

The synchronous rectification control IC for AC-DC converter

MM3669AF Series

Outline

MM3669 is secondary side synchronous rectification control IC to drive MOSFETs in isolated AC-DC converter. It is able to achieve very high efficiency by replacing secondary rectifier diode with MOSFET and MM3669. It is possible to correspond to various efficiency restrictions. And it is effective for the miniaturization of the power supply by the heat sink reduction and so on. MM3669 has 2 gate driver, this constitution is specialized in Half-

Bridge LLC resonant converter. MM3669 controls turn-ON/OFF of MOSFET by detecting the voltage between drain and source of MOSFET. This turn-OFF threshold voltage is adjustable by the external resistor. MM3669 has safety controller for LLC converter, as an example, preventing that VG is turned on at the same time. This IC uses SOP-10A package and supports flow conditions.

Features (Unless otherwise specified, Ta=+25°C)

- (1) Supply Voltage..... 7.5 to 15V
- (2) Gate Output Voltage..... 7.5 to 15V
It is equal to Supply Voltage.
- (3) Two output driver for the half-bridge LLC resonant converter
- (4) Frequency..... to 500kHz
- (5) Adjustable Turn-OFF threshold voltage
- (6) Safety controller for LLC converter

Applications

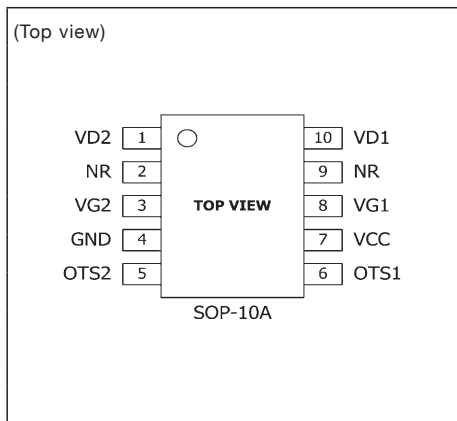
- (1) LCD TV
- (2) High-Power AC-DC Adaptor
- (3) Gaming Consoles
- (4) High-Power SMPS
- (5) Others

