

Discontinuous Conduction Mode PFC Controller

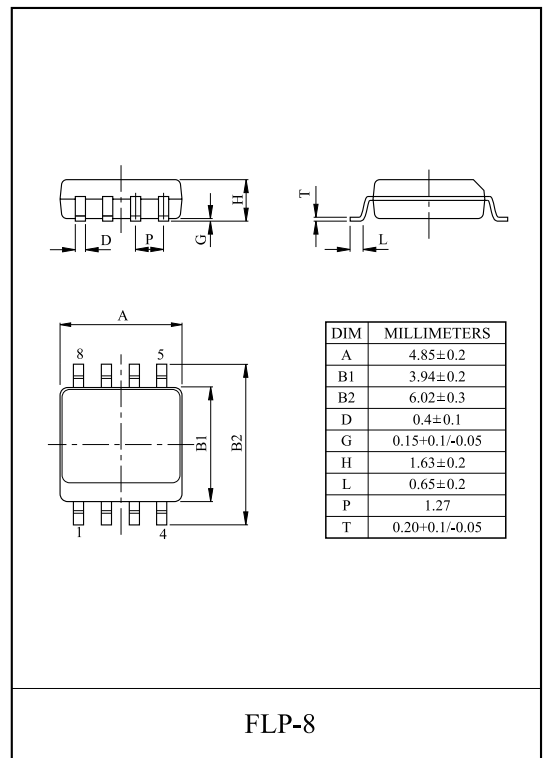
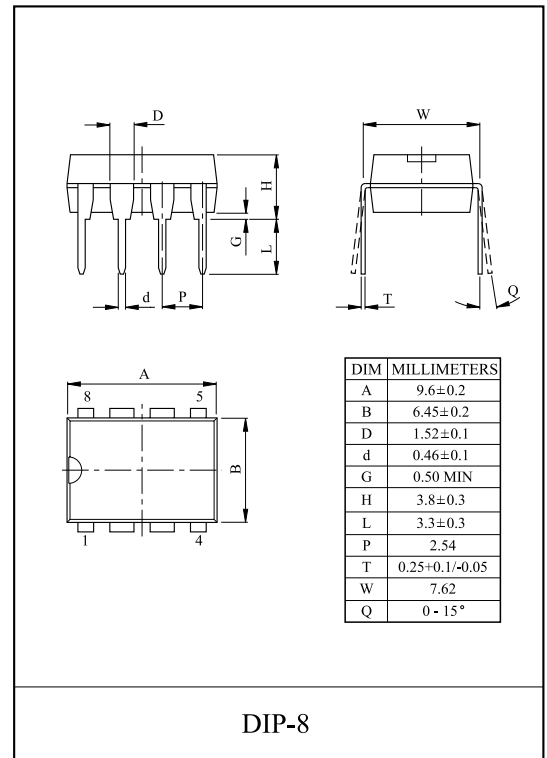
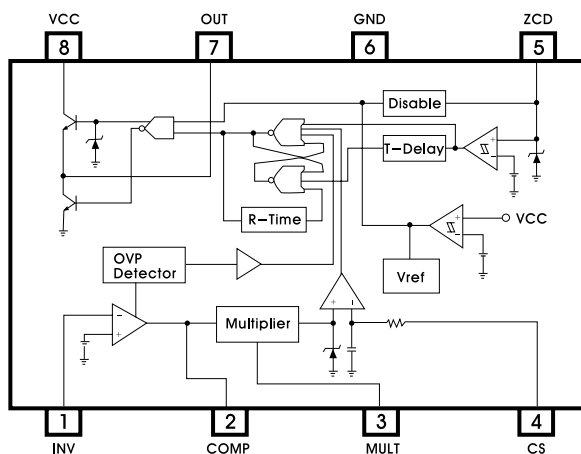
DESCRIPTIONS

It is Adaptable to a Discontinuous Mode of Operation that the KIA3562F/P is Advanced PFC (Power Factor Correction) Controller for the High Density Switching Mode Power Supply and Electronic Ballast systems. The Bulky External components are eliminated in the Internal Start-up circuits, though it is taken in Independent Boost Converter Operation. What is more, instead of the External components, the Low Pass Filter is mounted in Internal Current Sense block. Internal Clamping of the Error Amplifier and Multiplier Output improve turn on Overshoot Characteristics and Current Limiting. The One of features is able to prevent Abnormal Condition, Open Lamp & Over Voltage.

