

### PRELIMINARY

## **IRV300 Series**

300W 10:1 Ultra Wide Input Chassis-Mount Isolated DC-DC Converter

#### **FEATURES**

- 16.8V 160V steady state, with transient range of 14.4V – 168V for 100mS
- Output voltages of 12, 24 or 54 Volts
- Up to 300 Watts total output power
- Ruggedized and encased chassis-mount package 7.3" x 4.6" x 1.6" (185mm x 116mm x 40mm)
- Compliant to Railway standards EN 50155 and EN 50121-3-2
- High efficiency up to 92%, typical
- Tight Line and Load regulation
- Low Ripple and Noise
- Extensive self-protection shut down features, including over temperature shutdown
- Output voltage adjustable
- Green LED Power Indicator
- Remote On/Off and PUL
- Optional ORing feature for redundant or parallel operation with droop
- Optional Hold-up feature
- Operating ambient temperature range -40 to +70°C (10min +85°C)

Output Voltage (Vdc)	Output Current (A)	Input Voltage Range (Vdc)
12	25.0	16.8 to 160
24	12.5	16.8 to 160
54	5.5	16.8 to 160

Optimized for harsh environments in industrial/railway applications, the IRV300 DC-DC converter series offer regulated outputs in a ruggedized, encased chassis-mount package.

#### **PRODUCT OVERVIEW**

The IRV300 series is a 300W stand alone, system level, chassis mount isolated DC-DC converter. The converter features an ultra wide input designed to accept nominal battery voltages from 24V to 110V in a single product.

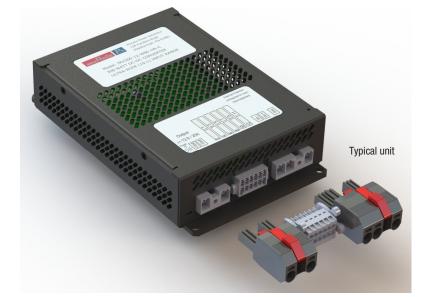
The IRV300 is ideally suited for Railway applications, meeting EN50155 standard in a single package. The output voltage has a wide trim range up to +15% of Vnom, and features a constant current output profile ideally suited for high inductive/capacitive loading.

They feature Programmable Undervoltage Lockout (PUL) to prevent deep discharge of the input batteries, Remote On/Off control and an Open Collector DC Output Power Good Signal including a visual LED as standard.

The IRV300 offer additional options such as "Hold Up" capability for overriding load dependent input interruptions of 10mS to 20mS not affecting the output and "ORing FET" for dual redundancy or power share incorporating droop voltage. The standard self protection features include Overvoltage protection, Current limit/Short circuit protection, Over temperature protection and ensure safe and reliable power delivery.

#### **SAFETY FEATURES**

- Protected against fire and smoke to EN 45545 (Pending)
- 4250Vdc input to output isolation
- UL 62368-1 and IEC/EN62368-1 safety approvals
- CE approved
- RoHS compliant





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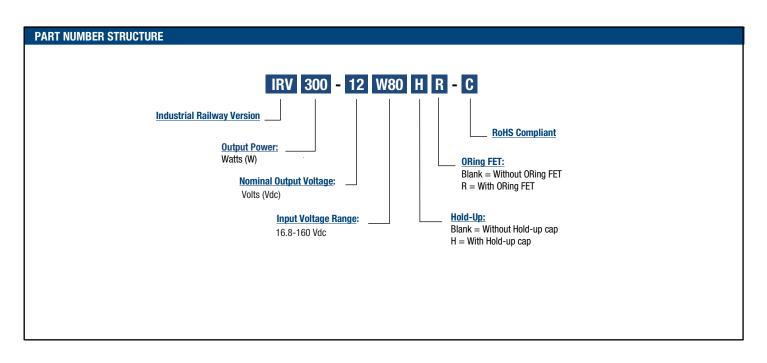
PERFORMANCE SI	PERFORMANCE SPECIFICATIONS SUMMARY AND ORDERING GUIDE ©©													
	Output				Input			Effici	0001	Destana o				
Root Model	Vout	lout	Power	R/N (mV	/ pk-pk)	Regulation	(max.) 3	Vin Nom.	Range	lin, no load	lin, full	EIIICI	ency	Package ④
	(V)	(A)	(W)	Тур.	Max.	Line	Load	(V)	(V)	(mA)	load (A)	Min.	Тур.	Case (inches)
IRV300-12W80	12	25	300	60	120	±0.5%	±0.5%	110	16.8-160	23	3	88.5%	92%	7.27 x 4.57 x 1.56
IRV300-24W80	24	12.5	300	190	240	±0.5%	±0.5%	110	16.8-160	19	3	86.0%	92%	7.27 x 4.57 x 1.56
IRV300-54W80	54	5.5	300	200	480	±0.5%	±0.5%	110	16.8-160	TBD	TBD	86.0%	90%	7.27 x 4.57 x 1.56

① Please refer to the Part Number Structure when ordering.

 $\odot$  All specifications are at 110V nominal line voltage, full load, +25°C unless otherwise noted. See detailed specifications.

③ Regulation specifications describe output voltage deviations from a nominal/midpoint value to either extreme (50% load step).

④ Please see the Mechanical Specifications for details.



#### Part Number Examples:

IRV300-12W80-C stands for Industrial Railway Version, 300W, 12Vout, 16.8-160Vin, including all standard features without options, RoHS Compliant.

IRV300-12W80H-C stands for Industrial Railway Version, 300W, 12Vout, 16.8-160Vin, Hold-up, RoHS Compliant.

IRV300-24W80R-C stands for Industrial Railway Version, 300W, 24Vout, 16.8-160Vin, ORing FET, RoHS Compliant.

IRV300-54W80HR-C stands for Industrial Railway Version, 300W, 54Vout, 16.8-160Vin, Hold-up, ORing FET, RoHS Compliant.

IRV300-MCK stands for Mating Connector Kit, (NOTE: The kit contains all 3 mating connectors. There is a Minimum Pack Quantity of 4 sets.)

## muRata P. Murata Power Solutions PRELIMINARY IRV300 Series

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ABSOLUTE MAXIMUM RATINGS	Conditions [1]	Minimum	Typical/Nominal	Maximum	Units
Input Voltage, Continuous	Full temperature range	16.8		160	Vdc
Voltage Brownout and Transients	14.4V (100mS, per EN50155) / 168V (100mS)	14.4		168	Vdc
Output Power		0		303	W
Output Current	Current-limited, no damage, short-circuit protected	0		31	A
Storage Temperature Range	Vin = Zero (no power)	-55		85	°C
Absolute maximums are stress ratings. Exposure of de	evices to greater than any of these conditions may a	dversely affect long-te	rm reliability. Proper oper	ration under conditions	other than those
listed in the Performance/Functional Specifications Ta	ble is not implied or recommended.				
INPUT					
Operating Input Voltage Range		16.8	24, 36, 48, 72, 96,110	160	Vdc
Recommended External Fuse	Fast blow		See PUL (P.17)		A
Start-up Voltage	Rising input voltage		16.5	16.7	Vdc
Undervoltage Shutdown (PUL set for 24Vin)	Falling input voltage. (14.4V for 100ms)		15.5		Vdc
Overvoltage Shutdown	Rising input voltage		170.0		Vdc
Reverse Polarity Protection [7]	With installed external fuse		Yes		Vdc
Input Current			11		
Full Load Conditions	Vin @ 110V nominal		3.0		A
Full Load Conditions	Vin @ 24V nominal		14.0		A
Low Line	Vin = minimum , 25A load		21		A
Inrush Transient			2.7		A
No Load Input Power	110Vin typ		2.5		W
Shut-Down Mode Input Power	nominal input voltage (110V)		1.4		W
GENERAL and SAFETY					
	Vin=24V, full load		89		%
Efficiency	Vin=110V, full load	88.5	92		%
Isolation	· · · · · · · · · · · · · · · · · · ·				
Isolation Voltage, Input to Output		4250			Vdc
Isolation Voltage, Input to Case		2830			Vdc
Isolation Voltage, Case to Output		1420			Vdc
Insulation Resistance	Measured with 500Vdc		100		MΩ
Safety Rating			Reinforced		
Safety (Designed to meet the following require-	UL 62368-1, IEC/EN62368-1, Demko		Approved		
ments)	EN 45545, HL1 to HL3 fire/smoke		Pending		
Calculated MTBF [2]	Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°C		1.02		Hours x 106
DYNAMIC CHARACTERISTICS					
Fixed Switching Frequency	Stage 1/Stage 2		250/200		kHz
Power Up Startup Time	Power On to Vout regulated		350		mS
On/Off Startup Time	Remote On to Vout regulated		50		mS
Dynamic Load Response	50-75-50% load step, settling time to within $\pm 1\%$ of Vout		50	350	μSec
Dynamic Load Peak Deviation	Same as above,		±100	±200	mV
FEATURES and OPTIONS	· · · · ·		•		
Remote On/Off Control [3]					
Positive Logic					
Positive Logic, ON state	ON=Pin open or external voltage	4		15	Vdc
Positive Logic, OFF state	OFF=Pin grounded or external voltage	0		0.7	Vdc
Control Current	Open collector/drain, sinking		1	2	mA
Programmable Undervoltage Lockout (PUL)	See Page 17 for details				
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**FUNCTIONAL SPECIFICATIONS, IRV300-12** 

## **IRV300 Series**

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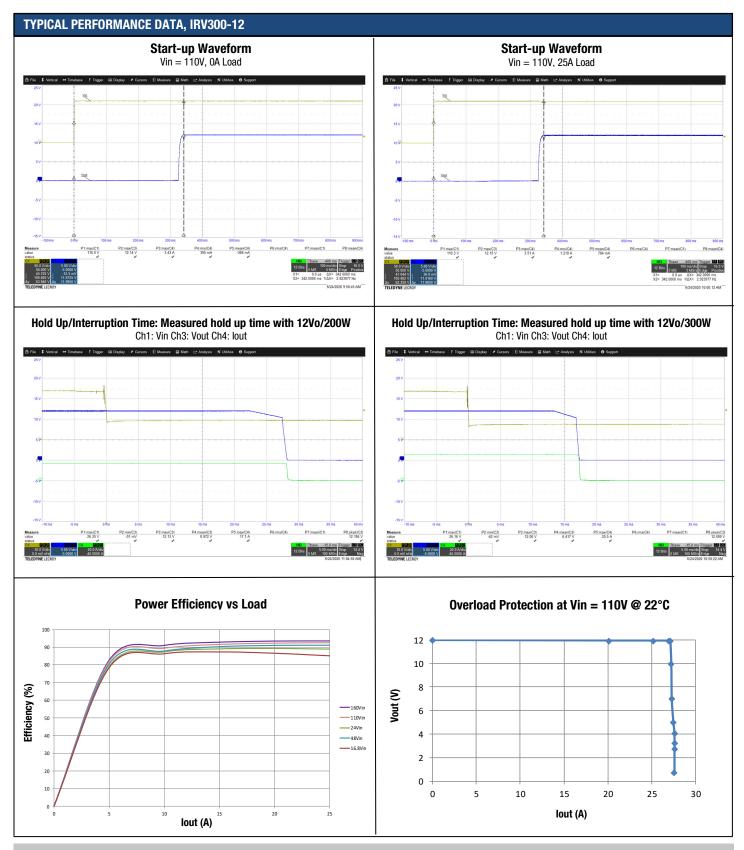
#### FUNCTIONAL SPECIFICATIONS, IRV300-12 (CONT.)

