MEDIATEK

GM1.0 and 2.0 Customized Setting Flow_V1.3

Revision History

Revision	Data (mm/dd/yyyy)	Author	Note
V1.0	05/21/2015	Ricky Wu/Filby Horng	1st version for customer
V1.1	07/21/2015	Cherry Chiu/Bo Jia	Detail test flow for customer
V1.2	09/06/2015	Cherry Chiu/Bo Jia	Modify　step"
V1.3	01/08/2016	Cherry Chiu	Modify　step"

Customized Setting Flow Step

Custom file
cust_battery_meter.h
cust_battery_meter_table.h

Customized Setting

New Cust file
cust_battery_meter.h
cust_battery_meter_table.h

&   Temp Load   p.4~p.5

0%   &   p.6~p.9

Tool   New custom file   p.10

p.11~p.13
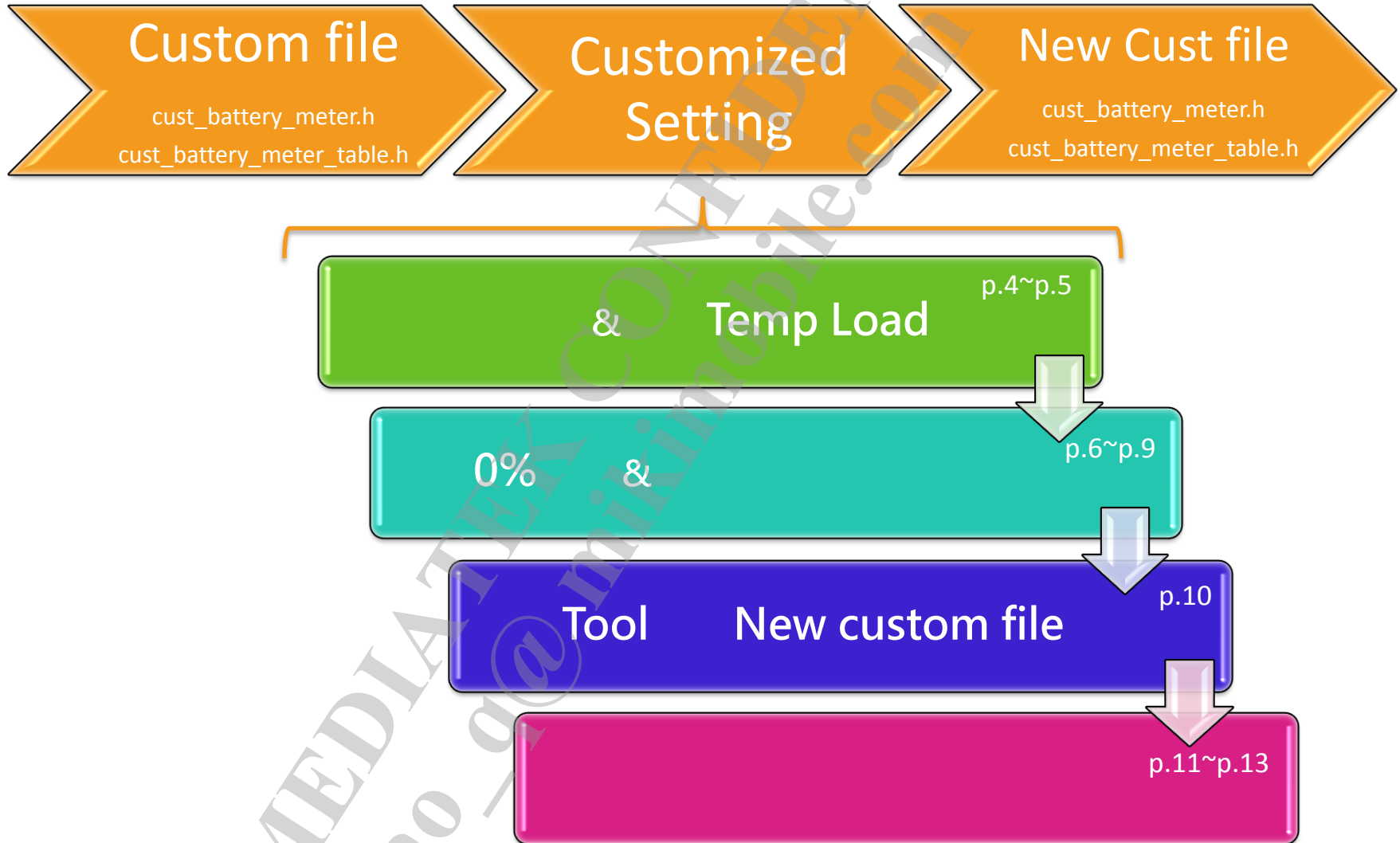
&　　Temp Load

- "cust_battery_meter_table.h" file　：
    - Step1. ZCV table (　)
        - Table size must be same at 50 ˚C /25 ˚C /0 ˚C /-10 ˚C
        - Allow DOD > 100
        - VC voltage can set at 2.8V

- "cust_battery_meter.h" file　：
    - Step1. CAR_TUNE_VALUE
        - #define CAR_TUNE_VALUE　　　　100　(　　　)
    - Step2. PCB impedance
        - #define FG_METER_RESISTANCE　　5　(PCB　　　　　mohm)
    - Step4. Turn off gauge 0% and gauge 1%
        - "//"
