AUK Semiconductor

S6503P

Power Factor Collector

Description

It is Adaptable to a Discontinuous Mode of Operation that the S6503P 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 External Part Counts High Speed Response Time

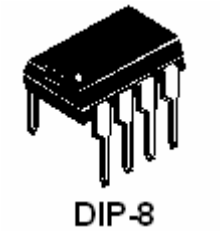
Applications

- Switching Mode Power Supply (SMPS)
- Electronic Ballast

Ordering Information

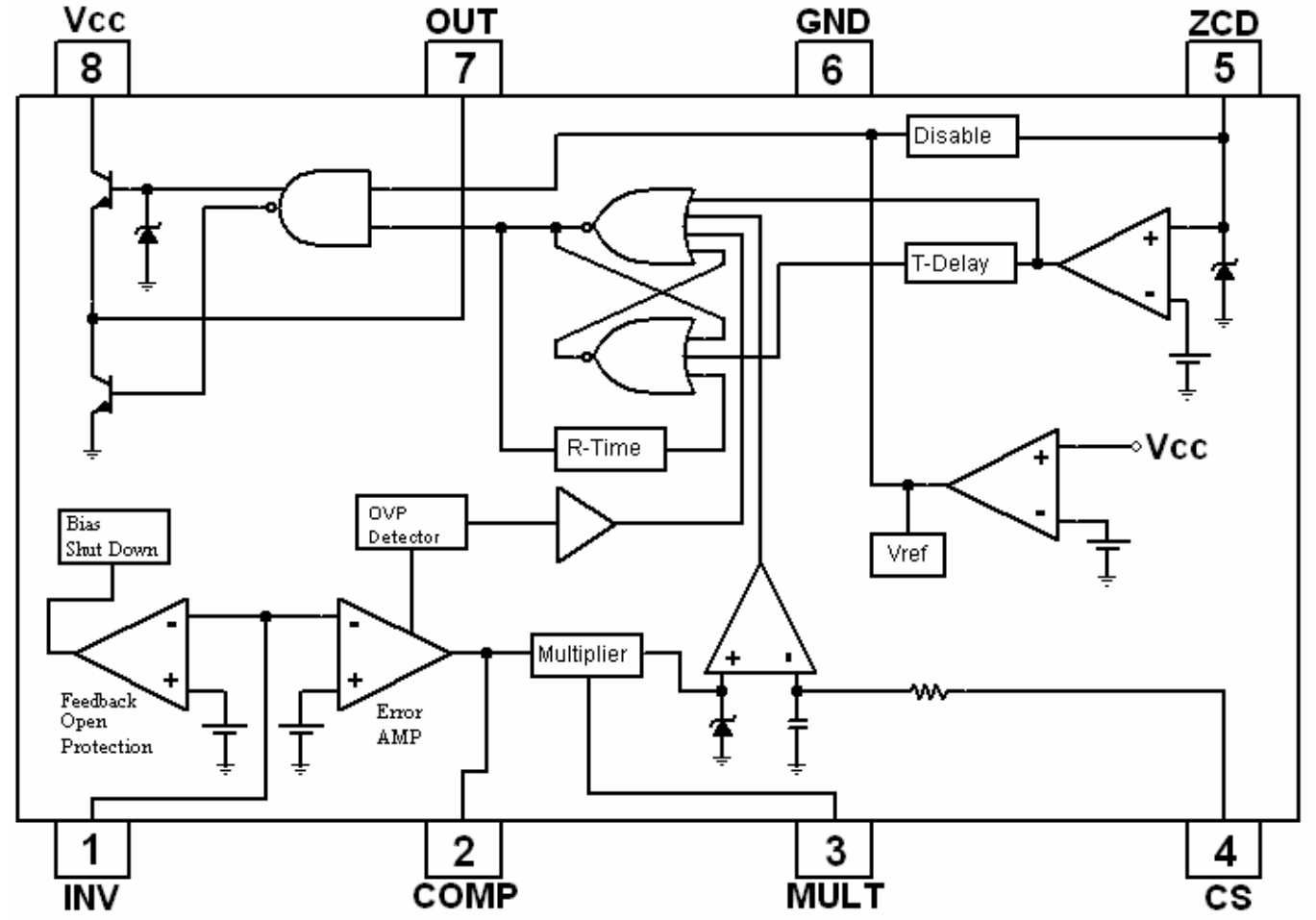
Type NO.	Marking	Package Code
S6503P	S6503P	DIP - 8

Package Outline



DIP-8

Block Diagram



Pin Description

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 Maximum Ratings

Characteristics	Symbol	Value	Unit
Maximum Supply Voltage	V_{CCMAX}	27	V
Output Peak Current	I_{PEAK}	±500	mA
Analog Input & Output (Pin 1,2,3,4,5)	V_{INMAX}	-0.3 ~ 7	V
ZCD Input Maximum Current	I_{ZCD}	±10	mA
Power Dissipation	P_{DMAX}	600	mW
Operating Junction Temperature	T_j	-35 ~ 150	℃
Storage Temperature	T_{stg}	-55 ~ 150	℃

Electrical Characteristics

(Ta = -25℃ to 125℃, V_{CC}=14V unless otherwise specified.)

