SY26715B

PWM Convertor
with On-Chip Power Switch and Start up Circuits
for 48V Telecom Systems

General Description

The SY26715B is a high-voltage DC/DC switching regulator with on-chip Power Switch and Startup Circuits. The SY26715B is targeted for applications requiring up to 6W.
The switching frequency is up to 1MHz. In addition, the SY26715B integrated input undervoltage and overvoltage detectors, cycle by cycle current limit and thermal shutdown to protect the convertor under fault conditions.

Ordering Information

SY26715□(□□□)

Package Code
Optional Spec Code

Ordering Number	Package type	Note
SY26715BSXD	DFN4*4-8	----

Features

- On Chip 200V Power Switch Circuit and Startup Circuit
- Programmable Switching Frequency
- Input Undervoltage and Overvoltage Detectors
- Internal Cycle by Cycle Current Limit
- Reliable Protections for Safety Requirement
- RoHS Compliant and Halogen Free
- Compact Package: DFN4*4-8

Applications

- Telecom Systems
- Wireless Base Station
- Low Power Bias Supply
- PoE (Power over Ethernet)/PD (Powered Device)

Recommended Operating Output Power	
Products	36-75Vdc
SY26715B	6W

Typical Applications

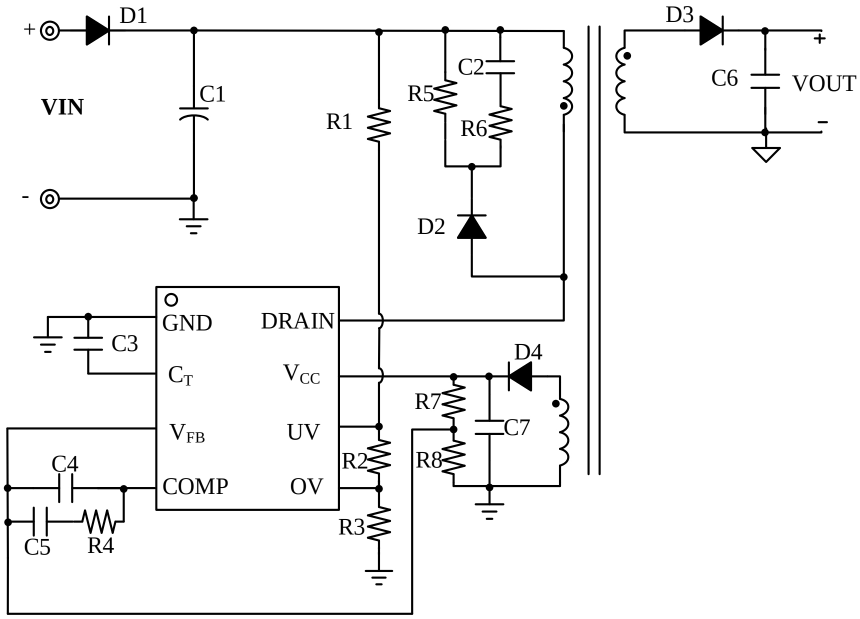
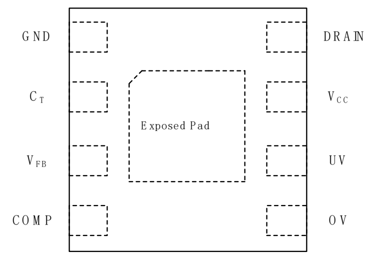


Fig.1 Typical Application Circuit

Pinout (top view)

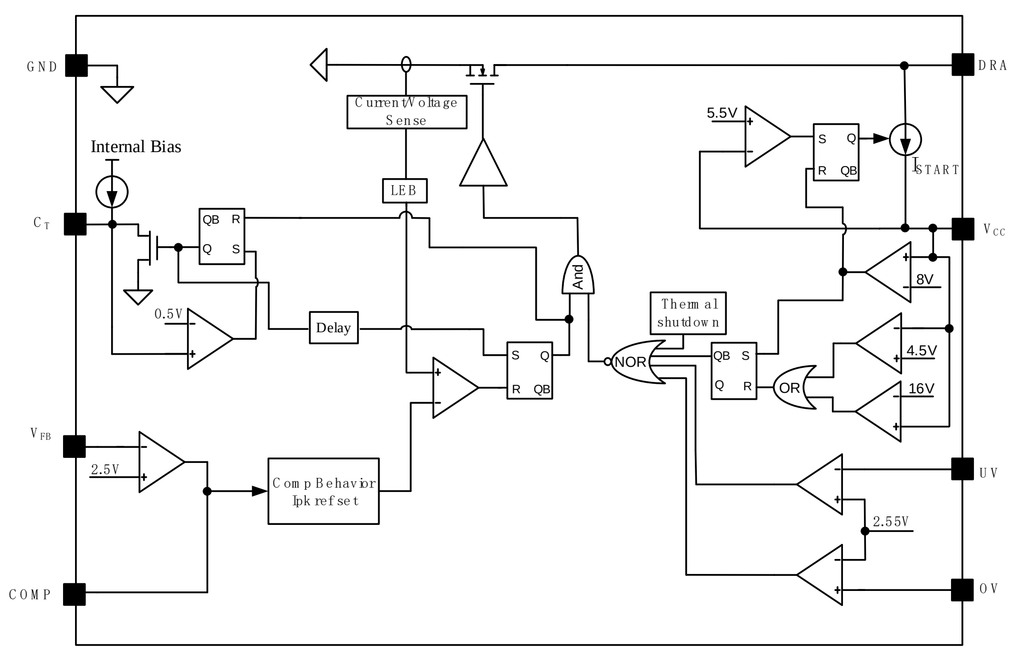


(DFN4*4-8)

