FEELING Technology

FP5451B

DUAL CHANNEL PWM CONTROL IC WITH SCP/DTC FUNCTION

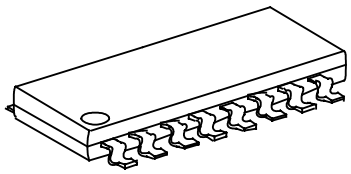
GENERAL DESCRIPTION

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.

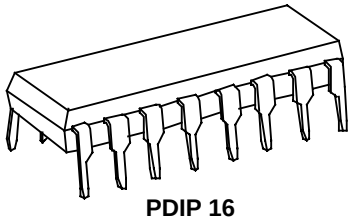
Using few external components, FP5451B, a high performance integrated IC, is designed for a control circuit. The circuit diagram of the typical application example is as below.

FEATURES

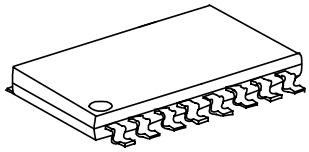
- Fixed Reference Voltage: 2.5V
- Reference Voltage Precision: 1%
- Output sink current up to 100mA
- Low quiescent supply current
- Wide operating voltage range: 4~40V
- Variable dead-time control (DTC)
- UVLO protection function
- SCP protection function (Typ. 1.3V)
- Oscillator Frequency: Max. 800KHz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



