ISOLATED DC-DC Converter
EC7A SERIES
APPLICATION NOTE

Approved By:

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Content

EC7A 10W Isolated DC-DC Converters

Application Note V10 April 2010

1. Introduction

The EC7A series offer 10 watts of output power in a 24 pin DIP and SMD copper package. The EC7A series has a 2:1 wide input voltage range of 9-18VDC, 18-36VDC and 36-75VDC, and provides a precisely regulated output. This series has features such as high efficiency, 1500VDC of isolation and allows an ambient operating temperature range of –40℃ to 85℃ (de-rating abov e 71 ℃). The modules are fully protected against input UVLO (under voltage lock out), output short circuit and output overvoltage conditions. All models are very suitable for distributed power architectures, telecommunications, battery operated equipment and industrial applications.

2. DC-DC Converter Features

*10W Isolated Output
* DIP-24 / SMD Metal Package
* Efficiency Up to 89%
* 2 : 1 Input Range
* Regulated Outputs
* PI Input Filter
* Continuous Short Circuit Protection
* No Tantalum Capacitor Inside
* CE Mark Meets 2004/108/EC
* UL60950-1 Approval

3. Electrical Block Diagram

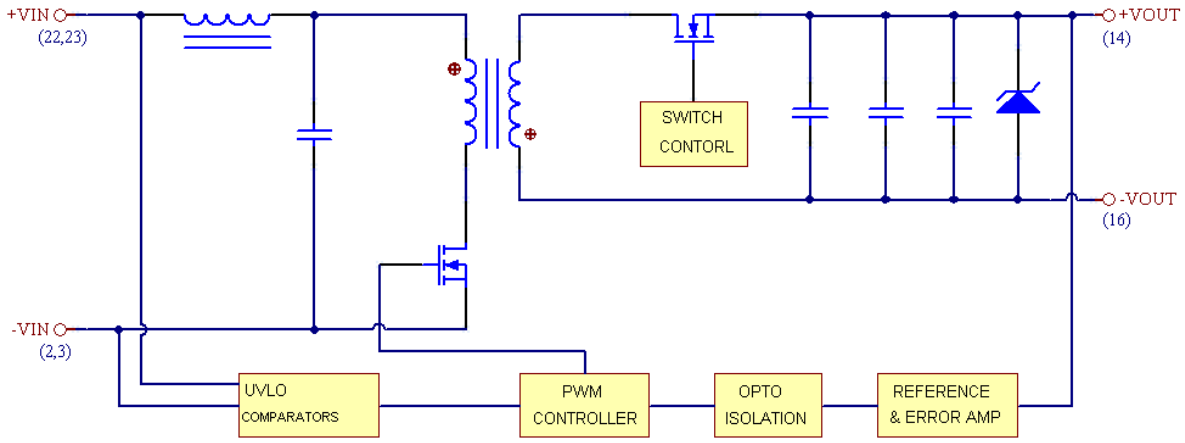


Figure 1 Electrical Block Diagram of single output module

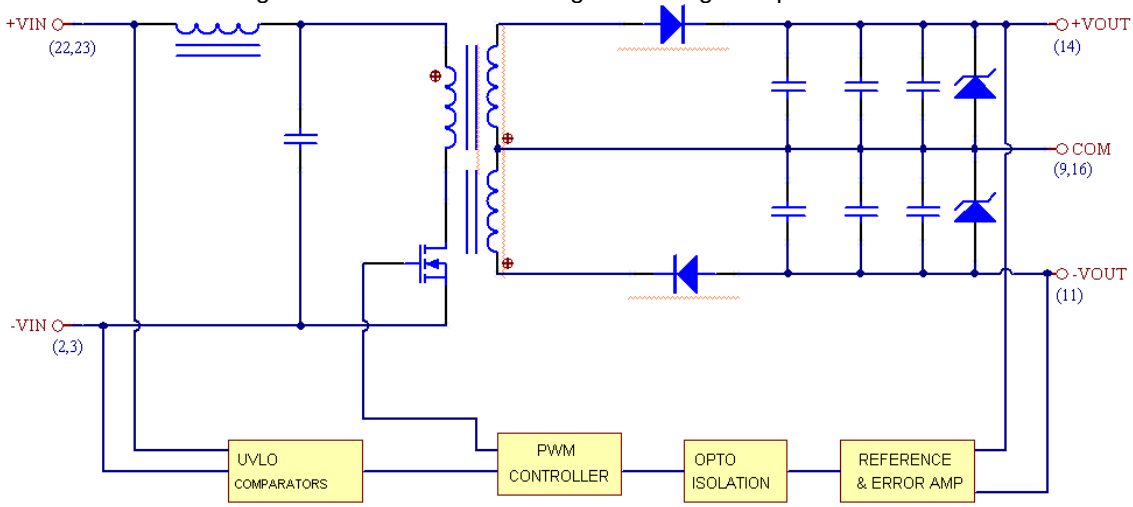


Figure 2 Electrical Block Diagram of dual output module

4. Technical Specifications

(All specifications are typical at nominal input, full load at 25℃ unless otherwise noted.)

ABSOLUTE MAXIMUM RATINGS						
PARAMETER	**NOTES and CONDITIONS**	Device	Min.	Typical	Max.	Units
Input Voltage						
Continuous		12Vin	9	12	18	Vdc
		24Vin	18	24	36	
		48Vin	36	48	75	
Transient	100ms	12Vin			25	Vdc
		24Vin			50	
		48Vin			100	
Operating Ambient Temperature	With de-rating, above 71℃	All	-40		+85	℃
Case Temperature		All			100	℃
Storage Temperature		All	-40		+125	℃
Input/Output Isolation Voltage	1 minute	All			1500	Vdc
INPUT CHARACTERISTICS						
PARAMETER	**NOTES and CONDITIONS**	Device	Min.	Typical	Max.	Units
Operating Input Voltage		12Vin	9	12	18	Vdc
		24Vin	18	24	36	
		48Vin	36	48	75	
Turn-On Voltage Threshold		12Vin	8	8.5	8.8	Vdc
		24Vin	16.5	17	17.5	
		48Vin	33	34	34.5	
Turn-Off Voltage Threshold		12Vin	7.7	8	8.3	Vdc
		24Vin	15.5	16	16.5	
		48Vin	31.5	32.5	33	
Lockout Hysteresis Voltage		12Vin		0.6		
		24Vin		0.9		
		48Vin		1.8		
Maximum Input Current	100% Load, Vin= 9V	12Vin		1000		mA
	100% Load, Vin=18V	24Vin		500		
	100% Load, Vin=36V	48Vin		250		
No-Load Input Current	Vin=12V	12S25		40		mA
		12S33		50		
		12S05		60		
		12S12		40		
		12S15		40		
		12D12		30		
		12D15		30		
	Vin=24V	24S25		30		
		24S33		30		
		24S05		30		
		24S12		30		
		24S15		30		
		24D12		20		
		24D15		20		
	Vin=48V	48S25		15		
		48S33		15		
		48S05		15		
		48S12		15		
		48S15		15		
		48D12		10		
		48D15		10		

Inrush Current (I^2t)		All			0.01	A^2s
Input Reflected-Ripple Current	P-P thru 1uH inductor, 5Hz to 20MHz	All		30		mA
OUTPUT CHARACTERISTIC						
PARAMETER	**NOTES and CONDITIONS**	Device	Min.	Typical	Max.	Units
Output Voltage Set Point	Vin=nominal input, Io= $Io_{max.}$	Vo=2.5Vdc Vo=3.3Vdc Vo=5Vdc Vo=12Vdc Vo=15Vdc Vo=±12Vdc Vo=±15Vdc	2.4625 3.2505 4.925 11.82 14.775 ±11.82 ±14.775	2.5 3.3 5 12 15 ±12 ±15	2.5375 3.3495 5.075 12.18 15.225 ±12.18 ±15.225	Vdc
Output Voltage Balance	Vin=nominal input, Io=$Io_{max.}$	Dual			±2.0	%
Output Voltage Regulation						
Load Regulation	Io=full load to 10% load	Single(DIP) Single(SMD) Dual			±0.5 ±1.0 ±1.0	%
Line Regulation	Vin=low line to high line, full load	Single Dual			±0.2 ±0.5	%
Temperature Coefficient	Ta=-40℃ to 85℃				±0.05	%/℃
Output Voltage Ripple and Noise (5Hz to 20MHz bandwidth)						
Peak-to-Peak	Full Load, 0.1uF ceramic capacitor	Vo=2.5Vdc Vo=3.3Vdc Vo=5Vdc Vo=12Vdc Vo=15Vdc Vo=±12Vdc Vo=±15Vdc			75 100 	mV
Operating Output Current Range		Vo=2.5Vdc Vo=3.3Vdc Vo=5Vdc Vo=12Vdc Vo=15Vdc Vo=±12Vdc Vo=±15Vdc	0 0 0 0 0 0 0		3000 3000 2000 835 666 ±416 ±333	mA
Output DC Current-Limit Inception	Vo=90% $V_{O, nominal}$		120			%
Maximum Output Capacitance	Full load (resistive)	Vo=2.5Vdc Vo=3.3Vdc Vo=5Vdc Vo=12Vdc Vo=15Vdc Vo=±12Vdc Vo=±15Vdc			3000 3000 2000 835 666 416 333	uF
DYNAMIC CHARACTERISTICS						
PARAMETER	**NOTES and CONDITIONS**	Device	Min.	Typical	Max.	Units
Output Voltage Current Transient						
Step Change in Output Current	75% to 100% of Io.max	All			±5	%
Setting Time (within 1% Vout nominal)	di/dt=0.1A/us	All			300	us
Turn-On Delay and Rise Time						
Turn-On Delay Time, From Input	Vin,min. to 10%Vo,set	24(48)S25 (33)		1		ms
		24(48)S05 (12)		2		ms
		others		5		ms

