR
 Topology = Buck
 Created = 7/15/15 2:57:00 AM
 BOM Cost = \$0.98
 Footprint = 80.0 mm²
 BOM Count = 4
 Total Pd = 0.22W

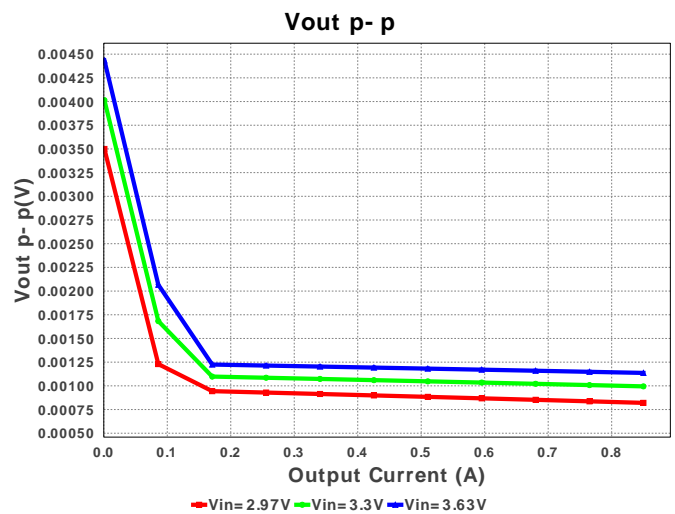
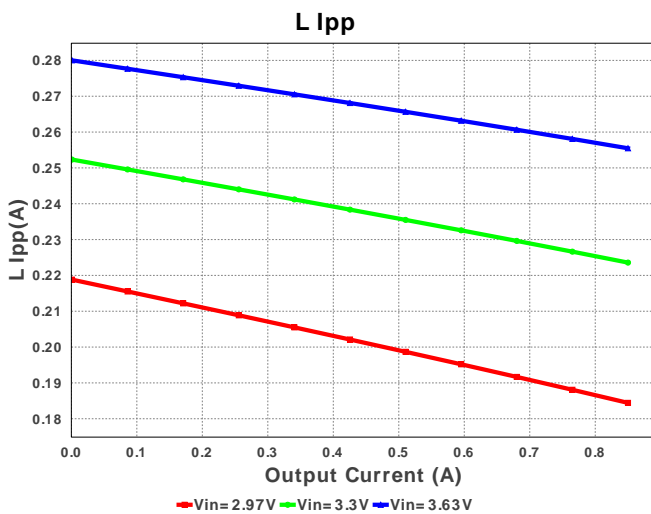
WEBENCH® Design Report

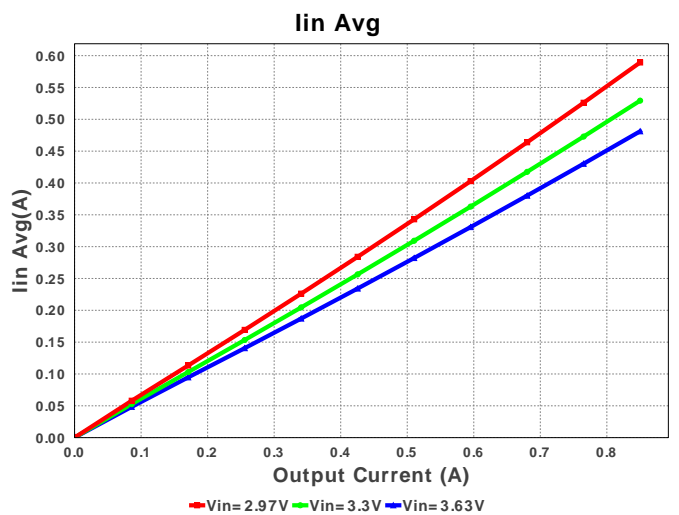
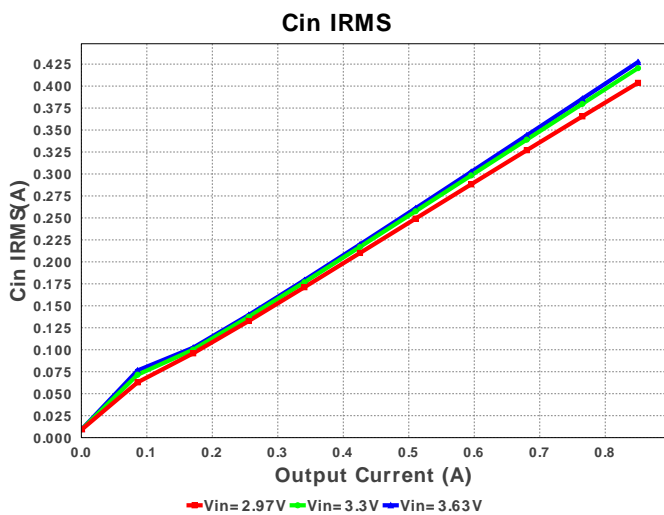
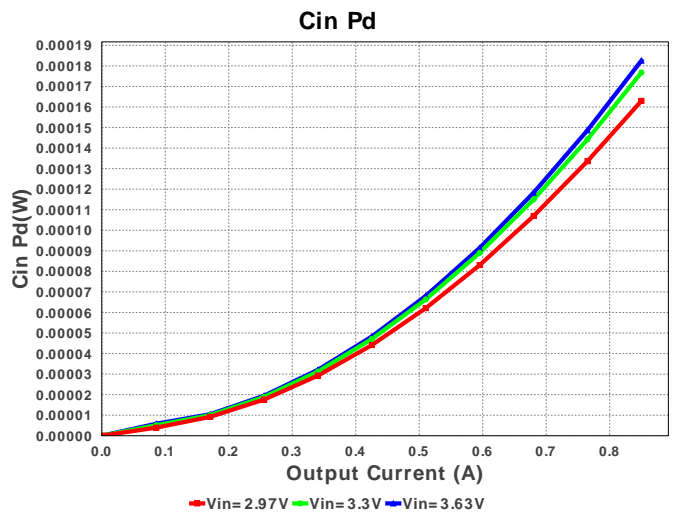
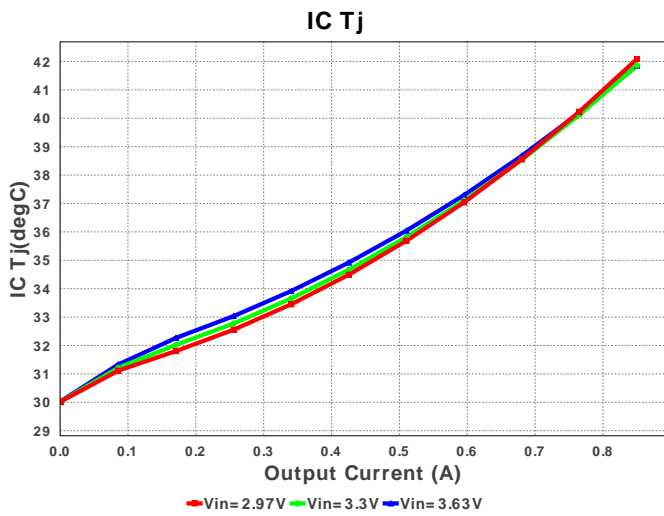
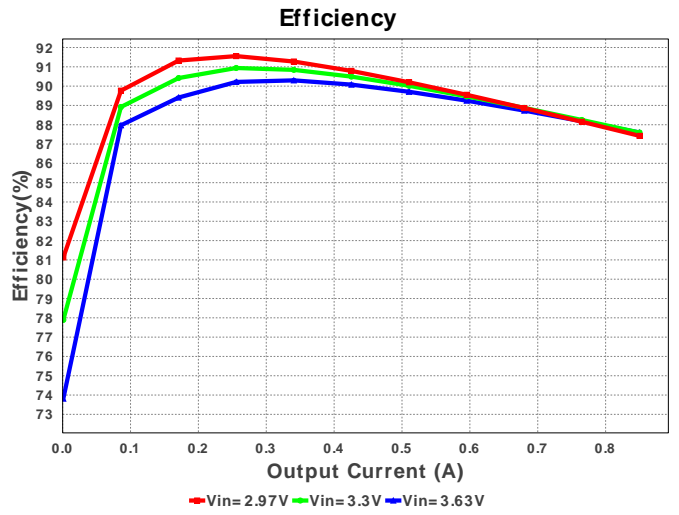
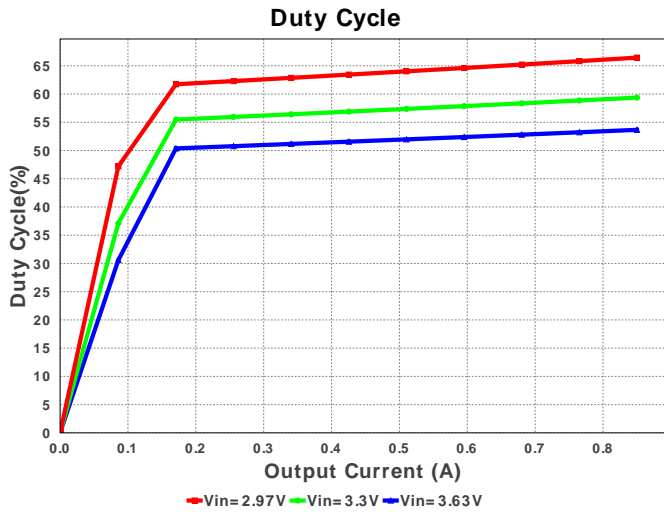
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 TPS62061DSGR 2.97V-3.63V to 1.80V @ 0.85A

