

3W, Wide Input Range SIP, Single & Dual Output DC/DC Converters



Features

- High Efficiency up to 81%
- 1600VDC Isolation
- MTBF > 1,000,000 Hours
- 2:1 Wide Input Range
- Low Cost
- Remote On/Off Control
- Temperature Performance -40°C to +70°C
- UL 94V-0 Package Material
- Internal SMD Construction

Applications

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

General Description

TRACO's TMR 3E-Series power modules are low-profile dc-dc converters that operate over input voltage ranges of 4.5-9VDC, 9-18VDC, 18-36VDC and 36-75VDC which provide precisely regulated single output voltages of 3.3V, 5V, 12V, 15V, $\pm 5V$, $\pm 12V$ and $\pm 15VDC$.

The -40°C to +70°C operating temperature range makes it ideal for data communication equipments, mobile battery driven equipments, distributed power systems, telecommunication equipments, mixed analog/digital subsystems, process/machine control equipments, computer peripheral systems and industrial robot systems.

The modules have a maximum power rating of 3W and a typical full-load efficiency of 81%, continuous short circuit, 30mV output ripple, built-in filtering for both input and output minimize the need for external filtering.

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Absolute Maximum Rating

Parameter	Model	Min	Max	Unit
Input Voltage				
Continuous	TMR 3-05xxE TMR 3-12xxE TMR 3-24xxE TMR 3-48xxE		9 18 36 75	VDC
Transient (for 100ms max.)	TMR 3-05xxE TMR 3-12xxE TMR 3-24xxE TMR 3-48xxE		11 25 50 100	
Operating Ambient Temperature				
Without derating	All	-40	+70	
With derating		-40	+80	
Operating Case Temperature	All	-40	+100	°C
Storage Temperature	All	-55	+125	°C

Output Specification

Parameter	Model	Min	Nominal	Max	Unit
Output Voltage ($V_{in} = V_{in\ nom}$; Full Load; $T_A = 25^\circ\text{C}$)	TMR 3-xx10E TMR 3-xx11E TMR 3-xx12E TMR 3-xx13E TMR 3-xx21E TMR 3-xx22E TMR 3-xx23E	3.267 4.95 11.88 14.85 ± 4.95 ± 11.88 ± 14.85	3.3 5 12 15 ± 5 ± 12 ± 15	3.333 5.05 12.12 15.15 ± 5.05 ± 12.12 ± 15.15	VDC
Output Regulation					
Line ($V_{in\ min}$ to $V_{in\ max}$ at Full Load)			± 0.3	± 0.5	
Output Regulation					
Load (25% to 100% of Full Load)			± 0.5	± 1.0	
Output Ripple & Noise					
Peak-to-Peak (5Hz to 20MHz bandwidth) (Measured with a 1 μ F/50V MLCC)	All		50	75	mV pk-pk

Output Specification (Continued)

Parameter	Model	Min	Nominal	Max	Unit
Temperature Coefficient	All	---	---	±0.02	%/°C
Output Voltage Overshoot (VO=3.3V 7%) ($V_{in\ min}$ to $V_{in\ max}$; Full Load; $T_A = 25^\circ\text{C}$)	All	---	---	5	%
Dynamic Load Response ($V_{in} = V_{in\ nom}$; $T_A=25^\circ\text{C}$ Load step change from 75% to 100% or 100 to 75% of Full Load Peak Deviation	All		±3%Vo	±5%Vo	mV
Setting Time ($V_{out} < 10\%$ peak deviation)			300	500	μS
Output Current	TMR 3-xx10E TMR 3-xx11E TMR 3-xx12E TMR 3-xx13E TMR 3-xx21E TMR 3-xx22E TMR 3-xx23E	175 150 63 f50 ±75 ±31 ±25		700 600 250 200 ±300 ±125 ±100	mA
Output Over Current Protection	All	110			%FL
Output Short Circuit Protection	All	Continuous			

Input Specification					
Parameter	Model	Min	Nominal	Max	Unit
Operating Input Voltage	TMR 3-05xxE	4.5	5	9	VDC
	TMR 3-12xxE	9	12	18	
	TMR 3-24xxE	18	24	36	
	TMR 3-48xxE	36	48	75	
Under Voltage Lockout Turn-on Threshold	TMR 3-05xxE	3	4	4.5	VDC
	TMR 3-12xxE	4.5	7	9	
	TMR 3-24xxE	8	12	18	
	TMR 3-48xxE	16	24	36	
Under Voltage Lockout Turn-off Threshold	TMR 3-05xxE	---	3.5	4	VDC
	TMR 3-12xxE	---	6.5	8.5	
	TMR 3-24xxE	---	11	17	
	TMR 3-48xxE	---	22	34	
Input Current (Maximum value at $V_{in} = V_{in\ nom}$; Full Load)	TMR 3-0510E		651		mA
	TMR 3-0511E		822		
	TMR 3-0512E		759		
	TMR 3-0513E		759		
	TMR 3-0521E		811		
	TMR 3-0522E		759		
	TMR 3-0523E		759		
	TMR 3-1210E		257		
	TMR 3-1211E		321		
	TMR 3-1212E		301		
	TMR 3-1213E		301		
	TMR 3-1221E		316		
	TMR 3-1222E		301		
	TMR 3-1223E		301		
	TMR 3-2410E		128		
	TMR 3-2411E		160		
	TMR 3-2412E		151		
	TMR 3-2413E		151		
	TMR 3-2421E		156		
	TMR 3-2422E		151		
	TMR 3-2423E		151		
	TMR 3-4810E		64		
	TMR 3-4811E		80		
	TMR 3-4812E		75		
	TMR 3-4813E		75		
	TMR 3-4821E		78		
	TMR 3-4822E		75		
	TMR 3-4823E		75		

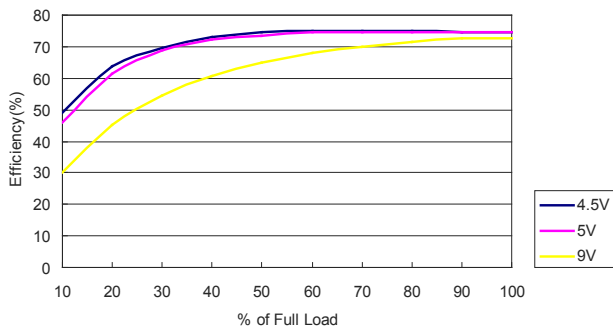
Input Specification					
Parameter	Model	Min	Nominal	Max	Unit
Input Standby current (Typical value at $V_{in} = V_{in\ nom}$; No Load)	TMR 3-0510E				mA
	TMR 3-0511E				
	TMR 3-0512E				
	TMR 3-0513E		70		
	TMR 3-0521E				
	TMR 3-0522E				
	TMR 3-0523E				
	TMR 3-1210E				
	TMR 3-1211E				
	TMR 3-1212E				
	TMR 3-1213E		20		
	TMR 3-1221E				
	TMR 3-1222E				
	TMR 3-1223E				
	TMR 3-2410E				
	TMR 3-2411E				
	TMR 3-2412E				
	TMR 3-2413E		10		
	TMR 3-2421E				
	TMR 3-2422E				
	TMR 3-2423E				
	TMR 3-4810E				
	TMR 3-4811E				
	TMR 3-4812E				
	TMR 3-4813E		8		
	TMR 3-4821E				
	TMR 3-4822E				
	TMR 3-4823E				
Remote ON/OFF Control (The On/Off pin voltage is referenced to- V_{in})	All				
Positive logic					
On/Off pin Low Voltage (Remote ON)		0		0.6	VDC
On/Off pin High Voltage (Remote OFF)		2.7		15	VDC
Remote Off Stand by Input Current	All			2.5	mA
Input Current of Remote Control Pin	All			1	mA

General Specification

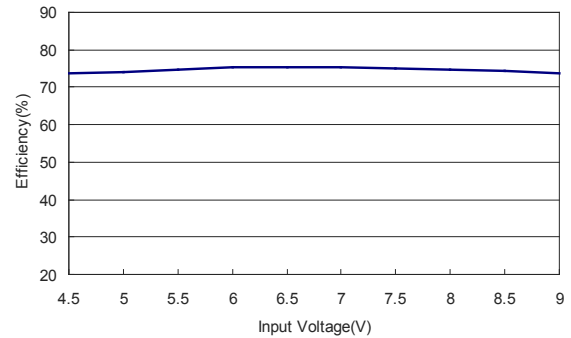
Parameter	Model	Min	Nominal	Max	Unit
Efficiency ($V_{in} = V_{in nom}$; Full Load; $T_A = 25^\circ\text{C}$)	TMR 3-0510E		71		%
	TMR 3-0511E		73		
	TMR 3-0512E		79		
	TMR 3-0513E		79		
	TMR 3-0521E		74		
	TMR 3-0522E		79		
	TMR 3-0523E		79		
	TMR 3-1210E		75		
	TMR 3-1211E		78		
	TMR 3-1212E		83		
	TMR 3-1213E		83		
	TMR 3-1221E		79		
	TMR 3-1222E		83		
	TMR 3-1223E		83		
	TMR 3-2410E		75		
	TMR 3-2411E		78		
	TMR 3-2412E		83		
	TMR 3-2413E		83		
	TMR 3-2421E		80		
	TMR 3-2422E		83		
	TMR 3-2423E		83		
	TMR 3-4810E		75		
	TMR 3-4811E		78		
	TMR 3-4812E		83		
	TMR 3-4813E		83		
	TMR 3-4821E		80		
	TMR 3-4822E		83		
	TMR 3-4823E		83		
Isolation voltage Input to Output (for 60 seconds)		1600			VDC
Isolation resistance	All	1000			MΩ
Isolation capacitance			60	200	pF
Switching Frequency			250		KHz
Weight			4.8		g
MTBF MIL-STD-217F, TC=25°C		1000			K Hours

Characteristic Curves

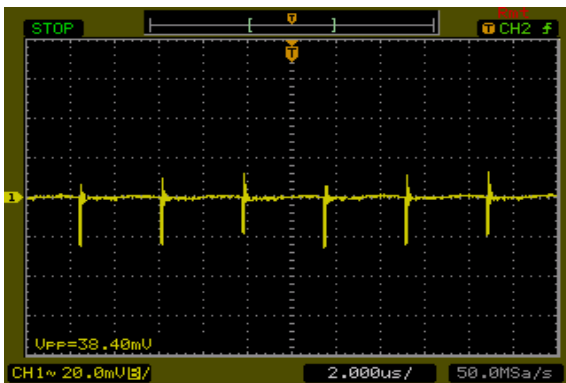
All test conditions are at 25°C The figures are identical for TMR 3-0510E



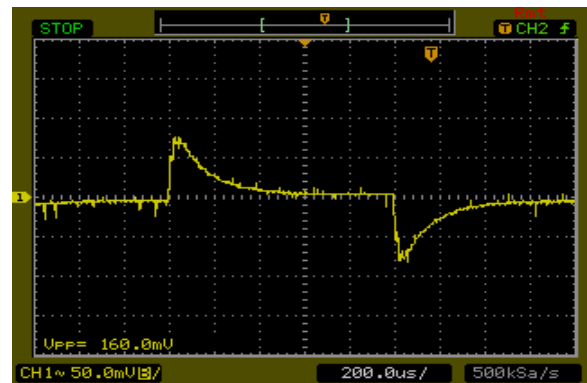
Efficiency Versus Output Current



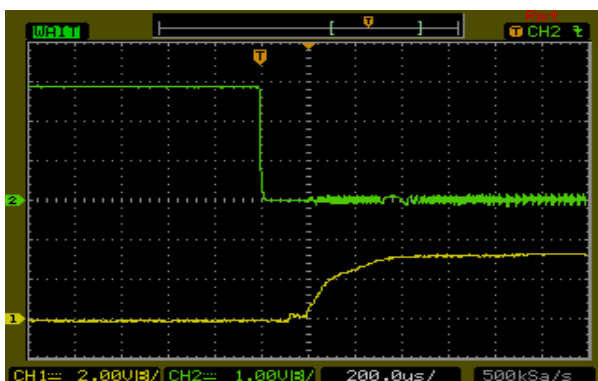
Efficiency Versus Input Voltage. Full Load



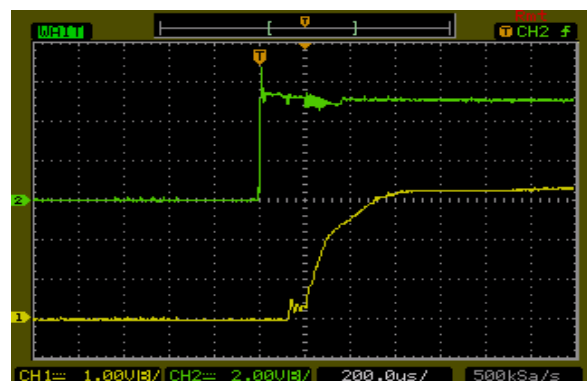
Typical Output Ripple and Noise.
 $V_{in} = V_{in\ nom}$; Full Load; T_A



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



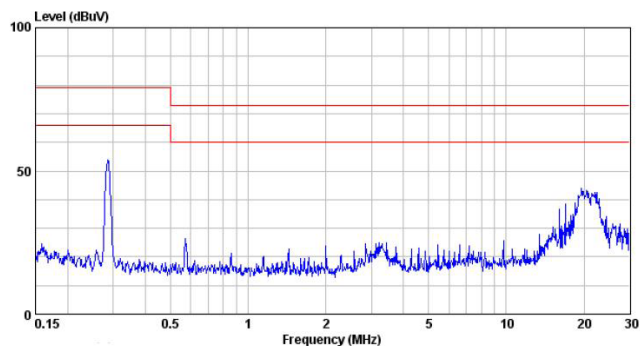
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load



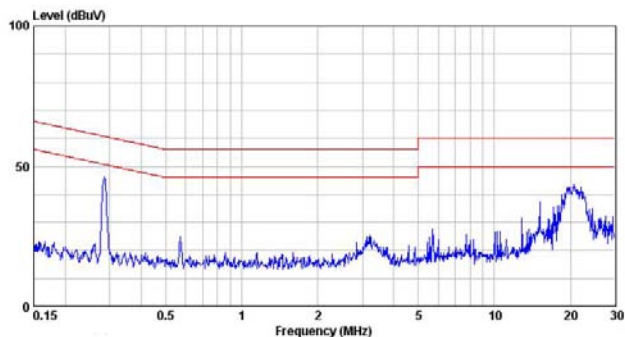
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

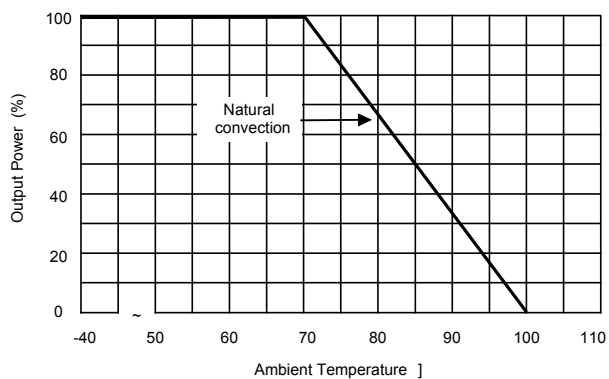
All test conditions are at 25°C The figures are identical for TMR 3-0510E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



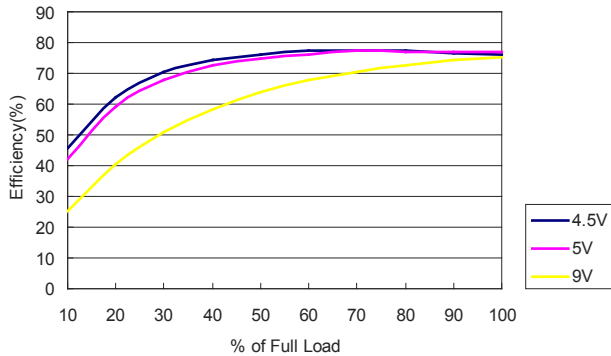
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



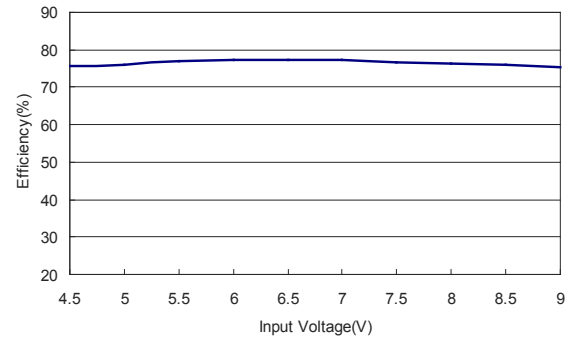
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

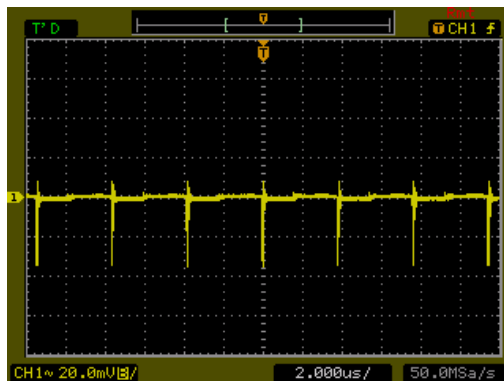
All test conditions are at 25°C The figures are identical for TMR 3-0511E



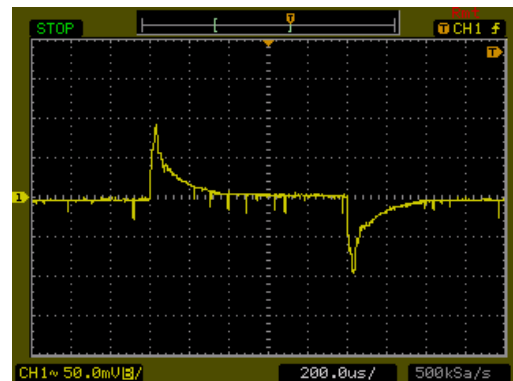
Efficiency Versus Output Current



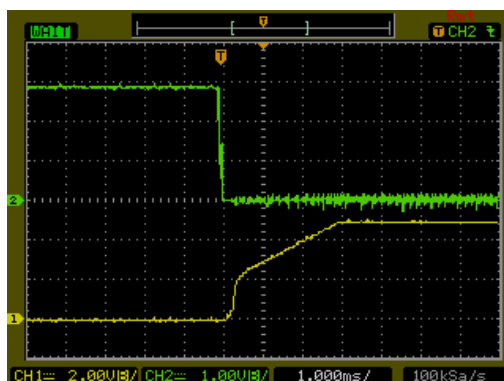
Efficiency Versus Input Voltage. Full Load



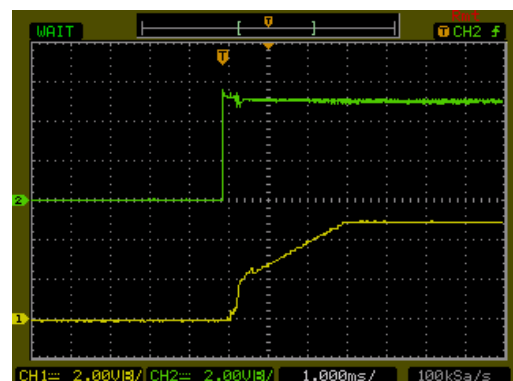
Typical Output Ripple and Noise.
 $V_{in} = V_{in nom}$; Full Load; T_A



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



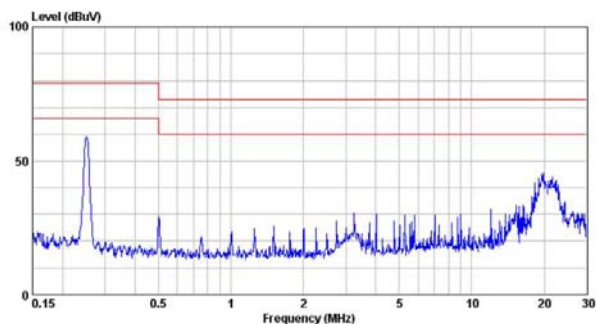
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load



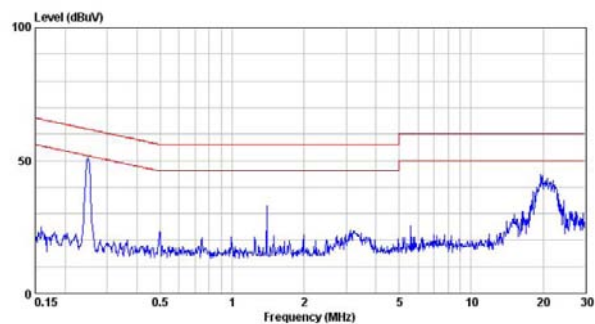
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load

Characteristic Curves

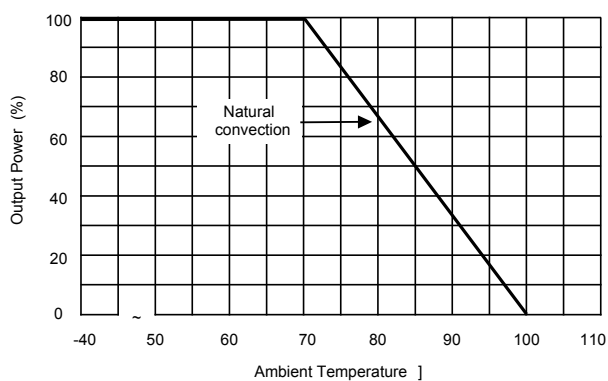
All test conditions are at 25°C The figures are identical for TMR 3-0511E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



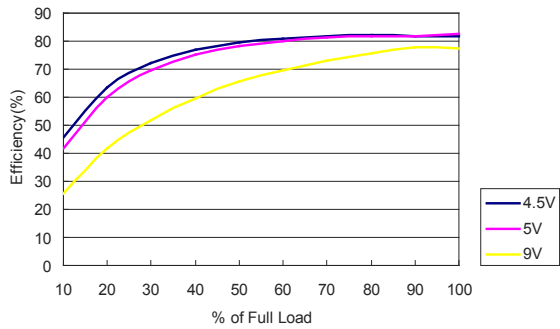
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



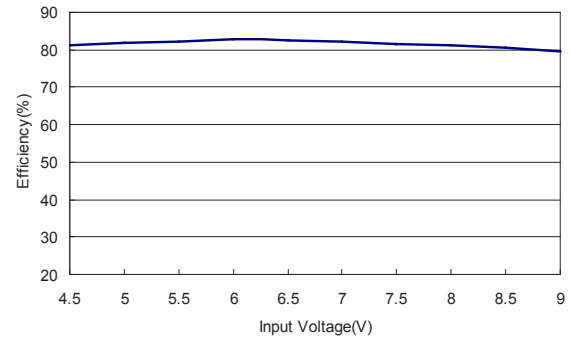
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

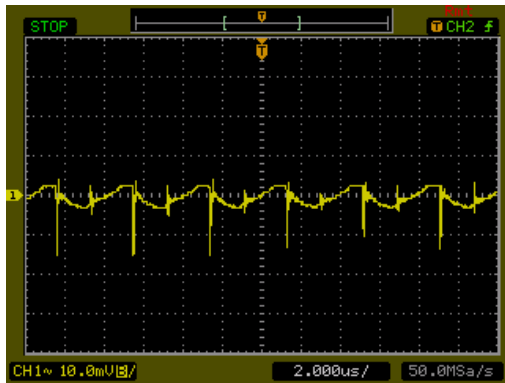
All test conditions are at 25°C The figures are identical for TMR 3-0512E



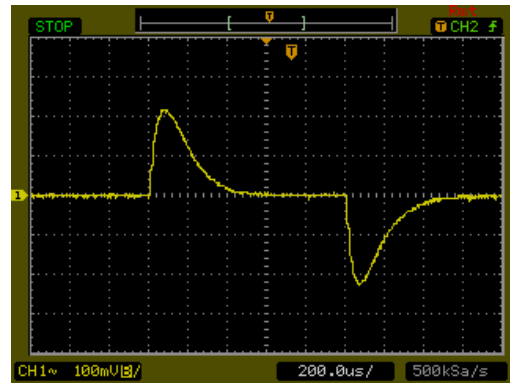
Efficiency Versus Output Current



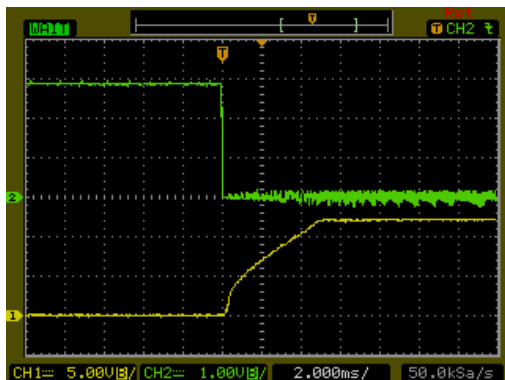
Efficiency Versus Input Voltage. Full Load



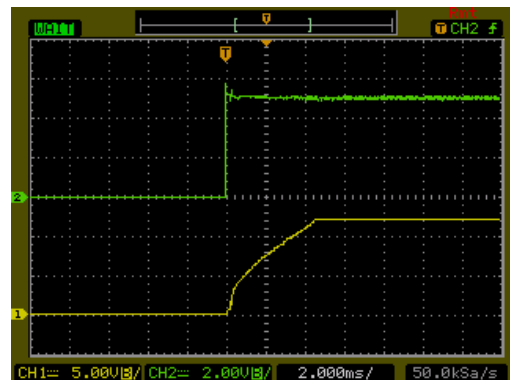
Typical Output Ripple and Noise.
 $V_{in} = V_{in nom}$; Full Load; T_A



