Single Cell Li-Ion Battery Linear Charger

Features

- **No External Power MOSFET, Sense Resistor or Blocking Diode Required**
- **Programmable Termination and Pre-Charge Threshold**
- **Programmable Constant Charge Current Limit to 500mA**
- **Programmable Constant Charge Current Limit to 1500mA in specific temperature range.**
- **Automatic Recharge**
- **Complete Pre-Charge, Constant Current, Constant Voltage and Charge Termination Charge Procedure with Thermal Regulation to Maximize Charge Rate without Risk of Over-heating**
- **Charges Single Cell Li-Ion Batteries Directly from USB Port**
- **Preset 4.2V Charge Voltage with ±1% Accuracy**
- **10% Charge Current Accuracy**
- **Internal Thermal Protection Circuit**
- **TDFN2X2-10 Package**
- **Operation over JEITA Range via Battery NTC – 1/2 Fast-Charge-Current at Cool, configure multiplier of Fast-Charge-Current at normal by SEL_ ICHG pin and 4.06V at Warm.**
- **Automatic Termination and Disable Mode (TTDM) for Absent Battery Pack With Thermistor**

General Description

The G2277 is a standalone linear Li-Ion battery charger with a complete pre-charge, constant-current and constant-voltage charge loop.

No external power MOSFET, sense resistor and blocking diode is required due to internal power MOSFET architecture. The charge voltage is regulated at 4.2V, and the charge current is programmable by an external resistor. The pre-charge current and termination current threshold are programmed via an external resistor on the G2277, the open drain NMOS /CHRG pin would be automatic weakly pull low and terminating the charge loop and /PG pin would be automatic strongly pull low at power ready.

Other features include under voltage lockout, automatic recharge, over temperature protection and a charge status indication pin.

Applications

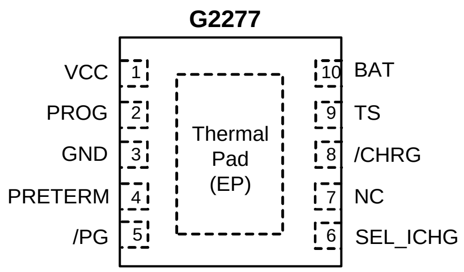
- **MP3 Players**
- **Cellular Phones**
- **PDAs**
- **Hand-Held Devices**

Ordering Information

ORDER NUMBER	MARKING	TEMP. RANGE	PACKAGE (Green)
G2277K21U	2277	-40°C ~ +85°C	TDFN2X2-10

Note: K2: TDFN2X2-10
1: Bonding Code
U: Tape & Reel
Green : Lead Free / Halogen Free

Pin Configuration



TDFN2X2-10

Absolute Maximum Ratings

V_{CC} to GND . . . . -0.3V to +10V
BAT to GND . . . . -0.3V to 7V
PROG to GND . . . . -0.3V to V_{CC}+0.3V
/CHRG to GND . . . . -0.3V to 10V
Operating Temperature Range . . . .-40°C to +85°C
Junction Temperature . . . .+150°C
Storage Temperature Range . . . .-65°C to +160°C
Reflow Temperature (soldering, 10sec) . . . . 260°C
ESD (HBM) 2KV
ESD (MM) 200V

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.

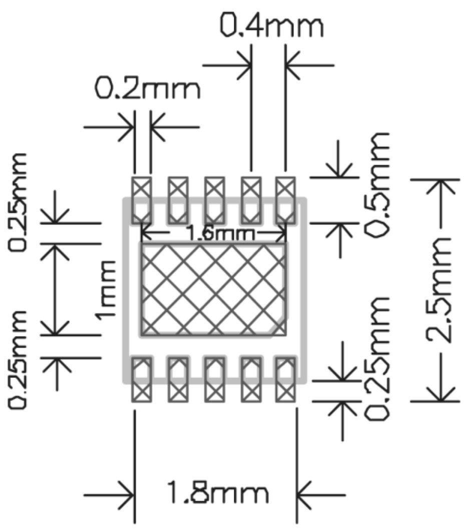
Thermal Information

THERMAL METRIC[1]		TDFN2x2-10	UNIT
$R_{\theta JA}$	Junction to ambient thermal resistance	66.4	°C/W
$R_{\theta JC\_top}$	Junction to case top thermal resistance	118.9	°C/W
$R_{\theta JB}$	Junction to board thermal resistance	33.6	°C/W
Ψ_{JT}	Junction to top characterization parameter	3.0	°C/W
Ψ_{JB}	Junction to board characterization parameter	33.6	°C/W
$R_{\theta JC\_bot}$	Junction to case bottom thermal resistance	7.3	°C/W

1. Package thermal metric is obtained using the method described in JEDEC specification JESD51-7, using a four-layer board.
2. The maximum power dissipation is $P_{D(MAX)} = \frac{(T_{JMAX} - T_A)}{R_{\theta JA}}$, Exceeding the maximum allowable power dissipation results in excessive die temperature, and the device will enter thermal shutdown.

Minimum Footprint PCB Layout Section

TDFN2X2-10



Electrical Characteristics

V_{cc}=5V; T_A=25°C, C_{IN}=1µF

The device is not guaranteed to function outside its operating conditions. Parameters with MIN and/or MAX limits are 100% tested at +25°C, unless otherwise specified.

