



**1.6X LINEAR REGULATOR FOR DC FAN DRIVER CONTROL**

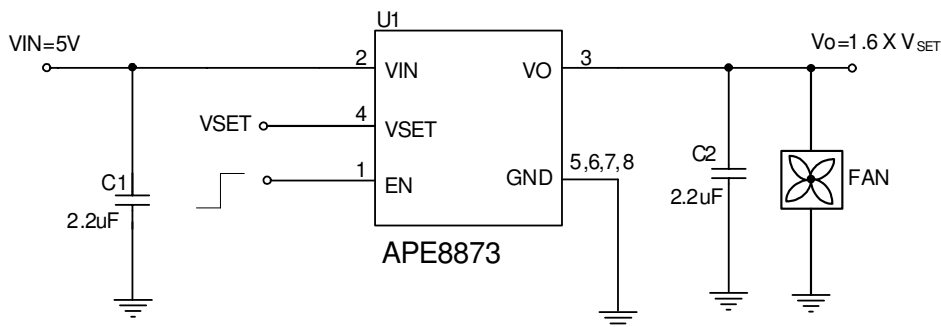
**FEATURES**

- Low Dropout Voltage: 150mV@0.5A
- $V_O$  Follows 1.6 times of  $V_{SET}$
- Enable/Shutdown function
- Stable with Low ESR Ceramic Capacitors
- Current-Limit and Thermal Shutdown Protection
- SOP-8 Pb-Free Package

**DESCRIPTION**

The APE8873 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  $V_{SET}$ . An enable pin further reduces power dissipation while shut-down. The features of current limit (with fold back current) and over temperature protection protect the device against current over-loads and over temperature. The APE8873 is available in a SOP-8 package.

**TYPICAL APPLICATION**



**PACKAGE ORDERING INFORMATION**

**APE8873X**  
 └───┬───┘  
 Package Type  
 M : SOP-8L

8873M → Part number  
 Y WW SSS → ID code: internal  
 └───┬───┘  
 WW: 01~52  
 └───┬───┘  
 Year: 8 : 2008

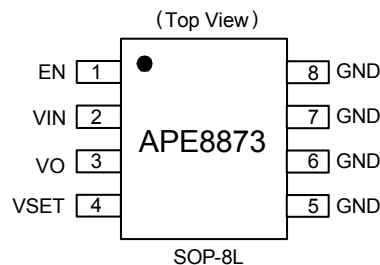


## ABSOLUTE MAXIMUM RATINGS

$V_{IN}$ Supply Voltage ( $V_{IN}$ )	-0.3 to 7 V
EN Voltage ( $V_{EN}$ )	-0.3V to $V_{IN}$
$V_{SET}$ Voltage ( $V_{SET}$ )	-0.3V to $V_{IN}$
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:  $R_{thja}$  is measured with the PCB copper area approximately 1.5 in<sup>2</sup> (Multi-layer)

## PACKAGE INFORMATION



## ELECTRICAL SPECIFICATIONS

( $V_{SET} = 2V$ ,  $V_{IN} = 5V$ ,  $I_O = 0.5A$ ,  $C_{IN}=C_{OUT}=2.2\mu F$ ,  $T_A=25^\circ C$  unless otherwise specified)

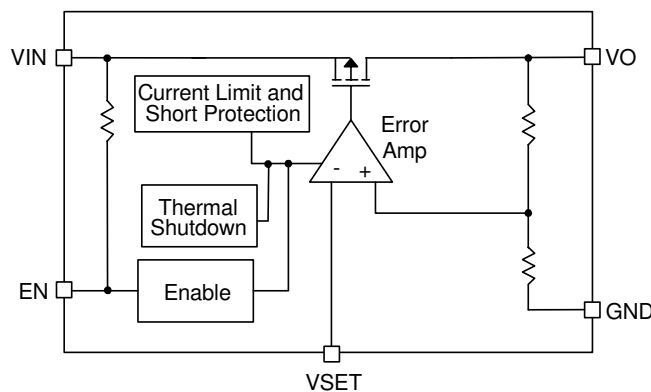
Parameter	SYM	TEST CONDITION	MIN	TYP	MAX	UNITS
$V_{IN}$ Supply Voltage Range	$V_{IN}$		4.5	-	5.5	V
Quiescent Current	$I_{CCQ}$	$V_O=5V$ , No Load	-	1	-	mA
Standby Current	$I_{STB}$	$V_{EN}=0V$	-	10	50	uA
Output Voltage/ $V_{SET}$ Voltage	$V_O/V_{SET}$	$V_{IN}=5.5V$ , $V_{SET}=1V\sim 3.2V$	1.552	1.6	1.648	V/V
Line Regulation		$V_{IN}=4.5V$ to $5.5V$	-	0.2	0.5	%
Load Regulation		$I_O=10mA \sim 0.5A$	-	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	-	A
Short Circuit Current	$I_{Short}$	$V_O < 0.6V$	-	0.5	-	A
Minimum $V_{SET}$ Voltage	$V_{SET}$		-	1	-	V
$V_{SET}$ Pin Current	$I_{SET}$		-	80	200	nA
EN Pin Logic Threshold Voltage	$V_{EN-H}$	Operating mode	2	-	-	V
	$V_{EN-L}$	Shutdown mode	-	-	0.8	
EN Pin Pull-Up Current	$I_{EN}$	$EN=0V$	-	1.5	10	uA
Thermal shutdown Temp	$T_{SD}$		-	150	-	°C
Thermal Shutdown Hysteresis			-	40	-	°C



## 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 $V_{SET}$
EN	This pin is pulling high inside. If EN input < 0.8V, the IC is into shutdown mode.

