ML63S Series DC-DC Converter

❖ Application

◆ *Power Source of Portable Products*
◆ *Palmtops*
◆ *Portable Cameras and Video Recorders*
◆ *Wireless mouse and keyboard*

❖ Ordering Information

ML63S xxxxxx
        ↑ ↑↑ ↑↑↑
        a b cde

Designator	Description
a	**Version**

b	**Output Voltage**
	eg. 30=3.0V
	      33=3.3V
	      50=5.0V

c	**Package Type** P = SOT-89 M = SOT-23 T = TO-92

d	**Device Orientation**
	R = Embossed Tape
	     (Orientation of Device : Right)
	L = Embossed Tape
	     (Orientation of Device : Left)
	B = Bag (TO-92)

e	G = Lead Free Part

❖ Features

● Small number of external components: inductor, diode and capacitor.
● Ultra low input current : Typical   7 uA
● Output Voltage Accuracy : +/- 2.5 %
● Low ripple and noise
● Low startup voltage : Max 0.9V (with 1mA input)
● High Efficiency: Typical 85%
● Package Available:
   SOT- 89 (500mW), SOT-23 (150mW) & TO - 92 (300mW)

❖ General Description

The ML63S is a group of PFM Step-up DC/DC converter IC with low supply current by CMOS process.

It consists of an oscillator, a PFM control circuit, a Lx switch driver transistor, a reference voltage unit, an error amplifier for voltage detection and a Lx switch protection circuit. It is suitable for use with battery-powered instruments with low noise and low supply current.

ML63S Version	Package Designator	Package	Switching Transistor	CE Function	VDD Pin	FB Pin	Features
ML63SA	M	SOT23-3	Build-in Transistor	No	No	No	Lx
	P	SOT89-3					
	T	TO-92					
ML63SB	M	SOT23-3	External Transistor	No	No	No	Ext
	P	SOT89-3					
	T	TO-92					
ML63SC	M	SOT23-5	Build-in Transistor	Yes	No	No	Lx+CE
	P	SOT89-5					
ML63SD	M	SOT23-5	External Transistor	Yes	No	No	Ext+CE
	P	SOT89-5					
ML63SE	M	SOT23-5	Build-in Transistor	No	Yes	No	Lx+VDD
	P	SOT89-5					
ML63SF	M	SOT23-5	Build-in Transistor	No	Yes	Yes	FB
	P	SOT89-5					

❖ *Marking*

SOT23:

ML63SA Series

Part No.	Marking	Description
ML63SA30MRG	7BXX	
ML63SA33MRG	77XX	XX = Production Date
ML63SA36MRG	74XX	Code
ML63SA45MRG	7KXX	e.g. B2
ML63SA50MRG	70XX	

ML63SC Series

Part No.	Marking	Description
ML63SC30MRG	7EXX	
ML63SC33MRG	7AXX	XX = Production Date
ML63SC36MRG	7HXX	Code
ML63SC45MRG	7SXX	e.g. B2
ML63SC50MRG	73XX	
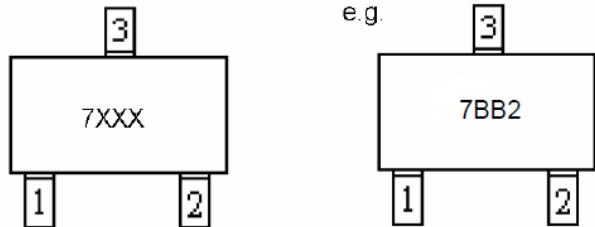
SOT89:

ML63SA and ML63SB Series

| Designator	Description
1,2	Year Code e.g. 05 = Year 2005
3,4	Week Code e.g. 30 = Week 30
5,6	Output Voltage e.g. 30 = 3.0V
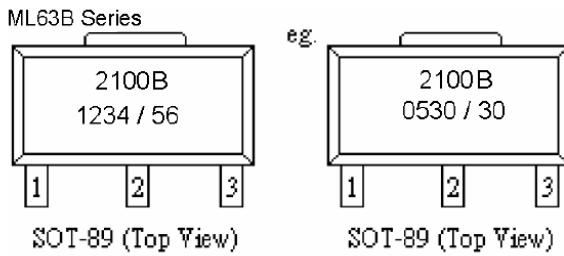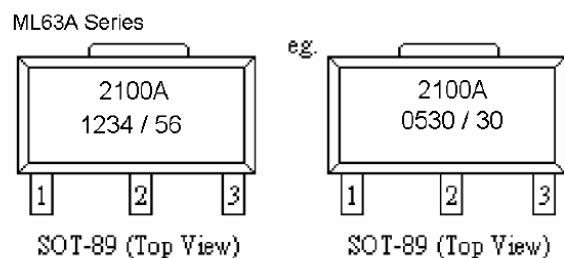
❖ *ML63SA*

