

## NON-ISOLATED DC/DC CONVERTERS

2.5 Vdc Input

0.9 Vdc - 1.65 Vdc/10 A Output

**bel**  
POWER PRODUCTS

### xRAH-10J Series RoHS Compliant Rev.A

- Non-Isolated
- Low Profile Package (7.82 mm)
- Fixed Frequency (300 kHz)
- Under-Voltage Lockout (UVLO)
- UL60950-1 Recognized (UL/cUL)
- Remote On/Off
- Short Circuit Protection
- Over Current Protection
- Trim Function



### Description

The Bel xRAH-10Jxx0 is part of the low cost non-isolated dc/dc power converter series. The modules use a SMD or SIP package for ease of layout and space savings. The output is closely regulated and the efficiency of 1.5 Vdc output is typically 88% at full load. Typical features include remote on/off, input under voltage lockout, over current protection and short circuit protection.

### Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Part Number Surface Mount	Part Number Vertical Mount
1.5 V	2.5 V	10 A	15 W	88%	SRAH-10J150	VRAH-10J150
1.2 V	2.5 V	10 A	12 W	83%	SRAH-10J120	VRAH-10J120
1.0 V	2.5 V	10 A	10 W	80%	SRAH-10J100	VRAH-10J100

- Notes:** 1. Add "0" suffix at the end of the model number to indicate "Tube Packaging", and "R" for "Reel Packaging", and "G" for "Tray Packaging".  
2. All part numbers above indicate RoHS 6. Change the second letter "R" to "7" for RoHS 5 part numbers.

### Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3 V	-	6 V	
Output Enable Terminal Voltage	-0.3 V	-	7 V	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-40 °C	-	125 °C	

### Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	2.25 V	2.5 V	2.75 V	
Input Current (no load)	-	75 mA	-	
Input Current (full load)				
Vo=1.5 V	-	6.8 A	-	
Vo=1.2 V	-	5.6 A	-	
Vo=1.0 V	-	4.9 A	-	
Remote Off Input Current	-	4 mA	8 mA	
Input Reflected Ripple Current (pk-pk)	-	80 mA	150 mA	Tested with simulated source impedance of 500 nH, 5 Hz to 20 MHz; with a 270 uF/16 V with ESR=0.018 ohm max, at 100 kHz at 25 °C
Input Reflected Ripple Current (rms)	-	25 mA	50 mA	
I <sup>2</sup> t Inrush Current Transient	-	0.04 A <sup>2</sup> s	0.10 A <sup>2</sup> s	
Turn on Voltage Threshold	2 V	2.1 V	2.15 V	
Turn off Voltage Threshold	1.8 V	2 V	2.15 V	

