



Texas Instruments

PMP11536 Test Report

Asia Power Design Service

PMP11536

1 General

1.1 **PURPOSE**

Provide the detailed data for evaluating and verifying the PMP11536.

PMP11536 is a power bank reference design within one Micro B port supporting fast charger input and two output ports. One is a USB type C port supporting 5V/3A output and another one is a USB type A port supporting 5V/2A output.

The valid input voltage can be up to 12V according to the charging protocol. The output voltage of type C port is fixed at 5.1V, as well as the type A port. The rated charging current is 3A and the rated output current for type C port and type A port are 3A and 2A respectively.

1.2 **REFERENCE DOCUMENTATION**

PMP11536_Schematic.pdf

PMP11536_Layout.zip

PMP11536_BOM.pdf

1.3 **TEST EQUIPMENTS**

Multi-meter: FLUKE 17B

DC Source: Chroma 62024P-100-50

Electronic Load: Chroma 63103A

Oscillation: Tektronix DPO3054

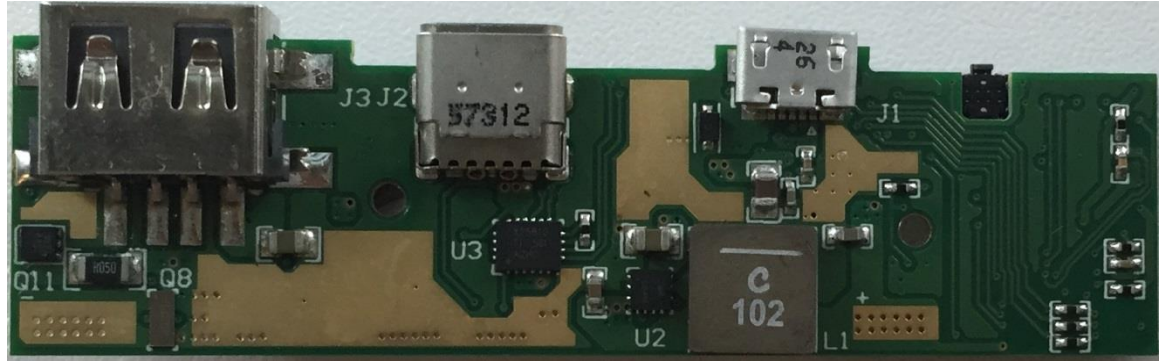
Infrared Thermometer: FLUKE Ti9

1.4 **PHOTOS**



Top View

PMP11536



Bottom View

2 INPUT AND OUTPUT CHARACTERISTICS

2.1 STANDBY CURRENT

PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
I_{STD}	Standby current		790		μA

2.2 EFFICIENCY

12Vin Charging & VBAT=3.2V

$V_{in}(V)$	$I_{in}(A)$	$V_{BAT}(V)$	$I_{BAT}(A)$	EFF.(%)
12.096	0.0427	3.194	0.0656	40.57%
12.083	0.1763	3.2009	0.4453	66.91%
12.065	0.3436	3.2098	0.9525	73.75%
12.044	0.5143	3.2189	1.4719	76.49%
12.024	0.6863	3.2278	1.9791	77.41%
12.008	0.86	3.2369	2.4872	77.96%
11.99	1.0164	3.2447	2.9241	77.85%

