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KA3504
PC SMPS Supervisory IC

Features

- PC Power Supply Output Monitor Circuitry
- Few External Components
- Over Voltage Protection for 3.3V/5V/12V Output
- Over Current Protection for 3.3V/5V/12V Output With Delay Time
- Fault Protection Output With Open Collector Output
- Power Supply on/off Delay Time Control (PSON)
- Power Good Signal Generator With Hysteresis
- Open Collector PG Output
- 300ms Power Good Delay
- Current Sense Setting Function With RI
- Latch Function Controlled by PSON and Protection Input
- 16-Pin Dual In-line Package

FPO (Fault Protection Output)

Fault Protection Output indicates the fault condition as protection signal. When fault state occurs, the main power is to be turned-off and the PGO signal goes LOW.
NORMAL = "LOW", FAULT = "HIGH"

PGO (Power Good Output)

Power Good Signal Generator is to monitor the voltage level of power supply for safe operation of a microprocessor having some delay time at turn-on. The delay time is prorammed by a timing capacitor connected to TPG pin of KA3504. The power good output should be low state before the output voltage is out of regulation at turn-off.
NORMAL = "HIGH", FAULT = "LOW"

Description

The KA3504 is complete output supervisory circuitry intended for use in the secondary side of the switched mode power supply. It provides all the functions necessary to monitor and control the output of the power supply system. Power good signal generator, Remote on and off control, some precision protection features against over-voltage and over-current are implemented. It directly senses all the output rails for OVP without any external dividers. As for output control, power good output (PGO) and Fault Protection output (FPO) are also included. Utilizing a minimum number of external components, the KA3504 offers a simple and cost effective solution, greatly reducing PCB board space for power supply system.

### OCP (Over Current Protection)

It has precision OCP functions for +3.3V, +5V, +12V outputs. The block is made up of three comparators with current source setting function. Two inputs of each OCP comparator are connected to both sides of output inductor that is located in the secondary output of SMPS.

OVP (Over Voltage Protection)

It has OVP functions for +3.3V, +5V, +12V outputs. The circuit is made up of a comparator with three detecting inputs.

Remote ON/OFF

Remote on/off section is used to control SMPS externally. If a high signal is supplied to the remote on/off input, FPO signal becomes a high state and all secondary outputs are grounded. The remote on/off signal is transferred with some on-delay and off-delay time of 8ms, 24ms respectively with 0.1µF external capacitor.
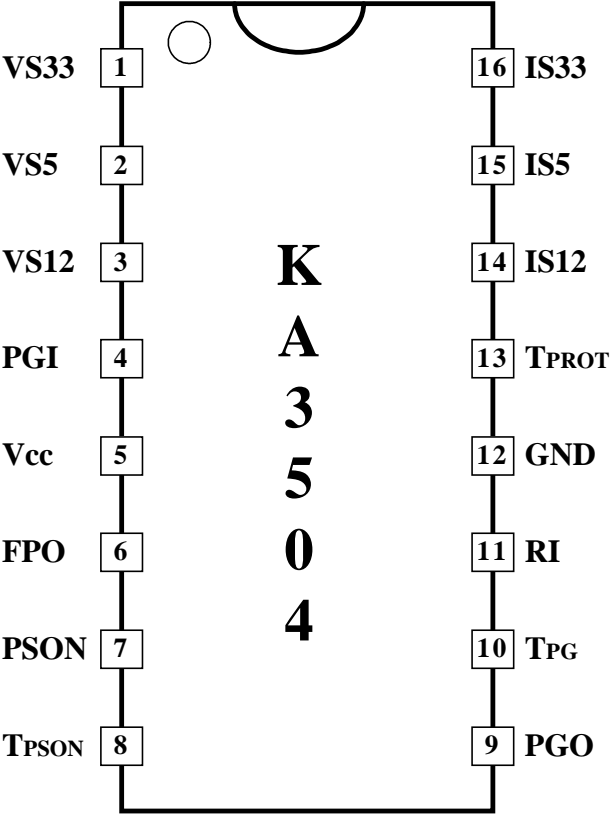
16-DIP

