

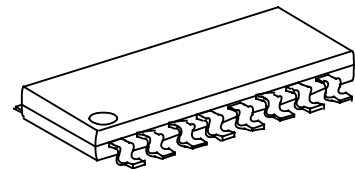
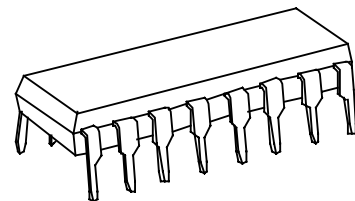
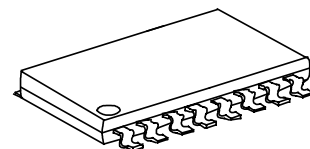
**DUAL CHANNEL PWM CONTROL IC  
WITH SCP/DTC FUNCTION****GENERAL DESCRIPTION**

The FP5451B, a 1-chip composed of dual open collector transistor pulse-width-modulation control circuits with two error amplifiers and dead-time comparators (DTC), the FP5451B contains a 2.5V precision voltage reference regulator, under-voltage lockout circuit (UVLO), short circuit protection circuit (SCP), applied to offer space and low cost in many applications such as the DC/DC converter and backlight inverter.

Using few external components, FP5451B, a high performance integrated IC, is designed for a control circuit. The circuit diagram of the typical application example is as below.

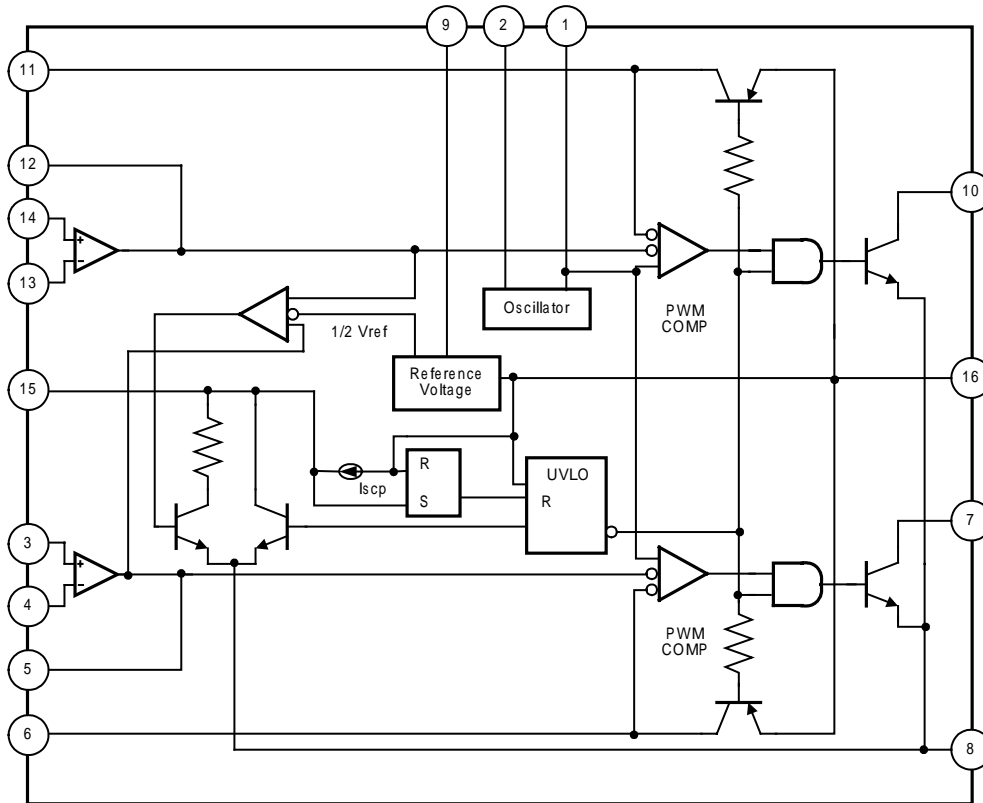
**FEATURES**

- Fixed Reference Voltage: 2.5V
- Reference Voltage Precision: 1%
- Output sink current up to 100mA
- Low quiescent supply current
- Wide operating voltage range: 4~40V
- Variable dead-time control (DTC)
- UVLO protection function
- SCP protection function (Typ. 1.3V)
- Oscillator Frequency: Max. 800KHz
- Package: SOP16 / PDIP16 / SSOP16

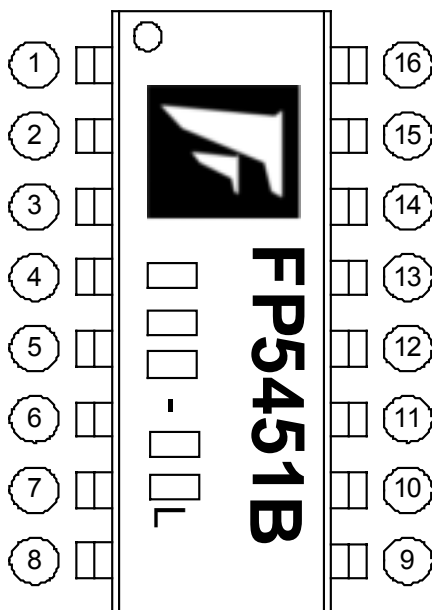
**SOP16****PDIP 16****SSOP 16****TYPICAL APPLICATION**