FEATURES

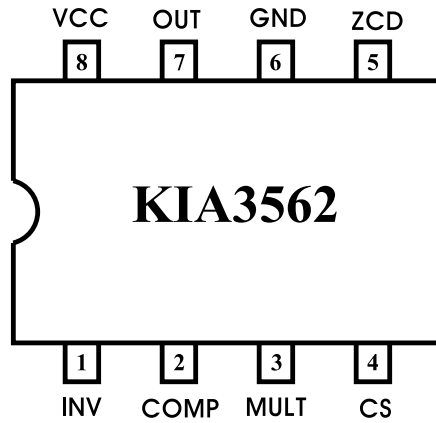
- Very Precise Adjustable Output OVP (Dynamic & Static OVP Function)
- Extremely Low Start-Up Current
- Low Operating Supply Current
- Internal Start-Up Timer
- Power Factor Maximizer & THD Minimizer Circuit
- Complete Wide Range Operation
- Feedback Open Protection
- Minimum On Timer
- Current Sense Filter On Chip
- Disable Function
- Extremely Minimized Exterbnal Part Counts

INTERNAL CIRCUIT BLOCK



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PIN CONNECTIONS



PIN DESCRIPTIONS

NO	SYMBOL	I / O	DESCRIPTION
1	INV	I	Inverting Input of Error Amplifier
2	COMP	O	Output of Error Amplifier
3	MULT	I	Multiplier Input
4	CS	I	Current Sense Input
5	ZCD	I	Zero Current Detect
6	GND	-	Ground
7	OUT	O	Totem-Pole Output
8	VCC	-	Power Supply Voltage

ABSOLUTE AMXIMUM RATINGS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Maximum Supply Voltage	$V_{CC \text{ max}}$	27	V
Output Peak Current	I_{peak}	± 500	mA
Analog inputs & Outputs(Pin 1,2,3,4,5)	$V_{\text{in max}}$	-0.3 ~ 7	V
ZCD Input Maximum Current	I_{zcd}	± 10	mA
Power Dissipation(8DIP)	$P_{\text{d max}}$	800	mW
Power Dissipation(8SOP)	$P_{\text{d max}}$	600	mW
Operating Junction Temperature	T_j	-35 ~ 150	°C
Storage Temperature	T_{stg}	-55 ~ 150	°C

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ELECTRICAL CHARACTERISTICS (Ta=-25°C to 125°C, V_{CC}=14V, unless otherwise specified)

CHARACTERISTIC	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage & Current Section						
V _{CC} Tun-On Threshold	V _{CC(On)}	V _{CC} Increasing	11	12	13	V
V _{CC} Tun-Off Threshold	V _{CC(Off)}	V _{CC} Decreasing	8.7	9.5	10.3	
Hysteresis Voltage	HYS	-	2	2.5	3	
Start-Up Current	I _{st}	Before Turn-On	20	40	70	uA
Quiescent Current	I _q	No Switching	1	4	6	mA
Operating Supply Current	I _{CC}	CL=1nF, f _{sw} =50KHz	2	5	8	
Operating Current at OVP	I _{CC_ovp}	V _{inv} =2.7V	0.5	2	4	
Operating Current at Disable	I _{CC_dis}	V _{zcd} 150mV	0.5	2	4	
Error Amplifier Section						
Input Voltage	V _{inv}	Ta=25°C	2.465	2.5	2.535	V
Line Regulation	dV _{inv}	V _{CC} =12 ~ 27V	-	0.1	5	mV
Input Bias Current	I _{inv}	-	-0.5	-0.1	0.5	mV
Open Loop Gain	A _v	-	60	80	-	dB
Gain Bandwidth	GB	-	-	1	-	MHz
Output Source Current	I _{source}	V _{comp} =4V, V _{inv} =2.4V	-2	-4	-	mA
Output Sink Current	I _{sink}	V _{comp} =4V, V _{inv} =2.6V	3	5	-	mA
Upper Clamp Voltage	V _{upper}	I _o =-100uA, V _{inv} =2.4V	-	5.6	-	V
Lower Clamp Voltage	V _{lower}	I _o =100uA, V _{inv} =2.6V	-	2.25	-	V
Feedback Open Protection Threshold Voltage	V _{fo}	V _{inv} Decreasing	150	200	250	mV

