OFF-LINE CURRENT MODE PWM CONTROL IC

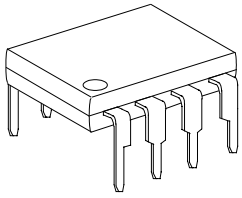
GENERAL DESCRIPTION

The FP3843, a 1-chip composed of high-current totem pole output circuits with a PWM latch, current sense comparator and an error amplifier, the FP3843 contains a 5V precision voltage reference regulator, under-voltage lockout circuit (UVLO), oscillator circuit, applied to offer space and low cost in many applications such as the DC/DC converter and off-line switching power supply.

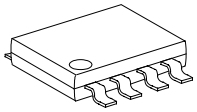
Using few external components, FP3843, a high performance integrated IC, is designed for a control circuit. The circuit diagram of the typical application example is as below.

FEATURES

- Precision Reference Voltage: 5.0V (±1%)
- Low start-up current: typ. 60uA
- High current totem pole output
- Low quiescent supply current
- Internal temperature compensated oscillator
- Double pulse suppression
- UVLO with Hysteresis function
- Oscillator Frequency: Max. 500KHz
- Package: PDIP8 / SOP8



PDIP8

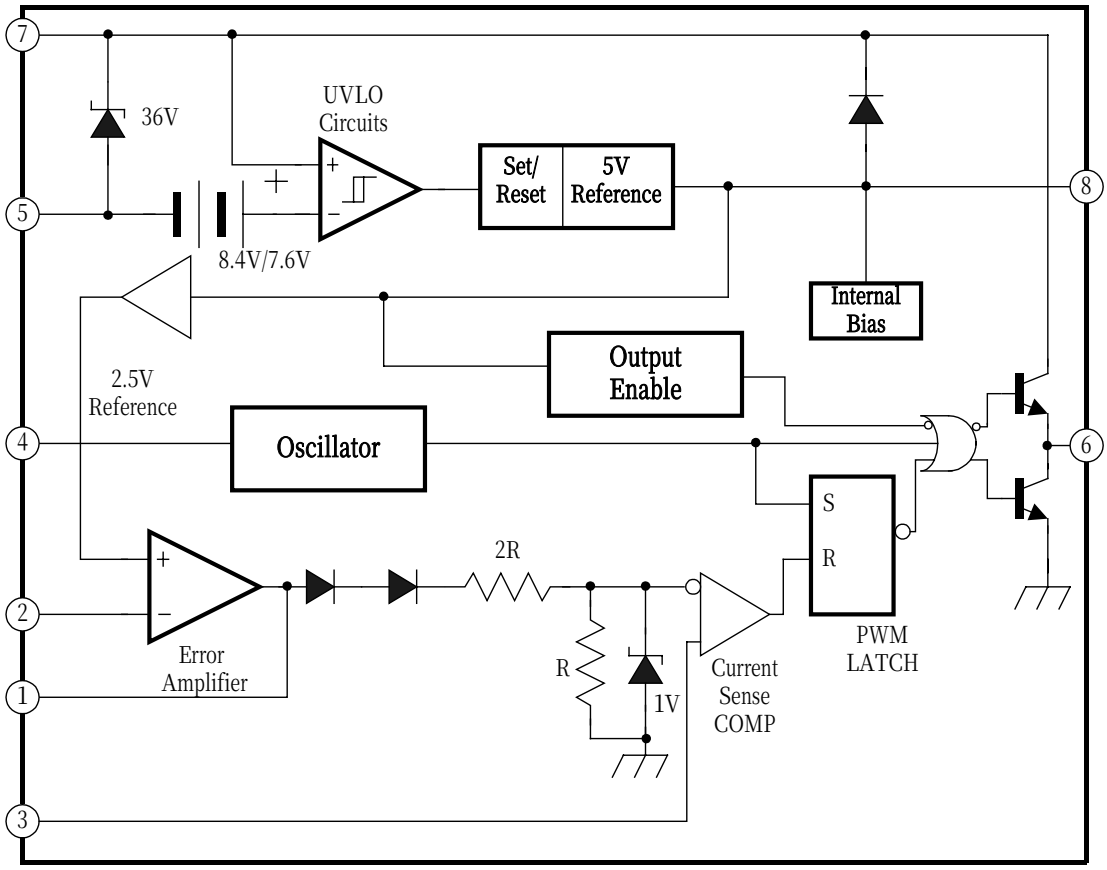


SOP8

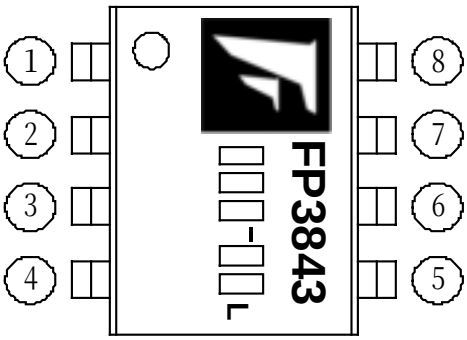
TYPICAL APPLICATION

- DC-DC Converter
- SMPS
- AC-DC Adaptor

FUNCTIONAL BLOCK DIAGRAM



MARK VIEW



PIN DESCRIPTION

NAME	NO.	STATUS	DESCRIPTION
COMP	1	O	Error Amplifier Feedback Output
V_{FB}	2	I	Error Amplifier Inverting Input
I_S	3	I	Current Sense Input
OSC	4	I	RC Network for Oscillator
GND	5	P	IC Ground
OUT	6	O	Totem Pole Output Drive for MOSFET
V_{CC}	7	P	IC Power Supply
V_{REF}	8	O	5.0V Reference Output

