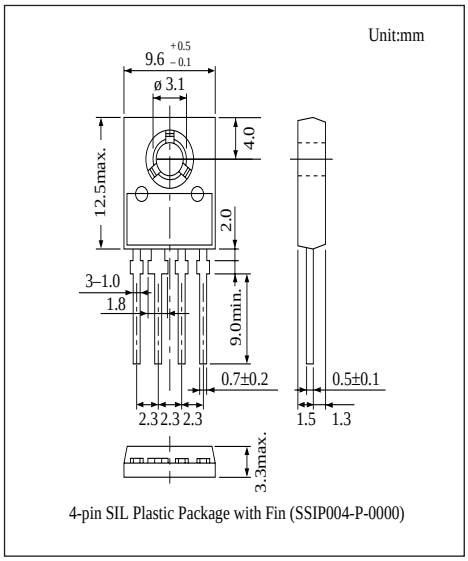
AN6535

4-pin Negative Adjustable Voltage Regulator



4-pin SIL Plastic Package with Fin (SSIP004-P-0000)

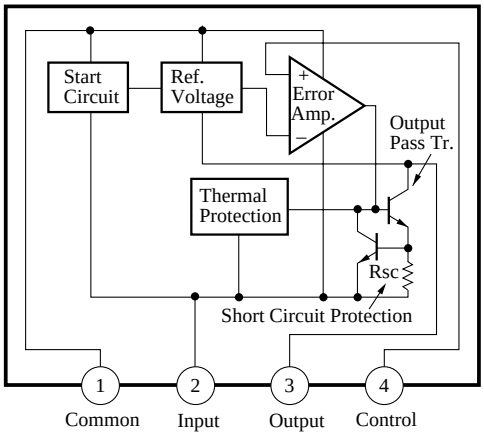
■ Overview

The AN6535 is a monolithic 4-pin negative adjustable 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 capacitance of up to 0.5A. With various protective circuits built in, it has high reliability and is provided in a 4-lead SIL plastic package.

■ Features

- Wide range of output voltages:V_O= –5 to –30V
- Interal thermal overload protection
- Interal short-circuit protection
- Output transistor safe area compensation

■ Block Diagram



■ Absolute Maximum Ratings (Ta=25˚C)

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	–40	V
Supply current	I_{CC} *1	1	A
Power dissipation	P_D	7.5	W
Operating ambient temperature	T_{opr}	–20 to +80	˚C
Storage	T_{stg}	–55 to +150	˚C

*1 The internal circuit is provided with a current limiting circuit.
*2 Maximum power dissipation value when there is no heat sink (The value varies depending on the external heat dissipation state)

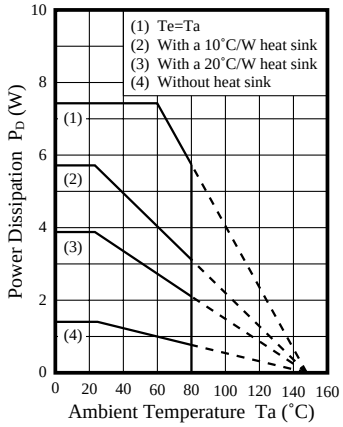
■ Electrical Characteristics (Ta=25˚C)

Parameter	Symbol	Condition		min	typ	max	Unit
Output voltage tolerance	V_O	V_I=V_O–3V to V_O–15V, I_O=5 to 350mA, T_j=25˚C		—	—	4	%
Line regulation	REG_{IN}	V_O=–5V, I_O=200mA, V_I=–7.5 to –25V, T_j=25˚C		—	—	1	%
		V_O=–18V, I_O=5mA, V_I=–21 to –33V, T_j=25˚C		—	—	0.75	%
		V_O=–18V, I_O=200mA, V_I=–21 to –25V, T_j=25˚C		—	—	0.67	%
Load regulation	REG_L	I_O=5 to 500mA, T_j=25˚C	V_O=–5V, V_I=–12V	—	—	1	%
			V_O=–18V, V_I=–25V				
Bias current	I_{Bias}	T_j=25˚C		—	1.5	3	mA
Control pin current	I_{cont}	T_j=25˚C		—	—	3	µA
Ripple rejection ratio	RR	V_I=–8 to –18V, V_O=–5V, f=120Hz		60	—	—	dB
Output noise voltage	V_{no}	V_O=–5V, f=10Hz to 100kHz		—	40	—	µV
Minimum input/output voltage difference	$V_{DIF\ (min.)}$	I_O=500mA, T_j=25˚C		—	1.1	—	V
Short-circuit current	I_{OS}	V_I=–35V, V_O=–5V, T_j=25˚C		—	100	600	mA
Peak output current	I_{OP}	V_O=–5V, T_j=25˚C		0.4	0.8	1.4	A
Output voltage temperatrue coefficient	$\Delta V_O/Ta$	V_O=–5V	T_j=–20 to +25˚C	—	0.2	—	mV/˚C
		I_O=5mA	T_j=25 to 150˚C	—	– 0.3	—	
Control pin voltage	V_{cont}	T_j=25˚C		–3.12	–3	–2.88	V

