#### **General Description**

The MAX20342 is a USB Type-C<sup>®</sup> 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 onresistance, low-capacitance double-pole double-throw (DPDT) USB switch that can pass Hi-Speed USB, fullspeed 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  $\pm 15$ kV human-body model (HBM) on CC1, CC2, SBU1, and SBU2 pins. The CDP and CDN pins are protected against ESD up to  $\pm 6$ kV. The MAX20342 is specified for  $\pm 15$ kV Air-Gap and  $\pm 8$ kV 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 -40°C to  $\pm 85^{\circ}$ C extended temperature range.

### **Applications**

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

USB Type-C® is a registered trademark of USB Implementers Forum.

Apple is a registered trademark of Apple Inc.

Samsung is a registered trademark of Samsung Electronics Co., Ltd

19-100858; Rev 3; 9/21

### USB Type-C Charger Detector with Integrated OVP

#### **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
- Supports USB Battery Charger Specification Revision 1.2
- Detects Proprietary Chargers such as Apple<sup>®</sup> and Samsung<sup>®</sup>
- 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<sup>2</sup>C 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<sub>B</sub> Connection Withstands up to +30V
  - V<sub>B</sub> 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.



# USB Type-C Charger Detector with Integrated OVP

### **Simplified Block Diagram**



### USB Type-C Charger Detector with Integrated OVP

### **Absolute Maximum Ratings**

V <sub>B</sub> to GND	0.3V to +30V
V <sub>B</sub> to OUT	0.3V to +26V
OUT to GND	0.3V to +7.5V
BAT to GND	0.3V to +6.0V
$\overline{\text{INT}},$ SDA, SCL, $\overline{\text{CE}},$ $\overline{\text{DB}}$ to GND	0.3V to +6.0V
CDN, CDP to GND	0.3V to +6.0V
CDN, CDP to GND (AudioCPEn enabled, s to +6.0V	switches off)3.0V
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 <sub>DD</sub> to GND0.3V to +2.2V
Continuous Power Dissipation (Multilayer Board) ( $T_A = +70^{\circ}C$ , derate 18.85mW/°C above +70°C) 1.508W
Continuous Current into VB, OUT 2000mA
Current into V <sub>B</sub> , OUT (T <sub>A</sub> = +70°C, 1500 hours) 3000mA
Continuous Current into CC1, CC2 600mA
Continuous Current into any other terminal 100mA
Operating Temperature Range40°C to +85°C
Junction Temperature Range40°C to +150°C
Storage Temperature Range40°C to +150°C
Soldering Temperature (reflow)+260°C

**Note 1:** CC1 and CC2 pins can withstand a short to +20V with a series  $10k\Omega$  resistor (sinking 2mA). Continuous Current is guaranteed for 100,000 hours at T<sub>A</sub> = 120°C. Throughout the data sheet, Current refers to the aforementioned condition of Continuous Current.

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	<u>21-100430</u>				
Land Pattern Number	Refer to Application Note 1891				
THERMAL RESISTANCE, FOUR LAYER BOARD					
Junction-to-Ambient (θ <sub>JA</sub> )	53.04°C/W				

For the latest package outline information and land patterns (footprints), go to <u>www.maximintegrated.com/packages</u>. 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 fourlayer board. For detailed information on package thermal considerations, refer to <u>www.maximintegrated.com/thermal-</u> <u>tutorial</u>.

### **Electrical Characteristics**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
GENERAL ELECTRICAL	CHARACTERIS	STICS				
Supply Voltage Range Output	VBAT		2.75		5.5	V
Supply Voltage Range Input	VB		4.4		28.0	V
Internal VB Regulator Voltage	VB_REG			3.75		V
Internal VCCINT Switchover Rising Threshold	VCCINT_SW OVER_THR	VCCINTOnBAT = '0', measured as (VB_REG - VBAT) rising, VCCINT = VB_REG above this threshold		180		mV
Internal VCCINT Switchover Falling Threshold	VCCINT_SW OVER_THF	VCCINTOnBAT = '0', measured as (VB_REG - VBAT) falling, VCCINT = VBAT below this threshold		50		mV
Internal VCCINT POR Rising Threshold	VCCINT_PO R	Measured on internal VCCINT rising		1.81		V
Internal VCCINT POR Threshold Hysteresis	VCCINT_PO R_HYS	Measured on internal VCCINT		150		mV
VDD Output Voltage	VDD	IDD = 20mA	1.7	1.8	1.9	V
VDD Undervoltage Lockout Rising Threshold	VDD_UVLO	VDD rising		1.62		V
VDD Undervoltage Lockout Threshold Hysteresis	VDD_UVLO_ HYS			100		mV
BAT Shutdown Quiescent Current	IBAT_SHDN	ShdnMode = '1', VBAT = 3.6V		2.5	4.2	μA
BAT Low-Power UFP Quiescent Current	IBAT_LP_UF P	LPUFP = '1', moisture detection enabled, VBAT = 3.6V, VB = 0.0V		16.4	27.0	μA
BAT Low-Power Low- Corrosion DRP Quiescent Current	IBAT_LP_D RPLC	LPDRP = '1', moisture detection enabled, DRP toggling state, VBAT = 3.6V, VB = 0.0V		16.7	28.0	μΑ
BAT UFP Quiescent Current	IBAT_UFP	Moisture detection enabled, UFP state, VBAT = 3.6V, VB = 0.0V		148.9		μA
BAT DFP Quiescent Current	IBAT_DFP	Moisture detection enabled, DFP state, VBAT = 3.6V, VB = 0.0V		181.8		μA
BAT DRP Quiescent Current	IBAT_DRP	Moisture detection enabled, DRP toggling state, VBAT = 3.6V, VB = 0.0V		166.3		μΑ

# USB Type-C Charger Detector with Integrated OVP

				TVD		
PARAMETER	SYMBOL	CONDITIONS	MIN	IYP	MAX	UNITS
BAT Quiescent	IBAT VB	VCCINTOnBAT = '0', Attached Sink state, VBAT = 4.2V, VB = 5.0V		3.2		uΔ
Present	IDAT_VD	VCCINTOnBAT = '1', Attached Sink state, VBAT = 4.2V, VB = 5.0V		292.6		μΑ
BAT Undervoltage Lockout Rising Threshold	VBAT_UVLO	VBAT rising	2.73	2.80	2.85	V
BAT Undervoltage Lockout Threshold Hysteresis	VBAT_UVLO _HYS			100		mV
BAT Overvoltage Lockout Rising Threshold	VBAT_OVLO	VBAT rising	5.20	5.35	5.50	V
BAT Overvoltage Lockout Threshold Hysteresis	VBAT_OVLO _HYS			200		mV
Shutdown/Low-Power UFP CC1 and CC2 Pulldown Resistor	RLP_UFP_P D			40		kΩ
Shutdown/Low-Power UFP CC1 and CC2 Detection Rising Threshold	VLP_UFP_T HR	CC1/CC2 rising		0.49		V
Shutdown/Low-Power UFP CC1 and CC2 Detection Falling Threshold	VLP_UFP_T HF	CC1/CC2 falling		0.45		V
Low-Power Low- Corrosion CC1 and CC2 Detection Driving Resistor	RLP_DRP_D ET			400		kΩ
Low-Power Low- Corrosion DRP CC1 and CC2 Detection Rising Threshold	VLP_DRPLC _THR	CC1/CC2 rising		1.15		V
Low-Power Low- Corrosion DRP CC1 and CC2 Detection Falling Threshold	VLP_DRPLC _THF	CC1/CC2 falling		0.68		V
Shutdown CC1 and CC2 Detection Debounce Time	tSHDN_CCD EB			85		μs
Low-Power UFP/Low Corrosion DRP CC1	tLP_CCDEB			1		ms

# USB Type-C Charger Detector with Integrated OVP

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS			
and CC2 Detection	OTHEOL	CONDITIONO			max	- Chille			
Debounce Time									
Thermal Shutdown Rising Threshold	TSHDN	TJ rising		165		°C			
Thermal Shutdown	TSHDN_HY			15		۰ <b>۲</b>			
Threshold Hysteresis	S			15		C			
V <sub>B</sub> OVERVOLTAGE P	ROTECTOR								
VB Detect Threshold Rising Threshold	VBDET	VB rising	4.19	4.30	4.40	V			
VB Detect Threshold Hysteresis	VBDET_HYS			400		mV			
VB Clamp Voltage	VB_CLAMP	IVB = 10mA		35		V			
VB Quiescent Current	IVB			360		μA			
VB to OUT On- Resistance	RON_VB_O UT	VB = 5.0V, IOUT = 100mA, TA = +25°C		47	60	mΩ			
VB Overvoltage Lockout Rising Threshold	VB_OVLO	VB rising	5.790	5.852	5.915	V			
VB Overvoltage Lockout Threshold Hysteresis	VB_OVLO_H YS			25		mV			
VB Detect Debounce Time	tVBDET_DE B			10		ms			
VB Fault Recovering Debounce Time	tVBFLT_DE B	Applies to overvoltage event		10		ms			
VB Soft-Start Time	tVB_SS	Measured from VOUT = $10\% \times VB$ to VOUT = $90\% \times VB$ , COUT = $1000\mu F$		15		ms			
VB-OUT Switch OK Time	tVB_OUT_S WT_OK	From soft-start end to VB_OUT switch interrupt OK		5		ms			
VB Overvoltage Lockout Turn-Off Time	tVB_OVLO_ OFF	From VB > VB_OVLO to VOUT stop rising, ROUT = $100\Omega$		100		ns			
DFP MODE									
OUT Connected Current Limit Source	IOUT_CUR_ LIMIT				2	А			
OUT Connected Voltage Source	VOUT_LVL				5.5	V			
USB TYPE-C	•	•							
USB TYPE-C/BC1.2 - PR	USB TYPE-C/BC1.2 - PROPRIETARY CHARGER DETECTION								
BC1.2 State Timeout	tTMO		180	200	220	ms			