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) ---------- 30V

Output Current (I_O) ---------- ±1A

Analog Input (V_{FB}, V_{SENSE}) ---------- -0.3V ~ +5.5V

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

Thermal Resistance Junction to Ambient (PDIP8 package) ---------- 100°C/W

(SOP8 package) ---------- 175°C/W

Power Dissipation

PDIP8

T_A=25°C ---------- 1.25W

T_A=70°C ---------- 750mW

SOP8

T_A=25°C ---------- 650mW

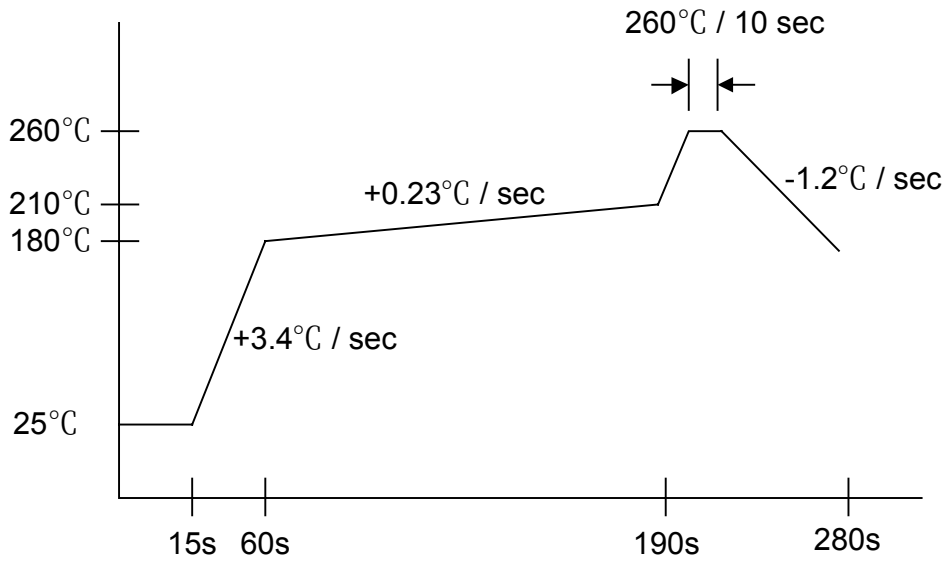
T_A=70°C ---------- 550mW

Operating Temperature Range (T_{OPR}) ---------- -20°C 85°C

Storage Temperature Range (T_{STG}) ---------- -65°C 150°C

PDIP8 Lead Temperature (soldering, 10 sec) ---------- +260°C

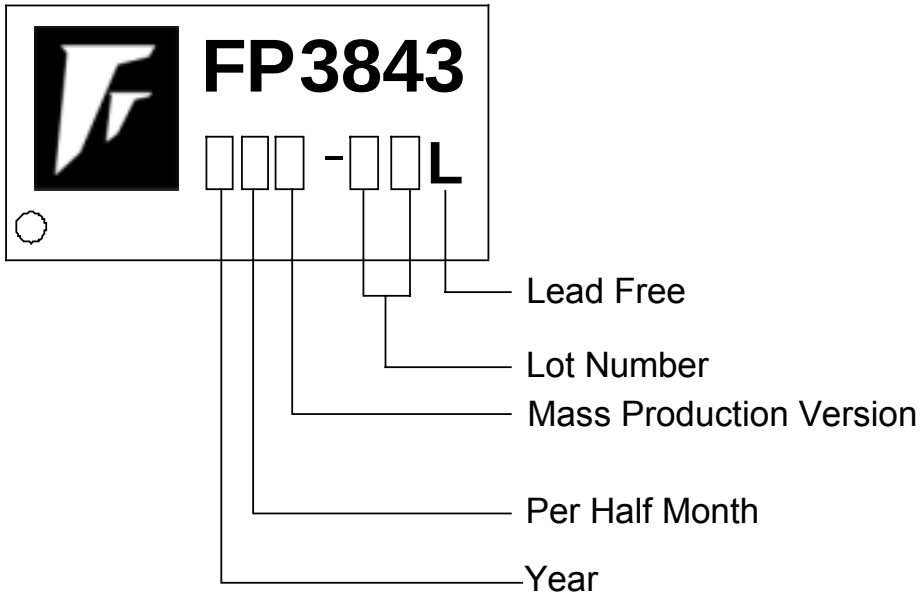
SOP8 Lead Temperature (soldering, 10 sec) ---------- +260°C



ORDER INFORMATION

Part Number	Operating Temperature	Package	Description
FP3843P-LF	-20℃ ~ +85℃	PDIP8	Tube
FP3843D-LF	-20℃ ~ +85℃	SOP8	Tube
FP3843DR-LF	-20℃ ~ +85℃	SOP8	Tape & Reel

IC DATE CODE DISTINGUISH

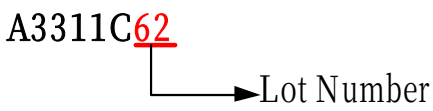


FOR EXAMPLE:

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

Lot Number is the last two numbers

For Example:



DC Electrical Characteristics

(V_{CC}=15V, R_T=10K,C_T=3.3nF,0°C≦T_A≦70°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Reference Section						
Output Voltage	V_{REF}	T_j=25°C, I_{REF}=1mA	4.9	5.0	5.1	V
Line Regulation	△V_{REF}	12V≦V_{CC}≦25V		2.0	20	mV
Load Regulation	△V_{REF}	1mA≦I_{REF}≦20mA		3.0	25	
Output Short Circuit	I_{SC}	T_A=25°C		-100	-180	mA
Oscillator Section						
Oscillation Frequency	f	T_j=25°C	49	52	55	KHz
Voltage Stability	△f/△V_{CC}	12V≦V_{CC}≦25V		0.2	1.0	%
Temperature Stability	△f/△T_A	T_{MIN}≦T_A≦T_{MAX}		0.5		%
Ampiltude	V_{OSC}	V_{P-P} of OSC pin		1.6		V
Error Amplifier Section						
Input Bias Current	I_{BIAS}	V_{FB}=5V		-0.1	-2.0	μA
Input Voltage	$V_{I(EA)}$	V_{COMP}=2.5V	2.42	2.5	2.58	V
Open Loop Gain	A_{VOL}	2V≦V_{OUT}≦4V	65	90		dB
Unity Gain Bandwidth	BW_U	Note 3	0.7	1.0		MHz
Power Supply Rejection Ratio	PSRR	12V≦V_{CC}≦25V	60	70		dB
Output Sink Current	I_{SINK}	V_{FB}=2.7V,V_{COMP}=1.1V	2	7		mA
Output Source Current	I_{SOURCE}	V_{FB}=2.3V,V_{COMP}=5V	-0.5	-1.0		
V_{COMP} High Voltage	V_{OH}	V_{FB}=2.3V, R_L=15KΩ to GND	5.0	6.0		V
V_{COMP} Low Voltage	V_{OL}	V_{FB}=2.7V, R_L=15KΩ to V_{REF}		0.8	1.1	
Current Sense Section						
Gain	G_V	(Note 1 & 2)	2.85	3.0	3.15	V/V
Maximum Input Signal	$V_{I\ (MAX)}$	V_{COMP}=5V(Note 1)	0.9	1.0	1.1	V
Supply Voltage Rejection	SVR	12V ≦ V_{CC} ≦ 25V (Note 1)		70		dB
Input Bias Current	I_{BIAS}			-2	-10	μA
Delay to Output	t_{DO}			150	300	ns

DC ELECTRICAL CHARACTERISTICS (Cont.)

