High Power LED Driver IC

DESCRIPTION

The AP7350Q is an instant On/Off LED drive IC for high flux LED and adjustable constant-current source, easily driving loads 50mA up to 1A through an external resistor. The $\overline{SHDN}$ of the AP7350Q permits LED brightness regulation by pulse width modulation (PWM). The LED brightness can be regulated via duty cycle. And if $\overline{SHDN}$ sets high, the AP7350Q will be in sleep mode. the $\overline{SHDN}$ pin also can be used as an enable input. This integration technology eliminates individual components by combining them into a small package, which results in a significant reduction of both system cost and board space.

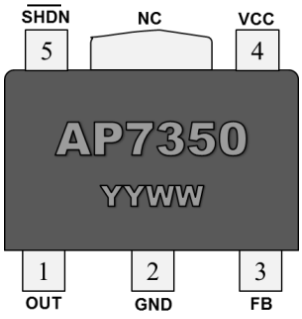
FEATURES

- Dimming control or Sleep mode by MiCOM signal
- LED drive current adjustable through external resistor (Max 1A under PWM)
- Very Simple Circuit Design and Very low cost design
- Very small package of 4.5x4.35mm SOT89-5L
- Halogen-Free Package is Available

Applications

- Backlighting LED Drive.
- High flux LED Drive
- Industrial Lamp Indicators
- Constant current source
- Automotive lighting

Pin Connection & Marking Information



SOT89-5

Ordering Information

Part No	Package	Packing	Finish	Halogen	REEL unit	Remark
AP7350Q	SOT-89-5	Tape & Reel	Sn	Free	1,000	MOQ 10Kp

Maximum Ratings

Characteristic	Symbol	Rating	Units
Power Supply Voltage	$V_{CC(MAX)}$	25	V
Output Voltage	$V_{OUT(MAX)}$	25	V
Output Sink Current	$I_{OUT(MAX)}$	1	A
High Wattage Land Pattern Power Dissipation	P_D 1)	1.3	W
Standard Land Pattern Power Dissipation	P_D 2)	0.9	W
Thermal Resistance Junction-Ambient	$R_{TH(J-A)}$ 1)	150	°C/W
Operating Temperature Range	T_{OPR}	-40 ~ 85	°C
Storage Temperature Range	T_{STG}	-55 ~ 125	°C

Note

1) Mounted on High Wattage Land Pattern Board (30mm × 30mm × 1.6mm) ---------- See Page 9

2) Mounted on Standard Land Pattern Board (50mm × 50mm × 1.6mm) ---------- See Page 9

Recommended operating conditions

Characteristic	Symbol	Rating		Units
		Min.	Max.	
Power Supply Voltage	$V_{CC(MAX)}$	3	24	V
Output Voltage	$V_{OUT(MAX)}$	1.5	Vcc	V
Output Sink Current	$I_{OUT(MAX)}$	-	1	A
Shut Down Voltage	SHDN	-0.3	Vcc	V

Electrical Characteristics

Test Conditions : Ta = 25°C, unless otherwise specified

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
IQ Maximum	I_Q	Vcc = 3~24V, Iout = 20mA, Vout = open	-	18	24	mA
Leak Current	Ileak	Vcc = 5V, Vout = 24V	-	0.1	1	uA
Feedback Voltage	V_{FB}	Vcc = 5V, Iout = 10mA	192	200	208	mV
Dropout Voltage	Vdrop	Vcc = 5V, Iout = 500mA	-	0.7	1.5	V
Line Regulation	ΔV_{FB1}	Vcc = 3~24V, Iout = 10mA	-	2	10	mV
Load Regulation	ΔV_{FB2}	Vcc = 5V, Iout = 10mA, Vout = Vcc	-	3	25	mV
SHDN Voltage ON	Vdis on	Vcc = 5V, Iout = 10mA, Vout = Vcc	1.5	-	-	V
SHDN Voltage Off	Vdis off	Vcc = 5V, Iout = 10mA	-	-	0.5	V
SHDN Pin Current	Idis	Vcc = 5V, SHDN = 5V	230	430	630	uA
Short Circuit Current	I_{SC}	R_{FB} = 0Ω	-	1.9	-	A
Thermal Shutdown	T_{TSD}	-	-	160	-	°C

