Introduction to Gauge Master 2.5

MEDIATEK

Ricky Wu

Revision History

Revision	Data (mm/dd/yyyy)	Author	Note
V1.0	06/28/2017	Ricky Wu	1st 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	**+-1%** +-2% (MT6763) @0~50	+-2% @0~50	+-3% @0~50
Voltage/Temp. ADC	**15 bits/** (2.5~4.8V,1ms)	**15 bits/** (2.5~4.8V,1ms)	**15 bits/** (2.5~4.8V,1ms)
Current ADC 1 bit+-	**15bits/** (0~6A,500mS)	**15bits/** (0~6A,62.5mS)	**15bits/** (0~6A,62.5mS)
Gauge Alg. Implementation	HW+SW	SW	SW
Timing Accuracy	**<+-1%**	**<+-1%**	**<+-1%**
Sense Resistor	**Yes**	**Yes**	**Yes**
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
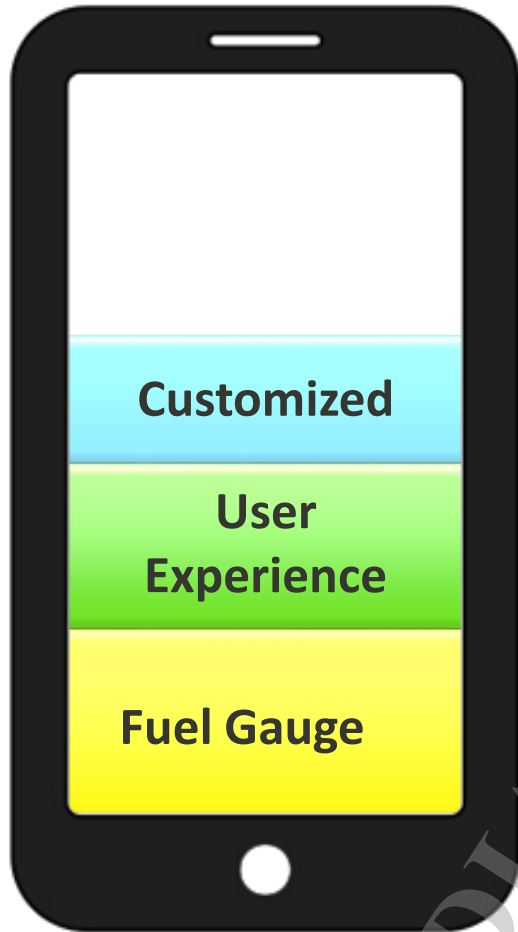
Gauge Master 2.0
- Customized
- User Experience
- Fuel Gauge
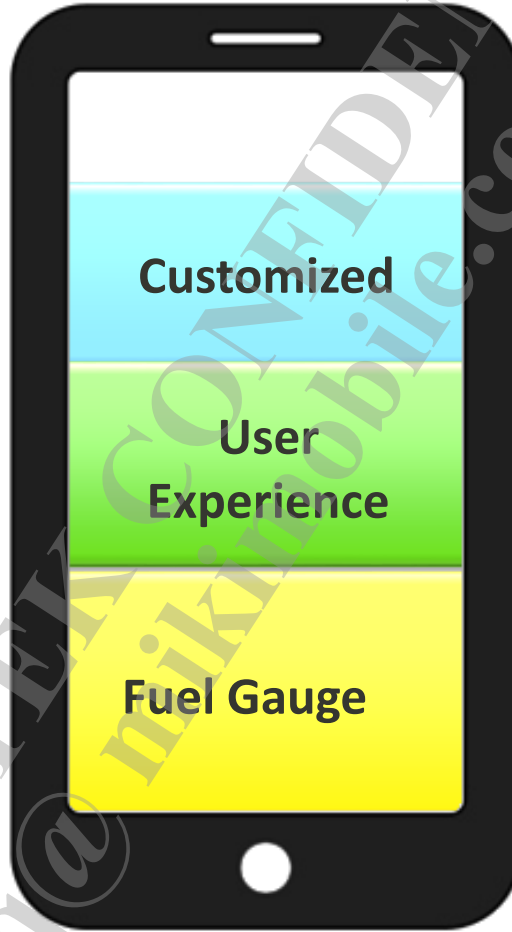
Gauge Master 2.5
- Customized
- User Experience
- Fuel Gauge

