

| 1 | HiperTFS2_Two-switch_Forward_012919; Rev.2.2; Copyright Power Integrations 2019 | INPUT | INFO | OUTPUT | UNIT | Two-switch Forward Transformer Design Spreadsheet |
|----|---|---------------|------|--------------|----------|---|
| 2 | Hiper-TFS MAIN OUTPUT (TWO-SWITCH FORWARD STAGE) | | | | | |
| 3 | OUTPUT VOLTAGE AND CURRENT | | | | | |
| | | | | | | Design Title |
| 4 | VMAIN | 2.00 | | 2.00 | V | Main output voltage |
| 5 | IMAIN | 175.00 | | 175.00 | A | Main output current |
| 6 | VOUT2 | | | 0.00 | V | Output2 voltage - enter zero or leave blank if none |
| 7 | IOUT2 | | | 0.00 | A | Output2 current - enter zero or leave blank if none |
| 8 | Post Regulated Output | | | | | |
| 9 | Post Regulator | NONE | | NONE | | Select post regulator from Mag-Amp, Buck, or NONE |
| 10 | V_SOURCE | NONE | | NONE | V | Select source of input voltage for post regulator. Enter None if Post regulator not used. |
| 11 | VOUT3 | | | 0.00 | V | Enter post regulator output voltage. Enter zero or leave blank if none |
| 12 | IOUT3 | | | 0.00 | A | Enter post regulator output current. Enter zero or leave blank if none |
| 13 | n_PR | | | 1.00 | | Enter post regulator efficiency (Buck only) |
| 14 | Coupled Inductor (Low Power) derived output | | | | | |
| 15 | VOUT4 | | | 0.00 | V | Output choke derived (low power) output voltage (typically -12 V) |
| 16 | IOUT4 | | | 0.00 | A | Output choke derived (low power) output current |
| 17 | System Power | | | | | |
| 18 | POUT(Main) | | | 350.0 | W | Total output power (Main converter) |
| 19 | POUT_PEAK(Main) | | | 350.0 | W | Peak Output power (Main converter). If there is no peak power requirement enter value equal to continuous power |
| 20 | POUT(Standby) | | | 12.3 | W | Continuous output power from Standby power supply |
| 21 | POUT_PEAK(Standby) | | | 12.3 | W | Peak output power from Standby section below |
| 22 | POUT(System Total) | | | 362.3 | W | Total system continuous output power |
| 23 | POUT_PEAK(System Total) | | | 362.3 | W | Total system peak output power |
| 24 | | | | | | |
| 25 | | | | | | |
| 26 | INPUT VOLTAGE AND UV/OV | | | | | |
| 27 | CIN_MIN | | | 310 | uF | Minimum Input Capacitance to meet holdup time. To increase CMIN, increase T_HOLDUP |
| 28 | T_HOLDUP | | | 20.0 | ms | Holdup time |
| 29 | CIN_ACTUAL | 270 | Info | 270 | uF | The selected capacitor will not meet the specified holdup time |
| 30 | CIN_ESR | | | 0.27 | Ω | Bulk capacitor ESR |
| 31 | IRMS_CIN | | | 1.59 | A | RMS current through bulk capacitor |
| 32 | PLOSS_CIN | | | 0.68 | W | Bulk capacitor ESR losses |
| 33 | VMIN | | | 300 | V | Minimum input voltage to guarantee output regulation at full load |
| 34 | VNOM | | | 380 | V | Nominal input voltage |
| 35 | VMAX | | | 420 | V | Maximum DC input voltage |
| 36 | RR | | | 3.92 | MΩ | R pin resistor |
| 37 | RL | | | 3.92 | MΩ | Line Sense resistor value (L-pin) - goal seek (VUV OFF) for std 1% resistor series |
| 38 | UV and OV thresholds | | | | | |
| 45 | Clamp Section | | | | | |
| 46 | Clamp Selection | CLAMP TO RAIL | | | | Select either "CLAMP TO RAIL" (default) or "CLAMP TO GND" |
