



### DESCRIPTION

The A6141-Q is a wide input, low-dropout regulator (LDO) supporting a 3V to 40V input voltage range and up to 150mA of load current. The A6141-Q has fixed output types including 3.3V and 5V.

The A6141-Q provides up to 150mA output current when input/output voltage differential drops to 240mV (V<sub>OUT</sub> =5V), and it also provides foldback short-circuit protection, thermal protection, and output current limit function. Thus, the maximum output current (150mA) must be used in the safe operation area. The very low power consumption of the A6141-Q (I<sub>q</sub>=2.5uA) can greatly improve the natural life of batteries.

The A6141-Q also includes high accuracy voltage reference, error amplifier, current limit circuit, and output driver module. It performs well with load transient response and good temperature characteristics.

The A6141-Q is available in the SOP8 package.

### FEATURES

- Low power consumption: 2.5uA (Typ.)
- Maximum output current: 150mA
- Small dropout voltage:  
240mV@50mA (V<sub>OUT</sub> =5.0V)  
335mV@50mA (V<sub>OUT</sub> =3.3V)
- Wide input voltage range: 3V~40V
- Fixed output option: 3.3V, 5.0V
- Highly accurate: ±2%
- Stable over a wide range of ceramic capacitor values: C<sub>IN</sub> /C<sub>OUT</sub> =1μF
- AEC-Q100 Certified

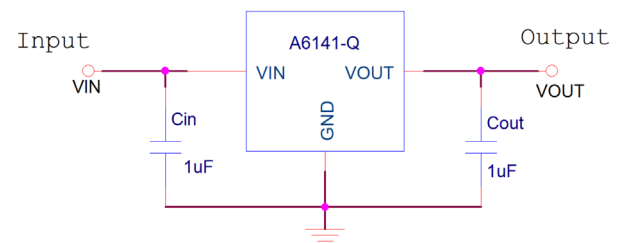
### APPLICATIONS

- Automotive.
- Battery-powered equipment.
- Reference voltage source regulation after switching power.
- Always-On Battery Applications
  - Door Modules
  - Remote Keyless-Entry Systems
  - Immobilizers

### ORDERING INFORMATION

Package Type	Part Number	
SOP8 SPQ: 2,500pcs/Reel	M8	A6141M8VR-33Q
		A6141M8VR-50Q
Note	V: Halogen-free Package R: Tape & Reel Q: AEC-Q100 certified	
AiT provides all RoHS products		

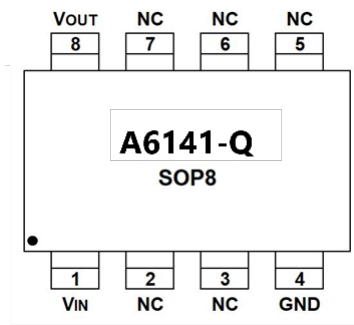
### TYPICAL APPLICATION



Input capacitor (C<sub>in</sub>=1uF) and Output capacitor (C<sub>out</sub>=1uF) are recommended in all application circuits. A ceramic capacitor is recommended.



**PIN DESCRIPTION**



Pin #	Symbol	Function
1	V <sub>IN</sub>	Supply Voltage Input.
2,3,5,6,7	NC	No connection
4	GND	Ground Pin
8	V <sub>OUT</sub>	Output Voltage



## ABSOLUTE MAXIMUM RATINGS

Max Input Voltage	44V
T <sub>J</sub> , Operating Junction Temperature	150°C
T <sub>A</sub> , Operating Ambient Temperature	-40°C to +125°C
θ <sub>JC</sub> , Package Thermal Resistance	40°C/W
θ <sub>JA</sub> , Package Thermal Resistance	80°C/W
T <sub>S</sub> , Storage Temperature	-40°C ~150°C
Lead Temperature & Time	260°C, 10s
ESD (HBM) *	>2000V

The stresses above may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

\* ESD susceptibility, HBM according to ANSI/ESDA/JEDEC JS001 (1.5 kΩ, 100 pF)

## RECOMMENDED WORK CONDITIONS

Parameter	Min	Max.	Unit
Input Voltage Range	3	40	V
Ambient Temperature	-40	105	°C



**ELECTRICAL CHARACTERISTICS**

C<sub>IN</sub>=1uF, C<sub>OUT</sub>=1uF, T<sub>A</sub>=-40°C~+140°C, unless Otherwise Stated.