# USB Type-C Charger Detector with Integrated OVP

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Data Contact Detect Timeout	tDCDtmo	DCDCpl = 0b0	1800	2000	2200	ms
Proprietary Charger Debounce	tPRDeb		5	7.5	10	ms
Primary to Secondary Timer	tPDSDWait		27	35	39	ms
Charger Detection Debounce	tCDDeb		45	50	55	ms
VB64 Threshold	VB64	CDP and CDN pins. Threshold in percent of VB voltage 3.8V < VB < 5.8V	57	64	71	%
VB64 Hysteresis	VB64_H			0.015		V
VB47 Threshold	VB47	CDP and CDN pins. Threshold in percent of VB voltage 3.8V < VB < 5.8V	43.3	47	51.7	%
VB47 Hysteresis	VB47_H			0.015		V
VB31 Threshold	VB31	CDP and CDN pins. Threshold in percent of VB voltage 3.8V < VB < 5.8V	26	31	36	%
VB31 Hysteresis	VB31_H			0.015		V
IWEAK Current	IWEAK		0.01	0.1	0.5	μA
RDM_DWN Resistor	RDM_DWN		14.25	20	24.8	kΩ
IDP_SRC Current	IDP_SRC/ID CD	0V to 2.5V	7	10	13	μA
IDM_SINK Current	IDM_SINK/I DATSINK	0.15V to 3.6V	50	80	110	μA
VLGC Threshold	VLGC		1.62	1.7	1.9	V
VLGC Hysteresis	VLGC_H			0.015		V
VDAT_REF Threshold	VDAT_REF		0.25	0.32	0.4	V
VDAT_REF Hysteresis	VDAT_REF_ H			0.015		V
VD33 Voltage	VDPDM_3P3 VSR/VSRC3 3	With IDP_SRC = 0 to 200µA	2.6	3.0	3.4	V
VSRC33ILIM Current Limit	ILIMVSRC33	VCDP/VCDN = 1.6V		1.5	3	mA
VDN_SRC Voltage	VDN_SRC/V SRC06	0 to 200µA	0.5	0.6	0.7	V
VDP_SRC Voltage	VDP_SRC/V SRC06	0 to 200µA	0.5	0.6	0.7	V

# USB Type-C Charger Detector with Integrated OVP

PARAMETER	SYMBOL	CONDITIONS	MIN	ТҮР	MAX	UNITS	
DP/DM Pulldown Resistor	RUSB		3	6.1	12	MΩ	
USB TYPE-C/CC DETECTION							
CC Pin Clamp Voltage	VCC_CLAM P	60µA ≤ ICC1, ICC2 ≤ 600µA		1.1	1.32	V	
CC Pin Clamp Voltage (5.5V)	VCC_CLAM P_5P5	ICC2, IICC2 < 2mA		5.25	5.5	V	
CC UFP Pulldown Resistance	RPD_UFP		4.59	5.10	5.61	kΩ	
CC DFP 0.5A Current Source	IDFP0.5_CC		-20%	80	+20%	μA	
CC DFP 1.5A Current Source	IDFP1.5_CC		-8%	180	+8%	μA	
CC DFP 3A Current Source	IDFP3A_CC		-8%	330	+8%	μA	
CC RA RD Threshold	VRA_RD0.5		0.15	0.2	0.25	V	
CC RA RD Hysteresis	VRA_RD0.5 _H			0.015		V	
CC UFP 0.5A RD Threshold	VUFP_RD0. 5		0.61	0.66	0.7	V	
CC UFP 0.5A RD Hysteresis	VUFP_RD0. 5_H			0.015		V	
CC UFP 1.5A RD Threshold	VUFP_RD1. 5		1.16	1.23	1.31	V	
CC UFP 1.5A RD Hysteresis	VUFP_RD1. 5_H			0.015		V	
CC DFP Vopen Detect Threshold	VDFP_VOP EN		1.5	1.575	1.65	V	
CC DFP Vopen Detect Hysteresis	VDFP_VOP EN_H			0.030		V	
CC DFP Vopen with 3.0A Detect Threshold	VDFP_VOP EN3A		2.45	2.6	2.75	V	
CC DFP Vopen with 3.0A Detect Hysteresis	VDFP_VOP EN3A_H			0.030		V	
CC V1P0 Threshold	VCC_V1P0		0.92	1.00	1.08	V	
CC V1P0 Hysteresis	VCC_V1P0_ H			0.015		V	
VB Discharge Value Threshold	VSAFE0V	Falling voltage level where a connected UFP finds VB removed	0.6	0.67	0.75	V	

# USB Type-C Charger Detector with Integrated OVP

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
VB Discharge Value Hysteresis	VSAFE0V_H	Rising hysteresis		45		mV
CC Pin Power-Up Time	tClampSwap	Maximum time allowed from removal of voltage clamp till $5.1k\Omega$ resistor attached			15	ms
CC Detection Debounce	tCCDeb		100	119	200	ms
USB Type-C Debounce	tPDDeb		10	15	20	ms
USB Type-C Quick Debounce	tQDeb		0.9	1	1.1	ms
VSAFE0V Debounce	tVSAFE0VD eb		9	10	11	ms
USB Type-C Error Recovery Delay	tErrorRecove ry		25			ms
USB Type-C DRP Toggle Time	tDRP		50	75	100	ms
DFP Duty Cycle at DRP	DDRP_DCY C	Programmable from 35% to 50% in 5% step, CCDRPPhase = 0b00		35		%
USB Type-C DRP Try	tDRPtry		90	100	110	ms
DRP Transition Time	tDRPTrans	Time a role swap from DFP to UFP or reverse is completed			1	ms
VCONN Enable Time	tVCONNON				2	ms
VCONN Disable Time	tVCONNOFF	Time from UFP detached or as directed by I <sup>2</sup> C command until VCONN is removed			35	ms
CC Pin Current Change Time	tSINKADJ	Time from CC pin changes state in UFP mode till current drawn from DFP reaches new value			60	ms
VB On Time	tVBON	Time from UFP is attached till VB ON			275	ms
VB Off Time	tVBOFF	Time from UFP is detached till VB reaches VSAFE0V			650	ms
USB TYPE-C/V <sub>CONN</sub> S	WITCH					
VCONN Source Requirements	VCONN		3.0		5.5	V
VCONN Switch On Resistance	RON_VCON _SW	VBAT = 4.2V, ICC = 0.1A		1.00	1.55	Ω
VCONN Overcurrent Protection Thresholds Accuracy	IOCP_VCON N_ACC	VBAT = 4.2V, TA = +25°C	-15		+15	%

# USB Type-C Charger Detector with Integrated OVP

PARAMETER	SYMBOL	CONDITIONS	MIN	ТҮР	MAX	UNITS
VCONN Short Circuit Current Protection Rising Threshold	ISCCP_VCO NN	CC load current rising	0.425	0.500	0.575	A
VCONN Overcurrent Protection Threshold Programmable Step	IOCP_VCON N_STEP	Programmable range is 200mA to 350mA		50		mA
VCONN Overcurrent Protection Interrupt Debounce Time	tOCP_VCON N_DEB	From detecting OCP to generating INT		2		ms
VCONN Overcurrent Protection Wait Time Before Turn Off	tOCP_VCON N_OFF	From generating INT to turning OFF VCONN switch		12		ms
VCONN Startup Time	tVCONN_90	Time from VCONN switch enable to CC settled at 90% of final value with VBAT = 4.2V		12	35	μs
SBU RESISTOR AND M	OISTURE DETEC	TION MEASUREMENT				
SBU1/SBU2 Continuous Resistor Detection Quiescent Current	IQ_SBUDET	200ms period, ADCAvgNum[2:0] ≤ 3		< 1.0		μA
Periodic Moisture Detection Quiescent Current	IQ_MOISTD ET	10s period		< 1.0		μΑ
Pullup Current 1X	IPU1X_RDE T_SBU	Pullup current on SBU1 or SBU2	1.952	2.000	2.048	μA
	IPU1X_RDE T_CCCD	Pullup current on CC1 or CC2 or CDP or CDN	1.840	2.000	2.160	
Pullup Current 4X	IPU4X_RDE T_SBU	Pullup current on SBU1 or SBU2	7.809	8.000	8.191	
	IPU4X_RDE T_CCCD	Pullup current on CC1 or CC2 or CDP or CDN	7.720	8.000	8.280	μΛ
Pullup Current 16X	IPU16X_RD ET_SBU	Pullup current on SBU1 or SBU2	31.234	32.000	32.766	цА
	IPU16X_RD ET_CCCD	Pullup current on CC1 or CC2 or CDP or CDN	31.000	32.000	33.000	μΑ
Pullup Current 64X	IPU64X_RD ET_SBU	Pullup current on SBU1 or SBU2	124.941	128.000	131.059	цА
	IPU64X_RD ET_CCCD	Pullup current on CC1 or CC2 or CDP or CDN	124.400	128.000	131.600	μΑ
Pulldown Switches On Resistance	RMOIST_S WPD	Enabled during moisture detection only	50	150	280	Ω
Pullup Forcing/Sensing	RMOIST_S WPU	(Note 2)	200	500	1050	Ω

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

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# USB Type-C Charger Detector with Integrated OVP

PARAMETER	SYMBOL	CONDITIONS	MIN	ТҮР	MAX	UNITS
Switches On Resistance						
SAR ADC Full Scale Voltage	VADC_FS		1.485	1.500	1.515	V
SAR ADC DAC Voltage Accuracy	VADC_DAC ACC		-0.3		+0.3	%
SAR ADC Comparator Static Error	VADC_COM PTH		-2.85		+2.85	mV
SAR ADC Comparator Maximum Dynamic Error	VADC_COM P_DYN			1.5		mV
SAR ADC Least Significant Bit	VADC_LSB	8 bits		0.392		% V_ADC _FS
SAR ADC RC Antialiasing Filter Time Constant	tADC_FILT			90		μs
SAR ADC Conversion Time	tADC_CONV	1.1ms (typ) additional delay prior to the first conversion		104		μs
	VADC_ERR	Voltage on pullup pin(s) = 0.375V	-1.47		+1.47	V_ADC
ADC Worst Case		Voltage on pullup pin(s) = 1.500V	-4.18		+4.18	_LSB (typ)
Accuracy		Voltage on pullup pin(s) = 0.375V	-2.31		+2.31	
		Voltage on pullup pin(s) = 1.500V	-1.64		+1.64	,
		IPU1X_RDET_SBU pullup current applied on SBU1 or SBU2	187.5		714.7	
Auto Detectable		IPU4X_RDET_SBU pullup current applied on SBU1 or SBU2	46.88		170.2	kO
Resistance Range	KSBU_KNG	IPU16X_RDET_SBU pullup current applied on SBU1 or SBU2	11.72		42.57	K12
		IPU64X_RDET_SBU pullup current applied on SBU1 or SBU2	2.93		10.64	
SBU1/SBU2 Resistance Ground Condition Range	RSBU_RNG _GND	IPU64X_RDET_SBU pullup current applied on SBU1 or SBU2. ADCGroundVth[3:0] = 0b0100	0		100.11	Ω
Auto Detectable	RCCCD_RN G	IPU1X_RDET_CCCD pullup current applied on CC1 or CC2 or CDP or CDN	187.5		672.6	kO
CC/CD Moisture Resistance Range		IPU4X_RDET_CCCD pullup current applied on CC1 or CC2 or CDP or CDN	46.88		149.7	

