G2206

6+3 Channels PMU and Li-ion Battery Charger for DSC

Features

- 2.6V ~ 5.5V Input Voltage Operation.
- 95% Efficient DC/DC Converter
- Built-in 1-ch synchronous boost converter, 1-ch auto buck-boost converter, 3-ch synchronous buck converter, 1-ch WLED driver, 2-ch LDOs for CMOS image sensor, and 1-ch low quiescent current LDO for RTC.
- 31-steps brightness control by I^2C for WLED Driver
- Low Power consumption (Sleep Mode) < 10μA.
- Built-In Selectable Power ON/OFF Sequence for 4 Channels Synchronous Rectified Converter.
- Built-In Short Circuit Protection (SCP), Under Voltage Protection (UVP), and cycle-by cycle current limit for DC/DC Converters.
- Integrated Li-ion linear charger with dynamic power path function.
- Charge voltage and current control with JEITA compliant.
- USB charger with Auto Power Source Detection which is compliant to USB Battery Charging Revision 1.2.
- Built-In Thermal Shutdown Function.
- Built-In Battery OVP Function.
- TQFN40 Package (5mmx5mm).

Applications

DSC and DV Power Supply

General Description

The G2206 provide a complete power supply solution for digital cameras. They improve performance, component count, and size compared to other multi-channel controllers in 1-cell Li-Ion. On-chip MOSFETs provide up to 92~95% efficiency for critical power supplies. All channels DC/DC operate at one fixed frequency of 1.5MHz/750KHz to optimize size, cost, and efficiency. All Synchronous converters operate at pulse skipping mode at light load. They also feature True-Shutdown as well as internal compensation to minimize external component count.

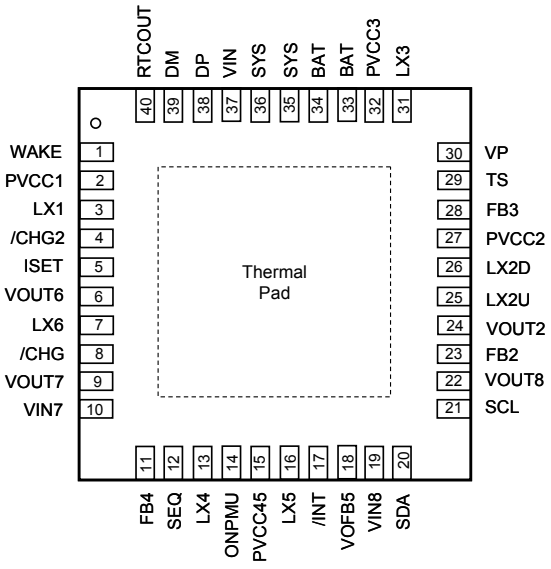
The G2206 also provide Li-ion linear charger with dynamic power path control. G2206 has USB power source detection and JEITA compliant. G2206 also has auto NTC-R 100kΩ/10kΩ detection circuit.

Ordering Information

ORDER NUMBER	MARKING	TEMP. RANGE	PACKAGE (Green)
G2206RG1U	2206	-40°C~+85°C	TQFN5X5-40

Note: RG:TQFN5x5-40
1: Bonding code
U: Tape & Reel
Green : Lead Free / Halogen Free.

Pin Configuration



G2206 TQFN5X5-40

Note: Recommend connecting the Thermal Pad to the Ground for excellent power dissipation.

Absolute Maximum Ratings

VIN . . . . . -0.3V to +28V
BAT, SYS, VCC, PVCC1, PVCC2, VOUT2, PVCC3, PVCC45, VIN7, VIN8. . . . . .-0.3V to +6.3V
VOUT6 . . . . . -0.3V to +24V
LX1,LX2D,LX2U,LX3,LX4,LX5(Spike Voltage<200ns) 9V
LX6 (Spike Voltage < 200ns). 27V
FB2, FB3, FB4, VOFB5, ISET, VOUT7, VOUT8, RTCOUT, VP . . . . . .-0.3V to +6.3V
WAKE, /PG, /CHG, SEQ, ONPMU, /INT, SDA, SCL, TS, DP, DM . . . . . -0.3V to +6.3V
Thermal Resistance Junction to Ambient, (θ_{JA})
TQFN5X5-40 . . . . 42°C/W(3)
Continuous Power Dissipation (T_A = +25°C)
TQFN5X5-40 . . . . . .3250mW(3)
Operation Ambient Temperature. . . . .-40°C to +85°C
Storage Temperature Range . . . . . .-55°C to 150°C
ESD Susceptibility (HBM) 4kV
ESD Susceptibility (MM) 300V
Reflow Temperature (soldering, 10sec) . . . . . .260°C

Recommended Operation Conditions

VIN . . . . . .4.5V to 5.5V
BAT, SYS . . . . . 2.8V to 5.5V
PVCC2, PVCC3, PVCC45. . . . . .2.5V to 5.5V
VIN7, VIN8. . . . . .1.5V to 3.3V
Operating Ambient Temperature . . . . . -40°C to 85°C
Operating Junction Temperature . . . . . 150°C

1. Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
2. Device are ESD sensitive. Handling precaution recommended. The Human Body model is a 100pF capacitor discharged through a 1.5KΩ resistor into each pin.
3. EVB G2206 Test

Electrical Characteristics

(SYS=VCC=PVCC1=PVCC2=PVCC3=PVCC45=3.6V, VOUT6=14V, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
GENERAL						
VCC minimum Startup Voltage	VCC_{ST}		---	---	2.6	V
VCC Input Voltage Range	V_{CC}		2.6	---	5.5	V
VCC, SYS over voltage threshold	VCC_{OVLO}		5.6	5.8		V
Switch-Off Input Current	I_{VDD}	No Switching	---	2.2	2.4	mA
PMU Shutdown Current	I_{PMU_SD}	ONPMU=0	---	1	10	μA
OSCILLATOR						
Frequency	F_{OSC}	CH1/CH2/CH3/CH4/CH5	1.3	1.5	1.7	MHz
	F_{OSC2}	CH6	650	750	850	KHz
CH1 DC/DC Converter						
Soft-Start Internal	SS_CH1		---	6	---	mS
VO1 regulation voltage accuracy	VO1		-1.5	---	1.5	%
Maximum Duty Cycle	D_{maxCH1}	FB1=0.77V	90	93	96	%
PVCC1 Leakage Current	I_{PVCC1_LK}	V_{LX1}=0V, PVCC1=5.0V	---	1	5	μA
LX1 Leakage Current	I_{LX1_LK}	V_{LX1}=5.0V	---	1	5	μA
Switch ON Resistance	Ron1-N		---	125	---	mΩ
	Ron1-P		---	125	---	
Peak Current Limit	I_{LIM_CH1}		2.0	2.5	---	A
Under Voltage Protection Threshold	$\%V_{UVP\_CH1}$	Ratio=V_{UVP}/V_{OUT}	---	93.75	---	%
Short Circuit Protection threshold	$\%V_{SCP\_CH1}$	Ratio=V_{SCP}/V_{OUT}	---	12.5	---	%

Electrical Characteristics (continued)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
CH2 DC/DC Converter							
Soft-Start Internal	SS_CH2			---	4	---	mS
FB2 pin Regulation Voltage	V_{FB2}	DICH2[2:0]=3'b100		0.788	0.80	0.812	V
Maximum Duty Cycle	D_{maxCH2}	FB2=0.77V	LX2U	90	93	96	%
		DICH2[2:0]=3'b100	LX2D	---	100	---	%
PVCC2 Leakage Current	I_{PVCC2_LK}	V_{LX2D}=0V, PVCC2=5.0V		---	1	5	μA
VO2 Leakage Current	I_{VO2_LK}	V_{LX2U}=0V, VO2=5.0V		---	1	5	μA
LX2D, LX2U Leakage Current	I_{LX2D_LK} I_{LX2U_LK}	V_{LX2D}= V_{LX2U} =5.0V		---	1	5	μA
Switch ON Resistance	Ron2-N			---	125	---	mΩ
	Ron2-P			---	125	---	
Peak Current Limit	I_{LIM_CH2}			1.7	2.0	---	A
Under Voltage Protection Threshold	ΔV_{UVP_CH2}	ΔV_{UVP_CH2}= FB_{SET} -VFB_{UVP}		---	50	---	mV
Short Circuit Protection threshold	V_{SCP_CH2}	FB2		---	0.1	---	V
CH3 DC/DC Converter , CH4 DC/DC Converter							
Soft-Start Internal	SS_CH3 SS_CH4				4		mS
FB3, FB4 pin Regulation Voltage	$V_{FB3,}$ V_{FB4}	DICH3[2:0]=DICH4[2:0]=3'b100		0.788	0.80	0.812	V
FB3, FB4 pin Input Current	I_{FB3} I_{FB4}	FB3=FB4=0.8V		---	---	100	nA
Maximum Duty Cycle	D_{max}	FB3=FB4=0.77V DICH3[2:0]=DICH4[2:0]=3'b100		---	100	---	%
PVCC3, PVCC4 Leakage Current	I_{PV_LK}	V_{LX3}= V_{LX4}=0V, PVCC3=PVCC45=5.0V		---	1	5	μA
LX3, LX4 Leakage Current	I_{LXx_LK}	V_{LX3}= V_{LX4}=5.0V		---	1	5	μA
Switch ON Resistance	Ron-N			---	200	---	mΩ
	Ron-P			---	250	---	
Peak Current Limit	I_{LIM_CH34}			3.0	3.5	---	A
Under Voltage Protection Threshold	ΔV_{UVP_CH34}	ΔV_{UVP_CHx}= FB_{SET} -VFB_{UVP}		---	50	---	mV
CH5 DC/DC Converter							
Soft-Start Internal	SS_CH5			---	4	---	mS
VO5 regulation voltage accuracy	VO5			-1.5	---	1.5	%
Maximum Duty Cycle	D_{max}	FB5=0.77V		---	100	---	%
PVCC5 Leakage Current	I_{PV_LK}	V_{LX5}=0V, PVCC45=5.0V		---	1	5	μA
LX5 Leakage Current	I_{LXx_LK}	V_{LX5}=5.0V		---	1	5	μA
Switch ON Resistance	Ron5-N			---	250	---	mΩ
	Ron5-P			---	250	---	
Peak Current Limit	I_{LIM_CH5}			1.3	1.5	---	A
Under Voltage Protection Threshold	ΔV_{UVP_CH5}	ΔV_{UVP_CH5}=0.8V-VFB_{UVP}		---	50	---	mV
CH6 LED driver							
Soft-Start Internal	SS_CH6			---	10	---	mS
ISET pin Regulation Voltage	V_{ISET}	100% setting		0.237	0.25	0.263	V
Maximum Duty Cycle	D_{maxCH6}	ISET=0.2V, 100% setting,		90	93	96	%
LX6 Leakage Current	I_{LX7_LK}	LXLED=16v, VOLED=16V		---	1	5	μA
Switch ON Resistance	Ron6-N			---	400	---	mΩ
	Ron6-P			---	1000	---	mΩ
Peak Current Limit	I_{LIM_CH7}			---	1.1	---	A
Over Voltage Protection of VO6	V_{OVP6}	VOUT6 rising, LEDOVP=1'b1		22.5	24	---	V

Electrical Characteristics (continued)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
CH7 LV LDO, CH8 LV LDO						
Input voltage range	V_{LDOI}		1.5	---	5.5	V
Soft-Start Internal	SS_LDO		---	2	---	mS
VOUT7, VOUT8 accuracy	$\%V_{LDOO}$	Io=100mA,	-1.5	---	1.5	%
LDO Input Current	I_{LDOI}	VOUT7(8)=2.9V	---	---	75	µA
Dropout Voltage	V_{DOLDO1}	VOUT7(8)=2.8V, Io=300mA	---	---	0.3	V
	V_{DOLDO2}	VOUT7(8)=1.0V, Io=300mA	---	---	0.2	V
Output current limit	I_{LIM_LDO7}	VIN7=VOUT7+0.6V	300	---	---	mA
	I_{LIM_LDO8}	VIN8=VOUT8+0.5V	300	---	---	
LDO Load Regulation	%LD	VIN7(8)=VOUT7(8)+0.5V, Io=1mA~200mA	---	---	0.5	%
Short Circuit Protection threshold	$\%V_{SCP\_CH7}$ $\%V_{SCP\_CH8}$	Ratio=V_{SCP}/V_{OUT}	---	12.5	---	%
RTC LDO						
Input voltage range (SYS)	V_{VINRTC}		---	---	5.5	V
Standby current	I_{Q1_RTC}	V_{BAT}=4.2v,	---	5	8	µA
Output voltage	V_{RTCO}	Io=0.1mA, V_{INRTC}=4.2v	3	3.05	3.1	V
Dropout Voltage	V_{DO1_RTC}	Io=50mA	---	---	1000	mV
	V_{DO2_RTC}	Io=3mA	---	---	60	mV
Maximum Output Current		V_{VINRTC}=4.2v, RTCO=95%*V_{RTCO}	60	---	200	mA
Wake Up Detect						
WAKE Impulse High Duration	T_{WAKEUP}	RTCOUT=3.05V	60	90	120	mS
WAKE Output	High level	RTCOUT=3.05V, I_{SOURCE}=0.5mA	---	RTCOUT -0.3V	RTCOUT	V
	Low level	RTCOUT=3.05V, I_{SINK}=0.5mA	0	0.3	---	V
BAT Wake Up Threshold Voltage	BAT_{WAKE}	RTCOUT=3.05V	3	3.15	3.3	V
VIN Wake Up Threshold voltage	VIN_{WAKE}	RTCOUT=3.05V	3.8	4	4.2	V
BAT Wake Up Deglitch Time	$t_{DGLBATWAKE}$		16	25	34	mS
VIN Wake Up Deglitch Time	$t_{DGLVINWAKE}$		16	25	34	mS
Logic Input						
ONPMU Input High Level Threshold	V_{HI}		1.4	---	---	V
ONPMU Input Low Level Threshold	V_{LO}		---	---	0.4	V

Charger Function

(VIN=5.0V, BAT=4.0V, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
GENERAL						
VIN Under Voltage Lockout Threshold	VIN_{UVLO}	VIN = 0V to 4V	---	3.3	---	V
VIN Under Voltage Lockout Hysteresis	ΔVIN_{UVLO}	VIN = 4V to 0V	---	200	---	mV
VIN supply current	I_{SUPPLY}	I_{SYS}=I_{BAT}=0mA, /ENCH=1'b0 (V_{BAT}>V_{REG1})	---	1	2	mA
		I_{SYS}=I_{BAT}=0mA, /ENCH=1'b1 (V_{BAT}>V_{REG1})	---	0.8	1.5	mA
VIN suspend current	I_{USUS}	VIN=5V. USUS=1'b1	---	300	---	μA
VIN automatic shutdown threshold	ΔV_{ASDN}	VIN-BAT , VIN rising		200	300	mV
VIN automatic shutdown hysteresis	ΔV_{ASDNHS}	VIN-BAT , VIN falling	10	50	---	mV
Voltage Regulation						
VIN DPM Regulation voltage	V_{DPM}	VIN	4.3	4.4	4.5	V
SYS Regulation voltage	V_{SYS1}	VIN=5.2V, I_{SYS}=800mA	4.8	4.9	5.0	V
SYS Regulation voltage in DPPM mode	V_{DPPM}	SYS	---	4.25	---	V
SYS Regulation voltage at Battery Supplement mode	ΔV_{SYS2}	BAT-SYS	---	30	---	mV
BAT Regulation voltage	V_{REG1}	Loading=20mA, /JEITA=1'b1, VSETH=1'b1,VSET2=1'b0	4.16	4.2	4.23	V
	V_{REG2}	Loading=20mA, /JEITA=1'b1, VSETH=1'b0,VSET2=1'b0	4.01	4.05	4.08	V
	V_{REG3}	Loading=20mA, /JEITA=1'b1, VSETH=1'b1,VSET2=1'b1	4.30	4.35	4.39	V
VIN to VSYS ON Resistance	R_{ON_IN}	I_{VIN}=1000mA	---	0.2	0.35	Ω
BAT to VSYS ON Resistance	R_{ON_BAT}	BAT=4.2V,I_{SYS}=1A	---	0.05	0.1	Ω
Re-Charge Threshold	ΔV_{RECHG}	Battery re-charge threshold =V_{REGX} - ΔV_{RECHG}	60	100	140	mV
Current Regulation						
Fast Charge Current Setting Range	I_{CHG}		100	---	1200	mA
Fast Charge Current Accuracy	I_{CHG1}	ISETA=4'b0100	470	500	530	mA
	I_{CHG2}	ISETA=4'b1001	940	1000	1060	mA
VIN Current Limit	I_{IN_LIMIT1}	ISET_IN[1:0]=2'b00	80	85	90	mA
	I_{IN_LIMIT2}	ISET_IN[1:0]=2'b10	450	475	500	mA
	I_{IN_LIMIT3}	ISET_IN[1:0]=2'b01	900	950	1000	mA
	I_{IN_LIMIT4}	ISET_IN[1:0]=2'b11	1.2	1.5	1.8	A
Pre-Charge						
BAT Pre-charge Threshold	V_{PRECH}	BAT Rising	2.9	3.0	3.1	V
BAT Pre-charge Threshold Hysteresis	ΔV_{PRECH}		---	200	---	mV
Pre-Charge Current	I_{PRECHG}	BAT=2V, I_{PRECHG}/I_{CHG}	5	10	15	%
Charge Termination Detection						
Termination current Ratio to Fast Charge	I_{TERM1}	I_{CHG}>200mA	5	10	15	%
	I_{TERM2}	I_{CHG}≤200mA	---	3.3	---	%
Logic INPUT/OUTPUT						
/CHG Pull Down Voltage	$V_{/CHG}$	$I_{/CHG}$=5mA	---	200	---	mV
/INT Pull Down Voltage	$V_{/INT}$	$I_{/INT}$=5mA	---	200	---	mV
/PG Pull Down Voltage	$V_{/PG}$	$I_{/PG}$=5mA	---	200	---	mV

Charger Function (continued)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Protection						
Thermal Regulation	THM_{REG}		---	120	---	°C
Thermal Shutdown Temperature	THM_{SD}		---	155	---	°C
Thermal Shutdown Hysteresis	ΔTHM_{SD}		---	20	---	°C
VIN Over Voltage Protection	VIN_{OVP}	VIN Rising	6.25	6.5	6.75	V
VIN Over Voltage Protection Hysteresis	ΔVIN_{OVP}	VIN=7V to 5V, VOVP - ΔVIN_{OVP}	---	350	---	mV
SYS Output Short Circuit Detection at VIN Power up	V_{SYS_SCP1}	VIN>VINUVLO & VIN>(BAT+ΔV_{ASDN})	1.1	1.2	1.3	V
SYS Output Short Circuit Detection Threshold at BAT Supplement Mode	V_{SYS_SCP2}	BAT-SYS	---	300	---	mV
Battery Installation Detection Threshold at TS	V_{NO_BAT}		---	90	---	% of VP
Time						
VIN PGOOD Deglitch Time	t_{PGOOD}	Time measured from VIN:0->5V 1µS rise-time to PGOOD Bit=H	---	1.875	---	mS
VIN Over Voltage Blanking Time	t_{VINOVP}		---	50	---	µS
Pre-Charge to Fast Charge Deglitch Time	t_{PF}		---	30	---	mS
Fast-Charge to Pre-Charge Deglitch Time	t_{FP}		---	30	---	mS
Termination Deglitch Time	t_{TERMI}		---	30	---	mS
Recharge Deglitch Time	t_{RECHG}		---	120	---	mS
Input power loss to SYS LDO Turn-Off Deglitch Time	t_{NO_VIN}		---	30	---	mS
Battery Installation Deglitch Time	t_{NO_BAT}		---	30	---	mS
NTC-R Detection Deglitch Time	t_{NTC-R}		---	30	---	mS
Pack Temperature Fault Detection Deglitch Time	t_{TS}		---	30	---	mS
SYS Output Short Circuit Deglitch Time at Battery Supplement Mode	t_{SYS_SCP}		---	250	---	µS
SYS Output Short circuit Recovery Time at Battery Supplement Mode	$t_{SYS\_SCP\_R}$		---	64	---	mS
Other						
VP regulation voltage	V_{VP}	V_{DPPM}=4.2V	3.234	3.3	3.366	V
VP Under Voltage Lockout Threshold			---	0.8	---	V
NTC						
Cold Temperature Trip Point(0°C)	V_{COLD}	NTC=100K	76	77	78	% of VP
		NTC=10K	71	72	73	
Hot Temperature Trip Point(60°C)	V_{HOT}	NTC=100K	28	29	30	% of VP
		NTC=10K	26	27	28	
Cool Temperature Trip Point(10°C)	V_{COOL}	NTC=100K	66	67	68	% of VP
		NTC=10K	62	63	64	
Warm Temperature Trip Point(45°C)	V_{WARM}	NTC=100K	35	36	37	% of VP
		NTC=10K	34	35	36	
Temperature Trip Point Hysteresis			---	1	---	% of VP

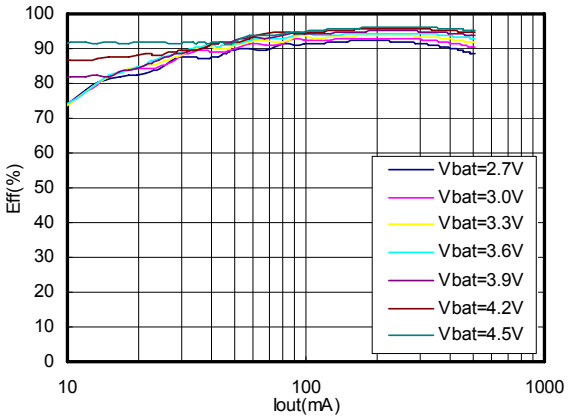
Charger Function (continued)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Auto Power Source Detection						
DP DCD Current Source	I_{DP_SRC}		7	10	13	µA
DM Pull Down Resistance	R_{DM_DWN}		14.25	19.5	24.8	kΩ
DP DCD Detect Voltage	V_{DP_DCD}	SDP/CDP/DCP	0.9	1.2	1.9	V
DM DCD Detect Voltage	V_{DM_DCD}	APPLE/SONY Charger	0.4	0.5	0.6	V
DP Source Voltage	V_{DP_SRC}	I_{DP_SRC}=250µA	0.5	0.6	0.7	V
DM Source Voltage	V_{DM_SRC}	I_{DM_SRC}=250µA				
DP Sink Current	I_{DP_SINK}		50	100	150	µA
DM Sink Current	I_{DM_SINK}					
DP & DM Data Detect Voltage	V_{DAT_REF}		0.25	0.325	0.4	V
DP Detect Voltage for APPLE/SONY	V_{DP_DET}	APPLE/SONY Charger	---	50	---	%VP
DM Detect Voltage for APPLE I & II	V_{DM_DET1}	APPLE Charger	---	47	---	%VP
DM Detect Voltage for SONY I & II	V_{DM_DET2}	SONY Charger	---	62	---	%VP
DP Detect Voltage for Special Charger	V_{DP_DET2}	Special Charger	0.25	0.325	0.4	V
Data Contact Detect Debounce Time	T_{DCD_DBNC}		15	30	45	mS
DCD Time Out	T_{DCD_TO}		300	430	700	mS
DP Voltage Source ON Time	T_{VDPSRC_ON}		50	84	100	mS
DM Voltage Source ON Time	T_{VDMSRC_ON}					mS
DP,DM Detect Debounce Time	T_{DET_DBNC}		15	30	45	mS
SMBus Interface						
Logic Input High Voltage		SCL, SDA	2	---	---	V
Logic Input Low Voltage		SCL, SDA	---	---	0.5	V
Logic Input Current		Logic inputs forced to VCC or GND	-2	---	2	µA
SMBus Input Capacitance		SCL, SDA	---	5	---	pF
SMBus Clock Frequency			---	---	400	kHz
SCL Clock Low Time	t_{LOW}	t_{LOW} , 10% to 10% points	1.3	---	---	µS
SCL Clock High Time	t_{HIGH}	t_{HIGH} , 90% to 90% points	0.6	---	---	µS
SMBus Start-Condition Setup Time			0.6	---	---	µS
SMBus Repeated Start-Condition Setup Time	$t_{SU:\ STA}$	90% to 90% points	0.6	---	---	uS
SMBus Start-Condition Hold Time	$t_{HD:\ STA}$	10% of SDA to 90% of SCL	0.6	---	---	µS
SMBus Stop-Condition Setup Time	$t_{SD:\ STO}$	90% of SCL to 10% of SDA	0.6	---	---	µS
SMBus Data Valid to SCL Rising-Edge Time	$t_{SU:\ DAT}$	10% or 90% of SDA to 10% of SCL	100	---	---	nS
SMBus Data-Hold Time	$t_{HD:\ DAT}$		300	---	---	nS
Rise Time of SCL/SDA signals	t_r	10% to 90% points	20	---	300	nS
Fall Time of SCL/SDA signals	t_f	90% to 10% points	20	---	300	nS
SMBus free time between a STOP and START condition	tBUF		1.3	---	---	µS
Set-up time for STOP condition	tSU;STO		0.6	---	---	µS

