**IPT Pick-up Design Equations**

|  |  |
| --- | --- |
| **Eq. #** | **Equation** |
| (1) | Io (for ) is the largest current possible: |
| (2) | Io (for ): |
| (3) | Vout: |
| (4) | Pout: |
| (5) | Duty Cycle (D):  Where Pmax is given by: |
| (6) | Qmax: |
| (7) | Qavg: |
| (8) | C2 Compensation Capacitor:  Impedance matching to increase overall power:  Rearranging and solving, we are able to find C2: |
| (9) | Max V2:  We know that VC2 is the voltage before the rectifier stage and due to parallel compensation:  Rearranging and solving we are able to find V2: |
| (10) | Max IC2: |
| (11) | Cmin can be found with the following formula: |
| (12) | fs (for ):  fs (for ): |
| (13) | IC,rms:  Given the two states of IC,rms when the switch is on and off: |
| (14) | Capacitor power loss (): |
| (15) | Evaluating feedback resistor network:  Rearranging both equations for Rf and equating we get the following equation:  Subbing in chosen and solving for Ra. |
| (16) | Rf can be found by using ‘1.’ from above solution: |
| (17) | N: |
| (18) | Bc(max): |
| (19) | Single strand copper cross sectional area (Acu): |
| (20) | Used winding area: |
| (21) | Jmax: |
| (22) | Bundle Rw (dc): |
| (23) | Steady-state wire losses (Pcu): |
| (24) | Gate driver resistance (Rg): |
| (25) | Is @ on:  Is @ off:  Where is given by: |
| (26) | tvf: |
| (27) | tvr: |
| (28) | ts,on:  Where = current rise time and = voltage fall time. |
| (29) | ts,off:  Where = current fall time and = voltage rise time. |
| (30) | Pswitching: |
| (31) | Pconduction: |
| (32) | Ptotal: |
| (33) | Tj,max: |
| (34) | ID,avg: |
| (35) | Pconduction loss: |
| (36) | Reverse recovery loss (Prr):  Where  However, due to the Schottky diode’s physical make-up: |
| (37) | Ptotal: |
| (38) | Tj,max:  Similar to (33): |