Package

SOP-10A

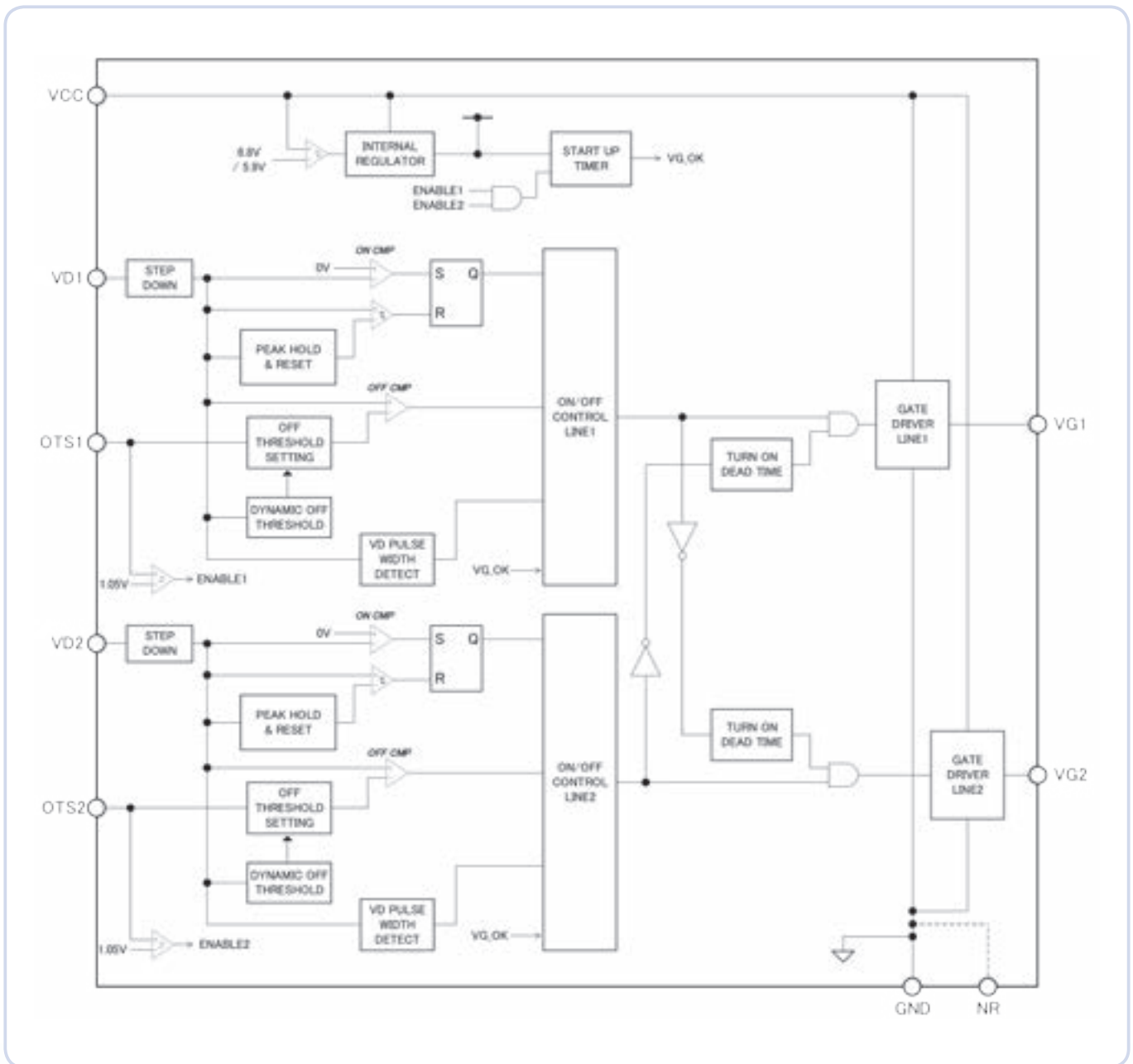
Pin assignment

SOP-10A



Pin no.	Symbol	Function
1	VD2	MOSFET Drain Voltage Detection (Line2)
2	NR	Noise Reduction
3	VG2	Gate Driver Output (Line2)
4	GND	Ground / MOSFET Source Connection
5	OTS2	Turn-Off Threshold Setting (Line2) / VG Output Disable
6	OTS1	Turn-Off Threshold Setting (Line1) / VG Output Disable
7	VCC	IC Power Input / Gate Driver Voltage Source
8	VG1	Gate Driver Output (Line1)
9	NR	Noise Reduction
10	VD1	MOSFET Drain Voltage Detection (Line1)

Block diagram



MM3669AF Series

Absolute maximum ratings

(Unless otherwise specified, Ta=+25°C)

ITEM	SYMBOL	MIN.	MAX.	UNIT
Supply Voltage	V _{CCMAX}	-0.3	17.0	V
VD Input Voltage	V _{VDMAX}	*1	17.0	V
VD Output Current	I _{VDMAX}	-1	-	mA
GATE Output Voltage	V _{GMAX}	-0.3	V _{CC}	V
Storage Temperature	T _{stg}	-50	150	°C
Power Dissipation *2	P _d	-	1200	mW

*1 When VD pin input voltage is shifted to minus, parasitic diode of ESD protection device is turned-on. To protect the parasitic diode, please adjust the external resistor to reduce the VD pin output current under 1mA.

*2 Mounting condition:
FR-4, 70×70×1.6mm, Double-sided PCB, Copper area is 90%

Recommended operating conditions

(Unless otherwise specified, Ta=+25°C)

ITEM	SYMBOL	MIN.	MAX.	UNIT
Operating Ambient Temperature	T _{opr}	-40	105	°C
Operating Supply Voltage	V _{CCOPR}	7.5	15.0	V
VD Pin Peak Voltage	V _{VDPEAK}	4.5	15.0	V
Switching Frequency	f _{SW}	-	500	kHz
OTS Input Voltage	V _{OTS}	-	2.0	V

