MAX20342

USB Type-C Charger Detector with Integrated OVP

General Description

The MAX20342 is a USB Type-C® charger detector that is also capable of detecting chargers compliant with the USB Battery Charging Specification Revision 1.2. The USB Type-C charger detection circuitry functions as a UFP or DRP depending on factory configuration.

The device implements USB Type-C detection logic and enables systems to support charging based on USB Type-C ports. The device also includes charger detection capability for BC1.2 compatible chargers and detects USB standard downstream ports (SDPs), USB charging downstream ports (CDPs), dedicated charger ports (DCPs), and other proprietary chargers. GPIO outputs allow the MAX20342 to control an external lithium-ion (Li+) battery charger based on charger detection results.

The MAX20342 integrates a resistance detection block that can be used to automatically configure factory configuration states based upon attached resistors. Additionally, the resistance measurement can be configured to detect the presence of moisture in the USB Type-C connector.

The MAX20342 also features an integrated low on-resistance, low-capacitance double-pole double-throw (DPDT) USB switch that can pass Hi-Speed USB, full-speed USB, low-speed USB, and UART signals. The switch position can be automatically configured by the USB detection logic or manually controlled.

The MAX20342 features high-ESD protection up to ±15kV human-body model (HBM) on CC1, CC2, SBU1, and SBU2 pins. The CDP and CDN pins are protected against ESD up to ±6kV. The MAX20342 is specified for ±15kV Air-Gap and ±8kV Contact Discharge IEC 61000-4-2 on the CC1, CC2, SBU1, and SBU2 pins. The MAX20342 is available in a 24-bump, 0.4mm pitch, 2.62mm x 2.02mm wafer-level package (WLP) and operates over the -40ºC to +85ºC extended temperature range.

Applications

- DSCs and Camcorders
- Tablets
- Smartphones
- e-Readers

Benefits and Features

- Low Power Consumption
  - Battery Standby Current 17µA (typ)
  - Battery Shutdown Current 2.5µA (typ)
- Delivers USB Compliance and Flexibility
  - Compliant with USB Type-C Specification Revision 1.3
  - Compliant with USB Battery Charger Specification Revision 1.2
  - Detects Proprietary Chargers such as Apple® and Samsung®
- Simplifies Complex System Designs
  - Integrated Overvoltage Protection
  - Negative Swing Audio Capable Hi-Speed USB/UART Switches
  - Automatic Switch and Charger Interface Control
  - Full Control through I^2C Interface
  - Interrupts for Device Status Changes
- Improves Quality and Reliability
  - Automatic Factory Mode Configuration
  - USB Type-C Port Moisture Detection
  - Low-Corrosion DRP Mode
- Robust Protection
  - V_B Connection Withstands up to +30V
  - V_B Surge Protection up to ±120V
  - ±15kV HBM ESD Protection on CC1, CC2, SBU1 and SBU2 Pins
  - ±6kV HBM ESD Protection on CDP and CDN Pins
  - ±15kV Air-Gap IEC 61000-4-2 on CC1, CC2, SBU1, and SBU2 Pins
  - ±8kV Contact Discharge IEC 61000-4-2 on CC1, CC2, SBU1, and SBU2 Pins
- Saves Board Space
  - 2.62mm x 2.02mm WLP Package

***Ordering Information* appears at end of data sheet.**

19-100858; Rev 1; 11/20

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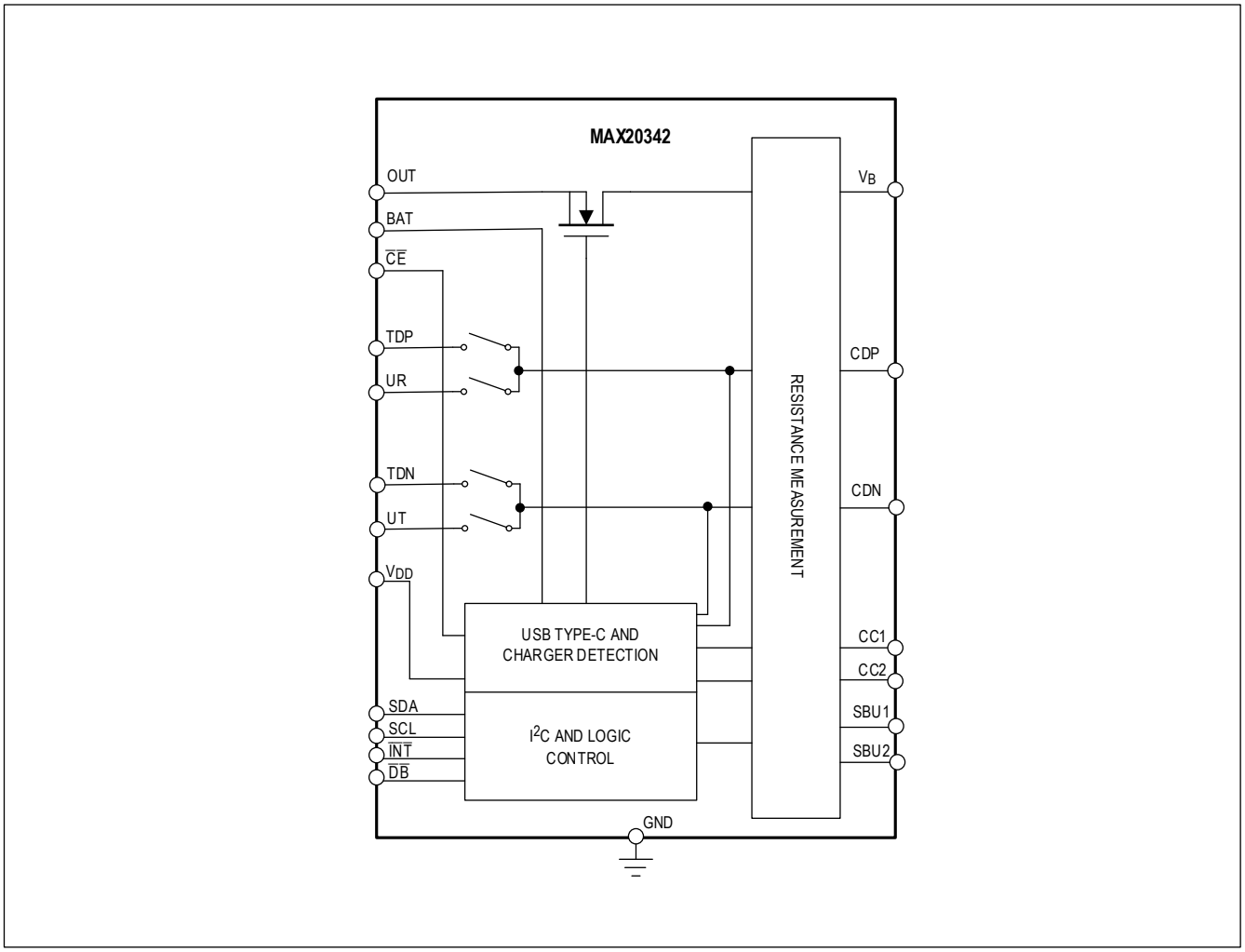
Simplified Block Diagram



Absolute Maximum Ratings

V_B to GND .....-0.3V to +30V

V_B to OUT .....-0.3V to +26V

OUT to GND .....-0.3V to +7.5V

BAT to GND .....-0.3V to +6.0V

$\overline{INT}$, SDA, SCL, $\overline{CE}$, $\overline{DB}$ to GND.....-0.3V to +6.0V

CDN, CDP to GND .....-0.3V to +6.0V

CDN, CDP to GND (AudioCPEn enabled, switches off) .. -3.0V to +6.0V

SBU1, SBU2 to GND.....-0.3V to +6.0V

CC1, CC2 to GND (Note 1) .....-0.3V to +6.0V

TDN, TDP to GND.....-0.3V to +6.0V

UT, UR to GND .....-0.3V to +6.0V

V_{DD} to GND..... -0.3V to +2.2V

Continuous Power Dissipation (Multilayer Board) (T_A = +70ºC, derate 18.85mW/ºC above +70ºC) 1.508W

Continuous Current into V_B, OUT 2000mA

Continuous Current into CC1, CC2 .....600mA

Continuous Current into any other terminal 100mA

Operating Temperature Range .....-40ºC to +85ºC

Junction Temperature Range.....-40ºC to +150ºC

Storage Temperature Range .....-40ºC to +150ºC

Soldering Temperature (reflow).....+260ºC

Note 1: CC1 and CC2 pins can withstand a short to +20V with a series 10kΩ resistor (sinking 2mA).

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.

Package Information

24-WLP

Package Code	W242A2+1
Outline Number	*21-100430*
Land Pattern Number	Refer to *Application Note 1891*
THERMAL RESISTANCE, FOUR LAYER BOARD	
Junction-to-Ambient (θ_{JA})	53.04°C/W

For the latest package outline information and land patterns (footprints), go to *www.maximintegrated.com/packages*. Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board. For detailed information on package thermal considerations, refer to *www.maximintegrated.com/thermal-tutorial.*

Electrical Characteristics

(V_{BAT} = 3.6V , V_B = 5V, C_{VDD} = 1µF, C_{VB} = 1µF, C_{OUT} = 1µF, C_{BAT} = 1µF, limits are production tested at T_A = +25°C. Limits over the operating temperature range and relevant supply voltage range are guaranteed by design and characterization.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
GENERAL ELECTRICAL CHARACTERISTICS						
Supply Voltage Range Output	V_{BAT}		2.75		5.5	V
Supply Voltage Range Input	V_B		4.4		28.0	V
Internal V_B Regulator Voltage	V_{B_REG}			3.75		V
Internal V_{CCINT} Switchover Rising Threshold	$V_{CCINT\_SWOVER\_THR}$	VCCINTOnBAT = '0', measured as (V_{B_REG} - V_{BAT}) rising, V_{CCINT} = V_{B_REG} above this threshold		180		mV
Internal V_{CCINT} Switchover Falling Threshold	$V_{CCINT\_SWOVER\_THF}$	VCCINTOnBAT = '0', measured as (V_{B_REG} - V_{BAT}) falling, V_{CCINT} = V_{BAT} below this threshold		50		mV
Internal V_{CCINT} POR Rising Threshold	V_{CCINT_POR}	Measured on internal V_{CCINT} rising		1.81		V
Internal V_{CCINT} POR Threshold Hysteresis	$V_{CCINT\_POR\_HYS}$	Measured on internal V_{CCINT}		150		mV
V_{DD} Output Voltage	V_{DD}	I_{DD} = 20mA	1.7	1.8	1.9	V
V_{DD} Undervoltage Lockout Rising Threshold	V_{DD_UVLO}	V_{DD} rising		1.62		V
V_{DD} Undervoltage Lockout Threshold Hysteresis	$V_{DD\_UVLO\_HYS}$			100		mV
BAT Shutdown Quiescent Current	I_{BAT_SHDN}	ShdnMode = '1', V_{BAT} = 3.6V		2.5	4.2	µA
BAT Low-Power UFP Quiescent Current	$I_{BAT\_LP\_UFP}$	LPUFP = '1', moisture detection enabled, V_{BAT} = 3.6V, V_B = 0.0V		16.4	27.0	µA
BAT Low-Power Low-Corrosion DRP Quiescent Current	$I_{BAT\_LP\_DRPLC}$	LPDRP = '1', moisture detection enabled, DRP toggling state, V_{BAT} = 3.6V, V_B = 0.0V		16.7	28.0	µA
BAT UFP Quiescent Current	I_{BAT_UFP}	Moisture detection enabled, UFP state, V_{BAT} = 3.6V, V_B = 0.0V		148.9		µA
BAT DFP Quiescent Current	I_{BAT_DFP}	Moisture detection enabled, DFP state, V_{BAT} = 3.6V, V_B = 0.0V		181.8		µA
BAT DRP Quiescent Current	I_{BAT_DRP}	Moisture detection enabled, DRP toggling state, V_{BAT} = 3.6V, V_B = 0.0V		166.3		µA
BAT Quiescent Current with V_B Present	I_{BAT_VB}	VCCINTOnBAT = '0', Attached Sink state, V_{BAT} = 4.2V, V_B = 5.0V		3.2		µA
		VCCINTOnBAT = '1', Attached Sink state, V_{BAT} = 4.2V, V_B = 5.0V		292.6		
BAT Undervoltage Lockout Rising Threshold	V_{BAT_UVLO}	V_{BAT} rising	2.73	2.80	2.85	V
BAT Undervoltage Lockout Threshold Hysteresis	$V_{BAT\_UVLO\_HYS}$			100		mV

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PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
BAT Overvoltage Lockout Rising Threshold	V_{BAT_OVLO}	V_{BAT} rising	5.20	5.35	5.50	V
BAT Overvoltage Lockout Threshold Hysteresis	$V_{BAT\_OVLO\_HYS}$			200		mV
Shutdown/Low-Power UFP CC1 and CC2 Pulldown Resistor	$R_{LP\_UFP\_PD}$			40		kΩ
Shutdown/Low-Power UFP CC1 and CC2 Detection Rising Threshold	$V_{LP\_UFP\_THR}$	CC1/CC2 rising		0.49		V
Shutdown/Low-Power UFP CC1 and CC2 Detection Falling Threshold	$V_{LP\_UFP\_THF}$	CC1/CC2 falling		0.45		V
Low-Power Low-Corrosion CC1 and CC2 Detection Driving Resistor	$R_{LP\_DRP\_DET}$			400		kΩ
Low-Power Low-Corrosion DRP CC1 and CC2 Detection Rising Threshold	$V_{LP\_DRPLC\_THR}$	CC1/CC2 rising		1.15		V
Low-Power Low-Corrosion DRP CC1 and CC2 Detection Falling Threshold	$V_{LP\_DRPLC\_THF}$	CC1/CC2 falling		0.68		V
Shutdown CC1 and CC2 Detection Debounce Time	t_{SHDN_CCDEB}			85		µs
Low-Power UFP/Low Corrosion DRP CC1 and CC2 Detection Debounce Time	t_{LP_CCDEB}			1		ms
Thermal Shutdown Rising Threshold	T_{SHDN}	T_J rising		165		°C
Thermal Shutdown Threshold Hysteresis	T_{SHDN_HYS}			15		°C
V_B OVERVOLTAGE PROTECTOR						
V_B Detect Threshold Rising Threshold	V_{BDET}	V_B rising	4.19	4.30	4.40	V
V_B Detect Threshold Hysteresis	V_{BDET_HYS}			400		mV
V_B Clamp Voltage	V_{B_CLAMP}	I_{VB} = 10mA		35		V
V_B Quiescent Current	I_{VB}			360		µA
V_B to OUT On-Resistance	$R_{ON\_VB\_OUT}$	V_B = 5.0V, I_{OUT} = 100mA, T_A = +25ºC		47	60	mΩ

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PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
V_B Overvoltage Lockout Rising Threshold	V_{B_OVLO}	V_B rising	5.790	5.852	5.915	V
V_B Overvoltage Lockout Threshold Hysteresis	$V_{B\_OVLO\_HYS}$			25		mV
V_B Detect Debounce Time	t_{VBDET_DEB}			10		ms
V_B Fault Recovering Debounce Time	t_{VBFLT_DEB}	Applies to overvoltage or thermal shutdown events		10		ms
V_B Soft-Start Time	t_{VB_SS}	Measured from V_{OUT} = 10% x V_B to V_{OUT} = 90% x V_B, C_{OUT} = 1000µF		15		ms
V_{B-OUT} Switch OK Time	$t_{VB\_OUT\_SWT\_OK}$	From soft-start end to V_{B_OUT} switch interrupt OK		5		ms
V_B Overvoltage Lockout Turn-Off Time	$t_{VB\_OVLO\_OFF}$	From V_B > V_{B_OVLO} to V_{OUT} stop rising, R_{OUT} = 100Ω		100		ns
DFP MODE						
OUT Connected Current Limit Source	$I_{OUT\_CUR\_LIMIT}$				2	A
OUT Connected Voltage Source	V_{OUT_LVL}				5.5	V
USB TYPE-C						
USB TYPE-C/BC1.2 - PROPRIETARY CHARGER DETECTION						
BC1.2 State Timeout	t_{TMO}		180	200	220	ms
Data Contact Detect Timeout	t_{DCDtmo}	DCDCpl = 0b0	1800	2000	2200	ms
Proprietary Charger Debounce	t_{PRDeb}		5	7.5	10	ms
Primary to Secondary Timer	$t_{PDSDWait}$		27	35	39	ms
Charger Detection Debounce	t_{CDDeb}		45	50	55	ms
V_{B64} Threshold	V_{B64}	CDP and CDN pins. Threshold in percent of V_B voltage 3.8V < V_B < 5.8V	57	64	71	%
V_{B64} Hysteresis	V_{B64_H}			0.015		V
V_{B47} Threshold	V_{B47}	CDP and CDN pins. Threshold in percent of V_B voltage 3.8V < V_B < 5.8V	43.3	47	51.7	%
V_{B47} Hysteresis	V_{B47_H}			0.015		V
V_{B31} Threshold	V_{B31}	CDP and CDN pins. Threshold in percent of V_B voltage 3.8V < V_B < 5.8V	26	31	36	%
V_{B31} Hysteresis	V_{B31_H}			0.015		V
I_{WEAK} Current	I_{WEAK}		0.01	0.1	0.5	µA
R_{DM_DWN} Resistor	R_{DM_DWN}		14.25	20	24.8	kΩ
I_{DP_SRC} Current	I_{DP_SRC}/I_{DCD}	0V to 2.5V	7	10	13	µA
I_{DM_SINK} Current	$I_{DM\_SINK}/I_{DATSINK}$	0.15V to 3.6V	50	80	110	µA
V_{LGC} Threshold	V_{LGC}		1.62	1.7	1.9	V
V_{LGC} Hysteresis	V_{LGC_H}			0.015		V

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PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
V_{DAT_REF} Threshold	V_{DAT_REF}		0.25	0.32	0.4	V
V_{DAT_REF} Hysteresis	$V_{DAT\_REF\_H}$			0.015		V
V_{D33} Voltage	$V_{DPDM\_3P3VSR}/V_{SRC33}$	With I_{DP_SRC} = 0 to 200µA	2.6	3.0	3.4	V
$V_{SRC33ILIM}$ Current Limit	$I_{LIMVSRC33}$	V_{CDP}/V_{CDN} = 1.6V		1.5	3	mA
V_{DN_SRC} Voltage	V_{DN_SRC}/V_{SRC06}	0 to 200µA	0.5	0.6	0.7	V
V_{DP_SRC} Voltage	V_{DP_SRC}/V_{SRC06}	0 to 200µA	0.5	0.6	0.7	V
DP/DM Pulldown Resistor	R_{USB}		3	6.1	12	MΩ
USB TYPE-C/CC DETECTION						
CC Pin Clamp Voltage	V_{CC_CLAMP}	60µA ≤ I_{CC1}, I_{CC2} ≤ 600µA		1.1	1.32	V
CC Pin Clamp Voltage (5.5V)	$V_{CC\_CLAMP\_5P5}$	I_{CC2}, I_{ICC2} < 2mA		5.25	5.5	V
CC UFP Pulldown Resistance	R_{PD_UFP}		4.59	5.10	5.61	kΩ
CC DFP 0.5A Current Source	$I_{DFP0.5\_CC}$		-20%	80	+20%	µA
CC DFP 1.5A Current Source	$I_{DFP1.5\_CC}$		-8%	180	+8%	µA
CC DFP 3A Current Source	I_{DFP3A_CC}		-8%	330	+8%	µA
CC RA RD Threshold	$V_{RA\_RD0.5}$		0.15	0.2	0.25	V
CC RA RD Hysteresis	$V_{RA\_RD0.5\_H}$			0.015		V
CC UFP 0.5A RD Threshold	$V_{UFP\_RD0.5}$		0.61	0.66	0.7	V
CC UFP 0.5A RD Hysteresis	$V_{UFP\_RD0.5\_H}$			0.015		V
CC UFP 1.5A RD Threshold	$V_{UFP\_RD1.5}$		1.16	1.23	1.31	V
CC UFP 1.5A RD Hysteresis	$V_{UFP\_RD1.5\_H}$			0.015		V
CC DFP V_{open} Detect Threshold	V_{DFP_VOPEN}		1.5	1.575	1.65	V
CC DFP V_{open} Detect Hysteresis	$V_{DFP\_VOPEN\_H}$			0.030		V
CC DFP V_{open} with 3.0A Detect Threshold	$V_{DFP\_VOPEN3A}$		2.45	2.6	2.75	V
CC DFP V_{open} with 3.0A Detect Hysteresis	$V_{DFP\_VOPEN3A\_H}$			0.030		V
CC V1P0 Threshold	V_{CC_V1P0}		0.92	1.00	1.08	V
CC V1P0 Hysteresis	$V_{CC\_V1P0\_H}$			0.015		V
V_B Discharge Value Threshold	V_{SAFE0V}	Falling voltage level where a connected UFP finds V_B removed	0.6	0.67	0.75	V
V_B Discharge Value Hysteresis	V_{SAFE0V_H}	Rising hysteresis		45		mV

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PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
CC Pin Power-Up Time	$t_{ClampSwap}$	Maximum time allowed from removal of voltage clamp till 5.1kΩ resistor attached			15	ms
CC Detection Debounce	t_{CCDeb}		100	119	200	ms
USB Type-C Debounce	t_{PDDeb}		10	15	20	ms
USB Type-C Quick Debounce	t_{QDeb}		0.9	1	1.1	ms
V_{SAFE0V} Debounce	$t_{VSAFE0VDeb}$		9	10	11	ms
USB Type-C Error Recovery Delay	$t_{ErrorRecovery}$		25			ms
USB Type-C DRP Toggle Time	t_{DRP}		50	75	100	ms
DFP Duty Cycle at DRP	D_{DRP_DCYC}	Programmable from 35% to 50% in 5% step, CCDRPPhase = 0b00		35		%
USB Type-C DRP Try	t_{DRPtry}		90	100	110	ms
DRP Transition Time	$t_{DRPTrans}$	Time a role swap from DFP to UFP or reverse is completed			1	ms
V_{CONN} Enable Time	$t_{VCONNON}$				2	ms
V_{CONN} Disable Time	$t_{VCONNOFF}$	Time from UFP detached or as directed by I^2C command until V_{CONN} is removed			35	ms
CC Pin Current Change Time	$t_{SINKADJ}$	Time from CC pin changes state in UFP mode till current drawn from DFP reaches new value			60	ms
V_B On Time	t_{VBON}	Time from UFP is attached till V_B ON			275	ms
V_B Off Time	t_{VBOFF}	Time from UFP is detached till V_B reaches V_{SAFE0V}			650	ms
USB TYPE-C/V_{CONN} SWITCH						
V_{CONN} Source Requirements	V_{CONN}		3.0		5.5	V
V_{CONN} Switch On Resistance	$R_{ON\_VCON\_SW}$	V_{BAT} = 4.2V, I_{CC} = 0.1A		1.00	1.55	Ω
V_{CONN} Overcurrent Protection Thresholds Accuracy	$I_{OCP\_VCONN\_ACC}$	V_{BAT} = 4.2V, T_A = +25ºC	-15		+15	%
V_{CONN} Short Circuit Current Protection Rising Threshold	I_{SCCP_VCONN}	CC load current rising	0.425	0.500	0.575	A
V_{CONN} Overcurrent Protection Threshold Programmable Step	$I_{OCP\_VCONN\_STEP}$	Programmable range is 200mA to 350mA		50		mA
V_{CONN} Overcurrent Protection Interrupt Debounce Time	$t_{OCP\_VCONN\_DEB}$	From detecting OCP to generating INT		2		ms
V_{CONN} Overcurrent Protection Wait Time Before Turn Off	$t_{OCP\_VCONN\_OFF}$	From generating INT to turning OFF V_{CONN} switch		12		ms
V_{CONN} Startup Time	t_{VCONN_90}	Time from V_{CONN} switch enable to CC settled at 90% of final value with V_{BAT} = 4.2V		12	35	µs

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PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
SBU RESISTOR AND MOISTURE DETECTION MEASUREMENT						
SBU1/SBU2 Continuous Resistor Detection Quiescent Current	I_{Q_SBUDET}	200ms period, ADCAvgNum[2:0] ≤ 3		< 1.0		µA
Periodic Moisture Detection Quiescent Current	$I_{Q\_MOISTDET}$	10s period		< 1.0		µA
Pullup Current 1X	$I_{PU1X\_RDET\_SBU}$	Pullup current on SBU1 or SBU2	1.952	2.000	2.048	µA
	$I_{PU1X\_RDET\_CCCD}$	Pullup current on CC1 or CC2 or CDP or CDN	1.840	2.000	2.160	
Pullup Current 4X	$I_{PU4X\_RDET\_SBU}$	Pullup current on SBU1 or SBU2	7.809	8.000	8.191	µA
	$I_{PU4X\_RDET\_CCCD}$	Pullup current on CC1 or CC2 or CDP or CDN	7.720	8.000	8.280	
Pullup Current 16X	$I_{PU16X\_RDET\_SBU}$	Pullup current on SBU1 or SBU2	31.234	32.000	32.766	µA
	$I_{PU16X\_RDET\_CCCD}$	Pullup current on CC1 or CC2 or CDP or CDN	31.000	32.000	33.000	
Pullup Current 64X	$I_{PU64X\_RDET\_SBU}$	Pullup current on SBU1 or SBU2	124.941	128.000	131.059	µA
	$I_{PU64X\_RDET\_CCCD}$	Pullup current on CC1 or CC2 or CDP or CDN	124.400	128.000	131.600	
Pulldown Switches On Resistance	R_{MOIST_SWPD}	Enabled during moisture detection only	50	150	280	Ω
Pullup Forcing/Sensing Switches On Resistance	R_{MOIST_SWPU}	(Note 2)	200	500	1050	Ω
SAR ADC Full Scale Voltage	V_{ADC_FS}		1.485	1.500	1.515	V
SAR ADC DAC Voltage Accuracy	V_{ADC_DACACC}		-0.3		+0.3	%
SAR ADC Comparator Static Error	V_{ADC_COMPTH}		-2.85		+2.85	mV
SAR ADC Comparator Maximum Dynamic Error	$V_{ADC\_COMP\_DYN}$			1.5		mV
SAR ADC Least Significant Bit	V_{ADC_LSB}	8 bits		0.392		% V_ADC_FS
SAR ADC RC Antialiasing Filter Time Constant	t_{ADC_FILT}			90		µs
SAR ADC Conversion Time	t_{ADC_CONV}	1.1ms (typ) additional delay prior to the first conversion		104		µs
ADC Worst Case Accuracy	V_{ADC_ERR}	Voltage on pullup pin(s) = 0.375V	-1.47		+1.47	V_ADC_LSB (typ)
		Voltage on pullup pin(s) = 1.500V	-4.18		+4.18	
		Voltage on pullup pin(s) = 0.375V	-2.31		+2.31	%
		Voltage on pullup pin(s) = 1.500V	-1.64		+1.64	