◆ *Pin Configuration*
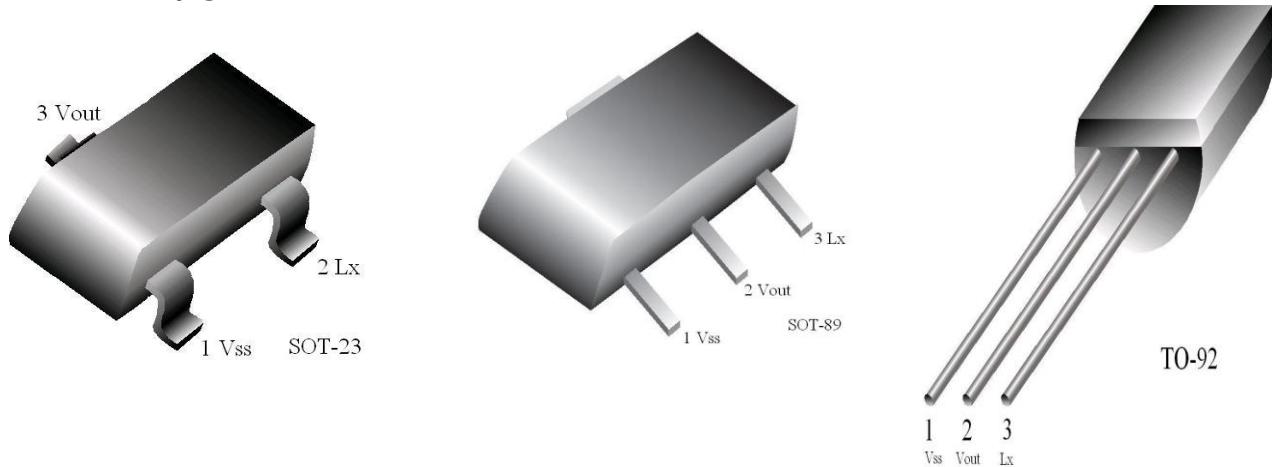
| Package Pin Number			Pin Name	Function
SOT23-3	**SOT89-3**	**TO-92**		
1	1	1	V_{SS}	Ground
3	2	2	V_{OUT}	Output Voltage monitor, Internal IC Power Supply
2	3	3	L_X	Switch

◆ *Block Diagram*
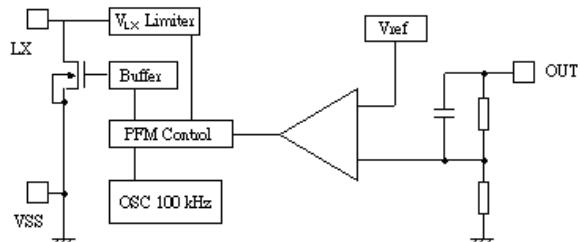
◆ *Typical Applications*
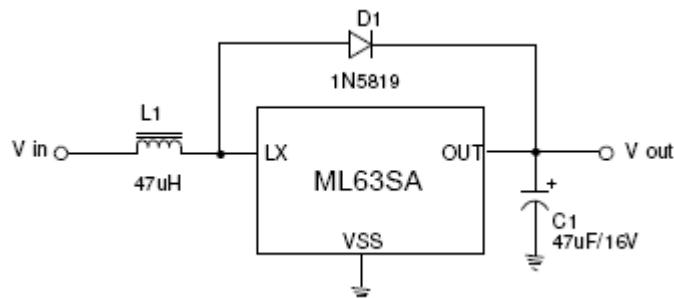
❖ *ML63SB*

