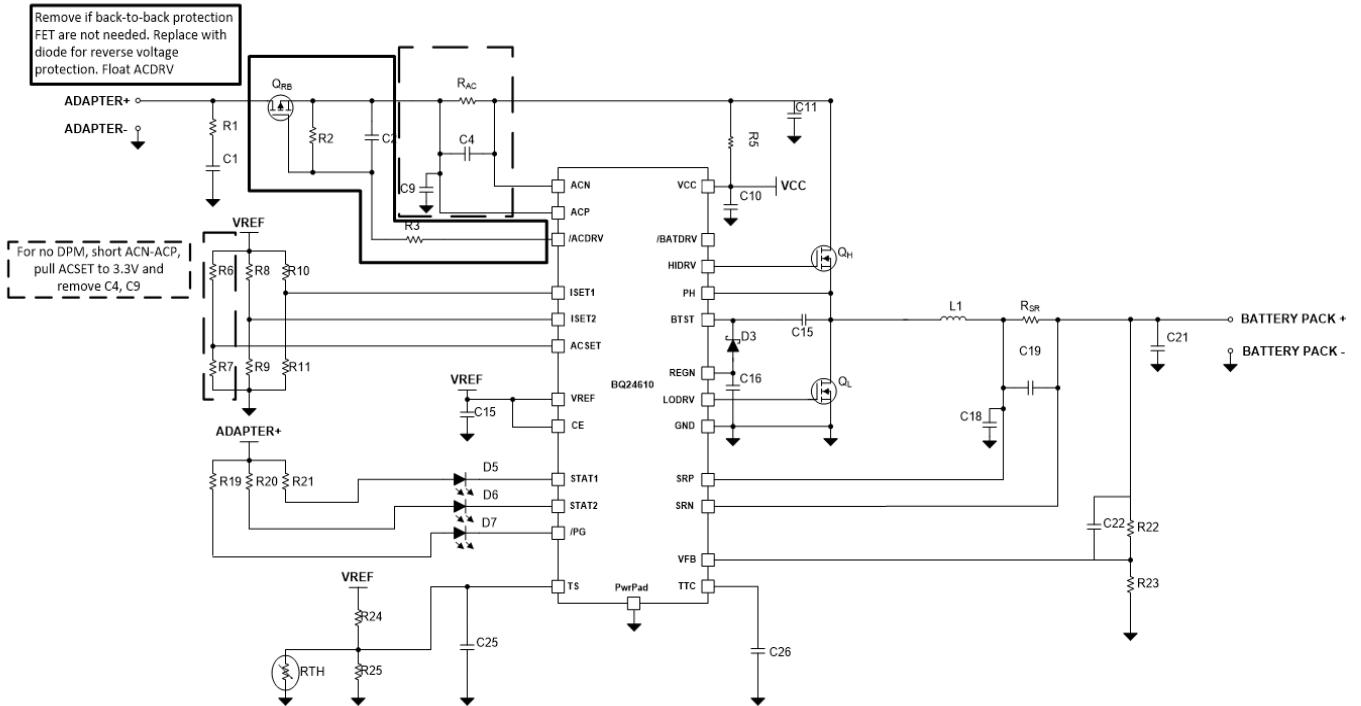
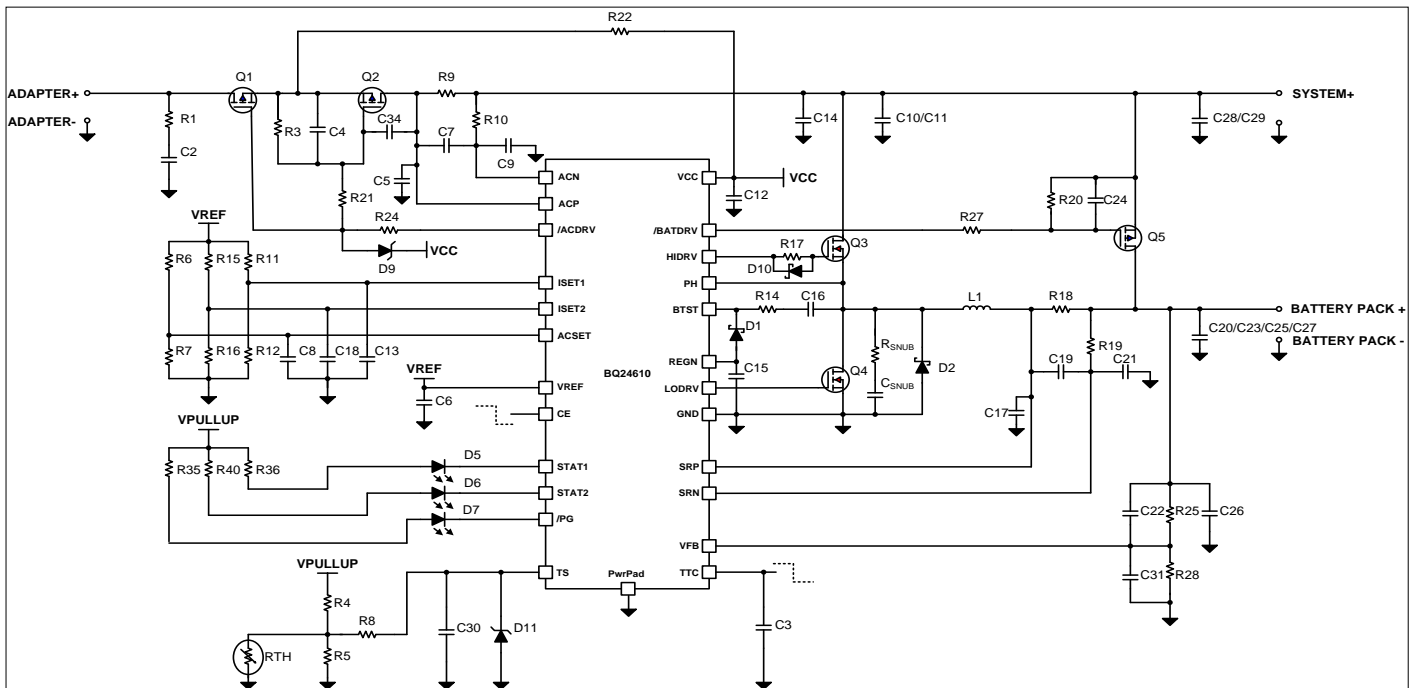