Electrical characteristics

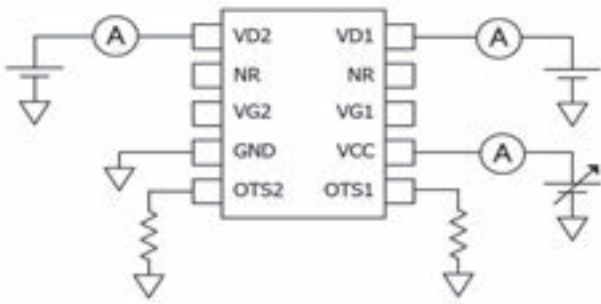
(Unless otherwise specified, Ta=+25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	*3
Supply Section							
VCC Turn On Threshold	V _{CC_START}		6.4	6.8	7.2	V	A
VCC Turn Off Threshold	V _{CC_STOP}		5.5	5.9	6.3	V	A
IC Supply Current	I _{CC}	Cl _{oad} =0pF, f _{sw} =100kHz	–	1.5	–	mA	C
Gate Driver Output							
VG Output High Voltage	V _{GH}	I _G =25mA	11.6	11.9	–	V	C
VG Output Low Voltage	V _{GL}	I _G =–25mA	–	0.05	0.1	V	C
Rise Time	t _R	Cl _{oad} =10nF V _G =2V→9V	–	70	120	ns	D
Fall Time	t _F	Cl _{oad} =10nF V _G =9V→2V	–	45	75	ns	D
Turn-On Propagation Delay	t _{DON}	Cl _{oad} =10nF, R _{OTS} =100kΩ V _D =V _{TH_ON} →V _G =2V	–	150	280	ns	D
Turn-Off Propagation Delay	t _{DOFF}	Cl _{oad} =10nF V _D =V _{TH_OFF} →V _G =9V	–	100	220	ns	D
Drain Voltage Detector							
Turn-On Threshold Voltage	V _{TH_ON}		–0.2	0	0.2	V	B
Turn-Off Threshold Voltage	V _{TH_OFF}	R _{OTS} =39kΩ	–12	–6	0	mV	B
		R _{OTS} =100kΩ	13	19	25	mV	B
VD Input Resistance	R _{VD}	V _D =12V	12	15	18	kΩ	A
Timer Section							
VD Peak Pulse Width Detect	t _{VDPW}		0.49	0.62	0.84	us	D
Dynamic Off-Threshold Time	t _{DOT}	f _{sw} =100kHz	1.8	2.4	3.0	us	D
		f _{sw} =300kHz	0.81	1.05	1.29	us	D
Turn On Dead Time	t _{DEAD}		–	450	–	ns	D
Gate Enable Mode							
Gate Enable Mode Voltage	V _{ENABLE}		0.9	1.05	1.2	V	E

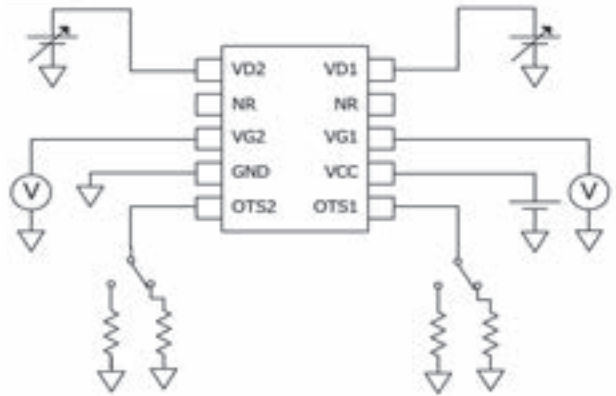
*3 The test circuit symbols.

Test circuit

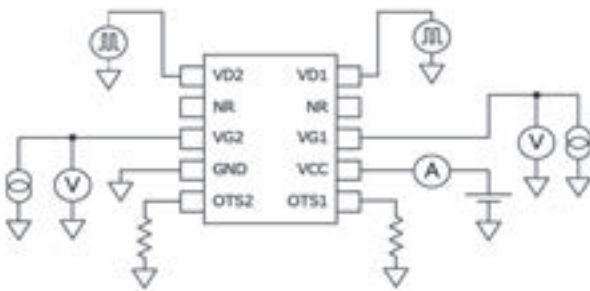
A



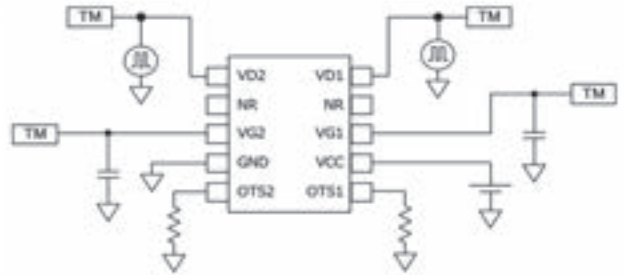
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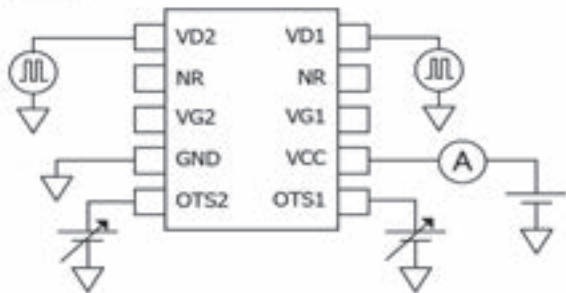
C