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PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Auto Detectable SBU1/SBU2 Resistance Range	R_{SBU_RNG}	$I_{PU1X\_RDET\_SBU}$ pullup current applied on SBU1 or SBU2	187.5		714.7	kΩ
		$I_{PU4X\_RDET\_SBU}$ pullup current applied on SBU1 or SBU2	46.88		170.2	
		$I_{PU16X\_RDET\_SBU}$ pullup current applied on SBU1 or SBU2	11.72		42.57	
		$I_{PU64X\_RDET\_SBU}$ pullup current applied on SBU1 or SBU2	2.93		10.64	
SBU1/SBU2 Resistance Ground Condition Range	$R_{SBU\_RNG\_GND}$	$I_{PU64X\_RDET\_SBU}$ pullup current applied on SBU1 or SBU2. ADCGroundVth[3:0] = 0b0100	0		100.11	Ω
Auto Detectable CC/CD Moisture Resistance Range	R_{CCCD_RNG}	$I_{PU1X\_RDET\_CCCD}$ pullup current applied on CC1 or CC2 or CDP or CDN	187.5		672.6	kΩ
		$I_{PU4X\_RDET\_CCCD}$ pullup current applied on CC1 or CC2 or CDP or CDN	46.88		149.7	
		$I_{PU16X\_RDET\_CCCD}$ pullup current applied on CC1 or CC2 or CDP or CDN	11.72		39.30	
		$I_{PU64X\_RDET\_CCCD}$ pullup current applied on CC1 or CC2 or CDP or CDN	2.93		9.86	
CC/CD Resistance Ground Condition Range	$R_{CCCD\_RNG\_GND}$	$I_{PU64X\_RDET\_CCCD}$ pullup current applied on CDP and/or CDN. ADCGroundVth[3:0] = 0b0100	0		99.70	Ω
SBU1/SBU2 Resistance Measurement Accuracy	R_{SBU_ACC}	Within R_{SBU_RNG} resistive range and under $I_{PU1X\_RDET\_SBU}$ pullup current applied on SBU1 or SBU2	-4.70		+4.70	%
		Within R_{SBU_RNG} resistive range and under $I_{PU4X\_RDET\_SBU}$ pullup current applied on SBU1 or SBU2	-4.70		+4.70	
		Within R_{SBU_RNG} resistive range and under $I_{PU16X\_RDET\_SBU}$ pullup current applied on SBU1 or SBU2	-4.70		+4.70	
		Within R_{SBU_RNG} resistive range and under $I_{PU64X\_RDET\_SBU}$ pullup current applied on SBU1 or SBU2	-4.70		+4.70	
CC/CD Resistance Measurement Accuracy	R_{CCCD_ACC}	Within R_{CCCD_RNG} resistive range and under $I_{PU1X\_RDET\_CCCD}$ pullup current applied on CC1 or CC2 or CDP or CDN	-10.31		+10.31	%
		Within R_{CCCD_RNG} resistive range and under $I_{PU4X\_RDET\_CCCD}$ pullup current applied on CC1 or CC2 or CDP or CDN	-5.81		+5.81	
		Within R_{CCCD_RNG} resistive range and under $I_{PU16X\_RDET\_CCCD}$ pullup current applied on CC1 or CC2 or CDP or CDN	-5.44		+5.44	
		Within R_{CCCD_RNG} resistive range and under $I_{PU64X\_RDET\_CCCD}$ pullup current applied on CC1 or CC2 or CDP or CDN	-5.13		+5.13	
USB DATA SWITCHES (TDP/TDN)						
Analog Signal Range	$V_{TDP/N}$		0		5.5	V
On-Resistance	R_{ON_TD}			3.7	6.0	Ω

(V_{BAT} = 3.6V , V_B = 5V, C_{VDD} = 1µF, C_{VB} = 1µF, C_{OUT} = 1µF, C_{BAT} = 1µF, limits are production tested at T_A = +25°C. Limits over the operating temperature range and relevant supply voltage range are guaranteed by design and characterization.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
On-Resistance Match Between Channels	ΔR_{ON_TD}	$I_{TDP/N}$ = 10mA, $V_{TDP/N}$ = 0.0V		0.02		Ω
On-Resistance Flatness	R_{FLAT_TD}	$I_{TDP/N}$ = 10mA, $V_{TDP/N}$ = 0.0V to 5.5V		0.005		Ω
Off Leakage Current	I_{OFF_TD}	$V_{CDP/N}$ = 0V, $V_{TDP/N}$ = 2.5V	-0.5	0.5	+1.5	µA
On Leakage Current	I_{ON_TD}	$V_{TDP/N}$ = 2.5V, $V_{CDP/N}$ = open	-1		+1.5	µA
Turn-On Time	t_{ON_TD}	$V_{TDP/N}$ = 1.5V, R_{LOAD} = 50Ω		55		µs
Turn-Off Time	t_{OFF_TD}	$V_{TDP/N}$ =1.5V, R_{LOAD} = 50Ω		20		µs
Output Skew Same Switch	$t_{SK(P)\_TD}$			40		ps
Output Skew Between Switch	$t_{SK(O)\_TD}$			40		ps
Break-Before-Make Time Delay	t_{BBM_TD}	R_{LOAD} = 50Ω, delay between one side of the switch opening and the other side closing	0	3		µs
-3dB Bandwidth	f_{BW_TD}	$V_{D\_}$ = 0dBm, R_S = R_L = 50Ω		400		MHz
Off-Isolation	V_{ISO_TD}	f = 20kHz, $V_{D\_}$ = 0.4Vp-p, R_L = 50Ω		-80		dB
Crosstalk	V_{CRTLK_TD}	f = 20kHz, $V_{D\_}$ = 0.4Vp-p, R_L = 50Ω		-80		dB
PSRR	V_{PSRR_TD}	V = 400mVpp, f = 20kHz, R_S = R_L = 50Ω		-60		dB
UART Switches (UR_UT)						
Analog Signal Range	$V_{UR/T}$		0		5.5	V
On-Resistance	R_{ON_U}			23	36	Ω
On-Resistance Match Between Channels	ΔR_{ON_U}	$I_{UR/T}$ = 1mA, $V_{UR/T}$ = 0.0V		0.3		Ω
On-Resistance Flatness	R_{FLAT_U}	$I_{UR/T}$ = 10mA, $V_{UR/T}$ = 0.0V to 5.5V		0.01		Ω
Off Leakage Current	I_{OFF_U}	$V_{CDP/N}$ = 0V, $V_{UR/T}$= 2.5V	-0.5	0.5	+1.5	µA
On Leakage Current	I_{ON_U}	$V_{UR/T}$ = 2.5V, $V_{CDP/N}$ = floating	-1		+1.5	µA
Turn-On Time	t_{ON_U}	$V_{UR/T}$ = 1.5V, R_{LOAD} = 50Ω		30		µs
Turn-Off Time	t_{OFF_U}	$V_{UR/T}$ = 1.5V, R_{LOAD} = 50 Ω		15		µs
Break-Before-Make Time Delay	t_{BBM_U}	R_{LOAD} = 50Ω, delay between one side of the switch opening and the other side closing	0	38		µs
-3dB Bandwidth	f_{BW_U}	V_D = 0dBm, R_S = R_L = 50Ω		350		MHz
Off-Isolation	V_{ISO_U}	f = 20kHz, V_D = 0.4Vp-p, R_L = 50Ω		-90		dB
Crosstalk	V_{CRTLK_U}	f = 20kHz, V_D = 0.4Vp-p, R_L = 50Ω		-70		dB
PSRR	V_{PSRR_U}	V = 400mVpp, f = 20kHz, R_S = R_L = 50Ω		-60		dB
I^2C INTERFACE TIMING						
Clock Frequency	f_{SCL}				1000	kHz
Hold Time (Repeated) START Condition	$t_{HD:STA}$		0.26			µs
CLK Low Period	t_{LOW}		0.5			µs
CLK High Period	t_{HIGH}		0.26			µs

(V_{BAT} = 3.6V , V_B = 5V, C_{VDD} = 1µF, C_{VB} = 1µF, C_{OUT} = 1µF, C_{BAT} = 1µF, limits are production tested at T_A = +25°C. Limits over the operating temperature range and relevant supply voltage range are guaranteed by design and characterization.)

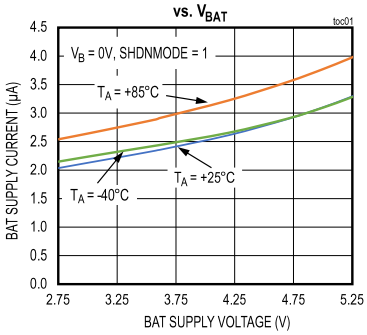
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Setup Time Repeated START Condition	$t_{SU:STA}$		0.26			µs
DATA Hold Time	$t_{HD:DAT}$		0			µs
DATA Valid Time	$t_{VD:DAT}$				0.45	µs
DATA Valid Acknowledge Time	$t_{VD:ACK}$				0.45	µs
DATA Setup time	$t_{SU:DAT}$		50			ns
Setup Time for STOP Condition	$t_{SU:STO}$		0.26			µs
Bus-Free Time Between STOP and START	t_{BUF}		0.5			µs
Pulse Width of Spikes that Must be Suppressed by the Input Filter	t_{sp}			50		ns
Input Logic High	V_{IN_IH}		1.5			V
Input Logic Low	V_{IN_IL}				0.3	V
Input Logic Leakage Current	I_{IN_LKG}		-1		+1	µA
OPEN DRAIN OUTPUTS ($\overline{CE}$, $\overline{DB}$, $\overline{INT}$)						
Open Drain Logic low	V_{OD_OL}	I_{OD} = 2mA			0.4	V
Open Drain Output High Leakage Current	I_{OD_LKG}		-1		+1	µA
ESD PROTECTION						
HBM		CDP/CDN		±6		kV
		SBU1/SBU2, CC1/CC2, V_B (connected to 1µF capacitor)		±15		
IEC61000-4-2 Contact Discharge		SBU1/SBU2, CC1/CC2, V_B (connected to 1µF capacitor)		±8		kV
IEC61000-4-2 Air Gap		SBU1/SBU2, CC1/CC2, V_B (connected to 1µF capacitor)		±15		kV
SURGE PROTECTION						
IEC61000-4-5 Surge		V_B		±120		V
		CC1/CC2, SBU1/SBU2		±45		

Note 2: During moisture detection in manual configuration, if more than one pin among SBU1, SBU2, CDP, CDN, CC1, and CC2 is pulled up at the same time, the pullup current is forced on a common internal node shared by the forcing switches, while the voltage measured by the ADC is that of another common internal node shared by the sensing switches. Both forcing and sensing switches have an R_{MOIST_SWPU} resistance. For example, if just two pins are pulled up, an overall equivalent resistance equal to R_{MOIST_SWPU} is applied between them. If the pullup pins are more than two, the resistive mesh internally applied between the pins is that shown in *Figure 7*, where the SWP[n] switches are the forcing/sensing ones with R_{MOIST_SWPU} resistance.

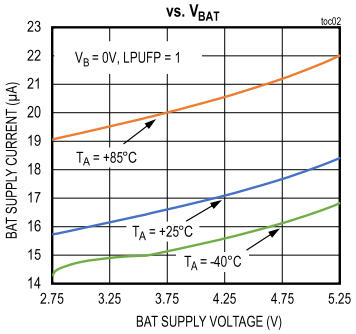
Typical Operating Characteristics

(T_A = +25ºC, V_B = 5V, unless otherwise noted.)

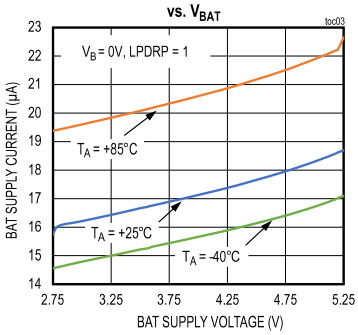
BAT SUPPLY CURRENT vs. V_{BAT}



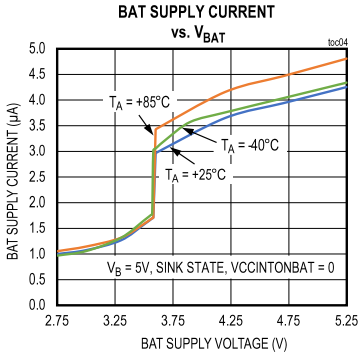
BAT SUPPLY CURRENT vs. V_{BAT}



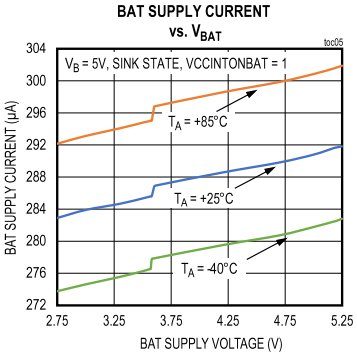
BAT SUPPLY CURRENT vs. V_{BAT}



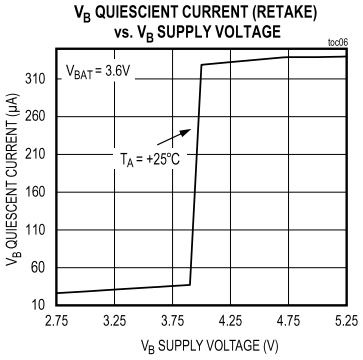
BAT SUPPLY CURRENT vs. V_{BAT}



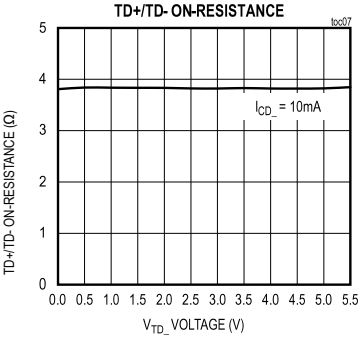
BAT SUPPLY CURRENT vs. V_{BAT}



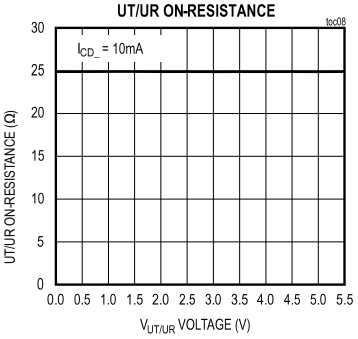
V_B QUIESCENT CURRENT (RETAKE) vs. V_B SUPPLY VOLTAGE



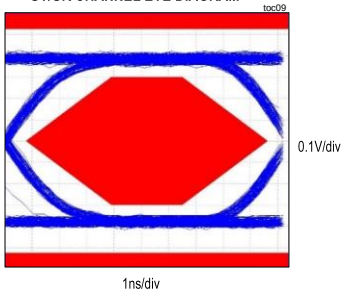
TD+/TD- ON-RESISTANCE



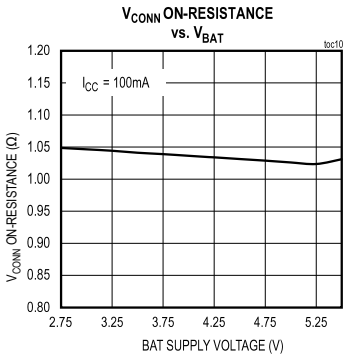
UT/UR ON-RESISTANCE

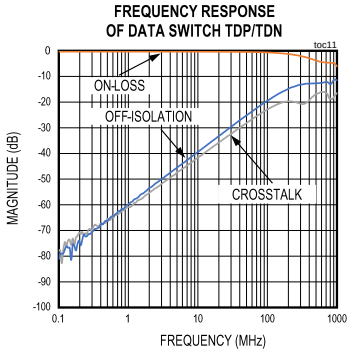


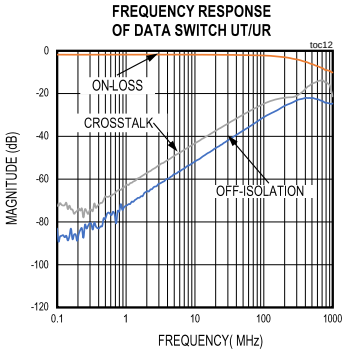
UT/UR CHANNEL EYE DIAGRAM



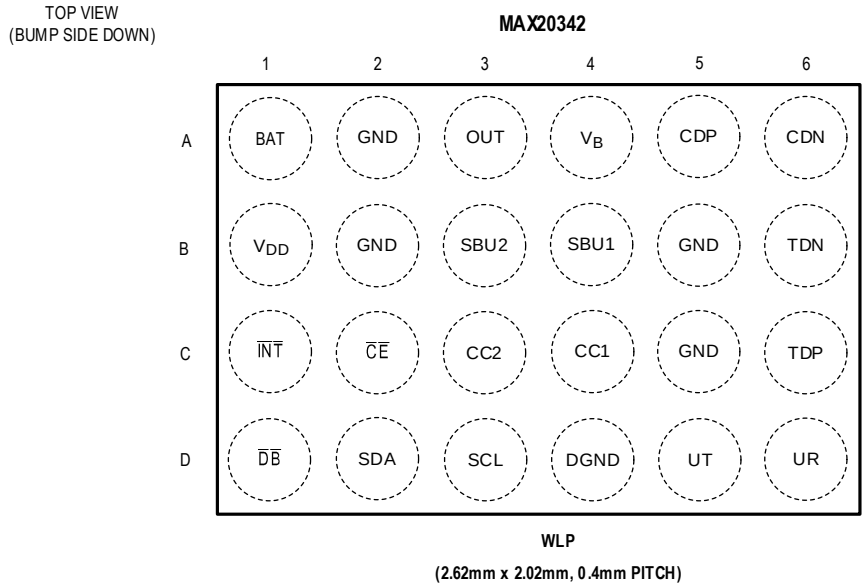
(T_A = +25°C, V_B = 5V, unless otherwise noted.)







Bump Configuration

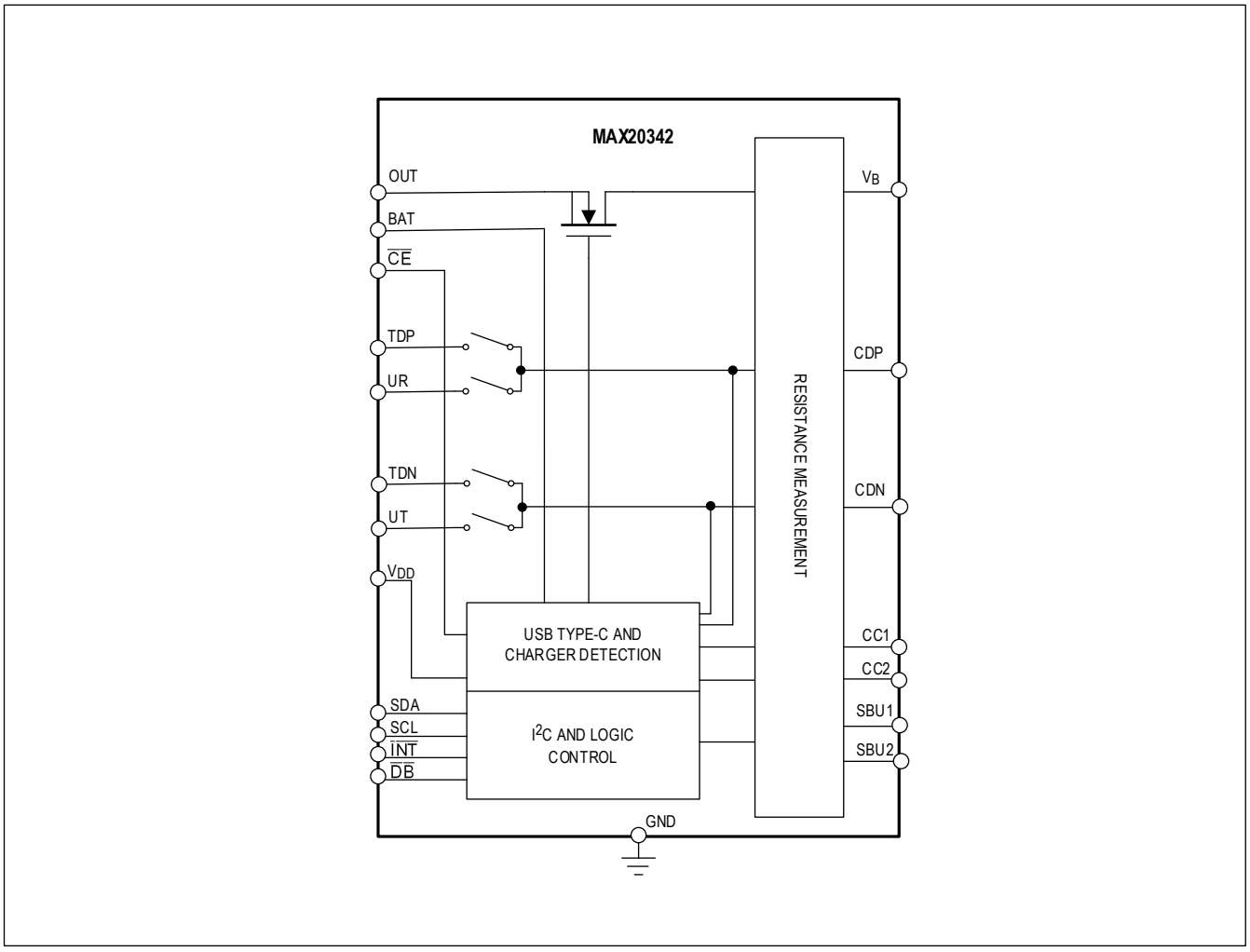


Pin Descriptions

PIN	NAME	FUNCTION
A1	BAT	Battery Connection Input. Bypass BAT to GND with a capacitor of 1µF effective capacitance.
A2	GND	Ground
A3	OUT	Overvoltage-Protected V_B Power Output. Bypass OUT to GND with a capacitor of 1µF effective capacitance.
A4	V_B	USB Type-C V_{BUS} Connection. Bypass V_B to GND with a capacitor of 1µF effective capacitance.
A5	CDP	USB Connector D+ Connection
A6	CDN	USB Connector D- Connection
B1	V_{DD}	Internal Supply Input. Bypass V_{DD} to GND with a capacitor of 1µF effective capacitance.
B2	GND	Ground
B3	SBU2	USB Type-C SBU2 Connection
B4	SBU1	USB Type-C SBU1 Connection
B5	GND	Ground
B6	TDN	USB Transceiver D- Connection
C1	$\overline{INT}$	Active-Low, Open-Drain Interrupt Output. Connect $\overline{INT}$ to an external pullup resistor.
C2	$\overline{CE}$	Active-Low, Open-Drain Charger Control Enable Output. Connect $\overline{CE}$ to an external pullup resistor.
C3	CC2	USB Type-C CC2 Connection
C4	CC1	USB Type-C CC1 Connection
C5	GND	Ground
C6	TDP	USB Transceiver D+ Connection

D1	$\overline{DB}$	Active-Low, Open-Drain Output. This pin is driven low when an 80kΩ resistor is connected to SBU1 or SBU2. Connect $\overline{DB}$ to an external pullup resistor.
D2	SDA	I²C Serial-Data Input/Output. Connect SDA to an external pullup resistor.
D3	SCL	I²C Serial-Clock Input. Connect SCL to an external pullup resistor.
D4	DGND	Digital Ground
D5	UT	UART Tx Device Connection
D6	UR	UART Rx Device Connection

Functional Diagram



Detailed Description

USB BC1.2 Charger Detection

The MAX20342 USB charger detection block is USB BC1.2 compliant with the additional capability to automatically detect some common proprietary charger types.

The Charger Detection State Machine follows USB BC1.2 requirements and detects SDP, CDP, and DCP charger types (see *Table 1*). In addition to the USB BC1.2 State Machine, the MAX20342 also detects a limited number of proprietary charger types (Apple, Samsung, and generic 500mA). The MAX20342 always reports SDP/CDP/DCP in addition to a detected proprietary type. For example, the Samsung proprietary charger uses D+/D- short and bias on D+/D-. The bias voltage is chosen so that, with a USB BC1.2 compliant state machine, it is detected as a DCP. The device reports this charger detected as both a DCP and a Samsung charger. See *Table 2* and *Table 3* for more details.

The MAX20342 also reports the operation status of the Charger Detection State Machine in the ChgTypRun interrupt bit in the register map.

Table 1. USB BC1.2 Charger Type Detection

CHGTYP[1:0]	CHARGER DETECTED
0b00	No CHGIN
0b01	SDP
0b10	CDP
0b11	DCP

Note: *Charge Detect running state is indicated until the Charger Detection State Machine is complete.*

Table 2. Proprietary Detection Table

		D+				
		0 TO 0.32V	**0.32V TO 31% OF V_B**	**31% TO 47% OF V_B**	**47% TO 64% OF V_B**	**64% TO 100% OF V_B**
D-	**0 TO 0.32V**	Unknown	Unknown	Unknown	Unknown	Unknown
	0.32V TO 31% OF V_B	Unknown	Samsung	Unknown	Unknown	Unknown
	31% TO 47% OF V_B	Unknown	Unknown	Apple 0.5A	Apple 2.0A	Unknown
	47% TO 64% OF V_B	Unknown	Unknown	Apple 1.0A	Apple 12W	Unknown
	64% TO 100% OF V_B	Unknown	Unknown	Unknown	Unknown	Unknown

Examples of ChgTyp[1:0] and PrChgTyp[2:0] values found for common chargers on the market are listed in *Table 3*. When the MAX20342 detects the charger, it sets the $\overline{CE}$ output based on the charger type found. *Figure 1* shows D+/D- termination for Apple chargers, Samsung charger, dedicated charger, and a standard USB host charging downstream port.

