A705

HIGH POWER ADVANCED CURRENT REGULATOR

DESCRIPTION

The A705 is a low dropout current regulator rated for 190mA, 210mA, 230mA, 250mA, 270mA, 290mA, 310mA, 330mA, and 350mA constant sink current. The low quiescent current and low dropout voltage are achieved by advanced Bi-CMOS process.

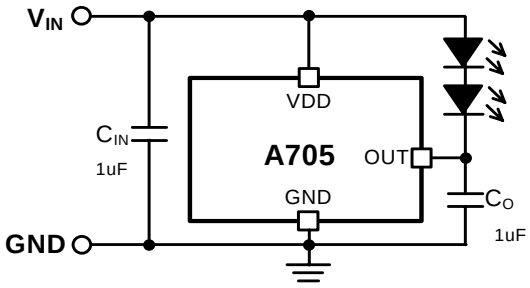
APPLICATIONS

- Power LED Driver
- LED Miner's Lamp

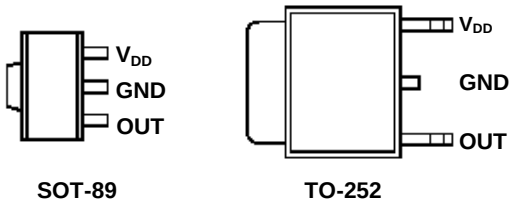
FEATURES

- **190/210/230/250/270/290/310/330/350mA ± 10mA constant sink current.**
- **Output short / open circuit protection.**
- **Low dropout voltage.**
- **Low quiescent current.**
- **Supply voltage range 2.7V ~ 12V.**
- **2KV HBM ESD protection.**
- **Advanced Bi-CMOS process.**
- **SOT-89 and TO-252 package available.**
- **Compatible with AMC7135.**

TYPICAL APPLICATION CIRCUIT



PACKAGE PIN OUT



(Top View)

ORDER INFORMATION (Note 1)

Output Current (Note 2)	N	SOT-89	S	TO-252
		3-pin		3-pin
180mA ~ 200mA		A705NGT-190		-
200mA ~ 220mA		A705NGT-210		A705SGT-210
220mA ~ 240mA		A705NGT-230		A705SGT-230
240mA ~ 260mA		A705NGT-250		A705SGT-250
260mA ~ 280mA		A705NGT-270		A705SGT-270
280mA ~ 300mA		A705NGT-290		A705SGT-290
300mA ~ 320mA		A705NGT-310		A705SGT-310
320mA ~ 340mA		A705NGT-330		A705SGT-330
340mA ~ 360mA		A705NGT-350		A705SGT-350

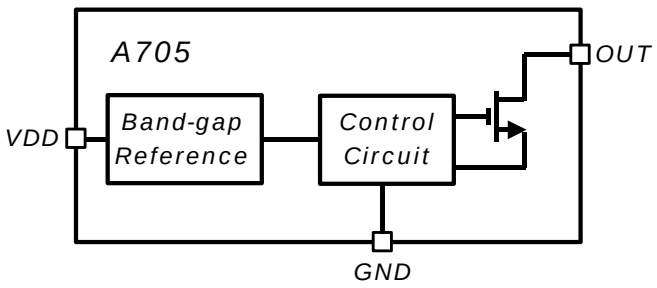
Note 1: The letter "G" is marked for Green process, and letter "T" is marked for Tape & Reel.
2: For other output current ranking, please consult sales or FAEs.

ABSOLUTE MAXIMUM RATINGS (Note)

Input Voltage, V_{DD}	-0.3V to 13.2V
Output Voltage, V_{OUT}	-0.3V to 17V
Maximum Junction Temperature, T_J	150°C
Storage Temperature Range	-40°C to 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.

BLOCK DIAGRAM



PIN DESCRIPTION

Pin Name	Pin Function
V_{DD}	Power supply.
OUT	Output pins. Connected to load.
GND	Ground.

THERMAL RESISTANCE

Package		θ_{JT} (°C /W)
N	SOT-89	35
S	TO-252	7

Note: $T_J = T_C + (P_D \times \theta_{JT})$
θ_{JT}: Thermal Resistance - Junction to Tab.
T_C: Case (Tab) Temperature.
T_J: Junction Temperature.
P_D: Power Consumption.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{DD}	2.7		12	V
Output Sink Current	I_{OUT}			360	mA
Junction Temperature	T_J			125	°C
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)