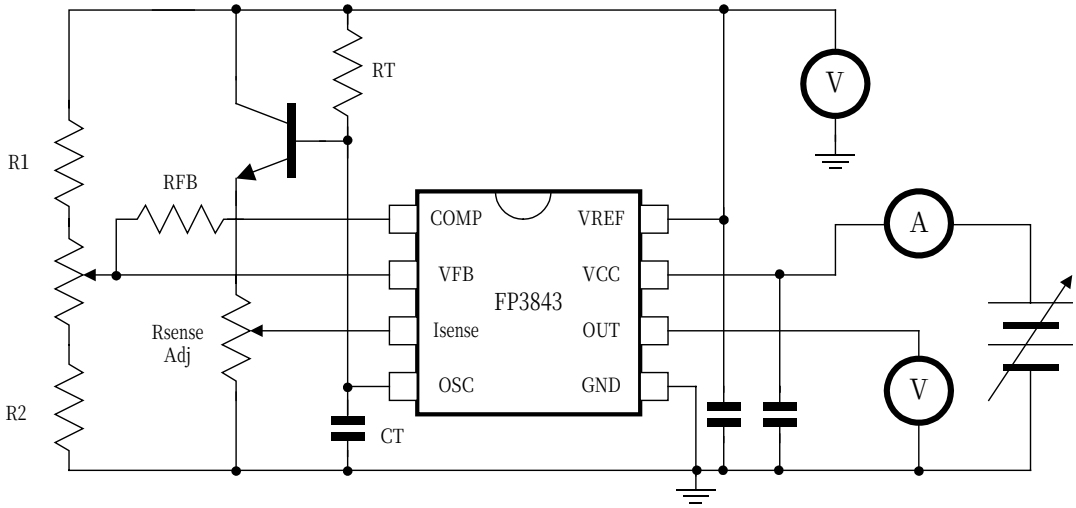
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Section						
V_{OUT} Low Voltage	V_{OL}	I_{SINK}=20mA		0.1	0.4	V
		I_{SINK}=200mA		1.6	2.2	
V_{OUT} High Voltage	V_{OH}	I_{SOURCE}=20mA	13	13.5		V
		I_{SOURCE}=200mA	12	13.0		
Rise Time	t_R	T_J=25°C,C_L=1nF (Note 3)		50	150	nS
Fall Time	t_F	T_J=25°C,C_L=1nF (Note 3)		50	150	
Under-Voltage Lockout Section						
Start Threshold	$V_{TH\ (ST)}$		7.8	8.4	9.0	V
Minimum Operating Voltage	$V_{OPR\ (MIN)}$	After Turn On	7.0	7.6	8.2	V
PWM Section						
Maximum Duty Cycle	$D_{(MAX)}$		94	96	100	%
Minimum Duty Cycle	$D_{(MIN)}$				0	
Total Standby Current						
Start-Up Current	I_{ST}			0.06	0.08	mA
Operating Supply Current	$I_{CC(OPR)}$	V_{FB}=0V V_{SENSE}=0V	5	6	8	
V_{CC} Zener Voltage	V_Z	I_{CC}=25mA	30	36		V

Notes 1. Parameter measured at trip point of latch with V_{FB}=0V.

