

MJA06C Series

DC-DC Power Module 6W

Electric Characteristic Note

Features

- ▶ Fully Encapsulated Plastic Case for Chassis and DIN-Rail Mounting Version
- ▶ 80-160VDC Wide Input Voltage Range
- ▶ Fully Regulated Output Voltage
- ▶ High Efficiency up to 84%
- ▶ I/O Isolation 3000VAC with Reinforced Insulation, rated for 1000Vrms Working Voltage
- ▶ Operating Ambient Temp. Range -40°C to +92.5°C
- ▶ No Min. Load Requirement
- ▶ Very Low No Load Power Consumption
- ▶ Under-voltage, Overload and Short Circuit Protection
- ▶ Remote On/Off Control
- ▶ EMI Emission EN 55032 Class A Approved
- ▶ EMC Immunity EN 61000-4-2,3,4,5,6,8 Approved
- ▶ UL/cUL/IEC/EN 62368-1 Safety Approval & CE Marking



Applications

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

Product Overview

The MINMAX MJA06C series is the latest 6Watt isolated DC-DC power module generation with 9 fixed output voltage models: 5 / 5.1 / 12 / 15 / 24 / 48 / ± 12 / ± 15 / ± 24 VDC. The wide input range from 80VDC to 160VDC is specifically for electricity and renewable energy field applications within the usage of terminal strip connectors in chassis and DIN-Rail package.

The key performances are: 3000VAC I/O Isolation, reinforced insulation, high efficiency, wide operating ambient temp. range -40°C to +92.5°C, no min. load, low no-load power consumption, remote on/off, built-in EMI emission EN 55032 Class A, UVLO, and SCP. The MJA06C series certifies in safety UL/cUL/IEC/EN 62368-1 with CB report and CE marking and offers a solution for eliminating components of a power board.

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Model Selection Guide							
Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load		@Max. Load
	VDC	VDC	mA	mA(typ.)	mA(typ.)	μF	%
MJA06-110S05C	110 (80 ~ 160)	5	1200	69	8	680	79
MJA06-110S051C		5.1	1200	70		680	79
MJA06-110S12C		12	500	66		330	83
MJA06-110S15C		15	400	66		330	83
MJA06-110S24C		24	250	65		150	84
MJA06-110S48C		48	125	67		68	82
MJA06-110D12C		±12	±250	65		150#	84
MJA06-110D15C		±15	±200	65		150#	84
MJA06-110D24C		±24	±125	66		68#	83

For each output

Input Specifications						
Parameter	Conditions / Model	Min.	Typ.	Max.	Unit	
Input Surge Voltage (1 sec. max.)		-0.7	---	170	VDC	
Start-Up Threshold Voltage		---	---	80		
Under Voltage Shutdown		---	74	---		
Start Up Time (Power On)	Nominal Vin and Constant Resistive Load	---	30	60	ms	
Input Filter	All Models	Internal Pi Type				

Remote On/Off Control						
Parameter	Conditions	Min.	Typ.	Max.	Unit	
Converter On	3.5V ~ 12V or Open Circuit					
Converter Off	0~1.2V or Short Circuit (Pin 1 and Pin 2)					
Control Input Current (on)	Vctrl = 5V	---	---	500	μA	
Control Input Current (off)	Vctrl = 0V	---	---	-500	μA	
Control Common	Referenced to Negative Input					
Standby Input Current	Nominal Vin	---	2.5	---	mA	

Output Specifications						
Parameter	Conditions / Model	Min.	Typ.	Max.	Unit	
Output Voltage Setting Accuracy		---	---	±2.0	%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%	---	---	±0.5	%	
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	24V & ±24V & 48V Output Models	---	180	---	mV _{P-P}
		Other Output Models	---	75	---	mV _{P-P}
Transient Recovery Time	25% Load Step Change	---	---	500	μsec	
Transient Response Deviation		---	±3	±5	%	
Temperature Coefficient		---	±0.01	±0.02	%/°C	
Over Load Protection	Hiccup	---	150	---	%	
Short Circuit Protection	Continuous, Automatic Recovery (Hiccup Mode 0.2Hz typ.)					

General Specifications					
Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds Reinforced insulation, rated for 1000Vrms working voltage	3000	---	---	VAC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100kHz, 1V	---	2200	---	pF
Switching Frequency		---	250	---	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	4,162,759	---	---	Hours
Safety Approvals	UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1 & 60950-1(CB-report)				

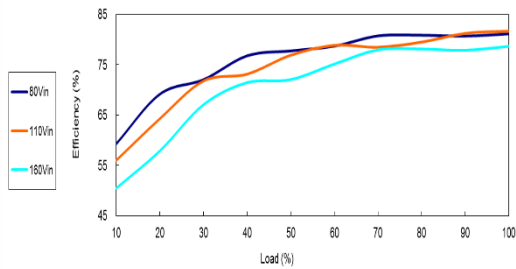
EMC Specifications				
Parameter	Standards & Level			Performance
EMI	Conduction	EN 55032	Without external components	Class A
	Radiation			
EMS	EN55035			
	ESD	Direct discharge	Indirect discharge HCP & VCP	
		EN61000-4-2 Air ± 8kV	Contact ± 6kV	
	Radiated immunity	EN61000-4-3 10V/m		
	Fast transient	EN61000-4-4 ±2kV		
	Surge	EN61000-4-5 ±2kV		
	Conducted immunity	EN61000-4-6 10Vrms		
PFMF	EN61000-4-8 100A/m			

Environmental Specifications			
Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+92.5	°C
Case Temperature	---	+105	°C
Storage Temperature Range	-50	+125	°C
Humidity (non condensing)	---	95	% rel. H
Altitude	---	5000	m
Lead Temperature (1.5mm from case for 10Sec.)	---	260	°C

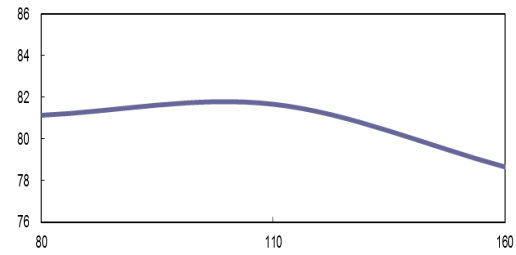
Notes	
1	Specifications typical at Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted.
2	Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
3	We recommend to protect the converter by a slow blow fuse in the input supply line.
4	Other input and output voltage may be available, please contact MINMAX.
5	Specifications are subject to change without notice.