◆ *Pin Configuration*
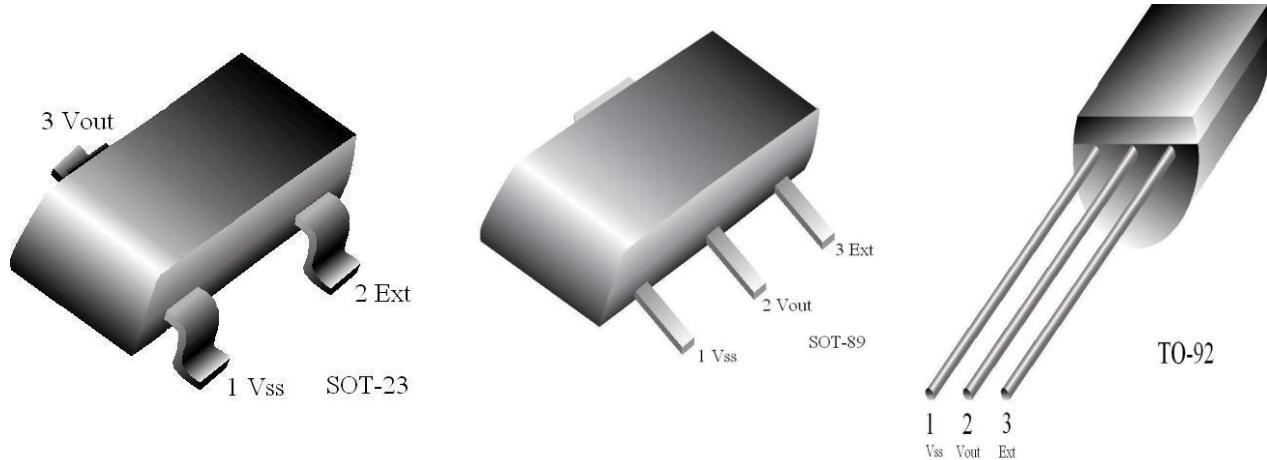
Package Pin Number			Pin Name	Function
SOT23-3	SOT89-3	TO-92		
1	1	1	V_{SS}	Ground
3	2	2	V_{OUT}	Output Voltage monitor, Internal IC Power Supply
2	3	3	EXT	External Switch Transistor Drive

◆ *Block Diagram*
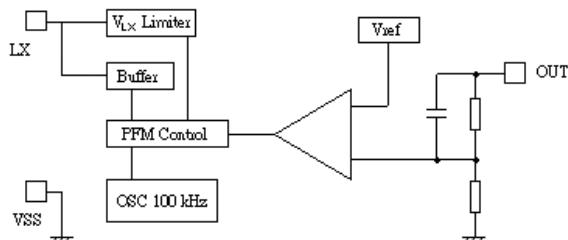
◆ *Typical Applications*
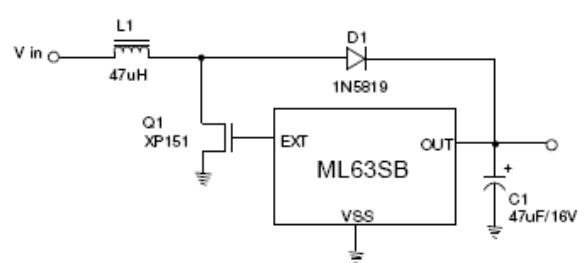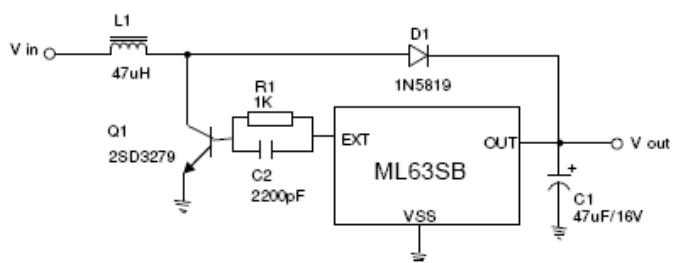
❖ *ML63SC*

