

# WEBENCH® Design Report

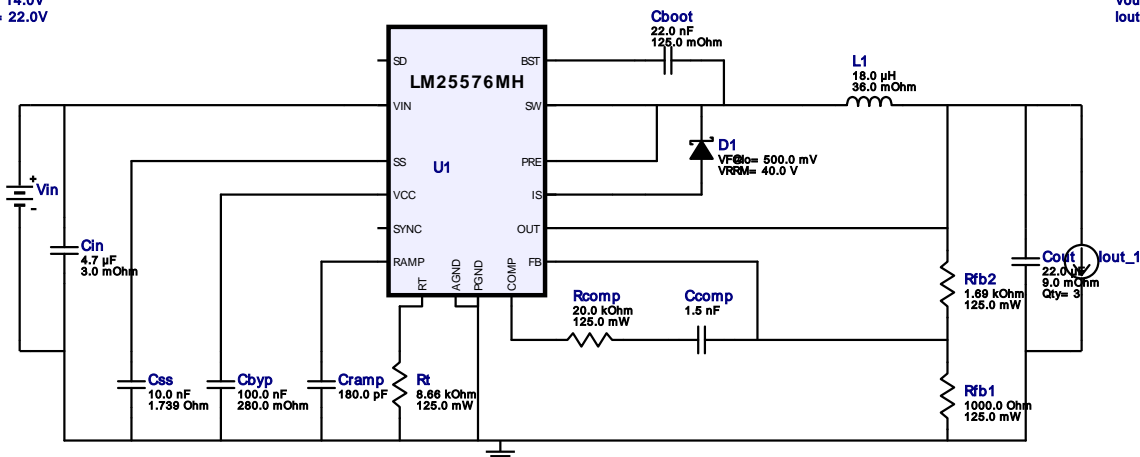
Design : 3917511/9 LM25576MHX/NOPB  
LM25576MHX/NOPB 14.0V-22.0V to 3.30V @ 2.0A

VinMin = 14.0V  
VinMax = 22.0V  
Vout = 3.3V  
Iout = 2.0A

Device = LM25576MHX/NOPB  
Topology = Buck  
Created = 6/13/15 7:50:39 AM  
BOM Cost = \$2.77  
Footprint = 427.0 mm<sup>2</sup>  
BOM Count = 16  
Total Pd = 1.13W






