

## 700mA HIGH VOLTAGE ADJUSTABLE CURRENT REGULATOR WITH ENABLE CONTROL

### DESCRIPTION

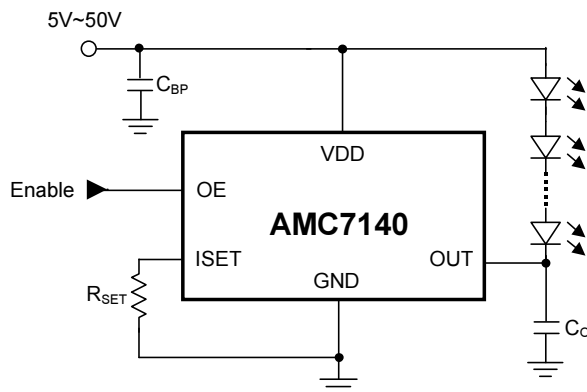
The AMC7140 is a high voltage, low dropout current regulator of maximum output current up to 700mA. The output current is decided by an external resistor, and the output sink current could be disabled via OE pin.

Build-in thermal protection to prevent the chip over heat damage.

### FEATURES

- 0.5V Output Drop-out Voltage at 700mA.
- 700mA Maximum Output Current.
- Output Current Controlled by External Resistor.
- 3 $\mu$ s Fast Response Output Stage Enable Control.
- Output Sustaining Voltage Up To 75V.
- Wide Supply Voltage Range: 5V~50V.
- TO-252-5L package.

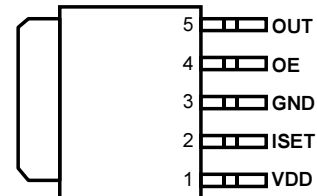
### TYPICAL APPLICATION CIRCUIT



### APPLICATIONS

- High Power LED Driver
- RGB Full Color Power LED driver
- LCD Monitor/TV LED backlight Driver
- LED Table Lamp

### PACKAGE PIN OUT



TO-252-5L  
(Top View)

### ORDER INFORMATION

<b>DL</b>	<b>TO-252</b>
	<b>5 pin</b>
<b>AMC7140DLGT</b>	
<b>AMC7140DLGT-A</b>	
<p>Note: <b>Part Number: A M C 7 1 4 0</b> <span style="border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> <span style="border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> <span style="border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> <span style="border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> - <span style="border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span></p> <p>Package Type.      DL: TO-252-5      ←      →      Option Code        Package Process.      G: Green      ←      →      Packing.      T: Tape &amp; Reel; N/A: Bulk</p>	

**ABSOLUTE MAXIMUM RATINGS** (Note)

Input Voltage, $V_{DD}$	55V
Output Sustaining Voltage, $V_{OUT}$	75V
Output Sink Current, $I_{OUT}$	700mA
Output Enable Voltage, $V_{OE}$	13.2V
Maximum Operating Junction Temperature, $T_J$	150°C
Storage Temperature Range	-55°C to 150°C
Lead Temperature (soldering, 10 seconds)	260°C
Note: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of the specified terminal.	

**PIN DESCRIPTION**

Pin Name	Pin Function
OUT	Output pin. Sink current is decided by the current on $R_{SET}$ connected to $I_{SET}$ pin. $I_{OUT} = 500 \times I_{SET} = 500 \times \frac{1.2V}{R_{SET}}$
OE	Output Stage Enable Control pin. High enables the OUT pin. It can be left floating for normally on.
$I_{SET}$	Output Current Setting pin. Connect a resistor from $I_{SET}$ to GND to set the LED bias current. $I_{SET} = 1.2V / R_{SET}$
VDD	Power Supply pin.
GND	Ground pin.

**THERMAL DATA**

Thermal Resistance from Junction to Ambient, $\theta_{JA}$	80°C /W
Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$ . The $\theta_{JA}$ numbers are guidelines for the thermal performance of the device/pc-board system. Connect the ground pin to ground using a large pad or ground plane for better heat dissipation. All of the above assume no ambient airflow.	

**Maximum Power Calculation:**

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_{A(MAX)}}{\theta_{JA}}$$

$T_J$ (°C): Maximum recommended junction temperature

$T_A$ (°C): Ambient temperature of the application

$\theta_{JA}$ (°C/W): Junction-to-Ambient temperature thermal resistance of the package, and other heat dissipating materials.