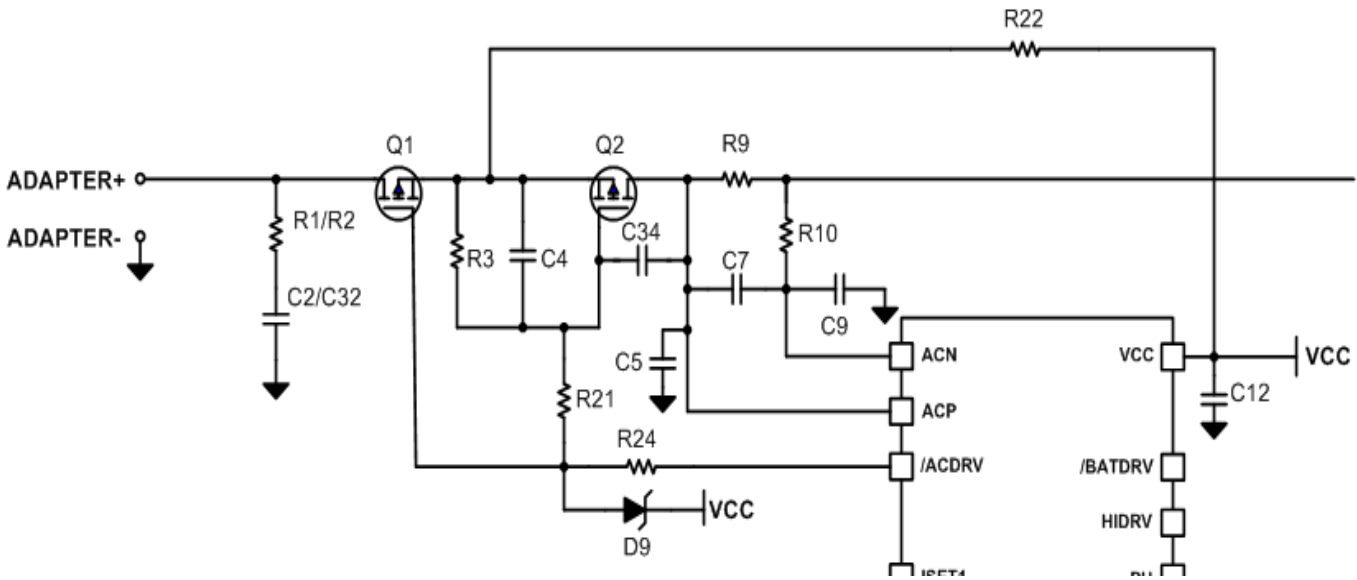


