

CONFIDENTIAL B

# Introduction to Ga Master 2.5



# Introduction to Gauge Master 2.5

# Ricky Wu



# Revision History

Revision	Data (mm/dd/yyyy)	Author	Note
V1.0	06/28/2017	Ricky Wu	1 <sup>st</sup> version for customer
V1.1	09/05/2017	Zhongneng Wen	Added Rfg auto calibration in factory with Multi ATE_Tool (option).
V1.2	12/19/2017	Zhongneng Wen	Updated Ref. phone. Changed to English.

# HW Spec Comparison

	MTK GM3.0 Coulomb + V	MTK GM2.5 Coulomb + V	MTK GM2.0 Coulomb
Ref. Phone	X30/P25/P30 /P23	MT6739	MT6737/MT6752/MT6797
SOC Error @ Diff. Temp	<b>+1%</b> +-2% (MT6763) @0~50	+-2% @0~50	+-3% @0~50
Voltage/Temp. ADC	<b>15 bits/</b> (2.5~4.8V,1ms)	<b>15 bits/</b> (2.5~4.8V,1ms)	<b>15 bits/</b> (2.5~4.8V,1ms)
Current ADC 1 bit+-	<b>15bits/</b> (0~6A,500mS)	<b>15bits/</b> (0~6A,62.5mS)	<b>15bits/</b> (0~6A,62.5mS)
Gauge Alg. Implementation	HW+SW	SW	SW
Timing Accuracy	<b>&lt;+-1%</b>	<b>&lt;+-1%</b>	<b>&lt;+-1%</b>
Sense Resistor	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
Package	Embedded	Embedded	Embedded
BOM #	1R	1R	1R
Chip Price	N.A	N.A	N.A

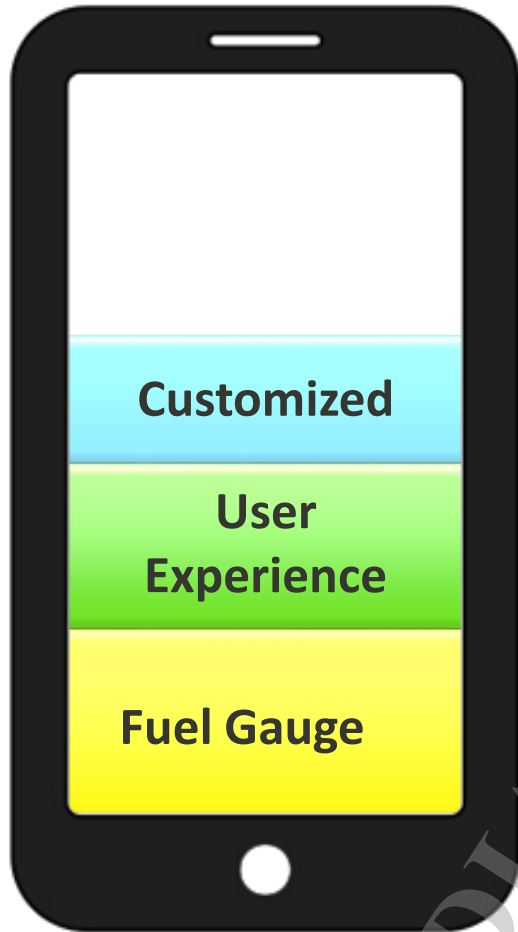
# SW Feature List

	GM3.0	GM2.5	GM2.0
SOC based on	Coulomb + Voltage mode	Coulomb + Voltage mode	Coulomb
Auto - K	Support	Support	No
Faster multi-battery profile import	Yes	Yes	No
Easier customization setting	Yes	Yes	No
SOC error compensation V voltage	Dynamic	Dynamic	Static
Battery aging	1. Capacity learning 2. Voltage compensation	1. Capacity learning 2. Voltage compensation	Capacity learning
Battery-cycle counting	Yes	No	No
Update rate	HW INT	SW INT	10S
Initial SOC (D0) at power on	Best	better	Normal
SOC smooth tracking	Best	Best	Normal

