

1.6x Linear DC Fan Driver with VOUT Fully on Control

AP2113

General Description

The AP2113 is a low dropout high performance linear regulator which is specially designed to drive a DC fan, the regulator delivers output current 600mA in minimum.

The AP2113 provides low quiescent current consumption 70μA, over current limit protection and load short current protection with fold-back limitation 50mA, which are ideal for battery powered system application.

The AP2113 output voltage (V_{OUT}) follows 1.6 times of V_{SET} input voltage until it reaches V_{IN} voltage minus dropout voltage (V_{DROP}) at adjustable mode (set $\overline{FON}$ pin logic high). The V_{SET} voltage must be larger than 1.0V to guarantee V_{OUT} 1.6 times of V_{SET} . An $\overline{FON}$ pin turns V_{OUT} fully on when set logic low.

The AP2113 is available in standard SOIC-8 and SOT-23-5 packages.

Features

- Output Voltage in Adjustable Mode Follows 1.6 Times of V_{SET} ($V_{OUT}/V_{SET}=1.6 \pm 3\%$)
- Low Quiescent Current: 70μA (Typ)
- Guarantee 0.6A Continuous Load
- Switchable Adjustable Mode/Full Speed Mode
- Over Current Protection
- Short Current Protection with Fold-back Limitation: 50mA
- Low Dropout Voltage:
150mV @ 600mA (Typ) at Full Speed Mode
200mV @ 600mA (Typ) at Adjustable Mode
- OTSD Protection
- Stable with 1.0μF Flexible Caps: Ceramic, Tantalum and Aluminum Electrolytic
- Operation Temperature Range: -40°C to 85°C
- ESD: MM 300V, HBM 6000V

Applications

- Notebook Computer Fan Driver
- Motherboards
- Peripheral Cards

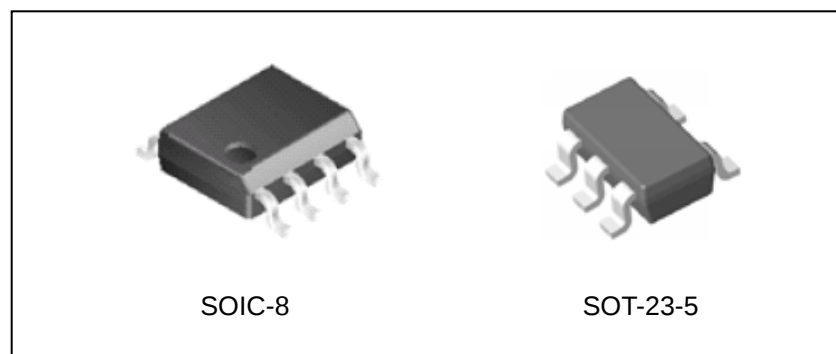


Figure 1. Package Type of AP2113

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Pin Configuration

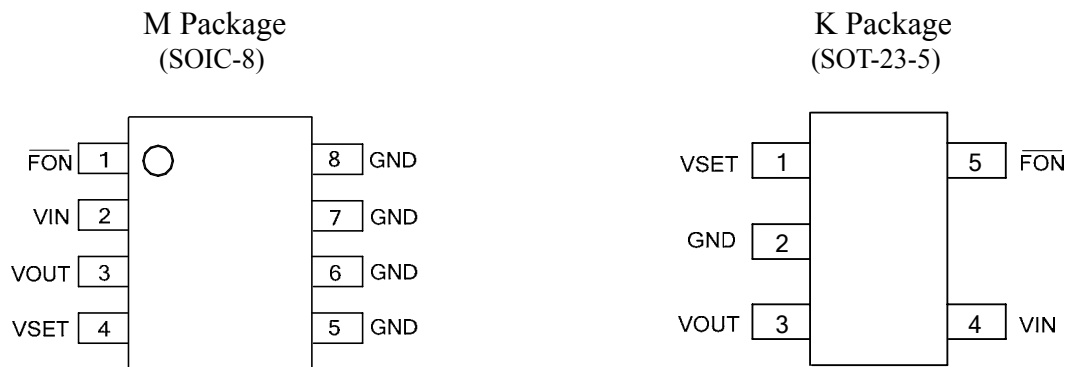


Figure 2. Pin Configuration of AP2113 (Top View)

