

## Dual Output Low ESR Cap. Low-Dropout 300mA Linear Regulator

### ■ FEATURES

- Up to 300mA Output Current for Each LDO.
- Low Quiescent Current : 50 $\mu$ A ( $V_{OUT1}$  and  $V_{OUT2}$  Enable Mode).
- Low Dropout : 200mV at 300mA Load Current and 3.3V Output Voltage.
- High PSRR : 70dB at 1kHz.
- Independent Shutdown Controls.
- Current Limit and Thermal Protection.
- Tiny SOT-23-6, DFN 6L-2X2 Package.

### ■ APPLICATIONS

- Cellular Phones.
- PDAs.
- Digital Still Cameras.
- Portable Consumer Equipments.

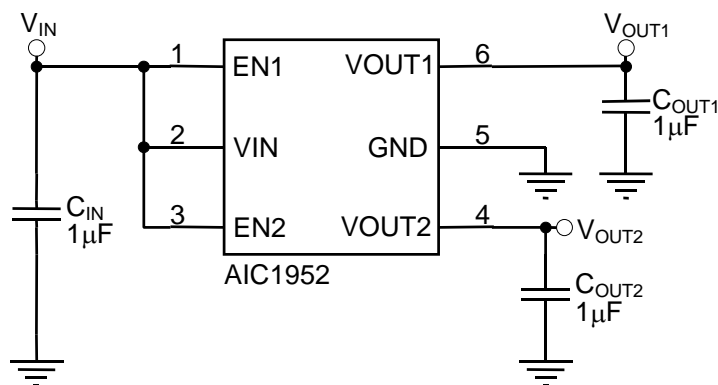
### ■ DESCRIPTION

The AIC1952 is a dual output linear regulator in a tiny SOT-23-6, DFN 6L-2X2 package. It is optimized for low ESR ceramic capacitors operation and up to 300mA continuous current on each output.

The AIC1952 offers high precision output voltage of  $\pm 2\%$ . At 300mA load current, a 200mV dropout is performed when output voltage is equal to 3.3V. The quality of low quiescent current and low dropout voltage makes this device ideal for battery power applications. The high ripple rejection and low noise of the AIC1952 provide enhanced performances for critical applications such as cellular phones, and PDAs.

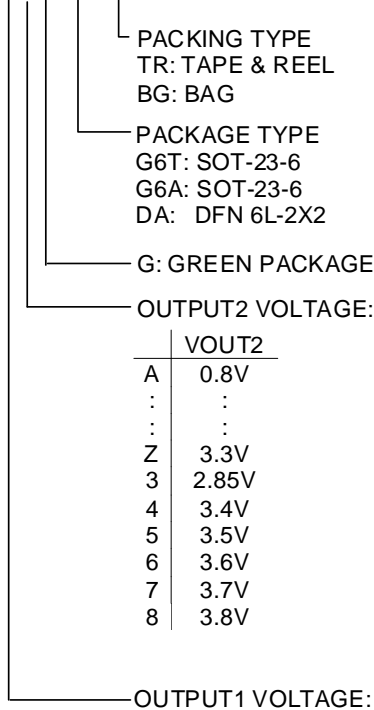
The AIC1952 includes current limit and thermal shutdown protection. Each of the output is controlled independently.

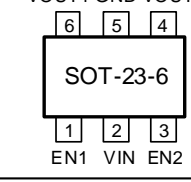
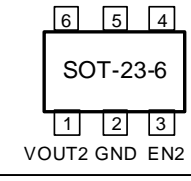
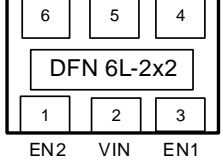
### ■ TYPICAL APPLICATION CIRCUIT



**ORDERING INFORMATION**

AIC1952-XXXXXXXX



PACKAGE TYPE	PIN CONFIGURATION
G6T (SOT-23-6)	FRONT VIEW VOUT1 GND VOUT2 
G6A (SOT-23-6)	FRONT VIEW VOUT1 VIN EN1 
DA (DFN 6L-2x2)	FRONT VIEW VOUT2 VOUT1 GND 

(Internally set VOUT1、VOUT2 and PACKAGE TYPE, refer to the "designator xxxxxx" table below. For other combinations, a unit of 0.1V within 0.8~3.8V, additional voltage versions and package type are available on demand.)

Example: AIC1952-KEGG6TTR

- Vout1 = 1.8V, Vout2 = 1.2V, with G6T type pin configuration in SOT-23-6 Green package and TAPE & REEL packing.

AIC1952-ZKGG6ATR

- Vout1 = 3.3V, Vout2 = 1.8V, with G6A type pin configuration in SOT-23-6 Green package and TAPE & REEL packing.

**●Designator xxxxxx**

Designator xxxxxx	Output Voltage		Designator xxxxxx	Output Voltage	
	VOUT1	VOUT2		VOUT1	VOUT2
WWGG6T WWGG6A	3.0	3.0	DEGG6T DEGG6A	1.1	1.2
EZGG6T EZGG6A	1.2	3.3	KHGG6T KHGG6A	1.8	1.5
W3GG6T W3GG6A	3.0	2.85	KEGG6T KEGG6A	1.8	1.2
ZKGG6T ZKGG6A	3.3	1.8	ZWGG6T ZWGG6A	3.3	3.0
UHGG6T UHGG6A	2.8	1.5	ZZGG6T ZZGG6A	3.3	3.3
33GG6T 33GG6A	2.85	2.85	KZGG6T KZGG6A	1.8	3.3
KUGG6T KUGG6A	1.8	2.8	UKGG6T UKGG6A	2.8	1.8
HUGG6T HUGG6A	1.5	2.8	ZUGG6T ZUGG6A	3.3	2.8
WRGG6T WRGG6A	3.0	2.5	ERGG6T ERGG6A	1.2	2.5
UZGG6T	2.8	3.3			