2. Gain defined as A= $\triangle V_{COMP}$ / $\triangle_{VSENSE}$; $0 \leqq V_{SENSE} \leqq 0.8V$

3. These parameters, although guaranteed, are not 100% tested in production.

Test Circuits



TYPICAL CHARACTERISTICS

Timing Resistor
VS
Oscillator Frequence

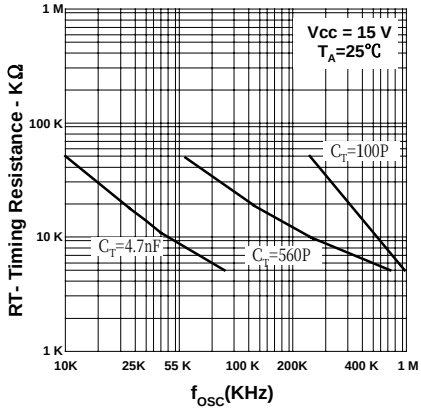


Figure 1

Maximum Output Duty Cycle
VS
Timing Resisror

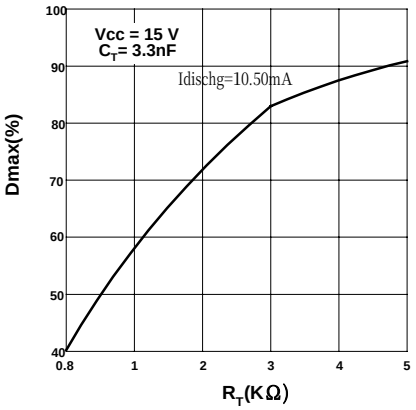


Figure 2

Oscillator Discharge Current
VS
Temperature

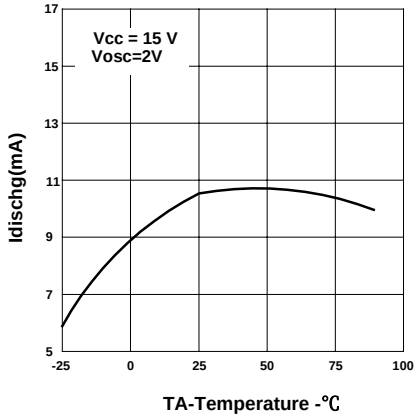


Figure 3

Reference Voltage Change
VS
Source Current

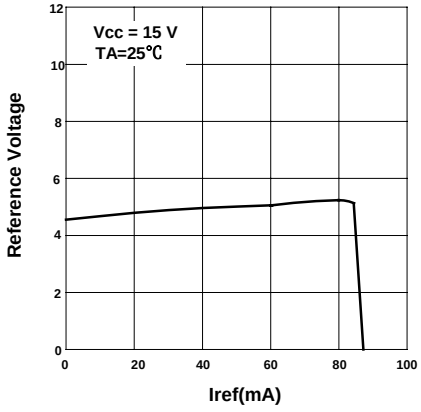


Figure 4

Reference Short Circuit Current
VS
Temperature

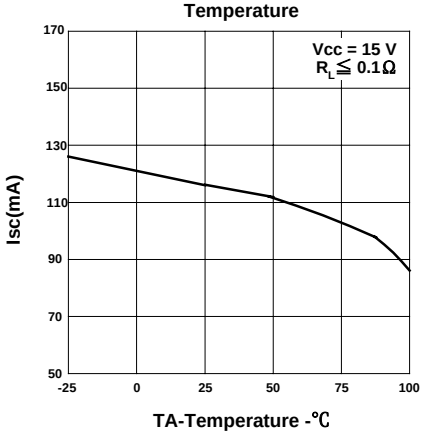


Figure 5

Current Sense Input Threshold
VS
Error Amp Output Voltage

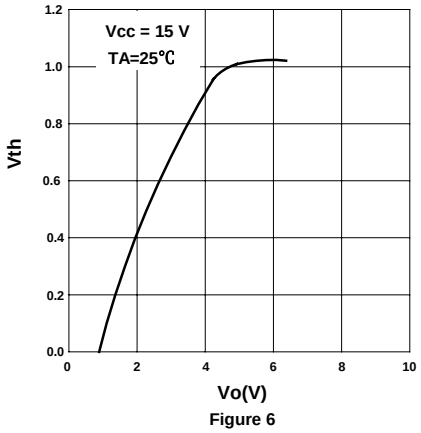


Figure 6

TYPICAL CHARACTERISTICS (continued)

Output Saturation Voltage VS Load Current

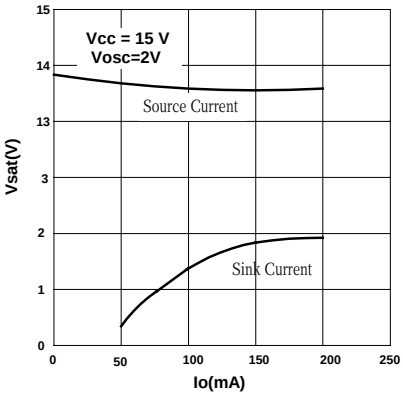


Figure 7

Supply Current VS Supply Voltage

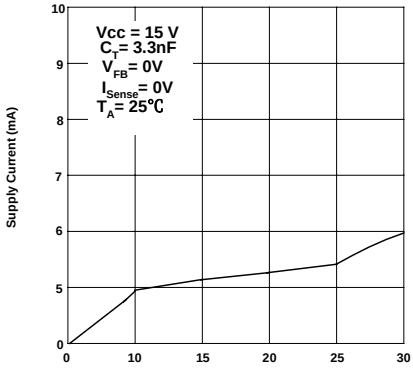


Figure 8

Output Waveform

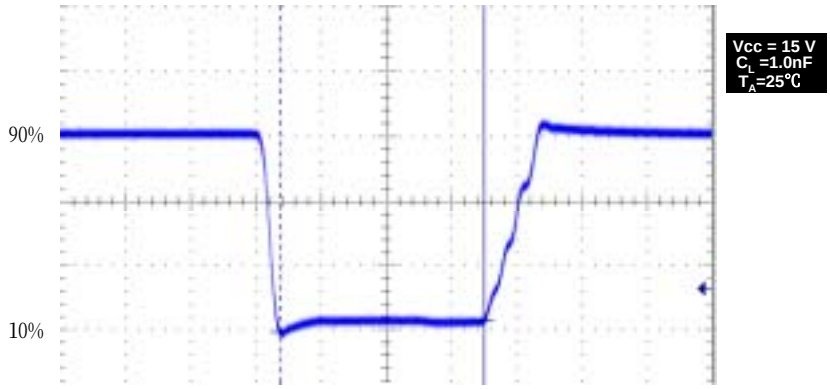


Figure 9

Output Cross Conduction

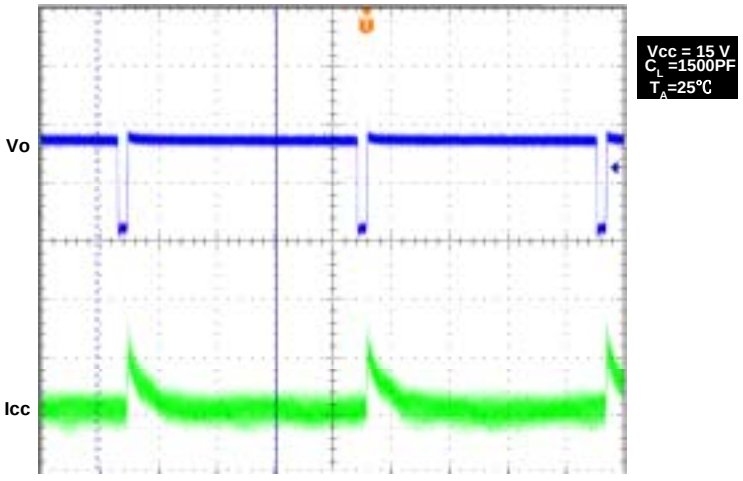
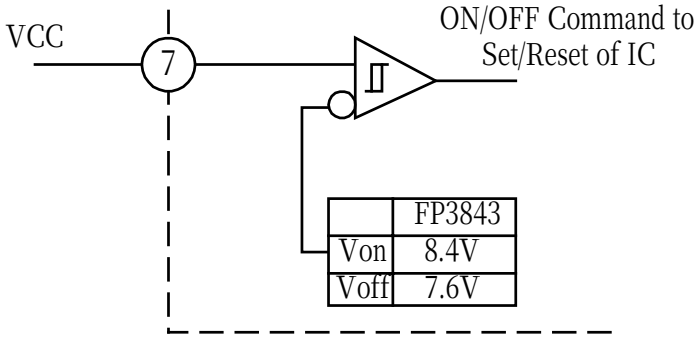


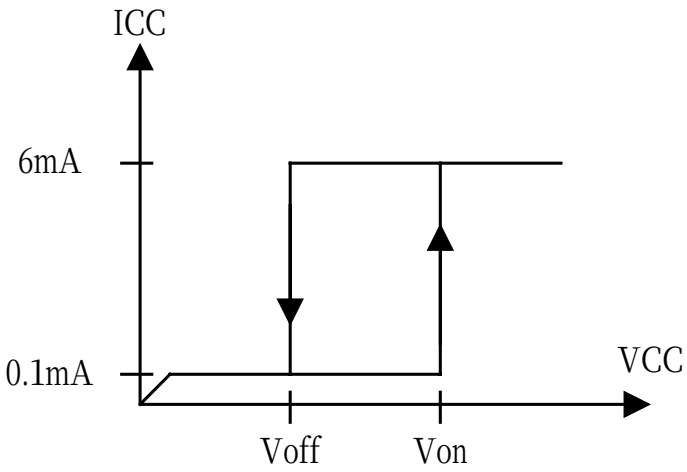
Figure 10

Function Descriptions

Under-Voltage Lockout

FP3843 has a lockout function such as below figure. The output of pin6 is low state during the range of under-voltage lockout (UVLO). V_{ON} is a threshold voltage for IC operation until V_{CC} is more than this voltage point, and the V_{OFF} is a minimum operating voltage to keep FP3843 working continuously.

