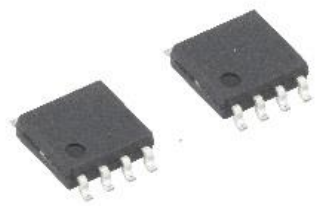
MITSUMI

PFC switching power control IC for LED lights

MM3460 series



Outline

This IC is an IC for switching power supply control that supports power factor improvement for LED lighting. It uses a 1-converter system that integrates a PFC (Power Factor Correction) circuit that complies with harmonic current regulation and an AC-DC converter, reducing the number of parts and reducing power loss compared to a normal 2-converter configuration. It can be configured with high efficiency. In addition, as a protection circuit, input undervoltage, overvoltage protection, output overvoltage with delay, short protection circuit are built-in, and it is a protection setting specialized for 1 converter method and LED lighting, compared with the conventional PFC-IC use. It can be set with a small number of parts. Furthermore, in order to support low standby power, the startup current and operating current are reduced. The package uses SOP-8. It also supports flow conditions.

Features

- Harmonic current regulation compliant
  (1 converter method)
- Power factor≒0.99 (reference value)
- High efficiency : 88%(reference value at rated load)
- No need for active filter (PFC) control circuit to reduce the number of parts
- Long life due to no primary electrolytic capacitor

Main specifications

- High withstand voltage input : 28V
- LED output : 5~60W
- Current seaside mode control

Applications

- LED lighting equipment
- LED bulb
- Other power supplies

Package

- SOP-8D

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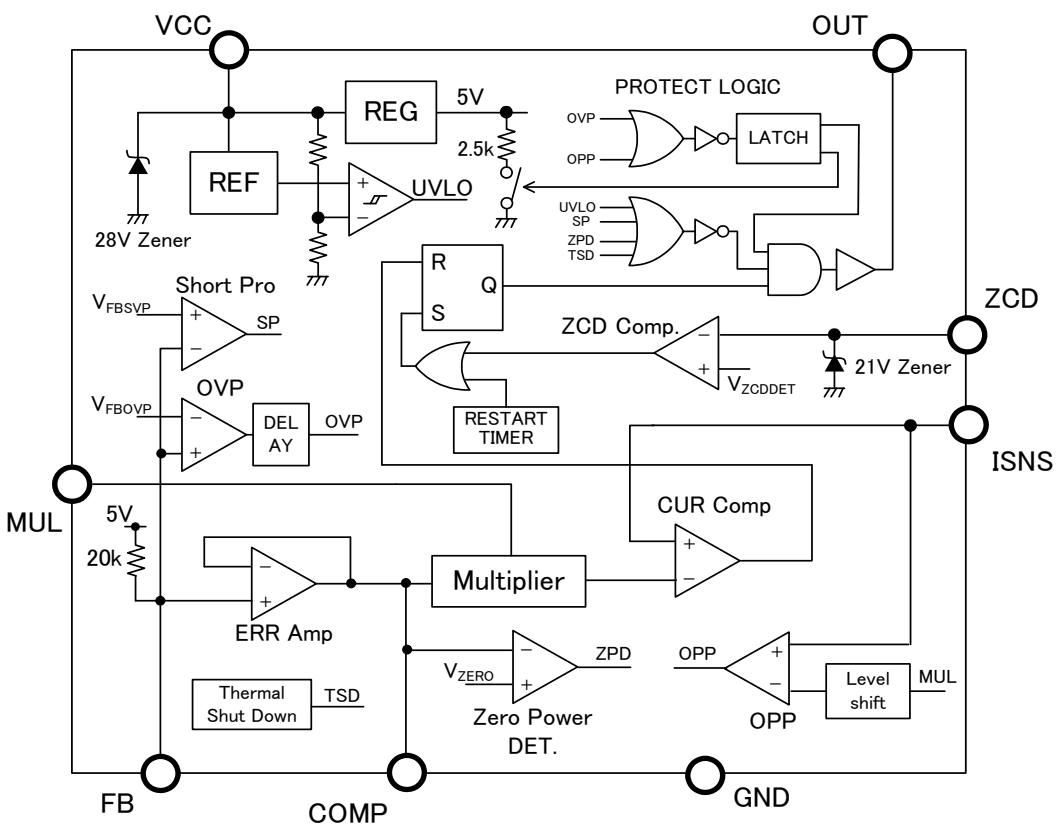
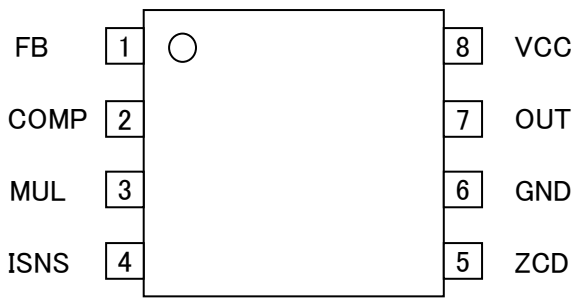
Dec, 2022 Rev.0

Equivalent Circuit Diagram



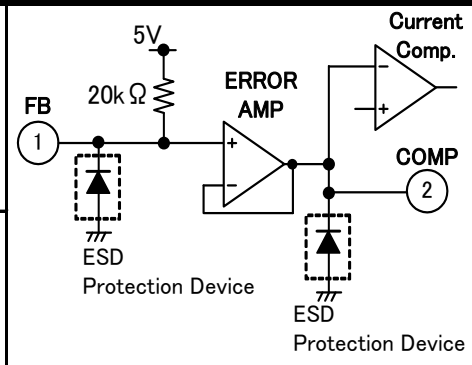
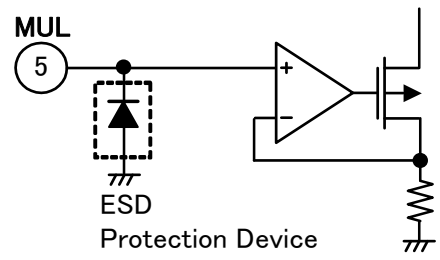
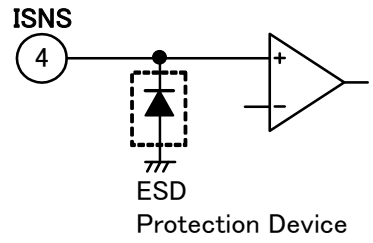
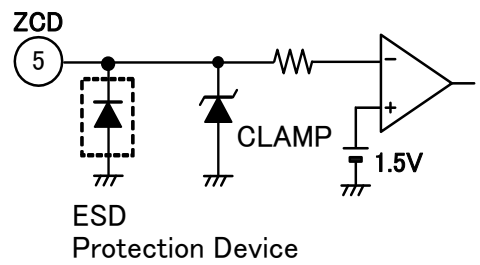
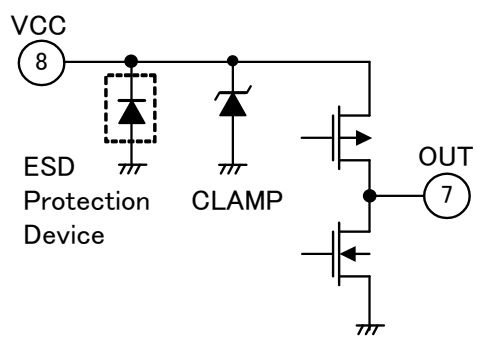
Pin configrations

TOP VIEW



SOP−8D

Pin explanations□

PIN No.	PIN NAME	INPUT / OUTPUT	PIN DESCRIPTION	EQUIVALENT CIRCUIT
1	FB	INPUT	Input of the error amplifier.	
2	COMP	OUTPUT	Outpu t of the error amplifier.	
3	MUL	INPUT	Input to the multiplier.	
4	ISNS	INPUT	Input to the current comparator for sensing MOSFET current signal.	
5	ZCD	INPUT	Input for the transformer zero detect comparetor.	
6	GND	-	GND	
7	OUT	OUTPUT	Gate driver Output for driving MOSFET.	
8	VCC	INPUT	Power supply.	