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

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# USB Type-C Charger Detector with Integrated OVP

PARAMETER	SYMBOL	CONDITIONS	MIN	ТҮР	MAX	UNITS		
		IPU16X_RDET_CCCD pullup current applied on CC1 or CC2 or CDP or CDN	11.72		39.30			
		IPU64X_RDET_CCCD pullup current applied on CC1 or CC2 or CDP or CDN	2.93		9.86			
CC/CD Resistance Ground Condition Range	RCCCD_RN G_GND	IPU64X_RDET_CCCD pullup current applied on CDP and/or CDN. ADCGroundVth[3:0] = 0b0100	0		99.70	Ω		
		Within RSBU_RNG resistive range and under IPU1X_RDET_SBU pullup current applied on SBU1 or SBU2	-4.70		+4.70			
SBU1/SBU2		Within RSBU_RNG resistive range and under IPU4X_RDET_SBU pullup current applied on SBU1 or SBU2	-4.70		+4.70			
Resistance Measurement Accuracy	RSBU_ACC	Within RSBU_RNG resistive range and under IPU16X_RDET_SBU pullup current applied on SBU1 or SBU2	-4.70		+4.70	%		
		Within RSBU_RNG resistive range and under IPU64X_RDET_SBU pullup current applied on SBU1 or SBU2	-4.70		+4.70			
	RCCCD_AC C	Within RCCCD_RNG resistive range and under IPU1X_RDET_CCCD pullup current applied on CC1 or CC2 or CDP or CDN	-10.31		+10.31			
CC/CD Resistance		Within RCCCD_RNG resistive range and under IPU4X_RDET_CCCD pullup current applied on CC1 or CC2 or CDP or CDN	-5.81		+5.81	0/		
Measurement Accuracy		Within RCCCD_RNG resistive range and under IPU16X_RDET_CCCD pullup current applied on CC1 or CC2 or CDP or CDN	-5.44		+5.44	70		
		Within RCCCD_RNG resistive range and under IPU64X_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	VTDP/N		0		5.5	V		
On-Resistance	RON_TD			3.7	6.0	Ω		
On-Resistance Match Between Channels	∆RON_TD	ITDP/N = 10mA, VTDP/N = 0.0V		0.02		Ω		

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

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# USB Type-C Charger Detector with Integrated OVP

the operating temperature	Tunge una Televa	The supply voltage range are guaranteed by a	colgi ana	onunuotonz		
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
On-Resistance Flatness	RFLAT_TD	ITDP/N = 10mA, VTDP/N = 0.0V to 5.5V		0.005		Ω
Off Leakage Current	IOFF_TD	VCDP/N = 0V, VTDP/N = 2.5V	-0.5	-0.5 0.5 +1.5		μA
On Leakage Current	ION_TD	VTDP/N = 2.5V, VCDP/N = open	-1		+1.5	μA
Turn-On Time	tON_TD	VTDP/N = 1.5V, RLOAD = 50Ω		55		μs
Turn-Off Time	tOFF_TD	VTDP/N =1.5V, RLOAD = 50Ω		20		μs
Output Skew Same Switch	tSK(P)_TD			40		ps
Output Skew Between Switch	tSK(O)_TD			40		ps
Break-Before-Make Time Delay	tBBM_TD	RLOAD = $50\Omega$ , delay between one side of the switch opening and the other side closing	0 3			μs
-3dB Bandwidth	fBW_TD	VD_= 0dBm, RS = RL = 50Ω		400		MHz
Off-Isolation	VISO_TD	$f = 20kHz, VD_{-} = 0.4Vp-p, RL = 50\Omega$		-80		dB
Crosstalk	VCRTLK_TD	$f = 20kHz, VD_{-} = 0.4Vp-p, RL = 50\Omega$		-80		dB
PSRR	VPSRR_TD	V = 400mVpp, f = 20kHz, RS = RL = $50\Omega$		-60		dB
UART Switches (UR_UT	)		<u> </u>			
Analog Signal Range	VUR/T		0		5.5	V
On-Resistance	RON_U			23	36	Ω
On-Resistance Match Between Channels	ΔRON_U	IUR/T = 1mA, VUR/T = 0.0V		0.3		Ω
On-Resistance Flatness	RFLAT_U	IUR/T = 10mA, VUR/T = 0.0V to 5.5V		0.01		Ω
Off Leakage Current	IOFF_U	VCDP/N = 0V, VUR/T= 2.5V	-0.5	0.5	+1.5	μA
On Leakage Current	ION_U	VUR/T = 2.5V, VCDP/N = floating	-1		+1.5	μA
Turn-On Time	tON_U	VUR/T = 1.5V, RLOAD = 50Ω		30		μs
Turn-Off Time	tOFF_U	VUR/T = 1.5V, RLOAD = 50 Ω		15		μs
Break-Before-Make Time Delay	tBBM_U	RLOAD = $50\Omega$ , delay between one side of the switch opening and the other side closing	0	38		μs
-3dB Bandwidth	fBW_U	$VD = 0dBm, RS = RL = 50\Omega$		350		MHz
Off-Isolation	VISO_U	$f = 20kHz, VD = 0.4Vp-p, RL = 50\Omega$		-90		dB
Crosstalk	VCRTLK_U	f = 20kHz, VD = $0.4$ Vp-p, RL = $50$ Ω		-70		dB
PSRR	VPSRR_U	V = 400mVpp, f = 20kHz, RS = RL = $50\Omega$		-60		dB
I <sup>2</sup> C INTERFACE TIMIN	1G					
Clock Frequency	fSCL				1000	kHz

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

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PARAMETER	SYMBOL	CONDITIONS	MIN	ТҮР	MAX	UNITS		
Hold Time (Repeated) START Condition	tHD:STA		0.26			μs		
CLK Low Period	tLOW		0.5			μs		
CLK High Period	tHIGH		0.26			μs		
Setup Time Repeated START Condition	tSU:STA		0.26			μs		
DATA Hold Time	tHD:DAT		0			μs		
DATA Valid Time	tVD:DAT				0.45	μs		
DATA Valid Acknowledge Time	tVD:ACK				0.45	μs		
DATA Setup time	tSU:DAT		50			ns		
Setup Time for STOP Condition	tSU:STO		0.26			μs		
Bus-Free Time Between STOP and START	tBUF		0.5			μs		
Pulse Width of Spikes that Must be Suppressed by the Input Filter	tsp			50		ns		
Input Logic High	VIN_IH		1.5			V		
Input Logic Low	VIN_IL				0.3	V		
Input Logic Leakage Current	IIN_LKG		-1		+1	μA		
OPEN DRAIN OUTPU	TS (CE, DB, INT)							
Open Drain Logic low	VOD_OL	IOD = 2mA			0.4	V		
Open Drain Output High Leakage Current	IOD_LKG		-1		+1	μΑ		
ESD PROTECTION								
		CDP/CDN		±6				
HBM		SBU1/SBU2, CC1/CC2, VB (connected to 1µF capacitor)		±15		kV		
IEC61000-4-2 Contact Discharge		SBU1/SBU2, CC1/CC2, VB (connected to 1µF capacitor)		±8		kV		
IEC61000-4-2 Air Gap		SBU1/SBU2, CC1/CC2, VB (connected to 1µF capacitor)		±15		kV		
SURGE PROTECTION		1	I			1		
IEC61000-4-5 Surge		VB		±120		V		

### USB Type-C Charger Detector with Integrated OVP

PARAMETER	SYMBOL	CONDITIONS	MIN	MIN TYP M		UNITS
		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<sub>MOIST\_SWPU</sub> resistance. For example, if just two pins are pulled up, an overall equivalent resistance equal to R<sub>MOIST\_SWPU</sub> 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<sub>MOIST\_SWPU</sub> resistance.

# USB Type-C Charger Detector with Integrated OVP

### **Typical Operating Characteristics**

( $T_A = +25^{\circ}C$ ,  $V_B = 5V$ , unless otherwise noted.)



# USB Type-C Charger Detector with Integrated OVP

#### (T<sub>A</sub> = +25°C, V<sub>B</sub> = 5V, unless otherwise noted.)



# USB Type-C Charger Detector with Integrated OVP

### **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 $1\mu$ F effective capacitance.
A4	VB	USB Type-C V <sub>BUS</sub> Connection. Bypass V <sub>B</sub> to GND with a capacitor of $1\mu$ F effective capacitance.
A5	CDP	USB Connector D+ Connection
A6	CDN	USB Connector D- Connection
B1	VDD	Internal Supply Input. Bypass V <sub>DD</sub> 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	INT	Active-Low, Open-Drain Interrupt Output. Connect INT to an external pullup resistor.
C2	CE	Active-Low, Open-Drain Charger Control Enable Output. Connect CE to an external pullup resistor.
C3	CC2	USB Type-C CC2 Connection
C4	CC1	USB Type-C CC1 Connection

# USB Type-C Charger Detector with Integrated OVP

C5	GND	Ground
C6	TDP	USB Transceiver D+ Connection
D1	DB	Active-Low, Open-Drain Output. This pin is driven low when an $80k\Omega$ resistor is connected to SBU1 or SBU2. Connect $\overline{DB}$ to an external pullup resistor.
D2	SDA	I <sup>2</sup> C Serial-Data Input/Output. Connect SDA to an external pullup resistor.
D3	SCL	I <sup>2</sup> C 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 supports USB BC1.2 with the additional capability to automatically detect some common proprietary charger types. Note that after the secondary detection of USB BC1.2 finishes, the device does not keep  $V_{DP\_SRC}$  enabled if DCP is detected. While this behavior can cause the device to fail the DCP test in USB BC1.2 compliance, this is not expected to cause any issue in the detection of BC1.2 chargers.