BQ24610 Simplified Non PowerPath



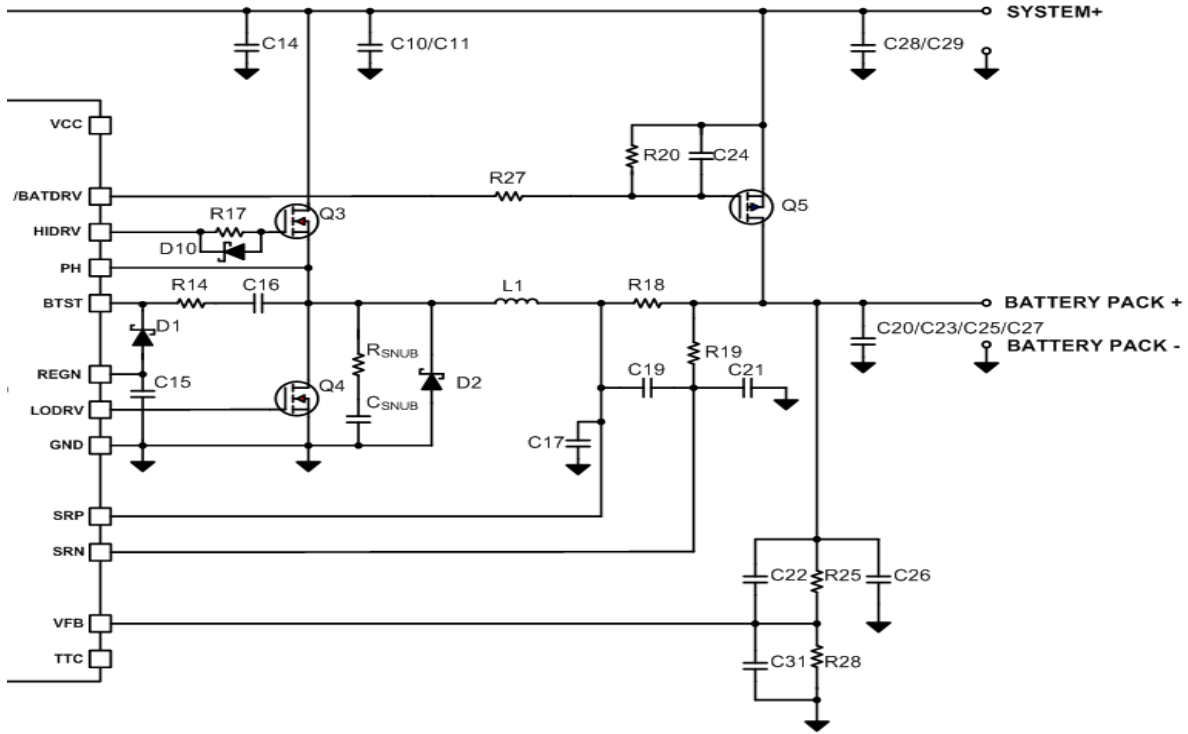
BQ24610 Schematic





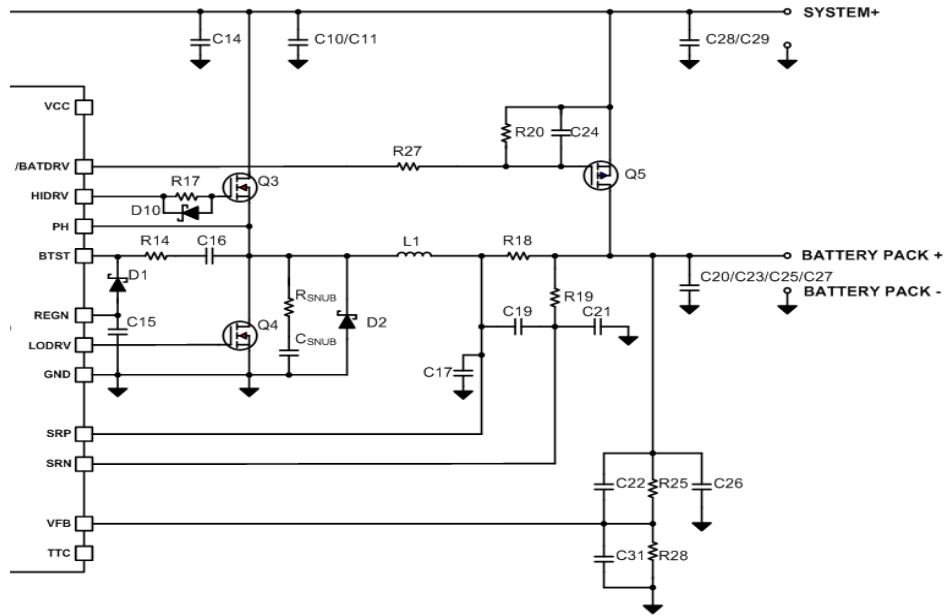
INPUT POWER - DESIGN CHECKLIST								
PIN NAME	REQUIREMENT	COMPONENT	MIN	TYP	MAX	DESCRIPTION	COMMENTS AND RELEVANT EQUATIONS	
ADAPTER+ / ADAPTER-	Input source to the charger							
	Recommended	Q1		-		Back-to-back input protection P-Channel MOSFETs	Used to isolate the battery and adapter. This blocks reverse current from the battery back the input. If Q1 not included, use diode to block reverse current	
		Q2		-				
	Recommended	R1/R2 C2/C32		2 Ω 2.2 uF		Input hot-plug snubber circuit	Used to dampen ringing due to input inrush current	
	Recommended	R3		100 kΩ		Input MOSFETs turn-on/turn-off delay	Used to isolate the battery and adapter. This also limits inrush current to the system by providing limited di/dt when connecting the adapter to the system by controlling the FET turn-on time	
		C4		0.1 uF				
Optional	R21 C34				Additional turn-on delay for Q2 to further limit di/dt and limit inrush current			
ACP-ACN 1-2	Differential input current sensing							
	Required	R9 (R _{AC})		10 mΩ		Input current sensing resistor	$I_{DIRV} = \frac{V_{ACN-ACP}}{20 \times R_{AC}}$	
	Recommended	C7		0.1 uF		Differential mode noise filtering	Filter differential-mode voltage to avoid amplification of high frequency signals, for more accurate current sensing	
	Recommended	C5		0.1 uF		Common mode noise filtering	Filter common-mode voltage to avoid amplification of high frequency signals, for more accurate current sensing	
	Optional	C9		0.1 uF				
Optional	R10							
/ACDRV 3	P-Channel MOSFET input protection gate driver							
	Recommended	R24		1 kΩ		Input MOSFETs gate drive strength limiting resistor	Increase turn-on time to limit inrush current	
