

SupIRBuck™

USER GUIDE FOR iP1837 EVALUATION BOARD FOR VTT CORE

DESCRIPTION

The iP1837 is a synchronous buck converter, providing a compact, high performance and flexible solution in a small 7.7mm X 7.7 mm LGA package.

Key features offered by the iP1837 include programmable soft-start ramp, precision 0.6V reference voltage, Power Good, thermal protection, programmable switching frequency, Enable input, input under-voltage lockout for proper start-up, and pre-bias start-up.

An output over-current protection function is implemented by sensing the voltage developed across the on-resistance of the synchronous rectifier MOSFET for optimum cost and performance.

This user guide contains the schematic and bill of materials for the iP1837 evaluation board. The guide describes operation and use of the evaluation board itself. Detailed application information for iP1837 is available in the iP1837 data sheet.

BOARD FEATURES

- $V_{in} = +12.0V (+ 13.2V Max)$
- $V_{cc}=+3.3V (3.46V Max)$
- $V_{out} = +1.05V @ 0- 20A$
- $F_s=600kHz$
- $L= 0.215uH$
- $C_{in}= 3x22uF$ (ceramic 1206) + 1X330uF (electrolytic)
- $C_{out}=20x22uF$ (ceramic 0805)+4x470uF SP Capacitor

CONNECTIONS and OPERATING INSTRUCTIONS

A well regulated +12V input supply should be connected to VIN+ and VIN-. A maximum 20A load should be connected to VOUT+ and VOUT-. The inputs and outputs of the board are listed in Table I.

iP1837 has two input supplies, one for biasing (Vcc) and the other as input voltage (Vin). Separate supplies should be applied to these inputs. Vcc input should be a well regulated 3.13V-3.46V supply and it would be connected to Vcc+ and Vcc-.

External Enable signal can be applied to the board via exposed Enable pad and *R18 should be removed for this purpose, For proper operation of iP1837, the voltage at Enable should always be kept below Vcc.*

Table I. Connections

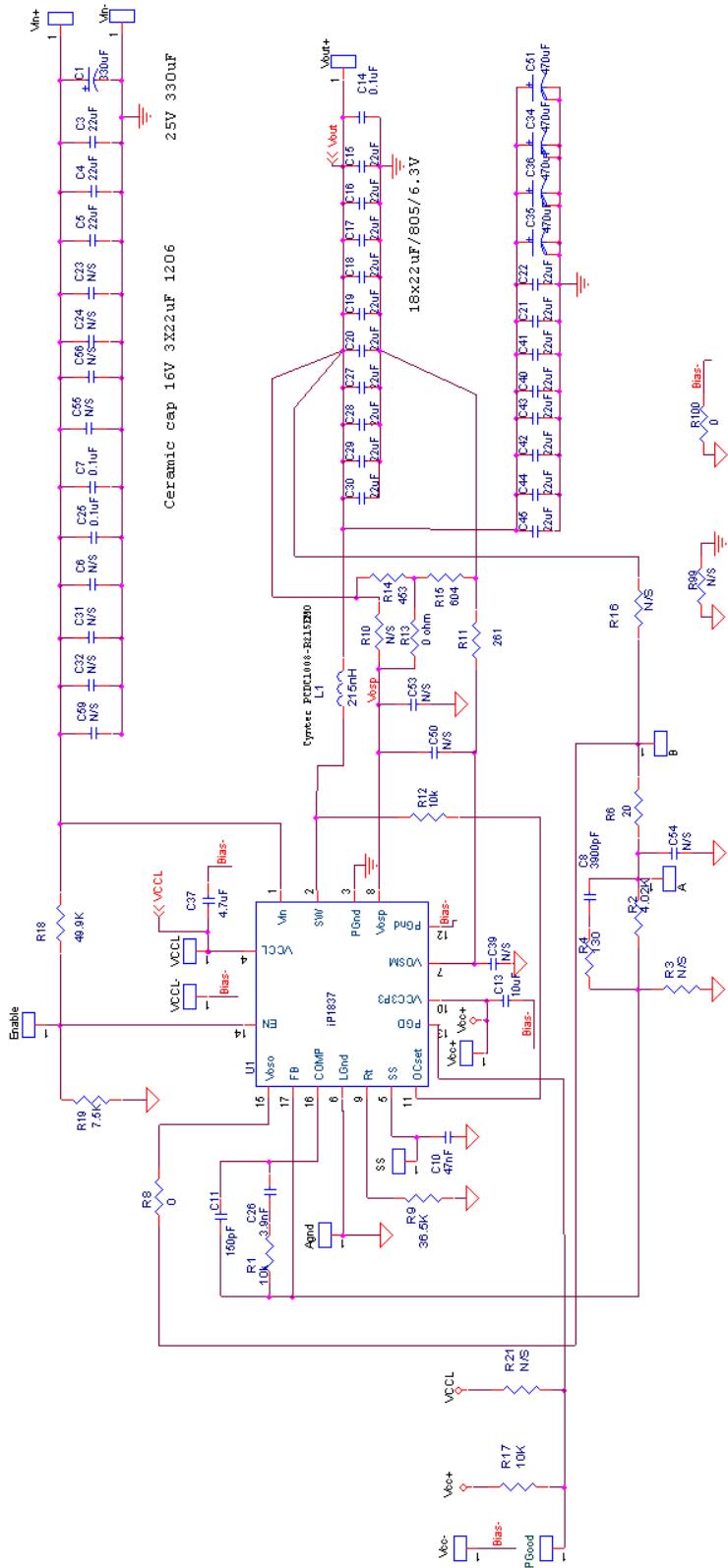
Connection	Signal Name
VIN+	V_{in} (+12V)
VIN-	Ground of V_{in}
Vcc+	Vcc input (+3.3V)
Vcc-	Ground for Vcc input
VOUT-	Ground of V_{out}
VOUT+	V_{out} (+1.05V)
Enable	Enable
P_Good	Power Good Signal

The demo board has a built in transient load set up. It can be used to test 14A step load response. 5V square pulses at 1KHz can be applied at Ext.Load Ctrl point. **Since the built in resistive load can not take 14A step load current continuously, do not apply gate pulses continuously, limit to 5-10 pulses maximum.**

LAYOUT

The PCB is a 6-layer board. All layers are 2 Oz. copper. The iP1837 and most of the passive components are mounted on the top side of the board.

