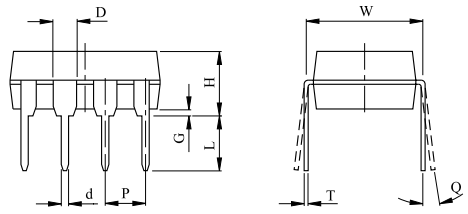
Simple Ballast Controller



DIM	MILLIMETERS
A	9.2±0.2
B	6.40±0.2
D	1.52±0.1
d	0.46±0.1
G	0.33 MIN
H	5.08 MAX
L	3.3±0.3
P	2.54±0.25
T	0.25+0.1/-0.05
W	7.62±0.25
Q	0 - 15°

DIP-8 (1)

DESCRIPTIONS.

The KIA3502 provides simple and high performance control functions for the half vridge L/C resonant system, specially electronic ballast. It internally integrated the essential functions of the half bridge L/C resonant system so the conventional system can be realized a minimum board area, small external components and low power dissipation. Internally integrated soft-start circuit eliminated the need for external soft-start circuit. preheating time, preheating frequency, operating frequency and ignition time can be controlled. separately using external capacitors and resistor. no lamps protection or any required protection like over current protection can be realized an external small signal transistor.

FEATURES.

- Internal Soft-Start
- Programmable Preheating Frequency
- Programmable Preheating Time
- Programmable Ignition Time
- Very Precision Internal Operating Frequency(±5%)
- No Lamp Protection or Over Current Protection
- Built-in Temperature Compensation Circuit
- Built-in Surge Protection Circuit
- Built-in UVLO Circuit
- Precision Internal Reference Voltage
- DIP-8, FLP-8 Package

INTERNAL CIRCUIT BLOCK.

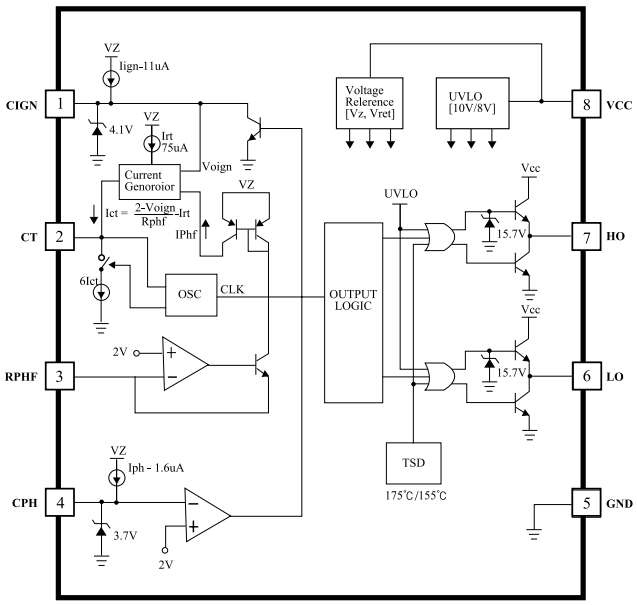
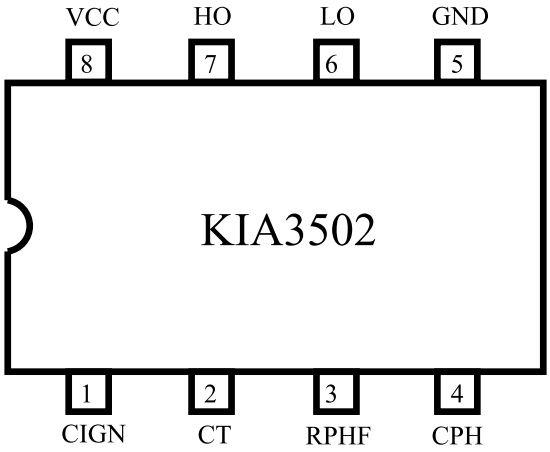


Fig1. PIN CONNECTIONS



PIN DESCRIPTIONS

NO	SYMBOL	I/O	DESCRIPTION
1	CIGN	I	Ignition Time Control Pin with external Capacitor
2	CT	I	Internal Oscillator Timing Control Pin with Capacitor
3	RPHF	I	Preheating Frequency Control Pin with external Resistor
4	CPH	I	Preheating Time Control Pin with external Capacitor
5	GND	-	Ground
6	LO	O	Low Side Gate Drive Output
7	HO	O	High Side Gate Drive Output
8	VCC	-	Supply Voltage

