



三合微科股份有限公司
SAMHOP Microelectronics Corp.

SM6802/3/4

**WHITE / BLUE LED DRIVER FOR
LI- ION BATTERY APPLICATION**

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WHITE / BLUE LED DRIVER FOR LI- ION BATTERY APPLICATION

GENERAL DESCRIPTION

The SM6802/ SM6803/ SM6804 are White/Blue LED Driver for Li-Ion Battery Application. No external component is required. Especially good for use Li-ion battery powered LCD display's backlight white LEDs. The special circuit design provides over 90% efficiency in low noise.

The SM6802/SM6803/SM6804 is Integrated with 16-step programmable output sink current for LEDs brightness control.

Target end applications are color LCD display, such as mobile phone with color display, smart phone, PDA, etc.

Device Name	Initial LED Sink Current	Max. LED Sink Current	LED Number
SM6802	20mA	20mA	2
SM6803	20mA	20mA	3
SM6804	20mA	20mA	4

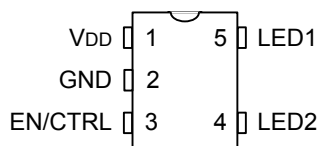
FEATURES

- * No external component required.
- * Programmable output current control, programming range 25% to 100% in 16 steps for LED brightness control.
- * Initial LED sink current 20 mA
- * 2channels (SOT-25), 3 channels (SOT-26/TSOP 6), 4 channels (MSOP-8) available.
- * 90% efficiency
- * Supply voltage range 3.0 V ~ 5.0 V
- * 0.1uA standby current

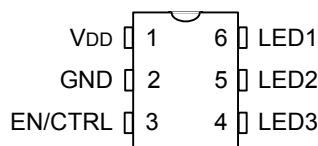
GENERAL APPLICATIONS

- * Small Size Color LCD Backlights
- * Mobile Phone, Smart Phone Keypad Backlights.

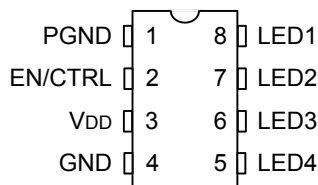
PIN ASSIGNMENTS



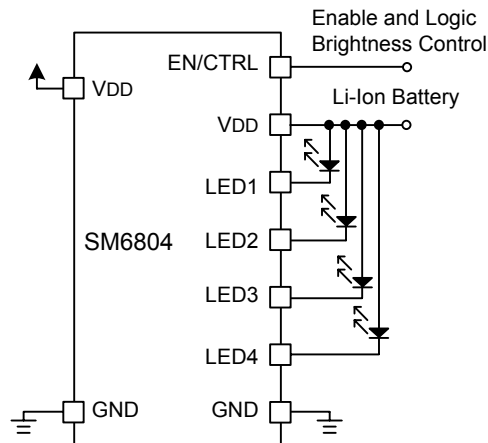
SM6802
SOT-25



SM6803
SOT-26 / TSOP 6



SM6804
MSOP-8

**WHITE / BLUE LED DRIVER FOR LI-ION BATTERY APPLICATION****TYPICAL APPLICATION****ABSOLUTE MAXIMUM RATINGS**

Characteristic	Symbol	Rating	Unit
Input Voltage	VDD	-0.3 ~ 7.0	V
Output Voltage	VLEDn	-0.3 ~ 7.0	V
Voltage at all other pins	-	-0.3 ~ 5.5	V
Maximum Junction Temperature	T _J	150	°C
Storage Temperature Range	-	-40 ~ 150	°C
Lead Temperature (soldering, 10 seconds)	-	260	°C

Note:

Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of the specified terminal.

