AXElite Powered By Innovation 亞瑟萊特科技股份有限公司 AXElite Technology Co., Ltd.

200KHz, 1A PWM Buck DC/DC Converter

❖ GENERAL DESCRIPTION

The AX3023 series are monolithic IC designed for a step-down DC/DC converter, and own the ability of driving a 1A load without additional transistor. It saves board space. The external shutdown function can be controlled by logic level and then come into standby mode. The internal compensation makes feedback control having good line and load regulation without external design. Regarding protected function, thermal shutdown is to prevent over temperature operating from damage, and current limit is against over current operating of the output switch. If the AX3023's V_{FB} is down below 0.5V, the switching frequency will be reduced. The AX3023 operates at a switching frequency of 200KHz thus allow smaller sized filter components. Other features include a guaranteed +3% tolerance on output voltage under specified input voltage and output load conditions, The chips are available in SOT23-5L and SOP-8L packages.

❖ FEATURES

- Output voltage: adjustable output version.
- Adjustable version output voltage range: 0.745V to 26V±3%.
- Fixed switching frequency is 200KHz
- Thermal-shutdown and current-limit protection.
- ON/OFF shutdown control input.
- Short Circuit Protect (SCP).
- Operating voltage can be up to 28V.
- Output load current: 1A.
- SOT23-5L and SOP-8L packages.
- Low power standby mode.
- Built-in switching transistor on chip.

❖ **BLOCK DIAGRAM**
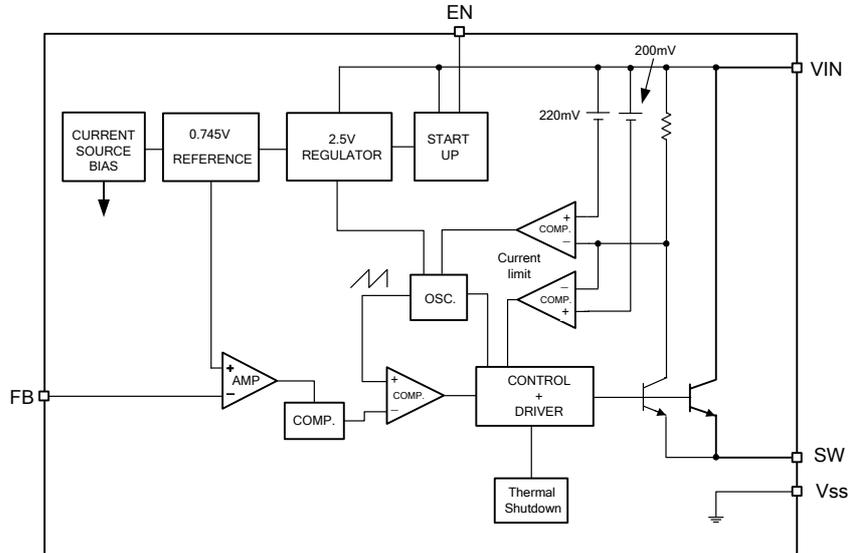
❖ **PIN ASSIGNMENT**

The packages of AX3023 are SOT23-5L and SOP-8L; the pin assignment is given by:

SOT23-5L

SOP-8L
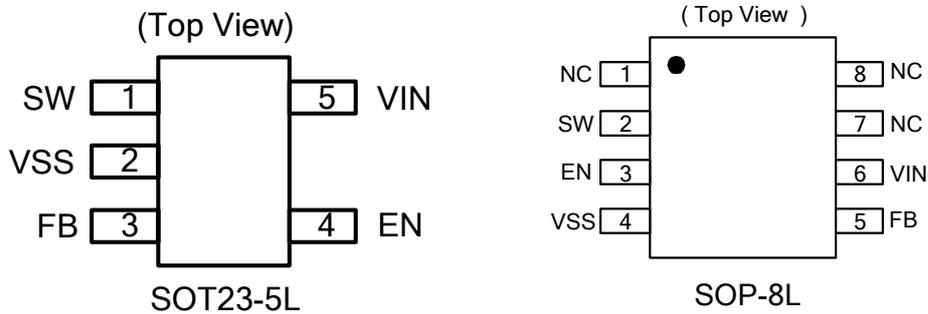
Name	Description
VIN	Operating voltage input
SW	Switching output
FB	Output voltage feedback control
EN	ON/OFF Shutdown
VSS	Ground pin
NC	No connect Pin