| 47 | VCLAMP | | | 150 | V | Asymmetric Clamp Zener Voltage |
| 48 | VDSOP | | | 570 | V | Estimated Maximum Hiper-TFS Drain voltage (at VOVOFF_MAX) |
| 49 | | | | | | |
| 50 | | | | | | |
| 51 | DUTY CYCLE VALUES (REGULATION) | | | | | |
| 52 | DVMIN | | | 0.57 | | Duty cycle at minimum DC input voltage |
| 53 | DVNOM_GOAL | | | 0.45 | | Target duty cycle at nominal input voltage (VNOM) |

| | | | | | |
|-----|-----------------------------------|-------|--|------------------------|---|
| 54 | DVNOM | | | 0.45 | Duty cycle at nominal DC input voltage |
| 55 | DVMAX | | | 0.40 | Duty cycle at maximum DC input voltage |
| 56 | DOVOFF_MIN | | | 0.37 | Duty cycle at over-voltage DC input voltage (DOVOFF_MIN) |
| 57 | Maximum Duty Cycle values | | | | |
| 58 | DMAX_UVOFF_MIN | | | 0.65 | Max duty cycle clamp at VUVOFF_MIN |
| 59 | DMAX_VMIN | | | 0.60 | Max duty clamp cycle at VMIN |
| 60 | DMAX_VNOM | | | 0.56 | Max duty clamp cycle at VNOM |
| 61 | DMAX_VMAX | | | 0.51 | Max duty clamp cycle at VMAX |
| 62 | DMAX_OVOFFMIN | | | 0.46 | Max duty clamp cycle at VOVOFF_MAX |
| 63 | | | | | |
| 64 | | | | | |
| 65 | DEVICE VARIABLES | | | | |
| 66 | Device | Auto | | TFS7708 | Selected HiperTFS device |
| 67 | Select Frequency mode | 66 | | 66 kHz | Select Frequency mode. |
| 68 | ILIMIT_MIN | | | 4.61 A | Device current limit (Minimum) |
| 69 | ILIMIT_TYP | | | 4.96 A | Device current limit (Typical) |
| 70 | ILIMIT_MAX | | | 5.31 A | Device current limit (Maximum) |
| 71 | fSMIN | | | 62,000 Hz | Device switching frequency (Minimum) |
| 72 | fS | | | 66,000 Hz | Device switching frequency (Typical) |
| 73 | fSMAX | | | 70,000 Hz | Device switching frequency (Maximum) |
| 74 | KI | 1.0 | | 1.0 | Select Current limit factor (KI=1.0 for default ILIMIT, or select KI=0.9 or KI=0.7) |
| 75 | R(FB) | | | 232 kΩ | Feedback (FB) pin resistor |
| 76 | ILIMIT_SELECT | | | 4.61 A | Selected current limit |
| 77 | RDS(ON) | | | 2.37 Ω | Sum of Rds(on) of high and low-side MOSFETs at 100°C |
| 78 | VDS | | | 5.65 V | HiperTFS full-load average on-state Drain to Source Voltage (sum for both MOSFETs) |
| 79 | Main MOSFET losses | | | | |
| 90 | | | | | |
| 91 | MAIN TRANSFORMER | | | | |
| 92 | Transformer core selection | | | | |
| 93 | Core Type | ETD39 | | ETD39 | Selected core type |
| 94 | AE | | | 1.25 cm ² | Core effective cross sectional area |
| 95 | LE | | | 9.21 cm | Core Effective Path Length |
| 96 | AL | | | 3150 nH/T ² | Ungapped Core Effective Inductance |
| 97 | BW | | | 25.70 mm | Bobbin Physical Winding Width |
| 98 | B_HT | | | 6.90 mm | Height of bobbin (to calculate fit) |
| 99 | B_WA | | | 1.77 cm ² | Bobbin Winding area |
| 100 | M | | | 4.50 mm | Bobbin safety margin tape width (2 * M = Total Margin) |
| 101 | | | | | |
| 102 | Primary Inductance | | | | |
| 103 | LMAG_MAX | | | 40.21 mH | Max LMAG to hit min zero-load resonant frequency, calculated from C_PRI. Do not exceed. |
| 104 | LMAG | | | 12.02 mH | Estimated magnetizing inductance of transformer; may be lower than LMAG_MAX due to minimum gap size of 0.05 mm. Enter actual value. |
