



MFW02 Series

DC-DC CONVERTER 2W, Regulated Output, DIP Package

Features

- ▶ Smallest Encapsulated 2W Converter
- ▶ Ultra-compact DIP-8 Package
- ▶ Wide 2:1 Input Voltage Range
- ▶ Fully Regulated Output Voltage
- ▶ I/O Isolation 1500 VDC
- ▶ Operating Ambient Temp. Range -40°C to +80°C
- ▶ No Min. Load Requirement
- ▶ Under-voltage, Overload and Short Circuit Protection
- ▶ UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking

Electric Characteristic Note



Applications

- ▶ Distributed power architectures
- ▶ Workstations
- ▶ Computer equipment
- ▶ Communications equipment

Product Overview

The MINMAX MFW02 series is the latest generation of high performance DC-DC converter modules setting a new standard concerning power density. The product offers a full 2W isolated DC-DC converter within an encapsulated DIP-8 package which occupies only 0.3 in² of PCB space. There are 28 models available for 5, 12, 24, 48VDC input with wide 2:1 input voltage range. Further features include under-voltage protection, overload protection, short circuit protection and no min. load requirement as well. An high efficiency allows operating temperatures range of -40°C to +80°C.

These DC-DC converters offer an economical solution for many cost critical applications in battery-powered equipment, instrumentation, distributed power architectures in communication, industrial electronics, energy facilities and many other critical applications where PCB space is limited.

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Model Selection Guide							
Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Max. capacitive Load	Efficiency (typ.)
				@Max. Load	@No Load		@Max. Load
	VDC	VDC	mA	mA(typ.)	mA(typ.)	μF	%
MFW02-05S033	5 (4.5 ~ 10)	3.3	400	334	40	100	79
MFW02-05S05		5	400	494			81
MFW02-05S12		12	167	472			85
MFW02-05S15		15	134	462			87
MFW02-05D05		±5	±200	482		100#	83
MFW02-05D12		±12	±83	469			85
MFW02-05D15		±15	±67	473			85
MFW02-12S033		12 (9 ~ 18)	3.3	400			138
MFW02-12S05	5		400	201	83		
MFW02-12S12	12		167	192	87		
MFW02-12S15	15		134	193	87		
MFW02-12D05	±5		±200	198	100#	84	
MFW02-12D12	±12		±83	193		86	
MFW02-12D15	±15		±67	195		86	
MFW02-24S033	24 (18 ~ 36)		3.3	400		70	15
MFW02-24S05		5	400	99	84		
MFW02-24S12		12	167	97	86		
MFW02-24S15		15	134	96	87		
MFW02-24D05		±5	±200	99	100#	84	
MFW02-24D12		±12	±83	97		86	
MFW02-24D15		±15	±67	97		86	
MFW02-48S033		48 (36 ~ 75)	3.3	400		35	
MFW02-48S05	5		400	50	83		
MFW02-48S12	12		167	49	85		
MFW02-48S15	15		134	49	86		
MFW02-48D05	±5		±200	51	100#	82	
MFW02-48D12	±12		±83	49		84	
MFW02-48D15	±15		±67	50		84	

For each output

Input Specifications					
Parameter	Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (1 sec. max.)	5V Input Models	-0.7	---	12	VDC
	12V Input Models	-0.7	---	25	
	24V Input Models	-0.7	---	50	
	48V Input Models	-0.7	---	100	
Start-Up Threshold Voltage	5V Input Models	---	---	4.5	VDC
	12V Input Models	---	---	9	
	24V Input Models	---	---	18	
	48V Input Models	---	---	36	
Short Circuit Input Power	All Models	---	---	0.5	W
Input Filter	Internal Capacitor				

Output Specifications					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	---	±1.5	%Vnom.
Output Voltage Balance	Dual Output, Balanced Loads	---	---	±2.0	%
Line Regulation	Vin=Min. to Max. @Full Load	---	---	±0.2	%
Load Regulation	Io=0% to 100%	---	---	±1.0	%
Cross Regulation (Dual)	Asymmetrical load 25% / 100% FL	---	---	±5.0	%
Minimum Load	No minimum Load Requirement				
Ripple & Noise	0-20 MHz Bandwidth	---	70	---	mV _{P-P}
Transient Recovery Time	25% Load Step Change	---	250	500	µsec
Transient Response Deviation		---	±3	±5	%
Temperature Coefficient		---	±0.01	±0.02	%/°C
Over Load Protection	Foldback	---	180	---	%
Short Circuit Protection	Continuous, Automatic Recovery				

General Specifications					
Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	1500	---	---	VDC
	1 Seconds	1800	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100kHz, 1V	---	100	---	pF
Switching Frequency		100	---	---	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	4,226,000	---	---	Hours
Safety Approvals	UL/cUL 60950-1 recognition(UL certificate), IEC/EN 60950-1(CB-report)				
	UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1(CB-report)				

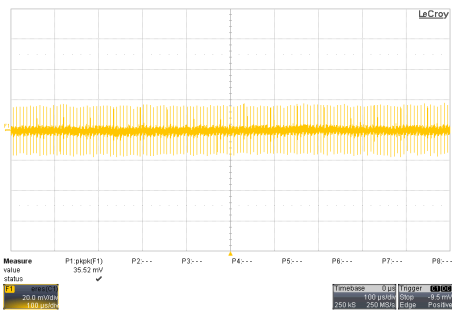
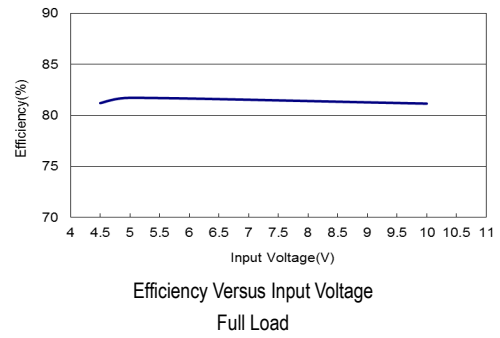
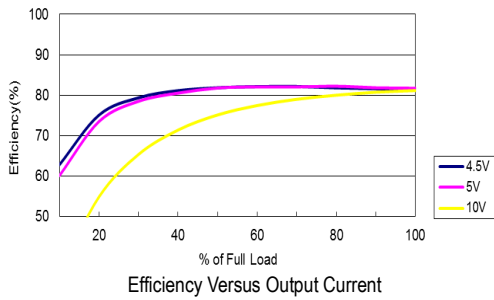
EMC Specifications				
Parameter	Standards & Level			Performance
EMI	Conduction	EN 55032	With external components	Class A, B ₍₅₎
	Radiation			
EMS	EN 55024			
	ESD	EN 61000-4-2 Air ± 8kV , Contact ± 6kV		A
	Radiated immunity	EN 61000-4-3 10V/m		A
	Fast transient (4)	EN 61000-4-4 ±2kV		A
	Surge (4)	EN 61000-4-5 ±1kV		A
	Conducted immunity	EN 61000-4-6 10Vrms		A
	PFMF	EN 61000-4-8 3A/M		A

Environmental Specifications				
Parameter	Min.	Max.	Unit	
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+80	°C	
Case Temperature	---	+95	°C	
Storage Temperature Range	-50	+125	°C	
Humidity (non condensing)	---	95	% rel. H	
Lead Temperature (1.5mm from case for 10Sec.)	---	260	°C	

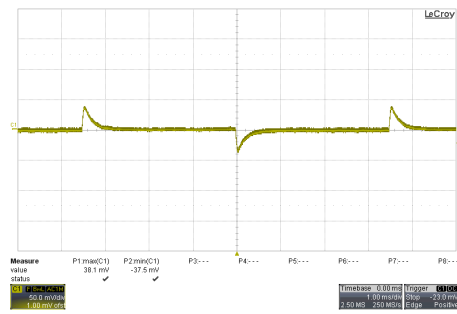
Notes	
1	Specifications typical at Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted.
2	We recommend to protect the converter by a slow blow fuse in the input supply line.
3	Other input and output voltage may be available, please contact MINMAX.
4	To meet EN 61000-4-4 & EN 61000-4-5 an external capacitor across the input pins is required, please contact MINMAX.
5	To meet EN 55032 Class A,B an external filter, please contact MINMAX.
6	Specifications are subject to change without notice.

Characteristic Curves

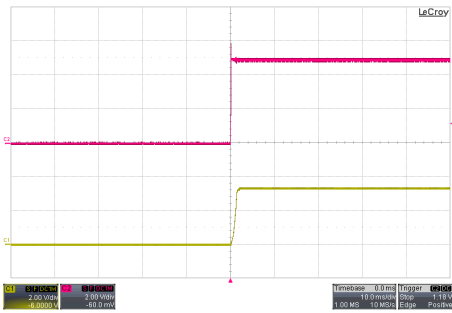
All test conditions are at 25°C. The figures are identical for MFW02-05S033



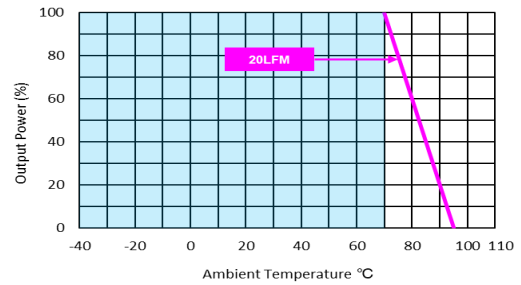
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load; $V_{in}=V_{in\ nom}$



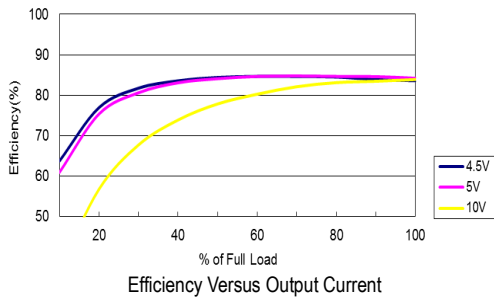
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



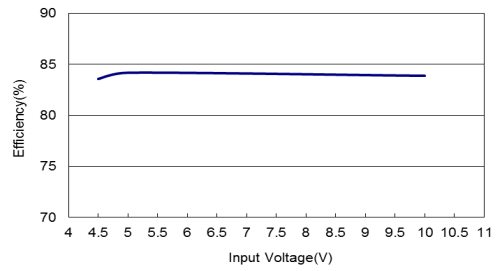
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

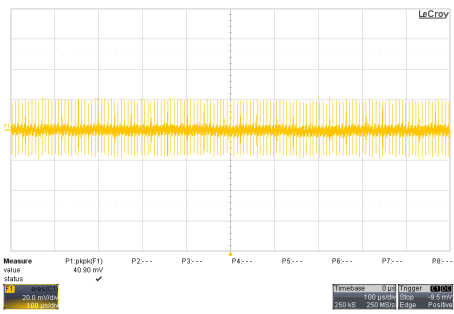
All test conditions are at 25°C The figures are identical for MFW02-05S05



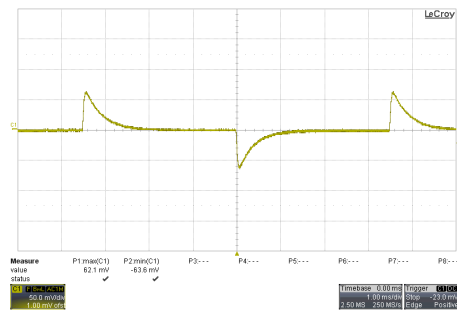
Efficiency Versus Output Current



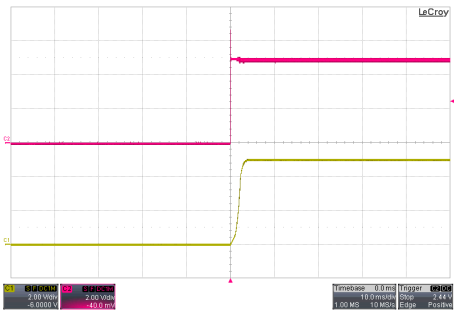
Efficiency Versus Input Voltage Full Load



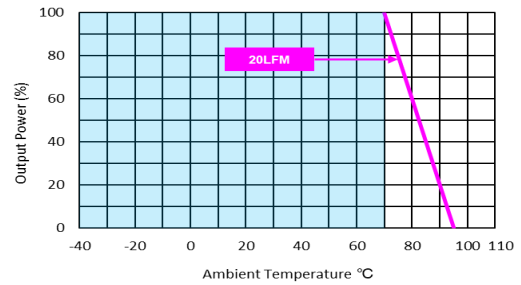
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