❖ ORDER/MARKING INFORMATION

Order Information

AX3023 X X

Package Type
B: SOT23-5L
S: SOP-8L

Packing
Blank : Tube
A : Taping

Top Marking (SOP-8L)	Top Marking (SOT23-5L)
Logo ←··· **AX**3023 ···→ Part number XX XX X ···→ ID code: internal → WW: 01~52 → Year : 08 = 2008	XXYW → WW : 01~26(A~Z) 27~52(a~z) → Year : 7 = 2007 A = 2010 → Part number code N1 : AX3023

❖ Absolute Maximum Ratings

Characteristics		Symbol	Rating	Unit
Maximum Supply Voltage		V_{IN}	+30	V
ON/OFF Pin Input Voltage		V_{EN}	-0.3 to V_{IN}	V
Feedback Pin Voltage		V_{FB}	-0.3 to 12	V
Output Voltage to Ground		V_{OUT}	-0.8	V
Power Dissipation Internally limited		PD	$(T_J-T_A)/\theta_{JA}$	W
Storage Temperature Range		T_{ST}	-65 to +150	℃
Operating Junction Temperature Range		T_J	-40 to +125	℃
Operating Supply Voltage		V_{OP}	+4.5 to +28	V
Thermal Resistance from Junction to case	SOP-8L	θ_{JC}	50	℃/W
	SOT23-5L		180	
Thermal Resistance from Junction to ambient	SOP-8L	θ_{JA}	120	℃/W
	SOT23-5L		250	

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❖ **Electrical Characteristics** (Unless otherwise specified, Ta=25°C, V_{IN}=12V. V_{OUT}=3.3V ILOAD = 0.3A)

Characteristics		Symbol	Conditions	Min	Typ	Max	Units
Feedback Voltage		V_{FB}	I_{OUT}=0.3A	0.723	0.745	0.767	V
Quiescent Current		I_Q	V_{FB}=1.2V force driver off	-	3.5	6	mA
Feedback bias current		I_{FB}	I_{OUT}=0.1A	-	-10	-50	nA
Shutdown supply Current		I_{SD}	V_{EN} =0V	-	2	10	uA
Oscillator frequency		F_{OSC}		140	200	260	KHz
Oscillator frequency of short circuit protect		F_{SCP}	(Adjustable) When V_{FB}<0.5V	-	50	-	KHz
Max. Duty Cycle (ON)		DC	V_{FB}=1.2V force driver off	-	0	-	%
Min. Duty Cycle (OFF)			V_{FB}=0V force driver on	-	100	-	
Current limit		I_{CL}	Pear current, No outside circuit V $_{FB}$=0V force driver on	1.2	-	-	A
Saturation voltage		V_{SAT}	I_{OUT}=1A, No outside circuit V_{FB}=0V force driver on	-	1.2	1.5	V
SW pin=0V	SW pin leakage current	I_{SWL}	V_{IN}=28V, No outside circuit V_{FB}=1.0V force driver off	-	-	-200	uA
SW pin=-0.8V				-	-5	-	mA
EN pin logic input threshold voltage		V_{IH}	High (regulator ON)	-		2.0	V
		V_{IL}	Low (regulator OFF)	0.5		-	
EN pin logic input current		I_H	V_{EN}=2.5V (ON)	-	20	-	uA
EN pin input current		I_L	V_{EN}=0.3V (OFF)	-	-5	-	
Thermal shutdown Temp		TSD		-	145	-	℃

