

### Features

- 60 Watts output power in Quarter brick
- Ultra wide 12:1 input voltage range from 14V to 160VDC
- Efficiency up to 89%
- Operating baseplate temperature -40°C to +110°C
- 3kVDC / 1 minute isolation
- Compliant with EN50155 and EN45545-2 railway standard
- RoHS compliant

### Application

- Industrial automation control system
- Railway application
- Transportation system

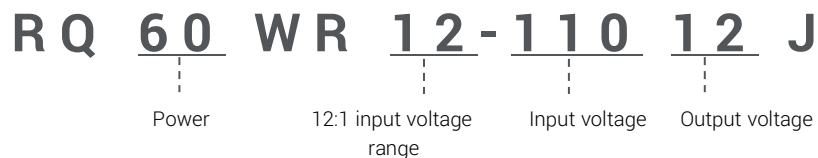


### Selection Guide

Part number	Input voltage	Output voltage	Output current @ full load	Efficiency <sup>(1)</sup> (typ.)	Ripple & Noise <sup>(2)</sup> (max.)	Capacitive load <sup>(3)</sup> (max.)
<b>RQ60WR12-11005J</b>	14-160 VDC Nom. 110VDC	5 VDC	12000mA	88%	100mVp-p	20000µF
<b>RQ60WR12-11012J</b>		12 VDC	5000mA	89%	150mVp-p	3300µF
<b>RQ60WR12-11024J</b>		24 VDC	2500mA	88%	200mVp-p	1200µF
<b>RQ60WR12-11048J</b>		48 VDC	1250mA	88%	300mVp-p	390µF
<b>RQ60WR12-11054J</b>		54 VDC	1111mA	88%	300mVp-p	330µF

- <sup>(1)</sup> The efficiency is test by nominal input and max. full load @25°C.
- <sup>(2)</sup> RQ60WR12-11005J measured with 20MHZ BW at Vin range 0%~100% load with a 47µF/10V X7R MLCC. Others measured with 20MHZ BW at Vin range 0%~100% load with a 1µF/50V X7R MLCC.
- <sup>(3)</sup> The capacitive load is test by minimum input and constant resistive load.
- All specifications valid at nominal input voltage, full load and 25°C after warm-up time unless otherwise stated.
- The product information and specifications are subject to change without prior notice.

### Part Number



## Specifications

	Parameter	Conditions	Min.	Typ.	Max.	Unit	
Input	Input filter			Pi type			
	Input voltage range		14	110	160	VDC	
	No load input current				15	mA	
	Under voltage lockout	0%~100% load		12		VDC	
	Start-up voltage	0%~100% load			13.9	VDC	
	Remote ON/OFF	DC-DC ON			Open or $3V < V_r < 12V$		
		DC-DC OFF			Short or $0V < V_r < 1.2V$		
	Input surge voltage	1s max.		200		VDC	
	Start-up time/max	100% Load at Nominal Vin		40		mS	
Output	Output voltage accuracy	100% Load & 110V input	-1		+1	%	
	Voltage adjustability			$\pm 10$		%	
	Minimum load				0	%	
	Line voltage regulation	LL to HL at 100% load	-0.2		+0.2	%	
	Load voltage regulation	0%~100% load	-0.2		+0.2	%	
	Temperature coefficient				0.05	%/°C	
	Transient response recovery time	25% load step change (75%-100% load)		500		$\mu$ s	
	Operating frequency	100% Load at Nominal Vin		250		kHz	
Environment	Operating ambient temperature	With derating	-40		110	°C	
	Operating baseplate temperature		-40		110	°C	
	Storage temperature		-55		125	°C	
	Baseplate temperature	100% Load at Nominal Vin			110	°C	
	Over temperature protection				115	°C	
	Relative humidity		5		95	%RH	
	Operating altitude				3000m		
	Safety approval				EN62368-1		
Function	Isolation voltage	1 minute, Input to Output Cut-off current: 1mA for VDC	3000			VDC	
		1 minute, Input to Output Cut-off current: 2mA for VAC	2000			VAC	
	Isolation resistance	500VDC	1000			M $\Omega$	
	Isolation capacitance				1500	pF	
	Short circuit protection				Continuous, automatic recovery		
	Over load protection				150	%	
	Over voltage protection Zener diode clamp	RQ60WR12-11005	5.6		8.0	VDC	
		RQ60WR12-11012	13.4		19.2	VDC	
		RQ60WR12-11024	26.9		38.4	VDC	
		RQ60WR12-11048	53.8		76.8	VDC	
		RQ60WR12-11054	60.5		86.4	VDC	
	MTBF	25°C	205			kHrs	
		51°C	84			kHrs	
Vibration				EN61373			
Physical	Dimension			57.9(L) x 36.8(W) x 12.7(H) mm			
	Weight			68	g		
	Case material			Plastic			
	Potting material			Silicon			
	Cooling method			Nature Convection			

