

Current Mode PWM Controller for Forward and Flyback Applications

General Description

The SC1201 controller offers everything needed to build cost-effective and reliable ac-dc switching supplies dedicated to ATX power supplies. Thanks to the use of an internally fixed timer, SC1201 detects an output overload without relying on the auxiliary Vcc. A Brown-Out input offers protection against low input voltages and improves the converter safety. Finally a SOIC-8 package saves PCB space and represents a solution of choice in cost sensitive project.

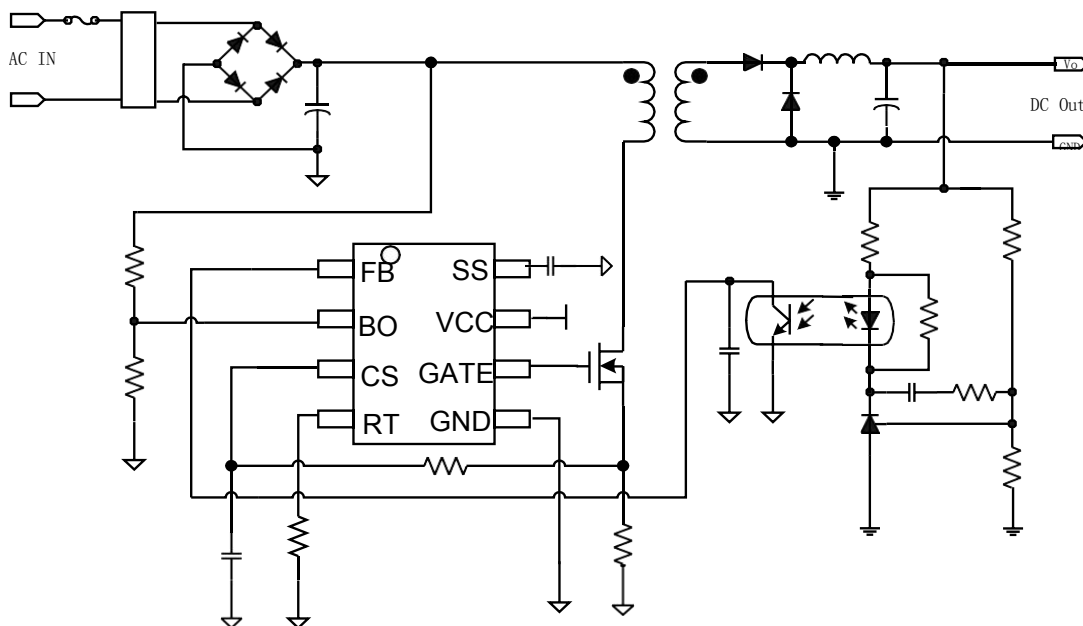
Features

- Peak Current Mode Control
- Adjustable Switching Frequency up to 500kHz
- Jittering Frequency Optimized EMI
- Adjustable Soft-start Timer
- Auto-recovery Brown-Out Detection
- Internal Leading Edge Blanking
- Adjustable Internal Ramp Compensation
- SOIC-8 and PDIP-8 Packages

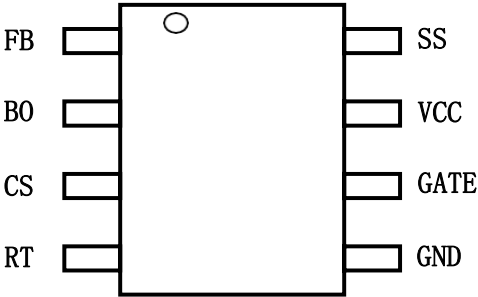
Typical Applications

- Power Supplies for PC Silver Boxes, Games Adapter...