OUTPUT	Conditions [1]	Minimum	Typical/Nominal	Maximum	Units
Total Output Power	See Derating	0	300	303	W
Voltage	·				
Nominal Output Voltage	No trim	11.88	12.00	12.12	Vdc
Setting Accuracy	At 50% load		1		% of Vnom.
Output Voltage Range [5]	User-adjustable	-8		+15	% of Vnom.
Overvoltage Protection [6]	Latching Mode	14.5	16	17.5	Vdc
Current	· · ·		· · ·		
Output Current Range	Vin=16.8V-160V	0.0	25.0		A
Short Circuit					
Short Circuit Current	Constant current mode	25.1	28	31	А
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage		Continuous		
Short circuit protection method	Constant Current limiting				
Regulation [4]					
Line Regulation	Vin=16.8V to 160V, output @ nominal load			±0.5	%
Load Regulation	lout=min. to max., Vin=110V			±0.5	%
Ripple and Noise	with a 1uF    10uF output caps		60	120	mV pk-pk
Temperature Coefficient	At all outputs		0.02		% of Vnom./°C
Maximum Capacitive Load	Constant resistance mode		0.1		F
Hold-up (Optional)	EN550155: Class S2 (@300W) / Class S3 (@180W)	10 / 20			mS
MECHANICAL					
Outline Dimensions			7.27 x 4.57 x 1.56		Inches
(Please refer to outline drawing)	L x W x H		184.6 x 116 x 39.7		mm
Case Material			Aluminum, Black Anodized		
Weight			32		Ounces
			900		Grams
EMI/RFI Shielding			Case		
ENVIRONMENTAL		u de la construcción de la constru La construcción de la construcción d			
Operating Ambient Temperature Range	Continuous (for 10min)	-40		70 (85)	°C
Operating Case Temperature Range	No derating	-40		90	0°
Thermal Protection/Shutdown			Yes		0°
Storage Temperature	Vin = Zero (no power)	-55		85	°C
Altitude				3000	m
Electromagnetic Interference	Meets EN50121-3-2				

#### **Performance Specification Notes**

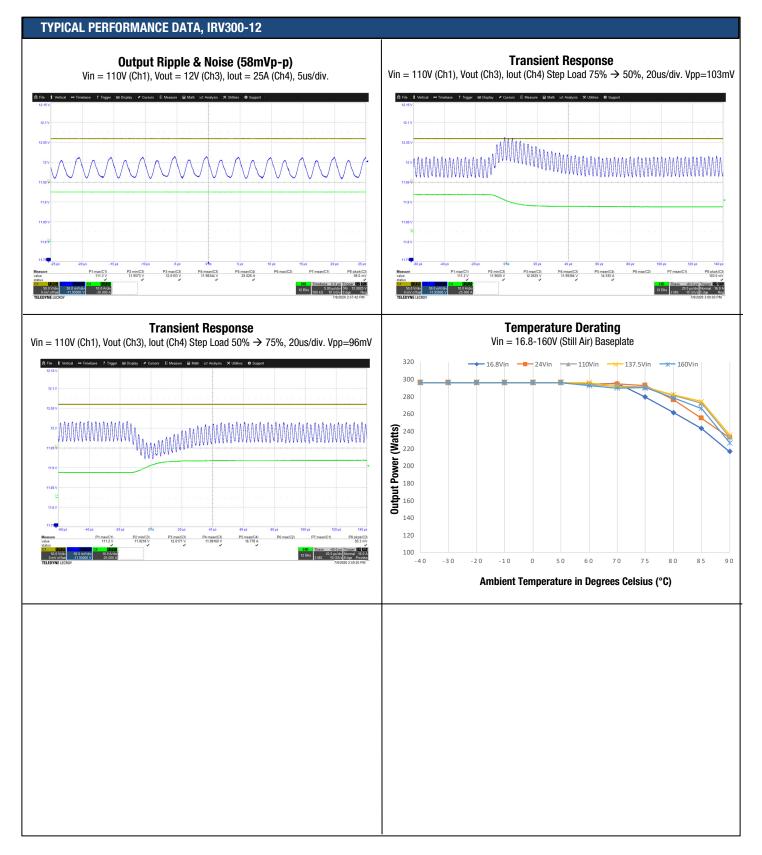
- 1. All specifications are typical unless noted. Ambient temperature =+25°Celsius, Vin is nominal, output current is maximum rated nominal.
- 2. Mean Time Before Failure (MTBF) is calculated using the Telcordia (Belcore) SR-332 Method 1, Case 3, Issue 3, Ground Benign, Controlled. Operating temperature = +40°C, full output load, natural air convection.
- 3. The On/Off Control is normally driven from a switch or relay. An open collector/open drain transistor may be used in saturation and cut-off (pinch-off) modes. External logic may also be used if voltage levels are fully compliant to the specifications.
- 4. Regulation specifications describe the deviation as the input line voltage or output load current is varied from a nominal midpoint value to either extreme (50% load).
- $5. \hspace{0.5cm} \text{Do not exceed maximum power ratings or output overvoltage when adjusting output trim values.}$
- 6. Output over-voltage protection (OVP) is latching mode. Recycle input to enable, after the output over-voltage condition has been removed.
- 7. If reverse polarity is accidentally applied to the input, to ensure reverse input protection, always connect an external fast blow input fuse in series with the +Vin input.

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### **IRV300 Series**



### **IRV300 Series**

300W 10:1 Ultra Wide Input Chassis-Mount Isolated DC-DC Converter

#### FUNCTIONAL SPECIFICATIONS IBV300-24

ABSOLUTE MAXIMUM RATINGS	Conditions [1]	Minimum	Typical/Nominal	Maximum	Units
Input Voltage, Continuous	Full temperature range	16.8		160	Vdc
Input Voltage, Transient	14.4V (100mS, per EN50155) / 168V (100mS)	14.4		168	Vdc
Output Power		0		303	W
Output Current	Current-limited, no damage, short-circuit protected	0		16.5	A
Storage Temperature Range	Vin = Zero (no power)	-55		85	°C
Absolute maximums are stress ratings. Exposure of de listed in the Performance/Functional Specifications Ta		versely affect long-t	erm reliability. Proper opera	tion under conditions	other than thos
INPUT					
Operating Input Voltage Range		16.8	24, 36, 48, 72, 96,110	160	Vdc
Recommended External Fuse	Fast blow		See PUL (P.17)		A
Start-up Voltage	Rising input voltage		16.5		Vdc
Undervoltage Shutdown (PUL set for 24Vin)	Falling input voltage. (14.4V for 100ms)		15.5		Vdc
Overvoltage Shutdown	Rising input voltage		170.0		Vdc
Reverse Polarity Protection [7]	With installed external fuse		Yes		Vdc
Input Current			100		1 100
Full Load Conditions	Vin @ 110V nominal		3.00		A
Full Load Conditions	Vin @ 24V nominal		14.1		A
Low Line	Vin = minimum , 12.5A load		20.6		A
Inrush Transient			2.7		A
No Load Input Power	110Vin typ		2.1		Ŵ
Shut-Down Mode Input Power	nominal input voltage (110V)		1.4		W
GENERAL and SAFETY	nonina inpat voltage (110v)		1.7		
	Vin=24V, full load		88.1		%
Efficiency	Vin=110V, full load	89.5	91.5		%
Isolation			· ·		
Isolation Voltage, Input to Output		4250			Vdc
Isolation Voltage, Input to Case		2830			Vdc
Isolation Voltage, Case to Output		1420			Vdc
Insulation Resistance	Measured with 500Vdc		100		MΩ
Safety Rating			Reinforced		
Safety (Designed to meet the following require-	UL 62368-1, IEC/EN62368-1, Demko		Approved		
ments)	EN 45545, HL1 to HL3 fire/smoke		Pending		
Calculated MTBF [2]	Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°C		1.03		Hours x 10 <sup>6</sup>
DYNAMIC CHARACTERISTICS					
Fixed Switching Frequency	Stage 1/Stage 2		250/200		kHz
Power Up Startup Time	Power On to Vout regulated		350		mS
On/Off Startup Time	Remote ON to Vout regulated		50		mS
Dynamic Load Response	50-75-50% load step, settling time to within ±1% of Vout		150	350	μSec
Dynamic Load Peak Deviation	Same as above,		±100	±200	mV
FEATURES and OPTIONS					
Remote On/Off Control [3]					
Positive Logic					
Positive Logic, ON state	ON=Pin open or external voltage	4		15	Vdc
Positive Logic, OFF state	OFF=Pin grounded or external voltage	0	+ +	0.7	Vdc
Control Current	Open collector/drain, sinking	0	1	2	mA

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300W 10:1 Ultra Wide Input Chassis-Mount Isolated DC-DC Converter