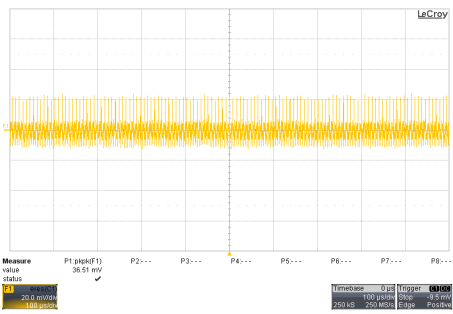
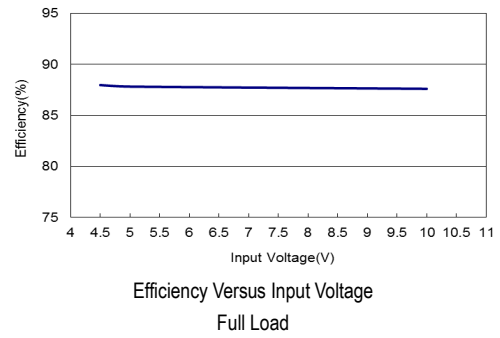
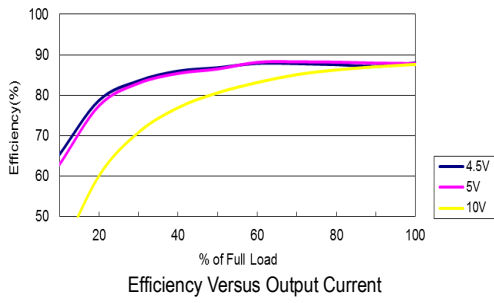
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



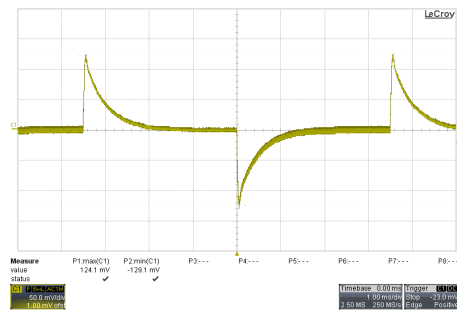
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

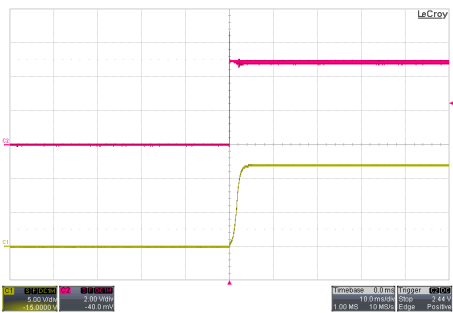
All test conditions are at 25°C The figures are identical for MFW02-05S12



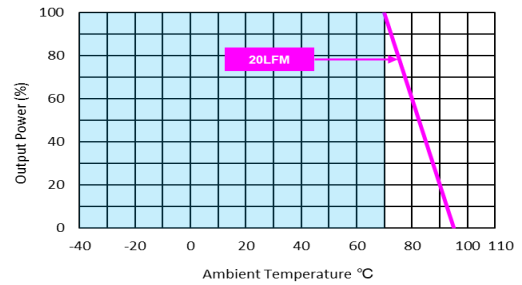
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



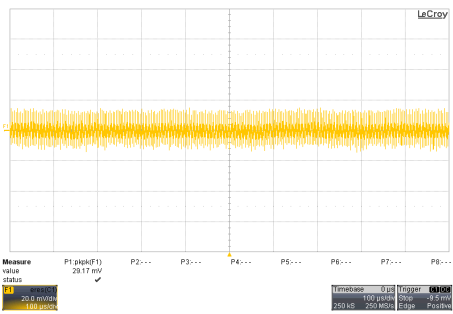
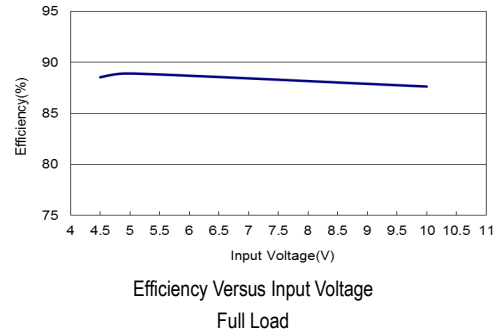
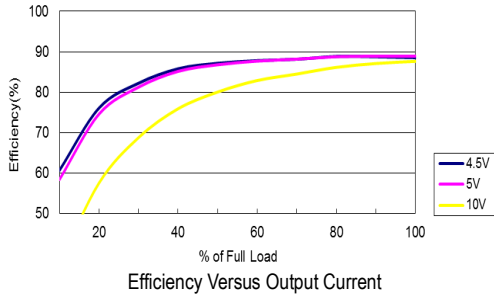
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



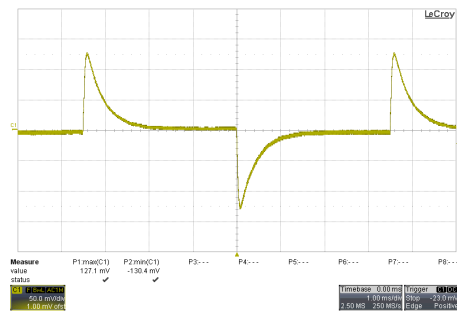
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

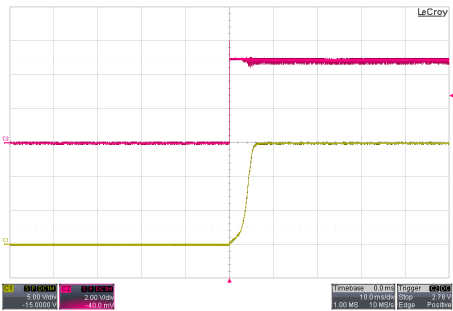
All test conditions are at 25°C. The figures are identical for MFW02-05S15



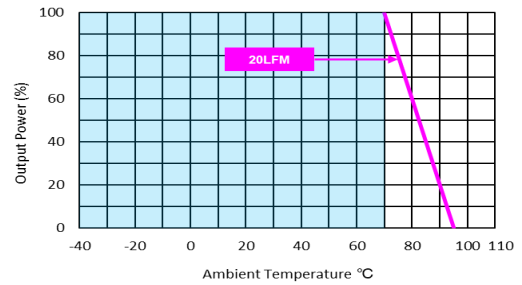
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



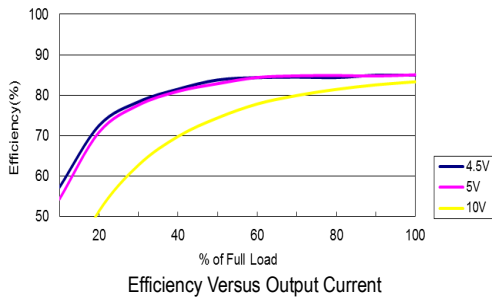
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



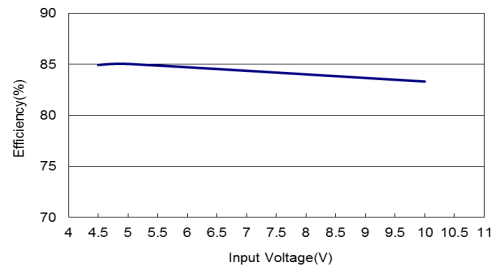
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

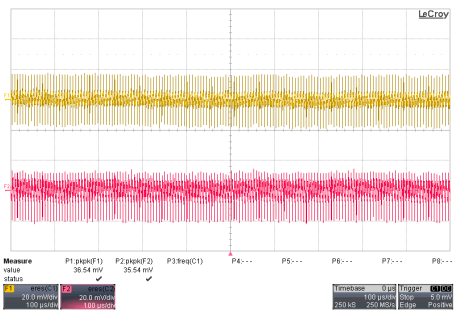
All test conditions are at 25°C The figures are identical for MFW02-05D05



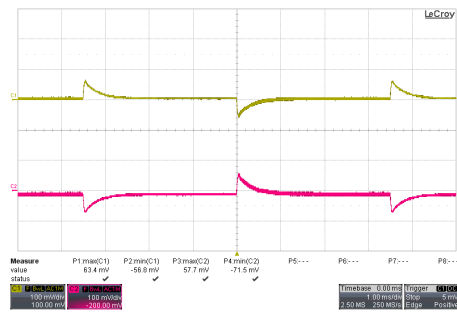
Efficiency Versus Output Current



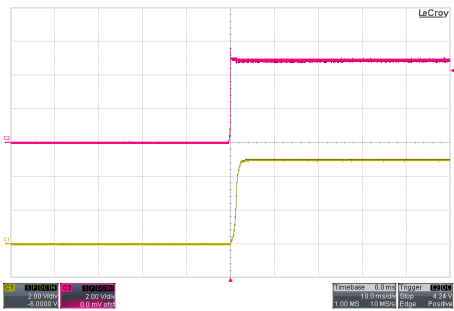
Efficiency Versus Input Voltage
Full Load



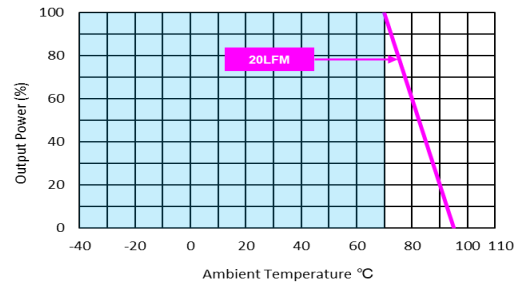
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



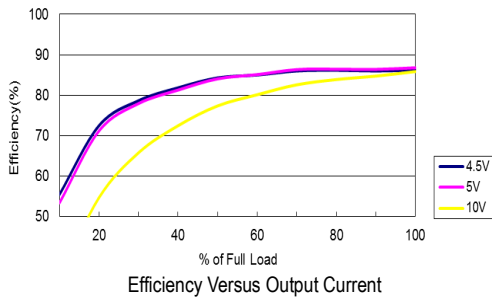
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



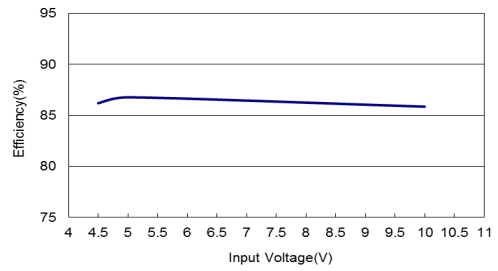
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

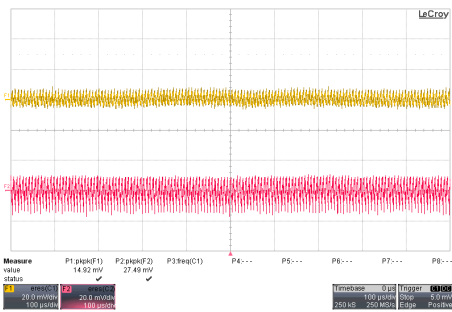
All test conditions are at 25°C The figures are identical for MFW02-05D12



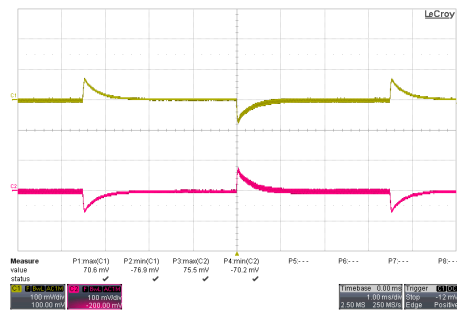
Efficiency Versus Output Current



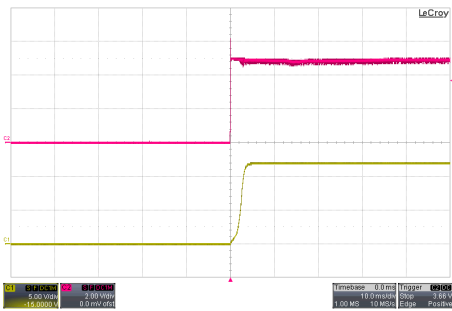
Efficiency Versus Input Voltage Full Load



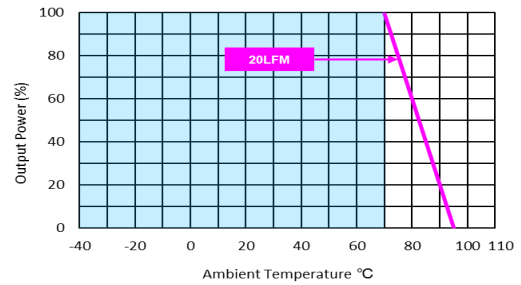
Typical Output Ripple and Noise $V_{in}=V_{in nom}$; Full Load



Transient Response to Dynamic Load Change from 100% to 75% of Full Load ; $V_{in}=V_{in nom}$



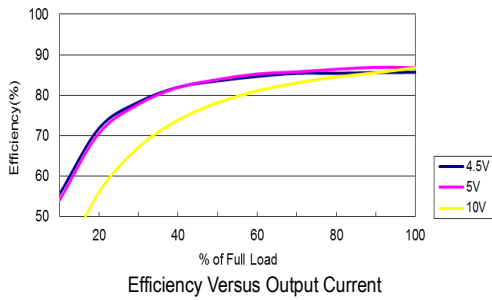
Typical Input Start-up and Output Rise Characteristic $V_{in}=V_{in nom}$; Full Load



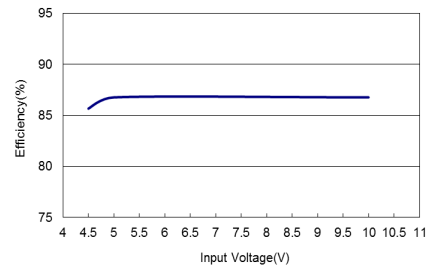
Derating Output Power Versus Ambient Temperature $V_{in}=V_{in nom}$

