MINMAX®

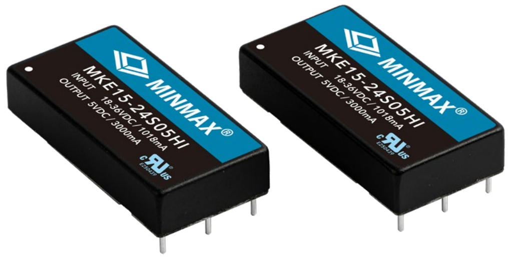
MKE15-HI Series

Electric Characteristic Note

MKE15-HI Series EC Note

DC-DC CONVERTER 15W, Ultra-high I/O Isolation, 2"×1" Package

Features



- ►**Industrial Standard 2"x1" Package**
- ►**Wide 2:1 Input Voltage Range**
- ►**Fully Regulated Output Voltage**
- ►**Ultra-high I/O Isolation 8000VDC with Reinforced Insulation, rated for 1000Vrms Working Voltage**
- ►**Operating Ambient Temp. Range -40℃ to +85℃**
- ►**No Min. Load Requirement**
- ►**Under-voltage, Overload/Voltage and Short Circuit Protection**
- ►**EMI Emission EN55032 Class A Approved**
- ►**UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking**

Applications

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

Product Overview

The MINMAX MKE15-HI series is a range of high performance 15W DC-DC converter within encapsulated 2"x1" package which specifically design for high isolation applications where reinforced insulation and high working voltage are required. There are 21 models available for input voltage of 12, 24, 48VDC with wide 2:1 input range and fixed output voltage. The I/O isolation is specified for 8000VDC with reinforced insulation, which rated for 1000Vrms working voltage. Further features include under-voltage, overload, over voltage, short circuit protection, no min. load requirement, EMI emission EN 55032 Class A approved, low I/O capacitance 80pF max. and operating ambient temp. range by -40℃ to 85℃ by high efficiency up to 90%. MKE15-HI series conform to UL/cUL/IEC/EN 62368-1 (60950-1) safety approvals. The MKE15-HI series offer a superior solution for demanding application in requesting a certified supplementary.

Table of contents

Model Selection Guide									
Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Reflected Ripple Current	Over Voltage Protection	Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load				@Max. Load
	VDC	VDC	mA	mA(typ.)	mA (typ.)	mA(typ.)	VDC	µF	%
MKE15-12S05HI	12 (9 ~ 18)	5	3000	1471	20	100	6.2	5100	85
MKE15-12S051HI		5.1	3000	1500			6.2		85
MKE15-12S12HI		12	1250	1420			15	870	88
MKE15-12S15HI		15	1000	1420			18	560	88
MKE15-12S24HI		24	625	1420			27	220	88
MKE15-12D12HI		±12	±625	1420			±15	440#	88
MKE15-12D15HI		±15	±500	1404			±18	280#	89
MKE15-24S05HI	24 (18 ~ 36)	5	3000	718	15	50	6.2	5100	87
MKE15-24S051HI		5.1	3000	733			6.2		87
MKE15-24S12HI		12	1250	710			15	870	88
MKE15-24S15HI		15	1000	702			18	560	89
MKE15-24S24HI		24	625	694			27	220	90
MKE15-24D12HI		±12	±625	694			±15	440#	90
MKE15-24D15HI		±15	±500	702			±18	280#	89
MKE15-48S05HI	48 (36 ~ 75)	5	3000	359	10	30	6.2	5100	87
MKE15-48S051HI		5.1	3000	366			6.2		87
MKE15-48S12HI		12	1250	359			15	870	87
MKE15-48S15HI		15	1000	347			18	560	90
MKE15-48S24HI		24	625	351			27	220	89
MKE15-48D12HI		±12	±625	351			±15	440#	89
MKE15-48D15HI		±15	±500	355			±18	280#	88

For each output

Input Specifications					
Parameter	Conditions / Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (100 ms max.)	12V Input Models	-0.7	---	25	VDC
	24V Input Models	-0.7	---	50	
	48V Input Models	-0.7	---	100	
Start-Up Threshold Voltage	12V Input Models	---	---	9	
	24V Input Models	---	---	18	
	48V Input Models	---	---	36	
Under Voltage Shutdown	12V Input Models	---	7.5	---	
	24V Input Models	---	15	---	
	48V Input Models	---	33	---	
Start Up Time (Power On)	Nominal Vin and Constant Resistive Load	---	---	30	ms
Input Filter	All Models	Internal Pi Type			

Output Specifications								
Parameter	Conditions / Model				Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy					---	---	±1.0	%Vnom.
Output Voltage Balance	Dual Output, Balanced Loads				---	---	±2.0	%
Line Regulation	Vin=Min. to Max. @Full Load				---	---	±0.5	%
Load Regulation	Io=0% to 100%		Single Output		---	---	±0.5	%
			Dual Output		---	---	±1.0	%
Minimum Load	No minimum Load Requirement							
Ripple & Noise	0-20 MHz Bandwidth	5V & 5.1Vo	Measured with a MLCC : 4.7µF		---	50	---	mV P-P
		12V,15V, ±12V, ±15Vo			---	100	---	mV P-P
		24Vo			---	150	---	mV P-P
Transient Recovery Time	25% Load Step Change(2)				---	---	300	µs
Transient Response Deviation					---	±3	±5	%
Temperature Coefficient					---	---	±0.02	%/℃
Over Load Protection	Hiccup				---	150	---	%
Short Circuit Protection	Continuous, Automatic Recovery (Hiccup Mode 0.7Hz typ.)							

Isolation, Safety Standards					
Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds Reinforced insulation, rated for 1000Vrms working voltage	4200	---	---	VAC
	Tested for 1 second	8000	---	---	VDC
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	---	80	pF
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)				

General Specifications					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Switching Frequency		---	285	---	kHz
MTBF(calculated)	MIL-HDBK-217F@25℃, Ground Benign	1,428,181	---	---	Hours

EMC Specifications				
Parameter	Standards & Level			Performance
EMI	Conduction	EN 55032	Without external components	Class A
	Radiation			
EMS(5)	EN 55035			
	ESD	Direct discharge	Indirect discharge HCP & VCP	A
		EN 61000-4-2 Air ± 15kV	Contact ± 8kV	
	Radiated immunity	EN 61000-4-3 10V/m		A
	Fast transient	EN 61000-4-4 ±2kV		A
	Surge	EN 61000-4-5 ±1kV		A
	Conducted immunity	EN 61000-4-6 10Vrms		A
	PFMF	EN 61000-4-8 100A/m		A

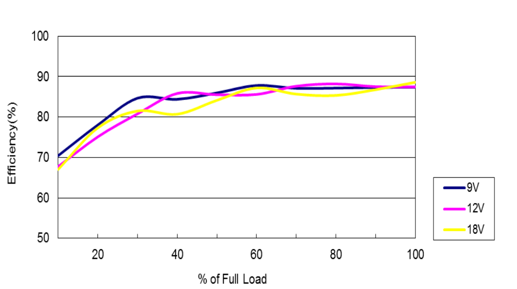
Environmental Specifications				
Parameter	Conditions / Model	Min.	Max.	Unit
Operating Ambient Temperature Range Nominal Vin, Load 100% Inom. (for Power Derating see relative Derating Curves)	MKE15-24S24HI, MKE15-24D12HI, MKE15-48S15HI	-40	+73	℃
	MKE15-12D15HI, MKE15-24S15HI, MKE15-24D15HI MKE15-48S24HI, MKE15-48D12HI		+70	
	MKE15-12S12HI, MKE15-12S15HI, MKE15-12S24HI MKE15-12D12HI, MKE15-24S12HI, MKE15-48D15HI		+68	
	MKE15-24S05HI, MKE15-24S051HI, MKE15-48S05HI MKE15-48S051HI, MKE15-48S12HI		+65	
	MKE15-12S05HI, MKE15-12S051HI		+59	
Thermal Impedance		13	---	℃/W
Case Temperature		---	+95	℃
Storage Temperature Range		-50	+125	℃
Humidity (non condensing)		---	95	% rel. H
Altitude		---	4000	m
Lead Temperature (1.5mm from case for 10Sec.)		---	260	℃

Notes

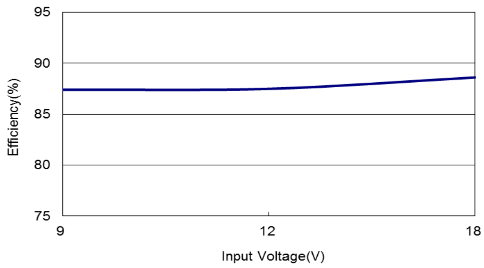
1. Specifications typical at Ta=+25℃, resistive load, nominal input voltage and rated output current unless otherwise noted.
2. Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
3. We recommend to protect the converter by a slow blow fuse in the input supply line.
4. Other input and output voltage may be available, please contact MINMAX.
5. The external components might be required to meet EMS standard for some of test items. Please contact MINMAX for the solution in detail.
6. Specifications are subject to change without notice.
7. The repeated high voltage isolation testing of the converter can degrade isolation capability, to a lesser or greater degree depending on materials, construction, environment and reflow solder process. Any material is susceptible to eventual chemical degradation when subject to very high applied voltages thus implying that the number of tests should be strictly limited. We therefore strongly advise against repeated high voltage isolation testing, but if it is absolutely required, that the voltage be reduced by 20% from specified test voltage. Furthermore, the high voltage isolation capability after reflow solder process should be evaluated as it is applied on system.