        - // #define SHUTDOWN GAUGE0
        - // #define SHUTDOWN_GAUGE1_XMINS

- custom fileTemp load　　0%

Note

Table size must be same at 50 ˚C /25 ˚C /0 ˚C /-10 ˚C

50℃		OCV	VC	mAh	R	DOD		25℃		OCV	VC	mAh	R	DOD
		3678	3617	2348	153	87				3695	3646	2352	123	86
		3676	3615	2376	153	88				3691	3643	2380	120	87
		3675	3615	2404	150	89				3690	3643	2408	118	88
		3675	3612	2432	158	90				3689	3641	2436	120	89
		3673	3611	2460	155	91				3688	3639	2464	123	90
		3672	3609	2488	158	92				3689	3636	2492	133	91
		3670	3604	2516	165	93				3686	3631	2520	138	92
		3665	3598	2544	168	94				3684	3628	2548	140	93
		3643	3577	2572	165	95				3677	3617	2576	150	94
		3607	3536	2600	178	96				3651	3592	2604	148	95
		3560	3486	2628	185	98				3617	3554	2632	158	96
		3498	3422	2656	190	99				3570	3504	2660	165	97
		3442	3354	2684	220	100				3513	3441	2688	180	98
		3340	3240	2712	250	101				3471	3378	2716	233	99
		3169	2881	2740	720	102				3406	3309	2744	243	100
		3112	2797	2746	788	102				3280	3154	2772	315	101
	Cmax			2695					Cmax			2745		
	Cmax_400mA			2665					Cmax_400mA			2706		