12Vin Charging & VBAT=3.5V

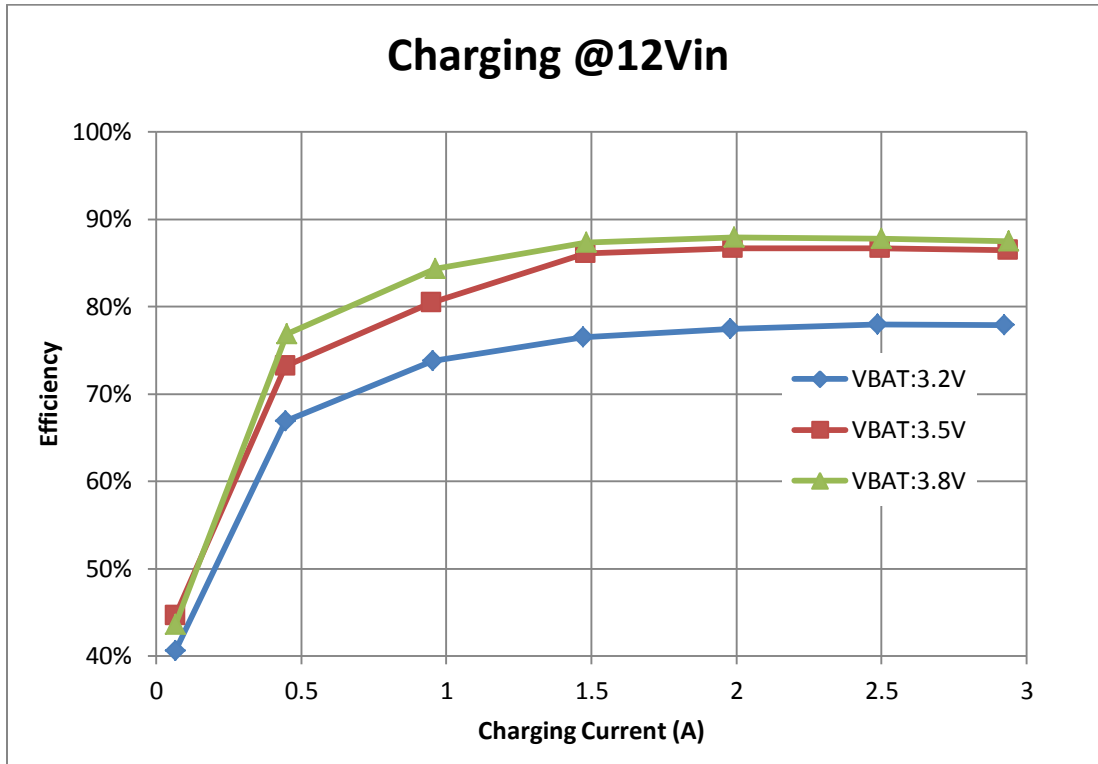
$V_{in}(V)$	$I_{in}(A)$	$V_{BAT}(V)$	$I_{BAT}(A)$	EFF.(%)
12.097	0.0424	3.4876	0.0656	44.61%
12.083	0.176	3.4944	0.4453	73.17%
12.063	0.3424	3.5034	0.9488	80.48%
12.045	0.5017	3.5127	1.4813	86.11%
12.03	0.6715	3.5216	1.9875	86.64%
12.009	0.8463	3.5307	2.4956	86.70%
11.992	1.0024	3.5385	2.9363	86.43%

12Vin Charging & VBAT=3.8V

$V_{in}(V)$	$I_{in}(A)$	$V_{BAT}(V)$	$I_{BAT}(A)$	EFF.(%)
12.098	0.0473	3.8005	0.0656	43.57%
12.086	0.1845	3.8075	0.45	76.84%

PMP11536

12.07	0.3608	3.8165	0.9619	84.30%
12.053	0.539	3.8257	1.4831	87.34%
12.037	0.722	3.8347	1.9922	87.90%
12.021	0.9013	3.8043	2.4994	87.76%
12.005	1.0667	3.8121	2.9381	87.46%



9Vin Charging & VBAT=3.2V

$V_{in}(V)$	$I_{in}(A)$	$V_{BAT}(V)$	$I_{BAT}(A)$	EFF.(%)
9.095	0.0454	3.194	0.0666	51.52%
9.072	0.219	3.2008	0.4453	71.74%
9.044	0.4377	3.2097	0.9534	77.30%
9.014	0.6645	3.2188	1.4728	79.15%
8.981	0.893	3.2278	1.9809	79.72%
8.929	1.1303	3.2368	2.4853	79.71%
8.874	1.3413	3.2445	2.9269	79.78%

9Vin Charging & VBAT=3.5V

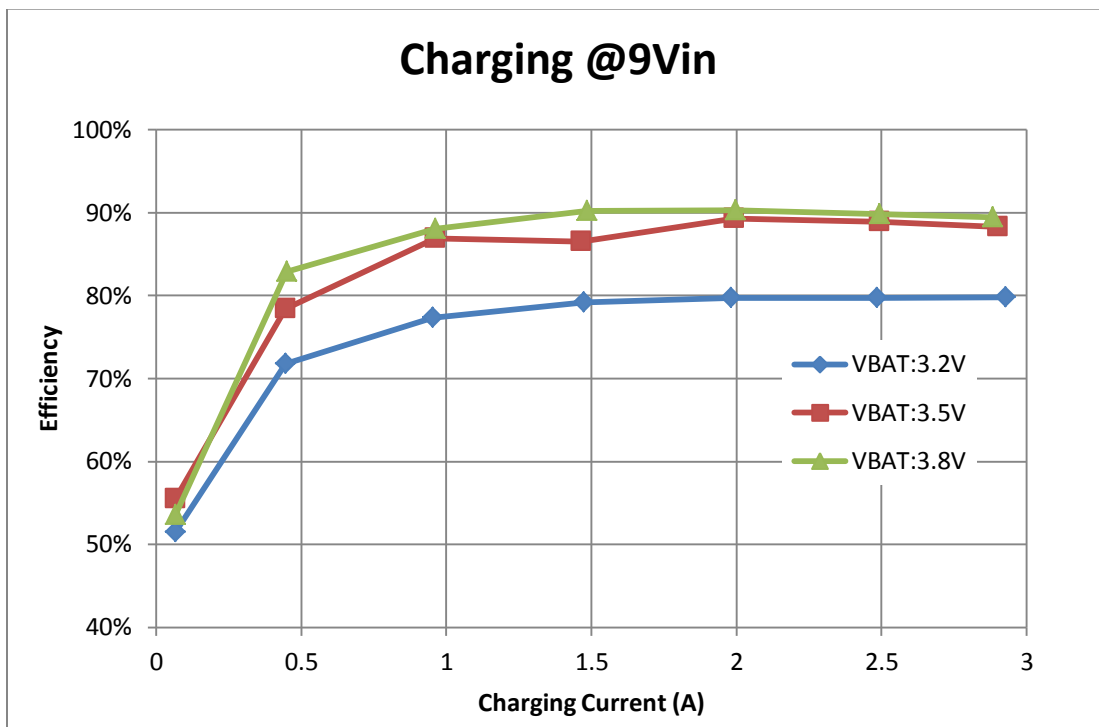
$V_{in}(V)$	$I_{in}(A)$	$V_{BAT}(V)$	$I_{BAT}(A)$	EFF.(%)
9.095	0.0453	3.4875	0.0656	55.53%
9.072	0.2187	3.4944	0.4453	78.43%
9.045	0.429	3.5035	0.9628	86.93%