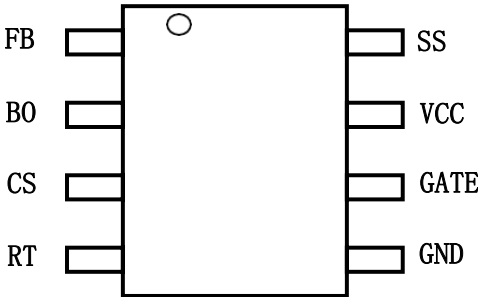
Typical Application



PIN CONNECTIONS



SOP8

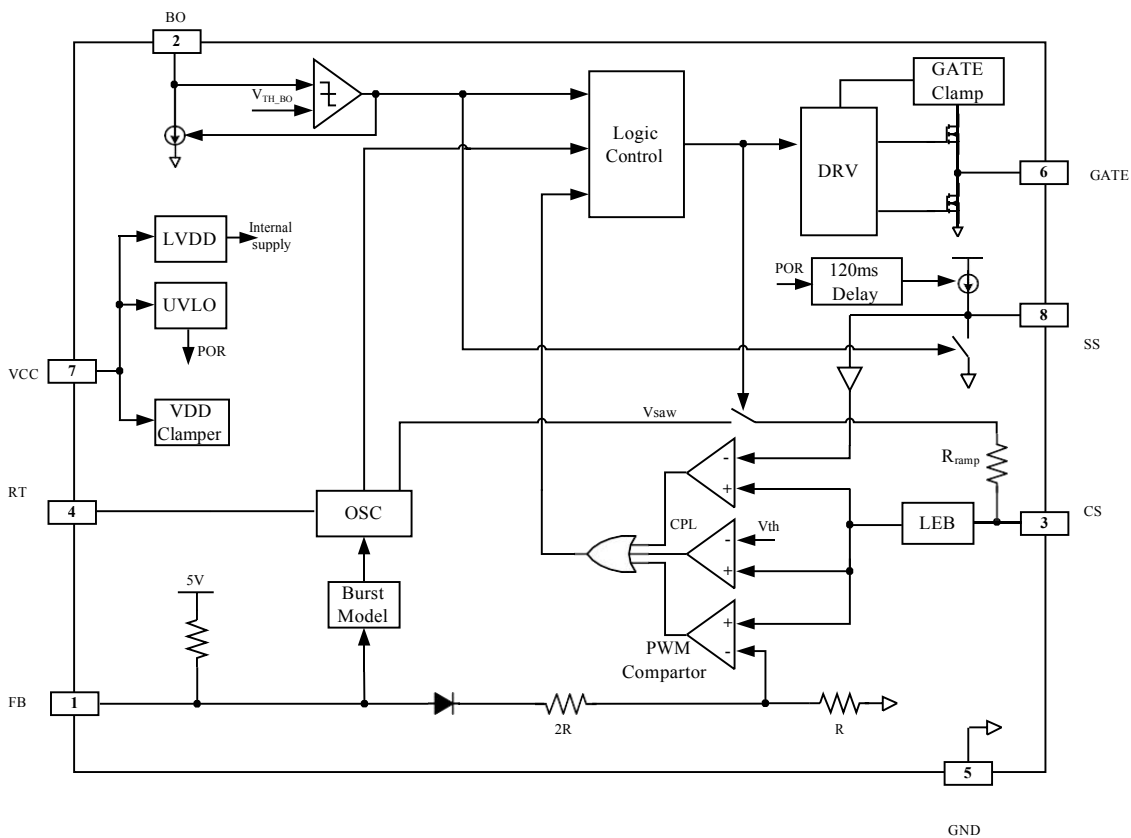


DIP8

PIN FUNCTIONS

Pin No.	Pin Name	Function	Pin Description
1	FB	Feedback	This pin directly connects to an optocoupler collector.
2	BO	Brown-out input	This pin monitors the input voltage image to offer a Brown-out protection.
3	CS	Current sense	Monitors the primary current and allows the selection of the ramp compensation amplitude.
4	R _T	Timing element	A resistor connected to ground fixes the switching frequency.
5	GND	GND	The controller ground pin.
6	Drv	Driver	This pin connects to the MOSFET gate
7	V _{CC}	V _{CC}	This pin accepts voltage range from 8 V up to 28 V
8	SSTART	Soft-start	A capacitor connected to ground selects the soft-start duration. The soft start is grounded during the delay timer

Internal Circuit Architecture:



MAXIMUMRATIS

Rating	Value
CS/FB/RT/BO/SS	-0.3V~7V
GATE	30V
Maximum Junction Temperature	150 °C
operating temperature range	-20 °C to 85 °C
Storage Temperature Range	-55 °C to 150 °C
Pin temperature (welding time 10 seconds)	260°C

ELECTRICAL CHARACTERISTICS(V_{CC} = 15 V, R_T = 47 k Ω , C_{DRV} = 1 nF. For typical values T_J = 25 °C, for min/max values T_J = -25 °C to +125 °C, unless otherwise noted)