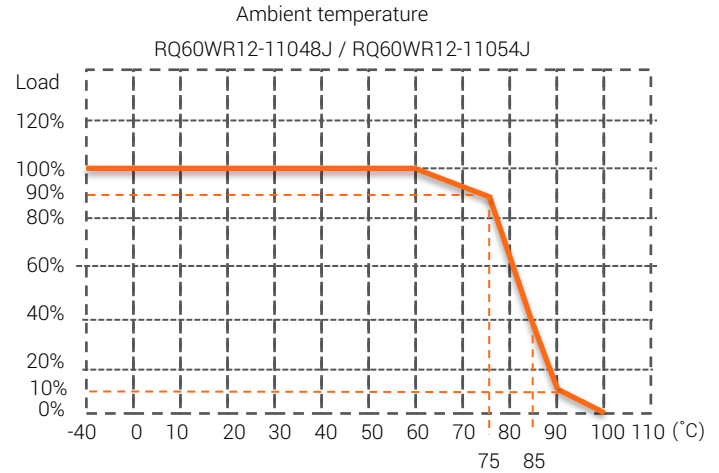
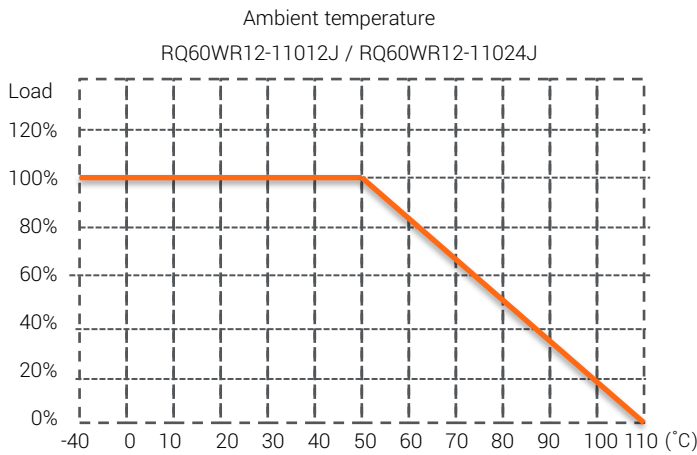
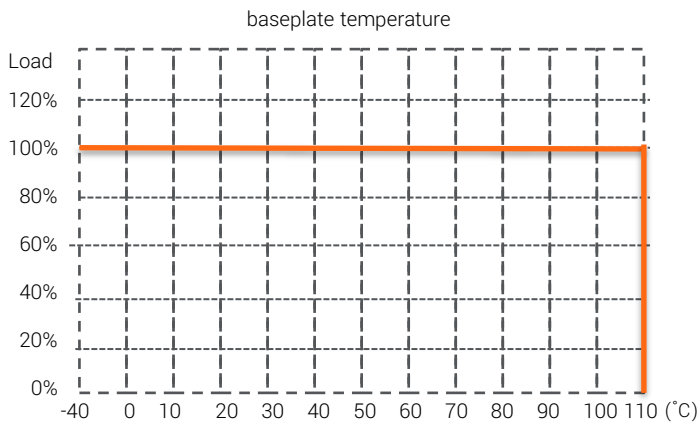
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The products were used in Computers, Industrial controls, Medical equipment, Transportation, EV, ECO-power, Aero-space application and communication.