Characteristic Curves

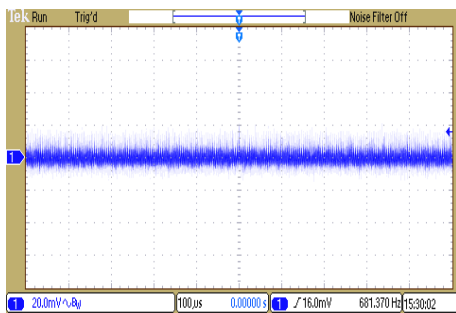
All test conditions are at 25°C The figures are identical for MJA06-110S05C



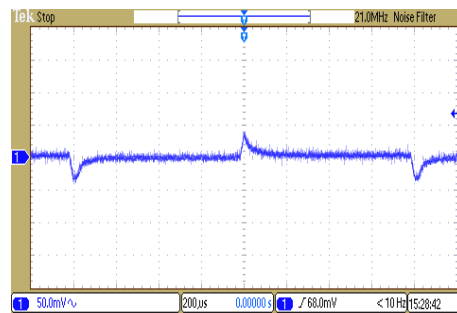
Efficiency Versus Output Current



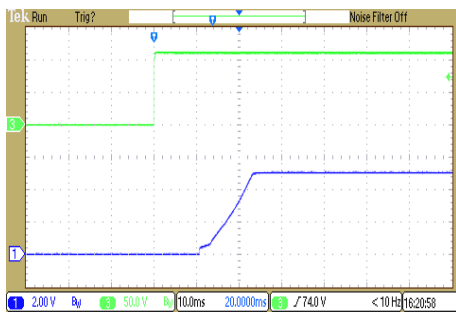
Efficiency Versus Input Voltage Full Load



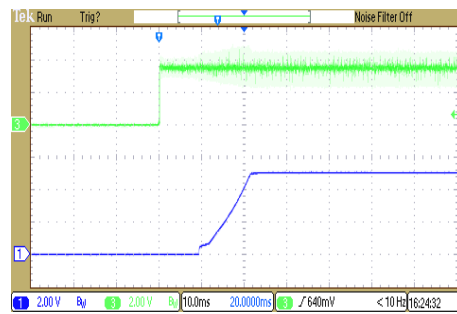
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



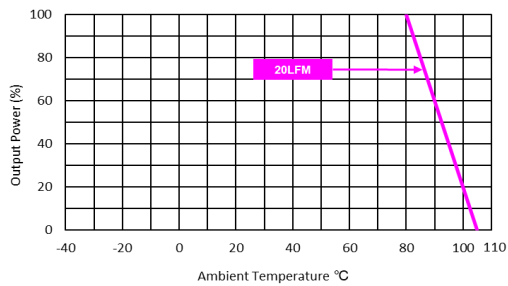
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



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



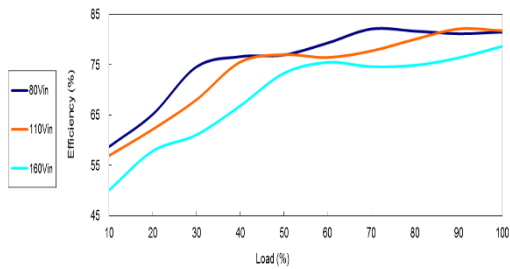
ON/OFF Voltage Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



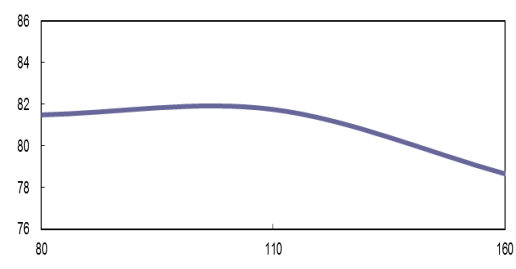
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

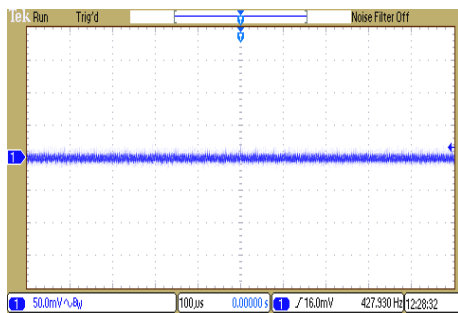
All test conditions are at 25°C The figures are identical for MJA06-110S051C



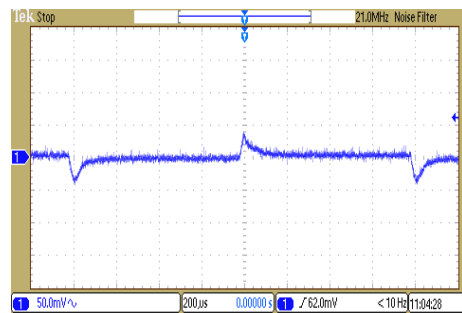
Efficiency Versus Output Current



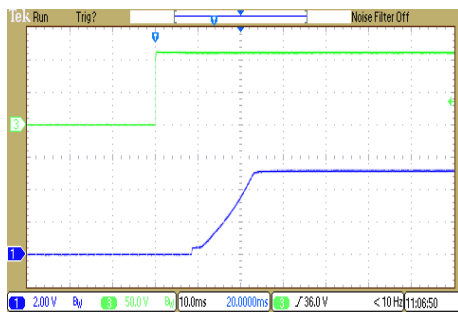
Efficiency Versus Input Voltage Full Load



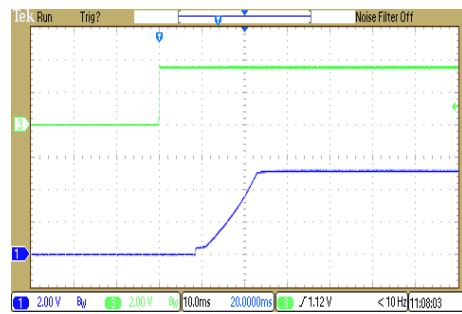
Typical Output Ripple and Noise
V_{in}=V_{in nom} ; Full Load



