Linear Adjustable Constant Current LED Driver MEL7136A/MEL7136B

General Description

The MEL7136A is a constant current regulator for driving LEDs with low quiescent current and low dropout voltage. The current is adjustable from 10mA to1A with an external resistor.

The MEL7136B is only a controller , and must be connected to an external NMOS. MEL7136B is an external transistor, is suitable for applications requiring a high output current . The output current of ME7136B can be adjusted by external DC control voltage or PWM control.

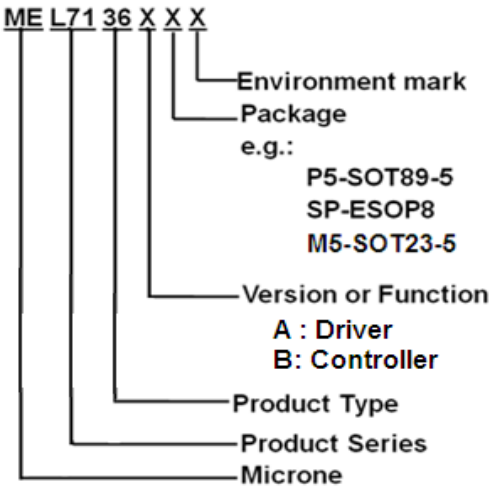
Only one external resistor is required to achieve a constant current LED driver. Soft start , thermal protection and low voltage protection are also provided.

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

- MEL7136B is only a controller , and must be connected to an external NMOS.
- The output current of ME7136B is adjustable
- Sink current:10mA to1A 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℃
- Soft start
- Low voltage protection: 2.5V
- Package: MEL7136A: SOT89-5, ESOP8
  MEL7136B: SOT23-5

Selection Guide

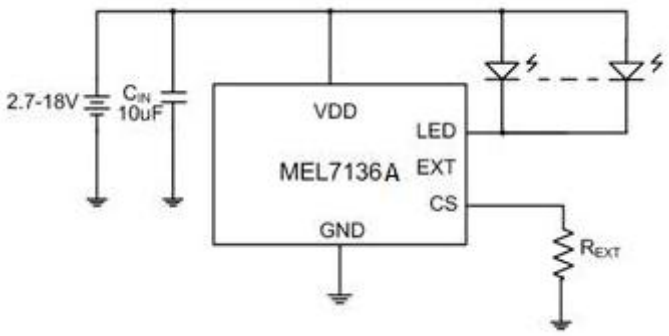


Typical Application

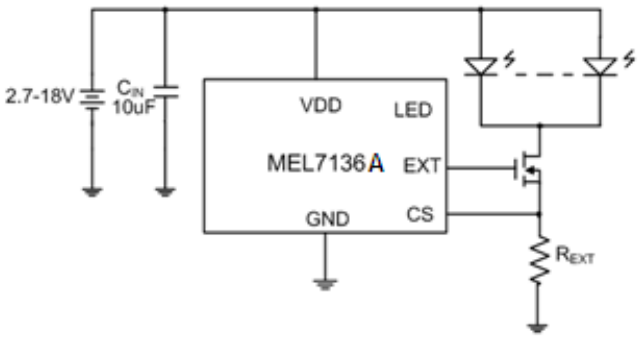
- Power Led driver and controller

MEL7136A

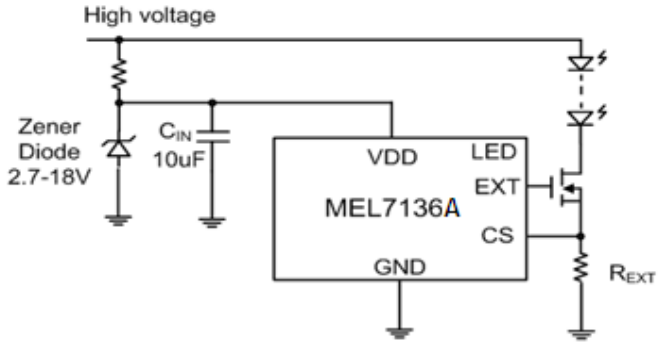
Low Voltage And Light Load (Under 1A)



Low Voltage And Heavy Load (Exceed 1A)

