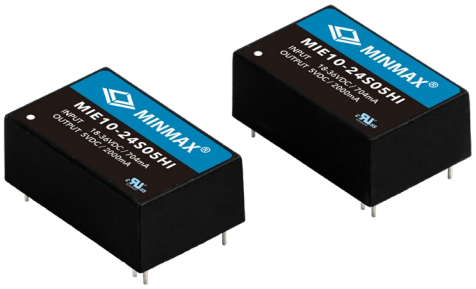
MINMAX®

MIE10-HI Series
Electric Characteristic Note

MIE10-HI Series EC Note

DC-DC CONVERTER 10W, Ultra-High Isolation, DIP Package

Features



- **Industrial Standard DIP-24 Package**
- **Wide 2:1 Input Voltage Range**
- **Fully Regulated Output Voltage**
- **Ultra-high I/O Isolation 9000VDC with reinforced Insulation, rate for 1000Vrms Working Voltage**
- **Operating Ambient Temp. Range -40℃ to +90℃**
- **No Min. Load Requirement**
- **Under-voltage, Overload/Voltage and Short Circuit Protection**
- **EMI Emission EN 55032 Class A Approved**
- **UL/cUL/IEC/EN 62368-1 Safety Approval & CE Marking**

Applications

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

Product Overview

The MINMAX MIE10-HI series is a new range of high performance 10W DC-DC converter within encapsulated DIP-24 package which specifically design for high isolation applications where reinforced insulation and high working voltage are required. There are 24 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 9000VDC 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 EN55032 Class A approved, low I/O capacitance 20pF max. and operating ambient temp. range by -40°C to 90°C by high efficiency up to 88%. MIE10-HI series conform to UL/cUL/IEC/EN 62368-1 safety approvals. The MIE10-HI series offer a superior solution for critical application in requesting a certified supplementary.

Table of contents

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Over Voltage Protection	Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load			@Max. Load
	VDC	VDC	Ma	mA(typ.)	mA(typ.)	VDC	μF	%
MIE10-12S033HI	12 (9 ~ 18)	3.3	2700	917	12	3.9	4700	81
MIE10-12S05HI		5	2000	1004		6.2	3300	83
MIE10-12S051HI		5.1	2000	1024		6.2	3300	83
MIE10-12S12HI		12	833	969		15	560	86
MIE10-12S15HI		15	666	946		18	360	88
MIE10-12S24HI		24	416	945		27	140	88
MIE10-12D12HI		±12	±416	945		±15	280#	88
MIE10-12D15HI		±15	±333	957		±18	180#	87
MIE10-24S033HI	24 (18 ~ 36)	3.3	2700	458	8	3.9	4700	81
MIE10-24S05HI		5	2000	496		6.2	3300	84
MIE10-24S051HI		5.1	2000	506		6.2	3300	84
MIE10-24S12HI		12	833	479		15	560	87
MIE10-24S15HI		15	666	473		18	360	88
MIE10-24S24HI		24	416	473		27	140	88
MIE10-24D12HI		±12	±416	473		±15	280#	88
MIE10-24D15HI		±15	±333	478		±18	180#	87
MIE10-48S033HI	48 (36 ~ 75)	3.3	2700	229	6	3.9	4700	81
MIE10-48S05HI		5	2000	248		6.2	3300	84
MIE10-48S051HI		5.1	2000	253		6.2	3300	84
MIE10-48S12HI		12	833	239		15	560	87
MIE10-48S15HI		15	666	237		18	360	88
MIE10-48S24HI		24	416	239		27	140	87
MIE10-48D12HI		±12	±416	239		±15	280#	87
MIE10-48D15HI		±15	±333	239		±18	180#	87

For each output

Input Specifications

Parameter	Conditions / Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (1 sec. 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	---	8	---	
	24V Input Models	---	16	---	
	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		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	%
Load Cross Regulation (Dual Output Models)	Asymmetrical Load 25/100% Full Load		---	---	±5.0	%
Minimum Load	No minimum Load Requirement					
Ripple & Noise	0-20 MHz Bandwidth	Measured with a 10μF MLCC	---	50	---	mV_{P-P}
Transient Recovery Time	25% Load Step Change		---	300	---	μsec
Transient Response Deviation			---	±3	±5	%
Temperature Coefficient			---	±0.01	±0.02	%/℃
Over Load Protection	Hiccup		---	150	---	%
Short Circuit Protection	Continuous, Automatic Recovery (Hiccup Mode 0.5Hz typ.)					

Isolation, Safety Standards

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds Reinforced insulation, rated for 1000Vrms working voltage	5000	---	---	VAC
	Tested for 1 second	9000	---	---	VDC
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	---	20	pF
Safety Approvals	UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1 & 60950-1(CB report)				

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Switching Frequency		---	240	---	kHz
MTBF(calculated)	MIL-HDBK-217F@25℃, Ground Benign	3,816,975	---	---	Hours

EMC Specifications

Parameter	Standards & Level			Performance
EMI	Conduction	EN 55032	Without external components	Class A
	Radiation			
$EMS_{(5)}$	EN 55024, 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 ±2kV		A
	Conducted immunity	EN 61000-4-6 10Vrms		A
	PFMF	EN 61000-4-8 100A/m, 1000A/m(1 sec.)		A

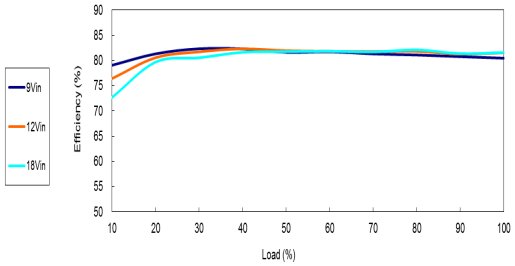
Environmental Specifications				
Parameter	Conditions	Min.	Max.	Unit
Operating Ambient Temperature Range Nominal Vin, Load 100% Inom. (for Power Derating see relative Derating Curves)	MIE10-12S033HI, MIE10-12S05HI, MIE10-12S051HI, MIE10-24S033HI MIE10-48S033HI	-40	+60	℃
	MIE10-12S12HI, MIE10-24S05HI, MIE10-24S051HI, MIE10-48S05HI MIE10-48S051HI		+65	
	MIE10-12S15HI, MIE10-12S24HI, MIE10-12D12HI, MIE10-12D15HI MIE10-24S12HI, MIE10-24S15HI, MIE10-24S24HI, MIE10-24D12HI MIE10-24D15HI, MIE10-48S12HI, MIE10-48S15HI, MIE10-48S24HI MIE10-48D12HI, MIE10-48D15HI		+75	
Case Temperature		---	105	℃
Storage Temperature Range		-50	+125	℃
Humidity (non condensing)		---	95	% rel. H
Altitude		---	5000	m
Lead Temperature (1.5mm from case for 10Sec.)		---	260	℃

Notes

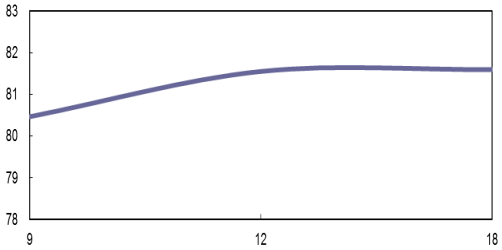
1 Specifications typical at Ta=+25℃, resistive load, nominal input voltage and rated output current unless otherwise noted.
2 Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
3 We recommend to protect the converter by a slow blow fuse in the 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.

Characteristic Curves

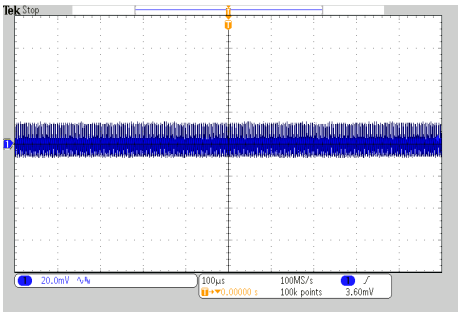
All test conditions are at 25°C The figures are identical for MIE10-12S033HI



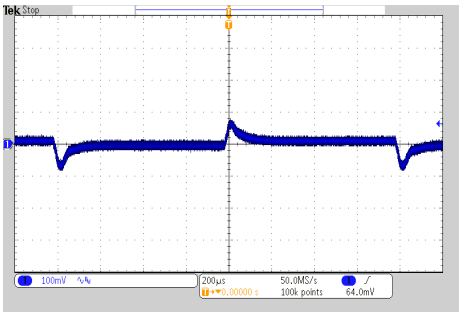
Efficiency Versus Output Current



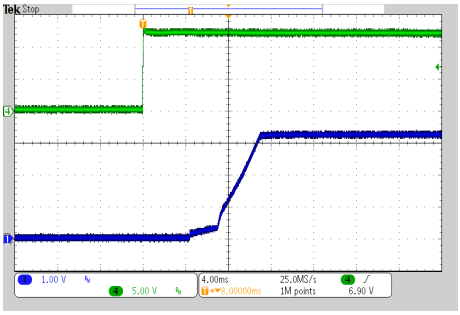
Efficiency Versus Input Voltage
Full Load



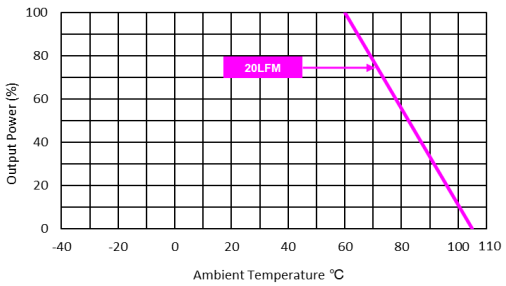
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



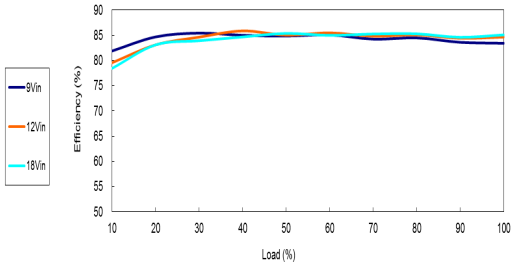
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



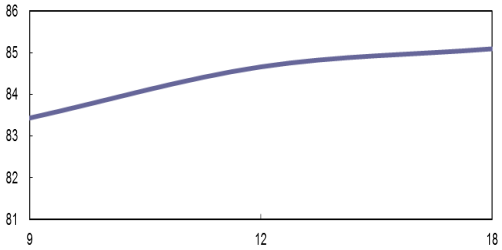
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

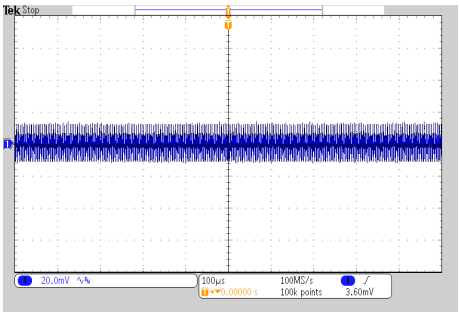
All test conditions are at 25°C The figures are identical for MIE10-12S05HI