#### FUNCTIONAL SPECIFICATIONS, IRV300-24 (CONT.)

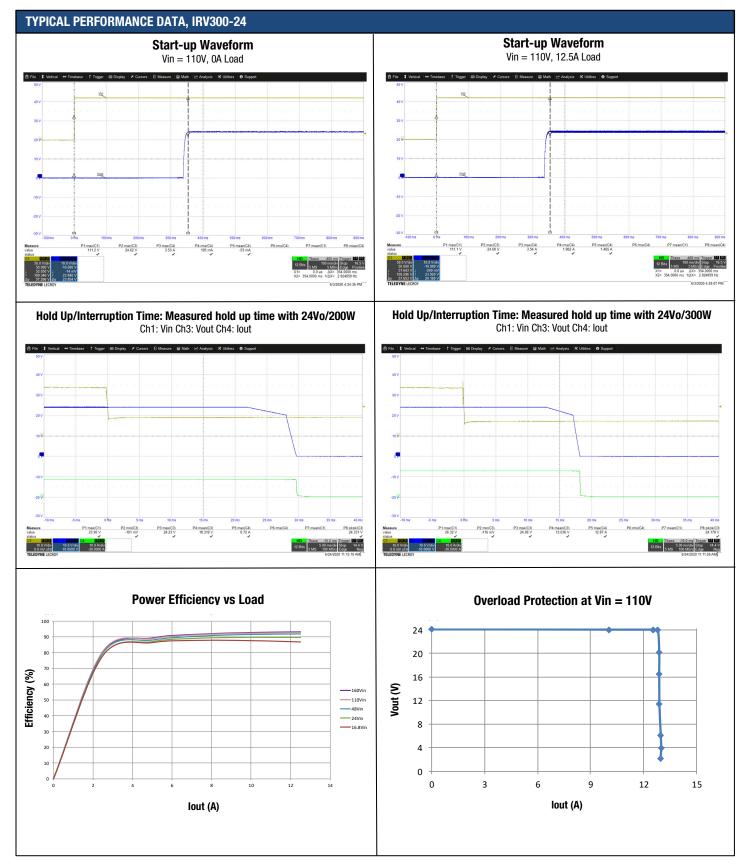
OUTPUT	Conditions [1]	Minimum	Typical/Nominal	Maximum	Units
Total Output Power	See Derating	0	300	303	W
Voltage					
Nominal Output Voltage	No trim	23.76	24	24.24	Vdc
Setting Accuracy	At 50% load		±1		% of Vnom.
Output Voltage Range [5]	User-adjustable	-10		+10	% of Vnom.
Overvoltage Protection [6]	Latching Mode	28	30	33	Vdc
Current	· · · · · · · · · · · · · · · · · · ·		· · ·		
Output Current Range	Vin=16.8V-160V	0	12.5		A
Short Circuit			1		
Short Circuit Current	Constant current mode	12.6	14.4	16.5	А
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage		Continuous		
Short circuit protection method	Constant Current limiting				
Regulation [4]	· · · · · · · · · · · · · · · · · · ·		· · ·		
Line Regulation	Vin=min. to max., Vout=nom., full load		±0.5		%
Load Regulation	lout=min. to max., Vin=110V		±0.5		%
Ripple and Noise	with a 1uF    10uF output caps		75	240	mV pk-pk
Temperature Coefficient	At all outputs		±0.02		% of Vnom./°C
Maximum Capacitive Load	Constant resistance mode			0.1	F
Hold-up (Optional)	EN550155: Class S2 (@300W) / Class S3 (@180W)	10 / 20			mS
MECHANICAL					
Outline Dimensions			7.27 x 4.57 x 1.56		Inches
(Please refer to outline drawing)	L x W x H		184.6 x 116 x 39.7		mm
Case Material			Aluminum, Black Anodized		
Weight			32		Ounces
			900		Grams
EMI/RFI Shielding			Case		
ENVIRONMENTAL					
Operating Ambient Temperature Range	Continuous (for 10min)	-40		70 (85)	°C
Operating Case Temperature Range	No derating	-40		90	°C
Thermal Protection/Shutdown	Temperature on PCB		Yes		°C
Storage Temperature	Vin = Zero (no power)	-55		85	°C
Altitude				3000	m
Electromagnetic Interference	Meets EN50121-3-2				

#### **Performance Specification Notes**

- 1. All specifications are typical unless noted. Ambient temperature =+25°Celsius, Vin is nominal, output current is maximum rated nominal.
- 2. Mean Time Before Failure (MTBF) is calculated using the Telcordia (Belcore) SR-332 Method 1, Case 3, Issue 3, Ground Benign, Controlled. Operating temperature = +40°C, full output load, natural air convection.
- 3. The On/Off Control is normally driven from a switch or relay. An open collector/open drain transistor may be used in saturation and cut-off (pinch-off) modes. External logic may also be used if voltage levels are fully compliant to the specifications.
- 4. Regulation specifications describe the deviation as the input line voltage or output load current is varied from a nominal midpoint value to either extreme (50% load).
- 5. Do not exceed maximum power ratings or output overvoltage when adjusting output trim values.
- 6. Output over-voltage protection (OVP) is latching mode. Recycle input to enable, after the output over-voltage condition has been removed.
- 7. If reverse polarity is accidentally applied to the input, to ensure reverse input protection, always connect an external fast blow input fuse in series with the +Vin input.

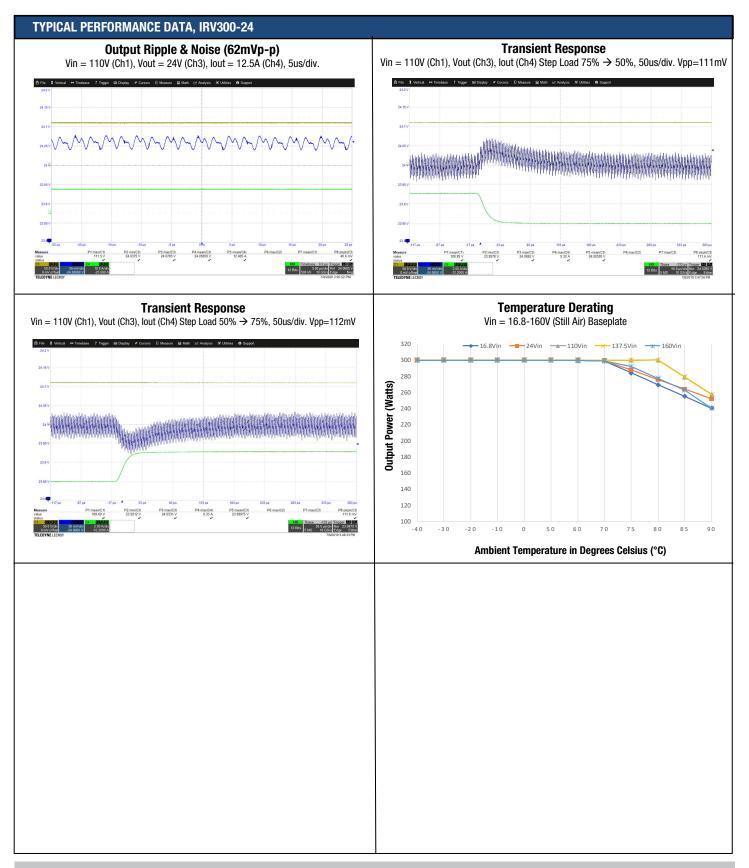
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### **IRV300 Series**



