

Linear Adjustable Constant Current LED Driver JTML7136A/JTML7136B

General Description

The JTML7136A is a constant current regulator for driving LEDs with low quiescent current and low dropout voltage. The current is adjustable from 10mA to 1A with an external resistor.

The JTML7136B is only a controller, and must be connected to an external NMOS. JTML7136B is an external transistor, is suitable for applications requiring a high output current. The output current of JTM7136B can be adjusted by external DC control voltage or PWM control.

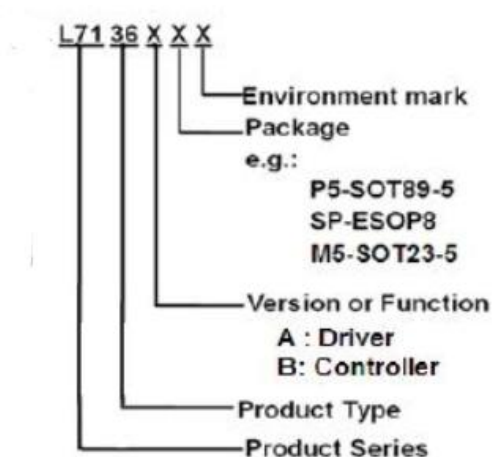
Only one external resistor is required to achieve a constant current LED driver. Soft start, thermal protection and low voltage protection are also provided.

The driver pin EXT is provided for current and voltage extension. Adding an external NMOS or NPN transistor to this pin can extend current and voltage range.

Features

- JTML7136B is only a controller, and must be connected to an external NMOS.
- The output current of JTM7136B is adjustable
- Sink current: 10mA to 1A adjustable with an external resistor
- Current and voltage range extendable by adding an external NMOS or NPN transistor
- Power supply voltage: 2.7-18V
- Low drop out voltage: 50mV@1A
- Low quiescent current: 80uA
- Thermal Shutdown protection: 165°C
- Soft start
- Low voltage protection: 2.5V
- Package: JTML7136A: SOT89-5, ESOP8
JTML7136B: SOT23-5

Selection Guide



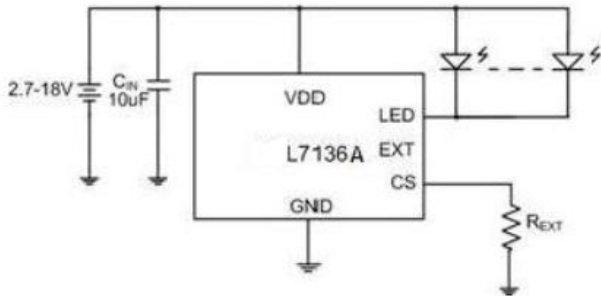
Typical Application

- Power Led driver and controller

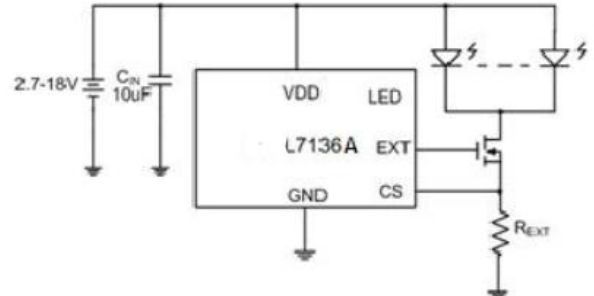
Typical Application Circuit

JTML7136A

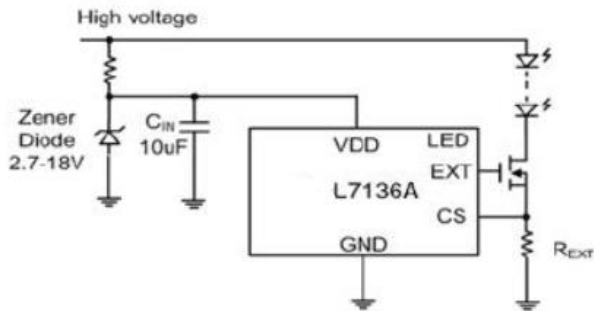
Low Voltage And Light Load (Under 1A)



Low Voltage And Heavy Load (Exceed 1A)