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 VB	31% TO 47% OF VB	47% TO 64% OF VB	64% TO 100% OF VB
	0 TO 0.32V	Unknown	Unknown	Unknown	Unknown	Unknown
	0.32V TO 31% OF VB	Unknown	Samsung	Unknown	Unknown	Unknown
D-	31% TO 47% OF VB	Unknown	Unknown	Apple 0.5A	Apple 2.0A	Unknown
	47% TO 64% OF VB	Unknown	Unknown	Apple 1.0A	Apple 12W	Unknown
	64% TO 100% OF VB	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 <u>Table 3</u>. When the MAX20342 detects the charger, it sets the  $\overline{CE}$  output based on the charger type found. <u>Table 4</u> shows D+/D-termination for Apple chargers, Samsung charger, dedicated charger, and a standard USB host charging downstream port.

Table 3.	Charger	Control	<b>Table</b>
----------	---------	---------	--------------

		DDCUOTVDI2-01	CE OUTPUT		
ADAPTER TYPE	CHGI YP[1:0]	PRCHGT (P[2:0]	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<sub>B</sub> voltage, CC resistor value, and SBU resistor value. See <u>Table 4</u> 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.

MAX20342 DEVICE CONFIGURATION BASED ON VB, 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 <sub>CONN</sub> POWERED DEVICE (E.G., DIGITAL HEADSET)
FACTAUTO/ USBAUTO	-	-	FactAuto = 1	FactAuto = 1	FactAuto = 1	USBAuto = 1	USBAuto = 1	USBAuto = 1	USBAuto = 1	USBAuto = 1
Vв	Not connected	Outside valid range	Valid	Valid	Valid	Valid	Valid	-	Not Connected	Not Connected
CC PINS	-	-	CC1 and CC2 = R <sub>p</sub>	CC1 and CC2 = R <sub>p</sub>	CC1 and CC2 = R <sub>p</sub>	Only CC1 = $R_p$ , or only CC2 = $R_p$	Only CC1 = R <sub>p</sub> , or only CC2 = R <sub>p</sub>	Only CC1 = R <sub>d</sub> , or only CC2 = R <sub>d</sub>	CC1 and CC2 = Ra	$\begin{array}{l} CC1 = R_d \\ and CC2 = \\ R_a, or CC1 \\ = R_a and \\ CC2 = R_d \\ Connect \\ BAT \\ (V_{CONN}) to \\ CC_with \\ R_a through \\ switch \end{array}$
SBU PINS	-	-	SBU1 or SBU2 = 30kΩ	SBU1 or SBU2 = 80.2kΩ	SBU1 or SBU2 = 150kΩ	-	-	-	-	-
OUT	High-Z	High-Z	High-Z	VB	VB	VB	VB	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
CE	High-Z	High-Z	High-Z	GND	GND	GND	High-Z or GND (*)	High-Z	High-Z	High-Z
DB	High-Z	High-Z	High-Z	GND	High-Z	High-Z	High-Z	High-Z	High-Z	High-Z
INT	High-Z	GND	GND	High-Z	High-Z	High-Z	High-Z	High-Z	High-Z	High-Z

### Table 4. Autoconfiguration Mode Table

(\*)  $\overline{CE}$  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.

### USB Type-C Charger Detector with Integrated OVP

#### **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<sub>B</sub> 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<sub>B</sub> or a CC connection has not been detected.

#### Moisture Detection Threshold R<sub>MOIST</sub>

The R<sub>MOIST</sub> 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<sub>MOIST</sub>, 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<sub>MOIST</sub>). <u>Table 5</u> 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 <u>Table 7</u> and <u>Table 8</u>.

#### Table 5. Moisture Detection Result

IPURESULT[1:0]	ADCRESULTAVG[7:0]	MOISTURE DETECTED (MEASURED RESISTANCE < R <sub>MOIST</sub> )
< 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 <u>Resistive Measurement</u> 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<sub>B</sub>, 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. <u>Figure 2</u> 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*.

## USB Type-C Charger Detector with Integrated OVP



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 <u>Resistive Measurement</u> 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 VB 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 VB 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 <u>Table 4</u>.

#### **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 <u>Resistive Measurement</u> 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 oneshot 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 <u>Table 6</u>. 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.

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Figure 6. SBU1/SBU2 Resistance Detection

### USB Type-C Charger Detector with Integrated OVP

RESULT C	N EACH PIN	OVERALL RESULT				
SBU1	SBU2	SBUDETABORTPRIORITY = '0' SBUDETABORTPRIORITY =				
Open	Open	Op	pen			
Ground	Ground	Gro	und			
Open	Ground	Gro	und			
Ground	Open	Gro	und			
Open	Finite	Fir	lite			
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			

#### Table 6. SBU Detection Overall Result

#### **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 RMOIST\_SWPD on-resistance) connects the pin to ground, while the two pullup switches (each with RMOIST\_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.

### USB Type-C Charger Detector with Integrated OVP



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 RSBU\_ACC and RCCCD\_ACC parameters in the ECT).

The parameters ADCSBUCorrNum[4:0], RSBU\_ACC, RSBU\_RNG, and RSBU\_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], RCCCD\_ACC, RCCCD\_RNG, and RCCCD\_RNG\_GND apply.

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#### **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  $2\mu$ A, 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  $128\mu$ A 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] =  $8\mu$ A,  $32\mu$ A, or  $128\mu$ A)

**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)
- (ADCResultAvg[7:0] ≤ (0x3F ADC shift factor)) AND (ADCResultAvg[7:0] > ADCGroundVth[3:0] AND IputResult[1:0] = 128µA)

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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 <u>Table 7</u> and <u>Table 8</u>.

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 variat

# 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 <sub>SBU_RNG</sub>		Resistance Measurement Accuracy R <sub>SBU_ACC</sub>	
	MIN	MAX	MIN	MAX
2μΑ	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  $30k\Omega$ , perform the following procedure:

- The target resistance is 30kΩ. Use <u>Table 7</u> 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.
- Compute the typical voltage target:  $30k\Omega \times 32\mu A = 0.96V$ .
- Since only SBU pins are pulled up, RSBU\_ACC applies, namely the combined accuracy of the ADC and the 32µA pullup current (see <u>Table 7</u>). Compute the minimum and maximum accessory mode detection voltage thresholds with the measurement accuracy (4.75%).
- Minimum threshold:  $0.96V \times (1 4.70\%) = 0.91488V$ . 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.
- 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.
- 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

	AUTO DETECTABLE RESISTANCE RANGE		RESISTANCE MEASUREMENT ACCURACY	
PULLUP CURRENT			Rcccd_acc	
	MIN	MAX	MIN	MAX
2μΑ	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%

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

- 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.
- Compute the typical voltage target:  $20k\Omega \times 32\mu A = 0.64V$ .
- Since pin(s) different from SBU1 and/or SBU2 only (i.e., CC1 and CC2) are pulled up, RCCCD\_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.
- 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.
- 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<sub>SBU\_RNG\_GND</sub> and R<sub>CCCD\_RNG\_GND</sub>, are determined by setting ADCGroundVth[3:0] with the following formulas:

RSBU RNG GND = [ 5.823mV x (ADCGroundVth[3:0] - 1) - 4.35mV ] / 131.059µA

RCCCD\_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:

RSBU RNG GND =  $[5.823 \text{mV} \times (4 - 1) - 4.35 \text{mV}] / 131.059 \mu\text{A} = 100.11 \Omega$  (The ECT value)

 $R_{CCCD_RNG_GND} = [5.823 \text{mV} \times (4 - 1) - 4.35 \text{mV}] / 131.600 \mu \text{A} = 99.70 \Omega$  (The ECT value)

#### **V**<sub>B</sub> Overvoltage Protection

The device features overvoltage protection up to +28V on the V<sub>B</sub> line. If the input voltage exceeds the overvoltage lockout threshold (V<sub>B\_OVLO</sub>), the low 50m $\Omega$  (typ) on-resistance internal FET disconnects V<sub>B</sub> 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<sub>B</sub> voltage is valid for a period longer than the debounce time (t<sub>VBFLT\_DEB</sub>). 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  $R_{ON_{TD}} 3.2\Omega$  (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  $R_{ON}$  23 $\Omega$  (typ) on-resistance.

#### Fault State

The device enters the Fault state when there is either an overvoltage condition on BAT ( $V_{BAT} > V_{BAT_OVLO}$ ) or a thermal condition ( $T_{DIE} > T_{SHDN}$ ). In either condition, the FAULT bit (bit 7 of register 0x07) becomes 1. After the device exits the overvoltage and thermal conditions, the FAULT bit remains asserted and the user needs to clear it by writing 1 to the FaultUnlock bit (bit 0 of register 0x19) to resume normal operation.

#### **Thermal Shutdown**

The MAX20342 features a thermal shutdown protection feature to protect the device from fault conditions. When the die temperature is  $T_{SHDN}$ , 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 (typ), the user can write 1 to the FaultUnlock bit to clear the FAULT status bit and resume operation.

#### Supply Voltage Selector

The MAX20342 features an internal supply voltage selector that chooses between V<sub>B</sub> and BAT inputs to power the internal blocks. If V<sub>B</sub> is not present, the internal power supply, V<sub>CCINT</sub>, is supplied from BAT. A typical 100 $\mu$ s POR is provided at the rising edge of V<sub>CC</sub>. When the device is connected to V<sub>B</sub>, the user can force the device to use BAT as the supply of V<sub>CC</sub> 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 I<sup>2</sup>C 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 I<sup>2</sup>C interface and the CC pin monitoring to detect the charger connection. All other blocks are disabled. On the I<sup>2</sup>C 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 I<sup>2</sup>C 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.

#### I<sup>2</sup>C Interface

The MAX20342 contains an  $I_2C$ -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. PC Interface Timing

When writing to the MAX20342 using the I<sup>2</sup>C interface, the master sends a START condition (S) followed by the MAX20342 I<sup>2</sup>C 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 I<sup>2</sup>C slave.
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Figure 10. PC 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

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#### **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.