Power supply decoupling capacitors and feedback components are located close to iP1837. The feedback resistors are connected to the output of the remote sense amplifier of the iP1837 and are located close to the iP1837. To improve efficiency, the circuit board is designed to minimize the length of the on-board power ground current path. Separate power ground and analog ground are used and may be connected together using a 0 ohm resistor at one of two possible locations



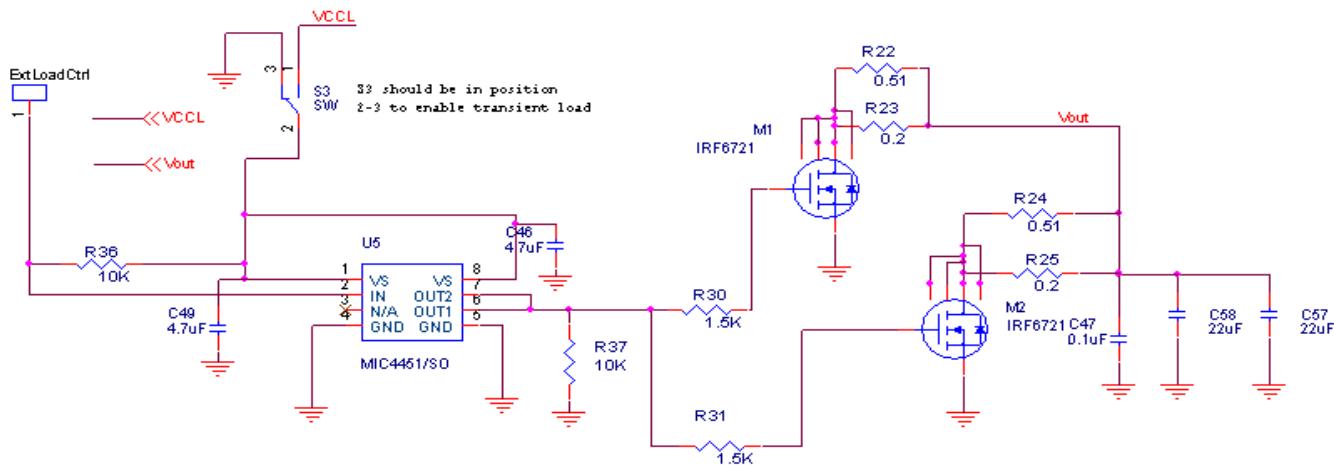
Single point of connection between Power Ground and Signal (“analog”) Ground

Fig. 1: Schematic of the iP1837 evaluation board

Bill of Materials

Item	Qty	Part Reference	Value	Description	Manufacturer	Part Number
1	3	C3 C4 C5	22uF	22uF,1206,16V, X5R, 20%	TDK	C3216X5R1C226M
2	1	C1	330uF	SMD Electrolytic, Fsize, 25V, 20%	Panasonic	EEV-FK1E331P
3	3	C7 C14 C25	0.1uF	0603, 25V, X7R, 10%	Murata	GRM188R71E104KA01B
4	1	C8 C26	3900pF	0603,50V,X7R,10%	Murata	GRM188R71H392KA01B
5	1	C10	47nF	0603,25V,X7R,10%	Murata	GRM188R71E473KA01J
6	1	C11	150pF	50V, 0603, NP0, 5%	Murata	GRM1885C1H151JA01D
7	1	C13	10uF	0603, X5R, 6.3V	TDK	C1608X5R0J106M
8	18	C15 C16 C17 C18 C19 C20 C21 C22 C27 C28 C29 C30 C40 C41 C42 C43 C44 C45	22uF	0805, 6.3V, X5R, 20%	Panasonic	ECJ-2FB0J226M
9	1	C37	4.7uF	0805, 10V, X5R	TDK	C2012X5R1A475K
10	4	C34 C35 c36 c51	470uF	SP CAPACITOR 470uF,6mOhm	Panasonic	EEFUDOD471L6
11	1	L1	0.215uH	0.215uH, DCR=0.29mohm	Cyntec	PCDC1008-R215EMO
12	1	R1	10k	0603,1/10W,1%	Rohm	MCR03EZPFX1002
13	1	R2	4.02k	0603,1/10W,1%	Rohm	MCR03EZPFX4021
14	1	R4	130	0603,1/10W,1%	Vishay/Dale	CRCW0603 130FKEA
15	1	R6	20	20,0603,1/10 W,1%	Vishay/Dale	CRCW060320R0FKEA
16	1	R9	36.5k	0603,1/10W,1%	Rohm	MCR03EZPFX3652
17	3	R8 R100 R13	0	0,0603,1/10 W,5%	Vishay/Dale	CRCW06030000Z0EA
18	1	R12	20k	0603,1/10 W,1%	Rohm	MCR03EZPFX2002
19	1	R14	453	0603,1/10 W,1%	Rohm	MCR03EZPFX4530
20	1	R15	604	0603,1/10 W,1%	Rohm	MCR03EZPFX6040
21	1	R11	261	0603,1/10 W,1%	Rohm	MCR03EZPFX2610
22	1	R18	49.9k	49.9K,0603,1/10 W,1%	Rohm	MCR03EZPFX4992
23	1	R19	7.5k	7.5K,0603,1/10W,1%	Rohm	MCR03EZPFX7501
24	1	R17	10k	0603,1/10 W,1%	Rohm	MCR03EZPFX1002
25	1	U1	iP1837	iP1837 7.7mmX7.7mm	International Rectifier	iP1837PbF

Schematic for Transient Load set up



BOM for Transient Load set up

Item	Qty	Part Reference	Value	Description	Manufacturer	Part Number
1	1	C46 C49	4.7uF	0603, 10V, X5R, 20%	TDK	C1608X5R1A106M
2	1	C47	0.1uF	0603, 25V, X7R, 10%	Murata	GRM188R71E104KA01B
3	2	C57 C58	22uF	0805, 6.3V, X5R, 20%	Panasonic	ECJ-2FB0J226M
4	2	R22 R24	0.51Ohm	0603, 1/10W, 1%	Rohm	MCR03EZPFL0R51
5	2	R23 R25	0.2 Ohm	0603, 1/10 W, 1%	Rohm	MCR03EZPFL0R20
6	2	R30 R31	1.5k	0603, 1/10 W, 1%	Rohm	MCR03EZPFX1501
7	2	R36 R37	10k	0603, 1/10 W, 1%	Rohm	MCR03EZPFX1002
8	2	M1 M2	IRF6721	Direct Fet 30V SQ	International Rectifier	IRF6721STRPbF
9	1	U5	MIC4451	Mosfet driver Inverting SO-8	Micrel	MIC4451YM

