Fairchild Reference Design RD-481

The following reference design supports inclusion of FSQ0370RNA in design of an auxiliary power supply. It should be used in conjunction with the FSQ0370RNA datasheet as well as Fairchild's application notes and technical support team. Please visit Fairchild's website at http://www.fairchildsemi.com.

Application	Fairchild Device	Input Voltage Range	Rated Output Power	Output Voltage (Rated Current)	Topology
Auxiliary Power	FSQ0370RNA	150-275 V_{AC}	18 $W_{nominal}$ 25 W_{peak}	24 V (0.675 A, 0.90 A_{peak}) 20 V (0.10 A, 0.15 A_{peak})	Flyback

Key Features

- Internal Avalanche Rugged 700 V SenseFET
- Consumes only 0.8 W at 230 V_{AC} & 0.5 W Load with Burst-Mode Operation
- Precision Fixed Operating Frequency, 100 kHz
- Internal Startup Circuit and Built-in Soft-Start
- Pulse-by-Pulse Current Limiting and Auto-Restart Mode
- Over-Voltage Protection (OVP), Overload Protection(OLP), Internal Thermal Shutdown Function (TSD)
- Under-Voltage Lockout (UVLO)
- Low Operating Current (3 mA)
- Adjustable Peak Current Limit

1. Schematics

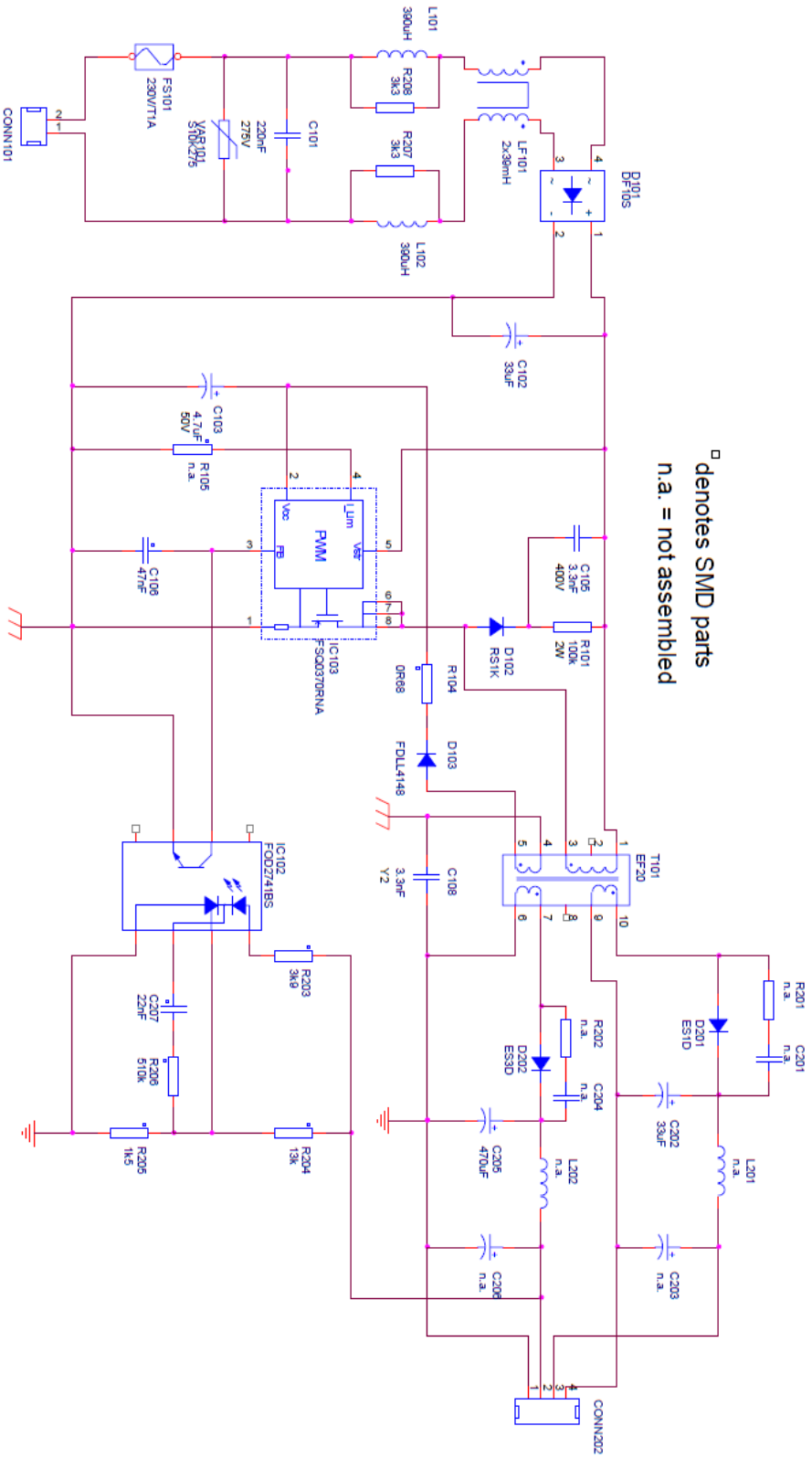

Figure 1. Schematic

2. Transformer

2.1. Transformer Schematic Diagram

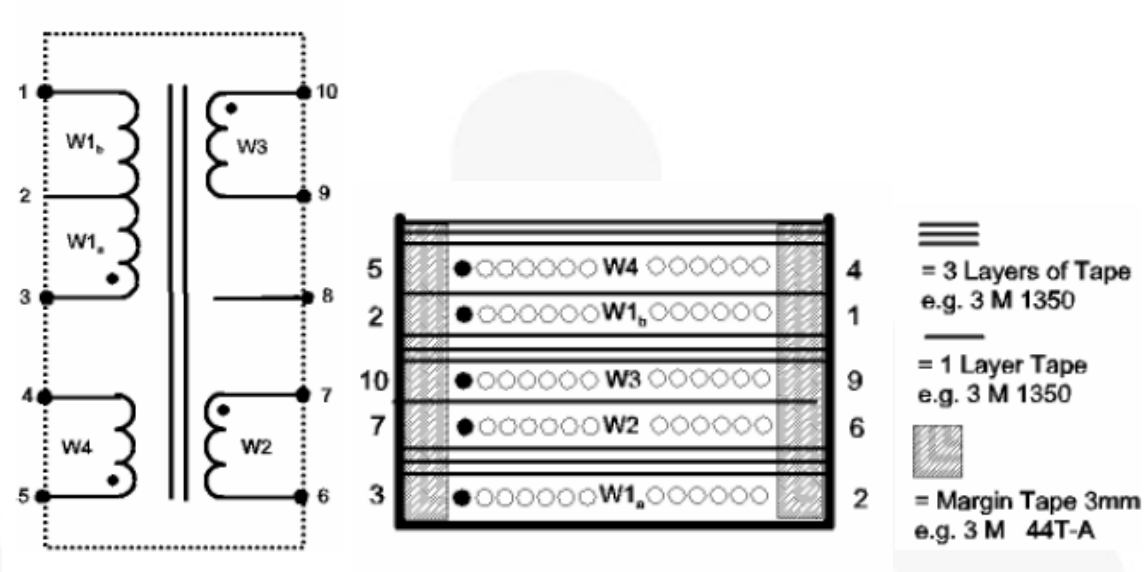

Figure 2. Transformer Configuration and Winding Stackup

2.2. Winding Specification

Winding	Pins (S→F)	Strands x Wire ø	Turns	Layers	Winding Method	Material
W1a	3→2	1 x 0.28 mm	39	2	Spaced	CuLL
W2	7→6	1 x 0.6 mm	16	2	Spaced	Tex E
W3	10→9	1 x 0.4 mm	15	1	Spaced	Tex E
W1b	2→1	1 x 0.28 mm	38	2	Spaced	CuLL
W4	5→4	1 x 0.15 mm	8	1	Spaced	CuLL

Core: EF 20
Material: Fi 324 (Vogt) or equivalent
Bobbin: EF 20 / 5.9 horizontal / 10-Pins
Gap in center leg: approx. 0.29 mm for A_L of 126 nH/Turns^2

2.3. Electrical Characteristics

	Pin	Specification	Remark
Inductance	1→3	0.75 mH ± 5%	10 kHz, 100 mV
Leakage	1→3	<20 µH	Short all other pins

