XC9250/XC9251 Series

30V Driver Transistor Built-In Step-Down DC/DC Converters

■GENERAL DESCRIPTION

The XC9250/XC9251 series are 30V operation step-down DC/DC converter ICs with an internal driver transistor. The internal Nch driver transistor is driven by bootstrap to achieve a stable, high-efficiency power supply up to an output current of 2.0A. Low ESR capacitors such as ceramic capacitors can be used for the load capacitor (C_L).

A 0.8V reference voltage source is incorporated in the IC, and the output voltage can be set to a value from 1.2V to 12.0V using external resistors (R_{FB1}, R_{FB2}).

300kHz or 500kHz can be selected for the switching frequency. The generation of unneeded noise can be suppressed by synchronizing to an external CLK in a range of ±25% of the free running frequency using the SYNC pin. In automatic PWM/PFM control, the IC operates by PFM control when the load is light to achieve high efficiency over the full load range from light to heavy.

The soft start time can be set as desired by adding an external capacitance to the SS pin.

With the built-in UVLO function, the driver transistor is forced OFF when input voltage becomes 4.5V or lower.

Internal protection circuits include over current protection, integral latch protection, short-circuit protection, and thermal shutdown circuits to enable safe use.

■APPLICATIONS

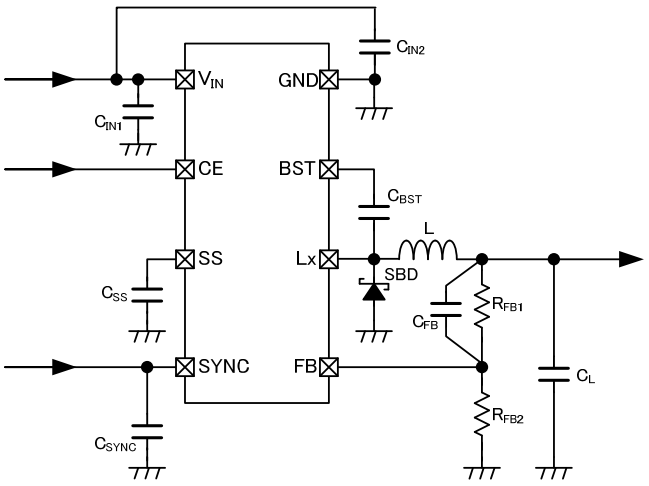
- Car navigation systems
- Car audios
- Industrial equipment

■FEATURES

Input Voltage	:	7～30V
FB Voltage	:	0.8V±2%
Oscillation Frequency	:	300kHz, 500kHz
Maximum Output Current	:	2.0A
Control Method	:	PWM (XC9250) PWM/PFM (XC9251)
Soft-start	:	External Capacitor (set by external capacitor C)
Protection Circuit	:	Over Current Protection 3.2A (TYP.) Integral Latch Method (XC9250/51A) Automatic Recovery (XC9250/51B) Thermal Shutdown
Low ESR Ceramic Capacitor	:	Ceramic Capacitor
Operating Ambient Temperature	:	-40℃ ~ +105℃
Package	:	SOP-8FD
Environmentally Friendly	:	EU RoHS Compliant, Pb Free

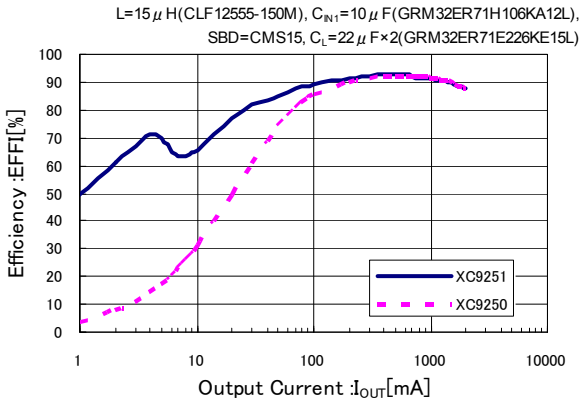
*Performance depends on external components and wiring on the PCB.

■TYPICAL APPLICATION CIRCUIT



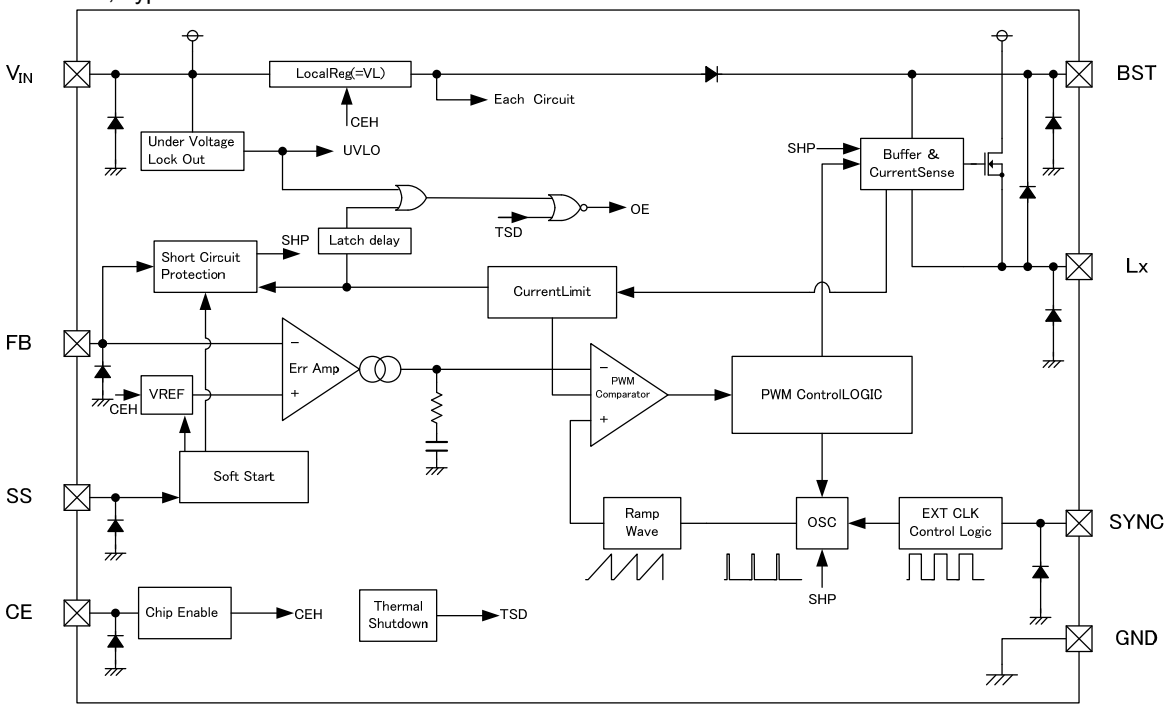
■TYPICAL PERFORMANCE CHARACTERISTICS

XC9250x085/XC9251x085
(V_{IN}=12V , V_{OUT}=5V)



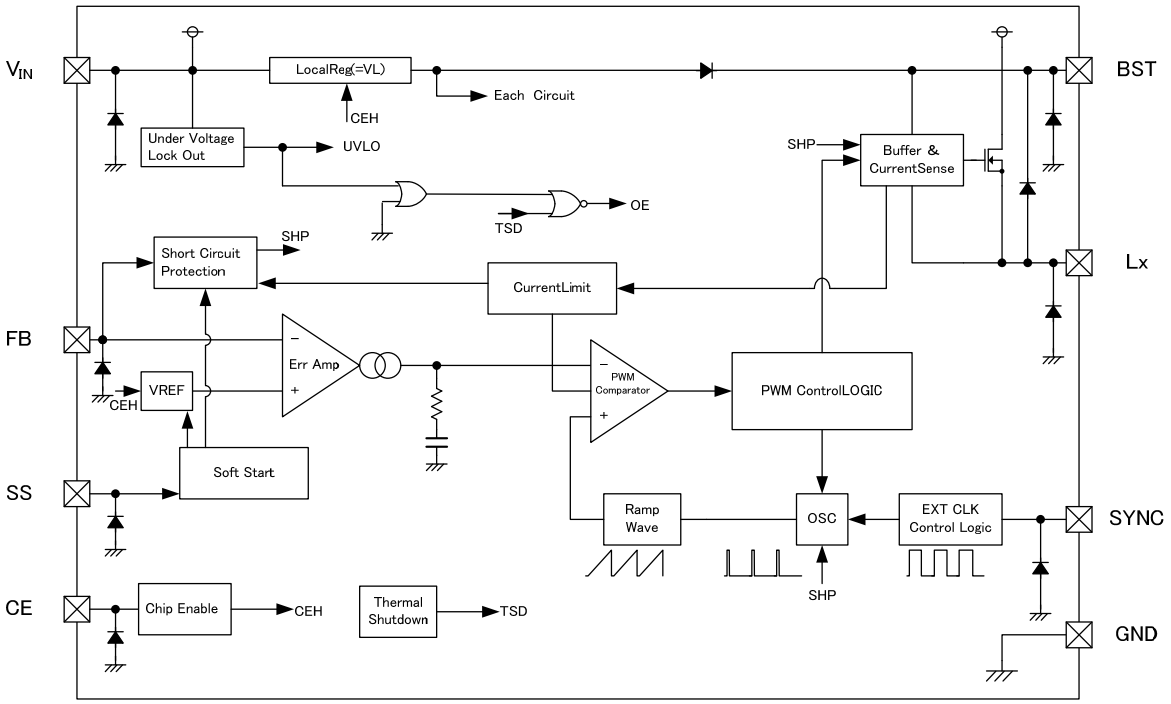
■BLOCK DIAGRAM

1) XC9250 Series, Type A



* Diodes inside the circuit are ESD protection diodes and parasitic diodes.

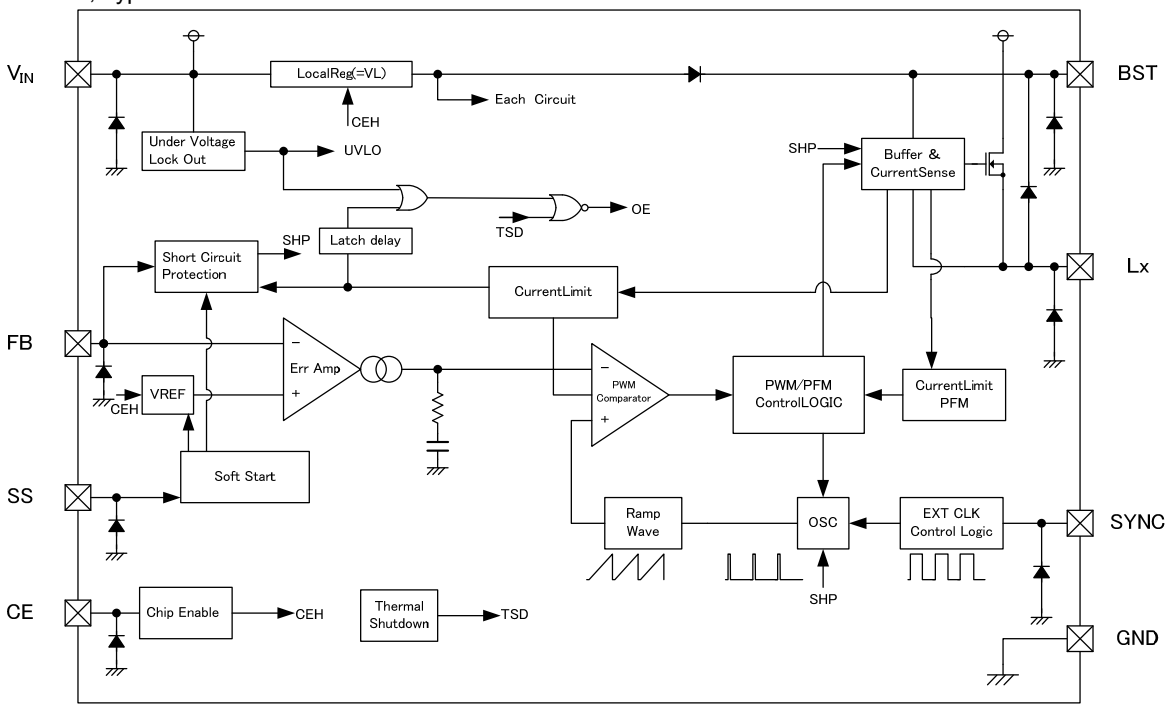
2) XC9250 Series, Type B



* Diodes inside the circuit are ESD protection diodes and parasitic diodes.

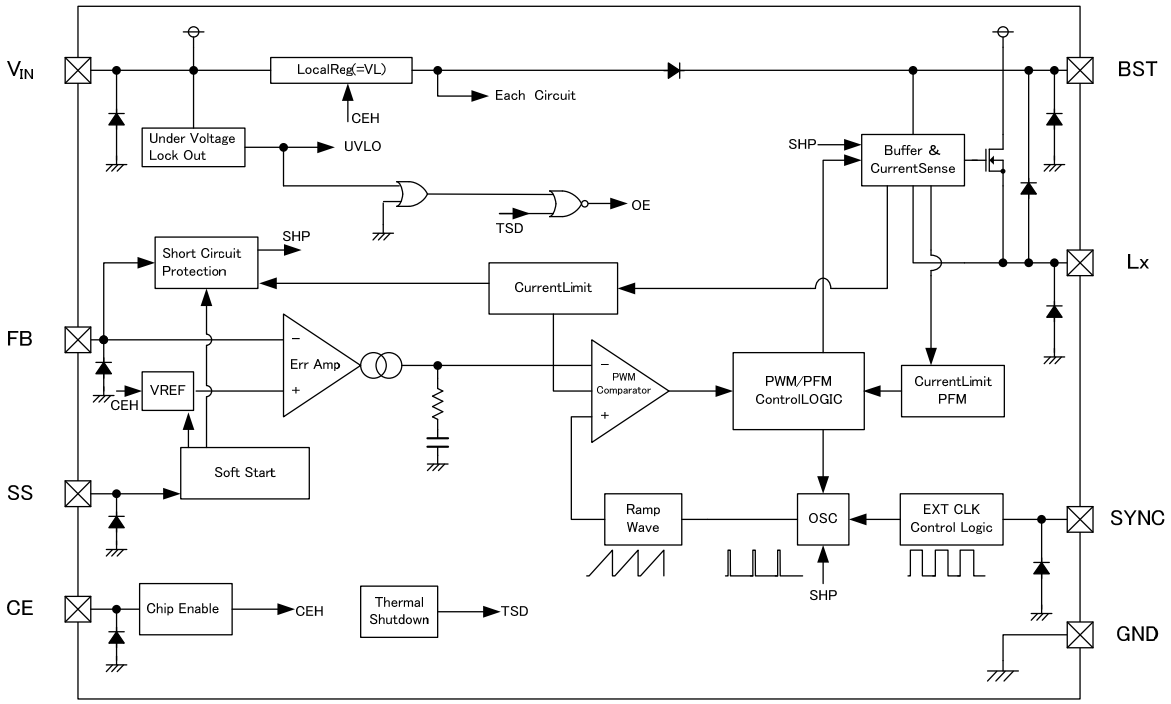
■BLOCK DIAGRAM (Continued)

3) XC9251 Series, Type A



* Diodes inside the circuit are ESD protection diodes and parasitic diodes.