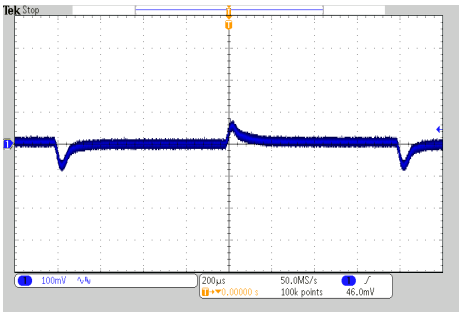
Efficiency Versus Output Current



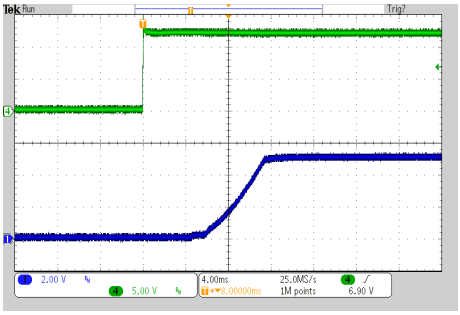
Efficiency Versus Input Voltage
Full Load



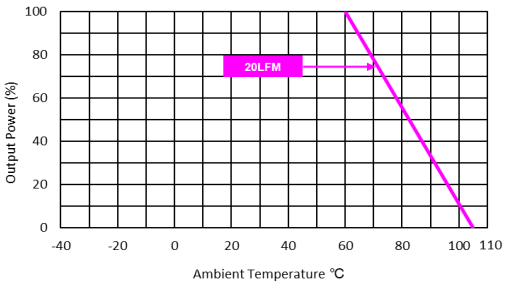
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



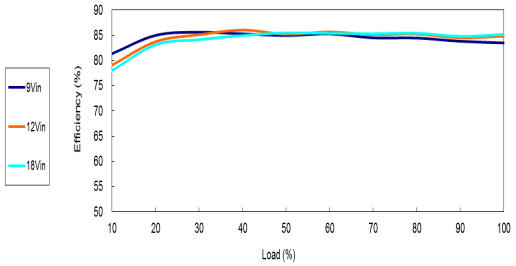
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



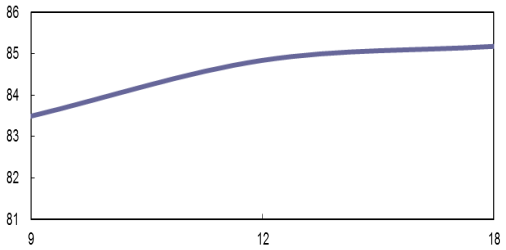
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

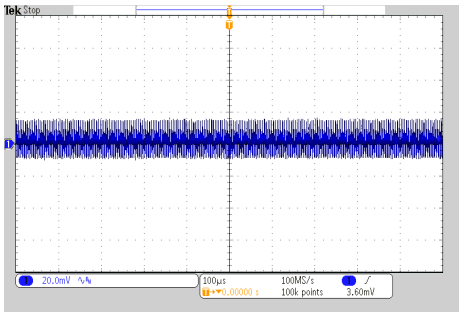
All test conditions are at 25°C The figures are identical for MIE10-12S051HI



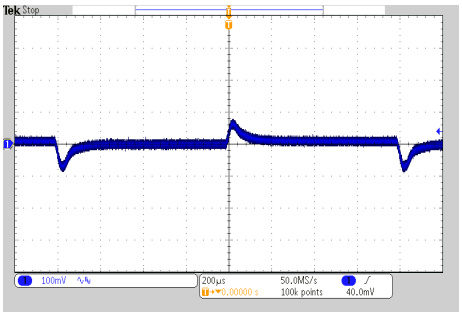
Efficiency Versus Output Current



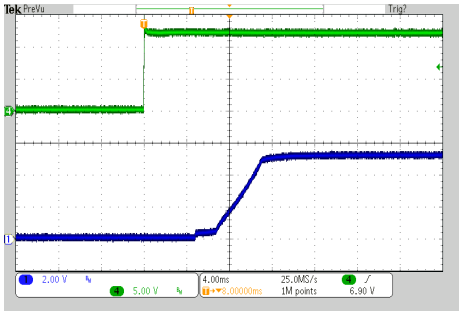
Efficiency Versus Input Voltage
Full Load



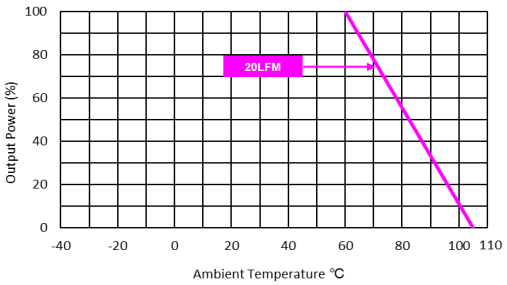
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



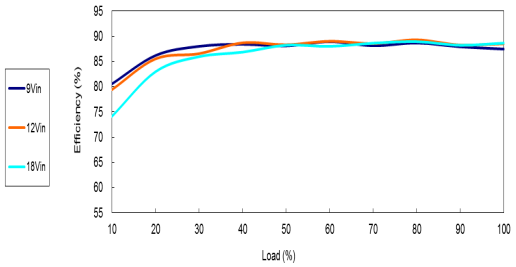
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



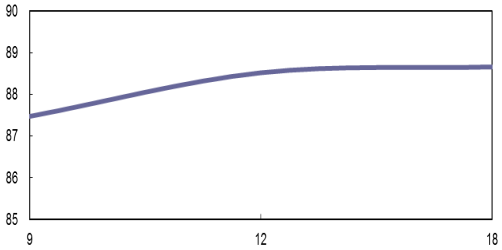
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

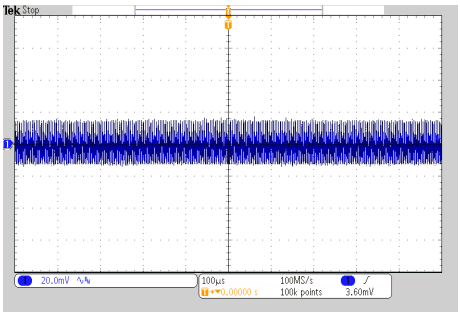
All test conditions are at 25°C The figures are identical for MIE10-12S12HI



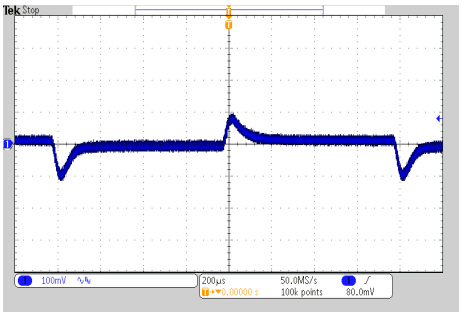
Efficiency Versus Output Current



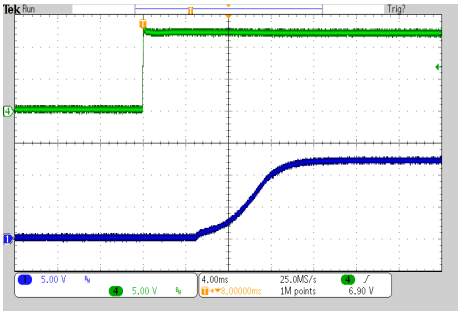
Efficiency Versus Input Voltage
Full Load



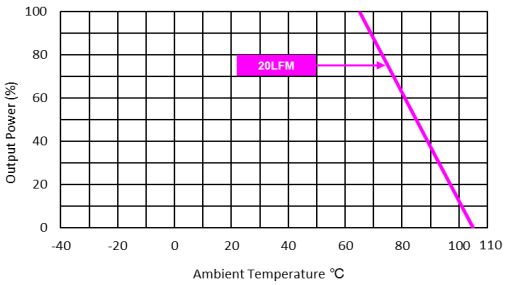
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



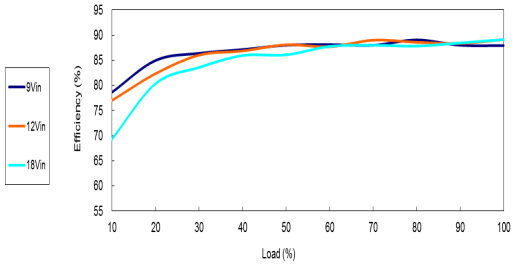
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



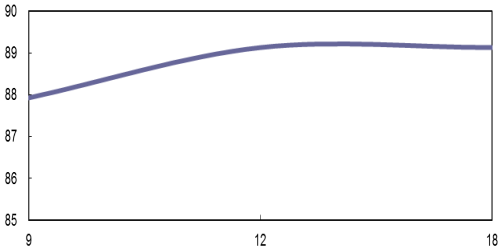
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

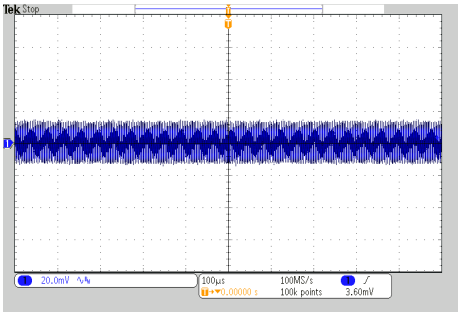
All test conditions are at 25°C The figures are identical for MIE10-12S15HI



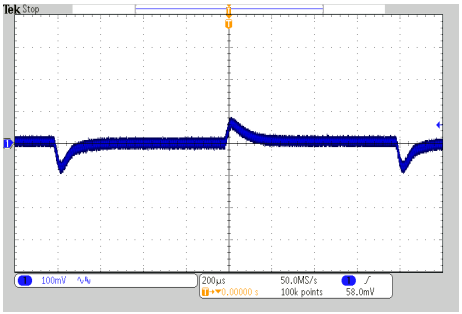
Efficiency Versus Output Current



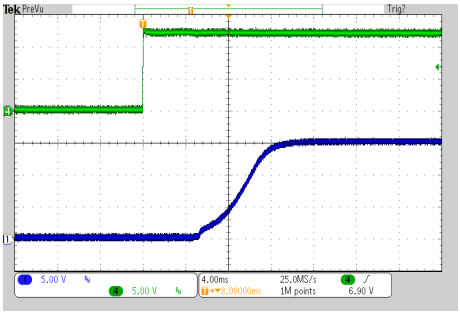
Efficiency Versus Input Voltage
Full Load



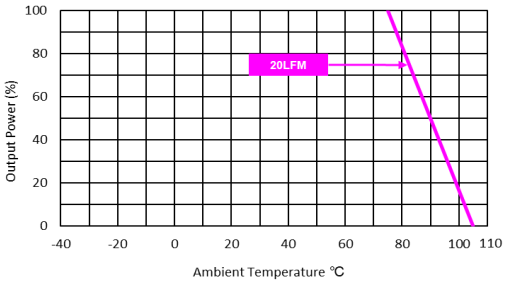
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



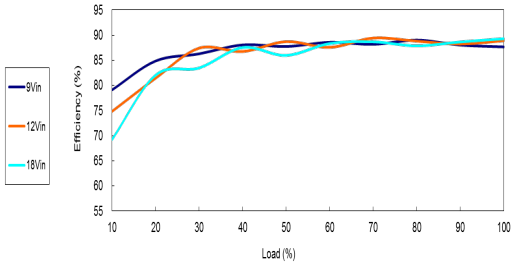
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



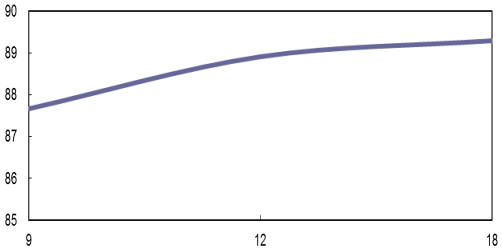
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

