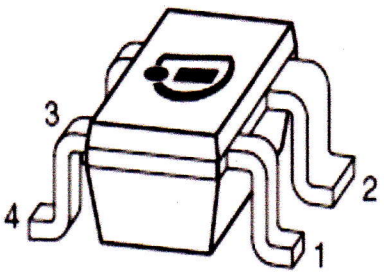
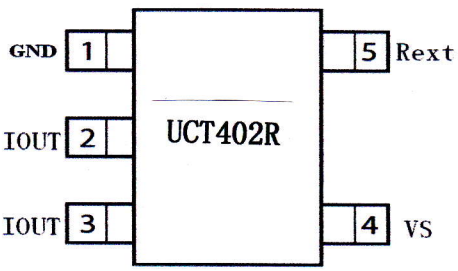
UCT402R Linear LED Driver

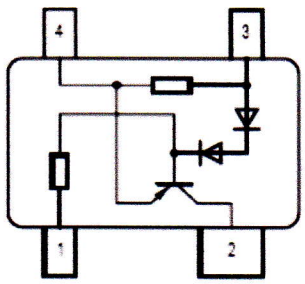
- Supplies stable bias current even at low battery voltage
- Suitable for PWM control up to 100kHz
- Ideal for stabilizing bias current of LEDs
- negative temperature coefficient protects LEDs against thermal overload
- Low Cost, Low External Parts Count, Easy-to-use, Fast Time-To-Market
- Pb-free (RoHS compliant) package [1)]
- qualified according AEC Q101
- Small Surface-Mount SOT23-5、SOT23-3L

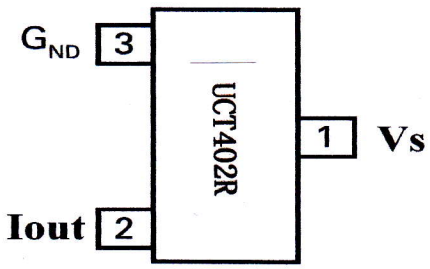
2 Pin Definition





SOT23-5





SOT23-3L

3 Maximum Ratings

Parameter	symbol	value	unit
Source voltage	V_S	18	V
Output current	I_{out}	60	mA
Output voltage	V_{out}	16	V
Reverse voltage between all terminals	V_R	0.5	
Total power dissipation, T_S=84℃	P_{tot}	330	mW
Junction temperature	T_j	150	℃
Storage temperature	T_{stg}	-65～150	

Thermal resistance

Package	parameter	symbol	value	unit
SOT23-5	Junction-soldering point[2)]	R_{thJS}	≤250	K/W
SOT23-3L	Junction-soldering point[2)]	R_{thJS}	≤300	K/W

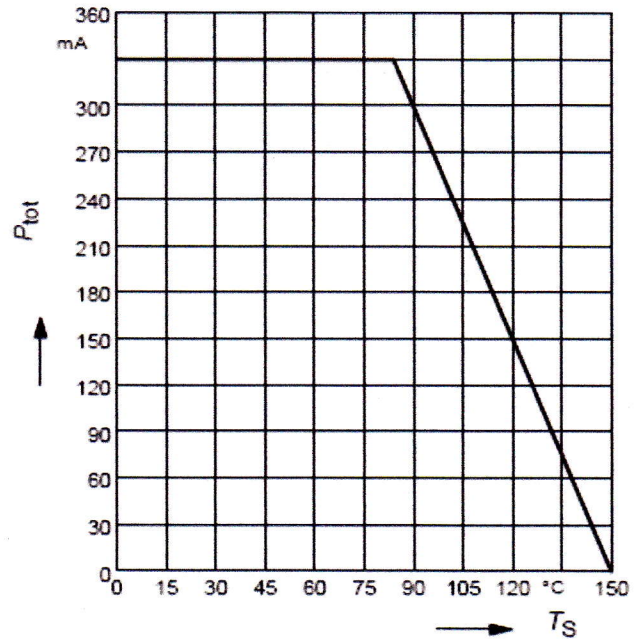
1 Pb-containing package may be available upon special request

