

General Description

The SY28826 is a dual-channel 6A load switch. Its integrated N-channel MOSFETs feature extremely low $R_{DS(ON)}$, helping to reduce power loss during normal operation. The capacitor programmable soft-start time controls the output voltage's slew rate at start-up independently on each channel, minimizing the inrush current. This device also offers independent enable controls for complex system sequencing. It integrates a discharge resistor to ensure quick output discharge when the switches are turned off.

The SY28826 is available in a compact DFN 3mm×2mm-14pin package which requires minimal space and provides better thermal performance.

Features

- Dual-Channel 6A Load Switch
- Wide Input Voltage Range: 0.8V to 5.5V
- Low Bias Current:
 - 20 μ A Typical (Both Channels)
 - 18 μ A Typical (Single Channel)
- Extremely Low $R_{DS(ON)}$ for the Integrated Switch: 18m Ω ($V_{BIAS}=5V$)
- Programmable Soft-Start Time
- Compact Package: DFN3×2-14

Applications

- Notebook Tablet, or Net PCs
- Desktop PCs
- Servers
- Set Top Boxes
- E-Book or MIDs
- Smart TVs
- Routers
- Industrial PCs
- Solid-state Drives (SSD)

Typical Application

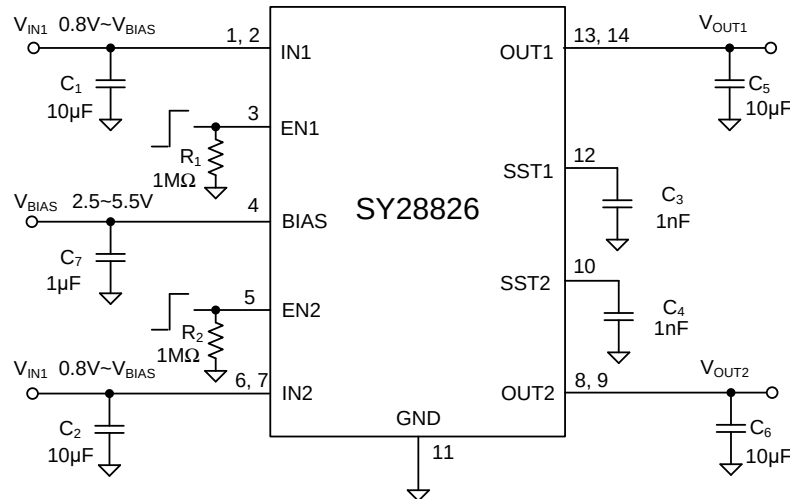


Figure 1. Schematic Diagram

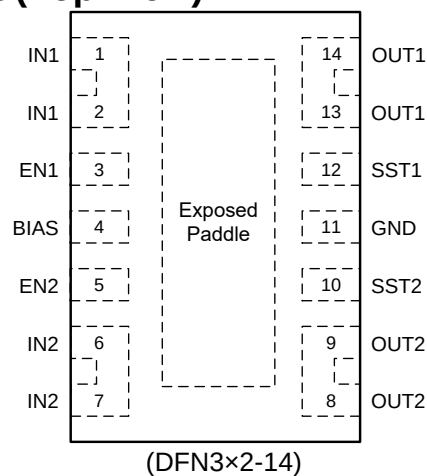
Ordering Information

Ordering Number	Package Type	Top Mark
SY28826DUC	DFN3×2-14 RoHS Compliant and Halogen Free	6Qxyz

Device code: 6Q

x=year code, y=week code, z= lot number code

Pinout (Top View)



Pin Name	Pin Number	Pin Description
IN1	1,2	Power input pin for channel 1.
EN1	3	Enable control input for channel 1. Pull High to enable channel 1. Do not leave floating.
BIAS	4	Bias pin. Bias supply for overdriving the gate of the pass switch between input and output. The recommended BIAS voltage range is 2.5V to 5.5V.
EN2	5	Enable control input for channel 2. Pull High to enable channel 2. Do not leave floating.
IN2	6,7	Power input pin for channel 2.
OUT2	8,9	Power output pin for channel 2.
SST2	10	Soft Start pin of channel 2. Connect a capacitor from this pin to the ground for slew rate programming. If not used in can be left floating.
GND	11	Ground pin.
SST1	12	Soft-Start pin of channel 1. Connect a capacitor from this pin to the ground for slew rate programming. If not used in can be left floating.
OUT1	13,14	Power output pin for channel 1.
Thermal Pad	Exposed pad	Thermal pad, tie to GND.