◆ *Pin Configuration*
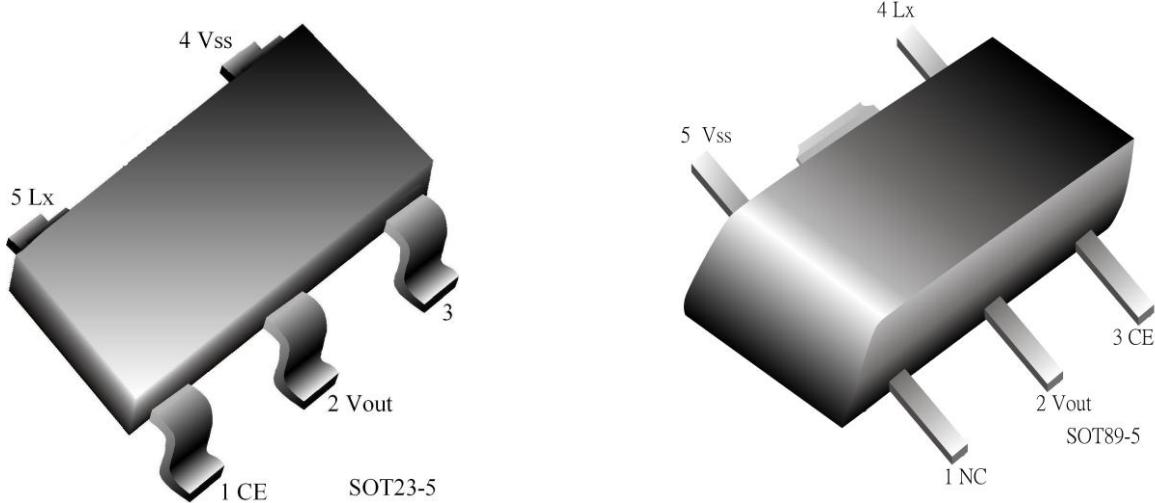
Package Pin Number		Pin Name	Function
SOT23-5	SOT89-5		
4	5	V_{SS}	Ground
2	2	V_{OUT}	Output Voltage monitor, Internal IC Power Supply
5	4	Lx	Switch
1	3	CE	Chip Enable
3	1	NC	NC

◆ *Block Diagram*
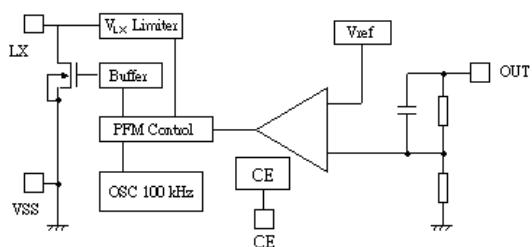
◆ *Typical Applications*
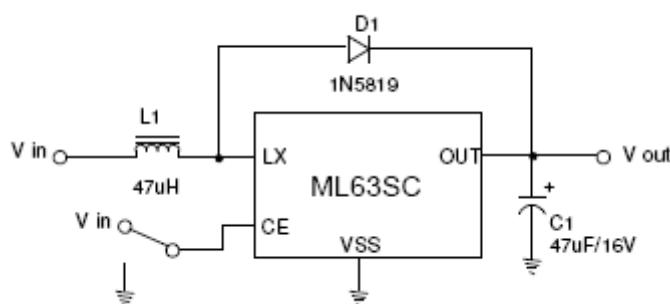
❖ *ML63SD*

◆ *Pin Configuration*
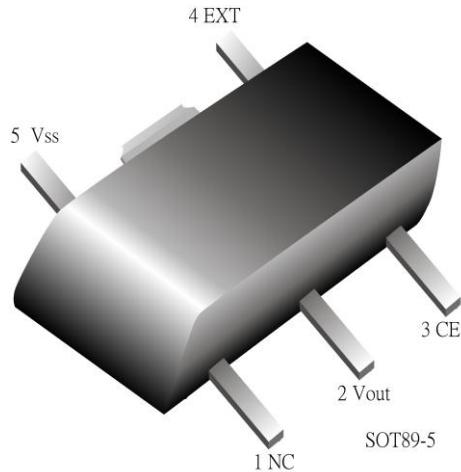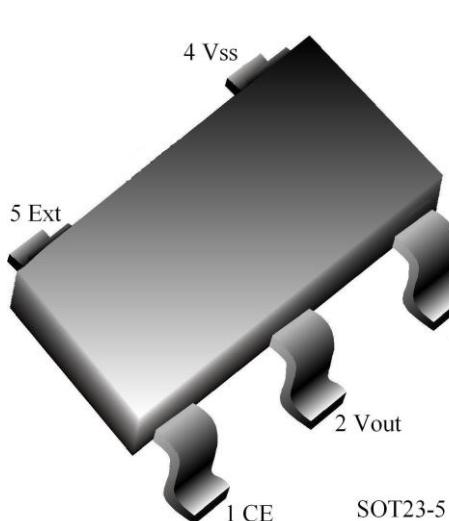
4 Vss

5 Ext

3

2 Vout

1 CE

SOT23-5

4 EXT

5 Vss

3 CE

2 Vout

1 NC

SOT89-5

Package Pin Number		Pin Name	Function
SOT23-5	SOT89-5		
4	5	V_{SS}	Ground
2	2	V_{OUT}	Output Voltage monitor, Internal IC Power Supply
5	4	EXT	External Switch Transistor Drive
1	3	CE	Chip Enable
3	1	NC	NC

