FEELING Technology

FP5472

DUAL PWM CONTROL IC WITH SCP/DTC FUNCTION

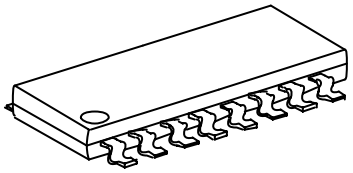
GENERAL DESCRIPTION

The FP5472, a 1-chip composed of totem-pole output stage pulse-width-modulation control circuits with two error amplifiers and dead-time comparators (DTC), the FP5472 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.

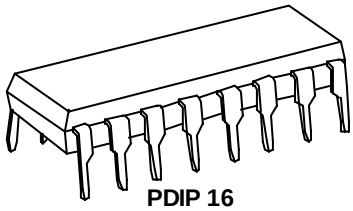
Using few external components, FP5472, a high performance integrated IC, is designed for a control circuit. The circuit diagram of the typical application example is as below.

FEATURES

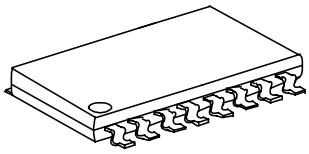
- Fixed Reference Voltage: 2.5V
- Reference Voltage Precision: 2% (FP5472)
- Totem-pole output stage
- Low quiescent supply current under 3.5mA
- Wide operating voltage range: 3.6~40V
- Variable dead-time control (DTC)
- UVLO protection function
- SCP protection function (threshold voltage: 1.3V)
- Oscillator Frequency: Max. 500KHz
- Package: PDIP16/SOP16/SSOP16



SOP16



PDIP 16

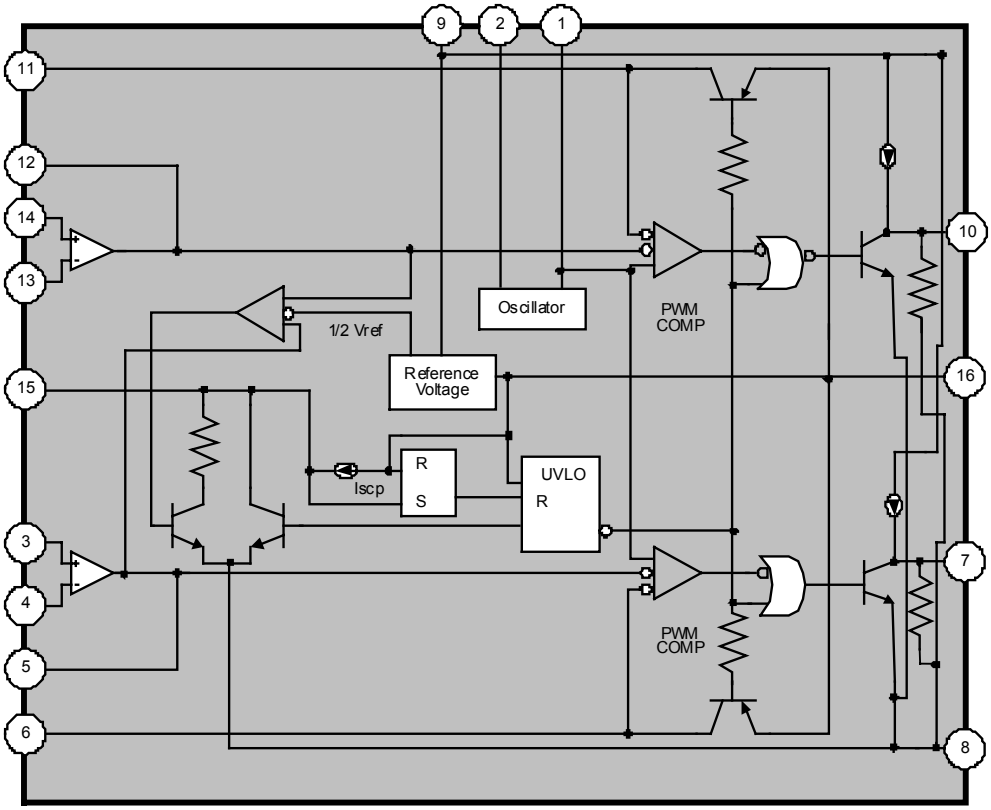


SSOP16

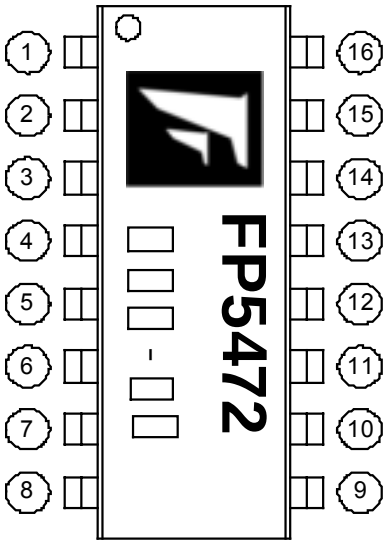
TYPICAL APPLICATION

- DC/DC converters for video cameras and TFT LCD monitor etc.
- Back light CCFL inverter.