Allow DOD > 100%

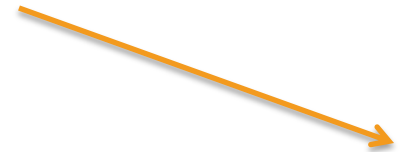VC voltage can set at 2.8V
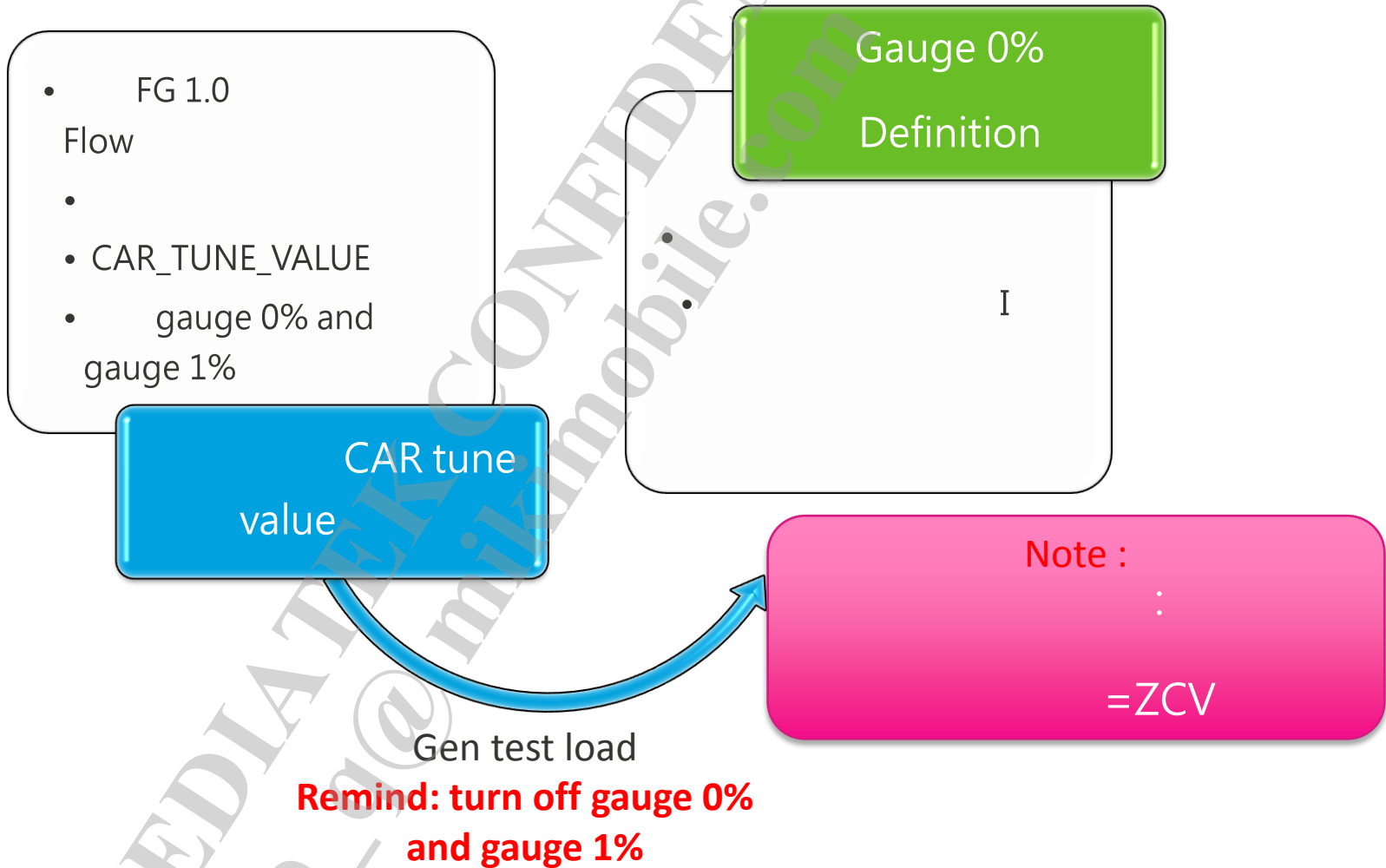
Gauge 0%   Step