2 For calculation of R_{thJA} please refer to Application Note Thermal Resistance

Electrical Characteristics at T_A=25°C, unless otherwise specified

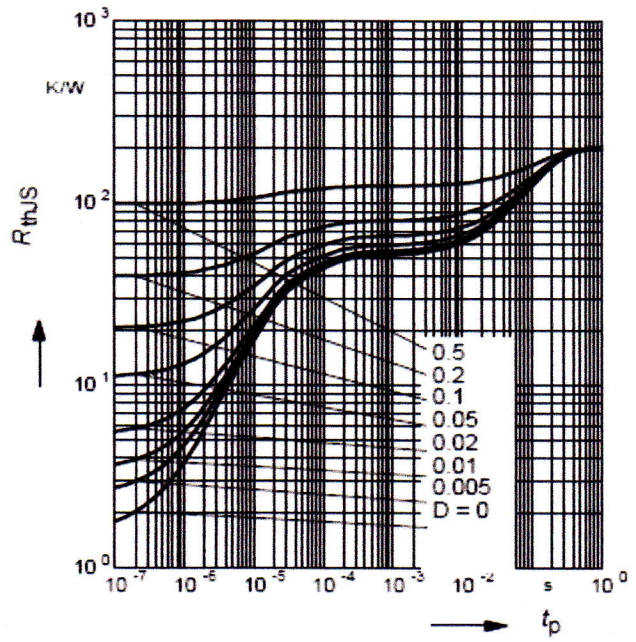
parameter	symbol	Values			Unit
		min	typ	max	
characteristics					
Supply current V_S=10V	I_S	350	440	540	μA
Output current V_S=10V, V_{out}=7.6V	I_{out}	18	20	22	mA
DC Characteristics with stabilized LED load					
Lowest sufficient battery voltage overhead I_{out}>18mA	V_{smin}	-	1.4	-	v
Voltage drop (VS-VCE) I_{out}=20mA	V_{drop}	-	0.75	-	
Output current change versus T_A V_S=10V	△Iout/Iout	-	-0.3	-	%/K
Output current change versus V_S V_S=10V	△Iout/Iout	-	2	-	%/V

Total power dissipation $P_{tot} = f(T_S)$	**Permissible Pulse Load** $R_{thJS} = f(tp)$



Permissible Pulse Load

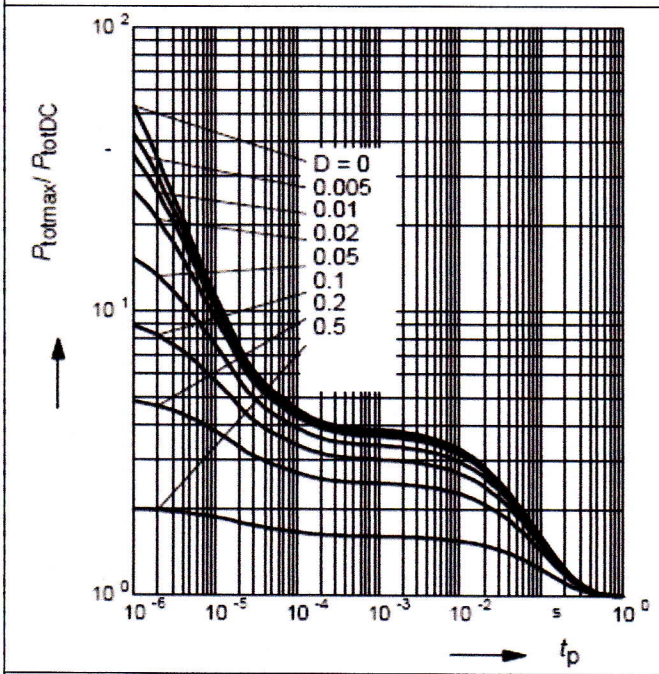
*P*totmax / *P*totDC = *f* (*t*p)



