CM6561A

No Bleed Resistor 8-PIN Transition Mode (Critical Conduction Mode) SINGLE PFC CONTROLLER with Green Mode Function

GENERAL DESCRIPTION

The CM6561A is pin to pin compatible with L6561 and L6562. There are several important improvements:

1. IAC (pin 3), Multiplier input pin, Current input instead of Voltage input; it will enhance input current THD and the system will be less sensitive the noise. The system can reduce one resistor between ground and IAC, multiplier input pin.
2. IAC (pin 3), Multiplier input pin: During the start up condition (the VCC is less than UVLO, 15V), IAC is connected to VCC, and the RAC resistor (between VIN and IAC pin) serves as a bleed resistor. Once the VCC is greater than UVLO, then RAC resistor provides the sine wave current from VIN to IAC pin. After VCC is greater than UVLO, the voltage of the IAC pin is around 1.4V. Therefore, the RAC resistor can be served as a bleed resistor. Usually, the value of the RAC is from 800K to 5Meg ohm.
3. IAC (pin 3), Multiplier input pin: During the start up, if the system turn-on time needs to be fast, an external high voltage bipolar and a diode can be added for VCC during the start-up, once VCC is greater than UVLO, 15V, IAC pin will go low and turn off the high voltage bipolar.
4. For the fast load transient and line transient, a slew rate enhancement error amplifier has been implemented between the output pin VEAO and the input pin, VFB to replace the conventional OP. Since transconductance amplifier does not need the local feed back (OP needs the local feedback); therefore, its VFB can fast and accurately sense OVP condition not like traditional OP, operational amplifier can not sense VFB for OVP.
5. Tri-Fault Detect Comparator on VFB pin for easy passing the single fault protection test of the UL1950 regulation.

The CM6561A is an 8-pin power factor corrector. It has a superior performance multiplier making the device capable of working in universal input voltage range applications with an excellent THD. The startup current has been reduced at few tens of mA and a disable function has been implemented on the ZCD pin, guaranteeing lower current consumption in stand by mode.

The totem pole output stage is capable of driving a power MOS or IGBT with +500mA source and -1A sink currents. The device is operating in transition mode and it is optimized for Electronic Lamp Ballast application, AC-DC adaptors and SMPS.

FEATURES

- Patent Filed #5,565,761, #5,747,977, #5,742,151, #5,804,950, #5,798,635
- Current input multiplier, IAC (Patented)
- No bleed resistor during the start up (Patented)
- Can ON-OFF high voltage bipolar during the system start up (Patented)
- Precision output over voltage protection comparator with 2.75V threshold which is 10% increased from 2.5V.
- Slew Rated Enhanced GM for Fast line and load transient response (Patented)
- Tri-Fault Detect Comparator for UL1950 (Patented)
- Green Mode PFC for light load pulse skipping (Patented)
- VCCOVP with threshold 18V and 16.5V
- Micro power start-up current (30uA Typ.)
- Very low operating supply current (1.5mA Typ.)
- Internal start up timer
- Current sense filter on chip
- Disable function
- 1% precision (@Tj = 25℃) internal reference voltage
- Transition mode operation (Critical Conduction Mode)
- Totem pole driver output current: +500mA sourcing current and -1A sink current
- 8-Pin DIP/SOIC packages
- Two suppliers: Champion and FairChild

24 Hours Technical Support---WebSIM

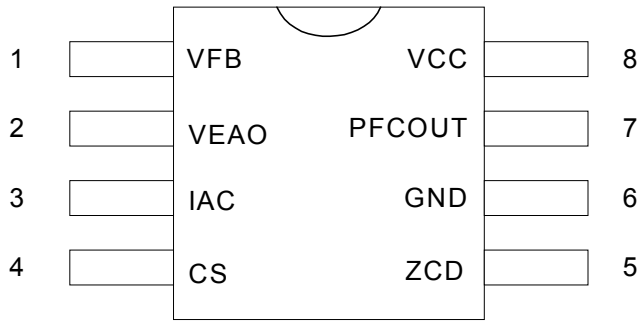
Champion provides customers an online circuit simulation tool called WebSIM. You could simply logon our website at www.champion-micro.com for details.