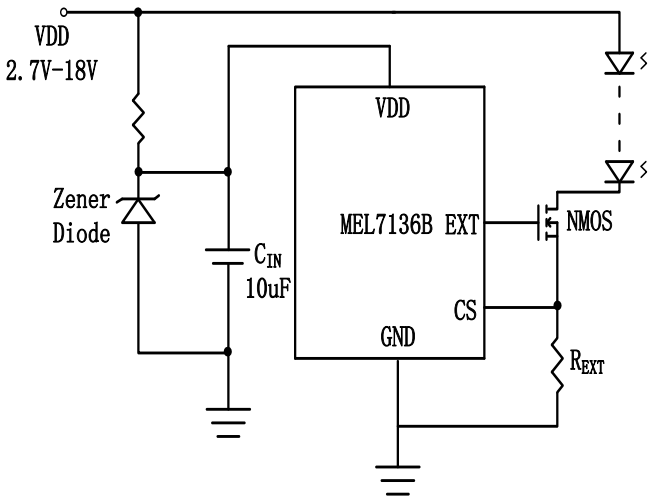


High Voltage Application

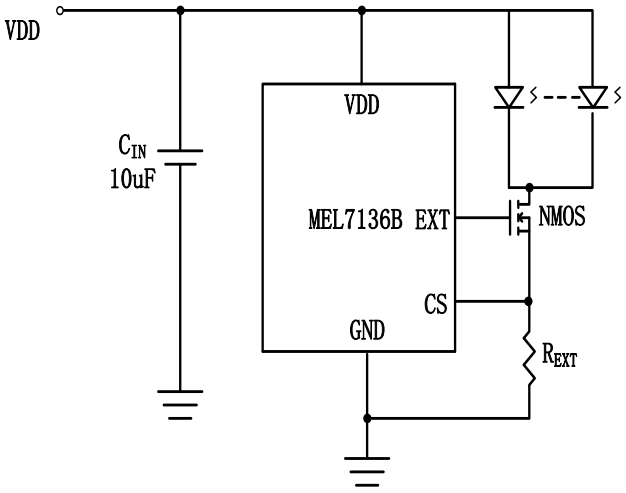


MEL7136B

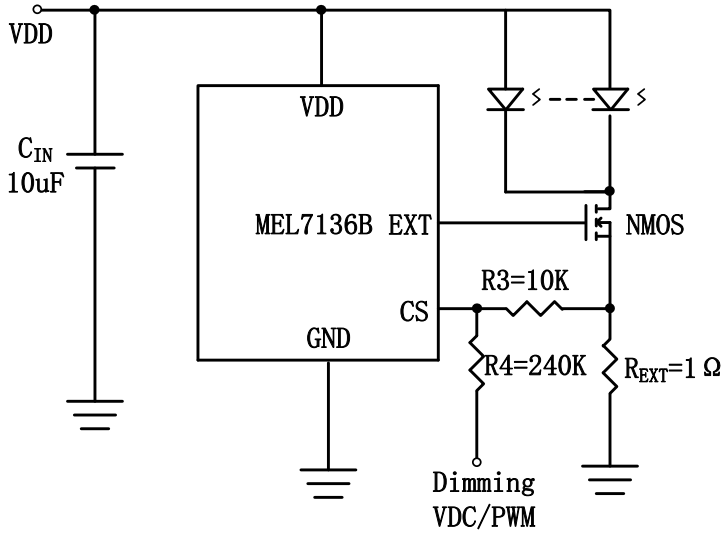
Low Voltage Application



High Voltage Application



Adjustable Output Current Application

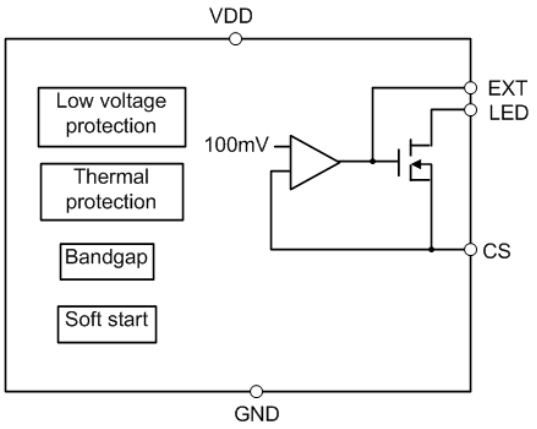


R_{EXT} Resistor Value selection:

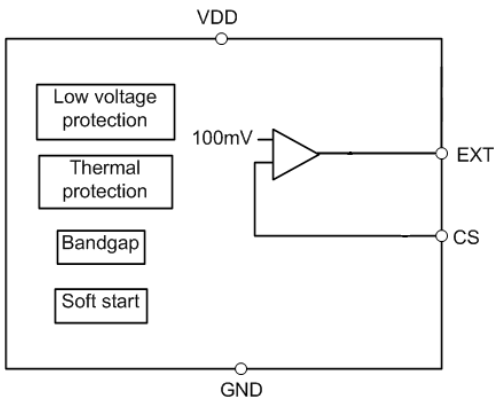
R_{EXT}(Ω)	ILED(mA)
10	10
1	100
0.286	350
0.1	1000

$$ILED = \frac{V_{CS}}{R_{EXT}}$$

Block Diagram

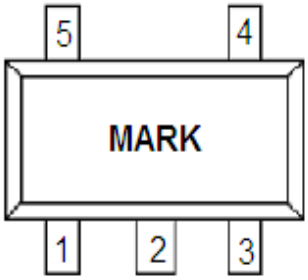


MEL7136A

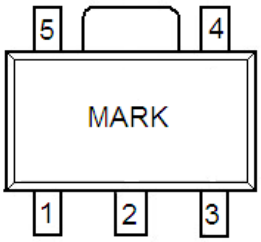


MEL7136B

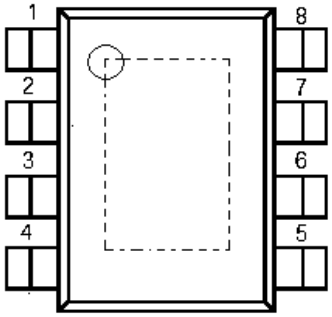
Pin Configuration



SOT23-5(only for MEL7136B)



SOT89-5



ESOP8

Pin Assignment

MEL7136A

Pin Number		Pin Name	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

MEL7136B

Pin Number	Pin Name	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

Parameter		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℃)
			2000（PCB mounted）(*1)	
	SOT23-5	P_D	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

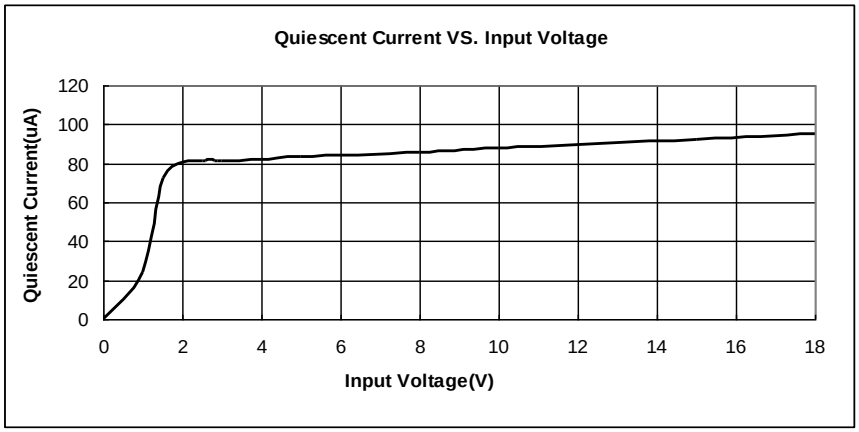
MEL7136A/MEL7136B

(V_{DD}= 3.6V, Ta=25^{O}C, unless otherwise noted)