- Dual Output Switch Regulator
- Backlight Inverter
- LCD Monitor

## FUNCTIONAL BLOCK DIAGRAM



### MARK VIEW



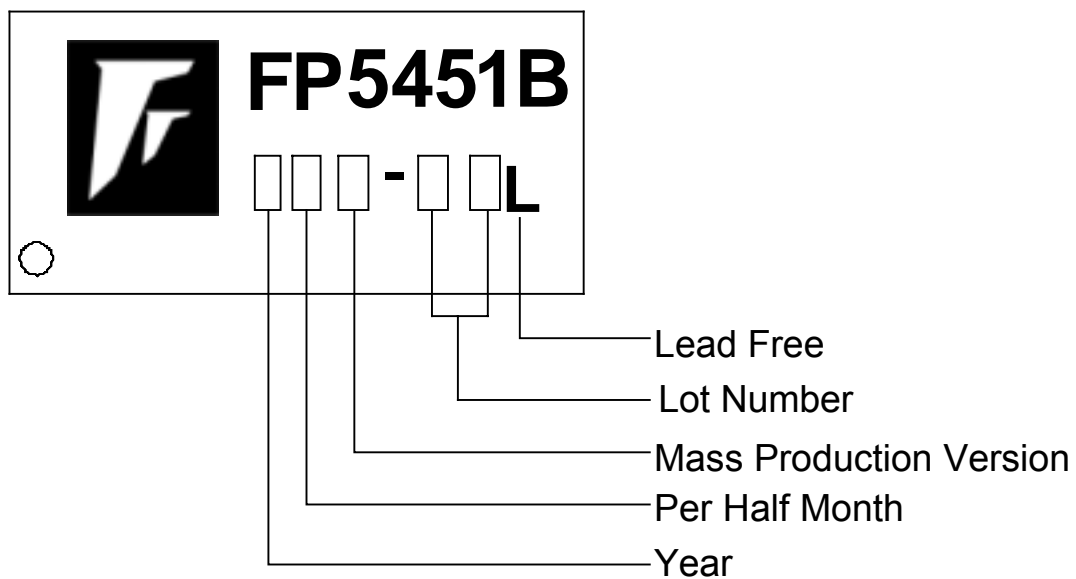
### PIN DESCRIPTION

NAME	NO.	STATUS	DESCRIPTION
CT	1	I	Connect a Capacitor for Oscillator
RT	2	I	Connect a Resistor for Oscillator
EA1+	3	I	Error Amplifier 1 Non-inverting Input
EA1-	4	I	Error Amplifier 1 Inverting Input
FB1	5	O	Error Amplifier 1 Feedback Output
DTC1	6	I	Output 1 Dead-Time Comparator
OUT1	7	O	Open Collector Output 1
GND	8	P	IC Ground
VCC	9	P	IC Power Supply
OUT2	10	O	Open Collector Output 2
DTC2	11	I	Output 2 Dead-Time Comparator
FB2	12	O	Error Amplifier 2 Feedback Output
EA2-	13	I	Error Amplifier 2 Inverting Input
EA2+	14	I	Error Amplifier 2 Non-inverting Input
SCP	15	I	Short Circuit Protection Input
VREF	16	O	2.5V Reference Voltage Output

## ORDER INFORMATION

Part Number	Operating Temperature	Package	Description
FP5451BP-LF	-20°C 85°C	PDIP16	Tube
FP5451BD-LF	-20°C 85°C	SOP16	Tube
FP5451BDR-LF	-20°C 85°C	SOP16	Tape & Reel
FP5451BR-LF	-20°C 85°C	SSOP16	Tube
FP5451BRR-LF	-20°C 85°C	SSOP16	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

Lot Number is the last two numbers

### For Example:

A3311C62  
 ↳ Lot Number

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V <sub>cc</sub> )	-----	+40V
Differential Input Voltage (V <sub>id</sub> )	-----	+20V
Collector Output Voltage (V <sub>o</sub> )	-----	+40V
Collector Output Current (I <sub>o</sub> )	-----	+150mA
Maximum Junction Temperature (T <sub>j</sub> )	-----	+150°C
Thermal Resistance Junction to Ambient (SOP package)	-----	175°C /W
(SSOP package)	-----	220 /W

### Power Dissipation

#### SOP16 package

T<sub>a</sub>=25 ----- 650mW

T<sub>a</sub>=70 ----- 550mW

#### PDIP16 package

T<sub>a</sub>=25 ----- 1000mW

T<sub>a</sub>=70 ----- 640mW

#### SSOP16 package

T<sub>a</sub>=25 ----- 450mW

T<sub>a</sub>=70 ----- 250mW

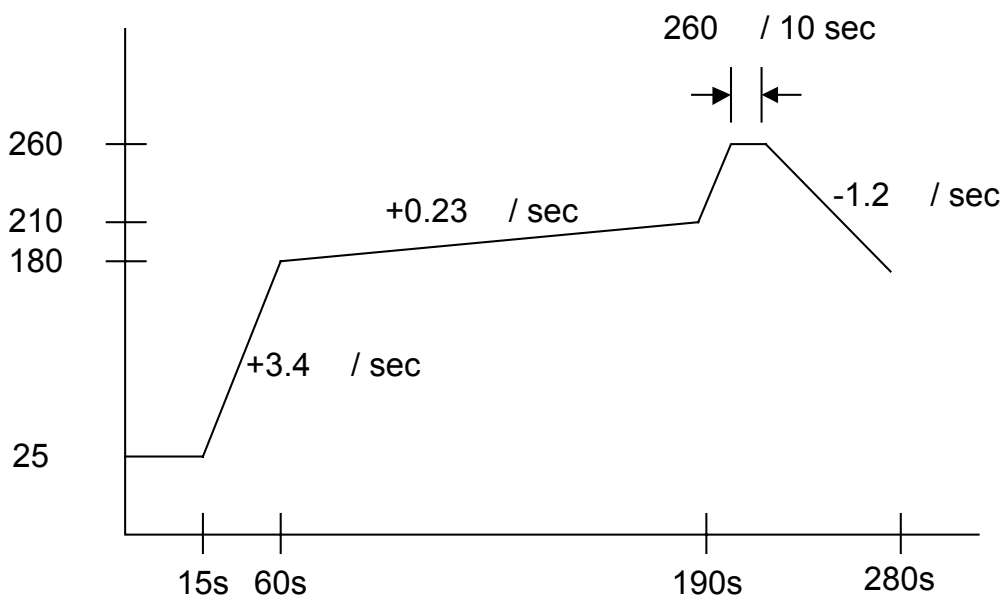
Operating Temperature Range ----- -20°C 85°C

Storage Temperature Range ----- -65°C 150°C

SOP16 Lead Temperature (soldering, 10 sec) ----- +260

PDIP16 Lead Temperature (soldering, 20 sec) ----- +260

SSOP16 Lead Temperature (soldering, 10 sec) ----- +260



## DC ELECTRICAL CHARACTERISTICS

Electrical characteristics over recommended operating free-air temperature range,  $V_{CC}=6V$ ,  
 $f=200kHz$  (unless otherwise noted)

### Reference section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output voltage (pin 16)	$V_{REF}$	$I_O=1mA$	2.45	2.5	2.55	V
Output voltage change with Temperature		$T_A=-20$ to 25		-0.1%	$\pm 1\%$	
		$T_A=25$ to 85		-0.2%	$\pm 1\%$	
Input voltage regulation	$V_{REF}/V_{REF}$	$V_{CC}=3.6V$ 40V		2	12.5	mV
Output voltage regulation	$V_{REF}/V_{REF}$	$I_O=0.1mA$ to 1 mA		1	7.5	mV
Short-circuit output current	$I_{SHORT}$	$V_O=0$	3	10	30	mA

### Undervoltage lockout section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Upper threshold voltage( $V_{CC}$ )	$V_{UPPER}$	$I_{O(REF)}=0.1mA$ , $T_A=25$		2.72		V
Lower threshold voltage( $V_{CC}$ )	$V_{LOW}$			2.6		V
Hysteresis ( $V_{CC}$ )	$V_{HYS}$		80	120		mV
Reset threshold voltage( $V_{CC}$ )	$V_{RESET}$		1.5	1.9		V

### Short-circuit protection control section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input threshold voltage (SCP)	$V_{TH}$	$T_A=25$	1.2	1.3	1.5	V
Standby voltage (SCP)	$V_{STANDBY}$	No pull-up	220	265	300	mV
Latched input voltage (SCP)	$V_{LATCH}$	No pull-up		220	280	mV
Input (source) current	$I_{SOURCE}$	$V_I=0.7V$ , $T_A=25$	-1.5	-2.0	-2.5	$\mu A$
Comparator threshold voltage (FEEDBACK)	$V_{COMP(TH)}$			1.2		V

### Oscillator section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Frequency	f	$C_T=220pF$ , $R_T=10K$		400		KHz
Standard deviation of frequency	f	$C_T=220pF$ , $R_T=10K$		10%		
Frequency change with voltage	f/ V	$V_{CC}=3.6V$ to 40V		1%		
Frequency change with Temperature	f/ T	$T_A=-20$ to 25		-0.4%	$\pm 2\%$	
		$T_A=25$ to 85		-0.2%	$\pm 2\%$	