- For GM1.0 & 2.0
  - step1.   .
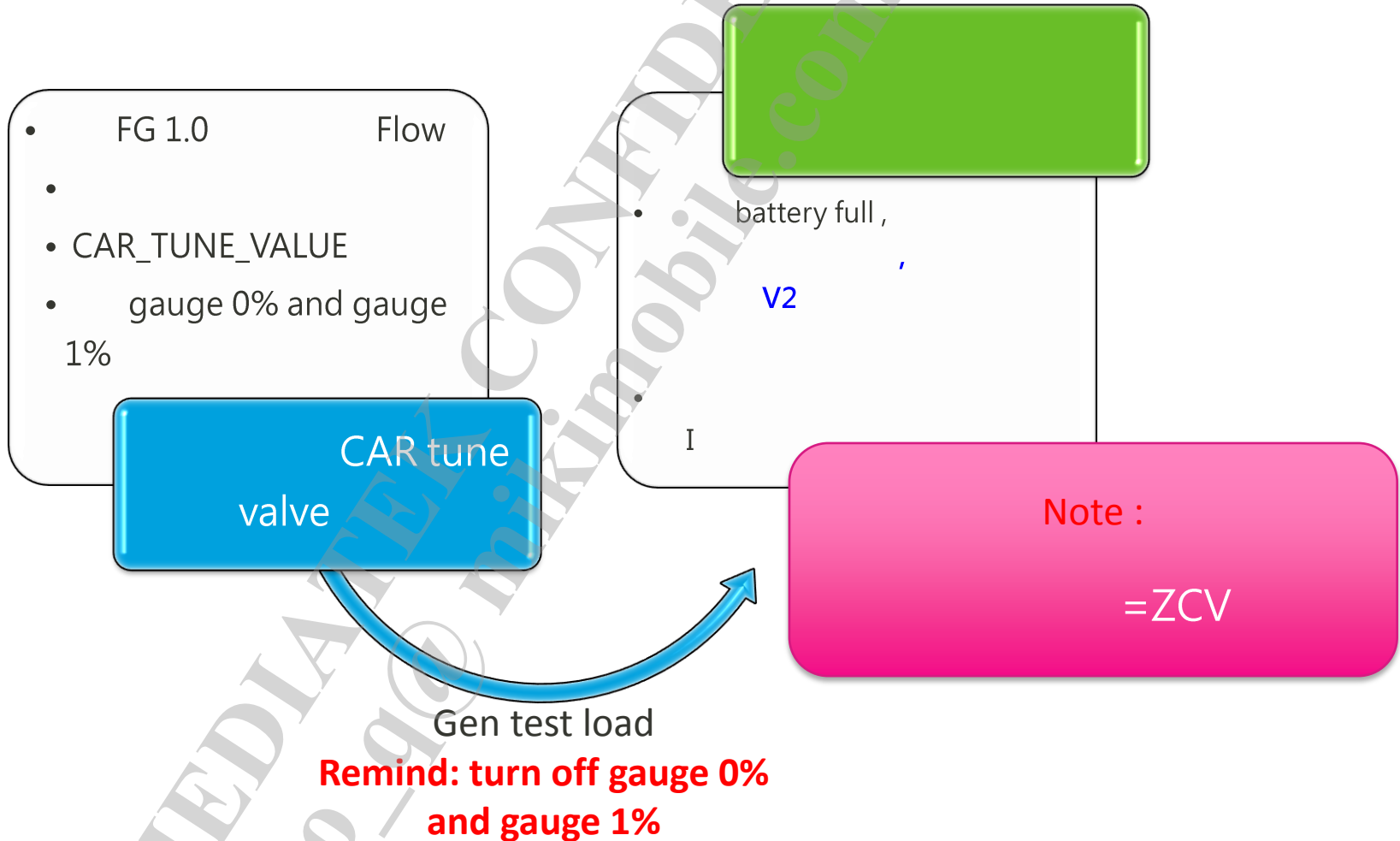 - Step2.log   [FGADC_D0],   I
  - Step3.

[FGADC_D0] (HW OCV 4126, HW OCV% 97, SW OCV 4131, SW OCV% 97, RTC% 19, VBAT% 86, VBAT 4037, T_avg 29, I 3984)

  - Note   3.7~3.8V

- Example:

(℃)	50℃	25℃	0℃	-10℃
I (mA)	363.3	188.2	183.1	263.5

-      FG 1.0   Flow
-
- CAR_TUNE_VALUE
-     gauge 0% and gauge 1%

CAR tune valve

- battery full ,

              ,

    V2

-     I

Note :

=ZCV

Gen test load

Remind: turn off gauge 0% and gauge 1%

step

- Step1. 30 (Warm and Hot 30%, Cool and Cold, :40/25/0/-10)
- Step2. OCV, log
  - **adb shell setprop persist.mediatek.fg.log.enable 1**
- Step3. (GP2 apk + elephant stress apk[])
- Step4.
- Step5. logZCV tableAvgVbatOCV
  - ➤ 3
- Step6.log

Step5AvgVbatOCV

log

Remind:
fg_current_avg

	HOT	WARM	COOL	COLD
(°C)	40	25	0	-10
(mV)	3657	3687	3854	4080
(mA)	1467.2	1148.9	1238.8	1324.9

step

- Step5-1.   HWOCVZCV table
  - MT6795
  - [FGADC_D0]   log

1.[FGADC_D0] (HW OCV 4239, HW OCV% 93, SW OCV 4223, SW OCV% 92, RTC% 0, VBAT% 90

  - HWOCVZCV table   example:

25°C	OCV	VC	mAh	R	DOD
	4331		0	130	0
Qmax	4308	4251	47	130	1
3362	4289	4233	93	133	3
	4271	4216	140	130	4
	4255	4200	186	133	6
	4239	4184	233	133	7
	4223	4168	279	133	8
	4207	4153	326	133	10
	4192	4137	372	133	11
	4178	4122	419	138	12

=233mAh

  - Note: Hot 50℃ ZCV table

step

- Step5-2. AvgVbat
  - kernel logAvgVbat
    - ✓ 3.4V MT6753/53T3.3V
    - ✓ MT6797 DLPT , Step
  - log "fg_coulomb_act" 0.1mAh example

```
[Tue Aug 11 15:10:58.033 2015] [ 8279.756920]<1>.(1)[173:bat_routine_thr][kernel]AvgVbat 3419,bt_vol 3445, AvgI 0, I 0, VChr 0, AvgT 43, T 44, ZCV 3600
[Tue Aug 11 15:11:08.251 2015] [ 8289.961926]<1>.(3)[173bat_routine_thr][kernel]AvgVbat 3415,bat_vol 3359, AvgI 0, I 0, VChr 0, AvgT 43, T 44, ZCV 3487
[Tue Aug 11 15:11:28.265 2015] [ 8309.960288]<2>.(2)[173:bat_routine_thr][kernel]AvgVbat 3411,bat_vol 3413, AvgI 0, I 0, VChr 0, AvgT 43, T 44, ZCV 347
[Tue Aug 11 15:11:38.139 2015] [ 8319.878554]<4>.(4)[173:bat_routine_thr][kernel]AvgVbat 3410,bat_vol 3389, AvgI 0, I 0, VChr 0, AvgT 43, T 44, ZCV 3600
[Tue Aug 11 15:11:58.137 2015] [ 8339.845580]<4>.(4)[173:bat_routine_thr][kernel]AvgVbat 3406,bat_vol 3355, AvgI 0, I 0, VChr 0, AvgT 43, T 44, ZCV 3600
[Tue Aug 11 15:12:08.137 2015] [ 8349.874910<4>.(4)[173:bat_routine_thr][kernel]AvgVbat 3405,bat_vol 3408, AvgI 0, I 0, VChr 0, AvgT 43, T 44, ZCV 3487
[Tue Aug 11 15:12:28.182 2015] [ 8369.894785]<4>.(4)[173:bat_routine_thr][kernel]AvgVbat 3400,bat_vol 3366, AvgI 0, I 0, VChr 0, AvgT 43, T 44, ZCV 3600
[Tue Aug 11 15:12:48.149 2015] [ 8389.901531]<3>.(2)[173:bat_routine_thr][kernel]AvgVbat 3391,bat_vol 3325, AvgI 0, I 0, VChr 0, AvgT 43, T 44, ZCV 3600
[Tue Aug 11 15:12:58.102 2015] [ 8399.791394]<1>.(2)[173:bat_routine_thr][kernel]AvgVbat 3389,bat_vol 3345, AvgI 0, I 0, VChr 0, AvgT 43, T 45, ZCV 3600

[Tue Aug 11 15:11:28.062 2015] [ 8309.744935]<0>.(4)[360:fuelgauged]MTK_FG: [fgauge_update_dod] fg_dod_1=94, fg_coulomb_act=-28246, fg_dod0=8, C_0mA=3356, C_400mA=
[Tue Aug 11 15:11:38.014 2015] [ 8319.683890]<4>.(1)[360:fuelgauged]MTK_FG: fg_coulomb_act_pre=-28205 fg_coulomb_act=-28290 duration_time=10 fg_coulomb_act_time=20
[Tue Aug 11 15:11:48.123 2015] [ 8329.797044]<3>.(4)[360:fuelgauged]MTK_FG fg_coulomb_act_pre=-28205 fg_coulomb_act=-28333 duration_time=10 fg_couomb_act_time=30 f
[Tue Aug 11 15:12:38.088 2015] [ 8379.793276]<2>.(1)[360:fuelgauged]MTK_FG: fg_coulomb_act_pre=-28460 fg_coulomb_act=-28545 duration_time=10 fg_coulomb_act_time=20
[Tue Aug 11 15:12:38.166 2015] [ 8379.873544]<1>.(3)[360:fuelgauged]MTK_FG: [fgauge_udate_dod] fg_dod_1=95, fg_coulomb_act=-28545, fg_dod0=8, C_0mA=3356, C_40mA=33
[Tue Aug 11 15:12:48.196 2015] [ 8389.916194]<1>.(1)[360:fuelgauged]MTK_FG: fg_coulomb_act_pre=-28460 fg_coulomb_act=-28591 duration_time=10 fg_coulomb_act_time=30
[Tue Aug 11 15:12:48.212 2015] [ 8389.922836]<1>.(2)[360:fuelgauged]MTK_FG: [fgauge_update_dod] fg_dod_1=95, fg_coulomb_act=-28591, fg_dod0=8, C_0mA=3356, C_400mA=3
[Tue Aug 11 15:13:18.054 2015] [ 8419.745761]<2>.(7)[360:fuelgauged]MTK_FG: fg_coulomb_act_pre=-28719 fg_coulomb_act=-28719 duration_time=10 fg_coulomb_act_time=0
```