| 105 | GAP | | | 0.00 mm | gap calculated from LMAG |
| 106 | FRES_SYS | | | 110 kHz | Estimated total XFMR + system resonant frequency |
| 107 | C_SYS | | | 175 pF | Estimated total XFMR + Sys parasitic cap reflected to primary, calc'd from LMAG and FRES |
| 108 | Diode Vf Selection | | | | |
| 114 | Turns | | | | |
| 115 | NMAIN | | | 1 turns | Main rounded turns |
| 116 | NS2 | | | N/A turns | 2nd output number of turns |
| 117 | VOUT2 ACTUAL | | | 0.0 V | Approximate Output2 voltage with NS2 = 0 turns (AC stacked secondary). VDMAIN and VDOUT2 affect this. |
| 118 | NP | | | 63 turns | Primary rounded turns. NMAIN and DVNOM_GOAL affect this. |

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|-----|--|------|------|----------------|--|
| 119 | HI SIDE BIAS WINDING (optional) | No | No | No | Can be used to eliminate pulse skipping at light load 132 kHz when zero transformer gap; better efficiency than adding gap |
| 120 | VBIAS | | | V | DC bias voltage from main transformer optional aux winding |
| 121 | NBIAS | | | turns | Vbias rounded turns |
| 122 | VBIAS_ACTUAL | | | V | Vbias not used |
| 123 | Flux calculations | | | | |
| 124 | BM_MAX | | | 2000 Gauss | Peak positive flux density at nominal switching frequency |
| 125 | BM PK-PK | | 3030 | Gauss | Peak-peak flux density at nominal conditions. Used to calculate core losses |
| 126 | BP_MAX | | | 2718 Gauss | Max transient positive flux density at Vmax (limited by DVMAX clamp) |
| 127 | BP PK-PK | | | 4119 Gauss | Max transient peak-peak flux density at Vmax (limited by DVMAX clamp) |
| 128 | | | | | |
| 129 | | | | | |
| 130 | TRANSFORMER LOSSES AND FIT ESTIMATE | | | | |
| 131 | Core loss | | | | |
| 132 | Core material | PC95 | | PC95 | Core material |
| 133 | core_loss_multiplier | | | 23.97 | Core Loss multiplier |
| 134 | f_coeff | | | 1.56 | Core Loss Frequency co-efficient |
| 135 | BAC_coeff | | | 2.89 | Core Loss AC flux density co-efficient |
| 136 | specific core loss | | | 70 mW/cc | Core loss per unit volume |
| 137 | core volume | | | 11.50 cm^3 | Volume of core |
| 138 | core loss | | | 0.81 W | Core loss |
| 139 | Primary Winding Fit and losses | | | | |
| 140 | L | 2 | | 2 layers | Transformer primary layers (split primary recommended) |
| 141 | OD_PRI | | | 0.70 mm | Primary winding diameter |
| 142 | FILAR_PRI | | | 1 strands | Number of parallel strands of wire (primary) |
| 143 | MLT_PRI | | | 6.90 cm | Mean length per turn |
| 144 | DCR_PRI | | | 249 mΩ | DC resistance of primary winding |
| 145 | PCOND_PRI | | | 0.89 W | Conduction loss in primary winding |
| 146 | FILL_PRI | | | 14 % | Fill factor (primary only) |
| 147 | Secondary Winding 1 (lower winding when AC stacked) | | | | |
| 148 | VOUT | | | 2.0 V | Specified voltage for this winding |
| 149 | NS1 | | | 1.0 turns | Number of turns |
| 150 | IRMS_SEC1 | | | 145.6 A | RMS current through winding |
| 151 | Foil/Wire | FOIL | | FOIL foil/wire | Select FOIL or WIRE for winding |
| 152 | OD/Thickness | 0.39 | | 0.39 mm | Wire diameter or Foil thickness |