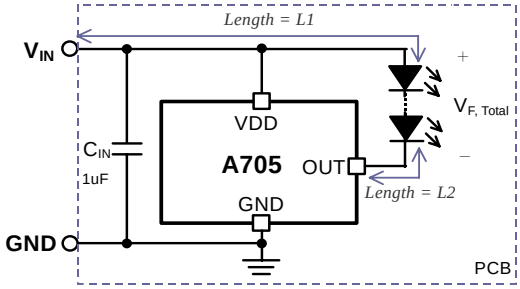
Parameter	Symbol	Condition		Min	Typ	Max	Unit	Apply Pin
Output Sink Current	I_{OUT}	V_{OUT}=0.2V	A705N	180	190	200	mA	OUT
			A705P	200	210	220		
			A705Q	220	230	240		
			A705R	240	250	260		
			A705S	260	270	280		
			A705T	280	290	300		
			A705V	300	310	320		
			A705W	320	330	340		
			A705X	340	350	360		
Load Regulation		V_{OUT}=0.2V to 3V				2	mA/V	
Line Regulation		V_{DD}= 3V to 12V, V_{OUT}=0.2V				2	mA/V	
Output Dropout Voltage (Note)	V_{OUTL}				120		mV	
Supply Current Consumption	I_{DD}				200		uA	VDD

Note: Output dropout voltage: 90% x I_{OUT} @ V_{OUT}=200mV

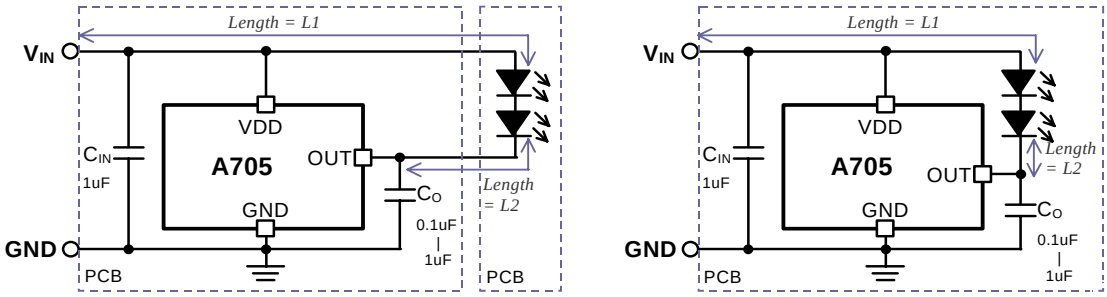
APPLICATION INFORMATION

Output Capacitor C_O and PCB layout:

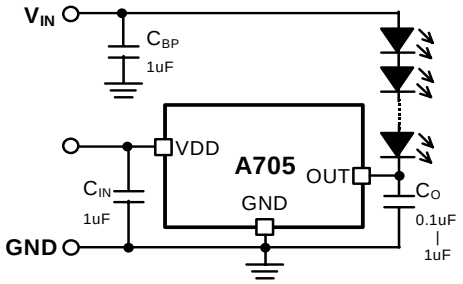
The output capacitor C_O may be removed under certain condition. Please refer to the following figure. If LED and A705 is located in the same PCB, and the length of the routing path L1<10cm & L2<3cm, the output capacitor C_O can be neglected. The number of LEDs in series could be 1 ~ 3, that the total V_F of the LED string is smaller 11V.



If LED and A705 is located in separate PCBs, or the length of the routing path L1>10cm or L2>3cm, the output capacitor C_O should be added. Typically, capacitance of 0.1uF ~ 1uF is recommended and 1uF is needed when L2 is much longer than 3cm.



If four LEDs or more are connected in series to OUT pin, the supply voltage to VDD pin and LED+ end should be separated because the voltage level of V_{LED+} is higher than the voltage rating of VDD pin. The recommended application circuit is shown in the following figure.



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 maximum junction temperature ratings of A705 should not be exceeded under continuous normal load conditions. When power consumption is over about 700mW (SOT-89 package, at T_A=70°C) or 1000mW (TO-252 package, at T_A=70°C), additional heat sink is required to control the junction temperature below 120°C.

The junction temperature is:

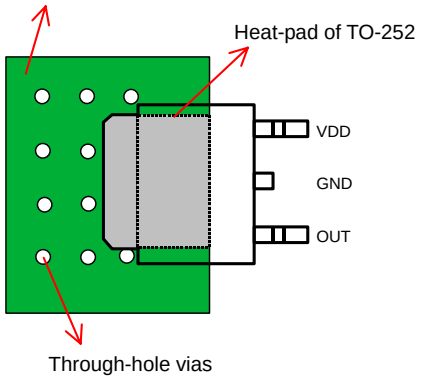
$$T_J = P_D (\theta_{JT} + \theta_{CS} + \theta_{SA}) + T_A$$

P_D .: Dissipated power.
θ_{JT}: Thermal resistance from the junction to the mounting tab of the package.
For SOT-89 package, θ_{JT} = 35.0 °C /W. For TO-252 package, θ_{JT} = 7.0 °C /W.
θ_{CS}: Thermal resistance through the interface between the IC and the surface on which it is mounted.
(typically, θ_{CS} < 1.0°C /W)
θ_{SA} ; Thermal resistance from the mounting surface to ambient (thermal resistance of the heat sink).

