XC6367/XC6368 Series

ETR0401_006

PWM Controlled, PWM/PFM Switchable Step-up DC/DC Controllers

☆Green Operation Compatible

■GENERAL DESCRIPTION

The XC6367/XC6368 series are multi-functional step-up DC/DC controllers which provide high efficiency outputs by using an externally connected transistor, coil, diode and capacitor.

Output voltage is selectable in 0.1V increments within a range of 1.5V ~ 6.5V (±2.5%). For output voltages outside this range, we recommend FB version, which has a 1.0V internal reference voltage. Using the FB version, the required output voltage can be set-up using 2 external resistors.

With a 300kHz oscillation frequency, the size of the external components can be reduced.

Control switches from PWM to PFM during light loads with the XC6368 (PWM/PFM switchable) and the series is highly efficient from light loads to large output currents.

Soft start time of XC6367/ XC6368A, B, and E series is internally set to 10ms and XC6367/68C, D, and F series regulate soft-start time by connecting resistors and capacitors externally.

During stand-by (CE pin "L"), supply current is reduced to less than 0.5μA.

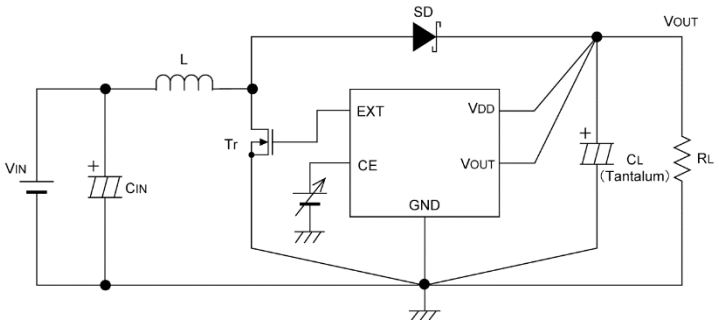
■APPLICATIONS

- ●E-book Readers / Electronic dictionaries
- ●Smart phones / Mobile phones
- ●Note PCs / Tablet PCs
- ●Digital audio equipments
- ●Multi-function power supplies

■FEATURES

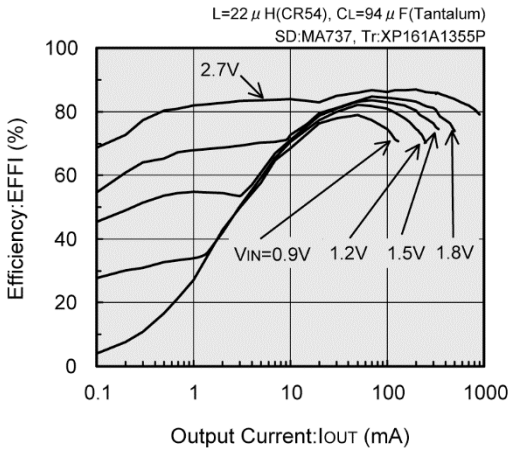
Input Voltage Range	: 0.9V ~ 10V
Operating Voltage Range	: 2.0V ~ 10V
Output Voltage Range	: 1.5V ~ 6.5V (0.1V increments) (±2.5%)
Oscillation Frequency	: 300kHz, 100kHz (±15%) Custom products for 180kHz, 500kHz
Output Current	: More than 200mA (V_{IN}=1.8V, V_{OUT}=3.3V)
High Efficiency	: 84% (TYP.)
Stand-by capability	: I_{STB}=0.5μA (MAX.)
Selection	: Soft-start set-up external Output voltage set-up internal (V_{OUT}) Output voltage set-up external (FB) PWM/PFM Control (XC6368)
Package	: SOT-25
Environmentally Friendly	: EU RoHS Compliant, Pb Free

■TYPICAL APPLICATION CIRCUIT



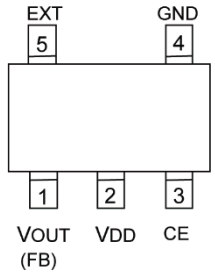
■ TYPICAL PERFORMANCE CHARACTERISTICS

XC6368A333MR (300kHz,3.3V)



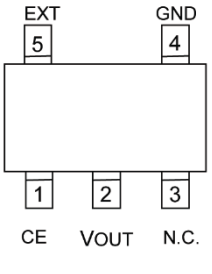
■PIN CONFIGURATION

XC6367/XC6368 series
A, B, C, D types



SOT-25
(TOP VIEW)

XC6367/XC6368 series
E, F types



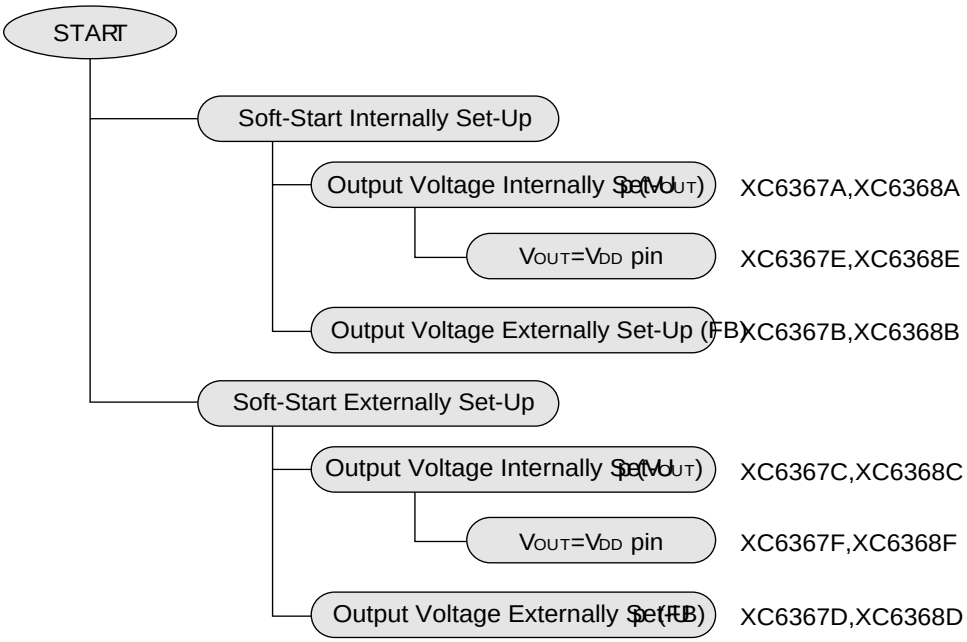
SOT-25
(TOP VIEW)

■PIN ASSIGNMENT

PIN NUMBER		PIN NAME	FUNCTION
XC6367/XC6368			
A, B, C, D	E, F		
5	5	EXT	: External Transistor Connection
2	-	V_{DD}	: Supply Voltage Input
4	4	GND	: Ground
3	1	CE	: Chip Enable (C, D, F Types: Soft Start External Set-Up, Soft Start Capacitor Connected)
1	2	V_{OUT} (FB)	: Output Voltage Monitor (E, F Types: Output Voltage Monitor, Power Supply) (B, D Types: Output Voltage External Set-up)

■PRODUCT CLASSIFICATION

●Selection Guide



■PRODUCT CLASSIFICATION (Continued)

●Ordering Information

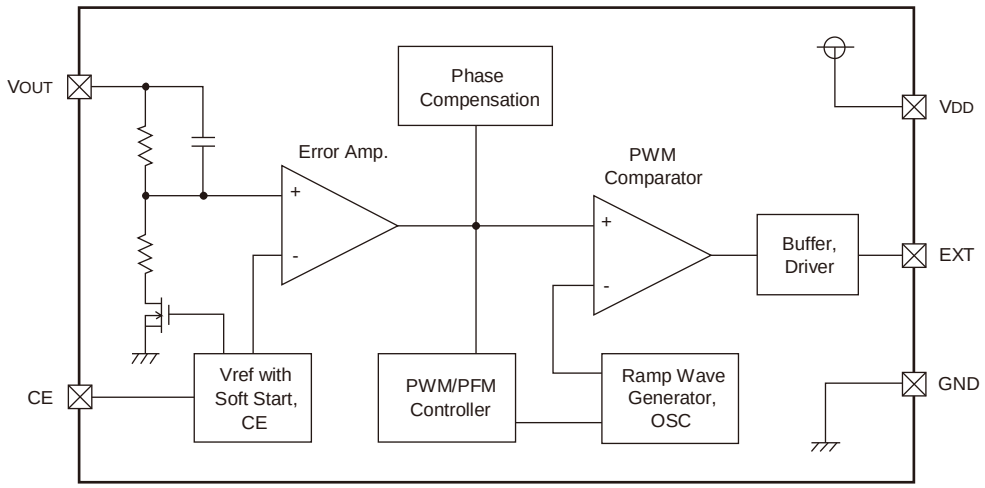
XC6367①②③④⑤⑥-⑦ (*1) PWM Control
XC6368①②③④⑤⑥-⑦ (*1) PWM/PFM Switching Control

DESIGNATOR	ITEM	SYMBOL	DESCRIPTION
①	Type of DC/DC Converter	A	VOUT type: VOUT internally set-up, Soft-start internally set-up
		B	FB type: VOUT externally set-up, Soft-start internally set-up
		C	VOUT type: VOUT internally set-up, Soft-start externally set-up
		D	FB type: VOUT externally set-up, Soft-start externally set-up
		E	VOUT type: VOUT internally set-up, Soft-start internally set-up
		F	VOUT type: VOUT internally set-up, Soft-start externally set-up
②③	Output Voltage	15 ~ 65	VOUT type: 3.0V output → ②=3, ③=0
		10	FB type (B, D types): 10 fixed → ②=1, ③=0 fixed
④	Oscillation Frequency	3	300kHz
		1	100kHz
		2	180kHz (Custom)
		5	500kHz (Custom)* B,D Type Only
⑤⑥-⑦	Package (Order Unit)	MR	SOT-25 (3,000/Reel)
		MR-G	SOT-25 (3,000/Reel)

(*1) The “-G” suffix indicates that the products are Halogen and Antimony free as well as being fully EU RoHS compliant.

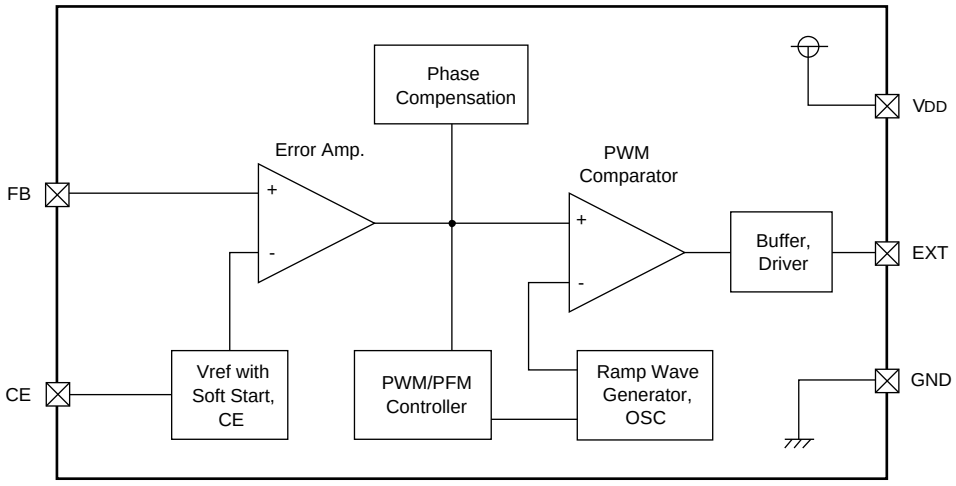
■BLOCK DIAGRAMS

XC6367, XC6368 Series A, C, E, F types (VOUT)



* VOUT and VDD of the E and F types should be connected internally.