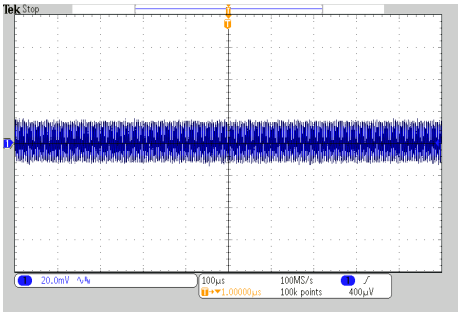
All test conditions are at 25°C The figures are identical for MIE10-12S24HI



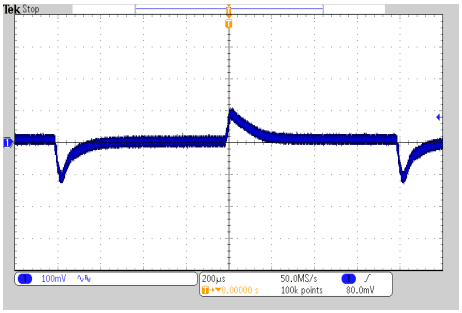
Efficiency Versus Output Current



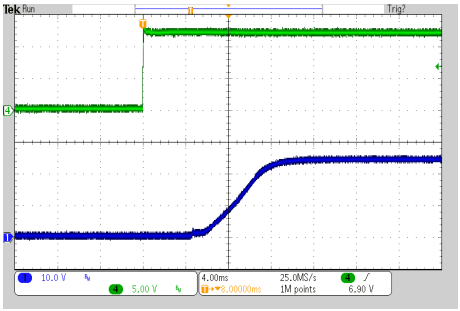
Efficiency Versus Input Voltage
Full Load



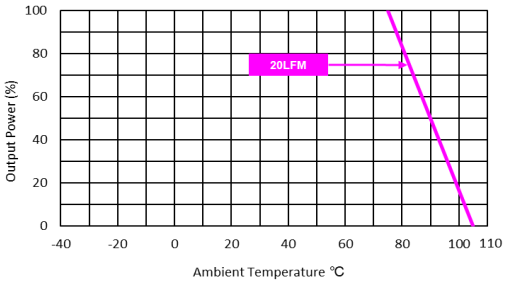
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



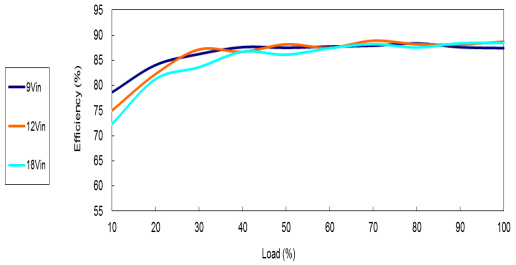
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



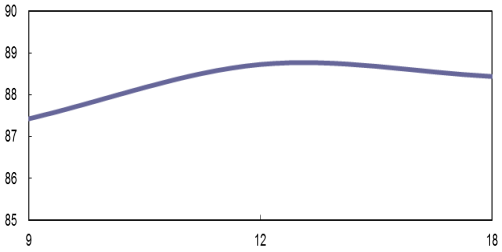
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

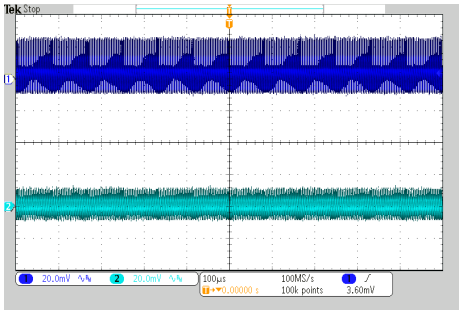
All test conditions are at 25°C The figures are identical for MIE10-12D12HI



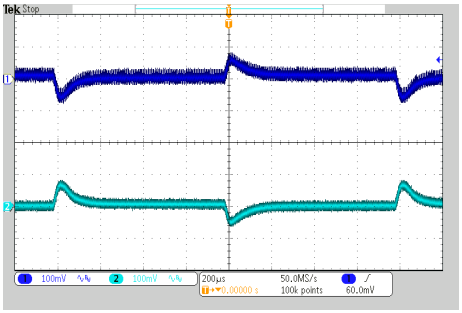
Efficiency Versus Output Current



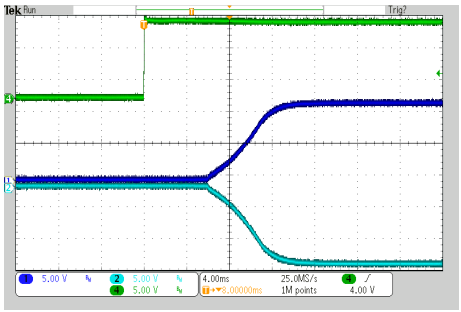
Efficiency Versus Input Voltage
Full Load



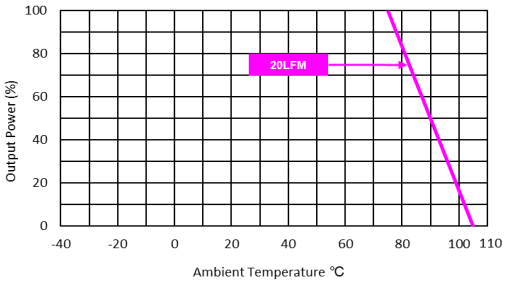
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



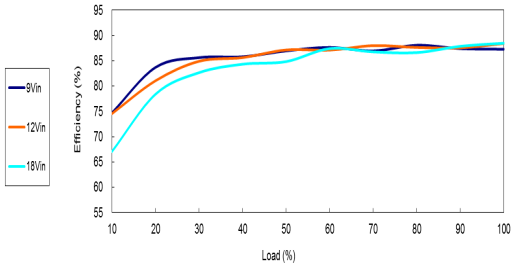
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



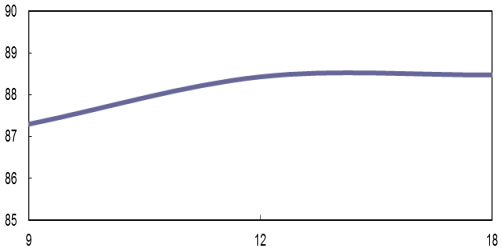
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

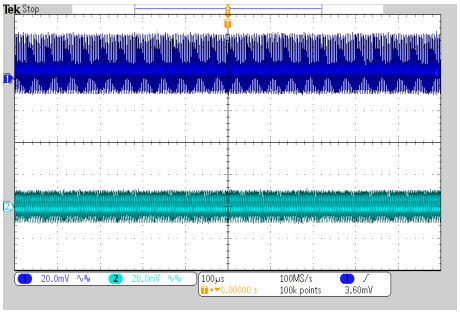
All test conditions are at 25°C The figures are identical for MIE10-12D15HI



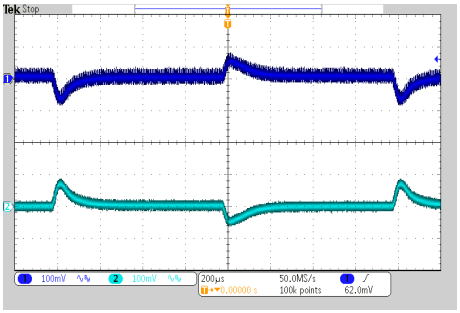
Efficiency Versus Output Current



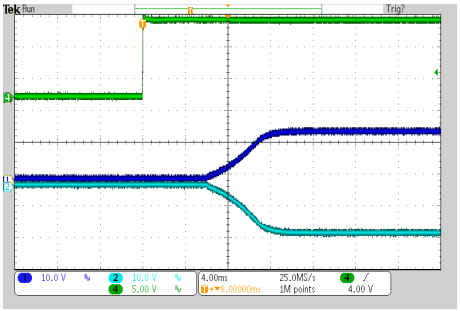
Efficiency Versus Input Voltage
Full Load



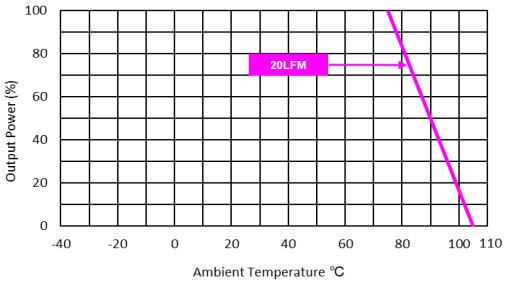
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



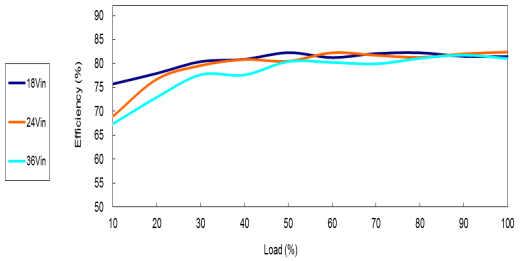
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



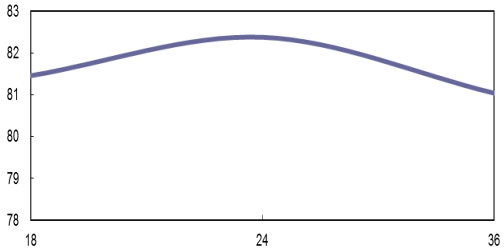
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

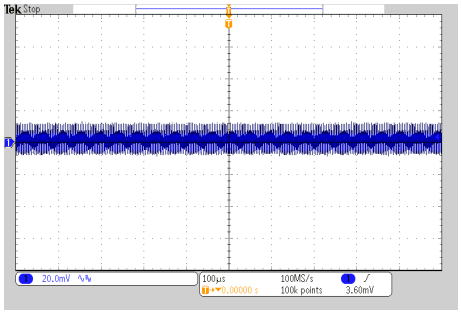
All test conditions are at 25°C The figures are identical for MIE10-24S033HI



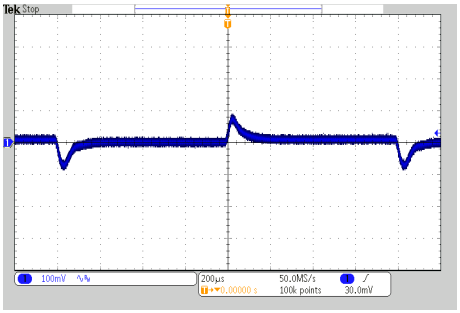
Efficiency Versus Output Current



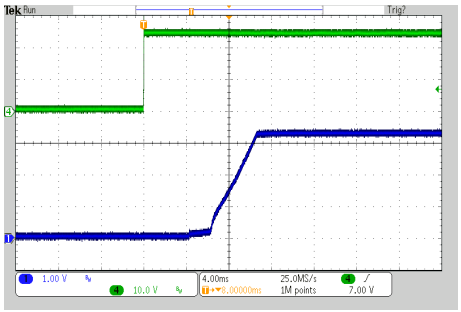
Efficiency Versus Input Voltage
Full Load



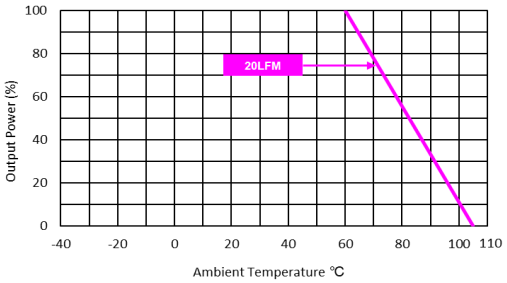
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



