150mA CMOS LDO Regulator (Preliminary)

CYT6166

Description

The CYT6166 series of fixed output low dropout linear regulators are designed for portable battery powered applications, which require low dropout voltage and low ground current. Each device contains a voltage reference unit, an error amplifier, a PMOS power transistor, and resistors for setting output voltage, and current limit and temperature limit protection circuits.

The CYT6166 has been designed to be used with low cost capacitors and requires a minimum output capacitor of 1.0μF. Standard voltage versions are 1.5, 1.8, 2.5, 2.8, 3.0, and 3.3V.

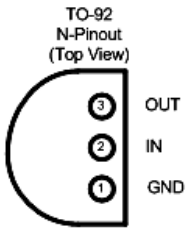
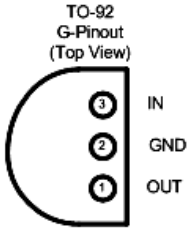
Features

- Typical Low Dropout Voltage of 203mV at 75mA.
- Guaranteed 150mA output over the full operating temperature range.
- Excellent Line and Load Regulation.
- High Accuracy Output Voltage of 2%.
- Typical Low Ground Current at 1mA
- Current Limiting and Thermal Protection.
- Standard SOT-23-3L, TO-92, and SOT-323-3L Package.

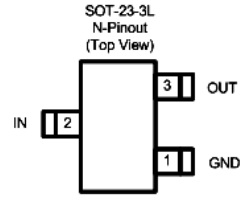
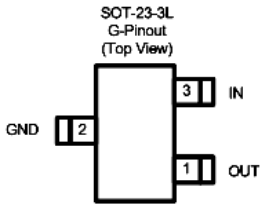
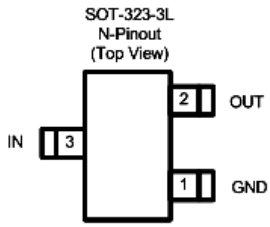
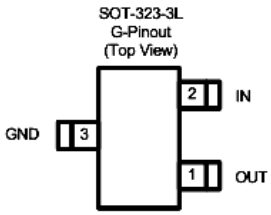
Applications

- Cellphones.
- Wireless LAN's.
- Hand-Held Instrumentation.
- Portable Video Game Devices.
- Digital Cameras.

Ordering/Marking Information

Package	Ordering Information		Marking Information	
	3.3V	CYT6166AHN	CYT6166AHN YYWW	YY: year code WW: week code.
	2.8V	CYT6166BHN	CYT6166BHN YYWW	
	2.5V	CYT6166CHN	CYT6166CHN YYWW	
	1.8V	CYT6166DHN	CYT6166DHN YYWW	
	1.5V	CYT6166EHN	CYT6166EHN YYWW	
	3.0V	CYT6166FHN	CYT6166FHN YYWW	
	3.3V	CYT6166AHG	CYT6166AHG YYWW	
	2.8V	CYT6166BHG	CYT6166BHG YYWW	
	2.5V	CYT6166CHG	CYT6166CHG YYWW	
	1.8V	CYT6166DHG	CYT6166DHG YYWW	
	1.5V	CYT6166EHG	CYT6166EHG YYWW	
	3.0V	CYT6166FHG	CYT6166FHG YYWW	

Ordering/Marking Information (Continued)

Package	Ordering Information		Marking Information	
	3.3V	CYT6166ALN	166AN_	Starting with 1, a bar on top of 1 is for production year 2001, and underlined 1 is for year 2002. The next character is marked on top for 2003, and underlined for 2004. The naming pattern continues with consecutive characters for later years. The last character is the week code. (A-Z: 1-26, a-z: 27-52)
	2.8V	CYT6166BLN	166BN_	
	2.5V	CYT6166CLN	166CN_	
	1.8V	CYT6166DLN	166DN_	
	1.5V	CYT6166ELN	166EN_	
	3.0V	CYT6166FLN	166FN_	
	3.3V	CYT6166ALG	166AG_	
	2.8V	CYT6166BLG	166BG_	
	2.5V	CYT6166CLG	166CG_	
	1.8V	CYT6166DLG	166DG_	
	1.5V	CYT6166ELG	166EG_	
	3.0V	CYT6166FLG	166FG_	
	3.3V	CYT6166APN	166AN_	
	2.8V	CYT6166BPN	166BN_	
	2.5V	CYT6166CPN	166CN_	
	1.8V	CYT6166DPN	166DN_	
	1.5V	CYT6166EPN	166EN_	
	3.0V	CYT6166FPN	166FN_	
	3.3V	CYT6166APG	166AG_	
	2.8V	CYT6166BPG	166BG_	
	2.5V	CYT6166CPG	166CG_	
	1.8V	CYT6166DPG	166DG_	
	1.5V	CYT6166EPG	166EG_	
	3.0V	CYT6166FPG	166FG_	