Output Voltage Rise Time	10%Vo,set to 90%Vo,set	24(48)S25 (33)		110		ms
		24(48)S05 (12)		65		ms
		others		5		ms
EFFICIENCY						
PARAMETER	**NOTES and CONDITIONS**	Device	Min.	Typical	Max.	Units
100% Load	Vin=12V	12S25		85		%
		12S33		85		
		12S05		88		
		12S12		88		
		12S15		88		
		12D12		87		
		12D15		86		
	Vin=24V	24S25		85		
		24S33		86		
		24S05		88		
		24S12		89		
		24S15		88		
		24D12		89		
		24D15		87		
	Vin=48V	48S25		85		
		48S33		85		
		48S05		88		
		48S12		89		
		48S15		88		
		48D12		88		
		48D15		86		
ISOLATION CHARACTERISTICS						
PARAMETER	**NOTES and CONDITIONS**	Device	Min.	Typical	Max.	Units
Isolation Voltage	Input to Output, 1 minutes	All			1500	Vdc
Isolation Resistance	Input to Output	All			1000	MΩ
Isolation Capacitance	Input to Output	All		1000		pF
FEATURE CHARACTERISTICS						
PARAMETER	**NOTES and CONDITIONS**	Device	Min.	Typical	Max.	Units
Switching Frequency		All		380		KHz
Output Over Voltage Protection	Zener or TVS Clamp	Vo=2.5V		3.9		V
		Vo=3.3V		3.9		
		Vo=5.0V		6.2		
		Vo=12V		15		
		Vo=15V		18		
GENERAL SPECIFICATIONS						
PARAMETER	**NOTES and CONDITIONS**	Device	Min.	Typical	Max.	Units
MTBF	Io=100% of Io.max; Ta=25℃ per MIL-HDBK-217F	ALL		1.15		M hours
Weight		ALL		18.4		grams

5. Main Features and Functions

5.1 Operating Temperature Range

The EC7A series converters can be operated by a wide ambient temperature range from -40℃ to 85℃ (de-rating above 71℃). The standard model has a copper case and case temperature can not over 100℃ at normal operating.

5.2 UVLO (Under Voltage Lock Out)

Input under voltage lockout is standard on the EC7A unit. The unit will shut down when the input voltage drops below a threshold, and the unit will operate when the input voltage goes above the upper threshold.

5.3 Over Current Protection

All models have internal over current and continuous short circuit protection. The unit operates normally once the fault condition is removed. At the point of current limit inception, the converter will go into hiccup mode protection.

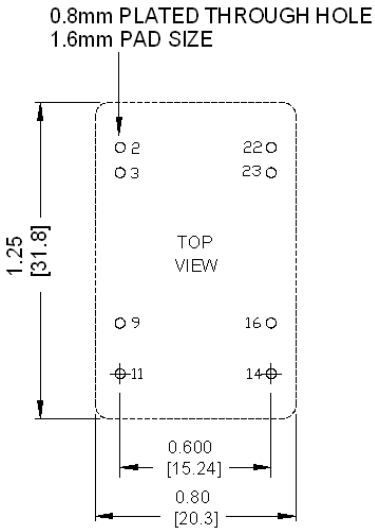
5.4 Over Voltage Protection

The over-voltage protection consists of a zener diode to limiting the out voltage.

6. Applications

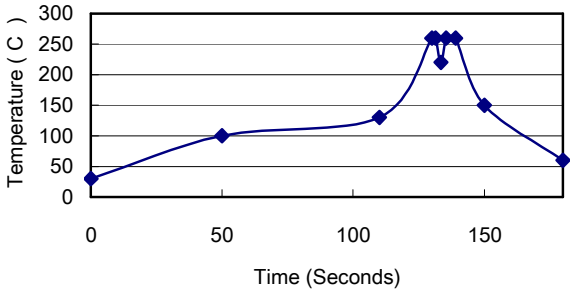
6.1 Recommended Layout PCB Footprints and Soldering Information

The system designer or the end user must ensure that other components and metal in the vicinity of the converter meet the spacing requirements to which the system is approved. Low resistance and low inductance PCB layout traces are the norm and should be used where possible. Due consideration must also be given to proper low impedance tracks between power module, input and output grounds. The recommended footprints and soldering profiles are shown below.



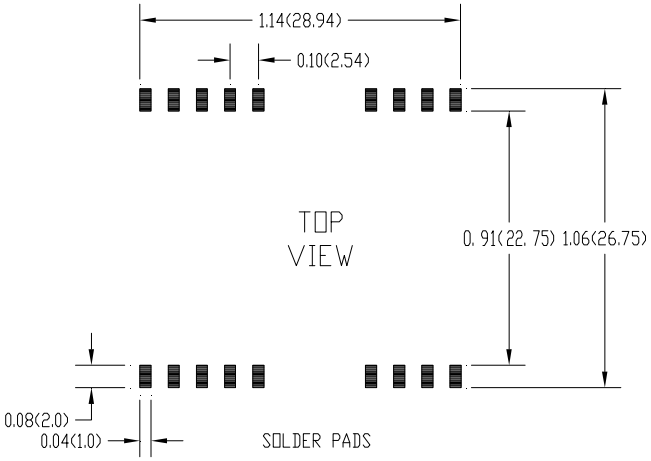
Note: Dimensions are in inches (millimeters)

Lead Free Wave Soldering Profile

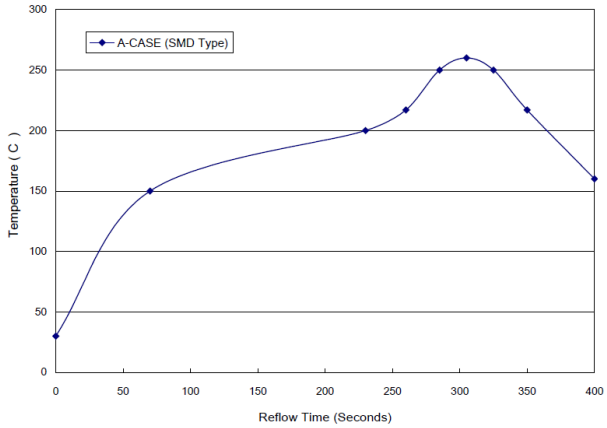


Note：

1. Soldering Materials: Sn/Cu/Ni
2. Ramp up rate during preheat: 1.4 ℃/Sec (From 50℃ to 100℃)
3. Soaking temperature: 0.5 ℃/Sec (From 100℃ to 130℃), 60±20 seconds
4. Peak temperature: 260℃, above 250℃ 3~6 Seconds
5. Ramp up rate during cooling: -10.0 ℃/Sec (From 260℃ to 150℃)



Lead Free Hot Air Reflow Profile



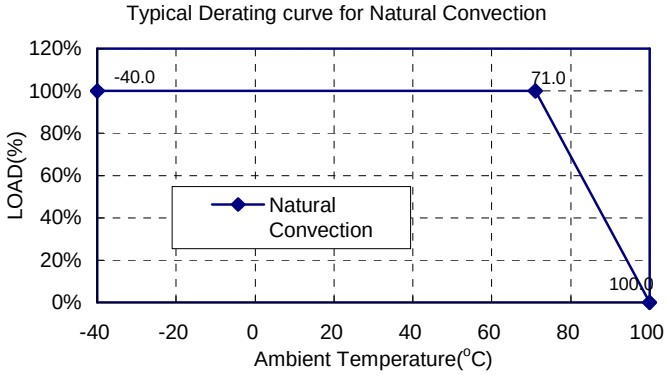
1. Soldering Paste: SHENMAO PF610-P (Sn/Ag/Cu)
2. Ramp up rate during preheat: 1.71 ℃/Sec (From 30℃ to 150℃)
3. Soaking temperature: 0.31 ℃/Sec (From 150℃ to 200℃), 160±10 seconds
4. Ramp up rate during reflow: 0.96 ℃/Sec (From 217℃ to 260℃)
5. Peak temperature: 260℃, above 217℃ 90 Seconds
6. Ramp up rate during cooling: -1.2 ℃/Sec (From 260℃ to 160℃)

Figure 3 Recommended PCB Layout Footprints and Wave Soldering Profiles for DIP-24 and SMD packages

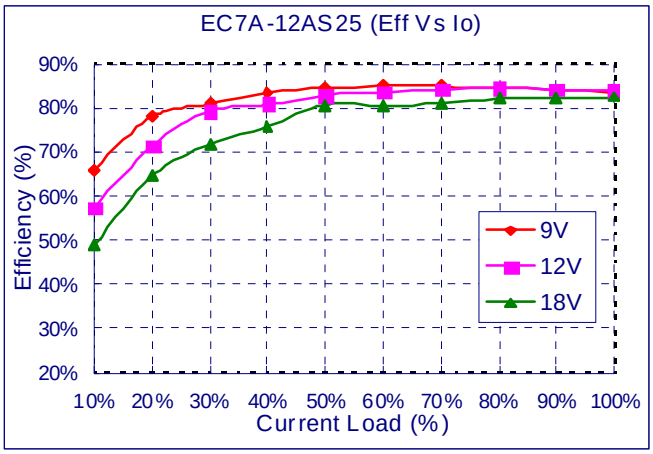
6.2 Power De-Rating Curves for EC7A Series

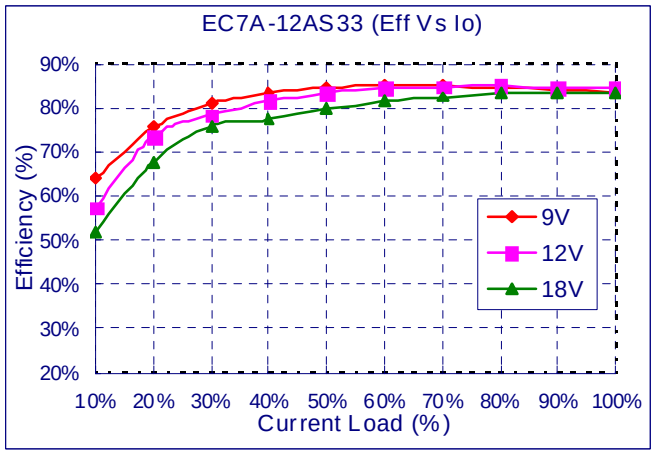
Operating Ambient temperature Range: -40℃ ~ 85℃ with de-rating above 71℃.