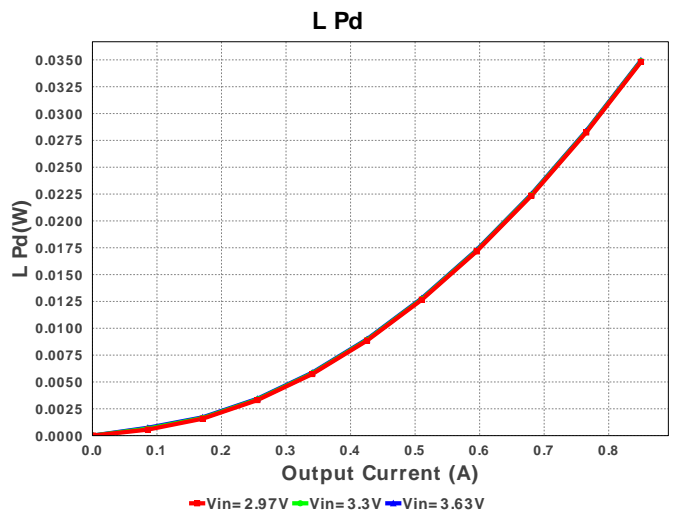
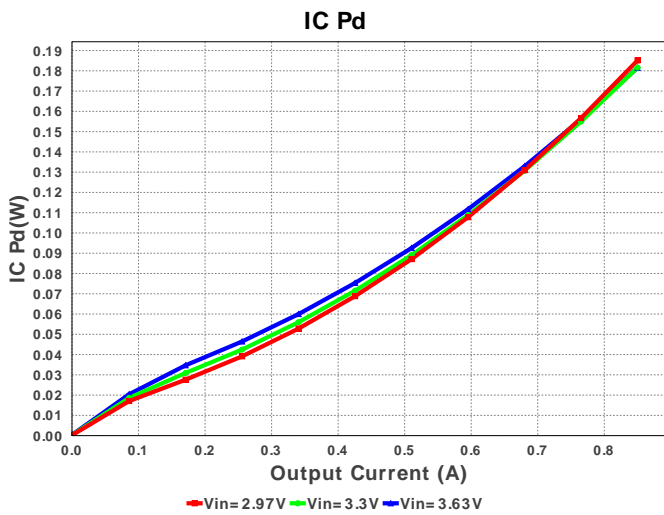
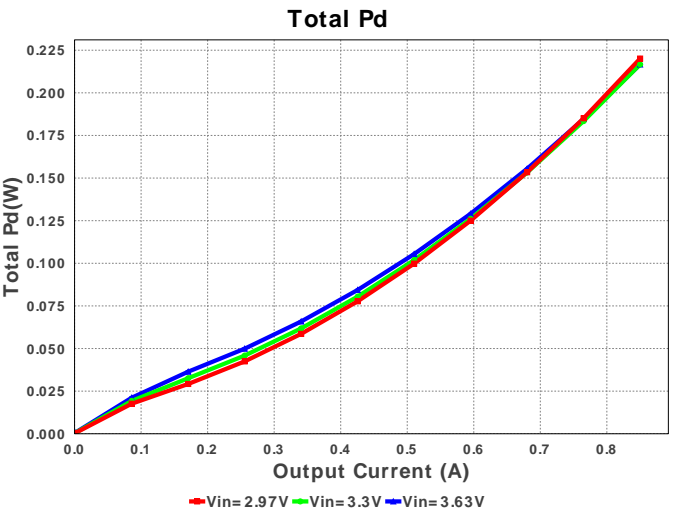
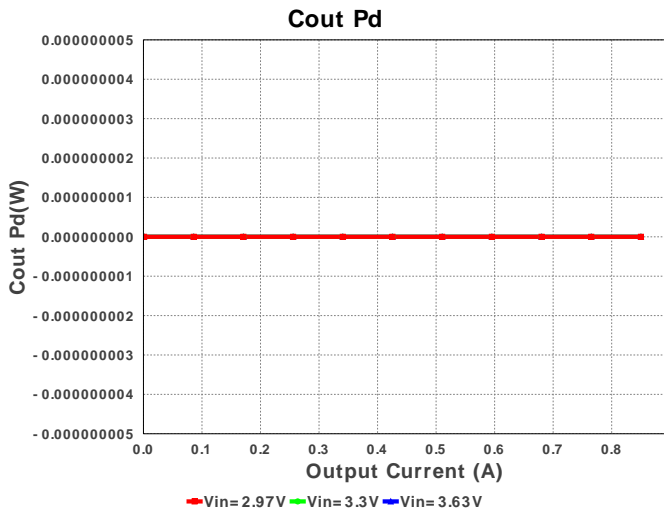
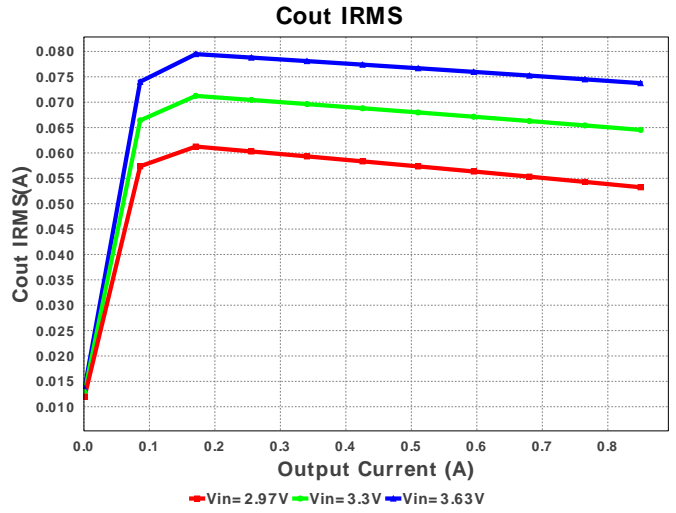
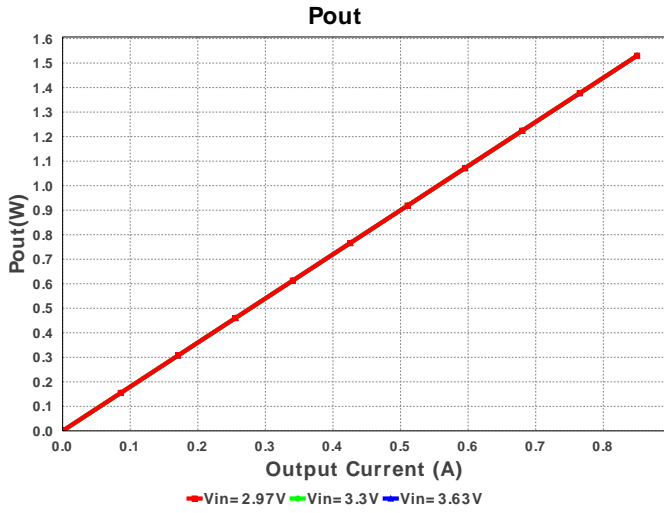