VinMin = 14.0V  
VinMax = 22.0V

Vout = 3.3V  
Iout = 2.0A

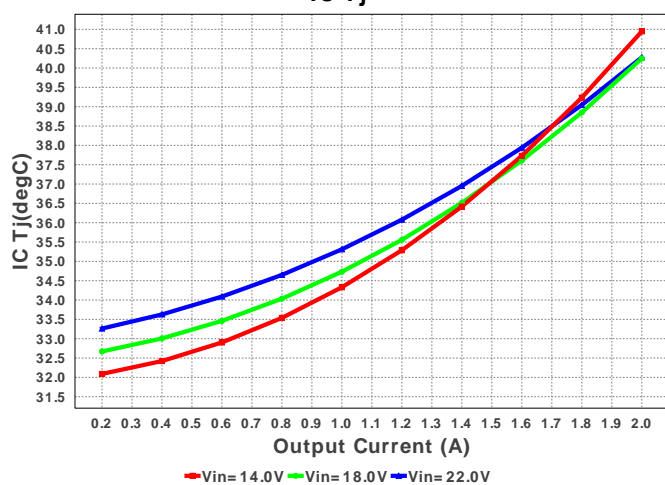


## Electrical BOM

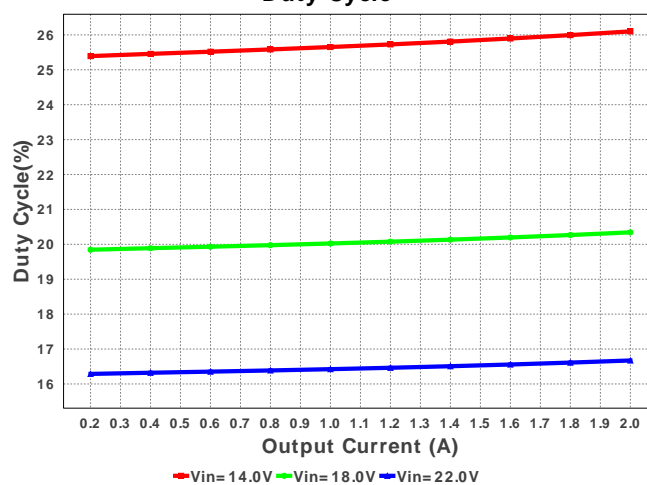
| #  | Name  | Manufacturer  | Part Number                         | Properties   | Qty | Price  | Footprint  |
|----|-------|---------------|-------------------------------------|--|-----|--------|--|
| 1. | Cboot | Kemet         | C0805C223K5RACTU<br>Series= X7R     | Cap= 22.0 nF<br>ESR= 125.0 mOhm<br>VDC= 50.0 V<br>IRMS= 645.0 mA | 1   | \$0.01 | <br>0805 7 mm <sup>2</sup>      |
| 2. | Cbyp  | AVX           | 08053C104KAT2A<br>Series= X7R       | Cap= 100.0 nF<br>ESR= 280.0 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A   | 1   | \$0.01 | <br>0805 7 mm <sup>2</sup>      |
| 3. | Ccomp | Yageo America | CC0805KRX7R9BB152<br>Series= X7R    | Cap= 1.5 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A                        | 1   | \$0.01 | <br>0805 7 mm <sup>2</sup>      |
| 4. | Cin   | MuRata        | GRM31CR71H475KA12L<br>Series= X7R   | Cap= 4.7 uF<br>ESR= 3.0 mOhm<br>VDC= 50.0 V<br>IRMS= 4.98 A      | 1   | \$0.07 | <br>1206 11 mm <sup>2</sup>     |
| 5. | Cout  | MuRata        | GRM21BR60J226ME39L<br>Series= X5R   | Cap= 22.0 uF<br>ESR= 9.0 mOhm<br>VDC= 6.3 V<br>IRMS= 3.5 A       | 3   | \$0.05 | <br>0805 7 mm <sup>2</sup>      |
| 6. | Cramp | Kemet         | C0805C181K5GACTU<br>Series= C0G/NP0 | Cap= 180.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                      | 1   | \$0.01 | <br>0805 7 mm <sup>2</sup>      |
| 7. | Css   | Kemet         | C0805C103K5RACTU<br>Series= X7R     | Cap= 10.0 nF<br>ESR= 1.739 Ohm<br>VDC= 50.0 V<br>IRMS= 411.0 mA  | 1   | \$0.01 | <br>0805 7 mm <sup>2</sup>      |
| 8. | D1    | Diodes Inc.   | B340A-13-F                          | VF@Io= 500.0 mV<br>VRRM= 40.0 V                                  | 1   | \$0.11 | <br>SMA 37 mm <sup>2</sup>      |
| 9. | L1    | Bourns        | SDR1307-180ML                       | L= 18.0 uH<br>DCR= 36.0 mOhm                                     | 1   | \$0.35 | <br>SDR1307 227 mm <sup>2</sup> |

| #   | Name  | Manufacturer      | Part Number                  | Properties  | Qty | Price  | Footprint   |
|-----|-------|-------------------|------------------------------|---|-----|--------|---|
| 10. | Rcomp | Panasonic         | ERJ-6ENF2002V<br>Series= 225 | Res= 20.0 kOhm<br>Power= 125.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 |  0805 7 mm <sup>2</sup>    |
| 11. | Rfb1  | Panasonic         | ERJ-6ENF1001V<br>Series= 225 | Res= 1000.0 Ohm<br>Power= 125.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 |  0805 7 mm <sup>2</sup>    |
| 12. | Rfb2  | Panasonic         | ERJ-6ENF1691V<br>Series= 225 | Res= 1.69 kOhm<br>Power= 125.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 |  0805 7 mm <sup>2</sup>    |
| 13. | Rt    | Panasonic         | ERJ-6ENF8661V<br>Series= 225 | Res= 8.66 kOhm<br>Power= 125.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 |  0805 7 mm <sup>2</sup>    |
| 14. | U1    | Texas Instruments | LM25576MHX/NOPB              | Switcher  | 1   | \$2.00 |  MXA20A 71 mm <sup>2</sup> |