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit	
Input Voltage	V <sub>IN</sub>		3	-	40	V	
Output Voltage	V <sub>OUT</sub>	V <sub>IN</sub> -V <sub>OUT</sub> =1V 1mA≤I <sub>OUT</sub> ≤30mA	V <sub>OUT</sub> x0.98	V <sub>OUT</sub>	V <sub>OUT</sub> X1.02	V	
Maximum Output Current	I <sub>OUT</sub> (Max.)	V <sub>IN</sub> -V <sub>OUT</sub> =1V	150	-	-	mA	
Dropout Voltage <sup>(1)</sup>	V <sub>DROP</sub>	I <sub>OUT</sub> =50mA	V <sub>OUT</sub> =3.3V	-	335	-	mV
			V <sub>OUT</sub> =5.0V	-	240	-	
Line Regulation	ΔV <sub>OUT</sub>	I <sub>OUT</sub> =10mA, I <sub>OUT</sub> +1V≤V <sub>IN</sub> ≤40V	-	0.2	0.3	%V	
	ΔV <sub>IN</sub> × V <sub>OUT</sub>						
Load Regulation	ΔV <sub>OUT</sub>	V <sub>IN</sub> =V <sub>OUT</sub> +1V 1mA≤I <sub>OUT</sub> ≤50mA	-	20	40	mV	
Quiescent Current	I <sub>q</sub>	V <sub>IN</sub> =V <sub>OUT</sub> +1V	-	2.5	5	μA	
Output Voltage Temperature Coefficient	ΔV <sub>OUT</sub> ΔT × V <sub>OUT</sub>	I <sub>OUT</sub> =10mA	-	±100	-	ppm/°C	
Ripple Rejection	P <sub>SRR</sub>	F=100Hz, Ripple=0.5V <sub>p-p</sub> V <sub>IN</sub> =V <sub>OUT</sub> +1V	-	50	-	dB	
Thermal Shutdown Temp	T <sub>SD</sub>		-	140	-	°C	
Thermal Shutdown Hysteresis	T <sub>SH</sub>		-	10	-	°C	

(1) V<sub>DROP</sub> = V<sub>IN</sub> - V<sub>OUT</sub> when V<sub>OUT</sub> drops below 98% of the normal V<sub>OUT</sub>.



## TYPICAL PERFORMANCE CHARACTERISTICS

Fig.1 Load Regulation ( $V_{IN} = 7V$ ,  $V_{OUT} = 5V$ )

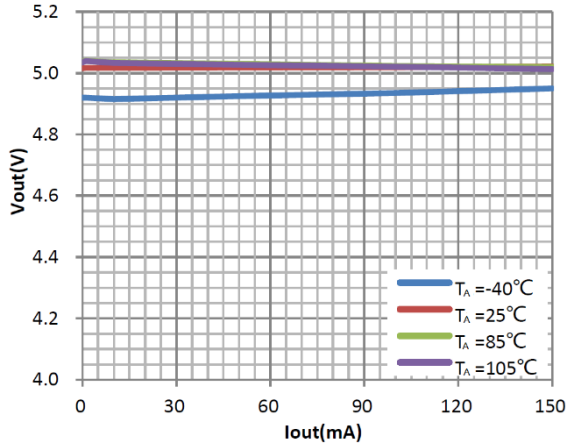


Fig.2 Load Regulation ( $V_{IN} = 12V$ ,  $V_{OUT} = 5V$ )

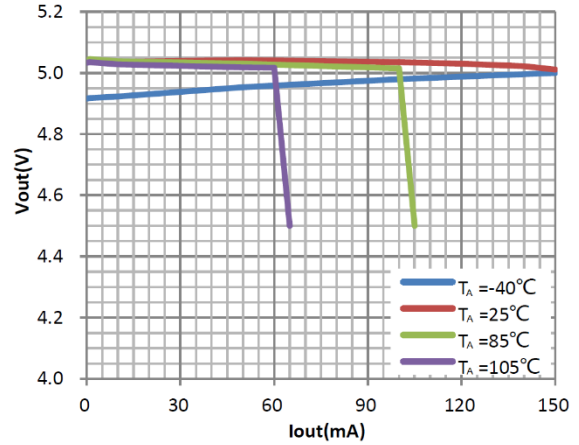


Fig.3 Load Regulation ( $V_{IN} = 16V$ ,  $V_{OUT} = 5V$ )