**IRV300 Series** 

300W 10:1 Ultra Wide Input Chassis-Mount Isolated DC-DC Converter

#### **FUNCTIONAL SPECIFICATIONS, IRV300-54**

Input Varlage, ContinuousFull temperature range16.816.0Vdc.Input Varlage, Transient14.4V (100ns, per EN6055) / 169V (100ms)14.416.8Vdc.Output Dovern00305Wdc.Storage Temperature RangeOur methinition, no damage, short-cinici protected0305Wdc.Storage Temperature RangeVm = Zero (top power)-5585Cc.Absolde maximums are stess ratings. Exposure of devices to greater thma any of these conditions may adversely affect long-term reliability. Proper operation under conditions:Wdc.NordRecommended External FuseTB.872.4, 36, 49.16.0Wdc.Recommended External FuseFatto biowTB.8Vdc.Wdc.NordResonational Specifications Table in traffic devices to greater thma providiageTB.8Vdc.Wdc.Recommended External FuseFatto biowTB.8Vdc.Wdc.Wdc.NordResonating input voltageTB.8Wdc.Wdc.Overvoltage Shutdown (PUL set for 24Vin)Fatto bio with misside devices for adma fuseWdc.Wdc.Patto additionsVm P mithing. (L4.4V for 100ms)TB.8Wdc.Wdc.Nord TableWith misside devices for adma fuseWdc.Wdc.Wdc.Patto additionsVm P mithing. (L4.4V for 100ms)TB.8Wdc.Wdc.Nord TableWith misside devices for adma fuseWdc.Wdc.Wdc.Patto additionsVm P mithing. (L4.4V for 100ms)TB.8Wdc.Wdc.<	ABSOLUTE MAXIMUM RATINGS	Conditions [1]	Minimum	Typical/Nominal	Maximum	Units
Output Darrent         O         305         W           Strange Temperature Range         Unrent-limited, no damage, stort-circut protected         0         189         A           Strange Temperature Range         Win = Zero, (mp power)         -56         189         -7C           Absolate maximums are sites ratings, Exposure of devices to greater than any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than those indevices to implete our recommonded.         -66         24, 88, 48, 74         -7C           Apendie maximums are sites ratings, Exposure of devices to greater than any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than those indevices to recommonded.         -7G         -7G           Apendie maximum are sites ratings, Exposure of devices to greater than any of these conditions may adversely affect long. The Provide ratio of the Provide rati Provide rati Provide ratio of the Provide rati Prov	Input Voltage, Continuous	Full temperature range	16.8		160	Vdc
Output Current         Current-limited, no damage, short-incut prodected         0         TED         A           Storage Temperature Range         Vin 2 Aro (no power)         -55         85         -9C           Absolute maximums are stress ratings. Exposure of devices to greater than any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than those issee in the product of devices to greater than any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than those issee issee it that any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than those issee issee it that any of these conditions and version of the product devices to greater than any of these conditions and version of the product devices to greater than any of these conditions and version of the product devices that any of these conditions is provide and the product devices that any of these conditions are stored and the product devices that any of these conditions are stored and the product devices that any of these conditions are stored and the product devices that any of these conditions are stored and the product devices that any of these conditions are stored and the product devices that any of these conditions are stored and the product devices that any of these conditions are stored and the product devices that any of these conditions are stored and the product devices that any of these conditions are stored and the product devices that any of these conditions are stored and the product devices that are sto	Input Voltage, Transient	14.4V (100mS, per EN50155) / 168V (100mS)	14.4		168	Vdc
Storage Persperature Range         Win = Zero (no pown)         -55         85         9C           Absolute maximums are stress mitings: Exposer of defices to grader than any of these conditions my adversely affect long-term reliability. Proge operation under conditions other than those listed in the Performance/Functional Specifications Table is not implied or recommended.         16.8         72.4         86.48         70         Vice           Operating input Voltage Range         Fast blow         16.8         72.4         86.48         0         40           Recommended External Fuse         Fast blow         TBD         40         40         40         40           Overothage Shutdrown (PUL set for 24Vin)         Falling input voltage         TBD         Vide         40	Output Power		0		305	W
Absolute maximum are astrages ratings. Exposure of devices to grater than any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than this is lise in the Promomended.         INPUT	Output Current	Current-limited, no damage, short-circuit protected	0		TBD	A
listed in the Performance/Functional Specifications Table is not implied or recommended. NPUT Operating input Voltage Range Performance/Functional Specifications Table is not implied or recommended External Fuse Fast blow Fast publicate Fast publicate Fast blow Fast publicate Fa	Storage Temperature Range	Vin = Zero (no power)	-55		85	°C
UNUT         24, 36, 48, 72, 95,110         160         Vdc           Operating input Voltage         Fast blow         TBD         A           Start-up Voltage         Hising input Voltage         TBD         Vdc           Overoatge Shutdown (PUL set for 24Vin)         Falling input Voltage         TBD         Vdc           Reverse Polarity Protection (7)         With installed external tase         TBD         Vdc           Ingut Current         Fall cad Conditions         Vin @ 110V nominal         TBD         A           Full cad Conditions         Vin @ 240 nominal         TBD         A           Low Line         Vin = minimum, 6.25A load         TBD         A           Shut-Down Mode Input Power         Vin max, 0;v071 = 0         TBD         W           Shut-Down Mode Input Power         Vin=110V, full load         89.5         91.5         %           Sturt-Down Mode Input Power         Vin=110V, full load         89.5         91.5         %           Sturt-Down Mode Input Power         Vin=110V, full load         89.5         91.5         %           Sturt-Down Mode Input Power         Vin=110V, full load         89.5         91.5         %           Sturt-Down Mode Input Power         Vin=110V, full load         89.5         91.5 <td></td> <td></td> <td>versely affect long-te</td> <td>erm reliability. Proper opera</td> <td>tion under conditions</td> <td>other than those</td>			versely affect long-te	erm reliability. Proper opera	tion under conditions	other than those
Operating input Votage nange         Inco.         Vice           Start-up Votage         Rising input votage (14 AV or 10ms)         TBD         A           Start-up Votage         Rising input votage, (14 AV or 10ms)         TBD         Vide           Overvotage Shutdown (PUL set for 24Vin)         Palling input votage, (14 AV or 10ms)         TBD         Vide           Overvotage Shutdown (PUL set for 24Vin)         Palling input votage, (14 AV or 10ms)         TBD         Vide           Pall Load Conditions         Vin @ 110V nominal         TBD         A           Full Load Conditions         Vin @ 110V nominal         TBD         A           Full Load Conditions         Vin @ 24V nominal         TBD         A           Inrush Transient         TBD         M         A           No Load Input Power         110Vin typ         TBD         W           Sturt-Down Mode Input Power         Vin minimum, 0:23A load         9         W           Sturt-Down Mode Input Power         Vin minimum, 0:23A load         9         W         W           Sturt-Down Mode Input Power         Vin minimum, 0:23A load         88.0         9         %         5           Sturt-Down Mode Input Power         Vin minimum, 0:23A load         88.0         9         %         5<						
Recommended External Puse         Fast blow         TBD         A           Sart-up Voltage         Rising input voltage         HBD         Vdc           Overroltage Stutidown (PUL set for 24Vin)         Failing input voltage         HBD         Vdc           Reverse Polarity Protection (7)         With installed external fuse         Yes         Vdc           Input Conditions         Vin @ 110V nominal         TBD         Vdc           Full Load Conditions         Vin @ 110V nominal         TBD         A           Low Line         Vin @ 24V nominal         TBD         A           Low Line         Vin @ 24V nominal         TBD         A           No Load Input Power         110Vin typ         TBD         WW           Shut-Down Mode Input Power         Vin min/max, 0n/0ff = 0         TBD         W           Shut-Down Mode Input Power         Vin min/max, 0n/0ff = 0         TBD         W           Shut-Down Mode Input Power         Vin min/max, 0n/0ff = 0         Stot         %           Isolation         Vin = 24V, full load         89.5         Stot.5         %           Isolation Voltage, Input to Output         Measured with 500Vdc         1500         Vdc         Vac           Isolation Voltage, Input to Output         Measured wi	Operating Input Voltage Range		16.8		160	Vdc
Undervoltage Shutdown (PUL set for 24Vin)         Falling input voltage (14 A/ for 100ms)         TBD         Vdc           Overvoltage Shutdown (PUL set for 24Vin)         Rising input voltage (14 A/ for 100ms)         TBD         Vdc           Reverse Polarity Protection (7)         With installed external use         TBD         Vdc           Full Load Conditions         Vm @ 110V nominal         TBD         A           Full Load Conditions         Vm @ 110V nominal         TBD         A           Full Load Conditions         Vm @ 110V nominal         TBD         A           Innush Transient         Vin = minimum , 6.26A load         TBD         A           No Load Input Power         110Vin typ         TBD         W         W           Shut-bown Mode Input Power         Vin=24V, full load         86.0         %         %           Isolation Voltage, Input to Output         Vin=24V, full load         86.0         %         %           Isolation Voltage, Input to Coutput         Measured with 500Vdc         1000         MQc         MQc           Isolation Voltage, Case to Output         Measured with 500Vdc         100.0         MQc         MQc           Isolation Voltage, Input to Case         Measured with 500Vdc         100.0         MQc         MQc	Recommended External Fuse	Fast blow				Α
Undervoltage Shutdown (PUL set for 24Vin) Reverse Polarity Protection [7] Vdc Reverse Polarity Protection [7] With installed external use Reverse Polarity Protection [7] With installed external use Reverse Polarity Protection [7] With installed external use Reverse Polarity Protection [7] With installed external use Full Load Conditions Vin @ 110V nominal Full Load Conditions Vin @ 110V nominal Full Load Conditions Vin @ 24V nominal Low Line Vin = minimum , 6.25A load Invush Transient No Load Input Power Vin minimum , 6.25A load Invush Transient No Load Input Power Vin minimum , 6.25A load No Load Input Power Vin minimum , 6.25A load No Load Input Power Vin minimum , 6.25A load Reverse Polarity Vin=24V, full load 86.0 StateSy Reverse StateSy Reverse State StateSy Reverse StateSy Reverse StateSy Reverse StateSy Reverse Reverse Reverse Reverse Reverse Reverse Reverse Reve	Start-up Voltage	Rising input voltage		TBD		Vdc
Dervotrage Shutdown i Rising input voltage i TBD Vide Reverse Polarity Protection [7] With installed oxtornal fuse Yes Vide Reverse Polarity Protection [7] With installed oxtornal fuse Yes Vide Full Lad Conditions Vin @ 110V nominal TBD A A Low Line Vin = minimum, 6.25A load TBD A A Low Line Vin = minimum, 6.25A load TBD M A No Load Input Power Vin min/max, On/Off = 0 Shut-Down Mode Input Power Vin min/max, On/Off = 0 Shut-Down Mode, Input to Case Shut-Down Mode, Input to Case Vin=110V, full load 89.5 Shaton Vinage, Input to Case Vin=110V, full load 89.5 Shaton Vinage, Input to Case Neasured with 500Vdc 100 Safety Rating Vin = 140, Safety Rever Vin Shut Power Vin Shut Power Vin Min/Max, Safety Rating Power Output 100, Information Power Vin Tisolation Vinage, Sae to Output 100, Viac Nation Power Viac Nation Resistance Neasured with 500Vdc 100 Safety Rating Vin E Via Shut Power Power Via Shut Power Via Shut Power Via Shut Power Via						
Reverse Polarity Protection [7] With installed external fuse Ves Ves Ves Ves input Current  Full Cad Conditions Vin @ 110V nominal TBD A  Full Cad Conditions Vin @ 24V nominal TBD A  Full Cad Conditions Vin @ 24V nominal TBD A  Imush Transient No Load Input Power 10 Non minimum, 6.25A load TBD W Shut-Down Mode Input Power Vin min/max, 0n/Off = 0 TBD W Shut-Down Mode Input Power Vin min/max, 0n/Off = 0 TBD W CENTRAL and SAFETY Vin=24V, full load 89.5 91.5 % Efficiency Vin=110V, full load 89.5 91.5 % Solation Voltage, Input to Output Insulation Voltage, Input to Output Isolation Voltage, Case to Output Isolation Resistance U  Eaders Vin=110V, full Isolation Resistance Vin=110V, full Isolation Voltage, Case to Output Isolation Voltage, Case to Output Isolation Voltage, Case to Output Isolation Resistance Vin=110V, full Isolation Voltage, Case to Output Isolation Resistance Isolation Voltage, Case to Output Isola	<b>, , ,</b>	8 I 8 (				
