

The PWM control IC for AC-DC converter

Monolithic IC MM3663 Series

Outline

This IC is the current mode PWM controller IC, designed for flyback converter. This IC can substantially reduce standby power by the start up circuit using the 500V high breakdown process, burst mode operating in low load, and optimization of supply current. Frequency reduction function in load of middle range and minimum frequency limit function prevent chattering noise in low load, and improve average efficiency. Select function of maximum frequency (66kHz or 100kHz) and adjustment function of FB pin voltage for oscillation stop which is innovation expand flexibility of the power supply design. Others, frequency jittering function, X capacitor discharge function make the measures of EMI easy. The M3663 which has various protection functions can assist safety design of power supply.

Features

1. Start up circuit by 500V high breakdown process reduce start up circuit loss.
2. Current mode PWM controller (select function of maximum oscillating frequency, 66kHz or 100kHz)
3. Frequency reduction function in load of middle range improve average efficiency.
4. Low voltage of UVLO and low supply current in oscillation stop reduce standby power more.
5. Noise diffusion, downsize filter by frequency jitter function in all range.
6. X capacitor discharge function which don't increase standby power can make the measures of EMI easy.
7. Seam of burst mode and continuous oscillation mode can be arbitrarily adjusted. Balance adjustment between standby power and output ripple.
8. Input voltage correction function of load current in over current protection realize flat correction characteristics.
9. Substantial protection functions included, current detect pin open detection, auxiliary winding short detection, and so on.
10. The CB certification in the X capacitor discharge function is acquired.
[IEC60065, IEC60950-1, IEC62368-1]

Package

SOP-8J

Applications

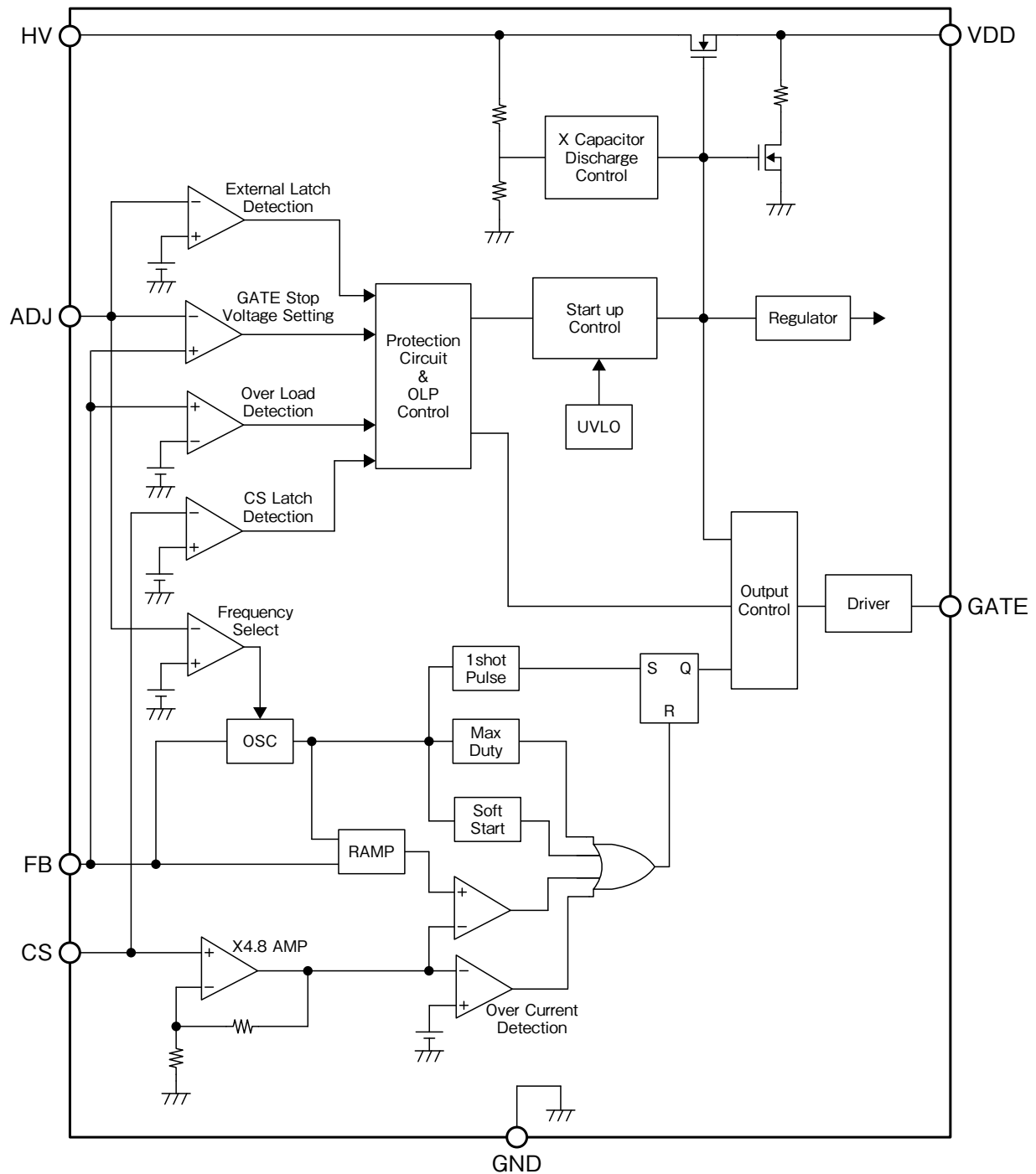
1. Flat panel TV
2. DVD Player, BD Player, BD Recorder
3. Printer, Copying Machine, FAX
4. AC/DC Adapters
5. Various Power Supplies

Lineup

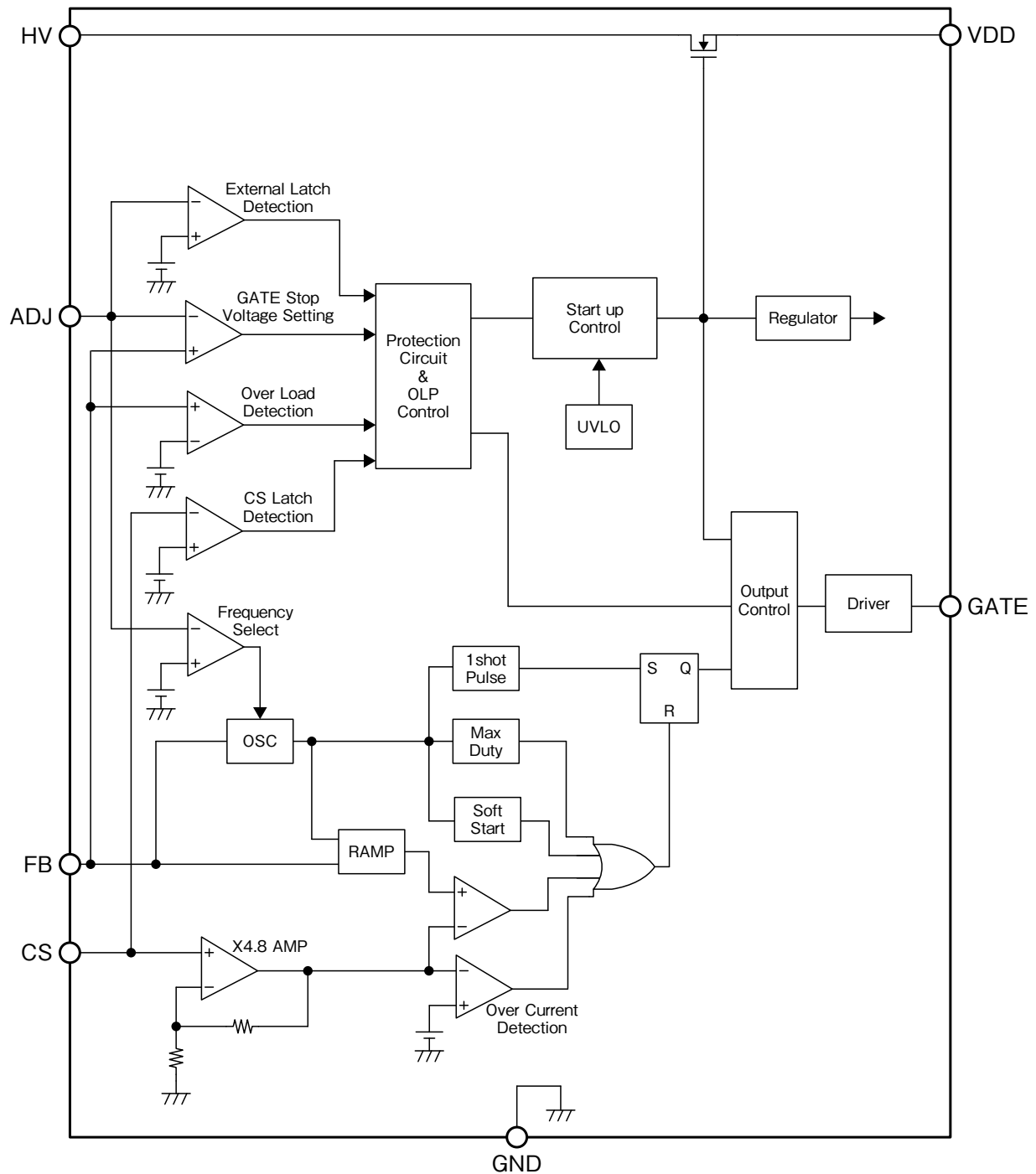
Product	Package	X-capacitor discharge	Function
MM3663AFFE	SOP-8J	○	Latch off in Over Load Protection
MM3663BFFE	SOP-8J	○	Auto restart in Over Load Protection
MM3663CFFE	SOP-8J		Latch off in Over Load Protection
MM3663DFFE	SOP-8J		Auto restart in Over Load Protection

