ARTESYN
ERM 20W SERIES
DC/DC Converter

PRODUCT DESCRIPTION

Advanced Energy's Artesyn ERM 20W series is a new range of high performance 20W isolated dc-dc converter within encapsulated 2"x1" package which specifically design for railway applications. There are 18 models available for railway input voltage of 24(9~36)Vdc or 48(18~75)Vdc or 110(40~160)Vdc and tight output voltage regulation. Further features include over current, over voltage, short circuit protection, remote ON/OFF, output trim and EMI filter meets EN55032/22 & FCC Part15 Class A as well.

AT A GLANCE

Total Power

20 Watts

Input Voltage

9 to 36 Vdc

18 to 75 Vdc

40 to 160 Vdc

# of Outputs

Single / Dual

RoHS

SPECIAL FEATURES

- Industrial Standard 2"×1" Package
- Ultra-wide 4:1 Input Voltage Range
- Fully Regulated Output Voltage
- I/O Isolation 3000Vac with Reinforced Insulation
- Operating Ambient Temp. Range -40 ^{O}C to +88^{O}C (With derating)
- No Minimum Load Requirement
- Overload and Short Circuit Protection
- Remote On/Off, Output Voltage Trim
- Designed-in Conducted EMI meets EN55032/22 Class A & FCC Level A
- Vibration and Shock meets EN61373
- Fire Protection Test meet EN45545-2
- Railway EMC Standard meets EN50121-3-2

SAFETY

- UL/cUL/IEC/EN62368-1 (60950-1)
- EN50155(IEC60571)
- CE Mark

TYPICAL APPLICATIONS

- Railway

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MODEL NUMBERS

Model[1]	Input Voltage	Output Voltage	Minimum Load	Maximum Load	Efficiency
ERM04A18	9-36Vdc	5Vdc	0A	4A	87%
ERM01B18	9-36Vdc	12Vdc	0A	1.67A	87%
ERM01C18	9-36Vdc	15Vdc	0A	1.33A	87%
ERM01H18	9-36Vdc	24Vdc	0A	0.833A	87%
ERM01BB18	9-36Vdc	±12Vdc	0A	±0.833A	86%
ERM01CC18	9-36Vdc	±15Vdc	0A	±0.667A	86%
ERM04A18B	9-36Vdc	5Vdc	0A	4A	87%
ERM01B18B	9-36Vdc	12Vdc	0A	1.67A	87%
ERM01C18B	9-36Vdc	15Vdc	0A	1.33A	87%
ERM01H18B	9-36Vdc	24Vdc	0A	0.833A	87%
ERM01BB18B	9-36Vdc	±12Vdc	0A	±0.833A	86%
ERM01CC18B	9-36Vdc	±15Vdc	0A	±0.667A	86%
ERM04A36	18-75Vdc	5Vdc	0A	4A	87%
ERM01B36	18-75Vdc	12Vdc	0A	1.67A	88%
ERM01C36	18-75Vdc	15Vdc	0A	1.33A	88%
ERM01H36	18-75Vdc	24Vdc	0A	0.833A	88%
ERM01BB36	18-75Vdc	±12Vdc	0A	±0.833A	87%
ERM01CC36	18-75Vdc	±15Vdc	0A	±0.667A	87%
ERM04A36B	18-75Vdc	5Vdc	0A	4A	87%
ERM01B36B	18-75Vdc	12Vdc	0A	1.67A	88%
ERM01C36B	18-75Vdc	15Vdc	0A	1.33A	88%
ERM01H36B	18-75Vdc	24Vdc	0A	0.833A	88%
ERM01BB36B	18-75Vdc	±12Vdc	0A	±0.833A	87%
ERM01CC36B	18-75Vdc	±15Vdc	0A	±0.667A	87%

MODEL NUMBERS

Model[1]	Input Voltage	Output Voltage	Minimum Load	Maximum Load	Efficiency
ERM04A110	40-160Vdc	5Vdc	0A	4A	84%
ERM01B110	40-160Vdc	12Vdc	0A	1.67A	86%
ERM01C110	40-160Vdc	15Vdc	0A	1.33A	86%
ERM01H110	40-160Vdc	24Vdc	0A	0.833A	86%
ERM01BB110	40-160Vdc	±12Vdc	0A	±0.833A	86%
ERM01CC110	40-160Vdc	±15Vdc	0A	±0.667A	86%
ERM04A110B	40-160Vdc	5Vdc	0A	4A	84%
ERM01B110B	40-160Vdc	12Vdc	0A	1.67A	86%
ERM01C110B	40-160Vdc	15Vdc	0A	1.33A	86%
ERM01H110B	40-160Vdc	24Vdc	0A	0.833A	86%
ERM01BB110B	40-160Vdc	±12Vdc	0A	±0.833A	86%
ERM01CC110B	40-160Vdc	±15Vdc	0A	±0.667A	86%

Note1 - Suffix “B” means baseplate, see mechanical drawing.

ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings

Stress in excess of those listed in the "Absolute Maximum Ratings" may cause permanent damage to the power supply. These are stress ratings only and functional operation of the unit is not implied at these or any other conditions above those given in the operational sections of this TRN. Exposure to any absolute maximum rated condition for extended periods may adversely affect the power supply's reliability.

Table 1. Absolute Maximum Ratings

Parameter	Model	Symbol	Min	Typ	Max	Unit
Input Surge Voltage 0.1 Sec.max	24V Input Models 48V Input Models 110V Input Models	$V_{IN,DC}$	-0.7 -0.7 -0.7	- - -	50 100 170	Vdc Vdc Vdc
Maximum Output Power	All models	$P_{O,max}$	-	-	20	W
Isolation Voltage Input to output (60 seconds) Input / Output to Case (60 seconds)	 All models All models		 3000 1500	 - -	 - -	 Vac Vac
Isolation Resistance 500Vdc	All models		1000	-	-	Mohm
Isolation Capacitance 100KHz, 1V	All models		-	1500	-	pF
Operating Case Temperature	All models	T_{CASE}	-	-	+105	^{O}C
Storage Temperature	All models	T_{STG}	-50		+125	^{O}C
Humidity (non-condensing) Operating Non-operating	 All models All models		 - -	 - -	 95 95	 % %
MTBF (MIL-HDBK-217F@25^{O}C, Full load, Ground Benign)	All models		655,100	-	-	Hours

Note 1 - With Derating and under Natural Convection

ELECTRICAL SPECIFICATIONS

Input Specifications

Table 2. Input Specifications

Parameter		Condition	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, DC	24V Input Models 48V Input Models 110V Input Models	All	$V_{IN,DC}$	9 18 40	24 48 110	36 75 160	Vdc Vdc Vdc
Start-Up Threshold Voltage	24V Input Models 48V Input Models 110V Input Models	All	$V_{IN,ON}$	- - -	- - -	9 18 40	Vdc Vdc Vdc
Under Voltage Shutdown	24V Input Models 48V Input Models 110V Input Models	All	$V_{IN,OFF}$	- - -	7.5 16 37	- - -	Vdc Vdc Vdc
Input Current	ERM04A18 ERM01B18 ERM01C18 ERM01H18 ERM01BB18 ERM01CC18 ERM04A36 ERM01B36 ERM01C36 ERM01H36 ERM01BB36 ERM01CC36 ERM04A110 ERM01B110 ERM01C110 ERM01H110 ERM01BB110 ERM01CC110	$V_{IN,DC}=V_{IN,nom}$	$I_{IN,full\ load}$	- - - - - - - - - - - - - - - - - -	958 960 955 957 969 969 479 474 472 473 479 479 216 212 211 211 211 212	- - - - - - - - - - - - - - - - - -	mA mA mA mA mA mA mA mA mA mA mA mA mA mA mA mA mA mA
Efficiency @Max. Load	ERM04A18 ERM01B18 ERM01C18 ERM01H18 ERM01BB18 ERM01CC18 ERM04A36 ERM01B36 ERM01C36 ERM01H36 ERM01BB36 ERM01CC36 ERM04A110 ERM01B110 ERM01C110 ERM01H110 ERM01BB110 ERM01CC110	$V_{IN,DC}=V_{IN,nom}$ $I_O=I_{O,max}$ $T_A=25\ ^oC$	η	- - - - - - - - - - - - - - - - - -	87 87 87 87 86 86 87 88 88 88 87 87 84 86 86 86 86 86	- - - - - - - - - - - - - - - - - -	% % % % % % % % % % % % % % % % % %

ELECTRICAL SPECIFICATIONS

Input Specifications

Table 2. Input Specifications con't

Parameter		Condition	Symbol	Min	Typ	Max	Unit
No Load Input Current (V_O On, I_O = 0A)	24V Input Models 48V Input Models 110V Input Models	$V_{IN,DC}=V_{IN,nom}$	I_{IN,no_load}	- - -	25 15 10	- - -	mA mA mA
Start Up Time		All		-	50	-	mSec
Input Filter		All	Internal Pi Type				

ELECTRICAL SPECIFICATIONS

Output Specifications

Table 3. Output Specifications

Parameter		Condition	Symbol	Min	Typ	Max	Unit
Output Voltage Set -Point		$V_{IN,DC}$=$V_{IN,nom}$ I_O=$I_{O,max}$, T_A=25 °C	$\pm V_O$	-	-	±1	%
Line Regulation		$V_{IN,DC}$=$V_{IN,min}$ to $V_{IN,max}$	$\pm\%V_O$	-	-	0.2	%
Load Regulation	Single Output	I_O=$I_{O,min}$ to $I_{O,max}$	$\pm\%V_O$	-	-	0.5	%
	Dual Output		$\pm\%V_O$	-	-	1.0	%
Output Current	ERM04A18	Convection Cooling	I_O	-	-	4	A
	ERM01B18			-	-	1.67	A
	ERM01C18			-	-	1.33	A
	ERM01H18			-	-	0.833	A
	ERM01BB18			-	-	±0.833	A
	ERM01CC18			-	-	±0.667	A
	ERM04A36			-	-	4	A
	ERM01B36			-	-	1.67	A
	ERM01C36			-	-	1.33	A
	ERM01H36			-	-	0.833	A
	ERM01BB36			-	-	±0.833	A
	ERM01CC36			-	-	±0.667	A
	ERM04A110			-	-	4	A
	ERM01B110			-	-	1.67	A
	ERM01C110			-	-	1.33	A
	ERM01H110			-	-	0.833	A
	ERM01BB110			-	-	±0.833	A
	ERM01CC110			-	-	±0.667	A
Load Capacitance	ERM04A18	All	C_O	-	-	6800	uF
	ERM01B18			-	-	1200	uF
	ERM01C18			-	-	750	uF
	ERM01H18			-	-	300	uF
	ERM01BB18			-	-	600[1]	uF
	ERM01CC18			-	-	380[1]	uF
	ERM04A36			-	-	6800	uF
	ERM01B36			-	-	1200	uF
	ERM01C36			-	-	750	uF
	ERM01H36			-	-	300	uF
	ERM01BB36			-	-	600[1]	uF
	ERM01CC36			-	-	380[1]	uF
	ERM04A110			-	-	6800	uF
	ERM01B110			-	-	1200	uF
	ERM01C110			-	-	750	uF
	ERM01H110			-	-	300	uF
	ERM01BB110			-	-	600[1]	uF
	ERM01CC110			-	-	380[1]	uF

Note 1 - For each output

ELECTRICAL SPECIFICATIONS

Output Specifications

Table 3. Output Specifications Con't

Parameter		Condition	Symbol	Min	Nom	Max	Unit
Trim Up/Down Range			$\%V_O$	-	-	±10	%
Switching Frequency		All	f_{SW}	-	320	-	KHz
Temperature Coefficient		All	±%/°C	-	-	0.02	%/°C
Output Over Current Protection[1]		All	$\%I_{O,max}$	-	150	-	%
Output Short Circuit Protection		All	Hiccup Mode 0.7Hz type, Automatic Recovery				
Output Ripple, pk-pk	5V Output Models 12V Output Models 15V Output Models ±12V Output Models ±15V Output Models	0 to 20MHz bandwidth Measure with a 10uF/25V MLCC	V_O	- - - - -	50 100 100 100 100	- - - - -	mV mV mV mV mV
	24V Output Models	0 to 20MHz bandwidth Measure with a 4.7uF/50V MLCC	V_O	-	150	-	mV
V_O Dynamic Response	Peak Deviation Recovery Time[2]	25% load change	$\pm\%V_O$ $\pm\%V_{SB}$	- -	3 -	5 300	% uSec
Output Over Voltage	ERM04A18 ERM01B18 ERM01C18 ERM01H18 ERM01BB18 ERM01CC18 ERM04A36 ERM01B36 ERM01C36 ERM01H36 ERM01BB36 ERM01CC36 ERM04A110 ERM01B110 ERM01C110 ERM01H110 ERM01BB110 ERM01CC110	All	V_O	- - - - - - - - - - - - - - - - - -	6.2 15 18 30 ±15 ±18 6.2 15 18 30 ±15 ±18 6.2 15 18 30 ±15 ±18	- - - - - - - - - - - - - - - - - -	Vdc Vdc Vdc Vdc Vdc Vdc Vdc Vdc Vdc Vdc Vdc Vdc Vdc Vdc Vdc Vdc Vdc Vdc

Note 1 - Hiccup mode.
Note 2 - Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.

ELECTRICAL SPECIFICATIONS

ERM04A18 Performance Curves

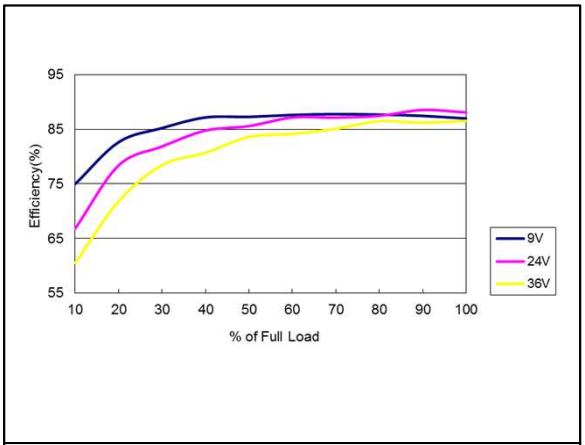


Figure 1: ERM04A18 Efficiency Versus Output Current Curve
Vin = 9 to 36Vdc Load: Io = 0 to 4A

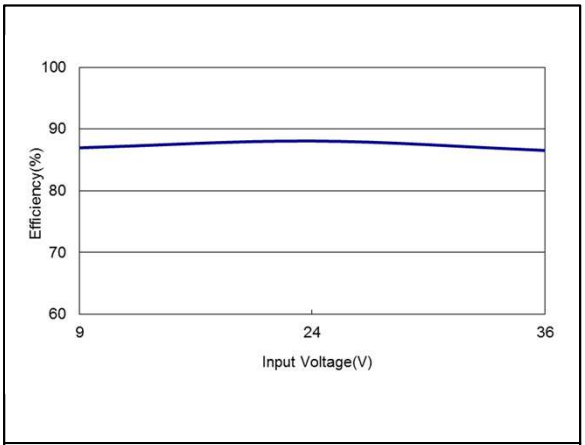


Figure 2: ERM04A18 Efficiency Versus Input Voltage Curve
Vin = 9 to 36Vdc Load: Io = 0 to 4A

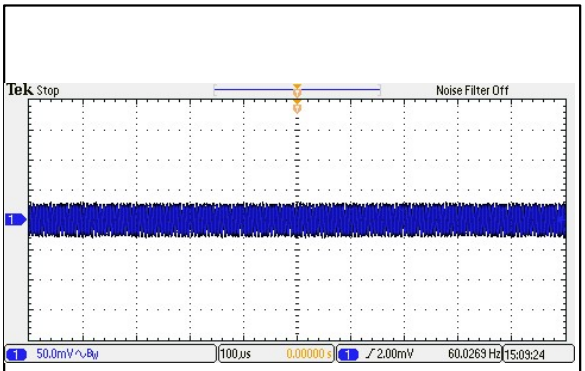


Figure 3: ERM04A18 Ripple and Noise Measurement
Vin = 24Vdc Load: Io = 4A
Ch 1: Vo

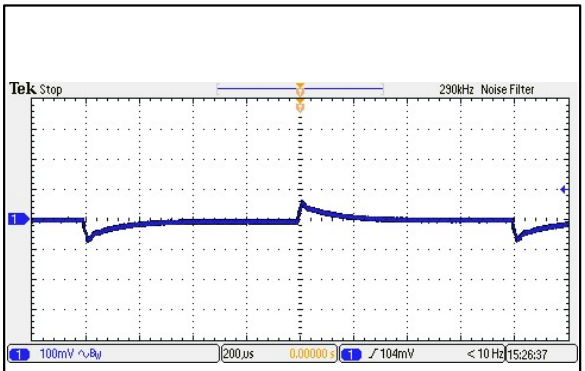


Figure 4: ERM04A18 Transient Response
Vin = 24Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

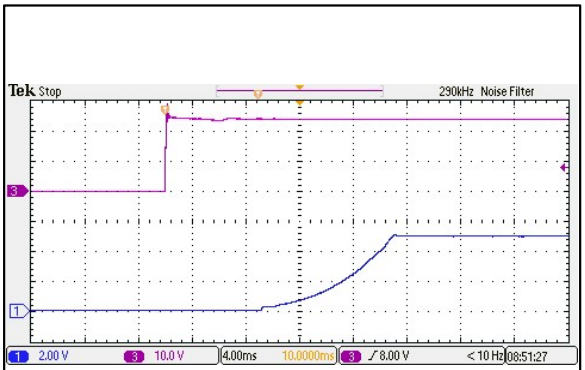


Figure 5: ERM04A18 Output Voltage Startup Characteristic by Vin
Vin = 24Vdc Load: Io = 4A
Ch 1: Vo Ch 3: Vin

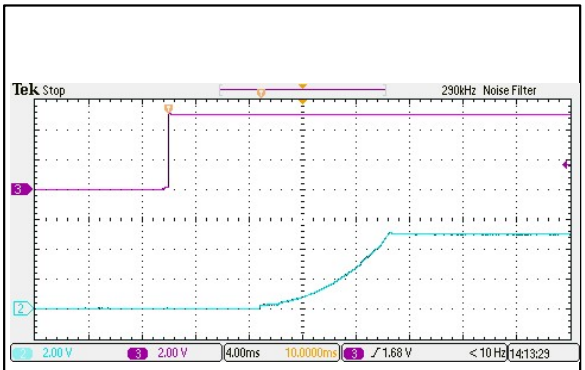


Figure 6: ERM04A18 Output Voltage Startup Characteristic by **On/Off**
Vin = 24Vdc Load: Io = 4A
Ch 2: Vo Ch 3: **On/Off**