❖ Application Circuit

Adjustable Output Voltage Version
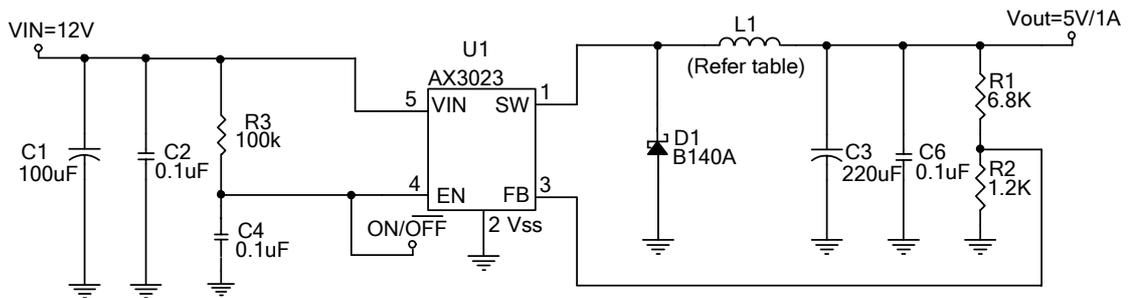
$$Vout = V_{FB} \times (1 + \frac{R1}{R2}), V_{FB} = 0.745V, R2 = 0.75K \sim 4K$$

Table 1 Resistor select for output voltage setting

V_{OUT}	R2	R1
5V	1.2K	6.8K
3.3V	2.4K	8.2K
2.5V	2K	4.7K
1.8V	3.3K	4.7K
1.5V	2K	2K
1.3V	2K	1.5K
1.2V	2K	1.2K

L1 recommend value (V_{IN}=12V ,I_{OUT}=1A,)			
V_{OUT}	1.8 V	2.5V	3.3V	5V
L1 Value	33uH	33uH	47uH	47uH

❖ **Function Descriptions**

Pin Functions

VIN

This is the positive input supply for the IC switching regulator. A suitable input bypass capacitor must be presented at this pin to minimize voltage transients and to supply the switching currents needed by the regulator.

V_{SS}

Circuit ground.

SW

Internal switch. The voltage at this pin switches between $(+V_{IN} - V_{SAT})$ and approximately $- 0.5V$, with a duty cycle of approximately V_{OUT} / V_{IN}. To minimize coupling to sensitive circuitry, the PC board copper area connected to this pin should be minimized.

FB

Senses the regulated output voltage to complete the feedback loop.

EN

Allows the switching regulator circuit to be shutdown using logic level signals thus dropping the total input supply current to approximately 10uA. Pulling this pin below a threshold voltage of approximately 0.5V shuts the regulator down, and pulling this pin above 2.0V (up to a maximum of VIN) turns the regulator on.

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❖ **Typical Characteristics**

Iout vs VFB (Vin=12V)

Temperature vs VFB (Vin=12V Iout=300mA)

Vin vs Iccq

Temperature vs Iccq (Vin=12V)

Vin vs Frequency

Temperature vs Frequency (Vin=12V Iout=300mA)

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❖ Typical Characteristics

Vin vs Fscp

Temperature vs Fscp (Vin=12V)

Vin vs Current Limit

Temperature vs Current Limit (Vin=12V)

Iout vs Saturation Voltage (Vin=12V)

Temperature vs Ishutdown (Vin=12V)

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❖ **Typical Characteristics**


Iout vs EFFI (Vin=8V Vout=5V)