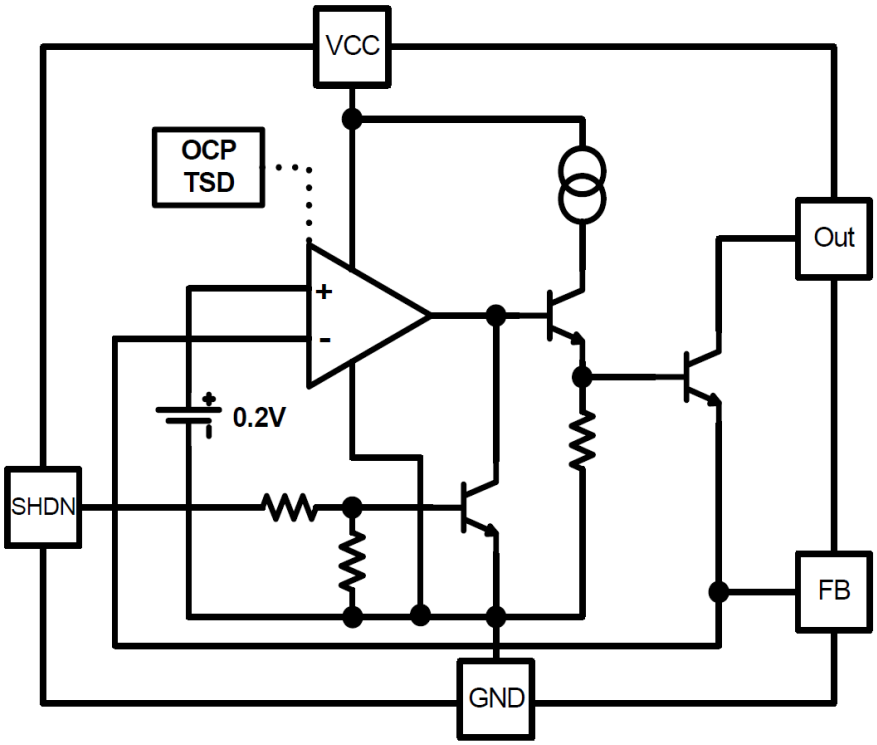
Notes

1. These parameters, although guaranteed, are not 100% tested in production.

Switching Characteristics

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Propagation Delay Time ("L" to "H")	tpLH	V_{CC} = 3.5V V_{SHDN}.H = 5V V_{SHDN}.L = GND RFB = 0.2Ω (IOUT = 1A) ROUT = 2Ω CL = 10pF	0.6	1	-	μs
Propagation Delay Time ("H" to "L")	tpHL		0.2	1	-	μs
Pulse width	tw		1			μs
Output Rise Time (turn off)	tr		0.5	1	-	μs
Output Fall Time (turn on)	tf		0.1	0.2	-	μs