◆ *Block Diagram*

LX

V_{LX} Limiter

Buffer

PFM Control

OSC 100 kHz

VSS

CE

CE

V_{ref}

OUT

◆ *Typical Applications*

V in

L1
47uH

Q1
2SD3279

R1
1K

C2
2200pF

V in

D1
1N5819

EXT

ML63SD

OUT

CE

VSS

V out

C1
47uF/16V

V in

L1
47uH

Q1
XP151

V in

D1
1N5819

EXT

ML63SD

OUT

CE

VSS

V out

C1
47uF/16V
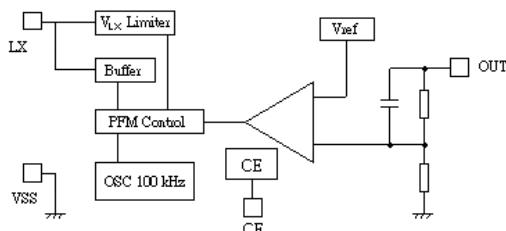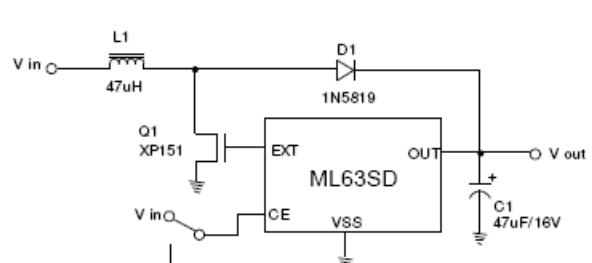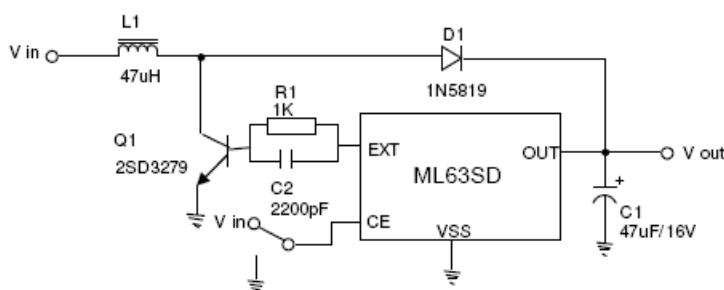
❖ *ML63SE*

◆ *Pin Configuration*
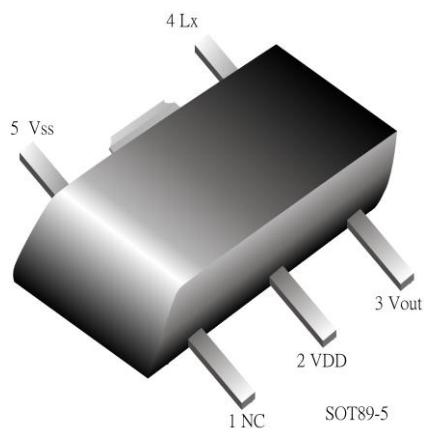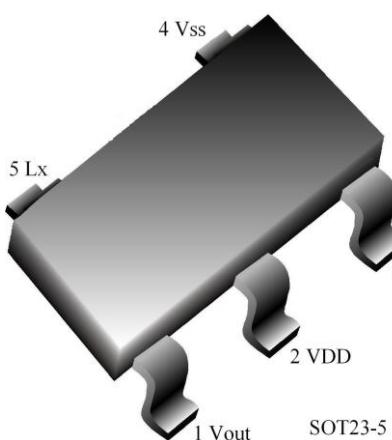
Package Pin Number		Pin Name	Function
SOT23-5	**SOT89-5**		
4	5	V_{SS}	Ground
2	2	V_{DD}	Power Supply
5	4	Lx	Switch
1	3	V_{OUT}	Output Voltage Monitor
3	1	NC	NC