Iout vs EFFI (Vin=12V Vout=5V)
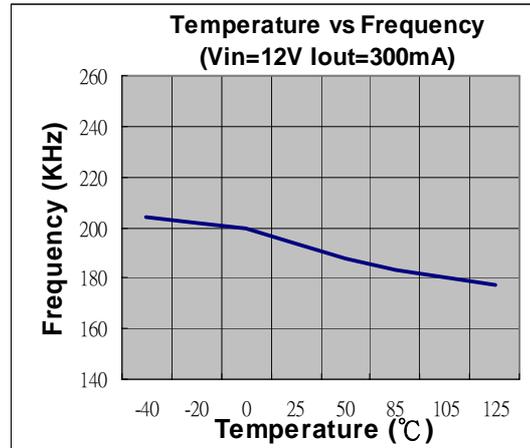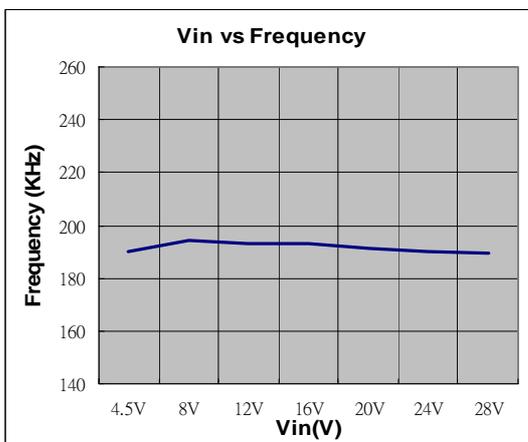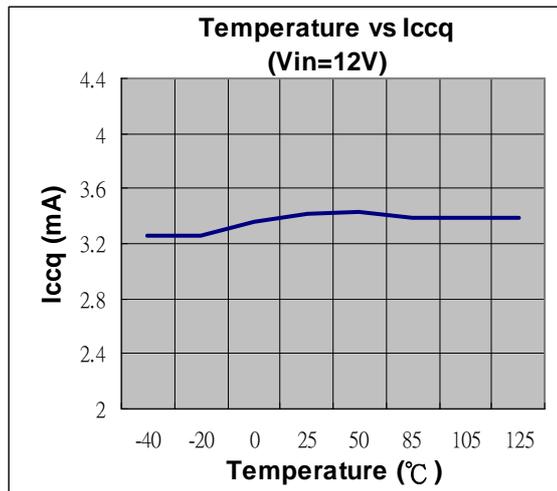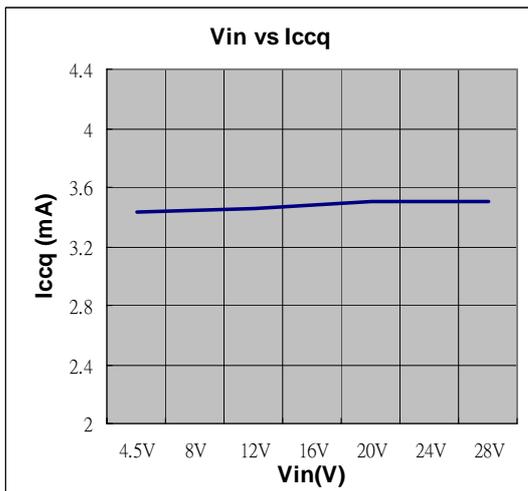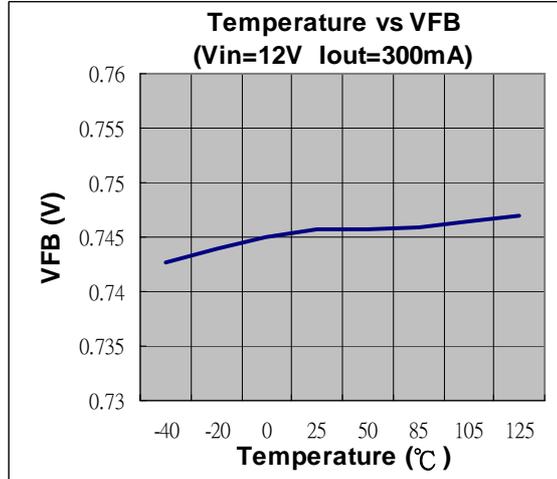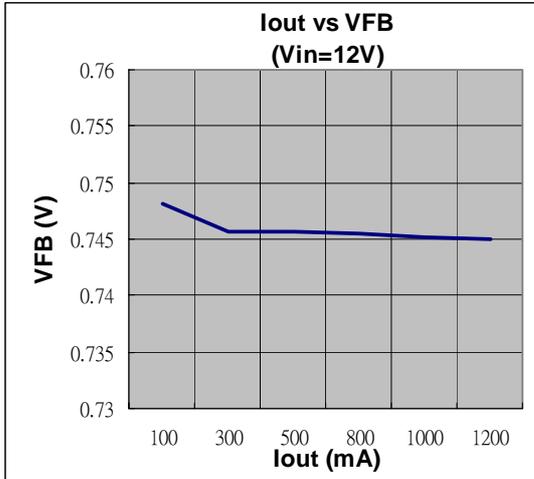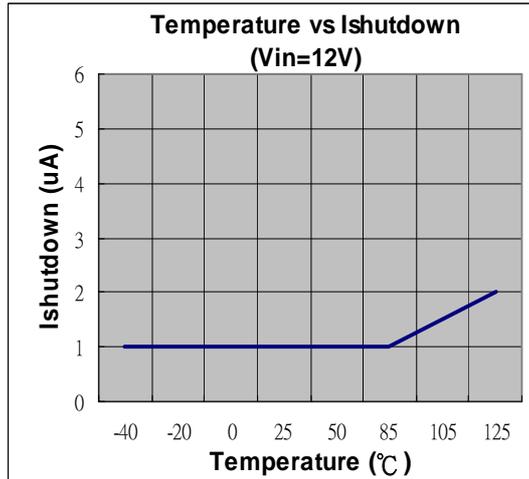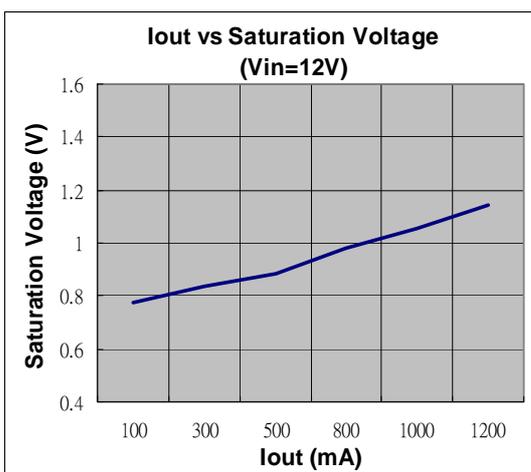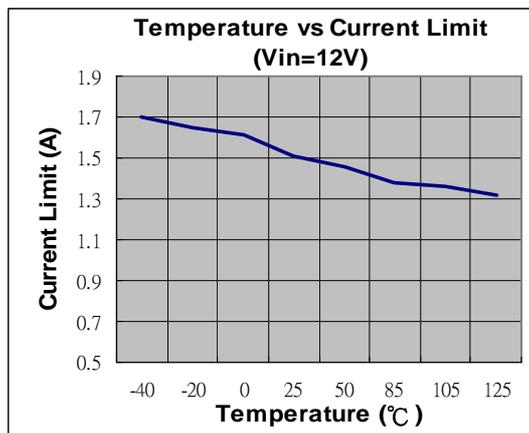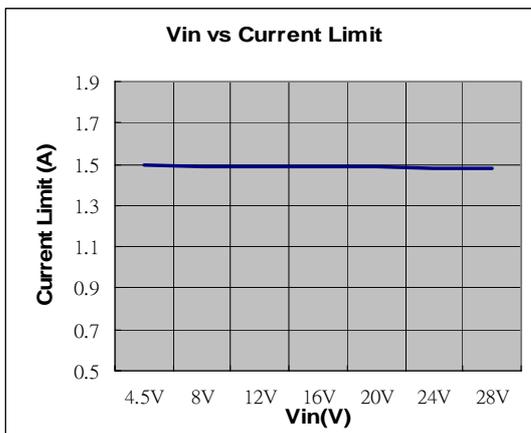