High Performance Current-Mode Controllers

Description

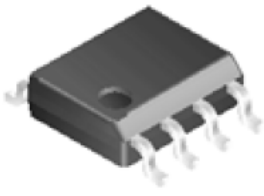
The PD3842A/3A/4A/5A are high performance fixed frequency current-mode PWM controller series.
These integrated circuits are optimized for off-line and DC-DC converter applications with minimum external components.
They feature under-voltage lockout (UVLO) circuit with low start-up current, trimmed oscillator for precise duty cycle control, current sense comparator providing maximum current limiting and a totem pole output stage for increasing output current.
In addition, these ICs also feature accurate protection against over-temperature, over-current and maximal output power.
The PD3842A and PD3844A have UVLO thresholds of 16V(on) and 10V(off); The corresponding thresholds for PD3843A and PD3845A are 8.4 V(on) and 7.6V(off).
The PD3842A and PD3843A can operate approaching 100% duty cycle; PD3844A and PD3845A can operate from zero to 50% duty cycle.
These ICs are available in SOIC-8 and DIP-8 packages.

Feature

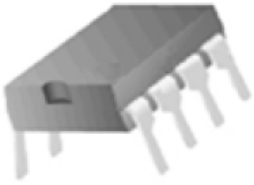
- Low Start-up Current:50μA
- Robust V_{REF} Line/Load Regulation
  Low Line Regulation:4mV
  Low Load Regulation:4mV
- High Stability of Reference Voltage over a Full Temperature Range:0.2mV/℃
- Operating Frequency up to 500KHz
- High PWM Frequency Stability over a Full Temperature Range:2.5%
- High PWM Frequency Stability under a Full Supply Voltage Range:0.2%
- Accurate Over-temperature Protection with Hysteresis

Application

- Off-line Converter
- DC-DC Converter
- Voltage Adapter
- CRT Monitor Power Supply
- Desktop Power Supply
- DVD/STB Power Supply



SOIC-8



DIP-8

Figure 1. Package Types of PD3842A/3A/4A/5A

Pin Configuration

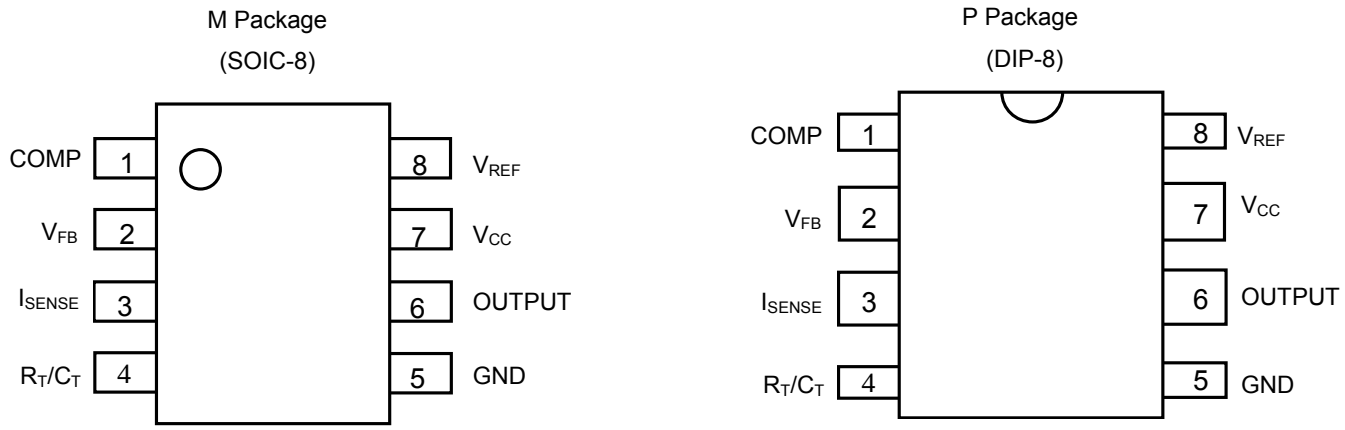


Figure 2. Pin Configuration of PD3842A/3A/4A/5A (Top View)

Pin Description

Pin Number	Pin Name	Function
1	COMP	This pin is the Error Amplifier output and is made available for loop compensation
2	V_{FB}	The inverting input of the Error Amplifier. It is normally connected to the switching power supply output through a resistor divider.
3	I_{SENSE}	A voltage proportional to inductor current is connected to this input. The PWM uses this information to terminate the output switch conduction.
4	R_T/C_T	The Oscillator frequency and maximum output duty cycle are programmed by connecting resistor R_T to V_{REF} and capacitor C_T to ground. Operation to 500 kHz is possible.
5	GND	The combined control circuitry and power ground.
6	OUTPUT	This output directly drives the gate of a power MOSFET. Peak currents up to 1.0 A are sourced and sunk by this pin.
7	V_{CC}	The positive supply of the control IC.
8	V_{REF}	This is the reference output. It provides charging current for capacitor C_T through resistor R_T.