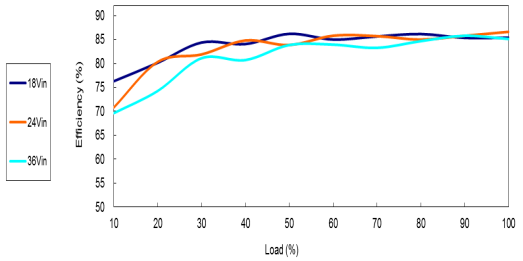
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



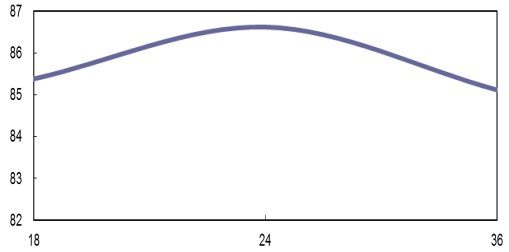
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

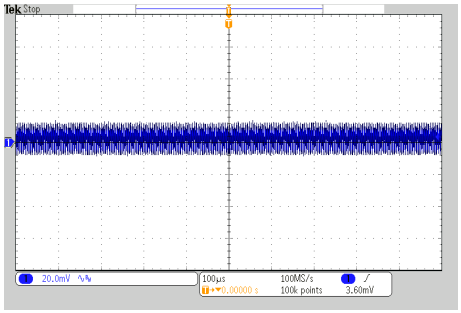
All test conditions are at 25°C The figures are identical for MIE10-24S05HI



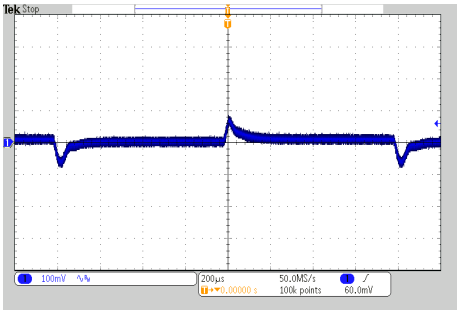
Efficiency Versus Output Current



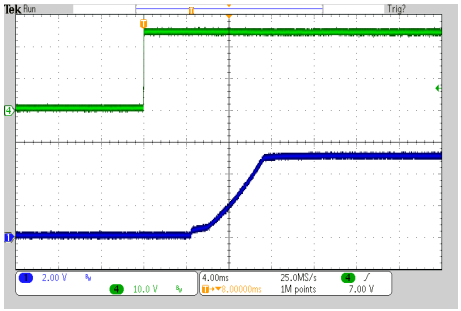
Efficiency Versus Input Voltage
Full Load



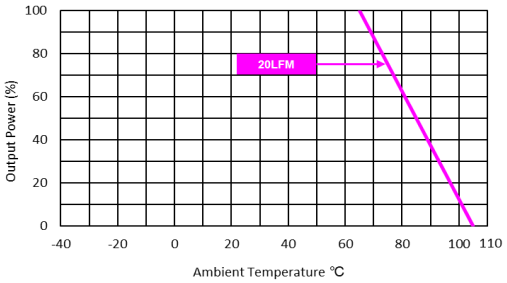
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



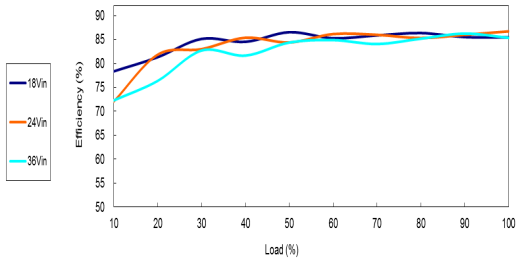
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



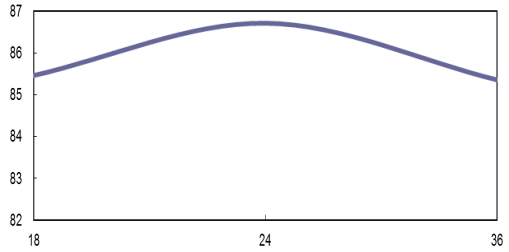
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

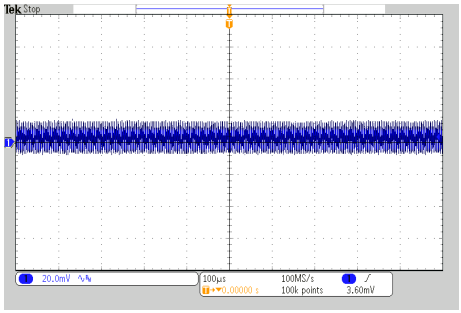
All test conditions are at 25°C The figures are identical for MIE10-24S051HI



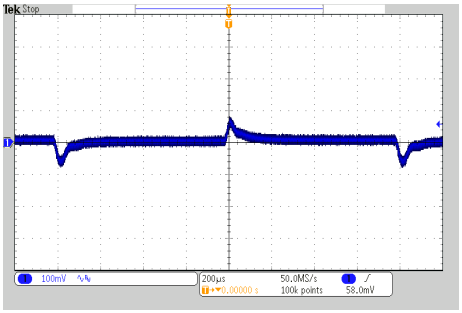
Efficiency Versus Output Current



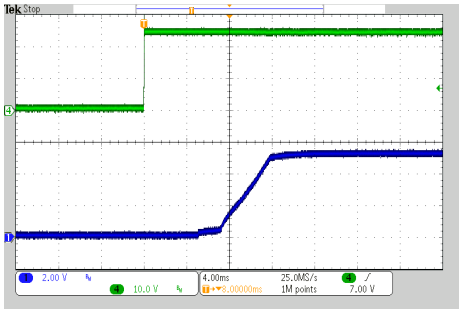
Efficiency Versus Input Voltage
Full Load



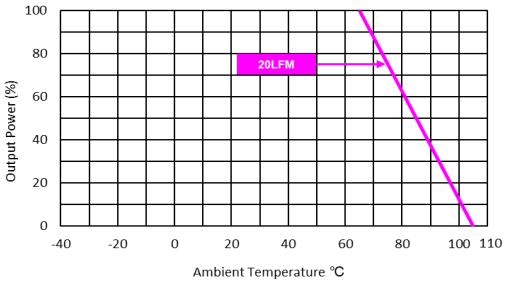
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



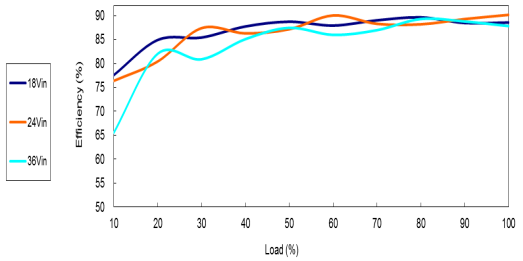
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



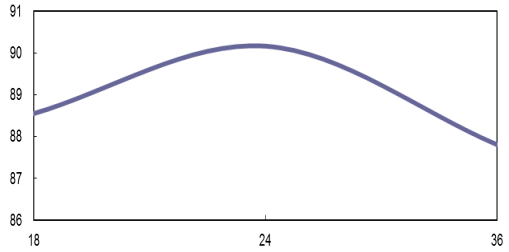
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

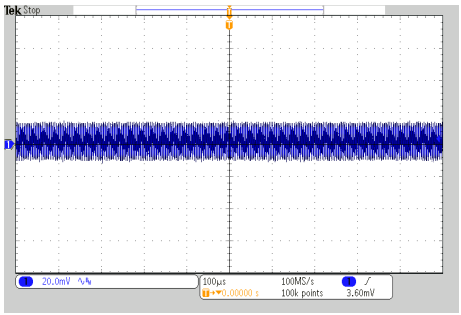
All test conditions are at 25°C The figures are identical for MIE10-24S12HI



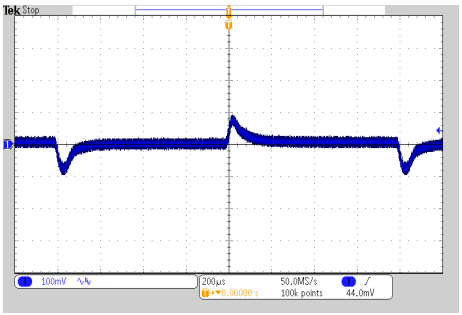
Efficiency Versus Output Current



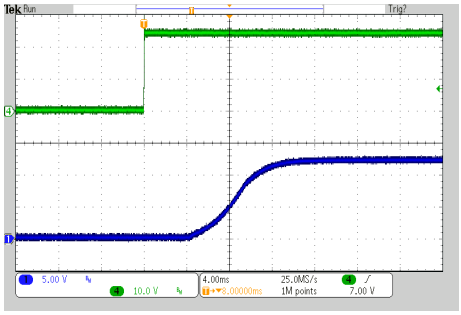
Efficiency Versus Input Voltage
Full Load



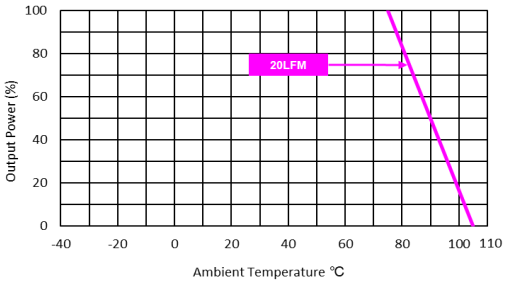
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



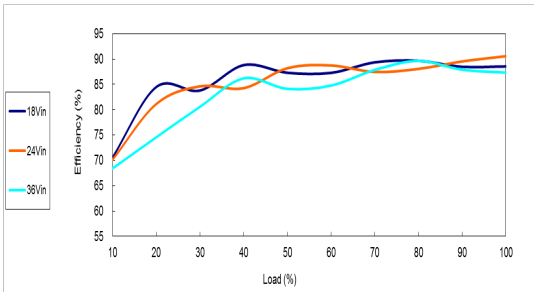
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



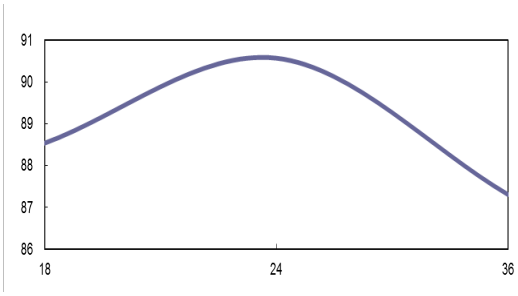
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

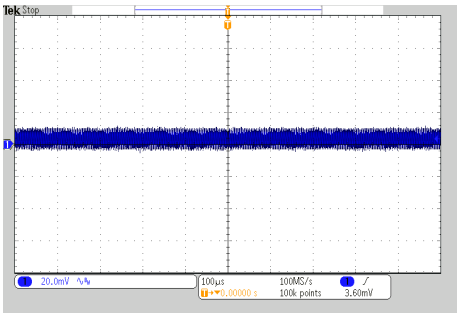
All test conditions are at 25°C The figures are identical for MIE10-24S15HI