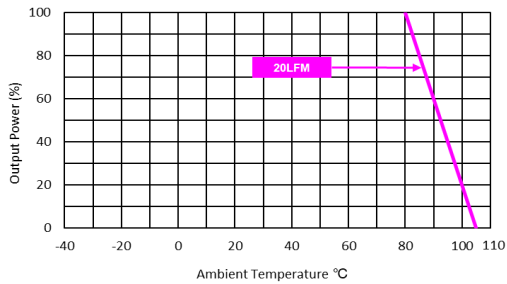
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; V_{in}=V_{in nom}



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



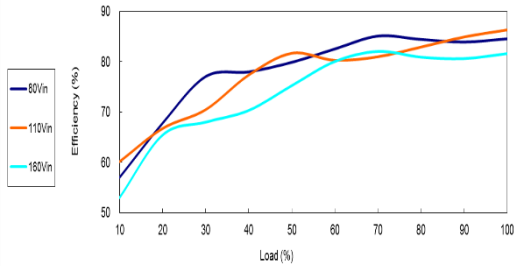
ON/OFF Voltage Start-Up and Output Rise Characteristic
V_{in}=V_{in nom} ; Full Load



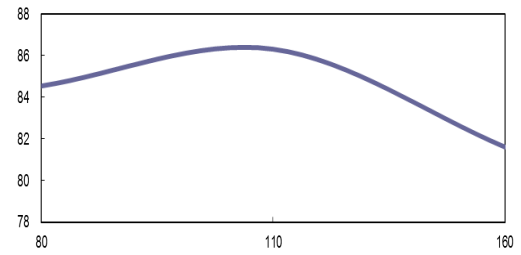
Derating Output Power Versus Ambient Temperature
V_{in}=V_{in nom}

Characteristic Curves

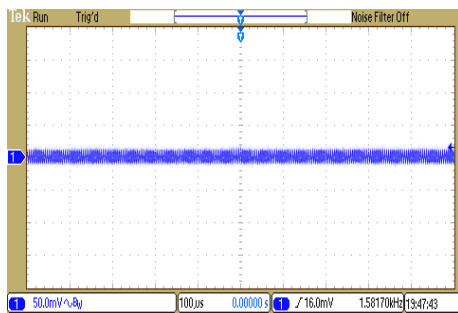
All test conditions are at 25°C The figures are identical for MJA06-110S12C



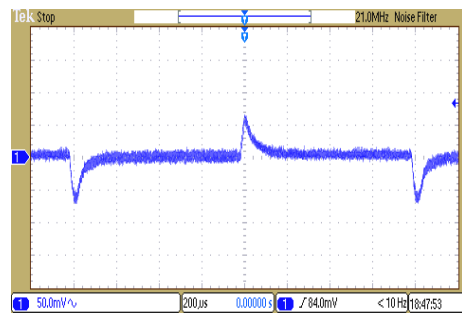
Efficiency Versus Output Current



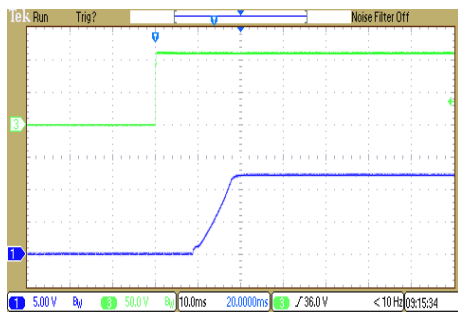
Efficiency Versus Input Voltage Full Load



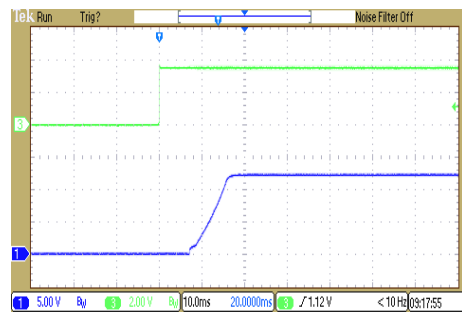
Typical Output Ripple and Noise
V_{in}=V_{in nom} ; Full Load



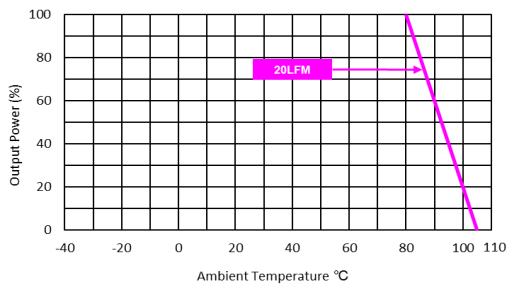
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; V_{in}=V_{in nom}



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



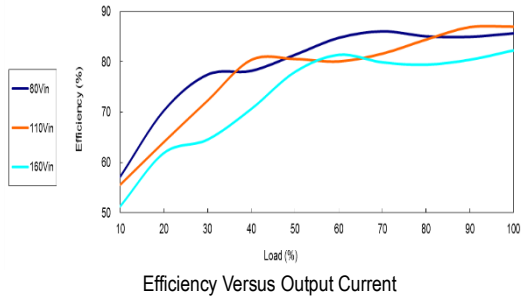
ON/OFF Voltage Start-Up and Output Rise Characteristic
V_{in}=V_{in nom} ; Full Load



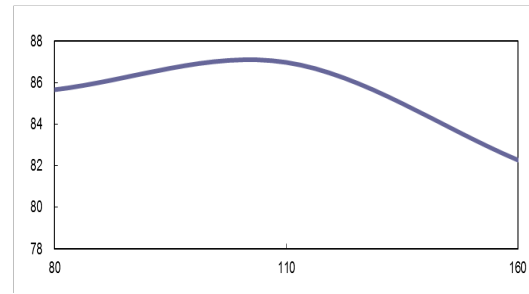
Derating Output Power Versus Ambient Temperature
V_{in}=V_{in nom}

Characteristic Curves

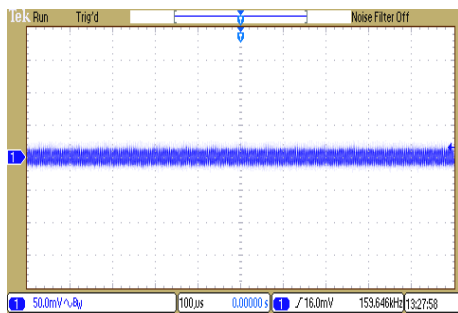
All test conditions are at 25°C The figures are identical for MJA06-110S15C