### Dead-time control section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input bias current (DTC)	$I_{BIAS}$				1	$\mu A$
Latch mode (source) current(DTC)	$I_{SOURCE}$	$T_A=25$	-80	-200		$\mu A$
Latched input voltage (DTC)	$V_{LATCH}$	$I_O=40\mu A$	2.3			V
Input threshold voltage at $f=10kHz$ (DTC)	$V_{TH}$	Zero duty cycle	1.85		1.95	V
		Maximum duty cycle	1.4		1.5	

## DC ELECTRICAL CHARACTERISTICS (Cont.)

### Error –amplifier section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input offset voltage	$V_{IO}$	$V_o(\text{FEEDBACK})=1.25\text{V}$			$\pm 6$	mV
Input offset current	$I_{IO}$	$V_o(\text{FEEDBACK})=1.25\text{V}$			$\pm 100$	nA
Input bias current	$I_{BIAS}$	$V_o(\text{FEEDBACK})=1.25\text{V}$		160	500	nA
Common-mode input voltage range	$V_{ICM}$	$V_{CC}=3.6\text{V to }40\text{V}$	0.3		1.6	V
Open-loop voltage amplification	$A_{VO}$	$R_F=200\text{K}$	70	80		dB
Unity-gain bandwidth	BW			1.5		MHz
Common-mode rejection ratio	CMRR		60	80		dB
Positive output voltage swing	$V_{POS}$		$V_{ref}-0.2$			V
Negative output voltage swing	$V_{NEG}$				1	V
Output (sink) current (FEEDBACK)	$I_{SINK}$	$V_{ID}=-0.1\text{V}, V_o=1.25\text{V}$	1	4.0		mA
Output (source) current (FEEDBACK)	$I_{SOURCE}$	$V_{ID}=0.1\text{V}, V_o=1.25\text{V}$	-45	-90		$\mu\text{A}$

### Output section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Collector off-state current	$I_{OFF}$	$V_o=50\text{V}$			10	$\mu\text{A}$
Output saturation voltage	$V_{SAT}$	$I_o=10\text{mA}$		0.7	1	V
Short-circuit output current	$I_{SC}$	$V_o=6\text{V}$		150		mA

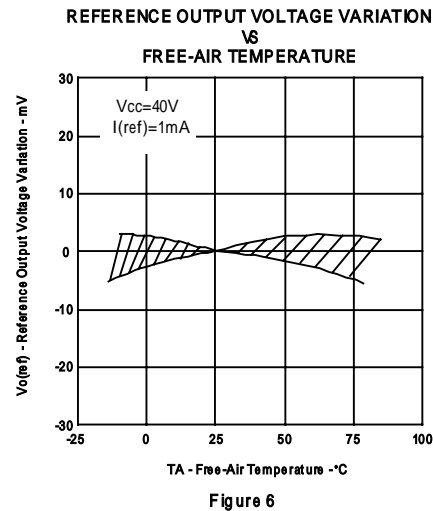
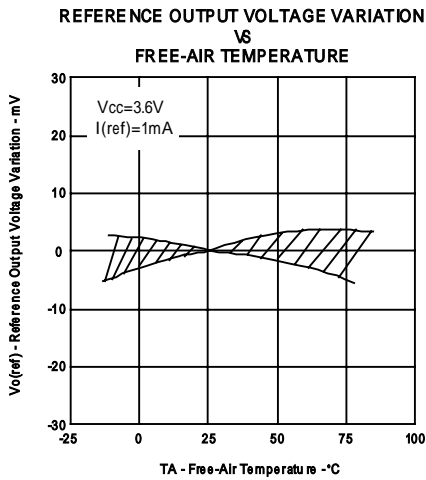
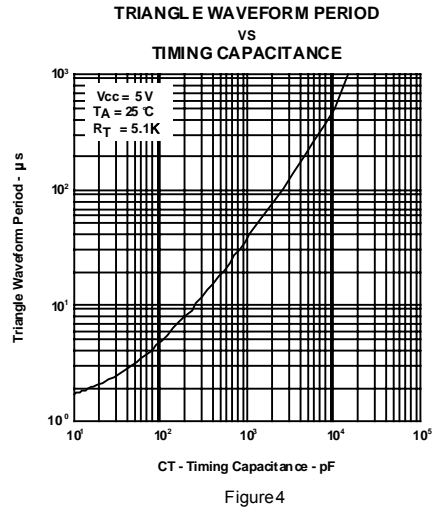
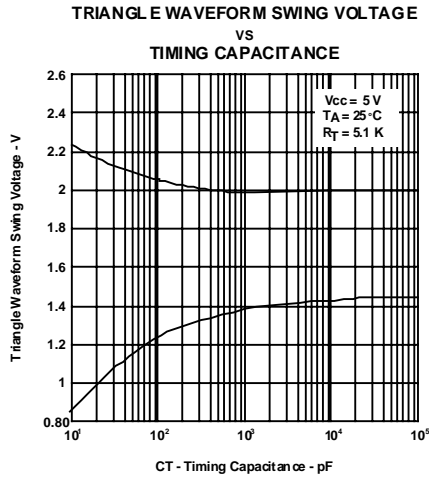
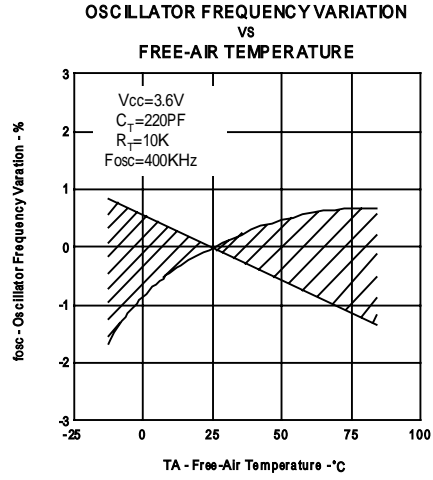
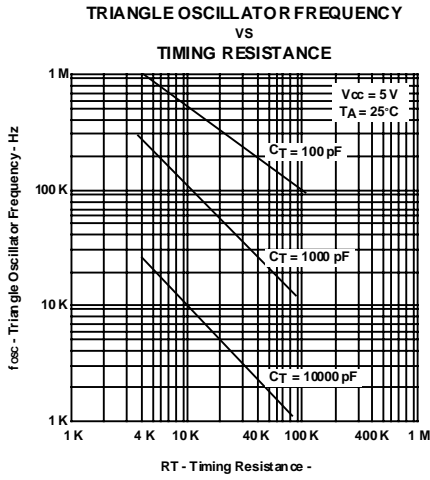
### Pwm comparator section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input threshold voltage at $f=10\text{kHz}(\text{FEEDBACK})$	$V_{TH}$	Zero duty cycle	1.85		1.95	V
		Maximum duty cycle	1.4		1.5	

### Total device

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Standby supply current	$I_{STANDBY}$	Off-state		1.3	1.8	mA
Average supply current	$I_{AVE}$	$R_T=10\text{K}$		1.7	2.4	mA