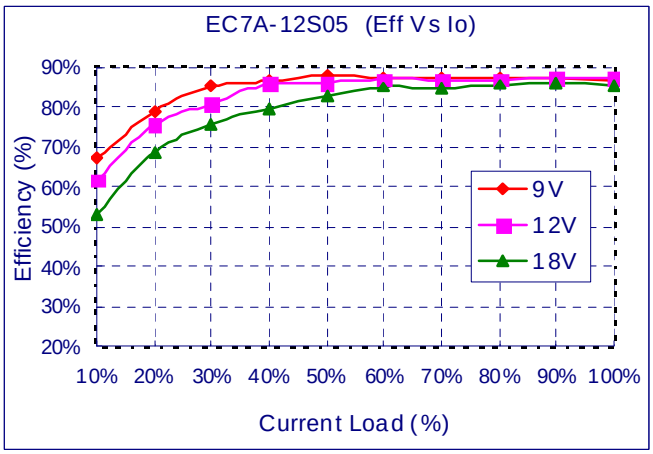
Maximum case temperature under any operating condition should not exceed 100℃.

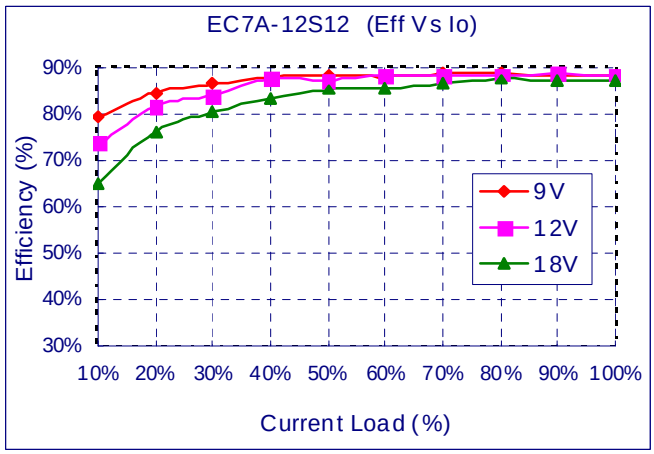


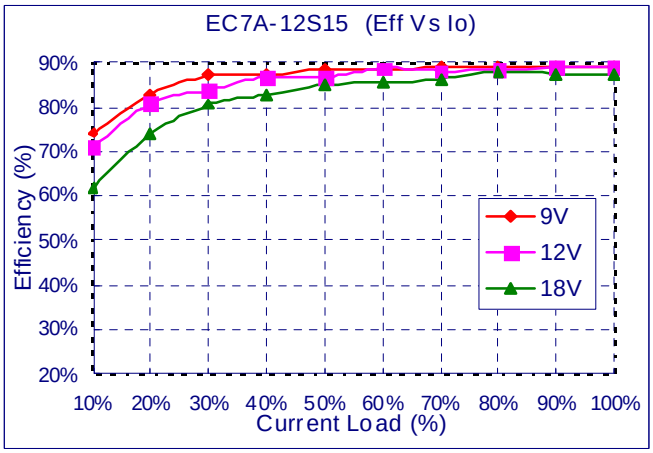
6.3 Efficiency vs. Load Curves

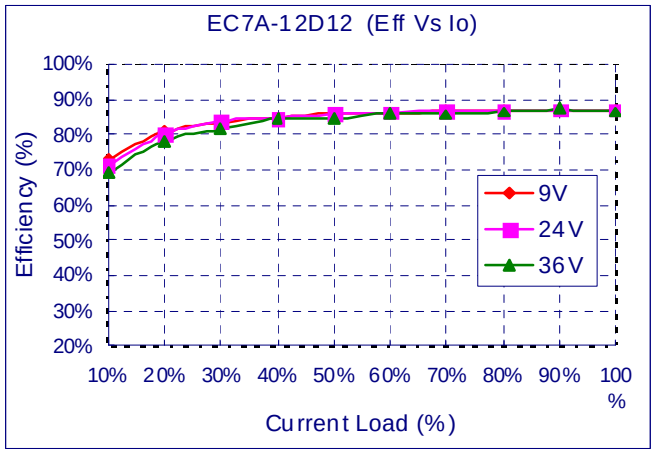


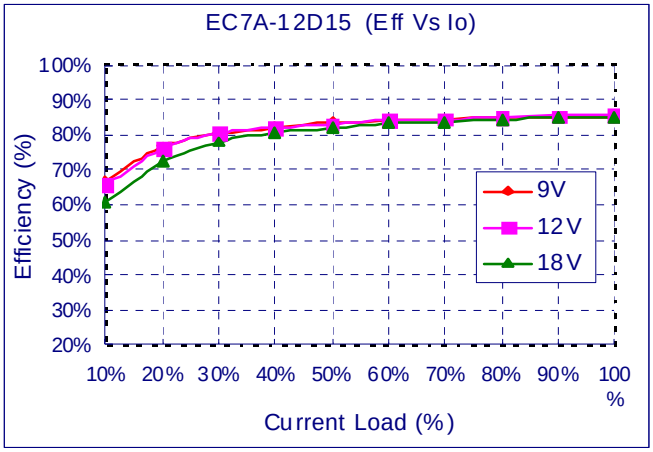


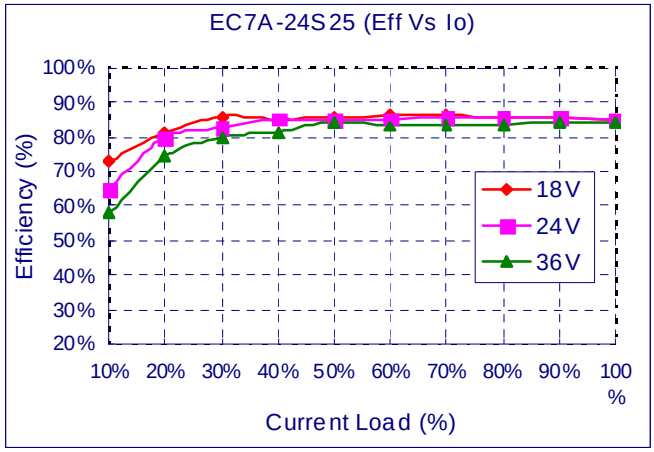


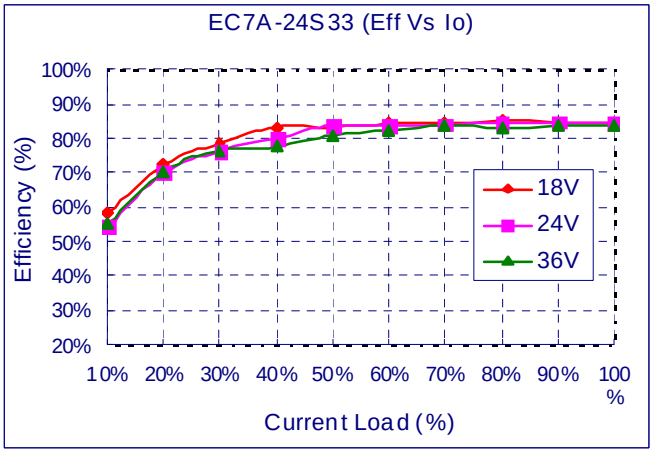


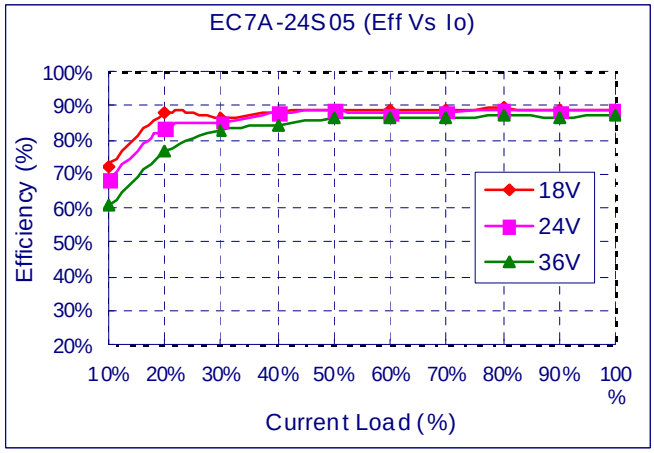


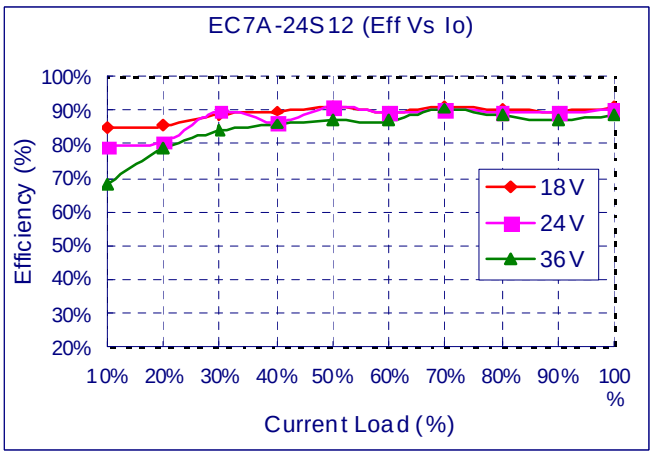


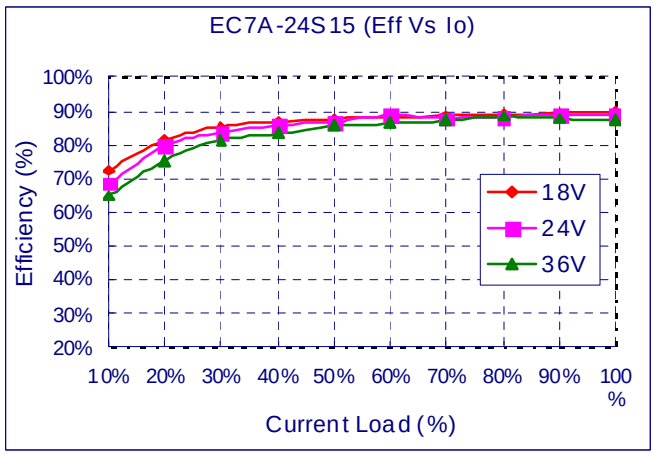

EC7A-12D15 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
9V
12V
18V

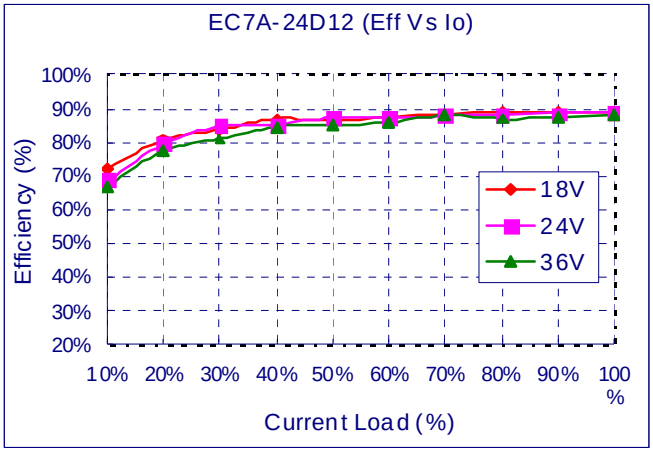

EC7A-24S25 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
18V
24V
36V

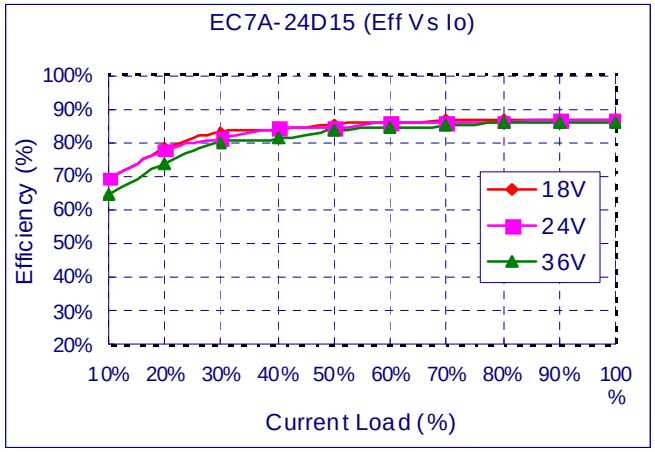

EC7A-24S33 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
18V
24V
36V

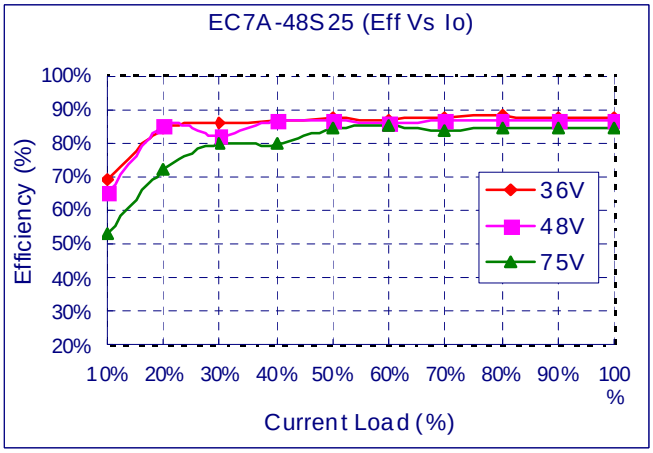

EC7A-24S05 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
18V
24V
36V

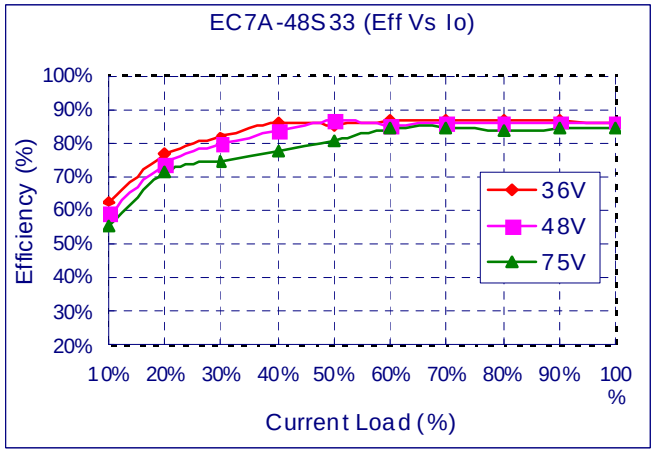

EC7A-24S12 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
18V
24V
36V

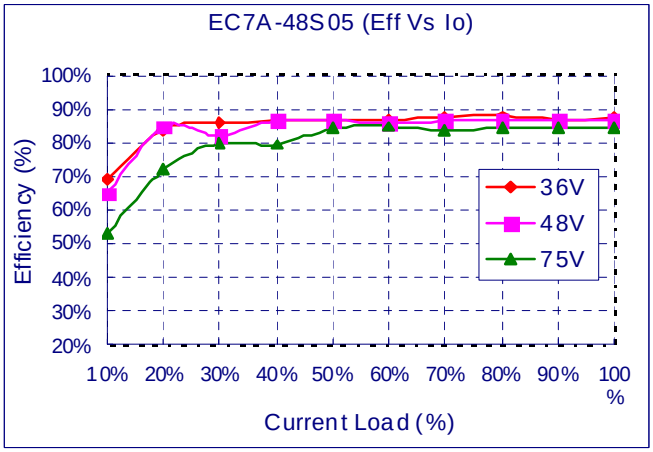

EC7A-24S15 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
18V
24V
36V

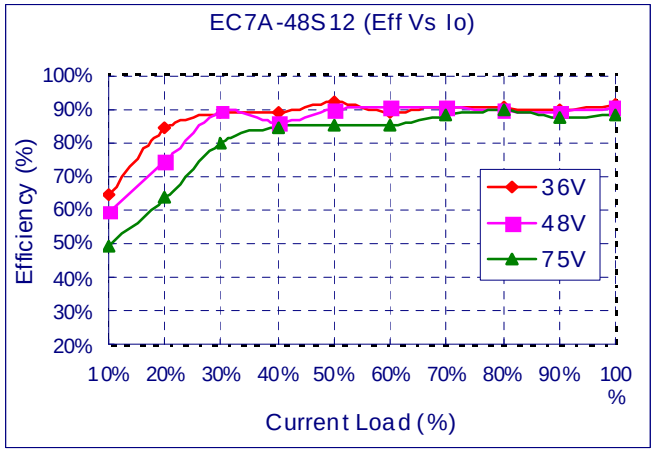

EC7A-24D12 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
18V
24V
36V

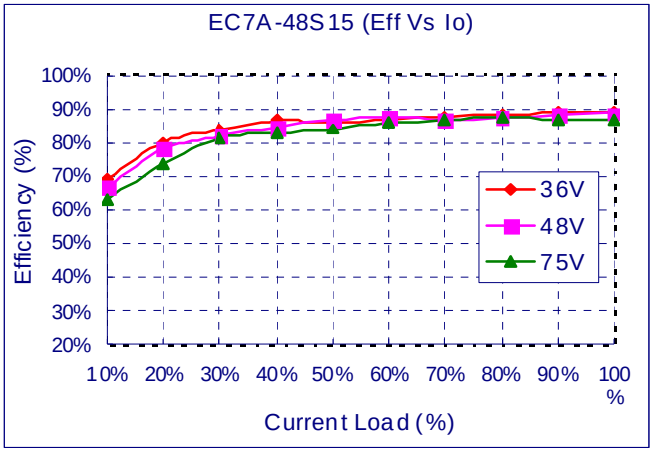

EC7A-24D15 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