4) XC9251 Series, Type B



* Diodes inside the circuit are ESD protection diodes and parasitic diodes.

■PRODUCT CLASSIFICATION

●Ordering Information

XC9250①②③④⑤⑥-⑦ PWM

XC9251①②③④⑤⑥-⑦ PWM/PFM Auto

DESIGNATOR	ITEM	SYMBOL	DESCRIPTION
①	Functional selection	A	Refer to Selection Guide
		B	
②③	Adjustable Output Voltage	08	Output voltage can be adjusted in 1.2V to 12V
④	Oscillation Frequency	3	300kHz
		5	500kHz
⑤⑥-⑦ (*1)	Package (Order Unit)	QR-G	SOP-8FD (1,000/Reel)

(*1) The "-G" suffix denotes Halogen and Antimony free as well as being fully RoHS compliant.

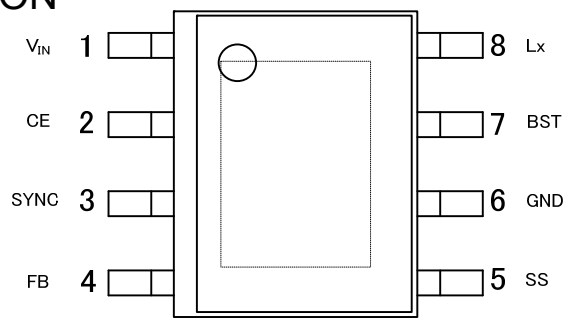
●Selection Guide

TYPE	CURRENT LIMITTER	LATCH PROTECTION	CHIP ENABLE	UVLO
A	YES	YES (*1)	YES	YES
B	YES	NO	YES	YES

TYPE	THERMAL SHUTDOWN	SOFT-START	SYNCHRONIZED with EXTERNAL CLOCK
A	YES	YES	YES
B	YES	YES	YES

(*1) The over-current protection latch is an integral latch type.

■PIN CONFIGURATION



SOP-8FD
(TOP VIEW)

* The dissipation pad for this IC should be solder-plated for mounting strength and heat dissipation. Please refer to the reference mount pattern and metal masking. The dissipation pad should be connected to the GND (No. 6) pin.

■PIN ASSIGNMENT

PIN NUMBER SOP-8FD	PIN NAME	FUNCTIONS
1	V_{IN}	Power Input
2	CE	Chip Enable
3	SYNC	External CLK Sync Pin
4	FB	Output Voltage Sense
5	SS	Soft-start Adjustment
6	GND	Ground
7	BST	Bootstrap
8	Lx	Switching Output

■FUNCTION

PIN NAME	SIGNAL	STATUS
CE	L	Stand-by
	H	Active
	OPEN	Undefined State (*1)
SYNC	L	Operates with internal clock frequency
	H	
	CLK	Synchronizes with External Clock Signal
	OPEN	Undefined State (*1)

(*1) Please do not leave the CE and SYNC pin open.

■ABSOLUTE MAXIMUM RATINGS

Ta=25℃

PARAMETER	SYMBOL	RATINGS	UNITS
V_{IN} Pin Voltage	V_{IN}	-0.3 ～ +36	V
BST Pin Voltage	V_{BST}	-0.3 or V_{LX}-0.3 (*1) ～ V_{LX}+6.5 or +36 (*2)	V
FB Pin Voltage	V_{FB}	-0.3 ～ +6.5	V
SYNC Pin Voltage	V_{SYNC}	-0.3 ～ +6.5	V
CE Pin Voltage	V_{CE}	-0.3 ～ +36	V
SS Pin Voltage	V_{CSS}	-0.3 ～ +6.5	V
Lx Pin Voltage	V_{Lx}	-0.3 ～ V_{IN}+0.3 or +36 (*3)	V
Lx Pin Current	I_{Lx}	4.2	A
Power Dissipation	Pd	300	mW
		1500 (PCB mounted)	
Surge Voltage	V_{SURGE}	46 (*4)	V
Operating Ambient Temperature	Topr	-40 ～ +105	℃
Storage Temperature	Tstg	-55 ～ +125	℃

* All voltages are described based on the GND pin.

(*1) The minimum value should be either -0.3 or V_{LX}-0.3 in the highest.

(*2) The maximum value should be either V_{LX}+6.5 or +36 in the lowest.

(*3) The maximum value should be either V_{IN}+0.3 or +36 in the lowest.

(*4) Applied Time≦400ms

■ELECTRICAL CHARACTERISTICS

●XC9250A/B083 Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
FB Voltage	V_{FB1}	V_{FB}=0.816V→0.784V, V_{SS}=6V, V_{FB} Voltage when Lx pin oscillates	0.784	0.8	0.816	V	③
FB Voltage Temperature Characteristics	$\Delta V_{FB}/(\Delta Topr \cdot V_{FB})$	-40℃≦Topr≦105℃	-	±50	-	ppm/℃	③
Output Voltage Setting Range	V_{OUTSET}	-	1.2 (*1)	-	12	V	-
Operating Voltage Range	V_{IN}	-	7	-	30	V	-
UVLO detect voltage	V_{UVLO1}	V_{IN}=4.9V→4.3V, V_{FB}=0.65V, V_{SS}=6V V_{IN} Voltage when Lx pin voltage changes from "H" level to "L" level	4.3	4.6	4.9	V	③
UVLO release voltage	V_{UVLO2}	V_{IN}=4.7V→5.3V, V_{FB}=0.65V, V_{SS}=6V V_{IN} Voltage when Lx pin voltage changes from "L" level to "H" level	4.7	5.0	5.3	V	③
Quiescent Current	I_q	V_{IN}=V_{CE}=30V, V_{FB}=0.95V	-	200	310	μA	④
Stand-by Current	I_{STB}	V_{IN}=30V, V_{CE}=0V, V_{SS}=0V, V_{SYNC}=0V	-	0.01	0.1	μA	④
Oscillation Frequency	f_{OSC}	Connected to external components, I_{OUT}=300mA	270	300	330	kHz	①
External Clock Signal Synchronized Frequency	SYNCOSC	Connected to external components, I_{OUT}=0mA	f_{OSC}x0.75	f_{OSC}	f_{OSC}x1.25	kHz	②
External Clock Signal Duty Cycle	D_{SYNC}	Connected to external components, I_{OUT}=0mA	25	-	75	%	②
Maximum Duty Cycle	D_{MAX}	V_{FB}=0.65V	83	85	88	%	③
Minimum Duty Cycle	D_{MIN}	V_{FB}=0.95V	-	-	0	%	③
Lx SW On Resistance	R_{Lx}	V_{FB}=0.65V, V_{SS}=6V	-	0.3	0.6	Ω	③
Current Limit (*2)	I_{LIM}	V_{FB}=0.65V, V_{SS}=6V	2.4	3.2	-	A	③
Latch Time	t_{LAT}	XC9250A series only Connected to external components, V_{FB}=0.65V, V_{SS}=6V	0.8	1.3	1.8	ms	⑤
Short Detect Voltage	V_{SHORT}	XC9250B series only, Connected to external components, V_{FB}=0.45V→0.35V, V_{SS}=6V V_{FB} Voltage when Oscillation Frequency is decreased	0.35	0.40	0.45	V	⑤
Internal Soft-start Time	t_{SS1}	V_{CE}=0→12V, V_{SS}=6V, V_{FB}=V_{FB1}×0.9V Time until Lx pin oscillates	0.8	1.3	2.0	ms	③
External Soft-start Time	t_{SS2}	V_{CE}=0→12V, V_{SS}=6V, V_{FB}=V_{FB1}×0.9V, C_{SS}=0.01μF Time until Lx pin oscillates	9	15	24	ms	③
Efficiency (*3)	EFFI	Connected to external components, I_{OUT}=1A	-	91	-	%	①
SYNC 'H' Voltage	V_{SYNCH}	Connected to external components, I_{OUT}=0mA	1.5	-	6	V	②
SYNC 'L' Voltage	V_{SYNCL}	Connected to external components, I_{OUT}=0mA	-	-	0.4	V	②
SYNC 'H' Current	I_{SYNCH}	V_{IN}=V_{CE}=30V, V_{SYNC}=6V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
SYNC 'L' Current	I_{SYNCL}	V_{IN}=V_{CE}=30V, V_{SYNC}=0V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
FB 'H' Current	I_{FBH}	V_{IN}=V_{CE}=30V, V_{FB}=6V, V_{SS}=6V	-0.1	0	0.1	V	④
FB 'L' Current	I_{FBL}	V_{IN}=V_{CE}=30V, V_{FB}=0V, V_{SS}=6V	-0.1	0	0.1	V	④
CE 'H' Voltage	V_{CEH}	V_{CE}=1.0V→2.8V, V_{FB}=0.65V, V_{SS}=6V V_{CE} Voltage when Lx pin voltage changes from "L" level to "H"	2.8	-	30	V	③
CE 'L' Voltage	V_{CEL}	V_{CE}=2.8V→1.0V, V_{FB}=0.65V, V_{SS}=6V V_{CE} Voltage when Lx pin voltage changes from "H" level to "L"	-	-	1	V	③
CE 'H' Current	I_{CEH}	V_{IN}=V_{CE}=30V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
CE 'L' Current	I_{CEL}	V_{IN}=30V, V_{CE}=0V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
Thermal Shutdown Temperature	T_{TSD}	Junction Temperature	-	150	-	℃	-
Hysteresis Width	T_{HYS}	Junction Temperature	-	25	-	℃	-

NOTE:
Unless otherwise stated, V_{IN}=V_{CE}=12V, V_{SYNC}=2V, V_{SS}=2V
External Components: Unless otherwise stated, L=22μH, C_{IN}=10μF, C_L=47μF, C_{BST}=1μF, R_{FB1}=2kΩ, R_{FB2}=390Ω, C_{FB}=10nF
(*1) Limited by a minimum ON time of 0.22μs (TYP.).
(*2) Current limit denotes the level of detection at peak of coil current.
(*3) EFFI=[(output voltage × output current)÷(inputvoltage × input current)]×100

■ ELECTRICAL CHARACTERISTICS (Continued)

●XC9251A/B083

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
FB Voltage	V_{FB1}	V_{FB}=0.816V→0.784V, V_{SS}=6V V_{FB} Voltage when Lx pin oscillates	0.784	0.8	0.816	V	③
FB Voltage Temperature Characteristics	ΔV_{FB}/ (ΔTopr･V_{FB})	-40℃≦Topr≦105℃	-	±50	-	ppm/℃	③
Output Voltage Setting Range	V_{OUTSET}	-	1.2 (*1)	-	V_{IN}-3 or 12 (*2)	V	-
Operating Voltage Range	V_{IN}	-	7	-	30	V	-
UVLO detect voltage	V_{UVLO1}	V_{IN}=4.9V→4.3V, V_{FB}=0.65V, V_{SS}=6V V_{IN} Voltage when Lx pin voltage changes from "H" level to "L" level	4.3	4.6	4.9	V	③
UVLO release voltage	V_{UVLO2}	V_{IN}=4.7V→5.3V, V_{FB}=0.65V, V_{SS}=6V V_{IN} Voltage when Lx pin voltage changes from "L" level to "H" level	4.7	5.0	5.3	V	③
Quiescent Current	I_q	V_{IN}=V_{CE}=30V, V_{FB}=0.95V	-	200	310	μA	④
Stand-by Current	I_{STB}	V_{IN}=30V, V_{CE}=0V, V_{SS}=0V, V_{SYNC}=0V	-	0.01	0.1	μA	④
Oscillation Frequency	f_{OSC}	Connected to external components, I_{OUT}=300mA	270	300	330	kHz	①
External Clock Signal Synchronized Frequency	SYNCOSC	Connected to external components, I_{OUT}=0mA	f_{OSC}x0.75	f_{OSC}	f_{OSC}x1.25	kHz	②
External Clock Signal Duty Cycle	D_{SYNC}	Connected to external components, I_{OUT}=0mA	25	-	75	%	②
Maximum Duty Cycle	D_{MAX}	V_{FB}=0.65V	83	85	88	%	③
Minimum Duty Cycle	D_{MIN}	V_{FB}=0.95V	-	-	0	%	③
Lx SW On Resistance	R_{Lx}	V_{FB}=0.65V, V_{SS}=6V	-	0.3	0.6	Ω	③
PFM Switch Current	I_{PFM}	Connected to external components, I_{OUT}=0mA	80	160	240	mA	①
Current Limit (*3)	I_{LIM}	V_{FB}=0.65V, V_{SS}=6V	2.4	3.2	-	A	③
Latch Time	t_{LAT}	XC9251A series only, Connected to external components, V_{FB}=0.65V, V_{SS}=6V	0.8	1.3	1.8	ms	⑤
Short Detect Voltage	V_{SHORT}	XC9251B series only, Connected to external components, V_{FB}=0.45V→0.35V, V_{SS}=6V V_{FB} Voltage when Oscillation Frequency is decreased	0.35	0.40	0.45	V	⑤
Internal Soft-start Time	t_{SS1}	V_{CE}=0→12V, V_{SS}=6V, V_{FB}=V_{FB1}×0.9V Time until Lx pin oscillates	0.8	1.3	2.0	ms	③
External Soft-start Time	t_{SS2}	V_{CE}=0→12V, V_{SS}=6V, V_{FB}=V_{FB1}×0.9V, C_{SS}=0.01μF Time until Lx pin oscillates	9	15	24	ms	③
Efficiency (*4)	EFFI	Connected to external components, I_{OUT}=1A	-	91	-	%	①
SYNC 'H' Voltage	V_{SYNCH}	Connected to external components, I_{OUT}=0mA	1.5	-	6	V	②
SYNC 'L' Voltage	V_{SYNCL}	Connected to external components, I_{OUT}=0mA	-	-	0.4	V	②
SYNC 'H' Current	I_{SYNCH}	V_{IN}=V_{CE}=30V, V_{SYNC}=6V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
SYNC 'L' Current	I_{SYNCL}	V_{IN}=V_{CE}=30V, V_{SYNC}=0V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
FB 'H' Current	I_{FBH}	V_{IN}=V_{CE}=30V, V_{FB}=6V, V_{SS}=6V	-0.1	0	0.1	V	④
FB 'L' Current	I_{FBL}	V_{IN}=V_{CE}=30V, V_{FB}=0V, V_{SS}=6V	-0.1	0	0.1	V	④
CE 'H' Voltage	V_{CEH}	V_{CE}=1.0V→2.8V, V_{FB}=0.65V, V_{SS}=6V V_{CE} Voltage when Lx pin voltage changes from "L" level to "H"	2.8	-	30	V	③
CE 'L' Voltage	V_{CEL}	V_{CE}=2.8V→1.0V, V_{FB}=0.65V, V_{SS}=6V V_{CE} Voltage when Lx pin voltage changes from "H" level to "L"	-	-	1	V	③
CE 'H' Current	I_{CEH}	V_{IN}=V_{CE}=30V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
CE 'L' Current	I_{CEL}	V_{IN}=30V, V_{CE}=0V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
Thermal Shutdown Temperature	T_{TSD}	Junction Temperature	-	150	-	℃	-
Hysteresis Width	T_{HYS}	Junction Temperature	-	25	-	℃	-