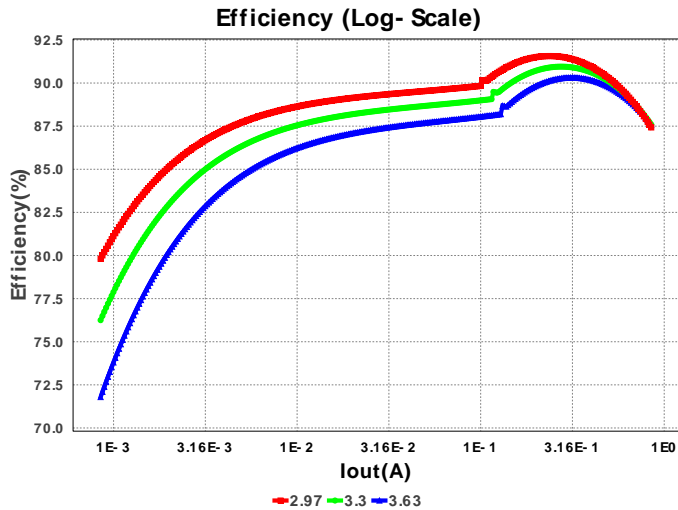
Electrical BOM

| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|----|------|---------------------------|-----------------------------------|---|-----|--------|-----------------------------|
| 1. | Cin | MuRata | GRM188R60J475ME19D Series= X5R | Cap= 4.7 uF ESR= 1.0 mOhm VDC= 6.3 V IRMS= 0.0 A | 1 | \$0.02 | 0603 5 mm ² |
| 2. | Cout | Samsung Electro-Mechanics | CL10A106MQ8NUNC Series= X5R | Cap= 10.0 uF VDC= 6.3 V IRMS= 0.0 A | 1 | \$0.02 | 0603 5 mm ² |
| 3. | L1 | Bourns | SRN3015-1R0Y | L= 1.0 uH DCR= 48.0 mOhm | 1 | \$0.14 | SRN3015 16 mm ² |
| 4. | U1 | Texas Instruments | TPS62061DSGR | Switcher | 1 | \$0.80 | DSG0008A 55 mm ² |