◆ *Block Diagram*
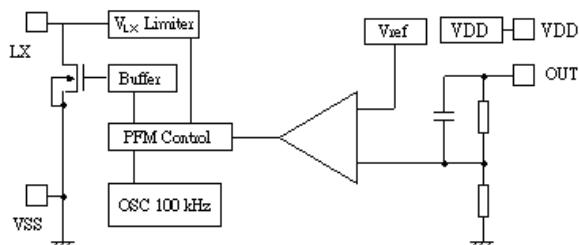

◆ *Typical Applications*
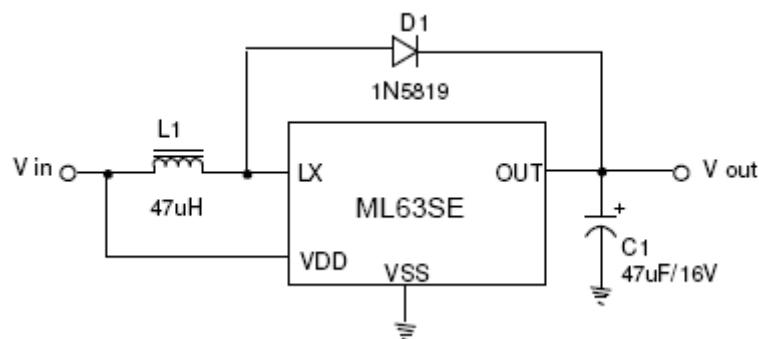
❖ *ML63SF*

◆ *Pin Configuration*
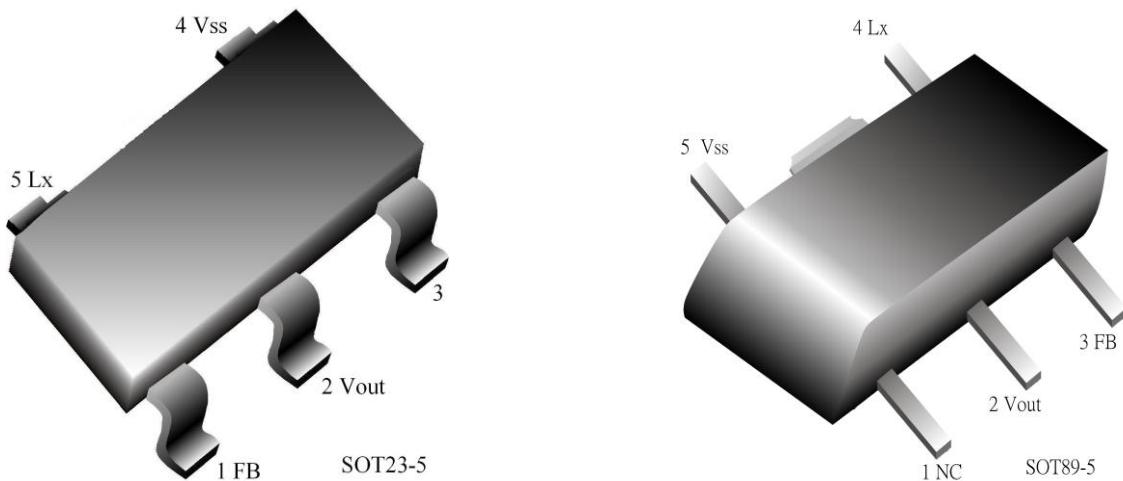
SOT23-5

SOT89-5

Package Pin Number		Pin Name	Function
SOT23-5	SOT89-5		
4	5	V_{SS}	Ground
2	2	V_{OUT}	Power Supply
5	4	Lx	Switch
1	3	FB	Feedback
3	1	NC	NC

◆ *Block Diagram*

◆ *Typical Applications*

MiniLogic Device Corporation
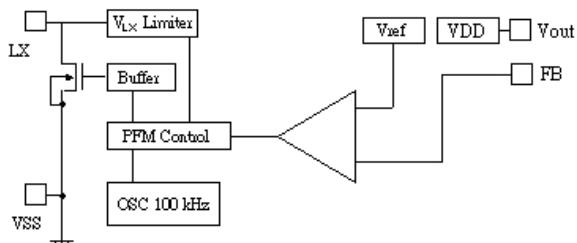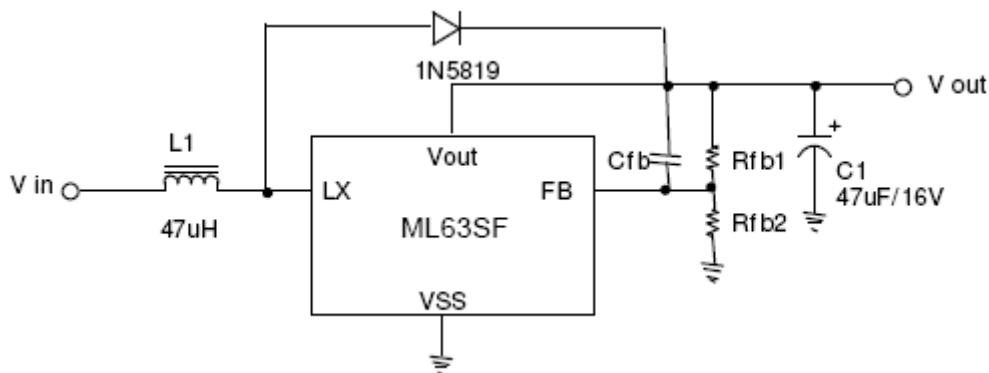
❖ *Absolute Maximum Ratings*

