

AN6531

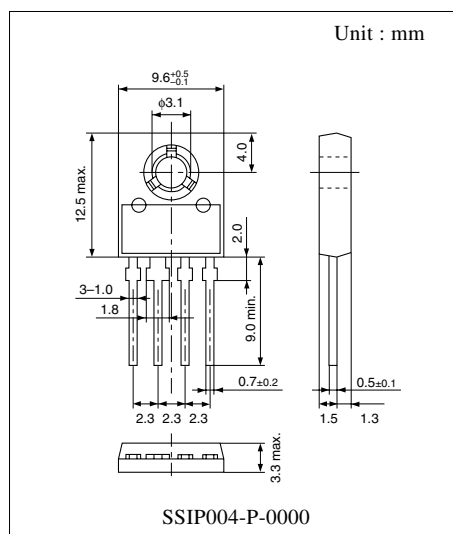
4-pin variable positive output voltage regulator

Overview

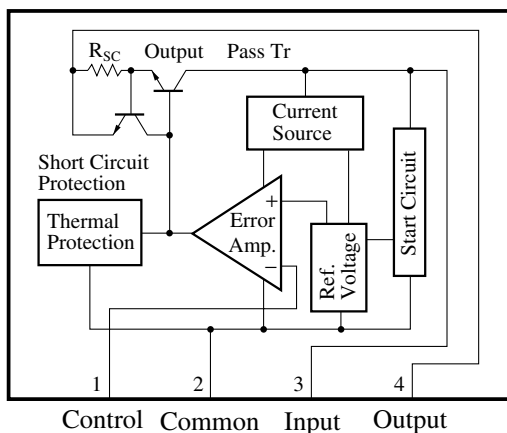
The AN6531 is a monolithic 4-pin variable positive output voltage regulator. With an external resistor, it provides any stabilized output voltages between 5V and 30V, and is optimum for the power circuits with a current capacity of up to 0.5A. This IC incorporates various protection circuits.

Features

- Wide range of output voltages: $V_O = 5$ to 30V
- Built-in thermal overload protection circuit
- Built-in overcurrent protection circuit
- Built-in ASO (area of safe operation) protection circuit



Block Diagram



■ Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	40	V
Supply current	I_{CC}^*	1.5	A
Power dissipation	P_D	7.5	W
Operating ambient temperature	T_{opr}	-20 to +75	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to +150	$^\circ\text{C}$

* The internal circuit is provided with a current limiting circuit.

