

Off-Line Linear LED Driver

FEATURES

- Constant Current Regulator
- Wide Range, Programmable LED Voltage
- Current Operation: 50mA ~ 100mA
- Can be Paralleled for Higher Current
- 5V to 500V Supply Voltage Range
- High Efficiency
- Stable LED Brightness
- Over Temperature Protection
- SOP-8 Exposed pad Package & TO252-5 Package
- Patent Pending Drive Architecture

APPLICATIONS

- LED Lamps (e.g. E27, GU10)
- General Illumination
- LED Strings (e.g. T-8 Tube)
- Constant Current Sink

DESCRIPTION

The AIC6609 is an off-line linear LED driver. The application of high bright LED is widely used for general illumination.

The AIC6609 can drive LEDs with a constant current of 50mA ~ 100mA. Multiple AIC6609 can also be used in parallel to provide higher currents.

The AIC6609 is available in a SOP-8 Exposed Pad Package and TO-252-5 Package.

TYPICAL APPLICATION CIRCUIT

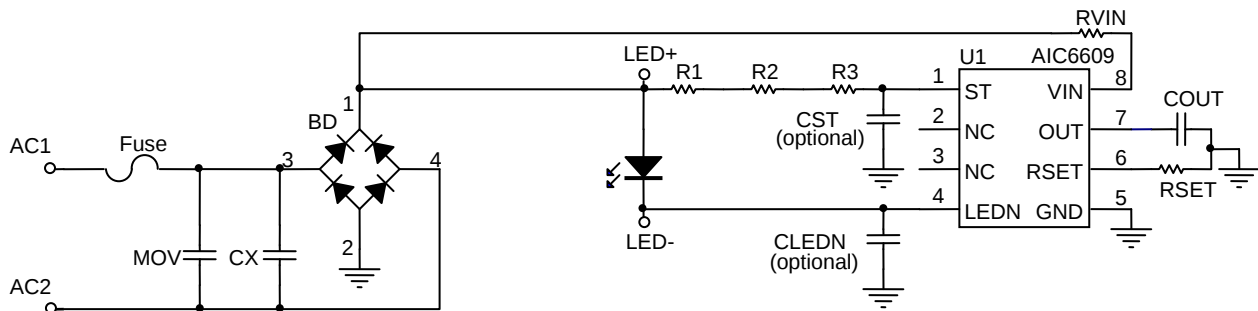


Fig.1. Typical Application Circuit for SOP-8

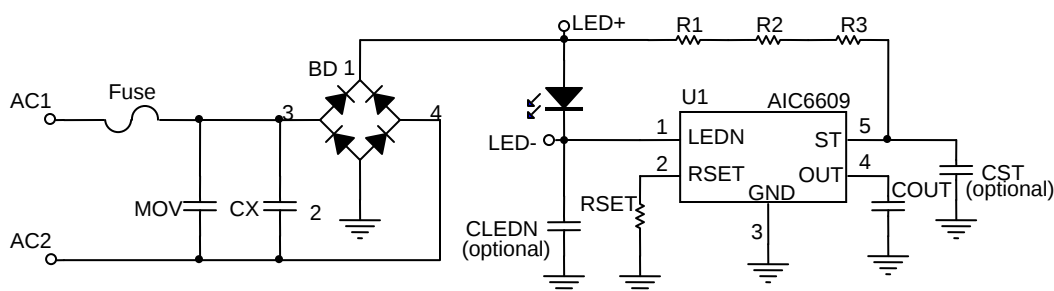
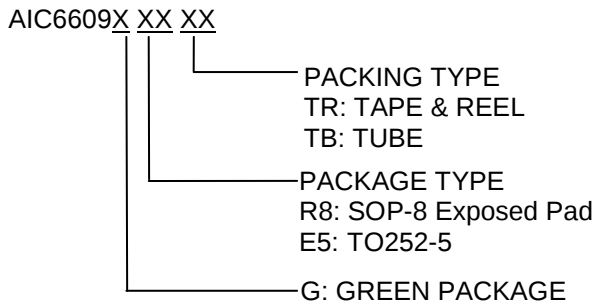