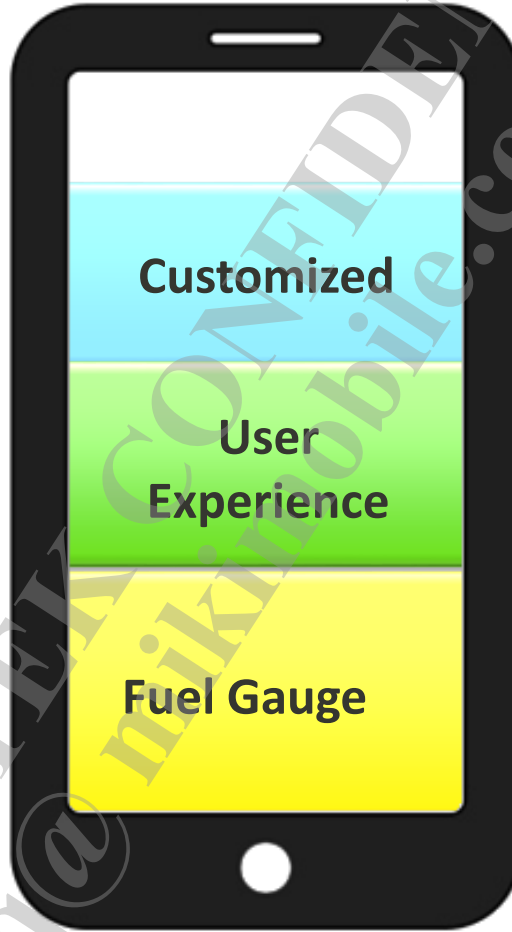
# Gauge Master Benchmark KPI

	GM2.0	GM2.5	GM3.0	Iphone6 - Tx	Maxxx
SOC accuracy	★★	★★★★	★★★★★	★★★★★	★
DOU	★	★★★★★	★★★★★	★★	★★★★★
User feeling	★★	★★★★	★★★★★	★	★★★★
Aging compensation	★	★★★★	★★★★★	★★	★★★★
Price	★★★★★	★★★★★	★★★★★	★	★★
Low power	★★	★★	★★★★	★★★★★	★★★★★