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## Output Specifications

Parameter		Min	Typ	Max	Notes	
Output Voltage Set Point	Vo=1.5 V	1.470 V	1.5 V	1.530 V	Test conditions: Vin=2.5 V, Io=full load	
	Vo=1.2 V	1.176 V	1.2 V	1.224 V		
	Vo=1.0 V	0.980 V	1.0 V	1.020 V		
Line Regulation	Vo=1.5 V	-	2 mV	5 mV		
	Vo=1.2 V	-	2 mV	5 mV		
	Vo=1.0 V	-	2 mV	5 mV		
Load Regulation	Vo=1.5 V	-	5 mV	10 mV		
	Vo=1.2 V	-	5 mV	10 mV		
	Vo=1.0 V	-	5 mV	10 mV		
Regulation Over Temperature (-40 °C to +85 °C)	Vo=1.5 V	-	13 mV	25 mV		
	Vo=1.2 V	-	10 mV	20 mV		
	Vo=1.0 V	-	9 mV	20 mV		
Output Current		0 A	-	10 A		
Current Limit Threshold		13 A	-	25 A		
Short Circuit Surge Transient	Vo=1.5 V	-	0.5 A <sup>2</sup> s	1.5 A <sup>2</sup> s		
	Vo=1.2 V	-	0.5 A <sup>2</sup> s	1.5 A <sup>2</sup> s		
	Vo=1.0 V	-	0.5 A <sup>2</sup> s	1.5 A <sup>2</sup> s		
Ripple and Noise (rms)		-	15 mV	25 mV	Test conditions: 0-20 MHz BW, with a 1 uF ceramic capacitor at the output.	
Ripple and Noise (pk-pk)		-	50 mV	100 mV		
Turn on Time		-	1 mS	2 mS		
Overshoot at Turn on		-	0%	3%		
Output Capacitance		220 uF	-	4000 uF		
<b>Transient Response</b>						
50% ~ 100% Max Load	Overshoot	Vo=1.5 V	-	90 mV	125 mV	Test conditions: di/dt = 0.5 A/uS; Vin = 2.5 V; with a 220 uF tantalum capacitor at the output.
	Settling Time		-	30 uS	60 uS	
100% ~ 50% Max Load	Overshoot	Vo=1.5 V	-	90 mV	125 mV	
	Settling Time		-	30 uS	60 uS	
50% ~ 100% Max Load	Overshoot	Vo=1.2 V	-	80 mV	120 mV	
	Settling Time		-	30 uS	60 uS	
100% ~ 50% Max Load	Overshoot	Vo=1.2 V	-	80 mV	120 mV	
	Settling Time		-	30 uS	60 uS	
50% ~ 100% Max Load	Overshoot	Vo=1.0 V	-	80 mV	120 mV	
	Settling Time		-	30 uS	60 uS	
100% ~ 50% Max Load	Overshoot	Vo=1.0 V	-	80 mV	120 mV	
	Settling Time		-	30 uS	60 uS	

**Note:** All specifications are typical at nominal input, full load at 25 °C unless otherwise stated.

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2.5 Vdc Input

0.9 Vdc - 1.65 Vdc/10 A Output



## General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				Measured at Vin=2.5 V, full load and Ta=25 °C.
Vo=1.5 V	85%	88%	-	
Vo=1.2 V	83%	86%	-	
Vo=1.0 V	79%	82%	-	
Switching Frequency	250 kHz	300 kHz	350 kHz	
Output Trim Range	90%Vo	-	110%Vo	
MTBF	4,447,157 hours			Calculated Per Bell Core SR-332 (Io = Nominal; Ta = 25 °C)
Dimensions (surface mount)				
Inches (L x W x H)	0.78 x 0.70 x 0.32			
Millimeters (L x W x H)	19.81 x 17.78 x 8.13			
Dimensions (vertical)				
Inches (L x W x H)	0.70 x 0.308 x 0.65			
Millimeters (L x W x H)	17.78 x 7.82 x 16.51			
Weight	-	4.7 g	-	

**Note:** All specifications are typical at nominal input, full load at 25 °C unless otherwise stated.

## Control Specifications

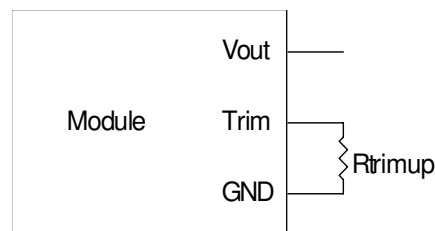
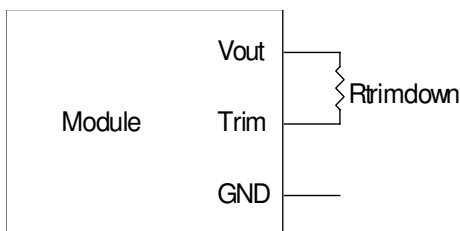
Parameter	Min	Typ	Max	Notes
<b>Remote On/Off</b>				
Signal Low (Unit Off)	0 V	-	0.5 V	Remote on/off pin open, the module is on.
Signal High (Unit On)	2 V	-	5.5 V	

## Output Trim Equations

Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) and the nominal output voltage of the converter (Vnom) are shown below. The Trim Down resistor should be connected between the Trim pin and Vout. The Trim Up resistor should be connected between the Trim pin and Ground. Only one of the resistors should be used for any given application.

$$R_{TrimDown} = \frac{A}{V_{nom} - V_{adj}} - B \qquad R_{TrimUp} = \frac{C}{V_{adj} - V_{nom}} - D$$