ABSOLUTE MAXIMUM RATINGS

(Ta = 25℃)

PARAMETER	SYMBOL	RATING	UNIT
Storage temperature	T_{STG}	-55 ～ +150	℃
Supply voltage	V_{CCMAX}	.3 ～ Self Limit（28	V
VCC pin input current	I_{VCCMAX}	+10	mA
FB pin supply voltage	V_{FBMAX}	-0.3 ～ +6	V
MUL pin supply voltage	V_{MULMAX}	-0.3 ～ +6	V
ISNS pin supply voltage	$V_{ISNSMAX}$	-0.3 ～ +6	V
ZCD pin input current	I_{ZCDMAX}	-2 ～ +5	mA
OUT pin input current	I_{OUTMAX}	-600 ～ +700	mA
Power dissipation	Pd	300 (alone)	mW

*1 : Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATING	UNIT
Operating Temperature	T_{OPR}	-40 ～ +105 *1	℃
Operating Supply Voltage	V_{OPR}	10 ～ 25.5	V
MUL pin supply voltage	V_{INMUL}	0 ～ +5.5	V
FB pin supply voltage	V_{INFB}	0 ～ +5.5	V
ISNS pin supply voltage	V_{INISNS}	0 ～ +5.5	V

Electorical Characteristics

(unless otherwise specified, Ta=+25℃, VCC=15V)

PARAMETER	SYMBOL	TEST CONDITIONS	CIRCUIT	MIN	TYP	MAX	UNIT
Start-up power supply current	I_{DDOFF}	VCC=9V	①	-	30	50	μA
Power supply current	I_{DDON}		①	-	1	2	mA
UVLO							
Under voltage lockout (UVLO)	V_{UVLO}	VCC=H→L	①	8	9	10	V
Under voltage lockout release voltage	$V_{UVLORelease}$	VCC=L→H	①	12	###	15	V
Under voltage lockout hysteresis voltage	$V_{UVLOhys}$	VCC=H→L→H	①	3.3	4.0	4.7	V
VCC clamp voltage	$V_{VCCclamp}$	I_{VCC}=1mA	②	26	28	30	V
ERR Amplifier							
Pullup resistance	R_{PULLUP}		④	14	20	26	kΩ
FB pin bias current	I_{FB}	FB=1V	④	-100	-200	##	μA
COMP pin source current	$I_{COMPSource}$	COMP=0V	④	-35	-70	-	μA
COMP pin sink current	$I_{COMPSink}$	COMP=5V	④	2.0	3.5	-	mA
Multiplier							
Amplification ratio K	K	MUL=1V、FB=COMP=2.25V	⑤	0.5	0.8	1	V
Multiplier input voltage	V_{MUL}		⑤	0～2.5	0～3.5	-	V
	V_{COMP}		⑤	1.25～2.5	1.25～3.5	-	V
Multiplier clamp voltage	$V_{MULclamp}$	MUL=3.5V、FB=COMP=2.75V	⑤	2.2	2.6	-	V

(unless otherwise specified, Ta=+25℃, VCC=15V)

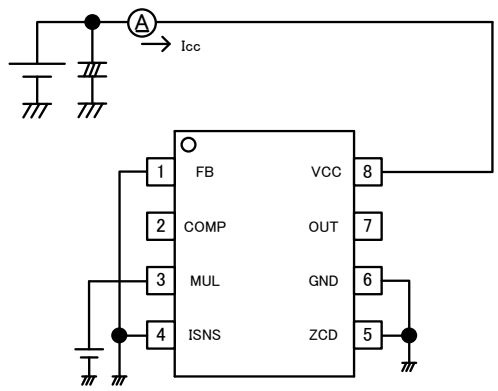
PARAMETER	SYMBOL	TEST CONDITIONS	CIRCUIT	MIN	TYP	MAX	UNIT
Zero current detect							
ZCD detection voltage	V_{ZCDDET}	ZCD=3V→0V	⑥	1.3	1.5	1.8	V
ZCD Input high clamp voltage	$V_{ZCDclampH}$	I_{ZCD}=1mA	②	20	21	23	V
ZCD Input low clamp voltage	$V_{ZCDclampL}$	I_{ZCD}=-1mA	②	-1	-1	-0	V
Cyrrent sense comparator							
Delay time	T_{ISNS}	FB=1.5V ISNS=0V→3V	⑤	-	200	400	ns
Drive							
On resistance (sink)	R_{ONsink}		③	–	8	12	Ω
On resistance (source)	$R_{ONsource}$		③	–	10	15	Ω
Output rise time	T_{rise}	Cout=1000pF Guaranteed by design	③	-	60	120	ns
Output fall time	T_{fall}	Cout=1000pF Guaranteed by design	③	-	30	70	ns
Restart timer							
Deley time	$T_{RESTART}$		⑥	100	200	400	us
Zero Power Detection							
Zero power detection voltage	V_{ZERO}	COMP=2V→0V	⑥	0.7	1.0	1.3	V

(unless otherwise specified, Ta=+25℃, VCC=15V)

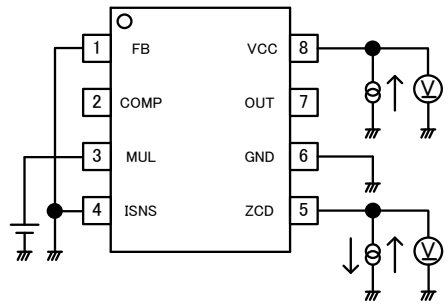
PARAMETER	SYMBOL	TEST CONDITIONS	CIRCUIT	MIN	TYP	MAX	UNIT
FB OVP Detection							
FB OVP detection voltage	V_{FBOVP}	FB=1V→5V	⑥	3.0	3.5	4.0	V
FB OVP detection deley time	T_{FBOVP}		⑥	50	100	200	ms
FB short Detection							
FB Short detection voltage	V_{FBSVP}	FB=1V→0V	⑥	0.3	0.5	0.7	V
FB Short detection hysteresis voltage	$V_{FBSVPhys}$	FB=1V→0V→1V	⑥	0.1	0.2	0.3	V
Over Power Detection							
Over Power detection voltage	V_{ISOPP}	MUL=0V、ISNS=0V →5V	⑤	4.0	4.5	5.0	V
Thermal Shut Down							
TSD detection temp.	T_{DET}	Guaranteed by design		-	150	-	℃
TSD release temp.	$T_{RELEASE}$	Guaranteed by design		-	130	-	℃

TEST CIRCUITS

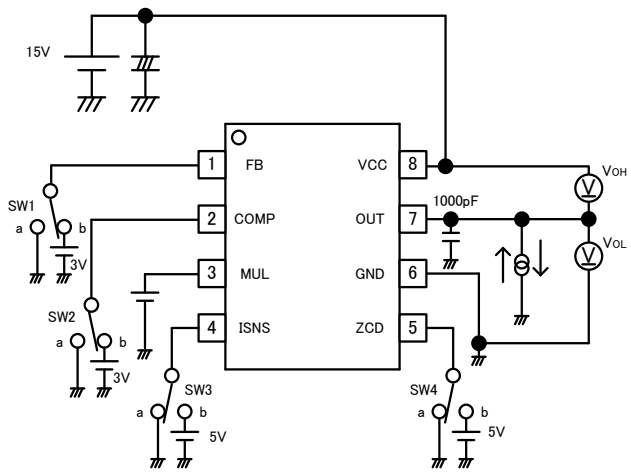
① I_{DDOFF} , I_{DDON} , V_{UVLO} , $V_{UVLORelease}$, V_U



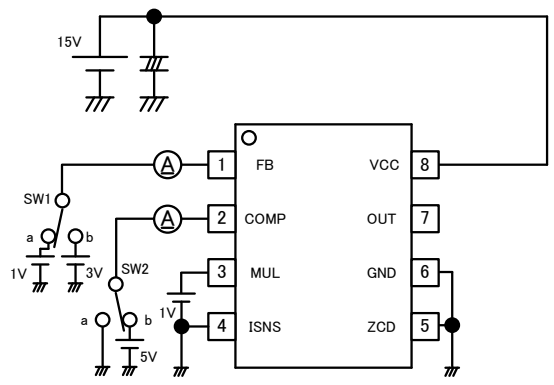
② $V_{VCCclamp}$, $V_{ZCDclampH}$, $V_{ZCDclampL}$



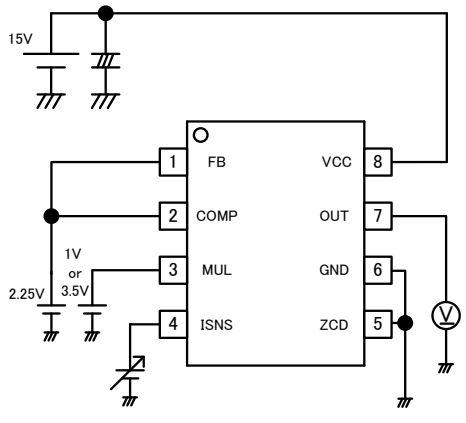
③ R_{ONsink} , $R_{ONsource}$, T_{rise} , T_{fall}



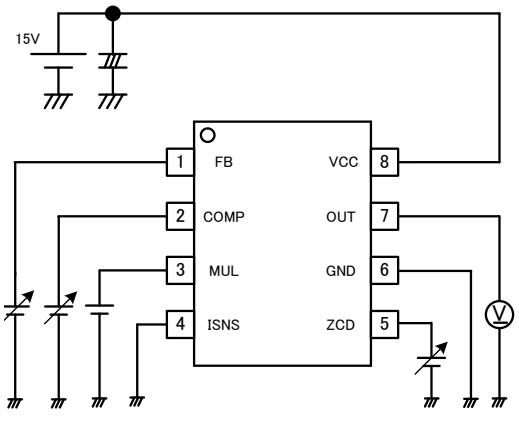
④R_{PULLUP} , I_{FB} , $I_{COMPSource}$, $I_{COMPSink}$