SOP16



PDIP 16

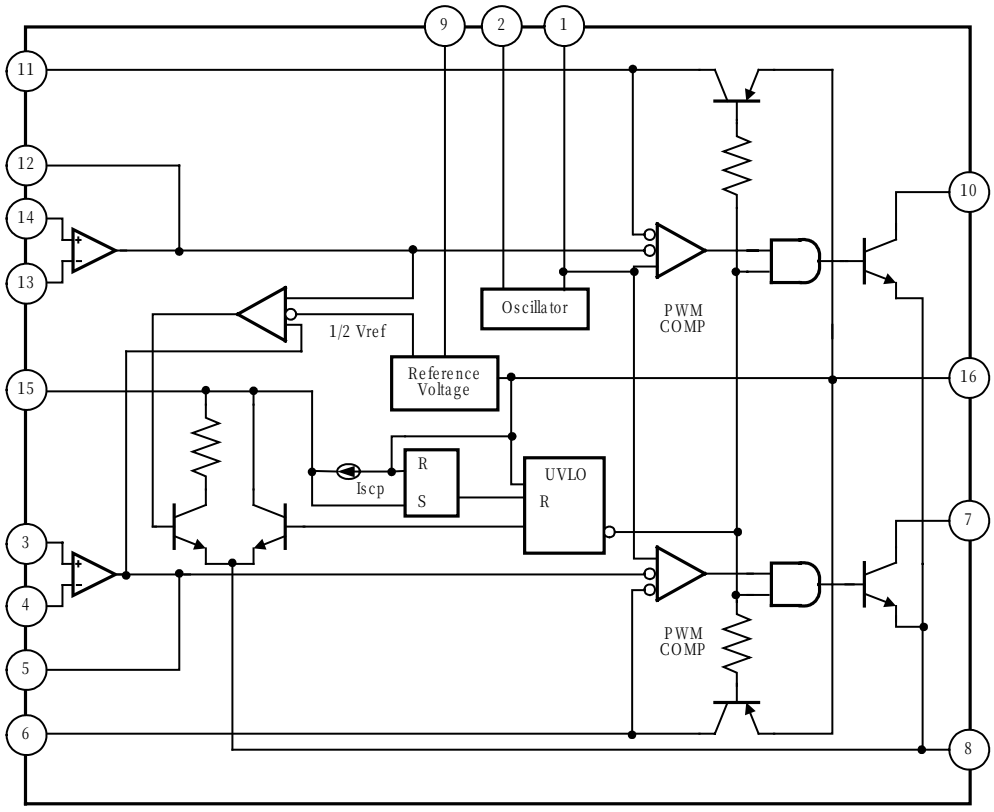


SSOP 16

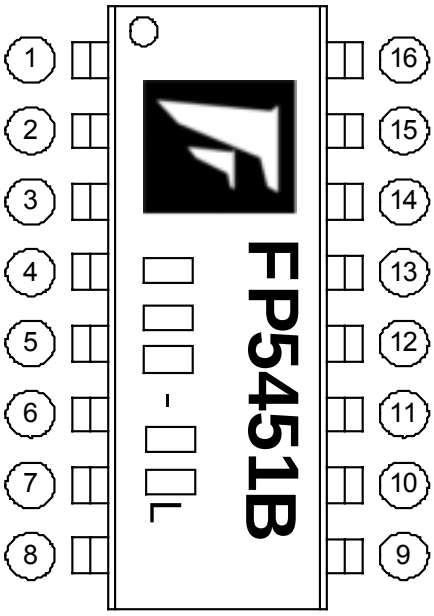
TYPICAL APPLICATION

- Dual Output Switch Regulator
- Backlight Inverter
- LCD Monitor

FUNCTIONAL BLOCK DIAGRAM



MARK VIEW



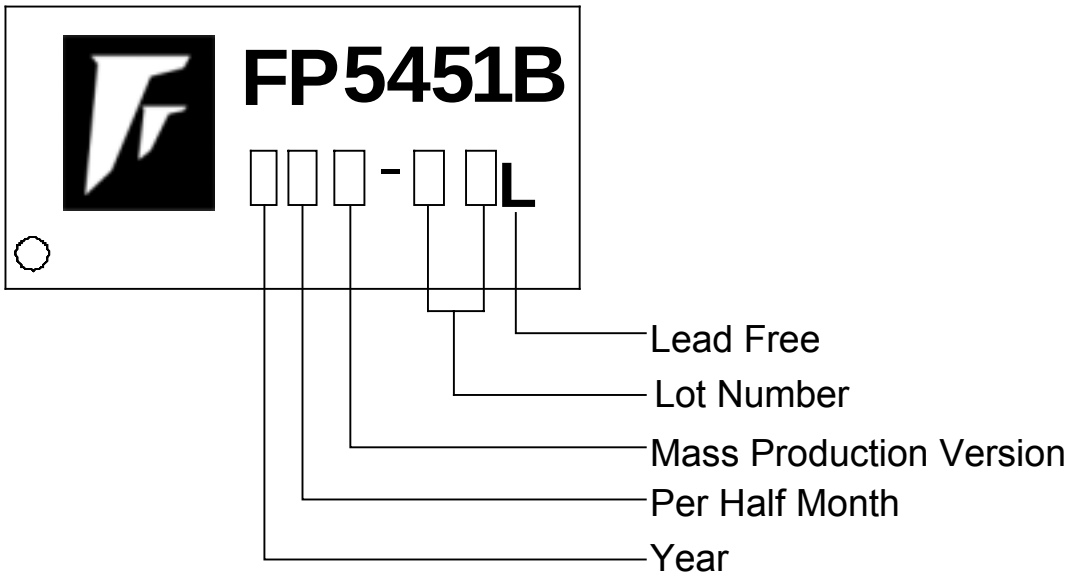
PIN DESCRIPTION

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

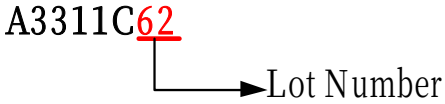


FOR EXAMPLE:

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:



ABSOLUTE MAXIMUM RATINGS

Supply Voltage (Vcc) ---------- +40V

Differential Input Voltage (V_{id}) ---------- +20V

Collector Output Voltage (Vo) ---------- +40V

Collector Output Current (Io) ---------- +150mA

Maximum Junction Temperature (T_j) ----------+150°C

Thermal Resistance Junction to Ambient (SOP package) ---------- 175°C /W

(SSOP package)---------- 220℃ /W

Power Dissipation

SOP16 package

Ta=25℃ ---------- 650mW

Ta=70℃ ---------- 550mW

PDIP16 package

Ta=25℃ ----------1000mW

Ta=70℃ ---------- 640mW

SSOP16 package

Ta=25℃ ---------- 450mW

Ta=70℃ ---------- 250mW

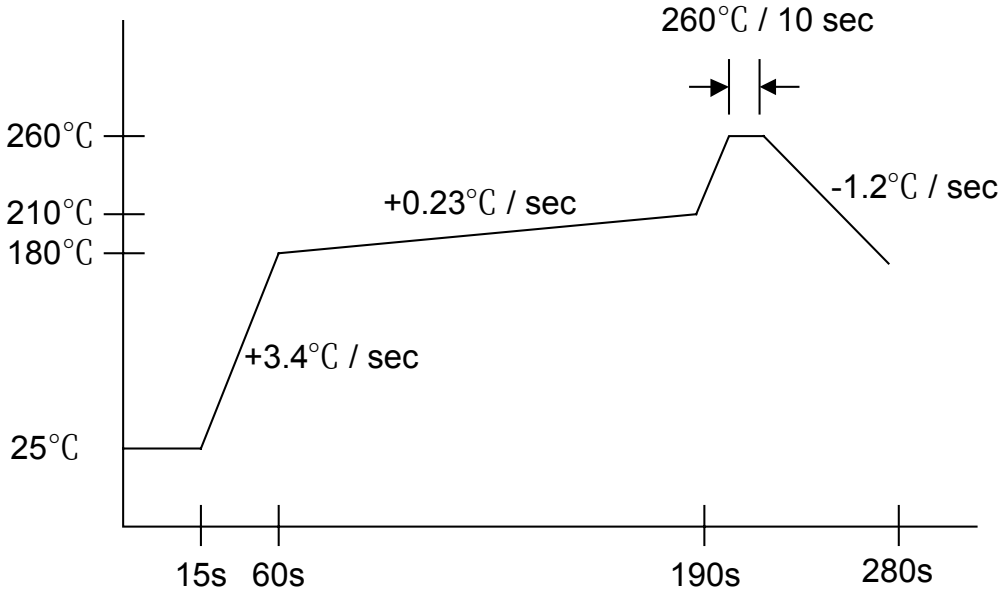
Operating Temperature Range ---------- -20°C 85°C

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%	±1%	
		T_A=25℃ to 85℃		-0.2%	±1%	
Input voltage regulation	$\triangle V_{REF}/V_{REF}$	Vcc=3.6V 40V		2	12.5	mV
Output voltage regulation	$\triangle V_{REF}/V_{REF}$	Io = 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(Vcc)	V_{UPPER}	$I_{O(REF)}$ = 0.1 mA, T_A=25℃		2.72		V
Lower threshold voltage(Vcc)	V_{LOW}			2.6		V
Hysteresis (Vcc)	V_{HYS}		80	120		mV
Reset threshold voltage(Vcc)	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	μA
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		KH_Z
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%	±2%	
		T_A=25℃ to 85℃		-0.2%	±2%	

Dead-time control section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input bias current (DTC)	I_{BIAS}				1	μA
Latch mode (source) current(DTC)	I_{SOURCE}	T_A=25℃	-80	-200		μA
Latched input voltage (DTC)	V_{LATCH}	I_O=40 μA	2.3			V
Input threshold voltage at f=10kH_Z(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}	Vo(FEEDBACK)=1.25V			±6	mV
Input offset current	I_{IO}	Vo(FEEDBACK)=1.25V			±100	nA
Input bias current	I_{BIAS}	Vo(FEEDBACK)=1.25V		160	500	nA
Common-mode input voltage range	V_{ICM}	V_{CC}=3.6V to 40 V	0.3		1.6	V
Open-loop voltage amplification	A_{VO}	R_F=200KΩ	70	80		dB
Unity-gain bandwidth	BW			1.5		MH_Z
Common-mode rejection ratio	CMRR		60	80		dB
Positive output voltage swing	V_{POS}		Vref-0.2			V
Negative output voltage swing	V_{NEG}				1	V
Output (sink) current (FEEDBACK)	I_{SINK}	V_{ID}=－0.1V,V_O=1.25V	1	4.0		mA
Output (source) current (FEEDBACK)	I_{SOURCE}	V_{ID}=0.1V, V_O=1.25V	-45	-90		μA

Output section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Collector off-state current	I_{OFF}	V_O=50V			10	μA
Output saturation voltage	V_{SAT}	I_O=10mA		0.7	1	V
Short-circuit output current	I_{SC}	V_O=6V		150		mA