Pin Descriptions

Pin Number		Pin Name	Function
SOIC-8	SOT-23-5		
1	5	$\overline{\text{FON}}$	Full speed mode / Adjustable mode selection input pin. Set low for full speed mode, set high for adjustable mode with 1.6x
2	4	VIN	Input voltage
3	3	VOUT	Output voltage
4	1	VSET	Voltage input pin, apply DC voltage into VSET as voltage reference, the output voltage follows 1.6 times of VSET voltage
5, 6, 7, 8	2	GND	Ground

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Functional Block Diagram

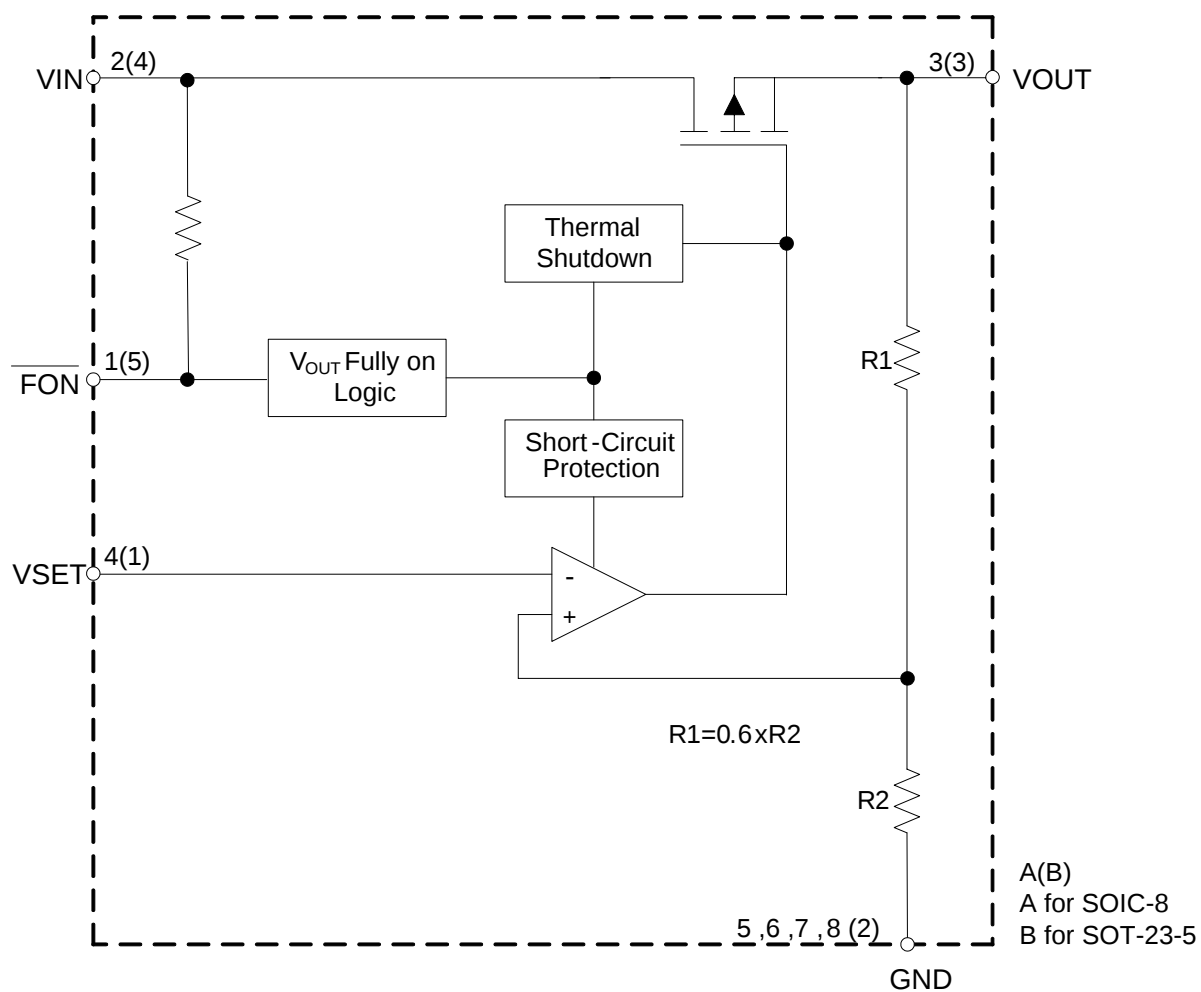
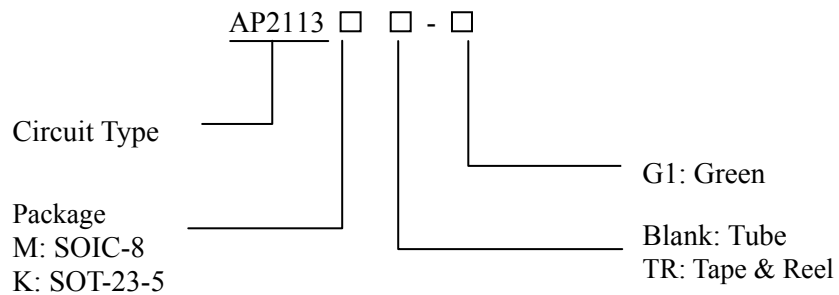


