Features:

- Thin film technology for precision and stability
- Excellent power to size ratio
- Outstanding pulse handling
- Excellent overall stability
- Sn termination on Ni barrier layer
- Tight tolerance down to $\pm 0.1\%$
- Extremely low TCR down to ± 5 ppm/°C
- High power rating up to 1W
- SMD enabled structure
- AEC-Q200 compliant
- 100% RoHS compliant and lead free without exemption
- Halogen free
- **REACH** compliant

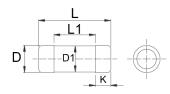


Electrical Specifications									
Type/Code	Package Size	Power Rating (Watts)	Maximum Working	Maximum Overload	TCR (ppm/°C)	Ohmic Range (Ω) and Tolerance			
	Size	@ 70 °C	Voltage ⁽¹⁾	Voltage ⁽²⁾		0.1%	0.5%	1% 1 - 1M 1 - 1M Ω (< 15mΩ) - 10 - 300K M	5%
		0.3			± 50	-		1 - 1M	
MLFA13 ⁽³⁾	0102	0.5	200	400	± 100	•	-	1 -	1M
		Jumper: 2 A			-		0Ω (<	1% 1 - 1M (< 15mΩ) - 300K 1	
	0204	0.4	200	400	± 5	10 - 332K	-		
					± 15		10 - 300K		
MLFA25					± 25	10 - 1M	10 - 3.4M	1 - 3.4M	
WILFA25					± 50	10 - 1M	1 - 3.4M	0.2 -	3.4M
					± 100		-	0.1 -	· 1M
		Jumper: 3 A			-		>) Ω0	15mΩ)	
					± 5	10 - 332K		-	
					± 15		10 - 300K		
MLFA1	0207	207	350	700	± 25	10 - 1M	10 - 3.4M	1 - 3	5.4M
IVILIAI	0207		350	700	± 50	10 - 1M	1 - 3.4M	0.2 -	3.4M
					± 100	-	-	0.1 -	· 1M
(1) \\(\hat{1}\): \\(\hat{1}\):		Jumper: 5 A			-		0Ω (15mΩ)		

Working Voltage = $\sqrt{P^*R_-}$ or Max. Operating Voltage listed above, whichever is lower.

RCWV (Rated Continuous Working Voltage) = $\sqrt{P^*R}$ or Max Operating Voltage, whichever is lower.

Mechanical Specifications



Type/Code	Weight (g)	L	L1 (min.)	D	D1	K	Unit
Type/Code	(1000 pc)	Body Length	Inner Body Length	Body Diameter	Middle Body Dia.	Termination	Offit
MLFA13	7.7	0.087 ± 0.004	0.043	0.043 ± 0.004	0.043 +0/-0.006	0.018 ± 0.002	inches
IVILEATS	7.7	2.20 ± 0.10	1.10	1.10 ± 0.10	1.10 +0/-0.15	0.45 ± 0.05	mm
MLFA25	18.7	0.138 ± 0.008	0.067	0.055 ± 0.006	0.055 +0/-0.008	0.031 ± 0.004	inches
IVILEAZS	10.7	3.50 ± 0.20	1.70	1.40 ± 0.15	1.40 +0/-0.2	0.80 ± 0.10	mm
MI EA4	90.0	0.232 ± 0.008	0.114	0.087 ± 0.008	0.087 +0/-0.008	0.051 ± 0.004	inches
MLFA1	80.9	5.90 ± 0.20	2.90	2.20 ± 0.20	2.20 +0/-0.2	1.30 ± 0.10	mm

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Overload Voltage = $2.5*\sqrt{P*R}$ or Max. Overload Voltage listed above, whichever is lower.

