27W PD3.0 & QC4 Charger with PI (INN3366C-H301) & Weltrend (WT6635P)

ZMY/TL, AE – China

Jun.29, 2018 (Rev-1)

ac-dc converters | led drivers | igbt drivers

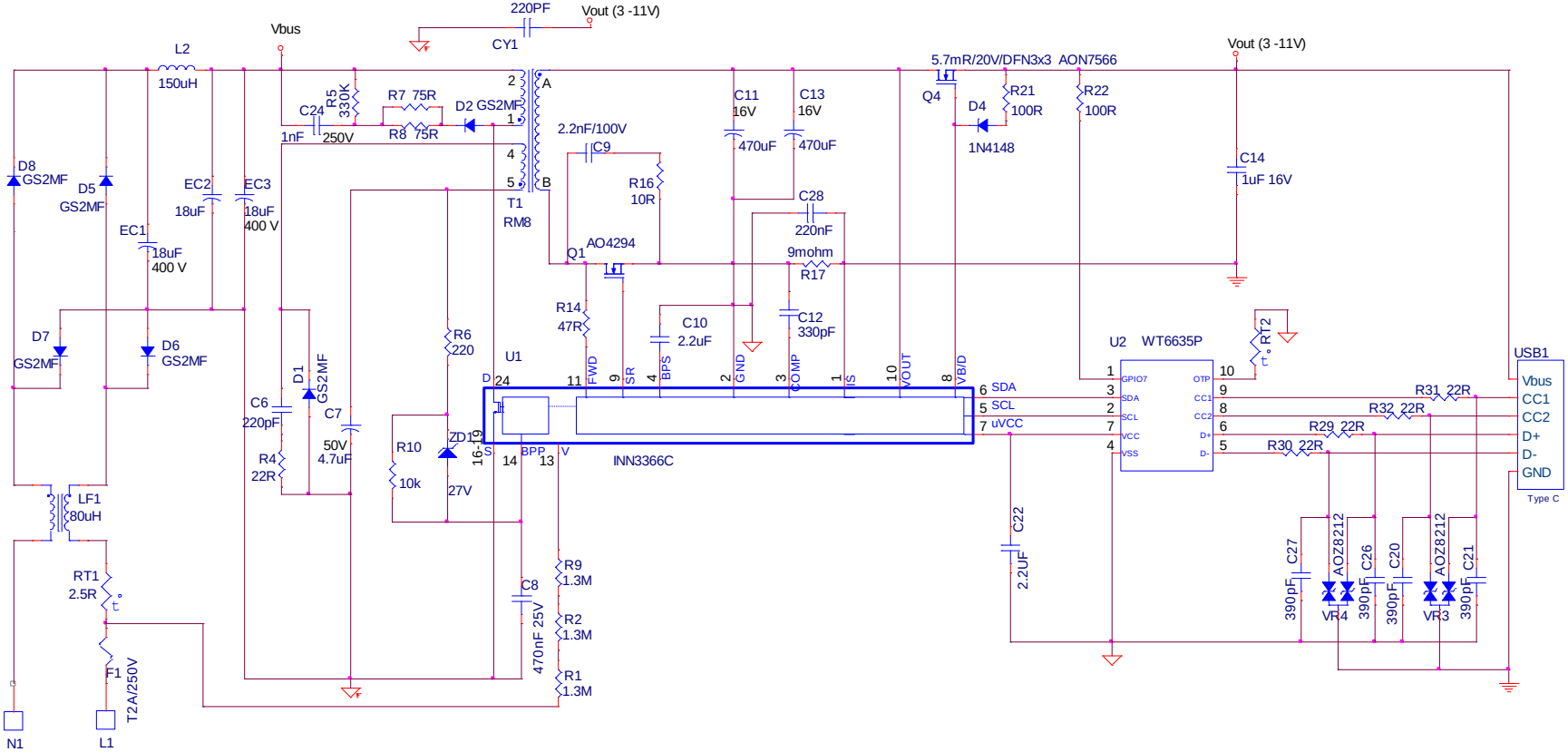
1. Power Supply Specification

Description	Symbol	Min	Typ	Max	Units	Comment/Conditions
INPUT						
Voltage	V_{IN}	90		264	V_{AC}	2 Wire no P.E
Frequency	f_{LINE}	47	50/60	63	Hz	
No-load Input Power	P_{IN}			75	mW	Input 230 V_{AC} @Vout=5V
OUTPUT						
Output Voltage (5V)			5.0		V	Measured at the End of Cable
Output Current (5V)			3		A	
Output Ripple Voltage (5V) ①			150		mV	See note 1
Output Voltage (9V)			9.0		V	Measured at the End of Cable
Output Current (9V)			3		A	
Output Ripple Voltage (9V) ①			200		mV	See note 1
Output Voltage (11V)			11.0		V	Measured at the End of Cable
Output Current (11V)			2.45		A	
Output Ripple Voltage (11V) ①			200		mV	See note 1
Total Output Power						
Continuous Output Power	P_{OUT}		27		W	For 9V output
Peak Output Power	P_{OUT_PK}				W	
Conducted EMI Margin		6			dB	CISPR22B/EN55022 class B
Average Efficiency	η				%	115 and 230 V_{AC} for 5Voutput
Ambient Temprature	T_{AMB}	0		40	℃	Free convection, sea level
Safety		Designed to meet IEC950, UL1950 Class II				

Note: 1 . Ripple Measured at the End of cable 1.0M, 20 MHz Bandwidth

2. Schematic

27W PD3.0/PPS with INNO3366&WT6635P



3. BOM

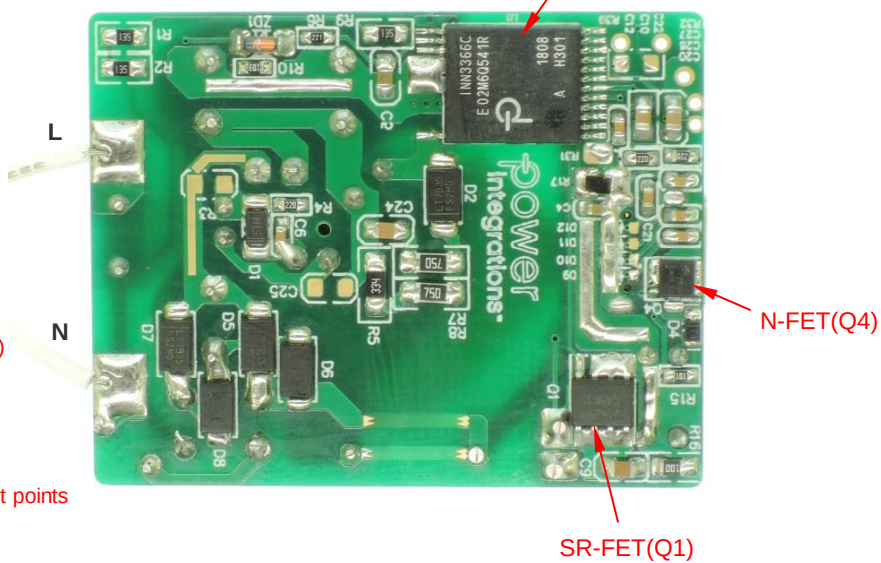
Item	Quantity	Reference	Part
1	1	CY1	Y-Cap,Y1,220PF
2	1	C24	1nF,250V,Ceramic,X7R,0805
3	1	C9	1nF,100V,Ceramic,X7R,0603
4	1	C6	220pF,250V,Ceramic,X7R,0603
5	1	C8	470nF,25V,Ceramic,X7R,0805
6	1	C28	22nF,250V,Ceramic,X7R,0805
7	1	C22,C23,C14	1uF,25V,Ceramic,X7R,0603
8	1	C10	2.2uF,25V,Ceramic,X7R,0805
9	1	C12	330PF,25V,Ceramic,X7R,0603
10	1	C11,C13	470uF,16V, Solid Cap
11	4	C21,C27,C25,C20	560pF,50V,Ceramic,X7R,0603
12	2	C15,C3	2.2uF,25V,Ceramic,X5R,0603
13	1	C7	10uF,50V, Electrolytic
14	3	EC1,EC3,EC2	18uF,400V, Electrolytic, 10mm
15	1	D2	M7 General purpose Rectifier,1A, 1000V SMA
16	1	D1	RS1DL,Fast Rectifier,0.8A, 200V SOD123
17	4	D7,D8,D9,D10	GS2MF,General purpose Rectifier,2A,1000V,SMAF
18	1	D4	1N4148,Fast Rectifier,0.15A, 75V SOD123
19	1	T1	RM8,Pin5+2, BW 7.2mm
20	1	U2	INN3366C H301,INNO-PRO
21	1	U1	WT6635P
22	1	VR2	27V,5%, 150 mW, SSMINI-2
23	4	D9,D10,D11,D12	TVS 12V SOD323
24	1	F1	T2A/250V 250V,Time-lag Fuse
25	1	LF1	80uH,CM chock,9*5*3, K5A material
26	1	L2	100uH,DM chock,6*8,0.25mm
	38		

Item	Quantity	Reference	Part
27	1	Q4	AON7566,N-Channel, 20V,5.7mR,DFN3X3
28	1	Q1	AO4294,N-Channel, 100V,SO-8
29	1	RT1	2.5R ,Diamter 7mm
30	1	R4	22R,5%,Thick Film,0603
31	1	R5	330K,5%,Thick Film,1206
32	2	R7,R8	75R,5%,Thick Film,1206
33	1	R6	220,5%,Thick Film,0603
34	1	R10	10k,1%,Thick Film,0603
35	3	R1,R2,R9	1.3M,1%,Thick Film,0805
36	1	R16	10R,5%,Thick Film,1805
37	1	R14	47R,1%,Thick Film,0603
38	2	R20,R22	4.7k,5%,Thick Film,0603
40	1	R17	10mohm,1% Metal Foil 0.5W 0805
41	1	R28	100K,5%,Thick Film,0603
42	2	R29,R30	5.1R,5%,Thick Film,0603
49	2	R31,R32	5.1R,5%,Thick Film,0603
50	1	RT2	100k,NTC
51			
52			
53			
	23		
Total	64		