Top Mark: FNB *xyz* (device code: **FNB**, ***x=year code, y=week code, z= lot number code*****)**

Pin number	Pin Name	Pin Description
1	GND	Ground pin.
2	C_T	Frequency setting pin. An external capacitor connected to this pin sets the max frequency.
3	V_{FB}	Feedback pin. It is the inverting input of the internal error amplifier, which is internally referenced to 2.5V.
4	COMP	Loop compensation pin. Connect a RC compensation network across this pin and V_{FB} pin to stabilize the control loop.
5	OV	Input over voltage detection pin. Connect this pin to a voltage divider to set the input voltage OVP point.
6	UV	Input under voltage detection pin. Connect this pin to a voltage divider to set the input voltage UVP point.
7	V_{CC}	IC power supply pin. Bypass this pin to the GND pin with a ceramic capacitor.
8	DRAIN	Drain of the internal power MOSFET.
	Exposed Pad	Connect Exposed Pad to GND plane for better thermal performance.

Block Diagram



Absolute Maximum Ratings [1]

V_{CC} -- -0.3V~18V
V_{FB} -- -0.3V~ 10V
V_{OV} -- -0.3V~ 10V
V_{UV}-- -0.3V~ 18V
V_{COMP}-- -0.3V~ 3.6V
V_{CT} -- -0.3V~3.6V
V_{DRAIN}-- -0.3V[*1]~200V
Power Dissipation, @ TA = 25°C DFN4*4-8-- 2.5W
Package Thermal Resistance [2]
DFN4*4-8, θ_{JA} -- 49°C/W
DFN4*4-8,θ_{JC} -- 24°C/W
DFN4*4-8,θ_{JB} -- 18°C/W
Operating junction Temperature Range -- -45°C to 150°C
Lead Temperature (Soldering, 10 sec.) -- 260°C
Storage Temperature Range -- -65°C to 150°C
[*1] Dynamic DRAIN negative voltage in 10ns Duration-- -1V
Dynamic DRAIN negative current in 10ns Duration-- -200mA
[*1] is guaranteed by design and characterized

Recommended Operating Conditions

V_{CC} -- 8- 12V
Operating Junction Temperature Range-- -40°C to 125°C

Notes：
(1) Stresses beyond the "Absolute Maximum Ratings" may cause perm anent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
(2) JESD 51-2， -5， -7， -8， -14 standard.

Electrical Characteristics

(Minimum and maximum values are at V_{DRAIN} = 40V, V_{VCC} = 8V， T_J = -40°C ~+125°C, unless otherwise specified. Typical values are at T_J = 25°C,unless otherwise specified.)

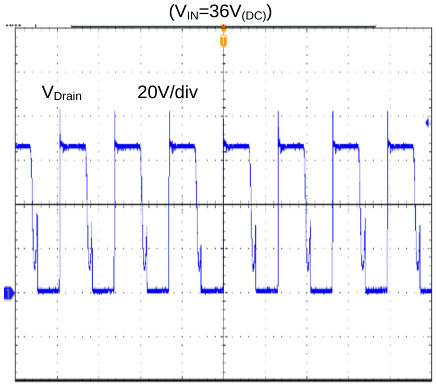
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Power Supply Section						
V_{CC} Turn On Threshold	V_{VCC_ON}	V_{VCC} Increasing	7.3	8	8.7	V
V_{CC} Min Threshold	V_{VCC_MIN}	V_{VCC} Decreasing	4.9	5.5	6.3	V
V_{CC} Turn Off Threshold	V_{VCC_OFF}	V_{VCC} Decreasing	3.9	4.5	4.9	V
V_{CC} OVP Threshold	V_{VCC_OVP}	V_{VCC} Increasing	14.8	16	17.2	V
Quiescent Current	I_Q		0.8	1.1	1.4	mA
Minimum Startup Voltage (Pin 8)	V_{START}(min)	I_{VCC}=0.3mA V_{VCC}=$V_{VCC(on)}$-0.2V T_J =25°C	9.0	9.5	9.8	V
		T_J = −40°C to 125°C	8.8		10.2	V
Start up Circuit Section						
Start up Current	I_{START1}	V_{VCC} = 0V	2.4	4.4	7.8	mA
	I_{START2}	V_{VCC} = 2V	3.5	6.4	9.5	mA
Error Amplifier section						
Reference Voltage	V_{FB_REF}		2.45	2.50	2.57	V
COMP Source Current	I_{SOURCE}	V_{FB}=2.3V	100	160	220	μA
COMP Sink Current	I_{SINK}	V_{FB}=2.7V,V_{COMP}=1.3V	400	550	750	μA
Input Under or Over Voltage Protections Section						
Undervoltage Lockout Threshold	V_{UV}	Increase Vin to exist UVP	2.4	2.55	2.7	V
Undervoltage Lockout Hysteresis	V_{UV_HYS}		0.10	0.16	0.22	V
Overvoltage Lockout Threshold	V_{OV}	Increase Vin to enter OVP	2.4	2.55	2.7	V
Overvoltage Lockout Hysteresis	V_{OV_HYS}		0.10	0.16	0.22	V
Switching Section						
Frequency	F_{SW1}	C_T=560pF T_J = 25°C	280	300	320	kHz
		C_T=560pF T_J = −40°C to 125°C	270		300	kHz
	F_{SW2}	C_T=100pF T_J = 25°C		800		kHz
Min On Time	T_{ON_MIN}	T_J =25°C		140		ns
		T_J = −40°C to 25°C	100		200	ns
Current Limit Section						
Current Limit Threshold	I_{Limit}		800	1000	1450	mA
Integrated MOSFET						
Break Down Voltage	V_{DS_MAX}	I_D=250uA	200			V
On Resistance	R_{DSON}	I_D=0.1A， T_J =25°C		1.4	2	Ω
		I_D=0.1A， T_J =125°C		2.3	3	Ω
Internal Over Temperature Protection Section						
Thermal Shut down Threshold	T_{OTP_SHDN}			150		°C
Hysteresis in Shutdown	T_{OTP_HYS}			20		°C