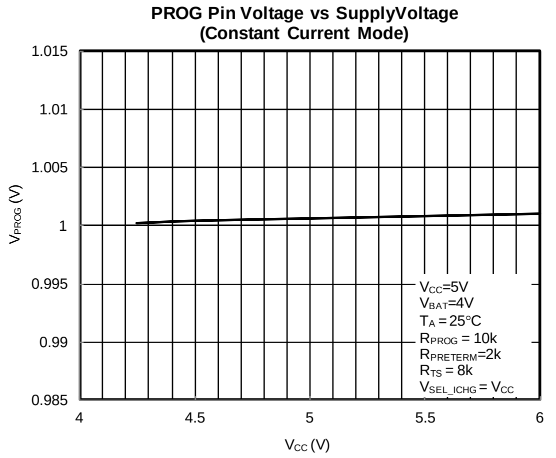
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
General						
Input Supply Voltage	V_{CC}		4.25	---	6.5	V
Input Supply Current	I_{CC}	Charge Mode , R_{PROG}=10k	---	300	2000	µA
	I_{CC_STBY}	Standby Mode (Charge Terminated) or V_{TS}=0V	---	200	500	µA
	I_{CC_SDN}	Shutdown Mode (R_{PROG} Not Connected, V_{CC}<V_{BAT})	---	25	50	µA
V_{CC} Under voltage Lockout Threshold	V_{UV}	From V_{CC} Low to High	3.7	3.8	3.92	V
V_{CC} Under voltage Lockout Hysteresis	V_{UVHYS}		150	200	300	mV
V_{CC} – V_{BAT} Lockout Threshold Voltage	V_{ASD_R}	V_{CC} from Low to High	70	100	140	mV
	V_{ASD_F}	V_{CC} from High to Low	5	30	50	mV
V_{CC} Over Voltage Protection	V_{OV}	V_{CC} Rising	5.75	6.0	6.25	V
V_{CC} Over Voltage Protection Hysteresis	V_{OV_HYS}		---	300	---	mV
BAT Pin Current	I_{BAT_STBY}	Standby Mode, V_{BAT}=4.2V	0	–2.5	–6	µA
	I_{BAT_SDN}	Shutdown Mode (SEL_ICHG>VCC-0.4V and R_{PROG} Not Connected)	---	±1	±2	µA
	I_{BAT_SLP}	Sleep Mode, V_{CC}=0V	---	±0.5	±1	µA
Manual Shutdown Threshold Voltage	V_{MSD_R}	PROG Pin Rising	1.15	1.21	1.3	V
	V_{MSD_F}	PROG Pin Falling	1.05	1.1	1.15	V
/CHRG Pin Weak Pull-Down Current	$I_{/CHRG}$	$V_{/CHRG}$=5V	8	20	35	µA
/CHRG Pin Output Low Voltage	$V_{/CHRG}$	$I_{/CHRG}$=5mA	---	0.35	0.6	V
/PG Pin Output Low Voltage	$V_{/PG}$	$I_{/CHRG}$=10mA	---	0.35	0.6	V
Voltage Regulation						
Regulated Output (Float) Voltage	V_{FLOAT}	$V_{TS\text{-}45°C} \le V_{TS} \le V_{TS\text{-}0°C}$, I_{BAT}=40mA	4.158	4.2	4.242	V
		$V_{TS\text{-}60°C} \le V_{TS} \le V_{TS\text{-}45°C}$, I_{BAT}=40mA	4.01	4.05	4.09	
V_{CC} to BAT ON Resistance	R_{ON_BAT}		---	600	---	mΩ
Recharge Battery Threshold Voltage	ΔV_{RECHRG}	V_{FLOAT}-$V_{RECHRG,}$	100	150	200	mV
Recharge Comparator Filter Time	$T_{RECHARGE}$	V_{BAT} High to Low	---	120	---	mS
Pre Charge Threshold Voltage	$V_{PRE\text{-}CHG}$	R_{PROG}=10kΩ, V_{BAT} Rising	2.8	2.9	3	V
Pre Charge Hysteresis Voltage	V_{TRHYS}	R_{PROG}=10kΩ	60	80	110	mV
Current Regulation						
BAT fast charge formula	I_{BAT}	V_{BAT}(FLOAT) > V_{BAT} > $V_{PRE\text{-}CHG}$; VCC = 5V	K_{ISET}/R_{PROG}			
Fast charge current factor	K_{ISET}	R_{PROG} = K_{ISET}/I_{BAT}, 100mA < I_{BAT} < 500mA	930	1000	1070	AΩ
		R_{PROG} = K_{ISET}/I_{BAT}, 50mA < I_{BAT} < 100mA	861	1000	1139	AΩ
		R_{PROG} = K_{ISET}/I_{BAT}, 10mA < I_{BAT} < 50mA	861	1000	1139	AΩ
PROG Pin Pull-Up Current	I_{PROG}	VCC=BAT=4.2V, SEL_ICHG>VCC-0.4V	---	3	---	µA
C/10 Termination Current Threshold	I_{TERM}	SEL_ICHG=VCC,PRETERM=VCC	0.085	0.1	0.115	A/A
Termination Comparator Filter Time	T_{TERM}	I_{BAT} Falling Below I_{CHG}/10	---	30	---	mS
Pre-Charge – SET BY PRETERM terminal						
PRE-TERM Pin Pull-Up Current	$I_{PRE\text{-}TERM}$	BAT=4V, R_{PROG}=10k, $R_{PRE\text{-}TERM}$ = 2kΩ	46	50	54	µA
Pre-charge current formula	%PRE-CHG (%)	$R_{PRE\text{-}TERM}$ = KPRE-CHG (Ω/%) × %PRE-CHG (%)	$R_{PRE\text{-}TERM}/K_{PRE\text{-}CHG\%}$			
Pre -charge Factor	$K_{PRE\text{-}CHG}$	$R_{PRE\text{-}TERM}$ = 2k to 10kΩ; R_{PROG} =2kΩ; where %$I_{FAST\text{-}CHG}$ is 20 to 100%	90	100	110	Ω/%
		$R_{PRE\text{-}TERM}$ = 1k to 2kΩ; R_{PROG} =2kΩ; where %$I_{FAST\text{-}CHG}$ is 10 to 20%	83	100	117	Ω/%

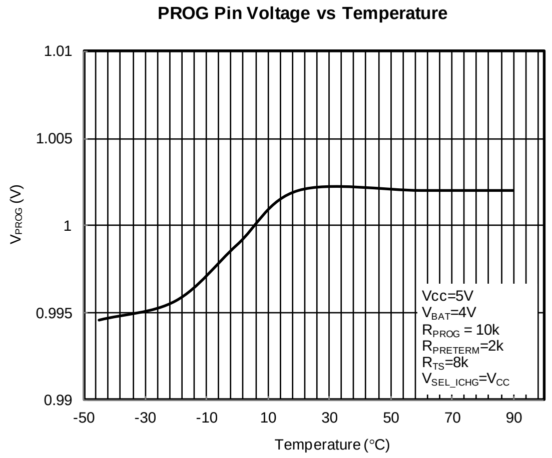
Electrical Characteristics (Continued)

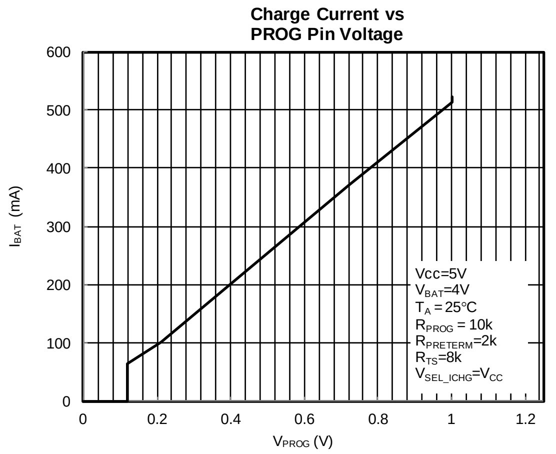
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
TERMINATION – SET BY PRETERM terminal						
Termination Current Threshold Formula	%TERM(%)	$R_{PRE\text{-}TERM}$ = KTERM (Ω/%) × %TERM (%)	$R_{PRE\text{-}TERM}$/ $K_{TERM\%}$			
Term Factor	K_{TERM}	$R_{PRE\text{-}TERM}$ = 2k to 10kΩ; R_{PROG} =2kΩ where %$I_{FAST\text{-}CHG}$ is10 to 50%	182	200	218	Ω/%
		$R_{PRE\text{-}TERM}$ = 1k to 2kΩ; R_{PROG} =2kΩ where %$I_{FAST\text{-}CHG}$ is 5 to 10%	170	200	230	Ω/%
Thermistor Monitor: 10k NTC						
NTC bias current	$I_{NTC\_0.3V}$	V_{TS} = 0.3V	48	50	52	µA
I NTC Fold back	$\Delta I_{NTC\_1.3V}$	V_{TS}: Set to 1.3V; ΔINTC _1.3V= INTC_0.3V- INTC_1.3V	0	1	2.5.	µA
	$I_{NTC\_1.55V}$	V_{TS}: Set to 1.55V	2.8	4	5.2	
TS maximum voltage clamp	$V_{CLAMP(TS)}$	V_{TS} = Open (Float)	1.7	2.1	2.5	V
TTDM Trip Point	V_{TTDM}	V_{TS}: 0.5V → 1.7V;	1.55	1.6	1.650	V
TTDM Trip Point hysteresis	$V_{TTDM,HYS}$	V_{TS}: 1.7V → 0.5V;	---	44	---	mV
Cold Temperature Trip Point (0°C)	V_{COLD}	V_{TS}: 1V → 1.5V	1.206	1.231	1.256	V
Cold temperature trip point hysteresis	$V_{COLD,HYS}$	V_{TS} :1.5V → 1V	---	88	---	mV
Cool Temperature Trip Point (10°C)	V_{COOL}	V_{TS}: 0.6V → 1V	0.766	0.791	0.816	V
Cool temperature trip point hysteresis	$V_{COOL,HYS}$	V_{TS}: 1V → 0.6V	---	35	---	mV
Cool2 Temperature Trip Point (24°C)	V_{COOL2}	V_{TS}: 0.3V → 0.7V	0.506	0.527	0.548	V
Cool2 temperature trip point hysteresis	$V_{COOL2,HYS}$	V_{TS}: 0.7V → 0.3V	---	22	---	mV
Warm Temperature Trip Point (45°C)	V_{WARM}	V_{TS}: 0.5V → 0.2V	0.263	0.278	0.293	V
Warm temperature trip point hysteresis	$V_{WARM,HYS}$	V_{TS}: 0.2V → 0.5V	---	14.7	---	mV
Hot Temperature Trip Point (60°C)	V_{HOT}	V_{TS}: 0.2V → 0.1V	0.164	0.176	0.188	V
Hot temperature trip point hysteresis	$V_{HOT,HYS}$	V_{TS}: 0.1V → 0.2V	---	11	---	mV
Charge Enable Threshold	V_{TS_EN}	V_{TS}: 0V → 0.16V;	77.44	88	98.56	mV
Charge Enable Threshold hysteresis	$V_{TS\_EN\_HYS}$	V_{TS}: 0.16V → 0V;	---	11	---	mV
SEL_ICHG Threshold:						
SEL_ICHG pull high Current	I_{SEL_ICHG}	V_{SEL_ICHG}=0V	1.5	2	2.5	µA
SEL_ICHG logic high threshold	$V_{SEL\_ICHG,H}$	VCC=5V	4.6	---	---	V
SEL_ICHG logic low threshold	$V_{SEL\_ICHG,L}$	VCC=5V	---	---	0.4	V
SEL_ICHG high Z voltage	$V_{SEL\_ICHG,HZ}$	VCC=5V	1.4	---	3.6	V
Protection						
Junction Temperature in Constant Temperature Mode	T_{LIM}		---	120	---	°C
Thermal Shutdown Temperature	T_{SD}		---	155	---	°C