4. Demo Board

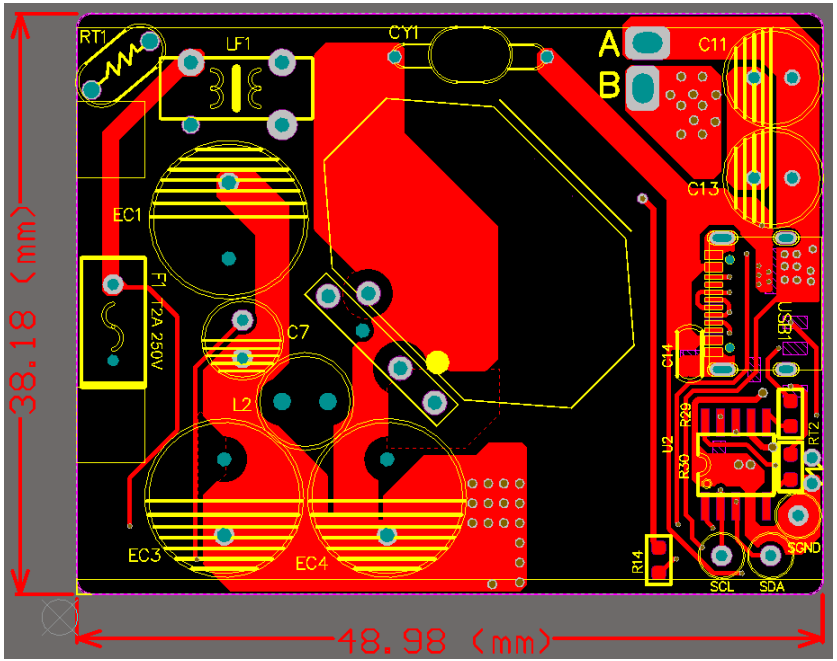
Component side

Solder-side

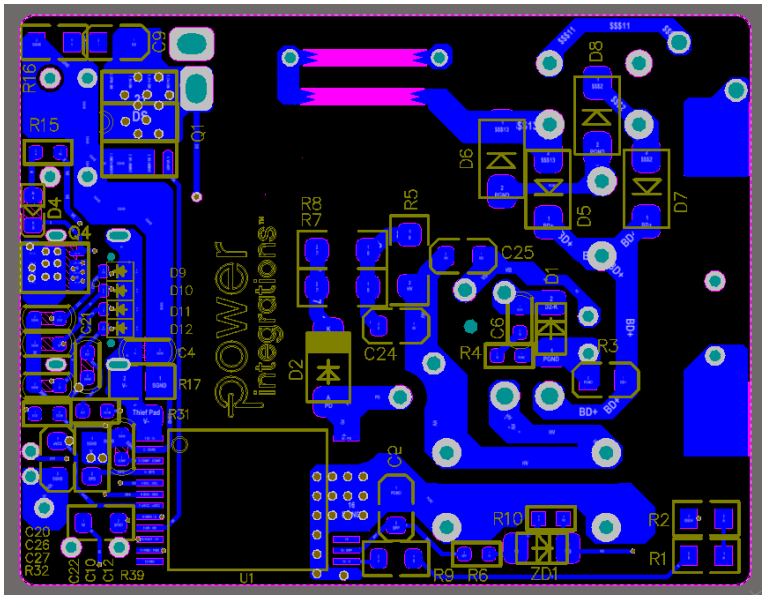


5. PCB Layout

Top side (Component side)

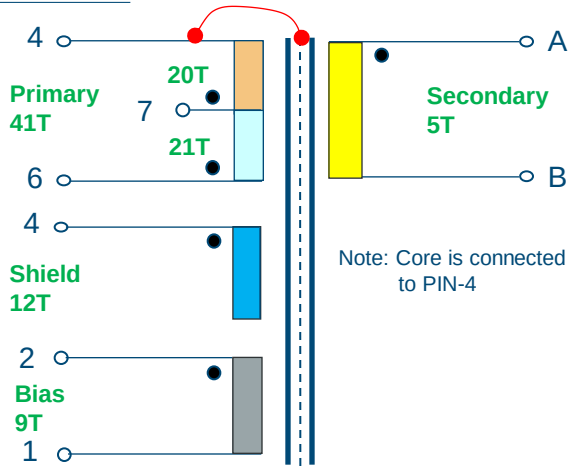


Bottom side (Solder side)



6.Transformer Design

SCHEMATIC



ELECTRICAL SPECIFICATIONS:

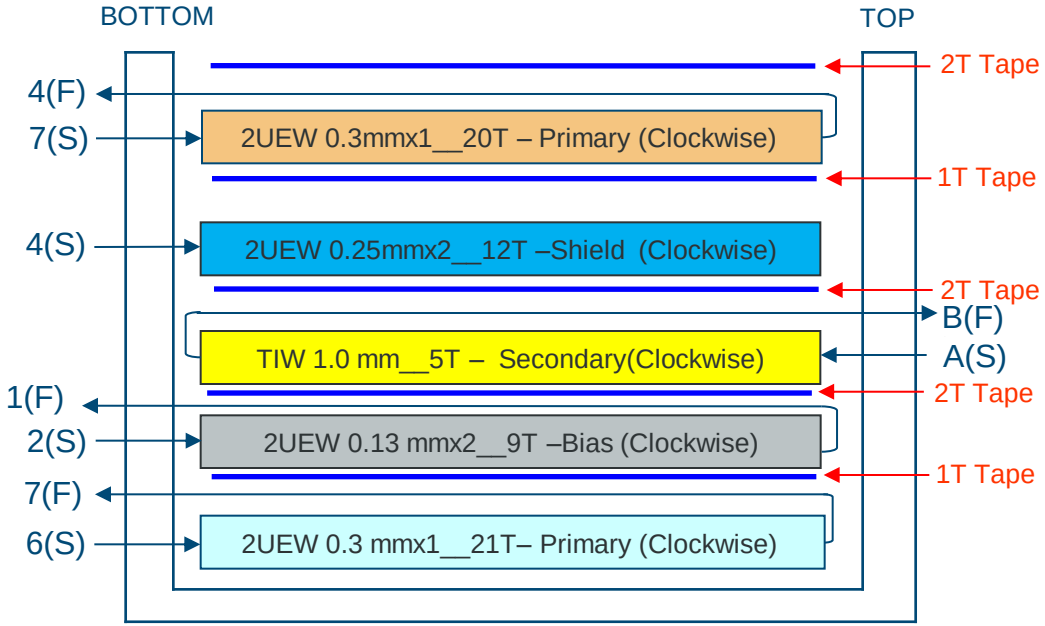
1. Primary Inductance (Lp) = 630uH ± 7% @ 10KHz
2. Primary Leakage Inductance < 10uH @ 10KHz
3. Electrical Strength = 3KV, 50/60Hz,1Min

MATERIALS:

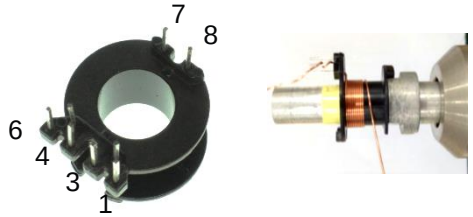
1. Core : RM8 (TDK PC95 or equivalent, Ae = 60mm^2)
2. Bobbin : RM8 (6pin), Bw = 7.2mm
3. Magnet Wires (Primary) : Type 2-UEW
4. Magnet Wire (Secondary) : Triple Insulated Wires

FINISHED :

1. Varnish the assembly completely



Wire started in clockwise direction from pin-6 and ended at 5 Top pin when looking from the bottom side of the bobbin in a “Clockwise” Direction.



Bobbin dressing direction – Clockwise

7.1 Regulation, Ripple, Efficiency at Vo = 5V (Measured on PCB , Short NTC)

V_{IN} (V_{AC})	P_{IN} (W)	V_{OUT} (V)	I_{OUT} (mA)	V_{RIPPLE} (mV_{P-P})	P_{OUT} (W)	η (%)	Average η(%)	DOE η (%)
90	0.021	5.02	0	41			89.57	84.13
	4.21	5.04	750	58	3.78	89.83		
	8.48	5.08	1500	83	7.62	89.86		
	12.84	5.11	2250	104	11.50	89.54		
	17.28	5.13	3000	110	15.39	89.06		
115	0.023	5.02	0	43			89.94	
	4.20	5.04	750	66	3.78	89.91		
	8.45	5.08	1500	79	7.62	90.18		
	12.78	5.11	2250	93	11.50	89.96		
	17.19	5.14	3000	106	15.42	89.70		
230	0.026	5.02	0	54			89.58	
	4.28	5.04	750	72	3.78	88.28		
	8.51	5.09	1500	89	7.64	89.72		
	12.82	5.12	2250	106	11.52	89.86		
	17.08	5.15	3000	114	15.45	90.46		
264	0.026	5.02	0	47			89.15	
	4.31	5.04	750	68	3.78	87.66		
	8.56	5.09	1500	85	7.64	89.23		
	12.89	5.12	2250	100	11.52	89.37		
	17.10	5.15	3000	108	15.45	90.35		

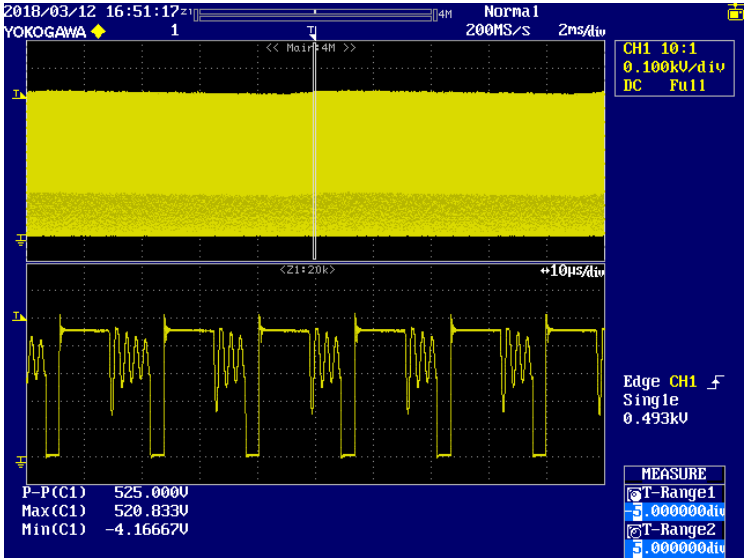
7.2 Regulation, Ripple, Efficiency at Vo = 9V (Measured on PCB , Short NTC)