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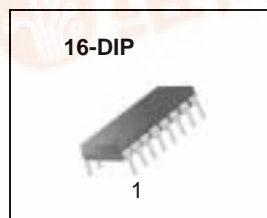
Internal Block Diagram
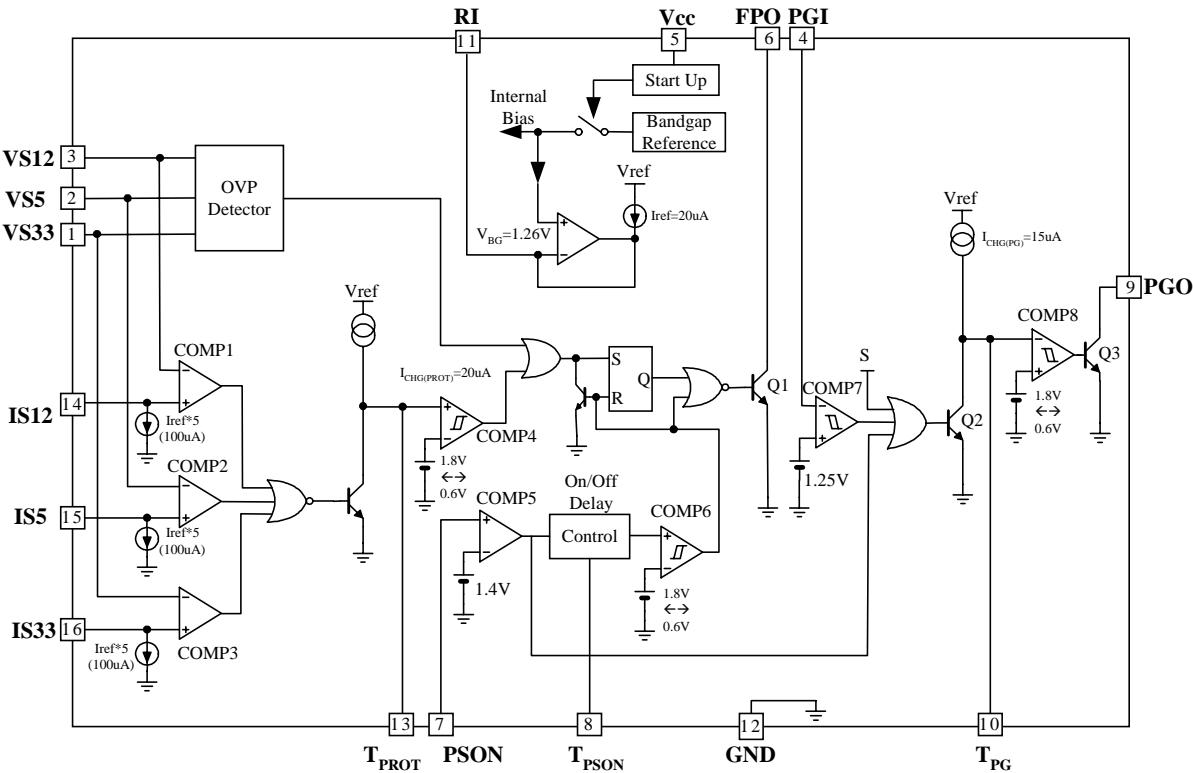
Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	15 ~ 30	V
Input Voltage	Vinput	30	V
FPO Voltage	V_{FPO}	30	V
FPO Maximum Current	I_{FPO}	20	mA
Operating Temperature	Topr	-20 ~ +85	°C
Storage Temperature Range	Tstg	-65 ~ +150	°C
Power Dissipation	P_D	1	W

Pin Assignments : KA3504

VS33	1		16	IS33
VS5	2		15	IS5
VS12	3	**K**	14	IS12
PGI	4	**A**	13	T$_{PROT}$
Vcc	5	**3**	12	GND
FPO	6	**5**	11	RI
PSON	7	**0**	10	T$_{PG}$
T$_{PSON}$	8	**4**	9	PGO