Pwm comparator section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input threshold voltage at f=10kHz(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=10K		1.7	2.4	mA

TYPICAL CHARCTERISTICS

TRIANGLE OSCILLATOR FREQUENCY
VS
TIMING RESISTANCE

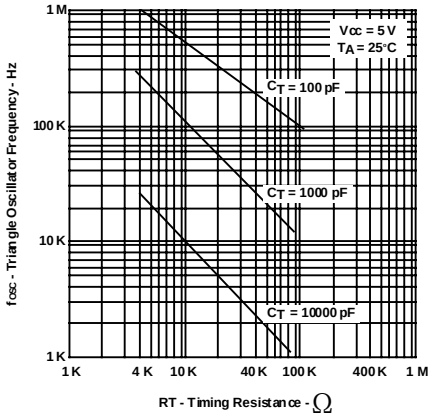


Figure1

OSCILLATOR FREQUENCY VARIATION
VS
FREE-AIR TEMPERATURE

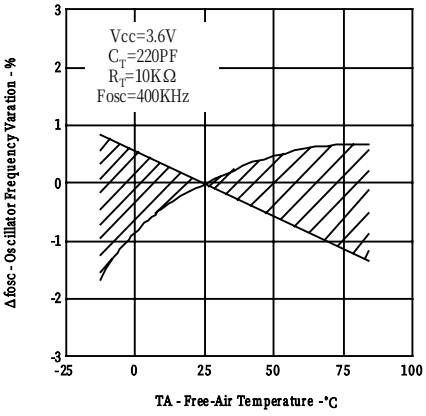


Figure 2

TRIANGLE WAVEFORM SWING VOLTAGE
VS
TIMING CAPACITANCE

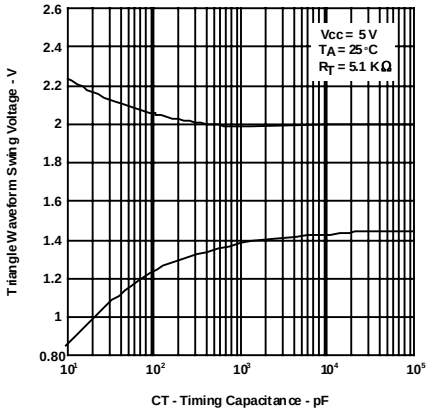


Figure3

TRIANGLE WAVEFORM PERIOD
VS
TIMING CAPACITANCE

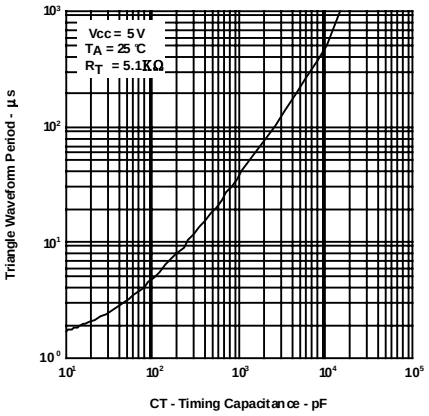


Figure4

REFERENCE OUTPUT VOLTAGE VARIATION
VS
FREE-AIR TEMPERATURE

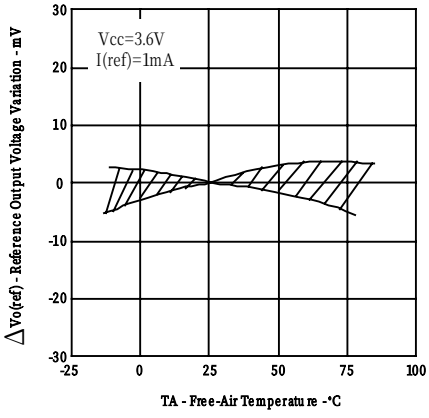


Figure 5

REFERENCE OUTPUT VOLTAGE VARIATION
VS
FREE-AIR TEMPERATURE

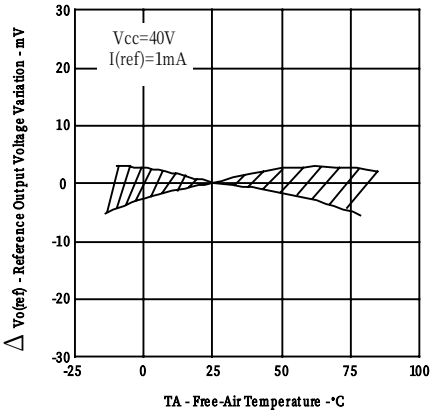
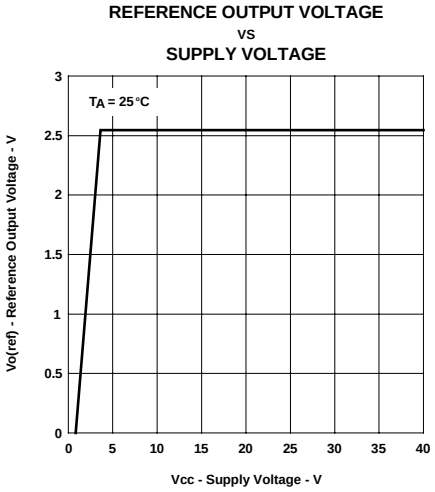


Figure 6

TYPICAL CHARCTERISTICS (Cont.)