Functional Block Diagram

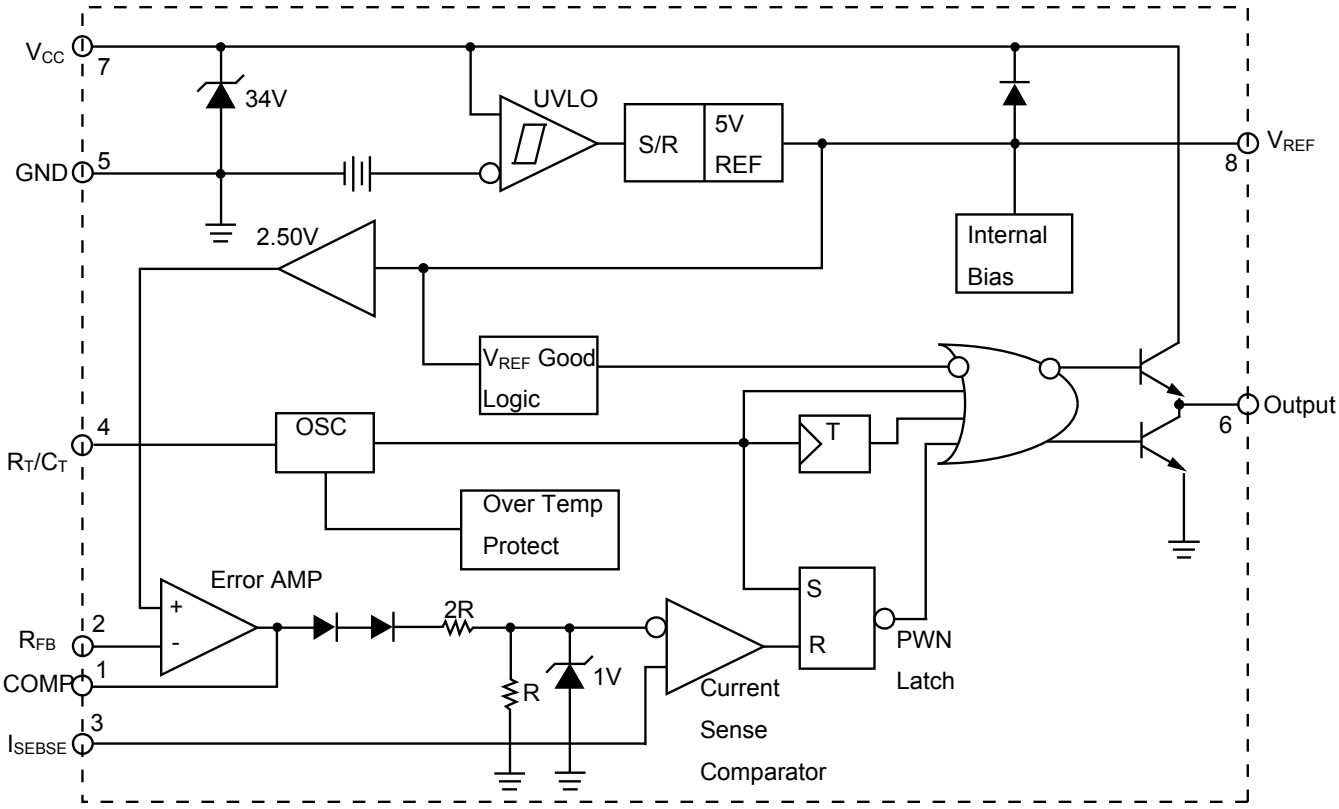


Figure 3. Functional Block Diagram of PD3842A/3A/4A/5A

Absolute Maximum Ratings(Note1,2)

Parameter	Symbol		Value	Unit
Supply Voltage	V_{CC}		30	V
Output Current	I_O		±1	A
Analog Inputs	V(ANA)		-0.3 to 6.3	V
Error Amp Output Sink Current	I_{SINK}(E.A)		10	mA
Power Dissipation at T_A<25℃(DIP-8)	P_D(Note 3)		1000	mW
Power Dissipation at T_A<25℃(SOIC-8)	P_D(Note 3)		460	mW
Junction Operating Temperature	T_J		-40 to 150	℃
Thermal Resistance(Junction to Ambient)	DIP-8	$R_{\theta JA}$	140	℃/W
	SOIC-8		160	℃/W
Storage Temperature Range	T_{STG}		-65 to 150	℃
Lead Temperature(Soldering,10sec)	T_{LEAD}		+300	℃
ESD(Machine Mode)			2500	V

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Note 2: All voltages are with respect to pin 5 and all currents are positive into specified terminal.