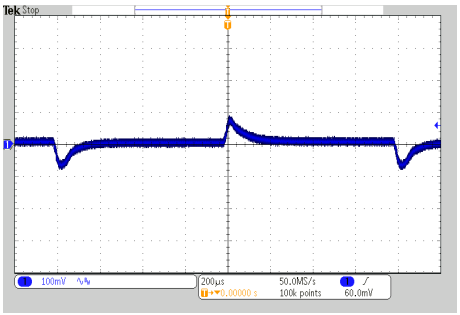
Efficiency Versus Output Current



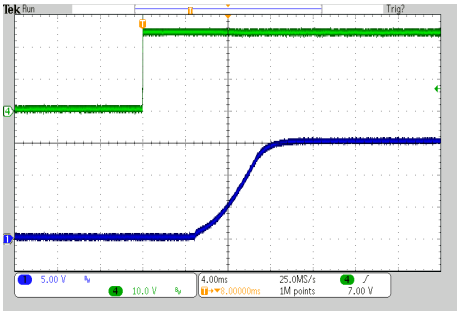
Efficiency Versus Input Voltage
Full Load



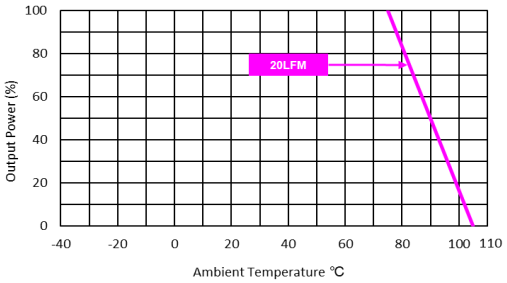
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



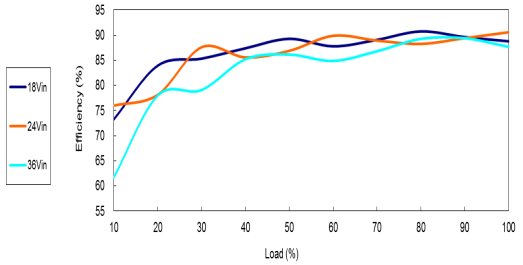
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



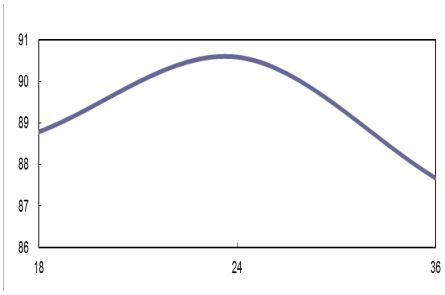
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

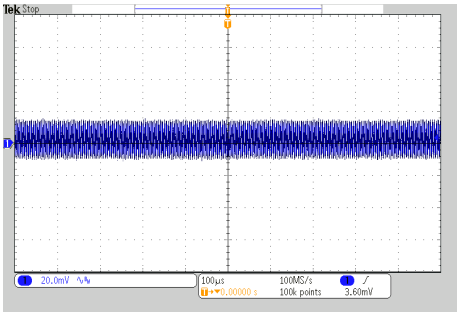
All test conditions are at 25°C The figures are identical for MIE10-24S24HI



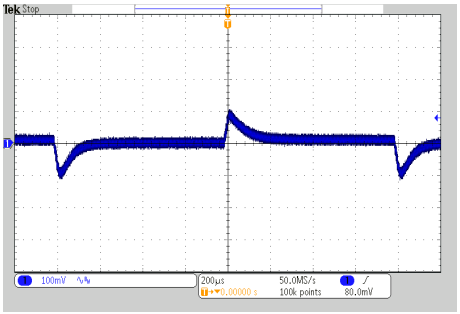
Efficiency Versus Output Current



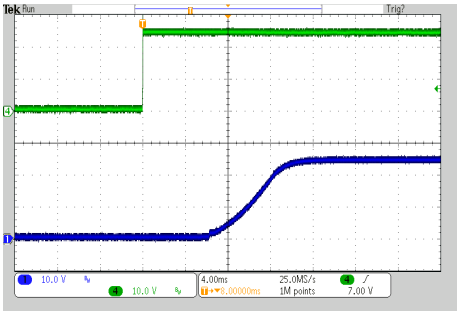
Efficiency Versus Input Voltage
Full Load



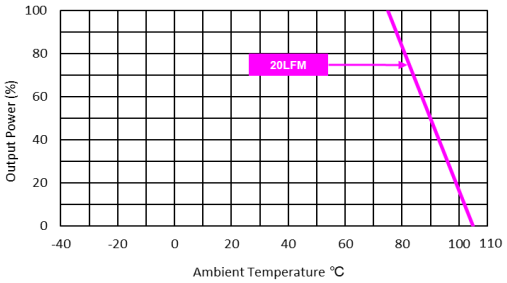
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



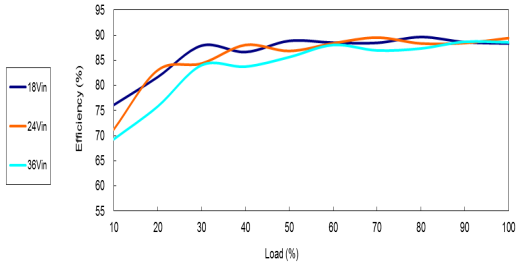
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



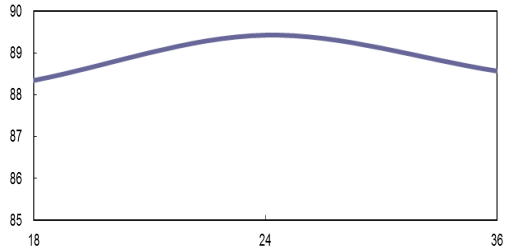
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

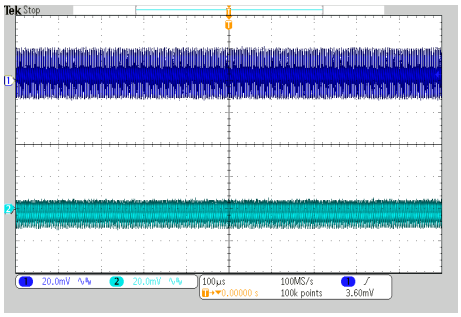
All test conditions are at 25°C The figures are identical for MIE10-24D12HI



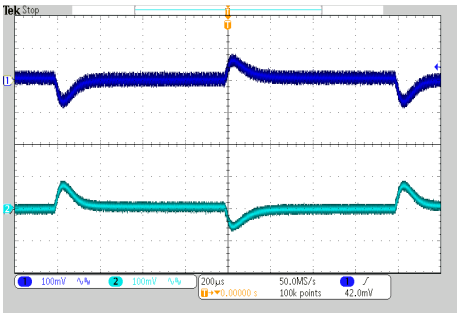
Efficiency Versus Output Current



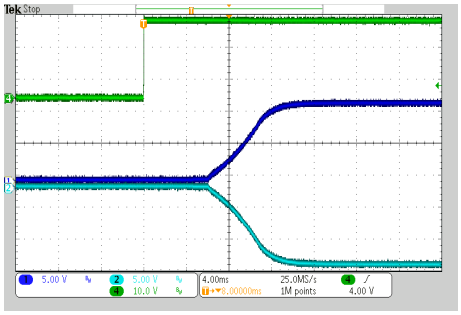
Efficiency Versus Input Voltage
Full Load



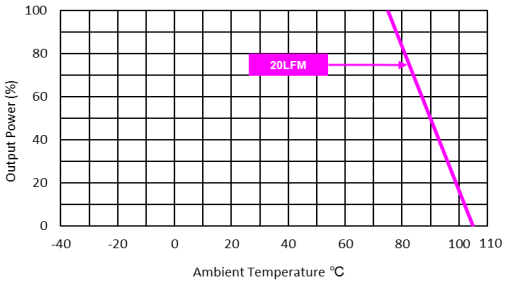
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



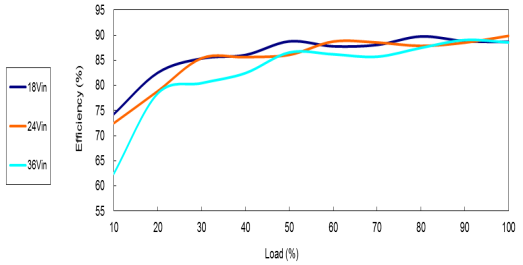
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



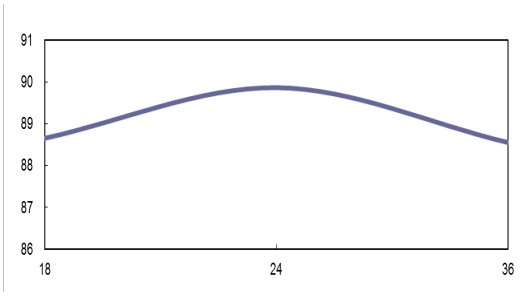
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

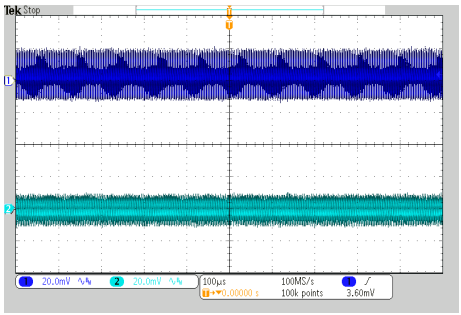
All test conditions are at 25°C The figures are identical for MIE10-24D15HI



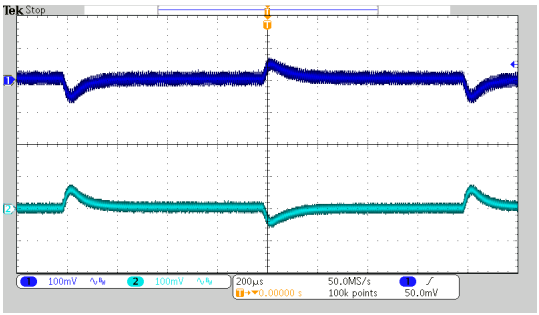
Efficiency Versus Output Current



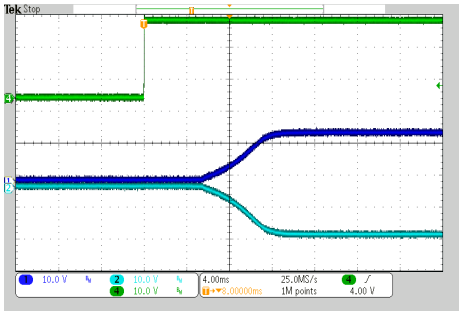
Efficiency Versus Input Voltage
Full Load



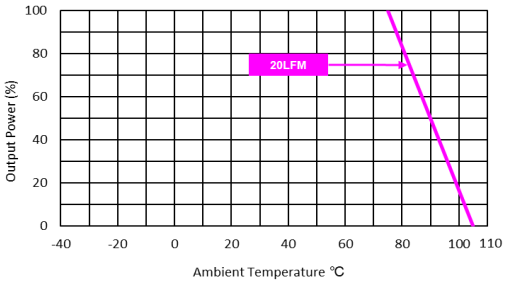
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



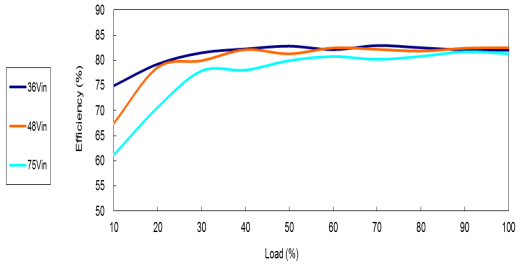
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