Typical Performance Characteristics

(Test condition: input: 36~75V_{DC}, output spec: 10V/0.5A, T_A= 25±5ºC)

Steady States

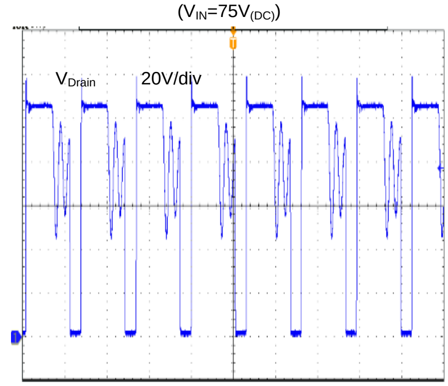
(V_{IN}=36$V_{(DC)}$)



Time (1µs/div)

Steady States

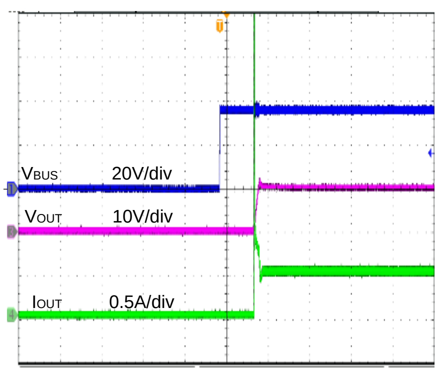
(V_{IN}=75$V_{(DC)}$)



Time (1µs/div)

Startup

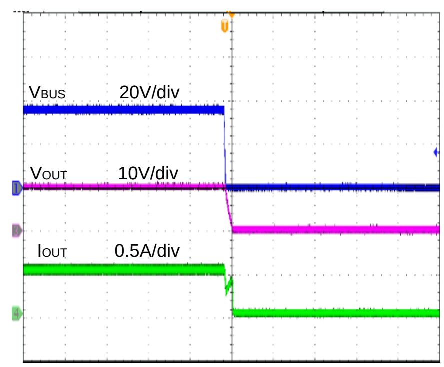
(V_{IN}=36$V_{(DC)}$)



Time (1µs/div)

Shutdown

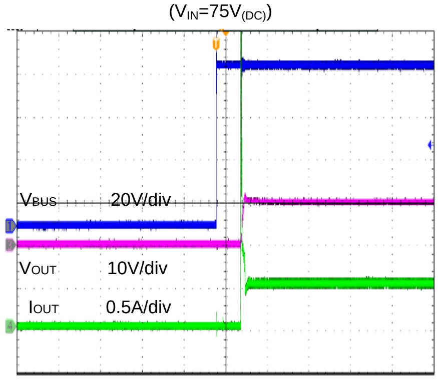
(V_{IN}=36$V_{(DC)}$)



Time (1µs/div)

Startup

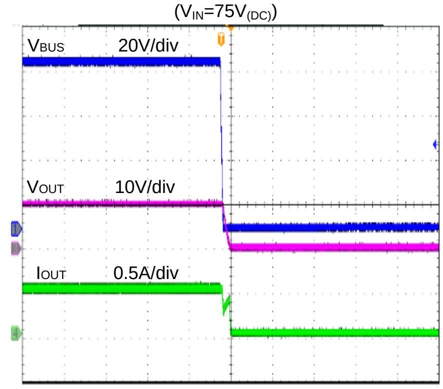
(V_{IN}=75$V_{(DC)}$)



Time (4ms/div)

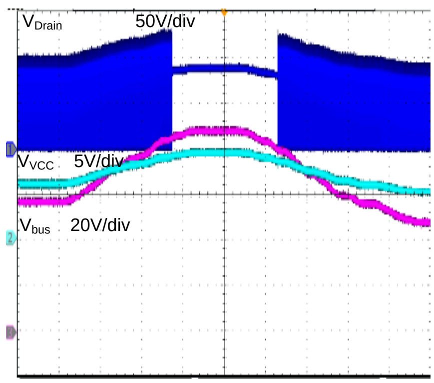
Shutdown

(V_{IN}=75$V_{(DC)}$)



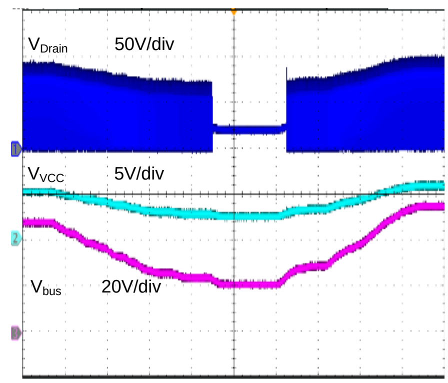
Time (4ms/div)

UV Protection



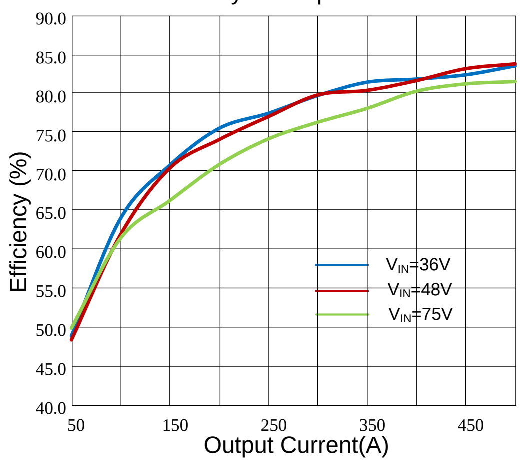
Time (1s/div)

OV Protection



Time (1s/div)

Efficiency vs Output Current



Operation

The SY26715B is a high-voltage DC/DC switching regulator with on-chip Power Switch and Startup Circuits.