ELECTRICAL SPECIFICATIONS

ERM04A18 Performance Curves

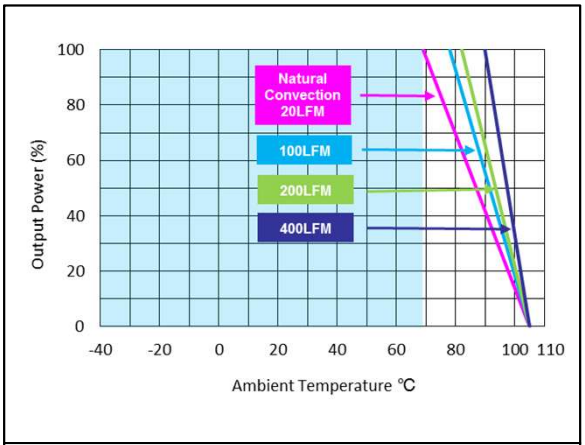


Figure 7: ERM04A18 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 24Vdc

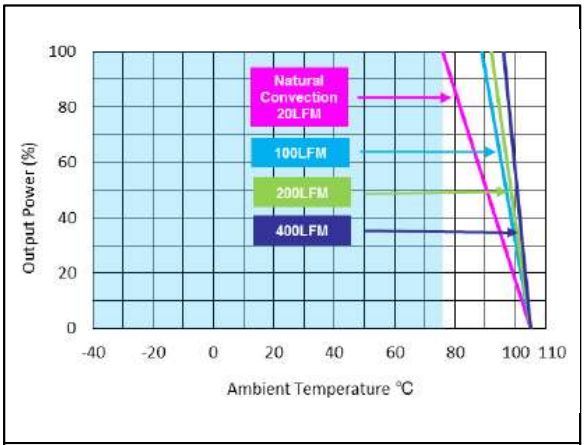


Figure 8: ERM04A18 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 24Vdc

ELECTRICAL SPECIFICATIONS

ERM01B18 Performance Curves

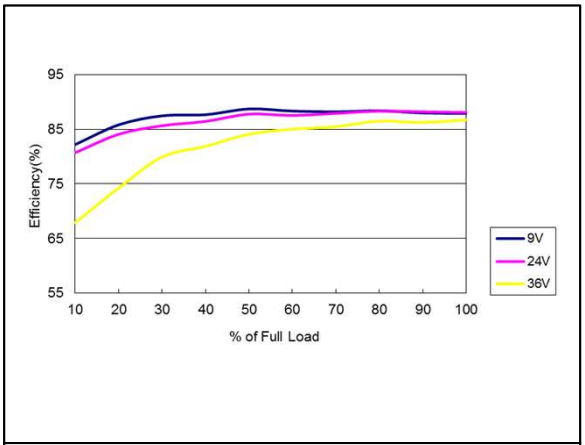


Figure 9: ERM01B18 Efficiency Versus Output Current Curve
Vin = 9 to 36Vdc Load: Io = 0 to 1.67A

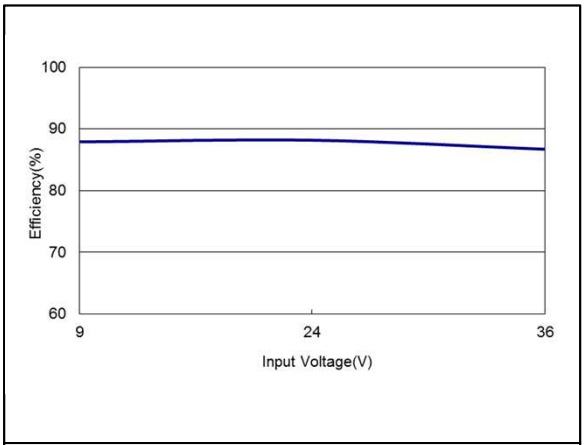


Figure 10: ERM01B18 Efficiency Versus Input Voltage Curve
Vin = 9 to 36Vdc Load: Io = 0 to 1.67A

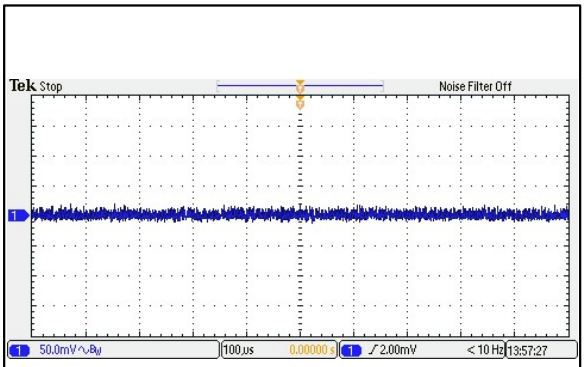


Figure 11: ERM01B18 Ripple and Noise Measurement
Vin = 24Vdc Load: Io = 1.67A
Ch 1: Vo

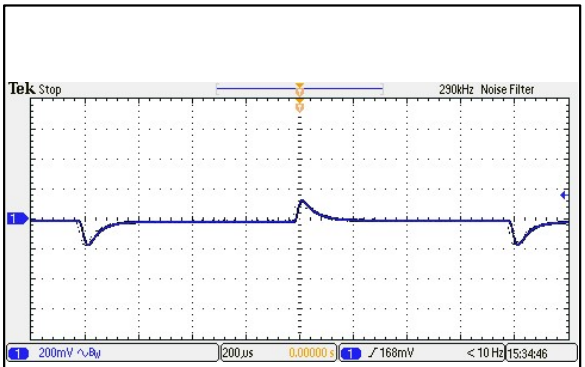


Figure 12: ERM01B18 Transient Response
Vin = 24Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

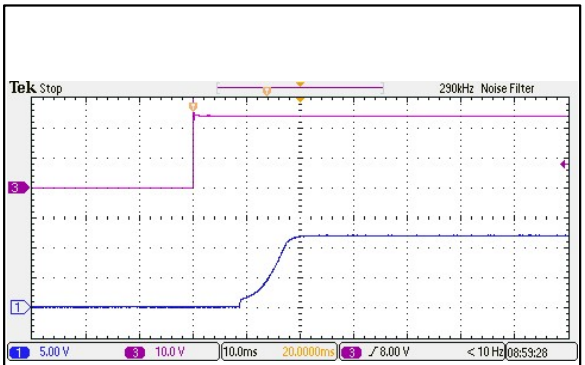


Figure 13: ERM01B18 Output Voltage Startup Characteristic by Vin
Vin = 24Vdc Load: Io = 1.67A
Ch 1: Vo Ch 3: Vin

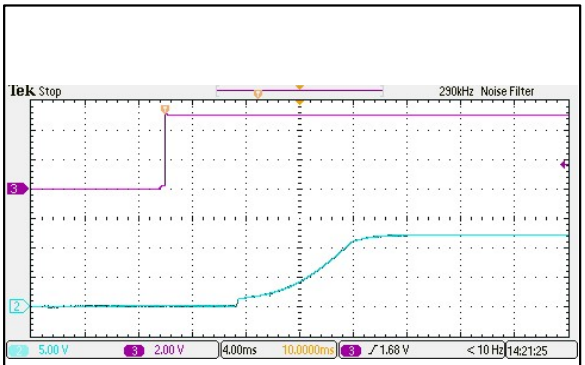


Figure 14: ERM01B18 Output Voltage Startup Characteristic by **On/Off**
Vin = 24Vdc Load: Io = 1.67A
Ch 2: Vo Ch 3: **On/Off**

ELECTRICAL SPECIFICATIONS

ERM01B18 Performance Curves

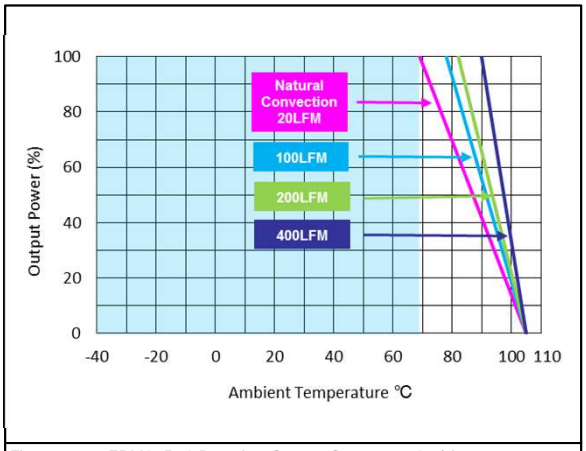


Figure 15: ERM01B18 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 24Vdc

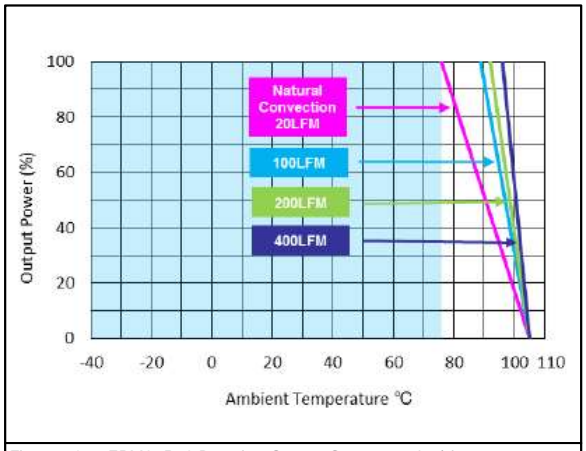


Figure 16: ERM01B18 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 24Vdc

ELECTRICAL SPECIFICATIONS

ERM01C18 Performance Curves

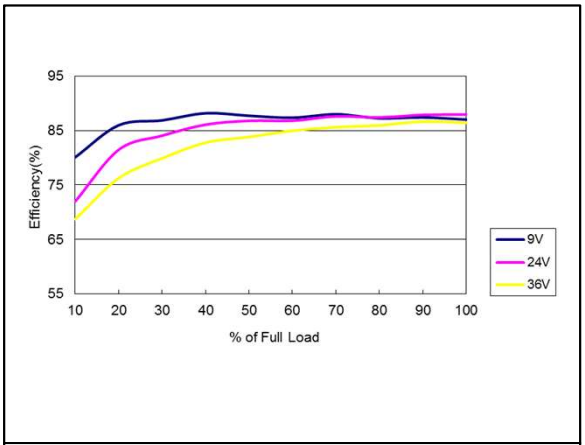


Figure 17: ERM01C18 Efficiency Versus Output Current Curve
Vin = 9 to 36Vdc Load: Io = 0 to 1.33A

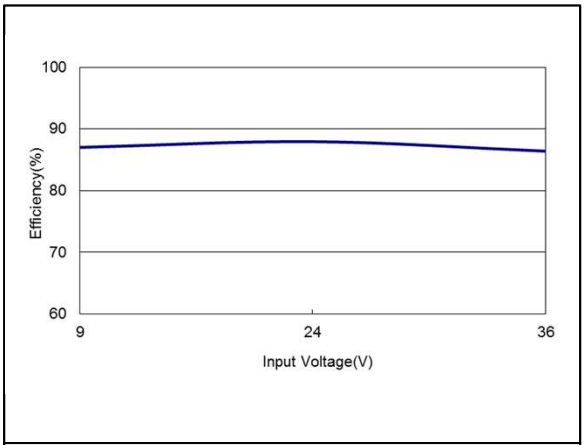


Figure 18: ERM01C18 Efficiency Versus Input Voltage Curve
Vin = 9 to 36Vdc Load: Io = 0 to 1.33A

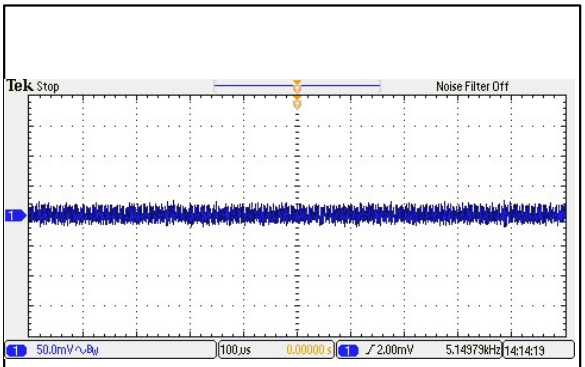


Figure 19: ERM01C18 Ripple and Noise Measurement
Vin = 24Vdc Load: Io = 1.33A
Ch 1: Vo

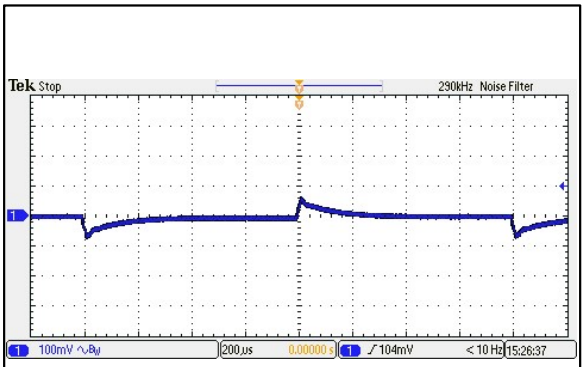


Figure 20: ERM01C18 Transient Response
Vin = 24Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

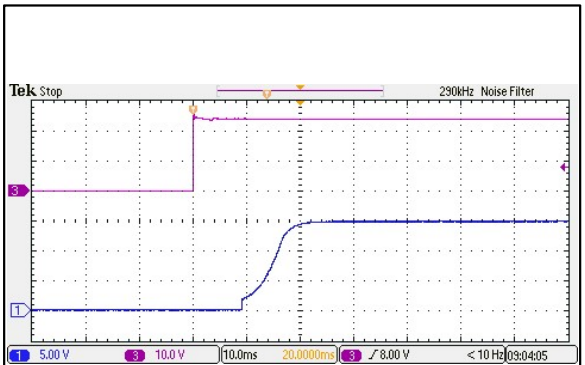


Figure 21: ERM01C18 Output Voltage Startup Characteristic by Vin
Vin = 24Vdc Load: Io = 1.33A
Ch 1: Vo Ch 3: Vin

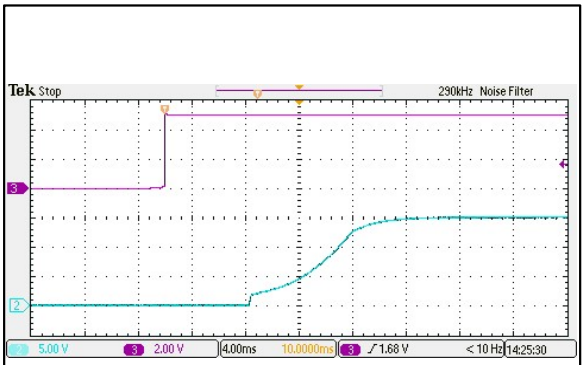


Figure 22: ERM01C18 Output Voltage Startup Characteristic by **On/Off**
Vin = 24Vdc Load: Io = 1.33A
Ch 2: Vo Ch 3: **On/Off**

ELECTRICAL SPECIFICATIONS

ERM01C18 Performance Curves

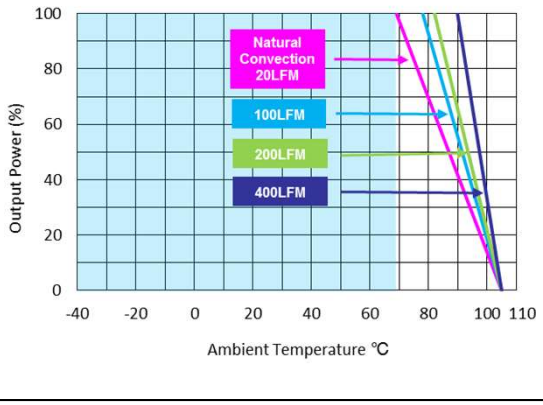


Figure 23: ERM01C18 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 24Vdc

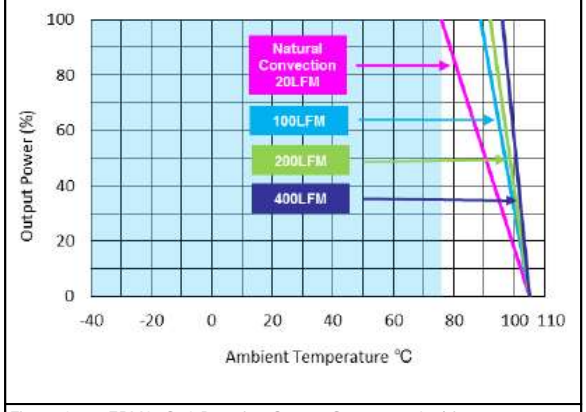


Figure 24: ERM01C18 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 24Vdc

ELECTRICAL SPECIFICATIONS

ERM01H18 Performance Curves

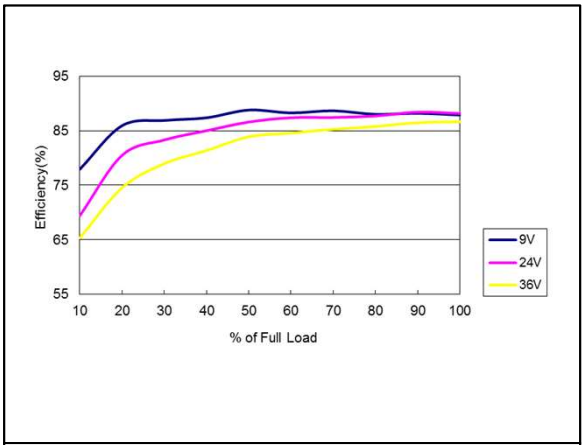


Figure 25: ERM01H18 Efficiency Versus Output Current Curve
Vin = 9 to 36Vdc Load: Io = 0 to 0.833A

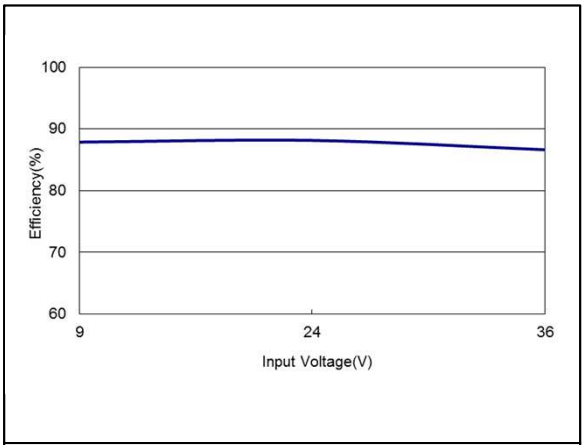


Figure 26: ERM01H18 Efficiency Versus Input Voltage Curve
Vin = 9 to 36Vdc Load: Io = 0 to 0.833A

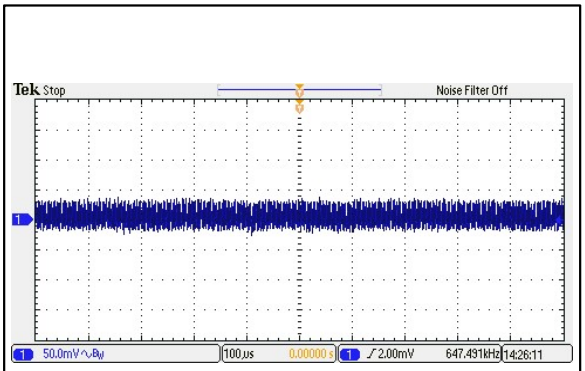


Figure 27: ERM01H18 Ripple and Noise Measurement
Vin = 24Vdc Load: Io = 0.833A
Ch 1: Vo