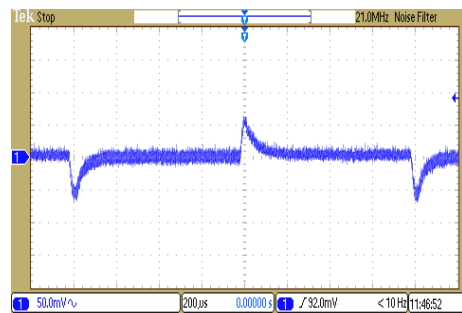
Efficiency Versus Output Current



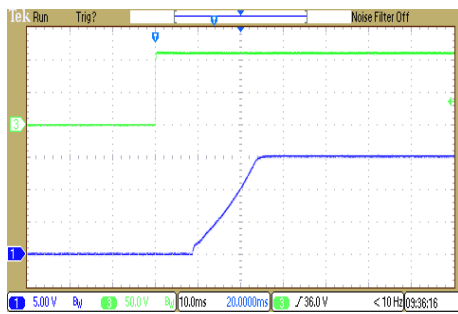
Efficiency Versus Input Voltage Full Load



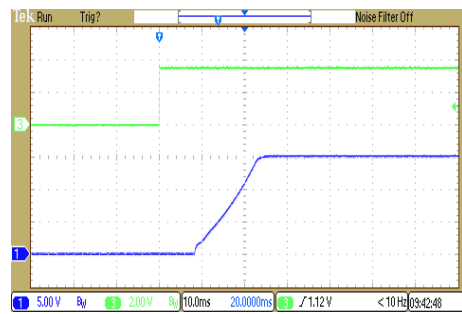
Typical Output Ripple and Noise
V_{in}=V_{in nom} ; Full Load



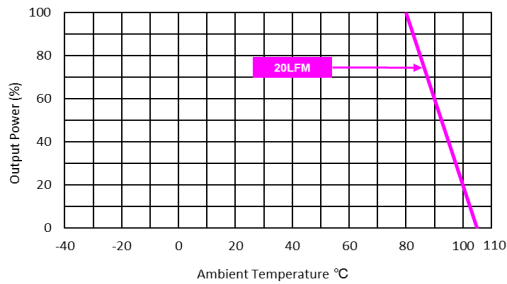
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; V_{in}=V_{in nom}



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



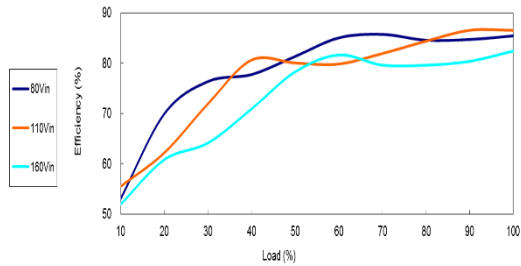
ON/OFF Voltage Start-Up and Output Rise Characteristic
V_{in}=V_{in nom} ; Full Load



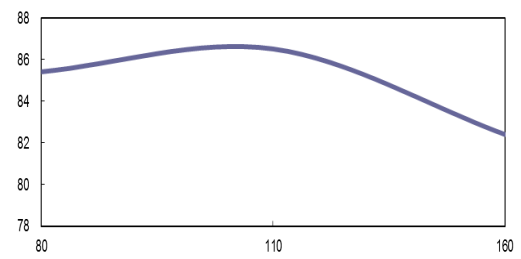
Derating Output Power Versus Ambient Temperature
V_{in}=V_{in nom}

Characteristic Curves

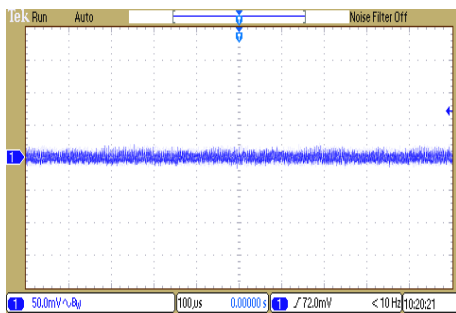
All test conditions are at 25°C The figures are identical for MJA06-110S24C



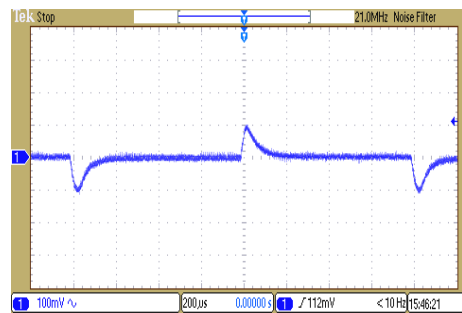
Efficiency Versus Output Current



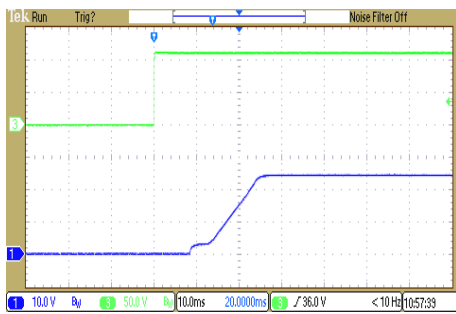
Efficiency Versus Input Voltage Full Load



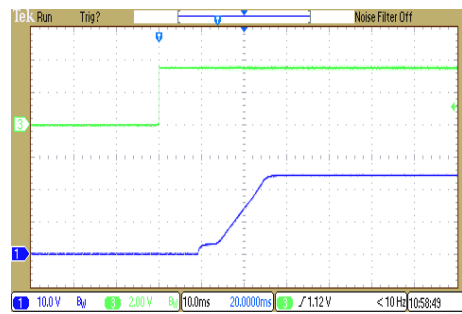
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



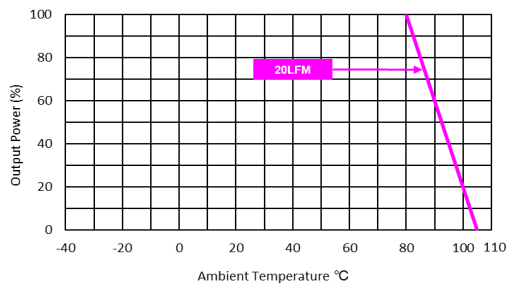
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



