# AMC1117

## 1A Low Dropout Positive Regulator

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## DESCRIPTION

The AMC1117 series of positive adjustable and fixed regulators is designed to provide 1A for applications requiring high efficiency. All internal circuitry is designed to operated down to 800mV input to output differential and the dropout voltage is fully specified as a function of load current.

The AMC1117 offers current limiting and thermal protection. The on chip trimming adjusts the reference voltage accuracy to 1%.

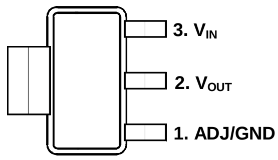
## FEATURES

- **Output current of 1A typical**
- **Three-terminal adjustable or fixed 1.5V, 1.8V, 2.5V, 3.3V, 5.0V outputs**
- **Low dropout of typical 800mV**
- **Thermal protection built in**
- **Typical 0.015% line regulation**
- **Typical 0.01% load regulation**
- **Fast transient response**
- **Available in SOT-223 and TO-252 packages**
- **Pin assignment identical to earlier LT1117 series.**

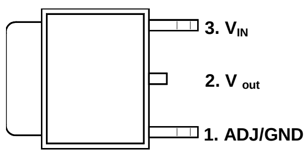
## APPLICATIONS

- 2.85V Model for SCSI-2 Active Termination
- Battery Charger
- High Efficiency Linear Regulators
- Battery Powered Instrumentation
- Post Regulator for Switching DC/DC Converter

## PACKAGE PIN OUT




**3-Pin Plastic SOT-223**
**Surface Mount**
**(Top View)**




**3-Pin Plastic TO-252**
**Surface Mount**
**(Top View)**

## VOLTAGE OPTIONS

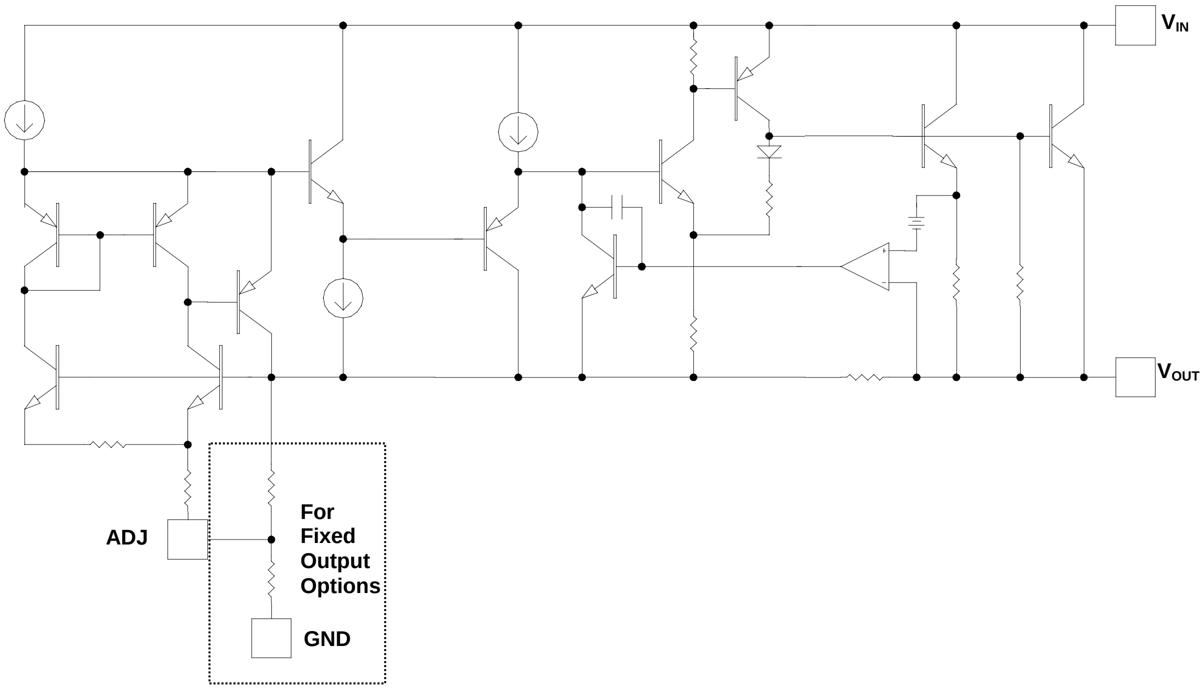
| | |
|---|---|
| AMC1117-1.5 | – 1.5V Fixed |
| AMC1117-1.8 | – 1.8V Fixed |
| AMC1117-2.5 | – 2.5V Fixed |
| AMC1117-3.3 | – 3.3V Fixed |
| AMC1117-5.0 | – 5.0V Fixed |
| AMC1117 | – Adjustable Output |