Block Diagram

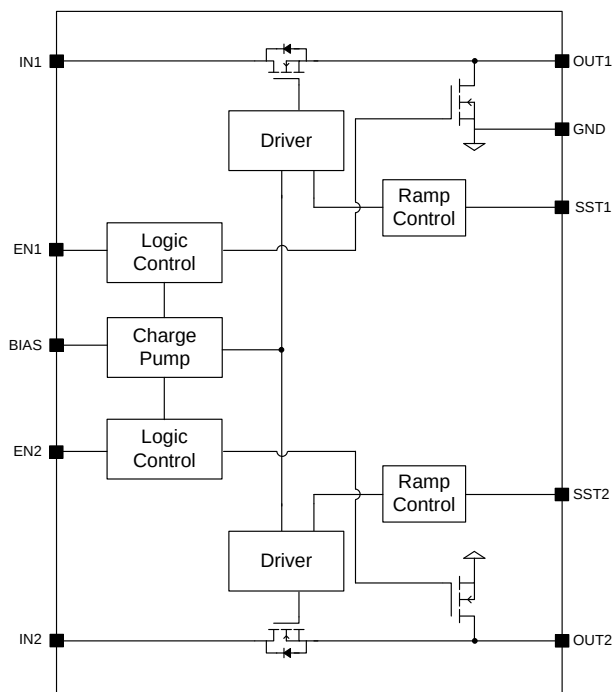


Figure 2. Block Diagram

Absolute Maximum Ratings

Parameter (Note 1)	Min	Max	Unit
IN1, IN2, OUT1, OUT2	-0.3	6	V
SST1, SST2	-0.3	OUT+6	
EN1, EN2, BIAS	-0.3	6	
Maximum Continuous Switch Current per Channel		6	A
Maximum Pulsed Switch Current per Channel, Pulse < 300μs, 3% Duty Cycle		8	A
Lead Temperature (Soldering, 10s)		260	°C
Junction Temperature, Operating	-40	150	
Storage Temperature	-65	150	

Thermal Information

Parameter (Note 2)	Typ	Unit
θ_{JA} Junction-to-Ambient Thermal Resistance	52.3	°C/W
θ_{JC} Junction-to-Case Thermal Resistance	11.5	
P_D Power Dissipation $T_A = 25^\circ\text{C}$	1.9	W

Recommended Operating Conditions

Parameter (Note 3)	Min	Max	Unit
IN1, IN2, OUT1, OUT2	0.8	V_{BIAS}	V
EN1, EN2	0	V_{BIAS}	
BIAS	2.5	5.5	
Junction Temperature, Operating	-40	125	°C
Ambient Temperature	-40	85	

Electrical Characteristics

($V_{IN} = V_{BIAS} = 5V$, $T_J = -40^{\circ}C$ to $+125^{\circ}C$. Typical values are at $T_J = 25^{\circ}C$, unless otherwise specified. The values are guaranteed by test, design or statistical correlation.)