⁽³⁾ Lower TCR with lower Power Ratings may be available - contact Stackpole

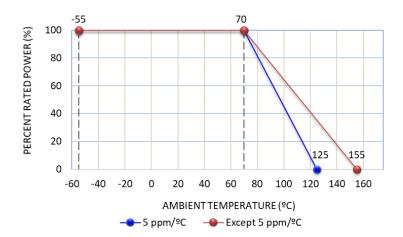
		Performance Characteristics	6	
Test	Test Method	Test Method	Test Specification	
rest	rest Method	r est ivietnoa	5% and below	Jumper
Temperature Coefficient of Resistance (T.C.R.)	JIS-C-5201-1 4.8 IEC-60115-1 4.8	At 25°C / - 55°C and 25°C / + 125°C, 25°C is the reference temperature. 5ppm: At 25°C / -10°C and 25°C / +85°C, 25°C is the reference temperature	As specified	
			10 Ω - 270 KΩ: ± (0.1% + 0.01 Ω)	
Short Time Overload	JIS-C-5201-1 4.13	RCWV*2.5 or max. overload voltage	< 10 Ω & > 270 KΩ: ± (0.15% + 0.01 Ω)	< 15 mΩ
	IEC-60115-1 4.13	whichever is lower for 5 seconds	MLFA13: \pm (0.15% + 0.01 Ω) 5 ppm/°C: \pm (0.05% + 0.01 Ω)	
Insulation Resistance	JIS-C-5201-1 4.6 IEC-60115-1 4.6	Max. overload voltage for 1 minute	≥10G	
Operational Life	MIL-STD-202 Method 108	Condition D Steady State TA = 125°C at derated power. Measurement at 24 ± 4 hours after test conclusion. 5 ppm/°C: 70 ± 2°C, RCWV for 1000 hours with 1.5 hours "ON" and 0.5 hour "OFF"	10 Ω - 270 K Ω : \pm (0.25% + 0.01 Ω) <10 Ω & > 270 K Ω : \pm (0.5% + 0.01 Ω) MLFA13: \pm (0.5% + 0.01 Ω)	< 15 mΩ
Biased Humidity	MIL-STD-202 Method 103	1000 hours 85°C / 85% R.H. 10% of operating power	10 Ω - 270 KΩ: \pm (0.5% + 0.01 Ω) < 10 Ω & > 270 K Ω: \pm (1% + 0.01 Ω) MLFA13: \pm (2% + 0.01 Ω)	< 15 mΩ
High Temperature Exposure	MIL-STD-202 Method 108	at +125°C / +155°C for 1000 hours	10 Ω - 270 K Ω: \pm (0.25% + 0.01 Ω) < 10 Ω & > 270 KΩ: \pm (1% + 0.01 Ω) MLFA13: \pm (1% + 0.01 Ω)	< 15 mΩ
Board Flex	AEC-Q200-005	Bending once for 60 seconds with 2 mm	10 Ω - 270 K Ω : \pm (0.1% + 0.01 Ω) < 10 Ω & > 270 K Ω : \pm (0.5% + 0.01 Ω) MLFA13: \pm (0.5% + 0.01 Ω)	< 15 mΩ
Solderability	JIS-5201-1 4.17 IEC 60115-1 4.17 J-STD 002	245 ± 5°C for 3 seconds	95% min. coverage	
Resistance to Soldering Heat	MIL-STD-202 Method 210	260 ± 5°C for 10 seconds	10 Ω - 270 K Ω : \pm (0.1% + 0.01 Ω) < 10 Ω & > 270 K Ω : \pm 0.25% + 0.01 Ω) MLFA13: \pm (0.25% + 0.01 Ω) 5 ppm/°C: \pm (0.05% + 0.01 Ω)	< 15 mΩ
Voltage Proof	JIS-C-5201-1 4.7 IEC 60115-1 4.7	1.42 times max. operating voltage for 1 minute	No breakdown or flashover	
Leaching	JIS-C-5201-1 4.18 IEC-60068-2-58 8.2.1	260 ± 5°C for 30 seconds	Individual leaching area ≤ 5% Total leaching area ≤ 10%	
Temperature Cycling	JESD22 Method JA-104	-55°C to + 125°C, 1000 cycles	10 Ω - 270 K Ω : \pm (0.25% + 0.01 Ω) < 10 Ω & > 270 K Ω : \pm 0.5% + 0.01 Ω) MLFA13: \pm (1% + 0.01 Ω)	< 15 mΩ
Mechanical Shock	MIL-STD-202 Method 213	Wave Form: Tolerance for half sine shock pulse. 'Peak value is 100 g's. Normal duration (D) is 6.	± (0.25% + 0.01 Ω)	< 15 mΩ
Vibration	MIL-STD-202 Method 204	5 g's for 20 minutes., 12 cycles each of 3 orientations 10-2000 Hz	± (0.5% + 0.01 Ω)	< 15 mΩ
ESD	AEC-Q200-002	Human body, 2 KV	± (0.5% + 0.05 Ω)	< 15 mΩ
Resistance to	MIL-STD-202	Add aqueous wash chemical - OKEM clean	No visible damage on appearance and	marking
Solvents	Method 215	or equivalent. Do not use banned solvents.	<u> </u>	
Terminal Strength	AEC-Q200-006	Force of 1.8 Kg for 60 seconds	No breakage	
Flammability	UL-94	V - 0 or V - 1 are acceptable. Electrical test not required.	No ignition of the tissue paper or scorchi pinewood board	ing of the