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ELECTRICAL CHARACTERISTICS(Continued) (Ta=-25°C to 125°C, V_{CC}=14V, unless otherwise specified)

CHARACTERISTIC	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT.
Multiplier Section						
Linear Operating Voltage	V _{mult}	-	2.8	3.2	-	V
Output Maximum Slope	dV _{cs} /dV _{mult}	V _{mult} =0.5~0.9V, V _{comp} =Upper Clamp	1.3	1.5	1.7	V/V
Multiplier Gain	K	Ta=25°C V _{mult} =1V, V _{comp} =3.5V	0.5	0.65	0.75	1/V
Current Sense (CS) Section						
Reference Clamp Voltage	V _{cs}	V _{mult} =2.5V, V _{comp} =Upper Clamp	1.65	1.75	1.85	V
Input Bias Current	I _{cs}	V _{cs} =0~1.6V	-0.5	-0.1	0.5	uA
Delay to Output	T _{dHL}	-	-	200	-	ns
Zero Current Detector (ZCD) Section						
Input Threshold Voltage	V _{zcd}	V _{zcd} Increasing	1.8	2.1	2.4	V
Hysteresis Voltage	HY(zcd)	-	-	0.5	-	V
Upper Clamp Voltage	V _{clamp(H)}	I _{zcd} =3mA	4.8	5.4	6	V
Lower Clamp Voltage	V _{clamp(L)}	I _{zcd} =-3mA	0.3	0.6	-	V
Input Bias Current	I _{zcd}	V _{zcd} =1~3V	-	1	-	uA
Source Current	I _{source(zcd)}	-	-3	-	-	mA
Sink Current	I _{sink(zcd)}	-	3	-	-	mA
Disable Input Voltage	V _{dis}	V _{zcd} Decreasing	150	200	250	mV
Reset Current after Disable	I _{dis}	Pin5=0V	-30	-80	-	uA
Restart Timer Section						
Restart Time delay	trst		70	130	300	us
Output Section						
Output High Voltage	V _{oh}	I _o =-10mA	10.5	11.5	12.5	V
		I _o =-100mA	10	11	12	
Maximum Voltage	V _{omax}	V _{cc} =20V, I _o =-1mA	11	13	15	
Output Low Voltage	V _{ol}	I _o =-10mA	-	1.2	2.5	
		I _o =-100mA	-	-	1	
Minimum On Time	T _{on(min)}	-	-	150	-	ns
Output Rising Time	tr	CL=1nF	-	150	-	ns
Output Falling Time	tf	CL=1nF	-	50	-	ns
Over Voltage Protector (OVP) Section						
Dynamic OVP Current	I _{ovp}	-	35	40	45	uA
Dynamic OVP Current Hysteresis	I _{ovp(hys)}	-	-	30	-	uA
Static OVP Threshold Voltage	V _{ovp}	V _{inv} =2.7V	2.1	2.25	2.4	V

APPLICATION INFORMATIONS

1. Main Inductor

$$L = \eta * (V_o - V_p) * V_p^2 / (4 * V_o * P_o * f)$$

Where,

η : Efficiency(0.95)
V_o : DC Link Voltage
V_p : Input Peak Voltage
P_o : Output Power
f : Switching Frequency

2. Resistor for Current Sense

$$R_s = 1.75 / I_{LP}$$

Where,

I_{LP} : Inductor Peak Current

3. Resistor for Multiplier

$$R_{ML} < 0.69 * R_{MU} / (V_p - 0.69)$$

Where,

R_{MU} : Upper Resistor for Multiplier Input
R_{ML} : Lower Resistor for Multiplier Input

4. Resistor for Error Amplifier

$$R_{EL} = 2.5 * R_{EU} / (V_o - 2.5)$$

Where,

R_{EU} : Upper Resistor for Error Amplifier Inverting Input
R_{EL} : Lower Resistor for Error Amplifier Inverting Input

APPLICATION INFORMATIONS (Continued)