ABSOLUTE MAXIMUM RATINGS

CHARACTERISTICS	SYMBOL	VALUE	UNIT
Maximum Supply Voltage	VCCMAX	30	V
Maximum Operating Supply Voltage	VOPMAX	24	V
Totem-pole Output Peak Current	IPEAK	±1	A
Power Dissipation(8DIP)	Pd	800	mW
PIN1,2,3,4, Voltage	VIN	-0.4 ~ 6	V
Output Clamp Diode Current	ICLAMP	30	mA
Operating Junction Temperature	Tj	-25~125	℃
Storage Temperature	Tstg	-55~150	℃

ELECTRICAL CHARACTERISTICS

(Ta=25℃, V_{CC}=14V, fosc=47KHz, unless otherwise specified.)

CHARACTERISTIC	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Total Supply Current Section						
Start-up Current	IST	Vcc=9V	-	125	250	uA
Quiescent Current	IQ	Not Switching	3	7.5	12	mA
Operating Supply Current	ICC	fosc=47KHz, Co=1nF	4	9	14	mA
Under Voltage Lock Output Section						
Vcc Tum-On Voltage	VCCON	Vcc Increasing	9	10	11	V
UVLO Hysteresis Voltage	HYS	-	1.5	2	2.5	V
Oscillator Section						
Operating Frequency	fop	CT = 220pF	42	47	52	KHz
Output Delay Time	Td	PIN1=PIN4=3V	1	1.75	2.35	uS
Preheating Frequency	fph	PIN4=0V, Rphf=27K	66	78	90	KHz
Output Preheating Delay Time	Tpd	PIN4=0V	0.6	1	1.4	uS
Preheating Section (Pin3, Pin4)						
Pin4(CPH) Threshold Voltage	VPH	PIN4 Voltage Increasing, Rphf=27K Ω	1.8	2.0	2.2	V
Pin4(CPH) Charging Current	IPH	Pin4=0V	-1.9	-1.6	-1.3	uA
Pin4(CPH) High Clamp Voltage	VPHT(H)	Pin4=Open	3.2	3.7	4.2	V
Pin3(PHF)Reference Voltage	VPHF	IPHF=-100uA	1.95	2.00	2.05	V
Pin3(PHF) Reference Voltage Line Regulation	DVPHF1	Vcc=14~20V	-6	0.1	6	mV
Pin3(PHF) Reference Voltage Load Regulation	DVPHF2	Io=-50uA ~ -200uA	-12	-0.1	12	mV

ELECTRICAL CHARACTERISTICS (Continued)

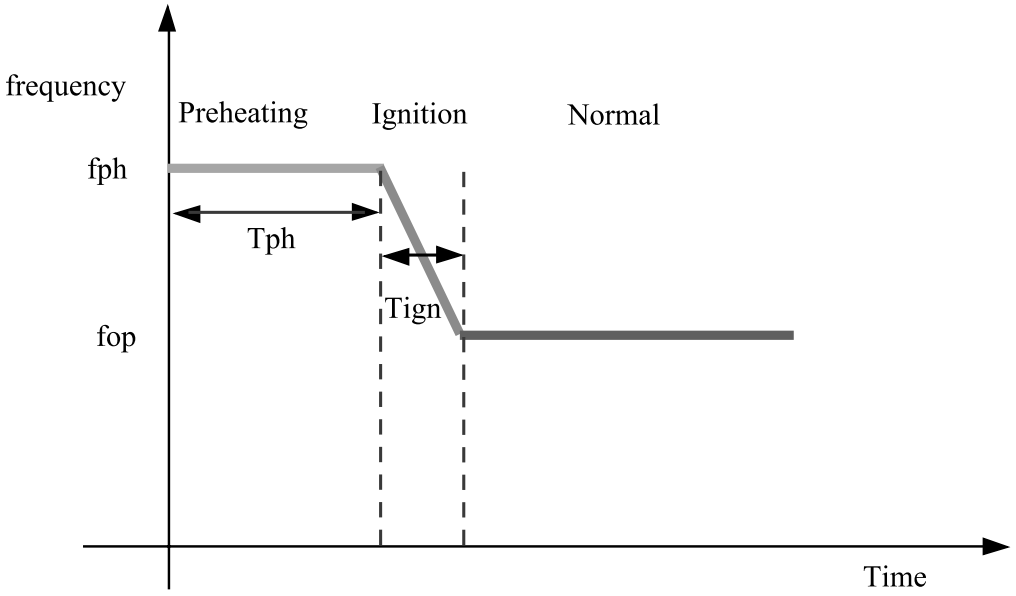
(Ta=25℃, V_{CC}=14V, fosc=47KHz, unless otherwise specified.)