Parameter	Symbol	Test Conditions			Min	Typ	Max	Unit
Input Voltage Range	V _{IN1,2}				0.8		V _{BIAS}	V
BIAS Voltage Range	V _{BIAS}				2.5		5.5	V
BIAS Quiescent Current (Single Channel)	I _{Q_BIAS_1}	V _{BIAS} = V _{IN1,2} =V _{EN1} =5V, V _{EN2} =0V, I _{OUT1,2} =0A, -40°C<T _A <85°C				18	29	μA
		V _{BIAS} = V _{IN1,2} =V _{EN1} =2.5V, V _{EN2} =0V, I _{OUT1,2} =0A, -40°C<T _A <85°C				7	14	
BIAS Quiescent Current (Both Channels)	I _{Q_BIAS_2}	V _{BIAS} = V _{IN1,2} =V _{EN1,2} =5V, I _{OUT1,2} =0A, -40°C<T _A <85°C				20	30	μA
		V _{BIAS} = V _{IN1,2} =V _{EN1,2} =2.5V, I _{OUT1,2} =0A, -40°C<T _A <85°C				8	15	
BIAS Shutdown Current	I _{SHD_BIAS}	V _{EN1,2} =0V, V _{OUT1,2} =0V					2	μA
Input Shutdown Current (per Channel)	I _{SHD_IN}	V _{EN1,2} =0V, V _{OUT1,2} =0V	V _{BIAS} =5V	V _{IN} =5V		0.5	8	μA
				V _{IN} =3.3V		0.1	3	
				V _{IN} =1.8V		0.07	2	
				V _{IN} =0.8V		0.04	1	
			V _{BIAS} =2.5V	V _{IN} =2.5V		0.13	3	
				V _{IN} =1.8V		0.07	2	
				V _{IN} =1.2V		0.05	2	
				V _{IN} =0.8V		0.04	1	
Integrate FET RON (per Channel)	R _{DS(ON)}	V _{BIAS} =5V, V _{IN} =0.8V to 5V, I _{OUT} =200mA, T _A =25°C				18	25	mΩ
		V _{BIAS} =5V, V _{IN} =0.8V to 5V, I _{OUT} =200mA, -40°C <T _A <85°C				18	27	
		V _{BIAS} =3.3V, V _{IN} =0.8V to 3.3V, I _{OUT} =200mA, T _A =25°C				20	27	
		V _{BIAS} =3.3V, V _{IN} =0.8V to 3.3V, I _{OUT} =200mA, -40°C <T _A <85°C				20	30	
EN Turn-on Threshold	V _{EN_ON}				1.2			V
EN Turn-off Threshold	V _{EN_OFF}						0.4	V
Output Discharge Resistor	R _{DIS}					190	270	Ω
Output Voltage Rise Time	t _{RISE}	R _L =10Ω, C _L =0.1μF, C _{SST} =1nF, V _{EN} =5V	V _{IN} = V _{BIAS} =5V	1030	1750	2850	μs	
			V _{IN} = 0.8V, V _{BIAS} =5V	185	365	570		
			V _{IN} = V _{BIAS} =2.5V	1310	2275	3550		
			V _{IN} =0.8V, V _{BIAS} =2.5V	450	825	1280		
Output Voltage Fall Time	t _{FALL}	R _L =10Ω, C _L =0.1μF, C _{SST} =1nF, V _{EN} =5V	V _{IN} = V _{BIAS} =5V	0.1	2	4	μs	
			V _{IN} = 0.8V, V _{BIAS} =5V	0.1	2	4		
			V _{IN} = V _{BIAS} =2.5V	0.1	2	4		
			V _{IN} =0.8V, V _{BIAS} =2.5V	0.1	2	4		
Turn On Delay Time	t _{D_ON}	R _L =10Ω, C _L =0.1μF, C _{SST} =1nF, V _{EN} =5V	V _{IN} = V _{BIAS} =5V	230	460	670	μs	
			V _{IN} = 0.8V, V _{BIAS} =5V	140	290	435		
			V _{IN} = V _{BIAS} =2.5V	430	850	1910		
			V _{IN} =0.8V, V _{BIAS} =2.5V	320	650	1120		
Turn Off Delay Time	t _{D_OFF}	R _L =10Ω, C _L =0.1μF, C _{SST} =1nF, V _{EN} =5V	V _{IN} = V _{BIAS} =5V	1	6	12	μs	
			V _{IN} = 0.8V, V _{BIAS} =5V	1	6	12		
			V _{IN} = V _{BIAS} =2.5V	5	15	25		
			V _{IN} =0.8V, V _{BIAS} =2.5V	5	15	25		

Note 1: Stresses beyond the “Absolute Maximum Ratings” may cause permanent 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. The device is mounted on a 2x2 FR-4 substrate PCB featuring 2oz copper. It includes the minimum recommended pad on the top layer, along with thermal vias connecting to the ground plane on the bottom layer. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note 2: θ_{JA} is measured in the natural convection at $T_A = 25^\circ\text{C}$ on a low effective single-layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard. The exposed pad of the DFN3x2-14 package is the case position for θ_{JC} measurement.

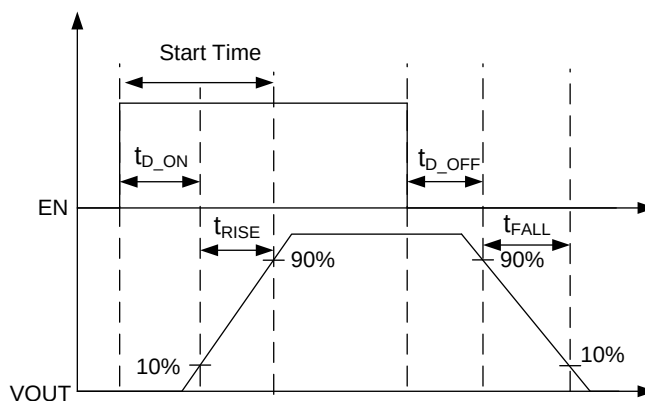
Note 3: The device is not guaranteed to function outside its operating conditions.

