iT6801

SELF-OSCILLATING HALF-BRIDGE DRIVER

1. Description

iT6801 is a half-bridge driver with programmable oscillator within a SOP-8L package to drive both lower MOSFET and floating upper MOSFET. It is suitable for electronic ballast of fluorescent lamp. It is equipped with internal clamp of 17.2 V zener diode, so the V_{CC} voltage is easily regulated. For proper operation assurance and low power start-up, it is designed with internal under voltage lockout (UVLO), so it takes little current for supply capacitor voltage to builds up. Oscillator frequency is controlled by the current drawn out from RT, which acts as minimum base frequency. The same current is duplicated internally to double base frequency for preheat.

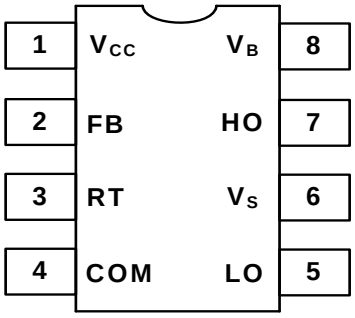
2. Features

- Built in preheat function
- Lamp open or End-Of-Life detection
- Micro power start-up
- Integrated 600 V half-bridge gate driver
- Increased under-voltage lockout Hysteresis
- Lower power level-shifting circuit
- Constant LO, HO pulse widths at startup
- Lower di / dt gate driver for better noise immunity
- Excellent latch immunity on all inputs and outputs

3. Applications

- Electronic Ballast

4. Pin Assignments



SOP-8L

5. Marking Information

Product Name	Marking
iT6801	iT6801 XXXXX X : Date Code

6. Ordering Code

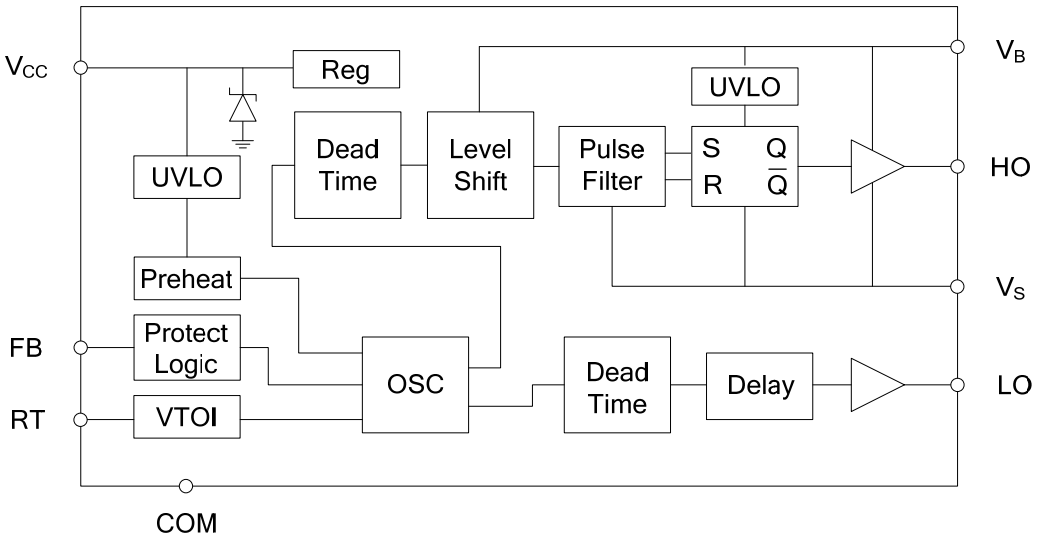
iT6801 □ └── Assembly Material	Assembly Material G: Halogen and Lead Free Device

Note: inergy defines " Green " as lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900 ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500 ppm by weight; Follow IEC 61249-2-21 and IPC / JEDEC J-STD-020C)

7. Pin Definitions

Pin No.	Symbol	Description
1	V_{CC}	Logic and internal gate drive supply voltage
2	FB	Feedback and protection
3	R_T	Oscillator frequency set
4	COM	IC power and signal ground
5	LO	Low side gate driver output
6	V_S	High voltage floating supply return
7	HO	High side gate driver output
8	V_B	High side gate driver floating supply

8. Block Diagram



9. Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits and beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to COM, all currents are defined positive into any lead. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