Input Current         Image         Vin @ 110V nominal         TBD         A           Full Load Conditions         Vin @ 24V nominal         TBD         A           Low Line         Vin = minimum, 6.25A load         TBD         A           Inrush Transient         Vin @ 24V nominal         TBD         A           No Load Input Power         110/in typ         TBD         W           Shut-Down Mode Input Power         Vin =minimum, 6.25A load         TBD         W           Shut-Down Mode Input Power         Vin =minimum, 6.25A load         TBD         W           Shut-Down Mode Input Power         Vin =minimum, 6.25A load         TBD         W           Shut-Down Mode Input Power         Vin =minimum, 6.25A load         TBD         W           Shut-Down Mode Input Power         Vin =10V, full load         86.0         %           Shut-Down Mode Input Power         Vin =10V, full load         89.5         91.5         %           Isolation Voltage, Input to Output         Isolation Voltage, Input to Output         Vin =10V, full load         89.5         91.5         %           Isolation Voltage, Case to Output         Measured with 500Vdc         100         MΩ         Yacc           Isolation Voltage, Input to Output         Isolaton Nesistance	5	<b>8</b> 1 8				
Full Load Conditions         Vin @ 110/nominal         TBD         A           Full Load Conditions         Vin @ 24/ nominal         TBD         A           Low Line         Vin = minimum, 6.25A load         TBD         A           Inrush Transient         Vin = minimum, 6.25A load         TBD         A           No Load Input Power         110/non typ         TBD         W           Shut-Down Mode Input Power         110/non typ         TBD         W           Shut-Down Mode Input Power         Vin min/max, 0n/Off = 0         TBD         W           State Down Mode Input Power         Vin min/max, 0n/Off = 0         TBD         W           State Down Mode Input Power         Vin min/max, 0n/Off = 0         TBD         W           State Down Mode Input Power         Vin min/max, 0n/Off = 0         TBD         W           States Down Mode Input Power         Vin min/max, 0n/Off = 0         TBD         Wdc           Isolation Voltage, Input to Output         4250         Vdc         Vdc           Isolation Voltage, Case to Output         1500         Wdc         MO           Isolation Voltage, Case to Output         100         MO         MC           Safety (Designed to meet the following requiremments)         UL 62388-1, IEC/EN62368-1, Dem/o				100		1 100
Full Lad Conditions     Vin @ 24V nominal     TBD     A       Low Line     Vin = minimum, 6.25A load     A     A       Inrush Transient     110Vin typ     TBD     M       No Load Input Power     110Vin typ     TBD     W       Shut-Down Mode Input Power     Vin min/max, On/Off = 0     TBD     W       Shut-Down Mode Input Power     Vin min/max, On/Off = 0     TBD     W       GENERAL and SAFETY     Vin=24V, full load     86.0     %       Efficiency     Vin=24V, full load     89.5     91.5     %       Isolation     Isolation Voltage, Input to Output     4250     Vic     Vic       Isolation Voltage, Input to Case     2830     Vic     Vic       Isolation Voltage, Input to Case     Measured with 500Vdc     100     MC       Safety Rating     UL 62368-1, IEC/EN62368-1, Demko     Approved     MC       Safety (Designed to meet the following requirements)     UL 62368-1, IEC/EN62368-1, Demko     Approved     Mours x 10 <sup>o</sup> Calculated MTBF [2]     Per Telocridia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°C     TBD     Hours x 10 <sup>o</sup> DYNAMIC CHARACTERISTICS     Fixed Switching Frequency     Sage 1/Stage 2     250/200     KHz       Power Up Startup Time     Power On to Vout regulated     50     50	•	Vin @ 110V nominal		TBD		Α
Low Line         Vin = minimum, 6,25A load         TBD         A           Inrush Translent         TBD         TBD         MA           No Load Input Power         110Vin typ         TBD         W           Shut-Down Mode Input Power         Vin = minimum, 6,25A load         TBD         W           Shut-Down Mode Input Power         Vin min/max, On/Off = 0         TBD         W           Shut-Down Mode Input Power         Vin = 110V, full load         88.5         91.5         %           Stolation         Vin=24V, full load         88.5         91.5         %           Isolation Votage, Input to Output         4250         V/dc         V/dc           Isolation Votage, Input to Case         2830         V/dc         V/dc           Isolation Votage, Gase to Output         1500         100         MQ           Safety Rating         UL 62368-1, IEC/EN62368-1, Demko         Approved            Safety (Designed to meet the following requirements)         UL 62368-1, IEC/EN62368-1, Demko         Approved            Calculated MTBF [2]         Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°C         TBD         Hours x 10°           Over Up Startup Time         Power On to Vout regulated         354         50         mS						
Inrush Translent         The Human Folderade         TBD         mA           No Load Input Power         110Vin typ         TBD         W           Shut-Down Mode Input Power         Vin min/max, On/Off = 0         TBD         W           GENERAL and SAFETY         Vin=24V, full load         86.0         %           Efficiency         Vin=24V, full load         89.5         91.5         %           Isolation Voltage, Input to Output         1600         M/dc         V/dc         1600           Isolation Voltage, Input to Case         2830         V/dc         1500         V/dc           Isolation Voltage, Case to Output         Measured with 500Vdc         100         M/Ω         Safety Atling         V/dc         V/dc           Safety Atling         Reinforced         M/Q         Safety Atling         Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°C         TBD         Hours x 10°           DYNAMIC CHARACTERISTICS         Freedowitching Frequency         Stage 1/Stage 2         250/200         KHz           Power Up Startup Time         Power On to Vout regulated         354         mS         SO           Dynamic Load Response         50-75-50% load step, setting time to within ±1% of Vout         TBD         TBD         g/sec						
No Load Input Power     110Vin typ     TBD     W       Shut-Down Mode Input Power     Vin min/max, 0n/0ff = 0     TBD     W       Shut-Down Mode Input Power     Vin min/max, 0n/0ff = 0     TBD     W       Shut-Down Mode Input Power     Vin min/max, 0n/0ff = 0     TBD     W       Efficiency     Vin=24V, full load     86.0     %       Isolation     Vin=110V, full load     89.5     91.5     %       Isolation Voltage, Input to Output     4250     Vdc     Vdc       Isolation Voltage, Input to Case     2830     Vdc     Vdc       Isolation Voltage, Case to Output     Measured with 500Vdc     100     MQ       Safety Rating     UL 62368-1, IEC/EN62368-1, Demko     Approved     E       Safety (Designed to meet the following requirements)     UL 62368-1, IEC/EN62368-1, Demko     Approved     Hours x 10 <sup>o</sup> Calculated MTBF [Z]     Pertecordia SR-332, Issue 3, Case 3, Ground Bening controlled, Tambient=40 <sup>o</sup> C     TBD     Hours x 10 <sup>o</sup> OVAMIIC CHARACTERISTICS     Fxeed Switching Frequency     Stage 1/Stage 2     250/200     KHz       Power Up Startup Time     Power On to Vout regulated     354     mS       On/Off Startup Time     Power On to Vout regulated     50     mS       Dynamic Load Peak Deviation     Same as above, ±TBD     ±TBD		VIII – HIIIIIIIIIII, O.2071000		TRD		
Shut-Down Mode Input Power         Vin min/max, 0n/Off = 0         TBD         W           GENERAL and SAFETY         Vin=24V, full load         86.0         %           Efficiency         Vin=24V, full load         89.5         91.5         %           Isolation         Vin=110V, full load         89.5         91.5         %           Isolation Voltage, Input to Output         4250         Vdc         Vdc           Isolation Voltage, Case to Output         1500         Vdc         Vdc           Isolation Voltage, Case to Output         1500         Vdc         Vdc           Isolation Voltage, Case to Output         100         MQ         MQ           Safety Rating         UL 62368-1, Demko         Approved            Safety (Designed to meet the following requirements)         UL 62368-1, IEC/EN62368-1, Demko         Approved            Calculated MTBF [2]         Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°C         TBD         Hours x 10°           OVNAMIC CHARACTERISTICS         Fixed Switching Frequency         Stage 1/Stage 2         250/200         kHz           Power Up Startup Time         Remote On to Vout regulated         354         mS         MC           OvfOrd Startup Time         Remote On to Vout regula		110Vin tvn				
GENERAL and SAFETY         Vin=24V, full load         86.0         %           Efficiency         Vin=10V, full load         89.5         91.5         %           Isolation         Vin=110V, full load         89.5         91.5         %           Isolation Voltage, input to Output         4250         Vdc         Vdc           Isolation Voltage, input to Case         2830         Vdc         Vdc           Isolation Voltage, Case to Output         1500         Vdc         Vac           Insulation Resistance         Measured with 500Vdc         100         MQ           Safety Rating         UL 62368-1, IEC/EN62368-1, Demko         Approved         EN           Safety (Designed to meet the following requirements)         UL 62368-1, IEC/EN62368-1, Demko         Approved         EN           Safety (Designed to meet the following requirements)         Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°C         TBD         Hours x 10 <sup>a</sup> DYNAMIC CHARACTERISTICS         Fixed Switching Frequency         Stage 1/Stage 2         250/200         KHz           Power Up Startup Time         Power Up Ot Vout regulated         354         mS         Stage           Dynamic Load Response         50-75-50% load step, setting time to within ±1% of Vout         TBD         TBD						
$\begin{tabular}{ c c c c c c } \hline Vin=24V, full load & 86.0 & % \\ \hline Vin=110V, full load & 89.5 & 91.5 & 0 & \% \\ \hline Vin=110V, full load & 89.5 & 91.5 & 0 & \% \\ \hline Vin=110V, full load & 89.5 & 91.5 & 0 & \% \\ \hline Vin=110V, full load & 89.5 & 91.5 & 0 & \% \\ \hline Isolation Voltage, Input to Output & 4250 & Vdc & Vdc & 2830 & Vdc & Vdc & 1800 & Vdc & 1800 & Vdc & 1800 & Vdc & 1800 & M\Omega \\ \hline Isolation Voltage, Case to Output & 1800 & 0.0 & Vdc & 100 & M\Omega & Safety Rating & UL 62368-1, IEC/EN62368-1, Demko & Approved & 0 & 0.0 & Vdc & 0 & 0.0 & Vdc & 0 & 0.0 & Vdc & 0 & 0.0 & 0 & 0.0 & 0 & 0.0 & 0 & 0 &$	•			TDD		
Entriency       Vin=110V, full load       89.5       91.5       %         Isolation       Vin=110V, full load       89.5       91.5       %         Isolation Voltage, Input to Output       4250       Vdc       Vdc         Isolation Voltage, Input to Case       2830       Vdc       Vdc         Isolation Voltage, Case to Output       1500       Vdc       Vdc         Isolation Voltage, Case to Output       Measured with 500Vdc       100       MΩ         Safety Rating       UL 62368-1, IEC/EN62368-1, Demko       Approved          Safety (Designed to meet the following requiremements)       UL 62368-1, IEC/EN62368-1, Demko       Approved          Ealculated MTBF [2]       Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=-40°C       TBD       Hours x 10°         DVNAMIC CHARACTERISTICS       Fixed Switching Frequency       Stage 1/Stage 2       250/200       kHz         Power Up Startup Time       Power On to Vout regulated       354       mS         Dynamic Load Response       50-75-50% load step, setting time to within ±1% of Vout       TBD       TBD       µSec         Dynamic Load Peak Deviation       Same as above,       ±TBD       ±TBD       mV         FEATURES and OPTIONS       Same as above,       ±TBD <td></td> <td>Vin=24V, full load</td> <td></td> <td>86.0</td> <td></td> <td>%</td>		Vin=24V, full load		86.0		%
Isolation Voltage, Input to Output       4250       Vdc         Isolation Voltage, Input to Case       22830       Vdc         Isolation Voltage, Case to Output       1500       Vdc         Isolation Resistance       Measured with 500Vdc       100       MΩ         Safety Rating       Reinforced       Mca       MΩ         Safety (Designed to meet the following requirements)       UL 62368-1, IEC/EN62368-1, Demko       Approved       MΩ         Safety (Designed to meet the following requirements)       UL 62368-1, IEC/EN62368-1, Demko       Approved       Must Status       M	Efficiency		89.5			
Isolation Voltage, Input to Case         2830         Vdc           Isolation Voltage, Case to Output         1500         Vac           Insulation Resistance         Measured with 500Vdc         1500         Vdc           Safety Rating         Insulation Resistance         100         MΩ           Safety Rating         UL 62368-1, IEC/EN62368-1, Demko         Reinforced         Insulation Resistance           Safety (Designed to meet the following requirements)         UL 62368-1, IEC/EN62368-1, Demko         Approved         Insulation Resistance         Pending           Calculated MTBF [2]         Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°C         TBD         Hours x 10°           DYNAMIC CHARACTERISTICS         Fixed Switching Frequency         Stage 1/Stage 2         250//200         kHz           Power Up Startup Time         Power On to Vout regulated         354         mS           On/Off Startup Time         Remote On to Vout regulated         50         mS           Dynamic Load Response         50-75-50% load step, setting time to within ±1% of Vout         TBD         TBD         µSec           Positive Logic         ON/ES         Amende On/Off Control [3]         TBD         ±TBD         mV           Positive Logic, OFF state         OFF=Pin grounded or external voltage	Isolation			<u> </u>		