XC6367, XC6368 Series B,D types (FB)



■ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNITS
V_{DD} Pin Voltage		V_{DD}	-0.3 ~ 12.0	V
V_{OUT} Pin Voltage		V_{OUT}	-0.3 ~ 12.0	V
FB Pin Voltage		V_{FB}	-0.3 ~ 12.0	V
CE Pin Voltage		V_{CE}	-0.3 ~ 12.0	V
EXT Pin Voltage		V_{EXT}	-0.3 ~ V_{DD} + 0.3	V
EXT Pin Current		I_{EXT}	±100	mA
Power Dissipation (Ta=25℃)	SOT-25	Pd	150	mW
			600 (40mm x 40mm standard board) (*1)	
			760 (JESD51-7 board) (*1)	
Operating Temperature Range		Topr	-30 ~ 80	℃
Storage Temperature Range		Tstg	-40 ~ 125	℃

* Voltage is all ground standardized.

(*1) The power dissipation figure shown is PCB mounted and is for reference only.
The mounting condition is please refer to PACKAGING INFORMATION.

■ELECTRICAL CHARACTERISTICS

XC6367A333MR, XC6368A333MR V_{OUT}=3.3V, FOSC=300kHz, Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	V_{OUT}		3.218	3.300	3.383	V
Supply Voltage (*1)	V_{DD}		2.0	-	10.0	V
Maximum Input Voltage	V_{IN}		10.0	-	-	V
Oscillation Start Voltage 1	V_{ST1}	Tr: 2SD1628, I_{OUT}=1.0mA	-	-	0.9	V
Oscillation Start Voltage 2	V_{ST2}	V_{OUT}=CE: Apply voltage	-	-	0.8	V
Oscillation Hold Voltage	V_{HLD}	Tr: Use of a 2SX1628, I_{OUT}=1.0mA	-	-	0.7	V
Supply Current 1	I_{DD1}	V_{OUT}=CE=setting output voltage x 0.95	-	130	200	μA
Supply Current 2	I_{DD2}	V_{OUT}=CE=setting output voltage + 0.5V	-	20	35	μA
Stand-by Current	I_{STB}	V_{OUT}=setting output voltage x 0.95, CE=0V	-	-	0.5	μA
Oscillator Frequency	FOSC	Same as I_{DD1}	255	300	345	kHz
Maximum Duty Ratio	MAXDTY	Same as I_{DD1}	78	85	92	%
PFM Duty Ratio (*3)	PFMDTY	I_{OUT}=0mA	15	25	35	%
CE "H" Voltage	V_{CEH}	V_{OUT}=setting output voltage x0.95	0.65	-	-	V
CE "L" Voltage	V_{CEL}	V_{OUT}=setting output voltage x0.95	-	-	0.20	V
EXT "H" ON Resistance	R_{EXTH}	Same as I_{DD1}, VEXT=V_{OUT}-0.4V	-	29	43	Ω
EXT "L" ON Resistance	R_{EXTL}	Same as I_{DD1}, V_{EXT}=0.4V	-	19	27	Ω
Efficiency (*2)	EFFI		-	84	-	%
Soft-Start Time	T_{SS}		5	10	20	ms

Conditions: Unless otherwise stated, connect V_{DD} to V_{OUT}; V_{IN}=setting output voltage x 0.6, I_{OUT}=130mA
NOTE:

* 1: When taking V_{DD} from another power source please ensure that V_{DD} = 2.0V or more.
Oscillation will occur with a value of V_{DD} = 0.8V or more, but with a value of V_{DD} = 2.0V or more, output voltage and oscillation frequency will be stable.

* 2: EFFI = {[(output voltage) x (output current)]÷[(input voltage) x (input current)] x 100

* 3: Applies to the XC6368 series only (duty ratio when control changes to PFM).

■ELECTRICAL CHARACTERISTICS (Continued)

XC6367A503MR, XC6368A503MR

V_{OUT}=5.0V, FOSC=300kHz,Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	V_{OUT}		4875	5.000	5.125	V
Supply Voltage (*1)	V_{DD}		2.0	-	10.0	V
Maximum Input Voltage	V_{IN}		10.0	-	-	V
Oscillation Start Voltage 1	V_{ST1}	Tr: 2SD1628, I_{OUT}=1.0mA	-	-	0.9	V
Oscillation Start Voltage 2	V_{ST2}	V_{OUT}=CE : Apply voltage	-	-	0.8	V
Oscillation Hold Voltage	V_{HLD}	Tr: 2SD1628, I_{OUT}=1.0mA	-	-	0.7	V
Supply Current 1	I_{DD1}	V_{OUT}=CE=setting output voltage x 0.95	-	180	280	μA
Supply Current 2	I_{DD2}	V_{OUT}=CE=setting output voltage + 0.5V	-	22	38	μA
Stand-by Current	I_{STB}	V_{OUT}=setting output voltage x 0.95, CE=0V	-	-	0.5	μA
Oscillation Frequency	FOSC	Same as I_{DD1}	255	300	345	kHz
Maximum Duty Ratio	MAXDTY	Same as I_{DD1}	78	85	92	%
PFM Duty Ratio (*3)	PFMDTY	I_{OUT}=0mA	15	25	35	%
CE "H" Voltage	V_{CEH}	V_{OUT}=setting output voltage x0.95	0.65	-	-	V
CE "L" Voltage	V_{CEL}	V_{OUT}=setting output voltage x0.95	-	-	0.20	V
EXT "H" ON Resistance	R_{EXTH}	Same as I_{DD1}, V_{EXT}=V_{OUT}-0.4V	-	20	29	Ω
EXT "L" ON Resistance	R_{EXTL}	Same as I_{DD1}, V_{EXT}=0.4V	-	13	19	Ω
Efficiency (*2)	EFFI		-	87	-	%
Soft-Start Time	T_{SS}	Connect R_{SS} and C_{SS}, CE:0V→3.0V (XC6367C/F and XC6368C/F series)	5	10	20	ms

Conditions: Unless otherwise specified, connect V_{DD} to V_{OUT}; V_{IN}=setting output voltage x 0.6, I_{OUT}=200mA

NOTE:

* 1: When taking V_{DD} from another power source please ensure that V_{DD} = 2.0V or more.
  Oscillation will occur with a value of V_{DD} = 0.8V or more, but with a value of V_{DD} = 2.0V or more, output voltage and oscillation frequency will be stable.

* 2: EFFI = {[(output voltage) x (output current)]÷[(input voltage) x (input current)] x 100

* 3: Applies to the XC6368 series only (duty ratio when control changes to PFM).

* 4: The values of supply voltage and NOTE *1 do not apply to XC6367E/F and XC6368E/F series. For XC6367E/F and XC6368E/F series, output voltage less than 2.0V cannot be set-up.

■ELECTRICAL CHARACTERISTICS (Continued)

XC6367B103MR, XC6368B103MR

V_{OUT}=3.0V , FOSC=300kHz, Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	V_{OUT}		2.925	3.000	3.075	V
Supply Voltage (*1)	V_{DD}		2.0	-	10.0	V
Maximum Input Voltage	V_{IN}		10.0	-	-	V
Oscillation Start Voltage 1	V_{ST1}	Tr: 2SD1628, I_{OUT}=1.0mA	-	-	0.9	V
Oscillation Start Voltage 2	V_{ST2}	V_{DD}=CE: Apply voltage, FB=0V	-	-	0.8	V
Oscillation Hold Voltage	V_{HLD}	Tr: 2SD1628, I_{OUT}=1.0mA	-	-	0.7	V
Supply Current 1	I_{DD1}	V_{DD}=CE=2.85V,FB=0V	-	120	190	μA
Supply Current 2	I_{DD2}	V_{DD}=CE=3.5V,FB=1.2V	-	20	34	μA
Stand-by Current	I_{STB}	V_{DD}=2.85V, CE=0V, FB=0V	-	-	0.5	μA
Oscillation Frequency	FOSC	Same as I_{DD1}	255	300	345	kHz
Maximum Duty Ratio	MAXDTY	Same as I_{DD1}	78	85	92	%
PFM Duty Ratio (*3)	PFMDTY	I_{OUT}=0mA	15	25	35	%
CE "H" Voltage	V_{CEH}	V_{DD}=2.85V,FB=0V	0.65	-	-	V
CE "L" Voltage	V_{CEL}	V_{DD}=2.85V,FB=0V	-	-	0.20	V
EXT "H" ON Resistance	R_{EXTH}	Same as I_{DD1}, V_{EXT}=V_{DD}-0.4V	-	32	47	Ω
EXT "L" ON Resistance	R_{EXTL}	Same as I_{DD1}, V_{EXT}=0.4V	-	20	30	Ω
Efficiency (*2)	EFFI		-	84	-	%
Soft-Start Time	T_{SS}	Connect R_{SS} and C_{SS}, CE:0V→3.0V (XC6367D/68D series)	5	10	20	ms

Conditions: Unless otherwise stated, V_{IN}=1.8V, I_{OUT}=120mA
External components : R_{FB1} = 400kΩ, R_{FB2} = 200kΩ, C_{FB} = 47pF

NOTE:

* 1: When taking V_{DD} from another power source please ensure that V_{DD} = 2.0V or more.
Oscillation will occur with a value of V_{DD} = 0.8V or more, but with a value of V_{DD} = 2.0V or more, output voltage and oscillation frequency will be stable.

* 2: EFFI = {[(output voltage) x (output current)]÷[(input voltage) x (input current)] x 100

* 3: Applies to the XC6368 series only (duty ratio when control changes to PFM).

■ELECTRICAL CHARACTERISTICS (Continued)

XC6367A331MR, XC6368A331MR V_{OUT}=3.3V, FOSC=100kHz, Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	V_{OUT}		3.218	3.300	3.383	V
Supply Voltage (* 1)	V_{DD}		2.0	-	10.0	V
Maximum Input Voltage	V_{IN}		10.0	-	-	V
Oscillation Start Voltage 1	V_{ST1}	Tr: 2SD1628, I_{OUT}=1.0mA	-	-	0.9	V
Oscillation Start Voltage 2	V_{ST2}	V_{OUT}=CE: Apply voltage	-	-	0.8	V
Oscillation Hold Voltage	V_{HLD}	Tr: 2SD1628, I_{OUT}=1.0mA	-	-	0.7	V
Supply Current 1	I_{DD1}	V_{OUT}=CE=setting output voltage x 0.95	-	50	100	μA
Supply Current 2	I_{DD2}	V_{OUT}=CE=setting output voltage + 0.5V	-	11	20	μA
Stand-by Current	I_{STB}	V_{OUT}=setting output voltage x 0.95, CE=0V	-	-	0.5	μA
Oscillation Frequency	FOSC	Same as I_{DD1}	85	100	115	kHz
Maximum Duty Ratio	MAXDTY	Same as I_{DD1}	78	85	92	%
PFM Duty Ratio (* 3)	PFMDTY	I_{OUT}=0mA	15	25	35	%
CE "H" Voltage	V_{CEH}	V_{OUT}=setting output voltage x0.95	0.65	-	-	V
CE "L" Voltage	V_{CEL}	V_{OUT}=setting output voltage x0.95	-	-	0.20	V
EXT "H" ON Resistance	R_{EXTH}	Same as I_{DD1}, V_{EXT}=V_{OUT}-0.4V	-	29	43	Ω
EXT "L" ON Resistance	R_{EXTL}	Same as I_{DD1}, V_{EXT}=0.4V	-	19	27	Ω
Efficiency (* 2)	EFFI		-	84	-	%
Soft-Start Time	T_{SS}		5	10	20	ms

Conditions: Unless otherwise stated, connect V_{DD} to V_{OUT}; V_{IN}=setting output voltage x 0.6, I_{OUT}=130mA

NOTE:

* 1: When taking V_{DD} from another power source please ensure that V_{DD} = 2.0V or more.
Oscillation will occur with a value of V_{DD} = 0.8V or more, but with a value of V_{DD} = 2.0V or more, output voltage and oscillation frequency will be stable.