Symbol	Parameter	Min	Max	Unit
V_B	High side floating supply voltage	- 0.3	625	V
V_S	High side floating supply offset voltage	V_B - 25	V_B + 0.3	
V_{HO}	High side floating output voltage	V_S - 0.3	V_B + 0.3	
V_{LO}	Low side output voltage	- 0.3	V_{CC} + 0.3	
V_{RT}	R_T pin voltage	- 0.3	6	
V_{FB}	FB pin voltage	- 0.3	6	
I_{CC}	Supply current (note 1)	-	15	mA
dV / dt	Allowable offset voltage slew rate	- 50	50	V / ns
P_D	Maximum power dissipation @ $T_A \leqq$ + 25 ℃	-	0.625	W
Rth_{JA}	Thermal resistance, junction to ambient	-	200	℃ / W
T_J	Junction temperature	- 55	150	℃
T_S	Storage temperature	- 55	150	
T_L	Lead temperature (soldering, 10 seconds)	-	300	

Note： This supply pin should not be driven by a DC, which is low impedance power source greater than the V_{CLAMP}.

10. Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{BS}	High side floating supply voltage	V_{CC} - 0.7	V_{CLAMP}	V
V_S	Steady state high side floating supply offset voltage	- 3.0	600	
V_{CC}	Supply voltage	V_{CCUV+} + 0.1 V	V_{CLAMP}	
I_{CC}	Supply current	-	5	mA
T_J	Junction temperature	- 40	125	℃

11. Static Electrical Characteristics

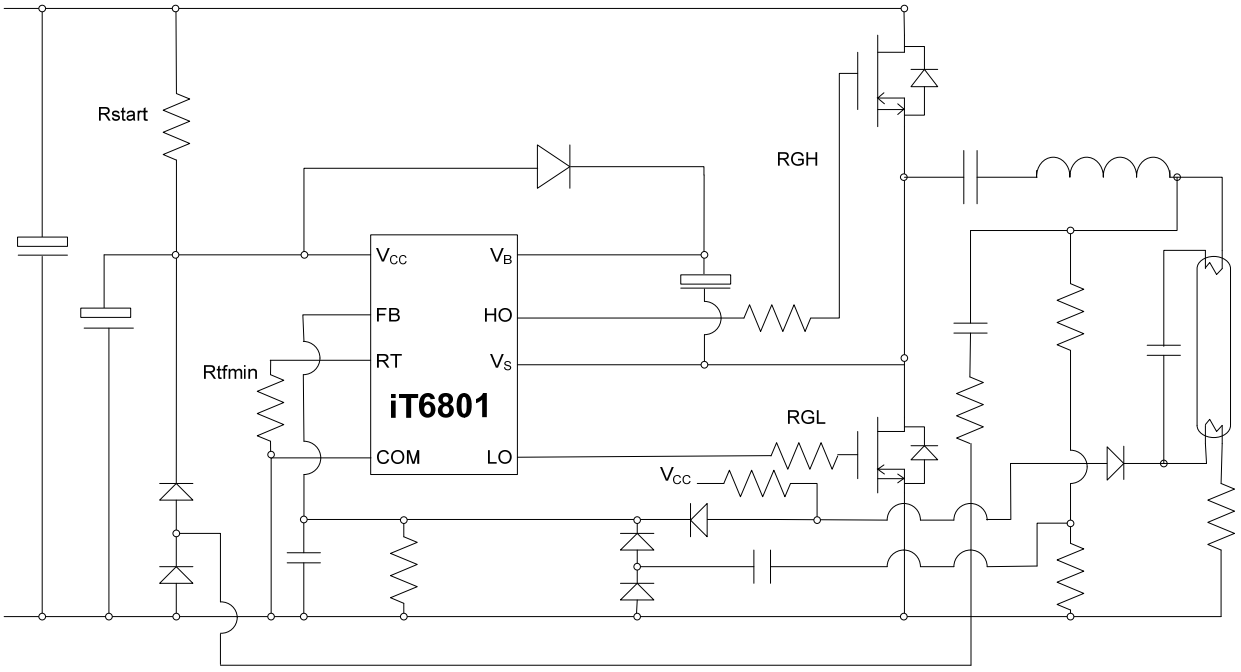
V_{BIAS} (V_{CC}, V_{BS}) = 15 V, R_T = 91K, V_S = 0 V and T_A = 25 ℃ unless otherwise specified. The output voltage and current (V_O and I_O) parameters are referenced to COM and are applicable to the respective output leads : HO or LO.
C_{LO} = C_{HO} = 1 nF.