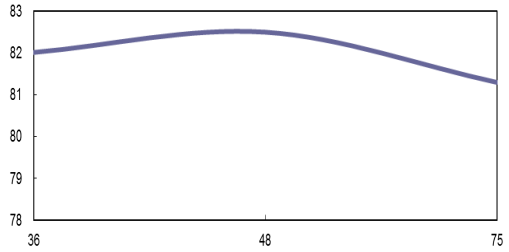
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

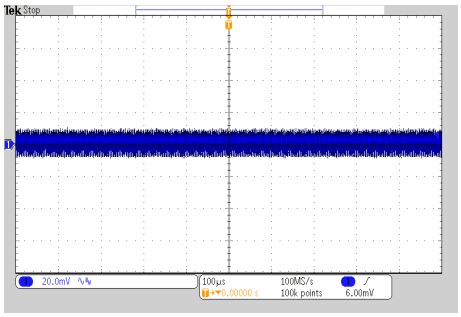
All test conditions are at 25°C The figures are identical for MIE10-48S033HI



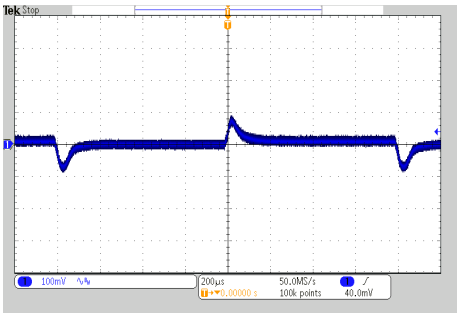
Efficiency Versus Output Current



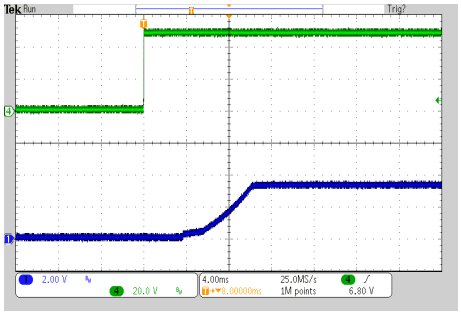
Efficiency Versus Input Voltage
Full Load



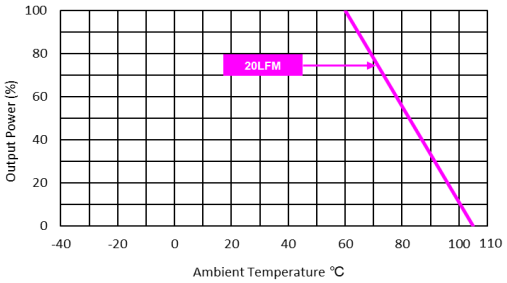
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



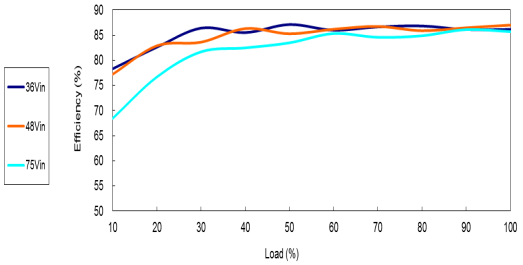
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



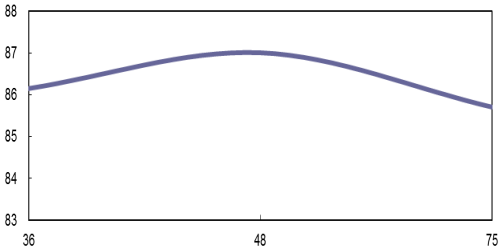
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

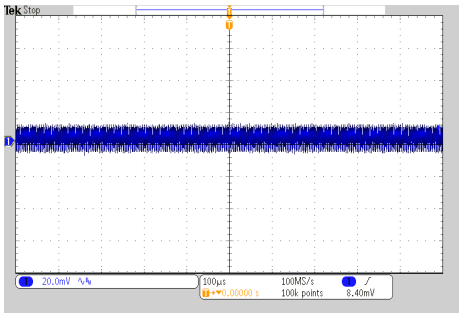
All test conditions are at 25℃ The figures are identical for MIE10-48S05HI



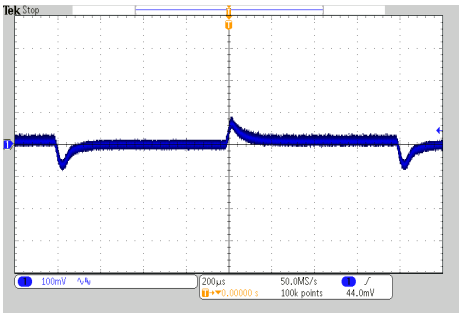
Efficiency Versus Output Current



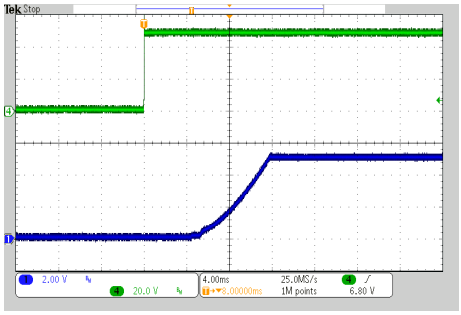
Efficiency Versus Input Voltage
Full Load



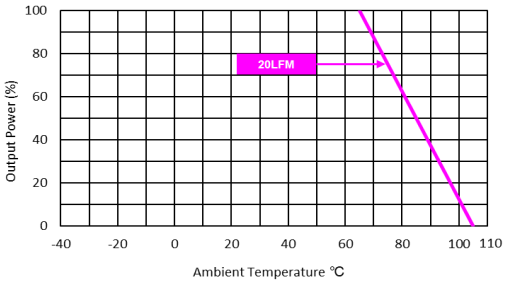
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



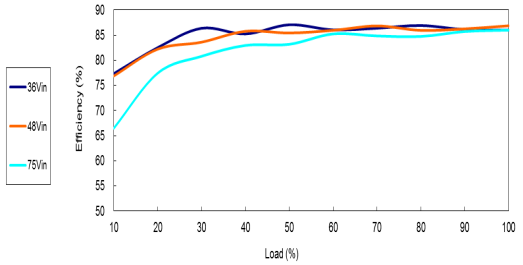
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



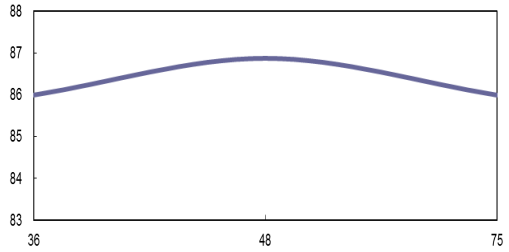
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

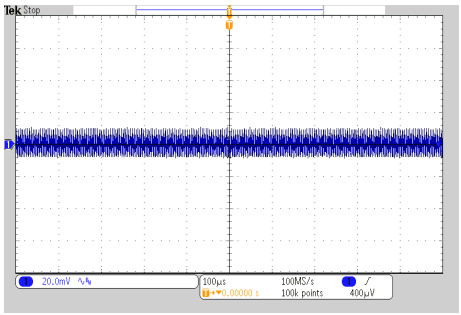
All test conditions are at 25°C The figures are identical for MIE10-48S051HI



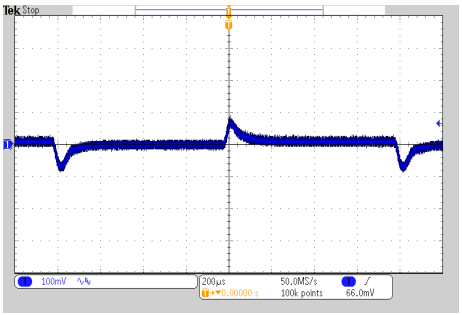
Efficiency Versus Output Current



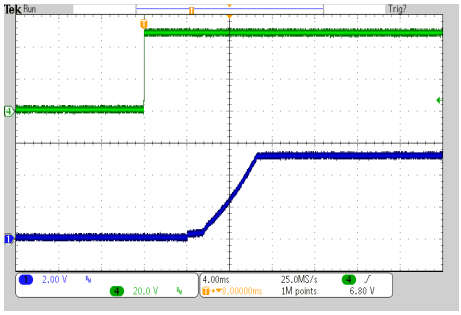
Efficiency Versus Input Voltage
Full Load



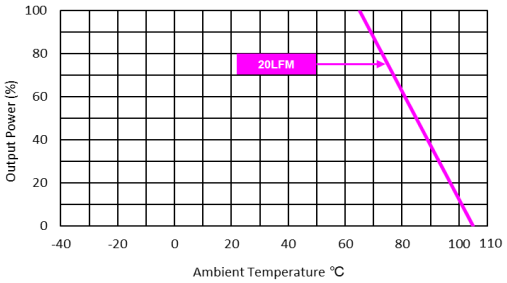
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



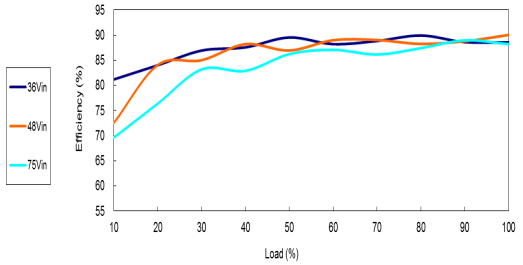
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



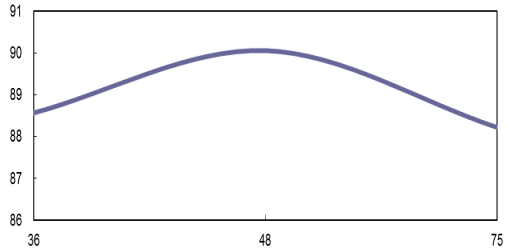
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

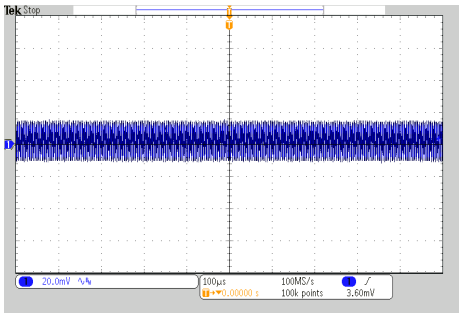
All test conditions are at 25°C The figures are identical for MIE10-48S12HI



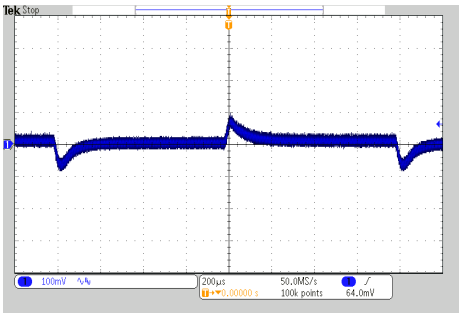
Efficiency Versus Output Current



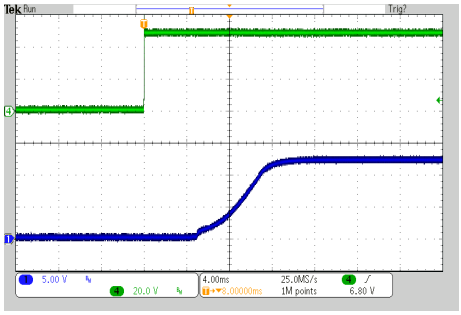
Efficiency Versus Input Voltage
Full Load