**The maximum power dissipation for a single-output regulator is:**

$$P_{D(MAX)} = [(V_{IN(MAX)} - V_{OUT(NOM)}) \times I_{OUT(NOM)} + V_{IN(MAX)} \times I_Q]$$

Where:  $V_{OUT(NOM)}$  = the nominal output voltage

$I_{OUT(NOM)}$  = the nominal output current, and

$I_Q$  = the quiescent current the regulator consumes at  $I_{OUT(MAX)}$

$V_{IN(MAX)}$  = the maximum input voltage

Then  $\theta_{JA} = (+150^\circ\text{C} - T_A) / P_D$

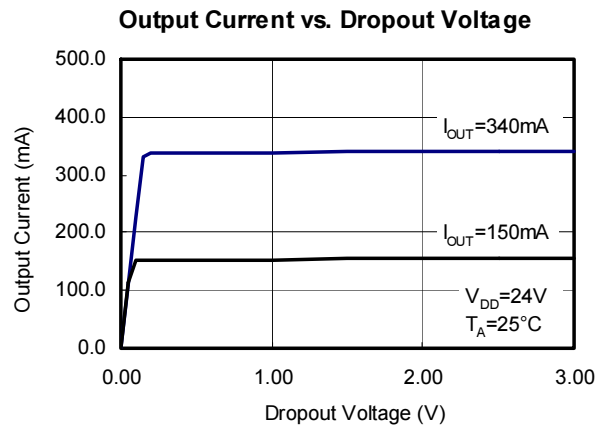
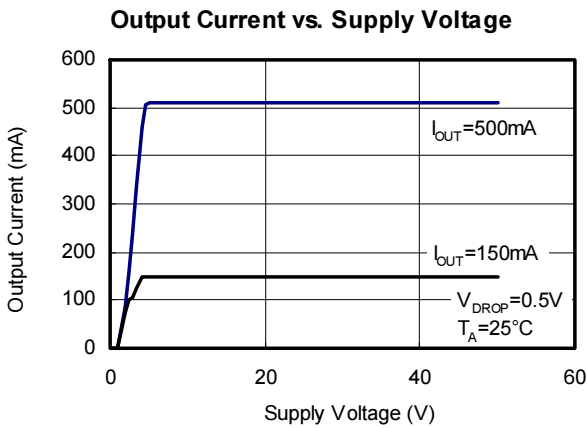
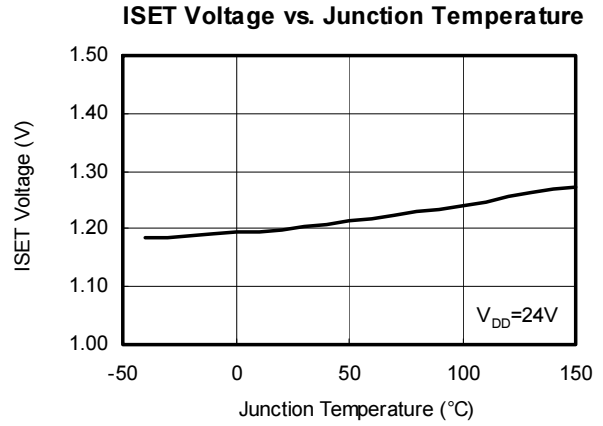
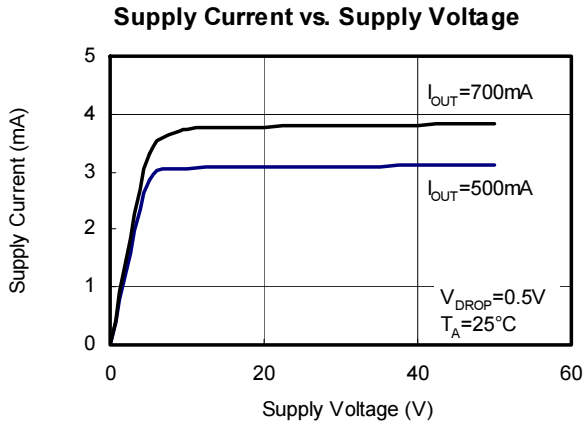
**RECOMMENDED OPERATING CONDITIONS**

Parameter		Symbol	Min	Typ	Max	Unit
Supply Voltage		$V_{DD}$	5		50	V
Output Enable Voltage		$V_{OE}$			12	V
Output Sink Current	AMC7140	$I_{OUT}$	200		355	mA
	AMC7140A		350		600	
Operating free-air temperature range		$T_A$	-40		+85	°C