Figure 3. Functional Block Diagram of AP2113

**1.6x Linear DC Fan Driver with VOUT Fully on Control****AP2113****Ordering Information**

Package	Temperature Range	Part Number	Marking ID	Packing Type
SOIC-8	-40 to 85°C	AP2113M-G1	2113M-G1	Tube
		AP2113MTR-G1	2113M-G1	Tape & Reel
SOT-23-5	-40 to 85°C	AP2113KTR-G1	G5O	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and Green.

**1.6x Linear DC Fan Driver with VOUT Fully on Control****AP2113****Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value		Unit
Input Voltage	V_{IN}	6.0		V
VSET Input Voltage	V_{SET}	5.5		V
$\overline{FON}$ Input Voltage	$V_{\overline{FON}}$	5.5		V
Operating Junction Temperature Range	T_J	150		°C
Storage Temperature Range	T_{STG}	-65 to 150		°C
Thermal Resistance (Junction to Ambient) (No Heat Sink)	θ_{JA}	SOIC-8	144	°C/W
ESD (Machine Model)		300		V
ESD (Human Body Model)		6000		V

Note 1: Stresses greater than those listed under “Absolute Maximum Ratings” 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 under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Input Voltage	V_{IN}	2.5	5.5	V
Operating Ambient Temperature Range	T_A	-40	85	°C

**1.6x Linear DC Fan Driver with VOUT Fully on Control****AP2113****Electrical Characteristics**

$V_{IN}=5.0V$, $V_{SET}=2V$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, Typical $T_A=25^\circ C$, Bold typeface applies over full temperature range, $-40^\circ C \leq T_A \leq 85^\circ C$ ranges, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Quiescent Current	I_Q	$V_{FON}=5V$, No Load		70	100	μA
		$V_{FON}=0V$, No Load			45	μA
Output Current	I_{OUT}	$V_{IN}=5.0V$, $V_{OUT}=3.2V$	600			mA
Output Voltage/ VSET Voltage	V_{OUT}/V_{SET}	$V_{IN}=5.5V$, $V_{SET}=1V$ to $3.2V$, $I_{OUT}=30mA$	1.552	1.6	1.648	V/V
Line Regulation	$\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta V_{IN}}$	$V_{IN}=V_{OUT}+1V$ to $5.5V$, $I_{OUT}=30mA$		0.02	0.1	%/V
Load Regulation	$\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta I_{OUT}}$	$1mA \leq I_{OUT} \leq 600mA$		0.2	1	%/A
Dropout Voltage	V_{DROP}	$V_{IN}=5V$, $V_{SET}=2V$, $V_{FON}=0V$, $I_{OUT}=600mA$		150	200	mV
		$V_{IN}=5V$, $V_{SET}=2V$, $V_{FON}=5V$, $I_{OUT}=600mA$		200	250	mV
Minimum VSET Voltage	V_{SET}			1		V
VSET Pin Current	I_{SET}	$V_{SET}=5V$			1	μA
Fold-back Short Current	I_{SHORT}	$V_{OUT}=0V$		50		mA
Output Current Limit	I_{LIMIT}			1000		mA
FON Logic Input High Level			1.6		5.5	V
FON Logic Input Low Level			0		0.4	V
FON Pin Bias Current		$V_{FON}=0V$		1.5	10	μA
Thermal Shutdown Temperature	T_{OTSD}			165		$^\circ C$
Thermal Shutdown Hysteresis	T_{HYOTSD}			25		