FUNCTIONAL BLOCK DIAGRAM



MARK VIEW



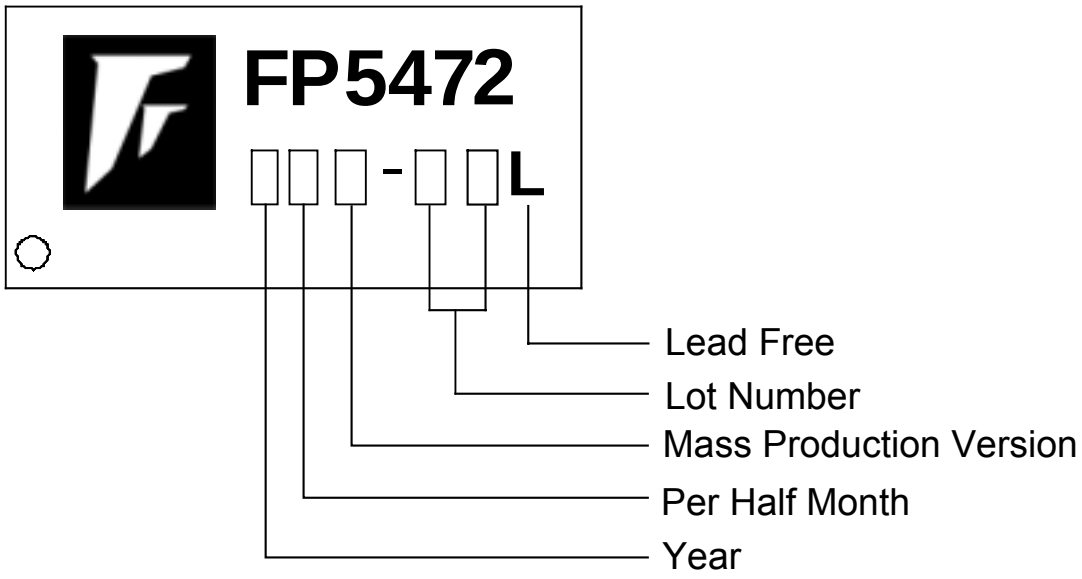
PIN DESCRIPTION

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	Totem-pole Output 1
GND	8	P	IC Ground
VCC	9	P	IC Power Supply
OUT2	10	O	Totem-pole 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
	15	I	Short Circuit Protection Input
VREF	16	O	2.5V Reference Voltage Output

ORDER INFORMATION

Part Number	Operating Temperature	Package	Description
FP5472P-LF	-20°C ~ +85°C	PDIP16	Tube
FP5472D-LF	-20°C ~ +85°C	SOP16	Tube
FP5472DR-LF	-20°C ~ +85°C	SOP16	Tape & Reel
FP5472R-LF	-20°C ~ +85°C	SSOP16	Tube
FP5472RR-LF	-20°C ~ +85°C	SSOP16	Tape & Reel

IC DATE CODE DISTINGUISH



FOR EXAMPLE:

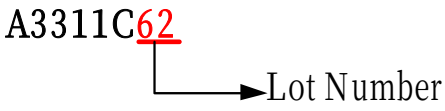
January A (Front Half Month), B (Last Half Month)

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

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

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

Thermal Resistance Junction to Ambient

PDIP16 package ---------- 125°C /W
SOP16 package ---------- 150°C /W
SSOP16 package ---------- 220°C /W

Power Dissipation

SOP16 package
Ta=25°C ---------- 650mW

Ta=70°C ---------- 550mW

DIP16 package

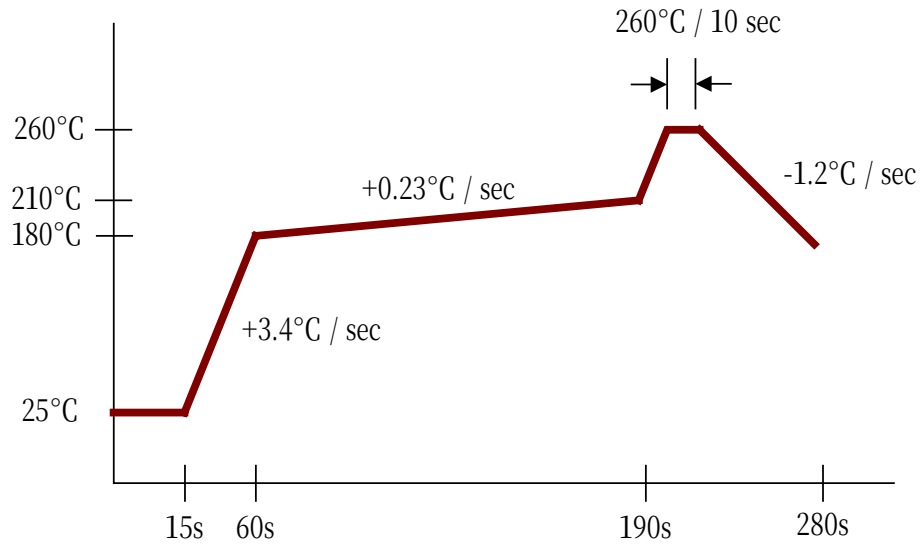
Ta=25°C ---------- 1000mW

Ta=70°C ---------- 640mW

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

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

Lead Temperature (soldering, 10 sec) ---------- +230°C



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°C to 25°C		-0.1%	±1%	
		T_A=25°C to 85°C		-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°C		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}		1.0	1.3		V

Short-circuit protection control section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input threshold voltage (SCP)	V_{TH}	T_A= 25°C	1.2	1.3	1.5	V
Standby voltage (SCP)	$V_{STANDBY}$	No pullup	60	80	100	mV
Latched input voltage (SCP)	V_{LATCH}	No pullup		40	60	mV
Input (source) current	I_{SOURCE}	V_I=0.7V, T_A=25°C	-1.	-2.0	-2.5	µA
Comparator threshold voltage (FEEDBACK)	$V_{COMP(TH)}$			1.20		V

Oscillator section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Frequency	f	C_T=330pF,R_T=10K		220		KH_Z
Standard deviation of frequency	$\triangle$f	C_T=330pF,R_T=10K		10%		
Frequency change with voltage	$\triangle$f/$\triangle$V	V_{CC}=3.6V to 40V		1%		
Frequency change with Temperature	$\triangle$f/$\triangle$T	T_A=-20°C to 25°C		-0.4%	±2%	
		T_A=25°C to 85°C		-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°C	-80	-260		µA
Latched input voltage (DTC)	V_{LATCH}	I_O=40 µA	2.2	2.3		V
Input threshold voltage at f=10kH_Z(DTC)	V_{TH}	Zero duty cycle		2.05	2.25	V
		Maximum duty cycle	1.2	1.35		

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-0.3			V
Negative output voltage swing	V_{NEG}				1	V
Output (sink) current (FEEDBACK)	I_{SINK}	VID=－0.1V,VO=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
Vout Low Voltage	V_{OL}	I_{SINK}=20mA		0.8	1.2	V
		I_{SINK} =130mA Vcc=15V		1.2	1.8	
Vout High Voltage	V_{OH}	I_{SOURCE}=20mA	4.0	4.5		V
		I_{SOURCE}=130mA Vcc=15V	12.7	13.2		
Rise Time	t_R	T_J=25°C,C_L=1nF		60	120	nS
Fall Time	t_F	T_J=25°C,C_L=1nF		30	60	nS

