Linear Adjustable Constant Current LED Driver MEL7136

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:
  MEL7136A/B：2.7~18V
  MEL7136C：2~18V
- Low drop out voltage: 50mV@1A
- Low quiescent current: 80uA
- Thermal Shutdown protection:165℃
- Soft start
- Low voltage protection:
  MEL7136A/B：2.5V
  MEL7136C：1.8V

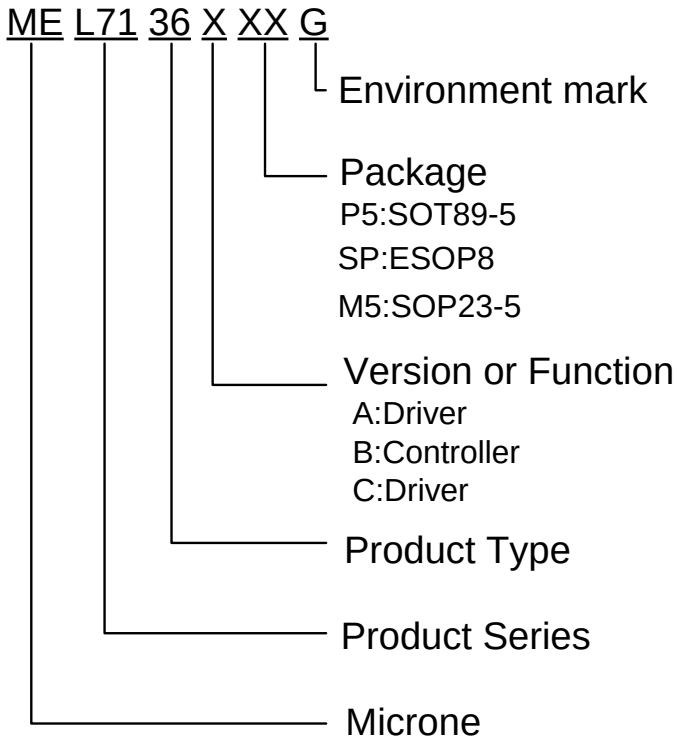
Typical Application

- Power Led driver and controller

Package

- MEL7136A: 5-pin SOT89-5
  6-pin ESOP8
- MEL7136B: 5-pin SOT23-5
- MEL7136C: 5-pin SOT89-5

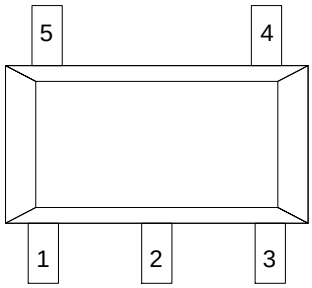
Selection Guide



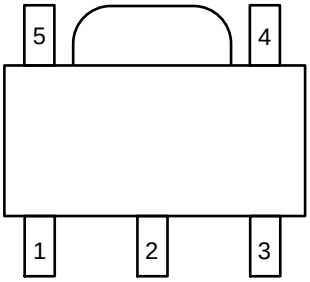
product series	product description
MEL7136AP5G	Package:SOT89-5
MEL7136ASPG	Package:ESOP8
MEL7136BM5G	Package:SOP23-5
MEL7136CP5G	Package:SOT89-5

NOTE: If you need other voltage and package, please contact our sales staff。

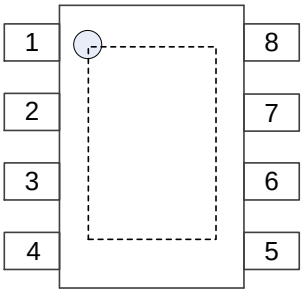
Pin Configuration& Pin Assignment



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

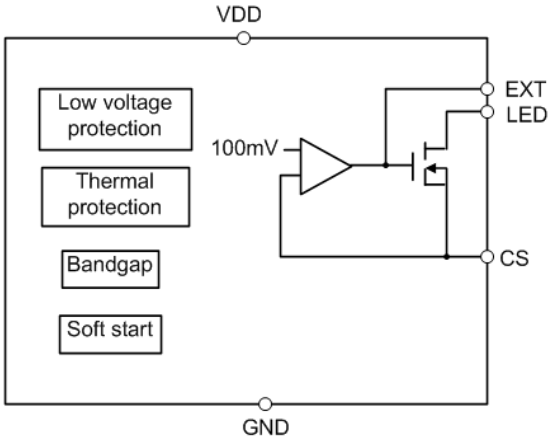
MEL7136B

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

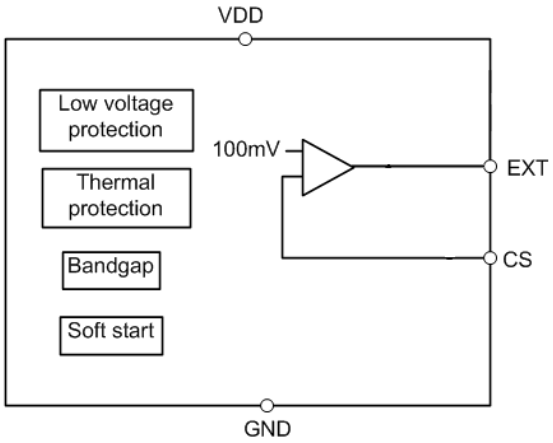
MEL7136C

Pin Number	Pin Name	Functions
SOT89-5		
1	CS	Output current detection
2	D(LED)	The negative input feet of LED
3	VDD	Power Input
4	GND	Ground
5	EXT	Driving external NMOS

Block Diagram



MEL7136A/C



MEL7136B

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～＋85	℃
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.