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Supply Voltage & Current Section						
V_{CC} Turn-On Threshold	$V_{CC(On)}$	V_{CC} Increasing	11	12	13	V
V_{CC} Turn-Off Threshold	$V_{CC(Off)}$	V_{CC} Decreasing	8.7	9.5	10.3	V
Hysteresis Voltage	HYS		2	2.5	3	V
Start-Up Current	I_{ST}	Before Turn-On	20	40	70	μA
Quiescent Current	I_Q	No Switching	1	4	6	mA
Operating Supply Current	I_{CC}	C_L=1nF, f_{sw}=50KHz	2	5	8	mA
Operating Current at OVP	I_{CC_OVP}	V_{INV}=2.7V	0.5	2	4	mA
Operating Current at Disable	I_{CC_DIS}	V_{ZCD}<150mV	0.5	2	4	mA
Error Amplifier Section						
Input Voltage	V_{INV}	Ta=25℃	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	μA
Open Loop Gain	Av		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

Electrical Characteristics (Continued)

(Ta = -25℃ to 125℃, V_{CC}=14V unless otherwise specified.)

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Multiplier Section						
Linear Operating Voltage	VMULT		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
Mltiplier Gain	K	Ta=25℃, 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	μA
Delay to Output	$T_{d(H-L)}$		-	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	48	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	-	μA
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	-	μA
Restart Timer Section						
Restart Time Delay	t_{rst}		70	130	300	μs

Electrical Characteristics (Continued)

(Ta = -25℃ to 125℃, Vcc=14V unless otherwise specified.)

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Output Section						
Output High Voltage	V_{OH}	I_O =-10mA	10.5	11.5	12.5	V
		I_O=-100mA	10	11	12	V
Maximum Voltage	V_{OMAX}	V_{CC}=20V, I_o=-1mA	11	13	15	V
Output Low Voltage	V_{OL}	I_O=10mA	-	0.1	1	V
		I_O=100mA	-	1.2	2.5	V
Output Voltage with UVLO Activated	$V_{O(UV)}$	I_O=1mA	-	-	1	V
Minimum On Time	$T_{ON(MIN)}$		-	150	1	ns
Output Rising Time	t_r	C_L = 1nF	-	50	-	ns
Output Falling Time	t_f	C_L = 1nF	-	50	-	ns
Over Voltage Protector (OVP) Section						
Dynamic OVP Current	I_{OVP}		35	40	45	μA
Dynamic OVP Current Hysteresis	$I_{OVP(HYS)}$		-	30	-	μA
Static OVP Threshold Voltage	V_{OVP}	V_{INV} = 2.7V	2.1	2.25	2.4	V