**●SOT-23-6 Marking**

Part No.	Marking	Output Voltage
AIC1952-xxGG6T	GQxxG	1st X -> Vout1, 2nd X -> Vout2 X=A,B,C...Y, Z, 3~8 (A=0.8V, B=0.9V,...Y=3.2V, Z=3.3V, 3=2.85V, 4=3.4V, 5=3.5V,...8=3.8V), 0.1V a step
AIC1952-xxGG6A	GPxxG	1st X -> Vout1, 2nd X -> Vout2 X=A,B,C...Y, Z, 3~8 (A=0.8V, B=0.9V,...Y=3.2V, Z=3.3V, 3=2.85V, 4=3.4V, 5=3.5V,...8=3.8V), 0.1V a step

**●DFN 6L-2X2 Marking**

Part No.	Marking	Output Voltage
AIC1952-xxGDA	GTxxG	1st X -> Vout1, 2nd X -> Vout2 X=A,B,C...Y, Z, 3~8 (A=0.8V, B=0.9V,...Y=3.2V, Z=3.3V, 3=2.85V, 4=3.4V, 5=3.5V,...8=3.8V), 0.1V a step

**■ ABSOLUTE MAXIMUM RATINGS**

Input Voltage .....	7V
EN Pin Voltage.....	7V
Operating Ambient Temperature Range $T_A$ .....	-40°C~85°C
Operating Maximum Junction Temperature $T_J$ .....	150°C
Storage Temperature Range $T_{STG}$ .....	-65°C~150°C
Lead Temperature (Soldering 10 Sec.).....	260°C
Thermal Resistance Junction to Case	
SOT-23-6 .....	115°C/W
DFN 6L-2X2*.....	30°C/W
Thermal Resistance Junction to Ambient	
SOT-23-6 .....	250°C/W
DFN 6L-2X2*.....	165°C/W

(Assume no ambient airflow)

**Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.**

\*The package is place on a two layers PCB with 2 ounces copper and 2 square inch, connected by 8 vias.

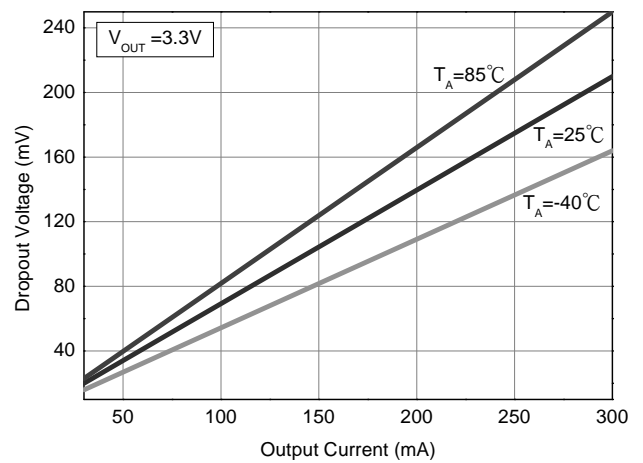
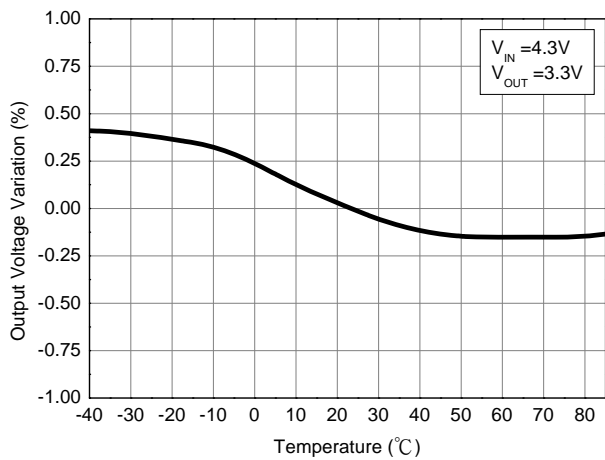
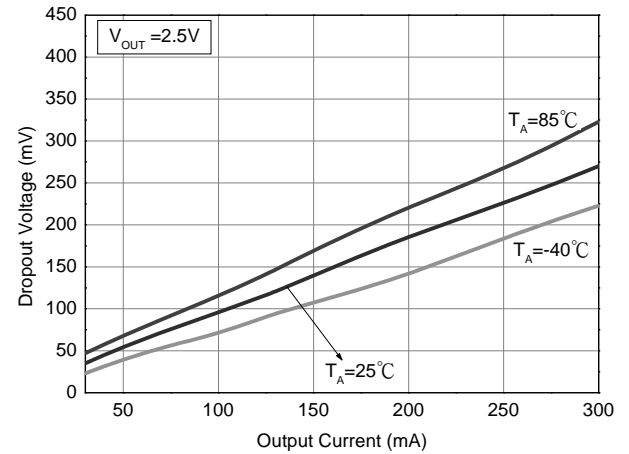
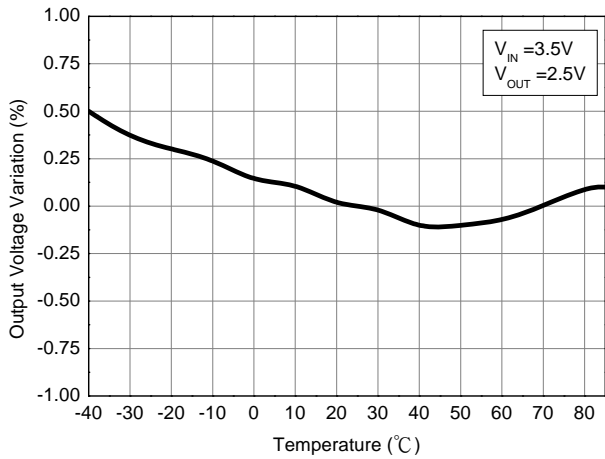
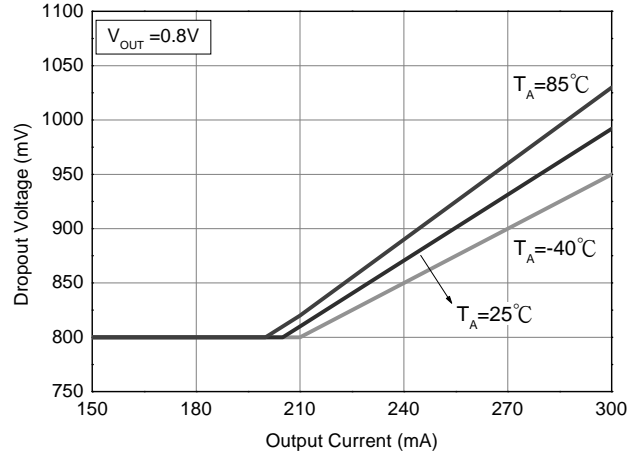
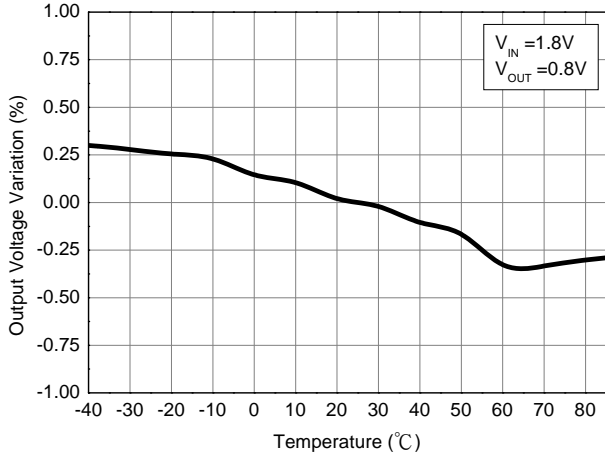
**ELECTRICAL CHARACTERISTICS**
**( $V_{IN} = V_{OUT} + 1V$ ,  $V_{EN1}=V_{EN2}= V_{IN}$ ,  $T_J=25^{\circ}C$ , unless otherwise specified) (Note 1)**