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



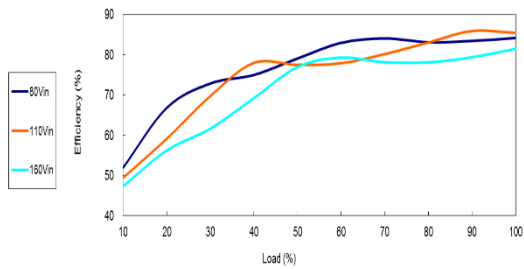
ON/OFF Voltage Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



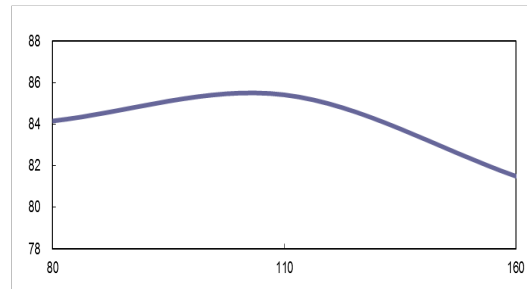
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

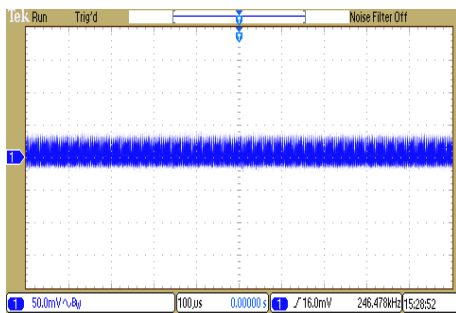
All test conditions are at 25°C The figures are identical for MJA06-110S48C



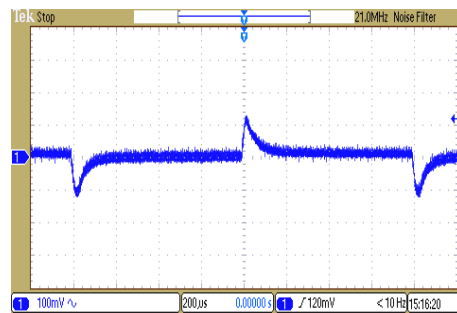
Efficiency Versus Output Current



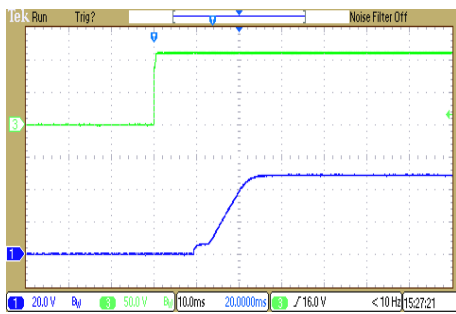
Efficiency Versus Input Voltage Full Load



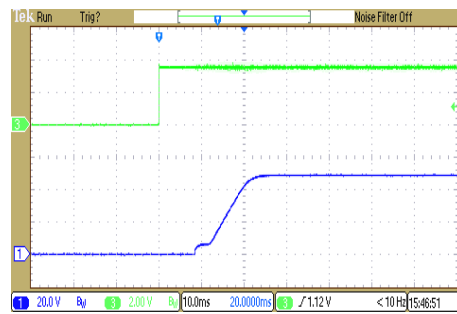
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



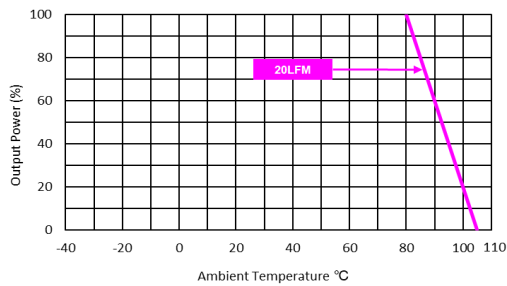
Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



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



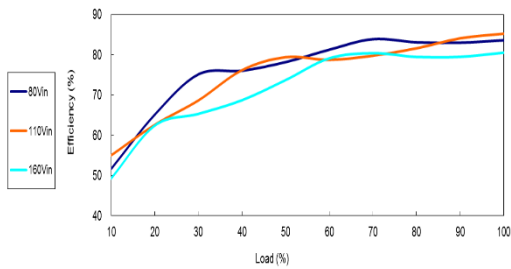
ON/OFF Voltage Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



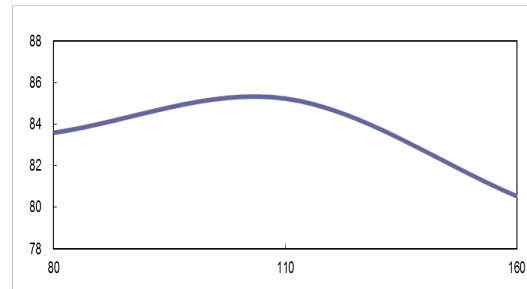
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

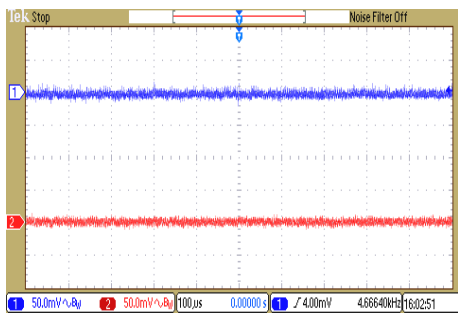
All test conditions are at 25°C The figures are identical for MJA06-110D12C



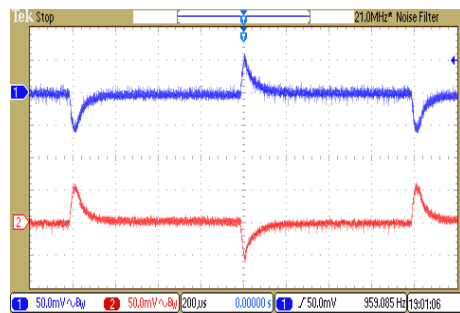
Efficiency Versus Output Current



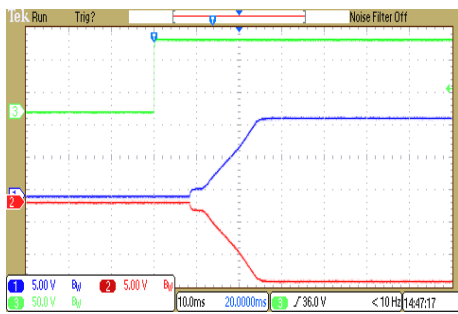
Efficiency Versus Input Voltage Full Load



