1.6X LINEAR FAN DRIVER WITH VO FULLY ON CONTROL

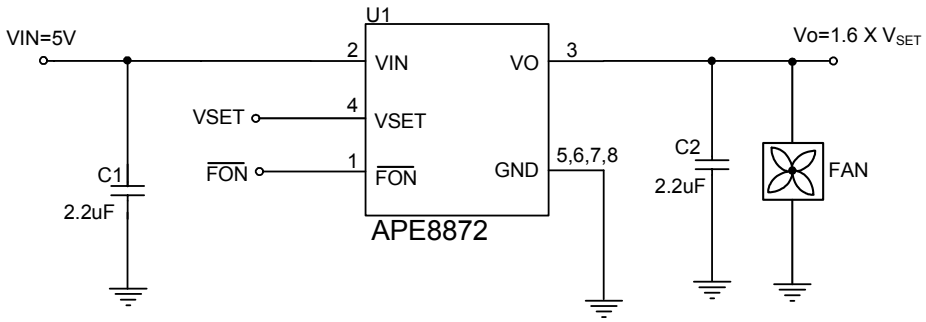
FEATURES

- **Low Dropout Voltage: 150mV@0.5A**
- **V_O Follows 1.6 times of V_{SET}**
- **FON Pin to Turn V_O Fully On**
- **Stable with Low ESR Ceramic Capacitors**
- **Current-Limit and Thermal Shutdown Protection**
- **SOP-8 Pb-Free Package**

DESCRIPTION

The APE8872 is a low dropout linear regulator which is designed to power a DC fan and delivers up to 500mA output current. The output voltage follows the 1.6 times of V_{SET} voltage and typical dropout voltage is only 150mV (typical) at 500mA output current. The V_{SET} voltage must be larger than 1V to guarantee V_O 1.6 times of V_{SET}. A FON pin turns V_O output fully on when given low. The features of current limit (with fold back current) and over temperature protection protect the device against current over-loads and over temperature. The APE8872 is available in a SOP-8 package.

TYPICAL APPLICATION



PACKAGE ORDERING INFORMATION

APE8872X

Package Type
M : SOP-8L

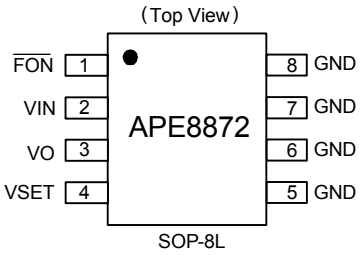
8872M → Part number
Y WW SSS → ID code: internal
WW: 01~52
Year: 8 : 2008

ABSOLUTE MAXIMUM RATINGS

V_{IN} Supply Voltage (V_{IN})	-0.3 to 7 V
$\overline{FON}$ Input Voltage (V_{FON})	-0.3V to VIN
V_{SET} Voltage (V_{SET})	-0.3V to VIN
Power Dissipation (P_D)	Internally limited
Storage Temperature Range (T_{ST})	-65 to +150°C
Junction Temperature Range (T_J)	-40 to 125°C
Operating Temperature Range (T_{OP})	-40 to +85°C
Thermal Resistance from Junction to case (R_{thjc})	20°C/W
Thermal Resistance from Junction to ambient (R_{thja})	60°C/W

Note: Rthja is measured with the PCB copper area approximately 1.5 in^2 (Multi-layer)

PACKAGE INFORMATION



ELECTRICAL SPECIFICATIONS

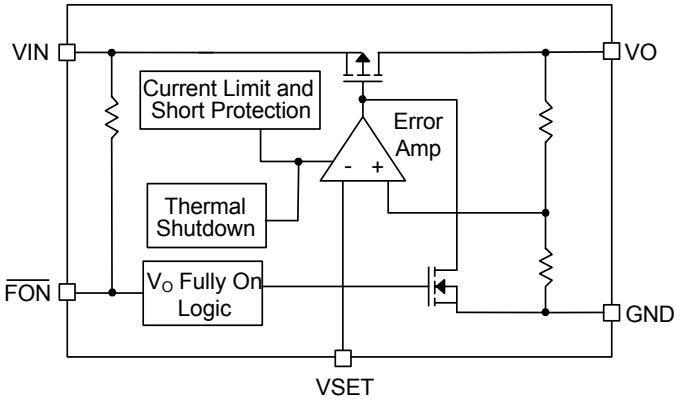
(V_{SET} = 2V, V_{IN} = 5V, I_o = 0.5A, C_{IN}=C_{OUT}=2.2uF, T_A=25°C unless otherwise specified)