Characteristic Curves

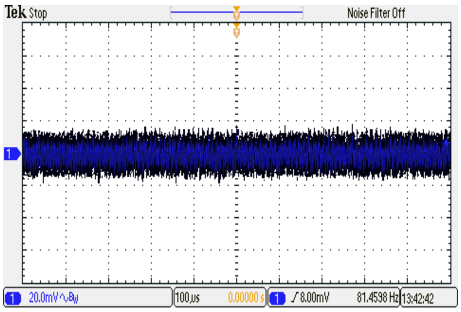
All test conditions are at 25℃ The figures are identical for MKE15-12S05HI



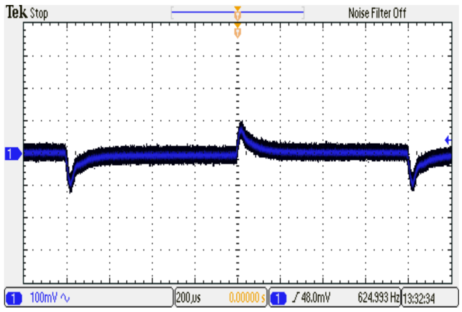
Efficiency Versus Output Current



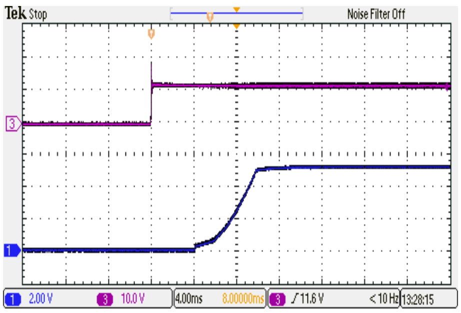
Efficiency Versus Input Voltage
Full Load



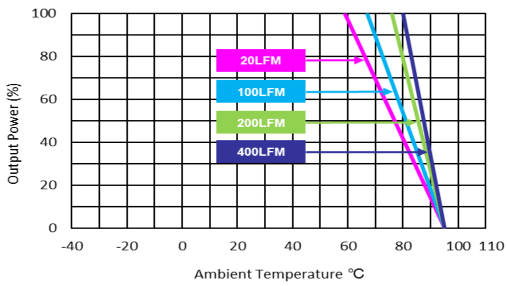
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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 Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

Characteristic Curves

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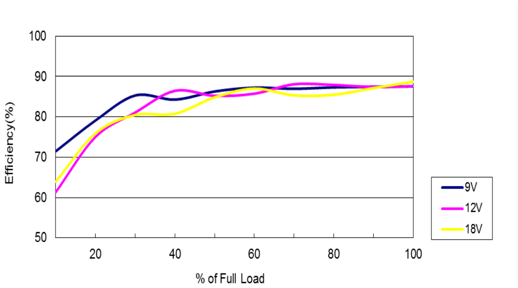
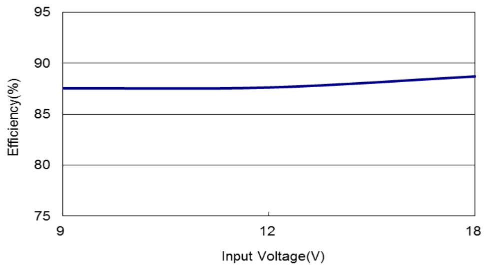
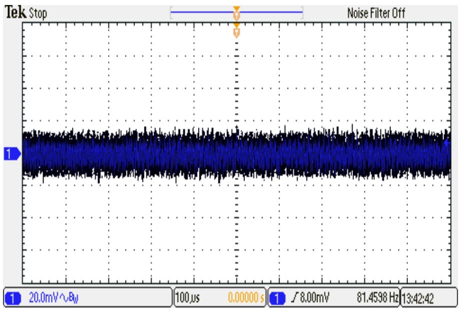


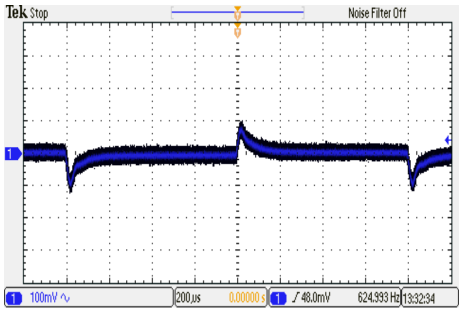
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



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



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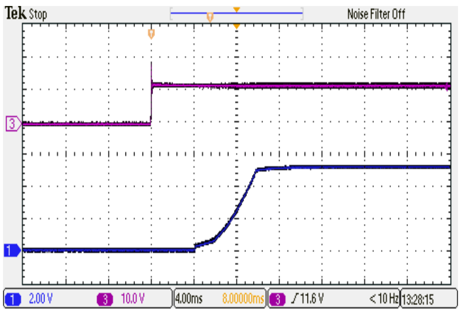

Typical Input Start-Up and Output Rise Characteristic
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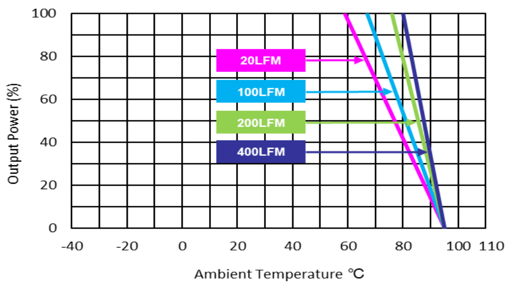

Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

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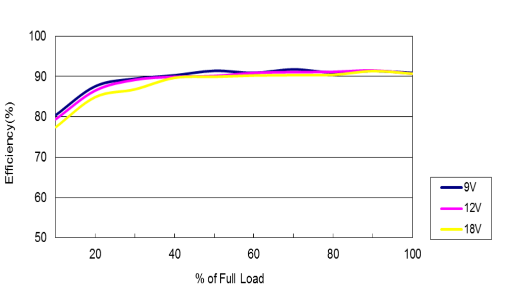
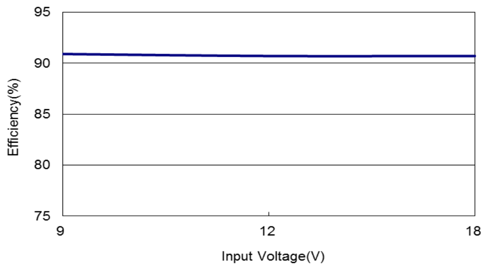
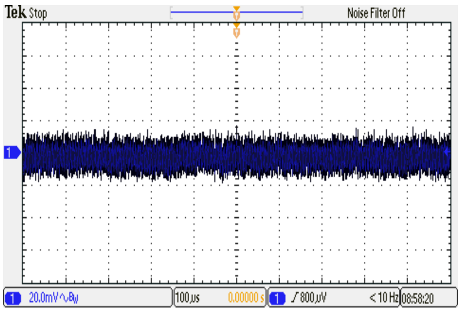


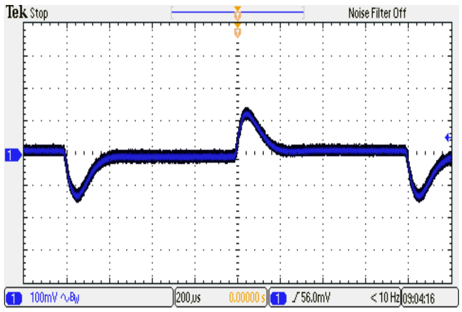
Efficiency Versus Output Current



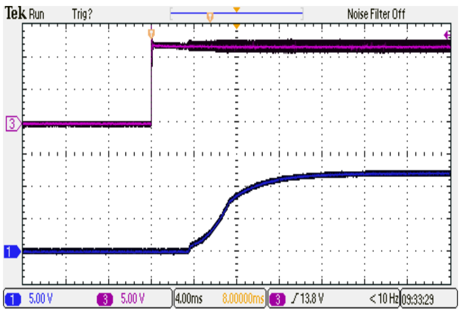
Efficiency Versus Input Voltage
Full Load



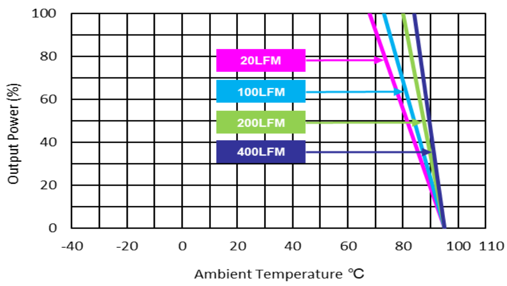
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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 Current Versus Ambient Temperature and Airflow
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Characteristic Curves

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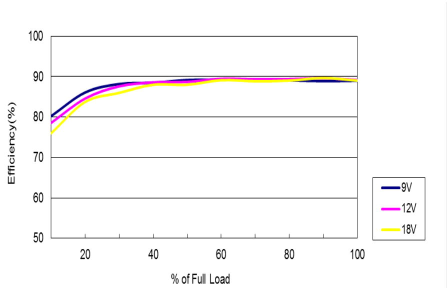
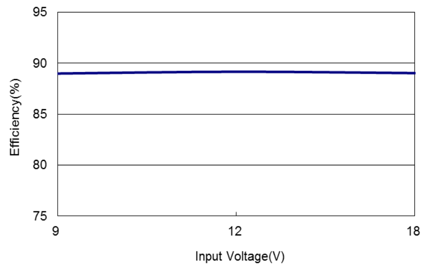
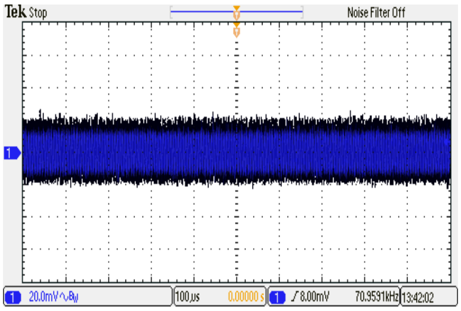


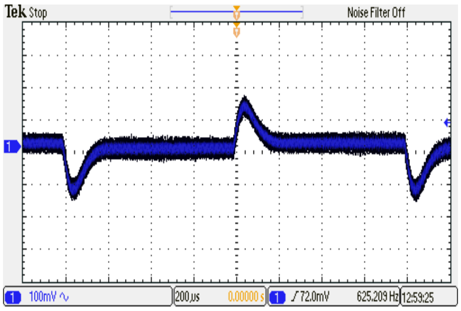
Efficiency Versus Output Current



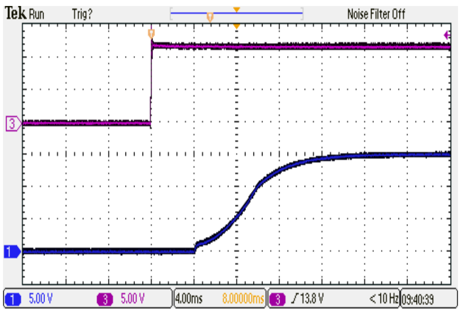
Efficiency Versus Input Voltage
Full Load



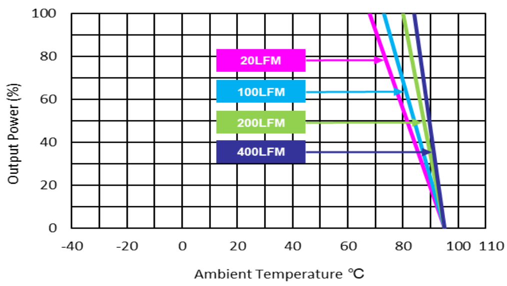
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



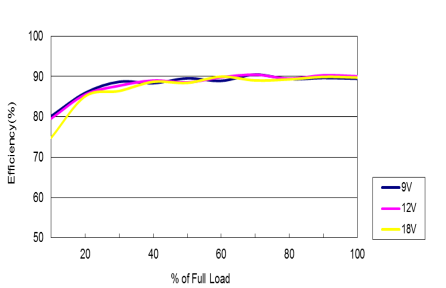
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