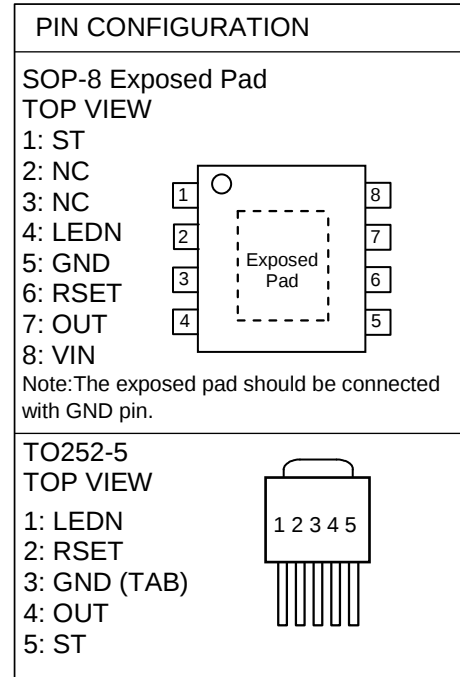
Fig.2. Typical Application Circuit for TO252-5

■ ORDERING INFORMATION



Example: AIC6609GR8TR

→ in SOP-8 Expose Pad Green Package and TAPE & REEL Packing Type.



■ ABSOLUTE MAXIMUM RATINGS

VIN Pin Voltage	550V
LEDN Pin Voltage	550V
ST Pin Voltage	30V
OUT Pin Voltage	6V
RSET Pin Voltage	6V
Operating Ambient Temperature Range T_A	-40°C~85°C
Operating Maximum Junction Temperature T_J	150°C
Storage Temperature Range T_{STG}	-65°C~150°C
Lead Temperature (Soldering 10 Sec.)	260°C
Thermal Resistance Junction to Case	
SOP-8 Exposed Pad*	15°C /W
TO252-5	8°C /W
Thermal Resistance Junction to Ambient	
SOP-8 Exposed Pad*	60°C /W
TO252-5	100°C /W

(Assume no Ambient Airflow)

Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

*The package is place on a two layers PCB with 2 ounces copper and 2 square inch, connected by 8 vias.

■ ELECTRICAL CHARACTERISTICS

(T_J=25°C, unless otherwise specified) (Note 1)

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage Section						
V _{IN} Operation Voltage		V _{IN}	5		500	V
Quiescent Current	V _{IN} =310V	I _{VIN}		350		μA
Output LED Current (Note 2)						
LED Current Range	I _{LEDN}		50		100	mA
LED Current Tolerance	I _{LEDN}		-5		+5	%
Output Voltage Regulator Section						
Regulation Voltage	V _{IN} =230V	V _{OUT}	4.5	5	5.5	V
Voltage Tolerance	I _{OUT} =0mA		-10		+10	%
Setting LED Current Section						
RSET Voltage	RSET=37.5KΩ	V _{RSET}		0.5		V
RSET Short	RSET=0Ω	I _{S3}	110			mA
RSET Open	RSET=∞Ω		0		1	mA
Over Temperature Protection						
Action Junction Temperature				140		℃

Note 1: Specifications are production tested at T_A=25°C. Specifications over the -40°C to 85°C operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls (SQC).

Note 2: Output LED Current = peak to peak.

