KOA SPEER ELECTRONICS, INC.

Surge and Pulse Resistors

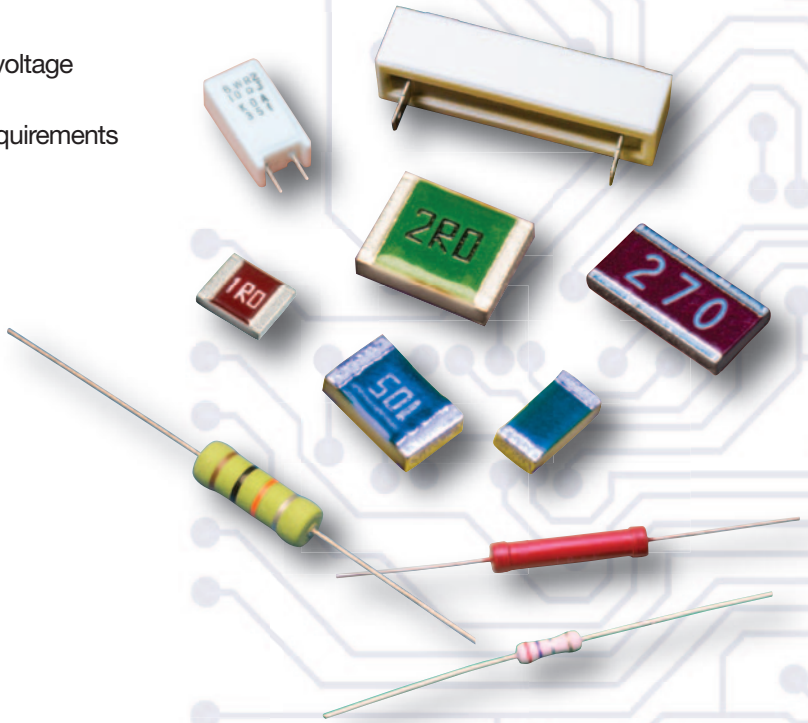
Excellent Surge and Pulse Withstanding Voltage

Features

- Superior to other resistors in surge/pulse withstanding voltage and high power
- Products with lead-free terminations meet EU RoHS requirements
- Most are AEC-Q200 Qualified

Applications

- Automotive Electronics
- Industrial equipment
- Power Supply
- X-Ray CT (with the exception of BRGV/BSRV/BWRV)



KOA Surge/Pulse Lineup

Surface Mount (SMT)

High Pulse Resistant	High Precision	Pulse Resistant	Surge Resistant	Wide Terminal High Power Rating
SG73*	SG73G*	SG73P*	SG73S*	WG73*

Through-hole

Low Resistance	High Resistance	Precision	Pulse Resistant Surge Resistant	Small Size Flame Retardant
BGR/BGRV†	BSR/BSRV†	BWR/BWRV†	HPC* PCF*	MOS

* AEC-Q200 qualified.

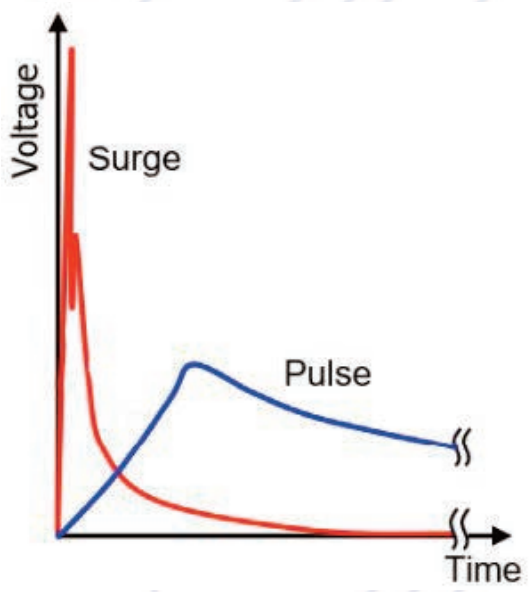
† Versions of resistors are AEC-Q200 qualified.