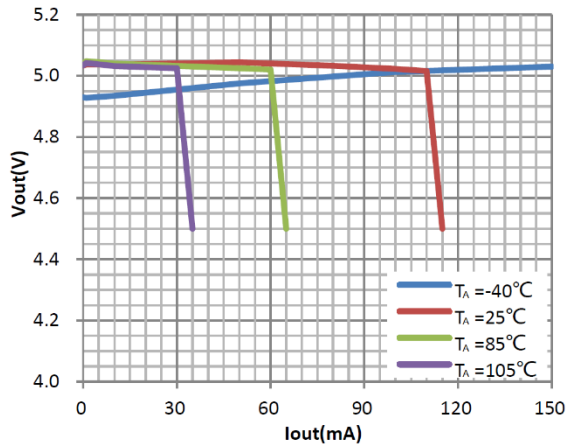


Fig.4 Line Regulation ( $V_{OUT} = 5.0V$ ,  $I_{OUT} = 1mA$ )

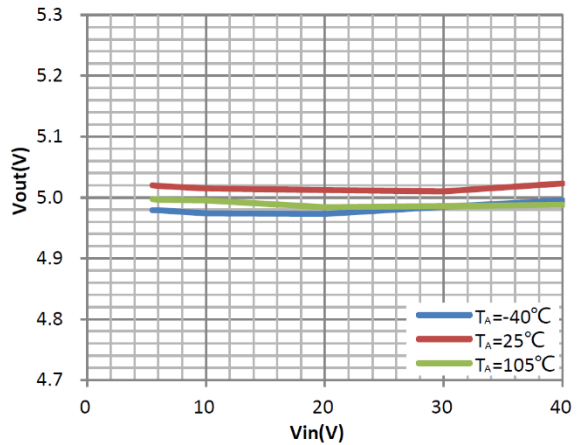


Fig.5 Dropout Voltage ( $V_{OUT} = 5V$ )