TYPICAL OPERATING WAVEFORMS

Vin=12.0V, Vcc=3.3V, Vo=1.05V, Io=0A-20A, Room Temperature, no airflow

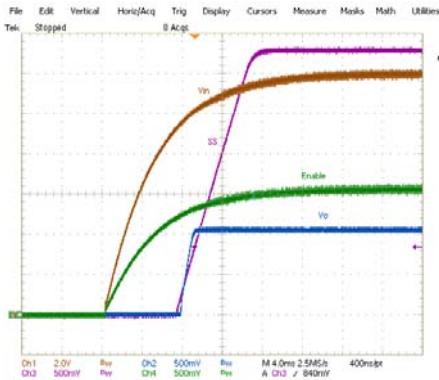


Fig. 2: Start up at 20A Load
Ch₁:V_{in}, Ch₂:V_o, Ch₃:V_{ss}, Ch₄:Enable

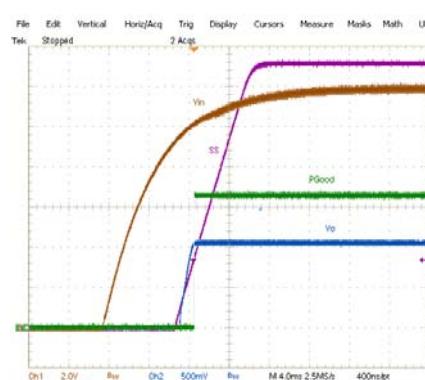


Fig. 3: Start up at 20A Load,
Ch₁:V_{in}, Ch₂:V_o, Ch₃:V_{ss}, Ch₄:V_{PGood}

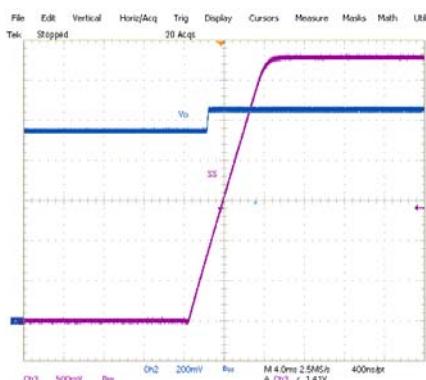


Fig. 4: Start up with Pre Bias , 0A Load,
Ch₂:V_o, Ch₃:V_{ss}

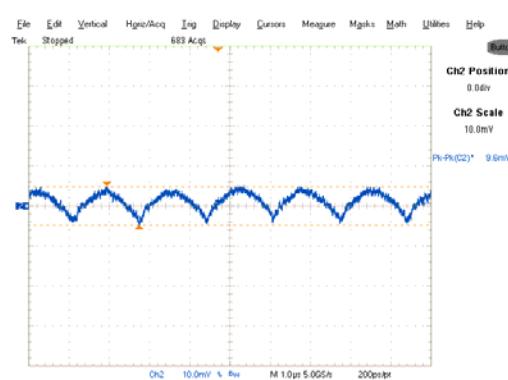


Fig. 5: Output Voltage Ripple, 20A load
Ch₂: V_{out},

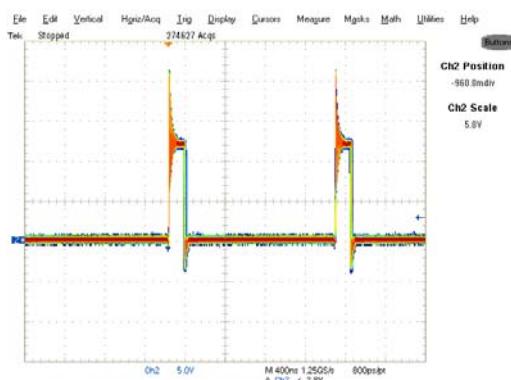


Fig. 6: Inductor node at 20A load
Ch₂:LX

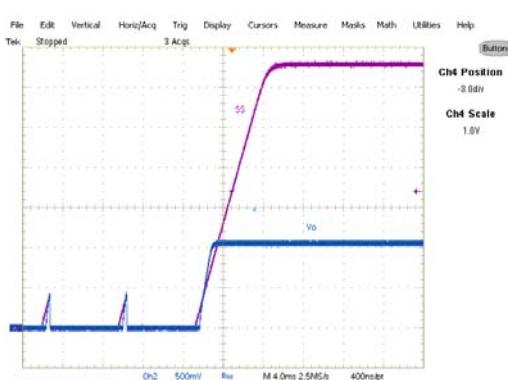


Fig. 7: Short (Hiccup) Recovery
Ch₂:V_{out}, Ch₃:V_{ss}

TYPICAL OPERATING WAVEFORMS

V_{in}=12.0V, V_{cc}=3.3V, V_o=1.05V, I_o=6-20A, Room Temperature, No airflow

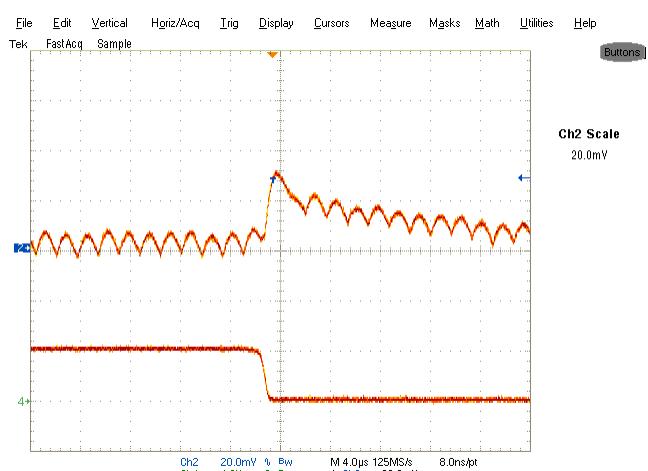
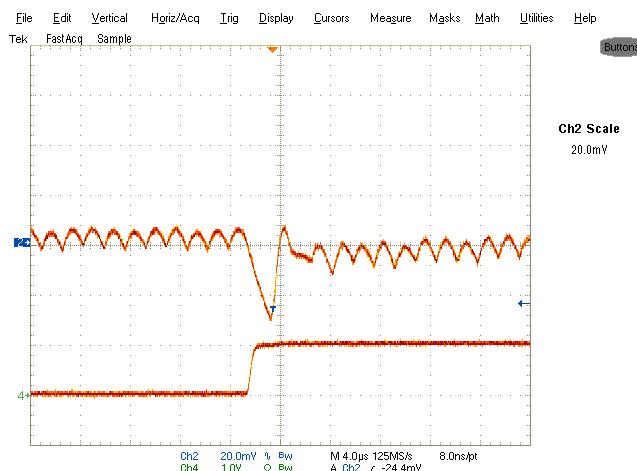
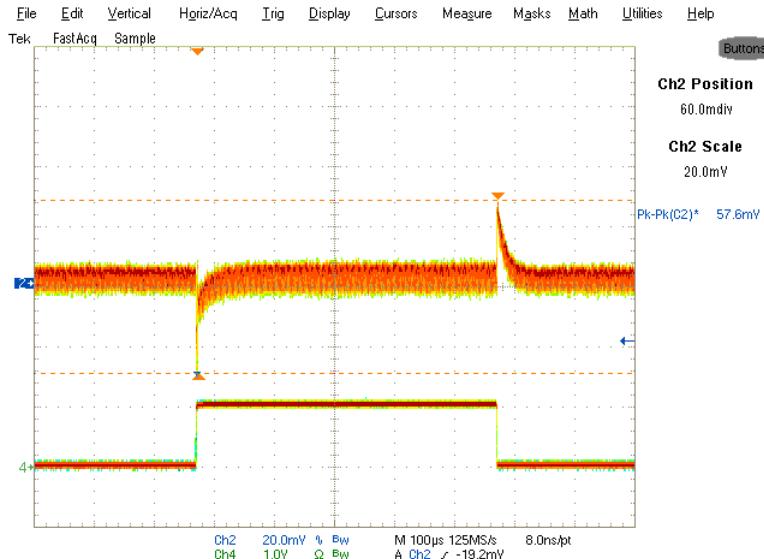