fg_coulomb_act0.1mAh
➔=2859.1mAh

step

- (for MT6797)
- ,cmdDLPT:
  - echo 1 > /proc/pbm/pbm_debug
- Key word:
  - [DLPT_POWER_OFF_EN] SOC=0 to power off , cnt=

```
[Mon Oct 26 18:37:07.246 2015] [ 1898.891519] <2>.(1)[176:bat_update_thre][DLPT_POWER_OFF_EN] run
[Mon Oct 26 18:37:17.258 2015] [ 1908.889372] <3>.(5)[176:bat_update_thre][DLPT_POWER_OFF_EN] run
[Mon Oct 26 18:37:27.248 2015] [ 1918.898388] <4>.(5)[176:bat_update_thre][DLPT_POWER_OFF_EN] run
[Mon Oct 26 18:37:37.262 2015] [ 1928.902060] <2>.(4)[176:bat_update_thre][DLPT_POWER_OFF_EN] run
[Mon Oct 26 18:37:47.257 2015] [ 1938.889476] <3>.(5)[176:bat_update_thre][DLPT_POWER_OFF_EN] run
[Mon Oct 26 18:37:47.257 2015] [ 1938.889483] <3>.(5)[176:bat_update_thre][DLPT_POWER_OFF_EN] SOC=0 to power off , cnt=1
[Mon Oct 26 18:37:57.525 2015] [ 1948.908132] <4>.(5)[176:bat_update_thre][DLPT_POWER_OFF_EN] run
[Mon Oct 26 18:37:57.525 2015] [ 1948.908139] <4>.(5)[176:bat_update_thre][DLPT_POWER_OFF_EN] SOC=0 to power off , cnt=2
```

```
[Mon Oct 26 18:36:17.207 2015] [ 1848.892076] <4>.(2)[447:fuelgauged]MTK_FG: [fgauge_update_dod] fg_dod_1=81, fg_coulomb_act=-6518, fg_dod0=58, C_0mA=2820, C_400mA=2764, C_FGCurrent=2640, fg_current_avg=12859, qmax_
[Mon Oct 26 18:36:27.199 2015] [ 1858.894151] <4>.(2)[447:fuelgauged]MTK_FG: [fgauge_update_dod] fg_dod_1=81, fg_coulomb_act=-6556, fg_dod0=58, C_0mA=2820, C_400mA=2764, C_FGCurrent=2642, fg_current_avg=12726, qmax_
[Mon Oct 26 18:36:37.203 2015] [ 1868.885914] <2>.(4)[447:fuelgauged]MTK_FG: [fgauge_update_dod] fg_dod_1=81, fg_coulomb_act=-6589, fg_dod0=58, C_0mA=2820, C_400mA=2764, C_FGCurrent=2640, fg_current_avg=12909, qmax_
[Mon Oct 26 18:36:47.219 2015] [ 1878.903359] <0>.(2)[447:fuelgauged]MTK_FG: [fgauge_update_dod] fg_dod_1=81, fg_coulomb_act=-6626, fg_dod0=58, C_0mA=2820, C_400mA=2764, C_FGCurrent=2641, fg_current_avg=12798, qmax_
[Mon Oct 26 18:36:57.221 2015] [ 1888.888413] <0>.(2)[447:fuelgauged]MTK_FG: [fgauge_update_dod] fg_dod_1=82, fg_coulomb_act=-6666, fg_dod0=58, C_0mA=2820, C_400mA=2764, C_FGCurrent=2643, fg_current_avg=12694, qmax_