POWER DISSIPATION TABLE

Package	θ ^o JA (°CW)	TA>25°C Derating factor(mW/°C)	TA<25°C Power rating(mW)	TA=70°C Power rating(mW)	TA=85°C Power rating(mW)
SOT-25	220	4.5	568	363	295
SOT-26	220	4.5	568	363	295
MSOP-8	180	5.56	695	444	361

Note:

Junction Temperature Calculation; $T_J = T_A + (P_D \cdot \theta_{JA})$

P_D: Power Dissipation, T_A: Ambient temperature, θ_{JA}: Thermal Resistance-Junction to Ambient

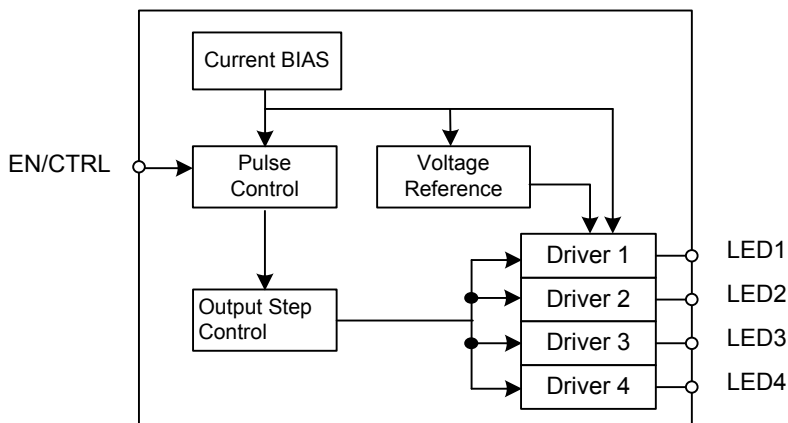
The θ_{JA} numbers are guidelines for the thermal performance of the device/PC-board system.

All of the above assume no ambient airflow.



WHITE / BLUE LED DRIVER FOR LI-ION BATTERY APPLICATION

BLOCK DIAGRAM



PIN DESCRIPTION (MSOP-8)

Pin NO.	I / O	Pin Name	Function Description
1	-	PGND	Power ground.
2	I	EN/CTRL	This pin combined enable and output sink current programming function. Pulling this pin constantly high will enable the device, Pulsing this pin constantly to GND will disable the device, To pulsing this pin low will decrease or increase the output Sink current, Please refer to the application section for further information.
3	-	VDD	Power supply
4	-	GND	Ground
5~8	O	LED1~LED4	Output pins, connect to LED's cathode.

NOTE: Power ground and Ground pin must be short on PCB Board.

**WHITE / BLUE LED DRIVER FOR LI-ION BATTERY APPLICATION****RECOMMENDED OPERATING CONDITIONS**

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	VDD	-	3	-	5	V
Output Sink Current	I _{LED}	-	-	-	25	mA
Operating free-air temperature range	T _a	-	-40	-	+85	C

DC ELECTRICAL CHARACTERISTICS(V_{DD} = 3.7V, T_a = 25°C, No Load, unless otherwise noted)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit	Apply Pin	
Input Voltage	"H" Level	V _{IH}	-	2	-	-	V	EN/CTRL
	"L" Level	V _{IL}	-	-	-	0.4		
Input Current	"H" Level	I _{IH}	-	-5.0	-	+5.0	μA	
	"L" Level	I _{IL}	-	-5.0	-	+5.0		
Short Low Pulse Width	t _s	-	9	-	30	μs		
Hold Time Between Pulse	t _H	-	10	-	-	μs		
Long Low Pulse Width	t _L	-	125	-	175	μs		
Minimum Disable Low Time	t _d	-	480	-	-	μs		
LED Dropout Voltage	V _{LEDL}	I _{LEDn} =20mA	-	100	120	mV	LEDn	
LED Maximum Sink Current	I _{LEDmax}	-	-	20	-	mA		
LED Sink Current Tolerance		I _{LEDn} =20mA, Between IC	-	-	+/-5	%		
LED Sink Current Deviation		Between LED1~LED4 (Note 1)	-	-	+/-3	%		
Supply Current	I _{DD}	-	-	400	600	μA	VDD	
Standby Supply Current	I _{DDSTBY}	-	-	0.1	-	μA		

Note 1: I_{LEDn} (max) -I_{LEDn} (average) and I_{LEDn}(average)-I_{LEDn}(min)