Operating Values

| # | Name | Value | Category | Description |
|-----|------------|----------------------|----------|---|
| 1. | Cin IRMS | 427.29 mA | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 73.749 mA | Current | Output capacitor RMS ripple current |
| 3. | Iin Avg | 481.17 mA | Current | Average input current |
| 4. | L Ipp | 255.47 mA | Current | Peak-to-peak inductor ripple current |
| 5. | BOM Count | 4 | General | Total Design BOM count |
| 6. | FootPrint | 80.0 mm ² | General | Total Foot Print Area of BOM components |
| 7. | Frequency | 3.0 MHz | General | Switching frequency |
| 8. | Pout | 1.53 W | General | Total output power |
| 9. | Total BOM | \$0.98 | General | Total BOM Cost |
| 10. | Vout OP | 1.8 V | Op_Point | Operational Output Voltage |
| 11. | Duty Cycle | 53.658 % | Op_point | Duty cycle |
| 12. | Efficiency | 87.597 % | Op_point | Steady state efficiency |
| 13. | IC Tj | 41.853 degC | Op_point | IC junction temperature |
| 14. | ICThetaJA | 65.3 degC/W | Op_point | IC junction-to-ambient thermal resistance |
| 15. | IOUT_OP | 850.0 mA | Op_point | Iout operating point |
| 16. | VIN_OP | 3.63 V | Op_point | Vin operating point |
| 17. | Vout p-p | 1.064 mV | Op_point | Peak-to-peak output ripple voltage |
| 18. | Cin Pd | 182.576 μW | Power | Input capacitor power dissipation |
| 19. | Cout Pd | 0.0 W | Power | Output capacitor power dissipation |
| 20. | IC Pd | 181.51 mW | Power | IC power dissipation |
| 21. | L Pd | 34.941 mW | Power | Inductor power dissipation |
| 22. | Total Pd | 216.637 mW | Power | Total Power Dissipation |

Design Inputs

| # | Name | Value | Description |
|----|---------|----------|------------------------------------|
| 1. | Iout | 850.0 m | Maximum Output Current |
| 2. | Iout1 | 850.0 m | Output Current #1 |
| 3. | VinMax | 3.63 | Maximum input voltage |
| 4. | VinMin | 2.97 | Minimum input voltage |
| 5. | Vout | 1.8 | Output Voltage |
| 6. | Vout1 | 1.8 | Output Voltage #1 |
| 7. | base_pn | TPS62061 | Texas Instruments Base Part Number |
| 8. | source | DC | Input Source Type |
| 9. | ta | 30.0 | Ambient temperature |

Design Assistance

1. TPS62061 Product Folder : <http://www.ti.com/product/TPS62061> : contains the data sheet and other resources.

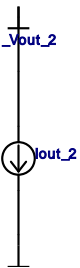
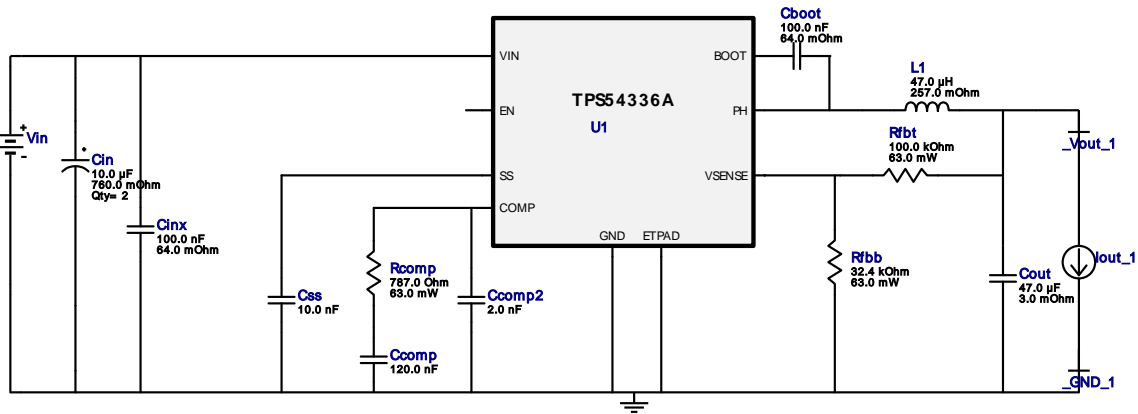


VinMin = 20.0V
 VinMax = 28.0V
 Vout = 3.3V
 Iout = 0.63A

Device = TPS54336ADDAR
 Topology = Buck
 Created = 7/15/15 2:57:01 AM
 BOM Cost = \$1.48
 Footprint = 285.0 mm²
 BOM Count = 13
 Total Pd = 0.38W