RCWV (rated continuous working voltage) = $\sqrt{P^*R}$ or max. operating voltage whichever is lower

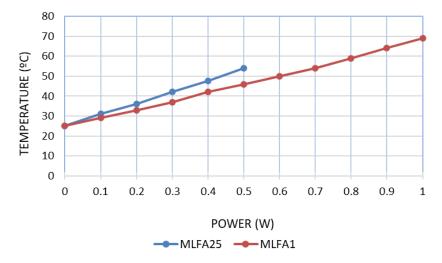
Storage temperature: $15 \sim 28^{\circ}$ C. Humidity < 80% R.H. Operating temperature range is -55°C to +125°C for 5 ppm/°C

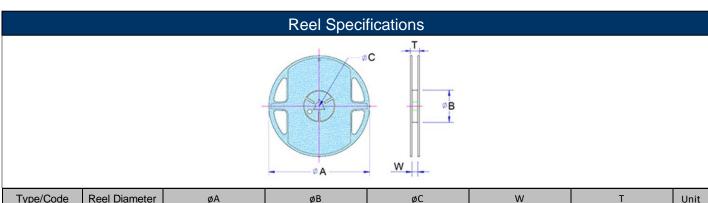
Operating temperature range is -55°C to +155°C for all others except 5 ppm/°C

Power Derating Curve:



Hot Spot Temperature:





Type/Code	Reel Diameter	øΑ	øΒ	øС	W	Т	Unit
MLFA13	0.276	7.028 ± 0.059	2.362 ± 0.039	0.512 ± 0.008	0.354 ± 0.020	0.492 ± 0.020	inches
IVILI ATS	7.00	178.50 ± 1.50	60.00 ± 1.00	13.00 ± 0.20	9.00 ± 0.50	12.50 ± 0.50	mm
MLFA25	0.276	7.028 ± 0.059	2.362 ± 0.039	0.512 ± 0.008	0.354 ± 0.020	0.492 ± 0.020	inches
IVILFAZO	7.00	178.50 ± 1.50	60.00 ± 1.00	13.00 ± 0.20	9.00 ± 0.50	12.50 ± 0.50	mm
MLFA1	0.276	7.028 ± 0.059	2.362 ± 0.039	0.512 ± 0.020	0.512 ± 0.020	0.610 ± 0.020	inches
IVILEAT	7.00	178.50 ± 1.50	60.00 ± 1.00	13.00 ± 0.50	13.00 ± 0.50	15.50 ± 0.50	mm