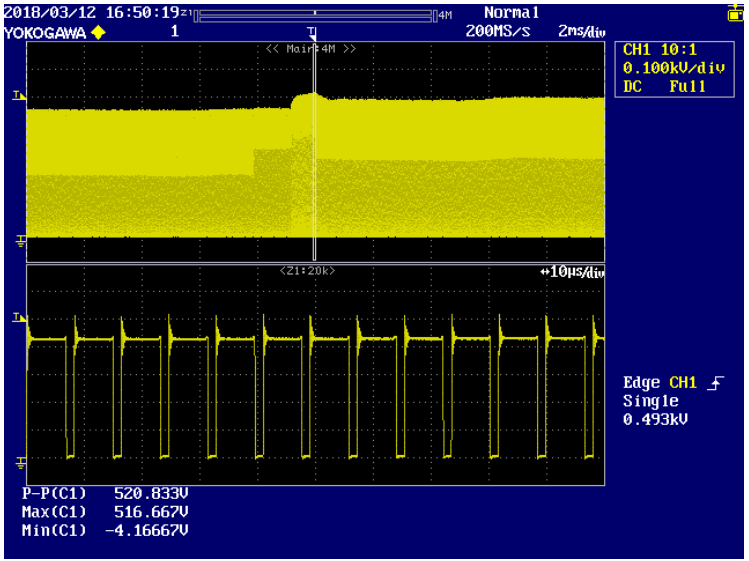
V_{IN} (V_{AC})	P_{IN} (W)	V_{OUT} (V)	I_{OUT} (mA)	V_{RIPPLE} (mV_{P-P})	P_{OUT} (W)	η (%)	Average η(%)	DOE η (%)
90	0.125	9.05	0	39			90.04	86.62
	7.56	9.06	750	64	6.80	89.88		
	15.11	9.09	1500	93	13.64	90.24		
	22.72	9.11	2250	122	20.50	90.22		
	30.50	9.13	3000	114	27.39	89.80		
115	0.126	9.05	0	37			90.79	
	7.53	9.06	750	72	6.80	90.24		
	14.98	9.09	1500	79	13.64	91.02		
	22.55	9.12	2250	91	20.52	91.00		
	30.17	9.14	3000	95	27.42	90.88		
230	0.124	9.05	0	43			90.74	
	7.62	9.06	750	72	6.80	89.17		
	14.99	9.10	1500	87	13.65	91.06		
	22.50	9.13	2250	100	20.54	91.30		
	30.06	9.16	3000	108	27.48	91.42		
264	0.141	9.05	0	41			90.16	
	7.67	9.06	750	77	6.80	88.65		
	15.10	9.10	1500	89	13.65	90.40		
	22.63	9.12	2250	102	20.52	90.68		
	30.09	9.12	3000	109	27.36	90.93		

7.3 Regulation, Ripple, Efficiency at Vo = 11V (Measured on PCB, Short NTC)

V_{IN} (V_{AC})	P_{IN} (W)	V_{OUT} (V)	I_{OUT} (mA)	V_{RIPPLE} (mV_{P-P})	P_{OUT} (W)	η (%)	Average η(%)	DOE η (%)
90	0.171	11.05	0	39			89.66	86.62
	7.63	11.05	614	66	6.78	88.85		
	15.06	11.07	1227	85	13.58	90.19		
	22.67	11.09	1845	106	20.46	90.26		
	30.37	11.10	2445	127	27.14	89.36		
115	0.224	11.05	0	47			90.27	
	7.62	11.05	614	77	6.78	88.97		
	14.97	11.08	1227	79	13.60	90.82		
	22.51	11.10	1845	93	20.48	90.98		
	30.07	11.11	2445	108	27.16	90.34		
230	0.135	11.05	0	47			90.44	
	7.66	11.05	614	70	6.78	88.50		
	14.94	11.08	1227	87	13.60	91.00		
	22.44	11.11	1845	102	20.50	91.35		
	29.90	11.12	2445	118	27.19	90.93		
264	0.234	11.05	0	37			89.95	
	7.73	11.05	614	70	6.78	87.73		
	15.04	11.08	1227	89	13.60	90.39		
	22.54	11.11	1845	100	20.50	90.94		
	29.94	11.11	2445	128	27.16	90.73		

8.1 Maximum Drain Voltage (Innoswitch3-Pro)





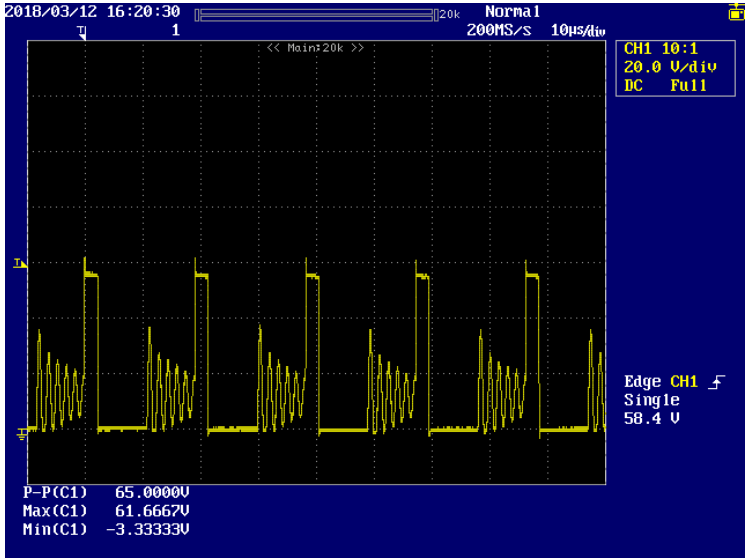
12V @2.25A with CC load

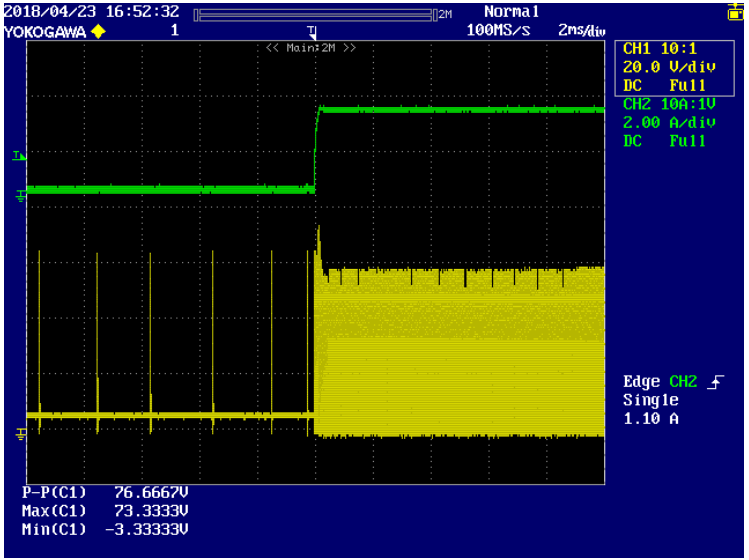
Test Conditions	Measured Results
Vo =12V Io = 2.25A V_{IN}=264V_{AC},	**VD_{drain_max} = 521V (Derating = 545/650V = 80.1%)**

5V transmit to 12V with 2.25A load

Test Conditions	Measured Results
Vo =5V-12V Io = 2.25A V_{IN}=264V_{AC},	**VD_{drain_max} = 517V (Derating = 545/650V = 79.5%)**

8.2 SR Vdss (SR-FET,Q1)

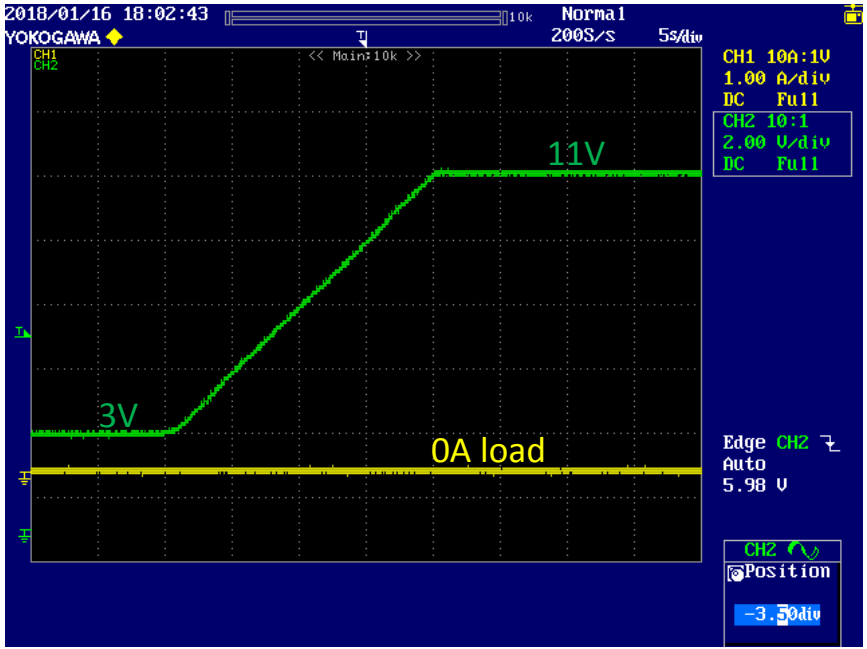


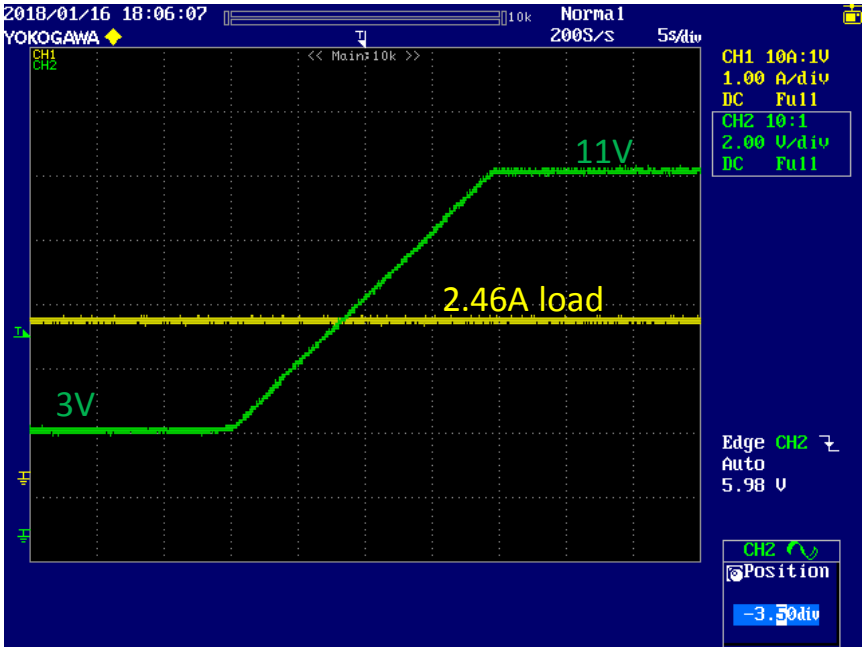


Test Conditions	Measured Results
Vo =12V Io = 2.25A V_{IN}=264V_{AC},	**V_{drain_max} = 61.7V** **Derating = 61.6/100V = 61.7%)**