Application Information

1. Main Inductor

$$L = \eta \times (V_O - V_P) \times V_P{}^2 / (4V_O \times P_O \times f)$$

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

$R_{ML} < 0.69 \times R_{MU} / (V_P - 0.69)$

Where,

R_{MU}: Under Resistor for Multiplier Input

R_{ML}: Lower Resistor for Multiplier Input

4. Resistor for Error Amplifier

$R_{EL} = 2.5 \times R_{EU} / (V_O - 2.5)$

Where,

R_{EU}: Under Resistor for Error Amplifier Inverting Input

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

5. Over Voltage Protector (OVP)

$\triangle V_O = R_{EU}[\Omega] \times 40[\mu A]$

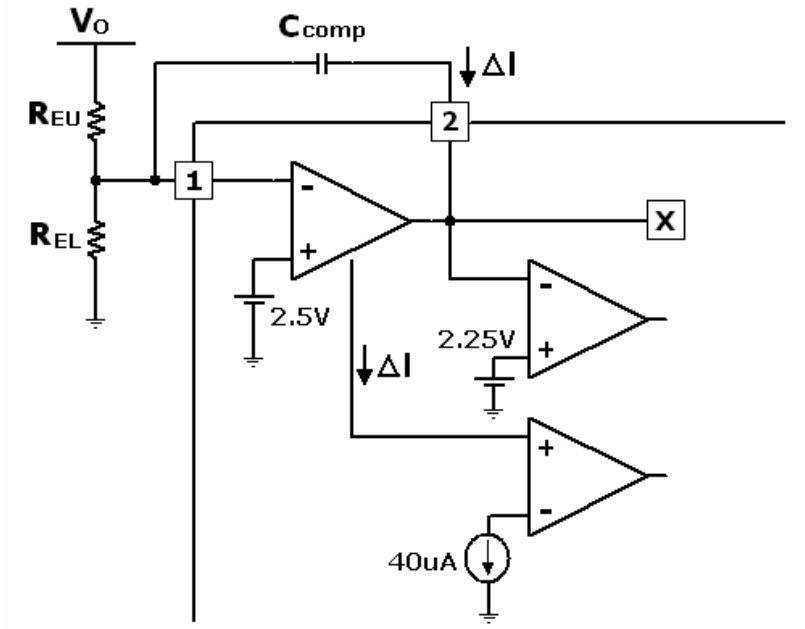


Fig.1 Over Voltage Protection Circuit

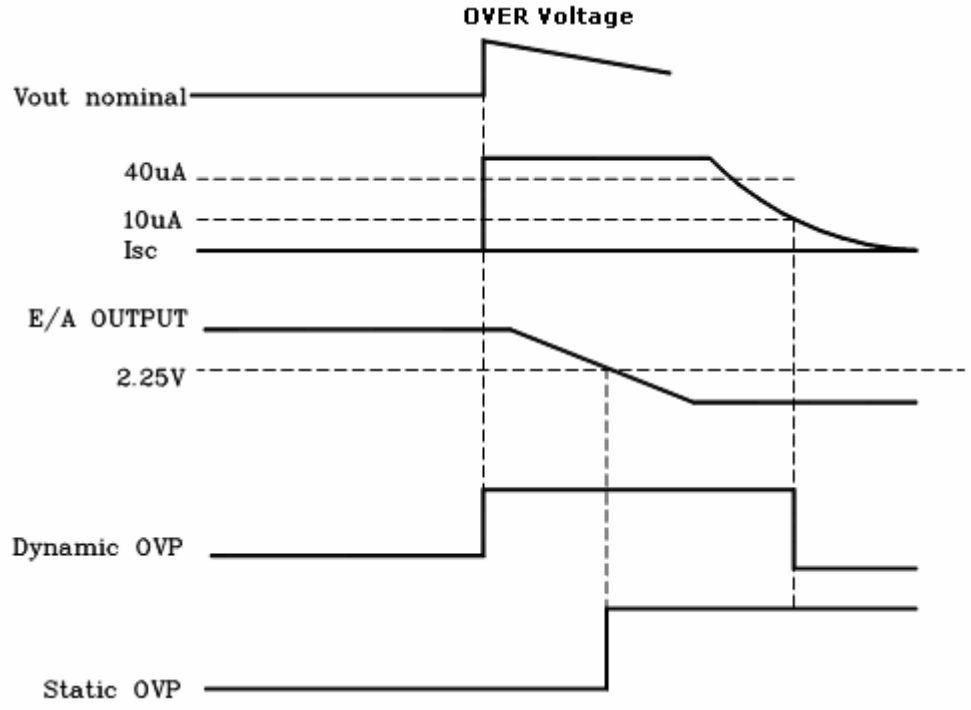
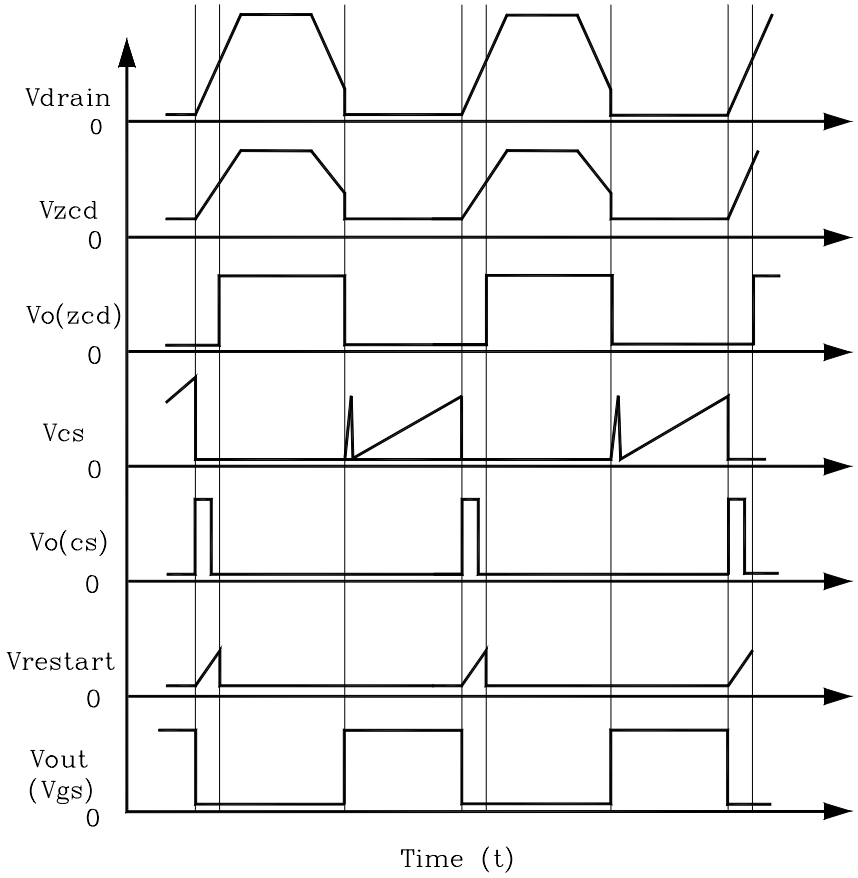
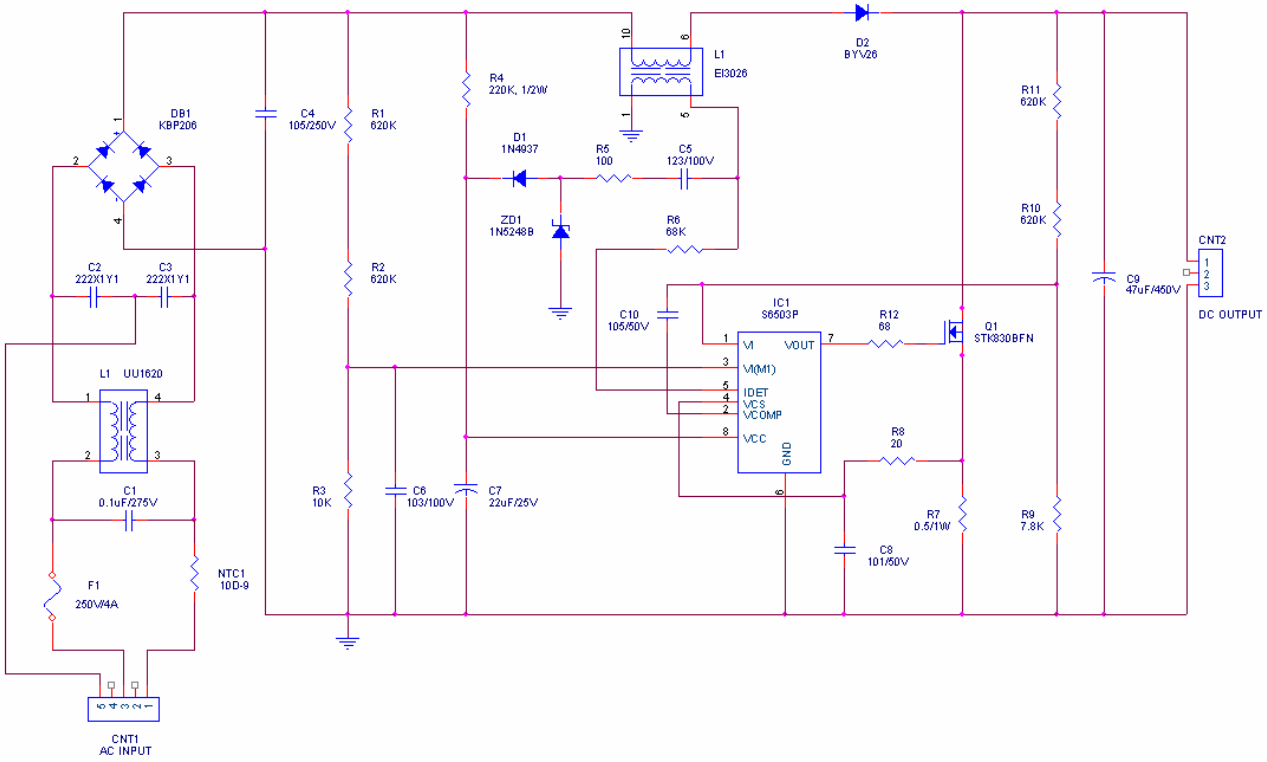


Fig.2 OVP Operating Timing Chart

Operating Timing Chart



Typical Application Circuit (85VAC ~ 265VAC, 80W)