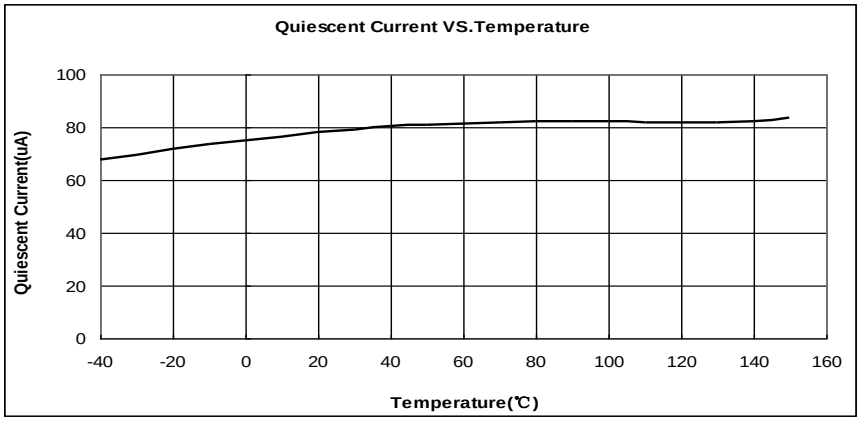
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Sink Current	I sink	V_{DD}=3.6V	10		1000	mA
Input Voltage	V_{DD}	I sink=1A	2.7		18	V
CS Voltage	V_{CS}		95	100	105	mV
Sink current accuracy	△ILED/ILED	I sink=1A	-5	-2.5	5	%
Load Regulation	LDR	VLED=0.2V to 3V V_{DD}=3.6V		0.1	2	mA/V
Line Regulation	LNR	VLED= 3V 3.6V≤V_{DD}≤18V		0.4	2	mA/V
Output dropout voltage	V drop	V_{DD}=3.6V, VLED= 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	Vhys			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	Tsd			165		℃

Type Characteristics

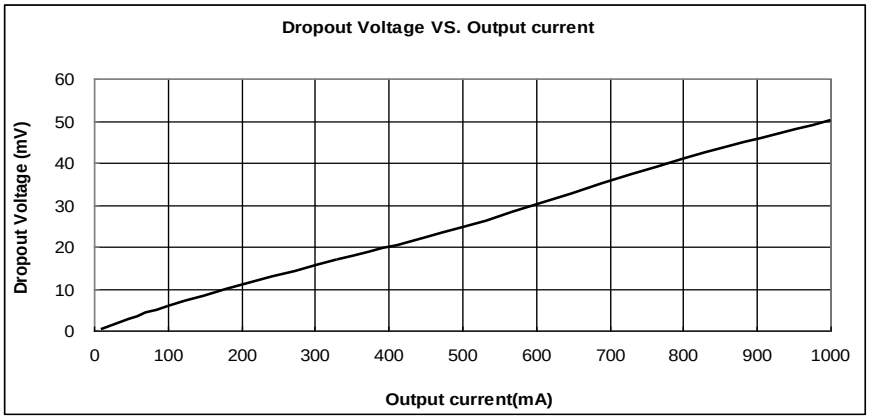
（1） Quiescent Current VS. Input Voltage （No external component）



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



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



Adjustment of the ME7136B 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.

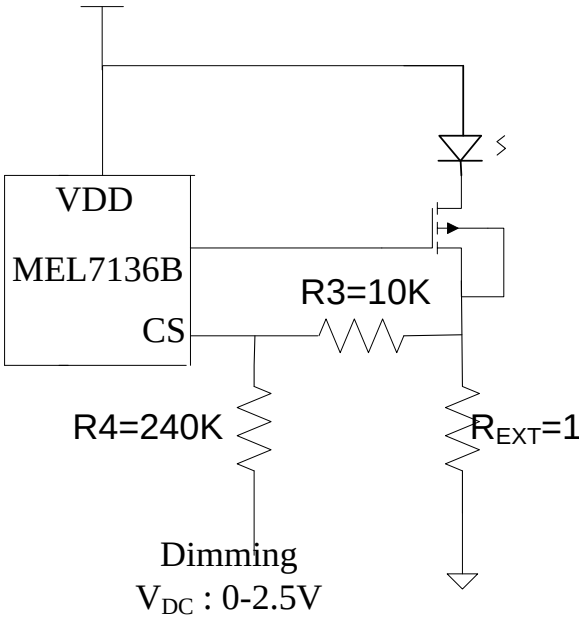


Figure 1. Dimming Control Using a DC Voltage

R4:R3=24:1

The average output current is given by:

$$ILED = \frac{V_{REF} - \frac{R3 \times (V_{DC} - V_{REF})}{R4}}{R_{EXT}} \qquad (0 \le VDC \le 2.5V)$$

$$ILED = 0 \qquad (2.5 \le VDC \le VDD)$$

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.