WHITE / BLUE LED DRIVER FOR LI- ION BATTERY APPLICATION

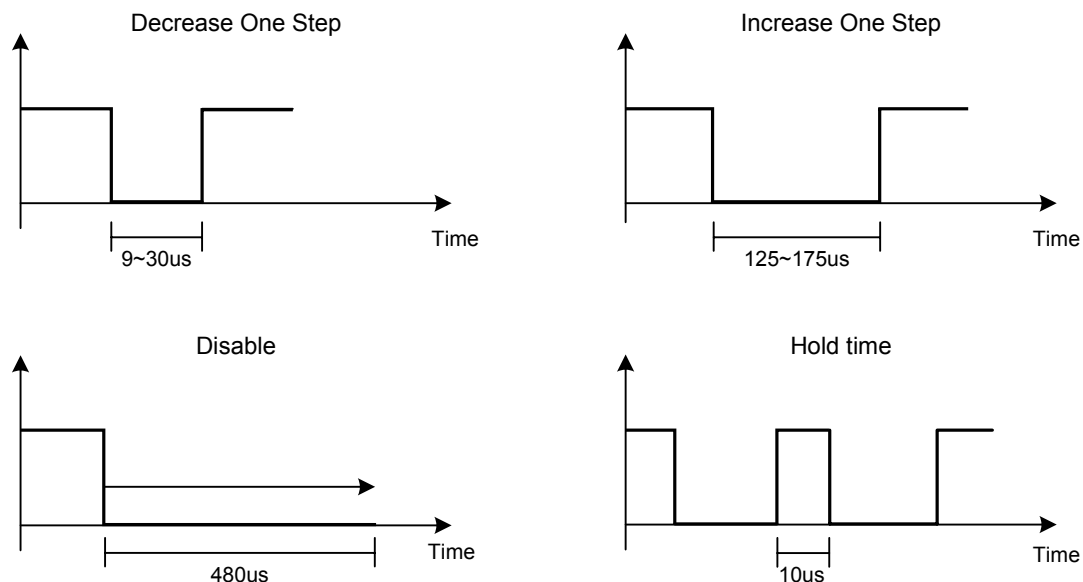
APPLICATION INFORMATION**Enable (EN/CTRL pin)**

The EN/CTRL pin serves two functions. One is the enable and disable of the device the other is the output sink current programming of the device. If the digital interface is not required the CTRL pin can be used as a standard enable pin for the device. Pulling the CTRL pin high will enable the device beginning sink current on LED pins. Pulling the CTRL pin to ground for a period of time $> 480\mu\text{s}$ will shutdown the device reducing the shutdown current to typical $0.1\ \mu\text{A}$.

This pin should not be left floating and need to be terminated.

Digital interface (EN/CTRL pin)

When power on the chip and pull high the EN/CTRL pin, the LED pins will start sink the initial sink current. The maximum LED sink current is $I_{LED\text{MAX}}$ (20mA). Pulling the EN/CTRL pin low for a period of time can program the output sink current. When pulling the CTRL pin to "low" between $9\ \mu\text{s}$ to $30\ \mu\text{s}$, the internal controller decreases its output sink current by one step (1 mA). When pulling the CTRL pin to "low" between $125\ \mu\text{s}$ to $175\ \mu\text{s}$, the internal controller increases its output sink current by one step. There are total 16 steps that control LED output sink current range from $I_{LED\text{MAX}}$ down to $I_{LED\text{MAX}}/4$. Between the "low" pulses, EN/CTRL should keep at "high" for at least $10\ \mu\text{s}$.