Characteristic Curves

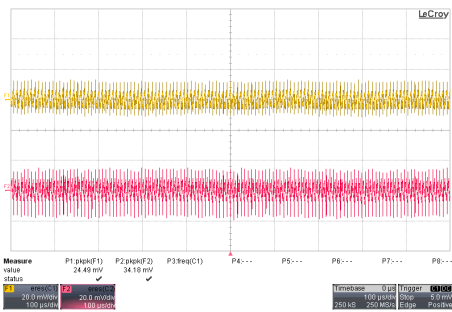
All test conditions are at 25°C The figures are identical for MFW02-05D15



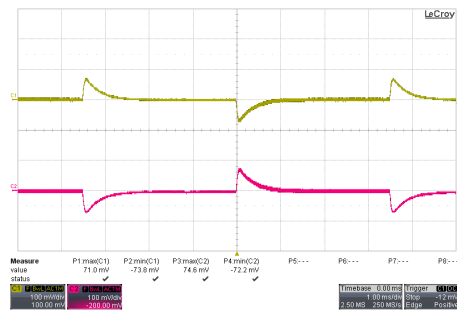
Efficiency Versus Output Current



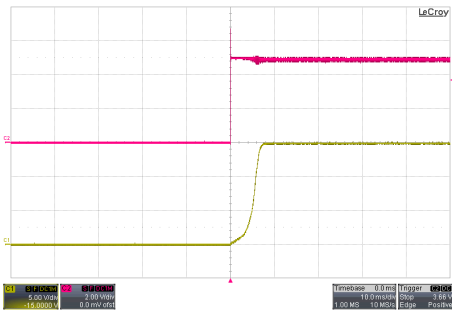
Efficiency Versus Input Voltage
Full Load



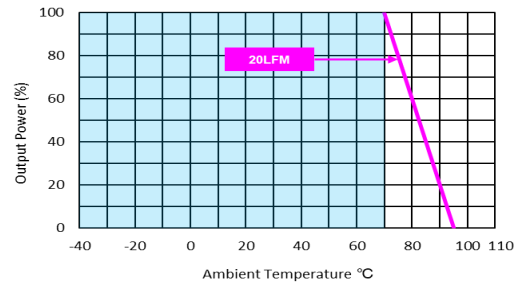
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



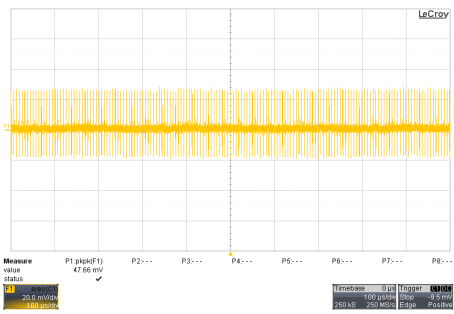
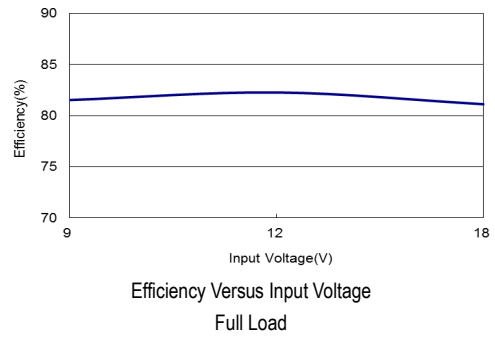
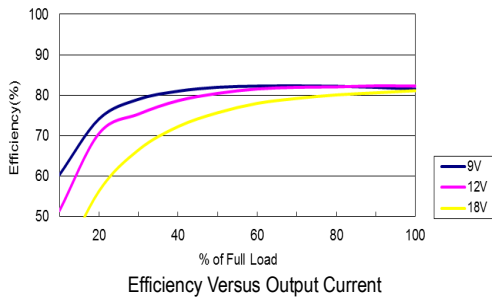
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



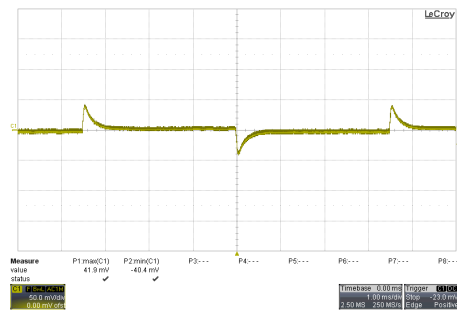
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

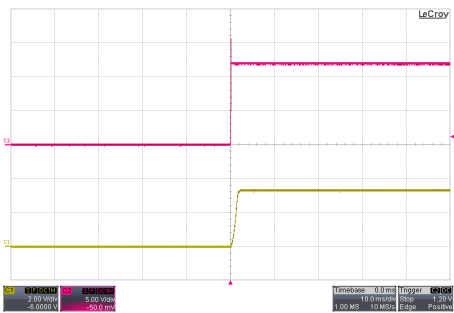
All test conditions are at 25°C The figures are identical for MFW02-12S033



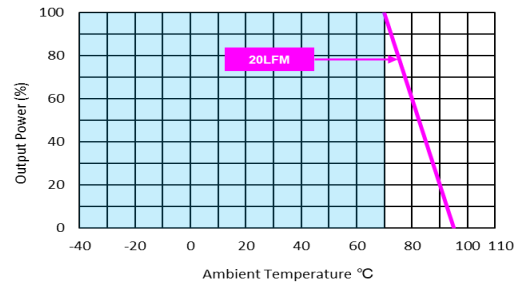
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



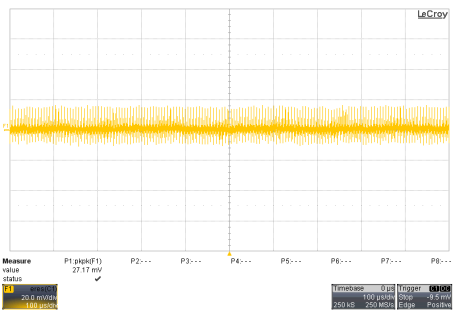
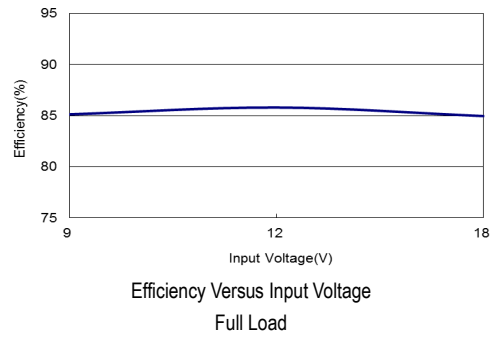
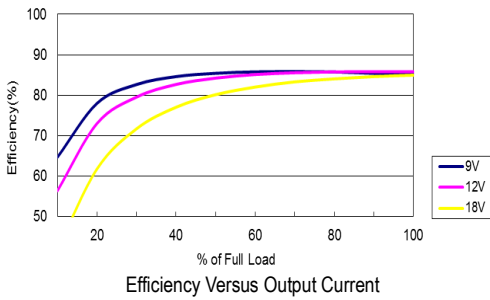
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



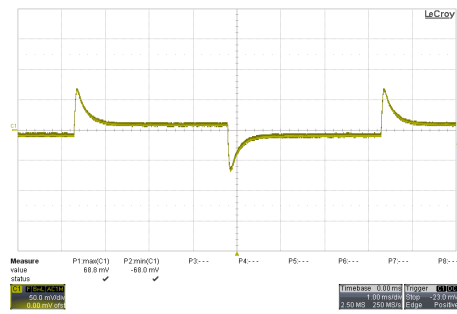
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

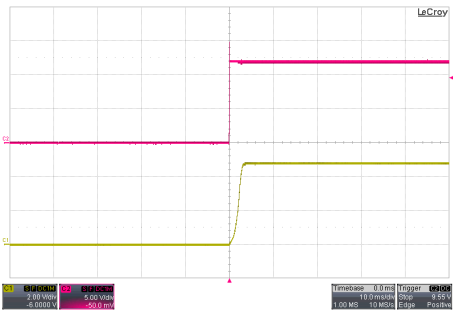
All test conditions are at 25°C The figures are identical for MFW02-12S05



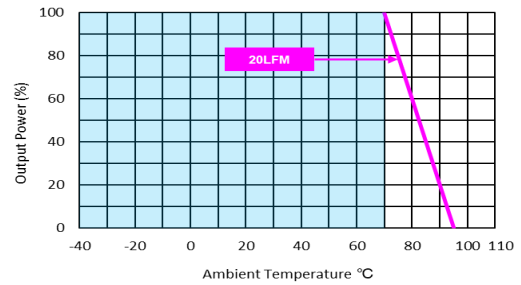
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



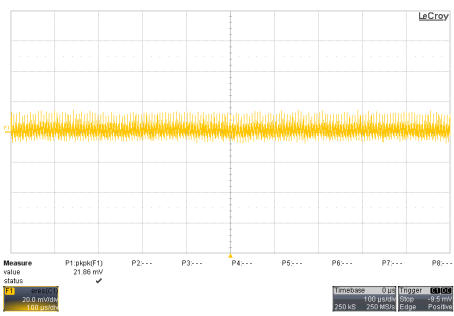
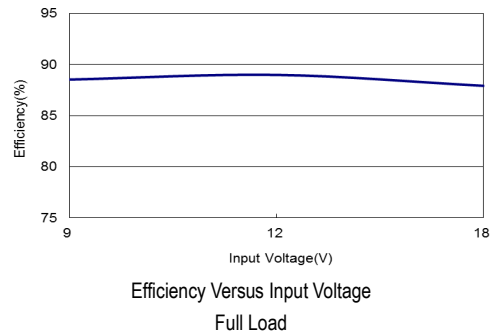
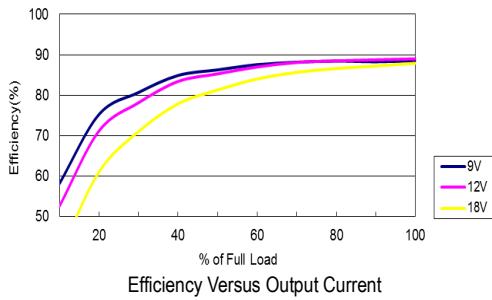
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



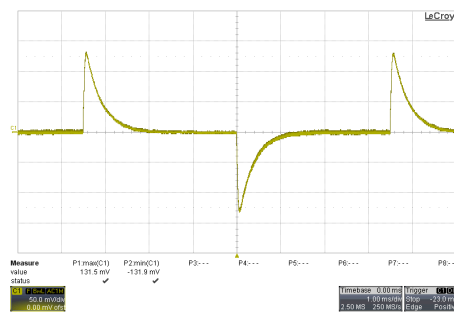
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

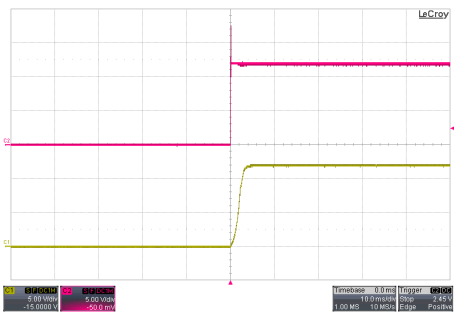
All test conditions are at 25°C The figures are identical for MFW02-12S12



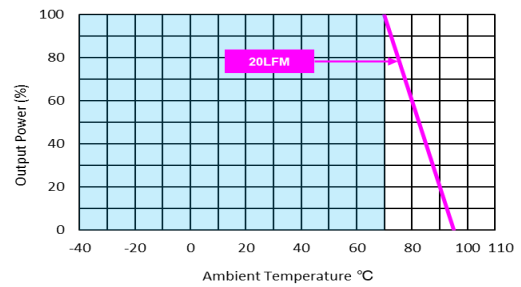
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



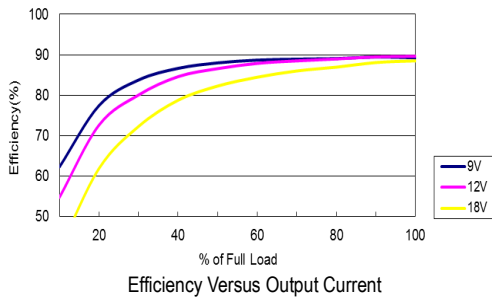
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



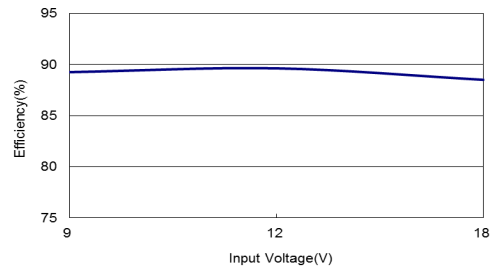
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

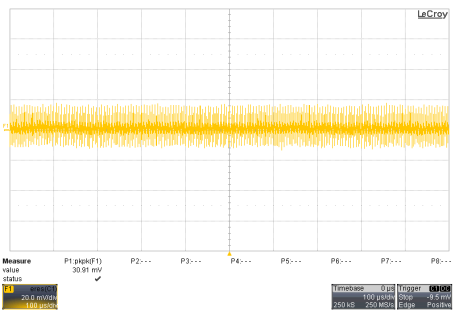
All test conditions are at 25°C The figures are identical for MFW02-12S15