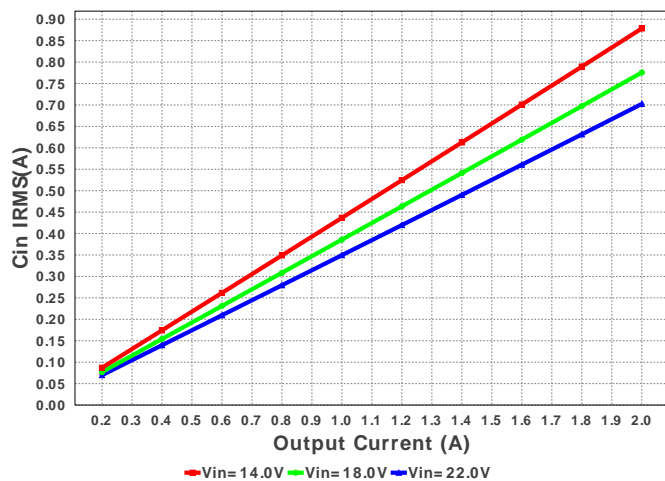
IC Tj



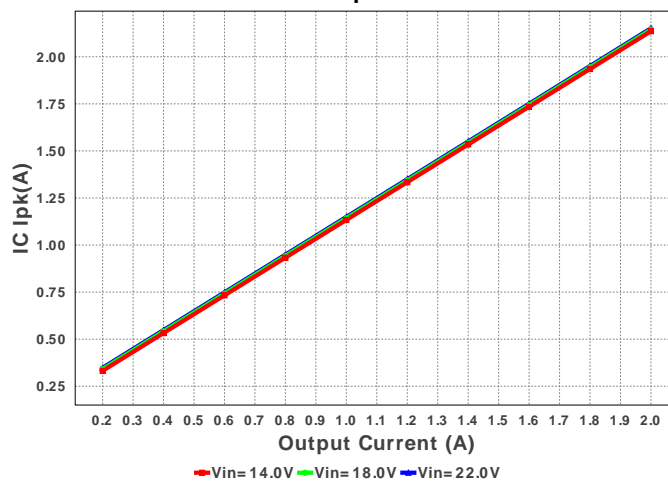
Duty Cycle

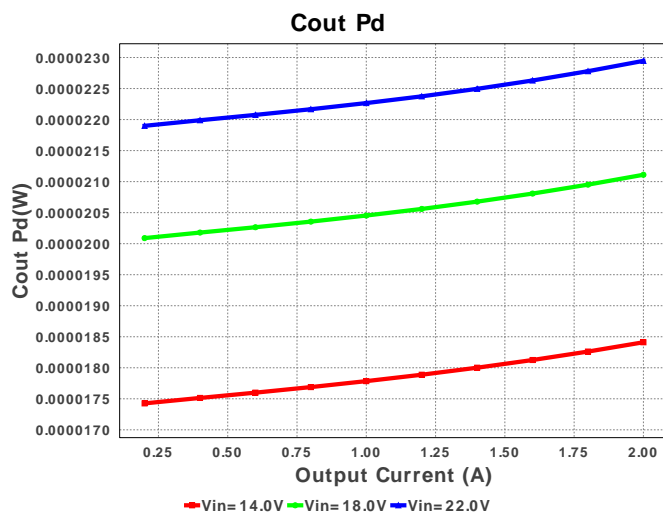
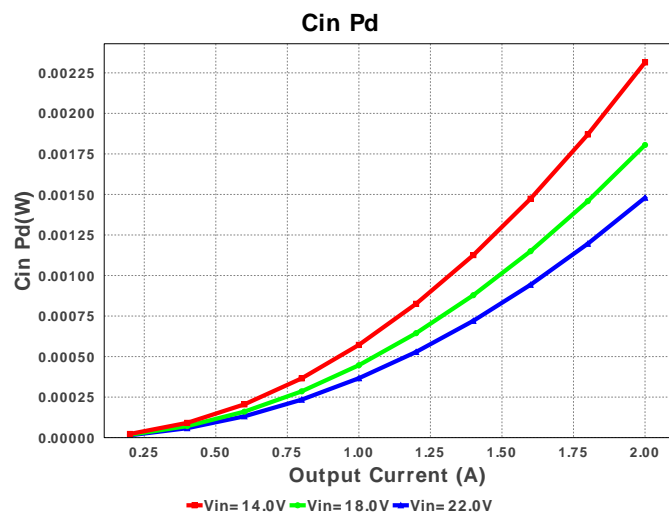