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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

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## **Register Map**

### MAX20342

ADDRESS	NAME	MSB							LSB
USER_INTER	RUPTS								
0x00	REVISION_ID[7:0]				Revisio	n_id[7:0]			
0x01	COMMON_INT[7:0]	FAULTInt	BatOVLOI nt	BatUVLOI nt	THMInt	LowPwrInt	ShdnWak eInt	VSAFE0VI nt	VBvalidInt
0x02	<u>CC_INT[7:0]</u>	-	-	CCStatInt	CCPinStat Int	CCIStatInt	CCVcnSta tInt	VCONNO CPInt	DetAbrtInt
0x03	BC_INT[7:0]	-	-	-	ChgTypInt	PrChgTypl nt	CHgDetR unRInt	CHgDetR unFInt	DCDTmol nt
0x04	OVP_INT[7:0]	-	-	-	_	_	-	SwtClosed Int	OVLOInt
0x05	<u>RES_INT1[7:0]</u>	-	-	-	ResAcc5I nt	ResAcc4I nt	ResAcc3I nt	ResAcc2I nt	ResAcc1I nt
0x06	<u>RES_INT2[7:0]</u>	-	-	ResGroun dInt	ResSBUIn t	ResFinitel nt	ResOpenI nt	ResAbortI nt	ResMoistI nt
0x07	COMMON_STATUS[7:0]	FAULT	BatOVLO	BatUVLO	THM	LowPwr	_	VSAFE0V	VBvalid
0x08	CC_STATUS1[7:0]	-	-	-	-	VCONNS C	CCVcnSta t	VCONNO CP	ChgDetAb ort
0x09	CC_STATUS2[7:0]	_		CCStat[2:0]	_	CCPins	Stat[1:0]	CCIStat[1:0]	
0x0A	BC_STATUS[7:0]	-	ChgTy	yp[1:0]		PrChgTyp[2:0	]	CHgDetR un	DCDTmo
0x0B	OVP_STATUS[7:0]	ltfRdy	_	_	_	_	_	SwtClosed	OVLO
0x0C	COMMON MASK[7:0]	FAULTM	BatOVLO M	BatUVLO M	ТНММ	LowPwrM	ShdnWak eM	VSAFE0V M	VBvalidM
0x0D	<u>CC_MASK[7:0]</u>	-	-	CCStatM	CCPinStat M	CCIStatM	CCVcnSta tM	VCONNO CPM	DetAbrtM
0x0E	BC MASK[7:0]	-	-	-	ChgTypM	PrChgTyp M	CHgDetR unRM	CHgDetR unFM	DCDTmo M
0x0F	OVP MASK[7:0]	-	-	-	_	_	-	SWT_clos edM	OVLOM

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ADDRESS	NAME	MSB							LSB
0x10	<u>RES_MASK1[7:0]</u>	-	_	-	ResAcc5I ntM	ResAcc4I ntM	ResAcc3I ntM	ResAcc2I ntM	ResAcc1I ntM
0x11	RES_MASK2[7:0]	-	-	ResGroun dIntM	ResSBUIn tM	ResFinitel ntM	ResOpenI ntM	ResAbortI ntM	ResMoistI ntM
USER_COMM	ION								
0x15	COMM_CTRL1[7:0]	INTEn	FactAuto	USBAuto	AudioCPE n	VCCINTO nBAT	LPDRP	LPUFP	ShdnMod e
0x16	COMM_CTRL2[7:0]	USBSWC[1:0]		NotUSBC mpl	DB	DBFrc	_	CE	CEFrc
0x17	RFU_RW[7:0]	-	-	_	-	-	-	_	-
0x18	RFU_RO[7:0]	-	-	_	-	_	_	_	_
0x19	COMM_CTRL3[7:0]	-	-	-	-	_	-	SwReset	FaultUnloc k
USER_OVP									
0x1A	OVP_CTRL[7:0]	I	Ι	_	VBPDEn	VBPDT	ˈmr[1:0]	VBOVF	'En[1:0]
USER_USBC									
0x20	CC_CTRL0[7:0]	-	-	CCSrcCur Ch	CCForceE rror	SnkAttach edLock	CCVcnSw p	CCSrcRst	CCSnkRst
0x21	CC_CTRL1[7:0]	CCVcnEn	CCTrySnk En	-	CCDbgSrc En	CCDbgSn kEn	CCAudEn	CCSrcEn	CCSnkEn
0x22	CC_CTRL2[7:0]	-	CCSrcC	urAd[1:0]	CCLpMod	deSel[1:0]		CCRpCtrl[2:0]	
0x23	CC_CTRL3[7:0]	Ι	Ι	RSVD	RSVD	_	_	_	CCDetEn
0x24	CC_CTRL4[7:0]	-	-	TryWaitSh ortDeb	CCErrorLo ck	_	_	ccDRPP	hase[1:0]
0x25	CC_CTRL5[7:0]	_	_	_	_	_	_	VBMask	ccSnkExit En
0x26	CC_CTRL6[7:0]	_	CCLadder Dis	_	_	_	– tQDebounce2[1:0]		nce2[1:0]
0x28	VCONN_ILIM[7:0]	_	_	_	CCVcnOc pEn		VCONN_	_ILIM[3:0]	

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ADDRESS	NAME	MSB							LSB
USER_BC12									
0x2A	BC_CTRL0[7:0]	_	-	-	_	_	_	-	ChgDetMa n
0x2B	BC_CTRL1[7:0]	DCDTmo	_	_	DCP3PDe t	RSVD	-	_	ChgDetEn
SBUDetResu	lt								
0x2C	SBU1DetResult1[7:0]	SBUDetA bortPriorit y	_	_	SBU1Det Ground	SBU1Det Abort	SBU1Det Open	SBU1De	etlpu[1:0]
0x2D	SBU1DetResult2[7:0]		SBU1DetVADC[7:0]						
0x2E	SBU2DetResult1[7:0]	_	_	_	SBU2Det Ground	SBU2Det Abort	SBU2Det Open	SBU2DetIpu[1:0]	
0x2F	SBU2DetResult2[7:0]		SBU2DetVADC[7:0]						
SBUDetConfi	SBUDetConfig								
0x30	SBUDetCtrl[7:0]	-	-	-	_	-	SBUDetC ontEn	SBUDetO neShotEn	SBUDetM anEn
0x31	RAcc1DetVMax[7:0]				RAcc1Det	VMax[7:0]			
0x32	RAcc1DetVMin[7:0]				RAcc1De	tVMin[7:0]			
0x33	RAcc1Detlpu[7:0]	_	_	_	_	_	_	RAcc1De	etlpu[1:0]
0x34	RAcc2DetVMax[7:0]				RAcc2Det	:VMax[7:0]	I		
0x35	RAcc2DetVMin[7:0]				RAcc2De	tVMin[7:0]			
0x36	RAcc2Detlpu[7:0]	-	-	-	-	_	-	RAcc2De	etlpu[1:0]
0x37	RAcc3DetVMax[7:0]				RAcc3Det	:VMax[7:0]	I		
0x38	RAcc3DetVMin[7:0]				RAcc3De	tVMin[7:0]			
0x39	RAcc3DetIpu[7:0]	_	_	_	_	_	_	RAcc3De	etlpu[1:0]
0x3A	RAcc4DetVMin[7:0]	RAcc4DetVMin[7:0]							
0x3B	RAcc4DetVMax[7:0]	RAcc4DetVMax[7:0]							
0x3C	RAcc4DetIpu[7:0]	_	_	_	_	_	_	RAcc4De	etlpu[1:0]

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## USB Type-C Charger Detector with Integrated OVP

	1	1						1					
ADDRESS	NAME	MSB							LSB				
0x3D	RAcc5DetVMax[7:0]				RAcc5De	tVMax[7:0]							
0x3E	RAcc5DetVMin[7:0]				RAcc5De	tVMin[7:0]							
0x3F	RAcc5DetIpu[7:0]	-	_	_	-	-	-	RAcc5De	ətlpu[1:0]				
MoistDet													
0x50	RMoistDetVth[7:0]				RMoistD	etVth[7:0]							
0x51	MoistDetCtrl[7:0]	-	-	-	MoistDetA utoCfg	MoistDetP erEn	MoistDetM anEn RMoistDetIpu[1:0]		etlpu[1:0]				
0x52	MoistDetPUConfig[7:0]	-	– – MoistDetPUConfig[5:0]										
0x53	MoistDetPDConfig[7:0]	-	– MoistDetPDConfig[6:0]										
0x54	MoistDetAutoCC1Result1[7 :0]	-	-	-	CC1MoiG nd	CC1MoiA brt	CC1MoiO pn	CC1MoiO pn CC1Moistlpu[1:0]					
0x55	MoistDetAutoCC1Result2[7 :0]	CC1MoistVADC[7:0]											
0x56	MoistDetAutoCC2Result1[7 :0]	-	-	-	CC2MoiG nd	CC2MoiA brt	CC2MoiO pn	CC2Mois	stlpu[1:0]				
0x57	MoistDetAutoCC2Result2[7 :0]				CC2Moist	VADC[7:0]							
0x58	MoistDetAutoSBU1Result1[ 7:0]	-	-	-	SBU1Moi Gnd	SBU1Moi Abrt	SBU1Moi Opn	SBU1Mo	istlpu[1:0]				
0x59	MoistDetAutoSBU1Result2[ 7:0]				SBU1Mois	tVADC[7:0]							
0x5A	MoistDetAutoSBU2Result1[ 7:0]	-	-	-	SBU2Moi Gnd	SBU2Moi Abrt	SBU2Moi Opn	SBU2Mo	istlpu[1:0]				
0x5B	MoistDetAutoSBU2Result2[ 7:0]	SBU2MoistVADC[7:0]											
ADCConfig	·												
0x5C	ADCCtrl1[7:0]	-		ADCGrou	ndVth[3:0]		AD	CRetryNum[2	2:0]				
0x5D	ADCCtrl2[7:0]	IpuRes	sult[1:0]			ADCCorrNum[5:0]							
0x5E	ADC_CTRL3[7:0]	AI	DCAvgNum[2	:0]		ADC	SBUCorrNun	n[4:0]	ADCSBUCorrNum[4:0]				