Electrical Characteristic Curves

Fig.1 Operating Supply Current vs. Supply Voltage

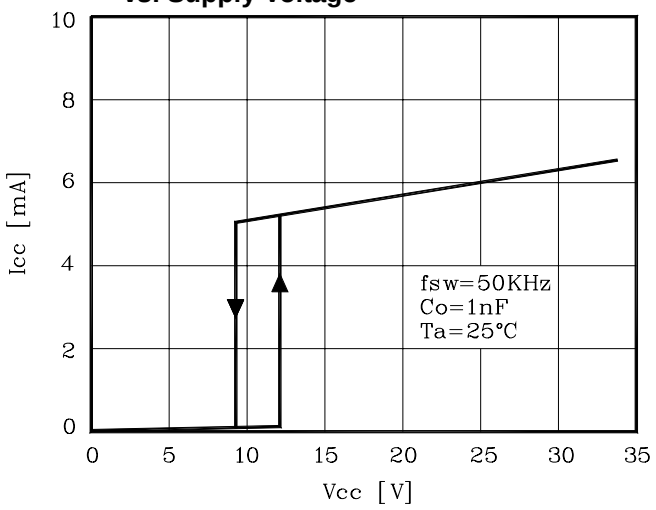


Fig.2 Start-Up Current vs. Supply Voltage

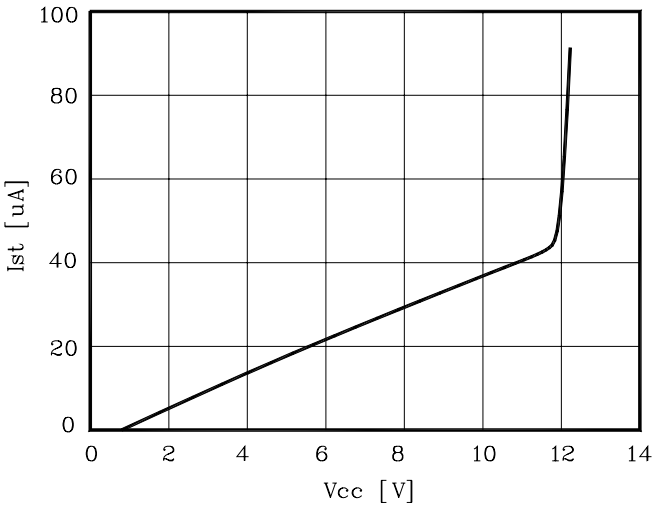


Fig.3 Output Voltage vs. Input Threshold Voltage

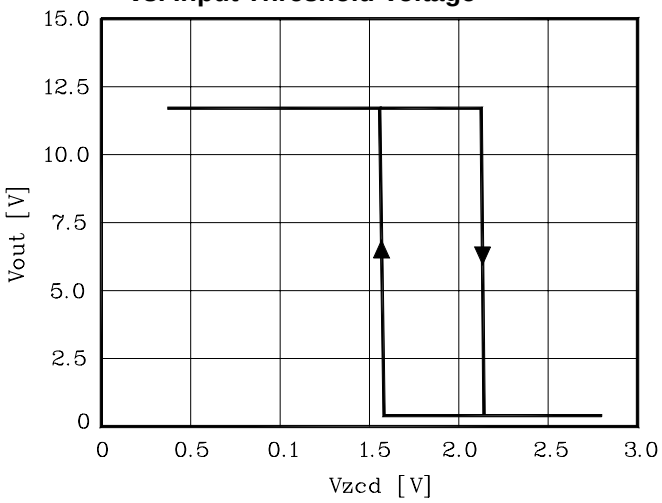


Fig.4 Output Voltage vs. Disable Input Voltage