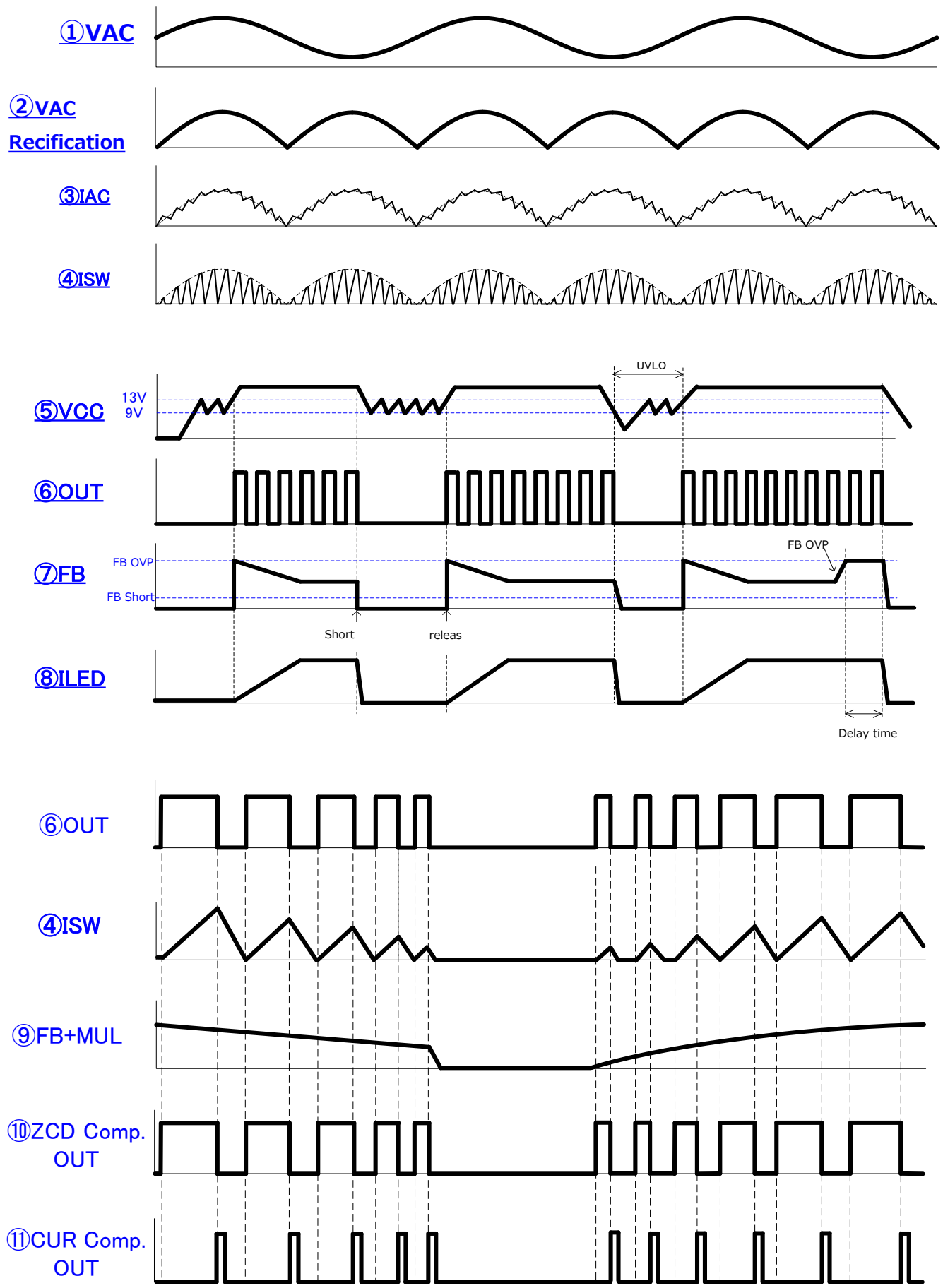
⑤ K , V_{MUL} , V_{COMP} , $V_{MULclamp}$, V_{ISOPP} , T_{I}



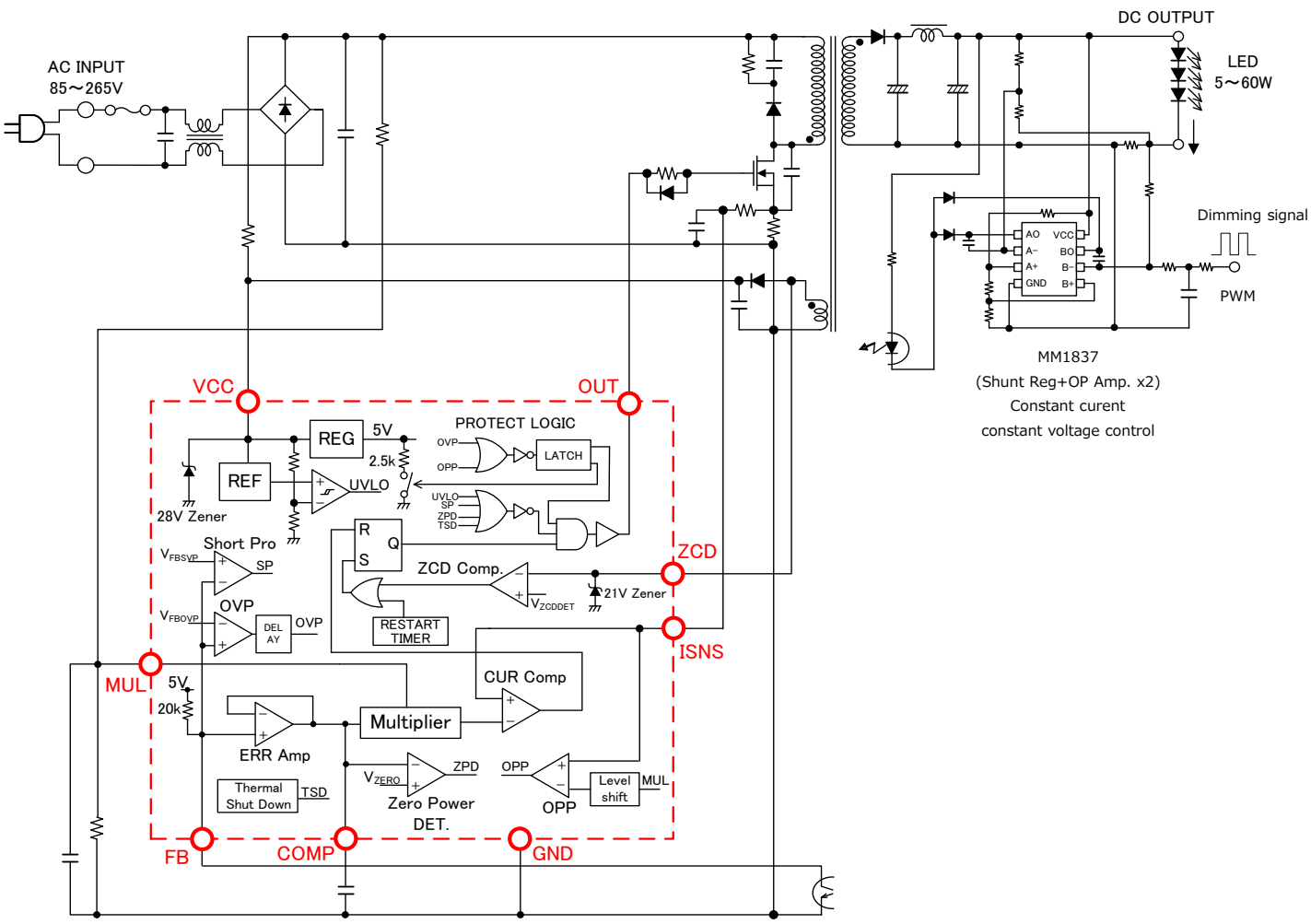
⑥V_{ZCDDET} ,$T_{RESTART}$,V_{ZERO} ,V_{FBSVP} ,$V_{FBSVPhys}$,V_{FBOVP} ,$T_{FBOVPhys}$