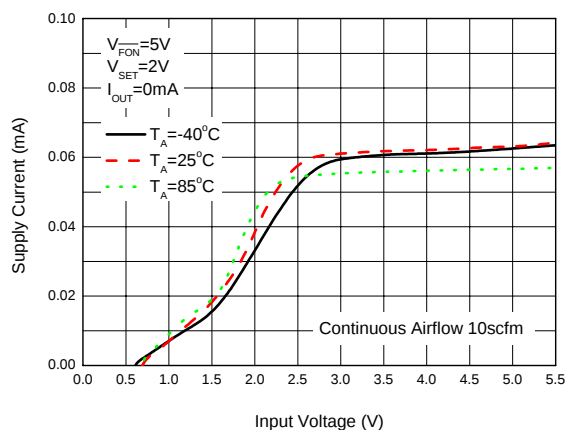
**1.6x Linear DC Fan Driver with V_{OUT} Fully on Control****AP2113****Typical Performance Characteristics**

Figure 4. Supply Current vs. Input Voltage

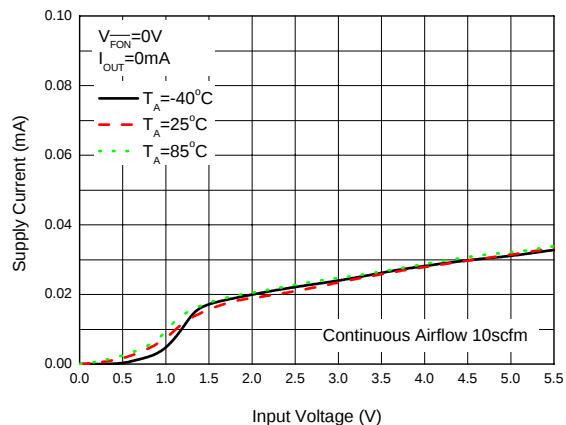


Figure 5. Supply Current vs. Input Voltage

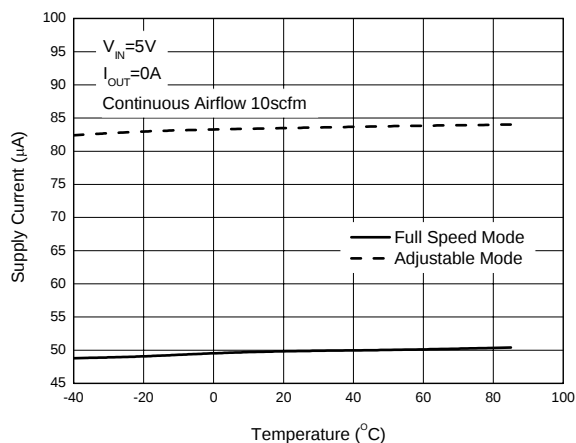
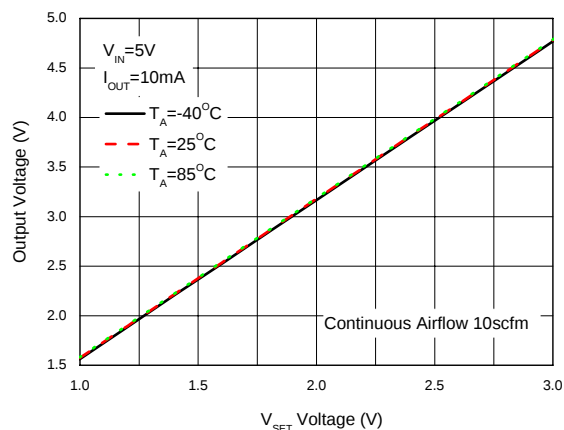