	Parameter	Conditions	Min.	Typ.	Max.	Unit
EMC	EMI	EN55032/55011		Class A/B		
	ESD	EN61000-4-2 air±8kV, contact±6kV		Criteria A		
	Radiated immunity	EN61000-4-3 10V/m		Criteria A		
	Fast transient <sup>(1)</sup>	EN61000-4-4 ±2kV		Criteria A		
	Surge <sup>(1)</sup>	EN61000-4-5 ±2kV		Criteria A		
	Conducted immunity	EN61000-4-6 10 V/rms		Criteria A		
	Magnetic field immunity	EN61000-4-8 10 A/m		Criteria A		

- <sup>(1)</sup> External input capacitor required 330µF/200V.
- All specifications valid at nominal input voltage, full load and 25°C after warm-up time unless otherwise stated.
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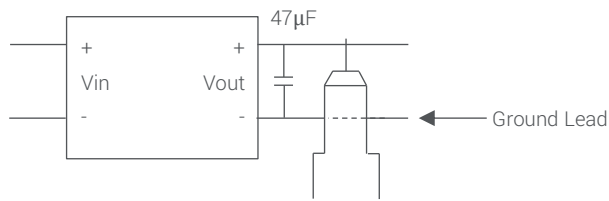
## Derating Curve



The de-rating curve was measured at 110V input in chamber with natural convection.

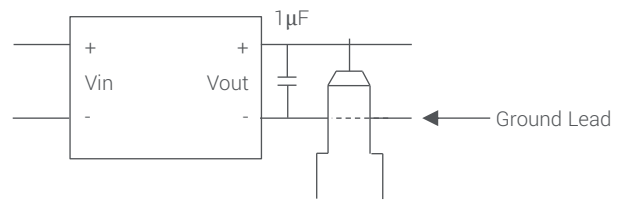
## Ripple & Noise Measure Method

RQ60WR12-11005



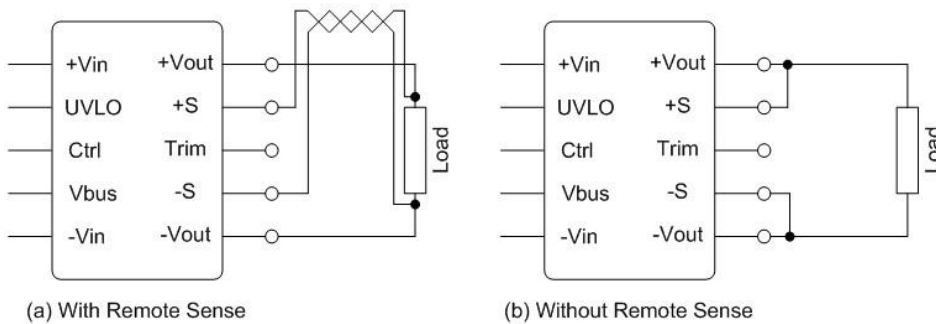
Measured with 20MHz bandwidth and 47µF ceramic capacitor.

RQ60WR12-11012, RQ60WR12-11024, RQ60WR12-11048, RQ60WR12-11054

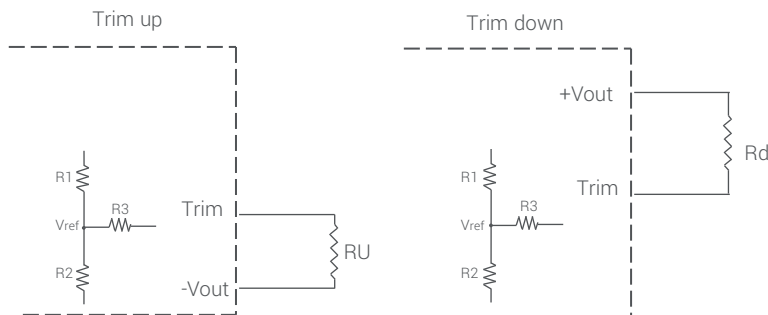


Measured with 20MHz bandwidth and 1µF ceramic capacitor

## Remote Sense Application



## Trim Application



Formula for trim resistor:

$$\text{UP: } R_u = \frac{aR_2}{R_2 - a} - R_3 \quad a = \frac{V_{ref}}{V'_o - V_{ref}} \cdot R_1$$

