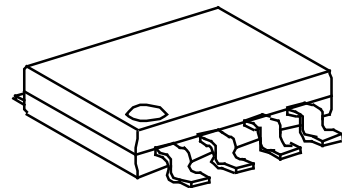
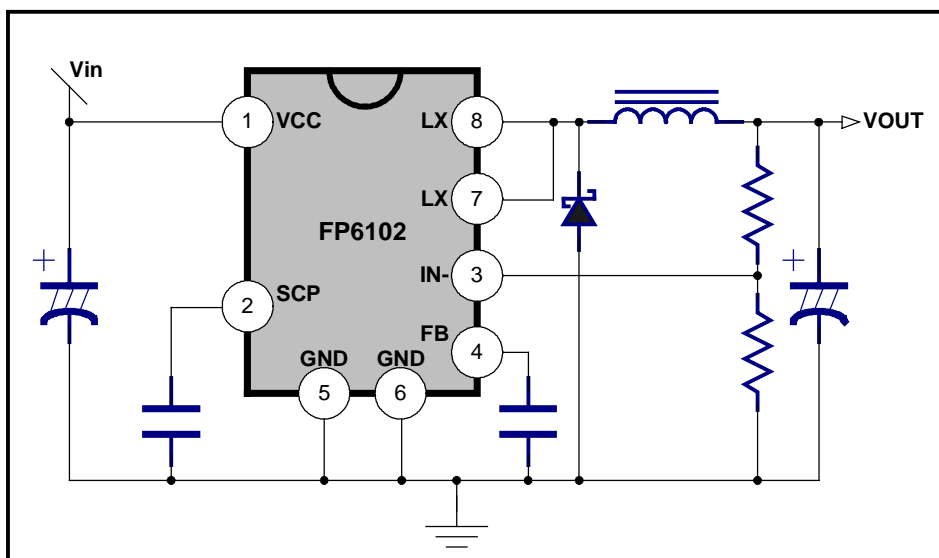


**SWITCHING BUCK REGULATOR****GENERAL DESCRIPTION**

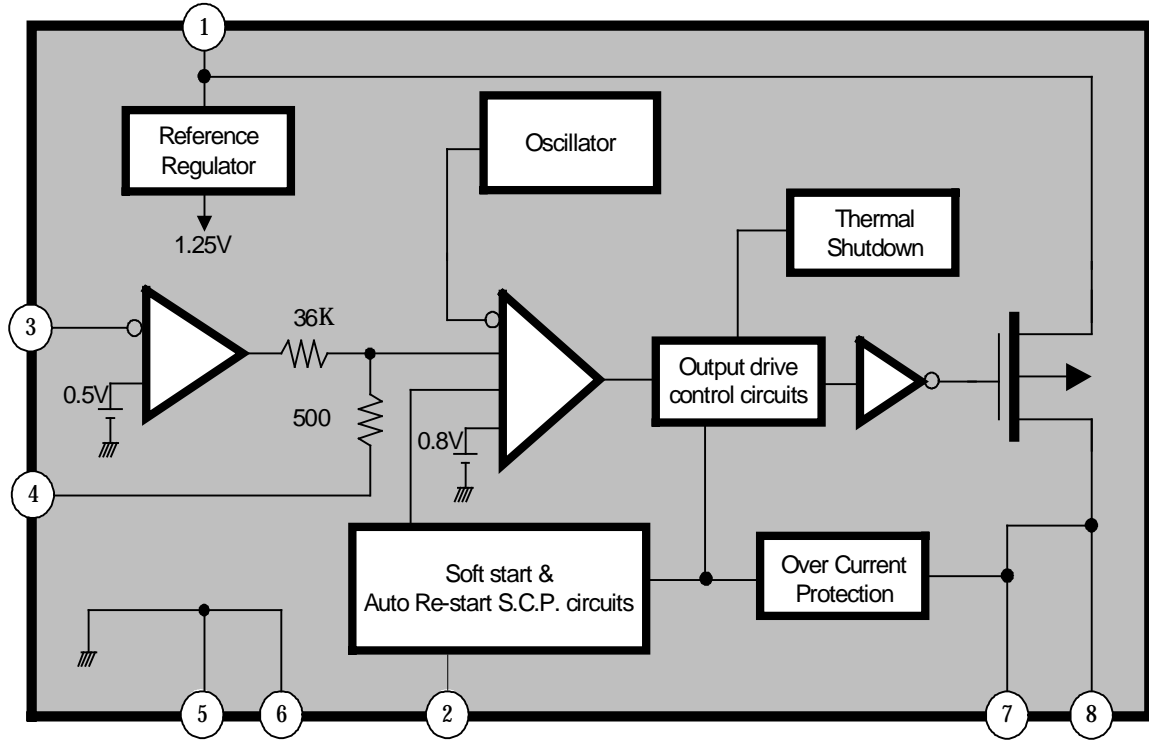
The **FP6102** is a buck topology of switching regulator for wide operating voltage applications field. The **FP6102** includes a high current P-MOSFET, high precision reference (0.5V) for comparing output voltage with feedback amplifier, an internal dead-time controller and oscillator for controlling the maximum duty cycle and PWM frequency, and has power-on programmable soft start time and short circuit PMOS turn-off and auto re-start protection functions.

**FEATURES**

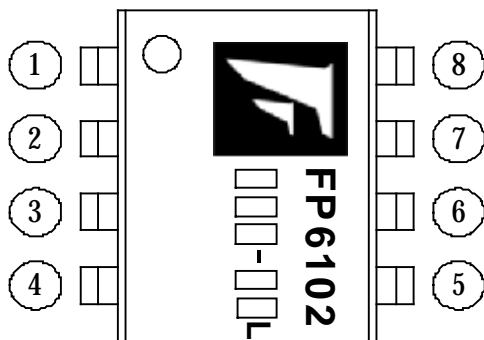
- Precision feedback reference voltage: 0.5V (2%)
- Wide supply voltage operating range: 3.6 to 20V
- Low current consumption: 3mA
- Internal fixed oscillator frequency: Typ. 340KHz
- Programmable Soft-Start function (SS)
- Short Circuit Shutdown and Auto Re-start function(ARSCP)
- Built-in P-MOSFET for 3A loading capability
- Over Current Protection
- Package: SOP8