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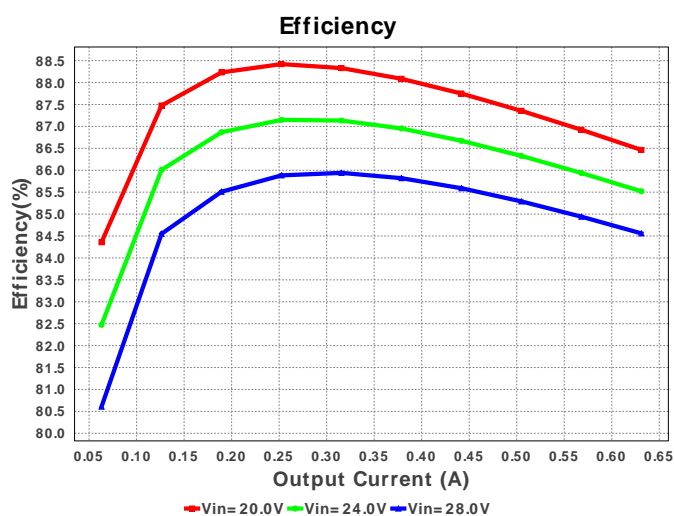
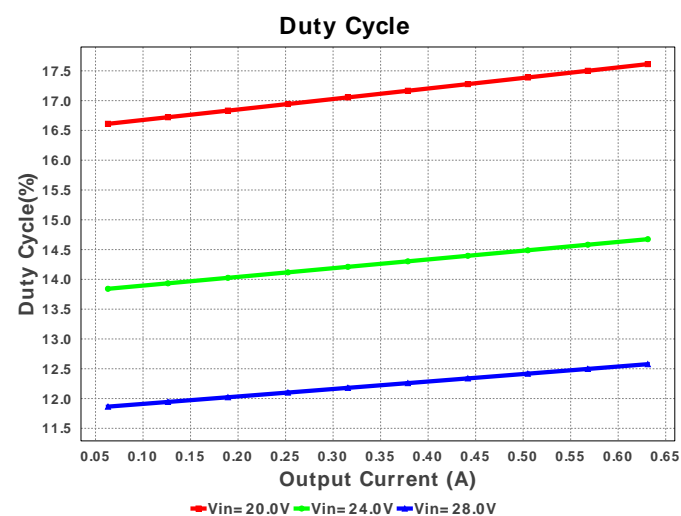
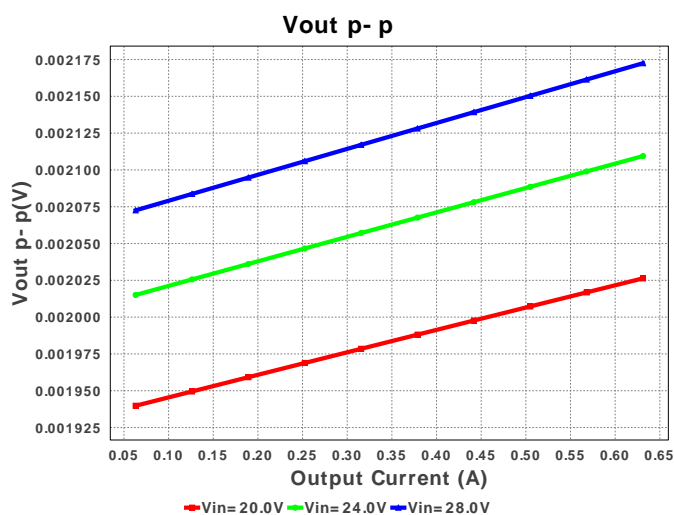
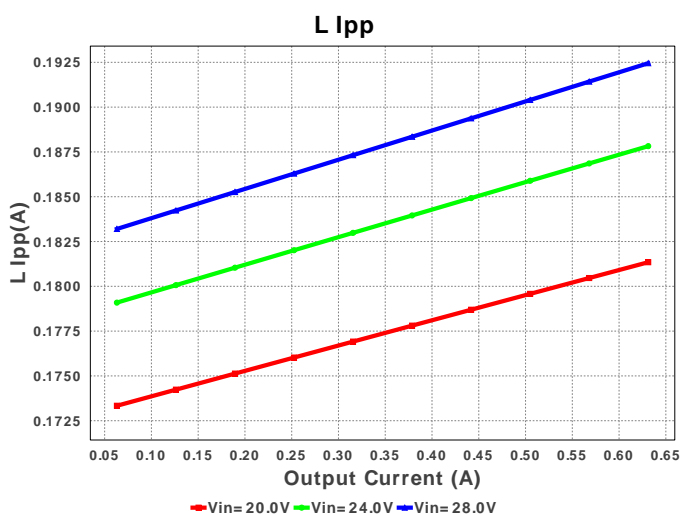
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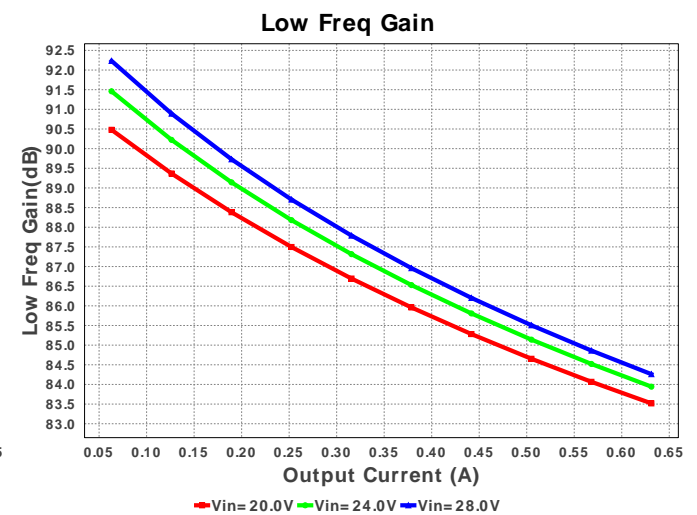
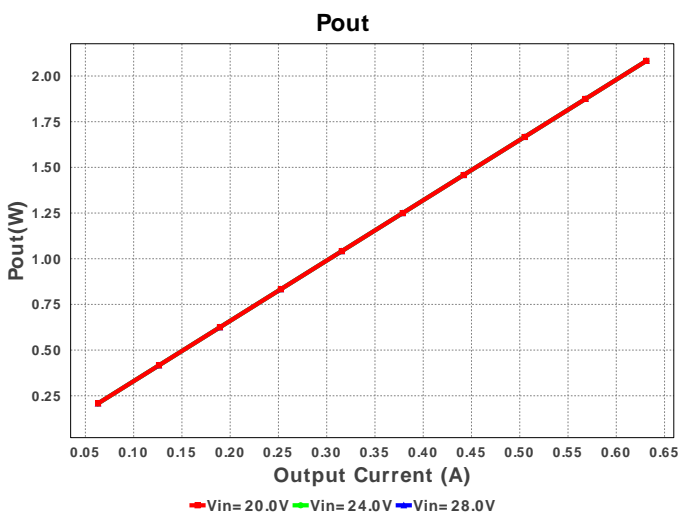
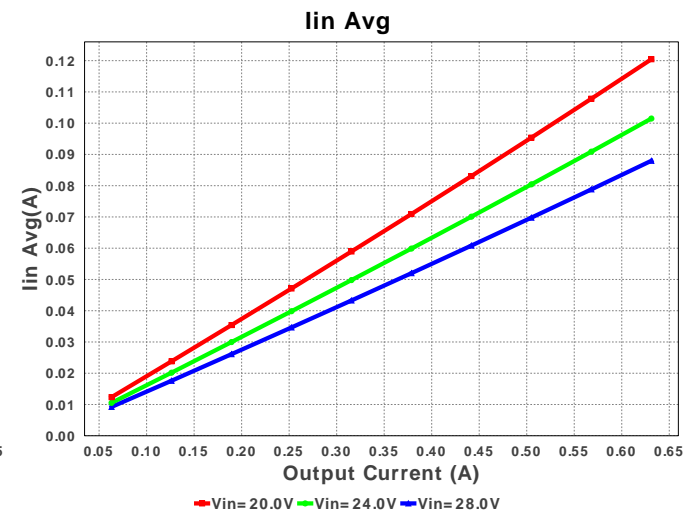
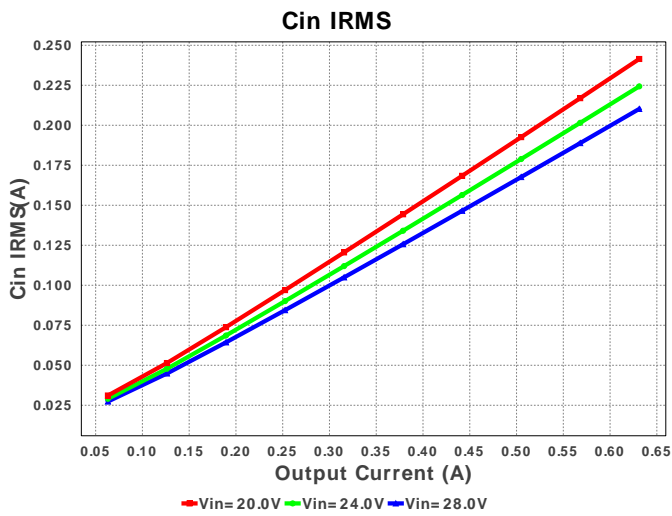
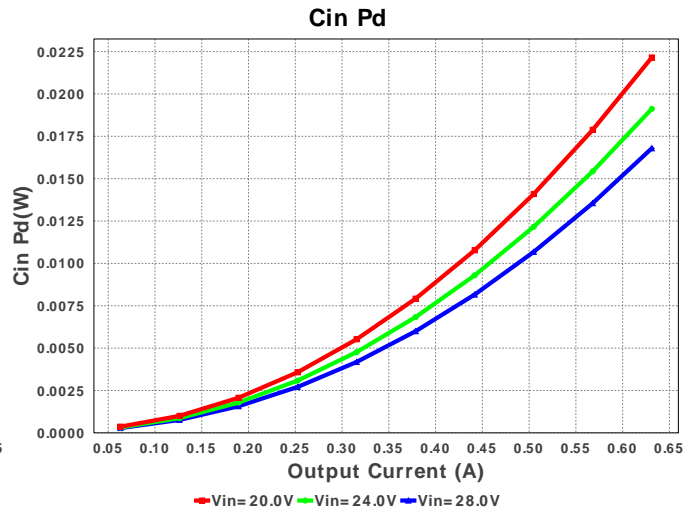
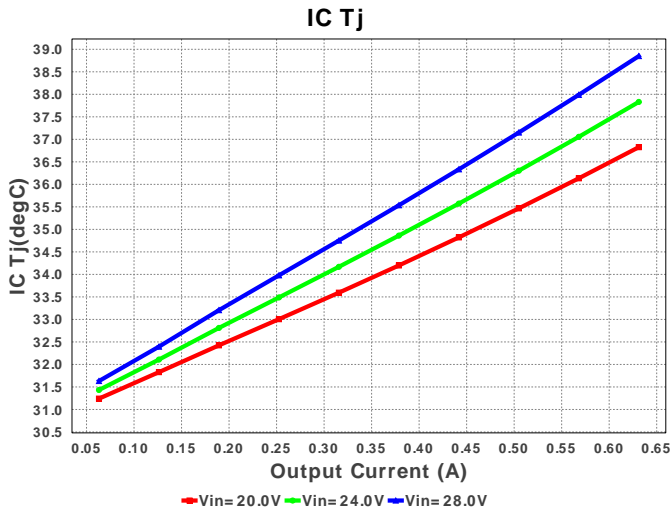