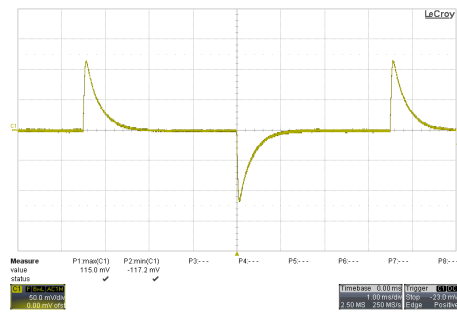
Efficiency Versus Output Current



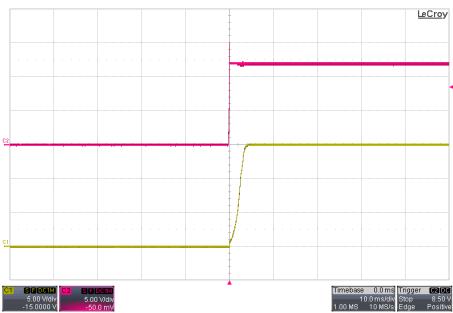
Efficiency Versus Input Voltage
Full Load



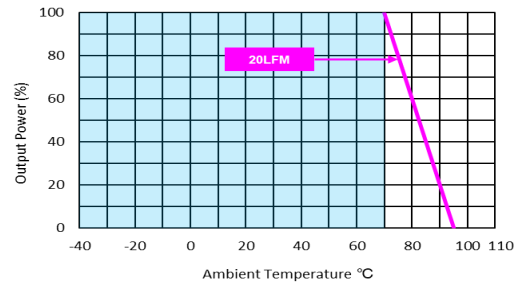
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



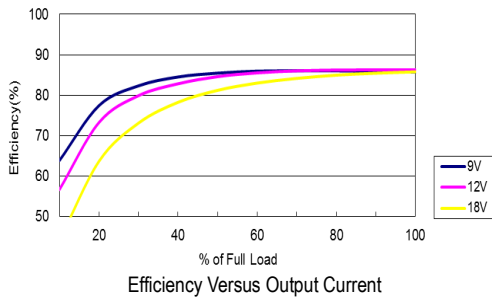
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



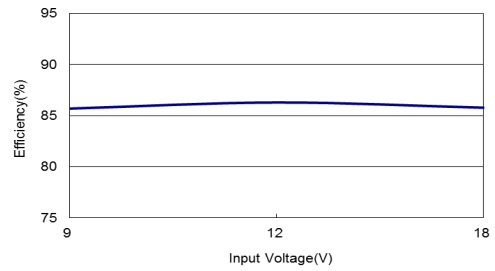
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

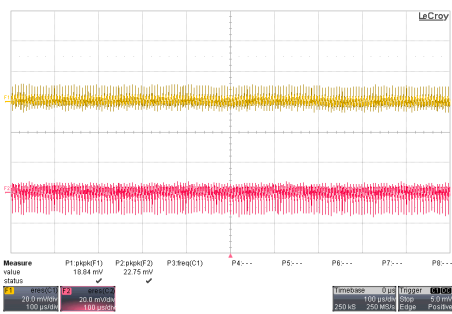
All test conditions are at 25°C. The figures are identical for MFW02-12D05



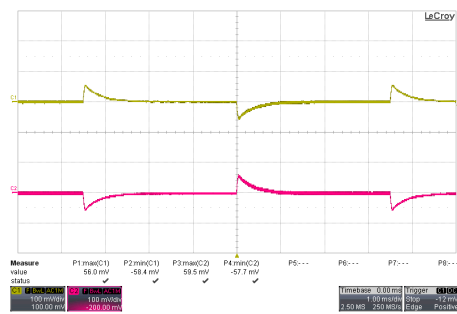
Efficiency Versus Output Current



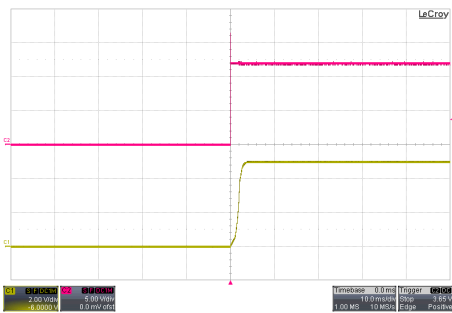
Efficiency Versus Input Voltage Full Load



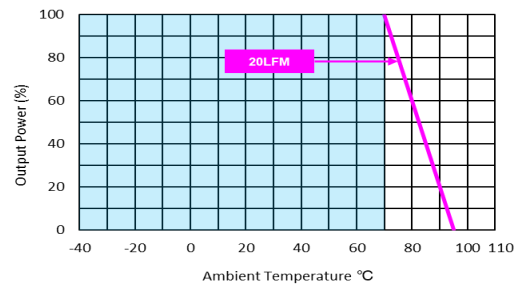
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load; $V_{in}=V_{in\ nom}$



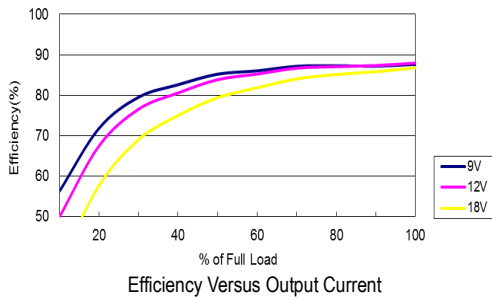
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



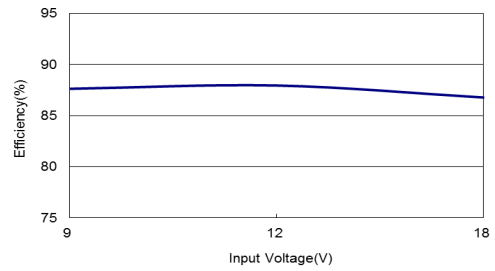
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

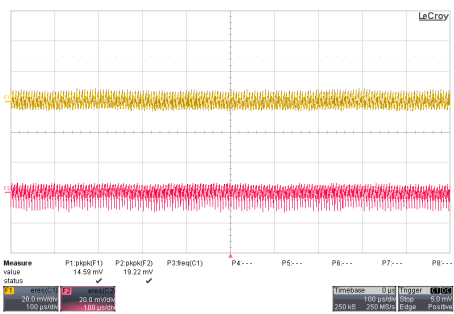
All test conditions are at 25°C The figures are identical for MFW02-12D12



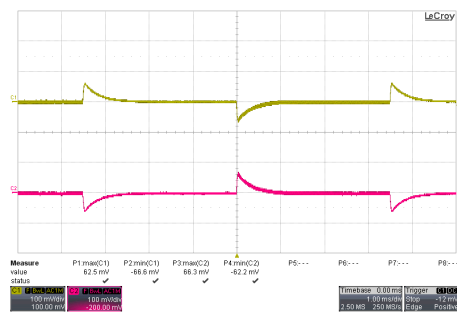
Efficiency Versus Output Current



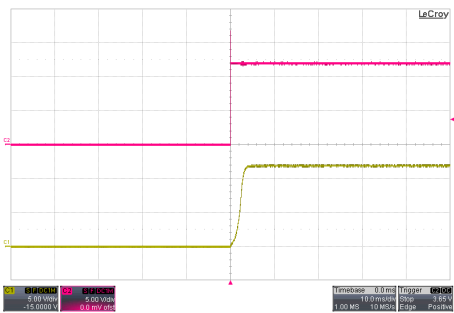
Efficiency Versus Input Voltage Full Load



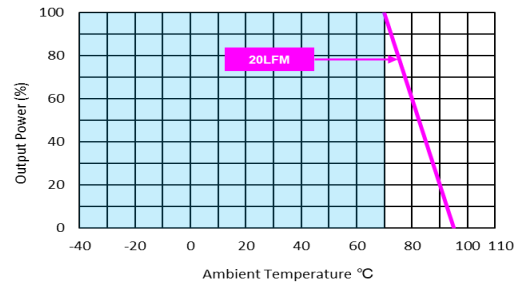
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



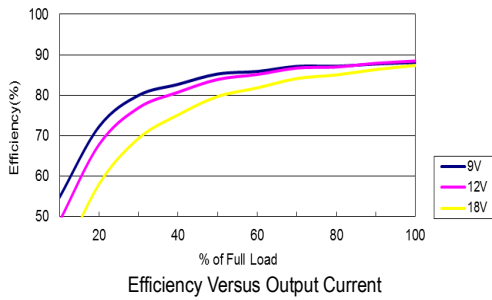
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



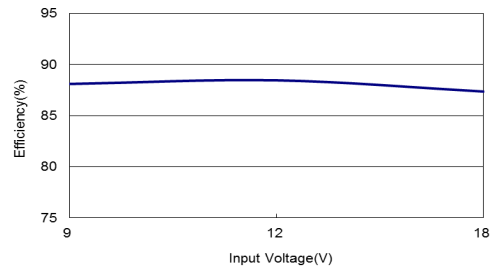
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

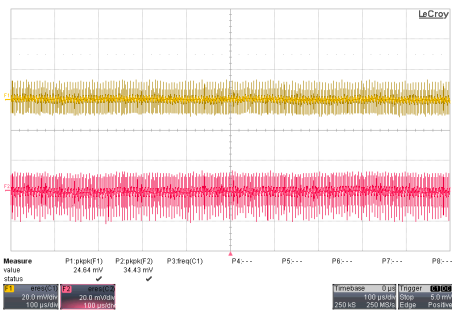
All test conditions are at 25°C The figures are identical for MFW02-12D15



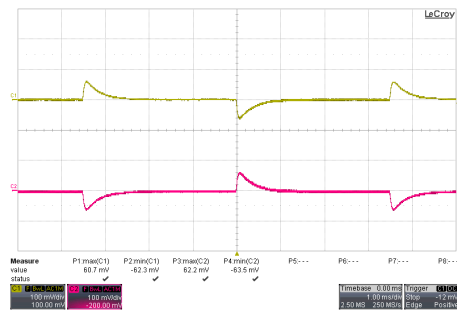
Efficiency Versus Output Current



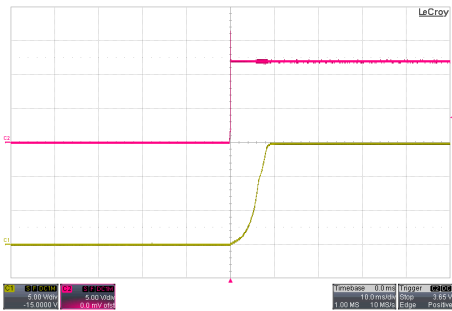
Efficiency Versus Input Voltage Full Load



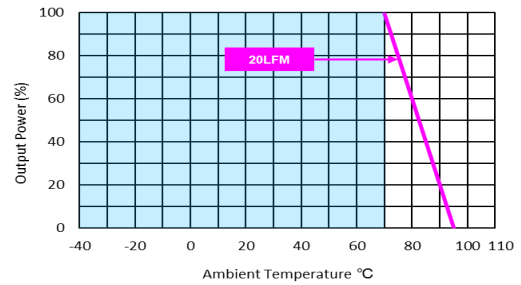
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load; $V_{in}=V_{in\ nom}$



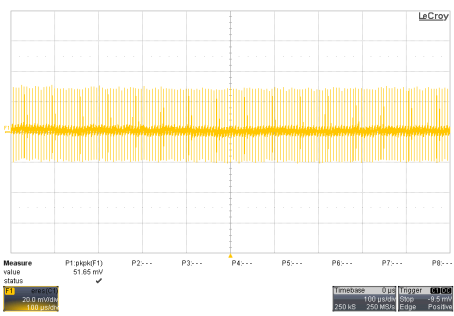
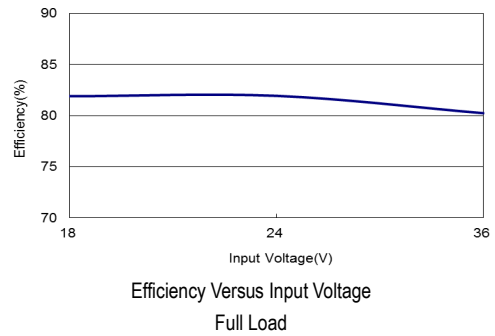
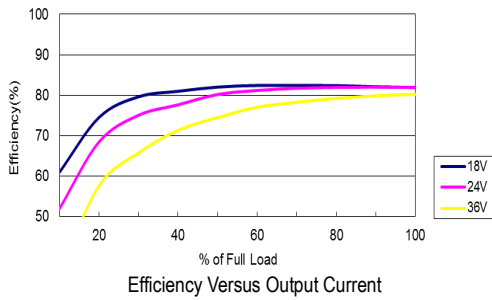
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



