XC9280 Series

ETR05064-001a

18V Operation 3.0A Synchronous Step-Down DC/DC Converters

■GENERAL DESCRIPTION

The XC9280 series is 18V bootstrap synchronous step-down DC/DC converter with built-in Nch-Nch driver transistors, the operating voltage range is 4.5V～18.0V, designed to allow the use of ceramic capacitors.

0.75V reference voltage source is incorporated in the IC, and the output voltage can be set to a value from 1.8V to 7.0V using external resistors (R_{FB1}, R_{FB2}).

Switching frequency is 1.2MHz. In PWM/PFM automatic switchover control, IC can change the control method between PWM and PFM based on the output current requirement and as a result IC can achieve high efficiency over the full load range.

XC9280 has a fixed internal soft start time which is 0.95ms (TYP.), additionally the time can be extended by using an external resistor and capacitor.

With the built-in UVLO function, the driver transistor is forced OFF when input voltage goes down to 3.33V (TYP.) or lower. Over current protection and thermal shutdown are embedded and they secure a safety operation.

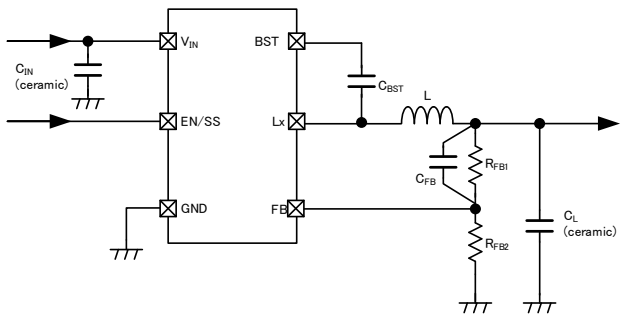
■APPLICATIONS

- Digital TV
- Set Top Box
- Security camera
- Smart meter
- Security system

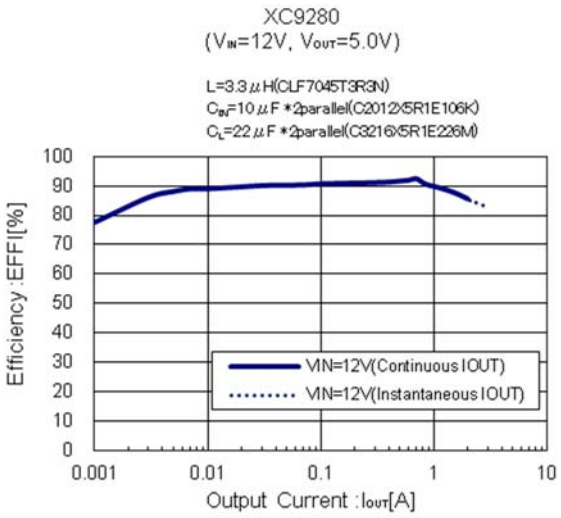
■FEATURES

Input Voltage Range	:	4.5V～18V（Absolute Max 20V）
Output Voltage Range	:	1.8V～7.0V or V_{IN} x 0.7
FB Voltage	:	0.75V±1.5%
Oscillation Frequency	:	1.2MHz
Output Current	:	3A peak 2.0A DC (V_{IN}=12V, V_{OUT}=5V)
Control Method	:	PWM/PFM Automatic
Soft-start Time	:	0.95ms Adjustable by RC
Protection Circuits	:	UVLO Over Current Protection （Automatic Recovery） Thermal Shutdown
Low ESR Ceramic Capacitor	:	Ceramic Capacitor
Package	:	TSOT-26
Environmentally Friendly	:	EU RoHS Compliant, Pb Free

■TYPICAL APPLICATION CIRCUIT

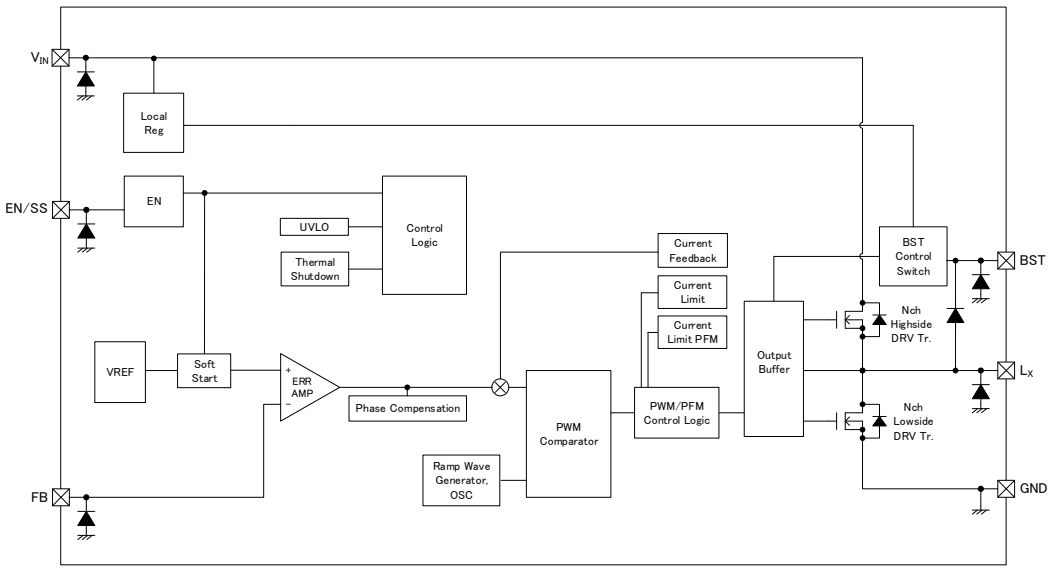


■TYPICAL PERFORMANCE CHARACTERISTICS



■BLOCK DIAGRAM

XC9280 Series



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

■PRODUCT CLASSIFICATION

1) Ordering Information

XC9280①②③④⑤⑥-⑦(*1)

DESIGNATOR	ITEM	SYMBOL	DESCRIPTION
①	Type	A	Refer to Selection Guide
②③	FB Voltage	75	0.75V
④	Oscillation Frequency	C	1.2MHz
⑤⑥-⑦ (*1)	Packages (Order Unit)	YR-G(*1)	TSOT-26 (3,000pcs/Reel)

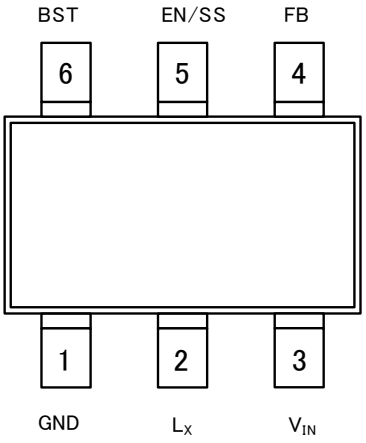
(*1) The “-G” suffix denotes Halogen and Antimony free as well as being fully EU RoHS compliant.

2) Selection Guide

TYPE	Chip Enable	UVLO	Thermal Shutdown
A	Yes	Yes	Yes

TYPE	Soft Start	Current Limiter	Automatic Recovery (Current Limiter)
A	Yes	Yes	Yes

■PIN CONFIGURATION



TSOT-26
(TOP VIEW)

■PIN ASSIGNMENT

PIN NUMBER TSOT-26	PIN NAME	FUNCTIONS
1	GND	Ground
2	L_X	Switching Output
3	V_{IN}	Power Input
4	FB	Output Voltage Sense
5	EN/SS	Enable/Soft-start
6	BST	Bootstrap

■FUNCTION CHART

PIN NAME	SIGNAL	STATUS
EN/SS	H	Active
	L	Stand-by
	OPEN	Undefined State(*1)

(*1) Please do not leave the EN/SS pin open. Each should have a certain voltage.

■ABSOLUTE MAXIMUM RATINGS

Ta=25℃

PARAMETER		SYMBOL	RATINGS	UNITS
V_{IN} Pin Voltage		V_{IN}	-0.3 ～ +20	V
EN/SS Pin Voltage		$V_{EN/SS}$	-0.3 ～ +20	V
FB Pin Voltage		V_{FB}	-0.3 ～ +6.2	V
BST Pin Voltage		V_{BST}	V_{LX} -0.3 ～ V_{LX} +6.2	V
Lx Pin Voltage		V_{Lx}	-0.3 ～ V_{IN}+0.3 or +20 (*1)	V
Lx Pin Current		I_{Lx}	6.0	A
Power Dissipation	TSOT-26	Pd	1300 (*2)	mW
Operating Ambient Temperature		Topr	-40 ～ +105	℃
Storage Temperature		Tstg	-55 ～ +125	℃

(*1) The maximum value should be either V_{IN}+0.3 or 20 in the lowest.

(*2) The power dissipation figure shown is PCB mounted and is for reference only.
Please see the power dissipation page for the mounting condition.

■ELECTRICAL CHARACTERISTICS

XC9280series

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	CIRCUIT
FB Voltage	V_{FB}	V_{FB}=0.761V → 0.739V V_{FB} Voltage when Lx pin oscillates	0.739	0.750	0.761	V	①
Setting Output Voltage Range(*1)	V_{OUTSET}	-	1.8	-	7.0 or V_{IN}x0.7(*4)	V	-
Operating Input Voltage Range(*1)	V_{IN}	-	4.5	-	18	V	-
UVLO Detect Voltage	V_{UVLOD}	V_{IN}:4.4V→2.7V、V_{FB}=0.675V V_{IN} Voltage which Lx pin voltage changes from "oscillation" to "L" level	2.70	3.33	-	V	①
UVLO Release Voltage	V_{UVLOR}	V_{IN}:2.7V→4.4V、V_{FB}=0.675V V_{IN} Voltage which Lx pin voltage changes from "L" level to "oscillation"	-	3.38	4.40	V	①
Quiescent Current	I_q	V_{IN}=$V_{EN/SS}$=12V、V_{FB}=0.825V、V_{LX}=0V	-	80	180	μA	②
Stand-by Current	I_{STBY}	V_{IN}=12V、$V_{EN/SS}$=V_{FB}=V_{LX}=0V	-	3.0	6.0	μA	⑤
Oscillation Frequency	f_{OSC}	Connected to external components, V_{IN}=$V_{EN/SS}$=6.0V、V_{FB}=0.675V	1.0	1.2	1.4	MHz	①
Maximum Duty Cycle	D_{MAX}	Connected to external components, V_{IN}=$V_{EN/SS}$=6.0V、V_{FB}=0.675V	75	90	-	%	①
Lx SW "H" On Resistance	R_{LxH}	-	-	166(*2)	-	mΩ	-
Lx SW "L" On Resistance	R_{LxL}	V_{FB}=5.5V、I_{LX}=100mA	-	130	-	mΩ	③
Lx SW "H" Off Current	I_{LXH}	V_{IN}=18V、$V_{EN/SS}$=0V、V_{FB}=1.5V V_{LX}=6.0V、V_{BST}=V_{LX}+5.0V	-1.0	-	-	μA	⑥
Lx SW "L" Off Current	I_{LXL}	V_{IN}=18V、$V_{EN/SS}$=V_{FB}=V_{LX}=0V	-	-	1.0	μA	⑧
PFM Switch Current	I_{PFM}	Connected to external components, V_{IN}=12V、V_{OUT}=5.0V、I_{OUT}=1mA	-	1.2	-	A	④
Current Limit	I_{LIM}	-	-	5.1	-	A	-
Internal Soft-Start Time	t_{SS1}	V_{FB}=0.675V	-	0.95	-	ms	①
External Soft-Start Time	t_{SS2}	V_{FB}=0.675V R_{SS}=430kΩ、C_{SS}=0.47μF	-	26	-	ms	⑦
Efficiency(*3)	EFFI	Connected to external components, V_{IN}=12V、V_{OUT}=5.0V、I_{OUT}=1.0A	-	90	-	%	④
FB Voltage Temperature Characteristics	ΔV_{FB}/(ΔT_{opr}・V_{FB})	-40℃≦T_{opr}≦105℃	-	±100	-	ppm/℃	①

Test Condition: Unless otherwise stated, V_{IN}=12V, $V_{EN/SS}$=12V

(*1): Please use within the range of V_{OUT}/V_{IN}≧0.136

(*2): Design reference value. This parameter is provided only for reference.