Pwm comparator section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input threshold voltage at f=10kHz(FEEDBACK)	V_{TH}	Zero duty cycle		2.05	2.25	V
		Maximum duty cycle	1.2	1.35		

Total device

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Standby supply current	$I_{STANDBY}$	Off-state		2.2	3.3	mA
Average supply current	I_{AVE}	R_T=10K		2.7	3.8	mA

TYPICAL CHATACTERISTICS

TRIANGLE OSCILLATOR FREQUENCY
VS
TIMING RESISTANCE

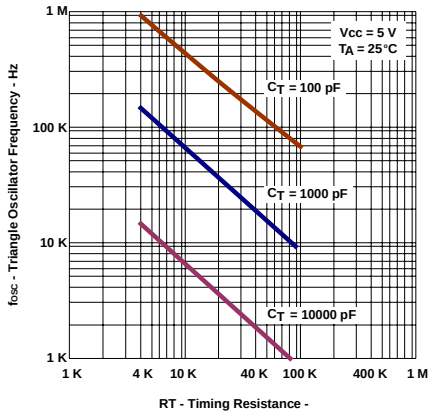


Figure 1

OSCILLATOR FREQUENCY VARIATION
VS
FREE-AIR TEMPERATURE

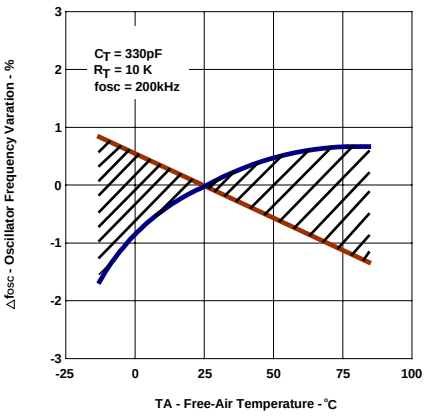


Figure 2

TRIANGLE WAVEFORM SWING VOLTAGE
VS
TIMING CAPACITANCE

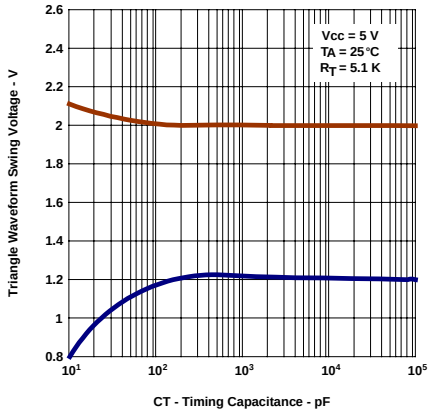


Figure 3

TRIANGLE WAVEFORM PERIOD
VS
TIMING CAPACITANCE

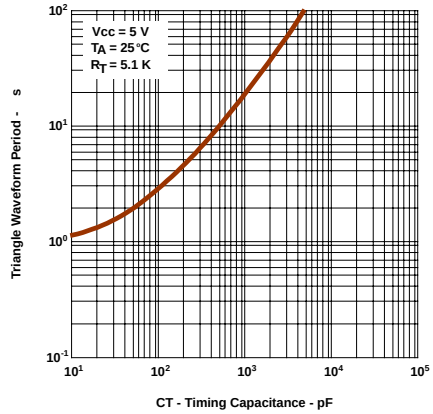