Isolation Voltage, Case to Output         Measured with 500Vdc         1500         Vac           Insulation Resistance         Measured with 500Vdc         100         MΩ           Safety Rating         Reinforced         MΩ           Safety Rating         UL 62368-1, IEC/EN62368-1, Demko         Approved           Safety (Designed to meet the following requirements)         UL 62368-1, IEC/EN62368-1, Demko         Approved           Calculated MTBF [2]         Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°C         TBD         Hours x 10°           DYNAMIC CHARACTERISTICS         Fixed Switching Frequency         Stage 1/Stage 2         250/200         kHz           Power Up Startup Time         Power On to Vout regulated         354         mS           On/Off Startup Time         Remote On to Vout regulated         50         mS           Dynamic Load Response         50-75-50% load step, settling time to within ±1% of Vout         TBD         ±TBD         µSec           Positive Logic, ON state         ON=Pin open or external voltage         4         15         Vdc           Positive Logic, OFF state         OFF=Pin grounded or external voltage         0         0.77         Vdc	Isolation Voltage, Input to Output		4250			Vdc
Insulation Resistance         Measured with 500Vdc         100         MΩ           Safety Rating         Reinforced         Reinforced         MΩ           Safety Rating         UL 62368-1, IEC/EN62368-1, Demko         Approved         MΩ           Safety (Designed to meet the following requirements)         UL 62368-1, IEC/EN62368-1, Demko         Approved         MΩ           Calculated MTBF [2]         Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°C         TBD         Hours x 10°           DYNAMIC CHARACTERISTICS         Fixed Switching Frequency         Stage 1/Stage 2         250/200         kHz           Power Up Startup Time         Power On to Vout regulated         354         mS         MS           Dynamic Load Response         50-75-50% load step, settling time to within ±1% of Vout         TBD         TBD         µSec           Positive Logic, ON State         ON=Pin open or external voltage         4         15         Vdc           Positive Logic, OFF state         OFF=Pin grounded or external voltage         0         0.7         Vdc	Isolation Voltage, Input to Case		2830			Vdc
Safety Rating         Reinforced         Reinforced           Safety (Designed to meet the following requirements)         UL 62368-1, IEC/EN62368-1, Demko         Approved         Approved           EN 45545, HL1 to HL3 fire/smoke         Pending         Mours x 10°           Calculated MTBF [2]         Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°C         TBD         Hours x 10°           DYNAMIC CHARACTERISTICS         Fixed Switching Frequency         Stage 1/Stage 2         250/200         KHz           Power Up Startup Time         Power On to Vout regulated         354         mS           On/Off Startup Time         Remote On to Vout regulated         50         mS           Dynamic Load Response         50-75-50% load step, settling time to within ±1% of Vout         TBD         ±TBD         µSec           Dynamic Load Peak Deviation         Same as above,         ±TBD         ±TBD         mV           FEATURES and OPTIONS         Features         UL 601         15         Vdc           Positive Logic, ON state         ON=Pin open or external voltage         0         0.7         Vdc           Positive Logic, OFF state         OFF=Pin grounded or external voltage         0         0.7         Vdc	Isolation Voltage, Case to Output		1500			Vac
Safety Rating         Reinforced         Reinforced           Safety (Designed to meet the following requirements)         UL 62368-1, IEC/EN62368-1, Demko         Approved         Approved           EN 45545, HL1 to HL3 fire/smoke         Pending         Mours x 10°           Calculated MTBF [2]         Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°C         TBD         Hours x 10°           DYNAMIC CHARACTERISTICS         Fixed Switching Frequency         Stage 1/Stage 2         250/200         KHz           Power Up Startup Time         Power On to Vout regulated         354         mS           On/Off Startup Time         Remote On to Vout regulated         50         mS           Dynamic Load Response         50-75-50% load step, settling time to within ±1% of Vout         TBD         ±TBD         µSec           Dynamic Load Peak Deviation         Same as above,         ±TBD         ±TBD         mV           FEATURES and OPTIONS         Features         UL 601         15         Vdc           Positive Logic, ON state         ON=Pin open or external voltage         0         0.7         Vdc           Positive Logic, OFF state         OFF=Pin grounded or external voltage         0         0.7         Vdc	Insulation Resistance	Measured with 500Vdc		100		ΜΩ
Safety (Designed to meet the following requirements)         UL 62368-1, IEC/EN62368-1, Demko         Approved           Safety (Designed to meet the following requirements)         EN 45545, HL1 to HL3 fire/smoke         Pending           Calculated MTBF [2]         Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°C         TBD         Hours x 10°           DYNAMIC CHARACTERISTICS         Fixed Switching Frequency         Stage 1/Stage 2         250/200         kHz           Power Up Startup Time         Power On to Vout regulated         354         mS           On/Off Startup Time         Remote On to Vout regulated         50         mS           Dynamic Load Response         50-75-50% load step, settling time to within ±1% of Vout         TBD         TBD         µSec           Dynamic Load Peak Deviation         Same as above,         ±TBD         ±TBD         mV           FEATURES and OPTIONS           Remote On/Off Control [3]           Positive Logic, ON state         ON=Pin open or external voltage         0         0.7         Vdc           Positive Logic, OFF state         OFF=Pin grounded or external voltage         0         0.7         Vdc						
ments)EN 45545, HL1 to HL3 fire/smokePendingCalculated MTBF [2]Per Telcordia SR-332, Issue 3, Case 3, Ground Benign controlled, Tambient=40°CTBDHours x 10°DYNAMIC CHARACTERISTICSFixed Switching FrequencyStage 1/Stage 2250/200kHzPower Up Startup TimePower On to Vout regulated354mSOn/Off Startup TimeRemote On to Vout regulated50mSDynamic Load Response50-75-50% load step, settling time to within ±1% of VoutTBDTBDμSecDynamic Load Peak DeviationSame as above,±TBD±TBDmVFEATURES and OPTIONSPositive Logic, ON statePositive Logic, ON stateON=Pin open or external voltage415VdcPositive Logic, OFF stateOFF=Pin grounded or external voltage00.7VdcControl CurrentOpen collector/drain, sinking12mA		UL 62368-1, IEC/EN62368-1, Demko		1		
Calculated W1BF [2]Benign controlled, Tambient=40°CTBDHours x 10%DYNAMIC CHARACTERISTICSFixed Switching FrequencyStage 1/Stage 2250/200kHzPower Up Startup TimePower On to Vout regulated354mSOn/Off Startup TimeRemote On to Vout regulated354mSDynamic Load Response50-75-50% load step, settling time to within ±1% of VoutTBDTBDµSecDynamic Load Peak DeviationSame as above,±TBD±TBDmVFEATURES and OPTIONSPositive Logic, ON stateON=Pin open or external voltage415VdcPositive Logic, OFF stateOFF=Pin grounded or external voltage00.7VdcControl CurrentOpen collector/drain, sinking12mA		EN 45545, HL1 to HL3 fire/smoke		Pending		
DYNAMIC CHARACTERISTICS         Fixed Switching Frequency       Stage 1/Stage 2       250/200       kHz         Power Up Startup Time       Power On to Vout regulated       354       mS         On/Off Startup Time       Remote On to Vout regulated       354       mS         Dynamic Load Response       50-75-50% load step, settling time to within ±1% of Vout       TBD       TBD       µSec         Dynamic Load Peak Deviation       Same as above,       ±TBD       ±TBD       mV         FEATURES and OPTIONS       Remote On/Off Control [3]       Positive Logic, ON state       ON=Pin open or external voltage       4       15       Vdc         Positive Logic, OFF state       OFF=Pin grounded or external voltage       0       0.7       Vdc         Control Current       Open collector/drain, sinking       1       2       mA	Calculated MTBF [2]			TBD		Hours x 106
Power Up Startup Time         Power On to Vout regulated         354         ms           On/Off Startup Time         Remote On to Vout regulated         354         ms           Dynamic Load Response         50-75-50% load step, settling time to within ±1% of Vout         TBD         TBD         µSec           Dynamic Load Response         50-75-50% load step, settling time to within ±1% of Vout         TBD         ±TBD         µSec           Dynamic Load Peak Deviation         Same as above,         ±TBD         ±TBD         mV           FEATURES and OPTIONS         Remote On/Off Control [3]               Positive Logic         ON=Pin open or external voltage         4         15         Vdc           Positive Logic, OFF state         OFF=Pin grounded or external voltage         0         0.7         Vdc           Control Current         Open collector/drain, sinking         1         2         mA	DYNAMIC CHARACTERISTICS			· · ·		·
On/Off Startup Time         Remote On to Vout regulated         501         MS           Dynamic Load Response         50-75-50% load step, settling time to within ±1% of Vout         TBD         TBD         μSec           Dynamic Load Response         50-75-50% load step, settling time to within ±1% of Vout         TBD         TBD         μSec           Dynamic Load Peak Deviation         Same as above,         ±TBD         ±TBD         mV           FEATURES and OPTIONS           Remote On/Off Control [3]           Positive Logic           Positive Logic, ON state         ON=Pin open or external voltage         4         15         Vdc           Positive Logic, OFF state         OFF=Pin grounded or external voltage         0         0.7         Vdc           Control Current         Open collector/drain, sinking         1         2         mA	Fixed Switching Frequency	Stage 1/Stage 2		250/200		kHz
Dynamic Load Response     50-75-50% load step, settling time to within ±1% of Vout     TBD     TBD     μSec       Dynamic Load Peak Deviation     Same as above,     ±1% of Vout     ±1% of Vout<		Power On to Vout regulated		354		mS
Dynamic Load Response     ±1% of Vout     TBD     TBD     μSec       Dynamic Load Peak Deviation     Same as above,     ±TBD     ±TBD     mV       FEATURES and OPTIONS       Remote On/Off Control [3]       Positive Logic       Positive Logic, ON state       ON=Pin open or external voltage     4     15     Vdc       Positive Logic, OFF state     OFF=Pin grounded or external voltage     0     0.7     Vdc       Control Current     Open collector/drain, sinking     1     2     mA	On/Off Startup Time	Remote On to Vout regulated			50	mS
Dynamic Load Peak Deviation     Same as above,     ±TBD     ±TBD     mV       FEATURES and OPTIONS       Remote On/Off Control [3]       Positive Logic       Positive Logic, ON state     ON=Pin open or external voltage     4     15     Vdc       Positive Logic, OFF state       OFF=Pin grounded or external voltage     0     0.7     Vdc       Control Current     Open collector/drain, sinking     1     2     mA	Dynamic Load Response			TBD	TBD	μSec
Remote On/Off Control [3]         Positive Logic       ON=Pin open or external voltage       4       15       Vdc         Positive Logic, ON state       OFF=Pin grounded or external voltage       0       0.7       Vdc         Control Current       Open collector/drain, sinking       1       2       mA	Dynamic Load Peak Deviation			±TBD	±TBD	mV
Remote On/Off Control [3]         Positive Logic       ON=Pin open or external voltage       4       15       Vdc         Positive Logic, ON state       OFF=Pin grounded or external voltage       0       0.7       Vdc         Control Current       Open collector/drain, sinking       1       2       mA	FEATURES and OPTIONS			· · ·		
Positive Logic, ON state         ON=Pin open or external voltage         4         15         Vdc           Positive Logic, OFF state         OFF=Pin grounded or external voltage         0         0.7         Vdc           Control Current         Open collector/drain, sinking         1         2         mA						
Positive Logic, ON state         ON=Pin open or external voltage         4         15         Vdc           Positive Logic, OFF state         OFF=Pin grounded or external voltage         0         0.7         Vdc           Control Current         Open collector/drain, sinking         1         2         mA						
Positive Logic, OFF state         OFF=Pin grounded or external voltage         0         0.7         Vdc           Control Current         Open collector/drain, sinking         1         2         mA	3	ON=Pin open or external voltage	4		15	Vdc
Control Current         Open collector/drain, sinking         1         2         mA				1 1		
· · · · · · · · · · · · · · · · · · ·		,	~	1 1	-	
	Programmable Undervoltage Lockout (PUL)	See Page 17 for details			-	