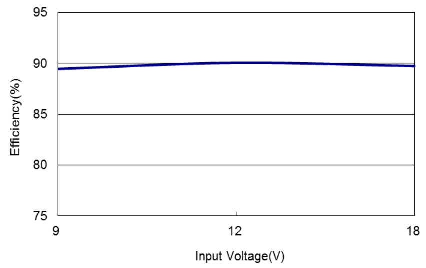
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

Characteristic Curves

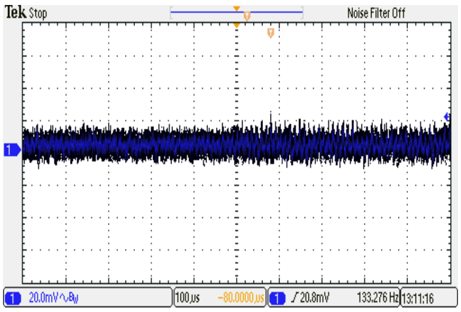
All test conditions are at 25℃ The figures are identical for MKE15-12S24HI



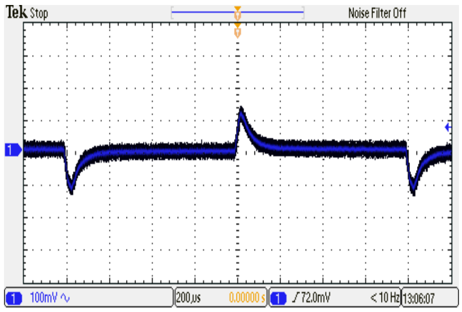
Efficiency Versus Output Current



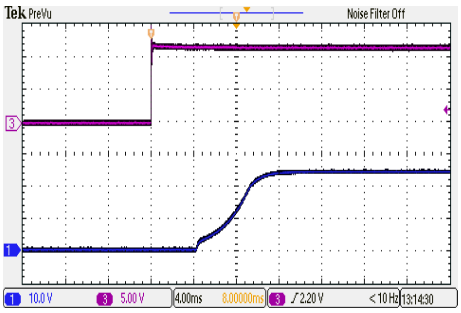
Efficiency Versus Input Voltage
Full Load



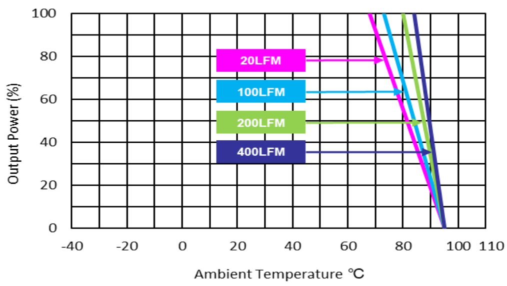
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



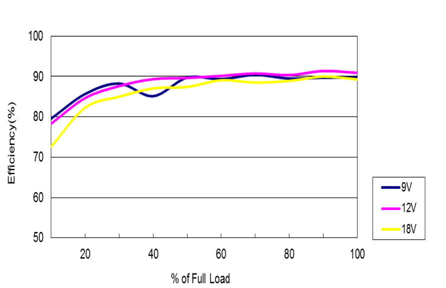
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



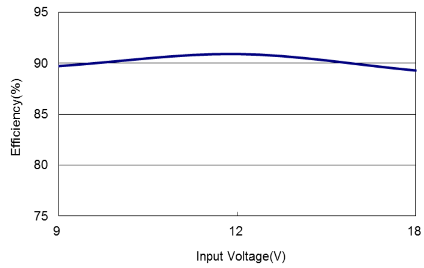
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

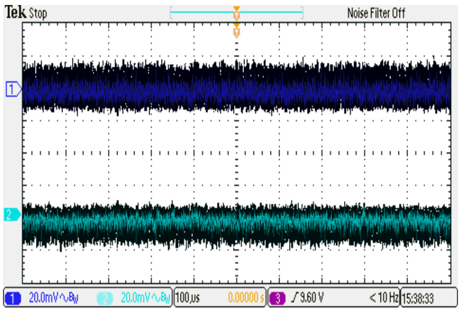
All test conditions are at 25℃ The figures are identical for MKE15-12D12HI



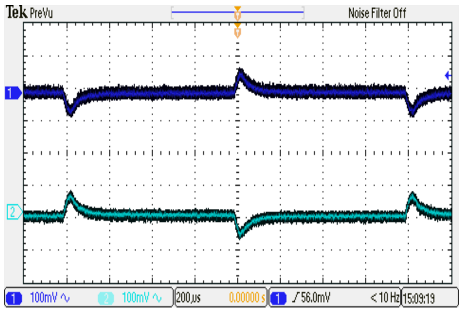
Efficiency Versus Output Current



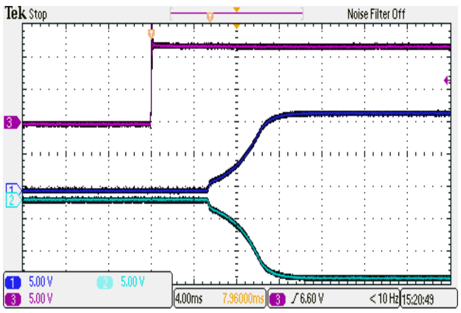
Efficiency Versus Input Voltage
Full Load



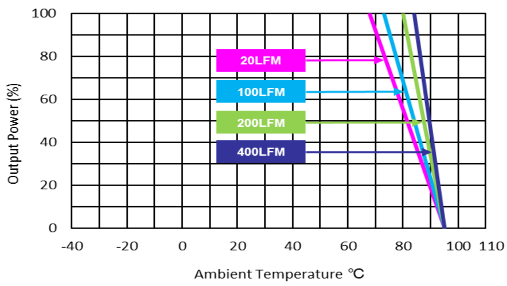
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



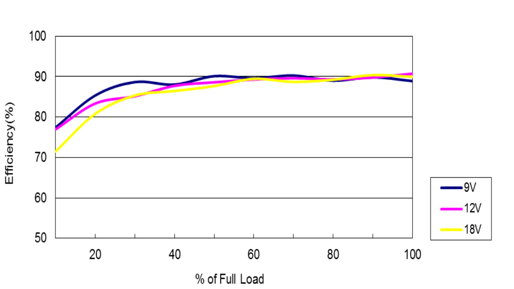
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



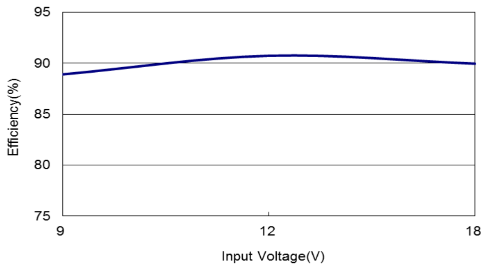
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

Characteristic Curves

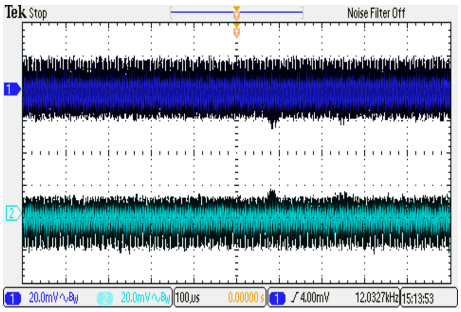
All test conditions are at 25℃ The figures are identical for MKE15-12D15HI



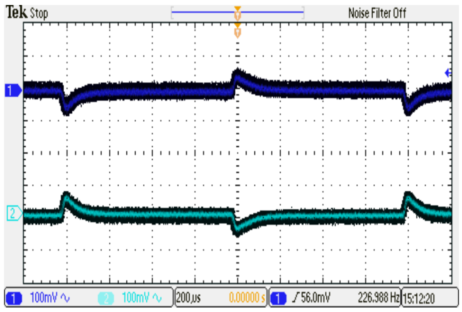
Efficiency Versus Output Current



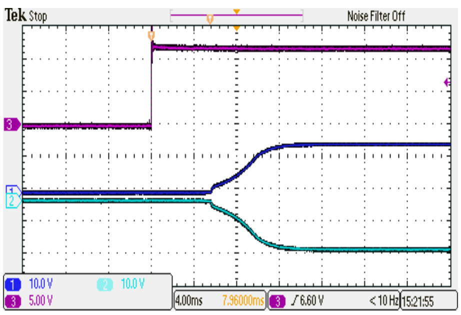
Efficiency Versus Input Voltage
Full Load



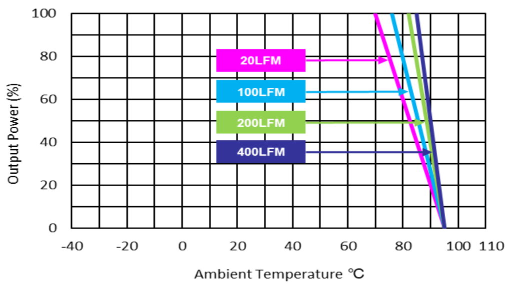
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



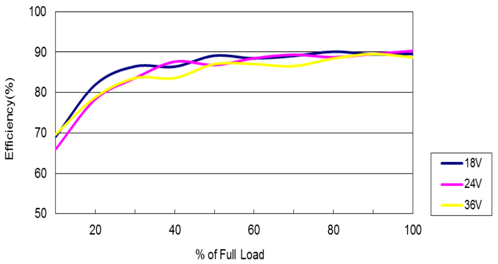
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



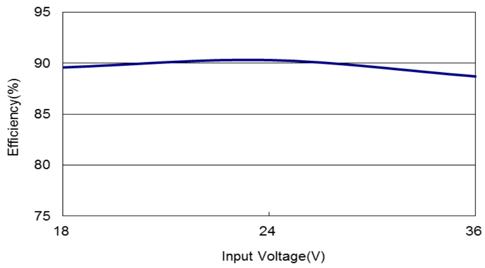
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

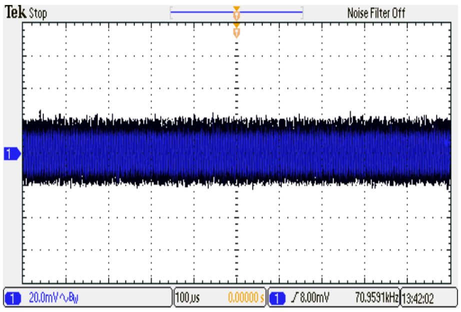
All test conditions are at 25℃ The figures are identical for MKE15-24S05HI



