

## Low Dropout Adjustable 350mA Current Regulator

### GENERAL DESCRIPTION

PT4404 is a low dropout current regulator with an adjustable constant sink current sink of up to 350mA. The dropout voltage at 350mA is typically 110mV with the quiescent current of only 100 $\mu$ A. The enable pin is used to shutdown the chip or control the LED brightness with a PWM signal.

The built-in thermal shutdown protection shuts down the chip when the chip temperature exceeds 150°C. An external resistor can be used to set the output current level. The PT4404 is packaged with SOT-89-5.

### FEATURES

- Supply voltage range: 2.7V-5.5V
- Current sink set by external resistor
- 110mV Low Dropout voltage for 350mA current output
- 100 $\mu$ A quiescent current
- 0.1 $\mu$ A shutdown current
- Built-in thermal shutdown protection
- SOT-89-5 Package

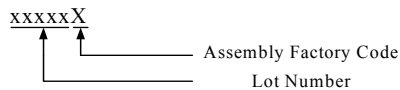
### APPLICATION

- Power LED Driver
- Constant current sink

### ORDERING INFORMATION

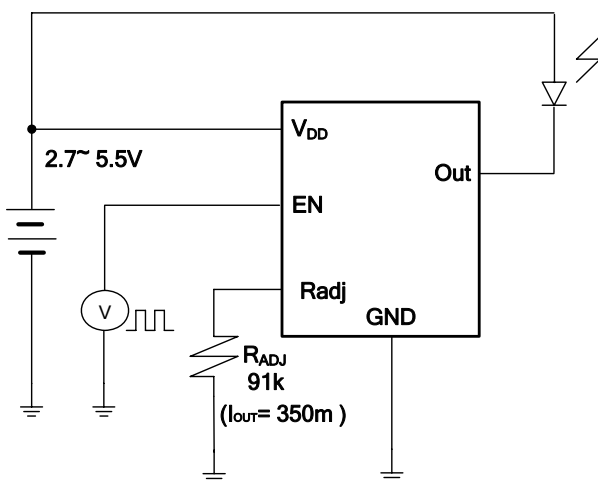
PACKAGE	TEMPERATURE RANGE	ORDERING PART NUMBER	TRANSPORMEDIA	MARKING
SOT-89-5	-40 °C to 85 °C	PT4404E89E	Tape and Reel 1000 units	PT4404 xxxxxX

Note:

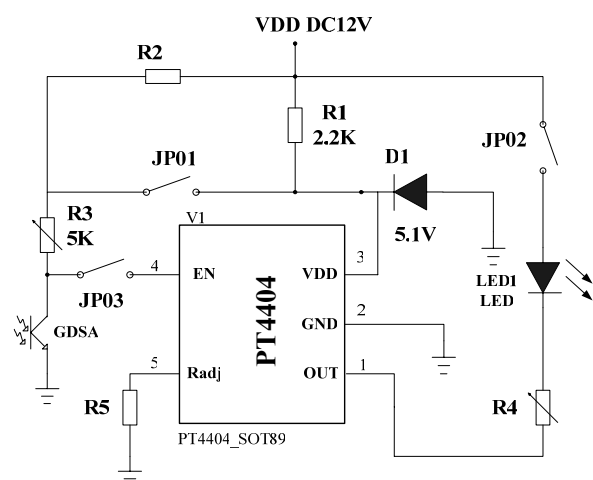


### TYPICAL APPLICATION CIRCUIT

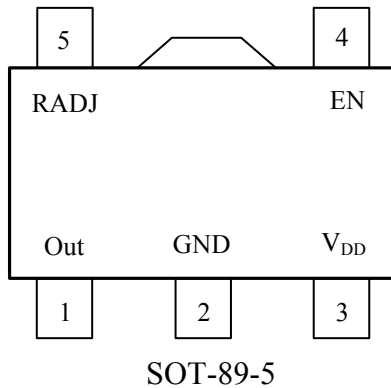
VDD $\leq$ 5.5V:



VDD $>$ 5.5V:



### PIN ASSIGNMENT



### PIN DESCRIPTIONS

SYMBOL	SOT-89-5	DESCRIPTION
V <sub>DD</sub>	3	Power Supply
GND	2	Ground
OUT	1	Adjustable Sink Current Output up to 350mA
RADJ	5	Connecting to an External Resistor for Setting Output Current
EN	4	Enable Input Logic, Enable High

### ABSOLUTE MAXIMUM RATINGS (Note 1)

SYMBOL	ITEMS	VALUE	UNIT
V <sub>DD</sub>	Supply Voltage	-0.3 to 6.5	V
V <sub>OUT</sub>	Out Voltage	-0.3 to 6.5	V
P <sub>DMAX</sub>	Power Dissipation (Note 2)	Internally Limited	W
P <sub>TR</sub>	Thermal Resistance, SOT-89-5 θ <sub>JA</sub>	45	°C/W
T <sub>J</sub>	Operation Junction Temperature Range	-40 to 150	°C
T <sub>STG</sub>	Storage Temperature	-55 to 150	°C
	ESD Susceptibility (Note 3)	2	kV

### RECOMMENDED OPERATING RANGE

SYMBOL	ITEMS	VALUE	UNIT
V <sub>DD</sub>	V <sub>DD</sub> Supply Voltage	+2.7 to +6.0	V
T <sub>OPT</sub>	Operating Temperature	-40 to +85	°C

**Note 1:** Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Recommended Operating Range indicates conditions for which the device is functional, but do not guarantee specific performance limits. Electrical Characteristics state DC and AC electrical specifications under particular test conditions which guarantee specific performance limits. This assumes that the device is within the Operating Range. Specifications are not guaranteed for parameters where no limit is given, however, the typical value is a good indication of device performance.

**Note 2:** The maximum power dissipation must be derated at elevated temperatures and is dictated by T<sub>JMAX</sub>, θ<sub>JA</sub>, and the ambient temperature T<sub>A</sub>. The maximum allowable power dissipation is P<sub>DMAX</sub> = (T<sub>JMAX</sub> - T<sub>A</sub>) / θ<sub>JA</sub> or the number given in Absolute Maximum Ratings, whichever is lower.

**Note 3:** Human body model, 100pF discharged through a 1.5kΩ resistor.

### ELECTRICAL CHARACTERISTICS (Note 4, 5)

The following specifications apply for  $R_{ADJ} = 91k\ \Omega$ ,  $T_A = 25\ ^\circ\text{C}$ , unless specified otherwise.

SYMBOL	ITEMS	CONDITIONS	Min.	Typ.	Max.	UNIT
$V_{DD}$	Input Voltage		2.7		5.5	V
$I_Q$	No load Operating Current	No any connection to Out		100		$\mu\text{A}$
$I_{SD}$	Shutdown Current	$EN = 0$		0.1	1	$\mu\text{A}$
	Load Regulation	$V_{OUT} = 0.2$ to $4V$		1		$\text{mA/V}$
	Line Regulation	$V_{DD} = 3$ to $6V$ $V_{OUT} = 0.2V$		3		$\text{mA/V}$
$I_{OUT}$	The output current of pin out	Dropout voltage = $500\text{mV}$	336	350	364	$\text{mA}$
$V_{DP}$ (Note 6)	Minimum Dropout voltage	$I_{OUT} = 0.9 \times \text{Maximum}(I_{OUT})$		110		$\text{mV}$
$I_T$	Output current temperature coefficient			100		$\text{ppm}/^\circ\text{C}$
$V_{ENL}$	EN Maximum Low Level Threshold	$V_{DD} = 5V$			1.4	V
$V_{ENH}$	EN Minimum High Level Threshold	$V_{DD} = 5V$	1.8			V