Pin Definitions

Pin No.	Name	Pin Function Description
1	VS33	Over Voltage Protection Input for the 3.3V. It Directly Senses the 3.3V Rail Without any External Divider.
2	VS5	Over Voltage Protection Input for the 5V. It Directly Senses the 5V Rail Without any External Divider.
3	VS12	Over Voltage Protection Input for the 12V. It Directly Senses the 12V Rail Without any External Divider.
4	PGI	Power Good Signal Generator Input. It Should be Supplied From a Bulk Dependent Voltage in Order to Detect Power on and off State.
5	V_{CC}	Supply Voltage. Its Recommended Operating Voltage is Ranged from 15V to 30V.
6	FPO	Fault Protection Output (Open Collector Output). This Pin Indicates the Fault Condition. When Fault State Occurs, the PGO Signal Goes Low. Normal = 'Low", Fault = "High".
7	PSON	Remote on/off Input. It does TTL Operation and its Threshold Voltage is 1.4V. In Case of Open Circuit, the Voltage at this Pin is High (5.0V). If PSON = "Low", then FPO = "Low". It Means the Main SMPS is Working. When PSON = "High or Open", then FPO = "High" and the main SMPS Stops to Work.
8	TPSON	Timing pin for PSON Delay. Ton/Toff=8ms/24ms (Typ.) with Cpson=0.1µF Externally. PSON On Delay Time (Ton) is Measured as PSON Input Goes Low to High. PSON Off Delay Time (Toff) can be Measured Reversely.
9	PGO	Power Good Output Signal (Open Collector). PGO = "High" means "Power Good" for Operation and PGO = "Low" Means "Power Fail".
10	TPG	Timing pin for PGO delay. TPG = 270ms (Typ.) with CPG = 2.2µF Externally. The High/low Threshold Voltages are 1.8V/0.6V and the Voltage of pin10 Would be Charged up to 2.9V for Noise Margin.
11	RI	OCP Current Sense Setting pin. The Reference Voltage at this pin is set to 1.25V Internally.You can fix the OCP Reference Current by Using RI Resistor.
12	GND	Ground
13	TPROT	Timing pin for Under Voltage Protection and Over Current Protection Blank-out time. Its Threshold Voltage is 1.8V and Clamped at 2.9V After full Charging. Target of Delay Time is 38ms and it is Realized Through External Capacitor (C=0.47µF).
14	IS12	Current Sense Input for +12V. This pin is Connected to the Current Sensing Resistor or Inductor. You can Define OCP Offset Voltage for +12V by Using RI Resistor Externally. If you Connected RI Resistor of 62kΩ at Pin11 to Ground, the Reference Current(Iref) Should be 20µA. After that, you can Make a Constant OCP Offset Voltage ($V_{OFFSET} = R_O \times 5 \times Iref$). In Case the Voltage Drop (=$I_{O.12} \times R_S$) of the Sense Resistor or Inductor is Larger than Offset Voltage, FPO Becomes "High" After Some Delay time and the Main SMPS is Turned-off. So the Over Current level is Determined by Following Equation. ($I_{O.12} = V_{OFFSET}/ R_S$) ∗ See Application Note for Details.
15	IS5	Current Sense Input for +5V. You can Make the +5V OCP Function as Previous Method in IS12 (Pin14).
16	IS33	Current Sense Input for +3.3V. You can also Make the +3.3V OCP Function as Previous Method in IS12 (Pin14).

Electrical Characteristics

(V_{CC} = 20V, -25°C $\leq$ Ta $\leq$ 85°C, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
PROTECTION SECTION						
Over Voltage Protection for 3.3V	V_{OVP33}	V_{PSON} = 0V	3.9	4.1	4.3	V
Over Voltage Protection for 5V	V_{OVP5}	V_{PSON} = 0V	5.7	6.1	6.5	V
Over Voltage Protection for 12V	V_{OVP12}	V_{PSON} = 0V	13.6	14.3	15.0	V
Offset Voltage of OCP Comparator	V_{offset}	V_{PSON} = 0V	-3	-	3	mV
Charging Current for OCP Delay	$I_{CHG(PROT)}$	-	-15	-21	-30	µA
3.3, 5, 12V Over Current Delay Time	$T_{D(OCP)}$	C = 0.47µF	24	38	57	msec
POWER SUPPLU ON/OFF SECTION (PSON) Note						
PSON Input Threshold Voltage	$V_{TH(PSON)}$	PSON: "H" $\rightarrow$ "L"	1	1.4	1.8	V
PSON Open Voltage	$V_{OPEN(PSON)}$	PSON: Open	4	-	5.25	V
PSON Input Low Current	$I_{LOW(PSON)}$	V_{PSON} = 0V	-	-	-1.6	mA
ON Delay Time	$T_{ON(PSON)}$	C = 0.1µF	4	8	14	msec
OFF Delay Time	$T_{OFF(PSON)}$	C = 0.1µF	16	24	34	msec
FPO SECTION						
FPO Saturation Voltage	$V_{SAT(FPO)}$	I_{FPO} = 10mA	-	0.2	0.4	V
FPO Leakage Current	$V_{LKG(FPO)}$	V_{FPO} = 20V	-	0.01	1	µA