Characteristics		Test Condition	Min	Typ	Max	Unit
SUPPLY SECTION AND V_{CC} MANAGEMENT						
I _{ST}	Start-up current, controller disabled	UVLO_OFF-1V			20	μ A
I _{OP2}	Internal IC consumption, controller switching	F _{sw} =100kHz ,C _{DRV} =1nf		2.1		mA
V _{CC_OFF}	Minimum Operating voltage at which driving pulses are stopped		7.5	8	8.5	V
V _{CC_ON}	Startup threshold at which driving pulses are authorized		8.5	9	9.5	V
V _{CC_CLAMP}	VDD OVP	IVDD=7mA	31	33	35	V
CURRENT COMPARATOR						
V _{cs_max}	Current Sense Voltage Threshold		0.92	1	1.08	V
LEB	Leading Edge Blanking Duration			200		ns
T _{delay}	Propagation delay			100		ns
INTERNAL OSCILLATOR						
F _{osc1}	Oscillator Frequency	RT=47 Kohm RT=8.5 Kohm	90 450	100 500	110 550	kHz
Δ F _{JITTER}	Frequency Modulation in percentage of f _{osc}		-5		5	%
T _{JITTER}	Frequency modulation Period			3.3		ms
F _{MAX}	Maximum operating frequency		500			kHz
DC _{MAX}	Maximum duty-cycle			48%		
FEEDBACK SECTION						
FBdiv	Internal voltage division from FB to CS setpoint			3		
I _{FB_SHORT}	FB pin = GND		1			mA
V _{FB}	FB pin = open			5.2		V
V _{SKIP}	Skip cycle level		0.2	0.3	0.4	
V _{SKIP} (HYS)	Skip threshold Hysteresis			25		mV
DRIVE OUTPUT						
T _r	Output voltage rise-time	C _{GATE} =1nf		65		ns
T _f	Output voltage fall-time	C _{GATE} =1nf		30		ns
GATE _{CLAMP}	Clamping voltage (maximum gate voltage)			14.5		V
V _{drop}	High-state voltage drop	V _{CC} =V _{CC} (min)+0.1		80		mV
SOFT START						
I _{SS}	Soft-start charge current	SSPin=GND	8	10	12	μ A
V _{SS}	Soft start completion voltage threshold		3.5	4	4.5	V
SS _{delay}	Internal delay before starting the Soft start when V _{CC} (on) is reached			120		ms
PROTECTION						
F _{cs}	Current sense fault voltage level triggering the timer		0.9	1	1.1	V
TFAULT	Timer delay before latching a fault (overload or short circuit)			15		ms
VBO	Brown-out voltage		0.95	1	1.05	V
IBO	Internal current source generating the Brown-out hysteresis		8	10	12	μ A

Introduction:

The SC1201 hosts a high-performance current-mode controller specifically developed to drive power supplies designed for the ATX and the adapter market.

Startup Sequence:

The startup sequence is activated when Vcc pin reaches VCC(on) level. Once the startup sequence has been activated the internal delay timer (SSdelay) runs. Only when the internal delay elapses the soft start can be allowed if the BO pin level is above VBO level. If the BO pin threshold is reached or as soon as this level will be reached the soft start is allowed. When the soft start is allowed the SS pin is released from the ground and the current source connected to this pin sources its current to the external capacitor connected on SS pin. The voltage variation of the SS pin divided by 4 gives the same peak current variation on the CS pin.

The following figures illustrate the different startup cases:

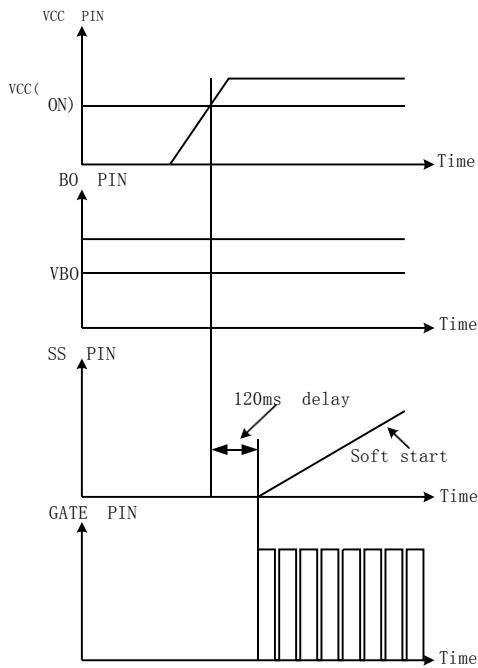


图 1

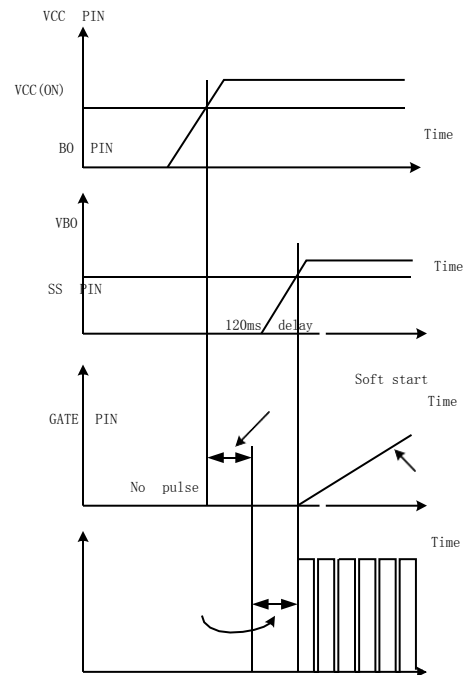


图 2

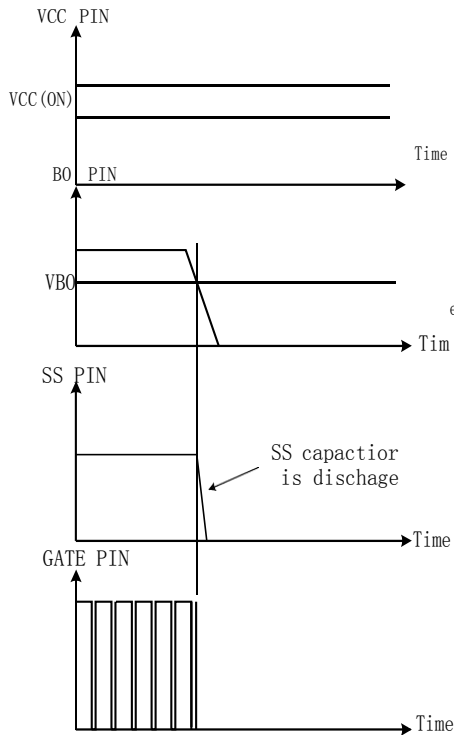


图 3

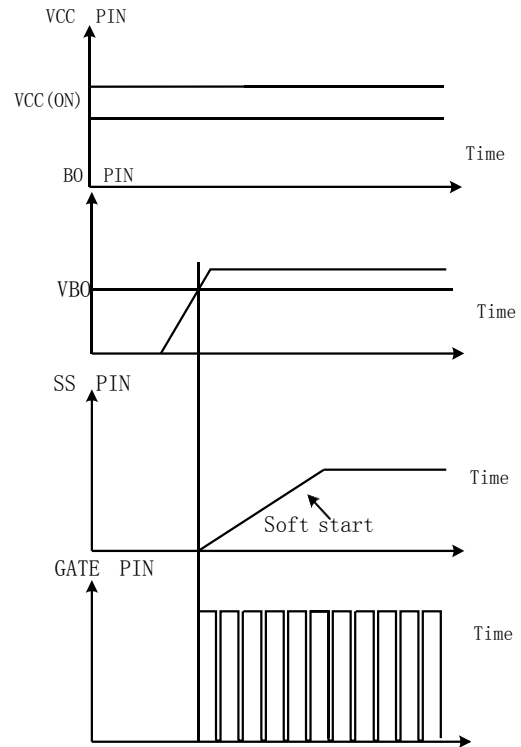


图 4

With the Case #1, when the VCC pin reaches the VCC(on) level, the internal timer starts. As the BO pin level is above the VBO threshold at the end of the internal delay, a soft start sequence is started.

With the Case #2, at the end of the internal delay, the BO pin level is below the VBO threshold thus the soft start sequence can not start. A new soft start sequence will start only when the BO pin reaches the VBO threshold.

When the BO pin is grounded, the controller is shut down and the SS pin is internally grounded in order to discharge the soft start capacitor connected to this pin (Case #3). If the BO pin is released, when its level reaches the VBO level a new soft start sequence happens.

Soft Start:

As illustrated by the following figure, the rising voltage on the SS pin voltage divided by 4 controls the peak current sensed on the CS pin. Thus as soon as the CS pin voltage becomes higher than the SS pin voltage divided by 4 the driver latch is reset.