Block Diagram

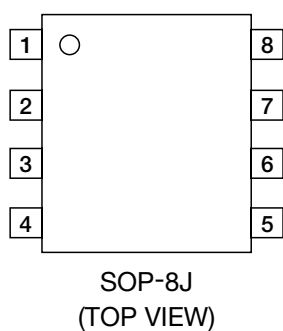
MM3663AFFE, MM3663BFFE



■ MM3663CFFE, MM3663DFFE



Pin Assignment



1	ADJ
2	FB
3	CS
4	GND
5	GATE
6	VDD
7	N.C.
8	HV

Pin Description

Pin No.	Pin name	Functions
1	ADJ	GATE output stop voltage setting, external latch input, and oscillator frequency select pin
2	FB	Feedback input pin
3	CS	Current sense pin
4	GND	Ground pin
5	GATE	Output pin
6	VDD	Power supply input pin
7	N.C.	No connection
8	HV	High voltage startup pin

Absolute Maximum Ratings (Except where noted otherwise Ta=25°C)

Item	Symbol	Ratings	Units
Storage Temperature	Tstg	-40 to +150	°C
Operating Temperature	Topr	-30 to +125	
VDD Pin Voltage	VDD	-0.3 to +30	V
ADJ Pin Voltage	VADJ	-0.3 to +5	
CS Pin Voltage	VCS	-0.3 to +5	
FB Pin Voltage	VFB	-0.3 to +5	
GATE Pin Voltage	VGATE	-0.3 to VDD	
Gate Pin Peak Current	IOH	-0.5	A
	IOL	1	
HV Pin Voltage	VHV	-0.3 to +500	V
Power Dissipation	Pd	300	mW

Recommended Operating Conditions (Except where noted otherwise Ta=25°C)

Item	Symbol	Ratings	Units
Operating Supply Voltage	Vop	10 to 24	V
HV Pin Input Voltage	Vhvop	100 to 450	
HV Pin Connection Resistance	Rvh	2.2 to 22	kΩ
X Capacitor Capacitance	Cx	0.1 to 6	μF
VDD Pin Capacitance	Cvdd	10 to 100	
Operating Temperature	Top	-30 to +105	°C

Electrical Characteristics

(Except where noted otherwise VDD=15V, FB=2V, CS=0V, ADJ=0.8V, Ta=25°C)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units	Measuring Circuit
High Voltage Input Section (HV Pin)							
HV Input Current 1	I _{h_v1}	HV=450V, VDD=23V A,B rank only	10	16	27	μA	A
HV Input Current 2	I _{h_v2}	HV=120V, VDD=5V	7	10.5	13	mA	A
AC Interception Detect Voltage Level (Note1)	V _{ac}	HV=120V Peak A,B rank only	65	75	85	%	A
AC Interception Detect Time	T _{ac}	HV=120V, VDD=23V A,B rank only From VDD on until X capacitor discharge start	20	30	40	ms	A
X Capacitor Discharge Current (Note1)	I _{xc}	HV=120V, VDD=15V A,B rank only HV input current after T _{ac} .	1.4			mA	A
Power Supply Input Section (VDD Pin)							
Source Current in Startup	I _{str}	HV=120V, VDD=5V	-12.8	-10.3	-6.8	mA	A
Source Current in Latch	I _{lat}	HV=120V, VDD=10V	-12	-9.5	-6	mA	A
Operating Start Voltage	V _{ddon}	VDD=15 → 23V	19.5	21	22.5	V	B
Operating Stop Voltage	V _{ddoff}	VDD=15 → 5V	6	6.5	7	V	B
Upper Level Voltage in Latch (Note1)	V _{ddlat1}	In Latch			15	V	A
Lower Level Voltage in Latch (Note1)	V _{ddlat2}	In Latch	10.5			V	A
Supply Current1	I _{dd1}	CL=Open	0.55	0.7	0.85	mA	B
Supply Current2	I _{dd2}	FB=0V	0.2	0.3	0.4	mA	B
Supply Current in Latch	I _{ddlat}	In Latch, FB=5V	0.15	0.25	0.35	mA	A
VDD Over Voltage Detection	V _{ddovp}	VDD=15 → 29.5V	25.3	27.3	29.3	V	B
VDD Over Voltage Detection Delay Time	T _{vddovp}	VDD=15 → 29.5V	25	50	190	μs	B
Various Function Settings Section (ADJ Pin)							
ADJ Voltage for 66kHz	V _{adj1}				1.21	V	B
ADJ Voltage for 100kHz	V _{adj2}		1.39			V	B
External Latch Stop Level	V _{ext}	ADJ=0.5 → 0.3V	0.35			V	B
ADJ Source Current	I _{adj}		-4.3	-4	-3.7	μA	C
Feedback Section (FB Pin)							
Maximum Duty Cycle (Note1)	D _{max}	f=F _{max}	75	84	91	%	B
FB Source Current	I _{fb}	FB=0V	-90	-58	-40	μA	D
Gate Stop Voltage 1	V _{off1}	F _{max} =66kHz, ADJ=0.8V	0.72	0.8	0.88	V	B
Gate Stop Voltage 2	V _{off2}	F _{max} =100kHz, ADJ=2.24V	0.72	0.8	0.88	V	B
Gate Stop Voltage Hysteresis Range (Note1)	V _{offhys}	F _{max} =66kHz, ADJ=0.8V		60		mV	B
Over Load Detection Voltage	V _{fbolp}	VDD=10V, FB=3.4 → 4.6V	3.5	4	4.5	V	B
Over Load Timer (Note1)	T _{fbolp}	FB=3.4 → 4.6V	190	250	310	ms	B
Restart Timer (Note1)	T _{restart}	FB=3.4 → 4.6V B,D rank only	1.5	2	2.5	s	B

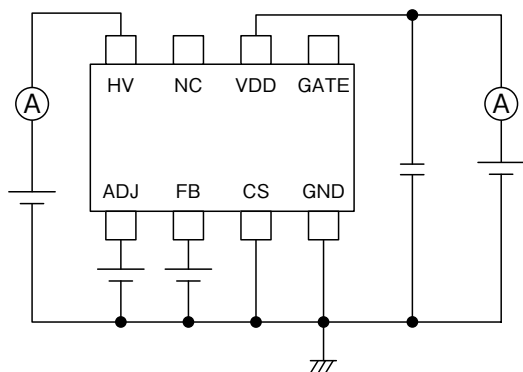
Note1 : The parameter is guaranteed by design.

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units	Measuring Circuit
Current Detection Section (CS Pin)							
Voltage Gain (Note1)	A _{vcs}			4.8		V/V	E
Over Current Detection Voltage1 (Note1)	V _{thcs1}	Duty=20%	0.432	0.455	0.478	V	E
Over Current Detection Voltage2 (Note1)	V _{thcs2}	Duty=40%	0.508	0.535	0.562	V	E
Minimum On Time1	T _{mo1}	CS=1V	410	610	810	ns	E
Minimum On Time2	T _{mo2}	Soft Start Range Over Load Range	220	320	420	ns	E
GATE Output Delay Time (Note1)	T _{off}			200		ns	E
CS Source Current (Note1)	I _{cs}			-0.8		μA	F
CS Latch Stop Detection Voltage	V _{thcslat}	CS=2 → 3V	2.25	2.5	2.75	V	E
Output Section (GATE Pin)							
L Output Voltage	V _{outl}	I _{ol} =100mA	0.5	1.2	2.2	V	G
H Output Voltage	V _{outh}	I _{oh} =-100mA	11	12.5	14	V	H
Rise Time	T _{rise}	CL=1nF	30	60	100	ns	I
Fall Time	T _{fall}	CL=1nF	20	40	70	ns	I
Soft Start Section							
Soft Start Time 1 (Note1)	T _{ss1}	F _{max} =66kHz		4.8		ms	B
Soft Start Time 2 (Note1)	T _{ss2}	F _{max} =100kHz		6.4		ms	B
Oscillator Section							
Maximum Frequency1	F _{max1}		60	66	72	kHz	B
Maximum Frequency2	F _{max2}	ADJ=2.24V	90	100	110	kHz	B
Frequency Change Ratio due to the power supply voltage	F _{crv}	VDD=10 ~ 24V	-2		+2	%	B
Frequency Change Ratio due to temperature (Note1)	F _{crt}	T _a =-30 ~ +125°C	-5		+5	%	B
Jitter Change Ratio 1	F _{jcr1}	F _{max} =66kHz	±3	±5.5	±8	%	B
Jitter Change Ratio 2	F _{jcr2}	F _{max} =100kHz	±5.5	±8.5	±11.5	%	B
FB Pin Threshold Voltage at Frequency Decrease Beginning (Note1)	V _{fbd}		1.54	1.6	1.66	V	B
FB Pin Threshold Voltage at Frequency Increase Beginning (Note1)	V _{fbi}		1.44	1.5	1.56	V	B
Minimum Frequency1	F _{min1}	FB=1.2V	20	22	24	kHz	B
Minimum Frequency2	F _{min2}	FB=1.2V, ADJ=2.24V	19	21	23	kHz	B

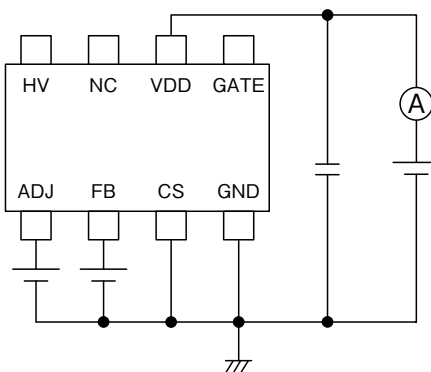
Note1 : The parameter is guaranteed by design.

