

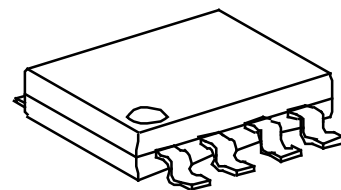
## 0.25V SWITCHING BUCK REGULATOR

### GENERAL DESCRIPTION

The **FP7102** is PWM control buck converter designed to provide a simple, high efficiency solution for driving high power LEDs. With a **0.25V** reference voltage feedback control to minimize power dissipation, an external resistor sets the current as needed for driving various types of LEDs. The **FP7102** includes a high current P-MOSFET, high efficiency and excellent transient characteristics. The PWM control circuit is able to the duty ratio linearly from 0 up to 100%. The features include user accessible EN/DIM pin for enabling and PWM dimming of LEDs, thermal shutdown, cycle-by cycle current limit and over current protection.

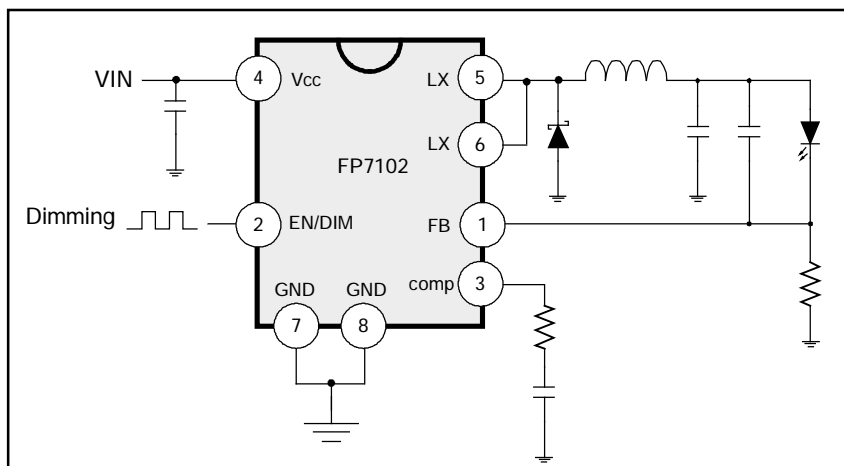
### FEATURES

- Precision feedback reference voltage: 0.25V (2%)
- Wide supply voltage operating range: 3.6 to 28V
- Low current consumption: 4mA
- Internal fixed oscillator frequency: Typ. 320KHz
- Internal Soft-Start function (SS)
- Built-in P-MOSFET for 2A loading capability
- Over Current Protection
- Package: SOP8