## USB Type-C Charger Detector with Integrated OVP

ADDRESS	NAME	MSB							LSB
0x5F	ADC_CTRL4[7:0]	_	Ι	ADCNoiseClampRng[5:0]					
0x60	ADCResultAvg[7:0]		ADCResultAvg[7:0]						
0x61	ADCResultMax[7:0]	ADCResultMax[7:0]							
0x62	ADCResultMin[7:0]				ADCResu	ultMin[7:0]			
USER_VB	USER_VB								
0x63	<u>VB_CTRL[7:0]</u>	-	-	-	_	_	_	ACTIV_DI SCH_EN	_

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							
Access Type	Write, Read							

BITFIELD	BITS	DESCRIPTION
FAULTInt	7	Fault Status Interrupt Bit. Asserted for any fault status change. 0b0: No fault status change 0b1: New fault status interrupt

## USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
		Battery Overvoltage Status Bit Interrupt
BatOVLOInt	6	0b0: No interrupt 0b1: New BatOVLO status interrupt
		Battery Undervoltage Status Bit Interrupt
BatUVLOInt	5	0b0: No interrupt 0b1: New BatUVLO status interrupt
		Thermal Shutdown Interrupt
THMInt	4	0b0: No interrupt 0b1: New THM status interrupt
		Low Power Mode Status Change Interrupt
LowPwrInt	3	0b0: No interrupt 0b1: New LowPwr status interrupt
ShdpW/akaInt	2	Shutdown Mode Wake Up Interrupt. It is set upon exiting from shutdown due to toggling the I <sup>2</sup> C interface or something attached to the USB Type-C port
Shunwakeint	Z	0b0: No exit from shutdown 0b1: Exit from shutdown
		V <sub>SAFE0V</sub> Interrupt
VSAFE0VInt	1	0b0: No interrupt 0b1: New V <sub>SAFE0V</sub> status interrupt
		V <sub>B</sub> Valid Range Detection Interrupt
VBvalidInt	0	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	VCONNOCPI nt	DetAbrtInt
Reset	_	-	0x0	0x0	0x0	0x0	0x0	0x0
Access Type	-	-	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read

## USB Type-C Charger Detector with Integrated OVP

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

#### BC INT (0x03)

BIT	7	6	5	4	3	2	1	0
Field	-	_	_	ChgTypInt	PrChgTypInt	CHgDetRunR Int	CHgDetRunFl nt	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

## USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
		Propietary Charger Type Interrupt
PrChgTypInt	3	0b0: No interrupt 0b1: New PrChgTyp status interrupt
		Charger Detection Runnning Rising Edge Interrupt
CHgDetRunRInt	2	0b0: No rising edge detected on ChgDetRun 0b1: Rising edge detected on ChgDetRun
		Charger Detection Runnning Falling Edge Interrupt
CHgDetRunFInt	1	0b0: No falling edge detected on ChgDetRun 0b1: Falling edge detected on ChgDetRun
		DCD Timer Interrupt
DCDTmoInt	0	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 <sub>B</sub> Switch Interrupt 0b0: No interrupt 0b1: New V <sub>B</sub> switch status interrupt
		$V_B$ Overvoltage Interrupt
OVLOInt	0	0b0: No interrupt 0b1: New overvoltage status interrupt

#### RES INT1 (0x05)

BIT 7 6 5 4 3 2 1	0
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## USB Type-C Charger Detector with Integrated OVP

Field	_	-	_	ResAcc5Int	ResAcc4Int	ResAcc3Int	ResAcc2Int	ResAcc1Int
Reset	-	-	-	0x0	0x0	0x0	0x0	0x0
Access Type	-	_	_	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

# USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
		Ground Resistive Measurement Result Interrupt
ResGroundInt	5	0b0: Ground resistive value not detected
		0b1: Ground resistive value detected
		SBU1/SBU2 Resistor Detection Measurement Result Interrupt
ResSBUInt	4	0b0: SBU1/SBU2 resistor detection measurement not completed
		0b1: SBU1/SBU2 resistor detection measurement completed
		Finite But Not Valid Resistive Measurement Result Interrupt
ResFiniteInt	3	0b0: Finite but not valid resistive value not detected
		0b1: Finite but not valid resistive value detected
		Open Resistive Measurement Result Interrupt
ResOpenInt	2	0b0: Open resistive value not detected
		0b1: Open resistive value detected
		Abort Resistive Measurement Result Interrupt
ResAbortInt	1	0b0: Abort resistive value not detected
		0b1: Abort resistive value detected
		Moisture Detection Measurement Valid Result Interrupt
ResMoistInt	0	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	ТНМ	LowPwr	-	VSAFE0V	VBvalid
Reset	0x0	0x0	0x0	0x0	0x0	-	0x0	0x0
Access Type	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 BATOVLO or THM present.

## USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
		0b0: Not in fault state 0b1: In fault state
		Battery Overvoltage Status Bit
BatOVLO	6	0b0: V <sub>BAT</sub> < V <sub>BAT_OVLO</sub> 0b1: V <sub>BAT</sub> > V <sub>BAT_OVLO</sub>
		Battery Undervoltage Status Bit
BatUVLO	5	0b0: Vbat > Vbat_uvlo 0b1: Vbat < Vbat_uvlo
		Thermal Shutdown Status
тнм	4	0b0: Thermal fault not active 0b1: Thermal fault active
		Low-Power Mode Status
LowPwr	3	0b0: Low-power mode (UFP or DRP) not active 0b1: Low-power mode (UFP or DRP) entered
		Status of V <sub>B</sub> Detection
VSAFE0V	1	0b0: V <sub>B</sub> < V <sub>SAFE0V</sub> 0b1: V <sub>B</sub> > V <sub>SAFE0V</sub>
		Status of $V_B$ Valid Range
VBvalid	0	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 <sub>CONN</sub> Short Circuit Detection

## USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
		0b0: V <sub>CONN</sub> current < I <sub>SCCP_VCONN_THR</sub> 0b1: V <sub>CONN</sub> current > I <sub>SCCP_VCONN_THR</sub>
		Status of V <sub>CONN</sub> Output
CCVcnStat	2	0b0: V <sub>CONN</sub> Disabled 0b1: V <sub>CONN</sub> Enabled
		V <sub>CONN</sub> Overcurrent Detection
VCONNOCP 1	1	0b0: V <sub>CONN</sub> current < V <sub>CONN_ILIM</sub> 0b1: V <sub>CONN</sub> current > V <sub>CONN_ILIM</sub>
		Charger Detection Abort Status
ChgDetAbort	0	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			0	x0	0:	x0
Access Type	-	Read Only			Read	l Only	Read	l Only

BITFIELD	BITS	DESCRIPTION				
		CC Pin State Machine Detection				
		0b000: No connection				
		0b001: Sink mode				
CCStat	6.4	0b010: Source mode				
CCSIA	0.4	0b011: Audio accessory mode				
		0b100: Debug accessory source mode				
		0b101: Error				
		0b110: Disabled				
		0b111: Debug accessory sink mode				
CCPinStat		Status of Active CC Pin				
		0b00: No determination				
	3:2	0b01: CC1 Active				
		0b10: CC2 Active				
		0b11: RFU				

## USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
CCIStat	1:0	CC Pin Detected and V <sub>B</sub> 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.

# USB Type-C Charger Detector with Integrated OVP

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	ltfRdy	-	-	-	-	-	SwtClosed	OVLO
Reset	0x0	-	-	-	-	-	0x0	0x0
Access Type	Read Only	-	_	_	_	_	Read Only	Read Only

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

### COMMON\_MASK (0x0C)

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

BITFIELD	BITS	DESCRIPTION
FAULTM	7	Fault Status Mask Bit

## USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
		0b0: Mask 0b1: Unmask
		Battery Overvoltage Status Bit Interrupt Mask
BatOVLOM	6	0b0: Mask 0b1: Unmask
		Battery Undervoltage Status Bit Interrupt Mask
BatUVLOM	5	0b0: Mask 0b1: Unmask
		Thermal Shutdown Interrupt Mask
ТНММ	4	0b0: Mask 0b1: Unmask
		Low-Power Mode Status Change Interrupt Mask
LowPwrM	3	0b0: Mask 0b1: Unmask
		Shutdown Mode Wake-up Interrupt Mask
ShdnWakeM	2	0b0: Mask 0b1: Unmask
		V <sub>SAFE0V</sub> Interrupt Mask
VSAFE0VM	1	0b0: Mask 0b1: Unmask
		V <sub>B</sub> Valid Range Interrupt Mask
VBvalidM	0	0b0: Mask 0b1: Unmask

### CC\_MASK (0x0D)

BIT	7	6	5	4	3	2	1	0
Field	-	-	CCStatM	CCPinStatM	CCIStatM	CCVcnStatM	VCONNOCP M	DetAbrtM
Reset	-	-	0x0	0x0	0x0	0x0	0x0	0x0
Access Type	-	_	Write, Read	Write, Read				

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## USB Type-C Charger Detector with Integrated OVP

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

#### BC\_MASK (0x0E)

BIT	7	6	5	4	3	2	1	0
Field	_	_	_	ChgTypM	PrChgTypM	CHgDetRunR M	CHgDetRunF M	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

## USB Type-C Charger Detector with Integrated OVP

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_closed M	OVLOM
Reset	-	_	-	-	_	_	0x0	0x0
Access Type	_	_	_	_	_	_	Write, Read	Write, Read

BITFIELD	BITS	DESCRIPTION
SWT_closedM	1	Status of V <sub>B</sub> Switch Interrupt Mask 0b0: Mask 0b1: Unmask
OVLOM	0	V <sub>B</sub> Overvoltage Interrupt Mask 0b0: Mask 0b1: Unmask

# USB Type-C Charger Detector with Integrated OVP

#### 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				

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

#### RES MASK2 (0x11)

BIT	7	6	5	4	3	2	1	0
Field	-	-	ResGroundInt M	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

## USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
		Ground Resistive Measurement Result Interrupt Mask
ResGroundIntM	5	0b0: Mask 0b1: Unmask
		SBI 11/SBI 12 Resistor Detection Measurement Result Interrunt Mask
ResSBUIntM	4	0b0: Mask 0b1: Unmask
		Finite But Not Valid Resistive Measurement result Interrupt Mask
ResFiniteIntM	3	0b0: Mask 0b1: Unmask
		Open Resistive Measurement Result Interrupt Mask
ResOpenIntM	2	0b0: Mask 0b1: Unmask
		Abort Resistive Measurement Result Interrupt Mask
ResAbortIntM	1	0b0: Mask 0b1: Unmask
		Moisture Detection Measurement Valid Result Interrupt Mask
ResMoistIntM	0	0b0: Mask 0b1: Unmask