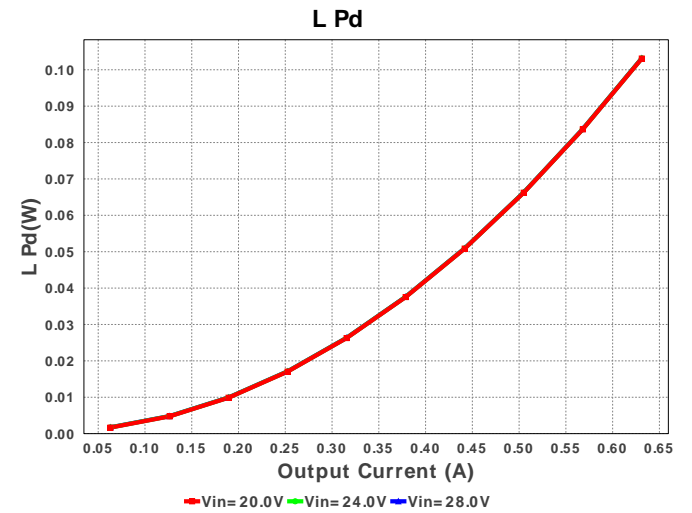
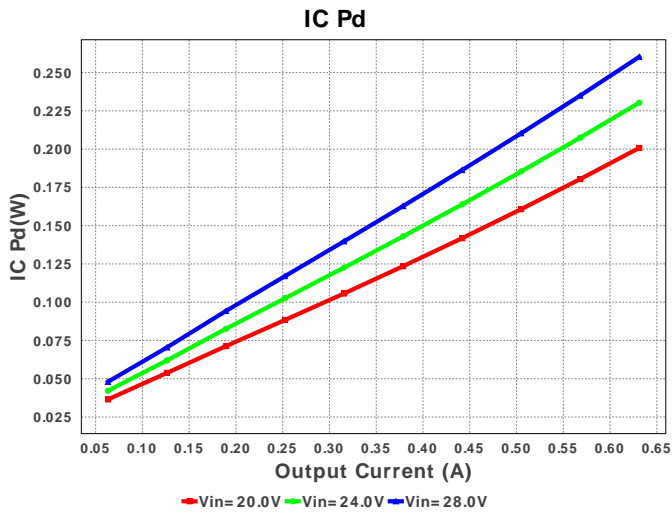
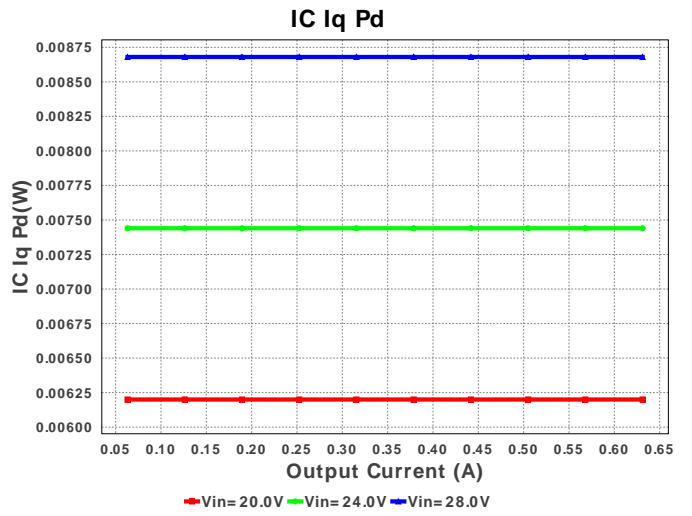
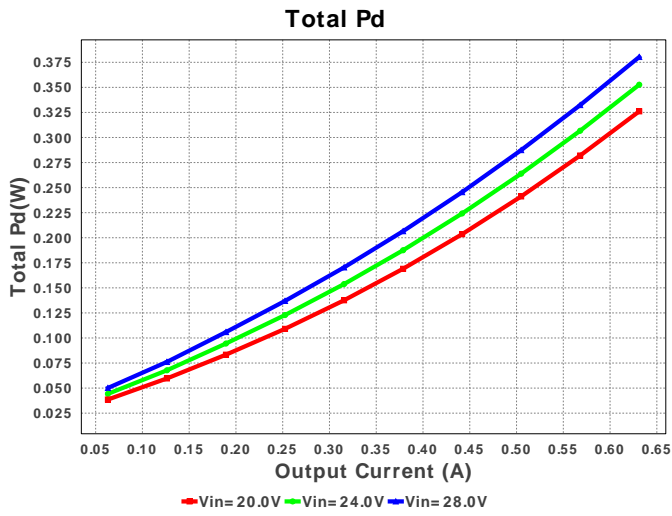
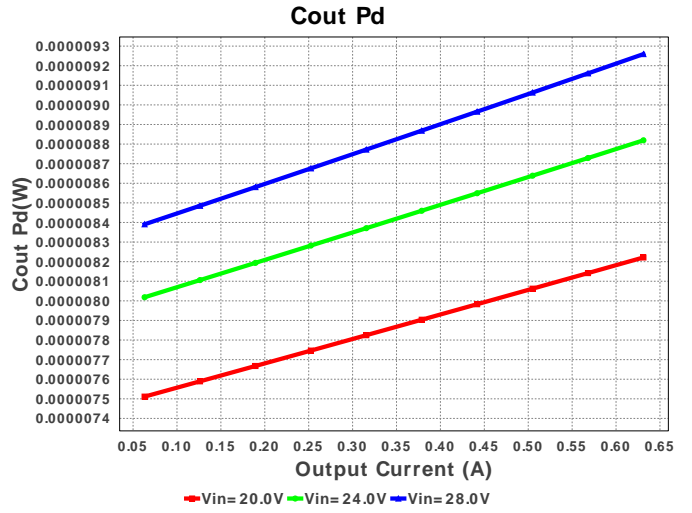
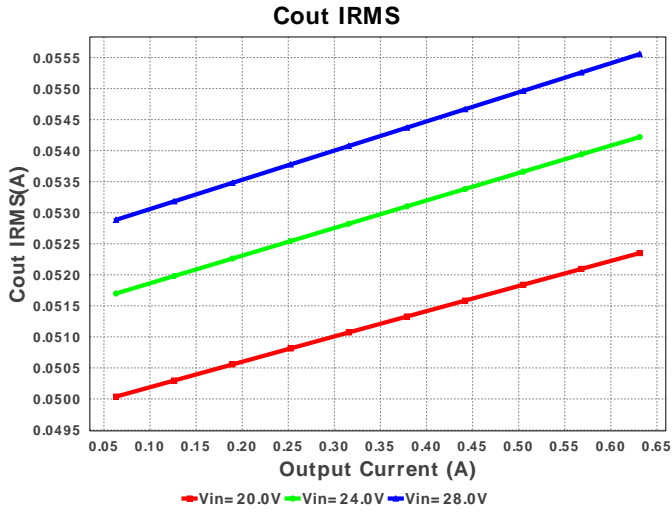
Electrical BOM