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



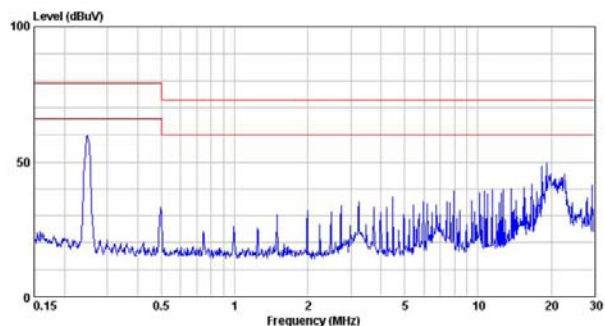
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load



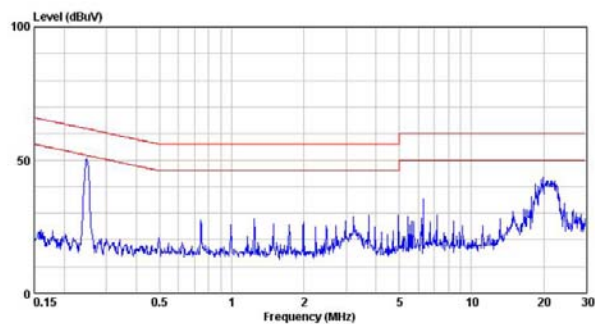
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load

Characteristic Curves

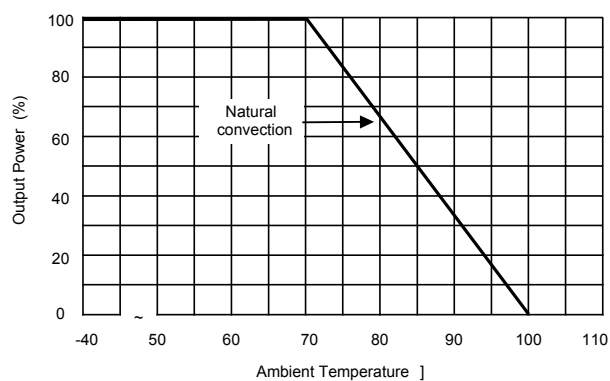
All test conditions are at 25°C The figures are identical for TMR 3-0512E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



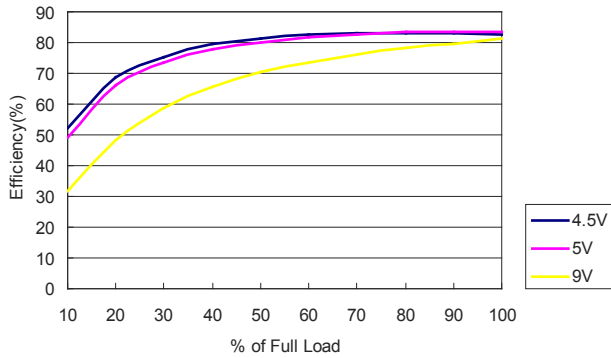
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



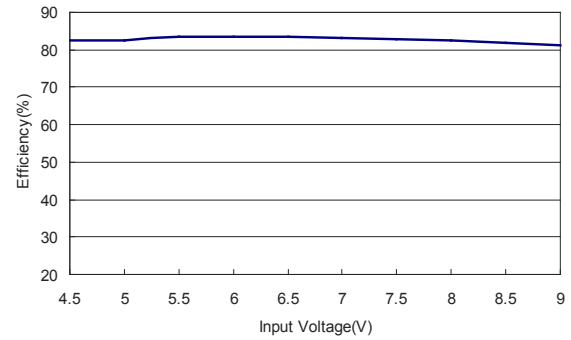
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

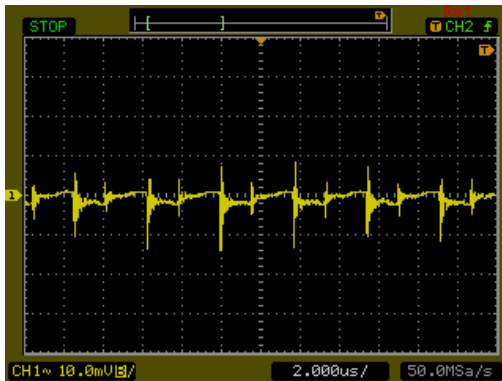
All test conditions are at 25°C The figures are identical for TMR 3-0513E



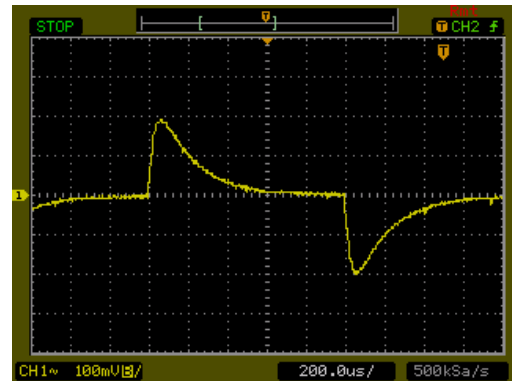
Efficiency Versus Output Current



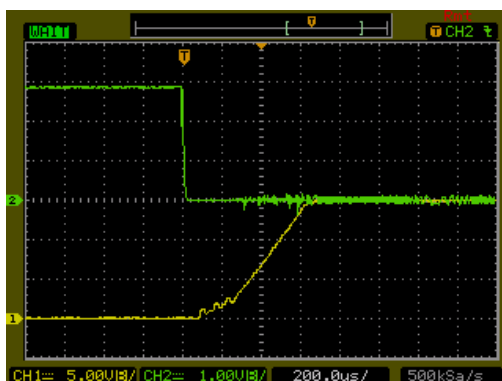
Efficiency Versus Input Voltage. Full Load



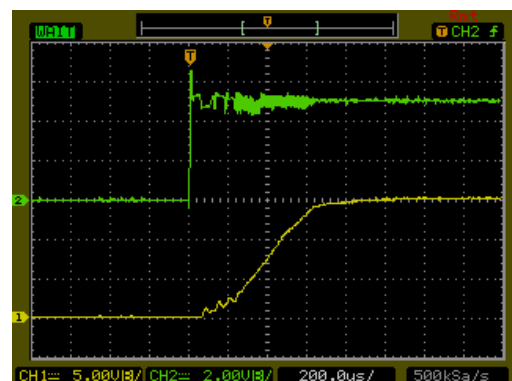
Typical Output Ripple and Noise.
 $V_{in} = V_{in\ nom}$; Full Load; T_A



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



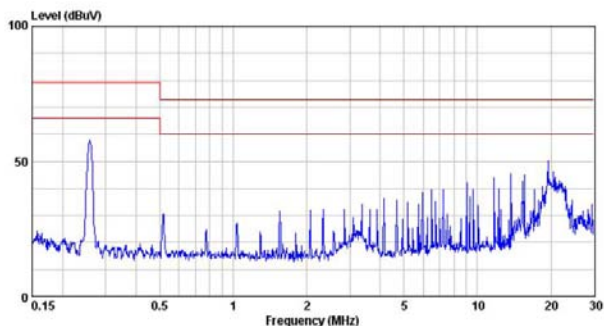
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load



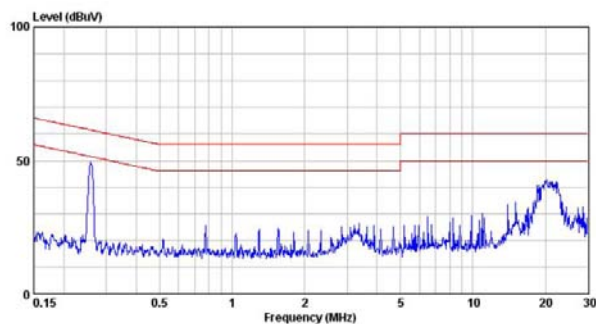
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

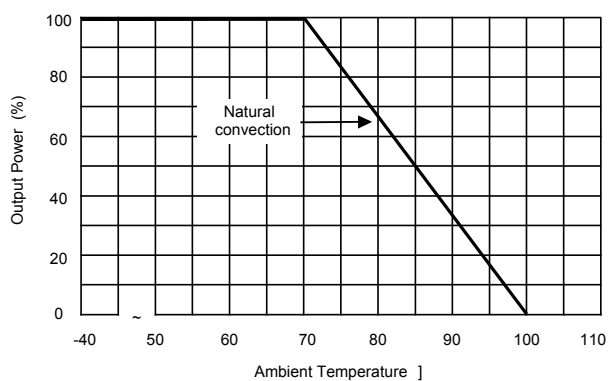
All test conditions are at 25°C The figures are identical for TMR 3-0513E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



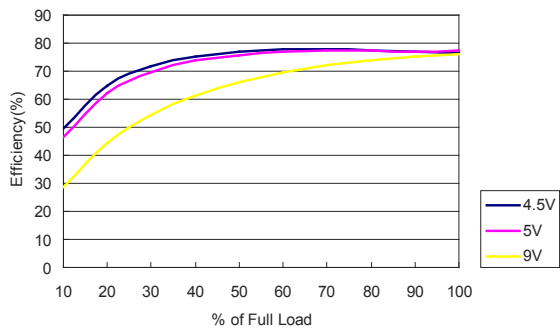
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



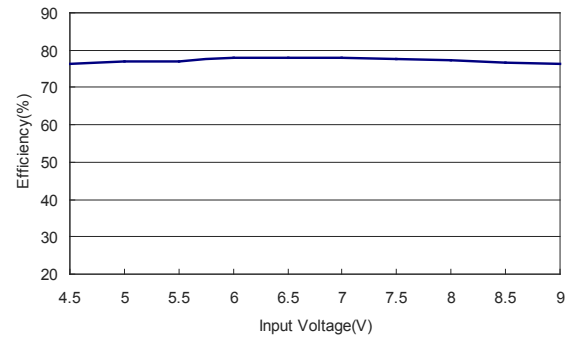
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

All test conditions are at 25°C The figures are identical for TMR 3-0521E



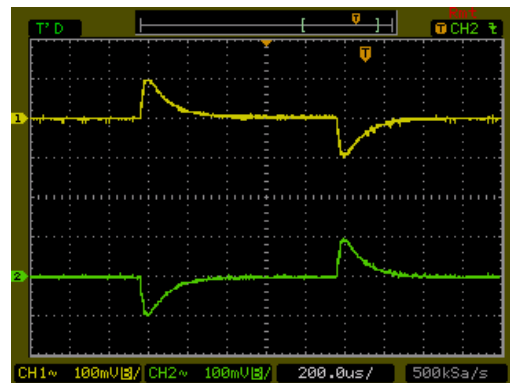
Efficiency Versus Output Current



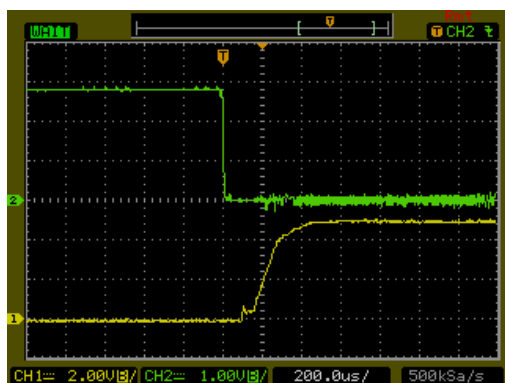
Efficiency Versus Input Voltage. Full Load



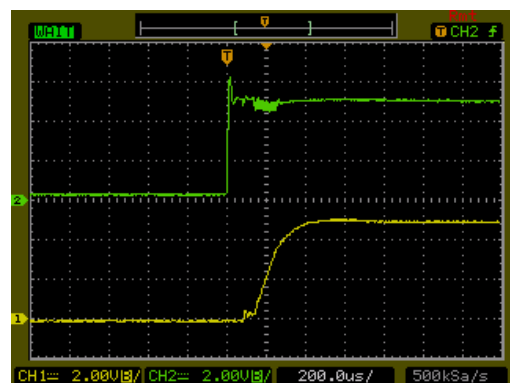
Typical Output Ripple and Noise.
 $V_{in} = V_{in\ nom}$; Full Load; T_A



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



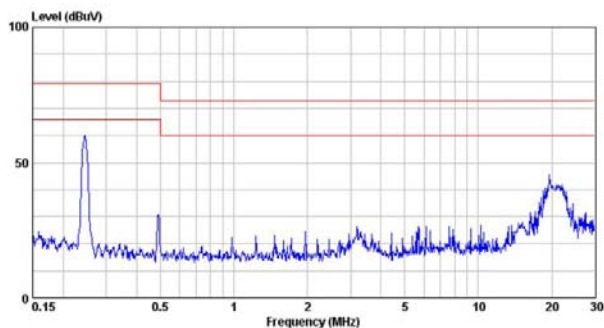
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load



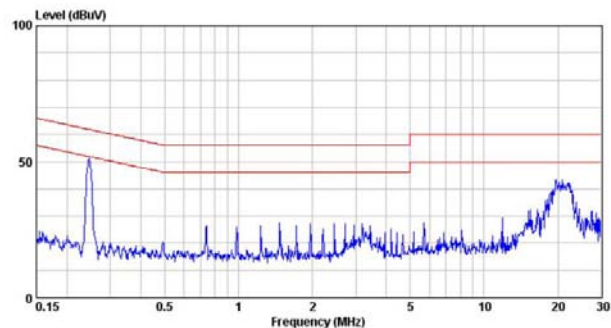
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

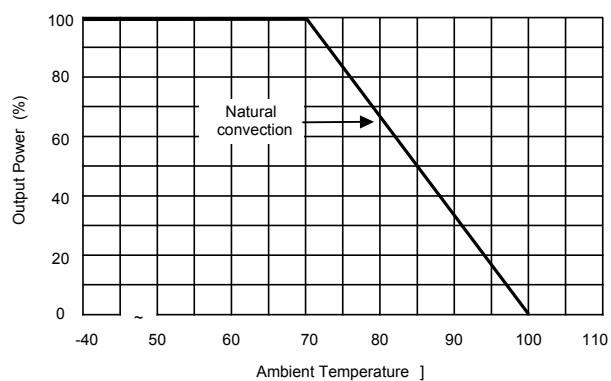
All test conditions are at 25°C The figures are identical for TMR 3-0521E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



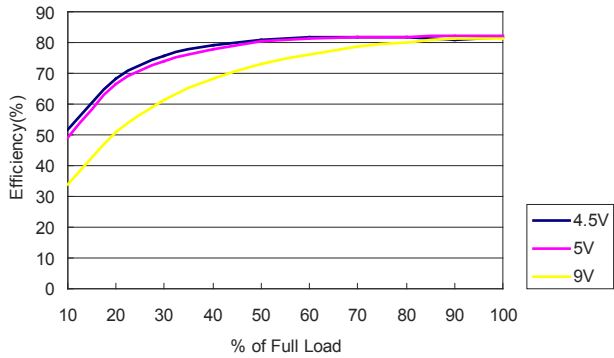
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



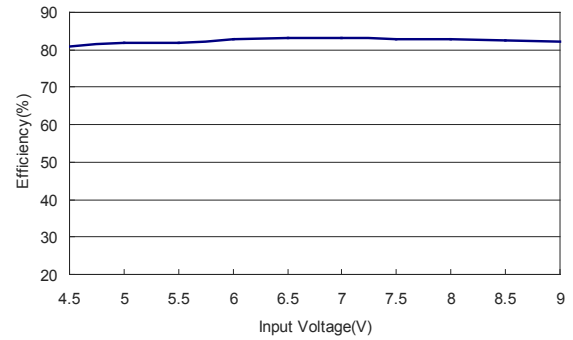
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

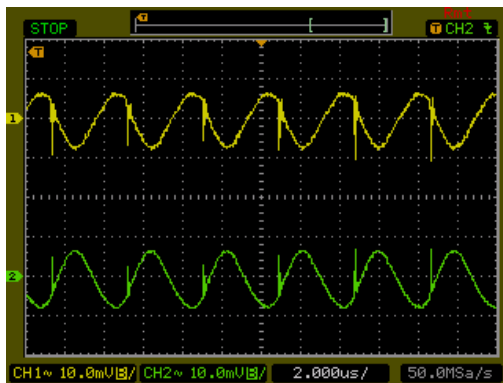
All test conditions are at 25°C The figures are identical for TMR 3-0522E



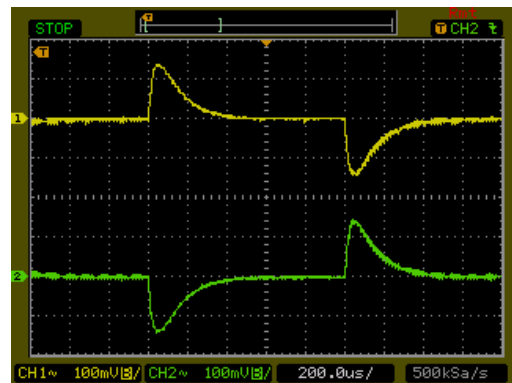
Efficiency Versus Output Current



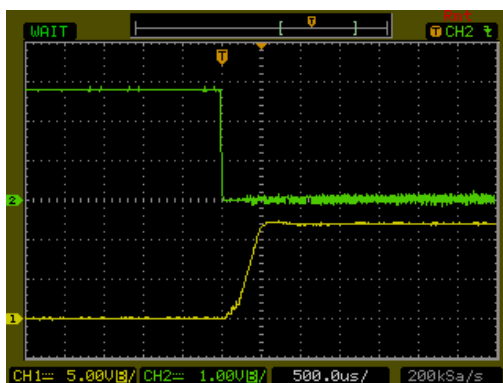
Efficiency Versus Input Voltage. Full Load



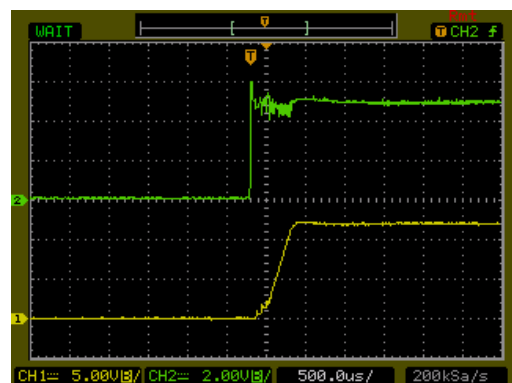
Typical Output Ripple and Noise.
 $V_{in} = V_{in\ nom}$; Full Load; T_A



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



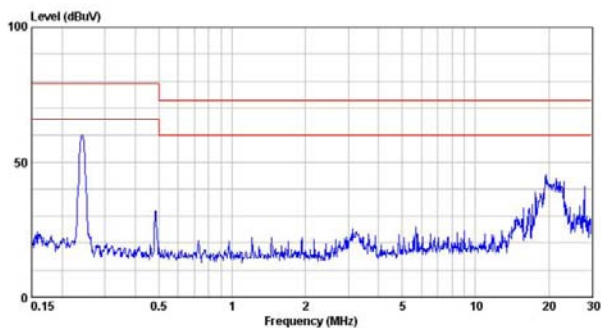
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load



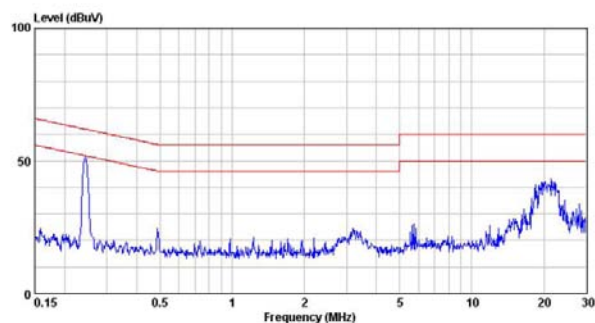
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

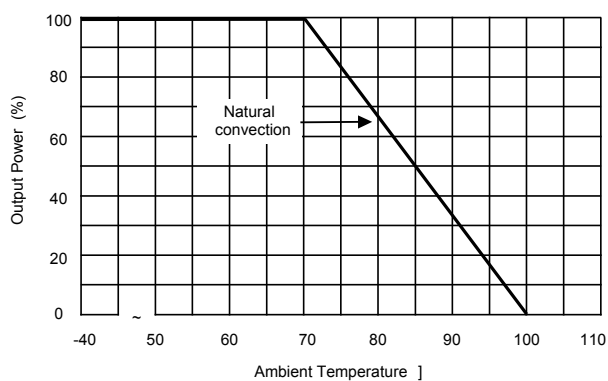
All test conditions are at 25°C The figures are identical for TMR 3-0522E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



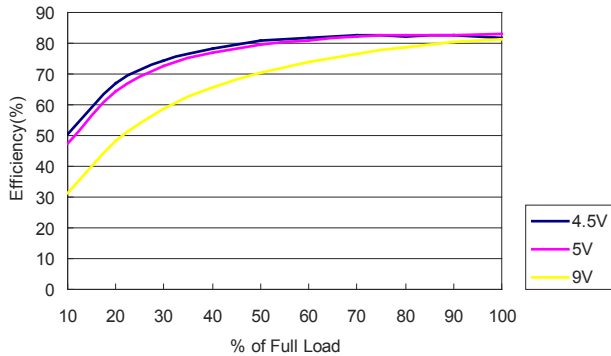
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



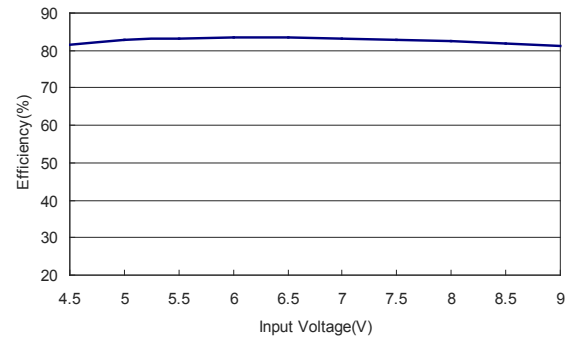
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

All test conditions are at 25°C The figures are identical for TMR 3-0523E



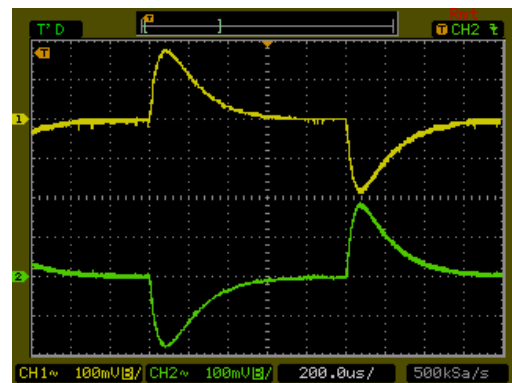
Efficiency Versus Output Current



Efficiency Versus Input Voltage. Full Load



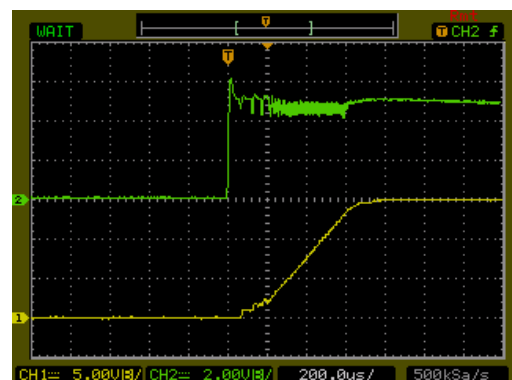
Typical Output Ripple and Noise.
 $V_{in} = V_{in\ nom}$; Full Load; T_A



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



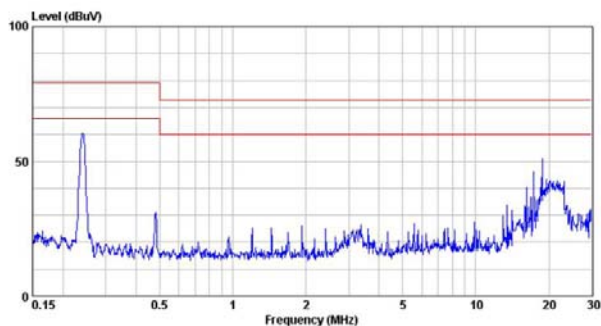
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load



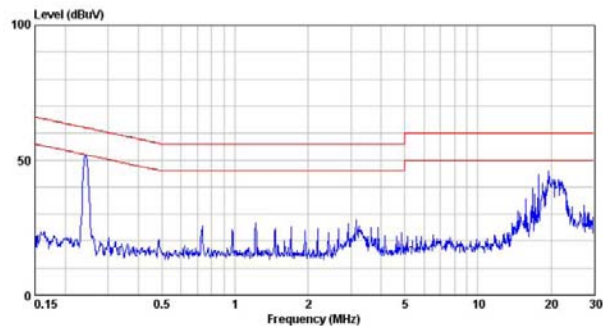
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

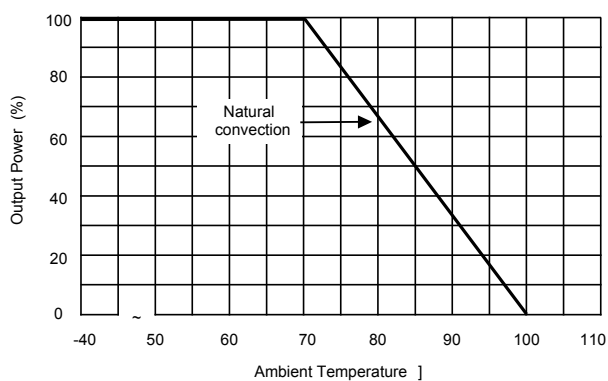
All test conditions are at 25°C The figures are identical for TMR 3-0523E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



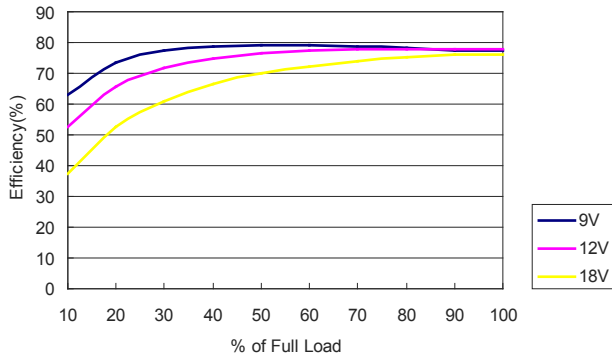
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