(*3): EFFI = {(output voltage) x (output current)} / {(input voltage) x (input current)} x 100

(*4): The maximum value should be either 7.0 or V_{IN}x0.7 in the lowest.

■ELECTRICAL CHARACTERISTICS

XC9280 series

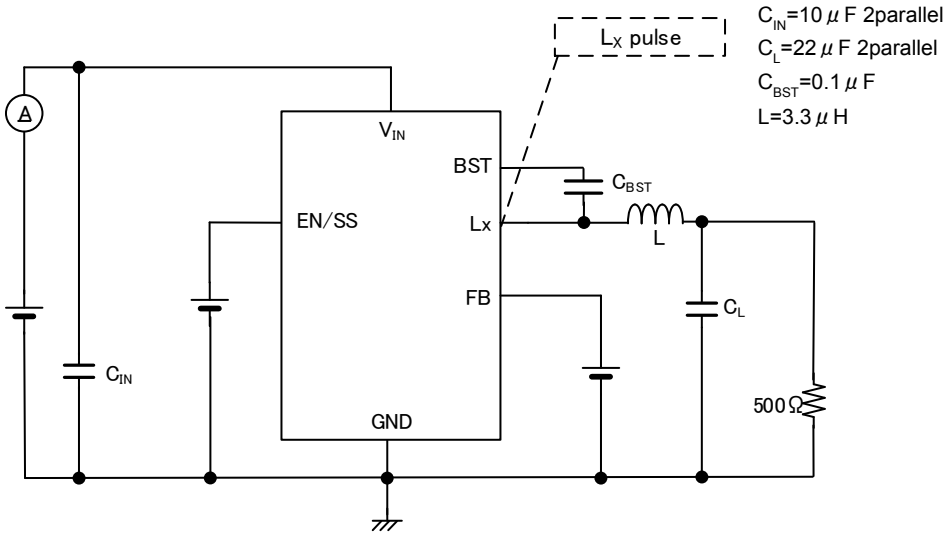
Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	CIRCUIT
FB “H” Current	I_{FBH}	V_{IN}=$V_{EN/SS}$=18V、V_{FB}=3.0V、V_{LX}=0V	-0.1	-	0.1	μA	⑧
FB “L” Current	I_{FBL}	V_{IN}=$V_{EN/SS}$=18V、V_{FB}=V_{LX}=0V	-0.1	-	0.1	μA	⑧
EN/SS “H” Voltage	$V_{EN/SSH}$	V_{IN}=18V、V_{FB}=0.71V	2.5	-	18	V	①
EN/SS “L” Voltage	$V_{EN/SSL}$	V_{IN}=18V、V_{FB}=1.5V	-	-	0.3	V	①
EN/SS “H” Current	$I_{EN/SSH}$	V_{IN}=$V_{EN/SS}$=18V、V_{FB}=1.5V、V_{LX}=0V	-	0.1	0.3	μA	⑧
EN/SS “L” Current	$I_{EN/SSL}$	V_{IN}=18V、$V_{EN/SS}$=V_{FB}=V_{LX}=0V	-0.1	-	0.1	μA	⑧
Thermal Shutdown Temperature	T_{TSD}	Junction Temperature	-	150	-	℃	-
Hysteresis Width	T_{HYS}	Junction Temperature	-	10	-	℃	-

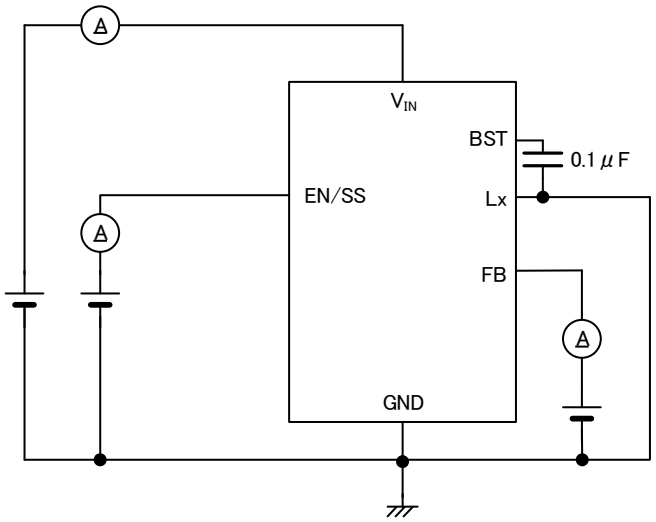
Test Condition: Unless otherwise stated, V_{IN}=12V, $V_{EN/SS}$=12V

■TEST CIRCUITS

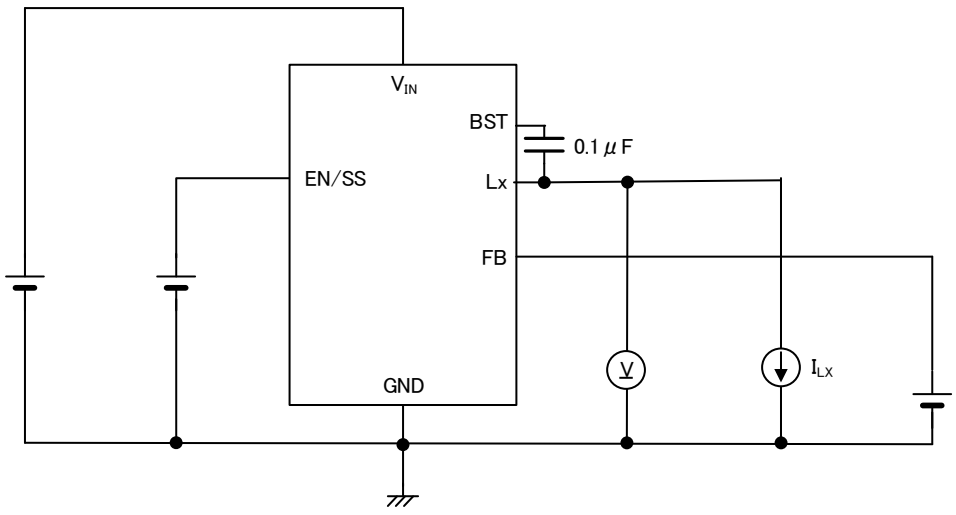
CIRCUIT①



CIRCUIT②



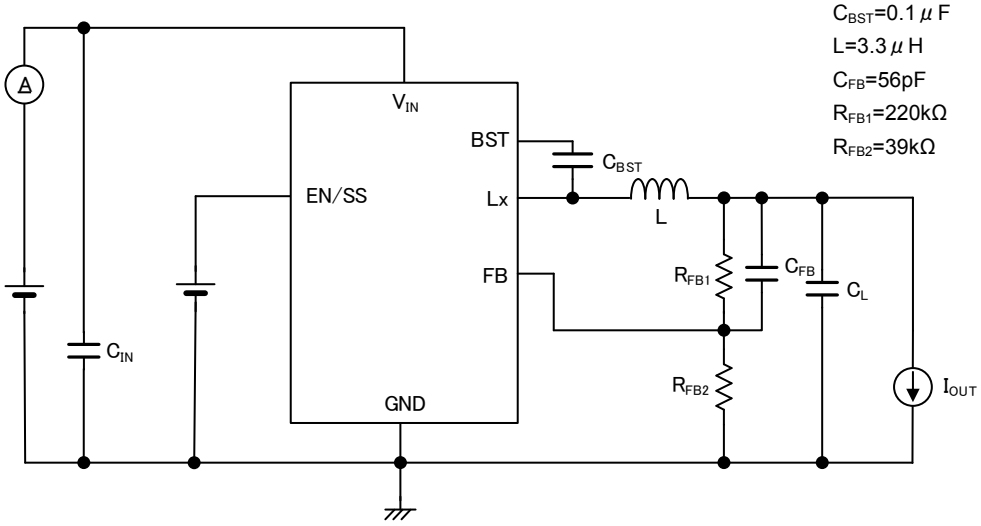
CIRCUIT③



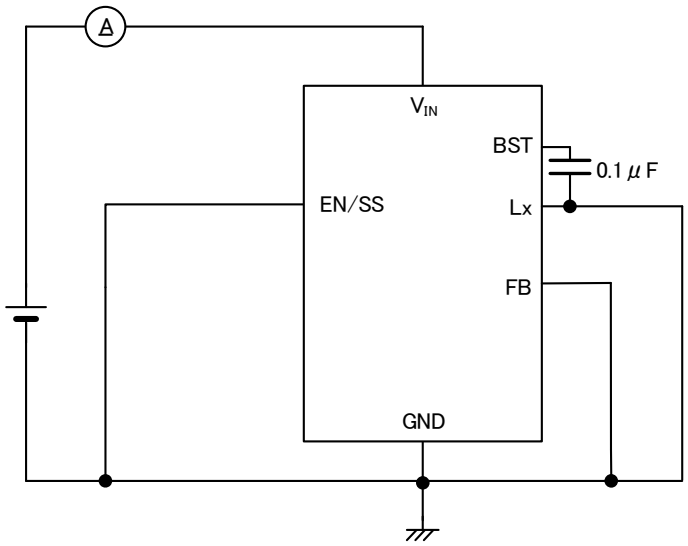
■TEST CIRCUITS(Continued)

CIRCUIT④

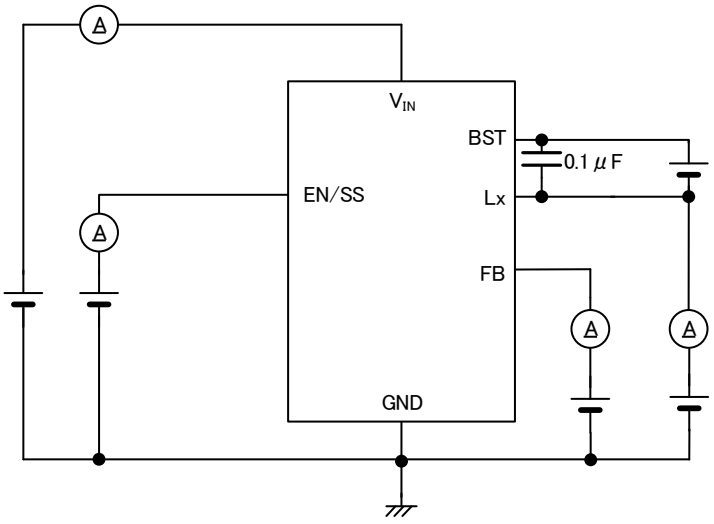
C_{IN}=10μF 2parallel
C_L=22μF 2parallel
C_{BST}=0.1μF
L=3.3μH
C_{FB}=56pF
R_{FB1}=220kΩ
R_{FB2}=39kΩ