APPLICATIONS

- Desktop PC Power Supply
- AC Adaptor
- Internet Server Power Supply
- IPC Power Supply
- UPS
- Battery Charger
- DC Motor Power Supply
- Monitor Power Supply
- Telecom System Power Supply
- Distributed Power

PIN CONFIGURATION

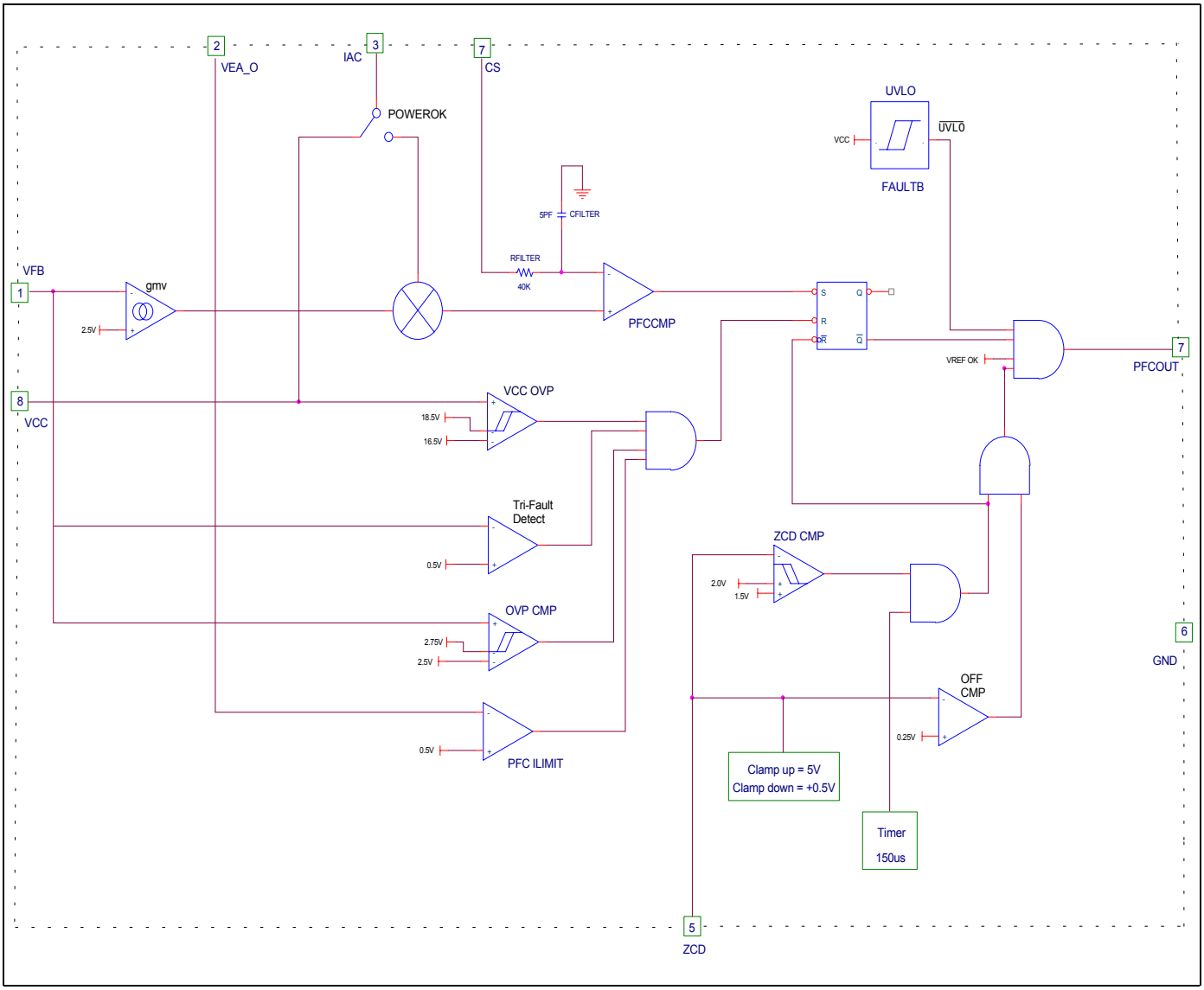
DIP-08 (P08)/SOP-08 (S08)
Top View



PIN DESCRIPTION

Pin No.	Symbol	Description	Operating Voltage			
			Min.	Typ.	Max.	Unit
1	V_{FB}	PFC transconductance voltage error amplifier input; PFCOVP Comparator input; Tri-Fault Detect Comparator input	0	2.5	3	V
2	VEAO	PFC transconductance voltage error amplifier output; Low Power Detect Comparator input	0		6	V
3	IAC	During Normal Operation: Multiplier input, it provides the information of line input voltage. It only needs one resistor (RAC) connected between line input and IAC pin. The value of RAC typically is between 800k ohm	0		1	V
3	IAC	During the System Start up: RAC serves as a bleed resistor for VCC pin	0		VCC+1V	V
4	CS	Input to the PFCCMP, current sense comparator of the PFC control loop. The Power MOSFET current is sensed by a resistor and the resulting voltage is applied to this pin and the signal will be filtered by an 800 KHz low pass filter before going to the PFCCMP, current sense comparator.	0		2	V
5	ZCD	Zero current detection input. If it is connected to GND, the device is disabled; Off Comparator input	0		5	V
6	GND	Ground				
7	PFCOUT	PFC driver output; It can drive Power MOSFET and IGBT with +500mA source current and -1A sink current	0		VCC	V
8	VCC	Supply voltage of driver and control circuits; VCCOVP Comparator input	0		20	V

BLOCK DIAGRAM



ORDERING INFORMATION

Part Number	Temperature Range	Package
CM6561AIP	-40℃ to 125℃	8-Pin PDIIP (P08)
CM6561AIS	-40℃ to 125℃	8-Pin SOP (S08)

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum ratings are those values beyond which the device could be permanently damaged.