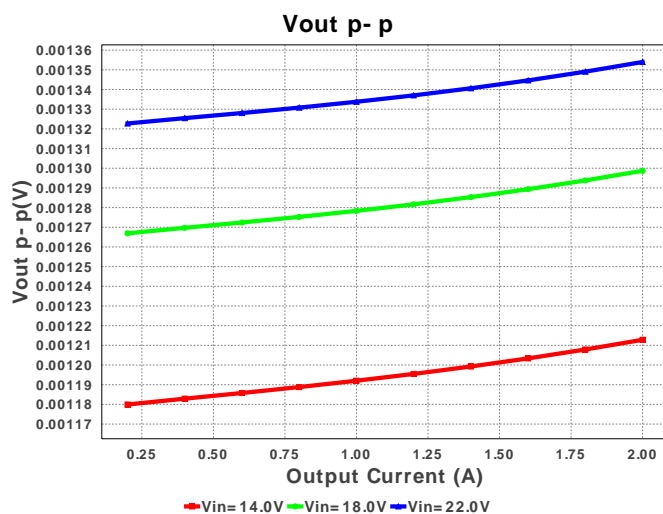
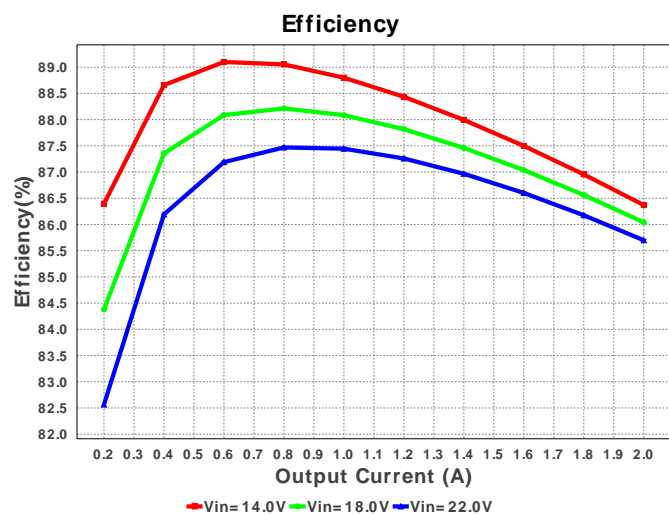
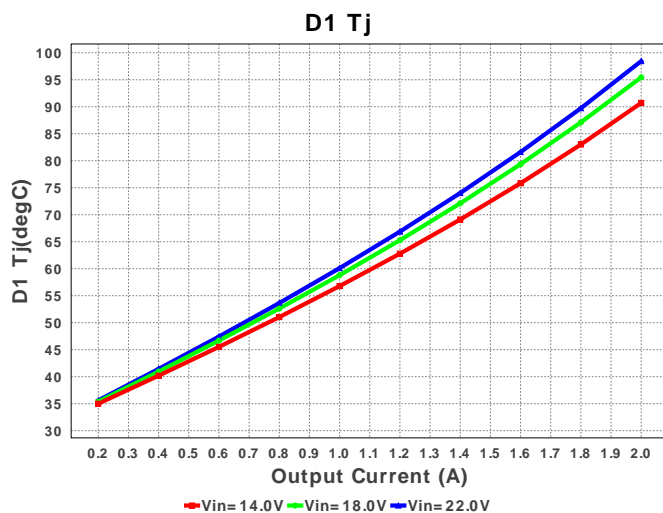
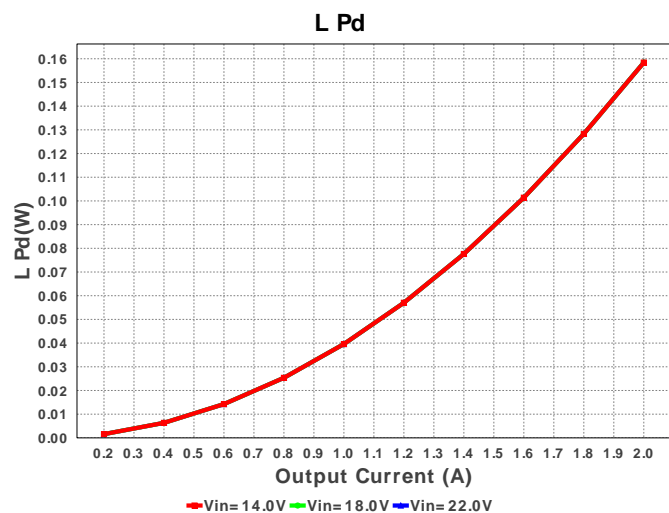