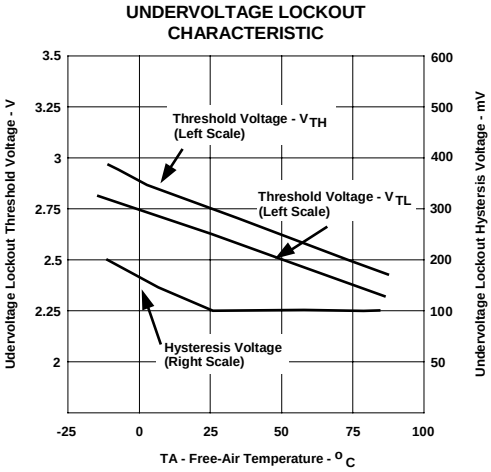


Figure 8

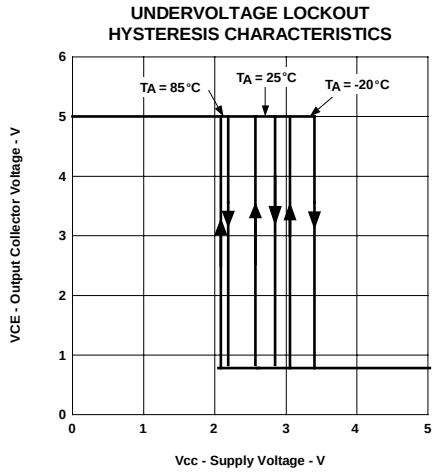


Figure 9

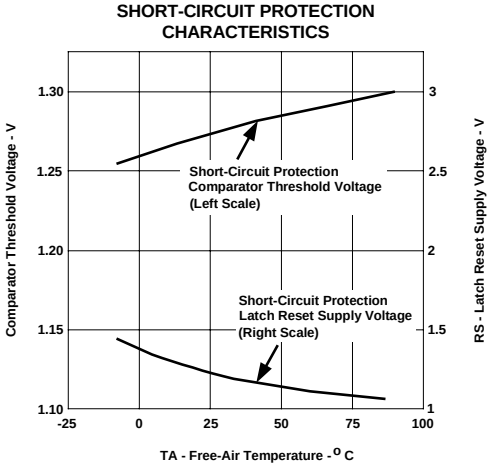


Figure 10

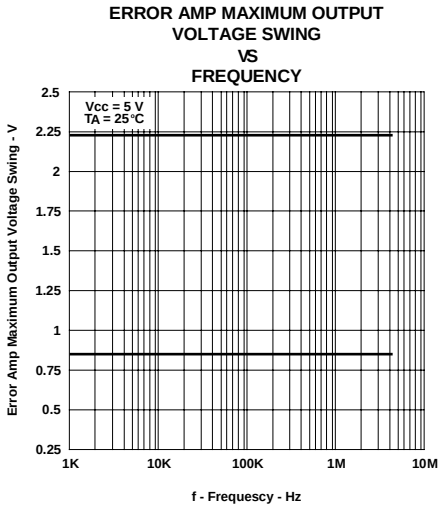
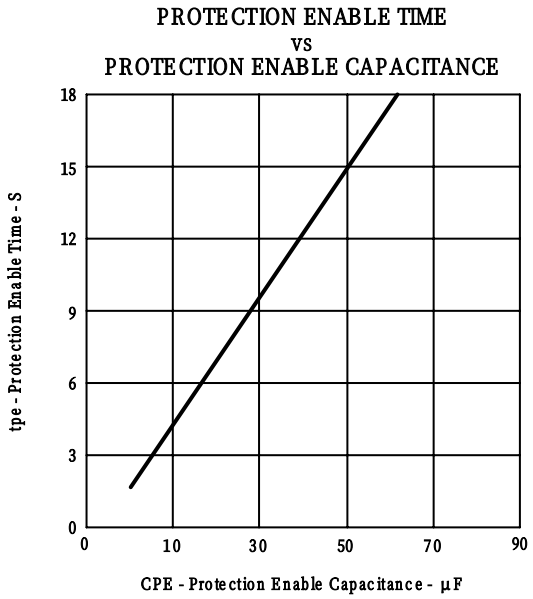


Figure 11

TYPICAL CHARCTERISTICS (Cont.)



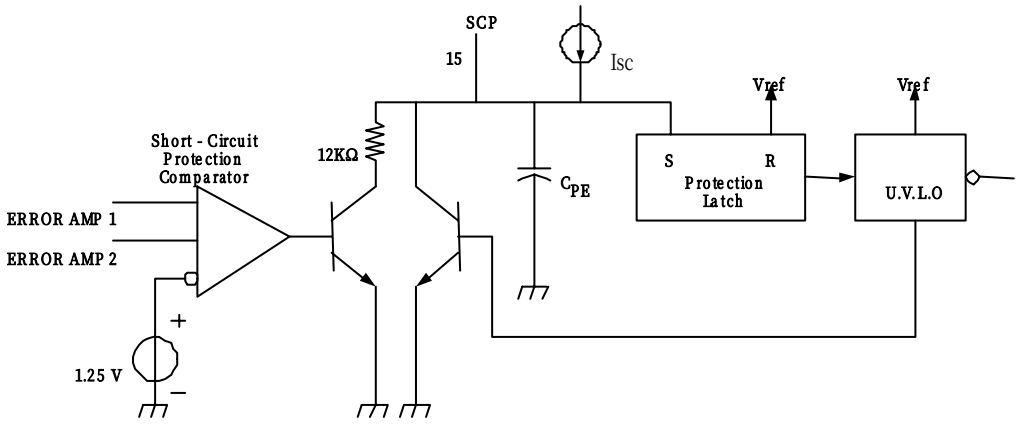


Figure 12

TYPICAL CHARCTERISTICS (Cont.)

