MTH100

- Designed for Extended Hold-Up Applications
- 80% Less Hold Up Capacitance Required
- High Energy Density
- High Efficiency
- User Programmable
- Reduces System Size and Weight
- 10 A Output Current
- Wide Input Range
- 3 Year Warranty

The MTH100 is a COTS hold-up module developed specifically for the defense and avionics market. The product is designed to maintain electronic system operation during extended input bus drop-out scenarios. It reduces the capacitance needed by up to 80%, charging the hold-up capacitor to a high voltage (35 V or 45 V) and uses the additional stored energy to supply the system.

Input Characteristics

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Input Voltage	10.00	28.00	40.00	VDC	
Transient Input Range			50.00	V	For 1 s
Input Current			10.05	A	At full load (10 A)
Additional Input Charging Current		1.50	2.50	A	At 10 VDC input, during hold up capacitor charging
No Load Current			50.00	mA	
Power Fail Voltage Threshold (DCFP)	10.00			V	Vfail set by resistor R1, see page 5
Reverse Voltage Protection					Required and to be provided, see page 5
Fuse Protection					External fuse required for overload protection

Output Characteristics

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Output Current			10	A	
Output Power			100	W	
Voltage Drop			130	mV	At 10 A
Output Voltage	Vin - 0.13			V	At 10 A load
Changeover Capacitor	150		470	µF	±20%, see page 5
Hold Up Time					See page 5

Charger Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Hold Up Capacitor (C1)	1000			uF	See page 5
Hold Up Capacitor Charge Time				s	See page 5
Set Accuracy		2		%	
Charger Output Voltage (VCap)	35 45		36.4 46.8	V	CVP not connected CVP connected
Ripple and Noise			1	% pk-pk	Of charger output @ 20 MHz
Overvoltage Protection	48	49	50	V	
Overload Protection					No damage for overload or short circuit. If Vout <30 V after 10 s the charger will shut down and restart after a further 10 s
Overtemperature Protection	102		107	ºC	With 5 ºC typical hysteresis
Charge/Discharge Detect Signal (CDD)	Open collector output, 100 V, 100 mA max, Low at 90% Vcap, High at 30% Vcap, Tolerance ±3%				
Power Fail Detect (DCFD)	Open collector output, 100 V, 100 mA max, Low at Vin >Vfail, High at Vin <Vfail, Tolerance ±3%				

General Specification

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficicency	98			%	At 28 VDC input and max power
Series Resistance			0.013	Ω	
Isolation	1000 1000			VDC	Input to Case Output to Case
Switiching Frequency		400		kHZ	

Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating Temperature	-40		+100	ºC	Case
Extended Temperature	-55			ºC	Start up with -LT screen option
Storage Temperature	-50		125	ºC	Excluding Packaging
Operating Altitude	70,000 feet (21336 m)				
Shock	100g MIL-STD 810D Method 516.3				
Bump	2000 bumps in each axes at 40g, MIL-STD-810D, Method 516.3				
Vibration	10 to 2000 Hz MIL-STD 810D, Method 514.3				
Salt Atmosphere	48 hours duration MIL-STD 810E, Method 509.1				

EMC

Standard	Category
Conducted Emissions	EN55022 Conducted Level B, MIL-STD-461E/F CE101, CE102
Immunity	MIL-STD 1275 A-D
Conducted Susceptibility	MIL-STD-461E CS101, CS114, CS115, CS116

EMC standards are met when use in conjunction with the MTF or DSF filter modules or other external components.