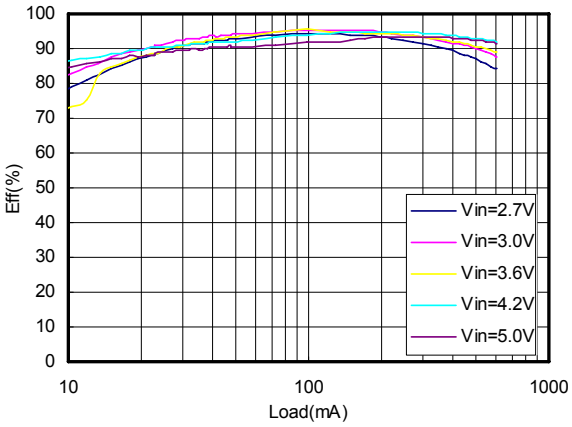
Typical Performance Characteristics

(T_A=25°C, unless otherwise specified)

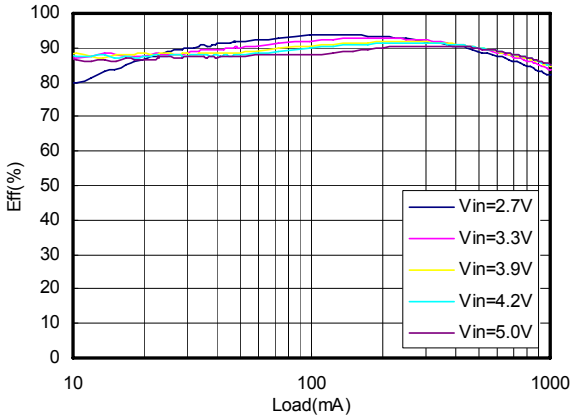
CH1 Step-Up Efficiency vs. Output Current



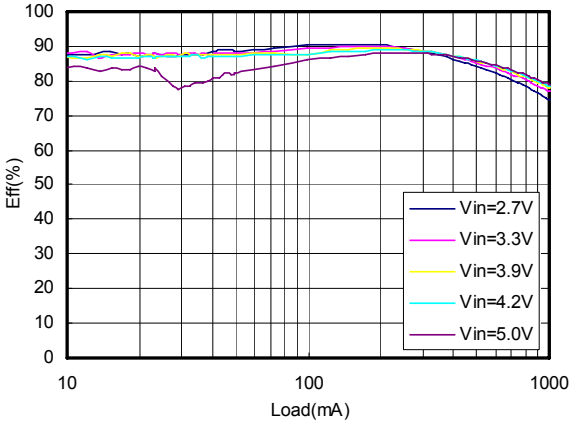
CH2 Step-Up/Down Efficiency vs. Output Current



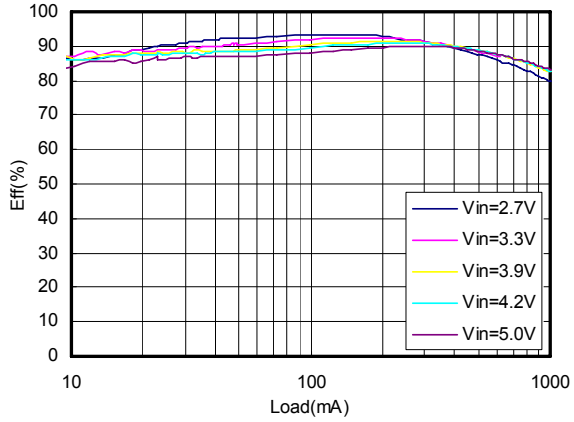
CH3 Step-Down Efficiency vs. Output Current



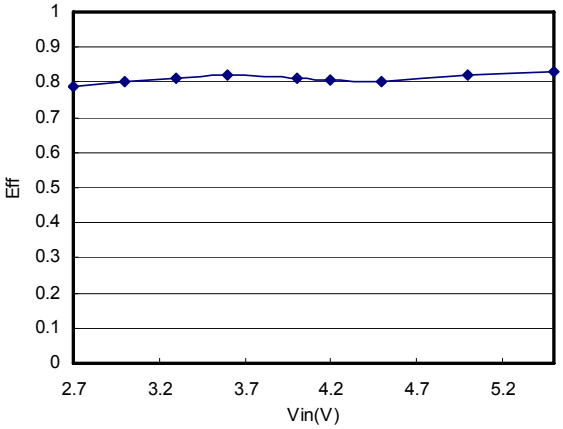
CH4 Step-Down Efficiency vs. Output Current



CH5 Step-Down Efficiency vs. Output Current

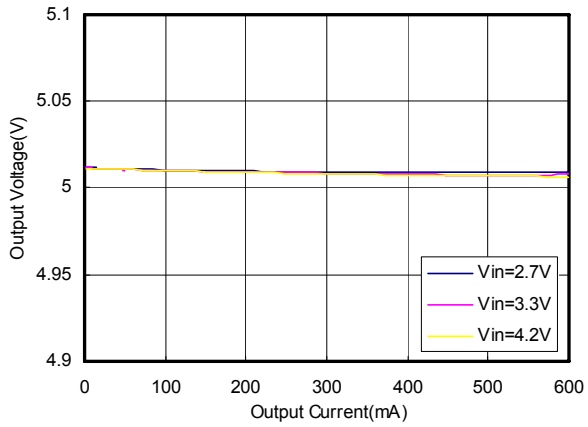


CH6 Efficiency vs. Input Voltage

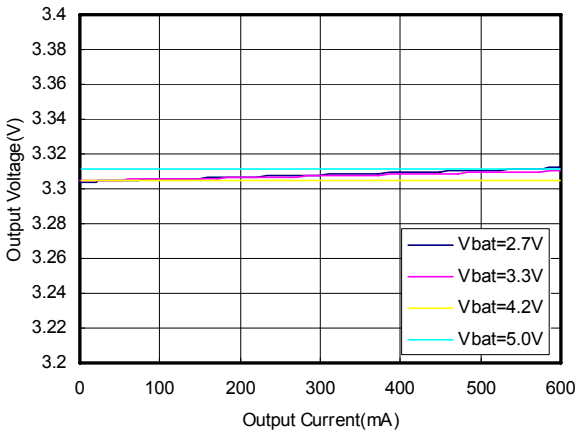


Typical Performance Characteristics (continued)

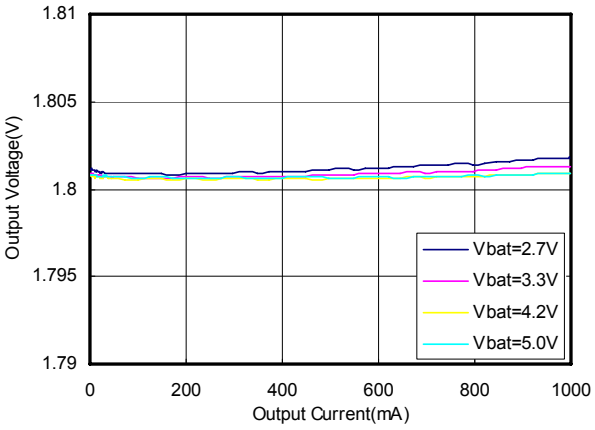
CH1 Step-Up Output Voltage vs. Output Current



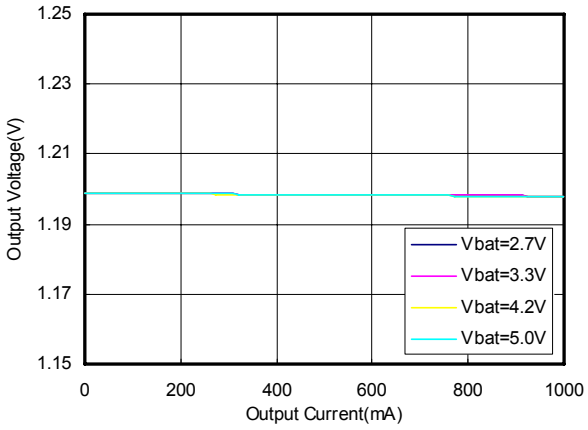
CH2 Step-Up/Down Output Voltage vs. Output Current



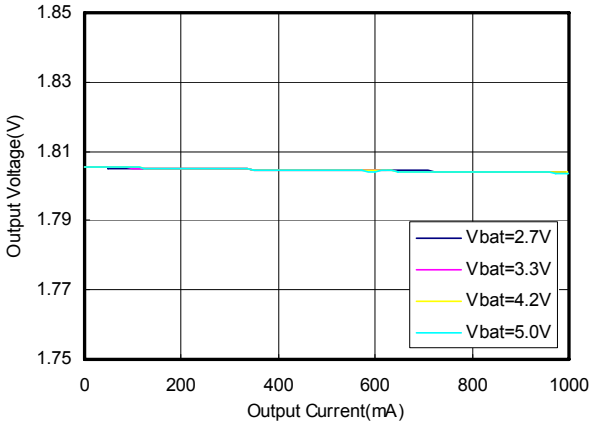
CH3 Step-Up Output Voltage vs. Output Current



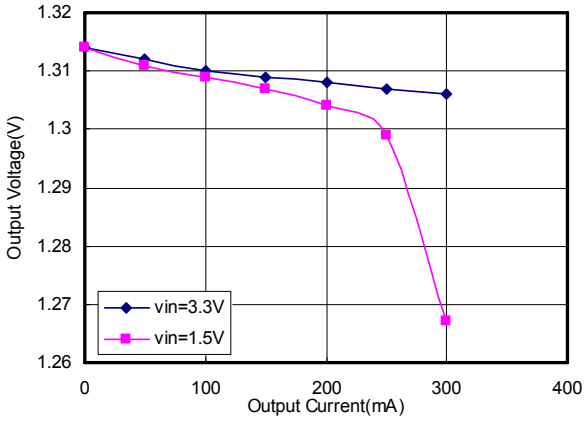
CH4 Step-Up Output Voltage vs. Output Current



CH5 Step-Up Output Voltage vs. Output Current

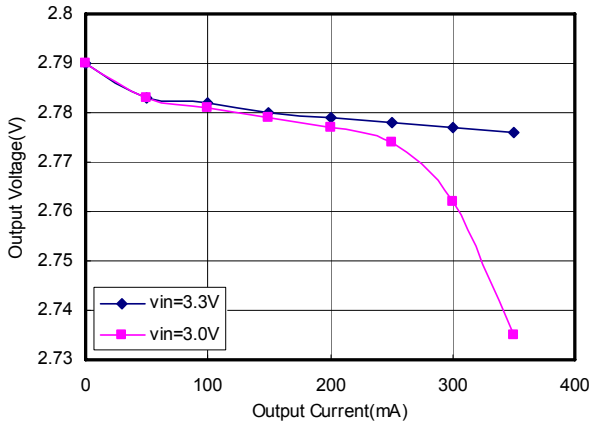


CH7 LDO Output Voltage vs. Output Current

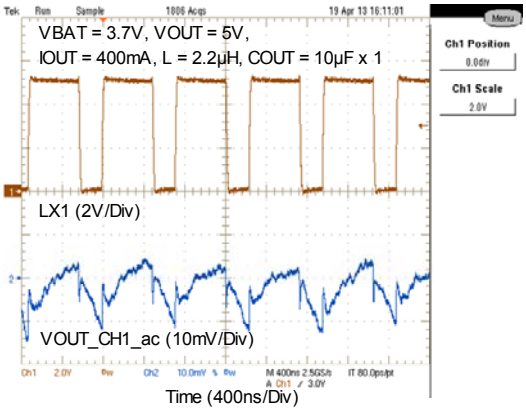


Typical Performance Characteristics (continued)

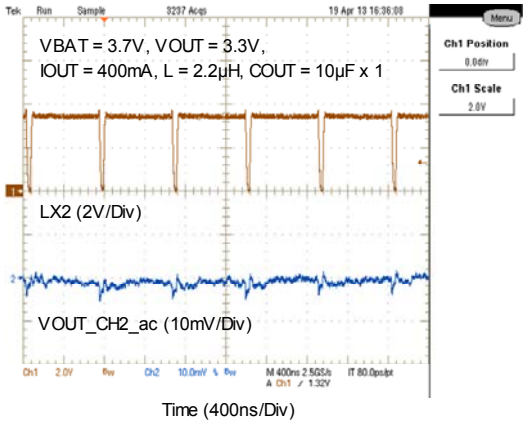
CH8 LDO Output Voltage vs. Output Current



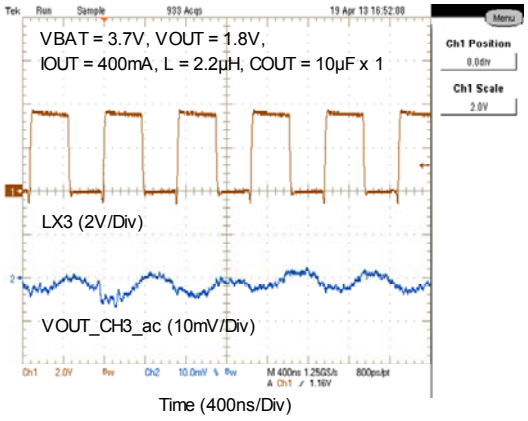
CH1 Output Voltage Ripple



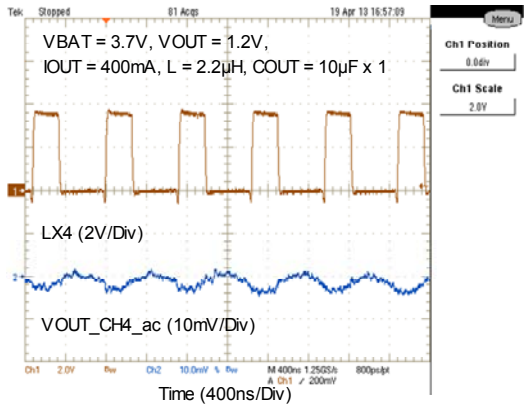
CH2 Output Voltage Ripple



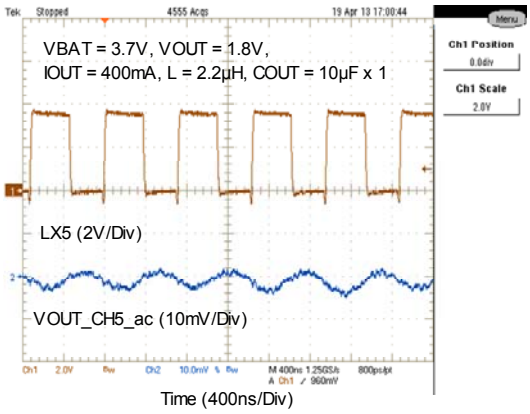
CH3 Output Voltage Ripple



CH4 Output Voltage Ripple

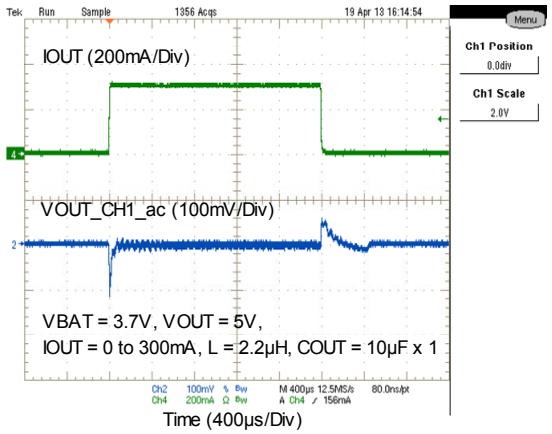


CH5 Output Voltage Ripple

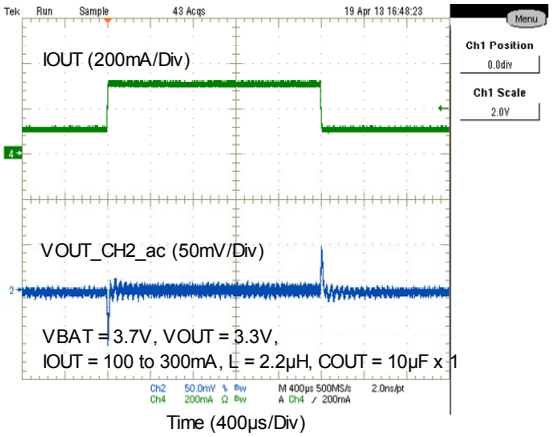


Typical Performance Characteristics (continued)

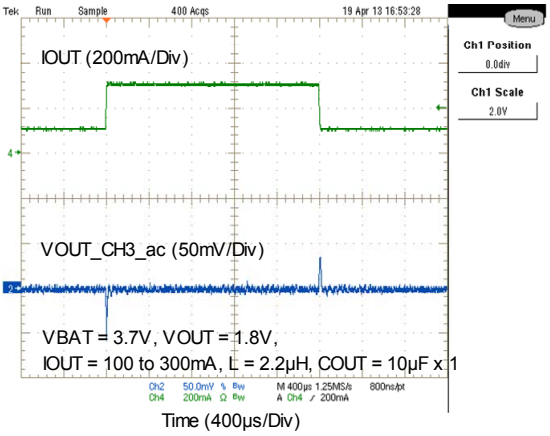
CH1 Load Transient Response



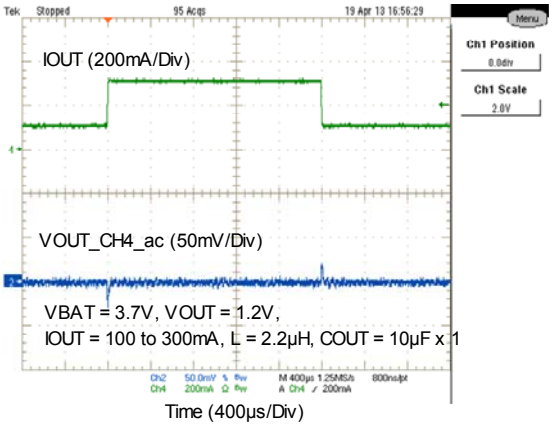
CH2 Load Transient Response



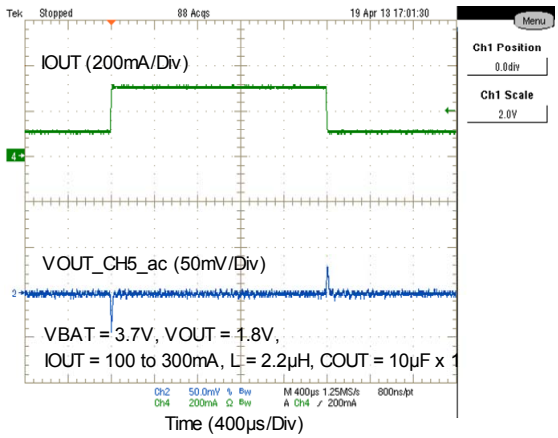
CH3 Load Transient Response



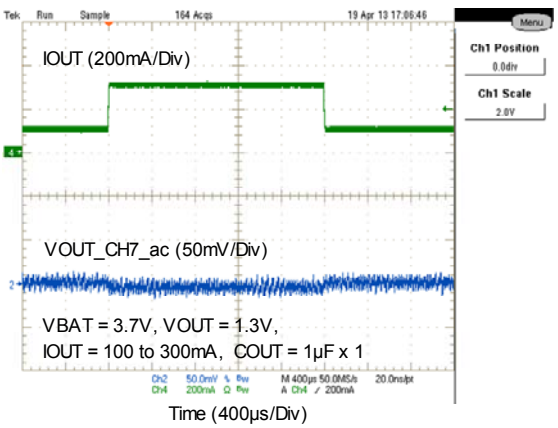
CH4 Load Transient Response



CH5 Load Transient Response

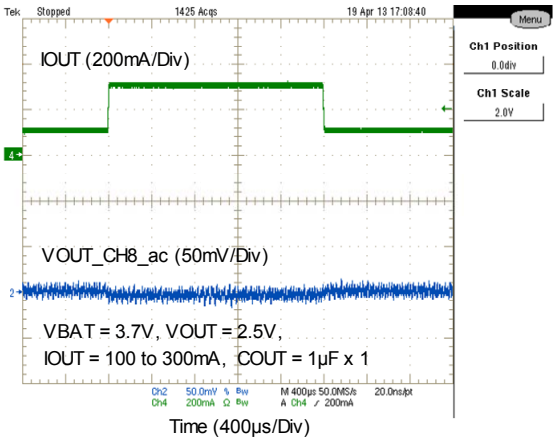


CH7 Load Transient Response

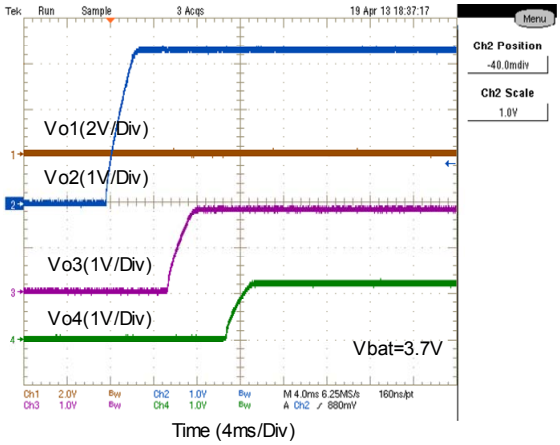


Typical Performance Characteristics (continued)

