



# Preliminary Specification

# CR-F33T

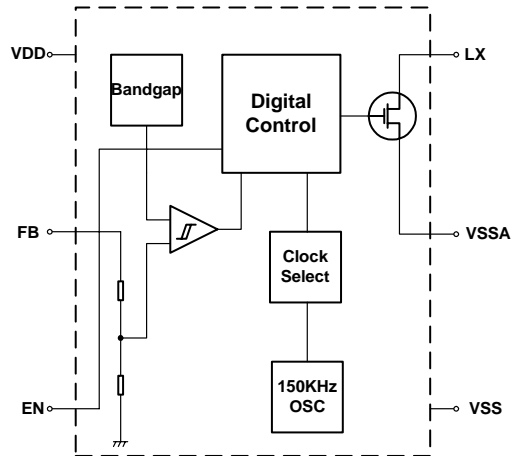
PFM STEP-UP  
DC/DC CONVERTER

## GENERAL DESCRIPTION

The CR-F33T is a PFM step-up DC/DC converter IC and has a high efficiency. These devices consist of a bandgap, a comparator, an oscillator, a driver, and a high current output switch.

The CR-F33T provides a higher fixed voltage from the smaller input voltage. The CR-F33T is used for single- or dual-cell battery operation.

## BLOCK DIAGRAM



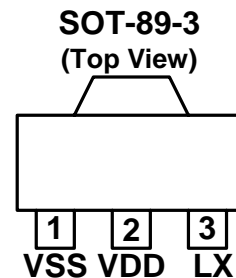
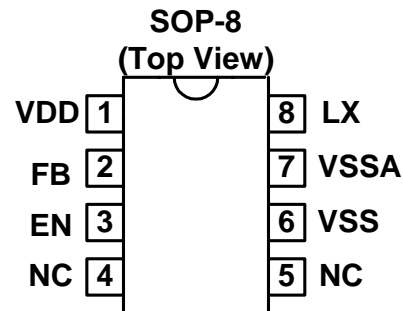
## FEATURES

- Low Voltage Operation Possible
- Low Supply Current
- Small Number of External Components
- Internal Power Switch

## APPLICATIONS

- Battery-Powered Instruments
- Hand-Held Instruments
- Hand-Held Communication Instruments
- Cameras

## PIN CONFIGURATION



## ORDERING INFORMATION

**CR-FXXX**

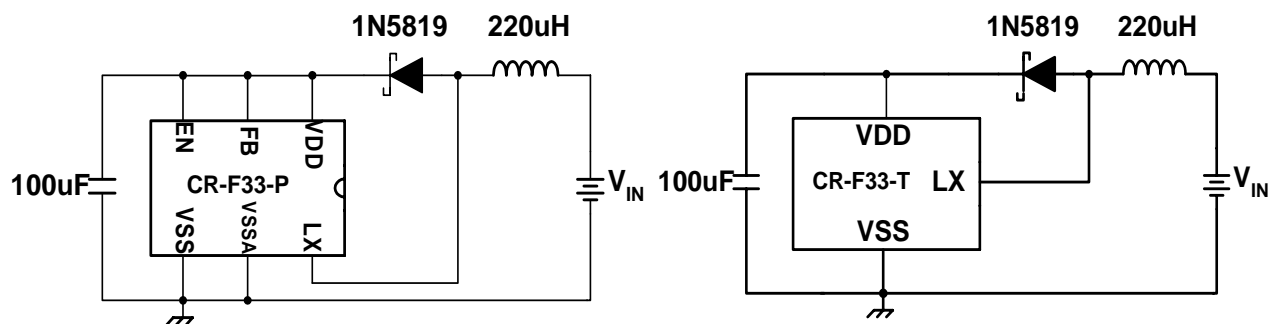
Step-up  
**Package**  
**P: SOP-8**  
**T: SOT-89-3**  
**Output Voltage**  
**33 : 3.3V**



**PIN DESCRIPTION**

Pin No.	Pin Name	Pin Function
1	VDD	Output voltage pin and also power supply pin for the device
2	FB	The pin of feedback voltage
3	EN	Chip enable pin
4	NC	No internal connection to this pin
5	NC	No internal connection to this pin
6	VSS	Ground pin
7	VSSA	Ground pin
8	LX	Switch pin, connected to inductor/diode