Parameter	Min.	Max.	Units
V_{CC} MAX		20	V
IAC (after start up)	GND-0.3	1.0	V
PFC OUT	GND – 0.3	VCC + 0.3	V
VEAO	GND-0.3	6.3	V
Voltage on Any Other Pin	GND – 0.3	8	V
I_{CC} Current (Average)		40	mA
Current Sense Input (CS)	-0.3	6	V
Zero Current Detector (Source)		10	mA
Zero Current Detector (Sink)		-5	mA
Junction Temperature	-40	150	℃
Storage Temperature Range	-65	150	℃
Operating Temperature Range	-40	125	℃
Lead Temperature (Soldering, 10 sec)		260	℃
Thermal Resistance (θ_{JA}) PDIP-08 SOP-08		 80 150	℃/W

ELECTRICAL CHARACTERISTICS unless otherwise stated, these specifications apply Vcc=+15V, T_A=Operating Temperature Range (Note 1)

Symbol	Parameter	Test Conditions	CM6561A			Unit
			Min.	Typ.	Max.	
Supply Voltage Section (VCC)						
	Operating Range	After turn on	10		20	V
	Turn-on Threshold		14.7	15	15.3	V
	Hysteresis		4.9	5	5.1	V
Supply Current Section (VCC)						
	Start-up Current	Before turn-on (V_{CC}=14V)	20	30	50	μA
	Quiescent Current	V_{PIN5}=>150mV, V_{CC}>V_{CCOFF}		1.5	3	mA
		V_{PIN5}<=150mV, V_{CC}>V_{CCOFF}		1.0	2.0	mA
		V_{PIN5}<=150mV, V_{CC}<V_{CCOFF}	20	30	50	μA
	Operating Supply Current	C_L=1nF @ 70KHz		3	4	mA
		In OVP condition V_{PIN1}=2.7V		1	1.5	mA
Voltage Error Amplifier (g_{mv})						
	Input Voltage Range		0		5.7	V
	Transconductance	V_{NONINV} = V_{INV}, VEAO = 3.75V	30	65	90	μmho
	Voltage Feedback Input Threshold	T_A=25℃	2.465	2.5	2.535	V
		11V<V_{CC}<18V	2.44		2.56	V
	Input Bias Current	Note 2	-1.0	-0.5		μA
	Output High Voltage		5.8	6.0		V
	Output Low Voltage			0.1	0.4	V
	Sink Current	V_{FB} = 3V, VEAO = 6V		-35	-20	μA
	Source Current	V_{FB} = 1.5V, VEAO = 1.5V	30	40		μA
	Open Loop Gain		50	60		dB
	Power Supply Rejection Ratio	11V < V_{CC} < 16.5V	50	60		dB

ELECTRICAL CHARACTERISTICS (Conti.) Unless otherwise stated, these specifications apply

Vcc=+15V, T_A=Operating Temperature Range (Note 1)

