200KHz, 1A PWM Buck DC/DC Converter

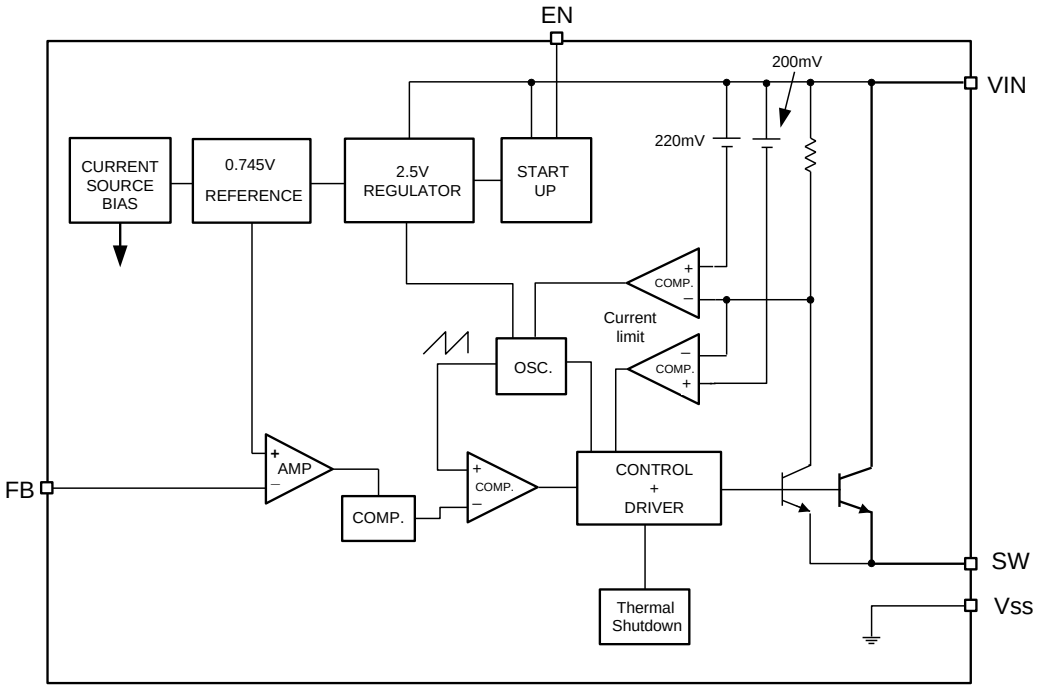
❖ GENERAL DESCRIPTION

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 SOT-23-5L and SOP-8L packages.

❖ FEATURES

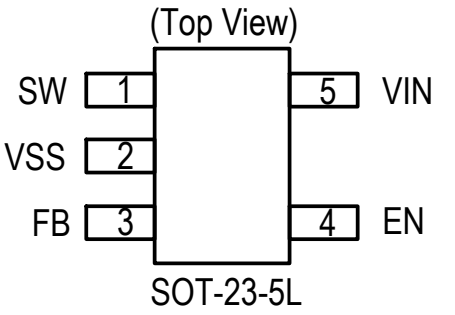
- Output voltage: adjustable output version.
- Adjustable version output voltage range: 0.745V to 22V±3%.
- Fixed switching frequency is 200KHz
- Thermal-shutdown and current-limit protection.
- ON/OFF shutdown control input.
- Short Circuit Protect (SCP).
- Operating voltage can be up to 24V.
- Output load current: 1A.
- SOT-23-5L and SOP-8L packages.
- Low power standby mode.
- Built-in switching transistor on chip.