## TYPICAL CHARACTERISTICS



## TYPICAL CHARACTERISTICS (Cont.)

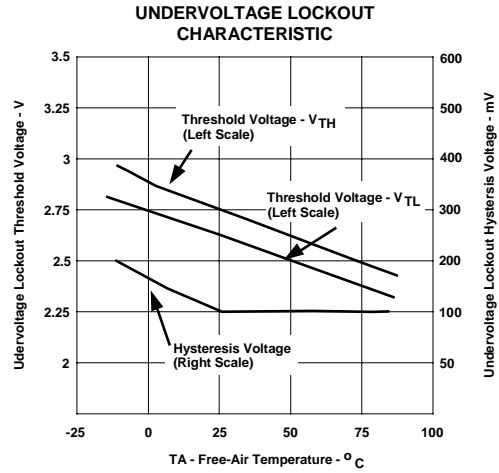
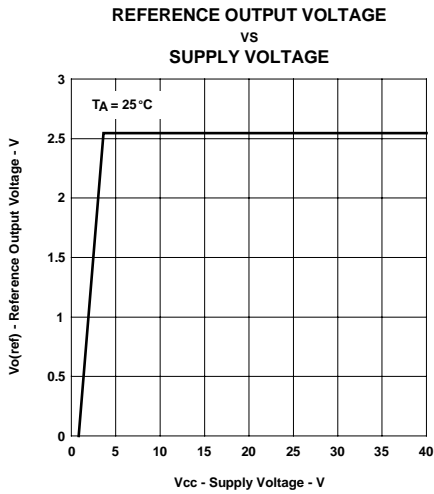


Figure 8

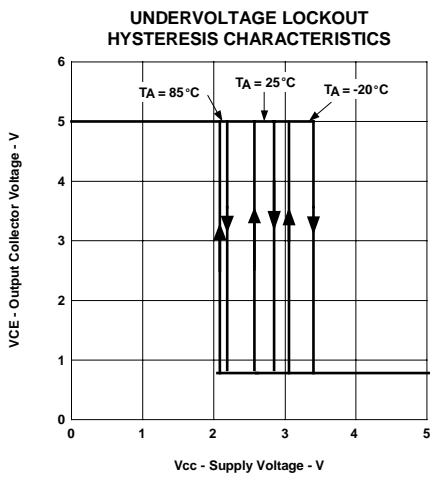


Figure 9

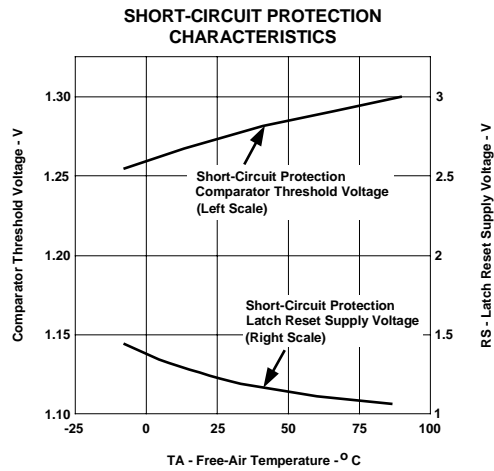


Figure 10

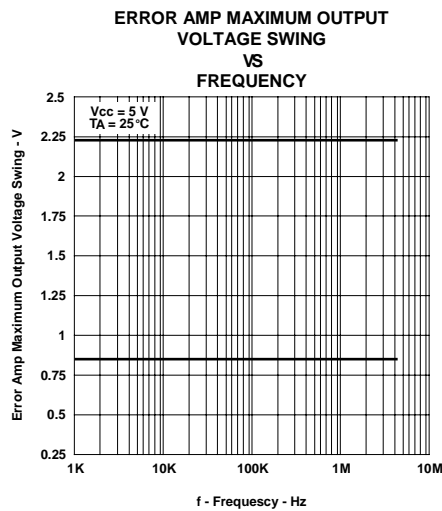


Figure 11



TYPICAL CHARACTERISTICS (Cont.)

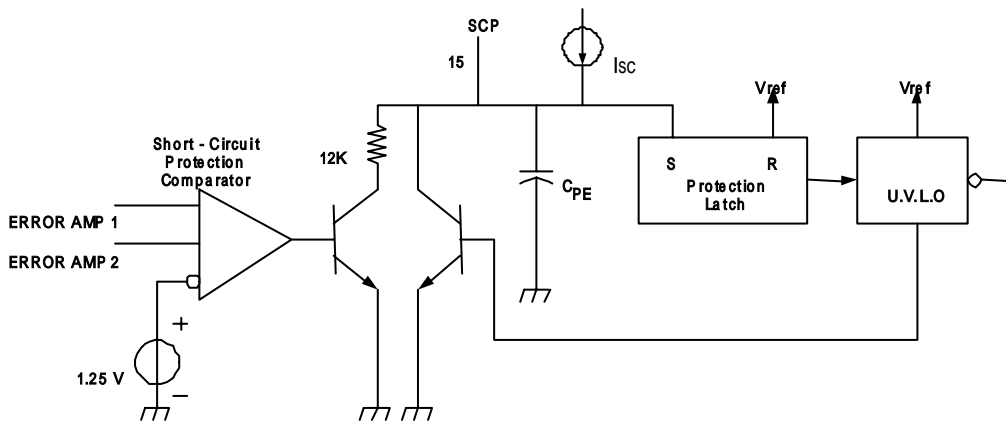
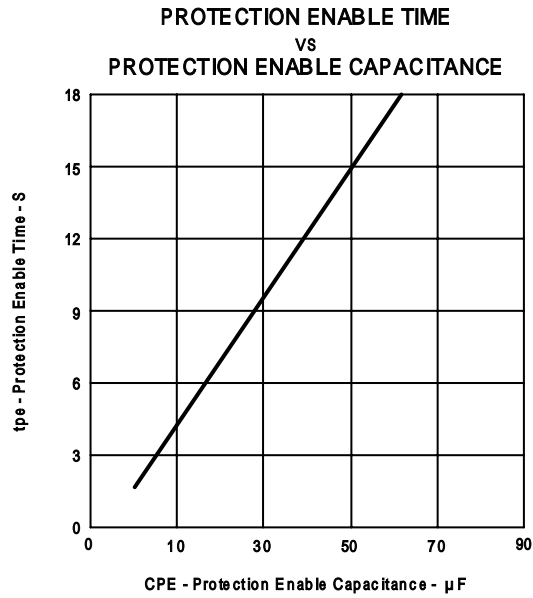