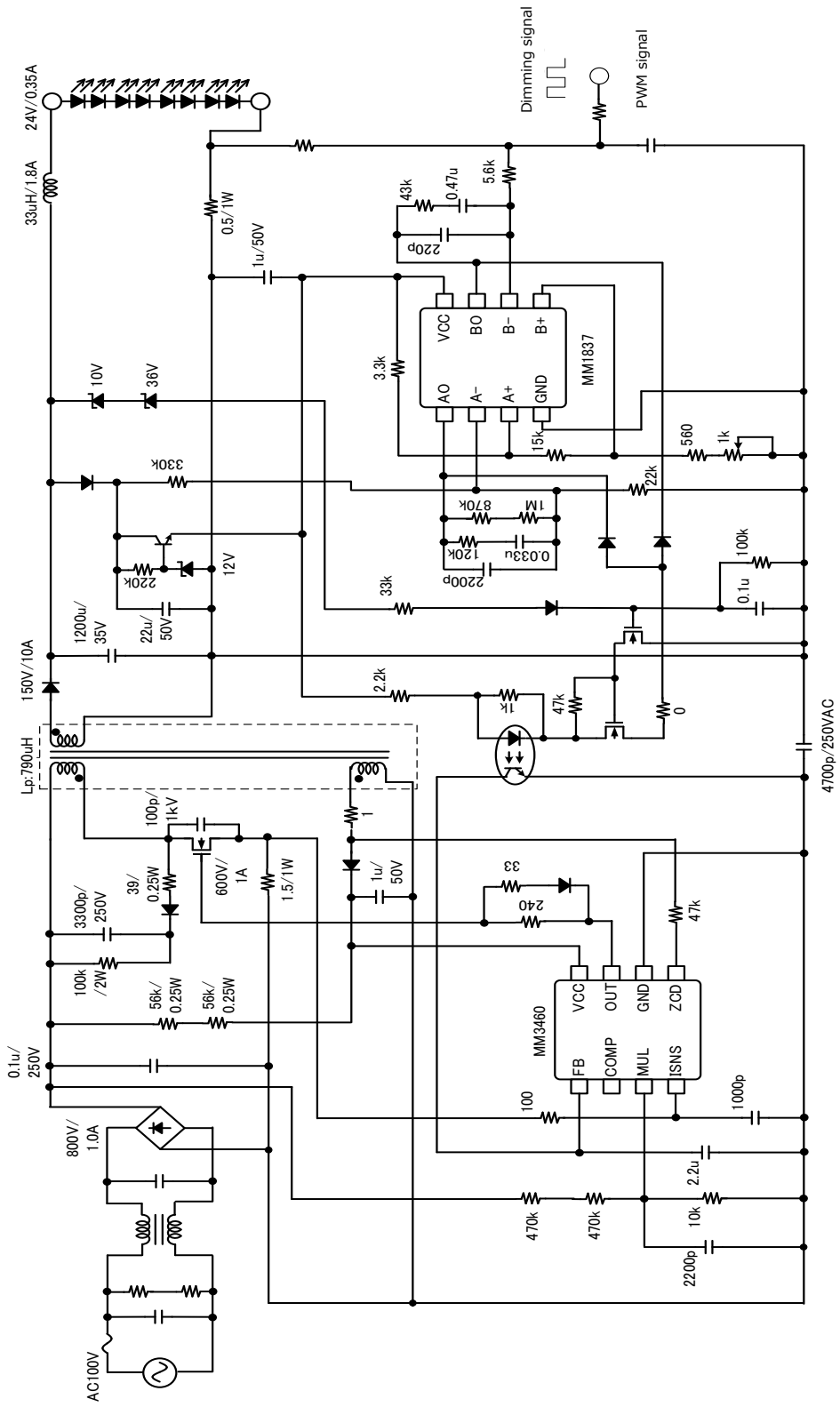
TIMING CHART



Application Circuits



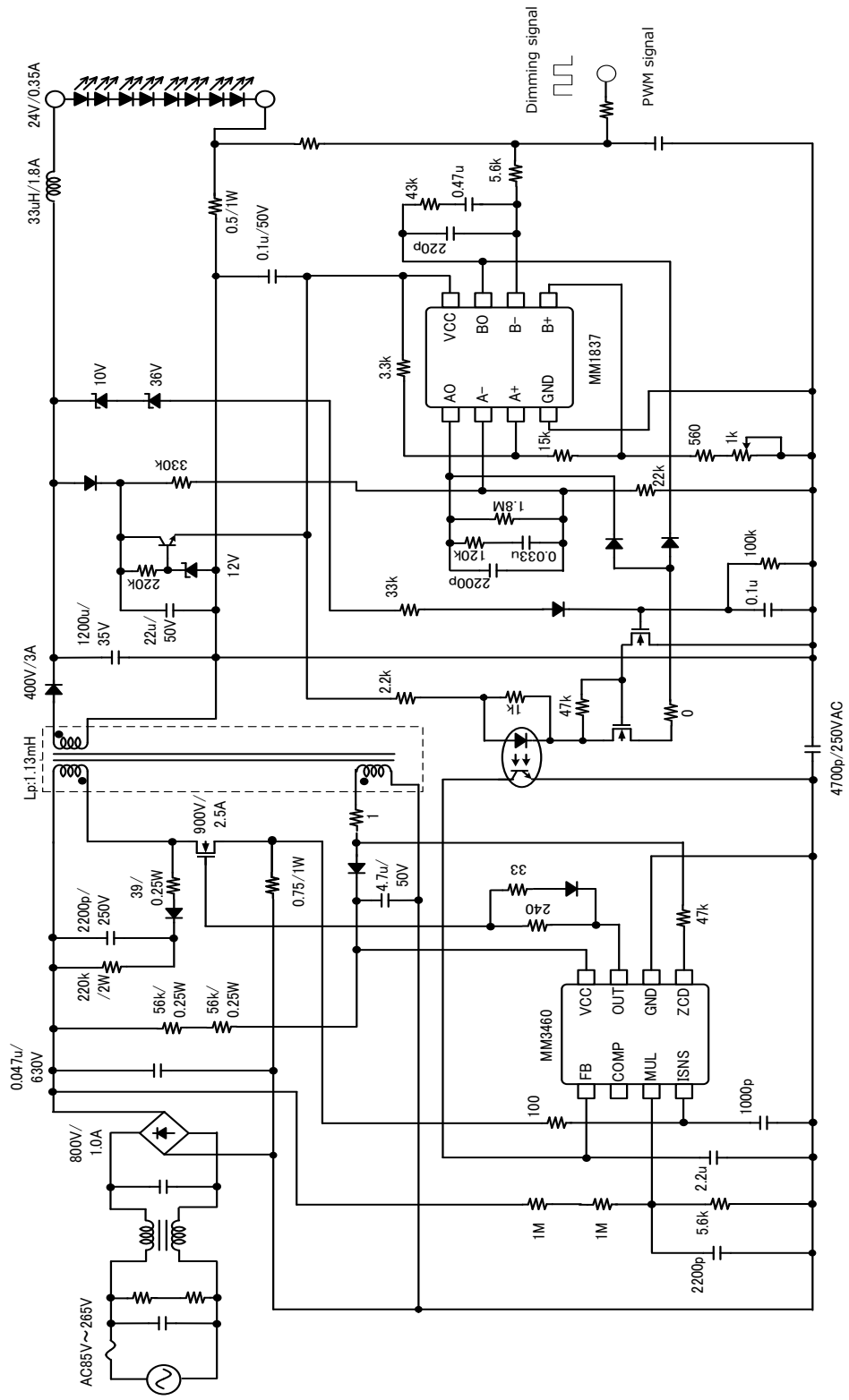
Application Circuits



caution : We shall not be liable for any trouble or damage caused by using this circuit .

In the event a problem which may affect industrial property or any other rights of us or a third party is encountered during the use of information described in these circuit, we shall not be liable for any such problem, nor grant a license therefore.