Table 3. Charger Control Output Table

ADAPTER TYPE	CHGTYP[1:0]	PRCHGTYP[2:0]	$\overline{CE}$ OUTPUT	
			NOTUSBCMPL = 0b0	NOTUSBCMPL = 0b1
Nothing connected			High	High
DCP	0x03 DCP	0x00 unknown	Low	Low
SDP	0x01 SDP	0x00 unknown	High	Low
CDP	0x02 CDP	0x00 unknown	Low	Low
Samsung 2A DCP	0x03 DCP	0x01 Samsung 2A	Low	Low
Apple 500mA	0x01 SDP	0x02 Apple 0.5A	Low	Low
Apple 1A	0x02 CDP	0x03 Apple 1A	Low	Low
Apple 2A	0x01 SDP	0x04 Apple 2A	Low	Low
Apple 12W	0x03 DCP	0x05 Apple 12W	Low	Low

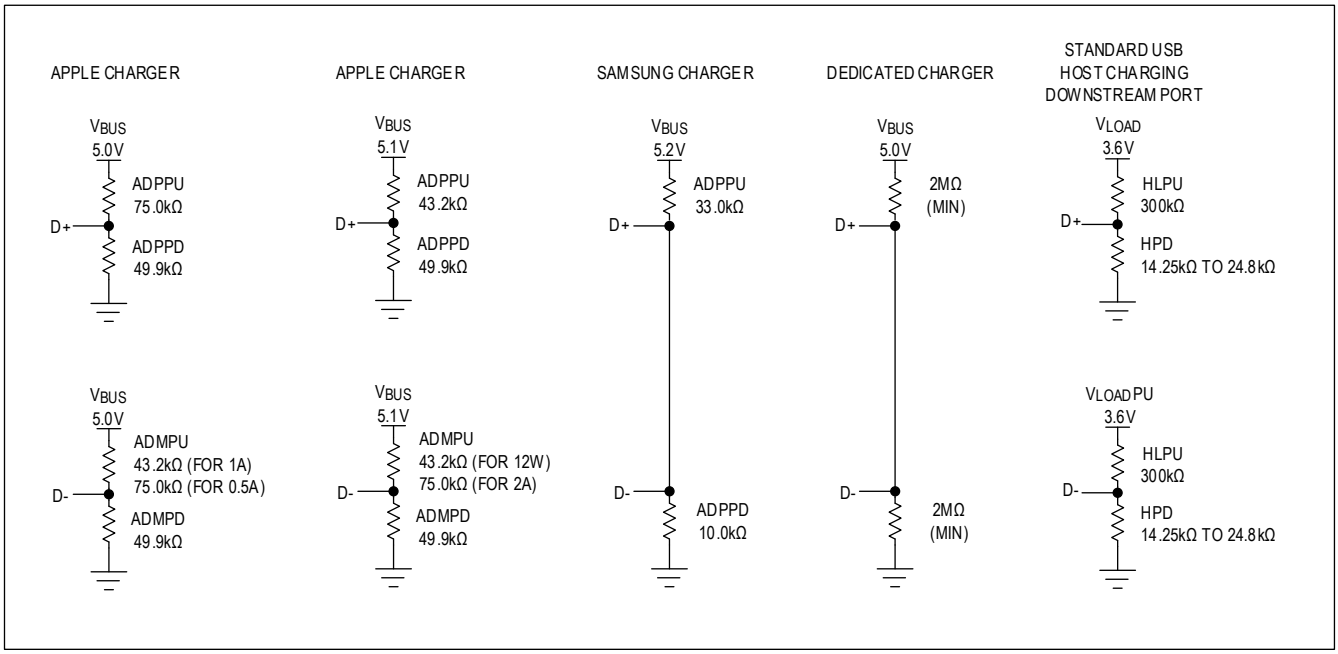


Figure 1. Apple Chargers, Samsung Charger, Dedicated Charger, and Standard USB Host Charging Downstream Port

Autoconfiguration Mode

The MAX20342 is capable of automatically setting the position of the internal analog switches, and $\overline{CE}$ and $\overline{DB}$ outputs based on the state of V_B voltage, CC resistor value, and SBU resistor value. See *Table 4* for more details.

The autoconfiguration state machine starts when either the device is in Debug Accessory Sink Mode and FactAuto = 1, or the device is connected to the valid V_B voltage and USBAuto = 1. If FactAuto = 0 and USBAuto = 0, the autoconfiguration cannot start.

Table 4. Autoconfiguration Mode Table

MAX20342 DEVICE CONFIGURATION BASED ON V_B, CC PINS, AND SBU PINS										
	RESET	**INVALID**	**UART**	**USB/ FACTORY**	**UART/ FACTORY**	**USB CHARGER (OTHER THAN SDP FOUND)**	**USB HOST (SDP FOUND)**	**USB DEVICE (SOURCE MODE, DRP ONLY)**	**ANALOG AUDIO ACCESSORY**	**V_{CONN} POWERED DEVICE (e.g., DIGITAL HEADSET)**
FACTAUTO/ USBAUTO	-	-	FactAuto = 1	FactAuto = 1	FactAuto = 1	USBAuto = 1	USBAuto = 1	USBAuto = 1	USBAuto = 1	USBAuto = 1
V_B	Not connected	Outside valid range	Valid	Valid	Valid	Valid	Valid	-	Not Connected	Not Connected
CC PINS	-	-	CC1 and CC2 = R_p	CC1 and CC2 = R_p	CC1 and CC2 = R_p	Only CC1 = R_p, or only CC2 = R_p	Only CC1 = R_p, or only CC2 = R_p	Only CC1 = R_d, or only CC2 = R_d	CC1 and CC2 = R_a	CC1 = R_d and CC2 = R_a, or CC1 = R_a and CC2 = R_d Connect BAT (V_{CONN}) to CC_ with R_a through switch
SBU PINS	-	-	SBU1 or SBU2 = 30kΩ	SBU1 or SBU2 = 80.2kΩ	SBU1 or SBU2 = 150kΩ	-	-	-	-	-
OUT	High-Z	High-Z	High-Z	V_B	V_B	V_B	V_B	OVP switch requires manual setting (**)	High-Z	High-Z
CDP/CDN SWITCH POSITION	-	-	UR/UT	TDP/TDN	UR/UT	OPEN	TDP/TDN	TDP/TDN	OPEN	TDP/TDN
$\overline{CE}$	High-Z	High-Z	High-Z	GND	GND	GND	High-Z or GND (*)	High-Z	High-Z	High-Z
$\overline{DB}$	High-Z	High-Z	High-Z	GND	High-Z	High-Z	High-Z	High-Z	High-Z	High-Z
$\overline{INT}$	High-Z	GND	GND	High-Z	High-Z	High-Z	High-Z	High-Z	High-Z	High-Z

(*) $\overline{CE}$ setting depends on NotUSBCmpl bit.

(**) If a USB device is detected, the OVP switch must be manually set as described in the OVP Manual Setting section.

OVP Manual Setting

In the case where a USB device is detected and the MAX20342 needs to source power from OUT to V_B, and then to the USB Type-C receptacle, the OVP switch needs to be manually set. When the MAX20342 has detected through the USB Type-C that a USB device has been attached, the user must follow the procedure to source power from OUT to V_B.

1. Manually close the OVP switch setting (VBOVPEn = 0x3). At this point, no power source must be attached to OUT.
2. Wait for SwtClosedInt interrupt request. At this point the OVP switch is closed and power can be attached to OUT.
3. Enable power source on OUT.

The user must follow the procedure to stop power sourcing to V_B.

1. Disable power source on OUT.
2. Manually open the OVP switch setting (VBOVPEn = 0x0). Wait for SwtClosedInt interrupt request. At this point the OVP switch is actually open.

The power source on OUT must not exceed 2A and 5.5V to avoid triggering the OVLO threshold. This restriction avoids a voltage drop between OUT and V_B ($OUT - V_B = R_{ON} \times I_{MAX}$) that is greater than the diode forward voltage (0.3V), which prevents current flow through the diode.

USB Type-C Detection

The MAX20342 is a complete solution for USB Type-C port charger detection and multiplexing USB and UART on a single USB Type-C connector.

The USB Type-C block detects connected accessories by using USB Type-C and USB BC1.2 charger detection. The USB Type-C block can also measure resistances on the SBU pin and automatically set switch positions and output status signals accordingly. In addition, the USB Type-C block can auto-configure switches for common connected accessories including USB cables (SDP/CDP, etc.) and customer-specific factory cables. A moisture/corrosion detection block allows the system to detect the presence of moisture in the USB Type-C port and alert the user to take specific action.

Dead Battery

In the case of a dead battery and no V_B attached, 1V voltage clamps are attached to CC1 and CC2 to ensure charging can start from a USB Type-C adapter.

CC Description

The MAX20342 can be configured to function as an Upstream Facing Port (UFP) or Dual Role Port (DRP) compliant with the USB Type-C 1.3 specification. The USB Type-C functions are controlled by a logic state machine which follows the USB Type-C standard requirements. When configured as a DRP, there is support for the optional Try.SNK function, placing priority on the Sink role.

Try.SNK Support

The MAX20342 operates as a UFP by default but can be configured to operate as a DRP. A DRP can act as either a Power Sink or a Power Source. The USB Type-C logic state machine cycles between Source and Sink at a rate of 75ms (typ). When the MAX20342 is connected to another device which is also a DRP, the source and sink roles are randomly assigned. The MAX20342 includes support for the Try.SNK state that allows the MAX20342 to be set to strongly prefer the sink role when connected to a standard DRP. If two devices with Try.SNK enable are connected, the role setting is again random.

Analog Audio Accessory Detection

The MAX20342 provides detection support for USB Type-C analog audio adapter detection by notifying the system microprocessor with an interrupt when an analog audio adapter is detected on the CC1 and CC2 pins. When an audio adapter is detected, the system is required to properly connect the audio codec to the CDP/CDN and SBU1/SBU2 with an external analog switch.

Moisture Detection

The MAX20342 supports resistance measurement between selected pins on the USB Type-C connector. This measurement can be used to determine if there is moisture or some other form of conductive debris present in the connector. The moisture detection function can be automatically configured (MoistDetAutoCfg = 1) or manually configured (MoistDetAutoCfg = 0) and also supports manual triggering (MoistDetManEn = 1) or periodic triggering (MoistDetPerEn = 1). The moisture detection function is run only when the MAX20342 is not in shutdown mode and V_B or a CC connection has not been detected.

Moisture Detection Threshold R_{MOIST}

The R_{MOIST} is defined by the combination of the ADC voltage threshold RMoistDetVth[7:0] and the selected pullup current RMoistDetIpu[1:0]. When the measured resistance is below R_{MOIST}, the ResMoistInt interrupt is asserted. Since both the voltage and current are needed to calculate resistance, the IpuResult[1:0] and ADCResultAvg[7:0] results are evaluated together to determine if moisture is detected (measured resistance < R_{MOIST}). *Table 5* lists the conditions for the indication of moisture. The resistance of the moisture threshold must be set with respect to the resistance constraints listed in *Table 7* and *Table 8*.

Table 5. Moisture Detection Result

IPURESULT[1:0]	ADCRESULTAVG[7:0]	MOISTURE DETECTED (MEASURED RESISTANCE < R_{MOIST})
< RMoistDetIpu[1:0]	Don't Care	No
== RMoistDetIpu[1:0]	< RMoistDetVth[7:0]	Yes
> RMoistDetIpu[1:0]	Don't Care	Yes

Automatic Configuration

If the automatic configuration mode is selected (MoistDetAutoCfg = 1), all the pulldown and pullup switches described in the *Resistive Measurement* section are automatically controlled during moisture detection. When an automatically configured moisture detection is triggered either manually (MoistDetManEn = 1) or periodically (MoistDetPerEn = 1), the resistance is measured between one of the CC pins and ground while all other USB Type-C pins (V_B, CDP, CDN, SBU1, SBU2, and the other CC) are grounded.

If the result is Open or Abort, the moisture detection ends, no interrupt is triggered, and the result is reported in IpuResult[1:0] and ADCResultAvg[7:0]. If the result is a finite resistance above the moisture threshold defined by RMoistDetVth[7:0] and RMoistDetIpu[1:0], the detection ends, ResFiniteInt interrupt is asserted, and the result is reported. If the result is below the moisture threshold, ResMoistInt interrupt is asserted and a burst of consecutive resistive measurements is performed on CC1/CC2/SBU1/SBU2 (pulled up one at a time) to ground while the other USB Type-C pins are grounded. Finally, the burst measurement results are reported in the registers MoistDetAutoCC1/CC2Result1, MoistDetAutoCC1/CC2Result2, MoistDetAutoSBU1/SBU2Result1, and MoistDetAutoSBU1/SBU2Result2. *Figure 2* shows the detection flow for automatically configured moisture detection.

Automatically configured moisture detection always starts on the alternate CC pin when the next detection is triggered either periodically or manually as shown in *Figure 4*.

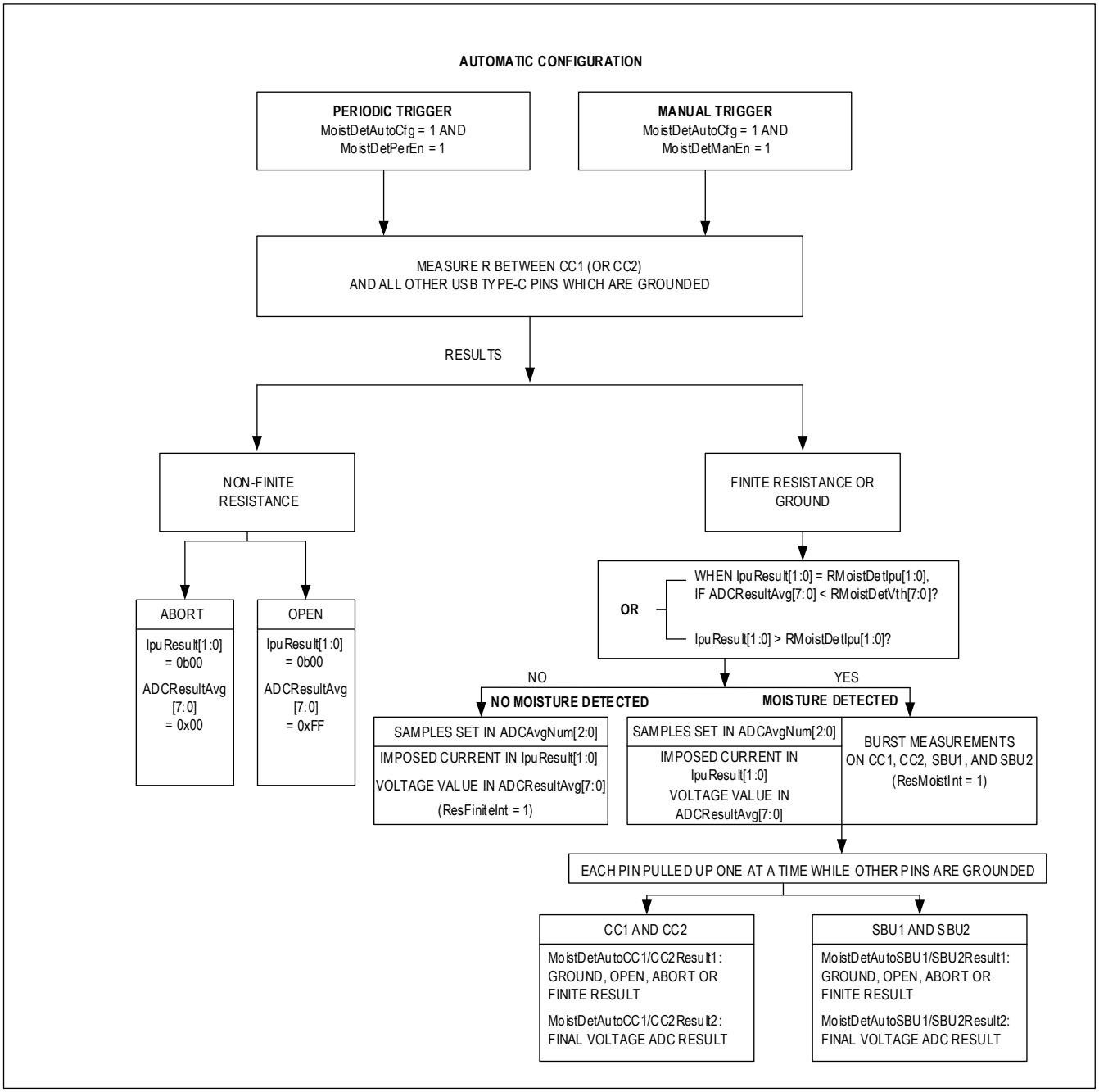


Figure 2. Automatically Configured Moisture Detection Flow

Manual Configuration

If manual configuration mode is selected (MoistDetAutoCfg = 0), all the pulldown and pullup switches described in the *Resistive Measurement* section are configured manually by MoistDetPUConfig[5:0] and MoistDetPDConfig[6:0]. The two pullup and one pulldown switches associated with each USB Type-C pin can be independently configured. This mode allows measuring resistance between the USB Type-C pins in different user-defined configurations. This manually configured moisture detection can also be triggered either manually (MoistDetManEn = 1) or periodically (MoistDetPerEn = 1).

If the result of the measurement is an Abort or Open, the corresponding ResAbortInt or ResOpenInt interrupt is asserted. If the resistance result is higher than or equal to the moisture resistance threshold, ResFiniteInt interrupt is asserted. If the result (including Ground) is lower than the moisture resistance threshold, the ResMoistInt interrupt is asserted instead.

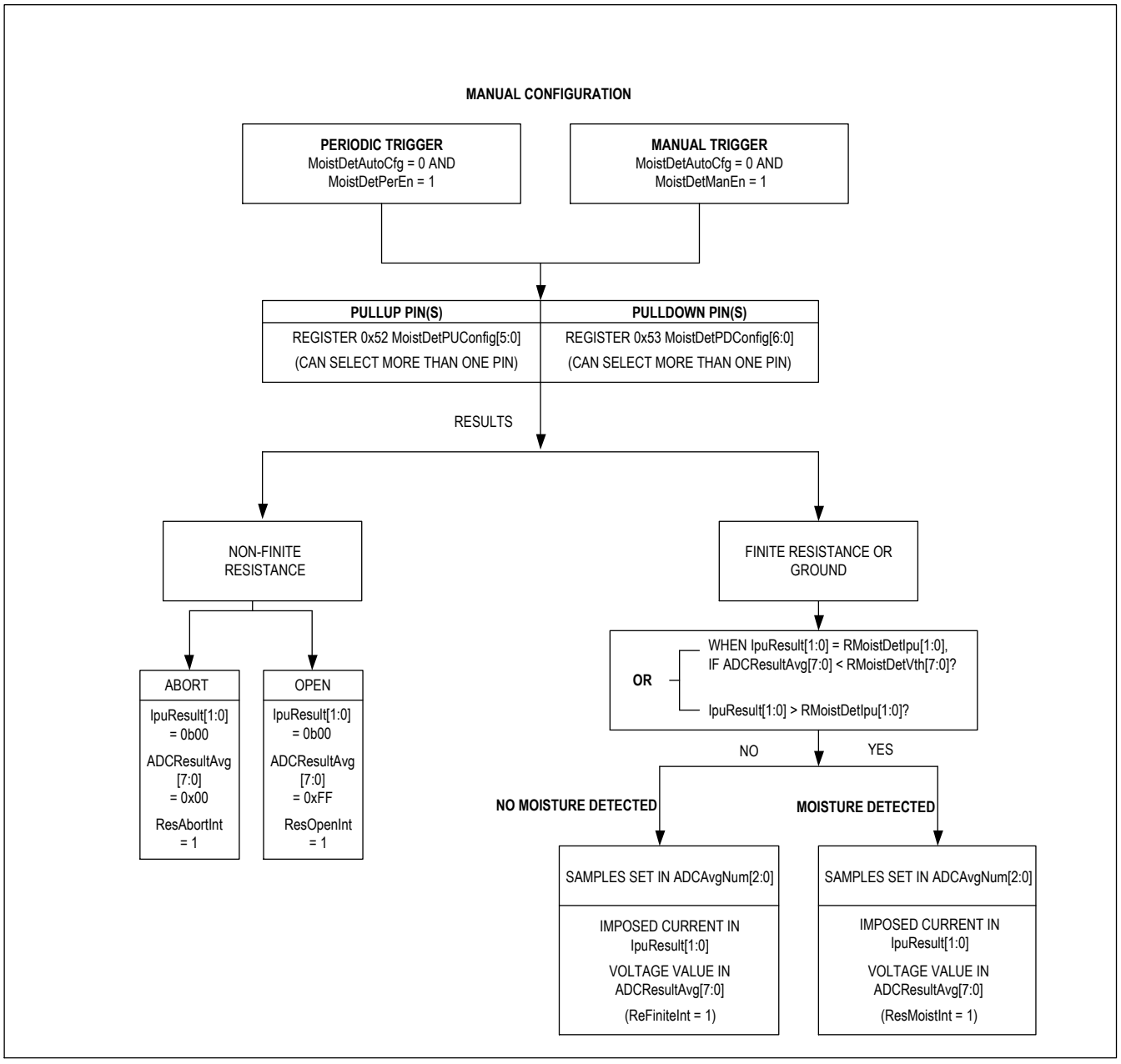


Figure 3. Manually Configured Moisture Detection Flow

Periodic and Manual Trigger

Moisture detection, either automatically or manually configured, can be triggered either manually or periodically. Moisture detection is manually triggered when MoistDetManEn is set to 1; it starts a single moisture detection. MoistDetManEn bit stays high until the end of the measurement and is then self-cleared. If MoistDetManEn is set to 1 while V_B or a CC connection is detected, a moisture detection starts as soon as the cable is detached. It is also possible to cancel the pending manual triggered detection by writing a 0 to MoistDetManEn while V_B or a CC connection has been detected.

When periodic triggering is enabled by setting MoisetDetPerEn to 1, the moisture detection is run periodically every 10 seconds (typ). It is also possible to manually trigger a moisture detection while periodic trigger is enabled. The 10-second timer does not reset by the manual trigger as shown in *Figure 4* and *Figure 5*.

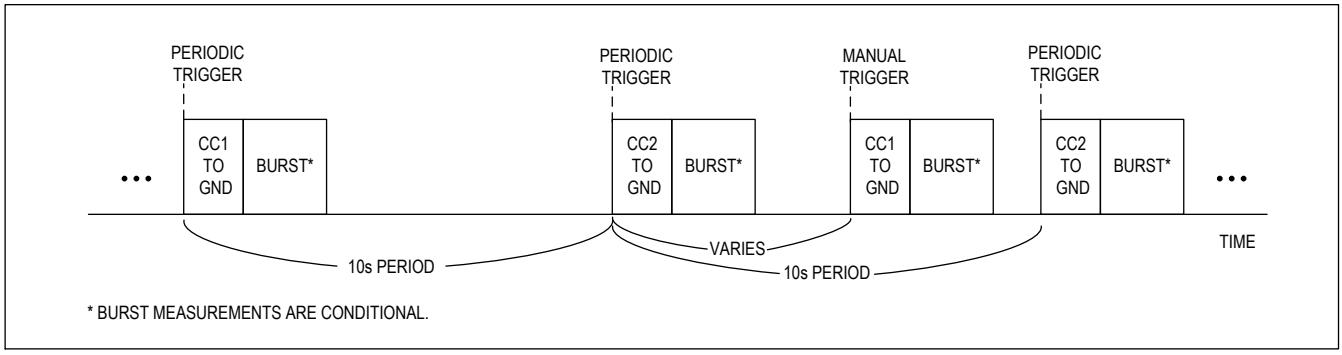


Figure 4. Moisture Detection Triggering for Automatic Configuration

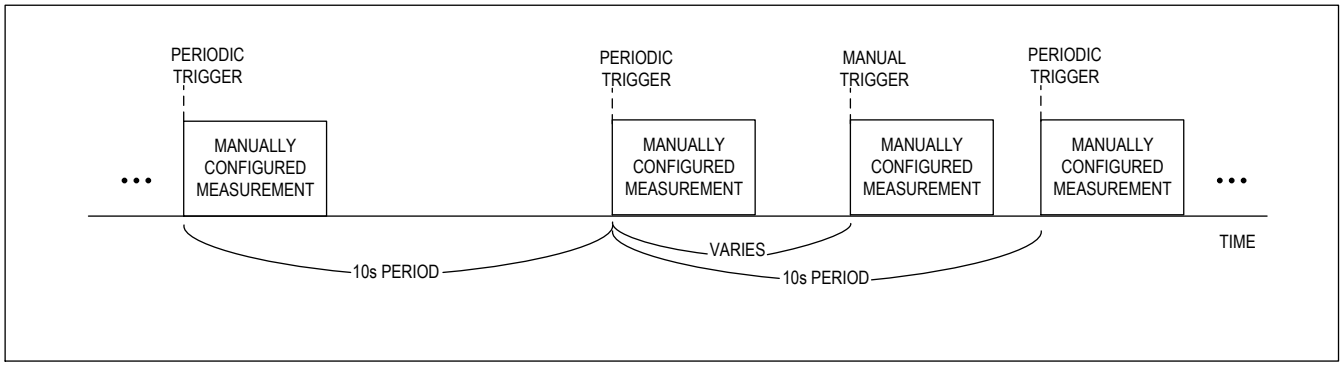


Figure 5. Moisture Detection Triggering for Manual Configuration

Debug Accessory Modes

The MAX20342 can automatically detect up to five accessory modes based on the measured resistance between SBU1 (or SBU2) and ground. These five resistance thresholds are selected by the corresponding RAcc1-5DetVMax[7:0], RAcc1-5DetVMin[7:0], and RAcc1-5DetIpu[1:0] register bits.