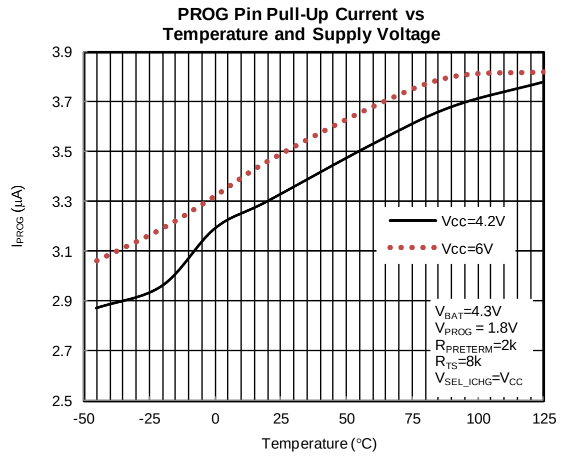
Typical Performance Characteristics

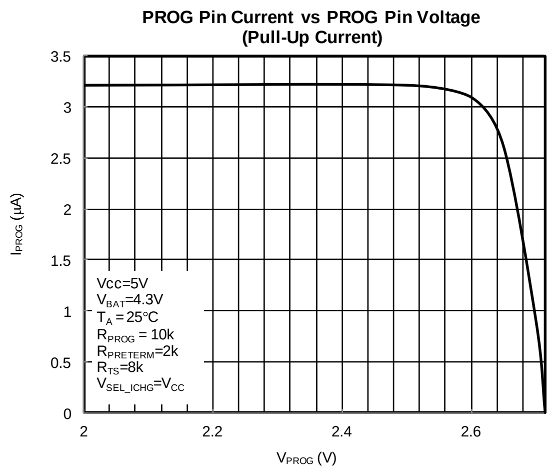
V_{IN}=5.0V, C_{VIN}=1μF, C_{VBAT}=1μF, T_A=25°C, unless otherwise noted.

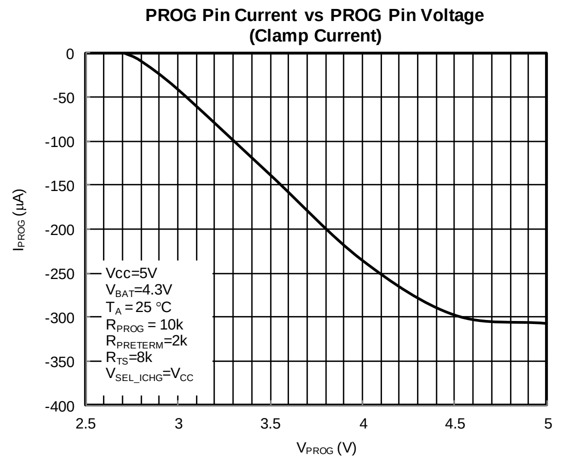






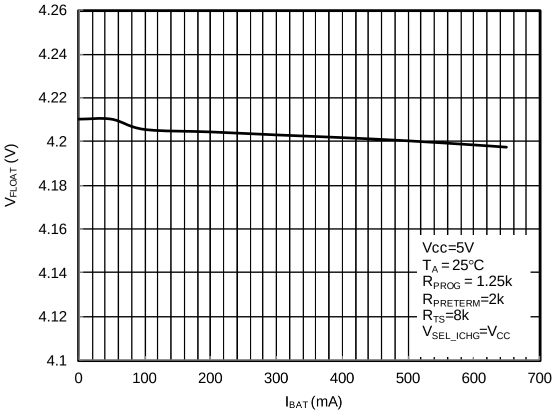




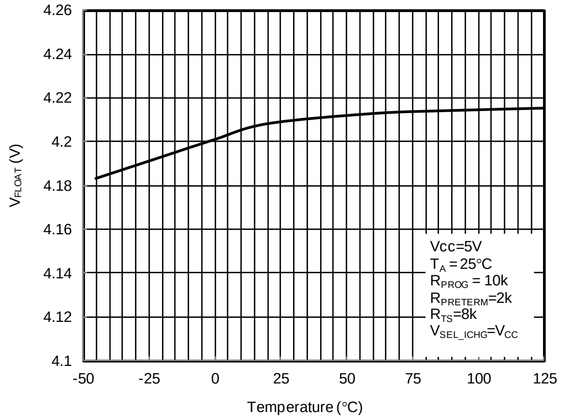


Typical Performance Characteristics (Continued)

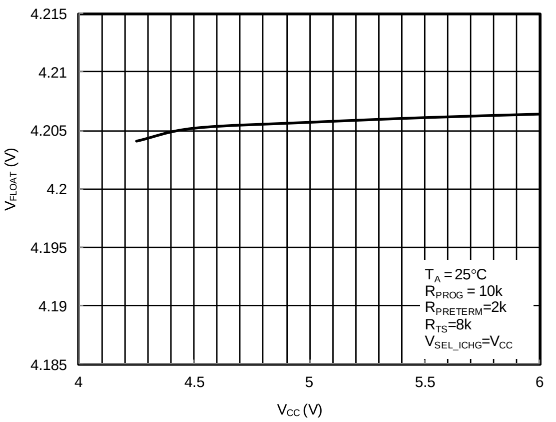
Regulated Output (Float) Voltage vs Charge Current