Output current versus supply voltage

*I*out = *f* (*V*S); *R*ext = Parameter

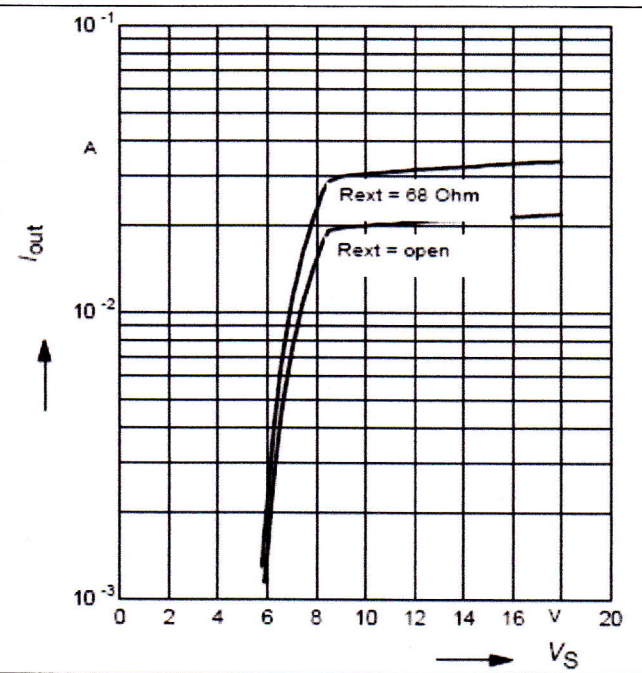
Load: two LEDs with *V*F = 3.8V in series



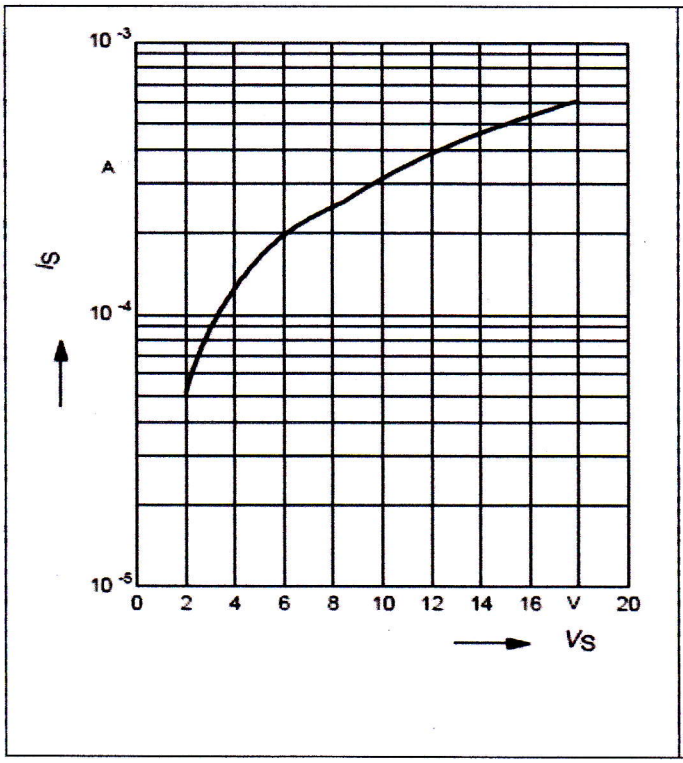
Supply current versus supply voltage

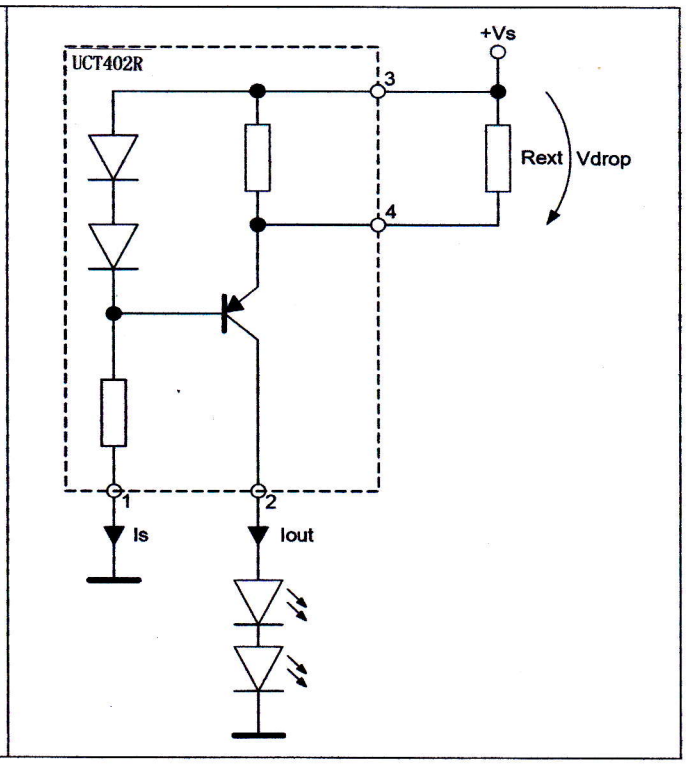
*I*S = *f*(*V*S)