Measuring Circuit

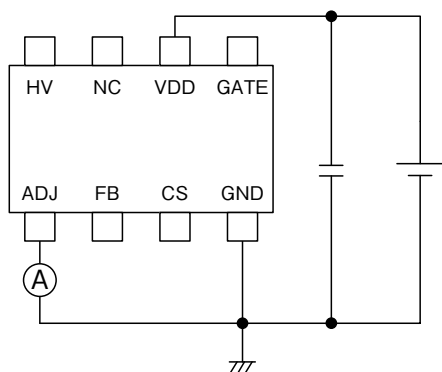
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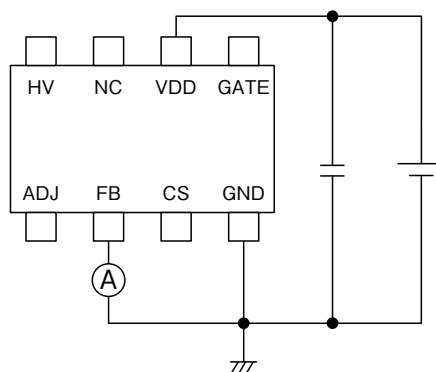
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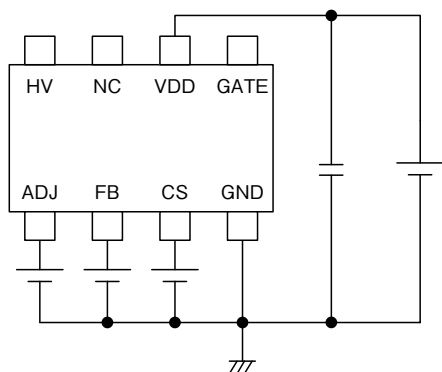
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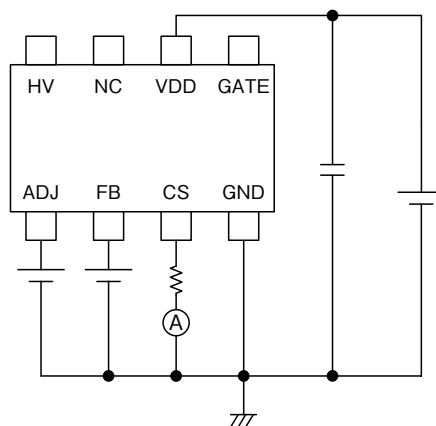
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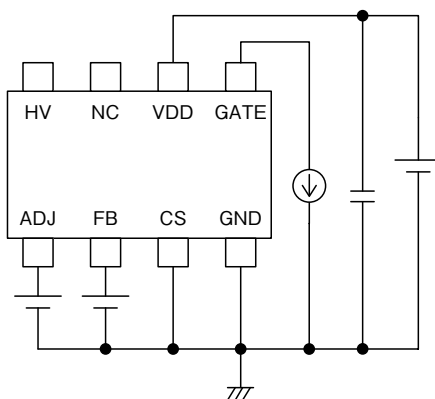
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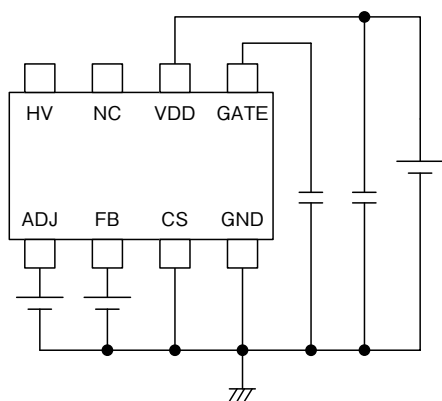
(F)



(H)



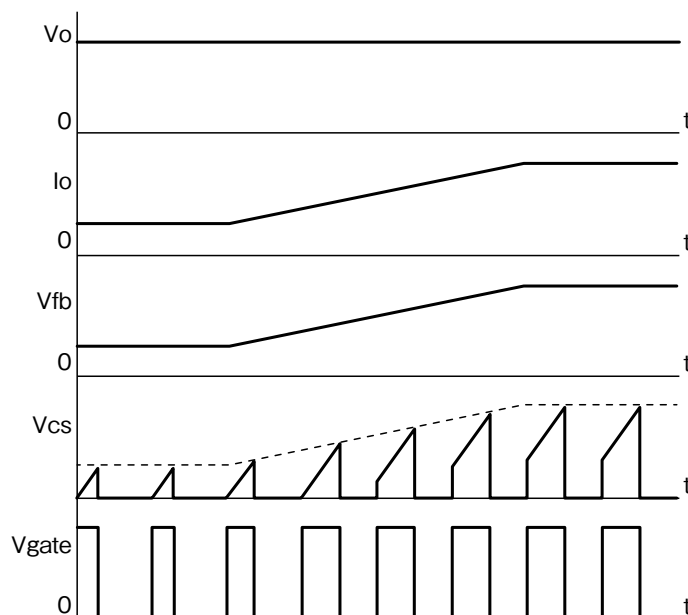
(I)



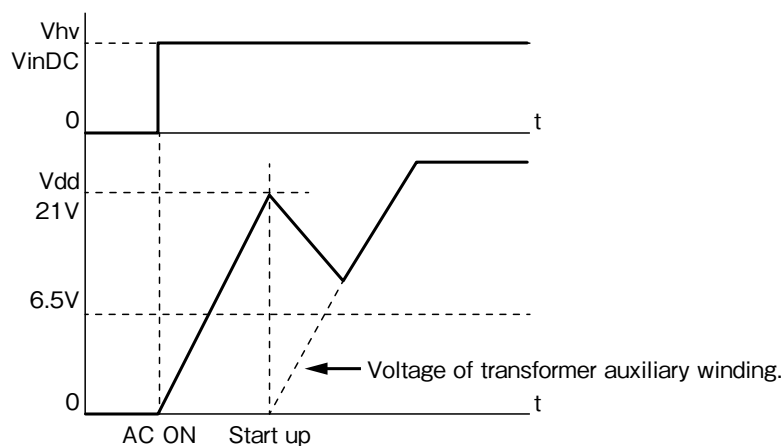
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- The details listed here are not a guarantee of the individual products at the time of ordering. When using the products, you will be asked to check their specifications.