■ TYPICAL PERFORMANCE CHARACTERISTICS

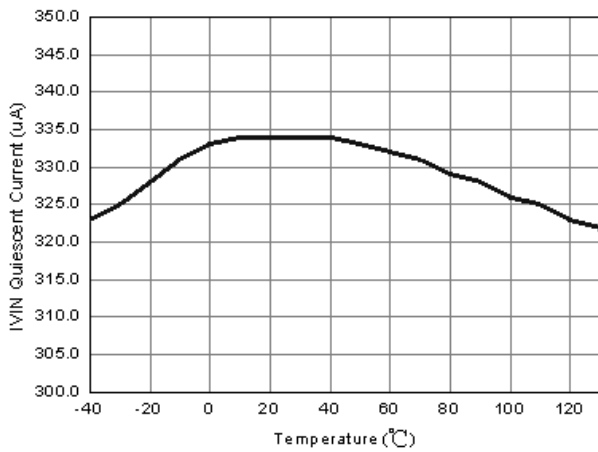


Fig.3 Quiescent Current

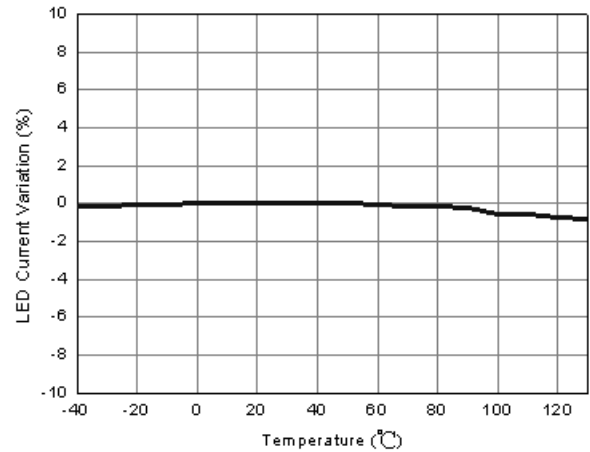


Fig.4 LED current vs. Temperature

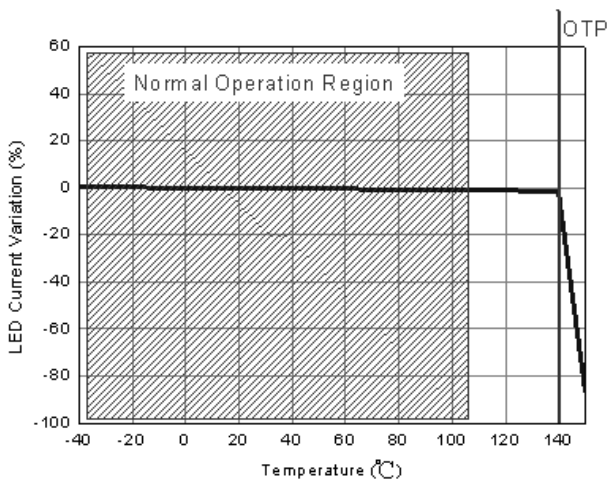
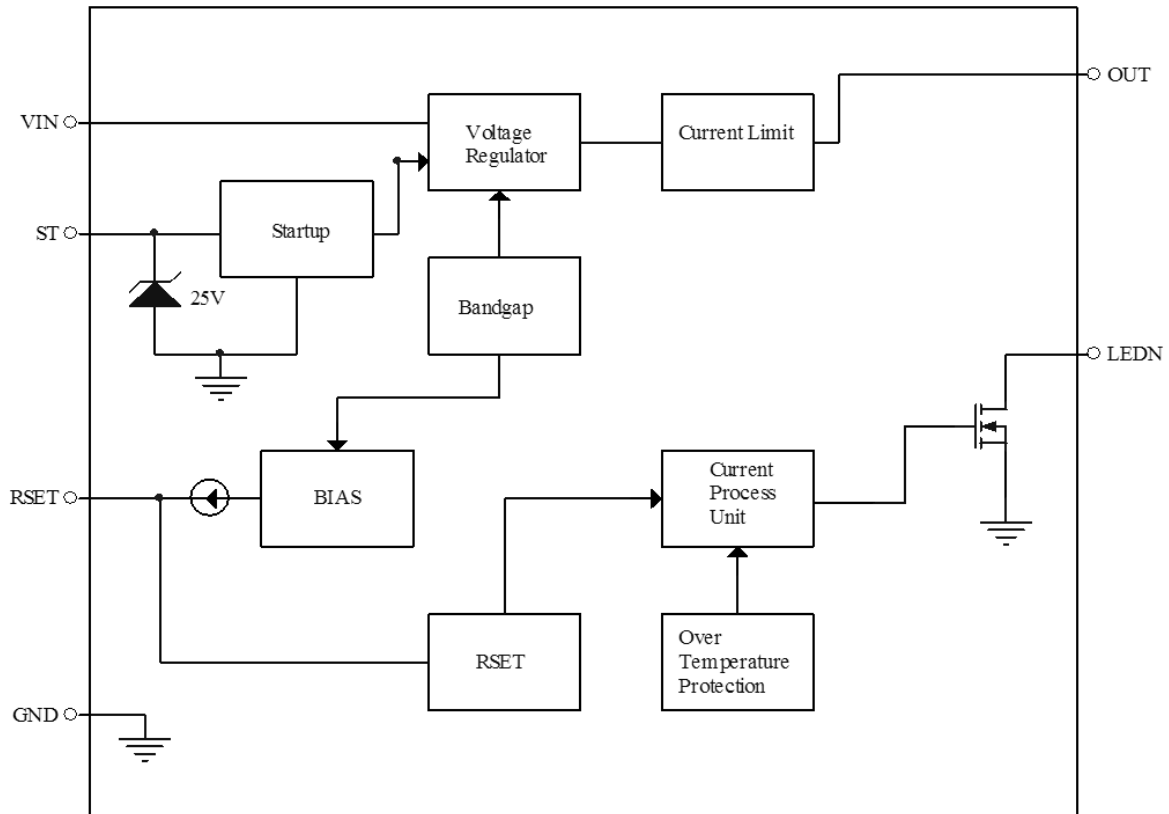