## ORDER INFORMATION

| $T_A$ (°C) | **SK** SOT-223, 3-pin | **SJ** TO-252, 3-pin |
|---|---|---|
| **0 to 70** | **AMC1117-X.XSKF (Lead Free)** | **AMC1117-X.XSJF (Lead Free)** |
| | **AMC1117SKF (Lead Free)** | **AMC1117SJF (Lead Free)** |

Note: 1.All surface-mount packages are available in Tape & Reel. Append the letter "T" to part number (i.e. AMC1117-X.XSJT).
2.The letter "F" is marked for Lead Free process.

## BLOCK DIAGRAM



| ABSOLUTE MAXIMUM RATINGS (Note1) | |
|---|---|
| Input Voltage | 7V |
| Operating Junction Temperature Range, $T_J$ | $0^oC$ to $150^oC$ |
| Storage Temperature Range | $-65^oC$ to $150^oC$ |
| Lead Temperature (soldiering, 10 seconds) | $260^oC$ |

Note 1: 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 | $\theta_{JA}$ ($^oC$ /W ) | Derating factor ( mW/$^oC$) $T_A \geq 25^oC$ | $T_A \leq 25^oC$ Power rating(mW) | $T_A=70^oC$ Power rating(mW) | $T_A= 85^oC$ Power rating (mW) |
|---|---|---|---|---|---|
| SKF | 136 | 7.35 | 919 | 588 | 478 |
| SJF | 80 | 12.5 | 1562 | 1000 | 812 |

Note :

1. $\theta_{JA}$: Thermal Resistance-Junction to Ambient, $D_F$ : Derating factor, Po: Power consumption.
   Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$, $Po = D_F \times (T_J - T_A)$
   The $\theta_{JA}$ numbers are guidelines for the thermal performance of the device/PC-board system.
   All of the above assume no ambient airflow.

2. $\theta_{JT}$: Thermal Resistance-Junction to Tab, $T_C$: case(Tab) temperature, $T_J = T_C + (P_D \times \theta_{JT})$
   For SK package, $\theta_{JT} = 15.0^oC$ /W.
   For SJ package, $\theta_{JT} = 7.0^oC$ /W.

## RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | Recommended Operating Conditions | | | Units |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Input Voltage | $V_{IN}$ | 2.7 | | 7 | V |
| Load Current (with adequate heat sinking) | $I_O$ | 5 | | | mA |
| Input Capacitor ($V_{IN}$ to GND) | | 10 | | | µF |
| Output Capacitor with ESR of 10Ω max., ($V_{OUT}$ to GND) | | 10 | | | µF |
| Junction temperature | $T_J$ | | | 125 | $^oC$ |

## ELECTRICAL CHARACTERISTICS

Unless otherwise specified, $I_O$ =10mA, and $T_J$ = 25 °C.