**STEP-UP CONVERTER APPLICATION**



**Absolute Maximum Ratings**

- Supply Voltage----- 0.3V to 7V
- Input Voltage----- 0.3V to  $V_{DD}+0.3$
- Operating Temperature Range----- 0 ° C to 50 ° C
- Storage Temperature Range----- 40 ° C to 150 ° C

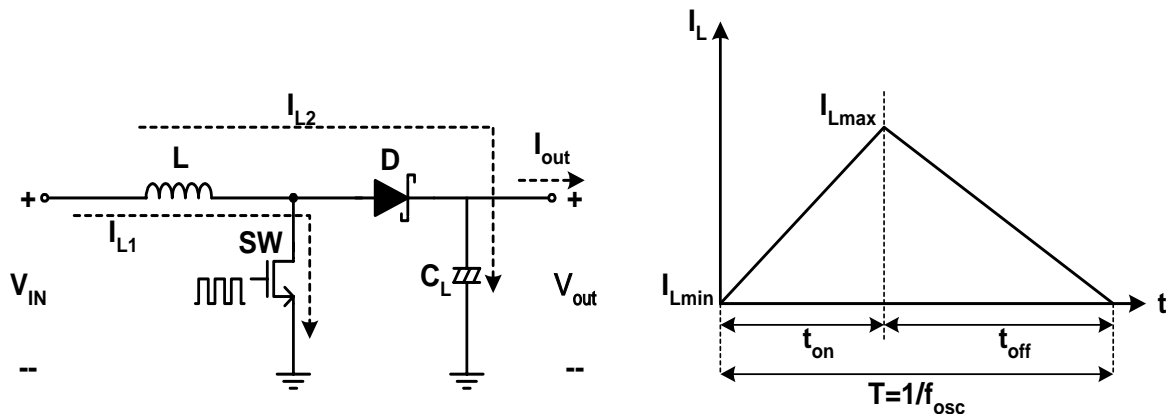


**Electrical Characteristics**

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Start-Up Voltage	$V_{ST}$	$I_{load} = 1mA$		0.9	1	V
Holding Voltage	$V_{Hold}$	$I_{load} = 1mA$	0.45			V
Input Voltage	$V_{IN}$	No Load	1		3.5	V
Output Voltage	$V_{DD}$		3	3.3	3.6	V
No-Load Input Current	$I_{IN}$	No Load		8	14	$\mu A$
Standby Current	$I_{SB}$	$V_{EN} = 0$			2	$\mu A$
Input Low Voltage	$V_{IL}$	Enable/Disable Pin	0		0.4	V
Input High Voltage	$V_{IH}$	Enable/Disable Pin	1		$V_{DD}$	V
Oscillator Frequency	Fosc			150		KHz
Efficiency		$V_{IN} = 1.5V, I_{load} = 10mA$		83		%

**OPERATION OF STEP-UP CONVERTER**

A step-up converter diagram is illustrated below. In the diagram, the converter can generate a fixed, higher voltage from a lower one. When SW stays ON,  $I_{L1}$  flows through L, and the converter converts the electric energy into the magnetic one and stores it in L, in which  $I_{max}$  is proportional to  $t_{on}$ ; when SW lies OFF, Shottky diode is forced to be ON, while the energy stored in inductor L be discharged into capacitor, thereby charging the output voltage to a value expected.