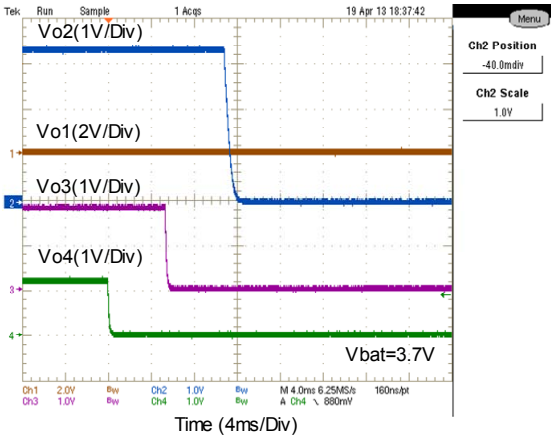
CH8 Load Transient Response



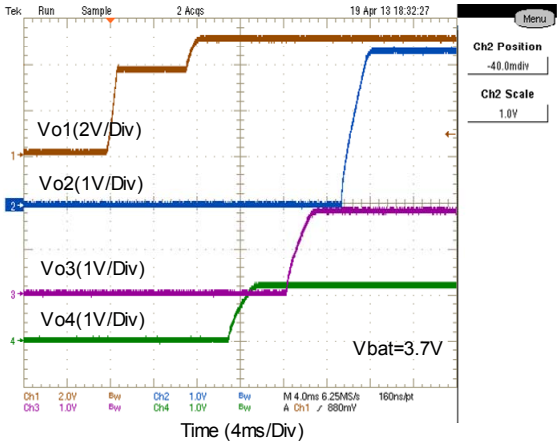
Power On Sequence R=0ohm



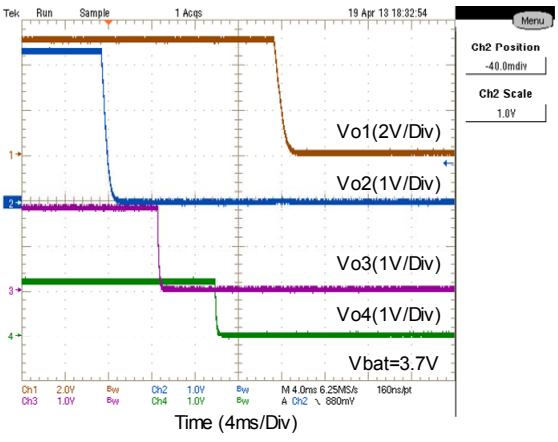
Power Off Sequence R=0ohm



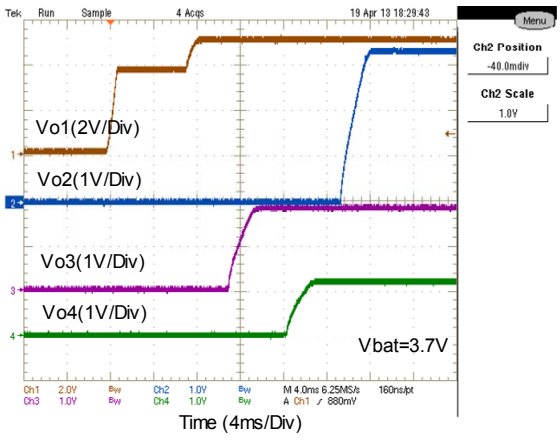
Power On Sequence R=0.63Kohm



Power Off Sequence R=0.63Kohm

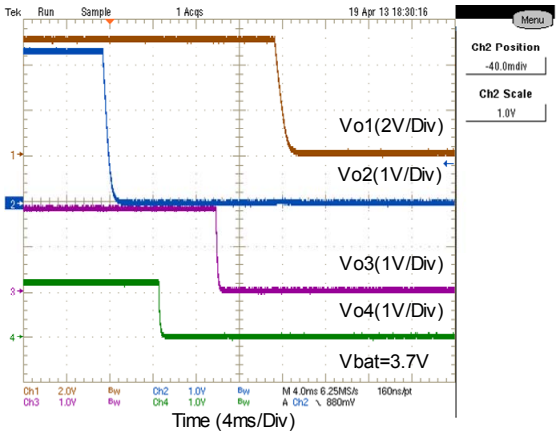


Power On Sequence R=10Kohm

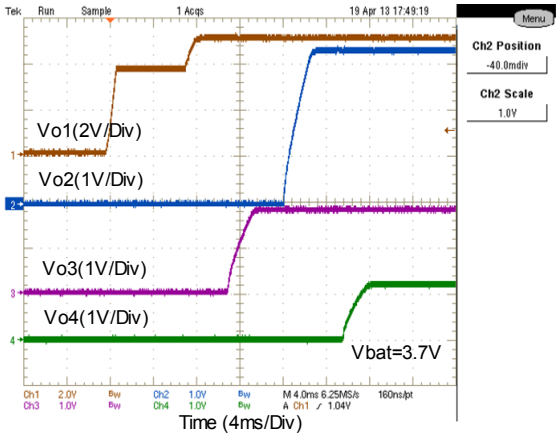


Typical Performance Characteristics (continued)

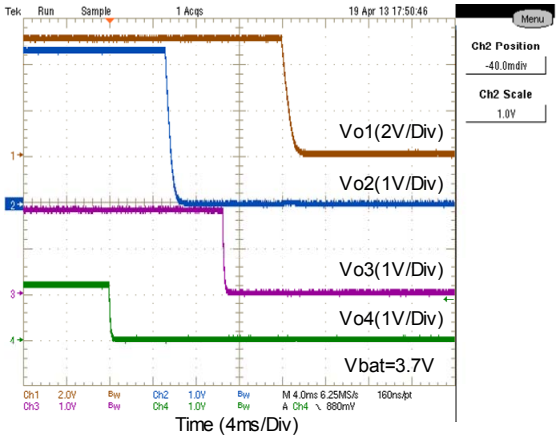
Power Off Sequence R=10Kohm



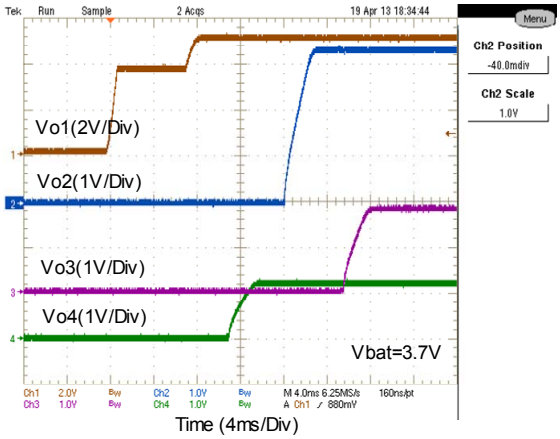
Power On Sequence R=40Kohm



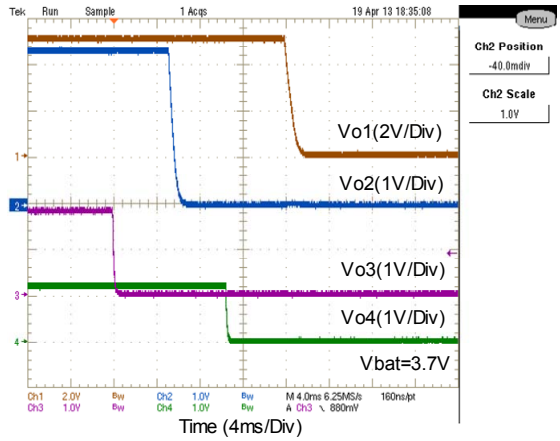
Power Off Sequence R=40Kohm



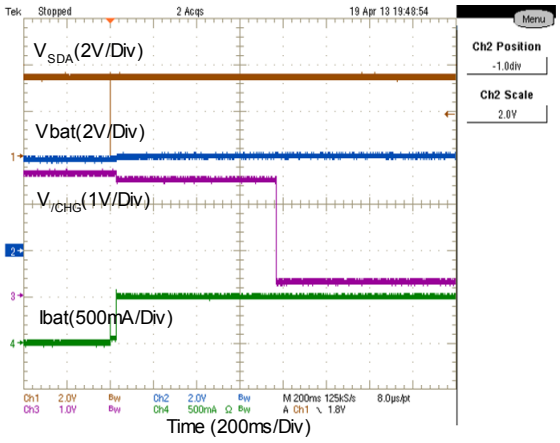
Power On Sequence R=160Kohm



Power Off Sequence R=160Kohm

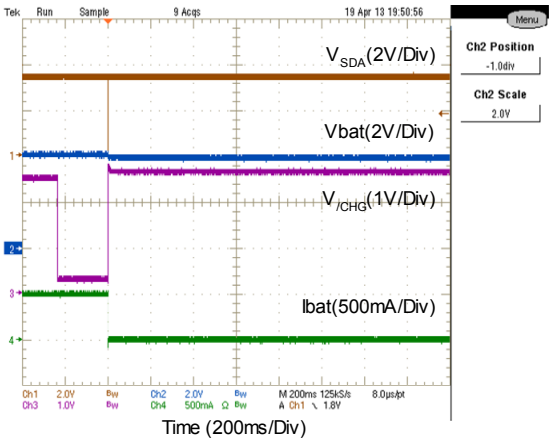


Charge On Control by I2C

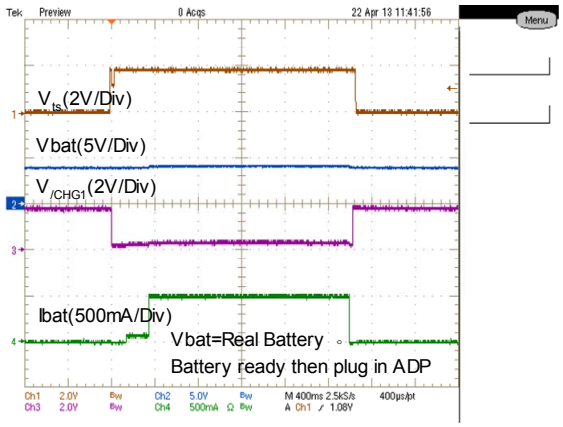


Typical Performance Characteristics (continued)

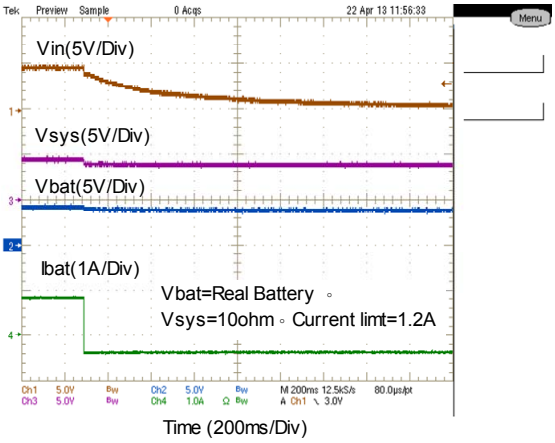
Charge Off Control by I2C



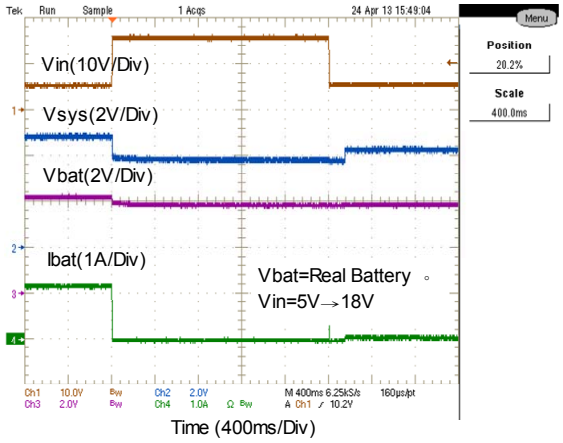
VTS On/Off



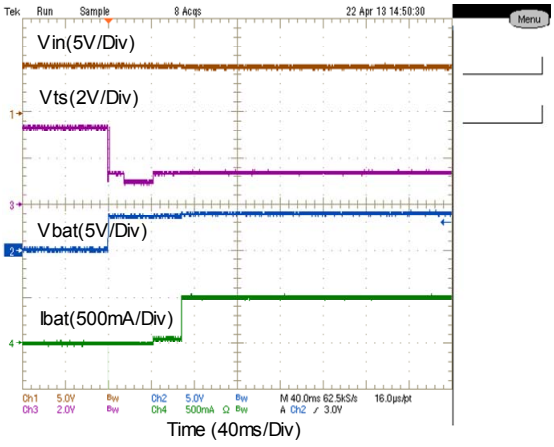
VIN Removal



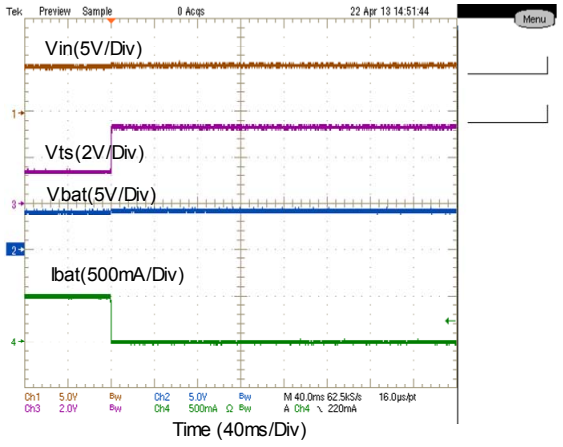
VIN Over Voltage Protection



Battery with NTC Resistor Plug-In

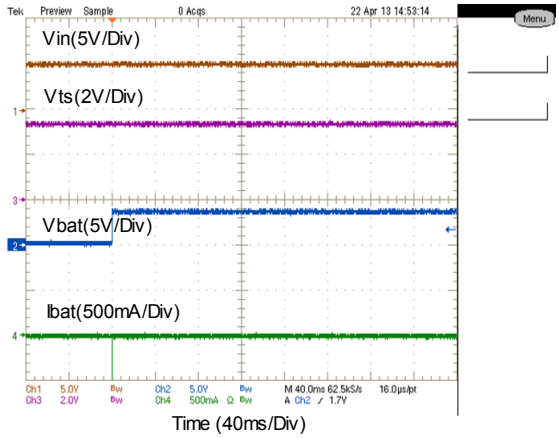


Battery with NTC Resistor Plug-Out

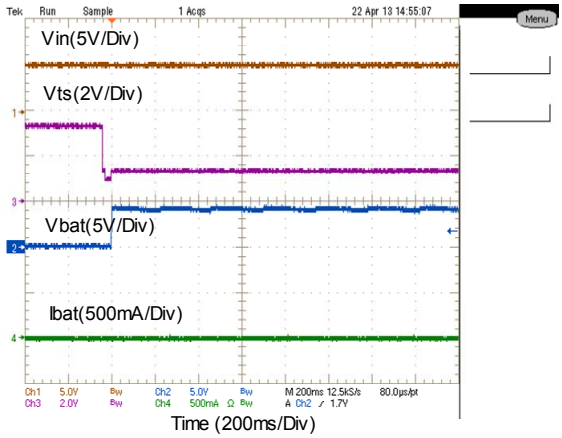


Typical Performance Characteristics (continued)

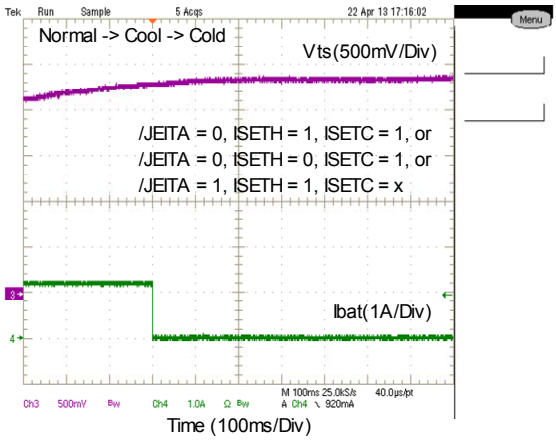
With Battery without NTC Resistor



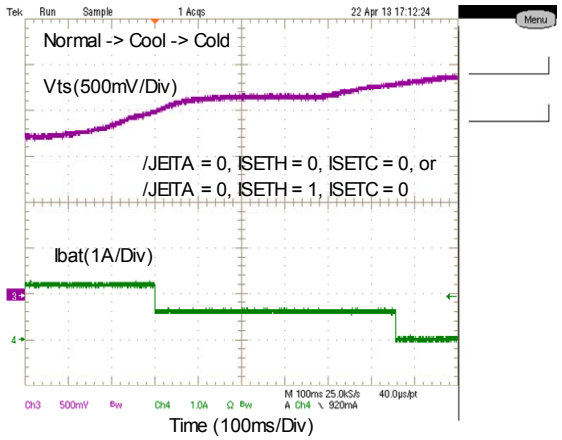
With NTC Resistor without Battery



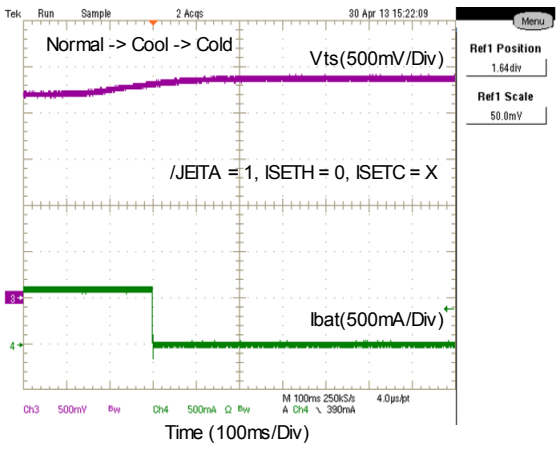
The Temperature of Battery Status



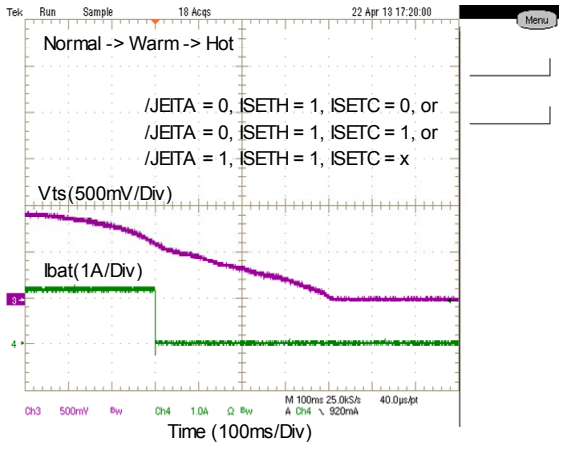
The Temperature of Battery Status



The Temperature of Battery Status

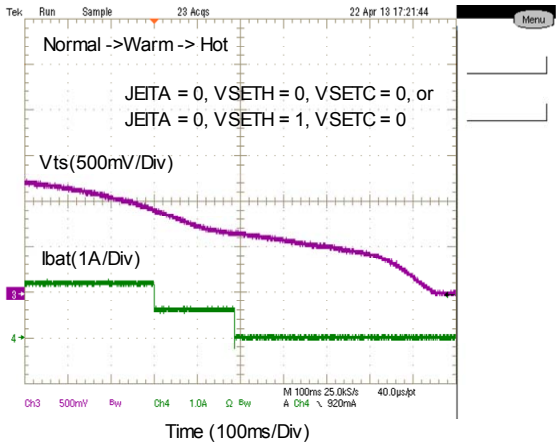


The Temperature of Battery Status

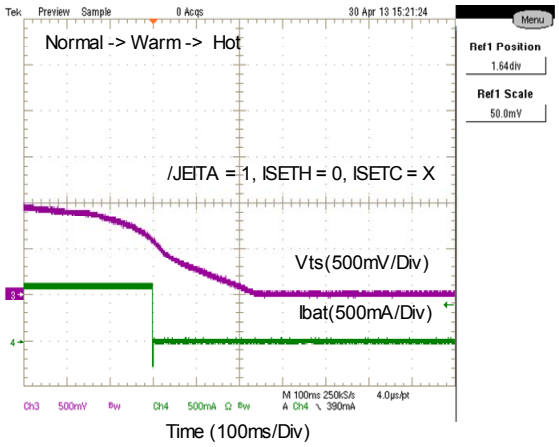


Typical Performance Characteristics (continued)

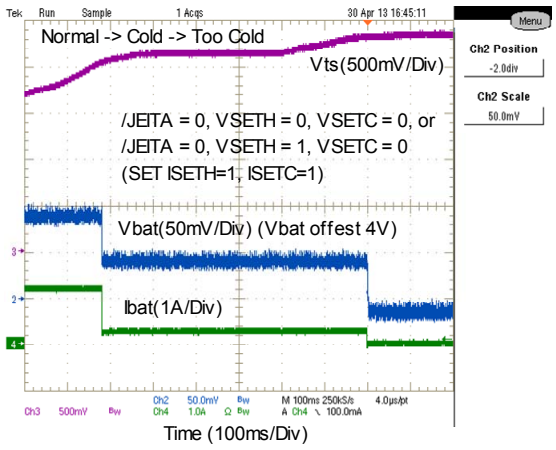
The Temperature of Battery Status



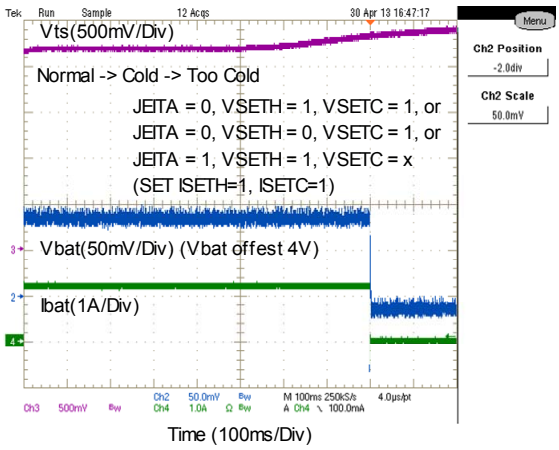
The Temperature of Battery Status



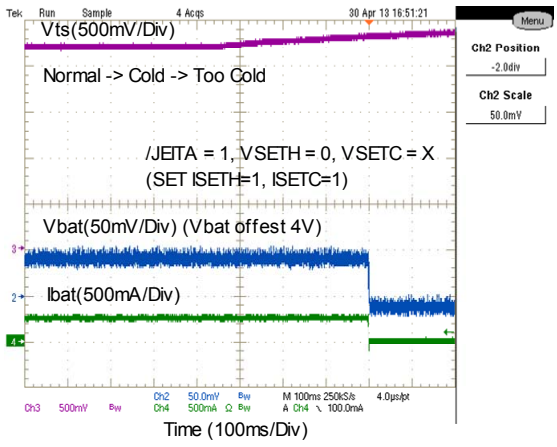
The Temperature of Battery Status



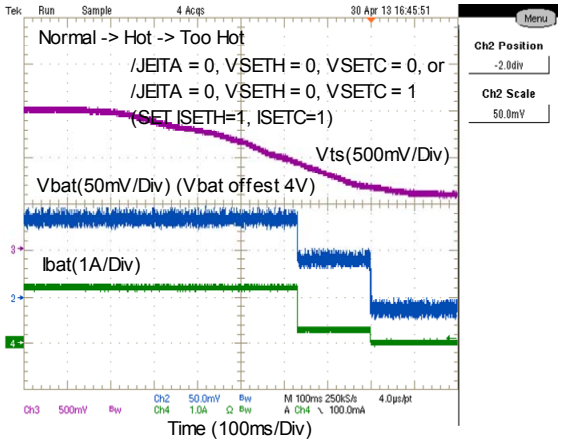
The Temperature of Battery Status



The Temperature of Battery Status

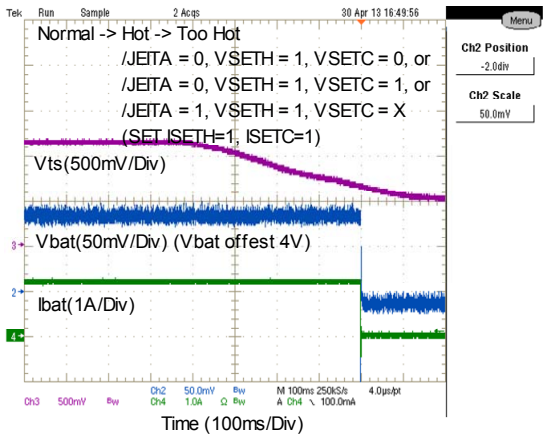


The Temperature of Battery Status

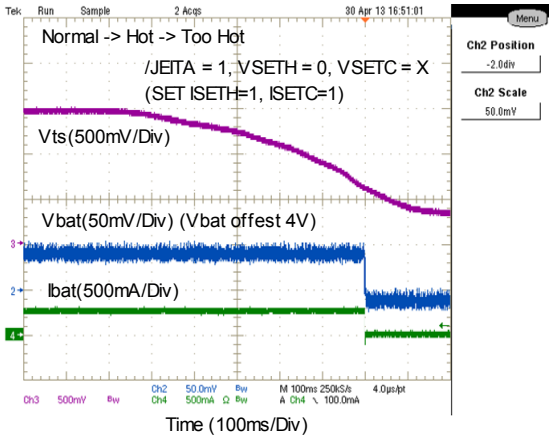


Typical Performance Characteristics (continued)