PMP11536

8.994	0.661	3.5124	1.4644	86.52%
8.973	0.875	3.5215	1.9913	89.31%
8.935	1.108	3.5304	2.4928	88.89%
8.871	1.31	3.5377	2.9006	88.30%

9Vin Charging & VBAT=3.8V

V _{in} (V)	I _{in} (A)	V _{BAT} (V)	I _{BAT} (A)	EFF.(%)
9.097	0.05	3.8004	0.0666	55.65%
9.081	0.2276	3.8074	0.45	82.90%
9.06	0.4604	3.8165	0.9628	88.09%
9.038	0.697	3.8258	1.485	90.19%
9.016	0.9401	3.8347	1.9959	90.30%
8.994	1.1855	3.8436	2.4928	89.86%
8.976	1.3832	3.8505	2.8838	89.44%



5Vin Charging & VBAT=3.2V

V _{in} (V)	I _{in} (A)	V _{BAT} (V)	I _{BAT} (A)	EFF.(%)
5.0864	0.0547	3.1743	0.0656	74.84%
5.0477	0.351	3.1811	0.4453	79.95%
4.9956	0.75	3.19	0.9534	81.17%
4.9395	1.1730	3.1992	1.4719	81.27%
4.894	1.5206	3.208	1.9772	85.23%

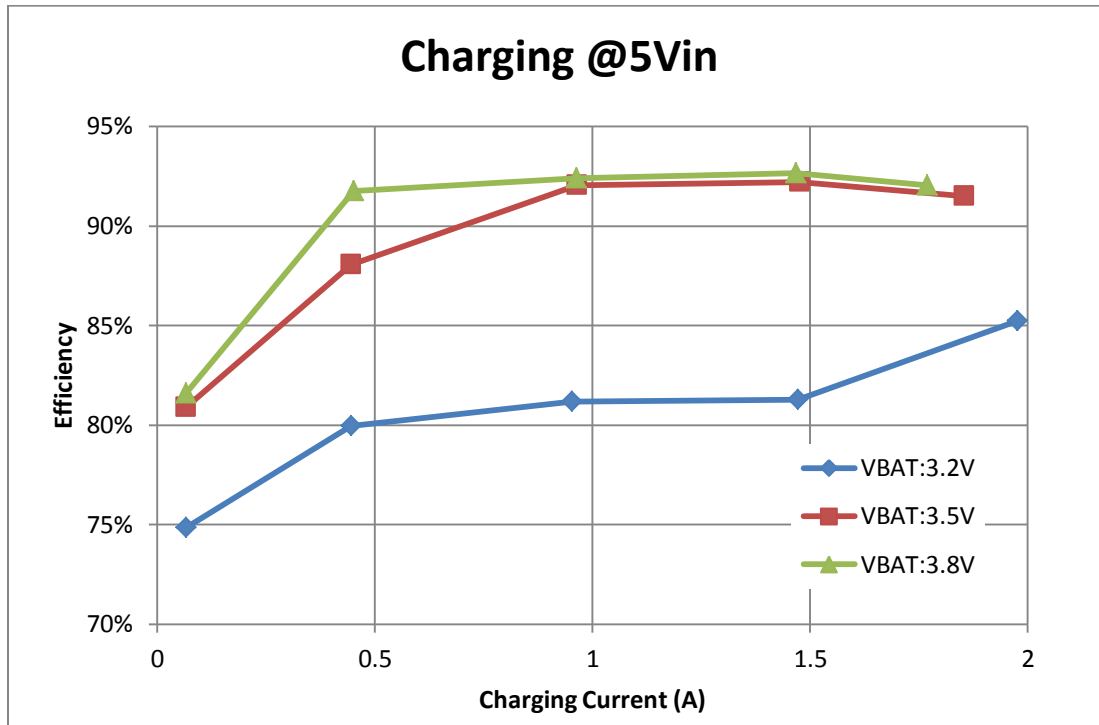
5Vin Charging & VBAT=3.5V

PMP11536

$V_{in}(V)$	$I_{in}(A)$	$V_{BAT}(V)$	$I_{BAT}(A)$	EFF.(%)
5.0868	0.0556	3.4876	0.0656	80.89%
5.0481	0.35	3.4944	0.4453	88.07%
4.9984	0.7347	3.5035	0.9647	92.04%
4.9448	1.1374	3.5125	1.4765	92.21%
4.9017	1.4556	3.5191	1.8553	91.51%