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT	
Input Voltage (Note 2)		$V_{IN}$	1.6		6.0	V	
Output Voltage Tolerance	$V_{IN}= 6V$ , $I_{OUT} = 1mA$	$V_{OUT}$	-2		2	%	
Continuous Output Current		$I_{OUT}$	300			mA	
Quiescent Current	$V_{EN2} = V_{EN1} = V_{IN}$	$I_Q$		50	80	$\mu A$	
GND Pin Current	$I_{OUT1} = 300mA$ & $I_{OUT2} = 300mA$ , $V_{EN2} = V_{EN1} = V_{IN}$	$I_{GND}$		55	80	$\mu A$	
Standby Current	$V_{EN1}=V_{EN2}= 0$	$I_{STBY}$			0.1	$\mu A$	
Output Current Limit	$V_{IN}= 5V$ , $V_{OUT} = GND$	$I_{IL}$	340	500	720	mA	
Dropout Voltage	$I_{OUT} = 300mA$	$V_{DROP}$			640	700	mV
					380	440	
					270	330	
					200	250	
Line Regulation	$V_{IN} = V_{OUT} + 1V$ to 6V	$\Delta V_{LIR}$		3	16	mV	
Load Regulation	$I_{OUT} = 1mA$ to 300mA	$\Delta V_{LOR}$		2	10	mV	
Ripple Rejection	$f=1kHz$ , Ripple=0.5Vp-p,	PSRR		70		dB	
Output Noise Voltage	$f= 10\sim 100KHz$			24		$\mu V_{rms}$	
Temperature Coefficient		TC		50		ppm/ $^{\circ}C$	
Thermal Shutdown Temperature	$V_{IN} = V_{OUT} + 1V$			150		$^{\circ}C$	
Thermal Shutdown Hysteresis				35		$^{\circ}C$	
<b>EN Pin SPECIFICATIONS</b>							
EN Pin Current	$V_{EN1} = V_{EN2} = V_{IN}$	$I_{EN}$			0.1	$\mu A$	
Shutdown Exit Delay Time		$\Delta t$		100		$\mu S$	
Max Output Discharge Resistance to GND during shutdown		RDSON_CLMP		20		$\Omega$	
EN Input Threshold	Output ON	$V_{ENH}$	1.6			V	
	Output OFF	$V_{ENL}$			0.25		

Note 1: Specifications are production tested at  $T_A=25^{\circ}C$ . Specifications over the  $-40^{\circ}C$  to  $85^{\circ}C$  operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls (SQC).

Note 2:  $V_{IN}(min)$  is the higher value of  $V_{out} + \text{Dropout Voltage}$  or 1.6V.