**SOP8****TYPICAL APPLICATION**

## FUNCTIONAL BLOCK DIAGRAM



### MARK VIEW



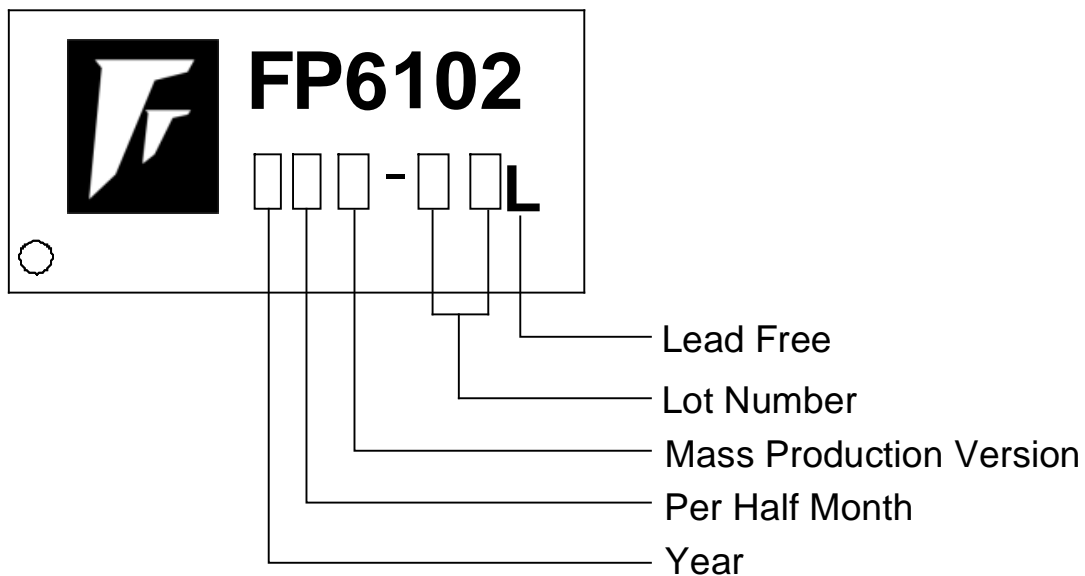
### PIN DESCRIPTION

Name	No.	I/O	Description
VCC	1	P	IC Power Supply (PMOS Source)
SS/SCP	2	I	Connecting with a Soft-start & ARSCP timing capacitor
IN-	3	I	Error Amplifier Inverting Input
FB	4	O	Error Amplifier Compensation Output
GND	5	P	IC Ground
	6		
LX	7	O	PMOS High Current Output
	8		

## ORDER INFORMATION

Part Number	Operating Temperature	Package	Description
FP6102D-LF	-25°C ~ +85°C	SOP8	Tube
FP6102DR-LF	-25°C ~ +85°C	SOP8	Tape & Reel

## IC DATE CODE DISTINGUISH



### FOR EXAMPLE:

January            A (Front Half Month), B (Last Half Month)  
 February         C, D  
 March             E, F                -----And so on

The printing ink of the lot number is a last two numbers of one wafer lot:

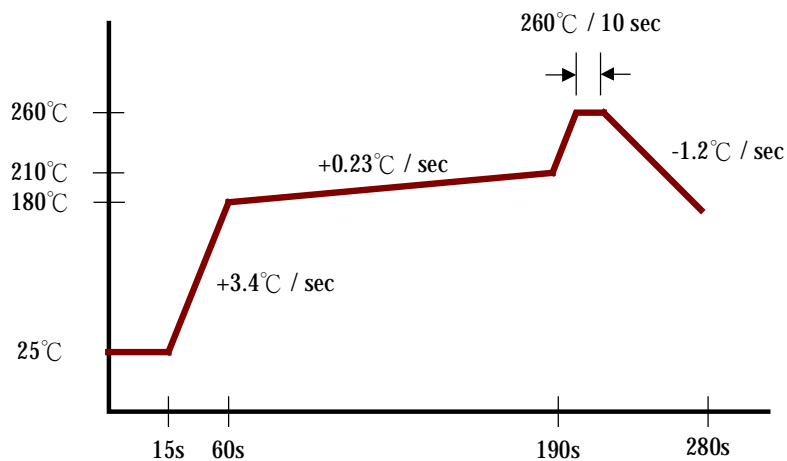
### For Example:

A3311C<sup>62</sup>  
 └──────────▶ Lot Number

## ABSOLUTE MAXIMUM RATINGS

Power supply voltage -----	+20V
Output source current -----	+3A
Error amplifier inverting input -----	-0.3V~+1.2V
Allowable dissipation	
SOP8   Ta ≤ +25°C -----	650mW
Thermal Resistance Junction to Ambient -----	175°C/W
Thermal Resistance Junction to Case -----	45°C/W
Operating temperature -----	-25°C ~ +85°C
Storage temperature -----	-55°C ~ +125°C
ESD Susceptibility	
HBM (Human Body Mode) -----	2KV
MM (Machine Mode) -----	200V
SOP8 Lead Temperature (soldering, 10 sec) -----	+260°C

### Recommend: IR Reflow



**FP6102 IR Re-flow Soldering Curve**

## DC ELECTRICAL CHARACTERISTICS

Electrical characteristics over recommended operating free-air temperature range,  $V_{CC}=6V$ , (unless otherwise noted)

### Reference

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output voltage	$V_{REF}$	COMP connected to FB	0.490	0.5	0.510	V
Input regulation	$\Delta V_{REF}$	$V_{CC}=3.6V$ to 20 V	-	2	12.5	mV
Output voltage change with temperature	$\Delta V_{REF} / V_{REF}$	$T_A = -25^{\circ}C$ to $25^{\circ}C$	-	1	2	%
		$T_A = 25^{\circ}C$ to $85^{\circ}C$	-	1	2	

### Soft Start section (S.S.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
S.S. Source current	$I_{SS}$	$V_{SS}=0V$	-7	-12	-17	$\mu A$
Soft start threshold voltage	$V_{SST}$	--	0.9	1.0	1.1	V

### Short Circuit Protection section (S.C.P.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
S.C.P. source current	$I_{SCP}$	$V_{SCP}=0V$	-7	-12	-17	$\mu A$
SCP re-start / hold time	$T_{RS} / T_{HOLD}$	$V_{FB}=0V$	-	1/8	-	-
S.C.P. threshold voltage	$V_{SCP}$	$V_{FB} > 450mV$	1.0	1.15	1.2	V
	$V_{SB}$	$V_{FB} < 450mV$	-	0.1	0.15	