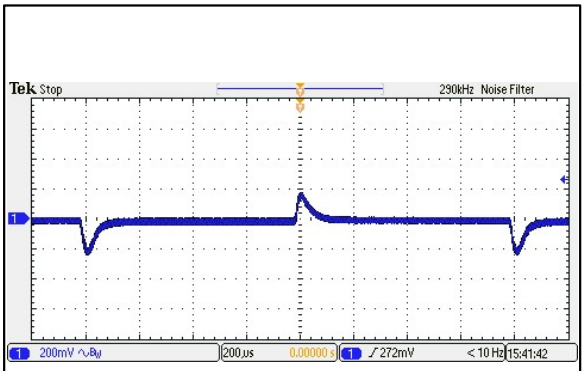


Figure 28: ERM01H18 Transient Response
Vin = 24Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

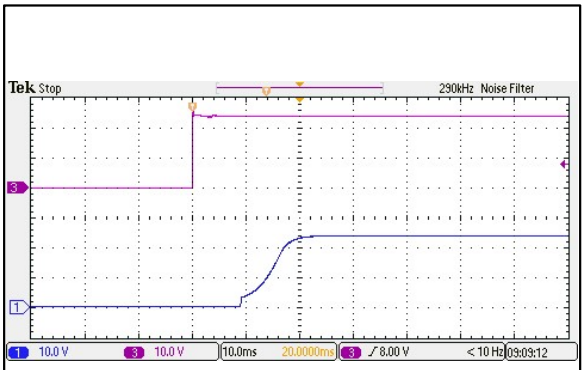


Figure 29: ERM01H18 Output Voltage Startup Characteristic by Vin
Vin = 24Vdc Load: Io = 0.833A
Ch 1: Vo Ch 3: Vin

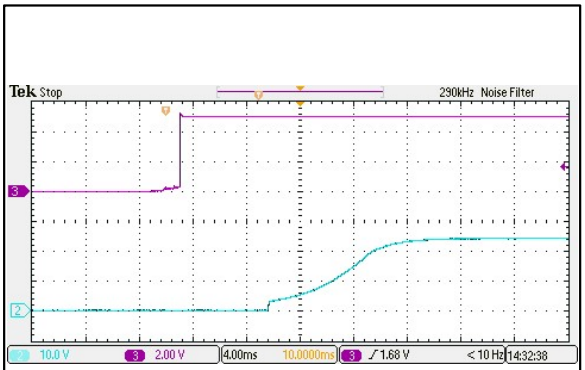


Figure 30: ERM01H18 Output Voltage Startup Characteristic by **On/Off**
Vin = 24Vdc Load: Io = 0.833A
Ch 2: Vo Ch 3: **On/Off**

ELECTRICAL SPECIFICATIONS

ERM01H18 Performance Curves

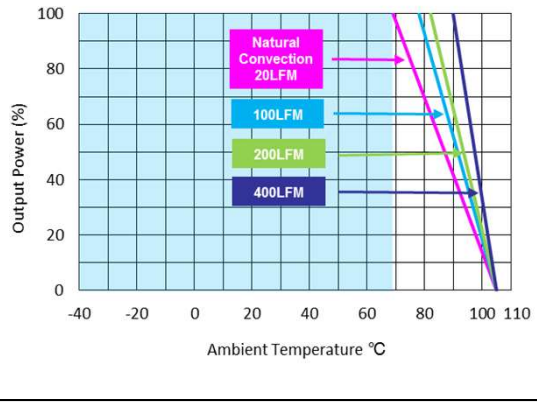


Figure 31: ERM01H18 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 24Vdc

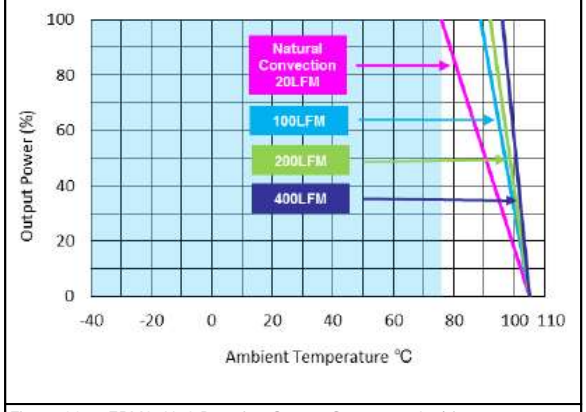


Figure 32: ERM01H18 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 24Vdc

ELECTRICAL SPECIFICATIONS

ERM01BB18 Performance Curves

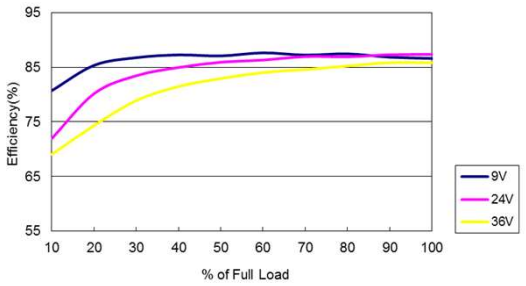


Figure 33: ERM01BB18 Efficiency Versus Output Current Curve
Vin = 9 to 36Vdc Load: Io = 0 to ±0.833A

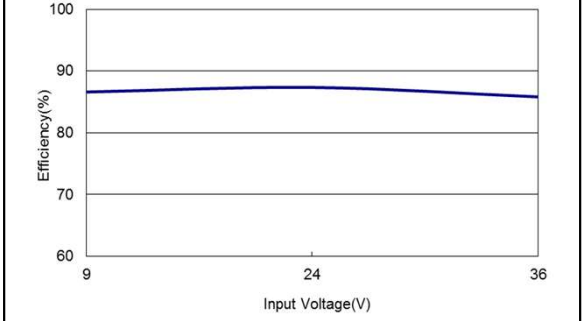


Figure 34: ERM01BB18 Efficiency Versus Input Voltage Curve
Vin = 9 to 36Vdc Load: Io = 0 to ±0.833A

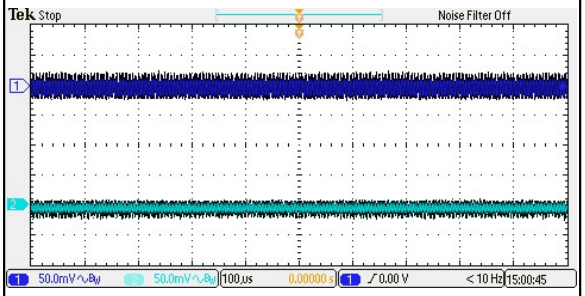


Figure 35: ERM01BB18 Ripple and Noise Measurement
Vin = 24Vdc Load: Io = ±0.833A
Ch 1: Vo1 Ch 2: Vo2

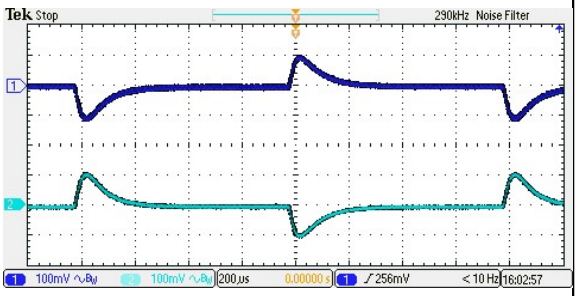


Figure 36: ERM01BB18 Transient Response
Vin = 24Vdc Load: Io = 100% to 75% load change
Ch 1: Vo1 Ch 2: Vo2

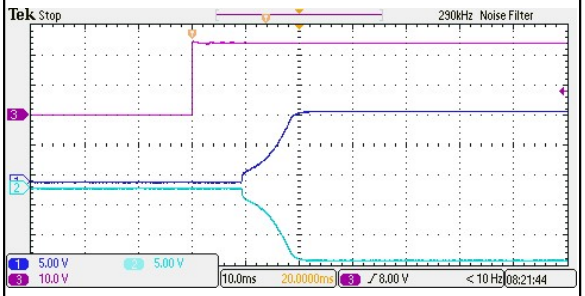


Figure 37: ERM01BB18 Output Voltage Startup Characteristic by Vin
Vin = 24Vdc Load: Io = ±0.833A
Ch 1: Vo1 Ch 2: Vo2 Ch 3: Vin

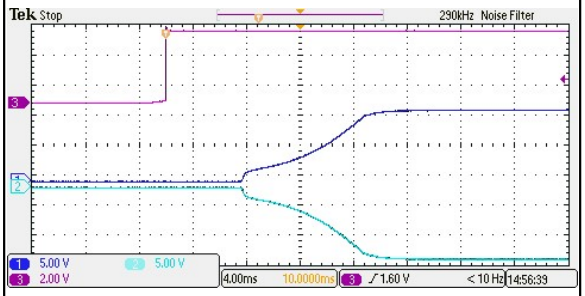


Figure 38: ERM01BB18 Output Voltage Startup Characteristic by On/Off Vin = 24Vdc Load: Io = ±0.833A
Ch 1: Vo1 Ch 2: Vo2 Ch 3: On/Off

ELECTRICAL SPECIFICATIONS

ERM01BB18 Performance Curves

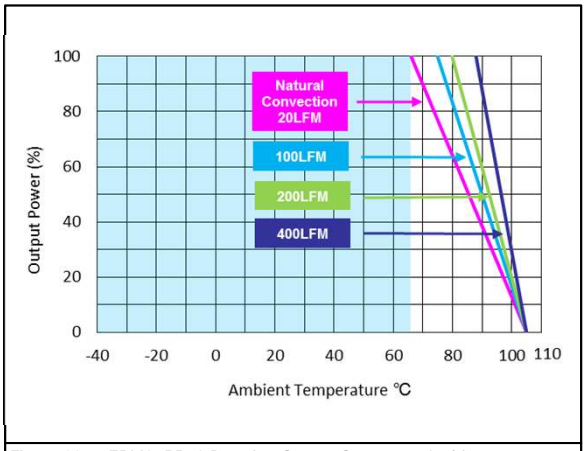


Figure 39: ERM01BB18 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 24Vdc

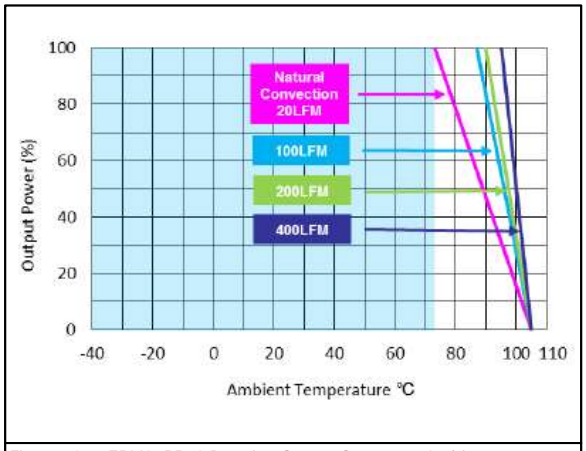


Figure 40: ERM01BB18 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 24Vdc

ELECTRICAL SPECIFICATIONS

ERM01CC18 Performance Curves

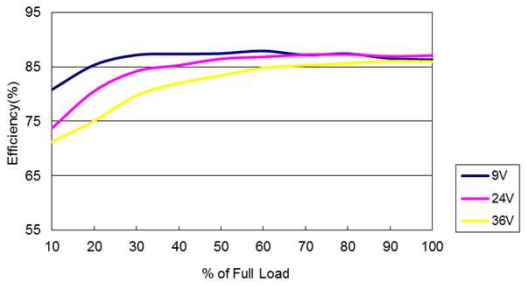


Figure 41: ERM01CC18 Efficiency Versus Output Current Curve
Vin = 9 to 36Vdc Load: Io = 0 to ±0.667A

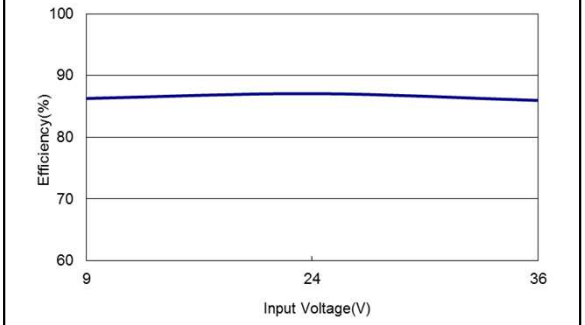


Figure 42: ERM01CC18 Efficiency Versus Input Voltage Curve
Vin = 9 to 36Vdc Load: Io = 0 to ±0.667A

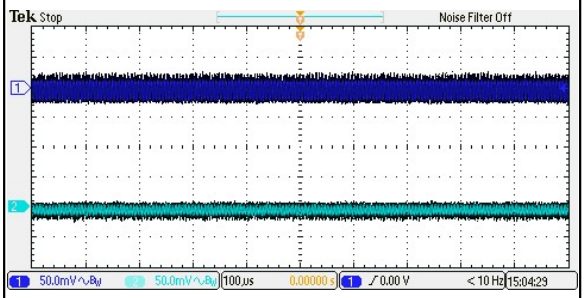


Figure 43: ERM01CC18 Ripple and Noise Measurement
Vin = 24Vdc Load: Io = ±0.667A
Ch 1: Vo1 Ch 2: Vo2

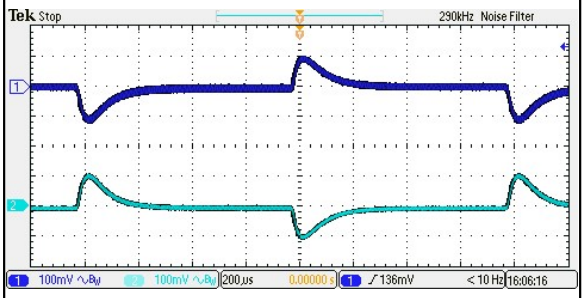


Figure 44: ERM01CC18 Transient Response
Vin = 24Vdc Load: Io = 100% to 75% load change
Ch 1: Vo1 Ch 2: Vo2

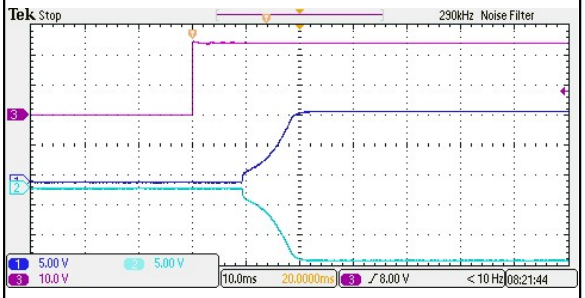


Figure 45: ERM01CC18 Output Voltage Startup Characteristic by Vin
Vin = 24Vdc Load: Io = ±0.667A
Ch 1: Vo1 Ch 2: Vo2 Ch 3: Vin

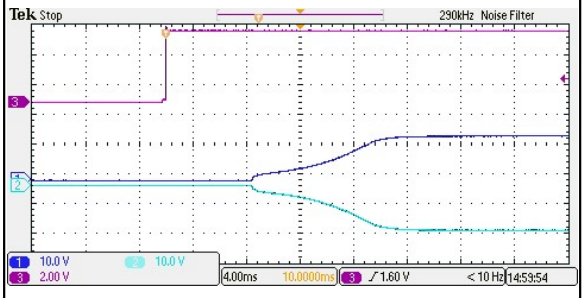


Figure 46: ERM01CC18 Output Voltage Startup Characteristic by On/Off Vin = 24Vdc Load: Io = ±0.667A
Ch 1: Vo1 Ch 2: Vo2 Ch 3: On/Off

ELECTRICAL SPECIFICATIONS

ERM01CC18 Performance Curves

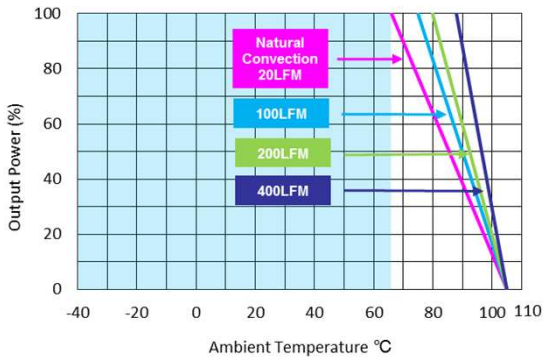


Figure 47: ERM01CC18 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 24Vdc

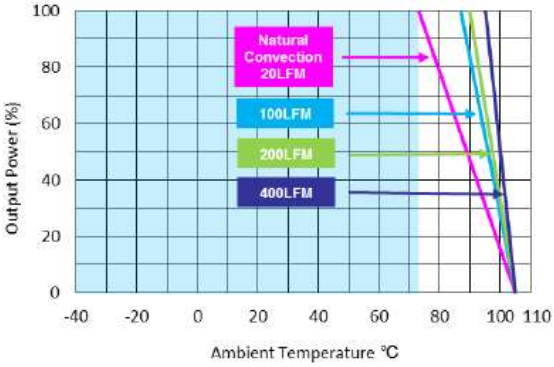


Figure 48: ERM01CC18 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 24Vdc

ELECTRICAL SPECIFICATIONS

ERM04A36 Performance Curves

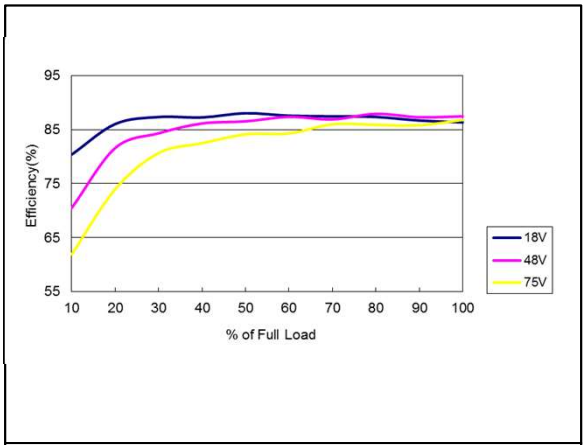


Figure 49: ERM04A36 Efficiency Versus Output Current Curve
Vin = 18 to 75Vdc Load: Io = 0 to 4A

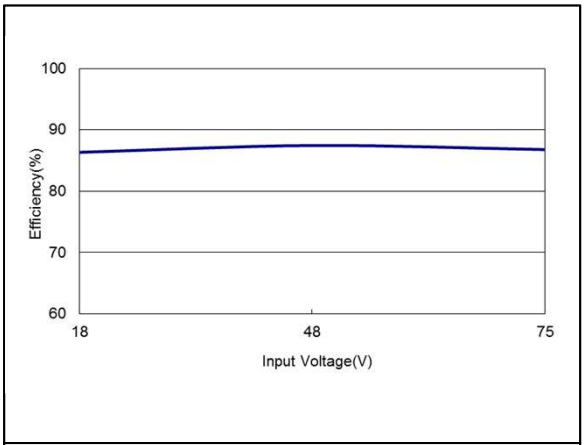


Figure 50: ERM04A36 Efficiency Versus Input Voltage Curve
Vin = 18 to 75Vdc Load: Io = 0 to 4A

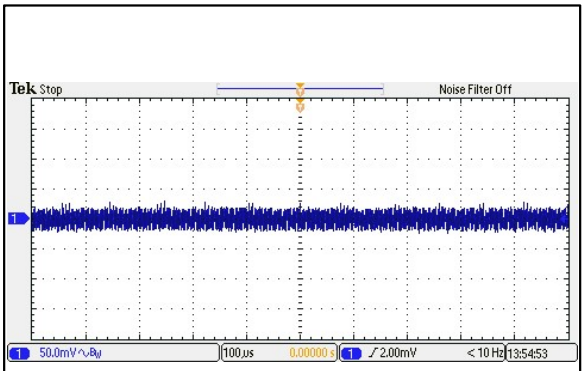


Figure 51: ERM04A36 Ripple and Noise Measurement
Vin = 48Vdc Load: Io = 4A
Ch 1: Vo