Electrical Characteristics

(V_{CC} = 20V, -25°C $\leq$ Ta $\leq$ 85°C, unless otherwise specified)

| Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
POWER GOOD SECTION						
PG Input Threshold Voltage	$V_{IN(PG1)}$	PG: "H"$\rightarrow$"L"	1.20	1.25	1.30	V
Hysteresis Voltage 1	HY1	COMP7	10	40	80	mV
Hysteresis Voltage 2	HY2	COMP4, 6, 8	0.6	1.2	-	V
Charging Current for PG Delay	$I_{CHG(PG)}$	-	-9	-14	-22	µA
PG Delay Time	$T_{D(PG)}$	C = 2.2µF	150	270	450	msec
PG Output Saturation Voltage	$V_{SAT(PG)}$	I_{PG} = 10mA	-	0.2	0.4	V
TOTAL DEVICE						
Stand-by Supply Current	I_{CC}	-	-	5	10	mA

Note:

1. It does TTL operation and its threshold voltage is 1.4V.

2. Power Supply ON Delay Time (Ton) is measured as PSON input goes "Low" to "High".

3. Power Supply OFF Delay Time (Toff) is measured as PSON input goes "High" to "Low".

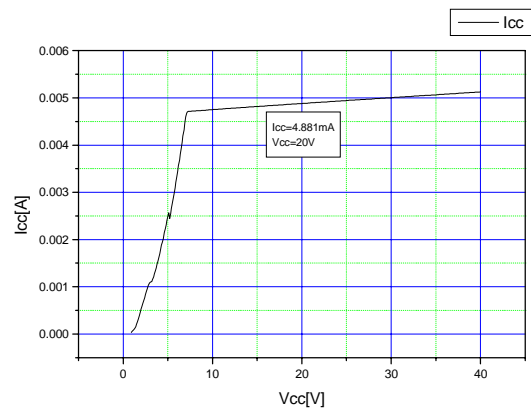# Timing / Housekeeping / Control
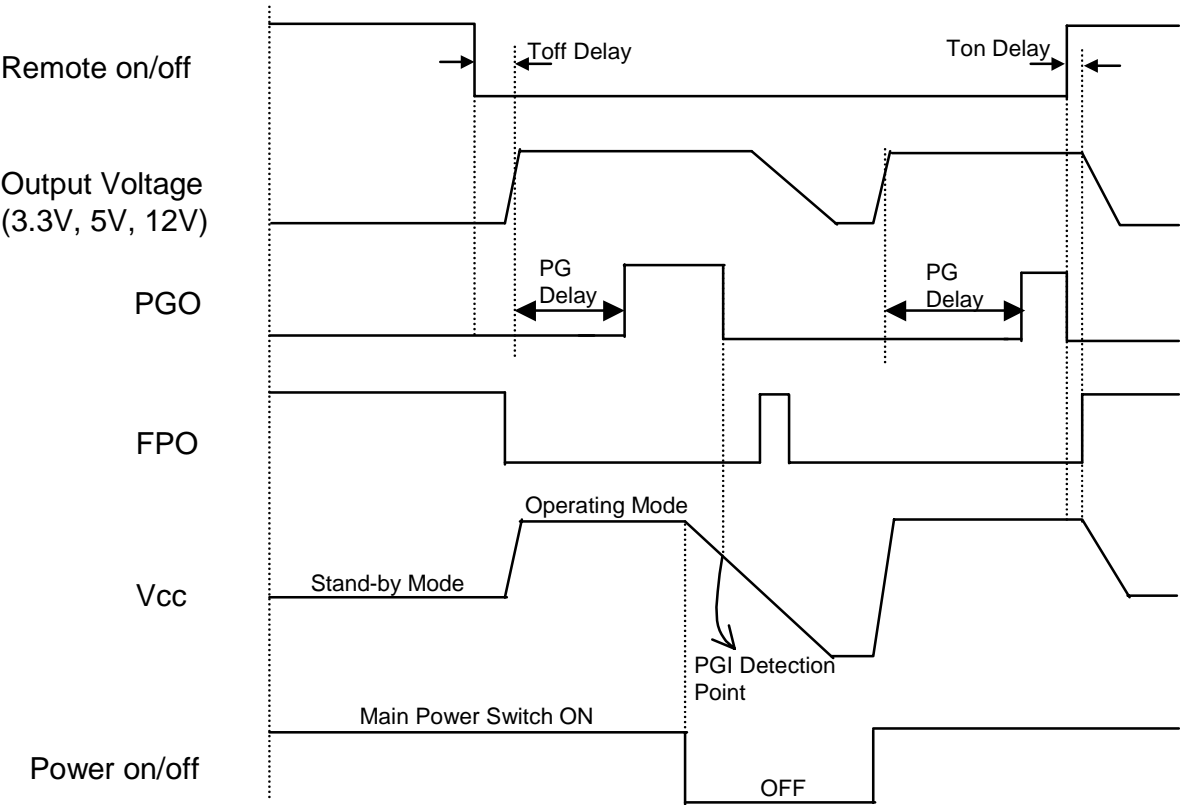
Test Circuit
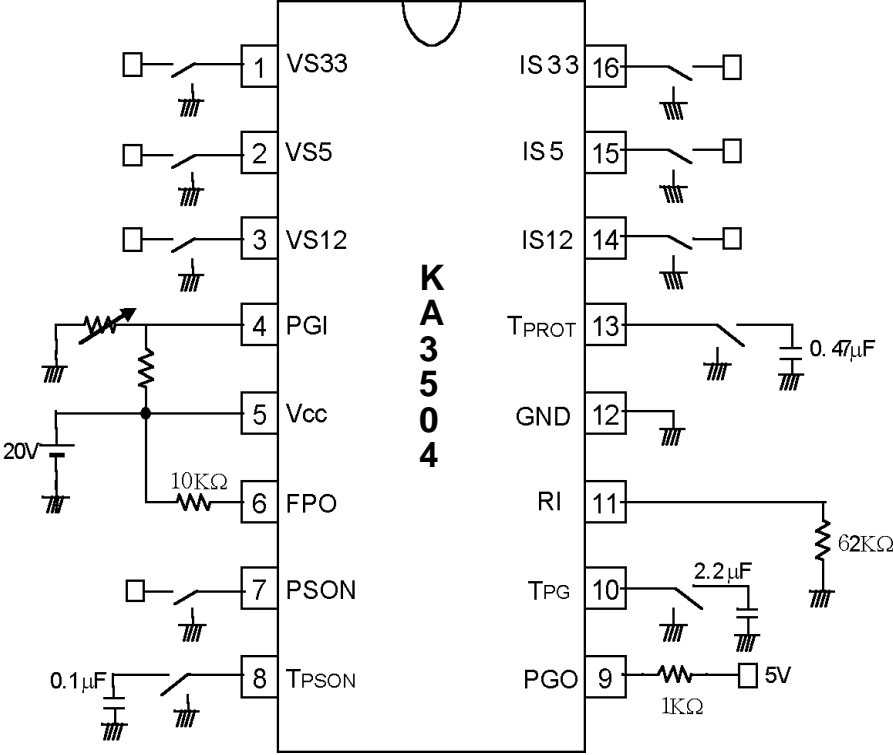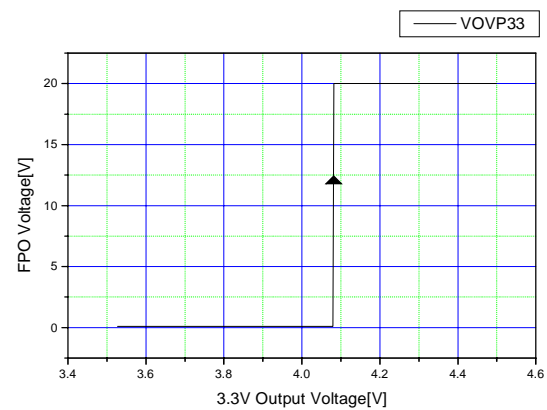
Typical Characteristics