Absolute Maximum Ratings[1]

Supply Input Voltage (V_{IN}) ..…….…… 0.7V to +6V

Power Dissipation (P_D) ……. Internally Limited [3]

Junction Temperature (T_J) ……..... …0°C to +125°C

Lead Temperature (soldering, 5 sec.) ….....… 260°C

Storage Temperature (T_S) ……. -40°C to +150°C

Operating Ratings[2]

Supply Input Voltage (V_{IN}) ……..... +2.0V to +5.5V

Junction Temperature (T_J) …….. 0°C to +125°C

Package Thermal Resistance

160°C/W (TO-92)

230°C/W (SOT-23-3L)

250°C/W (SOT-323-3L)

Electrical Characteristics

V_{IN} = 5V; C_{IN} = 2.2µF; C_{OUT} = 2.2µF; I_{OUT} = 10mA; T_J = 25°C; unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OUT}	Output Voltage Accuracy	CYT6166 – 1.5V	1.470	1.5	1.530	
		CYT6166 – 1.8V	1.764	1.8	1.836	V
		CYT6166 – 2.5V	2.450	2.5	2.550	V
		CYT6166 – 2.8V	2.744	2.8	2.856	V
		CYT6166 – 3.0V	2.940	3.0	3.060	V
		CYT6166 – 3.3V	3.234	3.3	3.366	V
ΔV_{OUT}	Line Regulation	V_{IN} = V_{OUT} + 1V to 5.5V, I_{OUT} = 10mA	--	1	--	%
ΔV_{OUT}	Load Regulation [5]	V_{IN} = 5V; I_{OUT} = 10mA to 150mA	--	1	--	%
$\Delta V_{OUT}/\Delta T$	Output Voltage Temperature Coefficient	Note 4	--	0.79	--	mV/°C
$V_{IN} - V_{OUT}$	Dropout Voltage [6]	I_{OUT} = 10mA	--	20	--	mV
		I_{OUT} = 75mA	--	203	--	
		I_{OUT} = 150mA	--	500	--	
$T_{PROTECTION}$	Thermal Protection	Thermal Protection Temperature	--	150	--	°C
		Protection Hysterisys	--	20	--	
PSRR	Ripple Rejection	f = 120 Hz	--	51	--	dB
I_Q	Quiescent Current	I_{OUT} = 10mA	--	1	2	mA
I_{LIMIT}	Current Limit		300	--	--	mA

Note 1: Exceeding the absolute maximum rating may damage the device.

Note 2: The device is not guaranteed to function outside its operating rating.

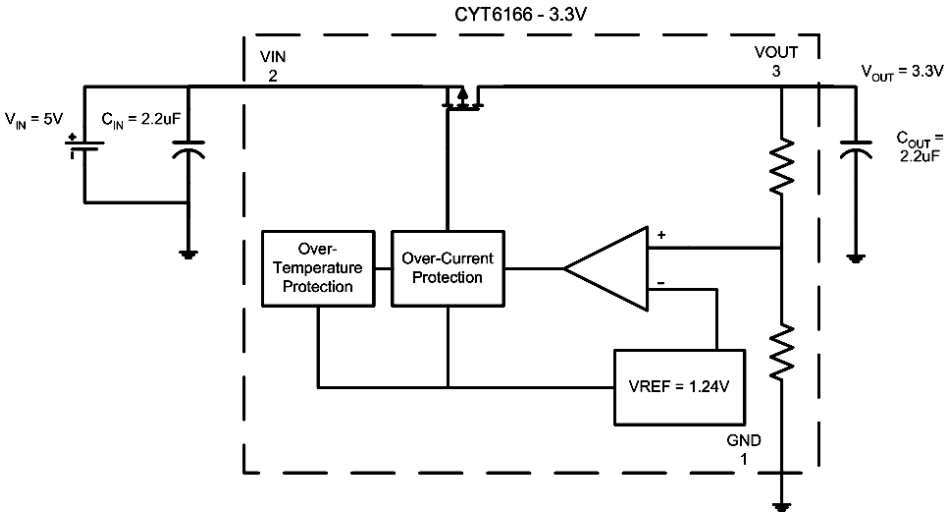
Note 3: The maximum allowable power dissipation at any T_A (ambient temperature) is calculated using: $P_{D(MAX)} = (T_{J(MAX)} – T_A)/\Theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown. See “Thermal Consideration” section for details

Note 4: Output voltage temperature coefficient is the worst case voltage change divided by the total temperature range.

Note 5: Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 0.1mA to 150mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.

Note 6: Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

Typical Application



Application Hints

Like any low dropout regulator, CYT6166 requires external capacitors to ensure stability. The external capacitors must be carefully selected to ensure performance.

Input Capacitor

An input capacitor of at least 2.2μF is required. Ceramic or Tantalum can be used. The value can be increase without upper limit.