Vnom	A	B	C	D
1.5 V	49.788	287.900	43.330	226.000
1.2 V	31.241	223.900	43.330	162.000
1.0 V	11.029	92.800	25.550	56.200



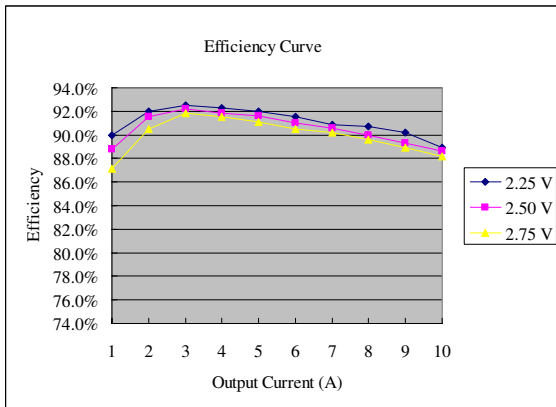
# NON-ISOLATED DC/DC CONVERTERS

2.5 Vdc Input

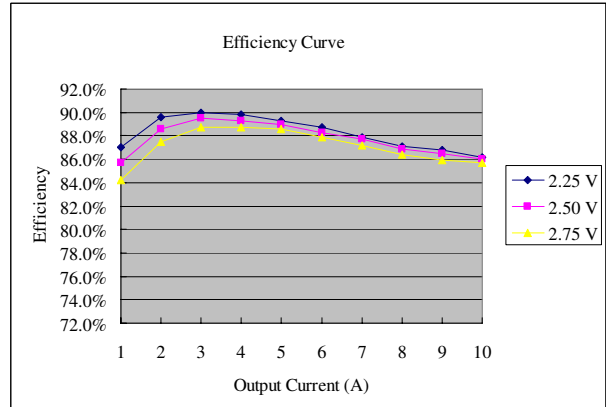
0.9 Vdc - 1.65 Vdc/10 A Output



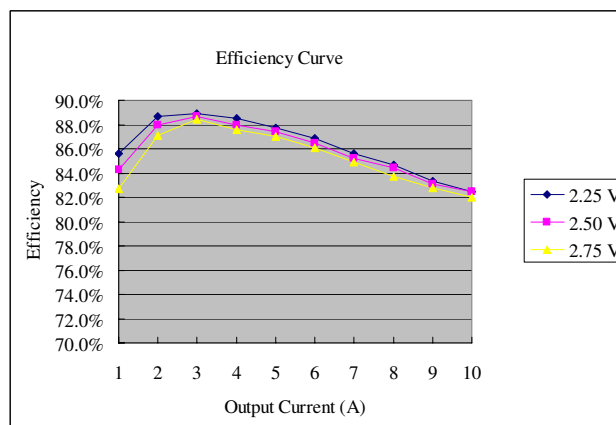
## Efficiency Data



xRAH-10J150

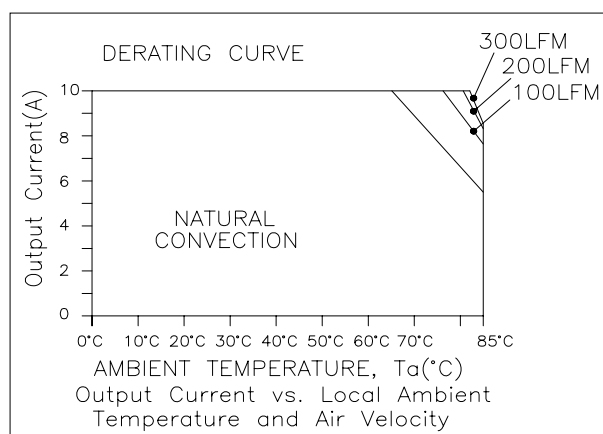


xRAH-10J120



xRAH-10J100