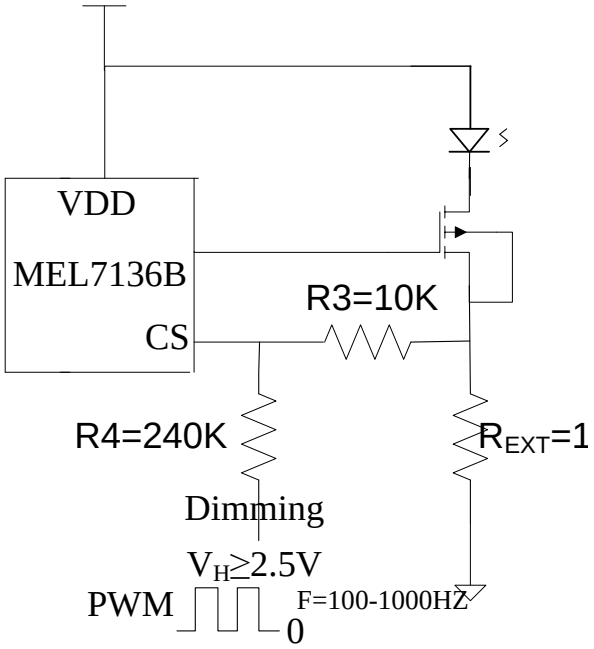


Figure 2. Dimming Control Using a PWM Signal

R4:R3=24:1

The average output current is given by:

$$ILED = \frac{V_{REF} - \frac{R3 \times (2.5 \times Duty - V_{REF})}{R4}}{R_{EXT}}$$

(2.5≤VPWM≤VDD & 0≤Duty≤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 MEL7136B is 100Hz to 1kHz.

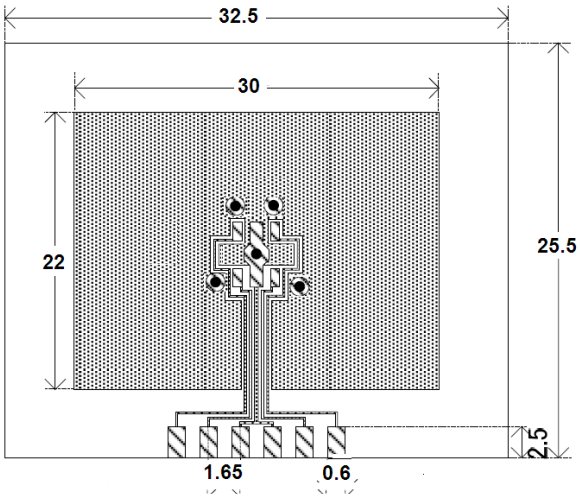
Power dissipation

● 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. Measurement condition

Condition: Mount on a board
Ambient: Natural convection
Soldering: Lead(pb) free
Board: Dimensions 30*35mm (1050mm^2 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