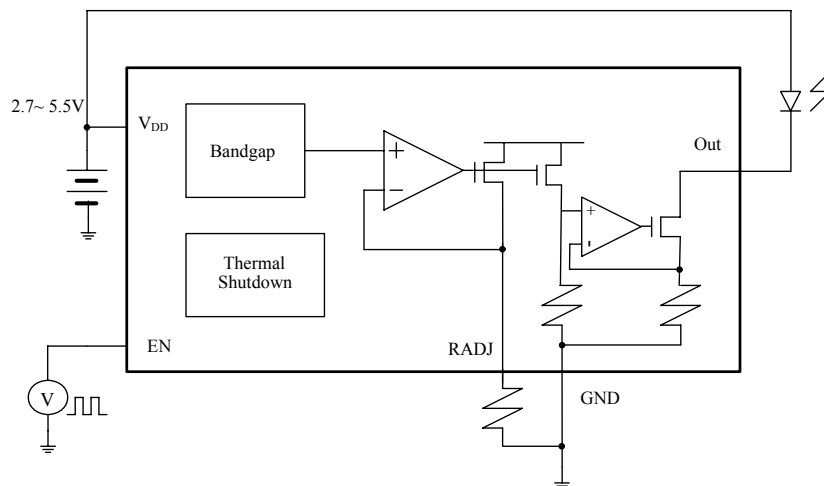
**Note 3:** Human body model,  $100\text{pF}$  discharged through a  $1.5\text{k}\Omega$  resistor.

**Note 4:** Typicals are measured at  $25\ ^\circ\text{C}$  and represent the parametric norm.

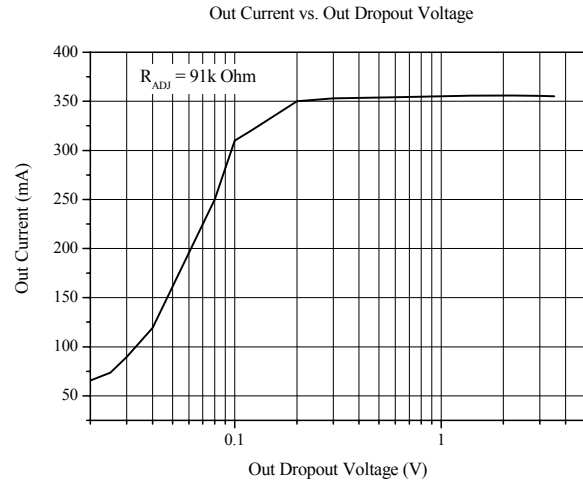
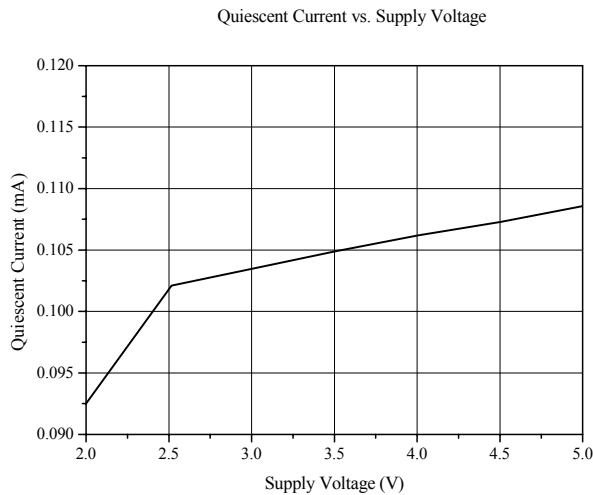
**Note 5:** Datasheet min/max specification limits are guaranteed by design, test, or statistical analysis.

**Note 6:** Dropout Voltage is defined as: the out pin voltage when the current of current sink drop to  $0.9 \times \text{Maximum}(I_{OUT})$  under  $2.7\ \text{V}$  input supply.

