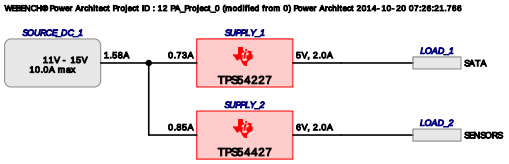
# WEBENCH® Power Architect




## Project Report

Project : 1244294/12 : PA_Project_0 (modified from 0)
Created : 2014-10-20 07:26:21.766
Optimize project optFactor=3

Project Summary

| | | |
|---|---|---|
| 1. | Total System Efficiency | 92.98 % |
| 2. | Total System BOM Count | 22.0 |
| 3. | Total System Footprint | 429.0 mm2 |
| 4. | Total System BOM Cost | $3.17 |
| 5. | Total System Power Dissipation | 1.661 W |

--> Launch WEBENCH Power Architect.

### Power Supplies

| # | Name | NSID | Description | Vout | Iout | Efficiency | Foot-print | Cost | Design | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | SUPPLY_1 | TPS54227 | Switcher : 2A Synchronous Buck Converter | 5 V | 2.0 A | 91.8% | 221 | $1.44 | 64 | 4 |
| 2. | SUPPLY_2 | TPS54427 | Switcher : 4A Synchronous Buck SWIFT Converter | 6 V | 2.0 A | 94% | 208 | $1.73 | 65 | 9 |

### Power Loads

| # | Name | VLoad | ILoad | Description |
|---|---|---|---|---|
| 1. | SATA | 5 V | 2 A | VoutRipple=1% |
| 2. | SENSORS | 6 V | 2 A | VoutRipple=1% |

Project Diagram

## Electrical Procurement BOM

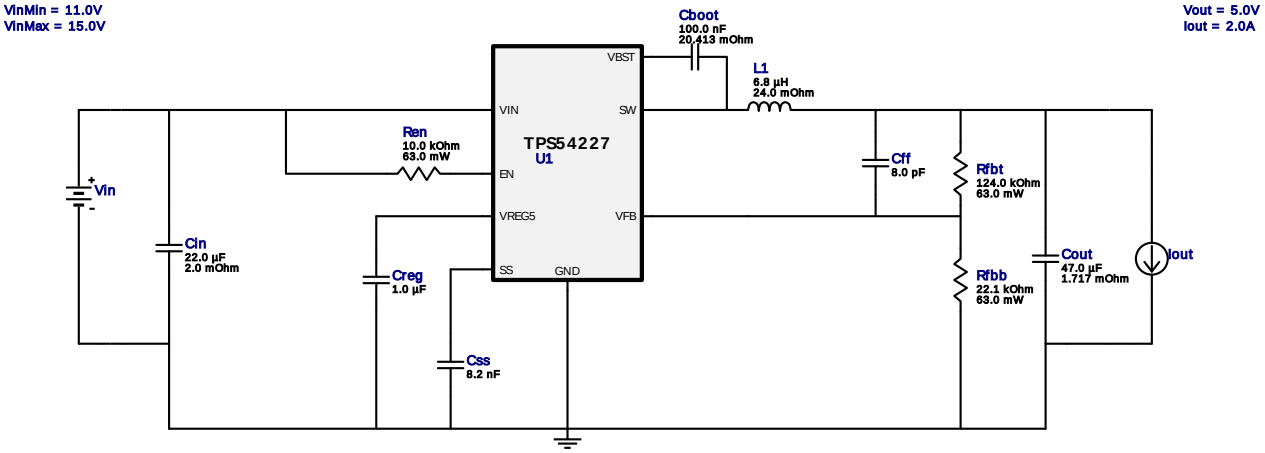
| Manufacturer | Part Number | Description | Quantity | Budgetary Price | Footprint ($mm^2$) |
|---|---|---|---|---|---|
| TDK | C1005X5R1A104K | 0402 | 2 | $0.01 | 6 |
| TDK | C3216X6S1A476M | 1206 | 2 | $0.26 | 22 |
| Yageo America | CC0805DRNP09BN8R0 | 0805 | 2 | $0.01 | 14 |
| Vishay-Dale | CRCW040210K0FKED | 0402 | 2 | $0.01 | 6 |
| Vishay-Dale | CRCW0402124KFKED | 0402 | 1 | $0.01 | 3 |
| Vishay-Dale | CRCW0402154KFKED | 0402 | 1 | $0.01 | 3 |
| Vishay-Dale | CRCW040222K1FKED | 0402 | 2 | $0.01 | 6 |
| MuRata | GRM155R61A105KE15D | 0402 | 2 | $0.01 | 6 |
| MuRata | GRM155R71E822KA01D | 0402 | 2 | $0.01 | 6 |
| MuRata | GRM32ER61E226KE15L | 1210 | 2 | $0.28 | 29 |
| Bourns | SRN8040-4R7Y | SRN8040 | 1 | $0.22 | 100 |
| Texas Instruments | TPS54227DDAR | R-PDSO-G8 | 1 | $0.61 | 57 |
| Texas Instruments | TPS54427DDAR | R-PDSO-G8 | 1 | $0.90 | 57 |
| TDK | VLP8040T-6R8M | VLP8040 | 1 | $0.22 | 113 |
| **Total** | | | **22** | **$3.17** | **429** |

# WEBENCH® Design Report

VinMin = 11.0V
VinMax = 15.0V
Vout = 5.0V
Iout = 2.0A

Device = TPS54227DDAR
Topology = Buck
Created = 10/20/14 7:26:20 AM
BOM Cost = $1.44
Footprint = 221.0 mm²
BOM Count = 11
Total Pd = 0.9W