CHARACTERISTIC	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Ignition Section (Pin1)						
Pin1(CIGN) Threshold Voltage	VIGN	PIN4 Voltage Increasing, Rphf=27K Ω	1.8	2.0	2.2	V
Pin1(CIGN) Charging Current	IIGN	Pin4=0V	-14	-11	-8	uA
Pin1(CIGN) High Clamp Voltage	VIGN(H)	Pin4=Open	3.8	4.3	4.8	V
Output Section						
Output High Voltage	VOH	Io=-100mA	11	12	-	V
Output Low Voltage	VOL	Io=100mA	-	0.9	1.4	V
Output Maximum Voltage	VHOMAX	Vcc=20V, No Load	13	15	17	V
Output Voltage With UVLO Activated	VUV	Vcc=5V, Io=100uA	-	0.2	1	V
Thermal Shut Down Protection						
Thermal Shut Down (Note2)	Ttsd	-	-	175	-	-
Thermal Shut Down Hysteresis (Note3)	Thys	-	-	20	-	-

* Note 1 : Output frequency is half of the internal oscillator frequency.

* Note 2, Note 3 : This characteristics can be guaranteed but not tested in final test step.

Fig2. OPERATING TIMING CHART



fph : Preheating Frequency (Rph)
fop : Operating Frequency(CT)
Tph : Preheating Time (Cph)
Tign : Ignition Time (Cign)

Fig3. APPLICATION INFORMATIONS

1. Operating frequcncy

Charging_time : $Tchg = \frac{CT \times Vchg\_pp}{Ichg}$

Discharging_time : $Tchg = \frac{CT \times Vchg\_pp}{Ichg}$

CT : Pin2 Capacitor
Vchg_pp : Amplitude of the Internal oscillator
Ichg : Charging current (Internally fixed)
Idis : Discharging current (Internally)

Tatal_period : T = Tchg+Tdis

$$Operating\_Frequcncy(fo) = \frac{1}{2} \times \frac{1}{Total\_Period} = \frac{1}{2} \times \frac{1}{Tchg+Tolis}$$

Final formula

$$Frequency : fo = (10.35 \times 10^{-5}) \times \frac{1}{CT}$$

Example) CT=220pF

$$\therefore fo = 10.35 \times 10^{-6} \times \frac{1}{220 \times 10^{-12}} = 47KHz$$

2. Preheating frequency

$$PreheatingCharging\_time : Tchg\_ph = \frac{CT \times Vchg\_pp}{Ichg}$$

$$PreheatingDischarging\_time : Tdis\_ph = \frac{CT \times Vchg\_ph\_pp}{Idis\_ph}$$

PreheatingTotal_period : Tph = Tchg_ph+Tdis_ph

CT : Pin2 Capacitor
Vchg_pp : Amplitude of the Internal oscillator (When preheation)
Ichg : Charging current (Internally fixed When preheating)
Idis : Discharging current (Internally When preheating)

$$PreheatingFrequency(fph) = \frac{1}{2} \times \frac{1}{PreheatingTotal\_Period} = \frac{1}{2} \times \frac{1}{Tchg\_ph+Tdis\_ph}$$

Final formula

$$\therefore fph = 0.1375 \times \frac{1}{CT} \times (78uA + \frac{2.0}{Rph})$$

Example) CT=220pF, Rph=27K ohm

$$\therefore fo = 0.1375 \times \frac{1}{CT} \times (78 \times 10^{-6} + \frac{2.0}{Rph}) = 0.1375 \times \frac{1}{220 \times 10^{-12}} \times (78 \times 10^{-6} + \frac{2.0}{27 \times 10^{3}}) = 95KHz$$