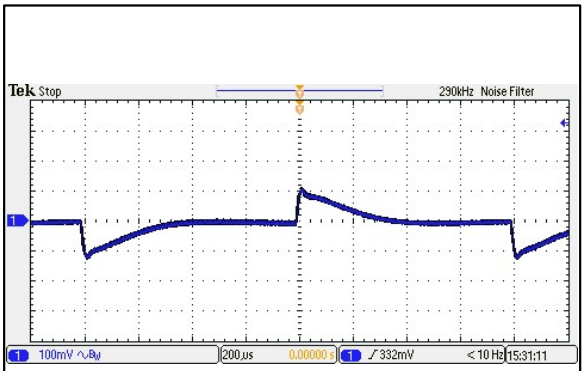


Figure 52: ERM04A36 Transient Response
Vin = 48Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

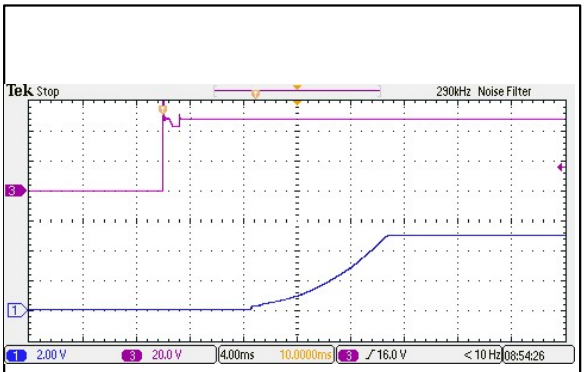


Figure 53: ERM04A36 Output Voltage Startup Characteristic by Vin
Vin = 48Vdc Load: Io = 4A
Ch 1: Vo Ch 3: Vin

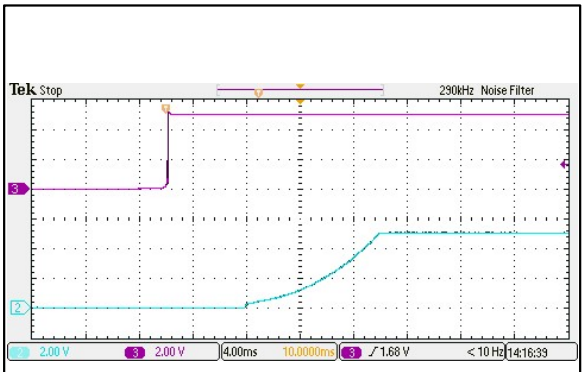


Figure 54: ERM04A36 Output Voltage Startup Characteristic by **On/Off**
Vin = 48Vdc Load: Io = 4A
Ch 2: Vo Ch 3: **On/Off**

ELECTRICAL SPECIFICATIONS

ERM04A36 Performance Curves

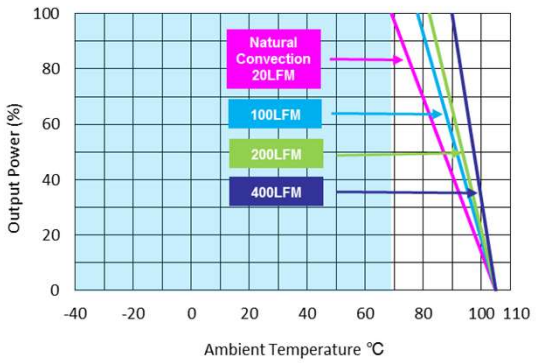


Figure 55: ERM04A36 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 48Vdc

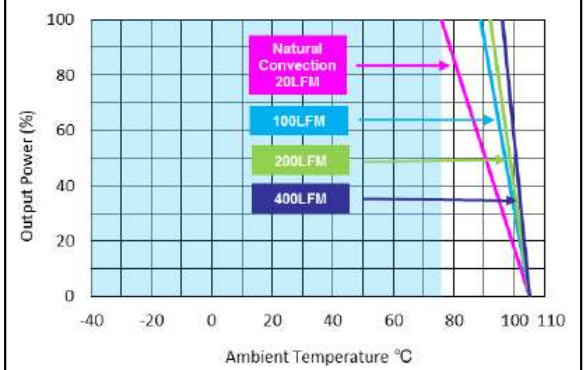


Figure 56: ERM04A36 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 48Vdc

ELECTRICAL SPECIFICATIONS

ERM01B36 Performance Curves

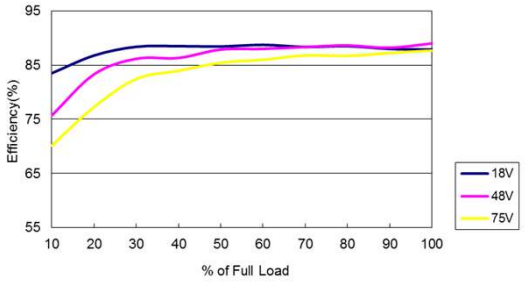


Figure 57: ERM01B36 Efficiency Versus Output Current Curve
Vin = 18 to 75Vdc Load: Io = 0 to 1.67A

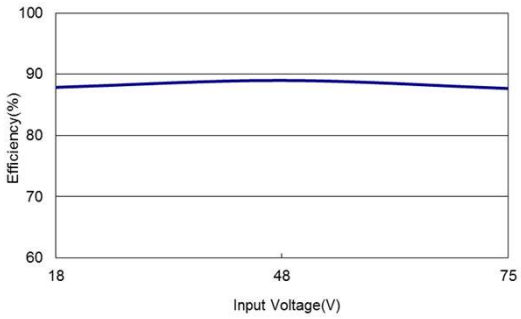


Figure 58: ERM01B36 Efficiency Versus Input Voltage Curve
Vin = 18 to 75Vdc Load: Io = 0 to 1.67A

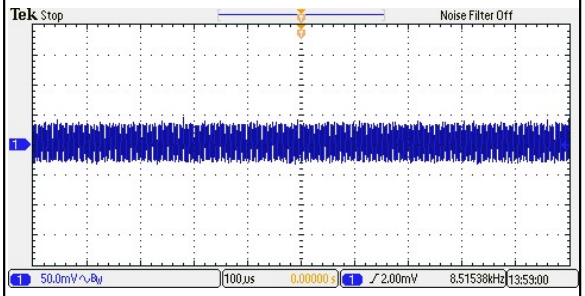


Figure 59: ERM01B36 Ripple and Noise Measurement
Vin = 48Vdc Load: Io = 1.67A
Ch 1: Vo

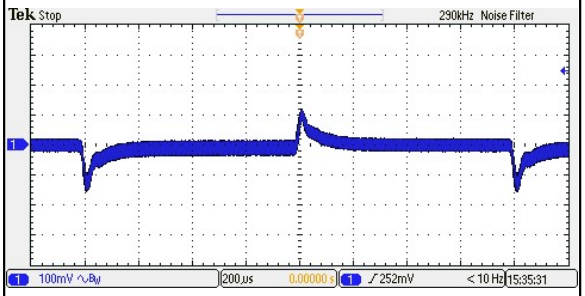


Figure 60: ERM01B36 Transient Response
Vin = 48Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

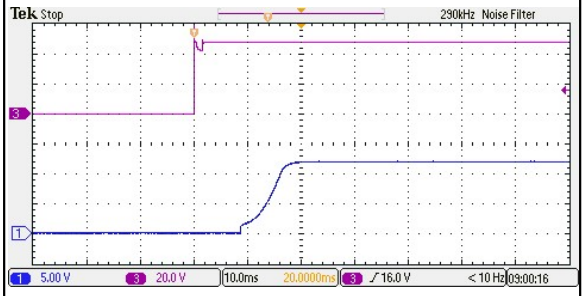


Figure 61: ERM01B36 Output Voltage Startup Characteristic by Vin
Vin = 48Vdc Load: Io = 1.67A
Ch 1: Vo Ch 3: Vin

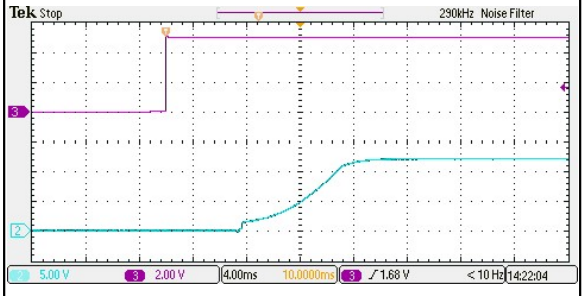


Figure 62: ERM01B36 Output Voltage Startup Characteristic by **On/Off**
Vin = 48Vdc Load: Io = 1.67A
Ch 2: Vo Ch 3: **On/Off**

ELECTRICAL SPECIFICATIONS

ERM01B36 Performance Curves

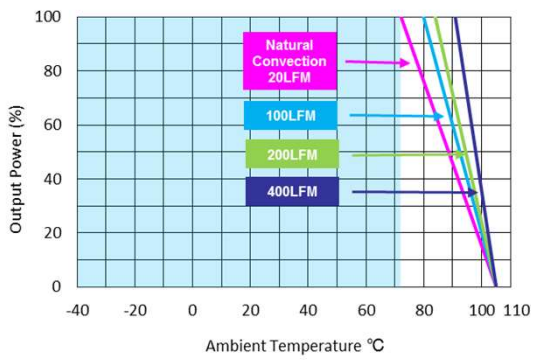


Figure 63: ERM01B36 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 48Vdc

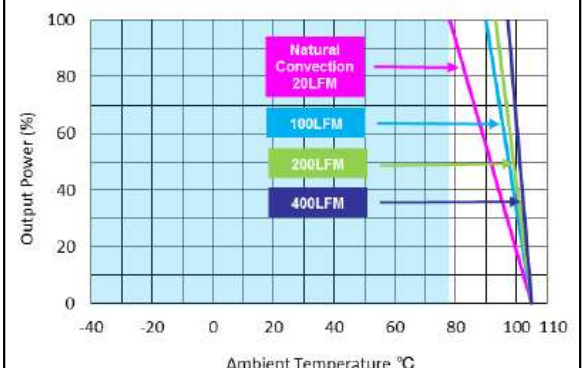


Figure 64: ERM01B36 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 48Vdc

ELECTRICAL SPECIFICATIONS

ERM01C36 Performance Curves

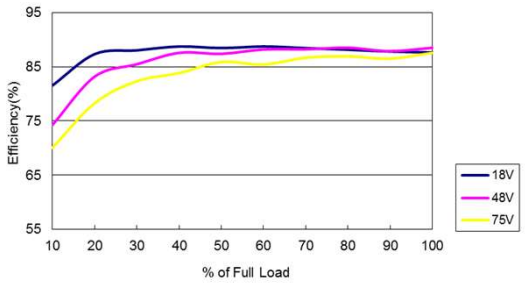


Figure 65: ERM01C36 Efficiency Versus Output Current Curve
Vin = 18 to 75Vdc Load: Io = 0 to 1.33A

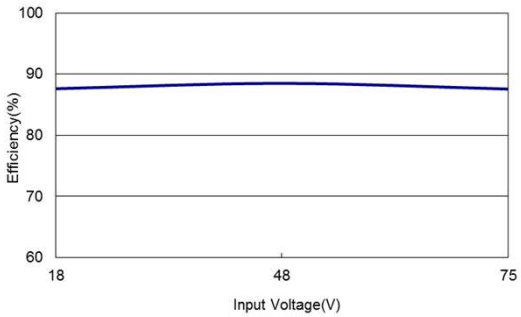


Figure 66: ERM01C36 Efficiency Versus Input Voltage Curve
Vin = 18 to 75Vdc Load: Io = 0 to 1.33A

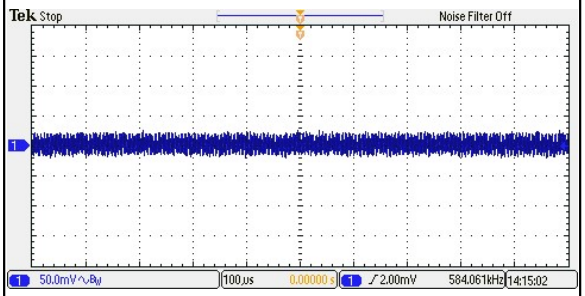


Figure 67: ERM01C36 Ripple and Noise Measurement
Vin = 48Vdc Load: Io = 1.33A
Ch 1: Vo

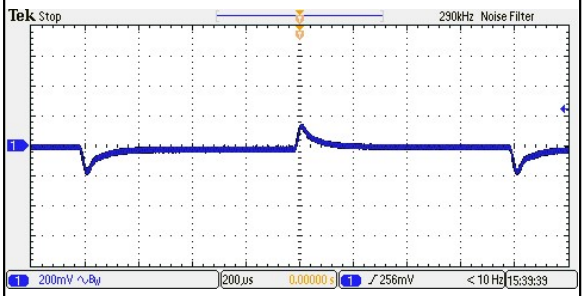


Figure 68: ERM01C36 Transient Response
Vin = 48Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

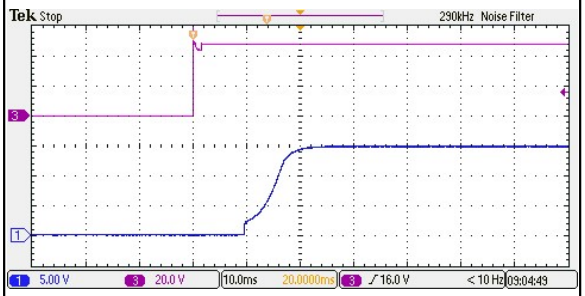


Figure 69: ERM01C36 Output Voltage Startup Characteristic by Vin
Vin = 48Vdc Load: Io = 1.33A
Ch 1: Vo Ch 3: Vin

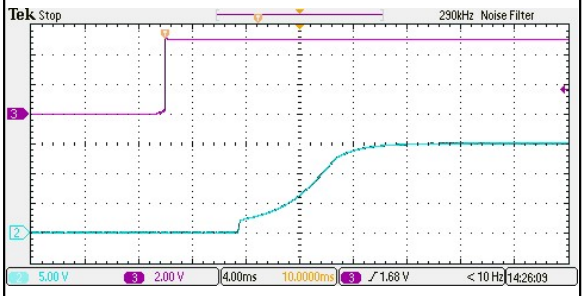


Figure 70: ERM01C36 Output Voltage Startup Characteristic by **On/Off**
Vin = 48Vdc Load: Io = 1.33A
Ch 2: Vo Ch 3: **On/Off**

ELECTRICAL SPECIFICATIONS

ERM01C36 Performance Curves

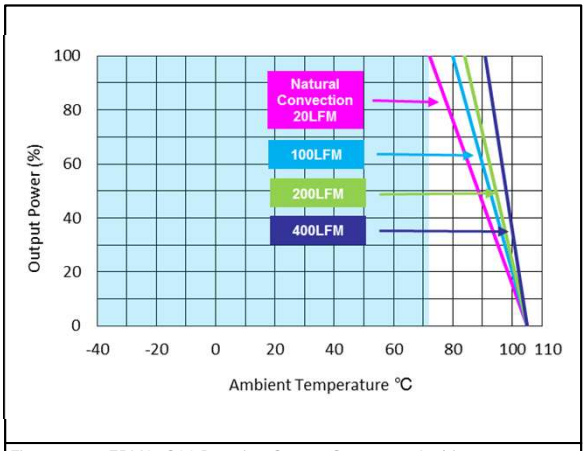


Figure 71: ERM01C36 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 48Vdc

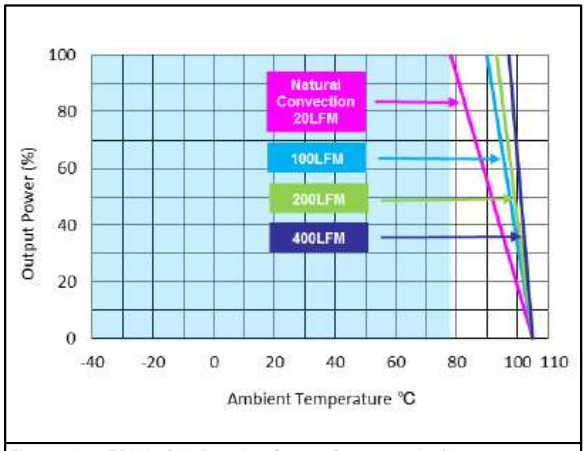


Figure 72: ERM01C36 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 48Vdc

ELECTRICAL SPECIFICATIONS

ERM01H36 Performance Curves

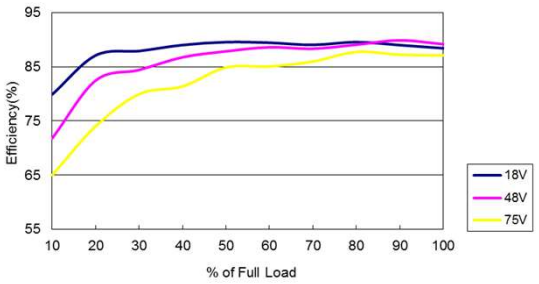


Figure 73: ERM01H36 Efficiency Versus Output Current Curve
Vin = 18 to 75Vdc Load: Io = 0 to 0.833A

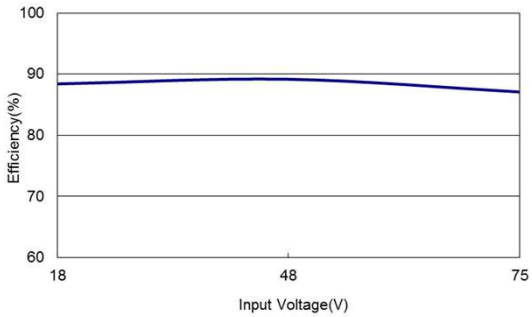


Figure 74: ERM01H36 Efficiency Versus Input Voltage Curve
Vin = 18 to 75Vdc Load: Io = 0 to 0.833A

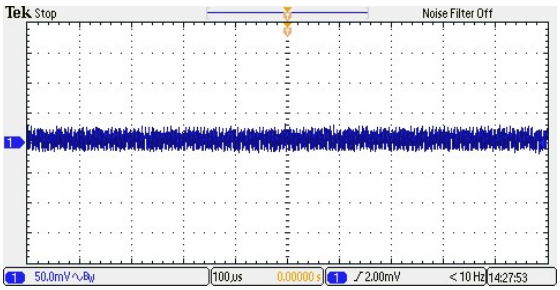


Figure 75: ERM01H36 Ripple and Noise Measurement
Vin = 48Vdc Load: Io = 0.833A
Ch 1: Vo

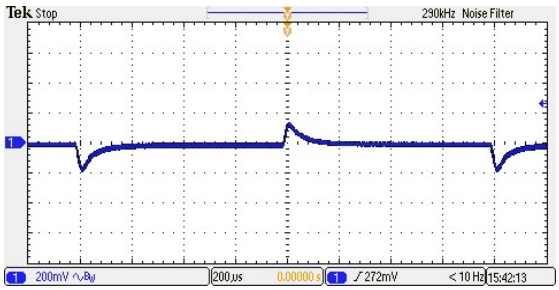


Figure 76: ERM01H36 Transient Response
Vin = 48Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