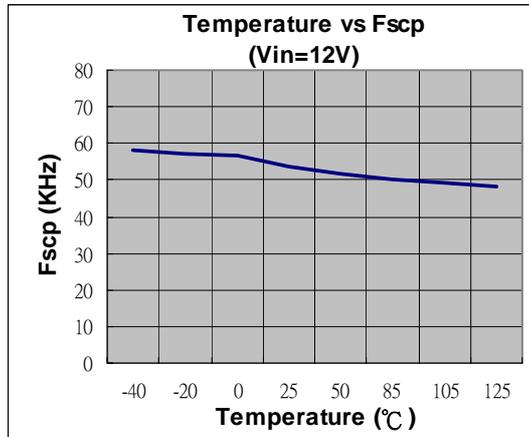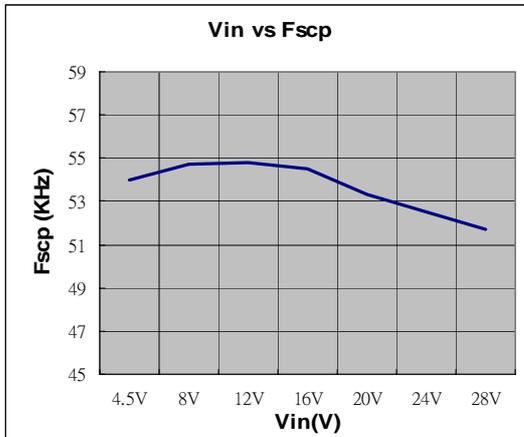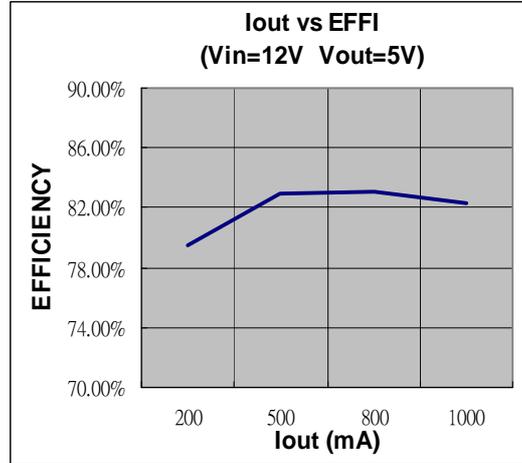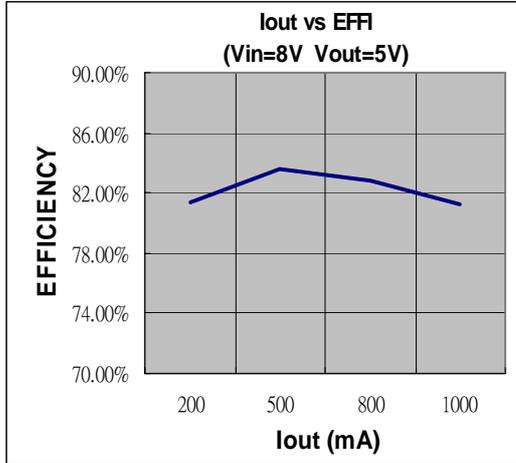
Output Ripple (12V→5V @1A)
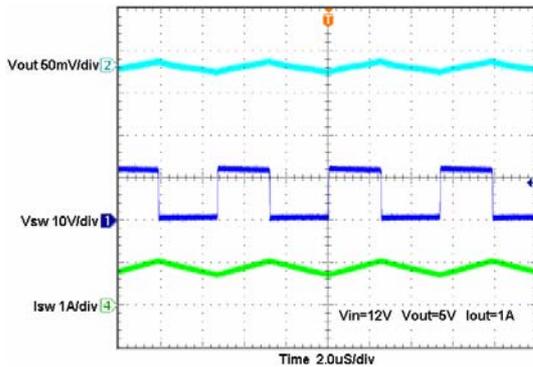
Output Ripple (24V→5V @1A)
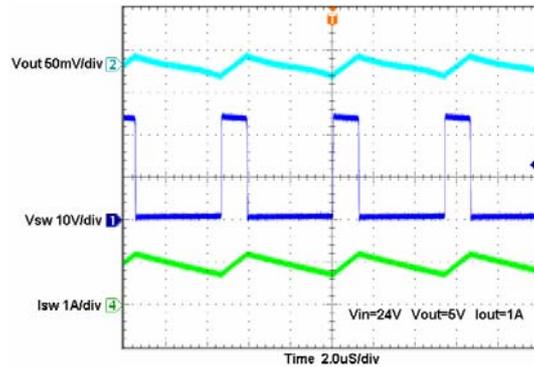
EN Off→ON Test (12V→5V @1A)
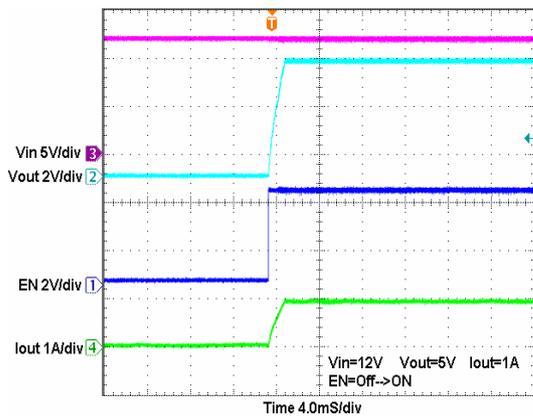
EN Off→ON Test (24V→5V @1A)