If any one of the RaccDet1-5 ranges is detected, the corresponding ResAcc1-5Int interrupt is asserted. In addition, RaccDet1-3 values also define the UART and factory modes. If one of the RaccDet1-3 is detected, the MAX20342 is configured according to *Table 4*.

Accessory Mode Detection

The five accessory modes (Accessory 1-5) are detected by measuring the resistance on the SBU1 and SBU2 pins using the scheme detailed in the *Resistive Measurement* section. The detection can be triggered manually (SBUDetManEn = 1), continuously (SBUDetContEn = 1), or one-shot (SBUDetOneShotEn = 1). One detection consists of measuring the resistances on SBU1/SBU2 to ground in sequence, reporting the results, and asserting the corresponding interrupts.

Manual trigger runs one detection as soon as SBUDetManEn is set to 1 (except in shutdown mode). Continuous and one-shot triggering work only when the device is in Debug Accessory Sink Mode (CCStat[2:0] = 0b111). With one-shot triggering, a single detection is run upon entering Debug Accessory Sink Mode. For continuous triggering, the detection is run periodically every 200ms until a resistance is found within one of the five accessory mode resistance ranges, or until the Debug Accessory Sink Mode is exited.

After both the SBU1 and SBU2 resistive measurements are completed, individual results are reported in the SBU1DetResult1/2 and SBU2DetResult1/2 registers, and the ResSBUInt interrupt is asserted. The overall result is derived based on these individual results and the SBUDetAbortPriority value as listed in *Table 6*. The corresponding ResAbortInt, ResOpenInt, or ResGroundInt interrupt is also asserted respectively if the overall result is Abort, Open, or Ground. If the overall result is a Finite resistance but not in any of the five accessory mode resistance ranges, a ResFiniteInt is asserted. If it is within one of these ranges, the corresponding ResAcc1-5Int interrupt is asserted.

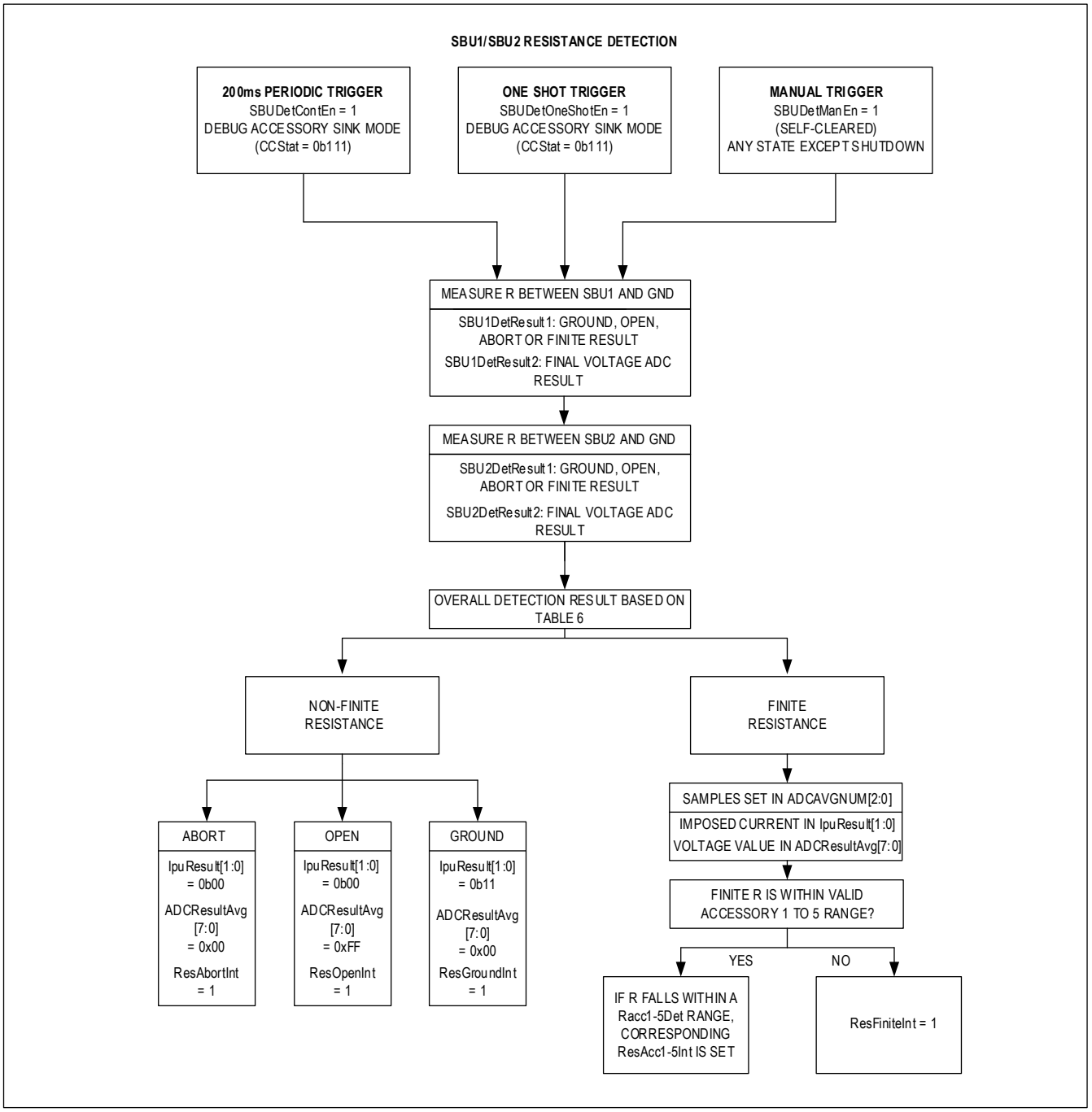


Figure 6. SBU1/SBU2 Resistance Detection

Table 6. SBU Detection Overall Result

RESULT ON EACH PIN		OVERALL RESULT	
SBU1	**SBU2**	**SBUDETABORTPRIORITY = '0'**	**SBUDETABORTPRIORITY = '1'**
Open	Open	Open	
Ground	Ground	Ground	
Open	Ground	Ground	
Ground	Open	Ground	
Open	Finite	Finite	
Finite	Open	Finite	
Ground	Finite	Finite	
Finite	Ground	Finite	
Finite	Finite	Abort	
Abort	Finite	Finite	Abort
Finite	Abort	Finite	Abort
Abort	Abort	Abort	
Open	Abort	Open	Abort
Abort	Open	Open	Abort
Ground	Abort	Ground	Abort
Abort	Ground	Ground	Abort

Resistive Measurement

The resistive measurement circuitries used for both moisture detection and SBU1/SBU2 accessory mode detection are the same. As shown in *Figure 7*, it consists of an 8-bit SAR ADC, four switchable pullup currents, one bank of pullup switches, and one bank of pulldown switches. Each USB Type-C pin has one pulldown switch and two pullup switches associated with it. The pulldown switch (each with R_{MOIST_SWPD} on-resistance) connects the pin to ground, while the two pullup switches (each with R_{MOIST_SWPU} on-resistance) connect the pin to the forced node where the pullup current source is connected and to the sensed node where the ADC is connected, respectively.

For example, to measure resistance between SBU1 and the other USB Type-C pins, the two pullup switches of SBU1 are closed, connecting SBU1 to the forced and sensed nodes. The pulldown switches of the other USB-C pins are also closed so that those pins are all grounded. When the pullup current is switched onto the forced node, the current flows through the resistance (between SBU1 and ground) and the voltage on SBU1 is sensed by the ADC on the sensed node. The resistance can then be determined, knowing the forced pullup current and the sensed voltage. These pullup and pulldown switches can be automatically or manually configured as described in the *Moisture Detection* section. In accessory mode detection, only the pullup switches on SBU1 and SBU2 (alternately) are enabled.

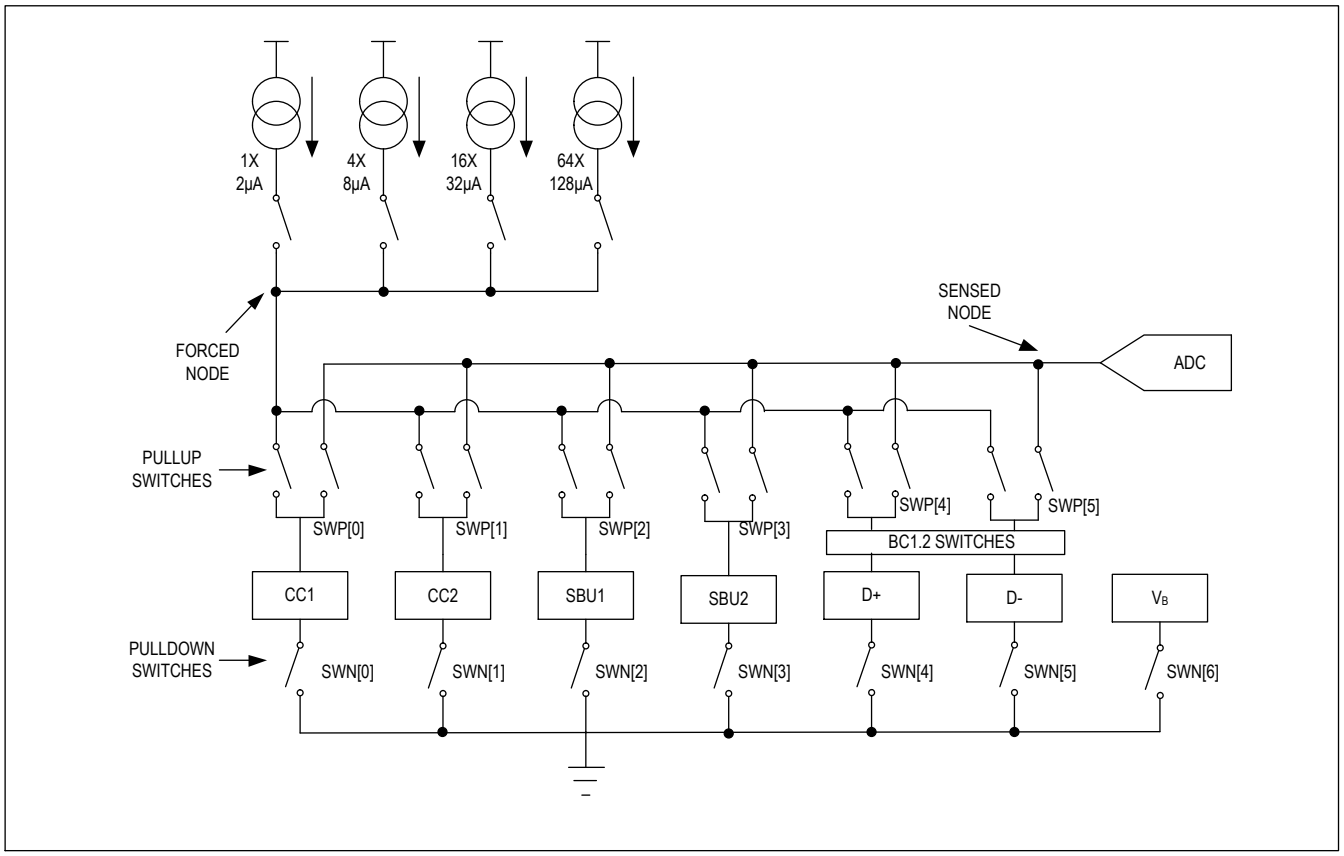


Figure 7. Resistive Measurement Simplified Diagram

For each measurement, the ADC takes $N = 2^{ADCAvgNum[2:0]}$ samples and records the maximum, minimum, and average values among these samples. To avoid operating the ADC with a small input level where the offset error is dominant, the device starts with the 2µA pullup current and increases it by a factor of four when the average ADC reading is lower than nearly a quarter of the ADC full scale value (see *Figure 8* for details), this continues until the maximum 128µA pullup current is reached. The final measurement result is reported in the ADCResultAvg/Min/Max[7:0] and IpuResult[1:0] register bits.

To address the intrinsic resistive measurement errors of the MAX20342, ADC shift factors are set and the device compares the ADC average reading to the threshold of (0x3F - ADC shift factor) when deciding whether or not to increase the pullup current by a factor of four. This helps prevent clamping the average ADC reading when the pullup current is increased prematurely due to the measurement errors (quantified by the R_{SBU_ACC} and R_{CCCD_ACC} parameters in the ECT).

The parameters ADCSBUCorrNum[4:0], R_{SBU_ACC}, R_{SBU_RNG}, and $R_{SBU\_RNG\_GND}$ apply when only the SBU1 and/or SBU2 pins are pulled up. In specific, these parameters always apply in accessory mode detection. For moisture detection, these parameters only apply in the following cases: during two of the four burst measurements (when SBU1 and SBU2 are pulled up), and when only SBU1 and/or SBU2 (not any other pins) are pulled up in Manual Configuration. In all the other moisture detection cases, the parameters ADCCorrNum[5:0], R_{CCCD_ACC}, R_{CCCD_RNG}, and $R_{CCCD\_RNG\_GND}$ apply.

Open/Ground/Abort/Finite Result

The flow of the resistive measurement is depicted in *Figure 8*. There are four possible results for each measurement, namely Open, Ground, Abort, and Finite:

Open: If the resistance on the node is open, the final imposed pullup current should be 2µA, while ADCResultMax[7:0] and ADCResultAvg[7:0] clamp at 0xFF (assuming ADCNoiseClampRng[5:0] is set to 0x00, as it should be in most cases). The Open result is reported with IpuResult[1:0] = 00 and ADCResultAvg/Min/Max = 0xFF.

Ground: If the resistance on the node is ground, the final imposed pullup current should be 128µA and the average ADC reading should be lower or equal than ADCGroundVth[3:0]. The Ground result is reported with IpuResult[1:0] = 11 and ADCResultAvg/Min/Max = 0x00.

Abort: If the resistive measurement returns one of the two listed results, it retries for up to ADCRetryNum[3:0] times. If the same result is returned for ADCRetryNum[3:0] times, the Abort result is reported with IputResult[1:0] = 00 and ADCResultAvg/Min/Max = 0x00. Abort indicates that the device is unable to determine the resistance due to unfiltered noise or uncorrected measurement error on the node. It is not expected to occur in most applications.

1. (ADCResultMax[7:0] = 0xFF) AND (IputResult[1:0] = 2µA) AND (ADCResultAvg[7:0] < (0xFF - ADCNoiseClampRng[5:0]))
2. (ADCResultMax[7:0] = 0xFF) AND (IputResult[1:0] = 8µA, 32µA, or 128µA)

Finite: The Finite resistance is reported if one of the two listed conditions is met. ADC_shift factor is equal to ADCSBUCorrNum[4:0] when only SBU1 and/or SBU2 are pulled up and equal to ADCCorrNum[5:0] in other cases. The detected resistance can be calculated with the final imposed current reflected in IpuResult[1:0], the sensed voltage reflected in ADCResultAvg[7:0], and the LSB of the ADC: R = ADCResultAvg[7:0] x LSB / IpuResult[1:0].

1. (ADCResultAvg[7:0] > (0x3F – ADC shift factor)) AND (ADCResultMax[7:0] < 0xFF)
2. (ADCResultAvg[7:0] ≤ (0x3F – ADC shift factor)) AND (ADCResultAvg[7:0] > ADCGroundVth[3:0] AND IputResult[1:0] = 128µA)

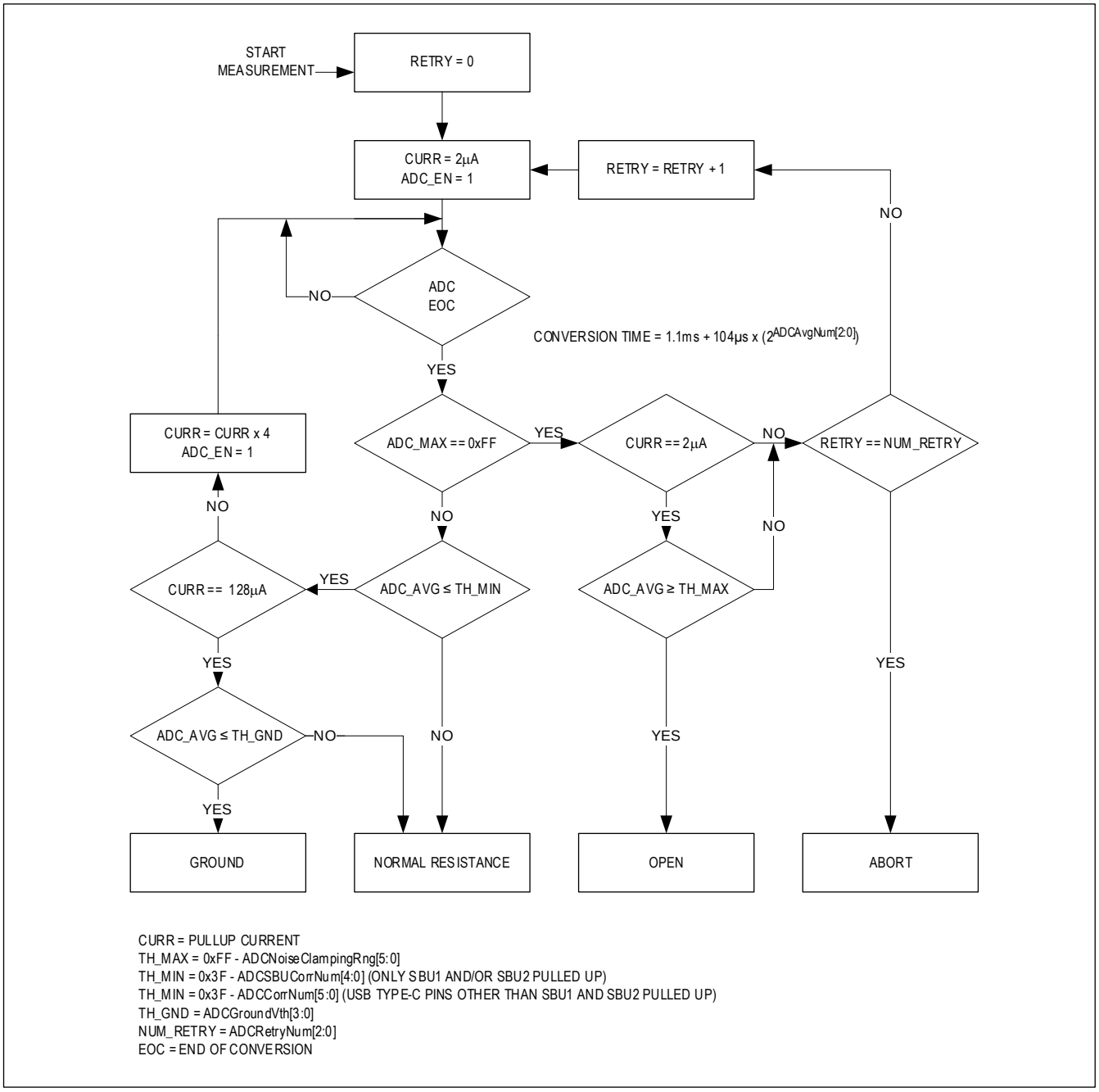


Figure 8. Resistive Measurement Flow

Moisture Detection and Accessory Mode Detection Auto-Detectable Resistances and Voltage Thresholds Setting

The allowed ranges from which the user can pick the target resistance values to be automatically detected are shown in *Table 7* and *Table 8*.

To account for the resistance measurement errors (R_{SBU_ACC} and R_{CCCD_ACC}), the moisture detection voltage threshold, RMoistDetVth[7:0], must be set with the corresponding accuracy percentage with the chosen pullup current. For the accessory mode detection, the minimum and maximum voltage thresholds, RAcc_DetVMin[7:0] and RAcc_DetVMax[7:0], for each of the five accessory modes also need to be adjusted with the corresponding accuracy percentage with the chosen pullup current. If the resistor on the SBU1 (or SBU2) has additional tolerance, error band RBAND needs to be widened by decreasing RAcc_DetVMin[7:0] and increasing RAcc_DetVMax[7:0] to account for the additional resistance variation.

Table 7. Auto Detectable Resistance Ranges and Accuracies - Accessory Mode Detection and Moisture Detection When Only SBU1 and/or SBU2 Are Pulled Up

PULLUP CURRENT	AUTO DETECTABLE RESISTANCE RANGE R_{SBU_RNG}		RESISTANCE MEASUREMENT ACCURACY R_{SBU_ACC}	
	MIN	MAX	MIN	MAX
2µA	187.5kΩ	714.7kΩ	-4.70%	+4.70%
8µA	46.88kΩ	170.2kΩ	-4.70%	+4.70%
32µA	11.72kΩ	42.57kΩ	-4.70%	+4.70%
128µA	2.93kΩ	10.64kΩ	-4.70%	+4.70%

For example, to detect an accessory resistance value of 30kΩ, perform the following procedure:

1. The target resistance is 30kΩ. Use *Table 7* to find the resistance range and measurement accuracy in which 30kΩ falls into. In this example, the target resistance belongs to the 32µA pullup current range.
2. Compute the typical voltage target: 30kΩ x 32µA = 0.96V.
3. Since only SBU pins are pulled up, R_{SBU_ACC} applies, namely the combined accuracy of the ADC and the 32µA pullup current (see *Table 7*). Compute the minimum and maximum accessory mode detection voltage thresholds with the measurement accuracy (4.75%).
   - Minimum threshold: 0.96V x (1 – 4.70%) = 0.91488V. With conversion, RAcc_DetVMin[7:0] = 155 = 0x9B.
   - Maximum threshold: 0.96V x (1 + 4.70%) = 1.00512V. With conversion, RAcc_DetVMax[7:0] = 171 = 0xAB.
4. The calculation refers to an ideal external resistance with zero tolerance. In practice, decreasing the minimum and increasing the maximum voltage thresholds by an amount dictated by the actual tolerance is necessary.
5. With an external resistor (1% tolerance), the minimum and maximum voltage thresholds would be:
   - Minimum threshold: 0.91488V x (1 – 1%) = 0.90573V. With conversion, RAcc_DetVMin[7:0] = 153 = 0x99.
   - Maximum threshold: 1.00512V x (1 + 1%) = 1.01517V. With conversion, RAcc_DetVMax[7:0] = 173 = 0xAD.

Table 8. Auto Detectable Resistance Ranges and Accuracies - Moisture Detection in Other Cases

PULLUP CURRENT	AUTO DETECTABLE RESISTANCE RANGE R_{CCCD_RNG}		RESISTANCE MEASUREMENT ACCURACY R_{CCCD_ACC}	
	MIN	MAX	MIN	MAX
2µA	187.5kΩ	672.6kΩ	-10.31%	+10.31%
8µA	46.88kΩ	149.7kΩ	-5.81%	+5.81%
32µA	11.72kΩ	39.30kΩ	-5.44%	+5.44%
128µA	2.93kΩ	9.86kΩ	-5.13%	+5.13%

For example, to detect a moisture resistance threshold of 20kΩ, perform the following procedure (the CC1 or CC2 pin is pulled up):

1. The target resistance is 20kΩ. Use *Table 8* to find the resistance range and measurement accuracy in which 20kΩ falls into. In this example, the target resistance belongs to the 32µA pullup current range.
2. Compute the typical voltage target: 20kΩ x 32µA = 0.64V.
3. Since pin(s) different from SBU1 and/or SBU2 only (i.e., CC1 and CC2) are pulled up, R_{CCCD_ACC} applies, namely the combined accuracy of the ADC and the 32µA pullup current (see *Table 8*). Compute the minimum moisture detection voltage threshold with the measurement accuracy (5.44%).
   - Moisture threshold: 0.64V x (1 – 5.44%) = 0.60518V. With conversion, RMoistDetVth[7:0] = 102 = 0x66.
4. The calculation refers to an ideal external resistance with zero tolerance. In practice, decreasing the moisture detection voltage threshold by an amount dictated by the actual tolerance is necessary.
5. With an external resistor (1% tolerance), the moisture threshold would be 0.60518V x (1 – 1%) = 0.59913V. With conversion, RMoistDetVth[7:0] = 101 = 0x65.

Ground Threshold for Accessory Mode Detection and Moisture Detection

The actual resistance ground condition ranges, $R_{SBU\_RNG\_GND}$ and $R_{CCCD\_RNG\_GND}$, are determined by setting ADCGroundVth[3:0] with the following formulas:

$R_{SBU\_RNG\_GND}$ = [5.823mV x (ADCGroundVth[3:0] – 1) – 4.35mV] / 131.059µA

$R_{CCCD\_RNG\_GND}$ = [5.823mV x (ADCGroundVth[3:0] – 1) – 4.35mV] / 131.600µA

For example, the default of ADCGroundVth[3:0] is 0b0100 or decimal 4. Therefore:

$R_{SBU\_RNG\_GND}$ = [5.823mV x (4 – 1) – 4.35mV] / 131.059µA = 100.11Ω (The ECT value)

$R_{CCCD\_RNG\_GND}$ = [5.823mV x (4 – 1) – 4.35mV] / 131.600µA = 99.70Ω (The ECT value)

V_B Overvoltage Protection

The device features overvoltage protection up to +28V on the V_B line. If the input voltage exceeds the overvoltage lockout threshold (V_{B_OVLO}), the low 50mΩ (typ) on-resistance internal FET disconnects V_B from OUT to protect low-voltage systems against voltage faults. The device features soft-start capability to minimize inrush current by slowly turning the internal FET on when the V_B voltage is valid for a period longer than the debounce time (t_{VBFLT_DEB}). When an overvoltage event occurs, the fault flag or interrupt is asserted depending on the INTEn configuration in the COMM_CTRL1 register.

USB Data Switch (TDN/TDP)

The device supports Hi-Speed, full-speed, and low-speed USB signal levels. The USB channel is bidirectional and has low R_{ON_TD} 3.2Ω (typ) on-resistance and C_{ON_TD} 4.5pF (typ) on-capacitance. The low on-resistance is stable as the analog input signals are swept from ground to 5.5V for low signal distortion.

UART Switch (UT, UR)

The MAX20342 supports standard single-supply UART signals. The UART channel supports high-speed signals. The UART channel is bidirectional and has a R_{ON_U} 23Ω (typ) on-resistance.