The SG73 Series is also available in anti-sulfur.

Definition of Pulse and Surge

Circuits that need to limit an instantaneous flow of large current, and circuits subject to static electricity (electrostatic discharge or ESD), require the use of resistors that are resistant to pulse and surge.

In this diagram, an overload with high power and long duration (transferring high energy) is called a "pulse," and an overload with high voltage but short duration (such as ESD) is called a "surge."



	Voltage	Time	Energy
Pulse	**Low**	**Long**	**High**
Surge (ESD)	High	Short	Low

Lineup of Pulse and Surge Resistant Resistors

Purpose	Item	Product Name	Series	Features
Pulse Resistant	SMD Type	Pulse resistant chip resistors	SG73	High pulse resistant
			SG73P	Pulse resistant (for general use)
			SG73G	High precision
			WG73	Wide terminal, high power rating
	Through-hole Type	Fixed metal oxide film resistors	MOS	Small size flame retardant
		Wire-wound resistors (with glass core)	BGR/V	High precision
		Metal oxide film	BSR/V	High resistance
		Wire-wound resistors (with ceramic core)	BWR/V	High power rating
		Ceramic resistor	HPC/PCF	Pulse resistant/surge resistant
Surge Resistant	SMD Type	Surge resistant chip resistors	SG73	High surge resistant
			SG73S	Surge resistant (for general use)
			WG73	Wide terminal, high power rating

Applications & Ratings

High Pulse Resistant

SG73

Part Designation	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (ppm/°C) Max.	Resistance Range (E-12) (K±10%, M±20%)	Absolute Maximum Working Voltage	Absolute Maximum Overload Voltage	Operating Temp. Range
SG731J (0603)	0.1W	70°C	125°C	±400	1Ω - 8.2Ω	50V	100V	-55°C to +155°C
				±200	10Ω - 1MΩ			
SG732A (0805)	0.125W		125°C	±400	1Ω - 8.2Ω	150V	200V	
				±200	10Ω - 1MΩ			
SG732B (1206)	.33W		125°C	±400	1Ω - 8.2Ω	200V	400V	
				±200	10Ω - 1MΩ			
SG732E (1210)	0.5W		125°C	±400	1Ω - 8.2Ω			
				±200	10Ω - 1MΩ			
SG732H/W2H (2010)	0.75W		125°C	±400	1Ω - 8.2Ω			
				±200	10Ω - 1MΩ			
SG733A/W3A (2512)	1W		125°C	±400	1Ω - 8.2Ω			
				±200	10Ω - 1MΩ			

Rated voltage = $\sqrt{\text{Power rating x resistance value}}$ or max. working voltage, whichever is lower.
If you're unsure whether to use "Rated Ambient Temperature" or "Rated Terminal Part Temperature," always give priority to the "Rated Terminal Part Temperature."
For more details on derating click here, "*Derating Curves – Caution & Terms*."

High Precision

SG73G

Part Designation	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (ppm/°C) Max.	Resistance Range (Ω) C±0.25%, D±0.5% E-24/E-96	Absolute Maximum Working Voltage	Absolute Maximum Overload Voltage	Operating Temp. Range
SG73G1J (0603)	0.2W	70°C	125°C	±50	10 - 1M	150V	200V	-55°C to +155°C
	0.33W*1	70°C	125°C					
SG73G2A (0805)	0.25W	70°C	125°C	±50	10 - 1M	200V	400V	
	0.5W*1	70°C	100°C					
SG73G2B (1206)	0.33W	70°C	125°C	±50	10 - 1M	200V	400V	
	0.5W*1	70°C	120°C					

Rated voltage = $\sqrt{\text{Power rating x resistance value}}$ or max. working voltage, whichever is lower.
If any questions should arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature," please give priority to the "Rated Terminal Part Temperature."
*1 If you use the rated power, please keep the terminal of the resistor below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature.
For more details on derating click here, "*Derating Curves – Caution & Terms*."