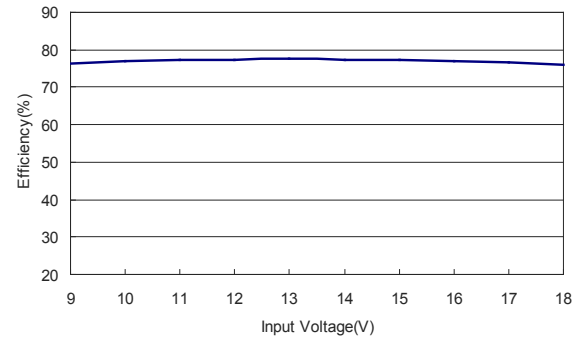
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

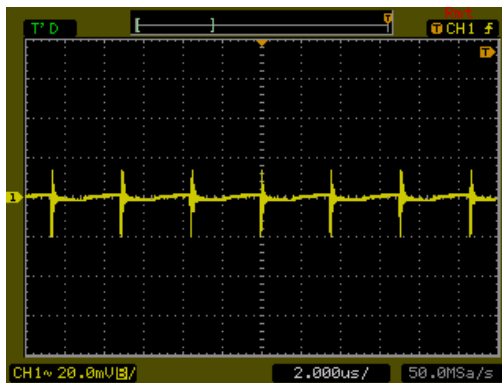
All test conditions are at 25°C The figures are identical for TMR 3-1210E



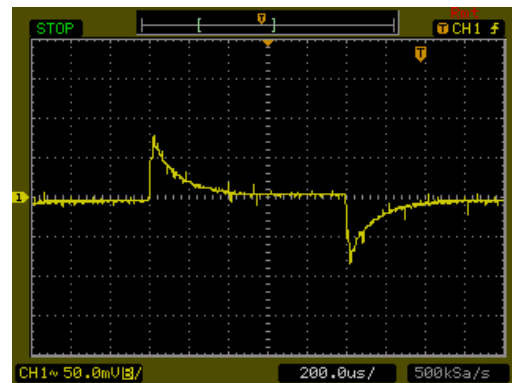
Efficiency Versus Output Current



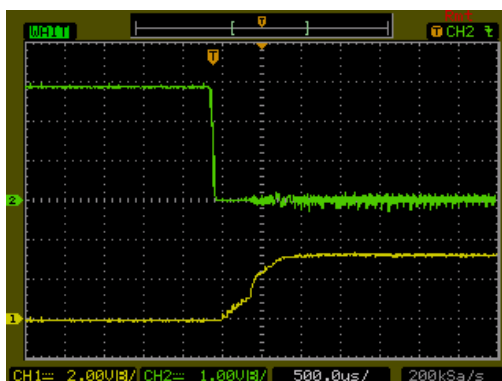
Efficiency Versus Input Voltage. Full Load



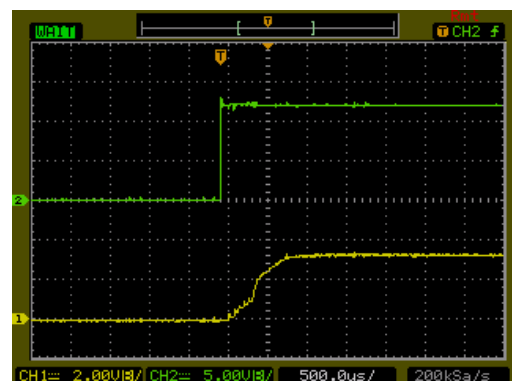
Typical Output Ripple and Noise.
 $V_{in} = V_{in nom}$; Full Load; T_A



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



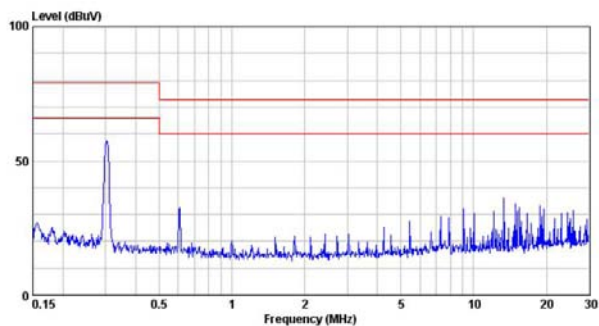
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load



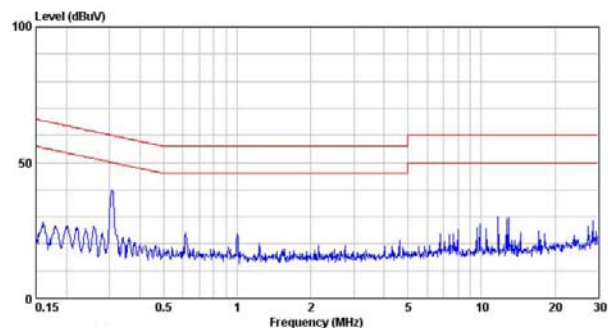
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load

Characteristic Curves

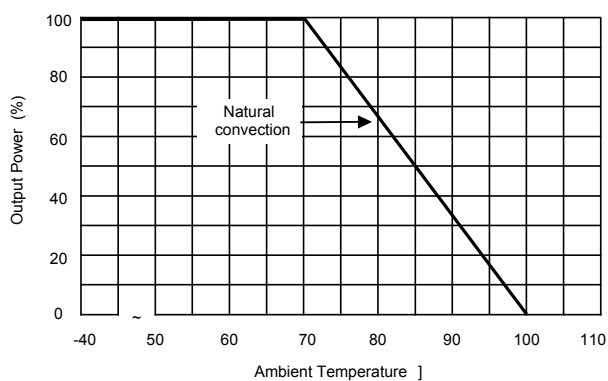
All test conditions are at 25°C The figures are identical for TMR 3-1210E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



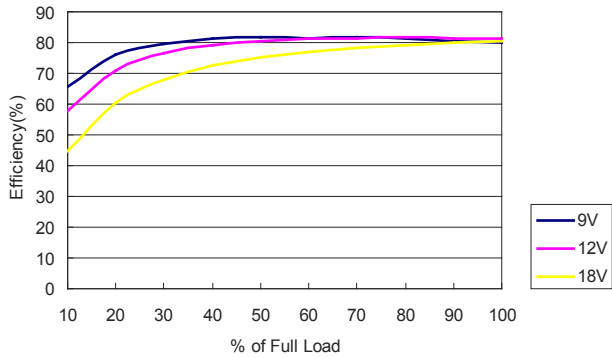
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



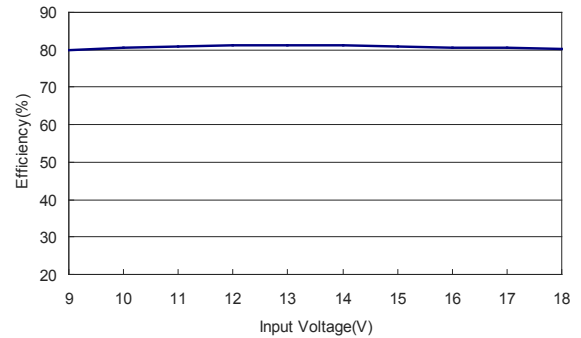
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

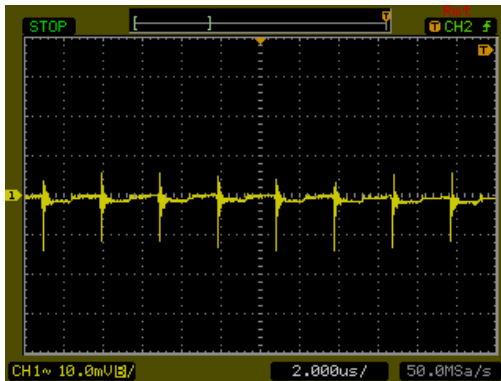
All test conditions are at 25°C The figures are identical for TMR 3-1211E



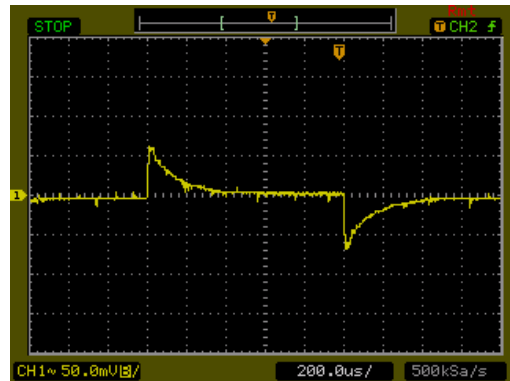
Efficiency Versus Output Current



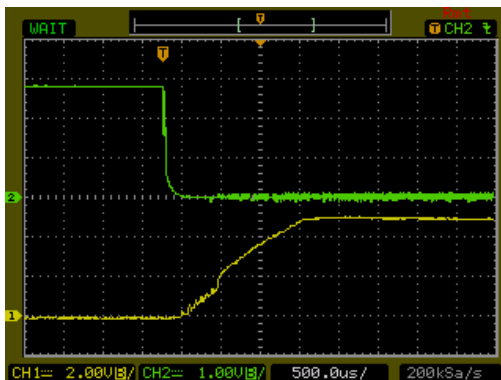
Efficiency Versus Input Voltage. Full Load



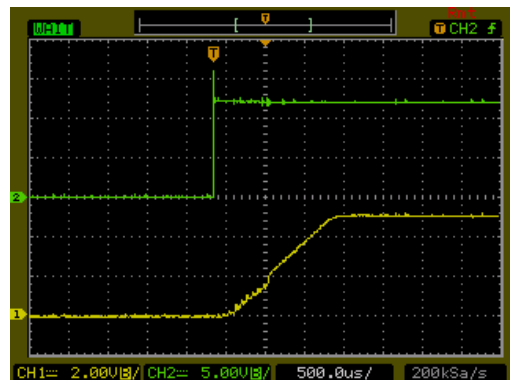
Typical Output Ripple and Noise.
 $V_{in} = V_{in nom}$; Full Load; T_A



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



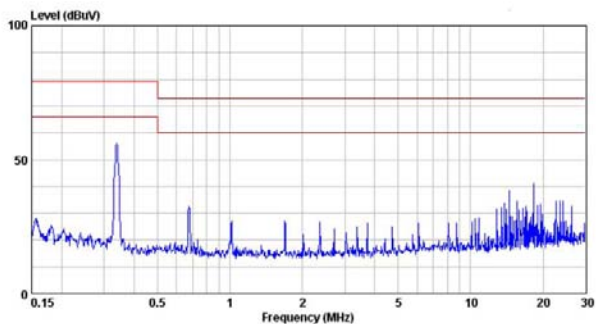
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load



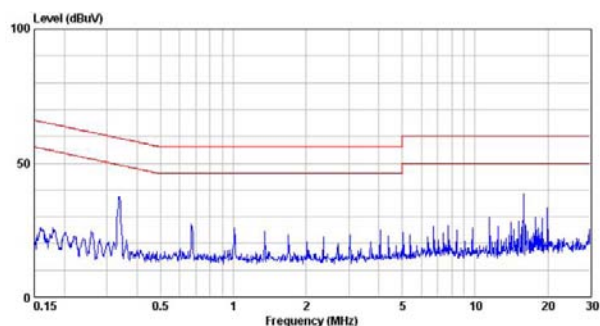
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load

Characteristic Curves

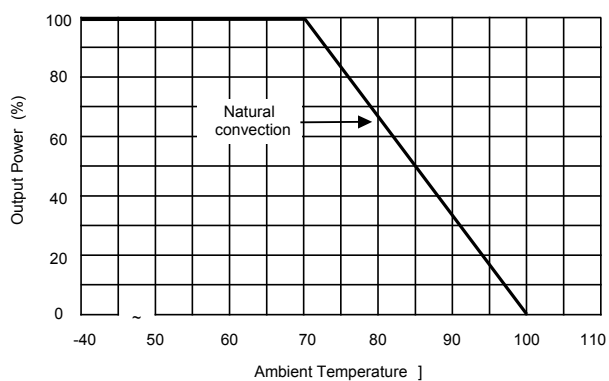
All test conditions are at 25°C The figures are identical for TMR 3-1211E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



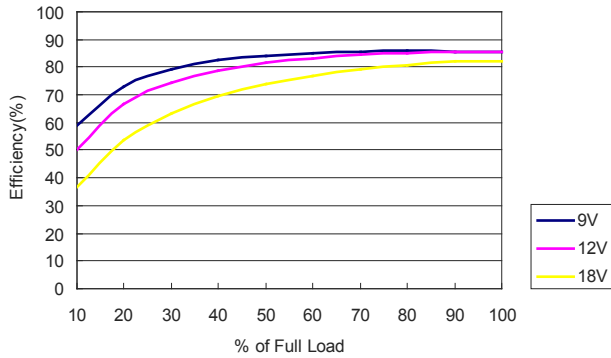
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



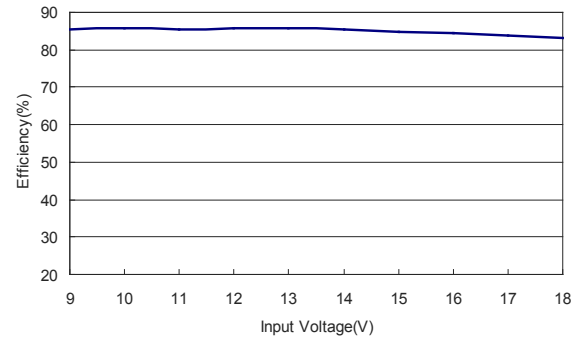
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

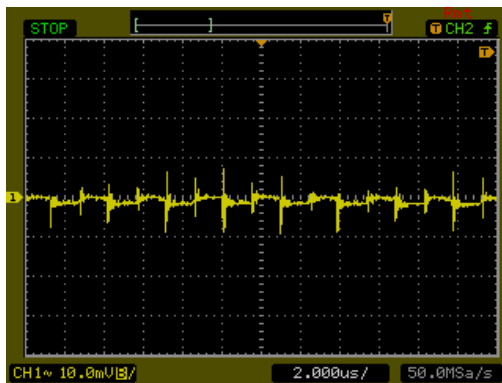
All test conditions are at 25°C The figures are identical for TMR 3-1212E



Efficiency Versus Output Current

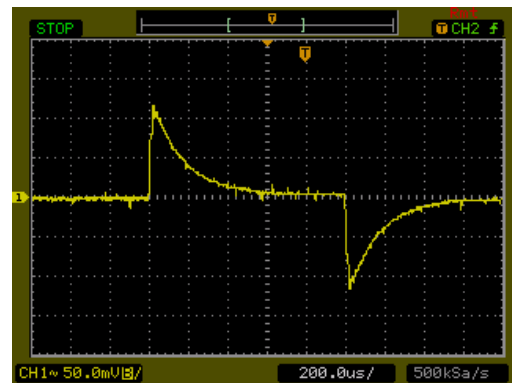


Efficiency Versus Input Voltage. Full Load



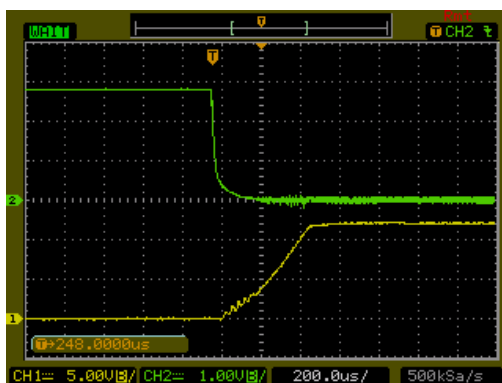
Typical Output Ripple and Noise.

$V_{in} = V_{in nom}$; Full Load; T_A



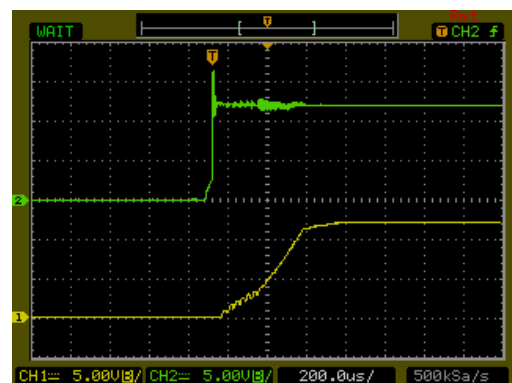
Transient Response to Dynamic Load Change from

100% to 75% of Full Load ; $V_{in} = V_{in nom}$



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in nom}$; Full Load

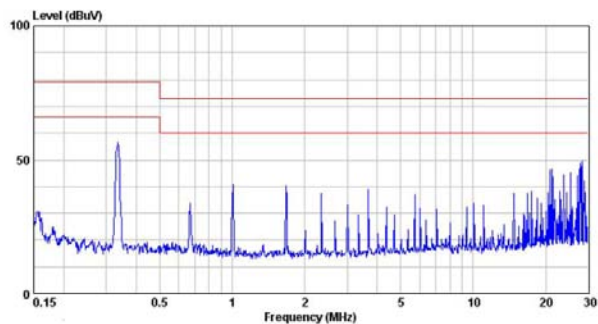


Typical Input Start-Up and Output Rise Characteristic

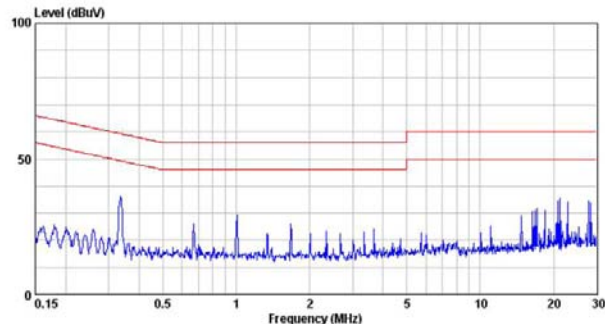
$V_{in} = V_{in nom}$; Full Load

Characteristic Curves

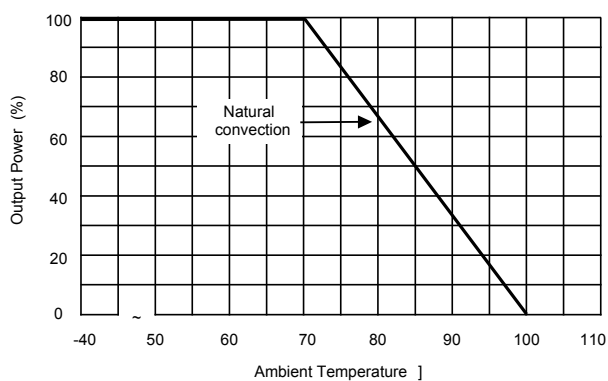
All test conditions are at 25°C The figures are identical for TMR 3-1212E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



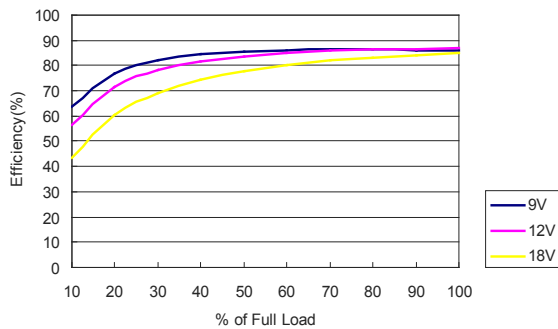
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



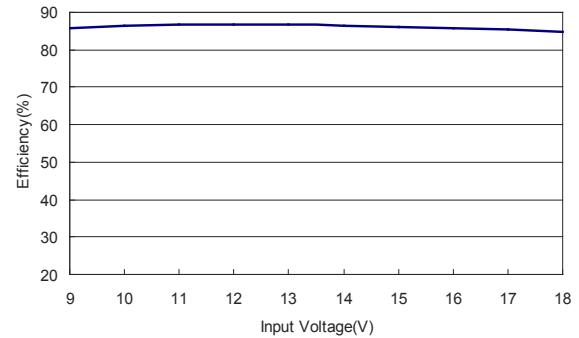
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

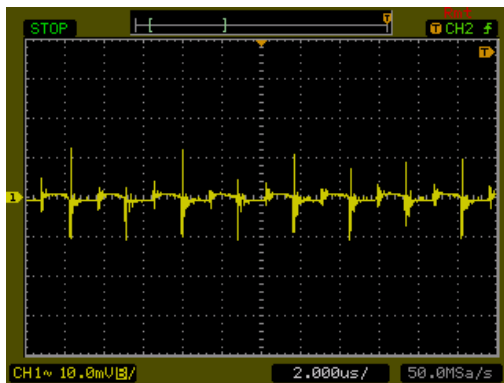
All test conditions are at 25°C The figures are identical for TMR 3-1213E



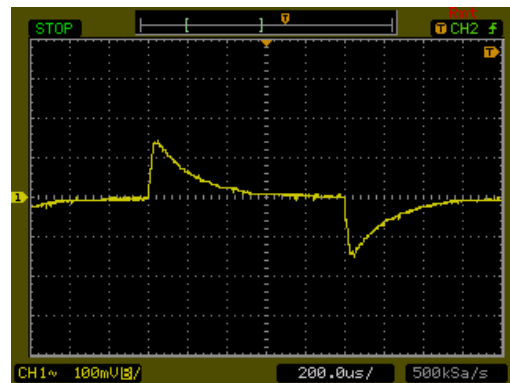
Efficiency Versus Output Current



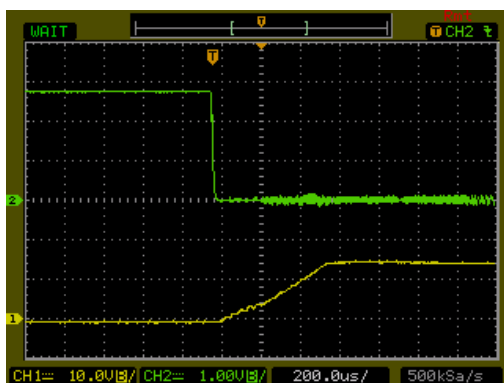
Efficiency Versus Input Voltage. Full Load



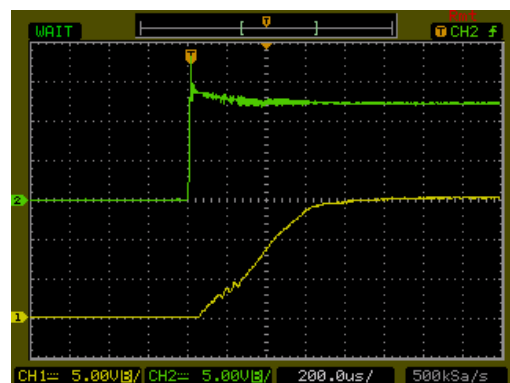
Typical Output Ripple and Noise.
 $V_{in} = V_{in nom}$; Full Load; T_A



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



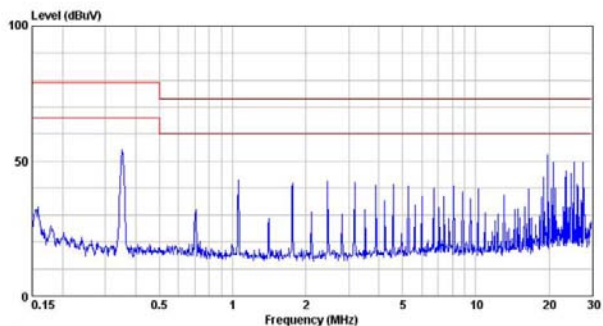
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load



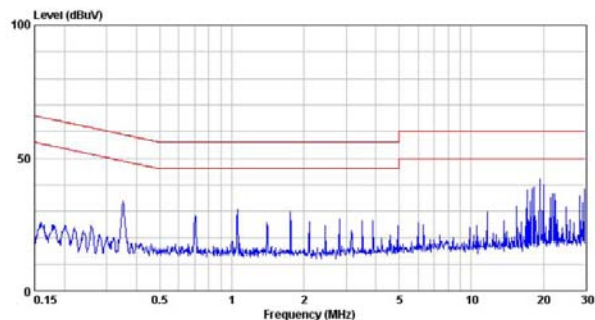
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load

Characteristic Curves

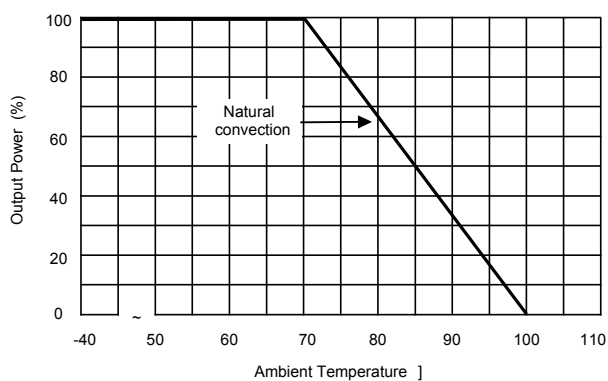
All test conditions are at 25°C The figures are identical for TMR 3-1213E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



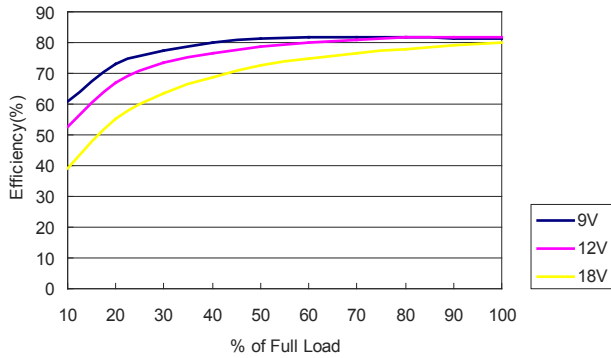
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