Internal Block Diagram



Design Consideration

1) Calculation for RFB

- RFB = 0.2V / ILED

2) Calculation for Vdrop

- Vdrop = VCC – VLED

3) Calculation for Power Dissipation on the AP7350Q

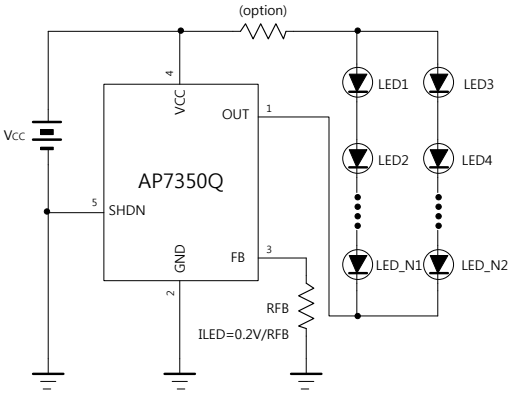
-PD1 = (Vdrop – VFB) x ILED

-PD2 = VCC x IQ

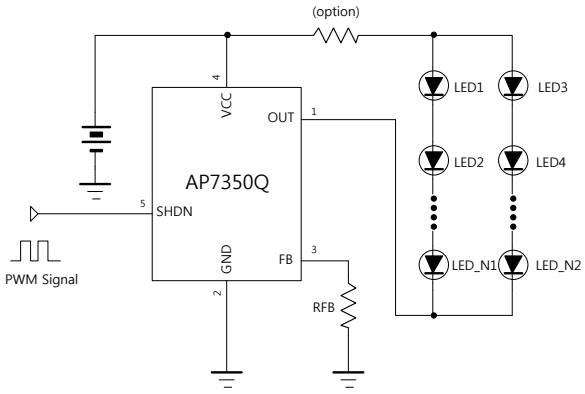
-PD(total) = PD1 + PD2

4) If does not use an Dimming function, connect SHDN Pin with the ground.

Typical Applications



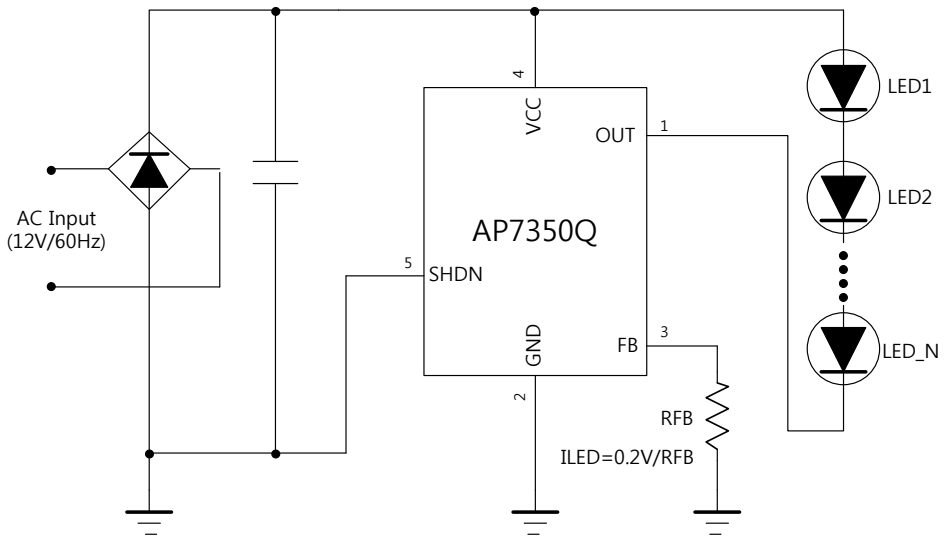
<APP1. Constant Current LED Driver Circuit>



<APP2. PWM Dimming LED Driver Circuit>

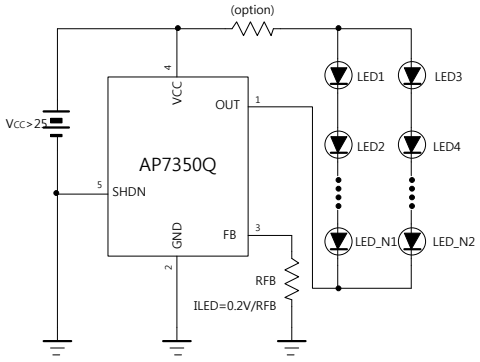
※ Caution

In the case of high current application, we recommend to control the PWM using by $\overline{SHDN}$.
If user cannot uses the PWM control, the application must be limited in $P_D(=V_{DROP} \times I_{LED})$.
So, in this case we recommend to minimize V_{DROP} or I_{LED}. (See page 9)