CIRCUIT⑤



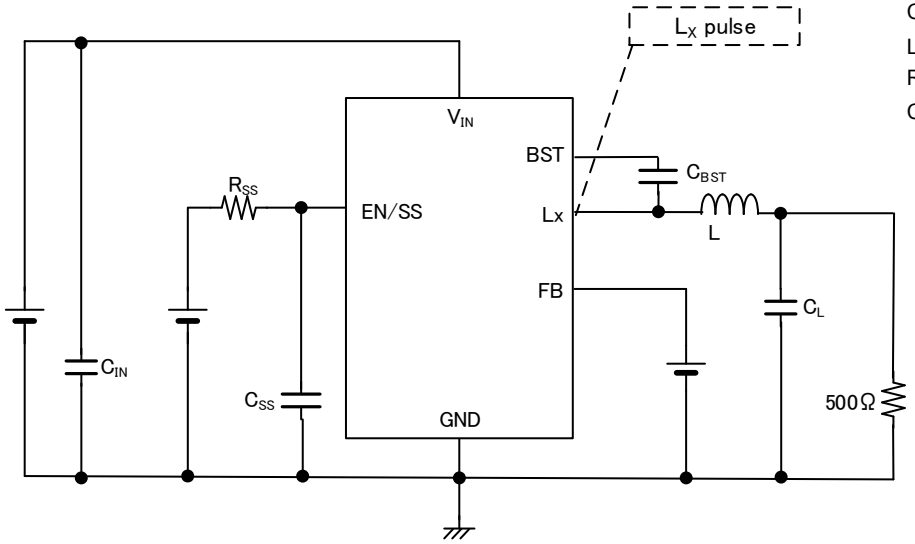
CIRCUIT⑥



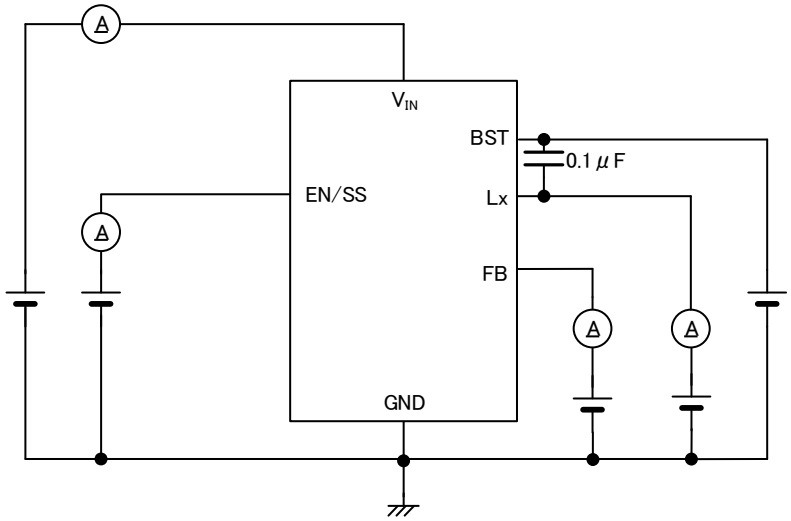
■TEST CIRCUITS(Continued)

CIRCUIT⑦

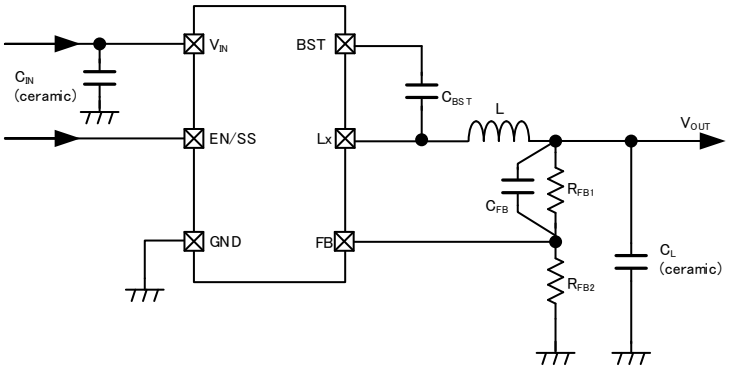
C_{IN}=10μF 2parallel
C_L=22μF 2parallel
C_{BST}=0.1μF
L=3.3μH
R_{SS}=430kΩ
C_{SS}=0.47μΩ



CIRCUIT⑧



■TYPICAL APPLICATION CIRCUIT



	VOUT	MANUFACTURER	PRODUCT NUMBER	VALUE
L	5.0V～7.0V	TDK	VLS5045EX-3R3N	3.3μH
			CLF7045NIT-3R3N	
	1.8V～4.9V	TDK	VLS5045EX-2R2N	2.2μH
			CLF7045NIT-2R2N	
CIN	-	TDK	C2012X5R1E106K	10μF/25V 2Parallel
			C3216X7R1E106K	10μF/25V 2Parallel
CL	3.3V～7.0V	TDK	C3216X5R1E226M	22μF/25V 2Parallel
			C4532X7R1E226M	22μF/25V 2Parallel
	1.8V～3.2V	TDK	C3216X5R1E226M	22μF/25V 3Parallel
			C4532X7R1E226M	22μF/25V 3Parallel
CBST	-	-	-	0.1μF/25V

<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 RFB1 and RFB2.

$V_{OUT}=0.75\times(R_{FB1}+R_{FB2})/R_{FB2}$
With $R_{FB2}\leqq 50k\Omega$

<CFB setting>
Adjust the value of the phase compensation speed-up capacitor CFB using the equation below.

$$C_{FB}=\frac{1}{2\pi\times fzfb\times R_{FB1}}$$

When VOUT=3.3V～7.0V, a target value for fzfb of about 10k～15kHz is optimum.
When VOUT=1.8V～3.2V, a target value for fzfb of about 30k～35kHz is optimum.

【Setting Example】
VOUT setting= 5.0V, RFB1=220kΩ, RFB2=39kΩ
VOUT=0.75V×(220kΩ+39kΩ) / 39kΩ =5.0V
fzfb=12.9kHz
CFB= 1/(2×π×12.9kHz×220kΩ) =56pF

【examples】

VOUT	RFB1	RFB2	CFB
5.0V	220kΩ	39kΩ	56pF
3.3V	91kΩ	27kΩ	120pF
1.8V	51kΩ	36kΩ	100pF

■TYPICAL APPLICATION CIRCUIT (Continued)

＜Soft-start Time Setting＞

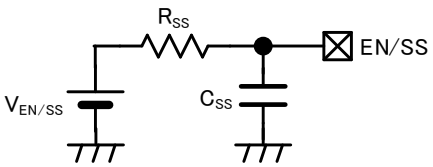
The soft-start time can be adjusted by adding a capacitor and a resistor to the EN/SS pin.
Soft-start time (t_{ss2}) is approximated by the equation below according to values of $V_{EN/SS}$, R_{SS}, and C_{SS}.

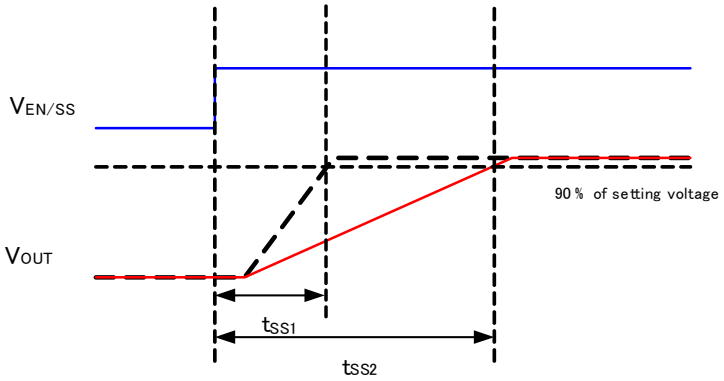
$$t_{ss2}=C_{ss} \times R_{ss} \times (\ln(V_{EN/SS}/(V_{EN/SS}-1.45)))$$

【Setting Example】

C_{SS}=0.47μF, R_{SS}=430kΩ, $V_{EN/SS}$=12V
$t_{SS2}=0.47x10^{-6} \times 430x10^{3} \times (\ln(12/(12-1.45)))=26ms$

* The soft-start time is the time from the start of $V_{EN/SS}$ until the output voltage reaches 90% of the set voltage.
If the EN/SS pin voltage rises without connecting C_{SS} and R_{SS} (R_{SS}=0Ω), Output rises with taking the soft-start time of t_{ss1}=0.95ms (TYP.) which is fixed internally.





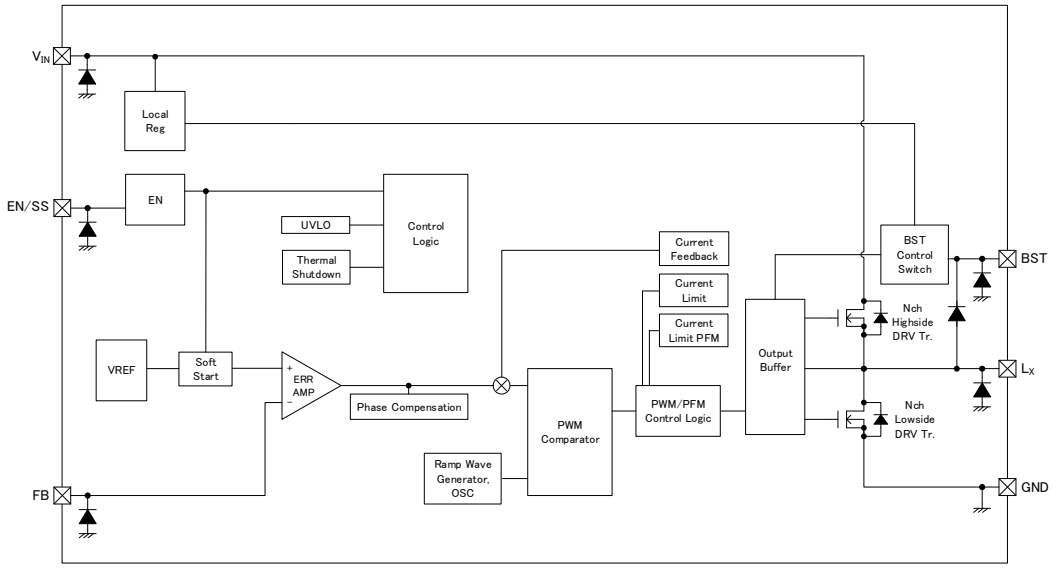
■OPERATIONAL EXPLANATION

The XC9280 series consists of a reference voltage source circuit, soft-start circuit, error amplifier circuit, PWM comparator circuit, PWM/PFM control circuit, ramp wave circuit、oscillator (OSC) circuit、phase compensation (Current feedback) circuit, current limit circuit, current limit PFM circuit, Nch High-side driver Tr.,Nch Low-side driver Tr.,output buffer circuit, internal power supply (LocalReg) circuit, under-voltage lockout (UVLO) circuit,、BST control circuit, thermal shutdown (TSD) circuit、control logic circuit .