D

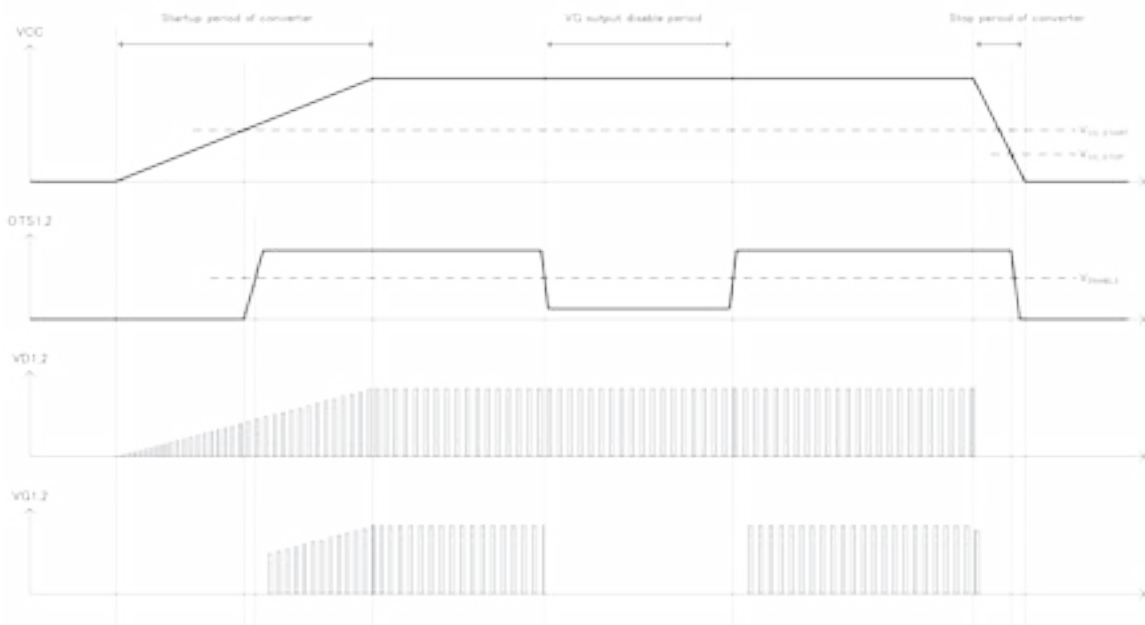


E

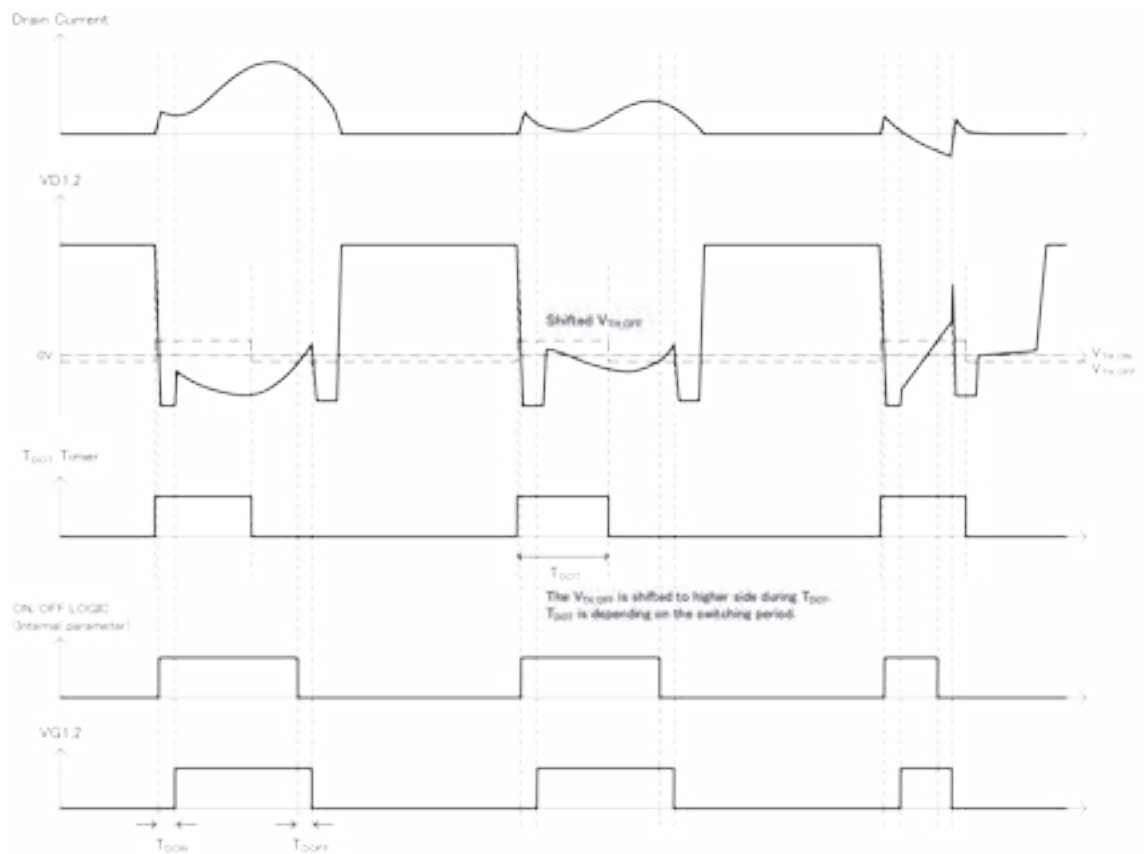


Timing chart

IC operation start ~ VG output disable ~ VG output enable ~ IC operation stop

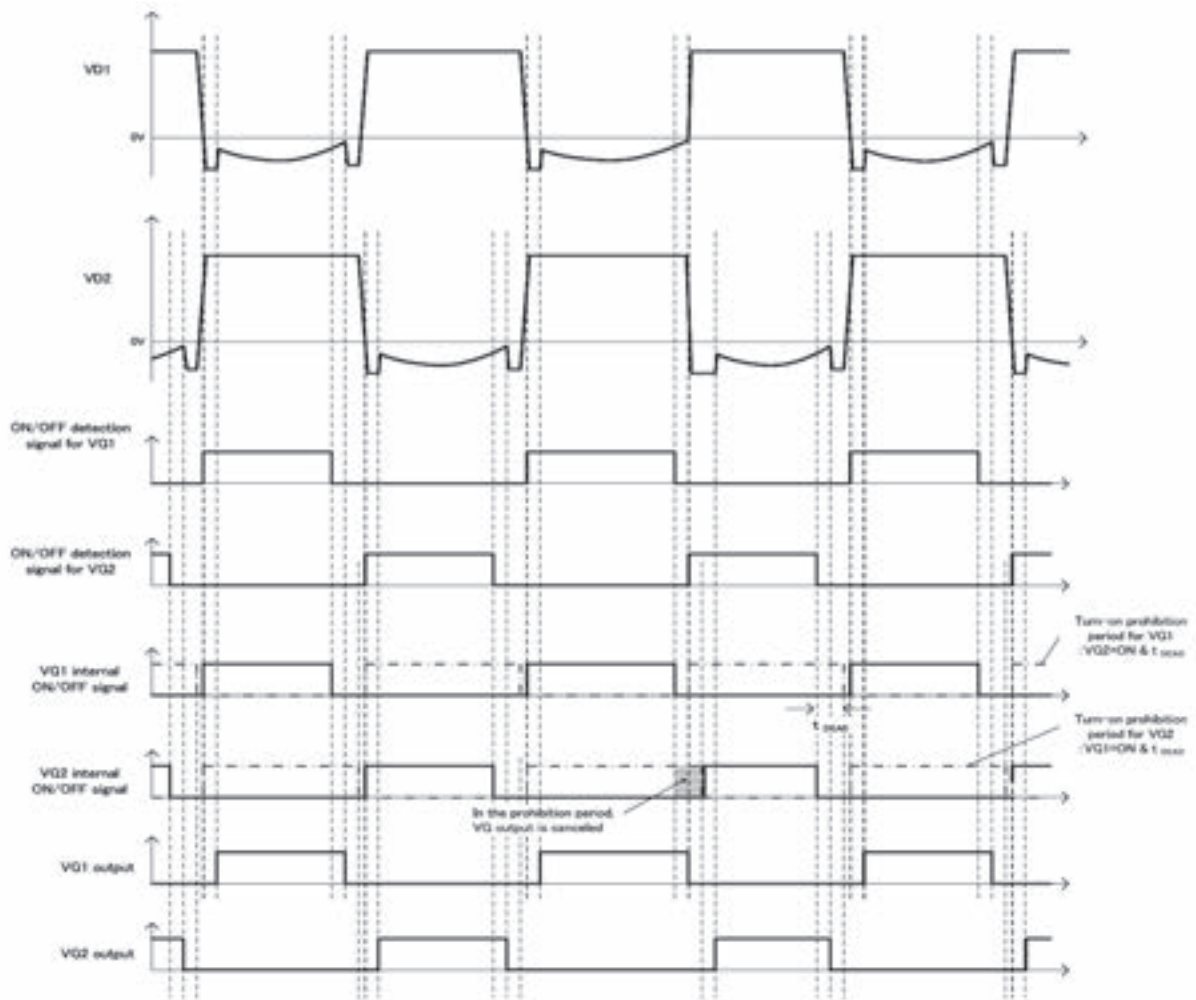


Operation for the VD input signal

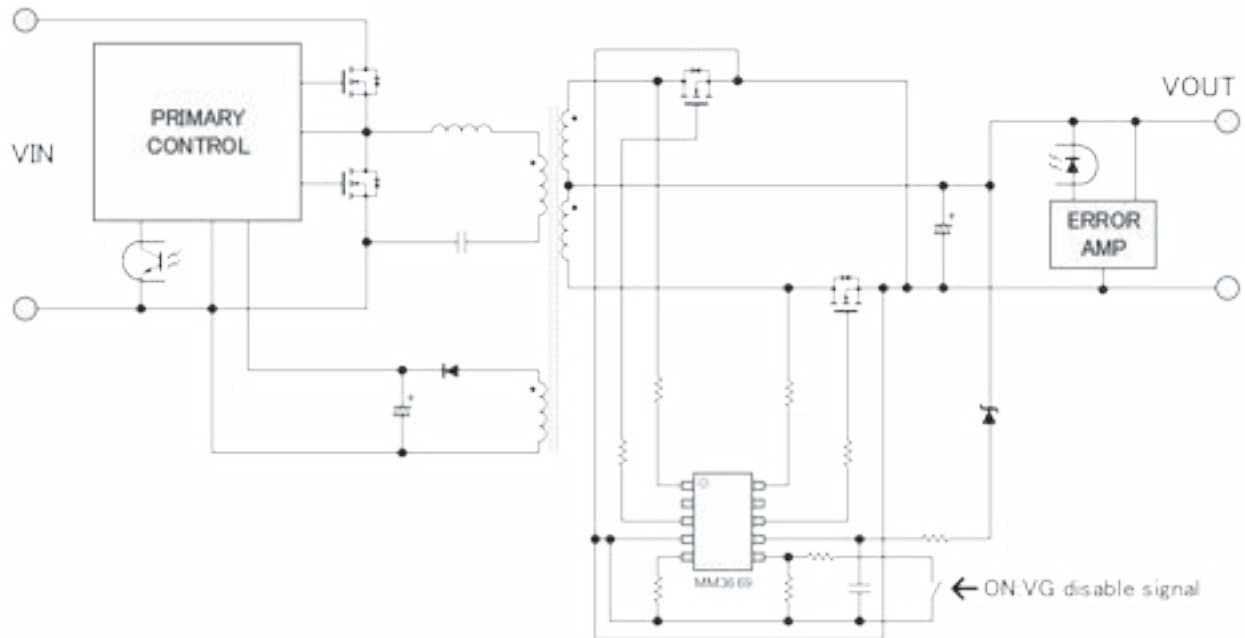


Timing chart