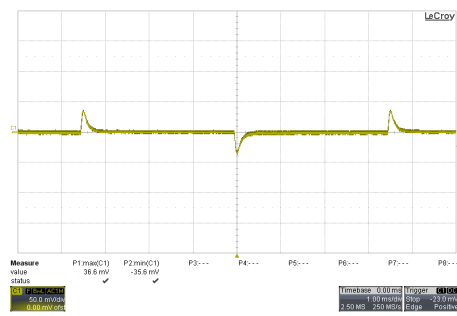
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

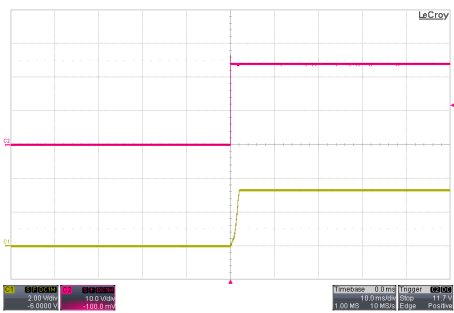
All test conditions are at 25°C The figures are identical for MFW02-24S033



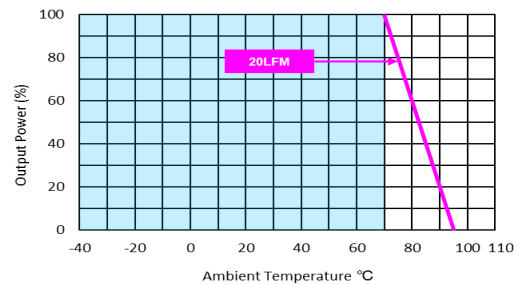
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



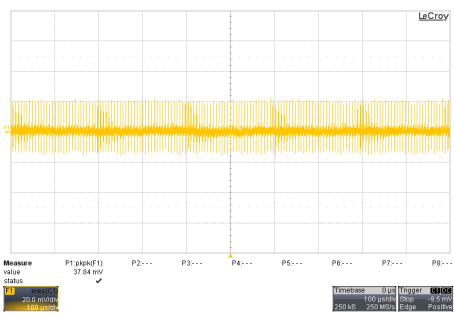
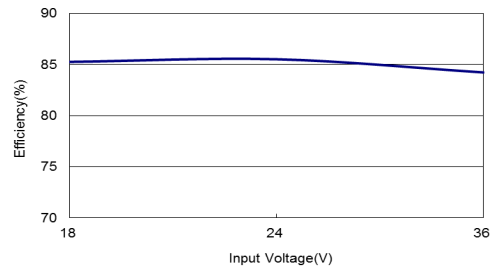
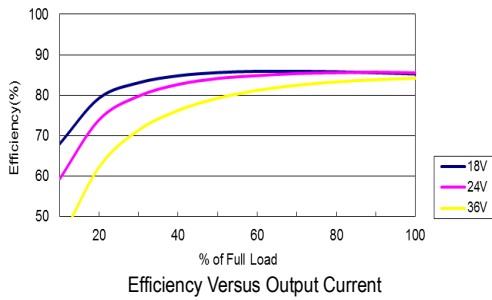
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



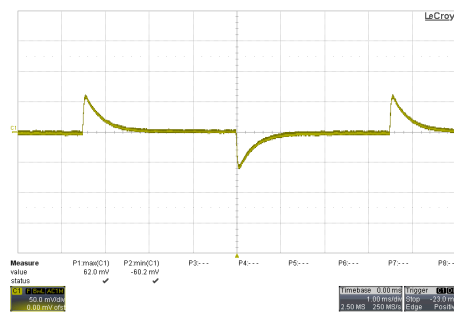
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

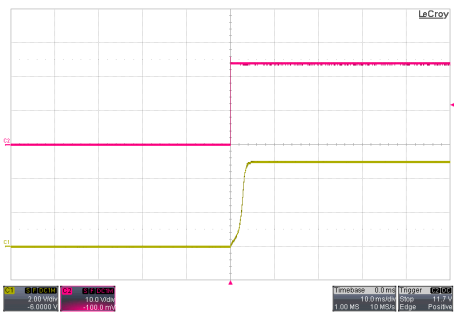
All test conditions are at 25°C The figures are identical for MFW02-24S05



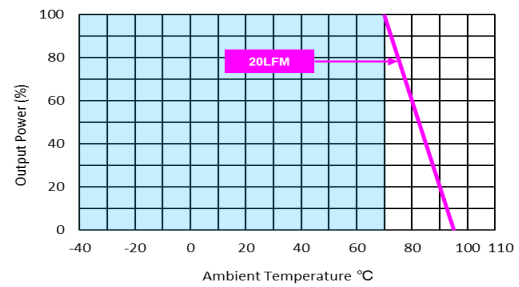
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



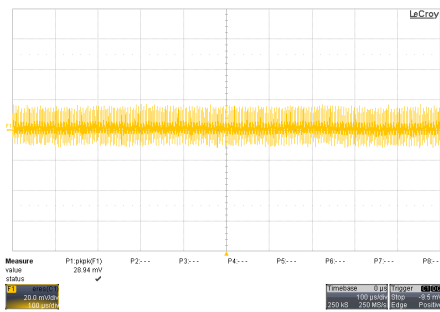
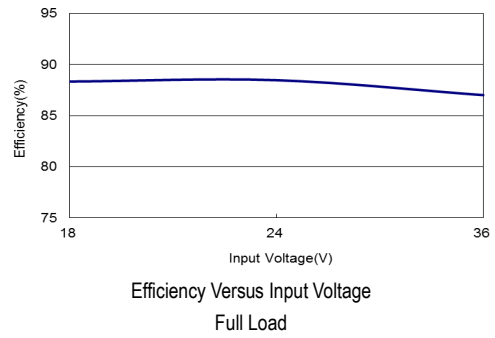
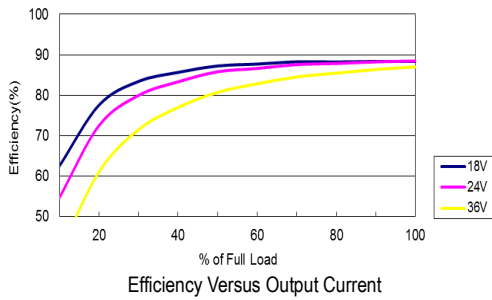
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



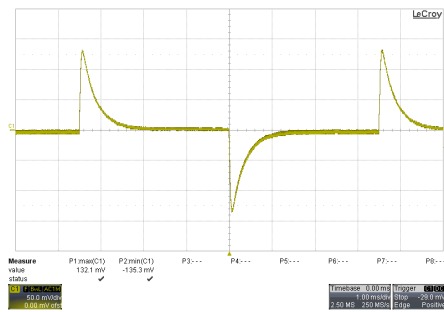
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

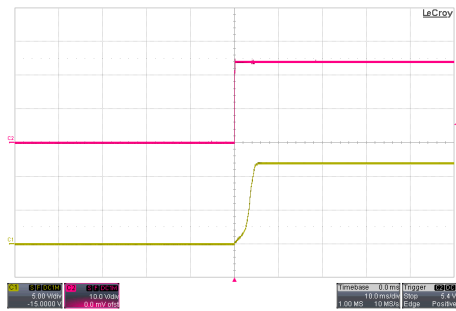
All test conditions are at 25°C The figures are identical for MFW02-24S12



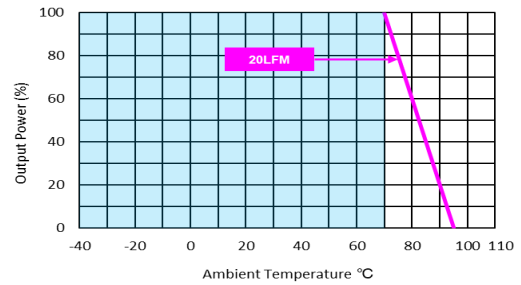
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



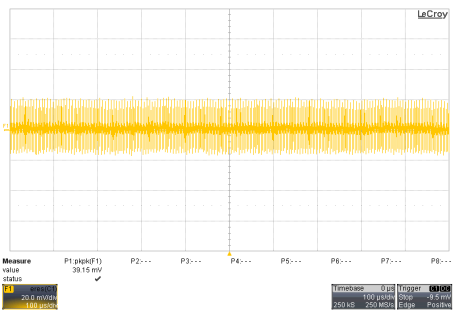
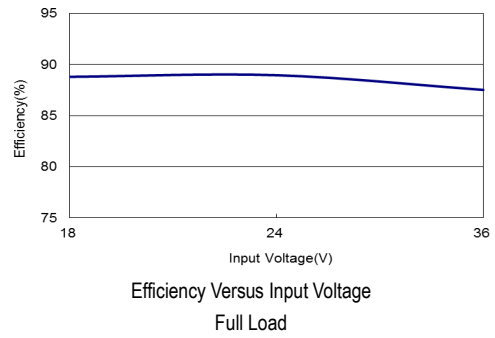
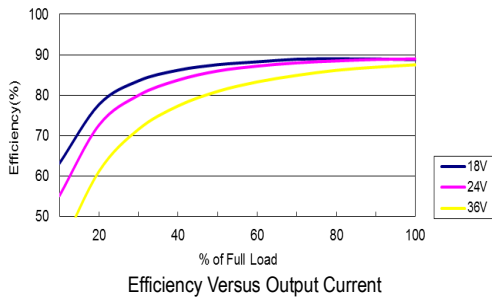
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



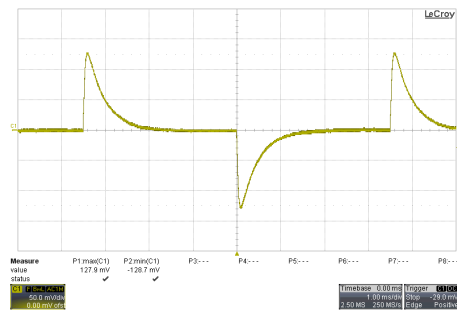
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

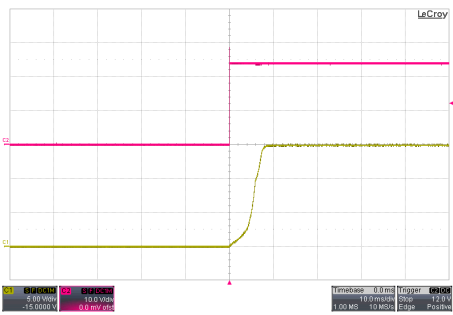
All test conditions are at 25°C The figures are identical for MFW02-24S15



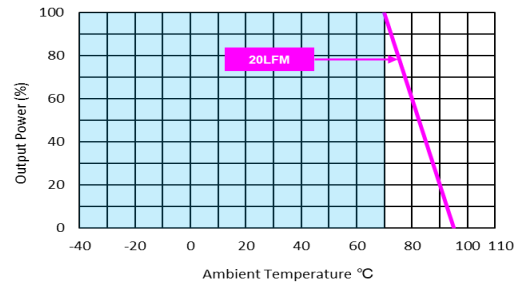
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load; $V_{in}=V_{in\ nom}$



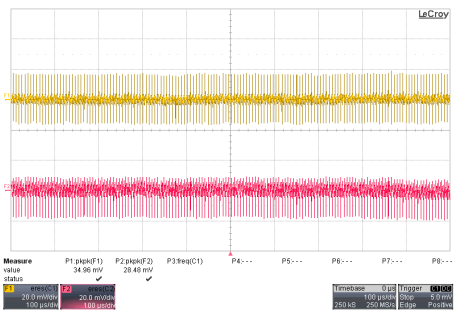
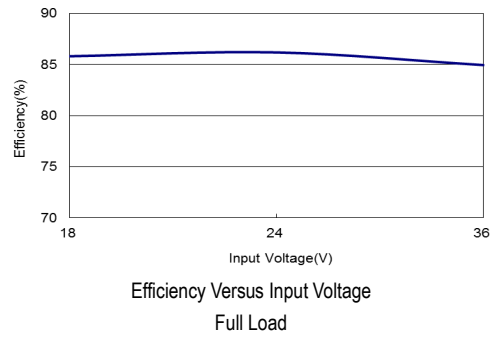
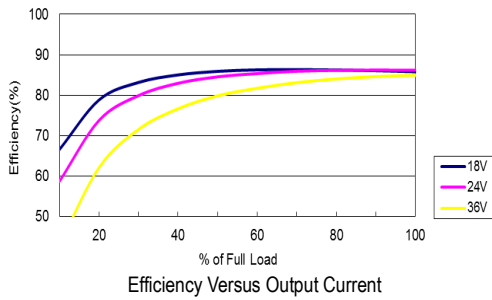
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



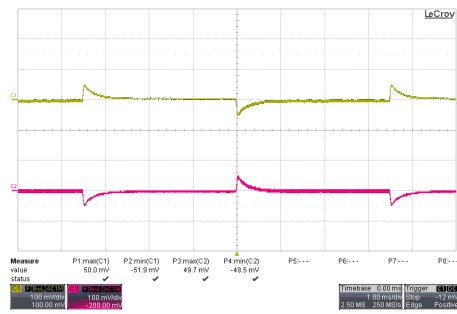
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