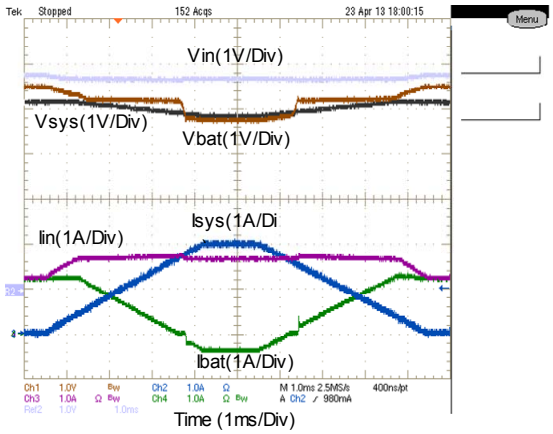
The Temperature of Battery Status



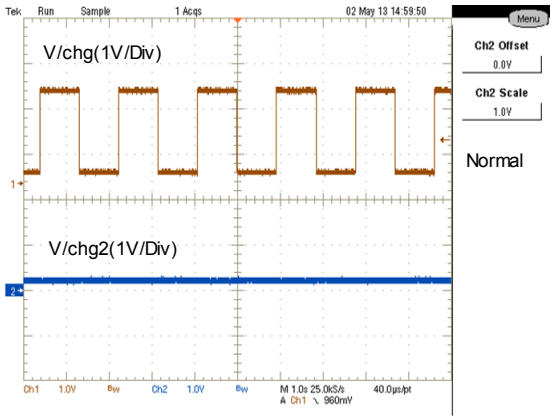
The Temperature of Battery Status



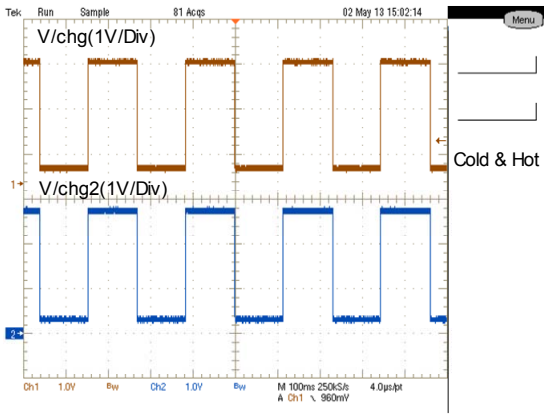
DPPM



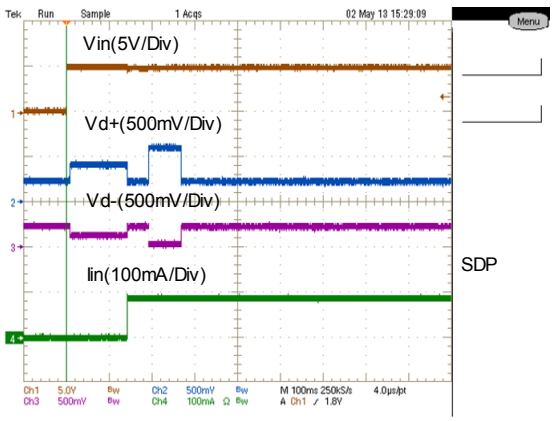
/Charge single control when charging



/Charge single control when charging

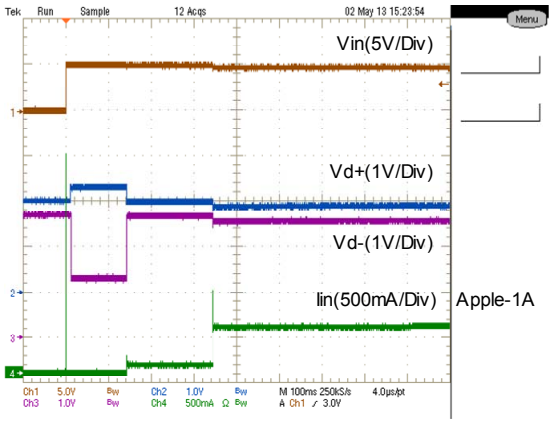


USB Charger Detection

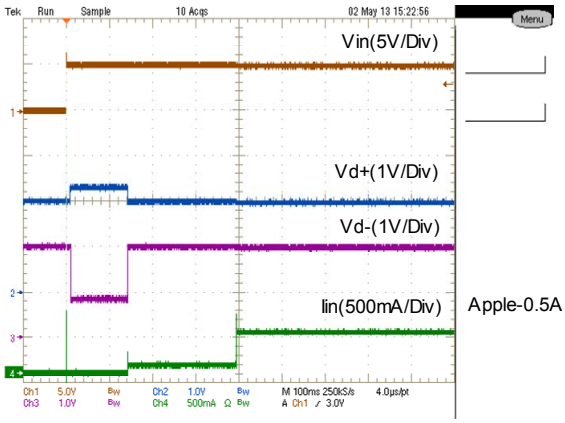


Typical Performance Characteristics (continued)

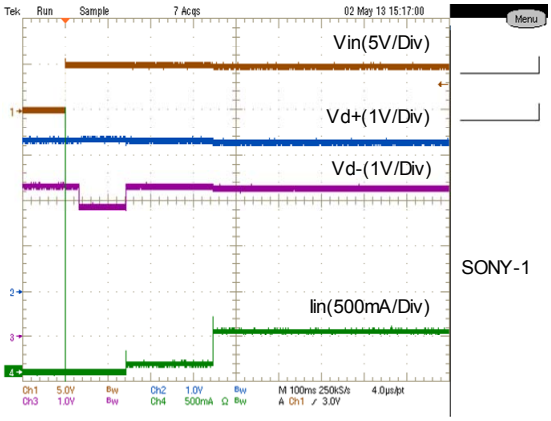
USB Charger Detection



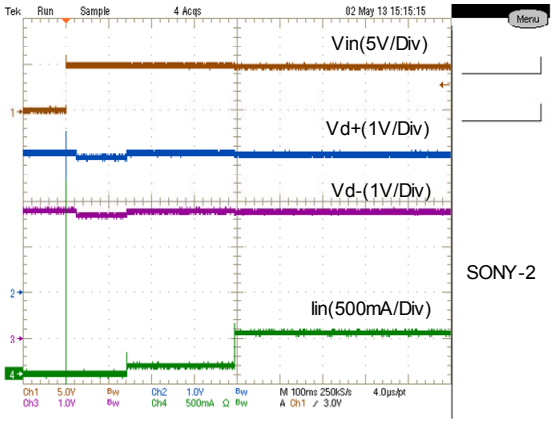
USB Charger Detection



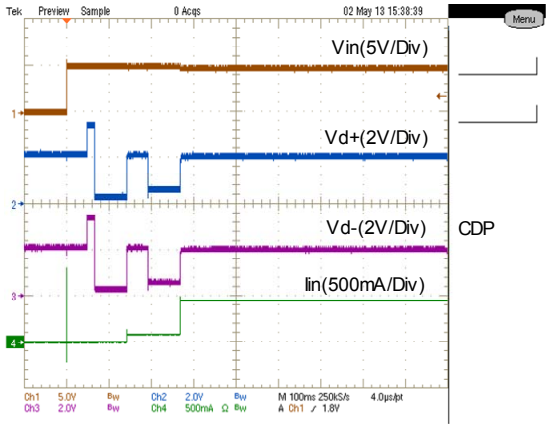
USB Charger Detection



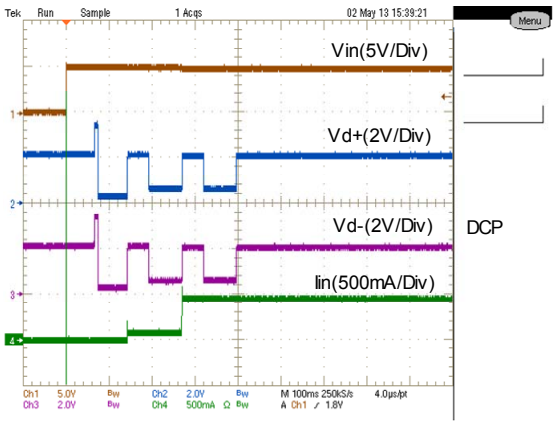
USB Charger Detection



USB Charger Detection

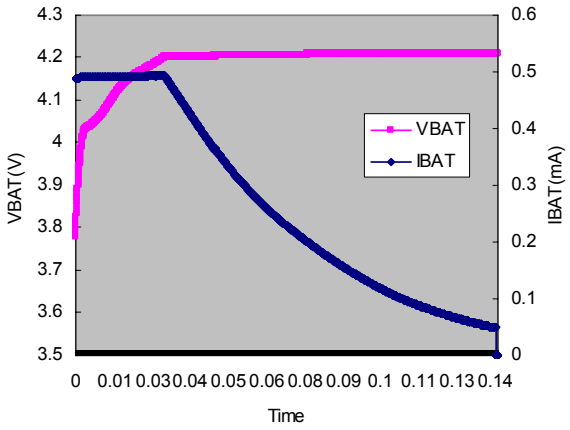


USB Charger Detection

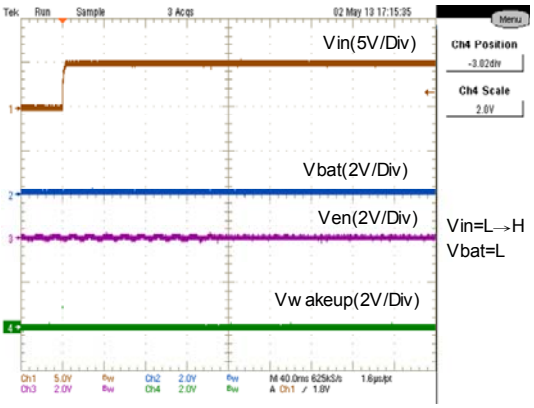


Typical Performance Characteristics (continued)

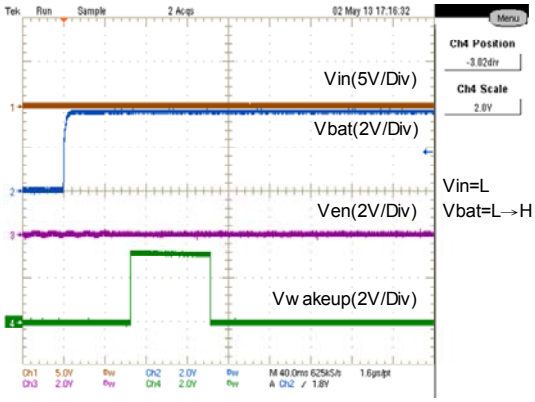
Battery Charge Cycle



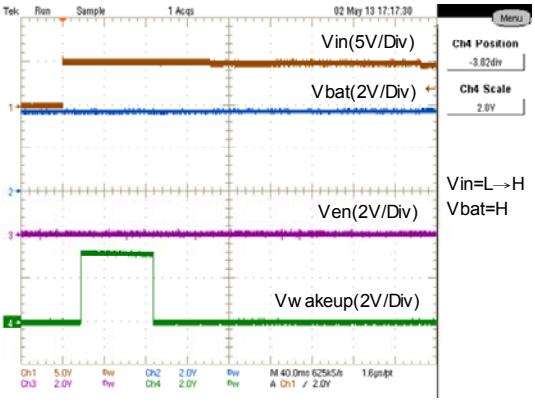
Wake Up Function(ONPMU=Ven=L)



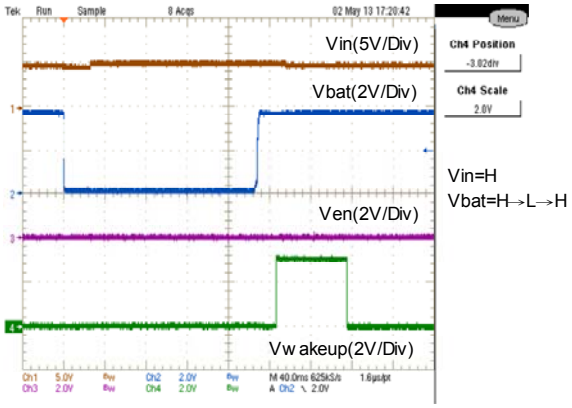
Wake Up Function(ONPMU=Ven=L)



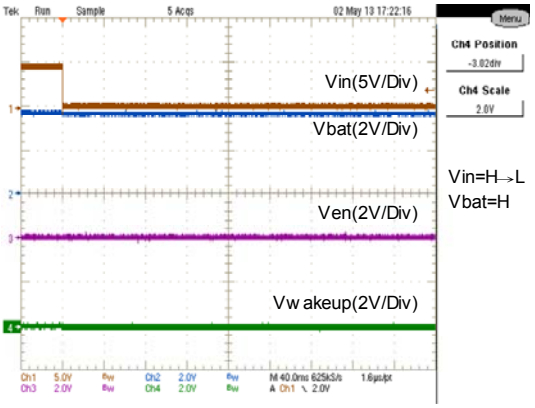
Wake Up Function(ONPMU=Ven=L)



Wake Up Function(ONPMU=Ven=L)

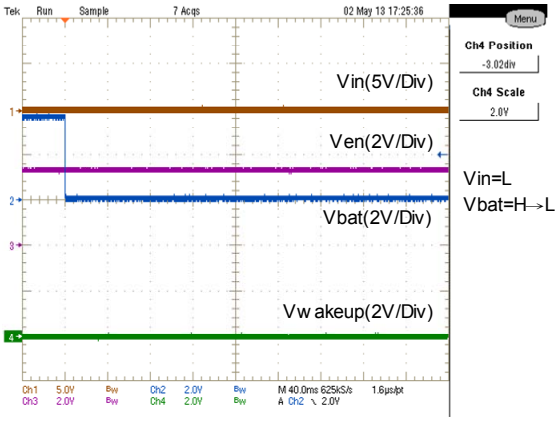


Wake Up Function(ONPMU=Ven=L)

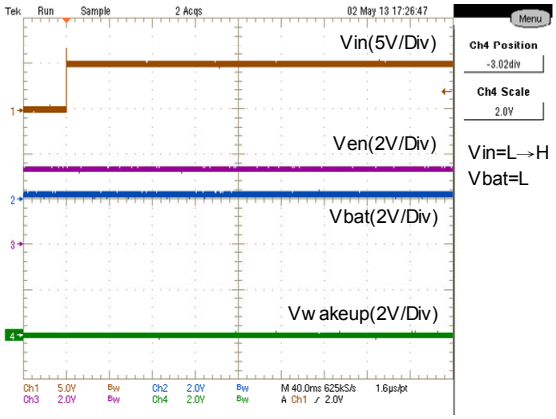


Typical Performance Characteristics (continued)

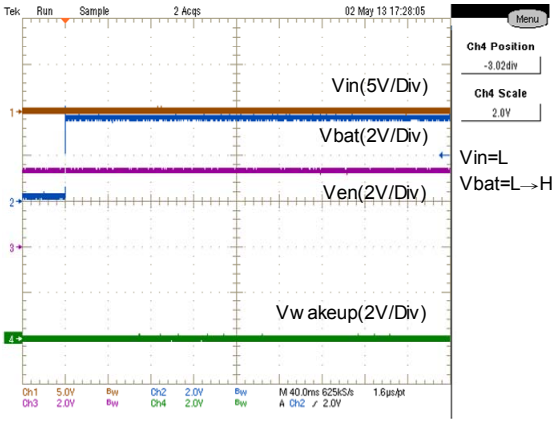
Wake Up Function(ONPMU=Ven=H)



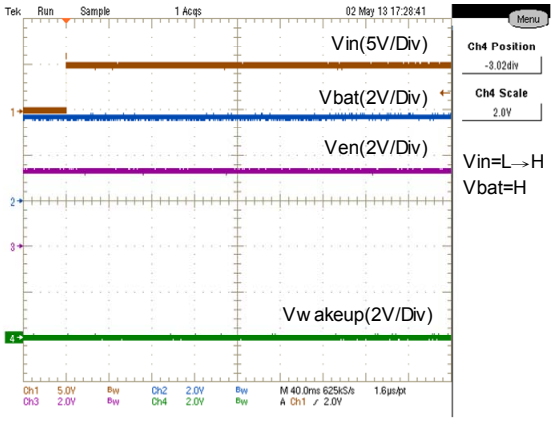
Wake Up Function(ONPMU=Ven=H)



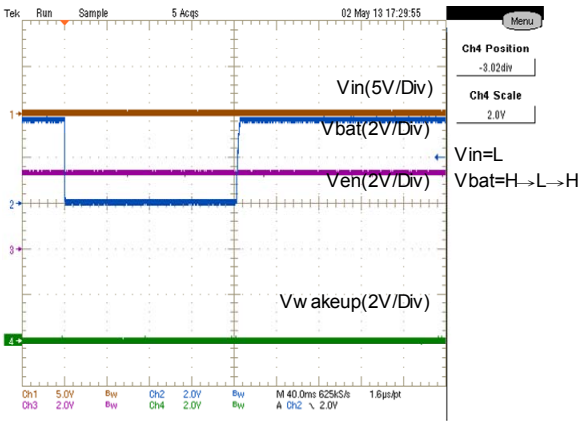
Wake Up Function(ONPMU=Ven=H)



Wake Up Function(ONPMU=Ven=H)

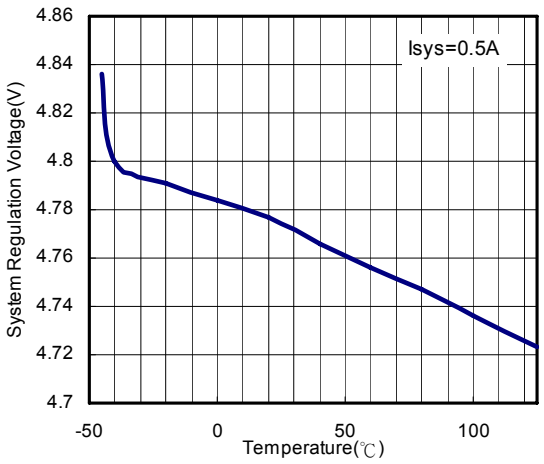


Wake Up Function(ONPMU=Ven=H)

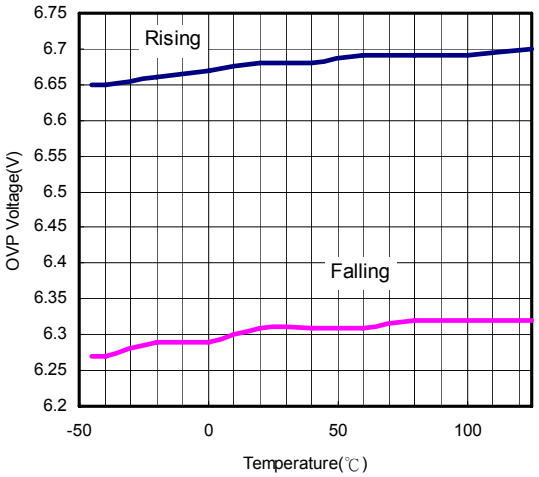


Typical Performance Characteristics (continued)

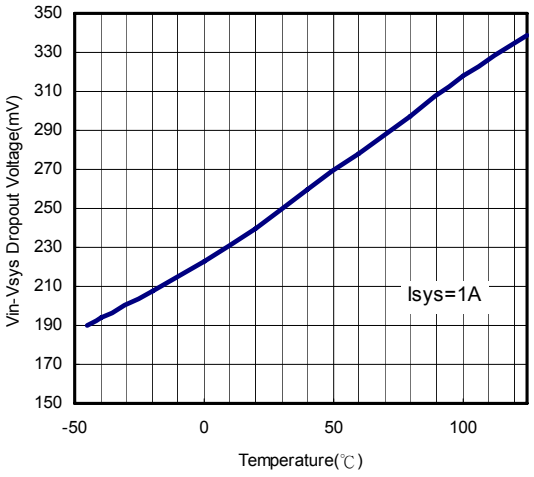
System Regulation Voltage vs. Temperature



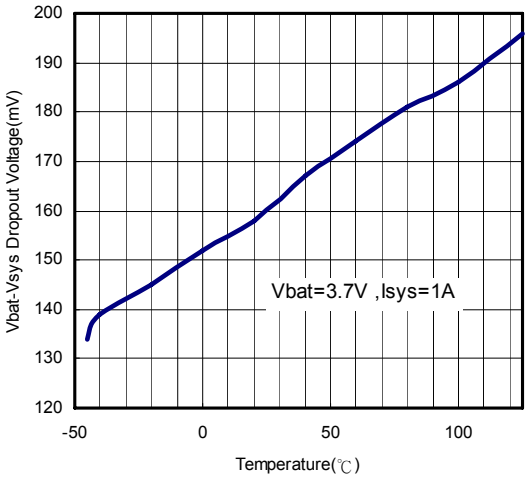
OVP Theshold Voltage vs. Temperature



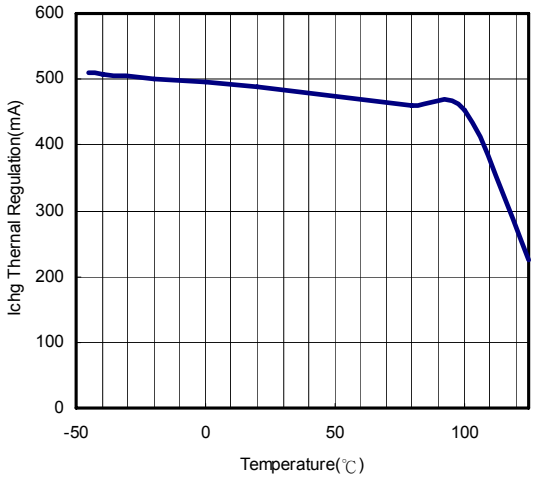
Vin-Vsys Dropout Voltage vs. Temperature



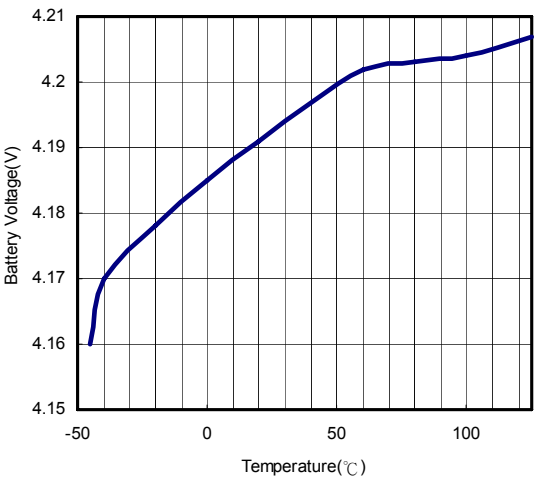
Vbat-Vsys Dropout Voltage vs. Temperature



