AP1084

1A LOW DROPOUT POSITIVE ADJUSTABLE OR FIXED-MODE REGULATOR

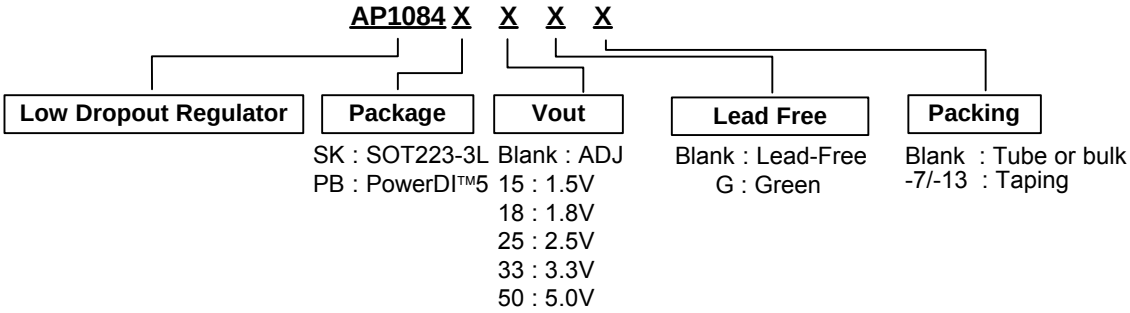
Features

- 1.4V maximum dropout at full load current
- Built-in thermal shutdown
- Output current limiting
- Adjustable output voltage or fixed 1.5V, 1.8V, 2.5V, 3.3V, 5.0V
- Fast transient response
- Good noise rejection
- Package: 3-Pin SOT223 and PowerDI™5 (Under Development) packages

General Description

AP1084 is a low dropout positive adjustable or fixed-mode regulator with minimum of 1.0A output current capability. The product is specifically designed to provide well-regulated supply for low voltage IC applications such as high-speed bus termination and low current 3.3V logic supply. AP1084 is also well suited for other applications such as VGA cards. AP1084 is guaranteed to have lower than 1.4V dropout at full load current making it ideal to provide well-regulated outputs of 1.25 to 3.3V with 4.7 to 12V input supply.

Ordering Information



Device (Note 1)	Package Code	Packaging (Note 2)	7" Tape and Reel		13" Tape and Reel	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix
AP1084SK	SK	SOT-223	3000/Tape & Reel	-7	10,000/Tape & Reel	-13
AP1084SK15	SK	SOT-223	3000/Tape & Reel	-7	10,000/Tape & Reel	-13
AP1084SK18	SK	SOT-223	3000/Tape & Reel	-7	10,000/Tape & Reel	-13
AP1084SK25	SK	SOT-223	3000/Tape & Reel	-7	10,000/Tape & Reel	-13
AP1084SK33	SK	SOT-223	3000/Tape & Reel	-7	10,000/Tape & Reel	-13
AP1084SK50	SK	SOT-223	3000/Tape & Reel	-7	10,000/Tape & Reel	-13
AP1084PB	PB	PowerDI™5	NA	NA	5000/Tape & Reel	-13
AP1084PB15	PB	PowerDI™5	NA	NA	5000/Tape & Reel	-13
AP1084PB18	PB	PowerDI™5	NA	NA	5000/Tape & Reel	-13
AP1084PB25	PB	PowerDI™5	NA	NA	5000/Tape & Reel	-13
AP1084PB33	PB	PowerDI™5	NA	NA	5000/Tape & Reel	-13
AP1084PB50	PB	PowerDI™5	NA	NA	5000/Tape & Reel	-13

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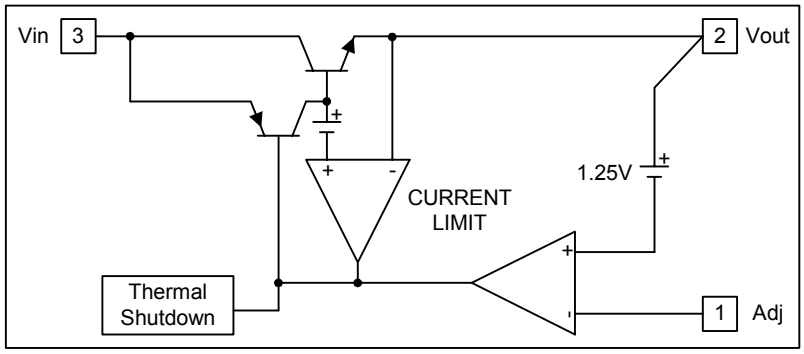
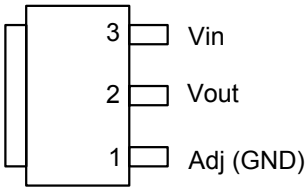
Block Diagram