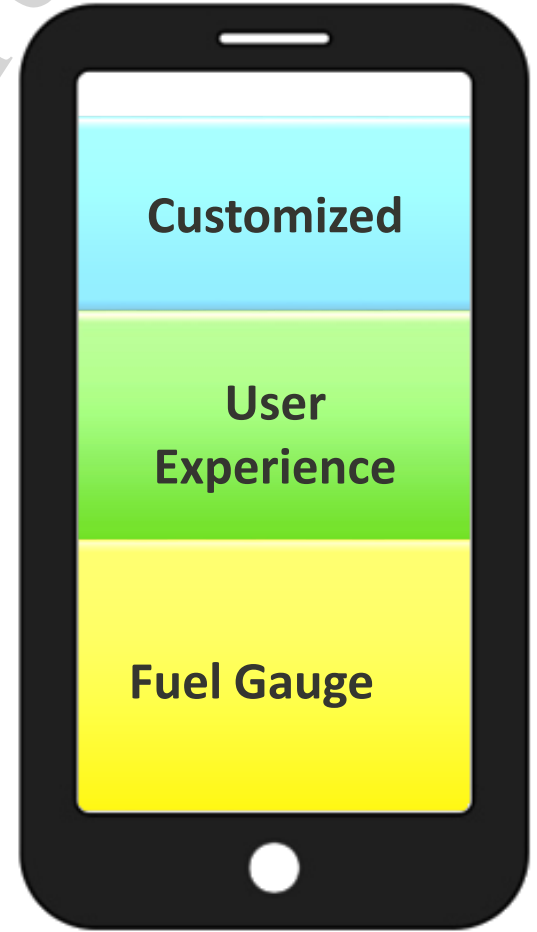
# Gauge Master Introduction



**Gauge Master 2.0**

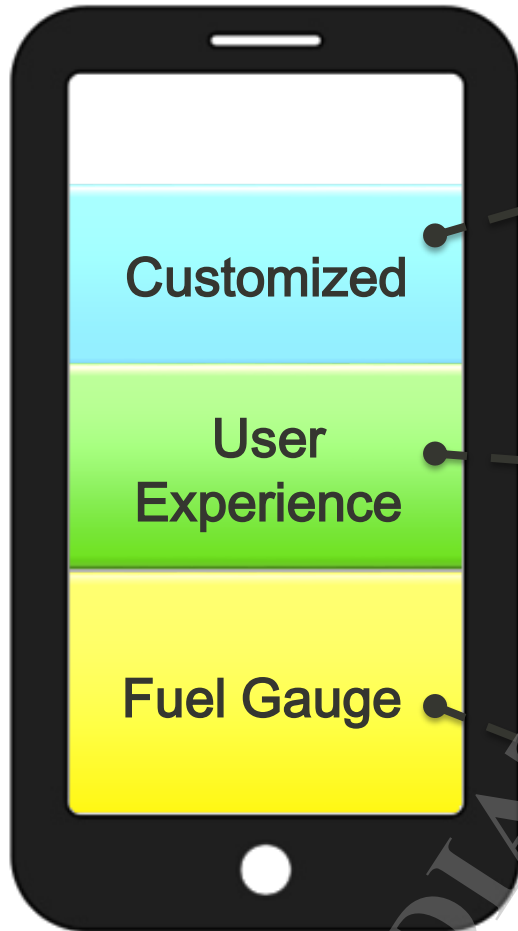


**Gauge Master 2.5**



**Gauge Master 3.0**

# What's New in GM2.5?



## Gauge Master 2.5

- Faster multi-battery profile import
- Easier customization settings import
- Without 1-week heavy-loading optimization
- Brilliant SOC accuracy by Rfg & PCB calibration

- Upgraded SOC Smooth tracking
- Enhanced SOC 100% UI adjustment
- Prolonged Daily of Use (DOU)

- Improved initial SOC (D0) at Power on
- Immediate Aging Compensation
- Dynamic SOC Error Compensation
- 1/63 Low power consumption
- Removed GM2.0 Limitation

# Faster & Easier Customization Flow

GM 2.0

GM 2.5 / GM3.0

Customization Parameters

Edit .h file manually

GUI tool  
generates .dtsi file

Heavy Loading Optimization

One week

Algorithm calculates automatically

mtk\_battery\_table.h

```
31 /*#define MTK_GET_BATTERY_ID BY GPIO*/
32
33 /* Qmax for battery */
34 int g_Q_MAX_T0(TOTAL_BATTERY_NUMBER) = { 2946, 2712, 2490, 1965 };
35 int g_Q_MAX_T1(TOTAL_BATTERY_NUMBER) = { 2796, 2851, 2468, 1984 };
36 int g_Q_MAX_T2(TOTAL_BATTERY_NUMBER) = { 2718, 2432, 2310, 1946 };
37 int g_Q_MAX_T3(TOTAL_BATTERY_NUMBER) = { 2535, 1991, 1858, 1873 };
38 int g_Q_MAX_T4(TOTAL_BATTERY_NUMBER) = { 2523, 1960, 1843, 1851 };
39
40 int g_Q_MAX_T0_H_CURRENT(TOTAL_BATTERY_NUMBER) = { 2646, 2412, 2190, 1900 };
41 int g_Q_MAX_T1_H_CURRENT(TOTAL_BATTERY_NUMBER) = { 2496, 2551, 2168, 1684 };
42 int g_Q_MAX_T2_H_CURRENT(TOTAL_BATTERY_NUMBER) = { 2418, 2132, 2010, 1646 };
43 int g_Q_MAX_T3_H_CURRENT(TOTAL_BATTERY_NUMBER) = { 2235, 1691, 1558, 1573 };
44 int g_Q_MAX_T4_H_CURRENT(TOTAL_BATTERY_NUMBER) = { 2223, 1660, 1543, 1551 };
```