5Vin Charging & VBAT=3.8V

$V_{in}(V)$	$I_{in}(A)$	$V_{BAT}(V)$	$I_{BAT}(A)$	EFF.(%)
5.0859	0.061	3.8007	0.0666	81.59%
5.0455	0.367	3.7682	0.4509	91.76%
4.9902	0.7895	3.7772	0.9638	92.40%
4.933	1.2153	3.786	1.4672	92.66%
4.896	1.4891	3.7913	1.77	92.04%



Type C DFP@ VBAT=3.2V

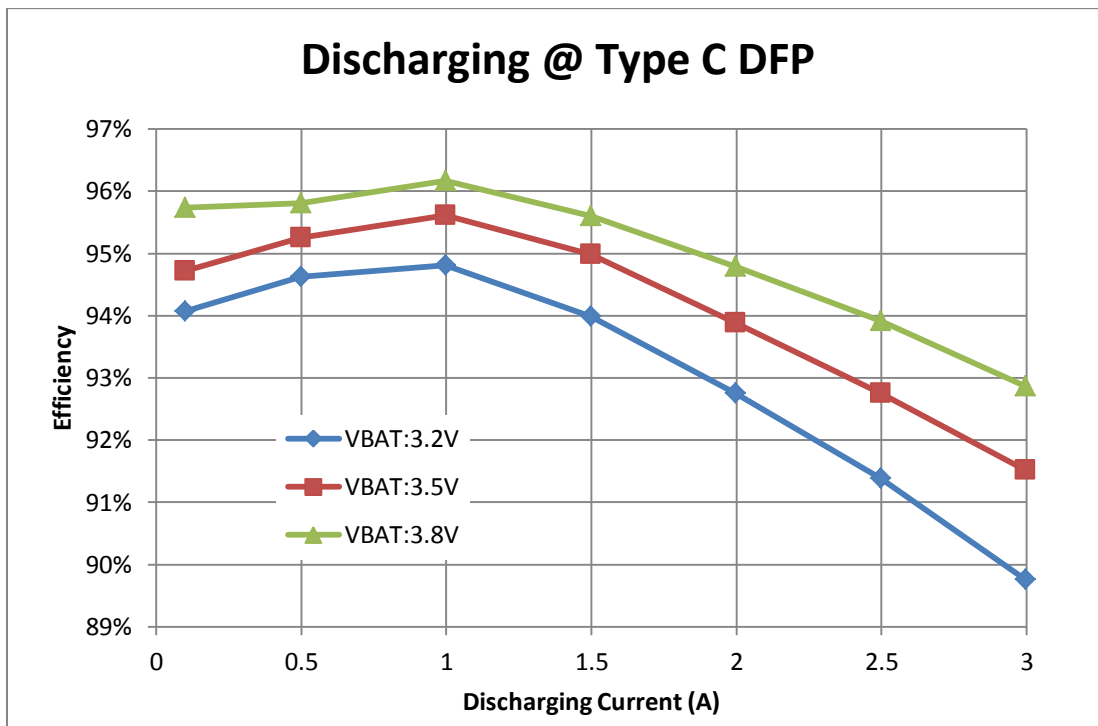
$V_{BAT}(V)$	$I_{BAT}(A)$	$V_o(V)$	$I_o(A)$	EFF.(%)
3.2055	0.1686	5.1875	0.098	94.07%
3.2057	0.845	5.1461	0.4981	94.63%
3.2045	1.6837	5.127	0.9977	94.81%
3.2038	2.5407	5.1079	1.4977	93.98%
3.2005	3.4223	5.0881	1.9967	92.75%
3.2072	4.3165	5.0672	2.4967	91.39%
3.2005	5.2616	5.0442	2.9966	89.76%

Type C DFP @ VBAT=3.5V

V _{BAT} (V)	I _{BAT} (A)	V _o (V)	I _o (A)	EFF.(%)
3.5062	0.1532	5.1915	0.098	94.72%
3.5087	0.7674	5.147	0.4983	95.25%
3.5046	1.527	5.1282	0.9978	95.62%
3.5077	2.2967	5.1093	1.4977	94.99%
3.5015	3.0917	5.0897	1.9968	93.88%
3.5016	3.897	5.069	2.497	92.76%
3.5028	4.7181	5.0474	2.9966	91.52%