Unit

inches

mm

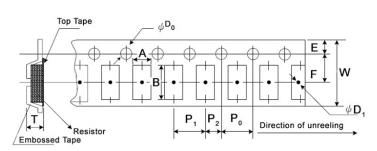
inches

mm

inches

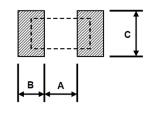
mm

Packaging Specifications - Embossed Plastic Tape



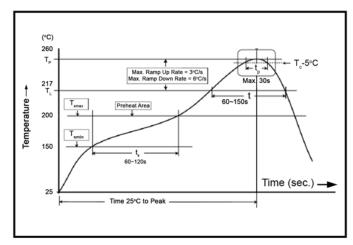
Type/Code	А	В	W	E	F	P0
MLFA13	0.051 ± 0.004	0.094 ± 0.004	0.315 ± 0.004	0.069 ± 0.004	0.138 ± 0.002	0.157 ± 0.004
IVILFAIS	1.30 ± 0.10	2.40 ± 0.10	8.00 ± 0.10	1.75 ± 0.10	3.50 ± 0.05	4.00 ± 0.10
MLFA25	0.061 ± 0.004	0.144 ± 0.004	0.315 ± 0.004	0.069 ± 0.004	0.138 ± 0.002	0.157 ± 0.004
IVILLAZO	1.55 ± 0.10	3.65 ± 0.10	8.00 ± 0.10	1.75 ± 0.10	3.50 ± 0.05	4.00 ± 0.10
NAL = 0.4	0.094 ± 0.004	0.242 ± 0.004	0.472 ± 0.004	0.069 ± 0.004	0.217 ± 0.002	0.157 ± 0.004
MLFA1	2.40 ± 0.10	6.15 ± 0.10	12.00 ± 0.10	1.75 ± 0.10	5.50 ± 0.05	4.00 ± 0.10
Type/Code	P1	P2	D0	D1	Т	Unit
MLFA13	0.157 ± 0.004	0.079 ± 0.002	0.059 ± 0.004	0.035 min.	0.059 ± 0.004	inches
IVILLAIS	4.00 ± 0.10	2.00 ± 0.05	1.50 ± 0.10	0.90 min.	1.50 ± 0.10	mm
MLFA25	0.157 ± 0.004	0.079 ± 0.002	0.059 ± 0.004	0.035 min.	0.071 ± 0.004	inches
IVILFAZS	4.00 ± 0.10	2.00 ± 0.05	1.50 ± 0.10	0.90 min.	1.80 ± 0.10	mm
MLFA1	0.157 ± 0.004	0.079 ± 0.002	0.059 ± 0.004	0.055 min.	0.106 ± 0.004	inches
IVILFAI	4.00 ± 0.10	2.00 ± 0.05	1.50 ± 0.10	1.40 min.	2.70 ± 0.10	mm

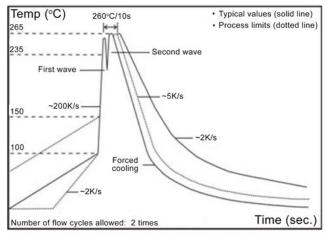
Recommended Pad Layout



Type/Code	A	В	С	Unit
MLFA13	0.039	0.031	0.059	inches
WEI ATS	1.00	0.80 1.50	mm	
MLFA25	0.063	0.047	0.063	inches
WILFA25	1.60	1.20	1.60	mm
MLFA1	0.118	0.067	0.094	inches
IVILFAT	3.00	1.70	2.40	mm

Soldering Condition:





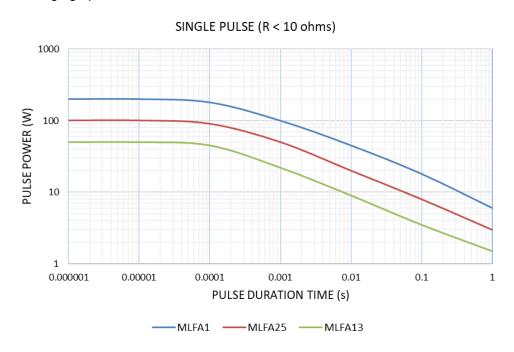
IR Reflow Soldering

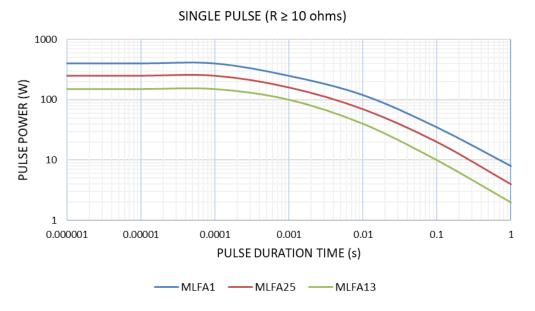
Wave Soldering (Flow Soldering)

- (1) Time of IR reflow soldering at maximum temperature point 260°C: 10 seconds
- (2) Time of wave soldering at maximum temperature point 260°C: 10 seconds
- (3) Time of soldering iron at maximum temperature point 410°C: 5 seconds

Pulse Withstanding Capacity

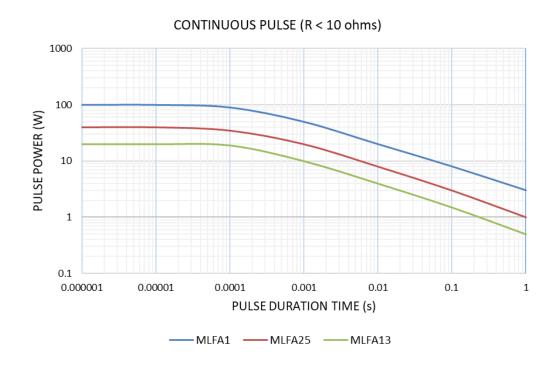
The single impulse graph is the result of the impulse of rectangular shape applied. The limit of acceptance was a shift in resistance of less than 1% from the initial value. The power applied was subject to the restrictions of the maximum permissible impulse voltage graph shown.