**Supply Voltage and Li-ion battery low warning**

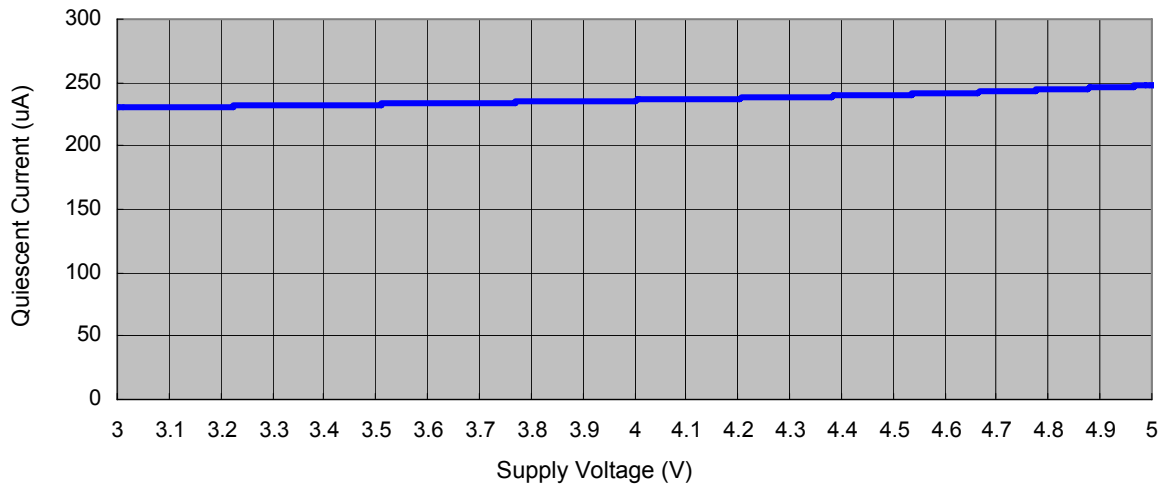
SM6802/3/4 works with supply voltage range from 3.0V to 5.0V. The white/blue LED forward voltage is in the range of 2.9V to 3.5V at 20mA current. The supply voltage range and LED forward voltage (V_f) should be set to fully utilize Li-ion battery energy. For example, the maximum white LED forward voltage limit at 3.2V (@ 20mA) when Li-ion battery discharge reaches 3.275V (normally around 1%~3% power left in the battery). When Li-ion battery voltage is lower than the preset low level, the LED current (brightness) will start to decrease.



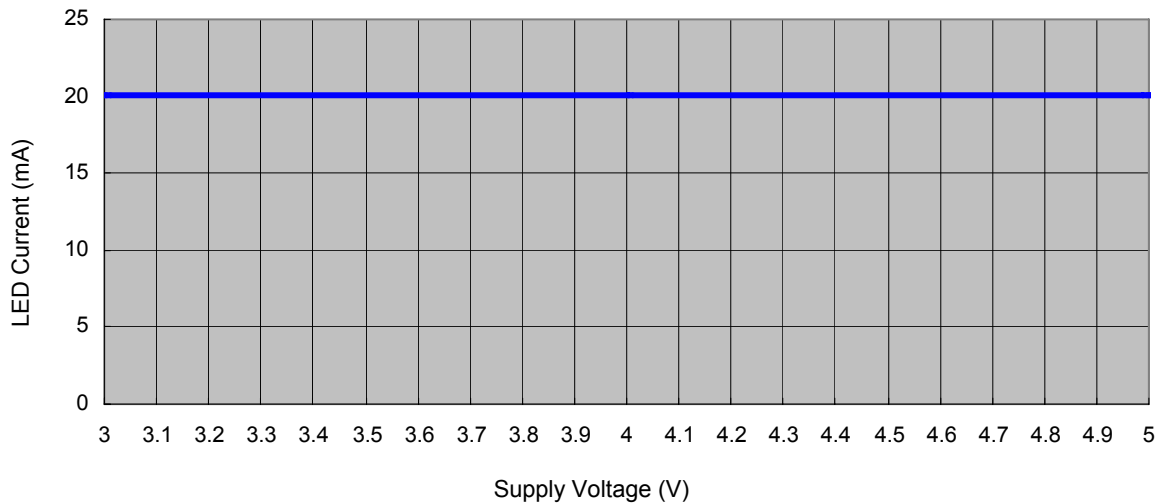
WHITE / BLUE LED DRIVER FOR LI- ION BATTERY APPLICATION