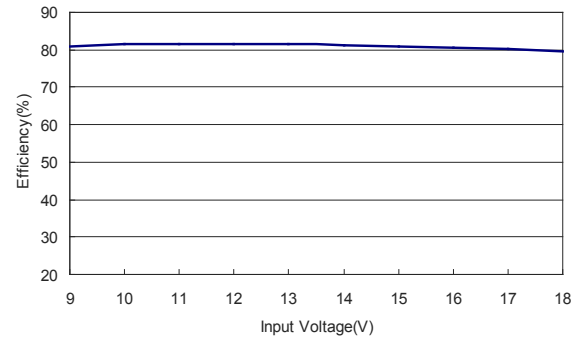
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

All test conditions are at 25°C The figures are identical for TMR 3-1221E



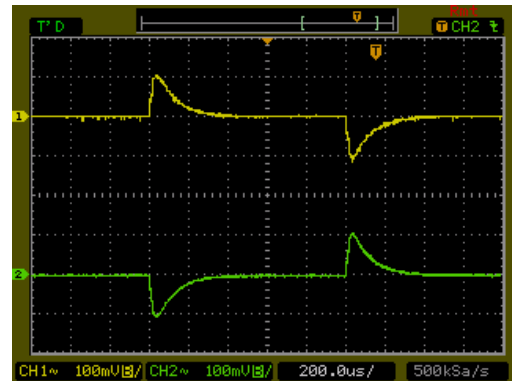
Efficiency Versus Output Current



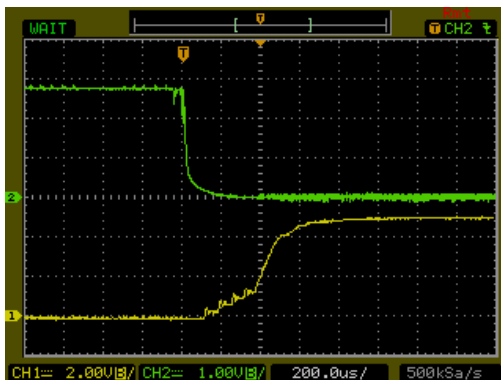
Efficiency Versus Input Voltage. Full Load



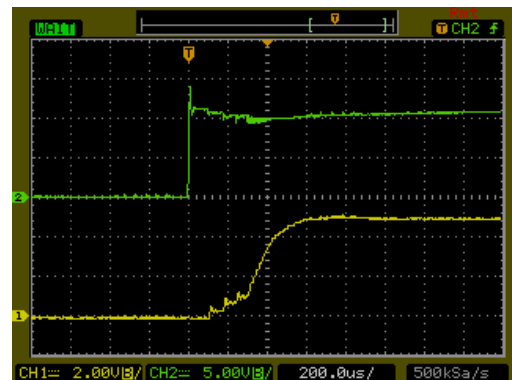
Typical Output Ripple and Noise.
 $V_{in} = V_{in\ nom}$; Full Load; T_A



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



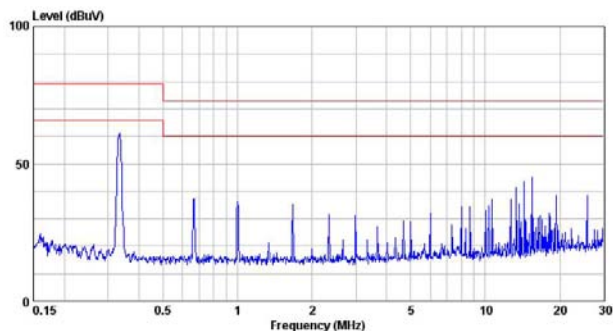
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load



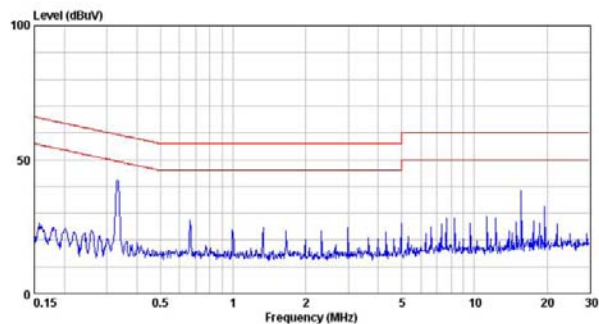
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

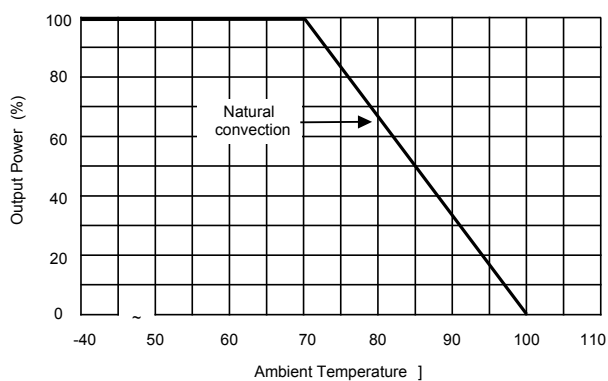
All test conditions are at 25°C The figures are identical for TMR 3-1221E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



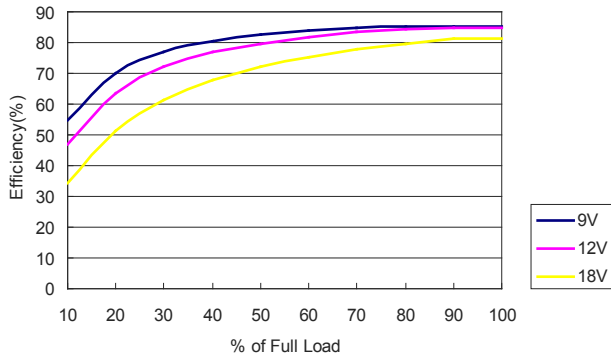
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



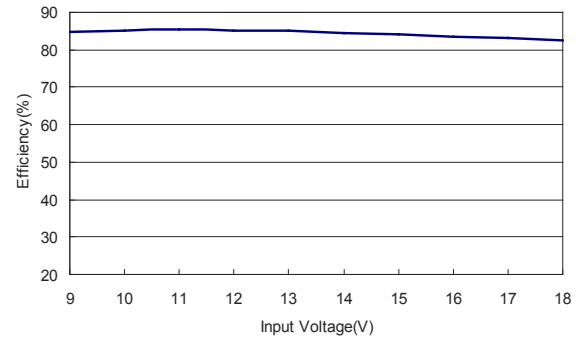
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

All test conditions are at 25°C The figures are identical for TMR 3-1222E



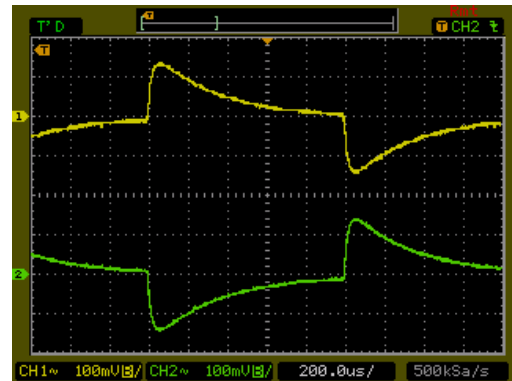
Efficiency Versus Output Current



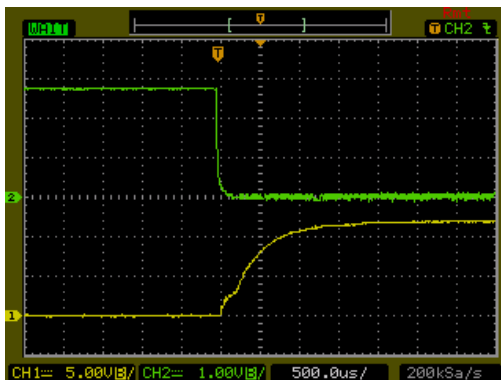
Efficiency Versus Input Voltage. Full Load



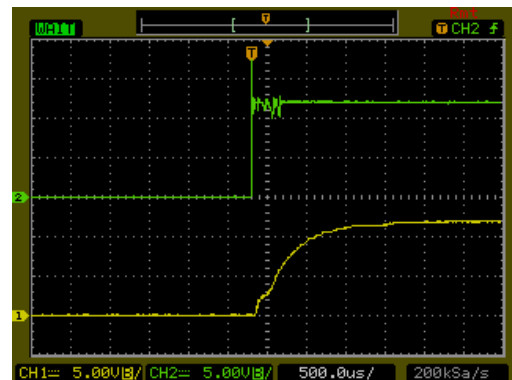
Typical Output Ripple and Noise.
 $V_{in} = V_{in\ nom}$; Full Load; T_A



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



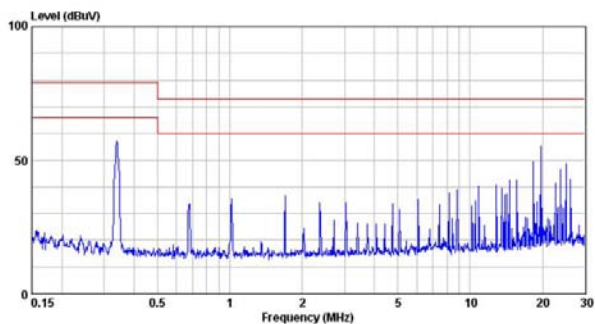
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load



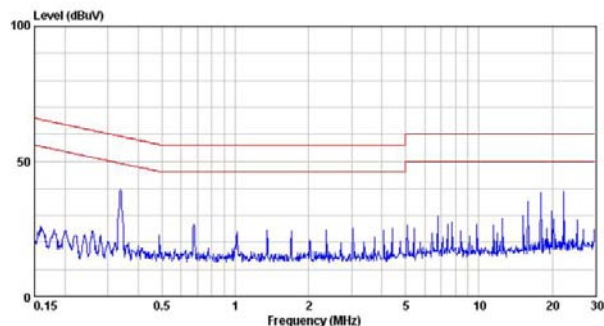
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

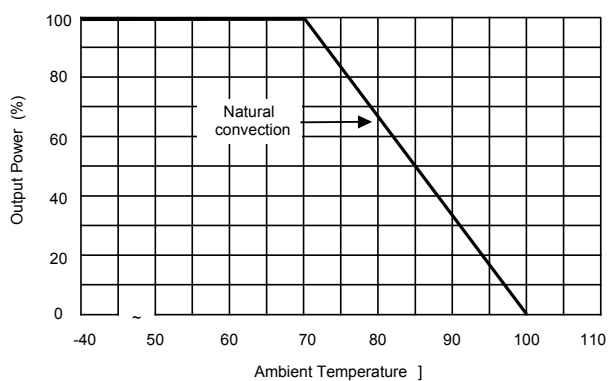
All test conditions are at 25°C The figures are identical for TMR 3-1222E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



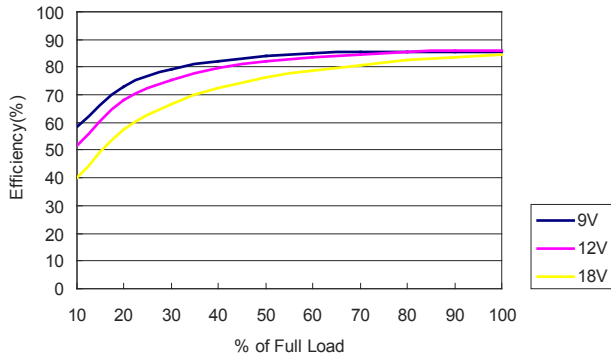
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



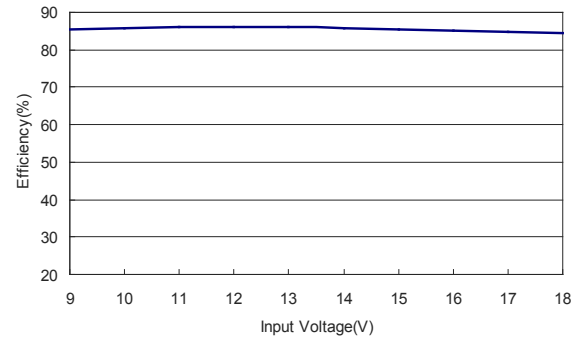
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

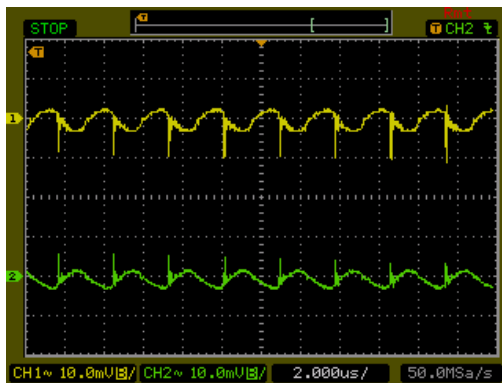
All test conditions are at 25°C The figures are identical for TMR 3-1223E



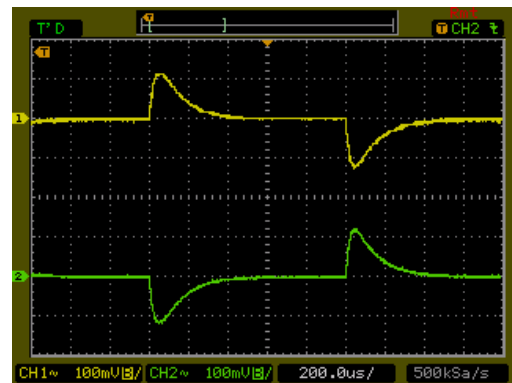
Efficiency Versus Output Current



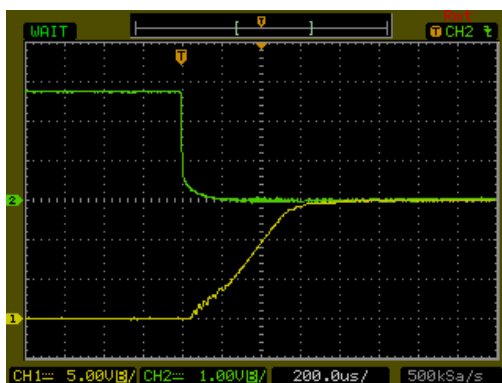
Efficiency Versus Input Voltage. Full Load



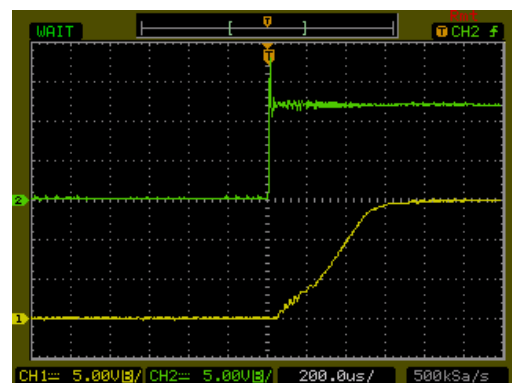
Typical Output Ripple and Noise.
 $V_{in} = V_{in\ nom}$; Full Load; T_A



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



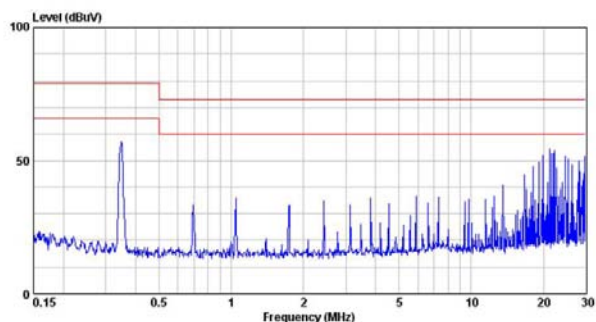
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load



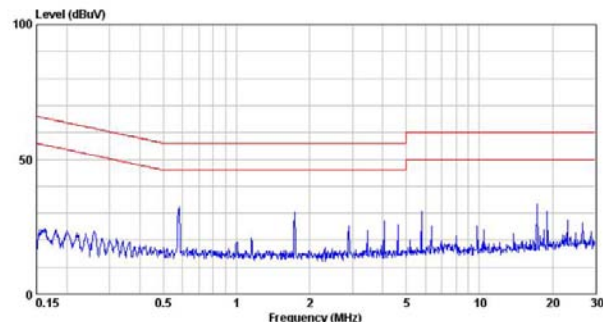
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

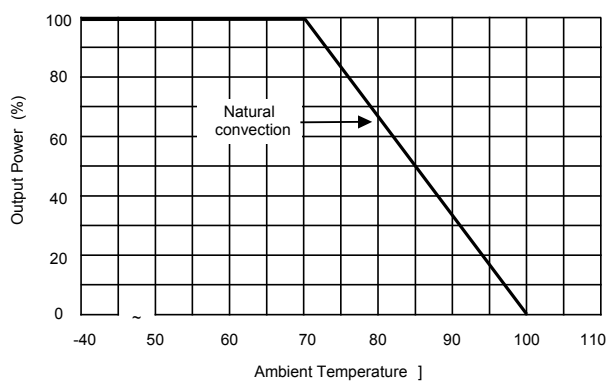
All test conditions are at 25°C The figures are identical for TMR 3-1223E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



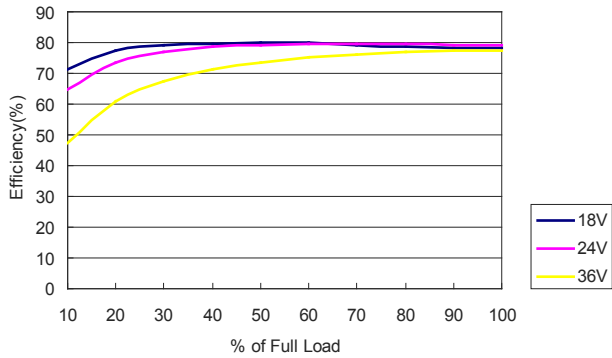
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



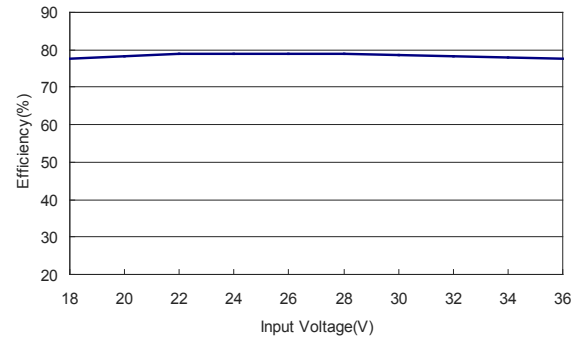
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

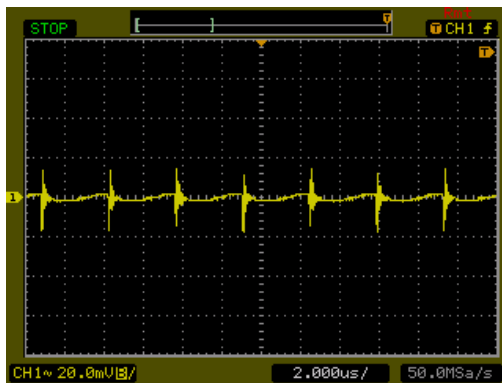
All test conditions are at 25°C The figures are identical for TMR 3-2410E



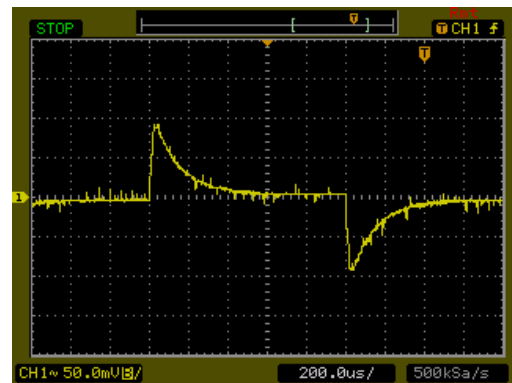
Efficiency Versus Output Current



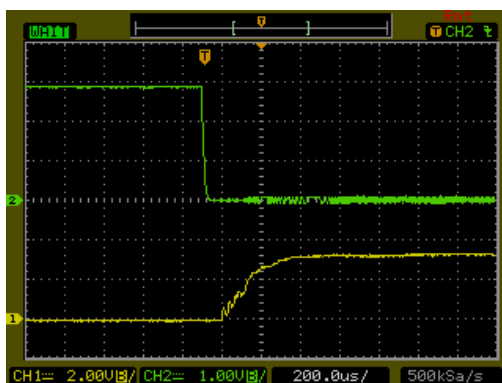
Efficiency Versus Input Voltage. Full Load



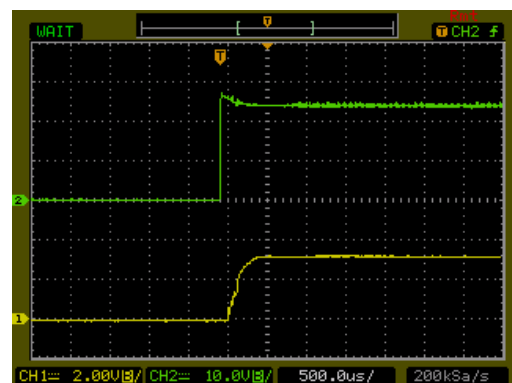
Typical Output Ripple and Noise.
 $V_{in} = V_{in nom}$; Full Load; T_A



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



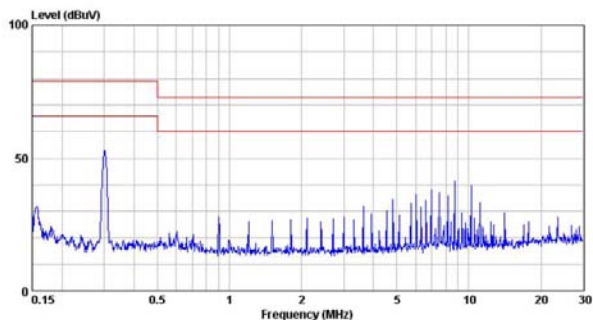
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load



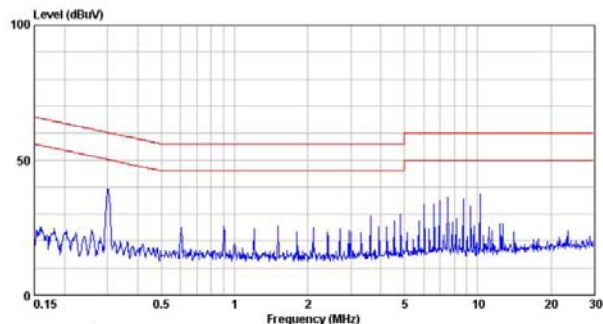
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load

Characteristic Curves

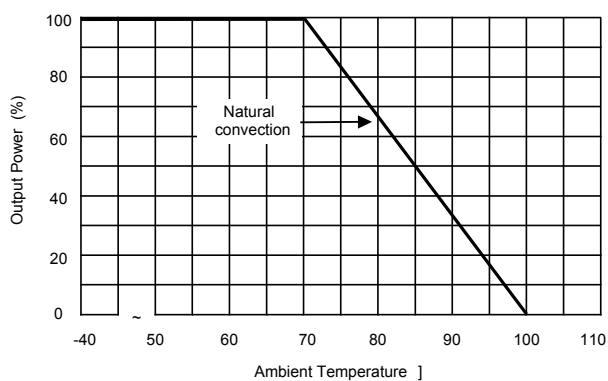
All test conditions are at 25°C The figures are identical for TMR 3-2410E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



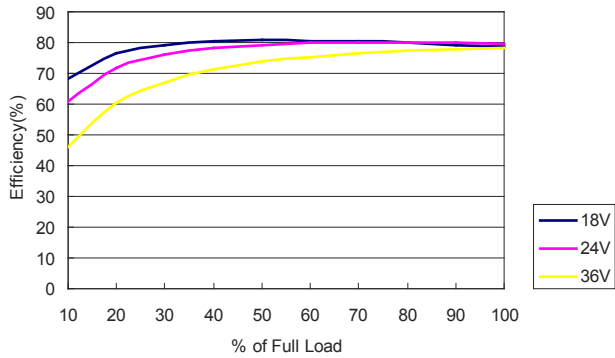
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



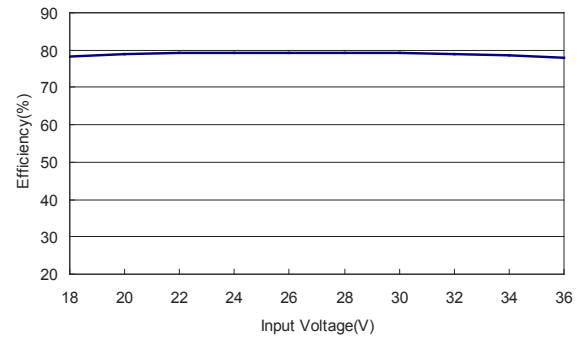
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

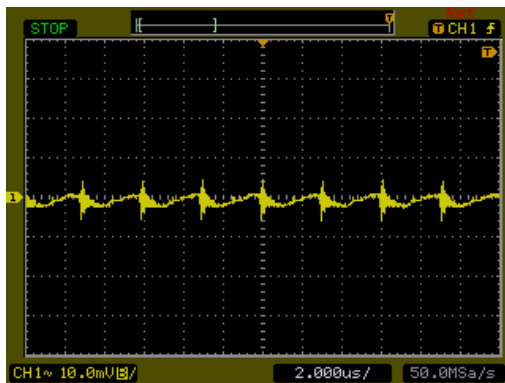
All test conditions are at 25°C The figures are identical for TMR 3-2411E



Efficiency Versus Output Current

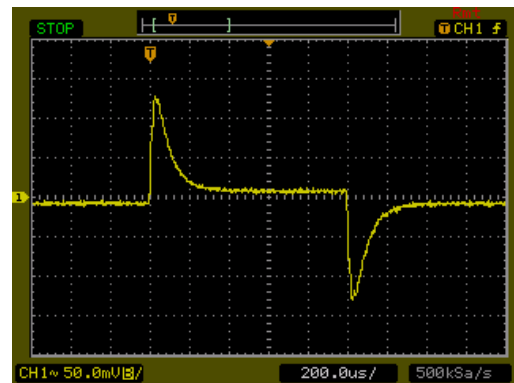


Efficiency Versus Input Voltage. Full Load



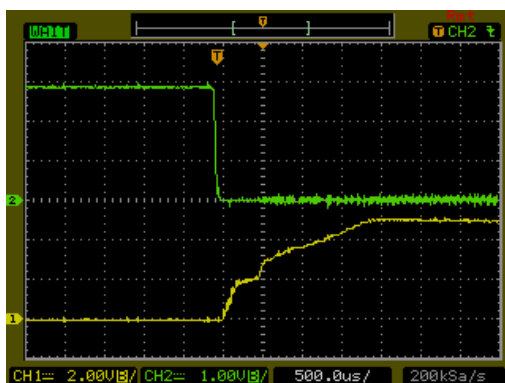
Typical Output Ripple and Noise.