Thermal Shutdown

The MAX20342 features a thermal shutdown protection feature to protect the device from fault conditions. When the die temperature is T_{SHDN_THR}, the device enters thermal shutdown mode and the fault flag or interrupt is asserted depending on the INTEn configuration in the COMM_CTRL1 register. When the die temperature drops below 150°C, the device automatically resumes operation and the fault flag or interrupt is cleared.

Supply Voltage Selector

The MAX20342 features an internal supply voltage selector that chooses between V_B and BAT inputs to power the internal blocks. If V_B is not present, the internal power supply, V_{CCINT}, is supplied from BAT. A typical 100µs POR is provided at the rising edge of V_{CC}. When the device is connected to V_B, the user can force the device to use BAT as the supply of V_{CC} through the COMM_CTRL1 register VCCINTOnBAT bit.

Low-Power Modes

To minimize power consumption, the MAX20342 supports three different low power modes: shutdown (ShdnMode), low-power UFP (LPUFP), and low-power DRP (LPDRP). Shutdown is the lowest power consumption mode. LPUFP has the UFP emulation on. LPDRP has the DRP emulation on.

Shutdown

To minimize power consumption to the lowest possible level when inactive, the MAX20342 features a low-power shutdown mode that is activated through the register COMM_CTRL1 ShdnMode enable bit in the I²C interface. When ShdnMode = 1, the device enters low-power state, and the battery current is reduced to I_{BAT_SHDN}. In this condition, the only blocks that are active are the I²C interface and the CC pin monitoring to detect the charger connection. All other blocks are disabled. On the I²C bus, the device exits shutdown mode when a logic-low is detected on either SDA or SCL for more than 50ns (typ).

Interrupts

The MAX20342 generates an interrupt for any bit status change in the I²C status register. The INTEn bit enables the interrupt output. When INTEn is disabled, all interrupts are masked but not cleared. The $\overline{INT}$ pin is defaulted as a flag function when the interrupt is disabled (INTEn = 0). In this condition, the $\overline{INT}$ pin is pulled low when an invalid or an unknown charger is inserted or when a UART factory cable is detected.

I²C Interface

The MAX20342 contains an I²C-compatible interface for data communication with a host controller (SCL and SDA). The interface supports a clock frequency of up to 1000kHz. SCL and SDA require pullup resistors that are connected to a positive supply.

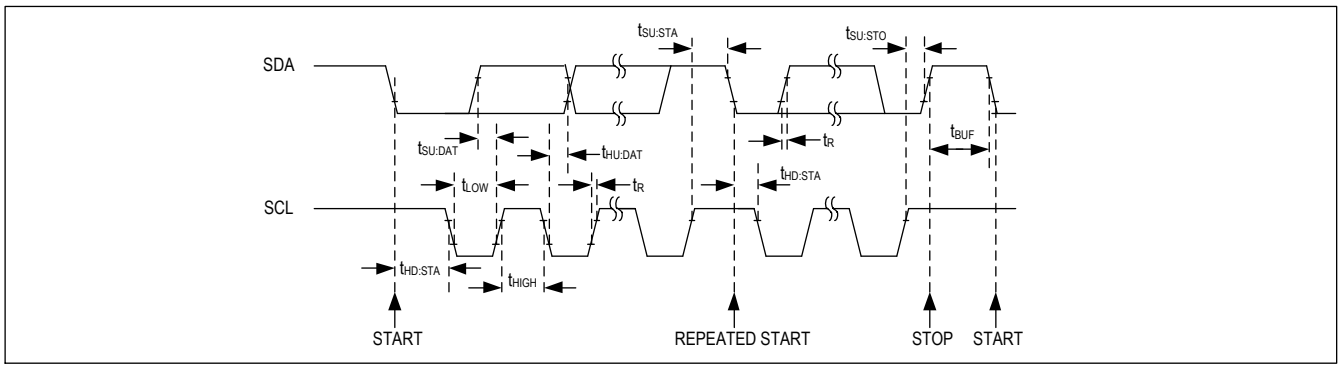


Figure 9. I²C Interface Timing

When writing to the MAX20342 using the I²C interface, the master sends a START condition (S) followed by the MAX20342 I²C address. After the address, the master sends the register address of the register that is to be programmed. The master then ends communication by issuing a STOP condition (P) to relinquish control of the bus, or a REPEATED START condition (Sr) to communicate to another I²C slave.

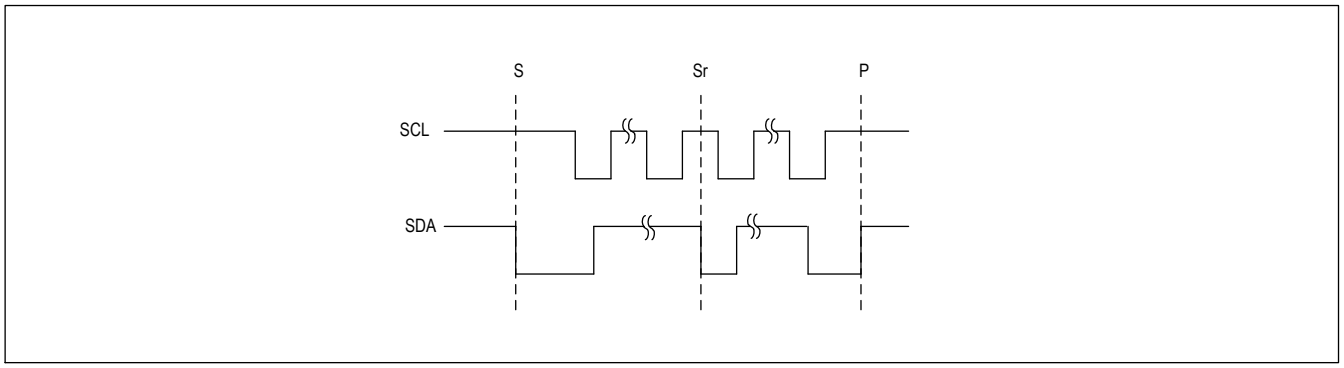


Figure 10. I²C START, STOP, and REPEATED START Conditions

Slave Address

The MAX20342 slave address is 0b0110101 (0x35) plus the Read/Write bit. Set the Read/Write bit high to configure the MAX20342 to read mode (0x6B). Set the Read/Write bit low to configure the MAX20342 to write mode (0x6A).

Bit Transfer

One data bit is transferred on the rising edge of each SCL clock cycle. The data on SDA must remain stable during the high period of the SCL clock pulse. Changes in SDA while SCL is high and stable are considered control signals (see *Figure 10*). Both SDA and SCL remain high when the bus is not active.

Single-Byte Write

In this operation, the master sends an address and two data bytes to the slave device. The following procedure describes the single byte write operation:

1. The master sends a START condition.
2. The master sends the 7-bit slave address plus a write bit (low).
3. The addressed slave asserts an ACK on the data line.
4. The master sends the 8-bit register address.
5. The slave asserts an ACK on the data line only if the address is valid (NAK if not).
6. The master sends 8 data bits.
7. The slave asserts an ACK on the data line.
8. The master generates a STOP condition.

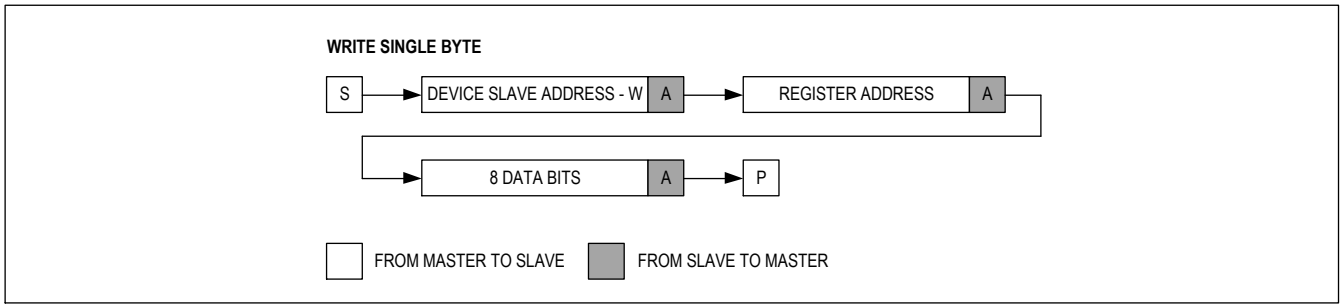


Figure 11. Write Byte Sequence

Burst Write

In this operation, the master sends an address and multiple data bytes to the slave device. The slave device automatically increments the register address after each data byte is sent, unless the register being accessed is 0x00, in which case the register address remains the same. The following procedure describes the burst write operation:

1. The master sends a START condition.
2. The master sends the 7-bit slave address plus a write bit (low).
3. The addressed slave asserts an ACK on the data line.
4. The master sends the 8-bit register address.
5. The slave asserts an ACK on the data line only if the address is valid (NAK if not).
6. The master sends 8 data bits.
7. The slave asserts an ACK on the data line.
8. Repeat step 6 and step 7 N-1 times.
9. The master generates a STOP condition.

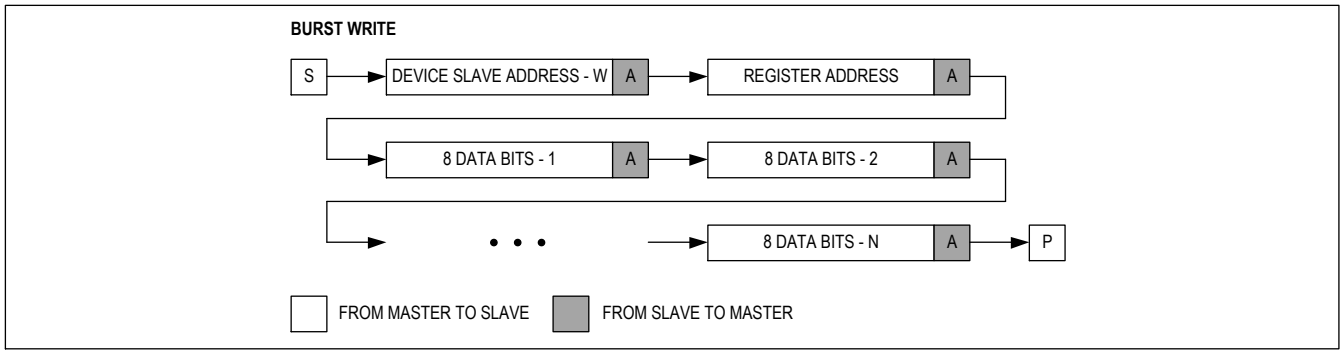


Figure 12. Burst Write Sequence

Single Byte Read

In this operation, the master sends an address plus two data bytes and receives one data byte from the slave device. The following procedure describes the single byte read operation:

1. The master sends a START condition.
2. The master sends the 7-bit slave address plus a write bit (low).
3. The addressed slave asserts an ACK on the data line.
4. The master sends the 8-bit register address.
5. The slave asserts an ACK on the data line only if the address is valid (NAK if not).
6. The master sends a REPEATED START condition.
7. The master sends the 7-bit slave address plus a read bit (high).
8. The addressed slave asserts an ACK on the data line.
9. The slave sends 8 data bits.
10. The master asserts a NACK on the data line.
11. The master generates a STOP condition.

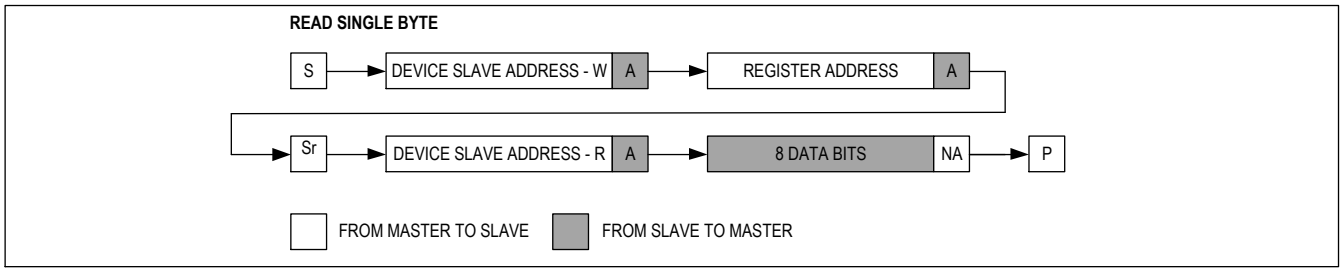


Figure 13. Read Byte Sequence

Burst Read

In this operation, the master sends an address plus two data bytes and receives multiple data bytes from the slave device. The following procedure describes the burst byte read operation:

1. The master sends a START condition.
2. The master sends the 7-bit slave address plus a write bit (low).
3. The addressed slave asserts an ACK on the data line.
4. The master sends the 8-bit register address.
5. The slave asserts an ACK on the data line only if the address is valid (NAK if not).
6. The master sends a REPEATED START condition.
7. The master sends the 7-bit slave address plus a read bit (high).
8. The slave asserts an ACK on the data line.
9. The slave sends 8 data bits.
10. The master asserts an ACK on the data line.
11. Repeat step 9 and step 10 N-2 times.
12. The slave sends the last 8 data bits.
13. The master asserts a NACK on the data line.
14. The master generates a STOP condition.

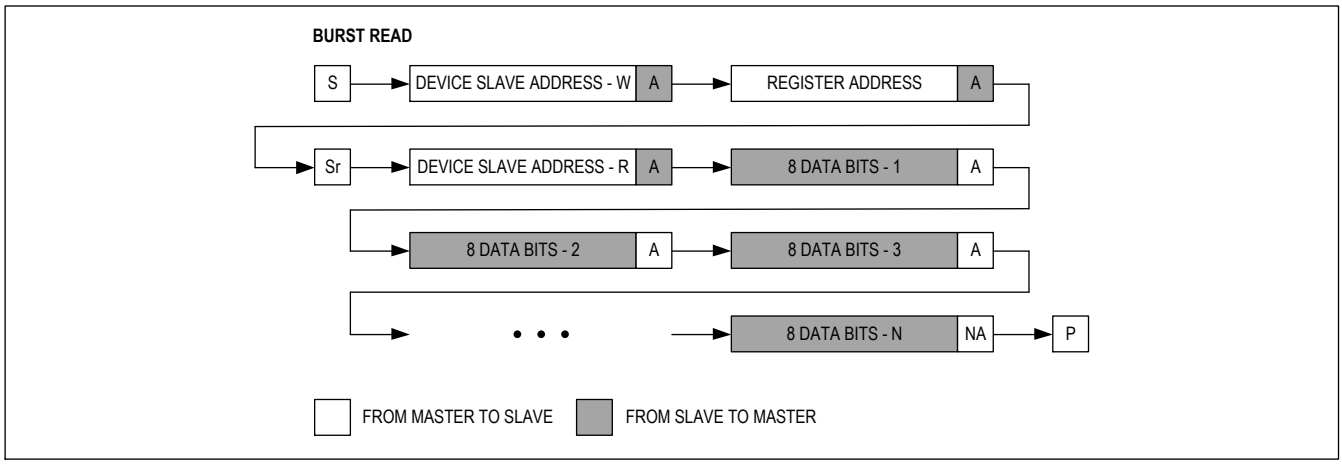


Figure 14. Burst Read Sequence

Acknowledge Bits

Data transfers are acknowledged with an acknowledge bit (ACK) or a not-acknowledge bit (NACK). Both the master and the MAX20342 generate ACK bits. To generate an ACK, pull SDA low before the rising edge of the ninth clock pulse and hold it low during the high period of the ninth clock pulse. To generate a NACK, leave SDA high before the rising edge of the ninth clock pulse and leave it high for the duration of the ninth clock pulse. Monitoring for NACK bits allows for detection of unsuccessful data transfers.

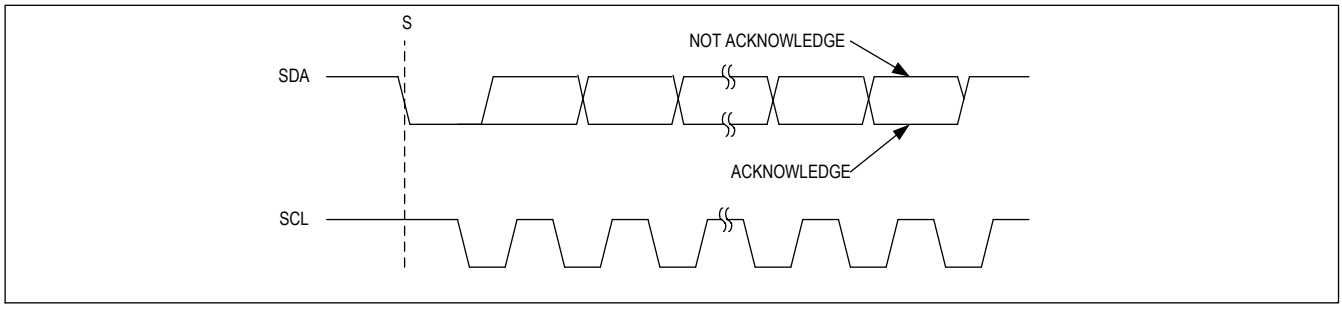


Figure 15. Acknowledge Bits

Register Map

MAX20342

ADDRESS	NAME	MSB							LSB
USER_INTERRUPTS									
0x00	REVISION_ID[7:0]	Revision_id[7:0]							
0x01	COMMON_INT[7:0]	FAULTInt	BatOVLOInt	BatUVLOInt	THMInt	LowPwrInt	ShdnWakeInt	VSAFE0VInt	VBvalidInt
0x02	CC_INT[7:0]	–	–	CCStatInt	CCPinStatInt	CCIStatInt	CCVcnStatInt	VCONNOCPInt	DetAbrtInt
0x03	BC_INT[7:0]	–	–	–	ChgTypInt	PrChgTypInt	CHgDetRunRInt	CHgDetRunFInt	DCDTmoInt
0x04	OVP_INT[7:0]	–	–	–	–	–	–	SwtClosedInt	OVLOInt
0x05	RES_INT1[7:0]	–	–	–	ResAcc5Int	ResAcc4Int	ResAcc3Int	ResAcc2Int	ResAcc1Int
0x06	RES_INT2[7:0]	–	–	ResGroundInt	ResSBUInt	ResFiniteInt	ResOpenInt	ResAbortInt	ResMoistInt
0x07	COMMON_STATUS[7:0]	FAULT	BatOVLO	BatUVLO	THM	LowPwr	–	VSAFE0V	VBvalid
0x08	CC_STATUS1[7:0]	–	–	–	–	VCONNSC	CCVcnStat	VCONNOCP	ChgDetAbort
0x09	CC_STATUS2[7:0]	–	CCStat[2:0]			CCPinStat[1:0]		CCIStat[1:0]	
0x0A	BC_STATUS[7:0]	–	ChgTyp[1:0]		PrChgTyp[2:0]			CHgDetRun	DCDTmo
0x0B	OVP_STATUS[7:0]	ItfRdy	–	–	–	–	–	SwtClosed	OVLO
0x0C	COMMON_MASK[7:0]	FAULTM	BatOVLOM	BatUVLOM	THMM	LowPwrM	ShdnWakeM	VSAFE0VM	VBvalidM
0x0D	CC_MASK[7:0]	–	–	CCStatM	CCPinStatM	CCIStatM	CCVcnStatM	VCONNOCPM	DetAbrtM
0x0E	BC_MASK[7:0]	–	–	–	ChgTypM	PrChgTypM	CHgDetRunRM	CHgDetRunFM	DCDTmoM
0x0F	OVP_MASK[7:0]	–	–	–	–	–	–	SWT_closedM	OVLOM

ADDRESS	NAME	MSB							LSB
0x10	RES_MASK1[7:0]	–	–	–	ResAcc5IntM	ResAcc4IntM	ResAcc3IntM	ResAcc2IntM	ResAcc1IntM
0x11	RES_MASK2[7:0]	–	–	ResGroundIntM	ResSBUIntM	ResFiniteIntM	ResOpenIntM	ResAbortIntM	ResMoistIntM
USER_COMMON									
0x15	COMM_CTRL1[7:0]	INTEn	FactAuto	USBAuto	AudioCPEn	VCCINTOnBAT	LPDRP	LPUFP	ShdnMode
0x16	COMM_CTRL2[7:0]	USBSWC[1:0]		NotUSBCmpl	DB	DBFrc	–	CE	CEFrc
0x17	RFU_RW[7:0]	RSRV[4:0]					RSRV[2:0]		
0x18	RFU_RO[7:0]	RSRV[7:0]							
0x19	COMM_CTRL3[7:0]	–	–	–	–	–	–	SwReset	FaultUnlock
USER_OVP									
0x1A	OVP_CTRL[7:0]	–	–	–	VBPDEn	VBPDTmr[1:0]		VBOVPEn[1:0]	
USER_USBC									
0x20	CC_CTRL0[7:0]	–	–	CCSrcCurCh	CCForceError	SnkAttachedLock	CCVcnSwp	CCSrcRst	CCSnkRst
0x21	CC_CTRL1[7:0]	CCVcnEn	CCTrySnkEn	–	CCDbgSrcEn	CCDbgSnkEn	CCAudEn	CCSrcEn	CCSnkEn
0x22	CC_CTRL2[7:0]	–	CCSrcCurAd[1:0]		CCLpModeSel[1:0]		CCRpCtrl[2:0]		
0x23	CC_CTRL3[7:0]	–	–	RSVD	RSVD	–	–	–	CCDetEn
0x24	CC_CTRL4[7:0]	–	–	TryWaitShortDeb	CCErrorLock	–	–	ccDRPPhase[1:0]	
0x25	CC_CTRL5[7:0]	–	–	–	–	–	–	VBMask	ccSnkExitEn
0x26	CC_CTRL6[7:0]	–	CCLadderDis	–	–	–	–	tQDebounce2[1:0]	
0x28	VCONN_ILIM[7:0]	–	–	–	CCVcnOcpEn	VCONN_ILIM[3:0]			

ADDRESS	NAME	MSB							LSB
USER_BC12									
0x2A	BC_CTRL0[7:0]	–	–	–	–	–	–	–	ChgDetMan
0x2B	BC_CTRL1[7:0]	DCDTmo	–	–	DCP3PDet	RSVD	–	–	ChgDetEn
SBUDetResult									
0x2C	SBU1DetResult1[7:0]	SBUDetAbortPriority	–	–	SBU1DetGround	SBU1DetAbort	SBU1DetOpen	SBU1DetIpu[1:0]	
0x2D	SBU1DetResult2[7:0]	SBU1DetVADC[7:0]							
0x2E	SBU2DetResult1[7:0]	–	–	–	SBU2DetGround	SBU2DetAbort	SBU2DetOpen	SBU2DetIpu[1:0]	
0x2F	SBU2DetResult2[7:0]	SBU2DetVADC[7:0]							
SBUDetConfig									
0x30	SBUDetCtrl[7:0]	–	–	–	–	–	SBUDetContEn	SBUDetOneShotEn	SBUDetManEn
0x31	RAcc1DetVMax[7:0]	RAcc1DetVMax[7:0]							
0x32	RAcc1DetVMin[7:0]	RAcc1DetVMin[7:0]							
0x33	RAcc1DetIpu[7:0]	–	–	–	–	–	–	RAcc1DetIpu[1:0]	
0x34	RAcc2DetVMax[7:0]	RAcc2DetVMax[7:0]							
0x35	RAcc2DetVMin[7:0]	RAcc2DetVMin[7:0]							
0x36	RAcc2DetIpu[7:0]	–	–	–	–	–	–	RAcc2DetIpu[1:0]	
0x37	RAcc3DetVMax[7:0]	RAcc3DetVMax[7:0]							
0x38	RAcc3DetVMin[7:0]	RAcc3DetVMin[7:0]							
0x39	RAcc3DetIpu[7:0]	–	–	–	–	–	–	RAcc3DetIpu[1:0]	
0x3A	RAcc4DetVMin[7:0]	RAcc4DetVMin[7:0]							
0x3B	RAcc4DetVMax[7:0]	RAcc4DetVMax[7:0]							
0x3C	RAcc4DetIpu[7:0]	–	–	–	–	–	–	RAcc4DetIpu[1:0]	

ADDRESS	NAME	MSB							LSB
0x3D	RAcc5DetVMax[7:0]	RAcc5DetVMax[7:0]							
0x3E	RAcc5DetVMin[7:0]	RAcc5DetVMin[7:0]							
0x3F	RAcc5DetIpu[7:0]	–	–	–	–	–	–	RAcc5DetIpu[1:0]	
MoistDet									
0x50	RMoistDetVth[7:0]	RMoistDetVth[7:0]							
0x51	MoistDetCtrl[7:0]	–	–	–	MoistDetAutoCfg	MoistDetPerEn	MoistDetManEn	RMoistDetIpu[1:0]	
0x52	MoistDetPUConfig[7:0]	–	–	MoistDetPUConfig[5:0]					
0x53	MoistDetPDConfig[7:0]	–	MoistDetPDConfig[6:0]						
0x54	MoistDetAutoCC1Result1[7:0]	–	–	–	CC1MoiGnd	CC1MoiAbrt	CC1MoiOpn	CC1MoistIpu[1:0]	
0x55	MoistDetAutoCC1Result2[7:0]	CC1MoistVADC[7:0]							
0x56	MoistDetAutoCC2Result1[7:0]	–	–	–	CC2MoiGnd	CC2MoiAbrt	CC2MoiOpn	CC2MoistIpu[1:0]	
0x57	MoistDetAutoCC2Result2[7:0]	CC2MoistVADC[7:0]							
0x58	MoistDetAutoSBU1Result1[7:0]	–	–	–	SBU1MoiGnd	SBU1MoiAbrt	SBU1MoiOpn	SBU1MoistIpu[1:0]	
0x59	MoistDetAutoSBU1Result2[7:0]	SBU1MoistVADC[7:0]							
0x5A	MoistDetAutoSBU2Result1[7:0]	–	–	–	SBU2MoiGnd	SBU2MoiAbrt	SBU2MoiOpn	SBU2MoistIpu[1:0]	
0x5B	MoistDetAutoSBU2Result2[7:0]	SBU2MoistVADC[7:0]							
ADCConfig									
0x5C	ADCCtrl1[7:0]	–	ADCGroundVth[3:0]				ADCRetryNum[2:0]		
0x5D	ADCCtrl2[7:0]	IpuResult[1:0]		ADCCorrNum[5:0]					
0x5E	ADC_CTRL3[7:0]	ADCAvgNum[2:0]			ADCSBUCorrNum[4:0]				

ADDRESS	NAME	MSB							LSB
0x5F	ADC_CTRL4[7:0]	–	–	ADCNoiseClampRng[5:0]					
0x60	ADCResultAvg[7:0]	ADCResultAvg[7:0]							
0x61	ADCResultMax[7:0]	ADCResultMax[7:0]							
0x62	ADCResultMin[7:0]	ADCResultMin[7:0]							
USER_VB									
0x63	VB_CTRL[7:0]	–	–	–	–	–	–	ACTIV_DISCH_EN	RSRV

Register Details

REVISION_ID (0x00)

BIT	7	6	5	4	3	2	1	0
Field	Revision_id[7:0]							
Reset	0x1							
Access Type	Read Only							

BITFIELD	BITS	DESCRIPTION
Revision_id	7:0	Information about the hardware revision.