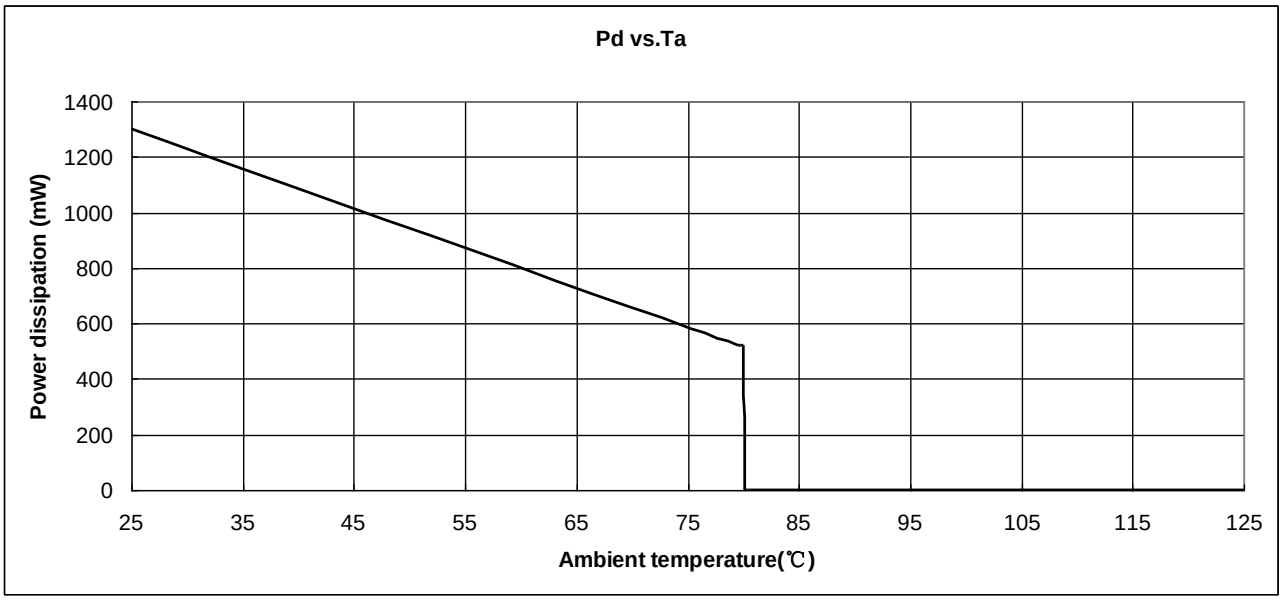


Evaluation Board(Unit:mm)

2. Power dissipation vs. Ambient temperature

Board Mount (T_j max=125 ℃)

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

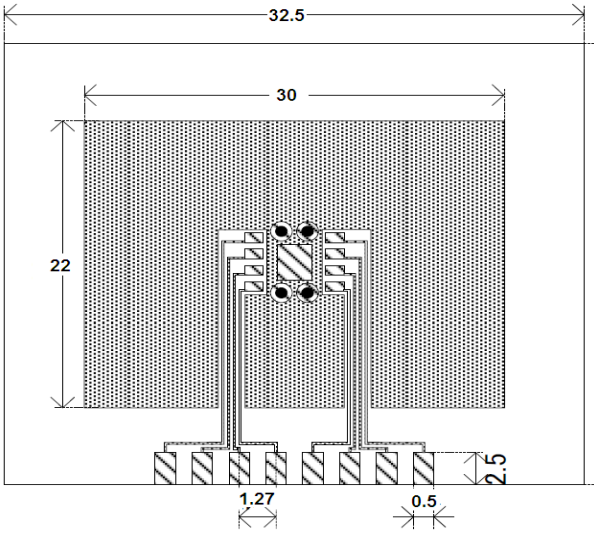


● ESOP8 power dissipation

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. Measurement condition

Condition: Mount on a board
Ambient: Natural convection
Soldering: Lead(pb) free
Board: Dimensions 30*35mm (1050mm^2 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