Figure 1. V$_{CC}$ - I$_{CC}$

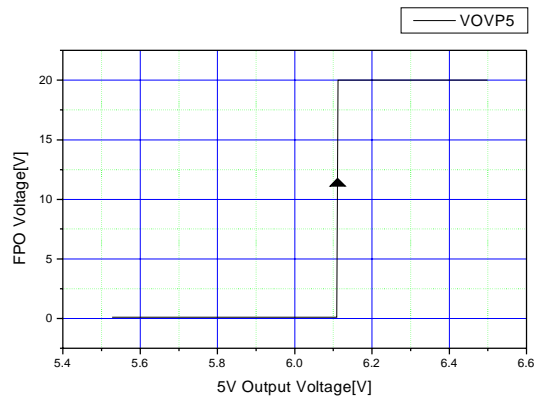**Figure 2. Over Voltage Protection for 3.3V**

Figure 3. Over Voltage Protection for +5V
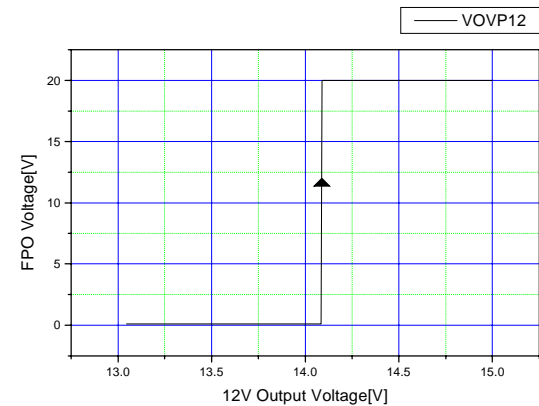

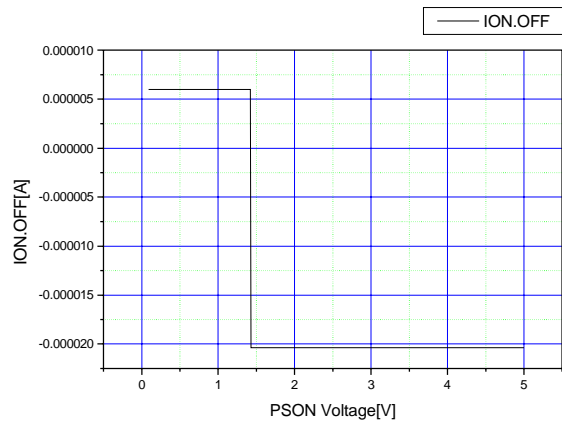**Figure 4. Over Voltage Protection for +12V**