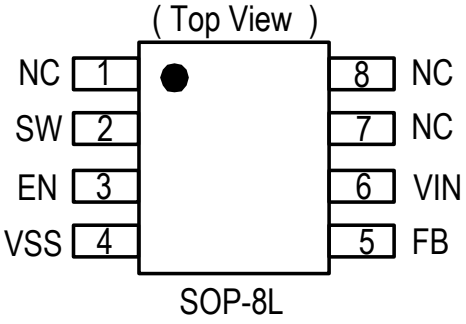
❖ BLOCK DIAGRAM



❖ PIN ASSIGNMENT

The packages of AX3023 are SOT-23-5L and SOP-8L; the pin assignment is given by:





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

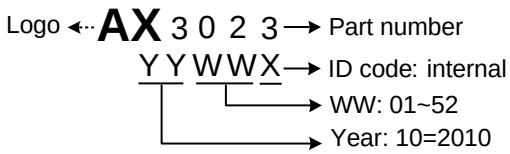
❖ ORDER/MARKING INFORMATION

Order Information

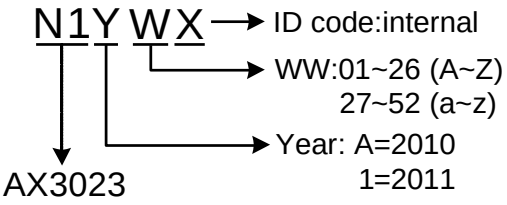
AX3023 X X

Package Type	Packing
B: SOT-23-5L	Blank : Tube
S: SOP-8L	A : Taping

Top Marking (SOP-8L)



Top Marking (SOT-23-5L)



❖ ABSOLUTE MAXIMUM RATINGS

Characteristics		Symbol	Rating	Unit
Maximum Supply Voltage		V_{IN}	+28	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	°C
Operating Junction Temperature Range		T_J	-40 to +125	°C
Operating Supply Voltage		V_{OP}	+4.5 to +24	V
Thermal Resistance from Junction to case	SOP-8L	θ_{JC}	50	°C/W
	SOT-23-5L		180	
	SOT-23-5L **(Note)**		110	
Thermal Resistance from Junction to ambient	SOP-8L	θ_{JA}	120	°C/W
	SOT-23-5L		250	
	SOT-23-5L **(Note)**		220	

Note: θ_{JA} is measured with the PCB copper area(need connect to V_{SS} pins) of approximately 1.5 in^2 (Multi-layer).

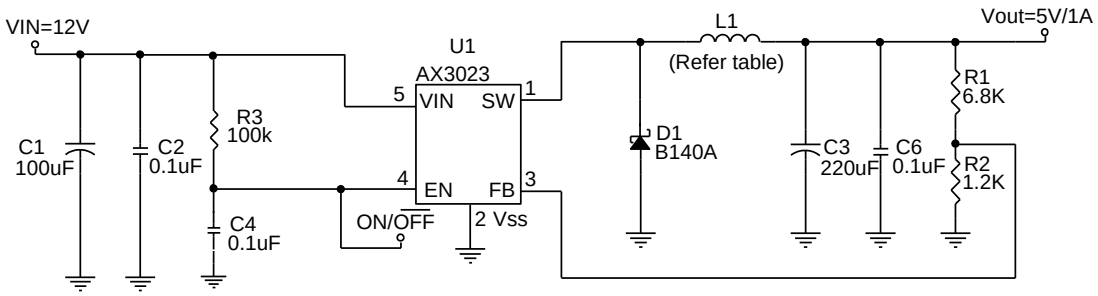
❖ ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, T_A=25°C, V_{IN}=12V, V_{OUT}=3.3V, I_{LOAD} = 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}=24V, 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	-	°C

❖ APPLICATION CIRCUIT

Adjustable Output Voltage Version



$$V_{OUT} = V_{FB} \times (1 + \frac{R1}{R2}),\ V_{FB} = 0.745V,\ R2 = 0.75K \sim 4K$$

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 (H)	33μ	33μ	47μ	47μ

❖ FUNCTION DESCRIPTIONS

Pin Functions

V_{IN}

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.