$V_{in} = V_{in\ nom}$; Full Load; T_A



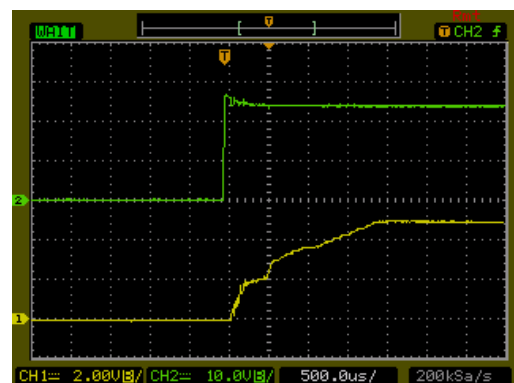
Transient Response to Dynamic Load Change from

100% to 75% of Full Load ; $V_{in} = V_{in\ nom}$



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\ nom}$; Full Load

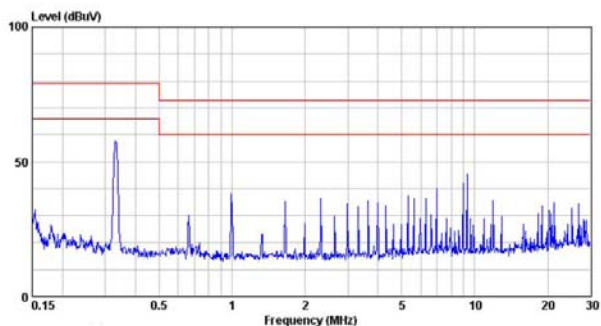


Typical Input Start-Up and Output Rise Characteristic

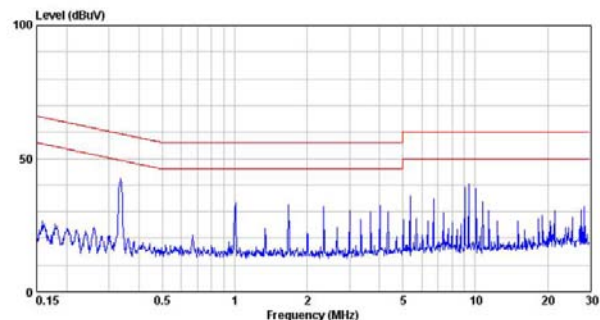
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

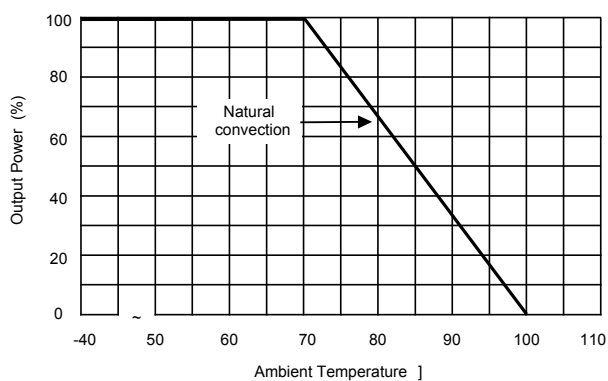
All test conditions are at 25°C The figures are identical for TMR 3-2411E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



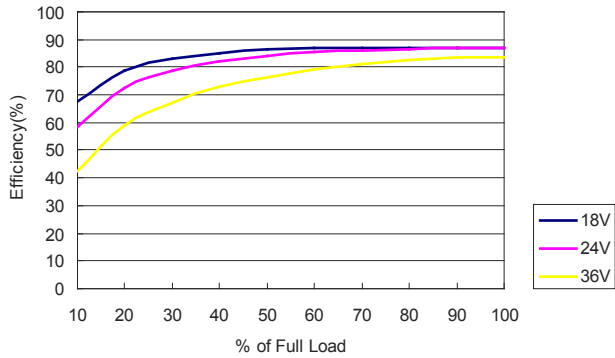
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



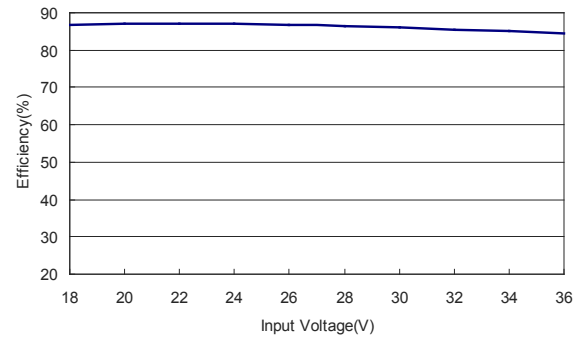
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

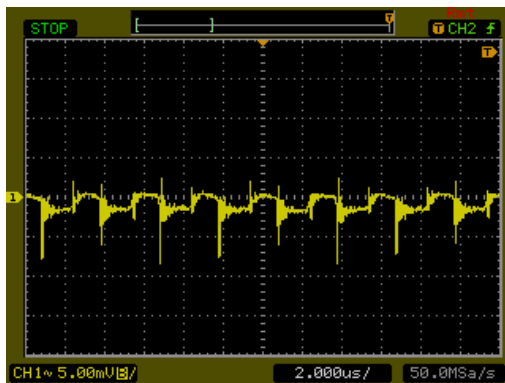
All test conditions are at 25°C The figures are identical for TMR 3-2412E



Efficiency Versus Output Current

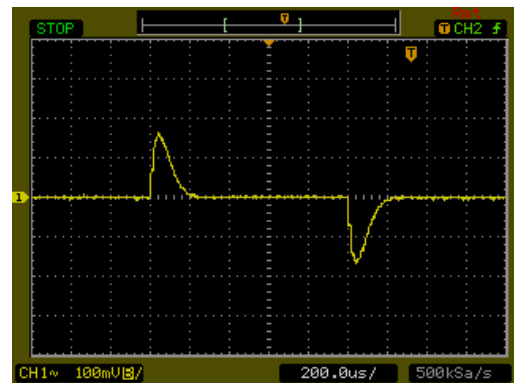


Efficiency Versus Input Voltage. Full Load



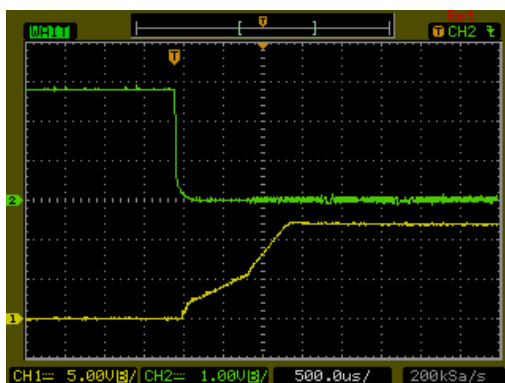
Typical Output Ripple and Noise.

$V_{in} = V_{in\ nom}$; Full Load; T_A



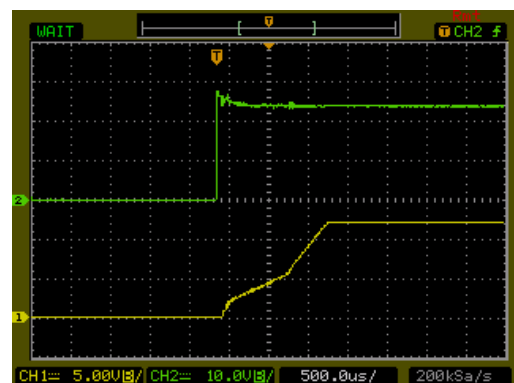
Transient Response to Dynamic Load Change from

100% to 75% of Full Load ; $V_{in} = V_{in\ nom}$



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\ nom}$; Full Load

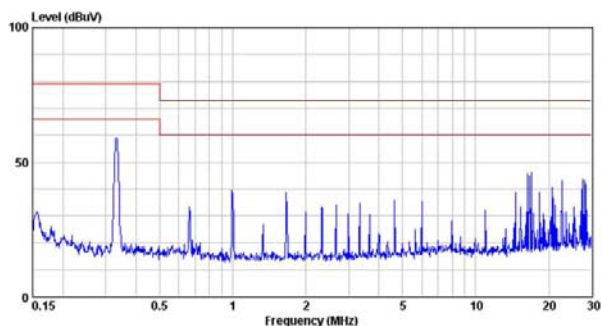


Typical Input Start-Up and Output Rise Characteristic

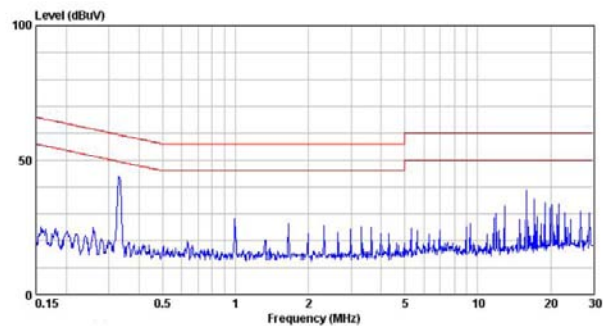
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

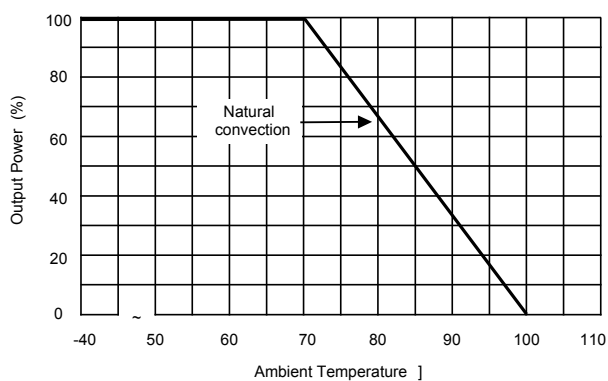
All test conditions are at 25°C The figures are identical for TMR 3-2412E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



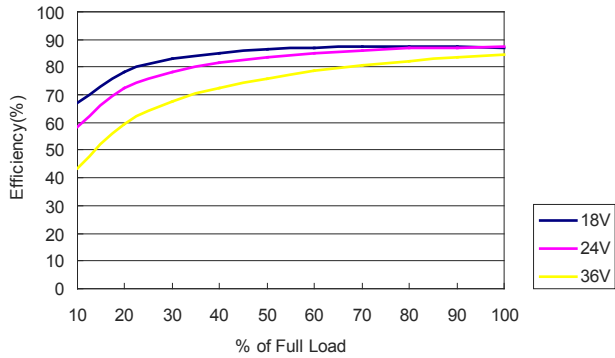
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



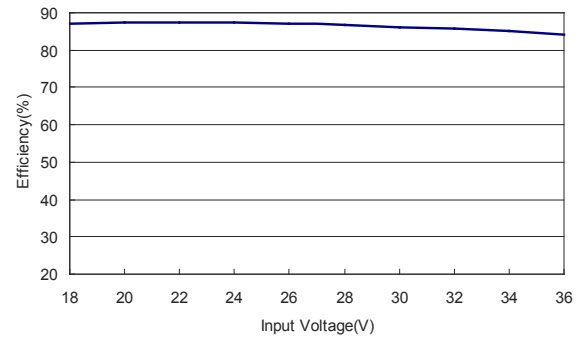
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

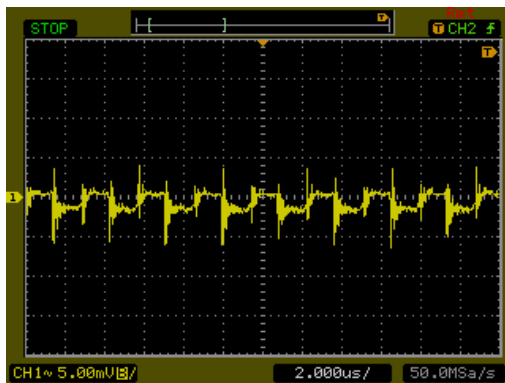
All test conditions are at 25°C The figures are identical for TMR 3-2413E



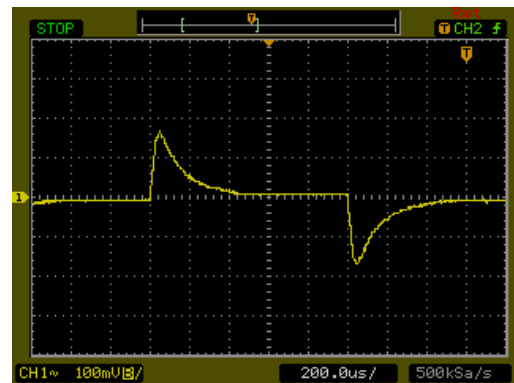
Efficiency Versus Output Current



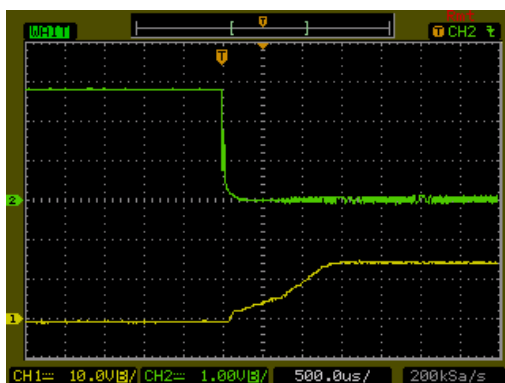
Efficiency Versus Input Voltage. Full Load



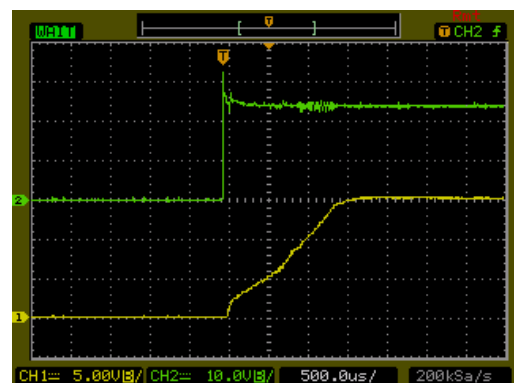
Typical Output Ripple and Noise.
 $V_{in} = V_{in nom}$; Full Load; T_A



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



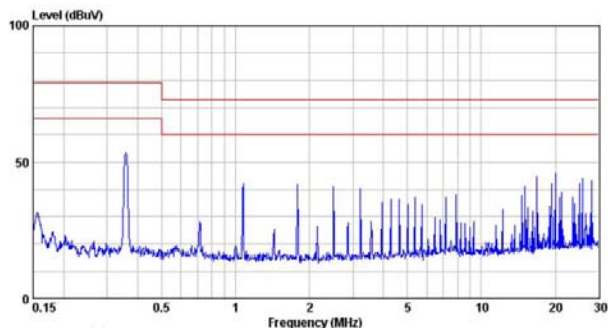
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load



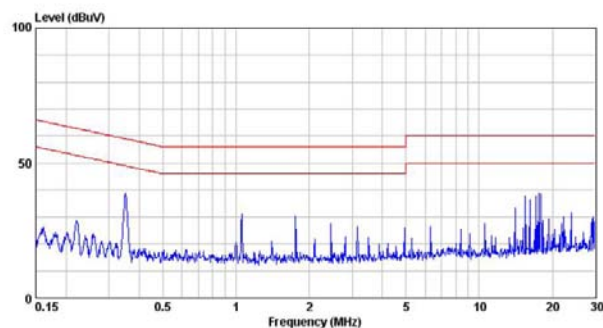
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load

Characteristic Curves

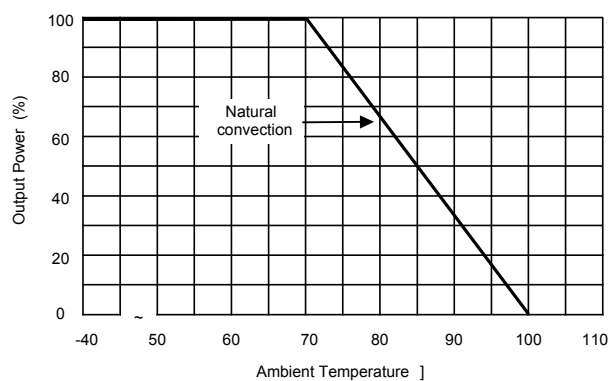
All test conditions are at 25°C The figures are identical for TMR 3-2413E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



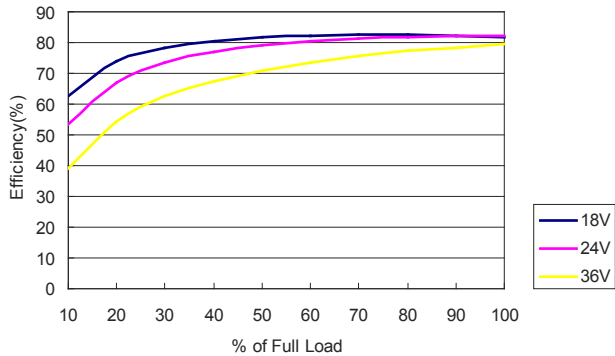
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



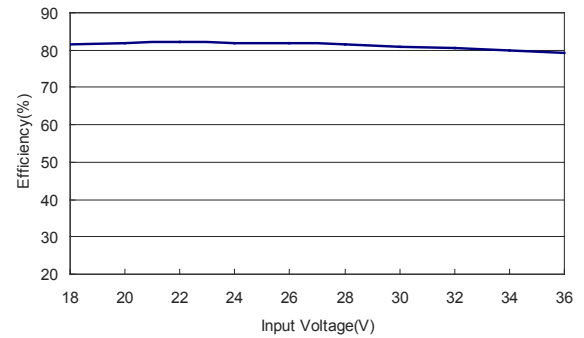
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

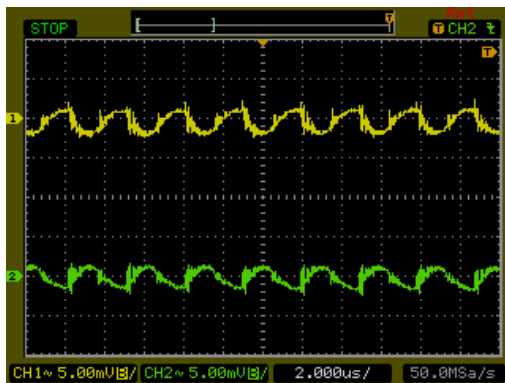
All test conditions are at 25°C The figures are identical for TMR 3-2421E



Efficiency Versus Output Current

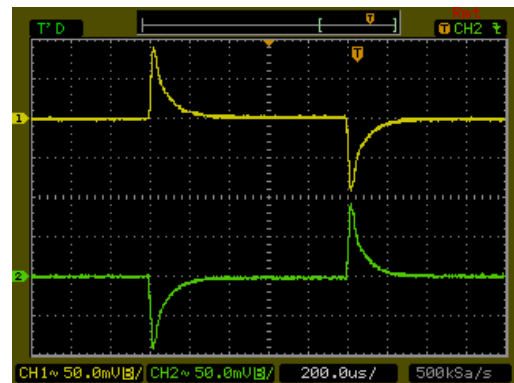


Efficiency Versus Input Voltage. Full Load



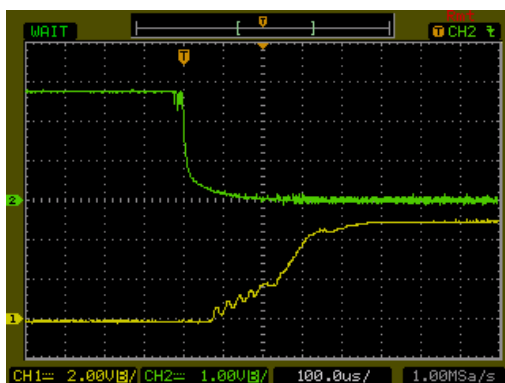
Typical Output Ripple and Noise.

$V_{in} = V_{in\ nom}$; Full Load; T_A



Transient Response to Dynamic Load Change from

100% to 75% of Full Load ; $V_{in} = V_{in\ nom}$



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\ nom}$; Full Load

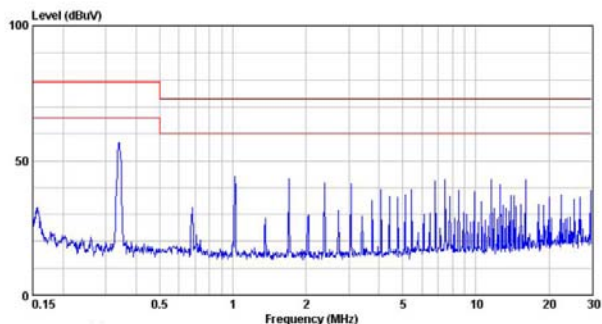


Typical Input Start-Up and Output Rise Characteristic

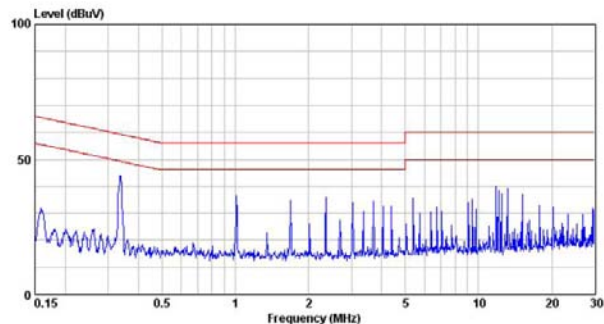
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

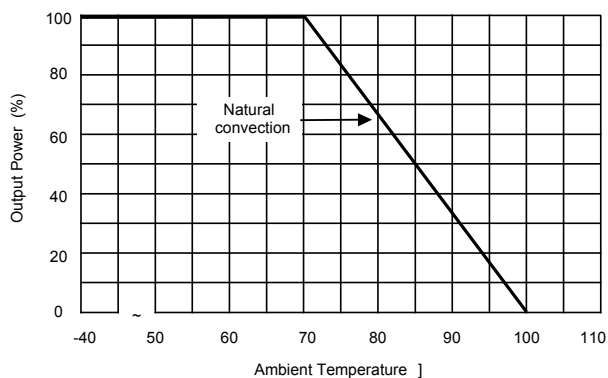
All test conditions are at 25°C The figures are identical for TMR 3-2421E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



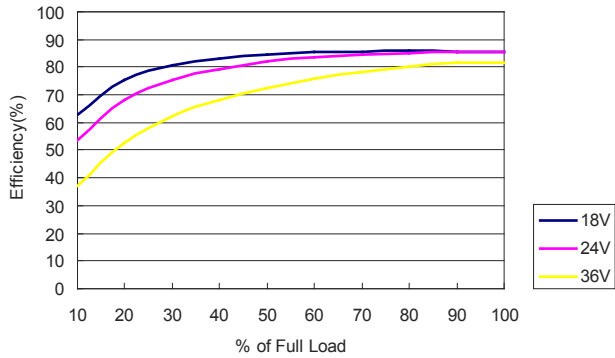
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



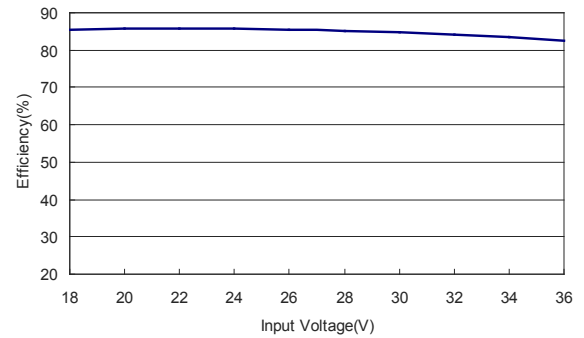
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

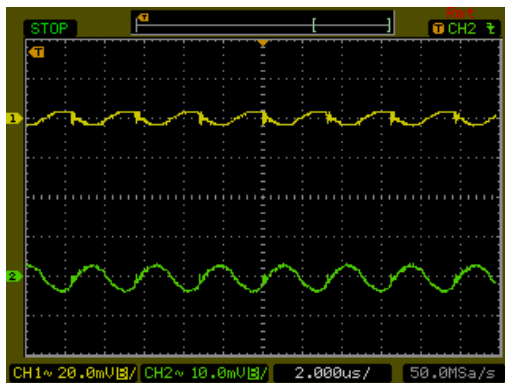
All test conditions are at 25°C The figures are identical for TMR 3-2422E



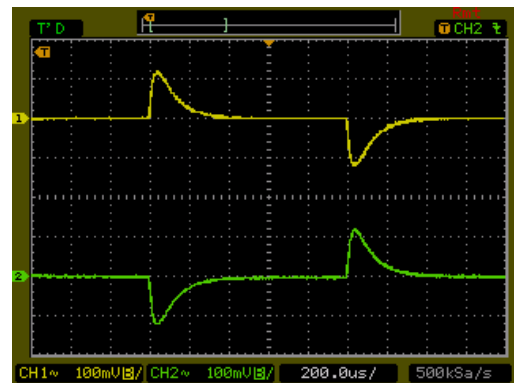
Efficiency Versus Output Current



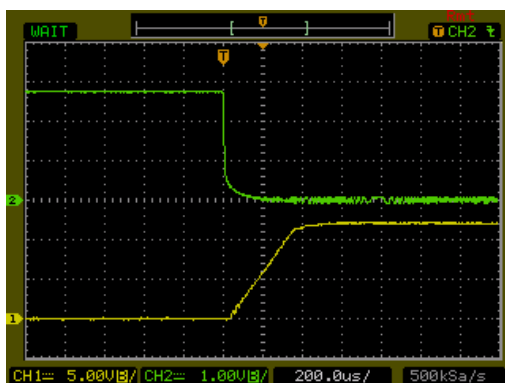
Efficiency Versus Input Voltage. Full Load