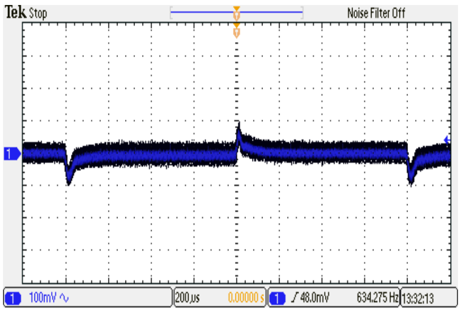
Efficiency Versus Output Current



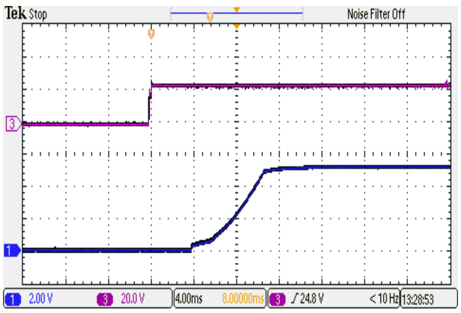
Efficiency Versus Input Voltage
Full Load



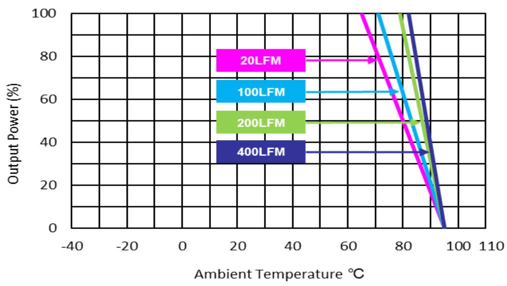
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



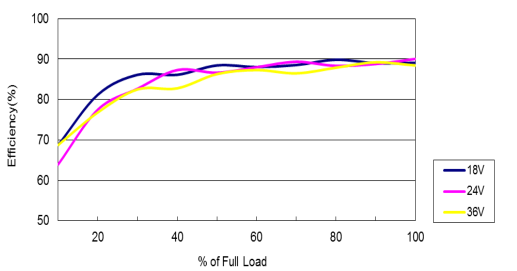
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



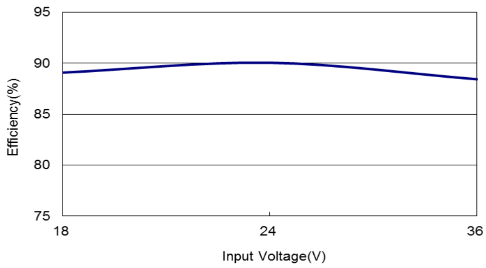
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

Characteristic Curves

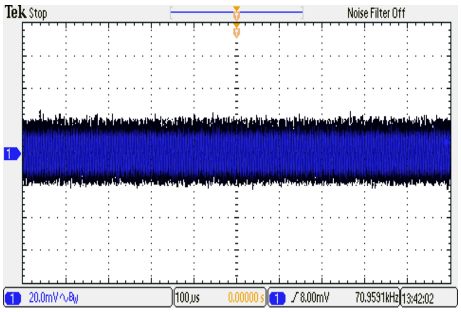
All test conditions are at 25℃ The figures are identical for MKE15-24S051HI



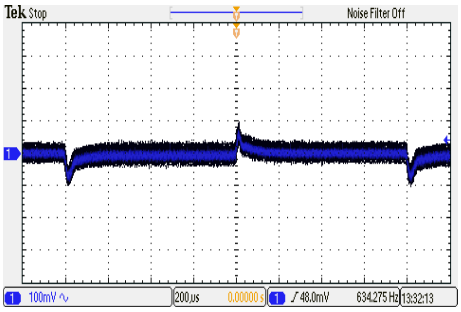
Efficiency Versus Output Current



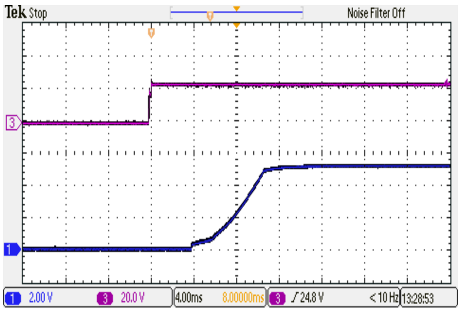
Efficiency Versus Input Voltage
Full Load



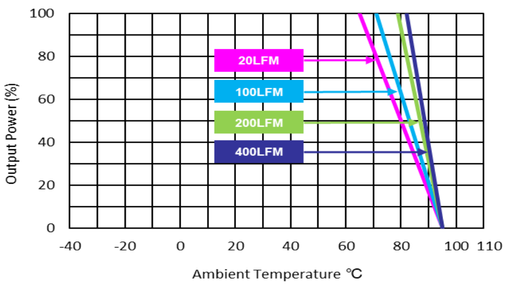
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



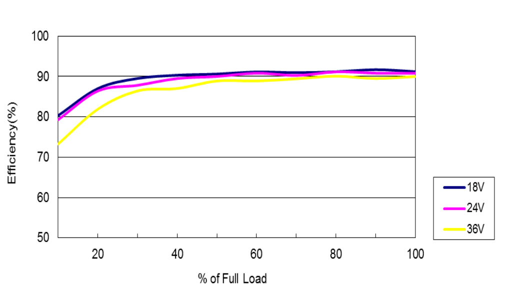
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



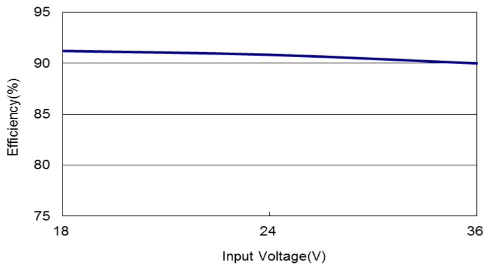
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

Characteristic Curves

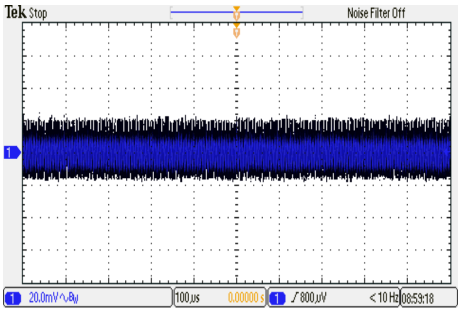
All test conditions are at 25℃ The figures are identical for MKE15-24S12HI



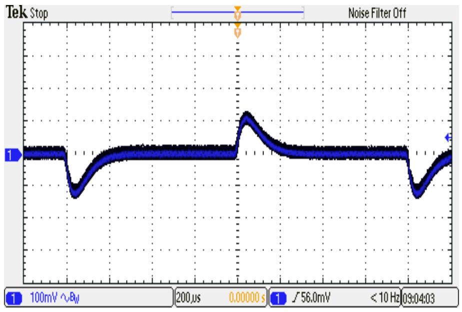
Efficiency Versus Output Current



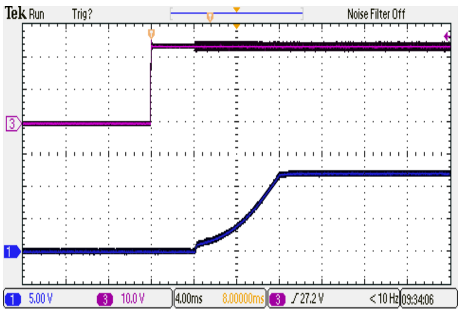
Efficiency Versus Input Voltage
Full Load



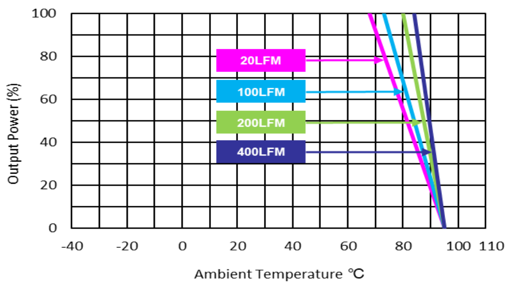
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



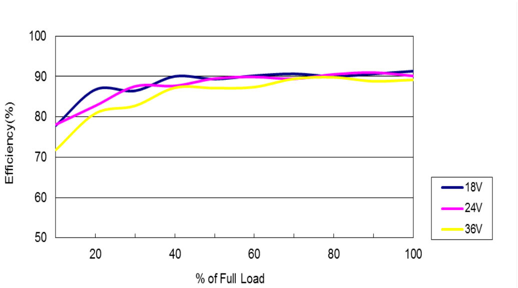
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



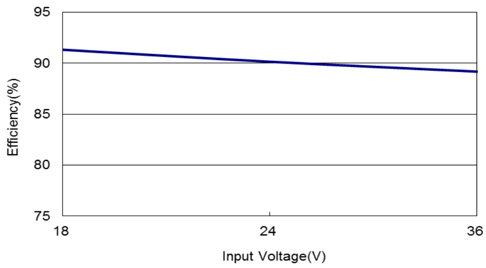
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

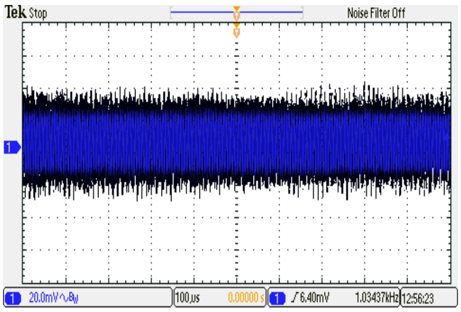
All test conditions are at 25℃ The figures are identical for MKE15-24S15HI



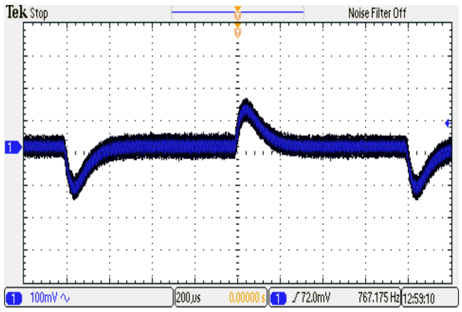
Efficiency Versus Output Current



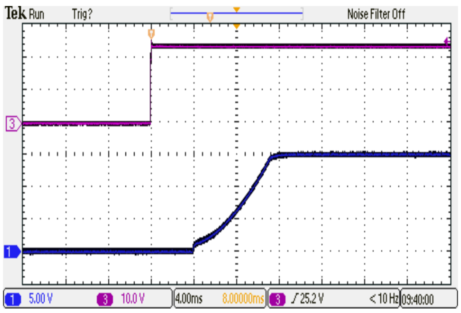
Efficiency Versus Input Voltage
Full Load