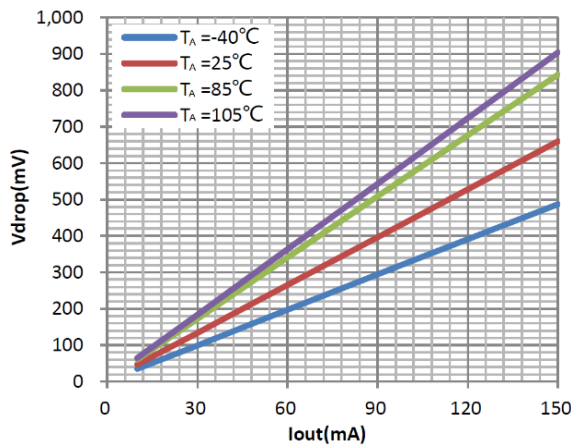


Fig.6  $I_q$

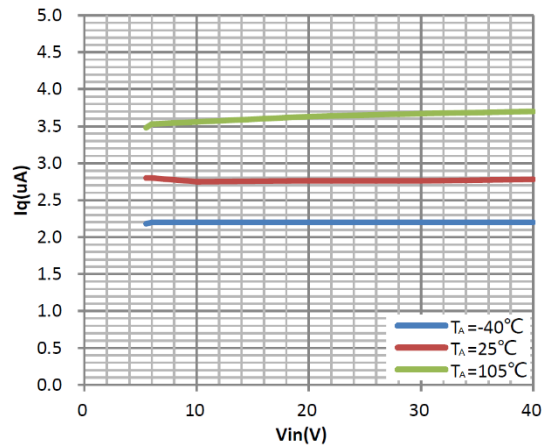




Fig.7 Safe Operation Area

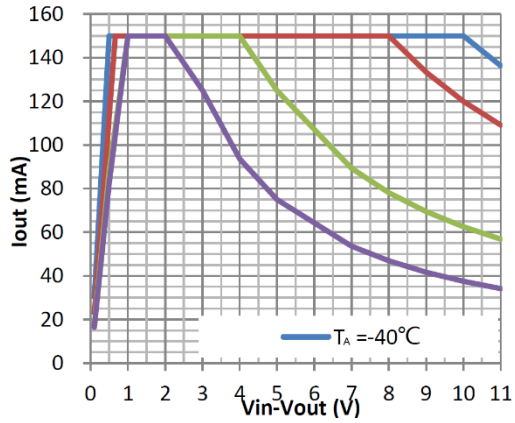
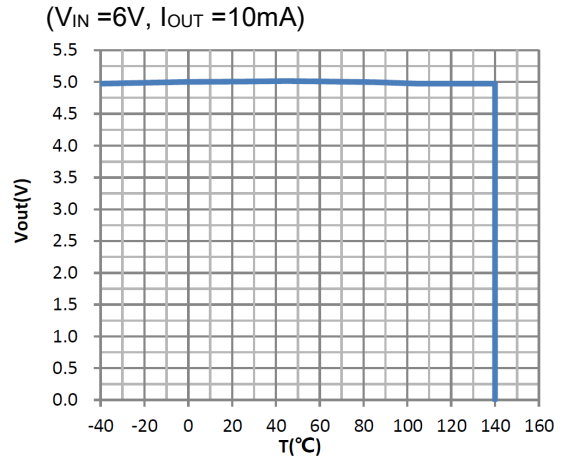
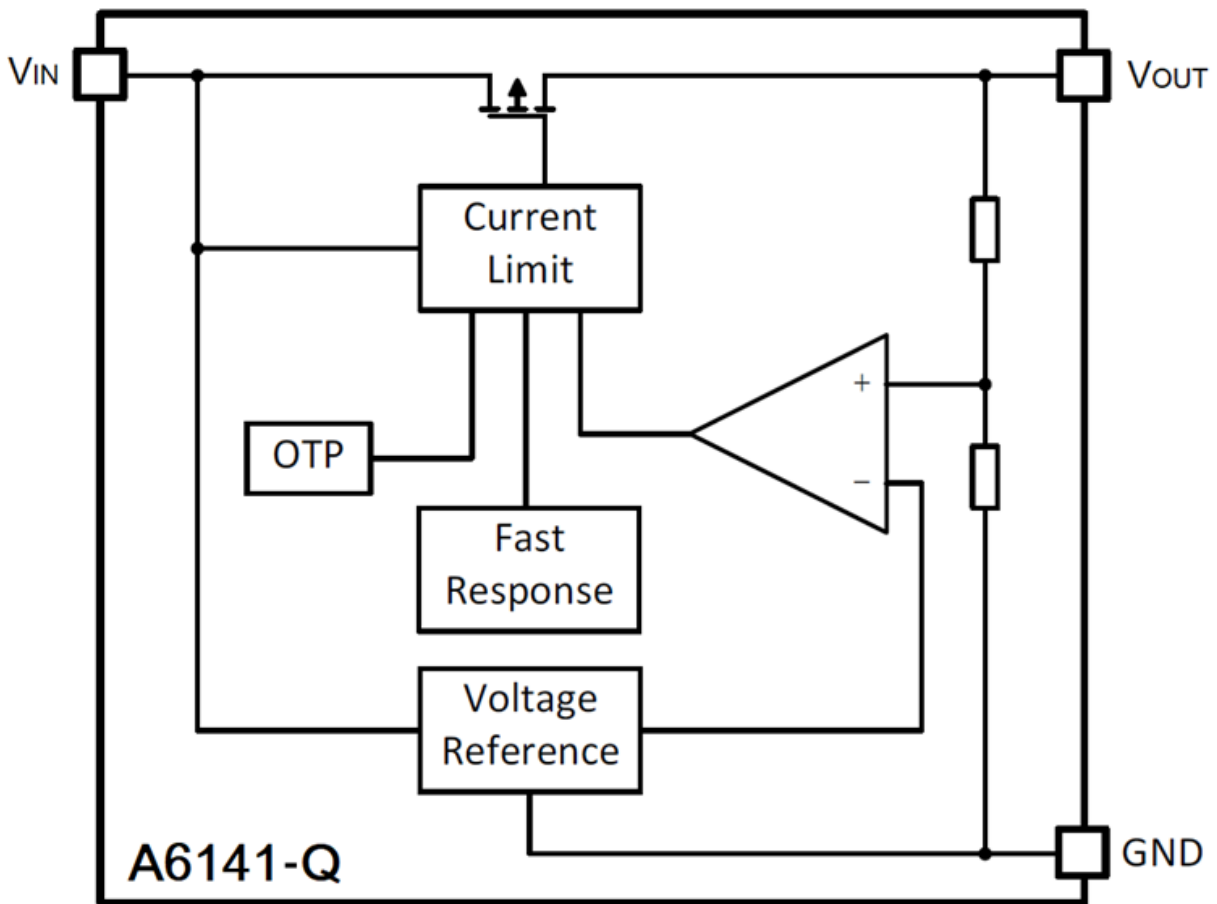


Fig.8 Output Voltage vs. Temp.



**BLOCK DIAGRAM**





## DETAILED INFORMATION

### Overview

The A6141-Q is a series of low dropout voltage and low power consumption regulators designed. The device accommodates a wide input supply voltage range of up to 40V and is available in 3.3V and 5V fixed output voltages. Its application circuit is very simple and only needs two outside capacitors. It is composed of these modules: high-accuracy voltage reference, current limit circuit, error amplifier, output driver, and power transistor.