Note 3: Board thickness 1.6mm, board dimension 90mm x 90mm.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Oscillation Frequency	f		500	KHz
Ambient Temperature	T_A	-40	85	℃

Electrical Characteristics

(V_{CC}=15V,R_T=10KΩ,C_T=3.3nF,T_A=-40 to 85℃,unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Reference Section						
Reference Output Voltage	V_{REF}	T_J=25℃,I_{REF}=1mA	4.90	5.00	5.10	V
Line Regulation	$\triangle V_{REF}$	12V≤V_{CC}≤25V	-	4	20	mV
Load Regulation	$\triangle V_{REF}$	1mA≤I_{REF}≤20mA	-	4	25	mV
Short Circuit Output Current	I_{SC}	T_A=25℃	-30	-100	-180	mA
Temperature Stability			-	0.2	0.4	mV/℃
Oscillator Section						
Oscillation Frequency	f_{OSC}	T_J=25℃	47	52	57	KHz
Oscillator Amplitude	V_{OSC}	Pin 4,peak to peak(Note 6)		1.6		V
Temperature Stability	$\triangle f_{OSC}/\triangle T$	(Note 6)		2.5		%
Voltage Stability	$\triangle f_{OSC}/\triangle V$	12V≤V_{CC}≤25V		0.2	1	%
Discharge Current	$I_{discharge}$	Vpin4=2V(Note 7)	7.5	8.4	9.3	mA
Error Amplifier Section						
Input Voltage	V_I	Vpin1=2.5V	2.42	2.50	2.58	V
Output Sink Current	I_{SINK}	Vpin1=1.1V	2.0	12		mA
Output Source Current	I_{SOURCE}	Vpin1=5V	-0.5	-1.0		mA
High Output Voltage	V_{OH}	R_L=15KΩ to GND	5	6.2		V

Electrical Characteristics(Continued)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Low Output Voltage	V_{OL}	R_L=15K to pin 8		0.8	1.1	V
Open Loop Voltage Gain	A	2V≤V_O≤4V	65	90		dB
Power Supply Rejection Ratio	PSRR	12V≤V_{CC}≤25V	60	70		dB
Current Sense Section						
Maximum Input Signal	$V_{I\ (MAX)}$	Vpin1=5V(Note 4)	0.9	1	1.1	V
Gain	Av	(Note 4,5)	2.85	3	3.15	V/V
Power Supply Rejection Ratio	PSRR	12V≤V_{CC}≤25V(Note 4,6)		70		dB
Delay to Output	TPLH	Vpin3=0 to 2V(Note 6)		150	300	ns
Input Bias Current	I_{BIAS}			-3	-10	μA
Output Section						
Low Output Voltage	V_{OL}	I_{SINK}=20mA		0.1	0.4	V
		I_{SINK}=200mA		1.6	2.2	V
High Output Voltage	V_{OH}	I_{SOURCE}=20mA	13	13.5		V
		I_{SOURCE}=200mA	12	13.4		V
Rise Time	t_R	T_J=25℃,C_L=1nF(Note 6)		50	150	ns
Fall Time	t_F	T_J=25℃,C_L=1nF(Note 6)		50	150	ns
Under-Voltage Lockout Section						
Start Threshold	$V_{TH(ST)}$	PD3842A/PD3844A	14.5	16	17.5	V
		PD3843A/PD3845A	7.8	8.4	9.0	V
Min. Operation Voltage(After Turn On)	$V_{CC\ Min.}$	PD3842A/PD3844A	8.5	10.0	11.5	V
		PD3843A/PD3845A	7.0	7.6	8.2	V
PWM Section						
Max. Duty Cycle	D(Max.)	PD3842A/PD3843A	94	97	-	%
	D(Max.)	PD3844A/PD3845A	46	48	50	%
Min. Duty Cycle	D(Min.)				0	%
Total Standby Current Section						
Start-Up Current	I_{ST}	V_{CC}=14V		300	500	μA
Operating Supply Current	I_{CC}	Vpin3=Vpin2=0V		12	17	mA
Zener Voltage	V_Z	I_{CC}=25mA	30	34		V
Over-Temperature Protect Section						
Shutdown Temperature	T_{SHUT}	(Note 6)		155		℃
Temperature Hysteresis	T_{HYS}	(Note 6)		25		℃

Note 4: Parameters are tested at trip point of latch with Vpin2 = 0.

Note 5: Here gain is defined as:

$$A=\frac{\triangle VPin1}{\triangle VPin3}\ ,0\le Vpin\ 3\le 0.8V$$

Note 6: These parameters, although guaranteed, are not 100% tested in production.

Note 7: This parameter is measured with R_T=10kΩ to V_{REF}, it contributes 0.3mA of current to the measured value. So the total current flowing into the C_T pin will be 0.3mA higher than the measured value approximately.

