
1A Low Dropout Voltage Regulator

FEATURES

- **Wide Input Range: 2.5V to 5.5V**
- **Available Output Voltages:**
1.5/1.8/2.0/2.5/2.8/3.0/3.3/3.7V
- **Low-Noise for RF Application**
- **Quick Start-Up (Typically 50us)**
- **Fast Response in Line/Load Transient**
- **Standby Current : <0.01uA**
- **TTL-Logic-Controlled Shutdown Input**
- **Low Temperature Coefficient**
- **Current Limiting Protection**
- **Thermal Shutdown Protection**
- **High Power Supply Rejection Ratio**
- **Only 1uF Output Capacitor Required for Stability**
- **Available Package (Lead-Free) :**
SOT-223, TO-252, TO-263

APPLICATIONS

- **Laptop, Palmtops, Notebook Computers**
- **Hand-Held Instruments**
- **PCMCIA Cards**
- **Portable Information Appliances**

GENERAL DESCRIPTION

The T6330A is designed for portable RF and wireless applications with demanding performance and space requirements. The T6330A performance is optimized for battery-powered systems to deliver ultra low noise and low quiescent current. Regulator ground current increases only slightly in dropout, further prolonging the battery life. The T6330A also works with small output capacitor, reducing the amount of board space necessary for power applications, critical in hand-held wireless devices. The T6330A consumes less than 0.01uA in shutdown mode and has fast turn-on time less than 50us. The other features include ultra low dropout voltage, high output accuracy, current limiting protection, and high ripple rejection ratio. Available in the SOT-223, TO-252 and TO - 263 packages.

PART NUMBER EXAMPLES

T6330A-18AXG
a b c d

a : Device Number

b : Output Voltage

15=1.5V, 18=1.8V, 20=2.0V, 25=2.5V
28=2.8V, 30=3.0V, 33=3.3V, 37=3.7V

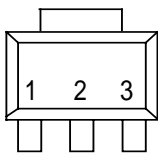
c : Pin-out / function and Package

AX=SOT-223(A), BX=SOT-223(B),
CX=SOT-223(C), DX=SOT-223(D),
AW=TO-252(A), BW=TO-252(B),
CW=TO-263(A), DW=TO-263(B),
EW=TO-263(C)

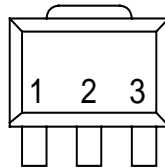
d : G=lead-free

PIN ARRANGEMENT (Top view)

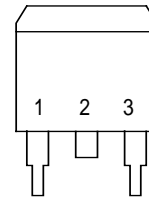
SOT-223
T6330A-XXXXG



TO-252
T6330A-XXXWG



SOT-263
T6330A-XXXWG



Parts. number	package	Pin out		
		1	2	3
T6330A-XXAXG	SOT-223(A)	OUT	GND	IN
T6330A-XXBXG	SOT-223(B)	GND	OUT	IN
T6330A-XXCXG	SOT-223(C)	GND	IN	OUT
T6330A-XXDXG	SOT-223(D)	IN	GND	OUT
T6330A-XXAWG	TO-252(A)	GND	OUT	IN
T6330A-XXBWG	TO-252(B)	IN	GND	OUT
T6330A-XXCWG	TO-263(A)	GND	OUT	IN
T6330A-XXDWG	TO-263(B)	GND	IN	OUT
T6330A-XXEWG	TO-263(C)	IN	GND	OUT

PIN DESCRIPTION

SYMBOL	DESCRIPTION
OUT	Voltage output
GND	Ground pin
IN	Input supply pin.

Absolute Maximum Ratings

Supply Voltage	-0.3V to 6V
EN Pin Input Voltage	-0.3V to 6V
Operating Junction Temperature	-55°C to +150°C
Operating temperature range	-40°C to +125°C
Storage temperature range	-65°C to +150°C
Lead temperature (soldering, 10sec)	260°C
Power Dissipation, PD @ TA = 25°C :	
SOT-223	1.8W
TO-252	2.0W
TO-263	2.2W
Package Thermal Resistance :	
SOT-223 θ_{JA}	80°C/W
TO-252 θ_{JA}	70°C/W
TO-263 θ_{JA}	65°C/W
ESD Susceptibility	
HBM (Human Body Mode)	2KV
MM (Machine Mode)	200V

Electrical Characteristics

($V_{IN} = V_{OUT} + 1V$, $T_A = 25^\circ C$, $C_{IN} = C_{OUT} = 10\mu F$, unless otherwise noted)