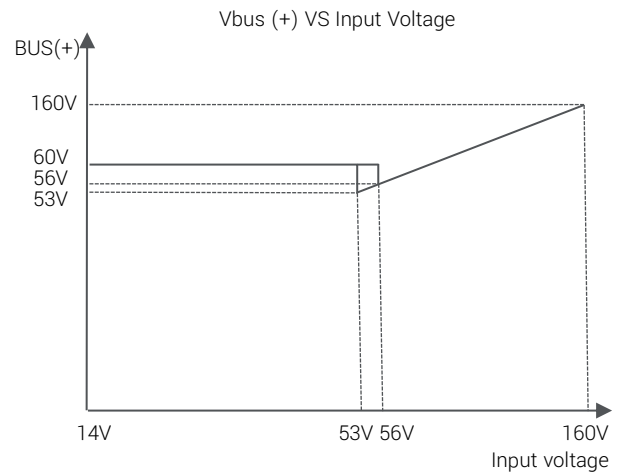
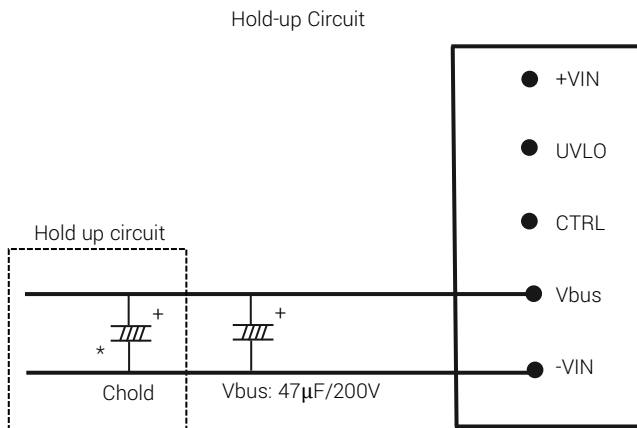
$$\text{DOWN: } R_d = \frac{bR_1}{R_1 - b} - R_3 \quad b = \frac{V'_o - V_{ref}}{V_{ref}} \cdot R_2$$

Note:

1.  $R_u$ ,  $R_d$  is mean trim resistor, please check the formula.
2.  $a$  &  $b$ : user define parameter, no actual meanings.
3.  $V'_o$  is mean trim up/down voltage.
4. Value for  $R_1$ ,  $R_2$ ,  $R_3$  and  $V_{ref}$  refer to the table below.

Vout	Vref	R1	R2	R3
5V	1.25V	30.30KΩ	10.00KΩ	68.00KΩ
12V	2.50V	12.56KΩ	3.30KΩ	24.90KΩ
24V	2.50V	17.20KΩ	2.00KΩ	15.00KΩ
48V	2.50V	36.40KΩ	2.00KΩ	15.80KΩ
54V	2.50V	41.20KΩ	2.00KΩ	15.80KΩ

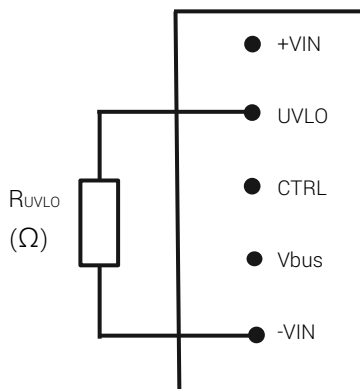
# Hold Up Time



## Chold table

Nominal Vin	24V	36V	48V	72V	96V	110V
10ms (S2)	800uF	800uF	800uF	440uF	180uF	120uF
30ms (C2)	2200uF	2200uF	2200uF	1200uF	540uF	400uF