Design : 1244294/64 TPS54227DDAR
TPS54227DDAR 11.0V-15.0V to 5.00V @ 2.0A

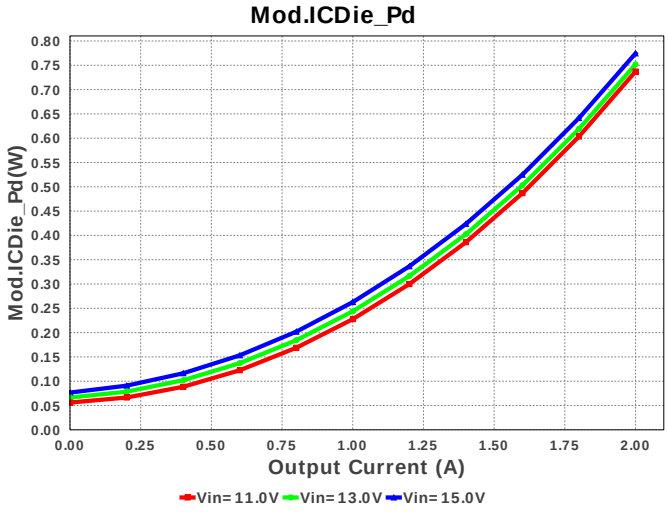


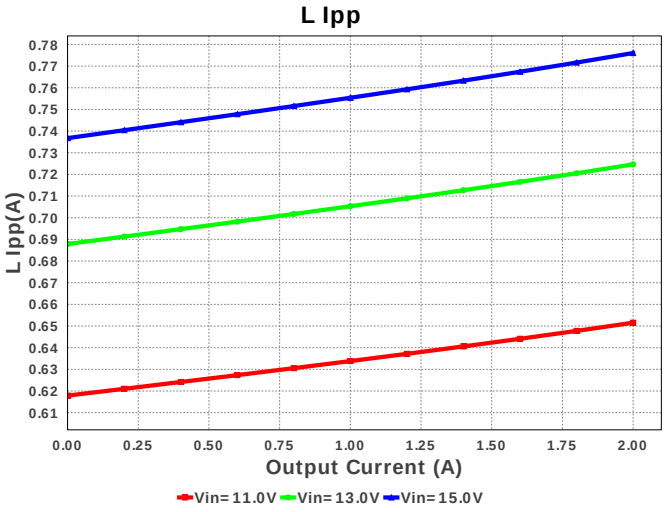

## Electrical BOM

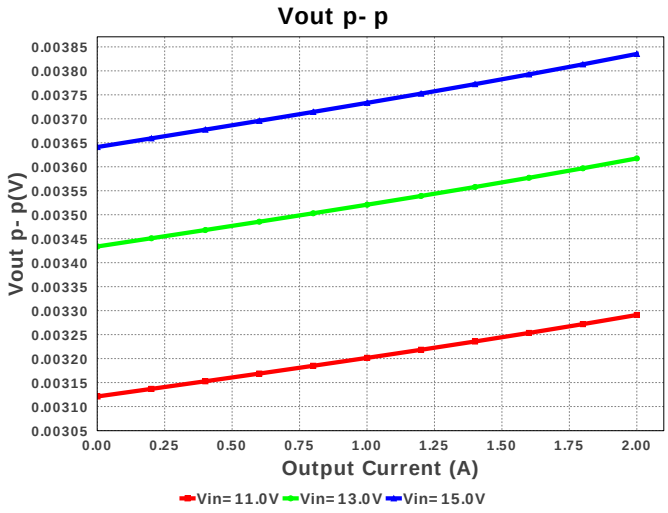
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cboot | TDK | C1005X5R1A104K<br>Series= 285 | Cap= 100.0 nF<br>ESR= 20.413 mOhm<br>VDC= 10.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0402 3 mm² |
| 2. | Cff | Yageo America | CC0805DRNP09BN8R0<br>Series= C0G/NP0 | Cap= 8.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 3. | Cin | MuRata | GRM32ER61E226KE15L<br>Series= X5R | Cap= 22.0 uF<br>ESR= 2.0 mOhm<br>VDC= 25.0 V<br>IRMS= 3.67 A | 1 | $0.28 | 1210 15 mm² |
| 4. | Cout | TDK | C3216X6S1A476M<br>Series= 285 | Cap= 47.0 uF<br>ESR= 1.717 mOhm<br>VDC= 10.0 V<br>IRMS= 0.0 A | 1 | $0.26 | 1206 11 mm² |
| 5. | Creg | MuRata | GRM155R61A105KE15D<br>Series= X5R | Cap= 1.0 uF<br>VDC= 10.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0402 3 mm² |
| 6. | Css | MuRata | GRM155R71E822KA01D<br>Series= X7R | Cap= 8.2 nF<br>VDC= 25.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0402 3 mm² |
| 7. | L1 | TDK | VLP8040T-6R8M | L= 6.8 µH<br>DCR= 24.0 mOhm | 1 | $0.22 | VLP8040 113 mm² |
| 8. | Ren | Vishay-Dale | CRCW040210K0FKED<br>Series= CRCW..e3 | Res= 10.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 9. | Rfbb | Vishay-Dale | CRCW040222K1FKED<br>Series= CRCW..e3 | Res= 22.1 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 10. | Rfbt | Vishay-Dale | CRCW0402124KFKED<br>Series= CRCW..e3 | Res= 124.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |

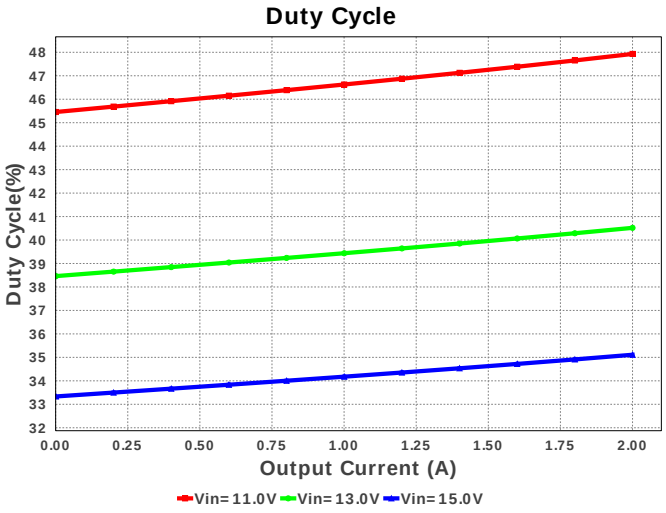
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 11. | U1 | Texas Instruments | TPS54227DDAR | Switcher | 1 | $0.61 | |