| 153 | FILAR_SEC1 | | | N/A strands | Number of parallel strands (wire selection only) |
| 154 | SEC1_WIDTH | | | 18.00 mm | Foil Width (Applicable if FOIL winding used) |
| 155 | SEC1_MLT | | | 6.90 cm | Mean length per turn |
| 156 | DCR_SEC1 | | | 0.22 mΩ | DC resistance of secondary winding |
| 157 | PCOND_SEC1 | | | 4.60 W | Conduction loss in secondary winding |
| 158 | FILL_SEC1 | | | 4 % | Fill factor (secondary 1 only) |
| 159 | Secondary Winding 2 (upper winding when AC stacked) | | | | |
| 160 | VOUT | | | 0.0 V | Specified voltage for this winding |
| 161 | NS2 | | | 0.0 turns | Number of turns |
| 162 | IRMS_SEC2 | | | 0.0 A | RMS current through winding |
| 163 | Foil/Wire | FOIL | | FOIL foil/wire | Select FOIL or WIRE for winding |
| 164 | OD/Thickness | | | 0.13 mm | Wire diameter or Foil thickness |
| 165 | FILAR_SEC2 | | | N/A strands | Number of parallel strands (wire selection only) |
| 166 | SEC2_WIDTH | | | 18.00 mm | Foil Width (Applicable if FOIL winding used) |
| 167 | SEC2_MLT | | | 6.90 cm | Mean length per turn |
| 168 | DCR_SEC2 | | | 0.00 mΩ | DC resistance of secondary winding |
| 169 | PCOND_SEC2 | | | 0.00 W | Conduction loss in secondary winding |
| 170 | FILL_SEC2 | | | 0 % | Fill factor (secondary 1 only) |
| 171 | Fill Factor and losses of main transformer | | | | |
| 172 | FILL_TOTAL | | | 18 % | Total transformer fill factor |
| 173 | TOTAL_CU_LOSS | | | 5.49 W | Total copper losses in transformer |
| 174 | TOTAL_CORE_LOSS | | | 0.81 W | Total core losses in transformer |

| | | | | | | |
|-----|---|--|------|-----------------|---------|--|
| 175 | TOTAL_TRF_LOSS | | | 6.29 | W | Total losses in transformer |
| 176 | | | | | | |
| 177 | | | | | | |
| 178 | CURRENT WAVESHAPe PARAMETERS | | | | | |
| 179 | IP | | | 3.66 | A | Peak primary current at Full Load, VNOM |
| 180 | IP_PEAK | | | 3.66 | A | Peak primary current at Peak Load and VNOM |
| 181 | IPRMS(NOM) | | | 1.89 | A | Primary RMS current at Full Load, VNOM |
| 182 | IMAG | | | 0.21 | A | Peak magnetizing current at VMIN |
| 183 | | | | | | |
| 184 | | | | | | |
| 185 | OUTPUT INDUCTOR | | | | | |
| 186 | KDI_ACTUAL | | | 0.49 | | Current ripple factor of combined Main and Output2 outputs |
| 187 | Turns | | | | | |
| 188 | POWDER TURNS MULTIPLIER | | | 3.00 | | Powder only. Multiplier factor between main number of turns in transformer and inductor (default value = 3 for 66kHz or 4 for 132kHz). |
| 189 | NMAIN_INDUCTOR | | | 3.0 | turns | Main output inductor number of turns - affected by powder turns multiplier or ferrite Target BM |
| 190 | NOUT2_INDUCTOR | | | | turns | Output 2 inductor number of turns |
| 191 | NOUT4_INDUCTOR | | | N/A | turns | Output 4 number of turns (low power) |
| 192 | Inductance and flux | | | | | |
| 193 | LMAIN_ACTUAL | | | 0.3 | uH | Estimated inductance of main output at full load |
| 194 | LOUT_2 | | | 0.0 | uH | Estimated inductance of auxiliary output at full load |
| 195 | BM_IND | | | 2409 | gauss | DC component of flux density |
| 196 | BAC_IND | | | 672 | gauss | AC component of flux density |