# UVLO

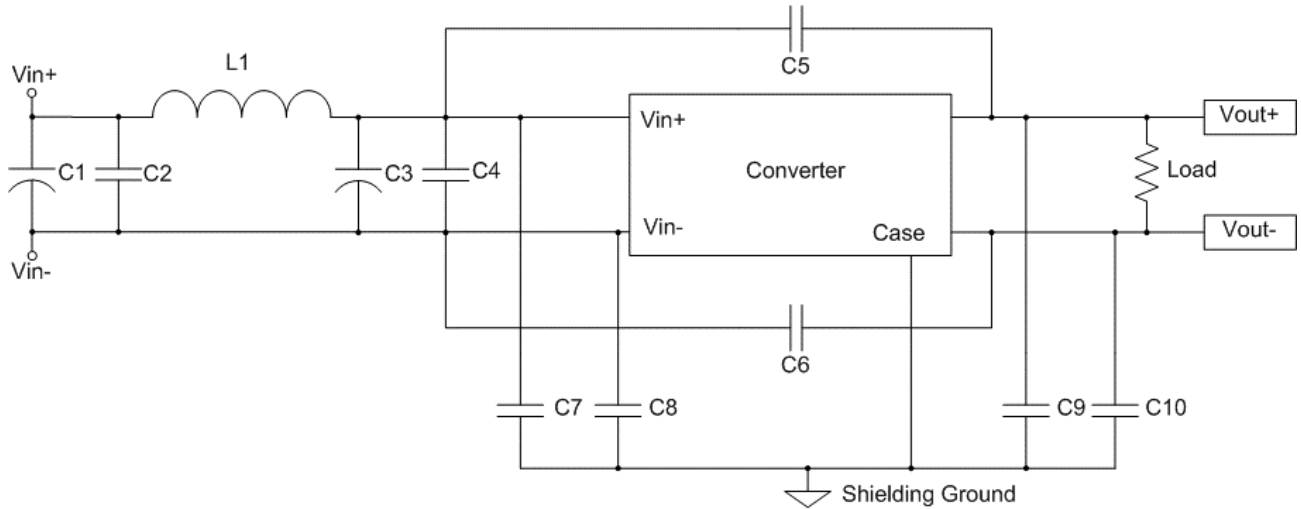


## UVLO table

UVLO External Resistor $R_{UVLO}(\Omega)$	OPEN	140K	62K
Turn-off Threshold	12.7V	19.6V	26.3V
Turn-on Threshold	13.6V	20.4V	27.3V

The under voltage threshold can set by external resistor placed between the UVLO and -VIN.