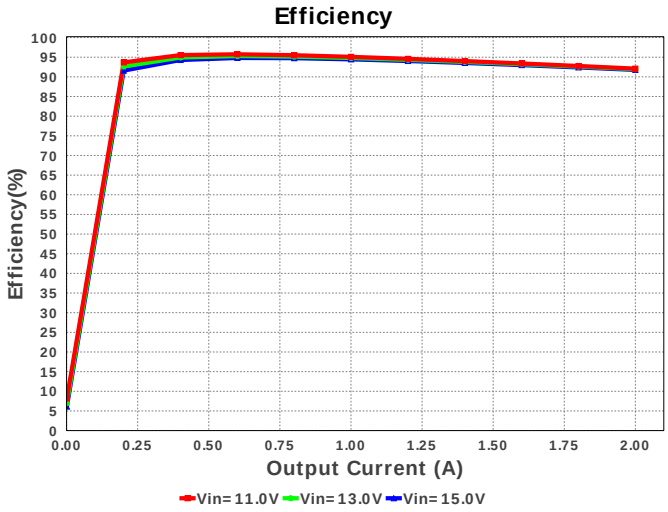
R-PDSO-G8 57 mm²

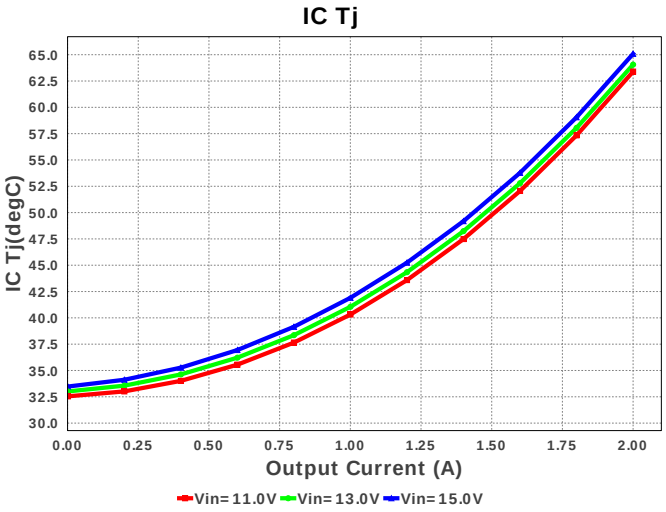


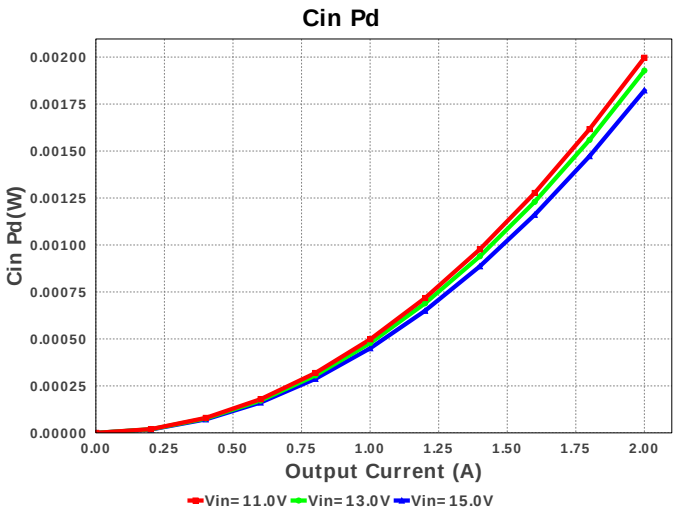



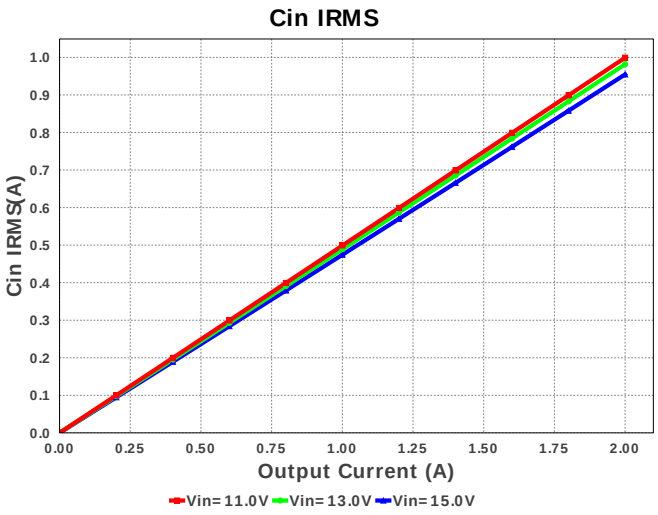



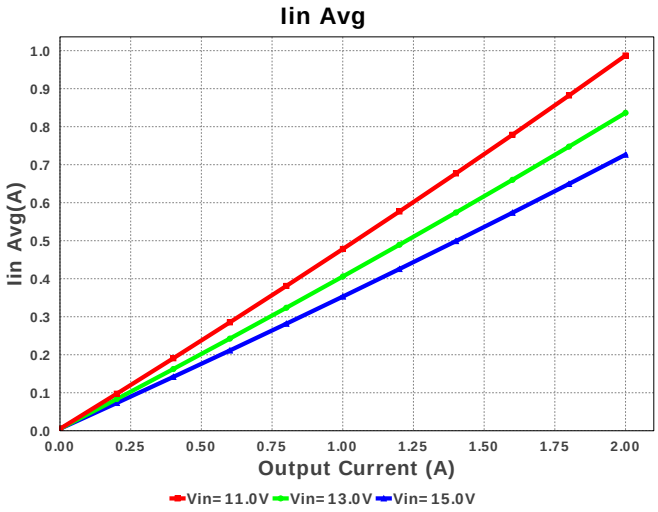



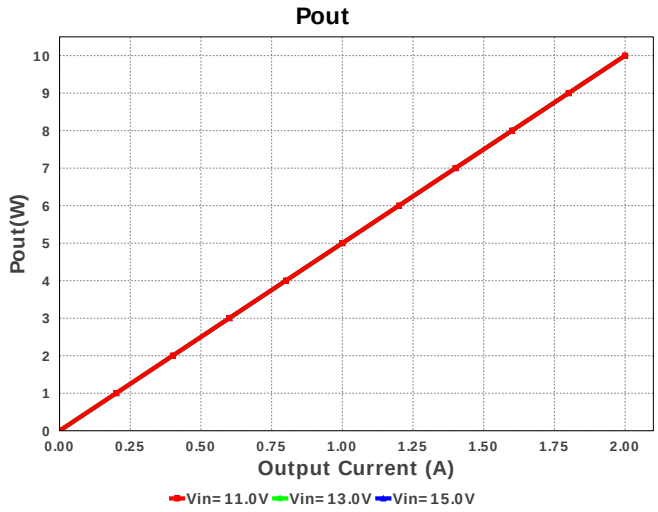



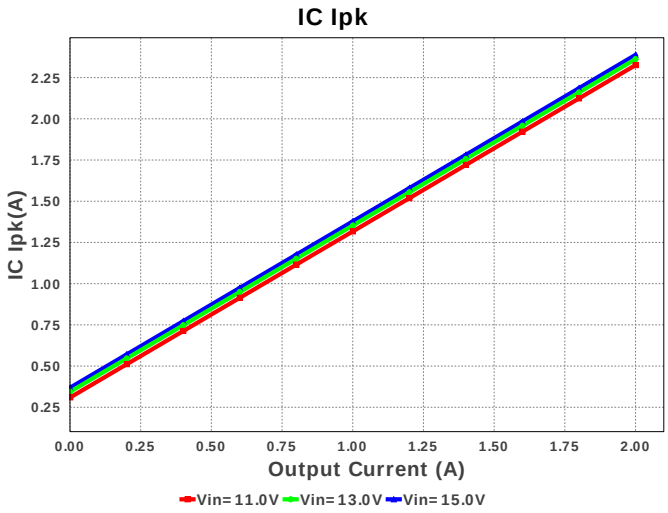



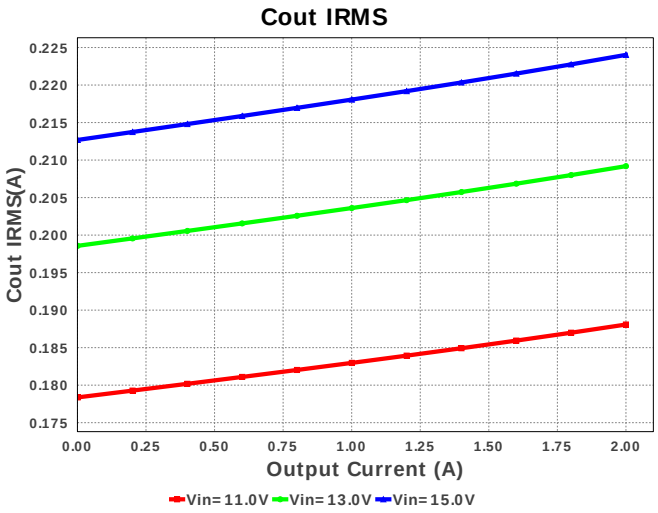


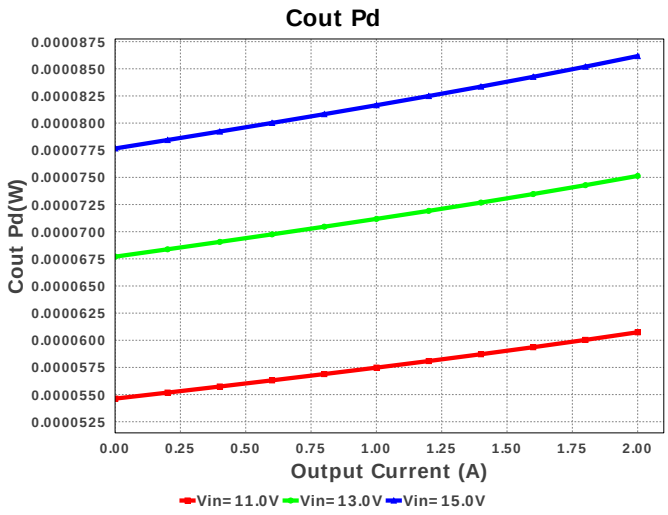



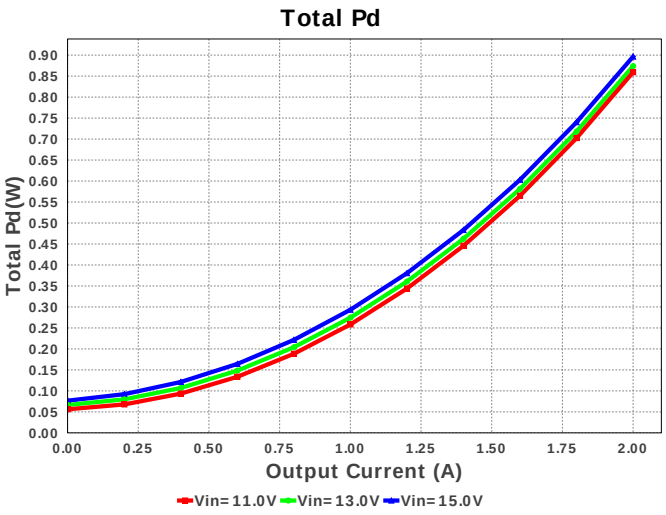



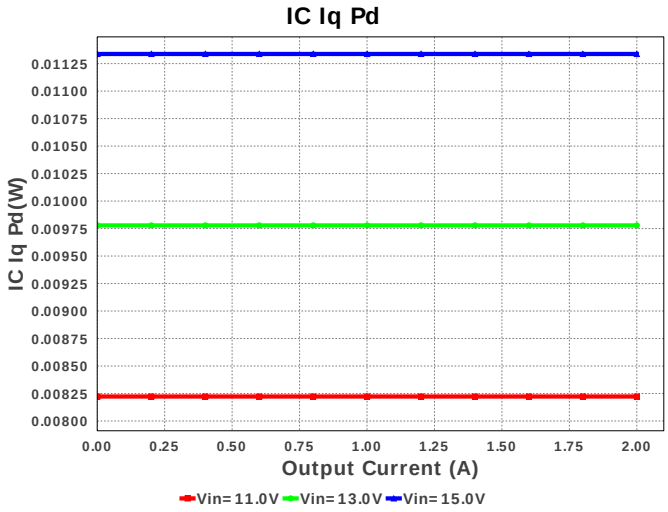



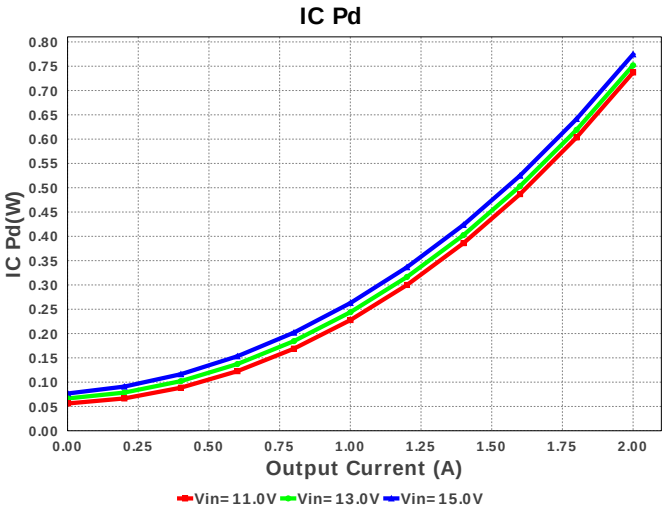



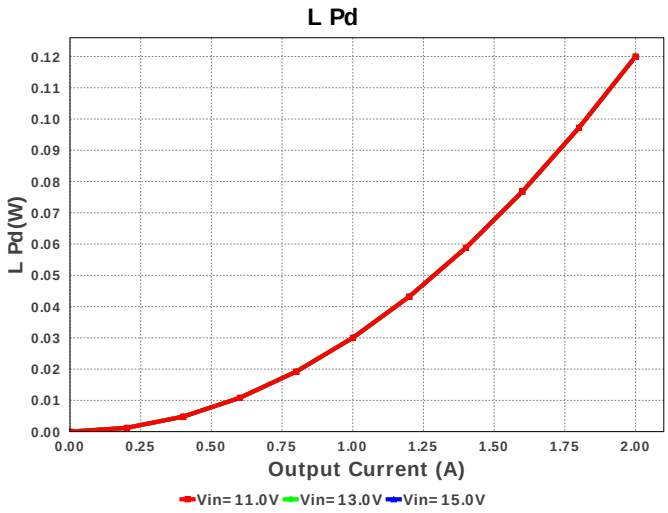






## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | Cin IRMS | 954.635 mA | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 224.022 mA | Current | Output capacitor RMS ripple current |
| 3. | IC Ipk | 2.388 A | Current | Peak switch current in IC |
| 4. | Iin Avg | 726.43 mA | Current | Average input current |
| 5. | L Ipp | 776.035 mA | Current | Peak-to-peak inductor ripple current |
| 6. | BOM Count | 11 | General | Total Design BOM count |
| 7. | FootPrint | 221.0 $mm^2$ | General | Total Foot Print Area of BOM components |
| 8. | Frequency | 665.357 kHz | General | Switching frequency |
| 9. | Pout | 10.0 W | General | Total output power |
| 10. | Total BOM | $1.44 | General | Total BOM Cost |
| 11. | Vout OP | 5.0 V | Op_Point | Operational Output Voltage |