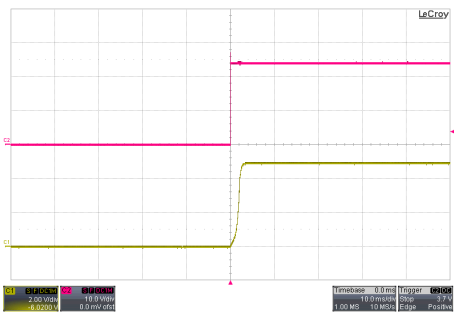
All test conditions are at 25°C The figures are identical for MFW02-24D05



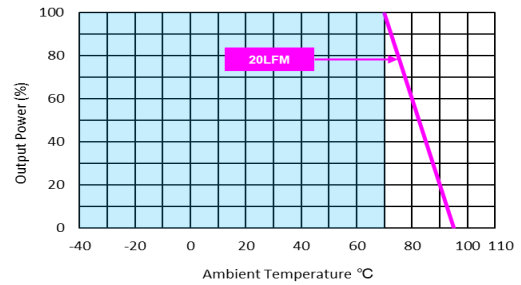
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



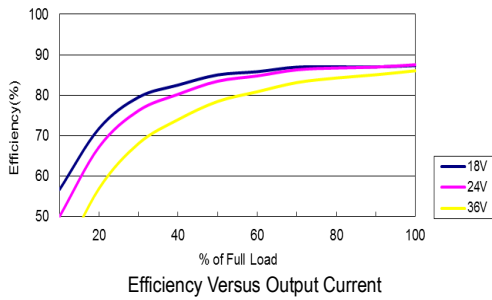
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



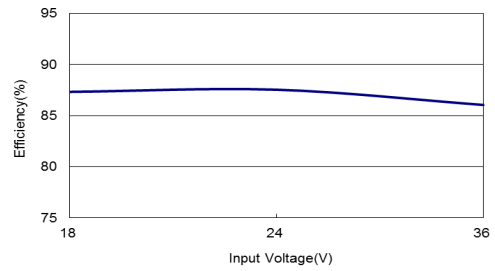
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

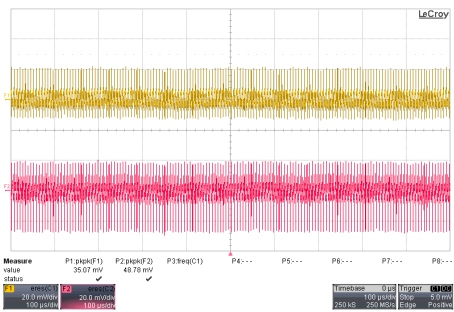
All test conditions are at 25°C The figures are identical for MFW02-24D12



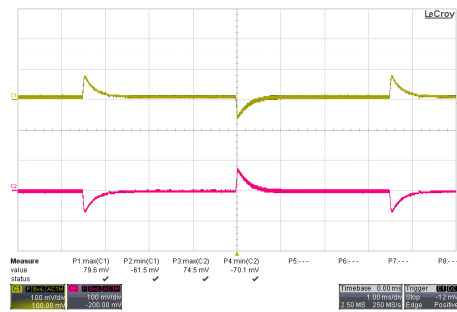
Efficiency Versus Output Current



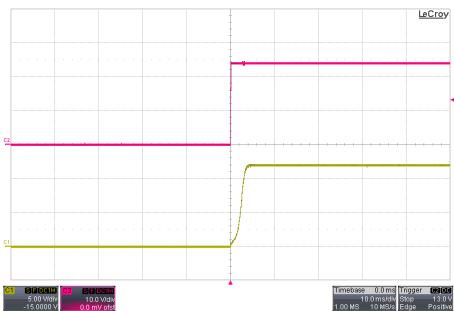
Efficiency Versus Input Voltage Full Load



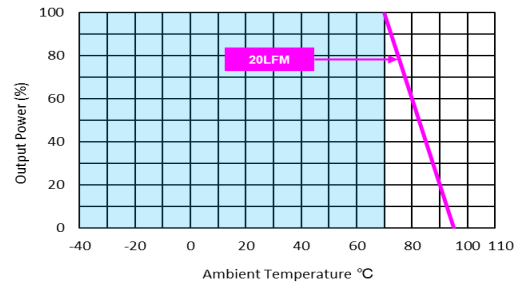
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



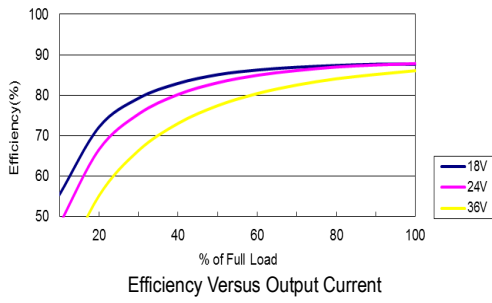
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



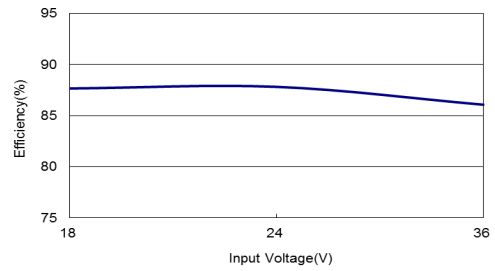
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

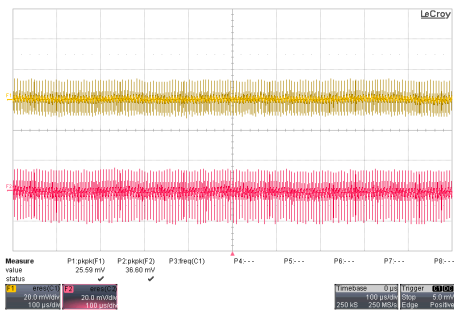
All test conditions are at 25°C The figures are identical for MFW02-24D15



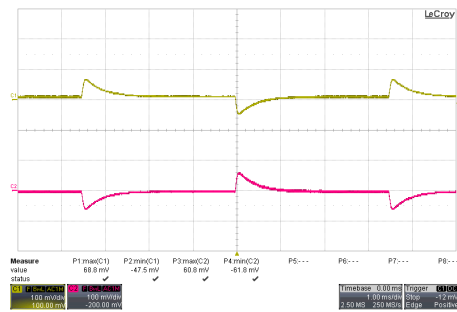
Efficiency Versus Output Current



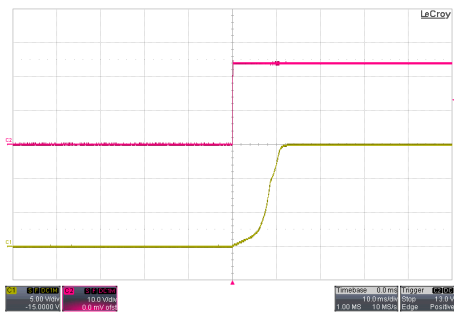
Efficiency Versus Input Voltage Full Load



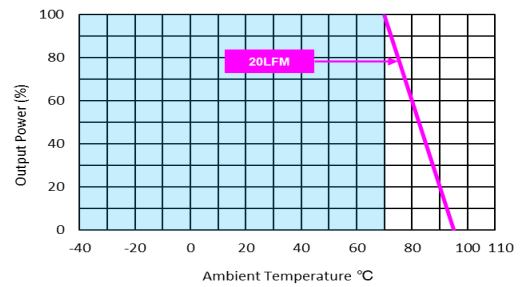
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



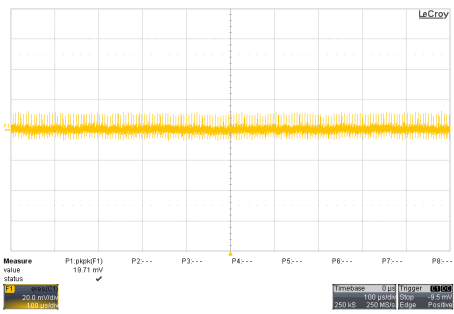
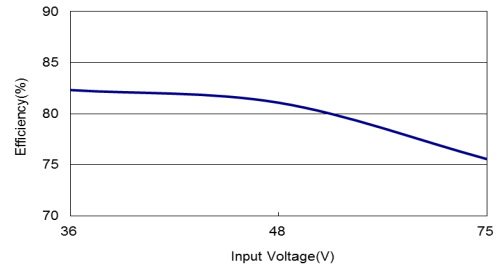
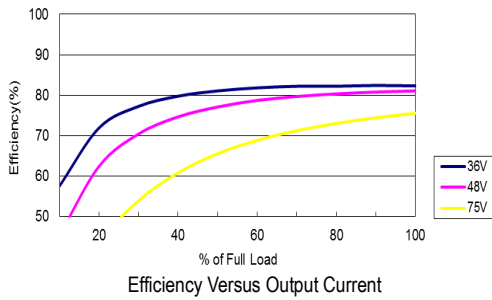
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



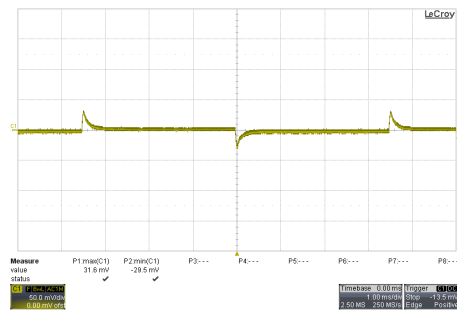
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

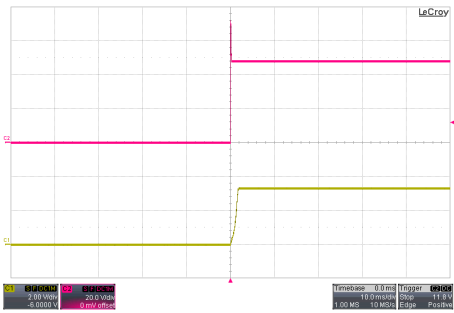
All test conditions are at 25°C The figures are identical for MFW02-48S033



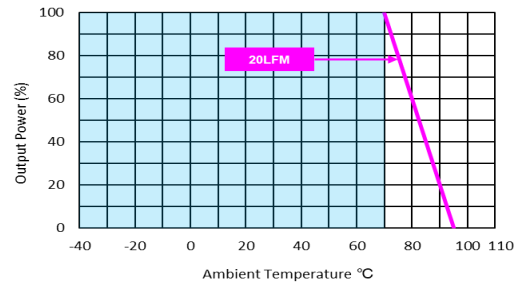
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



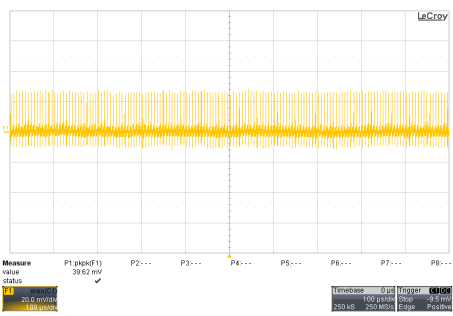
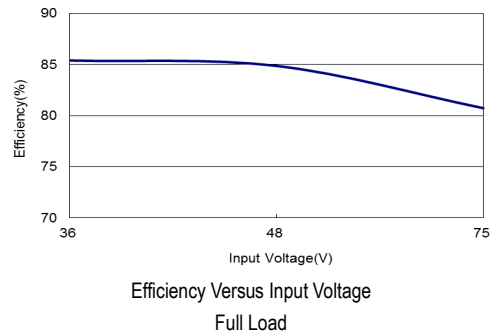
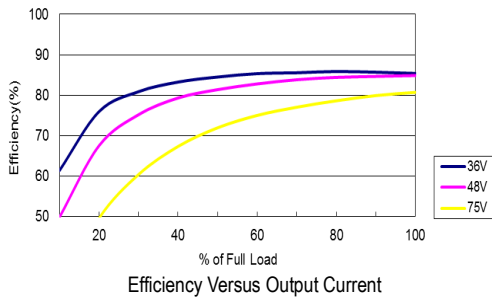
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



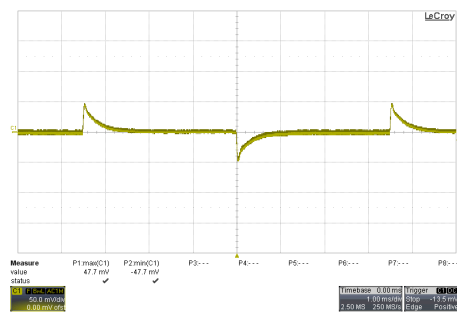
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

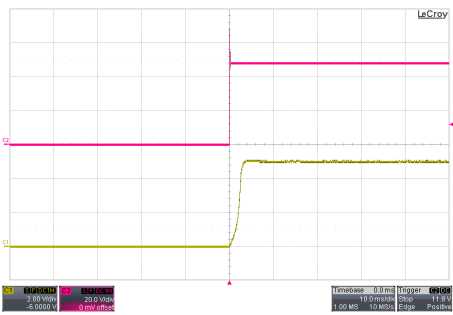
All test conditions are at 25°C. The figures are identical for MFW02-48S05



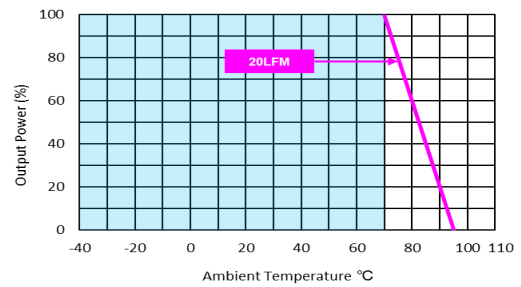
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load; $V_{in}=V_{in\ nom}$