The voltage feedback 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 phase compensation (Current feedback) circuit, and 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.

XC9280 シリーズ



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

<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 (1.2MHz).

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 voltage divider, 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.

■OPERATIONAL EXPLANATION (Continued)

< Current limiting, Short-circuit protection >
The XC9280 series incorporates a foldback circuit for current limiting and short-circuit protection.
When the output current reaches the current limit, the output voltage falls and the output current is limited.
When the overcurrent condition is canceled, the output voltage automatically recovers.

<Soft-start function>
The output voltage is soft-started by soft-starting the reference voltage.
The rise time of this reference voltage is the soft start time.
The soft-start time is set to 0.95 ms (TYP.) which is fixed internally or to the time set by adding a capacitor and a resistor to the EN / SS pin whichever is later.

<Thermal shutdown>
The thermal shutdown (TSD) as an over temperature limit is built in the XC9280 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 0.95ms (TYP.).

<UVLO>
When the V_{IN} pin voltage falls below 3.33V (TYP.), the driver transistor is forcibly turned off to prevent false pulse output due to instable operation of the internal circuits. When the V_{IN} pin voltage rises above 3.38V (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.

■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) Spike noise and ripple voltage arise in a switching regulator as with a DC/DC converter. These are greatly influenced by external component selection, such as the coil inductance, capacitance values, and board layout of external components. Once the design has been completed, verification with actual components should be done.

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

4) 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. The capacitance decrease caused by the bias voltage may become remarkable depending on the external size of the capacitor.

5) The ripple voltage could be increased when switching from discontinuous conduction mode to Continuous conduction mode. Especially when the input / output potential difference voltage is low, the ripple voltage may increased. Please evaluate IC well on customer's PCB.

6) If the voltage at the EN/SS Pin does not start from 0V but it is at the midpoint potential when the power is switched on, the soft-start function may not work properly and it may cause the larger inrush current.

7) The actual coil current may exceed the current limit value due to internal propagation delay.

8) When the voltage difference between input voltage and output voltage is low, the load regulation may be deteriorated by being limited by MAXDUTY.

9) 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.

■NOTE ON USE (Continued)

10) 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_{IN}) and the output capacitor (C_L) as close to the IC as possible.

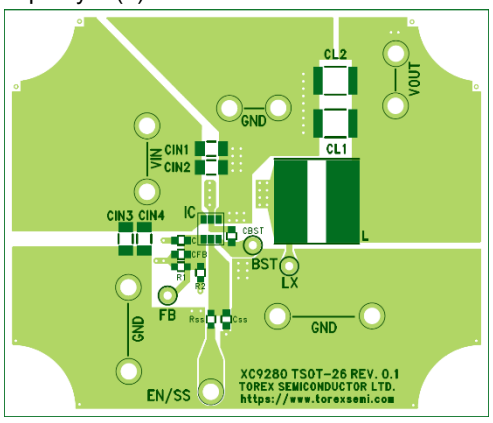
(1) In order to stabilize V_{IN} voltage level, we recommend that a by-pass capacitor (C_{IN}) be connected as close as possible to the V_{IN} and GND pins.
(2) Please mount each external component as close to the IC as possible.
(3) Wire external components as close to the IC as possible and use thick, short connecting traces to reduce the circuit impedance.
(4) 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.
(5) Please note that internal driver Tr. bring on heat because of the load current and ON resistance of High-side driver Tr., Low-side driver Tr..

(6) Please note that Tj should be lower than 125℃.
If it exceeds the value calculated from the following calculation formula, the thermal shutdown will operate due to the heat generation of the IC due to safety.
Reference Pattern Layout θ_{JA}= 64[℃/W]
Calculated values may not match actual operation depending on usage environment, usage conditions, transient conditions, etc.
Please evaluate IC well on customer's PCB.

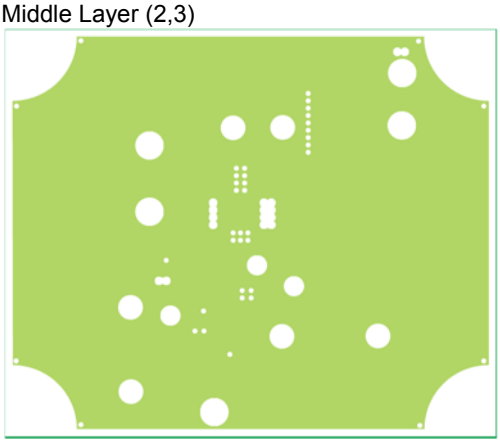
＜DC Maximum Output Voltage vs. Operating Ambient Temperature＞
$P_loss=V_{OUT}\times I_{OUT}\times(1/EFFI-1)$[W]
θ_{JA}=64 [℃/W]
T_j(Operating junction Temperature)≦125[℃]
Operating Ambient Temperature =$T_j-\theta_{JA}\times P_loss$

<Reference Pattern Layout>

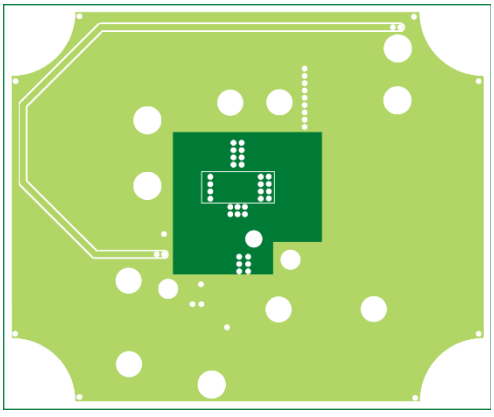
Top Layer (1)



Middle Layer (2,3)



Bottom Layer (4)

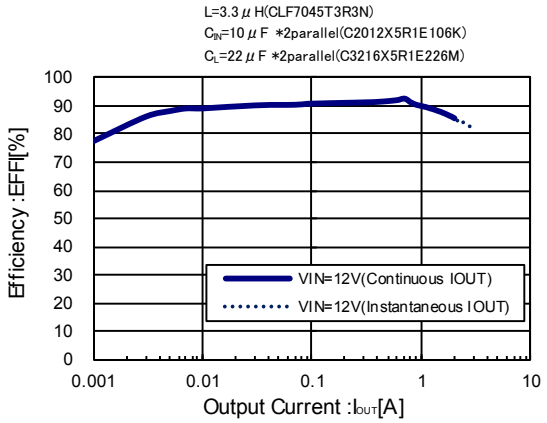


Board ：Dimensions 50mm×60mm(4 layer)
Copper thickness ：35μm
Material ：Glass Epoxy (FR-4)
Thickness ：1.6mm
θ_{JA}=64 [℃/W]

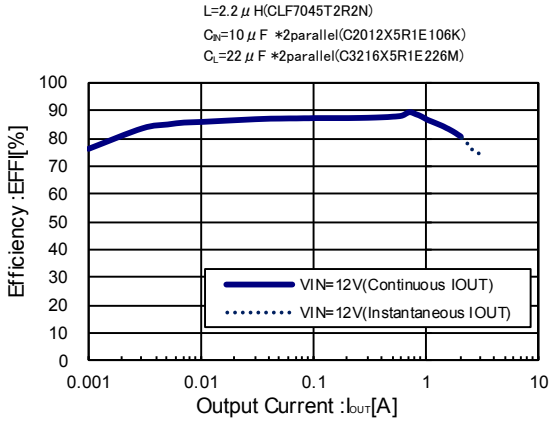
■TYPICAL PERFORMANCE CHARACTERISTICS

(1) Efficiency vs. Output current

XC9280
(V_{IN}=12V, V_{OUT}=5.0V)

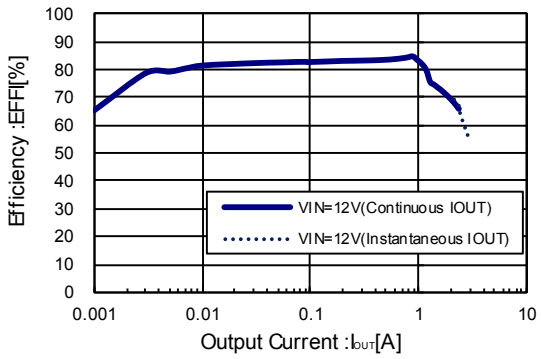


XC9280
(V_{IN}=12V, V_{OUT}=3.3V)

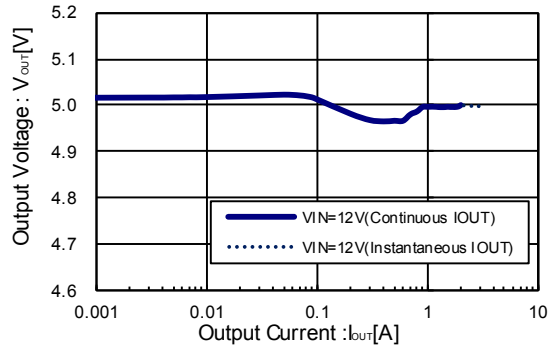


(2) Output Voltage vs. Output Current

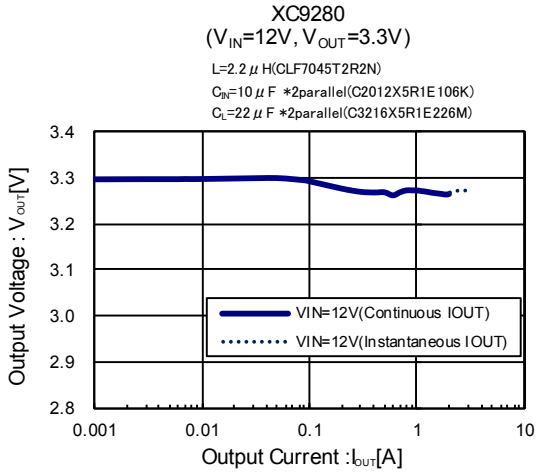
XC9280
(V_{IN}=12V, V_{OUT}=1.8V)



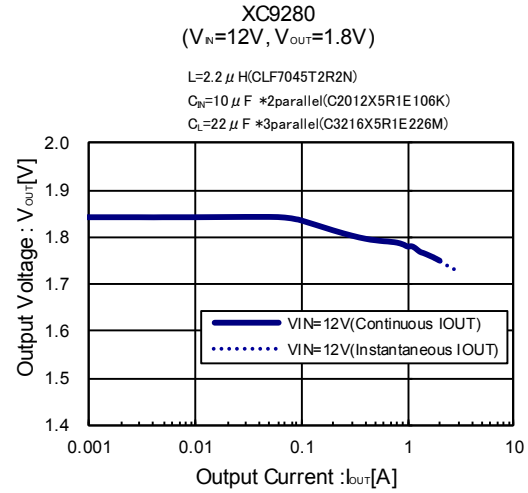
XC9280
(V_{IN}=12V, V_{OUT}=5.0V)