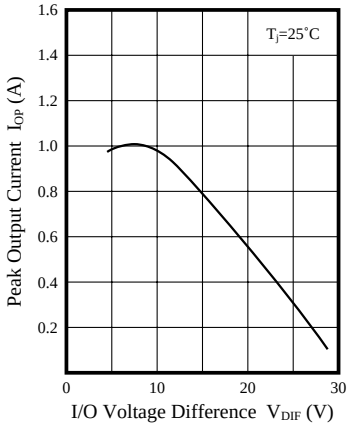
Note 1) The specified condition Tj=25˚C means that the test should be conducted with each test time reduced (within 10 ms) so that the drift in the characteristic value due to a temperature rise at chip junction can be ignored.
Note 2) Unless otherwise specified, V_I=–10V, V_O=–5V, I_O=350mA, C_I=2µF, and C_O=1µF

■ Characteristics Curve

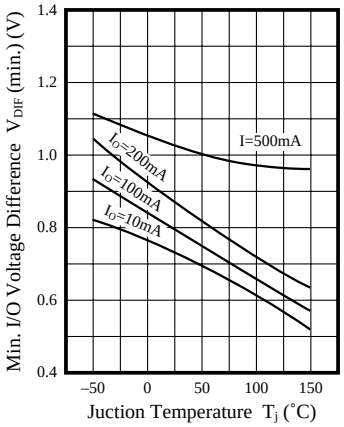
P_D – Ta



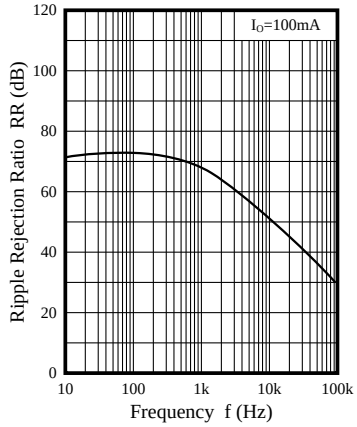
I_{OP} – V_{DIF}



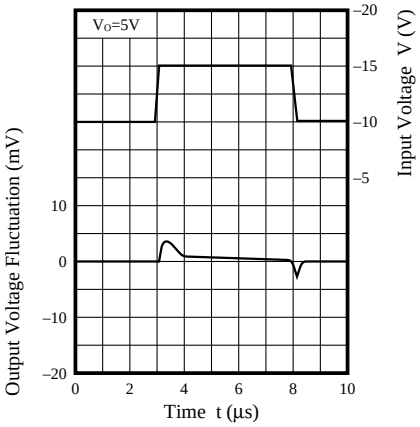
$V_{DIF\ (min.)}$ – T_j



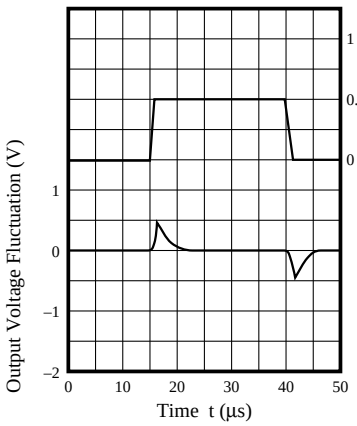
RR– f



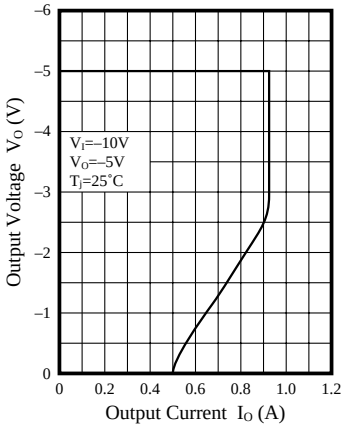
Line Transient Response



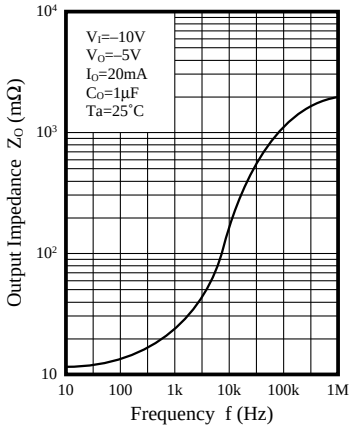
Load Transient Response



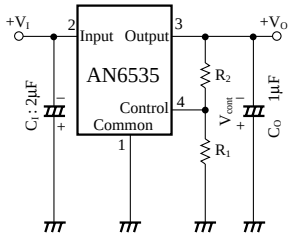
Output Current Limit



Z_O – f



■ Basic Regulator Circuit



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

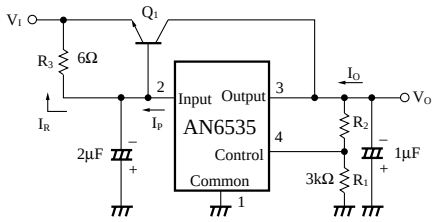
($V_{cont} \cong 3V$, $R_1 = 3k\Omega$)

C_I : Necessary when the V_I line is long.

C_O : Improves the transient response.

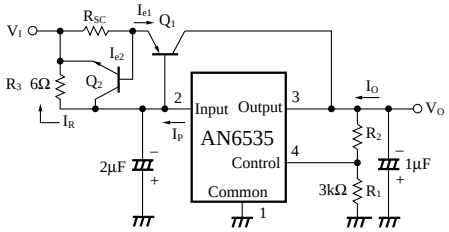
■ Application Circuits

(1) Current Boost Circuit



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

(2) Current Boost Circuit
(With Current Limiting Circuit)



$$R_{SC} = \frac{V_{BE\,(Q1)}}{I_{e1\,(max.)}}$$

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

$$I_{e1\,(max.)} = I_{P\,(max.)} - \frac{V_{BE\,(Q1)} + V_{BE\,(Q1)}}{R_3}$$