NOTE:
Unless otherwise stated, V_{IN}=V_{CE}=12V, V_{SYNC}=2V, V_{SS}=2V
External Components: Unless otherwise stated, L=22μH, C_{IN}=10μF, C_L=47μF, C_{BST}=1μF, R_{FB1}=2kΩ, R_{FB2}=390Ω, C_{FB}=10nF
(*1) Limited by a minimum ON time of 0.22μs (TYP.).
(*2) V_{IN}-3 or 12, whichever is lower.
(*3) Current limit denotes the level of detection at peak of coil current.
(*4) EFFI=[(output voltage × output current)÷(inputvoltage × input current)]×100

■ELECTRICAL CHARACTERISTICS (Continued)

●XC9250A/B085 Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
FB Voltage	V_{FB1}	V_{FB}=0.816V→0.784V, V_{SS}=6V V_{FB} Voltage when Lx pin oscillates	0.784	0.8	0.816	V	③
FB Voltage Temperature Characteristics	$\Delta V_{FB}/(\Delta Topr \cdot V_{FB})$	-40℃≦Topr≦105℃	-	±50	-	ppm/℃	③
Output Voltage Setting Range	V_{OUTSET}		1.2 (*1)	-	12	V	-
Operating Voltage Range	V_{IN}		7	-	30	V	-
UVLO detect voltage	V_{UVLO1}	V_{IN}=4.9V→4.3V, V_{FB}=0.65V, V_{SS}=6V V_{IN} Voltage when Lx pin voltage changes from "H" level to "L" level	4.3	4.6	4.9	V	③
UVLO release voltage	V_{UVLO2}	V_{IN}=4.7V→5.3V, V_{FB}=0.65V, V_{SS}=6V V_{IN} Voltage when Lx pin voltage changes from "L" level to "H" level	4.7	5.0	5.3	V	③
Quiescent Current	I_q	V_{IN}=V_{CE}=30V, V_{FB}=0.95V	-	250	360	μA	④
Stand-by Current	I_{STB}	V_{IN}=30V, V_{CE}=0V, V_{SS}=0V, V_{SYNC}=0V	-	0.01	0.1	μA	④
Oscillation Frequency	f_{OSC}	Connected to external components, I_{OUT}=300mA	450	500	550	kHz	①
External Clock Signal Synchronized Frequency	SYNCOSC	Connected to external components, I_{OUT}=0mA	f_{OSC}x0.75	f_{OSC}	f_{OSC}x1.25	kHz	②
External Clock Signal Duty Cycle	D_{SYNC}	Connected to external components, I_{OUT}=0mA	25	-	75	%	②
Maximum Duty Cycle	D_{MAX}	V_{FB}=0.65V	83	85	88	%	③
Minimum Duty Cycle	D_{MIN}	V_{FB}=0.95V	-	-	0	%	③
Lx SW On Resistance	R_{Lx}	V_{FB}=0.65V, V_{SS}=6V	-	0.3	0.6	Ω	③
Current Limit (*2)	I_{LIM}	V_{FB}=0.65V, V_{SS}=6V	2.4	3.2	-	A	③
Latch Time	t_{LAT}	XC9250A series only, Connected to external components, V_{FB}=0.65V, V_{SS}=6V	0.4	0.7	1.0	ms	⑤
Short Detect Voltage	V_{SHORT}	XC9250B series only, Connected to external components, V_{FB}=0.45V→0.35V, V_{SS}=6V V_{FB} Voltage when Oscillation Frequency is decreased	0.35	0.40	0.45	V	⑤
Internal Soft-start Time	t_{SS1}	V_{CE}=0→12V, V_{SS}=6V, V_{FB}=V_{FB1}×0.9V Time until Lx pin oscillates	0.4	0.7	1.2	ms	③
External Soft-start Time	t_{SS2}	V_{CE}=0→12V, V_{SS}=6V, V_{FB}=V_{FB1}×0.9V, C_{SS}=0.01μF Time until Lx pin oscillates	5	9	15	ms	③
Efficiency (*3)	EFFI	Connected to external components, I_{OUT}=1A	-	91	-	%	①
SYNC 'H' Voltage	V_{SYNCH}	Connected to external components, I_{OUT}=0mA	1.5	-	6	V	②
SYNC 'L' Voltage	V_{SYNCL}	Connected to external components, I_{OUT}=0mA	-	-	0.4	V	②
SYNC 'H' Current	I_{SYNCH}	V_{IN}=V_{CE}=30V, V_{SYNC}=6V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
SYNC 'L' Current	I_{SYNCL}	V_{IN}=V_{CE}=30V, V_{SYNC}=0V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
FB 'H' Current	I_{FBH}	V_{IN}=V_{CE}=30V, V_{FB}=6V, V_{SS}=6V	-0.1	0	0.1	V	④
FB 'L' Current	I_{FBL}	V_{IN}=V_{CE}=30V, V_{FB}=0V, V_{SS}=6V	-0.1	0	0.1	V	④
CE 'H' Voltage	V_{CEH}	V_{CE}=1.0V→2.8V, V_{FB}=0.65V, V_{SS}=6V V_{CE} Voltage when Lx pin voltage changes from "L" level to "H"	2.8	-	30	V	③
CE 'L' Voltage	V_{CEL}	V_{CE}=2.8V→1.0V, V_{FB}=0.65V, V_{SS}=6V V_{CE} Voltage when Lx pin voltage changes from "H" level to "L"	-	-	1	V	③
CE 'H' Current	I_{CEH}	V_{IN}=V_{CE}=30V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
CE 'L' Current	I_{CEL}	V_{IN}=30V, V_{CE}=0V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
Thermal Shutdown Temperature	T_{TSD}	Junction Temperature	-	150	-	℃	-
Hysteresis Width	T_{HYS}	Junction Temperature	-	25	-	℃	-

NOTE:
Unless otherwise stated, V_{IN}=V_{CE}=12V, V_{SYNC}=2V, V_{SS}=2V
External Components: Unless otherwise stated, L=22μH, C_{IN}=10μF, C_L=47μF, C_{BST}=1μF, R_{FB1}=2kΩ, R_{FB2}=390Ω, C_{FB}=10nF
(*1) Limited by a minimum ON time of 0.15μs (TYP.).
(*2) Current limit denotes the level of detection at peak of coil current.
(*3) EFFI=[(output voltage × output current)÷(inputvoltage × input current)]×100

■ ELECTRICAL CHARACTERISTICS (Continued)

●XC9251A/B085

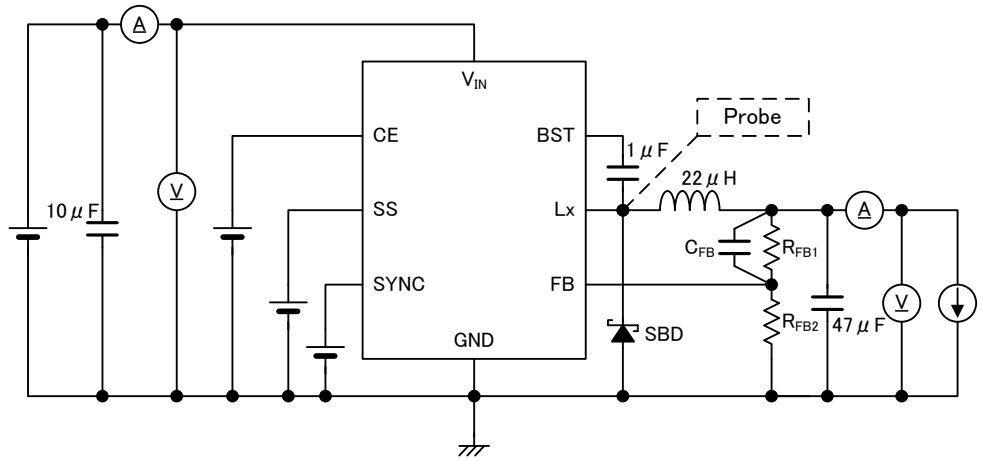
Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
FB Voltage	V_{FB1}	V_{FB}=0.816V→0.784V, V_{SS}=6V V_{FB} Voltage when Lx pin oscillates	0.784	0.8	0.816	V	③
FB Voltage Temperature Characteristics	ΔV_{FB}/ (ΔTopr･V_{FB})	-40℃≦Topr≦105℃	-	±50	-	ppm/℃	③
Output Voltage Setting Range	V_{OUTSET}		1.2 (*1)	-	V_{IN}-3 or 12 (*2)	V	-
Operating Voltage Range	V_{IN}		7	-	30	V	-
UVLO detect voltage	V_{UVLO1}	V_{IN}=4.9V→4.3V, V_{FB}=0.65V, V_{SS}=6V V_{IN} Voltage when Lx pin voltage changes from "H" level to "L" level	4.3	4.6	4.9	V	③
UVLO release voltage	V_{UVLO2}	V_{IN}=4.7V→5.3V, V_{FB}=0.65V, V_{SS}=6V V_{IN} Voltage when Lx pin voltage changes from "L" level to "H" level	4.7	5.0	5.3	V	③
Quiescent Current	I_q	V_{IN}=V_{CE}=30V, V_{FB}=0.95V	-	250	360	μA	④
Stand-by Current	I_{STB}	V_{IN}=30V, V_{CE}=0V, V_{SS}=0V, V_{SYNC}=0V	-	0.01	0.1	μA	④
Oscillation Frequency	f_{OSC}	Connected to external components, I_{OUT}=300mA	450	500	550	kHz	①
External Clock Signal Synchronized Frequency	SYNCOSC	Connected to external components, I_{OUT}=0mA	f_{OSC}x0.75	f_{OSC}	f_{OSC}x1.25	kHz	②
External Clock Signal Duty Cycle	D_{SYNC}	Connected to external components, I_{OUT}=0mA	25	-	75	%	②
Maximum Duty Cycle	D_{MAX}	V_{FB}=0.65V	83	85	88	%	③
Minimum Duty Cycle	D_{MIN}	V_{FB}=0.95V	-	-	0	%	③
Lx SW On Resistance	R_{Lx}	V_{FB}=0.65V, V_{SS}=6V	-	0.3	0.6	Ω	③
PFM Switch Current	I_{PFM}	Connected to external components, I_{OUT}=0mA	80	160	240	mA	①
Current Limit (*3)	I_{LIM}	V_{FB}=0.65V, V_{SS}=6V	2.4	3.2	-	A	③
Latch Time	t_{LAT}	XC9251A series only, Connected to external components, V_{FB}=0.65V, V_{SS}=6V	0.4	0.7	1.0	ms	⑤
Short Detect Voltage	V_{SHORT}	XC9251B series only, Connected to external components, V_{FB}=0.45V→0.35V, V_{SS}=6V V_{FB} Voltage when Oscillation Frequency is decreased	0.35	0.40	0.45	V	⑤
Internal Soft-Start Time	t_{SS1}	V_{CE}=0→12V, V_{SS}=6V, V_{FB}=V_{FB1}×0.9V Time until Lx pin oscillates	0.4	0.7	1.2	ms	③
External Soft-Start Time	t_{SS2}	V_{CE}=0→12V, V_{SS}=6V, V_{FB}=V_{FB1}×0.9V, C_{SS}=0.01μF Time until Lx pin oscillates	5	9	15	ms	③
Efficiency (*4)	EFFI	Connected to external components, I_{OUT}=1A	-	91	-	%	①
SYNC 'H' Voltage	V_{SYNCH}	Connected to external components, I_{OUT}=0mA	1.5	-	6	V	②
SYNC 'L' Voltage	V_{SYNCL}	Connected to external components, I_{OUT}=0mA	-	-	0.4	V	②
SYNC 'H' Current	I_{SYNCH}	V_{IN}=V_{CE}=30V, V_{SYNC}=6V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
SYNC 'L' Current	I_{SYNCL}	V_{IN}=V_{CE}=30V, V_{SYNC}=0V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
FB 'H' Current	I_{FBH}	V_{IN}=V_{CE}=30V, V_{FB}=6V, V_{SS}=6V	-0.1	0	0.1	V	④
FB 'L' Current	I_{FBL}	V_{IN}=V_{CE}=30V, V_{FB}=0V, V_{SS}=6V	-0.1	0	0.1	V	④
CE 'H' Voltage	V_{CEH}	V_{CE}=0.8V→2.8V, V_{FB}=0.65V, V_{SS}=6V V_{CE} Voltage when Lx pin voltage changes from "L" level to "H"	2.8	-	30	V	③
CE 'L' Voltage	V_{CEL}	V_{CE}=2.8V→0.8V, V_{FB}=0.65V, V_{SS}=6V V_{CE} Voltage when Lx pin voltage changes from "H" level to "L"	-	-	1	V	③
CE 'H' Current	I_{CEH}	V_{IN}=V_{CE}=30V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
CE 'L' Current	I_{CEL}	V_{IN}=30V, V_{CE}=0V, V_{FB}=0.95V	-0.1	0	0.1	μA	④
Thermal Shutdown Temperature	T_{TSD}	Junction Temperature	-	150	-	℃	-
Hysteresis Width	T_{HYS}	Junction Temperature	-	25	-	℃	-