5. Over Voltage Protector(OVP)

$$\Delta V_o [V] = R_{EU}[\Omega] * 40[\mu A]$$

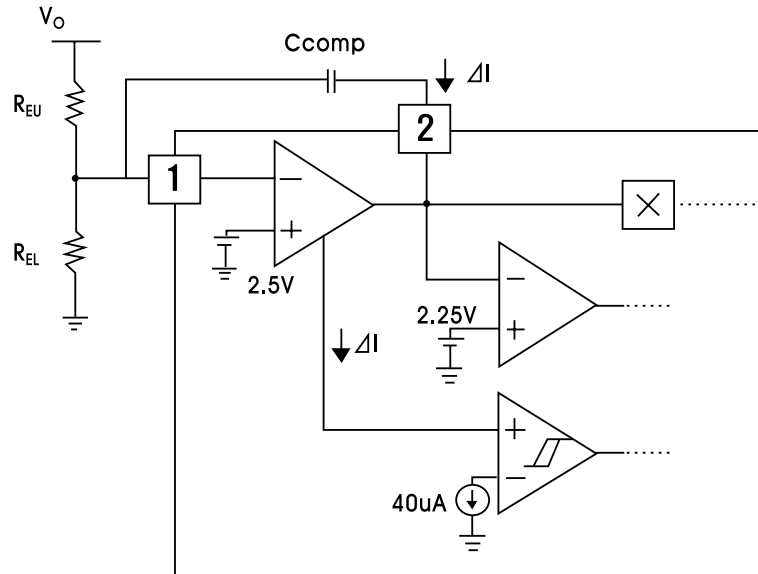


Fig.1 : Over Voltage Protection Circuit

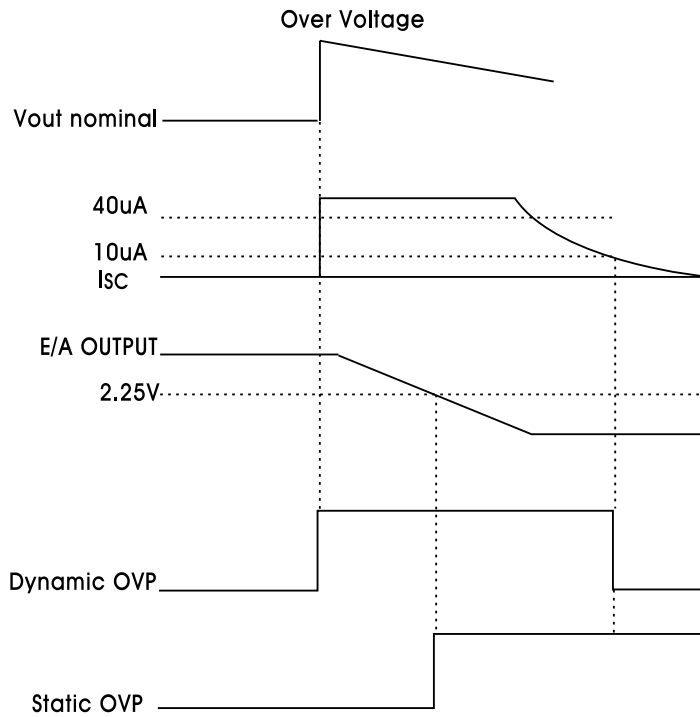
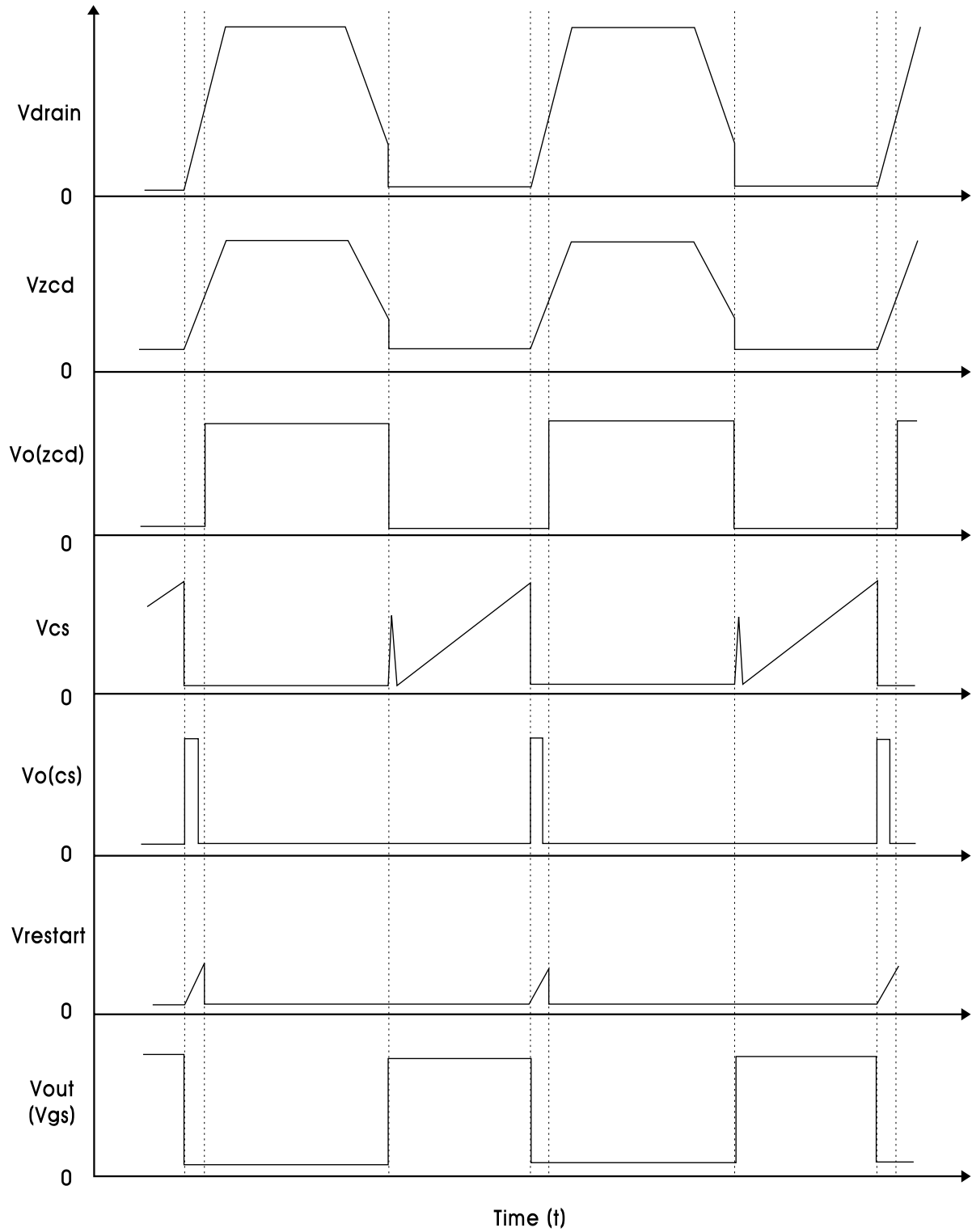