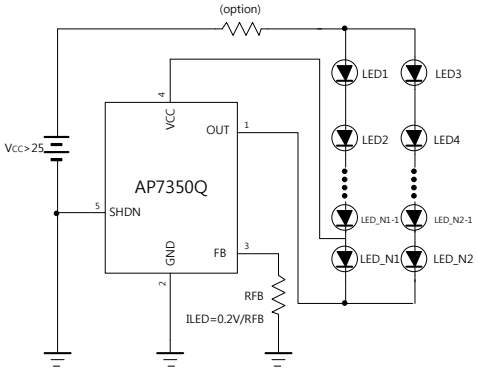


<APP3. VAC Landscape Lightning Application Circuit>

Typical Applications



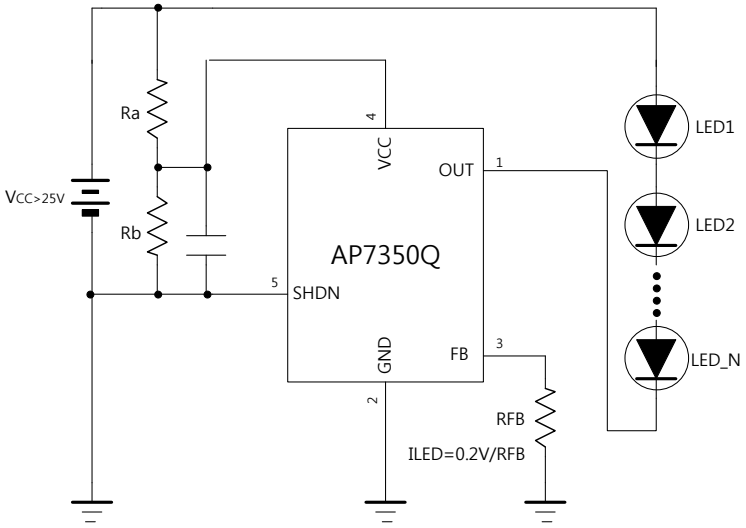
<APP4. High Voltage Operation of AP7305Q (1)>



<APP5. High Voltage Operation of AP7305Q (2)>

For operation in excess of AP7350Q specified maximum voltage (V_{CC} & V_{OUT}) of 25V, one way is to connect a sufficient number of LEDs between the power supply voltage and the DC input of the V_{CC}&V_{OUT} such that the voltage seen at pin(V_{CC} & V_{OUT})is less than 25V. That is to say, use additional LEDs to drop the voltage fed to the AP7350Q below its maximum rating, in the usual way. Refer to **APP4,5** Note that the exact number of diodes required will depend on the supply voltage V_{CC} and output voltage V_{OUT} ,the voltage drops across the particular LEDs being used. (Red, Blue and White LEDs have different forward voltage drop.)
Use enough LEDs such that voltage at pin(V_{CC} & V_{OUT}) of AP7350Q is < 25V.

※ Caution : When V_{CC} uses to exceed 25V, Dimming functions the use is impossible.