Application Circuits



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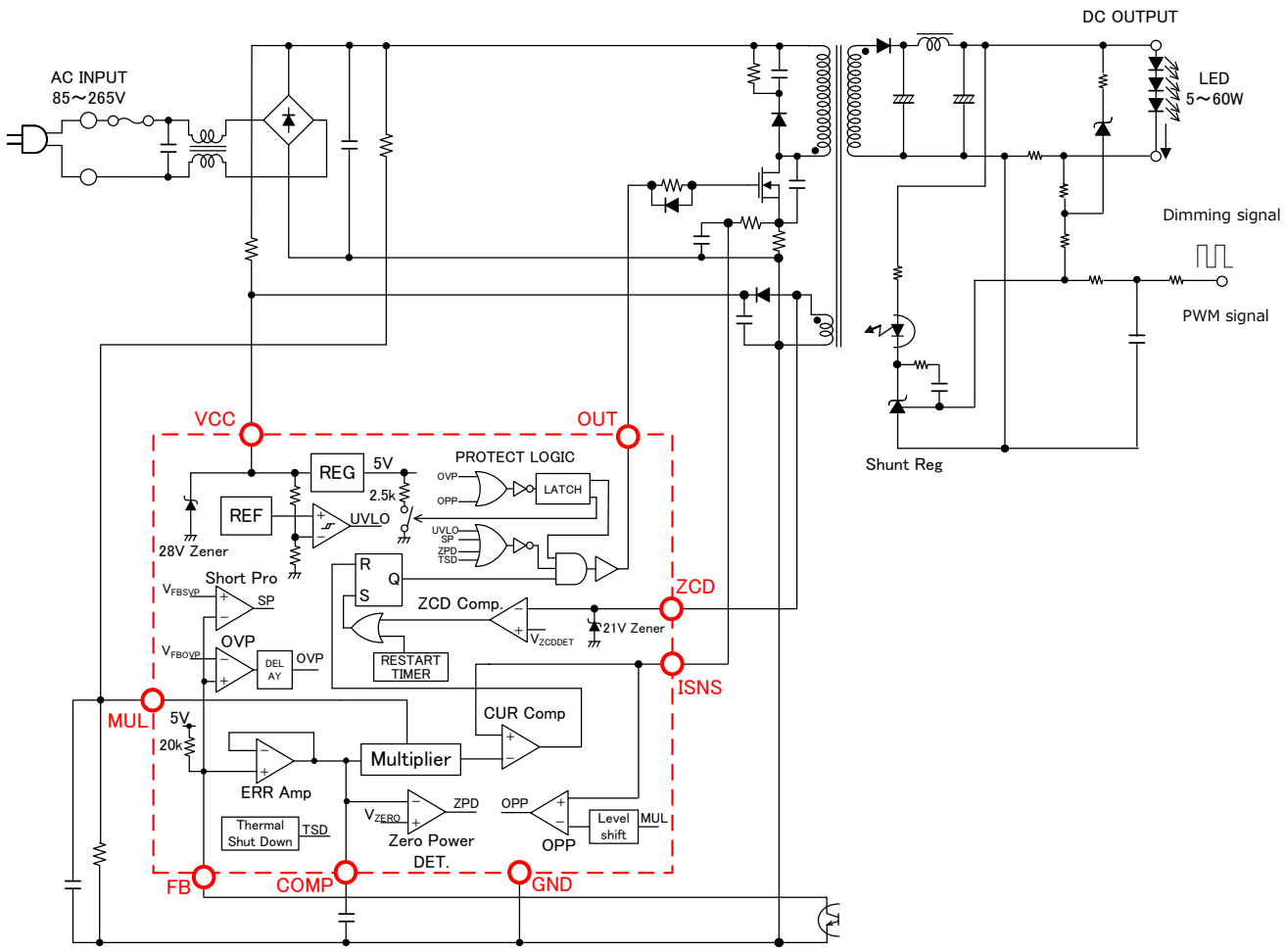
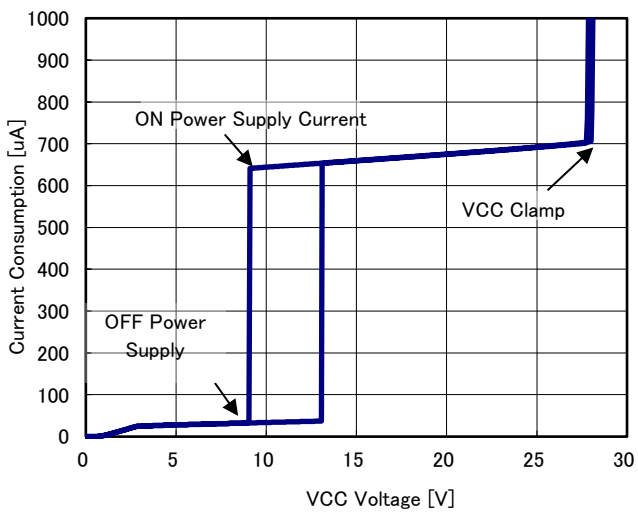
Application Circuits

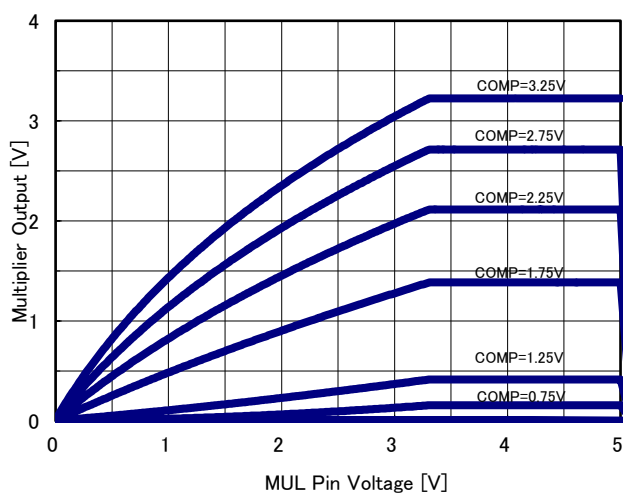


CHARACTERISTIC DATA (for example)

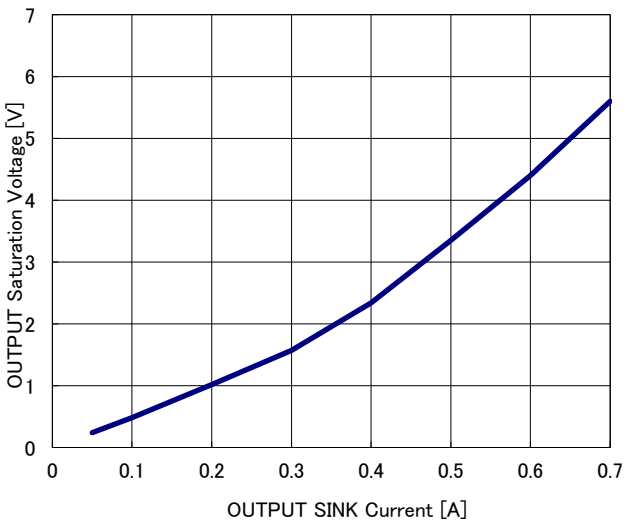
VCC Voltage - Current Consumption
VCC=0→30V→0V, FB=1.0V, MUL=1.0V,
ZCD=0.0V, ISNS=0V



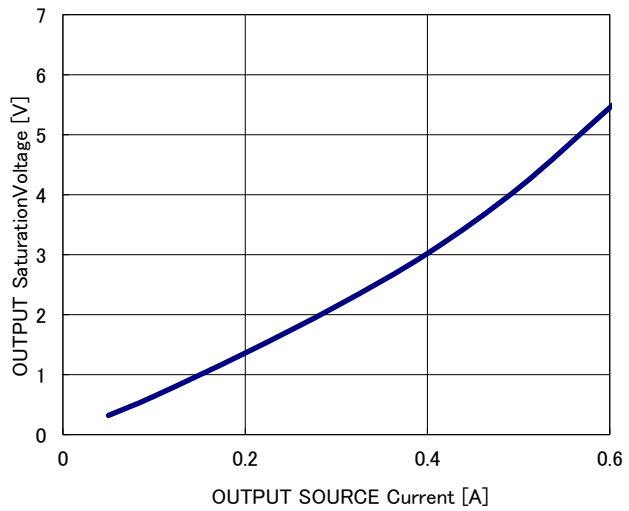
MUL Pin Voltage - Multiplier output
MUL=0→5V, COMP=0.75→3.25V,
FB=1.0V, ZCD=0.0V, ISNS=0.0V



OUT Pin Voltage - OUT Pin Sink Current
VCC=15V

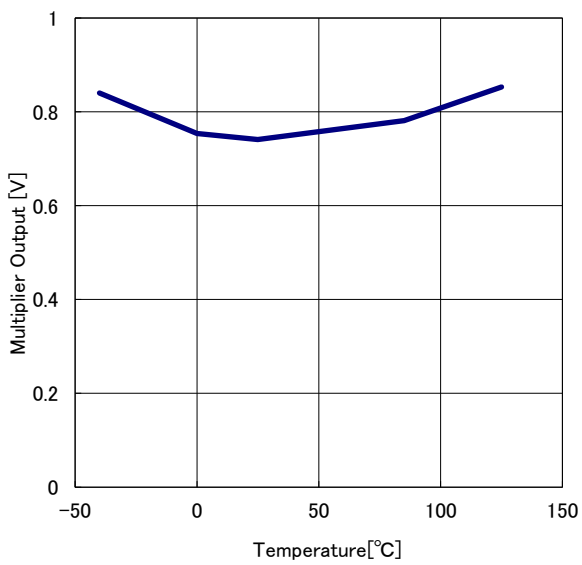


OUT Pin Voltage - OUT Pin Source Current
VCC=15V

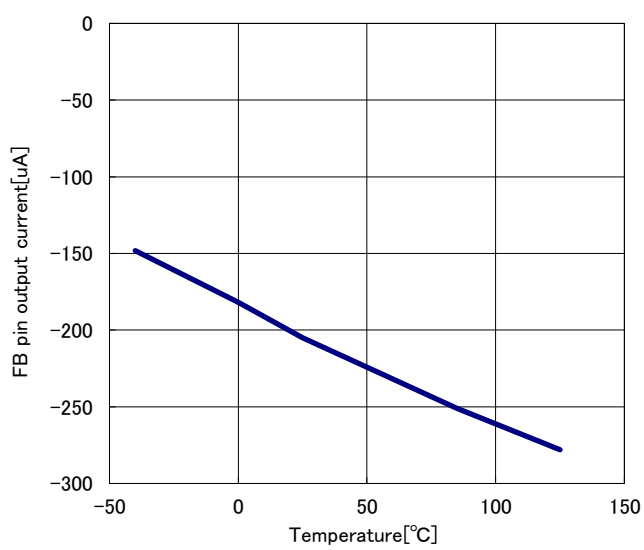


CHARACTERISTIC DATA (for example)