COMMON_INT (0x01)

BIT	7	6	5	4	3	2	1	0
Field	FAULTInt	BatOVLOInt	BatUVLOInt	THMInt	LowPwrInt	ShdnWakeInt	VSAFE0VInt	VBvalidInt
Reset	0x0	0x0	0x0	0x0	0x0	0x0	0x0	0x0
Access Type	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
FAULTInt	7	Fault Status Interrupt Bit. Asserted for any fault status change.

BITFIELD	BITS	DESCRIPTION
		0b0: No fault status change 0b1: New fault status interrupt
BatOVLOInt	6	Battery Overvoltage Status Bit Interrupt 0b0: No interrupt 0b1: New BatOVLO status interrupt
BatUVLOInt	5	Battery Undervoltage Status Bit Interrupt 0b0: No interrupt 0b1: New BatUVLO status interrupt
THMInt	4	Thermal Shutdown Interrupt 0b0: No interrupt 0b1: New THM status interrupt
LowPwrInt	3	Low Power Mode Status Change Interrupt 0b0: No interrupt 0b1: New LowPwr status interrupt
ShdnWakeInt	2	Shutdown Mode Wake Up Interrupt. It is set upon exiting from shutdown due to toggling the I^2C interface or something attached to the USB Type-C port 0b0: No exit from shutdown 0b1: Exit from shutdown
VSAFE0VInt	1	V_{SAFE0V} Interrupt 0b0: No interrupt 0b1: New V_{SAFE0V} status interrupt
VBvalidInt	0	V_B Valid Range Detection Interrupt 0b0: $V_B < V_{BDET}$ or $V_B > V_{B\_OVLO}$ 0b1: $V_B > V_{BDET}$ and $V_B < V_{B\_OVLO}$

CC_INT (0x02)

BIT	7	6	5	4	3	2	1	0
Field	–	–	CCStatInt	CCPinStatInt	CCIStatInt	CCVcnStatInt	VCONNOCPInt	DetAbrtInt
Reset	–	–	0x0	0x0	0x0	0x0	0x0	0x0

Access Type	–	–	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
CCStatInt	5	CC State Interrupt 0b0: No interrupt 0b1: New CCStat status interrupt
CCPinStatInt	4	CC Pin State Interrupt 0b0: No interrupt 0b1: New CCPinStat status interrupt
CCIStatInt	3	CCIStat Interrupt 0b0: No interrupt 0b1: New CCIStat status interrupt
CCVcnStatInt	2	CCVcnStat Interrupt 0b0: No interrupt 0b1: New CCVcnStat status interrupt
VCONNOCPInt	1	V_{CONN} Overcurrent Protection Interrupt 0b0: No interrupt 0b1: New VCONNOCP status interrupt
DetAbrtInt	0	Charger Detection Abort Interrupt 0b0: No interrupt 0b1: New charger detection abort interrupt

BC_INT (0x03)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	ChgTypInt	PrChgTypInt	CHgDetRunRInt	CHgDetRunFInt	DCDTmoInt
Reset	–	–	–	0x0	0x0	0x0	0x0	0x0
Access Type	–	–	–	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
ChgTypInt	4	Charger Type Interrupt 0b0: No interrupt 0b1: New ChgTyp status interrupt
PrChgTypInt	3	Propietary Charger Type Interrupt 0b0: No interrupt 0b1: New PrChgTyp status interrupt
CHgDetRunRInt	2	Charger Detection Runnning Rising Edge Interrupt 0b0: No rising edge detected on ChgDetRun 0b1: Rising edge detected on ChgDetRun
CHgDetRunFInt	1	Charger Detection Runnning Falling Edge Interrupt 0b0: No falling edge detected on ChgDetRun 0b1: Falling edge detected on ChgDetRun
DCDTmoInt	0	DCD Timer Interrupt 0b0: No interrupt 0b1: New DCDTmo status interrupt

OVP_INT (0x04)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	–	–	–	SwtClosedInt	OVLOInt
Reset	–	–	–	–	–	–	0x0	0x0
Access Type	–	–	–	–	–	–	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
SwtClosedInt	1	Status of the V_B Switch Interrupt 0b0: No interrupt 0b1: New V_B switch status interrupt
OVLOInt	0	V_B Overvoltage Interrupt 0b0: No interrupt 0b1: New overvoltage status interrupt

RES_INT1 (0x05)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	ResAcc5Int	ResAcc4Int	ResAcc3Int	ResAcc2Int	ResAcc1Int
Reset	–	–	–	0x0	0x0	0x0	0x0	0x0
Access Type	–	–	–	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
ResAcc5Int	4	SBU1/SBU2 Resistor Detection Measurement Valid Accessory 5 Resistor Result Interrupt 0b0: SBU1/SBU2 resistor detection Valid Accessory 5 not detected 0b1: SBU1/SBU2 resistor detection Valid Accessory 5 detected
ResAcc4Int	3	SBU1/SBU2 Resistor Detection Measurement Valid Accessory 4 Resistor Result Interrupt 0b0: SBU1/SBU2 resistor detection Valid Accessory 4 not detected 0b1: SBU1/SBU2 resistor detection Valid Accessory 4 detected
ResAcc3Int	2	SBU1/SBU2 Resistor Detection Measurement Valid Accessory 3 Resistor Result Interrupt 0b0: SBU1/SBU2 resistor detection Valid Accessory 3 not detected 0b1: SBU1/SBU2 resistor detection Valid Accessory 3 detected
ResAcc2Int	1	SBU1/SBU2 Resistor Detection Measurement Valid Accessory 2 Resistor Result Interrupt 0b0: SBU1/SBU2 resistor detection Valid Accessory 2 not detected 0b1: SBU1/SBU2 resistor detection Valid Accessory 2 detected
ResAcc1Int	0	SBU1/SBU2 Resistor Detection Measurement Valid Accessory 1 Resistor Result Interrupt 0b0: SBU1/SBU2 resistor detection Valid Accessory 1 not detected 0b1: SBU1/SBU2 resistor detection Valid Accessory 1 detected

RES_INT2 (0x06)

BIT	7	6	5	4	3	2	1	0
Field	–	–	ResGroundInt	ResSBUInt	ResFiniteInt	ResOpenInt	ResAbortInt	ResMoistInt
Reset	–	–	0x0	0x0	0x0	0x0	0x0	0x0

Access Type	–	–	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
ResGroundInt	5	Ground Resistive Measurement Result Interrupt 0b0: Ground resistive value not detected 0b1: Ground resistive value detected
ResSBUInt	4	SBU1/SBU2 Resistor Detection Measurement Result Interrupt 0b0: SBU1/SBU2 resistor detection measurement not completed 0b1: SBU1/SBU2 resistor detection measurement completed
ResFiniteInt	3	Finite But Not Valid Resistive Measurement Result Interrupt 0b0: Finite but not valid resistive value not detected 0b1: Finite but not valid resistive value detected
ResOpenInt	2	Open Resistive Measurement Result Interrupt 0b0: Open resistive value not detected 0b1: Open resistive value detected
ResAbortInt	1	Abort Resistive Measurement Result Interrupt 0b0: Abort resistive value not detected 0b1: Abort resistive value detected
ResMoistInt	0	Moisture Detection Measurement Valid Result Interrupt 0b0: Moisture detection valid value not detected 0b1: Moisture detection valid value detected

COMMON_STATUS (0x07)

BIT	7	6	5	4	3	2	1	0
Field	FAULT	BatOVLO	BatUVLO	THM	LowPwr	–	VSAFE0V	VBvalid
Reset	0x0	0x0	0x0	0x0	0x0	–	0x0	0x0
Access Type	Read Only	Read Only	Read Only	Read Only	Read Only	–	Read Only	Read Only

BITFIELD	BITS	DESCRIPTION
FAULT	7	Fault Status Bit. The Finite State Machine enters fault state in the case of a BAT Overvoltage or Thermal fault. Fault state is exited by asserting FaultUnlock bit with no

BITFIELD	BITS	DESCRIPTION
		BATOVLO or THM present. 0b0: Not in fault state 0b1: In fault state
BatOVLO	6	Battery Overvoltage Status Bit 0b0: $V_{BAT} < V_{BAT\_OVLO}$ 0b1: $V_{BAT} > V_{BAT\_OVLO}$
BatUVLO	5	Battery Undervoltage Status Bit 0b0: $V_{BAT} > V_{BAT\_UVLO}$ 0b1: $V_{BAT} < V_{BAT\_UVLO}$
THM	4	Thermal Shutdown Status 0b0: Thermal fault not active 0b1: Thermal fault active
LowPwr	3	Low-Power Mode Status 0b0: Low-power mode (UFP or DRP) not active 0b1: Low-power mode (UFP or DRP) entered
VSAFE0V	1	Status of V_B Detection 0b0: $V_B < V_{SAFE0V}$ 0b1: $V_B > V_{SAFE0V}$
VBvalid	0	Status of V_B Valid Range 0b0: $V_B < V_{BDET}$ or $V_B > V_{B\_OVLO}$ 0b1: $V_B > V_{BDET}$ and $V_B < V_{B\_OVLO}$

CC_STATUS1 (0x08)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	–	VCONNSC	CCVcnStat	VCONNOCP	ChgDetAbort
Reset	–	–	–	–	0x0	0x0	0x0	0x0
Access Type	–	–	–	–	Read Only	Read Only	Read Only	Read Only

BITFIELD	BITS	DESCRIPTION
VCONNSC	3	V_{CONN} Short Circuit Detection 0b0: V_{CONN} current < $I_{SCCP\_VCONN\_THR}$ 0b1: V_{CONN} current > $I_{SCCP\_VCONN\_THR}$
CCVcnStat	2	Status of V_{CONN} Output 0b0: V_{CONN} Disabled 0b1: V_{CONN} Enabled
VCONNOCP	1	V_{CONN} Overcurrent Detection 0b0: V_{CONN} current < V_{CONN_ILIM} 0b1: V_{CONN} current > V_{CONN_ILIM}
ChgDetAbort	0	Charger Detection Abort Status 0b0: CC FSM is not gating BC FSM 0b1: CC FSM is gating BC FSM. ChgDetMan allows manual run of charger detection

CC_STATUS2 (0x09)

BIT	7	6	5	4	3	2	1	0
Field	–	CCStat[2:0]			CCPinStat[1:0]		CCIStat[1:0]	
Reset	–	0x0			0x0		0x0	
Access Type	–	Read Only			Read Only		Read Only	

BITFIELD	BITS	DESCRIPTION
CCStat	6:4	CC Pin State Machine Detection 0b000: No connection 0b001: Sink mode 0b010: Source mode 0b011: Audio accessory mode 0b100: Debug accessory source mode 0b101: Error 0b110: Disabled 0b111: Debug accessory sink mode
CCPinStat	3:2	Status of Active CC Pin 0b00: No determination 0b01: CC1 Active

BITFIELD	BITS	DESCRIPTION
		0b10: CC2 Active 0b11: RFU
CCIStat	1:0	CC Pin Detected and V_B Current Allowed in UFP Mode 0b00: Not in sink mode 0b01: 500mA 0b10: 1.5A 0b11: 3.0A

BC_STATUS (0x0A)

BIT	7	6	5	4	3	2	1	0
Field	–	ChgTyp[1:0]		PrChgTyp[2:0]			CHgDetRun	DCDTmo
Reset	–	0x0		0x0			0x0	0x0
Access Type	–	Read Only		Read Only			Read Only	Read Only

BITFIELD	BITS	DESCRIPTION
ChgTyp	6:5	Output of Charger Detection 0b00: Nothing attached 0b01: SDP, USB cable attached 0b10: Charging downstream port (CDP). Current depends on USB operating speed. 0b11: Dedicated charger port (DCP). Current ranges up to 1.5A.
PrChgTyp	4:2	Output of Proprietary Charger Detection 0b000: Unknown 0b001: Samsung 2A 0b010: Apple 0.5A 0b011: Apple 1A 0b100: Apple 2A 0b101: Apple 12W 0b110: 3A DCP (if enabled and chgTyp = DCP) 0b111: Unidentified
CHgDetRun	1	Charger Detection Run Status 0b0: No charger detection running 0b1: Charger detection running or completed
DCDTmo	0	During Charger Detection, DCD Detection Timed Out Indicates D+/D- are open. BC1.2 detection continues as required by BC1.2 specification but SDP most likely is found.

BITFIELD	BITS	DESCRIPTION
		0b0: No timeout or detection has not run 0b1: DCD timeout occurred

OVP_STATUS (0x0B)

BIT	7	6	5	4	3	2	1	0
Field	ItfRdy	–	–	–	–	–	SwtClosed	OVLO
Reset	0x0	–	–	–	–	–	0x0	0x0
Access Type	Read Only	–	–	–	–	–	Read Only	Read Only

BITFIELD	BITS	DESCRIPTION
ItfRdy	7	OTP Loading Complete. RegMap ready (reset deasserted). 0b0: OTP loading not completed 0b1: OTP loading completed
SwtClosed	1	Status of the V_B Switch 0b0: Open or in soft-start 0b1: Closed
OVLO	0	V_B Overvoltage Condition 0b0: No V_B overvoltage 0b1: V_B overvoltage detected

COMMON_MASK (0x0C)

BIT	7	6	5	4	3	2	1	0
Field	FAULTM	BatOVLOM	BatUVLOM	THMM	LowPwrM	ShdnWakeM	VSAFE0VM	VBvalidM
Reset	0x0	0x0	0x0	0x0	0x0	0x1	0x0	0x0
Access Type	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
FAULTM	7	Fault Status Mask Bit

BITFIELD	BITS	DESCRIPTION
		0b0: Mask 0b1: Unmask
BatOVLOM	6	Battery Overvoltage Status Bit Interrupt Mask 0b0: Mask 0b1: Unmask
BatUVLOM	5	Battery Undervoltage Status Bit Interrupt Mask 0b0: Mask 0b1: Unmask
THMM	4	Thermal Shutdown Interrupt Mask 0b0: Mask 0b1: Unmask
LowPwrM	3	Low-Power Mode Status Change Interrupt Mask 0b0: Mask 0b1: Unmask
ShdnWakeM	2	Shutdown Mode Wake-up Interrupt Mask 0b0: Mask 0b1: Unmask
VSAFE0VM	1	V_{SAFE0V} Interrupt Mask 0b0: Mask 0b1: Unmask
VBvalidM	0	V_B Valid Range Interrupt Mask 0b0: Mask 0b1: Unmask

CC_MASK (0x0D)

BIT	7	6	5	4	3	2	1	0
Field	–	–	CCStatM	CCPinStatM	CCIStatM	CCVcnStatM	VCONNOCPM	DetAbrtM
Reset	–	–	0x0	0x0	0x0	0x0	0x0	0x0
Access Type	–	–	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
CCStatM	5	CCStat Interrupt Mask 0b0: Mask 0b1: Unmask
CCPinStatM	4	CCPinStat Interrupt Mask 0b0: Mask 0b1: Unmask
CCIStatM	3	CCIStat Interrupt Mask 0b0: Mask 0b1: Unmask
CCVcnStatM	2	CCVcnStat Interrupt Mask 0b0: Mask 0b1: Unmask
VCONNOCPM	1	VCONNOCP Interrupt Mask 0b0: Mask 0b1: Unmask
DetAbrtM	0	DetAbrt Interrupt Mask 0b0: Mask 0b1: Unmask

BC_MASK (0x0E)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	ChgTypM	PrChgTypM	CHgDetRunRM	CHgDetRunFM	DCDTmoM
Reset	–	–	–	0x0	0x0	0x0	0x0	0x0
Access Type	–	–	–	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
ChgTypM	4	ChgTyp Interrupt Mask

BITFIELD	BITS	DESCRIPTION
		0b0: Mask 0b1: Unmask
PrChgTypM	3	PrChgTyp Interrupt Mask 0b0: Mask 0b1: Unmask
CHgDetRunRM	2	Charger Detection Rising Run Status Interrupt Mask 0b0: Mask 0b1: Unmask
CHgDetRunFM	1	Charger Detection Falling Run Status Interrupt Mask 0b0: Mask 0b1: Unmask
DCDTmoM	0	DCDTmo Interrupt Mask 0b0: Mask 0b1: Unmask

OVP_MASK (0x0F)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	–	–	–	SWT_closedM	OVLOM
Reset	–	–	–	–	–	–	0x0	0x0
Access Type	–	–	–	–	–	–	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
SWT_closedM	1	Status of V_B Switch Interrupt Mask 0b0: Mask 0b1: Unmask
OVLOM	0	V_B Overvoltage Interrupt Mask 0b0: Mask 0b1: Unmask

RES_MASK1 (0x10)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	ResAcc5IntM	ResAcc4IntM	ResAcc3IntM	ResAcc2IntM	ResAcc1IntM
Reset	–	–	–	0x0	0x0	0x0	0x0	0x0
Access Type	–	–	–	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
ResAcc5IntM	4	SBU1/SBU2 Resistor Detection Measurement Valid Accessory 5 Result Interrupt Mask 0b0: Mask 0b1: Unmask
ResAcc4IntM	3	SBU1/SBU2 Resistor Detection Measurement Valid Accessory 4 Result Interrupt Mask 0b0: Mask 0b1: Unmask
ResAcc3IntM	2	SBU1/SBU2 Resistor Detection Measurement Valid Accessory 3 Result Interrupt Mask 0b0: Mask 0b1: Unmask
ResAcc2IntM	1	SBU1/SBU2 Resistor Detection Measurement Valid Accessory 2 Result Interrupt Mask 0b0: Mask 0b1: Unmask
ResAcc1IntM	0	SBU1/SBU2 Resistor Detection Measurement Valid Accessory 1 Result Interrupt Mask 0b0: Mask 0b1: Unmask

RES_MASK2 (0x11)

BIT	7	6	5	4	3	2	1	0
Field	–	–	ResGroundIntM	ResSBUIntM	ResFiniteIntM	ResOpenIntM	ResAbortIntM	ResMoistIntM
Reset	–	–	0x0	0x0	0x0	0x0	0x0	0x0
Access Type	–	–	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
ResGroundIntM	5	Ground Resistive Measurement Result Interrupt Mask 0b0: Mask 0b1: Unmask
ResSBUIntM	4	SBU1/SBU2 Resistor Detection Measurement Result Interrupt Mask 0b0: Mask 0b1: Unmask
ResFiniteIntM	3	Finite But Not Valid Resistive Measurement result Interrupt Mask 0b0: Mask 0b1: Unmask
ResOpenIntM	2	Open Resistive Measurement Result Interrupt Mask 0b0: Mask 0b1: Unmask
ResAbortIntM	1	Abort Resistive Measurement Result Interrupt Mask 0b0: Mask 0b1: Unmask
ResMoistIntM	0	Moisture Detection Measurement Valid Result Interrupt Mask 0b0: Mask 0b1: Unmask

COMM_CTRL1 (0x15)

BIT	7	6	5	4	3	2	1	0
Field	INTEn	FactAuto	USBAuto	AudioCPEn	VCCINTOnBAT	LPDRP	LPUFP	ShdnMode
Reset	0x1	0x1	0x1	0x0	0x0	0x0	0x0	0x0
Access Type	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
INTEn	7	Interrupt Enable to INTb 0b0: INTb acts as a THM, OVP, or autoconfiguration flag 0b1: INTb is set as an interrupt output

BITFIELD	BITS	DESCRIPTION
FactAuto	6	Autoconfiguration Enable Gating. Autoconfiguration FSM starts if USBAuto = 1 or if Debug Acccessory Sink Mode is entered and FactAuto = 1. 0b0: Debug accessory sink mode gated 0b1: Debug accessory sink mode not gated
USBAuto	5	Autoconfiguration Enable Gating. Autoconfiguration FSM starts if USBAuto = 1 or if Debug Acccessory Sink Mode is entered and FactAuto = 1. 0b0: USB valid gated 0b1: USB valid not gated
AudioCPEn	4	Enable of the Internal USB Switches Charge Pump to Support Audio Negative Rail 0b0: USB switches charge pump enable controlled automatically 0b1: USB switches charge pump forced enabled
VCCINTOnBAT	3	V_{CCINT} Switchover Forcing On BAT Side 0b0: Internal V_{CCINT} switchover is set on the highest between BAT and V_B or on V_B if $V_B > V_{BDET}$ 0b1: Internal V_{CCINT} switchover forced on BAT unless $V_{BAT} < V_{BAT\_UVLOB}$
LPDRP	2	Low-Power DRP Mode Enable 0b0: No low-power DRP mode enabled 0b1: Procedure to enter low-power DRP mode is triggered
LPUFP	1	Low-Power UFP Mode Enable 0b0: No low-power UFP mode enabled 0b1: Procedure to enter low-power UFP mode is triggered
ShdnMode	0	Shutdown Mode Enable 0b0: No shutdown mode enabled 0b1: Procedure to enter into shutdown mode is triggered

COMM_CTRL2 (0x16)

BIT	7	6	5	4	3	2	1	0
Field	USBSWC[1:0]		NotUSBCmpl	DB	DBFrc	–	CE	CEFrc
Reset	0x3		0x0	0x0	0x0	–	0x0	0x0
Access Type	Write, Read		Write, Read	Write, Read	Write, Read	–	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
USBSWC	7:6	USB Switch Control 0b00: All switches open 0b01: USB SW to UT/UR position 0b10: USB SW to TDP/TDN position 0b11: Follow the automatic hardware setting
NotUSBCmpl	5	Not USB Compliant in Case of SDP Detection. CEb is set low in case of SDP if NotUSBCompl = 1. 0b0: Compliant 0b1: Not compliant
DB	4	DB Output. With DBFrc = 0, registers are set by the result of charger FSM. With DBFrc = 1, registers are set by I²C command only. DB is the control of open drain output: DBb = !DB
DBFrc	3	Enable Force DB Outputs
CE	1	CE Output. With CEFrc = 0, registers are set by the result of charger FSM. With CEFrc = 1, registers are set by I²C command only. CE is the control of open drain output: CEb = !CE
CEFrc	0	Enable Force CE Outputs 0b0: CE outputs follow the charger detection FSM 0b1: CE outputs follows CEb register regardless of the result from charger detection FSM

RFU_RW (0x17)

BIT	7	6	5	4	3	2	1	0
Field	RSRV[4:0]					RSRV[2:0]		
Reset	0x00					0x00		
Access Type								

RFU_RO (0x18)

BIT	7	6	5	4	3	2	1	0
Field	RSRV[7:0]							
Reset	0x00							

Access Type	

COMM_CTRL3 (0x19)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	–	–	–	SwReset	FaultUnlock
Reset	–	–	–	–	–	–	0x0	0x0
Access Type	–	–	–	–	–	–	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
SwReset	1	Software Reset Bit. If set, it forces the part to reboot. This bit is self-cleared after action is completed. 0b0: Software reset not triggered 0b1: Software reset triggered
FaultUnlock	0	Fault Status Unlock. If set, it forces the system to exit from fault state if BATOVLO and THM faults are not present. This bit is self-cleared after action is completed. 0b0: Fault unlock not triggered 0b1: Fault unlock triggered

OVP_CTRL (0x1A)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	VBPDEn	VBPDTmr[1:0]		VBOVPEn[1:0]	
Reset	–	–	–	0x0	0x0		0x2	
Access Type	–	–	–	Write, Read	Write, Read		Write, Read	

BITFIELD	BITS	DESCRIPTION
VBPDEn	4	V_B 8kΩ Discharge Pulldown Enable. The bit is cleared after pulldown timer expires. 0b0: Pulldown disabled 0b1: Pulldown enabled
VBPDTmr	3:2	V_B 8kΩ Discharge Pulldown Timer Duration 0b00: 5ms 0b01: 15ms

BITFIELD	BITS	DESCRIPTION
		0b10: 30ms 0b11: 60ms
VBOVPEn	1:0	V_B Overvoltage Protector (OVP) Enable Control 0b00: Force OVP switch open 0b01: OVP switch closed when $V_B > V_{BDET}$ 0b10: OVP switch controlled by logic (closed after V_B attach based on Table 4) 0b11: OVP switch closed

CC_CTRL0 (0x20)

BIT	7	6	5	4	3	2	1	0
Field	–	–	CCSrcCurCh	CCForceError	SnkAttachedLock	CCVcnSwp	CCSrcRst	CCSnkRst
Reset	–	–	0x0	0x0	0x0	0x0	0x0	0x0
Access Type	–	–	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
CCSrcCurCh	5	Source Current Change Request. Request new pullup value to advertise a new allowed max current value while in Source (DFP) mode. Note this bit resets to 0 automatically when action is done. 0b0: No change request/previous change done 0b1: Request value in CCSrcCur to be read/previous change waiting to be in Source Mode (UFP)
CCForceError	4	Bit Automatically Resets to 0 After Action Is Done 0b0: No action 0b1: Force transition to ErrorRecovery state
SnkAttachedLock	3	Bit Automatically Resets to 0 After Action Is Done 0b0: Exit Sink Attached when $V_B < V_{BDET}$ for more than $t_{PDDebounce}$ 0b1: Locked in Sink Attached for a minimum of 1.1s if V_B is missing
CCVcnSwp	2	Signal State Machine to Swap V_{CONN} Roles. Bit resets to 0 after a write (Note this bit resets to 0 automatically when action is done) 0b0: No change in V_{CONN} role 0b1: Force change in V_{CONN}