| 197 | | | | | | |
| 198 | Core Selection | | | | | |
| 199 | Core Type | | Auto | Kool Mu 125u | | Select core type |
| 200 | Core | | Auto | 77324(O.D)=36.7 | | Output choke core size - verify on bench |
| 201 | AE | | | 67.80 | mm^2 | Core Effective Cross Sectional Area |
| 202 | LE | | | 89.80 | mm | Core Effective Path Length |
| 203 | AL | | | 117 | nH/T^2 | Ungapped Core Effective Inductance |
| 204 | BW | | | 67.54 | mm | Bobbin Physical Winding Width |
| 205 | VE | | | 6088 | mm^3 | Volume of core |
| 206 | Powder cores (Sendust and Powdered Iron) Cores | | | | | |
| 207 | MUR | | | 125 | | Relative permeability of material at 0 bias |
| 208 | H | | | 61.76 | AT/cm | Magnetic field strength |
| 209 | MUR_RATIO | | | 0.25 | | Ratio of permeability at full load divided by initial permeability |
| 210 | LMAIN_0bias | | | 1.1 | uH | Estimated inductance of main output with 0 DC bias |
| 211 | | | | | | |
| 212 | Ferrite Cores | | | | | |
| 213 | LG | | | N/A | mm | Gap length of inductor cores |
| 214 | Target BM | | | N/A | Gauss | Target maximum flux density |
| 215 | | | | | | |
| 216 | Choke wires | | | | | |
| 217 | Total number of layers | | | 0.58 | layers | Total number of layers for chosen toroid |
| 218 | IRMS_MAIN | | | 175.09 | A | RMS current through main inductor windings |
| 219 | IRMS_AUX | | | 0.00 | A | RMS current through aux winding |
| 220 | AWG_MAIN | | 12 | 12 | AWG | Main inductor winding wire gauge |
| 221 | OD_MAIN | | | 2.13 | mm | Main winding wire gauge outer diameter |
| 222 | FILAR_MAIN | | 6 | 6 | strands | Number of parallel strands for main output |
| 223 | RDC_MAIN | | | 0.12 | mΩ | Resistance of wire for main inductor winding |
| 224 | AC Resistance Ratio (Main) | | | 2.49 | | Ratio of total resistance (AC + DC) to the DC resistance (using Dowell curves) |
| 225 | CMA_MAIN | | | 224 | CMA | Cir mils per amp for main inductor winding |
| 226 | J_MAIN | | | 49.21 | A/mm^2 | Current density in main inductor winding |
| 227 | AWG_AUX | | | 0 | AWG | Aux winding wire gauge |

| | | | | | | | |
|-----|--|------|------|--|--------|-------------------|--|
| 228 | OD_AUX | | | | N/A | mm | Auxiliary winding wire gauge outer diameter |
| 229 | FILAR_AUX | | | | 2 | strands | Number of parallel strands for aux output |
| 230 | RDC_AUX | | | | 0.00 | mΩ | Resistance of wire for aux inductor winding |
| 231 | AC Resistance Ratio (Aux) | | | | 0.00 | | Ratio of total resistance (AC + DC) to the DC resistance (using Dowell curves) |
| 232 | CMA_AUX | | | | 0 | CMA | !!! Info. Low CMA may cause overheating. Verify acceptable temperature rise |
| 233 | J_AUX | | | | 0.00 | A/mm ² | Current density in auxiliary winding |
| 234 | | | | | | | |
| 235 | Choke Losses | | | | | | |
| 236 | PCOPPER_MAIN | | | | 3.55 | W | Copper loss in main inductor winding |
| 237 | PCOPPER_AUX | | | | 0.00 | W | Copper loss in aux inductor windings |
| 238 | PCORE | | | | 1.25 | W | Total core loss |
| 239 | PTOTAL_IND | | | | 4.80 | W | Total losses in output choke |
| 240 | | | | | | | |