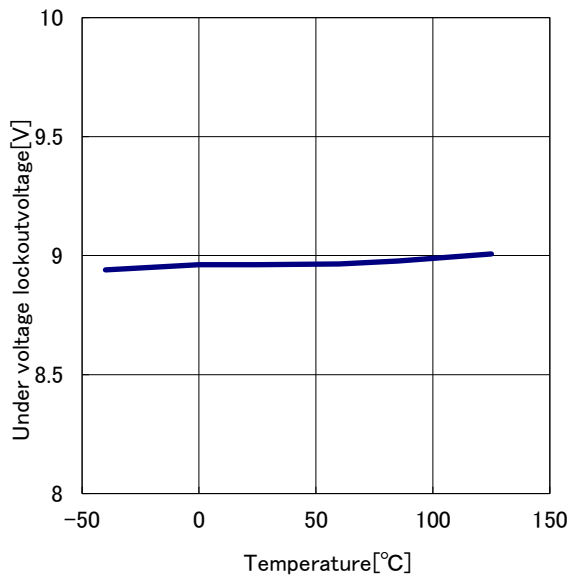
Multiplier output - Temperature
FB=2.25V, MUL=1.0V,ZCD=0.0V, ISNS=0.0V



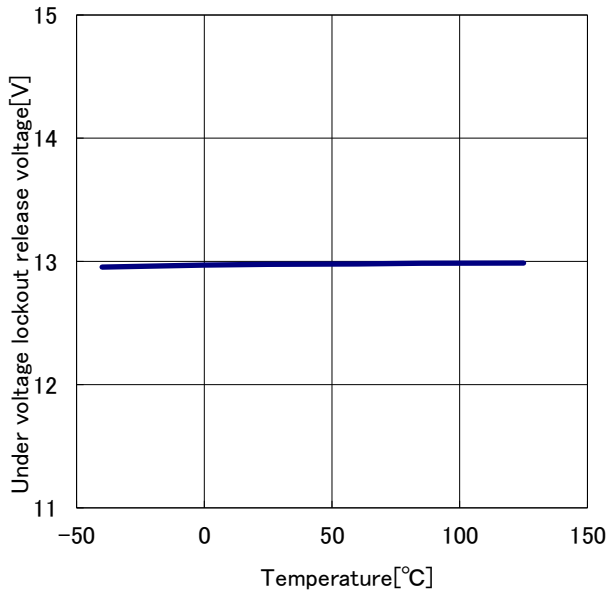
FB pin output current - Temperature
FB=1.0V



Under voltage lockout voltage - Temperature
VCC=15⇒0V

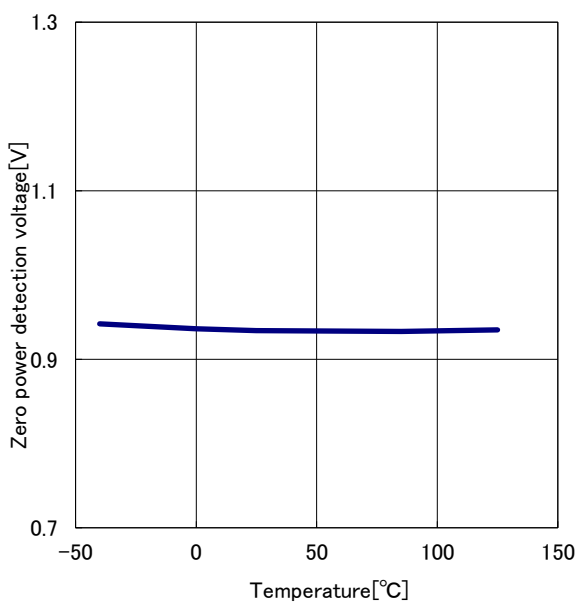


Under voltage lockout release voltage - Temperature
VCC=0⇒15V

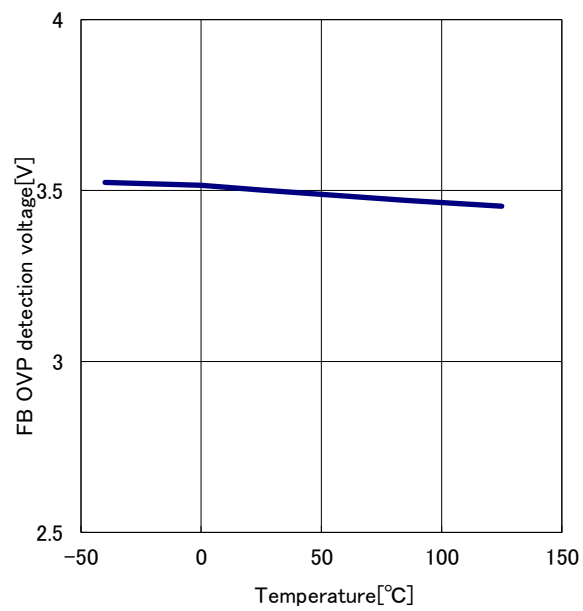


CHARACTERISTIC DATA (for example)

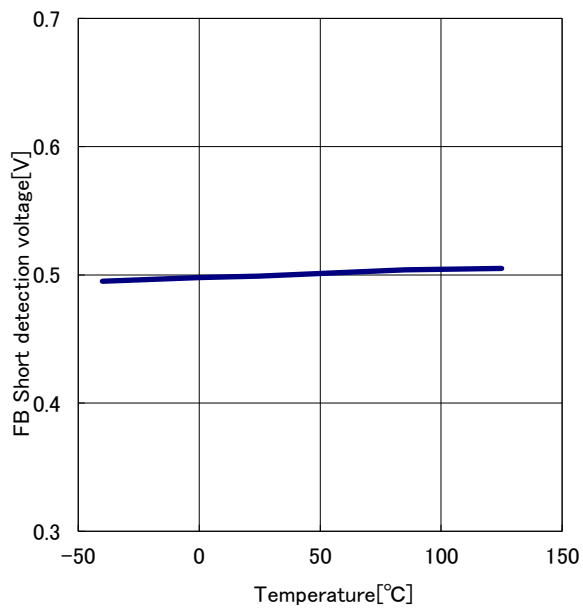
Zero power detection voltage - Temperature
VCC=15V
COMP=2V⇒0V