<APP6. Power Supply Where Separates Operation of AP7350Q>

Electrical Characteristic Curves

Fig.1 V_{FB} vs T_A

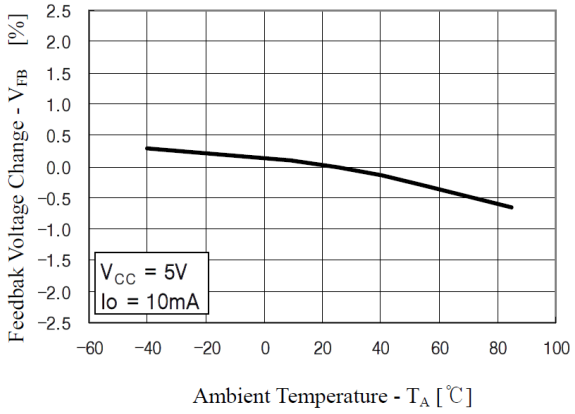


Fig.2 Line Regulation vs T_A

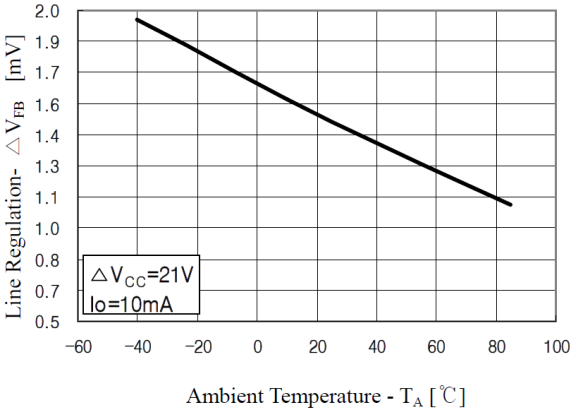


Fig.3 Load Regulation vs T_A

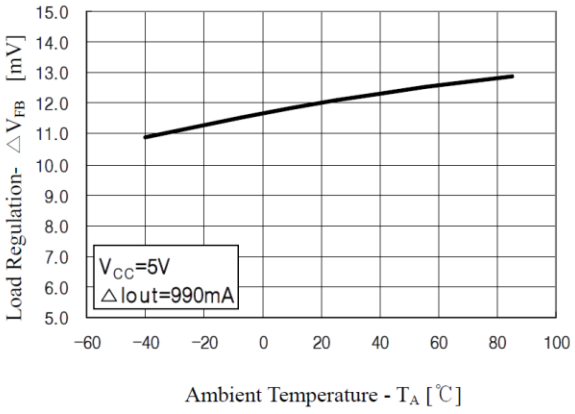


Fig.4 Quiescent Current vs T_A

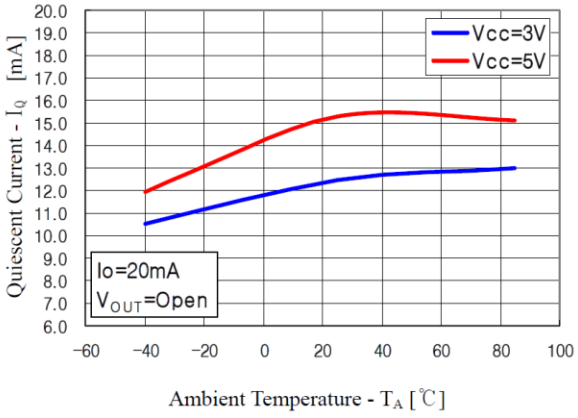


Fig.5 Dropout Voltage vs T_A

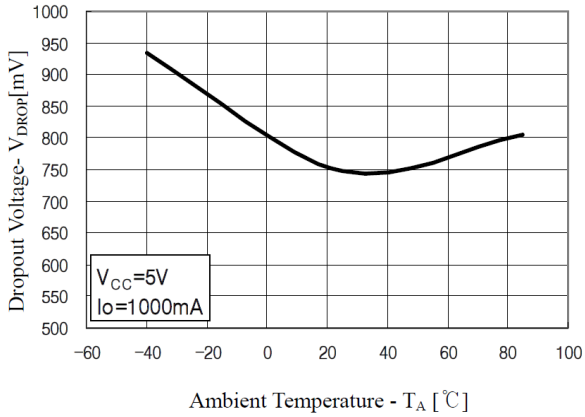
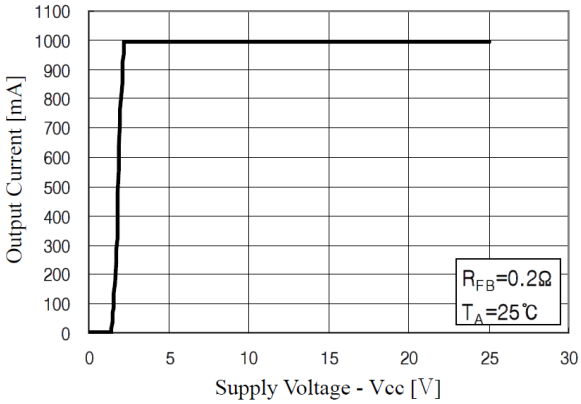