Timing Chart

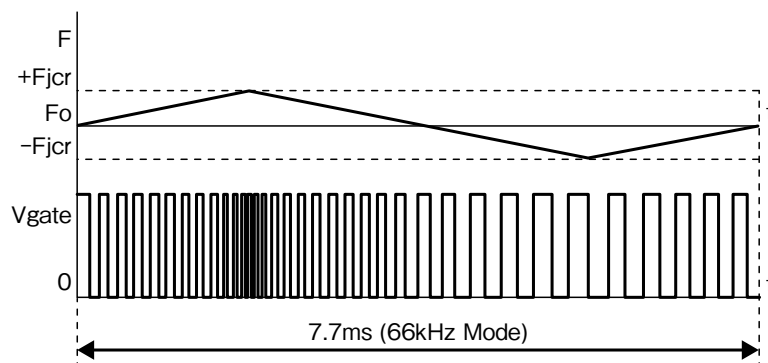
(1) Current mode control



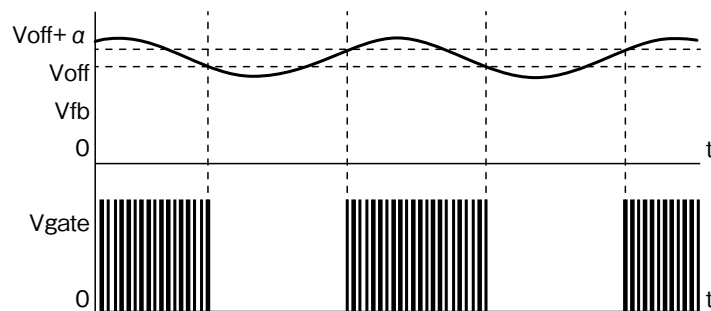
(2) VDD start up characteristics



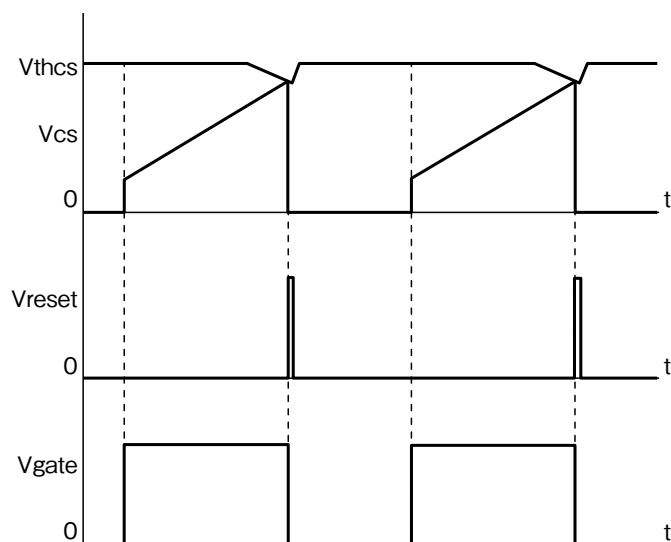
(3) Frequency jitter function



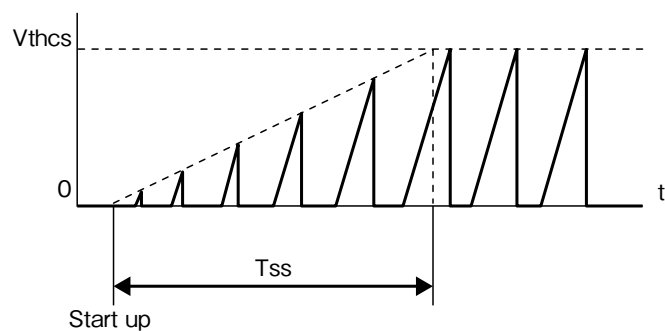
(4) Burst mode operation



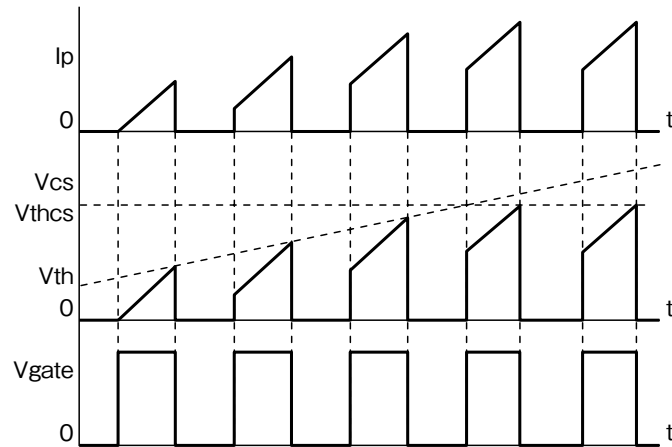
(5) Slope compensation



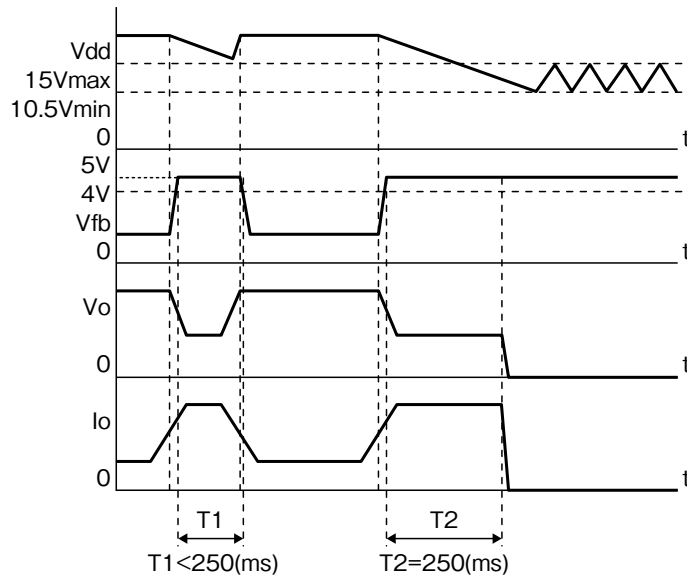
(6) Soft start



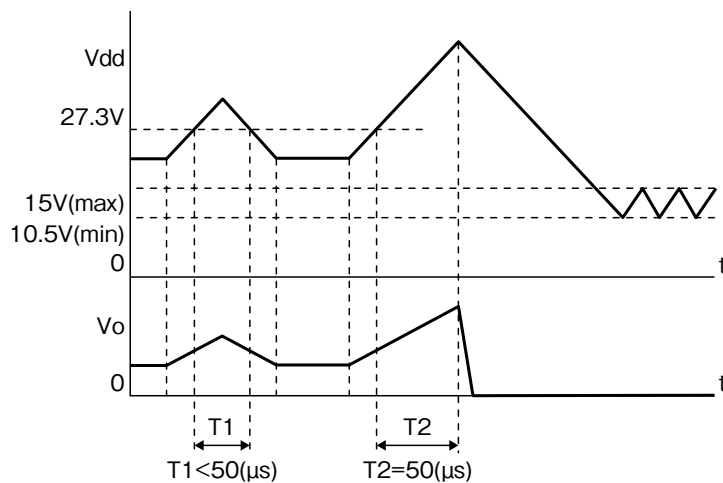
(7) Over current protection



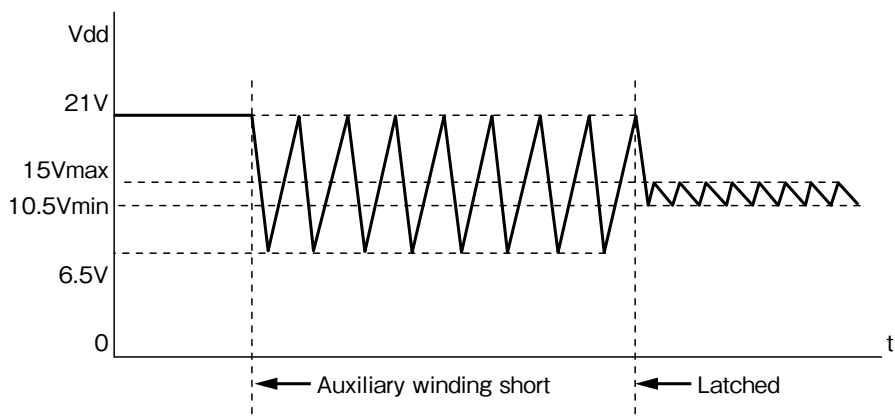
(8) Over load protection



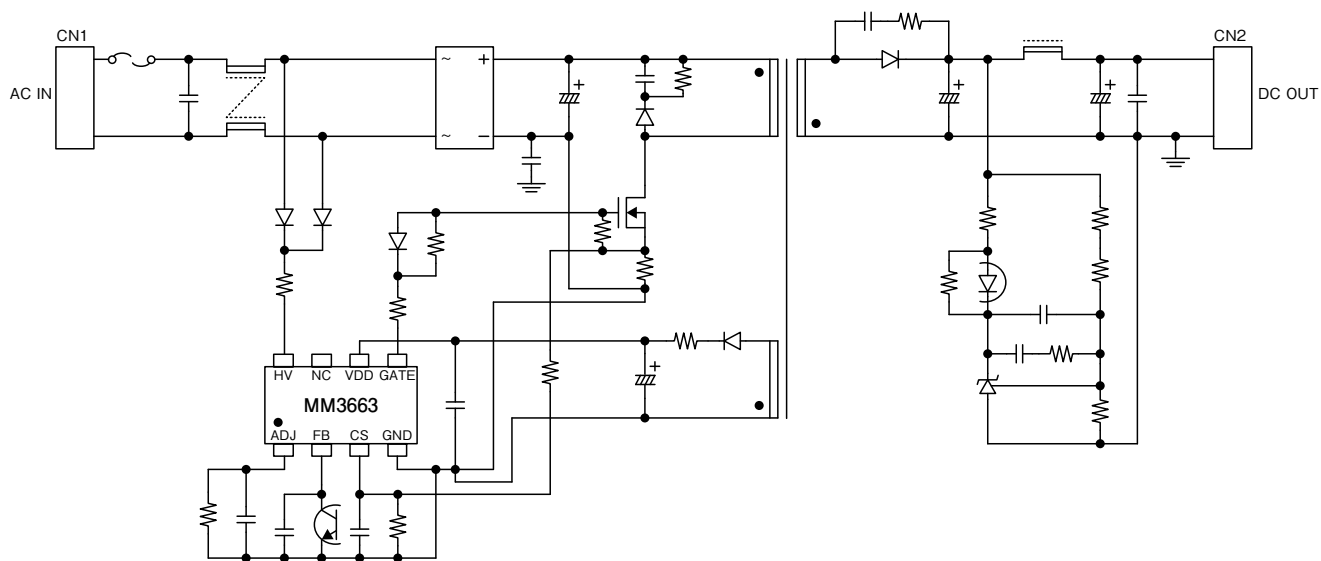
(9) Over voltage protection



(10) Auxiliary winding short protection

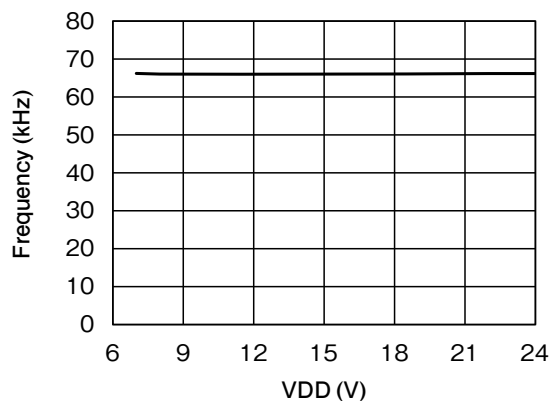


Application Circuit

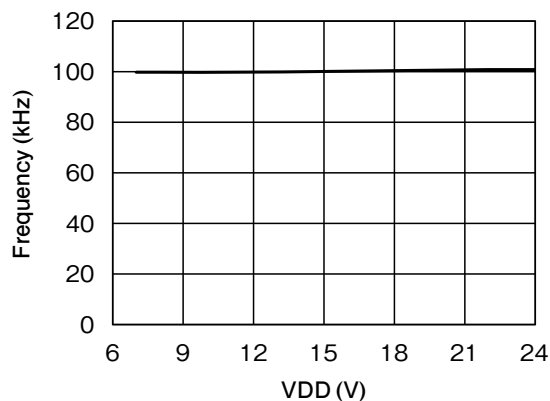


Characteristics (Except where noted otherwise Ta=25°C)

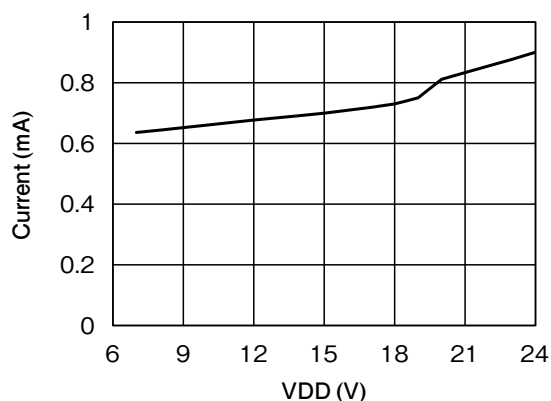
■ Maximum Frequency 1 - VDD Pin Voltage



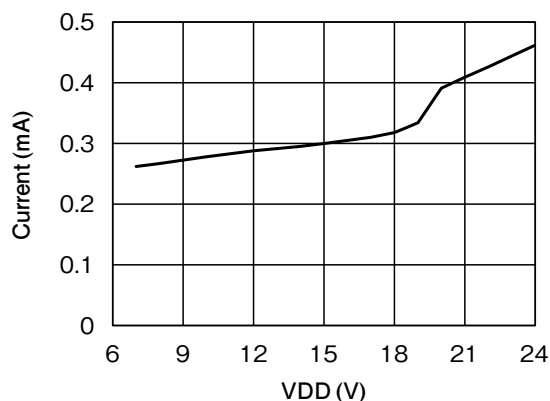
■ Maximum Frequency 2 - VDD Pin Voltage



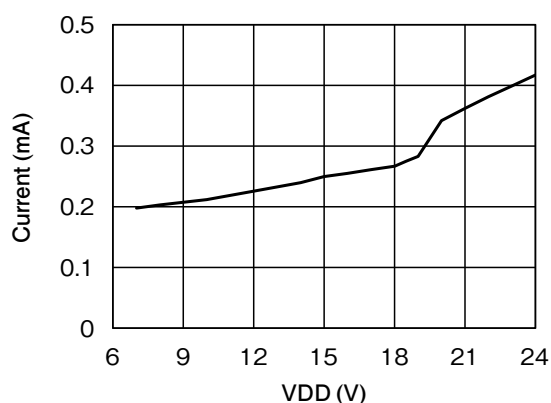
■ Supply Current 1 - VDD Pin Voltage



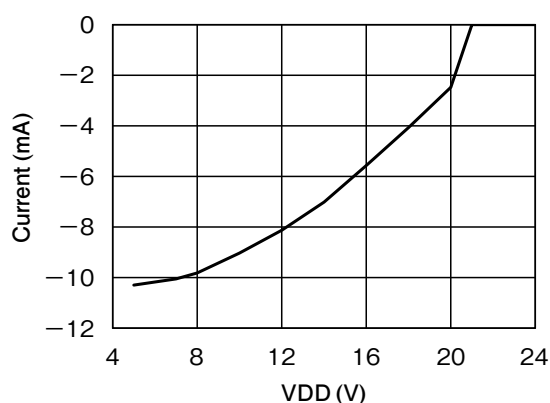
■ Supply Current 2 - VDD Pin Voltage



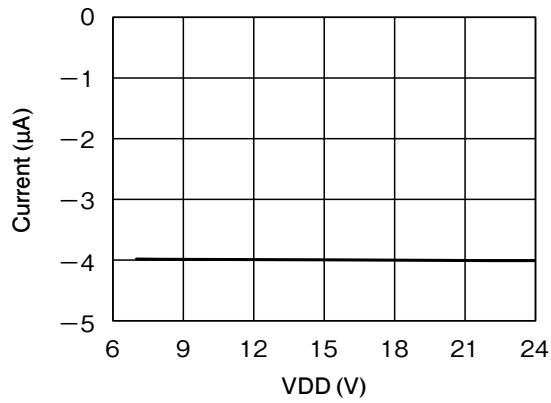
■ Supply Current in Latch - VDD Pin Voltage