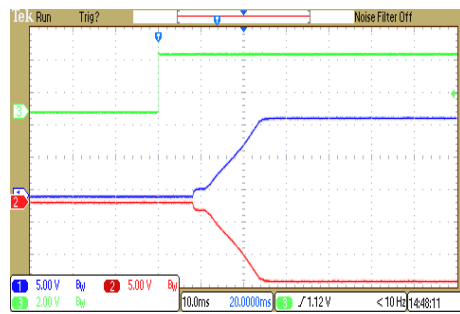
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



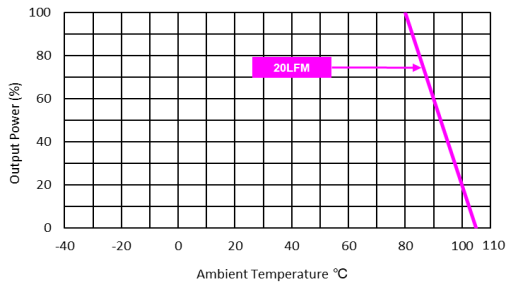
Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



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



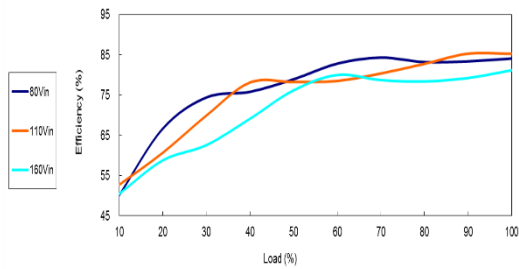
ON/OFF Voltage Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



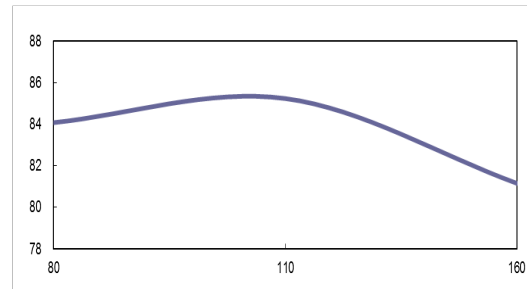
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

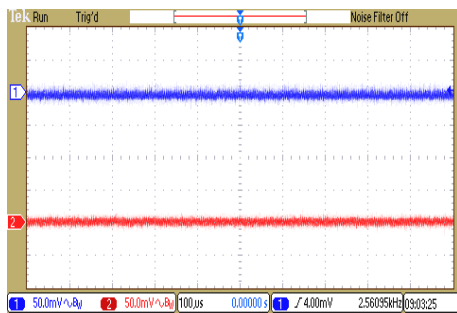
All test conditions are at 25°C The figures are identical for MJA06-110D15C



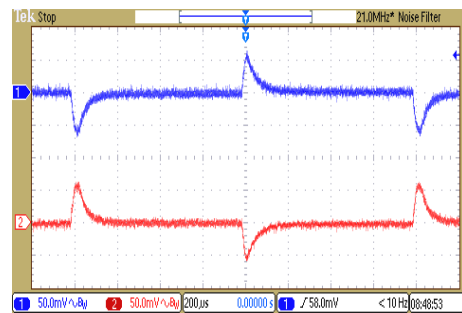
Efficiency Versus Output Current



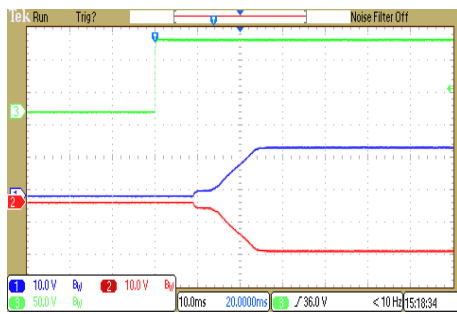
Efficiency Versus Input Voltage Full Load



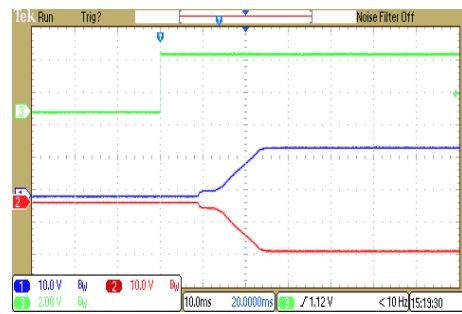
Typical Output Ripple and Noise
V_{in}=V_{in nom} ; Full Load



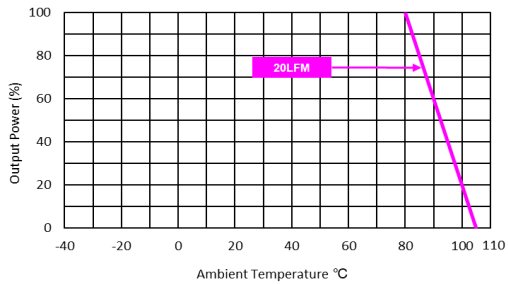
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; V_{in}=V_{in nom}



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



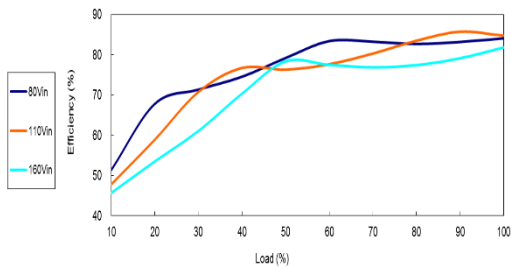
ON/OFF Voltage Start-Up and Output Rise Characteristic
V_{in}=V_{in nom} ; Full Load



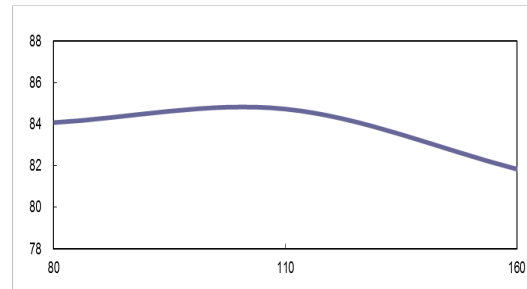
Derating Output Power Versus Ambient Temperature
V_{in}=V_{in nom}