Figure 6. Supply Current vs. Temperature

Figure 7. Output Voltage vs. V_{SET} Voltage

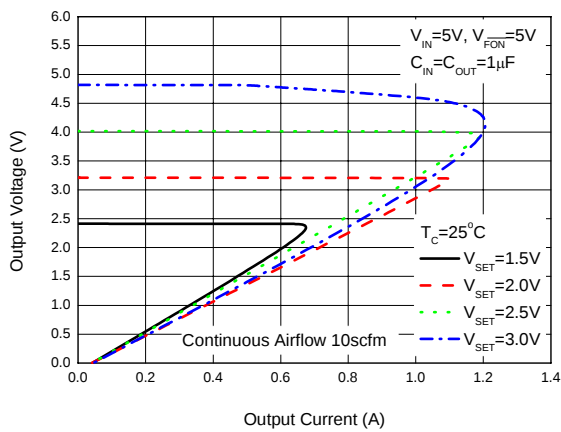
**1.6x Linear DC Fan Driver with VOUT Fully on Control****AP2113****Typical Performance Characteristics (Continued)**

Figure 8. Output Voltage vs. Output Current

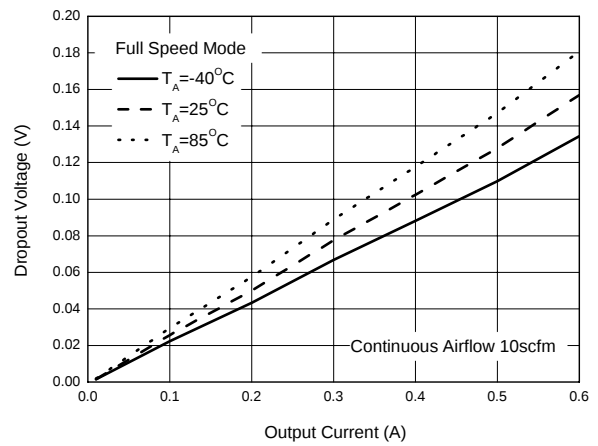
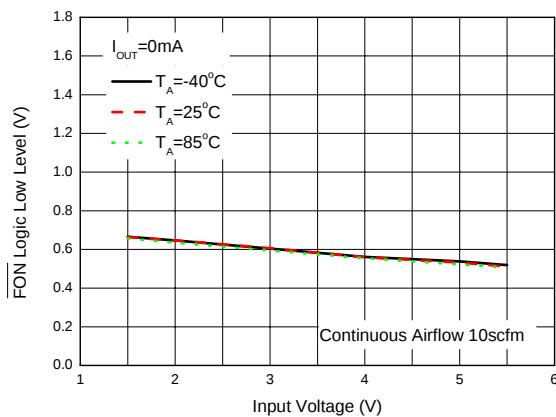
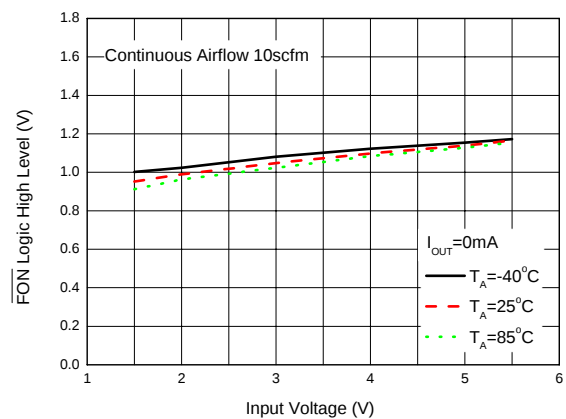


Figure 9. Dropout Voltage vs. Output Current

Figure 10. $\overline{\text{FON}}$ Logic Low Level vs. Input VoltageFigure 11. $\overline{\text{FON}}$ Logic High Level vs. Input Voltage