Battery Parameter Import & Customer Optimization

Property

Import GM Parameter File

	Unit	Min value	Max value	Customer optimization value	Description
g_FG_PSEUDO100_T0	1 %	80	100	95	Pseudo 100% percentage at T0.
g_FG_PSEUDO100_T1	1 %	80	100	110	Pseudo 100% percentage at T1.
g_FG_PSEUDO100_T2	1 %	80	100	95	Pseudo 100% percentage at T2.
g_FG_PSEUDO100_T3	1 %	80	100	95	Pseudo 100% percentage at T3.

DIFFERENCE\_FULLD

MT6336

Q\_MAX\_SYS

GM30

Battery Parameter Import & Customer Optimization

Property

Import Battery Parameter File

Import Battery 1 Characteristic Table

Import Battery 2 Characteristic Table

Import Battery 3 Characteristic Table

Import Battery 4 Characteristic Table

Ver:      Type:      Output:

Generate Customized file



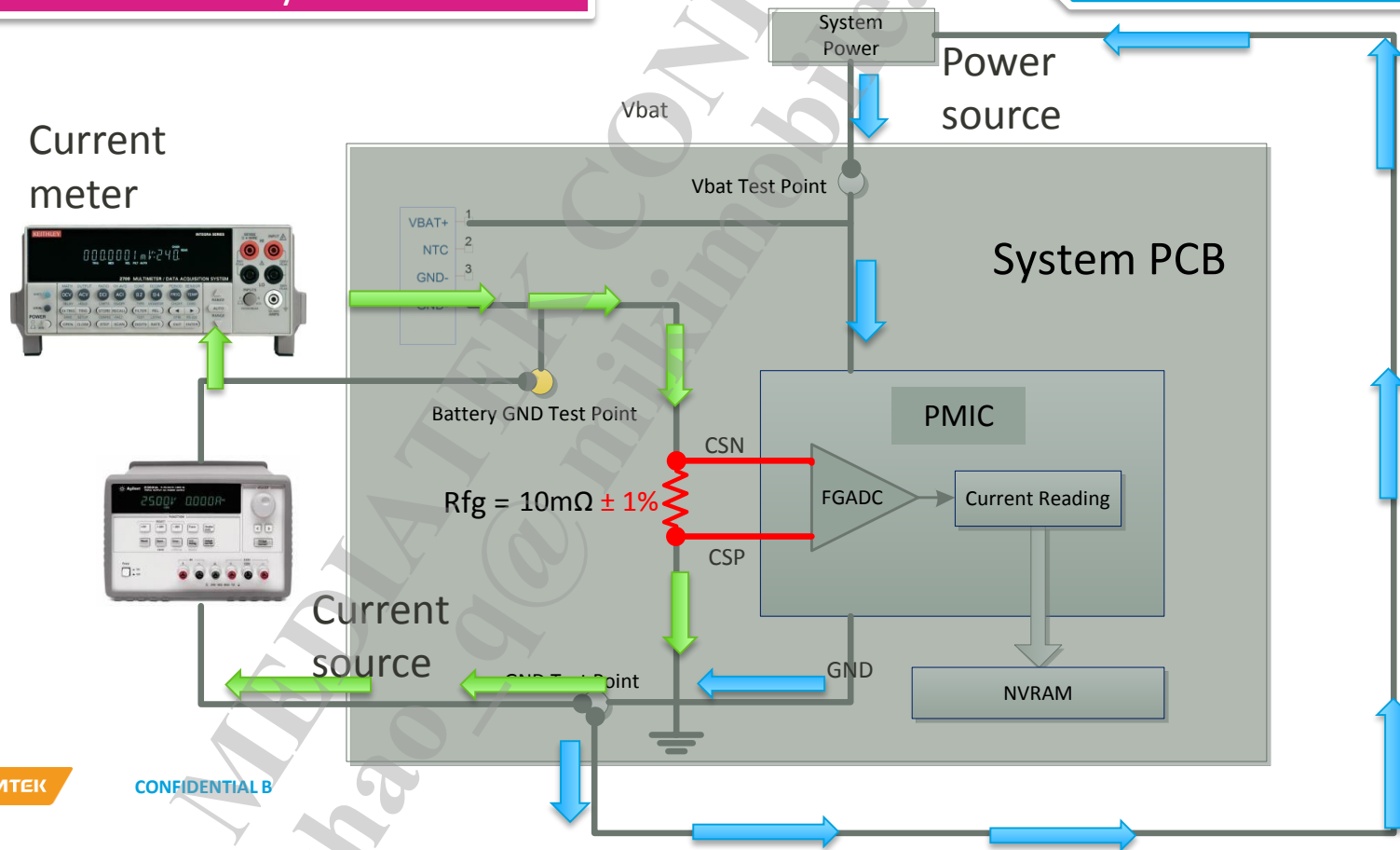
# Rfg Auto Calibration in Factory with Multi ATE\_Tool (GM2.5/GM3.0)