Note 4. Recommended Soft-Start Time Program Table:

Condition: RISE TIME (μs) 10% - 90%, $C_L = 0.1\mu\text{F}$, $C_{IN} = 1\mu\text{F}$, $R_L = 10\Omega$, TYPICAL VALUES at 25°C , $V_{BIAS} = 5\text{V}$, 25V X7R 10% CERAMIC CAP, under different V_{IN} .					
SST Cap (pF)	5V	3.3V	1.8V	1.5V	1.2V
0	210	154	104	93	81
220	555	385	231	209	178
470	1022	680	406	342	272
1000	1764	1208	714	616	488
2200	3808	2536	1450	1260	1024
4700	8200	5568	3192	2768	2296

Recommended Formula for C_{SST} & Soft-Start Slew Rate Calculation:

$$\frac{dV}{dt} = \frac{2.56}{C_{SST}(pF) + 145(pF)} (V/\mu s),$$



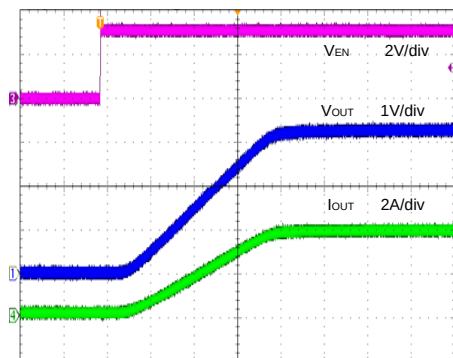
A capacitor to GND on the SSTx pins sets the slew rate for each channel. To ensure desired performance, a capacitor with a minimum voltage rating of 25V should be used on the SSTx pin.

(The equation accounts for 10% to 90% of measurement on VOUT).

Typical Performance Characteristics

Startup from Enable

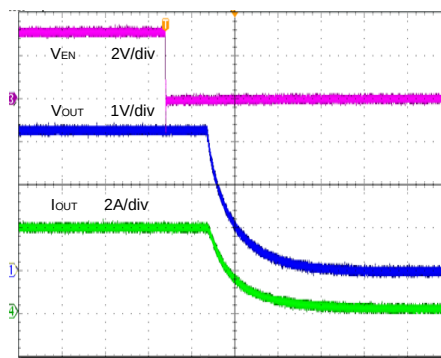
(VBIAS=VIN=3.3V, I_o=4A)



Time (800μs/div)

Shutdown from Enable

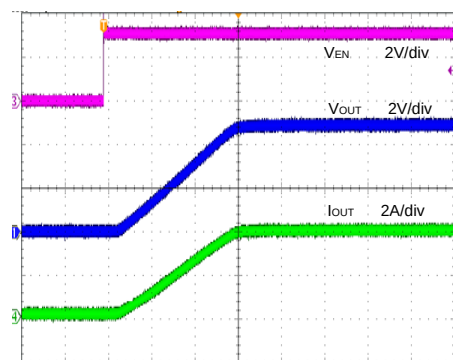
(VBIAS=VIN=3.3V, I_o=4A)



Time (10μs/div)

Startup from Enable

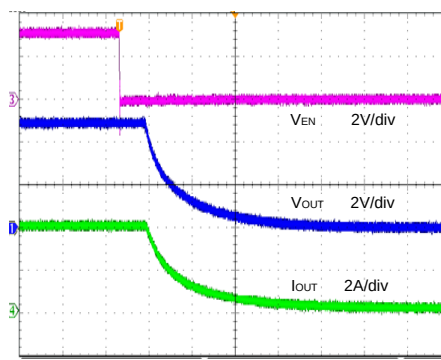
(VBIAS=VIN=5V, I_o=4A)



Time (800μs/div)

Shutdown from Enable

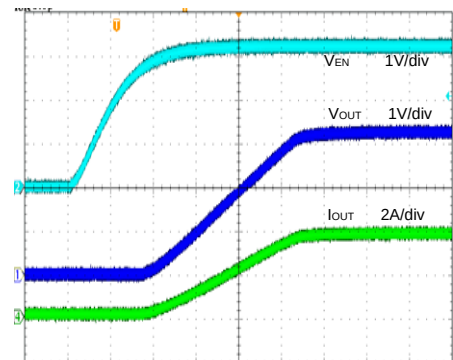
(VBIAS=VIN=3.3V, I_o=4A)



Time (10μs/div)

Startup from BIAS

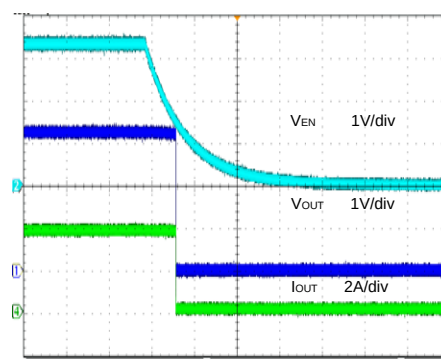
(VBIAS=VIN=3.3V, I_o=4A)