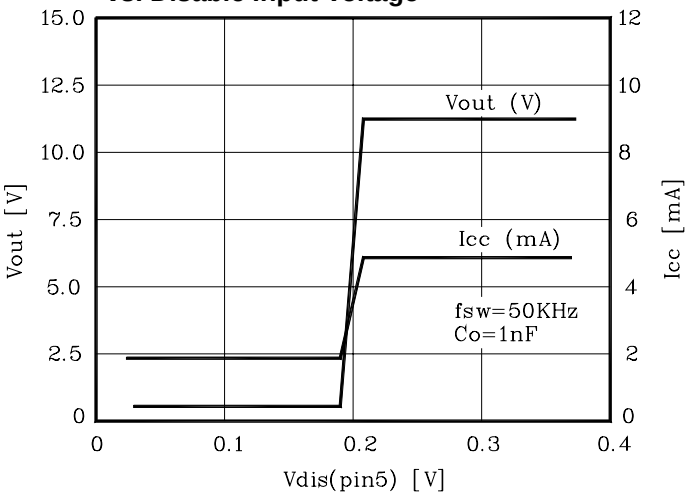


Fig. 5 Output Voltage vs. Input Voltage

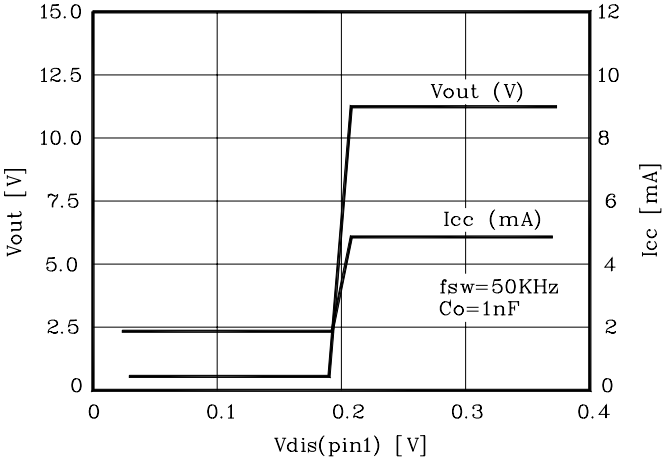


Fig.6 Reference Clamp Voltage vs. Linear Operating Voltage

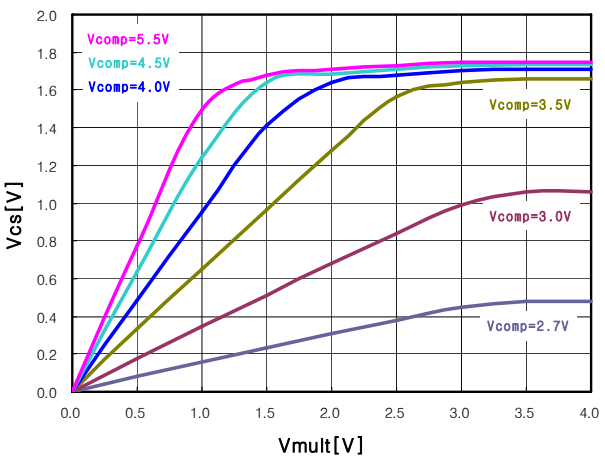


Fig.7 Output High Voltage vs. Output Source Current

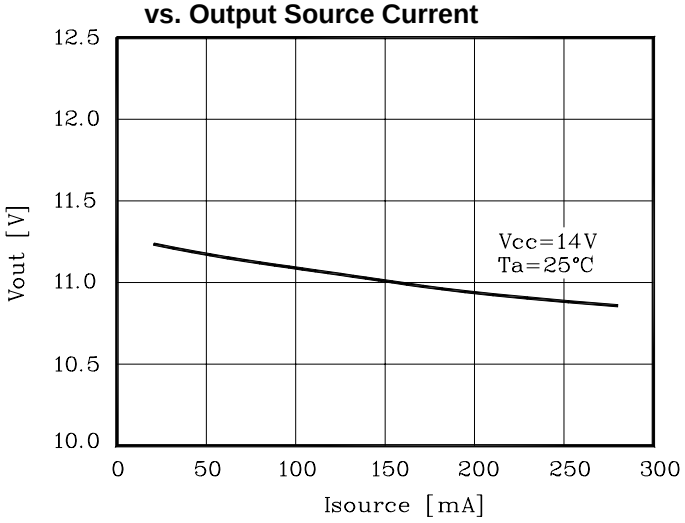


Fig.8 Output Low Voltage vs. Output Sink Current