Ichg Thermal Regulation vs. Temperature

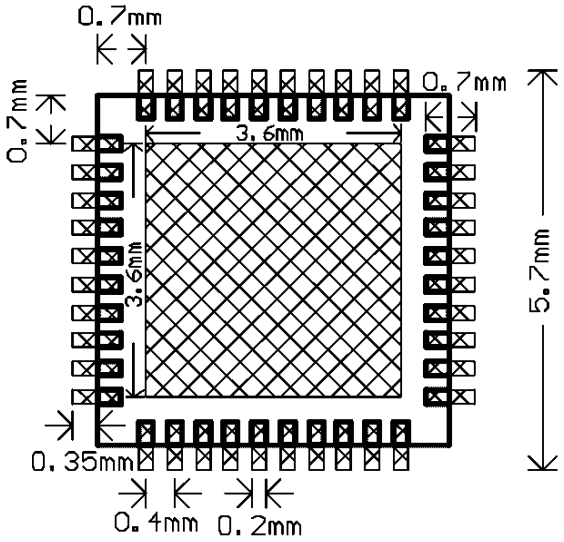


Battery Regulation Voltage vs. Temperature



Minimum Footprint PCB Layout Section

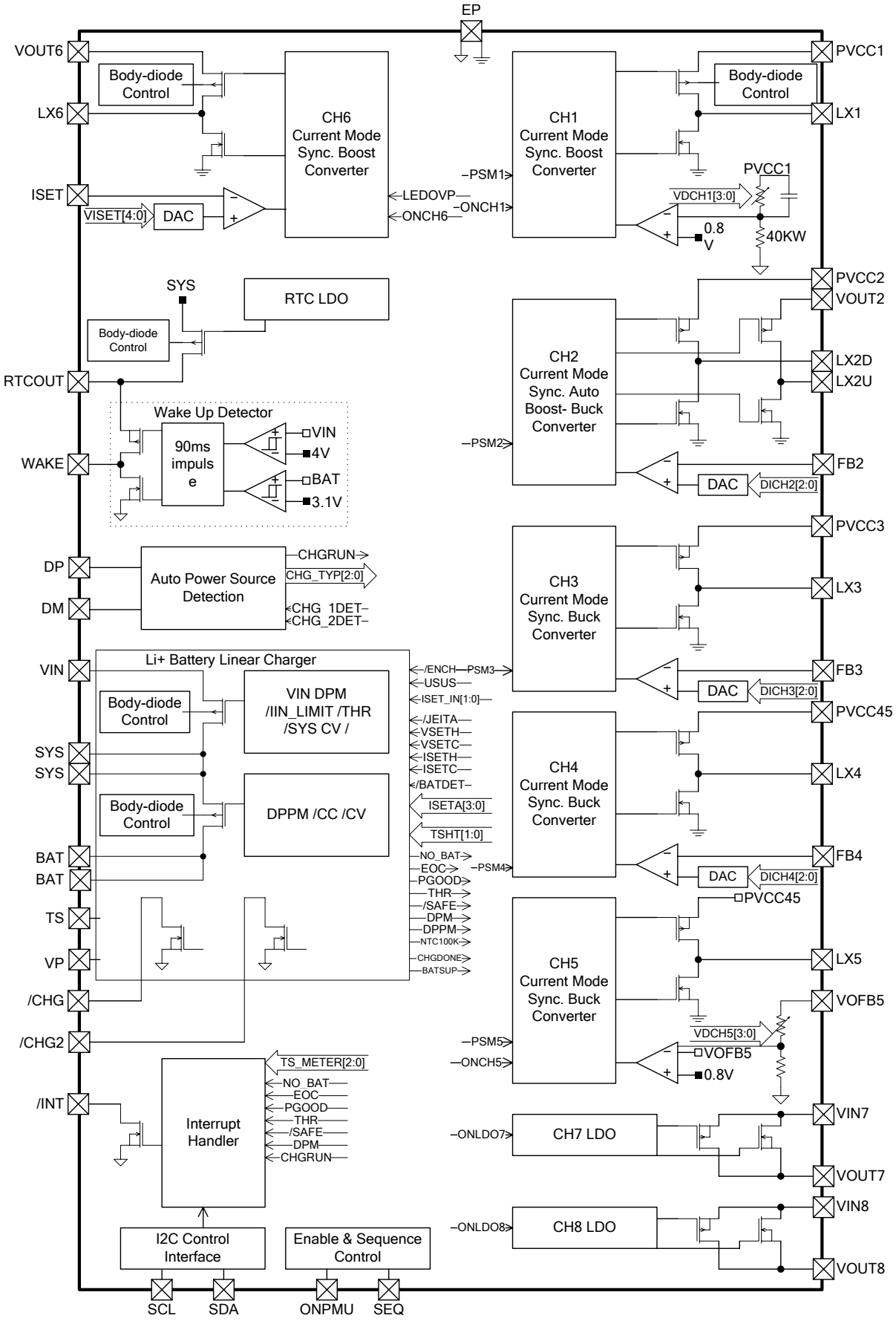
TQFN5X5-40



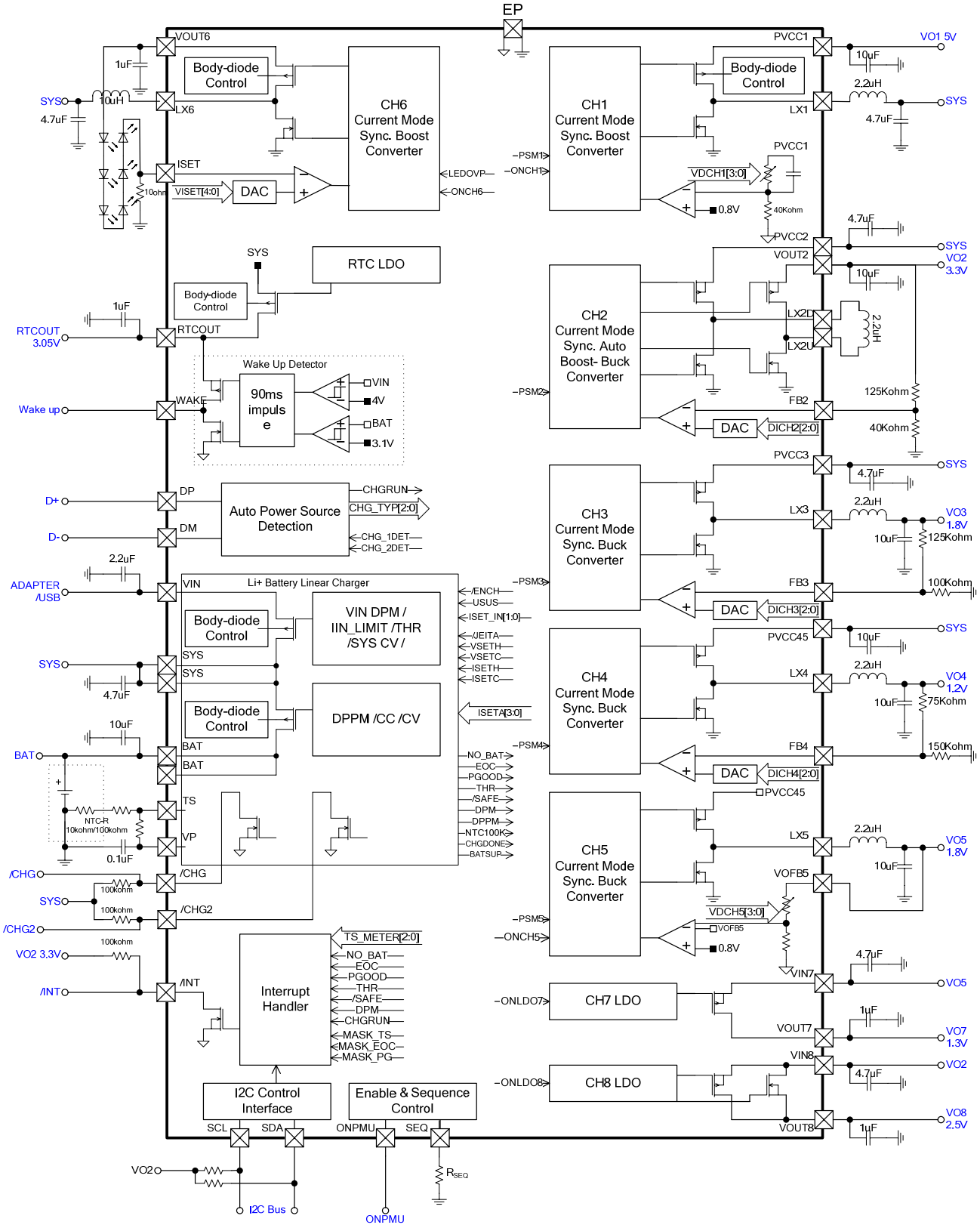
Pin Description

Pin No	Pin Name	Function
1	WAKE	Wake-up impulse push-pull output.
2	PVCC1	Power Output of CH1 Boost Converter
3	LX1	Inductor switch node CH1 Boost Converter.
4	/CHG2	2nd Charger status with open drain output.
5	ISET	LED current setting of CH6 LED Driver
6	VOUT6	Power output of CH6 LED Driver.
7	LX6	Inductor switch node of CH6 LED Driver.
8	/CHG	Charger status with open drain output.
9	VOUT7	LDO Output of CH7 LDO
10	VIN7	Power Input of CH7 LDO
11	FB4	Feedback Input of CH4 Buck Converter.
12	SEQ	Input Pin of Power Sequence Selection.
13	LX4	Inductor switch node of CH4 Buck Converter.
14	ONPMU	Enable PIN of PMU.
15	PVCC45	Power Input of CH4 and CH5 Buck Converter.
16	LX5	Inductor switch node of CH5 Buck Converter.
17	/INT	Interrupt Indicator with open drain output. If any toggle of events of JEITA Temperature, battery installed, end of charging, VIN power good, thermal regulation, safety timer expired, VIN DPM, power source detection happen, the output /INT goes low.
18	VOFB5	Power Feedback of CH5.
19	VIN8	Power Input of CH8 LDO
20	SDA	Data Input PIN of I^2C interface.
21	SCL	Clock Input PIN of I^2C interface.
22	VOUT8	LDO Output of CH8 LDO
23	FB2	Feedback Input of CH2 Buck-Boost Converter.
24	VOUT2	Power Output of CH2 Buck-Boost Converter
25	LX2U	Inductor switch node CH2 Buck-Boost Converter.
26	LX2D	Inductor switch node CH2 Buck-Boost Converter.
27	PVCC2	Power Input of CH2 Buck-Boost Converter
28	FB3	Feedback Input of CH3 Buck Converter.
29	TS	Battery Temperature Sense.
30	VP	Power output 3.3V buffer for battery temperature sense.
31	LX3	Inductor switch node of CH3 Buck Converter.
32	PVCC3	Power Input of CH3 Buck Converter.
33,34	BAT	Battery Charger current output. Bypass with a 10uF capacitor for stability.
35,36	SYS	System Supply output. Bypass with a 4.7uF or greater capacitor.
37	VIN	Adapter Power or USB Power Input. Bypass with a 4.7uF or greater capacitor.
38	DP	USB Input for D+
39	DM	USB Input for D-
40	RTCOUT	RTC power output.
EP	AGND, PGNDX	All converters' power ground and chip analog ground. For good thermal dissipation, connect EP to the power and analog ground plane.

Block Diagram



Application circuit



I2C Interface

G2206 I2C slave address=7'b0010010. The write or read bit stream (N≥1) is shown below:

Driven by Master

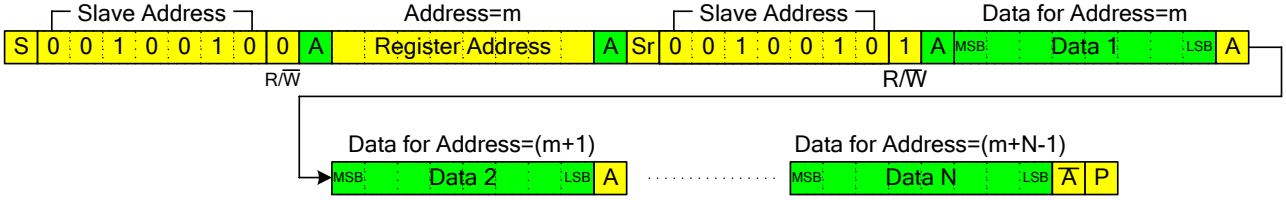
Driven by G2206

S Start

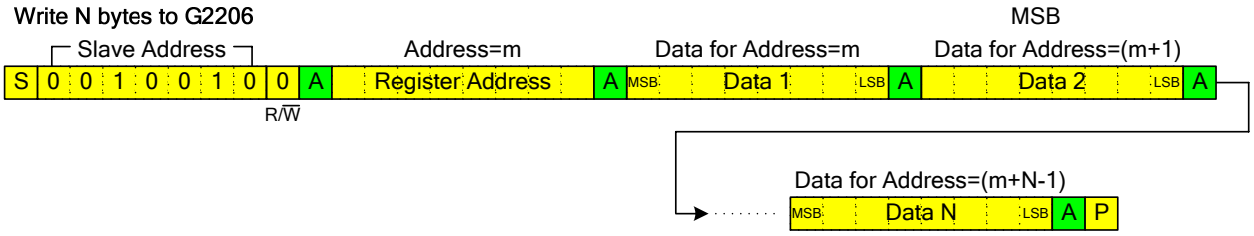
P Stop

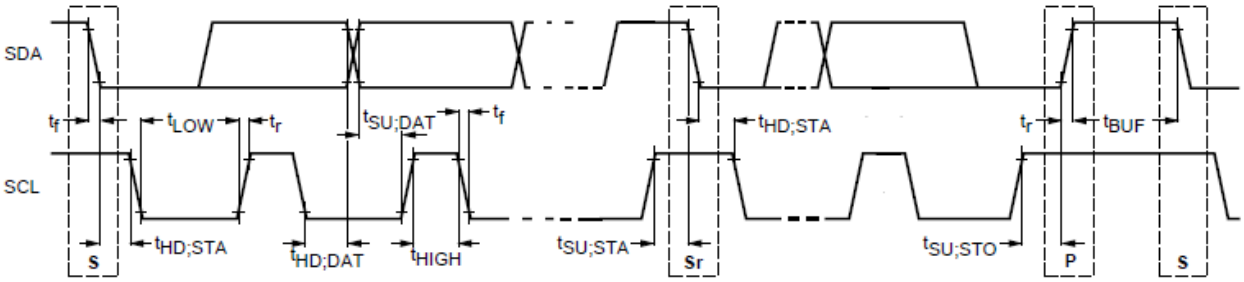
Sr Repeat Start

Read N bytes from G2206



Write N bytes to G2206





I2C Register Map

Address	Byte Name		Data							
			b7	b6	b5	b4	b3	b2	b1	b0
00h	A0	Meaning	PMURST	CHGRST	LEDOVP	PSM5	ENDPM	TSD	MOD6	TSSEL
		Default	1	0	0	1	0	0	1	1
		Read/Write	R/W	R/W	R/W	R/W	R/W	R	R	R/W
01h	A1	Meaning	ERR1	ERR2	ERR3	ERR4	ERR5	ERR6	ERR7	ERR8
		Default	0	0	0	0	0	0	0	0
		Read/Write	R	R	R	R	R	R	R	R
02h	A2	Meaning	ONCH5	ONLDO7	ONLDO8	VISET[4:0]				
		Default	0	0	0	0	0	0	0	0
		Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
03h	A3	Meaning	PSM1	PSM2	PSM3	PSM4	VDLDO8[3:0]			
		Default	1	1	1	1	1	1	0	0
		Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
04h	A4	Meaning	VDCH1[3:0]				ONCH1	DICH2[2:0]		
		Default	1	0	1	0	0	1	0	0
		Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
05h	A5	Meaning	FLST	DICH3[2:0]			FLST2	DICH4[2:0]		
		Default	1	1	0	0	1	1	0	0
		Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
06h	A6	Meaning	VDCH5[3:0]				VDLDO7[3:0]			
		Default	1	0	0	0	0	0	1	1
		Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
07h	A7	Meaning	TIMER[3:0]				/ENCH	USUS	ISET_IN[1:0]	
		Default	0	1	0	0	0	0	0	0
		Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
08h	A8	Meaning	TSHT[1:0]		reserved	CHGSTEN2	ISETA[3:0]			
		Default	0	0	0	1	0	1	0	0
		Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
09h	A9	Meaning	/JEITA	VSETH	VSETC	ISETH	ISETC	CHGSTEN	INT	DPM
		Default	0	0	0	0	0	1	0	0
		Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R
0Ah	A10	Meaning	TS_METER[2:0]			NO_BAT	EOC	PGOOD	THR	/SAFE
		Default	0	0	0	0	0	0	0	0
		Read/Write	R	R	R	R	R	R	R	R
0Bh	A11	Meaning	CHG_TYP[2:0]			VSET2	reserved	CHG_2DET	CHG_1DET	CHGRUN
		Default	0	0	0	0	0	1	1	0
		Read/Write	R	R	R	R/W	R	R/W	R/W	R
0Ch	A12	Meaning	DPPM	NTC100K	CHGDONE	BATSUP	reserved	/BATDET	reserved	reserved
		Default	1	1	0	0	0	0	0	0
		Read/Write	R	R	R	R	R/W	R/W	R/W	R/W