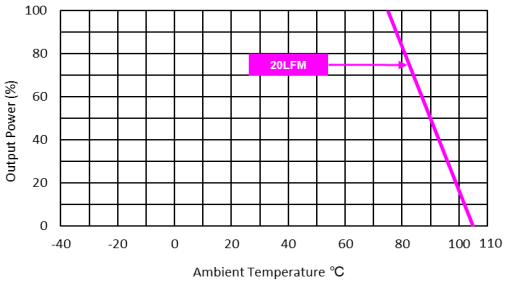
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



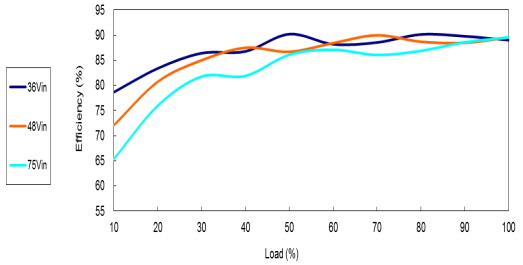
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



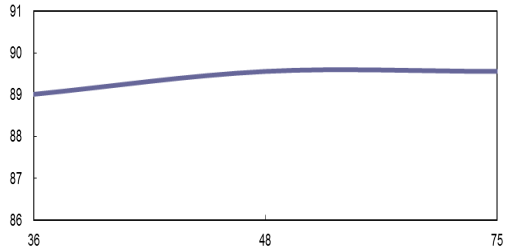
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

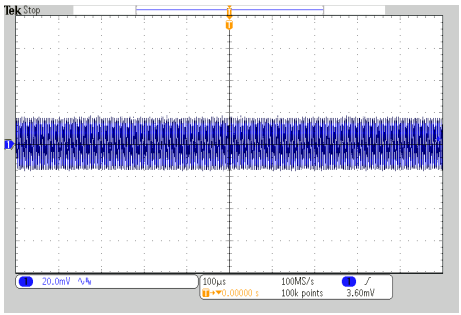
All test conditions are at 25°C The figures are identical for MIE10-48S15HI



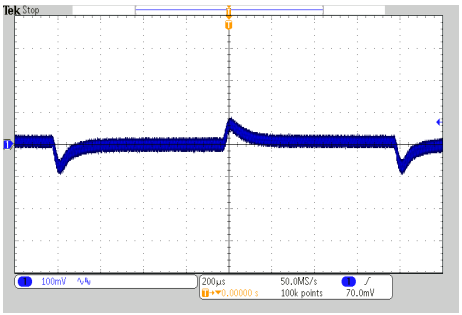
Efficiency Versus Output Current



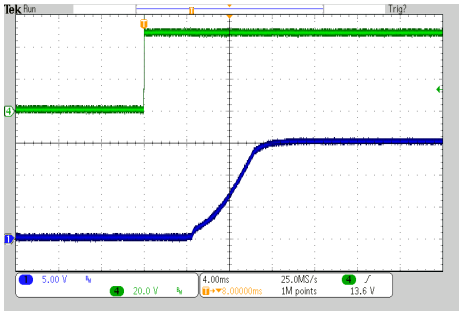
Efficiency Versus Input Voltage
Full Load



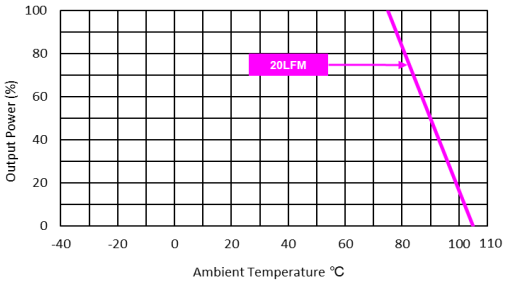
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



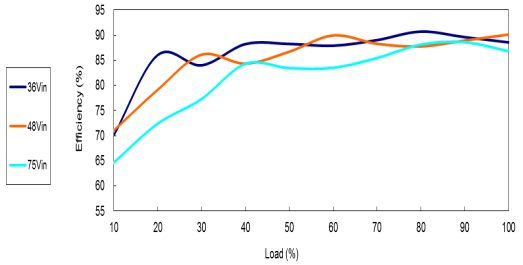
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



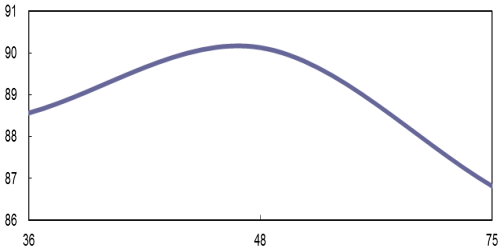
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

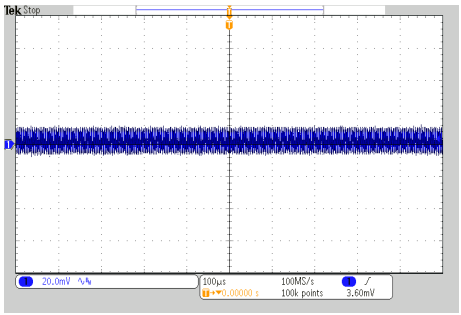
All test conditions are at 25°C The figures are identical for MIE10-48S24HI



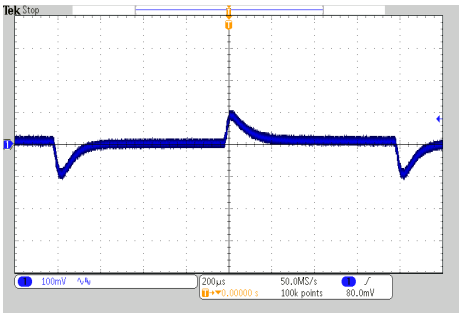
Efficiency Versus Output Current



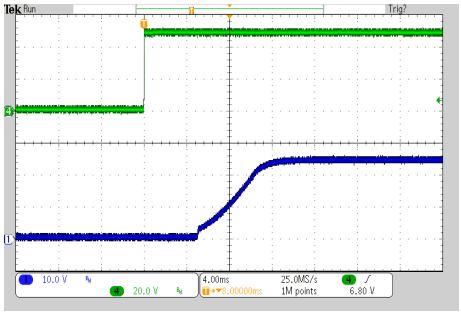
Efficiency Versus Input Voltage
Full Load



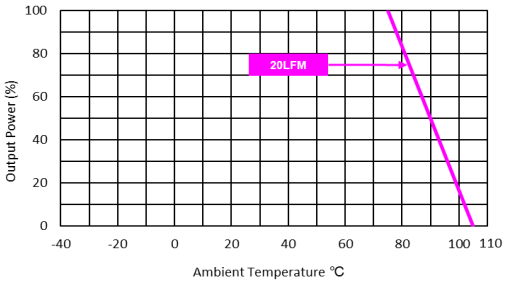
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



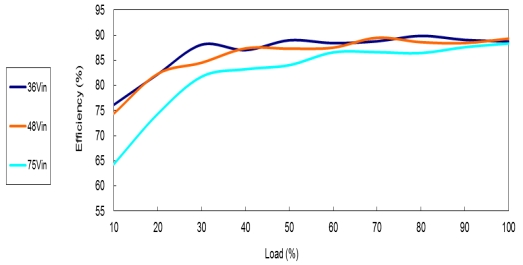
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



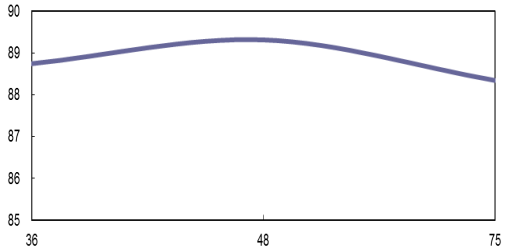
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

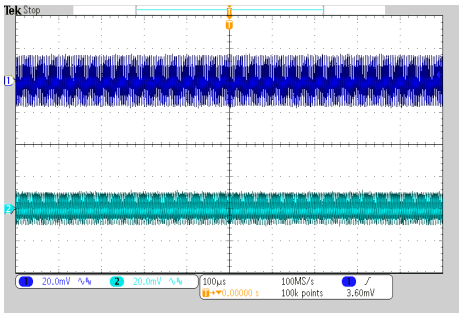
All test conditions are at 25°C The figures are identical for MIE10-48D12HI



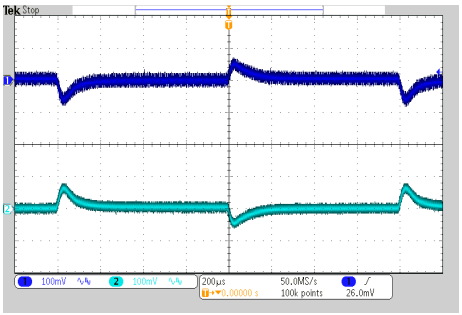
Efficiency Versus Output Current



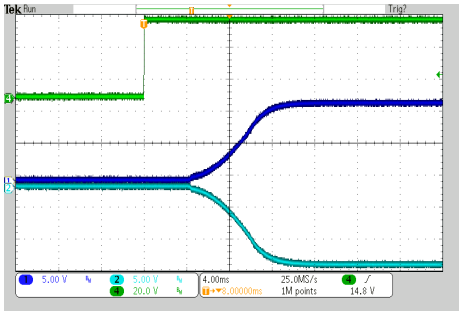
Efficiency Versus Input Voltage
Full Load



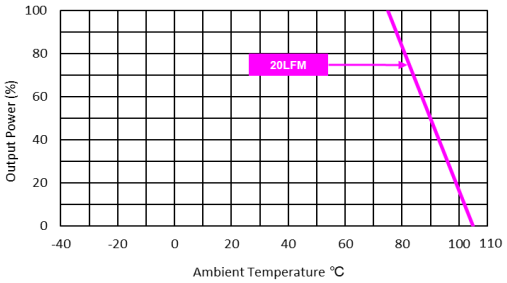
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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



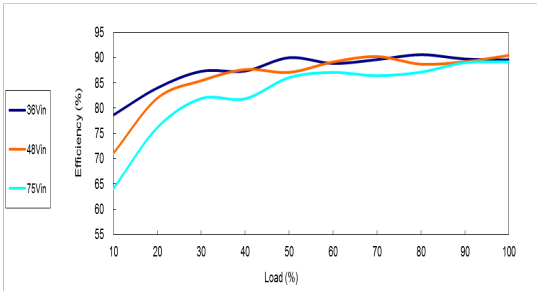
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



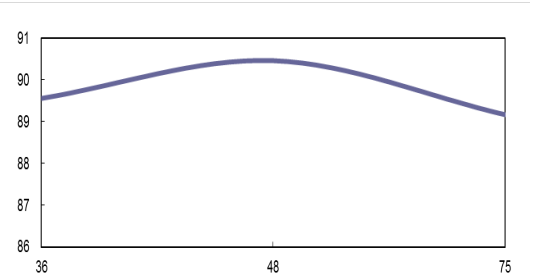
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

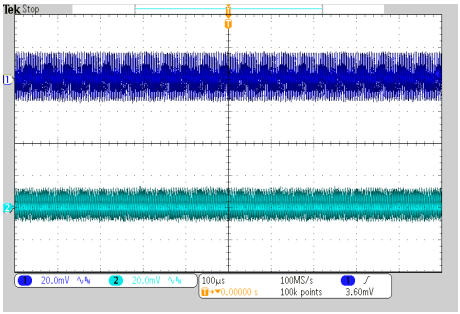
All test conditions are at 25°C The figures are identical for MIE10-48D15HI