Typical Performance Characteristics (Continued)

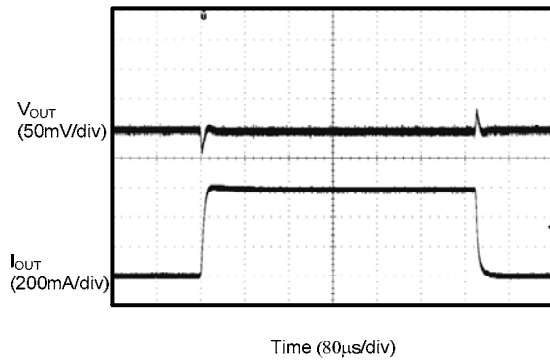


Figure 12. Load Transient
($V_{IN}=5V$, $V_{SET}=2V$, $V_{FON}=5V$, $C_{IN}=C_{OUT}=1\mu F$,
Slew Rate=250mA/ μs)

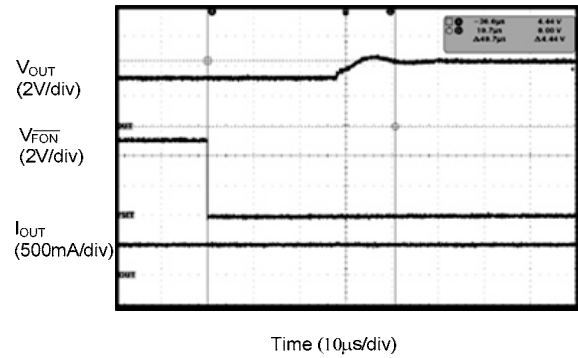


Figure 13. Mode Change Delay Time (V_{FON} Off)

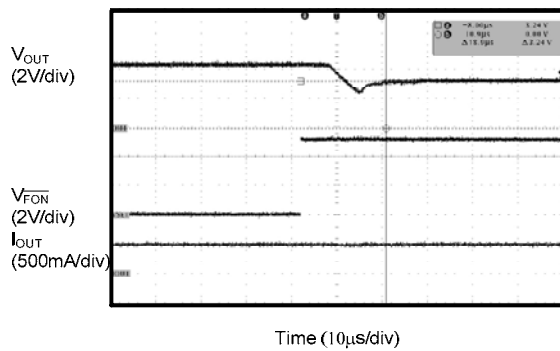


Figure 14. Mode Change Delay Time (V_{FON} On)