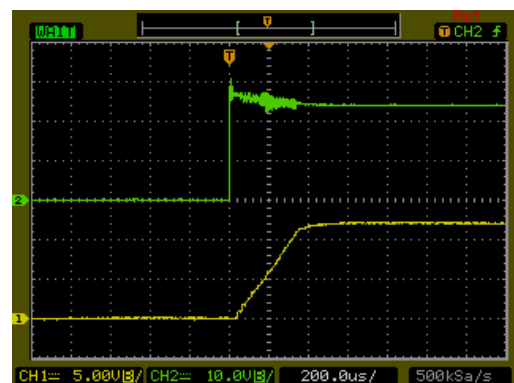
Typical Output Ripple and Noise.
 $V_{in} = V_{in nom}$; Full Load; T_A



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



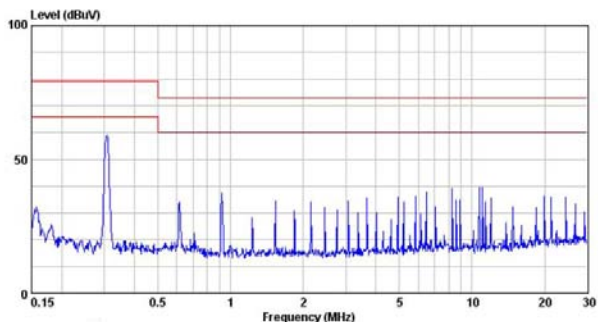
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load



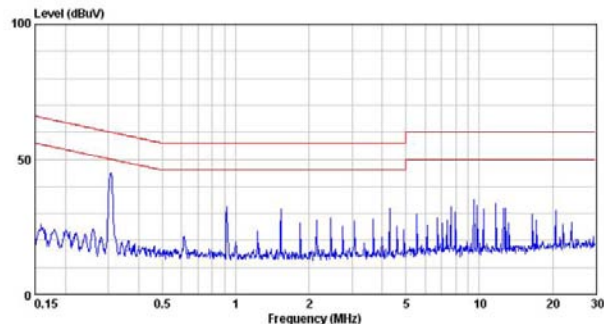
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load

Characteristic Curves

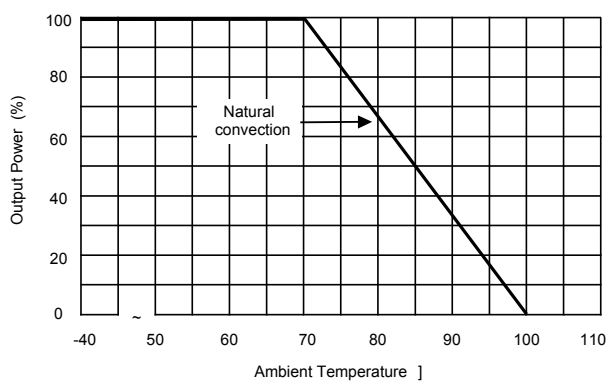
All test conditions are at 25°C The figures are identical for TMR 3-2422E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



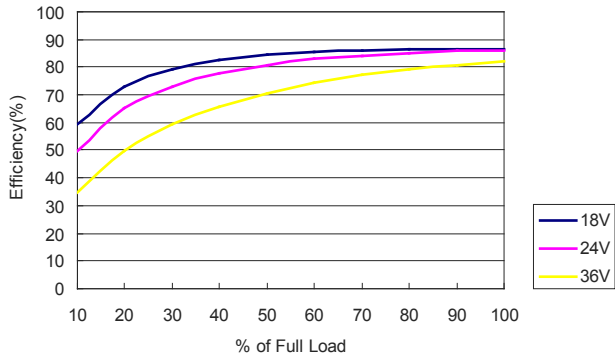
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



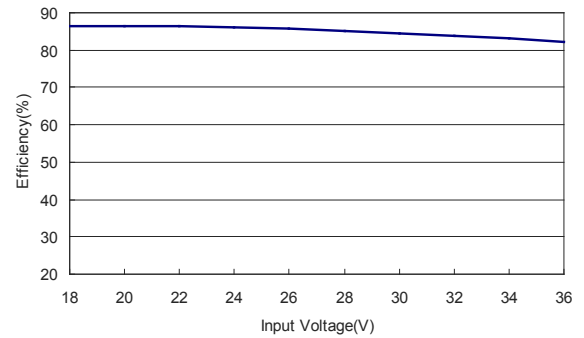
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

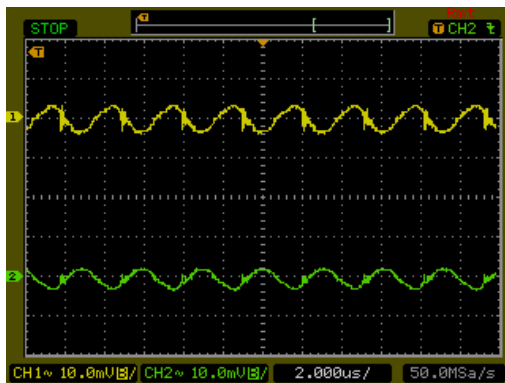
All test conditions are at 25°C The figures are identical for TMR 3-2423E



Efficiency Versus Output Current



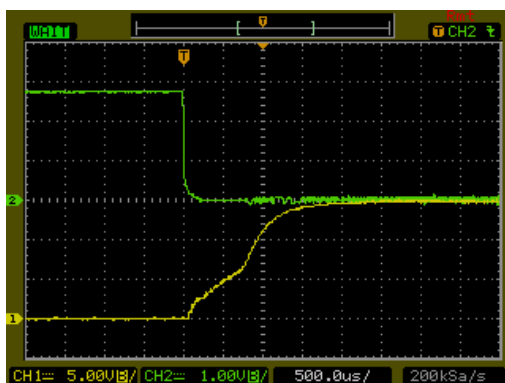
Efficiency Versus Input Voltage. Full Load



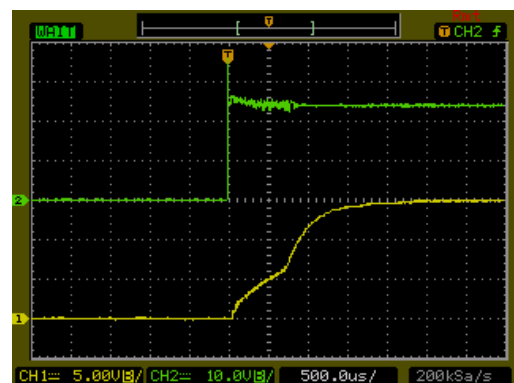
Typical Output Ripple and Noise.
 $V_{in} = V_{in nom}$; Full Load; T_A



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



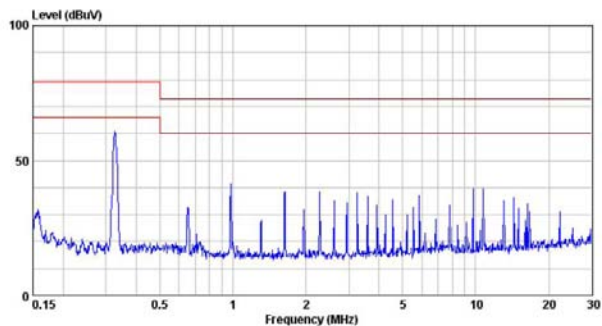
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load



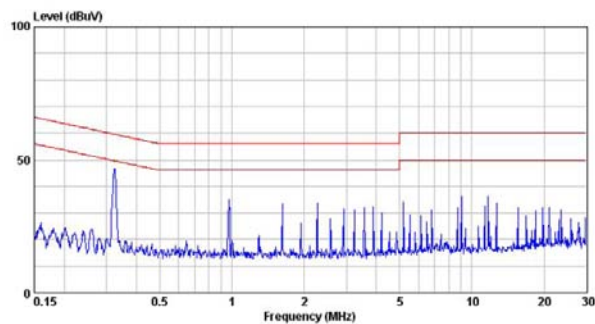
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load

Characteristic Curves

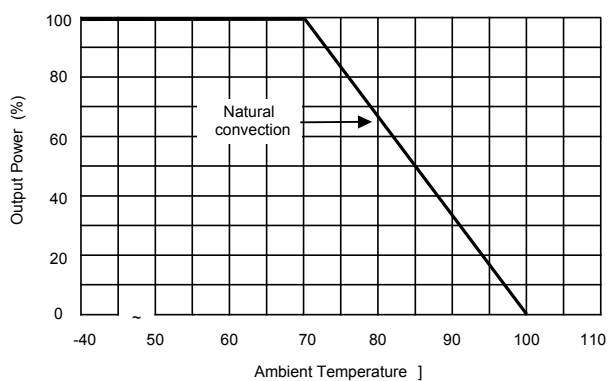
All test conditions are at 25°C The figures are identical for TMR 3-2423E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



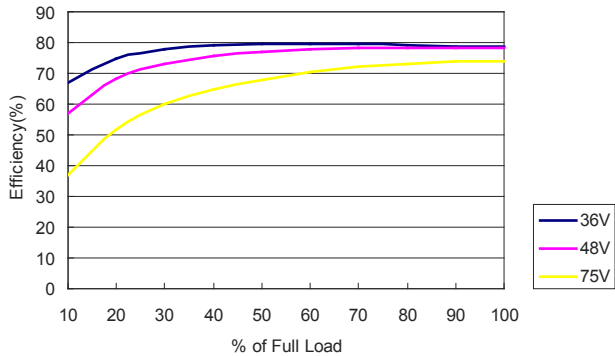
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



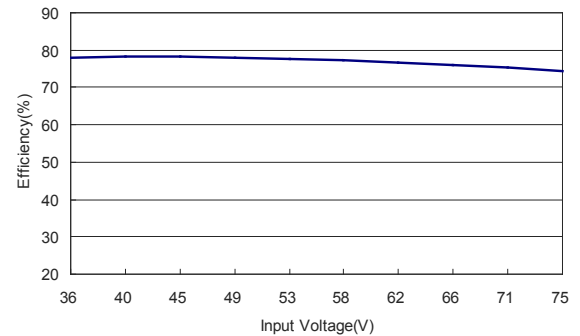
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

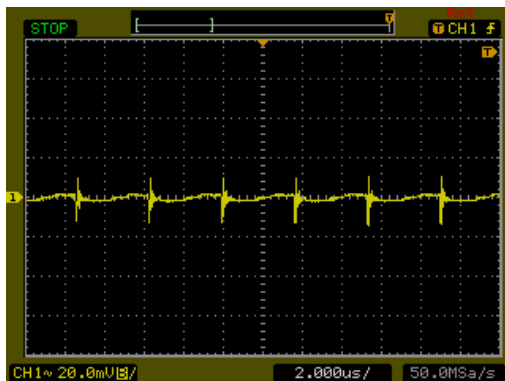
All test conditions are at 25°C The figures are identical for TMR 3-4810E



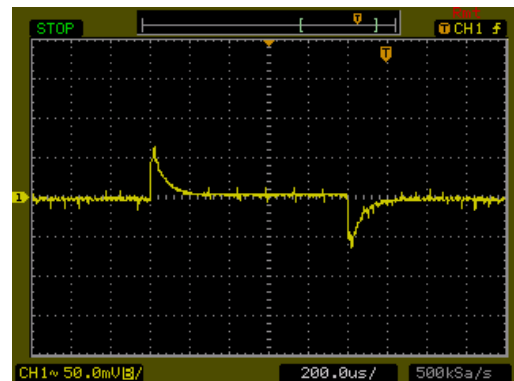
Efficiency Versus Output Current



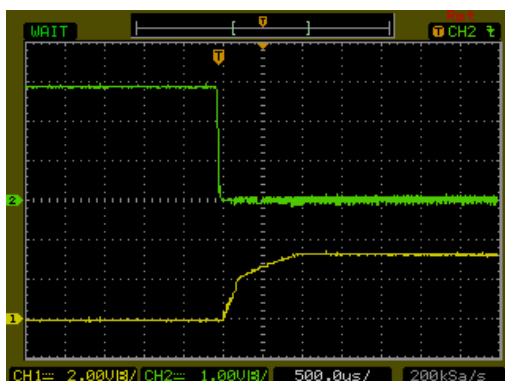
Efficiency Versus Input Voltage. Full Load



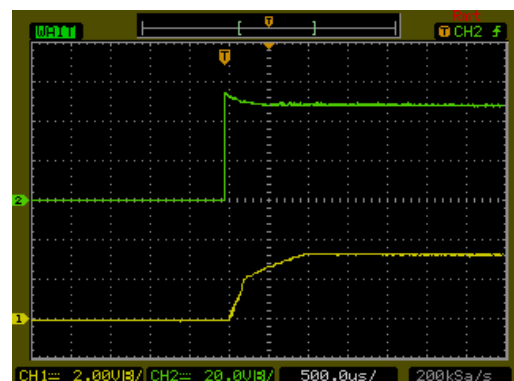
Typical Output Ripple and Noise.
 $V_{in} = V_{in\ nom}$; Full Load; T_A



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



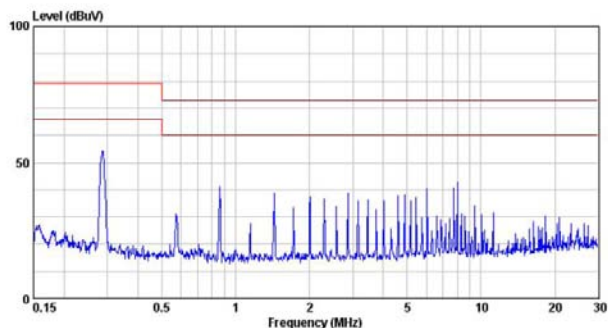
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load



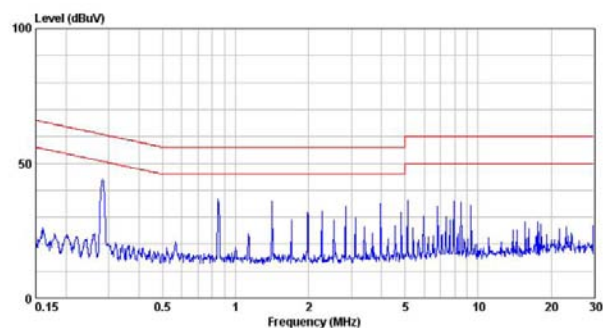
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

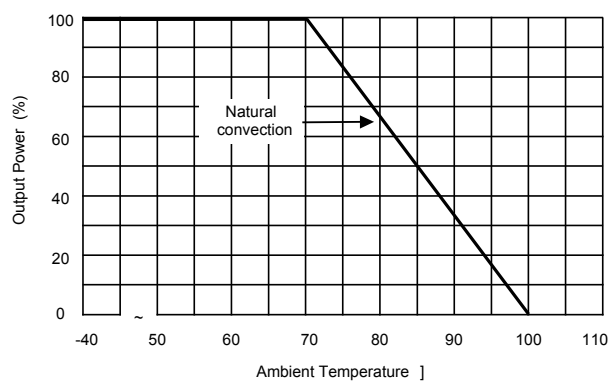
All test conditions are at 25°C The figures are identical for TMR 3-4810E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



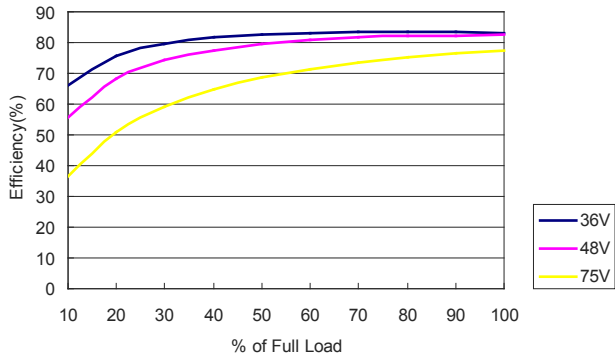
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



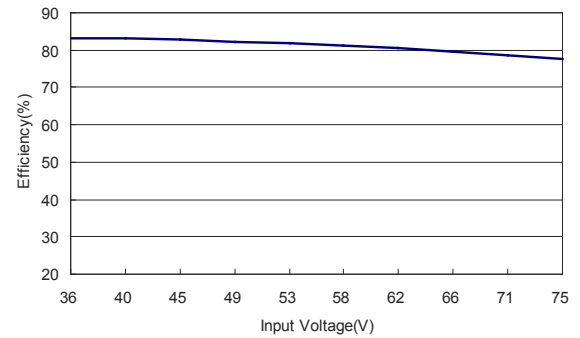
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

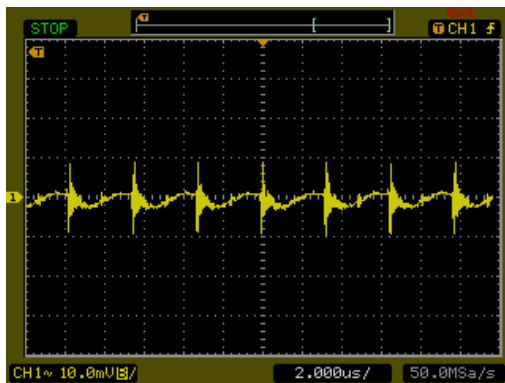
All test conditions are at 25°C The figures are identical for TMR 3-4811E



Efficiency Versus Output Current

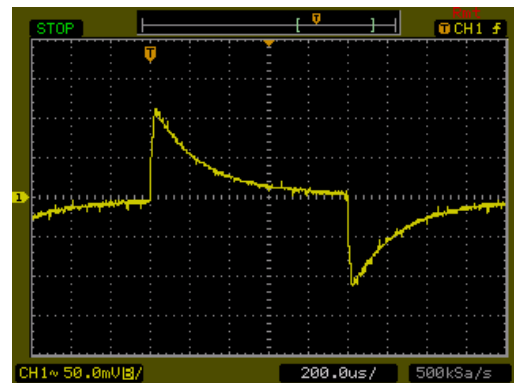


Efficiency Versus Input Voltage. Full Load



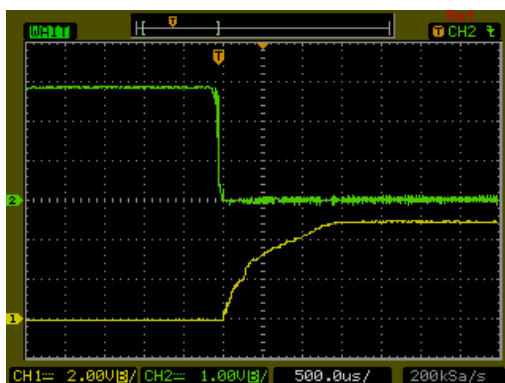
Typical Output Ripple and Noise.

$V_{in} = V_{in\ nom}$; Full Load; T_A



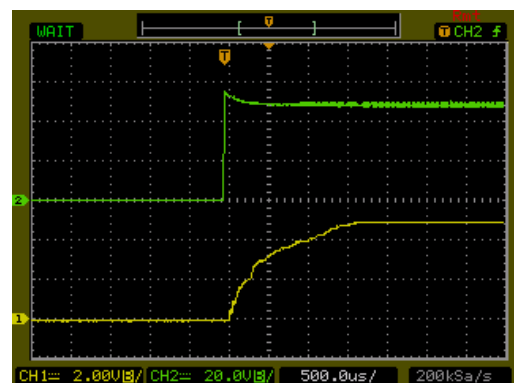
Transient Response to Dynamic Load Change from

100% to 75% of Full Load ; $V_{in} = V_{in\ nom}$



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\ nom}$; Full Load

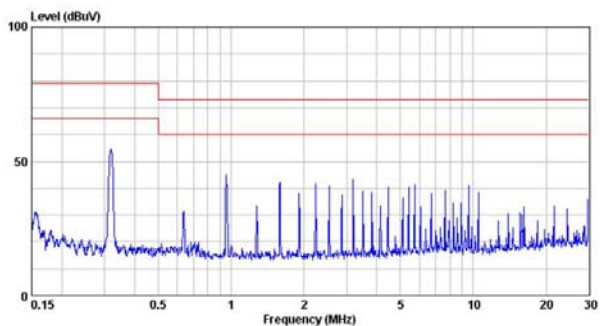


Typical Input Start-Up and Output Rise Characteristic

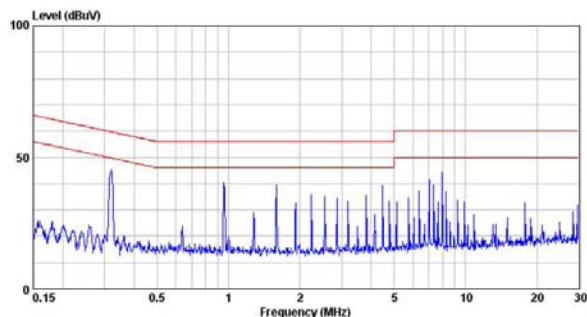
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

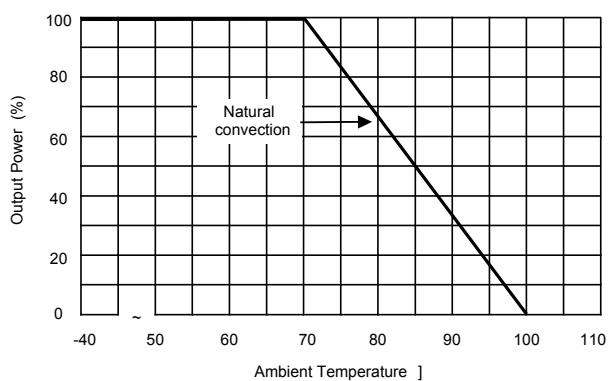
All test conditions are at 25°C The figures are identical for TMR 3-4811E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



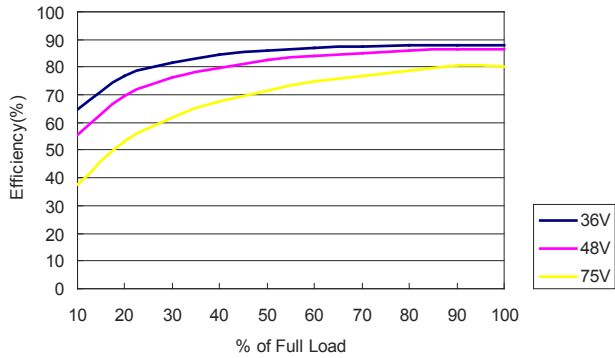
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



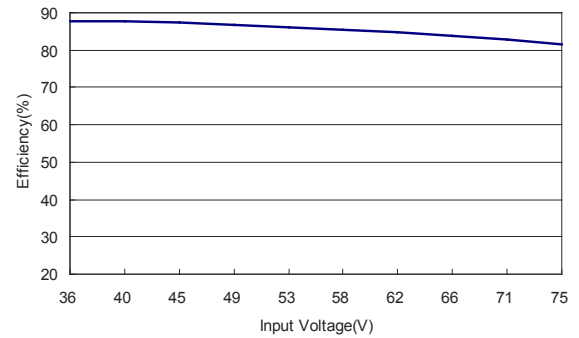
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

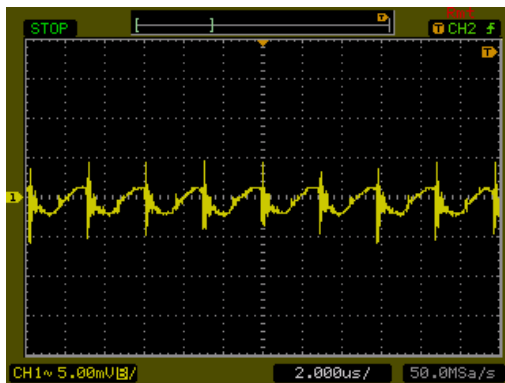
All test conditions are at 25°C The figures are identical for TMR 3-4812E



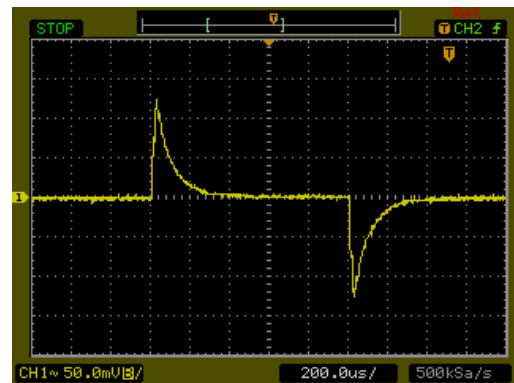
Efficiency Versus Output Current



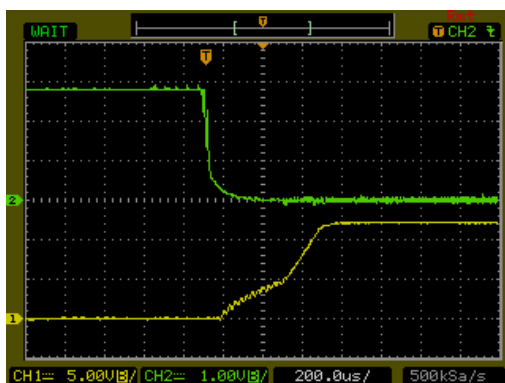
Efficiency Versus Input Voltage. Full Load