18V
24V
36V

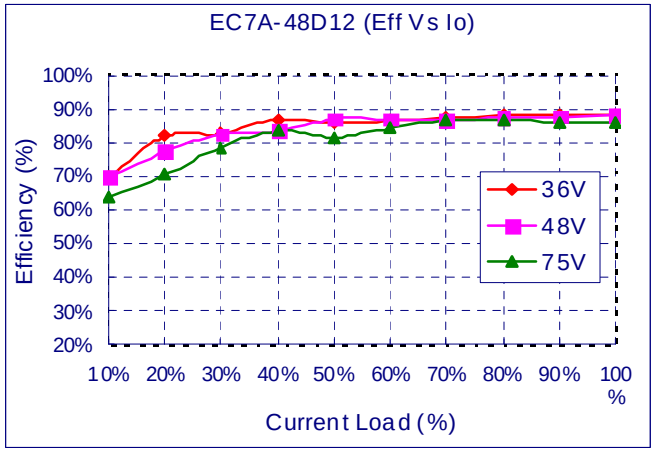

EC7A-48S25 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
36V
48V
75V

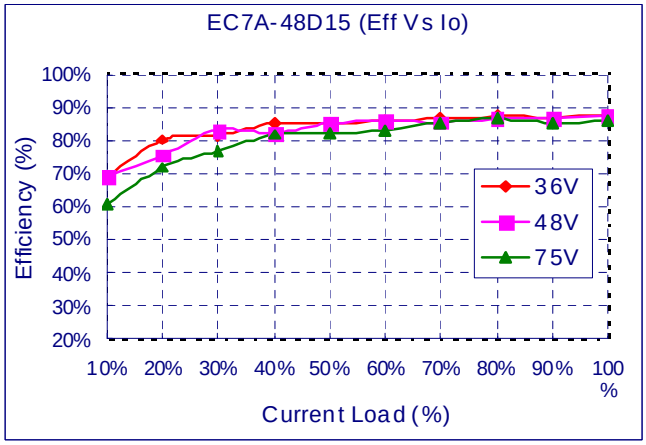

EC7A-48S33 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
36V
48V
75V


EC7A-48S05 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
36V
48V
75V


EC7A-48S12 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
36V
48V
75V

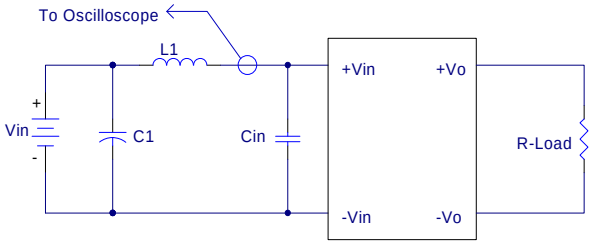

EC7A-48S15 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
36V
48V
75V


EC7A-48D12 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
36V
48V
75V


EC7A-48D15 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
36V
48V
75V

6.4 Input Capacitance at the Power Module

The converters must be connected to low AC source impedance. To avoid problems with loop stability source inductance should be low. Also, the input capacitors (Cin) should be placed close to the converter input pins to de-couple distribution inductance. However, the external input capacitors are chosen for suitable ripple handling capability. Low ESR capacitors are good choice. Circuit as shown in Figure 4 represents typical measurement methods for reflected ripple current. C1 and L1 simulate a typical DC source impedance. The input reflected-ripple current is measured by current probe to oscilloscope with a simulated source Inductance (L1).