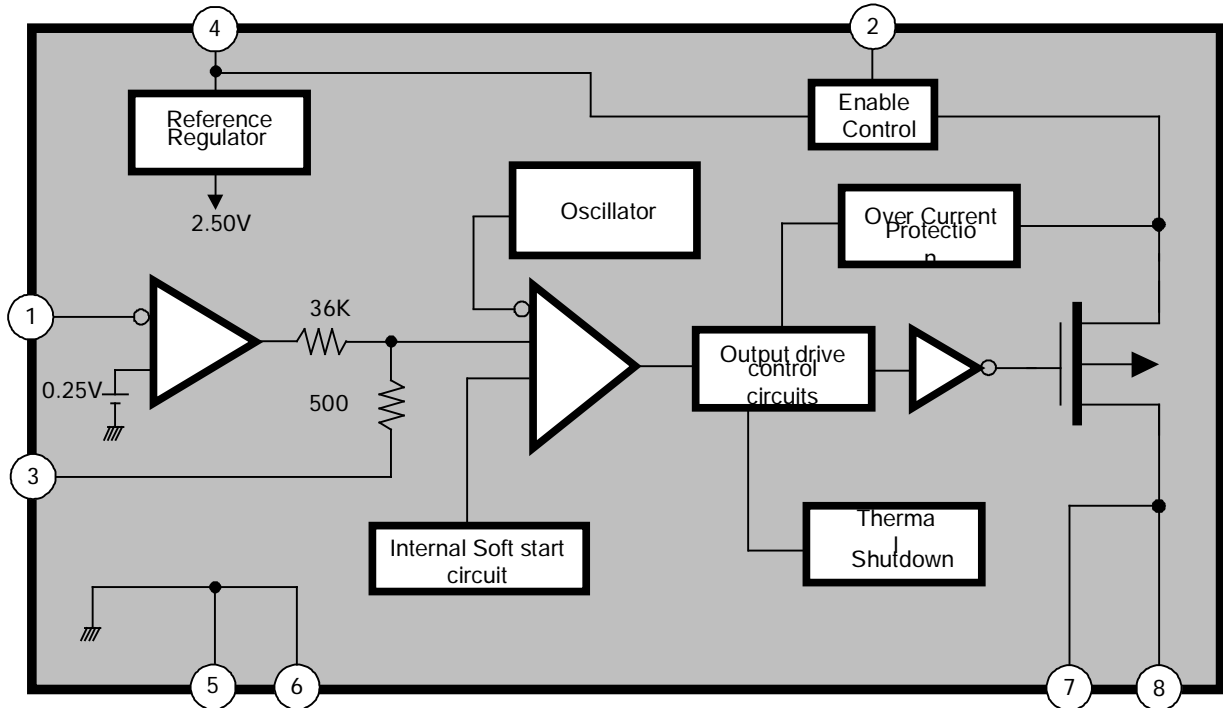


SOP8

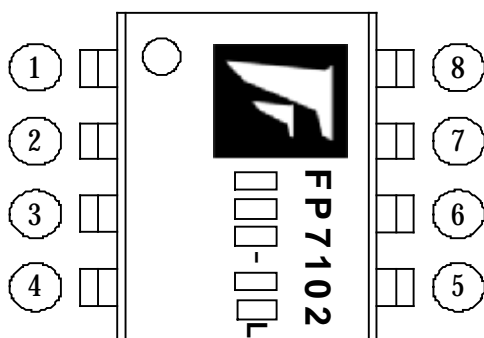
### TYPICAL APPLICATION



## FUNCTIONAL BLOCK DIAGRAM



### MARK VIEW



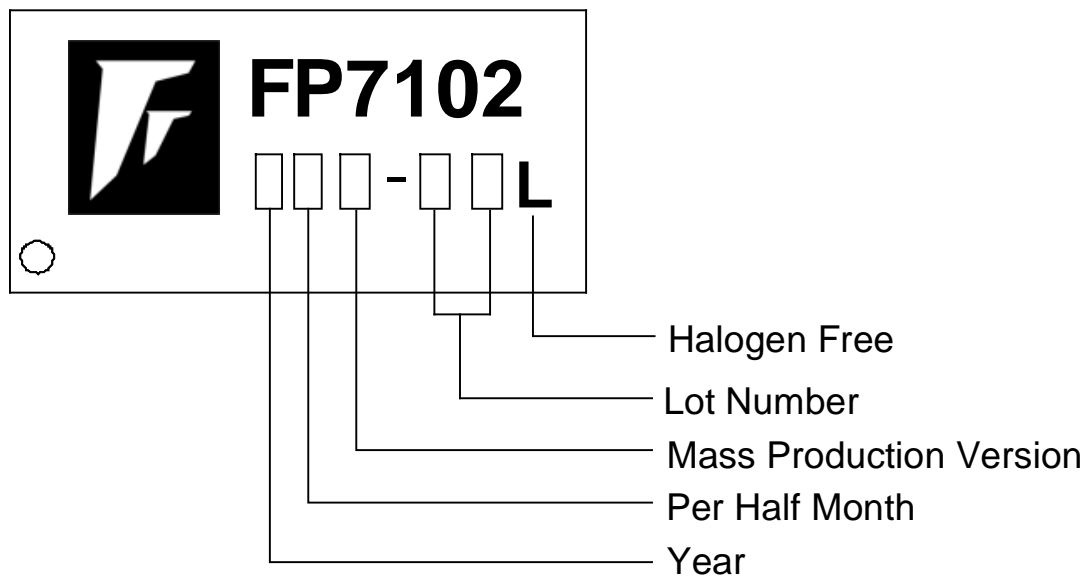
### PIN DESCRIPTION

Name	No.	I/O	Description
FB	1	I	Error Amplifier Inverting Input
EN/DIM	2	I	Enable Control
COMP	3	O	Error Amplifier Compensation Output
VCC	4	P	IC Power Supply (PMOS Source)
LX	5	P	PMOS High Current Output
	6		
GND	7	O	IC Ground
	8		

## ORDER INFORMATION

Part Number	Operating Temperature	Package	Description
FP7102D-LF	-25°C ~ +105°C	SOP8	Tube
FP7102DR-LF	-25°C ~ +105°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:

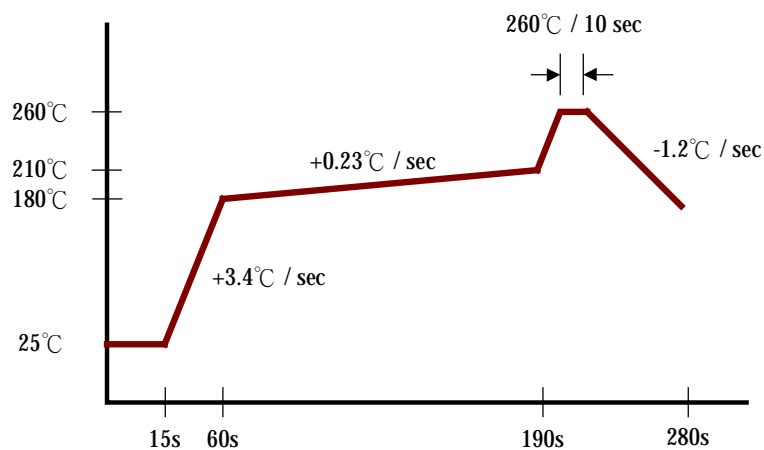
### For Example:

A3311C<sup>62</sup>  
 → Lot Number

## ABSOLUTE MAXIMUM RATINGS

Power supply voltage -----	+28V
Output source current -----	+2A
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 ~ +105°C
ESD Susceptibility	
HBM (Human Body Mode) -----	2KV
MM (Machine Mode) -----	200V
Storage temperature -----	-55°C ~ +125°C
SOP8 Lead Temperature (soldering, 10 sec) -----	+260°C

**Recommend: IR Reflow**



**FP7102 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	$V_{REF}$	FB connected to COMP	0.245	0.25	0.255	V
Input regulation	$\Delta V_{REF}$	$V_{CC}=3.6V$ to 25 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	

### Oscillator section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Oscillation frequency	f	--	-	320	-	KHz
Frequency change with voltage	$\Delta f / \Delta V$	$V_{CC}=3.6V$ to 25V	-	5	-	%
Frequency change with temperature	$\Delta f / \Delta T$	$T_a = -25^{\circ}C$ to $+85^{\circ}C$	-	5	-	%

### 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	$V_{POS}$	1.7	2	-	V
	Negative	$V_{NEG}$	-	0.1	0.2	
Output source current	$I_{SOURCE}$	$V_{comp}=200mV$	-15	-30	-	$\mu A$
Output sink current	$I_{SINK}$		15	30	-	$\mu A$

### Idle Period Adjustment section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Maximum duty cycle	$T_{DUTY}$	$V_{FB}=0.2V$	-	100	-	%