Fig. 8: Transient Response, 6A to 20A
Ch₂:V_{out}, Ch₄:I_{out} (14A/Div) (Only step load current of 14A is shown)

TYPICAL OPERATING WAVEFORMS

V_{in}=12.0V, V_{cc}=3.3V, V_o=1.05V, I_o=0A-20A, Room Temperature

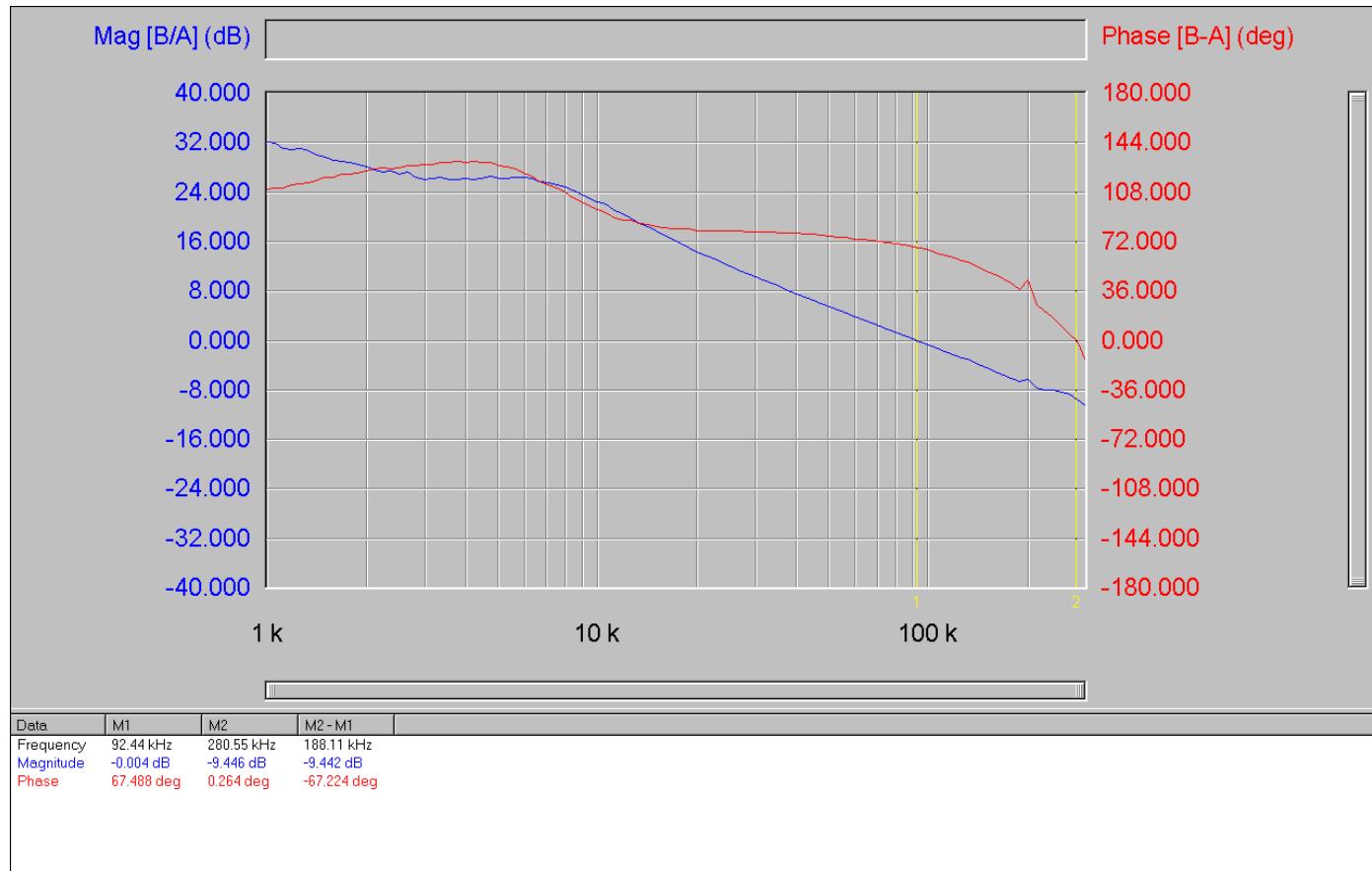


Fig. 9: Bode Plot at 20A load shows a bandwidth of 92.4KHz and phase margin of 67.5°

TYPICAL OPERATING WAVEFORMS

V_{in}=12.0V, V_{cc}=3.3V, V_o=1.05V, I_o=0A-20A, Room Temperature, No airflow
Efficiency-iP1837