Fig.5 Over Temperature Protection

■ BLOCK DIAGRAM



Functional Block Diagram of AIC6609

■ PIN DESCRIPTION

- ST PIN -Provide the Startup Current for the Controller.
- VIN PIN -Power Supply Input. (For SOP-8 Package)
- LEDN PIN -LED N Cathode Connection.
- RSET PIN -Set output peak current.
- OUT PIN -Connecting an Output Capacitor to Provide a Stable Voltage for the Internal Circuit.
- GND PIN -Ground.

■ APPLICATION INFORMATION

The AIC6609 is off-line constant current LED driver. It can drive LEDs with a constant current of 50mA ~ 100mA. Multiple AIC6609 can also be used in parallel to provide higher LED current.

SOFT START

The AIC6609 has soft start function to reduce the inrush current during the start-up period. According to the different AC input voltage, the Table 01 provides the commanded component value for soft start resistor R_{ST} ($R_1 \sim R_3$).

Table 01

Input Voltage	Estimated R_{ST} Resistor Value
AC110V	12.2M Ω
AC120V	13.7M Ω
AC220V	22.4M Ω
AC240V	27.5M Ω

OUTPUT CAPACITOR & INPUT RESISTOR

By connecting an output capacitor to the OUT pin and an input resistor to the VIN pin, a stable voltage can be provided for the internal circuit of AIC6609. A 1uF~10uF output ceramic capacitor is commanded for most AIC6609 applications. When choosing the output ceramic capacitor, X5R and X7R types are recommended because they retain their capacitance over wider ranges of voltage and temperature than other types. In addition, the input resistance of R_{VIN} must be larger than 33k Ω . When choosing the SMD input resistor, the SMD input resistor size must be bigger than 0805 size.

SETTING OUTPUT LED PEAK CURRENT

The output LED peak current of AIC6609 can be set by the external resistor R_{SET} . The relationship between $I_{OUT-PEAK}$ and R_{SET} is

$$R_{SET} = 3150/I_{OUT-PEAK}$$

THERMAL REGULATION

The AIC6609 includes the thermal-regulation circuit, which are designed to protect the device from excessive temperature. The internal thermal-regulation circuit adjusts the LED current if the junction temperature rises above the preset value of about 140°C.