Figure 12

## TYPICAL CHARACTERISTICS (Cont.)

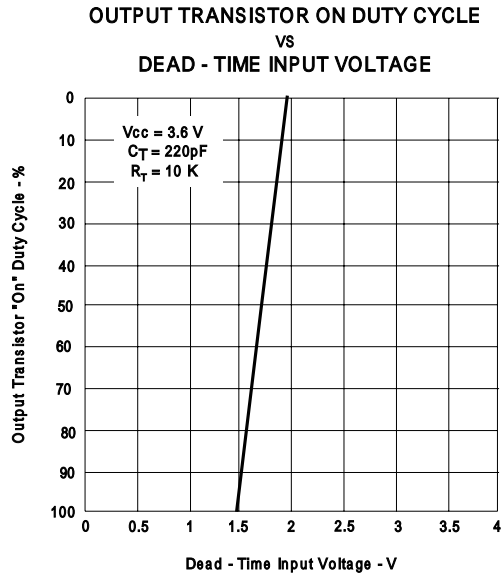


Figure 13

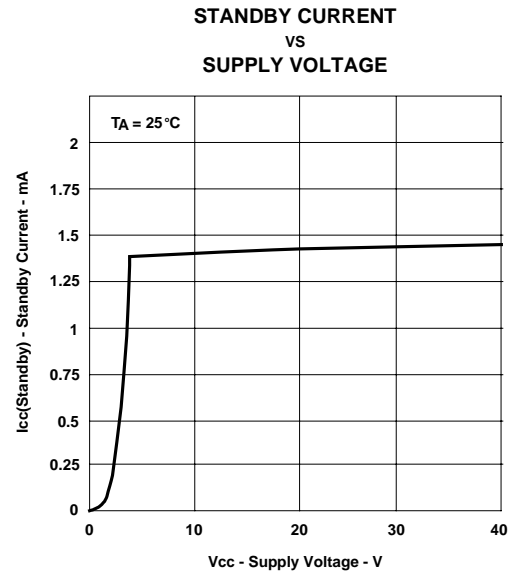


Figure 14

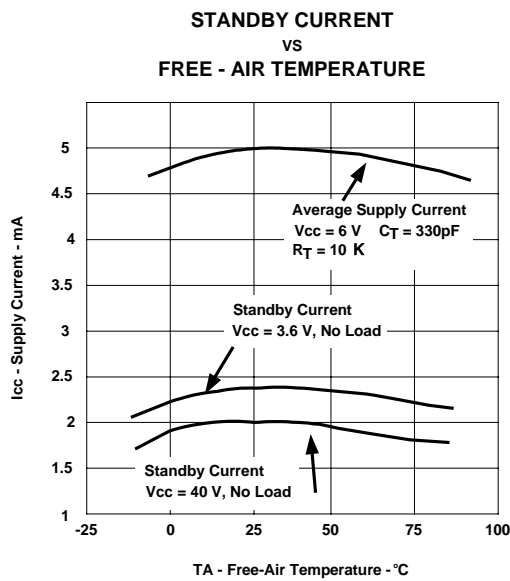


Figure 15

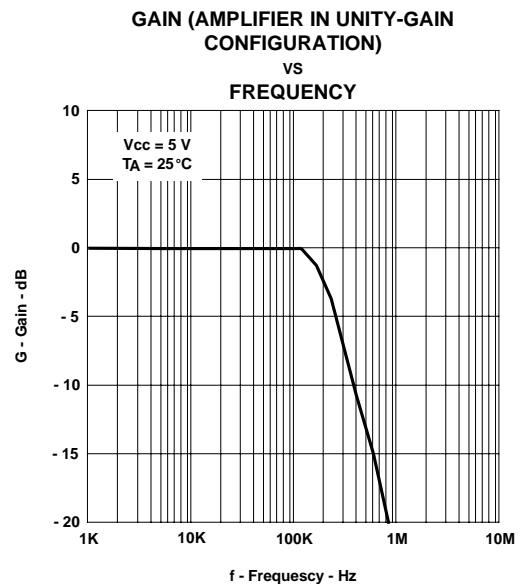
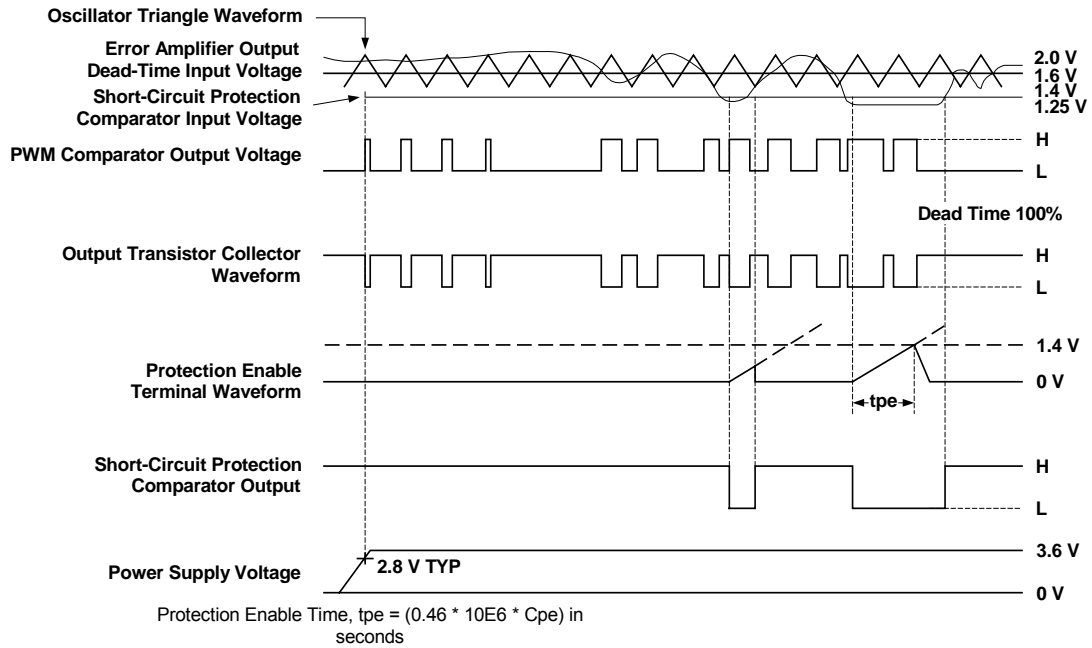