3. Bill of Materials

Reference	Value / Specification	Qty.	Manufacturer / Series
CONN101	2 Pin	1	Phoenix Contact GMKDS 1,5
CONN202	4 Pin	1	Phoenix Contact MKDSN 1,5
C101	220 nF / 275V	1	Arcotronics R46 Series
C102	33 µF / 400 V	1	Rubycon WA
C103	4.7 µF / 50 V	1	SAMWHA SD
C105	3.3 nF / 400 V	1	Wima FKS 2
C106	47 nF / 25 V	1	AVX MLC X7R
C108	3.3 nF / 250 V	1	Murata DE
C201,C204	n.a.	2	e.g. Epcos B37981M
C202	33 µF / 35 V	1	Rubycon ZL
C203,C206	n.a.	2	e.g. SAMWHA SD
C205	470 µF / 35 V	1	Rubycon ZL
C207	22 nF / 25 V	1	AVX MLC X7R
D101	DF10S	1	Fairchild
D102	RS1K	1	Fairchild
D103	FDLL4148	1	Fairchild
D201	ES1D	1	Fairchild
D202	ES3D	1	Fairchild
FS101	230 V/T1A	1	Wickmann TR5
IC102	FOD2741BS	1	Fairchild
IC103	FSQ0370RNA	1	Fairchild
LF101	2 x 39 mH / 0,6 A	1	Epcos B82731-M
L101,L102	390 µH / 180 mA	2	e.g. Epcos BC B78108-S
L201	n.a.	1	e.g. Epcos SBC B82141A
L202	n.a.	1	Coilcraft RFB0810
R101	100 k / 2 W	1	Any
R104	0R68 / 0,125 W	1	Any SMD0805
R105,R201,R202	n.a.	3	Any
R203	3k9 / 0.125 W	1	Any SMD0805
R204	13 k / 0.125 W	1	Any SMD0805
R205	1k5 / 0.125 W	1	Any SMD0805
R206	510 k / 0.125 W	1	Any SMD0805
R207,R208	3k3 / 0.125 W	2	Any SMD0805
T101	EF20	1	See specification
VAR101	n.a., S10K275	1	e.g. Epcos B72210S0271K101

4. Performance

4.1. Line Regulation

V_{IN} [V_{RMS}]	150	185	210	230	240	275	Min [%]	Max [%]
V_1 [V]	24,16	24,16	24,16	24,16	24,16	24,16	0,7	0,7
V_2 [V]	20,21	20,22	20,22	20,22	20,22	20,24	1,1	1,2

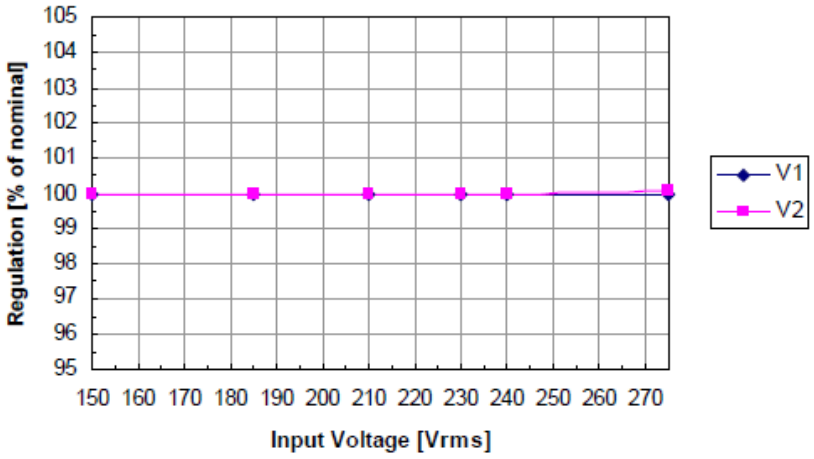

Figure 3. Line Regulation Plotted against Input Voltage

4.2. Efficiency

V_{IN} [V_{RMS}]	150	185	210	230	240	275
P_{OUT} [W]	18,33	18,33	18,33	18,33	18,33	18,33
P_{IN} [W]	20,58	20,74	20,63	20,58	20,61	20,78
Efficiency [%]	89,1	88,4	88,9	89,1	88,9	88,2

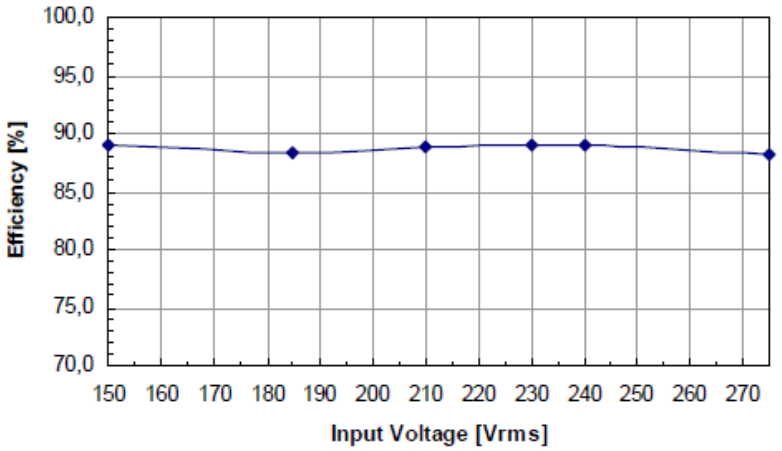

Figure 4. Efficiency Plotted Against Input Voltage

5. Related Resources

FSQ0370RNA – Product Folder

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