I2C Register Function Table

<table>
<tr><th>Byte Name</th><th>Data Bit</th><th>Data Name</th><th>Function Description</th></tr>
<tr><td>A0</td><td>b7</td><td>PMURST</td><td>Reset condition of the registers 02h~06h when ONPMU goes Low level.
<table>
<tr><th>SYS<1.3V</th><th>ONPMU</th><th>PMURST</th><th>Condition of registers 02h~06h</th></tr>
<tr><td>TRUE</td><td>X</td><td>X</td><td>Reset</td></tr>
<tr><td rowspan="3">FALSE</td><td rowspan="2">0</td><td>1</td><td>Reset</td></tr>
<tr><td>0</td><td>NO Reset</td></tr>
<tr><td>1</td><td>1</td><td>NO Reset</td></tr>
<tr><td></td><td></td><td>1</td><td>NO Reset</td></tr>
</table></td></tr>
<tr><td>A0</td><td>b6</td><td>CHGRST</td><td>Reset condition of the registers 07h~09h when BAT goes under BAT_{WAKE}(3.1V).
<table>
<tr><th>SYS<1.3V</th><th>VIN<VIN_{UVLO}</th><th>BAT<BAT_{WAKE}</th><th>CHGRST</th><th>Condition of registers 07h~09h</th></tr>
<tr><td>TRUE</td><td>X</td><td>X</td><td>X</td><td>Reset</td></tr>
<tr><td rowspan="4">FALSE</td><td>TRUE</td><td>X</td><td>X</td><td>Reset</td></tr>
<tr><td rowspan="3">FALSE</td><td rowspan="2">TRUE</td><td>1</td><td>Reset</td></tr>
<tr><td>0</td><td>NO Reset</td></tr>
<tr><td rowspan="2">FALSE</td><td>1</td><td>NO Reset</td></tr>
<tr><td>0</td><td>NO Reset</td></tr>
</table></td></tr>
<tr><td>A0</td><td>b5</td><td>LEDOVP</td><td>Setting CH6 VOUT6 over voltage protection threshold
<table>
<tr><th>LEDOVP</th><th>VOUT6 OVP threshold</th></tr>
<tr><td>0</td><td>15V</td></tr>
<tr><td>1</td><td>24V</td></tr>
</table></td></tr>
<tr><td>A0</td><td>b4</td><td>PSM5</td><td>CH5 Pulse Skipping Mode Enable Signal.
<table>
<tr><th>PSM5</th><th>Operation mode</th></tr>
<tr><td>0</td><td>PWM</td></tr>
<tr><td>1</td><td>PWM+PSM</td></tr>
</table></td></tr>
<tr><td>A0</td><td>b3</td><td>ENDPM</td><td>Enable VIN DPM function. But the VIN DPM function is always enabled if VIN charger type is detected as SDP.
<table>
<tr><th>CHG_TYP[2:0]</th><th>ENDPM</th><th>VIN DPM function</th></tr>
<tr><td>000</td><td>X</td><td>Enable</td></tr>
<tr><td rowspan="2">Others</td><td>1</td><td>Enable</td></tr>
<tr><td>0</td><td>Disable</td></tr>
</table></td></tr>
<tr><td>A0</td><td>b2</td><td>TSD</td><td>TSD is used to record if the thermal shutdown of G2206 occurs.
<table>
<tr><th>TSD</th><th>Thermal Shutdown occurs</th></tr>
<tr><td>0</td><td>NO</td></tr>
<tr><td>1</td><td>YES</td></tr>
</table></td></tr>
<tr><td>A0</td><td>b1</td><td>MOD6</td><td>MOD6 is used to record the result of CH6 mode detection.
<table>
<tr><th>MOD6</th><th>Operation mode</th></tr>
<tr><td>0</td><td>PWM</td></tr>
<tr><td>1</td><td>PWM+PSM</td></tr>
</table></td></tr>
<tr><td>A0</td><td>b0</td><td>TSSEL</td><td>TSSEL is used to set the TS/VP ratio when the register bit A12./BATDET=1’b1.
<table>
<tr><th rowspan="2">TSSEL</th><th colspan="2">TS/VP Ratio</th><th rowspan="2">NTC-R</th></tr>
<tr><th>Temp.=0°C</th><th>Temp.=60°C</th></tr>
<tr><td>0</td><td>72%</td><td>27%</td><td>10K</td></tr>
<tr><td>1</td><td>77%</td><td>29%</td><td>100K</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Byte Name</th><th>Data Bit</th><th>Data Name</th><th>Function Description</th></tr>
<tr><td>A1</td><td>b7~b0</td><td>ERR1
~ERR8</td><td>Record whether the UVP protection of CH1~CH5, CH7, CH8 and the OVP of CH6 ever occurs respectively.
<table>
<tr><th>ERRx</th><th>Protection Occurs</th></tr>
<tr><td>0</td><td>NO</td></tr>
<tr><td>1</td><td>YES</td></tr>
</table></td></tr>
<tr><td>A2</td><td>b7</td><td>ONCH5</td><td>CH5 Enable Signal.
<table>
<tr><th>ONCH5</th><th>CH5 Status</th></tr>
<tr><td>0</td><td>shutdown</td></tr>
<tr><td>1</td><td>operation</td></tr>
</table></td></tr>
<tr><td>A2</td><td>b6</td><td>ONLDO7</td><td>CH7 Enable Signal.
<table>
<tr><th>ONLDO7</th><th>LDO7 Status</th></tr>
<tr><td>0</td><td>shutdown</td></tr>
<tr><td>1</td><td>operation</td></tr>
</table></td></tr>
<tr><td>A2</td><td>b5</td><td>ONLDO8</td><td>CH8 Enable Signal.
<table>
<tr><th>ONLDO8</th><th>LDO8 Status</th></tr>
<tr><td>0</td><td>shutdown</td></tr>
<tr><td>1</td><td>operation</td></tr>
</table></td></tr>
<tr><td>A2</td><td>b4~b0</td><td>VISET[4:0]</td><td>Setting CH6 ISET Voltage, and shutdown CH6 if VISET[4:0]=5’b00000.
V(ISET)=0.25VxVISET[4:0]/31
<table>
<tr><th>VISET[4:0]</th><th>V(ISET)</th><th>VISET[4:0]</th><th>V(ISET)</th></tr>
<tr><td>11111</td><td>0.25V</td><td>00000</td><td>0V, CH6 shutdown</td></tr>
</table></td></tr>
<tr><td>A3</td><td>b7~b4</td><td>PSM1~4</td><td>CH1 ~CH4 Pulse Skipping Mode Enable Signal.
<table>
<tr><th>PSMx</th><th>Operation mode</th></tr>
<tr><td>0</td><td>PWM</td></tr>
<tr><td>1</td><td>PWM+PSM</td></tr>
</table></td></tr>
<tr><td>A3</td><td>b3~b0</td><td>VDLDO8
[3:0]</td><td>Setting LDO8 Output Voltage.
<table>
<tr><th>VDLDO8[3:0]</th><th>VO8</th><th>VDLDO8[3:0]</th><th>VO8</th><th>VDLDO8[3:0]</th><th>VO8</th><th>VDLDO8[3:0]</th><th>VO8</th></tr>
<tr><td>1111</td><td>3.3V</td><td>1011</td><td>2.5V</td><td>0111</td><td>1.7V</td><td>0011</td><td>1.3V</td></tr>
<tr><td>1110</td><td>3.2V</td><td>1010</td><td>2.2V</td><td>0110</td><td>1.6V</td><td>0010</td><td>1.2V</td></tr>
<tr><td>1101</td><td>3.1V</td><td>1001</td><td>2.0V</td><td>0101</td><td>1.5V</td><td>0001</td><td>1.1V</td></tr>
<tr><td>1100</td><td>2.8V</td><td>1000</td><td>1.8V</td><td>0100</td><td>1.4V</td><td>0000</td><td>SW</td></tr>
</table></td></tr>
<tr><td>A4</td><td>b7~b4</td><td>VDCH1
[3:0]</td><td>Setting CH1 Output Voltage
<table>
<tr><th>VDCH1[3:0]</th><th>VO1</th><th>VDCH1[3:0]</th><th>VO1</th><th>VDCH1[3:0]</th><th>VO1</th><th>VDCH1[3:0]</th><th>VO1</th></tr>
<tr><td>1111</td><td>5.5V</td><td>1011</td><td>5.1V</td><td>0111</td><td>4.7V</td><td>0011</td><td>3.9V</td></tr>
<tr><td>1110</td><td>5.4V</td><td>1010</td><td>5.0V</td><td>0110</td><td>4.6V</td><td>0010</td><td>3.8V</td></tr>
<tr><td>1101</td><td>5.3V</td><td>1001</td><td>4.9V</td><td>0101</td><td>4.5V</td><td>0001</td><td>3.7V</td></tr>
<tr><td>1100</td><td>5.2V</td><td>1000</td><td>4.8V</td><td>0100</td><td>4.0V</td><td>0000</td><td>3.6V</td></tr>
</table></td></tr>
<tr><td>A4</td><td>b3</td><td>ONCH1</td><td>CH1 Enable Signal when sequence ID is SEQ#0.
<table>
<tr><th>ONCH1</th><th>CH1 Status</th></tr>
<tr><td>0</td><td>shutdown</td></tr>
<tr><td>1</td><td>operation</td></tr>
</table></td></tr>
<tr><td>A4</td><td>b2~b0</td><td>DICH2
[2:0]</td><td>Setting CH2 Feedback Reference Voltage. VO2=VFB2x(R_{UP}+R_{DWN})/R_{DWN}
<table>
<tr><th>DICH2[2:0]</th><th>VFB2</th><th>DICH2[2:0]</th><th>VFB2</th></tr>
<tr><td>111</td><td>0.86V</td><td>011</td><td>0.78V</td></tr>
<tr><td>110</td><td>0.84V</td><td>010</td><td>0.76V</td></tr>
<tr><td>101</td><td>0.82V</td><td>001</td><td>0.74V</td></tr>
<tr><td>100</td><td>0.80V</td><td>000</td><td>0.72V</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Byte Name</th><th>Data Bit</th><th>Data Name</th><th>Function Description</th></tr>
<tr><td>A5</td><td>b7</td><td>FLST</td><td>FLST is used to control the /CHG pin status when the register bit A9.CHGSTEN=1’b0
<table>
<tr><th>FLST</th><th>/CHG Pin Status</th></tr>
<tr><td>1</td><td>Hi-Z</td></tr>
<tr><td>0</td><td>Low</td></tr>
</table></td></tr>
<tr><td>A5</td><td>b6~b4</td><td>DICH3 [2:0]</td><td>Setting CH3 Feedback Reference Voltage. VO3=VFB3x(R_{UP}+R_{DWN})/R_{DWN}
<table>
<tr><th>DICH3[2:0]</th><th>VFB3</th><th>DICH3[2:0]</th><th>VFB3</th></tr>
<tr><td>111</td><td>0.86V</td><td>011</td><td>0.78V</td></tr>
<tr><td>110</td><td>0.84V</td><td>010</td><td>0.76V</td></tr>
<tr><td>101</td><td>0.82V</td><td>001</td><td>0.74V</td></tr>
<tr><td>100</td><td>0.80V</td><td>000</td><td>0.72V</td></tr>
</table></td></tr>
<tr><td>A5</td><td>b3</td><td>FLST2</td><td>FLST2 is used to control the /CHG2 pin status when the register bit A8.CHGSTEN2=1’b0
<table>
<tr><th>FLST2</th><th>/CHG2 Pin Status</th></tr>
<tr><td>1</td><td>Hi-Z</td></tr>
<tr><td>0</td><td>Low</td></tr>
</table></td></tr>
<tr><td>A5</td><td>b2~b0</td><td>DICH4 [2:0]</td><td>Setting CH4 Feedback Reference Voltage. VO4=VFB4x(R_{UP}+R_{DWN})/R_{DWN}
<table>
<tr><th>DICH4[2:0]</th><th>VFB4</th><th>DICH4[2:0]</th><th>VFB4</th></tr>
<tr><td>111</td><td>0.86V</td><td>011</td><td>0.78V</td></tr>
<tr><td>110</td><td>0.84V</td><td>010</td><td>0.76V</td></tr>
<tr><td>101</td><td>0.82V</td><td>001</td><td>0.74V</td></tr>
<tr><td>100</td><td>0.80V</td><td>000</td><td>0.72V</td></tr>
</table></td></tr>
<tr><td>A6</td><td>b7~b4</td><td>VDCH5 [3:0]</td><td>Setting CH5 Output Voltage. When VDCH5=4’b0000, VO5= 0.8x(R_{UP}+R_{DWN})/R_{DWN}
<table>
<tr><th>VDCH5[3:0]</th><th>VO5</th><th>VDCH5[3:0]</th><th>VO5</th><th>VDCH5[3:0]</th><th>VO5</th><th>VDCH5[3:0]</th><th>VO5</th></tr>
<tr><td>1111</td><td>2.8V</td><td>1011</td><td>2.3V</td><td>0111</td><td>1.7V</td><td>0011</td><td>1.3V</td></tr>
<tr><td>1110</td><td>2.7V</td><td>1010</td><td>2.2V</td><td>0110</td><td>1.6V</td><td>0010</td><td>1.2V</td></tr>
<tr><td>1101</td><td>2.6V</td><td>1001</td><td>2.0V</td><td>0101</td><td>1.5V</td><td>0001</td><td>1.1V</td></tr>
<tr><td>1100</td><td>2.5V</td><td>1000</td><td>1.8V</td><td>0100</td><td>1.4V</td><td>0000</td><td>Ext.</td></tr>
</table></td></tr>
<tr><td>A6</td><td>b3~b0</td><td>VDLDO7 [3:0]</td><td>Setting LDO7 Output Voltage.
<table>
<tr><th>VDLDO7[3:0]</th><th>VO7</th><th>VDLDO7[3:0]</th><th>VO7</th><th>VDLDO7[3:0]</th><th>VO7</th><th>VDLDO7[3:0]</th><th>VO7</th></tr>
<tr><td>1111</td><td>3.3V</td><td>1011</td><td>2.5V</td><td>0111</td><td>1.7V</td><td>0011</td><td>1.3V</td></tr>
<tr><td>1110</td><td>3.2V</td><td>1010</td><td>2.2V</td><td>0110</td><td>1.6V</td><td>0010</td><td>1.2V</td></tr>
<tr><td>1101</td><td>3.1V</td><td>1001</td><td>2.0V</td><td>0101</td><td>1.5V</td><td>0001</td><td>1.1V</td></tr>
<tr><td>1100</td><td>2.8V</td><td>1000</td><td>1.8V</td><td>0100</td><td>1.4V</td><td>0000</td><td>SW</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Byte Name</th><th>Data Bit</th><th>Data Name</th><th>Function Description</th></tr>
<tr><td>A7</td><td>b7~b4</td><td>TIMER[3:0]</td><td>Setting Charger Safety Timer. T_{SAFE}=(TIMER[3:0]+1) hours.
Fast Charge safety time $T_{FASTCHG}=T_{SAFE}$. Pre-Charge safety time $T_{PRECHG}=T_{SAFE}/8$.</td></tr>
<tr><td>A7</td><td>b3</td><td>/ENCH</td><td>Charger Enable Signal.
<table>
<tr><th>/ENCH</th><th>Charger Status</th></tr>
<tr><td>0</td><td>operation</td></tr>
<tr><td>1</td><td>shutdown</td></tr>
</table></td></tr>
<tr><td>A7</td><td>b2</td><td>USUS</td><td>VIN Suspend Control Input.
<table>
<tr><th>USUS</th><th>VIN Status</th></tr>
<tr><td>0</td><td>No Suspend</td></tr>
<tr><td>1</td><td>Suspend</td></tr>
</table></td></tr>
<tr><td>A7</td><td>b1~b0</td><td>ISET_IN[1:0]</td><td>Setting VIN Current Limit Threshold.
<table>
<tr><th>ISET_IN[1:0]</th><th>VIN Current Limit</th></tr>
<tr><td>00</td><td>85mA</td></tr>
<tr><td>01</td><td>1.0A</td></tr>
<tr><td>10</td><td>475mA</td></tr>
<tr><td>11</td><td>1.5A</td></tr>
</table></td></tr>
<tr><td>A8</td><td>b7~b6</td><td>TSHT[1:0]</td><td>Set TS/VP ratio to monitor battery pack temperature for HOT boundary.
<table>
<tr><th rowspan="2">TSHT[1:0]</th><th rowspan="2">Battery Pack Temp.</th><th colspan="2">TS/VP Ratio</th></tr>
<tr><th>10k NTC-R</th><th>100k NTC-R</th></tr>
<tr><td>00</td><td>60°C</td><td>27%</td><td>29%</td></tr>
<tr><td>01</td><td>58°C</td><td>28%</td><td>30%</td></tr>
<tr><td>10</td><td>56°C</td><td>29%</td><td>31%</td></tr>
<tr><td>11</td><td>54°C</td><td>30%</td><td>32%</td></tr>
</table></td></tr>
<tr><td>A8</td><td>b4</td><td>CHGSTEN2</td><td>CHGSTEN2 is used to set indication method of /CHG2 PIN, and reset to 1’b0 only when SYS<1.3V.
/CHG2 pin status are directly controlled by the register bits A5.FLST2 if CHGSTEN2=1’b0.
When CHGSTEN2=1’b1, the /CHG2 pin status are based on the charger state shown below:
<table>
<tr><th rowspan="2">Charger State</th><th>CHGSTEN=1’b1</th></tr>
<tr><th>/CHG2 Status</th></tr>
<tr><td>Charging Done</td><td rowspan="4">Hi-Z</td></tr>
<tr><td>Recharging after Termination</td></tr>
<tr><td>IC Disabled or No valid VIN power</td></tr>
<tr><td>Battery Not Installed</td></tr>
<tr><td>Charging</td><td>Low</td></tr>
<tr><td>Safety Timer Expired</td><td rowspan="4">Flash at 4Hz (50% Duty)</td></tr>
<tr><td>Charger in Thermal Regulation</td></tr>
<tr><td>Charger in Thermal Shutdown</td></tr>
<tr><td>Battery Pack too cold or too hot</td></tr>
</table></td></tr>
<tr><td>A8</td><td>b3~b0</td><td>ISETA[3:0]</td><td>ISETA[3:0] is used to set the battery charge current level.
<table>
<tr><th>ISETA[3:0]</th><th>I_{CHG}</th><th>ISETA[3:0]</th><th>I_{CHG}</th><th>ISETA[3:0]</th><th>I_{CHG}</th><th>ISETA[3:0]</th><th>I_{CHG}</th></tr>
<tr><td>0000</td><td>0.1A</td><td>0100</td><td>0.5A</td><td>1000</td><td>0.9A</td><td>1100</td><td>1.2A</td></tr>
<tr><td>0001</td><td>0.2A</td><td>0101</td><td>0.6A</td><td>1001</td><td>1.0A</td><td>1101</td><td>1.2A</td></tr>
<tr><td>0010</td><td>0.3A</td><td>0110</td><td>0.7A</td><td>1010</td><td>1.1A</td><td>1110</td><td>1.2A</td></tr>
<tr><td>0011</td><td>0.4A</td><td>0111</td><td>0.8A</td><td>1011</td><td>1.2A</td><td>1111</td><td>1.2A</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Byte Name</th><th>Data Bit</th><th>Data Name</th><th>Function Description</th></tr>
<tr><td>A9</td><td>b7~b3</td><td>/JEITA
VSETH
VSETC
ISETH
ISETC</td><td>
If /JEITA is stated to low, VSETH/ISETH is used to setting battery regulation voltage and charging current between Temp=45°C and Temp=60 °C. VSETC/ISETC is used to setting battery regulation voltage and charging current between T=0°C and Temp=10 °C.
<table>
<tr><th rowspan="2">/JEITA</th><th rowspan="2">VSETH</th><th rowspan="2">VSETC</th><th colspan="3">V_{REG}</th></tr>
<tr><th>T=0°C~10°C</th><th>T=10°C~45°C</th><th>T=45°C~60°C</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>V_{BATREG}-0.15V</td><td>V_{BATREG}</td><td>V_{BATREG}-0.15V</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>V_{BATREG}</td><td>V_{BATREG}</td><td>V_{BATREG}-0.15V</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>V_{BATREG}-0.15V</td><td>V_{BATREG}</td><td>V_{BATREG}</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>V_{BATREG}</td><td>V_{BATREG}</td><td>V_{BATREG}</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>V_{BATREG}</td><td>V_{BATREG}</td><td>V_{BATREG}</td></tr>
<tr><td>1</td><td>0</td><td>X</td><td>V_{BATREG}-0.15V</td><td>V_{BATREG}-0.15V</td><td>V_{BATREG}-0.15V</td></tr>
<tr><th rowspan="2">/JEITA</th><th rowspan="2">ISETH</th><th rowspan="2">ISETC</th><th colspan="3">I_{CHG}</th></tr>
<tr><th>T=0°C~10°C</th><th>T=10°C~45°C</th><th>T=45°C~60°C</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0.5x$I_{FASTCHG}$</td><td>$I_{FASTCHG}$</td><td>0.5x$I_{FASTCHG}$</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>$I_{FASTCHG}$</td><td>$I_{FASTCHG}$</td><td>0.5x$I_{FASTCHG}$</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0.5x$I_{FASTCHG}$</td><td>$I_{FASTCHG}$</td><td>$I_{FASTCHG}$</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>$I_{FASTCHG}$</td><td>$I_{FASTCHG}$</td><td>$I_{FASTCHG}$</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>$I_{FASTCHG}$</td><td>$I_{FASTCHG}$</td><td>$I_{FASTCHG}$</td></tr>
<tr><td>1</td><td>0</td><td>X</td><td>0.5x$I_{FASTCHG}$</td><td>0.5x$I_{FASTCHG}$</td><td>0.5x$I_{FASTCHG}$</td></tr>
</table>
</td></tr>
<tr><td>A9</td><td>b2</td><td>CHGSTEN</td><td>
CHGSTEN is used to set indication method of /CHG PIN, and reset to 1’b0 only when SYS<1.3V. /CHG pin status are directly controlled by the register bits A5.FLST if CHGSTEN=1’b0.
When CHGSTEN=1’b1, the /CHG pin status are based on the charger state shown below:
<table>
<tr><th rowspan="2">Charger State</th><th>CHGSTEN=1’b1</th></tr>
<tr><th>/CHG Status</th></tr>
<tr><td>Charging Done</td><td rowspan="4">Hi-Z</td></tr>
<tr><td>Recharging after Termination</td></tr>
<tr><td>IC Disabled or No valid VIN power</td></tr>
<tr><td>Battery Not Installed</td></tr>
<tr><td>Charging</td><td>Flash at 0.5Hz (50% Duty)</td></tr>
<tr><td>Safety Timer Expired</td><td rowspan="4">Flash at 4Hz (50% Duty)</td></tr>
<tr><td>Charger in Thermal Regulation</td></tr>
<tr><td>Charger in Thermal Shutdown</td></tr>
<tr><td>Battery Pack too cold or too hot</td></tr>
</table>
</td></tr>
<tr><td>A9</td><td>b1</td><td>INT</td><td>
INT is used to control the output status of /INT pin. When interrupt events happen, /INT pin goes low and the bit A9.INT is set to 1’b1. After Micro-processor write the bit to be 1’b0, /INT pin goes to high-Z state.
<table>
<tr><th>INT</th><th>/INT Pin Status</th></tr>
<tr><td>0</td><td>Hi-Z</td></tr>
<tr><td>1</td><td>Low</td></tr>
</table>
</td></tr>
<tr><td>A9</td><td>b0</td><td>DPM</td><td>
DPM is used to record the VIN DPM mode status .
<table>
<tr><th>DPM</th><th>Status</th></tr>
<tr><td>0</td><td>Out of VIN DPM Mode</td></tr>
<tr><td>1</td><td>In VIN DPM Mode</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Byte Name</th><th>Data Bit</th><th>Data Name</th><th>Function Description</th></tr>
<tr><td>A10</td><td>b7~b5</td><td>TS_METER [2:0]</td><td>Record the battery temperature by detecting the TS pin voltage.
<table>
<tr><th>TS_METER[2:0]</th><th>Battery Temp.</th></tr>
<tr><td>110</td><td>T ≤ 0°C</td></tr>
<tr><td>100</td><td>0°C < T ≤ 10°C</td></tr>
<tr><td>000</td><td>10°C < T ≤ 45°C</td></tr>
<tr><td>001</td><td>45°C < T ≤ 60°C</td></tr>
<tr><td>011</td><td>60°C < T</td></tr>
<tr><td>010</td><td>VP<0.8V</td></tr>
</table></td></tr>
<tr><td>A10</td><td>b4</td><td>NO_BAT</td><td>Battery installed by detecting TS<90%xVP.
<table>
<tr><th>NO_BAT</th><th>Battery installed</th></tr>
<tr><td>0</td><td>YES</td></tr>
<tr><td>1</td><td>NO</td></tr>
</table></td></tr>
<tr><td>A10</td><td>b3</td><td>EOC</td><td>EOC show the charger status.
<table>
<tr><th>EOC</th><th>Char er Status</th></tr>
<tr><td>0</td><td>During Charging</td></tr>
<tr><td>1</td><td>Charging Done or Recharging after Termination</td></tr>
</table></td></tr>
<tr><td>A10</td><td>b2</td><td>PGOOD</td><td>VIN power status.
<table>
<tr><th>PGOOD</th><th>VIN Status</th></tr>
<tr><td>0</td><td>VIN < V_{UVLO}</td></tr>
<tr><td>0</td><td>V_{UVLO} < VIN < (V_{BAT}+ V_{ASDN})</td></tr>
<tr><td>1</td><td>(V_{BAT}+ V_{ASDN}) < VIN < V_{OVLO}</td></tr>
<tr><td>0</td><td>VIN > V_{OVLO}</td></tr>
</table></td></tr>
<tr><td>A10</td><td>b1</td><td>THR</td><td>THR show the status of thermal regulation on charger
<table>
<tr><th>THR</th><th>Thermal Regulation Happen</th></tr>
<tr><td>0</td><td>NO</td></tr>
<tr><td>1</td><td>YES</td></tr>
</table></td></tr>
<tr><td>A10</td><td>b0</td><td>/SAFE</td><td>/SAFE show the status of Safety Timer.
<table>
<tr><th>/SAFE</th><th>Safety Timer Status</th></tr>
<tr><td>0</td><td>No Expired</td></tr>
<tr><td>1</td><td>Expired</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Byte Name</th><th>Data Bit</th><th>Data Name</th><th>Function Description</th></tr>
<tr><td>A11</td><td>b7~b5</td><td>CHG_TYP [2:0]</td><td>CHG_TYP[2:0] is used to record the charger type.
<table>
<tr><th>CHG_TYP[2:0]</th><th>Charger Type</th></tr>
<tr><td>000</td><td>Stand Downstream Port (SDP)</td></tr>
<tr><td>001</td><td>SONY Charger-1 (0.5A)</td></tr>
<tr><td>010</td><td>SONY Charger-2 (0.5A)</td></tr>
<tr><td>011</td><td>APPLE Charger-1 (0.5A)</td></tr>
<tr><td>100</td><td>APPLE Charger-2 (1.0A)</td></tr>
<tr><td>111</td><td>Dedicated Charging Port (DCP)</td></tr>
<tr><td>110</td><td>Charging Downstream Port (CDP)</td></tr>
<tr><td>101</td><td>Special Charger (1.0A)</td></tr>
</table></td></tr>
<tr><td>A11</td><td>b4</td><td>VSET2</td><td>VSET2 is used to set the battery regulation voltage.
<table>
<tr><th>VSET2</th><th>V_{BATREG}</th></tr>
<tr><td>0</td><td>4.2V</td></tr>
<tr><td>1</td><td>4.35V</td></tr>
</table></td></tr>
<tr><td>A11</td><td>b2</td><td>CHG_2DET</td><td>CHG_2DET is used to enable the secondary detection of charger type.
<table>
<tr><th>CHG_2DET</th><th>Secondary Detection</th></tr>
<tr><td>0</td><td>Disable</td></tr>
<tr><td>1</td><td>Enable</td></tr>
</table></td></tr>
<tr><td>A11</td><td>b1</td><td>CHG_1DET</td><td>CHG_DET is used to enable the primary detection of charger type.
<table>
<tr><th>CHG_1DET</th><th>Primary Detection</th></tr>
<tr><td>0</td><td>Disable</td></tr>
<tr><td>1</td><td>Enable</td></tr>
</table></td></tr>
<tr><td>A11</td><td>b0</td><td>CHGRUN</td><td>CHGRUN is used to record the Auto Power Source Detection Status.
<table>
<tr><th>CHGRUN</th><th>APSD Status</th></tr>
<tr><td>0</td><td>Not Running</td></tr>
<tr><td>1</td><td>Running</td></tr>
</table></td></tr>
<tr><td>A12</td><td>b7</td><td>DPPM</td><td>DPPM is used to record the DPPM mode status .
<table>
<tr><th>DPPM</th><th>Status</th></tr>
<tr><td>0</td><td>Out of DPPM Mode</td></tr>
<tr><td>1</td><td>In DPPM Mode</td></tr>
</table></td></tr>
<tr><td>A12</td><td>b6</td><td>NTC100K</td><td>NTC100K is used to record the resistance of the NTC thermistor.
<table>
<tr><th>NTC100K</th><th>NTC Thermistor</th></tr>
<tr><td>0</td><td>10KΩ</td></tr>
<tr><td>1</td><td>100KΩ</td></tr>
</table></td></tr>
<tr><td>A12</td><td>b5</td><td>CHGDONE</td><td>CHGDONE show the charger status. CHGDONE is reset by recharging.
<table>
<tr><th>CHGDONE</th><th>Charger Status</th></tr>
<tr><td>0</td><td>During Charging</td></tr>
<tr><td>1</td><td>Charging Done</td></tr>
</table></td></tr>
<tr><td>A12</td><td>b4</td><td>BATSUP</td><td>BATSUP is used to record the Battery Supplement mode status .
<table>
<tr><th>BATSUP</th><th>Status</th></tr>
<tr><td>0</td><td>Out of Battery Supplement Mode</td></tr>
<tr><td>1</td><td>In Battery Supplement Mode</td></tr>
</table></td></tr>
<tr><td>A12</td><td>b2</td><td>/BATDET</td><td>/BATDET bit is used to disable the auto battery type detection.
The TS/VP threshold of Battery pack temperature monitor is auto adjusted by the battery type detection result if the /BATDET bit is 1’b0. Otherwise, the TS/VP threshold is decided by the register bit A0.TSSEL.
<table>
<tr><th>/BATDET</th><th>Auto Battery Type Detection</th></tr>
<tr><td>0</td><td>Enable</td></tr>
<tr><td>1</td><td>Disable</td></tr>
</table></td></tr>
</table>

FUNCTION DESCRIPTION

PMU

The G2206's PMU includes five DC/DC Converter, one WLED driver working in boost mode, and three LDO regulators to generate a multiple-output digital camera power-supply system.

	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9
	Boost	Buck-Boost	Buck	Buck	Buck	Boost	LDO	LDO	LDO
Topology	Synchronous PWM	Synchronous PWM	Synchronous PWM	Synchronous PWM	Synchronous PWM	Synchronous PWM			
Fsw (MHz)	1.5	1.5	1.5	1.5	1.5	0.75			
VOUT	3.6V~5.5V configured by I2C	Configured by External Resistors	Configured by External Resistors	Configured by External Resistors	1.1V~2.8V by I2C or by External Resistors		1.1V~3.3V or Power Switch by I2C	1.1V~3.3V or Power Switch by I2C	3.05V
Reference voltage on FB		0.72V~0.86V by I2C	0.72V~0.86V by I2C	0.72V~0.86V by I2C					
Light load mode	Yes	Yes	Yes	Yes	Yes	Yes			

PMU Power ON/OFF Sequence

G2206's CH1, CH2, CH3 and CH4 start to power on when the voltage on SYS is higher than its UVLO threshold 1.3V, and toggle ONPMU high. After finishing the power on sequence, toggling ONPMU low will start the power off sequence. G2206 support six power on/off sequences for CH1, CH2, CH3 and CH4 by different resistor connecting between SEQ pin to ground.

R_SEQ		Sequence
Short to SYS	Power-on	CH2→CH3→CH4
	Power-off	CH4→CH3→CH2
40kΩ	Power-on	CH1→CH3→CH2→CH4
	Power-off	CH4→CH2→CH3→CH1
10kΩ	Power-on	CH1→CH3→CH4→CH2
	Power-off	CH2→CH4→CH3→CH1
2.5kΩ	Power-on	CH1→CH2→CH4→CH3
	Power-off	CH3→CH4→CH2→CH1
0.63kΩ	Power-on	CH1→CH4→CH3→CH2
	Power-off	CH2→CH3→CH4→CH1
160kΩ	Power-on	CH1→CH4→CH2→CH3
	Power-off	CH3→CH2→CH4→CH1

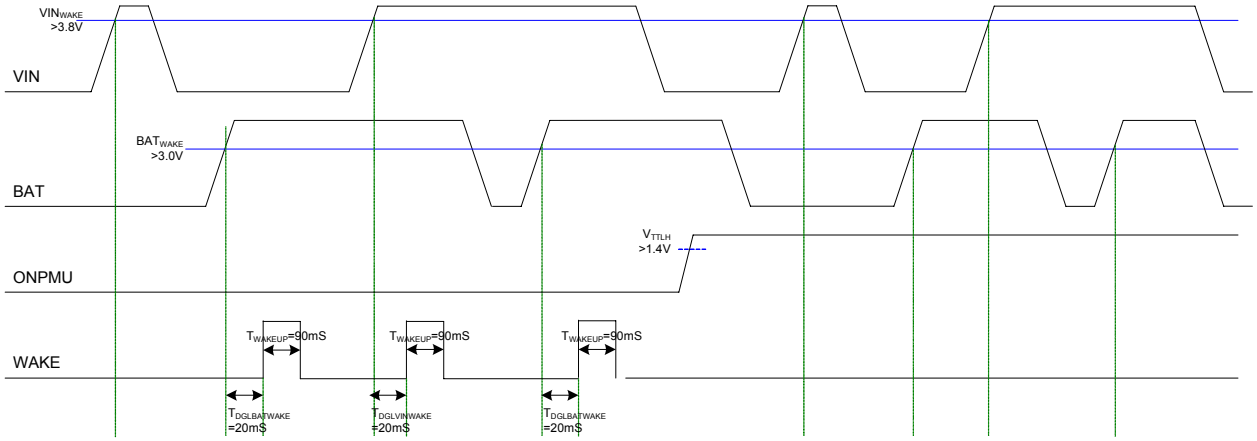
PMU Fault Protection

G2206 PMU provides battery over voltage protection, over-current protection, under-voltage protection, short-circuit protection, and thermal shutdown protection to achieve complete protection.