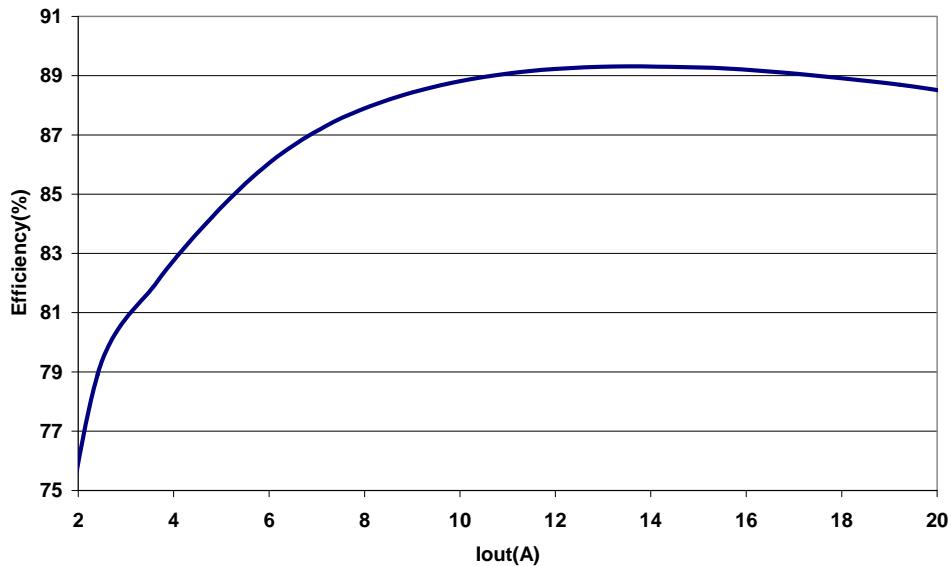


Fig.10: Efficiency versus load current

Power Dissipation-iP1837

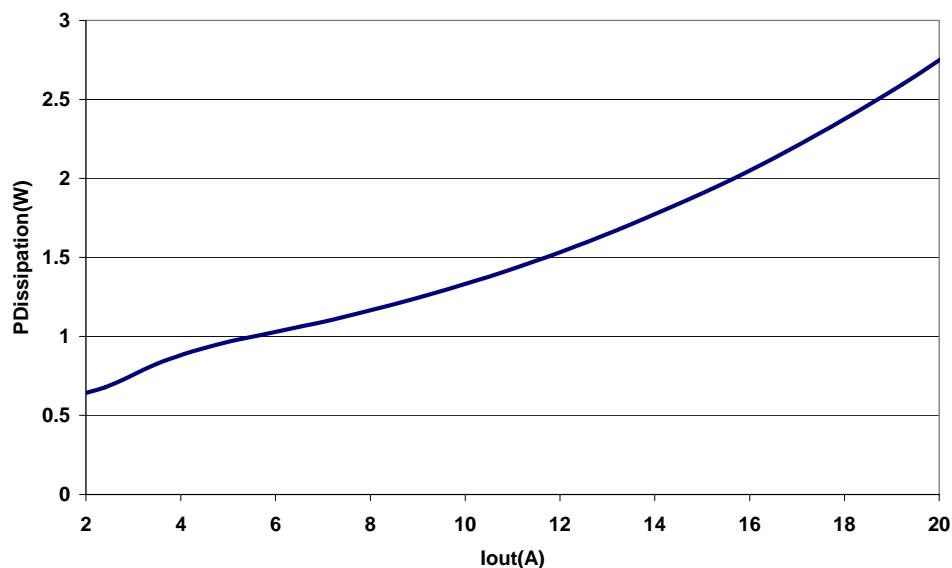


Fig.11: Power loss versus load current

THERMAL IMAGES

Vin=12.0V, Vcc=3.3V, Vo=1.05V, Io=0A-20A, Room Temperature, No airflow