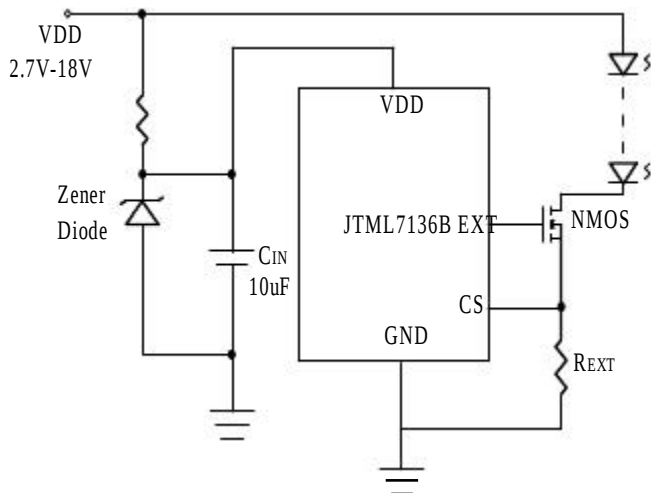


High Voltage Application

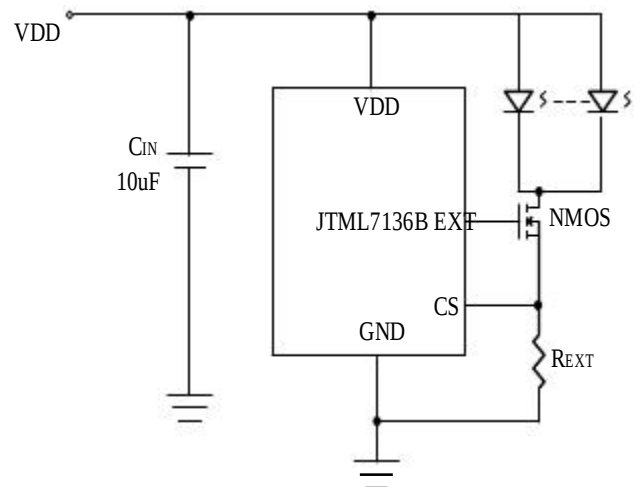


JTML7136B

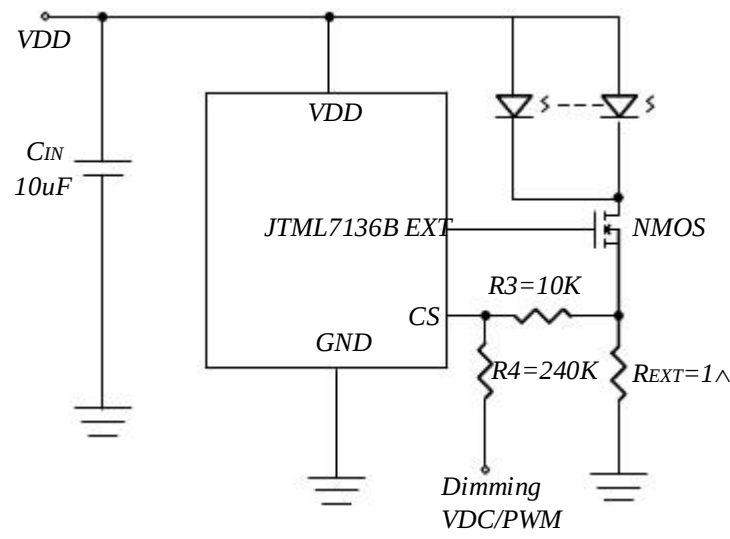
Low Voltage Application



High Voltage Application



Adjustable Output Current Application

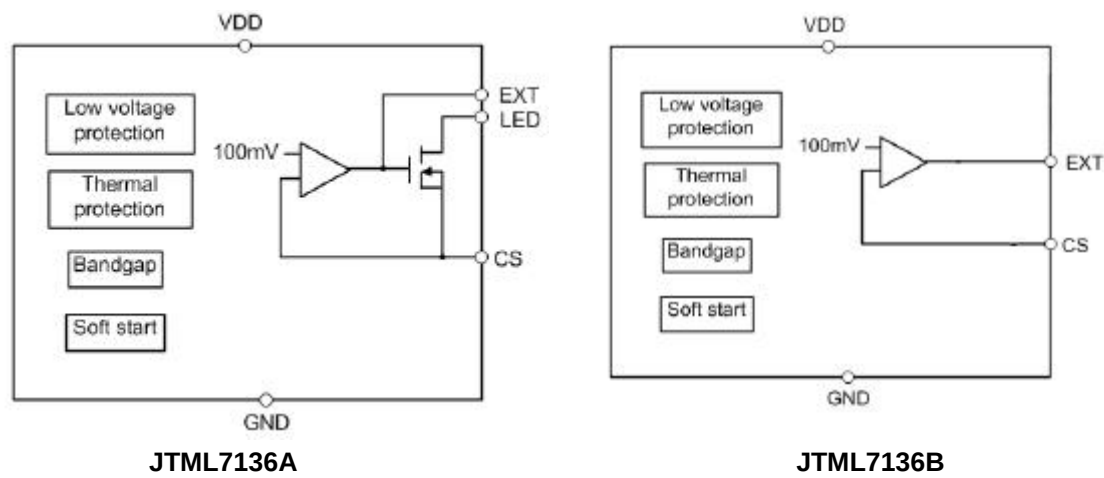


R_{EXT} Resistor Value selection:

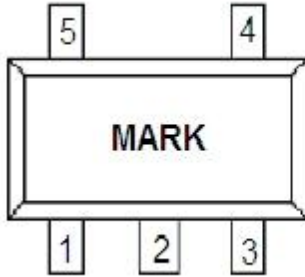
R _{EXT} (Ω)	I _{LED} (mA)
10	10
1	100
0.286	350
0.1	1000

$$I_{LED} = \frac{V_{CS}}{R_{EXT}}$$

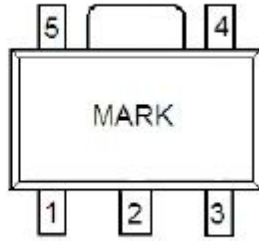
Block Diagram



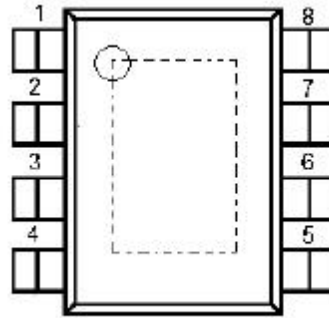
Pin Configuration



SOT23-5(only for JTML7136B)



SOT89-5



ESOP8

Pin Assignment

JTML7136A

Pin Number		Pin NaJTM	Functions
ESOP8	SOT89-5		
2	1	CS	Output current detection
1	2	D(LED)	The negative input feet of LED
3	3	VDD	Power Input
5	4	GND	Ground
7	5	EXT	Driving external NMOS
4,6,8		NC	No connection

JTML7136B

Pin Number	Pin NaJTM	Functions
SOT23-5		
1	NC	NC
2	GND	Ground
3	VDD	Power Input
4	CS	Output current detection
5	EXT	Driving external NMOS

Absolute Maximum Ratings

ParaJTMter		Symbol	Ratings	Units
Input Voltage		V _{DD}	18	V
Voltage on LED,CS		V _{LED} , V _{CS} ,	-0.3~V _{DD} +0.3	V
Voltage on EXT		V _{EXT}	6	V
Output Current		I _{OUT}	1.5	A
Power Dissipation	SOT89-5	P _D	500	mW
			1300 (PCB mounted) (*1)	

	ESOP8	P _D	2000	mW (T=25℃)
	SOT23-5	P _D	2000 (PCB mounted) ^(*1)	
			300	
Operating Temperature Range		T _{OPR}	−40~+125	℃
Storage Temperature Range		T _{STG}	−40~+150	℃
Lead Temperature			260℃, 4sec	
ESD(ESD voltage for human body model)		V _{ESD}	2000	V

*1:The power dissipation figure shown in PCB mounted. Please refer to page8-9 for details.

Electrical Characteristics

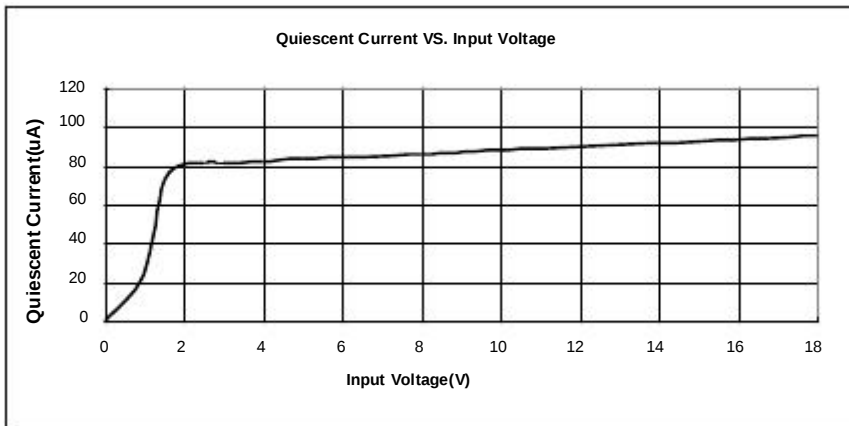
JTML7136A/JTML7136B

(V_{DD}= 3.6V, Ta=25oC, unless otherwise noted)