Fig.6 Output Current vs Supply Voltage



Electrical Characteristic Curves

Fig.7 Dimming Curve

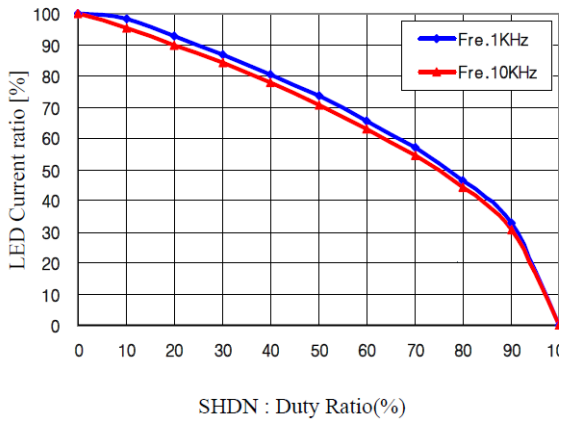


Fig.8 Power Dissipation vs TA

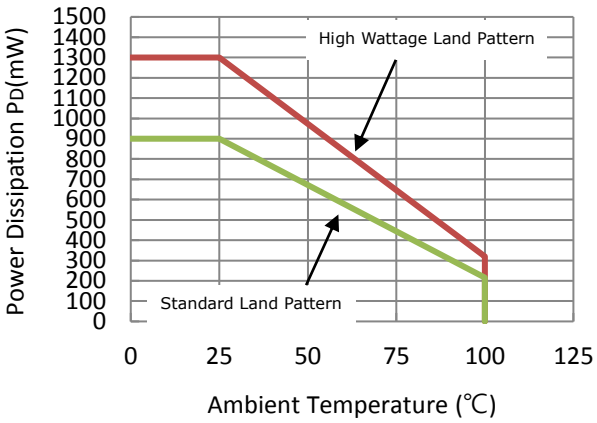
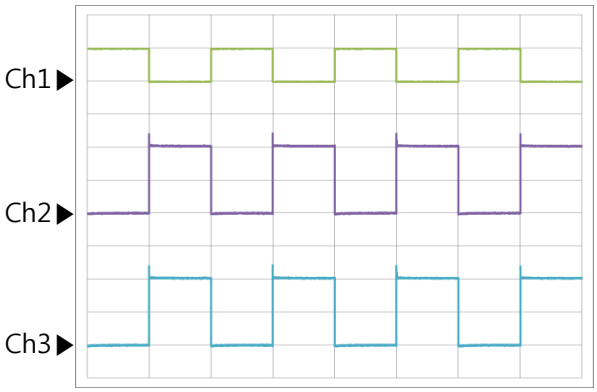
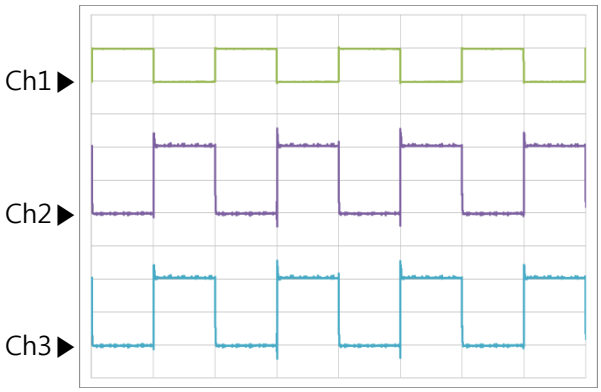


Fig.9 Dimming Waveform [1kHz]