Parameter	SYM	TEST CONDITION	MIN	TYP	MAX	UNITS
VIN Supply Voltage Range	V_{IN}		4.5	-	5.5	V
Quiescent Current	I_{CCQ}	VO=5V, No Load	-	1	-	mA
Output Voltage/V_{SET} Voltage	V_O/V_{SET}	V_{IN}=5.5V, V_{SET}=1V~3.2V	1.552	1.6	1.648	V/V
Line Regulation		VIN=4.5V to 5.5V	-	0.2	0.5	%
Load Regulation		I_O=10mA ~ 0.5A	-	0.2	0.5	%
Output Resistance	$R_{DS(ON)}$	I_O =0.5A, V_{SET}=3.4V	-	300	400	mΩ
Current Limit	I_{Limt}		-	1.5	3	A
Short Circuit Current	I_{Short}	Vo<0.6V	-	0.5	3	A
Minimum V_{SET} Voltage	V_{SET}		-	1	-	V
V_{SET} Pin Current	I_{SET}		-	80	200	nA
$\overline{FON}$ Pin Logic Threshold Voltage	$V_{\overline{FON}\text{-H}}$	Normal Operating	2	-	-	V
	$V_{\overline{FON}\text{-L}}$	Regulator Fully On	-	-	0.8	
$\overline{FON}$ Pin Bias Current	$I_{\overline{FON}}$	$\overline{FON}$=0V	-	1.5	10	uA
Thermal shutdown Temp	T_{SD}		-	150	-	℃
Thermal Shutdown Hysteresis			-	40	-	℃

PIN DESCRIPTIONS

PIN SYMBOL	PIN DESCRIPTION
GND	GND pin
VIN	IC power supply pin
VO	Output Pin. Its voltage is 1.6 times of V_{SET}
VSET	This pin sets the output voltage. Its voltage must be larger than 1V to guarantee V_O 1.6 times of VSET
$\overline{FON}$	$\overline{FON}$ Input. Pulling this pin below 0.4V turns the regulator fully on. Internally pulled high.

BLOCK DIAGRAM



FUNCTION DESCRIPTION

Output Voltage Regulation

The Output Voltage is set by V_{SET} voltage. V_O output voltage follows the 1.6 times of V_{SET} voltage until it reaches V_{IN} voltage.

Current-Limit

The APE8872 monitors the current via the output PMOS and limits the maximum current to prevent load and APE8872 from damages during overload or short circuit conditions.

Short Current Protection

When the output voltage drops below 0.6V (typical), which is caused by over load or short circuit, the fold back current limit circuitry limits the output current to 500mA. The fold back current limit is used to reduce the power dissipation during short circuit condition.

Thermal Shutdown

A thermal shutdown circuit limits the junction temperature of APE8872. When the junction temperature exceeds +150°C, a thermal sensor turns off the output PMOS, allowing the device to cool down. The regulator regulates the output again through initiation of a new soft-start cycle after the junction temperature cools by 40°C, resulting in a pulsed output during continuous thermal overload conditions.

APPLICATION INFORMATION

Capacitor Selection

Normally, use a 2.2uF capacitor on the input and a 2.2uF capacitor on the output of the APE8872. In order to insure the circuit stability, the proper output capacitor value should be larger than 1uF. With X5R and X7R dielectrics, 2.2uF is sufficient at all operating temperatures.