	Optional	D9				Input MOSFETs gate-source Zener clamp	Clamp Vgs under MOSFET abs. max. Vgs to protect MOSFET	
VCC 24	IC power positive supply							
	Required	R22		10 Ω		VCC inrush current limiting		
	Required	C12		1.0 uF		VCC decoupling capacitor		

BQ24610 - Output Power Design



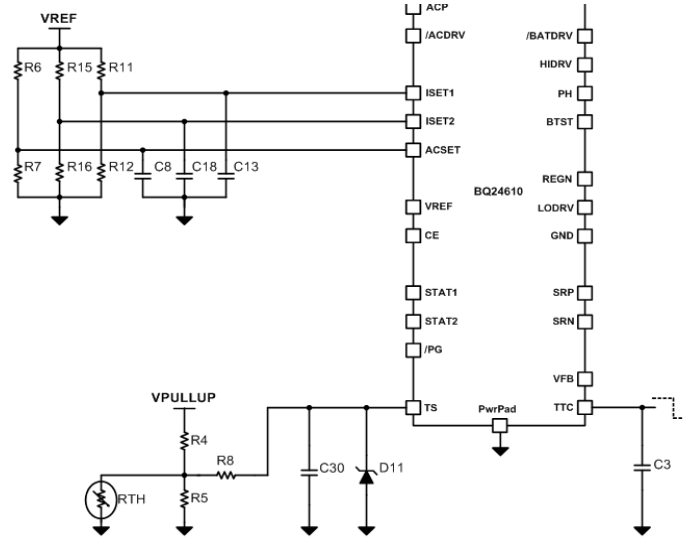
PIN NAME	REQUIREMENT	COMPONENT	MIN	TYP	MAX	DESCRIPTION	COMMENTS AND RELEVANT EQUATIONS
SYSTEM+	System output either from input source or battery						
	Required	C10/C11		10 uF		High frequency converter input capacitor(s)	
	Required	C28/C29		10 uF		System output noise filtering capacitor(s)	
	Recommended	C14		10 nF		High frequency noise decoupling capacitor	
/BATDRV	P-Channel BAFET power path gate driver						
	Recommended	Q5		-		External P-Channel BAFET for power path	If power path is not needed, remove Q5 and float BATDRV as shown in BQ24610 Simplified Non PowerPath
	Recommended	R27		1 kΩ		Input MOSFETs gate drive strength limiting resistor	Increase turn-on time to limit shoot-through current
	Recommended	R20		100 kΩ		External BAFET turn-on/turn-off delay	
		C24		0.1 uF			
BATTERY PACK+ / BATTERY PACK-	Battery or battery pack connection to the charger						
	Required	C20/C23/C25/C27		*uF		Converter output filtering capacitor(s)	$f_o = \frac{1}{2 \cdot \pi \cdot \sqrt{L_{out}} \cdot C_{out}}$ Recommended: 12 kHz < fo < 17 kHz
VFB	Battery regulation voltage feedback						
	Required	R25		*kΩ		Resistor divider feedback for battery voltage regulation setting	$V_{BATREG} = \left(1 + \frac{R_{25}}{R_{28}}\right) \times 2.1V$ $V_{RECHG} = \left(1 + \frac{R_{25}}{R_{28}}\right) \times 2.05V$ $V_{BATLOWV} = \left(1 + \frac{R_{25}}{R_{28}}\right) \times 1.55V$
		R28		*kΩ			
	Optional	C26		100 nF		High frequency noise decoupling capacitor	
	Optional	C22		22pF			
Optional	C31		DNP				