Applications & Ratings

Pulse Resistant (for general use)

SG73P

Part Designation	Power Rating*1	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (ppm/°C) Max.	Resistance Range (Ω) (E-24)/E-96 (D±0.5%)	(E-24)/E-96 (F±1%)	(E-24) (G±2%, J±5%)	Absolute Maximum Working Voltage	Absolute Maximum Overload Voltage	Operating Temp. Range
SG73P1E (0402)	0.33W	70°C	105°C	±200	10 - 1M	1 - 1M	1 - 10M	75V	100V	-55°C to +155°C
SG73P1EW (0402)	0.33W	70°C	105°C	±100	10 - 1M	10 - 1M	10 - 1M	75V	100V	
				±200	—	1 - 9.76	1 - 9.1 1.1M - 10M			
SG73P1J (0603)	0.5W	70°C	105°C	±100	510 - 576k	510 - 576k	510 - 560k	150V	200V	
				±100*2	10 - 499 590k - 1M	1 - 499 590k - 1M	1 - 470 620k - 10M			
SG73P2A (0805)	0.75W	70°C	105°C	±100	100 - 100k	100 - 100k	100 - 100k	400V	600V (800V)*3	
				±200	10 - 97.6 102k - 1M	1 - 97.6 102k - 1M	1 - 91 110k - 10M			
SG73P2B (1206)	1W	70°C	105°C	±100	300-1M	300-1M	300-1.1M	200V	400V	
				±200	10 - 294	1 - 294	1 - 270 1.2M - 10M			
SG73P2E (1210)	1.5W	70°C	105°C	±200	10 - 1M	1 - 1M	1 - 10M	200V	400V	

Rated voltage = $\sqrt{\text{Power rating x resistance value}}$ or max. working voltage, whichever is lower.

*1 If the terminal part temperature exceeds the rated terminal part temperature, even if it is below the rated ambient temperature, apply the derating curve for the terminal part temperature.

*2 Cold T.C.R. (-55°C ~ +25°C) is +150 x 10^{-6}/K.

*3 Applies when power rating is 0.4W or lower. Please contact KOA Speer for how to handle a specific surge/pulse.

If any questions should arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature," please give priority to the "Rated Terminal Part Temperature."

For more details on derating click here, "Derating Curves – Caution & Terms."

Surge Resistant

SG73S

Part Designation	Power Rating*1	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (ppm/°C) Max.	Resistance Range (Ω) (E-24)/E-96 (D±0.5%)	(E-24)/E-96 (F±1%)	(E-24) (G±2%, J±5%)	Maximum Working Voltage	Maximum Overload Voltage	Operating Temp. Range
SG73S1E (0402)	0.33W	70°C	105°C	±200	10 - 1M	1 - 1M	1 - 10M	75V	100V	-55°C to +155°C
SG73S1J (0603)	0.5W	70°C	105°C	±100	510 - 576k	510 - 576k	510 - 560k	150V	200V	
				±100*2	10 - 499 590k - 1M	1 - 499 590k - 1M	1 - 470 620k - 10M			
SG73S2A (0805)	0.75W	70°C	105°C	±200	10 - 1M	1 - 1M	1 - 10M	400V	600V (800V)*3	
SG73S2B (1206)	1W	70°C	105°C	±200	10 - 1M	1 - 1M	1 - 10M	200V	400V	
SG73S2E (1210)	1.5W	70°C	105°C	±200	10 - 1M	1 - 1M	1 - 10M	200V	400V	

*1 If the terminal part temperature exceeds the rated part temperature, even if it is below the rated ambient temperature, apply the derating curve for the terminal part temperature.

*2 Cold T.C.R. (-55°C ~ +25°C) is +150 x 10^{-6}/K

*3 Applies when power rating is 0.4W or lower.