Figure 16

## TIMING WAVEFORM



FP5451B Timing Diagram

## APPLICATION NOTE

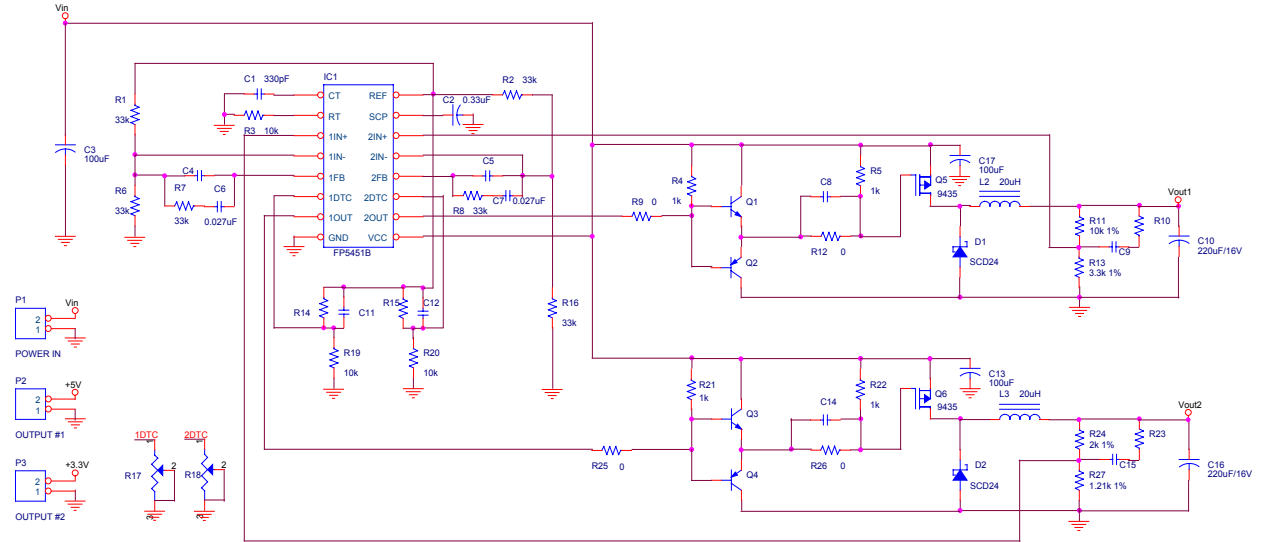
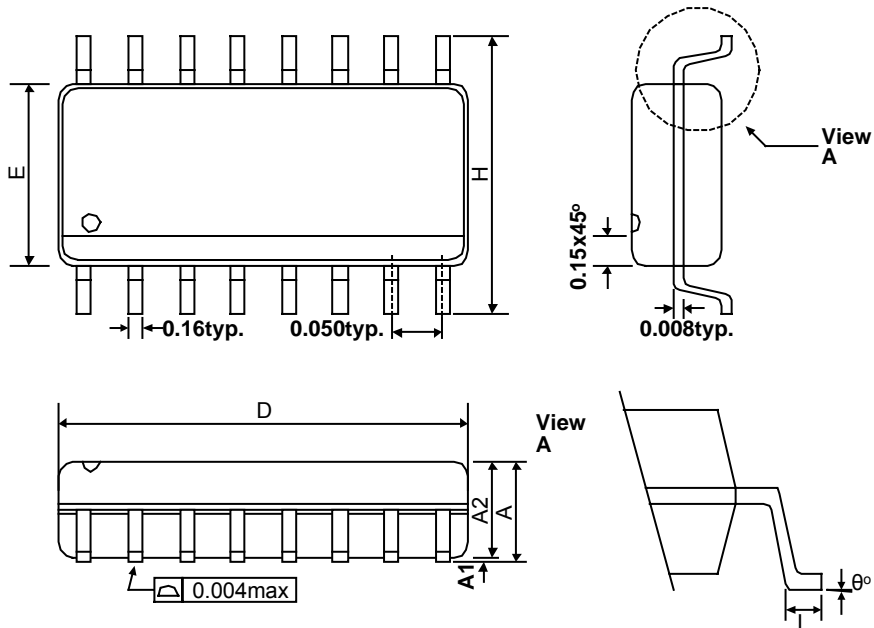


Figure 17. 2-channel dc-dc converter circuit

## PACKAGE OUTLINE

SOP-16L

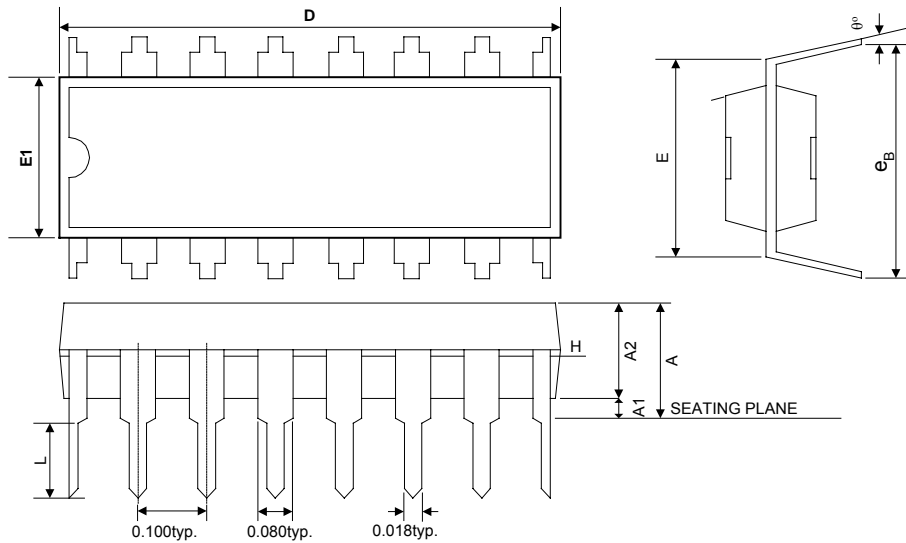


SYMBOLS	MIN	MAX
A	0.053	0.069
A1	0.004	0.010
D	0.386	0.394
E	0.150	0.157
H	0.228	0.244
L	0.016	0.050
°	0	8

NOTE:

1. JEDEC OUTLINE: MS-012 AC
2. DIMENSIONS "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED .15mm (.006in) PER SIDE
3. DIMENSIONS "E" DOES NOT INCLUDE INTER-LEAD FLASH, OR PROTRUSIONS.
4. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED .25mm (.010in) PER SIDE.

## PDIP-16L

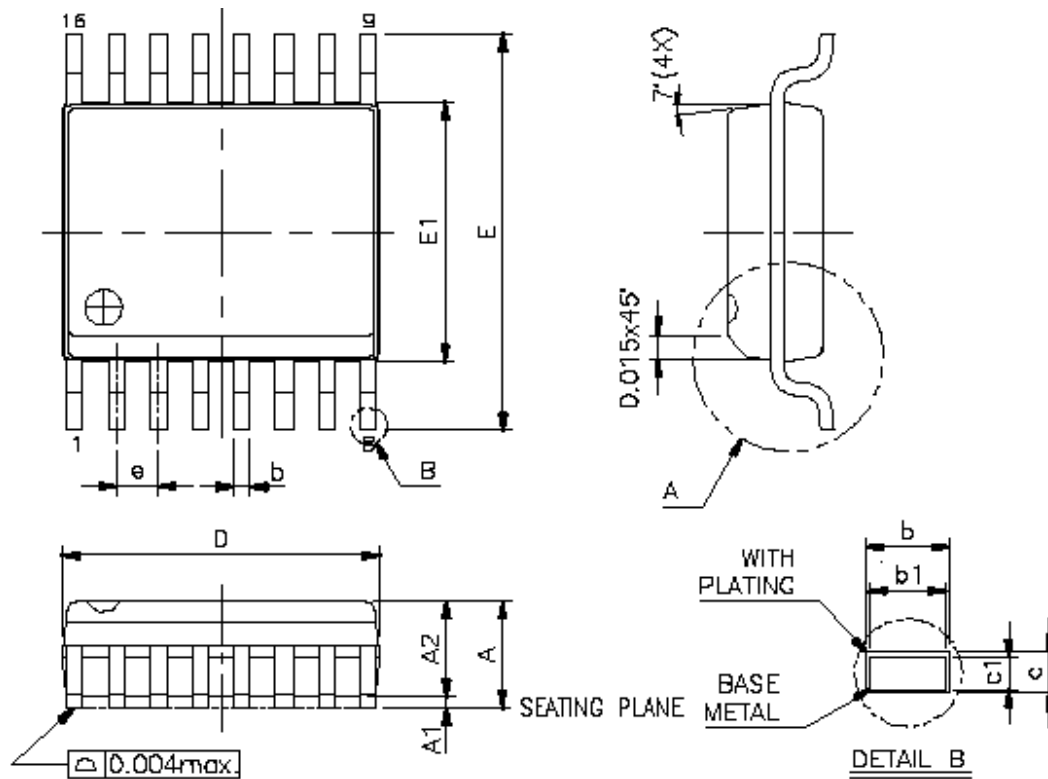


SYMBOLS	MIN.	NOR.	MAX.
A	—	—	0.210
A1	0.015	—	—
A2	0.125	0.130	0.135
D	0.735	0.755	0.775
E	0.300 BSC.		
E1	0.245	0.250	0.255
L	0.115	0.130	0.150
e <sub>θ</sub>	0.335	0.355	0.375
°	0	7	15

### NOTES:

1. JEDEC OUTLINE: MS-001 BB
2. "D", "E1" DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH.  
e<sub>θ</sub> IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.  
POINTED OR ROUNDED LEAD TIPS ARE PREFERRED TO EASE INSERTION.
3. DISTANCE BETWEEN LEADS INCLUDING DAM BAR PROTRUSIONS TO BE .005 INCH MINIMUM.
4. DATUM PLANE COINCIDENT WITH THE BOTTOM OF LEAD, WHERE LEAD EXITS BODY.