**TYPICAL PERFORMANCE CHARACTERISTICS**



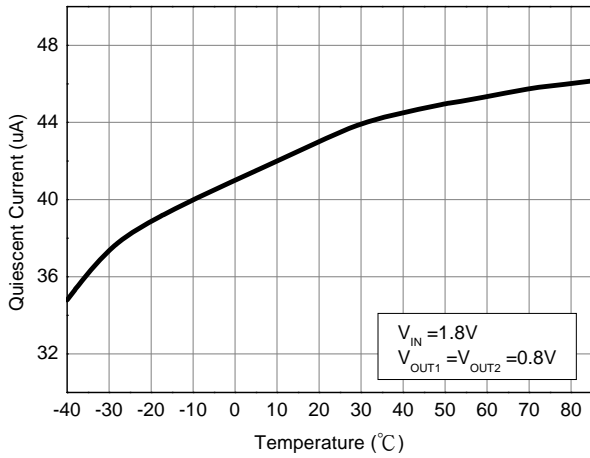


Fig.7 Dual LDO Quiescent Current vs. Temperature

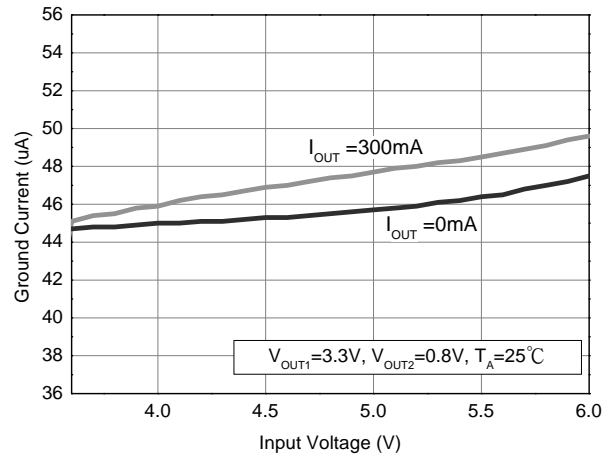


Fig.8 Dual LDO Quiescent Current and Ground Current vs. Input Voltage

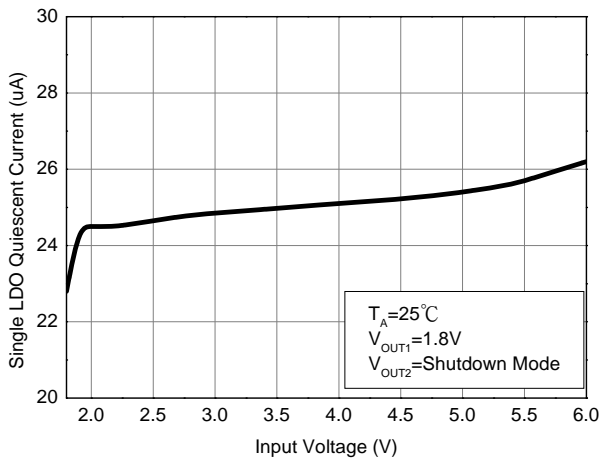


Fig.9 Single LDO Quiescent Current vs. Input Voltage

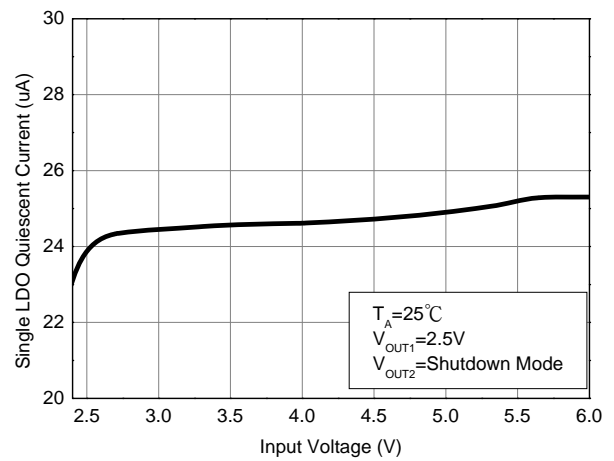


Fig.10 Single LDO Quiescent Current vs. Input Voltage

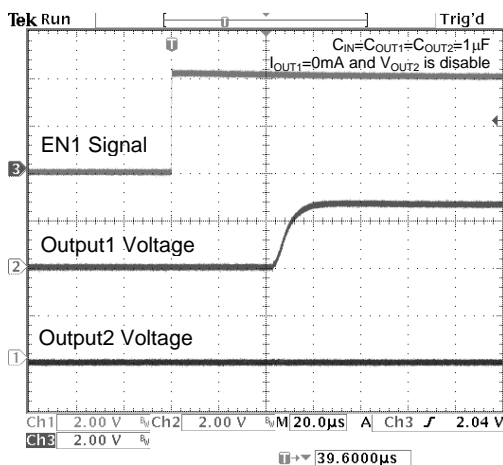


Fig.11 Start Up Waveform at  $V_{IN}=3.8V$ ,  $V_{OUT1}=2.8V$  and  $V_{OUT2}=1.8V$