Figure 4

REFERENCE OUTPUT VOLTAGE VARIATION
VS
FREE-AIR TEMPERATURE

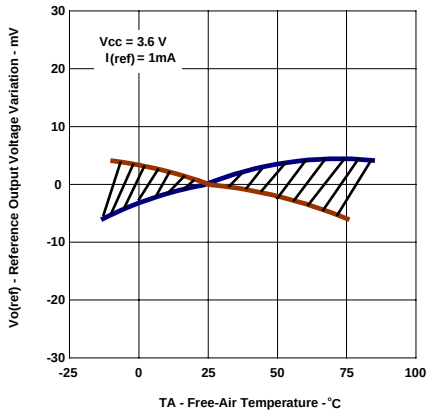


Figure 5

REFERENCE OUTPUT VOLTAGE VARIATION
VS
FREE-AIR TEMPERATURE

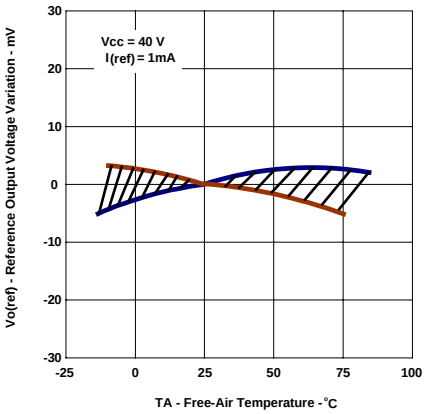


Figure 6

TYPICAL CHATACTERISTICS

REFERENCE OUTPUT VOLTAGE
VS
SUPPLY VOLTAGE

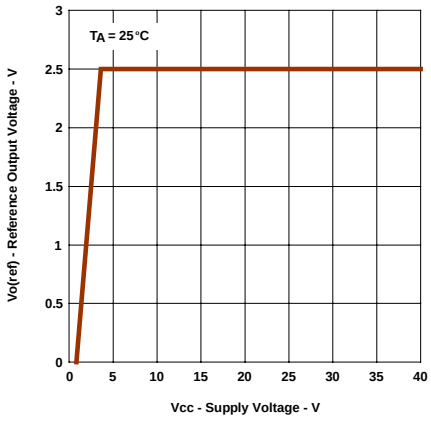


Figure 7

UNDERVOLTAGE LOCKOUT
CHARACTERISTIC

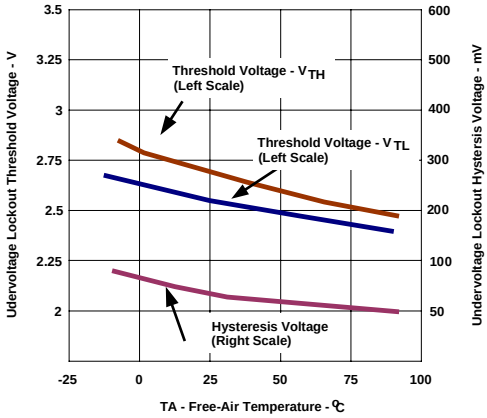


Figure 8

UNDERVOLTAGE LOCKOUT
HYSTERESIS CHARACTERISTICS

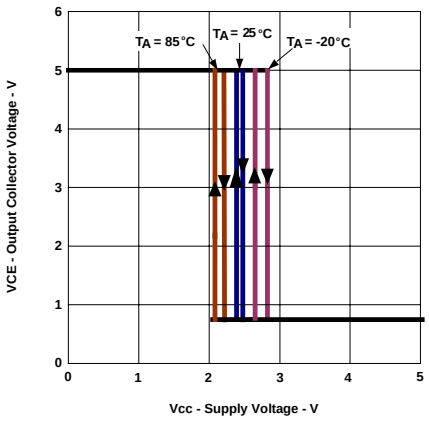


Figure 9

SHORT-CIRCUIT PROTECTION
CHARACTERISTICS

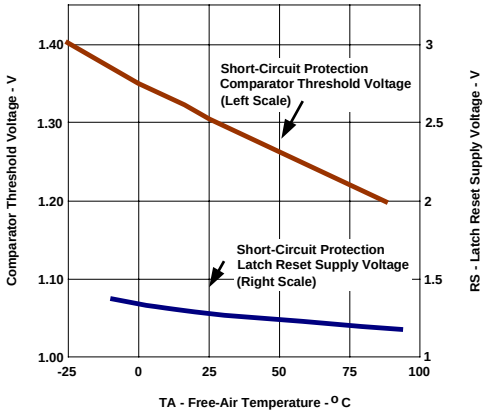


Figure 10

ERROR AMP MAXIMUM OUTPUT
VOLTAGE SWING
VS
FREQUENCY

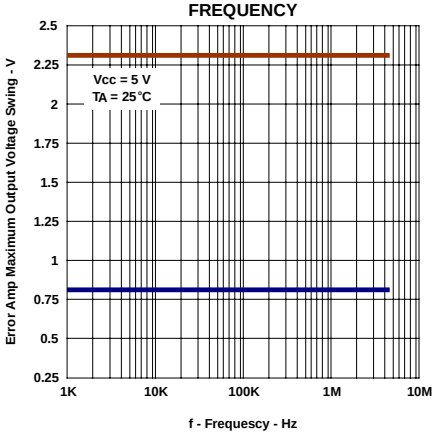
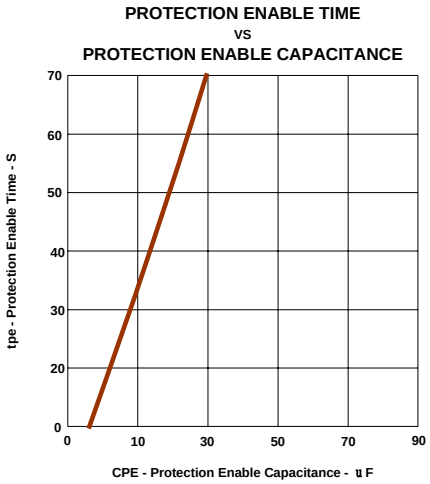