Load: two LEDs with *V*F = 3.8V in series

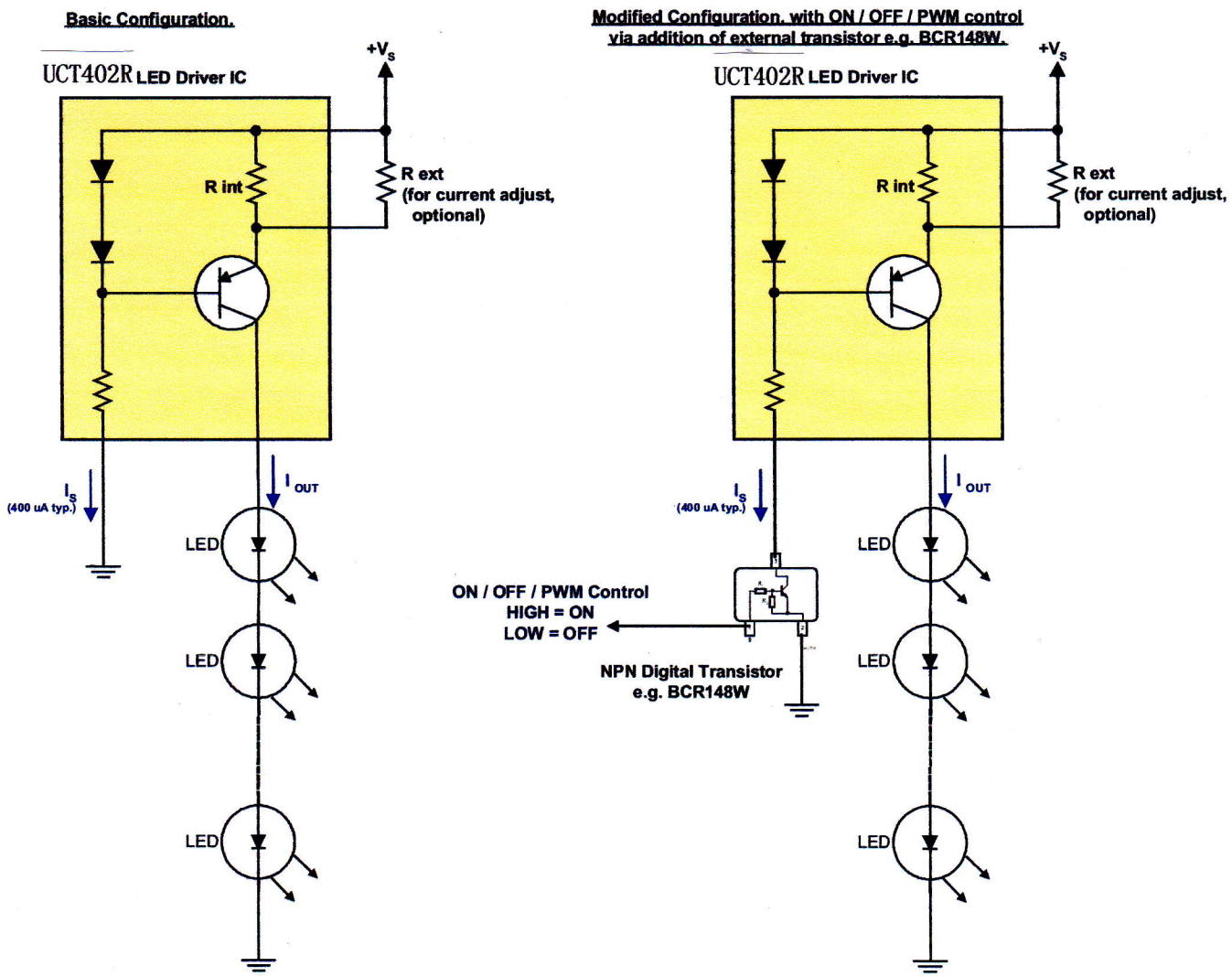


Application Circuit:

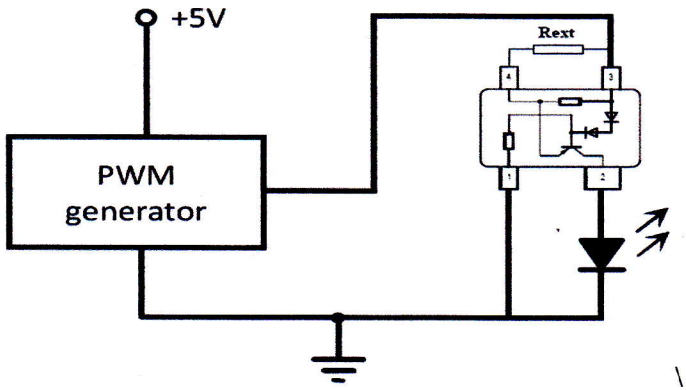

10 -3
A
Is
10 -4
10 -5
0 2 4 6 8 10 12 14 16 V 20
Vs


UCT402R
+Vs
3
4
Rext
Vdrop
1
2
Is
Iout

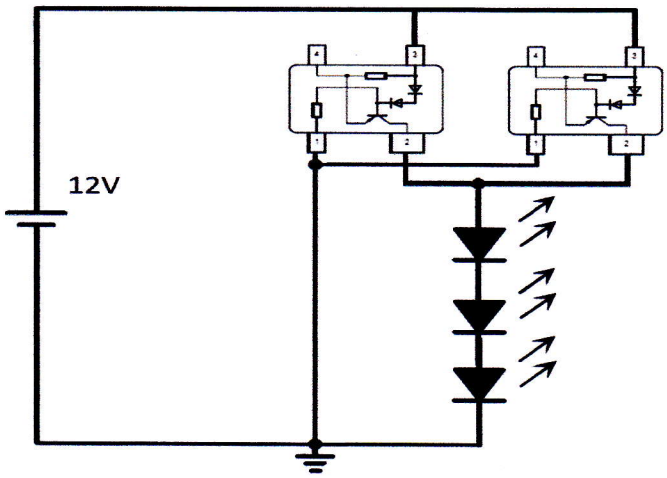
4 Application Circuits



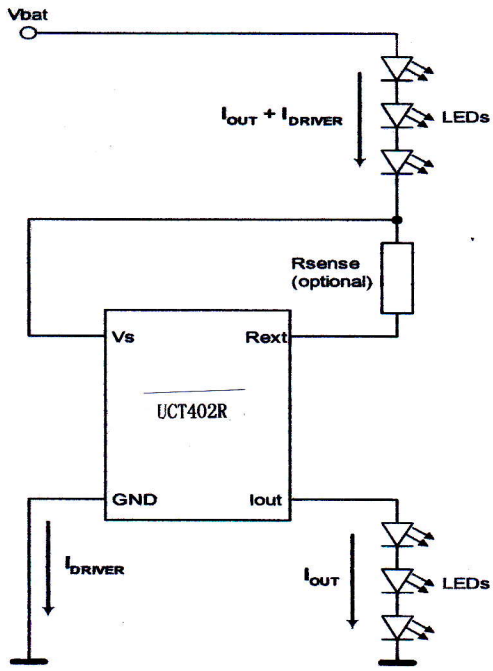
4.1 5V PWM lighting application



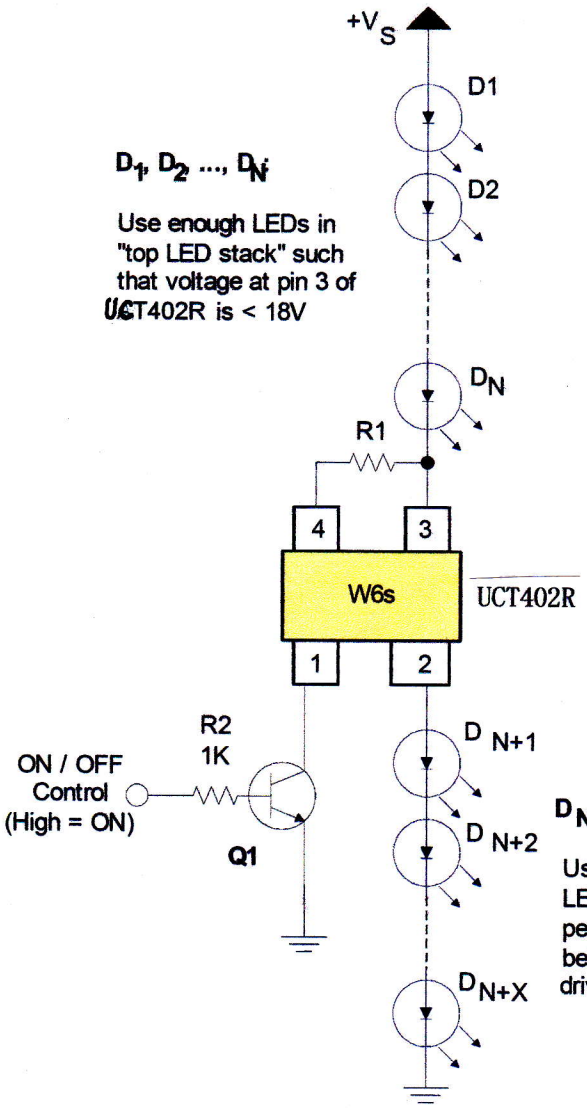
4.2 Parallel connection application



4.3 Using UCT402R at high supply voltages



I_{DRIVER} is negligibly small due to DC current gain of LED Driver transistor cell. Therefore difference in current for top and bottom LED stacks is negligible.



D_1, D_2 ..., D_N:

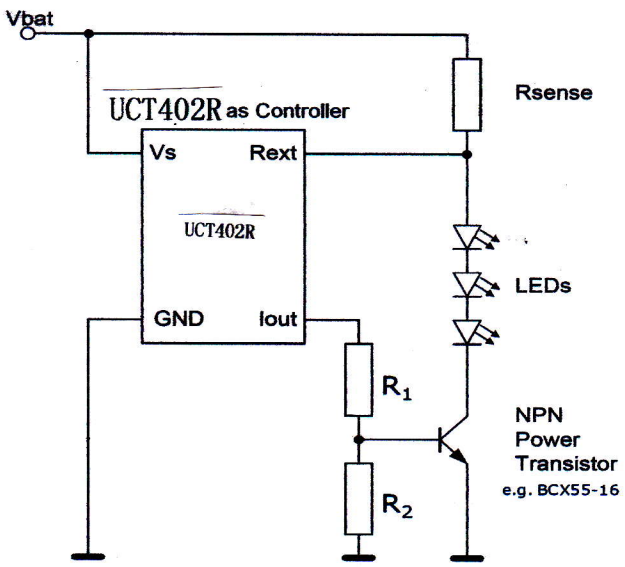
Use enough LEDs in "top LED stack" such that voltage at pin 3 of UCT402R is < 18V

Note: maximum possible number of LEDs that can be used in entire circuit depends upon $+V_S$ & voltage drop across particular diode types. Q1 and R2 are optional, if it is desired to switch LED stack on and off at this point. If switch is not needed, ground pin 1 of UCT402R. Be sure Q1 can handle voltage present at pin 1 of UCT402R given the value of $+V_S$ selected. Infineon produces a broad range of switching transistors suitable for Q1.

D_{N+1}, D_{N+2} ..., D_{N+X}:

Use maximum number of LEDs in "bottom stack" that permits sufficient voltage between pin 2 and ground to drive them.