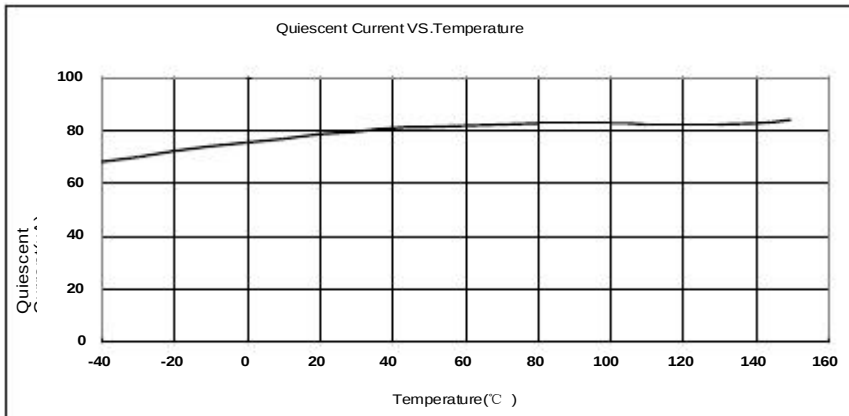
ParaJTmter	Symbol	Conditions	Min.	Typ.	Max.	Units
Sink Current	I sink	V _{DD} =3.6V	10		1000	mA
Input Voltage	V _{DD}	I sink=1A	2.7		18	V
CS Voltage	V _{CS}		95	100	105	mV
Sink current accuracy	ΔILED/ILED	I sink=1A	-5	-2.5	5	%
Load Regulation	LDR	V _{LED} =0.2V to 3V V _{DD} =3.6V		0.1	2	mA/V
Line Regulation	LNR	V _{LED} = 3V 3.6V≤V _{DD} ≤18V		0.4	2	mA/V
Output dropout voltage	V drop	V _{DD} =3.6V, V _{LED} = 0.5V		50	100	mV
Quiescent Current	I _{SS}	V _{DD} =3.6V		80	100	uA
Low Voltage Protection			2.3	2.5	2.7	V
Low voltage hysteresis	V _{hys}			0.15		V
Maximal EXT Voltage	V _{EXT}	V _{DD} =5.0V, V _{CS} =0V	2.5	3.6	4.5	V
Thermal Shutdown protection	T _{sd}			165		℃

Type Characteristics

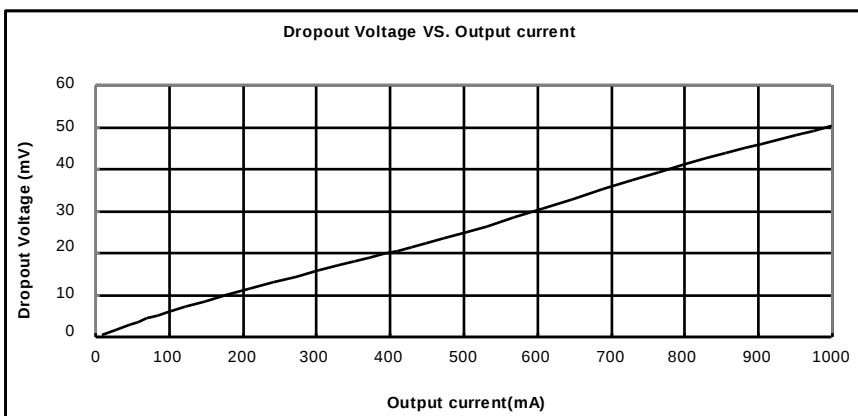
- (1) Quiescent Current VS. Input Voltage (No external component)



- (2) Quiescent Current VS. Temperature ($V_{DD}=3.6V$)



- (3) Dropout Voltage VS. Output Current ($V_{DD}=3.6V$)



Adjustment of the JTM7136B output current

1 Output current adjustment by external DC control voltage

The Dimming pin can be driven by an external dc voltage (V_{DC}), as shown, to adjust the output current to a value below the nominal average value defined by R_{EXT} . $V_{REF}=0.1V$.

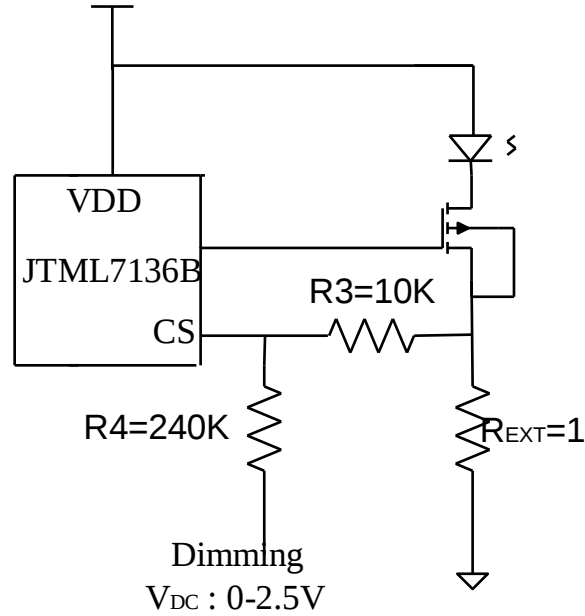


Figure 1. Dimming Control Using a DC Voltage

$$R4:R3=24:1$$

The average output current is given by:

$$I_{LED} = \frac{V_{REF}}{R_{EXT}} \cdot \frac{R3 \times (V_{DC} - V_{REF})}{R4} \quad (0 \leq V_{DC} \leq 2.5V)$$

$$I_{LED} = 0 \quad (2.5 \leq V_{DC} \leq V_{DD})$$

2 Output current adjustment by PWM control

A Pulse Width Modulated (PWM) signal with duty cycle PWM can be applied to the Dimming pin, as shown below, to adjust the output current to a value below the nominal average value set by resistor R_{EXT} . $V_{REF}=0.1V$.