If PC Board copper is going to be used as a heat sink, below table can be used to determine the appropriate size of copper foil required. For multi-layered PCB, these layers can also be used as a heat sink. They can be connected with several through-hole vias.

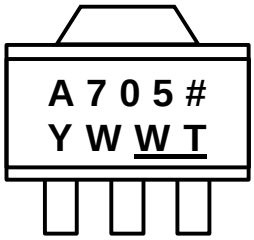
PCB θ_{SA} (°C /W)	59	45	38	33	27	24	21
PCB heat sink size (mm^2)	500	1000	1500	2000	3000	4000	5000

Recommended figure of PCB area used as a heat sink.



PACKAGE

Top Marking for SOT-89



 # : Output Current Options

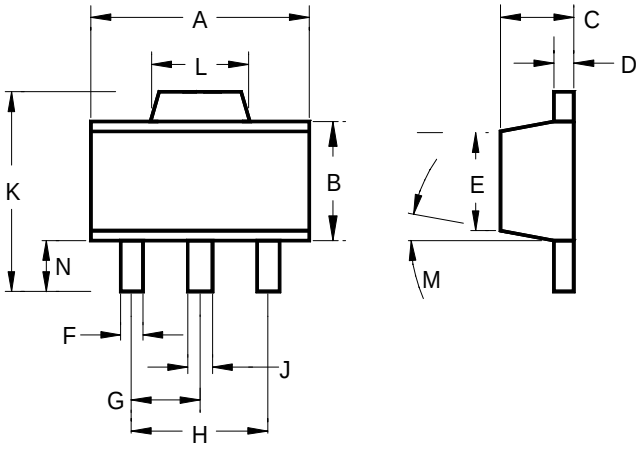
N = 190mA; P = 210mA; Q = 230mA; R = 250mA; S = 270mA;
T = 290mA; V = 310mA; W = 330mA; X = 350mA

Y : Year Code

WW : Week Code

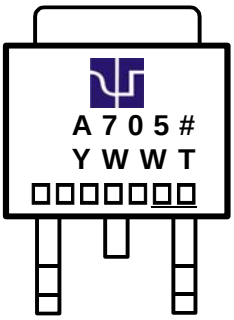
T : Trace Code

3-Pin Surface Mount SOT-89



	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.173	-	0.181	4.39	-	4.59
B	0.090	-	0.102	2.28	-	2.59
C	0.055	-	0.063	1.39	-	1.60
D	0.015	-	0.017	0.38	-	0.43
E	0.084	-	0.090	2.13	-	2.28
F	0.016	-	0.019	0.33	-	0.48
G	0.059 BSC			1.49 BSC		
H	0.118 BSC			2.99 BSC		
J	0.018	-	0.022	0.45	-	0.55
K	0.155	-	0.167	3.94	-	4.24
L	0.067	-	0.072	1.70	-	1.82
M	0°	-	8°	0°	-	8°
N	0.035	-	0.047	0.89	-	1.19

Top Marking for TO-252



 # : Output Current Options

N = 190mA; P = 210mA; Q = 230mA; R = 250mA; S = 270mA;
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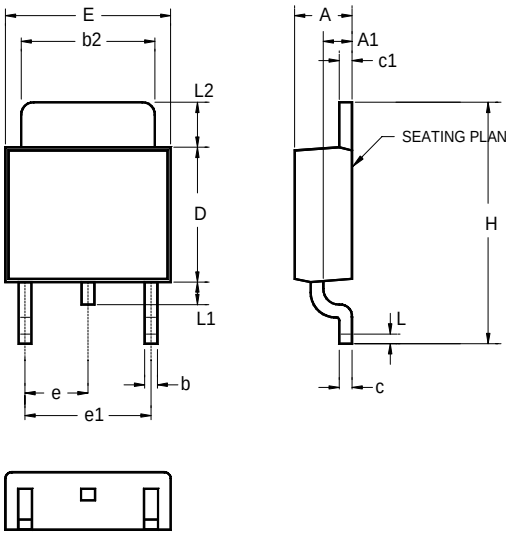
WW : Week Code

T : Trace Code

□□□□□□□ : Lot Number

3-Pin Surface Mount TO-252



	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.086	-	0.094	2.18	-	2.39
A1	0.040	-	0.050	1.02	-	1.27
b	-	0.024	-	-	0.61	-
b2	0.205	-	0.215	5.21	-	5.46
c	0.018	-	0.023	0.46	-	0.58
c1	0.018	-	0.023	0.46	-	0.58
D	0.210	-	0.220	5.33	-	5.59
E	0.250	-	0.265	6.35	-	6.73
e	0.090 BSC			2.29 BSC		
e1	0.180 BSC			4.58 BSC		
H	0.370	-	0.410	9.40	-	10.41
L	0.020	-	-	0.51	-	-
L1	0.025	-	0.040	0.64	-	1.02
L2	0.060	-	0.080	1.52	-	2.03

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