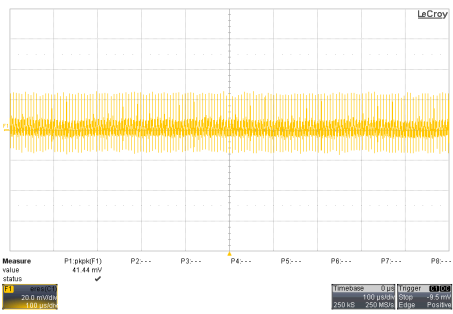
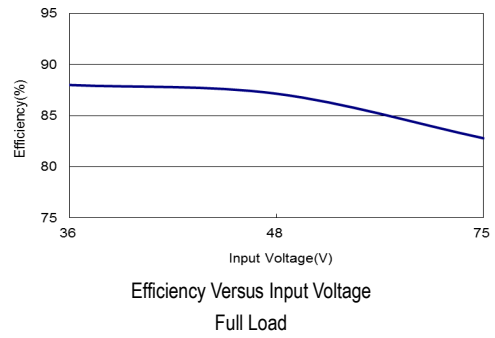
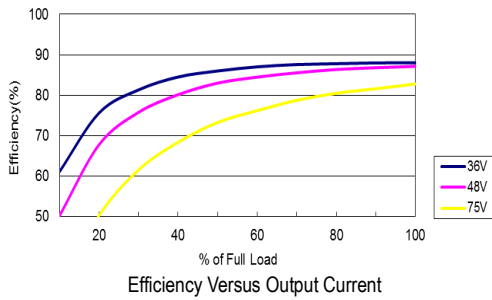
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



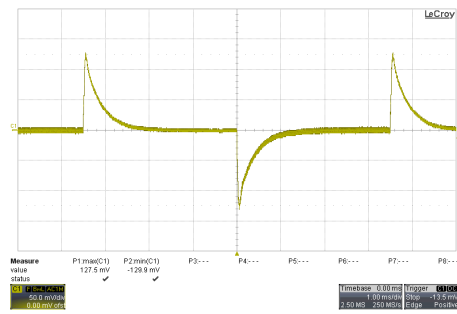
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

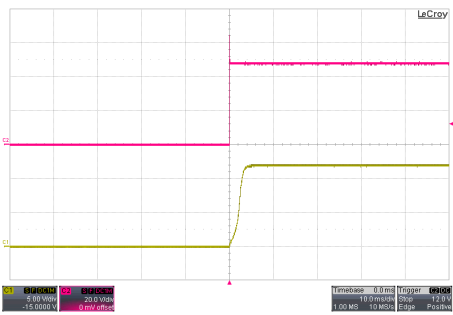
All test conditions are at 25°C The figures are identical for MFW02-48S12



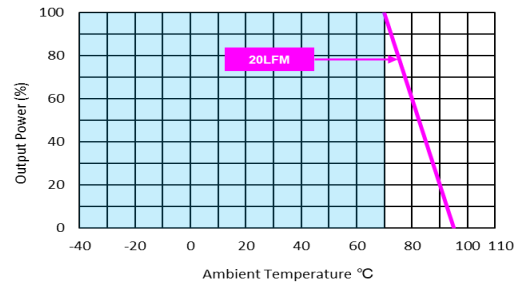
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



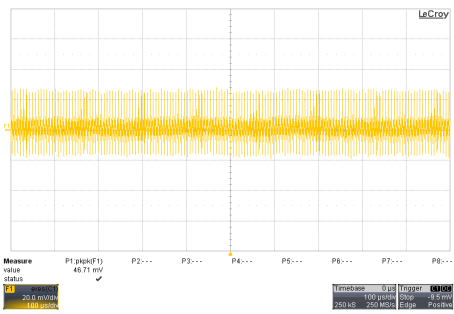
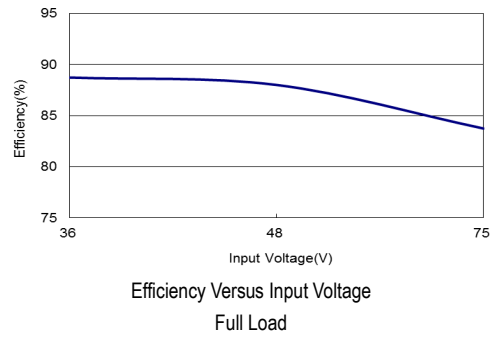
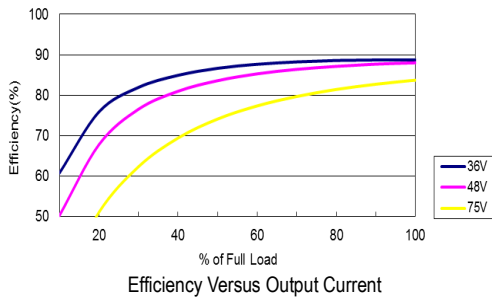
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



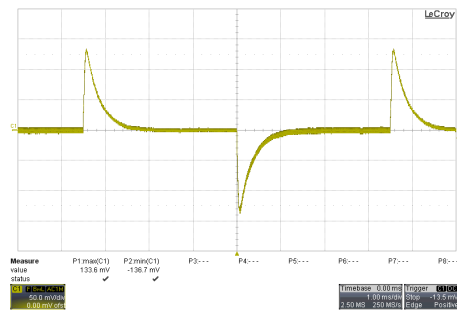
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

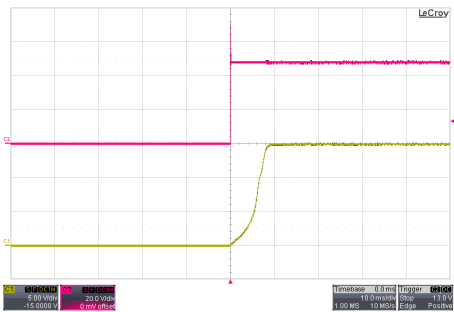
All test conditions are at 25°C The figures are identical for MFW02-48S15



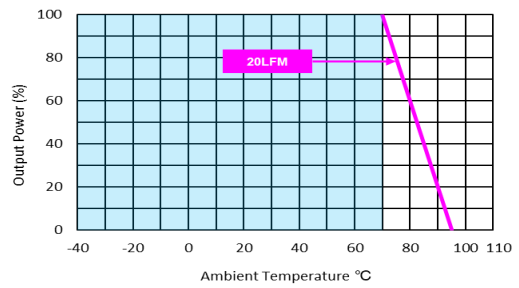
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



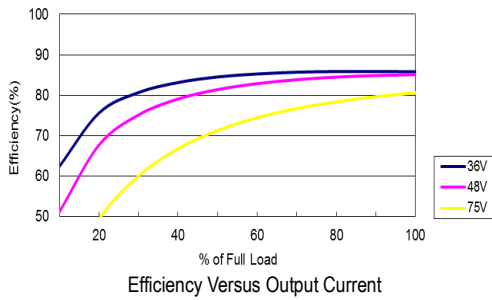
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



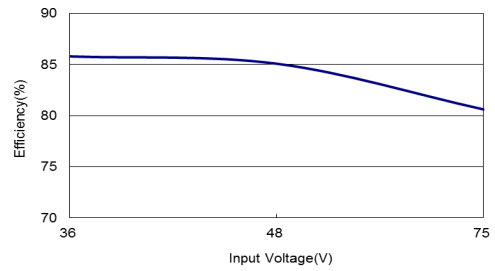
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

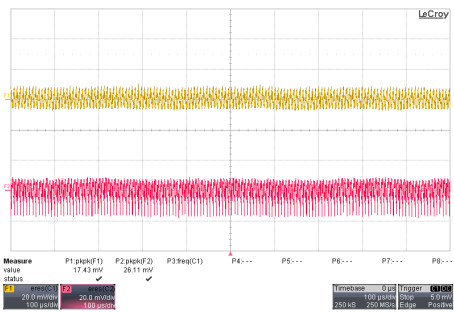
All test conditions are at 25°C The figures are identical for MFW02-48D05



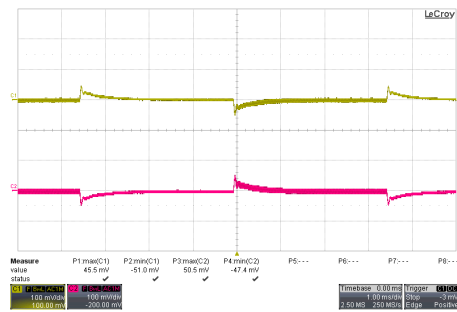
Efficiency Versus Output Current



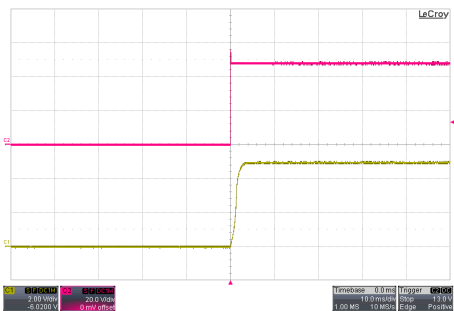
Efficiency Versus Input Voltage Full Load



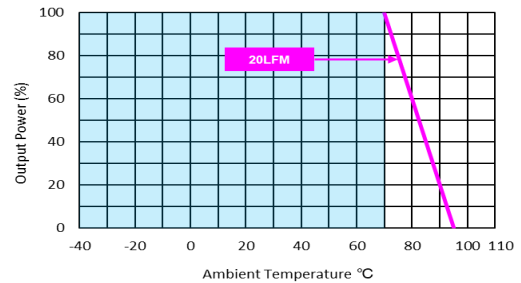
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



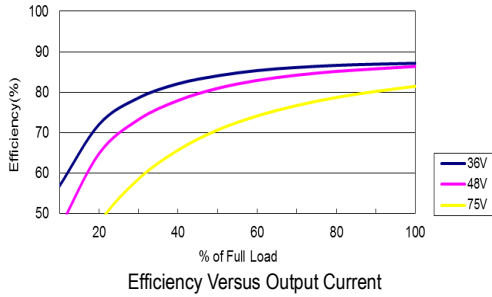
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



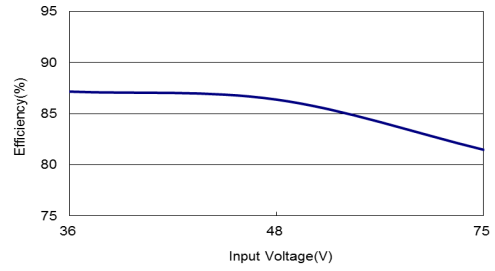
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

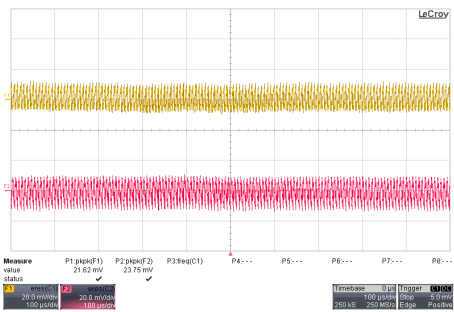
All test conditions are at 25°C The figures are identical for MFW02-48D12



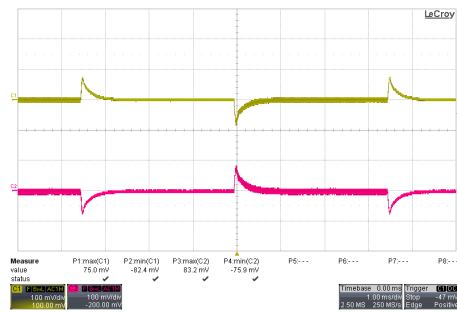
Efficiency Versus Output Current



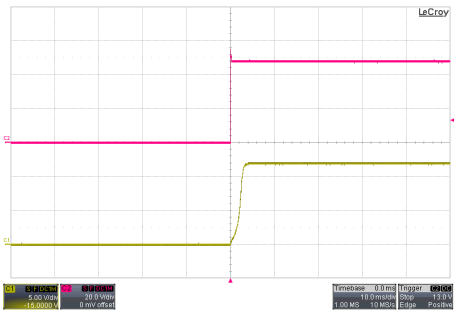
Efficiency Versus Input Voltage Full Load



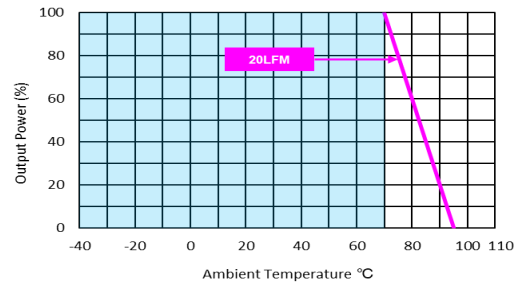
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