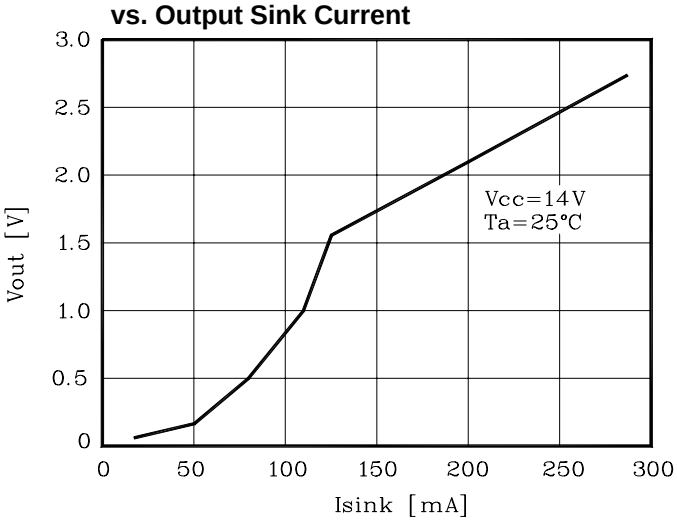


Fig.9 Operating Supply Voltage vs. Ambient Temperature

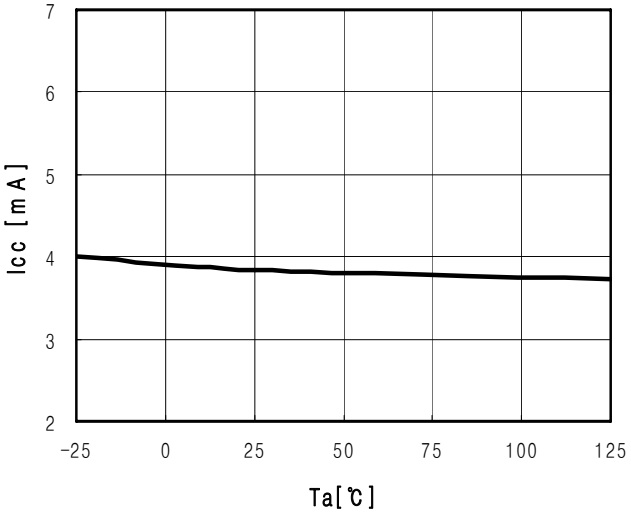


Fig.10 Multiplier Gain vs. Ambient Temperature

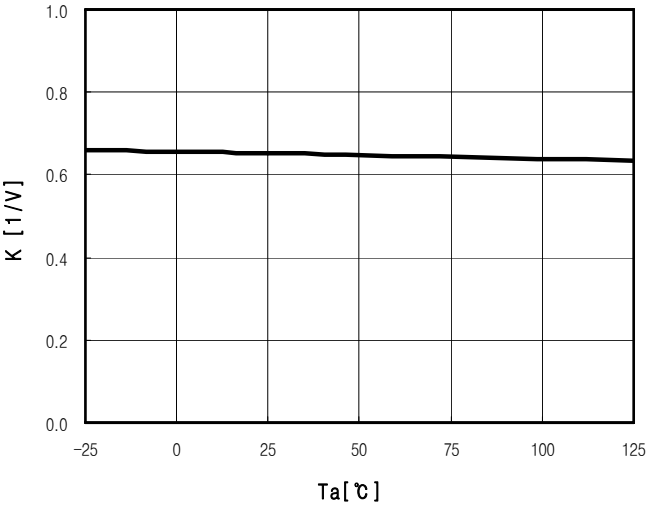


Fig.11 Output High Voltage vs. Ambient Temperature

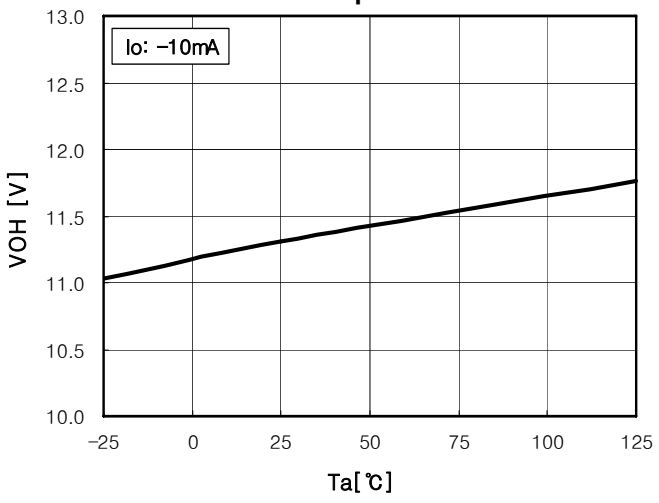


Fig.12 Output Low Voltage vs. Ambient Temperature