**DC ELECTRICAL CHARACTERISTICS**

$V_{DD}=24V, T_A=25^{\circ}C, \text{ No Load, (Unless otherwise noted)}$						
Parameter	Condition		Min	Typ	Max	Unit
Output Current	$V_{OUT}=0.5V, R_{SET}=3K\Omega$			200		mA
	$V_{OUT}=0.5V, R_{SET}=1.71K\Omega$			350		
	$V_{OUT}=0.5V, R_{SET}=1K\Omega$			600		
Output Current Deviation	AMC7140	$V_{OUT}=0.5V, I_{OUT}=200mA\sim 350mA$			$\pm 5$	%
	AMC7140A	$V_{OUT}=0.5V, I_{OUT}=350mA\sim 600mA$			$\pm 5$	
SET Current Range			200		1400	$\mu A$
Minimum Output Current	$I_{SET}=200\mu A$			100		mA
Maximum Output Current	$I_{SET}=1400\mu A$			700		mA
Output Dropout Voltage	$I_{SET}=1000\mu A, \text{ Note 1}$			0.35		V
Load Regulation	$V_{OUT}=0.5V \text{ to } 3V$				3	mA/V
Line Regulation	$V_{OUT}=0.5V, I_{OUT}=350mA, V_{DD}=5V \text{ to } 50V$			0.08	0.15	%/V
Thermal Shutdown Junction Temperature	Hysteresis = 20°C			160		°C
“Low” Input Voltage			0		0.8	V
“High” Input Voltage	Should lower than $V_{DD}$ .		2		$\text{Min}\{V_{DD}, 12\}$	V
“Low” Input Current			-20		+20	$\mu A$
“High” Input Current			-5.0		+5.0	$\mu A$
Output Enable Delay Time	OE from Low to High, $V_{OUT}=0.5V, I_{OUT}=350mA, 50\%$			3		$\mu S$
Output Disable Delay Time	OE from High to Low, $V_{OUT}=0.5V, I_{OUT}=350mA, 50\%$			3		$\mu S$
Supply Current Consumption					5	mA

Note1: Output dropout voltage:  $90\% \times I_{OUT} @ V_{OUT}=500mV$

**CHARACTERIZATION CURVES**


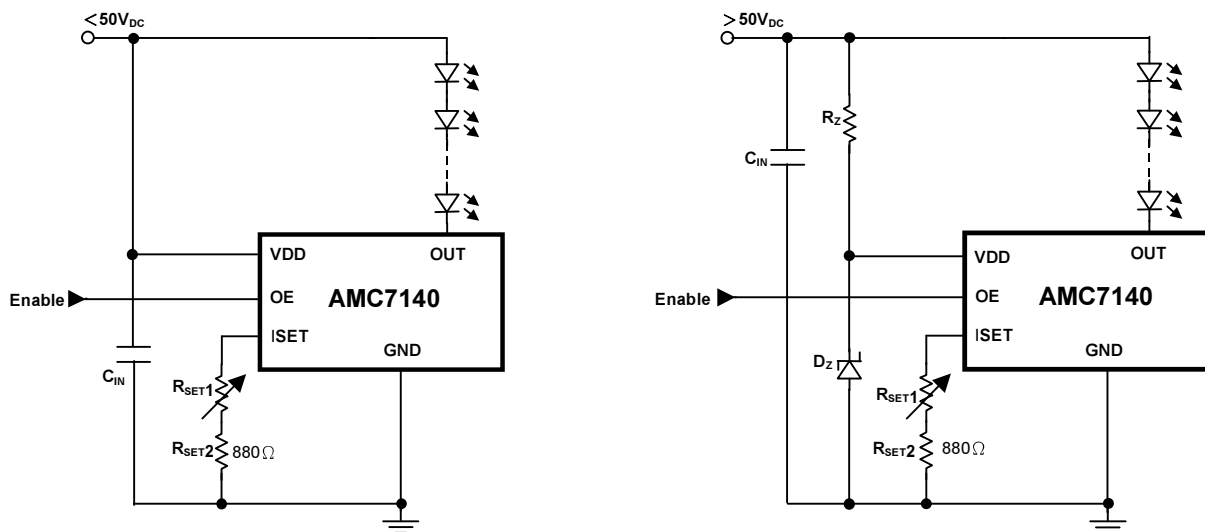
**APPLICATION INFORMATION**

AMC7140 is a high voltage, low dropout current regulator for maximum output current up to 700mA with OE pin control. The current could be linearly adjusted through variable resistor connected to I<sub>SET</sub> pin, or by PWM control via OE pin. Although the absolute maximum rating of OUT pin 75V, the dropout voltage between OUT pin and GND pin should not be too large when current is sinking because of the thermal dissipation capability of the package.