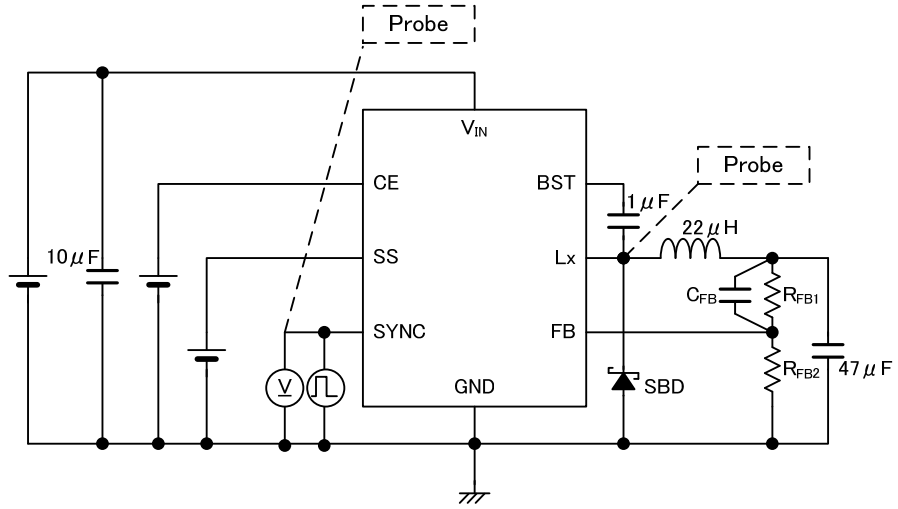
NOTE:
Unless otherwise stated, V_{IN}=V_{CE}=12V, V_{SYNC}=2V, V_{SS}=2V
External Components: Unless otherwise stated, L=22μH, C_{IN}=10μF, C_L=47μF, C_{BST}=1μF, R_{FB1}=2kΩ, R_{FB2}=390Ω, C_{FB}=10nF
(*1) Limited by a minimum ON time of 0.15μs (TYP.).
(*2) V_{IN}-3 or 12, whichever is lower.
(*3) Current limit denotes the level of detection at peak of coil current.
(*4) EFFI=[(output voltage × output current)÷(inputvoltage × input current)]×100

■TEST CIRCUITS

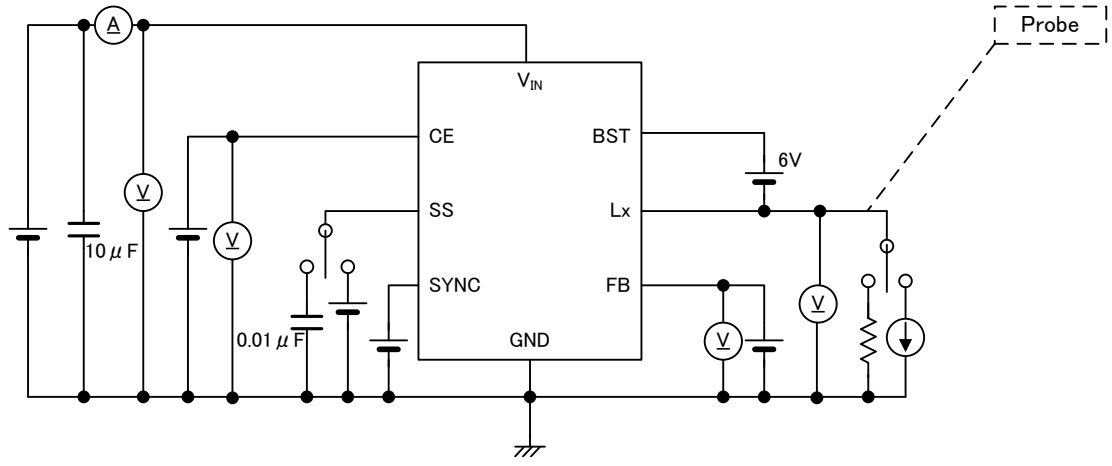
Circuit①



Circuit②

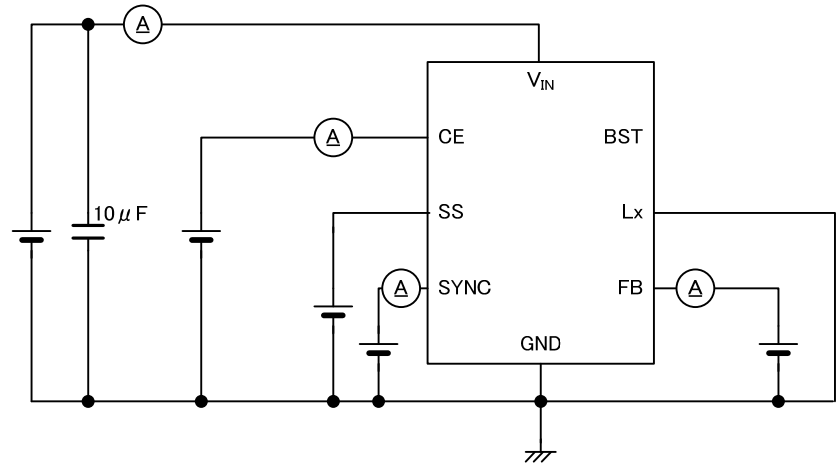


Circuit③

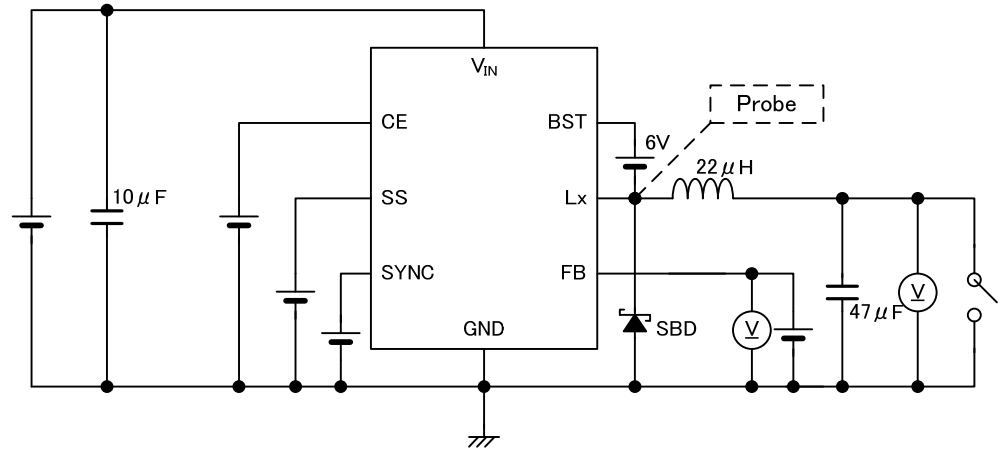


■TEST CIRCUITS (Continued)

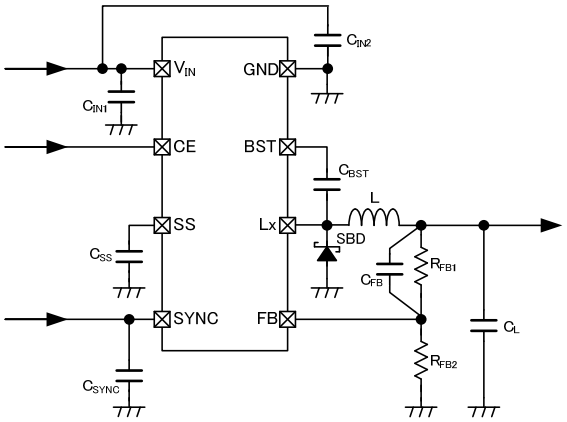
Circuit④



Circuit⑤



■TYPICAL APPLICATION CIRCUIT



【Typical Examples】

	MANUFACTURER	PRODUCT NUMBER	VALUE
L	TDK	CLF12555-150M	15 μH
		CLF12555-220M	22 μH
		CLF12555-330M	33 μH
	Toho Zinc	TCM-0840-200	20 μH
C_{IN1}	Murata	GRM32ER71H106K	10 μF/50V
C_{IN2}	Murata	GRM21BB31H105K	1 μF/50V
C_L	Murata	GRM32ER71A476K	47 μF/10V
		GRM32ER71E226K	22 μF/25V 2parallel
	Panasonic	25SVPD47M	47 μF/25V, ESR=30mΩ
SBD	TOSHIBA	CMS15	V_F=0.58V (3A)
C_{SS}			0.01 μF/10V (*1)
C_{SYNC}			1000pF/10V (*2)
C_{BST}			1 μF/10V

(*1) Can also be used without C_{SS} (SS pin OPEN). When used without C_{SS}, the IC starts at the soft start time set internally.

(*2) Can be used without C_{SYNC} if the external CLK synchronization function is not used. In this case, connect the SYNC pin to GND in close proximity to the IC.

<Output voltage setting>

The output voltage can be set by adding an external dividing resistor. The output voltage is determined by the equation below based on the values of R_{FB1} and R_{FB2}.

$$V_{OUT}=0.8 \times (R_{FB1}+R_{FB2})/R_{FB2}$$

with $R_{FB2} \leqq 15k\Omega$

Adjust the value of the phase compensation speed-up capacitor. Adjust the C_{FB} value so that fzfb = $1/(2\times\pi\times C_{FB}\times R_{FB1})$ is about 10kHz.

【Setting Example】

When R_{FB1}=68kΩ, R_{FB2}=13kΩ, V_{OUT}=0.8×(68kΩ+13kΩ) / 13kΩ≒4.98V

When fzfb is set to a target of 10.64kHz using the above equation, C_{FB}=1/(2×π×10.64kHz×68kΩ)≒220pF

If the dropout voltage is too large and the minimum Lx ON time is not attained, pulse skipping will occur and the output voltage will not be stable. Use with an Lx ON time longer than the minimum. The minimum ON time is 0.22 μs (TYP.) at a set frequency of 300kHz, or 0.15 μs (TYP.) at a set frequency of 500kHz.

■TYPICAL APPLICATION CIRCUIT (Continued)

<Inductance value setting>

In the XC9250 and XC9251 series, it is optimum to set an inductance value within the range below based on the set frequency and setting output voltage.

f_{OSCSET}: Set frequency

V_{OUTSET}: Setting output voltage

f_{OSCSET}	$1.2V \leqq V_{OUTSET} \leqq 6V$	$6V < V_{OUTSET} \leqq 12V$
300kHz	20 μH 22 μH	33 μH
500kHz	15 μH	20 μH 22 μH

<Soft-start function>

The soft start time of the XC9250 and XC9251 series can be adjusted externally (SS pin). The soft start time is the time from the start of V_{CE} until the output voltage reaches 90% of the set voltage. The soft start time depends on the external capacitance C_{SS}, and is determined by the equation below.

$t_{SS2} = 1.08 \times C_{SS} / I_{SS}$ [ms]

C_{SS}: External capacitance [nF]

I_{SS}: When f_{OSCSET}=300kHz, 0.72 [μA (TYP.)] When f_{OSCSET}=500kHz, 1.2 [μA(TYP.)]

f_{OSCSET}: Set frequency [kHz]

* Note that the value of the soft start time t_{SS2} varies depending on the effective capacitance value of the delay capacitance C_{SS}.

【Calculation Example】

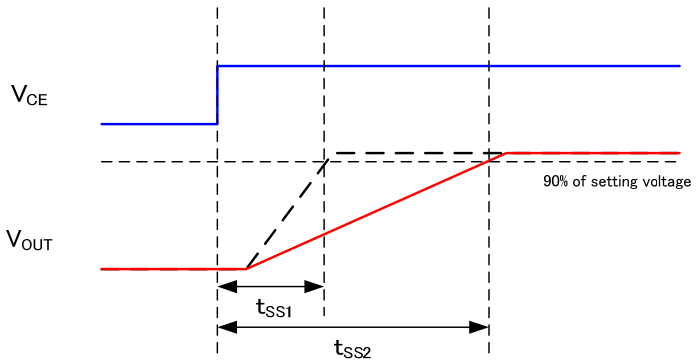
When f_{OSCSET}=300kHz and C_{SS}=10nF, tss2=1.08×10/0.72=15ms

When f_{OSCSET}=500kHz and C_{SS}=10nF, tss2=1.08×10/1.2=9ms

The minimum value t_{SS2} of the soft-start time is set internally. The internal soft-start time t_{SS1} is determined by the equation below.