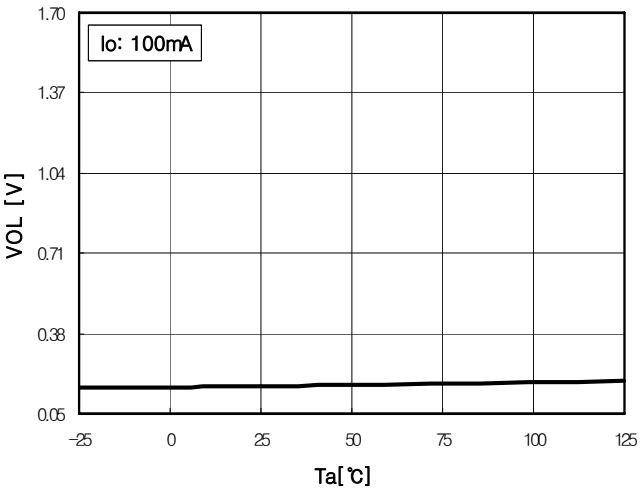


Fig.13 Output Maximum Slop vs. Ambient Temperature

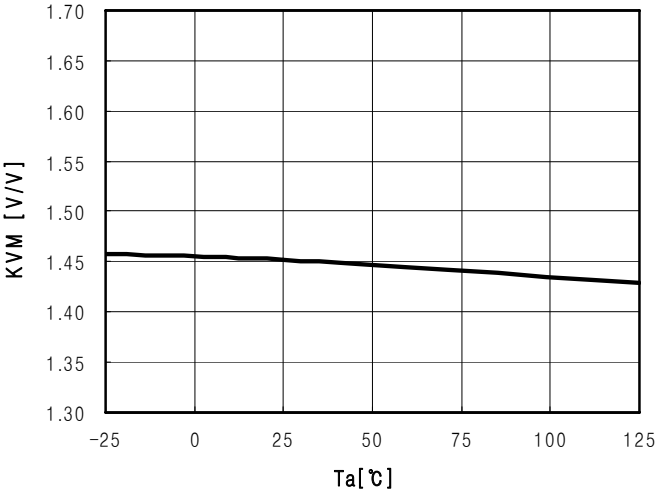
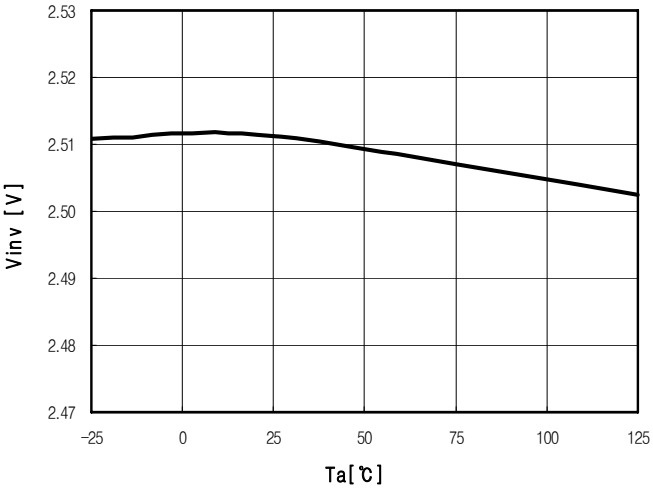
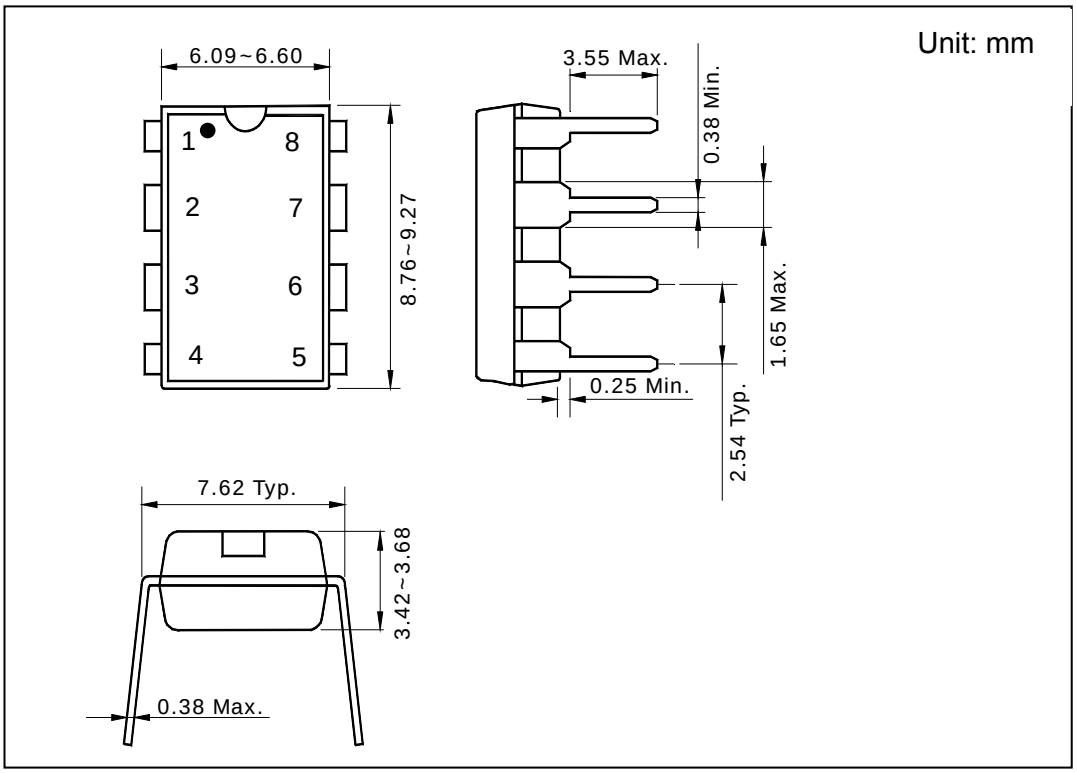


Fig.14 Input Voltage vs. Ambient Temperature



Outline Dimensions



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