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 12. | Duty Cycle | 35.111 % | Op_point | Duty cycle |
| 13. | Efficiency | 91.773 % | Op_point | Steady state efficiency |
| 14. | IC Tj | 65.084 degC | Op_point | IC junction temperature |
| 15. | ICThetaJA | 45.3 degC/W | Op_point | IC junction-to-ambient thermal resistance |
| 16. | IOUT_OP | 2.0 A | Op_point | Iout operating point |
| 17. | VIN_OP | 15.0 V | Op_point | Vin operating point |
| 18. | Vout p-p | 3.835 mV | Op_point | Peak-to-peak output ripple voltage |
| 19. | Cin Pd | 1.823 mW | Power | Input capacitor power dissipation |
| 20. | Cout Pd | 86.169 µW | Power | Output capacitor power dissipation |
| 21. | IC Iq Pd | 11.337 mW | Power | IC Iq Pd |
| 22. | IC Pd | 774.484 mW | Power | IC power dissipation |
| 23. | L Pd | 120.0 mW | Power | Inductor power dissipation |
| 24. | Total Pd | 896.451 mW | Power | Total Power Dissipation |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 2.0 A | Maximum Output Current |
| 2. | Iout1 | 2.0 Amps | Output Current #1 |
| 3. | VinMax | 15.0 V | Maximum input voltage |
| 4. | VinMin | 11.0 V | Minimum input voltage |
| 5. | Vout | 5.0 V | Output Voltage |
| 6. | Vout1 | 5.0 Volt | Output Voltage #1 |
| 7. | base_pn | TPS54227 | Base Product Number |
| 8. | source | DC | Input Source Type |
| 9. | Ta | 30.0 degC | Ambient temperature |

## Design Assistance

1. **TPS54227** Product Folder : http://www.ti.com/product/tps54227 : contains the data sheet and other resources.

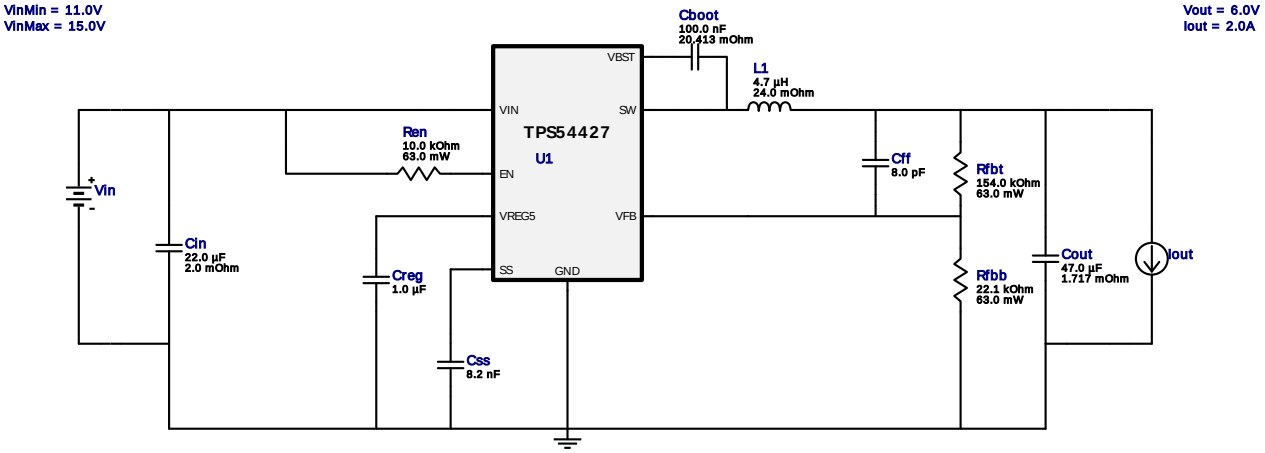
TEXAS INSTRUMENTS

# WEBENCH® Design Report

VinMin = 11.0V
VinMax = 15.0V
Vout = 6.0V
Iout = 2.0A

Device = TPS54427DDAR
Topology = Buck
Created = 10/20/14 7:26:21 AM
BOM Cost = $1.73
Footprint = 208.0 mm²
BOM Count = 11
Total Pd = 0.76W