When f_{OSCSET}=300kHz, tss1=1.3ms（TYP.）

When f_{OSCSET}=500kHz, tss1=0.7ms（TYP.）



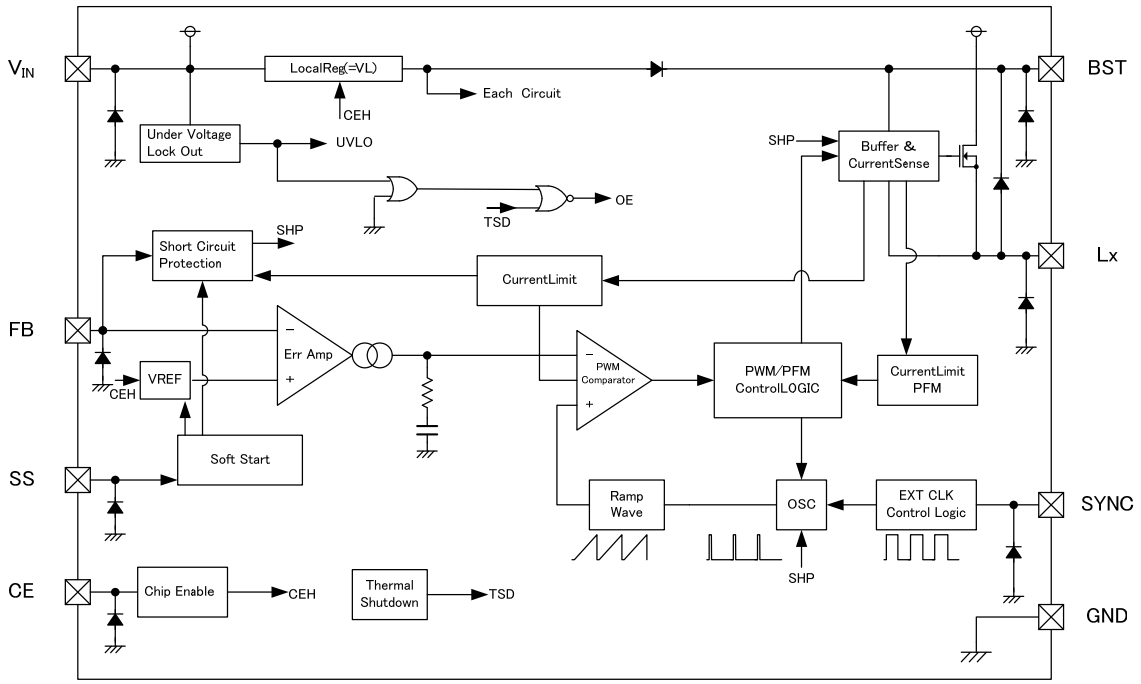
■OPERATIONAL EXPLANATION

The XC9250/XC9251 series consists internally of a reference voltage supply, ramp wave circuit, error amp, PWM comparator, phase compensation circuit, N-ch MOS driver transistor, current limiting circuit, under-voltage lockout (UVLO) circuit, internal power supply (VL) circuit, thermal shutdown (TSD) circuit, oscillator (OSC) circuit, soft-start circuit, control block and other elements.

The voltage feed back from the FB pin is compared to the internal reference voltage by the error amp, the output from the error amp is phase compensated, and the signal is input to the PWM comparator to determine the ON time of switching during PWM operation. The output signal from the error amp is compared to the ramp wave by the PWM comparator, and the output is sent to the buffer drive circuit and output from the Lx pin as the duty width of switching. This operation is performed continuously to stabilize the output voltage.

The driver transistor current is monitored at each switching by the output signal from the error amp is modulated as a multi-feedback signal. This allows a stable feedback system to be obtained even when a low ESR capacitor such as a ceramic capacitor is used, and this stabilizes the output voltage.

Because the IC uses an N-ch MOS transistor for the Hi side driver, a voltage higher than the V_{IN} voltage is required to turn on the driver. To generate a voltage higher than the V_{IN} voltage, the bootstrap method is used.



XC9251 Series, Type B

<Reference voltage source>

The reference voltage source provides the reference voltage to ensure stable output voltage of the DC/DC converter.

<Oscillator circuit>

The ramp wave circuit determines switching frequency. The frequency is fixed internally and can be selected from 300kHz, 500 kHz. Clock pulses generated in this circuit are used to produce ramp waveforms needed for PWM operation.

<Error amplifier>

The error amplifier is designed to monitor output voltage. The amplifier compares the reference voltage with the feedback voltage divided by the internal split resistors, R_{FB1} and R_{FB2}. When a voltage is lower than the reference voltage, then the voltage is fed back, the output voltage of the error amplifier increases. The error amplifier output is fixed internally to deliver an optimized signal to the mixer which is a part of a PWM comparator.

<Chip enable>

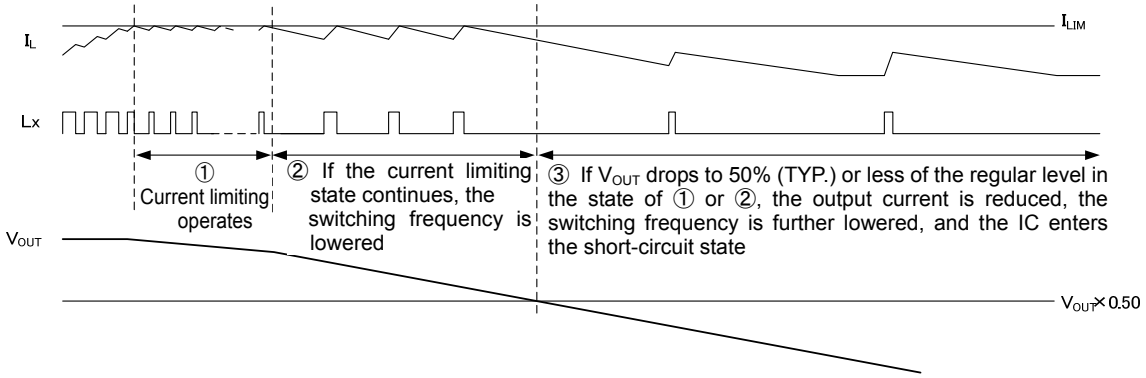
The XC9250/XC9251 series can be put in the standby state by inputting L level into the CE pin. In the standby state, the quiescent current of the IC is 0.01 μA (TYP.). When H level is input into CE pin, operation starts. The input of the CE pin is CMOS input and the sink current is 0 μA (TYP.).

■OPERATIONAL EXPLANATION (Continued)

<Current limiting, short-circuit protection>

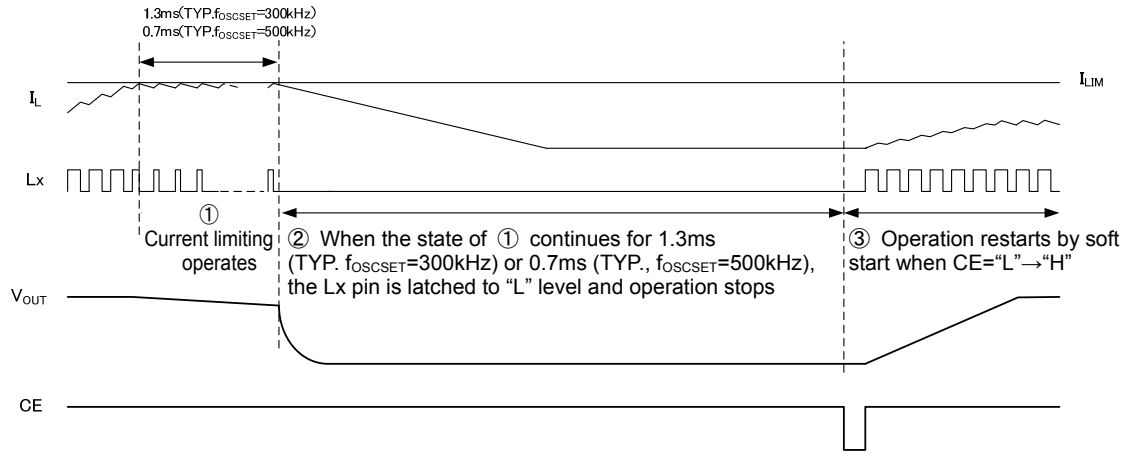
The current limiting circuits of type B combine both current limiting and short-circuit protection.

(1) The current in the N-ch MOS driver transistor connected to the Lx pin is monitored, and when the load current attains the limiting current, the current limiting circuit activates and the output voltage drops.
(2) As the current limiting state continues, the switching frequency drops to prevent coil current (I_L) overlay. When the current limiting state is released, the switching frequency returns to the set frequency.
(3) If the output voltage drops further from states (2), the output current is limited, the switching frequency is lowered further, and the short-circuit state is entered. When the load becomes lighter than the short-circuit state, restart takes place automatically. To prevent overshoot during restart, restart takes place by soft-start.



<Integral latch protection>

When the current limiting state continues for a certain time, the correct limiting circuit of type A latches and stops the Lx pin in the "H" level state (turning off the driver Tr). To restart operation by soft-start once in the latch stop state, "L" level must be input into the CE pin followed by "H" level, or briefly lowering the V_{IN} voltage below the UVLO detection voltage must be performed.



<Thermal shutdown>

The thermal shutdown (TSD) as an over current limit is built in the XC9250/XC9251 series.
When the junction temperature reaches the detection temperature, the driver transistor is forcibly turned off. When the junction temperature falls to the release temperature while in the output stop state, restart takes place by soft-start.

<UVLO>

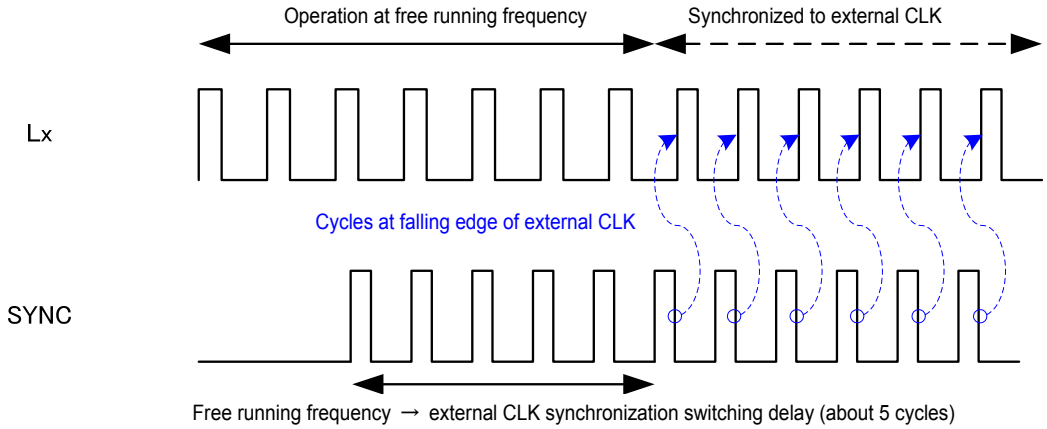
When the V_{IN} pin voltage falls below 4.6V (TYP.), EXTB becomes "H" level and forcibly stops output to prevent false pulse output due to instable operation of the internal circuits. When the V_{IN} pin voltage rises above 5.0V (TYP.), the UVLO function is released, the soft-start function activates, and output start operation begins. Stopping by UVLO is not shutdown; only pulse output is stopped and the internal circuits continue to operate.

■OPERATIONAL EXPLANATION (Continued)

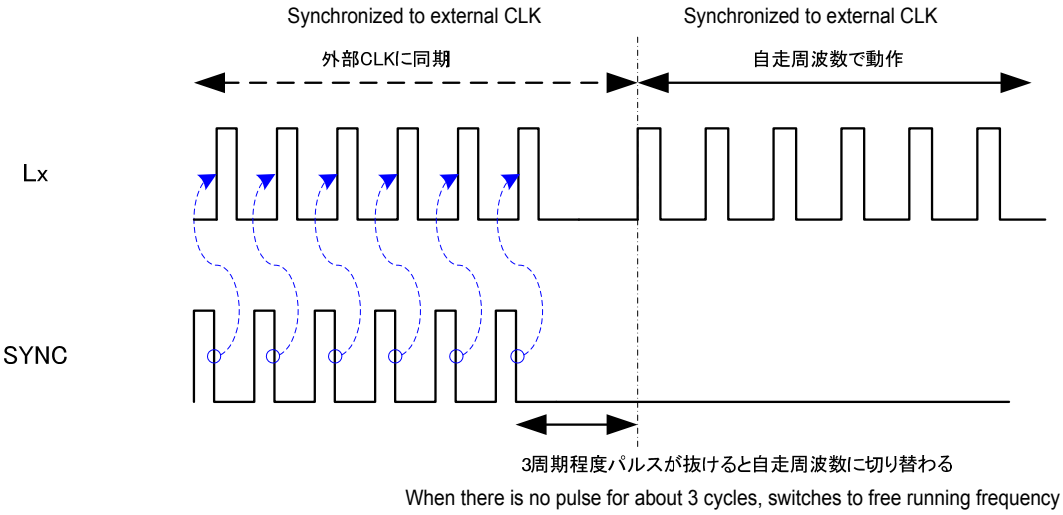
<SYNC function>

When an external CLK (±25% of free running frequency, on duty 25% to 75%) is input into the SYNC pin, operation is synchronized to the falling edge of the external CLK (external CLK synchronization function). When synchronized to the external CLK, the control mode is automatically PWM control. When the external CLK is fixed at "H" voltage or "L" voltage for about 3 cycles of the free running frequency, external CLK synchronization stops and operation at the free running frequency takes place.

(1) Switching from free running frequency ⇒ external CLK synchronization



(2) Switching from external CLK synchronization ⇒ free running frequency



■NOTE ON USE

1. For the phenomenon of temporal and transitional voltage decrease or voltage increase, the IC may be damaged or deteriorated if IC is used beyond the absolute MAX. specifications.

2. Make sure that the absolute maximum ratings of the external components and of this IC are not exceeded.

3. The DC/DC converter characteristics depend greatly on the externally connected components as well as on the characteristics of this IC, so refer to the specifications and standard circuit examples of each component when carefully considering which components to select. Be especially careful of the capacitor characteristics and use B characteristics (JIS standard) or X7R, X5R (EIA standard) ceramic capacitors.

4. The DC/DC converter of this IC uses a current-limiting circuit to monitor the coil peak current. If the potential dropout voltage is large or the load current is large, the peak current will increase, which makes it easier for current limitation to be applied which in turn could cause the operation to become unstable. When the peak current becomes large, adjust the coil inductance and sufficiently check the operation. The following formula is used to show the peak current.

$$\text{Peak Current: } Ipk = (V_{IN} - V_{OUT}) \times \text{OnDuty} / (2 \times L \times f_{OSC}) + I_{OUT}$$

L: Coil Inductance [H]
f_{OSC}: Oscillation Frequency [Hz]
I_{OUT}: Load Current [A]

5. If the difference between input voltage and output voltage is large, when the current limit circuit activates, the switching current might overlap and exceed the current limit spec. due to the circuit delay time.

6. The ripple voltage could be increased when switching from discontinuous conduction mode to Continuous conduction mode. Please apply the ICs only after careful examination by the customer.