Error source:

1. Rfg  $\pm 1\%$
2. Rfg SMT error
3. CSN and CSP layout mismatch

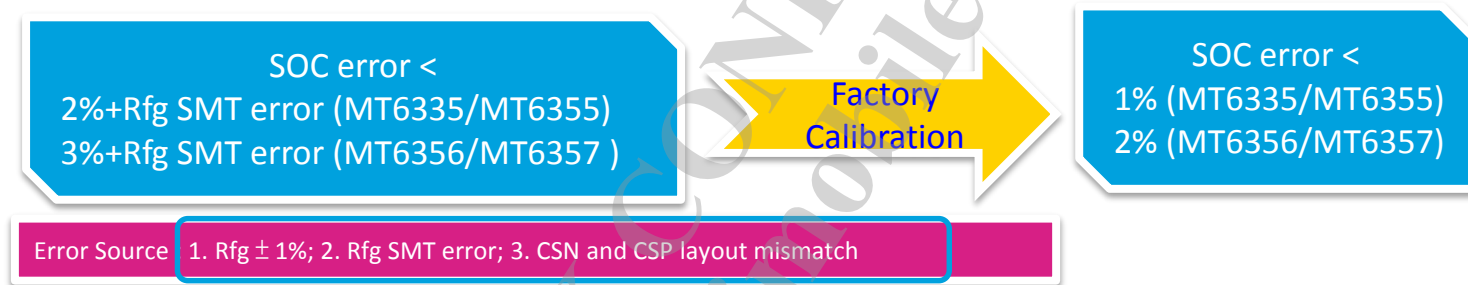
Multi ATE  
Calibration

SOC error <  
1% (MT6335/MT6355)  
2% (MT6356/MT6357)



# Rfg Auto Calibration in Factory with Multi ATE\_Tool (Option)

- GM2.5/GM3.0 factory calibration can calibrate Rfg 1% error and SMT error, but it will increase the cost.



	<u>w/i</u> Factory Calibration	<u>w/o</u> Factory Calibration
R&D cost	No increase  (Still need >10 pcs phone to do C.T.V calibration; use average value as SW default value)	No increase  (Still need >10 pcs phone to do C.T.V calibration; use average value as SW default value)
Production cost	<ol style="list-style-type: none"> <li>Instrument and equipment (N x Precision programmable power supply etc.)</li> <li>Production time cost/human resource cost</li> </ol>	None

**MEDIATEK**

*everyday genius*