## Thermal Derating Curve



**Note:** Derating curve is for 1.2 V output and tested at nominal input voltage.

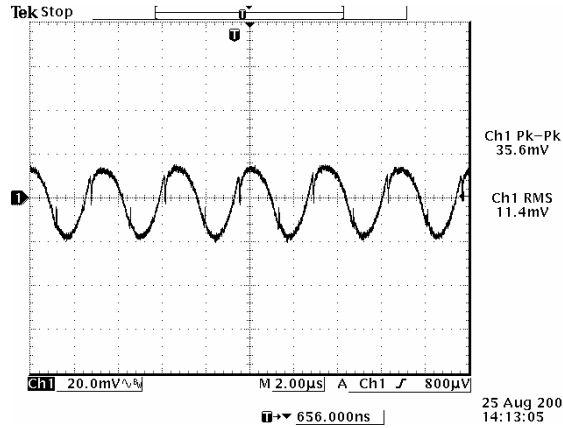
# NON-ISOLATED DC/DC CONVERTERS

2.5 Vdc Input

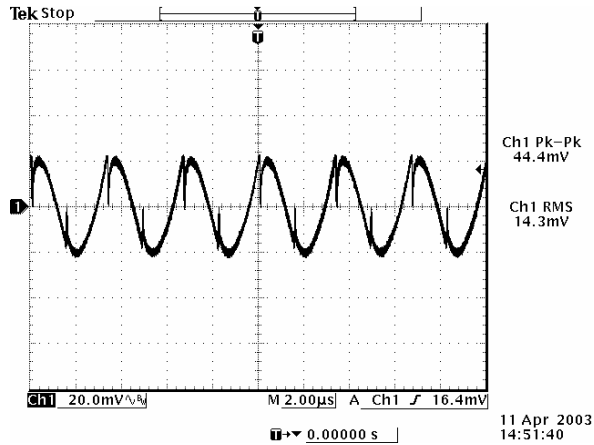
0.9 Vdc - 1.65 Vdc/10 A Output



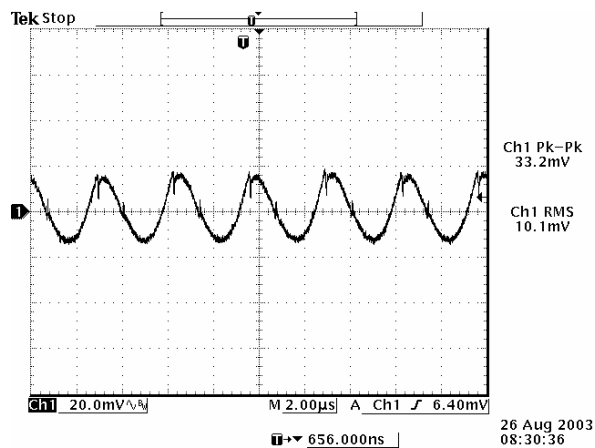
## Ripple and Noise Waveforms



### Ripple and Noise at max Load 1.0 Vdc Output



### Ripple and Noise at max Load 1.2 Vdc Output



### Ripple and Noise at max Load 1.5 Vdc Output

**Note:** Ripple and noise with a 1µF ceramic capacitor at the output,  $T_a=25$  deg C.

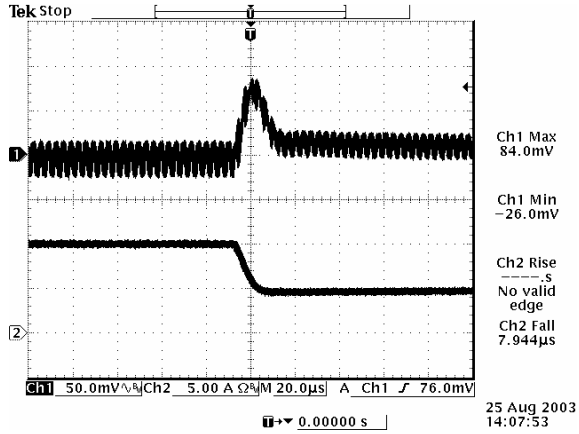