The internal error amplifier allows the SY26715B to be easily configured for primary side regulation operation in isolated configuration. The switching frequency is up to 1MHz. In addition, the SY26715B integrated input undervoltage and overvoltage detectors, cycle by cycle current limit, output short circuit protection, VCC over voltage protection and thermal shutdown to protect the convertor under fault conditions.

Start-up Operation

After DC supply is powered on, the BUS voltage ramps up. The capacitor across V_{CC} and GND pins, C_{VCC}, is charged up by DRAIN through internal start-up circuit. Once V_{VCC} rises up to V_{VCC_ON}, the start-up circuit is disabled and the internal blocks starts the operation. V_{VCC} will subsequently be pulled down by the power consumption of the circuitry. Under normal operating condition (no fault triggered), if V_{CC} drops to V_{VCC_MIN} threshold, the start-up circuit will be enabled to charge V_{CC} pin capacitor (PWM switching will not stop), then V_{CC} will rise again. As V_{CC} rises to V_{VCC_ON}, the start-up circuit will be disabled, due to IC's power dissipation, V_{CC} will drops again. This process will repeat until the auxiliary winding of Flyback transformer can supply sufficient energy to maintain V_{CC} above V_{VCC_MIN}.

After initial startup, the V_{CC} voltage should be above V_{VCC_MIN} using an auxiliary winding. This will prevent the start-up current source from turning on and reduce power dissipation. Also, the load should not be directly connected to the V_{CC} capacitor. Otherwise, the load may override the startup circuit.

Shut-down Operation

After DC supply is powered off, the energy stored in the BUS capacitor will be discharged. When the auxiliary winding of Flyback transformer cannot supply enough energy to the V_{CC} pin, V_{VCC} will decrease. Once V_{VCC} is below V_{VCC_OFF}, the IC will stop working.

Operation Frequency Setting

The frequency is set by the external capacitor (C_{CT}) connected to the C_T pin. An internal current source charges C_T to 0.5V. The charge current I_{CT} is typically 111.5uA. The C_T is initially charged from 0V when the PWM turns high. The PWM will turn high when V_{CT} reaches 0.5V and delays about 710ns. The frequency can be sketchily calculated as,

$$f_s = \frac{1}{\frac{C_{CT} \times 0.5V}{I_{CT}} + 710ns}$$

As the SY26715B has no slope compensation, the duty cycle should be designed lower than 50 percent to avoid the sub-harmonic oscillation.

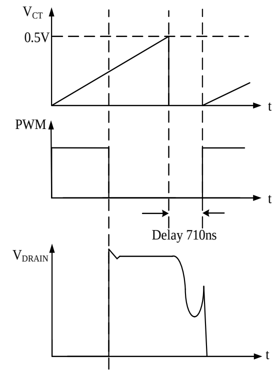


Fig.2 Frequency Setting

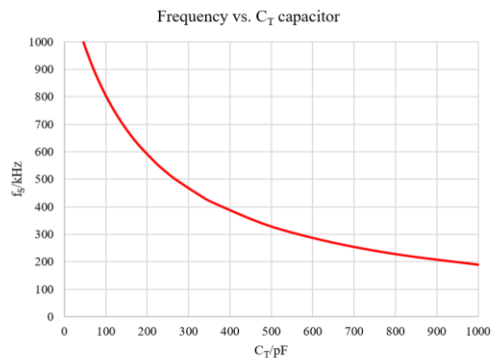


Fig.3 Frequency vs. CT capacitor

Error Amplifier

The internal error amplifier (EA) regulates the voltage of V_{FB} pin. The inverting input and output of the error amplifier are V_{FB} and COMP, respectively. The internal reference voltage of the EA is V_{FB_REF} (2.5 V typical value referred to GND). A RC compensation network connected between the COMP pin and the V_{FB} pin is used to compensate the system control loop. The R is required and it is recommended to be not less than 10kΩ.

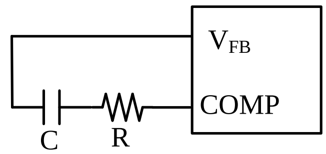


Fig.4 COMP RC compensation network

Fault Protection Modes

V_{CC} Over Voltage Protection

When the V_{CC} voltage exceeds V_{VCC_OVP} threshold, SY26715B will stop switching and discharge the V_{CC} voltage. Once V_{VCC} is below V_{VCC_OFF}, the SY26715B will shut down, and V_{CC} will be charged again by DRAIN through internal start up circuit.

Input Under Voltage and Over Voltage Protection

The SY26715B includes input under voltage (UV) and over voltage (OV) protection circuits. The UV and OV thresholds are 2.55 V. When the UV is below 2.55 V or the OV voltage is above 2.55 V, SY26715B will stop switching and discharge the V_{CC} voltage, Once V_{VCC} is below V_{VCC_MIN}, V_{CC} will be charged again. The UV/OV detectors incorporate 160 mV hysteresis to prevent noise from triggering the UVP/OVP.

Over Temperature Protection (OTP)

SY26715B includes over temperature protection (OTP) circuit to prevent the overheating due to the excessive power dissipation. It will shut down the switching operation when the junction temperature exceeds the OTP threshold, about 150°C. In OTP mode, if the junction temperature decreases by approximately 20°C, the IC will resume the normal operation. For a continuous normal operation, provide an adequate cooling so that the junction temperature does not exceed the OTP threshold.