7. In some cases, ripple voltage may increase in the XC9251 series when the load is light. This is for the purpose of charging the CBST, and is normal operation.

8. The IC enters test mode when a 6V external power supply is applied to the SS pin. Do not apply an external power supply to the SS pin during use.

9. The operation of the IC becomes unstable below the minimum operating voltage.

10. The effects of ambient noise and the state of the circuit board may cause release from the current limiting state, and the latch time may lengthen or latch operation may not take place. Test sufficiently using the actual equipment.

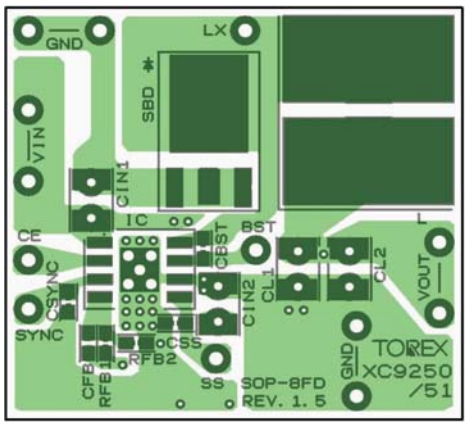
11. When operation changes from free running frequency to external CLK synchronization, the output voltage may fluctuate. Please apply the ICs only after careful examination by the customer.

12. Instructions of pattern layouts
The operation may become unstable due to noise and/or phase lag from the output current when the wire impedance is high, please place the input capacitor(C_{IN1}, C_{IN2}) and the output capacitor (C_L) as close to the IC as possible.

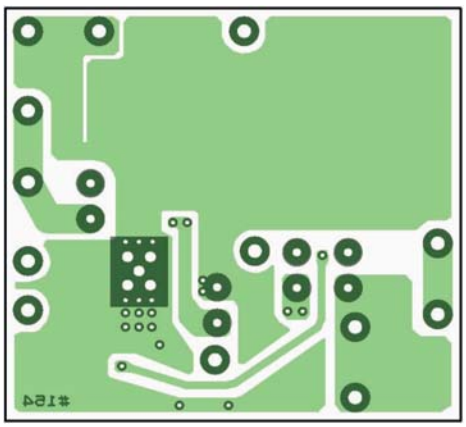
(1) In order to stabilize V_{IN} voltage level, we recommend that a by-pass capacitor (C_{IN1}) be connected as close as possible to the V_{IN} pin.
(2) In order to stabilize GND voltage level, we recommend that a by-pass capacitor (C_{IN2}) be connected as close as possible to the GND pin.
(3) Please mount each external component as close to the IC as possible.
(4) Wire external components as close to the IC as possible and use thick, short connecting traces to reduce the circuit impedance.
(5) Make sure that the GND traces are as thick as possible, as variations in ground potential caused by high ground currents at the time of switching may result in instability of the IC.
(6) Because this product contains an internal driver, heat is generated due to the I_{OUT} current and ON resistance of the N-ch MOS driver transistor.

■NOTE ON USE (Continued)

<Reference Pattern Layout>



Front



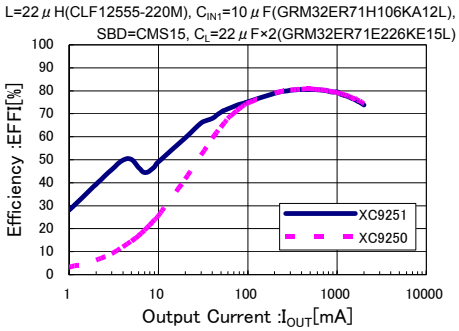
Back

13. Torex places an importance on improving our products and their reliability.
We request that users incorporate fail-safe designs and post-aging protection treatment when using Torex products in their systems.

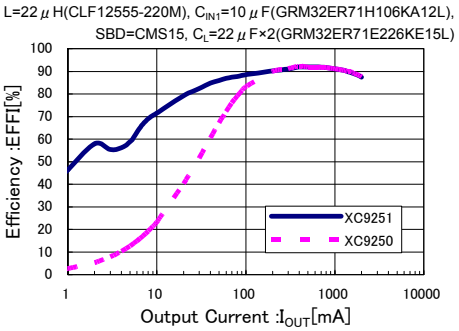
■TYPICAL PERFORMANCE CHARACTERISTICS

(1) Efficiency vs. Output current

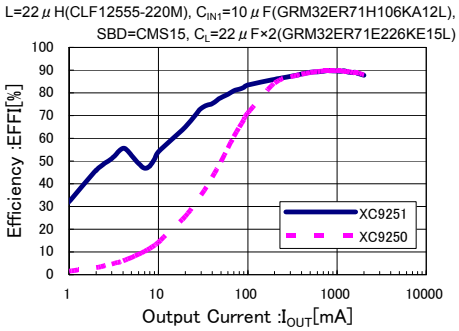
XC9250x083/XC9251x083
(V_{IN}=12V , V_{OUT}=1.8V)



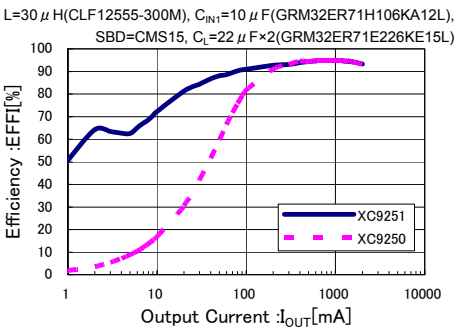
XC9250x083/XC9251x083
(V_{IN}=12V , V_{OUT}=5V)



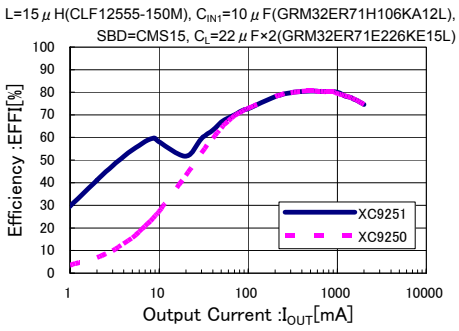
XC9250x083/XC9251x083
(V_{IN}=24V , V_{OUT}=5V)



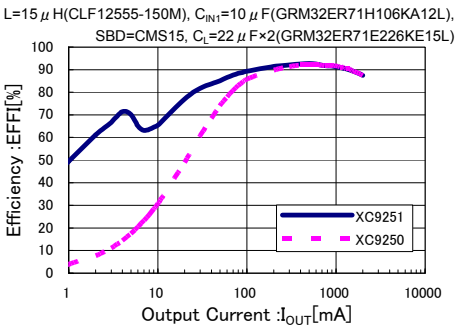
XC9250x083/XC9251x083
(V_{IN}=24V , V_{OUT}=12V)



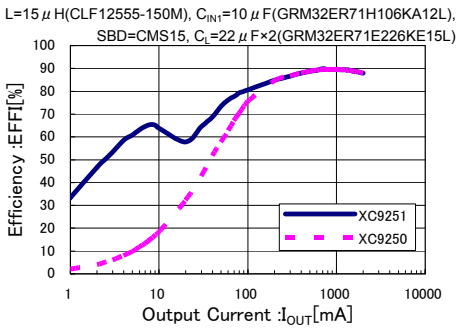
XC9250x085/XC9251x085
(V_{IN}=12V , V_{OUT}=1.8V)



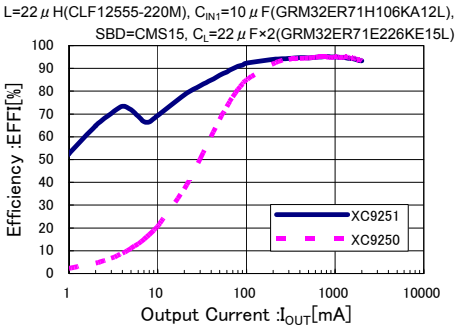
XC9250x085/XC9251x085
(V_{IN}=12V , V_{OUT}=5V)



XC9250x085/XC9251x085
(V_{IN}=24V , V_{OUT}=5V)



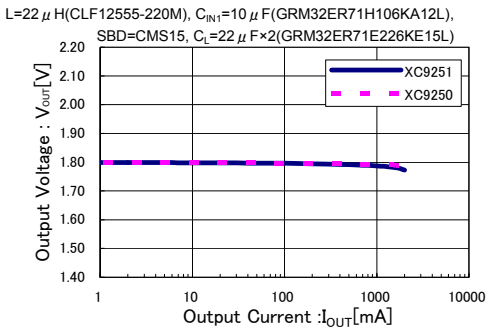
XC9250x085/XC9251x085
(V_{IN}=24V , V_{OUT}=12V)



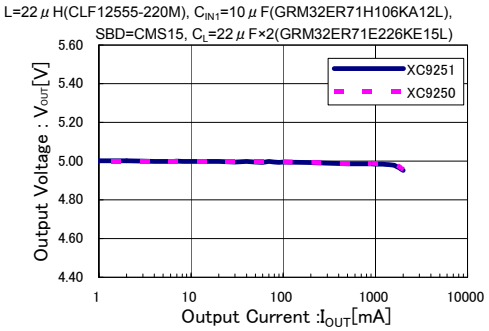
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(2) Output Voltage vs. Output Currnt

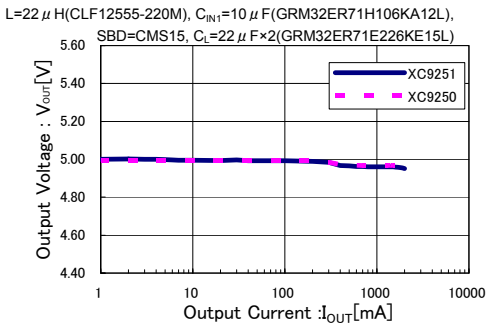
XC9250x083/XC9251x083
(V_{IN}=12V , V_{OUT}=1.8V)



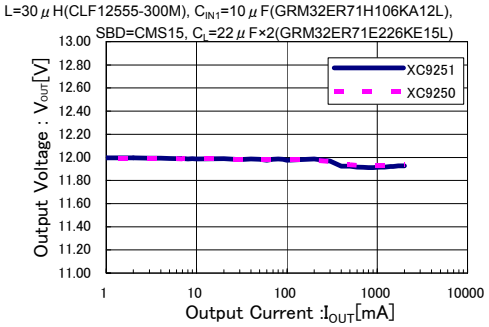
XC9250x083/XC9251x083
(V_{IN}=12V , V_{OUT}=5V)



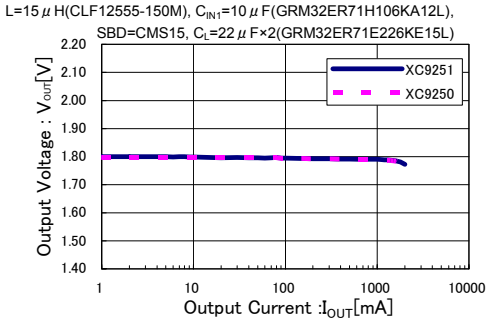
XC9250x083/XC9251x083
(V_{IN}=24V , V_{OUT}=5V)



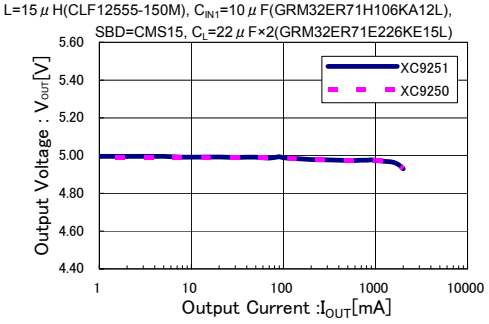
XC9250x083/XC9251x083
(V_{IN}=24V , V_{OUT}=12V)



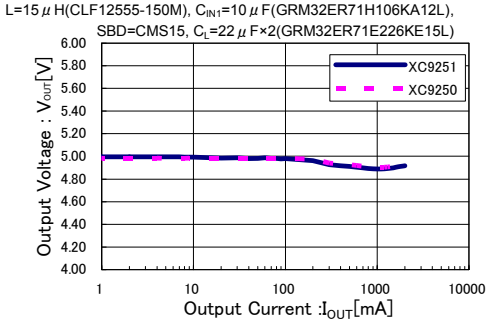
XC9250x085/XC9251x085
(V_{IN}=12V , V_{OUT}=1.8V)



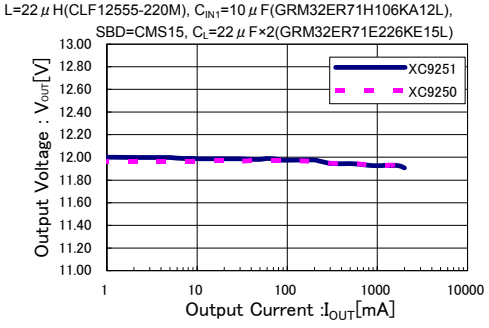
XC9250x085/XC9251x085
(V_{IN}=12V , V_{OUT}=5V)



XC9250x085/XC9251x085
(V_{IN}=24V , V_{OUT}=5V)



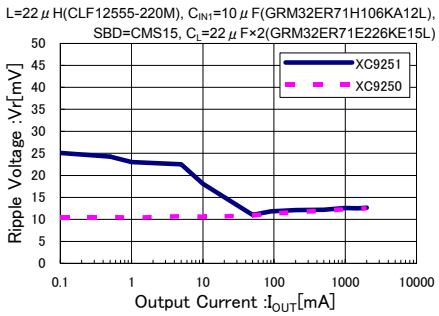
XC9250x085/XC9251x085
(V_{IN}=24V , V_{OUT}=12V)



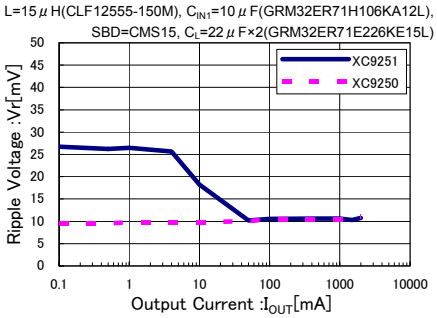
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(3) Ripple Voltage vs. Output Current

XC9250x083/XC9251x083
(V_{IN}=12V , V_{OUT}=5V)