Prevention of the turn-on of the VG at the same time



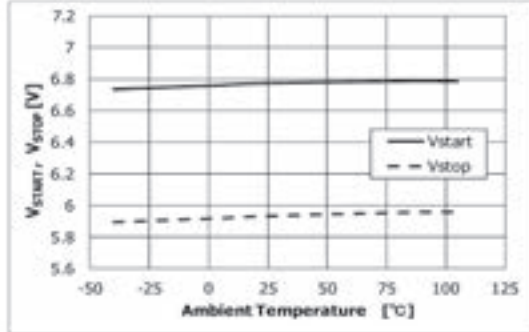
Typical application circuit



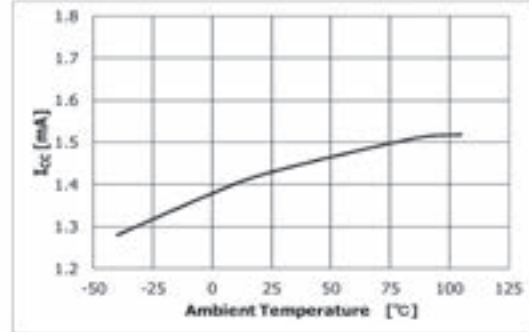
Application hints

- The above circuit shows one example of connection of MM3669. Constants of the best wiring and parts in the surrounding are