Brown-Out Protection:

By monitoring the level on BO pin, the controller protects the forward converter against low input voltage conditions. When the BO pin level falls below the VBO level, the controllers stops pulsing until the input level goes back to normal and resumes the operation via a new soft start sequence.

The brown-out comparator features a fixed voltage reference level (VBO). The hysteresis is implemented by using the internal current connected between the BO pin and the ground when the BO pin is below the internal voltage.

Short Circuit or Over Load Protection:

A short circuit or an overload situation is detected when the CS pin level reaching its maximum level at 1 V. In the case the fault status is stored in the latch and allows the digital timer count. If the digital timer ends then the fault is latched and the controller permanently stops the pulses on the driver pin.

If the fault is gone before ending the digital timer, the timer is reset only after 3 switching controller periods without fault detection (or when the CS pin < 1 V during at least 3 switching periods).

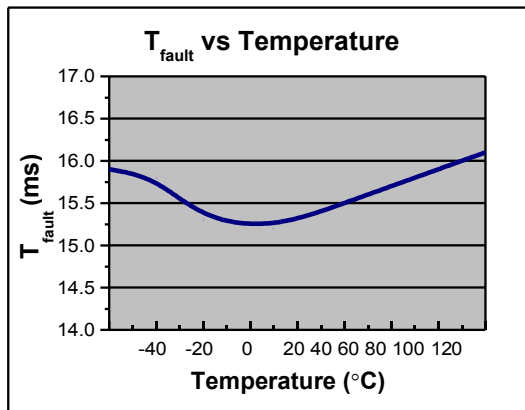
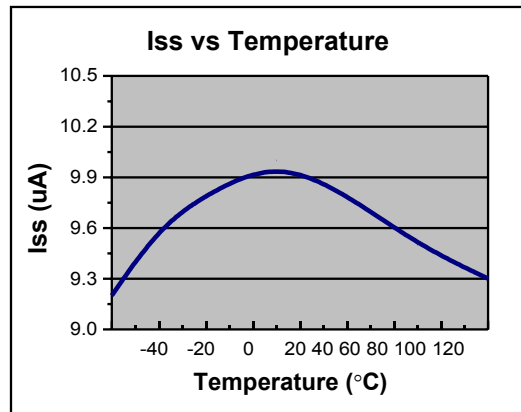
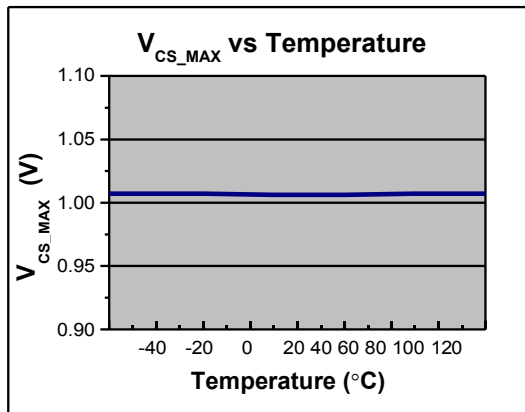
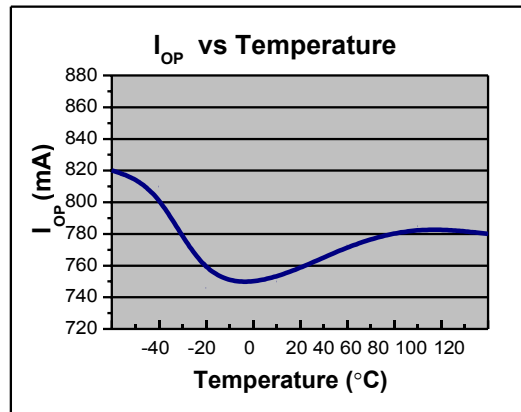
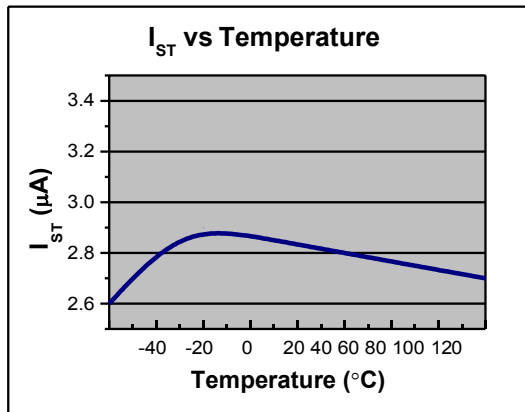
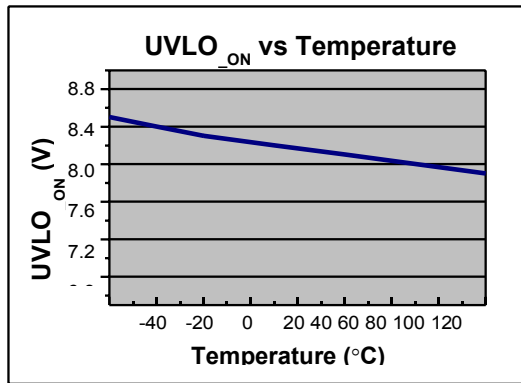
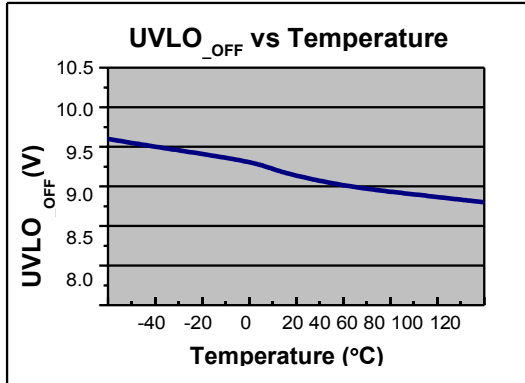
If the fault is latched the controller can be reset if a BO reset is sensed or if VCC is cycled down to VCC(off). The fault timer is typically set to 15 ms.