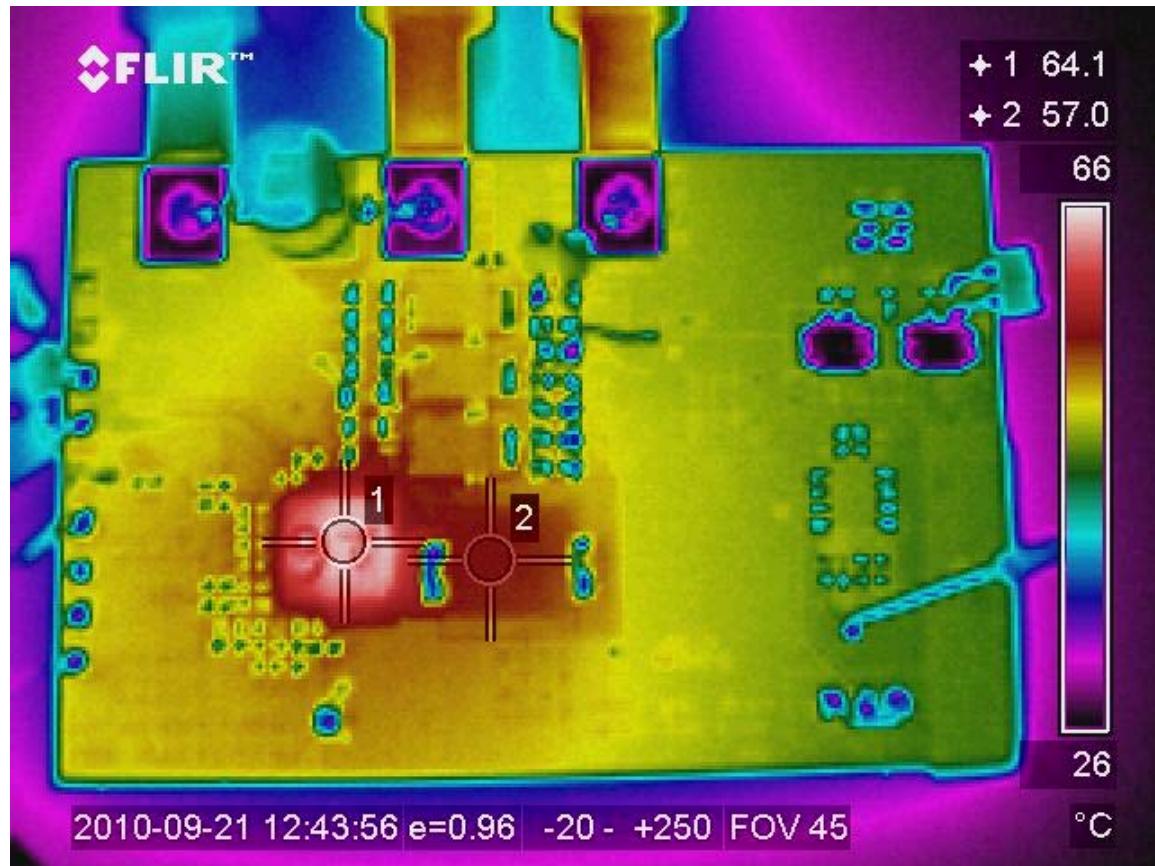


Fig. 12: Thermal image of the board at 20A load

Test point 1 is iP1837

Test point 2 is inductor

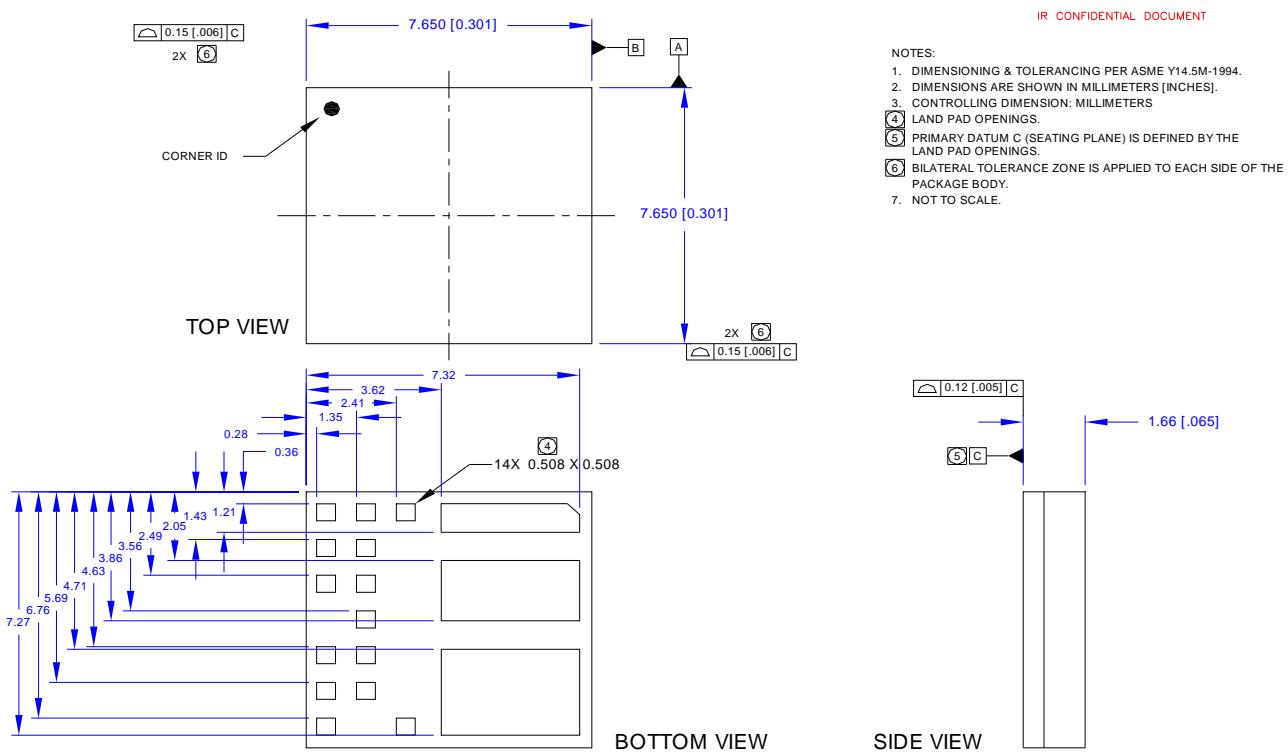
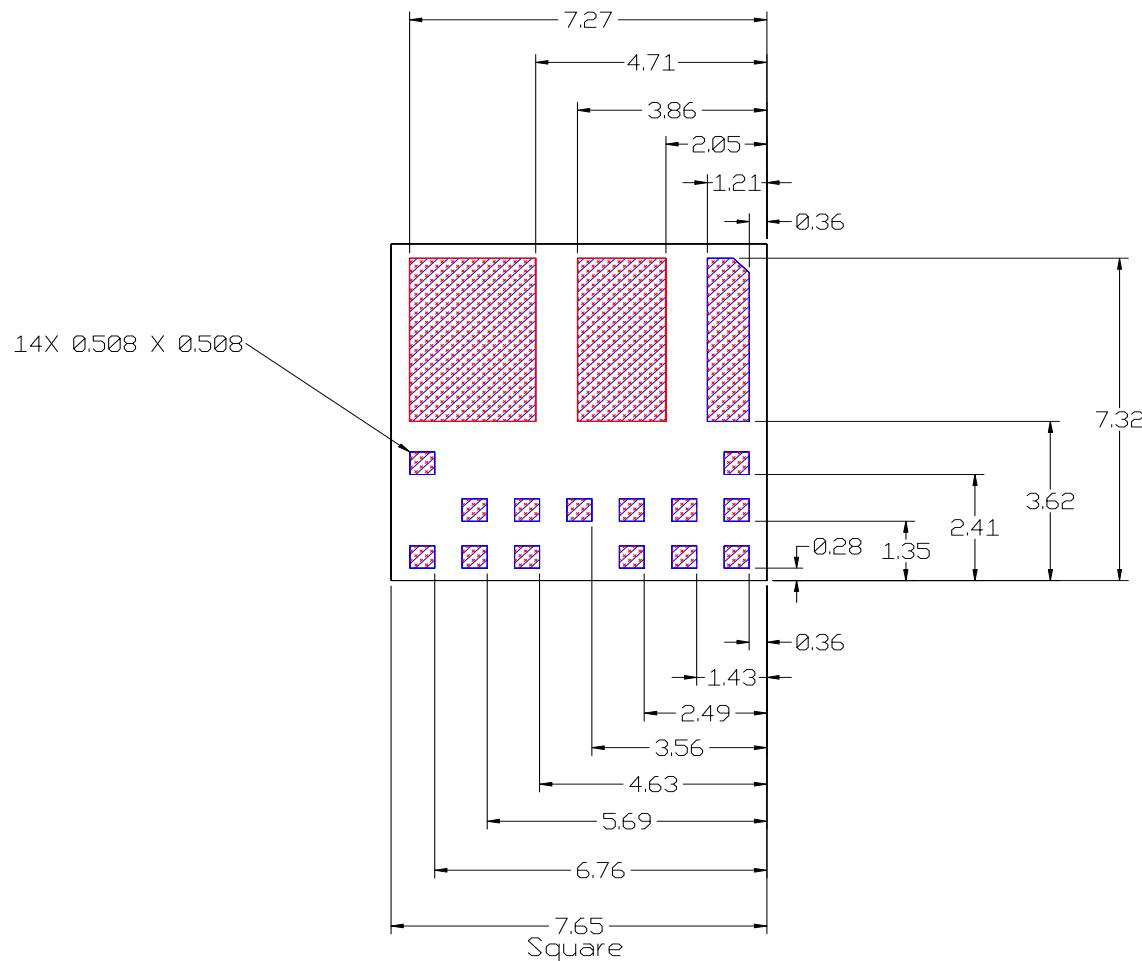