Models & Ratings

Output Voltage	Input Voltage	Efficiency	Model Number
Vin - (Iout x 0.013)[1]	10 - 40 VDC	98 %	MTH100
Vcap - 0.8 V[2]			

1. During normal operation.
2. During hold-up time.
3. For -55 ºC extended operating range add suffix '-LT' to the part number

MTBF Calculations

Temperature / Environment	Ground Mobile - GM	Airbourne Inhabited Cargo - AIC	Airbourne Inhabited Fighter - AIF
20 ºC	1560851 Hrs	1179429 Hrs	553496 Hrs
40 ºC	1048943 Hrs	795673 Hrs	373869 Hrs
60 ºC	730034 Hrs	557914 Hrs	263091 Hrs
80 ºC	520067 Hrs	402490 Hrs	191184 Hrs
100 ºC	374123 Hrs	295449 Hrs	142217 Hrs

Block Diagram

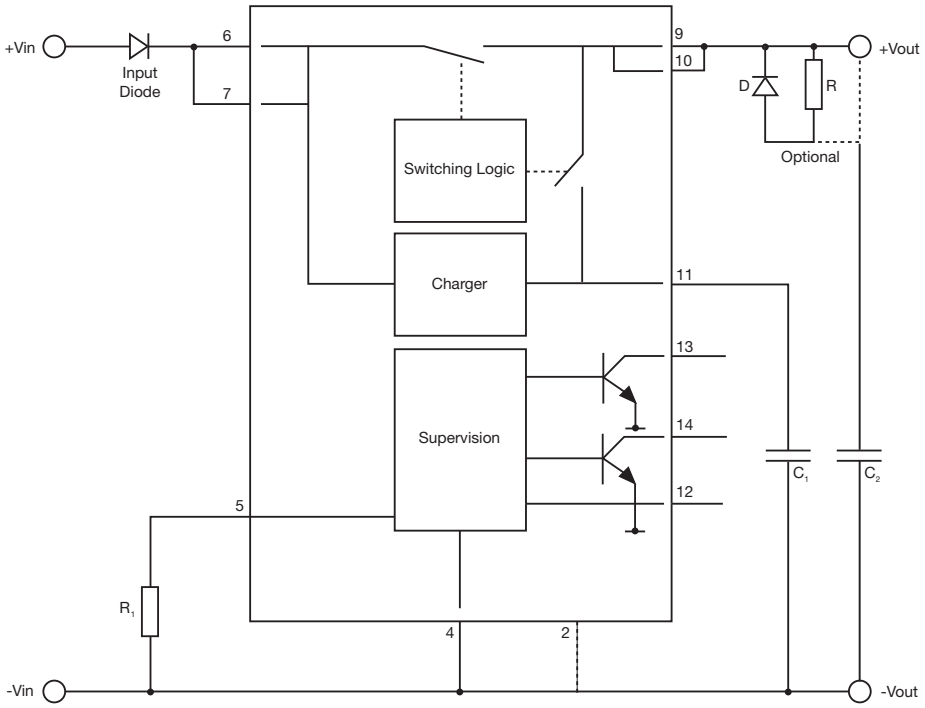


Figure 1 - Block diagram

The MTH100 module includes three main circuits:

Switching Logic This circuit monitors the input bus voltage and compares it to the power fail threshold voltage Vfail (set externally). When the input exceeds the fail threshold the charger and hold up switch are enabled.

Charger The charger is used to charge the hold up capacitor to 35 V or 45 V depending on the setting of the CVP pin 12.

Supervision Circuit The supervision circuit monitors the charging status of the hold up capacitor. It also generates two isolated flags: input DC fail detect (DCFD) and the charge/discharge detect (CDD). These signals are used at the system level for management of power interruption.

EMC Conducted Emissions

Test conditions: Vin = 28 V, 22 Ω output load, Vcap = 45 V, 1 kΩ load on the charger; using MTF50 with 1 µF on input.