# NON-ISOLATED DC/DC CONVERTERS

2.5 Vdc Input

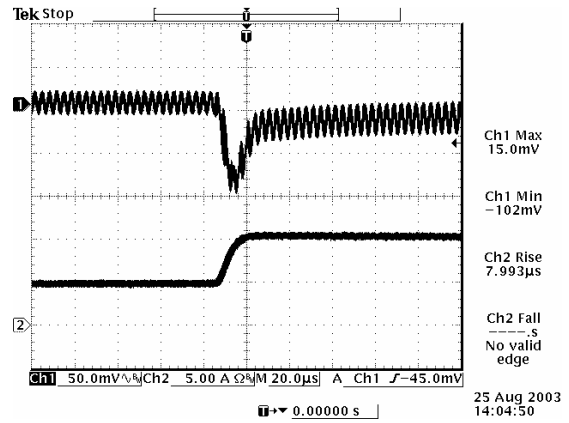
0.9 Vdc - 1.65 Vdc/10 A Output



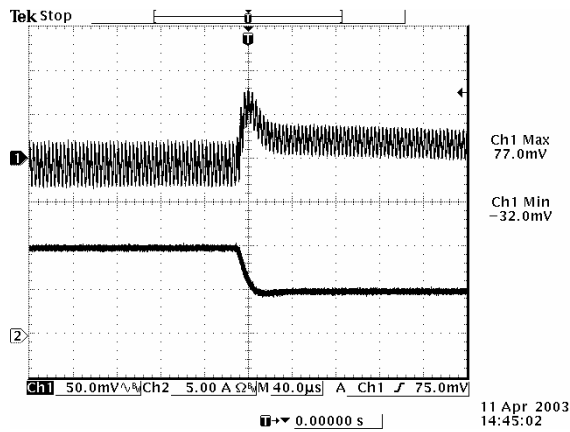
## Transient Response Waveforms



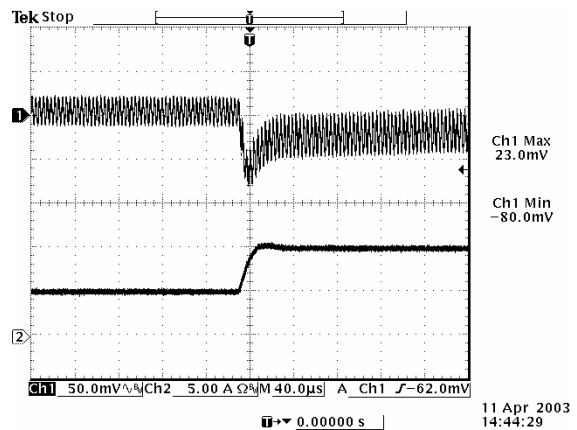
Transients 100% to 50% load 1.0 Vdc output



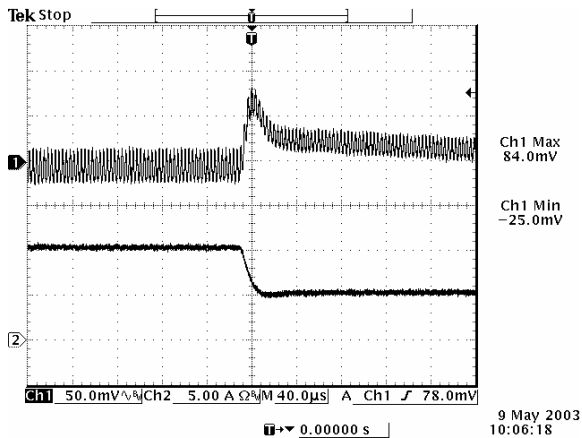
Transients 50% to 100% load 1.0 Vdc output



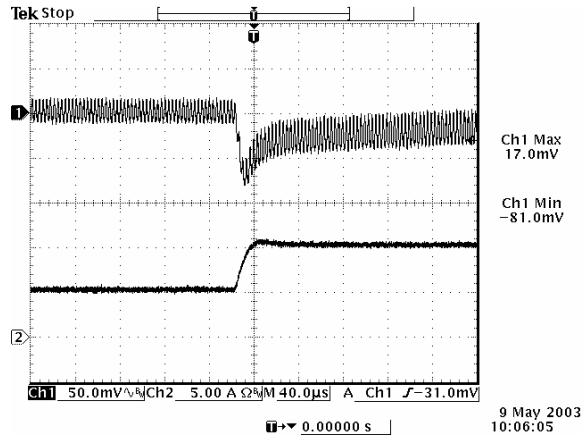
Transients 100% to 50% load 1.2 Vdc output