Connection Diagram

3 PIN SOT-223

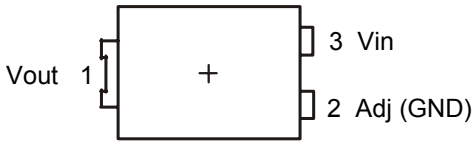
(Top View)



Tab is Vout

3 PIN PowerDI™5

(Top View)



Pin Descriptions

Name	I/O	Pin No.		Function
		SOT-223	PowerDI™ 5	
Adj (GND)	I	1	1	Adjustable (Ground only for fixed mode) A resistor divider from this pin to the Vout pin and ground sets the output voltage. (Ground only for Fixed-Mode)
Vout	O	2	2/3/5/6/7/8	The output of the regulator. A minimum of 10uF (0.15Ω ≤ ESR ≤ 20Ω) capacitor must be connected from this pin to ground to insure stability.
Vin	I	3	4	The input pin of regulator. Typically a large storage capacitor (0.15Ω ≤ ESR ≤ 20Ω) is connected from this pin to ground to insure that the input voltage does not sag below the minimum dropout voltage during the load transient response. This pin must always be 1.4V (1.3V) higher than Vout in order for the device to regulate properly.

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Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
Vin	DC Supply Voltage	-0.3 to 12	V
P_D	Power Dissipation	Internally Limited	
T_{ST}	Storage Temperature	-65 to +150	^oC
T_{OP}	Operating Junction Temperature Range	0 to +150	^oC

Electrical Characteristics (Under Operating Conditions)

Sym.	Parameter	Conditions (Notes)	Min.	Typ.	Max.	Unit
V_{REF}	Reference Voltage	Io=10mA, Tj=25°C, (Vin-Vout)=1.5V	1.225	1.250	1.275	V
Line Regulation	AP1084-XXX	I_O=10mA, V_{OUT}+1.5V<V_{IN}<12V, T_J =25°C			0.2	%
	AP1084-1.5	I_{OUT} = 10mA, T_J = 25°C, 3V≤V_{IN}≤12V	1.470	1.500	1.530	V
	AP1084-1.8	I_{OUT} = 10mA, T_J = 25°C, 3.3V≤V_{IN}≤12V	1.764	1.800	1.836	V
	AP1084-2.5	I_{OUT} = 10mA, T_J = 25°C, 4V≤V_{IN}≤12V	2.450	2.500	2.550	V
	AP1084-3.3	I_{OUT} = 10mA, T_J = 25°C, 4.8V≤V_{IN}≤12V	3.235	3.300	3.365	V
	AP1084-5.0	I_{OUT} = 10mA, T_J = 25°C, 6.5V≤V_{IN}≤12V	4.900	5.000	5.100	V
Load Regulation	AP1084-Adj	V_{IN}=3.3V, 0mA<Io<1A, T_J =25°C (Note 1,2)			1	%
	AP1084-1.5	V_{IN}=3V, 0mA<Io<1A, T_J =25°C (Note 1,2)		12	15	mV
	AP1084-1.8	V_{IN}=3.3V, 0mA<Io<1A T_J =25°C (Note 1,2)		15	18	mV
	AP1084-2.5	V_{IN}=4V, 0mA<Io<1A T_J =25°C (Note 1,2)		20	25	mV
	AP1084-3.3	V_{IN} = 5V, 0mA<Io<1A , T_J=25°C (Note 1,2)		26	33	mV
	AP1084-5.0	V_{IN} = 8V, 0mA<Io<1A, T_J=25°C (Note 1,2)		40	50	mV
ΔVo	Dropout Voltage	Io=1.0A (ΔVout = 1% Vout)		1.3	1.4	V
	Current Limit	Vin-Vout=5V	1.0			A
	Minimum Load Current			5	10	mA
	Temperature Stability	Io=10mA		0.5		%
θ_{JA}	Thermal Resistance Junction-to-Ambient (No heat sink ;No air flow)	SOT-223 : Control Circuitry/Power Transistor PowerDI™5 : Control Circuitry/Power Transistor		117 TBD		°C/W

Note 1: See thermal regulation specifications for changes in output voltage due to heating effects. Line and load regulation are measured at a constant junction temperature by low duty cycle pulse testing. Load regulation is measured at the output lead = 1/18" from the package.