different depending on the specification of the power supply. Please use MM3669 after it examines enough. Please refer to an application note for the setting methods of neighboring parts.

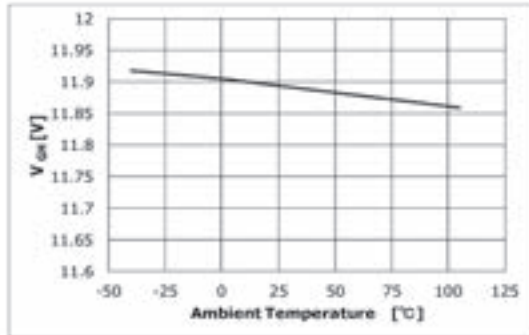
13-1 Temp. VS. VCC Turn On / Off Threshold



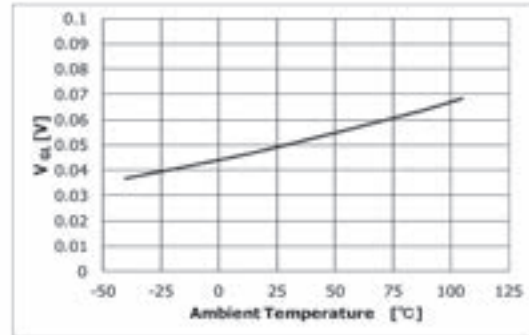