[Mon Oct 26 18:37:07.205 2015] [ 1898.888678] <2>.(5)[447:fuelgauged]MTK_FG: [fgauge_update_dod] fg_dod_1=82, fg_coulomb_act=-6702, fg_dod0=58, C_0mA=2820, C_400mA=2764, C_FGCurrent=2645, fg_current_avg=12545, qmax_
[Mon Oct 26 18:37:17.219 2015] [ 1908.886613] <3>.(4)[447:fuelgauged]MTK_FG: [fgauge_update_dod] fg_dod_1=82, fg_coulomb_act=-6737, fg_dod0=58, C_0mA=2820, C_400mA=2764, C_FGCurrent=2645, fg_current_avg=12545, qmax_
[Mon Oct 26 18:37:27.210 2015] [ 1918.893279] <4>.(0)[447:fuelgauged]MTK_FG: [fgauge_update_dod] fg_dod_1=82, fg_coulomb_act=-6775, fg_dod0=58, C_0mA=2820, C_400mA=2764, C_FGCurrent=2645, fg_current_avg=12540, qmax_
[Mon Oct 26 18:37:37.219 2015] [ 1928.893584] <2>.(0)[447:fuelgauged]MTK_FG: [fgauge_update_dod] fg_dod_1=82, fg_coulomb_act=-6813, fg_dod0=58, C_0mA=2820, C_400mA=2764, C_FGCurrent=2643, fg_current_avg=12676, qmax_
[Mon Oct 26 18:37:47.215 2015] [ 1938.886755] <3>.(4)[447:fuelgauged]MTK_FG: [fgauge_update_dod] fg_dod_1=82, fg_coulomb_act=-6844, fg_dod0=58, C_0mA=2820, C_400mA=2764, C_FGCurrent=2642, fg_current_avg=12727, qmax_
[Mon Oct 26 18:37:57.489 2015] [ 1948.894851] <2>.(0)[447:fuelgauged]MTK_FG: [fgauge_update_dod] fg_dod_1=82, fg_coulomb_act=-6865, fg_dod0=58, C_0mA=2820, C_400mA=2764, C_FGCurrent=2644, fg_current_avg=12631, qmax_
```

fg_coulomb_act0.1mAh
→=686.5mAh

step

- Step5-3. += 　　　OCV

  ➢
  ➢ 　ZCV table　OCV
  ➢ Example
    ✓ 233 mAh + 2859.1 mAh = 3092.1 mAh

25°C	OCV	VC	mAh	R	DOD
	3730	3657	2791	128	83
	3722	3649	2837	128	84
	3714	3640	2884	128	86
	3706	3629	2930	128	87
	3695	3625	2977	128	89
	3688	3622	3023	125	90
	3687	3618	3070	130	91
	3685	3612	3116	133	93
	3683	3596	3163	140	94

OCV3687mV

	HOT	WARM	COOL	COLD
(°C)	40	25	0	-10
(mV)	3657	3687	3854	4080
(mA)	1467.2	1148.9	1238.8	1324.9

Tool　　New custom file

- ”Gauge Master-Customized Setting” toolnew custom file ” Gauge Master-Customized Setting Tool SOP”

- Tool　　　　input file

  - ”cust_battery_meter_table.h” file

  - ” cust_battery_meter.h” file
    - ”Turn off gauge 0% and gauge 1%”