L1: 1uH.
C1: None
Cin: 6.8uF Ceramic capacitor.

Figure 4 Input Reflected-Ripple Test Setup

6.5 Test Set-Up

The basic test set-up to measure parameters such as efficiency and load regulation is shown in Figure 5. When testing the modules under any transient conditions please ensure that the transient response of the source is sufficient to power the equipment under test. We can calculate the

- Efficiency
- Load regulation and line regulation.

The value of efficiency is defined as:

$$\eta = \frac{Vo \times Io}{Vin \times Iin} \times 100\%$$

Where

Vo is output voltage,
Io is output current,
Vin is input voltage,
Iin is input current.

The value of load regulation is defined as:

$$Load.reg = \frac{V_{FL} - V_{NL}}{V_{NL}} \times 100\%$$

Where

V_{FL} is the output voltage at full load
V_{NL} is the output voltage at 10% load

The value of line regulation is defined as:

$$Line.reg = \frac{V_{HL} - V_{LL}}{V_{LL}} \times 100\%$$

Where

VHL is the output voltage of maximum input voltage at full load.
VLL is the output voltage of minimum input voltage at full load.

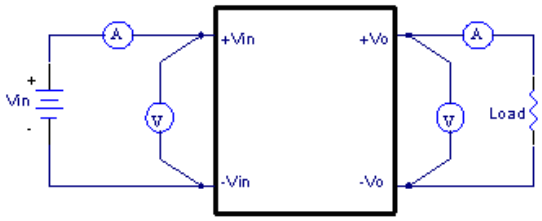
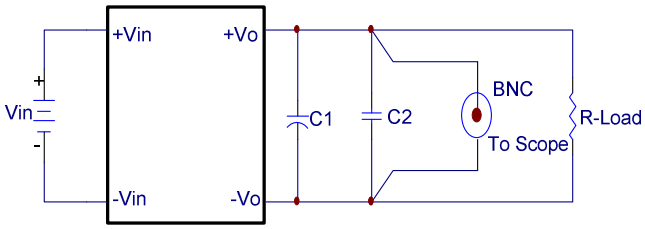


Figure 5 EC7A Series Test Setup

6.6 Output Ripple and Noise Measurement

The test set-up for noise and ripple measurements is shown in Figure 6. A coaxial cable was used to prevent impedance mismatch reflections disturbing the noise readings at higher frequencies. Measurements are taken with output appropriately loaded and all ripple/noise specifications are from 5Hz to 20MHz Band Width.



Note: C1: None
C2: 0.1uF Ceramic capacitor

Figure 6 Output Voltage Ripple and Noise Measurement Set-Up

6.7 Output Capacitance

The EC7A series converters provide unconditional stability with or without external capacitors. For good transient response low ESR output capacitors should be located close to the point of load. These series converters are designed to work with load capacitance to see technical specifications.

7. Safety & EMC

7.1 Input Fusing and Safety Considerations.

The EC7A series converters have not an internal fuse. However, to achieve maximum safety and system protection, always use an input line fuse. We recommended a time delay fuse 3A for 12Vin models, 2A for 24Vin models and 1A for 48Vin modules. Figure 7 circuit is recommended by a Transient Voltage Suppressor diode across the input terminal to protect the unit against surge or spike voltage and input reverse voltage.

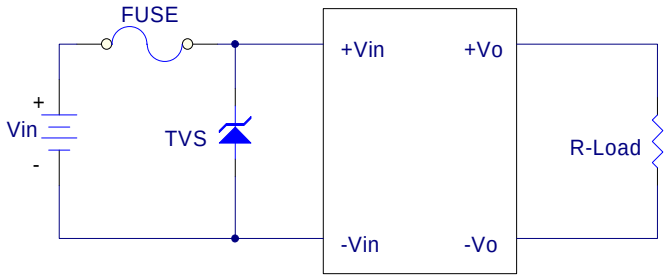


Figure 7 Input Protection

7.2 EMC Considerations

EMI Test standard: EN55022
Test Condition: Input Voltage: Nominal, Output Load: Full Load

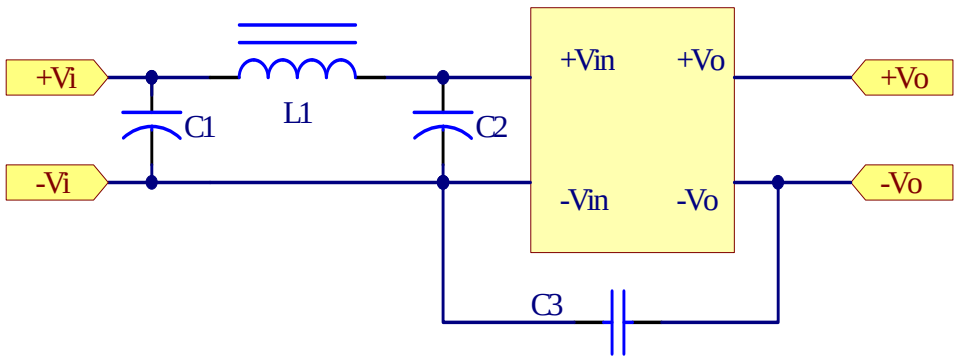
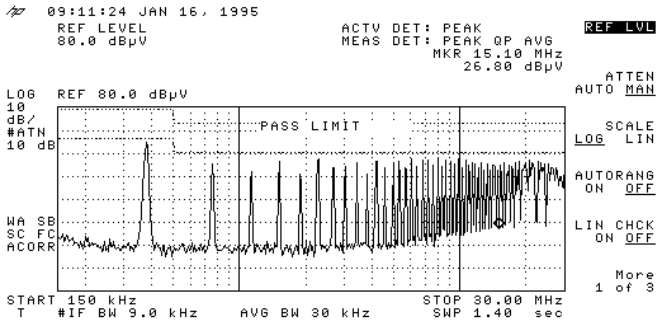
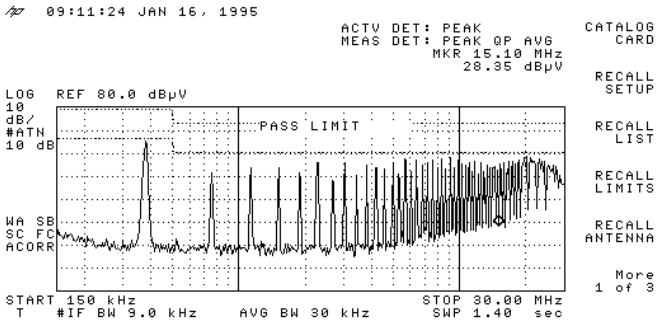


Figure 8 Connection circuit for conducted EMI testing

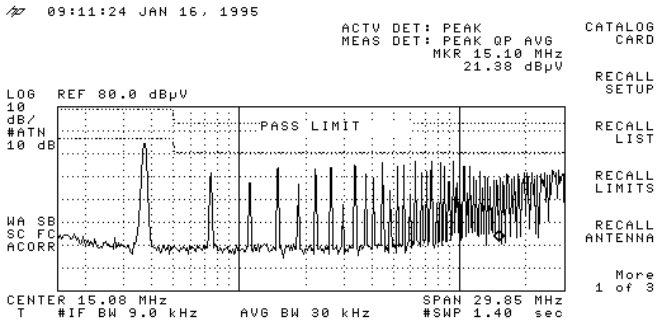
Model No.	EN55022 Class A				EN55022 Class B			
	C1	C2	C3	L1	C1	C2	C3	L1
EC7A-12S25	NC	NC	NC	Short	22uF/50V KY ESR<0.7Ω	NC	NC	3.5uH
EC7A-12S33	NC	NC	NC	Short	22uF/50V KY ESR<0.7Ω	NC	NC	3.5uH
EC7A-12S05	NC	NC	NC	Short	22uF/50V KY ESR<0.7Ω	NC	NC	3.5uH
EC7A-12S12	NC	NC	NC	Short	22uF/50V KY ESR<0.7Ω	NC	NC	3.5uH
EC7A-12S15	NC	NC	NC	Short	22uF/50V KY ESR<0.7Ω	NC	NC	3.5uH
EC7A-12D12	NC	NC	NC	Short	47uV/25V KY	NC	NC	8uH
EC7A-12D15	NC	NC	NC	Short	47uV/25V KY	NC	NC	8uH
EC7A-24S25	22uF/50V KY ESR<0.7Ω	NC	NC	0.7uH	22uF/50V KY ESR<0.7Ω	NC	NC	3.5uH
EC7A-24S33	22uF/50V KY ESR<0.7Ω	NC	NC	0.7uH	22uF/50V KY ESR<0.7Ω	NC	NC	3.5uH
EC7A-24S05	22uF/50V KY ESR<0.7Ω	NC	NC	0.7uH	22uF/50V KY ESR<0.7Ω	NC	NC	3.5uH
EC7A-24S12	22uF/50V KY ESR<0.7Ω	NC	NC	0.7uH	22uF/50V KY ESR<0.7Ω	NC	NC	3.5uH
EC7A-24S15	22uF/50V KY ESR<0.7Ω	NC	NC	0.7uH	22uF/50V KY ESR<0.7Ω	NC	NC	3.5uH
EC7A-24D12	NC	NC	NC	Short	22uF/50V KY	NC	NC	8uH
EC7A-24D15	NC	NC	NC	Short	22uF/50V KY	NC	NC	8uH
EC7A-48S25	22uF/100V KMF ESR<0.66Ω	NC	NC	0.7uH	22uF/100V KMF ESR<0.66Ω	NC	NC	3.5uH
EC7A-48S33	22uF/100V KMF ESR<0.66Ω	NC	NC	0.7uH	22uF/100V KMF ESR<0.66Ω	NC	NC	3.5uH
EC7A-48S05	22uF/100V KMF ESR<0.66Ω	NC	NC	0.7uH	22uF/100V KMF ESR<0.66Ω	NC	NC	3.5uH
EC7A-48S12	22uF/100V KMF ESR<0.66Ω	NC	NC	0.7uH	22uF/100V KMF ESR<0.66Ω	NC	NC	3.5uH
EC7A-48S15	22uF/100V KMF ESR<0.66Ω	NC	NC	0.7uH	22uF/100V KMF ESR<0.66Ω	NC	NC	3.5uH
EC7A-48D12	NC	NC	NC	Short	10uF/100V KMF	NC	680pF/3KV	8uH
EC7A-48D15	NC	NC	NC	Short	10uF/100V KMF	NC	NC	8uH