## BLOCK DIAGRAM



## FUNCTION DESCRIPTION

### Output Voltage Regulation

The Output Voltage is set by VSET voltage. VO output voltage follows the 1.6 times of VSET voltage until it reaches VIN voltage.

### Current-Limit

The APE8873 monitors the current via the output PMOS and limits the maximum current to prevent load and APE8873 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 APE8873. 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.



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## **APPLICATION INFORMATION**

### **Capacitor Selection**

Normally, use a 2.2uF capacitor on the input and a 2.2uF capacitor on the output of the APE8873. 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 APE8873 series can deliver a current of up to 500mA over the full operating junction temperature range. However, the maximum output current must be derated 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:

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

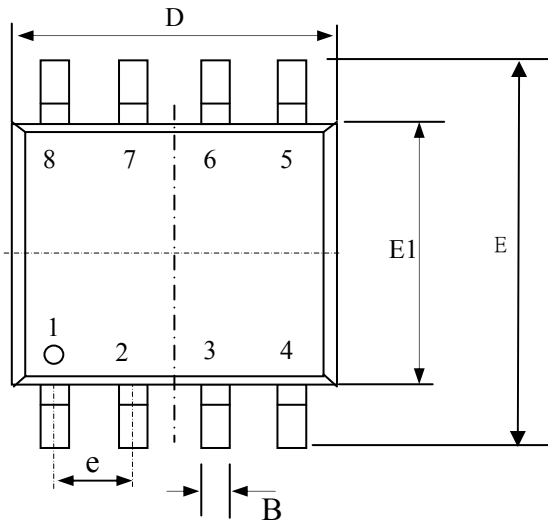
Where  $T_{J(MAX)}$  is the maximum junction temperature of the die (125° C) and  $T_A$  is the maximum ambient temperature. The junction to ambient thermal resistance ( $R_{thja}$ ) for SOP-8L package at recommended minimum footprint is 60°C/W. Visit our website in which “Recommended Footprints for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

### **PCB Layout**

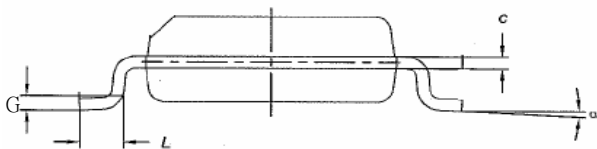
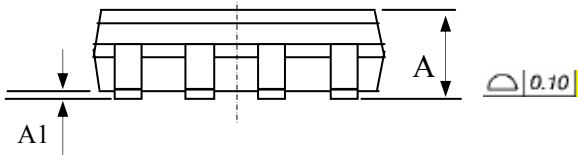
1. Please place the input capacitors close to the  $V_{IN}$
2. Ceramic capacitors for load must be placed near the load as close as possible
3. To place APE8873 and output capacitors near the load is good for performance.
4. Large current paths that  $V_{IN}$  and Output lines must have wide tracks.
5. GND connect large copper area can reduced IC temperature.



Package Outline : SO-8

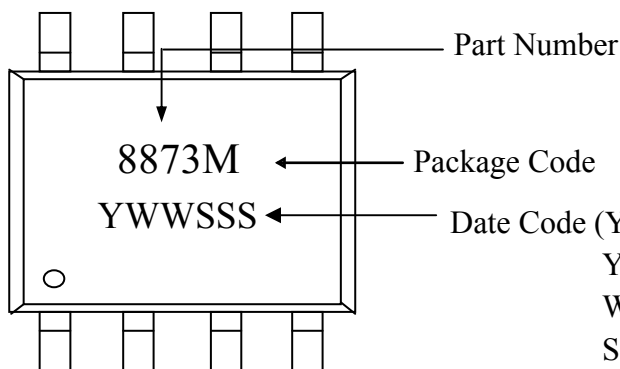


SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.18	0.25
B	0.33	0.41	0.51
c	0.19	0.22	0.25
D	4.80	4.90	5.00
E	5.80	6.15	6.50
E1	3.80	3.90	4.00
e	1.27 TYP		
G	0.254 TYP		
L	0.38	—	0.90
$\alpha$	0.00	4.00	8.00



1. All Dimension Are In Millimeters.
2. Dimension Does Not Include Mold Protrusions.

Part Marking Information & Packing : SO-8



Y : Last Digit Of The Year  
 WW : Week  
 SSS : Sequence