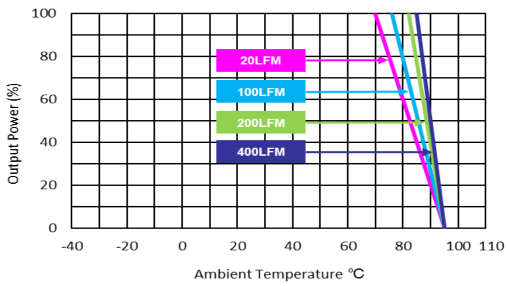
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



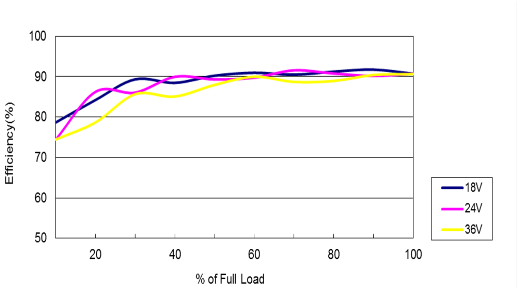
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



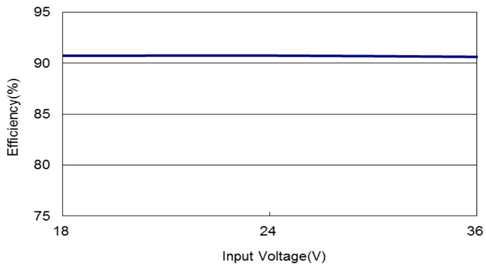
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

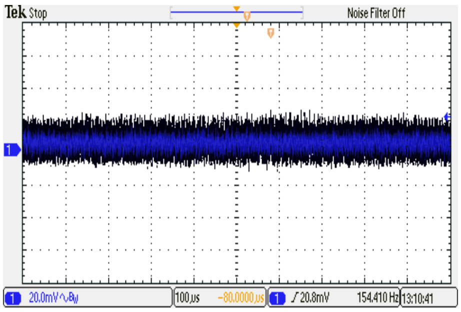
All test conditions are at 25℃ The figures are identical for MKE15-24S24HI



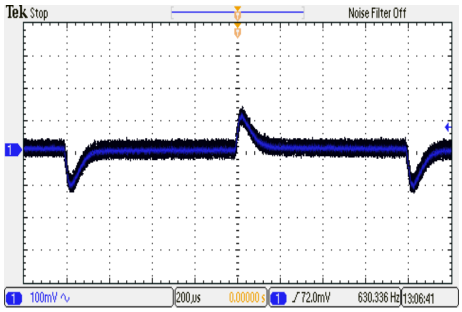
Efficiency Versus Output Current



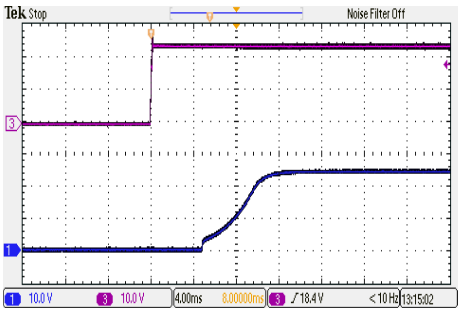
Efficiency Versus Input Voltage
Full Load



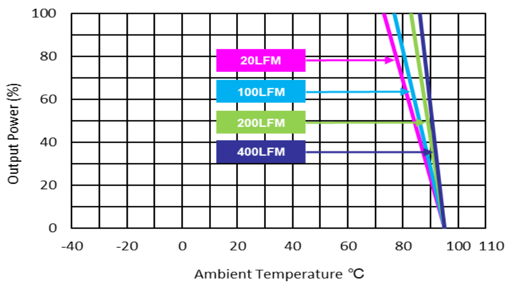
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



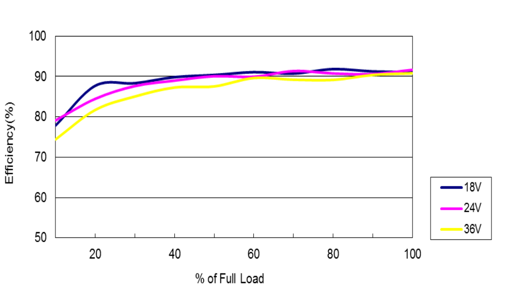
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



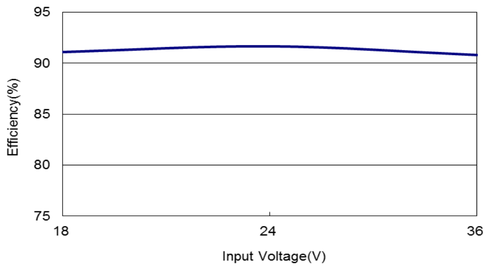
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

Characteristic Curves

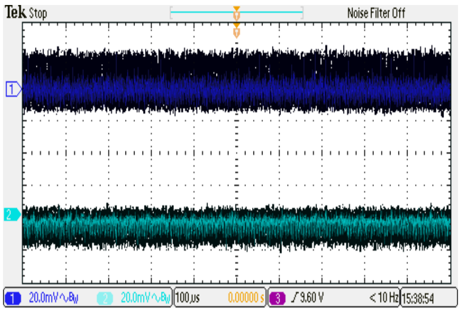
All test conditions are at 25℃ The figures are identical for MKE15-24D12HI



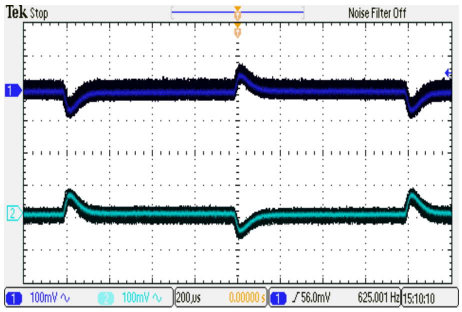
Efficiency Versus Output Current



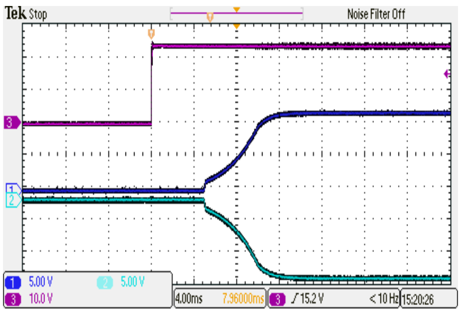
Efficiency Versus Input Voltage
Full Load



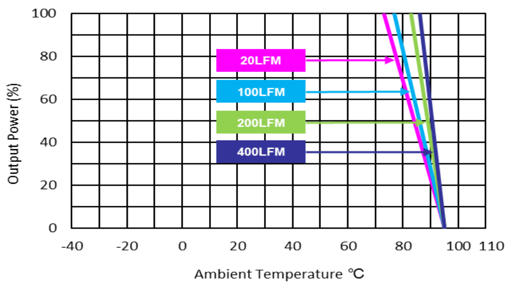
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



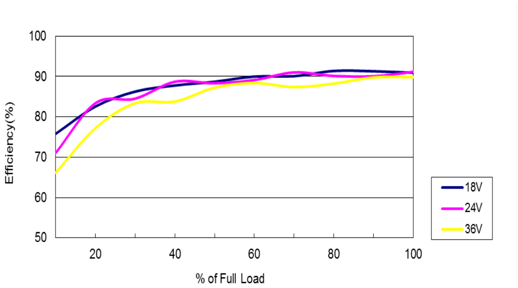
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



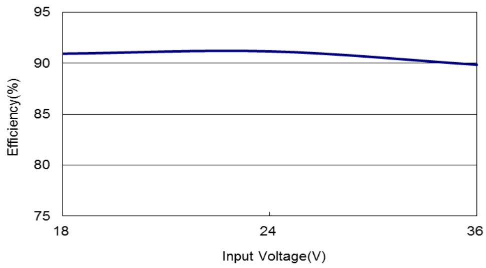
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

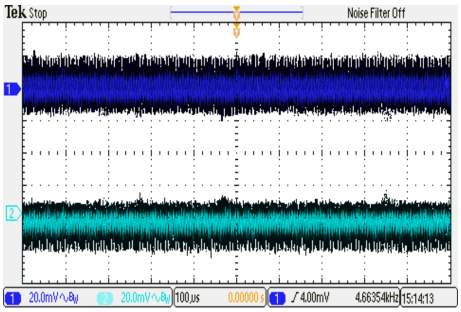
All test conditions are at 25℃ The figures are identical for MKE15-24D15HI



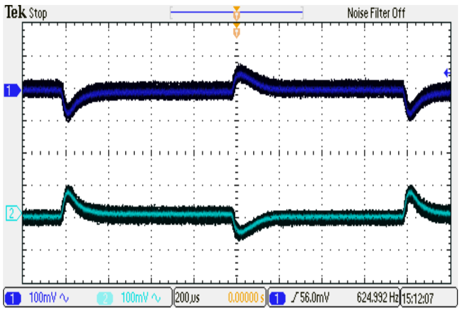
Efficiency Versus Output Current



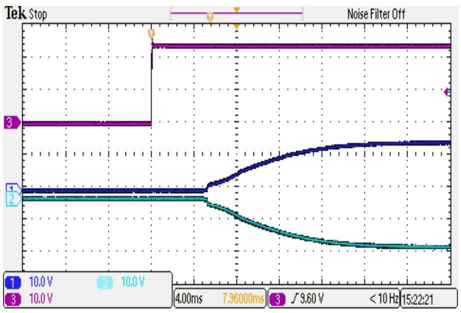
Efficiency Versus Input Voltage
Full Load



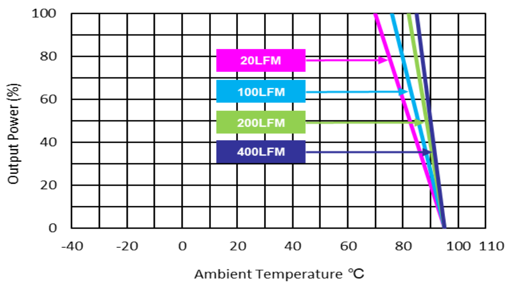
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



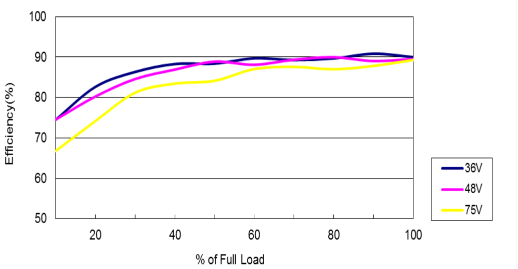
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



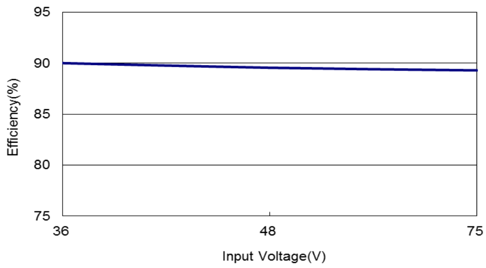
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