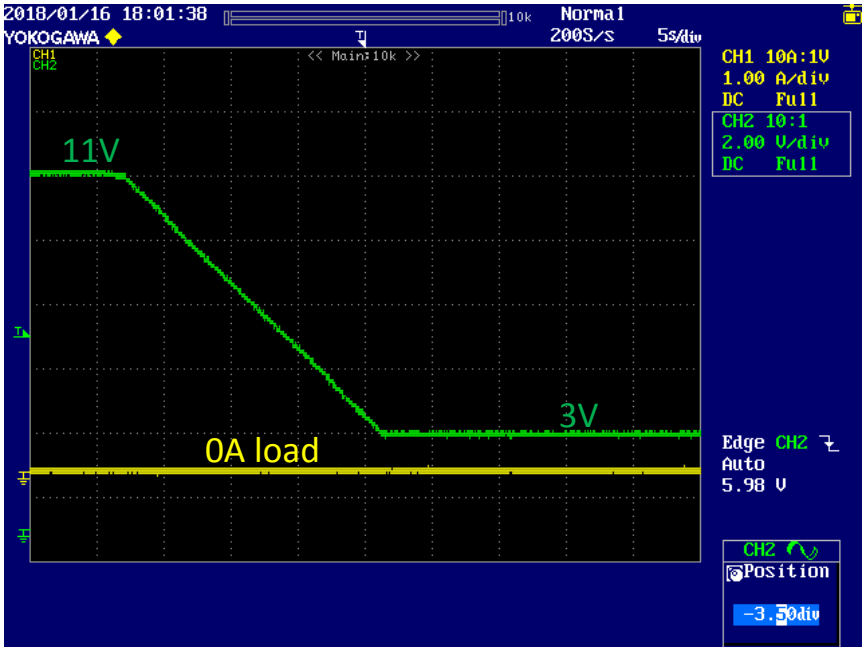
Test Conditions	Measured Results
Vo =5V Io =3A V_{IN}=264V_{AC},	**V_{drain_max} = 73.3V** **Derating = 73.3/100V = 73.3%)**

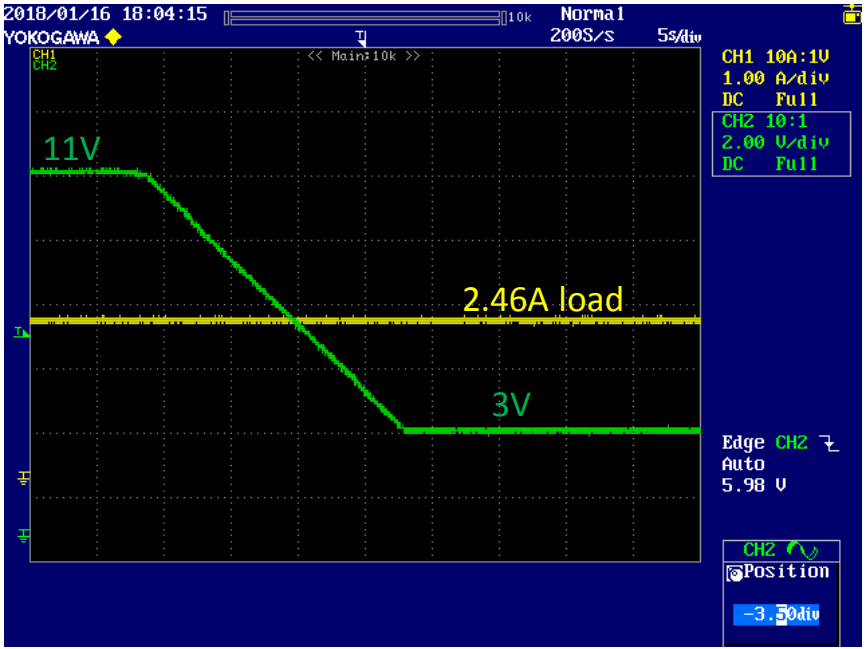
9.1 Output Voltage Transition (3V To 11V at 90Vac)



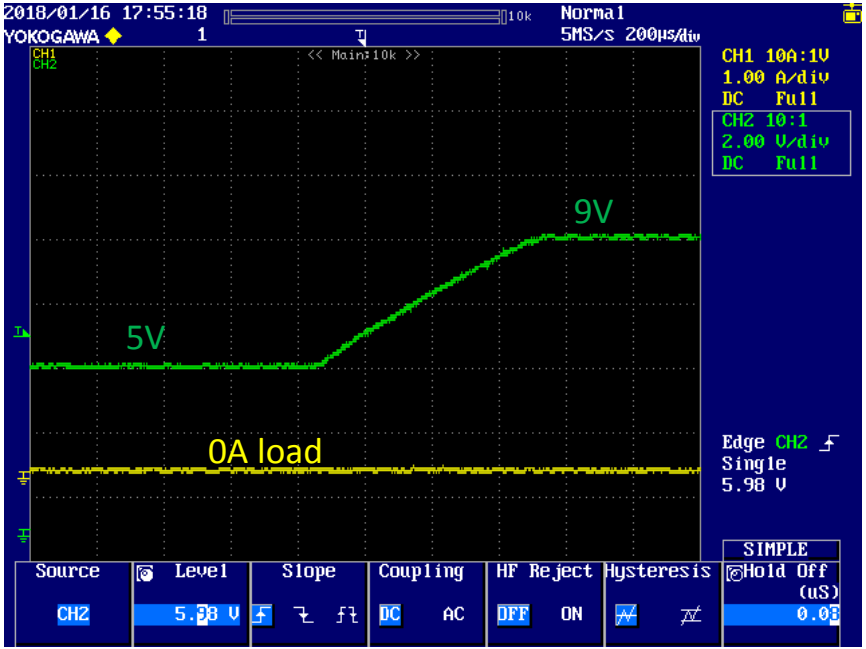


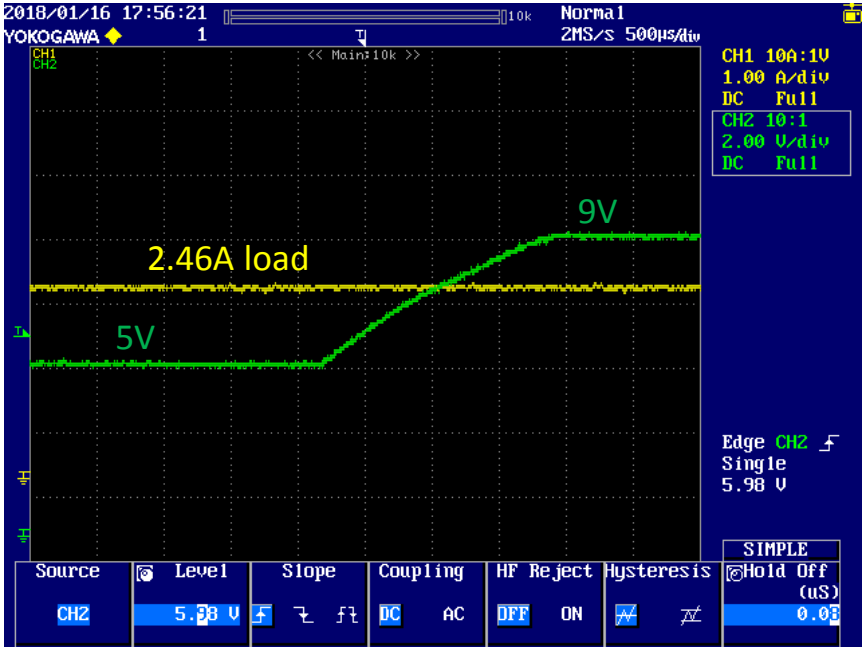
9.2 Output Voltage Transition (11V To 3V at 90Vac)