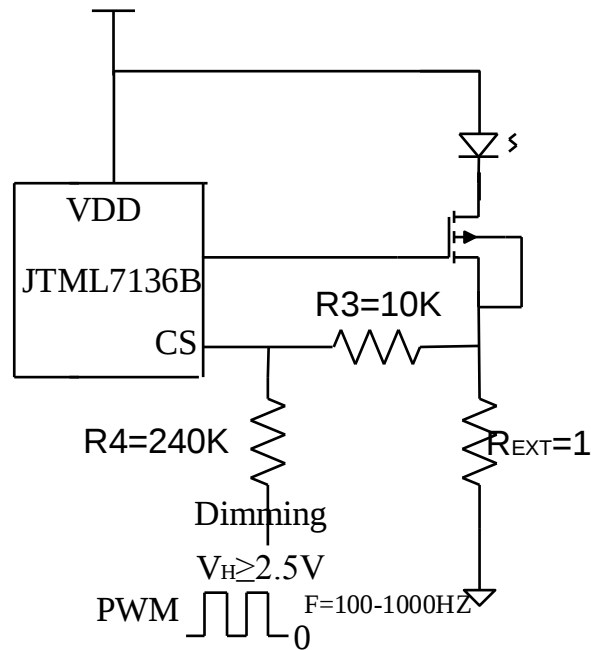


Figure 2. Dimming Control Using a PWM Signal

$R4:R3=24:1$

The average output current is given by:

$$I_{LED} = \frac{V_{REF} \cdot \left(\frac{R3 \times (2.5 \times \text{Duty} - V_{REF})}{R4} \right)}{R_{EXT}}$$

$(2.5 \leq V_{PWM} \leq V_{DD} \text{ \& } 0 \leq \text{Duty} \leq 100\%)$

PWM dimming provides reduced brightness by modulating the LED's forward current between 0% and 100%. The LED brightness is controlled by adjusting the relative ratios of the on time to the off time. A 25% brightness level is achieved by turning the LED on at full current for 25% of one cycle. To ensure this switching process between on and off state is invisible by human eyes, the switching frequency must be greater than 100 Hz. Above 100 Hz, the human eyes average the on and off times, seeing only an effective brightness that is proportional to the LED's on-time duty cycle. The advantage of PWM dimming is that the forward current is always constant, therefore the LED color does not vary with brightness as it does with analog dimming. Pulsing the current provides precise brightness control while preserving the color purity. The best dimming frequency of JTML7136B is 100Hz to 1kHz.

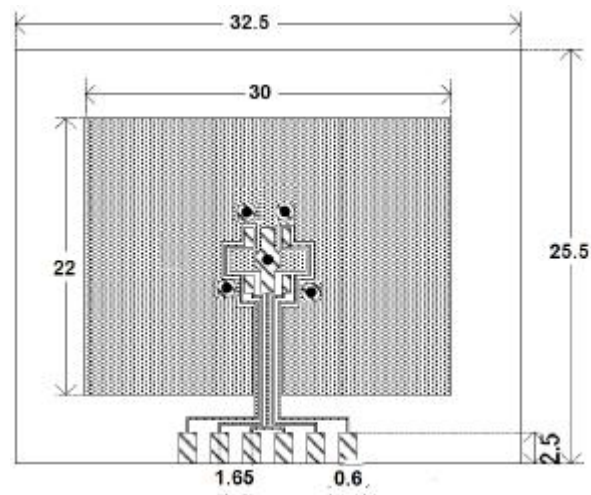
Power dissipation

• SOT89-5 power dissipation

The power dissipation data for the SOT89-5 is shown as below. The value of power dissipation varies with the mount board conditions. Please use this data as the reference data taken in the following condions.

1. condition

- Condition: Mount on a board
- Ambient: Natural convection
- Soldering: Lead(pb) free
- Board: Dimensions 30*35mm (1050mm2 in one side)
Copper(Cu) traces occupy 50% of the board
Area in top and back faces
- Material: Glass Epoxy (FR-4)
- Thickness: 1.6mm
- Through-hole: 5*0.8 Diameter