#### COMM CTRL1 (0x15)

BIT	7	6	5	4	3	2	1	0
Field	INTEn	FactAuto	USBAuto	AudioCPEn	VCCINTOnB AT	LPDRP	LPUFP	ShdnMode
Reset	0x1	0x1	0x1	0x0	0x0	0x0	0x0	0x0
Access Type	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

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# USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
	-	Autoconfiguration Enable Gating. Autoconfiguration FSM starts if USBAuto = 1 or if Debug Acccessory Sink Mode is entered and FactAuto = 1.
FactAuto	6	0b0: Debug accessory sink mode gated 0b1: Debug accessory sink mode not gated
	-	Autoconfiguration Enable Gating. Autoconfiguration FSM starts if USBAuto = 1 or if Debug Acccessory Sink Mode is entered and FactAuto = 1.
USBAUIO	5	0b0: USB valid gated 0b1: USB valid not gated
		Enable of the Internal USB Switches Charge Pump to Support Audio Negative Rail
AudioCPEn	4	0b0: USB switches charge pump enable controlled automatically 0b1: USB switches charge pump forced enabled
		V <sub>CCINT</sub> Switchover Forcing On BAT Side
VCCINTOnBAT	3	0b0: Internal V <sub>CCINT</sub> switchover is set on the highest between BAT and V <sub>B</sub> or on V <sub>B</sub> if V <sub>B</sub> > $V_{BDET}$
		UD1: Internal V <sub>CCINT</sub> switchover forced on BAT unless V <sub>BAT</sub> < V <sub>BAT_UVLOB</sub>
		Low-Power DRP Mode Enable
LPDRP	2	0b0: No low-power DRP mode enabled 0b1: Procedure to enter low-power DRP mode is triggered
		Low-Power UFP Mode Enable
LPUFP	1	0b0: No low-power UFP mode enabled 0b1: Procedure to enter low-power UFP mode is triggered
ShdnMode		Shutdown Mode Enable
	0	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	USBSV	VC[1:0]	NotUSBCmpl	DB	DBFrc	-	CE	CEFrc
Reset	0)	x3	0x0	0x0	0x0	-	0x0	0x0
Access Type	Write,	Read	Write, Read	Write, Read	Write, Read	_	Write, Read	Write, Read

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## USB Type-C Charger Detector with Integrated OVP

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 I <sup>2</sup> C 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 I <sup>2</sup> C command only. CE is the control of open drain output: CEb = ICE
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

#### 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

## USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
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		0:	x2
Access Type	-	-	-	Write, Read	Write, Read		Write,	, Read

BITFIELD	BITS	DESCRIPTION
VBPDEn	4	$V_{B}$ 8k $\Omega$ Discharge Pulldown Enable. The bit is cleared after pulldown timer expires. 0b0: Pulldown disabled 0b1: Pulldown enabled
VBPDTmr	3.2	V <sub>B</sub> 8kΩ Discharge Pulldown Timer Duration 0b00: 5ms 0b01: 15ms 0b10: 30ms 0b11: 60ms
VBOVPEn	1:0	$\label{eq:VB} V_B \mbox{ Overvoltage Protector (OVP) Enable Control} \\ 0b00: \mbox{ Force OVP switch open} \\ 0b01: \mbox{ OVP switch closed when } V_B > V_{BDET} \\ 0b10: \mbox{ OVP switch controlled by logic (closed after V_B attach based on Table 4)} \\ 0b11: \mbox{ OVP switch closed} \\ \end{tabular}$

### CC\_CTRL0 (0x20)

BIT	7	6	5	4	3	2	1	0
Field	_	_	CCSrcCurCh	CCForceError	SnkAttachedL ock	CCVcnSwp	CCSrcRst	CCSnkRst
Reset	_	-	0x0	0x0	0x0	0x0	0x0	0x0

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Access Type	_	-	Write, Rea	Write, Read	Write, Read	Write, Read	Write, Read	Write, Read		
BITFIEL	D	BITS		DESCRIPTION						
CCSrcCurCh		5	Sc ma wh Ob Mo	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 Ob Ob	Bit Automatically Resets to 0 After Action Is Done 0b0: No action 0b1: Force transition to ErrorRecovery state						
SnkAttachedLocl	k	3 0 0		Bit Automatically Resets to 0 After Action Is Done 0b0: Exit Sink Attached when V <sub>B</sub> < V <sub>BDET</sub> for more than t <sub>PDDebounce</sub> 0b1: Locked in Sink Attached for a minimum of 1.1s if V <sub>B</sub> is missing						
CCVcnSwp		2	2 0b 2 0b 0b		Signal State Machine to Swap V <sub>CONN</sub> Roles. Bit resets to 0 after a write (Note this bit resets to 0 automatically when action is done) 0b0: No change in V <sub>CONN</sub> role 0b1: Force change in V <sub>CONN</sub>					
CCSrcRst		1 0 0		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	Fc Bit Ob Ob	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				

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BITFIELD	BITS	DESCRIPTION
CCVcnEn	7	Force State of V <sub>CONN</sub> 0b0: Force V <sub>CONN</sub> 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 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	-	CCSrcC	CCSrcCurAd[1:0]		CCLpModeSel[1:0]		CCRpCtrl[2:0]		
Reset	-	0:	0x0		0x0		0x0		
Access Type	-	Write,	Write, Read		Write, Read		Write, Read		

## USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
		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).
CCSrcCurAd	6:5	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 <sub>B</sub> . 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 <sub>CONN</sub> 0b010: 5µA on CC line not pulled down and not used as V <sub>CONN</sub> 0b011: 80µA on CC line not pulled down and not used as V <sub>CONN</sub> 0b100: 180µA on CC line not pulled down and not used as V <sub>CONN</sub> 0b100: 180µA on CC line not pulled down and not used as V <sub>CONN</sub> 0b101: 330µA on CC line not pulled down and not used as V <sub>CONN</sub> 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
		USB Type-C Detection FSM Enable
CCDetEn	0	0b0: USB Type-C FSM disabled 0b1: USB Type-C FSM enabled

# USB Type-C Charger Detector with Integrated OVP

#### CC CTRL4 (0x24)

BIT	7	6	5	4	3	2	1	0
Field	_	_	TryWaitShort Deb	CCErrorLock	_	_	ccDRPP	hase[1:0]
Reset	-	_	0x0	0x0	_	_	0	x0
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 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

## USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
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	-	-	-	-	0×0	
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)

ВІТ	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 <sub>CONN</sub> Overcurrent Protection Enable 0b0: VCONNOCP does have impact on V <sub>CONN</sub> switch 0b1: VCONNOCP turns off the V <sub>CONN</sub> switch after 12ms

# USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
VCONN_ILIM	3:0	V <sub>CONN</sub> 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)

## USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
		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	SBUDetAbort Priority	_	_	SBU1DetGro und	SBU1DetAbor t	SBU1DetOpe n	SBU1Detlpu[1:0]	
Reset	0x0	-	-	0x0	0x0	0x0	0:	x0
Access Type	Write, Read	_	_	Read Only	Read Only	Read Only	Read Only	

BITFIELD	BITS	DESCRIPTION
		Priority of Abort Condition in SBU1/SBU2 Resistor Detection Measurement
SBUDetAbortPriority	7	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.
		SBU1 Resistor Detection Measurement Ground Result
SBU1DetGround	4	0b0: Latest SBU1 resistor detection measurement result was not a Ground. 0b1: Latest SBU1 resistor detection measurement result was a Ground.
		SBU1 Resistor Detection Measurement Abort Result
SBU1DetAbort	3	0b0: Latest SBU1 resistor detection measurement result was not an Abort. 0b1: Latest SBU1 resistor detection measurement result was an Abort.
		SBU1 Resistor Detection Measurement Open Result
SBU1DetOpen	2	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.

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

#### SBU1DetResult2 (0x2D)

ВІТ	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	_	_	_	SBU2DetGro und	SBU2DetAbor t	SBU2DetOpe n	SBU2De	etlpu[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
	4	0b0: Latest SBU2 resistor detection measurement result was not a Ground. 0b1: Latest SBU2 resistor detection measurement result was a Ground.
SBU2DetAbort		SBU2 Resistor Detection Measurement Abort Result
	3	0b0: Latest SBU2 resistor detection measurement result was not an Abort. 0b1: Latest SBU2 resistor detection measurement result was an Abort.

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BITFIELD	BITS	DESCRIPTION
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.
SBU2Detlpu	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	-	-	-	_	_	SBUDetCont En	SBUDetOneS hotEn	SBUDetManE n
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

## USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
		<ul> <li>0b0: SBU1/SBU2 resistor detection continuous measurements in debug accessory mode sink disabled.</li> <li>0b1: SBU1/SBU2 resistor detection continuous measurements in debug accessory mode sink enabled.</li> </ul>
		Enable of SBU1/SBU2 One-Shot Resistor Detection Measurement in Debug Accessory Sink Mode
SBUDetOneShotEn	1	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
		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								
## USB Type-C Charger Detector with Integrated OVP

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

#### RAcc1Detlpu (0x33)

BIT	7	6	5	4	3	2	1	0
Field	-	-	-	-	-	-	RAcc1D	etlpu[1:0]
Reset	-	-	-	-	-	-	0x2	
Access Type	_	_	_	_	_	_	Write, Read	

BITFIELD	BITS	DESCRIPTION
RAcc1Detlpu	1:0	Accessory 1 Resistor Final Imposed Pullup Current. If the final pullup current is equal to the configured RAcc1Detlpu[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
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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.

#### RAcc2Detlpu (0x36)

BIT	7	6	5	4	3	2	1	0
Field	-	-	-	-	-	-	RAcc2De	etlpu[1:0]
Reset	-	-	-	-	-	-	0x1	
Access Type	-	-	-	-	-	-	Write, Read	

BITFIELD	BITS	DESCRIPTION
RAcc2Detlpu	1:0	Accessory 2 Resistor Final Imposed Pullup Current. If the final pullup current is equal to the configured RAcc2Detlpu[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. 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						

## USB Type-C Charger Detector with Integrated OVP

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.