## **IRV300 Series**

300W 10:1 Ultra Wide Input Chassis-Mount Isolated DC-DC Converter

#### FUNCTIONAL SPECIFICATIONS, IRV300-54 (CONT.)

OUTPUT	Conditions [1]	Minimum	Typical/Nominal	Maximum	Units
Total Output Power	See Derating	0	302	305	W
Voltage					
Nominal Output Voltage	No trim	53.46	54	54.54	Vdc
Setting Accuracy	At 50% load		±1		% of Vnom.
Output Voltage Range [5]	User-adjustable	47		57	Vdc
Overvoltage Protection [6]	Latching Mode	60	62.5	65	Vdc
Current					
Output Current Range	Vin=16.8V-160V	0	5.5		A
Short Circuit					I
Short Circuit Current	Constant current mode	TBD	TBD	TBD	А
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage		Continuous		
Short circuit protection method	Constant current limiting				
Regulation [4]					
Line Regulation	Vin=min. to max., Vout=nom., full load			±0.5	%
Load Regulation	lout=min. to max., Vin=110DV			±0.5	%
Ripple and Noise	with a 1uF    10uF output caps		200	480	mV pk-pk
Temperature Coefficient			±0.02		% of Vnom./°C
Maximum Capacitive Load	Constant resistance mode	0	0.1		F
Hold-up (Optional)	EN550155: Class S2 (@300W) / Class 3 (@TBDW)	10 / 20			mS
MECHANICAL					
Outline Dimensions			7.27 x 4.57 x 1.56		Inches
(Please refer to outline drawing)	L x W x H		184.6 x 116 x 39.7		mm
Case Material			Aluminum, Black Anodized	ł	
Weight			32		Ounces
EMI/RFI Shielding			900 Case		Grams
ENVIRONMENTAL		<u> </u>	6455		
Operating Ambient Temperature Range	Continuous (for 10min.)	-40		70 (85)	°C
Operating Case Temperature Range	No derating	-40		90	<u> </u>
Thermal Protection/Shutdown	No defailing	0	Yes	50	<u> </u>
Storage Temperature	Vin = Zero (no power)	-55	100	85	0°
Altitude				3000	m
Electromagnetic Interference	Meets EN50121-3-2			5000	

#### **Performance Specification Notes**

- 1. All specifications are typical unless noted. Ambient temperature =+25°Celsius, Vin is nominal, output current is maximum rated nominal.
- Mean Time Before Failure (MTBF) is calculated using the Telcordia (Belcore) SR-332 Method 1, Case 3, Issue 3, Ground Benign, Controlled. Operating temperature = +40°C, full output load, natural air convection.
- The On/Off Control is normally driven from a switch or relay. An open collector/open drain transistor may be used in saturation and cut-off (pinch-off) modes. External logic may also be used if voltage levels are fully compliant to the specifications.
- 4. Regulation specifications describe the deviation as the input line voltage or output load current is varied from a nominal midpoint value to either extreme (50% load).
- 5. Do not exceed maximum power ratings or output overvoltage when adjusting output trim values.
- 6. Output over-voltage protection (OVP) is latching mode. Recycle input to enable, after the output over-voltage condition has been removed.
- 7. If reverse polarity is accidentally applied to the input, to ensure reverse input protection, always connect an external fast blow input fuse in series with the +Vin input.

**IRV300 Series** 

TYPICAL PERFORMANCE DATA, IRV300-54	
TYPICAL PERFORMANCE DATA, IRV300-54 Start-up Waveform TBD	Start-up Waveform TBD
Hold Up/Interruption Time: Measured hold up time with 54Vo/200W	Hold Up/Interruption Time: Measured hold up time with 54Vo/300W TBD
Power Efficiency vs Load	Overload Protection at Vin = 110V @ 22°C
	TBD

## muRata P. Murata Power Solutions PRELIMINARY IRV300 Series

TYPICAL PERFORMANCE DATA, IRV300-54					
<b>Output Ripple &amp; Noise (TBDmVp-p)</b> Vin = 110V (Ch1), Vout = 54V (Ch3), Iout = 5.5A (Ch4), 5us/div.	<b>Transient Response</b> Vin = 110V (Ch1), Vout (Ch3), lout (Ch4) Step Load 75% $\rightarrow$ 50%, 50us/div. Vpp=TBDmV				
TBD	TBD				
<b>Transient Response</b> Vin = 110V (Ch1), Vout (Ch3), lout (Ch4) Step Load 50% $\rightarrow$ 75%, 50us/div. Vpp=TBDmV	<b>Temperature Derating</b> Vin = 16.8-160V (Still Air) Baseplate				
TBD	TBD				
TBD					

# muRata P. Murata Power Solutions

## **IRV300 Series**

300W 10:1 Ultra Wide Input Chassis-Mount Isolated DC-DC Converter

#### **ENVIRONMENTAL QUALIFICATION TESTING:**

	Test Method	Standard	Test	t Conditions	Status
Ad	Low temperature start-up test	EN 50155:2017, clause 13.4.4 IEC/EN 60068-2-1	Temperature, duration: Performance test:	-40 °C, 2 h +25 °C	Not operating
Be	Dry heat test cycle A	EN 50155:2017, clause 13.4.5 IEC/EN 60068-2-2	Temperature: Duration:	70 °C 6 h	Operating perf. crit. A
Db 2	Cyclic damp heat test	EN 50155:2017, clause 13.4.7 IEC/EN 60068-2-30	Temperature: Cycles (respiration effect) Duration:	55 °C and 25 °C 2 2x 24 h	Not operating
Ка	Salt mist test sodium chloride (NaCl) solution	EN 50155:2017, clause 13.4.10 IEC/EN 60068-2-11	Temperature: Duration:	35 <sup>±2</sup> °C 48 h	Not operating
	Functional random vibration test	EN 50155:2017, clause 13.4.11.4 EN 61373:2010, clause 8, class B, body mounted <sup>1</sup>	Acceleration amplitude: Frequency band: Test duration:	0.1 g <sub>n</sub> = 1.01 m/s <sup>2</sup> 5 – 150 Hz 30 min (10 min in each axis)	Operating perf. crit. A
	Simulated long life testing	EN 50155:2017, clause 13.4.11.2 EN 61373:2010, clause 9, class B, body mounted <sup>1</sup>	Acceleration amplitude: Frequency band: Test duration:	0.58 g <sub>n</sub> = 5.72 m/s <sup>2</sup> 5 – 150 Hz 15 h (5 h in each axis)	Not operating
	Shock test	EN 50155:2017, clause 13.4.11.3 EN 61373:2010, clause 10, class B, body mounted <sup>1</sup>	Acceleration amplitude: Bump duration: Number of bumps:	5.1gn 30 ms 18 (3 in each direction)	Operating perf. crit. A
	Vibration sinusoidal	AREMA Part 11.5.1 class C, D, E, I, J	Acceleration amplitude: Frequency band: Test duration:	0.3" (5 – 20 Hz) 1.5 g <sub>n</sub> = 14.7 m/s <sup>2</sup> 10 – 200 Hz 12 h (4 h in each axis)	Operating perf. crit. A
	Mechanical shock	AREMA Part 11.5.1 class C, D, E, I, J	Acceleration amplitude: Bump duration: Number of bumps:	10 g <sub>n</sub> = 98 m/s <sup>2</sup> 11 ms 18 (3 in each direction)	Operating perf. crit. A

<sup>1</sup> Body mounted = chassis of a railway coach

EN 50155:2017 STANDARD						
Nominal Input	Permanent Input Range (0.7 - 1.25 Vin)	Brownout 100ms (0.6 x Vin)	Transient 1s (1.4 x Vin)			
24V	16.8V – 30V	14.4V	33.6V			
28V	19.6V – 35V	16.8V	39.2V			
36V	25.2V – 45V	21.6V	50.4V			
48V	33.6V – 60V	28.8V	67.2V			
72V	50.4V – 90V	43.2V	100.8V			
96V	67.2V – 120V	57.6V	134.4V			
110V	77V – 137.5V	66V	154V			



### PRELIMINARY

### **IRV300 Series**

300W 10:1 Ultra Wide Input Chassis-Mount Isolated DC-DC Converter

#### **TECHNICAL NOTES**

#### **Output Voltage Adjustment**

The output voltage can be adjusted higher (trimming-up) or lower (trimming-down) than the nominal voltage by connecting an external resistor across VO\_UP and VO\_ADJ or VO\_DOWN and VO\_ADJ at the control connector. Short-circuit VO\_UP and VO\_ADJ will set output voltage to maximum. Short-circuit VO\_DOWN and VO\_ADJ will set output voltage to minimum.

To adjust output voltage Vo higher than nominal voltage for IRV300-12: External resistor R\_UP for trimming-up  $R_UP = 0.4645(13.8-Vo)/(Vo-12) (k\Omega)$ 

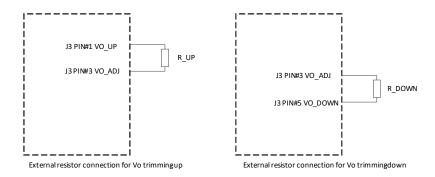
To adjust output voltage Vo lower than nominal voltage for IRV300-12: External resistor R\_DOWN for trimming-down  $R_DOWN = 1.3(Vo-11)/(12-Vo) (k\Omega)$ 

To adjust output voltage Vo higher than nominal voltage for IRV300-24: External resistor R\_UP for trimming-up  $R_UP = 0.2753(26.4-V0)/(Vo-24)$  (k $\Omega$ )

To adjust output voltage Vo lower than nominal voltage for IRV300-24: External resistor R\_DOWN for trimming-down  $R_DOWN = 2.61(Vo-21.6)/(24-Vo) (k\Omega)$ 

To adjust output voltage Vo higher than nominal voltage for IRV300-54: External resistor R\_UP for trimming-up TBD To adjust output voltage Vo lower than nominal voltage for IRV300-54: External resistor R\_DOWN for trimming-down TBD

Model	Trim Down	Trim Up
IRV300-12W80	Vout=11.0V	Vout=13.2V
	R_DOWN=0Ω	R_UP= 0.232kΩ
IRV300-24W80	Vout=21.6V	Vout=26.4V
	R_DOWN=0Ω	R_UP=0Ω
IRV300-54W80	Vout=48.0V	Vout=57.0V
	R_DOWN=TBD	R_UP=TBD



External resistor connection diagram for output voltage adjustment

### muRata P. Murata Power Solutions

### PRELIMINARY

## **IRV300 Series**

Isolated DC-DC Converter

300W 10:1 Ultra Wide Input Chassis-Mount

#### Hold Up Option

Hold Up feature ensures the output uninterrupted for no less than 10mS at full load when the input voltage drops lower than 14.4V. When input voltage drops to lower than VIN\_OFF (refer to PUL section) but is higher than 14.4V, a 100mS timer is set. If the input voltage doesn't recover to above VIN\_ON in 100mS, the timer will be reset, the converter will shut down. If the input voltage drops lower than 14.4V, Hold Up circuit starts to work to keep the output uninterrupted. The converter will shut down if the output voltage starts to drop and cause the open-collector P\_OK+ signal to be released (to open status) or the timer is reset.

#### **PUL Specification and Recommended External Fuse**

IRV300 Series PUL table and formula for PUL resistor selection and calculation of battery under voltage protection setup.