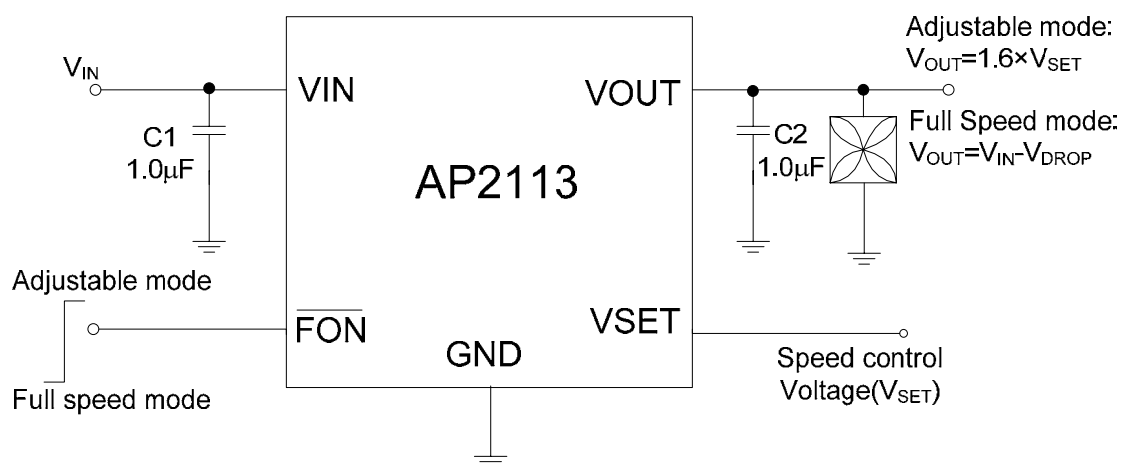
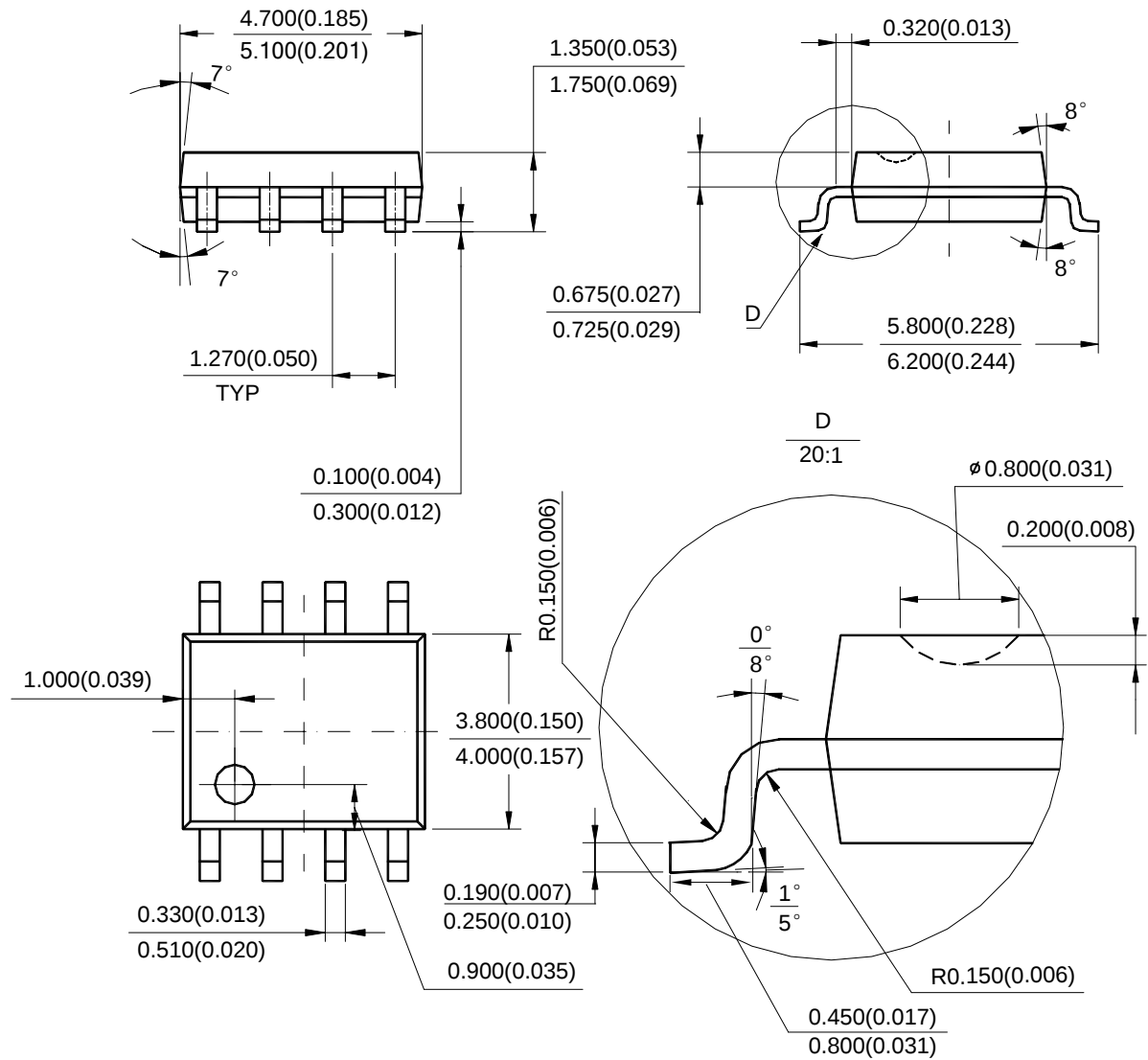
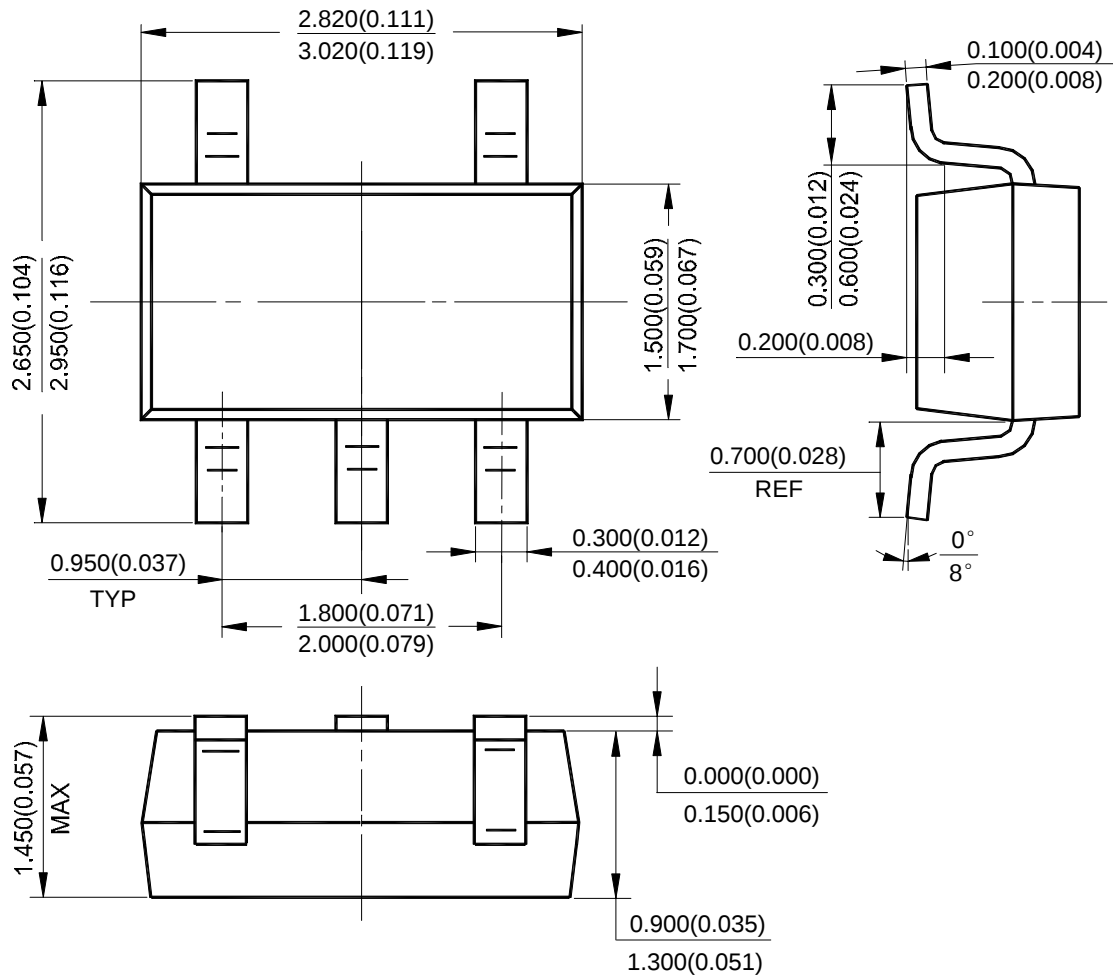
1.6x Linear DC Fan Driver with VOUT Fully on Control**AP2113****Typical Application**

Figure 15. Typical Application of AP2113

1.6x Linear DC Fan Driver with VOUT Fully on Control
AP2113
Mechanical Dimensions
SOIC-8
Unit: mm(inch)


Note: Eject hole, oriented hole and mold mark is optional.

1.6x Linear DC Fan Driver with VOUT Fully on Control
AP2113
Mechanical Dimensions (Continued)
SOT-23-5
Unit: mm(inch)




BCD Semiconductor Manufacturing Limited

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