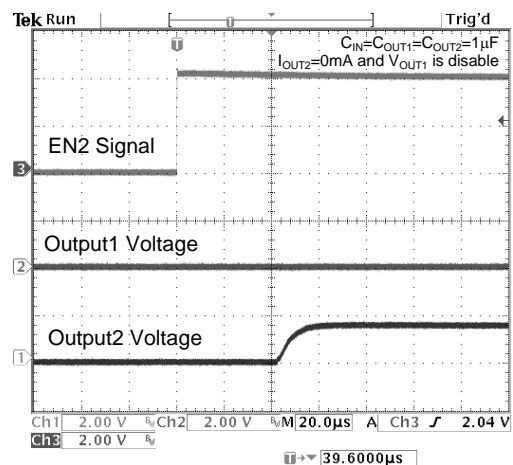
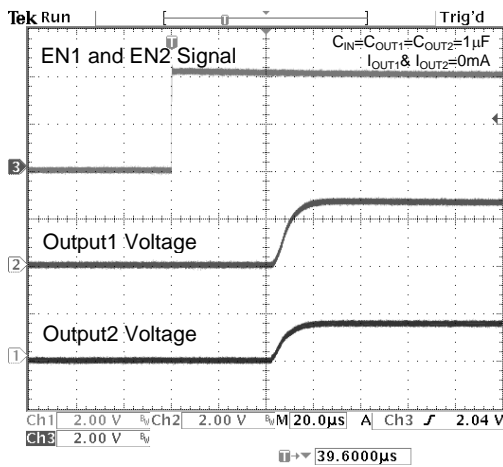
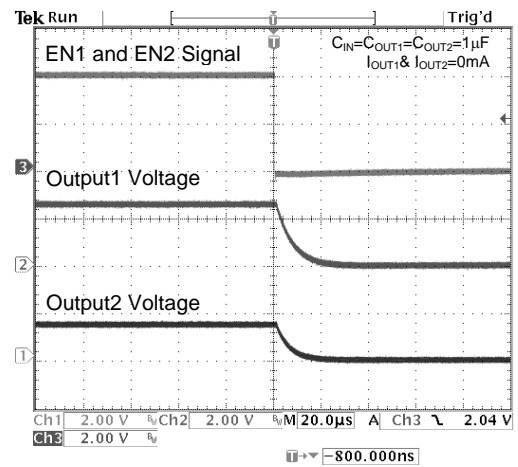
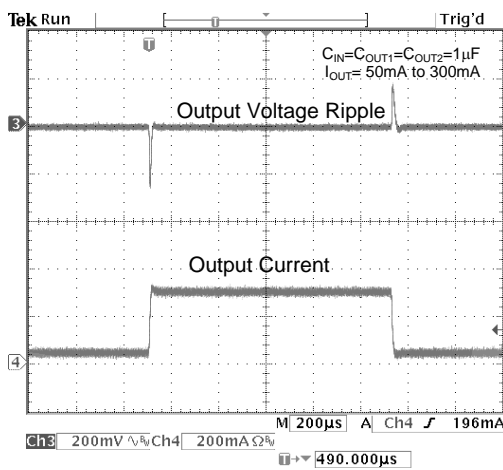
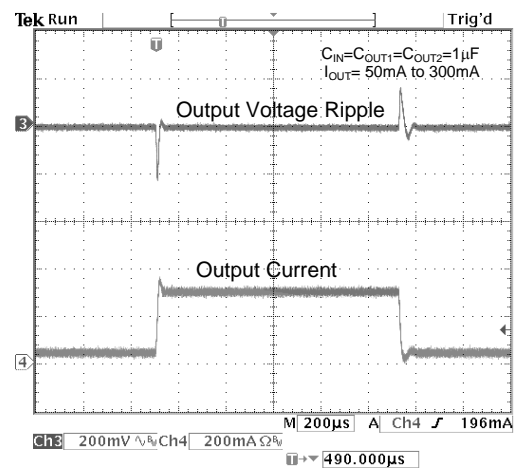
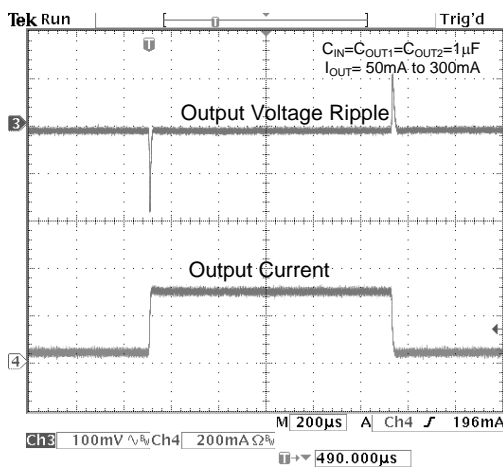
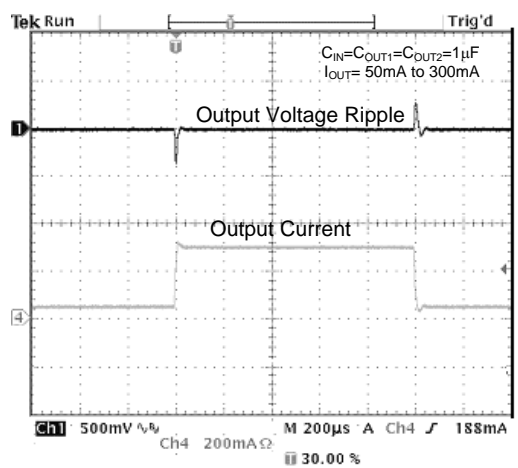


Fig.12 Start Up Waveform at  $V_{IN}=3.8V$ ,  $V_{OUT1}=2.8V$  and  $V_{OUT2}=1.8V$


 Fig.13 Start Up Waveform at  $V_{IN}=3.8V$ ,  $V_{OUT1}=2.8V$  and  $V_{OUT2}=1.8V$ 

 Fig.14 Shutdown Waveform at  $V_{IN}=3.8V$ ,  $V_{OUT1}=2.8V$  and  $V_{OUT2}=1.8V$ 