Parameter	Symbol	Ratings	Units
Input Voltage	V_{IN}	6.5	V
V_{DD} Input Voltage	V_{DD}	6.5	V
Lx Pin Voltage	V_{LX}	6.5	V
EXT Pin Voltage	V_{EXT}	$-0.3 \sim V_{OUT} + 0.3$	V
CE Pin Voltage	VCE	$-0.3 \sim V_{OUT} + 0.3$	V
Lx Pin Current	I_{LX}	600	mA
EXT Pin Current	I_{EXT}	± 30	mA
Continuous Total Power Dissipation	SOT-89	500	
	TO-92 Pd	300	mW
	SOT-23	150	
Operating Ambient Temperature	Topr	$-25 \sim +85$	^{o}C
Storage Temperature	Tstg	$-40 \sim +125$	^{o}C

❖ *Electrical Characteristics*

$V_{IN} = V_{OUT} * 0.6$, $V_{SS} = 0V$, $I_{OUT} = 10mA$, $T_a = 25\,^{o}C$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V_{OUT}		Vout * 0.975	Vout	Vout * 1.025	V
Input Voltage	V_{IN}				6.5	V
Startup Voltage	V_{START}	$I_{OUT} = 1mA$, V_{IN}: 0→2V		0.8	0.9	V
Hold-on Voltage	V_{HOLD}	$I_{OUT} = 1mA$, V_{IN}: 2→0V			0.8	V
Supply Current 1	I_{DD1}	No external component, $V_{IN} = V_{OUT} * 0.95$		35		uA
Supply Current 2	I_{DD2}	$V_{IN} = V_{IN} + 0.5V$		7		uA
Lx Switching Current	I_{LX}	$V_{LX} = 0.4V$, $V_{IN} = V_{OUT} * 0.95$		150		mA
Lx Leakage Current	I_{LXLEAK}	$V_{IN} = V_{LX} = 6.0V$			0.5	uA
CE "High" Voltage	V_{CEH}	$V_{IN} = V_{OUT} * 0.95$	0.9			V
CE "Low" Voltage	V_{CEL}	$V_{IN} = V_{OUT} * 0.95$			0.3	V
CE "High" Current	I_{CEH}	$V_{OUT} = 6.0V$, $V_{CE} = 6.0V$	-0.5		0.5	uA
CE "Low" Current	I_{CEL}	$V_{OUT} = 6.0V$, $V_{CE} = 0.0V$	-0.5		0.5	uA
Oscillator Frequency	F_{OSC}			100		KHz
Duty Cycle	MAXDTY			78		%
Efficiency	EFF			85		%

Note : 1. Schottky diode: 1N5817 or 1N5819 (forward voltage drop : 0.2V)

2. Inductor : 47uH (ESR < 0.1Ω)

3. Capacitor : Tantalum type, 47 uF

Rev. D, August 2011

❖ *Electrical Characteristics*

V_{IN} = 1.6V, I_{OUT} = 10mA, Ta = 25 °C, unless otherwise provided.
ML63SA27 V_{OUT} = 2.7V

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V_{OUT}		2.633	2.700	2.767	V
Input Voltage	V_{IN}				6.5	V
Startup Voltage	V_{START}	I_{OUT} = 1mA		0.8	0.9	V
Hold-on Voltage	V_{HOLD}	I_{OUT} = 1mA			0.8	V
Supply Current 1	I_{DD1}	V_{IN} = 2.57V		35		uA
Supply Current 2	I_{DD2}	V_{IN} = 2.75V		7		uA
Lx Switching Current	I_{LX}	V_{LX}=0.4V, V_{IN}=2.57V		100		mA
Lx Leakage Current	I_{LXLEAK}	V_{IN}=6.0V, V_{LX}=6.0V			0.5	uA
Oscillator Frequency	F_{OSC}			100		KHz
Oscillator Duty Cycle	MAXDTY			78		%
Efficiency	EFF			85		%