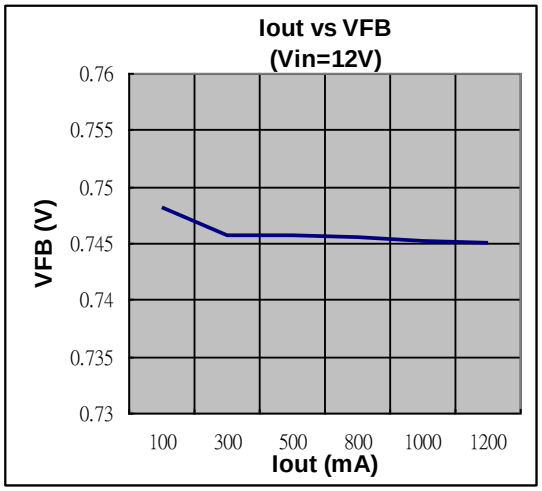
FB

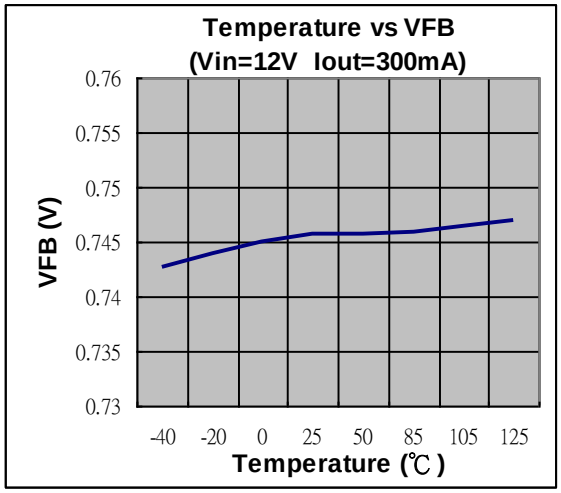
Senses the regulated output voltage to complete the feedback loop.

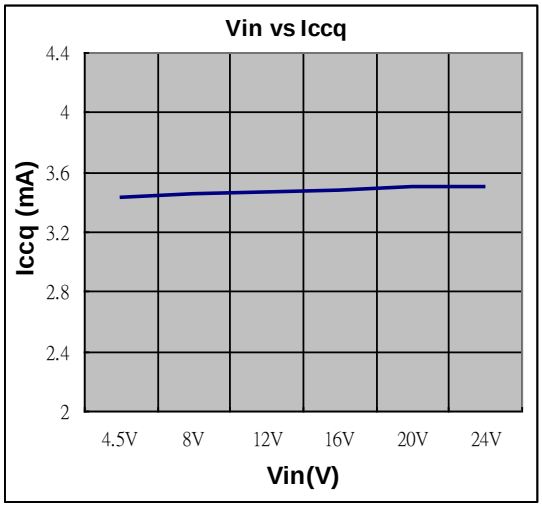
EN

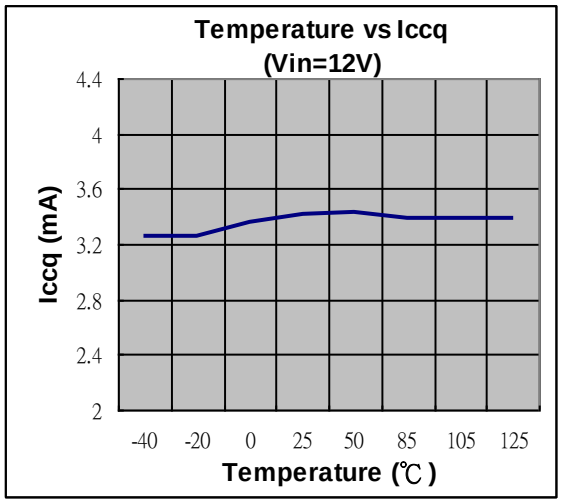
Allows the switching regulator circuit to be shutdown using logic level signals thus dropping the total input supply current to approximately 10uA. Pulling this pin below a threshold voltage of approximately 0.5V shuts the regulator down, and pulling this pin above 2.0V (up to a maximum of V_{IN}) turns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