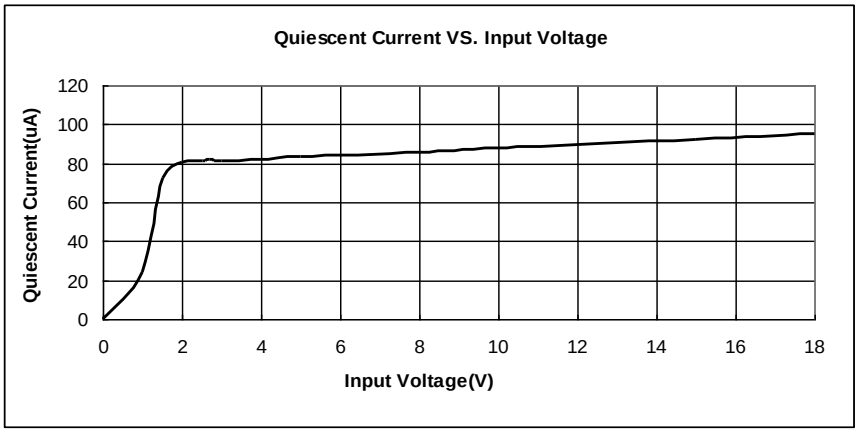
Electrical Characteristics

MEL7136A/MEL7136B/MEL7136C (V_{DD}= 3.6V, Ta=25^{O}C, unless otherwise noted)

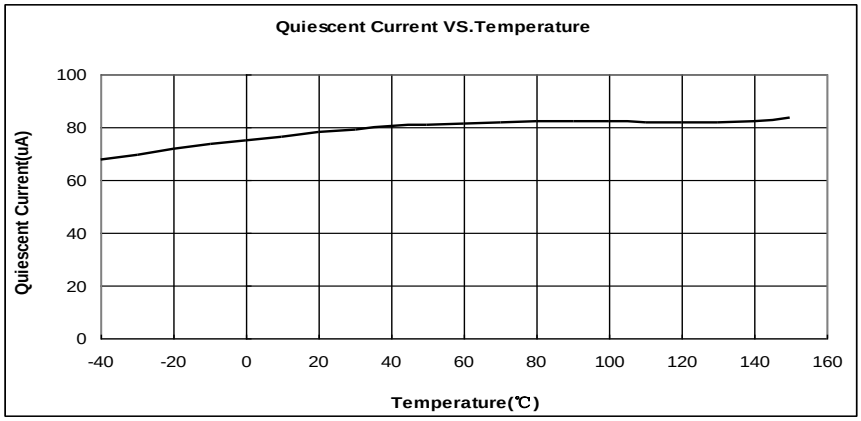
Parameter		Symbol	Conditions	Min.	Typ.	Max.	Units
Sink Current		I sink	V_{DD}=3.6V	10		1000	mA
Input Voltage	MEL7136A/B	V_{DD}	I sink=1A	2.7		18	V
	MEL7136C			2		18	
CS Voltage		V_{CS}		95	100	105	mV
Sink current accuracy		△ILED/ILED	I sink=1A	-5	-2.5	5	%
Load Regulation		LDR	VLED=0.2V to 3V V_{DD}=3.6V		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	MEL7136A/B			2.3	2.5	2.7	V
	MEL7136C				1.8	2	
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

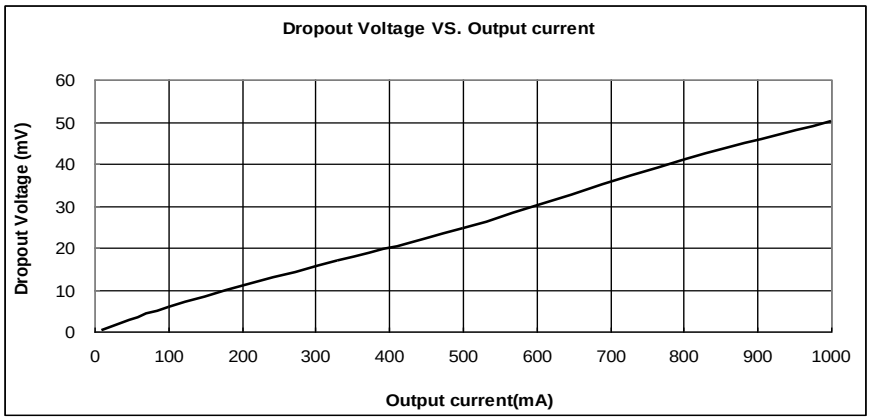
（1） Quiescent Current VS. Input Voltage （No external component）



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



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



Adjustment of the MEL7136B 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.