Here are some of the typical application examples:

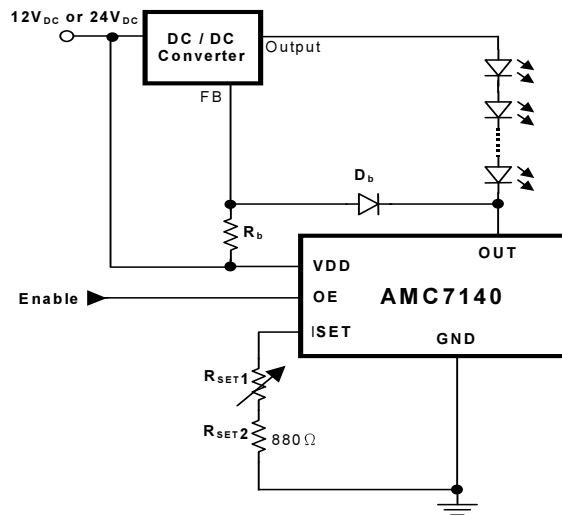
**DC Voltage Input:**

Any DC voltage level between 5V to 50V could be adopted as power source V<sub>DD</sub> for typical application of AMC7140 as long as V<sub>DD</sub> is larger than the total forward voltage drop of the LED string (at expecting current) by 0.35V. If 50V ~ 60V voltage level is adopted as power source to positive end of the LED string, one Zener shunt regulator could be used to provide appropriate voltage to VDD pin.



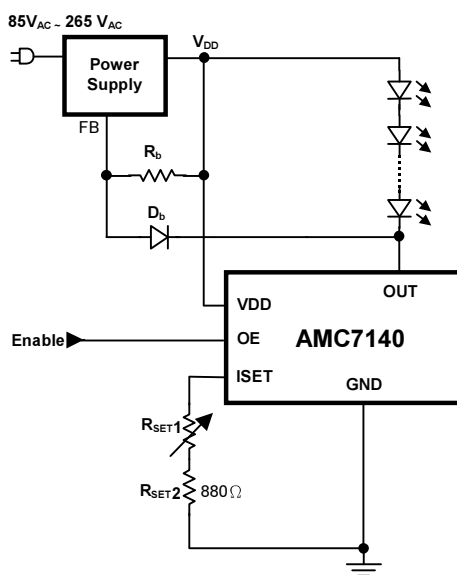
**LED Backlight Solution:**

AMC7140 could coordinate with any type of DC-to-DC converter through feedback path to realized LED backlight module. The number of LEDs in the string is variable even with certain fixed power source since the output voltage of the DC-to-DC converter could be modulated according to feedback signal.



**AC Voltage Input:**

AMC7140 could work with any kind of well-known or well-developed switch-mode power supply system. Simply cut off the internal feedback path of the power supply system and then feed the signal from AMC7140 back to the power supply system instead.



**THERMAL CONSIDERATION**
**The Maximum Power Dissipation on Current Regulator:**

$$P_{D(MAX)} = V_{OUT(MAX)} \times I_{OUT(NOM)} + V_{IN(MAX)} \times I_{DD}$$

$V_{OUT(MAX)}$  = the maximum voltage on output pin;

$I_{OUT(NOM)}$  = the nominal output current;

$I_{DD}$  = the quiescent current the regulator consumes at  $I_{OUT(NOM)}$ ;

$V_{IN(MAX)}$  = the maximum input voltage.

**Thermal Consideration:**

The AMC7140 has internal power and thermal limiting circuitry designed to protect the device under overload conditions. However, maximum junction temperature ratings should not be exceeded under continuous normal load conditions. The thermal protection circuit of AMC7140 prevents the device from damage due to excessive power dissipation. When the device junction temperature rises to approximately 150°C, the regulator will be turned off. When power consumption is over about 1000mW (TO-252 package, at  $T_A=70^\circ\text{C}$ ), additional heat sink is required to control the junction temperature below 125°C.