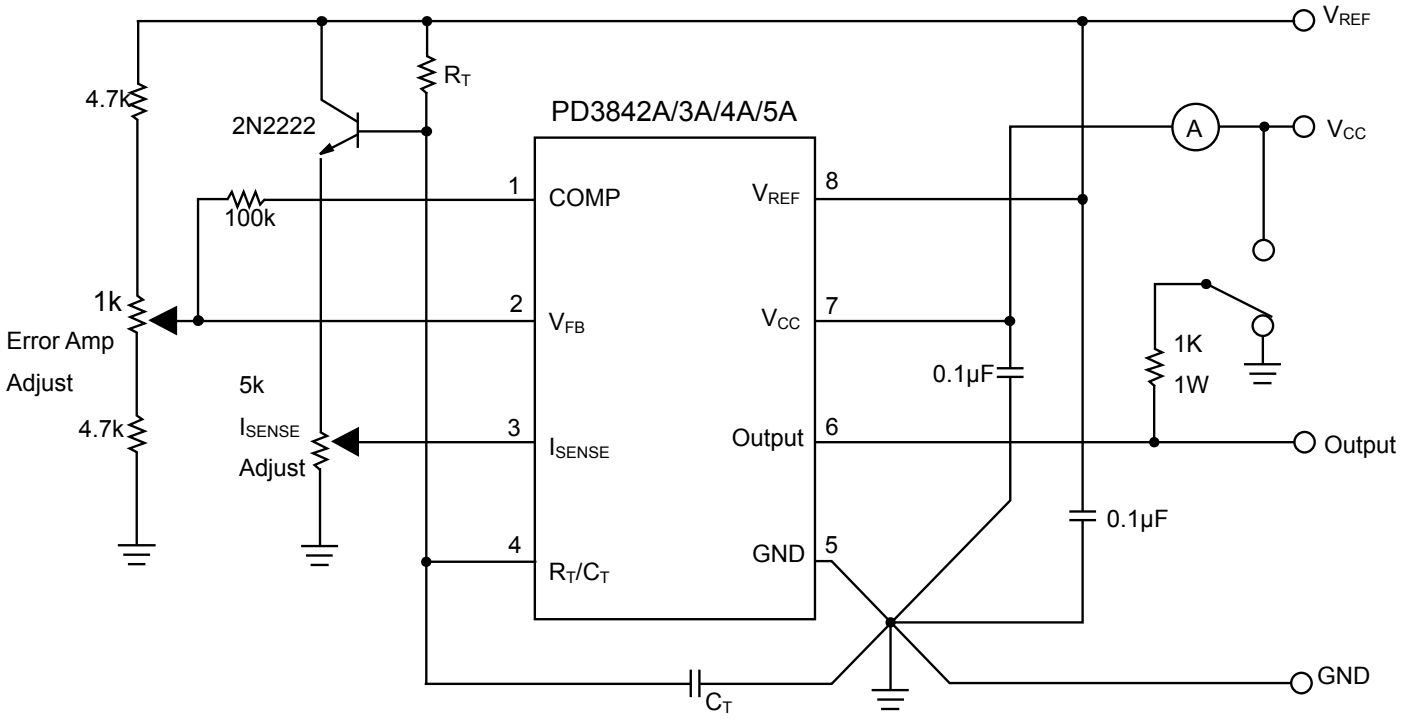


Figure 4. Basic Test Circuit

Figure 4 is the basic test circuit for PD384xA. In testing, the high peak currents associated with capacitive loads necessitate careful grounding techniques. Timing and bypass capacitors should be connected close to pin 5 in a single point ground. The transistor and 5kΩ potentiometer are used to sample the oscillator waveform and apply an adjustable ramp to pin 3.