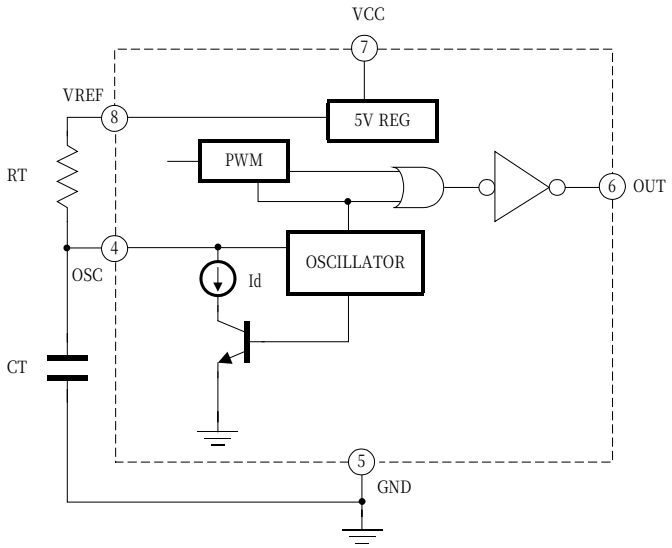


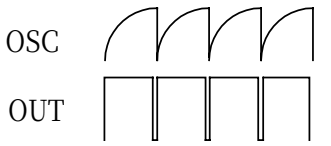


During UVLO, the Output is low

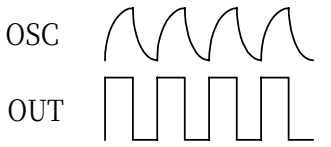
Oscillator and Output Waveforms

It uses an external RC circuit for oscillation of FP3843, C_T is charged from V_{REF} and through R_T and discharged to the internal circuits including a source current I_D and a NPN transistor. The waveforms of different R_T/C_T are also shown as below.





Large RT/Small CT

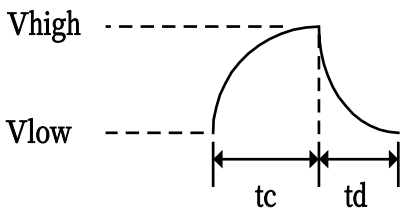


Small RT/Large CT

The charge and discharge time could be calculated by these formulas:

$$tc = RtCt \ln\left(\frac{Vref - Vlow}{Vref - Vhigh}\right)$$

$$td = RtCt \ln\left(\frac{Vref - IdRt - Vlow}{Vref - IdRt - Vhigh}\right)$$



For example:

FP3843 V_{REF}=5.0V, V_{HIGH}=2.7V, V_{LOW}=1.0V, I_D=8.3mA (IC specification)

And external R_T= 10KΩ, C_T= 3.3nF

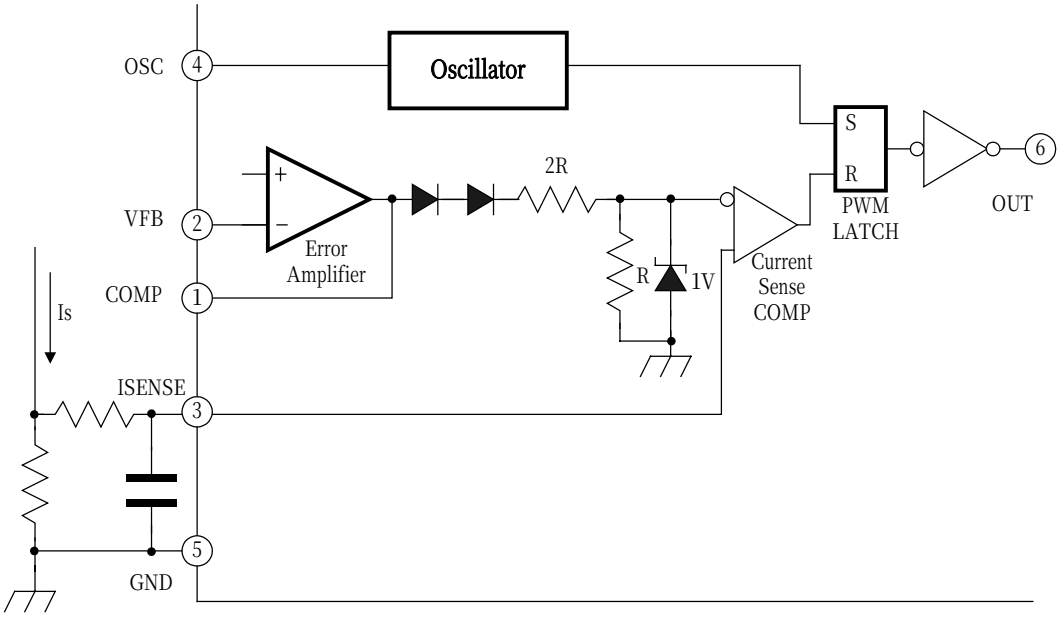
t_C = 10000 * 3.3e-9 * ln (4/2.3) = 0.000033 * 0.5534 = 18.26μs

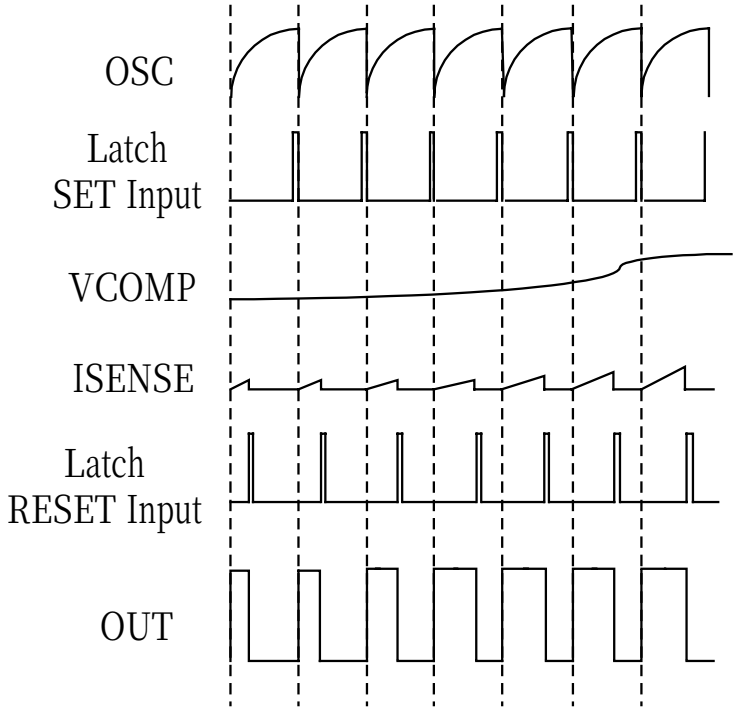
t_D = 10000 * 3.3e-9 * ln (1.02) = 0.000033 * 0.021 = 0.7μs