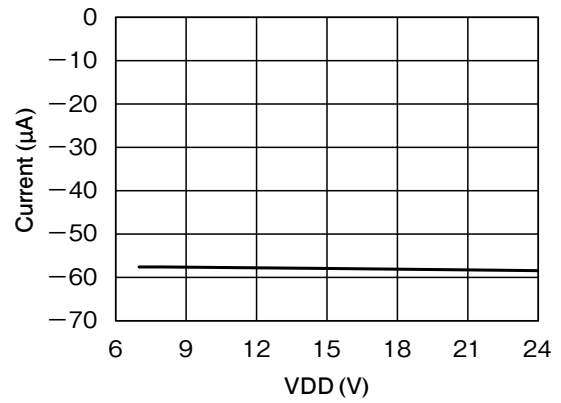
■ Source Current in Startup - VDD Pin Voltage



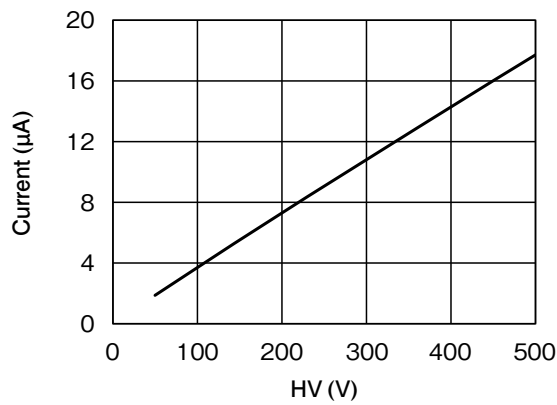
■ ADJ Source Current - VDD Pin Voltage



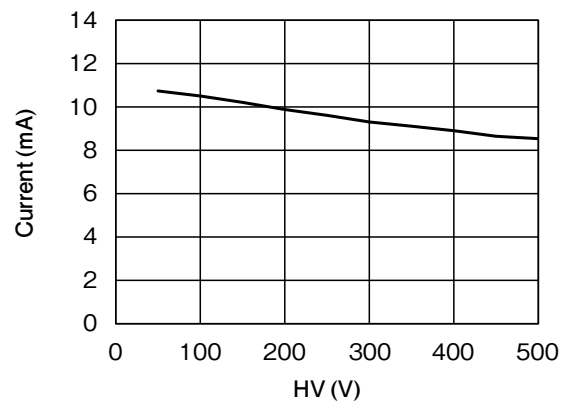
■ FB Source Current - VDD Pin Voltage



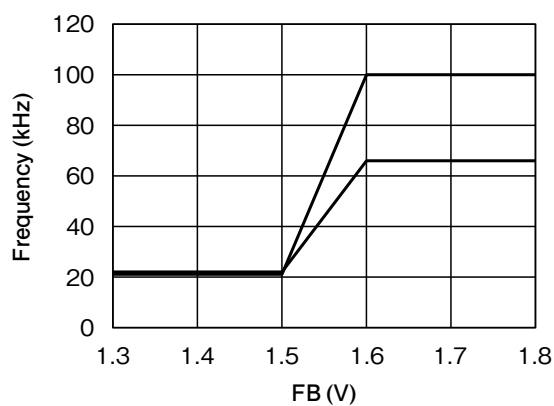
■ HV Input Current 1 - HV Pin Voltage



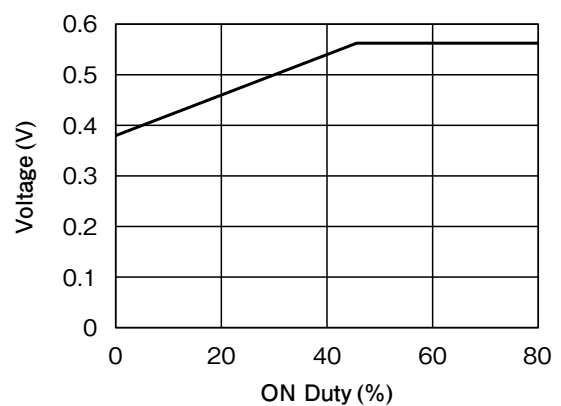
■ HV Input Current 2 - HV Pin Voltage



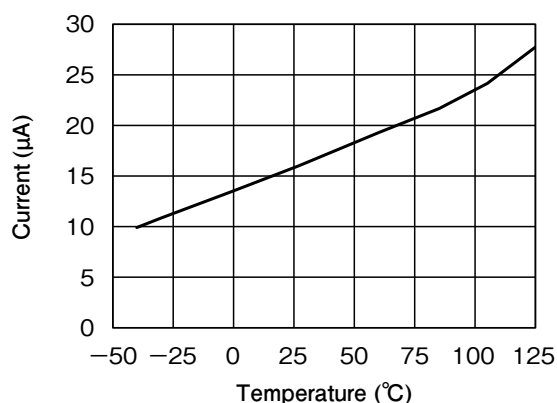
■ Frequency - FB Pin Voltage



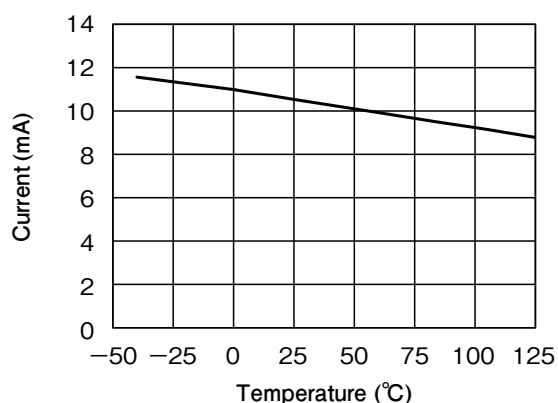
■ Over Current Detection Voltage - ON Duty



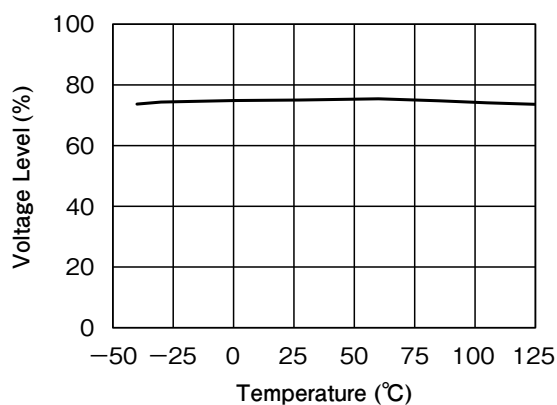
■ HV Input Current 1 - Temperature



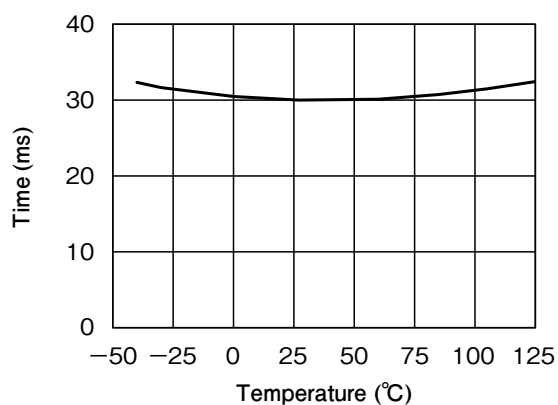
■ HV Input Current 2 - Temperature



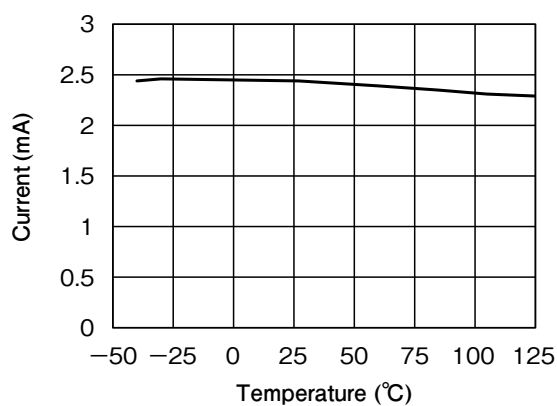
■ AC Interception Detect Voltage Level - Temperature



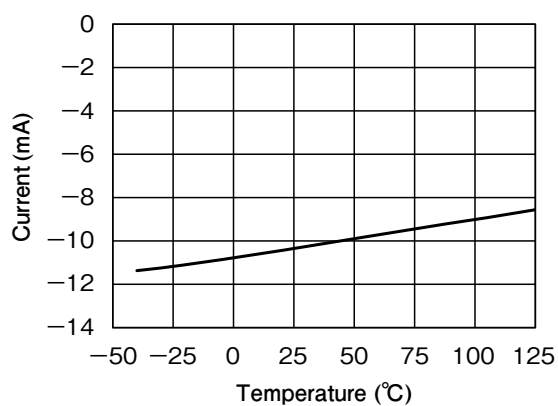
■ AC Interception Detect Time - Temperature