Typical Performance Characteristics

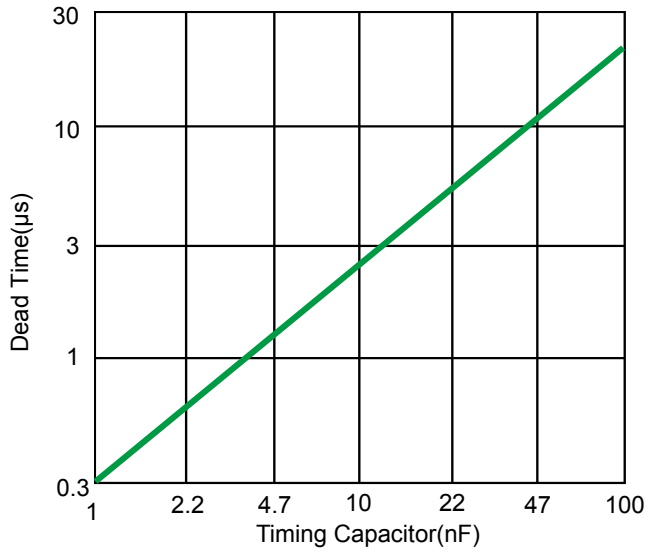


Figure5. Oscillator Dead Time vs. Timing Capacitor

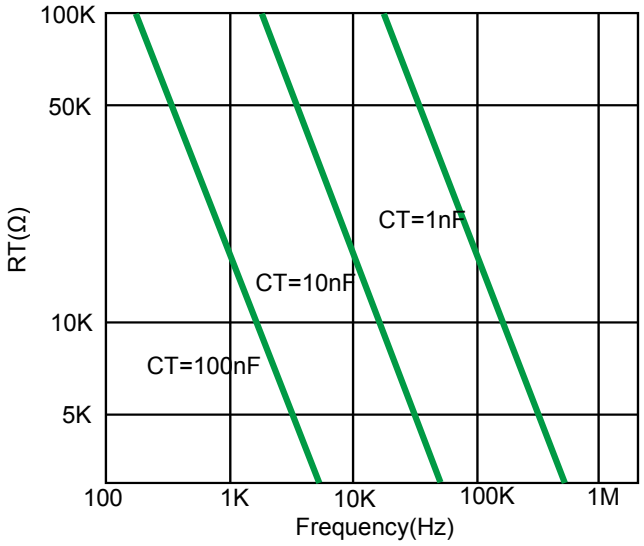


Figure 6. Timing Resistor vs. Frequency

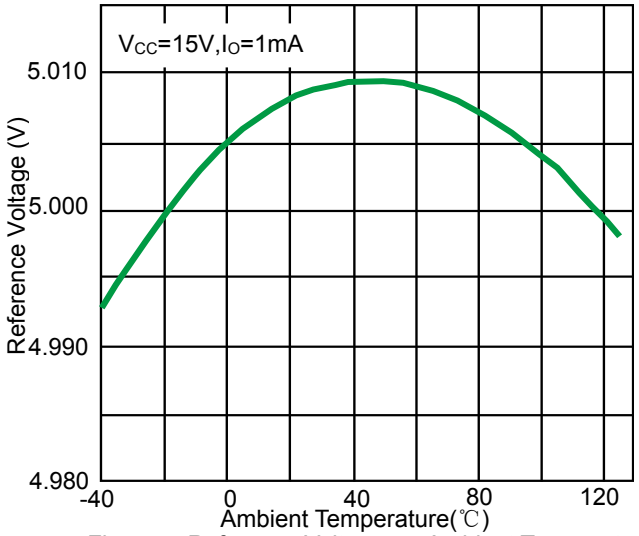


Figure 7. Reference Voltage vs. Ambient Temperature

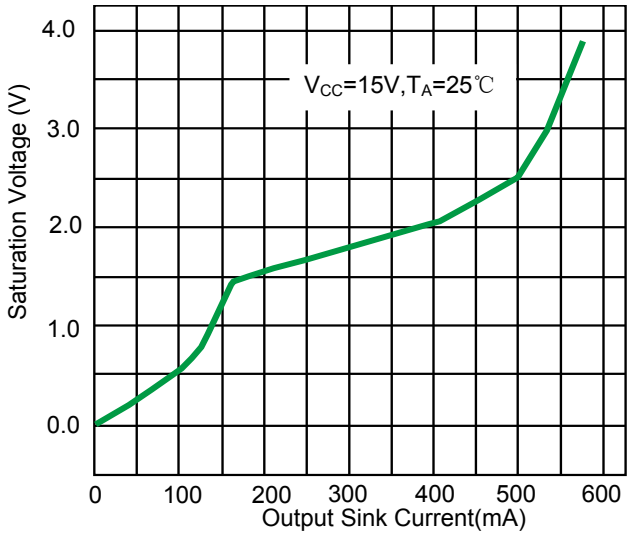