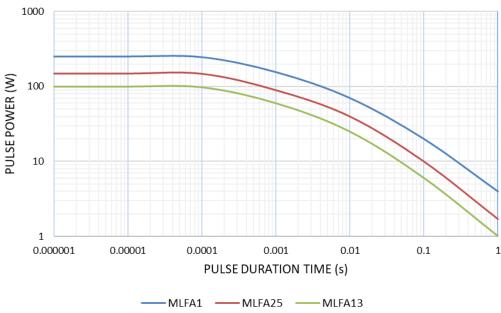


Continuous Pulse

The continuous load graph was obtained by applying repetitive rectangular pulses where the pulse period was adjusted so that the average power dissipated in the resistor was equal to its rated power at 70°C. Again the limit of acceptance was a shift in resistance of less than 1% from the initial value.

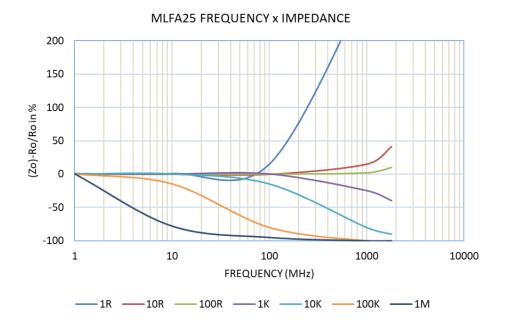




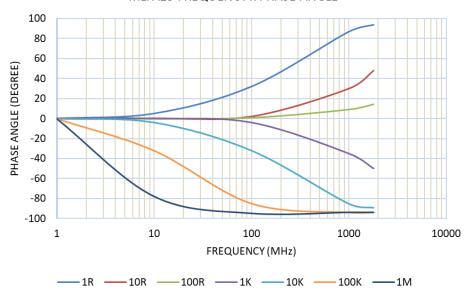


Frequency Behavior

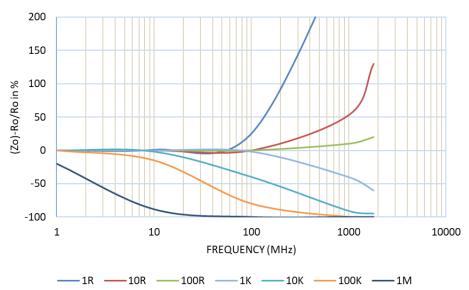
Resistors are designed to function according to Ohmic laws. This is basically true of resistors for frequencies up to 100 kHz. At higher frequencies, there is an additional contribution to the impedance by an ideal resistor switched in series with a coil and both switched parallel to a capacitor. The values of the capacitance and inductance are mainly determined by the dimensions of the terminations and the conductive path length. The environment surrounding components has a large influence on the behavior of the component on the printed-circuit board.