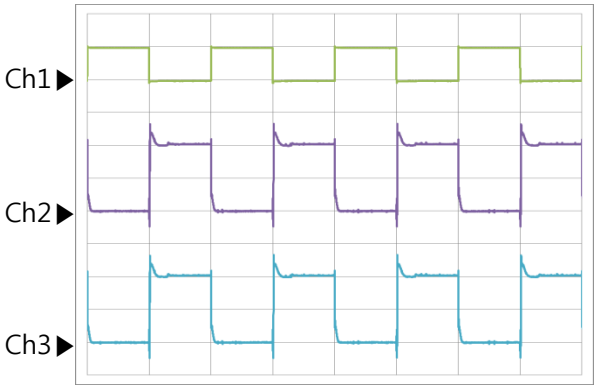
Ch1 : V_{SHDN}, 5V/Div
Ch2 : V_{FB}, 100mV/Div
Ch3 : I_{FB}, 5mA/Div

Fig.10 Dimming Waveform [10kHz]



Ch1 : V_{SHDN}, 5V/Div
Ch2 : V_{FB}, 100mV/Div
Ch3 : I_{FB}, 5mA/Div

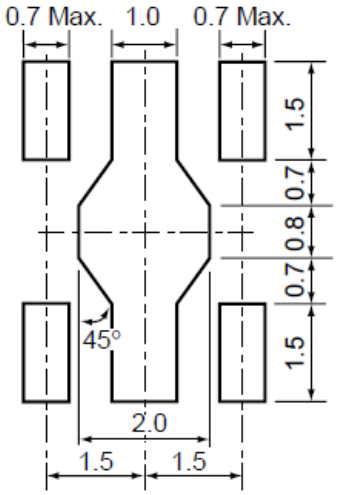
Fig.11 Dimming Waveform [50kHz]



Ch1 : V_{SHDN}, 5V/Div
Ch2 : V_{FB}, 100mV/Div
Ch3 : I_{FB}, 5mA/Div

Recommend PCB solder land

Unit : mm



Power Dissipation

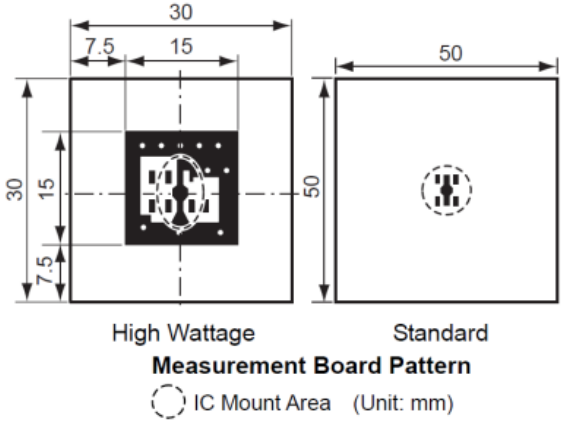
<Table 1. PCB Condition>

	High Wattage Land Pattern	Standard Land Pattern
Environment	Mounting on Board (Wind velocity = 0m/s)	Mounting on Board (Wind velocity = 0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)	Glass cloth epoxy plastic (Double sided)
Board Dimension	30mm × 30mm × 1.6mm	50mm × 50mm × 1.6mm
Copper Ratio	Top side : Approx. 20% , Back side : Approx. 100%	Top side : Approx. 10% , Back side : Approx. 100%
Through-holes	Φ0.85mm × 10pcs	-

<Table 2. Power Dissipation of Land Patterns>

	High Wattage Land Pattern	Standard Land Pattern
Power Dissipation	1300mW	900mW
Thermal Resistance	77°C/W	111°C/W