❖ TYPICAL CHARACTERISTICS









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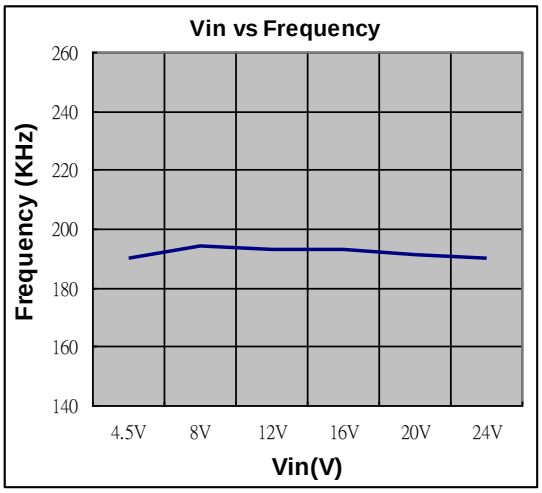

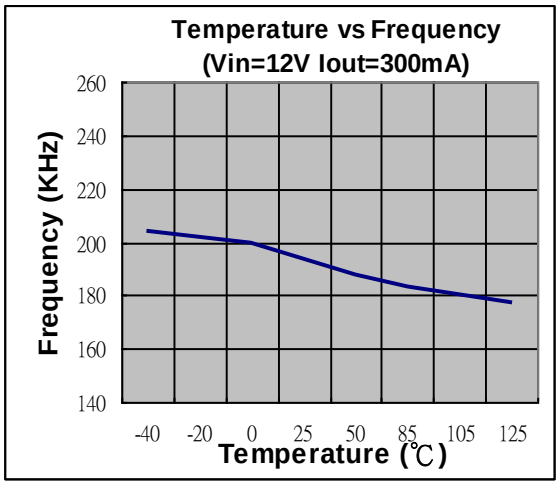

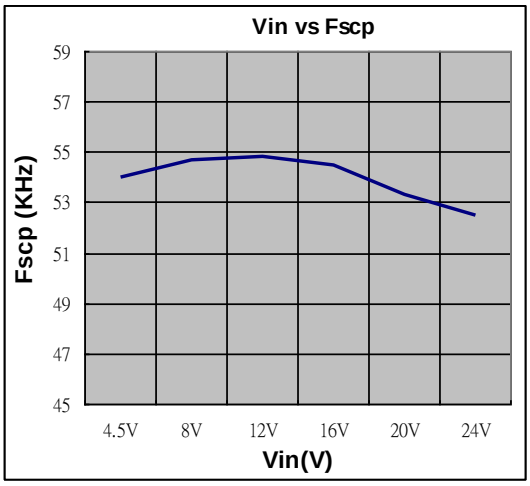

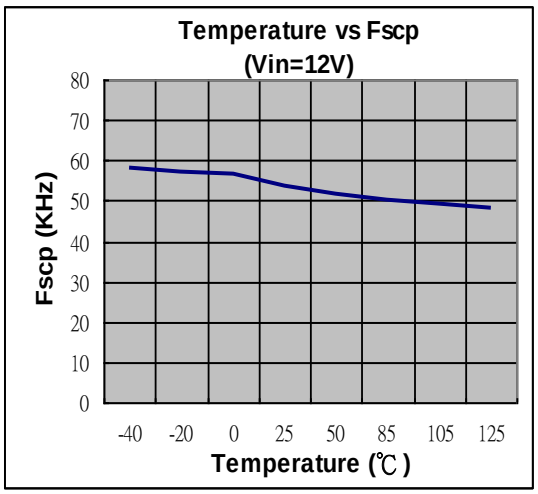

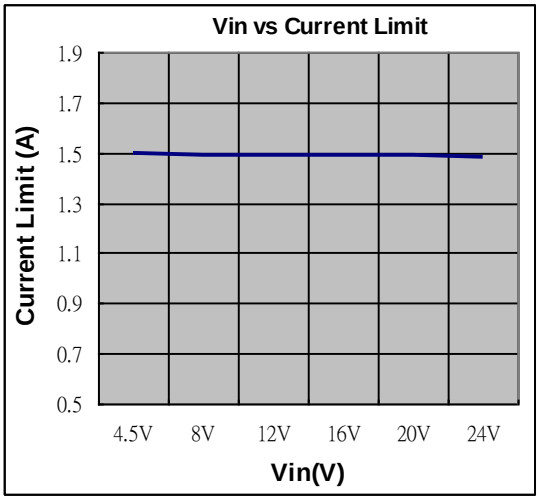