### Oscillator section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Oscillation frequency	f	--	-	340	-	KHz
Frequency change with voltage	$\Delta f / \Delta V$	$V_{CC}=3.6V$ to 20V	-	5	-	%
Frequency change with temperature	$\Delta f / \Delta T$	$T_a = -25^{\circ}C$ to $85^{\circ}C$	-	5	-	%

### Thermal Shutdown section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Thermal shutdown temperature	--	--	-	145	-	$^{\circ}C$

## DC ELECTRICAL CHARACTERISTICS (Cont.)

### Error Amplifier section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Input bias current	$I_B$	--	-1.0	-0.2	1.0	$\mu A$
Voltage Gain	$A_V$	--	-	100	-	V/V
Frequency bandwidth	BW	$A_V=0$ dB	-	6	-	MHz
Output voltage Swing	Positive	$V_{IN}=0.3V$	0.78	0.87	-	V
	Negative	$V_{IN}=0.7V$	-	0.05	0.2	
Output source current	$I_{SOURCE}$	$V_{FB}=500mV$	-30	-45	-	$\mu A$
Output sink current	$I_{SINK}$		30	45	-	$\mu A$

### Idle Period Adjustment section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Maximum duty cycle	$T_{DUTY}$	$V_{IN-}=0.2V$	-	90	-	%

### Total device section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Average supply current	$I_{STANDBY}$	--	-	3.8	5	mA

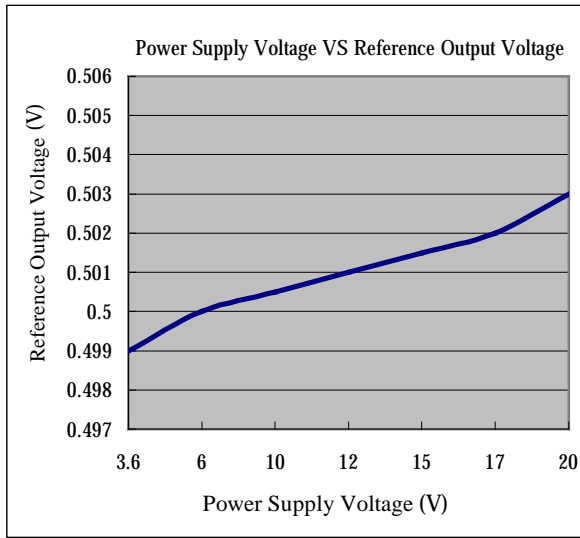
### Output section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
PMOS D-S voltage	$V_{DSS}$	$V_{FB}=0.1V$	-	-20	-	V
PMOS source current	$I_D$	--	-	-3	-	A
PMOS On resistance	$R_{DS(ON)}$	$V_{CC}=4.5V, V_{IN-}=0V$	-	40.5	52	$m\Omega$
		$V_{CC}=10V, V_{IN-}=0V$	-	64	87	
Output leakage current	$I_L$	$V_{DS}=-24V, V_{GS}=0V$	-	-	-1	$\mu A$

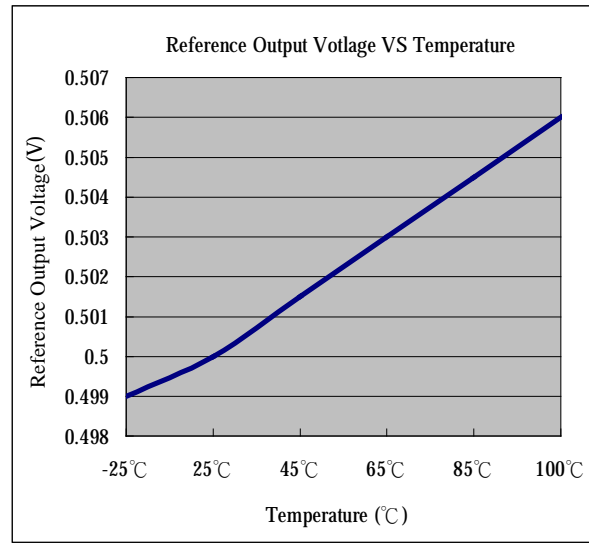
### Over Current Protection section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
PMOS OCP current	$I_{OCP}$	--	-	4	-	A