Gauge Master 3.0
- Customized
- User Experience
- Fuel Gauge
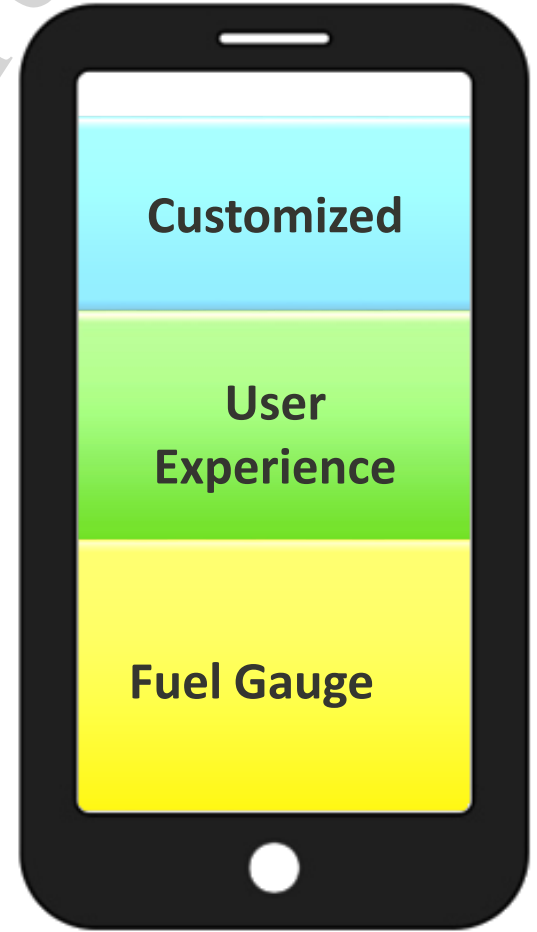
What's New in GM2.5?
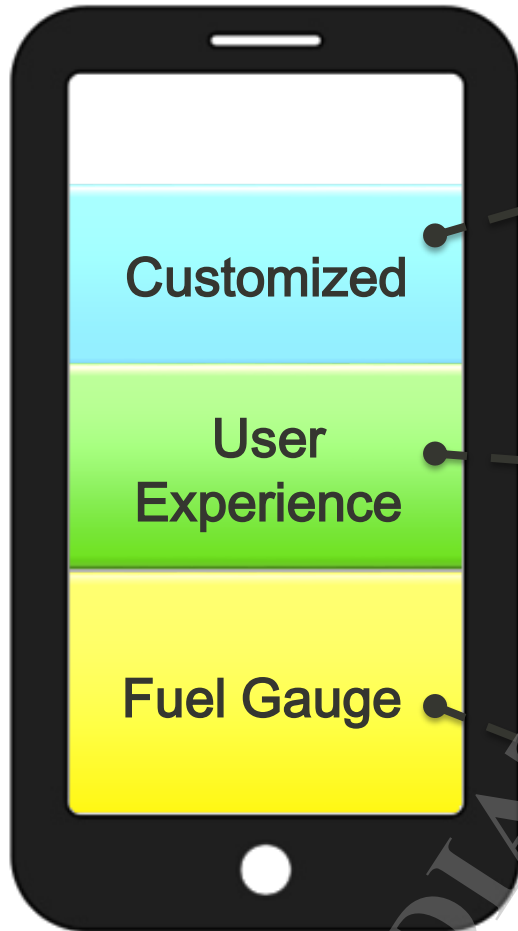
Customized