Power Supply Design Considerations

Transformer Design Considerations (N_{PS} and L_M)

Once the frequency f_S is set, the inductance of the transformer could be induced. The design flow is shown as below:

(a) Select N_{PS}

$$N_{PS} \le \frac{V_{MOS\_(BR)DS} \times 90\% - V_{DC\_MAX} - \Delta V_S}{V_{OUT} + V_{D\_F}} \quad (1)$$

(b) Preset minimum frequency f_{S_MIN}

(c) Compute inductor L_M and maximum primary peak current $I_{P\_PK\_MAX}$

$$I_{P\_PK\_MAX} = \frac{2P_{OUT}}{\eta \times V_{DC\_MIN}} + \frac{2P_{OUT}}{\eta \times N_{PS} \times (V_{OUT} + V_{D\_F})} \quad (2)$$

$$L_M = \frac{2P_{OUT}}{\eta \times I^2_{P\_PK\_MAX} \times f_S} \quad (3)$$

The SY26715B has min ton limit，the switching peak current is recommended to be lower than 0.5A at maximum input voltage and min on time condition, it can make the output ripple in a proper range.

So the inductor should be higher than:

$$L_M \ge \frac{V_{DC\_MAX} \cdot T_{ON\_MIN}}{I_{pk}} \quad (4)$$

Where η is the efficiency; P_{OUT} is rated full load power

(d) Compute current rising time t_1 and current falling time t_2

$$t_1 = \frac{L_M \times I_{P\_PK\_MAX}}{V_{BUS}} \quad (5)$$

$$t_2 = \frac{L_M \times I_{P\_PK\_MAX}}{N_{PS} \times (V_{OUT} + V_{D\_F})} \quad (6)$$

$$t_S = \frac{1}{f_{S\_MIN}} \quad (7)$$

(e) Compute primary maximum RMS current $I_{P\text{-}RMS\text{-}MAX}$ for the transformer fabrication.

$$I_{P\_RMS\_MAX} = \frac{\sqrt{3}}{3} I_{P\_PK\_MAX} \times \sqrt{\frac{t_1}{t_S}} \quad (8)$$

(f) Compute secondary maximum peak current $I_{S\_PK\_MAX}$ and RMS current $I_{S\_RM\_MAX}$ for the transformer fabrication.

$$I_{S\_PK\_MAX} = N_{PS} \times I_{P\_PK\_MAX} \quad (9)$$

$$I_{S\_RMS\_MAX} = \frac{\sqrt{3}}{3} N_{PS} \cdot I_{P\_PK\_MAX} \cdot \sqrt{\frac{t_2}{t_S}} \quad (10)$$

Transformer design (N_P,N_S,N_{AUX})

The design of the transformer is similar with ordinary Flyback transformer. the parameters below are necessary:

Necessary parameters	
Turns ratio	N_{PS}
Inductance	L_M
Primary maximum current	$I_{P\_PK\_MAX}$
Primary maximum RMS current	$I_{P\_RMS\_MAX}$
Secondary maximum RMS current	$I_{S\_RMS\_MAX}$

The design rules are as followed:

(a) Select the magnetic core style, identify the effective area A_e.

(b) Preset the maximum magnetic flux ΔB
ΔB=0.22~0.26T

(c) Compute primary turn N_P

$$N_P = \frac{L_M \times I_{P\_PK\_MAX}}{\Delta B \times A_e} \quad (11)$$

(d) Compute secondary turn N_S

$$N_S = \frac{N_P}{N_{PS}} \quad (12)$$

(e) compute auxiliary turn N_{AUX}

$$N_{AUX} = N_S \times \frac{V_{VCC}}{V_{OUT}} \quad (13)$$

Where V_{VCC} is the working voltage of VCC pin
(f) Select an appropriate wire diameter

With $I_{P\_RMS\_MAX}$ and $I_{S\_RMS\_MAX}$, select appropriate wire to make sure the current density ranges from 4A/mm^2 to 10A/mm^2.

(g) If the winding area of the core and bobbin is not enough, reselect the core style, go to **(a)** and redesign the transformer until the ideal transformer is achieved.

RCD snubber for MOSFET

The power loss of the snubber P_{RCD} is evaluated first

$$P_{RCD} = \frac{N_{PS} \times (V_{OUT} + V_{D\_F}) + \Delta V_S}{\Delta V_S} \times \frac{L_K}{L_M} \times P_{OUT} \quad (14)$$

Where N_{PS} is the turns ratio of the Flyback transformer; V_{OUT} is the output voltage; $V_{D\text{-}F}$ is the forward voltage of the power diode; ΔV_S is the overshoot voltage clamped by RCD snubber; L_K is the leakage inductor; L_M is the inductance of the Flyback transformer; P_{OUT} is the output power.

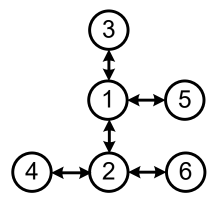
The R_{RCD} is related with the power loss:

$$R_{RCD} = \frac{(N_{PS} \times (V_{OUT} + V_{D\_F}) + \Delta V_S)^2}{P_{RCD}} \quad (15)$$

The C_{RCD} is related with the voltage ripple of the snubber ΔV_{C_RCD}: $C_{RCD} = \frac{N_{PS} \times (V_{OUT} + V_{D\_F}) + \Delta V_S}{R_{RCD} f_S \Delta V_{C\_RCD}}$ (16)

Layout Considerations

A proper PCB design must follow the below guidelines:
(a) It is desirable to maximize the PCB copper area connected to GND pin to achieve the best thermal and noise performance. If the board space allowed, a ground plane is highly desirable. Reasonable paths are suggested to be placed underneath the ground pad to enhance the soldering quality and thermal performance.
(b) The circuit loop of all switching circuit should be kept as small as possible: primary power loop, secondary loop and auxiliary power loop.
(c) The connection of primary ground is recommended as:



Ground ①: ground of BUS capacitor.
Ground ②: ground of bias supply capacitor.
Ground ③: ground node of auxiliary winding.
Ground ④: ground node of divider resistor.
Ground ⑤: primary ground node of Y capacitor.
Ground ⑥: ground of IC GND.