## DC ELECTRICAL CHARACTERISTICS (Cont.)

### Output section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
PMOS D-S voltage	$V_{DSS}$	$V_{COMP}=0.1V$	-	-20	-	V
PMOS source current	$I_D$	--	-	-2	-	A
PMOS On resistance	$R_{DS(ON)}$	$V_{CC}=5.0V, V_{FB}=0V$	-	70	150	$m\Omega$
		$V_{CC}=10V, V_{FB}=0V$	-	42	90	
Output leakage current	$I_L$	--	-	5	-	$\mu A$

### Thermal Shutdown section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Thermal shutdown temperature	--	--	-	150	-	$^{\circ}C$

### Over Current Protection section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
PMOS OCP current	$I_{OCP}$	--	-	3	-	A

### Total device section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
EN Input Current	$I_{EN}$	EN pin open			20	$\mu A$
Upper threshold voltage (EN)	$V_{UPPER}$	--		1.12		V
Lower threshold voltage (EN)	$V_{LOW}$	--		0.87		V
Hysteresis	$V_{HYS}$	--	210	250		mV
Average supply current	$I_{AVE}$	--	-	4	6	mA

## DETAILED DESCRIPTION

### Voltage Reference

A 2.5V reference regulator supplies **FP7102** internal circuits and uses the resistive dividers to provide a **0.25V** precision reference voltage on the non-inverting terminal of error amplifier.

### Setting the LED Current

**FP7102** is a constant current buck regulator. The LEDs are connected between  $V_{OUT}$  and FB pin as shown in the Typical Application Circuit. The FB pin is at **0.25V** in regulation and therefore the LEDs current  $I_F$  is set by  $V_{FB}$  and the resistor  $R_2$  from FB to ground by the following equation:

$$I_F = \frac{V_{FB}}{R_2}$$

$I_F$  should not exceed the 2A current capability of FP7102 and therefore  $R_2$  minimum must be approximately  $0.13\Omega$ .

### Output Voltage

The output voltage is primarily determined by the number of LEDs(n) connected from  $V_{OUT}$  to FB pin and therefore  $V_{OUT}$  can be written as:

$$V_{OUT} = ((n \times V_F) + V_{FB})$$

where  $V_F$  is the forward voltage of one LED at the set LED current level (see LED manufacturer datasheet for forward characteristics curve).

### Oscillator

The fixed frequency generates from an internal oscillator, and the typical values are **320KHz**.