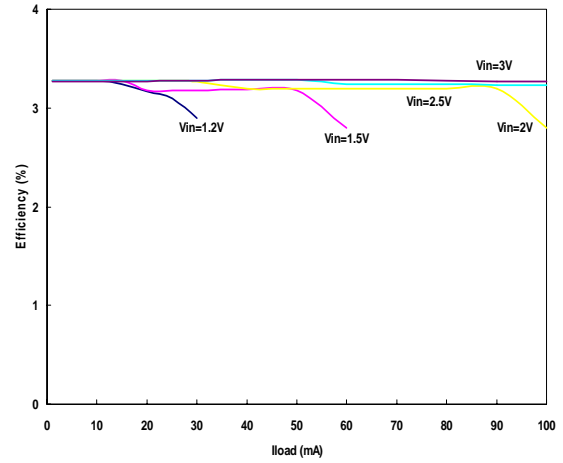
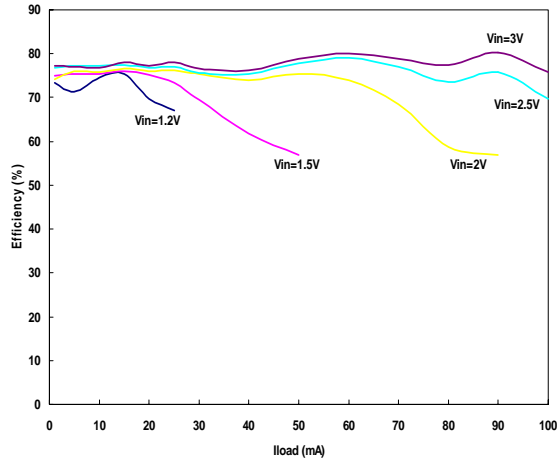


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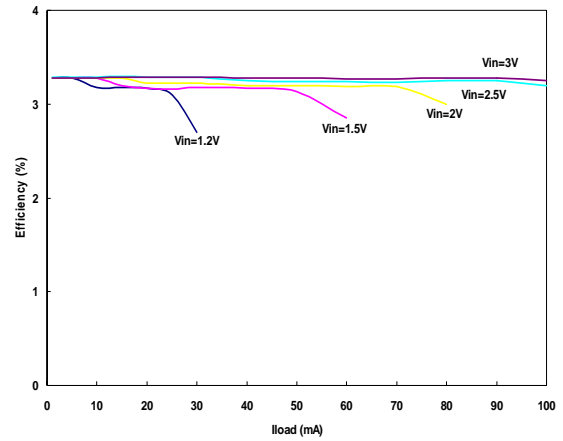
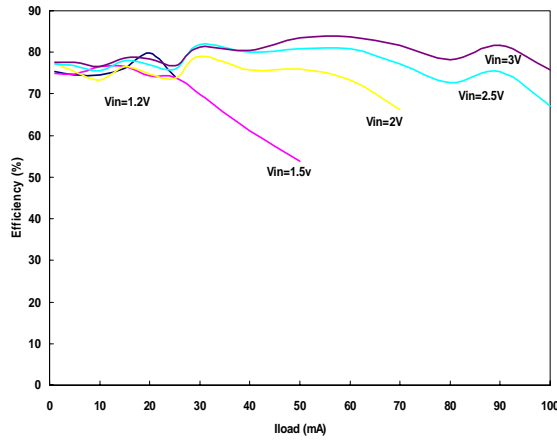
# CR-F33T PFM STEP-UP DC/DC CONVERTER

## TYPICAL PERFORMANCE CHARACTERISTICS

◆  $L=47\mu\text{H}$ ;  $C=100\mu\text{F}$



◆  $L=100\mu\text{H}$ ;  $C=100\mu\text{F}$

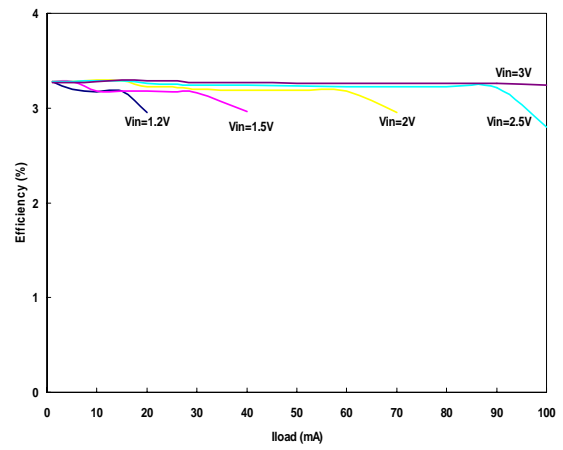
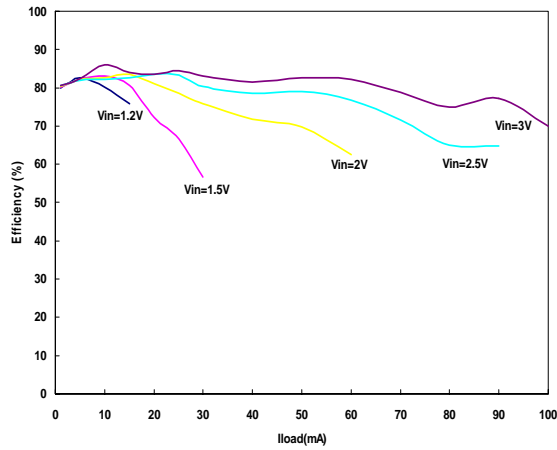