BITFIELD	BITS	DESCRIPTION
CCSrcRst	1	Force a Reset of the State Machine – Immediate transition to Unattached.SRC state. Bit resets to 0 after a write (Note this bit resets to 0 automatically when action is done) 0b0: No reset 0b1: Request reset
CCSnkRst	0	Force a Reset of the State Machine – Immediate Transition to Unattached.SNK State. Bit resets to 0 after a write (Note this bit resets to 0 automatically when action is done) 0b0: No reset 0b1: Request reset

CC_CTRL1 (0x21)

BIT	7	6	5	4	3	2	1	0
Field	CCVcnEn	CCTrySnkEn	–	CCDbgSrcEn	CCDbgSnkEn	CCAudEn	CCSrcEn	CCSnkEn
Reset	0x1	0x0	–	0x0	0x1	0x1	0x0	0x1
Access Type	Write, Read	Write, Read	–	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
CCVcnEn	7	Force State of V_{CONN} 0b0: Force V_{CONN} off 0b1: Automatic operation based on State Machine
CCTrySnkEn	6	Allow Transition to Try.SNK States 0b0: Try.SNK is disabled 0b1: Try.SNK is enabled
CCDbgSrcEn	4	Enable Detection of USB Type-C Debug Accessory Source Mode 0b0: Disabled 0b1: Enabled
CCDbgSnkEn	3	Enable Detection of USB Type-C Debug Accessory Sink Mode 0b0: Disabled 0b1: Enabled
CCAudEn	2	Enable Detection of USB Type-C Audio Adapter

BITFIELD	BITS	DESCRIPTION
		0b0: Disabled 0b1: Enabled
CCSrcEn	1	Enable Detection of USB Type-C Source Mode 0b0: Disabled 0b1: Enabled
CCSnkEn	0	Enable Detection of USB Type-C Sink Mode 0b0: Disabled 0b1: Enabled

CC_CTRL2 (0x22)

BIT	7	6	5	4	3	2	1	0
Field	–	CCSrcCurAd[1:0]		CCLpModeSel[1:0]		CCRpCtrl[2:0]		
Reset	–	0x0		0x0		0x0		
Access Type	–	Write, Read		Write, Read		Write, Read		

BITFIELD	BITS	DESCRIPTION
CCSrcCurAd	6:5	New Request Value for Source Mode Pullup. Note this value is latched in when CCSrcCurCh bit is written to 1. Changes to the pullup value only take place if the operation state is DFP (CCStat = 0b010). 0b00: 0.5A Advertised when in Source Mode (DFP) 0b01: 1.5A Advertised when in Source Mode (DFP) 0b10: 3.0A Advertised when in Source Mode (DFP) (Cannot source 3A on V_B. This is only for USB_PD collision avoidance support) 0b11: Reserved
CCLpModeSel	4:3	CC Detection with Low-Power Mode 0b00 : Normal operation 0b01: Use 5.0µA current source in Unattached.SRC state instead of 80µA 0b10: Use 1.0µA current source in Unattached.SRC state instead of 80µA
CCRpCtrl	2:0	Current Source Value to be Forced 0b000: Current sources driven by state machine 0b001: 1µA on CC line not pulled down and not used as V_{CONN} 0b010: 5µA on CC line not pulled down and not used as V_{CONN} 0b011: 80µA on CC line not pulled down and not used as V_{CONN} 0b100: 180µA on CC line not pulled down and not used as V_{CONN}

BITFIELD	BITS	DESCRIPTION
		0b101: 330µA on CC line not pulled down and not used as V_{CONN} 0b110, 0b111: No source

CC_CTRL3 (0x23)

BIT	7	6	5	4	3	2	1	0
Field	–	–	RSVD	RSVD	–	–	–	CCDetEn
Reset	–	–			–	–	–	0x1
Access Type	–	–	Write, Read	Write, Read	–	–	–	Write, Read

BITFIELD	BITS	DESCRIPTION
RSVD	5	Reserved
RSVD	4	Reserved
CCDetEn	0	USB Type-C Detection FSM Enable 0b0: USB Type-C FSM disabled 0b1: USB Type-C FSM enabled

CC_CTRL4 (0x24)

BIT	7	6	5	4	3	2	1	0
Field	–	–	TryWaitShortDeb	CCErrorLock	–	–	ccDRPPhase[1:0]	
Reset	–	–	0x0	0x0	–	–	0x0	
Access Type	–	–	Write, Read	Write, Read	–	–	Write, Read	

BITFIELD	BITS	DESCRIPTION
TryWaitShortDeb	5	Debounce Time from TryWait.SRC to Attached.SRC 0b0:120ms 0b1:15ms
CCErrorLock	4	Lock FSM in ErrorRecovery State

BITFIELD	BITS	DESCRIPTION
		0b0: No effect 0b1: Stay in ErrorRecovery state
ccDRPPhase	1:0	Percent of Time Device is Acting as Unattached.SRC when CCSnkEn = 1 and CCSrcEn = 1 0b00: 35% 0b01: 40% 0b10: 45% 0b11: 50%

CC_CTRL5 (0x25)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	–	–	–	VBMask	ccSnkExitEn
Reset	–	–	–	–	–	–	0x1	0x1
Access Type	–	–	–	–	–	–	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
VBMask	1	Ignore V_B Status In Transition from Unattached.SNK to Attached.SNK 0b0: V_B is checked 0b1: V_B is ignored
ccSnkExitEn	0	Exit Attached.SNK State Selection 0b0: Exit Attached.SNK state based on V_B level only 0b1: Exit Attached.SNK state based on V_B level or when CC < $V_{RA\_RD0.5}$

CC_CTRL6 (0x26)

BIT	7	6	5	4	3	2	1	0
Field	–	CCLadderDis	–	–	–	–	tQDebounce2[1:0]	
Reset	–	0x0	–	–	–	–	0x0	
Access Type	–	Write, Read	–	–	–	–	Write, Read	

BITFIELD	BITS	DESCRIPTION
CCLadderDis	6	When High, Disable CC Resistor Ladder. To be used in case of "Manual" power role swap, to make CC "more" Hi-Z
tQDebounce2	1:0	Quick Debounce2 Selection 0b00: 1ms 0b01: 2ms 0b10: 3ms 0b11: 20ms

VCONN_ILIM (0x28)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	CCVcnOcpEn	VCONN_ILIM[3:0]			
Reset	–	–	–	0x1	0x8			
Access Type	–	–	–	Write, Read	Write, Read			

BITFIELD	BITS	DESCRIPTION
CCVcnOcpEn	4	V_{CONN} Overcurrent Protection Enable 0b0: VCONNOCP does have impact on V_{CONN} switch 0b1: VCONNOCP turns off the V_{CONN} switch after 12ms
VCONN_ILIM	3:0	V_{CONN} Switch Overcurrent Threshold 0b0000: Reserved 0b0001: 200mA 0b0010: 250mA 0b0011: 300mA 0b0100: 350mA >=0b0101: Reserved

BC_CTRL0 (0x2A)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	–	–	–	–	ChgDetMan
Reset	–	–	–	–	–	–	–	0x0
Access Type	–	–	–	–	–	–	–	Write, Read

BITFIELD	BITS	DESCRIPTION
ChgDetMan	0	Manual Charger Detection Run Enable. The bit auto resets to '0'. 0b0: Not enabled 0b1: Request manual run of charger detection

BC_CTRL1 (0x2B)

BIT	7	6	5	4	3	2	1	0
Field	DCDTmo	–	–	DCP3PDet	RSVD	–	–	ChgDetEn
Reset	0x0	–	–	0x0	0x0	–	–	0x1
Access Type	Write, Read	–	–	Write, Read	Write, Read	–	–	Write, Read

BITFIELD	BITS	DESCRIPTION
DCDTmo	7	Data Contact Detection Wait Time 0b0: 2000ms 0b1: 800ms
DCP3PDet	4	Enable Detection of 3A DCP (adds detection step after BC1.2 completes to detect presence of 3A DCP – D+/D- short with 2 series diode clamp) 0b0: Not enabled 0b1: Enabled
RSVD	3	Reserved
ChgDetEn	0	Charger Detection Enable 0b0: Not enabled 0b1: Enabled, charger detection runs every time $V_B > V_{BDET}$ and ChgDetAbort = 0

SBU1DetResult1 (0x2C)

BIT	7	6	5	4	3	2	1	0
Field	SBUDetAbortPriority	–	–	SBU1DetGround	SBU1DetAbort	SBU1DetOpen	SBU1DetIpu[1:0]	
Reset	0x0	–	–	0x0	0x0	0x0	0x0	
Access Type	Write, Read	–	–	Read Only	Read Only	Read Only	Read Only	

BITFIELD	BITS	DESCRIPTION
SBUDetAbortPriority	7	Priority of Abort Condition in SBU1/SBU2 Resistor Detection Measurement 0b0: During SBU1/SBU2 resistor detection, an Abort result on one of the two pins is Don't Care unless an Abort result is found also on the other pin. 0b1: During SBU1/SBU2 resistor detection, an Abort result on one of the two pins has high priority and an overall Abort result is reported.
SBU1DetGround	4	SBU1 Resistor Detection Measurement Ground Result 0b0: Latest SBU1 resistor detection measurement result was not a Ground. 0b1: Latest SBU1 resistor detection measurement result was a Ground.
SBU1DetAbort	3	SBU1 Resistor Detection Measurement Abort Result 0b0: Latest SBU1 resistor detection measurement result was not an Abort. 0b1: Latest SBU1 resistor detection measurement result was an Abort.
SBU1DetOpen	2	SBU1 Resistor Detection Measurement Open Result 0b0: Latest SBU1 resistor detection measurement result was not an Open. 0b1: Latest SBU1 resistor detection measurement result was an Open.
SBU1DetIpu	1:0	SBU1 Resistor Detection Measurement Final Imposed Pullup Current. If the result is Abort or Open, this is set to 0b00. If the result is Ground, this is set to 0b11. 0b00: 2µA 0b01: 8µA 0b10: 32µA 0b11: 128µA

SBU1DetResult2 (0x2D)

BIT	7	6	5	4	3	2	1	0
Field	SBU1DetVADC[7:0]							
Reset	0x00							
Access Type	Read Only							

BITFIELD	BITS	DESCRIPTION
SBU1DetVADC	7:0	SBU1 Resistor Detection Measurement Final Voltage ADC Result. If the result is Abort or Ground, this is set to 0x00. If the result is Open, this is set to 0xFF. LSB = 5.882mV = 0.392% typ.

SBU2DetResult1 (0x2E)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	SBU2DetGround	SBU2DetAbort	SBU2DetOpen	SBU2DetIpu[1:0]	
Reset	–	–	–	0x0	0x0	0x0	0x0	
Access Type	–	–	–	Read Only	Read Only	Read Only	Read Only	

BITFIELD	BITS	DESCRIPTION
SBU2DetGround	4	SBU2 Resistor Detection Measurement Ground Result 0b0: Latest SBU2 resistor detection measurement result was not a Ground. 0b1: Latest SBU2 resistor detection measurement result was a Ground.
SBU2DetAbort	3	SBU2 Resistor Detection Measurement Abort Result 0b0: Latest SBU2 resistor detection measurement result was not an Abort. 0b1: Latest SBU2 resistor detection measurement result was an Abort.
SBU2DetOpen	2	SBU2 Resistor Detection Measurement Open Result 0b0: Latest SBU2 resistor detection measurement result was not an Open. 0b1: Latest SBU2 resistor detection measurement result was an Open.
SBU2DetIpu	1:0	SBU2 Resistor Detection Measurement Final Imposed Pullup Current. If the result is Abort or Open, this is set to 0b00. If the result is Ground, this is set to 0b11. 0b00: 2µA 0b01: 8µA 0b10: 32µA 0b11: 128µA

SBU2DetResult2 (0x2F)

BIT	7	6	5	4	3	2	1	0
Field	SBU2DetVADC[7:0]							
Reset	0x00							
Access Type	Read Only							

BITFIELD	BITS	DESCRIPTION
SBU2DetVADC	7:0	SBU2 Resistor Detection Measurement Final Voltage ADC Result. If the result is Abort or Ground, this is set to 0x00. If the result is Open, this is set to 0xFF. LSB = 5.882mV = 0.392% typ.

SBUDetCtrl (0x30)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	–	–	SBUDetContEn	SBUDetOneShotEn	SBUDetManEn
Reset	–	–	–	–	–	0x1	0x0	0x0
Access Type	–	–	–	–	–	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
SBUDetContEn	2	Enable of SBU1/SBU2 Continuous Resistor Detection Measurements in Debug Accessory Sink Mode 0b0: SBU1/SBU2 resistor detection continuous measurements in debug accessory mode sink disabled. 0b1: SBU1/SBU2 resistor detection continuous measurements in debug accessory mode sink enabled.
SBUDetOneShotEn	1	Enable of SBU1/SBU2 One-Shot Resistor Detection Measurement in Debug Accessory Sink Mode 0b0: SBU1/SBU2 resistor detection one-shot measurement in debug accessory mode sink disabled. 0b1: SBU1/SBU2 resistor detection one-shot measurement in debug accessory mode sink enabled.
SBUDetManEn	0	Enable of SBU1/SBU2 Resistor Detection Manual Measurement 0b0: SBU1/SBU2 resistor detection manual measurement disabled. 0b1: SBU1/SBU2 resistor detection manual measurement enabled.

RAcc1DetVMax (0x31)

BIT	7	6	5	4	3	2	1	0
Field	RAcc1DetVMax[7:0]							
Reset	0xAE							

Access Type	Write, Read

BITFIELD	BITS	DESCRIPTION
RAcc1DetVMax	7:0	SBU1/SBU2 Valid Accessory 1 Resistor Maximum Final Voltage ADC Result Threshold. LSB = 5.882mV = 0.392% typ.

RAcc1DetVMin (0x32)

BIT	7	6	5	4	3	2	1	0
Field	RAcc1DetVMin[7:0]							
Reset	0x99							
Access Type	Write, Read							

BITFIELD	BITS	DESCRIPTION
RAcc1DetVMin	7:0	SBU1/SBU2 Valid Accessory 1 Resistor Minimum Final Voltage ADC Result Threshold. LSB = 5.882mV = 0.392% typ.

RAcc1DetIpu (0x33)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	–	–	–	RAcc1DetIpu[1:0]	
Reset	–	–	–	–	–	–	0x2	
Access Type	–	–	–	–	–	–	Write, Read	

BITFIELD	BITS	DESCRIPTION
RAcc1DetIpu	1:0	Accessory 1 Resistor Final Imposed Pullup Current. If the final pullup current is equal to the configured RAcc1DetIpu[1:0] setting and the ADC result is within the [RAcc1DetVMin[7:0],RAcc1DetVMax[7:0]] range, SBU1/SBU2 Valid accessory 1 resistor is detected. 0b00: 2µA 0b01: 8µA 0b10: 32µA 0b11: 128µA

RAcc2DetVMax (0x34)

BIT	7	6	5	4	3	2	1	0
Field	RAcc2DetVMax[7:0]							
Reset	0x74							
Access Type	Write, Read							

BITFIELD	BITS	DESCRIPTION
RAcc2DetVMax	7:0	SBU1/SBU2 Valid Accessory 2 Resistor Maximum Final Voltage ADC Result Threshold. LSB = 5.882mV = 0.392% typ.

RAcc2DetVMin (0x35)

BIT	7	6	5	4	3	2	1	0
Field	RAcc2DetVMin[7:0]							
Reset	0x66							
Access Type	Write, Read							

BITFIELD	BITS	DESCRIPTION
RAcc2DetVMin	7:0	SBU1/SBU2 Valid Accessory 2 Resistor Minimum Final Voltage ADC Result Threshold. LSB = 5.882mV = 0.392% typ.

RAcc2DetIpu (0x36)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	–	–	–	RAcc2DetIpu[1:0]	
Reset	–	–	–	–	–	–	0x1	
Access Type	–	–	–	–	–	–	Write, Read	

BITFIELD	BITS	DESCRIPTION
RAcc2DetIpu	1:0	Accessory 2 Resistor Final Imposed Pullup Current. If the final pullup current is equal to the configured RAcc2DetIpu[1:0] setting and the ADC result is within the [RAcc2DetVMin[7:0],RAcc2DetVMax[7:0]] range, SBU1/SBU2 Valid accessory 2 resistor is detected.

BITFIELD	BITS	DESCRIPTION
		0b00: 2µA 0b01: 8µA 0b10: 32µA 0b11: 128µA

RAcc3DetVMax (0x37)

BIT	7	6	5	4	3	2	1	0
Field	RAcc3DetVMax[7:0]							
Reset	0xD9							
Access Type	Write, Read							

BITFIELD	BITS	DESCRIPTION
RAcc3DetVMax	7:0	SBU1/SBU2 Valid Accessory 3 Resistor Maximum Final Voltage ADC Result Threshold. LSB = 5.882mV = 0.392% typ.

RAcc3DetVMin (0x38)

BIT	7	6	5	4	3	2	1	0
Field	RAcc3DetVMin[7:0]							
Reset	0xBF							
Access Type	Write, Read							

BITFIELD	BITS	DESCRIPTION
RAcc3DetVMin	7:0	SBU1/SBU2 Valid Accessory 3 Resistor Maximum Final Voltage ADC Result Threshold. LSB = 5.882mV = 0.392% typ.

RAcc3DetIpu (0x39)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	–	–	–	RAcc3DetIpu[1:0]	
Reset	–	–	–	–	–	–	0x1	

Access Type	–	–	–	–	–	–	Write, Read

BITFIELD	BITS	DESCRIPTION
RAcc3DetIpu	1:0	Accessory 3 Resistor Final Imposed Pullup Current. If the final pullup current is equal to the configured RAcc3DetIpu[1:0] setting and the ADC result is within the [RAcc3DetVMin[7:0],RAcc3DetVMax[7:0]] range, SBU1/SBU2 Valid accessory 3 resistor is detected. 0b00: 2µA 0b01: 8µA 0b10: 32µA 0b11: 128µA

RAcc4DetVMin (0x3A)

BIT	7	6	5	4	3	2	1	0
Field	RAcc4DetVMin[7:0]							
Reset	0x00							
Access Type	Write, Read							

BITFIELD	BITS	DESCRIPTION
RAcc4DetVMin	7:0	SBU1/SBU2 Valid Accessory 4 Resistor Maximum Final Voltage ADC Result Threshold. LSB = 5.882mV = 0.392% typ.

RAcc4DetVMax (0x3B)

BIT	7	6	5	4	3	2	1	0
Field	RAcc4DetVMax[7:0]							
Reset	0x00							
Access Type	Write, Read							

BITFIELD	BITS	DESCRIPTION
RAcc4DetVMax	7:0	SBU1/SBU2 Valid Accessory 4 Resistor Minimum Final Voltage ADC Result Threshold. LSB = 5.882mV = 0.392% typ.

RAcc4DetIpu (0x3C)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	–	–	–	RAcc4DetIpu[1:0]	
Reset	–	–	–	–	–	–	0x0	
Access Type	–	–	–	–	–	–	Write, Read	

BITFIELD	BITS	DESCRIPTION
RAcc4DetIpu	1:0	Accessory 4 Resistor Final Imposed Pullup Current. If the final pullup current is equal to the configured RAcc4DetIpu[1:0] setting and the ADC result is within the [RAcc4DetVMin[7:0],RAcc4DetVMax[7:0]] range, SBU1/SBU2 Valid accessory 4 resistor is detected. 0b00: 2µA 0b01: 8µA 0b10: 32µA 0b11: 128µA

RAcc5DetVMax (0x3D)

BIT	7	6	5	4	3	2	1	0
Field	RAcc5DetVMax[7:0]							
Reset	0x00							
Access Type	Write, Read							

BITFIELD	BITS	DESCRIPTION
RAcc5DetVMax	7:0	SBU1/SBU2 Valid Accessory 5 Resistor Maximum Final Voltage ADC Result Threshold. LSB = 5.882mV = 0.392% typ.

RAcc5DetVMin (0x3E)

BIT	7	6	5	4	3	2	1	0
Field	RAcc5DetVMin[7:0]							
Reset	0x00							
Access Type	Write, Read							

BITFIELD	BITS	DESCRIPTION
RAcc5DetVMin	7:0	SBU1/SBU2 Valid Accessory 5 Resistor Minimum Final Voltage ADC Result Threshold. LSB = 5.882mV = 0.392% typ.

RAcc5DetIpu (0x3F)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	–	–	–	RAcc5DetIpu[1:0]	
Reset	–	–	–	–	–	–	0x0	
Access Type	–	–	–	–	–	–	Write, Read	

BITFIELD	BITS	DESCRIPTION
RAcc5DetIpu	1:0	Accessory 5 Resistor Final Imposed Pullup Current. If the final pullup current is equal to the configured RAcc5DetIpu[1:0] setting and the ADC result is within the [RAcc5DetVMin[7:0],RAcc5DetVMax[7:0]] range, SBU1/SBU2 Valid accessory 5 resistor is detected. 0b00: 2µA 0b01: 8µA 0b10: 32µA 0b11: 128µA

RMoistDetVth (0x50)

BIT	7	6	5	4	3	2	1	0
Field	RMoistDetVth[7:0]							
Reset	0x66							
Access Type	Write, Read							

BITFIELD	BITS	DESCRIPTION
RMoistDetVth	7:0	Moisture Detection Valid Final Voltage ADC Result Threshold. LSB = 5.882mV = 0.392% typ.

MoistDetCtrl (0x51)

BIT	7	6	5	4	3	2	1	0

Field	–	–	–	MoistDetAutoCfg	MoistDetPerEn	MoistDetManEn	RMoistDetIpu[1:0]
Reset	–	–	–	0x1	0x1	0x0	0x2
Access Type	–	–	–	Write, Read	Write, Read	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
MoistDetAutoCfg	4	Enable Automatic Configuration of Moisture Detection Measurements. If MoistDetAutoCfg = 1, the system measures the resistance between CC1 (alternately CC2) and all other pins of the USB Type-C connector. If MoistDetAutoCfg = 0, the pins to be pulled up and those to be grounded are determined by MoistDetPUConfig[5:0] and MoistDetPDConfig[6:0] settings. 0b0: Moisture detection measurements automatic configuration disabled. 0b1: Moisture detection measurements automatic configuration enabled.
MoistDetPerEn	3	Enable of Unattached Mode Moisture Detection Periodic Measurements. If set high, moisture detection measurements are executed every 10s in unattached mode. In attached states, moisture detection is skipped. 0b0: Moisture detection periodic measurements disabled. 0b1: Moisture detection periodic measurements enabled.
MoistDetManEn	2	Enable of Unattached Mode Moisture Detection Manual Measurement. If set high, a single moisture detection measurement is executed. Self-clearing. If set high while not in unattached mode, it stays armed until detachment is detected and can optionally be cleared through I^2C interface. 0b0: Moisture detection manual measurement disabled. 0b1: Moisture detection manual measurement enabled.
RMoistDetIpu	1:0	Target Pullup Current Used to Specify Moisture Resistance Threshold R_{MOIST}. Together with RMoistDetVth[7:0], it sets the desired resistance threshold for moisture: R_{MOIST} = RMoistDetIpu[1:0] x RMoistDetVth[7:0] x LSB, where LSB = 5.882mV = 0.392% (typ). 0b00: 2µA 0b01: 8µA 0b10: 32µA 0b11: 128µA

MoistDetPUConfig (0x52)

BIT	7	6	5	4	3	2	1	0
Field	–	–	MoistDetPUConfig[5:0]					

Reset	–	–	0x00
Access Type	–	–	Write, Read

BITFIELD	BITS	DESCRIPTION
MoistDetPUConfig	5:0	Pullup Switch Control for Manually Configured Moisture Detection. Active when MoistDetAutoCfg = 0. Bit 0: Enables CC1 pullup force/sense switches Bit 1: Enables CC2 pullup force/sense switches Bit 2: Enables SBU1 pullup force/sense switches Bit 3: Enables SBU2 pullup force/sense switches Bit 4: Enables CDP pullup force/sense switches Bit 5: Enables CDN pullup force/sense switches

MoistDetPDConfig (0x53)

BIT	7	6	5	4	3	2	1	0
Field	–	MoistDetPDConfig[6:0]						
Reset	–	0x00						
Access Type	–	Write, Read						

BITFIELD	BITS	DESCRIPTION
MoistDetPDConfig	6:0	Pulldown Switch Control for Manually Configured Moisture Detection. Active when MoistDetAutoCfg = 0. Bit 0: Enables CC1 pulldown switch Bit 1: Enables CC2 pulldown switch Bit 2: Enables SBU1 pulldown switch Bit 3: Enables SBU2 pulldown switch Bit 4: Enables CDP pulldown switch Bit 5: Enables CDN pulldown switch Bit 6: Enables V_B pulldown switch

MoistDetAutoCC1Result1 (0x54)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	CC1MoiGnd	CC1MoiAbrt	CC1MoiOpn	CC1MoistIpu[1:0]	
Reset	–	–	–	0x0	0x0	0x0	0x0	

Access Type	–	–	–	Read Only	Read Only	Read Only	Read Only

BITFIELD	BITS	DESCRIPTION
CC1MoiGnd	4	Moisture Detection Burst Measurement Ground Result Indicator for CC1 0b0: Latest CC1 moisture detection burst measurement result was not a Ground. 0b1: Latest CC1 moisture detection burst measurement result was a Ground.
CC1MoiAbrt	3	Moisture Detection Burst Measurement Abort Result Indicator for CC1 0b0: Latest CC1 moisture detection burst measurement result was not an Abort. 0b1: Latest CC1 moisture detection burst measurement result was an Abort.
CC1MoiOpn	2	Moisture Detection Burst Measurement Open Result Indicator for CC1 0b0: Latest CC1 moisture detection burst measurement result was not an Open. 0b1: Latest CC1 moisture detection burst measurement result was an Open.
CC1MoistIpu	1:0	Moisture Detection Burst Measurement Final Pullup Current for CC1. If the result is Abort or Open, this is set to 0b00. If the result is Ground, this is set to 0b11. 0b00: 2µA 0b01: 8µA 0b10: 32µA 0b11: 128µA

MoistDetAutoCC1Result2 (0x55)

BIT	7	6	5	4	3	2	1	0
Field	CC1MoistVADC[7:0]							
Reset	0x00							
Access Type	Read Only							

BITFIELD	BITS	DESCRIPTION
CC1MoistVADC	7:0	Moisture Detection Burst Measurement Final ADC Value for CC1. If the result is Abort or Ground, this is set to 0x00. If the result is Open, this is set to 0xFF. LSB = 5.882mV = 0.392% (typ).