13-2 Temp. VS. IC Supply Current



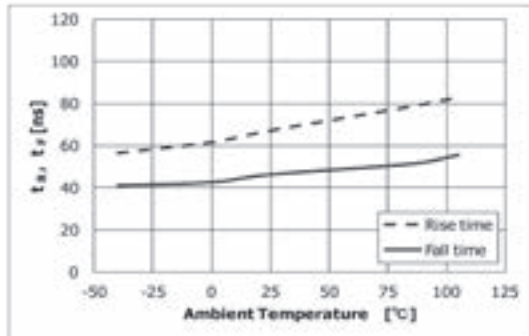
13-3 Temp. VS. VG Output High Voltage



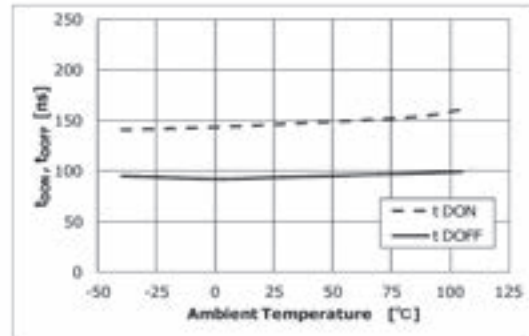
13-4 Temp. VS. VG Output Low Voltage



13-5 Temp. VS. Rise / Fall Time



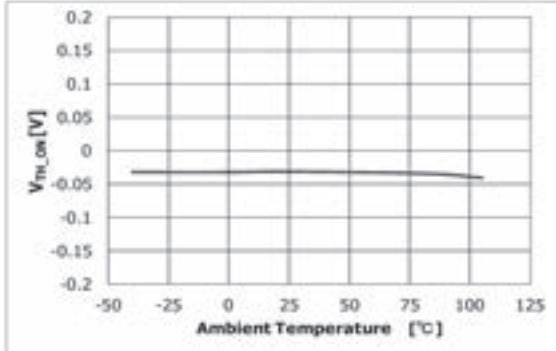
13-6 Temp. VS. Turn- On/ Off Propagation Delay