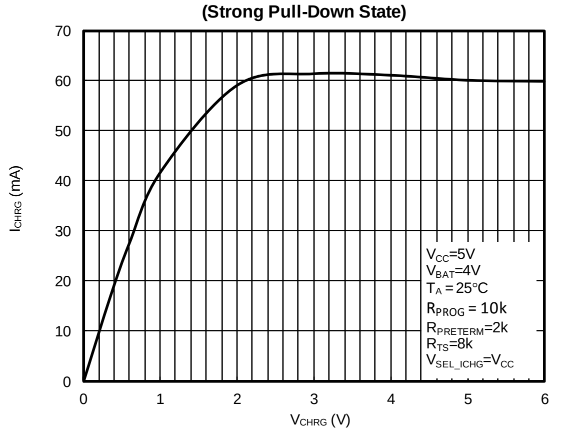
Regulated Output (Float) Voltage vs Temperature



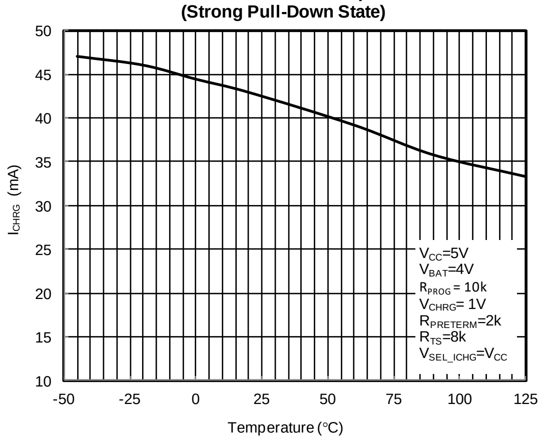
Regulated Output (Float) Voltage vs Supply Voltage



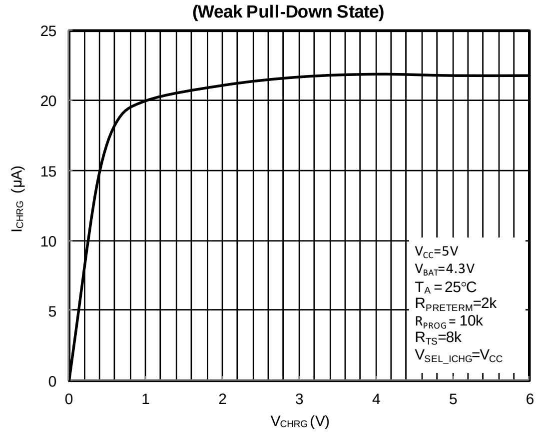
/CHRG Pin I-V Curve
(Strong Pull-Down State)



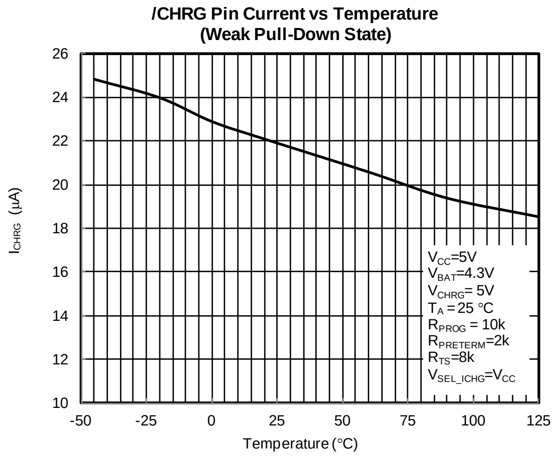
/CHRG Pin Current vs Temperature
(Strong Pull-Down State)

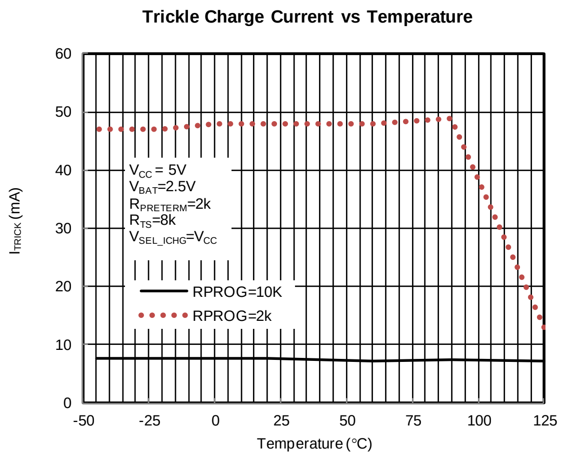


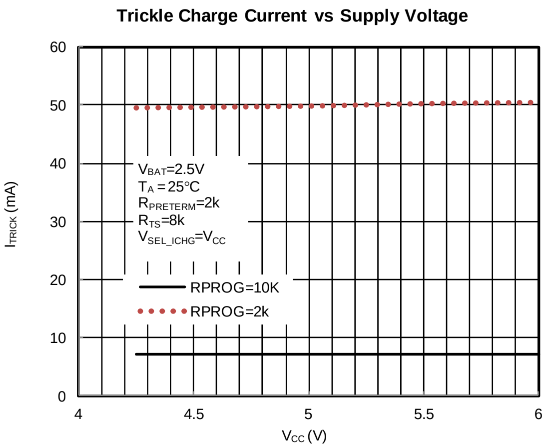
/CHRG Pin I-V Curve
(Weak Pull-Down State)

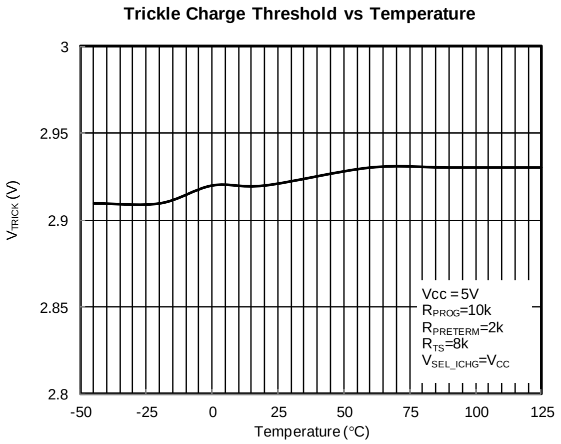


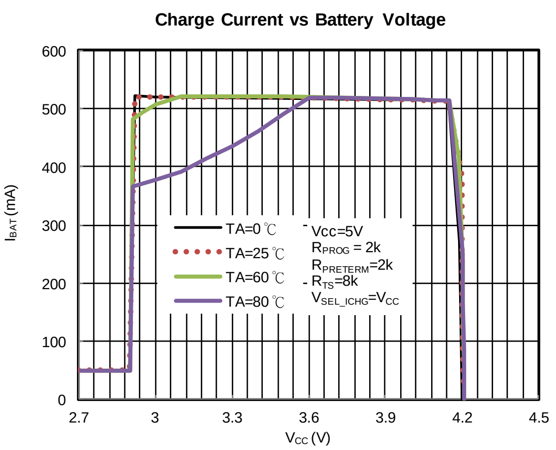
Typical Performance Characteristics (Continued)