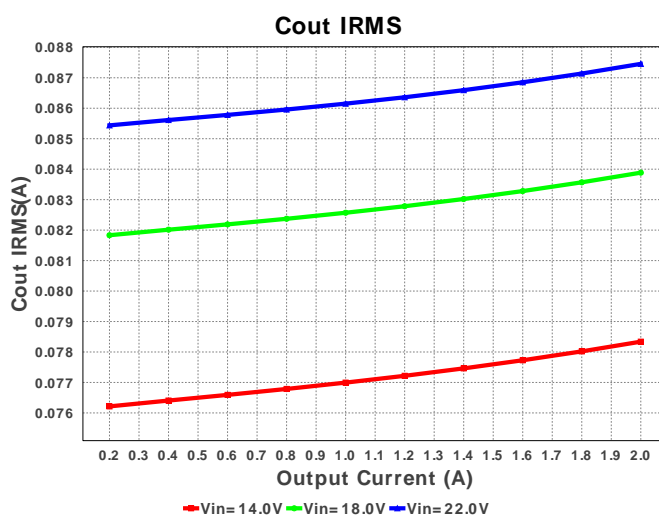
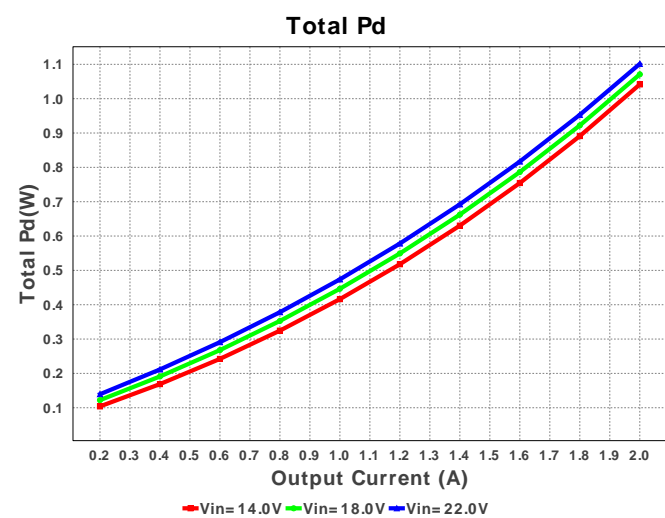
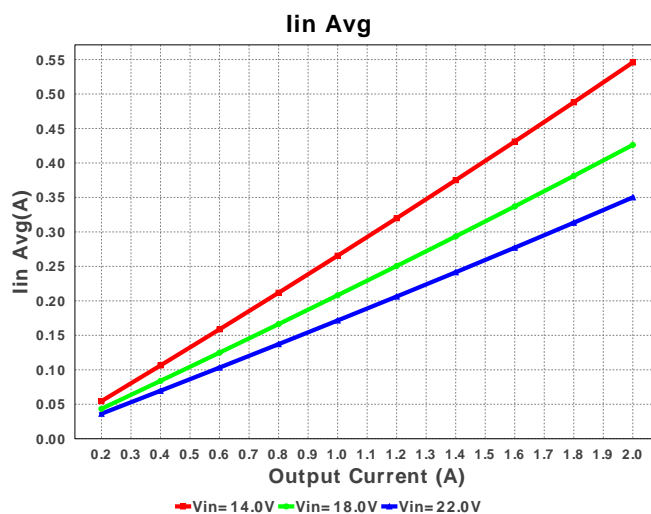