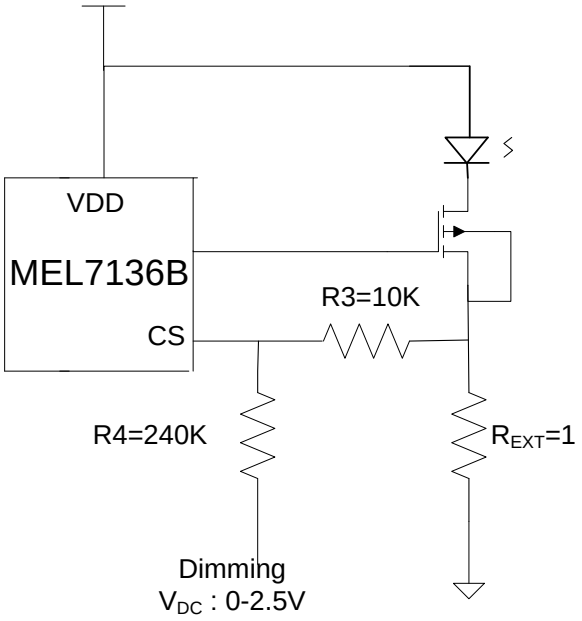


Figure 1. Dimming Control Using a DC Voltage

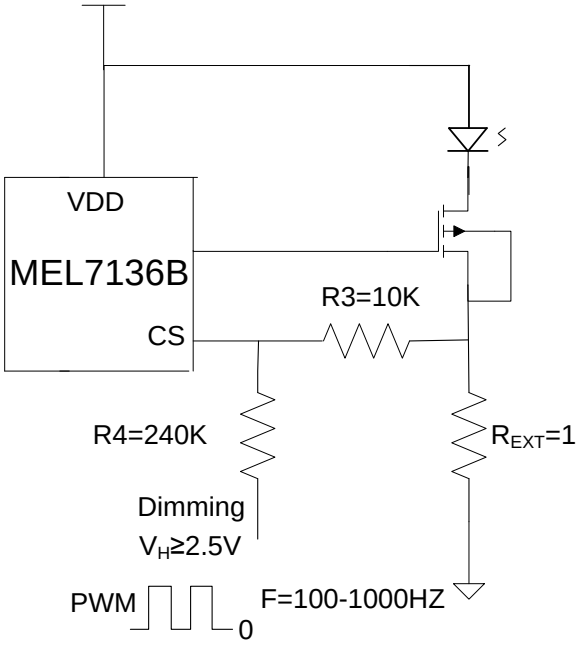


Figure 2. Dimming Control Using a PWM Signal

R4:R3=24:1,The average output current is given by:

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

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

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. R4:R3=24:1,The average output current is given by:

$$ILED = \frac{V_{REF} - \frac{R3 \times (2.5 \times Duty - V_{REF})}{R4}}{R_{EXT}} \qquad (2.5 \le VPWM \le VDD \ \& \ 0 \le Duty \le 100\%)$$

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.