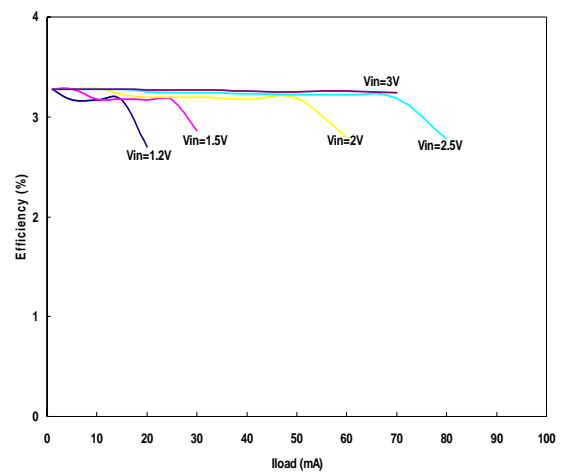
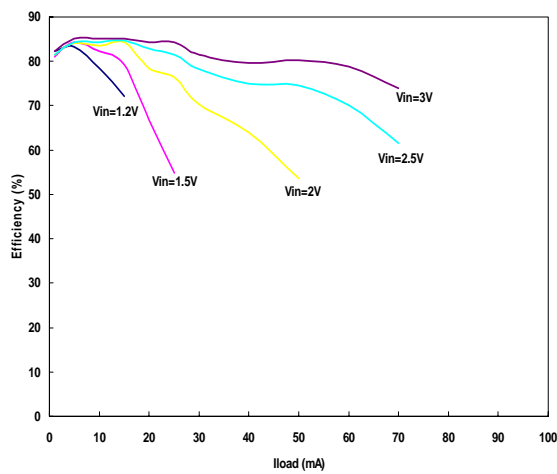
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# CR-F33T PFM STEP-UP DC/DC CONVERTER