XC9280
(V_{IN}=12V, V_{OUT}=3.3V)

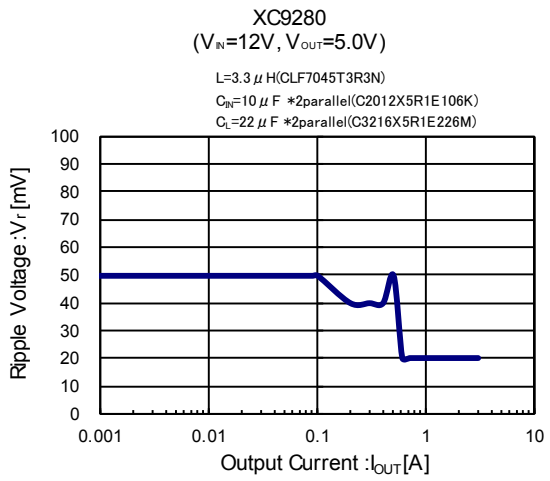


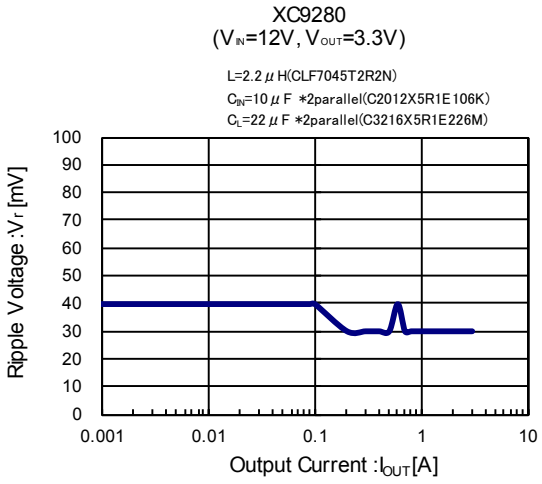
XC9280
(V_{IN}=12V, V_{OUT}=1.8V)

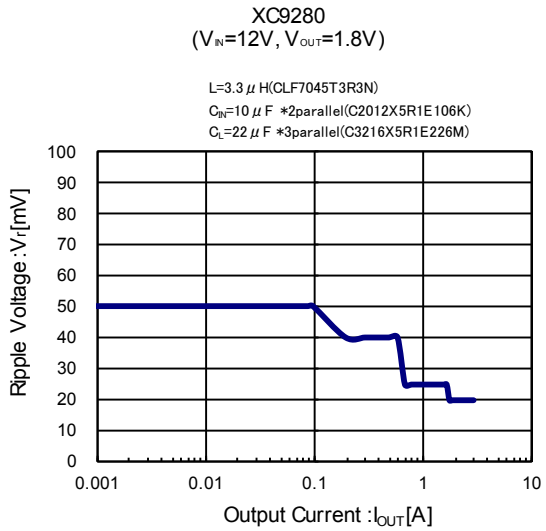


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

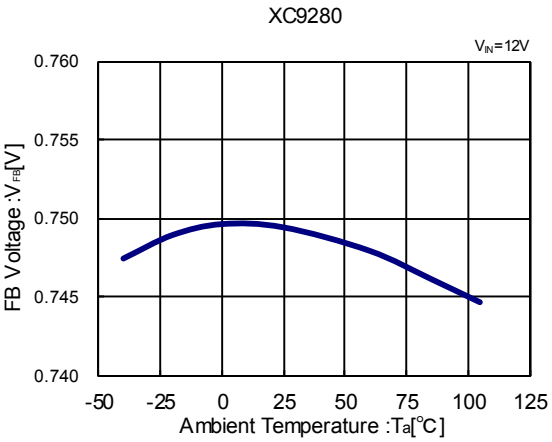
(3) Ripple Voltage vs. Output Current



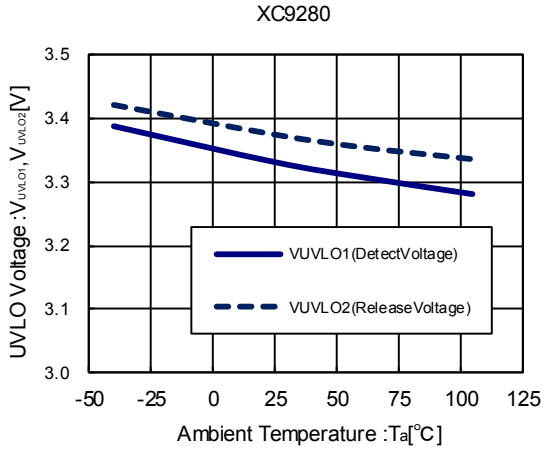




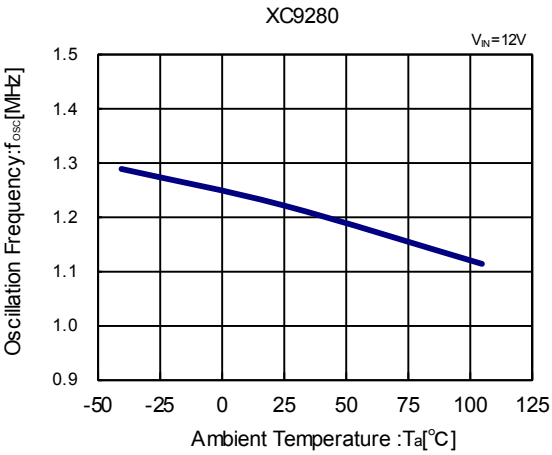
(4) FB Voltage vs. Ambient Temperature



(5) UVLO Voltage vs. Ambient Temperature

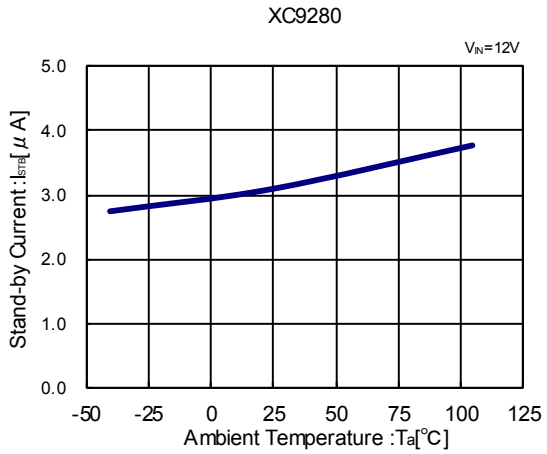


(6) Oscillation Frequency vs. Ambient Temperature

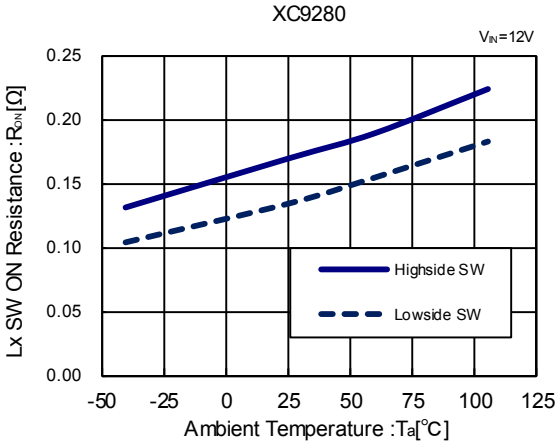


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

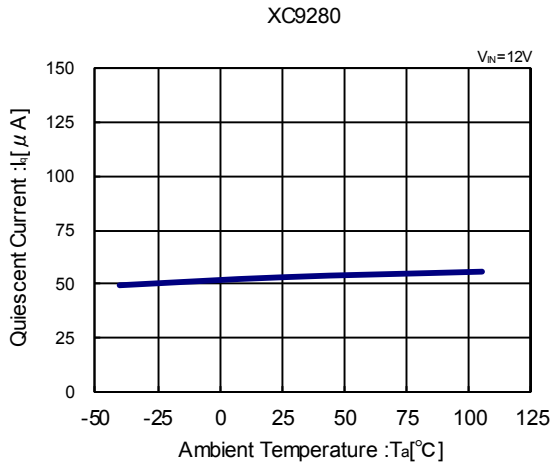
(7) Stand-by Current vs. Ambient Temperature



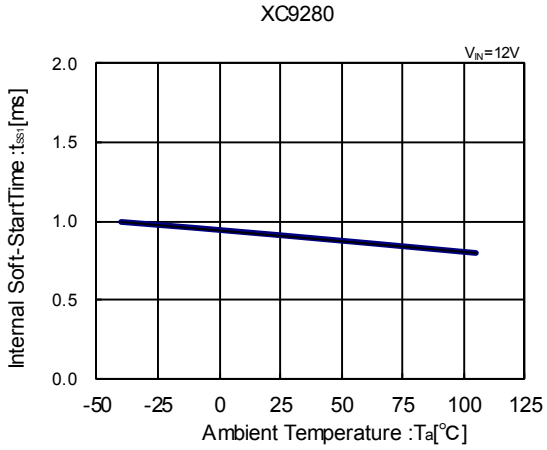
(8) Lx SW ON Resistance vs. Ambient Temperature



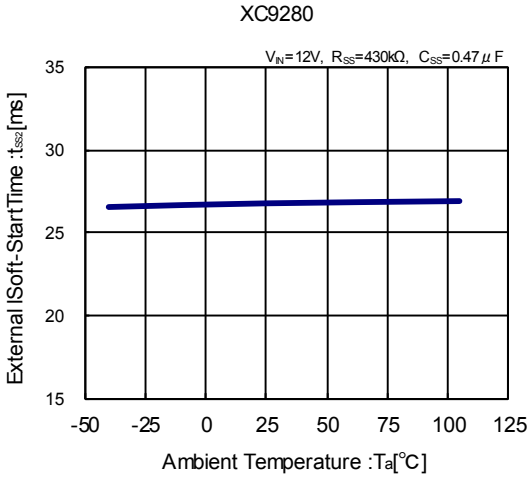
(9) Quiescent Current vs. Ambient Temperature



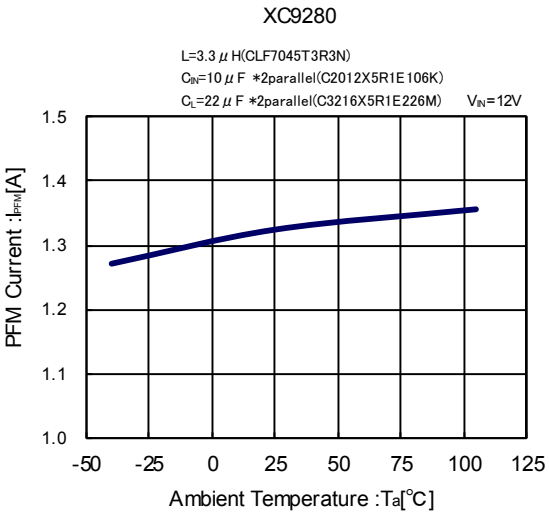
(10) Internal Soft-Start Time vs. Ambient Temperature