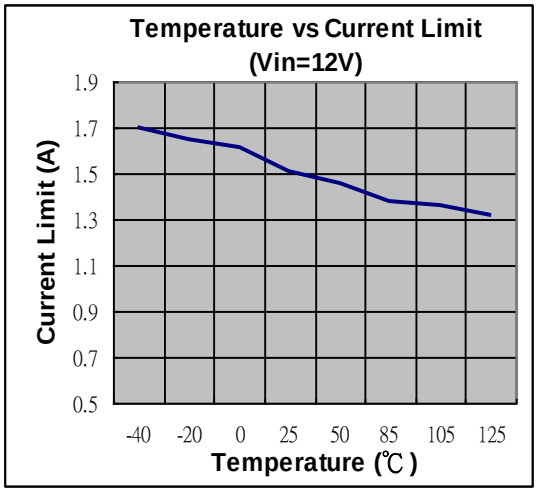

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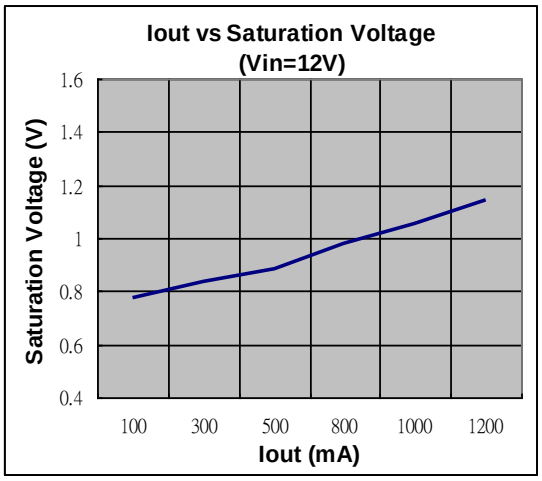
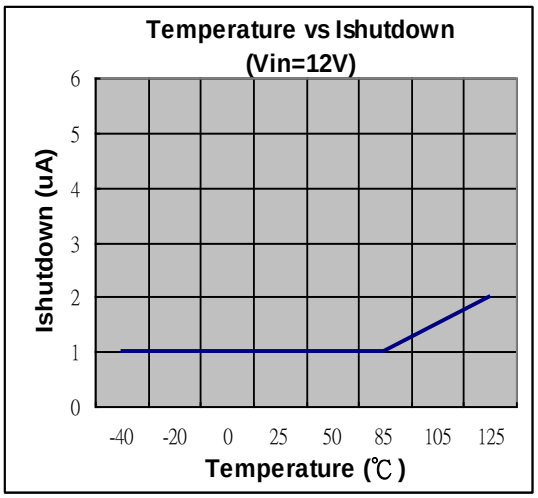
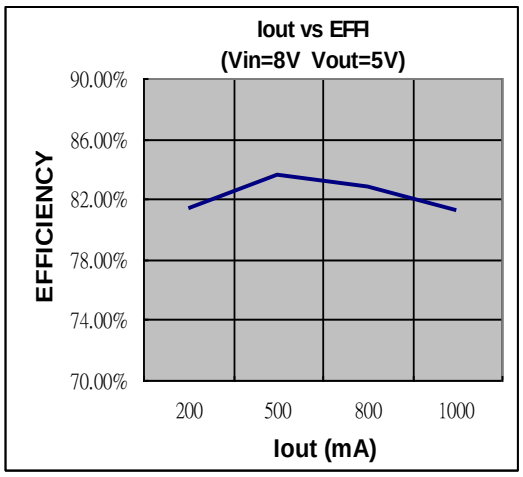
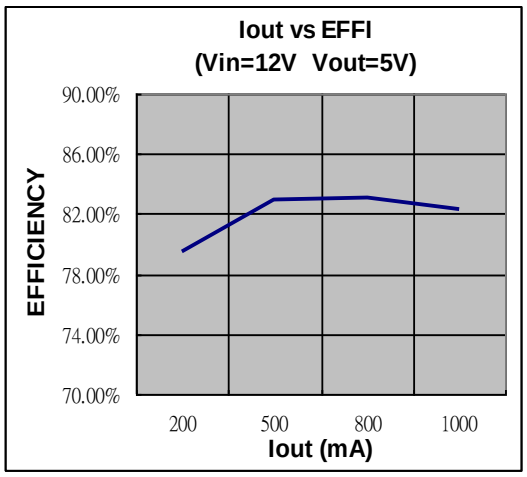