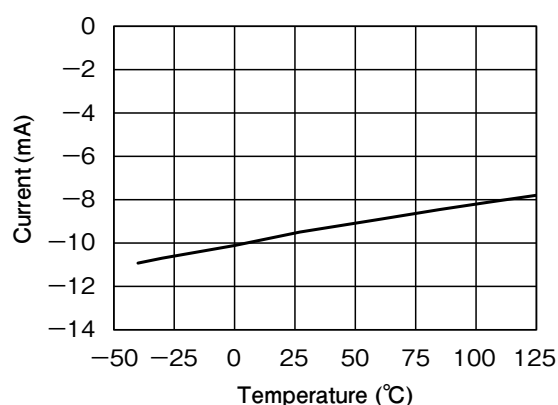
■ X Capacitor Discharge Current - Temperature



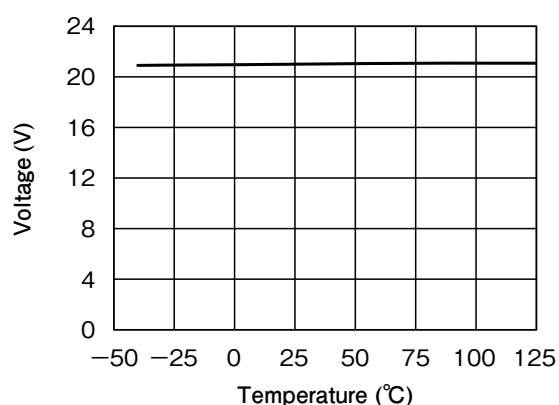
■ Source Current in Startup - Temperature



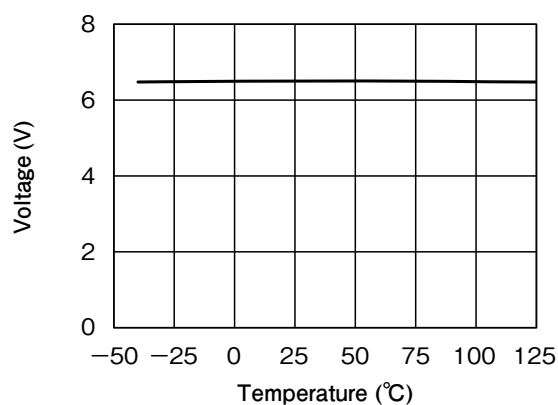
■ Source Current in Latch - Temperature



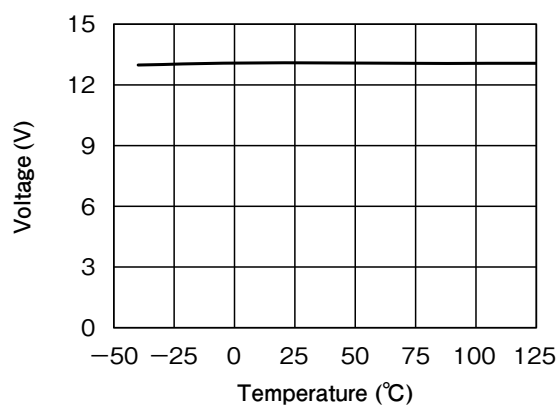
■ Operating Start Voltage - Temperature



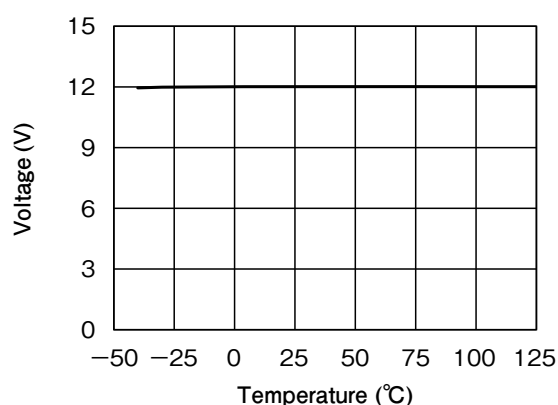
■ Operating Stop Voltage - Temperature



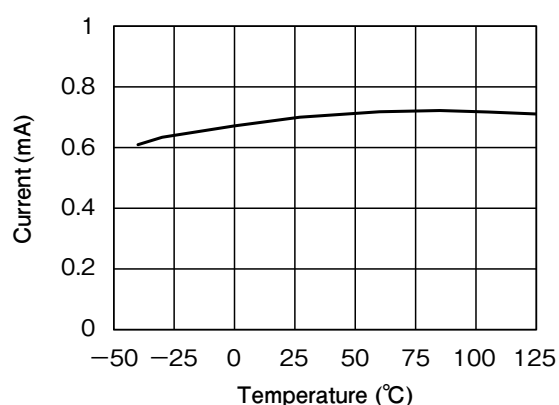
■ Upper Level Voltage in Latch - Temperature



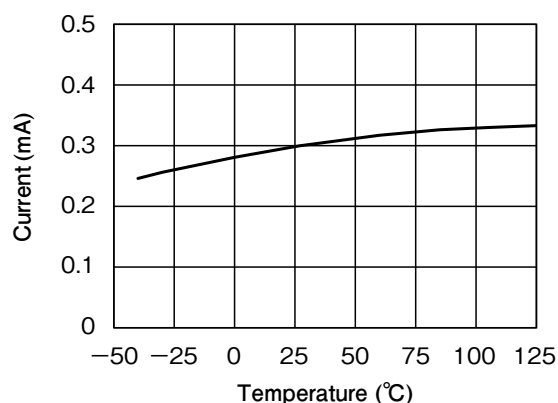
■ Lower Level Voltage in Latch - Temperature



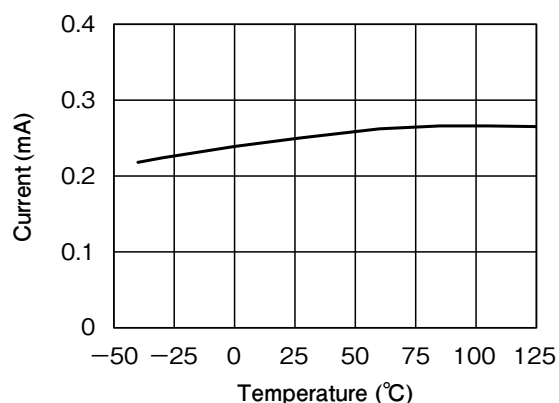
■ Supply Current 1 - Temperature



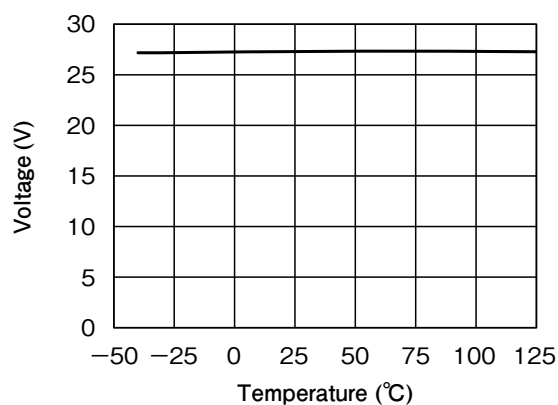
■ Supply Current 2 - Temperature



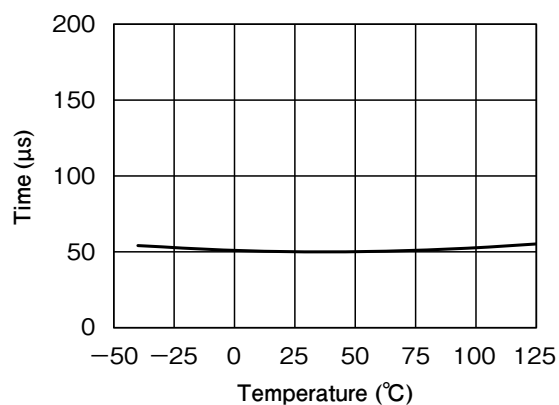
■ Supply Current in Latch - Temperature



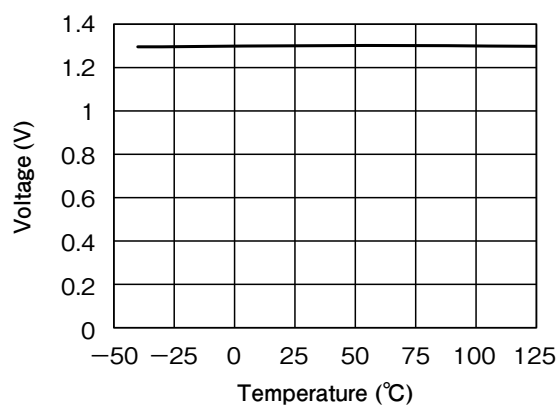
■ VDD Over Voltage Detection - Temperature



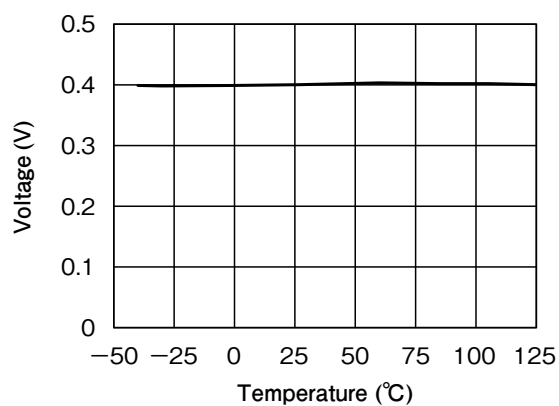
■ VDD Over Voltage Detection Delay Time - Temperature



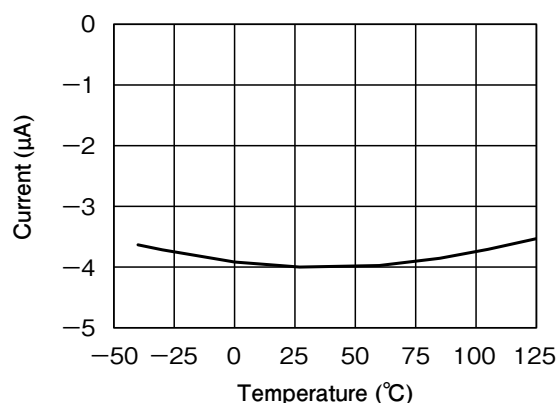
■ Frequency Switching Voltage - Temperature