TYPICAL OPERATION CHARACTERISTICS

Quiescent Current vs. Supply Voltage



I_{LED} vs. Supply Voltage

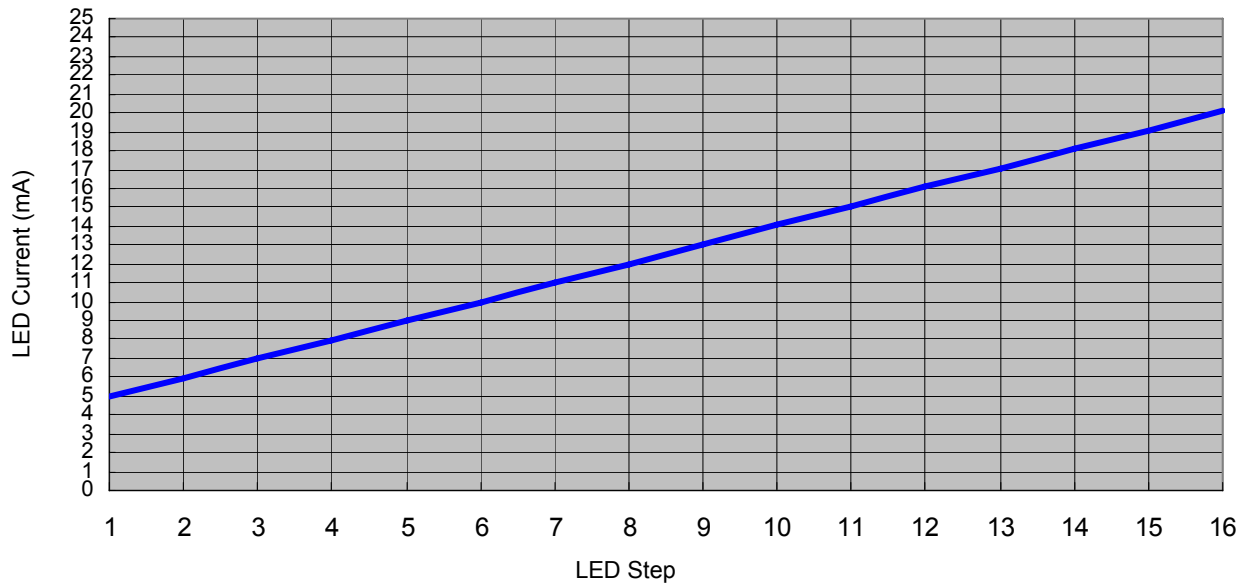




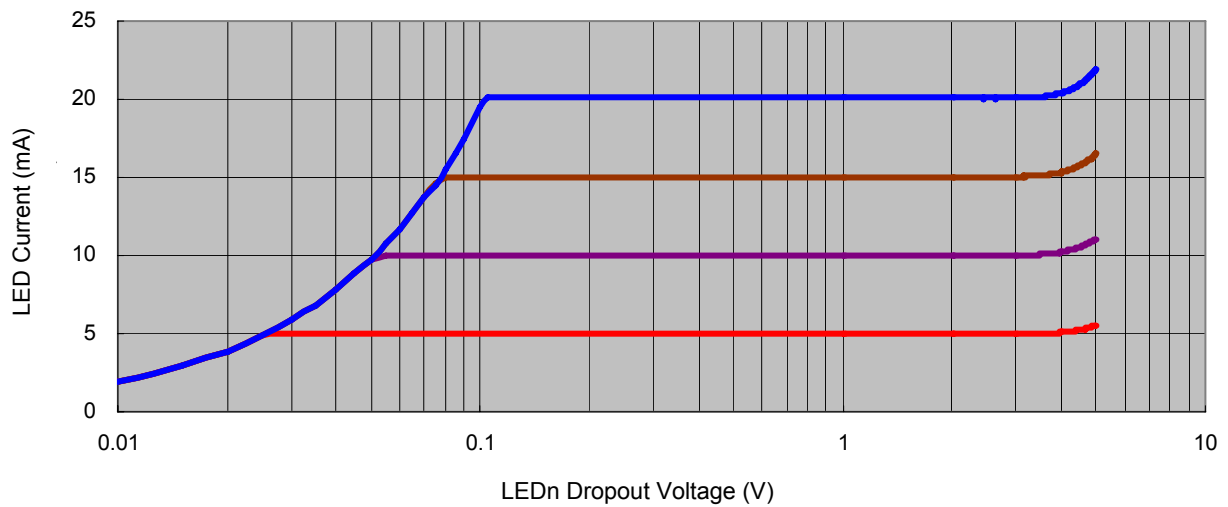
WHITE / BLUE LED DRIVER FOR LI- ION BATTERY APPLICATION