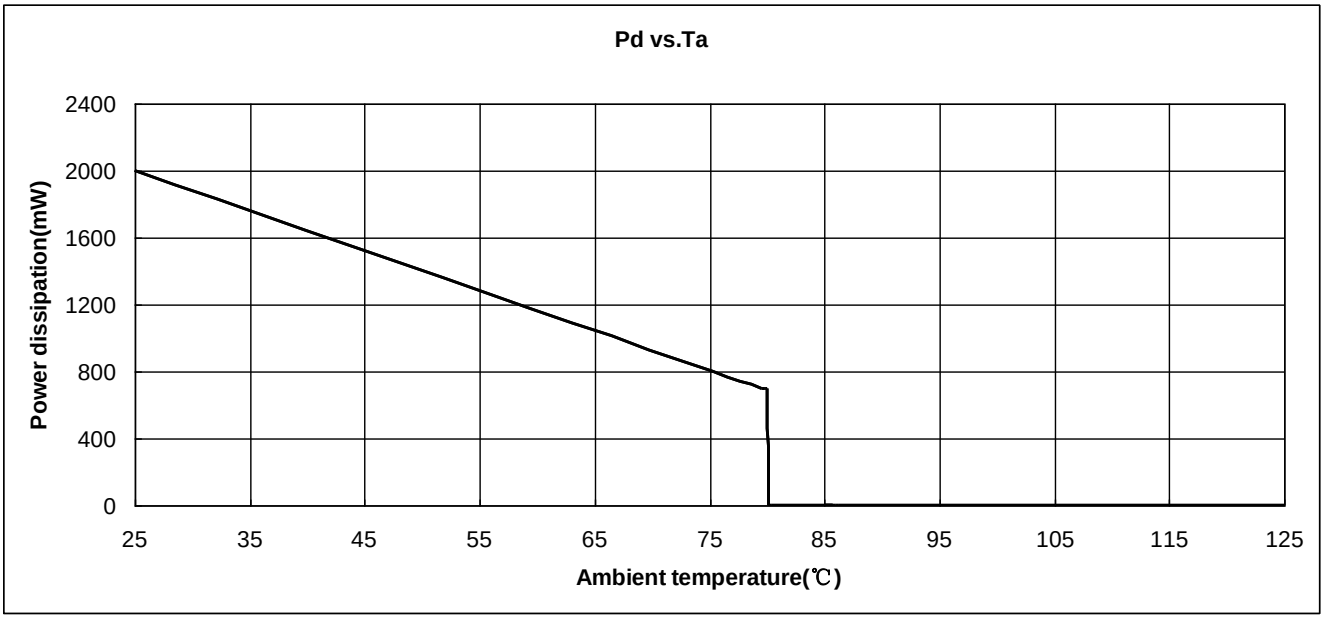


Evaluation Board(Unit:mm)

4. Power dissipation vs. Ambient temperature

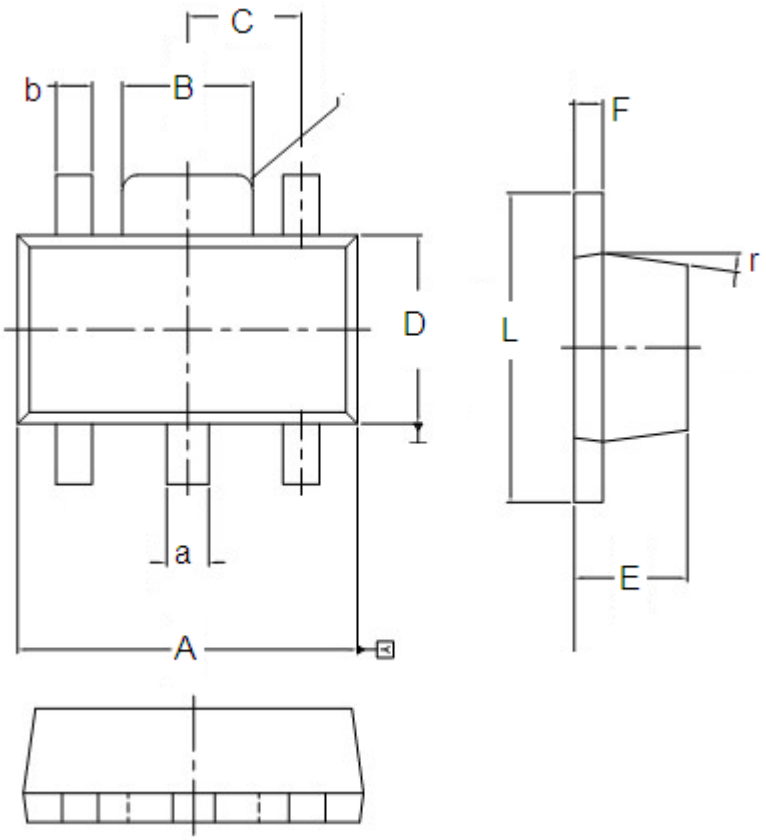
Board Mount (T_j max=125 ℃)