Thermal Considerations

The APE8872 series can deliver a current of up to 500mA over the full operating junction temperature range. However, the maximum output current must be dated at higher ambient temperature to ensure the junction temperature does not exceed 125°C. With all possible conditions, the junction temperature must be within the range specified under operating conditions. Power dissipation can be calculated based on the output current and the voltage drop across regulator.

$$P_D = (V_{IN} - V_O)\ I_O$$

The final operating junction temperature for any set of conditions can be estimated by the following thermal equation:

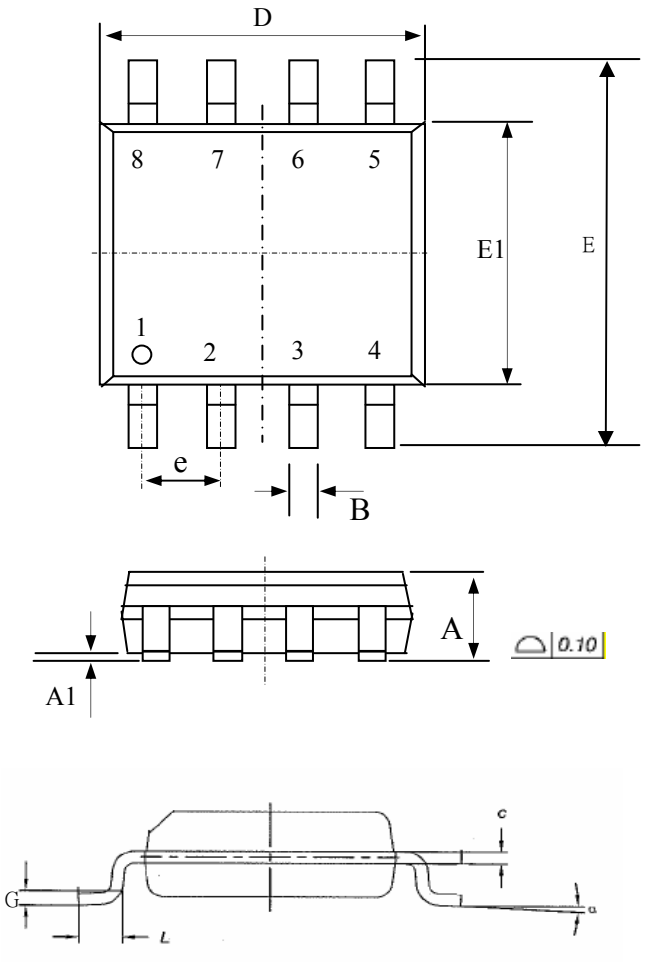
$$P_{D\ (MAX)} = (T_{J\ (MAX)} - T_A) / R_{thja}$$

Where $T_{J\ (MAX)}$ is the maximum junction temperature of the die (125° C) and T_A is the maximum ambient temperature. The junction to ambient thermal resistance (R_{thja}) for SOP-8L package at recommended minimum footprint is 60°C/W. Visit our website in which “Recommended Footprints for Soldering Surface Mount Packages” for detail.

PCB Layout

1. Please place the input capacitors close to the V_{IN}
2. Ceramic capacitors for load must be placed near the load as close as possible
3. To place APE8872 and output capacitors near the load is good for performance.
4. Large current paths that V_{IN} and Output lines must have wide tracks.
5. GND connect large copper area can reduced IC temperature.

Package Outline : SO-8

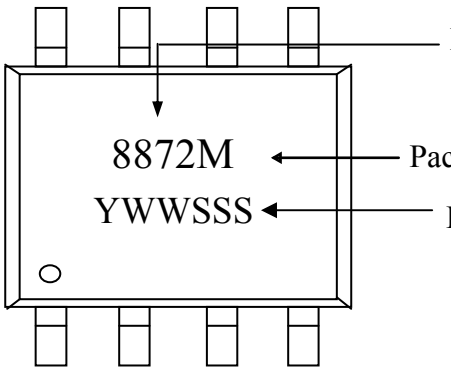


		Millimeters	
SYMBOLS	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.18	0.25
B	0.33	0.41	0.51
c	0.19	0.22	0.25
D	4.80	4.90	5.00
E	5.80	6.15	6.50
E1	3.80	3.90	4.00
e	1.27 TYP		
G	0.254 TYP		
L	0.38	—	0.90
α	0.00	4.00	8.00

1.All Dimension Are In Millimeters.

2.Dimension Does Not Include Mold Protrusions.

Part Marking Information & Packing : SO-8



Part Number

Package Code

Date Code (YWWSSS)

Y：Last Digit Of The Year

WW：Week

SSS：Sequence