Battery	R_PUL	VIN_ON	VIN_OFF	External Fuse
24V	Not connected	16.4V	15.5V	25A fast, Littelfuse 0314025
36V	<b>267k</b> Ω	19.9V	17.9V	20A fast, Littelfuse 0314020
48V	82.5kΩ	28.7V	26.3V	15A fast, Littelfuse 0314015
72V	48.7kΩ	37.5V	33.6V	12A fast Littelfuse 0314012
96V	<b>22k</b> Ω	63.6V	57.5V	8A fast Schurter 8020.5077.G
110V	18.7kΩ	72.4V	65.3V	8A fast Schurter 8020.5077.G

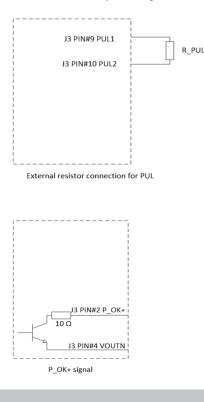
Input under voltage turn off could be setup by selecting PUL resistor given in the table above. The resistor value could also be calculated based on the preferred turn-off voltage that customers select for battery protection.

 $R_PUL = 953.62/(VIN_OFF-14.4)$ 

Where R\_PUL is PUL resistor in kΩ, VIN\_OFF is the turn-off voltage in Volt. Corresponding turn-on voltage VIN\_ON is

 $VIN_{ON} = 15.95(R_{PUL}+66.23)/R_{PUL}$ 

When input voltage drops lower than VIN\_OFF, the converter will continue operating 100mS before turning off the output. When input voltage drops lower than 14.4V, the converter enters input interruption mode. The hold-up circuit will keep the output uninterrupted for no less than 10mS under nominal load output. The converter will be shut down if input voltage is not recovered to above 16V afterward.



#### P OK+ Signal

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PRELIMINARY IRV

**IRV300 Series** 

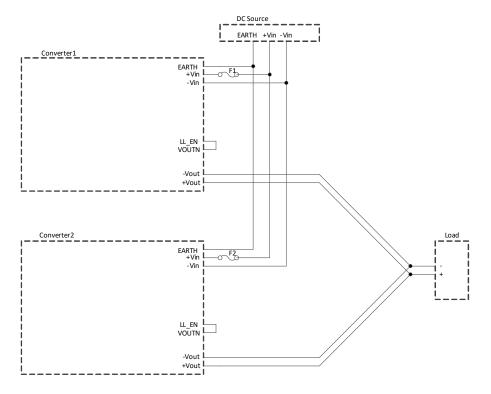
300W 10:1 Ultra Wide Input Chassis-Mount Isolated DC-DC Converter

#### **ORing FET Option**

ORing FET feature allows outputs of multiple units to be connected in parallel when high output power is required or when N+1 redundancy operation is required.

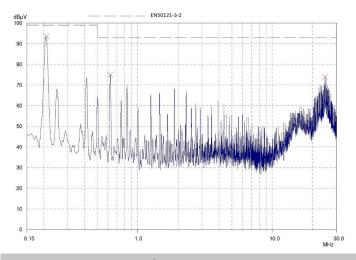
The units in parallel have passive current sharing. To put units in parallel operation, load line has to be enabled on each unit by connecting the LL\_EN pin to VOUTN pin on the control connector. The output voltage will drop with the increase of output current by 10mV/A for 12V and 24V model, 100mV/A for 54V model.

The output power cables should have the same gauge and length for each unit from the output connector to the meeting points to the load to ensure balanced power output for each unit.

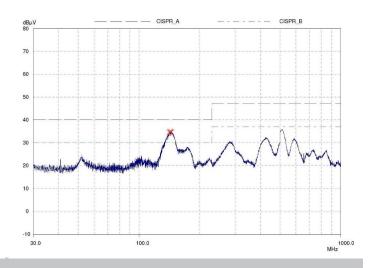




#### Conducted Emission Test, (110Vin, 12V @ 24A out)

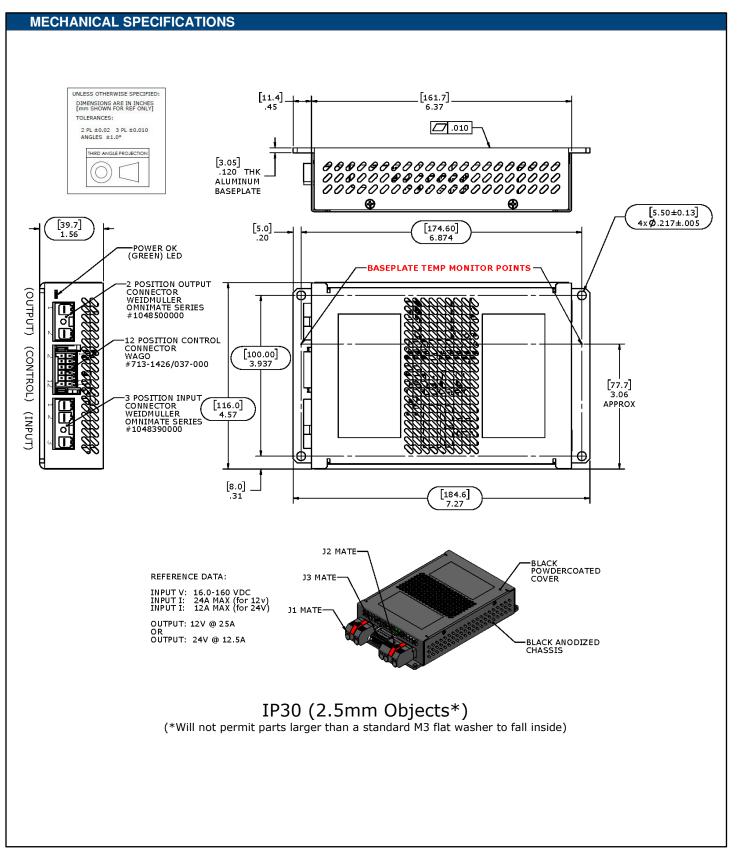


#### Radiated Emission Test, (110Vin, 12V @ 24A out)



**IRV300 Series** 

300W 10:1 Ultra Wide Input Chassis-Mount Isolated DC-DC Converter



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### 300W 10:1 Ultra Wide Input Chassis-Mount Isolated DC-DC Converter

#### PIN FUNCTION & DESCRIPTION (J3 CONTROL)

**PIN 1: VO\_UP**, for output voltage adjustment. When a resistor is connected between VO\_UP and VO\_ADJ (PIN 3), the output voltage will be set to a value that is higher than nominal voltage (12V for IRV300-12, 24V for IRV300-24). When the connected resistor is zero (short-circuiting PIN 1 and PIN 3), the output voltage is set to maximum (13.8V for IRV300-12, 26.4V for IRV300-24 and 57V for IRV300-54).

**PIN 2: P\_OK+**, open collector output . When the output voltage is higher than 10.5V for IRV300-12 (20.5V for IRV300-24 and 43.8V for IRV300-54), the voltage between  $P_OK+$  (PIN 2) and VOutN (PIN 4) is pull down to less than 0.8V.

**PIN 3: VO\_ADJ**, for output voltage adjustment. Used with PIN 1 or PIN 5 to set the output voltage higher or lower than nominal voltage.

**PIN 4: VOUTN**, used with P\_OK+ (PIN 2) for output voltage status. This pin is internally connected to the negative terminal of the output connector.

**PIN 5: VO\_DOWN**, for output voltage adjustment. When a resistor is connected between VO\_DOWN and VO\_ADJ (PIN3), the output voltage will be set to a value that is lower than nominal voltage. When the connected resistor is zero (short-circuiting PIN5 and PIN3), the output voltage is set to minimum (11 for IRV300-12, 21.6V for IRV300-24, 47V for IRV300-54).

**PIN 6: LL\_EN**, for units with output ORing feature. Connect this pin to VOUTN (PIN 4) will enable output voltage droop with the increase of load current. This pin must be connected to VOUTN (PIN 4) before connecting outputs in parallel and enabling the ORing function.

PIN 7: and PIN 8: No connection

**PIN 9: PUL1** and **PIN 10: PUL2**, for Programmable Under voltage Lockout (PUL).

**PIN 11: ON/OFF+**, for output inhibit. Output is OFF when this pin is pull down to lower than 0.8V with reference to VINN (PIN 12). For output ON state, leave this pin open or connect and keep its voltage higher than 4V.

**PIN 12: VINN**, this pin is internally connected to the negative terminal of the input connector.

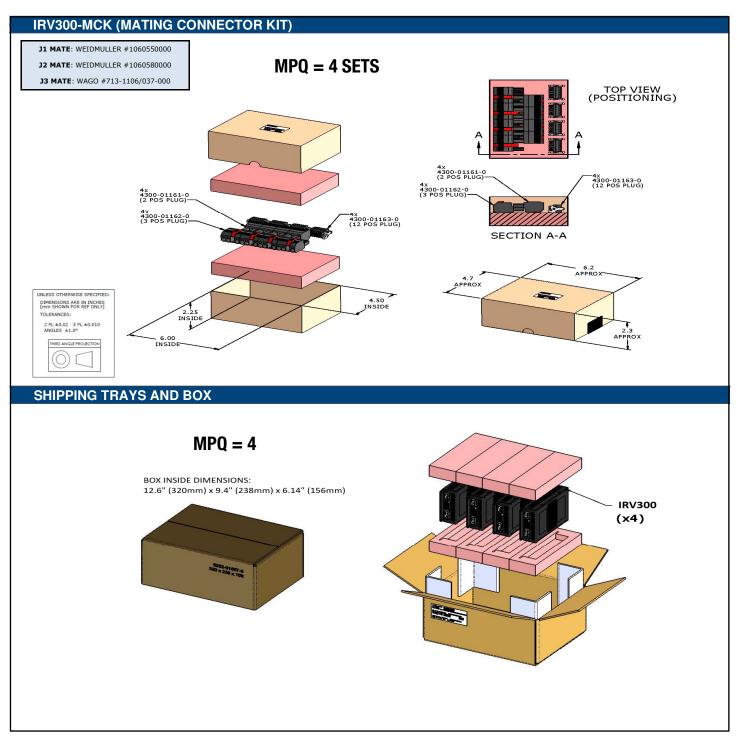
J1 OUTPUT		
PIN #	PIN # FUNCTION	
1	+Vout	
2	-Vout	

J2 INPUT	
PIN #	FUNCTION
1	-Vin
2	+Vin
3	GND

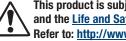
<b>J3 CONTROL</b>		
PIN #	FUNCTION	
1	VO_UP	
2	P_0K+	
3	VO_ADJ	
4	VOUTN	
5	VO_DOWN	
6	LL_EN	
7	No Connection	
8	No Connection	
9	PUL1	
10	PUL2	
11	ON/OFF+	
12	VINN	

### **IRV300 Series**

300W 10:1 Ultra Wide Input Chassis-Mount Isolated DC-DC Converter



Murata Power Solutions, Inc. 129 Flanders Road, Westborough, MA 01581 USA ISO 9001 and 14001 REGISTERED



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