TYPICAL OPERATION CHARACTERISTICS

ILED vs. Brightness Control



ILED vs. LEDn Dropout Voltage



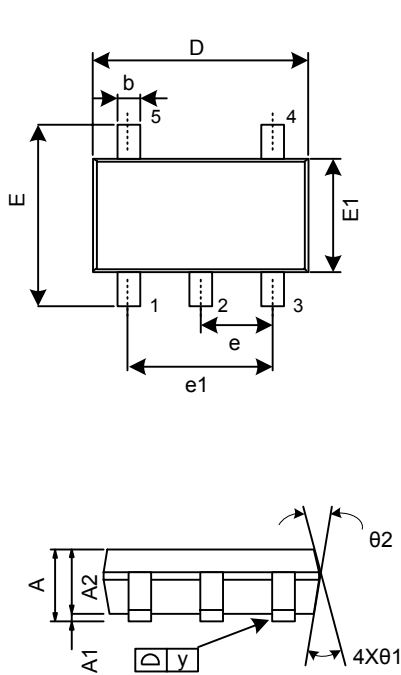


WHITE / BLUE LED DRIVER FOR LI-ION BATTERY APPLICATION

PACKAGE

SM6802L Surface Mount SOT-25

Unit : mm



SYMBOL	MIN.	MOM.	MAX.
A	1.05	-	1.35
A1	0.05	-	0.15
A2	1.00	1.10	1.20
b	0.30	-	0.50
c	0.08	-	0.20
D	2.80	2.90	3.00
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95 BSC.		
e1	1.90 BSC.		
L	0.35	0.45	0.55
L1	0.60 REF		
L2	0.25 BSC.		
R	0.10	-	-
y	-	-	0.10
θ	0°	-	8°
θ1	7°NOM		
θ2	5°NOM		

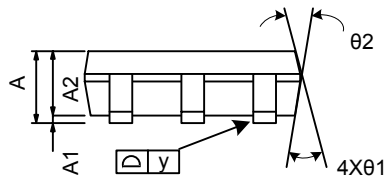
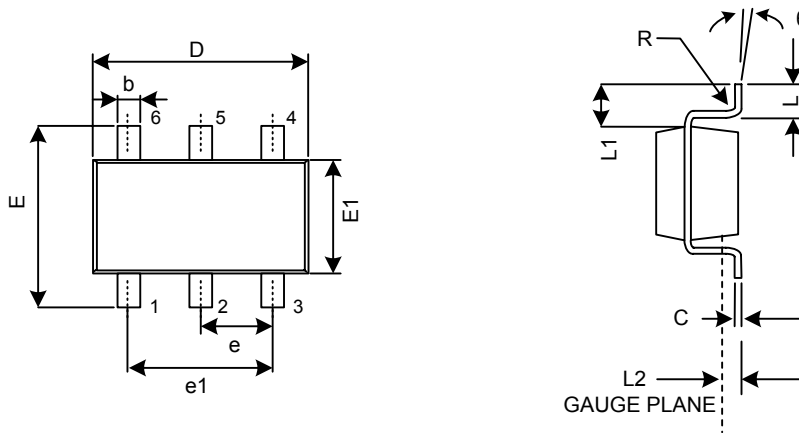


WHITE / BLUE LED DRIVER FOR LI-ION BATTERY APPLICATION

PACKAGE

SM6803L Surface Mount SOT-26

Unit : mm



SYMBOL	MIN.	MOM.	MAX.
A	1.05	-	1.35
A1	0.05	-	0.15
A2	1.00	1.10	1.20
b	0.30	-	0.50
c	0.08	-	0.20
D	2.80	2.90	3.00
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95 BSC.		
e1	1.90 BSC.		
L	0.35	0.45	0.55
L1	0.60 REF		
L2	0.25 BSC.		
R	0.10	-	-
y	-	-	0.10
theta	0°	-	8°
theta1	7°NOM		
theta2	5°NOM		

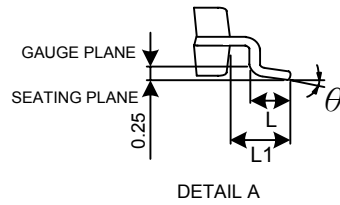
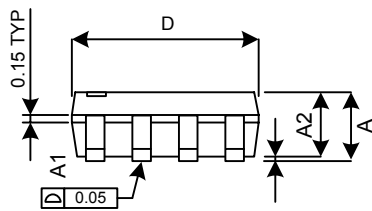
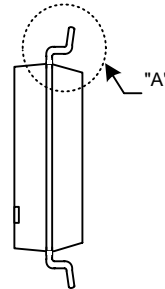
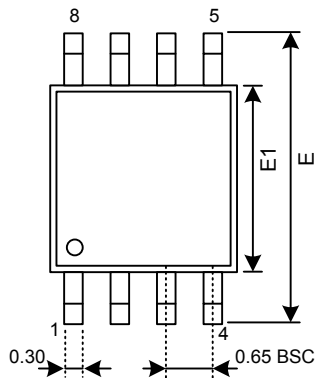