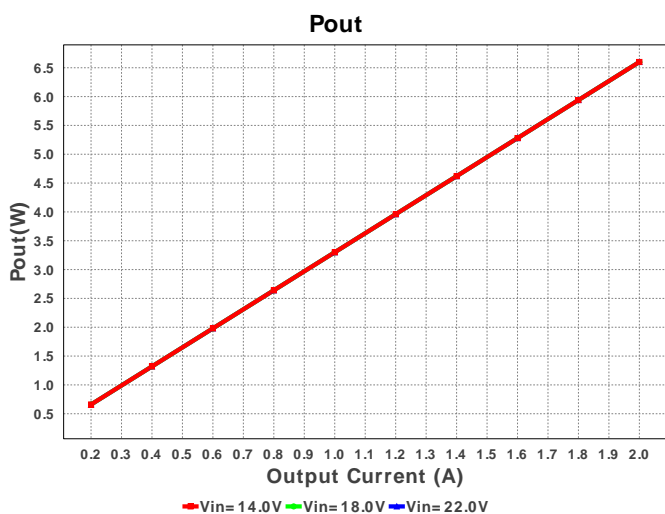
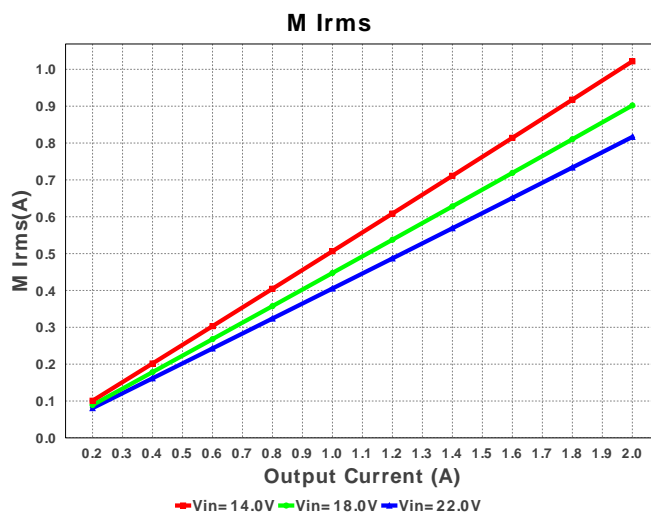
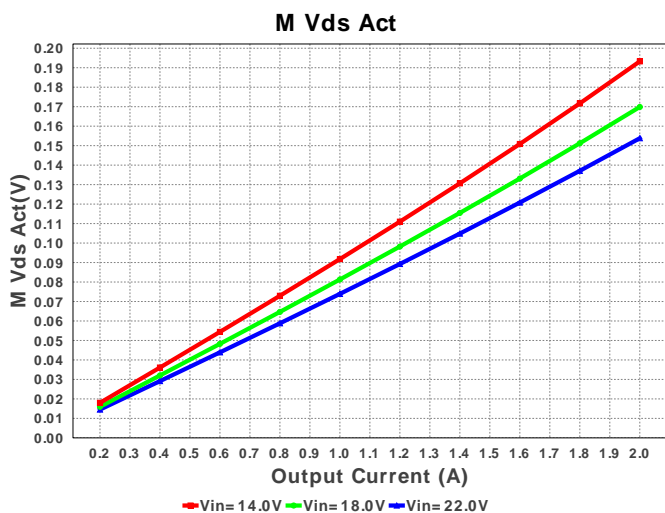
Cin IRMS