| Parameter | | Symbol | Test Conditions | AMC1117 Min | AMC1117 Typ | AMC1117 Max | Units |
|---|---|---|---|---|---|---|---|
| Reference Voltage | AMC1117 | $V_{REF}$ | $I_O$ = 10mA, $V_{IN}$ = 5V | 1.238 | 1.250 | 1.262 | V |
| | | | 10mA ≤ $I_O$ ≤ 1A, 2.65V ≤ $V_{IN}$ ≤ 7V | 1.225 | 1.250 | 1.275 | |
| Output Voltage | AMC1117-1.5 | $V_{OUT}$ | $I_O$ = 10mA, $V_{IN}$ = 3.0V | 1.485 | 1.500 | 1.515 | V |
| | | | 10mA ≤ $I_O$ ≤ 1A, 3.0V ≤ $V_{IN}$ ≤ 7V | 1.470 | 1.500 | 1.530 | |
| | AMC1117-1.8 | | $I_O$ = 10mA, $V_{IN}$ = 3.3V | 1.782 | 1.8 | 1.818 | |
| | | | 10mA ≤ $I_O$ ≤ 1A, 3.3V ≤ $V_{IN}$ ≤ 7V | 1.764 | 1.8 | 1.836 | |
| | AMC1117-2.5 | | $I_O$ = 10mA, $V_{IN}$ = 4.0V | 2.475 | 2.500 | 2.525 | |
| | | | 10mA ≤ $I_O$ ≤ 1A, 4.0V ≤ $V_{IN}$ ≤ 7V | 2.450 | 2.500 | 2.550 | |
| | AMC1117-3.3 | | $I_O$ = 10mA, $V_{IN}$ = 4.8V | 3.267 | 3.300 | 3.333 | |
| | | | 10mA ≤ $I_O$ ≤ 1A, 4.8V ≤ $V_{IN}$ ≤ 7V | 3.235 | 3.300 | 3.365 | |
| | AMC1117-5.0 | | $I_O$ = 10mA, $V_{IN}$ = 6.5V | 4.950 | 5.000 | 5.050 | |
| | | | 10mA ≤ $I_O$ ≤ 1A, 6.5V ≤ $V_{IN}$ ≤ 7V | 4.900 | 5.000 | 5.100 | |
| Line Regulation | AMC1117 | $\Delta V_{OI}$ | $I_O$ = 10mA, $V_{OUT}$ +1.5V ≤ $V_{IN}$ ≤ 7V | | 0.04 | 0.20 | % |
| | AMC1117-X.X | | $I_O$ = 10mA, $V_{OUT}$ +1.5V ≤ $V_{IN}$ ≤ 7V | | 1.0 | 6.0 | mV |
| Load Regulation | AMC1117 | $\Delta V_{OL}$ | 10mA ≤ $I_O$ ≤ 1A, $V_{IN}$ = $V_{OUT}$ +1.5V | | 0.10 | 0.40 | % |
| | AMC1117-X.X | | 10mA ≤ $I_O$ ≤ 1A, $V_{IN}$ = $V_{OUT}$ +1.5V | | 1.0 | 10.0 | mV |
| Dropout Voltage | | $\Delta V$ | $I_O$ = 10mA, $V_{IN}$ ≧ 2.65V | | 0.8 | 1.15 | V |
| | | | $I_O$ = 500mA, $V_{IN}$ ≧ 2.65V | | 0.8 | 1.25 | |
| | | | $I_O$ = 1A, $V_{IN}$ ≧ 2.65V | | 0.8 | 1.30 | |
| Minimum Load Current (Note 1) | | | $V_{IN}$ ≤ 7V | | 2 | 7 | mA |
| Quiescent Current | AMC1117-X.X | $I_Q$ | $V_{IN}$ ≤ 7V | | 6 | 13 | mA |
| Current Limit | | $I_{CL}$ | $V_{IN}$ – $V_{OUT}$ = 3V | 1 | 1.2 | | A |
| Adjust Pin Current | | | $I_O$ = 10mA, $V_{IN}$ – $V_{OUT}$ = 2V | | 50 | 120 | µA |
| Thermal Regulation (Note 2) | | | $T_A$ = 25 °C, 30 ms pulse | | 0.01 | 0.1 | %/W |
| Ripple rejection (Note 2) | | $R_R$ | $f_O$ = 120HZ, 1$V_{RMS}$, $I_O$ = 400mA, $V_{IN}$ – $V_{OUT}$ = 3V | 60 | 75 | | dB |