Time (800μs/div)

Shutdown from BIAS

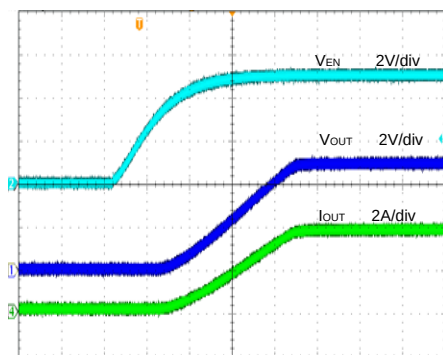
(VBIAS=VIN=3.3V, I_o=4A)



Time (100ms/div)

Startup from BIAS

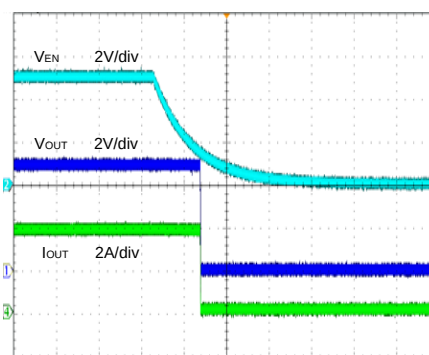
(VBIAS=VIN=5V, I_O=4A)



Time (800µs/div)

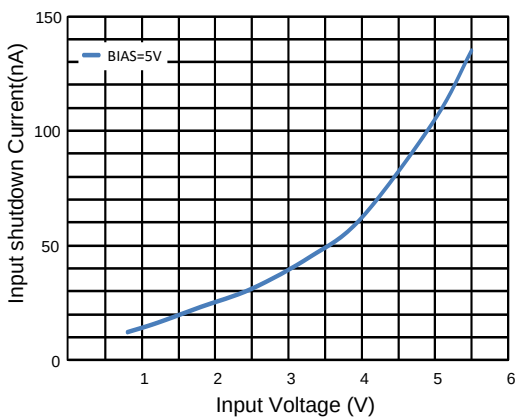
Shutdown from BIAS

(VBIAS=VIN=5V, I_O=4A)

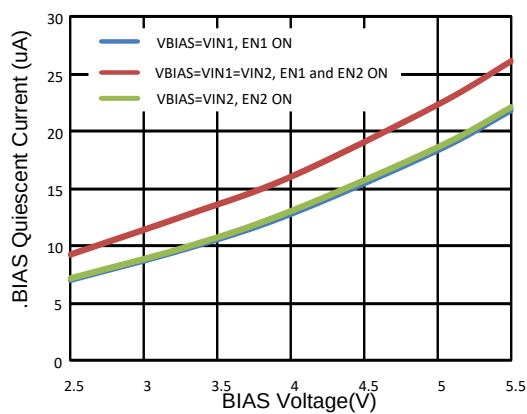


Time (100ms/div)

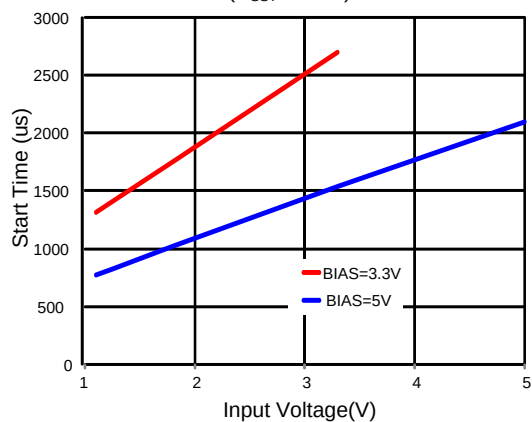
Input shutdown Current(per Channel) vs. Input Voltage