Fig. 13. Mechanical Outline Drawing



All dimensions in mm

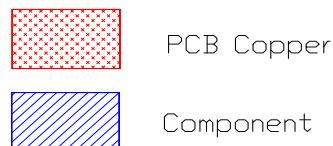
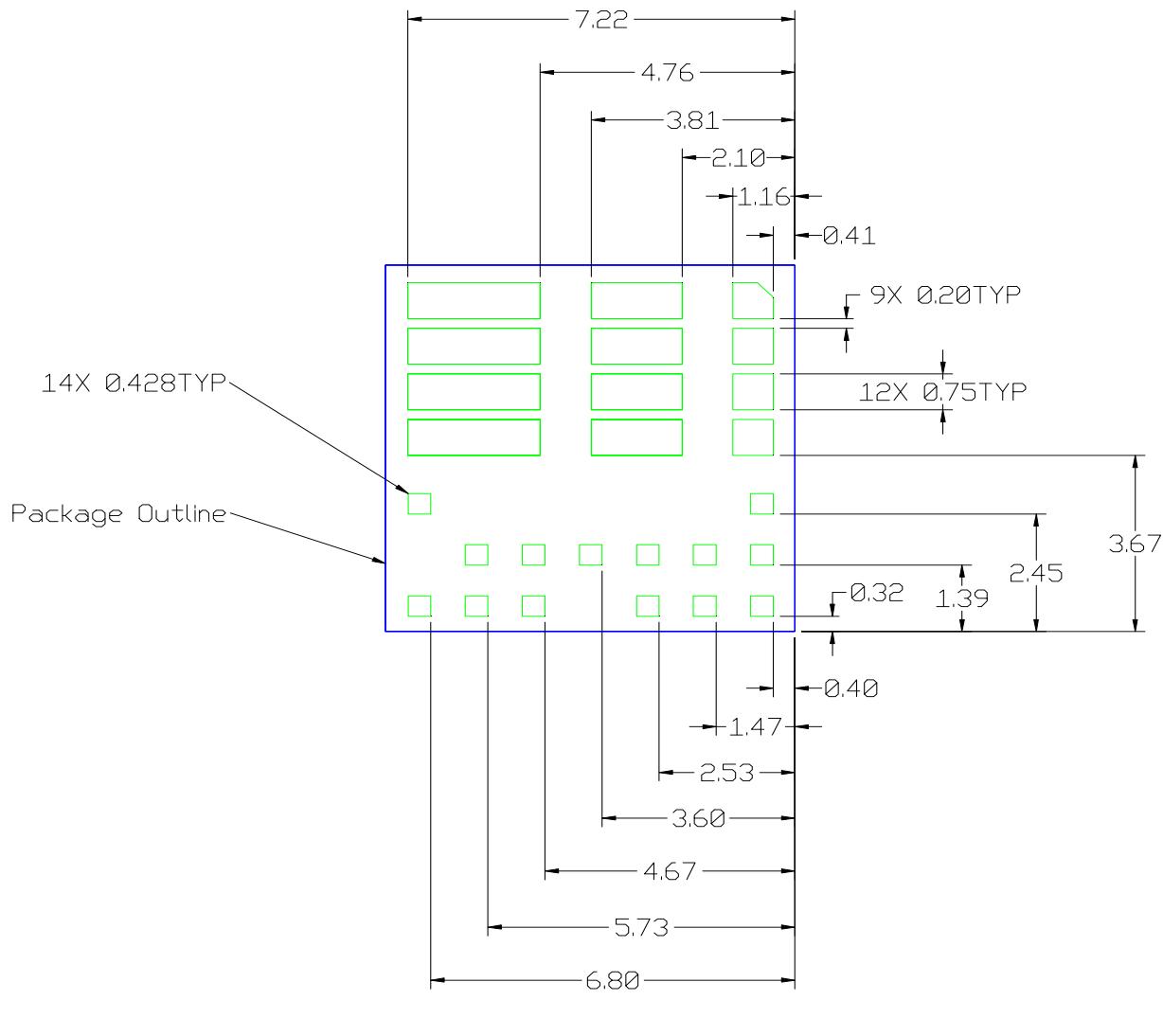


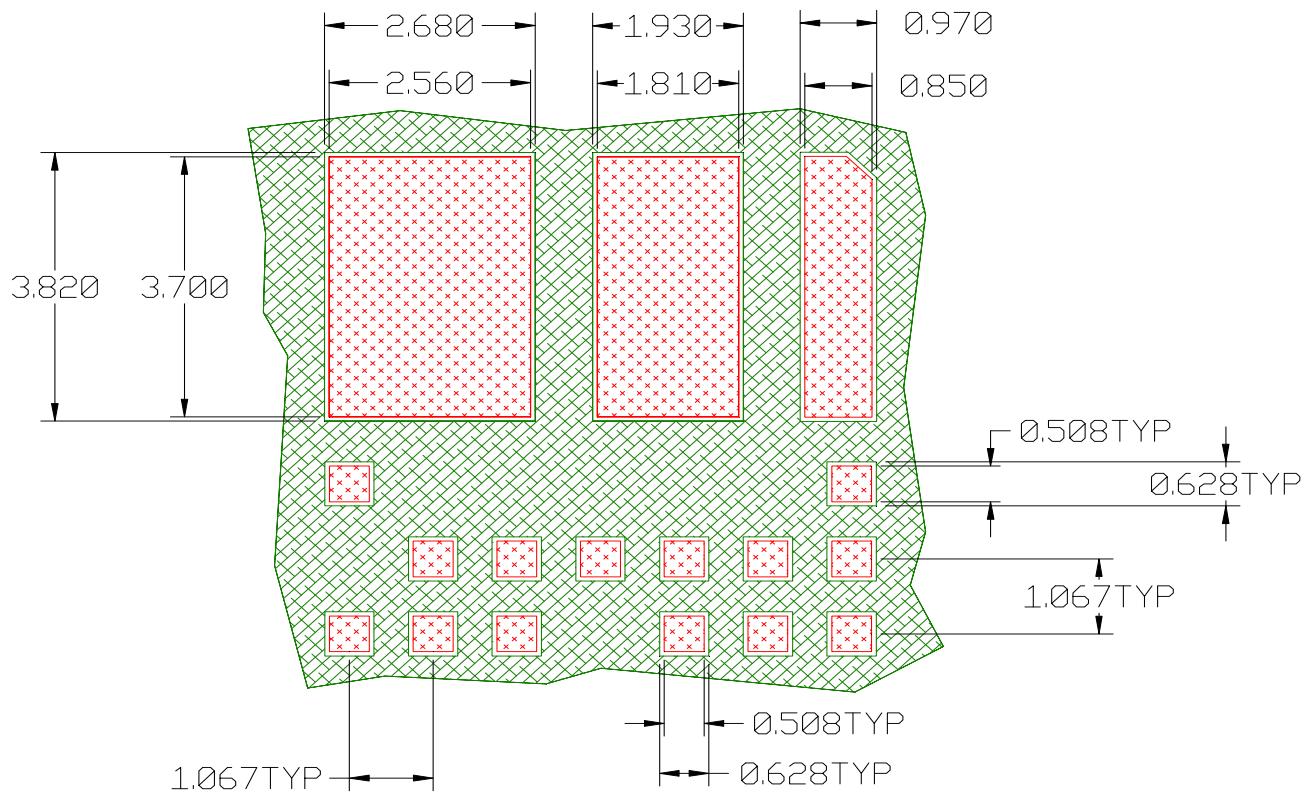
Fig. 14. PCB Metal and Components Placement