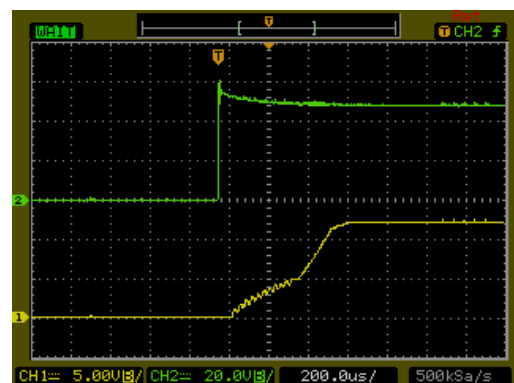
Typical Output Ripple and Noise.
 $V_{in} = V_{in nom}$; Full Load; T_A



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



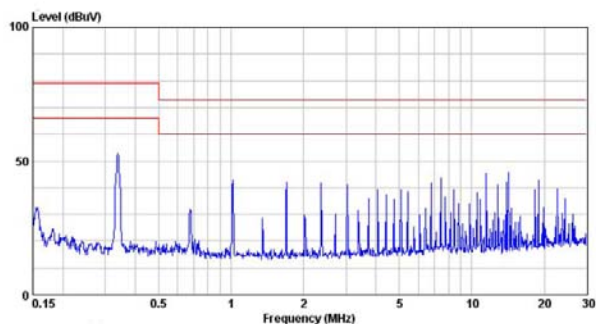
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load



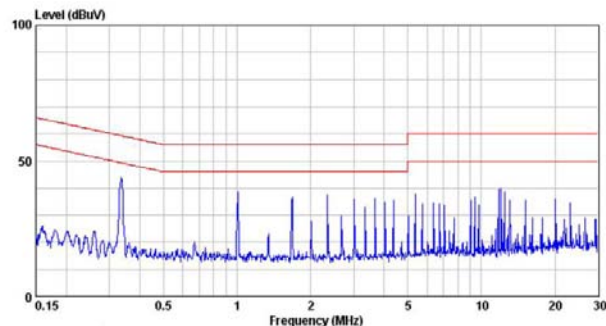
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load

Characteristic Curves

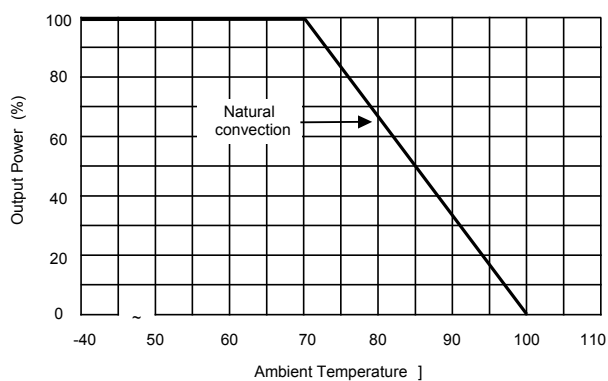
All test conditions are at 25°C The figures are identical for TMR 3-4812E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



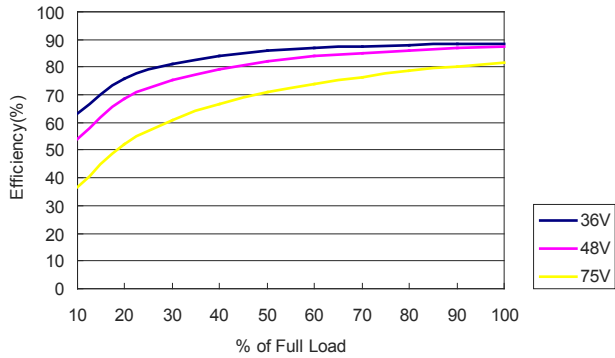
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



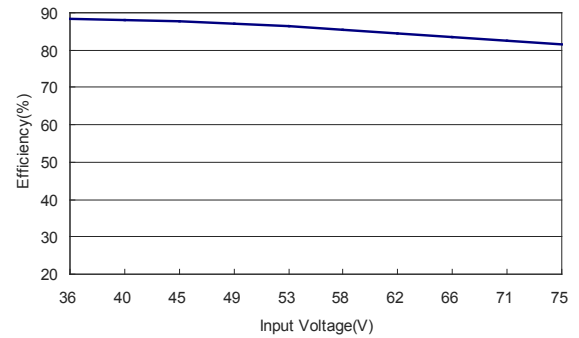
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

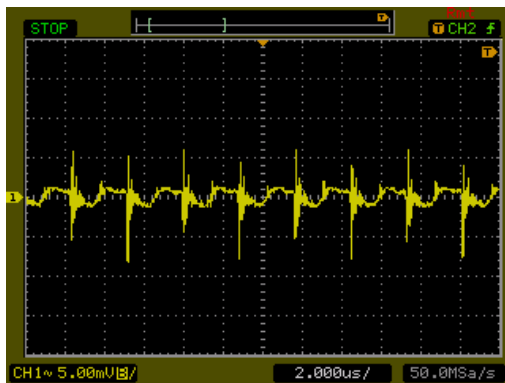
All test conditions are at 25°C The figures are identical for TMR 3-4813E



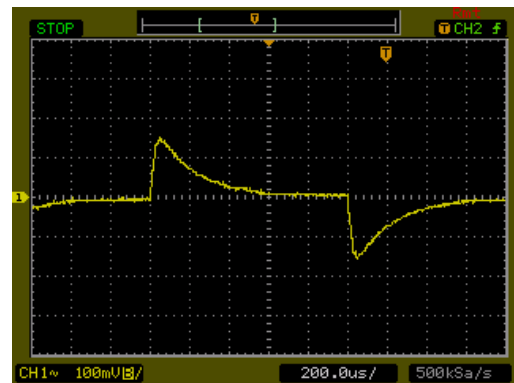
Efficiency Versus Output Current



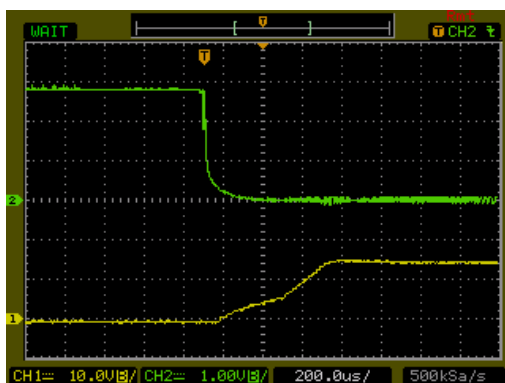
Efficiency Versus Input Voltage. Full Load



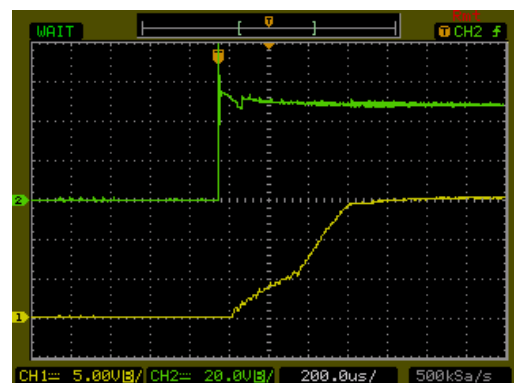
Typical Output Ripple and Noise.
 $V_{in} = V_{in\ nom}$; Full Load; T_A



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



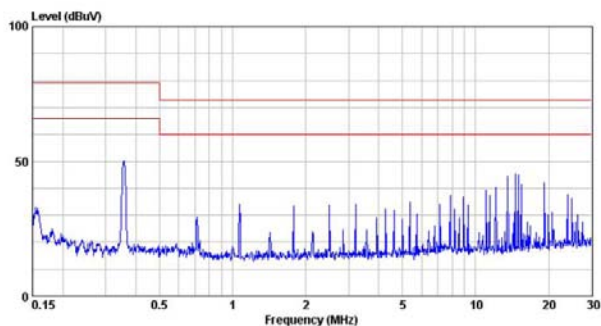
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load



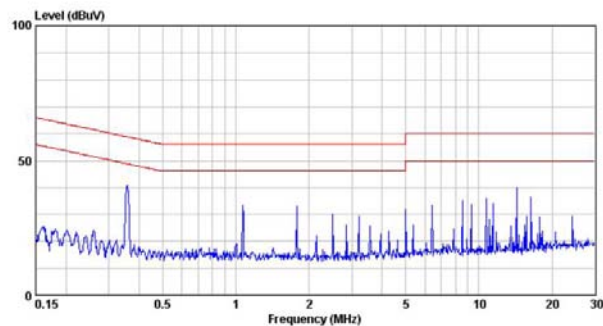
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

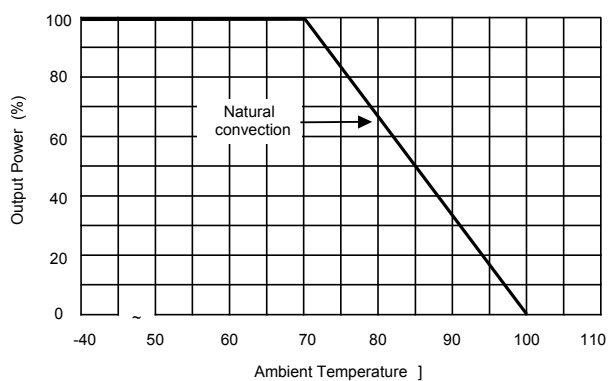
All test conditions are at 25°C The figures are identical for TMR 3-4813E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



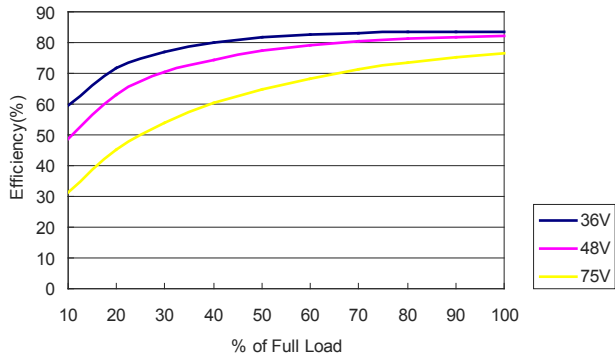
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



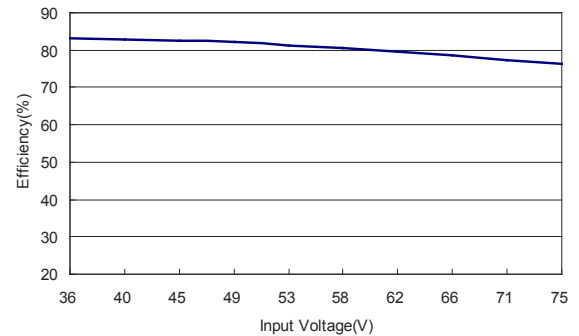
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

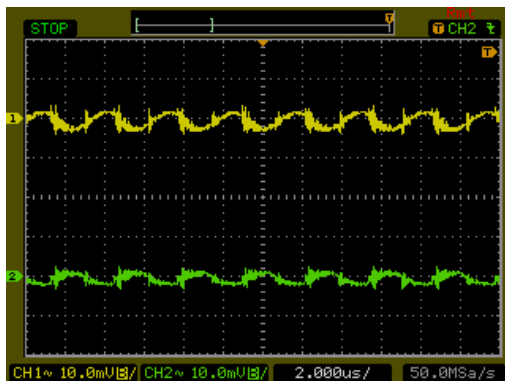
All test conditions are at 25°C The figures are identical for TMR 3-4821E



Efficiency Versus Output Current

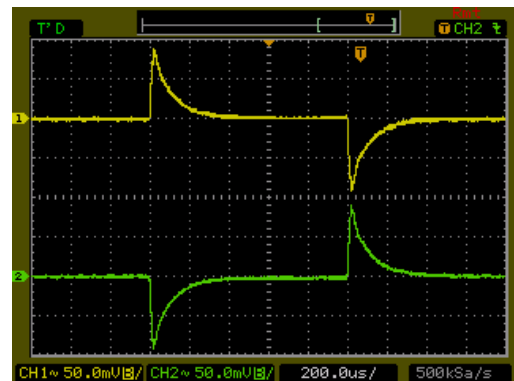


Efficiency Versus Input Voltage. Full Load



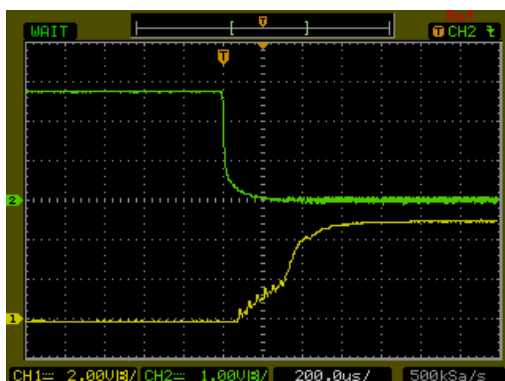
Typical Output Ripple and Noise.

$V_{in} = V_{in nom}$; Full Load; T_A



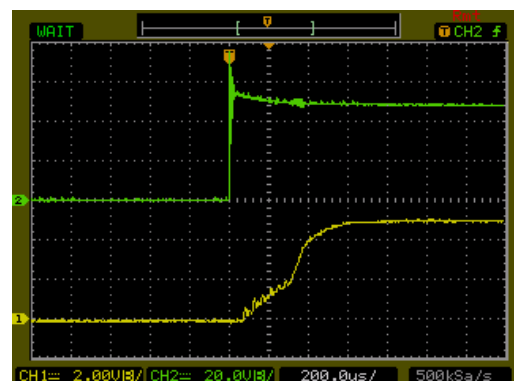
Transient Response to Dynamic Load Change from

100% to 75% of Full Load ; $V_{in} = V_{in nom}$



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in nom}$; Full Load

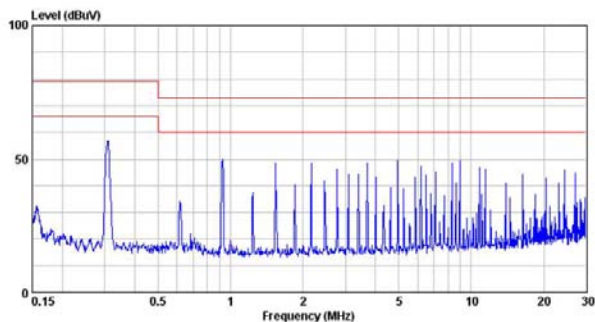


Typical Input Start-Up and Output Rise Characteristic

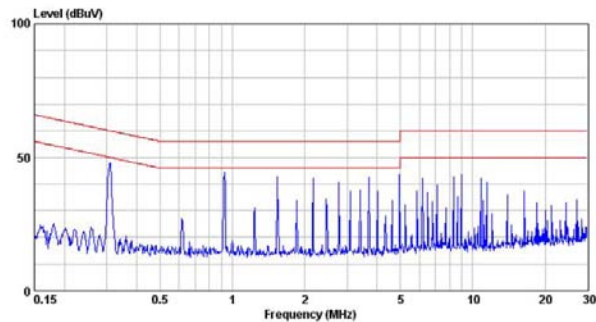
$V_{in} = V_{in nom}$; Full Load

Characteristic Curves

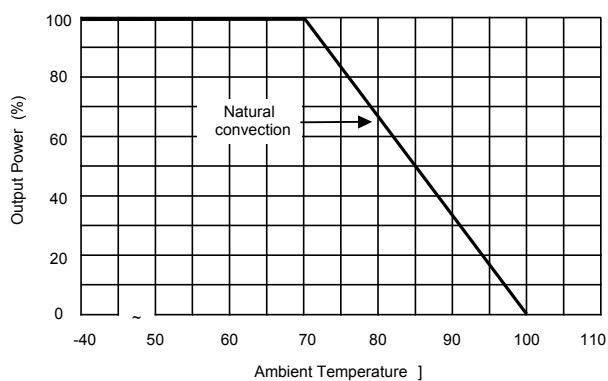
All test conditions are at 25°C The figures are identical for TMR 3-4821E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



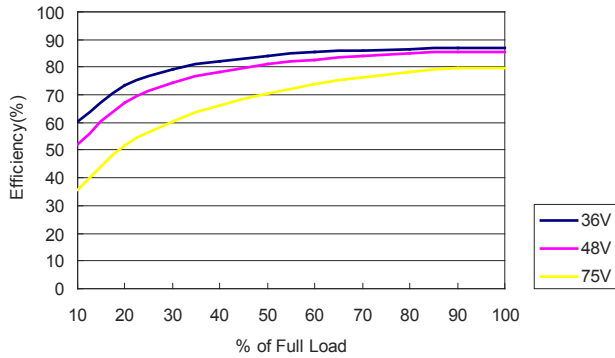
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



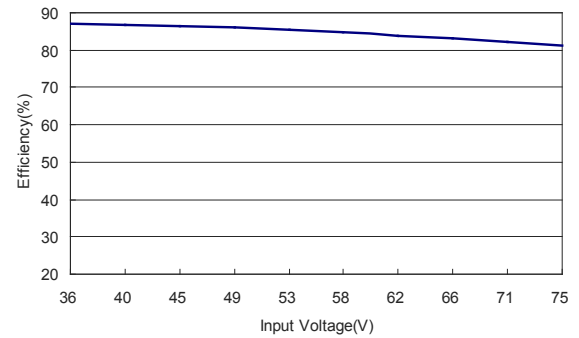
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

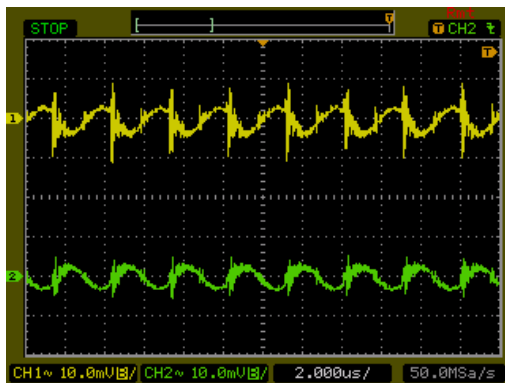
All test conditions are at 25°C The figures are identical for TMR 3-4822E



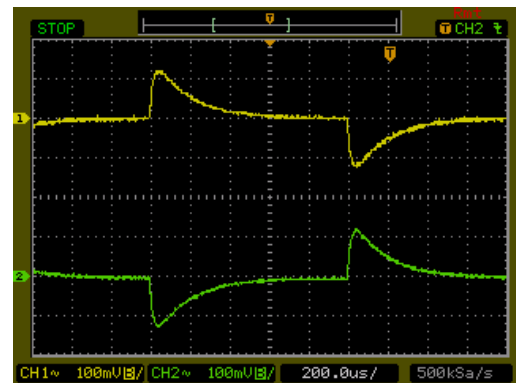
Efficiency Versus Output Current



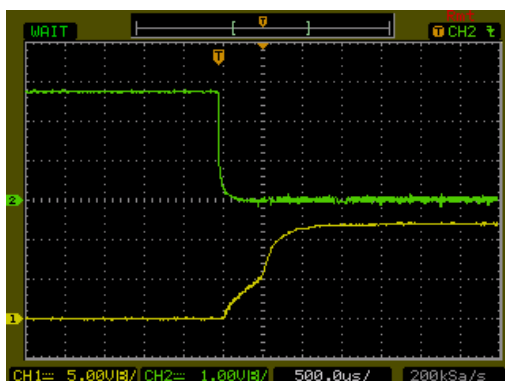
Efficiency Versus Input Voltage. Full Load



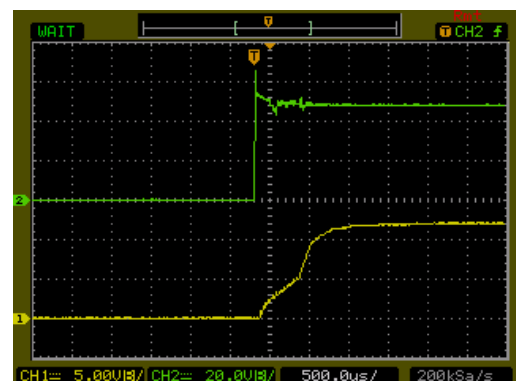
Typical Output Ripple and Noise.
 $V_{in} = V_{in nom}$; Full Load; T_A



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



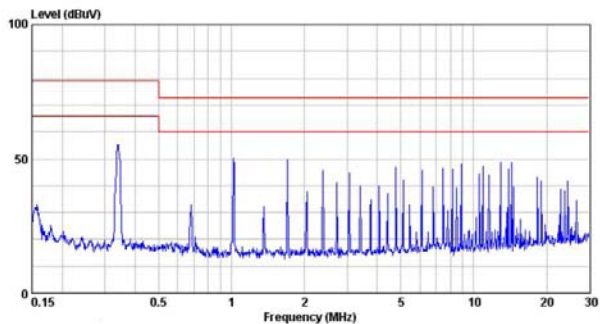
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load



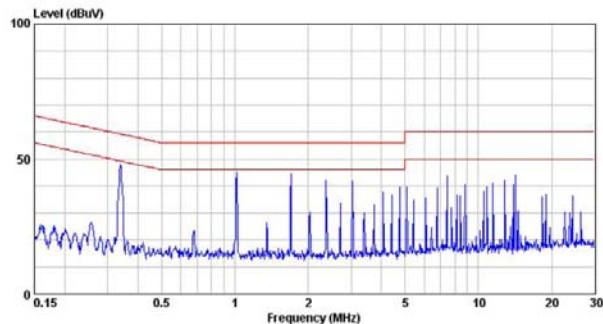
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load

Characteristic Curves

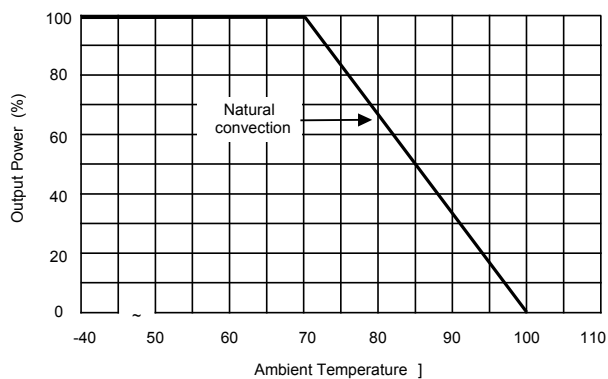
All test conditions are at 25°C The figures are identical for TMR 3-4822E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



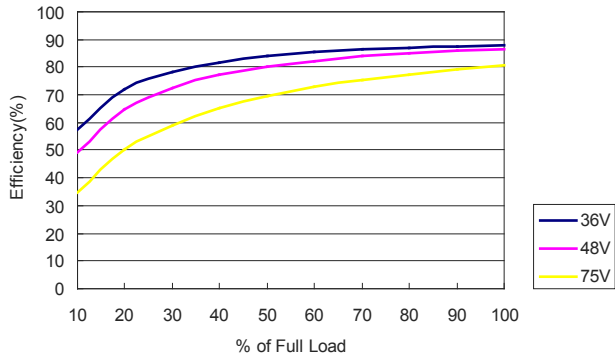
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



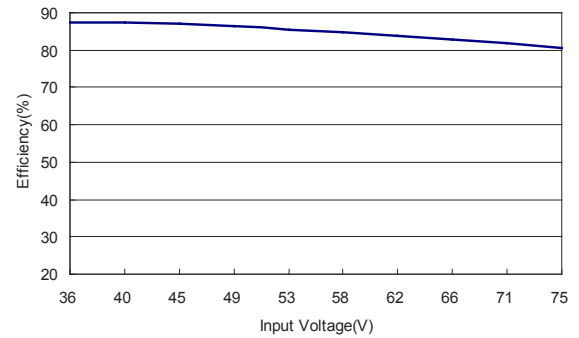
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in} = V_{in\ nom}$

Characteristic Curves

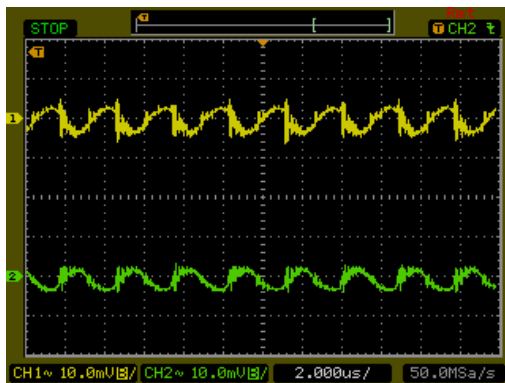
All test conditions are at 25°C The figures are identical for TMR 3-4823E



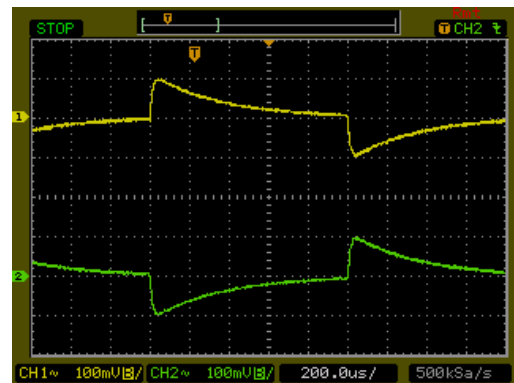
Efficiency Versus Output Current



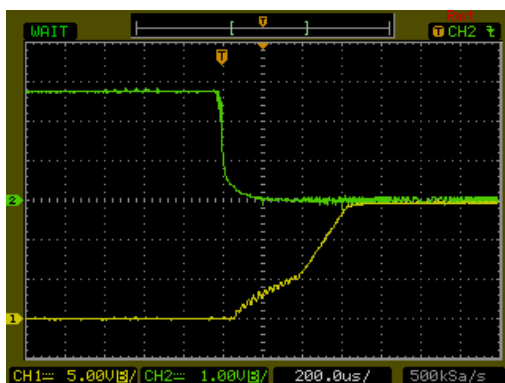
Efficiency Versus Input Voltage. Full Load