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



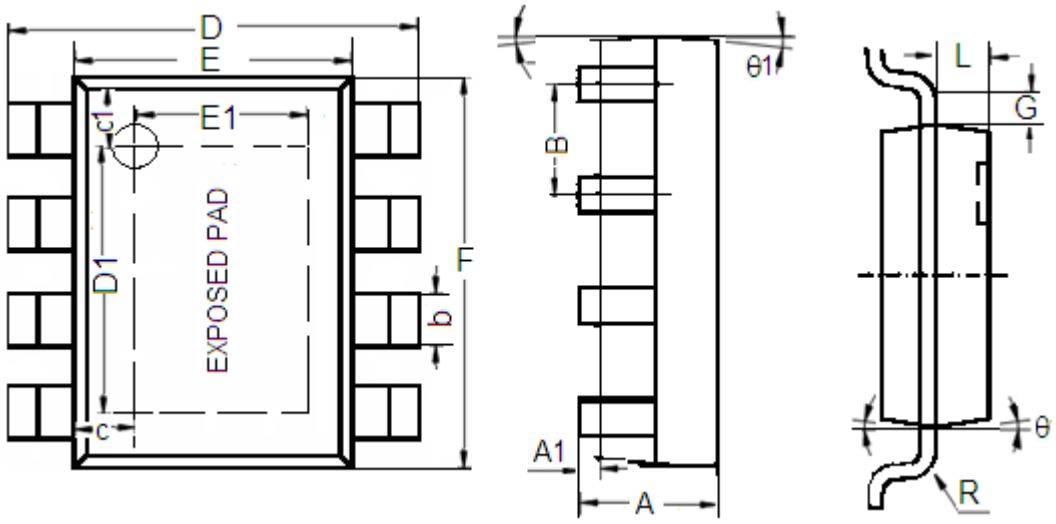
Packaging Information

● Packaging Type: SOT89-5



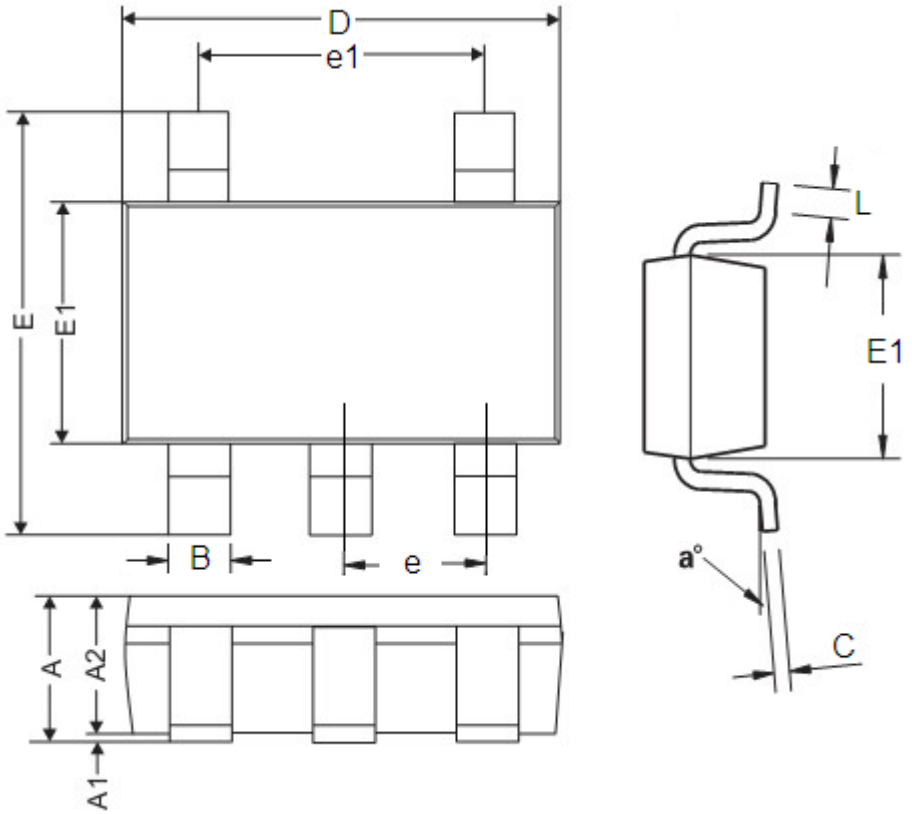
DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	4.4	4.6	0.173	0.181
a	0.5	0.62	0.02	0.024
B	1.63	1.83	0.064	0.072
b	0.44	0.54	0.017	0.021
C	Type:1.5		Type:0.059	
D	2.4	2.6	0.094	0.102
E	1.4	1.6	0.054	0.063
F	0.35	0.43	0.013	0.017
L	3.95	4.25	0.155	0.167
r	Type:8^0		Type:8^0	

● Packaging Type: SOP8-PP



Character	Dimension (mm)		Dimension (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	Millimeters		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

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