The junction temperature is:

$$T_J = P_D (\theta_{JT} + \theta_{CS} + \theta_{SA}) + T_A$$

$P_D$  : Dissipated power.

$\theta_{JT}$ : Thermal resistance from the junction to the mounting tab of the package.

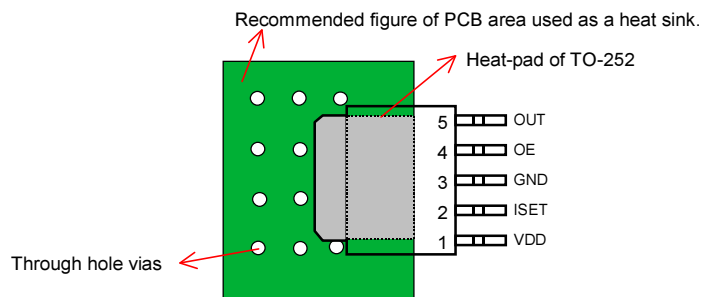
For TO-252 package,  $\theta_{JT} = 7.0 \text{ }^\circ\text{C/W}$ .

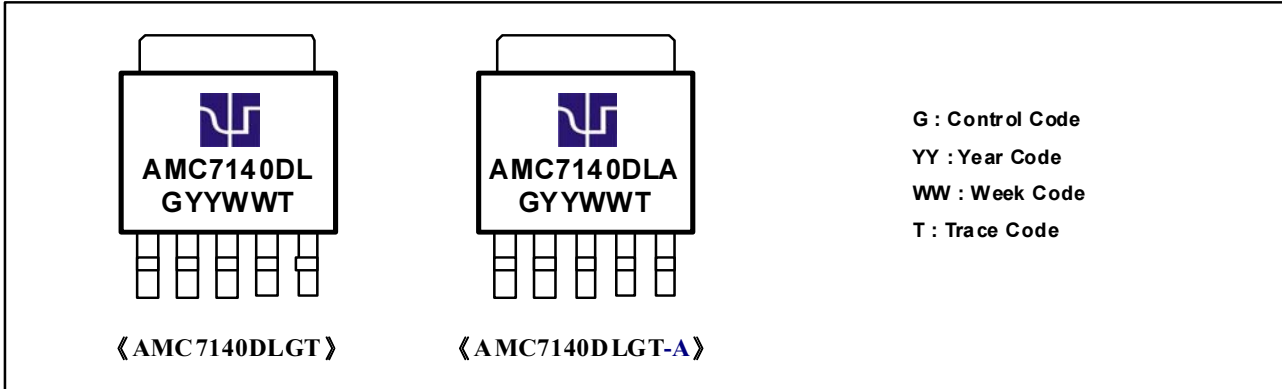
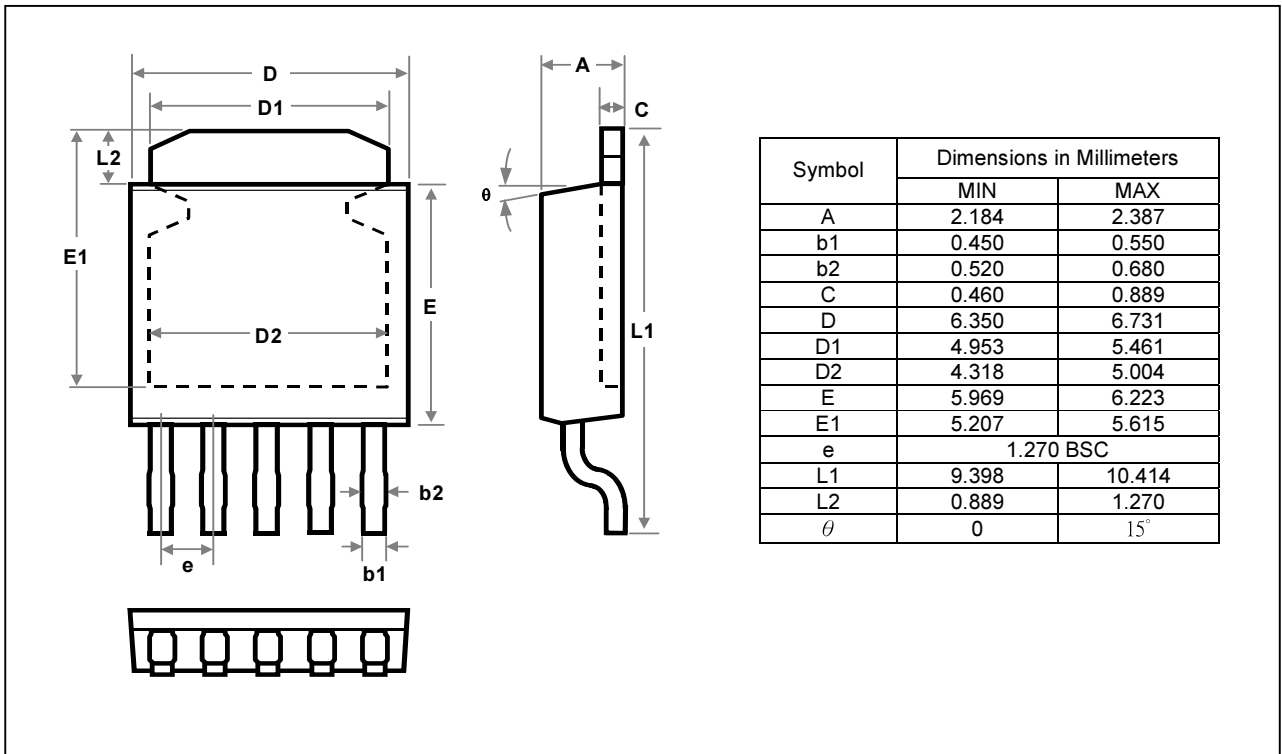
$\theta_{CS}$ : Thermal resistance through the interface between the IC and the surface on which it is mounted.  
(typically,  $\theta_{CS} < 1.0^\circ\text{C/W}$ )