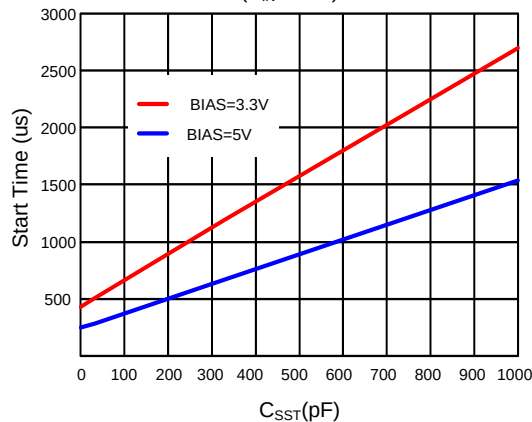
BIAS Quiescent Current vs. BIAS Voltage

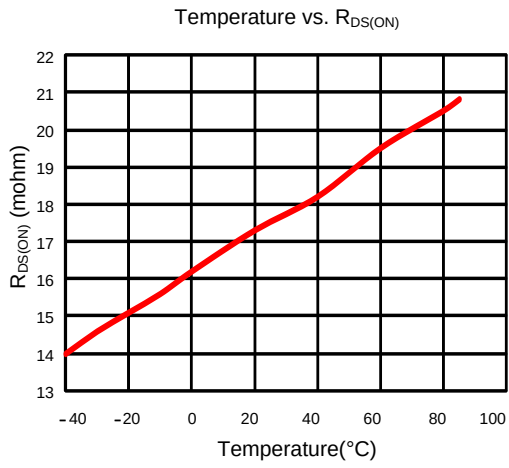


Start Time Vs. Input Voltage (C_{SST}=NULL)



Start Time vs. CT (V_{IN}=3.3V)





Application Information

The SY28826 is a dual-channel 6A load switch. The extremely low $R_{DS(ON)}$ of the integrated N-channel MOSFETs helps to reduce power loss during normal operation. The programmable soft-start time controls the slew rate of the output voltage during start-up and minimizes the inrush current. The switch offers independent enable control for complex system sequencing. Additionally, it integrates a discharge resistor to swiftly discharge the output when the switch is turned off.

The SY28826 is available in a compact DFN3×2-14 package which requires minimal space and provides improved thermal performance.

EN ON/OFF Control:

The EN pins control the state of the switches. Asserting EN high enables the switch. EN is active-high and has a low threshold, making it capable of interfacing with low-voltage signals. This pin cannot be left floating and must be tied either high or low for proper operation.

Input Capacitor:

In most applications, it is recommended to bypass IN_x to GND using 10 μ F ceramic capacitors, placed as close as possible to the device. If the power source exhibits significant inductance due to long lead lengths, the input capacitor helps to clamp any overshoot caused by the device's tank circuit.

V_{IN} and V_{BIAS} Voltage Range:

For optimal R_{ON} performance, make sure $V_{IN} \leq V_{BIAS}$. The device will still be functional if $V_{IN} > V_{BIAS}$ but the R_{ON} may exceed the typical value listed in Electrical Characteristics.

Soft-Start Time Program:

Connect a capacitor from SST pins to GND to control the slew rate of the output voltage at power-on. This pin can be left floating to obtain a predetermined slew rate (minimum T_{SST}) on the output. Use the following equation to determine the soft-start time:

$$SR_{OUT} = \frac{2.56}{C_{SST}(pF) + 145(pF)} (v / \mu s)$$

$$t_{RISE} = 0.8 \times \frac{V_{IN}}{SR_{OUT}} (\mu s)$$

PCB Layout Guide:

For best performance of the SY28826, the following guidelines must be strictly followed:

1. Keep all power traces as short and wide as possible. It's recommended to use a 2-layer or 4-layer board for thermal performance and better current capability.
2. It is recommended to place a minimum of 6 vias around each power pin to efficiently distribute current across different layers of the PCB.
3. Place the input/output and BIAS capacitors close to the device for better transient performance.

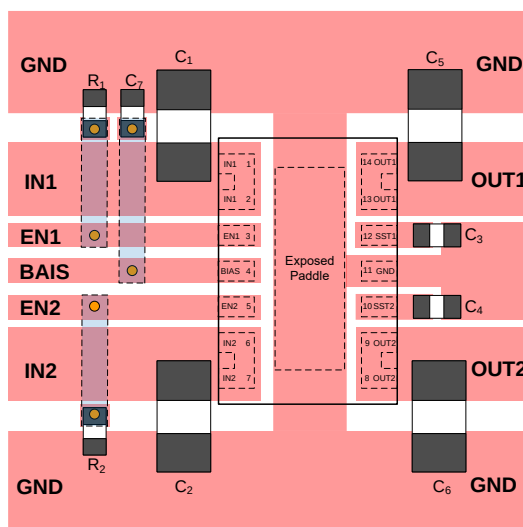
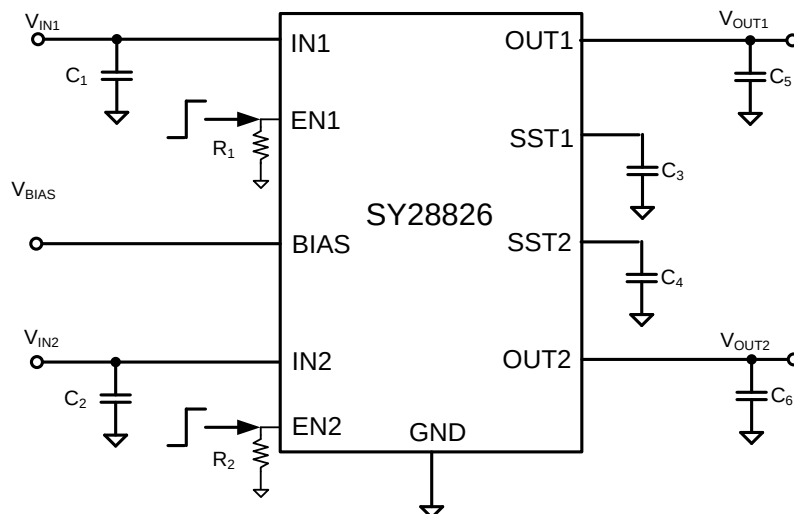