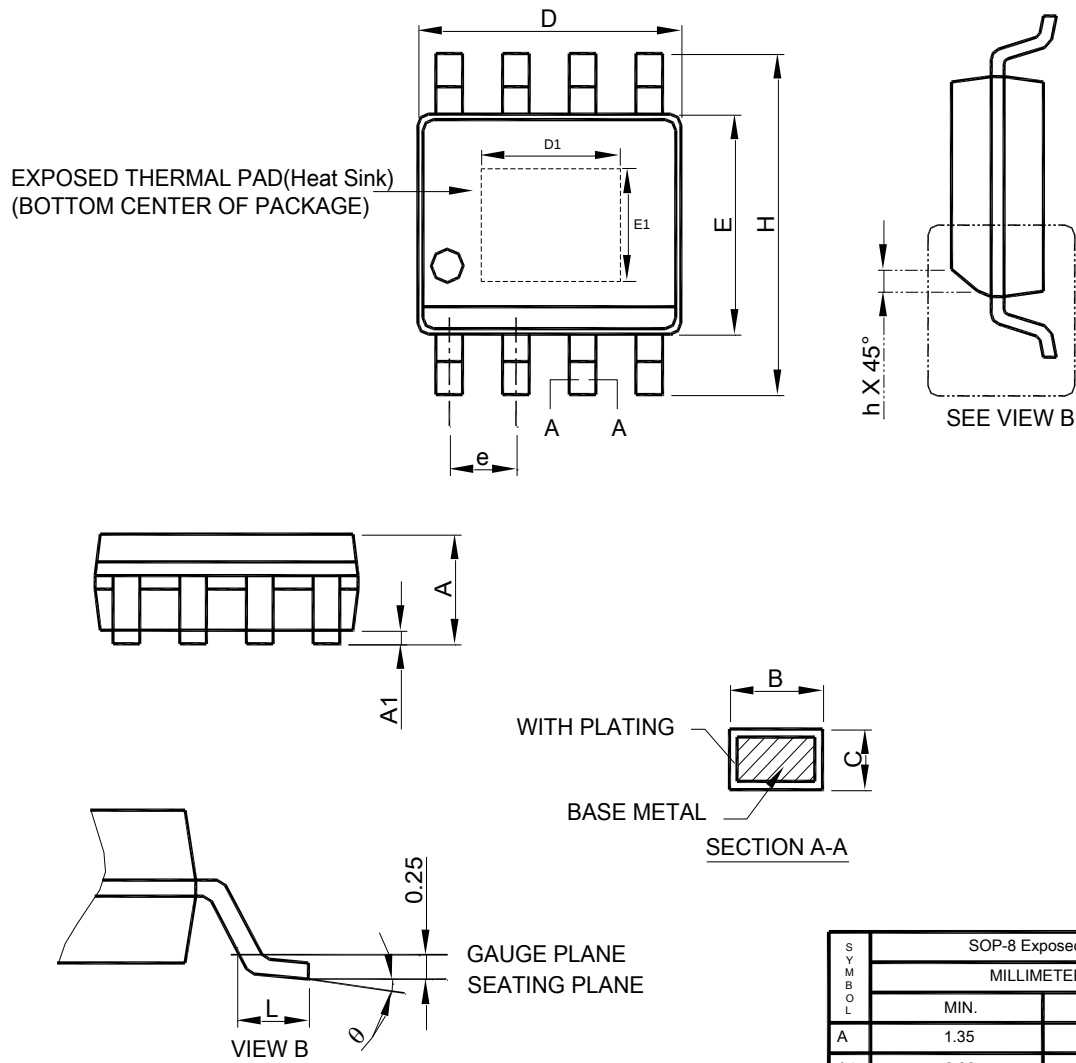
POWER DISSIPATION

The maximum power dissipation of AIC6609 depends on the thermal resistance of its case and circuit board, the temperature difference between the die junction and ambient air, and the rate of airflow. The rate of temperature rise is greatly affected by the mounting pad configuration on the PCB, the board material, and the ambient temperature. When the IC mounting with good thermal conductivity is used, the junction temperature will be low even when large power dissipation applies.

As a general rule, the lower temperature is, the better reliability of the device is. So the PCB mounting pad should provide maximum thermal conductivity to maintain low device temperature.