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

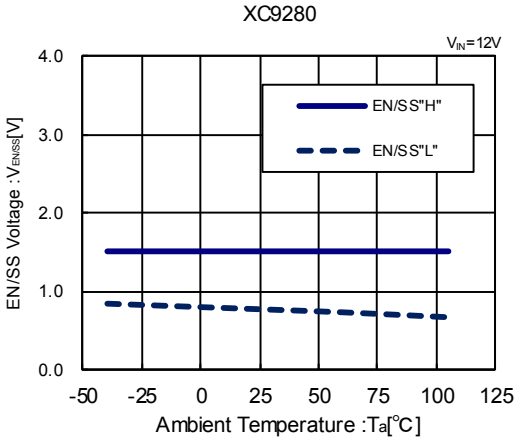


(12) PFM Current vs. Ambient Temperature

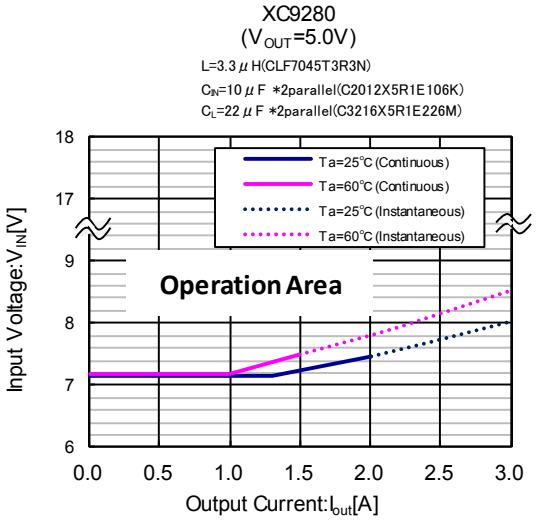


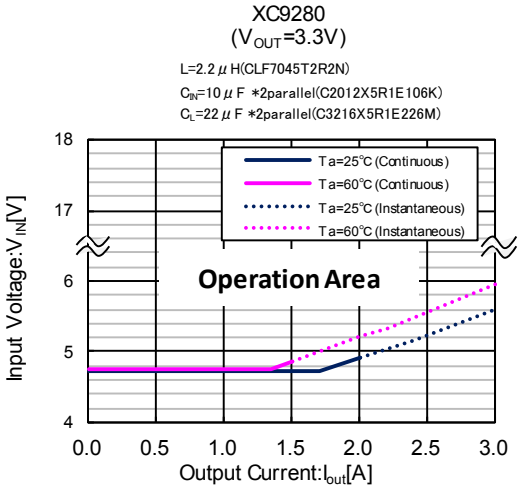
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

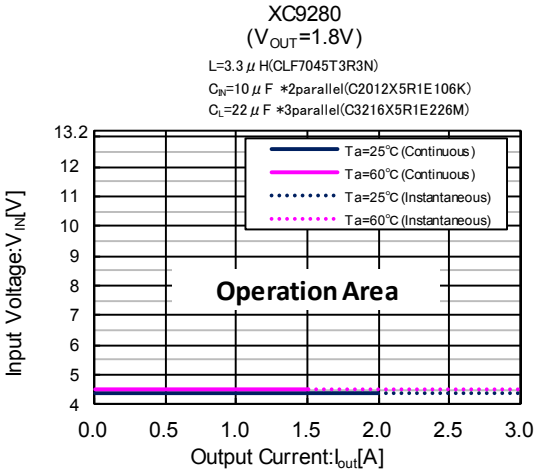
(13) EN/SS Voltage vs. Ambient Temperature



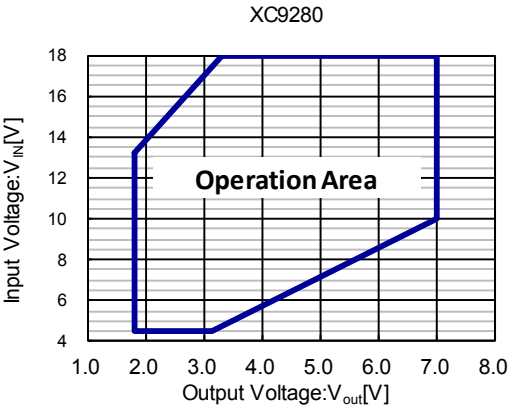
(14) I_{OUT}-V_{IN} Operation Area



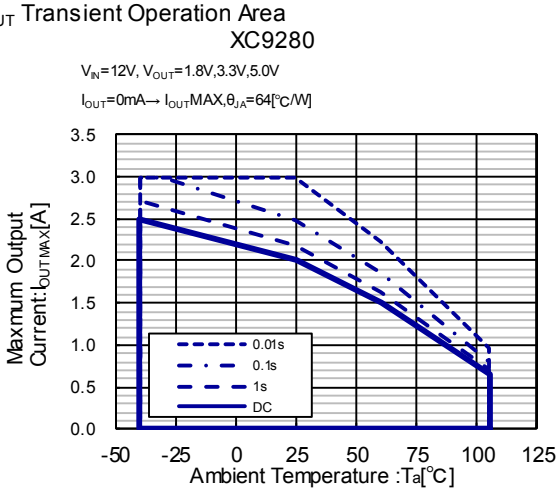




(15) V_{OUT}-V_{IN} Operation Area



(16) I_{OUT} Transient Operation Area



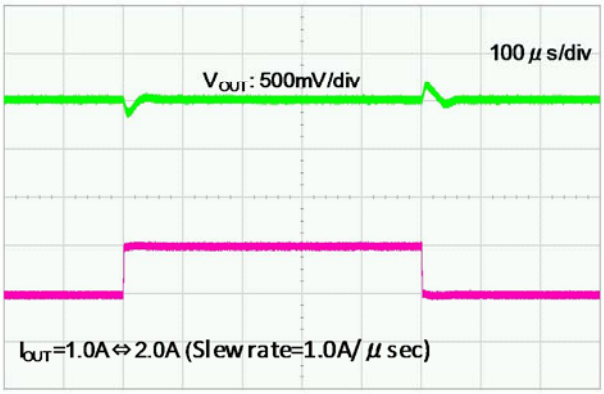
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(17-1) Load Transient Response (V_{OUT}=5.0V)

XC9280

(V_{IN}=12V, V_{OUT}=5.0V, I_{OUT}=1.0A⇔2.0A)

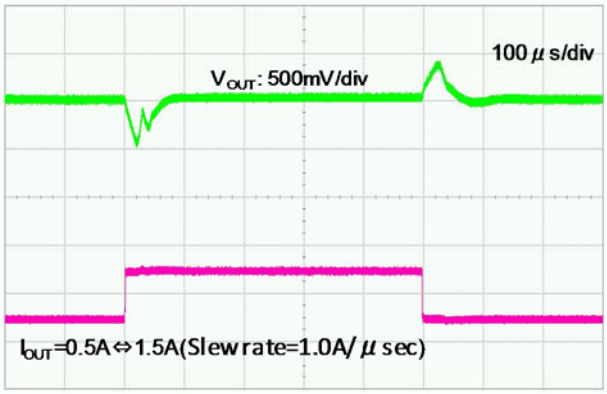
L=3.3μH(CLF7045T3R3N)
C_{IN}=10μF *2parallel(C2012X5R1E106K)
C_L=22μF *2parallel(C3216X5R1E226M)



XC9280

(V_{IN}=12V, V_{OUT}=5.0V, I_{OUT}=0.5A⇔1.5A)

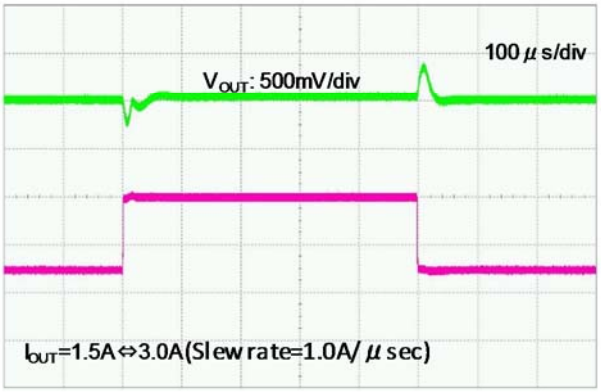
L=3.3μH(CLF7045T3R3N)
C_{IN}=10μF *2parallel(C2012X5R1E106K)
C_L=22μF *2parallel(C3216X5R1E226M)



XC9280

(V_{IN}=12V, V_{OUT}=5.0V, I_{OUT}=1.5A⇔3.0A)

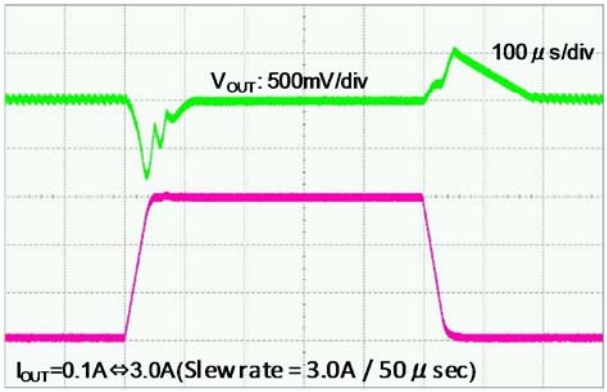
L=3.3μH(CLF7045T3R3N)
C_{IN}=10μF *2parallel(C2012X5R1E106K)
C_L=22μF *2parallel(C3216X5R1E226M)



XC9280

(V_{IN}=12V, V_{OUT}=5.0V, I_{OUT}=0.1A⇔3.0A)

L=3.3μH(CLF7045T3R3N)
C_{IN}=10μF *2parallel(C2012X5R1E106K)
C_L=22μF *2parallel(C3216X5R1E226M)

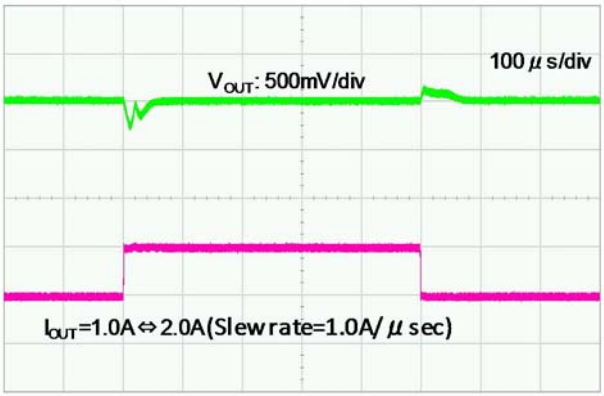


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(17-2) Load Transient Response (V_{OUT}=3.3V)

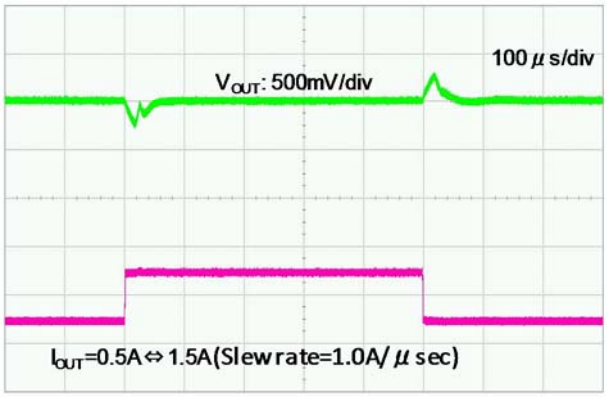
XC9280
(V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=1.0A⇔2.0A)