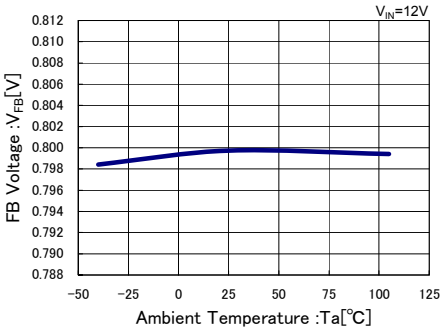


XC9250x085/XC9251x085
(V_{IN}=12V , V_{OUT}=5V)



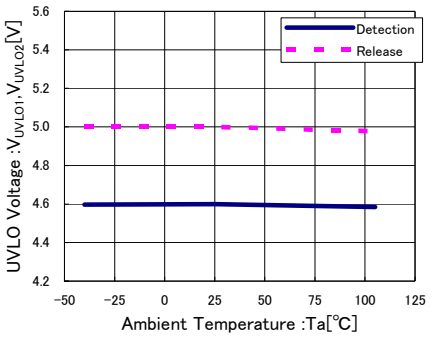
(4) FB Voltage vs. Ambient Temperature

XC9250/XC9251



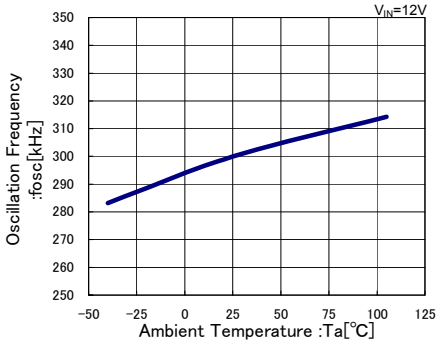
(5) UVLO Voltage vs. Ambient Temperature

XC9250/XC9251

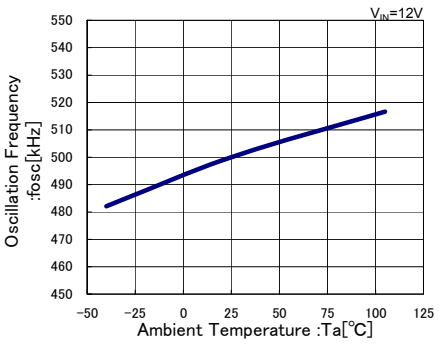


(6) Oscillation Frequency vs. Ambient Temperature

XC9250x083/XC9251x083

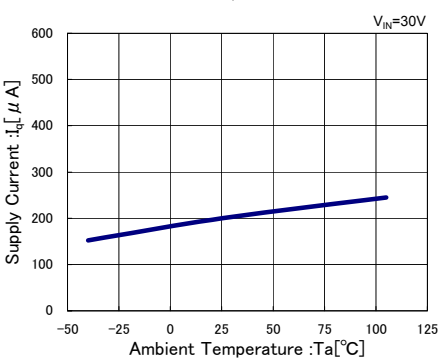


XC9250x085/XC9251x085

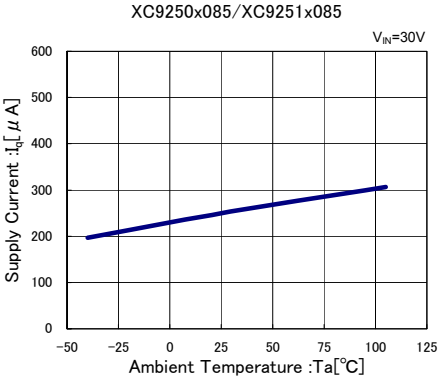


(7) Supply Current vs. Ambient Temperature

XC9250x083/XC9251x083

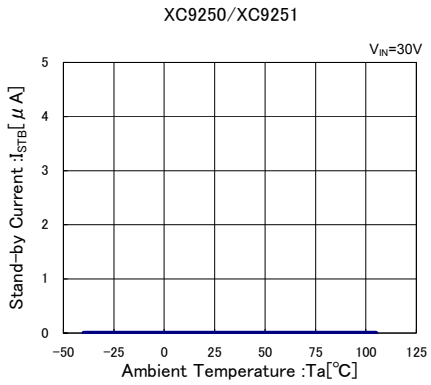


XC9250x085/XC9251x085

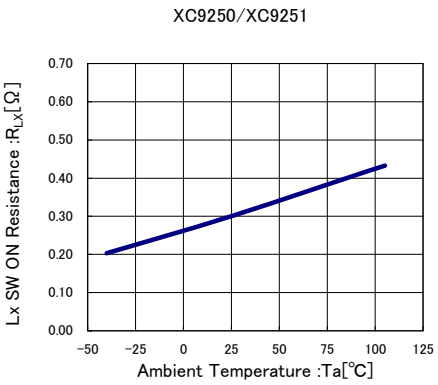


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

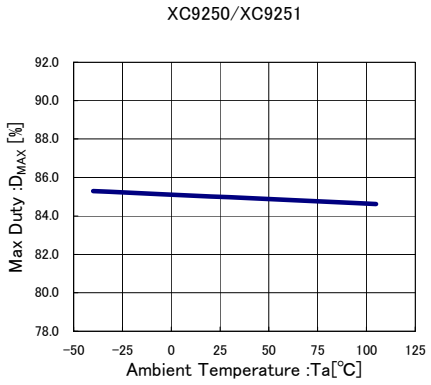
(8) Stand-by Current vs. Ambient Temperature



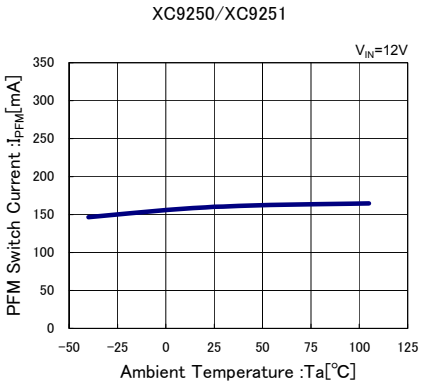
(9) Lx SW ON Resistance vs. Ambient Temperature



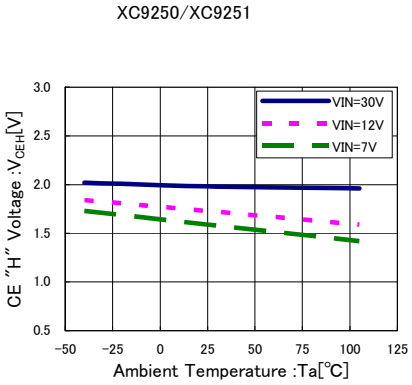
(10) Max Duty vs. Ambient Temperature



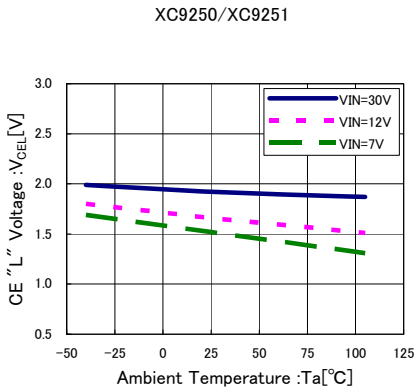
(11) PFM Switch Current vs. Ambient Temperature



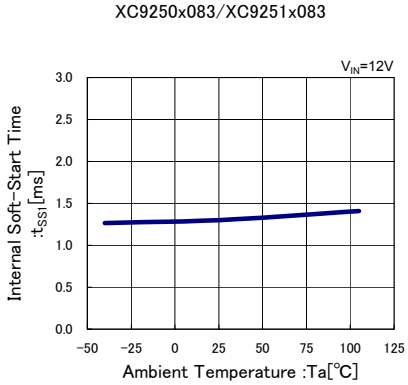
(12) CE "H" Voltage vs. Ambient Temperature

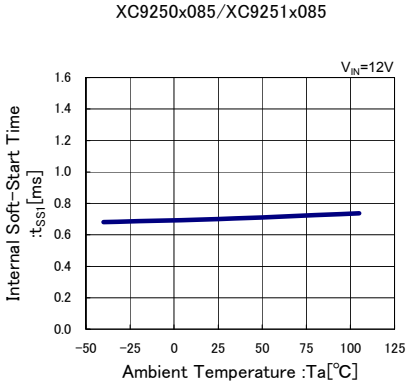


(13) CE "L" Voltage vs. Ambient Temperature



(14) Internal Soft-Start Time vs. Ambient Temperature

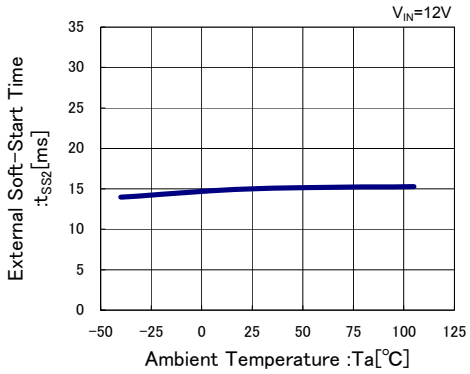




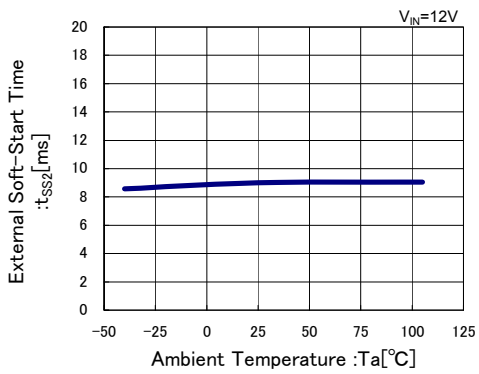
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(15) External Soft-Start Time vs. Ambient Temperature

XC9250x083/XC9251x083



XC9250x085/XC9251x085



■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

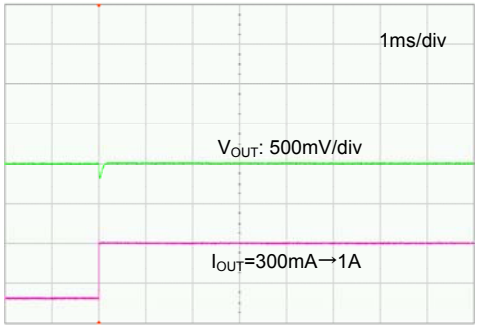
(16) Load Transient Response

XC9250x083/XC9251x083

V_{IN}=12V, V_{OUT}=5V, I_{OUT}=300mA→1A

L=22μH(CLF12555-220M), C_{IN1}=10μF(GRM32ER71H106KA12L),

SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)

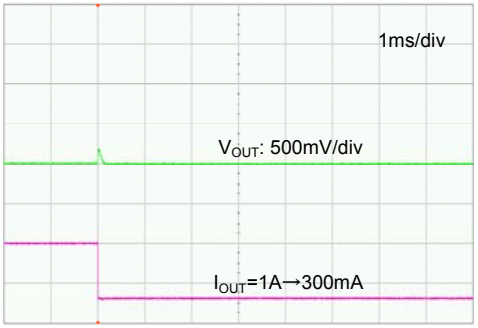


XC9250x083/XC9251x083

V_{IN}=12V, V_{OUT}=5V, I_{OUT}=1A→300mA

L=22μH(CLF12555-220M), C_{IN1}=10μF(GRM32ER71H106KA12L),

SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)

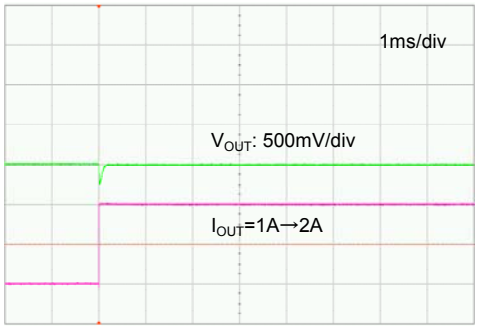


XC9250x083/XC9251x083

V_{IN}=12V, V_{OUT}=5V, I_{OUT}=1A→2A

L=22μH(CLF12555-220M), C_{IN1}=10μF(GRM32ER71H106KA12L),

SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)

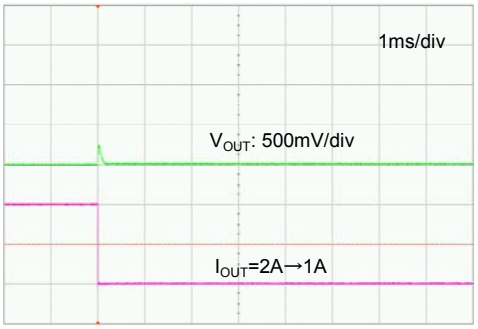


XC9250x083/XC9251x083

V_{IN}=12V, V_{OUT}=5V, I_{OUT}=2A→1A

L=22μH(CLF12555-220M), C_{IN1}=10μF(GRM32ER71H106KA12L),

SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)

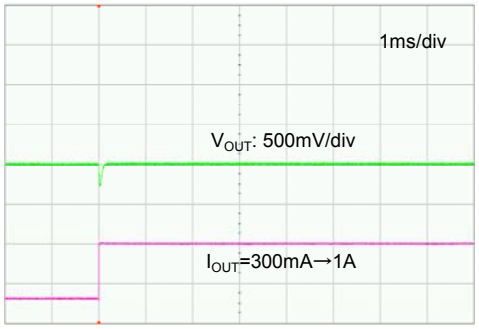


XC9250x085/XC9251x085

V_{IN}=12V, V_{OUT}=5V, I_{OUT}=300mA→1A

L=15μH(CLF12555-150M), C_{IN1}=10μF(GRM32ER71H106KA12L),

SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)

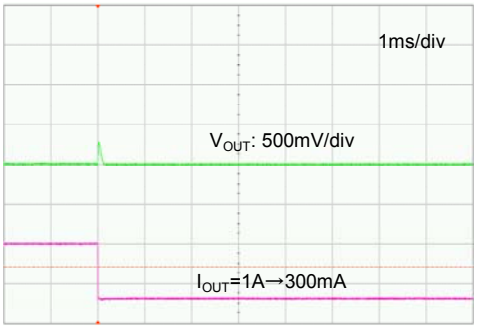


XC9250x085/XC9251x085

V_{IN}=12V, V_{OUT}=5V, I_{OUT}=1A→300mA

L=15μH(CLF12555-150M), C_{IN1}=10μF(GRM32ER71H106KA12L),

SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)