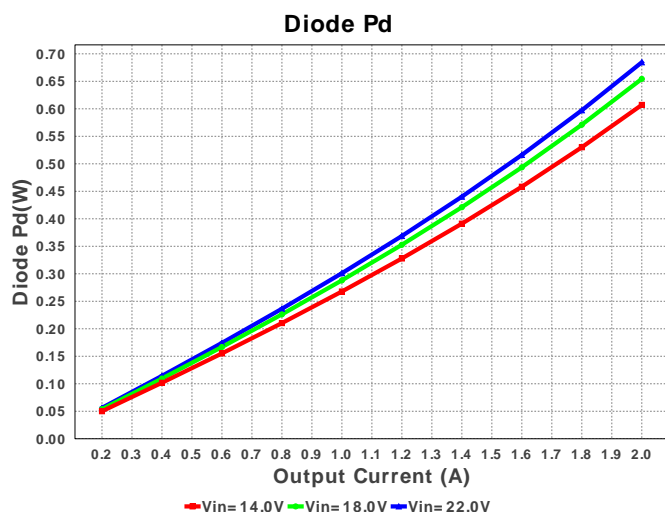
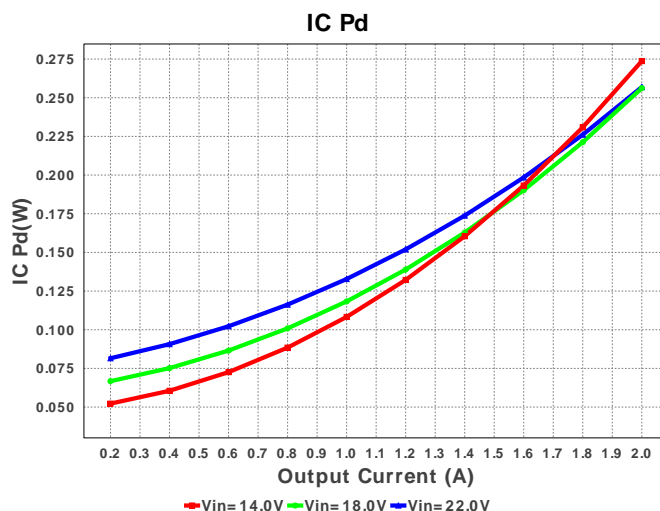
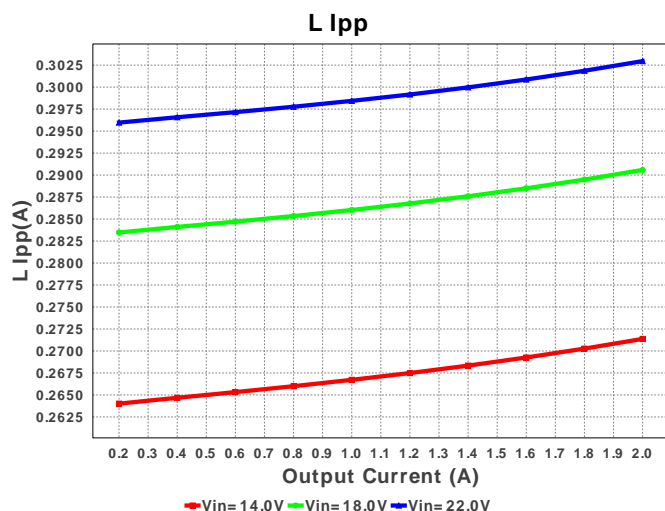