(d) bias supply trace should be connected to the bias supply capacitor first instead of GND pin. The bias supply capacitor should be put beside the IC.
(e) The resistor divider connected to V_{FB} pin is recommended to be put beside the IC.

Design Example

A design example of typical application is shown below step by step.
Note: All selected parameter (set value) needs to adjust according to the practical condition.

#1. Identify design specification

Design Specification			
V_{DC}	36V~75V	V_{OUT}	10V
I_{OUT}	0.5A	η	82%

#2. Transformer design (N_{PS}, L_M, N_P,N_S,N_{AUX})
(1)Refer to Transformer selection (N_{PS} and L_M)

Conditions			
V_{DC_MIN}	36V	V_{DC_MAX}	75V
ΔV_S	50V	$V_{MOS\_(BR)DS}$	200V
P_{OUT_MAX}	5W	V_{D_F}	0.5V
C_{Drain}	50pF	f_{S_MIN}	700kHz

(a) Compute turns ratio N_{PS} first:

$$N_{PS} \le \frac{V_{MOS\_(BR)DS} \times 90\% - V_{DC\_MAX} - \Delta V_S}{V_{OUT} + V_{D\_F}}$$

$$= \frac{200V \times 0.9 - 75V - 50V}{10V + 0.5V}$$

$$= 5.24$$

N_{PS} is set to: $N_{PS}=3$

(b)f_{S_MIN} is preset

$$f_{S\_MIN} = 700kHz$$

(c) Compute inductor L_M and maximum primary peak current $I_{P\_PK\_MAX}$

$$I_{P\_PK\_MAX} = \frac{2P_{OUT}}{\eta \times V_{DC\_MIN}} + \frac{2P_{OUT}}{\eta \times N_{PS} \times (V_{OUT} + V_{D\_F})}$$

$$= \frac{2 \times 5W}{82\% \times 36V} + \frac{2 \times 5W}{82\% \times 3 \times (10V + 0.5V)}$$

$$= 0.339A + 0.387A$$

$$= 0.726A$$

$$L_M = \frac{2P_{OUT}}{\eta \times I^2_{P\_PK\_MAX} \times f_{S\_MIN}}$$

$$= \frac{2 \times 5W}{82\% \times (0.726A)^2 \times 700kHz}$$

$$= 33 \times 10^{-6} H$$

$$= 33uH$$

The SY26715B has min ton limit， the switching peak current is recommended to be lower than 0.5A at maximum input voltage and min on time condition, it can make the output ripple in a proper range.
So the inductor should be higher than:

$$L_M \geq \frac{V_{DC\_MAX} \cdot T_{on\_min}}{I_{pk}} = \frac{75V \times 160ns}{0.5A} = 24uH$$

Set: L_M=30μH

(d) Compute current rising time t_1 and current falling time t_2

$$t_1 = \frac{L_M \times I_{P\_PK\_MAX}}{V_{DC\_MIN}} = \frac{30\mu H \times 0.726A}{36V} = 0.61\mu s$$

$$t_2 = \frac{L_M \times I_{P\_PK\_MAX}}{N_{PS} \times (V_{OUT} + V_{D\_F})} = \frac{30\mu H \times 0.726A}{3 \times (10V + 0.5V)} = 0.69\mu s$$

$$t_S = t_1 + t_2 = 0.61\mu s + 0.69\mu s = 1.3\mu s$$

(e) Compute primary maximum RMS current $I_{P\_RMS\_MAX}$ for the transformer fabrication.

$$I_{P\_RMS\_MAX} = \frac{\sqrt{3}}{3} I_{P\_PK\_MAX} \times \sqrt{\frac{t_1}{t_S}} = \frac{\sqrt{3}}{3} \times 0.726A \times \sqrt{\frac{0.61\mu s}{1.3\mu s}} = 0.287A$$

(f) Compute secondary maximum peak current $I_{S\_PK\_MAX}$ and RMS current $I_{S\_RMS\_MAX}$ for the transformer fabrication.

$$I_{S\_PK\_MAX} = N_{PS} \times I_{P\_PK\_MAX} = 2 \times 0.726A = 1.52A$$

$$I_{S\_RMS\_MAX} = N_{PS} \times \frac{\sqrt{3}}{3} I_{P\_PK\_MAX} \times \sqrt{\frac{t_2}{t_S}} = 3 \times \frac{\sqrt{3}}{3} \times 0.726A \times \sqrt{\frac{0.69\mu s}{1.3\mu s}} = 0.916A$$

(2) Refer to Transformer number of turns selection (N_P,N_S,N_{AUX})

(a) Select the magnetic core style, identify the effective area A_e.

(b) Preset the maximum magnetic flux ΔB. Usually ΔB=0.1~0.18T for 700kHz frequency application.