## ◆ L=150uH; C=100uF

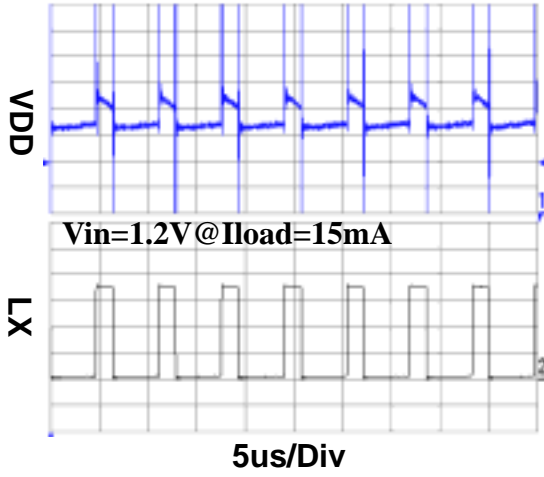


## ◆ L=220uH; C=100uF

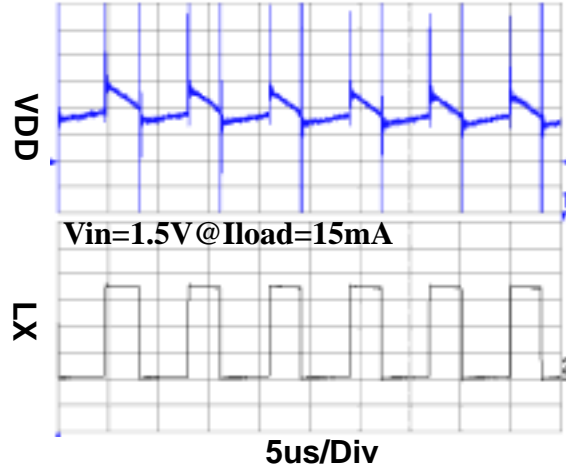




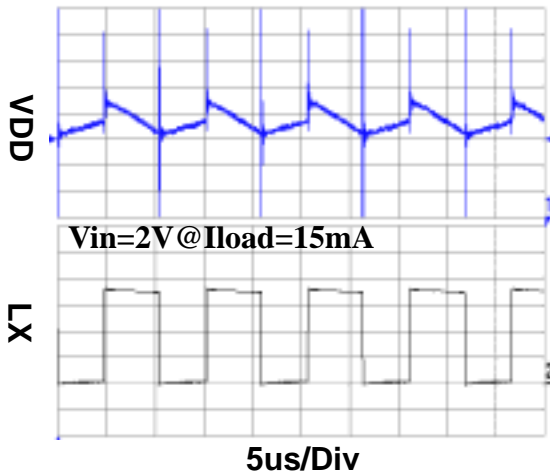
LX Pin Waveform & VDD



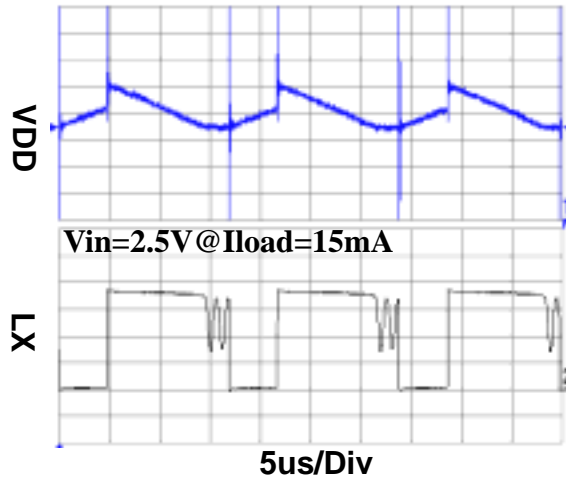
LX Pin Waveform & VDD



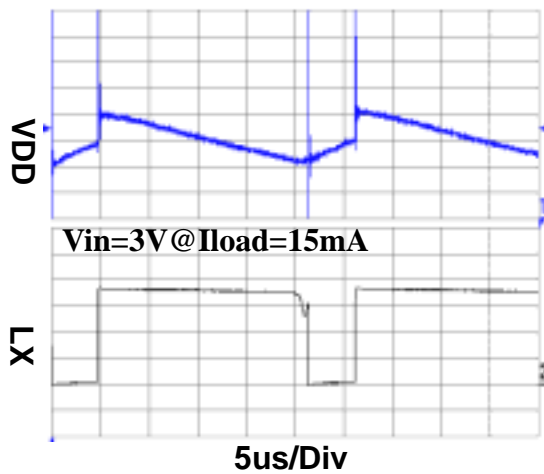
LX Pin Waveform & VDD



LX Pin Waveform & VDD



LX Pin Waveform & VDD





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## CR-F33T PFM STEP-UP DC/DC CONVERTER

The magnitude of inductor will influence the performance of DC/DC converter. The following table guides users to select the suitable magnitude of inductor for single- or dual-cell battery operation when the output terminal connects to different current load. Consequently, users can obtain a cell battery with longer life.