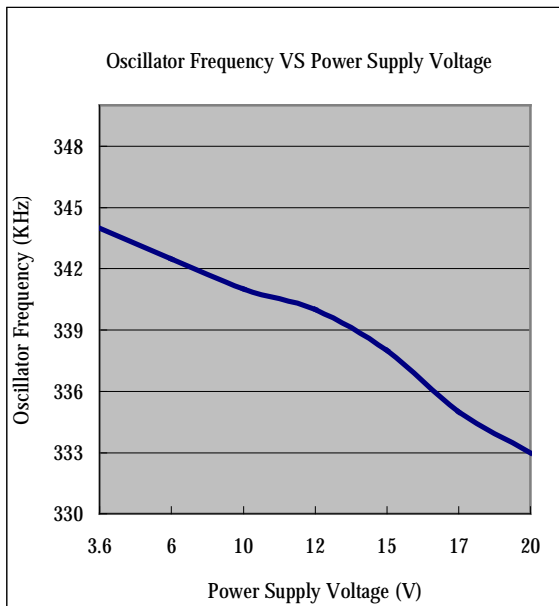
## TYPICAL CHATACTERISTICS



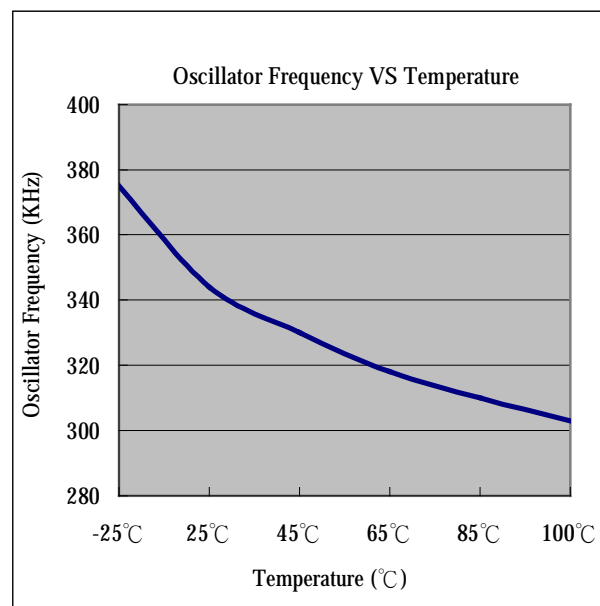
**Figure 1**



**Figure 2**



**Figure 3**



**Figure 4**

## TYPICAL CHATACTERISTICS (con.)

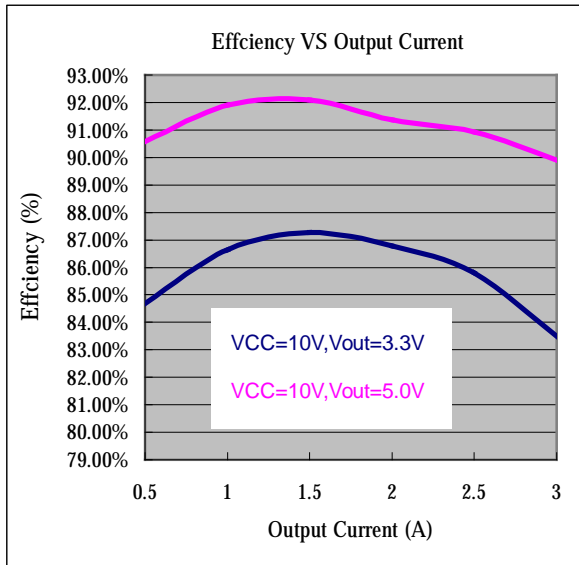