* 2: EFFI = {[(output voltage) x (output current)]÷[(input voltage) x (input current)] x 100

* 3: Applies to the XC6368 series only (duty ratio when control changes to PFM).

■ELECTRICAL CHARACTERISTICS (Continued)

XC6367A501MR, XC6368A501MR V_{OUT}=5.0V, FOSC=100kHz, Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	V_{OUT}		4875	5.000	5.125	V
Supply Voltage (*1)	V_{DD}		2.0	-	10.0	V
Maximum Input Voltage	V_{IN}		10.0	-	-	V
Oscillation Start Voltage 1	V_{ST1}	Tr: 2SD1628, I_{OUT}=1.0mA	-	-	0.9	V
Oscillation Start Voltage 2	V_{ST2}	V_{OUT}=CE: Apply voltage	-	-	0.8	V
Oscillation Hold Voltage	V_{HLD}	Tr: 2SX1628, I_{OUT}=1.0mA	-	-	0.7	V
Supply Current 1	I_{DD1}	V_{OUT}=CE=setting output voltage x 0.95	-	70	120	μA
Supply Current 2	I_{DD2}	V_{OUT}=CE=setting output voltage + 0.5V	-	11	22	μA
Stand-by Current	I_{STB}	V_{OUT}=setting output voltage x 0.95, CE=0V	-	-	0.5	μA
Oscillation Frequency	FOSC	Same as I_{DD1}	85	100	115	kHz
Maximum Duty Ratio	MAXDTY	Same as I_{DD1}	78	85	92	%
PFM Duty Ratio (*3)	PFMDTY	I_{OUT}=0mA	15	25	35	%
CE "H" Voltage	V_{CEH}	V_{OUT}=setting output voltage x0.95	0.65	-	-	V
CE "L" Voltage	V_{CEL}	V_{OUT}=setting output voltage x0.95	-	-	0.20	V
EXT "H" ON Resistance	R_{EXTH}	Same as I_{DD1}, V_{EXT}=V_{OUT}-0.4V	-	20	29	Ω
EXT "L" ON Resistance	R_{EXTL}	Same as I_{DD1}, V_{EXT}=0.4V	-	13	19	Ω
Efficiency (*2)	EFFI		-	87	-	%
Soft-Start Time	T_{SS}		5	10	20	ms

Conditions: Unless otherwise stated, connect V_{DD} to V_{OUT}; V_{IN}=setting output voltage x 0.6, I_{OUT}=200mA

NOTE:

* 1: When taking V_{DD} from another power source please ensure that V_{DD} = 2.0V or more.
Oscillation will occur with a value of V_{DD} = 0.8V or more, but with a value of V_{DD} = 2.0V or more, output voltage and oscillation frequency will be stable.

* 2: EFFI = {[(output voltage) x (output current)]÷[(input voltage) x (input current)] x 100

* 3: Applies to the XC6368 series only (duty ratio when control changes to PFM).

■ELECTRICAL CHARACTERISTICS (Continued)

XC6367B101MR, XC6368B101MR V_{OUT}=3.0V, FOSC=100kHz, Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	V_{OUT}		2.925	3.000	3.075	V
Supply Voltage (*1)	V_{DD}		2.0	-	10.0	V
Maximum Input Voltage	V_{IN}		10.0	-	-	V
Oscillation Start Voltage 1	V_{ST1}	Tr: 2SD1628, I_{OUT}=1.0mA	-	-	0.9	V
Oscillation Start Voltage 2	V_{ST2}	V_{DD}=CE: Apply voltage, FB=0V	-	-	0.8	V
Oscillation Hold Voltage	V_{HLD}	Tr: 2SD1628, I_{OUT}=1.0mA	-	-	0.7	V
Supply Current 1	I_{DD1}	V_{DD}=CE=2.85V, FB=0V	-	50	90	μA
Supply Current 2	I_{DD2}	V_{DD}=CE=3.5V, FB=1.2V	-	11	20	μA
Stand-by Current	I_{STB}	V_{DD}=2.85V, CE=0V, FB=0V	-	-	0.5	μA
Oscillation Frequency	FOSC	Same as I_{DD1}	85	100	115	kHz
Maximum Duty Ratio	MAXDTY	Same as I_{DD1}	78	85	92	%
PFM Duty Ratio (*3)	PFMDTY	I_{OUT}=0mA	15	25	35	%
CE "H" Voltage	V_{CEH}	V_{DD} =2.85V,FB=0V	0.65	-	-	V
CE "L" Voltage	V_{CEL}	V_{DD} =2.85V,FB=0V	-	-	0.20	V
EXT "H" ON Resistance	R_{EXTH}	Same as I_{DD1}, V_{EXT}=V_{DD}-0.4V	-	32	47	Ω
EXT "L" ON Resistance	R_{EXTL}	Same as I_{DD1}, V_{EXT}=0.4V	-	20	30	Ω
Efficiency (*2)	EFFI		-	84	-	%
Soft-Start Time	T_{SS}		5	10	20	ms

Conditions: Unless otherwise stated, V_{IN}=1.8V, I_{OUT}=120mA
External components : $R_{FB}1$ = 400kΩ, $R_{FB}2$ = 200kΩ, C_{FB} = 47pF

NOTE:

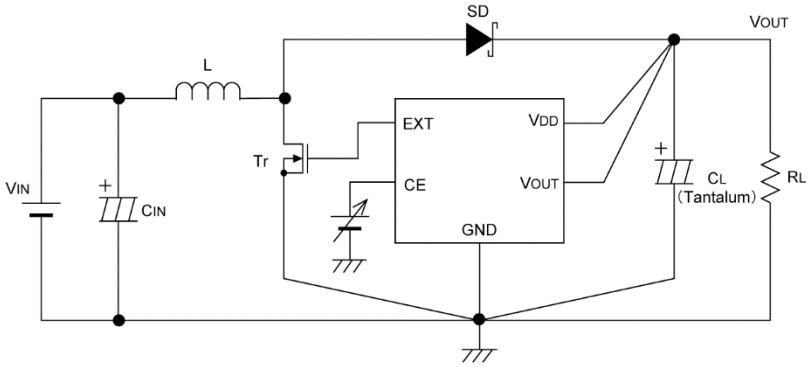
* 1: When taking V_{DD} from another power source please ensure that V_{DD} = 2.0V or more.
Oscillation will occur with a value of V_{DD} = 0.8V or more, but with a value of V_{DD} = 2.0V or more, output voltage and oscillation frequency will be stable.

* 2: EFFI = {[(output voltage) x (output current)]÷[(input voltage) x (input current)] x 100

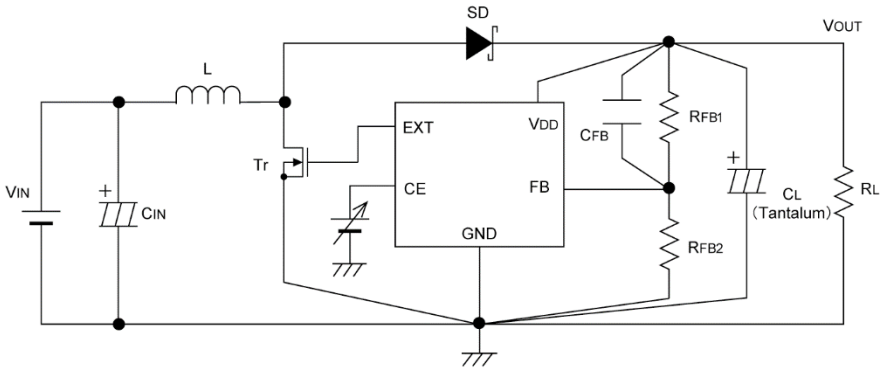
* 3: Applies to the XC6368 series only (duty ratio when control changes to PFM).

■TEST CIRCUITS

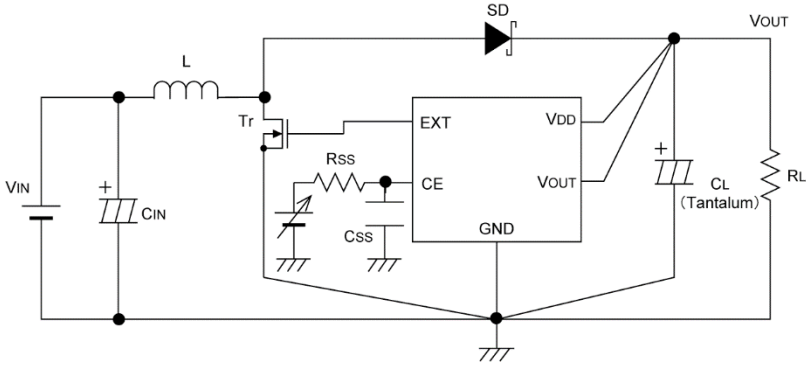
Circuit 1. XC6367A, XC6368A



Circuit 2. XC6367B, XC6368B

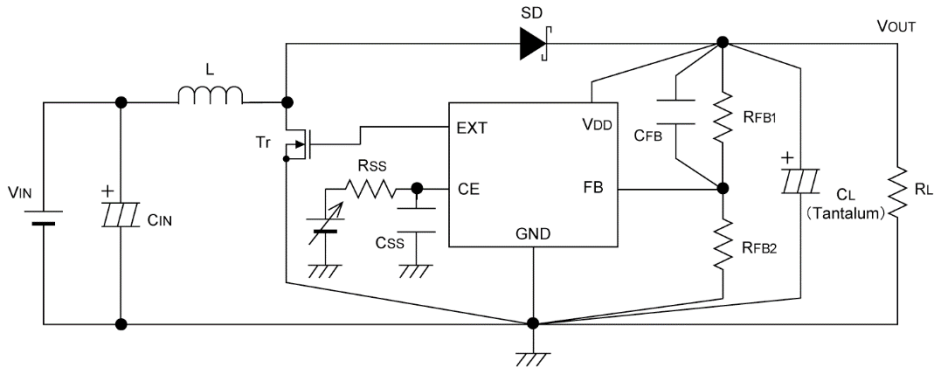


Circuit 3. XC6367C, XC6368C

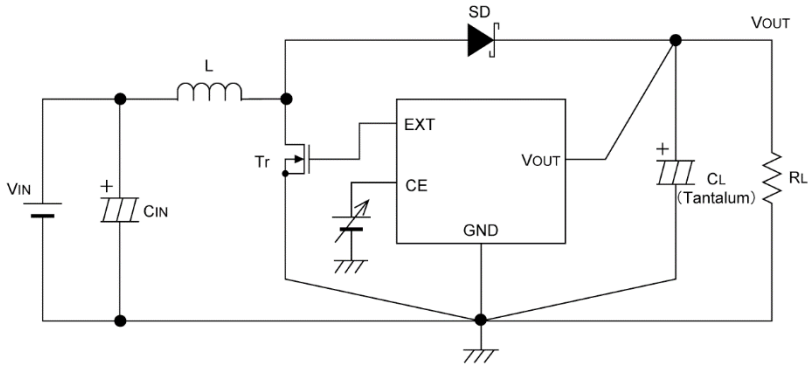


■TEST CIRCUITS (Continued)