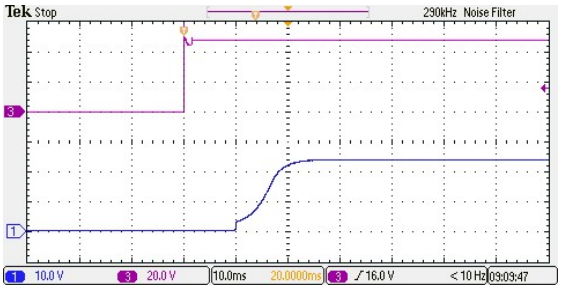


Figure 77: ERM01H36 Output Voltage Startup Characteristic by Vin
Vin = 48Vdc Load: Io = 0.833A
Ch 1: Vo Ch 3: Vin

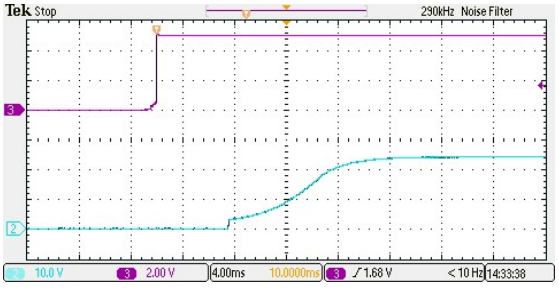


Figure 78: ERM01H36 Output Voltage Startup Characteristic by **On/Off** Vin = 48Vdc Load: Io = 0.833A
Ch 2: Vo Ch 3: **On/Off**

ELECTRICAL SPECIFICATIONS

ERM01H36 Performance Curves

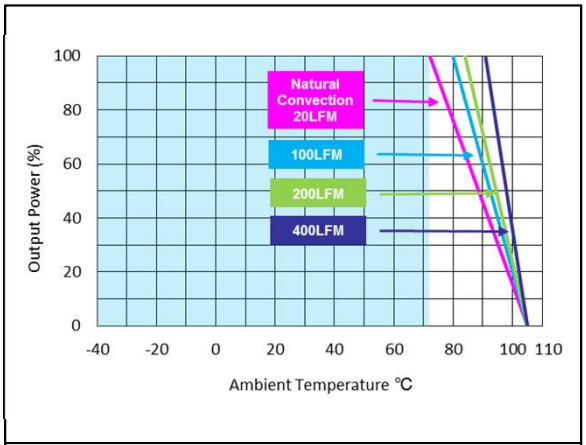


Figure 79: ERM01H36 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 48Vdc

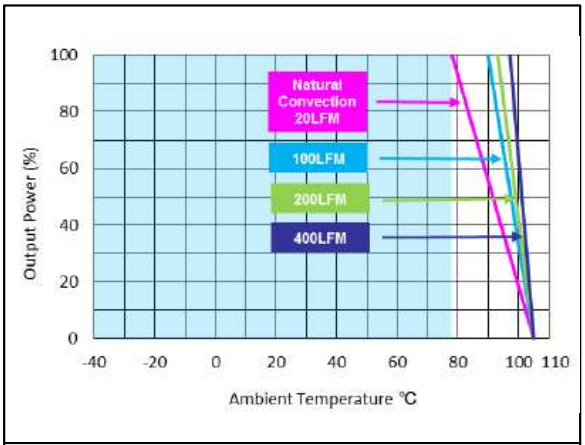


Figure 80: ERM01H36 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 48Vdc

ELECTRICAL SPECIFICATIONS

ERM01BB36 Performance Curves

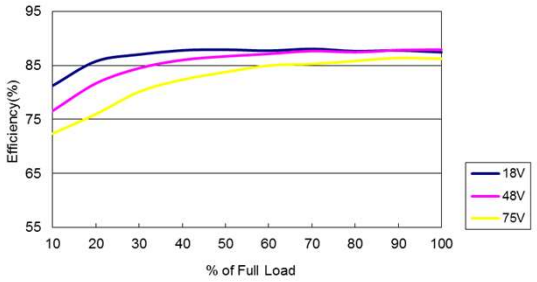


Figure 81: ERM01BB36 Efficiency Versus Output Current Curve
Vin = 18 to 75Vdc Load: Io = 0 to ±0.833A

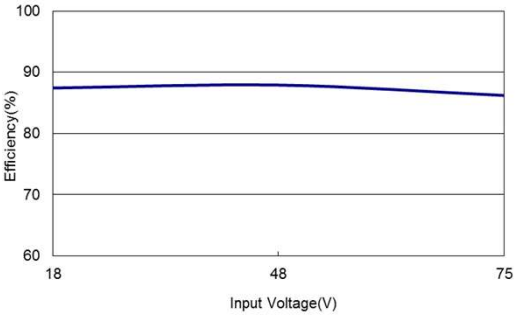


Figure 82: ERM01BB36 Efficiency Versus Input Voltage Curve
Vin = 18 to 75Vdc Load: Io = 0 to ±0.833A

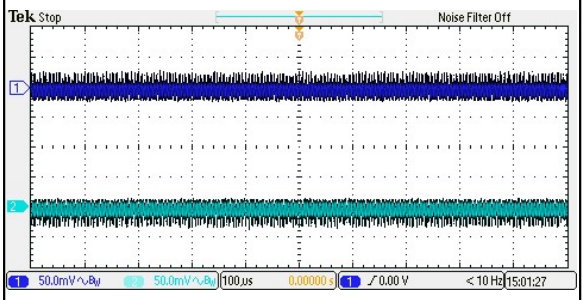


Figure 83: ERM01BB36 Ripple and Noise Measurement
Vin = 48Vdc Load: Io = ±0.833A
Ch 1: Vo1 Ch 2: Vo2

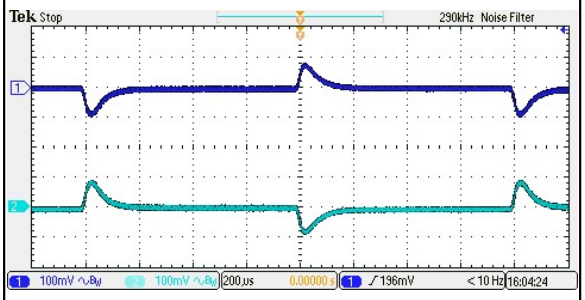


Figure 84: ERM01BB36 Transient Response
Vin = 48Vdc Load: Io = 100% to 75% load change
Ch 1: Vo1 Ch 2: Vo2

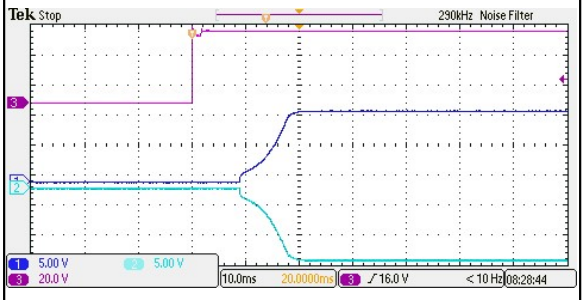


Figure 85: ERM01BB36 Output Voltage Startup Characteristic by Vin
Vin = 48Vdc Load: Io = ±0.833A
Ch 1: Vo1 Ch 2: Vo2 Ch 3: Vin

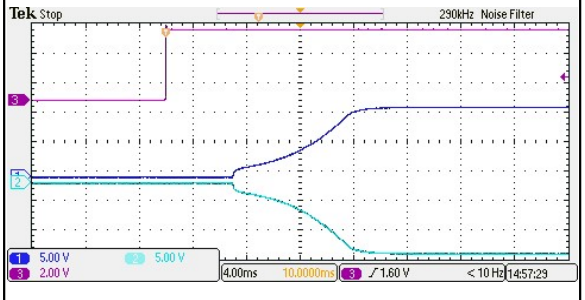


Figure 86: ERM01BB36 Output Voltage Startup Characteristic by On/Off Vin = 48Vdc Load: Io = ±0.833A
Ch 1: Vo1 Ch 2: Vo2 Ch 3: On/Off

ELECTRICAL SPECIFICATIONS

ERM01BB36 Performance Curves

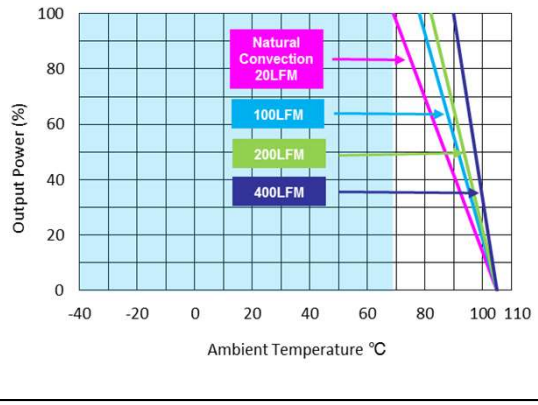


Figure 87: ERM01BB36 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 48Vdc

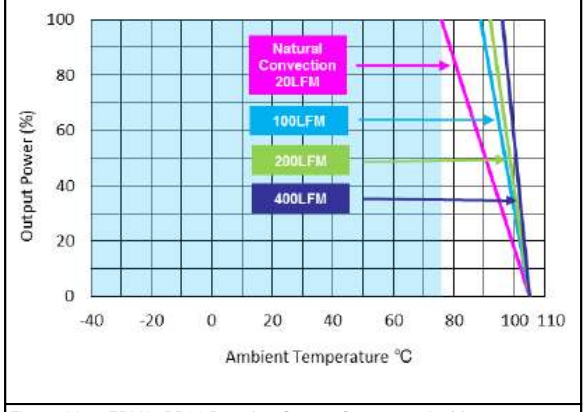


Figure 88: ERM01BB36 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 48Vdc

ELECTRICAL SPECIFICATIONS

ERM01CC36 Performance Curves

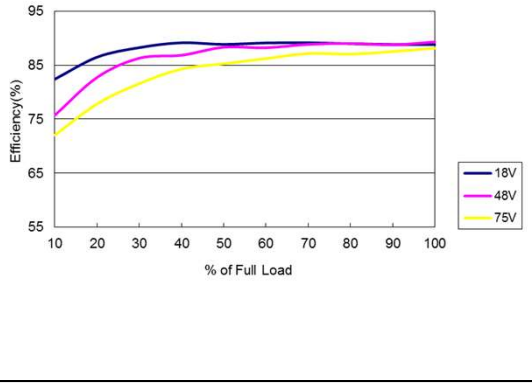


Figure 89: ERM01CC36 Efficiency Versus Output Current Curve
Vin = 18 to 75Vdc Load: Io = 0 to ±0.667A

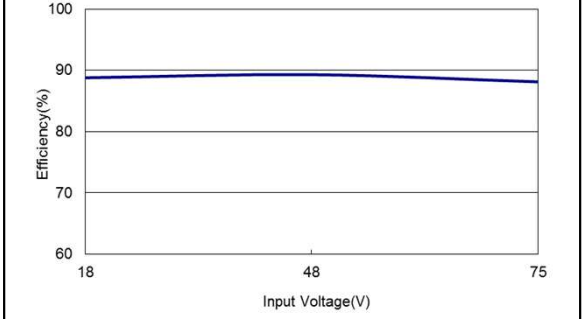


Figure 90: ERM01CC36 Efficiency Versus Input Voltage Curve
Vin = 18 to 75Vdc Load: Io = 0 to ±0.667A

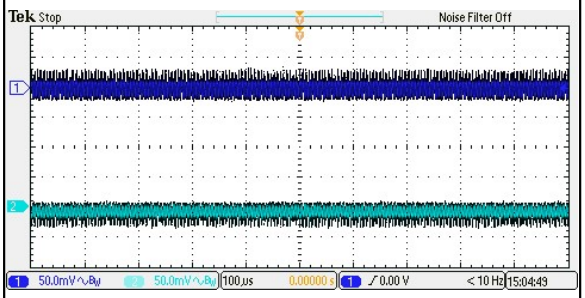


Figure 91: ERM01CC36 Ripple and Noise Measurement
Vin = 48Vdc Load: Io = ±0.667A
Ch 1: Vo1 Ch 2: Vo2

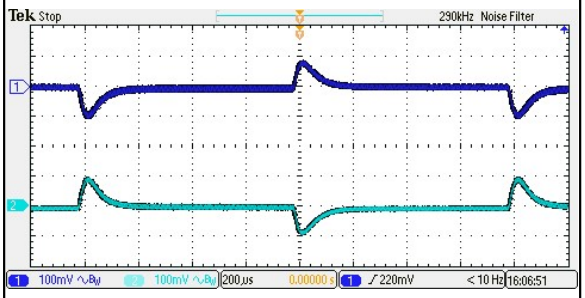


Figure 92: ERM01CC36 Transient Response
Vin = 48Vdc Load: Io = 100% to 75% load change
Ch 1: Vo1 Ch 2: Vo2

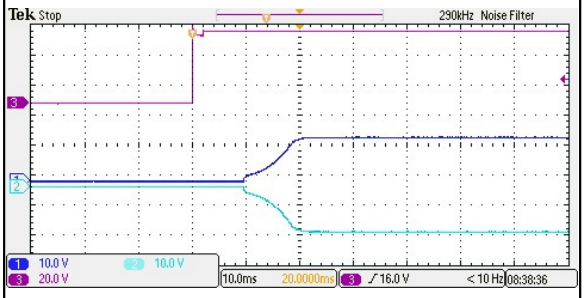


Figure 93: ERM01CC36 Output Voltage Startup Characteristic by Vin
Vin = 48Vdc Load: Io = ±0.667A
Ch 1: Vo1 Ch 2: Vo2 Ch 3: Vin

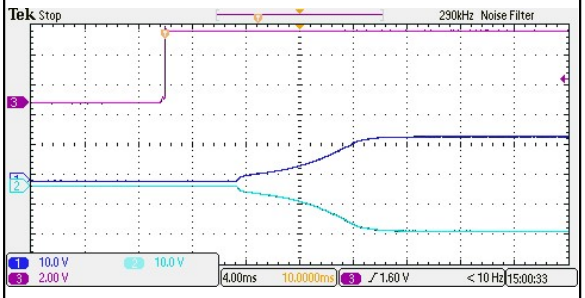


Figure 94: ERM01CC36 Output Voltage Startup Characteristic by On/Off Vin = 48Vdc Load: Io = ±0.667A
Ch 1: Vo1 Ch 2: Vo2 Ch 3: On/Off

ELECTRICAL SPECIFICATIONS

ERM01CC36 Performance Curves

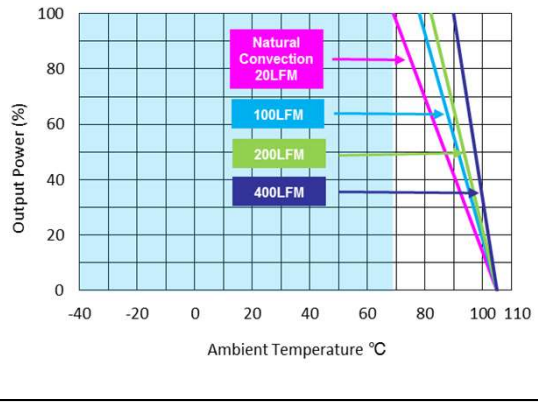


Figure 95: ERM01CC36 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 48Vdc

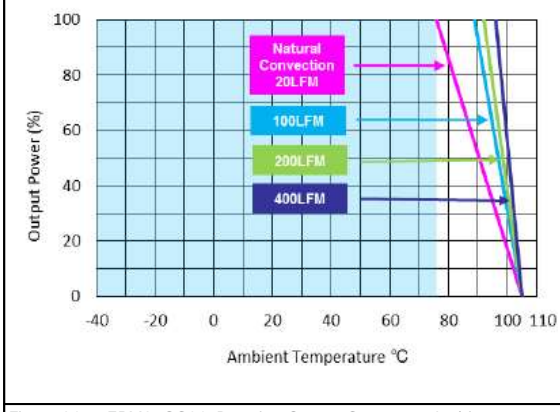


Figure 96: ERM01CC36 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 48Vdc

ELECTRICAL SPECIFICATIONS

ERM04A110 Performance Curves

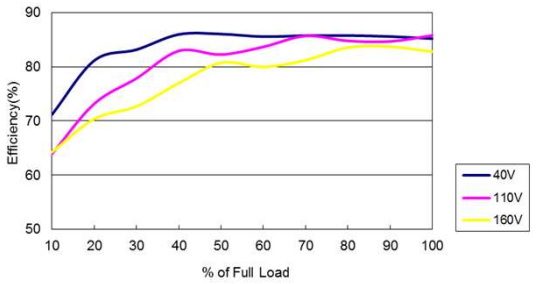


Figure 97: ERM04A110 Efficiency Versus Output Current Curve
Vin = 40 to 160Vdc Load: Io = 0 to 4A

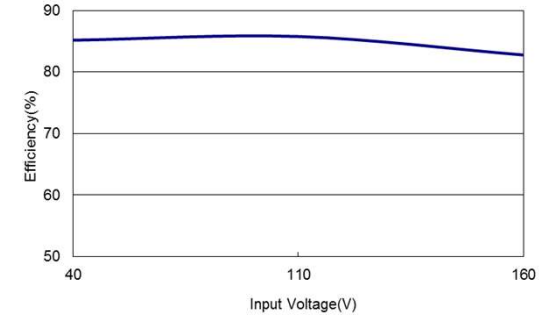


Figure 98: ERM04A110 Efficiency Versus Input Voltage Curve
Vin = 40 to 160Vdc Load: Io = 0 to 4A

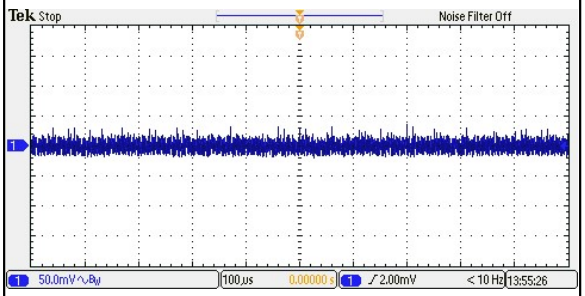


Figure 99: ERM04A110 Ripple and Noise Measurement
Vin = 110Vdc Load: Io = 4A
Ch 1: Vo

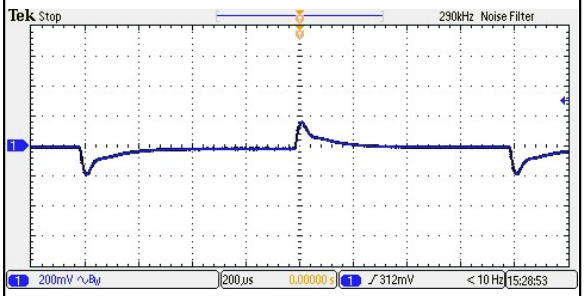


Figure 100: ERM04A110 Transient Response
Vin = 110Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