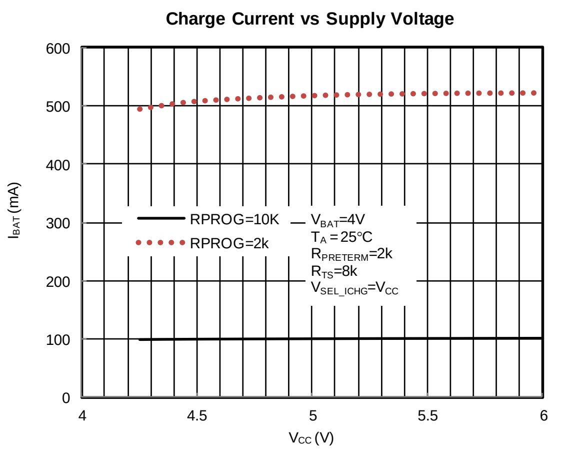






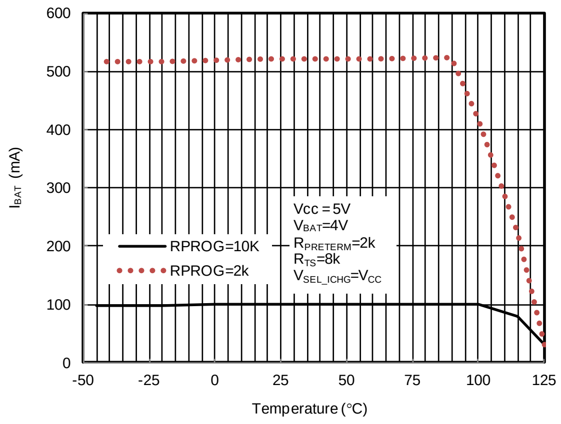




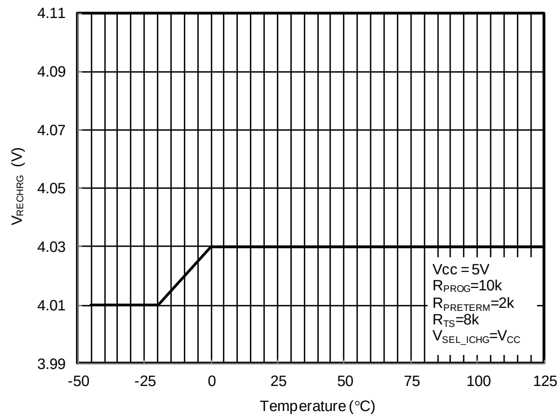


Typical Performance Characteristics (Continued)

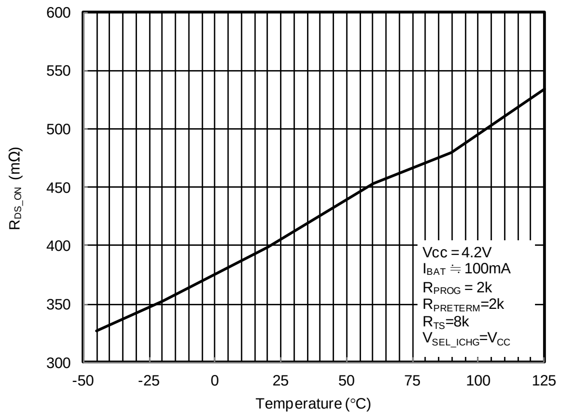
Charge Current vs Temperature



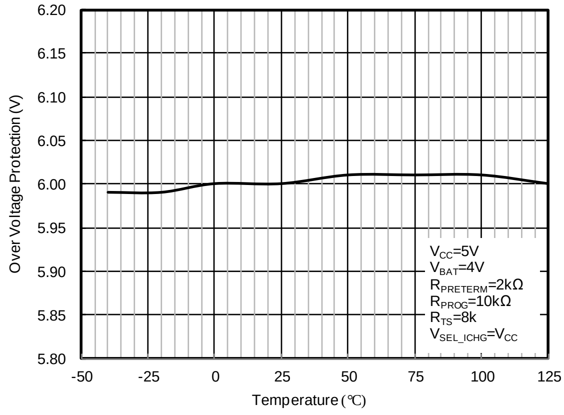
Recharge Voltage Threshold vs Temperature



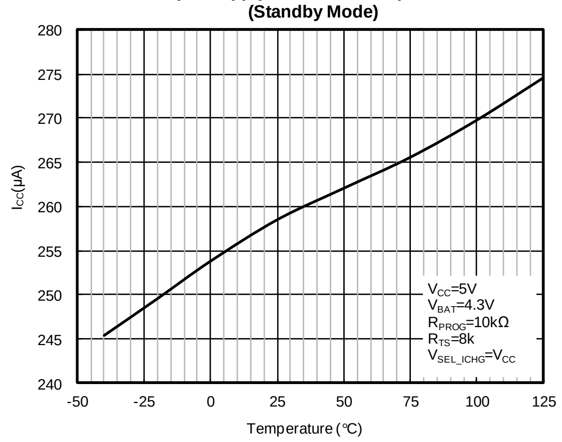
Power FET "ON" Resistance vs Temperature



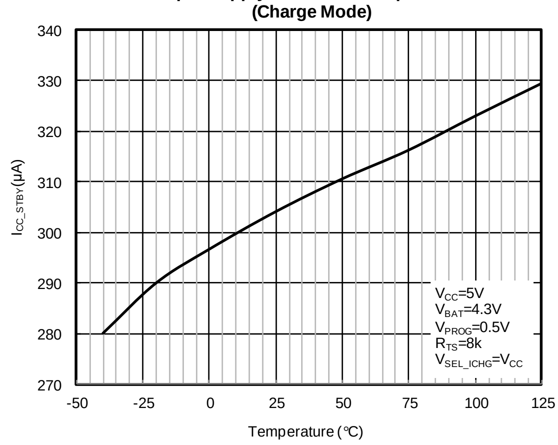
Over Voltage Protection vs Temperature



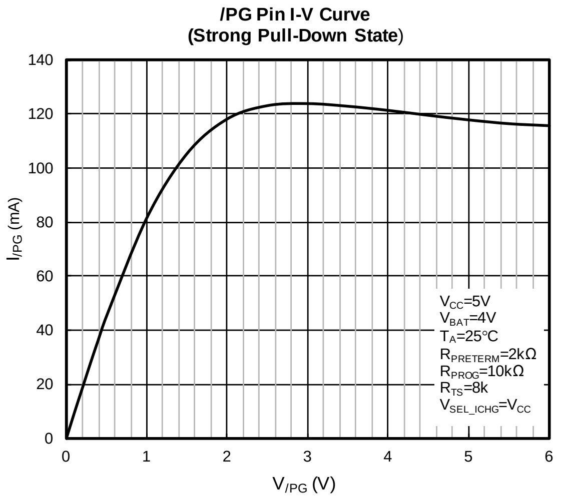
Input Supply Current vs Temperature (Standby Mode)