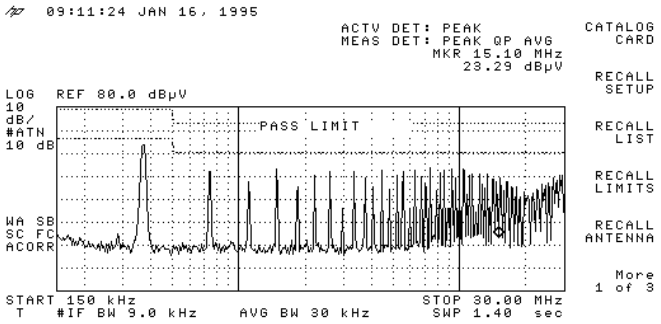
Conducted Class A of EC7A -12S25



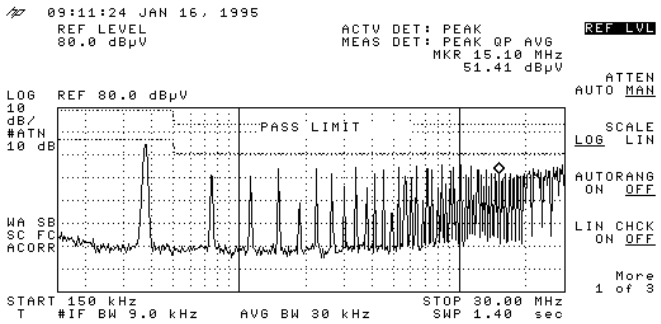
Conducted Class A EC7A -12S33



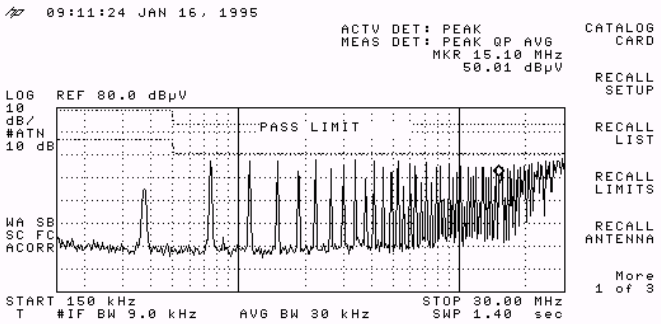
Conducted Class A EC7A -12S05



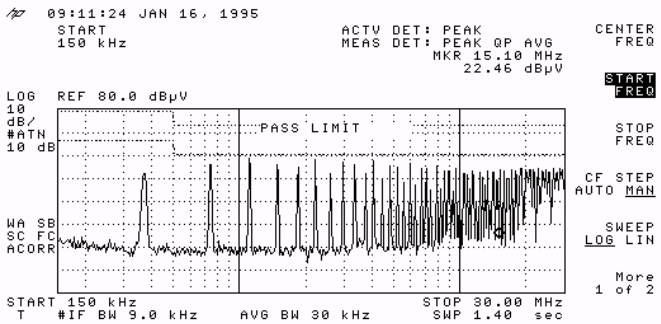
Conducted Class A EC7A -12S12



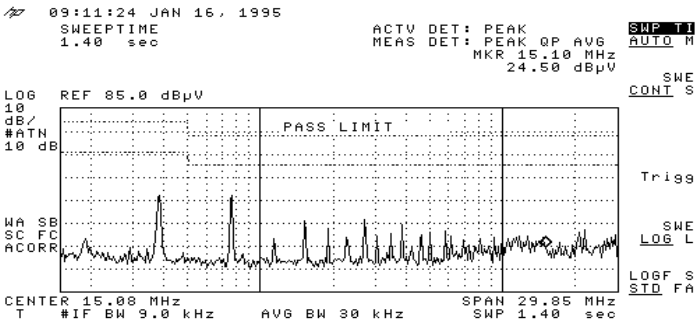
Conducted Class A of EC7A -12S15



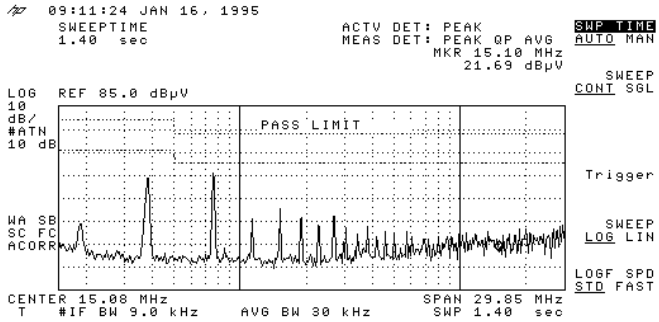
Conducted Class A of EC7A-12D12



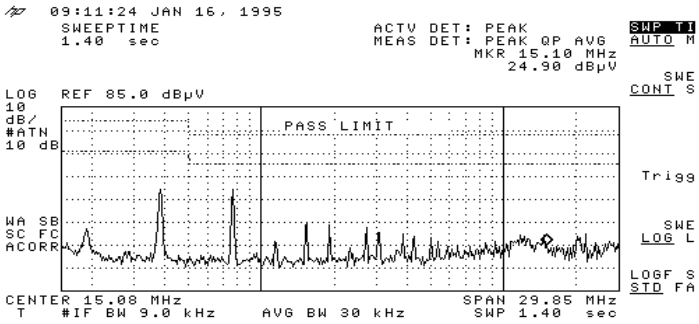
Conducted Class A EC7A-12D15



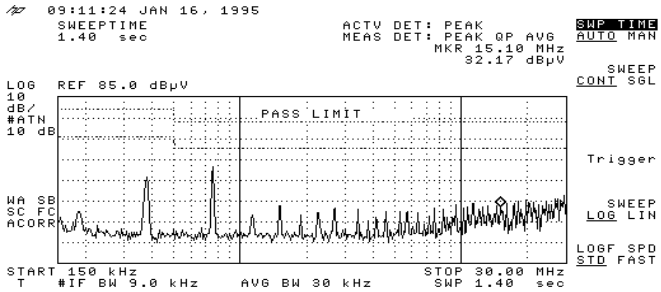
Conducted Class A EC7A -24S25



Conducted Class A EC7A-24S33



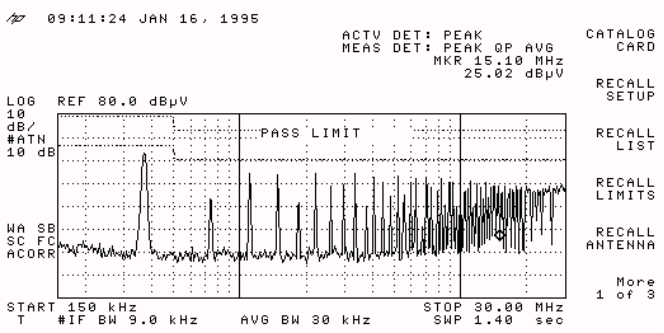
Conducted Class A EC7A -24S05



Conducted Class A of EC7A -24S12

TBD

Conducted Class A of EC7A -24S15



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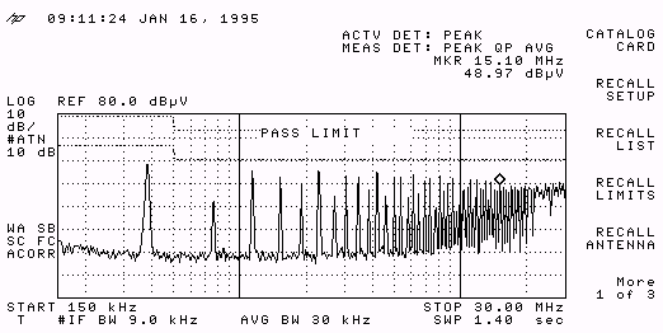

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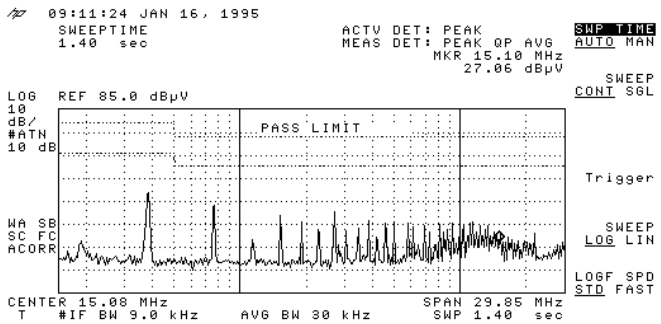
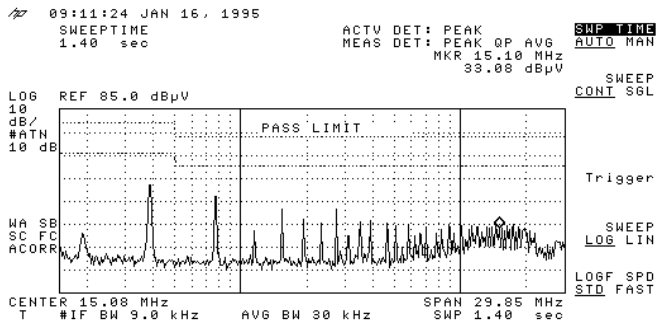
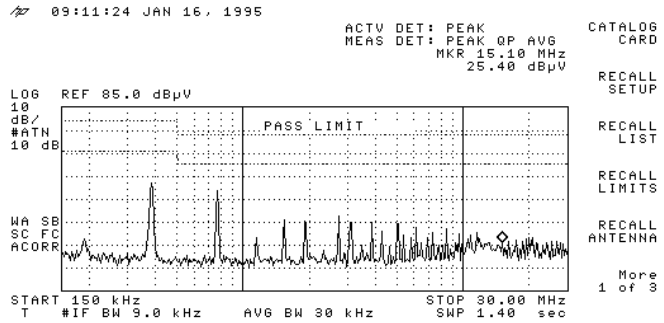