 Fig.15 Load Transient Response at  $V_{IN}=2.8V$ ,  $V_{OUT}=1.8V$ 

 Fig.16 Load Transient Response at  $V_{IN}=3.5V$ ,  $V_{OUT}=2.5V$ 

 Fig.17 Load Transient Response at  $V_{IN}=2.5V$ ,  $V_{OUT}=1.5V$ 

 Fig.18 Load Transient Response at  $V_{IN}=4.3V$ ,  $V_{OUT}=3.3V$



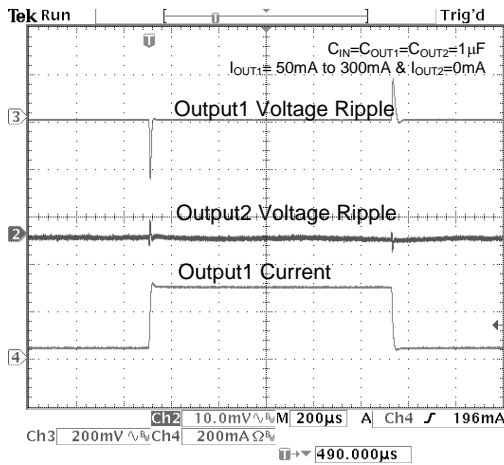


Fig.19 Cross Talk at  $V_{IN}=3.8V$ ,  $V_{OUT1}=1.8V$  and  $V_{OUT2}=2.8V$

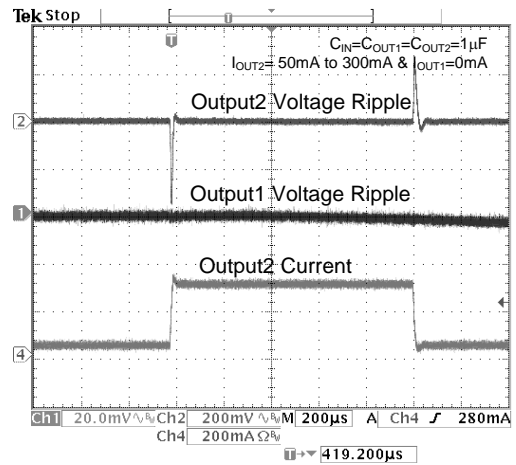


Fig.20 Cross Talk at  $V_{IN}=3.8V$ ,  $V_{OUT1}=1.8V$  and  $V_{OUT2}=2.8V$

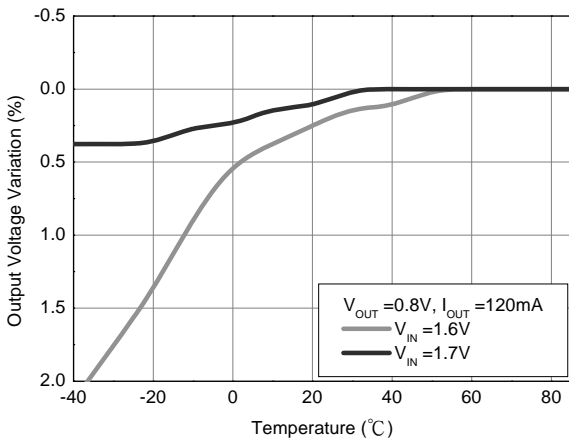


Fig.21 Output Voltage Variation vs. Temperature.

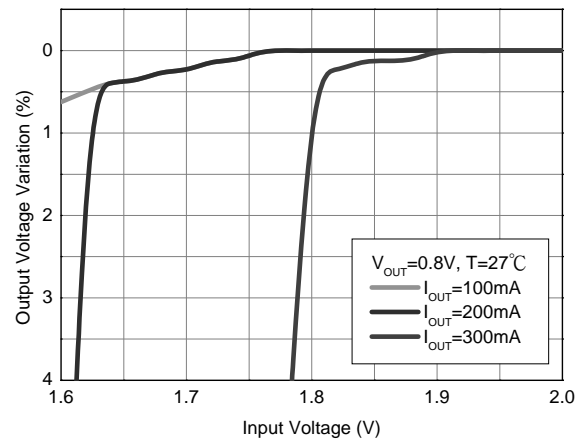


Fig.22 Output Voltage vs. Input Voltage.

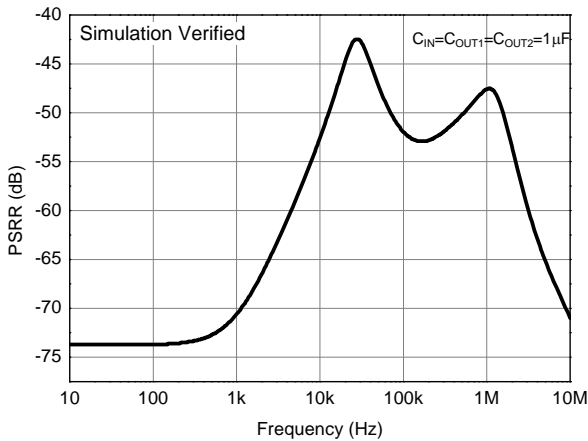
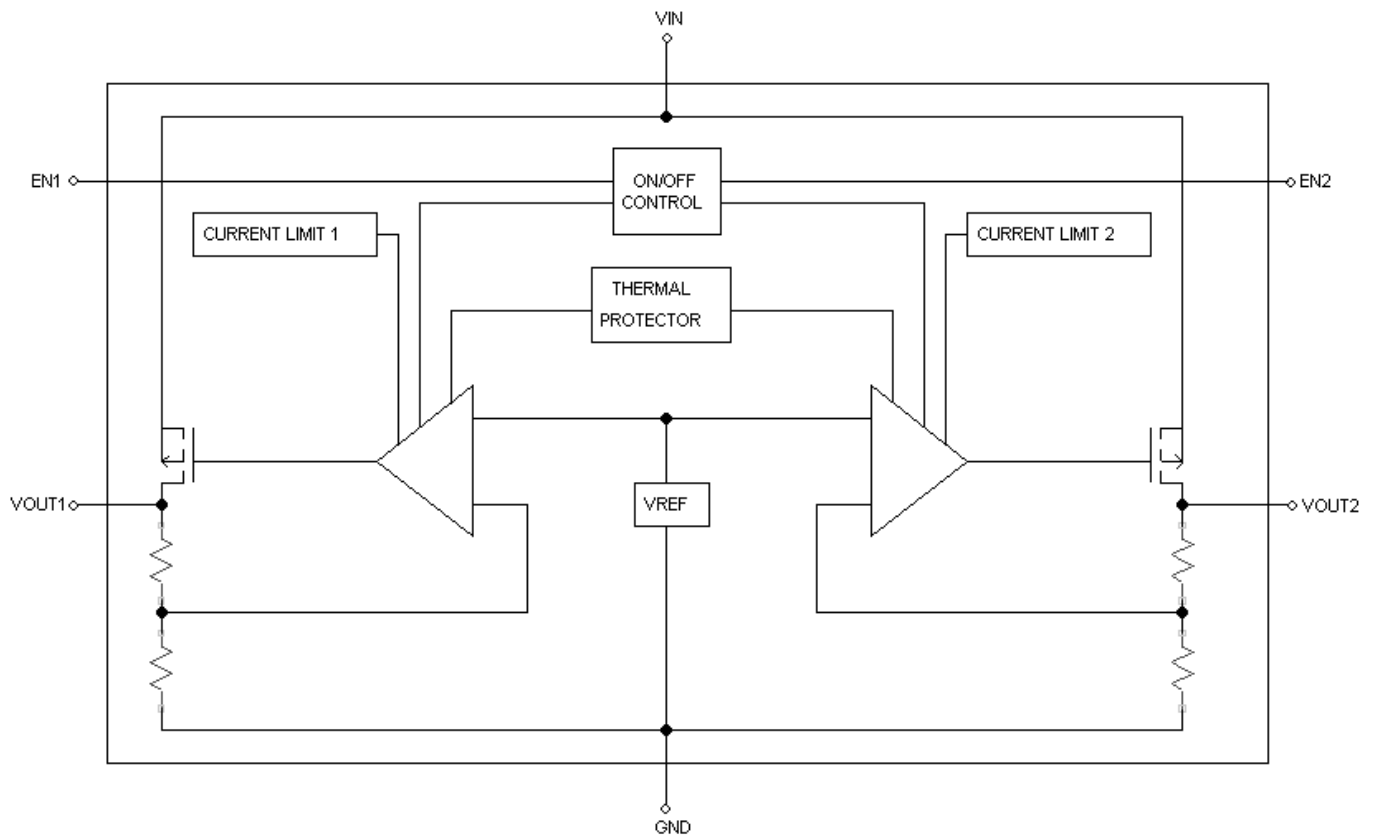