## SSOP-16L



SYMBOLS	MIN.	MAX.
A	0.053	0.069
A1	0.004	0.010
A2	-	0.059
b	0.008	0.012
b1	0.008	0.011
c	0.007	0.010
c1	0.007	0.009
D	0.189	0.197
E	0.228	0.244
E1	0.150	0.157
L	0.016	0.050
e	0.025 Basic	
°	0	8

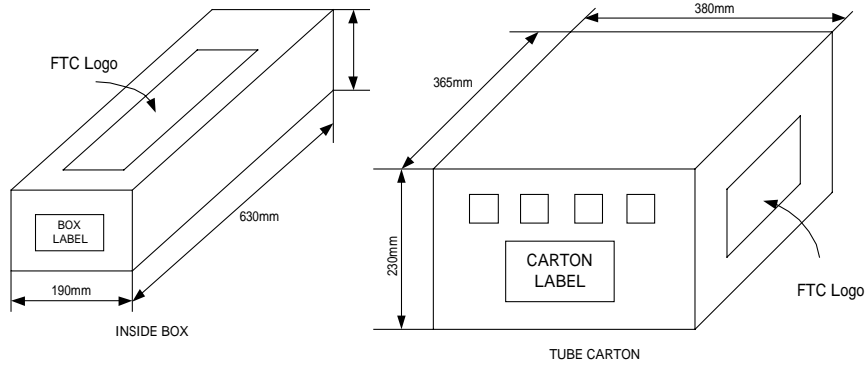
### NOTES:

1. JEDEC OUTLINE: MO-137 AB
2. "D", DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .15mm(.006in).
3. "E", DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .25mm(.010in) PER SIDE.
4. DATUM PLANE COINCIDENT WITH THE BOTTOM OF LEAD, WHERE LEAD EXITS BODY.

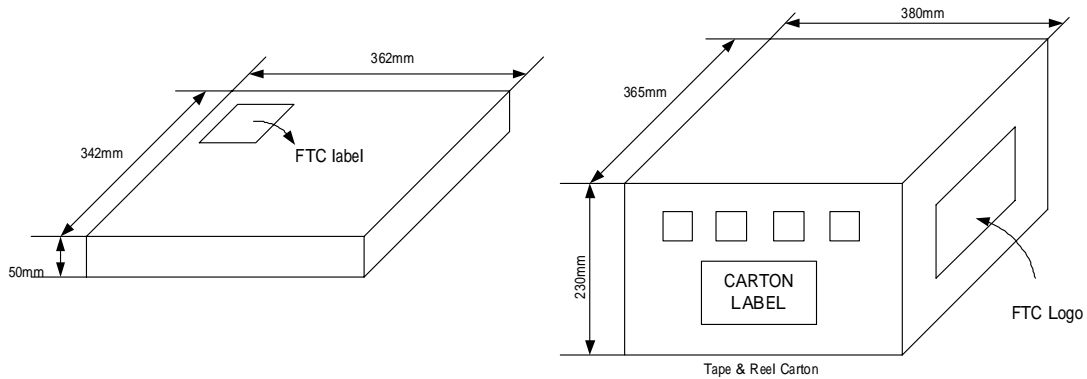
## PACKING SPECIFICATIONS

### BOX DIMENSION

#### TUBE INSIDE BOX AND CARTON



#### TAPE AND REEL INSIDE BOX AND CARTON



## PACKING QUANTITY SPECIFICATIONS

50 EA/TUBE	2500 EA / REEL
50 TUBES / INSIDE BOX	4 INSIDE BOXES / CARTON
4 INSIDE BOXES / CARTON	

## LABEL SPECIFICATIONS

### TAPPING & REEL

Feeling Technology Corp.  
 Product : FP5451B  
 Lot No : A3311C62  
 D/C : 4Xx-XXL  
 Q'ty :

無鉛  
 Lead Free



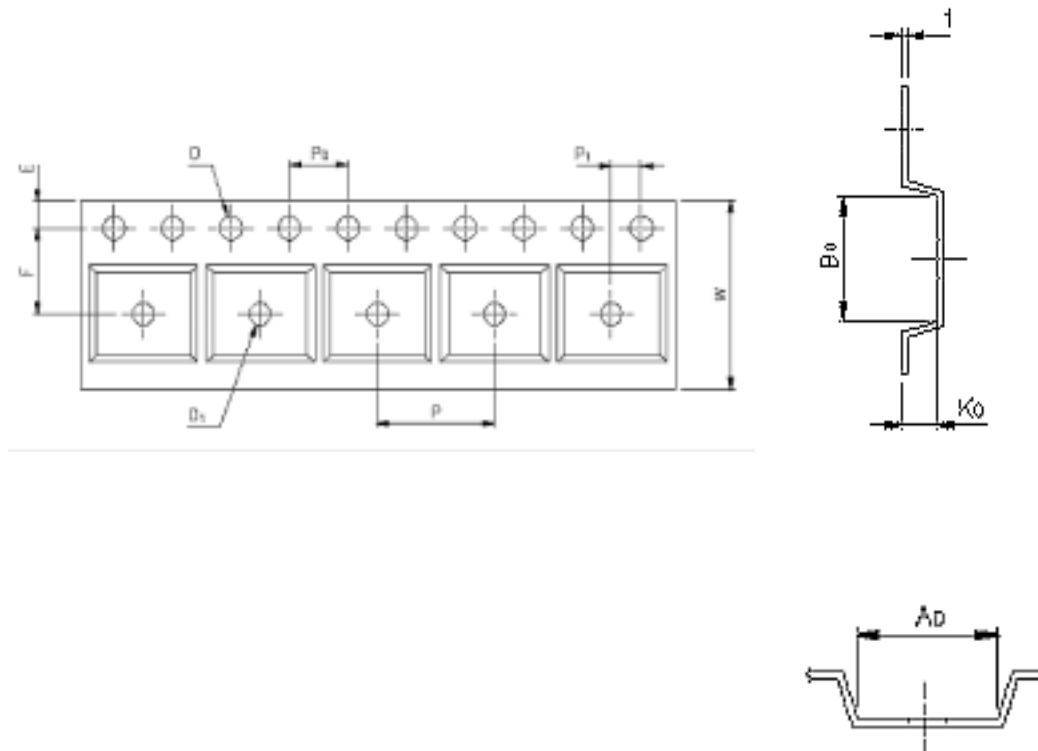
CARTON

Feeling Technology Corp.	
Product Type: FP5451B	
Lot No: A3311C62	
Date Code: 4Xx-XXL	
Package Type: SOP-16L	
Marking Type: Laser	
Total Q'ty: 10,000	
<div style="border: 1px solid black; padding: 2px; display: inline-block;">             無鉛 Lead Free           </div>	