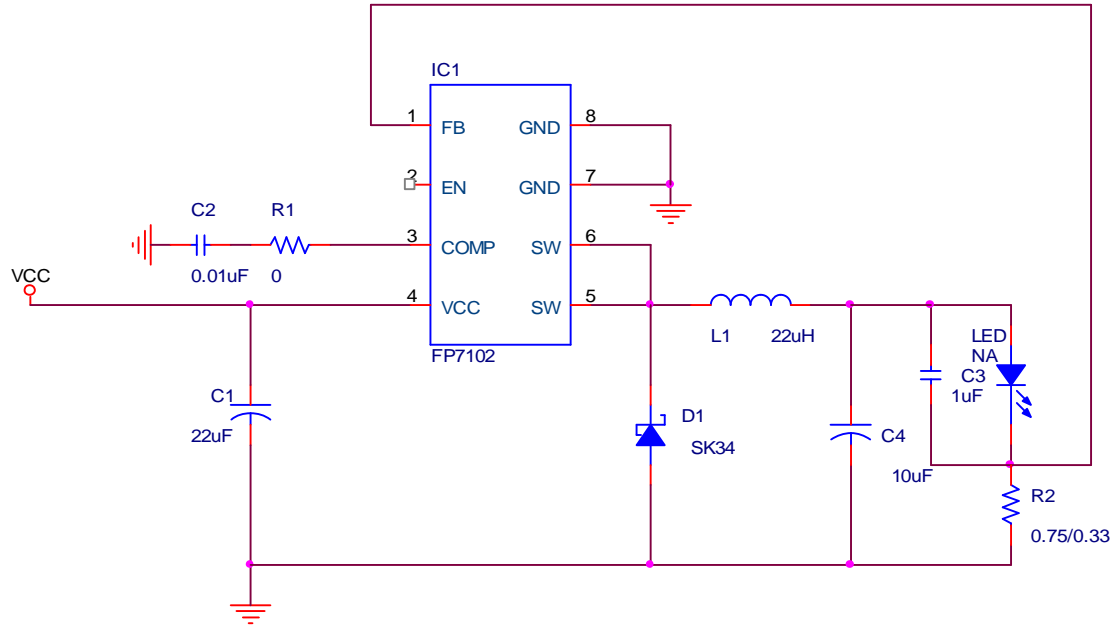
### Thermal Protection

The thermal protection is functional due to a heavy loading drop and junction temperature achieve  $150^\circ\text{C}$ , then **FP7102** output turn off. When junction temperature is lower than  $150^\circ\text{C}$ , **FP7102** starts again and power switch turns on.

### Over Current Protection

The **FP7102** uses cycle-by-cycle current limit to protect the internal power switch. During each switching cycle, a current limit comparator detects if the power switch current exceeds the internal setting current, and begins over current protection decrease the oscillator frequency to prevent thermal issue.