V_{IN} = 1.8V, I_{OUT} = 10mA, Ta = 25 °C, unless otherwise provided.
ML63SA30 V_{OUT} = 3.0V

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V_{OUT}		2.925	3.000	3.075	V
Input Voltage	V_{IN}				6.5	V
Startup Voltage	V_{START}	I_{OUT} = 1mA		0.8	0.9	V
Hold-on Voltage	V_{HOLD}	I_{OUT} = 1mA			0.8	V
Supply Current 1	I_{DD1}	V_{IN} = 2.85V		35		uA
Supply Current 2	I_{DD2}	V_{IN} = 3.05V		7		uA
Lx Switching Current	I_{LX}	V_{LX}=0.4V, V_{IN}=2.85V		150		mA
Lx Leakage Current	I_{LXLEAK}	V_{IN}=6.0V, V_{LX}=6.0V			0.5	uA
Oscillator Frequency	F_{OSC}			100		KHz
Oscillator Duty Cycle	MAXDTY			78		%
Efficiency	EFF			85		%

V_{IN} = 2.0V, I_{OUT} = 10mA, Ta = 25 °C, unless otherwise provided.
ML63SA33 V_{OUT} = 3.3V

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V_{OUT}		3.218	3.300	3.383	V
Input Voltage	V_{IN}				6.5	V
Startup Voltage	V_{START}	I_{OUT} = 1mA		0.8	0.9	V
Hold-on Voltage	V_{HOLD}	I_{OUT} = 1mA			0.8	V
Supply Current 1	I_{DD1}	V_{IN} = 3.135V		35		uA
Supply Current 2	I_{DD2}	V_{IN} = 3.35V		7		uA
Lx Switching Current	I_{LX}	V_{LX}=0.4V, V_{IN}=3.135V		180		mA
Lx Leakage Current	I_{LXLEAK}	V_{IN}=6.0V, V_{LX}=6.0V			0.5	uA
Oscillator Frequency	F_{OSC}			100		KHz
Oscillator Duty Cycle	MAXDTY			78		%
Efficiency	EFF			85		%

V_{IN} = 3.0V, I_{OUT} = 10mA, Ta = 25 °C, unless otherwise provided.
ML63SA50 V_{OUT} = 5.0V

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V_{OUT}		4.875	5.000	5.125	V
Input Voltage	V_{IN}				6.5	V
Startup Voltage	V_{START}	I_{OUT} = 1mA		0.8	0.9	V
Hold-on Voltage	V_{HOLD}	I_{OUT} = 1mA			0.8	V
Supply Current 1	I_{DD1}	V_{IN} = 4.75V		60		uA
Supply Current 2	I_{DD2}	V_{IN} = 5.05V		7		uA
Lx Switching Current	I_{LX}	V_{LX}=0.4V, V_{IN}= 4.75V		210		mA
Lx Leakage Current	I_{LXLEAK}	V_{IN}=6.0V, V_{LX}=6.0V			0.5	uA
Oscillator Frequency	F_{OSC}			100		KHz
Oscillator Duty Cycle	MAXDTY			78		%
Efficiency	EFF			85		%

❖ *Application Notes*

1. It is recommended to use capacitor with a capacity of 10uF or more for good frequency characteristics, otherwise it will lead to high output ripple. Tantalum type capacitor is recommended. As there may be the case where a spike-shaped high voltage is generated by the inductor when Lx transistor is turned off, the operating voltage of capacitor should be at least three times of the output set voltage so as to avoid over-voltage damage.

2. It is recommended to use inductor has sufficiently small d.c. resistance, large allowable current and hardly reaches magnetic saturation. When the inductance of inductor is small, there may be the case that the inductor current exceeds the absolute maximum ratings at the maximum load condition.

3. It is recommended to place external components as close as possible to the DC/DC converter so as to minimize the interconnection parasitic between components and DC/DC converter, especially for the capacitor connected to V_{OUT} pin. It is recommended to place 0.1uF ceramic capacitor between V_{OUT} pin and V_{SS} pin.

4. It is recommended to provide sufficient grounding for V_{SS} pin. This will help to stable the zero level within DC/DC converter induced by the switching current level variation during operation. And the insufficient grounding may result in unstable operation of DC/DC converter.