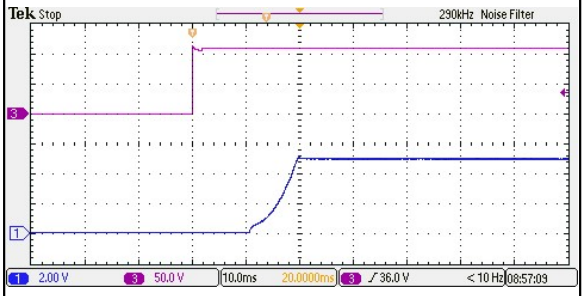


Figure 101: ERM04A110 Output Voltage Startup Characteristic by Vin
Vin = 110Vdc Load: Io = 4A
Ch 1: Vo Ch 3: Vin

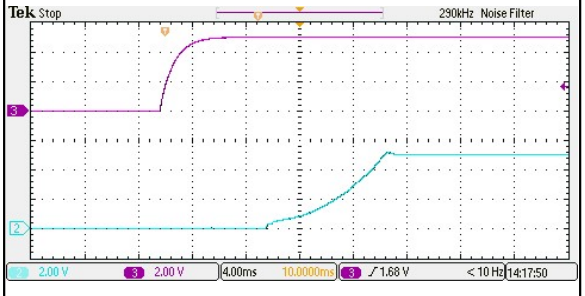


Figure 102: ERM04A110 Output Voltage Startup Characteristic by **On/Off** Vin = 110Vdc Load: Io = 4A
Ch 2: Vo Ch 3: **On/Off**

ELECTRICAL SPECIFICATIONS

ERM04A110 Performance Curves

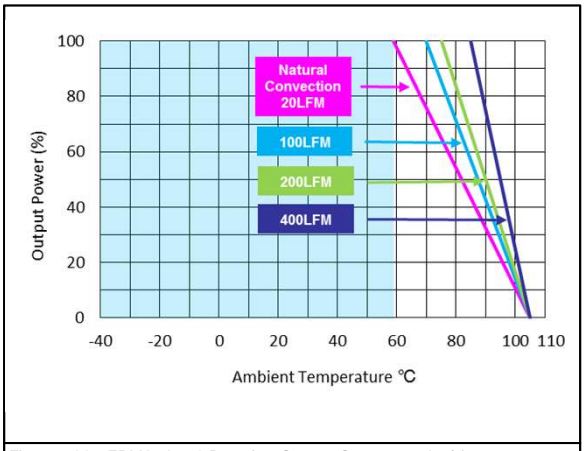


Figure 103: ERM04A110 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 110Vdc

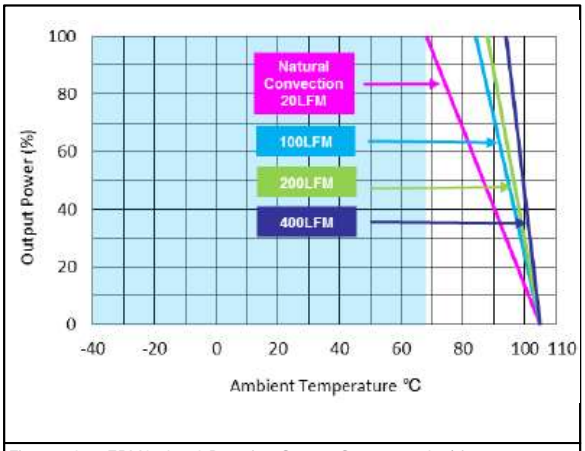


Figure 104: ERM04A110 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 110Vdc

ELECTRICAL SPECIFICATIONS

ERM01B110 Performance Curves

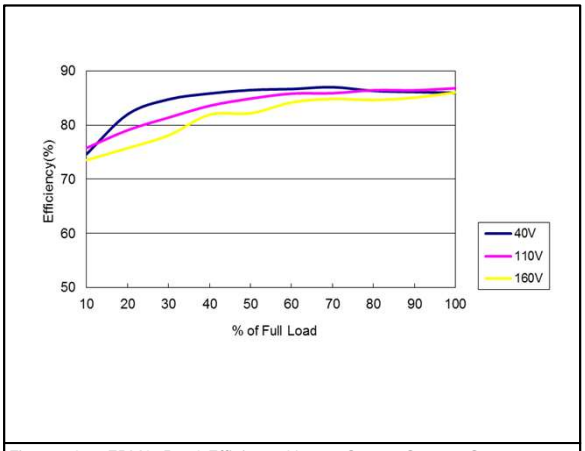


Figure 105: ERM01B110 Efficiency Versus Output Current Curve
Vin = 40 to 160Vdc Load: Io = 0 to 1.67A

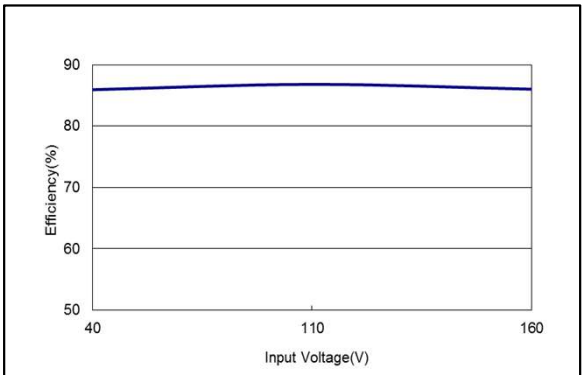


Figure 106: ERM01B110 Efficiency Versus Input Voltage Curve
Vin = 40 to 160Vdc Load: Io = 0 to 1.67A

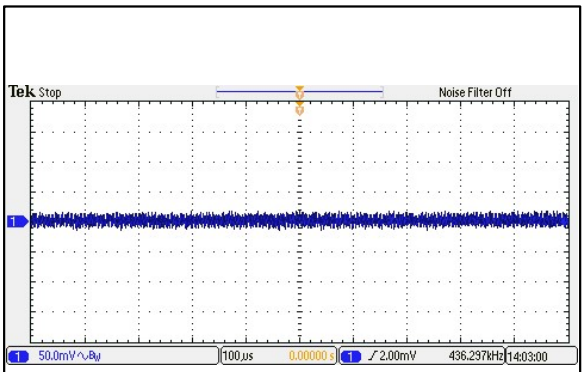


Figure 107: ERM01B110 Ripple and Noise Measurement
Vin = 110Vdc Load: Io = 1.67A
Ch 1: Vo

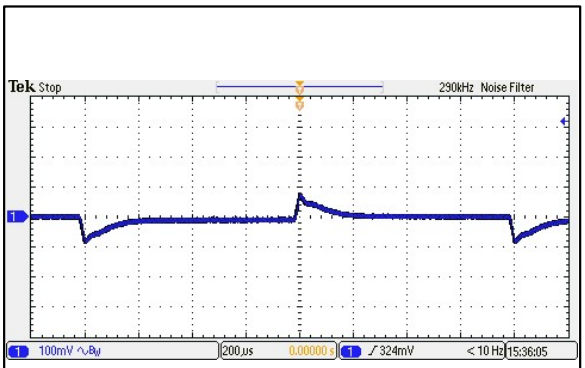


Figure 108: ERM01B110 Transient Response
Vin = 110Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

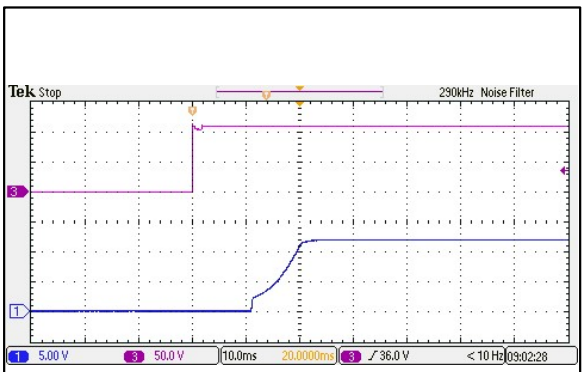


Figure 109: ERM01B110 Output Voltage Startup Characteristic by Vin
Vin = 110Vdc Load: Io = 1.67A
Ch 1: Vo Ch 3: Vin

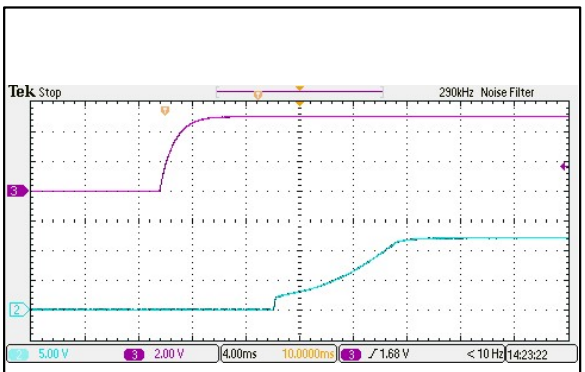


Figure 110: ERM01B110 Output Voltage Startup Characteristic by **On/Off** Vin = 110Vdc Load: Io = 1.67A
Ch 2: Vo Ch 3: **On/Off**

ELECTRICAL SPECIFICATIONS

ERM01B110 Performance Curves

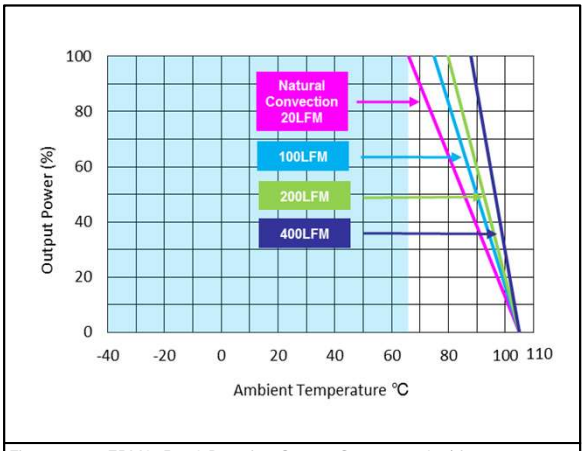


Figure 111: ERM01B110 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 110Vdc

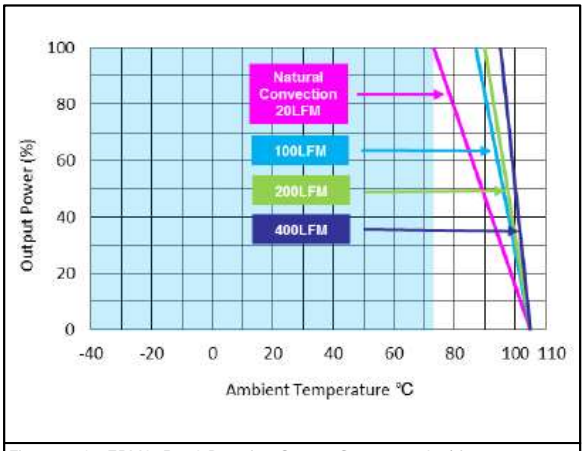


Figure 112: ERM01B110 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 110Vdc

ELECTRICAL SPECIFICATIONS

ERM01C110 Performance Curves

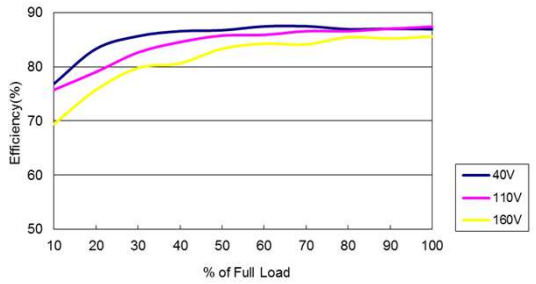


Figure 113: ERM01C110 Efficiency Versus Output Current Curve
Vin = 40 to 160Vdc Load: Io = 0 to 1.33A

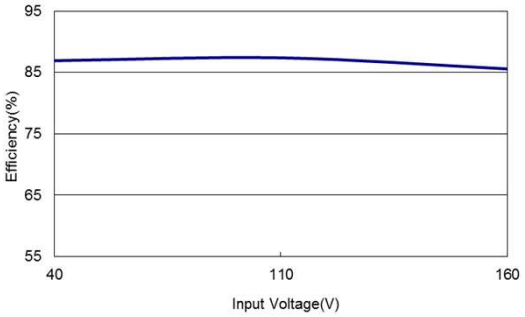


Figure 114: ERM01C110 Efficiency Versus Input Voltage Curve
Vin = 40 to 160Vdc Load: Io = 0 to 1.33A

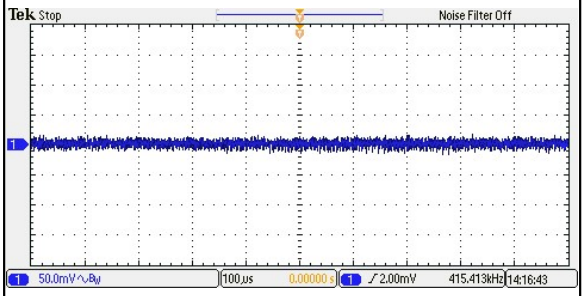


Figure 115: ERM01C110 Ripple and Noise Measurement
Vin = 110Vdc Load: Io = 1.33A
Ch 1: Vo

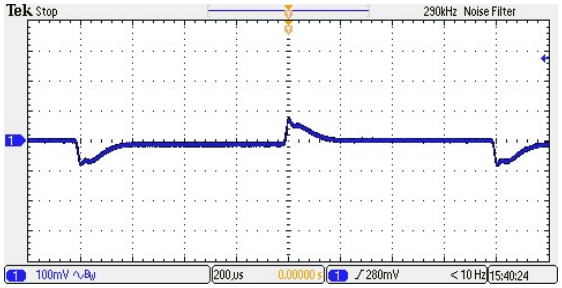


Figure 116: ERM01C110 Transient Response
Vin = 110Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

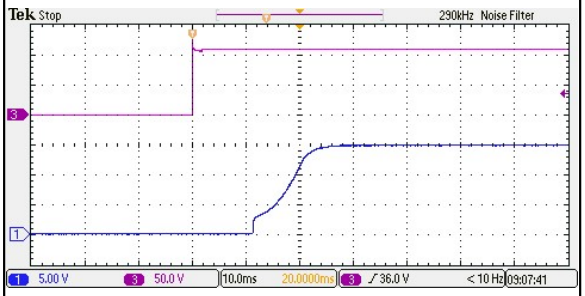


Figure 117: ERM01C110 Output Voltage Startup Characteristic by Vin
Vin = 110Vdc Load: Io = 1.33A
Ch 1: Vo Ch 3: Vin

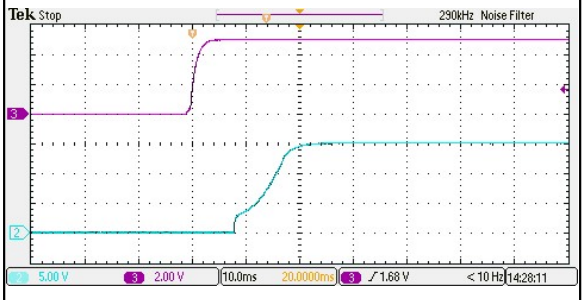


Figure 118: ERM01C110 Output Voltage Startup Characteristic by **On/Off** Vin = 110Vdc Load: Io = 1.33A
Ch 2: Vo Ch 3: **On/Off**

ELECTRICAL SPECIFICATIONS

ERM01C110 Performance Curves

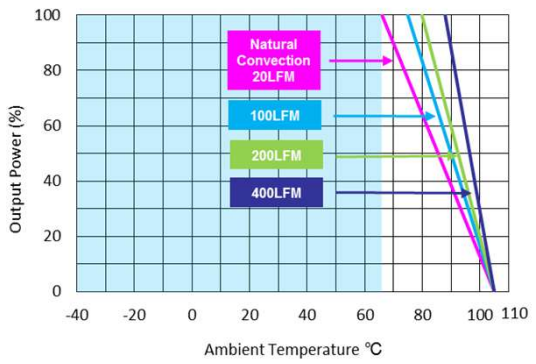


Figure 119: ERM01C110 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 110Vdc

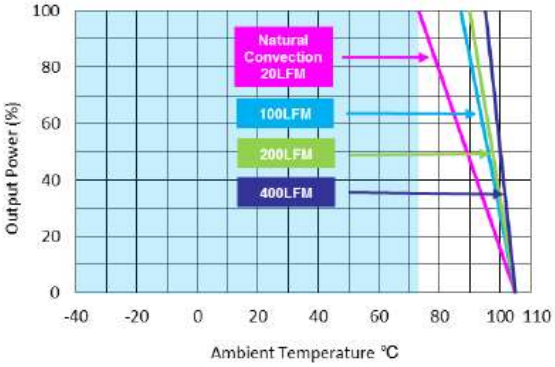


Figure 120: ERM01C110 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 110Vdc

ELECTRICAL SPECIFICATIONS

ERM01H110 Performance Curves

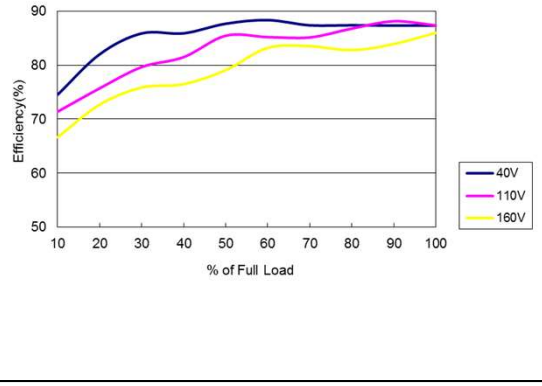


Figure 121: ERM01H110 Efficiency Versus Output Current Curve
Vin = 40 to 160Vdc Load: Io = 0 to 0.833A

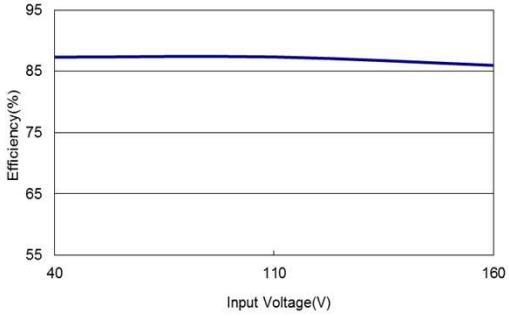


Figure 122: ERM01H110 Efficiency Versus Input Voltage Curve
Vin = 40 to 160Vdc Load: Io = 0 to 0.833A

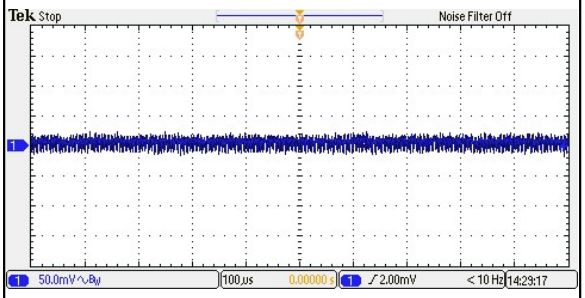


Figure 123: ERM01H110 Ripple and Noise Measurement
Vin = 110Vdc Load: Io = 0.833A
Ch 1: Vo

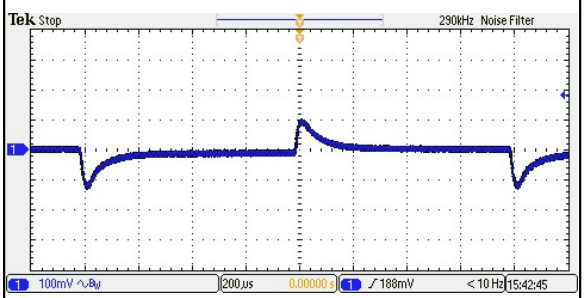


Figure 124: ERM01H110 Transient Response
Vin = 110Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