Symbol	Parameter	Test Conditions	CM6561A			Unit
			Min.	Typ.	Max.	
	Line Regulation	V_{CC} = 12 to 18V		2	5	mV
	Gain Bandwidth	Note 3		1		MHz
Multiplier Section						
	Output Max. Slope; dVmul/dIAC	VEAO=5.7V		10		K ohm
	Maximum Multiplier output, Vmul	VEAO=6V, IAC=150uA	1.65	1.7	1.75	V
Current Sense Comparator (PFCCMP)						
	Current Sense Reference Clamp	VEAO=5.7V	1.65	1.7	1.75	V
	Input Bias Current	VOS = 0		-0.05	-1	µA
	Delay to Output	Note 3		200	400	ns
	Current Sense Offset			0	15	mV
Zero Current Detector						
	Input Threshold Voltage Rising Edge	Note 3		2.0		V
	Hysteresis	Note 3	0.4	0.5	0.6	V
	Upper Clamp Voltage	I_{ZCD}=20µA	4.5	5.1	5.9	V
	Upper Clamp Voltage	I_{ZCD}=3mA	4.7	5.2	6.1	V
	Lower Clamp Voltage	I_{ZCD}=3mA	0.3	0.65	1	V
	Sink Bias Current	1V<=V_{ZCD}<=4.5V		2		µA
	Source Current Capability		1	1.5		mA
	Sink Current Capability			-1.5	-1	mA
	Disable Threshold		220	250	285	MV
	Restart Current After Disable	V_{ZCD}<V_{dis}; V_{CC}>V_{CCOFF}	-100	-200	-300	µA
Output Section						
	Output Low Rdson	Iout=-20mA at room temp		15	30	ohm
		Iout=-100mA at room temp		15	30	ohm
		Iout=10mA, Vcc=9V at room temp		0.4	0.8	V
	Output High Rdson	Iout=20mA at room temp		30	45	ohm
		Iout=100mA at room temp		30	45	ohm
	Output Voltage Rise Time	C_L=1nF; Note 3		50		ns
	Output Voltage Fall Time	C_L=1nF; Note 3		40		ns

ELECTRICAL CHARACTERISTICS (Conti.) Unless otherwise stated, these specifications apply

Vcc=+14.5V, T_A=Operating Temperature Range (Note 1)

Symbol	Parameter	Test Conditions	CM6561A			Unit
			Min.	Typ.	Max.	
VCC OVP Comparator						
	Threshold Voltage	Sweep VCC	17.4	17.9	18.4	V
	Hysteresis		1.4	1.5	1.65	V
PFC OVP Comparator						
	Threshold Voltage	Sweep VFB	2.70	2.77	2.85	V
	Hysteresis		230		290	mV
Tri-Fault Detect Comparator						
	Fault Detect High	Sweep VFB	2.70	2.77	2.85	V
	Time to Fault Detect High	VFB=Vfault detect low to VFB=OPEN		2	4	mS
	Fault Detect Low	**Sweep VFB**	**0.4**	**0.5**	**0.6**	**V**
Restart Timer						
	Start Timer	Note 3		150		μs

Note 1: Limits are guaranteed by 100% testing, sampling, or correlation with worst-case test conditions.

Note 2: Includes all bias currents to other circuits connected to the V_{FB} pin.

Note 3: Guaranteed by design, not 100% production test.

FUNCTIONAL DESCRIPTION

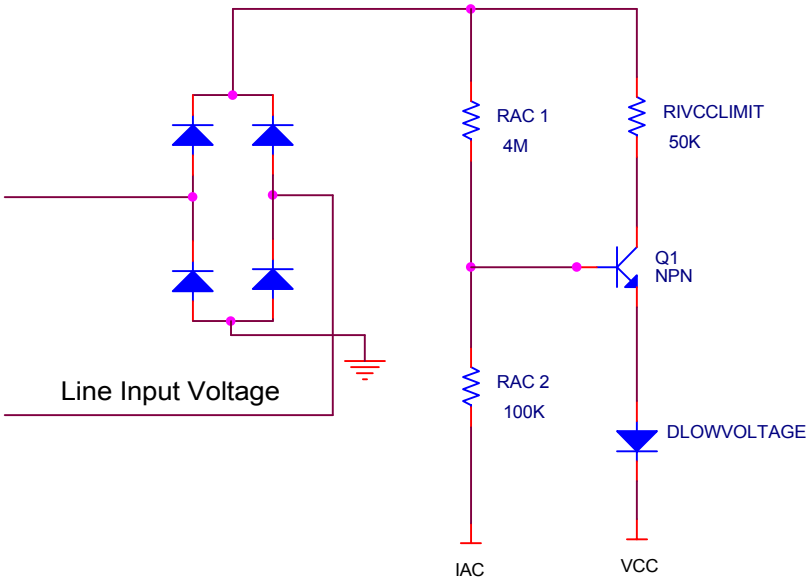
IAC PIN 3:

IAC PIN serves several functions:

During the system Start-Up, IAC pin is connected to VCC; therefore, the external RAC which is between IAC and line input voltage can be served as a Start-Up resistor (bleed resistor). Once VCC is greater than UVLO, 15V, IAC pin will be connected to the multiplier input which is a current mirror and IAC voltage is about 1.4V.
Usually, the value of the RAC is between 800 Kohm to 5 Mohm. For an 800 Kohm RAC, VCC bypass capacitor is 10uF and VIN=80VAC, the start-up time is about 2.2 second.