Figure 8. Output Saturation Characteristics

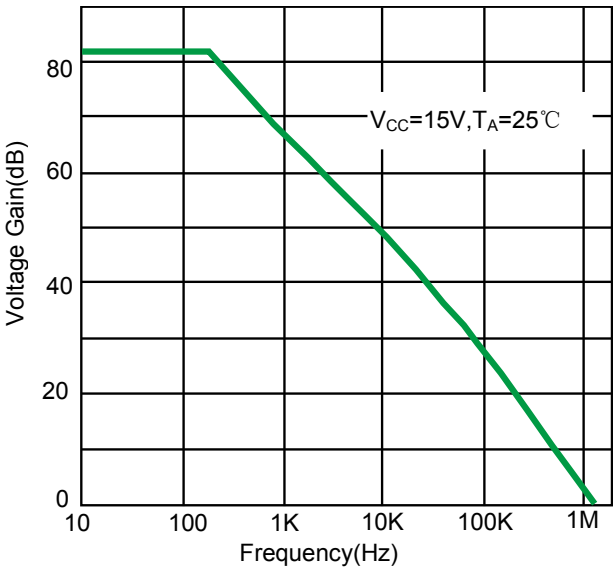


Figure 9.Error Amplifier Open-Loop Frequency Response

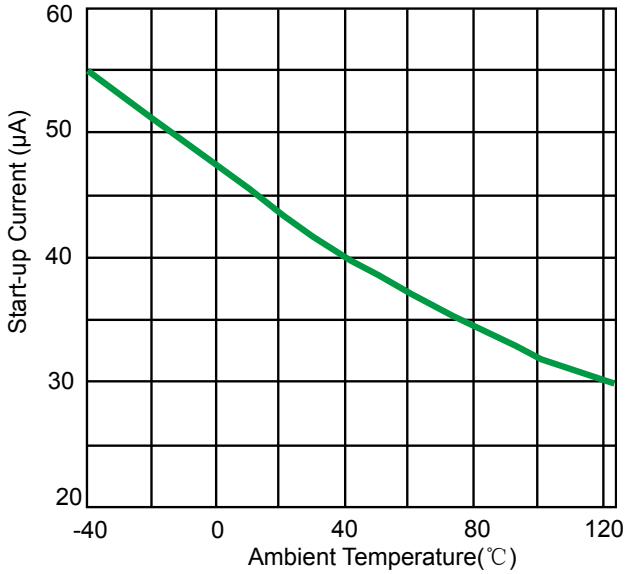


Figure 10.Start-up Current vs. Ambient Temperature

Typical Application

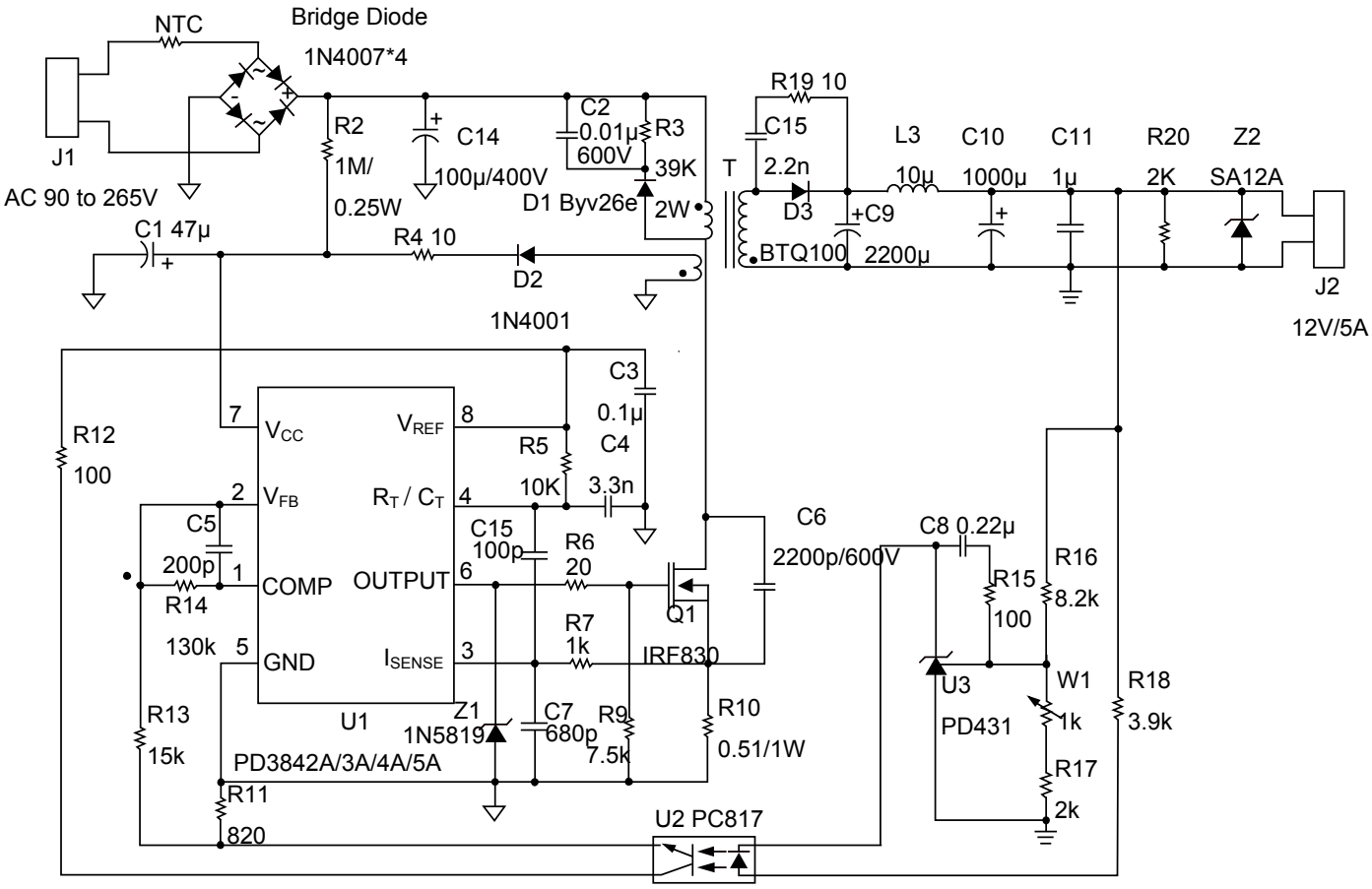
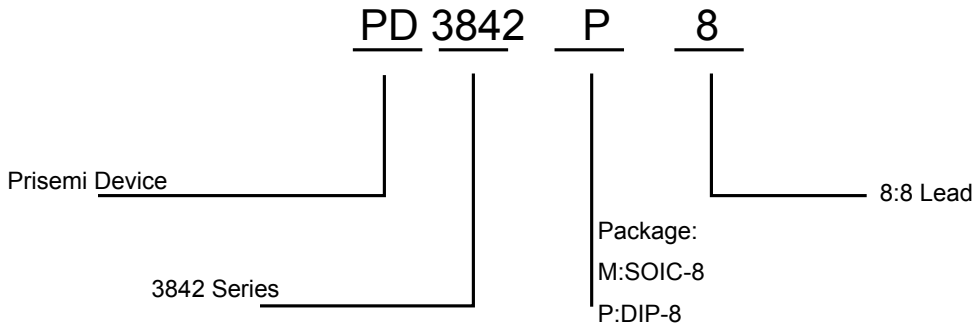