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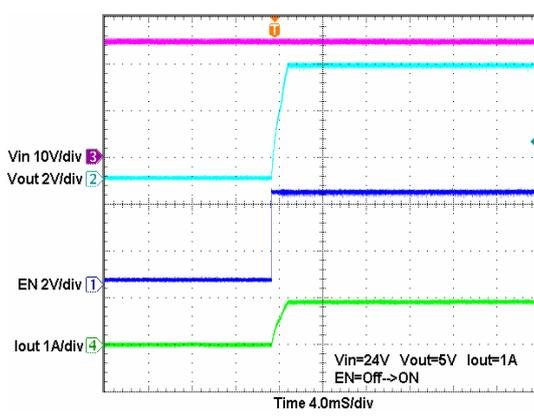
❖ Typical Characteristics

Load Transient (12V→5V @0.1~1A)   Load Transient (24V→5V @0.1~1A)
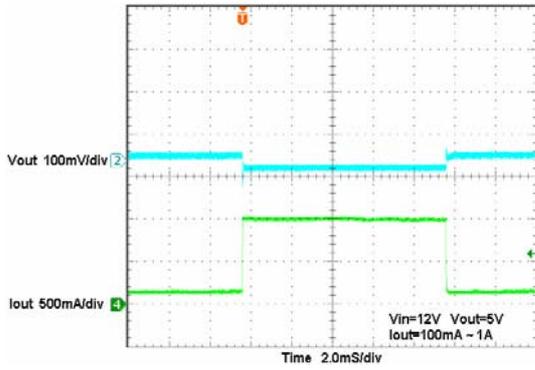
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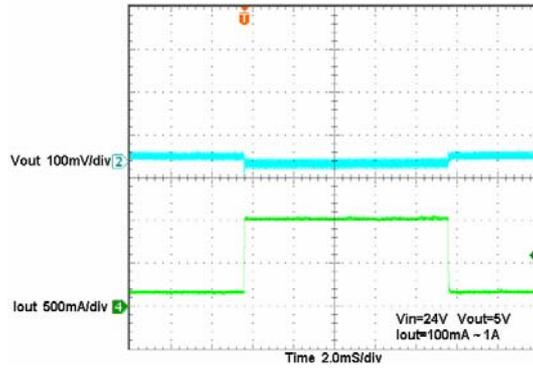
❖ **Package Outlines**