f_{OSC}= 1 / (t_C + t_D) = 52.74KHz

Error Amplifier, Current Sense and Output PWM Waveforms

The duty cycle of PWM waveform is depended on the error amplifier and current sense signal, which are compared together by PWM Latch.





Large RT/Small CT

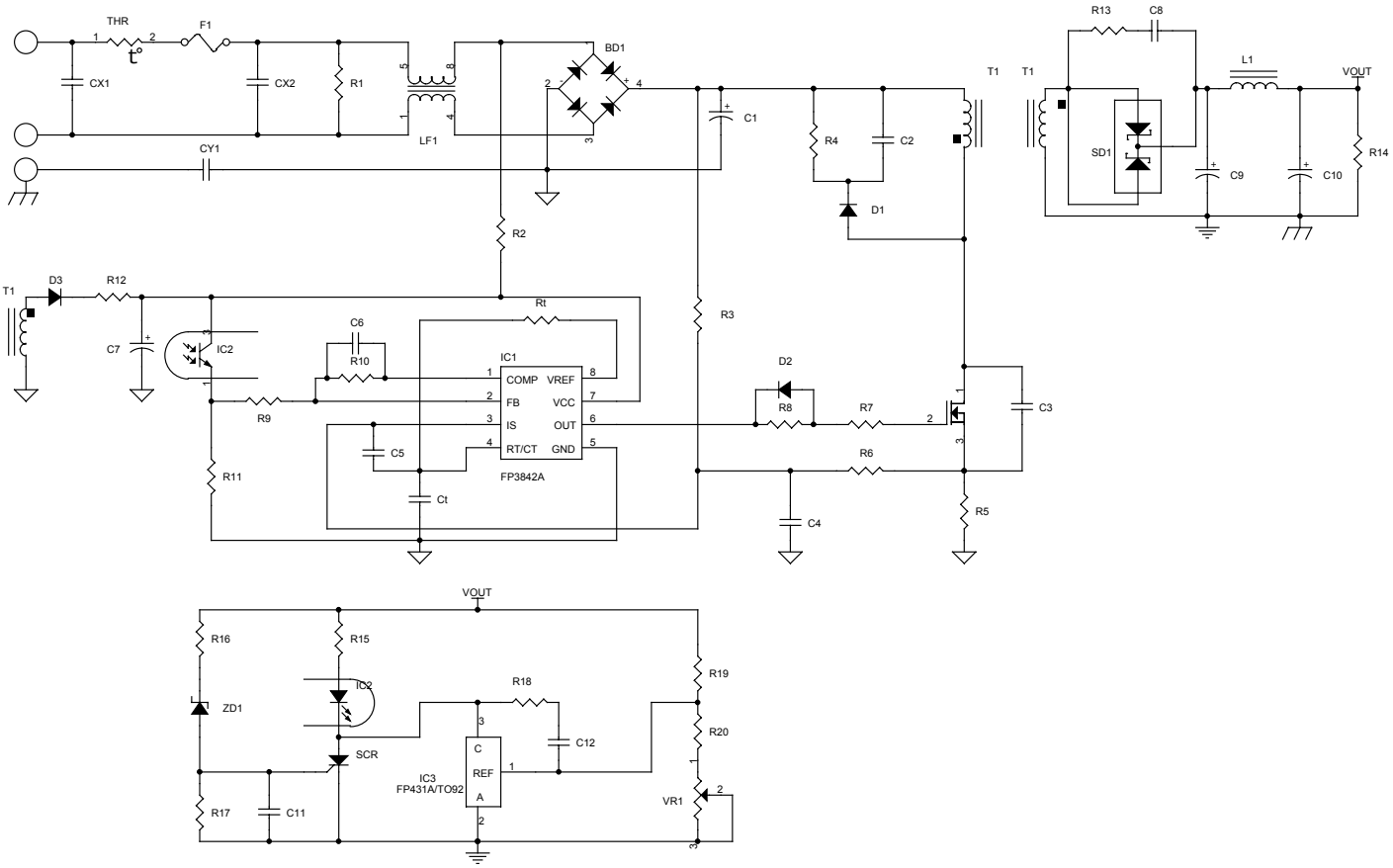
Application Example

This is a simple application circuit for 35W Adaptor example. The gate of MOSFET is connected to pin6 of FP3843, and PWM duty is determined by EA feedback signal from the photo coupler and R5 sense voltage.

The initial start-up voltage of FP3843 comes from AC line and through R2, and normal supply voltage is available until the T1 transformer converted the store energy to T1 primary side output through D3 and R12 to FP3843.

The V_{REF} voltage of FP431 with R19 and R20 determine the output voltage of VOUT.