Rated voltage = $\sqrt{\text{Power rating x resistance value}}$ or max. working voltage, whichever is lower

Please contact KOA Speer for how to handle a specific surge/pulse

If any questions should arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature," please give priority to the "Rated Terminal Part Temperature."

For more details on derating click here, "*Derating Curves – Caution & Terms*."

Applications & Ratings

Wide Terminal High Power Rating

WG73

Part Designation	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (X 10^{-6}/K)	Resistance Range (Ω) K±10% E-12	Resistance Range (Ω) M±20% E-12	Maximum Working Voltage	Maximum Overload Voltage	Operating Temperature Range
WG732B (0612)	1.0W	70°C	±125°C	±100	560m ~ 1k	560m ~ 1k	200V	400V	-55°C to +155°C
WG732H (1020)	1.5W		±125°C	±100	560m ~ 1k	560m ~ 1k	200V	400V	
WG733A (1225)	2.0W		±125°C	±100	560m ~ 1k	560m ~ 1k	200V	400V	

Rated voltage = √Power rating x resistance value or max. working voltage, whichever is lower.
If you're unsure whether to use "Rated Ambient Temperature" or "Rated Terminal Part Temperature," always give priority to the "Rated Terminal Part Temperature."
For more details on derating click here, "*Derating Curves – Caution & Terms*."

Low Resistance
Wirewound with Glass Core
BGR

High Resistance
Metal Oxide Film
BSR

Precision
Wirewound with Ceramic Core
BWR

Type	Power Rating	Resistance Range (Ω) E24 F±1%	G±2%	J±5%	K±10%	Style & Weight (g/1 piece) S	N	E	P	X	Y	YS	Z	H	Q	HA	HB	QA	QB
BWR1	1W	1~56	0.22~75	0.1~75	—	1.3	—	—	—	—	—	—	—	—	—	—	—	—	—
BWR2	2W	1~160	0.22~200	0.1~200	—	2.1	3.9	—	—	—	—	—	—	—	—	—	—	—	—
BWR3	3W	1~300	0.22~390	0.1~390	—	3.9	5.9	—	—	—	—	—	—	—	—	—	—	—	—
BWR5	5W	1~300	0.22~390	0.1~390	—	5.1	7.2	5.7	5.6	—	—	—	—	—	—	—	—	—	—
BWR7	7W	1~360	0.22~390	0.1~390	—	7.5	10.8	—	—	—	—	—	—	—	—	—	—	—	—
BWR10	10W	1~390	0.22~390	0.1~390	—	10.2	15.0	—	—	—	—	—	—	—	—	—	—	—	—
BWR15	15W	1~390	0.22~390	0.1~390	—	18.8	—	—	—	—	—	—	—	—	—	—	—	—	—
BWR20	20W	1~390	0.22~390	0.1~390	—	23.3	—	—	—	—	—	—	—	—	—	—	—	—	—
BGR5	5W	—	—	10~390	0.39~9.1	—	—	—	—	6.1	7.6	6.6	7.6	—	6.2	—	—	—	—
BGR7	7W	—	—	10~390	0.39~9.1	—	—	—	—	8.2	9.1	7.8	9.1	—	7.8	—	—	—	—
BGR10	10W	—	—	10~390	0.39~9.1	—	—	—	—	11.0	12.4	10.4	11.4	9.9	10.7	13.6	—	14.5	—
BGR15	15W	—	—	10~390	0.51~9.1	—	—	—	—	18.8	—	—	20.5	18.4	18.6	24.4	27.5	24.6	27.7
BGR20	20W	—	—	10~390	0.51~9.1	—	—	—	—	22.3	—	—	24.0	21.9	22.1	27.9	31.0	28.1	31.3
BGR30	30W	—	—	10~390	2.2~9.1	—	—	—	—	—	—	—	—	59.3	59.6	73.9	73.5	74.2	73.8
BGR40	40W	—	—	10~390	2.2~9.1	—	—	—	—	—	—	—	—	70.4	70.6	85.0	84.6	85.2	84.8
BSR2	2W	—	—	430~13k	—	2.1	3.8	—	—	—	—	—	—	—	—	—	—	—	—
BSR3	3W	—	—	430~27k	—	3.9	5.9	—	—	—	—	—	—	—	—	—	—	—	—
BSR5	5W	—	—	430~51k	—	5.1	7.2	5.7	—	6.1	7.6	6.6	7.6	—	6.2	—	—	—	—
BSR7	7W	—	—	430~56k	—	7.4	10.8	—	—	8.2	9.1	7.8	9.1	—	7.8	—	—	—	—
BSR10	10W	—	—	430~75k	—	10.2	15.0	—	—	11.0	12.4	10.4	11.4	10.9	10.7	13.7	—	14.5	—
BSR15	15W	—	—	430~56k	—	18.8	—	—	—	18.5	—	—	20.5	18.4	18.6	24.4	27.5	24.6	27.7
BSR20	20W	—	—	430~56k	—	23.3	—	—	—	22.0	—	—	24.0	21.9	22.1	27.9	31.0	28.1	31.3