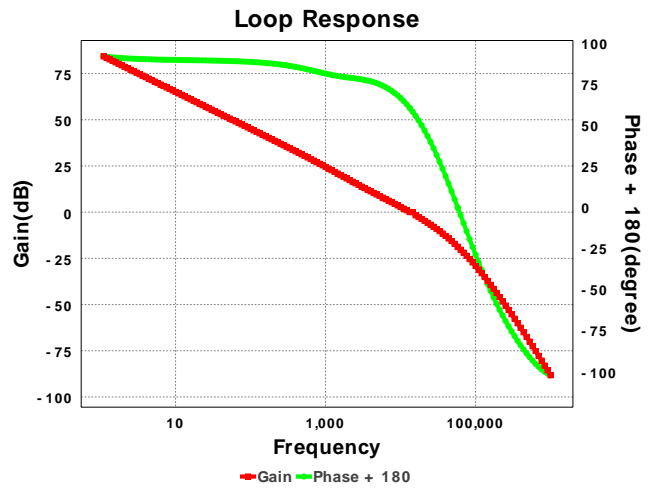
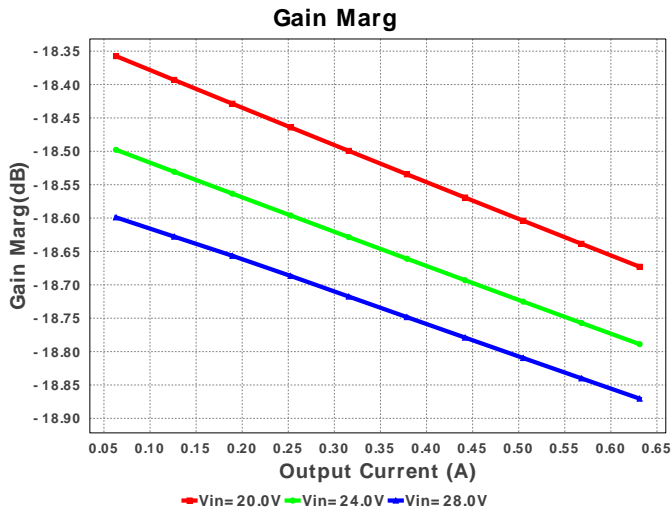
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|----|--------|--------------|---------------------------------------|--|-----|--------|----------------------------------|
| 1. | Cboot | Kemet | C0805C104K5RACTU Series= X7R | Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A | 1 | \$0.01 | 0805 7 mm ² |
| 2. | Ccomp | MuRata | GRM188R61A124KA01D Series= X5R | Cap= 120.0 nF VDC= 10.0 V IRMS= 0.0 A | 1 | \$0.01 | 0603 5 mm ² |
| 3. | Ccomp2 | MuRata | GRM2165C1H202JA01D Series= C0G/NP0 | Cap= 2.0 nF VDC= 50.0 V IRMS= 0.0 A | 1 | \$0.03 | 0805 7 mm ² |
| 4. | Cin | Nichicon | UUD1V100MCL1GS Series= uD | Cap= 10.0 uF ESR= 760.0 mOhm VDC= 35.0 V IRMS= 150.0 mA | 2 | \$0.10 | SM_RADIAL_5MM 58 mm ² |
| 5. | Cinx | 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 |
| 6. | Cout | MuRata | GRM31CR60J476ME19L Series= X5R | Cap= 47.0 uF ESR= 3.0 mOhm VDC= 6.3 V IRMS= 0.0 A | 1 | \$0.12 | 1206 11 mm ² |

| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|-----|-------|-------------------|--------------------------------------|--|-----|--------|--|
| 7. | Css | MuRata | GRM033R61A103KA01D Series= X5R | Cap= 10.0 nF VDC= 10.0 V IRMS= 0.0 A | 1 | \$0.01 |  0201 2 mm ² |
| 8. | L1 | Bourns | SRN6045-470M | L= 47.0 µH DCR= 257.0 mOhm | 1 | \$0.16 |  SRN6045 64 mm ² |
| 9. | Rcomp | Vishay-Dale | CRCW0402787RFKED Series= CRCW..e3 | Res= 787.0 Ohm Power= 63.0 mW Tolerance= 1.0% | 1 | \$0.01 |  0402 3 mm ² |
| 10. | Rfbb | Vishay-Dale | CRCW040232K4FKED Series= CRCW..e3 | Res= 32.4 kOhm Power= 63.0 mW Tolerance= 1.0% | 1 | \$0.01 |  0402 3 mm ² |
| 11. | Rfbt | Vishay-Dale | CRCW0402100KFKED Series= CRCW..e3 | Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0% | 1 | \$0.01 |  0402 3 mm ² |
| 12. | U1 | Texas Instruments | TPS54336ADDAR | Switcher | 1 | \$0.90 |  R-PDSO-G8 57 mm ² |









Operating Values

| # | Name | Value | Category | Description |
|-----|---------------------|-----------------------|----------|---|
| 1. | Cin IRMS | 210.213 mA | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 55.555 mA | Current | Output capacitor RMS ripple current |
| 3. | Iin Avg | 87.971 mA | Current | Average input current |
| 4. | L Ipp | 192.45 mA | Current | Peak-to-peak inductor ripple current |
| 5. | BOM Count | 13 | General | Total Design BOM count |
| 6. | FootPrint | 285.0 mm ² | General | Total Foot Print Area of BOM components |
| 7. | Frequency | 340.0 kHz | General | Switching frequency |
| 8. | IC Tolerance | 10.0 mV | General | IC Feedback Tolerance |
| 9. | Pout | 2.083 W | General | Total output power |
| 10. | Total BOM | \$1.48 | General | Total BOM Cost |
| 11. | ICThetaJA Effective | 34.0 degC/W | Op_Point | Effective IC Junction-to-Ambient Thermal Resistance |
| 12. | Low Freq Gain | 84.261 dB | Op_Point | Gain at 10Hz |
| 13. | Vout OP | 3.3 V | Op_Point | Operational Output Voltage |
| 14. | Cross Freq | 13.348 kHz | Op_point | Bode plot crossover frequency |
| 15. | Duty Cycle | 12.577 % | Op_point | Duty cycle |
| 16. | Efficiency | 84.56 % | Op_point | Steady state efficiency |
| 17. | Gain Marg | -18.87 dB | Op_point | Bode Plot Gain Margin |
| 18. | IC Tj | 38.849 degC | Op_point | IC junction temperature |
| 19. | IOUT_OP | 631.17 mA | Op_point | Iout operating point |
| 20. | Phase Marg | 60.738 deg | Op_point | Bode Plot Phase Margin |
| 21. | VIN_OP | 28.0 V | Op_point | Vin operating point |
| 22. | Vout p-p | 2.172 mV | Op_point | Peak-to-peak output ripple voltage |
| 23. | Cin Pd | 16.792 mW | Power | Input capacitor power dissipation |
| 24. | Cout Pd | 9.259 μW | Power | Output capacitor power dissipation |
| 25. | IC Iq Pd | 8.68 mW | Power | IC Iq Pd |
| 26. | IC Pd | 260.261 mW | Power | IC power dissipation |
| 27. | L Pd | 103.176 mW | Power | Inductor power dissipation |
| 28. | Total Pd | 380.316 mW | Power | Total Power Dissipation |

Design Inputs

| # | Name | Value | Description |
|----|---------|-----------|------------------------------------|
| 1. | Iout | 631.17 m | Maximum Output Current |
| 2. | Iout1 | 631.17 m | Output Current #1 |
| 3. | VinMax | 28.0 | Maximum input voltage |
| 4. | VinMin | 20.0 | Minimum input voltage |
| 5. | Vout | 3.3 | Output Voltage |
| 6. | Vout1 | 3.3 | Output Voltage #1 |
| 7. | base_pn | TPS54336A | Texas Instruments Base Part Number |
| 8. | source | DC | Input Source Type |
| 9. | ta | 30.0 | Ambient temperature |

Design Assistance

1. TPS54336A Product Folder : <http://www.ti.com/product/TPS54336A> : 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.

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