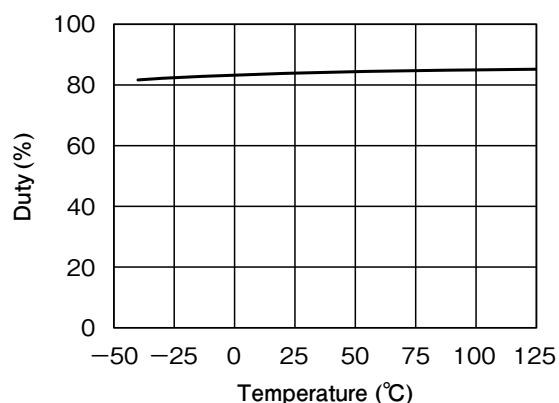
■ External Latch Stop Level - Temperature



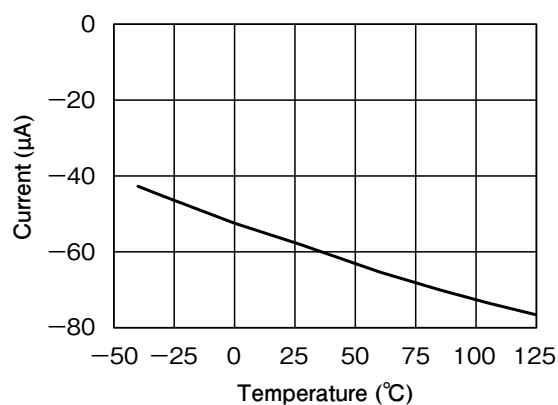
■ ADJ Source Current - Temperature



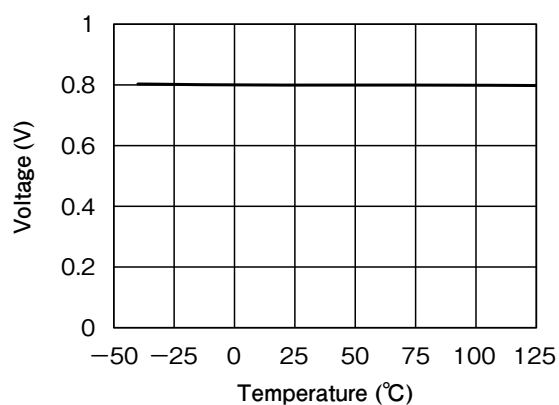
■ Maximum Duty Cycle - Temperature



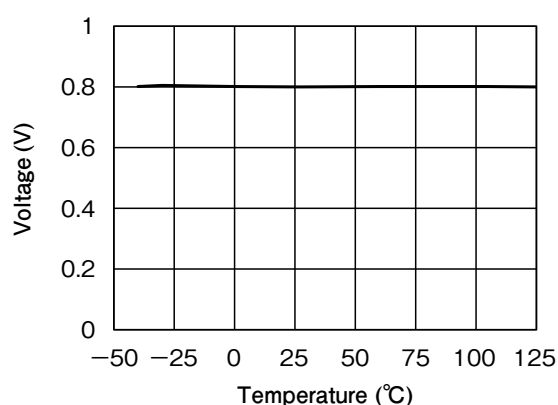
■ FB Source Current - Temperature



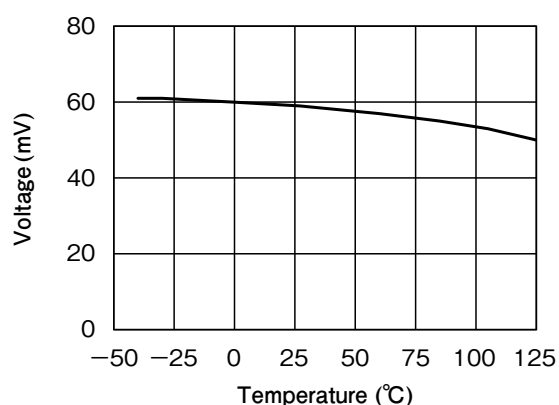
■ Gate Stop Voltage 1 - Temperature



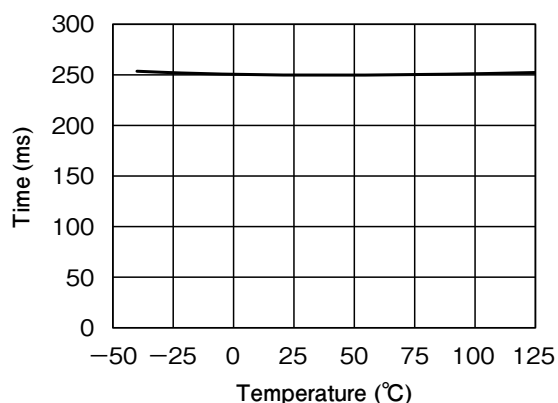
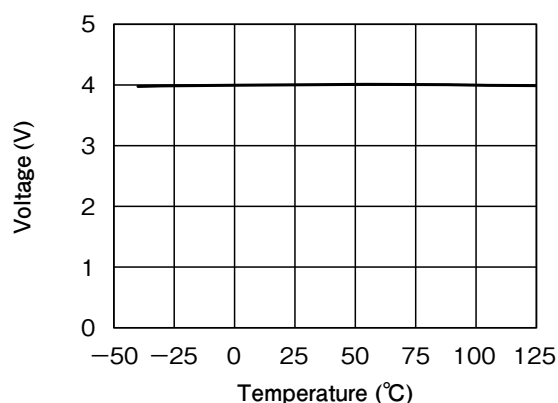
■ Gate Stop Voltage 2 - Temperature



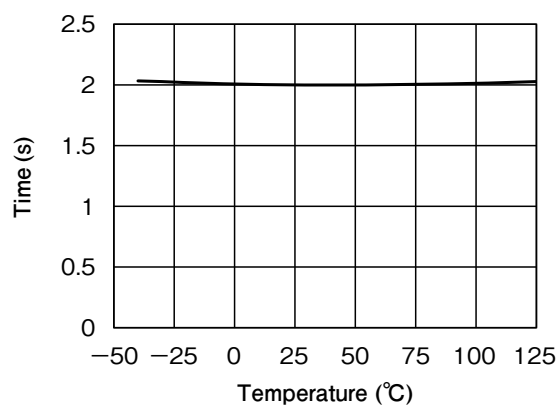
■ Gate Stop Voltage Hysteresis Range - Temperature



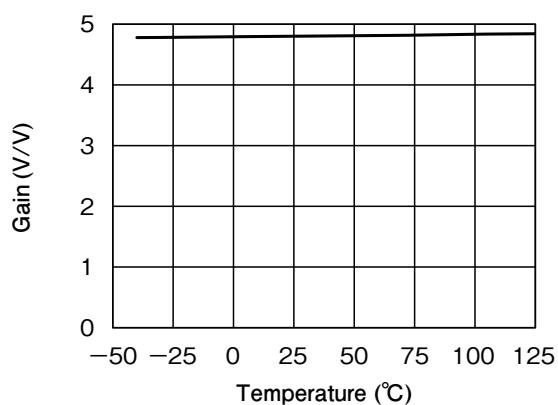
■ Over Load Detection Voltage - Temperature ■ Over Load Timer - Temperature



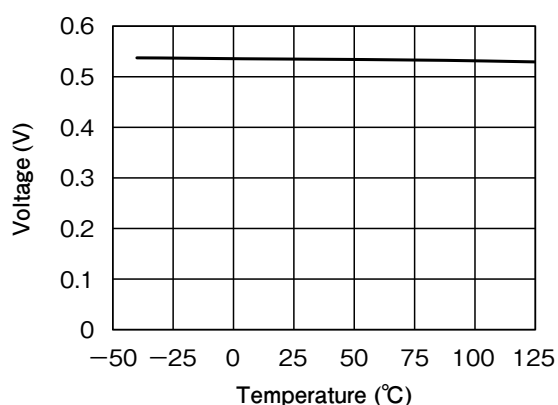
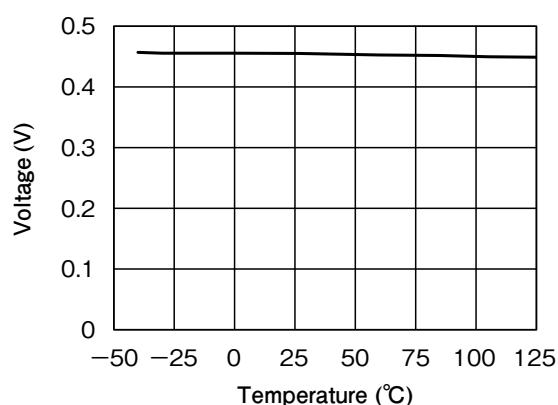
■ Restart Timer - Temperature



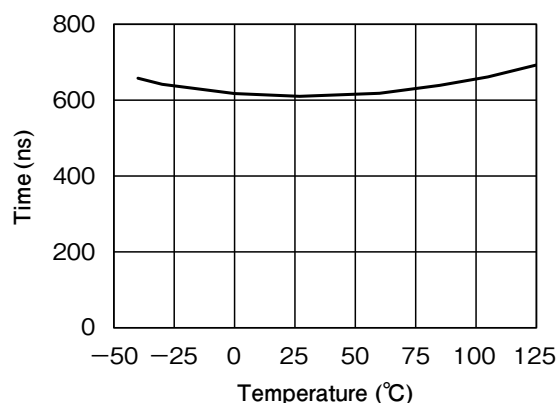
■ Voltage Gain - Temperature



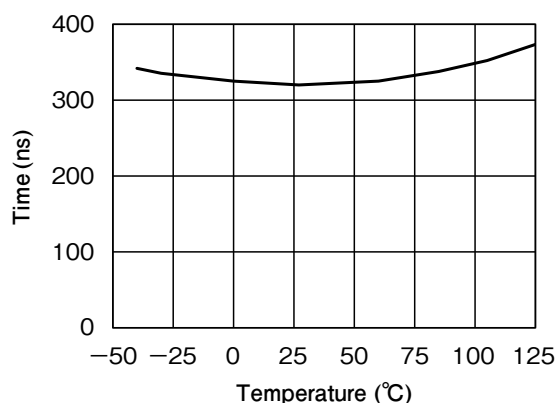
■ Over Current Detection Voltage 1 - Temperature ■ Over Current Detection Voltage 2 - Temperature