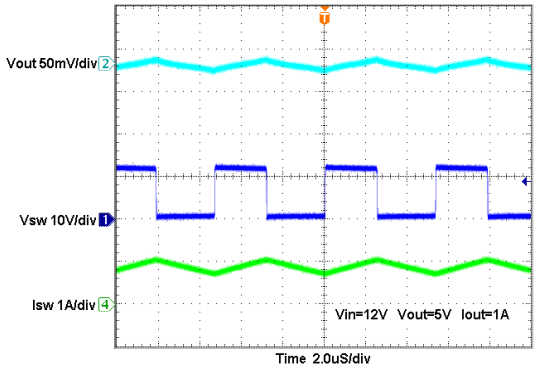




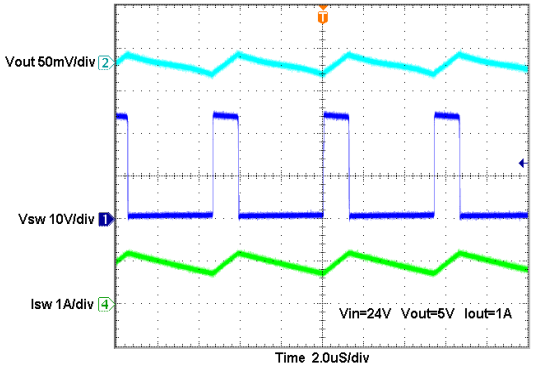


❖ TYPICAL CHARACTERISTICS

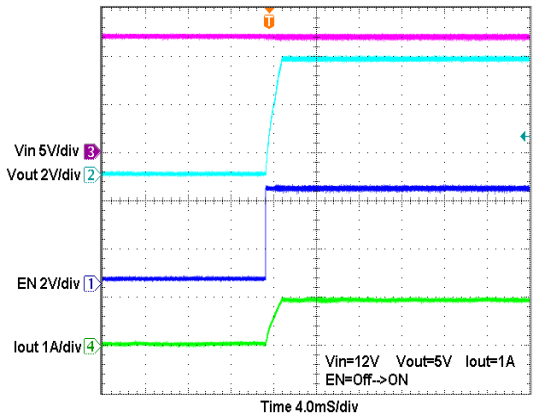
Output Ripple (12V→5V @1A)



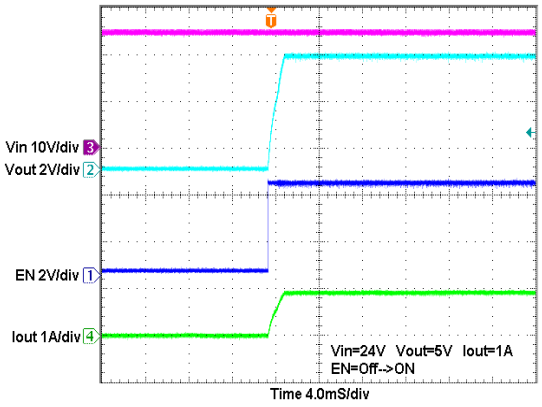
Output Ripple (24V→5V @1A)



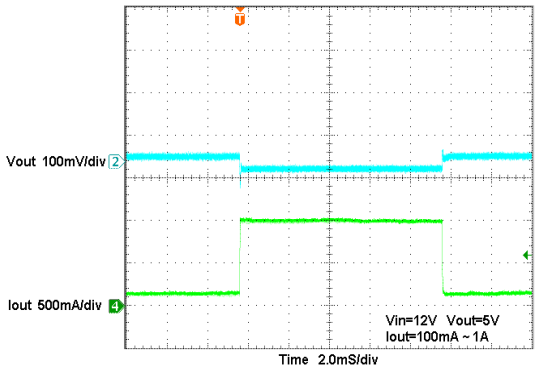
EN Off→ON Test (12V→5V @1A)