Fig.2 : Ovp Operation Timing Circuit

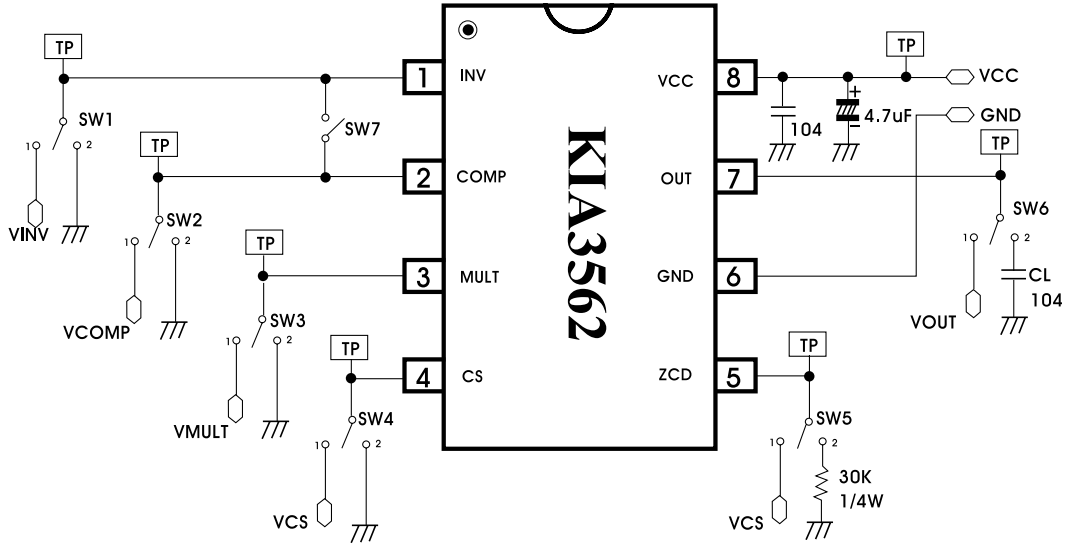
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APPLICATION TIMING CHART