FB OVP detection voltage - Temperature
VCC=15V
FB=2V⇒5V

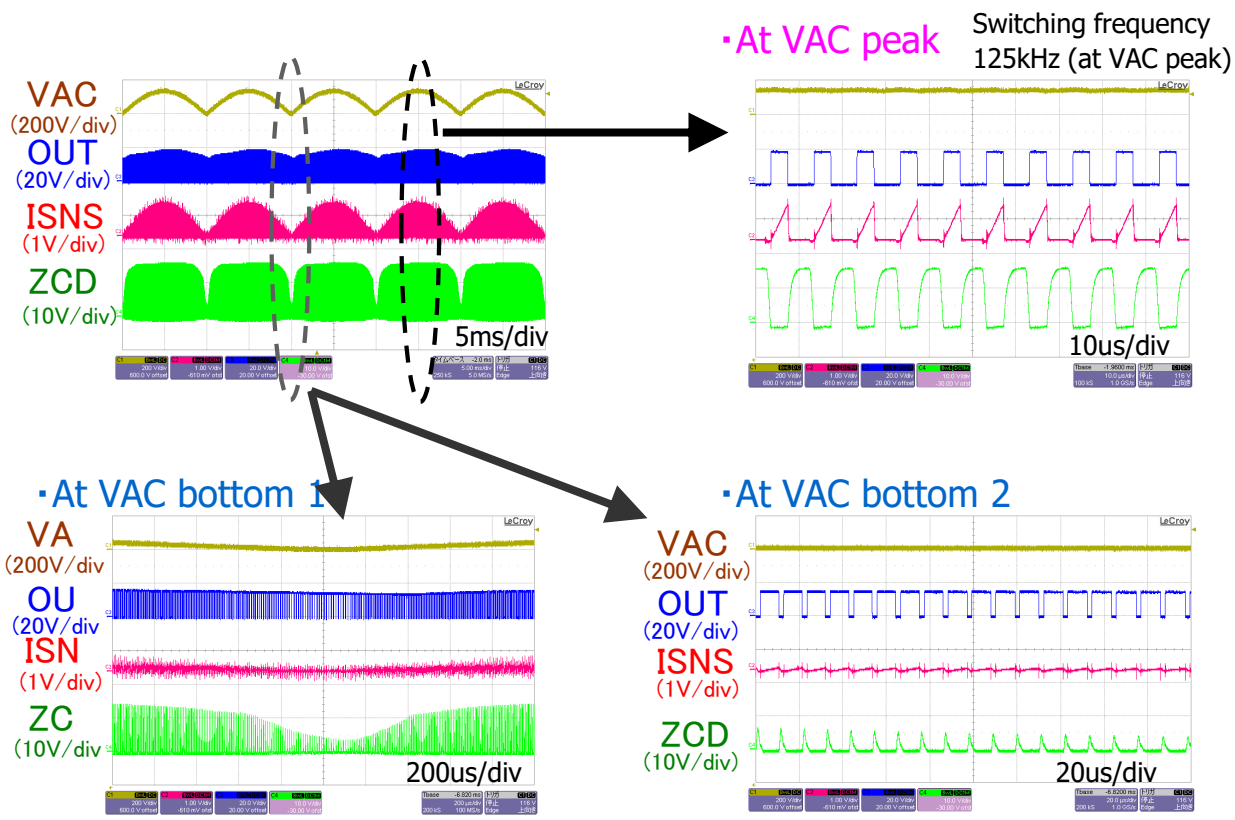


FB Short detection voltage - Temperature
VCC=15V
FB=2V⇒0V



CHARACTERISTIC DATA (for example)

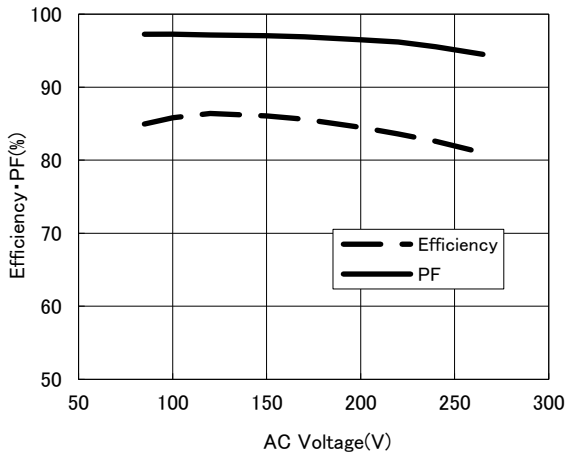
Input ; AC=100V/50Hz, Output ; 8LEDs/350mA⇒Efficiency ; 87%、Power factor ; 99%



CHARACTERISTIC DATA (for example)

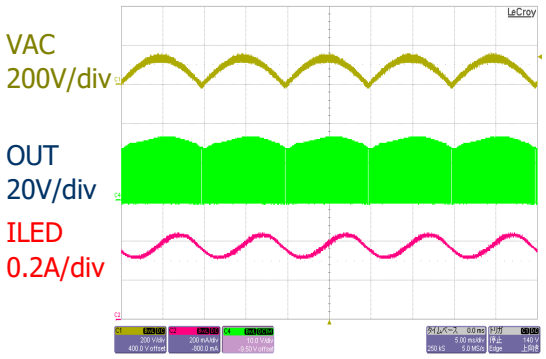
Line Regulation

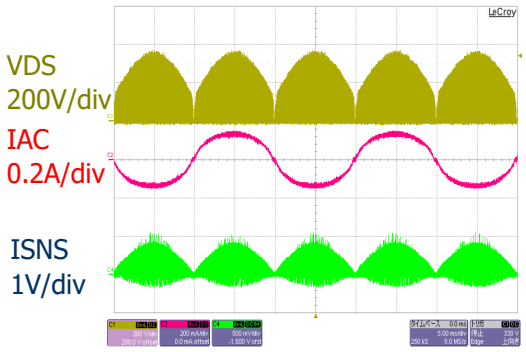
AC Voltage vs Efficiency , Power Factor



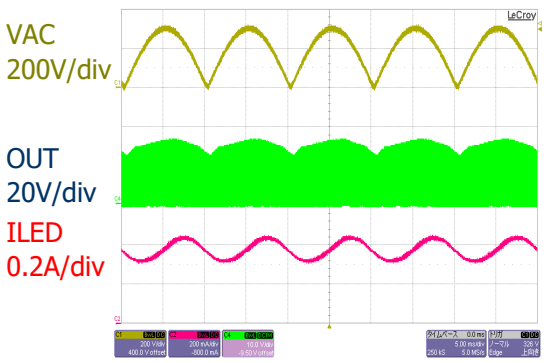
AC 85～265V (World Wide Input Demo Board)
8LEDs/350mA

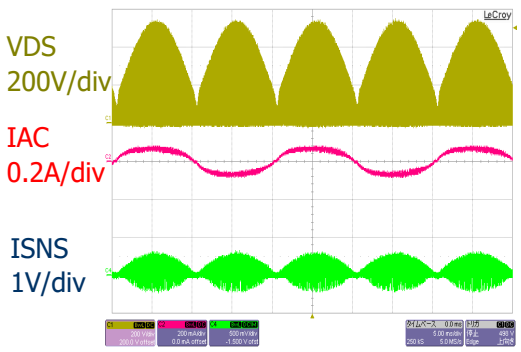
IN：AC 100V



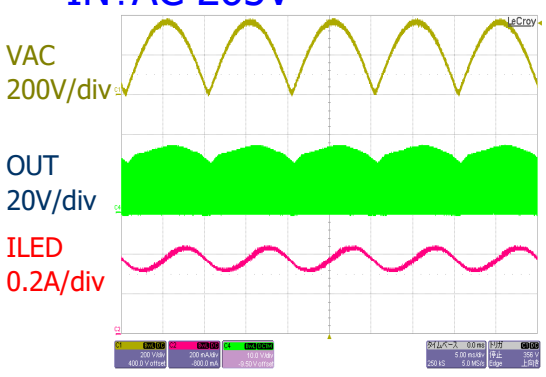


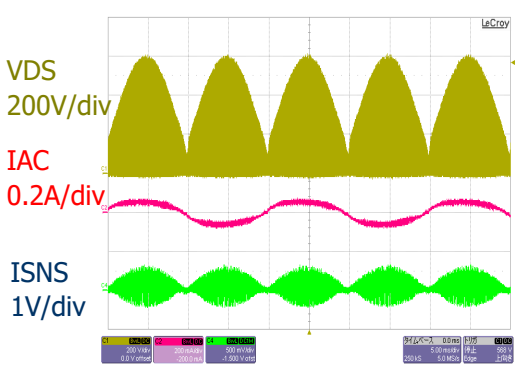
IN：AC 220V





IN：AC 265V



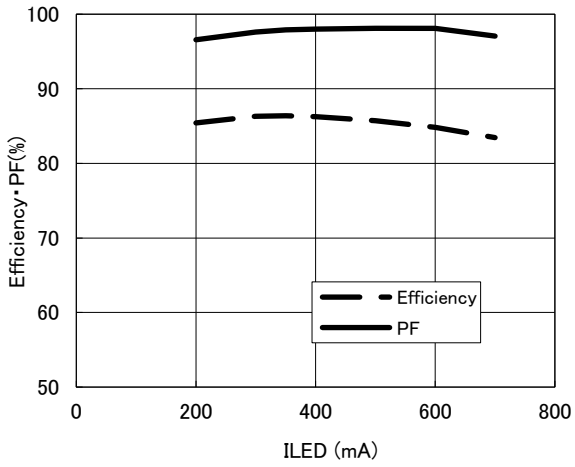


CHARACTERISTIC DATA (for example)