Characteristic Curves

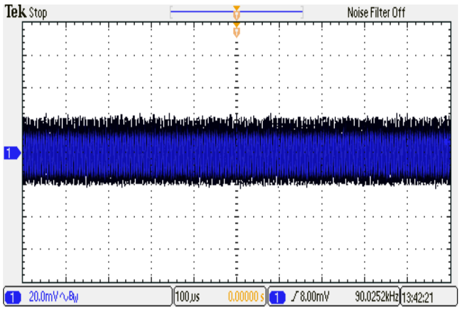
All test conditions are at 25℃ The figures are identical for MKE15-48S05HI



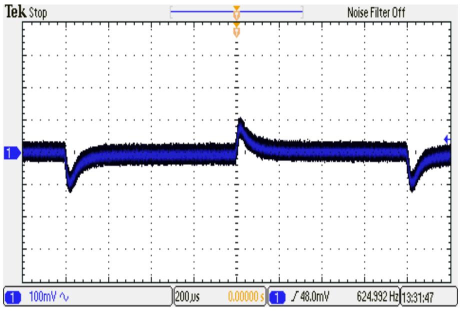
Efficiency Versus Output Current



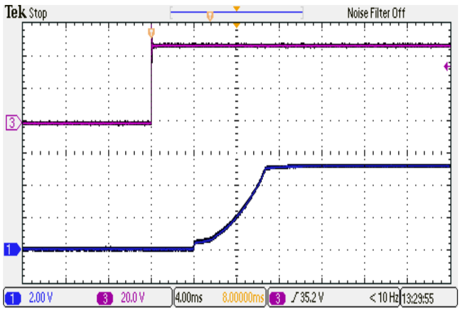
Efficiency Versus Input Voltage
Full Load



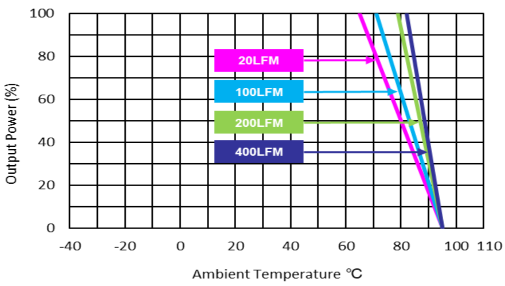
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



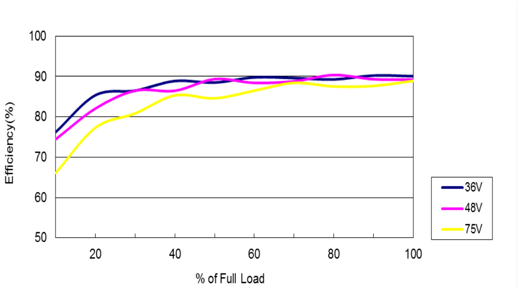
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



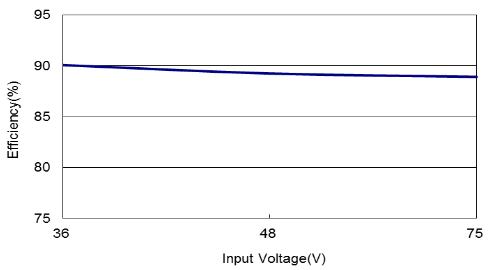
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

Characteristic Curves

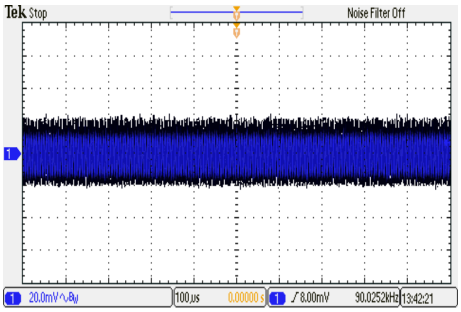
All test conditions are at 25℃ The figures are identical for MKE15-48S051HI



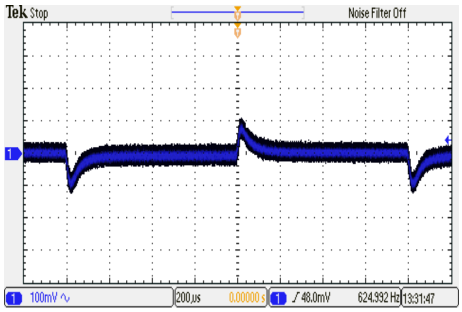
Efficiency Versus Output Current



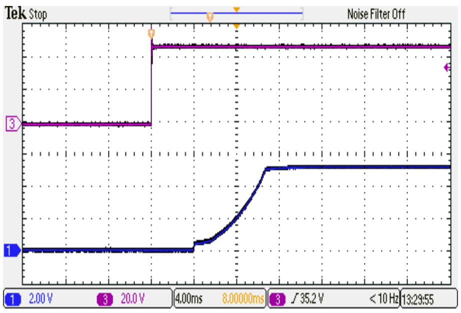
Efficiency Versus Input Voltage
Full Load



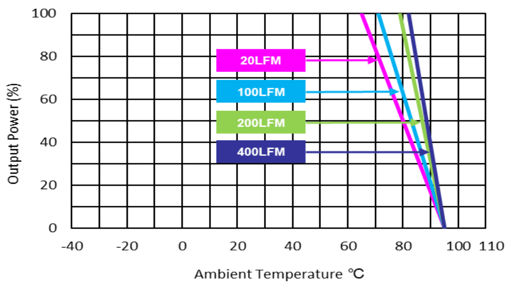
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



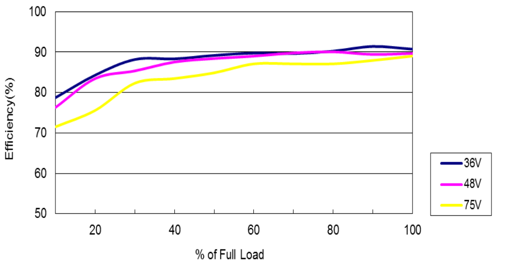
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



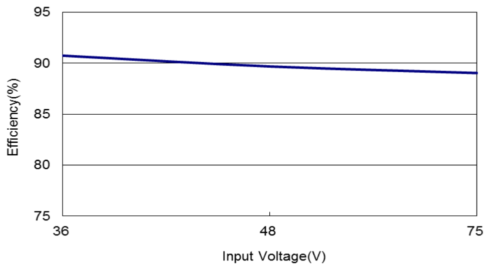
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

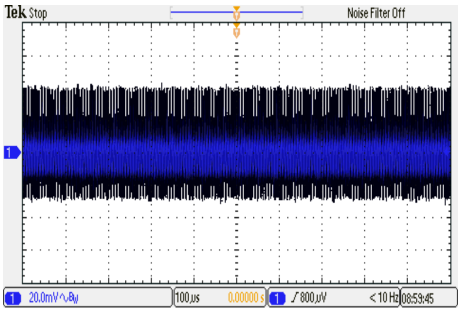
All test conditions are at 25℃ The figures are identical for MKE15-48S12HI



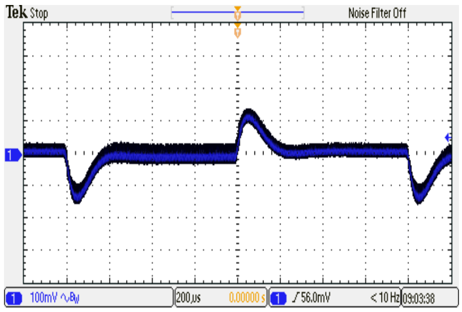
Efficiency Versus Output Current



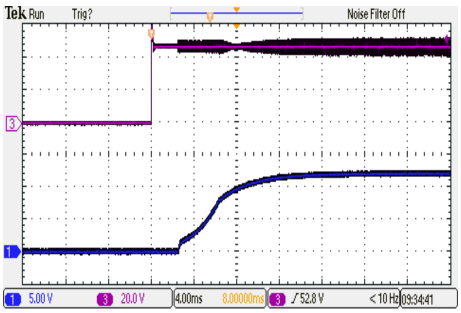
Efficiency Versus Input Voltage
Full Load



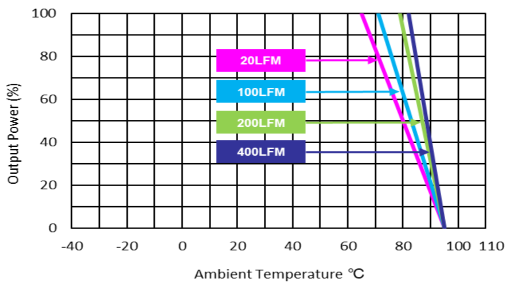
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



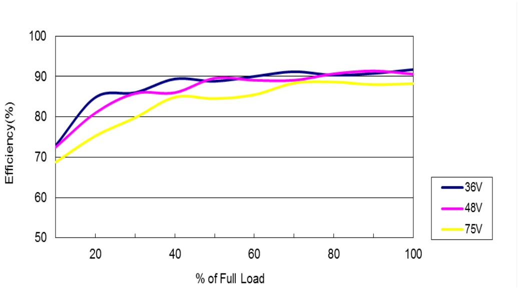
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



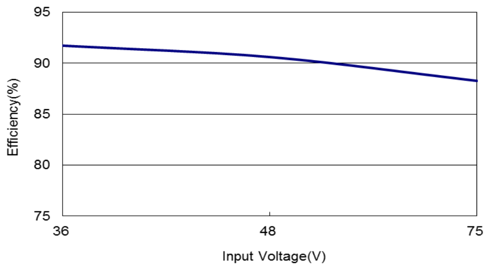
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

Characteristic Curves

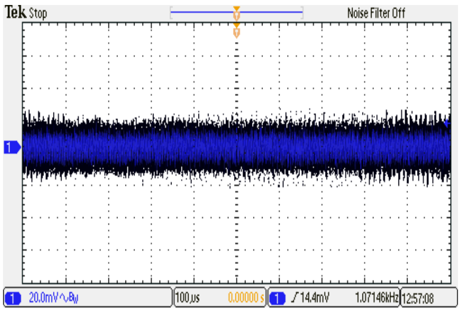
All test conditions are at 25℃ The figures are identical for MKE15-48S15HI