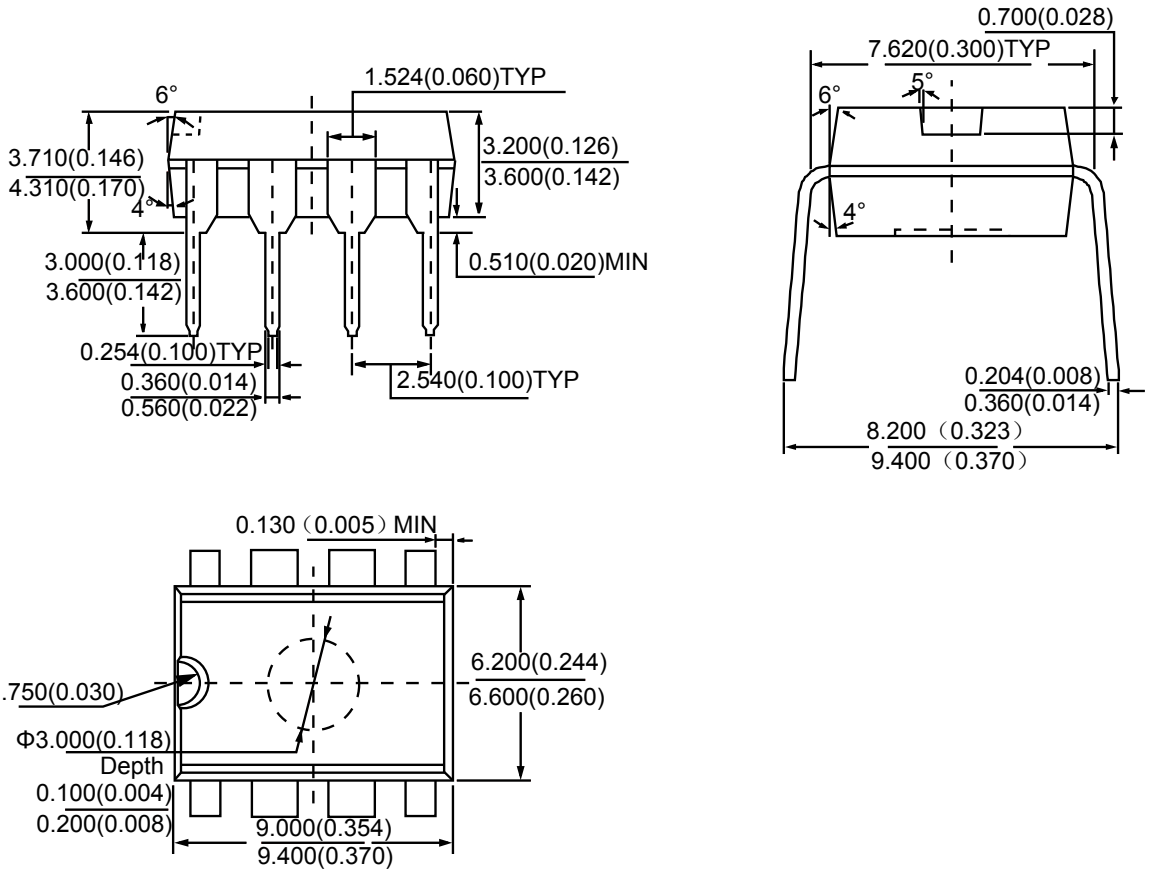
Figure 11. Typical Application of PD3842A/3A/4A/5A