Fig.23 PSRR at  $V_{IN}=2.5V$ ,  $V_{OUT}=1.0V$  and  $I_{OUT}=10mA$ .

**■ BLOCK DIAGRAM**

**■ PIN DESCRIPTION**

- VIN PIN - Power input.
- GND PIN - Ground.
- EN1 PIN - Output 1 ON/OFF controller. This pin isn't allowed to float.
- EN2 PIN - Output 2 ON/OFF controller. This pin isn't allowed to float.
- VOUT1 PIN - Output 1.
- VOUT2 PIN - Output 2.

## ■ APPLICATION INFORMATION

The AIC1952 is a low-dropout, low quiescent-current, dual-output linear regulator for battery power applications. These parts are available with preset output voltages ranging from 0.8V to 3.8V, and the parts can supply loads up to 300mA.

### SHUTDOWN

The AIC1952 has two independent shutdown control inputs (EN1 and EN2). By connecting EN1 pin to ground, output1 can be shut down. By connecting EN2 pin to ground, output2 can be shut down. By connecting both of EN1 pin and EN2 pin to ground, the AIC1952 can be shut down to reduce the supply current to 0.1μA.

### CURRENT LIMIT

The AIC1952 includes two independent current limiters, which monitor and control the maximum output current. If the output is overloaded or shorted to ground, this can protect the device from being damaged.

### THERMAL PROTECTION

The AIC1952 includes a thermal-limiting circuit, which is designed to protect the device against overload condition. When the junction temperature exceeds  $T_J=150^{\circ}\text{C}$ , the thermal-limiting circuit turns off the pass transistors and allows the IC to cool. For continuous load condition, maximum rating of junction temperature must not be exceeded.

### INPUT-OUTPUT CAPACITORS

Linear regulators require input and output capacitors

to maintain stability. Input capacitor at 1μF with a 1μF ceramic output capacitor for each regulator is recommended. When choosing the input and output ceramic capacitors, X5R and X7R types are recommended because they retain their capacitance over wider ranges of voltage and temperature than other types.

### POWER DISSIPATION

The maximum power dissipation of AIC1952 depends on the thermal resistance of its case and circuit board, the temperature difference between the die junction and ambient air, and the rate of airflow. The rate of temperature rise is greatly affected by the mounting pad configuration on the PCB, the board material, and the ambient temperature. When the IC mounting with good thermal conductivity is used, the junction temperature will be low even when large power dissipation applies.

The power dissipation across the device is

$$P = I_{OUT1} (V_{IN} - V_{OUT1}) + I_{OUT2} (V_{IN} - V_{OUT2})$$

The maximum power dissipation is:

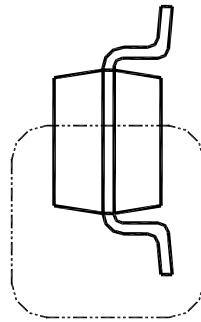
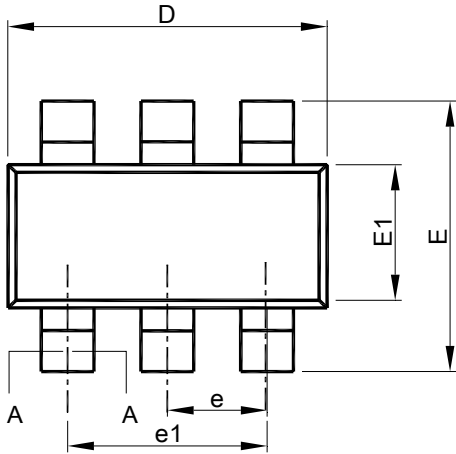
$$P_{MAX} = \frac{(T_{J-max} - T_A)}{R\theta_{JA}}$$

Where  $T_{J-max}$  is the maximum allowable junction temperature ( $150^{\circ}\text{C}$ ), and  $T_A$  is the ambient temperature suitable in application.