OUTPUT TRANSISTOR ON DUTY CYCLE
VS
DEAD - TIME INPUT VOLTAGE

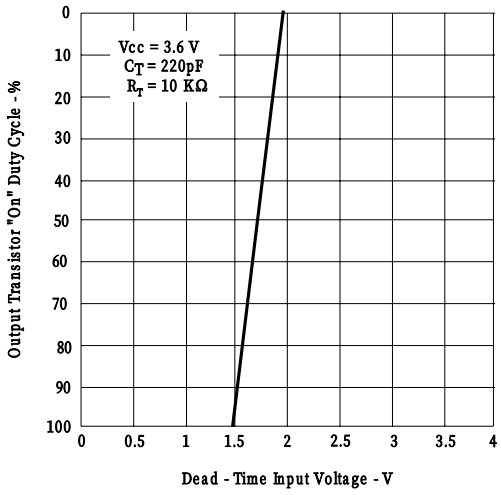


Figure 13

STANDBY CURRENT
VS
SUPPLY VOLTAGE

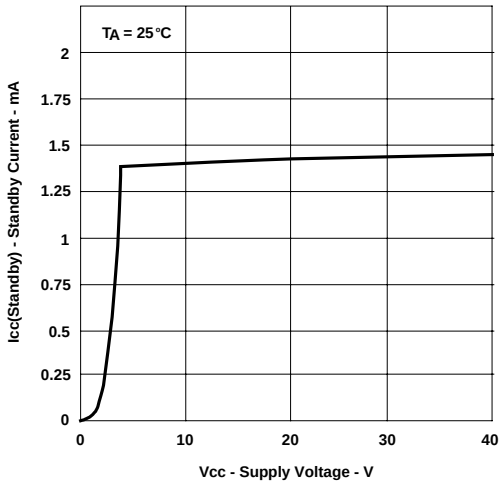


Figure 14

STANDBY CURRENT
VS
FREE - AIR TEMPERATURE

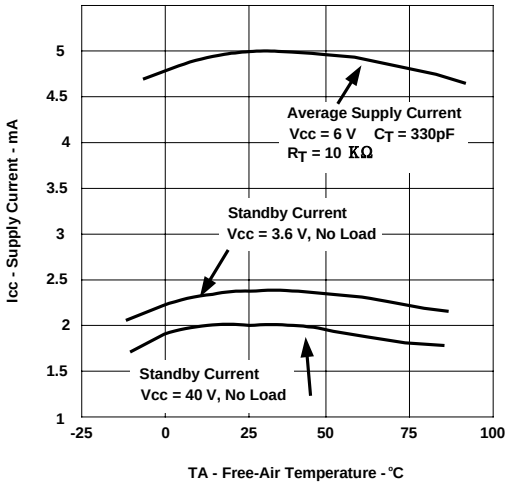


Figure 15

GAIN (AMPLIFIER IN UNITY-GAIN CONFIGURATION)
VS
FREQUENCY

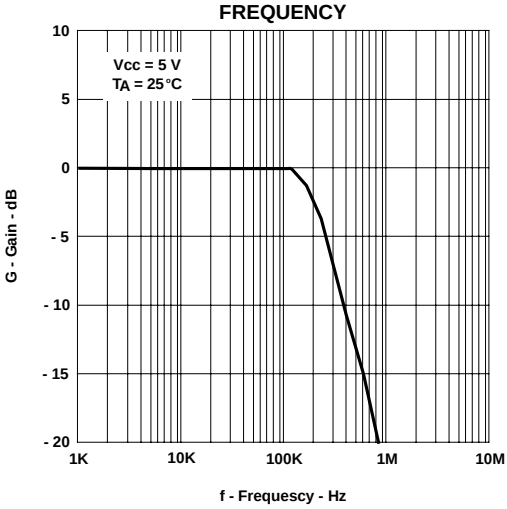
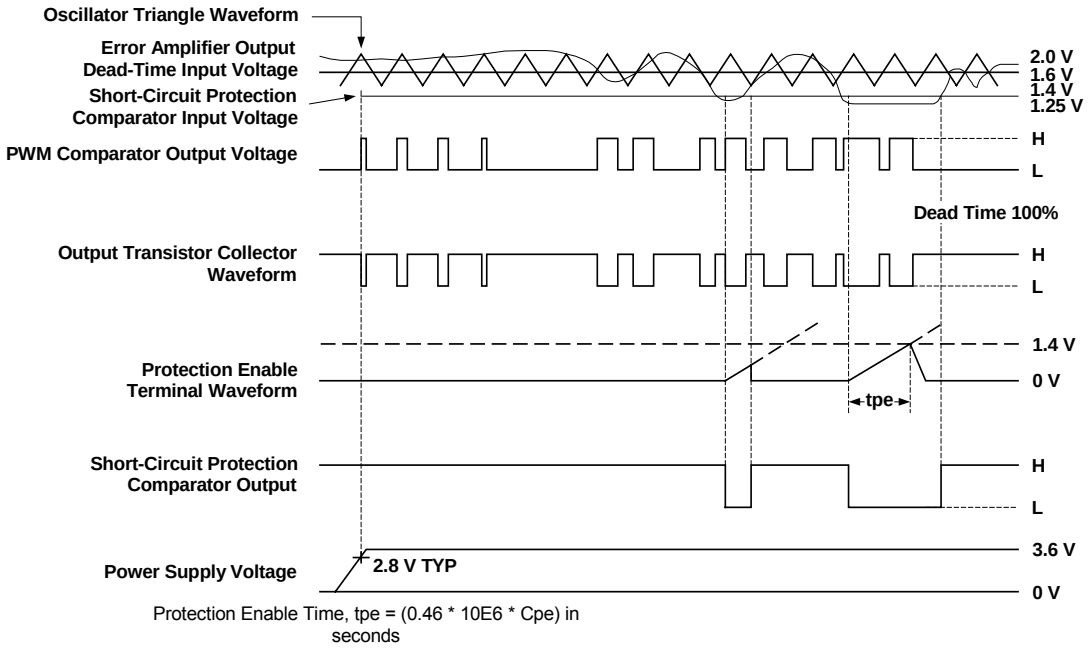