Symbol	Definition	Min	Typ	Max	Units	Conditions
Low Voltage Supply Characteristics						
V_{CCUV+}	Rising V_{CC} under-voltage lockout threshold	-	11	-	V	
V_{CCUV-}	Falling V_{CC} under-voltage lockout threshold	-	9	-		
$V_{CCUVHYS}$	V_{CC} under-voltage lockout Hysteresis	-	2	-		
I_{QCCUV}	Micro-power startup V_{CC} supply current	-	25	50	μA	$V_{CC} \leqq V_{CCUV-}$
I_{QCC}	Quiescent V_{CC} supply current	-	300	-		$V_{CC} \geqq V_{CCUV+}$
V_{CLAMP}	V_{CC} zener clamp voltage	-	17.2	-	V	I_{CC} = 5 mA
Floating Supply Characteristics						
I_{QBS}	Quiescent V_{BS} supply current	-	20	-	μA	
V_{BSUV+}	V_{BS} supply under-voltage positive going threshold	-	6.5	-	V	
V_{BSUV-}	V_{BS} supply under-voltage negative going threshold	-	5.5	-		
I_{LK}	Offset supply leakage current	-	-	50	μA	V_B = V_S = 600 V
Oscillator I / O Characteristics						
f_{RUN}	Frequency range	30	50	100	kHz	
f_{PRE}	Preheat frequency	1.9	2	2.2	f_{RUN}	
V_{RT}	Bias voltage	1.9	2	2.1	V	
N_{PRE}	Preheat steps	-	64	-	step	
t_{PRE}	Preheat time	-	128 K	-	cycle	
Protection Characteristics						
V_{LOP}	Lamp open protection	-	3.25	-	V	
V_{LOPR}	Lamp open resumption	-	1.0	-	V	
V_{OVP}	Over voltage protection	-	2.5	-	V	
V_{RUNOVP}	Run time over voltage protection	-	1.25	-	V	

11. Static Electrical Characteristics (cont.)

Symbol	Definition	Min	Typ	Max	Units	Conditions
Gate Driver Output Characteristics						
V_{OH}	High-level output voltage, V_{BIAS} - V_O	-	0	100	mV	I_O = 0 A
V_{OL}	Low-level output voltage, V_O	-	0	100		
V_{OLUV}	UV-mode output voltage, V_O	-	0	100		I_O = 0 A , $V_{CC} \leqq V_{CCUV-}$
t_r	Output rise time	-	200	-	ns	V_{CC} = 15 V C_{LO} = C_{HO} = 1 nF
t_f	Output fall time	-	100	-		
t_{sd}	Shutdown propagation delay	-	400	-		
t_d	Output dead-time	-	1.8	-	μs	
I_{O+}	Output source current	-	220	-	mA	
I_{O-}	Output sink current	-	300	-		