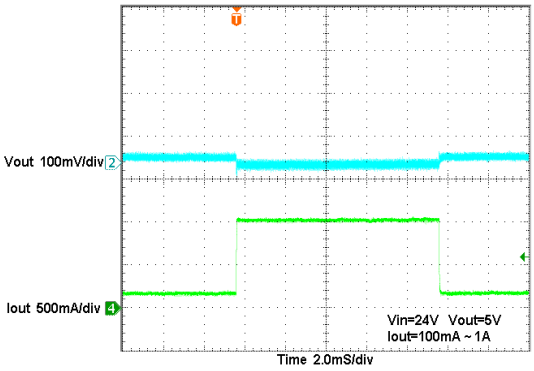
EN Off→ON Test (24V→5V @1A)



Load Transient (12V→5V @0.1~1A)

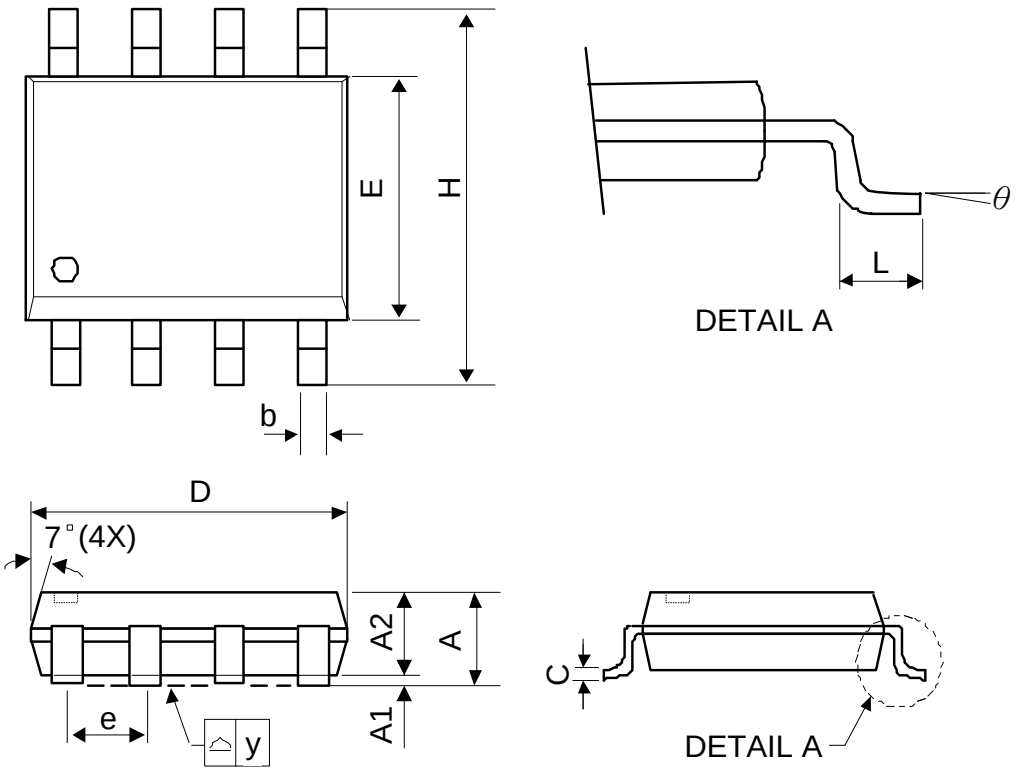


Load Transient (24V→5V @0.1~1A)