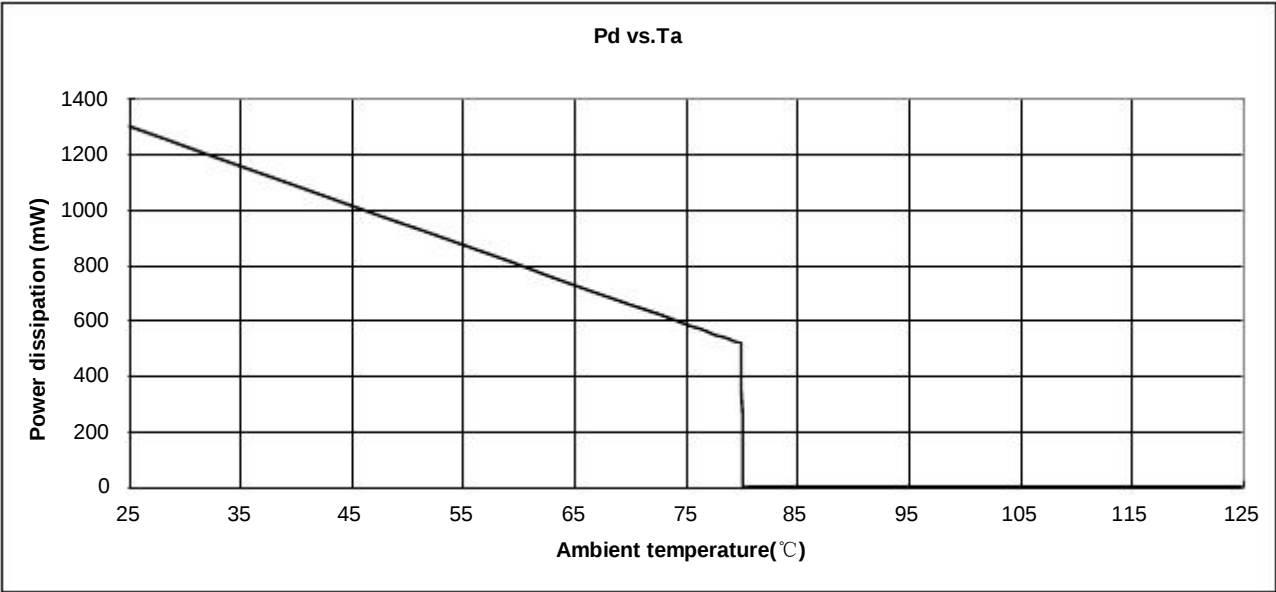


Evaluation Board(Unit:mm)

2. Power dissipation vs. Ambient temperature

Board Mount (Tj max=125 °C)

Ambient Temperature(°C)	Power Dissipation(mW)	Thermal Resistance(°C/W)
25	1300	76.92
85	520	



● ESOP8 power dissipation

The power dissipation data for the ESOP8 is shown as below. The value of power dissipation varies with the mount board conditions. Please use this data as the reference data taken in the following condions.

3. condition
- Condition: Mount on a board

Ambient: Natural convection

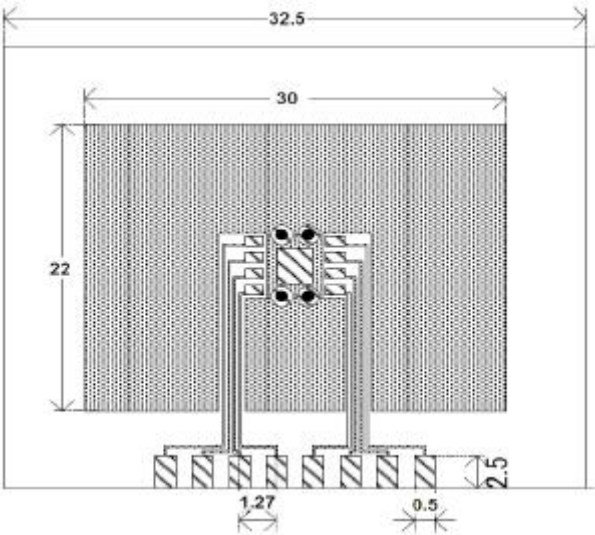
Soldering: Lead(pb) free

Board: Dimensions 30*35mm (1050mm² in one side)
Copper(Cu) traces occupy 50% of the board
Area in top and back faces

Material: Glass Epoxy (FR-4)