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

User Experience

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

Fuel Gauge

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

Gauge Master 2.5

Faster & Easier Customization Flow

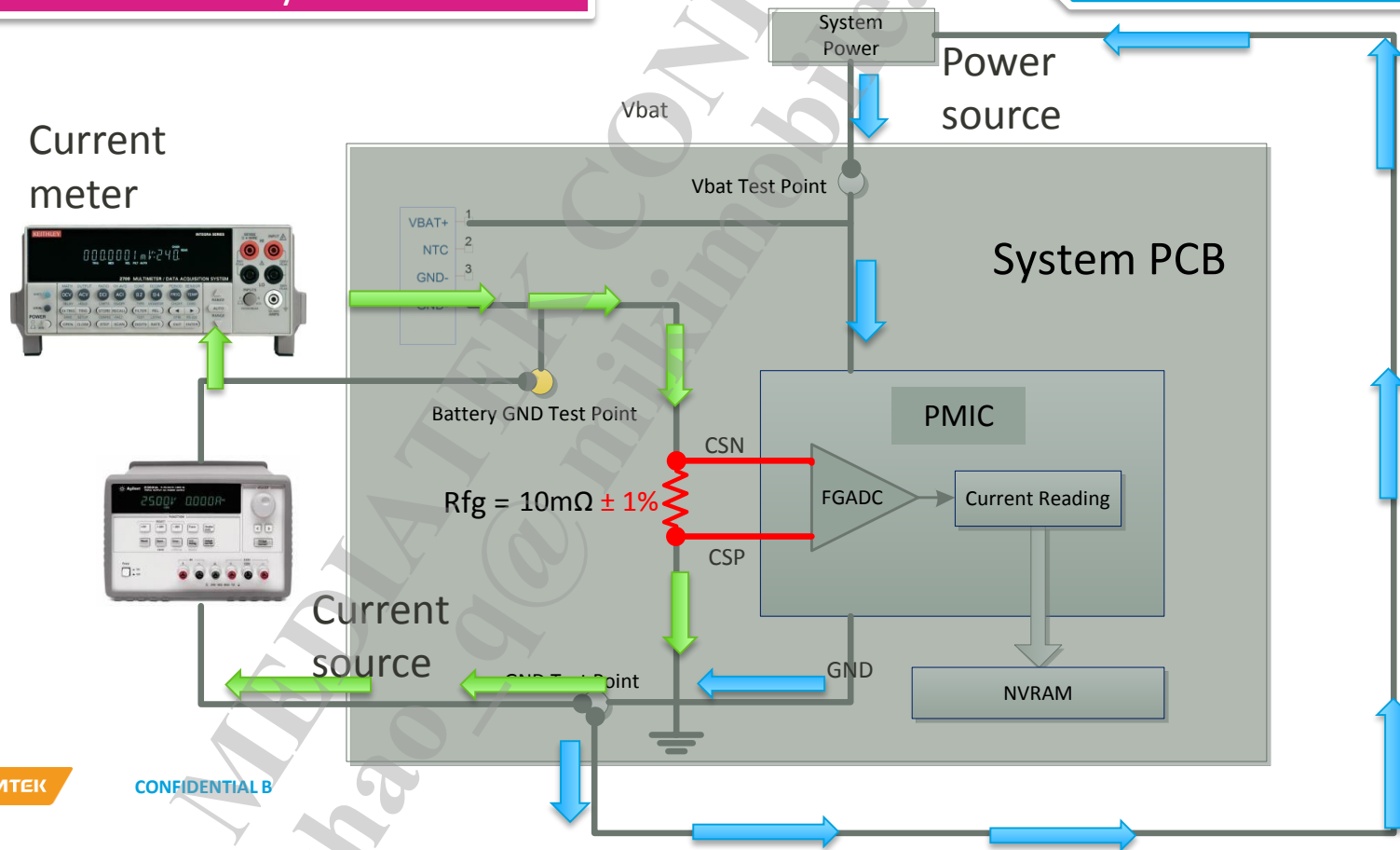|	GM 2.0	GM 2.5 / GM3.0
Customization Parameters	**Edit .h file manually**	**GUI tool generates .dtsi file**
Heavy Loading Optimization	**One week**	**Algorithm calculates automatically**

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)

System Power

Power source

Current meter

Vbat

Vbat Test Point

System PCB

VBAT+ 1
NTC   2
GND-   3
GND

Battery GND Test Point

CSN

$Rfg = 10m\Omega \pm 1\%$

FGADC

PMIC

Current Reading

CSP

Current source

GND Test Point

GND

NVRAM

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.

| SOC error < 2%+Rfg SMT error (MT6335/MT6355) 3%+Rfg SMT error (MT6356/MT6357) | → Factory Calibration → | SOC error < 1% (MT6335/MT6355) 2% (MT6356/MT6357) |

Error Source | 1. Rfg ± 1%; 2. Rfg SMT error; 3. CSN and CSP layout mismatch
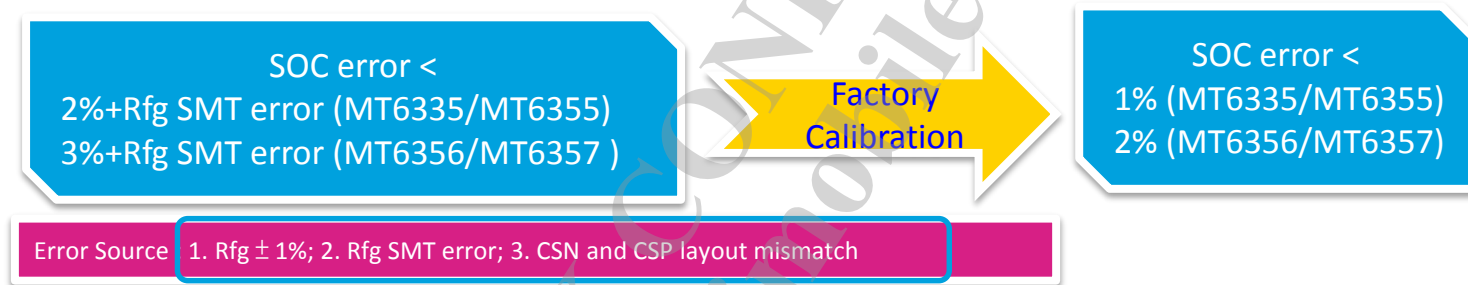
	w/i Factory Calibration	**w/o Factory Calibration**
R&D cost	No increase (Still need >10 pcs phone to do C.T.V calibration; use average value as SW default value)	No increase (Still need >10 pcs phone to do C.T.V calibration; use average value as SW default value)
Production cost	1. Instrument and equipment (N x Precision programmable power supply etc.) 2. Production time cost/human resource cost	None

everyday genius