OUTPUT POWER - DESIGN CHECKLIST



SRP-SRN	13-14				Differential charge current sensing	
		Required	R18 (R _{SR})	10 mΩ	Charge current sensing resistor	$I_{CHARGE} = \frac{V_{ISET} - 1}{20 \times R_{SR}}$
		Recommended	C19	0.1 uF	Differential mode noise filtering	Filter differential-mode voltage to avoid amplification of high frequency signals, for more accurate current sensing
		Recommended	C17	0.1 uF	Common mode noise filtering	Filter common-mode voltage to avoid amplification of high frequency signals, for more accurate current sensing
		Optional	C21	0.1 uF		
REGN	18				Internal LDO output	
		Required	C15	1.0 uF	Internal LDO output stabilizing capacitor	
		Required	D1		Bootstrap capacitor refresh and blocking Schottky diode	Schottky diodes reduce the risk associated with charge supplied back to the gate driver supply from the bootstrap capacitor and minimize leakage current. Fast reverse recovery minimizes losses
LODRV	19				Converter Low-Side N-Channel MOSFET gate driver	
		Required	Q4	-	Converter synchronous Low-Side N-Channel MOSFET	
PH & BTST	20 & 22				PH node	
		Required	L1	*uH	Converter output filtering inductor	$f_o = \frac{1}{2 \cdot \pi \cdot \sqrt{L_{out} \cdot C_{out}}}$ Recommended: 12 kHz < f _o < 17 kHz
		Required	C16	0.1 uF	Converter bootstrap capacitor for High-Side N-Channel MOSFET gate driver	
		Recommended	R14	10 Ω	Bootstrap capacitor discharge current limiting resistor	Limits peak current through bootstrap diode, and also reduces switch node ringing by slowing down turn-on of HSFET
		Recommended	R _{SNUB} C _{SNUB}	DNP DNP	Switching converter snubber circuit	Reduce switch node ringing on HSFET turn-on. Recommended to include footprint for evaluation, in case parasitic components from layout result in higher than expected ringing causing switching loss and EMI noise.
HIDRV	21				Converter High-Side N-Channel MOSFET gate driver	
		Required	Q3	-	Converter active High-Side N-Channel MOSFET	
		Recommended	R17		Converter active High-Side MOSFET gate drive strength limiting resistor	Increase turn-on time of HSFET to reduce ringing at PH node. Also increases turn-off time and reduces efficiency
		Optional	D10		Diode for fast High-Side MOSFET turn-off	Adding gate resistor limits turn-on and turn-off of HSFET resulting in lower efficiency. Diode allows faster turn-off and slower turn-on, reducing ringing on HSFET turn-on, and also reducing effects on efficiency by turning off faster.
GND	17				IC Ground return	