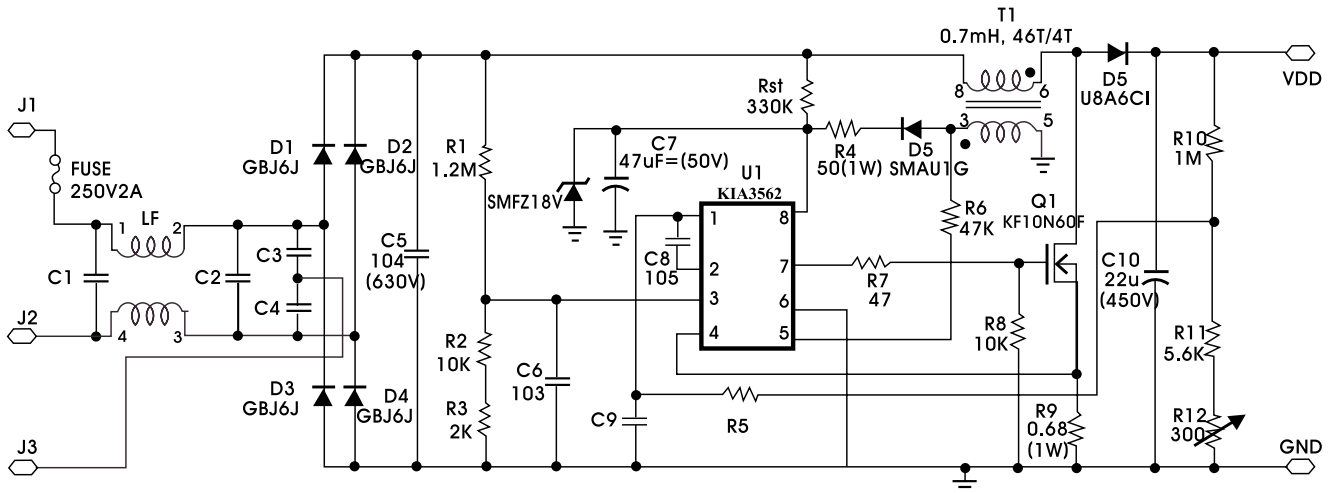


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TEST CIRCUIT



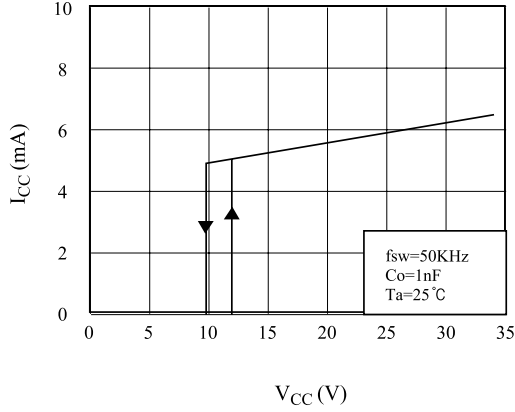
TYPICAL APPLICATION CIRCUIT ($P_o:80W, 90V_{AC}\sim 270V_{AC}$)



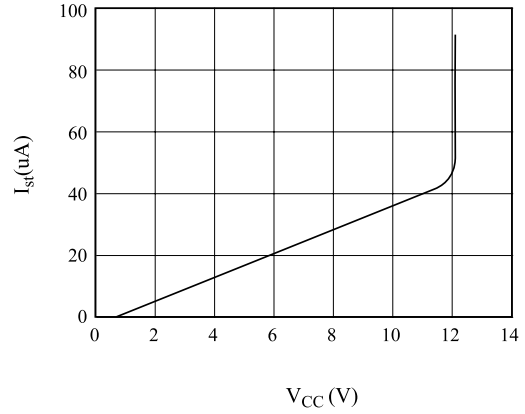
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ELECTRICAL CHARACTERISTICS CURVES