Design : 1244294/65 TPS54427DDAR
TPS54427DDAR 11.0V-15.0V to 6.00V @ 2.0A

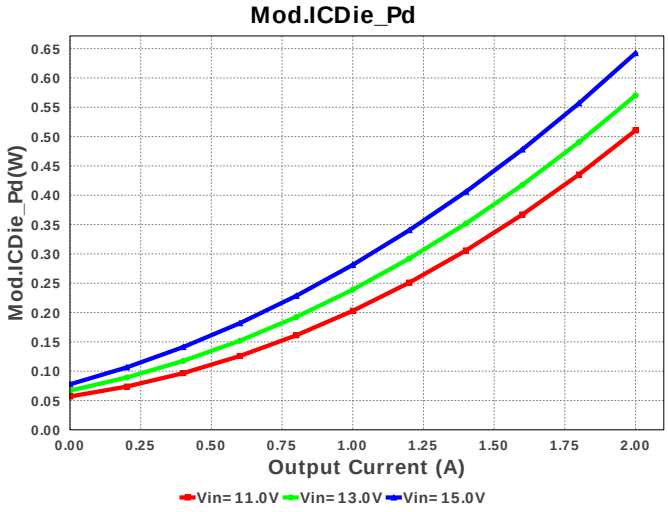


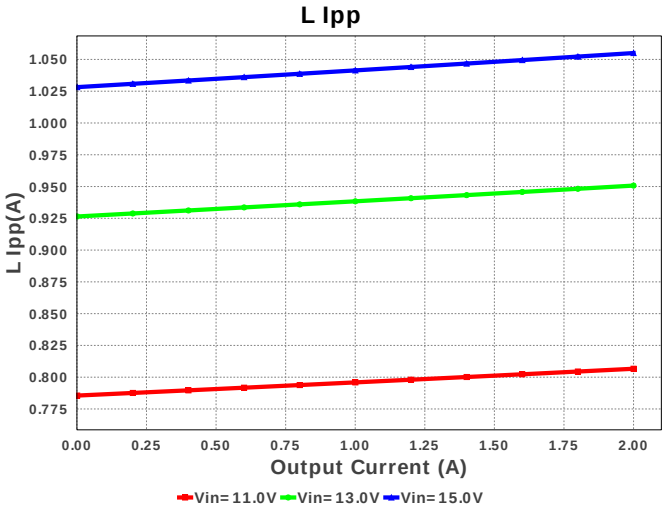

## Electrical BOM

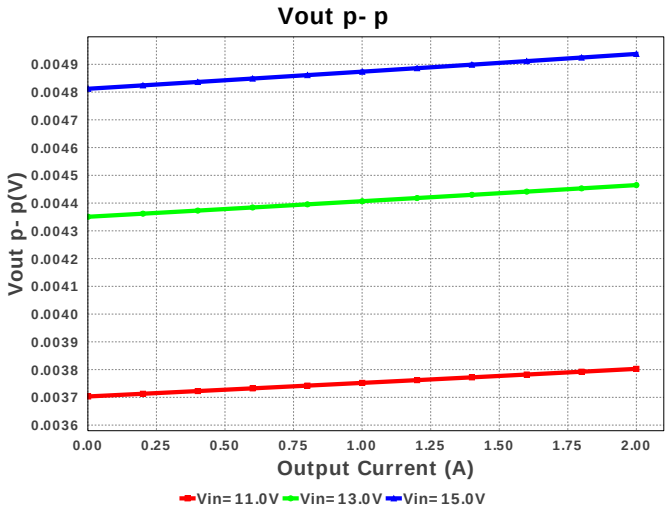
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cboot | TDK | C1005X5R1A104K<br>Series= 285 | Cap= 100.0 nF<br>ESR= 20.413 mOhm<br>VDC= 10.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0402 3 mm² |
| 2. | Cff | Yageo America | CC0805DRNP09BN8R0<br>Series= C0G/NP0 | Cap= 8.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 3. | Cin | MuRata | GRM32ER61E226KE15L<br>Series= X5R | Cap= 22.0 uF<br>ESR= 2.0 mOhm<br>VDC= 25.0 V<br>IRMS= 3.67 A | 1 | $0.28 | 1210 15 mm² |
| 4. | Cout | TDK | C3216X6S1A476M<br>Series= 285 | Cap= 47.0 uF<br>ESR= 1.717 mOhm<br>VDC= 10.0 V<br>IRMS= 0.0 A | 1 | $0.26 | 1206 11 mm² |
| 5. | Creg | MuRata | GRM155R61A105KE15D<br>Series= X5R | Cap= 1.0 uF<br>VDC= 10.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0402 3 mm² |
| 6. | Css | MuRata | GRM155R71E822KA01D<br>Series= X7R | Cap= 8.2 nF<br>VDC= 25.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0402 3 mm² |
| 7. | L1 | Bourns | SRN8040-4R7Y | L= 4.7 µH<br>DCR= 24.0 mOhm | 1 | $0.22 | SRN8040 100 mm² |
| 8. | Ren | Vishay-Dale | CRCW040210K0FKED<br>Series= CRCW..e3 | Res= 10.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 9. | Rfbb | Vishay-Dale | CRCW040222K1FKED<br>Series= CRCW..e3 | Res= 22.1 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 10. | Rfbt | Vishay-Dale | CRCW0402154KFKED<br>Series= CRCW..e3 | Res= 154.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |

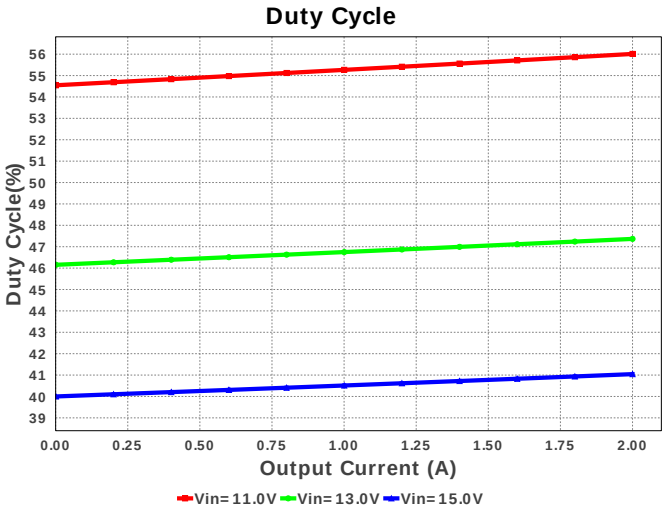
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 11. | U1 | Texas Instruments | TPS54427DDAR | Switcher | 1 | $0.90 | |