L=2.2μH(CLF7045T2R2N)
$C_{(L)}$=10μF *2parallel(C2012X5R1E106K)
C_L=22μF *2parallel(C3216X5R1E226M)



XC9280
(V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=0.5A⇔1.5A)

L=2.2μH(CLF7045T2R2N)
$C_{(L)}$=10μF *2parallel(C2012X5R1E106K)
C_L=22μF *2parallel(C3216X5R1E226M)



XC9280
(V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=1.5A⇔3.0A)

L=2.2μH(CLF7045T2R2N)
$C_{(L)}$=10μF *2parallel(C2012X5R1E106K)
C_L=22μF *2parallel(C3216X5R1E226M)

XC9280
(V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=0.1A⇔3.0A)

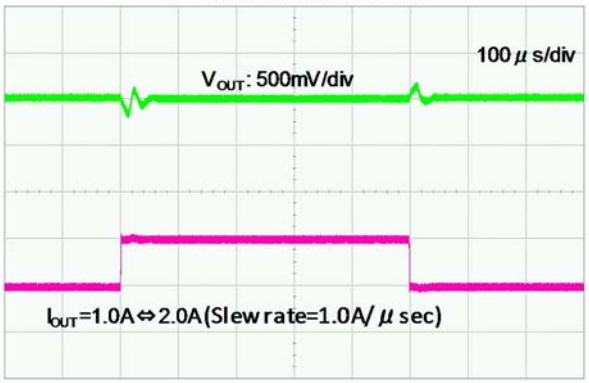
L=2.2μH(CLF7045T2R2N)
$C_{(L)}$=10μF *2parallel(C2012X5R1E106K)
C_L=22μF *2parallel(C3216X5R1E226M)

■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(17-3) Load Transient Response (V_{OUT}=1.8V)

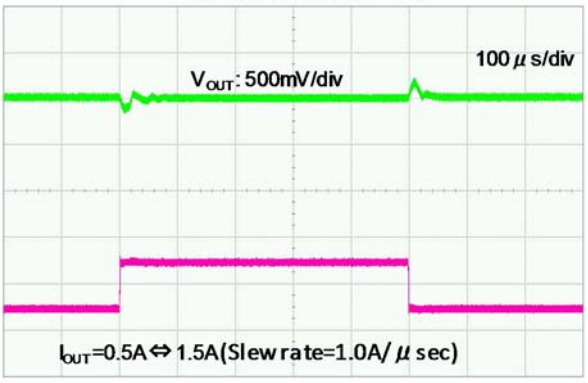
XC9280
(V_{IN}=12V, V_{OUT}=1.8V, I_{OUT}=1.0A⇔2.0A)

L=2.2μH(CLF7045T2R2N)
C_{IN}=10μF ×2parallel(C2012X5R1E106K)
C_L=22μF ×3parallel(C3216X5R1E226M)



XC9280
(V_{IN}=12V, V_{OUT}=1.8V, I_{OUT}=0.5A⇔1.5A)

L=2.2μH(CLF7045T2R2N)
C_{IN}=10μF ×2parallel(C2012X5R1E106K)
C_L=22μF ×3parallel(C3216X5R1E226M)



XC9280
(V_{IN}=12V, V_{OUT}=1.8V, I_{OUT}=1.5A⇔3.0A)

L=2.2μH(CLF7045T2R2N)
C_{IN}=10μF ×2parallel(C2012X5R1E106K)
C_L=22μF ×3parallel(C3216X5R1E226M)

XC9280
(V_{IN}=12V, V_{OUT}=1.8V, I_{OUT}=0.1A⇔3.0A)

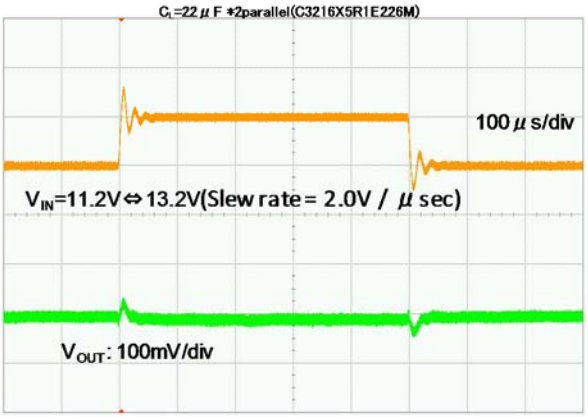
L=2.2μH(CLF7045T2R2N)
C_{IN}=10μF ×2parallel(C2012X5R1E106K)
C_L=22μF ×3parallel(C3216X5R1E226M)

■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(18) Input Transient Response

XC9280
(V_{IN}=11.5V⇔13.5V, V_{OUT}=5.0V, I_{OUT}=1.0A)
L=3.3μH(CLF7045T3R3N)
C_{IN}=10μF ×2parallel(C2012X5R1E106K)
C_L=22μF ×2parallel(C3216X5R1E226M)

XC9280
(V_{IN}=11.5V⇔13.5V, V_{OUT}=3.3V, I_{OUT}=1.0A)
L=2.2μH(CLF7045T3R3N)
C_{IN}=10μF ×2parallel(C2012X5R1E106K)
C_L=22μF ×2parallel(C3216X5R1E226M)



XC9280
(V_{IN}=11.5V⇔13.5V, V_{OUT}=1.8V, I_{OUT}=1.0A)
L=2.2μH(CLF7045T3R3N)
C_{IN}=10μF ×2parallel(C2012X5R1E106K)
C_L=22μF ×3parallel(C3216X5R1E226M)

■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

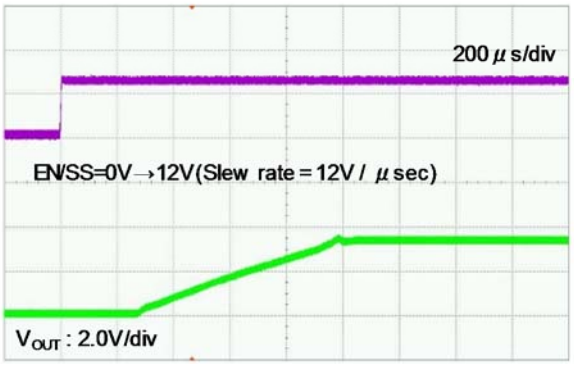
(19) EN/SS Rising Response

XC9280
(V_{IN}=12V, V_{CE}=0→12V, V_{OUT}=5.0V, I_{OUT}=1.0A)

L=3.3μH(CLF7045T3R3N)
C_{IN}=10μF *2parallel(C2012X5R1E106K)
C_L=22μF *2parallel(C3216X5R1E226M)

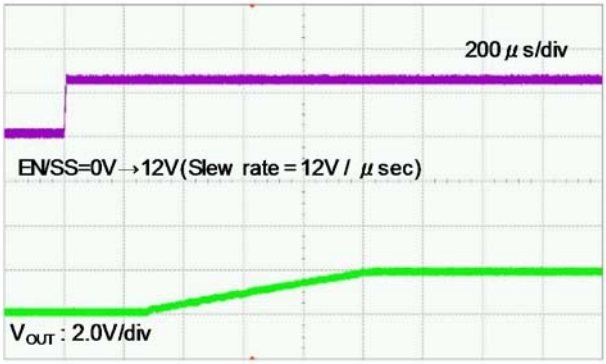
XC9280
(V_{IN}=12V, V_{CE}=0→12V, V_{OUT}=3.3V, I_{OUT}=1.0A)

L=2.2μH(CLF7045T2R2N)
C_{IN}=10μF *2parallel(C2012X5R1E106K)
C_L=22μF *2parallel(C3216X5R1E226M)



XC9280
(V_{IN}=12V, V_{CE}=0→12V, V_{OUT}=1.8V, I_{OUT}=1.0A)

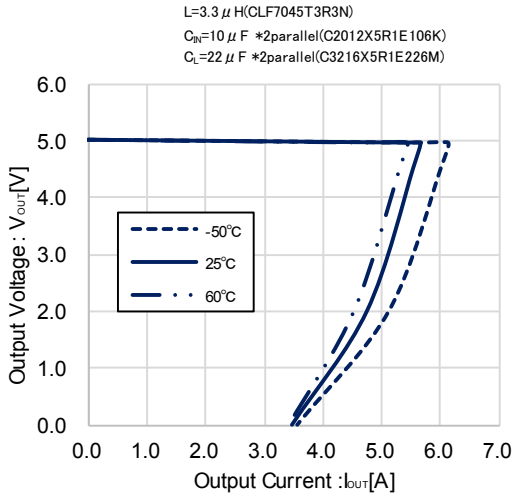
L=2.2μH(CLF7045T2R2N)
C_{IN}=10μF *2parallel(C2012X5R1E106K)
C_L=22μF *3parallel(C3216X5R1E226M)



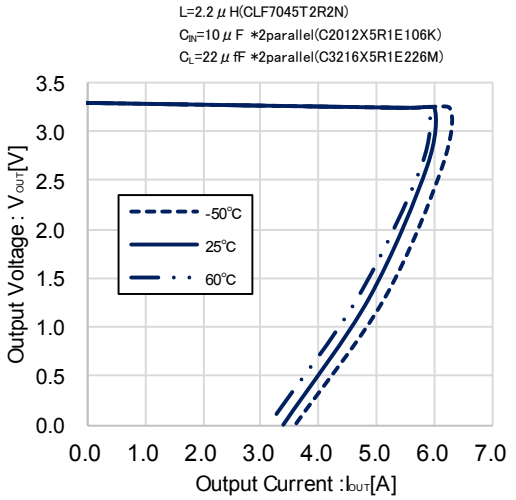
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(20) Output Voltage vs. Output Current

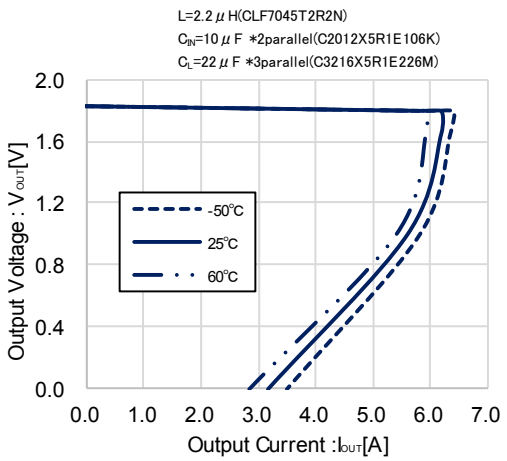
XC9280
(V_{IN}=12V, V_{OUT}=5.0V)



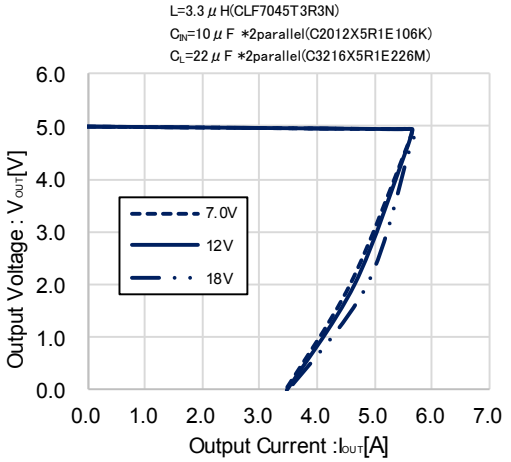
XC9280
(V_{IN}=12V, V_{OUT}=3.3V)