Figure 11

TYPICAL CHATACTERISTICS



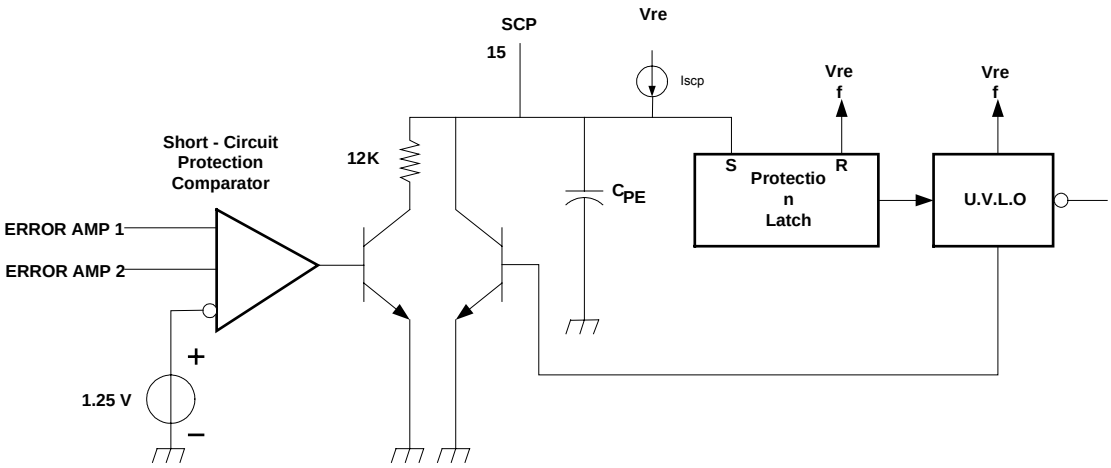


Figure 12

TYPICAL CHATACTERISTICS

OUTPUT TRANSISTOR ON DUTY CYCLE
VS
DEAD - TIME INPUT VOLTAGE

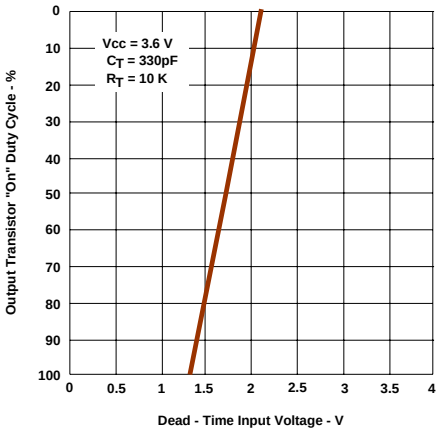


Figure 13

STANDBY CURRENT
VS
SUPPLY VOLTAGE

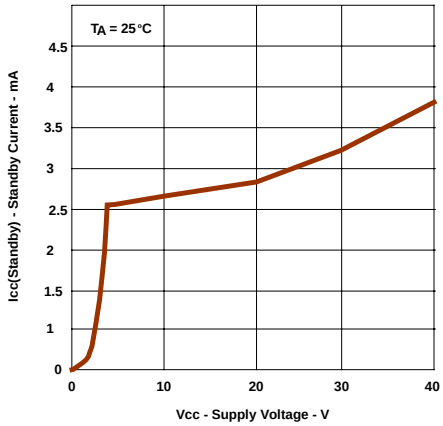


Figure 14

STANDBY CURRENT
VS
FREE - AIR TEMPERATURE

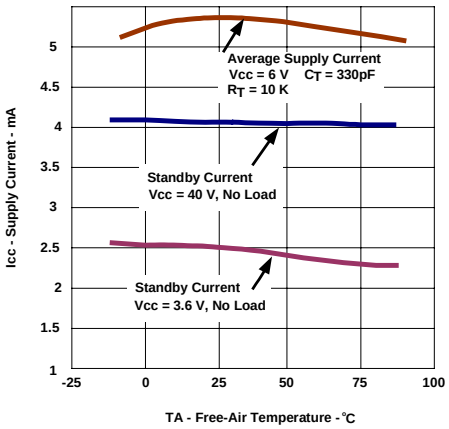


Figure 15

GAIN (AMPLIFIER IN UNITY-GAIN CONFIGURATION)
VS
FREQUENCY

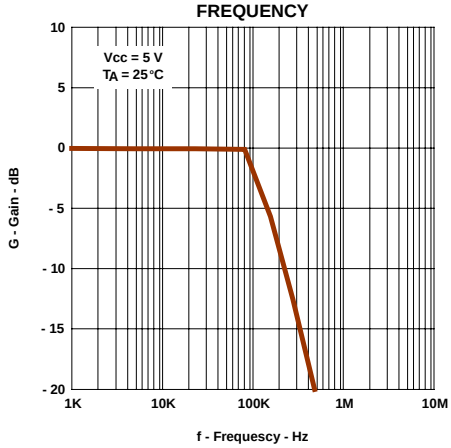
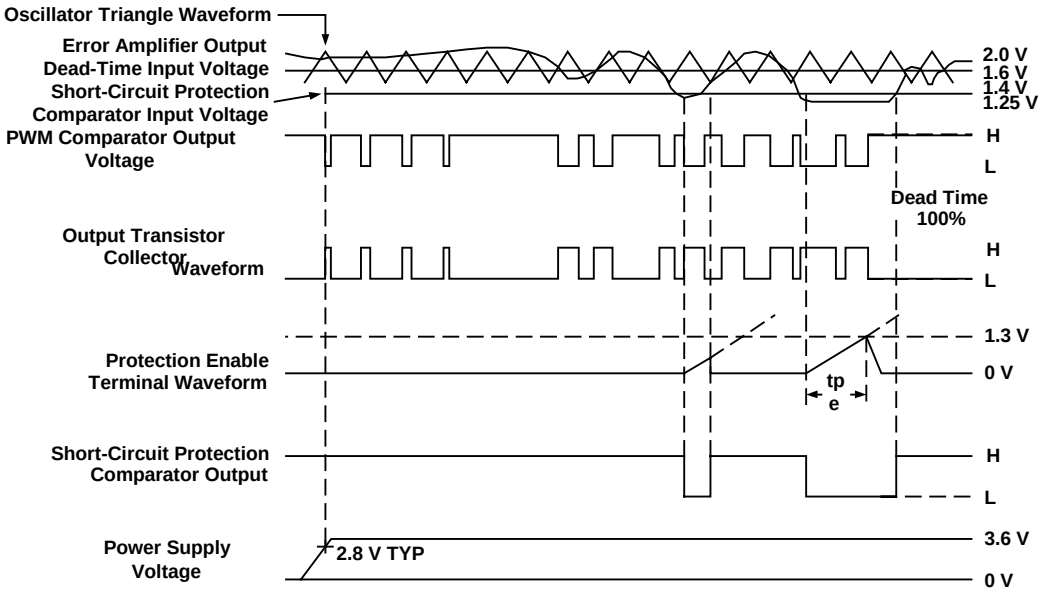