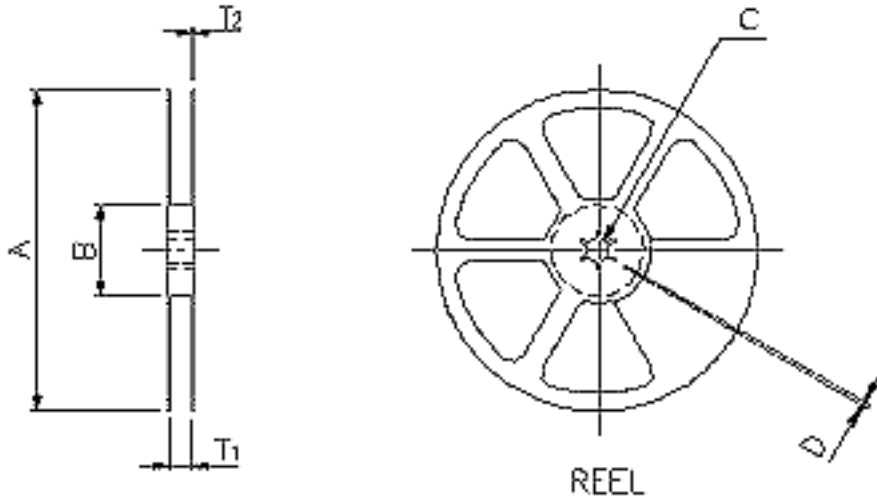
**SOP16**  
**CARRIER TAPE DIMENSIONS**

APPLICATION	W	P	E	F	D	D <sub>1</sub>
SOP16	16.0±0.3	8.0±0.1	1.75±0.1	7.5±0.1	1.55 <sup>+0.1</sup>	1.5 <sup>+0.25</sup>

APPLICATION	P <sub>0</sub>	P <sub>1</sub>	A <sub>0</sub>	B <sub>0</sub>	K <sub>0</sub>	t
SOP16	4.0±0.1	2.0±0.1	6.5±0.1	10.3±0.1	2.1±0.1	0.30±0.05



**REEL DIMENSIONS**



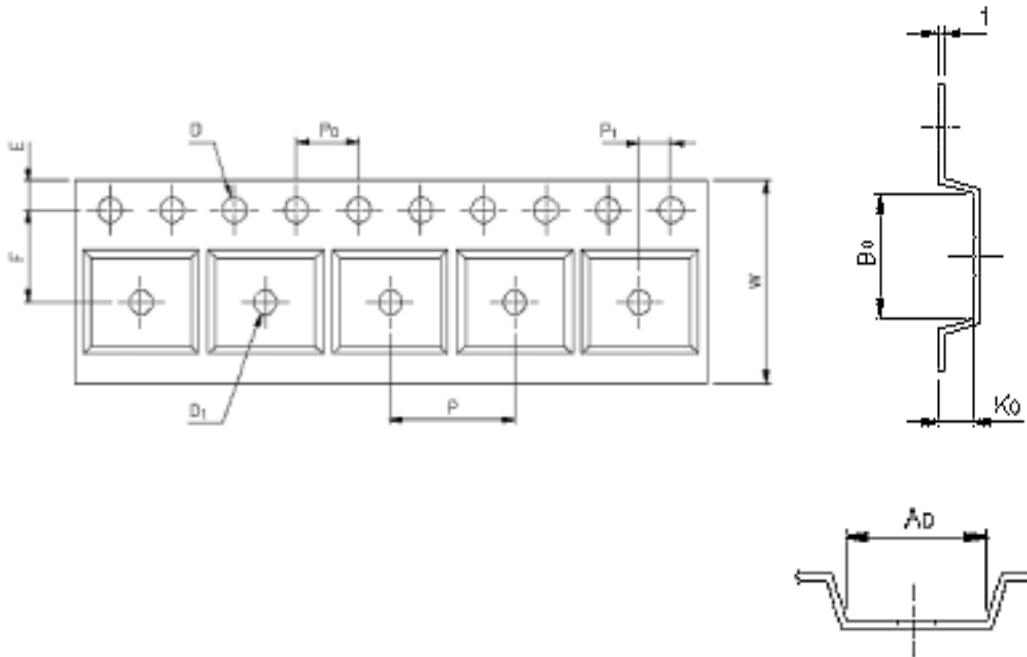
APPLICATION	MATERIAL	A	B	C	D	T1	T2
SOP16	PLASTIC REEL (BLUE)	330±3	100±2.0	13.0±0.5	2.0±0.5	16.4 <sup>+0.3</sup> <sub>-0.2</sub>	2.5±0.5

SSOP16

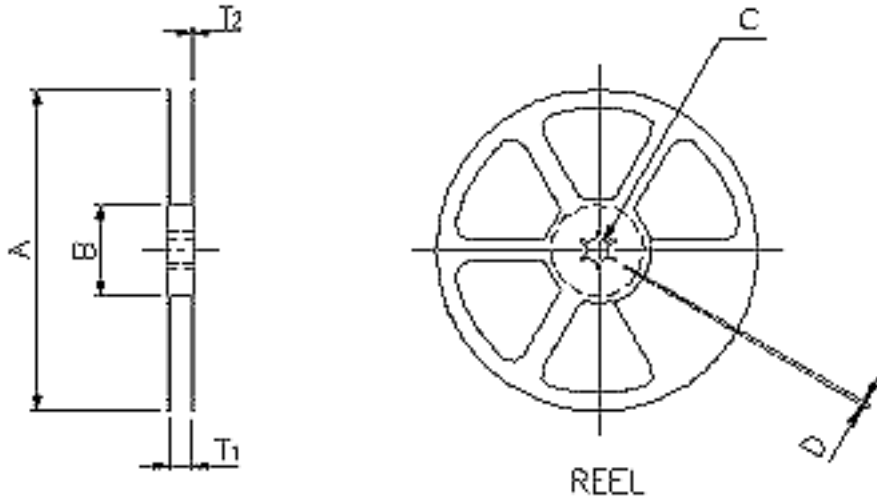
## CARRIER TAPE DIMENSIONS

APPLICATION	W	P	E	F	D	D <sub>1</sub>
SSOP16	12.0±0.3	8.0±0.1	1.75±0.1	5.5±0.05	1.5 <sup>+0.1</sup>	1.5 <sup>+0.25</sup>

APPLICATION	P <sub>0</sub>	P <sub>1</sub>	A <sub>0</sub>	B <sub>0</sub>	K <sub>0</sub>	t
SSOP16	4.0±0.1	2.0±0.05	6.5±0.1	10.3±0.1	2.1±0.1	0.30±0.05



**REEL DIMENSIONS**



APPLICATION	MATERIAL	A	B	C	D	T1	T2
SSOP16	PLASTIC REEL (BLUE)	330	62	$12.75^{+0.15}$	$2.0 \pm 0.15$	12.4	16.8