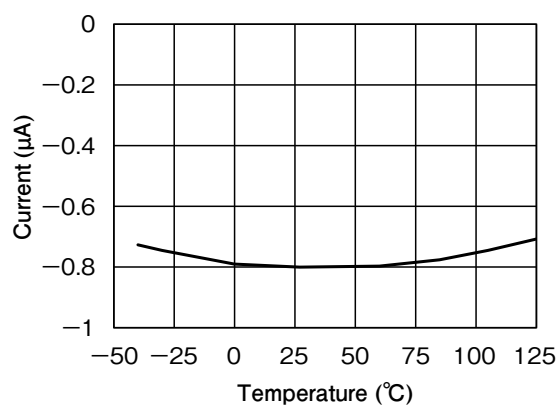
■ Minimum On Time 1 - Temperature



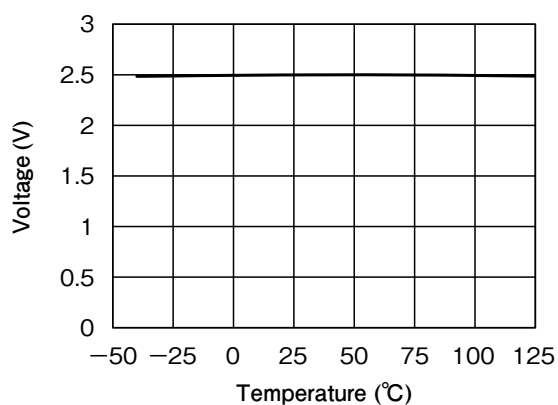
■ Minimum On Time 2 - Temperature



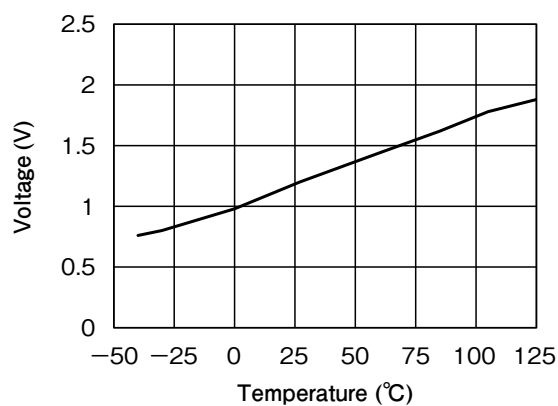
■ CS Source Current - Temperature



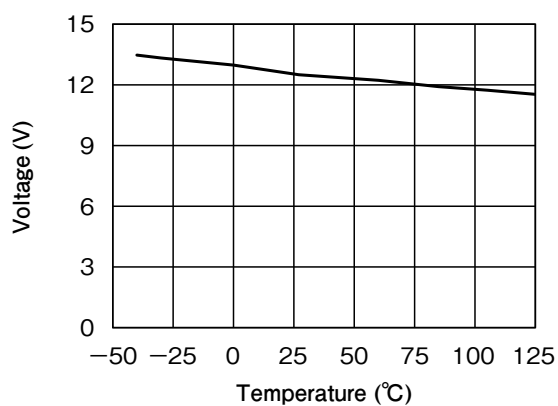
■ CS Latch Stop Detection Voltage - Temperature



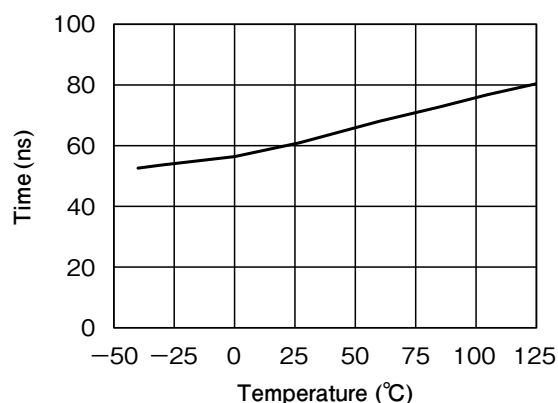
■ L Output Voltage - Temperature



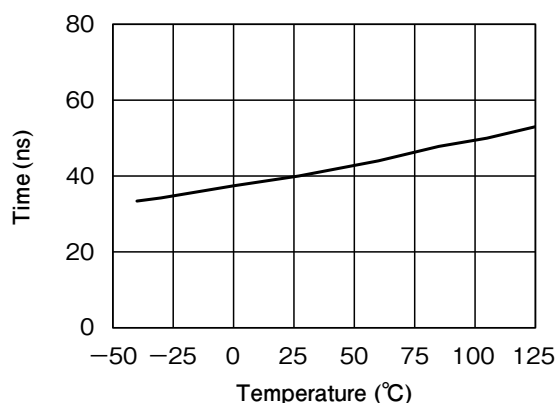
■ H Output Voltage - Temperature



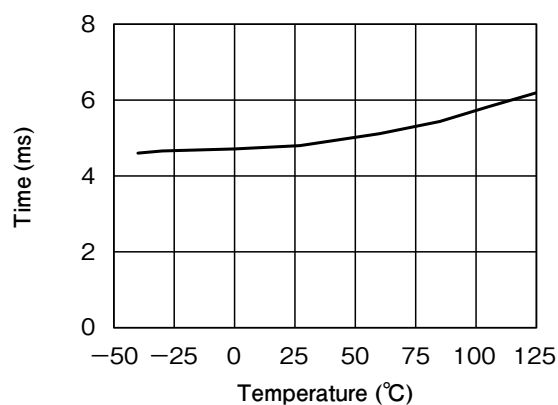
■ Rise Time - Temperature



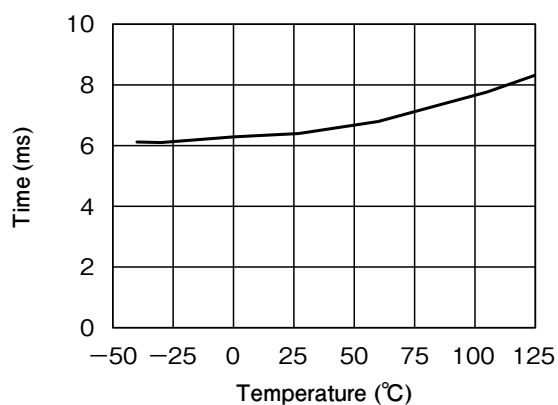
■ Fall Time - Temperature



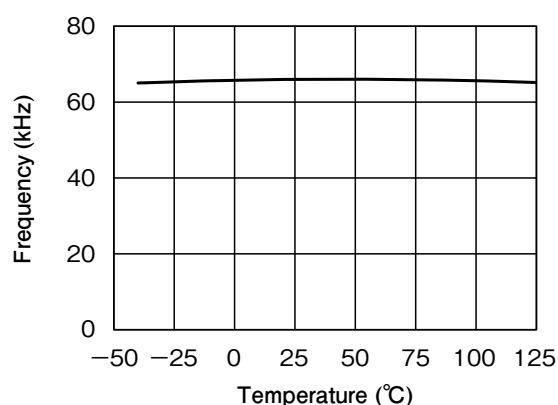
■ Soft Start Time 1 - Temperature



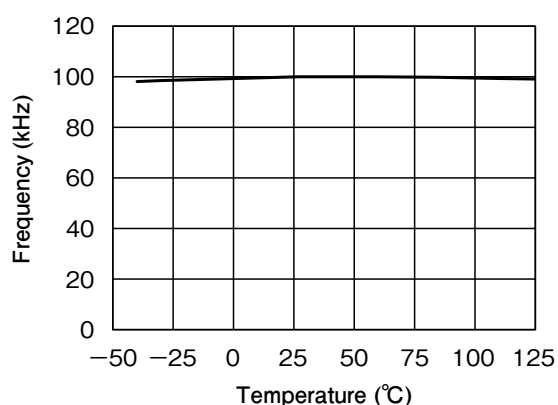
■ Soft Start Time 2 - Temperature



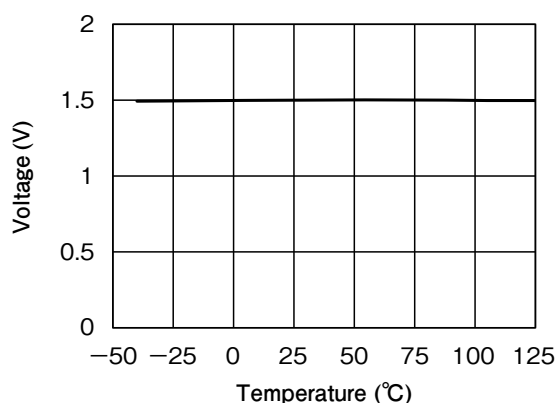
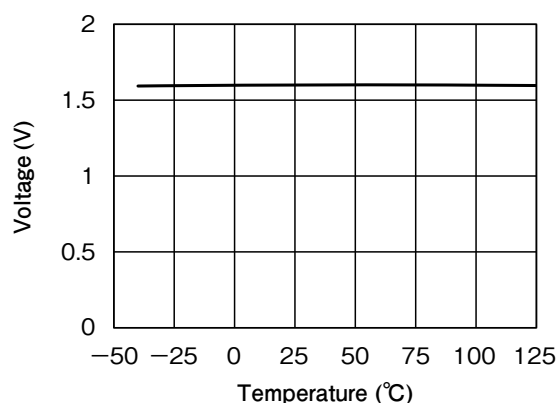
■ Maximum Frequency 1 - Temperature



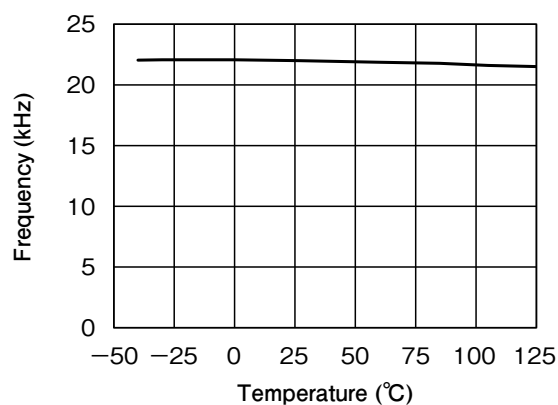
■ Maximum Frequency 2 - Temperature



■ Frequency Decrease Beginning Voltage - Temperature ■ Frequency Increase Beginning Voltage - Temperature



■ Minimum Frequency 1 - Temperature



■ Minimum Frequency 2 - Temperature