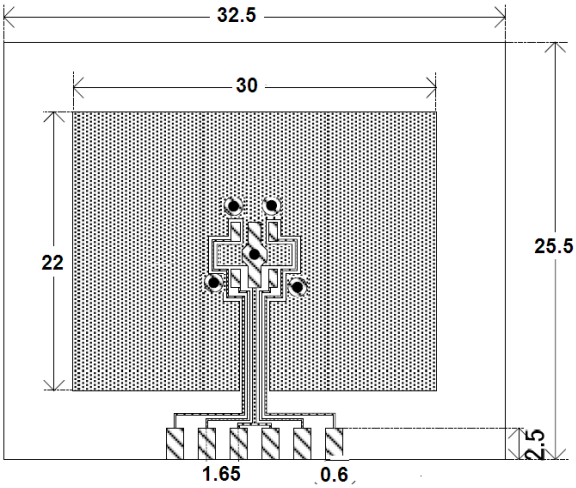
Power dissipation

- 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

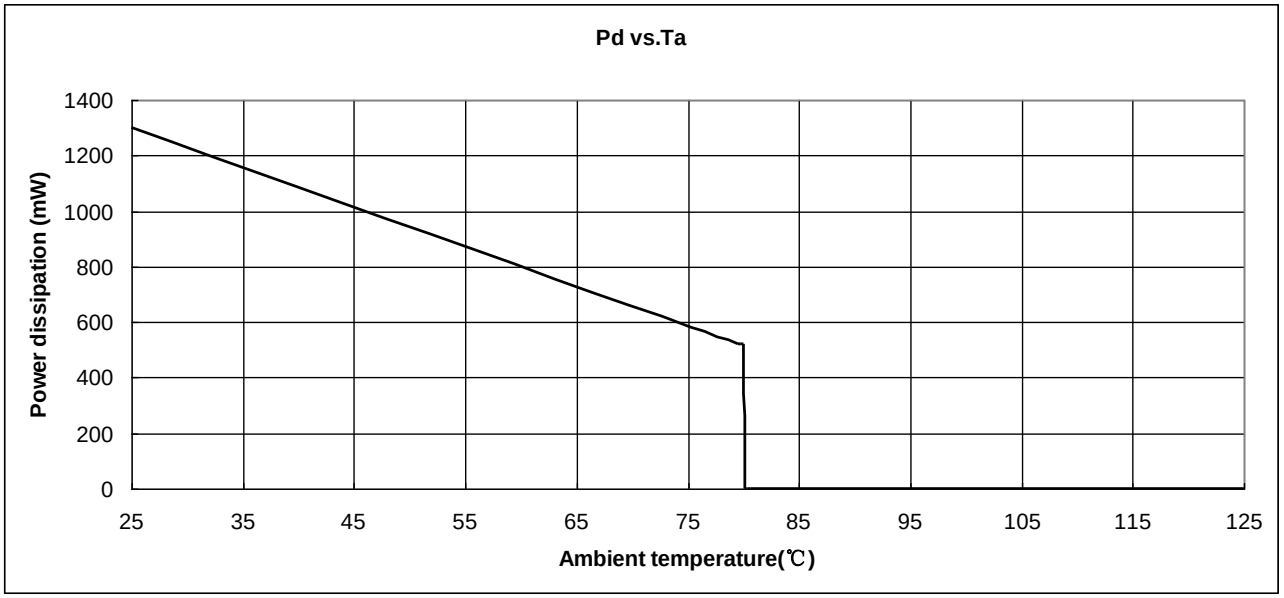


Evaluation Board(Unit:mm)

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	

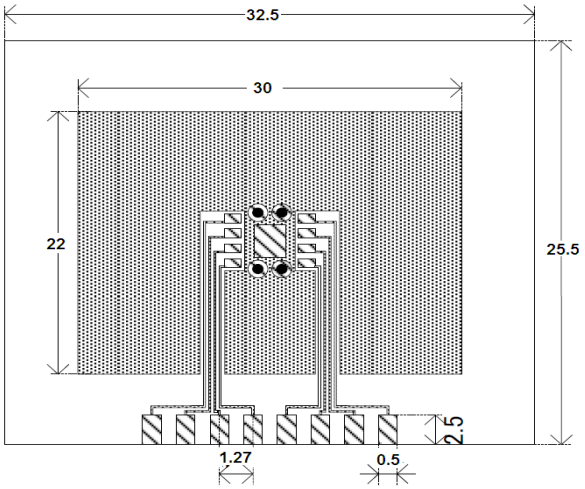


● ESOP8 power dissipation

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.

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: 4*0.8 Diameter

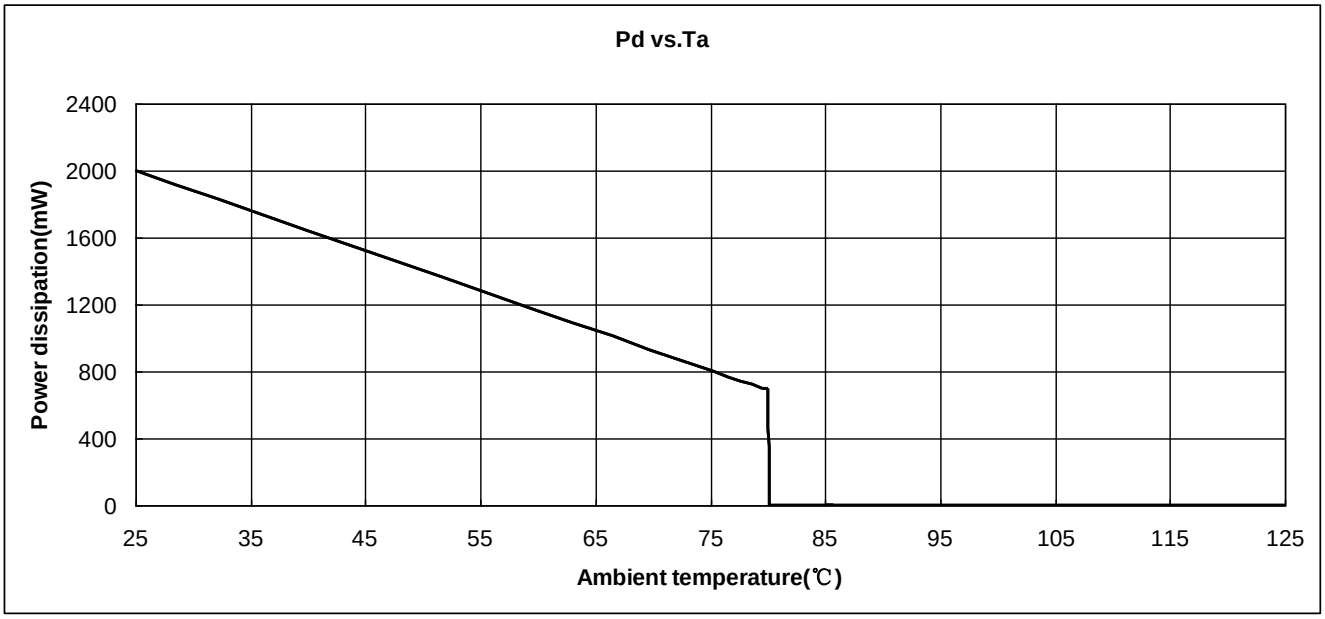


Evaluation Board(Unit:mm)

2. Power dissipation vs. Ambient temperature

Board Mount (T_j max=125 ℃)