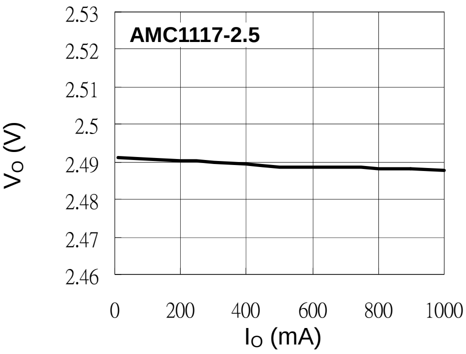
Note 1: For the adjustable device, the minimum load current is the minimum current required to maintain regulation. Normally the current in the resistor divider used to set the output voltage is selected to meet the minimum load current requirement.

Note 2: These parameters, although guaranteed, are not tested in production.

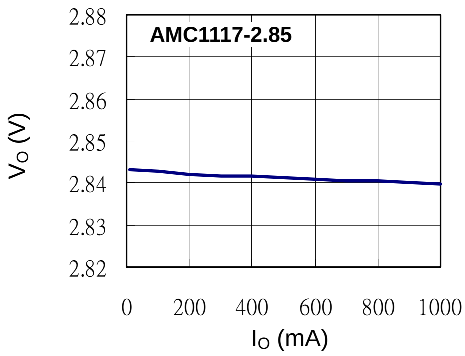
## CHARACTERIZATION CURVES

Unless otherwise specified, $V_{IN}$= $V_{OUT}$+2V，$C_{IN}$=1μF，$C_{OUT}$=4.7μF，$T_A$=25°C