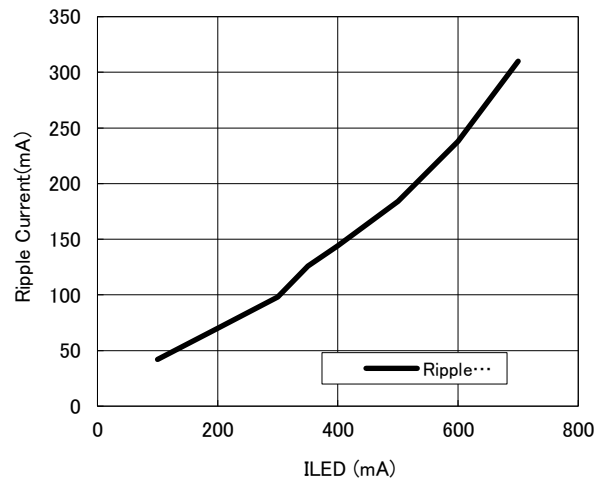
Road Regulation

AC 85～265V (World Wide Input Demo Board 8LEDs/50Hz

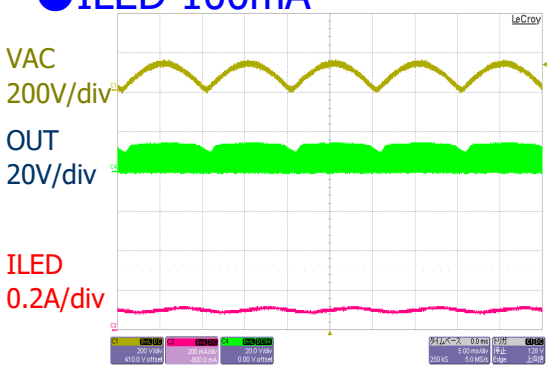
ILED vs Efficiency , Power Factor

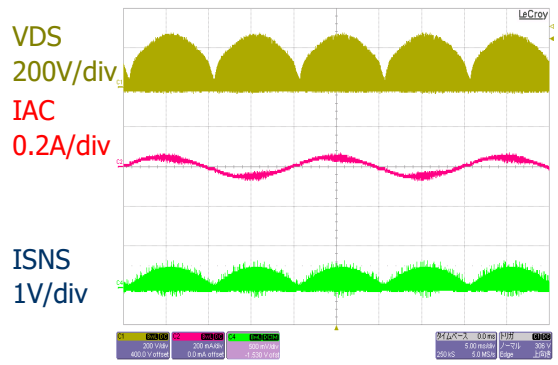


ILED vs Output Ripple Current



● ILED 100mA





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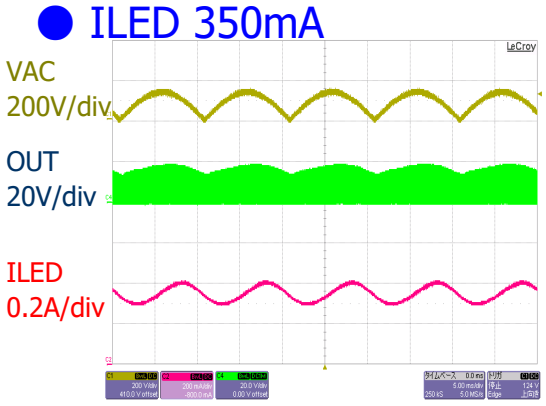

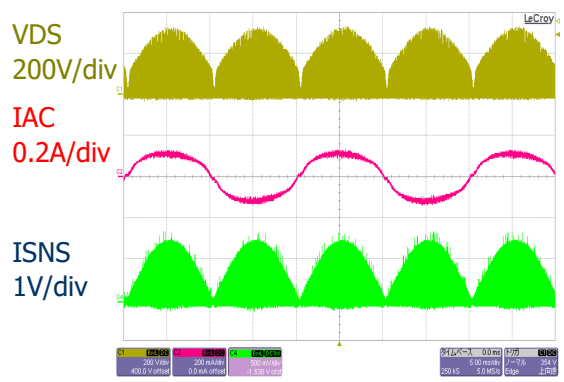

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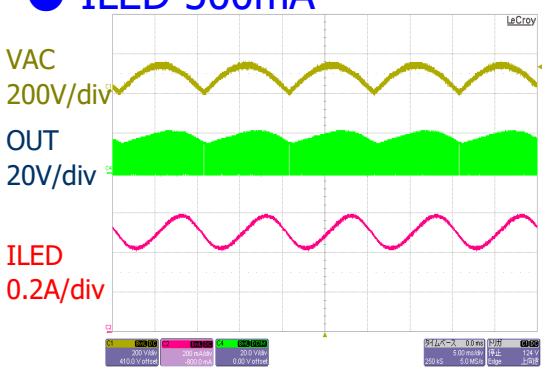
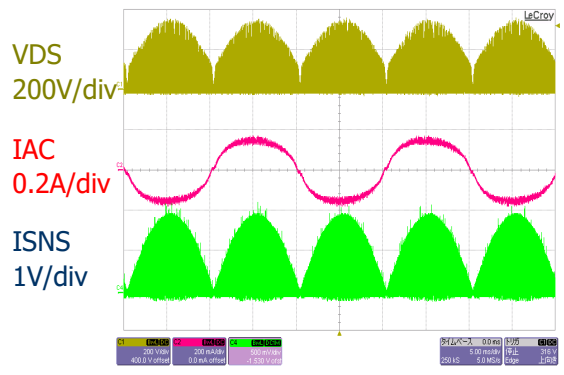
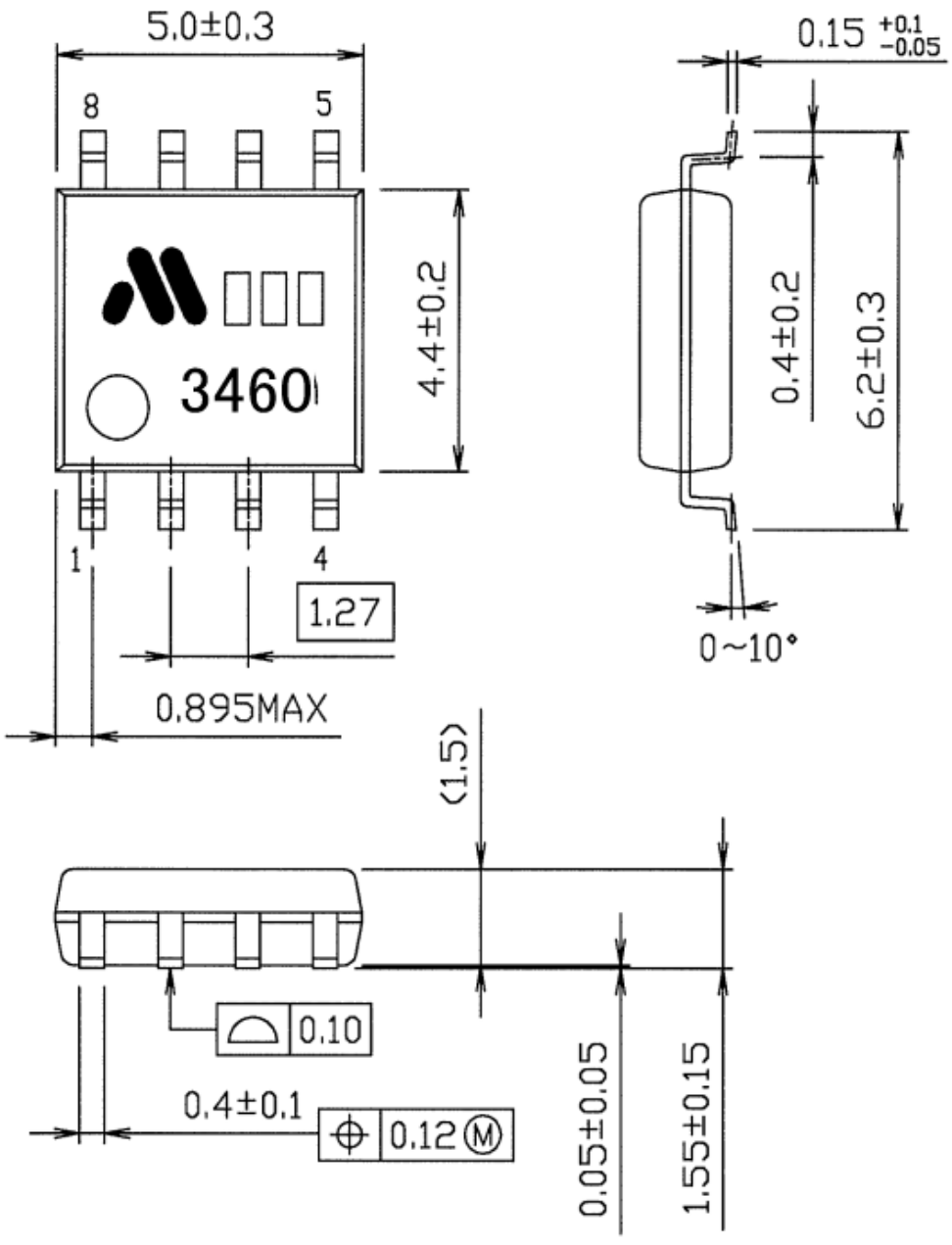




Demensions

UNIT	mm



Marking Contents