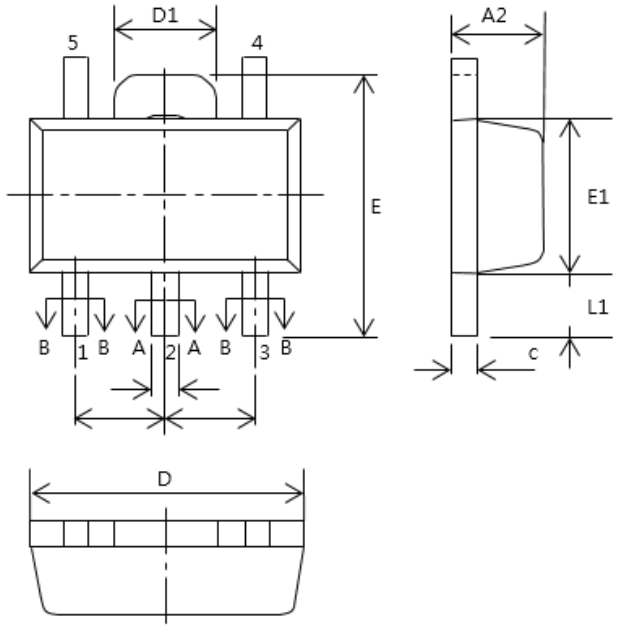
(Topt=25°C,Tjmax=125°C)



REV. 01

Package Dimension

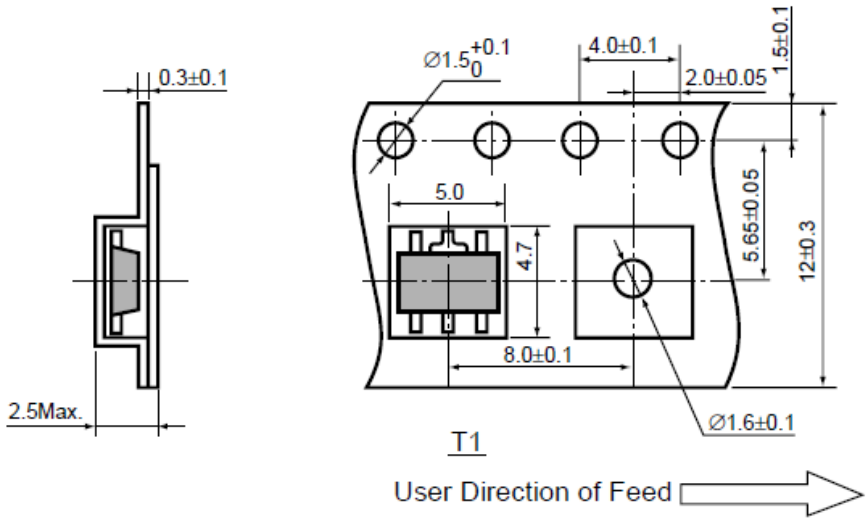
Unit : mm



SOT-89-5L unit : mm			
DIM	MIN	NOM	MAX
A2	1.40	1.50	1.60
D	4.30	4.50	4.70
D1	1.83REF		
E	3.95	-	4.25
E1	2.30	2.50	2.70
e	1.50BSC		
L1	0.89	-	1.20

Taping Specification

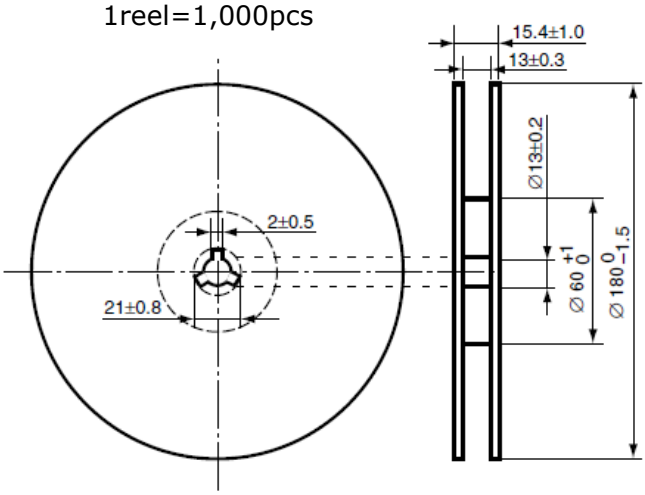
Unit : mm



Reel Specification

Unit : mm

1reel=1,000pcs



Revision History

No	Date	Contents
00	2015-12-30	Initial Brief Datasheet Release
01	2016-04-01	Addition switching characteristics

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