Figure 16

TIMING WAVEFORM



FP5451B Timing Diagram

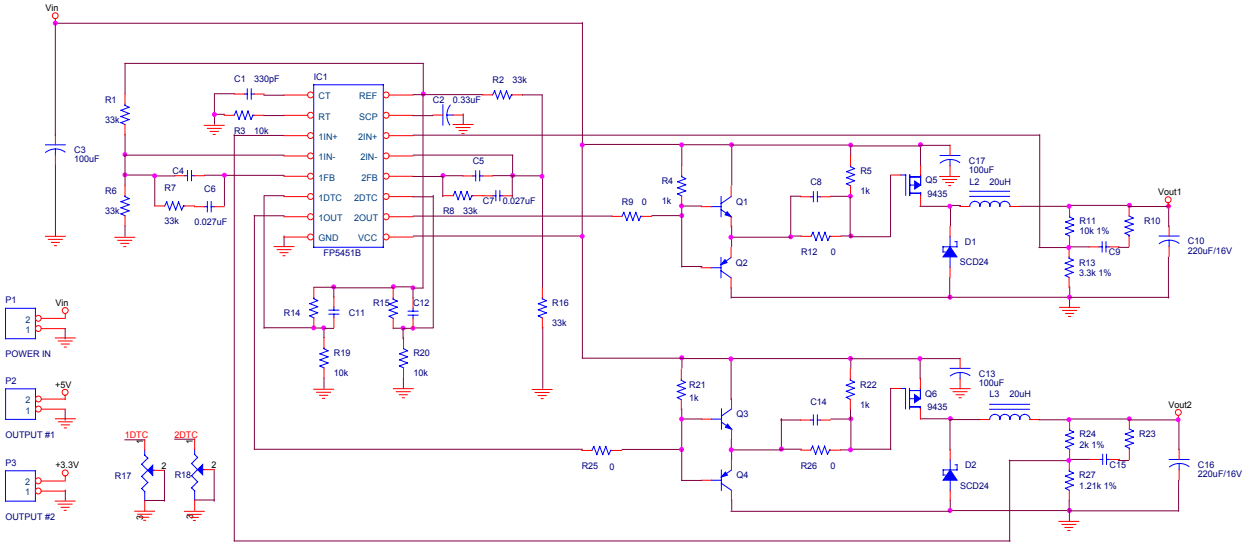
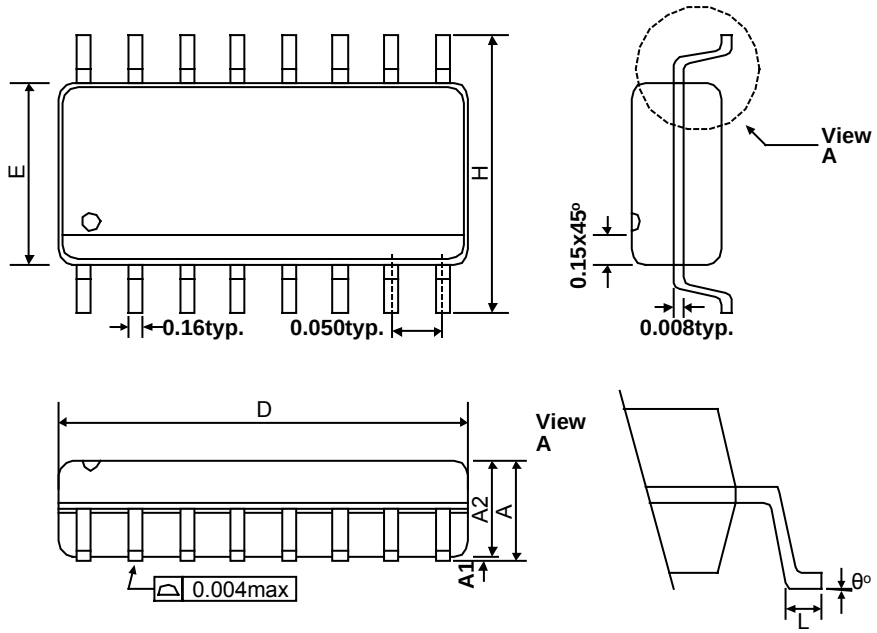


Figure 17. 2-channel dc-dc converter circuit

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
θ °	0	8

NOTE:

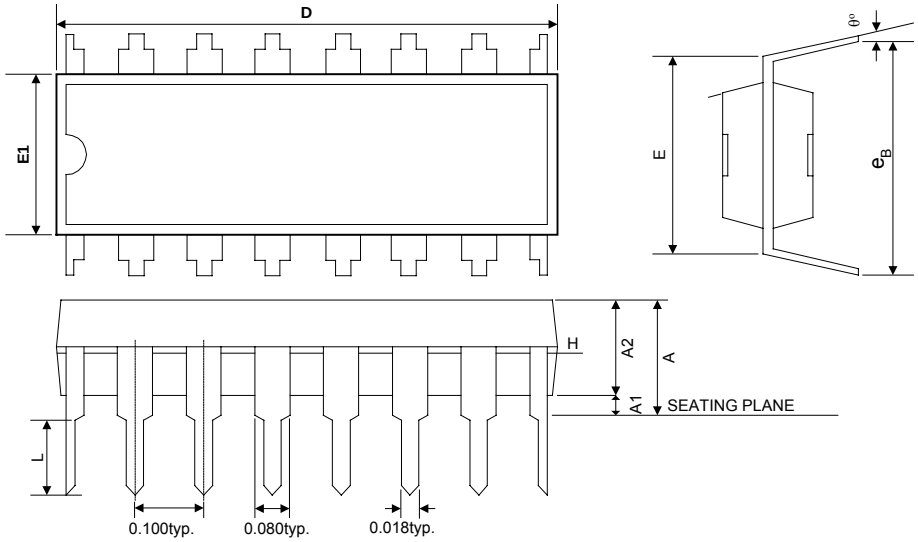
1.JEDEC OUTLINE:MS-012 AC

2.DIMENSIONS “D” DOES NOT INCLUDE MOLD FLASH,PROTRUSIONS OR GATE BURRS.MOLD FLASH,PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED .15mm (.0.06in) PER SIDE

3.DIMENSIONS “E” DOES NOT INCLUDE INTER-LEAD FLASH,OR PROTRUSIONS.

4.INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED .25mm (.0.10in) 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_θ	0.335	0.355	0.375
θ °	0	7	15

NOTES:

1.JEDEC OUTLINE: MS-001 BB

2.“D”, “E1” DIMENSIONS DO NOT INCLUDE MOLD FALSH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH.