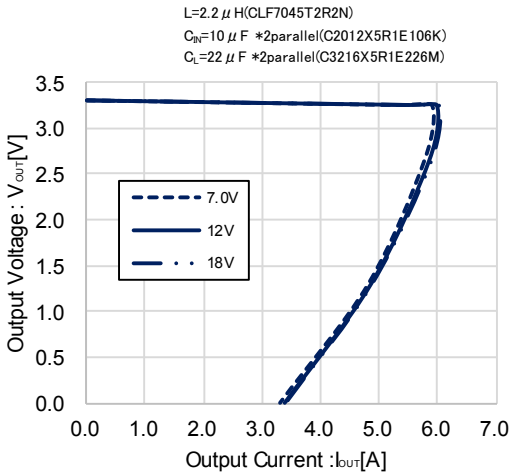
XC9280
(V_{IN}=12V, V_{OUT}=1.8V)



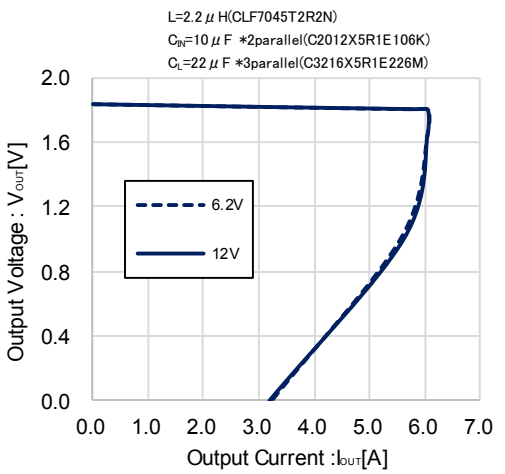
XC9280
(V_{OUT}=5.0V)



XC9280
(V_{OUT}=3.3V)

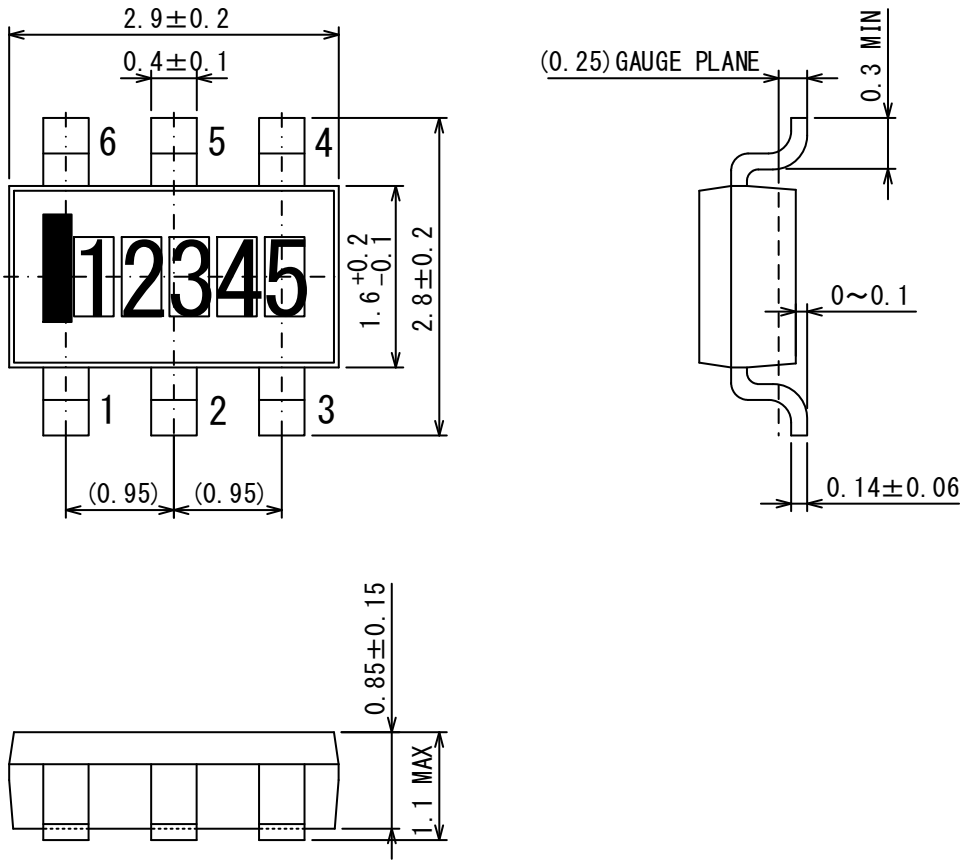


XC9280
(V_{OUT}=1.8V)

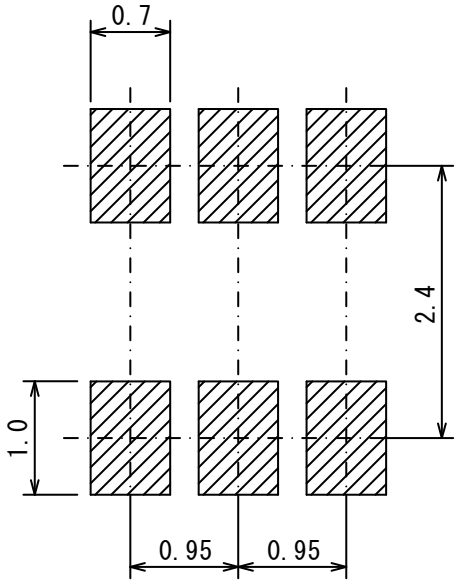


■PACKAGING INFORMATION

●TSOT-26 (unit: mm)



●TSOT-26 Reference Pattern Layout (unit: mm)



●TSOT-26 Reference Metal Mask Design (unit: mm)

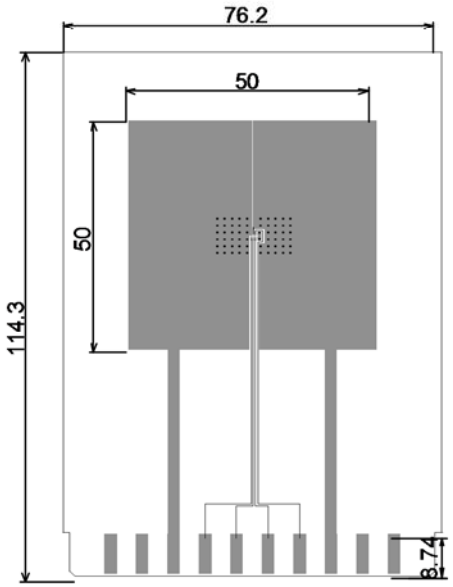
*Same as Pattern Layout size

●TSOT-26 Power Dissipation 105℃

Power dissipation data for the TSOT-26 is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as the reference data taken in the following condition.

1. Measurement Condition

Condition: Mount on a board
Ambient: Natural convection
Soldering: Lead (Pb) free
Board: The board using 4 copper layer.
(76.2mm×114.3mm・・・Area: about 8700mm^2)
Each copper layer are as follows.
1st layer : 25mm×50mm_Connected to 2 pin.
25mm×50mm_Connected to 3 pin.
2nd layer : 35mm×70mm_Connected to 2 pin.
35mm×70mm_Connected to 3 pin.
3rd layer : 35mm×70mm_Connected to 2 pin.
35mm×70mm_Connected to 3 pin.
4th layer : 25mm×50mm_Connected to 2 pin.
25mm×50mm_Connected to 3 pin.
Material: Glass Epoxy (FR-4)
Thickness: 1.6mm
Through-hole: φ0.2mm: 60 pcs

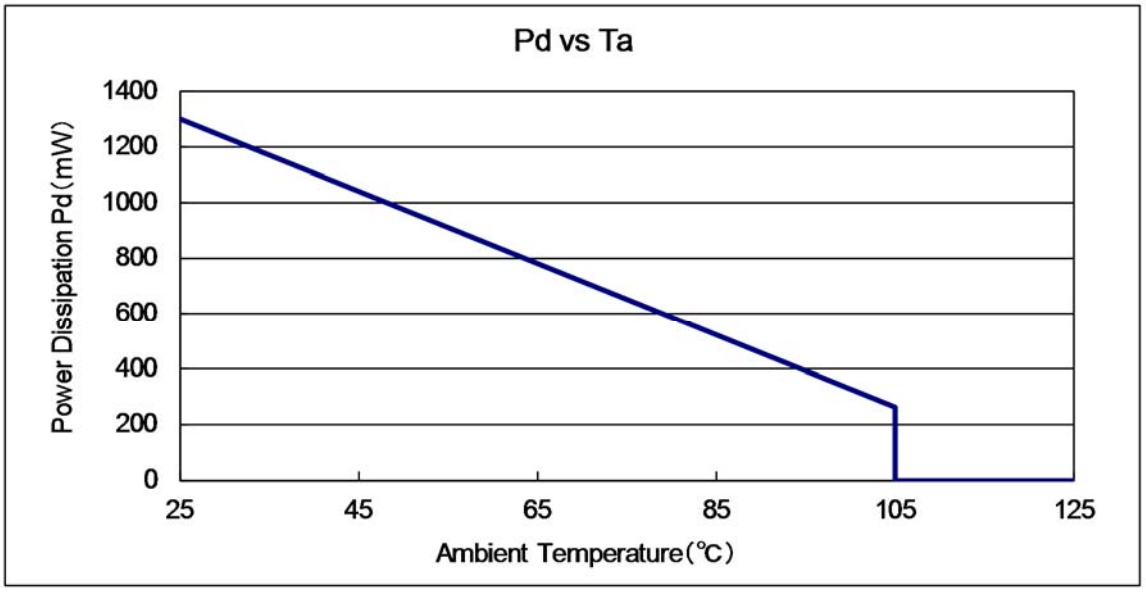


Evaluation Board (Unit: mm)

2.Power Dissipation vs. Ambient Temperature

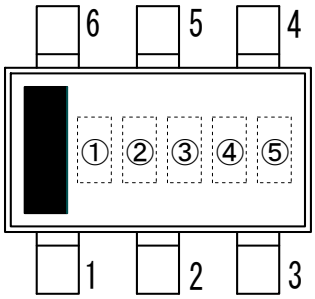
Board Mount (Tj max = 125℃)

Ambient Temperature (℃)	Power Dissipation Pd (mW)	Thermal Resistance (℃/W)
25	1300	76.92
105	260	



■MARKING RULE

TSOT-26



①,②,③ Type、Oscillation Frequency

Mark			Type	Oscillation Frequency	Product Series
①	②	③			
1	1	A	A	1.2MHz	XC9280A75CYR-G

④,⑤ represents production lot number
01～09, 0A～0Z, 11～9Z, A1～A9, AA～AZ, B1～ZZ repeated
(G, I, J, O, Q, W excluded)* No character inversion used.

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