The current Limit module can keep the chip and power system away from danger when the load current is more than 180mA.

The A6141-Q uses a trimming technique to assure the accuracy of output value within  $\pm 2\%$ , at the same time, temperature compensation is elaborately considered in this chip, which makes the A6141-Q's temperature coefficient within  $\pm 100\text{ppm}/^\circ\text{C}$ .

### Current Limit

The A6141-Q has an internal current limit circuit that protects the regulator during transient high-load current faults or short events. The current limit is a foldback scheme. In a high-load current fault, the foldback scheme limits the output current. The output voltage is not regulated when the device is in the current limit. When a current limit event occurs, the device begins to heat up because of the increase in power dissipation. When the device is in the foldback current limit, if the thermal shutdown is triggered, the device turns off. After the device cools down, the internal thermal shutdown circuit turns the device back on. If the output current fault condition continues, the device cycles between the current limit and thermal shutdown.

### THERMAL CONSIDERATIONS

Knowing the input voltage, the output voltage, and the load profile of the application, the total power dissipation can be calculated:

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

With

$P_D$ : continuous power dissipation       $I_{OUT}$ : output current  
 $V_{IN}$ : input voltage       $I_Q$ : quiescent current  
 $V_{OUT}$ : output voltage

The maximum acceptable thermal resistance  $R_{thJA}$  can then be calculated:

$$R_{thJA,MAX} = \frac{T_{J,MAX} - T_A}{P_D}$$

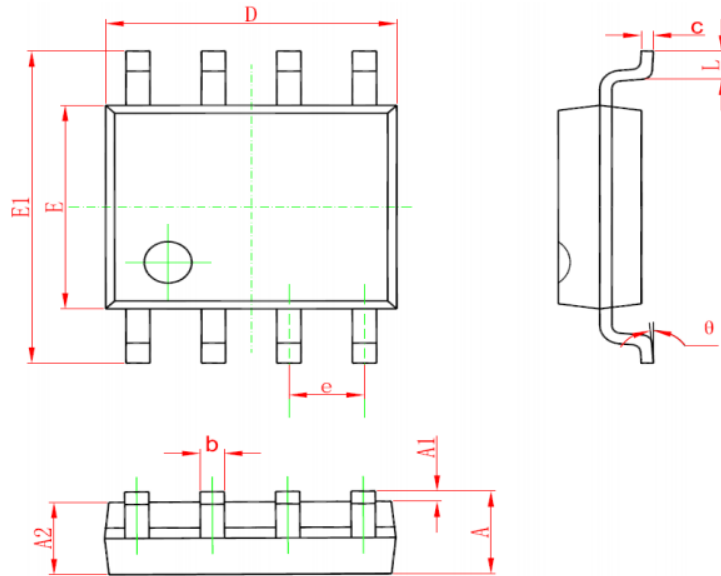
With

$T_{J,MAX}$ : maximum allowed junction temperature  
 $T_A$ : ambient temperature



**PACKAGE INFORMATION**

Dimension in SOP8 (Unit: mm)



Symbol	Min	Max
A	1.350	1.750
A1	0.050	0.250
A2	1.300	1.500
b	0.380	0.470
c	0.170	0.250
D	4.800	5.000
E	3.800	4.000
E1	5.800	6.200
e	1.270(BSC)	
L	0.450	0.800
$\theta$	0°	8°





**AiT Semiconductor Inc.**

[www.ait-ic.com](http://www.ait-ic.com)

**A6141-Q**

LOW DROPOUT VOLTAGE REGULATOR  
AEC-Q, 40V 150mA LOW CONSUMPTION LDO

---

## **IMPORTANT NOTICE**

AiT Semiconductor Inc. (AiT) reserves the right to make changes to any its product, specifications, to discontinue any integrated circuit product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

AiT Semiconductor Inc.'s integrated circuit products are not designed, intended, authorized, or warranted to be suitable for use in life support applications, devices or systems or other critical applications. Use of AiT products in such applications is understood to be fully at the risk of the customer. As used herein may involve potential risks of death, personal injury, or server property, or environmental damage. In order to minimize risks associated with the customer's applications, the customer should provide adequate design and operating safeguards.

AiT Semiconductor Inc. assumes to no liability to customer product design or application support. AiT warrants the performance of its products of the specifications applicable at the time of sale.