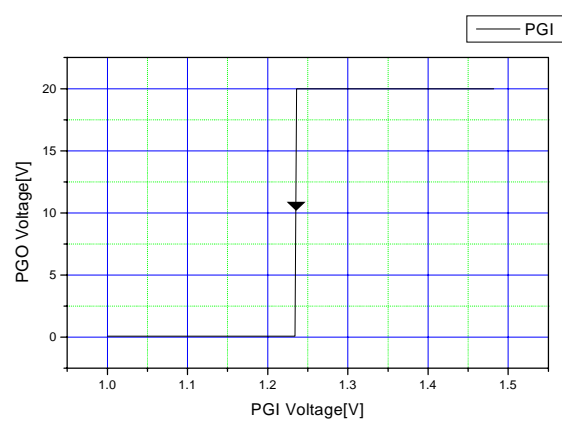**Figure 5. PS On/Off Delay Current**

Figure 6. PG Input Threshold Voltage
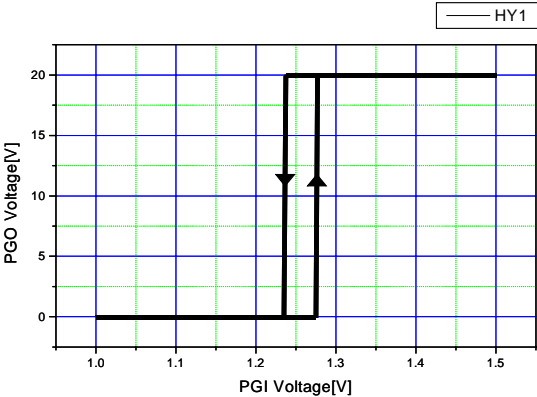
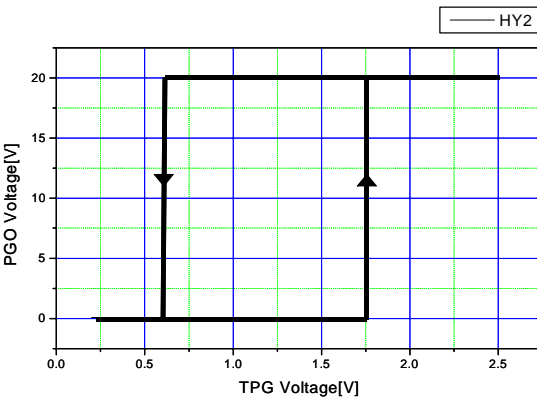## Typical Characteristics (Continued)