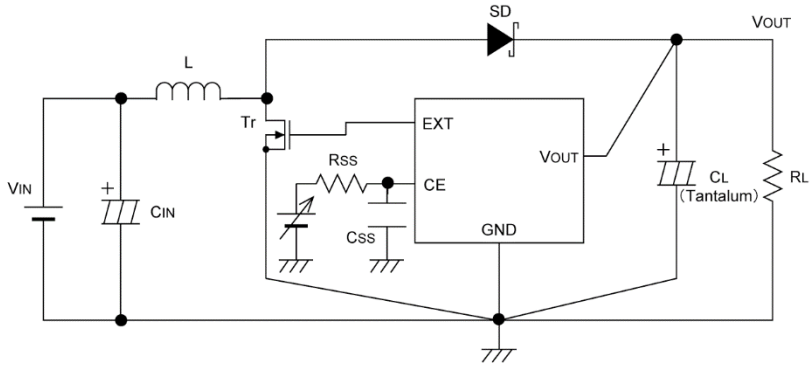
Circuit 4. XC6367D, XC6368D



Circuit 5. XC6367E, XC6368E

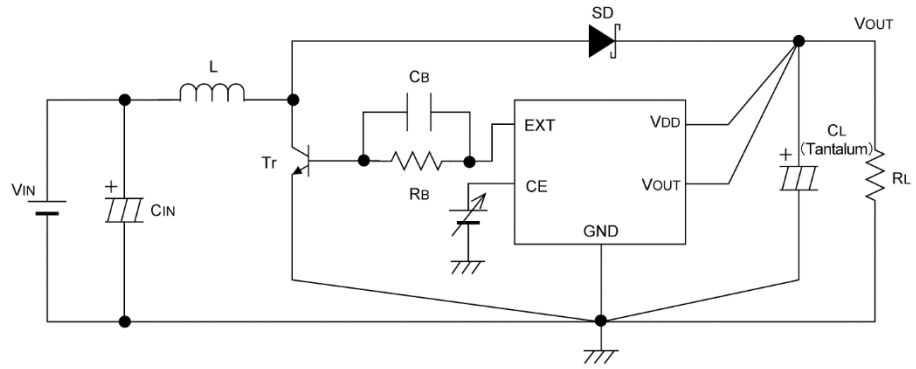


Circuit 6. XC6367F, XC6368F

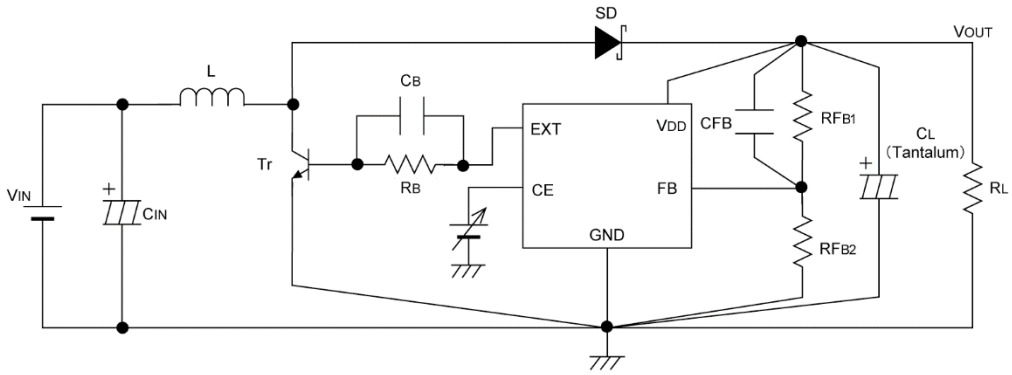


■TEST CIRCUITS (Continued)

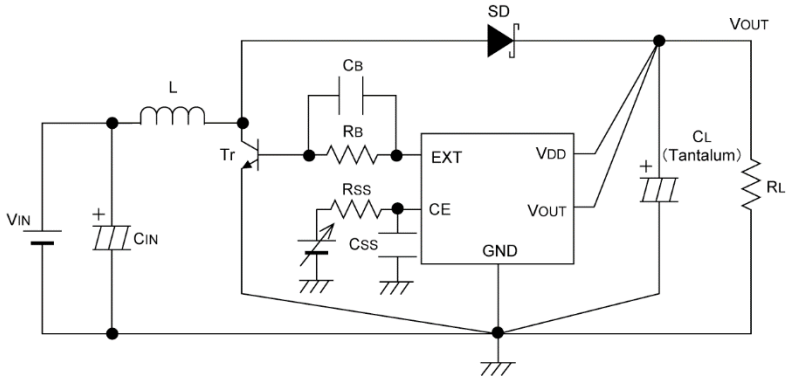
Circuit 7. XC6367A, XC6368A（NPN Transistor）



Circuit 8. XC6367B, XC6368B（NPN Transistor）

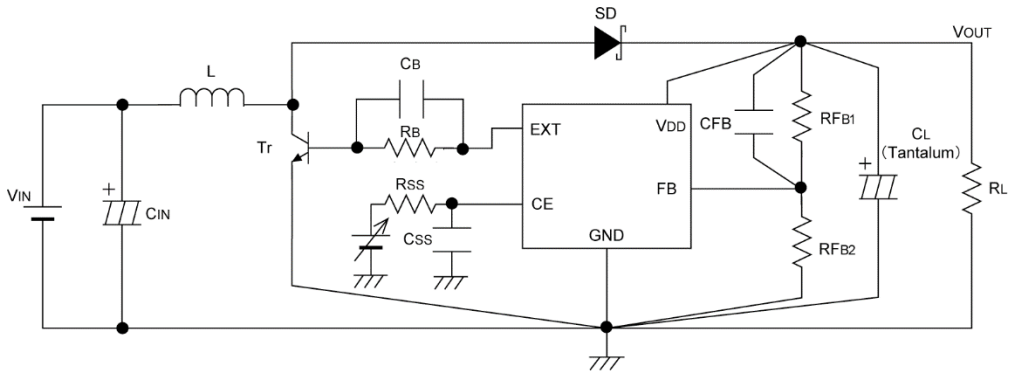


Circuit 9. XC6367C, XC6368C（NPN Transistor）

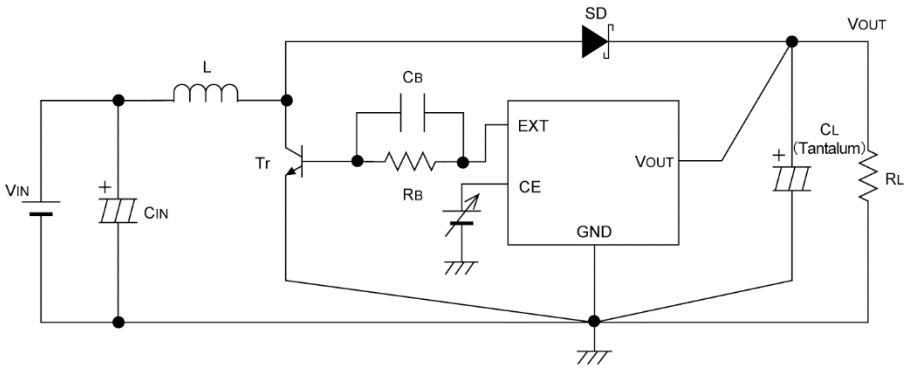


■TEST CIRCUITS (Continued)

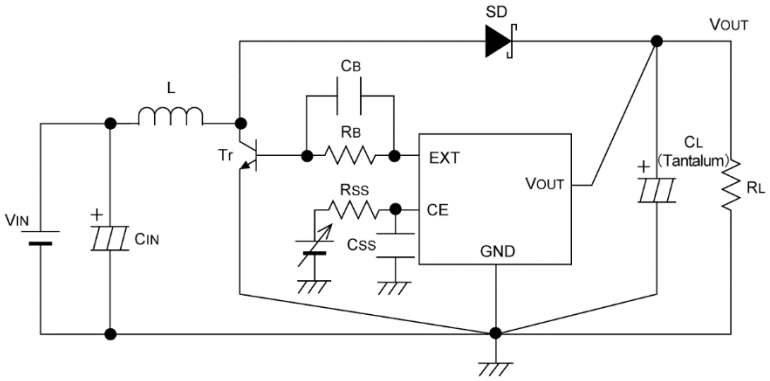
Circuit 10. XC6367D, XC6368D（NPN Transistor）



Circuit 11. XC6367E, XC6368E（NPN Transistor）



Circuit 12. XC6367F, XC6368F（NPN Transistor）



■TEST CIRCUITS (Continued)

●External Components

Tr : XP161A1355PR (N-ch Power MOSFET, TOREX)
As the breakdown voltage of XP161A1355PR is 8V, take care with the power supply voltage. With output voltages over 6V, use the XP161A1265PR with a breakdown voltage of 12V.
V_{ST1} : XP161A1355PR = 1.2V (MAX.)
XP161A1265PR = 1.5V (MAX.)
L : 22μH (CR54, SUMIDA FOSC=300kHz)
47μH (CR75, SUMIDA FOSC=100, 180kHz)
10μH (CR54, SUMIDA FOSC=500kHz)
SD : MA2Q735 (Schottky Diode, MATSUSHITA)
C_{IN} : 16V, 220μF (Aluminium Electrolytic Capacitor)
CL : 16V, 47μF + 47μF (Tantalum capacitor, NICHICON MCE)

NPN Tr type:

Tr : 2SD1628 (SANYO)
Rb : 500Ω(Adjust according to load and Tr. hFE levels)
Cb : 2200pF (Ceramic Type)

Set up so that $CB \leq 1 \div (2 \pi \times RB \times FOSC \times 0.7)$

C, D, F type (soft-start externally set-up):

C_{SS} : 0.1μF (Ceramic Capacitor)
R_{SS} : 470kΩ(C, F Type), 220kΩ(D Type)

B, D type (FB versions)

R_{FB} : Set up so that $R_{FB1} \div R_{FB2} = V_{OUT} - 1$ (V_{OUT} = setting output voltage),
Please use with $R_{FB1} + R_{FB2} \leqq 2M\Omega$
C_{FB} : Set up so that $fzfb = 1 \div (2 \times \pi \times CFB \times RFB1)$ is within the 0.1 to 20kHz range (10kHz conventional)
Adjustments necessary in respect of L, C_L.
e.g V_{OUT} = 3.0V
R_{FB1} = 400kΩ, R_{FB2} = 200kΩ, C_{FB} = 47pF

For using MOSFET, We recommend using TOREX MOSFETs, which has a gate protection diode built-in.

GATE PROTECTION DIODE BUILT-IN MOSFET	$R_{ds\ (ON)}$
XP161A1355PR	0.15Ω@ Vgs=1.5V
XP161A1265PR	0.095Ω@ Vgs=2.5V

■NOTES ON USE

1. Take ample care to ensure that none of the IC's, nor the external component's, absolute maximum ratings are exceeded.
2. Be extremely careful when selecting parts and do not limit your reference to the specifications and characteristics for the DC/DC converter alone. The IC also depends, to a great extent, upon the external components.
3. Arrange the peripherals in the environs of the IC. In order to reduce wiring impedance, use short, thick wires. In particular, wire the load capacitor as close as possible and strengthen the ground wiring sufficiently.
4. Ground current during switching may cause the IC's operations to become unstable due to changes in ground voltage, so please strengthen the IC's GND pin surroundings.