Figure 16

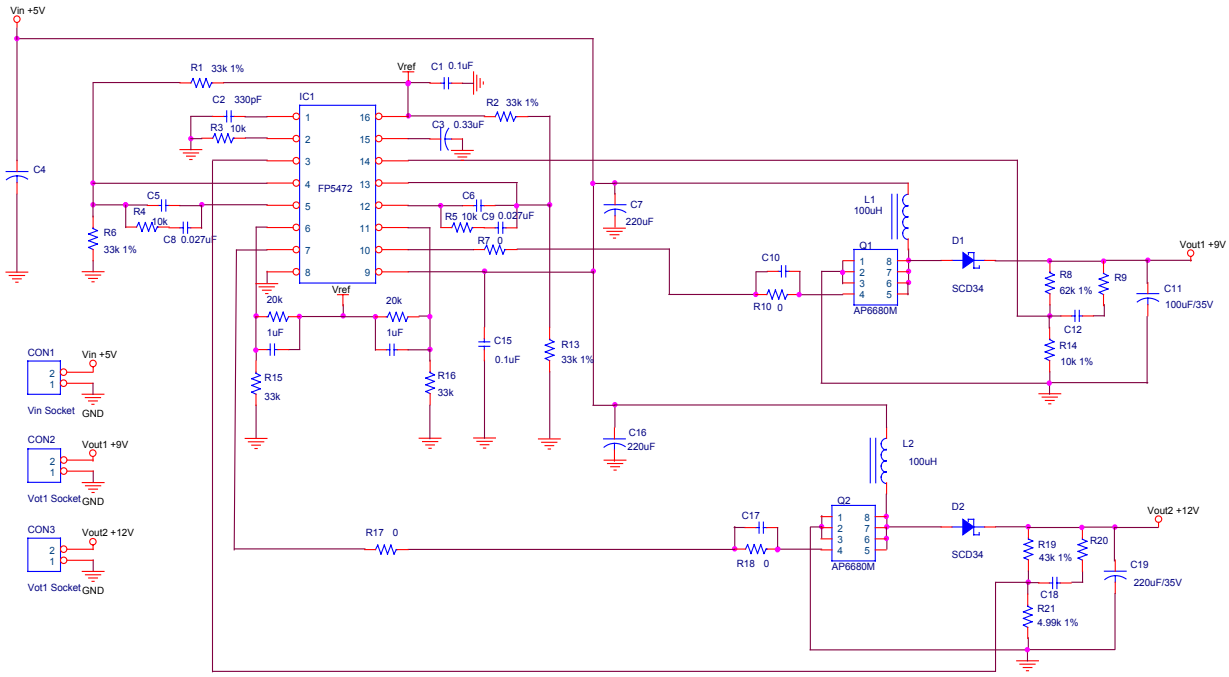
FP5452 TIMING WAVEFORM



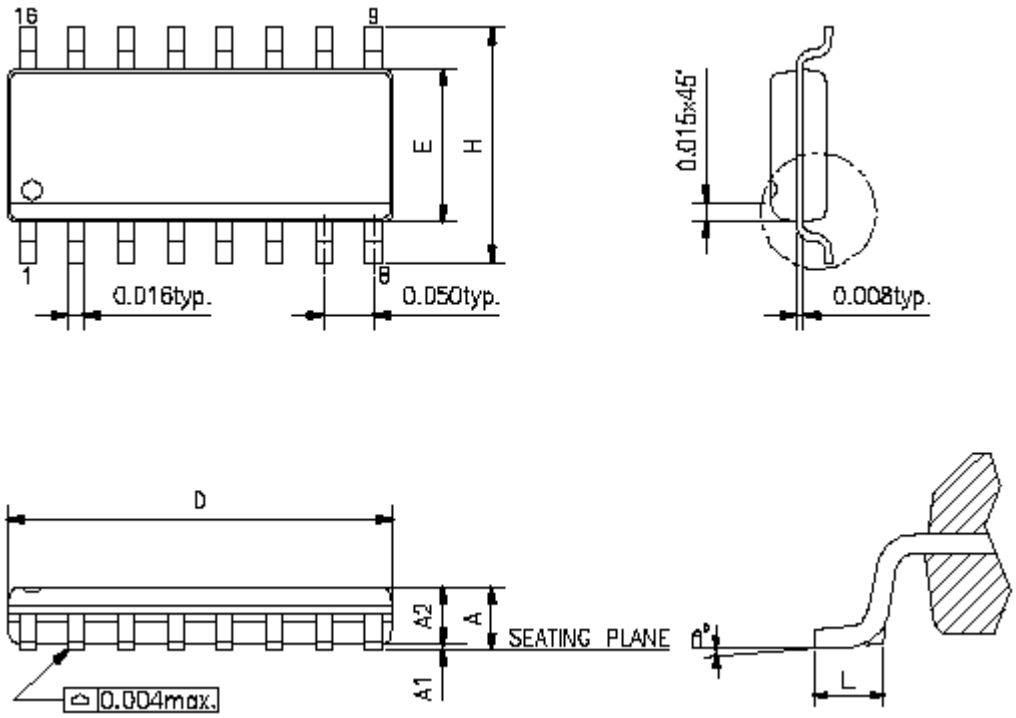
Protection Enable Time, tpe = (0.658 * 10E6 * Cpe) in seconds

FP5472 Timing Diagram

APPLICATION INFORMATION



PACKAGE OUTLINE
SOP-16L



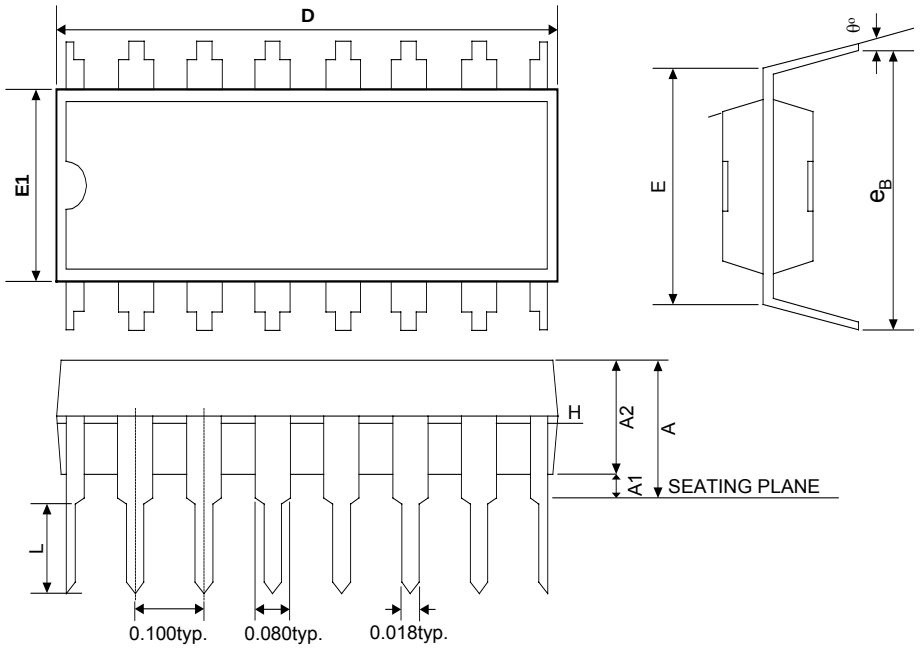
SYMBOLS	MIN	MAX
A	0.053	0.069
A1	0.004	0.010
A2	0.049	0.065
D	0.386	0.394
E	0.150	0.157
H	0.228	0.244
L	0.016	0.050
θ°	0	8