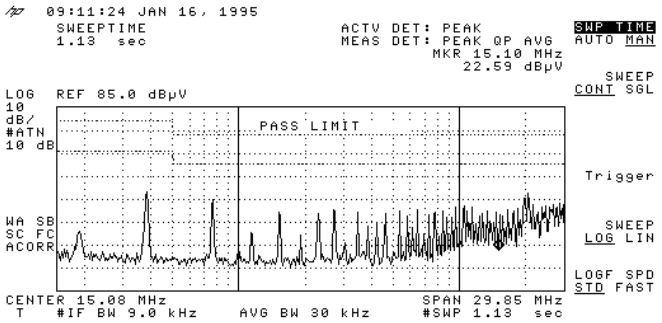
Conducted Class A EC7A -48S25



Conducted Class A EC7A -48S33



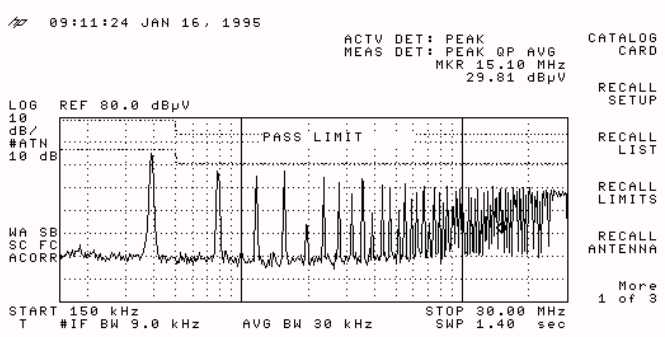
Conducted Class A of EC7A-48S05



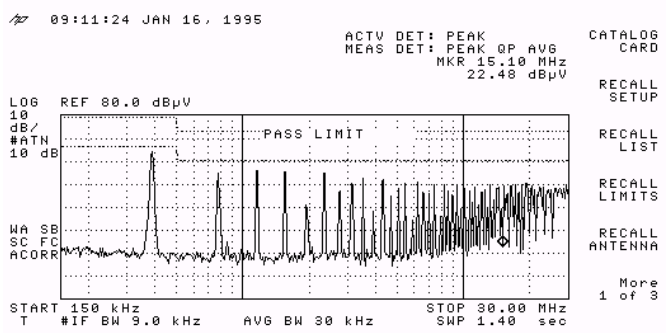
Conducted Class A EC7A -48S12

TBD

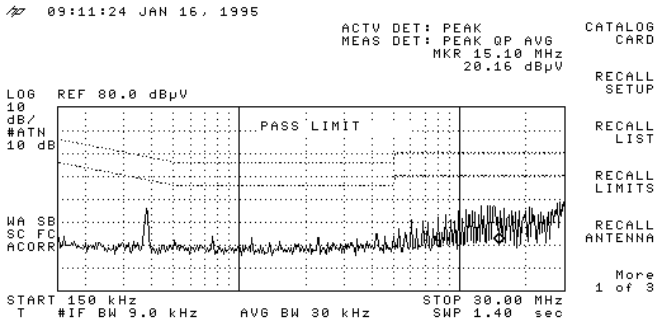
Conducted Class A EC7A -48S15



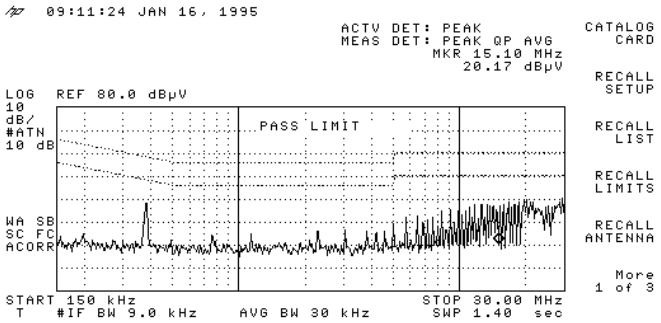
Conducted Class A of EC7A -48D12



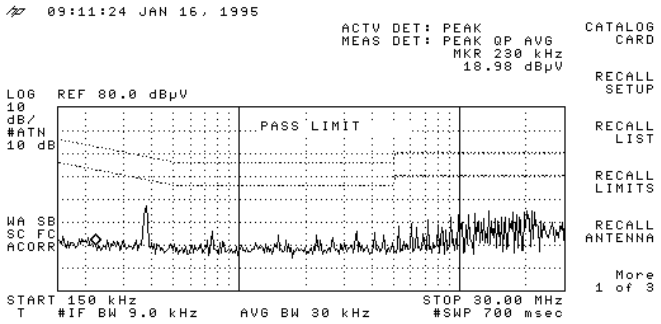
Conducted Class A EC7A -48D15



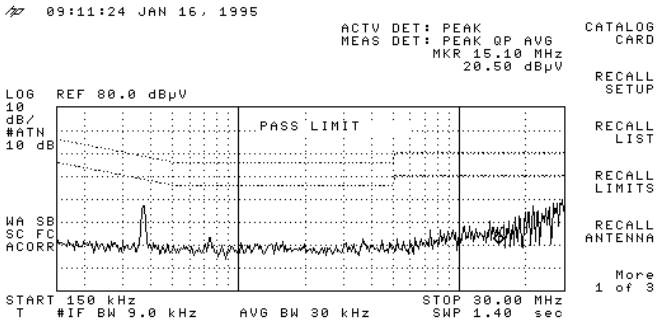
Conducted Class B of EC7A -12S25



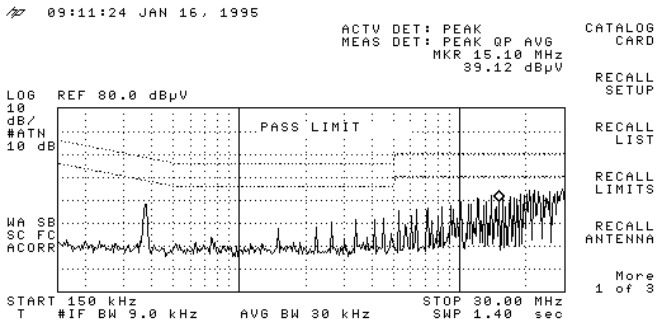
Conducted Class B EC7A -12S33



Conducted Class B EC7A -12S05



Conducted Class B EC7A -12S12



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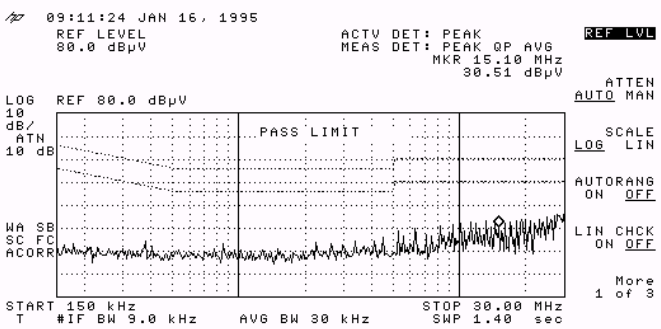

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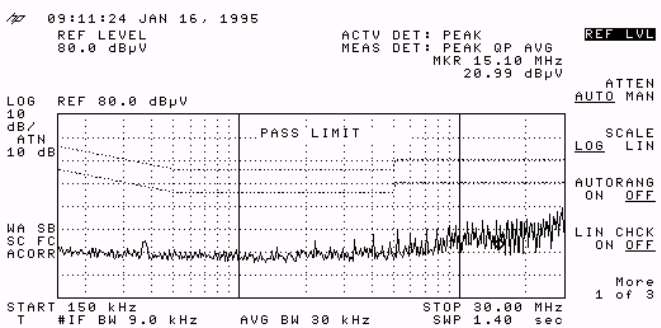
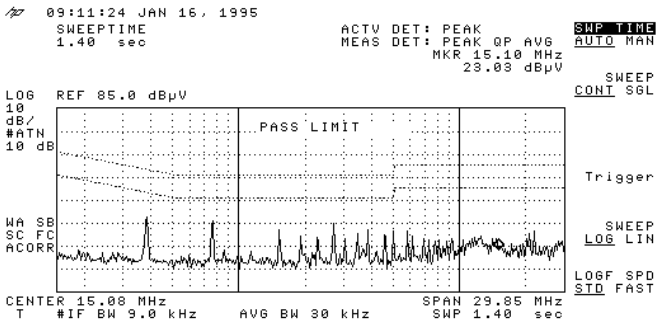
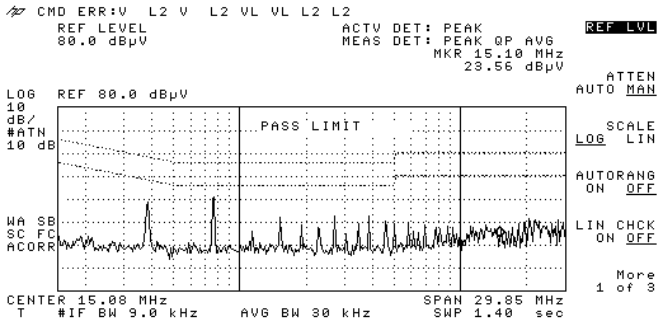