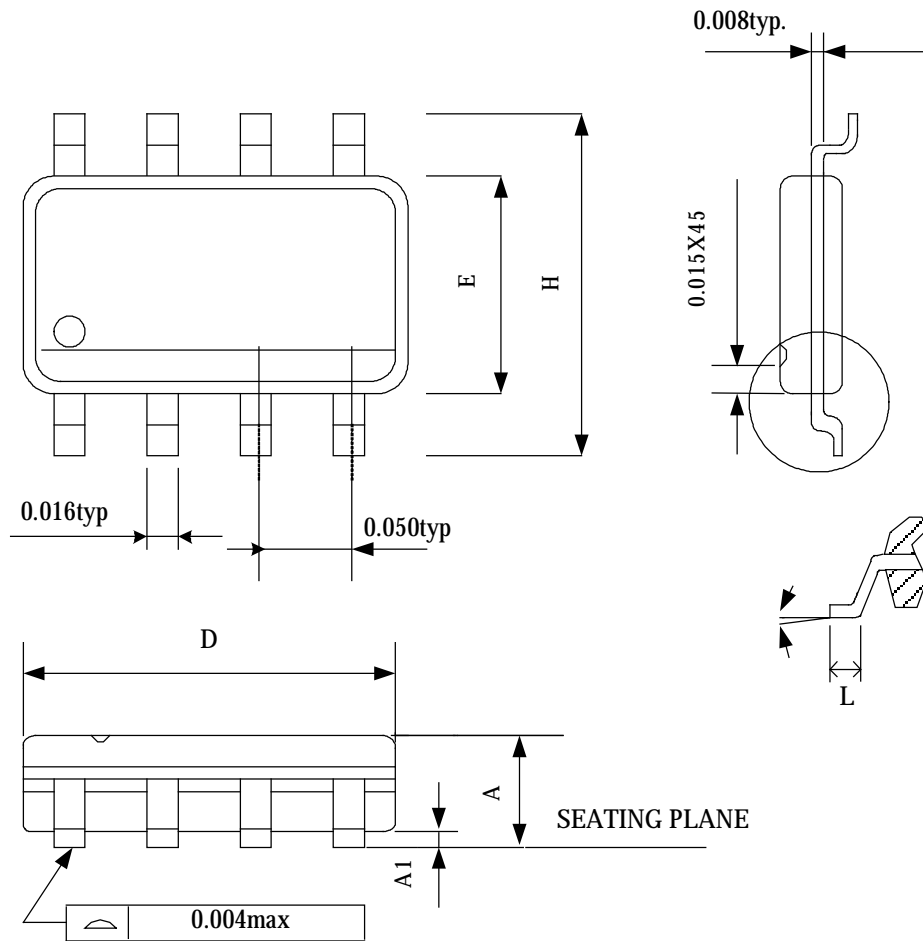
## APPLICATION INFORMATION



**FP7102 1W/3W LED for DC Input Circuit**



## 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

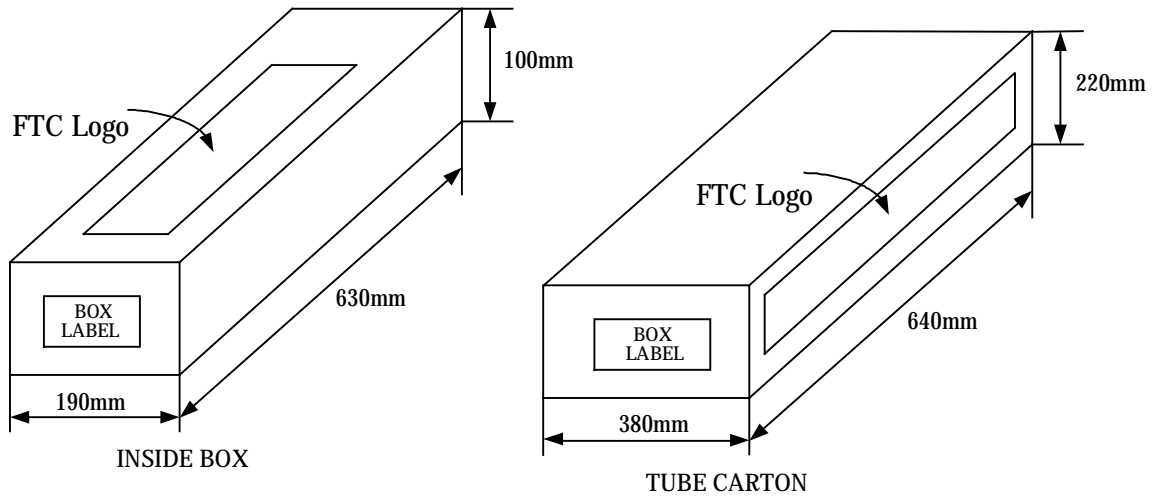
UNIT:INCH

### NOTE:

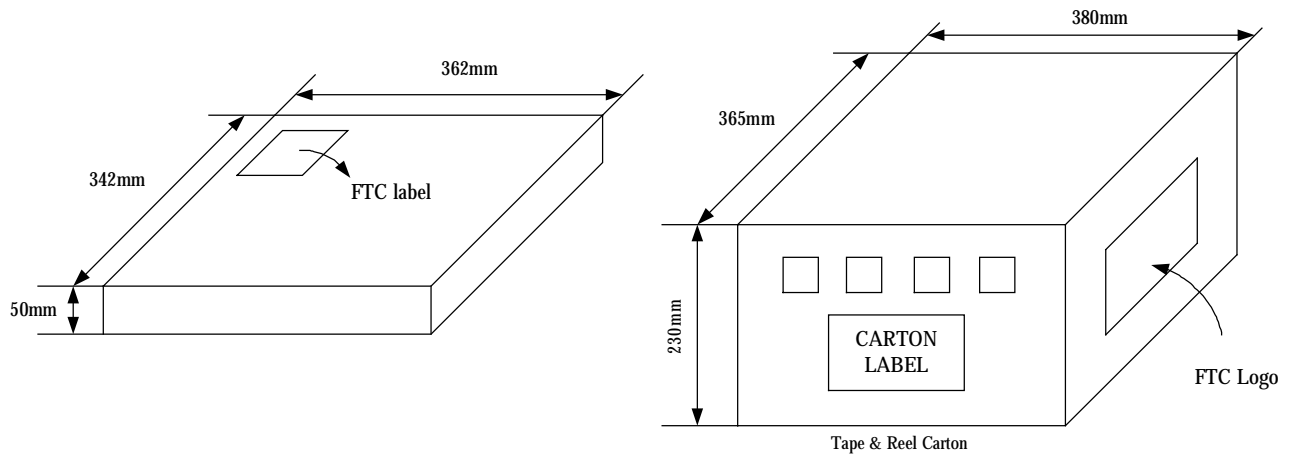
1. JEDEC OUTLINE: MS-012 AA
2. DIMENSIONS "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED .15mm (.06in) PER SIDE
3. DIMENSIONS "E" DOES NOT INCLUDE INTER-LEAD FLASH, OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED .25mm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