Note 2: Line and load regulation are guaranteed up to the maximum power dissipation of 5W. Power dissipation is determined by the difference between input and output and the output current. Guaranteed maximum power dissipation will not be available over the full input/output range.

Note 3: Output is connected to the PCB copper area 5.5mm*5.5mm separately. If you need large PD or lower Tc & Tj, please connect to the large copper area >> 5.5mm*5.5mm (like 10mm*10mm).

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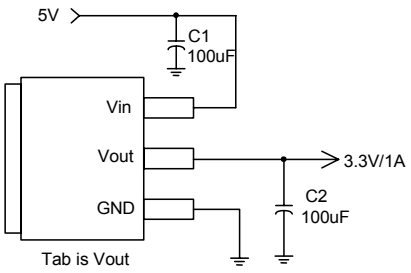
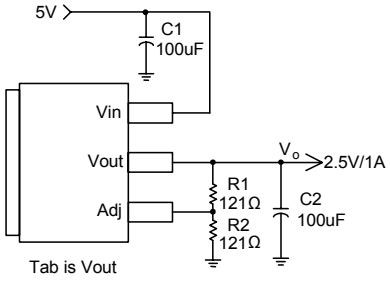
Typical Circuit



(5V/3.3V fixed output)



(5V/2.5V ADJ output)

Note: $V_o = V_{REF} * (1 + \frac{R_2}{R_1})$

Functional Description

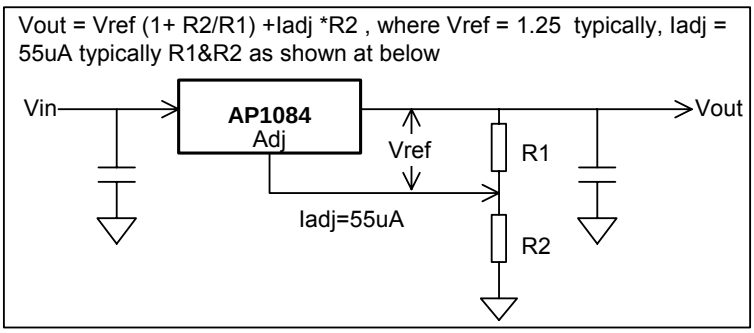
Introduction

The AP1084 adjustable Low Dropout (LDO) regulator is a 3 terminal device that can easily be programmed with the addition of two external resistors to any voltages within the range of 1.25V to Vin-1.4V. The AP1084 only needs 1.4V differential between Vin and Vout to maintain output regulation. In addition, the output voltage tolerances are also extremely tight and they include the transient response as part of the specification. For example, Intel VRE specification calls for a total of +/- 100mV including initial tolerance, load regulation and 0 to 1.0A load step.

The AP1084 is specifically designed to meet the fast current transient needs as well as providing an accurate initial voltage, reducing the overall system cost with the need for fewer output capacitors.

Output Voltage Setting

The AP1084 can be programmed to any voltages in the range of 1.25V to Vin-1.4V with the addition of R1 and R2 external resistors according to the following formula:



The AP1084 keeps a constant 1.25V between the output pin and the adjust pin. By placing a resistor R1 across these two pins a constant current flows through R1, adding to the **Iadj** current and into the R2 resistor producing a voltage equal to the (1.25/R1)*R2+Iadj*R2 which will be added to the 1.25V to set the output voltage. This is summarized in the above equation. Since the minimum load current requirement of the AP1084 is 10mA, R1 is typically selected to be 121Ω resistor so that it automatically satisfies the minimum current requirement. Notice that since Iadj is typically in the range of 55uA it only adds a small error to the output voltage and should only be considered when a very precise output voltage setting is required. For example, in a typical 3.3V application where R1=121Ω and R2=200Ω the error due to **Iadj** is only 0.3% of the nominal set point.