## EMI filtering-suggestion for EN55032/55011 Class A

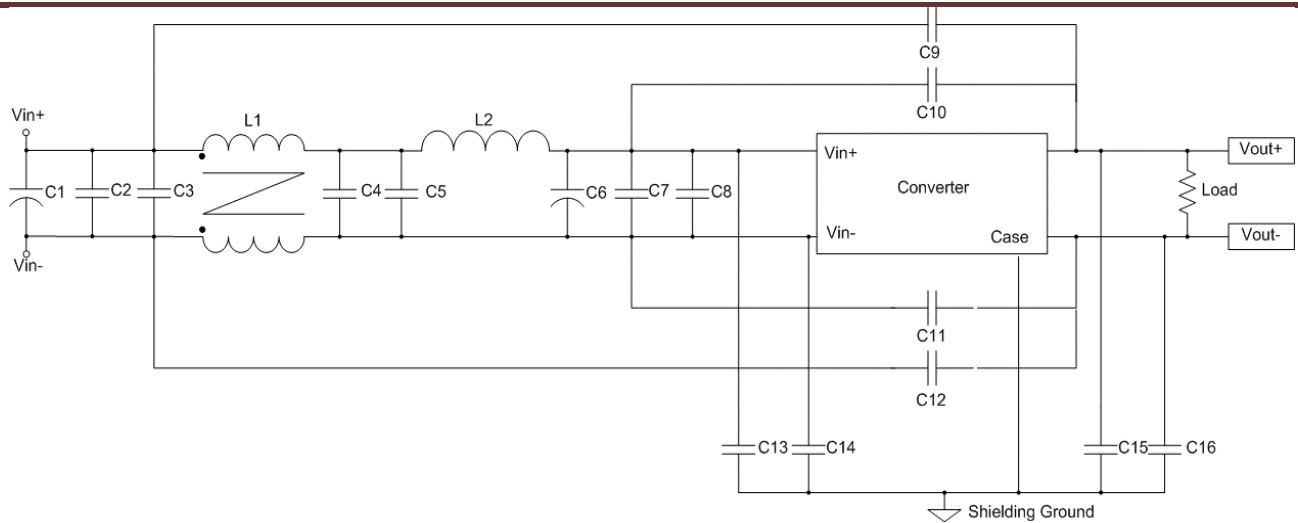


Vout	C1	C2,4	C3	C5	C6	C7,8,9,10	L1
5V	100uF	0.68uF	47uF	1000pF	1000pF	1000pF	10uF GSTD1265PE-100M
	200V Aluminum Cap. KXJ Series	1210 250V Ceramic Cap.	200V Aluminum Cap. KXJ Series	1808 3kV Ceramic Cap.	1808 3kV Ceramic Cap.	1206 2kV Ceramic Cap.	
12V	100uF	0.68uF	47uF	1000pF	1000pF	1000pF	10uF GSTD1265PE-100M
	200V Aluminum Cap. KXJ Series	1210 250V Ceramic Cap.	200V Aluminum Cap. KXJ Series	1808 3kV Ceramic Cap.	1808 3kV Ceramic Cap.	1206 2kV Ceramic Cap.	
24V	100uF	0.68uF	47uF	2200pF	1000pF	1000pF	10uF GSTD1265PE-100M
	200V Aluminum Cap. KXJ Series	1210 250V Ceramic Cap.	200V Aluminum Cap. KXJ Series	1808 3kV Ceramic Cap.	1808 3kV Ceramic Cap.	1206 2kV Ceramic Cap.	
48V	100uF	0.68uF	47uF	2200pF	2200pF	1000pF	10uF GSTD1265PE-100M
	200V Aluminum Cap. KXJ Series	1210 250V Ceramic Cap.	200V Aluminum Cap. KXJ Series	1808 3kV Ceramic Cap.	1808 3kV Ceramic Cap.	1206 2kV Ceramic Cap.	
54V	100uF	0.68uF	47uF	2200pF	2200pF	1000pF	10uF GSTD1265PE-100M
	200V Aluminum Cap. KXJ Series	1210 250V Ceramic Cap.	200V Aluminum Cap. KXJ Series	1808 3kV Ceramic Cap.	1808 3kV Ceramic Cap.	1206 2kV Ceramic Cap.	

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## EMI filtering-suggestion for EN55032/55011 Class B

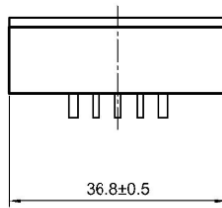
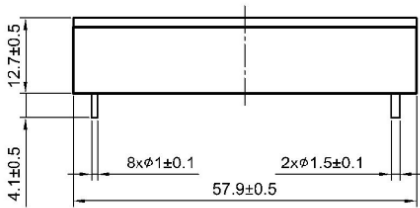