Type C DFP @ VBAT=3.8V

V _{BAT} (V)	I _{BAT} (A)	V _o (V)	I _o (A)	EFF.(%)
3.7978	0.14	5.1943	0.098	95.74%
3.8033	0.704	5.1479	0.4983	95.80%
3.8013	1.4	5.1295	0.9977	96.16%
3.8006	2.1066	5.1108	1.4977	95.60%
3.8065	2.8178	5.0917	1.9969	94.79%
3.8039	3.545	5.0718	2.497	93.92%
3.8086	4.279	5.0507	2.9966	92.87%



Type A Discharging @ 5Vo & VBAT=3.2V

V _{BAT} (V)	I _{BAT} (A)	V _o (V)	I _o (A)	EFF.(%)
----------------------	----------------------	--------------------	--------------------	---------

PMP11536

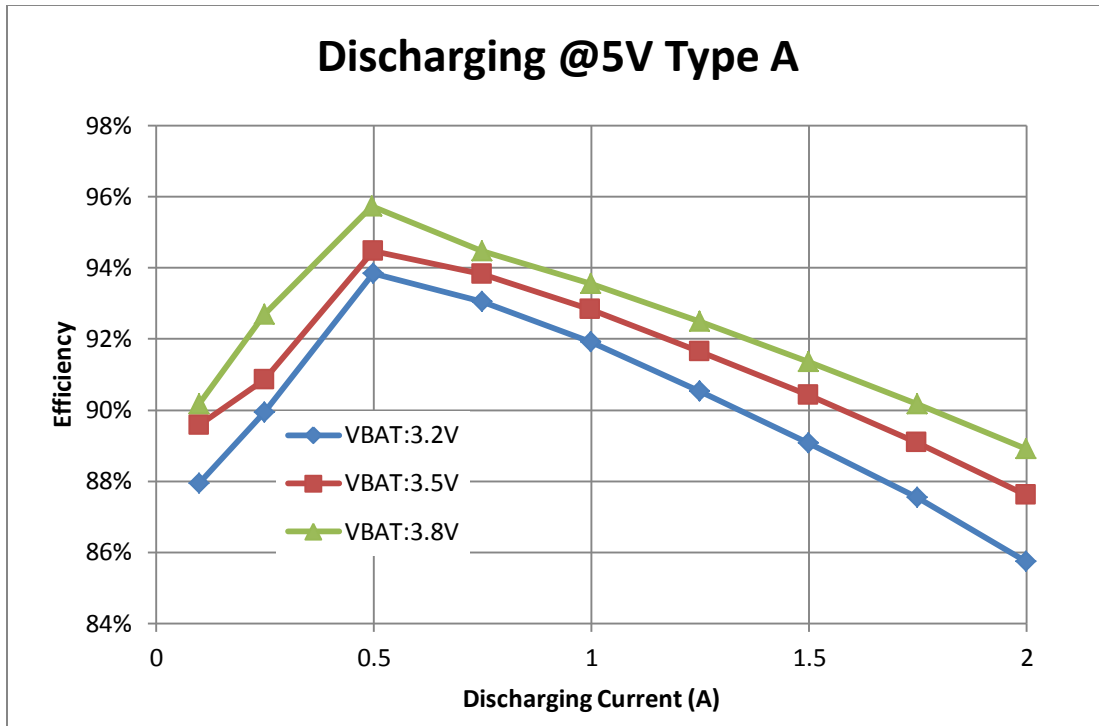
3.2055	0.1783	5.1083	0.0984	87.95%
3.2017	0.4383	5.0813	0.2484	89.94%
3.2078	0.8415	5.0782	0.4988	93.84%
3.2019	1.2698	5.0509	0.7491	93.06%
3.207	1.7008	5.0236	0.998	91.92%
3.2015	2.1514	4.9956	1.2483	90.54%
3.2053	2.6074	4.967	1.4988	89.08%
3.2082	3.0735	4.9377	1.7482	87.54%
3.1983	3.5761	4.9071	1.9985	85.74%