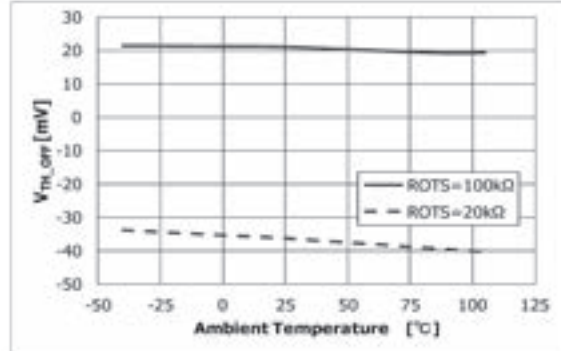
Typical performance characteristics

(Unless otherwise specified, $T_a=+25^\circ\text{C}$)

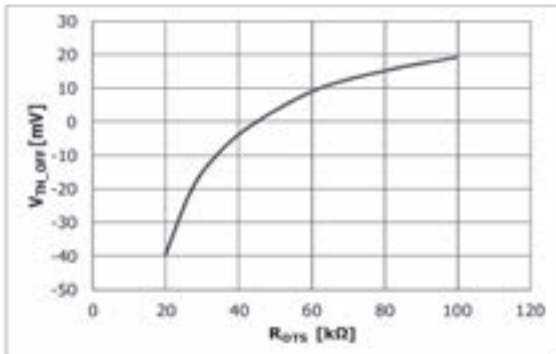
13-7 Temp. VS. Turn-On Threshold Voltage



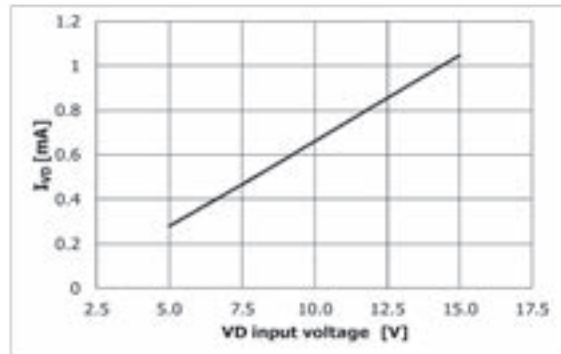
13-8 Temp. VS. Turn-Off Threshold Voltage



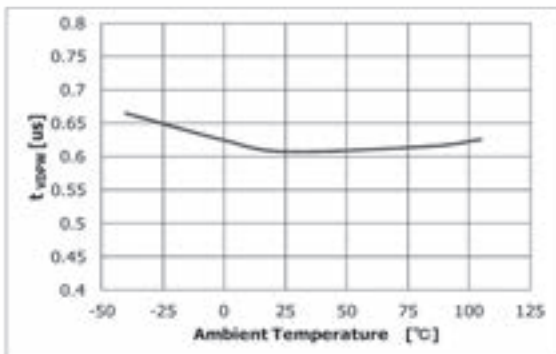
13-9 R_{OTS} VS. Turn Off Threshold Voltage



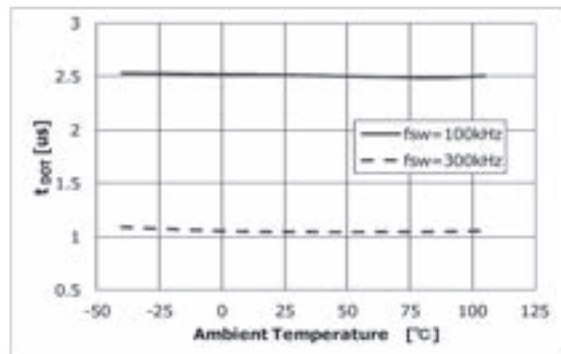
13-10 V_D Input Voltage VS. V_D Input Current



13-11 Temp. VS. V_D Peak Pulse Width Detect



13-12 Temp. VS. Dynamic Off-Threshold Time



13-13 Temp. VS. Gate Enable Mode Voltage