Characteristic Curves

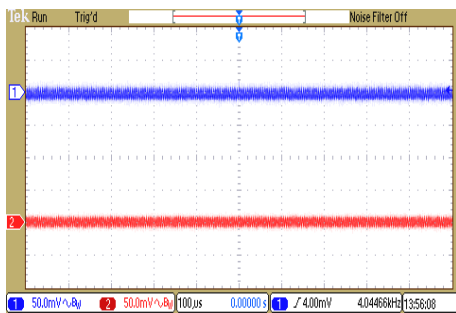
All test conditions are at 25°C The figures are identical for MJA06-110D24C



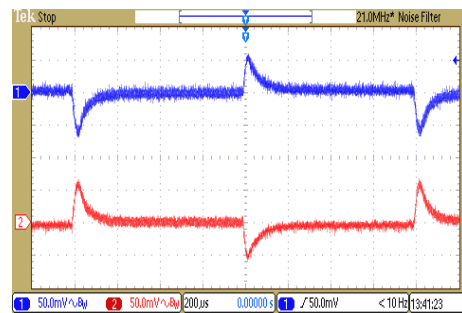
Efficiency Versus Output Current



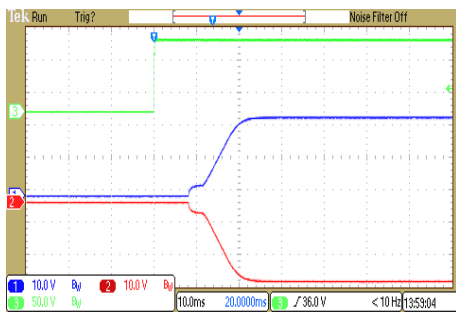
Efficiency Versus Input Voltage Full Load



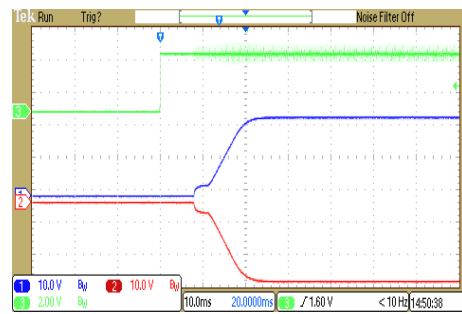
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



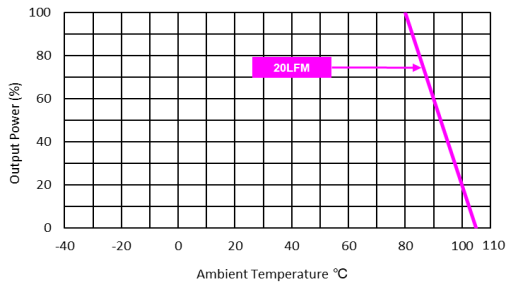
Transient Response to Dynamic Load Change
 from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



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



ON/OFF Voltage 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

Note:
 Screw type Terminal: Wires 1.5mm² max.
 Recommended Terminal Screw tightening torque: 0.2Nm (1.7lb.in.) max.

Pin Connections

Pin	Single Output	Dual Output
1	Remote On/Off	Remote On/Off
2	-Vin	-Vin
3	+Vin	+Vin
4	-Vout	-Vout
5	NC	Common
6	+Vout	+Vout

NC: No Connection

- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.5 (X.XX±0.02)
 X.XX±0.25 (X.XXX±0.01)

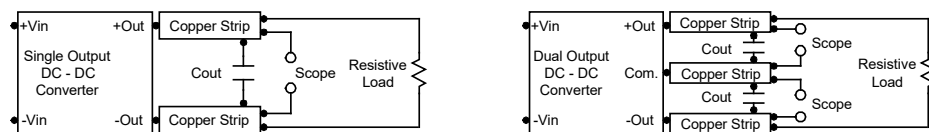
Physical Characteristics

Case Size	: 53.0x34.0x26.5mm (2.09x1.34x1.04 inches)
Case Material	: Plastic resin (flammability to UL 94V-0 rated)
Weight	: 47.8 g

Test Setup

Peak-to-Peak Output Noise Measurement Test

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



Technical Notes

Remote On/Off

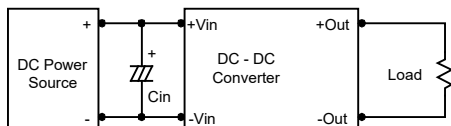
Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the -Vin terminal. The switch can be an open collector or equivalent. A logic low is 0V to 1.2V. A logic high is 3.5V to 12V. The maximum sink current at the on/off terminal (Pin 1) during a logic low is -500 μ A.

Overload Protection

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

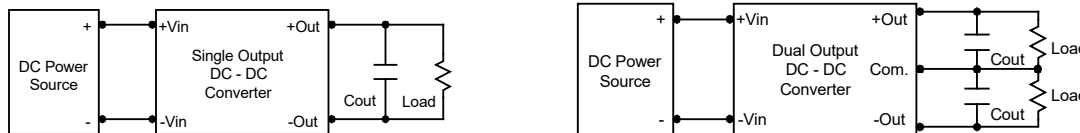
Input Source Impedance

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup. Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0 Ω at 100 kHz) capacitor of a 1 μ F for the 110V devices.



Output Ripple Reduction

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



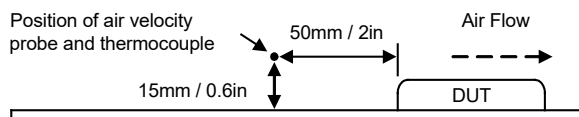
Maximum Capacitive Load

The MJA06C series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. The maximum capacitance can be found in the data sheet.

Thermal Considerations

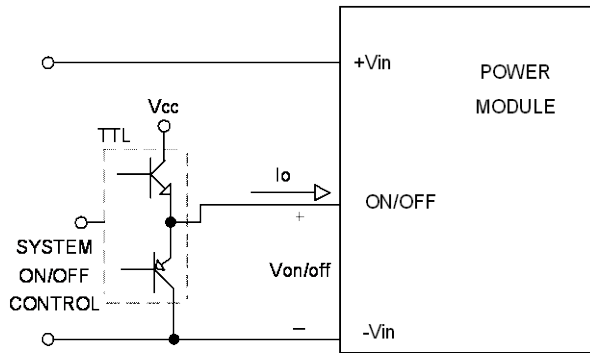
Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the case temperature must be kept below 105 $^{\circ}$ C.