❖ PACKAGE OUTLINES

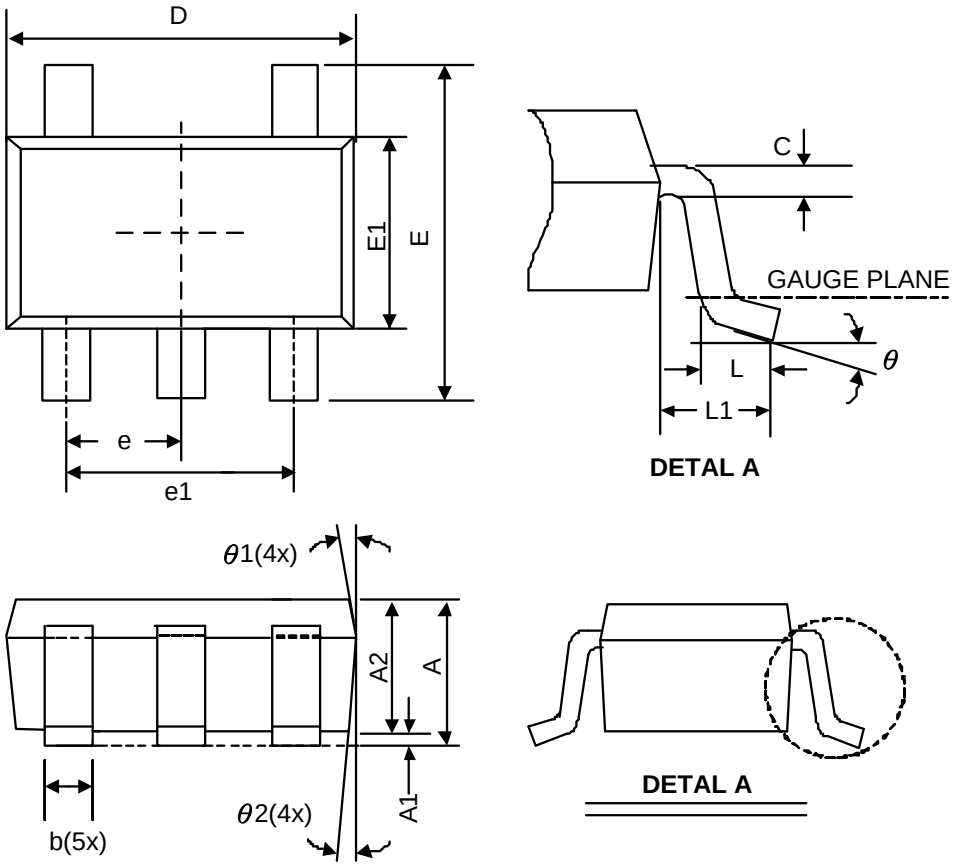
(1) SOP-8L



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.75	-	-	0.069
A1	0.1	-	0.25	0.04	-	0.1
A2	1.25	-	-	0.049	-	-
C	0.1	0.2	0.25	0.0075	0.008	0.01
D	4.7	4.9	5.1	0.185	0.193	0.2
E	3.7	3.9	4.1	0.146	0.154	0.161
H	5.8	6	6.2	0.228	0.236	0.244
L	0.4	-	1.27	0.015	-	0.05
b	0.31	0.41	0.51	0.012	0.016	0.02
e	1.27 BSC			0.050 BSC		
y	-	-	0.1	-	-	0.004
θ	0°	-	8°	0°	-	8°

Mold flash shall not exceed 0.25mm per side
JEDEC outline: MS-012 AA

(2) SOT-23-5L



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.45	-	-	0.057
A1	0	0.08	0.15	0	0.003	0.006
A2	0.9	1.1	1.3	0.035	0.043	0.051
b	0.3	0.4	0.5	0.012	0.016	0.02
C	0.08	0.15	0.22	0.003	0.006	0.009
D	2.7	2.9	3.1	0.106	0.114	0.122
E1	1.4	1.6	1.8	0.055	0.063	0.071
E	2.6	2.8	3	0.102	0.11	0.118
L	0.3	0.45	0.6	0.012	0.018	0.024
L1	0.5	0.6	0.7	0.02	0.024	0.028
e1	1.9 BSC			0.075 BSC		
e	0.95 BSC			0.037 BSC		
θ	0°	4°	8°	0°	4°	8°
θ 1	5°	10°	15°	5°	10°	15°
θ 2	5°	10°	15°	5°	10°	15°

JEDEC outline: MO-178 AA