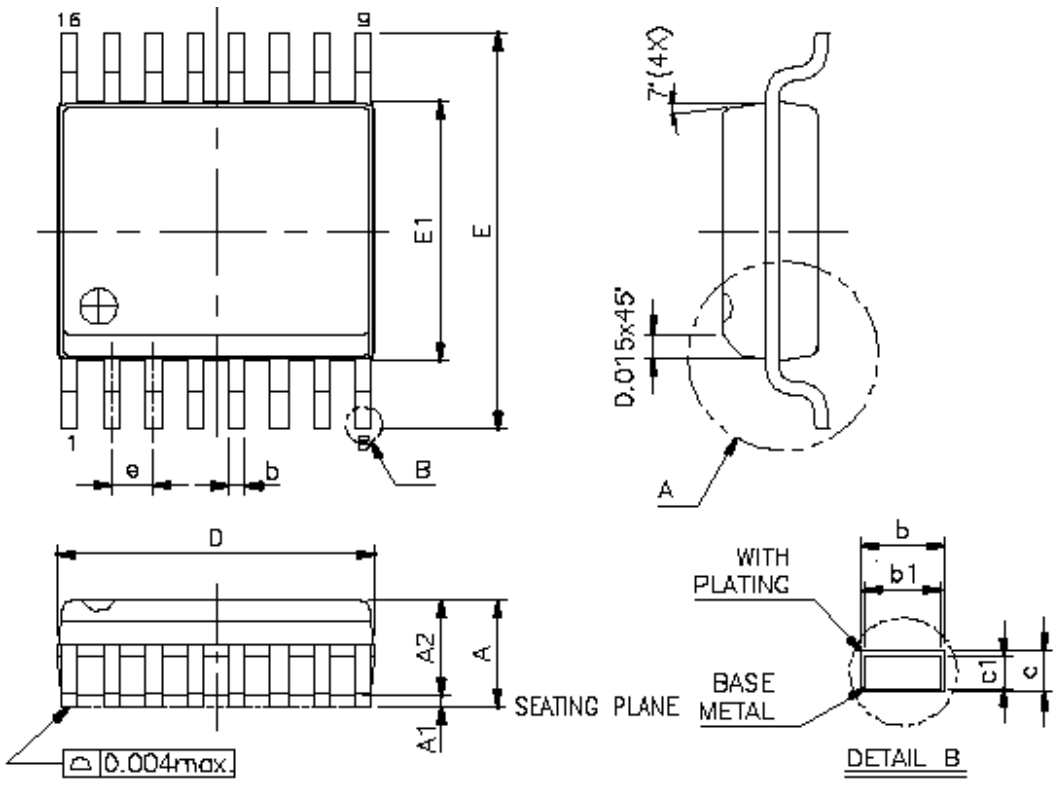
eB IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.

POINTED OR ROUNDED LEAD TIPS ARE PREFERRED TO EASE INSERTION.

3.DISTANCE BETWEEN LEADS INCLUDING DAM BAR PROTRUSIONS TO BE .005 INCH MININUM.

4.DATUM PLANE CONCIDENT 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	
θ°	0	8

NOTES:
1.JEDEC OUTLINE: MO-137 AB

2.“D”,DIMENSIONS DO NOT INCLUDE MOLD FALSH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .15mm(006in).

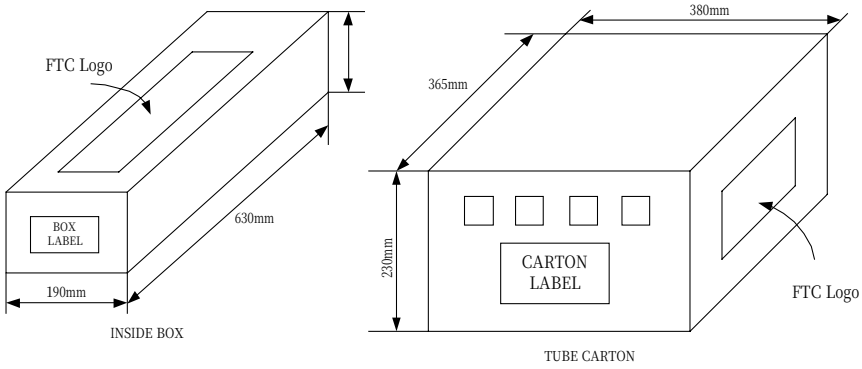
3.“E”,DIMENSIONS DO NOT INCLUDE MOLD FALSH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .25mm(010in) PER SIDE.

4.DATUM PLANE CONCIDENT WITH THE BOTTOM OF LEAD, WHERE LEAD EXITS BODY.