Figure 5

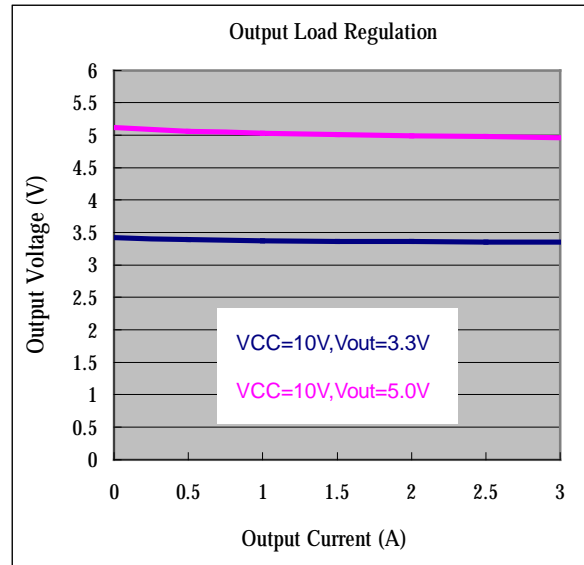


Figure 6

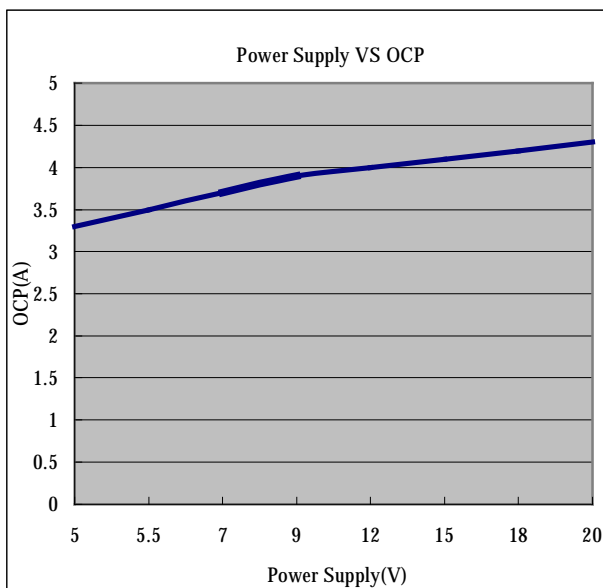


Figure 7

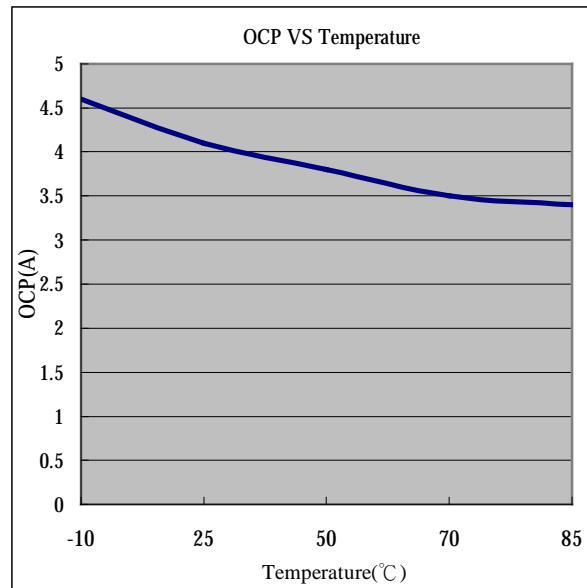
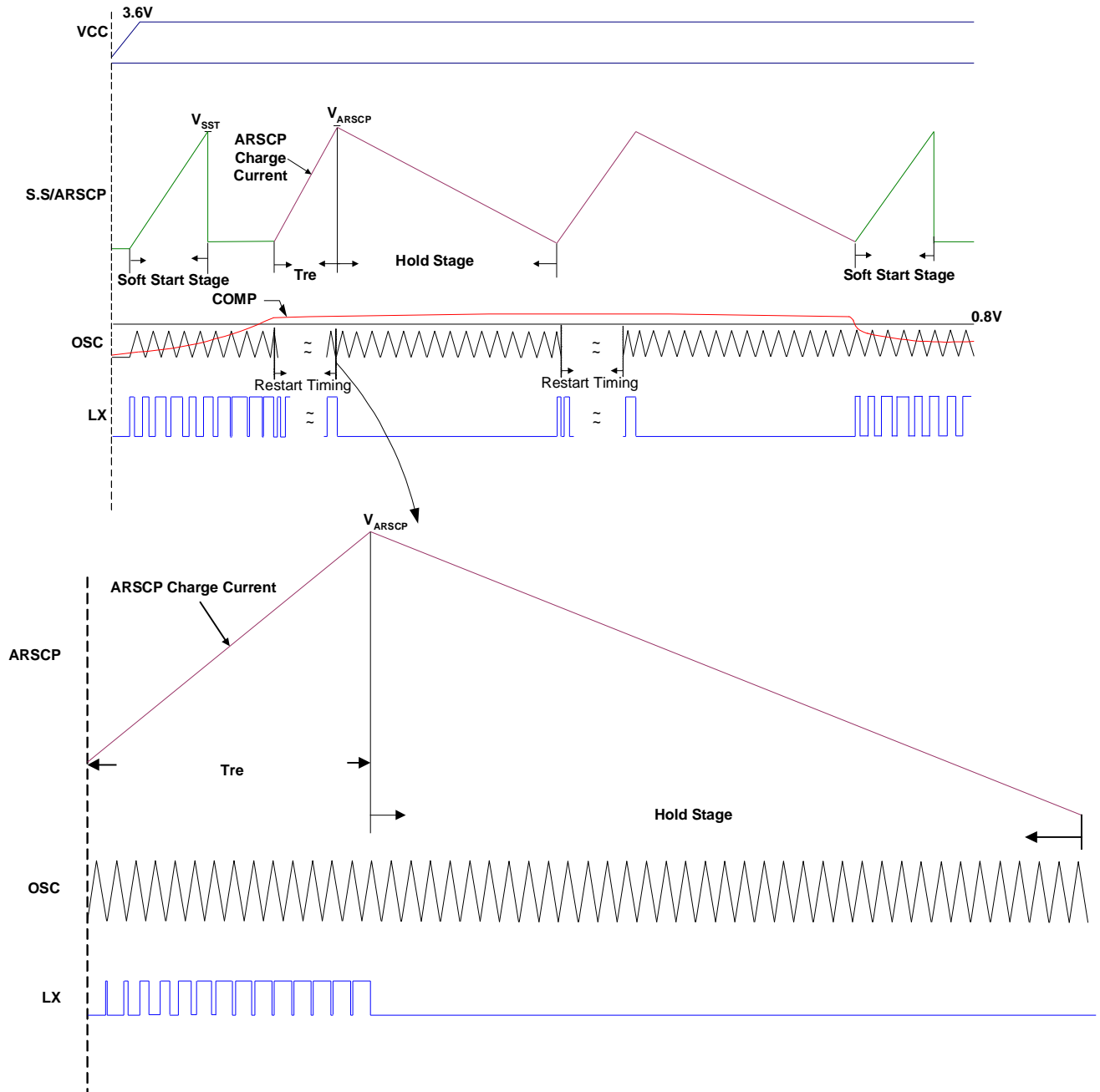
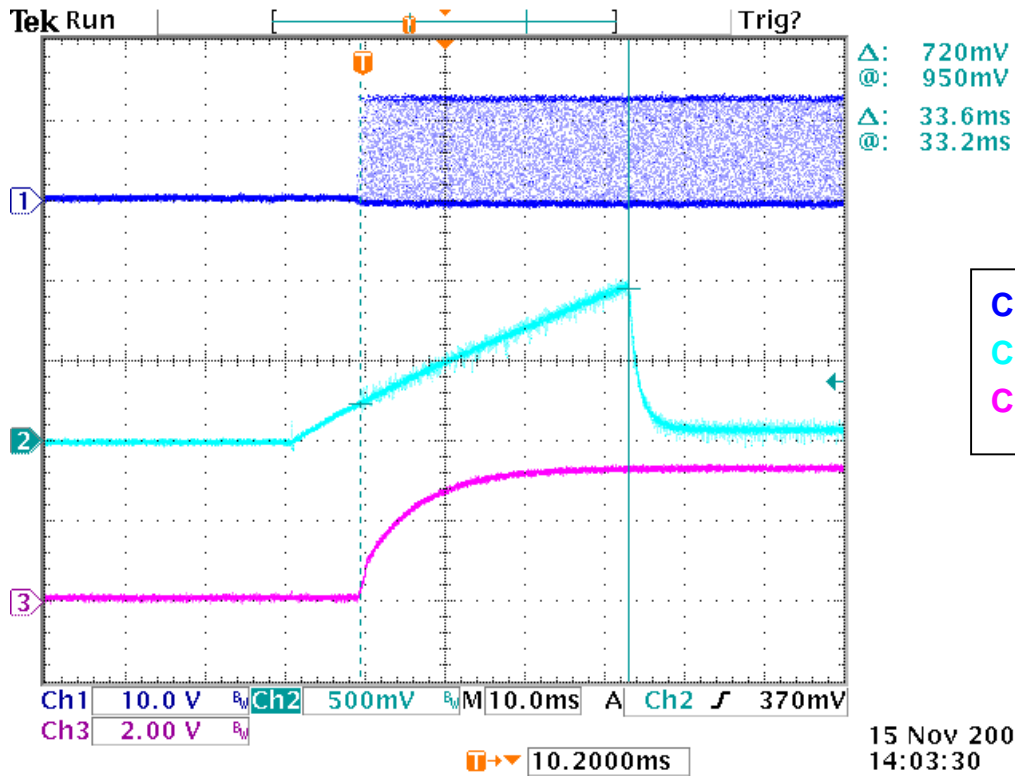