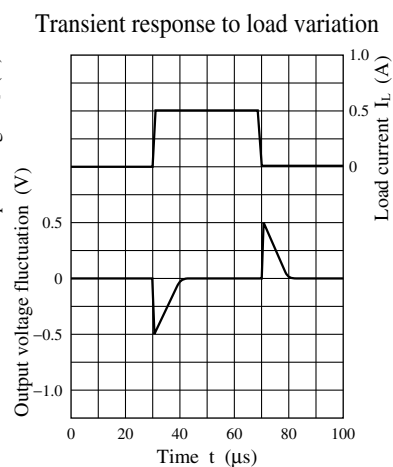
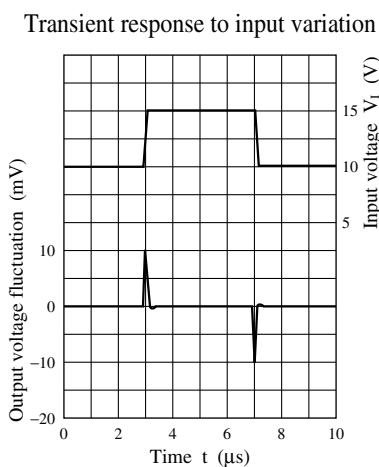
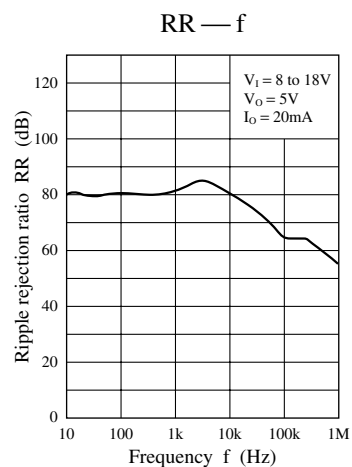
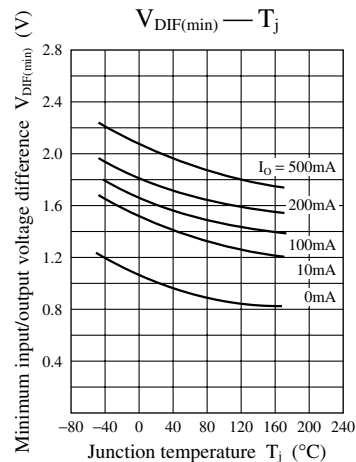
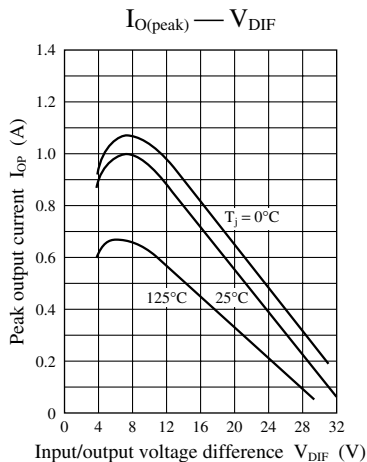
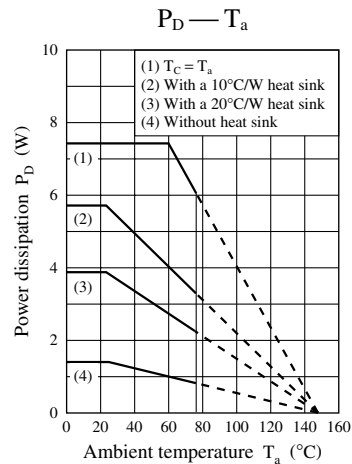
■ Electrical Characteristics at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage tolerance	V_O	$V_I = V_O + 3\text{V to } V_O + 15\text{V}$, $I_O = 5 \text{ to } 350\text{mA}$, $T_j = 25^\circ\text{C}$	—	—	4	%
Line regulation	REG_{IN}	$V_O = 5\text{V}$, $I_O = 200\text{mA}$, $V_I = 7.5 \text{ to } 25\text{V}$, $T_j = 25^\circ\text{C}$	—	—	1	%
		$V_O = 18\text{V}$, $I_O = 5\text{mA}$, $V_I = 21 \text{ to } 33\text{V}$, $T_j = 25^\circ\text{C}$	—	—	0.75	%
		$V_O = 18\text{V}$, $I_O = 200\text{mA}$, $V_I = 21 \text{ to } 25\text{V}$, $T_j = 25^\circ\text{C}$	—	—	0.67	%
Load regulation	REG_L	$V_O = 5\text{V}$, $V_I = 12\text{V}$, $I_O = 5 \text{ to } 500\text{mA}$, $T_j = 25^\circ\text{C}$	—	—	1	%
Bias current	I_{Bias}	$T_j = 25^\circ\text{C}$	—	3	5	mA
Control pin current	I_{cont}	$T_j = 25^\circ\text{C}$	—	1	8	μA
Ripple rejection ratio	RR	$V_I = 8 \text{ to } 18\text{V}$, $V_O = 5\text{V}$, $f = 120\text{Hz}$	62	80	—	dB
Output noise voltage	V_{no}	$V_O = 5\text{V}$, $f = 10\text{Hz to } 100\text{kHz}$	—	40	—	μV
Minimum input/output voltage difference	$V_{DIF(min)}$	$I_O = 500\text{mA}$, $T_j = 25^\circ\text{C}$	—	2	—	V
Output short-circuit current	I_{OS}	$V_I = 35\text{V}$, $V_O = 5\text{V}$, $T_j = 25^\circ\text{C}$	—	50	600	mA
Peak output current	I_{OP}	$V_O = 5\text{V}$, $T_j = 25^\circ\text{C}$	0.4	1	1.4	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$V_O = 5\text{V}$ $I_O = 5\text{mA}$	$T_j = -55 \text{ to } +25^\circ\text{C}$	—	0.5	$\text{mV}/^\circ\text{C}$
			$T_j = 25 \text{ to } 150^\circ\text{C}$	—	-0.5	
Control pin voltage	V_{cont}	$T_j = 25^\circ\text{C}$	4.8	5	5.2	V