(c) Compute primary turn N_P

$$N_P = \frac{L_M \times I_{P\_PK\_MAX}}{\Delta B \times A_e}$$

(d) Compute secondary turn N_S

$$N_S = \frac{N_P}{N_{PS}}$$

(e) Compute auxiliary turn N_{AUX}

$$N_{AUX} = N_S \times \frac{V_{VCC}}{V_{OUT}} = N_S \times \frac{12}{12} = N_S$$

(f) Select an appropriate wire diameter

With $I_{P\_RMS\_MAX}$ and $I_{S\_RMS\_MAX}$, select appropriate wire to make sure the current density ranges from 4A/mm^2 to 10A/mm^2.

Primary wire diameter selection: current density j is set to 10A/mm^2.

The compute primary wirecross-sectional area $S1=\frac{I_{P\_RMS\_MAX}}{j}=\frac{0.287}{10}=0.0287\text{mm}^2$

Calculate the skin depth when the frequency f_s = 700kHz ,
The resistivity of copper is $\rho = 1.724\times10^{-8}$

The permittivity of air is $\mu_0 = 4\pi\times10^{-7}$

$$\delta=\sqrt{\frac{\rho}{\pi\times f_s\times\mu_0}}=\sqrt{\frac{1.724\times10^{-8}}{\pi\times700\times10^3\times4\times\pi\times10^{-7}}}=7.898\times10^{-5}\text{m}$$

The wire diameter should less than 2δ=0.158mm
So select the primary wire diameter D1=0.1mm
The parallel numbers of the primary wire will be,

$$n1\geq\frac{4\times S1}{\pi\times D1^2}=\frac{4\times0.0287}{\pi\times0.1^2}=3.65$$

Secondary wire diameter selection: current density j is set to 10A/mm^2.

The compute secondary wirecross-sectional area $S2=\frac{I_{S\_RMS\_MAX}}{j}=\frac{0.916}{10}=0.0916\text{mm}^2$

Select the primary wire diameter D2=0.1mm
The parallel numbers of the primary wire will be,

$$n2\geq\frac{4\times S2}{\pi\times D1^2}=\frac{4\times0.0916}{\pi\times0.1^2}=11$$

Consider transformer style, the actual primary and secondary wire diameter can be adjusted for best production.

(g) If the winding area of the core and bobbin is not enough, reselect the core style, go to **(a)** and redesign the transformer until the ideal transformer is achieved.

#3. Select secondary power diode

Refer to Power Device Design

Known conditions at this step			
V_{DC_MAX}	75V	N_{PS}	3
V_{OUT}	10V	V_{D_F}	0.5V

Compute the voltage and the current stress of secondary power diode

$$\begin{aligned}V_{D\_R\_MAX}&=\frac{V_{DC\_MAX}}{N_{PS}}+V_{OUT}\\&=\frac{75V}{3}+10V\\&=35V\end{aligned}$$

$$I_{D\_PK\_MAX}=I_{S\_PK\_MAX}=N_{PS}\times I_{P\_PK\_MAX}=2\times0.726A=1.52A$$

$$I_{D\_AVG}=I_{OUT}=0.5A$$

#4. Final result

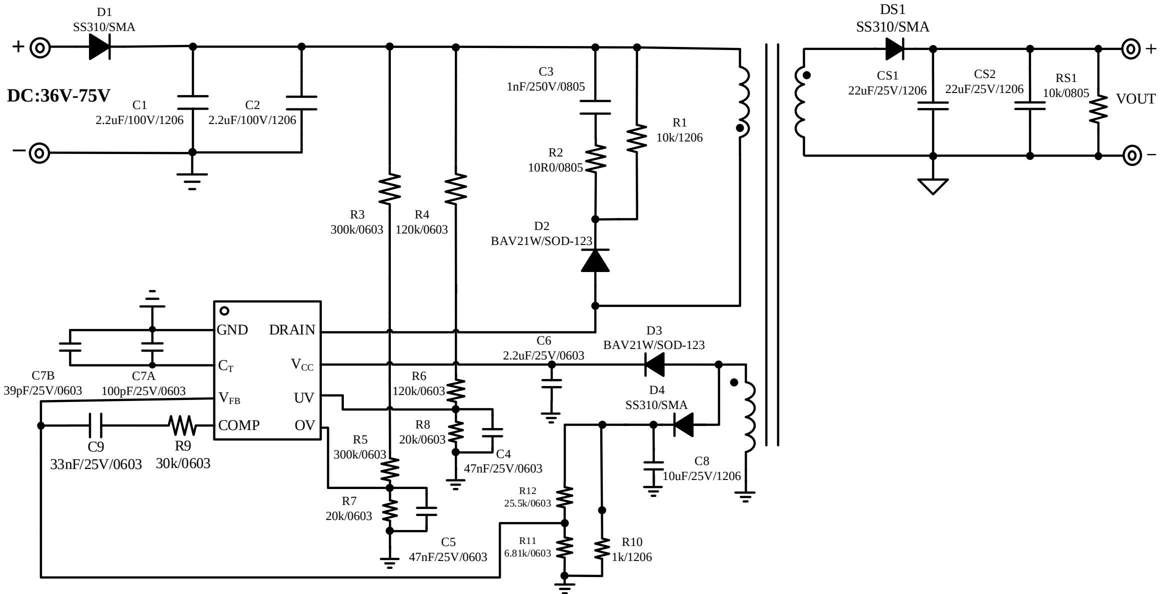
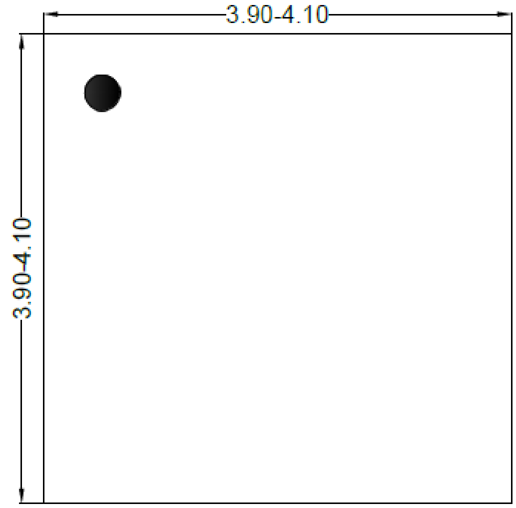
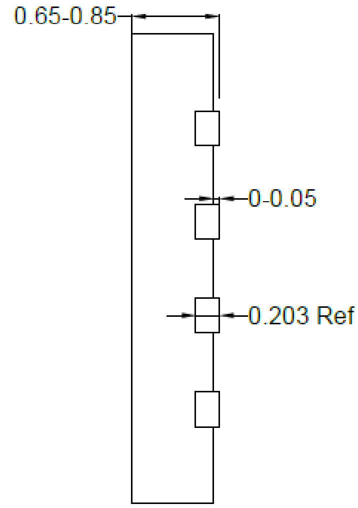