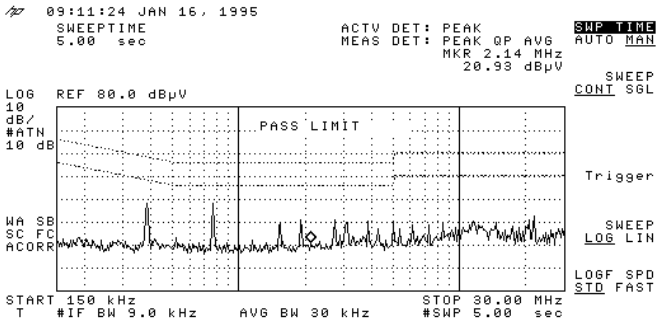
Conducted Class B EC7A-12D15



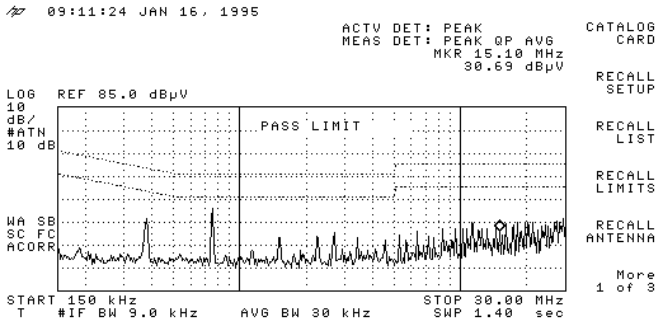
Conducted Class B EC7A -24S25



Conducted Class B EC7A-24S33



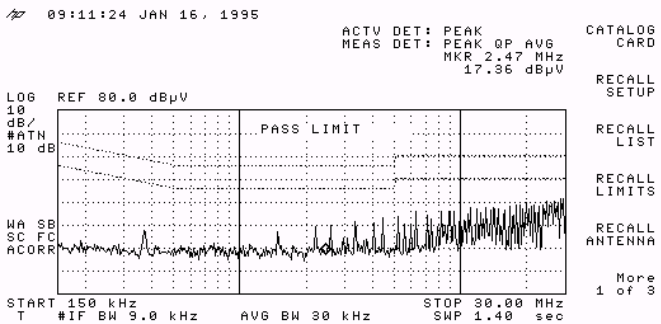
Conducted Class B EC7A -24S05



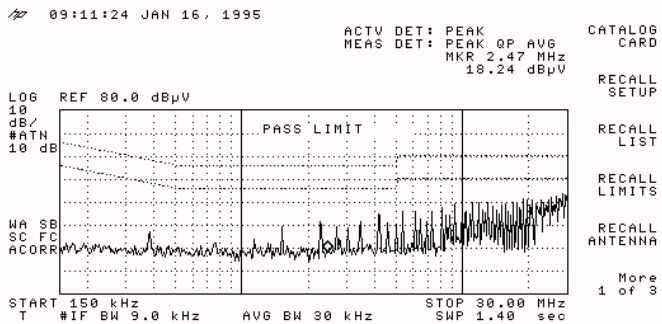
Conducted Class B of EC7A -24S12

TBD

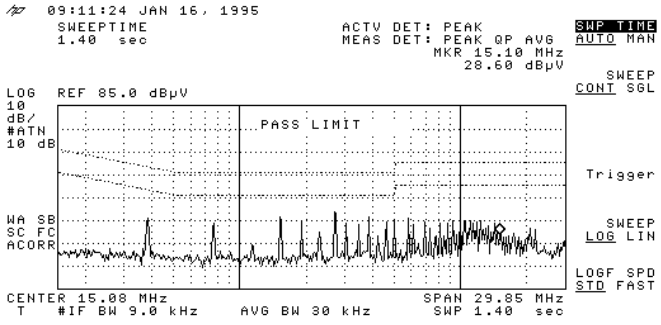
Conducted Class B of EC7A -24S15



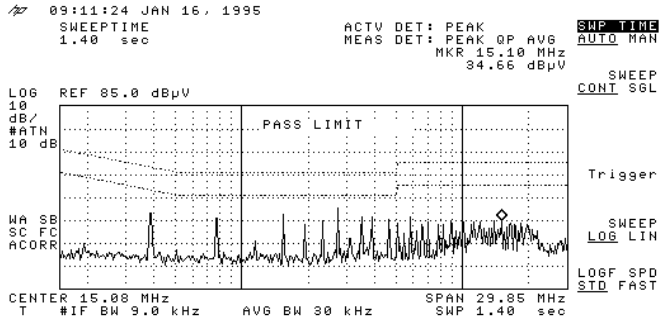
Conducted Class B EC7A -24D12



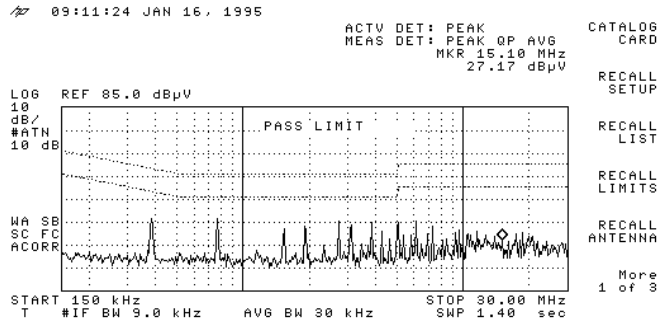
Conducted Class B EC7A -24D15



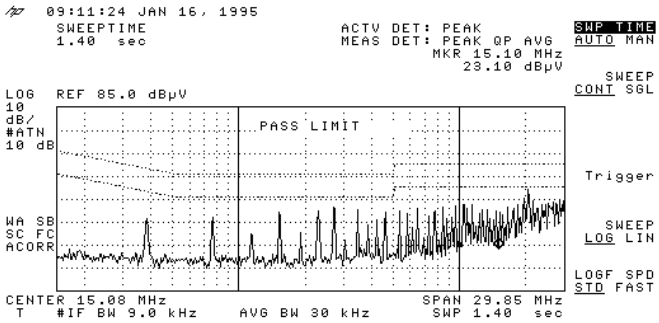
Conducted Class B EC7A -48S25



Conducted Class B EC7A -48S33



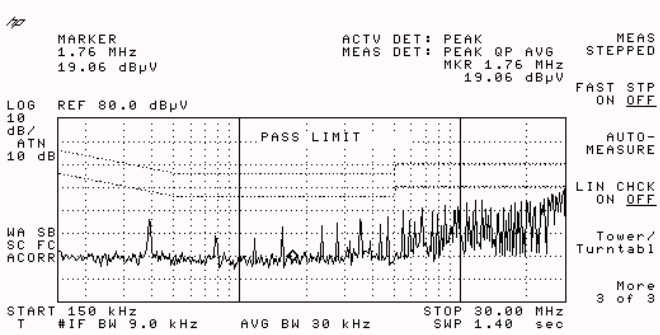
Conducted Class B of EC7A-48S05



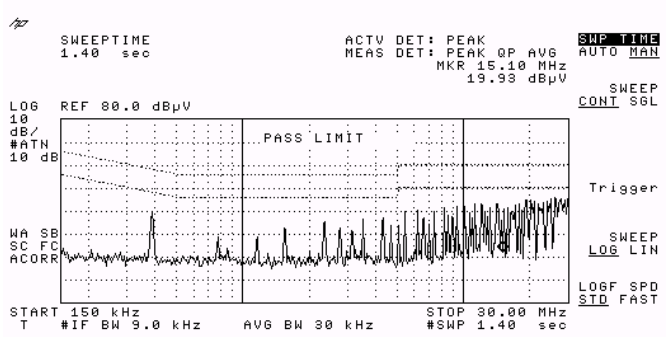
Conducted Class B EC7A -48S12

TBD

Conducted Class B EC7A -48S15



Conducted Class B of EC7A -48D12



Conducted Class B EC7A -48D15

8. Part Number

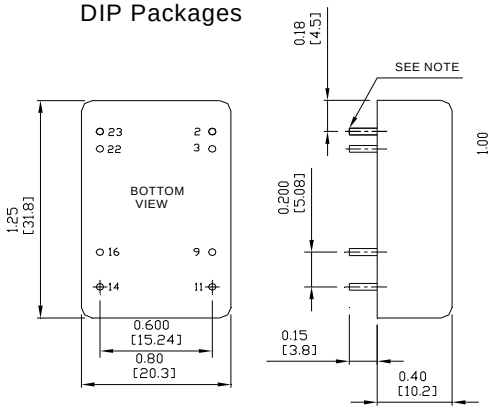
EC7A – XX S XX S

- EC7A SERIES
- 12：Nominal Input Voltage 12VDC
  24：Nominal Input Voltage 24VDC
  48：Nominal Input Voltage 48VDC
- S：Single Output
  D：Dual Output
- 25：Output Voltage 2.5 VDC
  33：Output Voltage 3.3 VDC
  05：Output Voltage 5 VDC
  12：Output Voltage 12 VDC
  15：Output Voltage 15 VDC
- None: DIP Packages
  S：SMD Packages

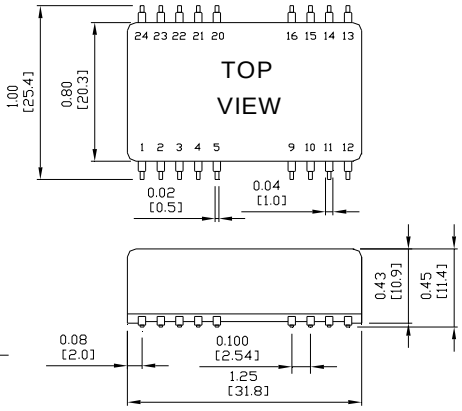
9. Mechanical Specifications

NOTE:Pin Size is 0.02"Inch (0.5mm)DIA
All Dimensions In Inches (mm)
Tolerances Inches: X.XX= ±0.02 , X.XXX= ±0.010
Millimeters: X.X= ±0.5 , X.XX=±0.25

DIP Packages



SMD Packages



PIN CONNECTION				
Pin	Single Output		Dual Output	
	DIP	SMD	DIP	SMD
1,24	NP	NC	NP	NC
2,3	-V Input		-V Input	
4,5	NP	NC	NP	NC
9	NP	NC	Common	
10	NP	NC	NP	NC
11	NC		-V Output	
12	NP	NC	NP	NC
13	NP	+V Output	NP	NC
14	+V Output		+V Output	
15	NP	-V Output	NP	NC
16	-V Output		Common	
20,21	NP	NC	NP	NC
22,23	+V Input		+V Input	

* NC-NO CONNECTION WITH PIN
* NP-NO PIN

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