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Functional Description (Continued)

Load Regulation
Since the AP1084 is only a 3 terminal device, it is not possible to provide true remote sensing of the output voltage at the load. The best load regulation is achieved when the bottom side of R2 is connected to the load and the top-side of R1 resistor is connected directly to the case or the Vout pin of the regulator and not to the load. It is important to note that for high current applications, this can re-present a significant percentage of the overall load regulation and one must keep the path from the regulator to the load as short as possible to minimize this effect.

Stability
The AP1084 requires the use of an output capacitor as part of the frequency compensation in order to make the regulator stable. For most applications a minimum of 10uF aluminum electrolytic capacitor insures both stability and good transient response.

Thermal Design
The AP1084 incorporates an internal thermal shutdown that protects the device when the junction temperature exceeds the maximum allowable junction temperature. Although this device can operate with junction temperatures in the range of **150°C**, it is recommended that the selected heat sink be chosen such that during maximum continuous load operation the junction temperature is kept below the temperature.

Layout Consideration
The output capacitors must be located as close to the Vout terminal of the device as possible. It is recommended to use a section of a layer of the PC board as a plane to connect the Vout pin to the output capacitors to prevent any high frequency oscillation that may result due to excessive trace inductance.

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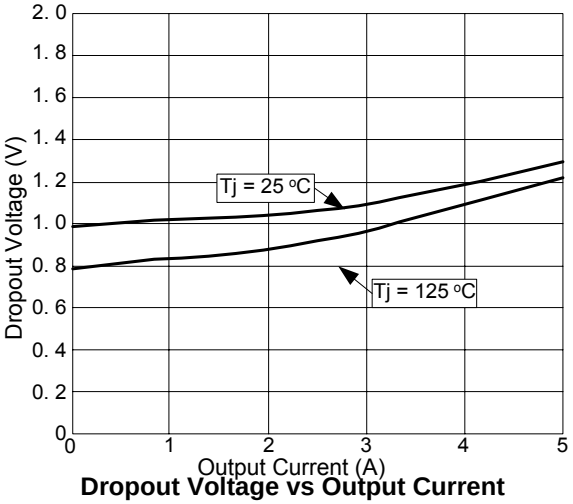
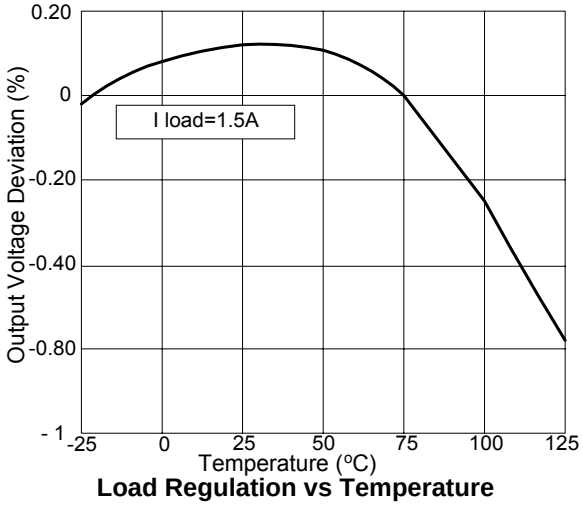
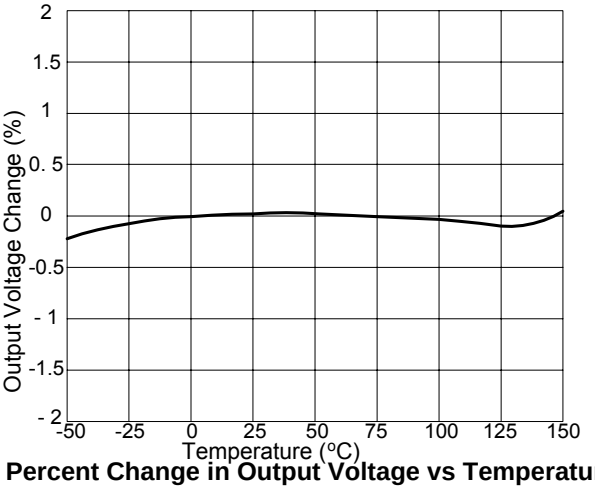
Performance Characteristics