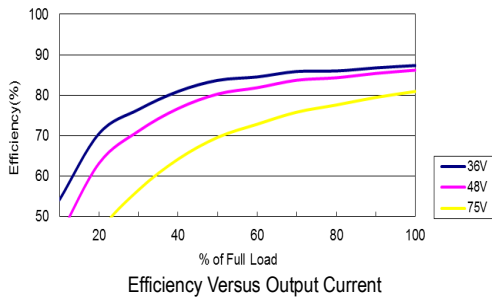
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



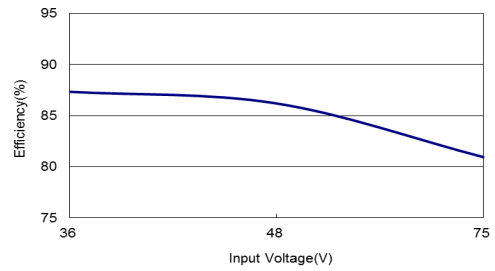
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

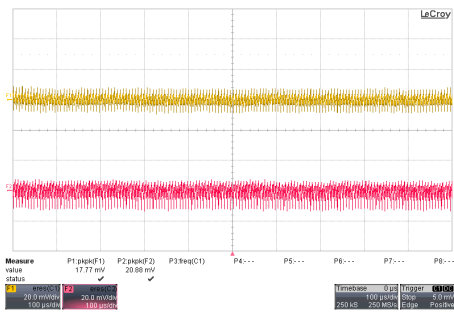
All test conditions are at 25°C The figures are identical for MFW02-48D15



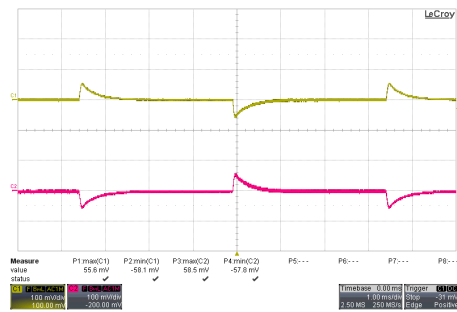
Efficiency Versus Output Current



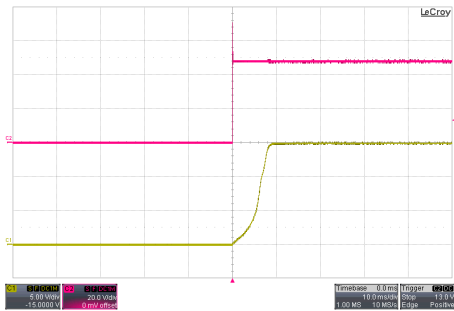
Efficiency Versus Input Voltage Full Load



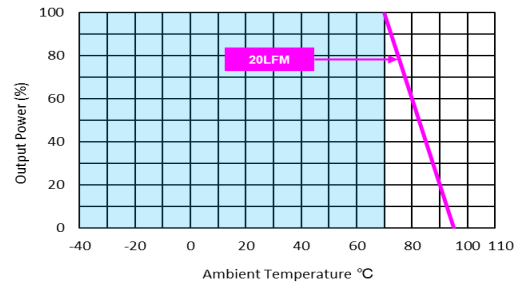
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load; $V_{in}=V_{in\ nom}$



Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Package Specifications

Mechanical Dimensions

Pin Connections

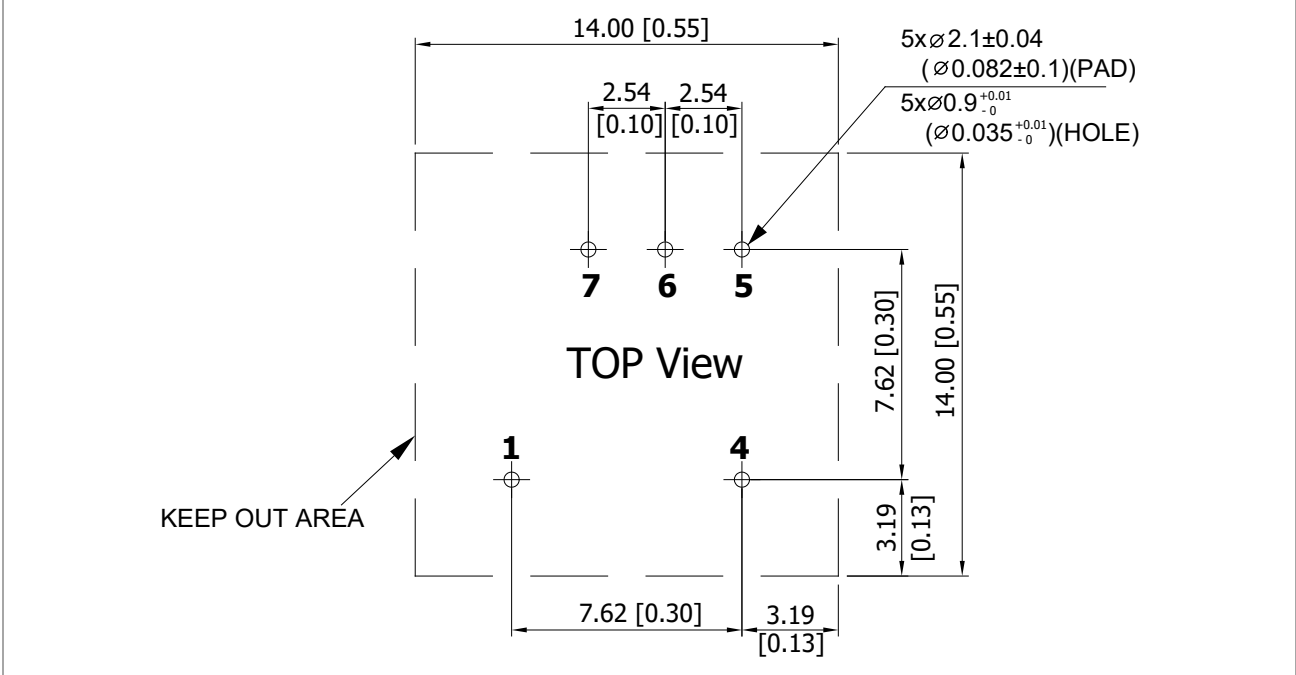
Pin	Single Output	Dual Output
1	-Vin	-Vin
4	+Vin	+Vin
5	+Vout	+Vout
6	No Pin	Common
7	-Vout	-Vout

▶ All dimensions in mm (inches)
 ▶ Tolerance: X.X±0.5 (X.XX±0.02)
 X.XX±0.25 (X.XXX±0.01)
 ▶ Pin diameter $\varnothing 0.5 \pm 0.05$ (0.02±0.002)

Physical Characteristics

Case Size	: 14.0x14.0x8.0mm (0.55x0.55x0.31 inches)
Case Material	: Non-Conductive Black Plastic (flammability to UL 94V-0 rated)
Pin Material	: Phosphor Bronze with Tin Plate Over Nickel Subplate
Weight	: 3.9g

Recommended Pad Layout for Single & Dual Output Converter



Packaging Information

unit : mm
10 PCS per TUBE

Wave Soldering Considerations

Lead free wave solder profile

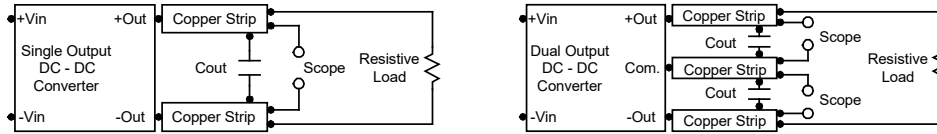
Profile Feature	Reference Parameter
Heating rate during preheat	Rise temp. speed : 3 °C/sec max.
Final preheat temperature	Preheat temp. : 100~130 °C
Peak temperature	Peak temp. : 250~260 °C
Time within peak temperature	Peak time(T1+T2) : 4~6 sec
Ramp-down rate	5 °C/sec max.

Reference Solder: Sn-Ag-Cu, Sn-Cu, Sn-Ag
 Hand Welding: Soldering iron, Power 60W
 Welding Time: 2~4 sec
 Temp.: 380~400°C

Test Setup

Peak-to-Peak Output Noise Measurement Test

Use a C_{out} 0.47 μ F ceramic capacitor. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC-DC Converter.



Technical Notes

Maximum Capacitive Load

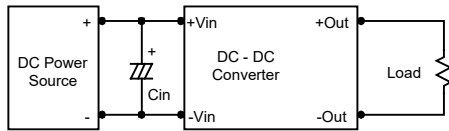
The MFW02 series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. The maximum capacitance can be found in the data sheet.

Overload Protection

To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally once the output current is brought back into its specified range.

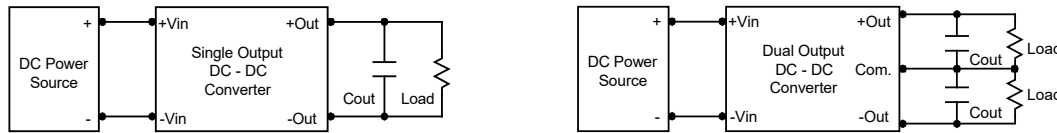
Input Source Impedance

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup. Capacitor mounted close to the power module helps ensure stability of the unit, it is commended to use a good quality low Equivalent Series Resistance (ESR < 1.0 Ω at 100 kHz) capacitor of a 8.2 μ F for the 5V input device, a 3.3 μ F for the 12V input devices and a 1.5 μ F for the 24V and 48V devices.



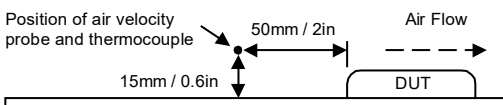
Output Ripple Reduction

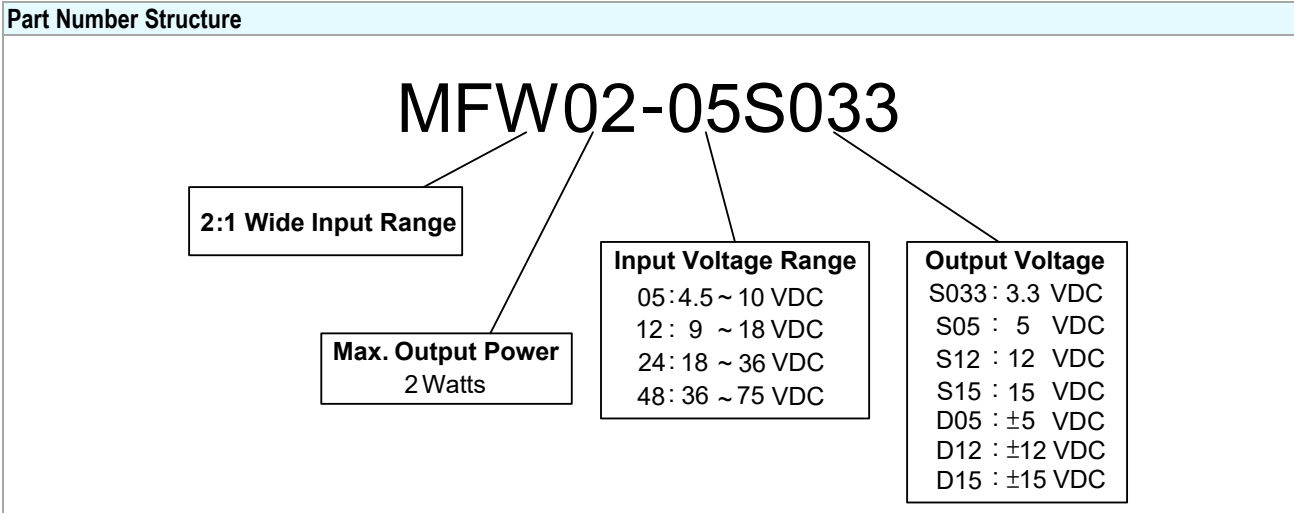
A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance. To reduce output ripple, it is recommended to use 3.3 μ F capacitors at the output.



Thermal Considerations

Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the case temperature must be kept below 105°C. The derating curves are determined from measurements obtained in a test setup.





MTBF and Reliability

The MTBF of MFW02 series of DC-DC converters has been calculated using

MIL-HDBK 217F NOTICE2, Operating Temperature 25°C, Ground Benign.

Model	MTBF	Unit
MFW02-05S033	4,261,825	Hours
MFW02-05S05	3,988,844	
MFW02-05S12	5,184,269	
MFW02-05S15	5,499,102	
MFW02-05D05	3,969,049	
MFW02-05D12	4,527,103	
MFW02-05D15	4,937,872	
MFW02-12S033	4,570,451	
MFW02-12S05	4,029,105	
MFW02-12S12	5,187,740	
MFW02-12S15	5,464,091	
MFW02-12D05	4,274,322	
MFW02-12D12	4,706,233	
MFW02-12D15	4,828,841	
MFW02-24S033	4,347,969	
MFW02-24S05	3,870,680	
MFW02-24S12	4,857,279	
MFW02-24S15	4,959,378	
MFW02-24D05	4,216,872	
MFW02-24D12	4,487,989	
MFW02-24D15	4,584,419	
MFW02-48S033	4,473,197	
MFW02-48S05	4,226,376	
MFW02-48S12	5,152,740	
MFW02-48S15	5,324,187	
MFW02-48D05	3,877,633	
MFW02-48D12	4,415,511	
MFW02-48D15	5,324,187	