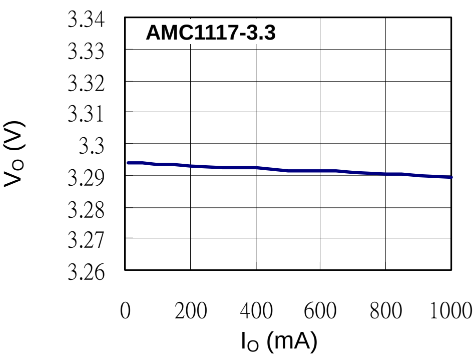
### Load Regulation



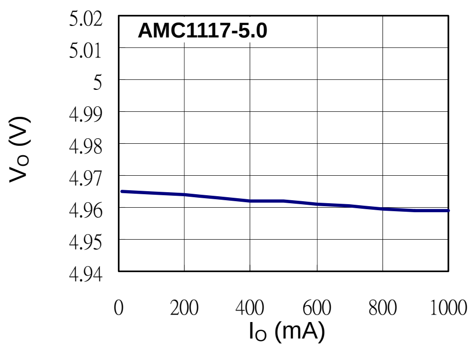

### Load Regulation



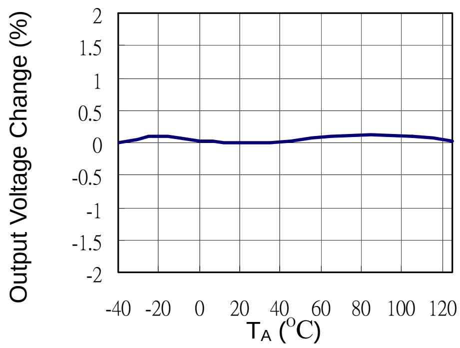

### Load Regulation



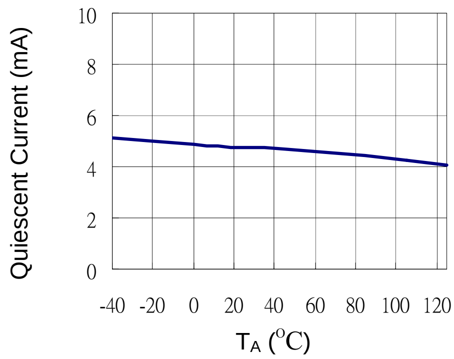

### Load Regulation



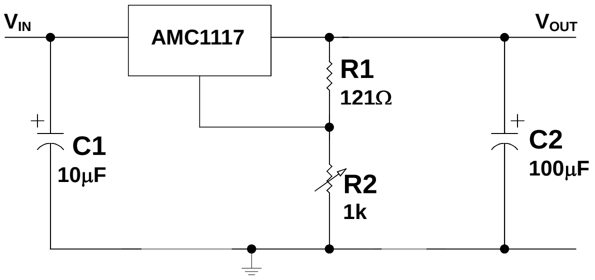

### Temperature Stability




### Quiescent Current vs. Temperature

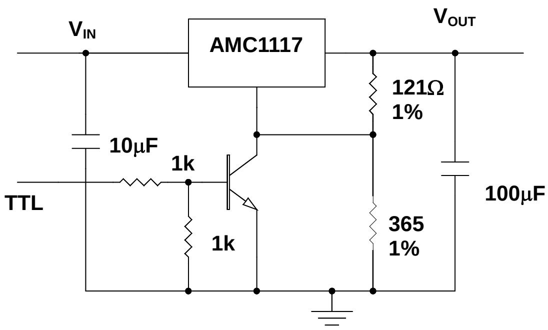


## APPLICATION INFORMATION

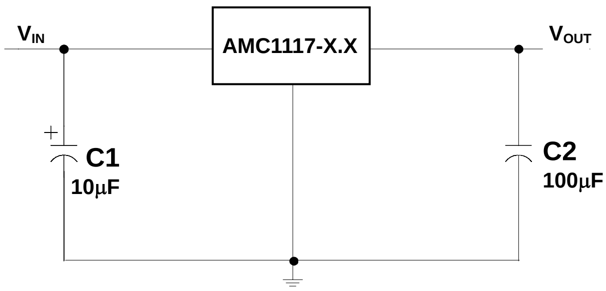



**Adjustable Regulator**

$$V_{OUT} = 1.25V \left(1 + \frac{R2}{R1}\right)$$




**5V Regulator with Shutdown**




**Fixed Voltage Regulator**

# Application Note:

**Maximum Power Calculation:**

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_{A(MAX)}}{\theta_{JA}}$$

$T_J(^oC)$: Maximum recommended junction temperature

$T_A(^oC)$: Ambient temperature of the application

$\theta_{JA}(^oC/W)$: Junction-to-junction temperature thermal resistance of the package, and other heat dissipating materials.

**The maximum power dissipation of a single-output regulator** :

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

Where: $V_{OUT(NOM)}$ = the nominal output voltage
$I_{OUT(NOM)}$ = the nominal output current, and
$I_Q$ = the quiescent current the regulator consumes at $I_{OUT(MAX)}$
$V_{IN(MAX)}$ = the maximum input voltage

Then $\theta_{JA} = (150\,^oC - T_A)/ P_D$

**Thermal consideration:**

When power consumption is over about 404 mW (for SOT-223 package, 687mW for TO-252 package, at $T_A$=70 $^o$C), additional heat sink is required to control the junction temperature below 125 $^o$C.

The junction temperature is: $T_J = P_D (\theta_{JT} + \theta_{CS} + \theta_{SA}) + T_A$

$P_D$: Dissipated power.

$\theta_{JT}$: Thermal resistance from the junction to the mounting tab of the package.

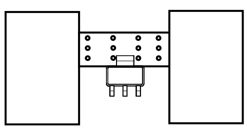
$\theta_{CS}$: Thermal resistance through the interface between the IC and the surface on which it is mounted. (Typically, $\theta_{CS}$ < 1.0°C/W)

$\theta_{SA}$: Thermal resistance from the mounting surface to ambient (thermal resistance of the heat sink).