| 241 | | | | | | | |
| 242 | SECONDARY OUTPUT DIODE PARAMETERS | | | | | | |
| 243 | Main Output | | | | | | |
| 244 | ISFWRMS | | | | 145.56 | A | Full load forward diode RMS current at nominal input voltage |
| 245 | ISCATCHRMS | | | | 161.70 | A | Freewheeling diode RMS current at nominal input voltage |
| 246 | IDAVMAINF | | | | 99.62 | A | Worst case average current of forward rectifier at VMIN (single device rating) |
| 247 | IDAVMAINC | | | | 104.23 | A | Worst case average current of freewheeling diode at VMAX(single device rating) |
| 248 | IRMSMAIN | | | | 24.58 | A | Maximum RMS current, Main output capacitor |
| 249 | PD_LOSS_MAIN | | | | 87.50 | W | Conduction loss of forward diode |
| 250 | | | | | | | |
| 251 | Second Output | | | | | | |
| 252 | ISFWD2RMS | | | | 0.00 | A | Full load forward diode RMS current at nominal input voltage |
| 253 | ISCATCH2RMS | | | | 0.00 | A | Freewheeling diode RMS current at nominal input voltage |
| 254 | IDAVOUT2F | | | | 0.00 | A | Worst case average current of forward rectifier at VMIN (single device rating) |
| 255 | IDAVOUT2C | | | | 0.00 | A | Worst case average current of freewheeling diode at VMAX(single device rating) |
| 256 | IRMSOUT2 | | | | 0.00 | A | Maximum RMS current, Main output capacitor |
| 257 | PD_LOSS_OUT2 | | | | 0.00 | W | Conduction loss of forward diode |
| 258 | | | | | | | |
| 259 | Diode Derating | | | | | | |
| 260 | VPIVMAINF | | 1.00 | | 9.05 | V | Main Forward Diode peak-inverse voltage (at VDSOP), including derating |
| 261 | VPIVMAINC | | 1.00 | | 6.67 | V | Main Catch Diode peak-inverse voltage (at VOVOFF_MAX), including derating |
| 262 | VPIVOUT2F | | 1.00 | | 0.00 | V | Output2 Forward Diode peak-inverse voltage (at VDSOP), including derating |
| 263 | VPIVOUT2C | | 1.00 | | 0.00 | V | Output2 Catch Diode peak-inverse voltage (at VOVOFF_MAX), including derating |
| 264 | VPIVB | | 1.00 | | N/A | V | Bias output rectifier peak-inverse voltage (at VDSOP), including derating |
| 265 | | | | | | | |
| 266 | | | | | | | |
| 267 | Hiper-TFS STANDBY SECTION (FLYBACK STAGE) | | | | | | |
| 268 | ENTER APPLICATION VARIABLES | | | | | | |
| 269 | VACMIN | | | | 85 | V | Minimum AC Input Voltage |
| 270 | VACMAX | | | | 265 | V | Maximum AC Input Voltage |
| 271 | fL | | | | 50 | Hz | AC Mains Frequency |
| 272 | VO_SB | 12.0 | | | 12.0 | V | Output Voltage (at continuous power) |
| 273 | IO_SB | 1.00 | | | 1.00 | A | Power Supply Output Current (corresponding to peak power) |

| | | | | | | |
|-----|--|------|------|-------------------------|--------|---|
| 274 | IO_SB_PK | | | 1.00 | A | Peak output current |
| 275 | POUT_SB | | | 12.00 | W | Continuous Output Power |
| 276 | POUT_SB_TOTAL | | | 12.32 | W | Total Standby power (Includes Bias winding power) |
| 277 | POUT_SB_PK | | | 12.32 | W | Peak Standby Output Power |
| 278 | n | 0.85 | | 0.85 | | Efficiency Estimate at output terminals. Under 0.7 if no better data available |
| 279 | Z | | | 0.50 | | Z Factor. Ratio of secondary side losses to the total losses in the power supply. Use 0.5 if no better data available |