MoistDetAutoCC2Result1 (0x56)

BIT	7	6	5	4	3	2	1	0

Field	–	–	–	CC2MoiGnd	CC2MoiAbrt	CC2MoiOpn	CC2MoistIpu[1:0]
Reset	–	–	–	0x0	0x0	0x0	0x0
Access Type	–	–	–	Read Only	Read Only	Read Only	Read Only

BITFIELD	BITS	DESCRIPTION
CC2MoiGnd	4	Moisture Detection Burst Measurement Ground Result Indicator for CC2 0b0: Latest CC2 moisture detection burst measurement result was not a Ground. 0b1: Latest CC2 moisture detection burst measurement result was a Ground.
CC2MoiAbrt	3	Moisture Detection Burst Measurement Abort Result Indicator for CC2 0b0: Latest CC2 moisture detection burst measurement result was not an Abort. 0b1: Latest CC2 moisture detection burst measurement result was an Abort.
CC2MoiOpn	2	Moisture Detection Burst Measurement Open Result Indicator for CC2 0b0: Latest CC2 moisture detection burst measurement result was not an Open. 0b1: Latest CC2 moisture detection burst measurement result was an Open.
CC2MoistIpu	1:0	Moisture Detection Burst Measurement Final Pullup Current for CC2. If the result is Abort or Open, this is set to 0b00; if the result is Ground, this is set to 0b11. 0b00: 2µA 0b01: 8µA 0b10: 32µA 0b11: 128µA

MoistDetAutoCC2Result2 (0x57)

BIT	7	6	5	4	3	2	1	0
Field	CC2MoistVADC[7:0]							
Reset	0x00							
Access Type	Read Only							

BITFIELD	BITS	DESCRIPTION
CC2MoistVADC	7:0	Moisture Detection Burst Measurement Final ADC Value for CC2. If the result is Abort or Ground, this is set to 0x00. If the result is Open, this is set to 0xFF. LSB = 5.882mV = 0.392% (typ).

MoistDetAutoSBU1Result1 (0x58)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	SBU1MoiGnd	SBU1MoiAbrt	SBU1MoiOpn	SBU1MoistIpu[1:0]	
Reset	–	–	–	0x0	0x0	0x0	0x0	
Access Type	–	–	–	Read Only	Read Only	Read Only	Read Only	

BITFIELD	BITS	DESCRIPTION
SBU1MoiGnd	4	Moisture Detection Burst Measurement Ground Result Indicator for SBU1 0b0: Latest SBU1 moisture detection burst measurement result was not a Ground. 0b1: Latest SBU1 moisture detection burst measurement result was a Ground.
SBU1MoiAbrt	3	Moisture Detection Burst Measurement Abort Result Indicator for SBU1 0b0: Latest SBU1 moisture detection burst measurement result was not an Abort. 0b1: Latest SBU1 moisture detection burst measurement result was an Abort.
SBU1MoiOpn	2	Moisture Detection Burst Measurement Open Result Indicator for SBU1 0b0: Latest SBU1 moisture detection burst measurement result was not an Open. 0b1: Latest SBU1 moisture detection burst measurement result was an Open.
SBU1MoistIpu	1:0	Moisture Detection Burst Measurement Final Pullup Current for SBU1. If the result is Abort or Open, this is set to 0b00. If the result is Ground, this is set to 0b11. 0b00: 2µA 0b01: 8µA 0b10: 32µA 0b11: 128µA

MoistDetAutoSBU1Result2 (0x59)

BIT	7	6	5	4	3	2	1	0
Field	SBU1MoistVADC[7:0]							
Reset	0x00							
Access Type	Read Only							

BITFIELD	BITS	DESCRIPTION
SBU1MoistVADC	7:0	Moisture Detection Burst Measurement Final ADC Value for SBU1. If the result is Abort or Ground, this is set to 0x00. If the result is Open, this is set to 0xFF. LSB = 5.882mV = 0.392% (typ).

MoistDetAutoSBU2Result1 (0x5A)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	SBU2MoiGnd	SBU2MoiAbrt	SBU2MoiOpn	SBU2MoistIpu[1:0]	
Reset	–	–	–	0x0	0x0	0x0	0x0	
Access Type	–	–	–	Read Only	Read Only	Read Only	Read Only	

BITFIELD	BITS	DESCRIPTION
SBU2MoiGnd	4	Moisture Detection Burst Measurement Ground Result Indicator for SBU2 0b0: Latest SBU2 moisture detection burst measurement result was not a Ground. 0b1: Latest SBU2 moisture detection burst measurement result was a Ground.
SBU2MoiAbrt	3	Moisture Detection Burst Measurement Abort Result Indicator for SBU2 0b0: Latest SBU2 moisture detection burst measurement result was not an Abort. 0b1: Latest SBU2 moisture detection burst measurement result was an Abort.
SBU2MoiOpn	2	Moisture Detection Burst Measurement Open Result Indicator for SBU2 0b0: Latest SBU2 moisture detection burst measurement result was not an Open. 0b1: Latest SBU2 moisture detection burst measurement result was an Open.
SBU2MoistIpu	1:0	Moisture Detection Burst Measurement Final Pullup Current for SBU2. If the result is Abort or Open, this is set to 0b00. If the result is Ground, this is set to 0b11. 0b00: 2µA 0b01: 8µA 0b10: 32µA 0b11: 128µA

MoistDetAutoSBU2Result2 (0x5B)

BIT	7	6	5	4	3	2	1	0
Field	SBU2MoistVADC[7:0]							

Reset	0x00
Access Type	Read Only

BITFIELD	BITS	DESCRIPTION
SBU2MoistVADC	7:0	Moisture Detection Burst Measurement Final ADC Value for SBU2. If the result is Abort or Ground, this is set to 0x00. If the result is Open, this is set to 0xFF. LSB = 5.882mV = 0.392% (typ).

ADCCtrl1 (0x5C)

BIT	7	6	5	4	3	2	1	0
Field	–	ADCGroundVth[3:0]				ADCRetryNum[2:0]		
Reset	–	0x4				0x1		
Access Type	–	Write, Read				Write, Read		

BITFIELD	BITS	DESCRIPTION
ADCGroundVth	6:3	ADC Ground Threshold. It applies to resistive measurements used in both Moisture Detection and Accessory Mode Detection. The actual ground condition range, namely the $R_{SBU\_RNG\_GND}$ and $R_{CCCD\_RNG\_GND}$, depends on the setting of ADCGroundVth[3:0]. If the final average ADC reading of a measurement is ≤ the actual ground threshold, the Ground result is reported. LSB = 5.882mV = 0.392% (typ).
ADCRetryNum	2:0	Number of Resistive Measurement Retries. It applies to resistive measurement used in both moisture detection and accessory mode detection. The device retries the measurement if one of the following conditions is true: 1. (maximum ADC reading = 0xFF) AND (pullup current = 2µA) AND (average ADC reading < (0xFF - ADCNoiseClampRng[5:0])) 2. (maximum ADC reading = 0xFF) AND (pullup current ≠ 2µA) If the condition is still true after this number of retries, the Abort result is reported. 0x0: No retry. >0x0: Number of retry attempts.

ADCCtrl2 (0x5D)

BIT	7	6	5	4	3	2	1	0
Field	IpuResult[1:0]		ADCCorrNum[5:0]					

Reset	0x0	0x7
Access Type	Read Only	Write, Read

BITFIELD	BITS	DESCRIPTION
IpuResult	7:6	Final Imposed Pullup Current Once a Resistive Measurement is Complete. It is set to 0b00 if the result is Abort or Open. It is set to 0b11 if the result is Open. 0b00: 2µA 0b01: 8µA 0b10: 32µA 0b11: 128µA
ADCCorrNum	5:0	ADC Shift Factor for USB Type-C Pins When Not Only SBU1 and/or SBU2 are Pulled Up. It applies to resistive measurements used in Moisture Detection. This register must NOT be set lower than the default value.

ADC_CTRL3 (0x5E)

BIT	7	6	5	4	3	2	1	0
Field	ADCAvgNum[2:0]			ADCSBUCorrNum[4:0]				
Reset	0x1			0x3				
Access Type	Write, Read			Write, Read				

BITFIELD	BITS	DESCRIPTION
ADCAvgNum	7:5	Number of Samples in ADC Reading Averaging. It applies to any resistive measurements used in moisture detection and accessory mode detection. 0x0: 1 sample 0x1: 2 samples 0x2: 4 samples 0x3: 8 samples 0x4: 16 samples 0x5: 32 samples 0x6: 64 samples 0x7: 128 samples
ADCSBUCorrNum	4:0	ADC Shift Factor for When Only SBU1 and/or SBU2 Are Pulled Up. It applies to SBU1/SBU2 resistive measurements used in both Moisture Detection and Accessory Mode detection. This register must NOT be set lower than the default value.

ADC_CTRL4 (0x5F)

BIT	7	6	5	4	3	2	1	0
Field	–	–	ADCNoiseClampRng[5:0]					
Reset	–	–	0x0					
Access Type	–	–	Write, Read					

BITFIELD	BITS	DESCRIPTION
ADCNoiseClampRng	5:0	ADC Result Margin to Account for External Noise and Avoid Result Clamping Close to Full-Scale. This register must NOT be changed from the default value.

ADCResultAvg (0x60)

BIT	7	6	5	4	3	2	1	0
Field	ADCResultAvg[7:0]							
Reset	0x00							
Access Type	Read Only							

BITFIELD	BITS	DESCRIPTION
ADCResultAvg	7:0	Final Average ADC Reading. It is set to 0x00 if the result is Abort or Ground, and to 0xFF if the result is Open. LSB = 5.882mV = 0.392% typ.

ADCResultMax (0x61)

BIT	7	6	5	4	3	2	1	0
Field	ADCResultMax[7:0]							
Reset	0x00							
Access Type	Read Only							

BITFIELD	BITS	DESCRIPTION
ADCResultMax	7:0	Final Maximum ADC Reading. It is set to 0x00 if the result is Abort or Ground, and to 0xFF if the result is Open. LSB = 5.882mV = 0.392% typ.

ADCResultMin (0x62)

BIT	7	6	5	4	3	2	1	0
Field	ADCResultMin[7:0]							
Reset	0x00							
Access Type	Read Only							

BITFIELD	BITS	DESCRIPTION
ADCResultMin	7:0	Final Minimum ADC Reading. It is set to 0x00 if the result is Abort or Ground, and to 0xFF if the result is Open. LSB = 5.882mV = 0.392% typ.

VB_CTRL (0x63)

BIT	7	6	5	4	3	2	1	0
Field	–	–	–	–	–	–	ACTIV_DISCH_EN	RSRV
Reset	–	–	–	–	–	–	0x0	0
Access Type	–	–	–	–	–	–	Write, Read	

BITFIELD	BITS	DESCRIPTION
ACTIV_DISCH_EN	1	Active Discharge Control 0b0: Active discharge disabled on V_B 0b1: Active discharge enabled on V_B

Applications Information

Hi-Speed USB

Hi-Speed USB requires careful PCB layout with 45Ω single-ended/90Ω differential controlled-impedance traces that are matched by equal lengths.

Power Supply Bypassing

Bypass V_B, V_{DD}, and BAT with 1µF ceramic capacitors to GND as close as possible to the device.

Power-On Reset (POR)

The MAX20342 provides secure operation with the power-on reset circuits. When the power supply for the device exceeds the POR rising value 1.6V (typ) and stays above the maximum falling edge, the internal logic is in a known state for safe operation. However, the *Electrical Characteristics* table parameters are not guaranteed until the V_B and BAT voltages meet the specified global conditions.

Choosing I²C Pullup Resistors

The I²C interface requires pullup resistors to provide a logic-high level to data and clock lines. There are trade-offs between power dissipation and speed, and a compromise must be made in choosing pullup resistor values. Every device connected to the bus introduces some capacitance even when the device is not in operation. The I²C interface specifies 120ns rise time to go from low to high (30% to 70%) for fast mode plus, which is defined for a clock frequency up to 1000kHz (see the I²C specifications in the *Electrical Characteristics* table for details). To meet the rise time requirement, choose pullup resistors so that the rise time $t_R = 0.85 \times R_{PULLUP} \times C_{BUS} < 120ns$. If the transition time becomes too slow, the setup and hold times might not be met and waveforms might not be recognized.

Resetting the I²C Bus from Suspend

If the I²C bus is suspended due to a weak or dead battery, an I²C STOP command needs to be performed after enabling the I²C buffers and pullup bias. The I²C STOP command is necessary before restarting the I²C traffic.

Extended ESD Protection

The CDP and CDN pins are protected against ESD up to ±6kV. The CC1, CC2, SBU1 and SBU2 pins are further protected up to ±15kV (HBM) without damage. The V_B input withstands up to ±15kV (HBM) if bypassed with a 1µF ceramic capacitor close to the pin. The ESD structures withstand high ESD both in normal operation and when the device is powered down. After an ESD event, the MAX20342 continues to function without latch-up.

ESD Test Conditions

ESD performance depends on a variety of conditions. Contact Maxim for a reliability report that documents test setup, test methodology, and test results.

Human Body Model

Figure 16 shows the human-body model, while *Figure 17* shows the current waveform it generates when discharged into a low-impedance state. This model consists of a 100pF capacitor charged to the ESD voltage of interest that is then discharged into the device through a 1.5kΩ resistor.

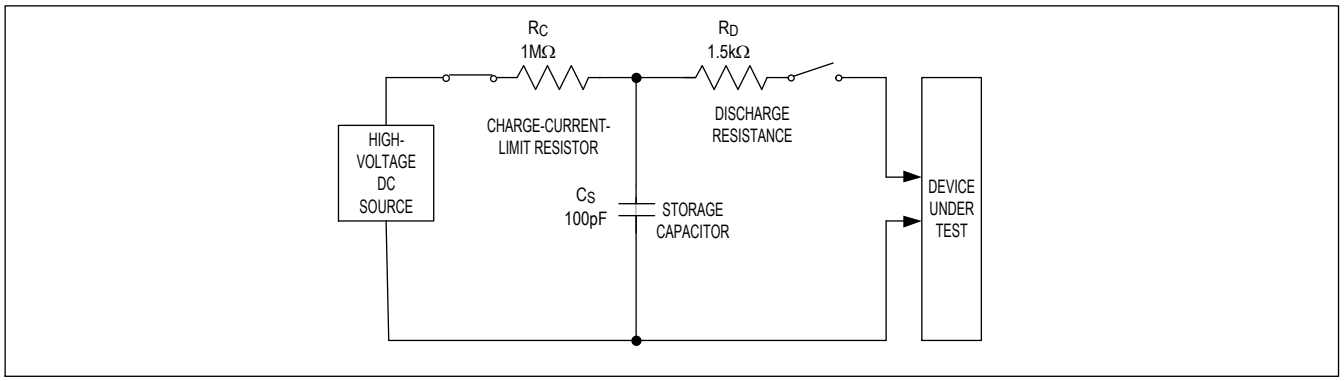


Figure 16. Human Body ESD Test Model

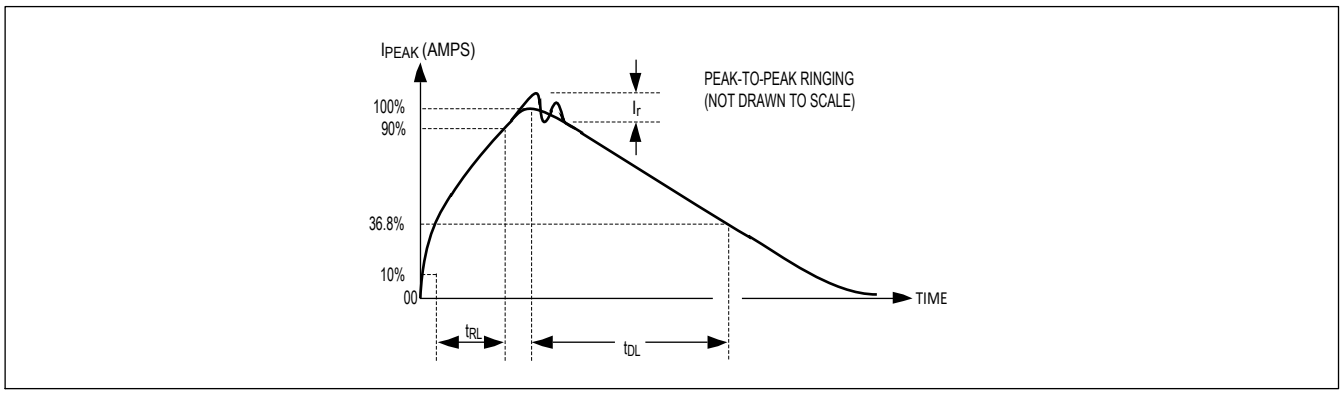


Figure 17. Human Body Current Waveform

IEC 61000-4-2

The IEC 61000-4-2 standard covers ESD testing and performance of finished equipment. It does not specifically refer to integrated circuits. The MAX20342 is specified for ±15kV Air-Gap and ±8kV Contact Discharge IEC 61000-4-2 on the CC1, CC2, SBU1, and SBU2 pins.

The main difference between tests done using the Human Body Model and IEC 61000-4-2 is higher peak current in IEC 61000-4-2. Because series resistance is lower in the IEC 61000-4-2 ESD test model (*Figure 18)*, the ESD-withstand voltage measured to this standard is generally lower than that measured using the HBM. *Figure 19* shows the current waveform for the ±6kV IEC 61000-4-2 Level 4 ESD Contact Discharge test. The Contact Discharge method connects the probe to the device before the probe is energized.

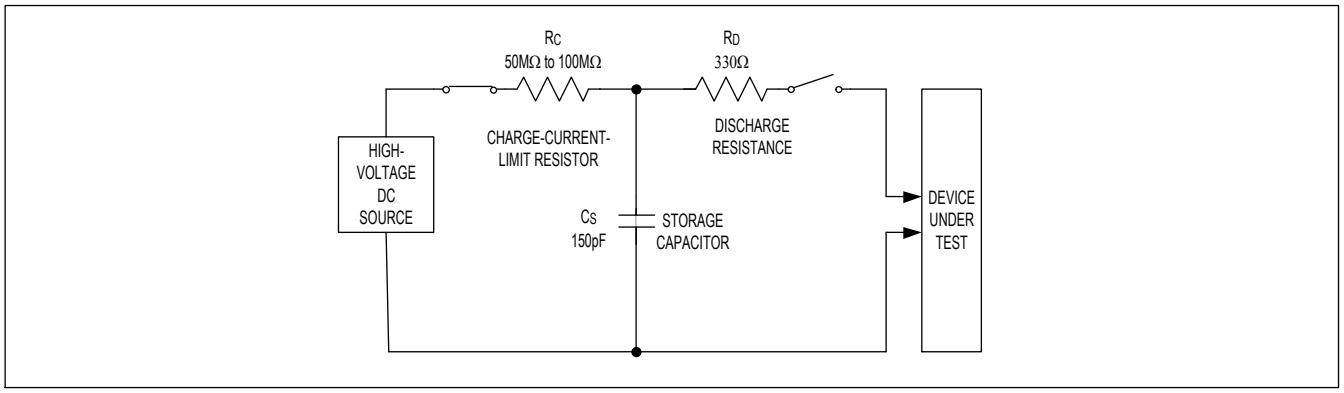


Figure 18. IEC61000-4-2 ESD Test Model

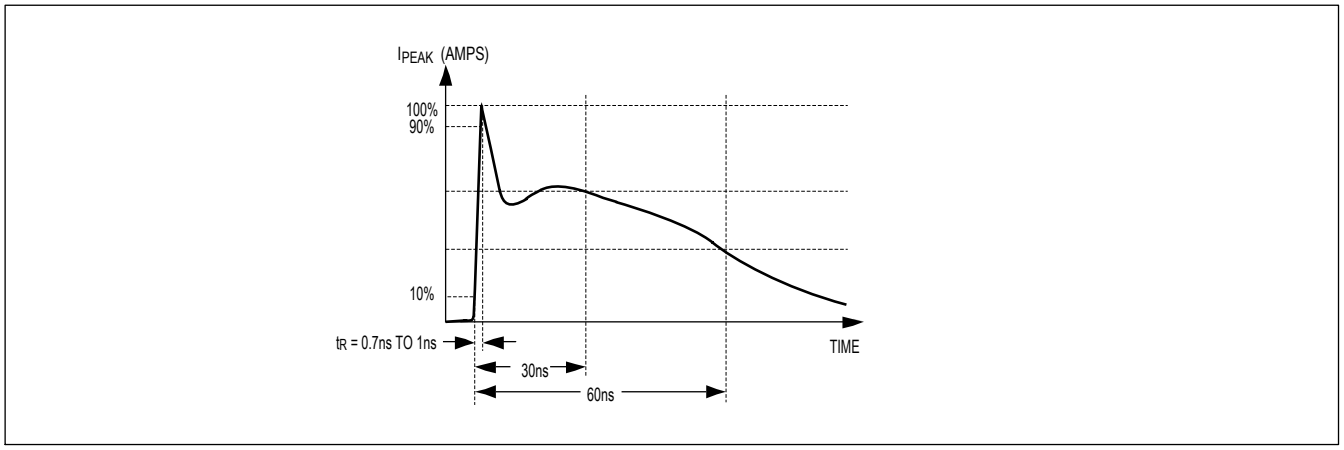
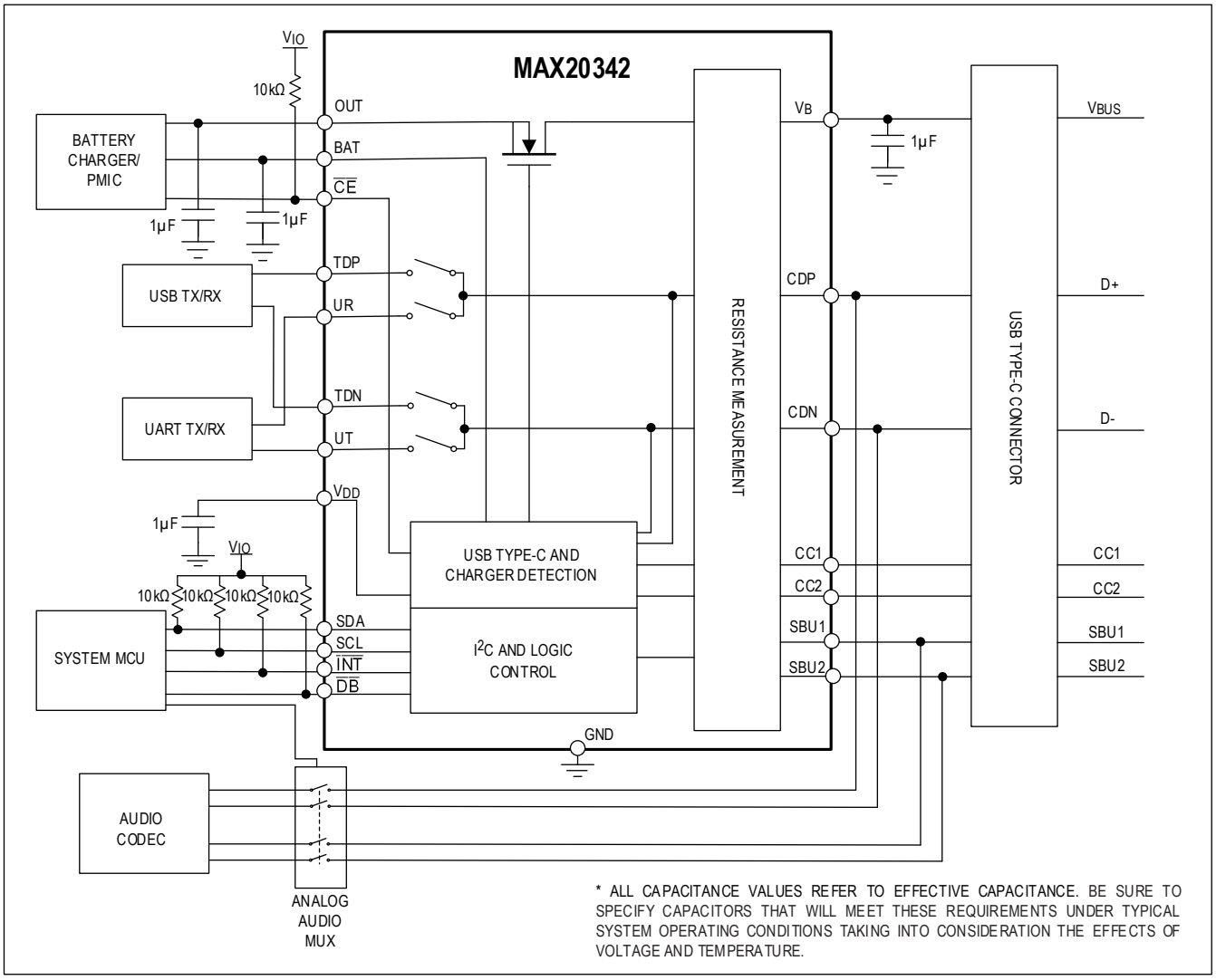


Figure 19. IEC61000-4-2 ESD Generator Current Waveform

Typical Application Circuits



Ordering Information

PART NUMBER	TEMP RANGE	PIN-PACKAGE
MAX20342EWG+	-40°C to +85°C	24 WLP
MAX20342EWG+T	-40°C to +85°C	24 WLP

+Denotes a lead(Pb)-free/RoHS-compliant package.

T = Tape and reel.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	6/20	Initial release	—
1	11/20	Updated the *Shutdown* section	37