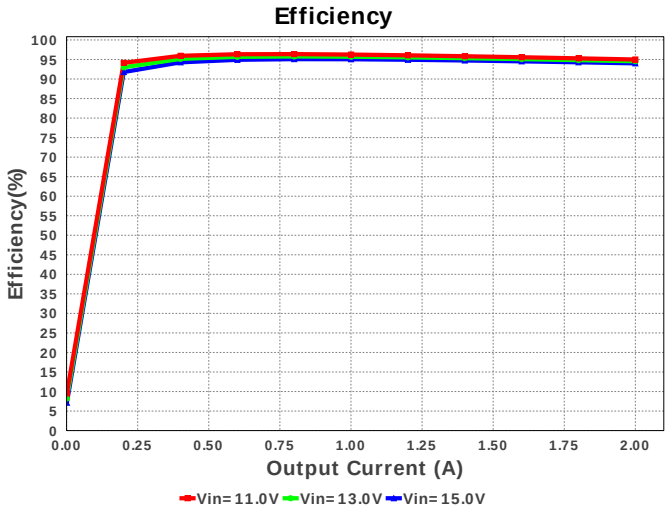
R-PDSO-G8 57 mm²

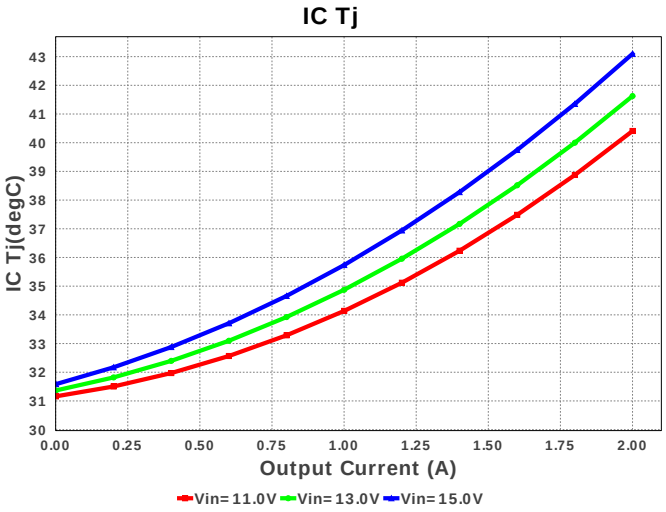


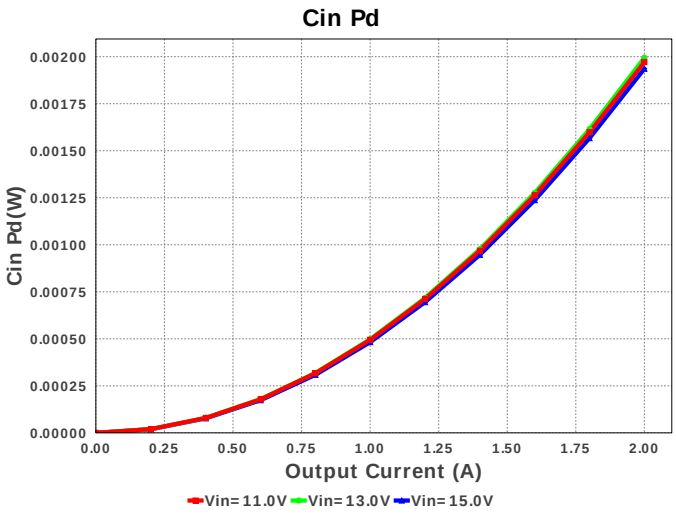



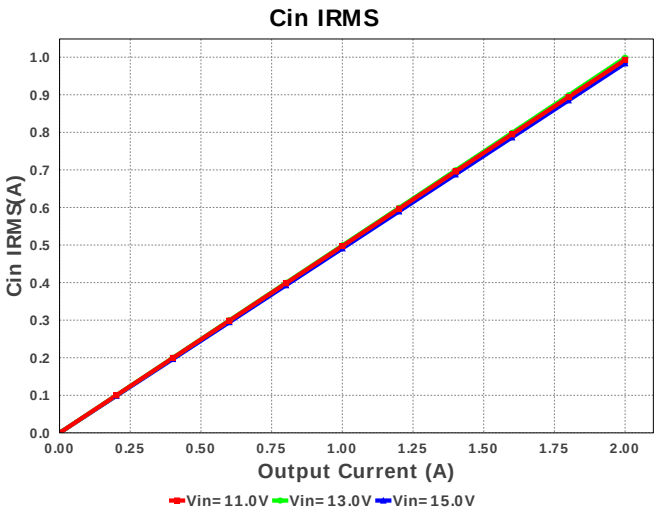



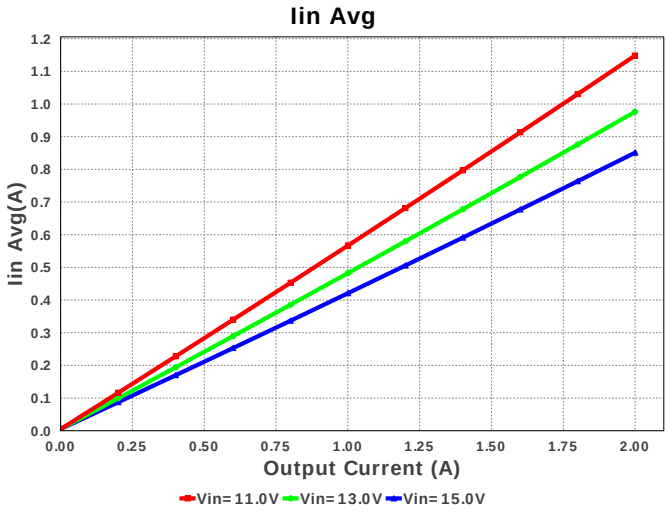



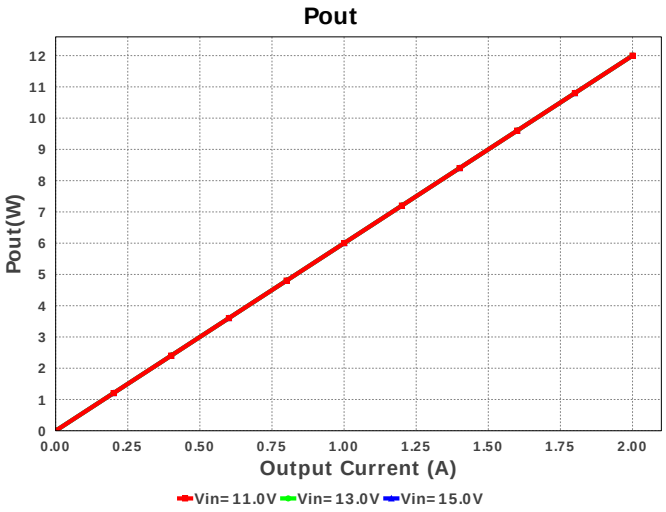



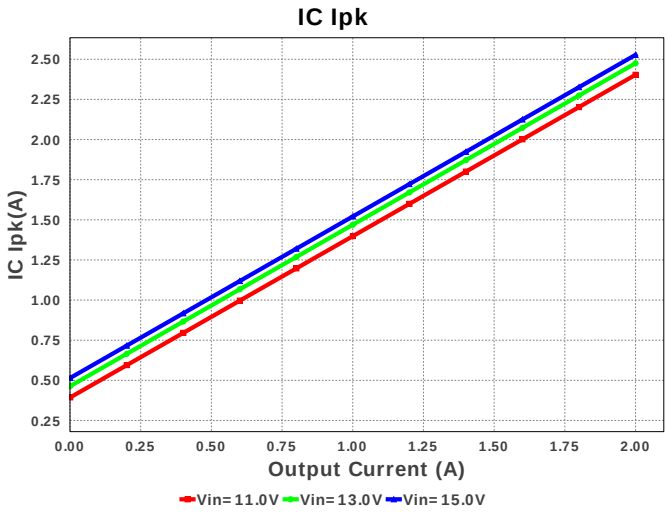



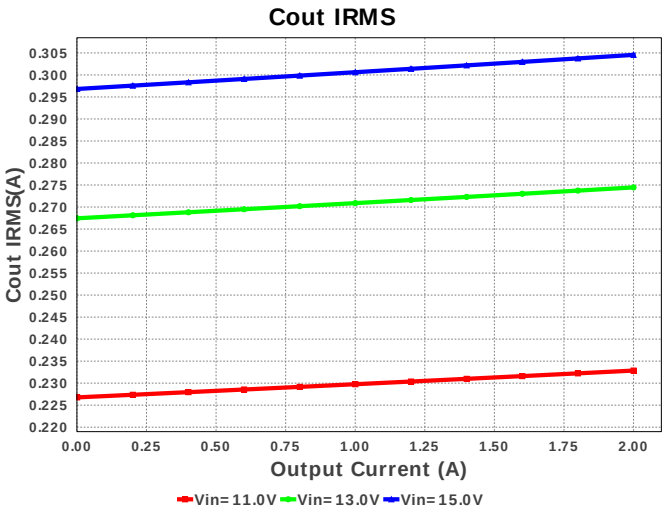


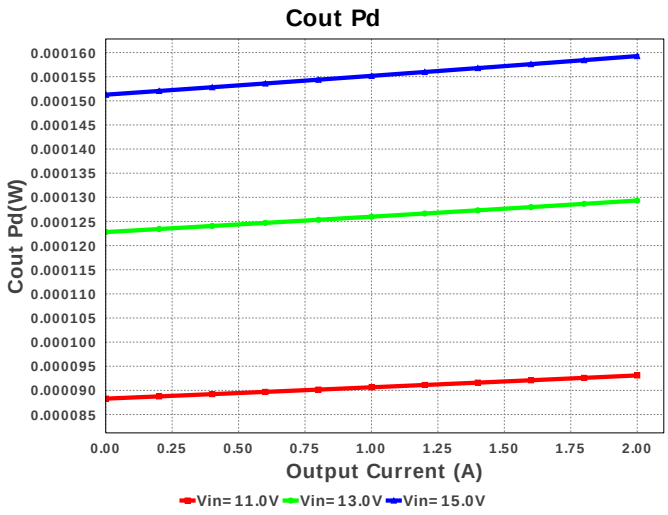



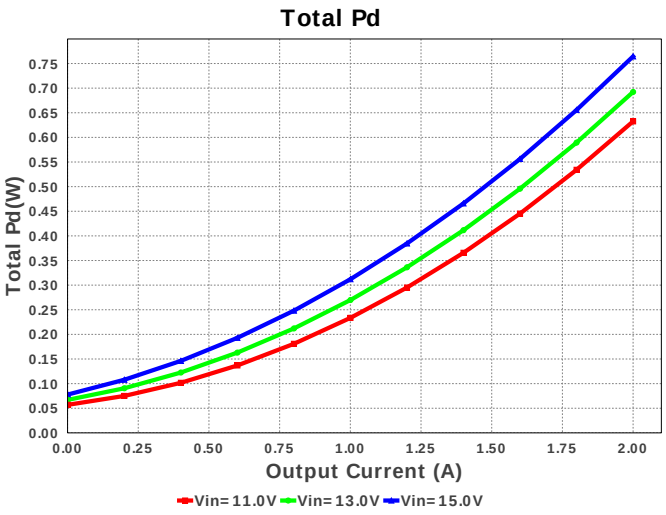



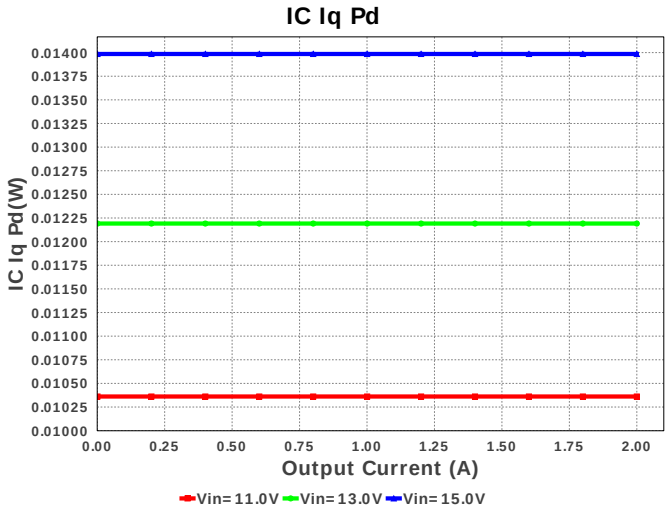



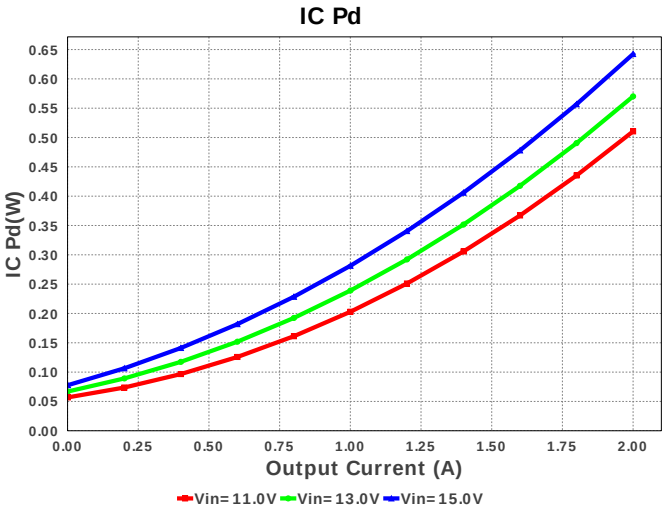



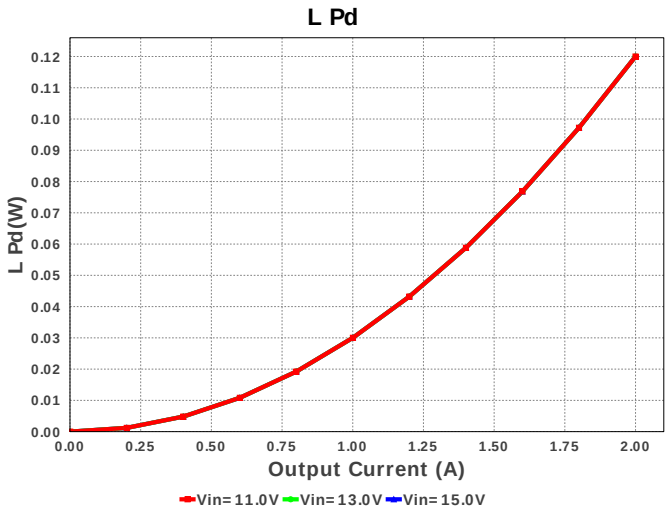






## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | Cin IRMS | 983.827 mA | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 304.558 mA | Current | Output capacitor RMS ripple current |
| 3. | IC Ipk | 2.528 A | Current | Peak switch current in IC |
| 4. | Iin Avg | 850.96 mA | Current | Average input current |
| 5. | L Ipp | 1.055 A | Current | Peak-to-peak inductor ripple current |
| 6. | BOM Count | 11 | General | Total Design BOM count |
| 7. | FootPrint | 208.0 $mm^2$ | General | Total Foot Print Area of BOM components |
| 8. | Frequency | 744.958 kHz | General | Switching frequency |
| 9. | Pout | 12.0 W | General | Total output power |
| 10. | Total BOM | $1.73 | General | Total BOM Cost |
| 11. | Vout OP | 6.0 V | Op_Point | Operational Output Voltage |

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 12. | Duty Cycle | 41.044 % | Op_point | Duty cycle |