	Protection type	Threshold	Protection methods	Reset Method
SYS	OVP	SYS>5.8V	IC shutdown	Reset by toggling ONPMU
CH1 Boost	Current Limit	NMOS current>2.5A	NMOS Off, PMOS on	Automatic Reset at next cycle
	UVP	VOUT1<93.75%*$VOUT_{SET}$	IC shutdown if period above 128ms	Reset by toggling ONPMU
	SCP	VOUT1<12.5%*$VOUT_{SET}$	Disable LXSU switching	Remove SCP condition.
	VOUT SCP	VOUT1<1V	Disable LXSU switching	Remove VOUT1<1V condition.
CH2 Buck-Boost	Current Limit	LX2D PMOS current>2.0A	PMOS Off, NMOS on	Automatic Reset at next cycle
	UVP	FB2< ($FB2_{SET}$-50mV)	IC shutdown if period above 128ms	Reset by toggling ONPMU
	SCP	FB2<0.1V	Disable LX2U switching	Remove FB2<0.1V condition
	VOUT SCP	VOUT2<1V	Disable LX2U switching	Remove VOUT2<1V condition.
CH3 Buck	Current Limit	PMOS current>3.5A	PMOS Off, NMOS on	Automatic Reset at next cycle
	UVP	FB3< ($FB3_{SET}$-50mV)	IC shutdown if period above 128ms	Reset by toggling ONPMU
CH4 Buck	Current Limit	NMOS current>3.5A	PMOS Off, NMOS on	Automatic Reset at next cycle
	UVP	FB4< ($FB4_{SET}$-50mV)	IC shutdown if period above 128ms	Reset by toggling ONPMU
CH5 Buck	Current Limit	NMOS current>1.5A	PMOS Off, NMOS on	Automatic Reset at next cycle
	UVP	FB2< 0.75V	IC shutdown if period above 128ms	Reset by toggling ONPMU
CH6 WLED Driver	Current Limit	NMOS current>1.1A	NMOS Off	Automatic Reset at next cycle
	OVP	VOUT6>OVP_{SET}	NMOS Off	VOUT6<OVP_{SET}
	SCP	VOUT6<0.8V	Disable LX6 Switching	Remove SCP condition
CH7,CH8 LDO	Current Limit	PMOS current>300mA		PMOS current<300mA
	UVP	VOUTX<12.5%*$VOUTX_{SET}$	PMOS Off	Reset by toggling ONPMU Or I2C Control
CH9 RTCLDO	Current Limit	PMOS current>150mA		PMOS current<150mA
Thermal	TSD	Junction Temp. >150°C	IC shutdown	Reset by toggling ONPMU

WAKE UP

G2206 provide a high signal with 90mS(typ.) duration at WAKE pin to notify Controller that the power is valid. The high level of WAKE is the output voltage of RTCLDO. WAKE signal is asserted with deglitch time $T_{DGLBATWAKE}$ and $T_{DGLVINWAKE}$ after BAT or VIN voltage reaching its threshold voltage to eliminate any chattering on the input.



Li-ion Charger

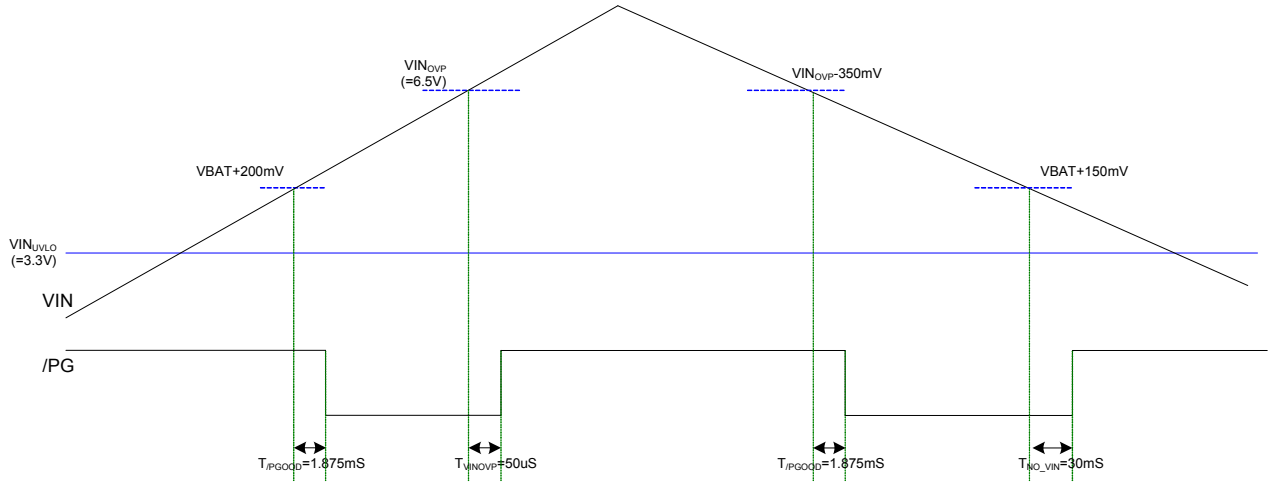
VIN Power Good /PG

/PG, with open drain output, is used to indicate the VIN voltage meets below conditions:

- $V_{VIN} > VIN_{UVLO}$
- $V_{VIN} > V_{BAT}+VIN_{ASDN}$
- $V_{VIN} < VIN_{OVP}$

The condition of $V_{VIN} > V_{BAT}+VIN_{ASDN}$ is asserted with deglitch time $T_{/PGOOD}$ (=1.875mS). After the condition is asserted, a deglitch time T_{NO_VIN} (=30mS) is inserted.

VIN over voltage condition is asserted with deglitch time t_{VINOVP} (=50uS).After the condition is asserted, a deglitch time $T_{/PGOOD}$ (=1.875mS) is inserted.



VIN Over-Voltage Protection (OVP)

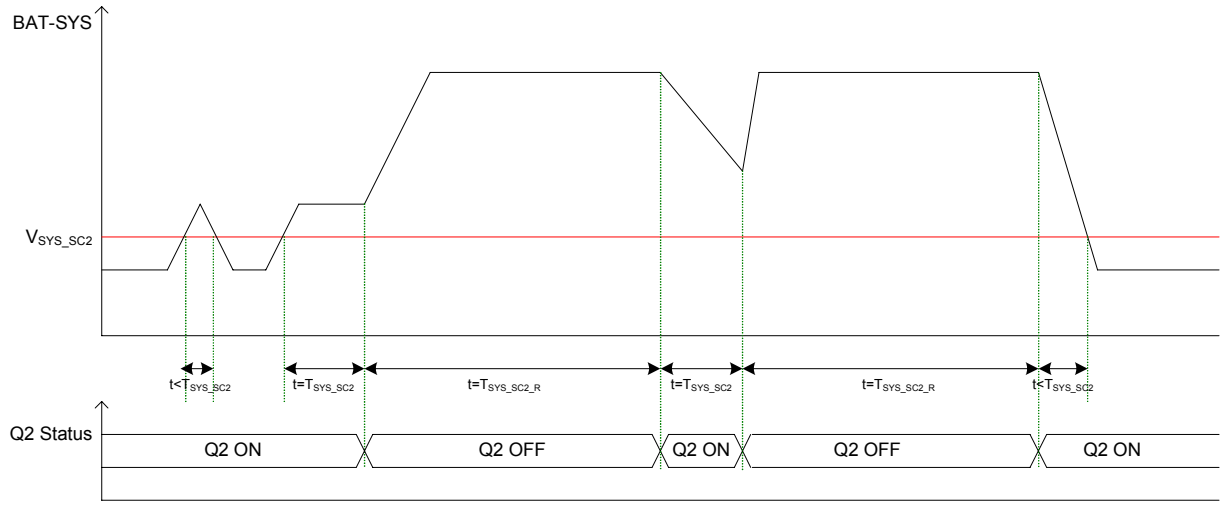
The G2206 Li-ion charger accepts VIN input voltage up to 28V without damage. When $VIN>VIN_{OVP}$ for a period longer than T_{VINOVP}, the Q1 FET that connects VIN to SYS is OFF and the battery charging is stopped. When in VIN OVP mode, the SYS output is connected to battery through Q2 FET is fully ON. Once the OVP function is removed, the safety timer are reset and a new charge cycle will be indicated by the /CHG output.

VIN Under-Voltage Lockout (UVLO)

The G2206 Li-ion charger remains in power down mode when the input voltage VIN is below the under-voltage threshold VIN_{UVLO}. In power down mode, the Q1 FET that connects VIN to SYS is OFF, and the Q2 FET that connects BAT to SYS is ON. The V_{SYS_SC2} circuit is active and monitors for overload conditions on SYS.

SYS Short Circuit Protection (SCP)

In VIN suspend mode (USUS=1'b1) or power down Mode (VIN<VIN_{UVLO}), the SYS is powered by battery pack, and the VSYS_SC2 circuit is active for overload condition on SYS. When (BAT-SYS)>V_{SYS_SC2}, for a period longer than t_{SYS_SCP}, the Q2 FET that connects BAT to SYS is turned OFF and the internal recovery timer is start. After the time $t_{SYS\_SCP\_R}$ of the recovery timer is reached, the Q2 FET is turned ON for a period t_{SYS_SCP} to see if the overload condition is removed.

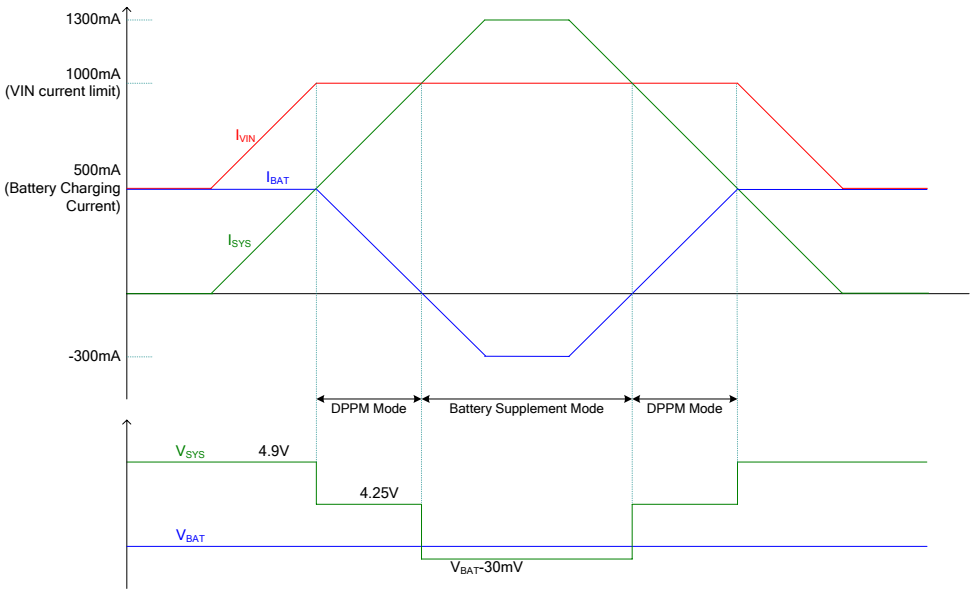


Dynamic Power Path Management

VIN-DPM mode is utilized in G2206 Li-ion charger for preventing it from crashing poorly designed or incorrectly configured VIN power source. If VIN voltage falls below V_{DPM} (4.4V typ.), the input current limit is reduced to prevent the VIN voltage falling further. When in VIN-DPM mode, the register DPM is 1'b1.

DPPM mode is utilized in G2206 Li-ion charger to maintain SYS voltage in the increasing SYS output current. When the sum of the battery charging current and the SYS output current exceeds the VIN input current limit, the SYS voltage falls. Once the SYS voltage falls below V_{DPPM} (4.3V typ.), the battery charging current is reduced to prevent the SYS voltage falling further. IN DPPM mode, the battery charging termination detection is halted and the register DPPM is 1'b1

In DPPM mode, if the battery charging current is reduced to zero and the SYS output current increases beyond the VIN input current limit, the SYS voltage falls further. When the SYS voltage falls below V_{SYS2}, the battery supplements the SYS load. In Battery Supplement Mode, the SYS short circuit is active and the battery charging termination detection is halted, and the register BATSUP is 1'b1.

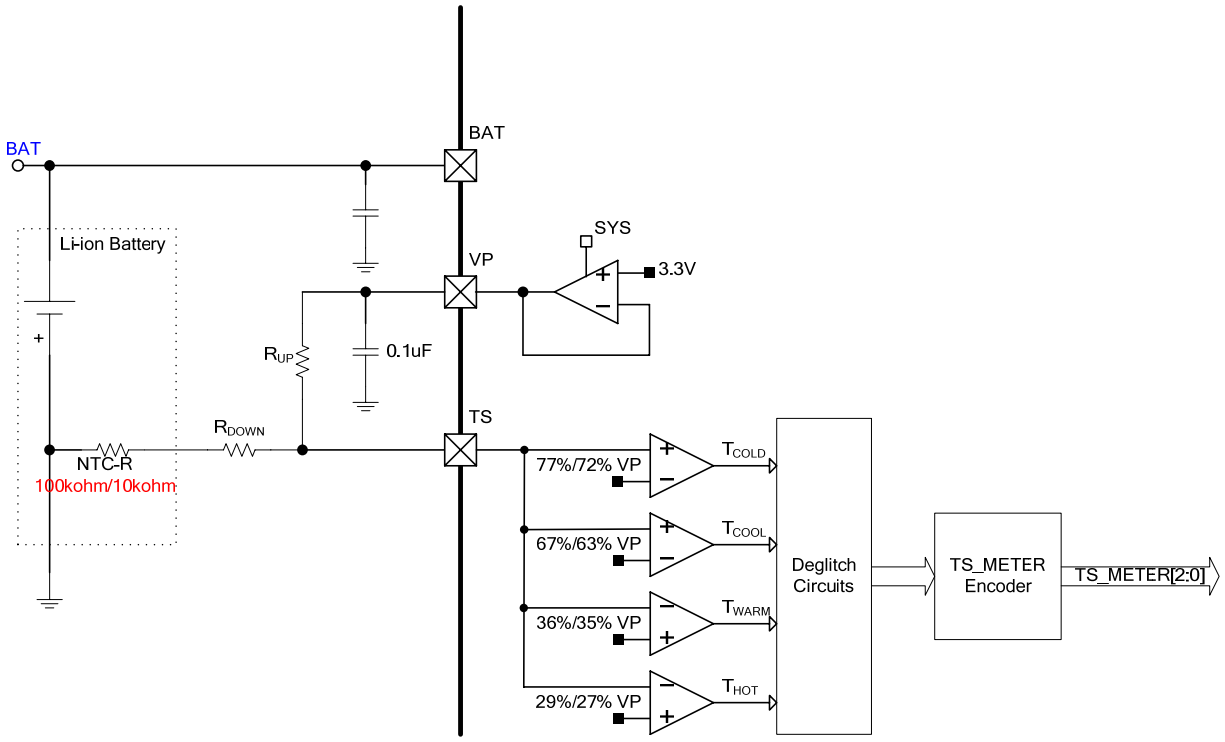


VIN Suspend Mode or VIN not Connected

When no input source is connected to VIN or in VIN suspend mode by setting register USUS=1'b1, SYS is powered strictly from battery. During this mode, the Q2 FET that connects BAT to SYS is fully on, and the SYS voltage is not regulated, but the SYS short circuit protection is active.

Battery Detection & Battery Pack Temperature Monitoring

When input source is connected to VIN or ONPMU pin is applied high, the G2206 detects battery is presented or not by detecting the voltage level of TS pin. If the voltage of TS pin is lower than 90% of VP with duration longer than t_{NO_BAT} (30ms typ.), the battery is presented and the register NO_BAT is 1'b0.



After the battery is installed and the G2206 battery detection is finished, the TS input voltage connects to the NTC thermistor in the battery pack to monitor the battery temperature and prevent over temperature condition. During charging with the voltage at TS is outside of the operating range (V_{COLD} to V_{HOT}), charging is suspended and the safety timer maintain their values but suspend counting.

The G2206 provides users easily implement the JEITA standard for systems with I2C interface. Charge current and voltage where the voltage at TS is inside the range (V_{COLD} to V_{COOL} , V_{COOL} to V_{WARM}, and V_{HOT} to V_{WARM}) can be controlled by I2C. See in detail at I2C Register Function Table.

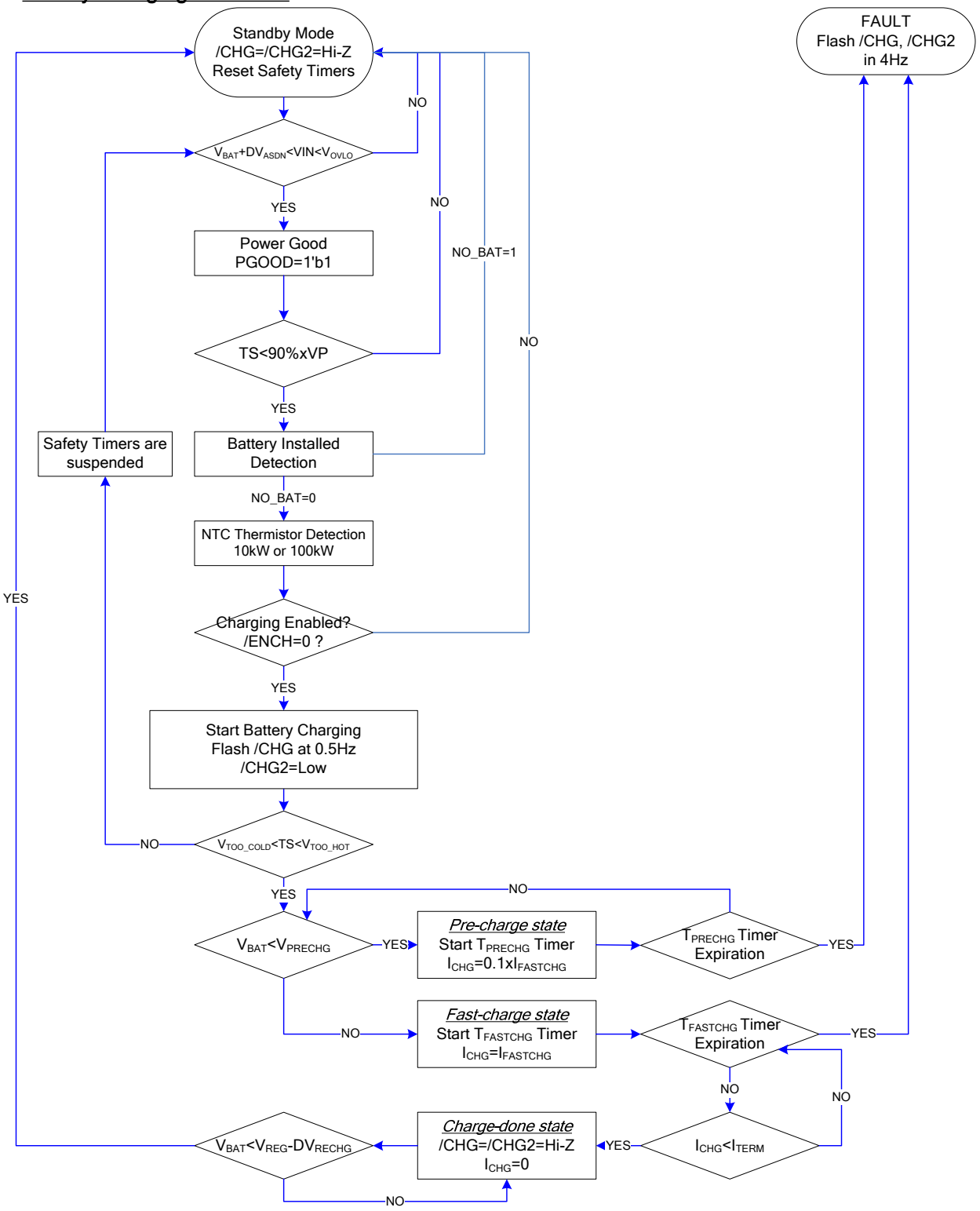
The G2206 supports 100k and 10k NTC thermistor, and the suggested R_{UP} and R_{DOWN} resistor values are as below:

NTC Thermistor	R_{UP} (Ω)	R_{DOWN} (Ω)
10K	11K	1K
100K	117K	26K

Battery Charging

Once the VIN power good is sustained, battery is installed, and the battery pack temperature is in the operating range, set /ENCH low to initiate battery charging. The battery is charged in three phases: pre-charge, constant current fast charge, and a constant voltage regulation. The battery charging flow chart is as below:

Battery Charging Flowchart



In the pre-charge phase, the battery is charged at with the pre-charge current (I_{PRECHG}). The battery is charged with the fast-charge current (I_{CHG}) when the battery voltage is higher than V_{PRECHG}. As the battery voltage reaches $V_{BAT(REG)}$, the battery is held at a constant voltage of $V_{BAT(REG)}$ and the charge current tapers off as the battery approaches full charge. When the battery current reach I_{TERM}, the /CHG pin indicates charging done by going high-impedance.

The termination detection is disabled whenever the charging current is reduced in these four conditions as below:

- Thermal regulation loop is active, and is indicated by register THR=1'b1
- DPPM loop is active, and is indicated by register DPPM=1'b1
- VIN-DPM loop is active, and is indicated by register DPM=1'b1
- Battery Supplement Mode is active, and is indicated by register BATSUP=1'b1

The fast-charge current is set by register ISETA[3:0] throught I2C control. The ratio of pre-charge current to fast-charge current is 10%. When the fast-charge current is set lower than or equal to 200mA, the ratio of termination detection current to fast-charge current is 3.3%. Otherwise, the ratio of termination detection current to fast-charge current is 10%.

Once a charge cycle is complete, the battery voltage is monitored. When the battery voltage falls below V_{RCH}, a new charging cycle is start.

Safety Timer

The G2206 charger contains an internal safety timer for the pre-charge, fast-charge phases to prevent potential damage to the battery and the system. The timer value of the fast-charge phase is programmed by the register TIMER[3:0] through I2C control, and the timer value of pre-charge is 1/8 of the fast-charge timer value. See details in the Register Function Table. When the temperature of the battery pack monitored by the NTC thermistor through TS pin is out of the operating range ($0^0C<T<60^OC$), the safety timer maintains the timer value but suspends the counting. Once the temperature is back in the operating range, the safety timer resumes from the timer value maintained previously.

Thermal Regulation Loop and Thermal Shutdown

The G2206 contain a thermal regulation loop that monitors the die temperature. If the temperature heat up, the thermal regulation loop reduces the VIN input current limit to maintain the die temperature less than THM_{REG} (120^OC typ.). Ther battery termination detection is disabled when thermal regulation loop is active.
Despite the operation of the thermal loop, the die temperature continues to rise above THM_{SD}(155^OC typ.) in some cases, the FET Q1 connects VIN to SYS is turned OFF, and G2206 charger enters Battery Supplement Mode to ensure that the battery powers the load on SYS.