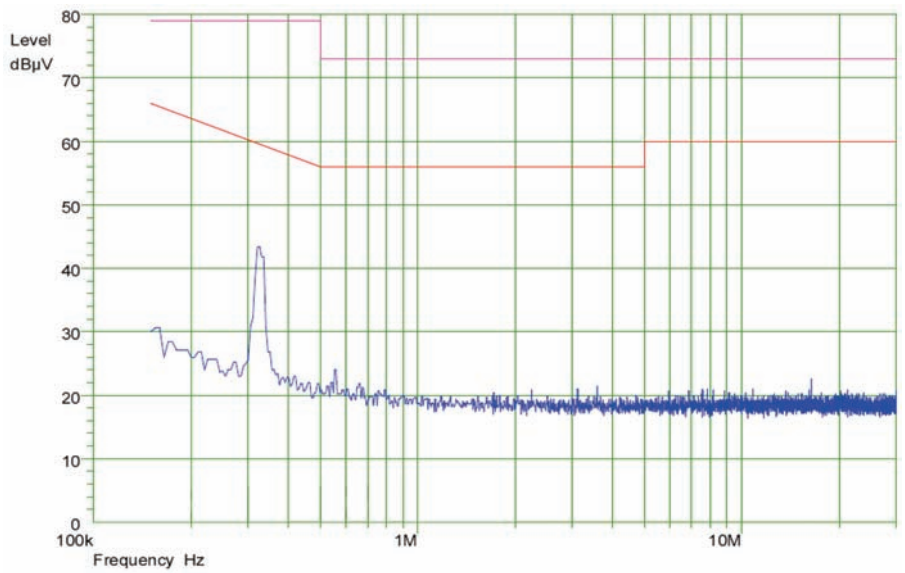


Figure 2 - Conducted emissions

Application Notes

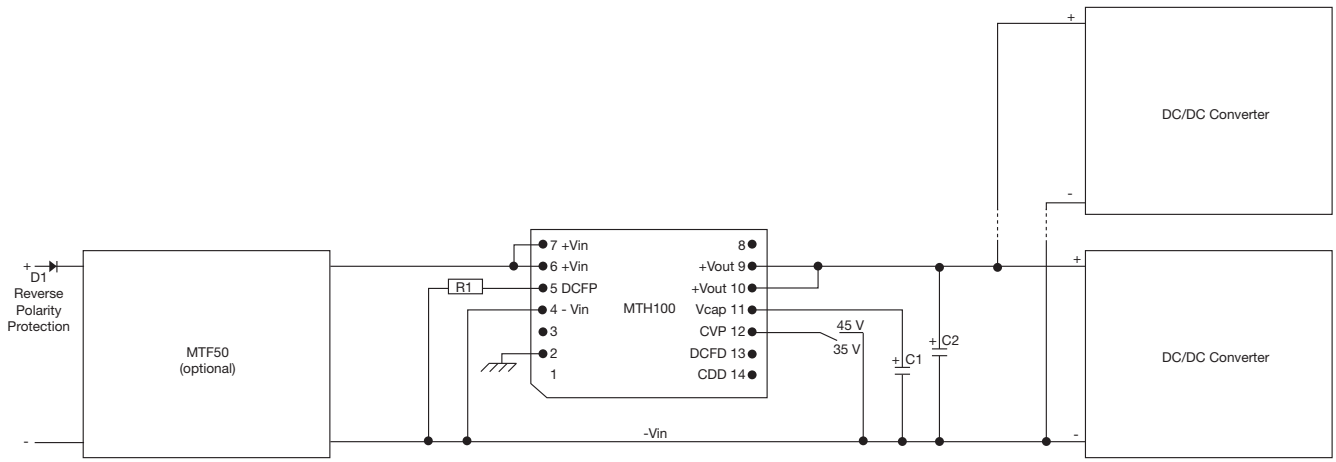


Figure 3 - Connection diagram

$$R1 = \left(\frac{40.67}{V_{fail} - 9.785} - 3.92\right) \times 10^3$$

$$C1 = \left(\frac{2 \times P_{out} \times {}^{t}\text{hold-up}}{V_{cap}^2 - V_{min}^2}\right) \times 1.1$$

$$C2 = \frac{P_{out} \times 400 \times 10^{-6}}{V_{fail}^2 - V_{min}^2}$$

R1:	Resistor setting the input voltage fail threshold (DCFP)
V_{fail}:	Required fail voltage
C1:	Hold up capacitor (minimum value including tolerance)
^{t} hold up:	Hold up time required
V_{cap}:	C1 charge voltage
V_{min}:	Minimum DC/DC input voltage (≥10 VDC)
P_{out}:	Output power from MTH100
C2:	Changeover capacitor