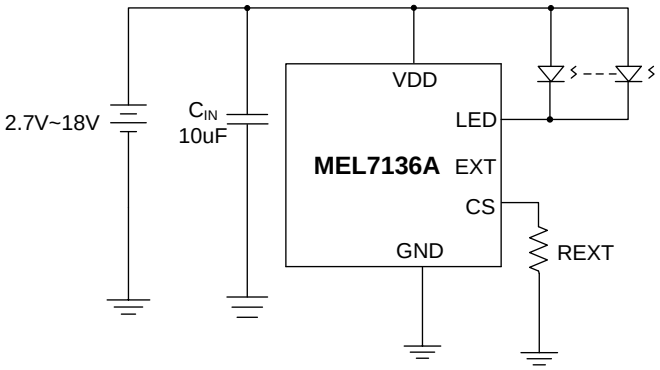
Ambient Temperature(℃)	Power Dissipation(mW)	Thermal Resistance(℃/W)
25	2000	66.67
85	700	



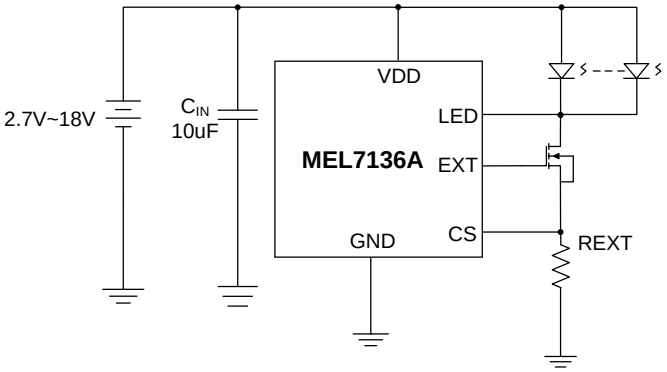
Typical Application Circuit

MEL7136A

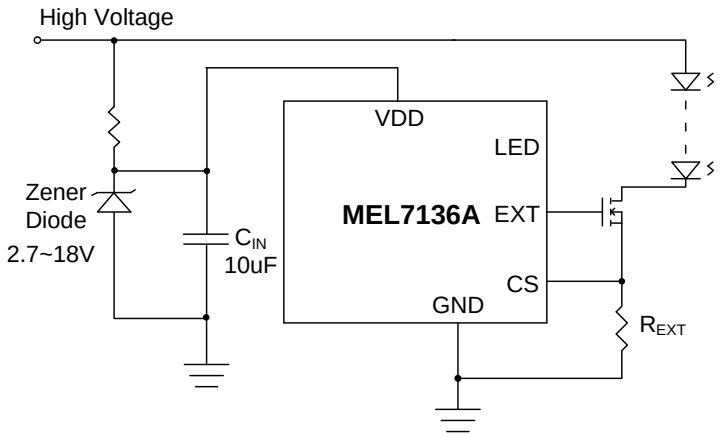
Low Voltage And Light Load (Under 1A)



Low Voltage And Heavy Load (Exceed 1A)