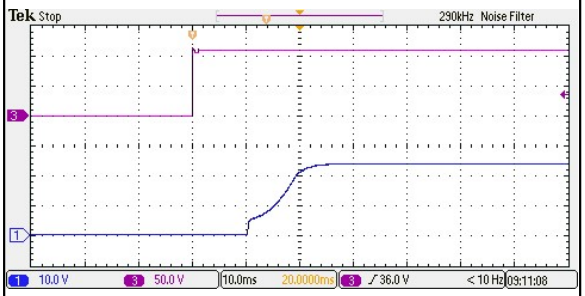


Figure 125: ERM01H110 Output Voltage Startup Characteristic by Vin
Vin = 110Vdc Load: Io = 0.833A
Ch 1: Vo Ch 3: Vin

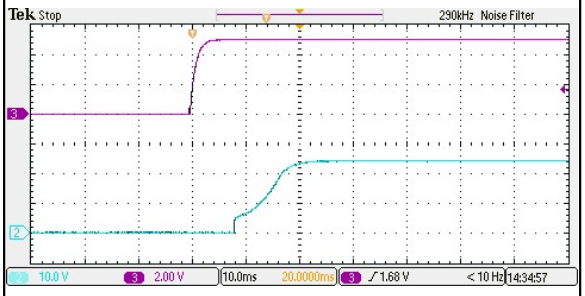


Figure 126: ERM01H110 Output Voltage Startup Characteristic by **On/Off** Vin = 110Vdc Load: Io = 0.833A
Ch 2: Vo Ch 3: **On/Off**

ELECTRICAL SPECIFICATIONS

ERM01H110 Performance Curves

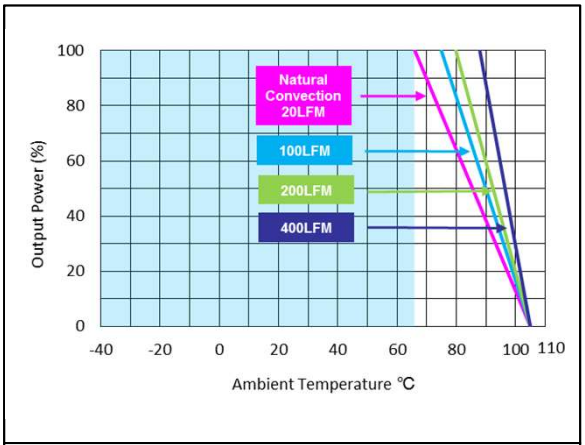


Figure 127: ERM01H110 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 110Vdc

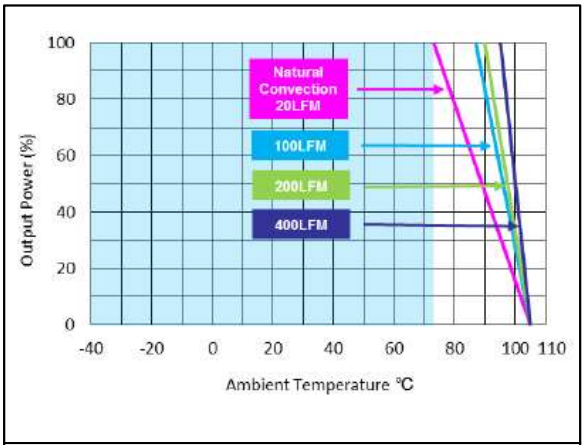


Figure 128: ERM01H110 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 110Vdc

ELECTRICAL SPECIFICATIONS

ERM01BB110 Performance Curves

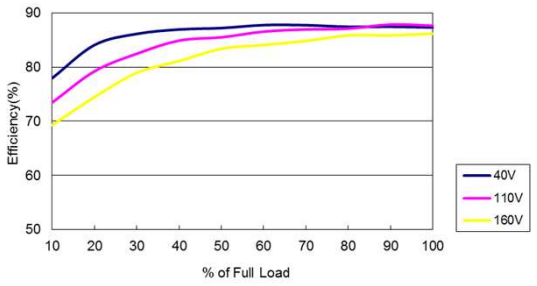


Figure 129: ERM01BB110 Efficiency Versus Output Current Curve
Vin = 40 to 160Vdc Load: Io = 0 to ±0.833A

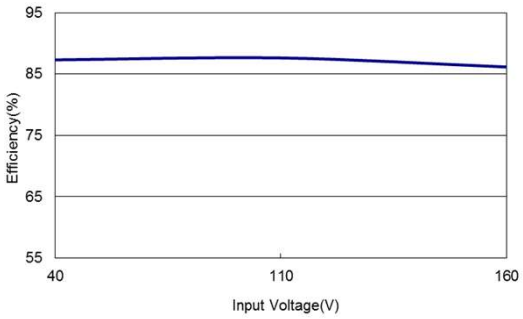


Figure 130: ERM01BB110 Efficiency Versus Input Voltage Curve
Vin = 40 to 160Vdc Load: Io = 0 to ±0.833A

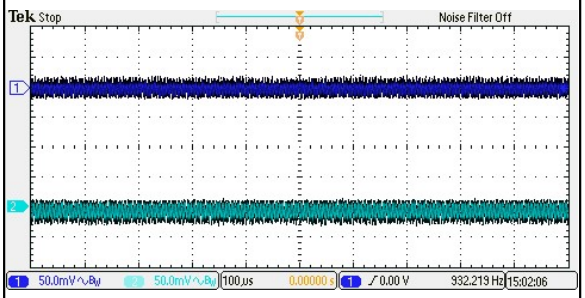


Figure 131: ERM01BB110 Ripple and Noise Measurement
Vin = 110Vdc Load: Io = ±0.833A
Ch 1: Vo1 Ch 2: Vo2

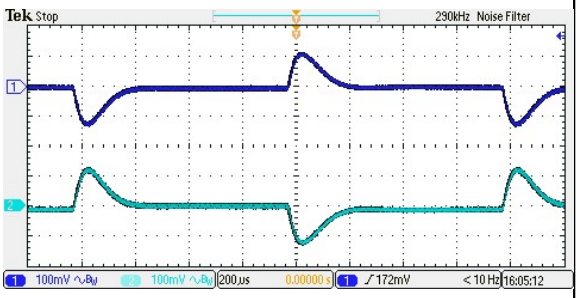


Figure 132: ERM01BB110 Transient Response
Vin = 110Vdc Load: Io = 100% to 75% load change
Ch 1: Vo1 Ch 2: Vo2

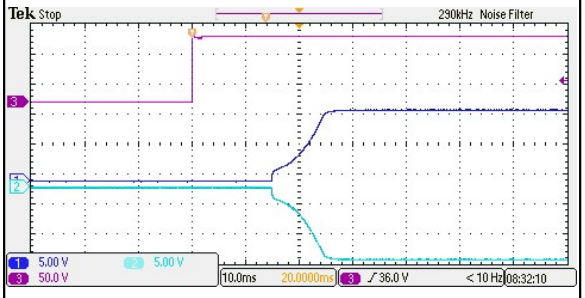


Figure 133: ERM01BB110 Output Voltage Startup Characteristic by Vin
Vin = 110Vdc Load: Io = ±0.833A
Ch 1: Vo1 Ch 2: Vo2 Ch 3: Vin

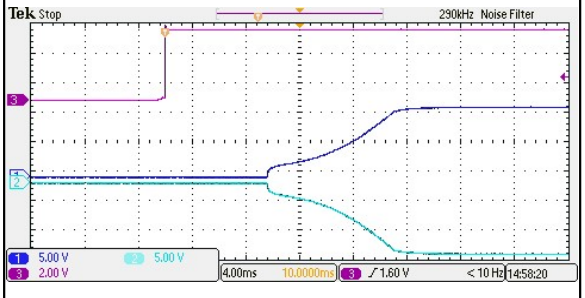


Figure 134: ERM01BB110 Output Voltage Startup Characteristic by On/Off Vin = 110Vdc Load: Io = ±0.833
Ch 1: Vo1 Ch 2: Vo2 Ch 3: On/Off

ELECTRICAL SPECIFICATIONS

ERM01BB110 Performance Curves

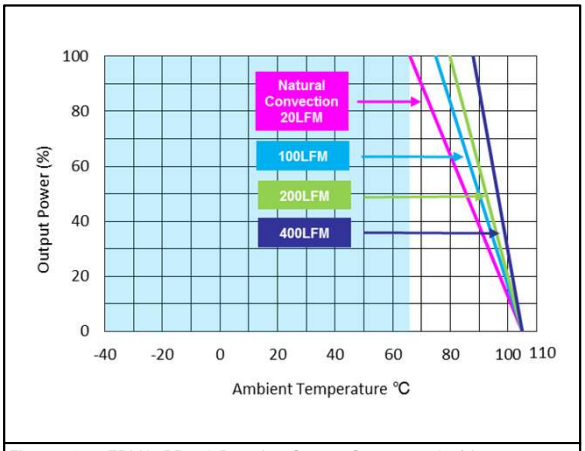


Figure 135: ERM01BB110 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 110Vdc

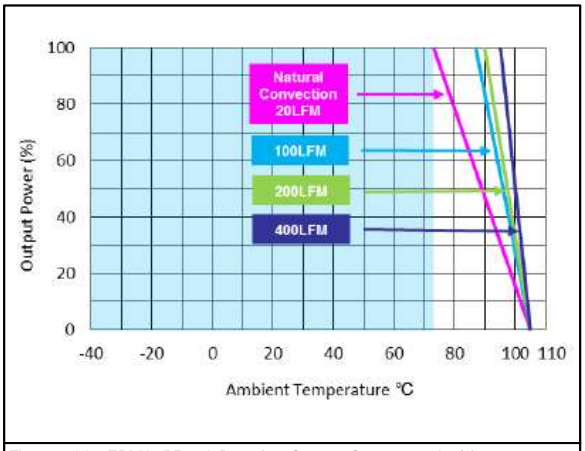


Figure 136: ERM01BB110 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 110Vdc

ELECTRICAL SPECIFICATIONS

ERM01CC110 Performance Curves

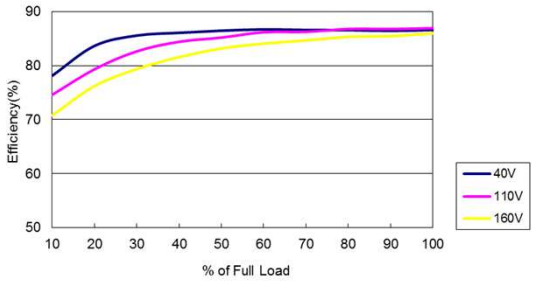


Figure 137: ERM01CC110 Efficiency Versus Output Current Curve
Vin = 40 to 160Vdc Load: Io = 0 to ±0.667A

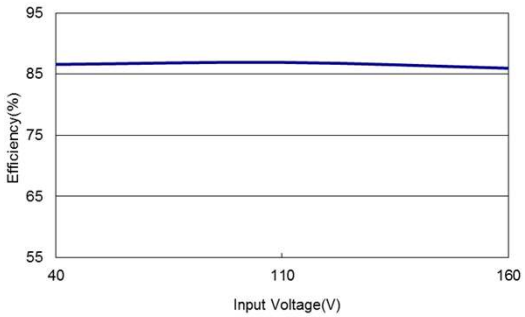


Figure 138: ERM01CC110 Efficiency Versus Input Voltage Curve
Vin = 40 to 160Vdc Load: Io = 0 to ±0.667A

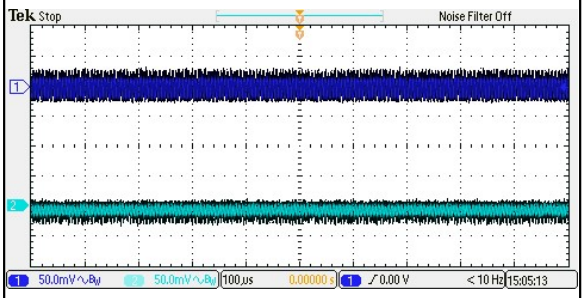


Figure 139: ERM01CC110 Ripple and Noise Measurement
Vin = 110Vdc Load: Io = ±0.667A
Ch 1: Vo1 Ch 2: Vo2

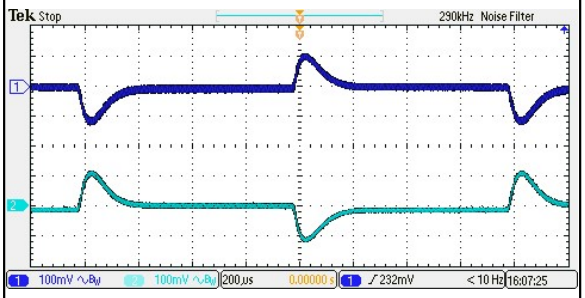


Figure 140: ERM01CC110 Transient Response
Vin = 110Vdc Load: Io = 100% to 75% load change
Ch 1: Vo1 Ch 2: Vo2

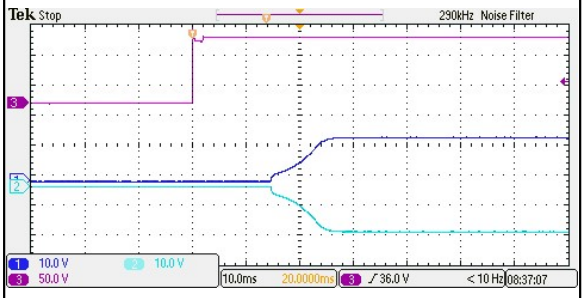


Figure 141: ERM01CC110 Output Voltage Startup Characteristic by Vin
Vin = 110Vdc Load: Io = ±0.667A
Ch 1: Vo1 Ch 2: Vo2 Ch 3: Vin

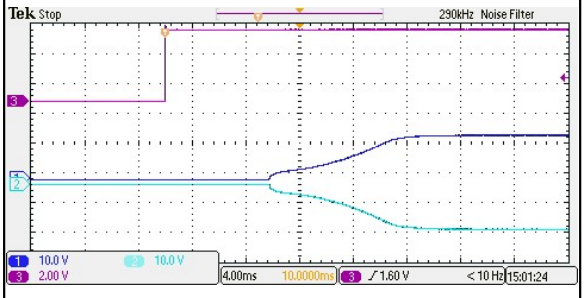


Figure 142: ERM01CC110 Output Voltage Startup Characteristic by **On/Off** Vin = 110Vdc Load: Io = ±0.667
Ch 1: Vo1 Ch 2: Vo2 Ch 3: On/Off

ELECTRICAL SPECIFICATIONS

ERM01CC110 Performance Curves

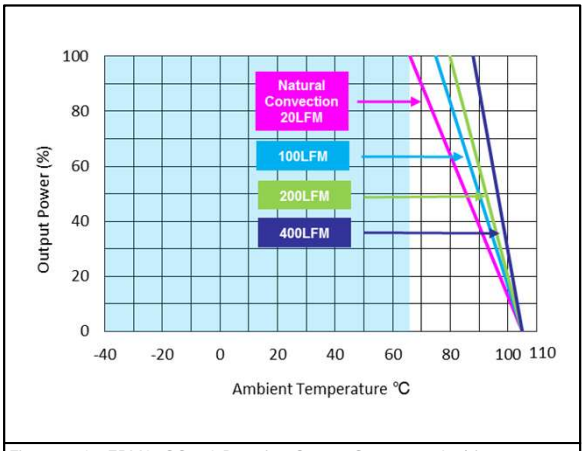


Figure 143: ERM01CC110 Derating Output Current vs Ambient Temperature (without heatsink)
Vin = 110Vdc

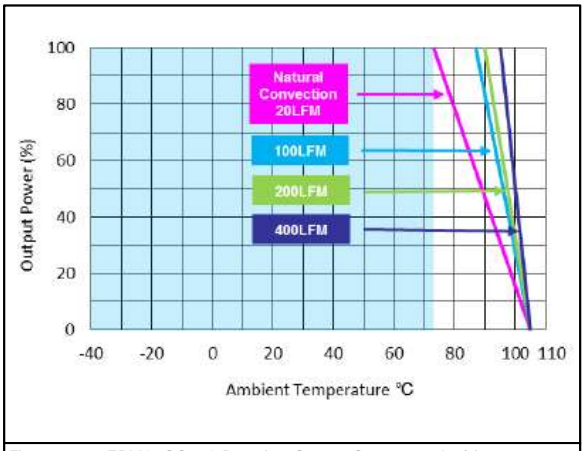
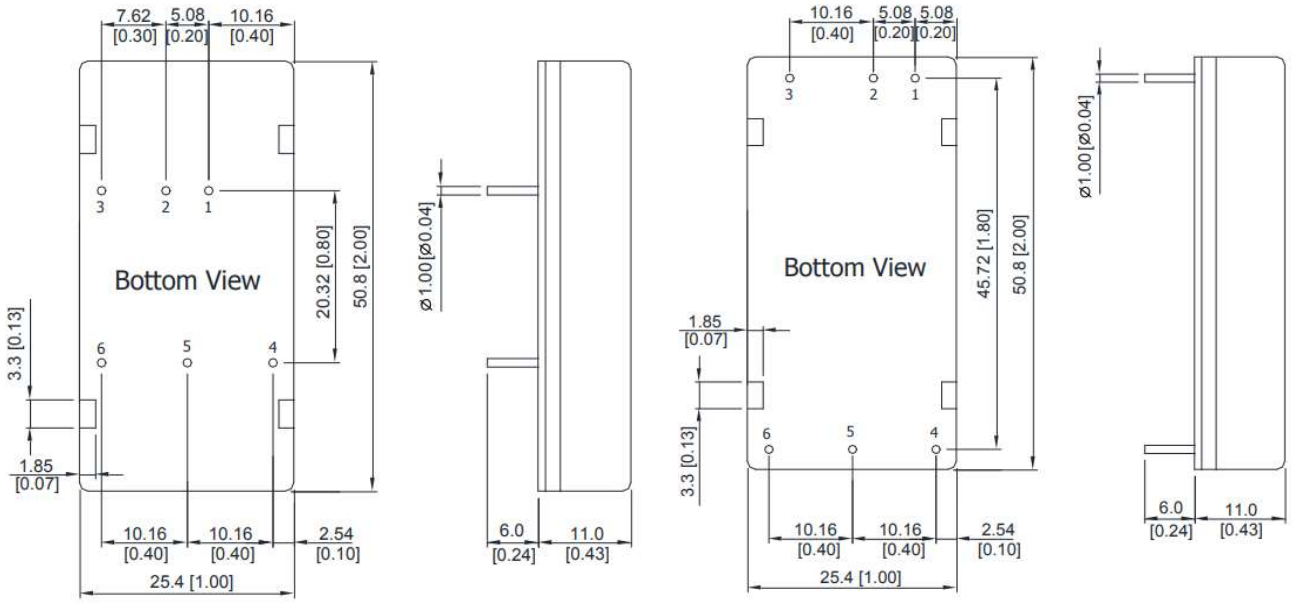