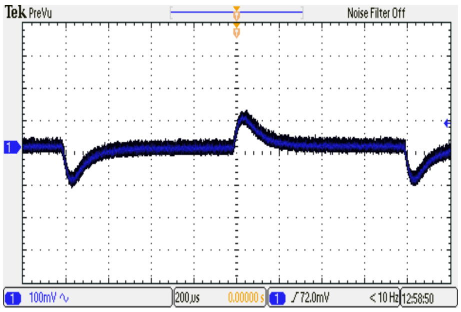
Efficiency Versus Output Current



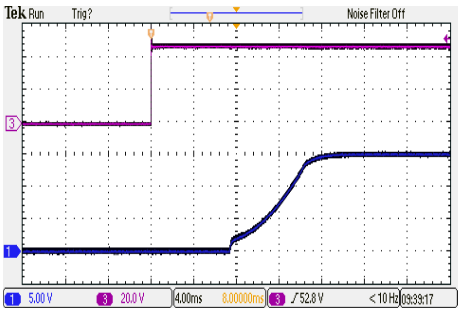
Efficiency Versus Input Voltage
Full Load



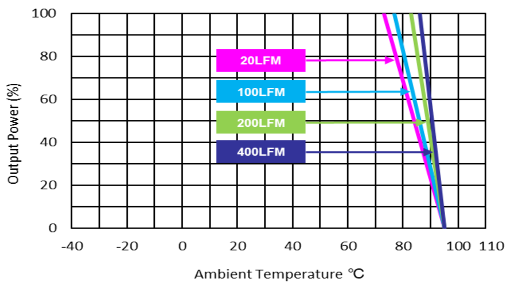
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



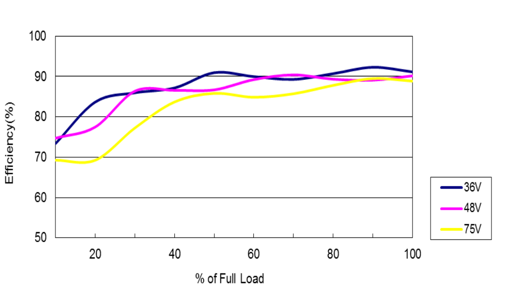
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



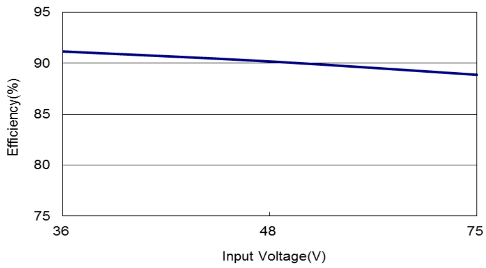
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

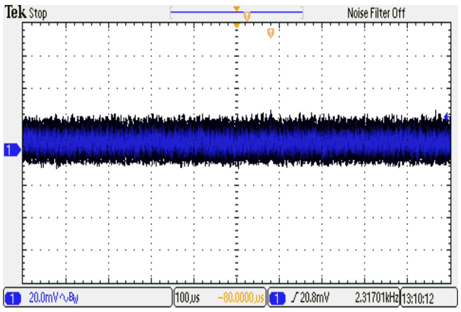
All test conditions are at 25℃ The figures are identical for MKE15-48S24HI



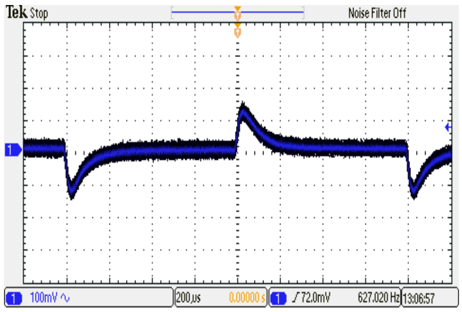
Efficiency Versus Output Current



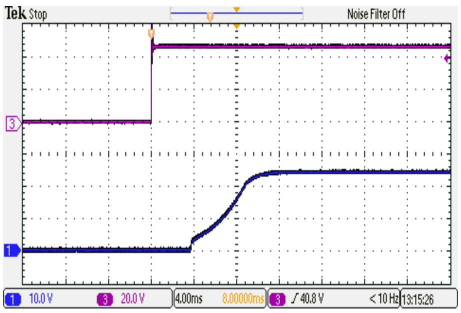
Efficiency Versus Input Voltage
Full Load



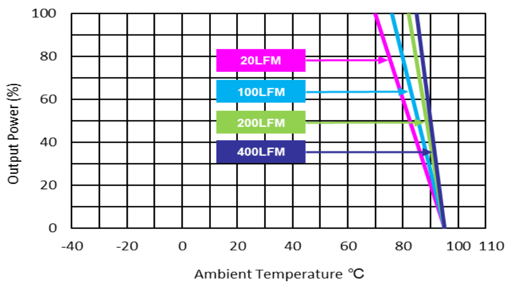
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



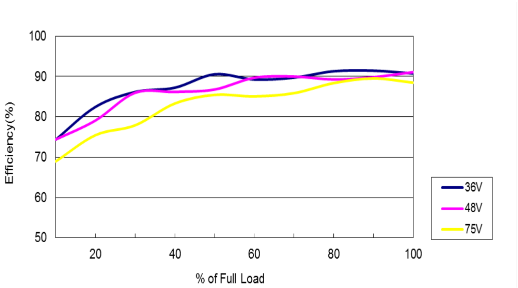
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



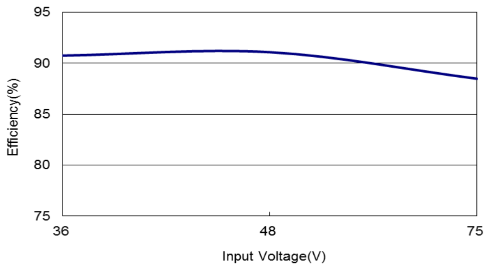
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

Characteristic Curves

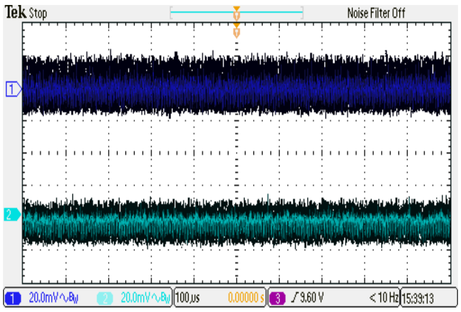
All test conditions are at 25℃ The figures are identical for MKE15-48D12HI



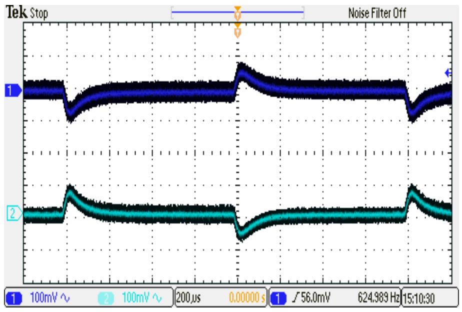
Efficiency Versus Output Current



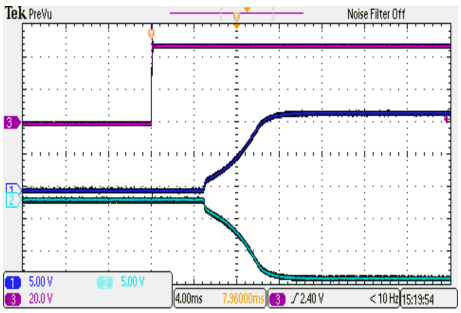
Efficiency Versus Input Voltage
Full Load



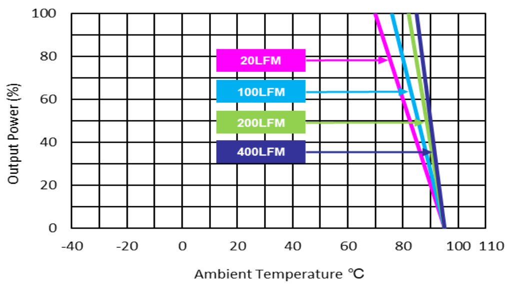
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



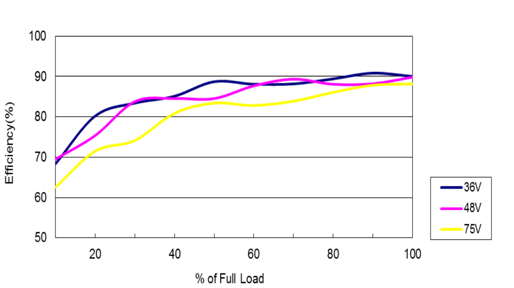
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



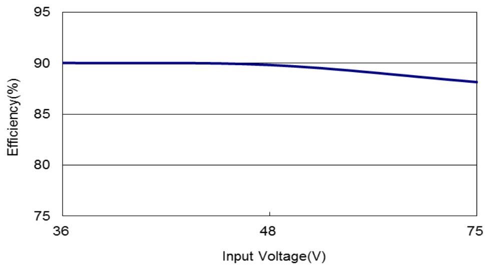
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

Characteristic Curves

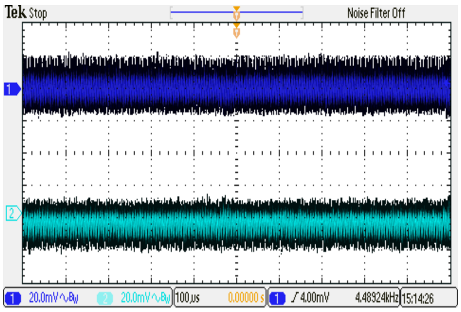
All test conditions are at 25℃ The figures are identical for MKE15-48D15HI



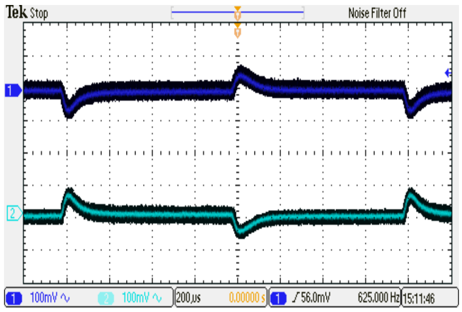
Efficiency Versus Output Current



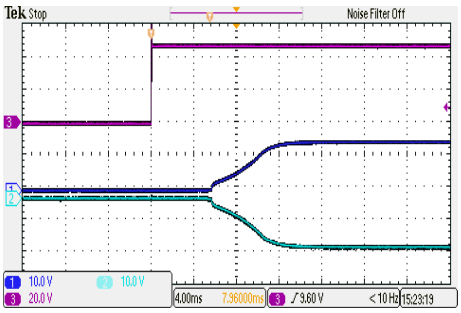
Efficiency Versus Input Voltage
Full Load



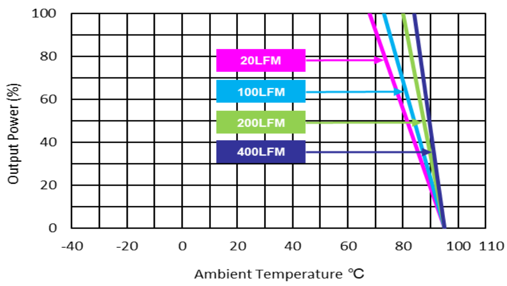
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