Type A Discharging @5Vo & VBAT=3.5V

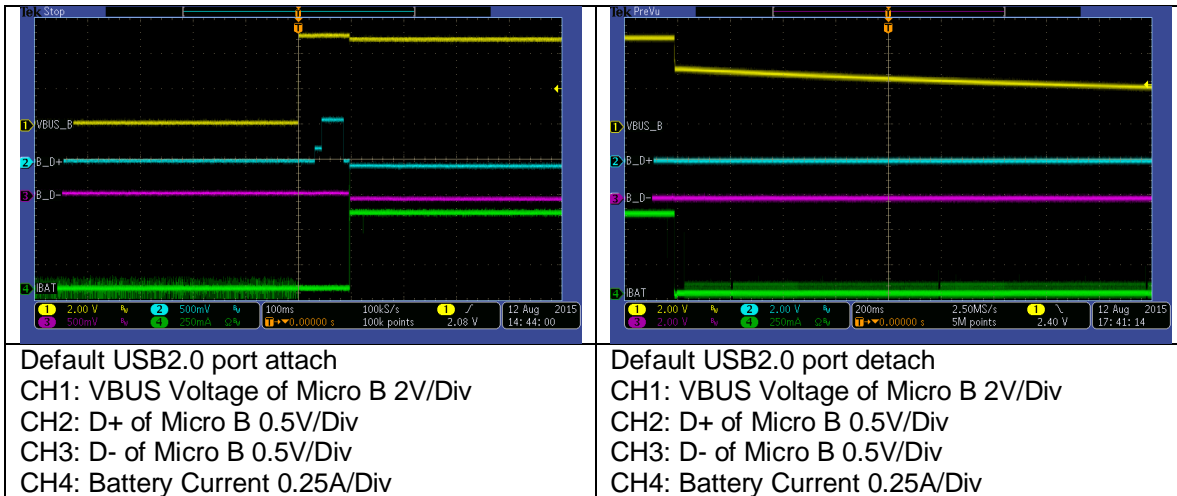
V _{BAT} (V)	I _{BAT} (A)	V _o (V)	I _o (A)	EFF.(%)
3.506	0.16	5.1064	0.0984	89.57%
3.5018	0.397	5.0853	0.2484	90.86%
3.5012	0.7658	5.0781	0.4988	94.47%
3.4992	1.1525	5.0509	0.7491	93.82%
3.5068	1.54	5.0238	0.9979	92.83%
3.5025	1.9428	4.9959	1.2482	91.64%
3.5094	2.3464	4.9676	1.4989	90.42%
3.506	2.764	4.9387	1.7481	89.09%
3.5014	3.1976	4.9085	1.9986	87.62%

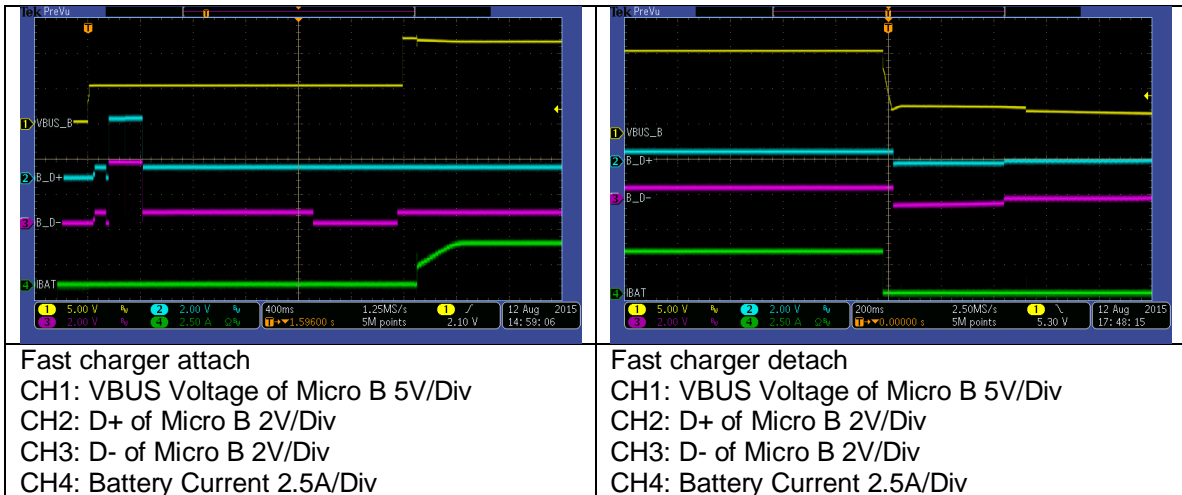
Type A Discharging @5Vo & VBAT=3.8V

V _{BAT} (V)	I _{BAT} (A)	V _o (V)	I _o (A)	EFF.(%)
3.807	0.1472	5.13	0.0985	90.17%
3.7947	0.3588	5.0806	0.2484	92.69%
3.8047	0.6903	5.0798	0.495	95.74%
3.805	1.0526	5.0509	0.7491	94.47%
3.8037	1.4088	5.0237	0.998	93.56%
3.8034	1.7725	4.9957	1.2483	92.50%
3.8027	2.143	4.9675	1.4989	91.37%
3.7998	2.5198	4.9387	1.7482	90.17%
3.8075	2.898	4.9088	1.9986	88.91%