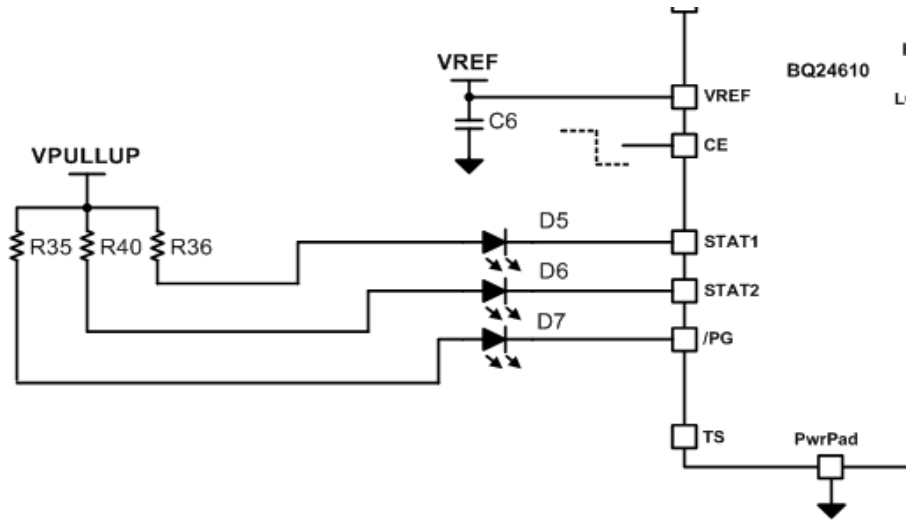
BQ24610 - Hardware Programmed Input Design



HARDWARE PROGRAMMED INPUT - DESIGN CHECKLIST

PIN	REQUIREMENT	COMPONENT	MIN	TYP	MAX	DESCRIPTION	COMMENTS AND RELEVANT EQUATIONS
TS						Battery thermistor temperature qualification window setting resistor network	
	Required	R4		*Ω		Resistor network to set window for thermistor temperature-based battery charging profile	
	Required	R5		*Ω			
	Recommended	RTH		*Ω		External battery thermistor	
	Recommended	R8		100 Ω		Current limiting resistor for TS pin transient	
	Recommended	C30		0.1 uF		High frequency noise decoupling and/or thermistor detach delay capacitor	
TTC						Safety timer and termination setting and disable	
	Recommended	C3 (C _{TTC})		*nF		Safety timer setting capacitor	Cannot be floating HIGH disables safety timer LOW disables termination and safety timer Capacitor sets safety timer duration See Electrical Characteristics table for minimum and maximum fast charge safety timer settings $t_{CHARGE} = C_{TTC} \times K_{TTC}$
ISET1						Fast charge current reference setting	
	Required	R11		*Ω		Resistor divider network for fast charge current setting	$I_{CHARGE} = \frac{V_{ISET1}}{20 \times R_{SR}}$
Recommended	C13		0.1 uF		High frequency noise decoupling capacitor		
ISET2						Pre-charge and termination current reference setting	
	Required	R15		*Ω		Resistor divider network for pre-charge and termination current setting	$I_{TERM} = \frac{V_{ISET2}}{100 \times R_{SR}}$ $I_{PRECHARGE} = \frac{V_{ISET2}}{100 \times R_{SR}}$
Recommended	C18		0.1 uF		High frequency noise decoupling capacitor		
ACSET						Input current limit reference setting	
	Required	R6		*Ω		Resistor divider network for input current limit setting	$I_{DPM} = \frac{V_{ACSET}}{20 \times R_{AC}}$
Recommended	C8		0.1 uF		High frequency noise decoupling capacitor		

BQ24610 - Hardware Programmed Input Design



COMMUNICATION AND MISC INPUT/OUTPUT SIGNAL - DESIGN CHECKLIST

PIN NAME	REQUIREMENT	COMPONENT	MIN	TYP	MAX	DESCRIPTION	COMMENTS AND RELEVANT EQUATIONS
CE	4					Active HIGH input signal pin to enable charge	Cannot be floating HIGH enables charging LOW disables charging
STAT1	5					Open-drain output signal for charging status	Refer to Datasheet Table 2 for description
		Recommended	R36		10 kΩ	Charging status indicating LED	
		Optional	D5			Charging status indicating LED	
STAT2	9					Open-drain output signal for charging status	Refer to Datasheet Table 2 for description
		Recommended	R40		10 kΩ	Charging status indicating LED	
		Optional	D6			Charging status indicating LED	
/PG	8					Open-drain output signal for input power status	
		Recommended	R35		10 kΩ	Input status indicating LED	
		Optional	D7			Input status indicating LED	
VREF	10	Required	C6			Internal 3.3V LDO	Internal 3.3V LDO output stabilizing capacitor
PwrPad	-					IC Thermal dissipation pad	