$\theta_{SA}$ : Thermal resistance from the mounting surface to ambient (thermal resistance of the heat sink).

If PC Board copper is going to be used as a heat sink, below table can be used to determine the appropriate size of copper foil required. For multi-layered PCB, these layers can also be used as a heat sink. They can be connected with several through-hole vias.

PCB $\theta_{SA}$ ( $^\circ\text{C/W}$ )	59	45	38	33	27	24	21
PCB heat sink size ( $\text{mm}^2$ )	500	1000	1500	2000	3000	4000	5000



**PACKAGE**
**Top Marking For TO-252 5-Pin**

**TO-252-5L**




**REVISION HISTORY**

Version	Revision Summary			
	No.	Applicable Section(s)	Description	Page(s)
<b>A</b> Nov. 2006	1	All	Initial release to formal version.	1 ~ 7
<b>B</b> Apr. 2007	1	Typical Application Circuit	Add C <sub>BP</sub>	1
	2	Characterization Curves	New section.	4
	3	Thermal Consideration	New section.	7
<b>C</b> Feb. 2008	1	Typical Application Circuit	Add C <sub>O</sub>	1
	2	Absolute Maximum Ratings	Add OE pin voltage rating.	2
	3	Pin Description	Revise OE pin description.	2
	4	Recommended Operating Conditions	Add the minimum value (100mA) for output sink current item.	3
	5	Electrical Characteristics	Add the parameters of load regulation, line regulation, and input high level.	3
<b>D</b> Aug. 2008	1	Order Information	Add Green Process package option.	1
	2	Recommended Operating Conditions	Add OE pin voltage range.	3
	3	Package	1. Add Marking Diagram. 2. Revise the figure for package dimension.	8
<b>E</b> Mar. 2010	1	Order Information, Package	Remove Lead-Free Process package option.	1, 8
	2	Absolute Maximum Ratings	1. Modify the "Input Voltage, V <sub>DD</sub> " rating to 55V. 2. Modify the "Storage Temperature Range" to -55°C to 150°C.	2
	3	DC Electrical Characteristics	1. Revise the parameter of "Output Current Deviation" from (±5% for full current range) to (±16.5mA for small current or ±5% for large current). 2. Add the parameter of "Minimum Output Current" of 100mA.	3
	4	Package	Revise package dimension.	8
<b>F</b> Dec. 2010	1	Order Information, Package	Add the option of AMC7140DLGT-A.	1, 8
	2	Absolute Maximum Ratings	Add the rating for output sink current, I <sub>OUT</sub> .	2
	3	Recommended Operating Conditions	Update the recommended output sink current for AMC7140 and AMC7140A.	3
	4	DC Electrical Characteristics	Update the parameter of "Output Current", "Output Current Deviation", and "Line Regulation".	3

**IMPORTANT NOTICE**

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