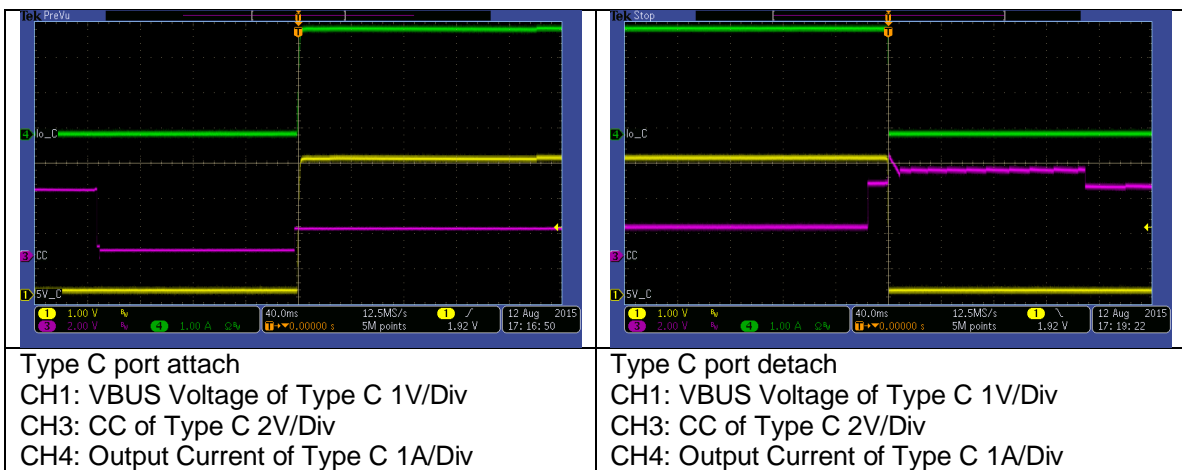
2.3 INPUT DETECTION



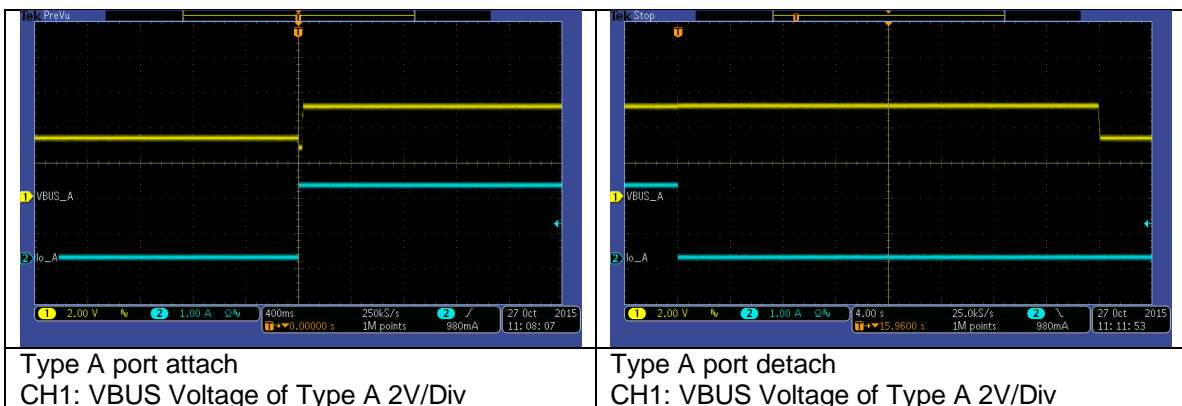


2.4 OUTPUT DETECTION

TYPE C

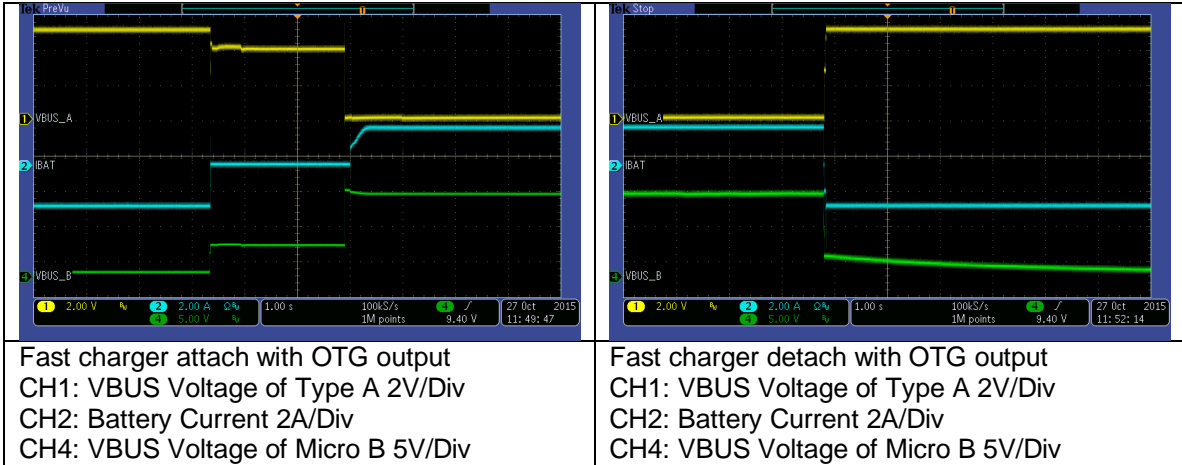


TYPE A

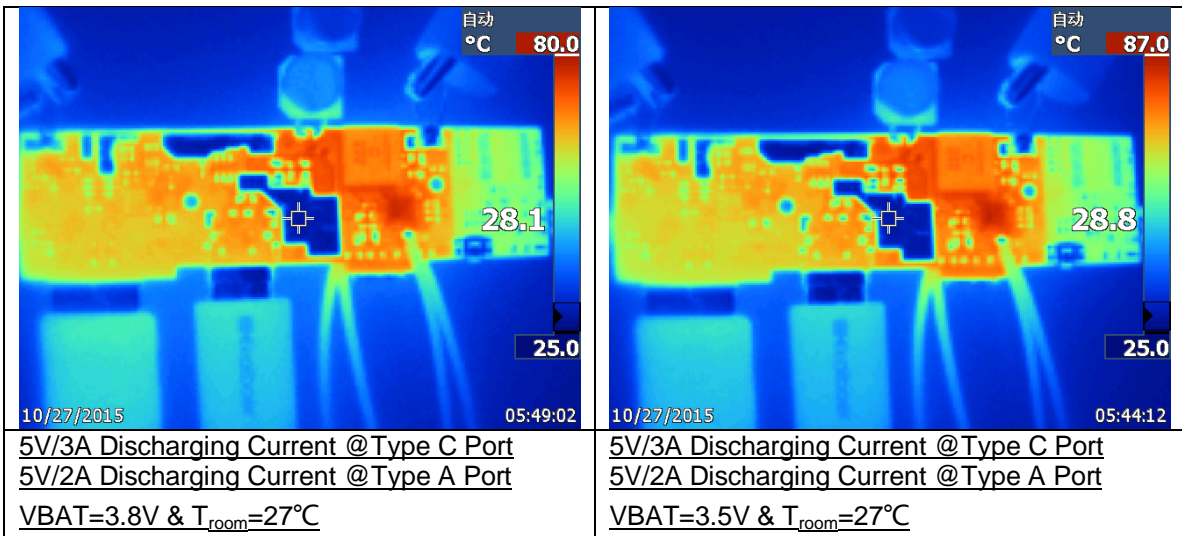


CH2: Output Current of Type A 1A/Div	CH4: Output Current of Type A 1A/Div
--------------------------------------	--------------------------------------

2.5 OTG OVP



3 THERMAL



IMPORTANT NOTICE FOR TI REFERENCE DESIGNS

Texas Instruments Incorporated ("TI") reference designs are solely intended to assist designers ("Buyers") who are developing systems that incorporate TI semiconductor products (also referred to herein as "components"). Buyer understands and agrees that Buyer remains responsible for using its independent analysis, evaluation and judgment in designing Buyer's systems and products.

TI reference designs have been created using standard laboratory conditions and engineering practices. **TI has not conducted any testing other than that specifically described in the published documentation for a particular reference design.** TI may make corrections, enhancements, improvements and other changes to its reference designs.

Buyers are authorized to use TI reference designs with the TI component(s) identified in each particular reference design and to modify the reference design in the development of their end products. HOWEVER, NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY THIRD PARTY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT, IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI REFERENCE DESIGNS ARE PROVIDED "AS IS". TI MAKES NO WARRANTIES OR REPRESENTATIONS WITH REGARD TO THE REFERENCE