12. Application Circuit



13. Timing Diagram

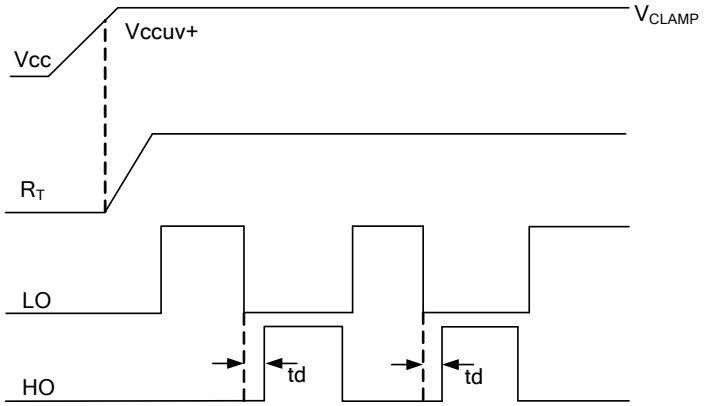


Figure 1. Input / Output Timing Diagram

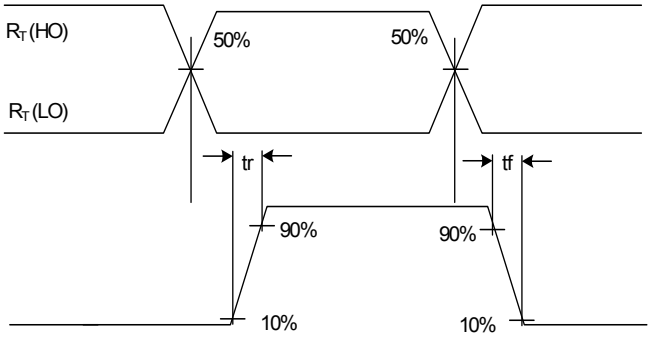


Figure 2. Switching Time Waveforms

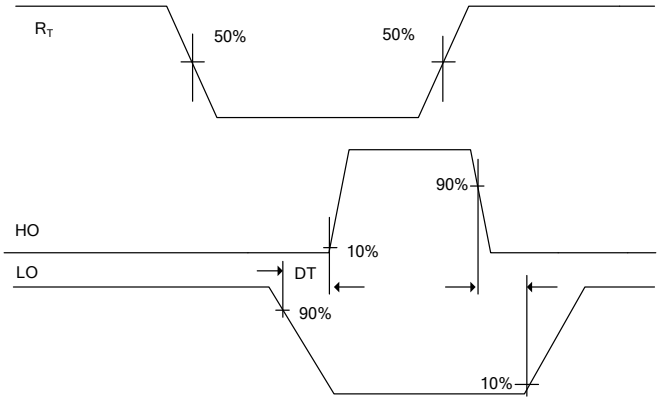


Figure 3. Dead-Time Waveform Definitions

14. Functional Description

iT6801 is a half bridge driver with fixed 50% duty and controllable frequency. Therefore, the ballast could be designed using minimal external component.

Under voltage lock out:

The power is supplied between V_{CC} (pin1) and COM (pin4). Below UVLO start voltage, controller is in UVLO state, it takes very small current, as low as 25uA, to detect external voltage and protection. Once it rises above UVLO start voltage, the controller starts to operate. iT6801 provides a sweep preheat function; It always starts from twice of the frequency, and then slowly decreases. The standard preheat time is 128K cycles of the switching period corresponds to 1.8s. In the operation mode, the controller consumes about 3mA. It will continue to operate unless the voltage drops below UVLO off voltage.

The VCC voltage is clamped at about 17.2V, and so V_B is also clamped at 17.2V.

Oscillator

The oscillator frequency that acts as minimum base frequency is controlled by the current drawn out from RT (pin3). The same current is duplicated internally to double base frequency for preheat. The frequency decreased in 64 steps toward base frequency, 2K cycles each step, giving total 128K cycles preheat time which is about 1.8 sec.

RT pin is fixed at 2.0V, and the maximum sourcing current is 50uA. More than that, the voltage would decay. The suggested value is about 20uA, corresponds to 50KHz base frequency.

Feed back

It is a high impedance input. Above 3.25V, iT6801 is turned into lamp open protection. Once below 1 V, the oscillator starts to oscillate from preheat stage. During preheat time, feedback pin is compared with 2.5V for over voltage protection. If it is triggered, it is latched. Than the oscillator stops and IC consumes less then 300uA. After the preheat time period, the over voltage reference is decreased to 1.75V.
During (lamp open, over voltage) protect state, the current consumption is below 300uA. Any restart will initiate through preheat procedure.

Output

There is a dead time about 1.8 us, in which high and low side output both are low. The sink current capability is set as 300 mA, which is stronger than 220 mA in source current capability.