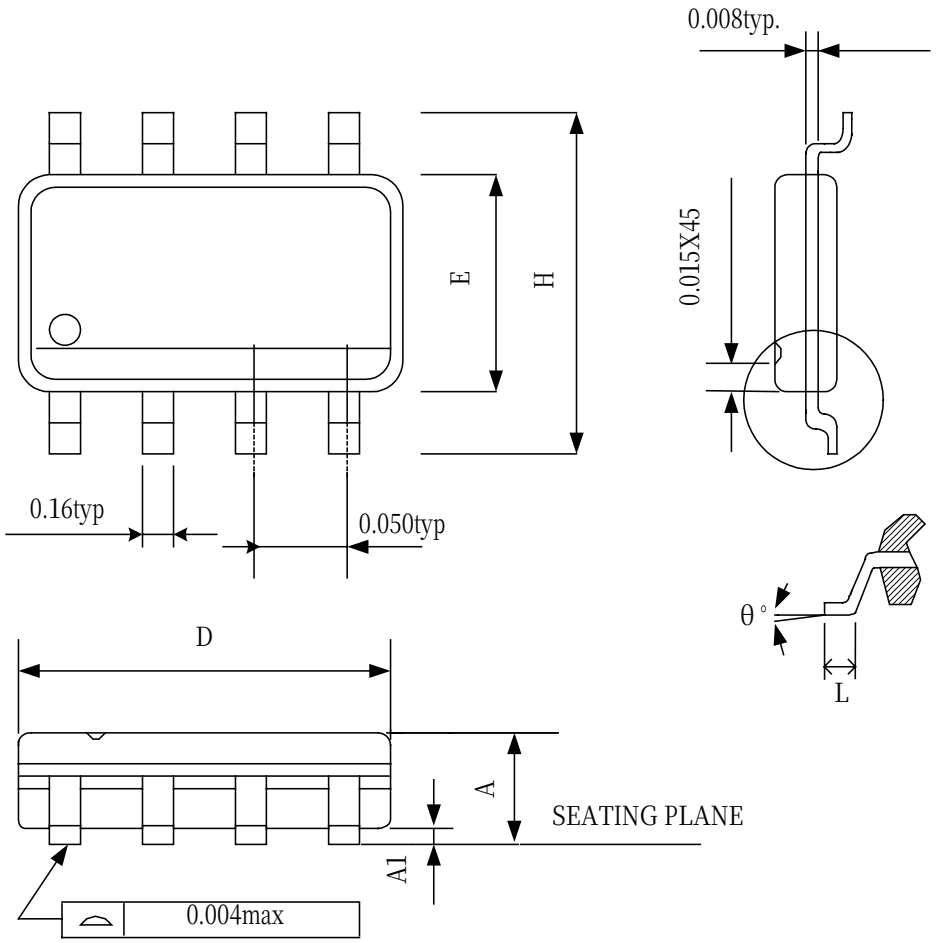
SCR and ZD1 is a very simple circuit for V_{OUT} over-voltage protection.



35W AC-DC Adaptor

PACKAGE OUTLINE

SOP8

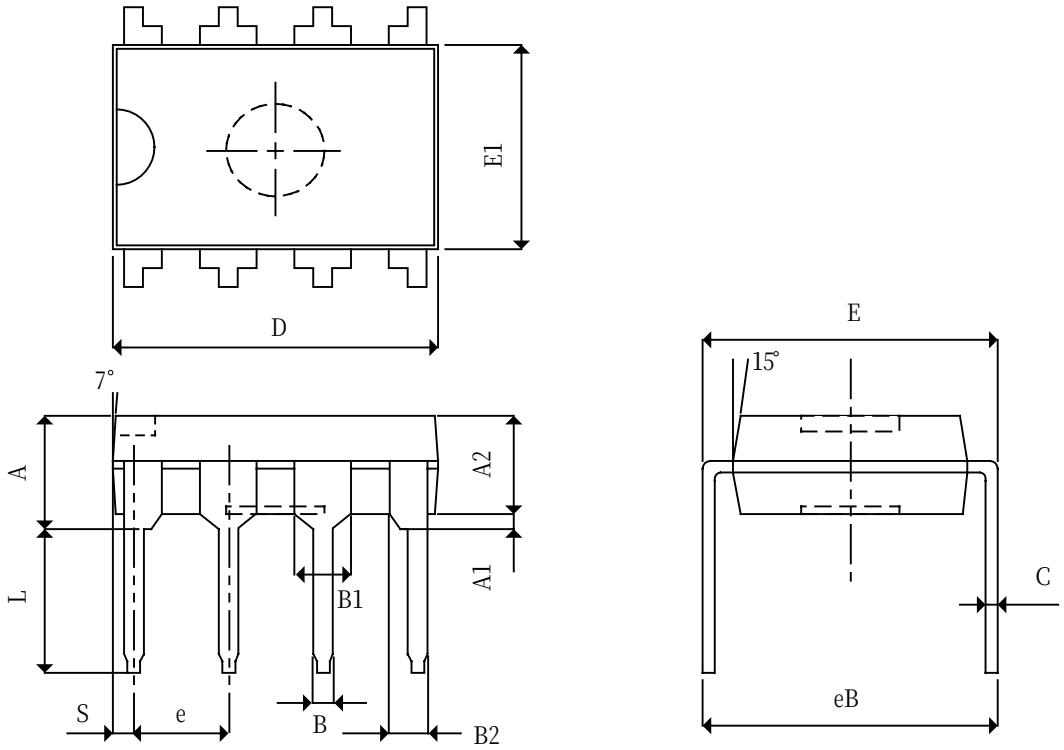


SYMBOLS	MIN	MAX
A	0.053	0.069
A1	0.004	0.010
D	0.189	0.196
E	0.150	0.157
H	0.228	0.244
L	0.016	0.050
θ °	0	8

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 (.0.06in) 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.

PDIP8



SYMBOLS	MIN	MAX
A	0.142	0.165
A1	0.015	----
A2	0.128	0.136
B	0.014	0.022
B1	0.055	0.065
B2	0.032	0.046
C	0.008	0.013
D	0.359	0.375
E	0.300	0.325
E1	0.244	0.260
e	0.095	0.110
L	0.125	
eB	0.330	0.370
S	0.028	0.038

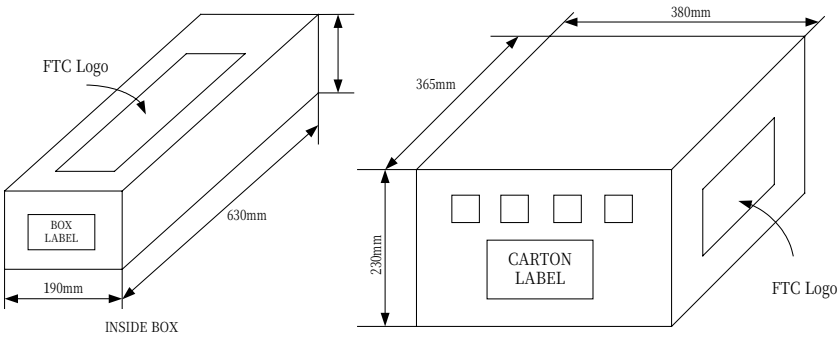
NOTE:

1. CONTROLLING DIMENSION: INCH
2. TOLERANCE: 0.010” UNLESS OTHERWISE SPECIFIED.
3. PACKAGE DIMENSION EXCLUDE MOLDING FLASH.
4. PACKAGE DIMENSIONS ARE IN COMPLIANCE WITH JEDEC STANDARD MS-001 AB JUL85’ ISSUE B.