Current Load (mA)	1-cell battery	2-cell battery
$I_{load} < 10$	220uH	220uH
$10 < I_{load} < 20$	150uH	220uH
$20 < I_{load} < 30$	47uH	220uH
$30 < I_{load} < 40$	47uH	150uH
$40 < I_{load} < 50$	47uH	150uH
$50 < I_{load} < 60$	/	100uH
$70 < I_{load} < 80$	/	47uH
$80 < I_{load} < 90$	/	47uH
$90 < I_{load} < 100$	/	47uH

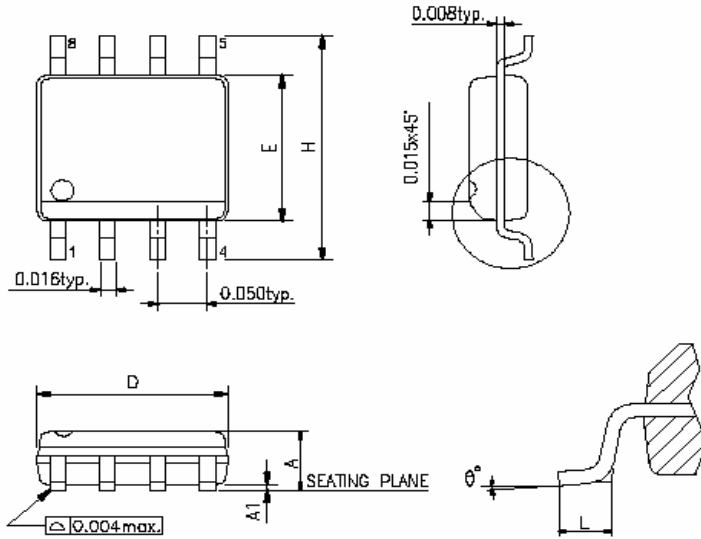


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## PACKAGE INFORMATION



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
$\theta$	0	8

UNIT : INCH

**NOTES:**

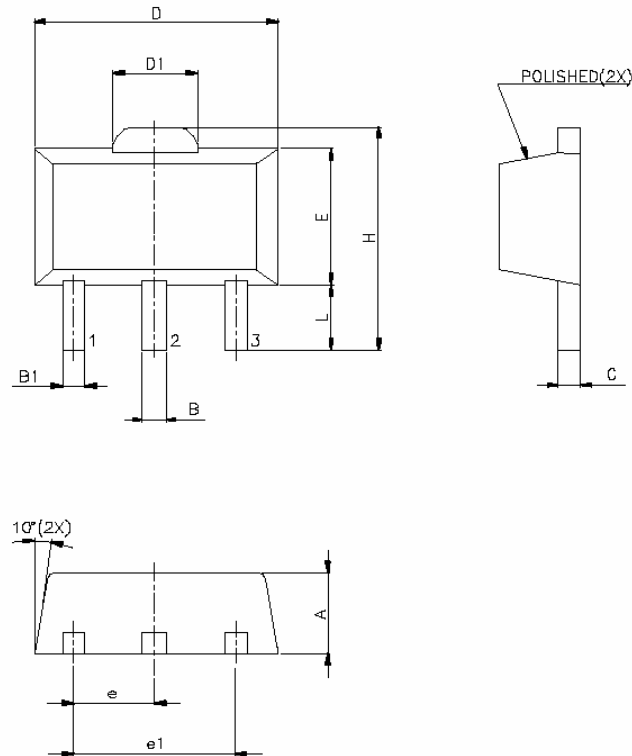
1. JEDEC OUTLINE : MS-012 AA
2. DIMENSIONS "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED .15mm (.006in) PER SIDE.
3. DIMENSIONS "E" DOES NOT INCLUDE INTER-LEAD FLASH, OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED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