Slope Compensation:

Slope compensation is a known mean to cure subharmonic oscillations. These oscillations take place at half of the switching frequency and occur only during Continuous Conduction Mode (CCM) with a duty-cycle close to and above 50%. To lower the current loop gain, one usually injects between 50 and 100% of the inductor downslope.

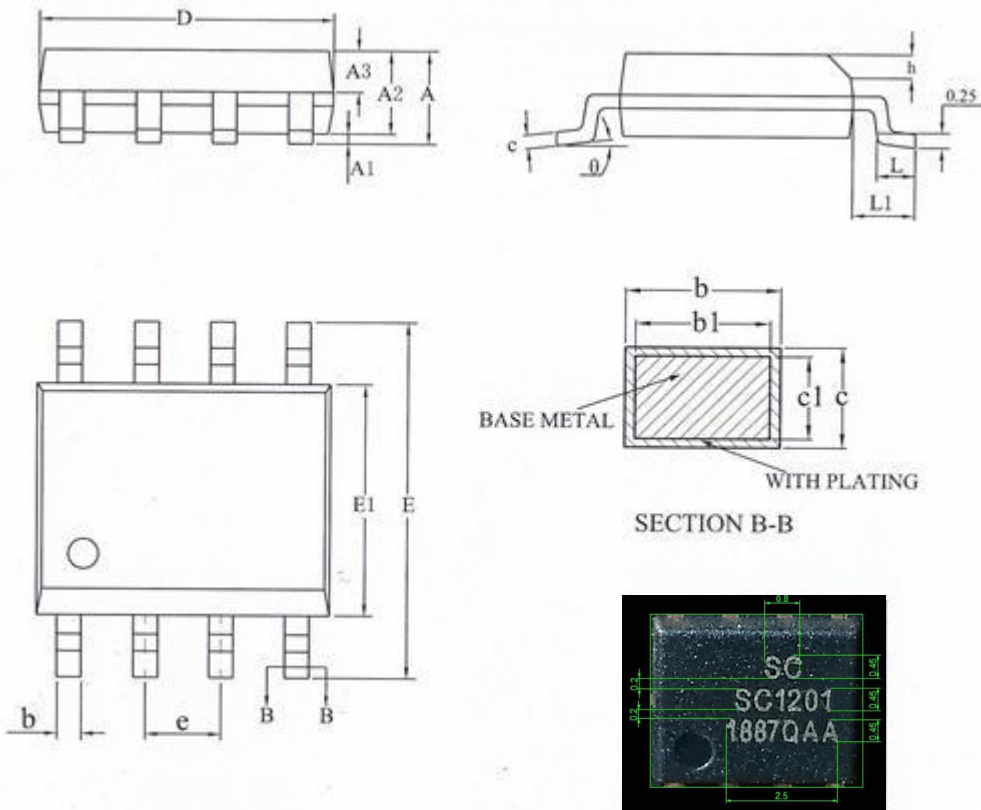
TYPICAL CHARACTERISTICS

(VDD=20V, TA=25°C).