Figure 8

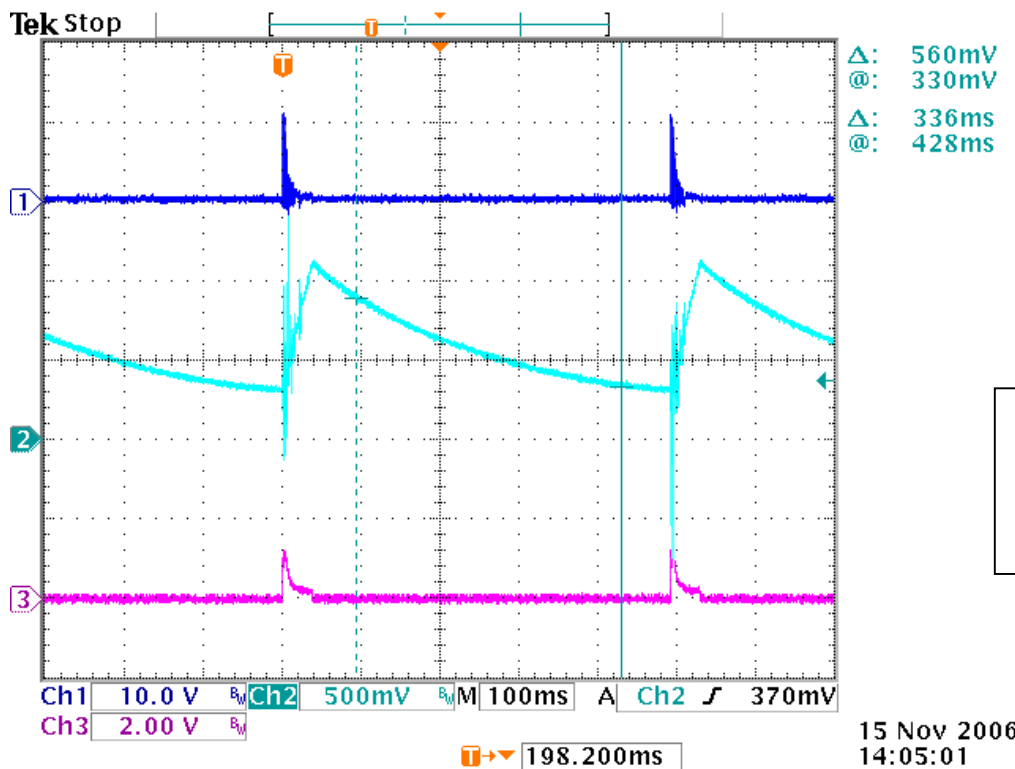


## TIMING WAVEFORM





Soft-Start Function



ARSCP Function

## DETAILED DESCRIPTION

### Voltage reference

A 1.25V reference regulator supplies **FP6102** internal circuits and uses the resistive dividers to provide a 0.5V precision reference voltage on the non-inverting terminal of error amplifier and SCP comparator 1.0V threshold voltage.

### Error amplifier

The error amplifier compares a sample of the dc-dc converter output voltage to the 0.5V(Vref) reference and generates an error signal for the PWM comparator. Output voltage of dc-dc converter is setting with the resistor divider using the following expression (see fig 9):

$$V_{out} = \left(1 + \frac{R1}{R2}\right) * V_{ref}$$

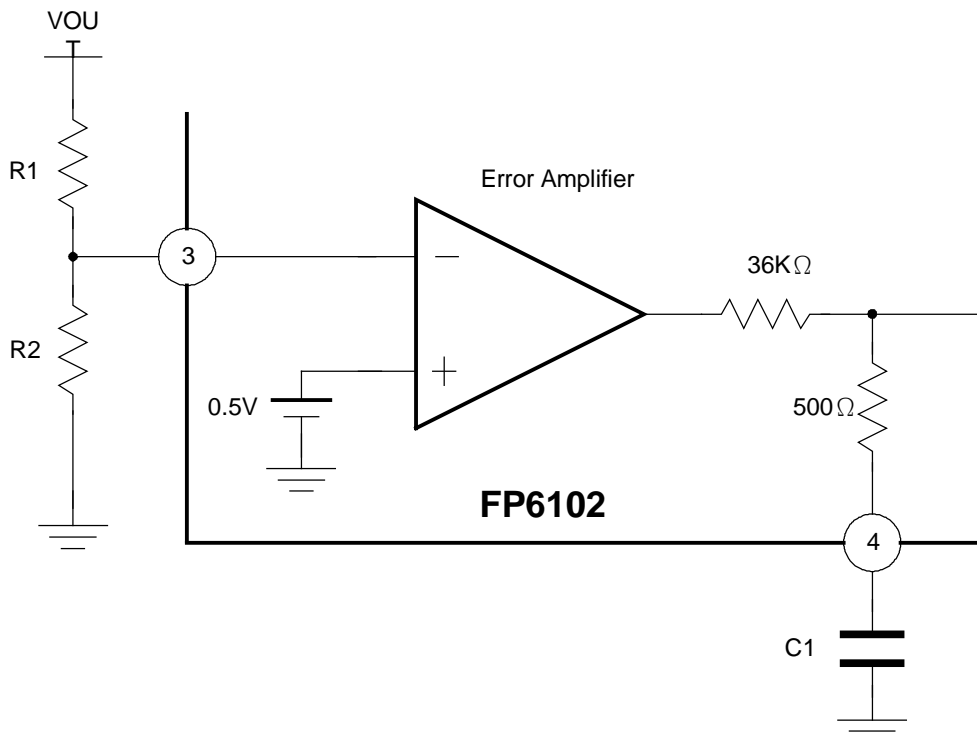


Figure 9. Error Amplifier with Feedback resistance divider

### Oscillator

The fixed frequency generates from an internal RC oscillator, and the typical value is **340KHz**.

**Soft Start/ Short-circuit protection (S.S. / S.C.P.)**

The soft start is functional after power on, and the interval of soft start time is determined by a capacitor connected to SCP pin (pin 2). When soft start function finished, the internal soft start voltage is setting high, but external SCP pin exceeds low. Thus **FP6102** turns on short circuit detection / protection function.

The time of soft start is following expression:

$$T_{SS} = 0.07 * C[mF]$$

The short circuit protection is functional due to a heavy loading drop. The output of error amplifier (COMP pin) is maintaining a  $V_{POS}$  (typ. 1.0V). The capacitor is charged until SCP threshold voltage (typ. 1.2V), then **FP6102** output turn off and the capacitor is discharged to low.

The time of short circuit protection is following expression:

$$T_{SCP} = \frac{V * C_{SCP}}{I} = \frac{(V_{TH} - V_{SS-Start}) * C_{SCP}}{I_{source}} = 0.09 * C_{SCP}$$

Restart timing of short circuit protection is following expression:

$$T_{scp} = 1.8 * C[mF]$$

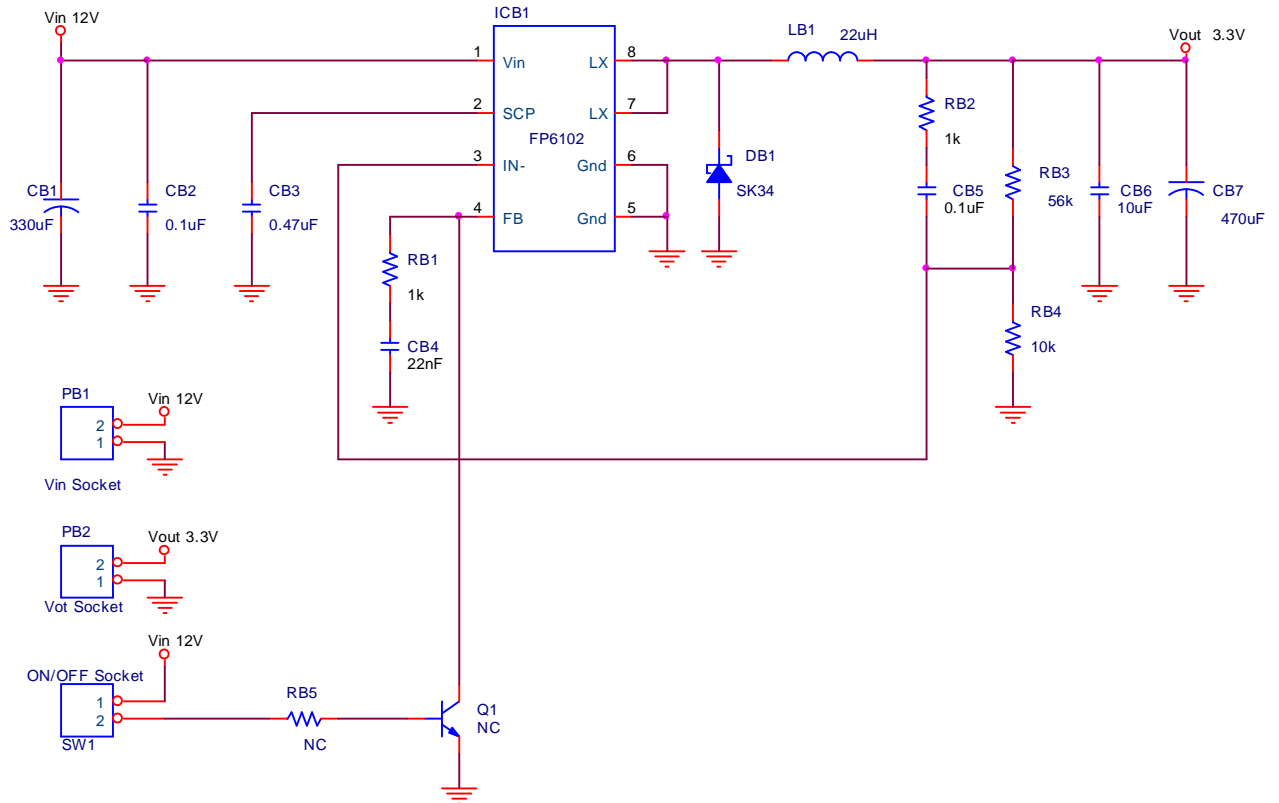
**Thermal Protection**

The thermal protection is functional due to a heavy loading drop and interior temperature achieves 145 degree, then **FP6102** output turn off and start short circuit protection function. When interior temperature lower than 145 degree, **FP6102** Soft-Start starts again and output turn on.

**Over Current Protection**

Due to **FP6102** senses over 4A, **FP6102** initiates OCP function and enters ARSCP function. When current is under 4A, **FP6102** turns on and continues PWM operation.

## APPLICATION NOTE



**FP6102 Basic DC-DC Regulator Circuits**

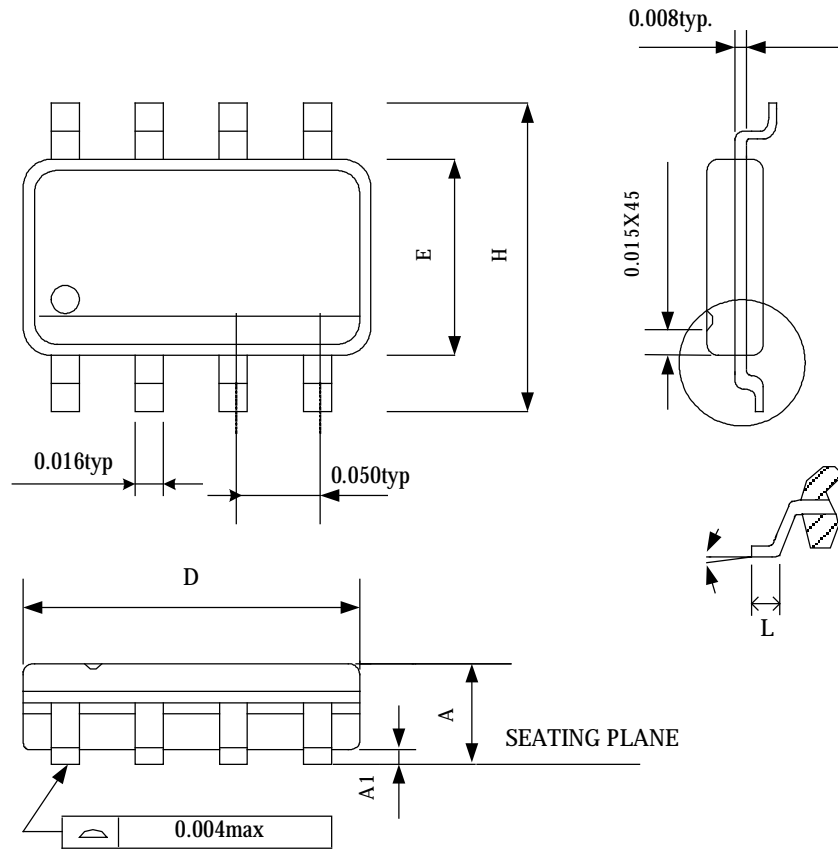
**For example:**

The  $V_{IN}$  is one 12V power supply, and the  $V_{OUT}$  is designed for 3.3V / 2A solution.

The output voltage formula is:

$$V_{OUT} = \left(1 + \frac{R1}{R2}\right) * V_{ref} = \left(1 + \frac{56K\Omega}{10K\Omega}\right) * 0.5V = 3.30V$$

## PACKAGE OUTLINE SOP8



SYMBOLS	MIN	MAX
A	0.053	0.069
A1	0.004	0.010
D	0.189	0.196
E	0.150	0.157
H	0.228	0.244
L	0.016	0.050
$\theta^\circ$	0	8