Naming Rule



Product dimension (DIP-8)

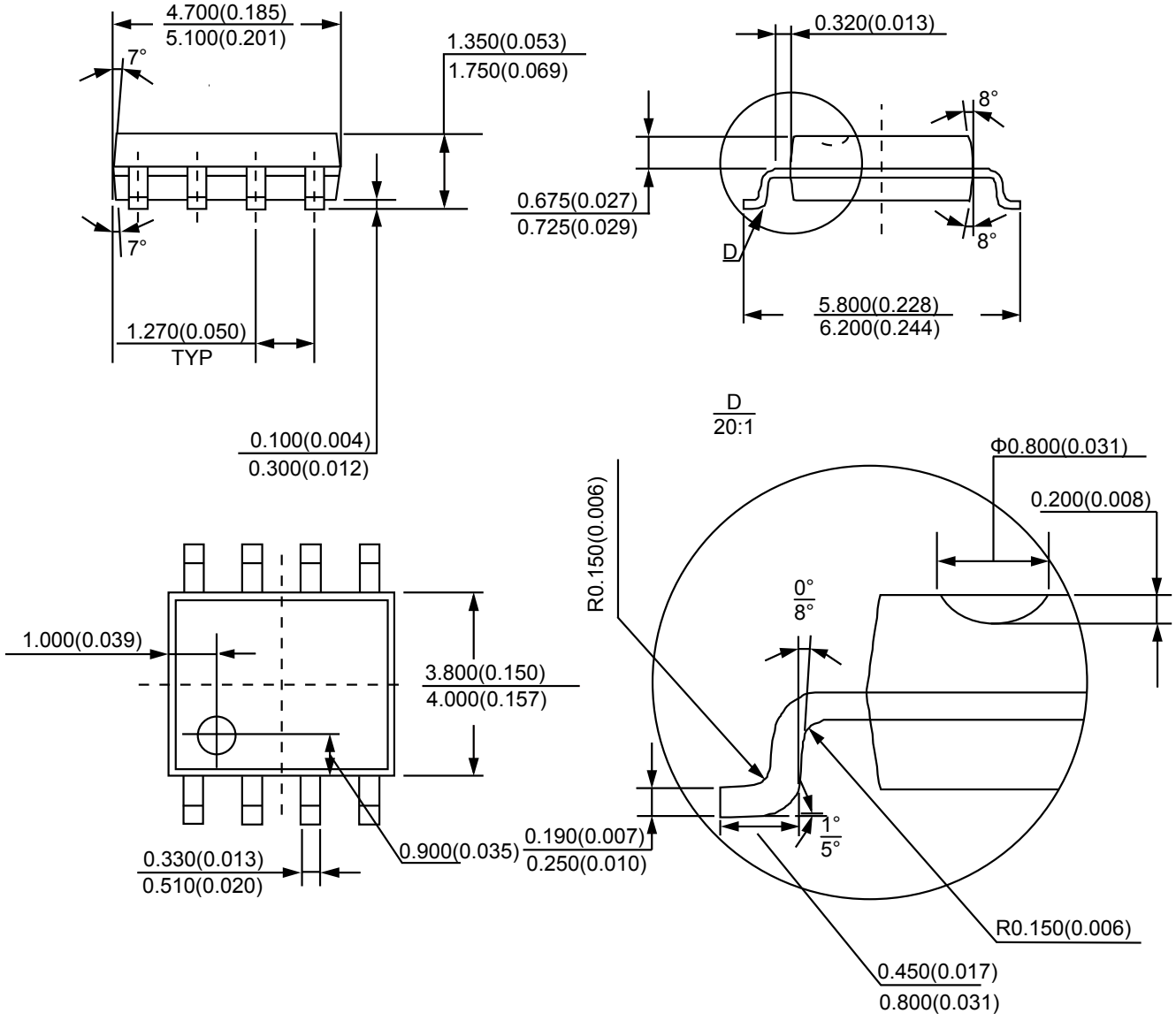
DIP-8 Unit:mm(inch)



Note: Eject hole, oriented hole and mold mark is optional.

Product dimension (SOIC-8)

SOIC-8 Unit:mm(inch)



Note: Eject hole, oriented hole and mold mark is optional.

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