Green Mode with Fast Start Up with high voltage bipolar and low voltage diode.

The following circuit can be used for the Fast Start Up, if the on time needs to be less than 100mS and Green Mode Performance is needed.



After VCC is greater than UVLO, IAC is connected to the input of the current mirror which is also the input of the multiplier. This current input multiplier is less sensitive to the noise since it is sensing current instead of the voltage. Not like the conventional voltage input multiplier which senses the voltage and it requires a two resistor network to sense the line input voltage information.

VFB (PIN 1)

VFB PIN 1 also serves several functions:

1. Slew Rate Enhancement Transconductance Amplifier to speed up the load transient and the line transient.
2. VFB PIN 1 is the inverting input of the Slew Rate Enhancement Transconductance Amp, GM. Due to its unique GM shape, during the balance condition, its GM value is the lowest value and during the imbalance condition, it GM value increases. When the system is in the steady state, GM value is low, the system compensation resistor and capacitor can be used a small value to achieve the 30Hz voltage loop unity bandwidth. When the system is in the transient, the GM value increases and the system bandwidth increase as well.
3. Fast and Precision PFC Over Voltage Protection
4. CM6561A is implemented with the Slew Rate Enhancement GM; therefore, it does not require a local feed back (Which is a must item for the Conventional Operational Amplifier.) Its compensation network is connected between VEAO and GROUND and there is not feedback compensation network between VEAO and VFB.
5. Since there is no local feedback between VEAO and VFB, the VFB node can sense the PFC output voltage without any delay; not like the conventional operational amplifier (It has 100mS time constant. This may stress the 380V PFC output capacitor.) CM6561A's PFCOVP use the VFB pin to sense the PFC over voltage condition without any delay.
6. Comply with UL1950, single fault protection without any additional external circuit. At VFB pin 1, CM6561A has been implemented with the tri-fault protection circuit to ensure the system power supply can comply with the UL1950.

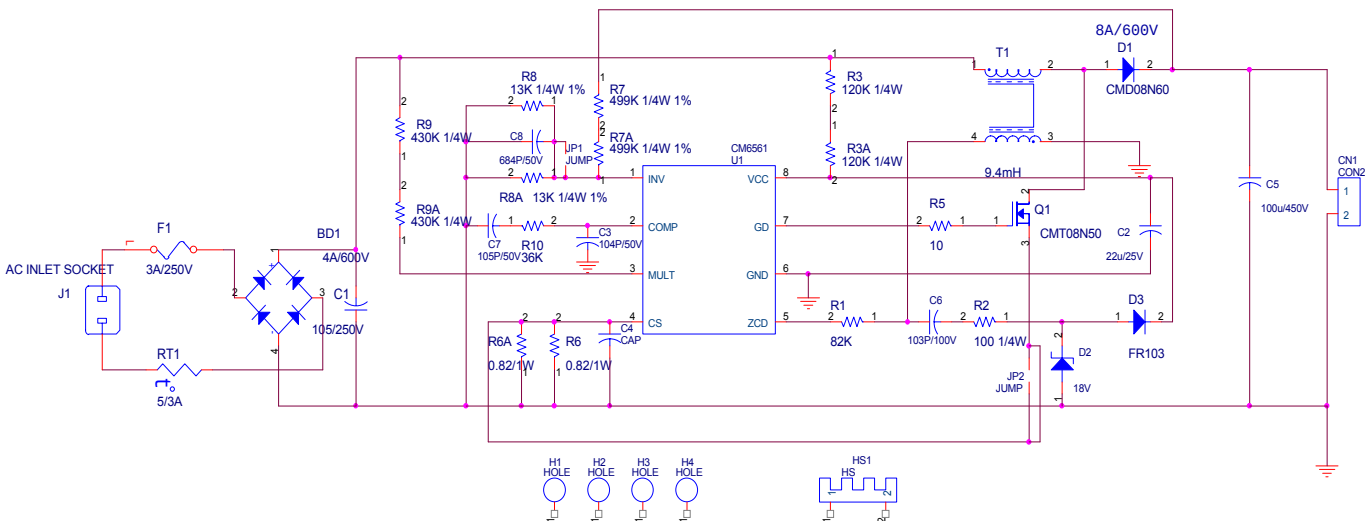
VEAO (PIN 2)

VEAO is the output pin of the slew rate enhancement GM. It can be used as the conventional OP but we not suggest because it will dramatically slow down the system speed. For the proper usage of the VEAO, the compensation network should be connected between VEAO and GROUND.