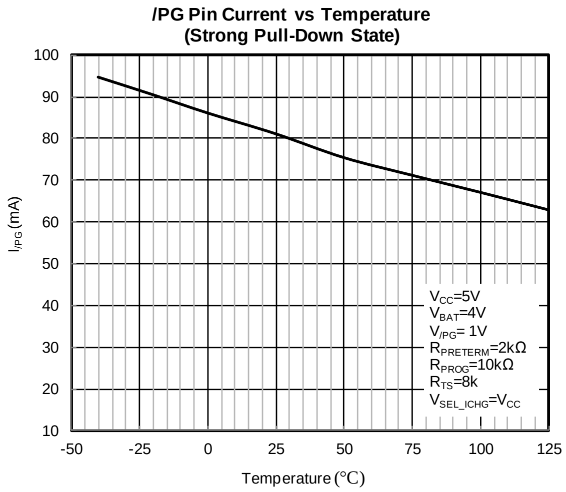


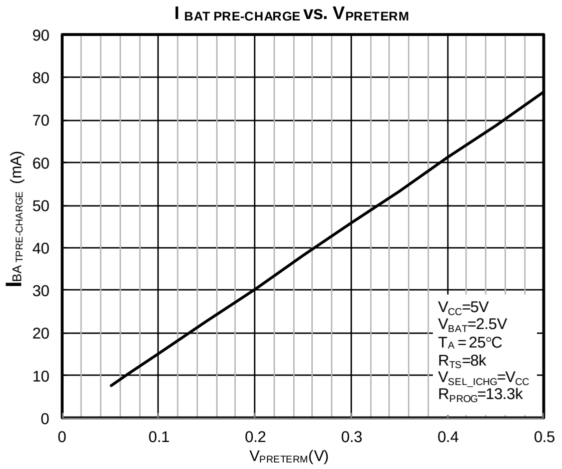
Input Supply Current vs Temperature (Charge Mode)

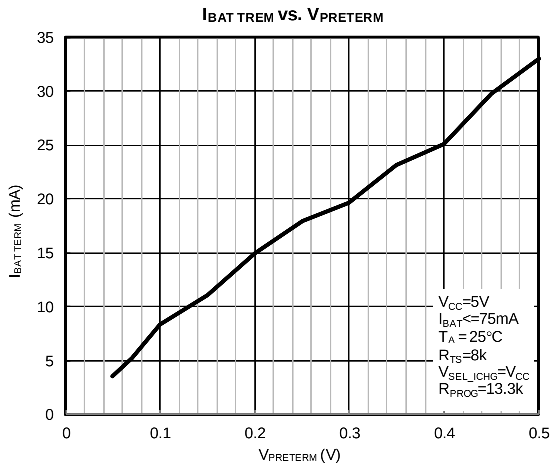


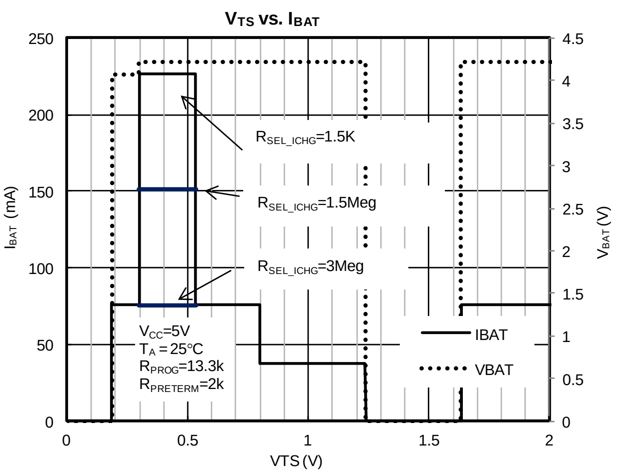
Typical Performance Characteristics (Continued)









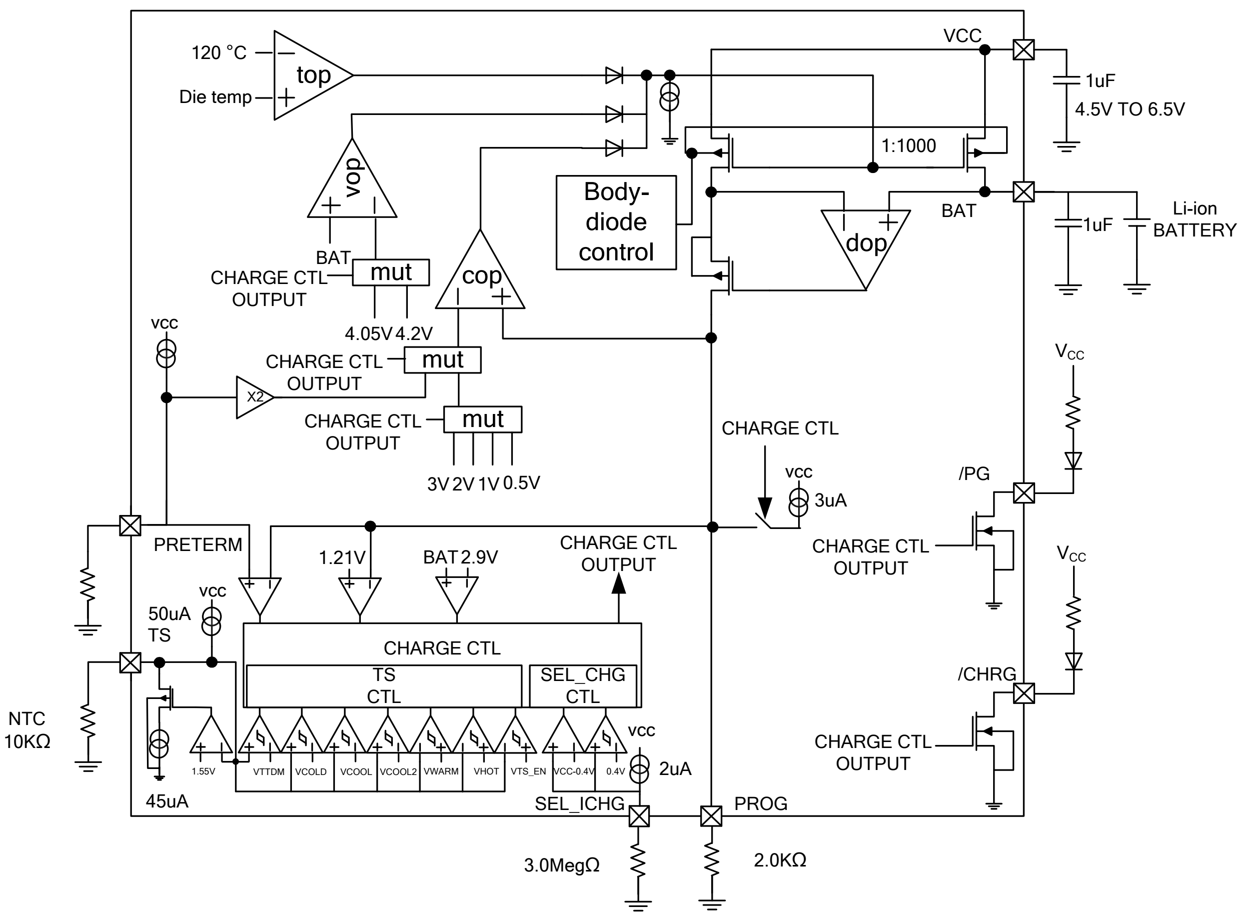


Pin Description

PIN	PIN NAME	FUNCTION
1	V_{CC}	Power supply input
2	PROG	Constant charge current program pin, $I_{BAT}= (V_{PROG}/R_{PROG})*1000=K_{ISET}/ R_{PROG}$.
3	GND	IC ground.
4	PRETERM	Programs the Current Termination Threshold (5 to 50% of I_{BAT} which is set by I_{PROG}) and Sets the Pre- Charge Current to twice the Termination Current Level. Expected range of programming resistor is 1k to 10kΩ (2k: I_{BAT}/10 for term; I_{BAT}/5 for Pre-Charge)
5	/PG	Low (FET on) indicates the input voltage is above UVLO and the OUT (battery) voltage.
6	SEL_ICHG	Configure PROG pin voltage in fast Charge current mode.
7	NC	Do not make a connection to this terminal (for internal use) – Do not route through this terminal
8	/CHRG	Low (FET on) indicates charging and Open Drain (FET off) indicates no Charging or Charge complete.
9	TS	External NTC Thermistor Input. TS monitors a 10kΩ NTC thermistor.
10	BAT	Charge current output pin
EP	EP	The thermal pad must be connected to the same potential as the GND terminal on the printed circuit board. Do not use the thermal pad as the primary ground input for the device. GND terminal must be connected to ground at all times.