15. Typical Characteristics

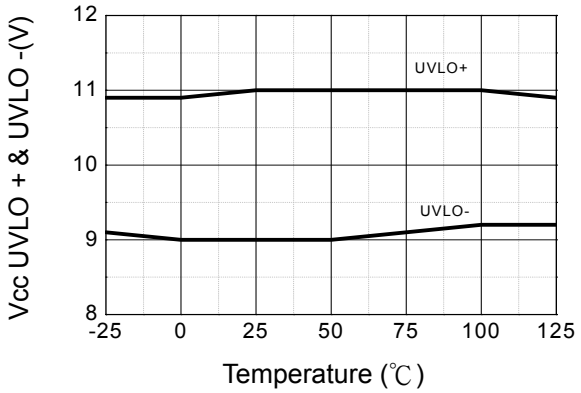


Figure 1. Vcc UVLO + & UVLO - vs Temperature

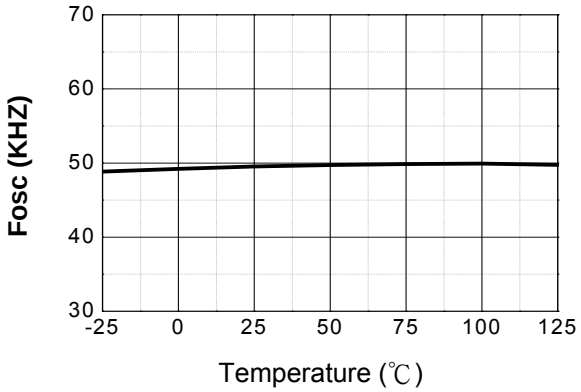


Figure 2. Fosc vs Temperature

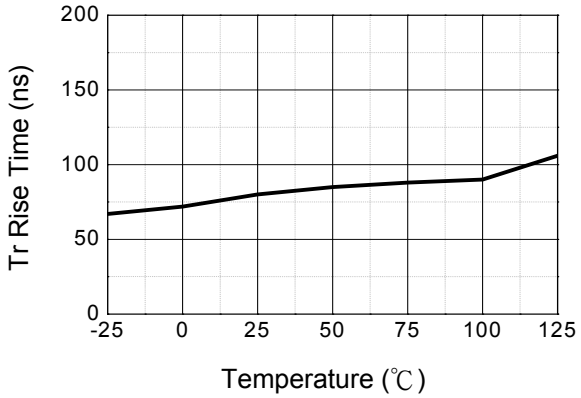


Figure 3. Tr Rise Time vs Temperature

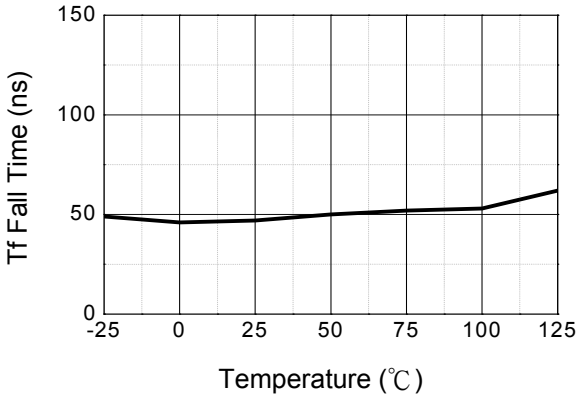


Figure 4. Tf Fall Time vs Temperature

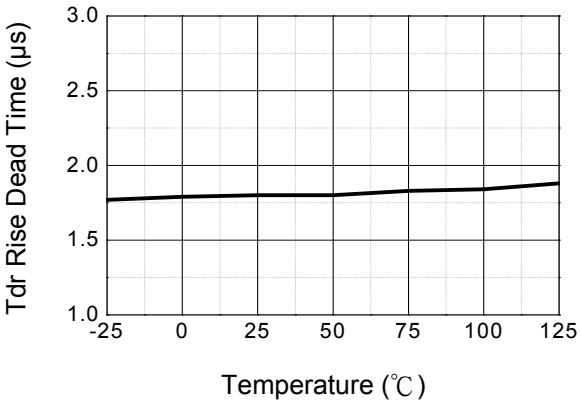


Figure 5. Tdr Rise Dead Time vs Temperature

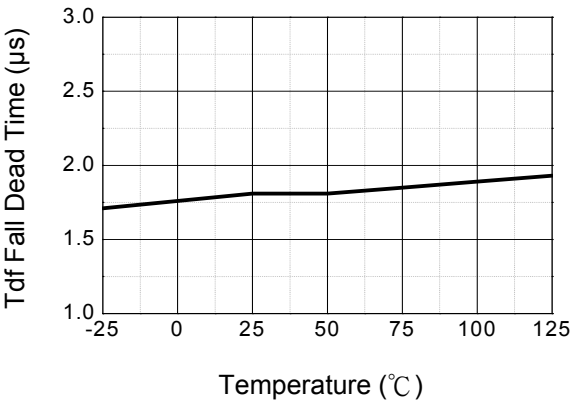
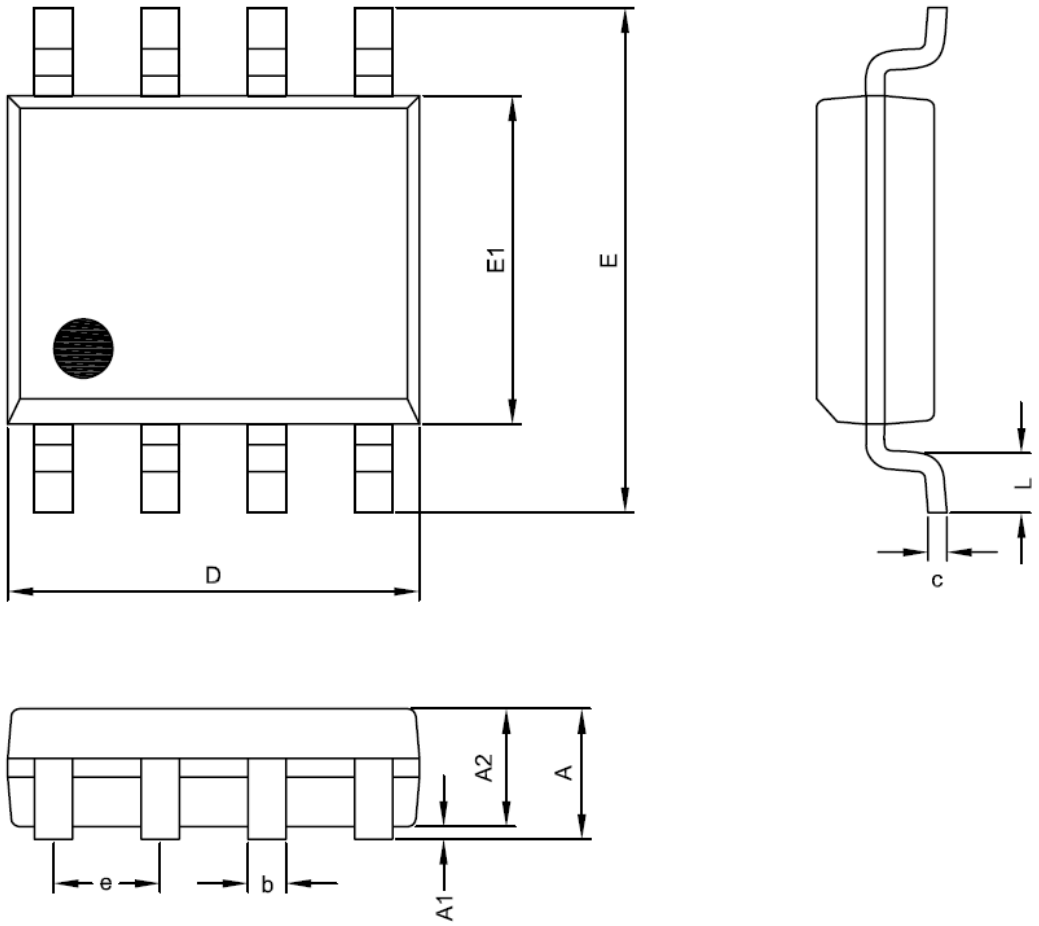


Figure 6. Tdf Fall Dead Time vs Temperature

16. Package Dimensions

SOP- 8L



Symbol	Dimensions In Millimeters	
	MIN.	MAX.
A	1.35	1.75
A1	0.00	0.25
A2	1.15	1.50
D	4.80	5.00
E	5.80	6.20
E1	3.80	4.00
c	0.19	0.27
b	0.33	0.53
e	1.27 BSC	
L	0.40	1.27

Notes：

1. Jedec outline ： MS-012AA
2. Dimensions ” D ” does not include mold flash, protrusions and gate burrs shall not exceed .15 mm (.006 in) per side .
3. Dimensions “ E1 ” does not include inter-lead flash, or protrusions. Inter-lead flash and protrusions shall not exceed .25 mm (.010 in) per side.