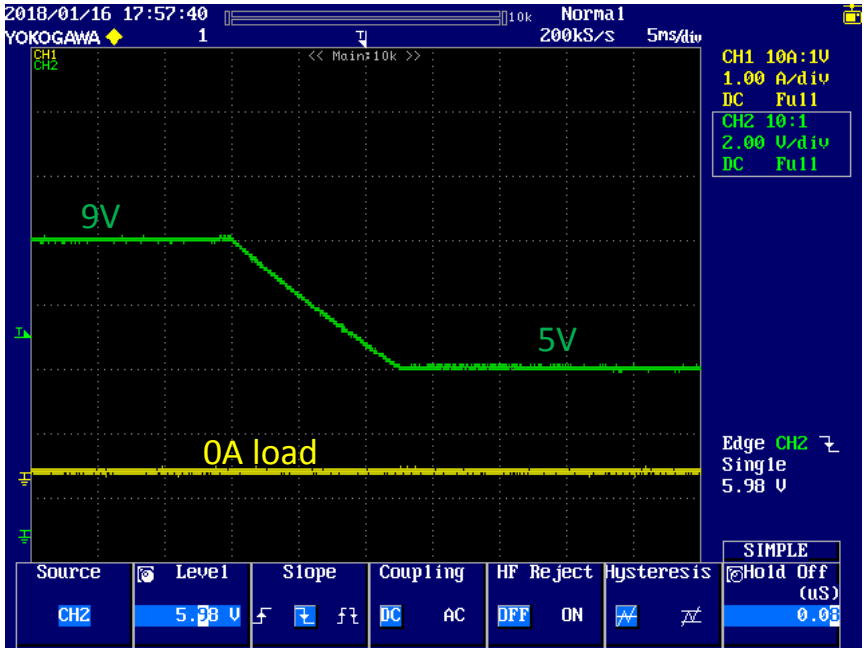


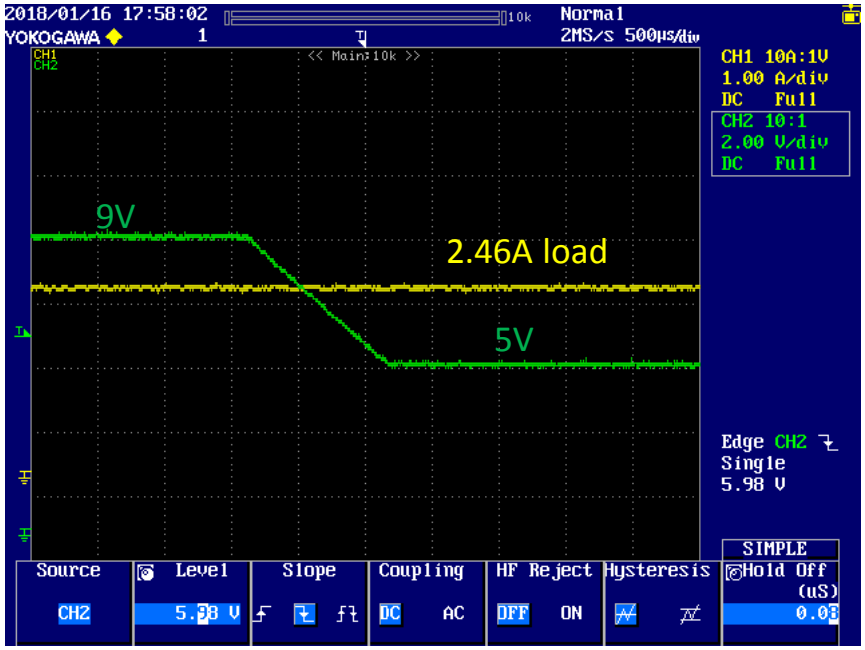
9.3 Output Voltage Transition (5V To 9V at 90Vac)



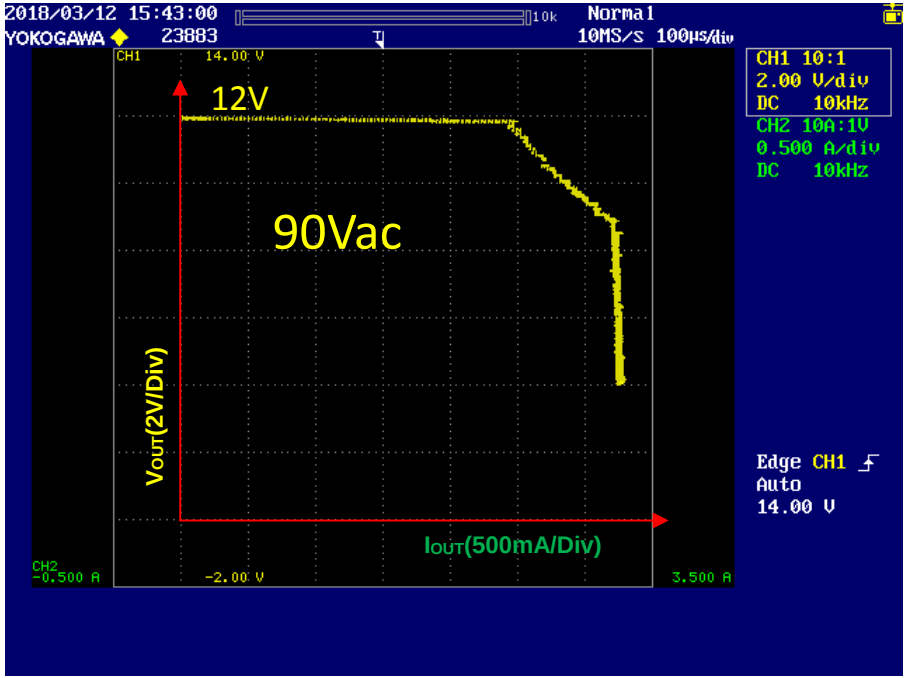


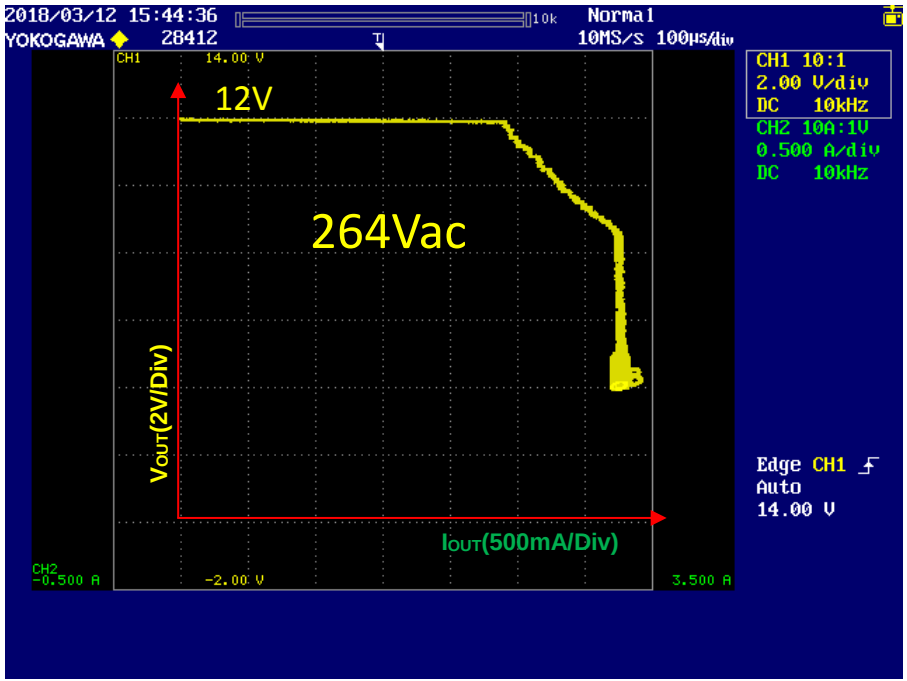
9.4 Output Voltage Transition (9V To 5V at 90Vac)