(1) SOP-8L

DETAIL A

DETAIL A
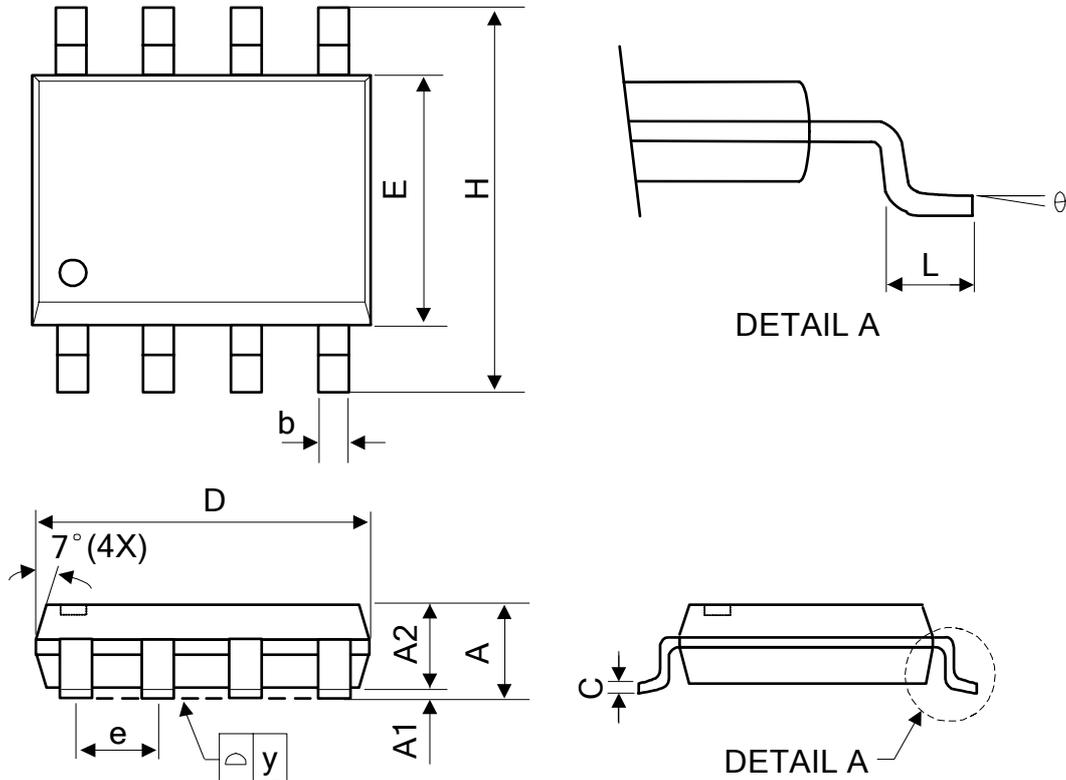
Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.40	1.60	1.75	0.055	0.063	0.069
A1	0.10	-	0.25	0.040	-	0.100
A2	1.30	1.45	1.50	0.051	0.057	0.059
C	0.19	0.20	0.25	0.0075	0.008	0.010
D	4.80	4.90	5.00	0.189	0.193	0.197
E	3.80	3.90	4.00	0.150	0.154	0.157
H	5.79	5.99	6.20	0.228	0.236	0.244
L	0.38	0.71	1.27	0.015	0.028	0.050
b	0.33	0.41	0.51	0.013	0.016	0.020
e	1.27 TYP			0.050 TYP		
y	-	-	0.10	-	-	0.004
θ	0°	-	8°	0°	-	8°