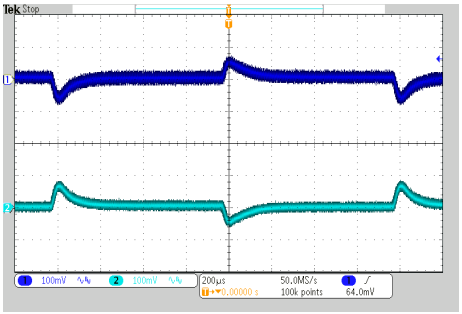
Efficiency Versus Output Current



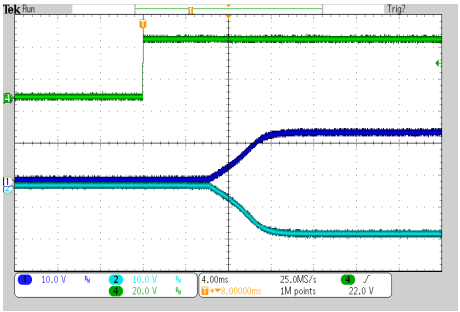
Efficiency Versus Input Voltage
Full Load



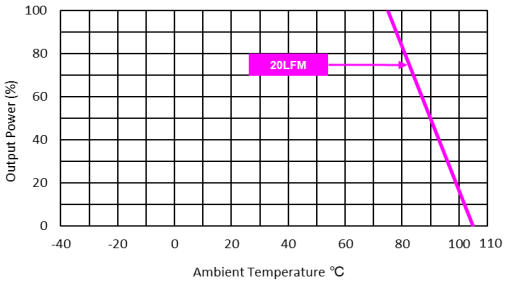
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



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



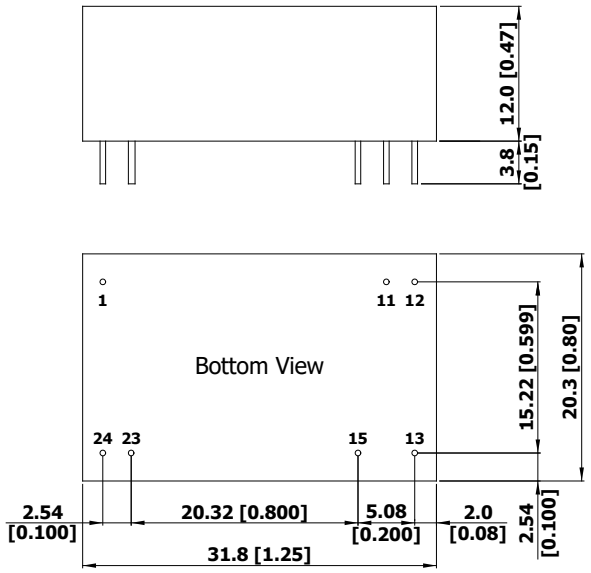
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$; Full Load



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

Package Specifications

Mechanical Dimensions



Pin Connections

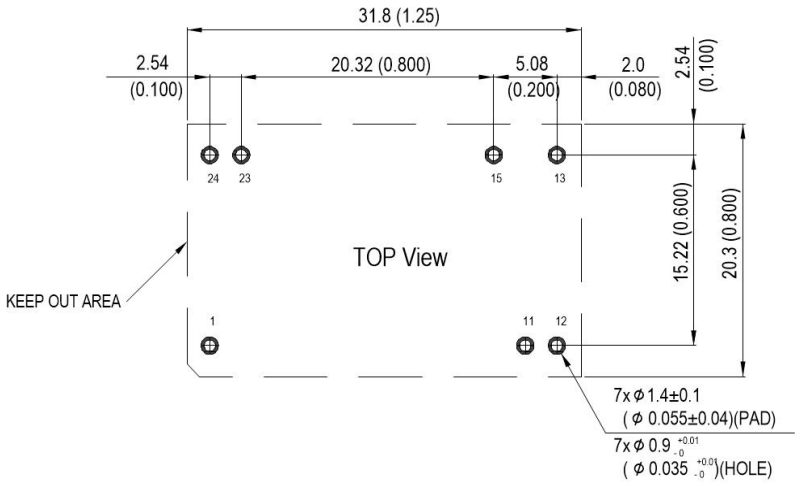
Pin	Single Output	Dual Output	Diameter mm (inches)
1	+Vin	+Vin	Ø 0.6 [0.02]
11	No Pin	Common	Ø 0.6 [0.02]
12	-Vout	No Pin	Ø 0.6 [0.02]
13	+Vout	-Vout	Ø 0.6 [0.02]
15	No Pin	+Vout	Ø 0.6 [0.02]
23	-Vin	-Vin	Ø 0.6 [0.02]
24	-Vin	-Vin	Ø 0.6 [0.02]

- 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	:	31.8x20.3x12.0mm (1.25x0.80x0.47 inches)
Case Material	:	Plastic resin (flammability to UL 94V-0 rated)
Pin Material	:	Copper Alloy
Weight	:	16g

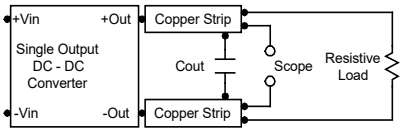
Recommended Pad Layout for Single & Dual Output Converter

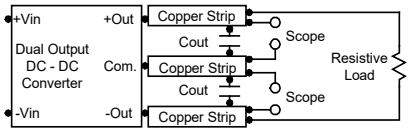


Test Setup

Peak-to-Peak Output Noise Measurement Test

Refer to the output specifications or add 4.7µF capacitor if the output specifications undefine Cout. 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

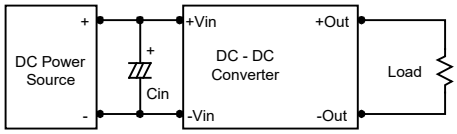
To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

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.

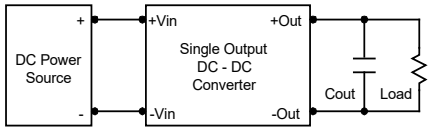
Input Source Impedance

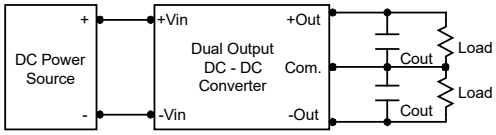
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor on the input to insure startup. 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.



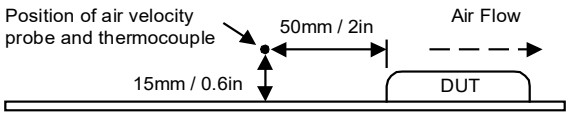


Maximum Capacitive Load

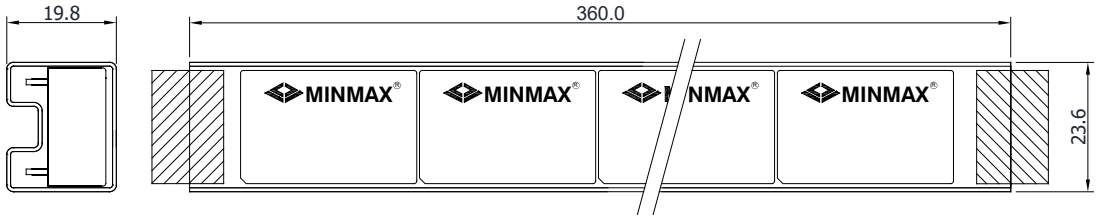
The MIE10-HI series has limitation of maximum connected capacitance on the output. The power module may operate in current limiting mode during start-up, affecting the ramp-up and the startup time. Connect capacitors at the point of load for best performance. The maximum capacitance can be found in the 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 105°C. The derating curves are determined from measurements obtained in a test setup.



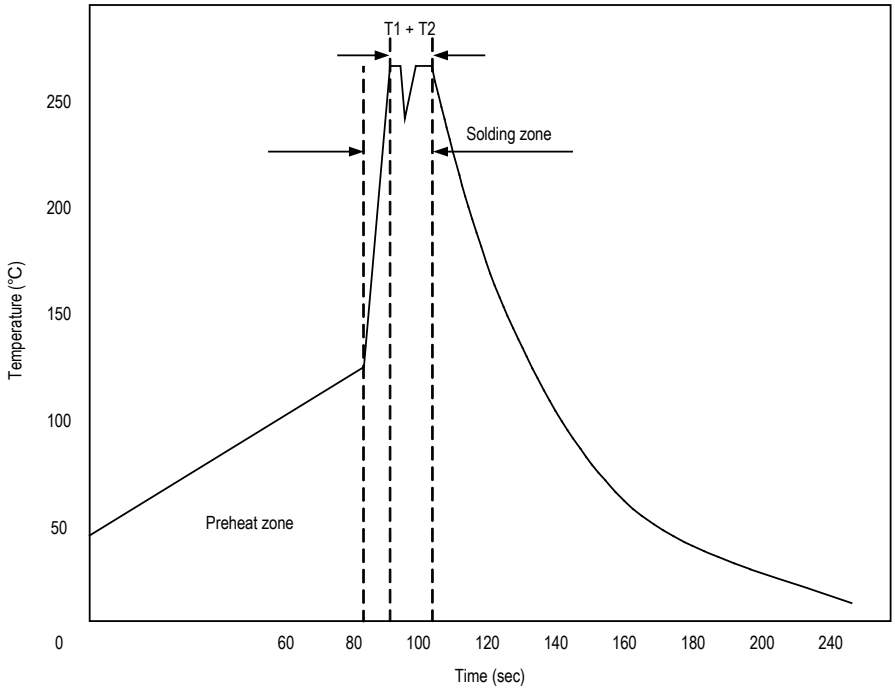
Packaging Information



Unit: mm
10 PCS per TUBE

Wave Soldering Considerations

Lead free wave solder profile



Zone	Reference Parameter
Preheat	Rise temp. speed：3℃/sec max.
zone	Preheat temp.：100~130℃
Actual	Peak temp.：250~260℃
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℃

Part Number Structure

M	I	E	10	-	12	S	033	HI
	Package Type DIP-24	Application Ultra-High Isolation Wide 2:1 Input Voltage Range	Output Power 10 Watt		Input Voltage Range 12: 9 ~ 18 VDC 24: 18 ~ 36 VDC 48: 36 ~ 75 VDC	Output Quantity S: Single D: Dual	Output Voltage 033: 3.3 VDC 05: 5 VDC 051: 5.1 VDC 12: 12 VDC 15: 15 VDC 24: 24 VDC	I/O Isolation Voltage 9000 VDC

MTBF and Reliability

The MTBF of MIE10-HI series of DC-DC converters has been calculated using

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

Model	MTBF	Unit
MIE10-12S033HI	3,817,105	Hours
MIE10-12S05HI	3,881,160	
MIE10-12S051HI	3,881,160	
MIE10-12S12HI	4,581,900	
MIE10-12S15HI	5,062,197	
MIE10-12S24HI	5,062,831	
MIE10-12D12HI	4,865,451	
MIE10-12D15HI	4,632,330	
MIE10-24S033HI	3,817,350	
MIE10-24S05HI	4,110,978	
MIE10-24S051HI	4,110,978	
MIE10-24S12HI	4,820,959	
MIE10-24S15HI	5.062,294	
MIE10-24S24HI	5,062,845	
MIE10-24D12HI	4,865,539	
MIE10-24D15HI	4,632,415	
MIE10-48S033HI	3,816,975	
MIE10-48S05HI	4,112,147	
MIE10-48S051HI	4,112,147	
MIE10-48S12HI	4,820,384	
MIE10-48S15HI	5,061,657	
MIE10-48S24HI	4,818,238	
MIE10-48D12HI	4,632,913	
MIE10-48D15HI	4,632,488	