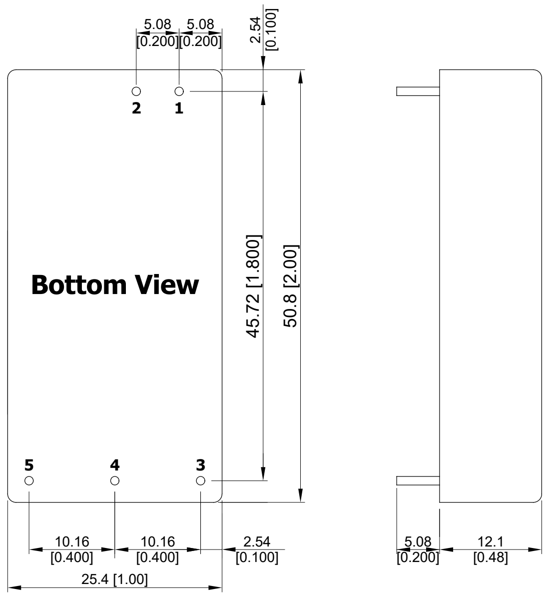
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Package Specifications

Mechanical Dimensions



Pin Connections

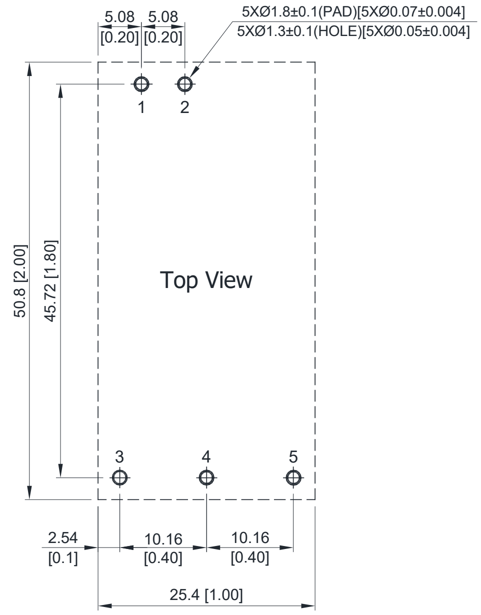
Pin	Single Output	Dual Output	Diameter mm (inches)
1	+Vin	+Vin	Ø 1.0 [0.04]
2	-Vin	-Vin	Ø 1.0 [0.04]
3	+Vout	+Vout	Ø 1.0 [0.04]
4	No Pin	Common	Ø 1.0 [0.04]
5	-Vout	-Vout	Ø 1.0 [0.04]

- All dimensions in mm (inches)
- Tolerance: X.X±0.5 (X.XX±0.02)
  X.XX±0.25 (X.XXX±0.01)
- Pin diameter tolerance: X.X±0.05 (X.XX±0.002)

Physical Characteristics

Case Size	:	50.8x25.4x12.1mm (2.0x1.0x0.48 inches)
Case Material	:	Plastic resin (flammability to UL 94V-0 rated)
Pin Material	:	Copper Alloy
Weight	:	30g

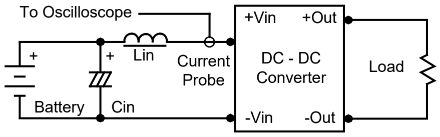
Recommended Pad Layout for Single & Dual Output Converter



Test Setup

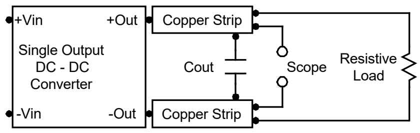
Input Reflected-Ripple Current Test Setup

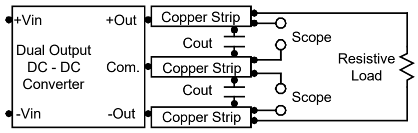
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 kHz) to simulate source impedance. Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 kHz.



Peak-to-Peak Output Noise Measurement Test

Use a Cout 4.7μF 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

Overload Protection

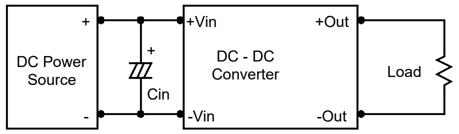
To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

Overvoltage Protection

The output overvoltage clamp consists of control circuitry, which is independent of the primary regulation loop, that monitors the voltage on the output terminals. The control loop of the clamp has a higher voltage set point than the primary loop. This provides a redundant voltage control that reduces the risk of output overvoltage. The OVP level can be found in the output data.

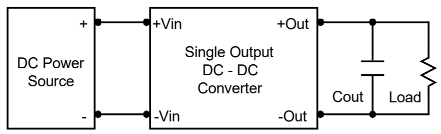
Input Source Impedance

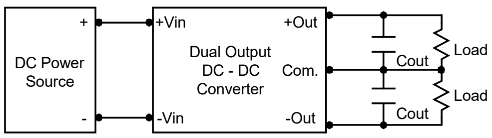
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor on the input to insure startup. By using a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 kHz) capacitor of a 10μF for the 12V input devices and a 4.7μF for the 24V input devices and a 2.2μF for the 48V devices, capacitor mounted close to the power module helps ensure stability of the unit.



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 4.7μF capacitors at the output.



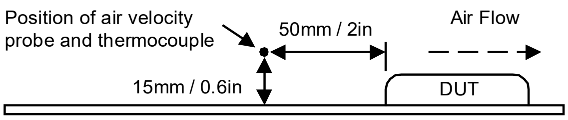


Maximum Capacitive Load

The MKE15-HI series has limitation of maximum connected capacitance on the output. The power module may operate in current limiting mode during start-up, affecting the ramp-up and the startup time. Connect capacitors at the point of load for best performance. The maximum capacitance can be found in the data sheet.

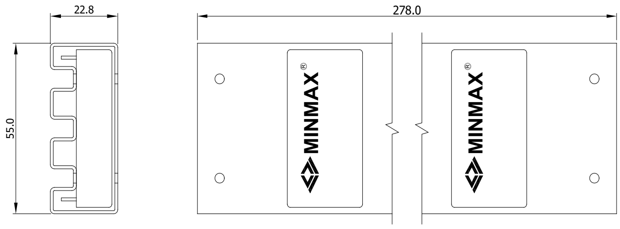
Thermal Considerations

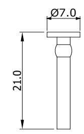
Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the case temperature must be kept below 95°C. The derating curves are determined from measurements obtained in a test setup.



Packaging Information for Tube

Tube | Nail

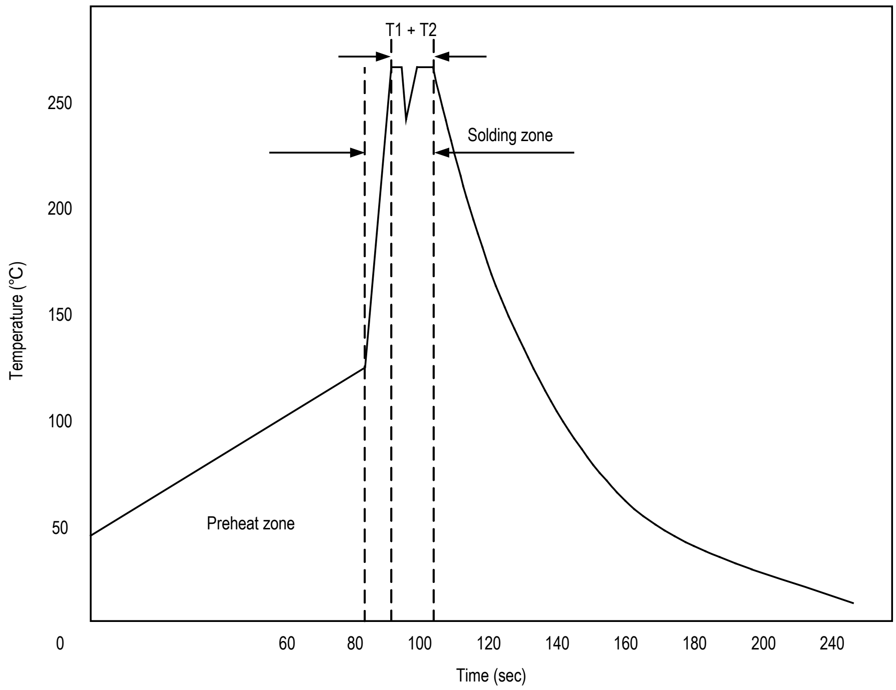




Unit: mm
10 PCS per TUBE

Wave Soldering Considerations

Lead free wave solder profile



Zone	Reference Parameter
Preheat	Rise temp. speed：3°C/sec max.
zone	Preheat temp.：100~130°C
Actual	Peak temp.：250~260°C
heating	Peak time(T1+T2)：4~6 sec

Hand Welding Parameter

Reference Solder: Sn-Ag-Cu：Sn-Cu：Sn-Ag

Hand Welding: Soldering iron：Power 60W

Welding Time: 2~4 sec

Temp.: 380~400°C

Part Number Structure

M	K	E	15	-	12	S	05	HI
	Package Type 2" X 1"	Application Ultra-High Isolation Wide 2:1 Input Voltage Range	Output Power 15 Watt		Input Voltage Range 12: 9 ~ 18 VDC 24: 18 ~ 36 VDC 48: 36 ~ 75 VDC	Output Quantity S: Single D: Dual	Output Voltage 05: 5 VDC 051: 5.1 VDC 12: 12 VDC 15: 15 VDC 24: 24 VDC	I/O Isolation Voltage 8000 VDC

MTBF and Reliability

The MTBF of MKE15-HI series of DC-DC converters has been calculated using

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

Model	MTBF	Unit
MKE15-12S05HI	1,428,181	Hours
MKE15-12S051HI	1,428,181	
MKE15-12S12HI	1,927,407	
MKE15-12S15HI	2,026,516	
MKE15-12S24HI	1,780,163	
MKE15-12D12HI	1,780,163	
MKE15-12D15HI	2,108,738	
MKE15-24S05HI	1,646,820	
MKE15-24S051HI	1,646,820	
MKE15-24S12HI	1,975,949	
MKE15-24S15HI	2,068,481	
MKE15-24S24HI	2,019,674	
MKE15-24D12HI	2,019,674	
MKE15-24D15HI	2,134,001	
MKE15-48S05HI	1,749,638	
MKE15-48S051HI	1,749,638	
MKE15-48S12HI	1,866,230	
MKE15-48S15HI	1,953,706	
MKE15-48S24HI	1,809,937	
MKE15-48D12HI	1,809,937	
MKE15-48D15HI	2,031,988	