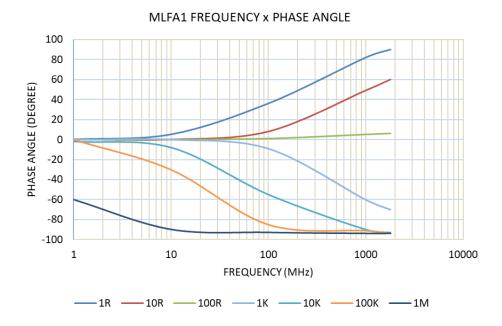


MLFA25 FREQUENCY x PHASE ANGLE



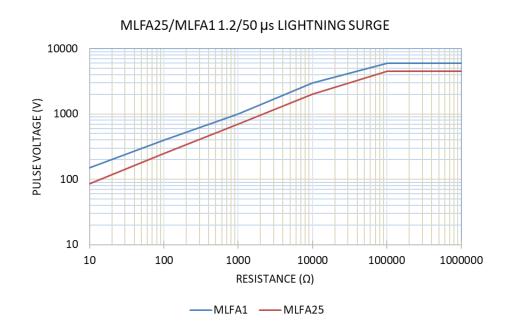
MLFA1 FREQUENCY x IMPEDANCE

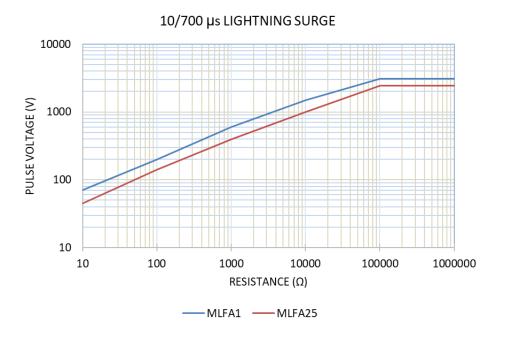




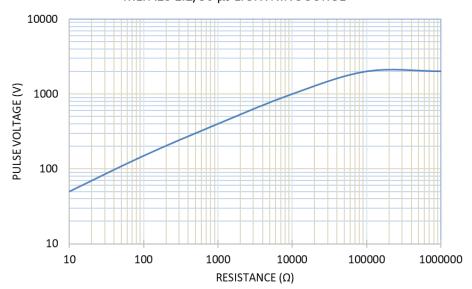
Lightning Surge

Resistors are tested in accordance with IEC 60 115-1 using both $1.2 / 50 \mu s$ and $10 / 700 \mu s$ pulse shapes. The limit of acceptance is a shift in resistance of less than 0.5% from the initial value.

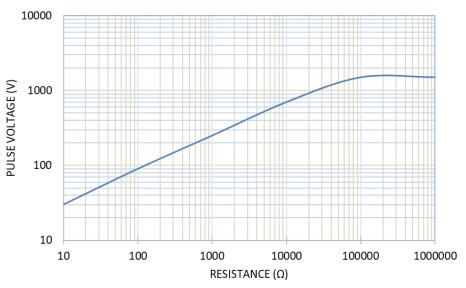




MLFA13 1.2/50 µs LIGHTNING SURGE







RoHS Compliance

Stackpole Electronics has joined the worldwide effort to reduce the amount of lead in electronic components and to meet the various regulatory requirements now prevalent, such as the European Union's directive regarding "Restrictions on Hazardous Substances" (RoHS 3). As part of this ongoing program, we periodically update this document with the status regarding the availability of our compliant components. All our standard part numbers are compliant to EU Directive 2011/65/EU of the European Parliament as amended by Directive (EU) 2015/863/EU as regards the list of restricted substances.

	RoHS Compliance Status								
Standard Product Series	Description	Package / Termination Type	Standard Series RoHS Compliant	Lead-Free Termination Composition	Lead-Free Mfg. Effective Date (Std Product Series)	Lead-Free Effective Date Code (YY/WW)			
MLFA	Metal Film Melf Resistor (AEC-Q200 Qualified)	SMD	YES	100% Matte Sn	Always	Always			

Conflict Metals" Commitment

We at Stackpole Electronics, Inc. are joined with our industry in opposing the use of metals mined in the "conflict region" of the eastern Democratic Republic of the Congo (DRC) in our products. Recognizing that the supply chain for metals used in the electronics industry is very complex, we work closely with our own suppliers to verify to the extent possible that the materials and products we supply do not contain metals sourced from this conflict region. As such, we are in compliance with the requirements of Dodd-Frank Act regarding Conflict Minerals.

Compliance to "REACH"

We certify that all passive components supplied by Stackpole Electronics, Inc. are SVHC (Substances of Very High Concern) free and compliant with the requirements of EU Directive 1907/2006/EC, "The Registration, Evaluation, Authorization and Restriction of Chemicals", otherwise referred to as REACH. Contact us for complete list of REACH Substance Candidate List.

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Stackpole Electronics, Inc.

Metal Film Melf Resistor - AEC-Q200 Qualified

Resistive Product Solutions

Environmental Policy

It is the policy of Stackpole Electronics, Inc. (SEI) to protect the environment in all localities in which we operate. We continually strive to improve our effect on the environment. We observe all applicable laws and regulations regarding the protection of our environment and all requests related to the environment to which we have agreed. We are committed to the prevention of all forms of pollution.