Figure 3. PCB Layout Suggestion

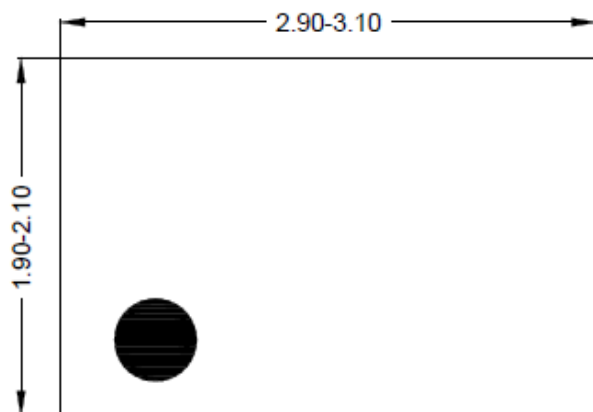
Schematic



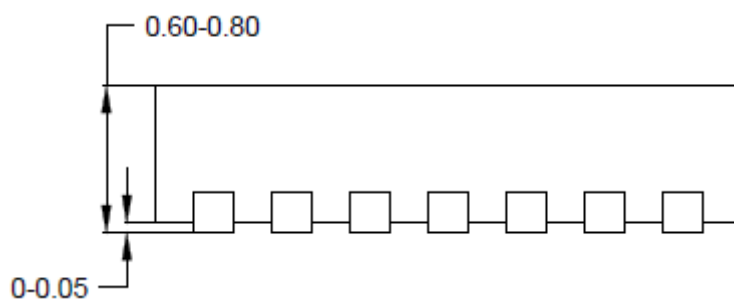
BOM List

Reference Designator	Description	Part Number	Manufacturer
C ₁	10μF/10V, 0805, X5R	GRM21BR71A106K	Murata
C ₂	10μF/10V, 0805, X5R	GRM21BR71A106K	Murata
C ₃	1nF/50V, 0603, X5R	GRM1885C1H102J	Murata
C ₄	1nF/50V, 0603, X5R	GRM1885C1H102J	Murata
C ₅	10μF/10V, 0805, X5R	C1608X5R1E105K	Murata
C ₆	10μF/10V, 0805, X5R	C1608X5R1E105K	Murata
R ₁	1MΩ, 0603		
R ₂	1MΩ, 0603		