APPLICATION INFORMATIONS (Continued)

3. Preheating Time

$$\text{Preheating\_Time : } Tph = \frac{Cph \times Vph}{Iph}$$

CT : Pin2 Capacitor
Vph : Constant Voltage (Internally fixed)
Iph : Constant current (Internally fixed)

$$\text{Preheating\_Time : } Tph = 1.25 \times 10^{6} \times Cph$$

Example) Cph=0.33uF

$$\therefore Tph = 1.25 \times 10^{6} \times 0.33 \times 10^{-6} = 413ms$$

4. Ignition Time

$$\text{Ignition\_Time : } Tign = \frac{Cign \times Vign}{Iign}$$

Cign : Pin1 Capacitor
Vign : Constant Voltage (Internally fixed)
Iign : Constant current (Internally fixed)

$$\text{Ignition\_Time : } Tign = 0.182 \times 10^{3} \times Cign$$

Example) Cign=47nF

$$\therefore Tign = 0.182 \times 10^{6} \times 47 \times 10^{-9} = 8.5ms$$

Fig4. TEST CIRCUIT

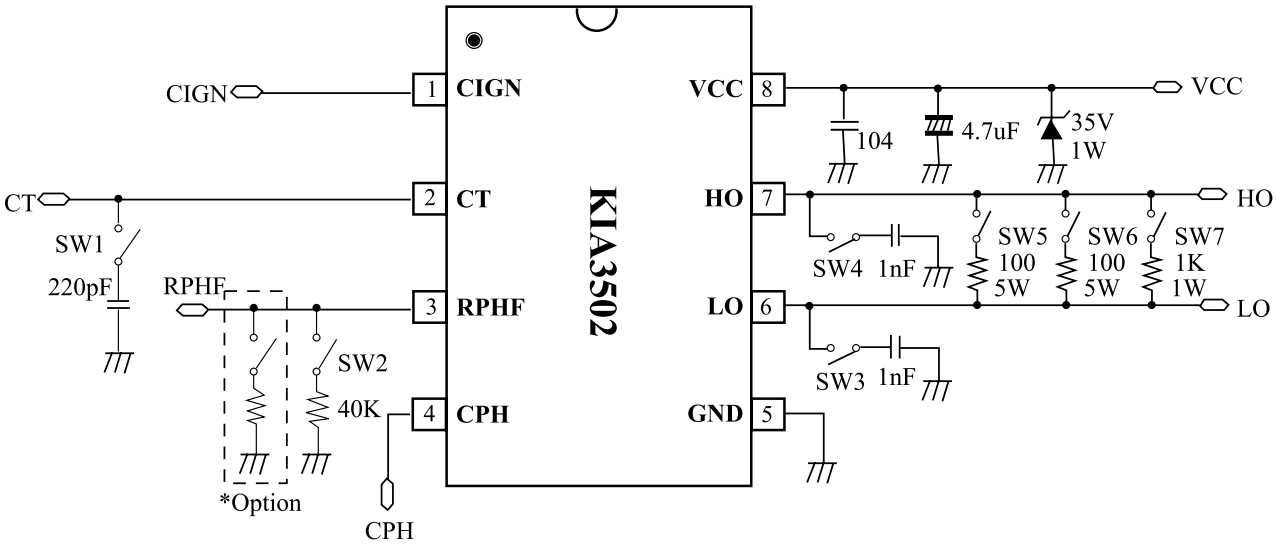
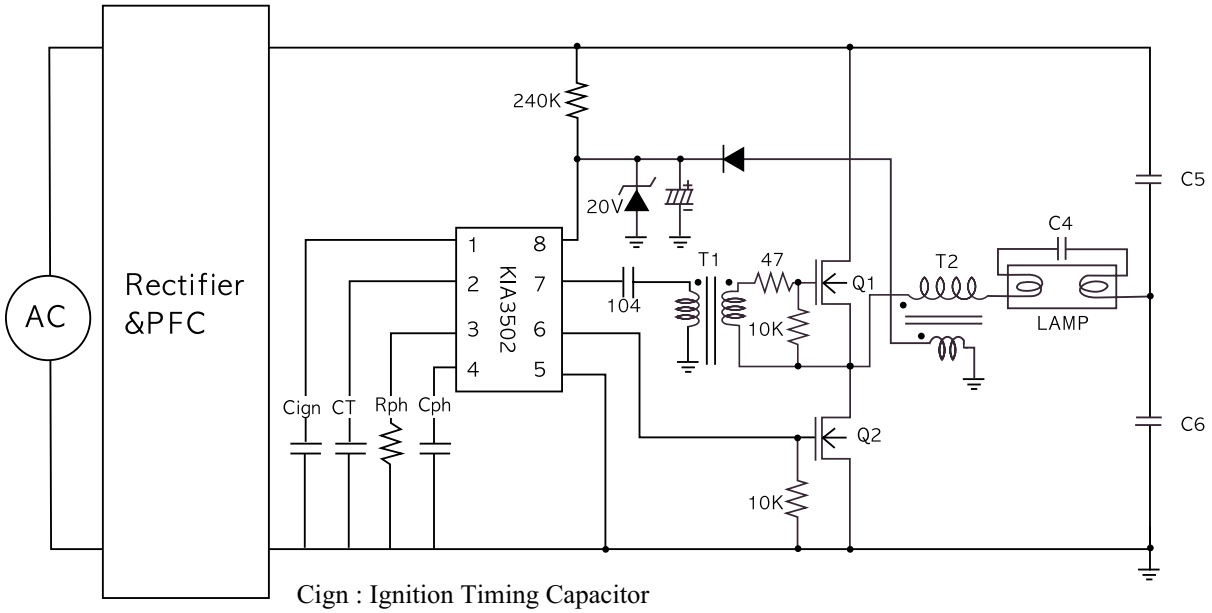
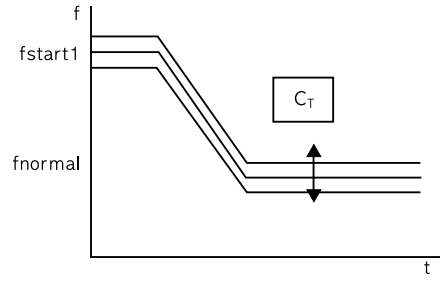
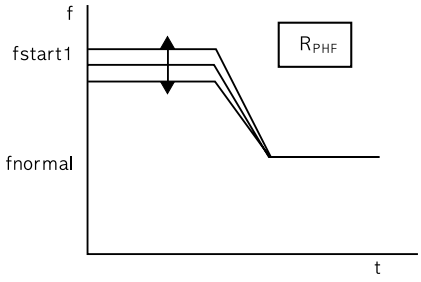