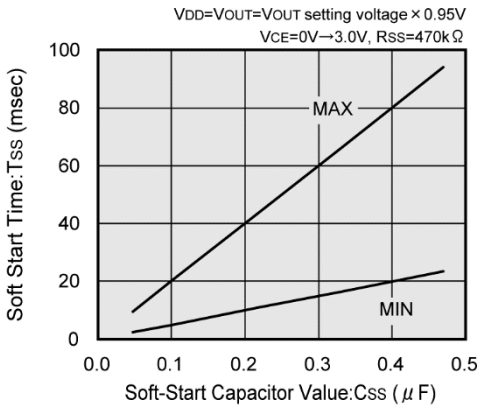
●External Components

1.Setting soft-start time

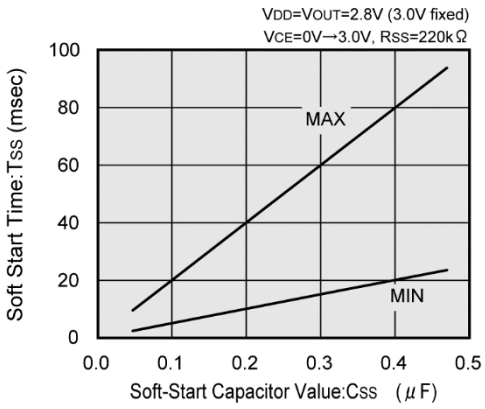
In order to lengthen soft-start time we recommend that you use the C or D types of the series which have soft start time externally set-up.

Soft-start time (T_{SS}) is between MIN & MAX, as indicated in the graphs below, so please select soft-start capacitor value (C_{SS}) to suit your application.

XC6367/XC6368CxxxMR (V_{OUT})



XC6367/XC6368D10xMR (FB)

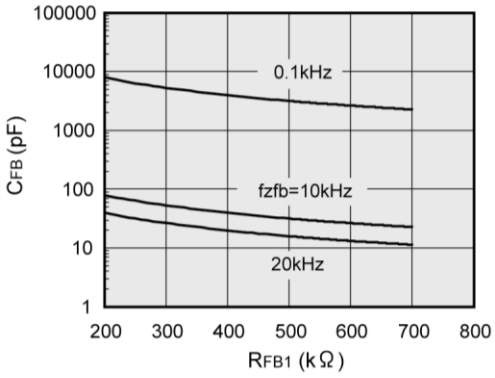


2. R_{FB1}, C_{FB} set up

$fzfb = 1 \div (2 \pi x C_{FB} x R_{FB1})$

In order to achieve a value for fzfb within the range of 0.1kHz to 20kHz, we recommend that values for R_{FB1} & C_{FB} are selected from the area indicated within the lines of fzfb = 0.1kHz and fzfb = 20 kHz as shown on the graph below. Please select combinations of values as close to the fzfb = 10kHz line as possible.

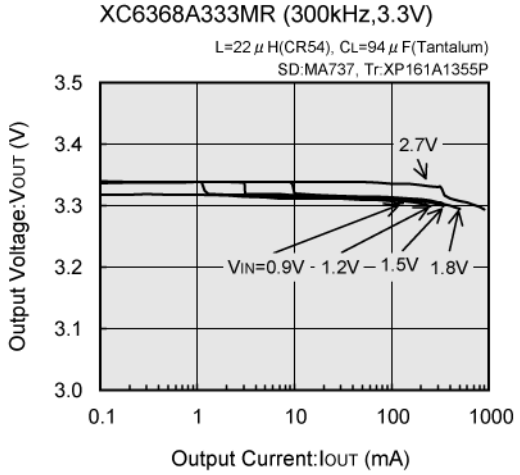
XC6367/6368B10xMR (FB)
XC6367/6368D10xMR (FB)



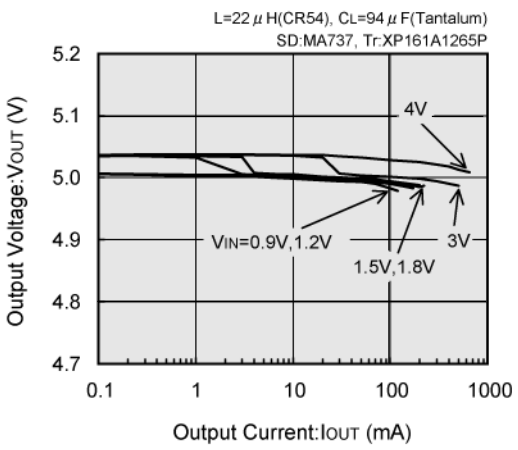
■TYPICAL PERFORMANCE CHARACTERISTICS

(1) Output Voltage vs. Output Current

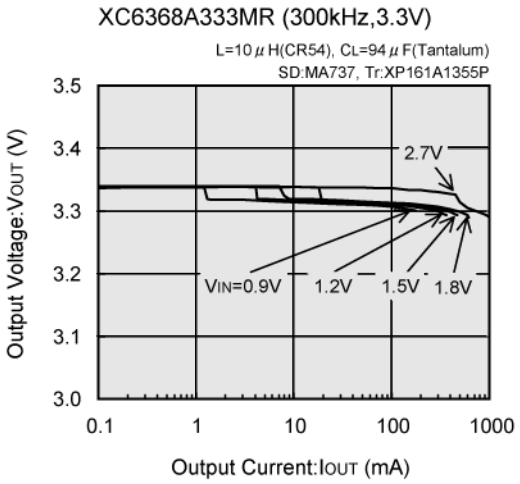
XC6368A333MR (300kHz,3.3V)



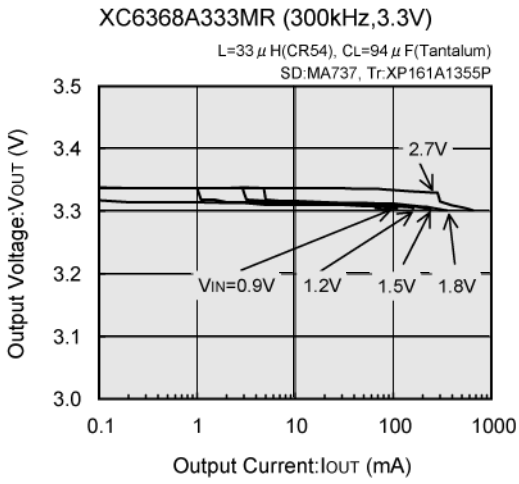
XC6368A503MR (300kHz,5.0V)



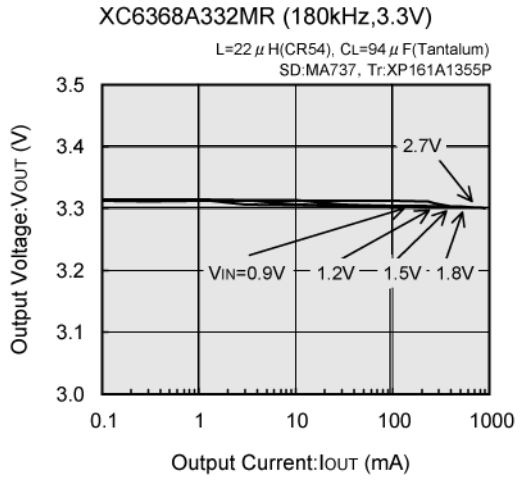
XC6368A333MR (300kHz,3.3V)



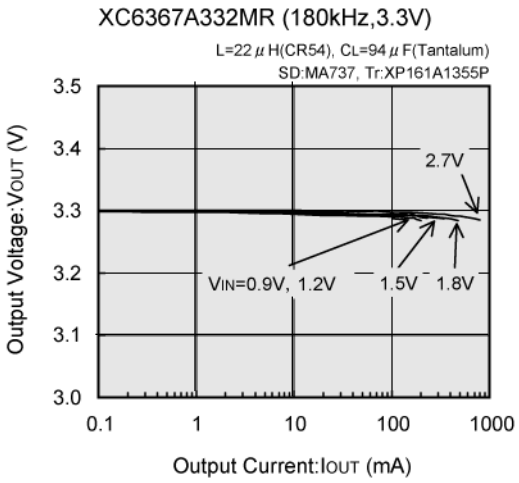
XC6368A333MR (300kHz,3.3V)



XC6368A332MR (180kHz,3.3V)



XC6367A332MR (180kHz,3.3V)

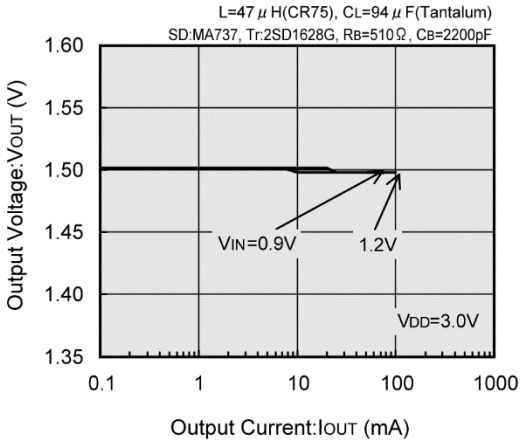


〈External component〉 CIN=220μF (Electrolytic capacitor)

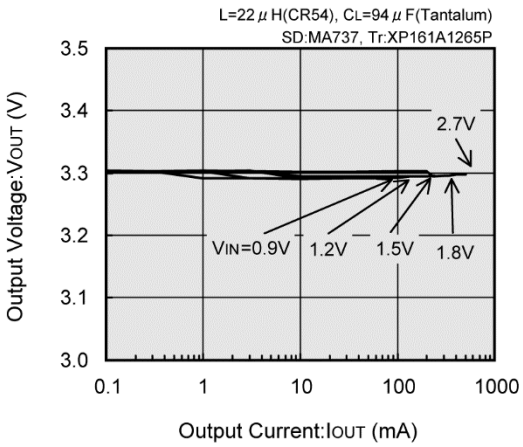
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(1) Output Voltage vs. Output Current (Continued)

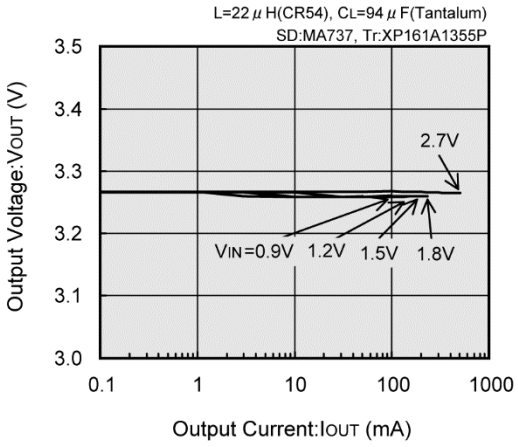
XC6368A151MR (100kHz,1.5V)



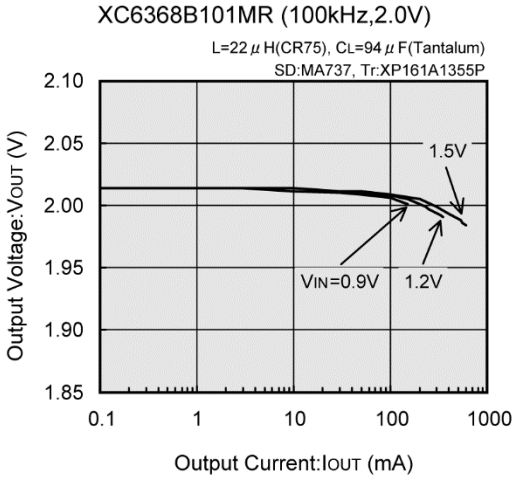
XC6368B103MR (300kHz,3.3V)