## PACKING SPECIFICATIONS BOX DIMENSION

### TUBE INSIDE BOX AND CARTON



### TAPE AND REEL INSIDE BOX AND CARTON



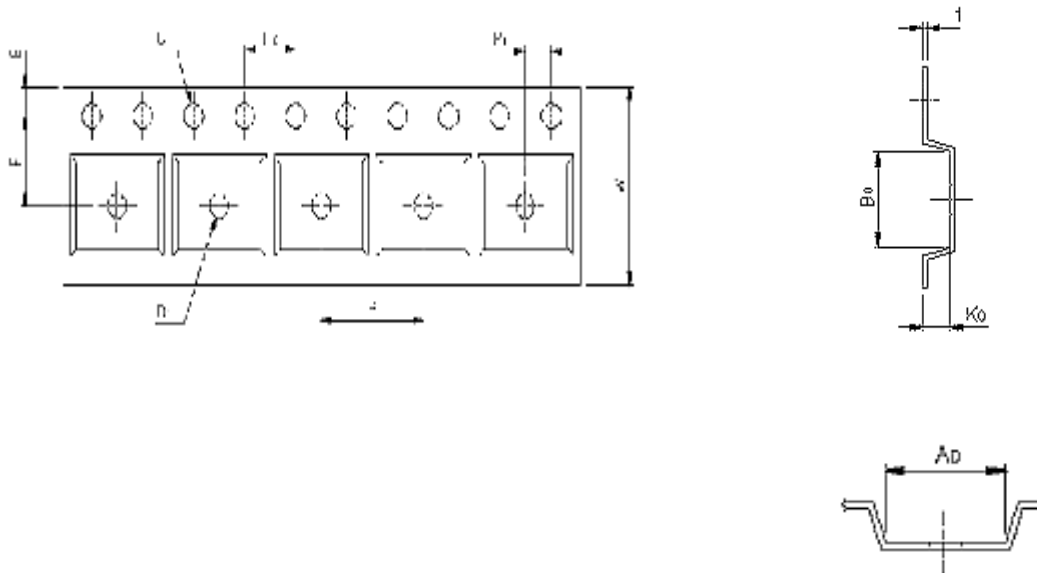
## PACKING QUANTITY SPECIFICATIONS

FP7102D-LF SOP8	FP7102DR-LF SOP8
100 EA/TUBE	2500 EA / REEL
100 TUBES / INSIDE BOX	1 REEL / INSIDE BOX
4 INSIDE BOXES / CARTON	4 INSIDE BOXES / CARTON

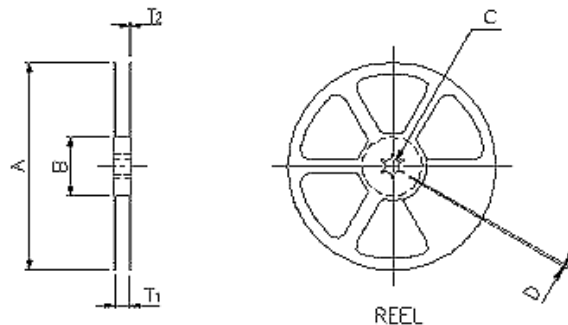
## CARRIER TAPE DIMENSIONS SOP8

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