DESIGNS OR USE OF THE REFERENCE DESIGNS, EXPRESS, IMPLIED OR STATUTORY, INCLUDING ACCURACY OR COMPLETENESS. TI DISCLAIMS ANY WARRANTY OF TITLE AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, QUIET ENJOYMENT, QUIET POSSESSION, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS WITH REGARD TO TI REFERENCE DESIGNS OR USE THEREOF. TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY BUYERS AGAINST ANY THIRD PARTY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON A COMBINATION OF COMPONENTS PROVIDED IN A TI REFERENCE DESIGN. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, SPECIAL, INCIDENTAL, CONSEQUENTIAL OR INDIRECT DAMAGES, HOWEVER CAUSED, ON ANY THEORY OF LIABILITY AND WHETHER OR NOT TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, ARISING IN ANY WAY OUT OF TI REFERENCE DESIGNS OR BUYER'S USE OF TI REFERENCE DESIGNS.

TI reserves the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques for TI components are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

Reproduction of significant portions of TI information in TI data books, data sheets or reference designs is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards that anticipate dangerous failures, monitor failures and their consequences, lessen the likelihood of dangerous failures and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in Buyer's safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed an agreement specifically governing such use.

Only those TI components that TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components that have **not** been so designated is solely at Buyer's risk, and Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.