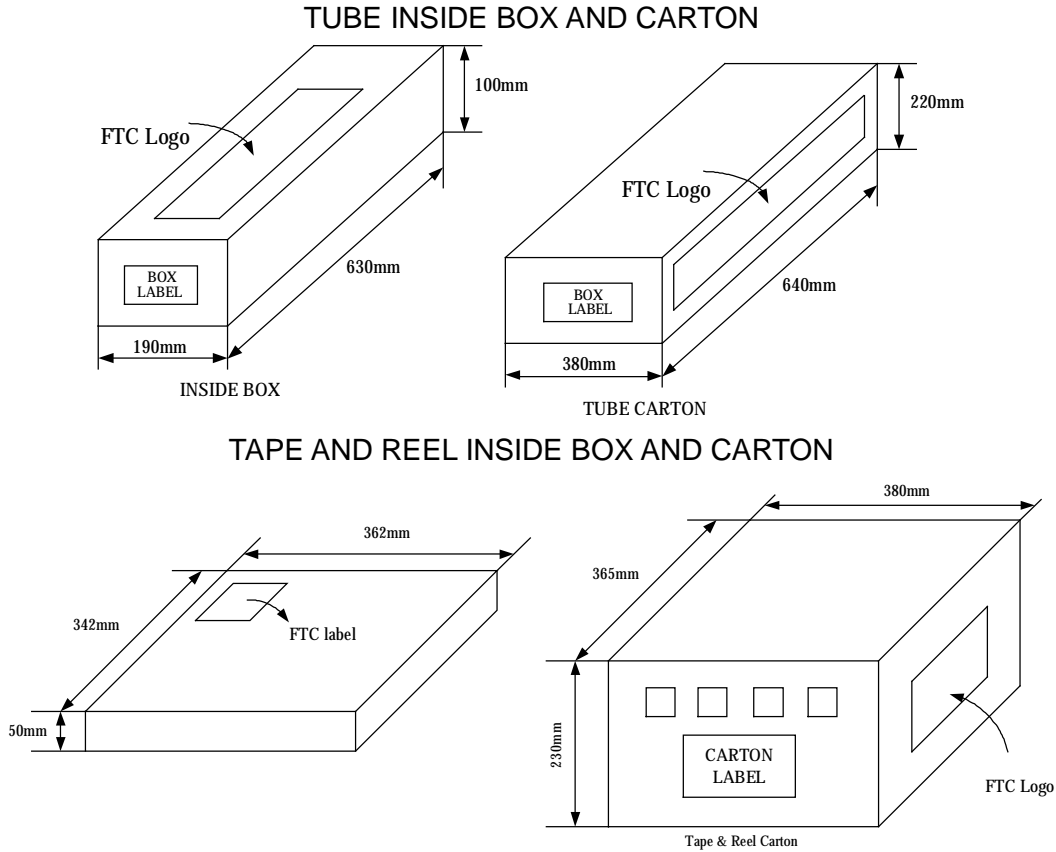
UNIT:INCH

### NOTE:

1. JEDEC OUTLINE:MS-012 AA
2. DIMENSIONS "D" DOES NOT INCLUDE MOLD FLASH,PROTRUSIONS OR GATE BURRS.MOLD FLASH,PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED .15mm (.06in) PER SIDE
3. DIMENSIONS "E" DOES NOT INCLUDE INTER-LEAD FLASH,OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED .25mm (.0.10in) PER SIDE.

## PACKING SPECIFICATIONS

### BOX DIMENSION



## PACKING QUANTITY SPECIFICATIONS

FP6102D-LF SOP8	FP6102DR-LF SOP8
100 EA/TUBE	2500 EA / REEL
100 TUBES / INSIDE BOX	1 REEL / INSIDE BOX
4 INSIDE BOXES / CARTON	4 INSIDE BOXES / CARTON

## LABEL SPECIFICATIONS

Tapping & Reel / Carton

**Feeling Technology Corp.**  
 Product: FP6102DR-LF  
 Lot No: A123456789.1-G  
 D/C: 8GH-89L  
 Q'ty: 10000  
 2008/05/28

Anti-Static Aluminum Foil Bags

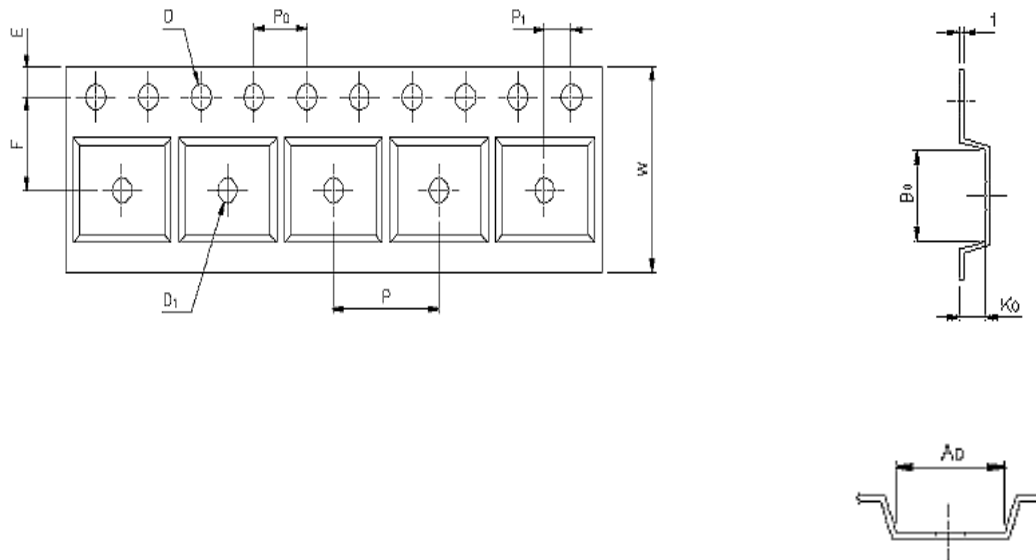


## SOP8

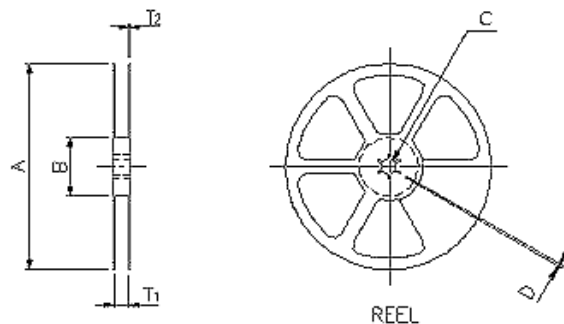
### CARRIER TAPE DIMENSIONS

APPLICATION	W	P	E	F	D	D <sub>1</sub>
SOP8	12.0 <sup>+0.3</sup> <sub>-0.1</sub>	8.0±0.1	1.75±0.1	5.5±0.1	1.55±0.1	1.5 <sup>+0.25</sup>

APPLICATION	P <sub>0</sub>	P <sub>1</sub>	A <sub>D</sub>	B <sub>0</sub>	K <sub>0</sub>	t
SOP8	4.0±0.1	2.0±0.1	6.4±0.1	5.20±0.1	2.1±0.10	0.30±0.013



### REEL DIMENSIONS



APPLICATION	MATERIAL	A	B	C	D	T <sub>1</sub>	T <sub>2</sub>
SOP8	PLASTIC REEL	330±0.1	62±1.5	12.75±0.15	2±0.6	12.4±0.2	2.0±0.2