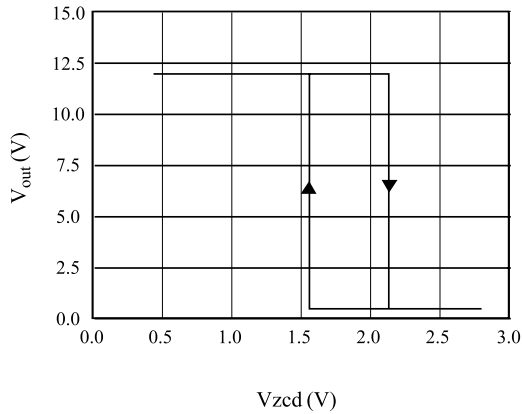
Operating Supply Current



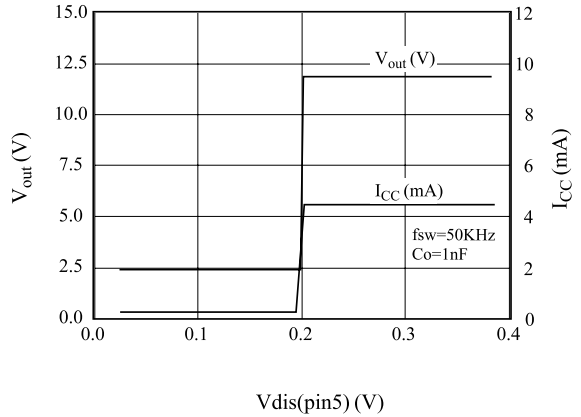
V_{CC} Start-up Current



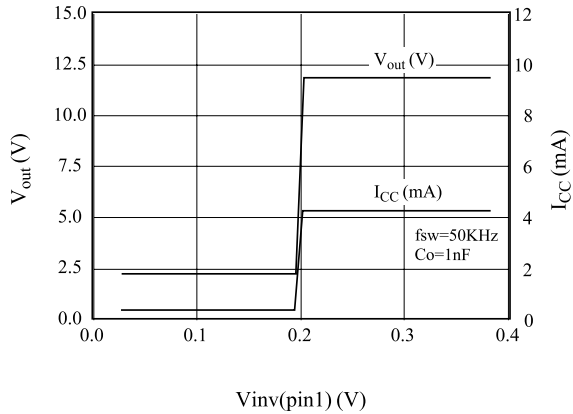
ZCD Input Threshold Voltage



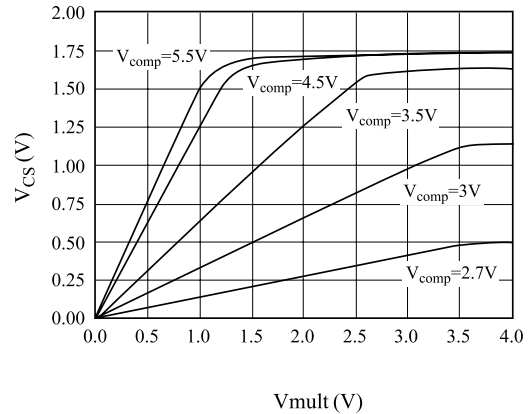
Disable Input Threshold Voltage



Feedback Open Protection Voltage



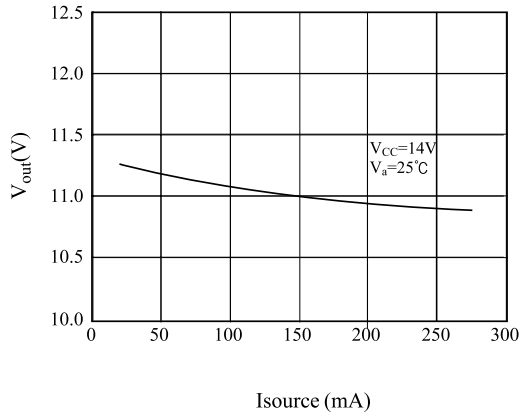
Multiplier Input vs. CS Threshold Voltage



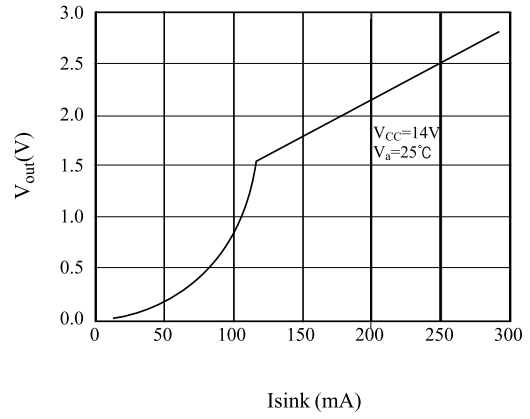
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(ELECTRICAL CHARACTERISTICS CURVES (Continued))