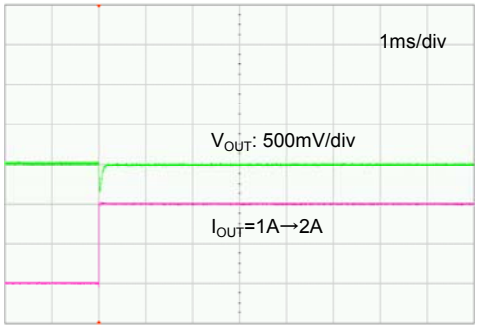


XC9250x085/XC9251x085

V_{IN}=12V, V_{OUT}=5V, I_{OUT}=1A→2A

L=15μH(CLF12555-150M), C_{IN1}=10μF(GRM32ER71H106KA12L),

SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)

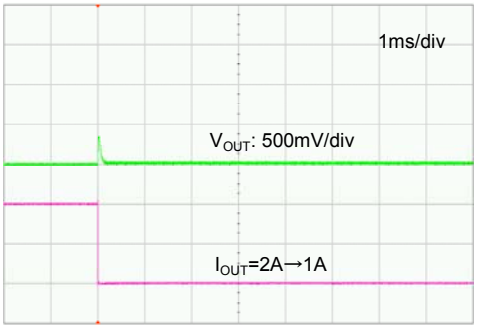


XC9250x085/XC9251x085

V_{IN}=12V, V_{OUT}=5V, I_{OUT}=2A→1A

L=15μH(CLF12555-150M), C_{IN1}=10μF(GRM32ER71H106KA12L),

SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)

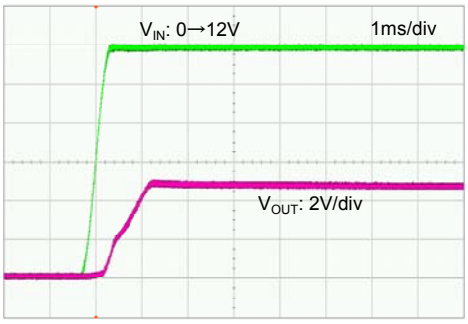


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(17) Rising Response Time

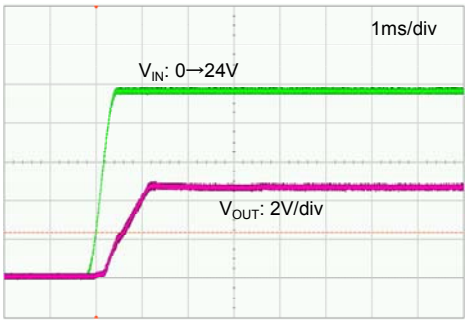
XC9250x083/XC9251x083

V_{IN}=0→12V, V_{OUT}=5V, I_{OUT}=1mA
L=22μH(CLF12555-220M), C_{IN1}=10μF(GRM32ER71H106KA12L),
SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)



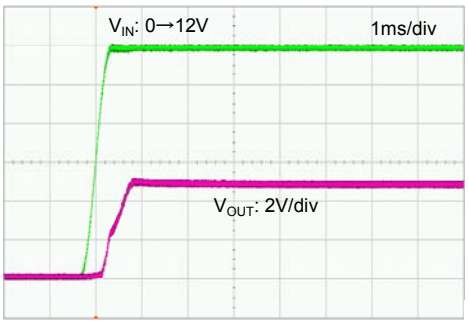
XC9250x083/XC9251x083

V_{IN}=0→24V, V_{OUT}=5V, I_{OUT}=1mA
L=22μH(CLF12555-220M), C_{IN1}=10μF(GRM32ER71H106KA12L),
SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)



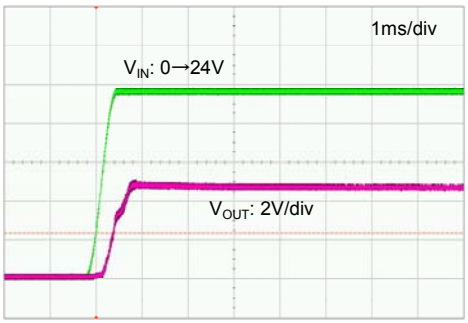
XC9250x085/XC9251x085

V_{IN}=0→12V, V_{OUT}=5V, I_{OUT}=1mA
L=15μH(CLF12555-150M), C_{IN1}=10μF(GRM32ER71H106KA12L),
SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)



XC9250x085/XC9251x085

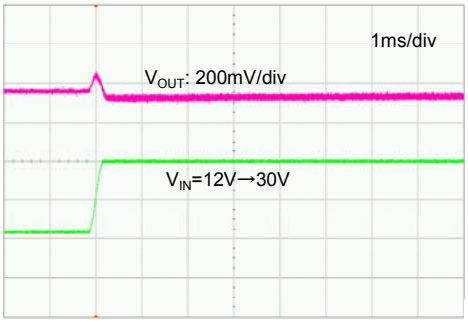
V_{IN}=0→24V, V_{OUT}=5V, I_{OUT}=1mA
L=15μH(CLF12555-150M), C_{IN1}=10μF(GRM32ER71H106KA12L),
SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)



(18) Input Transient Response

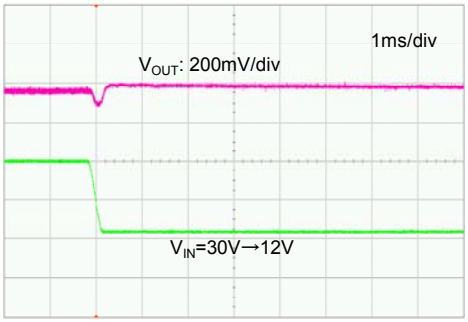
XC9250x083/XC9251x083

V_{IN}=12V→30V, V_{OUT}=5V, I_{OUT}=1A
L=22μH(CLF12555-220M), C_{IN1}=10μF(GRM32ER71H106KA12L),
SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)



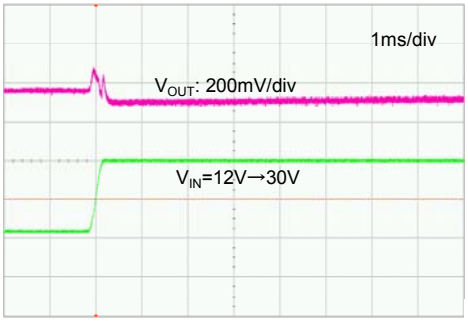
XC9250x083/XC9251x083

V_{IN}=30V→12V, V_{OUT}=5V, I_{OUT}=1A
L=22μH(CLF12555-220M), C_{IN1}=10μF(GRM32ER71H106KA12L),
SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)



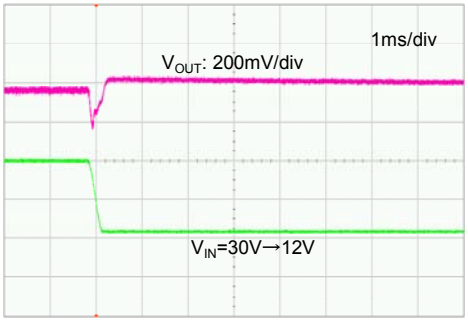
XC9250x085/XC9251x085

V_{IN}=12V→30V, V_{OUT}=5V, I_{OUT}=1A
L=15μH(CLF12555-150M), C_{IN1}=10μF(GRM32ER71H106KA12L),
SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)



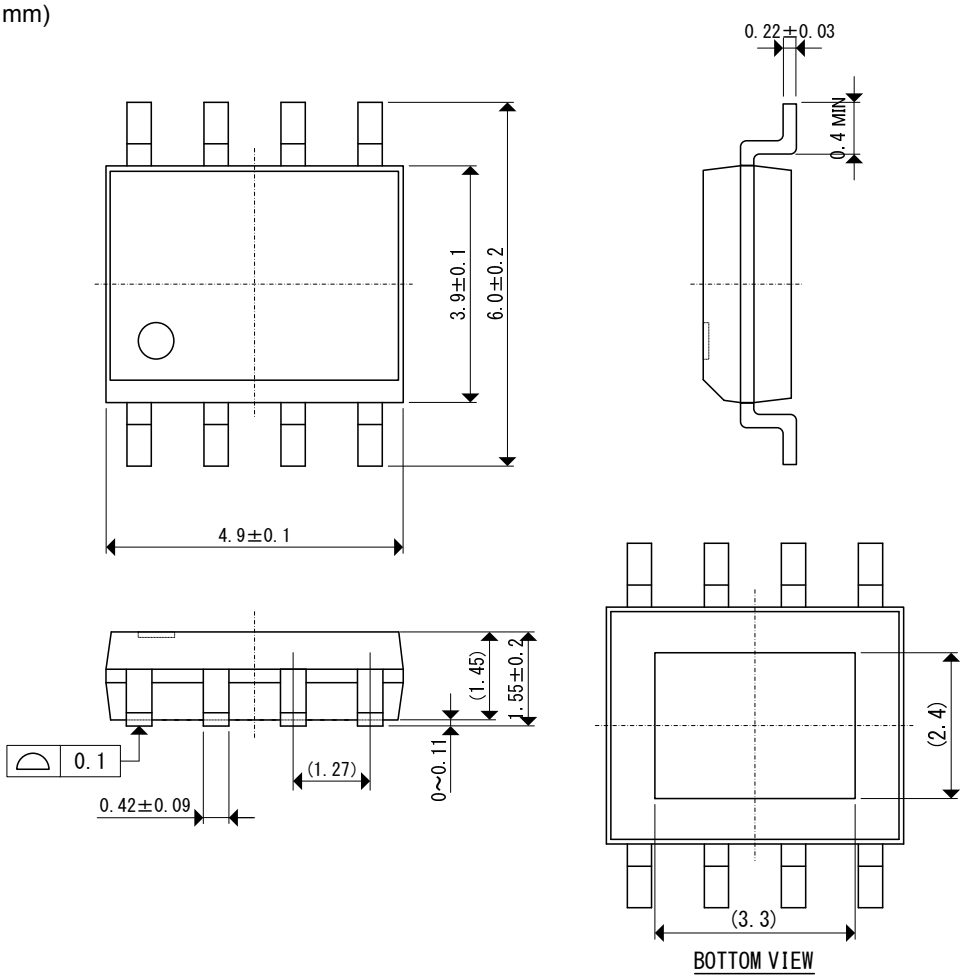
XC9250x085/XC9251x085

V_{IN}=30V→12V, V_{OUT}=5V, I_{OUT}=1A
L=15μH(CLF12555-150M), C_{IN1}=10μF(GRM32ER71H106KA12L),
SBD=CMS15, C_L=22μF×2(GRM32ER71E226KE15L)

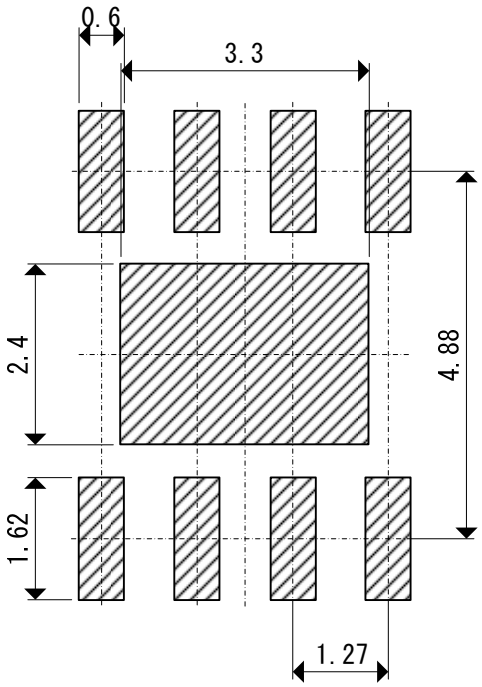


■PACKAGING INFORMATION

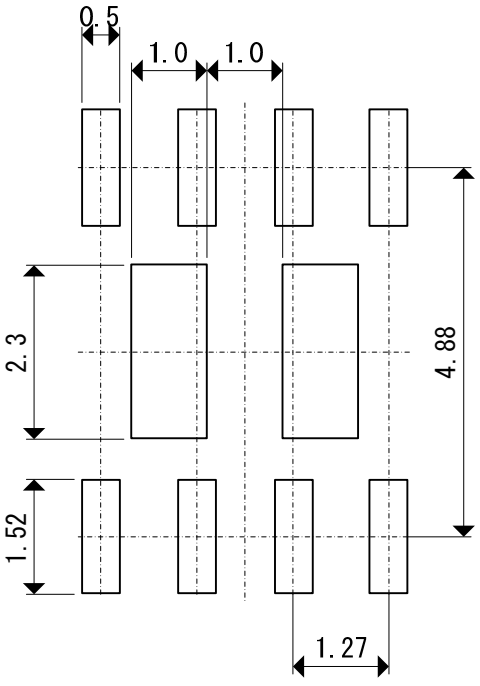
●SOP-8FD (unit: mm)



●SOP-8FD Reference Pattern Layout (unit: mm)

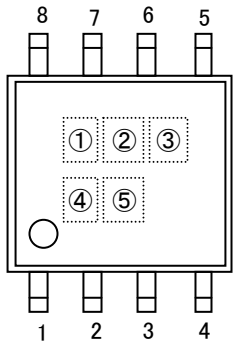


●SOP-8FD Reference Metal Mask Design (unit: mm)



■MARKING RULE

SOP-8FD



① represents products series

MARK	PRODUCT SERIES
F	XC9250******-G
	XC9251******-G

② represents products type

MARK	PRODUCT SERIES
A	XC9250A*****-G
	XC9251A*****-G
B	XC9250B*****-G
	XC9251B*****-G

③ represents FB voltage and oscillation frequency

MARK	VOLTAGE (V)	OSCILLATION FREQUENCY	PRODUCT SERIES
3	0.8	300kHz	XC9250*083**-G
5		500kHz	XC9250*085**-G
A	0.8	300kHz	XC9251*083**-G
B		500kHz	XC9251*085**-G

④⑤ represents production lot number
01～09, 0A～0Z, 11～9Z, A1～A9, AA～AZ, B1～ZZ in order.
(G, I, J, O, Q, W excluded)
* No character inversion used.

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