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(2) SOT23-5L

DETAL A

DETAL A
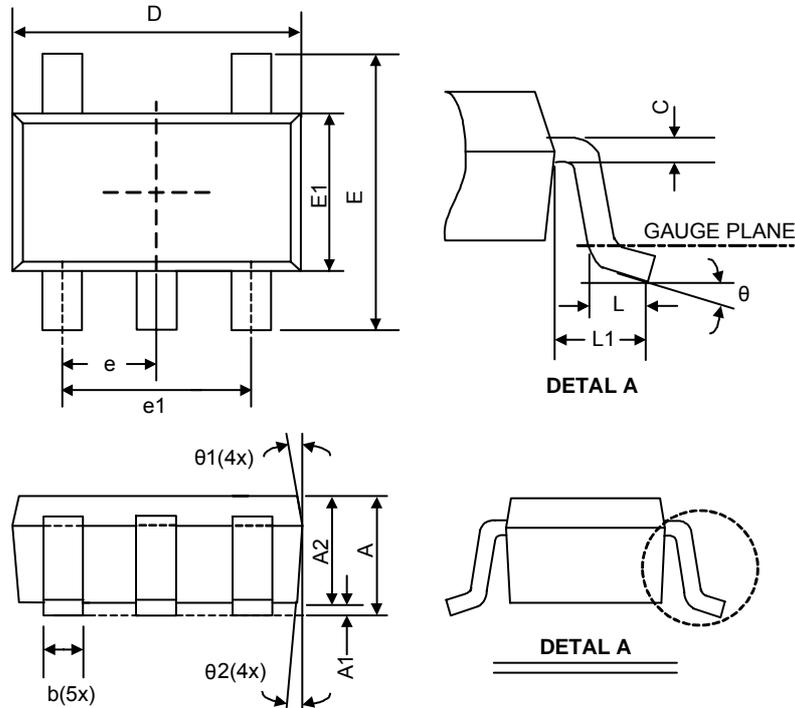
Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.05	-	1.35	0.041	-	0.053
A1	0.05	-	0.15	0.002	-	0.006
A2	1.00	1.10	1.20	0.039	0.043	0.047
b	0.30	-	0.50	0.012	-	0.020
C	0.08	-	0.22	0.003	-	0.009
D	2.80	2.90	3.00	0.110	0.114	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
E	2.60	2.80	3.00	0.102	0.110	0.118
L	0.30	-	0.60	0.012	-	0.024
L1	0.50	0.60	0.70	0.020	0.024	0.028
e1	1.80	1.90	2.00	0.071	0.075	0.079
e	0.85	0.95	1.05	0.033	0.037	0.041
θ	0°	4°	8°	0°	4°	8°
θ1	5°	10°	15°	5°	10°	15°
θ2	5°	10°	15°	5°	10°	15°