WHITE / BLUE LED DRIVER FOR LI-ION BATTERY APPLICATION

PACKAGE

SM6804L 8 -Pin Plastic MSOP

Unit : mm



SYMBOL	MIN.	MON.	MAX.
A	-	-	1.10
A1	0.00	-	0.15
A2	0.75	0.85	0.95
D	3.00 BSC.		
E	4.90 BSC.		
E1	3.00 BSC.		
L	0.40	0.60	0.80
L1	0.95 REF		
θ	0	-	8

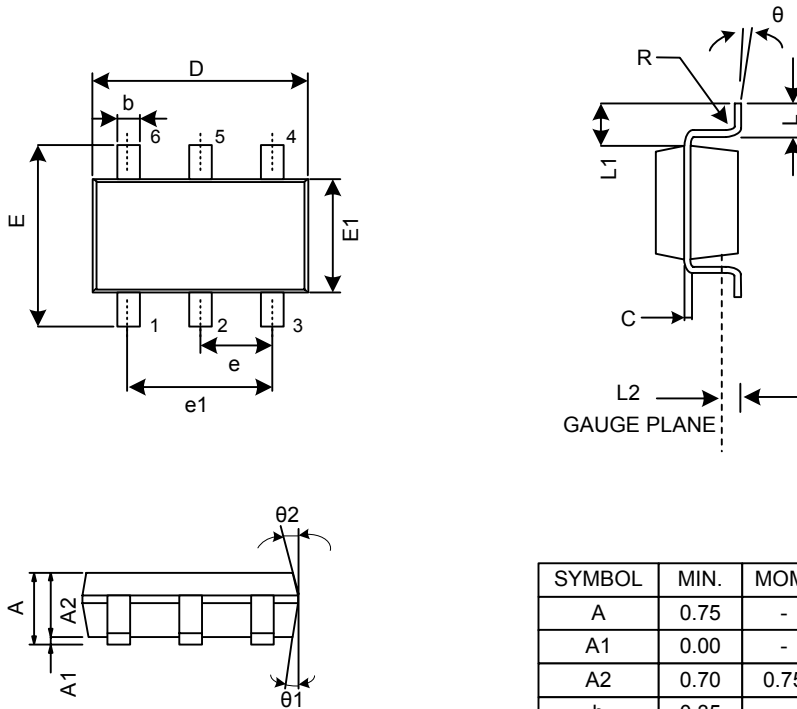


WHITE / BLUE LED DRIVER FOR LI-ION BATTERY APPLICATION

PACKAGE

SM6803T Surface Mount TSOP 6

Unit : mm



SYMBOL	MIN.	MOM.	MAX.
A	0.75	-	0.90
A1	0.00	-	0.10
A2	0.70	0.75	0.80
b	0.35	-	0.51
c	0.10	-	0.25
D	2.90 BSC.		
E	2.80 BSC.		
E1	1.60 BSC.		
e	0.95 BSC.		
e1	1.90 BSC.		
L	0.37	-	-
L1	0.60 REF		
L2	0.25 BSC.		
R	0.10	-	-
θ	0°	-	8°
θ1	7°NOM		
θ2	5°NOM		



WHITE / BLUE LED DRIVER FOR LI- ION BATTERY APPLICATION

Ordering Information

Package	Marking	Part Number (Tape and Reel)
SOT-25	SM6802	SM6802
SOT-26	SM6803	SM6803
TSOP 6	SM6803T	SM6803T
MSOP 8	SM6804	SM6804

Lead Free Information

Package	Marking	Lead Free Part Number
SOT-25	SM6802L	SM6802L
SOT-26	SM6803L	SM6803L
TSOP 6	SM6803T	SM6803TL
MSOP 8	SM6804L	SM6804L

Green Information

Package	Marking	Green Part Number
SOT-25	SM6802G	SM6802G
SOT-26	SM6803G	SM6803G
TSOP 6	SM6803T	SM6803TG
MSOP 8	SM6804G	SM6804G