UNIT:INCH

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



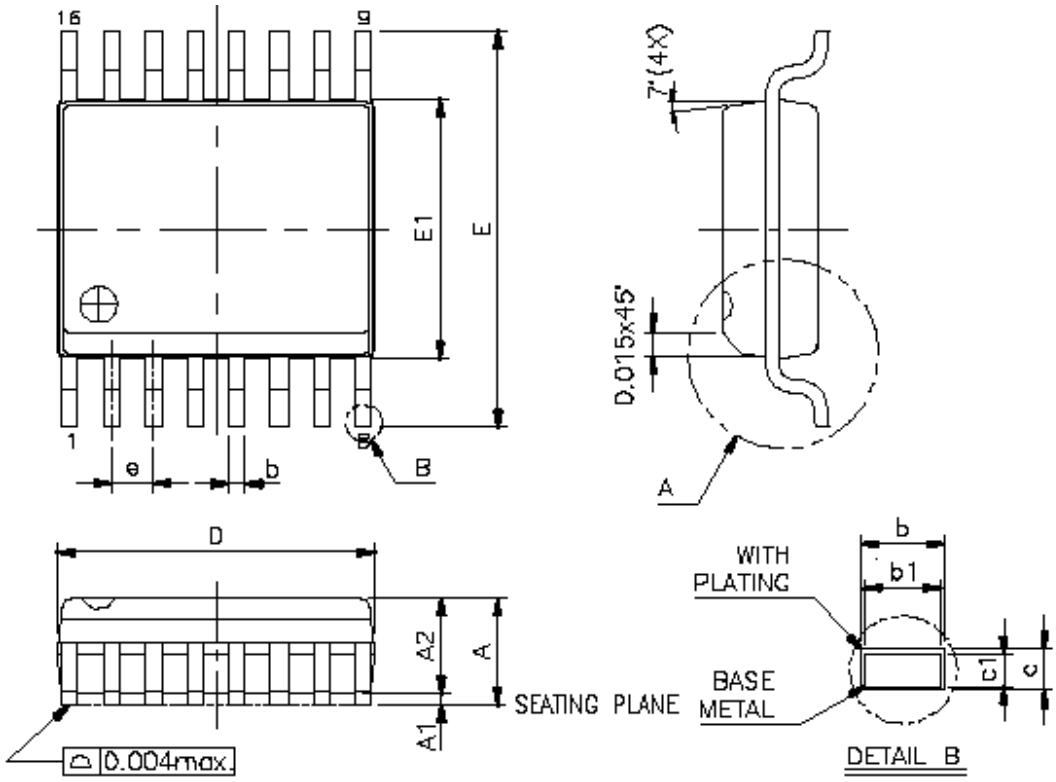
SYMBOLS	MIN.	NOR.	MAX.
A	—	—	0.210
A1	0.015	—	—
A2	0.125	0.130	0.135
D	0.735	0.755	0.775
E		0.300 BSC.	
E1	0.245	0.250	0.255
L	0.115	0.130	0.150
e_θ	0.335	0.355	0.375
θ °	0	7	15

UNIT:INCH

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.
3. eB IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
4. POINTED OR ROUNDED LEAD TIPS ARE PREFERRED TO EASE INSERTION.
5. DISTANCE BETWEEN LEADS INCLUDING DAM BAR PROTRUSIONS TO BE .005 INCH MININUM.
6. 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

UNIT:INCH

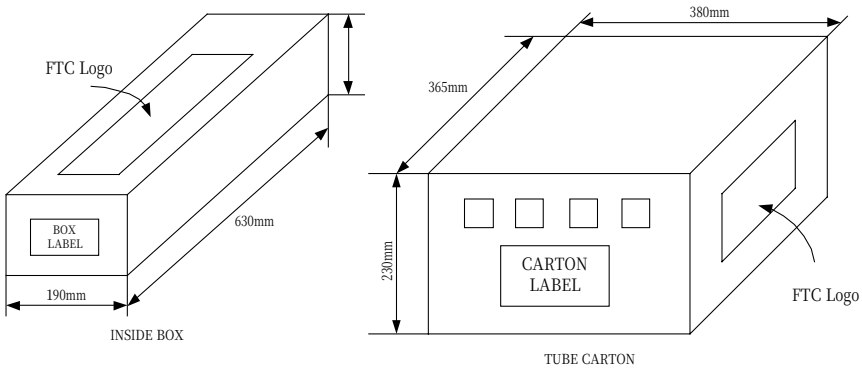
NOTES:

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.

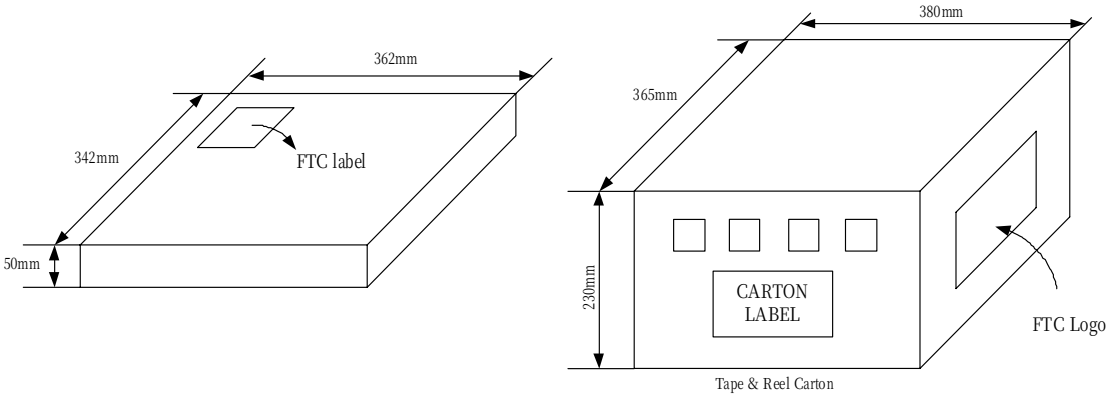
PACKING SPECIFICATIONS

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 FP5472DR-LF
Lot No A3311C62-L
D/C 4Xx-XXL
Q'ty ◎ ◎

無鉛
Lead Free

CARTON

Feeling Technology Corp.