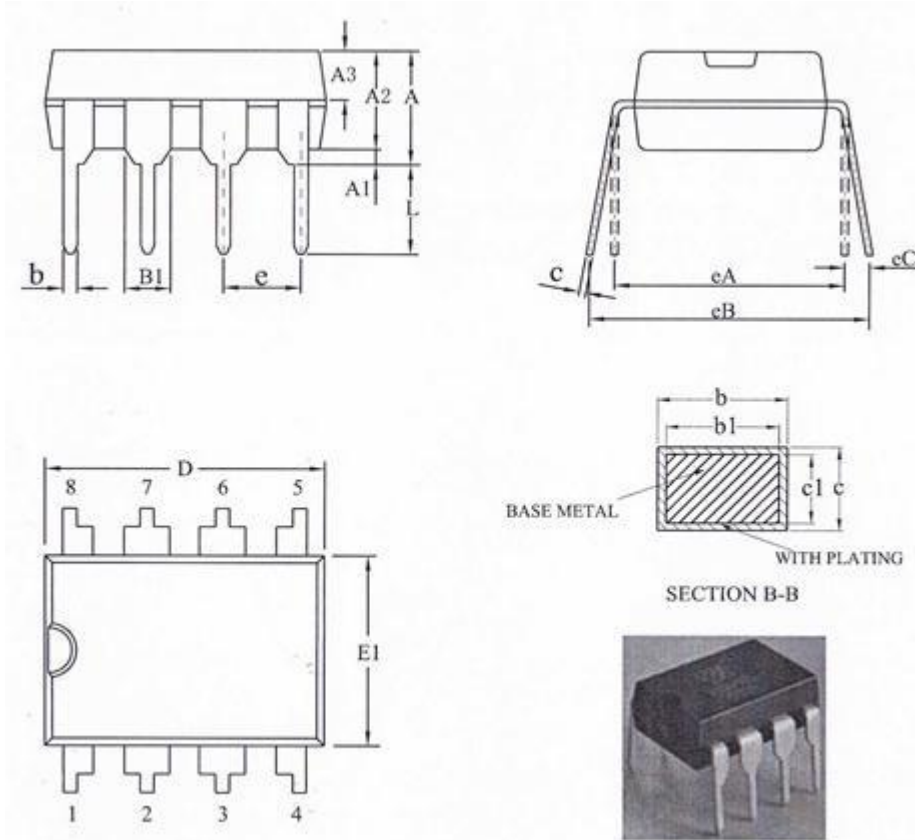
PACKAGE DIMENSIONS

SOP-8L



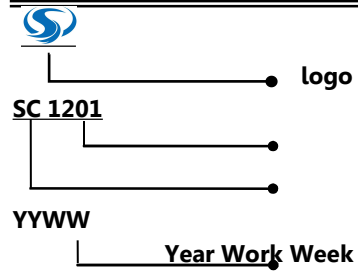
DIM	MM		
	MIN	TYP	MAX
A	1.35	-	1.75
A1	0.10	-	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.35	-	0.49
b1	0.38	0.41	0.44
c	0.20	-	0.24
c1	0.19	0.20	0.21
D	4.70	4.90	5.10
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27BSC		
h	0.25	-	0.50
L	0.4	-	1.25
L1	1.05REF		
θ°	0°	-	8°

DIP-8L



DIM	MM		
	MIN	TYP	MAX
A	3.60	3.80	4.00
A1	0.51	-	-
A2	3.20	3.30	3.40
A3	1.55	1.60	1.65
b	0.44	-	0.52
b1	0.43	0.46	0.49
B1	1.52REF		
c	0.25	-	0.29
c1	0.24	0.25	0.26
D	9.15	9.25	9.35
E1	6.25	6.35	6.45
e	2.54BSC		
eA	7.62REF		
eB	7.62	-	9.30
eC	0	-	0.84
L	3.00	-	-

MARKING DIRGRAMS



ORDERING INFORMATION

Device	PACKAGE	Marking	Shipping		
SC1201	SOP-8L	1201	4000 / Tape & Reel	-	