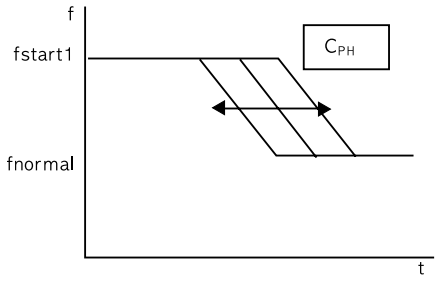
Fig5. TYPICAL APPLICATION CIRCUIT



Cign : Ignition Timing Capacitor
CT : Oscillator timing Capacitor
Rph : Pre-heating timing Resistor
Cph : pre-heating timing Capacitor







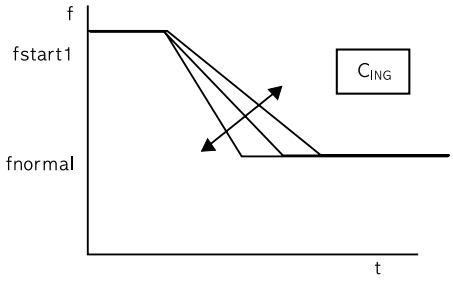


Fig6. V_{CC} - I_{CC}

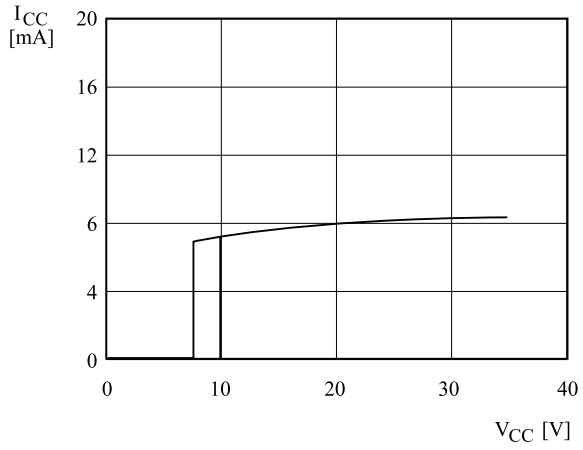


Fig7. STAND-BY CURRENT

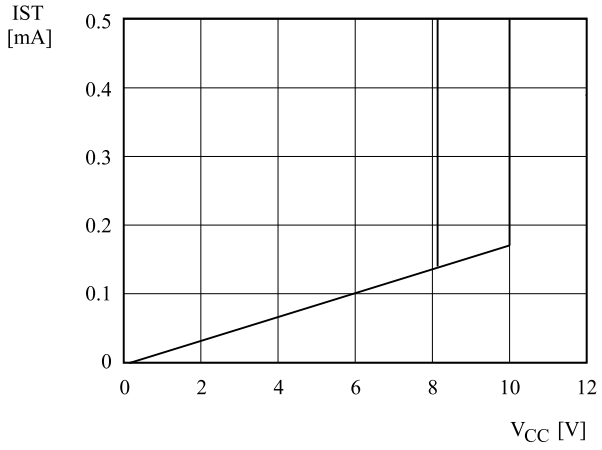


Fig8. V_{CC} - FOP1,2

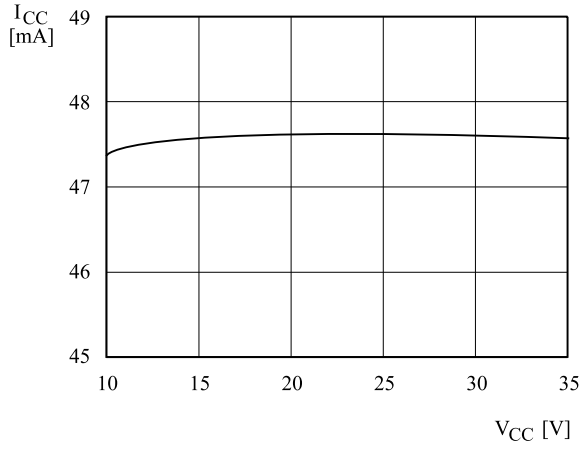


Fig9. V_{CC} - FPHT1,2

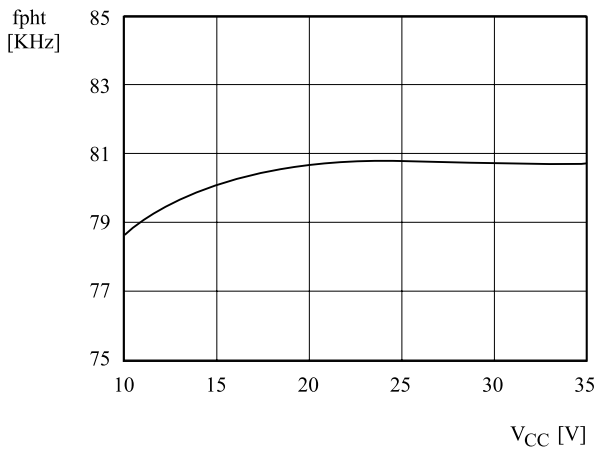


Fig10. TEMP - FOP1,2

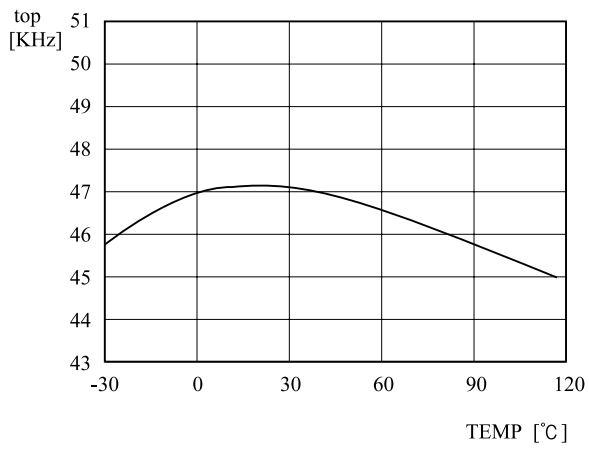


Fig11. TEMP - FPHT1,2