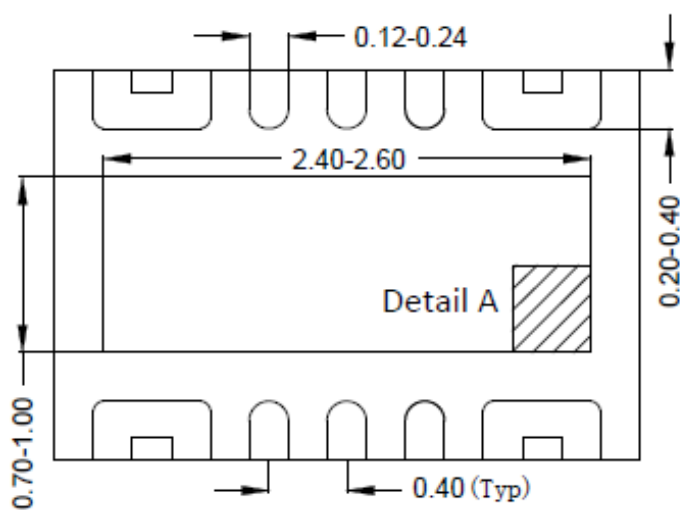
DFN3×2-14 Package Outline Drawing



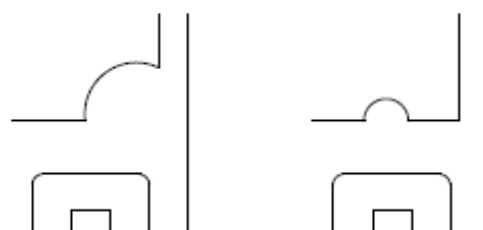
Top View



Side View

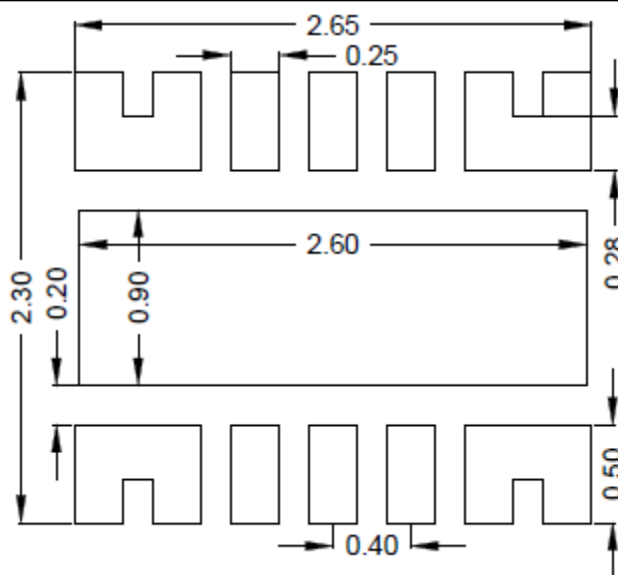


Bottom View



Detail A

Pin1 Identifier: two options

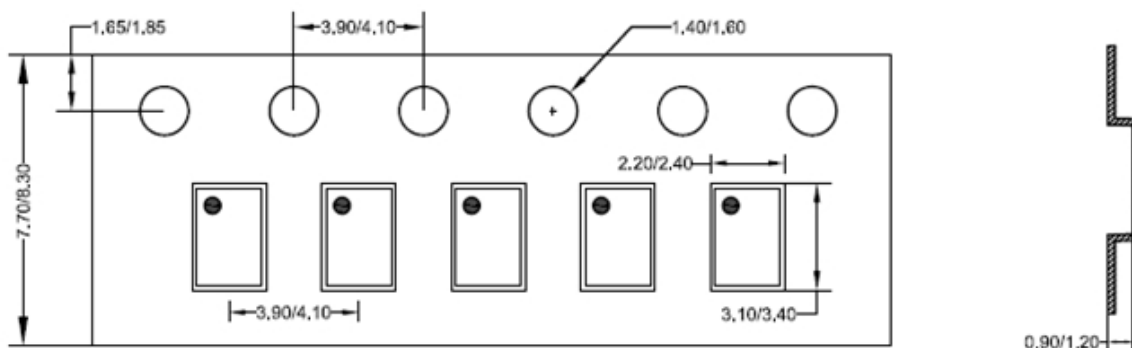


**Recommended PCB Layout
(Reference Only)**

Note: All dimensions are in millimeters and exclude mold flash and metal burr.

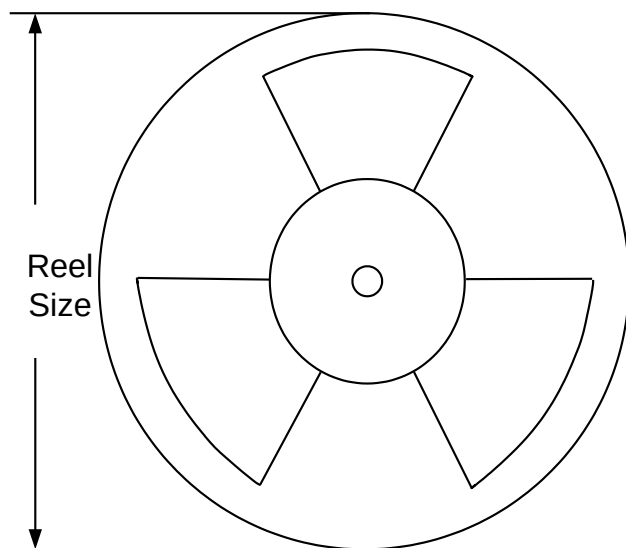
Taping & Reel Specification

DFN3×2 Taping Orientation



Feeding direction →

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 (pcs)
DFN3×2-14	8	4	7"	400	160	3000

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
Aug.08, 2024	Revision 1.0	1. Language improvements for clarity. 2. Add Load Current Absolute Maximum Ratings (page 3)
Dec.28, 2021	Revision 0.9A	Update the taping spec (Pin 1 is on the upper left.)
Jan.15, 2021	Revision 0.9	Initial Release

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