IC Ipk









## Operating Values

| #   | Name         | Value                 | Category | Description                               |
|-----|--------------|-----------------------|----------|---|
| 1.  | Cin IRMS     | 703.446 mA            | Current  | Input capacitor RMS ripple current        |
| 2.  | Cout IRMS    | 87.849 mA             | Current  | Output capacitor RMS ripple current       |
| 3.  | IC Ipk       | 2.151 A               | Current  | Peak switch current in IC                 |
| 4.  | Iin Avg      | 351.58 mA             | Current  | Average input current                     |
| 5.  | L Ipp        | 304.32 mA             | Current  | Peak-to-peak inductor ripple current      |
| 6.  | M Irms       | 818.468 mA            | Current  | MOSFET RMS current                        |
| 7.  | BOM Count    | 16                    | General  | Total Design BOM count                    |
| 8.  | FootPrint    | 427.0 mm <sup>2</sup> | General  | Total Foot Print Area of BOM components   |
| 9.  | Frequency    | 571.723 kHz           | General  | Switching frequency                       |
| 10. | IC Tolerance | 18.0 mV               | General  | IC Feedback Tolerance                     |
| 11. | M Vds Act    | 154.171 mV            | General  | Voltage drop across the MosFET            |
| 12. | Pout         | 6.6 W                 | General  | Total output power                        |
| 13. | Total BOM    | \$2.77                | General  | Total BOM Cost                            |
| 14. | D1 Tj        | 101.715 degC          | Op_Point | D1 junction temperature                   |
| 15. | Vout OP      | 3.3 V                 | Op_Point | Operational Output Voltage                |
| 16. | Duty Cycle   | 16.747 %              | Op_point | Duty cycle                                |
| 17. | Efficiency   | 85.33 %               | Op_point | Steady state efficiency                   |
| 18. | IC Tj        | 40.304 degC           | Op_point | IC junction temperature                   |
| 19. | ICThetaJA    | 40.0 degC/W           | Op_point | IC junction-to-ambient thermal resistance |
| 20. | IOUT_OP      | 2.0 A                 | Op_point | Iout operating point                      |
| 21. | VIN_OP       | 22.0 V                | Op_point | Vin operating point                       |
| 22. | Vout p-p     | 1.36 mV               | Op_point | Peak-to-peak output ripple voltage        |
| 23. | Cin Pd       | 1.485 mW              | Power    | Input capacitor power dissipation         |
| 24. | Cout Pd      | 23.152 μW             | Power    | Output capacitor power dissipation        |
| 25. | Diode Pd     | 717.152 mW            | Power    | Diode power dissipation                   |
| 26. | IC Pd        | 257.604 mW            | Power    | IC power dissipation                      |
| 27. | L Pd         | 158.4 mW              | Power    | Inductor power dissipation                |
| 28. | Total Pd     | 1.135 W               | Power    | Total Power Dissipation                   |

## Design Inputs

| #  | Name    | Value   | Description                        |
|----|---------|---------|------------------------------------|
| 1. | Iout    | 2.0     | Maximum Output Current             |
| 2. | Iout1   | 2.0     | Output Current #1                  |
| 3. | VinMax  | 22.0    | Maximum input voltage              |
| 4. | VinMin  | 14.0    | Minimum input voltage              |
| 5. | Vout    | 3.3     | Output Voltage                     |
| 6. | Vout1   | 3.3     | Output Voltage #1                  |
| 7. | base_pn | LM25576 | Texas Instruments Base Part Number |
| 8. | source  | DC      | Input Source Type                  |
| 9. | ta      | 30.0    | Ambient temperature                |

## Design Assistance

1. LM25576 Product Folder : <http://www.ti.com/product/LM25576> : contains the data sheet and other resources.

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