| 280 | tC | | | 3.00 | ms | Bridge Rectifier Conduction Time Estimate |
| 281 | | | | | | |
| 282 | | | | | | |
| 283 | ENTER Hiper-TFS STANDBY VARIABLES | | | | | |
| 284 | Select Current Limit | | INC | Increased Current Limit | | Enter "LOW" for low current limit, "RED" for reduced current limit (sealed adapters), "STD" for standard current limit or "INC" for increased current limit (peak or higher power applications) |
| 285 | ILIM_MIN | | | 0.70 | A | Minimum Current Limit |
| 286 | ILIM_TYP | | | 0.75 | A | Typical Current Limit |
| 287 | ILIM_MAX | | | 0.80 | A | Maximum Current Limit |
| 288 | R(EN) | | | 107 | kΩ | Enable pin resistor |
| 289 | fSmin | | | 124,000 | Hz | Minimum Device Switching Frequency |
| 290 | I^2fmin | | | 66.8 | A^2kHz | I^2f (product of current limit squared and frequency is trimmed for tighter tolerance) |
| 291 | VOR | | | 100 | V | Reflected Output Voltage (VOR < 135 V Recommended) |
| 292 | VDS | | | 10.0 | V | Hiper-TFS Standby On State Drain to Source Voltage |
| 293 | VD_SB | | | 0.70 | V | Output Winding Diode Forward Voltage Drop |
| 294 | KP | | | 1.55 | | Ripple to Peak Current Ratio (KP < 6) |
| 295 | KP_TRANSIENT | | | 1.22 | | Transient Ripple to Peak Current Ratio. Ensure KP_TRANSIENT > 0.25 |
| 296 | | | | | | |
| 297 | | | | | | |
| 298 | ENTER BIAS WINDING VARIABLES | | | | | |
| 299 | VB | | | 16.0 | V | Bias Winding Voltage |
| 300 | IB | | | 20.0 | mA | Bias winding Load current |
| 301 | PB | | | 0.32 | W | Bias winding power |
| 302 | VDB | | | 0.70 | V | Bias Winding Diode Forward Voltage Drop |
| 303 | NB | | | 6.6 | turns | Bias Winding Number of Turns |
| 304 | VZOV | | | 22 | V | Over Voltage Protection zener diode voltage. |
| 305 | | | | | | |
| 306 | | | | | | |
| 307 | UVLO VARIABLES | | | | | |
| 308 | RLS | | | 3.92 | MΩ | Line sense resistor (from Main converter section) |
| 309 | V_UV_ACTUAL | | | 100 | V | Typical DC start-up voltage |
| 310 | | | | | | |
| 311 | | | | | | |
| 312 | ENTER TRANSFORMER CORE/CONSTRUCTION VARIABLES | | | | | |
| 313 | Core Type | | EE25 | EE25 | | Enter Transformer Core |
| 314 | AE | | | 0.40 | cm^2 | Core Effective Cross Sectional Area |
| 315 | LE | | | 7.34 | cm | Core Effective Path Length |
| 316 | AL | | | 1420 | nH/T^2 | Ungapped Core Effective Inductance |
| 317 | BW | | | 10.20 | mm | Bobbin Physical Winding Width |
| 318 | M | | | 0.00 | mm | Safety Margin Width (Half the Primary to Secondary Creepage Distance) |
| 319 | L | 2 | | 2 | | Number of Primary Layers |
| 320 | NS_SB | 5 | | 5 | | Number of Secondary Turns |
| 321 | | | | | | |
| 322 | | | | | | |
| 323 | DC INPUT VOLTAGE PARAMETERS | | | | | |
| 324 | VMIN_SB | | | 117 | V | Minimum DC Input Voltage |
| 325 | VMAX_SB | | | 375 | V | Maximum DC Input Voltage |
| 326 | | | | | | |
| 327 | | | | | | |

| | | | | | |
|-----|--|--|------|--------------|--|
| 328 | CURRENT WAVEFORM SHAPE PARAMETERS | | | | |
| 329 | DMAX_SB | | | 0.35 | Duty Ratio at full load, minimum primary inductance and minimum input voltage |
| 330 | IAVG | | | 0.13 A | Average Primary Current |