Symbol	Description	Conditions	Min.	Typ.	Max	Unit	
V_{IN}	Input Voltage		2.5	-	5.5	V	
ΔV_{OUT}	Output Voltage Accuracy	$I_{OUT} = 1mA$	-2	-	+2	%	
I_{OUT}	Output current		-	1	-	A	
I_{LIM}	Current Limit	$R_{Load} = 1\ ohm$	-	1.2	-	A	
I_Q	Quiescent Current	$EN \geq 1.2V$, $I_{OUT} = 0mA$	-	35	50	μA	
ΔV_{LINE}	Line Regulation	$V_{IN} = V_{OUT} + 1V$ to 5.5V, $I_{OUT} = 1mA$	-	3	10	mV	
ΔV_{LOAD}	Load Regulation	$0.1mA < I_{OUT} < 500mA$	-	10	30	mV	
V_{DROP}	Dropout Voltage	$I_L = 100mA$	-	70	100	mV	
		$I_L = 500mA$	-	350	550	mV	
		$I_L = 1.0A$	-	800	1000	mV	
I_{SHDN}	Shutdown current	$EN = V_{IN}$	-	0.01	1	μA	
I_{IBEN}	EN Input Bias Current	$EN = V_{IN}$ or GND	-	0	100	nA	
V_{ENH}	EN Input High Voltage		1.2	-	-	V	
V_{ENL}	EN Input Low Voltage		-	-	0.4	V	
PSRR	Power Supply Rejection Rate	$C_{OUT} = 10\mu F$, $I_{OUT} = 100mA$	$f = 100Hz$	-	-60	-	dB
			$f = 10KHz$	-	-30	-	
T_{SD}	Thermal Shutdown Temperature		-	165	-	°C	
ΔT_{SD}	Thermal Shutdown Temperature Hysteresis		-	30	-	°C	

Applications Information

Like any voltage regulator, the external capacitors used for the T6330A must be carefully selected for regulator stability and performance. Using a capacitor whose value is $> 10\mu\text{F}$ on the T6330A input and the amount of capacitance can be increased without limit. The input capacitor must be located a distance of not more than 0.5 inch from the input pin of the IC and returned to a clean analog ground. Any good quality ceramic or tantalum can be used for this capacitor. The capacitor with larger value and lower ESR (equivalent series resistance) provides better PSRR and line-transient response.

The output capacitor must meet both requirements for minimum amount of capacitance and ESR in all voltage regulator application. The T6330A is designed specifically to work with low ESR ceramic output capacitor in space-saving and performance consideration. Using a ceramic capacitor whose value is at least $10\mu\text{F}$ with ESR is more than $20\text{m}\Omega$ on the T6330A output ensures stability. The T6330A still works well with output capacitor of other types due to the wide stable ESR range. Output capacitor of larger capacitance can reduce noise and improve load transient response, stability and PSRR. The output capacitor should be located within 0.5 inch from the VOUT pin of the T6330A and returned to a clean analog ground.

Enable Function

The T6330A features an voltage regulator enable/disable function. To assure the T6330A voltage regulator will switch on, the EN turn on control level must be greater than 1.2V. The T6330A voltage regulator will go into shutdown mode when the voltage on the EN pin falls below 0.4V. The T6330A equips a quick-discharge function to protect the system. When the regulator is turned off by EN pin, the internal MOSFET between VOUT and GND will be turned on to discharge output voltage quickly. If the enable function is not needed in a specific application, it may be tied to GND/VIN to keep the voltage regulator in a continuously on state.

Thermal Considerations

Thermal protection limits power dissipation in T6330A. When the operating junction temperature exceeds 165°C, the OTP circuit starts the thermal shutdown function and turns the pass element off. The pass element turns on again after the junction temperature cools by 30°C. For continuous operation, do not exceed absolute maximum operating junction temperature 125°C. The power dissipation definition in device is shown as following formula :