XC6368B102MR (180kHz,3.3V)



XC6368B101MR (100kHz,2.0V)

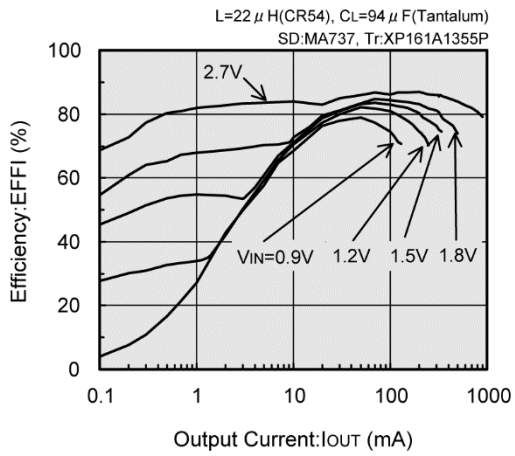


〈External component〉 CIN=220μF (Electrolytic capacitor)

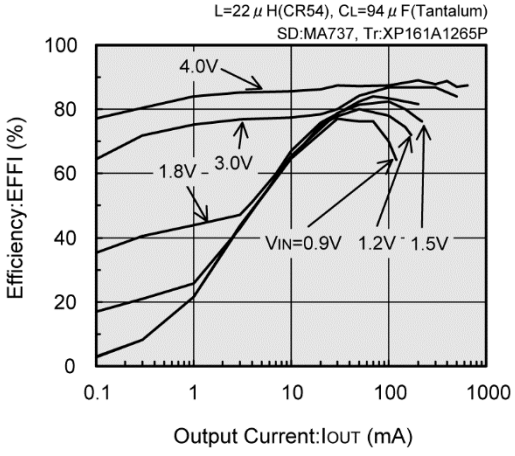
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(2) Efficiency vs. Output Current

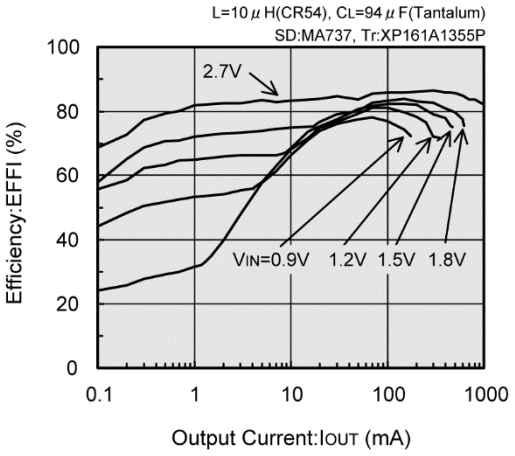
XC6368A333MR (300kHz,3.3V)



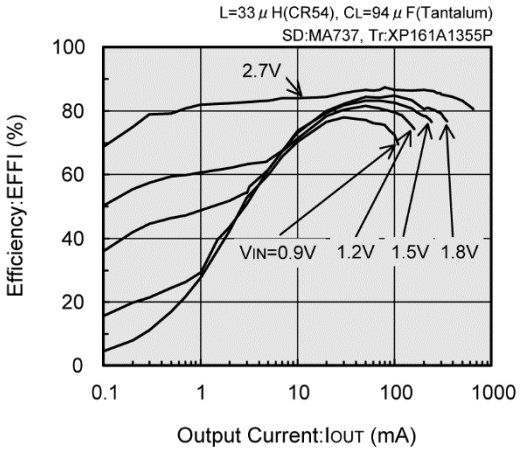
XC6368A503MR (300kHz,5.0V)



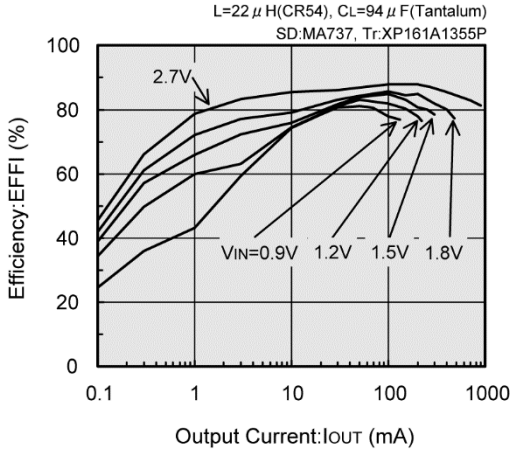
XC6368A333MR (300kHz,3.3V)



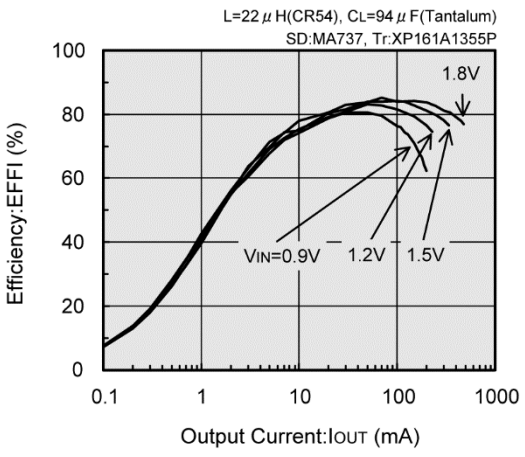
XC6368A333MR (300kHz,3.3V)



XC6368A332MR (180kHz,3.3V)



XC6367A332MR (180kHz,3.3V)

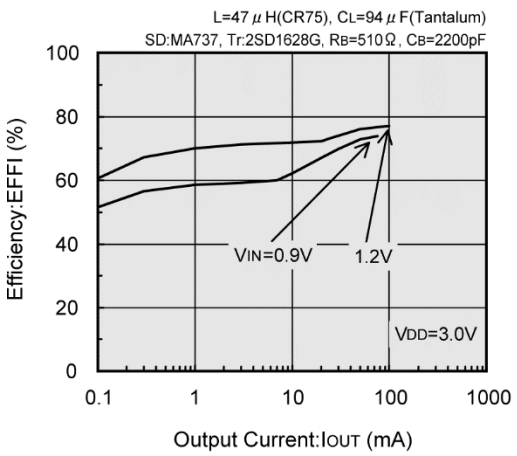


〈External component〉 CIN=220μF (Electrolytic capacitor)

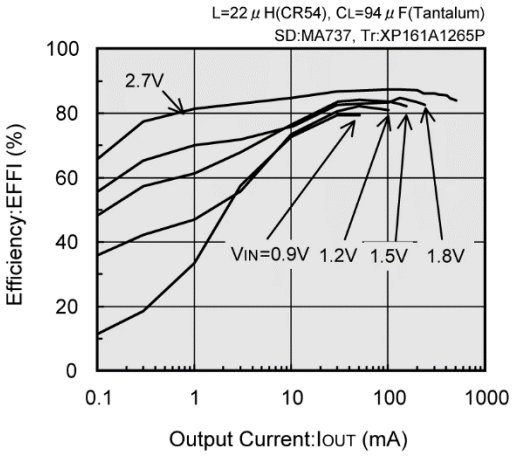
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(2) Efficiency vs. Output Current (Continued)

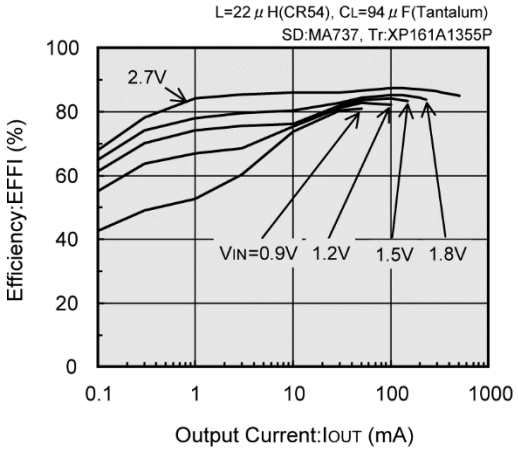
XC6368A151MR (100kHz,1.5V)



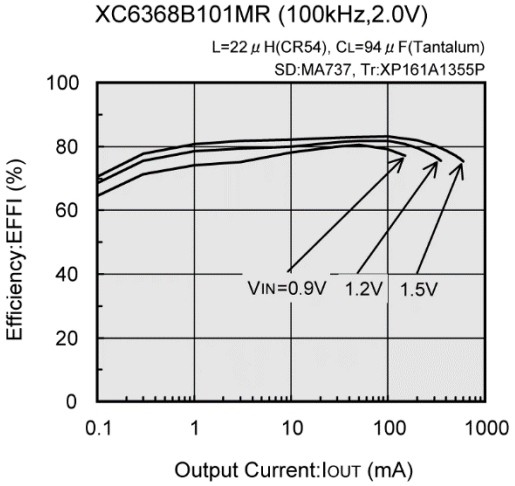
XC6368B103MR (300kHz,3.3V)



XC6368B102MR (180kHz,3.3V)



XC6368B101MR (100kHz,2.0V)

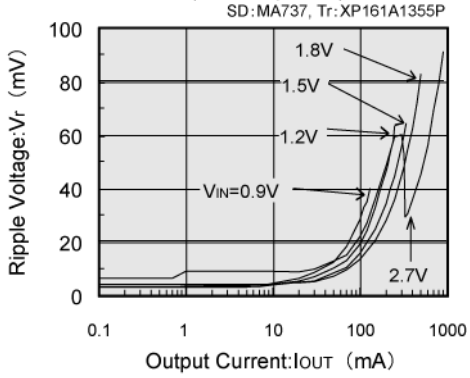


〈External component〉 CIN=220μF (Electrolytic capacitor)

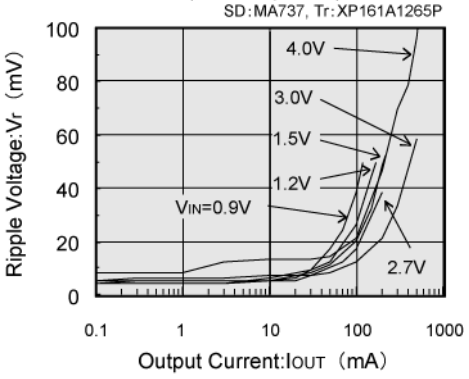
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(3) Ripple Voltage vs. Output Current