■ PHYSICAL DIMENSIONS

● SOP-8 Exposed Pad

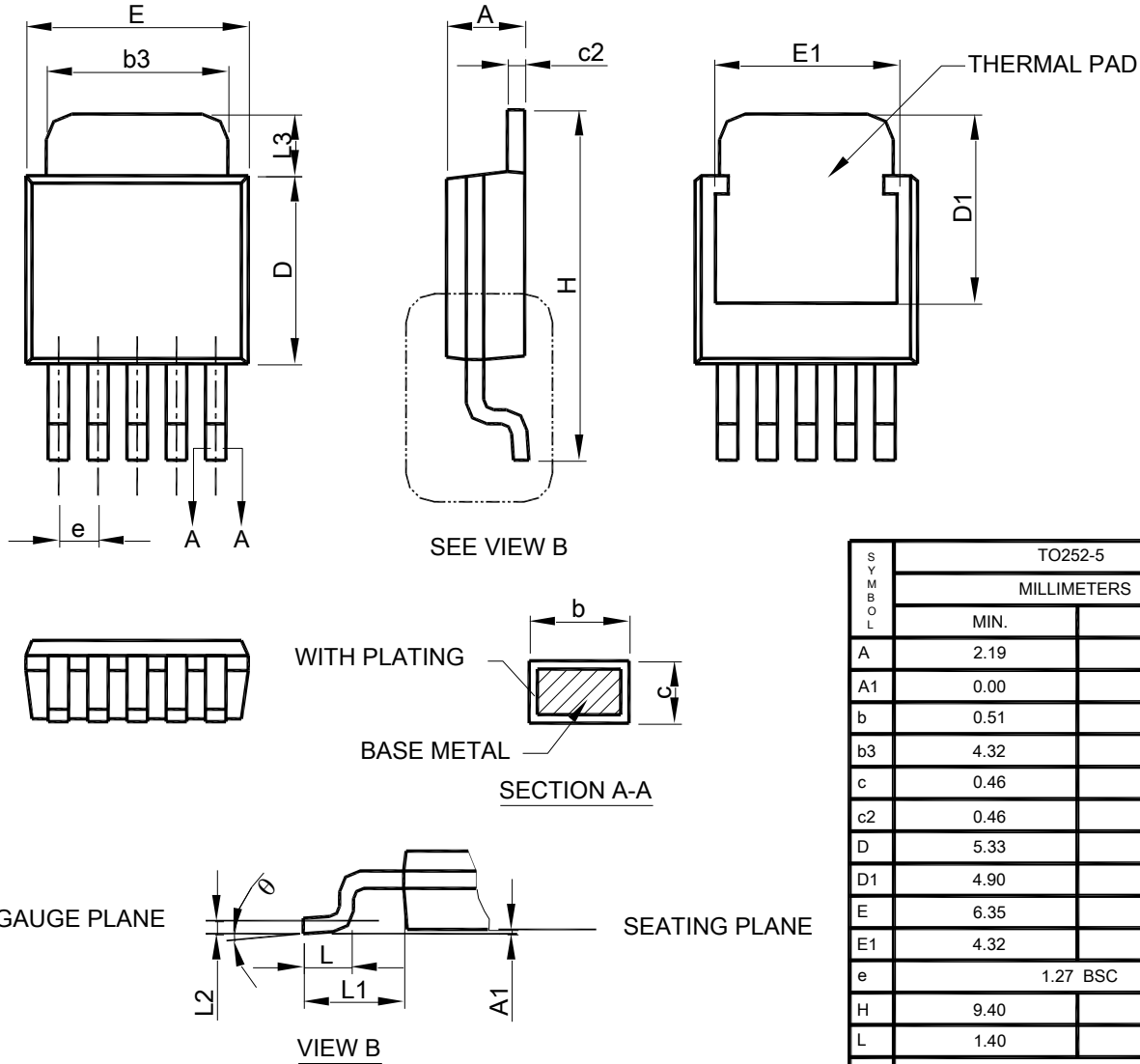


Note : 1. Refer to JEDEC MS-012E.

2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side .
3. Dimension "E" does not include inter-lead flash or protrusions.
4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

SYMBOL	SOP-8 Exposed Pad	
	MILLIMETERS	
	MIN.	MAX.
A	1.35	1.75
A1	0.00	0.15
B	0.31	0.51
C	0.17	0.25
D	4.80	5.00
D1	1.50	3.50
E	3.80	4.00
E1	1.0	2.55
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.27
θ	0°	8°

● **TO252-5**



- Note: 1. Refer to JEDEC TO-252AD and AB.
2. Dimension "E" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side .
3. Dimension "D" does not include inter-lead flash or protrusions.
4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

Note:

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