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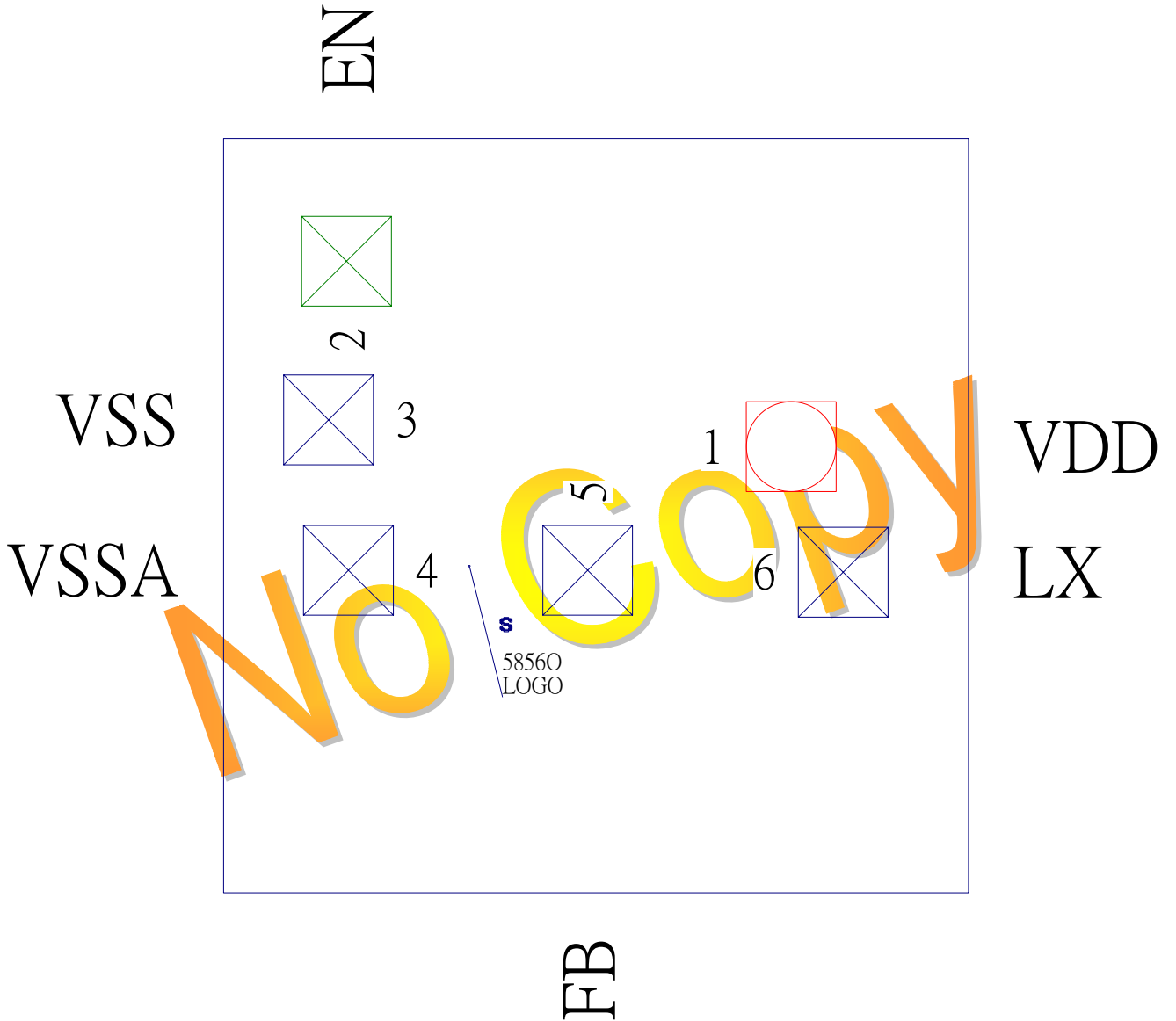
SYMBOLS	MIN.	MAX.
A	1.40	1.60
B	0.44	0.56
B1	0.36	0.48
C	0.35	0.44
D	4.40	4.60
D1	1.35	1.83
E	2.29	2.60
H	3.94	4.25
e	1.50 BSC	
e1	3.00 BSC	
L	0.89	1.2

UNIT : mm

### NOTES:

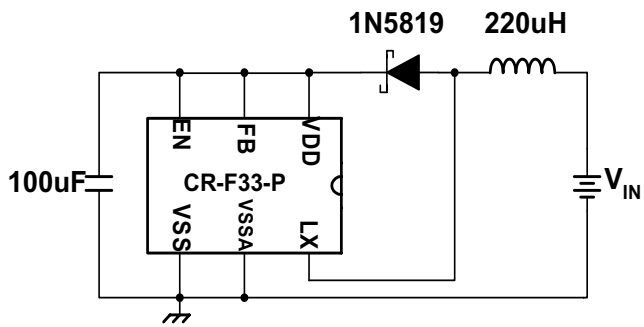
1. JEDEC OUTLINE : TO-243 AA
2. DIMENSION B1, 2 PLACES.