### SIMPLIFIED BLOCK DIAGRAM



### TYPICAL PERFORMANCE CHARACTERISTICS



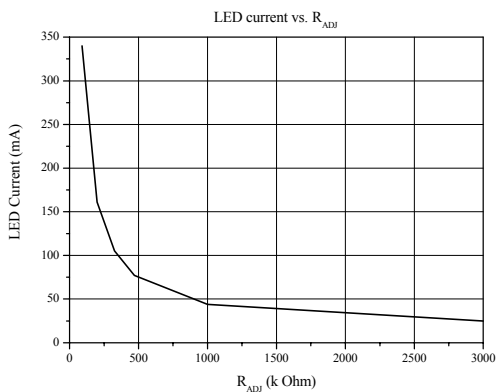
### APPLICATION INFORMATION

#### Set the LED current by $R_{ADJ}$ :

The PT4404 can be set to a fixed output current by a resistor  $R_{ADJ}$  connected from RADJ pin to GND pin. The output current can be programmed between a few milliamps and up to more than 350mA. The current into LED can be calculated by the formula as below:

$$I_{OUT} = 31850\ (V) / R_{ADJ}\ (\Omega)$$

Figure 1 shows the typical value of  $R_{ADJ}$  versus LED current.



#### The Maximum Power Dissipation on Regulator:

$$P_{D(MAX)} = V_{OUT(MAX)} \times I_{OUT(NOM)} + V_{IN(MAX)} \times I_Q$$

$V_{OUT(MAX)}$  = the maximum voltage on output pin;  
 $I_{OUT(NOM)}$  = the nominal output current;  
 $I_Q$  = the quiescent current the regulator consumes at  $I_{OUT(MAX)}$ ;  
 $V_{IN(MAX)}$  = the maximum input voltage.

#### Thermal Consideration:

The PT4404 has internal thermal limiting circuitry designed to protect the device under overload conditions. However, maximum junction temperature ratings should not be exceeded under continuous normal load conditions. The thermal protection circuit of PT4404 prevents the device from damage due to excessive power dissipation. When the device temperature rises to approximately 150°C, the regulator will be turned off. When power consumption is over about 1.33W (SOT-89-5 package, at  $T_A=60^\circ\text{C}$ ), additional heat sink is required to control the junction temperature below 120°C.

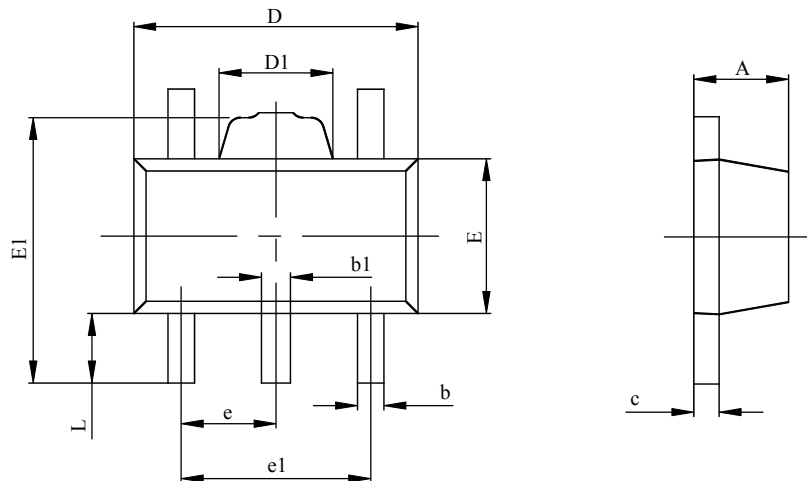
$$T_J = P_D (\theta_{JA}) + T_A$$

$P_D$  : Dissipated power

$\theta_{JA}$ : Thermal resistance from the junction to ambient

### PACKAGE INFORMATION

#### SOT-89-5 Package



SYMBOL	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.360	0.560	0.014	0.022
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.400	1.800	0.055	0.071
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP.		0.060 TYP.	
e1	2.900	3.100	0.114	0.122
L	0.900	1.100	0.035	0.043