| 331 | IP_SB | | | 0.70 A | Minimum Peak Primary Current |
| 332 | IR_SB | | | 0.70 A | Primary Ripple Current |
| 333 | IRMS_SB | | | 0.28 A | Primary RMS Current |
| 334 | | | | | |
| 335 | | | | | |
| 336 | TRANSFORMER PRIMARY DESIGN PARAMETERS | | | | |
| 337 | LP_SB | | | 441 uH | Typical Primary Inductance. +/- 10% to ensure a minimum primary inductance of 401 uH |
| 338 | LP_TOLERANCE | | | 10.0 % | Primary inductance tolerance |
| 339 | NP_SB | | | 39 turns | Primary Winding Number of Turns |
| 340 | ALG | | | 285 nH/T^2 | Gapped Core Effective Inductance |
| 341 | BM | | | 2227 Gauss | Maximum Operating Flux Density, BM<3000 is recommended |
| 342 | BAC | | | 1113 Gauss | AC Flux Density for Core Loss Curves (0.5 X Peak to Peak) |
| 343 | ur | | | 2053 | Relative Permeability of Ungapped Core |
| 344 | LG | | | 0.14 mm | Gap Length (Lg > 0.1 mm) |
| 345 | BWE | | | 20.4 mm | Effective Bobbin Width |
| 346 | OD | | | 0.52 mm | Maximum Primary Wire Diameter including insulation |
| 347 | INS | | | 0.07 mm | Estimated Total Insulation Thickness (= 2 * film thickness) |
| 348 | DIA | | | 0.45 mm | Bare conductor diameter |
| 349 | AWG | | | 26 AWG | Primary Wire Gauge (Rounded to next smaller standard AWG value) |
| 350 | CM | | | 256 Cmil | Bare conductor effective area in circular mils |
| 351 | CMA | | Info | 929 Cmil/Amp | CAN DECREASE CMA < 500 (decrease L (primary layers), increase NS,use smaller Core) |
| 352 | | | | | |
| 353 | | | | | |
| 354 | TRANSFORMER SECONDARY DESIGN PARAMETERS | | | | |
| 355 | Lumped parameters | | | | |
| 356 | ISP | | | 5.5 A | Peak Secondary Current |
| 357 | ISRMS | | | 2.35 A | Secondary RMS Current |
| 358 | IRIPPLE | | | 2.13 A | Output Capacitor RMS Ripple Current |
| 359 | CMS | | | 470 Cmil | Secondary Bare Conductor minimum circular mils |
| 360 | AWGS | | | 23 AWG | Secondary Wire Gauge (Rounded up to next larger standard AWG value) |
| 361 | | | | | |
| 362 | | | | | |
| 363 | VOLTAGE STRESS PARAMETERS | | | | |
| 364 | VDRAIN | | | 605 V | Maximum Drain Voltage Estimate (Assumes 20% zener clamp tolerance and an additional 10% temperature tolerance) |
| 365 | PIVS | | | 60 V | Output Rectifier Maximum Peak Inverse Voltage |
| 366 | | | | | |
| 367 | | | | | |
| 368 | Forward DC-DC System efficiency | | | | |
| 369 | P_MOSFET_MAIN_TOTAL | | | 9.43 W | HiperTFS losses |
| 370 | P_XFMR_LOSS | | | 6.3 W | Main transformer losses |
| 371 | P_MAIN_OUT_DIODE | | | 87.5 W | Output diode losses |
| 372 | P_CIN_ESR | | | 0.68 W | Bulk capacitor ESR losses |
| 373 | P_IND_MAIN | | | 4.8 W | Output choke losses |
| 374 | OTHER_LOSSES | | | 6.13 W | Other losses (includes PCB traces, clamp loss, magamp loss etc.) |
| 375 | | | | | |
| 376 | EFFICIENCY_STDBY | | | 85.0% | Estimated efficiency of flyback power supply |
| 377 | EFFICIENCY_MAIN | | | 75.3% | Estimated Forward efficiency |
| 378 | EFFICIENCY_SYSTEM | | | 75.6% | Estimated System efficiency (forward + standby) |
| 379 | Other Losses | | | | |
| 382 | Detailed Mosfet Loss Information | | | | |
| 390 | | | | | |