/CHG and /CHG2 Indicator

The open-drain /CHG and /CHG2 output indicates various charger operations, and the indication method is controlled by the register CHGSTEN and CHGSTEN2 through I2C interface.

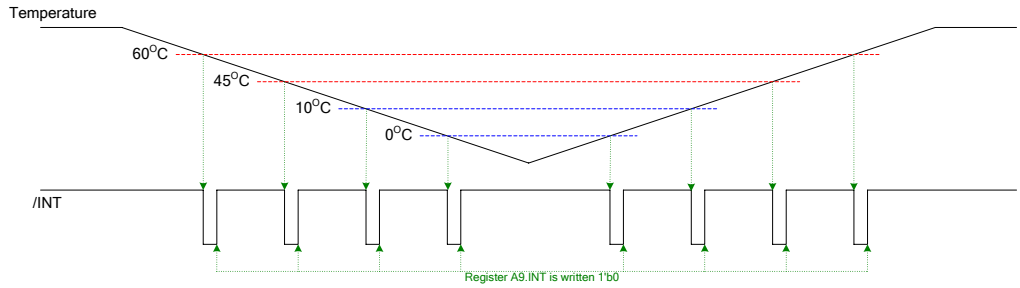
<table>
<tr><td rowspan="3">Charger State</td><td colspan="3">/CHG Status</td><td colspan="3">/CHG2 Status</td></tr>
<tr><td rowspan="2">CHGSTEN=1'b1</td><td colspan="2">CHGSTEN=1'b0</td><td rowspan="2">CHGSTEN2=1'b1</td><td colspan="2">CHGSTEN2=1'b0</td></tr>
<tr><td>FLST=1</td><td>FLST=0</td><td>FLST2=1</td><td>FLST2=0</td></tr>
<tr><td>Charging Done</td><td rowspan="4">Hi-Z</td><td rowspan="9">Hi-Z</td><td rowspan="9">Low</td><td rowspan="4">Hi-Z</td><td rowspan="9">Low</td></tr>
<tr><td>Recharging after Termination</td></tr>
<tr><td>IC Disabled or No valid VIN power</td></tr>
<tr><td>Battery Not Installed</td></tr>
<tr><td>Charging</td><td>Flash at 0.5Hz</td><td>Low</td></tr>
<tr><td>Safety Timer Expired</td><td rowspan="4">Flash at 4Hz</td><td rowspan="4">Flash at 4Hz</td></tr>
<tr><td>Charger in Thermal Regulation</td></tr>
<tr><td>Charger in Thermal Shutdown</td></tr>
<tr><td>Battery Pack too cold or too hot</td></tr>
</table>

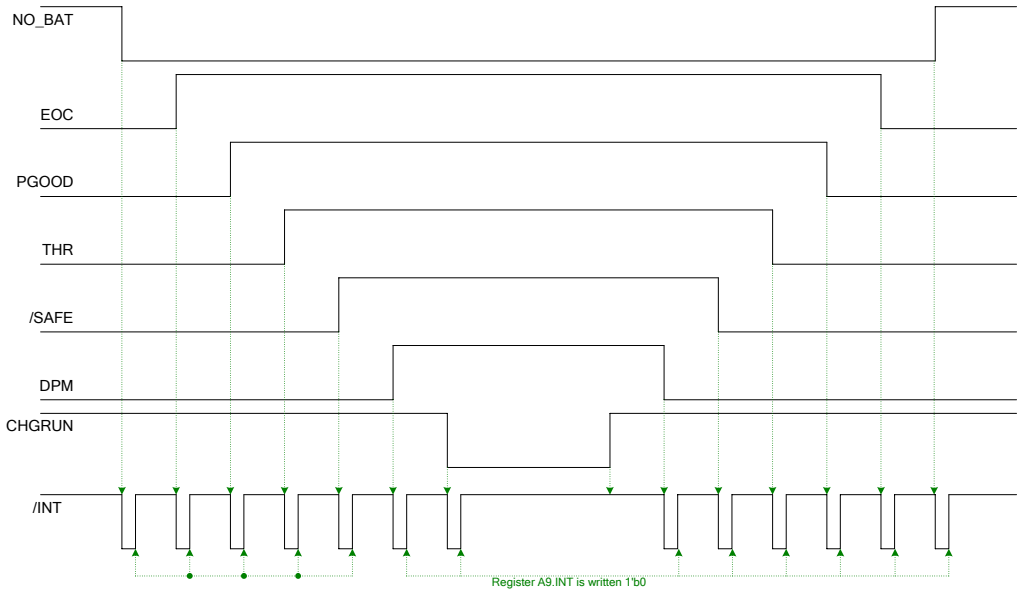
/INT, Interupt Signal

The G2206 indicates interrupt signal to external processor by /INT open-drain output. /INT is toggled low and INT bit is set to 1'b1 when these conditions shown below happen. After /INT is toggled low in these conditions, /INT is toggled high by written INT bit 1'b0 through I^2C interface.

- JEITA temperature limit detected by TS voltage, V_{COLD}, V_{COOL}, V_{WARM}, V_{HOT} are reached.
- Battery not installed.
- End of Charging.
- VIN power good
- Safety timer expired.
- VIN DPM happens or not
- Thermal regulation loop is active or not.
- Auto Power Source Detection completed.

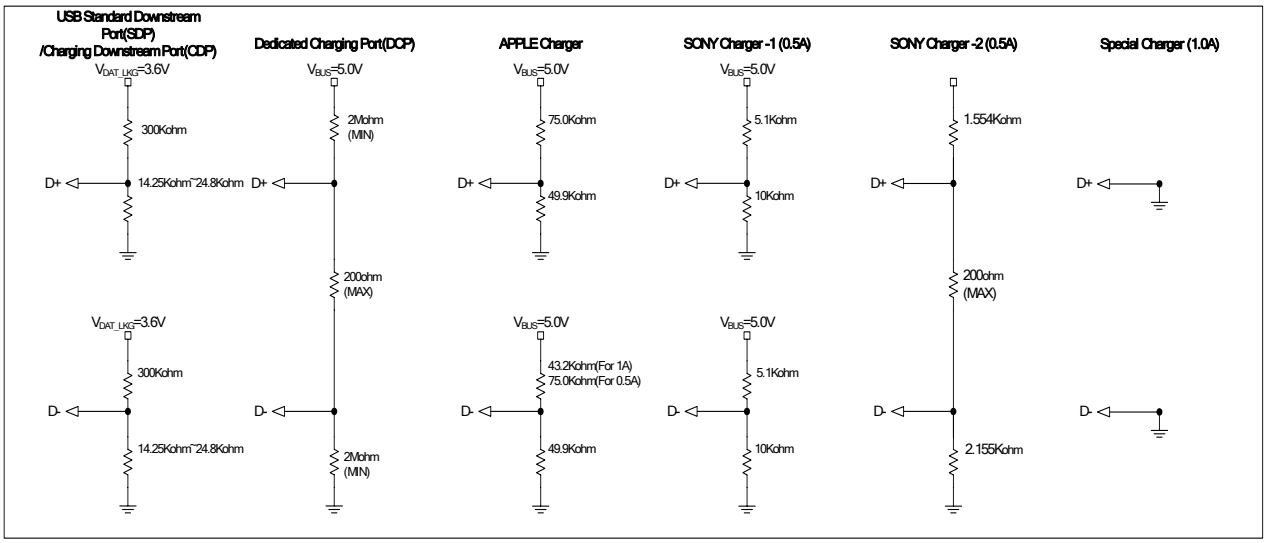
/INT Toggle Low	When PMU turns on with event condition		During PMU On	
	No Event	Event Occurred	Event Appear	Event Disappear
JEITA Temperature Limit	NO	YES	YES	YES
Battery Not Installed (NO_BAT)	NO	YES	YES	YES
End of Charging (EOC)	NO	YES	YES	YES
VIN Power Good (PGOOD)	NO	YES	YES	YES
Safety Timer Expired (/SAFE)	NO	YES	YES	YES
VIN DPM is active (DPM)	NO	YES	YES	YES
Thermal Regulation is active (THR)	NO	YES	YES	YES
Auto Power Source Detection is active (CHGRUN)	NO	NO	NO	YES





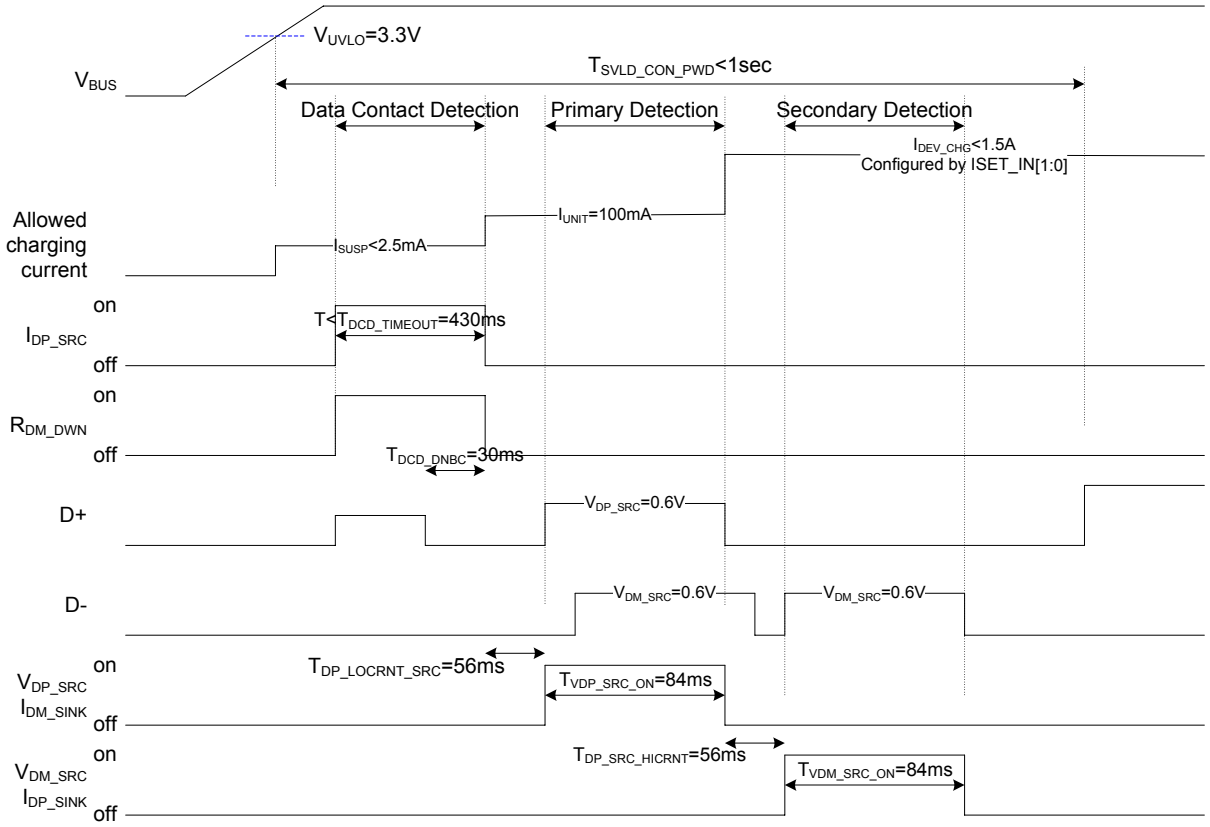
USB Charger Detection

The G2206 has USB charger detection circuit compliant with USB Battery Charging Revision 1.2. The USB charger detection circuit detects USB standard downstream port (SDP), USB charging downstream port (CDP), dedicated charging port (DCP), APPLE chargers, SONY chargers, and special charger to control the Li-ion battery charger. The downstream port topology is shown below:

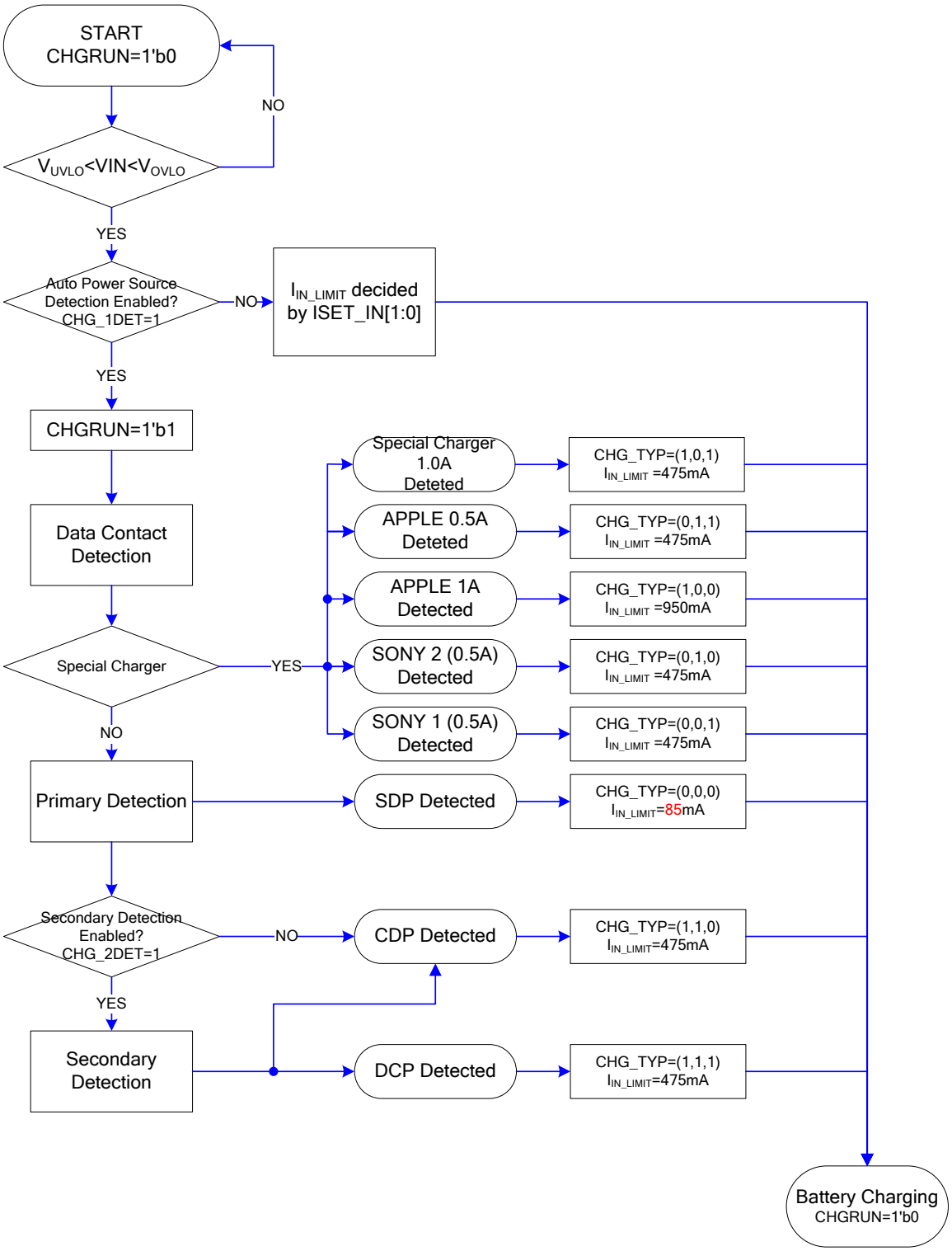


After VIN exceeds VIN_{UVLO}, USB detection sequence starts with three phases: Data Contact Detection (DCD), Primary Detection, and Secondary Detection. See the flow chart and the timing sequence of CDP detection in details.

Auto Power Source Detection Timing of CDP



Auto Power Source Detection Flowchart

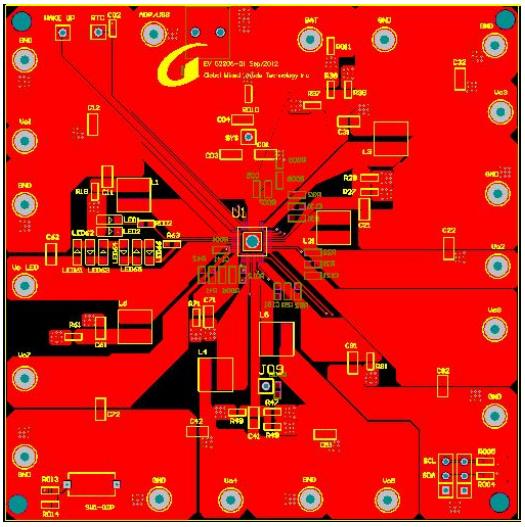


PCB Layout Considerations

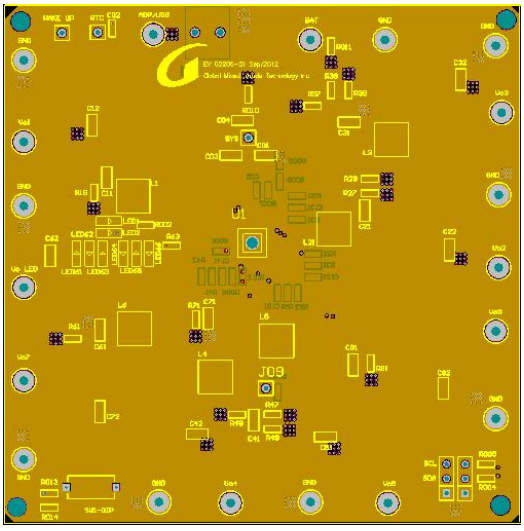
1. Power loop of converters should be connected with the shortest and widest traces as possible.
2. The REF should connect to G2206 as close as possible, and keep away from switch noise source, such as LX node.
3. The feedback network trace must be from the output capacitor, and the external feedback resistors should be placed next to the FB pin. The route of feedback network should keep away from the switching noise source.
4. The input capacitor should be placed as close as possible to the IC pins as well as the output capacitor.
5. The exposed pad (EP) is internally connected to all converters power ground, for good thermal dissipation, multilayer PCB is recommended, and the EP pad must be connected to the power and analog ground plane.

EV Board PCB Layout Section

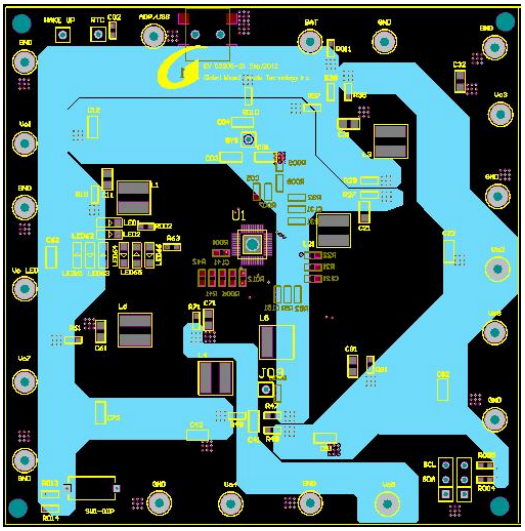
Top Side



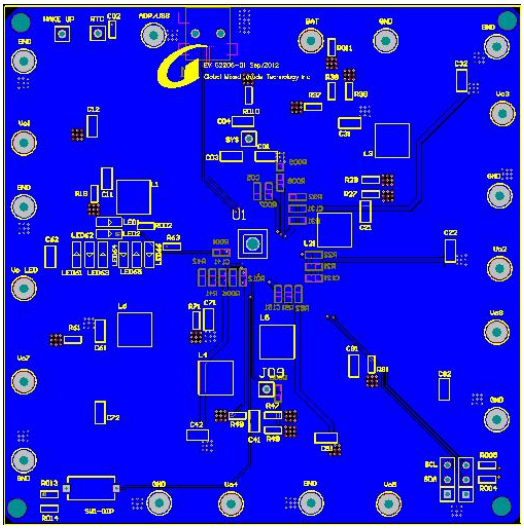
Midlayer1



Midlayer2

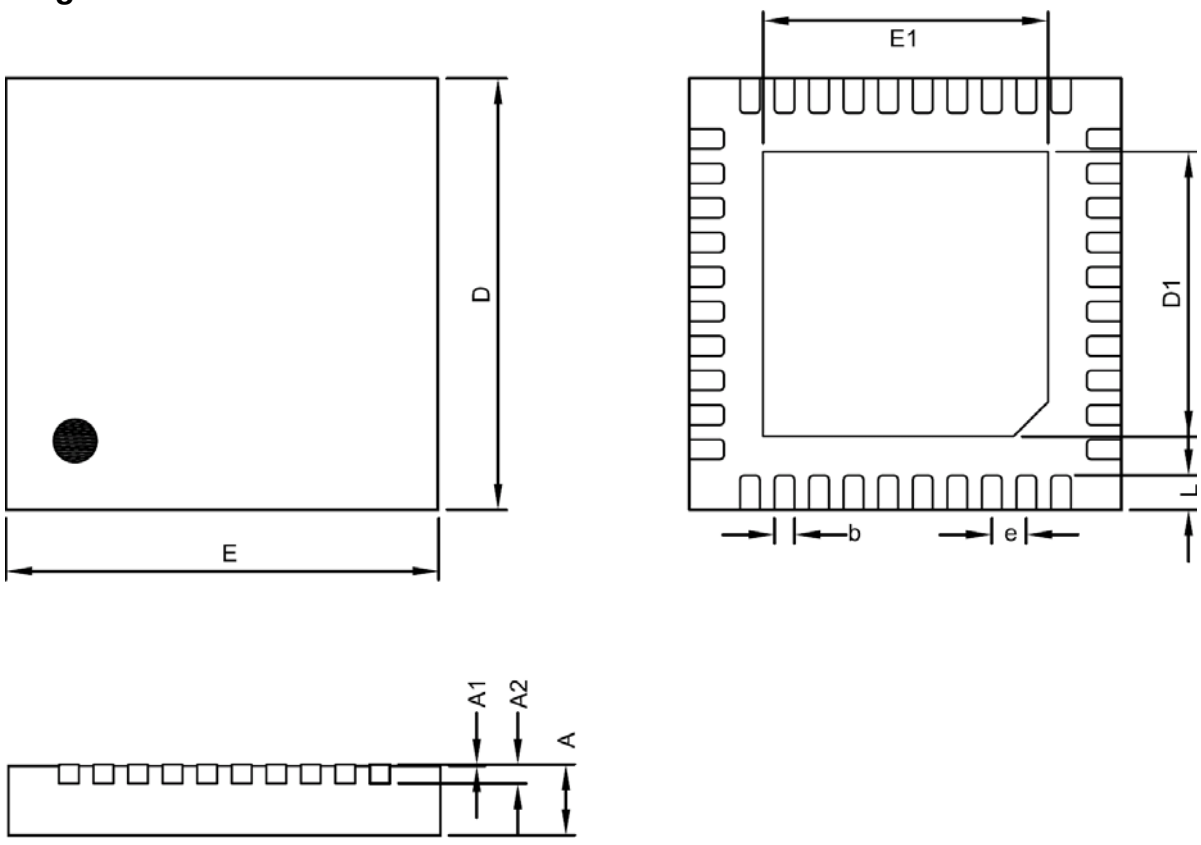


Bottom side



TQFN5X5-40 Board	Information
Board Material	FR4
Size	90mm×90mm
Board Thickness	1.6mm
Layers	4
Copper Thickness	2 oz.

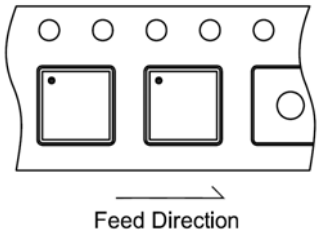
Package Information



TQFN5X5-40 Package

Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.0276	0.0295	0.0315
A1	0.00	---	0.05	0.0000	---	0.0020
A2	0.20 REF			0.0079 REF		
D	4.95	5.00	5.05	0.1949	0.1969	0.1988
E	4.95	5.00	5.05	0.1949	0.1969	0.1988
D1	3.50	3.60	3.70	0.1378	0.1417	0.1457
E1	3.50	3.60	3.70	0.1378	0.1417	0.1457
b	0.15	0.20	0.25	0.0059	0.0079	0.0098
e	0.40 BSC			0.0157 BSC		
L	0.35	0.40	0.45	0.0138	0.0157	0.0177

Taping Specification



PACKAGE	Q'TY/REEL
TQFN5X5-40	3,000 ea