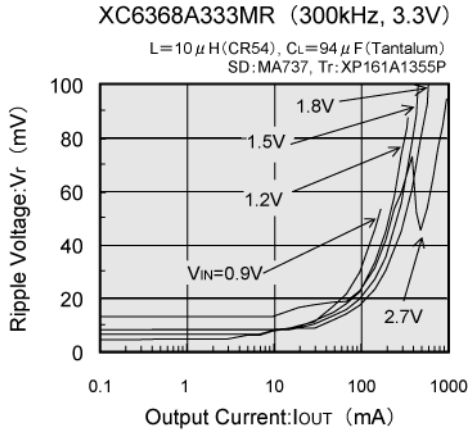
XC6368A333MR（300kHz, 3.3V）



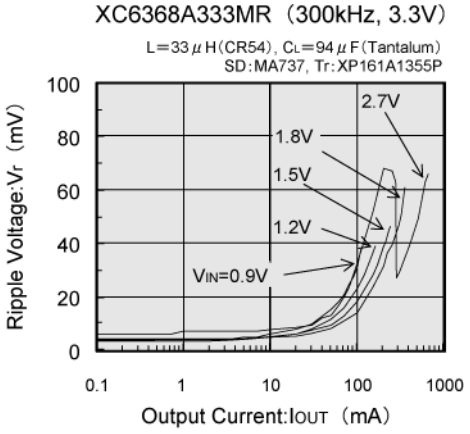
XC6368A503MR（300kHz, 5.0V）



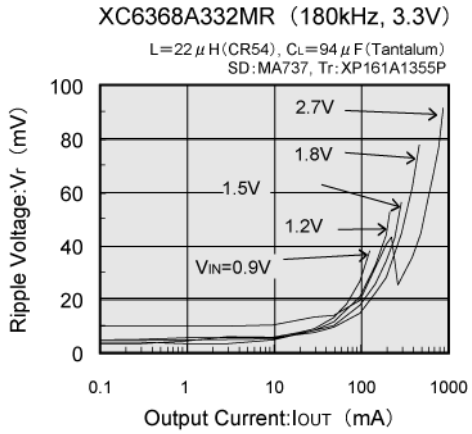
XC6368A333MR（300kHz, 3.3V）



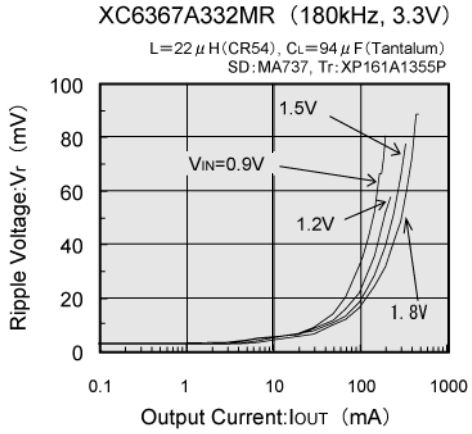
XC6368A333MR（300kHz, 3.3V）



XC6368A332MR（180kHz, 3.3V）

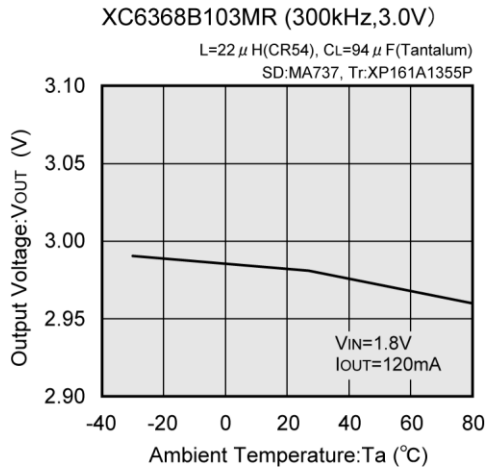


XC6367A332MR（180kHz, 3.3V）

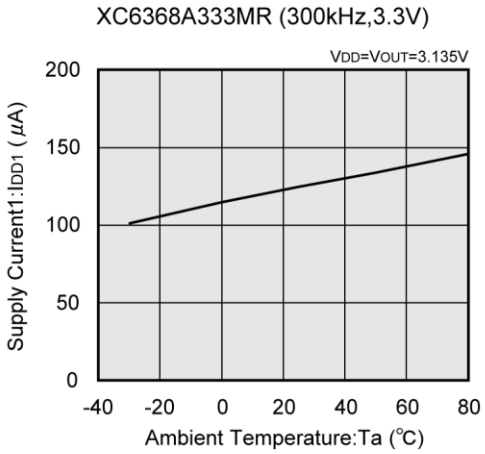


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

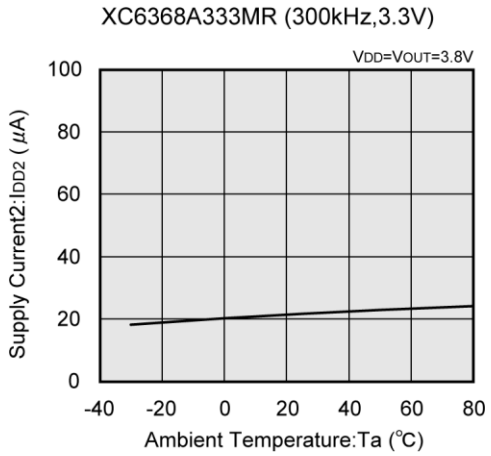
(4) Output Voltage vs. Ambient Temperature



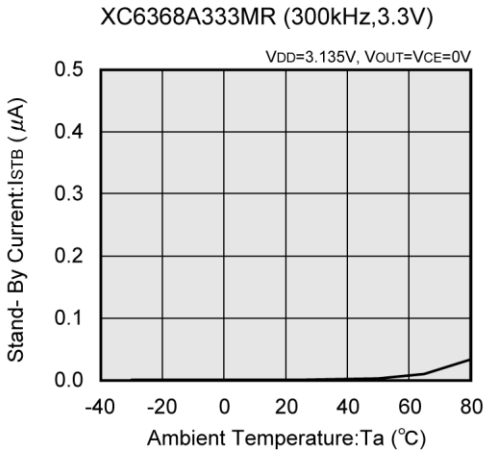
(5) Supply Current 1 vs. Ambient Temperature



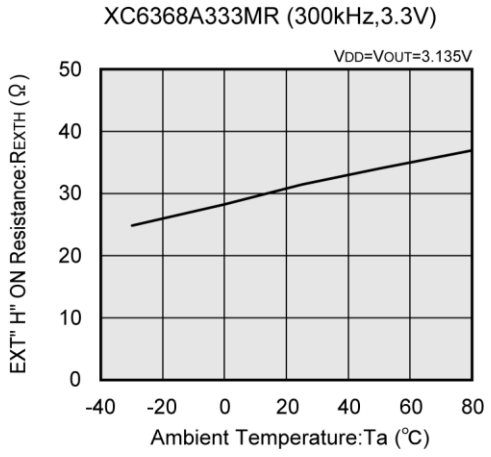
(6) Supply Current 2 vs. Ambient Temperature



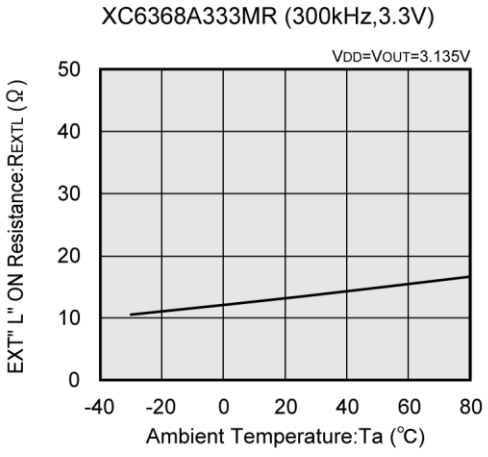
(7) Stand-by Current vs. Ambient Temperature



(8) EXT "H" On Resistance vs. Ambient Temperature

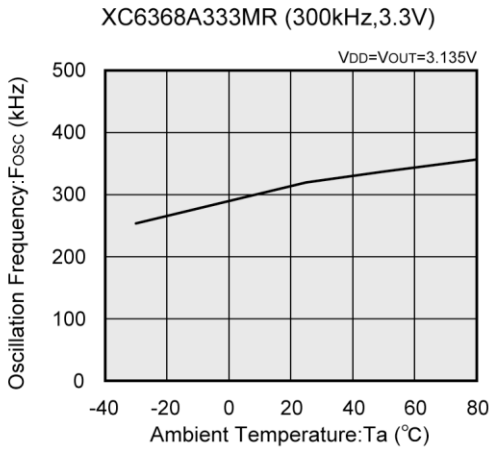


(9) EXT "L" On Resistance vs. Ambient Temperature

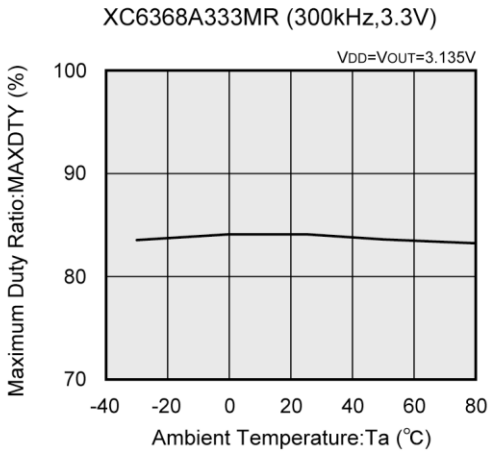


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

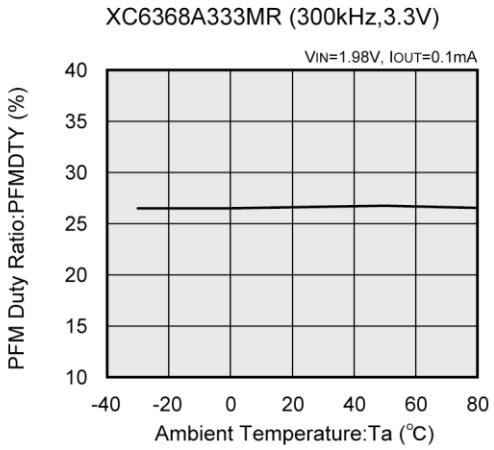
(10) Oscillation Frequency vs. Ambient Temperature



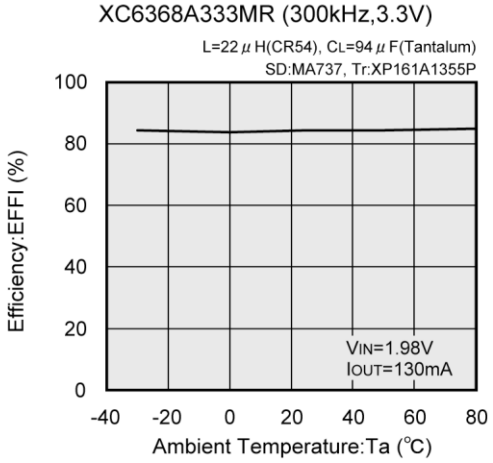
(11) Maximum Duty Ratio vs. Ambient Temperature



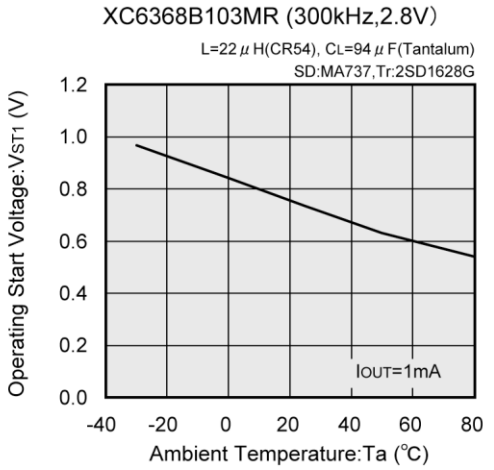
(12) PFM Duty Ratio vs. Ambient Temperature