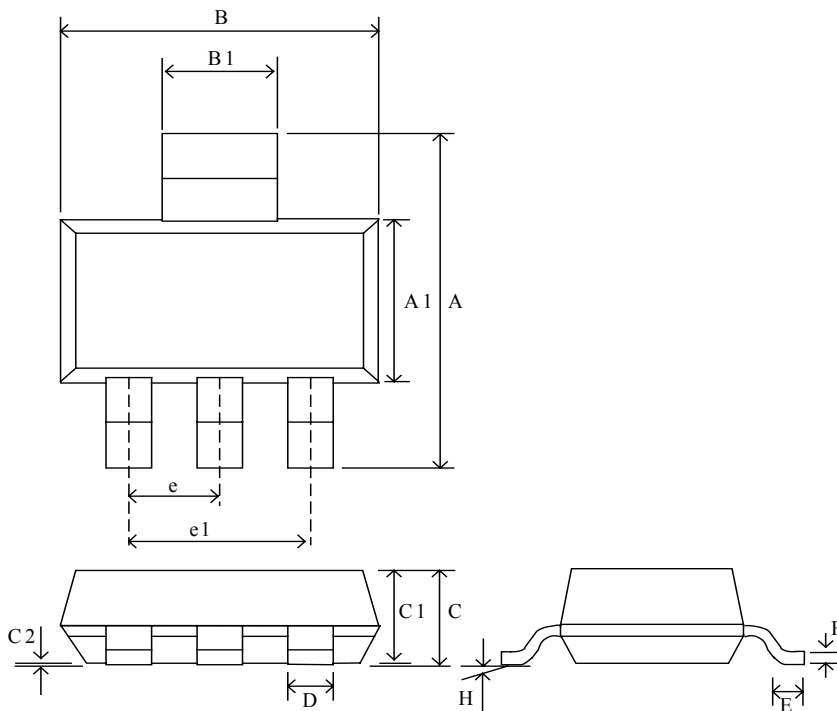
$$PD = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_Q$$

The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junction to ambient. The maximum power dissipation can be calculated by following formula :

$$PD(MAX) = (T_{J(MAX)} - T_A) / \theta_{JA}$$

Where $T_{J(MAX)}$ is the maximum operating junction temperature 125°C, T_A is the ambient temperature and the θ_{JA} is the junction to ambient thermal resistance. For recommended operating conditions specification of T6330A, where $T_{J(MAX)}$ is the maximum junction temperature of the die (125°C) and T_A is the maximum ambient temperature.

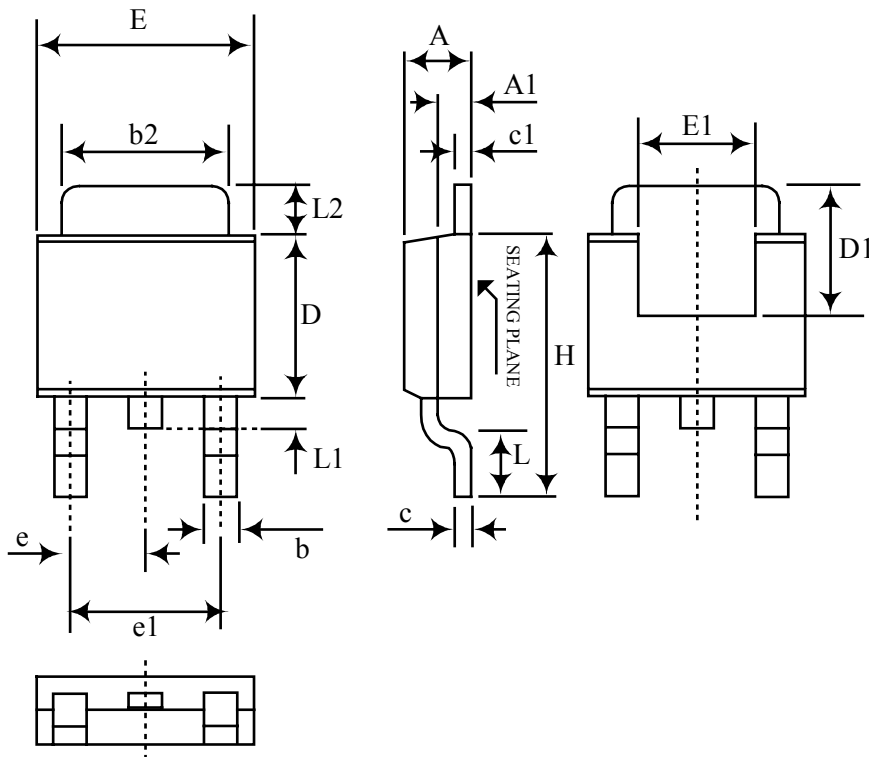
PACKAGE DIMENSIONS
PACKAGE DIMENSIONS
SOT-223



Symbol	Dimension in mm			Dimension in inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	6.70	7.00	7.30	0.263	0.275	0.287
A1	3.30	3.50	3.70	0.129	0.137	0.145
B	6.30	6.50	6.70	0.248	0.255	0.263
B1	2.90	3.00	3.10	0.114	0.118	0.122
C	-	-	1.80	-	-	0.70
C1	1.50	1.60	1.70	0.059	0.062	0.066
C2	0.02	-	0.10	0.001	-	0.003
D	0.66	0.70	0.84	0.025	0.027	0.033
E	0.75	-	-	0.029	-	-
e	-	2.30	-	-	0.090	-
e1	-	4.6	-	-	0.181	-
F	0.23	0.30	0.35	0.009	0.011	0.013
H	0~10°			0~10°		