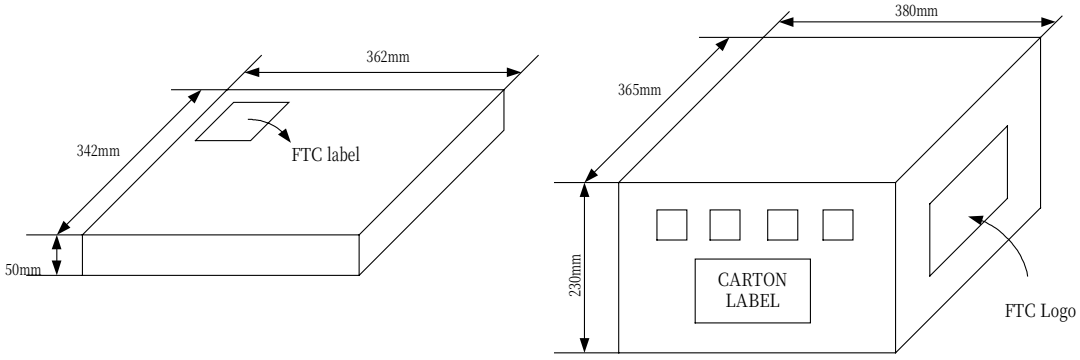
PACKING SPECIFICATIONS

BOX DIMENSION

TUBE INSIDE BOX AND CARTON



TAPE & REEL INSIDE BOX AND CARTON



PACKING QUANTITY SPECIFICATIONS

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

LABEL SPECIFICATIONS

TAPPING & REEL

Feeling Technology Corp.
Product : FP3843
Lot No : A3311C62
D/C : 4Xx-XXL
Q'ty : ◎ ◎

無鉛
Lead Free

CARTON

Feeling Technology Corp.

Product Type: FP3843

Lot No: A3311C62

Date Code: 4Xx-XXL

Package Type: SOP-8L

Marking Type: Laser

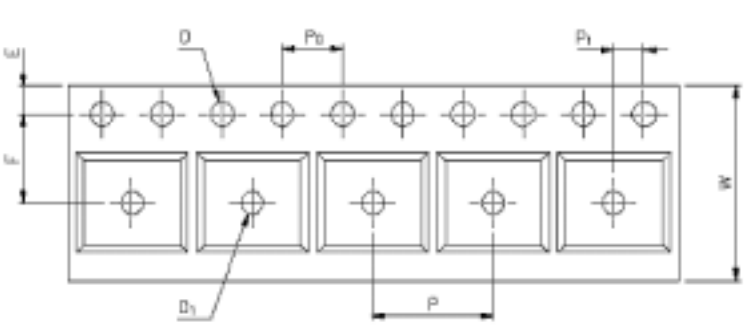
Total Q'ty: 10,000

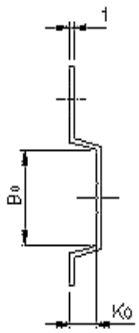
無 鉛
Lead Free

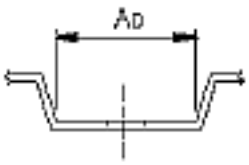
CARRIER TAPE DIMENSIONS

APPLICATION	W	P	E	F	D	D_1
SOP8	$12.0^{+0.3}_{-0.1}$	8.0±0.1	1.75±0.1	5.5±0.1	1.55±0.1	$1.5^{+0.25}$

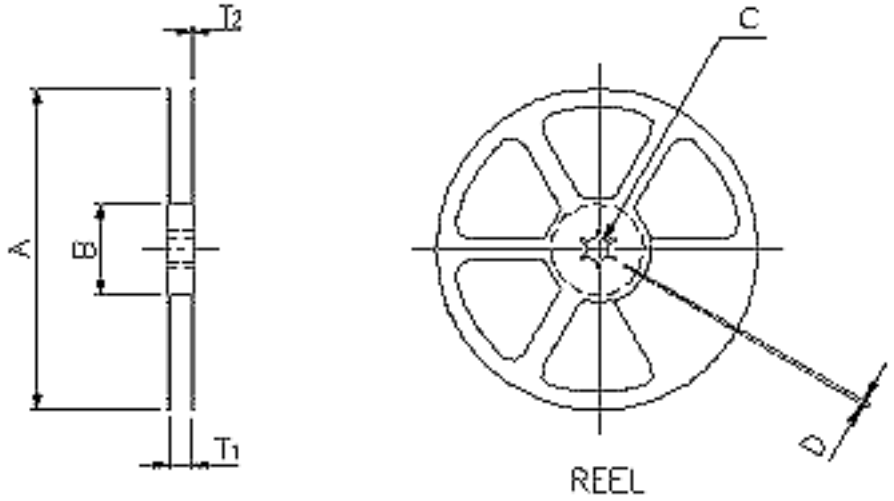
APPLICATION	P_0	P_1	A_0	B_0	K_0	t
SOP8	4.0±0.1	2.0±0.1	6.4±0.1	5.20±0.1	2.1±0.10	0.30±0.013







REEL DIMENISIONS



APPLICATION	MATERIAL	A	B	C	D	T_1	T_2
SOP8	PLASTIC REEL (WHILE)	330±0.1	62±1.5	12.75+0.15	2+0.6	12.4+0.2	2.0+0.2

SGS REPORT

SGS

Test Report

FEELING TECHNOLOGY CORP.
2F, NO.287, SEC.2, KUANG FU RD., SHIN-CHU CITY, TAIWAN, R.O.C.

Report No : CE/2003/81704
Date : 2003/08/28
Page : 1 of 1

The following merchandise was(were) submitted and identified by the client as :

Type of Product	:	POWER IC (FP3843)
Style/Item No	:	SOP-8
Sample Received	:	2003/08/25.
Testing Date	:	2003/08/25 TO 2003/08/28

Test Result

PART NAME NO.1 : IC(MIX ALL PARTS)

Test Item(s):	Unit	Method	MDL	Result NO.1					Spec.
Lead (Pb)	ppm	ICP-AES After Aa per US EPA3050B or Acid digestion.	2	16.3					---

NOTE: (1) N.D. = Not detected.(<MDL)
(2) ppm = mg/kg
(3) MDL= Method Detection Limit
(4) " --" = Not Applicable
(5) *=Results shown are of the adjusted analytical results.

Aaron Lee/S.R. Supervisor
Signed for and on behalf of
SGS TAIWAN LTD.

TW/0239584