Vout	C1	C2,3,4, 5,7,8	C6	C9	C10	C11	C12	C13,14, 15,16	L1	L2
5V	100uF 200V Aluminum Cap. KXJ Series	0.68uF 1210 250V Ceramic Cap.	47uF 200V Aluminum Cap. KXJ Series	N.C.	3300pF 1206 3kV Ceramic Cap.	3300pF 1808 3kV Ceramic Cap.	N.C.	4700pF 1206 2kV Ceramic Cap.	CommomChoke A10 T16X12X8C 2.2mH ±35%	4.7uF GSTD1265PE- 4R7M
12V	100uF 200V Aluminum Cap. KXJ Series	0.68uF 1210 250V Ceramic Cap.	47uF 200V Aluminum Cap. KXJ Series	1500pF 1808 3kV Ceramic Cap.	2200pF 1808 3kV Ceramic Cap.	2200pF 1808 3kV Ceramic Cap.	1500pF 1808 3kV Ceramic Cap.	1000pF 1206 2kV Ceramic Cap.	CommomChoke A10 T16X12X8C 2.2mH ±35%	4.7uF GSTD1265PE- 4R7M
24V	100uF 200V Aluminum Cap. KXJ Series	0.68uF 1210 250V Ceramic Cap.	47uF 200V Aluminum Cap. KXJ Series	1000pF 1808 3kV Ceramic Cap.	2200pF 1808 3kV Ceramic Cap.	1000pF 1808 3kV Ceramic Cap.	1000pF 1808 3kV Ceramic Cap.	1000pF 1206 2kV Ceramic Cap.	CommomChoke A10 T16X12X8C 2.2mH ±35%	4.7uF GSTD1265PE- 4R7M
48V	100uF 200V Aluminum Cap. KXJ Series	0.68uF 1210 250V Ceramic Cap.	47uF 200V Aluminum Cap. KXJ Series	N.C.	2200pF 1808 3kV Ceramic Cap.	2200pF 1808 3kV Ceramic Cap.	N.C.	4700pF 2kV Ceramic Cap.	CommomChoke A10 T16X12X8C 2.2mH ±35%	4.7uF GSTD1265PE- 4R7M
54V	100uF 200V Aluminum Cap. KXJ Series	0.68uF 1210 250V Ceramic Cap.	47uF 200V Aluminum Cap. KXJ Series	N.C.	2200pF 1808 3kV Ceramic Cap.	2200pF 1808 3kV Ceramic Cap.	N.C.	4700pF 2kV Ceramic Cap.	CommomChoke A10 T16X12X8C 2.2mH ±35%	4.7uF GSTD1265PE- 4R7M

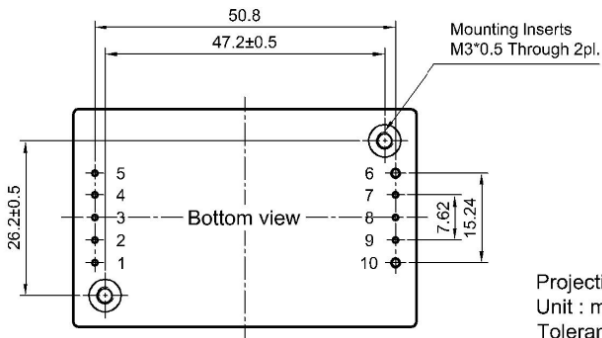
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## Mechanical Dimension & Pinning

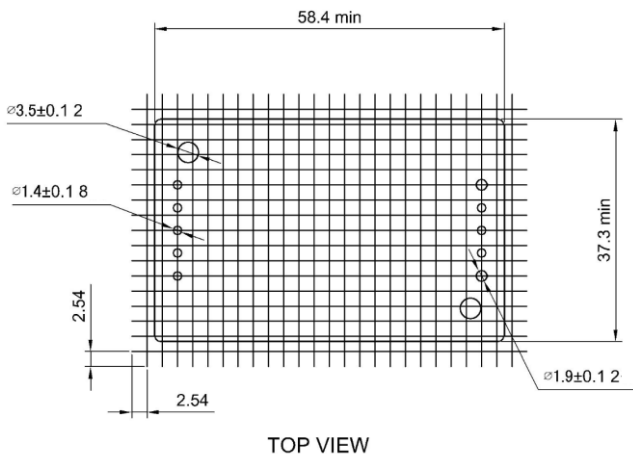


Pin	Function
1	+Vin
2	UVLO
3	Ctrl
4	Vbus
5	-Vin
6	-Vout
7	-S
8	Trim
9	+S
10	+Vout

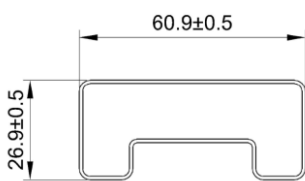


Projection : Third angle projection  
 Unit : mm  
 Tolerance : ±0.25mm

## Recommended Footprint



## Package



UNIT:mm  
 1 Tube = 11 pcs  
 Length:520±2mm

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