# KS5856AO Pattern Diagram

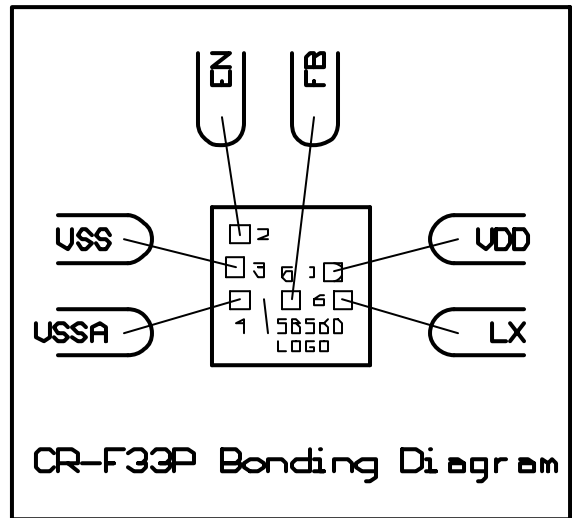


Main Pattern Size : 602.000 × 610.000 $\mu$ m
Date : 2004.01.15
Remark : IC substrate connect to <input type="checkbox"/> VSS/GND <input type="checkbox"/> VDD or <input type="checkbox"/> Floating

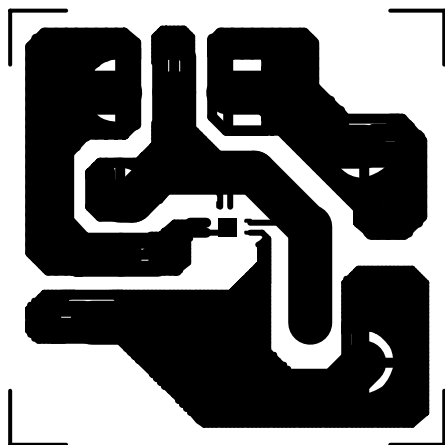
### 1. Step-up converter application



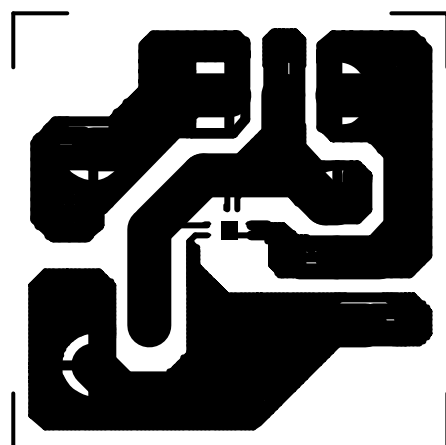
### 2. Bonding Diagram



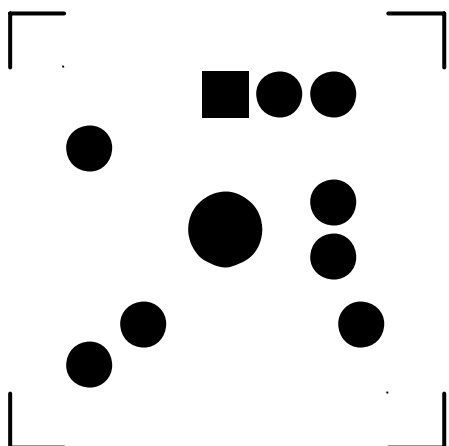
### 3. PCB layout for reference only



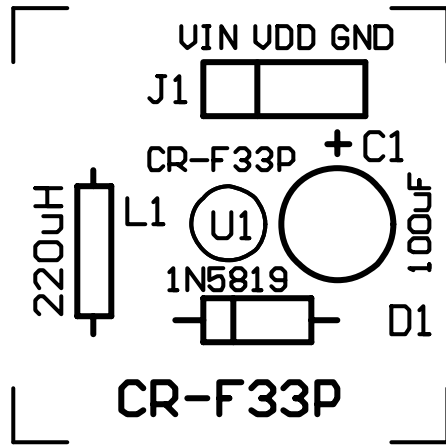
Bottom Layer



Bottom Layer



Bottom Solder



CR-F33P  
Top Overlay