Transients 50% to 100% load 1.2 Vdc output



Transients 100% to 50% load 1.5 Vdc output



Transients 50% to 100% load 1.5 Vdc output

**Note:** Transient response at 2.5 V input, di/dt=0.5 A/µs, with 220 µF tantalum cap at the output, Ta=25 deg C.

# NON-ISOLATED DC/DC CONVERTERS

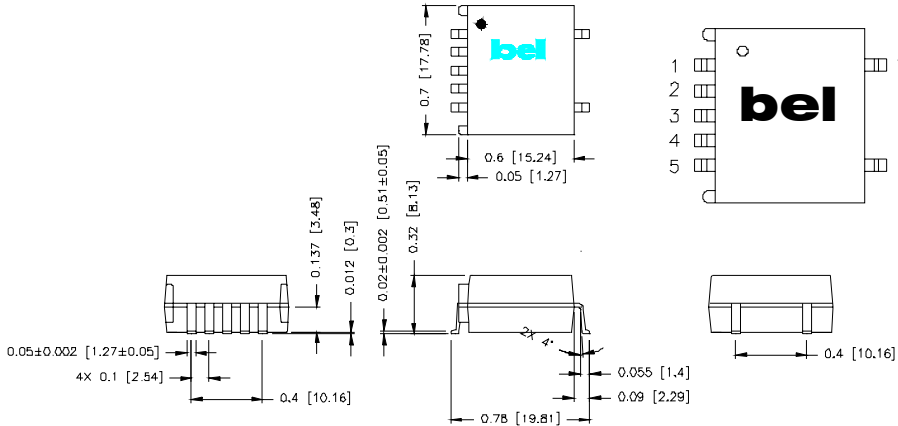
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## Mechanical Outline

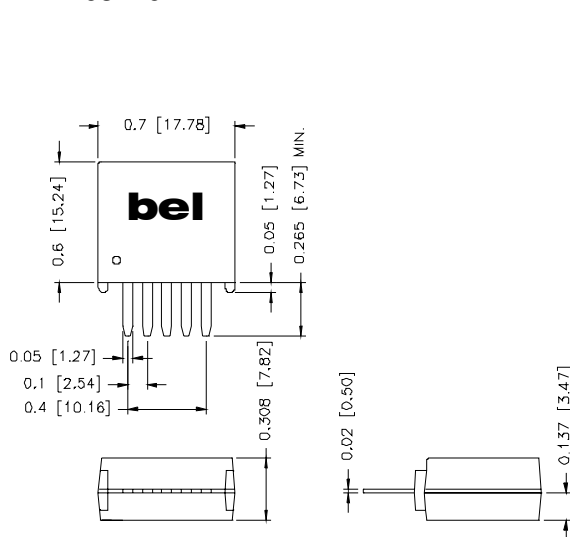
### SRAH-10Jxx0



### Pin Connections

Pin	Function
1	Remote On/Off
2	Vin
3	Ground
4	Vout
5	Trim
6	N/A
7	N/A

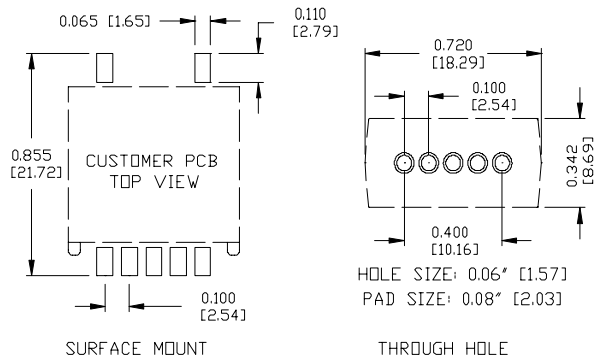
### VRAH-10Jxx0



### Pin Connections

Pin	Function
1	Remote On/Off
2	Vin
3	Ground
4	Vout
5	Trim

### RECOMMENDED PCB PAD LAYOUT



## RoHS Compliance

Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products. These parts are not however compatible with the higher temperatures associated with lead free solder processes and must be soldered using a reflow profile with a peak temperature of no more than 240 °C.



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