The derating curves are determined from measurements obtained in a test setup.

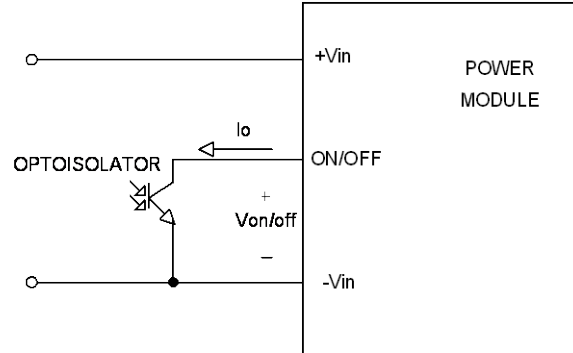


Remote On/Off Implementation

The positive logic remote ON/OFF control circuit is included. Turns the module ON during logic High on the ON/OFF pin and turns OFF during logic Low. The ON/OFF input signal (Von/off) that referenced to -Vin. If not using the remote ON/OFF feature, please open circuit between ON/OFF pin and -Vin pin to turn the module on.

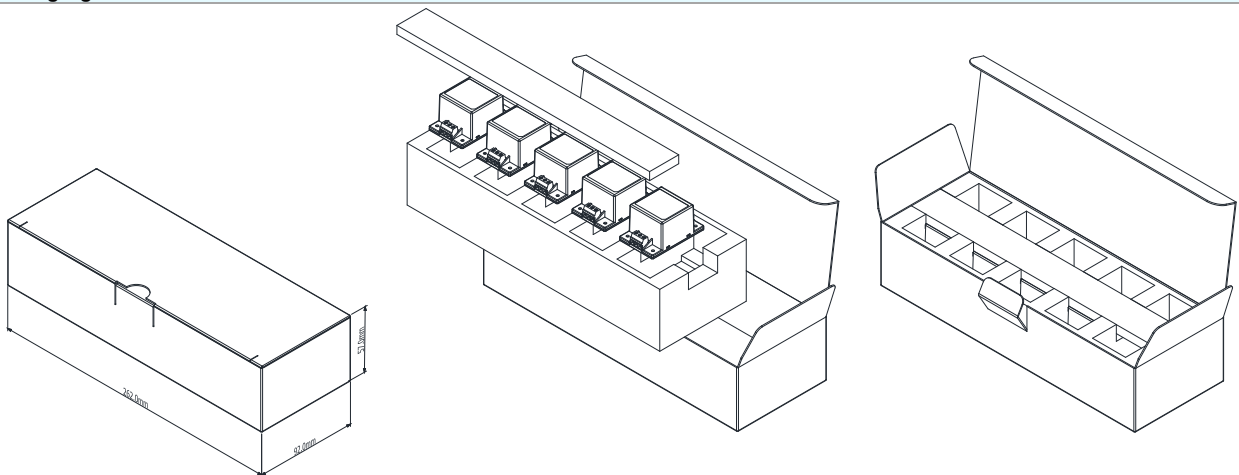


Level Control Using TTL Output

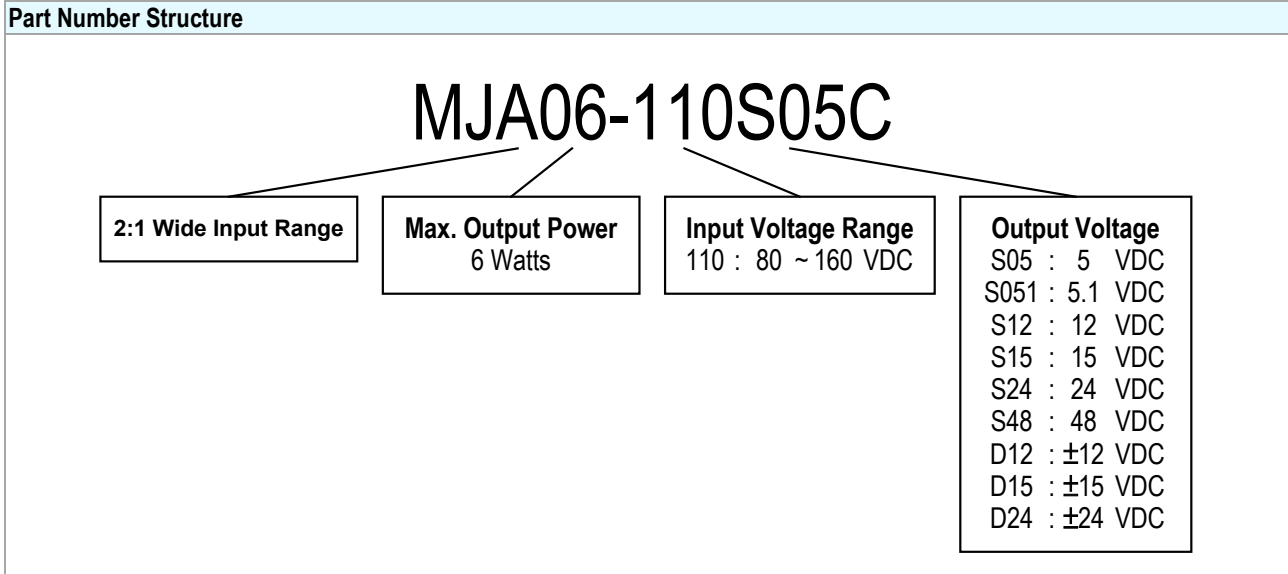


Isolated-Closure Remote ON/OFF

Packaging Information



Unit: mm
5 PCS per Box



MTBF and Reliability

The MTBF of MJA06C series of DC-DC converters has been calculated using MIL-HDBK 217F NOTICE2, Operating Temperature 25°C, Ground Benign.

Model	MTBF	Unit
MJA06-110S05C	4,178,732	Hours
MJA06-110S051C	4,162,759	
MJA06-110S12C	4,321,316	
MJA06-110S15C	4,280,022	
MJA06-110S24C	4,305,545	
MJA06-110S48C	4,186,022	
MJA06-110D12C	4,354,756	
MJA06-110D15C	4,308,302	
MJA06-110D24C	4,205,959	