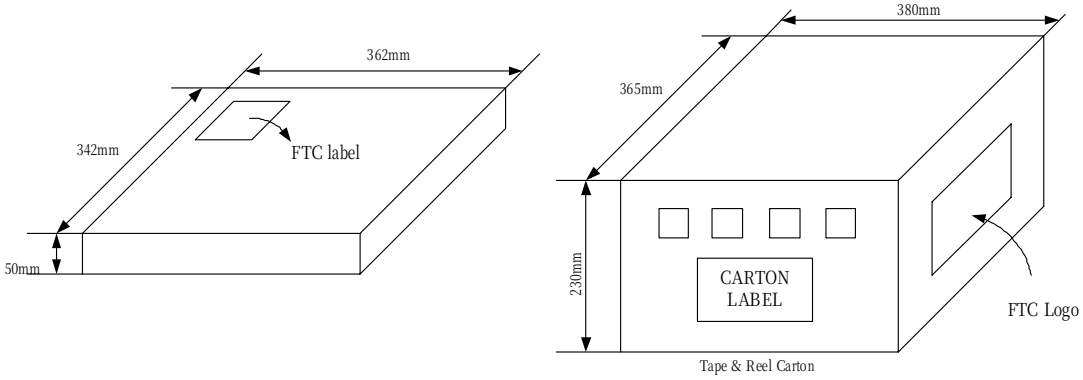
PACKING SPECIFICATIONS

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

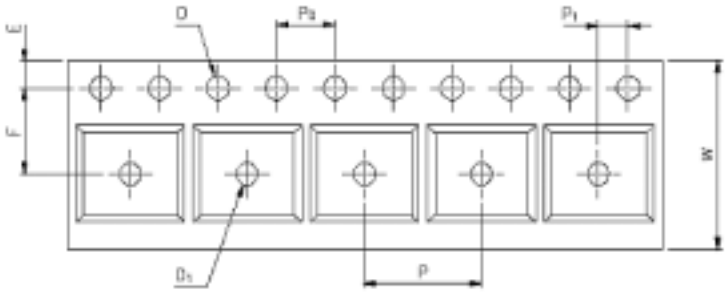
無鉛
Lead Free

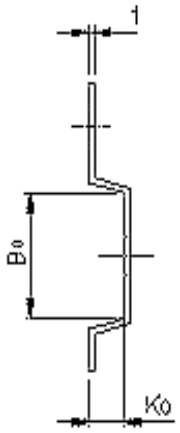
SOP16

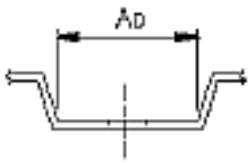
CARRIER TAPE DIMENSIONS

APPLICATION	W	P	E	F	D	D_1
SOP16	16.0±0.3	8.0±0.1	1.75±0.1	7.5±0.1	$1.55^{+0.1}$	$1.5^{+0.25}$

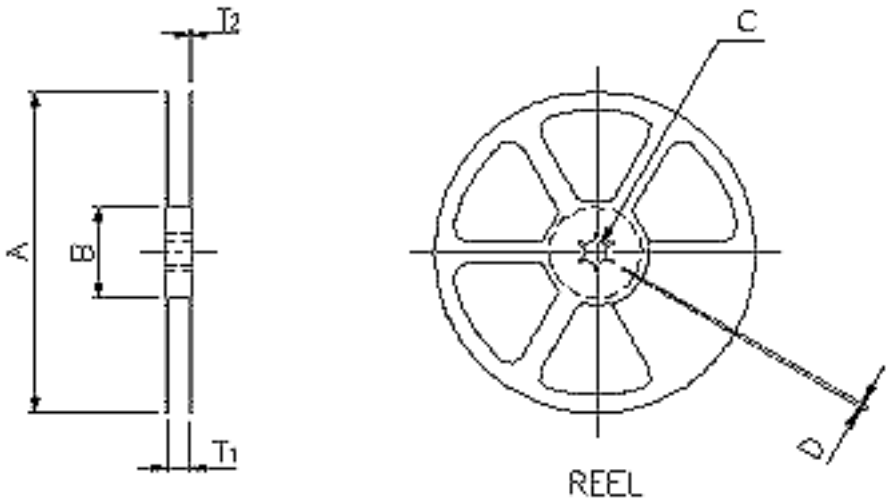
APPLICATION	P_0	P_1	A_0	B_0	K_0	t
SOP16	4.0±0.1	2.0±0.1	6.5±0.1	10.3±0.1	2.1±0.1	0.30±0.05







REEL DIMENISIONS



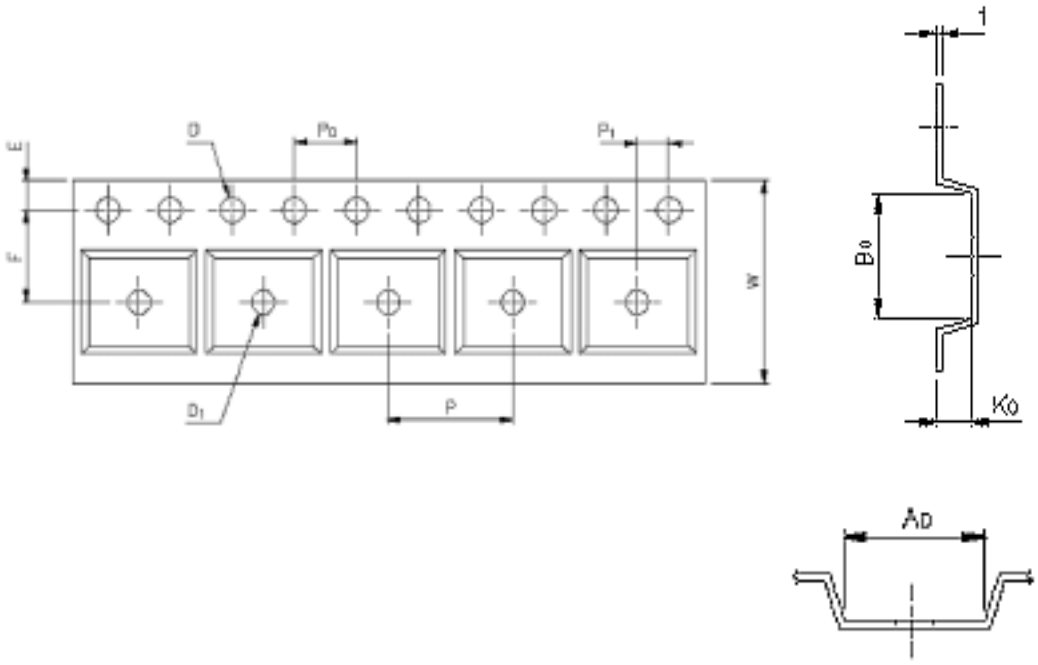
APPLICATION	MATERIAL	A	B	C	D	T1	T2
SOP16	PLASTIC REEL (BLUE)	330±3	100±2.0	13.0±0.5	2.0±0.5	$16.4^{+0.3}_{-0.2}$	2.5±0.5

SSOP16

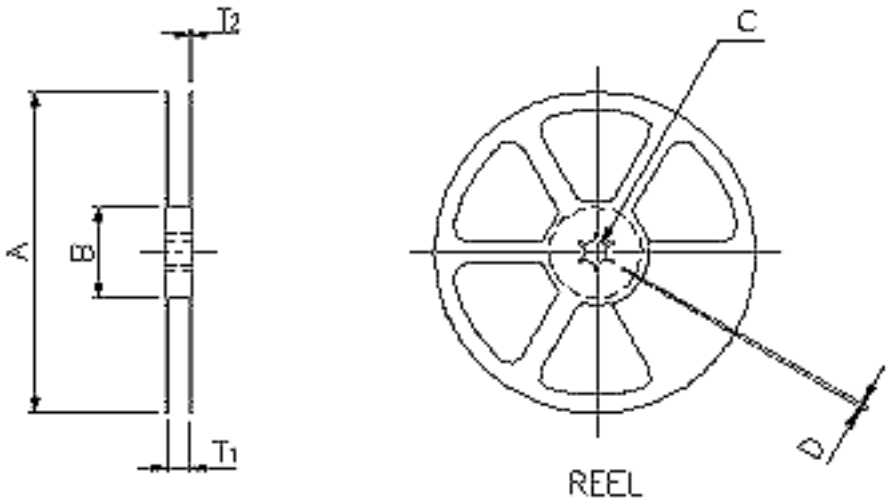
CARRIER TAPE DIMENSIONS

APPLICATION	W	P	E	F	D	D_1
SSOP16	12.0±0.3	8.0±0.1	1.75±0.1	5.5±0.05	$1.5^{+0.1}$	$1.5^{+0.25}$

APPLICATION	P_0	P_1	A_0	B_0	K_0	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 DIMENISIONS



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