Block Diagram & Application Circuit

500mA Single Cell Li-Ion Charger



Detailed Description

Under voltage Lockout (UVLO)

An internal under voltage lockout circuit monitors the input voltage and keeps the charger in shutdown mode until V_{CC} rise above 3.8V. The UVLO circuit has a built-in hysteresis of 0.2V.

PRE_TERM – Pre-Charge and Termination Programmable Threshold

Pre-Term is used to program both the pre-charge current and the termination current threshold. The pre-charge current level is a factor of two higher than the termination current level. The termination can be set between 5 and 50% of the programmed output current level set by PROG.

$R_{PRE\text{-}TERM} = \%Term \times K_{TERM} = \%Pre\text{-}CHG \times K_{PRE\text{-}CHG}$

Where:

• %Term is the percent of fast charge current where termination occurs;

• %Pre-CHG is the percent of fast charge current that is desired during pre-charge;

• K_{TERM} and $K_{PRE\text{-}CHG}$ are gain factors found in the electrical specifications

PRE_TERM floating Pre-Charge and Termination Threshold

If left PRE_TERM pin floating the termination and pre-charge are set internally at 10/10% respectively. The charge current is programmed by an external resistor from the PROG pin to ground. The charge current is 1000 times the current out of the PROG pin. In the constant-current mode, the program resistor and the charge current can be calculated by the following equations:

$R_{PROG} = 1000 * 1V / I_{CHG}$, $I_{CHG} = 1000 * 1V / R_{PROG}$.

In the Pre-charge mode, the program resistor and the charge current can be calculated by the following equations:

$R_{PROG} = 1000 * 0.1V / I_{CHG}$, $I_{CHG}=1000 * 0.1V / R_{PROG}$;

The charge current out of the BAT pin can be determined by PROG pin voltage by the following equation:

$I_{BAT} = 1000 * V_{PROG} / R_{PROG}$

Normal Charge Cycle

When the voltage at the V_{CC} pin is over the UVLO threshold, the program resistor is connected from the PROG pin to ground and the voltage at V_{CC} pin is over the voltage at BAT pin plus 0.1V, the charge cycle would start to charge. If the BAT pin voltage is less than 2.9V, the charge cycle starts from trickle-charge mode. If the BAT pin voltage is greater than 2.9V, the charge cycle would start from constant-current mode.

In the trickle-charge mode, the charge current is about 1/10th programmed charging current. In the constant-current mode, the G2277 would supply fully programmed charge current. When the BAT pin approaches the final regulation voltage (4.2V), the G2277 enters to the constant-voltage mode and the charge current starts to decrease from programmed current. When the charge current drops below to 1/10th programmed current, the open drain NMO /CHRG pin would be pull low weakly and turning off the charge loop.

The G2277 constantly monitors the BAT pin voltage in standby mode. If this voltage drops below the 4.05V re-charge threshold (V_{RECHRG}), another charge cycle begins and current is once again supplied to the battery. Manually restart a charge cycle when in standby mode, the input voltage must be removed and reapplied, or the charger must be shut down and restarted using the PROG pin. Fig. 1 shows the state diagram of a typical charge cycle.

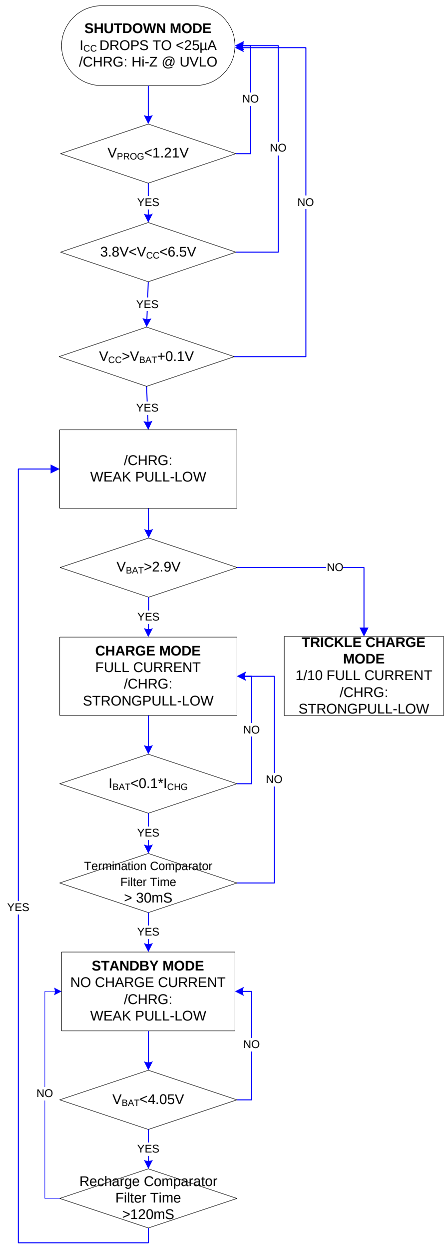


Fig. 1 State Diagram

Charge Status Indicator (/CHRG)

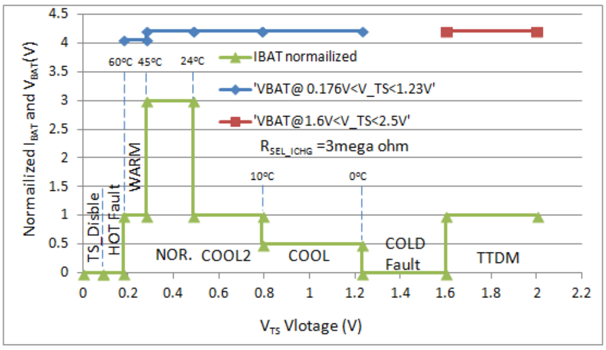
The charge status output has three different states: strong pull-down (~10mA), weak pull-down (~20µA) and high impedance. The strong pull-down indicates that G2277 is charging. Once the charge cycle has terminated, the pin state is determined by under voltage lockout conditions. A weak pull-down indicates that the input voltage rises above the UVLO and $V_{CC}>V_{BAT}+V_{ASD}$, but is less than OVP ($V_{CC}<V_{OVP}$). High impedance indicates charge termination, manual shutdown, UVLO or over temperature conditions.

Charge Status Indicator (/PG)

/PG function as /CHRG weak pull-down. /PG pull-down indicates that the input voltage rises above the UVLO and $V_{CC}>V_{BAT}+V_{ASD}$, but is less than OVP ($V_{CC}<V_{OVP}$). High impedance indicates charge termination, manual shutdown, UVLO or over temperature conditions.