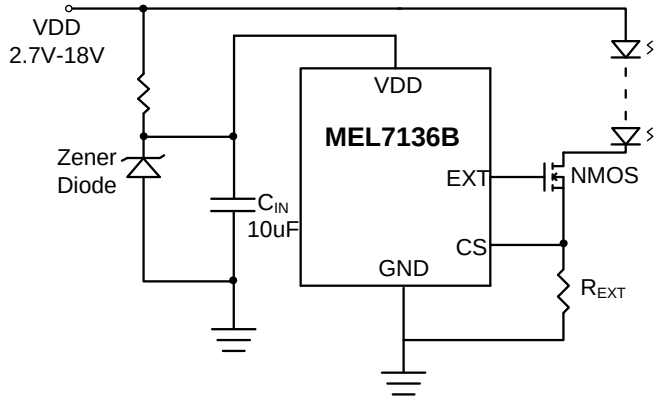


High Voltage Application

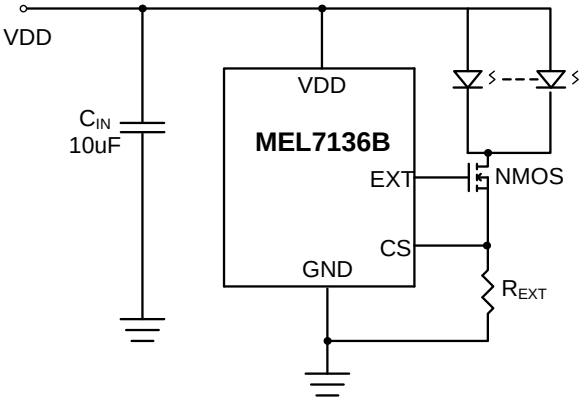


MEL7136B

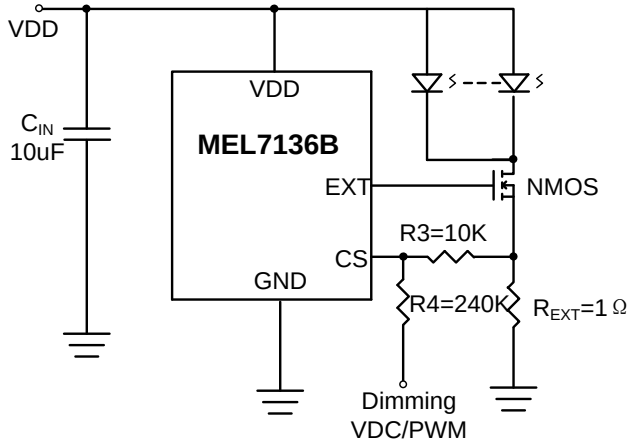
Low Voltage Application



High Voltage Application

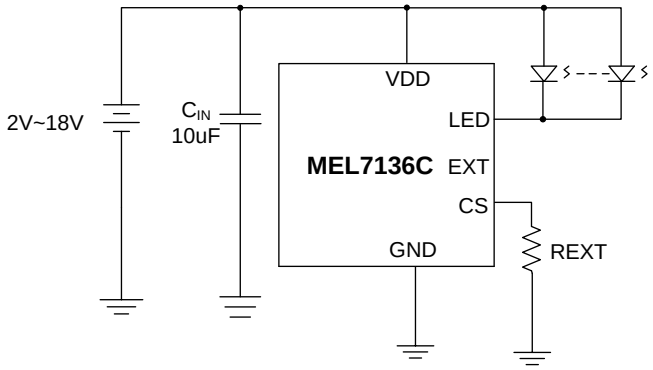


Adjustable Output Current Application

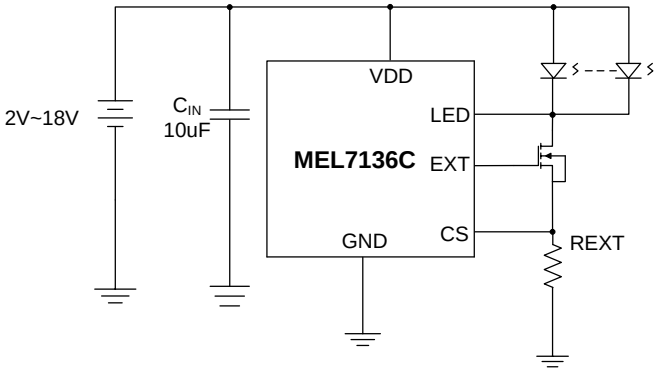


MEL7136C

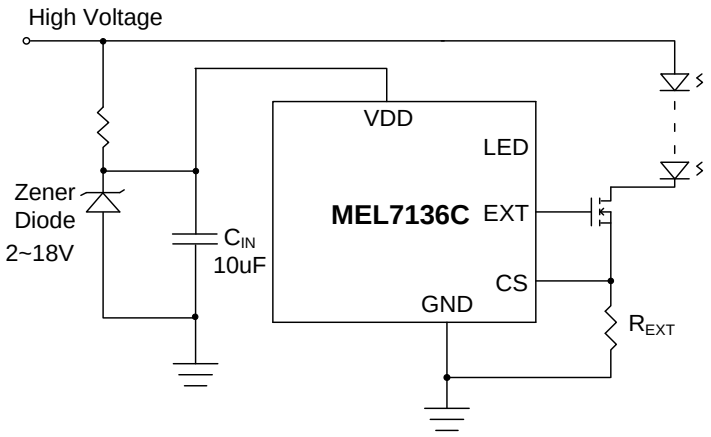
Low Voltage And Light Load (Under 1A)



Low Voltage And Heavy Load (Exceed 1A)



High Voltage Application



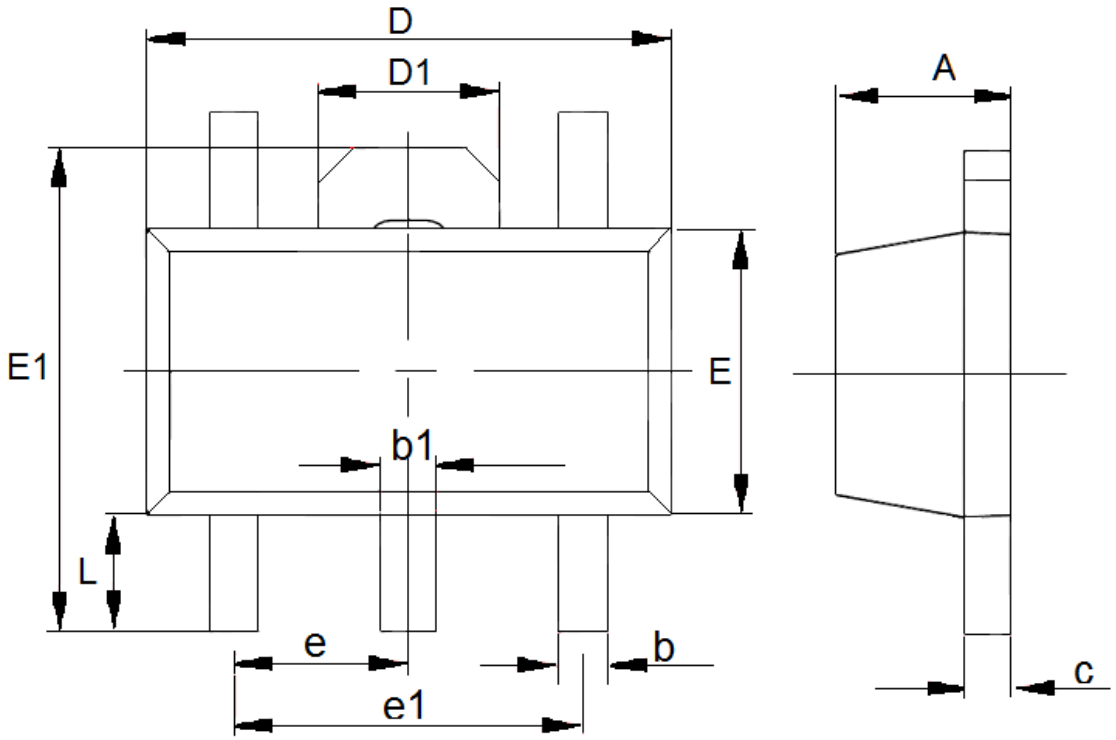
R_{EXT} Resistor Value selection:

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

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

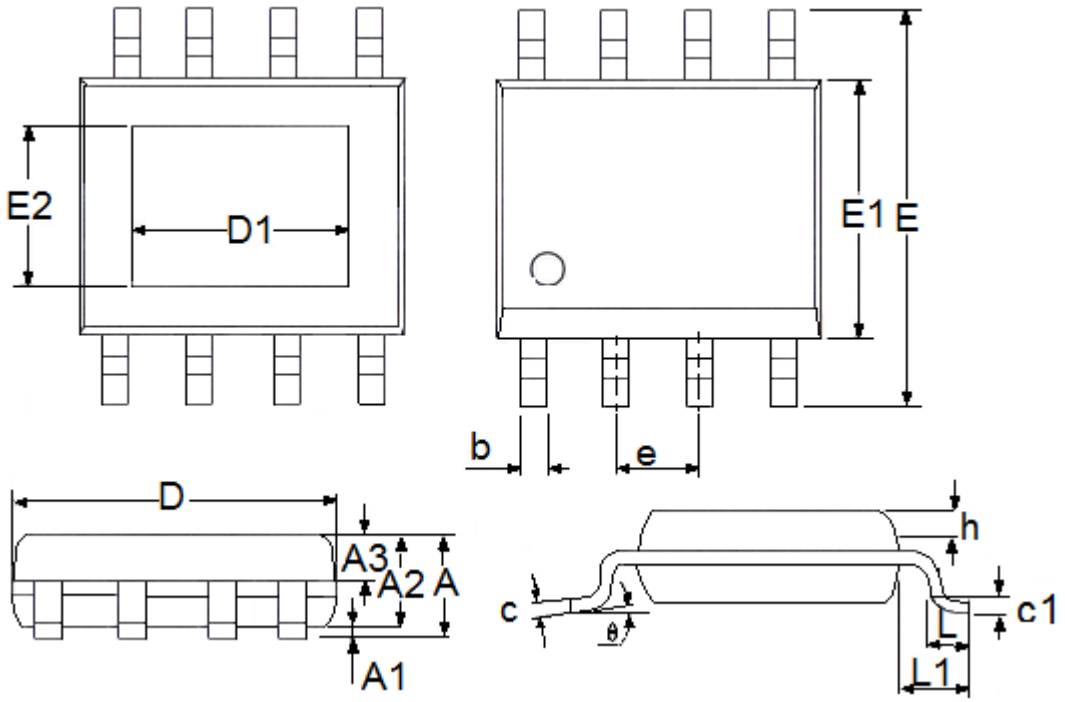
Package Information

- **Package Type:SOT89-5**



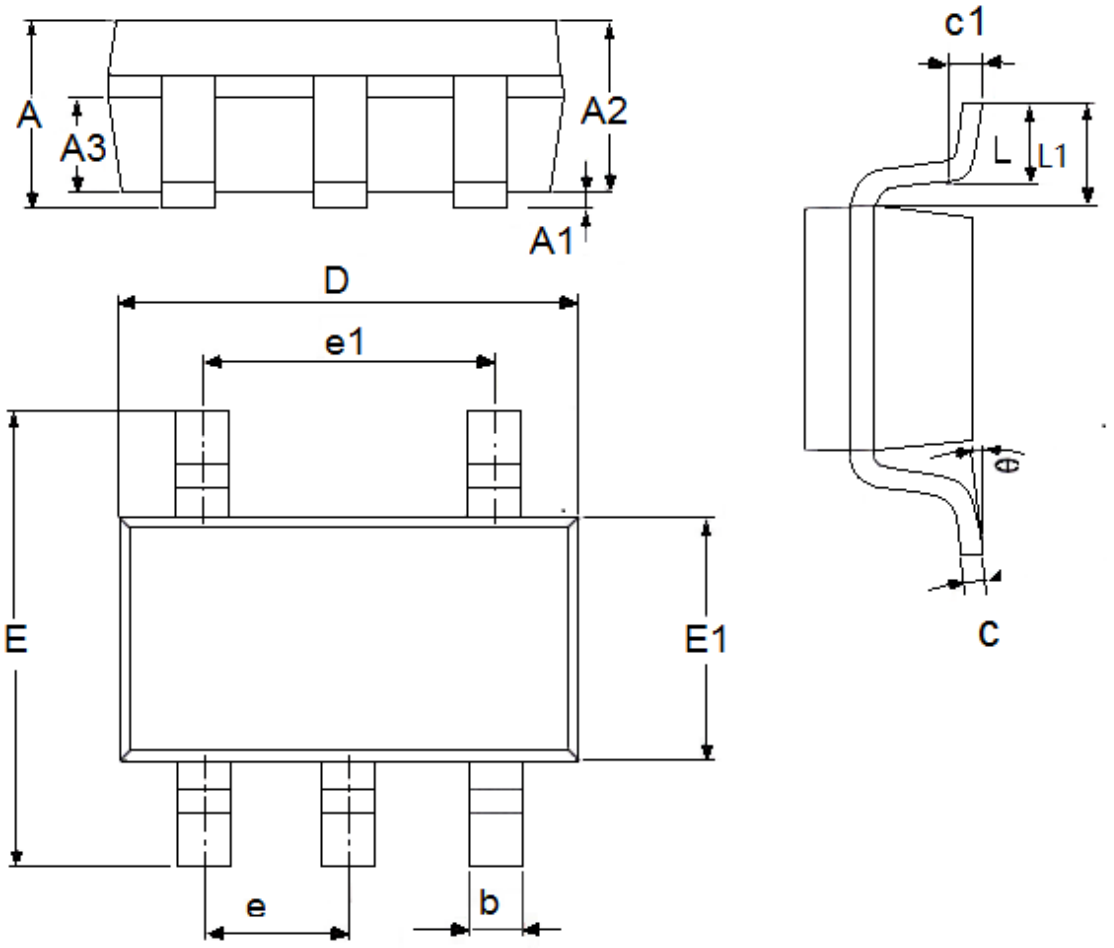
DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.4	1.6	0.0551	0.0630
b	0.32	0.52	0.0126	0.0205
b1	0.38	0.58	0.0150	0.0228
c	0.35	0.47	0.0138	0.0185
D	4.4	4.6	0.1732	0.1811
D1	1.55(TYP)		0.061(TYP)	
e1	3(TYP)		0.1181(TYP)	
E	2.3	2.6	0.0906	0.1023
E1	3.94	4.4	0.1551	0.1732
e	1.5(TYP)		0.0591(TYP)	
L	0.8	1.2	0.0315	0.0472

- **Package Type:ESOP8**



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.3	1.75	0.0512	0.0689
A1	0	0.2	0.0000	0.0079
A2	1.25	1.65	0.0492	0.0650
A3	0.5	0.7	0.0197	0.0276
b	0.33	0.51	0.0130	0.0201
c	0.17	0.25	0.0067	0.0098
D	4.7	5.1	0.1850	0.2008
E	5.8	6.2	0.2283	0.2441
E1	3.8	4	0.1496	0.1575
e	1.27(TYP)		0.05(TYP)	
h	0.25	0.5	0.0098	0.0197
L	0.4	1.27	0.0157	0.0500
L1	1.04(TYP)		0.0409(TYP)	
θ	0	8°	0.0000	8°
c1	0.25(TYP)		0.0098(TYP)	
D1(90*90)	2.09(TYP)		0.0823(TYP)	
D1(95*130)	3.1(TYP)		0.122(TYP)	
E2(90*90)	2.09(TYP)		0.0823(TYP)	
E2(95*130)	2.21(TYP)		0.087(TYP)	

- **Package Type:SOT23-5**



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.05	1.45	0.0413	0.0571
A1	0	0.15	0.0000	0.0059
A2	0.9	1.3	0.0354	0.0512
A3	0.6	0.7	0.0236	0.0276
b	0.25	0.5	0.0098	0.0197
c	0.1	0.23	0.0039	0.0091
D	2.82	3.05	0.1110	0.1201
e1	1.9(TYP)		0.0748(TYP)	
E	2.6	3.05	0.1024	0.1201
E1	1.5	1.75	0.0512	0.0689
e	0.95(TYP)		0.0374(TYP)	
L	0.25	0.6	0.0098	0.0236
L1	0.59(TYP)		0.0232(TYP)	
θ	0	8°	0.0000	8°
c1	0.2(TYP)		0.0079(TYP)	

- The information described herein is subject to change without notice.
- Nanjing Micro One Electronics Inc is not responsible for any problems caused by circuits or diagrams described herein whose related industrial properties, patents, or other rights belong to third parties. The application circuit examples explain typical applications of the products, and do not guarantee the success of any specific mass-production design.
- Use of the information described herein for other purposes and/or reproduction or copying without the express permission of Nanjing Micro One Electronics Inc is strictly prohibited.
- The products described herein cannot be used as part of any device or equipment affecting the human body, such as exercise equipment, medical equipment, security systems, gas equipment, or any apparatus installed in airplanes and other vehicles, without prior written permission of Nanjing Micro One Electronics Inc.
- Although Nanjing Micro One Electronics Inc exerts the greatest possible effort to ensure high quality and reliability, the failure or malfunction of semiconductor products may occur. The user of these products should therefore give thorough consideration to safety design, including redundancy, fire-prevention measures, and malfunction prevention, to prevent any accidents, fires, or community damage that may ensue.