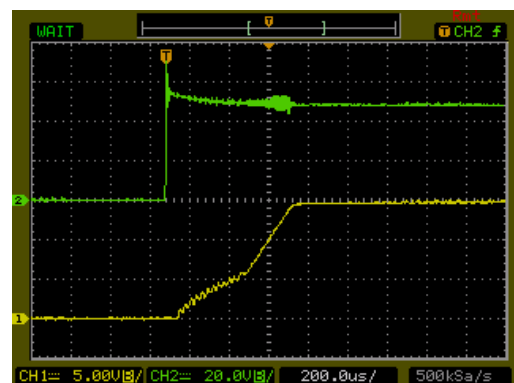
Typical Output Ripple and Noise.
 $V_{in} = V_{in nom}$; Full Load; T_A



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



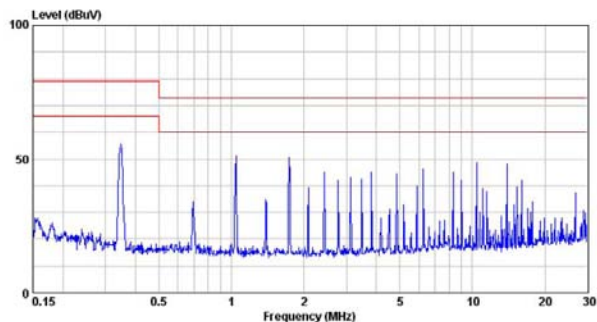
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load



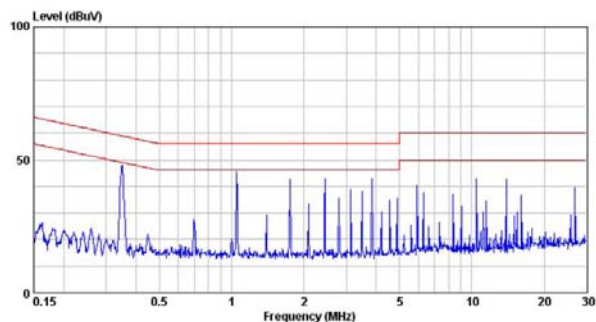
Typical Input Start-Up and Output Rise Characteristic
 $V_{in} = V_{in nom}$; Full Load

Characteristic Curves

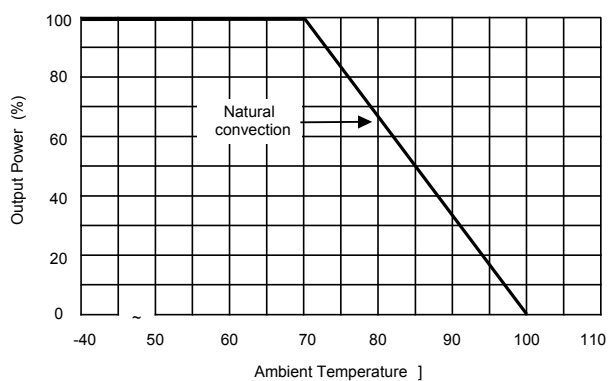
All test conditions are at 25°C The figures are identical for TMR 3-4823E (Continued)



Conduction Emission of EN55022 Class A
 $V_{in} = V_{in\ nom}$; Full Load



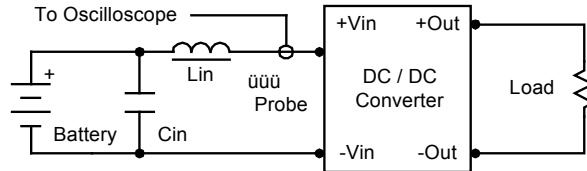
Conduction Emission of EN55022 Class B
 $V_{in} = V_{in\ nom}$; Full Load



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

Testing Configurations

Input reflected-ripple current measurement test up

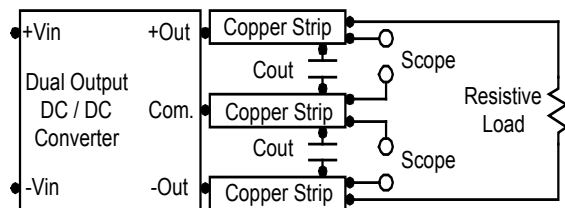
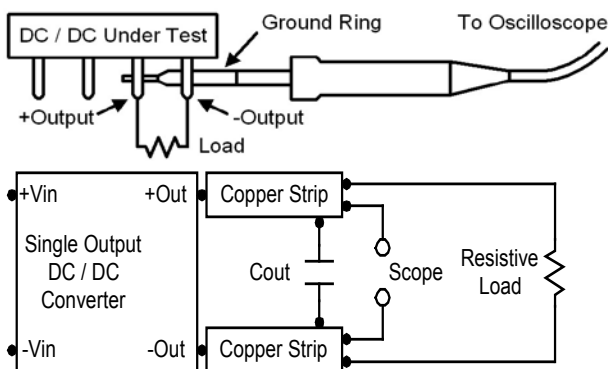


Input reflected-ripple current is measured with an inductor L_{in} ($4.7\mu H$) and C_{in} ($220\mu F$, $ESR < 1.0\Omega$ at 100 KHz) to simulate source impedance.

Capacitor C_{in} , offsets possible battery impedance.

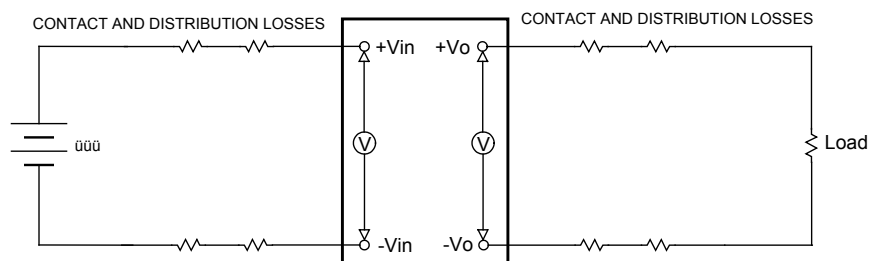
Current ripple is measured at the input terminals of the module, measurement bandwidth is $0\text{--}500\text{ KHz}$.

Peak-to-peak output ripple & noise measurement test up

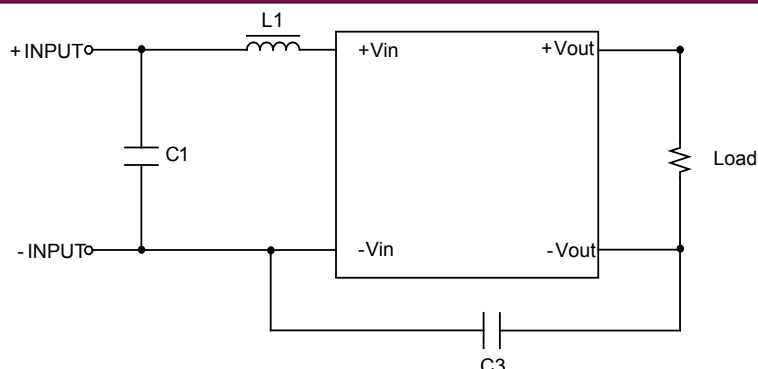


Output voltage and efficiency measurement test up

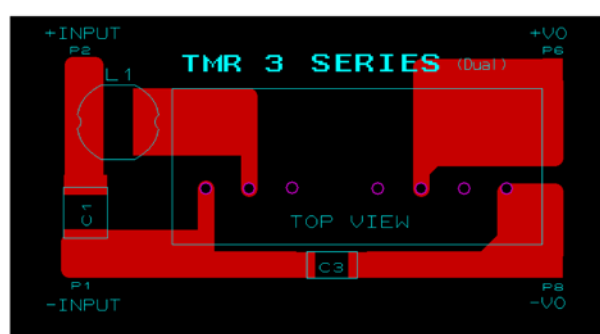
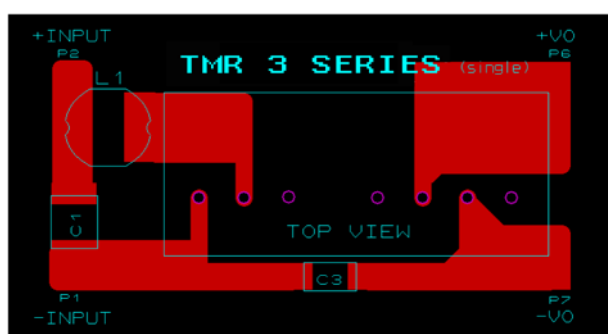
$$\text{Efficiency} = \left(\frac{V_{out} \times I_{out}}{V_{in} \times I_{in}} \right) \times 100\% = [\%]$$



EMC considerations



Suggested Schematic to comply with EN55022 Conducted Noise Class A

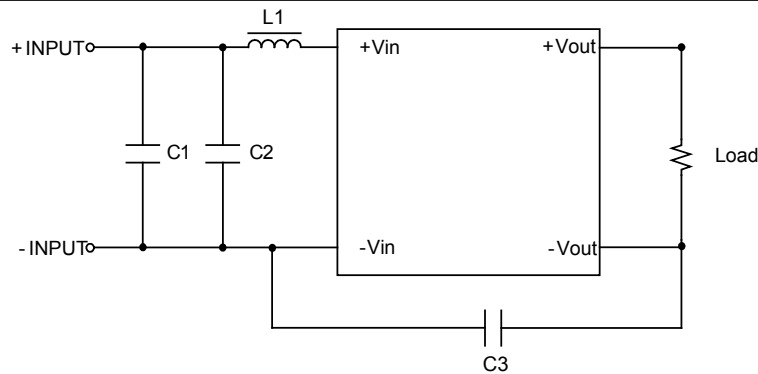


Recommended PCB Layout with Input Filter

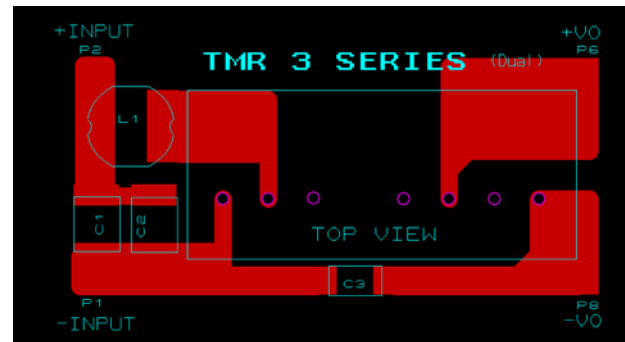
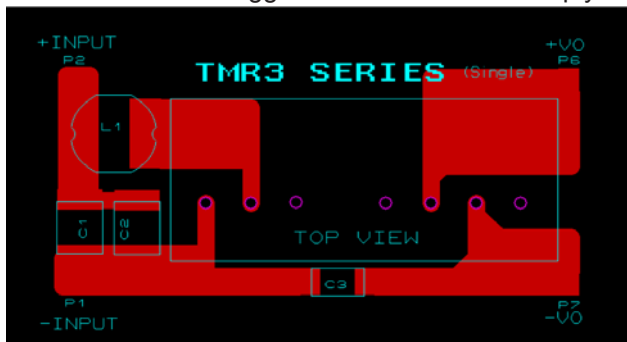
To comply with conducted noise according to EN55022 CLASS A following components are required:

Model	Component	Value
TMR 3-05XXE	C1	10 μ F/25V 1206 X7R
	C3	470pF/2KV 1808 X7R
	L1	3.3 μ H SCD0403T/2A
TMR 3-12XXE	C1	4.7 μ F /25V 1206 X7R
	C3	470pF/2KV 1808 X7R
	L1	3.3 μ H SCD0403T/2A
TMR3-24XXE	C1	4.7 μ F /50V 1812 X7R
	C3	470pF/2KV 1808 X7R
	L1	12 μ H SR0302T/0.75A
TMR 3-48XXE	C1	1 μ F /100V 1812 X7R
	C3	470pF/2KV 1808 X7R
	L1	88 μ H SCD0403T/1.42A

EMC Considerations (Continued)



Suggested Schematic to comply with EN55022 Conducted Noise Class B



Recommended PCB Layout with Input Filter

To comply with conducted noise according to EN55022 CLASS B following components are required:

Model	Component	Value
TMR 3-05XXE	C1&C2	10 μ F/25V 1210 X7R
	C3	2200pF/2KV 1808 X7R
	L1	3.3 μ H SCD0403T/2A
TMR 3-12XXE	C1&C2	10 μ F/25V 1210 X7R
	C3	2200pF/2KV 1808 X7R
	L1	3.3 μ H SCD0403T/2A
TMR 3-24XXE	C1	10 μ F/50V 2220 X7R
	C3	1000pF/2KV 1808 X7R
	L1	27 μ H SCD0403T/0.71A
TMR 3-48XXE	C1	4.7 μ F/100V 2220 X7R
	C3	1000pF/2KV 1808 X7R
	L1	88 μ H SCD0403T/1.42A

Input Source Impedance

The power module should be connected to a low impedance input source. Highly inductive source impedance can affect the stability of the power module. Input external L-C filter is recommended to minimize input reflected ripple current. The inductor is simulated source impedance of 12 μ H and capacitor is Nippon chemi-con 47 μ F/100V. The capacitor must as close as possible to the input terminals of the power module for lower impedance.

Output Over Current 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.

Short Circuitry Protection

Continuous, hiccup and auto-recovery mode.

During short circuit, converter still shut down, The average current during this condition will be very low and the device will be safe in this condition.

Remote ON/OFF Control

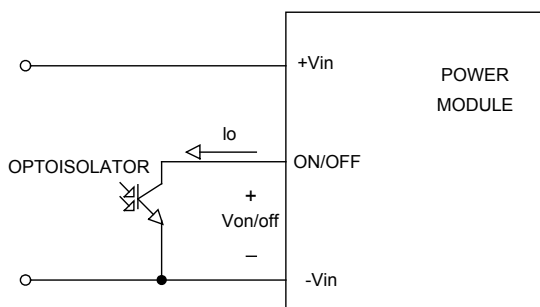
The positive logic remote ON/OFF control circuit is included.

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.

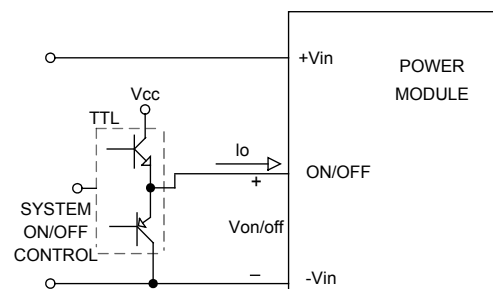
The negative logic remote ON/OFF control circuit is included.

Turns the module ON during logic Low on the On/Off pin and turns OFF during logic High. The On/Off pin is an open collector/drain logic input signal (Von/off) that referenced to GND. If not using the remote on/off feature. Please short circuit between on/off pin and -Vin pin to turn the module on.

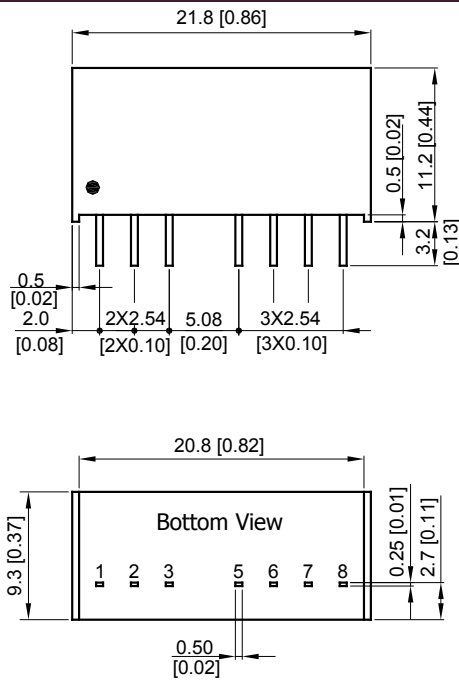
Remote ON/OFF implementation



Isolated-Closure Remote ON/OFF



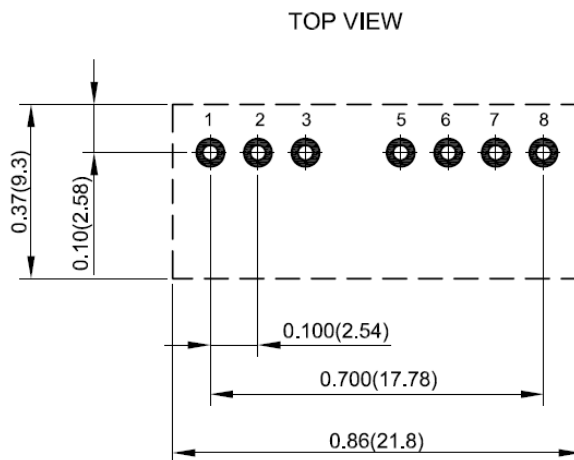
Level Control Using TTL Output

Mechanical Dimensions

Pin Connections

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

NC: No Connection

1. All dimensions in mm (inches)
Tolerance: X.X±0.25 (X.XX±0.01")
X.XX±0.13 (X.XXX±0.005")
2. Pin pitch tolerance: ±0.25 (±0.01")
3. Pin dimension tolerance: ±0.1 (±0.004")

Recommended Pad Layout for Single & Dual Output Converter


1. All Dimensions in Inches (mm)
Tolerance: x.xx ±0.02" (x.x ±0.5mm)
x.xxx ±0.01" (x.xx ±0.25mm)
2. Pin Pitch Tolerance: ±0.01" (±0.25mm)
3. Pin Dimension Tolerance: ±0.004" (±0.1mm)

PAD SIZE (LEAD FREE RECOMMENDED)

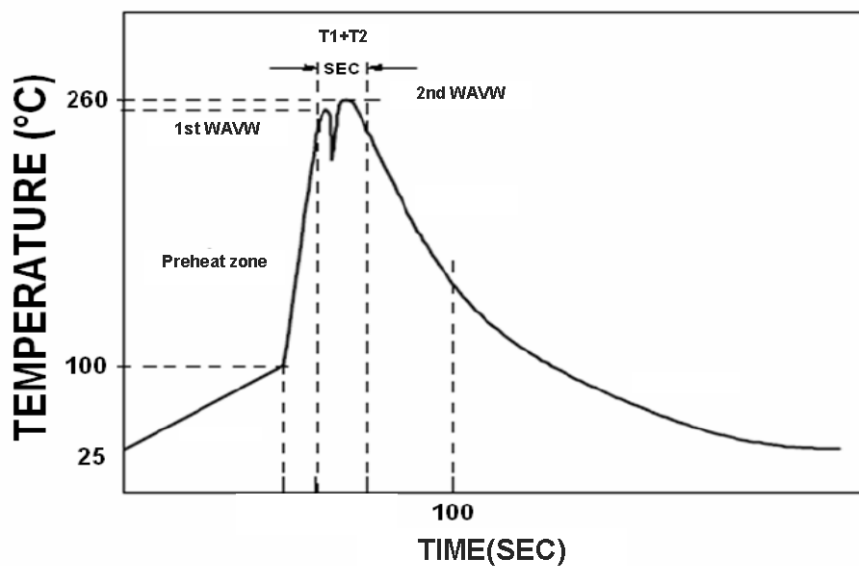
PIN THROUGH HOLE: ∅0.031in (0.8mm)

TOP VIEW PAD: ∅0.059in (1.5mm)

BOTTOM VIEW PAD: ∅0.071in (1.8mm)

Soldering and Reflow Considerations

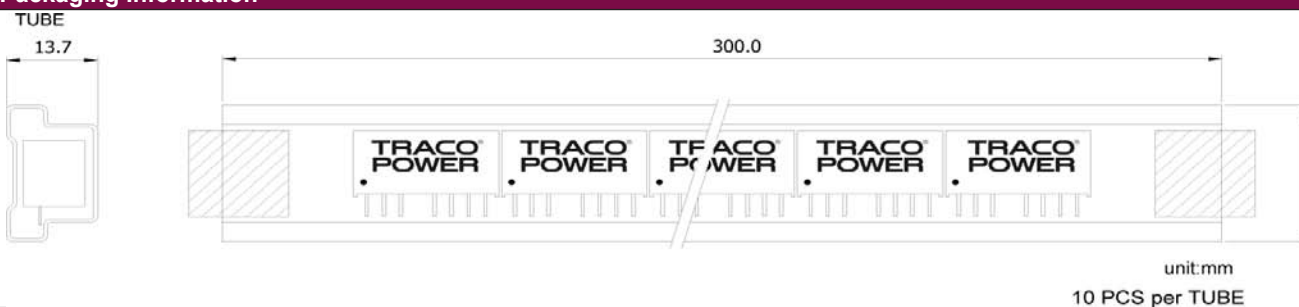
Lead free wave solder profile for TMR 3E Series



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

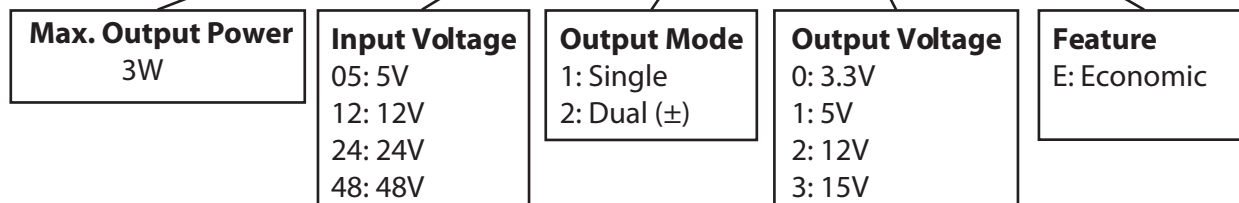
Reference Solder: Sn-Ag-Cu : Sn-Cu : Sn-Ag
 Hand Welding: Soldering iron : Power 60W
 Welding Time: 2~4 sec
 Temp.: 380~400°C

Packaging Information



Part Number Structure

TMR 3-2413E



Model Number	Input Range (VDC)	Output Voltage (VDC)	Max. Output Current (mA)	Input Current at Full Load ⁽¹⁾ (mA)	Efficiency ⁽²⁾ (%)
TMR 3-0510E	4.5-9	3.3	700	651	71
TMR 3-0511E	4.5-9	5	600	822	73
TMR 3-0512E	4.5-9	12	250	759	79
TMR 3-0513E	4.5-9	15	200	759	79
TMR 3-0521E	4.5-9	±5	±300	811	74
TMR 3-0522E	4.5-9	±12	±125	759	79
TMR 3-0523E	4.5-9	±15	±100	759	79
TMR 3-1210E	9-18	3.3	700	257	75
TMR 3-1211E	9-18	5	600	321	78
TMR 3-1212E	9-18	12	250	301	83
TMR 3-1213E	9-18	15	200	301	83
TMR 3-1221E	9-18	±5	±300	316	79
TMR 3-1222E	9-18	±12	±125	301	83
TMR 3-1223E	9-18	±15	±100	301	83
TMR 3-2410E	18-36	3.3	700	128	75
TMR 3-2411E	18-36	5	600	160	78
TMR 3-2412E	18-36	12	250	151	83
TMR 3-2413E	18-36	15	200	151	83
TMR 3-2421E	18-36	±5	±300	156	80
TMR 3-2422E	18-36	±12	±125	151	83
TMR 3-2423E	18-36	±15	±100	151	83
TMR 3-4810E	36-75	3.3	700	64	75
TMR 3-4811E	36-75	5	600	80	78
TMR 3-4812E	36-75	12	250	75	83
TMR 3-4813E	36-75	15	200	75	83
TMR 3-4821E	36-75	±5	±300	78	80
TMR 3-4822E	36-75	±12	±125	75	83
TMR 3-4823E	36-75	±15	±100	75	83

Note 1. Maximum value at nominal input voltage and full load of standard type.

Note 2. Typical value at nominal input voltage and full load.

Safety and Installation Instruction**Fusing Consideration**

Caution: This power module is not internally fused. An input line fuse must always be used.

This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture. To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse. The safety agencies require a normal-blow fuse in 5Vin with maximum rating of 2A, in 12Vin with maximum rating of 1A, in 24Vin with maximum rating of 500mA and in 48Vin with maximum rating of 250mA. Based on the information provided in this data sheet on Inrush energy and maximum dc input current; the same type of fuse with lower rating can be used. Refer to the fuse manufacturer's data for further information.

MTBF and Reliability

The MTBF of TMR 3E series of DC/DC converters has been calculated using MIL-HDBK 217F NOTICE2, Operating Temperature 25°C, Ground Benign.

TMR 3-0510E: MTBF=1,235,483 Hours
TMR 3-0511E: MTBF=1,352,265 Hours
TMR 3-0512E: MTBF=1,402,525 Hours
TMR 3-0513E: MTBF=1,379,310 Hours
TMR 3-0521E: MTBF=1,235,483 Hours
TMR 3-0522E: MTBF=1,413,627 Hours
TMR 3-0523E: MTBF=1,393,146 Hours
TMR 3-1210E: MTBF=1,219,363 Hours
TMR 3-1211E: MTBF=1,352,265 Hours
TMR 3-1212E: MTBF=1,382,361 Hours
TMR 3-1223E: MTBF=1,379,310 Hours
TMR 3-1221E: MTBF=1,219,363 Hours
TMR 3-1222E: MTBF=1,393,146 Hours
TMR 3-1223E: MTBF=1,373,249 Hours
TMR 3-2410E: MTBF=1,211,534 Hours
TMR 3-2411E: MTBF=1,324,153 Hours
TMR 3-2412E: MTBF=1,372,495 Hours
TMR 3-2413E: MTBF=1,369,488 Hours
TMR 3-2421E: MTBF=1,211,534 Hours
TMR 3-2422E: MTBF=1,383,126 Hours
TMR 3-2423E: MTBF=1,383,126 Hours
TMR 3-4810E: MTBF=1,203,659 Hours
TMR 3-4811E: MTBF=1,314,924 Hours
TMR 3-4812E: MTBF=1,362,769 Hours
TMR 3-4813E: MTBF=1,359,804 Hours
TMR 3-4821E: MTBF=1,203,659 Hours
TMR 3-4822E: MTBF=1,373,249 Hours
TMR 3-4223E: MTBF=1,373,249 Hours

Specifications can be changed without notice