Thickness: 1.6mm

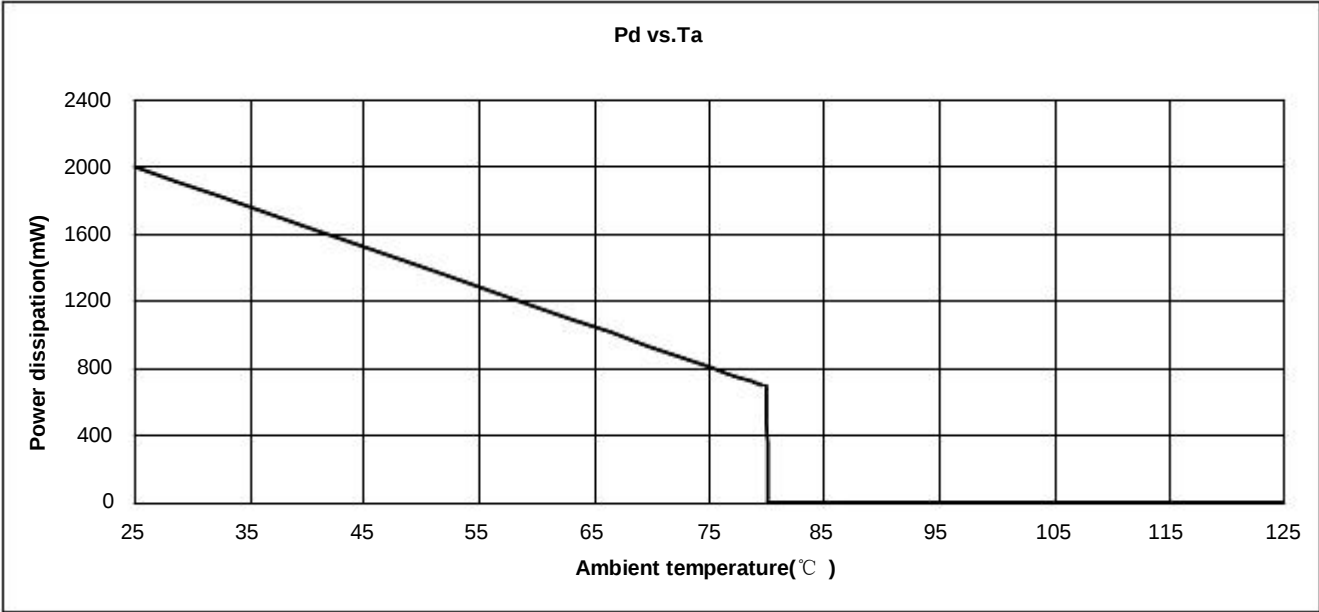
Through-hole: 4*0.8 Diameter



4. Power dissipation vs. Ambient temperature
- Board Mount (T_j max=125 °C)

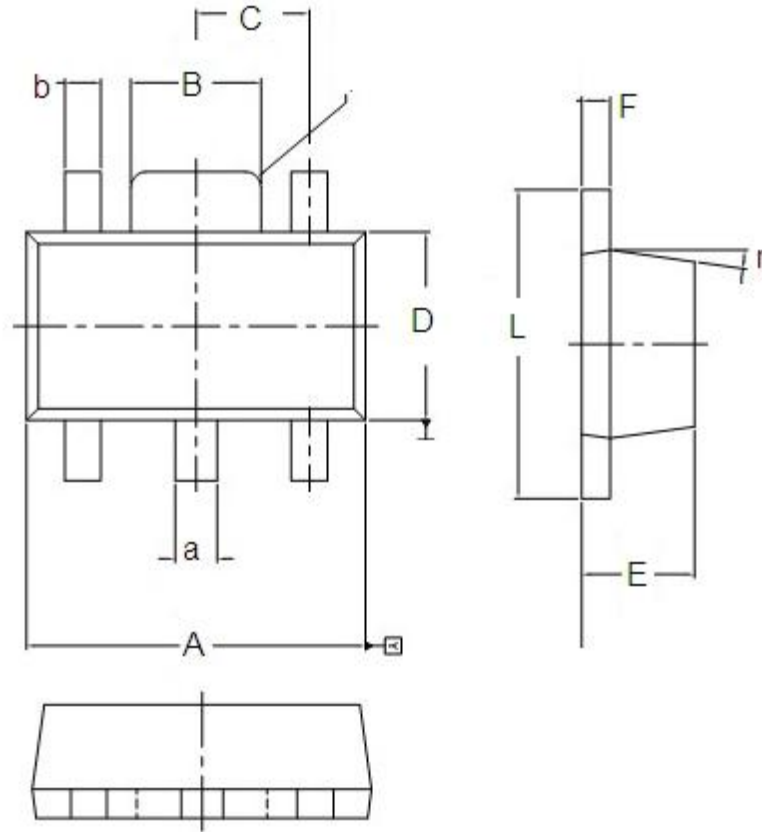
Evaluation Board(Unit:mm)

Ambient Temperature(°C)	Power Dissipation(mW)	Thermal Resistance(°C/W)
25	2000	66.67
85	700	