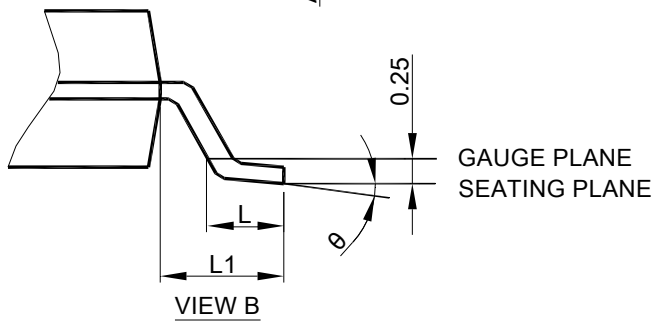
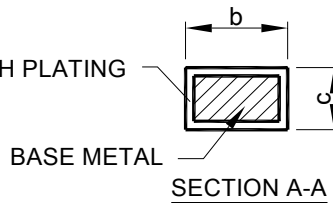
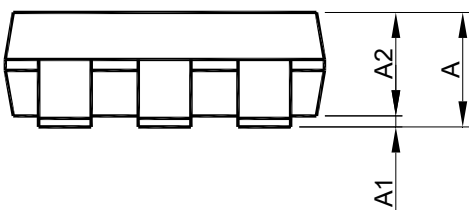
As a general rule, the lower temperature is, the better reliability of the device is. So the PCB mounting pad should provide maximum thermal conductivity to maintain low device temperature.

■ PHYSICAL DIMENSIONS

● SOT-23-6 PACKAGE OUTLINE DRAWING



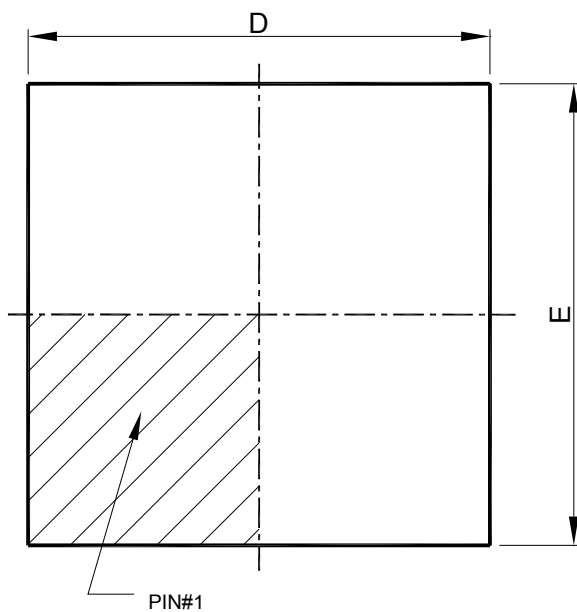
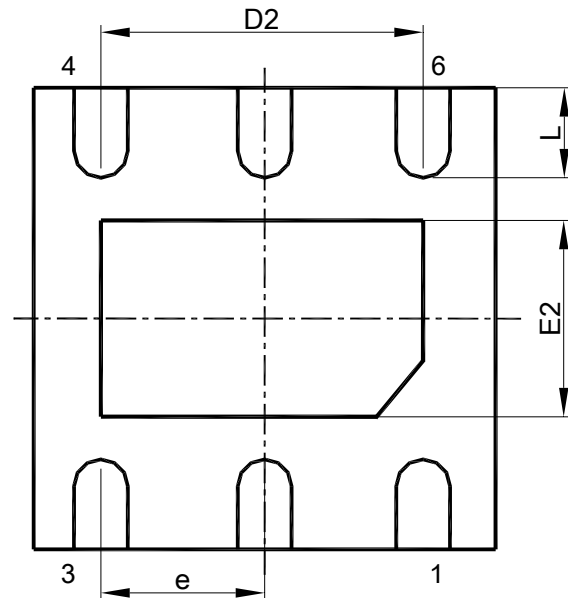
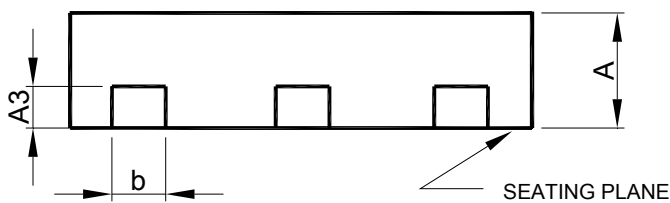
SEE VIEW B



SYMBOL	SOT-23-6	
	MILLIMETERS	
	MIN.	MAX.
A	0.95	1.45
A1	0.00	0.15
A2	0.90	1.30
b	0.30	0.50
c	0.08	0.22
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
e	0.95 BSC	
e1	1.90 BSC	
L	0.30	0.60
L1	0.60 REF	
θ	0°	8°

Note : 1. Refer to JEDEC MO-178AB.

2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 10 mil per side.
3. Dimension "E1" does not include inter-lead flash or protrusions.
4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

**• DFN 6L-2X2 PACKAGE OUTLINE DRAWING**

**TOP VIEW**

**BOTTOM VIEW**

**SIDE VIEW**

SYMBOL	DFN 6L-2x2x0.75-0.65mm	
	MILLIMETERS	
	MIN.	MAX.
A	0.70	0.80
A3	0.20 BSC	
b	0.20	0.35
D	2.00 BSC	
D2	1.10	1.60
E	2.00 BSC	
E2	0.55	0.85
e	0.65 BSC	
L	0.25	0.45

- Note :
1. DIMENSION AND TOLERANCING CONFORM TO ASME Y14.5M-1994.
  2. CONTROLLING DIMENSIONS : MILLIMETER , CONVERTED INCH DIMENSION ARE NOT NECESSARILY EXACT.
  3. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.10 AND 0.25 mm FROM TERMINAL TIP.

**Note:**

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