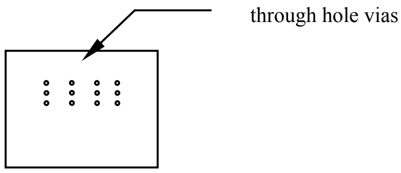
If PC Board copper is going to be used as a heat sink, below table can be used to determine the appropriate size of copper foil required. For multi-layered PCB, these layers can also be used as a heat sink. They can be connected with several through hole vias.

| PCB $\theta_{SA}$ ($^o$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.



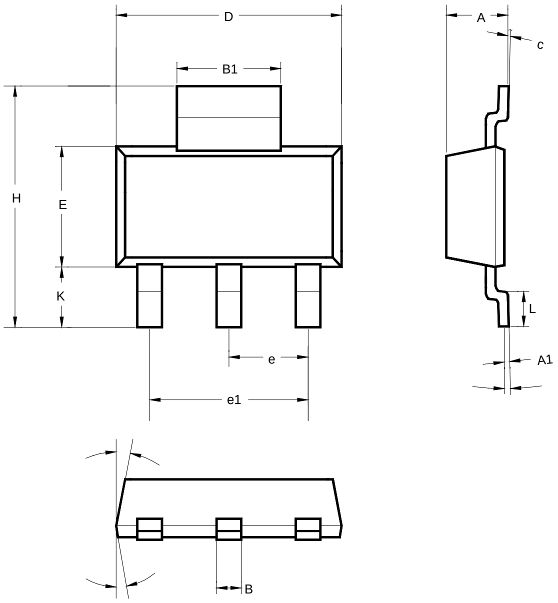
(Top View)




(Bottom View)

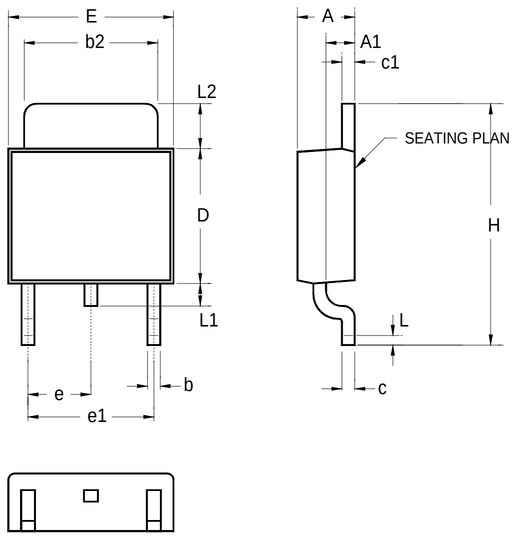
## PACKAGE

### 3-Pin Surface Mount SOT-223 (SK)




| | MILLIMETERS | | |
|---|---|---|---|
| | MIN | TYP | MAX |
| A | 1.50 | 1.65 | 1.80 |
| A1 | 0.02 | 0.05 | 0.08 |
| B | 0.60 | 0.70 | 0.80 |
| B1 | 2.90 | - | 3.15 |
| c | 0.28 | 0.30 | 0.32 |
| D | 6.30 | 6.50 | 6.70 |
| E | 3.30 | 3.50 | 3.70 |
| e | 2.3 BSC | | |
| e1 | 4.6 BSC | | |
| H | 6.70 | 7.00 | 7.30 |
| L | 0.91 | 1.00 | 1.10 |
| K | 1.50 | 1.75 | 2.00 |
| α | 0° | 5° | 10° |
| β | | 3° | |

### 3-Pin Surface Mount TO-252 (SJ)




| | 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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**ADDtek Corp.**
9F, No. 20, Sec. 3, Bade Rd., Taipei, Taiwan, 105
TEL: 2-25700299
FAX: 2-25700196