Figure 144: ERM01CC110 Derating Output Current vs Ambient Temperature (with heatsink)
Vin = 110Vdc

MECHANICAL SPECIFICATIONS

Mechanical Outlines - Without Heatsink



Pin Connectors - ERMxxxxx Models		
Pin	**Single Output**	**Dual Output**
1	+Vin	+Vin
2	-Vin	-Vin
3	Remote On/Off	Remote On/Off
4	+Vout	+Vout
5	Trim	Common
6	-Vout	-Vout

Pin Connectors - ERMxxxxxB Models		
Pin	**Single Output**	**Dual Output**
1	+Vin	+Vin
2	-Vin	-Vin
3	Remote On/Off	Remote On/Off
4	+Vout	+Vout
5	-Vout	Common
6	Trim	-Vout

T: 11.0 mm (0.43 inch) for 24 V Output Models
T: 10.2 mm (0.40 inch) for Other Output Models

Note:
1.All dimensions in mm (inches)
2.Tolerance: X.X±0.75 (X.XX±0.03)
X.XX±0.25 (X.XXX±0.01)
3.Pin diameter 1.0±0.05 (0.04±0.002)

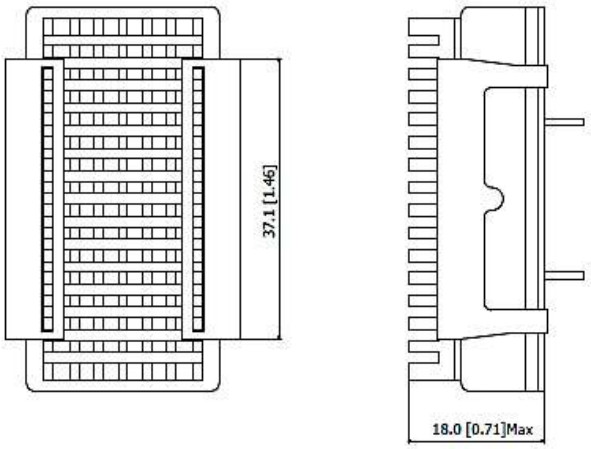
Physical Characteristics

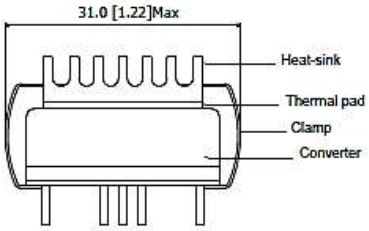
Case Size	50.8x25.4x11.0 mm (2.0x1.0x0.43 inches)
Case Material	Red Copper, Powder Coating
Base Material	FR4 PCB (flammability to UL 94V-0 rated)
Insulated Frame Material	Non-Conductive Black Plastic (flammability to UL 94V-0 rated)
Pin Material	Tinned Copper
Potting Material	Epoxy (flammability to UL 94V-0 rated)
Weight	40.5g

Note: To order the converter with heatsink, please add a suffix –HS (ERM00B110-HS) to order code.

MECHANICAL SPECIFICATIONS

Mechanical Outlines - With Heatsink





Note:
1.All dimensions in mm (inches)
2.Tolerance: X.X±0.75 (X.XX±0.03)
X.XX±0.25 (X.XXX±0.01)
3.Pin diameter 1.0±0.05 (0.04±0.002)

Physical Characteristics

Heatsink Size	37.1x31.0x18.0 mm (1.46x1.22x0.71 inches)
Heatsink Material	Aluminum
Finish	Black Anodized coating
Weight	9.0g

The advantages of adding a heatsink are:

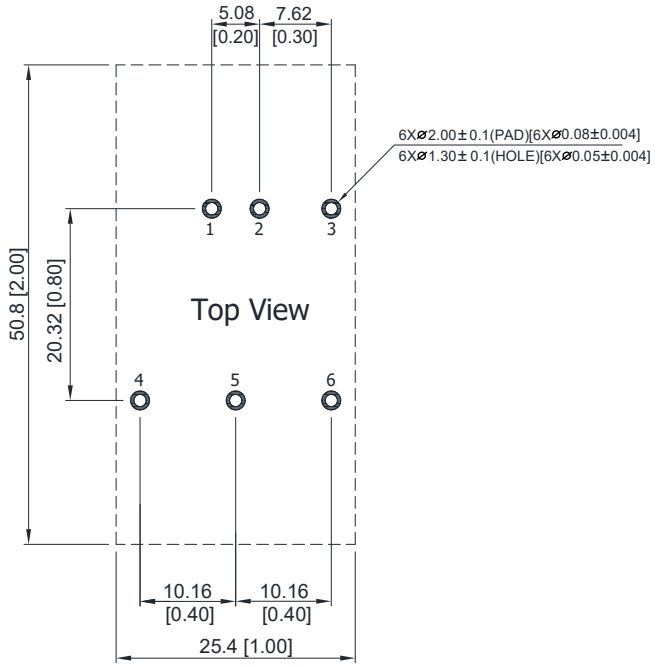
1. To improve heat dissipation and increase the stability and reliability of the DC/DC converters at high operating temperatures.
2. To increase Operating temperature of the DC/DC converter, please refer to Derating Curve.

Note:

1. All specifications are subject to change without notice. Mechanical drawings are for reference only.
2. Warranty: 3 years
3. Label and logo appearance may vary from what is shown on mechanical drawings.

MECHANICAL SPECIFICATIONS

Recommended Pad Layout



ENVIRONMENTAL SPECIFICATIONS

EMC Immunity

ERM 20W series power supply is designed to meet the following EMC immunity specifications.

Table 4. EMC Specifications

Parameter	Standards & Level		Performance
General	Compliance with EN50121-3-2 Railway Applications		
EMI	Conduction	EN55032, EN55022, FCC part15	Class A
EMS	EN55024		
	ESD	EN61000-4-2 Air ±8kV, Contact ±6kV	Criteria A
	Radiated immunity	EN61000-4-3 10V/m	Criteria A
	Fast transient[1]	EN61000-4-4 ±2KV	Criteria A
	Surge[1]	EN61000-4-5 ±2KV	Criteria A
	Conducted immunity	EN61000-4-6 10Vrms	Criteria A
	PFMF	EN61000-4-8 3A/M	Criteria A

Note1 - To meet EN61000-4-4 & EN61000-4-5, an external capacitor across the input pins is required.
Suggested capacitor: 24V input models: CHEMI-CON KY Series 390μF/63V.
48V input models: CHEMI-CON KY Series 330μF/100V.
110V input models: CHEMI-CON KXJ Series 390μF/200V.

ENVIRONMENTAL SPECIFICATIONS

Safety Certifications

The ERM 20W series power supply is intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand alone product.

Table 5. Safety Certifications for ERM 20W series power supply system

Document	Description
cUL/UL 60950-1 (UL certificate)	US Requirements
IEC/EN 60950-1 (CB-report)	European Requirements (All CENELEC Countries)
cUL/UL 62368-1 (UL certificate)	US Requirements
IEC/EN 62368-1 (CB-report)	European Requirements (All CENELEC Countries)
CE mark	

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature

Table 6. Operating Temperature

Parameter	Model / Condition	Min		Max		Unit
		Without Heatsink	With Heatsink	Without Heatsink	With Heatsink	
Operating Temperature Range Natural Convection[1] Nominal Vin, Load 100% Inom. (for Power Derating see relative Derating Curves)	ERM01B36 ERM01C36 ERM01H36	-40		72	78	°C
	ERM04A18 ERM01B18 ERM01C18 ERM01H18 ERM04A36 ERM01BB36 ERM01CC36			69	76	°C
	ERM01BB18 ERM01CC18 ERM01B110 ERM01C110 ERM01H110 ERM01BB110 ERM01CC110			66	73	°C
	ERM04A110			59	68	°C
Thermal Impedance	Natural Convection	12.1	9.8	-		°C/W
	100LFM	9.2	5.4	-		°C/W
	200LFM	7.8	4.5	-		°C/W
	400LFM	5.2	3.0	-		°C/W
Cooling Test	Compliance to IEC/EN60068-2-1					
Dry Heat	Compliance to IEC/EN60068-2-2					
Damp Heat	Compliance to IEC/EN60068-2-30					
Shock & Vibrate Test	Compliance to IEC/EN 61373					
RFI	Six-Sided Shielded, Metal Case					
Lead Temperature (1.5mm from case for 10Sec.)		-		260		°C

Note1 - The “natural convection” is about 20LFM but is not equal to still air (0 LFM).

ENVIRONMENTAL SPECIFICATIONS

MTBF and Reliability

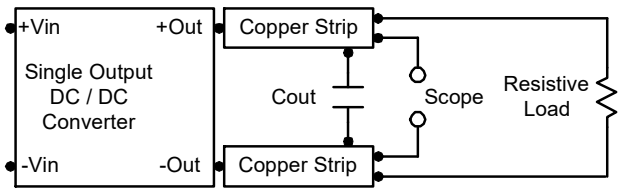
The MTBF of ERM 20W series of DC/DC converters has been calculated using MIL-HDBK 217F NOTICE2, Operating Temperature 25 ^{O}C, Ground Benign.

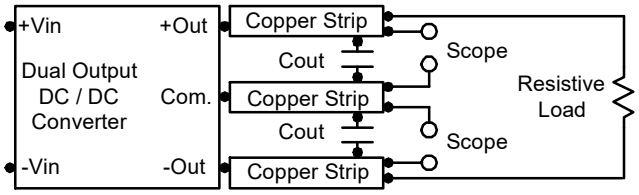
Model	MTBF	Unit
ERM04A18	873,800	Hours
ERM01B18	1,180,000	
ERM01C18	1,179,000	
ERM01H18	1,179,000	
ERM01BB18	1,042,000	
ERM01CC18	1,041,000	
ERM04A36	873,000	
ERM01B36	1,290,000	
ERM01C36	1,290,000	
ERM01H36	1,289,000	
ERM01BB36	1,142,000	
ERM01CC36	1,142,000	
ERM04A110	665,100	
ERM01B110	927,700	
ERM01C110	939,300	
ERM01H110	1,051,000	
ERM01BB110	1,041,000	
ERM01CC110	1,041,000	

APPLICATION NOTES

Peak-to-Peak Output Noise Measurement Test

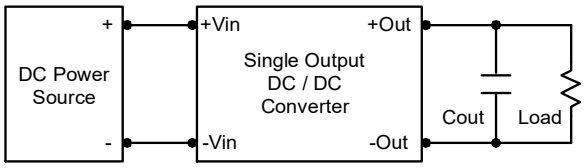
Use a 1µF ceramic capacitor and a 10µF tantalum capacitor. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20MHz. Position the load between 50 mm and 75 mm from the DC/DC Converter.

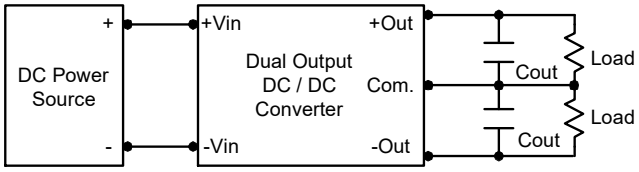




Output Ripple Reduction

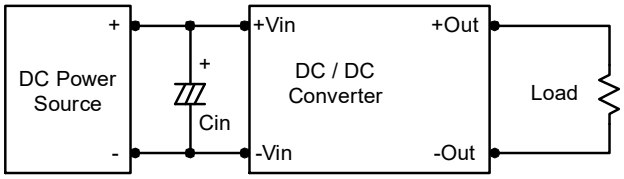
A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance. To reduce output ripple, it is recommended to use 4.7uF capacitors at the output.





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 < 1.0Ω at 100 KHz) capacitor of a 4.7µF for the 24V input devices, a 2.2µF for the 48V devices and a 1µF for the 110V devices.



APPLICATION NOTES

Output Over Current 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 Table 3.

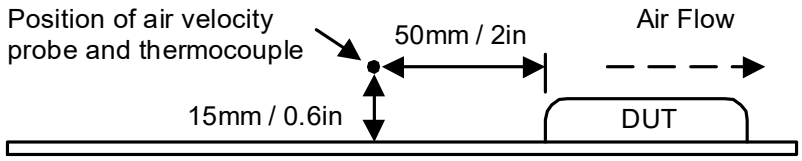
Maximum Capacitive Load

The ERM 20W 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℃.

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



APPLICATION NOTES

Remote ON/OFF

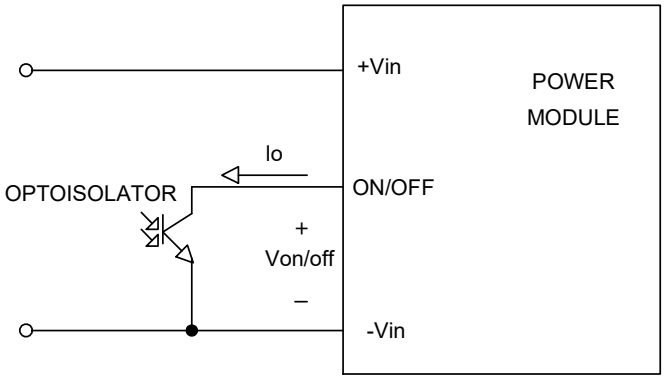
Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the -Vin terminal. The switch can be an open collector 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 3) during a logic low is -100µA.

Table 7. Remote ON/OFF Control

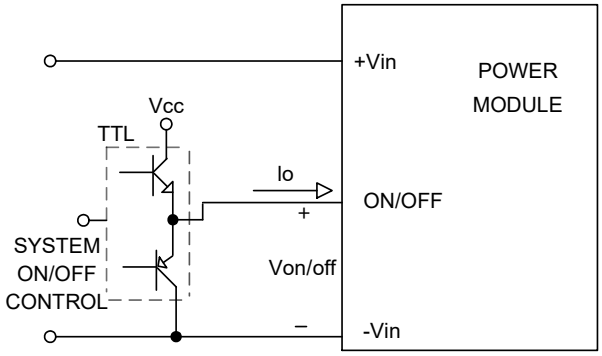
Parameter	Condition	Symbol	Min	Typ	Max	Unit
Converter On	3.5V ~ 12V or Open Circuit					
Converter Off	0V ~ 1.2V or Short Circuit					
Control Input Current (on)	Vctrl = 5.0V		---	0.5	---	mA
Control Input Current (off)	Vctrl = 0V		---	-0.5	---	mA
Control Common	Referenced to Negative Input					
Standby Input Current	Nominal Vin		---	2.5	---	mA

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 GND. If not using the remote on/off feature, please open circuit between on/off pin and -Vin pin to turn the module on.



Isolated-Closure Remote ON/OFF

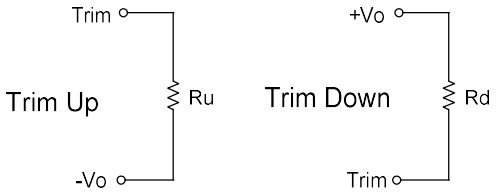


Level Control Using TTL Output

Application Notes

External Output Trimming

The ERM 20W series Output can be externally trimmed by using the method shown below.



5V Output Models Trim Table:

Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Vdc
Rd=	156.81	70.69	41.99	27.64	19.03	13.29	9.18	6.11	3.72	1.80	KOhm
Trim up	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**%**
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Vdc
Ru=	119.77	53.70	31.67	20.66	14.05	9.65	6.50	4.14	2.31	0.84	KOhm

12V Output Models Trim Table:

Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Vdc
Rd=	419.81	187.68	110.30	71.61	48.40	32.93	21.87	13.58	7.13	1.98	KOhm
Trim up	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**%**
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Vdc
Ru=	344.74	154.37	90.92	59.19	40.15	27.46	18.39	11.59	6.31	2.07	KOhm

15V Output Models Trim Table:

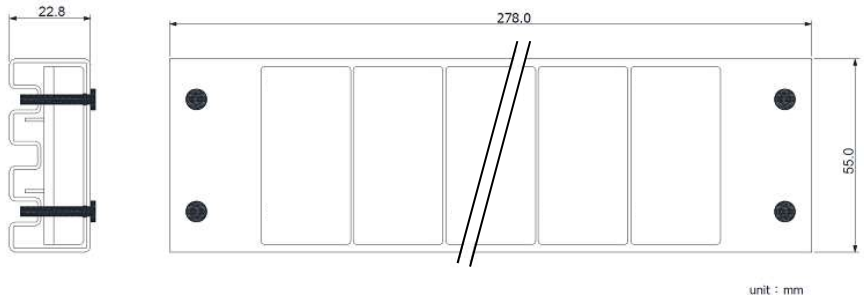
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Vdc
Rd=	602.92	269.91	158.91	103.41	70.10	47.90	32.05	20.15	10.90	3.50	KOhm
Trim up	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**%**
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Vdc
Ru=	482.88	215.89	126.89	82.40	55.70	37.90	25.18	15.65	8.23	2.30	KOhm

24V Output Models Trim Table:

Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Vdc
Rd=	598.97	267.93	157.59	102.42	69.31	47.25	31.48	19.66	10.46	3.11	KOhm
Trim up	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**%**
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Vdc
Ru=	486.83	217.87	128.21	83.38	56.49	38.56	25.75	16.14	8.67	2.69	KOhm

APPLICATION NOTES

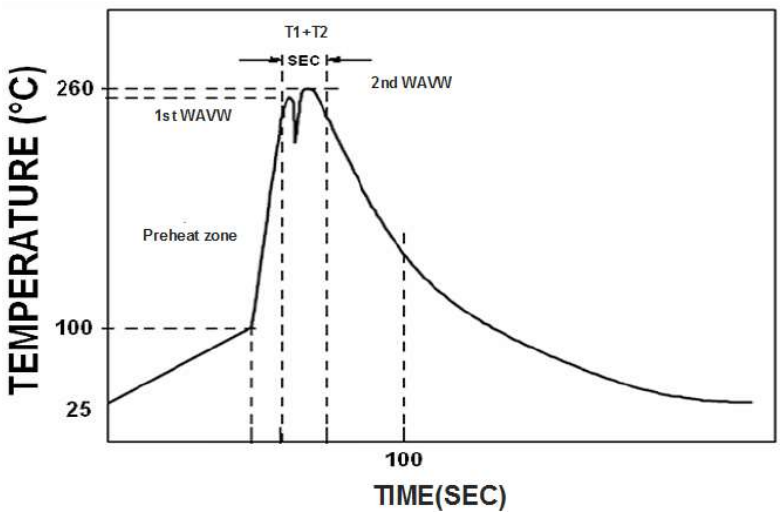
Packaging Information



10 PCS per TUBE

Soldering and Reflow Considerations

Lead free wave solder profile for ERM 20W Series



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

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

RECORD OF REVISION AND CHANGES

1.0	Date	Description	Originators
1.0	05.01.2017	First Issue	E. Bai

ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

Our products enable customer innovation in complex applications for a wide range of industries including semiconductor equipment, industrial, manufacturing, telecommunications, data center computing, and medical. With deep applications know-how and responsive service and support across the globe, we build collaborative partnerships to meet rapid technological developments, propel growth for our customers, and innovate the future of power.

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For international contact information,
visit advancedenergy.com.

powersales@aei.com (Sales Support)
productsupport.ep@aei.com (Technical Support)
+1 888 412 7832

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