#### RAcc3Detlpu (0x39)

BIT	7	6	5	4	3	2	1	0
Field	-	-	-	-	-	-	RAcc3D	etlpu[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
--	--	-----	---	---	---	---	---	---	---	---

# USB Type-C Charger Detector with Integrated OVP

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)

ВІТ	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	-	_	-	-	-	-	RAcc4De	etlpu[1:0]
Reset	-	-	-	-	-	-	0x0	
Access Type	_	_	-	_	_	_	Write, Read	

BITFIELD	BITS	DESCRIPTION
RAcc4Detlpu	1:0	Accessory 4 Resistor Final Imposed Pullup Current. If the final pullup current is equal to the configured RAcc4Detlpu[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

# USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
		0b10: 32μA 0b11: 128μA

#### RAcc5DetVMax (0x3D)

ВІТ	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	

# USB Type-C Charger Detector with Integrated OVP

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	_	_	_	MoistDetAuto Cfg	MoistDetPerE n	MoistDetMan En	RMoistDetIpu[1:0]	
Reset	_	-	-	0x1	0x1	0x0	0x2	
Access Type	-	-	-	Write, Read	Write, Read	Write, Read	Write	Read

BITFIELD	BITS	DESCRIPTION
		Enable Automatic Configuration of Moisture Detection Measurements.
MoistDetAutoCfg	4	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.

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BITFIELD	BITS	DESCRIPTION
		0b0: Moisture detection measurements automatic configuration disabled. 0b1: Moisture detection measurements automatic configuration enabled.
MoistDetPerEn	3	<ul> <li>Enable of Unattached Mode Moisture Detection Periodic Measurements.</li> <li>If set high, moisture detection measurements are executed every 10s in unattached mode. In attached states, moisture detection is skipped.</li> <li>0b0: Moisture detection periodic measurements disabled.</li> <li>0b1: Moisture detection periodic measurements enabled.</li> </ul>
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 <sup>2</sup> C 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 <sub>MOIST</sub> . Together with RMoistDetVth[7:0], it sets the desired resistance threshold for moisture: R <sub>MOIST</sub> = 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
		Pullup Switch Control for Manually Configured Moisture Detection. Active when MoistDetAutoCfg = 0.
MoistDetPUConfig	5:0	Bit 0: Enables CC1 pullup force/sense switches
		Bit 1: Enables CC2 pullup force/sense switches
		Bit 3: Enables SBU2 pullup force/sense switches

# USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION
		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
		Pulldown Switch Control for Manually Configured Moisture Detection. Active when MoistDetAutoCfg = 0.
	6:0	Bit 0: Enables CC1 pulldown switch
MaintDatBDConfig		Bit 1: Enables CC2 pulldown switch
MoistDetFDConing		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 <sub>B</sub> pulldown switch

#### MoistDetAutoCC1Result1 (0x54)

ВІТ	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

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BITFIELD	BITS	DESCRIPTION
		0b0: Latest CC1 moisture detection burst measurement result was not an Abort. 0b1: Latest CC1 moisture detection burst measurement result was an Abort.
		Moisture Detection Burst Measurement Open Result Indicator for CC1
CC1MoiOpn	2	0b0: Latest CC1 moisture detection burst measurement result was not an Open. 0b1: Latest CC1 moisture detection burst measurement result was an Open.
		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.
CC1MoistIpu	1:0	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 = $5.882$ mV = $0.392\%$ (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	

## USB Type-C Charger Detector with Integrated OVP

BITFIELD	BITS	DESCRIPTION			
		Moisture Detection Burst Measurement Ground Result Indicator for CC2			
CC2MoiGnd	4	0b0: Latest CC2 moisture detection burst measurement result was not a Ground. 0b1: Latest CC2 moisture detection burst measurement result was a Ground.			
		Moisture Detection Burst Measurement Abort Result Indicator for CC2			
CC2MoiAbrt	3	0b0: Latest CC2 moisture detection burst measurement result was not an Abort. 0b1: Latest CC2 moisture detection burst measurement result was an Abort.			
		Moisture Detection Burst Measurement Open Result Indicator for CC2			
CC2MoiOpn	2	0b0: Latest CC2 moisture detection burst measurement result was not an Open. 0b1: Latest CC2 moisture detection burst measurement result was an Open.			
		Moisture Detection Burst Measurement Final Pullup Current for CC2. If the result is			
CC2Moistlpu	1:0				
		0600. 2μΑ 0601: 8μΑ			
		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	SBU1Mo	istlpu[1:0]

# USB Type-C Charger Detector with Integrated OVP

Reset	_	_	_	0x0	0x0	0x0	0x0
Access Type	_	_	_	Read Only	Read Only	Read Only	Read Only

BITFIELD	BITS	DESCRIPTION
		Moisture Detection Burst Measurement Ground Result Indicator for SBU1
SBU1MoiGnd	4	0b0: Latest SBU1 moisture detection burst measurement result was not a Ground. 0b1: Latest SBU1 moisture detection burst measurement result was a Ground.
		Moisture Detection Burst Measurement Abort Result Indicator for SBU1
SBU1MoiAbrt	3	0b0: Latest SBU1 moisture detection burst measurement result was not an Abort. 0b1: Latest SBU1 moisture detection burst measurement result was an Abort.
		Moisture Detection Burst Measurement Open Result Indicator for SBU1
SBU1MoiOpn	2	0b0: Latest SBU1 moisture detection burst measurement result was not an Open. 0b1: Latest SBU1 moisture detection burst measurement result was an Open.
SBU1Moistlpu		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.
	1:0	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).

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#### MoistDetAutoSBU2Result1 (0x5A)

ВІТ	7	6	5	4	3	2	1	0
Field	_	-	-	SBU2MoiGnd	SBU2MoiAbrt	SBU2MoiOpn	SBU2Mo	istlpu[1:0]
Reset	-	-	-	0x0	0x0	0x0	0x0	
Access Type	-	-	-	Read Only	Read Only	Read Only	Read Only	

BITFIELD	BITS	DESCRIPTION
		Moisture Detection Burst Measurement Ground Result Indicator for SBU2
SBU2MoiGnd	4	0b0: Latest SBU2 moisture detection burst measurement result was not a Ground. 0b1: Latest SBU2 moisture detection burst measurement result was a Ground.
		Moisture Detection Burst Measurement Abort Result Indicator for SBU2
SBU2MoiAbrt	3	0b0: Latest SBU2 moisture detection burst measurement result was not an Abort. 0b1: Latest SBU2 moisture detection burst measurement result was an Abort.
		Moisture Detection Burst Measurement Open Result Indicator for SBU2
SBU2MoiOpn	2	0b0: Latest SBU2 moisture detection burst measurement result was not an Open. 0b1: Latest SBU2 moisture detection burst measurement result was an Open.
SBU2Moistlpu		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.
	1:0	0b00: 2μΑ
		0b01: 8µA 0b10 <sup>-</sup> 32uA
		0b11: 128µA

#### MoistDetAutoSBU2Result2 (0x5B)

BIT	7	6	5	4	3	2	1	0
Field		SBU2MoistVADC[7:0]						
Reset		0x00						
Access Type		Read Only						

# USB Type-C Charger Detector with Integrated OVP

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	-		ADCGrou	ndVth[3:0]	ADCRetryNum[2:0]			
Reset	-		0:	x4		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 $\leq$ 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	lpuRes	sult[1:0]	ADCCorrNum[5:0]						
Reset	0:	x0		0x7					
Access Type	Read	l Only	Write, Read						

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BITFIELD	BITS	DESCRIPTION
lpuResult	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
		Number of Samples in ADC Reading Averaging. It applies to any resistive measurements used in moisture detection and accessory mode detection.
ADCAvgNum	7:5	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)

ВІТ	7	6	5	4	3	2	1	0
Field	_	_			ADCNoiseC	lampRng[5:0]		

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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)

ВІТ	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)

ВІТ	7	6	5	4	3	2	1	0		
Field	ADCResultMax[7:0]									
Reset		0x00								
Access Type				Read	l 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				ADCResu	ultMin[7:0]			

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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_DISC H_EN	-
Reset	-	-	-	-	-	-	0x0	-
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  $45\Omega$  single-ended/90 $\Omega$  differential controlled-impedance traces that are matched by equal lengths.

#### **Power Supply Bypassing**

Bypass VB, VDD, 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 <u>Electrical Characteristics</u> table parameters are not guaranteed until the V<sub>B</sub> and BAT voltages meet the specified global conditions.

#### Choosing I<sup>2</sup>C Pullup Resistors

The I<sup>2</sup>C 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 I<sup>2</sup>C 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 I<sup>2</sup>C specifications in the *Electrical Characteristics* table for details). To meet the rise time requirement, choose pullup resistors so that the rise time t<sub>R</sub> = 0.85 x R<sub>PULLUP</sub> x C<sub>BUS</sub> < 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 I<sup>2</sup>C Bus from Suspend

If the I<sup>2</sup>C bus is suspended due to a weak or dead battery, an I<sup>2</sup>C STOP command needs to be performed after enabling the I<sup>2</sup>C buffers and pullup bias. The I<sup>2</sup>C STOP command is necessary before restarting the I<sup>2</sup>C traffic.

#### **Extended ESD Protection**

The CDP and CDN pins are protected against ESD up to  $\pm$ 6kV. The CC1, CC2, SBU1 and SBU2 pins are further protected up to  $\pm$ 15kV (HBM) without damage. The VB input withstands up to  $\pm$ 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.

## USB Type-C Charger Detector with Integrated OVP

#### 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  $1.5k\Omega$  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  $\pm$ 15kV Air-Gap and  $\pm$ 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  $\pm$ 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.

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Figure 18. IEC61000-4-2 ESD Test Model



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

## USB Type-C Charger Detector with Integrated OVP

## **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.

## USB Type-C Charger Detector with Integrated OVP

#### **Revision History**

REVISION NUMBER	REVISION DATE	DESCRIPTION	
0	6/20	Initial release	_
1	11/20	Updated the Shutdown section	37
2	6/21	Updated Absolute Maximum Ratings section	
3	9/21	Updated Benefits and Features and USB BC1.2 Charger Detection sections, Electrical Characteristics table; added Fault State section	

For pricing, delivery, and ordering information, please visit Maxim Integrated's online storefront at https://www.maximintegrated.com/en/storefront.html.

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