| 13. | Efficiency | 94.011 % | Op_point | Steady state efficiency |
| 14. | IC Tj | 43.098 degC | Op_point | IC junction temperature |
| 15. | ICThetaJA | 20.39 degC/W | Op_point | IC junction-to-ambient thermal resistance |
| 16. | IOUT_OP | 2.0 A | Op_point | Iout operating point |
| 17. | VIN_OP | 15.0 V | Op_point | Vin operating point |
| 18. | Vout p-p | 4.937 mV | Op_point | Peak-to-peak output ripple voltage |
| 19. | Cin Pd | 1.936 mW | Power | Input capacitor power dissipation |
| 20. | Cout Pd | 159.261 µW | Power | Output capacitor power dissipation |
| 21. | IC Iq Pd | 13.985 mW | Power | IC Iq Pd |
| 22. | IC Pd | 642.369 mW | Power | IC power dissipation |
| 23. | L Pd | 120.0 mW | Power | Inductor power dissipation |
| 24. | Total Pd | 764.46 mW | Power | Total Power Dissipation |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 2.0 A | Maximum Output Current |
| 2. | Iout1 | 2.0 Amps | Output Current #1 |
| 3. | VinMax | 15.0 V | Maximum input voltage |
| 4. | VinMin | 11.0 V | Minimum input voltage |
| 5. | Vout | 6.0 V | Output Voltage |
| 6. | Vout1 | 6.0 Volt | Output Voltage #1 |
| 7. | base_pn | TPS54427 | Base Product Number |
| 8. | source | DC | Input Source Type |
| 9. | Ta | 30.0 degC | Ambient temperature |

## Design Assistance

1. **TPS54427** Product Folder : http://www.ti.com/product/tps54427 : contains the data sheet and other resources.