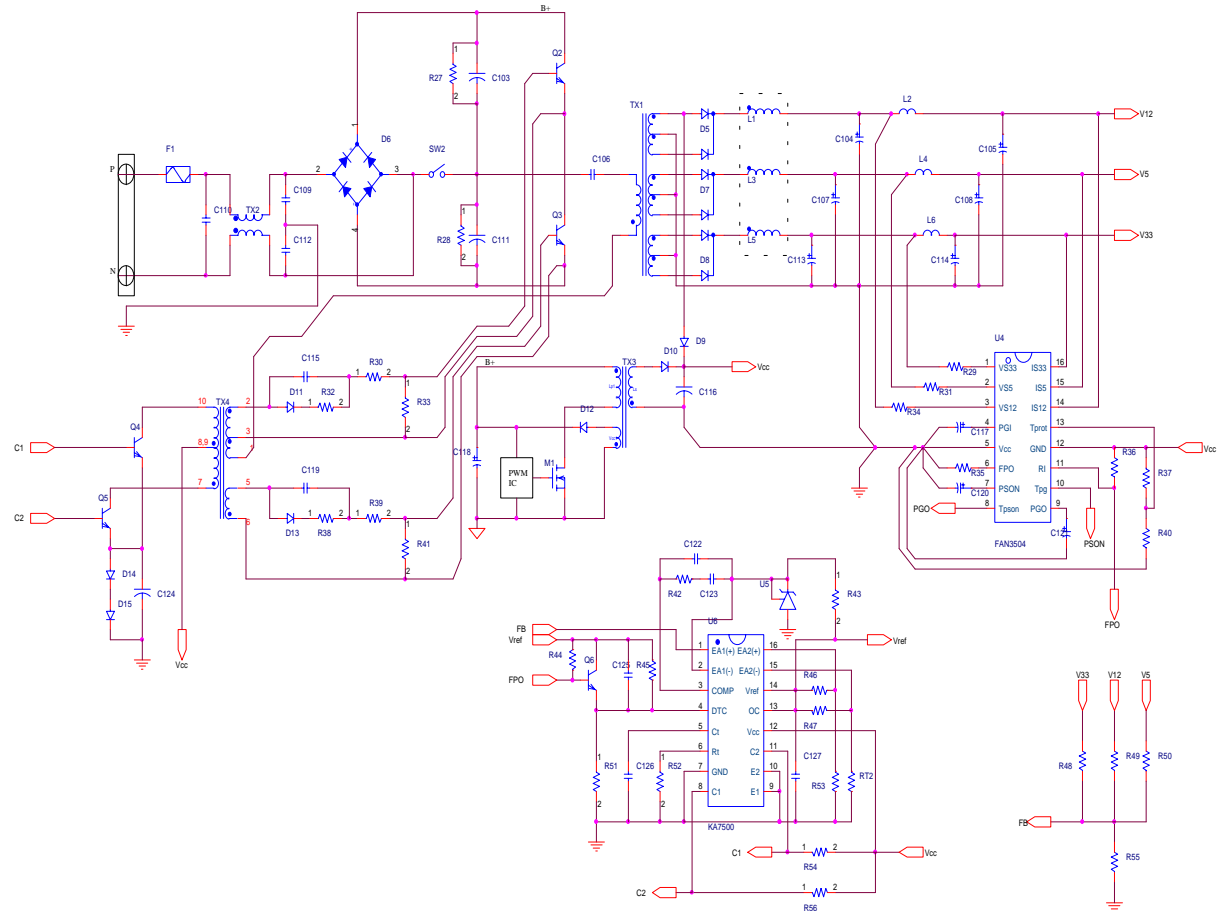
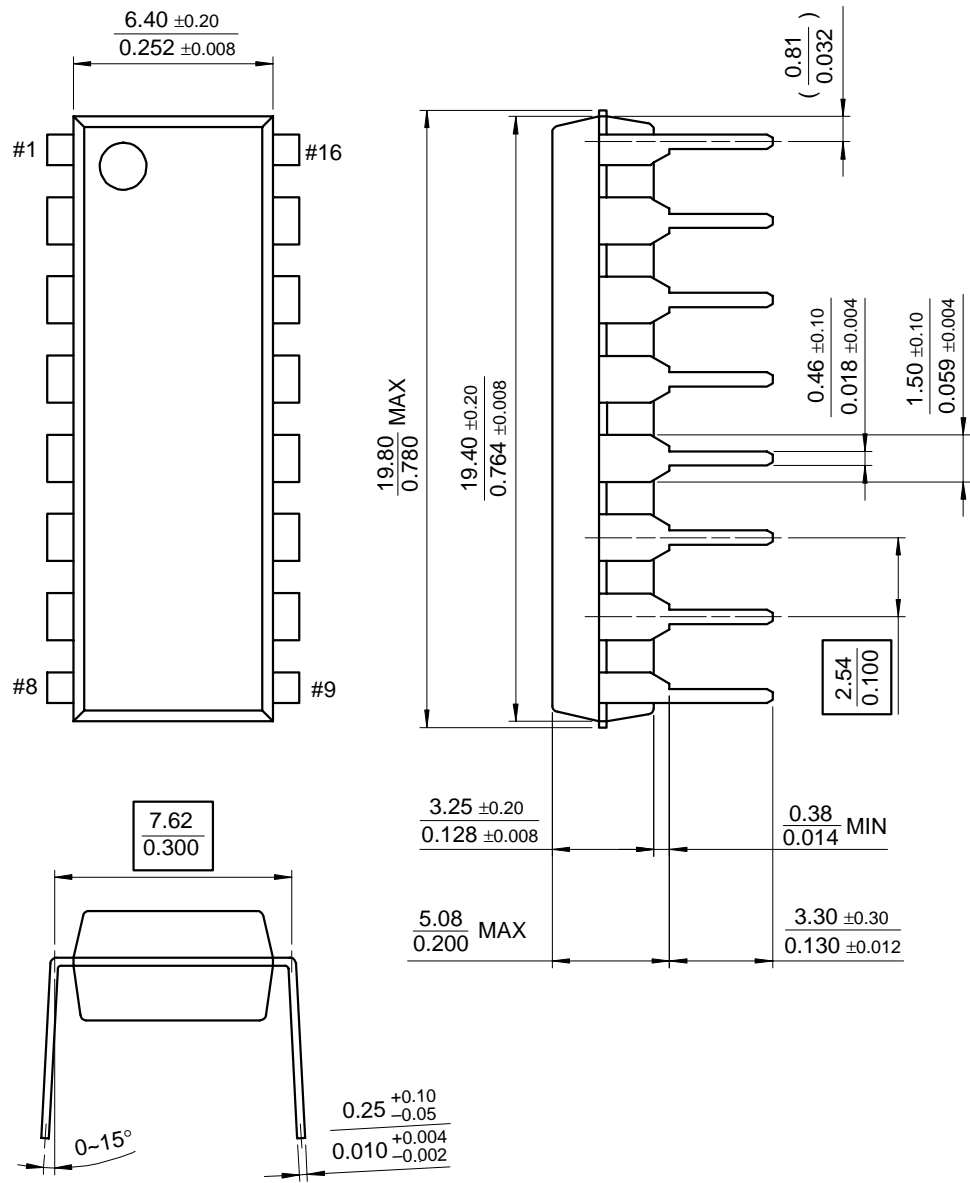Figure 7. Hysteresis Voltage 1

Figure 8. Hysteresis Voltage 2

Application Circuit

Mechanical Dimensions

Package

Dimensions in millimeters

16-DIP

Ordering Information

Product Number	Package	Operating Temperature
KA3504	16-DIP	-25°C ~ +85°C