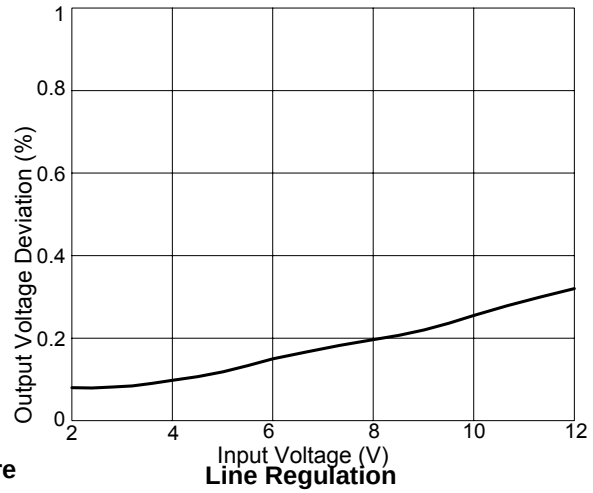
Dropout Voltage vs Output Current



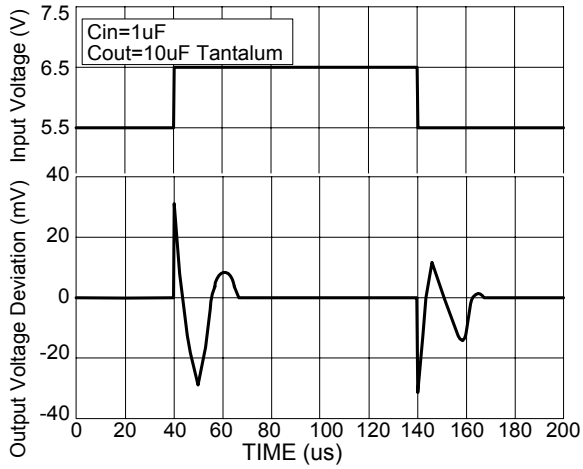
Load Regulation vs Temperature



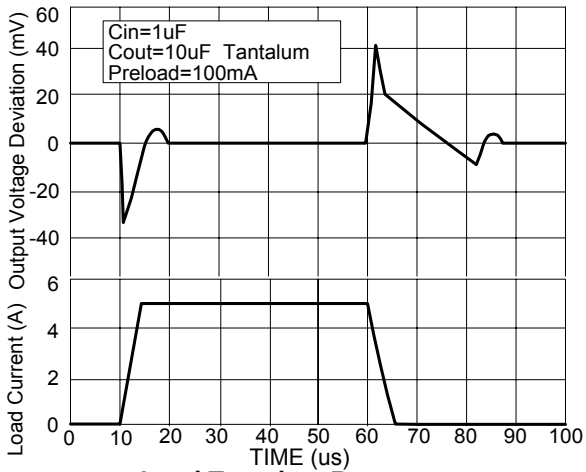
Percent Change in Output Voltage vs Temperature



Line Regulation



Line Transient Response



Load Transient Response

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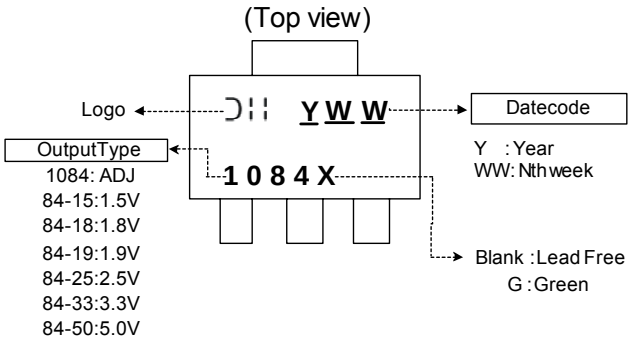
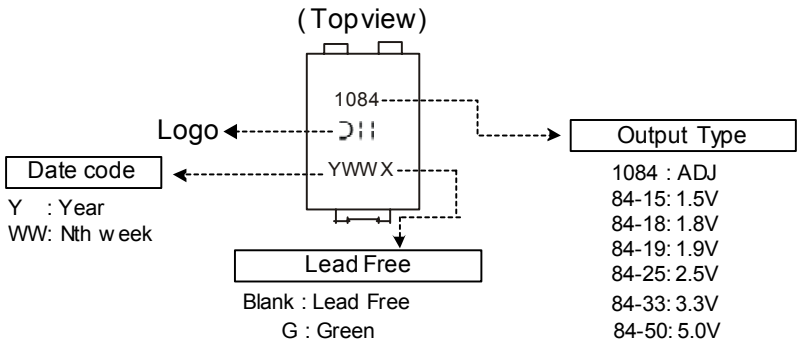
Marking Information