4.4 UCT402R using as controller



The resistors R_{sense}, R_1 and R_2 can be calculated according to the following equations. All parameters marked with a star * are related to the transistor's data sheet. $I_{LED} = \frac{V_{drop}}{\frac{R_{int} \cdot R_{sense}}{R_{int} + R_{sense}}}$

The transistor base current is defined by:

(6) $I_B = \frac{I_{LED}}{B^*}$ *B...DC current gain of transistor*

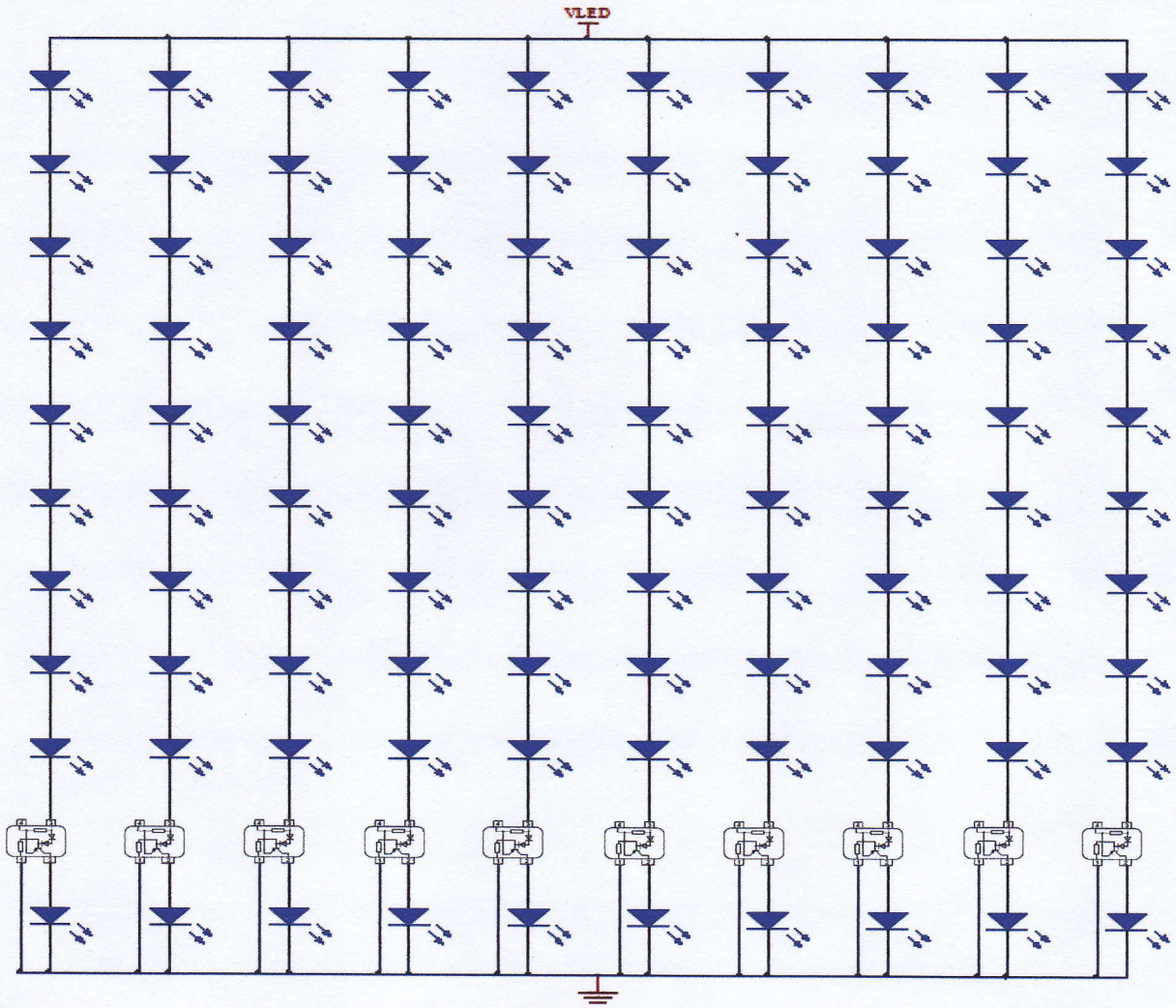
The resistor R_2 is calculated according:

(7) $R_2 = \frac{V_{BE(on)}^*}{I_{R2}}$ $I_{R2} = 2...10 \cdot I_B$

The resistor R_1 is calculated according:

(8) $R_1 = \frac{V_{BAT(\min)} - V_{S(\min)} - V_{BE(on)}^*}{I_B + I_{R2}}$

4.5 36V light tube application

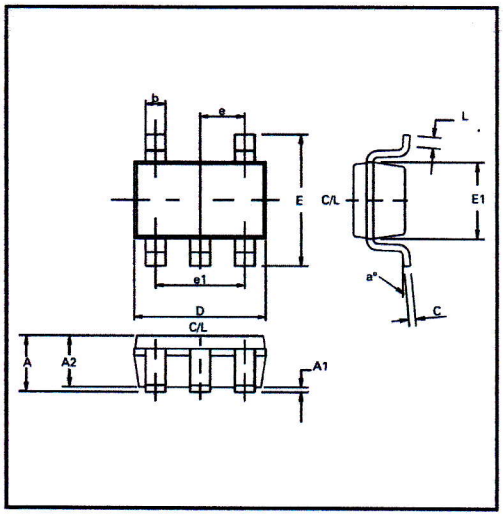


LED current could be adjusted by using Rext connected between Vs and Rext

Package

■ SOT23-5

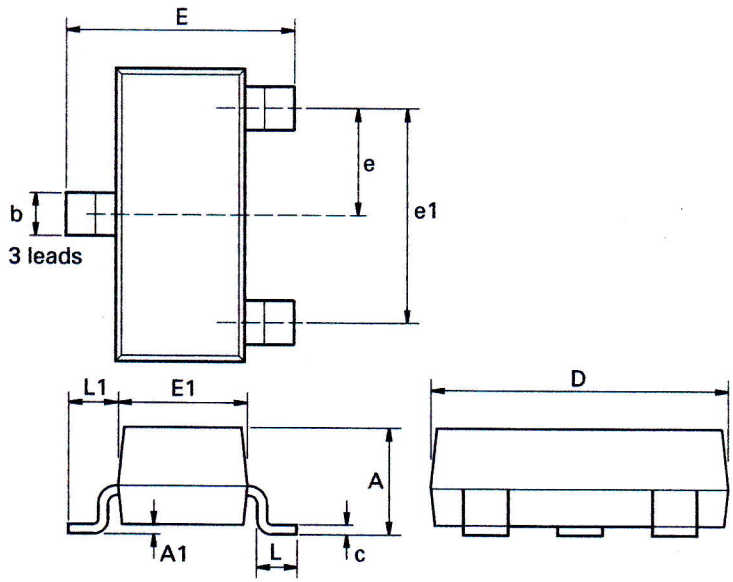
SOT23-5 PACKAGE OUTLINE



SOT23-5 PACKAGE DIMENSIONS

DIM	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	0.90	1.45	0.035	0.057
A1	0.00	0.15	0.00	0.006
A2	0.90	1.3	0.035	0.051
b	0.35	0.50	0.014	0.020
C	0.09	0.20	0.0035	0.008
D	2.80	3.00	0.110	0.118
E	2.60	3.00	0.102	0.118
E1	1.50	1.75	0.059	0.069
e	0.95 REF		0.037 REF	
e1	1.90 REF		0.075 REF	
L	0.10	0.60	0.004	0.024
a°	0	10	0	10

■ SOT23-3L



Dim.	Millimeters		Inches		Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	-	1.12	-	0.044	e1	1.90 NOM		0.075 NOM	
A1	0.01	0.10	0.0004	0.004	E	2.10	2.64	0.083	0.104
b	0.30	0.50	0.012	0.020	E1	1.20	1.40	0.047	0.055
c	0.085	0.20	0.003	0.008	L	0.25	0.60	0.0098	0.0236
D	2.80	3.04	0.110	0.120	L1	0.45	0.62	0.018	0.024
e	0.95 NOM		0.037 NOM		-	-	-	-	-