Maximum charge time at Vin = 10 V			
C1 (µF)	Vcap (V)	Time (s)	
		Typical	Max
10,000	45	1.2	1.5
10,000	35	0.8	1.0
30,000	45	3.4	4.0
30,000	35	2.0	2.4
50,000	45	5.5	6.0
50,000	35	3.2	3.8

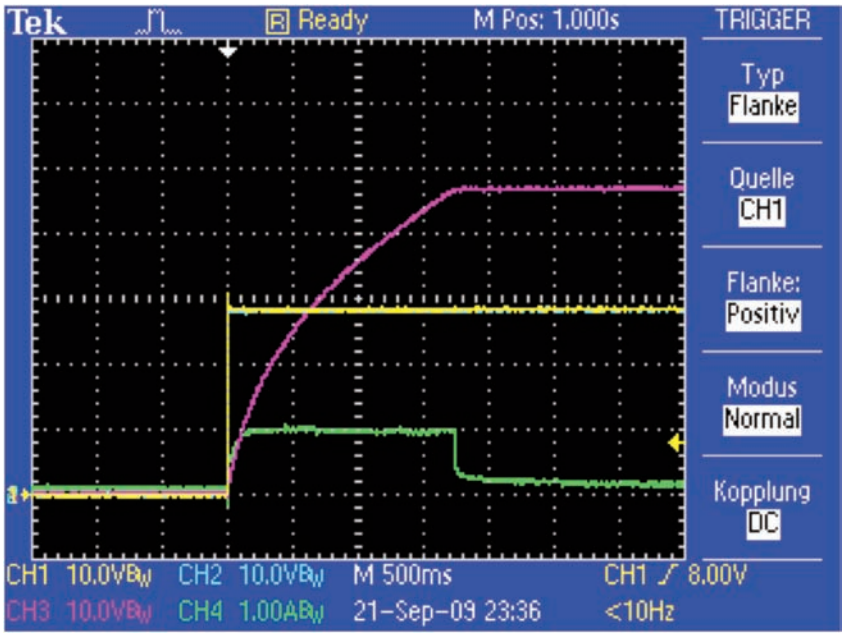
Notes

1. C1 has a minimum value of 1000 µF, this enables an open circuit or missing component to be detected. There is no maximum limit other than extended charge time.
2. MTH100 charges the Hold-up capacitor C1 to 45V max when charge voltage programming (CVP) pin is connected or 35V when not connected. Charging starts when the input voltage reaches the power fail voltage threshold.
3. Input DC fail programming (DCFP) sets the power fail voltage threshold using resistor R1. See formula for the value required.
4. Input DC fail detect (DCFD) is an open collector circuit which changes state when the input voltage fails below the set threshold.
5. Charge/discharge detect (CDD) is an open collector circuit which goes low when C1 is charged to 90% of Vcap or high when C1 discharges down to 30% of Vcap.
6. DCFD & CDD may be pulled up to +Vout with a suitable pull up resistor to create a signal referenced to the input or may be used to drive an opto-coupler diode with a suitable current limiting resistor where the signal is required to be referenced to the output.

Charge Time

Example:

C1 = 30 mF
C2 = 150 µs
Vcap = 45 V
CVP = Low
DCFP = 10 V
t_{charge} = 1.7 s

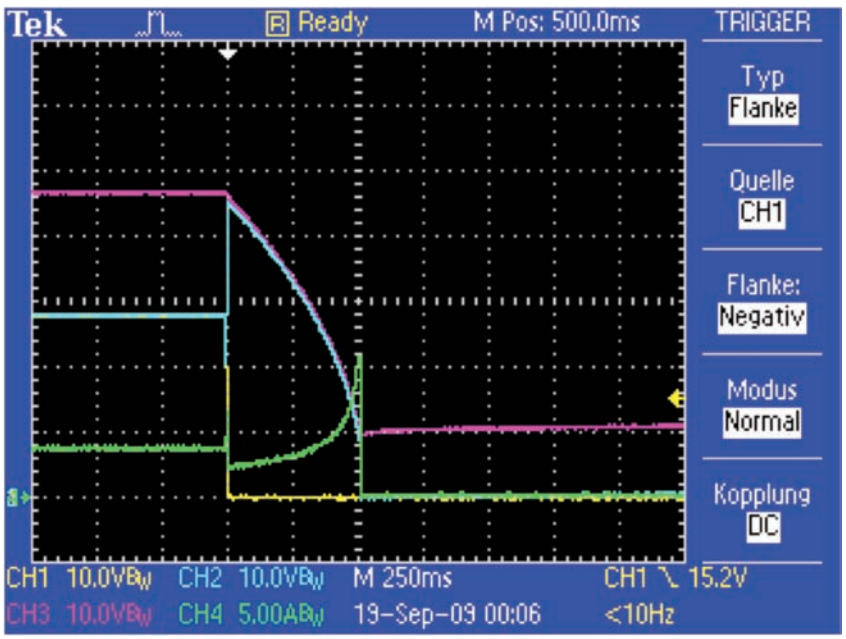


CH1 Vin	
CH3 Vcap	CH4 Iin 1A / div (input current)

Hold Up Time

Example:

C1 = 50 mF
C2 = 150 µF
Constant Power Load = 10.5 A
Vcap = 45 V
CVP = Low
DCFP = 15 V
$t_{hold\ up}$ = 500 ms



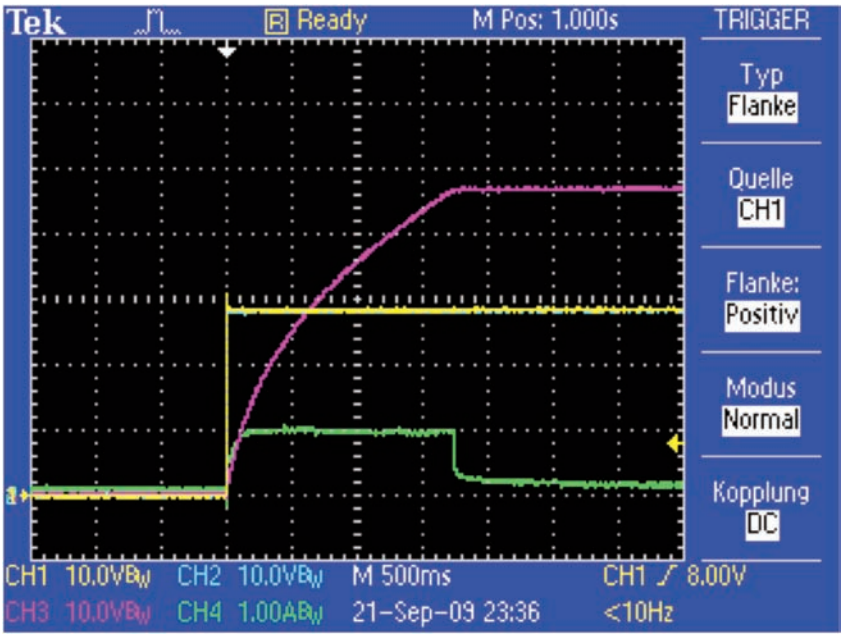
CH1 Vin	CH2 Vout
CH3 Vcap	CH4 Iout

Digital Outputs (DCFD, CDD)

Digital outputs at rising Vin and Vcap

Example:

C1	=	30 mF
Constant Power Load	=	10.5 A
Vcap	=	45 V
DCFP	=	10 V

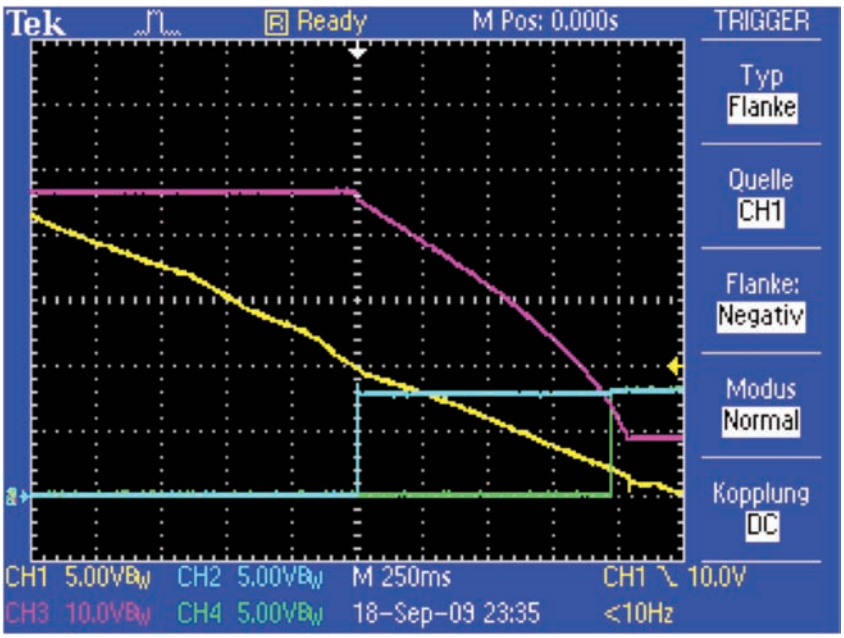


CH1 Vin	DCFD
CH3 Vcap	CDD

Digital outputs at falling Vin and Vcap

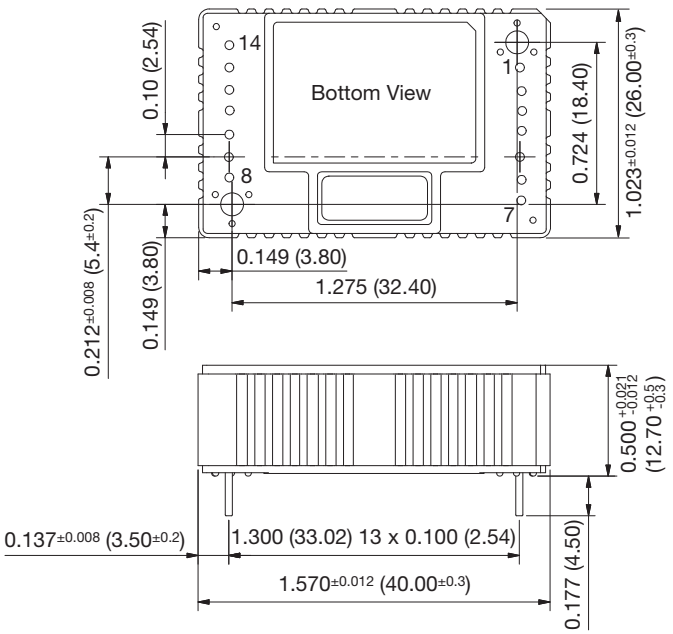
Example:

C1	=	30 mF
Constant Power Load	=	10.5 A
Vcap	=	45 V
DCFP	=	10 V



CH1 Vin	DCFD
CH3 Vcap	CDD

Mechanical Details



Pin	Function	Pin	Function
1	Not fitted	8	Not fitted
2	Case	9	+Vout
3	Not fitted	10	+Vout
4	-Vin	11	Hold-up capacitor voltage, Vcap
5	Input DC fail programming (DCFP)	12	Charge voltage programming (CVP)
6	+Vin	13	Input DC fail detect (DCFD)
7	+Vin	14	Charge/discharge detect (CDD)

Notes

1. Dimensions are in inches (mm)
2. Tolerance: ±0.02 (±0.5)
3. Weight: 0.06 lb (25 g)
4. Materials & Finish:
   Pin - Diameter: 0.032 (0.8), Material: Cu Zn30 2.5 µm Ni
   Finish: 0.2-0.5 µm AU (HV 170-200)
   Mounting Hole - Diameter: 0.102 (2.6)
   Case - Material: Aluminium (Al Mg Si 0.5), Finish: Chromated
   Nameplate - Non-conductive plastic

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