(1) SOT-223



(2) PowerDI™5



Date Code Key

Year	2006	2007	2008	2009	2010
Code	**T**	**U**	**V**	**W**	**X**

Month	Jan	Feb	March	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**O**	**N**	**D**

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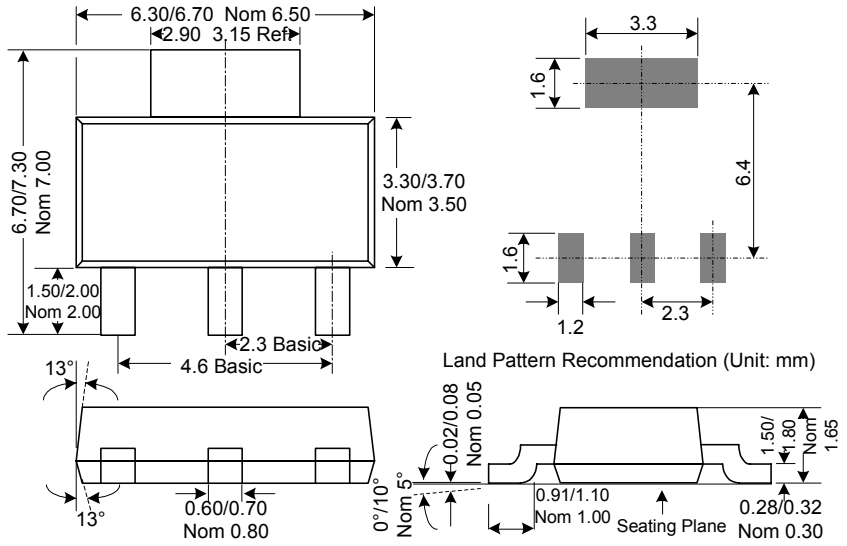
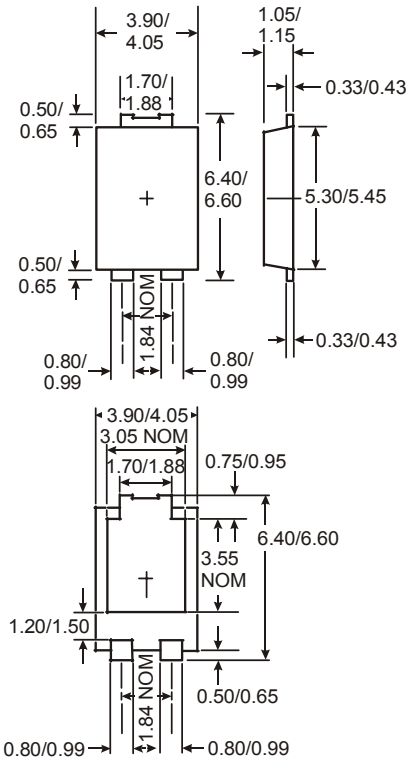
Package Diagrams (All Dimensions in mm)

(1) SOT-223



(2) PowerDI™5



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Marking Code Table

Device	Package (Note 4)	Marking Code	Date Code
AP1084SK	SOT-223	1084	YWW
AP1084SK15	SOT-223	84-15	YWW
AP1084SK18	SOT-223	84-18	YWW
AP1084SK25	SOT-223	84-25	YWW
AP1084SK33	SOT-223	84-33	YWW
AP1084SK50	SOT-223	84-50	YWW
AP1084PB	PowerDI™5	1084	YWW
AP1084PB15	PowerDI™5	84-15	YWW
AP1084PB18	PowerDI™5	84-18	YWW
AP1084PB25	PowerDI™5	84-25	YWW
AP1084PB33	PowerDI™5	84-33	YWW
AP1084PB50	PowerDI™5	84-50	YWW

Note: 4. For Packaging Details, go to our website at http://www.diodes.com/datasheets/ap02007.pdf.

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