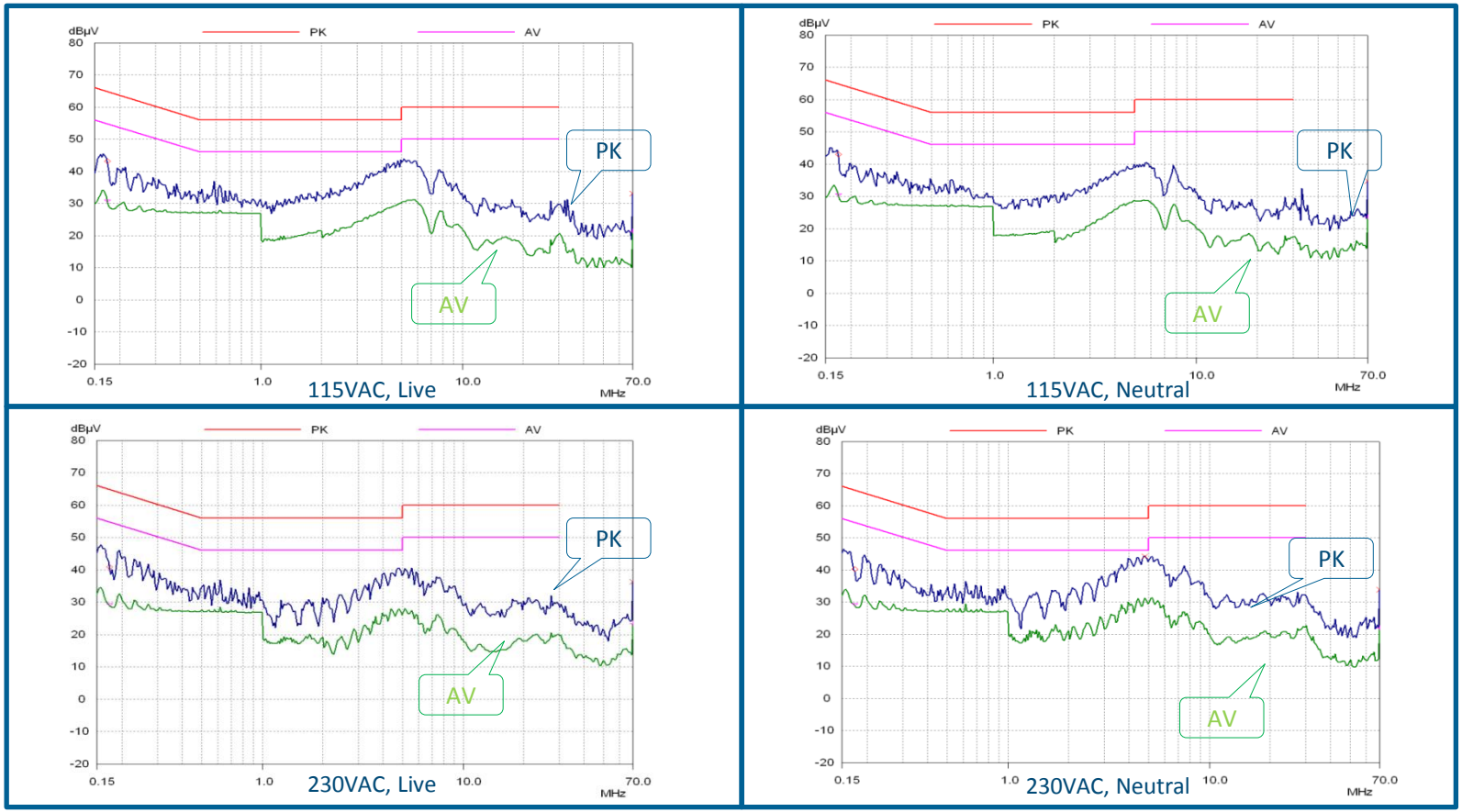


10. Output VI Characteristic (Measured on PCB end)

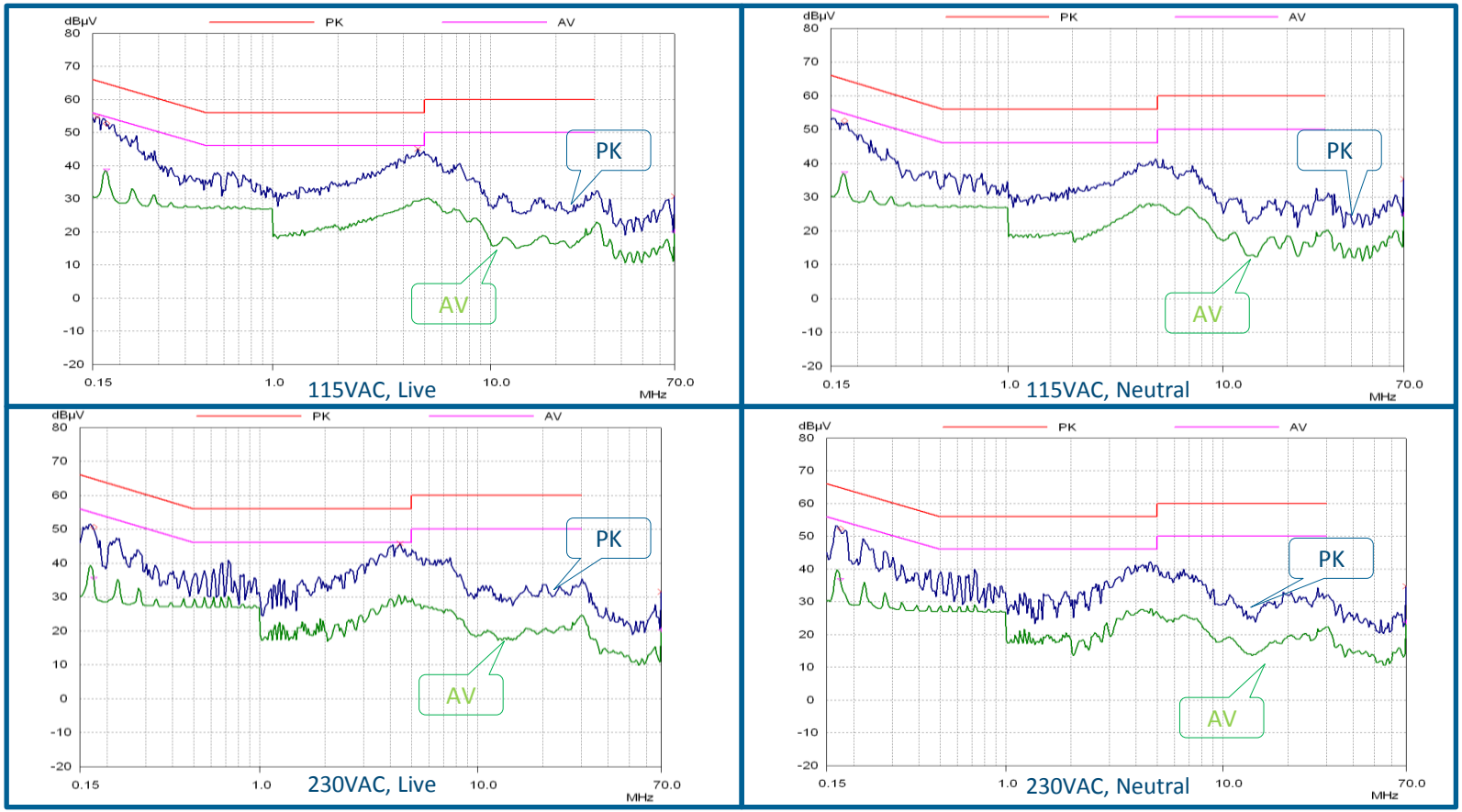




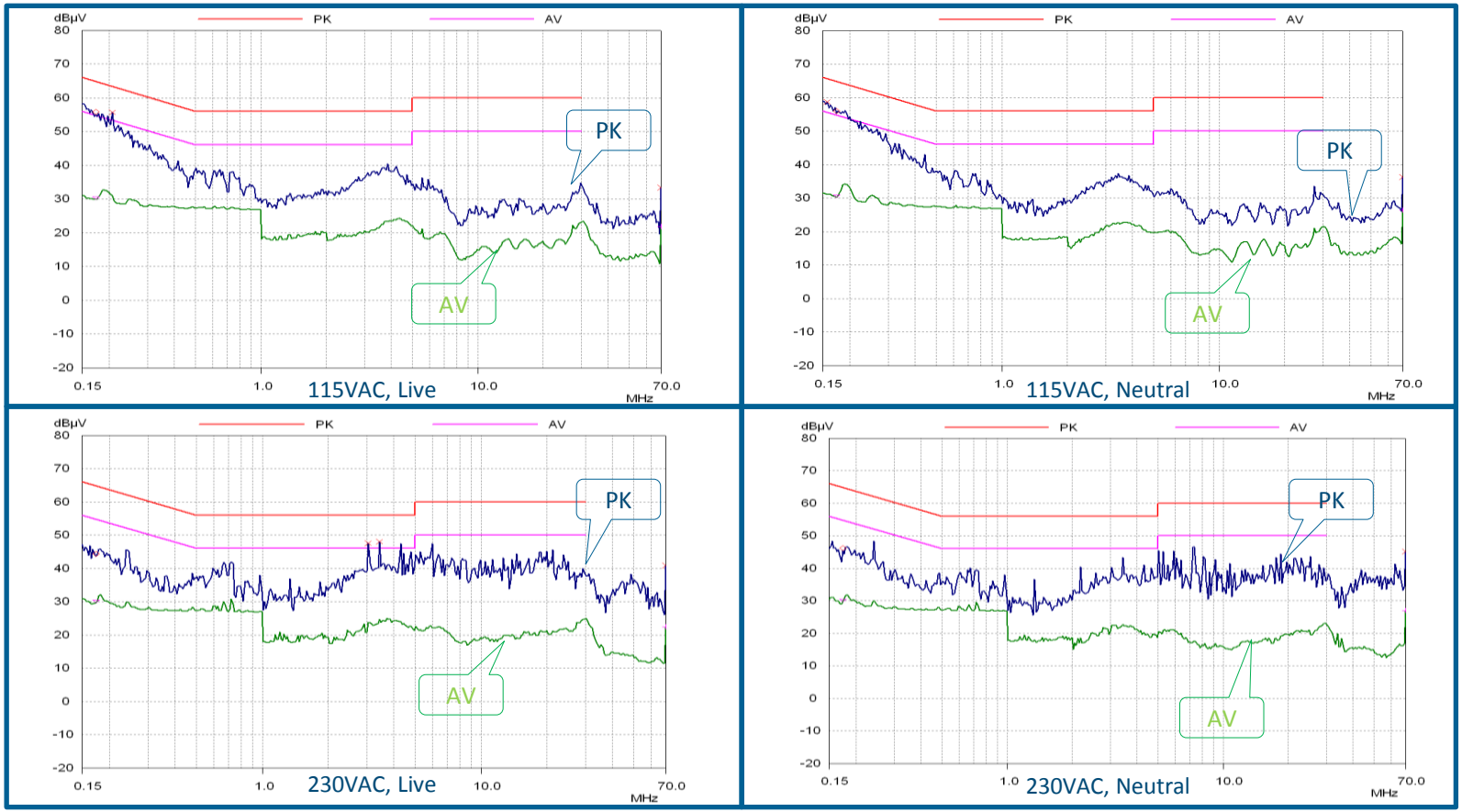
11.1 Conducted Emission – PK and AV (Output Resistive 5V 3A)



11.2 Conducted Emission – PK and AV (Output Resistive 9V 3A)



11.3 Conducted Emission – PK and AV (Output Resistive 11V 2.46A)



12.1 Radiated Emission (230Vac Output Resistive 5V 3A)

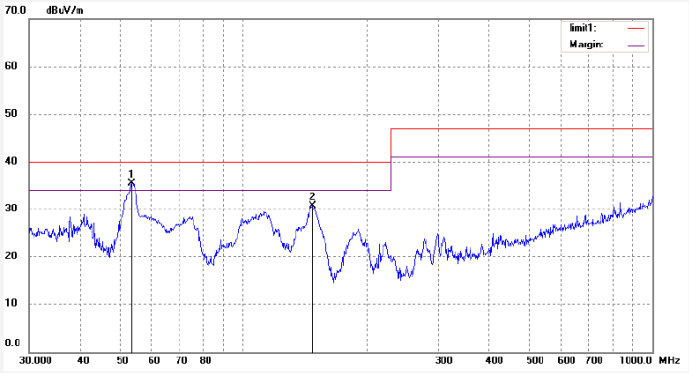
ACCURATE TECHNOLOGY CO., LTD.
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: PI #4915
Standard: EN55022 ClassB Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT:
Mode: Full load
Model: 5V 3A 2#
Manufacturer:

Polarization: Vertical
Power Source: AC 230V/50Hz
Date: 18/04/16/
Time: 16/00/39
Engineer Signature:
Distance: 3m

Note:



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	53.3179	48.30	-12.82	35.48	40.00	-4.52	peak			
2	147.9214	45.81	-15.06	30.75	40.00	-9.25	peak			

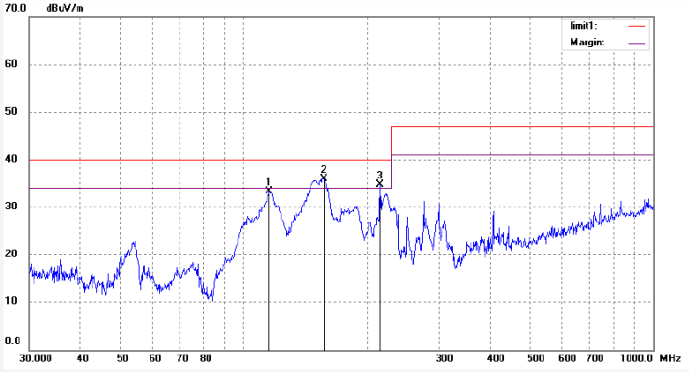
ACCURATE TECHNOLOGY CO., LTD.
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: PI #4916
Standard: EN55022 ClassB Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT:
Mode: Full load
Model: 5V 3A 2#
Manufacturer:

Polarization: Horizontal
Power Source: AC 230V/50Hz
Date: 18/04/16/
Time: 16/00/52
Engineer Signature:
Distance: 3m

Note:



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	115.7256	46.37	-13.06	33.31	40.00	-6.69	peak			
2	157.0073	50.77	-14.74	36.03	40.00	-3.97	peak			
3	215.2677	46.43	-11.66	34.77	40.00	-5.23	peak			

12.2 Radiated Emission (230Vac Output Resistive 12V 2A)

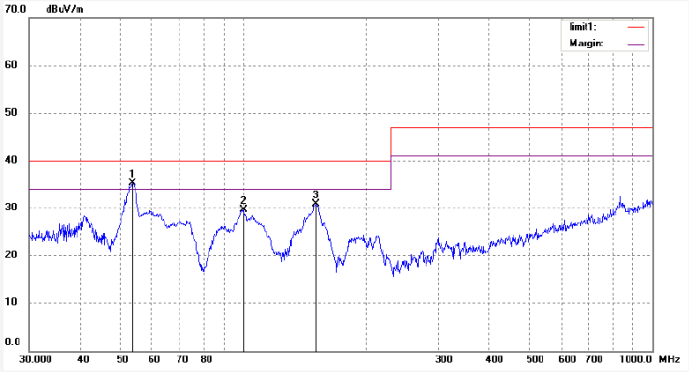
ACCURATE TECHNOLOGY CO., LTD.
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: PI #4914
Standard: EN55022 ClassB Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT:
Mode: Full load
Model: 12V 2A 2#
Manufacturer:

Polarization: Vertical
Power Source: AC 230V/50Hz
Date: 18/04/16/
Time: 15/58/13
Engineer Signature:
Distance: 3m

Note:



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	53.6932	48.04	-12.85	35.19	40.00	-4.81	peak			
2	100.2286	42.77	-13.08	29.69	40.00	-10.31	peak			
3	151.0666	45.87	-15.01	30.86	40.00	-9.14	peak			

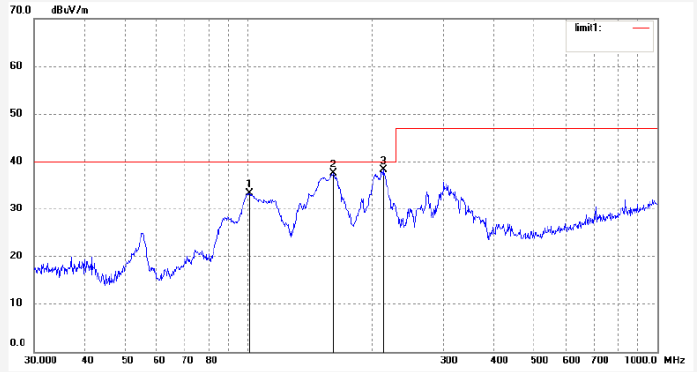
ACCURATE TECHNOLOGY CO., LTD.
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: PI #4912
Standard: EN55022 ClassB Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT:
Mode: Full load
Model: 12V 2A 2#
Manufacturer:

Polarization: Horizontal
Power Source: AC 230V/50Hz
Date: 18/04/16/
Time: 15/56/10
Engineer Signature:
Distance: 3m

Note:



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	100.9339	46.61	-13.20	33.41	40.00	-6.59	peak			
2	162.0414	51.85	-14.38	37.47	40.00	-2.53	peak			
3	213.7634	49.94	-11.76	38.18	40.00	-1.82	peak			

13. Product Spec - InnoSwitch3-Pro

InnoSwitch3-Pro Family

Digitally Controllable Off-Line CV/CC QR Flyback Switcher IC with Integrated High-Voltage MOSFET, Synchronous Rectification and FluxLink Feedback

Product Highlights

Digitally Controlled via I²C Interface
- Dynamic adjustment of power supply voltage and current
- Telemetry for power supply status and fault monitoring
- Comprehensive set of configurable protection features

Highly Integrated, Compact Footprint
- Multi-mode Quasi-Resonant (QR) / DCM / CCM flyback controller, 650 V or 725 V MOSFET, secondary-side sensing and synchronous rectifier driver
- Optimized efficiency across line and load range
- Integrated FluxLink™, HIPOT-isolated, feedback link
- Instantaneous transient response
- Drives low-cost N-channel MOSFET series load switch
- Integrated 3.6 V supply for external MCU

EcoSmart™ – Energy Efficient
- Less than 30 mW no-load including line sense and MCU
- Enables power supply designs that easily comply with all global energy efficiency regulations
- Low heat dissipation

Advanced Protection / Safety Features
- Input voltage monitoring with accurate brown-in/brown-out and overvoltage protection
- Output OV/UV fault detection with independently configured responses
- Secondary FET / diode short protection
- Open SR FET gate detection
- Hysteretic thermal shutdown
- Programmable watchdog timer for system faults

Full Safety and Regulatory Compliance
- Reinforced insulation
- Isolation voltage >4000 VAC
- 100% production HIPOT compliance testing
- UL1577 and TUV (EN60950) safety approved

Green Package
- Halogen free and RoHS compliant

Applications
- High efficiency USB PD 3.0 + PPS/QC adapters
- Multiprotocol adapters including QuickCharge, AFC, FCP, SCP
- Direct-charge mobile device chargers
- Multi-chemistry tool and general purpose battery chargers
- Adjustable CV and CC LED ballast

Description

The InnoSwitch™3-Pro series family of ICs dramatically simplifies the development and manufacturing of fully programmable, highly efficient power supplies, particularly those in compact enclosures. The universal I²C interface enables dynamic control of output voltage and current along with many configurable features. Telemetry provides reporting of programmed features and fault modes.

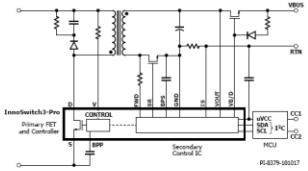


Figure 1. Typical Application.

Figure 2. High Creepage, Safety-Compliant InSOP-24D Package.

Output Power Table[1]

Product[4,5]	230 VAC ± 15%		85-265 VAC	
	Adapter[2]	Open Frame[3]	Adapter[2]	Open Frame[3]
INN3365C/3375C	25 W	30 W	22 W	25 W
INN3366C/3376C	35 W	40 W	27 W	36 W
INN3377C	40 W	45 W	36 W	40 W
INN3367C	45 W	50 W	40 W	45 W
INN3368C	55 W	65 W	50 W	55 W

Table 1. Output Power Table.
Notes:
1. Maximum output power is dependent on the design, with maximum IC package temperature kept <125 °C.
2. Minimum continuous power in a typical non-ventilated enclosed typical size adapter measured at 40 °C ambient.
2. Minimum peak power capability.
3. C Package: InSOP-24D.
5. INNxxx5xC – 650 V MOSFET, INNxxx7xC – 725 V MOSFET.

InnoSwitch3-Pro devices are ideal for AC/DC power supply applications where fine (10 mV, 50 mA) output voltage and current adjustment are necessary. Typical implementations comprise a system microprocessor or dedicated microcontroller with an I²C port that is used to configure, control and supervise operation of the power sub-system. The uVCC pin provides a bias supply for the microprocessor in stand-alone implementations such as USB PD adapters and chargers.

Absolute Maximum Ratings[1,2]

DRAIN Pin Voltage	-0.3 V to 650 V / 725 V
DRAIN Pin Peak Current: INN33x5C	1.84 A (3.45 A)[3]
INN33x6C	2.32 A (4.35 A)[3]
INN33x7C	2.64 A (4.95 A)[3]
INN3368C	2.96 A (5.55 A)[3]
BPP/BPS Pin Voltage	-0.3 to 6 V
BPP/BPS Current	100 mA
SCL, SDA, uVCC Pin Voltage	-0.3 to 6 V
uVCC Current[6]	12 mA
FWD Pin Voltage	-1.5 V to 150 V
SR Pin Voltage	-0.3 V to 6 V
V Pin Voltage (INN336x)	-0.3 V to 650 V
V Pin Voltage (INN337x)	-0.3 V to 725 V
VOUT Pin Voltage	-0.3 V to 27 V
Storage Temperature	-65 to 150 °C
Operating Junction Temperature[4]	-40 to 150 °C
Ambient Temperature	-40 to 105 °C
Lead Temperature[5]	260 °C

Notes:
1. All voltages referenced to SOURCE and Secondary GROUND, T_A = 25 °C.
2. Maximum ratings specified may be applied one at a time without causing permanent damage to the product. Exposure to Absolute Maximum Ratings conditions for extended periods of time may affect product reliability.
3. Higher peak Drain current is allowed while the Drain voltage is simultaneously less than 400 V.
4. Normally limited by internal circuitry.
5. 1/16" from case for 5 seconds.
6. Only at 5 V output, the uVCC pin can supply 50 mA maximum current for 0.5 seconds.