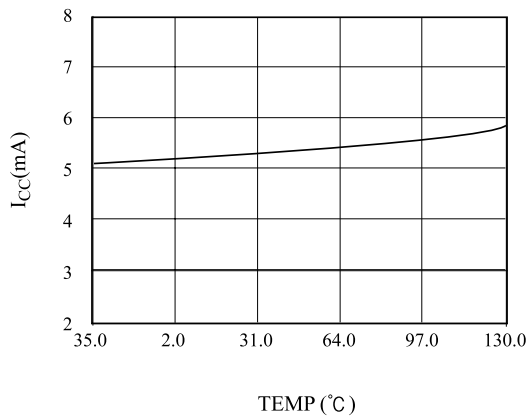
Output High Voltage



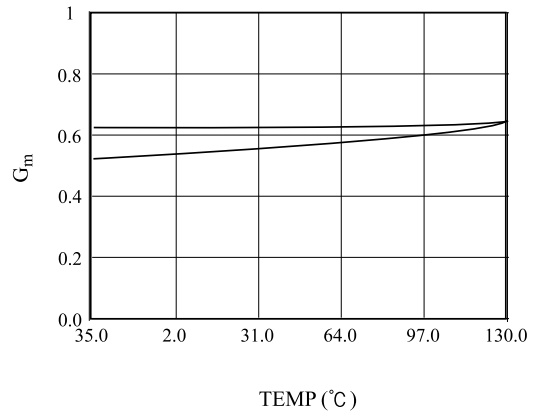
Output Low Voltage



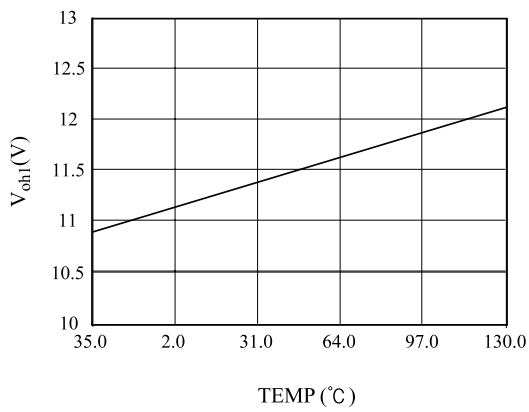
I_{CC} vs TEMP



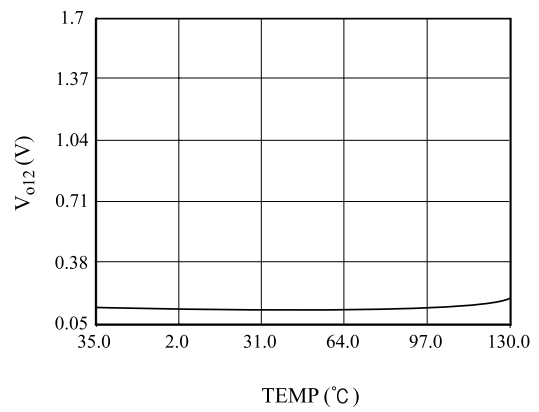
G_m vs TEMP



VO_{H1} vs TEMP



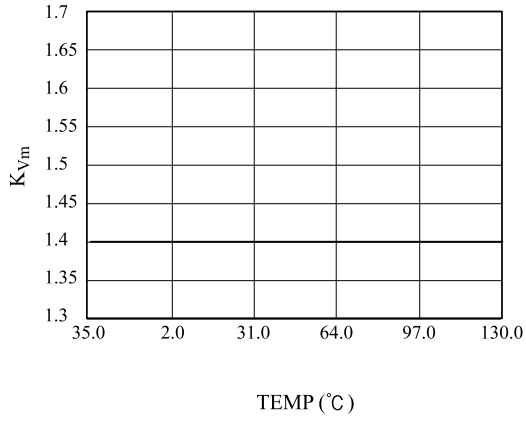
VO_{L2} vs TEMP



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(ELECTRICAL CHARACTERISTICS CURVES (Continued))

KVM vs TEMP



VINV vs TEMP