VEAO pin also is the input pin of the low-power-detect comparator. When VEAO potential goes low, it means the power supply system needs less power. When VEAO is less than 0.5V, the low-power-detect comparator will trigger the GREEN MODE function of the CM6561A.

The other pins are similar as L6561 and L6562.

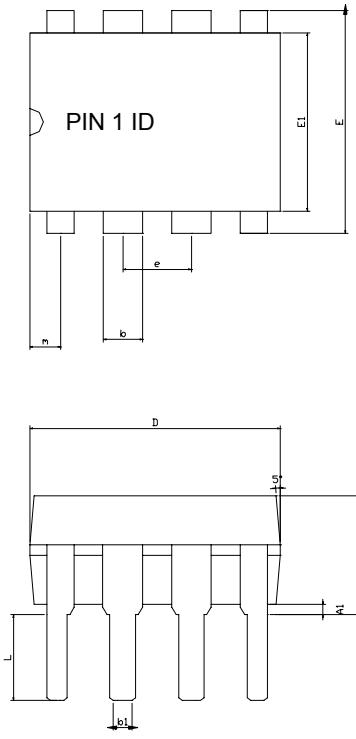
APPLICATION CIRCUIT (CM6561A)



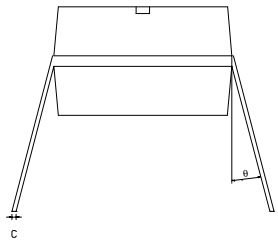
Use VEAO as GM

PACKAGE DIMENSION

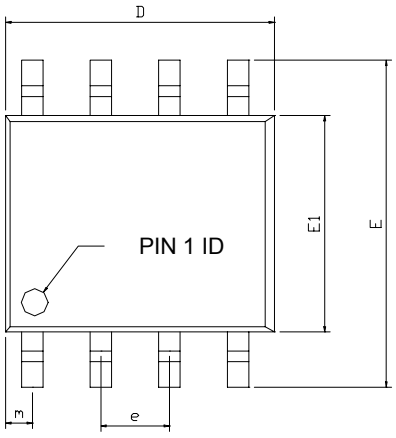
8-PIN PDIP (P08)



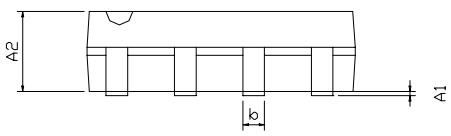
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	4.32	---	---	0.170
A1	0.38	---	---	0.015	---	---
b	1.40	---	1.65	0.055	---	0.065
b1	0.40	---	0.56	0.016	---	0.022
C	0.20	---	0.31	0.008	---	0.012
D	9.27	---	9.77	0.365	---	0.385
E	7.49	---	8.26	0.295	---	0.325
E1	6.09	---	6.61	0.240	---	0.260
e	---	2.54	---	---	0.100	---
L	3.18	---	---	0.125	---	---
m	0.50	---	---	0.02	---	---
θ	0	---	15	0	---	15

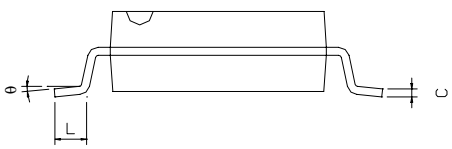


8-Pin SOP (S08)



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHS		
	MIN	NOM	MAX	MIN	NOM	MAX
A1	0.10	---	0.25	0.004	---	0.010
A2	1.40	---	1.55	0.055	---	0.061
b	0.30	---	0.51	0.012	---	0.020
C	0.15	---	0.26	0.006	---	0.010
D	4.60	---	5.06	0.169	---	0.199
E	5.79	---	6.20	0.228	---	0.244
E1	3.76	---	4.01	0.148	---	0.158
e	---	1.27	---	---	0.050	---
L	0.38	---	0.69	0.015	---	0.035
m	0.43	---	0.69	0.017	---	0.027
θ	0°	---	8°	0°	---	8°





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