Thermal Resistance

Thermal Resistance: (θ_{JA})	76 °C/W[1], 65 °C/W[2]
(θ_{JC})	8 °C/W[3]

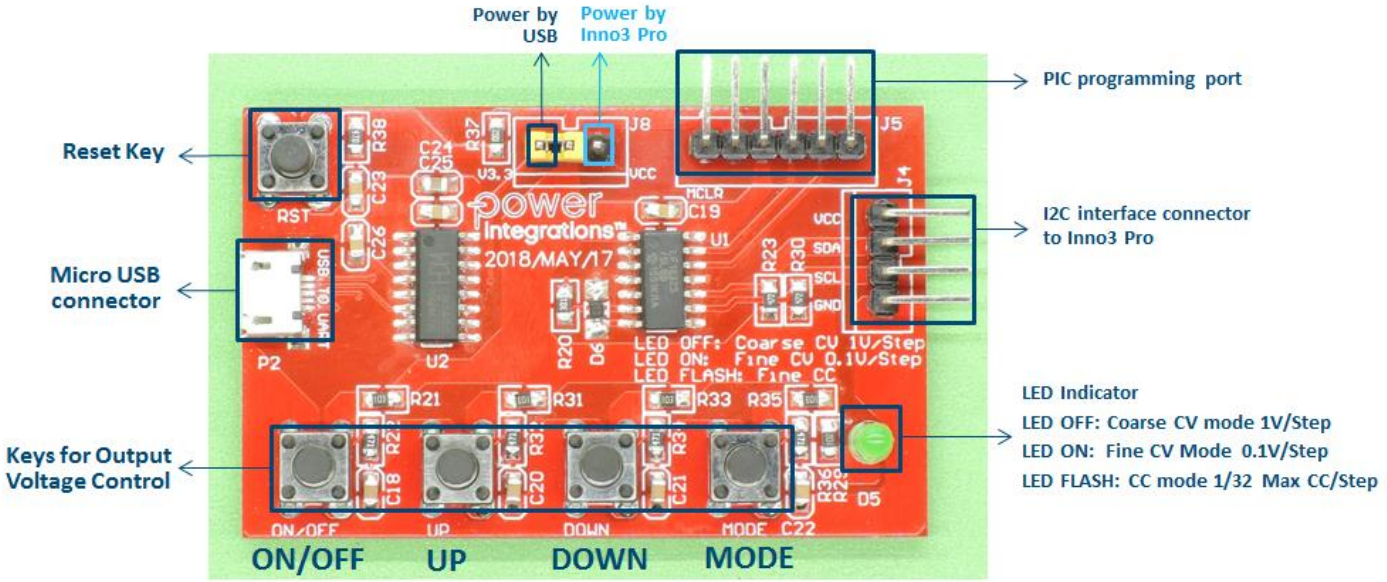
Notes:
1. Soldered to 0.36 sq. inch (232 mm²) 2 oz. (610 g/m²) copper clad.
2. Soldered to 1 sq. inch (645 mm²), 2 oz. (610 g/m²) copper clad.
3. The case temperature is measured on the top of the package.

Parameter	Conditions	Rating	Units
Ratings for UL1577			
Primary-Side Current Rating	Current from pin (16-19) to pin 24	1.5	A
Primary-Side Power Rating	T_{AMB} = 25 °C (device mounted in socket resulting in T_{CASE} = 120 °C)	1.35	W
Secondary-Side Power Rating	T_{AMB} = 25 °C (device mounted in socket)	0.125	W

Parameter	Symbol	Conditions SOURCE = 0 V, T_J = -40 °C to 125 °C (Unless Otherwise Specified)	Min	Typ	Max	Units
Control Functions						
Startup Switching Frequency	f_{SW}	T_J = 25 °C	23	25	27	kHz
Jitter Modulation Frequency	f_M	T_J = 25 °C, f_{SW} = 100 kHz	0.80	1.25	1.70	kHz
Maximum On-Time	$t_{ON(MAX)}$	T_J = 25 °C	12.4	14.6	16.9	µs
Minimum Primary Feedback Block-Out Timer	t_{BLOCK}				$t_{OFF(MIN)}$	µs

14. I²C Test Kit for Supporting Evaluation (Obtain from PI)

- Selectable power (via INNO-3-PRO's uV pin or USB)
- Write/set CV values to INNO3-PRO for Lab evaluation or EMI test without a USB port
- Full Read/Write Function when connected with USB (PC)



15. SR-FET Source - AO4294

ALPHA & OMEGA SEMICONDUCTOR

AO4294

100V N-Channel MOSFET

General Description

- Trench Power MV MOSFET technology
- Low $R_{DS(ON)}$
- Low Gate Charge
- Optimized for fast-switching applications

Product Summary

V_{DS}	100V
I_D (at V_{GS}=10V)	11.5A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 12mΩ
$R_{DS(ON)}$ (at V_{GS}=4.5V)	< 15.5mΩ

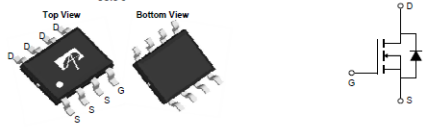
Applications

- Synchronus Rectification in DC/DC and AC/DC Converters
- Industrial and Motor Drive applications

100% UIS Tested
100% Rg Tested

Green Product

SOIC-8



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AO4294	SO-8	Tape & Reel	3000

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	100	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current	T_A=25°C	I_D	11.5	A
	T_A=70°C		9	
Pulsed Drain Current [C]		I_{DM}	46	
Avalanche Current [C]		I_{AS}	20	A
Avalanche energy [C]	L=0.1mH	E_{AS}	20	mJ
V_{DS} Spike	10µs	V_{SPIKE}	120	V
Power Dissipation [B]	T_A=25°C	P_D	3.1	W
	T_A=70°C		2.0	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	°C

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	31	40	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		59	75	°C/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	16	24	°C/W

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	I_D=250µA, V_{GS}=0V	100			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=100V, V_{GS}=0V			1	µA
		T_J=55°C			5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±20V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=250µA	1.4	1.9	2.4	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=11.5A		10	12	mΩ
		T_J=125°C		17.5	21	
		V_{GS}=4.5V, I_D=9.5A		12.5	15.5	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=11.5A		45		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.71	1	V
I_S	Maximum Body-Diode Continuous Current				4	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=50V, f=1MHz		2420		pF
C_{oss}	Output Capacitance			170		pF
C_{rss}	Reverse Transfer Capacitance			11		pF
R_g	Gate resistance	f=1MHz	0.2	0.55	0.9	Ω
SWITCHING PARAMETERS						
$Q_{g(10V)}$	Total Gate Charge	V_{GS}=10V, V_{DS}=50V, I_D=11.5A		33	50	nC
$Q_{g(4.5V)}$	Total Gate Charge			15	25	nC
Q_{gs}	Gate Source Charge			7		nC
Q_{gd}	Gate Drain Charge			4		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=50V, R_L=4.35Ω, R_{GEN}=3Ω		8		ns
t_r	Turn-On Rise Time			3		ns
$t_{D(off)}$	Turn-Off DelayTime			25		ns
t_f	Turn-Off Fall Time			4		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=11.5A, dI/dt=500A/µs		25		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=11.5A, dI/dt=500A/µs		110		nC

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A =25° C. The value in any given application depends on the user's specific board design.
B. The power dissipation P_D is based on $T_{J(MAX)}$=150° C, using ≤ 10s junction-to-ambient thermal resistance.
C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150° C. Ratings are based on low frequency and duty cycles to keep initialT_J=25° C.
D. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to lead $R_{\theta JL}$ and lead to ambient.
E. The static characteristics in Figures 1 to 6 are obtained using <300µs pulses, duty cycle 0.5% max.
F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, assuming a maximum junction temperature of $T_{J(MAX)}$=150° C. The SOA curve provides a single pulse rating.

16. Weltrend USB-PD3.0 Controller WT6635P

1. General Description

The WT6635P is a highly integrated USB Power Delivery (PD) controller that supports USB PD 3.0 Programmable Power Supply specification and Qualcomm® Quick Charge™ 4 or Quick Charge 4+ technologies. It is designed for USB Type-C power source applications such as power adapters, wall chargers, power strip, and etc.

The WT6635P minimizes external components by integrating USB PD baseband PHY, Type-C detection and an 8-bit MCU to allow small form factor and low BOM cost. Low operation voltage (3V) supports PD 3.0 Programmable Power Supply (PPS) specification. One-Time-Programmable ROM is provided for program code and user configuration data.

Without the features of Constant Voltage (CV), Constant Current (CC), voltage/current monitoring and load switch control pin, WT6635P must pair with the CV/CC controller, equipped with dynamic Over Voltage/Current Protection (OVP/OCP) & load switch control pin, by I^2C interface.

2. Features

- Supports USB Type-C Rev.1.3 and Power Delivery Rev. 3.0
- Supports USB BC1.2 Dedicated Charging Port (DCP)
- Supports Quick Charge 4 and Quick Charge 4+
- Supports SuperCharge Protocol™
- 10-bit ADC for voltage and temperature measuring
- 8-bit MCU with One-Time-Programmable ROM
- Master I^2C interface
- Internal RC oscillator
- General purpose I/Os
- On-chip temperature sensor
- Built-in current source for external NTC thermistor
- Watchdog timer
- Built-in 1.8V regulator
- Supports power saving mode
- Operating voltage range: 3.0V to 5.25V
- Operating temperature range: -20°C to +105°C
- Package: SOP8, SOP10

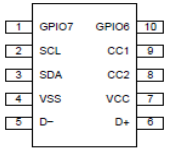
Weltrend 偉詮電子
WT6635P
USB PD Controller

3. Pin Configuration

3.1 Package

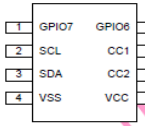
10-pin SOP

WT6635P-SG10A

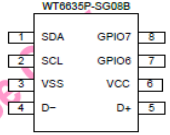


8-pin SOP

WT6635P-SG08A



WT6635P-SG08B



3.2 Pin Description

Pin Number 10A	08A	08B	Pin Name	Function	I/O Voltage	Input Type	Output Type	Description
1	1	8	GPIO7	GPIO7	HV	TTL	OD	General purpose I/O
				ADC7		AN	-	ADC input
				IRQ7		TTL	-	IRQ input
2	2	2	GPIO2	GPIO2	HV	TTL	OD	General purpose I/O
				SCL		TTL	ODPH	I^2C SCL
				IRQ2		TTL	-	IRQ input
3	3	1	GPIO3	GPIO3	HV	TTL	OD	General purpose I/O
				SDA		TTL	ODPH	I^2C SDA
				IRQ3		TTL	-	IRQ input
4	4	3	VSS	VSS	-	-	-	Ground
5		4	GPIO5	GPIO5	HV	TTL	OD	Serial purpose I/O
				D-		AN	-	USB D-
				ADC5		AN	-	ADC input
				IRQ5		TTL	-	IRQ input
6		5	GPIO4	GPIO5	HV	TTL	OD	Serial purpose I/O
				D+		AN	-	USB D+
				ADC4		AN	-	ADC input
				IRQ4		TTL	-	IRQ input
7	5	6	VCC	VCC	LV	-	AN	Power

17. Design History

Revision History				
Date	**Author**	**Revision**	**Description & changes**	**Reviewed**
29-Jun-2018	ZMY/TL	Rev-1	Initial Release	EH Quek

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