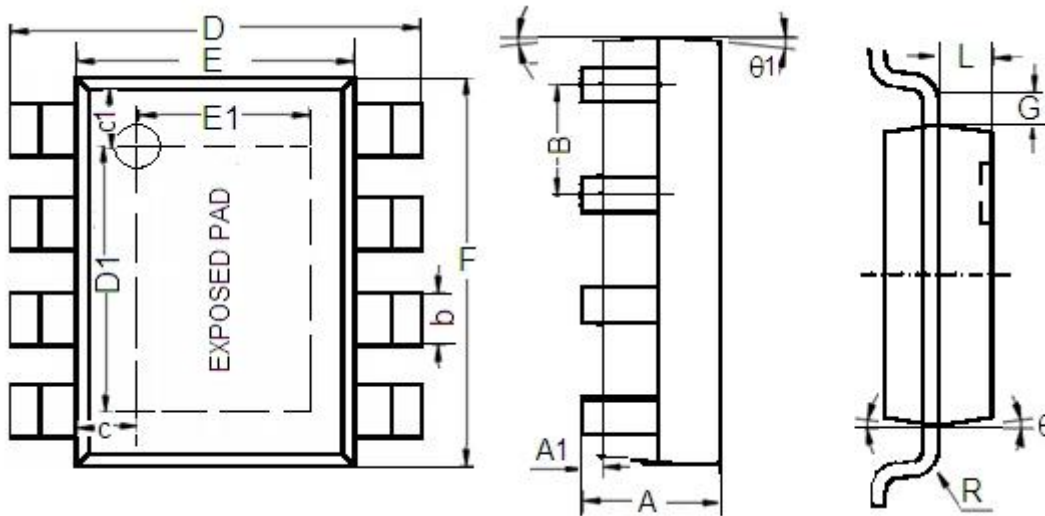
Packaging Information

- Packaging Type: SOT89-5



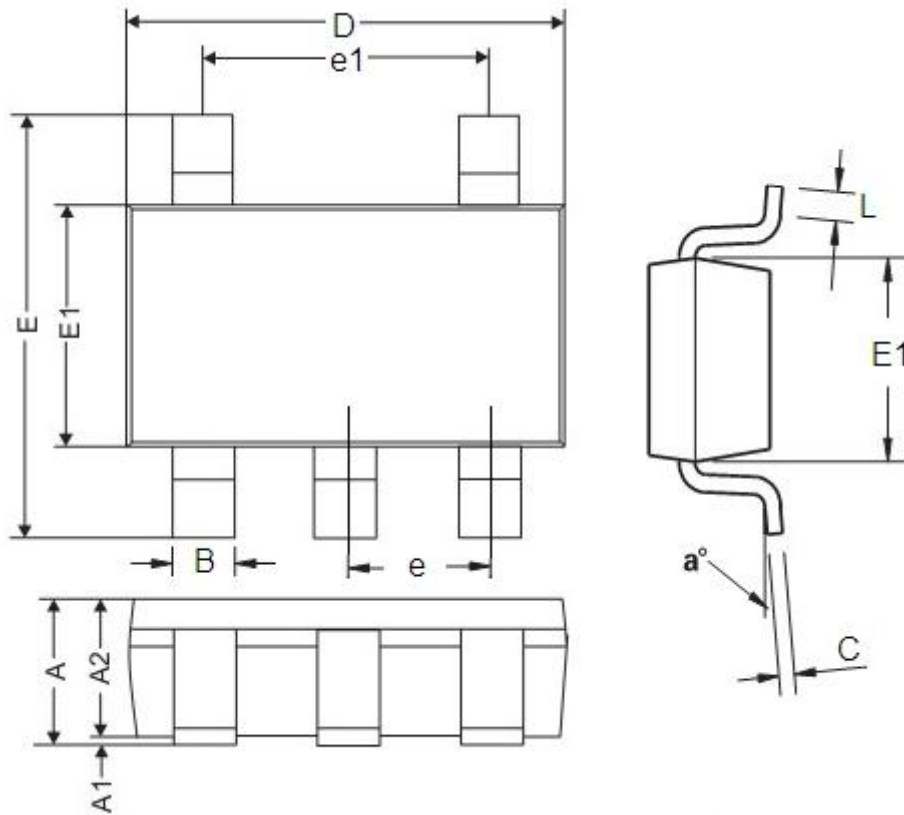
DIM	MilliJTmeters		Inches	
	Min	Max	Min	Max
A	4.4	4.6	0.173	0.181
a	0.5	0.62	0.02	0.024
B	1.63	1.83	0.064	0.072
b	0.44	0.54	0.017	0.021
C	Type:1.5		Type:0.059	
D	2.4	2.6	0.094	0.102
E	1.4	1.6	0.054	0.063
F	0.35	0.43	0.013	0.017
L	3.95	4.25	0.155	0.167
r	Type:8 ⁰		Type:8 ⁰	

- Packaging Type: SOP8-PP



Character	DiJTMnsion (mm)		DiJTMnsion (Inches)	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.1	0.3	0.004	0.012
B	1.27(Typ.)		0.05(Typ.)	
b	0.330	0.510	0.013	0.020
c	0.9(Typ.)		0.035(Typ.)	
c1	1.0(Typ.)		0.039(Typ.)	
D	5.8	6.2	0.228	0.244
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	2.313	2.513	0.091	0.099
F	4.7	5.1	0.185	0.201
L	0.675	0.725	0.027	0.029
G	0.32(Typ.)		0.013(Typ.)	
R	0.15(Typ.)		0.006(Typ.)	
θ1	7°		7°	
θ	8°		8°	

Package type:SOT23-5 Unit:mm(inch)



DIM	MilliJTMMeters		Inches	
	Min	Max	Min	Max
A	0.9	1.45	0.0354	0.0570
A1	0	0.15	0	0.0059
A2	0.9	1.3	0.0354	0.0511
B	0.2	0.5	0.0078	0.0196
C	0.09	0.26	0.0035	0.0102
D	2.7	3.10	0.1062	0.1220
E	2.2	3.2	0.0866	0.1181
E1	1.30	1.80	0.0511	0.0708
e	0.95REF		0.0374REF	
e1	1.90REF		0.0748REF	
L	0.10	0.60	0.0039	0.0236
a ⁰	0 ⁰	30 ⁰	0 ⁰	30 ⁰