Fig.5 Design example, V_{IN}=36V-75V, V_{OUT}=10V @ 0.5A

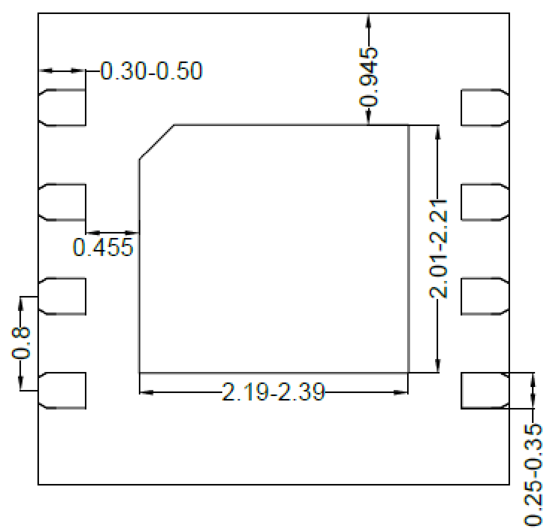
DFN4X4-8 Package Outline Drawing



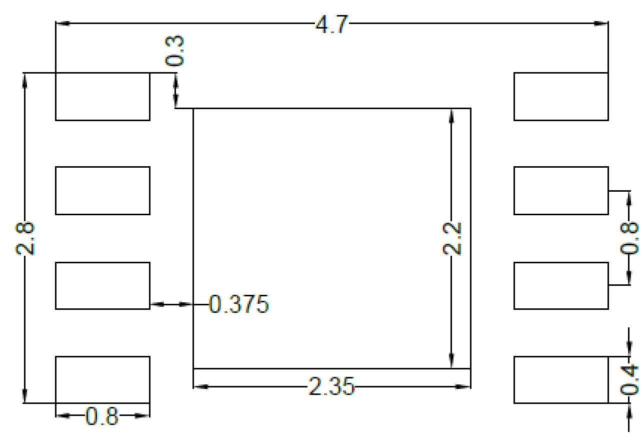
Top view



Side view



Bottom view

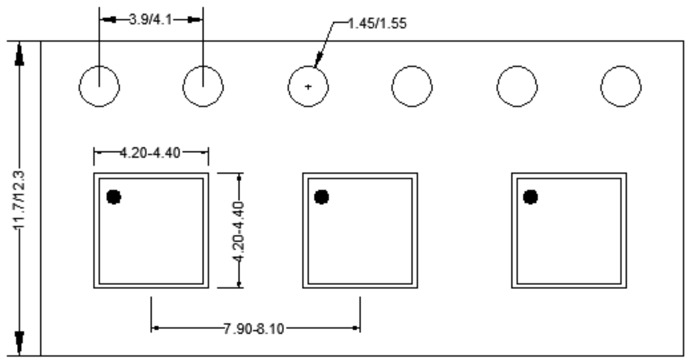


Recommended PCB layout (Reference only)

Notes: 1, All dimension in millimeter and exclude mold flash & metal burr;

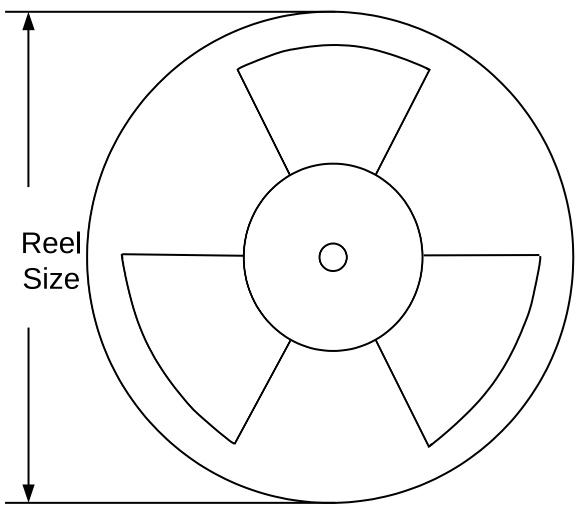
Taping & Reel Specification

1. Taping orientation for packages（DFN4X4-8）



Feeding direction

2. Carrier Tape & Reel specification for packages



Package type	Tape width (mm)	Pocket pitch(mm)	Reel size (Inch)	Trailer length(mm)	Leader length (mm)	Qty per reel
DFN4X4-8	12	8	13"	400	400	5000

Revision History

The revision history provided is for informational purpose only and is believed to be accurate, however, not warranted. Please make sure that you have the latest revision.

Date	Revision	Change
September 16, 2022	Revision 0.9	Initial Release

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