Product Type: FP5472DR-LF

Lot No: A3311C62-L

Date Code: 4Xx-XXL

Package Type:SOP-16L

Marking Type: Laser

Total Q'ty: 10,000

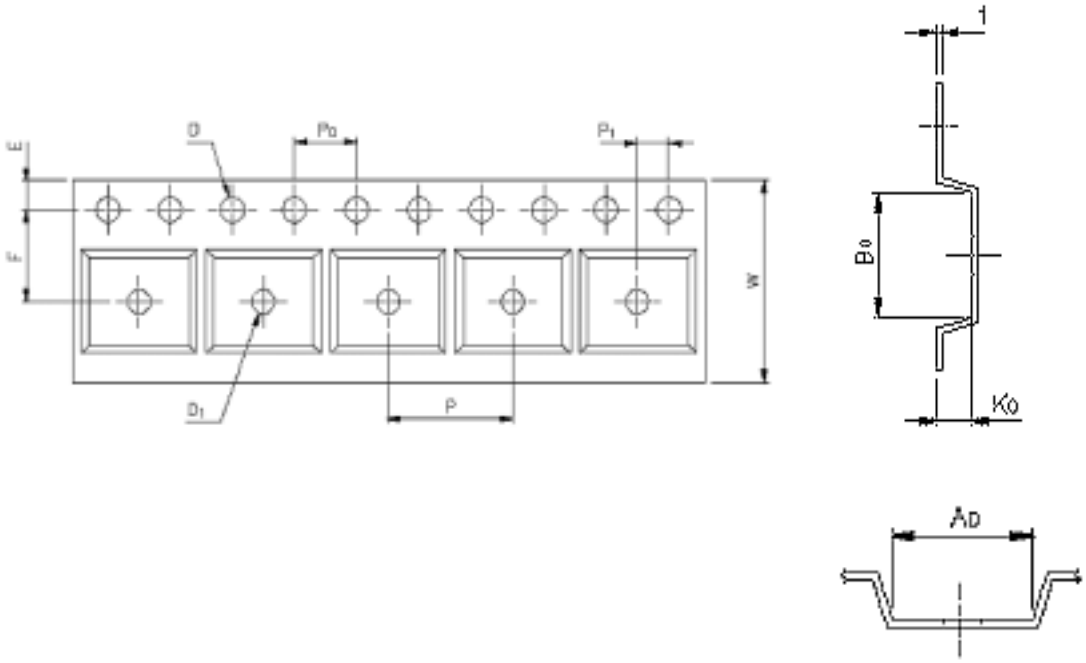
無鉛
Lead Free

SOP16

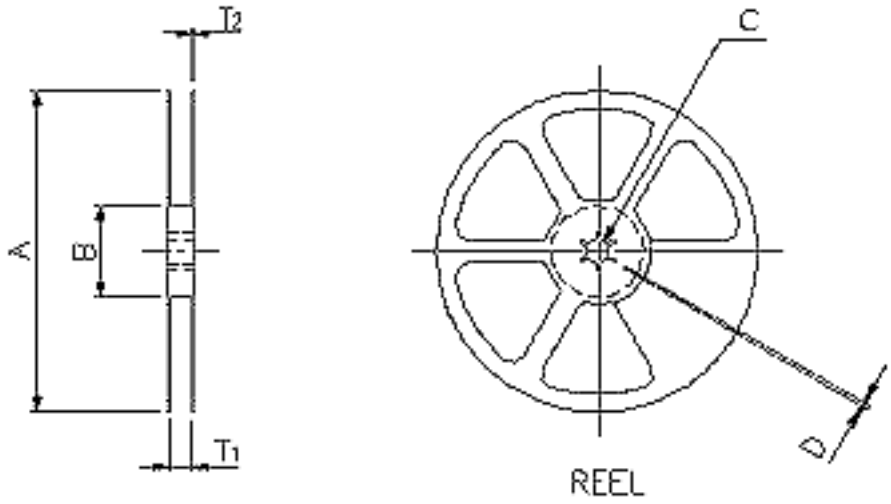
CARRIER TAPE DIMENSIONS

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



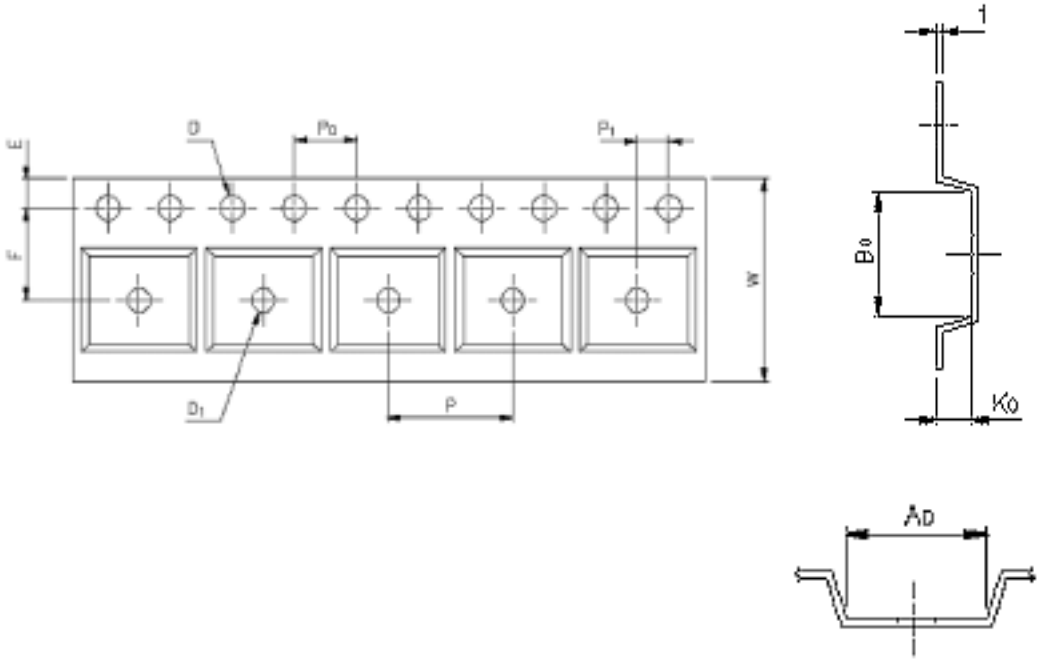
APPLICATION	MATERIAL	A	B	C	D	T1	T2
SOP16	PLASTIC REEL (BLUE)	330±3	100±2.0	13.0±0.5	2.0±0.5	16.4 $^{+0.3}_{-0.2}$	2.5±0.5

SSOP16

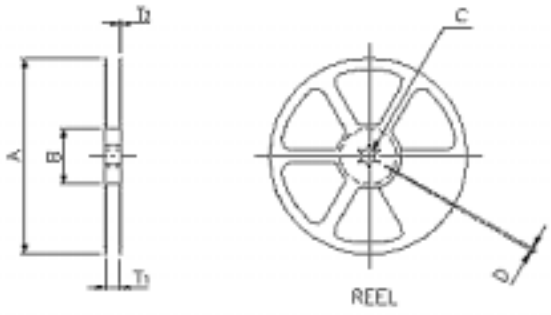
CARRIER TAPE DIMENSIONS

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