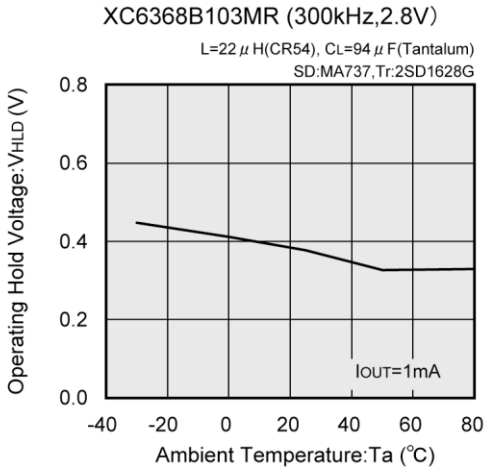
(13) Efficiency vs. Ambient Temperature



(14) Operation Start Voltage vs. Ambient Temperature

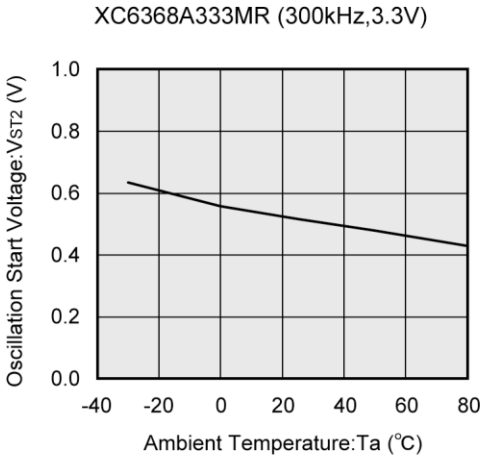


(15) Operation Hold Voltage vs. Ambient Temperature

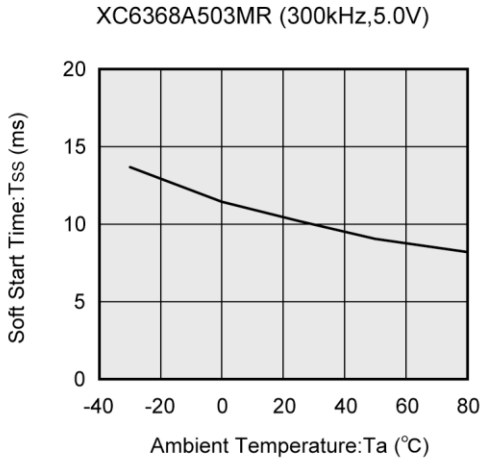


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

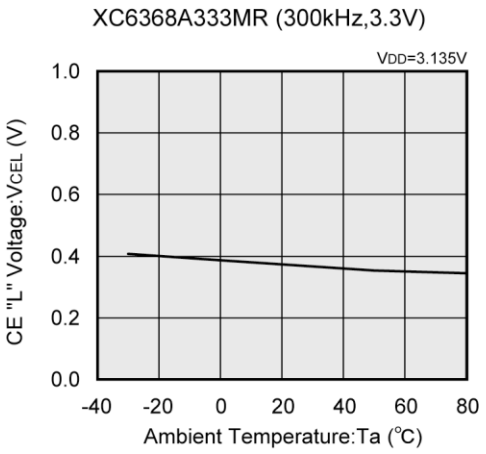
(16) Oscillation Start Voltage vs. Ambient Temperature



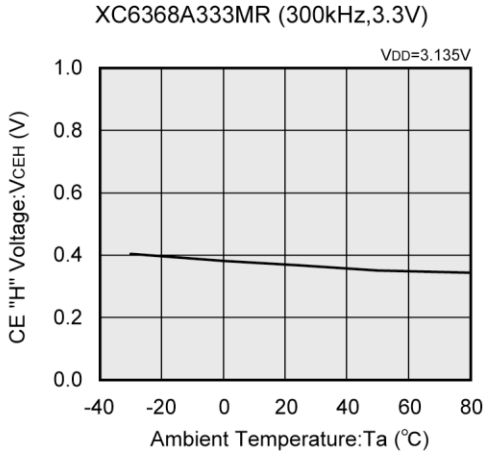
(17) Soft-Start Time vs. Ambient Temperature



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



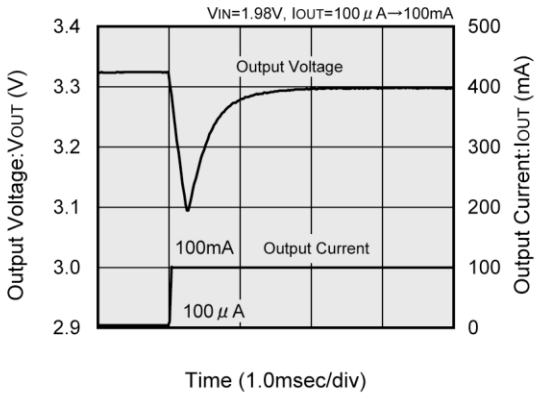
(19) CE "H" Voltage vs. Ambient Temperature



■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

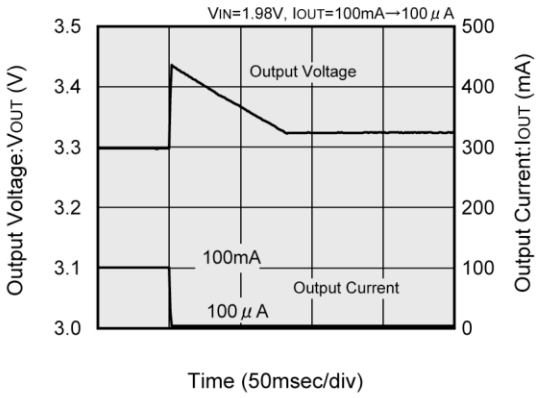
(20) Load Transient Response

XC6368A333MR (300kHz,3.3V)



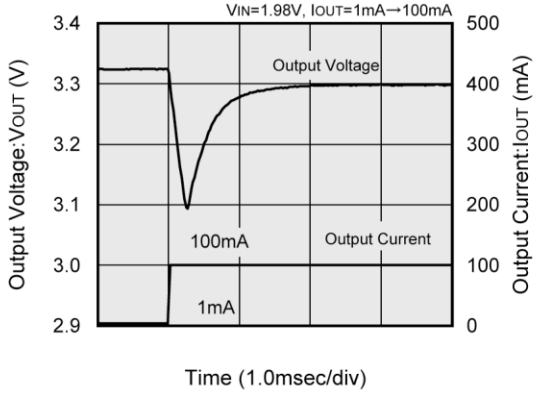
Time (1.0msec/div)

XC6368A333MR (300kHz,3.3V)



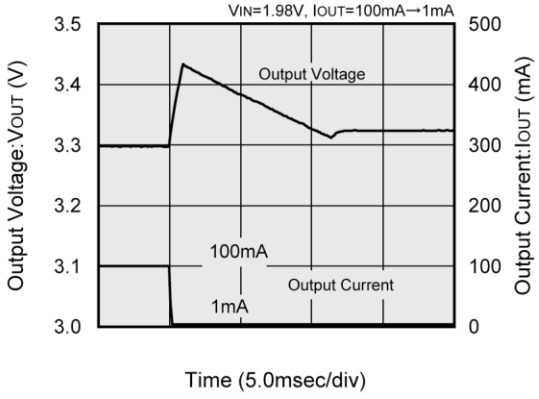
Time (50msec/div)

XC6368A333MR (300kHz,3.3V)



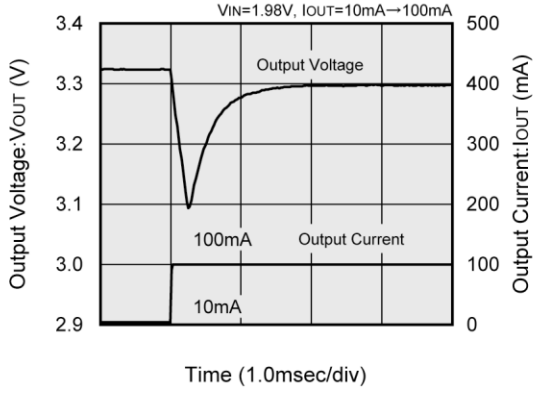
Time (1.0msec/div)

XC6368A333MR (300kHz,3.3V)



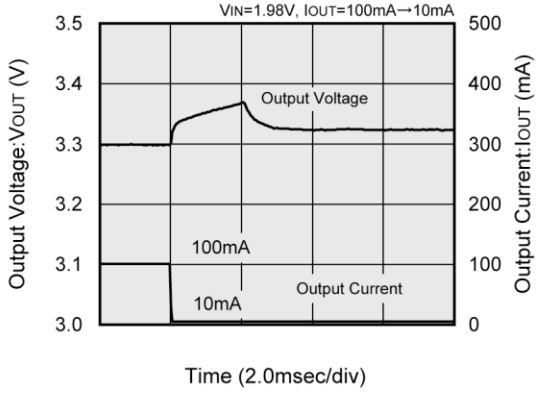
Time (5.0msec/div)

XC6368A333MR (300kHz,3.3V)



Time (1.0msec/div)

XC6368A333MR (300kHz,3.3V)



Time (2.0msec/div)

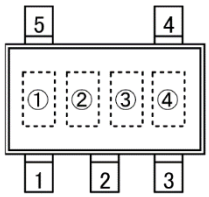
■PACKAGING INFORMATION

For the latest package information go to, www.torexsemi.com/technical-support/packages

PACKAGE	OUTLINE / LAND PATTERN	THERMAL CHARACTERISTICS	
SOT-25	SOT-25 PKG	Standard Board	SOT-25 Power Dissipation
		JESD51-7 Board	

■MARKING RULE

●XC6367/6368 Series



SOT-25
(TOP VIEW)

① represents product series

MARK	PRODUCT SERIES	MARK	PRODUCT SERIES
A	XC6367A	K	XC6368A
B	XC6367B	L	XC6368B
C	XC6367C	M	XC6368C
D	XC6367D	N	XC6368D
E	XC6367E	P	XC6368E
F	XC6367F	R	XC6368F

② represents integer of output voltage and oscillation frequency

OUTPUT VOLTAGE (V)	OSCILLATION FREQUENCY (kHz)			
	100	180	300	500
1	B	1	1	B
2	C	2	2	
3	D	3	3	
4	E	4	4	
5	F	5	5	
6	H	6	6	

③ represents decimal number of output voltage and oscillation frequency

OUTPUT VOLTAGE (V)	OSCILLATION FREQUENCY (kHz)			
	100	180	300	500
0	0	0	A	A
1	1	1	B	
2	2	2	C	
3	3	3	D	
4	4	4	E	
5	5	5	F	
6	6	6	H	
7	7	7	K	
8	8	8	L	
9	9	9	M	

④ represents production lot number
0 to 9, A to Z repeated (G, I, J, O, Q, W excluded)

1. The product and product specifications contained herein are subject to change without notice to improve performance characteristics. Consult us, or our representatives before use, to confirm that the information in this datasheet is up to date.

2. The information in this datasheet is intended to illustrate the operation and characteristics of our products. We neither make warranties or representations with respect to the accuracy or completeness of the information contained in this datasheet nor grant any license to any intellectual property rights of ours or any third party concerning with the information in this datasheet.

3. Applicable export control laws and regulations should be complied and the procedures required by such laws and regulations should also be followed, when the product or any information contained in this datasheet is exported.

4. The product is neither intended nor warranted for use in equipment of systems which require extremely high levels of quality and/or reliability and/or a malfunction or failure which may cause loss of human life, bodily injury, serious property damage including but not limited to devices or equipment used in 1) nuclear facilities, 2) aerospace industry, 3) medical facilities, 4) automobile industry and other transportation industry and 5) safety devices and safety equipment to control combustions and explosions. Do not use the product for the above use unless agreed by us in writing in advance.

5. Although we make continuous efforts to improve the quality and reliability of our products; nevertheless Semiconductors are likely to fail with a certain probability. So in order to prevent personal injury and/or property damage resulting from such failure, customers are required to incorporate adequate safety measures in their designs, such as system fail safes, redundancy and fire prevention features.

6. Our products are not designed to be Radiation-resistant.

7. Please use the product listed in this datasheet within the specified ranges.

8. We assume no responsibility for damage or loss due to abnormal use.

9.

TOREX SEMICONDUCTOR LTD.