TS

The TS function is designed to follow the new JEITA temperature standard for Li-Ion and Li-Poly batteries. There are now four thresholds, 60°C, 45°C, 24°C 10°C, and 0°C. Normal operation occurs between 10°C and 24°C. If between 0°C and 10°C the charge current level is cut in half, If between 24°C and 45°C the charge current level is multiple 1~3 times setting by SEL_ICHG PIN and if between 45°C and 60°C the regulation voltage is reduced to 4.05V, see Figure follow. The TS feature is implemented using an internal 50µA current source to bias the thermistor (designed for use with a 10k NTC β = 3370 (SEMITEC 103AT-2 or Mitsubishi TH05-3H103F) connected from the TS terminal to GND. If this feature is not needed, a fixed 8.2kΩ can be placed between TS and Vss to allow normal operation. If the TS terminal is driven high the TS function is also in normal operation. This may be done if the host is monitoring the thermistor and then the host would determine when to pull the TS terminal low to disable charge. The TS terminal has three additional features, when the TS terminal is pulled low or floated. A low disables charge (similar to a high on the BAT_EN feature) and a float puts the charger in TTDM. Above 60°C or below 0°C the charge is disabled. it is not possible to use thermistor values other than the 10k NTC (at 25°C).



Over Temperature Protection

An internal thermal feedback loop reduces the programmed charge current if the die temperature attempts to rise above a preset value of approximately 120°C. This feature protects the G2277 from excessive temperature and allows the user to push the limits of the power handling capability of a given circuit board without risk of damaging the G2277. The charge current can be set according to typical (not worst-case) ambient temperature with the assurance that the charger will automatically reduce the current in worst-case conditions.

SEL_ICHG Function

The G2277 provide charge current level is multiple 1~3 times function in specific temperature range

$V_{TS-45°C} \leq V_{TS} \leq V_{TS-24°C}$.

When SEL_ICHG>VCC-0.4V, $I_{BAT}=K_{ISET}/R_{PROG}$.
When 1.4V<SEL_ICHG<VCC-1.4V,

$I_{BAT}=2*K_{ISET}/R_{PROG}$.

When SEL_ICHG < 0.4V, $I_{BAT}=3*K_{ISET}/R_{PROG}$.

Manual Shutdown

The G2277 can be put into shutdown mode by removing R_{PROG} thus floating the PROG pin in SEL_ICHG pin floating. This reduces the battery drain current to less than 1µA and the quiescent current to less than 25µA. The G2277 would be restarted by reconnecting the program resistor.

Application Information

Power Dissipation

The die attachment area of the G2277's lead frame is connected to pin 2, which is the GND pin. Therefore, the GND pin of G2277 can carry away the heat of the G2277 die very effectively. To improve the power dissipation, connect the GND pin to ground using a large ground plane near the GND pin.

V_{CC} Bypass Capacitor

Several types of capacitors can be used for input bypassing. Because of the self-resonant and high Q characteristics of some types of ceramic capacitors, it could generate high voltage transients under some start-up conditions, such as connecting the charger input to a live power source. Adding a 1.5Ω resistor in series with a ceramic capacitor will minimize the start-up voltage overshoot transients.

USB and Wall Adapter Power

The power source of G2277 can be both a wall adapter and a USB port. Fig 2 shows an example of how to combine wall adapter and USB power inputs.

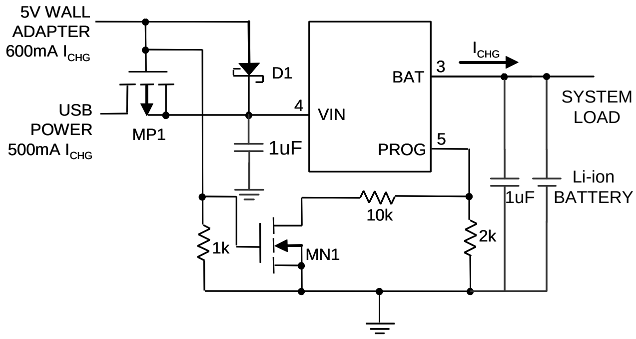
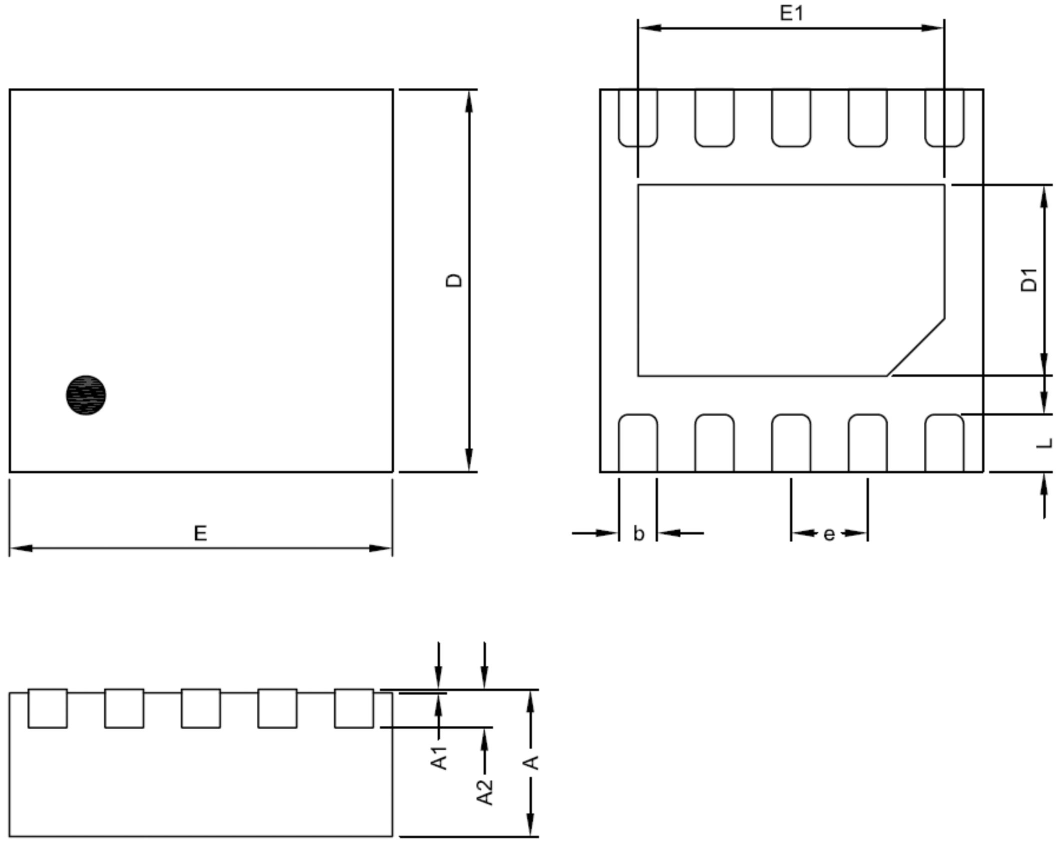


Fig. 2 Combining Wall Adapter and USB Power

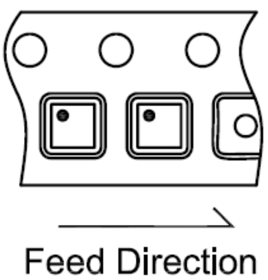
Package Information



TDFN2X2-10 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	1.95	2.00	2.05	0.0768	0.0787	0.0807
E	1.95	2.00	2.05	0.0768	0.0787	0.0807
D1	0.85	0.95	1.05	0.0334	0.0374	0.0413
E1	1.35	1.50	1.65	0.0531	0.0591	0.0650
b	0.15	0.20	0.25	0.0059	0.0079	0.0098
e	0.40 BSC			0.0157 BSC		
L	0.20	0.30	0.35	0.0079	0.0118	0.0138

Taping Specification



PACKAGE	Q'TY/REEL
TDFN2X2-10	3,000 ea