Stencil Aperture

All dimensions in mm

Fig. 15. Stencil Design



All dimensions in mm

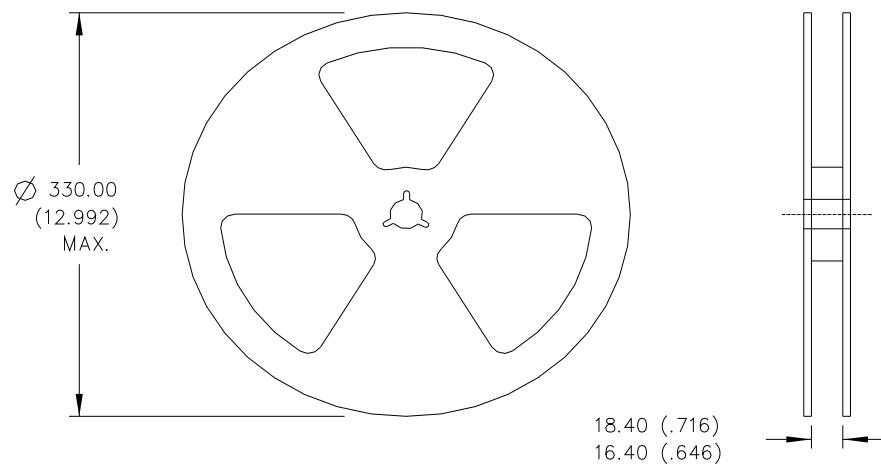
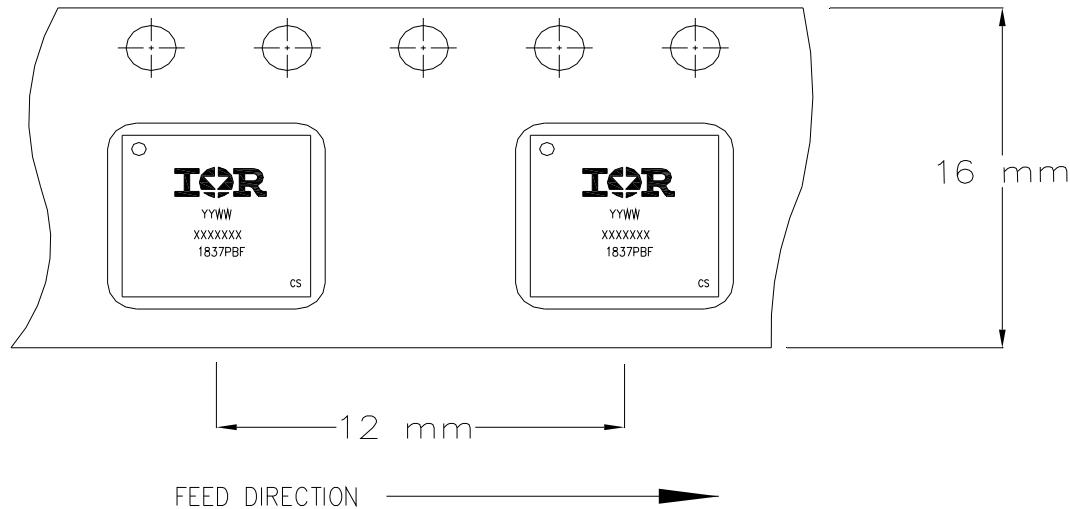


PCB Copper



PCB Solder Resist

Fig. 16. Solder Resist



NOTES:

1. CONTROLLING DIMENSION: MILLIMETER.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
3. OUTLINE CONFORMS TO EIA-481 & EIA-541.

Fig. 17. Tape and Reel Information

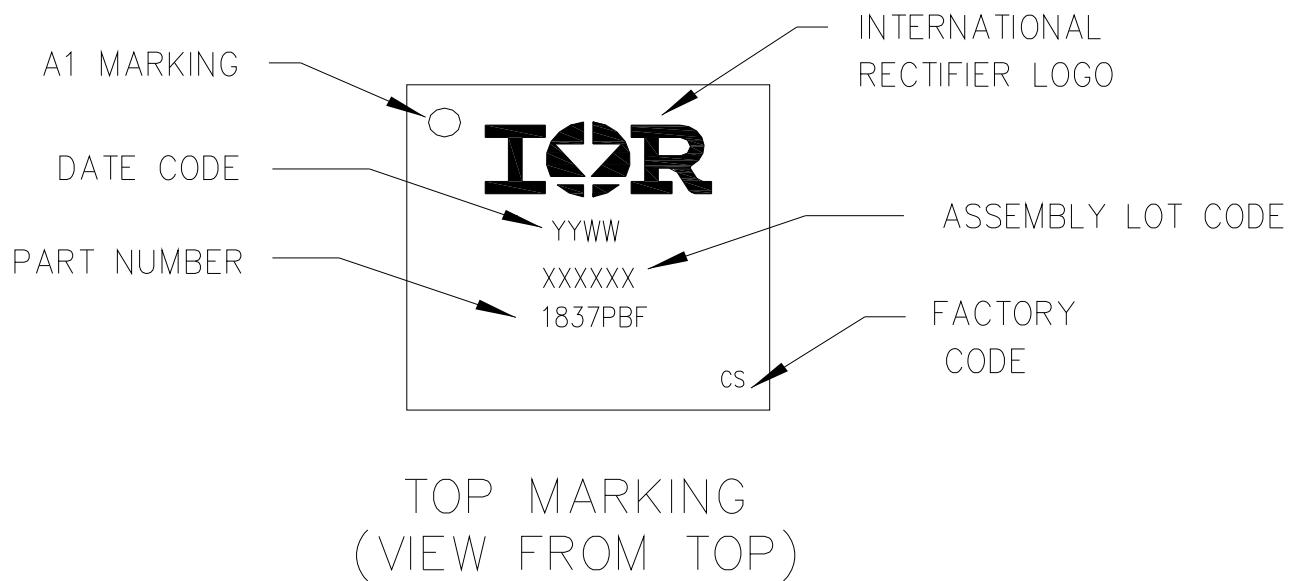


Fig. 18. Part Marking

International
IR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903

This product has been designed and qualified for the Consumer market
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