PACKAGE DIMENSIONS

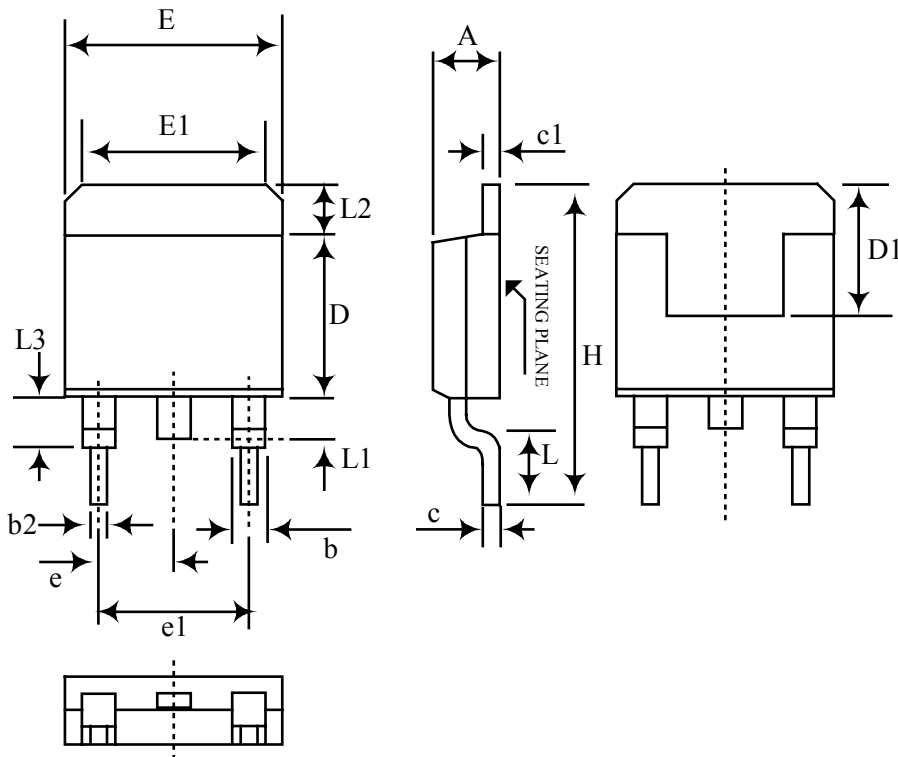
3-LEAD TO-252



Symbol	Dimension in inch		Dimension in mm	
	Min.	Max.	Min.	Max.
A	0.087	0.094	2.20	2.40
A1	0.037	0.041	0.95	1.05
b	0.030	0.033	0.77	0.85
b2	0.209	0.215	5.30	5.45
c	0.017	0.023	0.43	0.58
c1	0.017	0.023	0.43	0.58
D	0.236	0.244	6.00	6.20
D1	0.150 (REF.)		3.80 (REF.)	
E	0.250	0.262	6.35	6.65
E1	0.150 (REF.)		3.80 (REF.)	
e	0.090 (TYP.)		2.29 (TYP.)	
e1	0.180 (TYP.)		4.58 (TYP.)	
H	0.338	0.345	8.60	9.00
L	0.056	0.064	1.42	1.63
L1	0.026	0.033	0.65	0.85
L2	0.043	0.047	1.10	1.20

PACKAGE DIMENSIONS

3-LEAD TO-263



Symbol	Dimension in inch		Dimension in mm	
	Min.	Max.	Min.	Max.
A	0.169	0.185	4.30	4.70
b	0.046	0.054	1.17	1.37
b2	0.027	0.035	0.70	0.90
c	0.017	0.024	0.45	0.60
c1	0.049	0.055	1.25	1.40
D	0.354	0.370	9.00	9.40
D1	0.330 (REF.)		8.40 (REF.)	
E	0.380	0.433	9.70	11.0
E1	0.275 (REF.)		7.00 (REF.)	
e	0.100 (TYP.)		2.54 (TYP.)	
e1	0.200 (TYP.)		5.08 (TYP.)	
H	0.590	0.614	15.00	15.60
L	0.098	0.0101	2.51	2.57
L1	0.047	0.063	1.20	1.60
L2	0.039	0.055	1.00	1.40
L3	0.108 (REF.)		2.75 (REF.)	