  -

  -

(℃)	50℃	25℃	0℃	-10℃
I (mA)	363.3	188.2	183.1	263.5

	HOT	WARM	COOL	COLD
(℃)	40	25	0	-10
(mV)	3657	3687	3854	4080
(mA)	1467.2	1148.9	1238.8	1324.9

Step

System 100% Definition

- UI 1% T1

- Example :
  - Set #define SHUTDOWN_GAUGE1_MINS **60**
  - When UI SOC=1% , 60min

System 1% keep timing Definition

- 100% ( )

- Example :
  - Set #define BATTERYPSEUDO100 **95**
  - FG SOC >= 95% ➔ UI SOC =100%

System Display SOC – System 1% keep timing

- Set Customized file cust_battery_meter.h
    - #define SHUTDOWN_GAUGE1_MINS **60**
        - The number is UI%=1% display timing , when over this timing (Min), system will shutdown

System Display SOC – System 100%

- Set Customized file cust_battery_meter.h
  - #define BATTERYPSEUDO100 **95**
    - The number near 100 Discharge Battert Full to 99% is fast
    - The number near 90 Discharge Battert Full to 99% is slow

Advanced Customized setting

System Display SOC – System 1%

- Set Customized file cust_battery_meter.h

  - #define BATTERYPSEUDO1 **4**

    - The number near 0 , large loading UI will drop to 0% too fast

Battery SOC
– Loading Parameter Adjustment

- Set Customized file cust_battery_meter.h
  - #define Q_MAX_SYS_VOLTAGE **3400**
    - The factor can optimized Loading to Qmax ratio

Battery SOC
- SW OCV Precision Adjustment

- Set Customized file cust_battery_meter.h
  - #define FG_METER_RESISTANCE **5**
    - Customer can use this setting to adjust the PCB impedance

Battery SOC – Power on off

- Set Customized file cust_battery_meter.h
    - #define DIFFERENCE_HWOCV_RTC **30**
        - The number as large as keep D0=RTC
    - #define DIFFERENCE_HWOCV_SWOCV **10**
        - The number as small as high probability let D0=SW OCV
    - #define DIFFERENCE_SWOCV_RTC **10**
        - The number as large as high probability let D0=RTC

Smooth and Monotonic SOC – 100% tracking time

- Set Customized file cust_battery_meter.h
  - #define CHARGE_TRACKING_TIME **60**
    - When Charger first let battery full, UI% will per CHARGE_TRACKING_TIME UI+1% until to 100%

Customized Setting Check List

No.	Item	Details Reference
1	Battery ZCV table measurement and import	"Fuel Gauge Battery ZCV Table Test SOP_V1.0" "Fuel Gauge Application Notes_V1.0"
2	CAR_TUNE_VALUE tuning	"Fuel Gauge Application Notes_V1.0"
3	PCB impedance parameter tuning	"GM1.0_2.0 Customized Setting Flow" - SW OCV Precision Adjustment, "define FG_METER_RESISTANCE **5**"
4	Gauge 0% definition tuning	"GM1.0_2.0 Customized Setting Flow"
5	Loading parameter tuning	"GM1.0_2.0 Customized Setting Flow" - System 1%, "#define BATTERYPSEUDO1 **4**" - Loading Parameter, "#define Q_MAX_SYS_VOLTAGE **3400**"
6	User experience parameter tuning	"GM1.0_2.0 Customized Setting Flow" - System 1% keep timing, "#define SHUTDOWN_GAUGE1_MINS **60**" - System 100%, "#define BATTERYPSEUDO100 **95**"

Q&A

Q&A

Question	Ans
1. Charge UI 99% to 100% timing too long	
2. Discharge Battert Full to 99% too fast	Please reference system 100% Setting
3. Charge Curve need linearity	
4. UI% less than 5% can't power on after system power down	Please reference Gauge 0% Definition setting
5. UI% still has 8%, but use heavy loading, UI% fast drop to 0% shutdown	Please reference System 1% setting
6. UI% 1% Display is too long	Please reference System 1% keep timing setting
7. Change battery the UI% is not change	Please reference Power on off setting
8. Charge 95% to 100% is too fast	Please reference 100% tracking time setting
9. The resistance distribution of Rfg is wide after SMT, and one CAR_TUNE_VALUE can not cover all devices	Suggest that use metal film resistor as Rfg