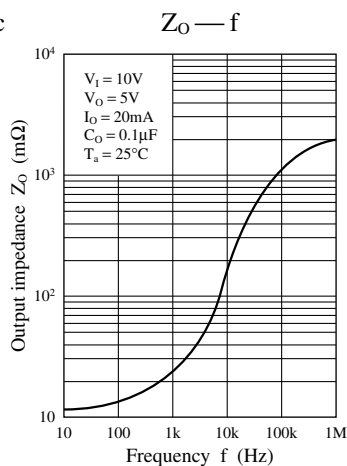
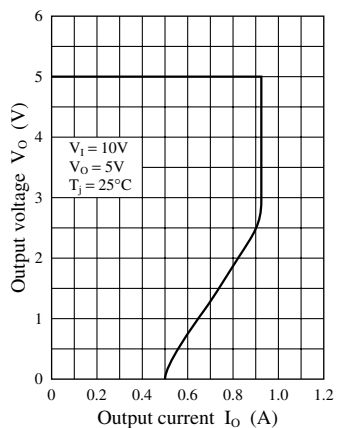
Note 1) The specified condition $T_j = 25^\circ\text{C}$ means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.

Note 2) Unless otherwise specified, $V_I = 10\text{V}$, $V_O = 5\text{V}$, $I_O = 350\text{mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$

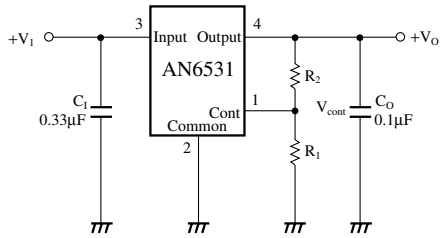
Main Characteristics



Current limiting characteristic



Basic Regulator Circuit



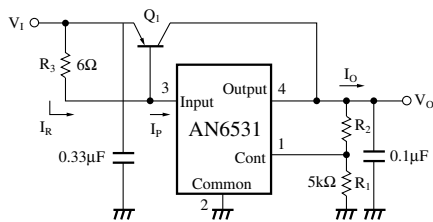
$$V_O = V_{\text{cont}} \left(\frac{R_1 + R_2}{R_1} \right)$$

$$(V_{\text{cont}} \approx 5V, R_1 = 5k\Omega)$$

C_1 is necessary when the V_1 line is long.
 C_0 improves the transient response.

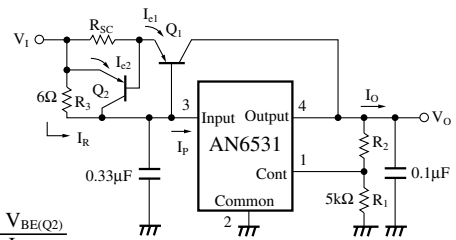
Application Circuit Examples

1. Current bootstrap circuit



$$R_3 = \frac{V_{BE(Q1)} \cdot \beta}{(\beta + 1) I_P - I_O}$$

2. Current bootstrap circuit (with current limiting circuit)



$$R_{SC} = \frac{V_{BE(Q2)}}{I_{e1(max)}}$$

$$R_3 = \frac{V_{BE(Q1)} + I_{e1} R_{SC}}{I_O - I_{e1}}$$

$$I_{e2(max)} = I_{P(max)} - \frac{V_{BE(Q1)} + V_{BE(Q2)}}{R_3}$$