Output Capacitor

An output capacitor is required for stability. It must be placed no more than 1 cm away from the V_{OUT} pin, and connected directly between V_{OUT} and GND pins. The minimum value is 2.2μF but may be increase without limit.

Thermal Considerations

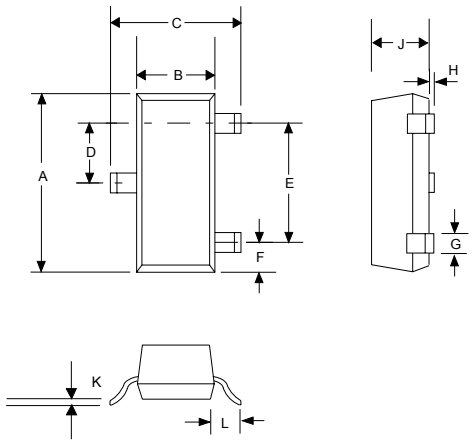
It is important that the thermal limit of the package is not exceeded. The CYT6166 has built-in thermal protection. When the thermal limit is exceeded, the IC will enter protection, and V_{OUT} will be pulled to ground. The power dissipation for a given application can be calculated as following:

The power dissipation (P_D) is

$P_D = I_{OUT} * [V_{IN} – V_{OUT}]$

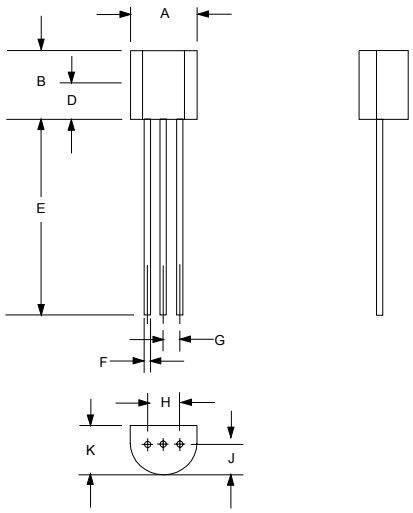
The thermal limit of the package is then limited to $P_{D(MAX)} = [T_J – T_A]/\Theta_{JA}$ where T_J is the junction temperature, T_A is the ambient temperature, and Θ_{JA} is around 250°C/W for CYT6166. CYT6166 is designed to enter thermal protection at 150°C. For example, if T_A is 25°C then the maximum P_D is limited to about 0.5W. In other words, if $I_{OUT(MAX)}$ = 150mA, then $[V_{IN} – V_{OUT}]$ cannot exceed 3.33V.

OUTLINE DRAWING SOT-23-3L (SC-59)



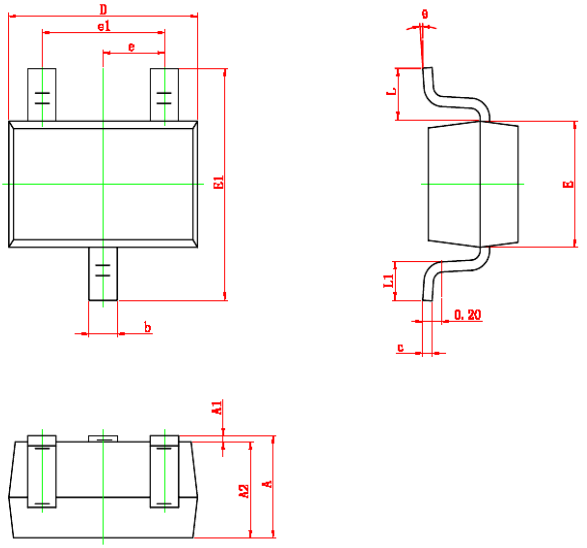
DIMENSIONS				
DIM^N	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.110	0.120	2.80	3.04
B	0.047	0.055	1.20	1.40
C	0.083	0.104	2.10	2.64
D	0.035	0.040	0.89	1.03
E	0.070	0.080	1.78	2.05
F	0.018	0.024	0.45	0.60
G	0.015	0.020	0.37	0.51
H	0.0005	0.004	0.013	0.10
J	0.034	0.040	0.887	1.02
K	0.003	0.007	0.085	0.18
L	-	0.027	-	0.69

OUTLINE DRAWING TO-92



DIMENSIONS				
DIM^N	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.445	5.207
B	0.170	0.210	4.318	5.334
E	0.500	0.610	12.70	15.50
F	0.016	0.021	0.407	0.533
G	0.045	0.055	1.143	1.397
H	0.095	0.105	2.413	2.667
J	0.080	0.105	2.032	2.667
K	0.125	0.165	3.175	4.191

OUTLINE DRAWING SOT-323-3L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.200	0.400	0.008	0.016
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 TYP		0.026 TYP	
e1	1.200	1.400	0.047	0.055
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°