Type	Power Rating	Max. Working Voltage (V) BSR	Max. Working Voltage (V) BGR,BWR	Max. Overload Voltage (V) BSR	Max. Overload Voltage (V) BGR,BWR	T.C.R. (x10^{-6}/K) BWR	T.C.R. (x10^{-6}/K) BSR	T.C.R. (x10^{-6}/K) BGR	Rated Ambient Temperature	Operating Temperature Range
BWR1	1W	—	E=√P•R	—	E=√P•R•10	±100	—	—	+70°C	-40°C to +155°C
B□R2	2W	250		500			±300			
B□R3	3W	300		600						
B□R5	5W	350		700				±250		
B□R7	7W	500		1000						
B□R10	10W	700		1400						
B□R15	15W	700		1400						
B□R20	20W	750		1500					+25°C	
BGR30	30W	—		—		—	—			
BGR40	40W	—		—						

Rated voltage= √Power Rating × Resistance value or Max. working voltage, whichever is lower.
□Represents the space to designate product type via character G, W, or S.
Please consult with us in advance about custom-made products.

Applications & Ratings

Low Resistance
Wirewound with Glass Core
BGRV

High Resistance
Metal Oxide Film
BSRV

Precision
Wirewound with Ceramic Core
BWRV

Type	Power Rating	Resistance Range (Ω) E24		Style & Weight (g/1pcs)					
		J±5%	K±10%	S*	N*	Q	QA	QC	QE
BWRV3	3W	1~390	—	3.9	5.9	—	—	—	—
BWRV5	5W	1~390	—	5.1	7.2	—	—	—	—
BWRV7	7W	1~390	—	7.5	10.8	—	—	—	—
BWRV10	10W	1~390	—	10.2	15.0	—	—	—	—
BWRV15	15W	1~390	—	18.8	—	—	—	—	—
BWRV20	20W	1~390	—	23.3	—	—	—	—	—
BWRV40	40W (60W)	4.3~220	—	—	—	93.5	—	—	107.5
BGRV5	5W	10~390	5.1~9.1	—	—	6.2	—	—	—
BGRV7	7W	10~390	5.1~9.1	—	—	7.9	—	—	—
BGRV10	10W	10~390	5.1~9.1	—	—	10.7	14.5	—	—
BGRV15	15W	10~390	5.1~9.1	—	—	18.6	24.6	—	—
BGRV20	20W	10~390	5.1~9.1	—	—	22.1	28.1	—	—
BGRV30	30W	10~390	5.1~9.1	—	—	59.6	—	84.6	73.9
BGRV30TQW		10~100	5.1~9.1	—	—				
BGRV40	40W	10~390	5.1~9.1	—	—	70.6	—	105.0	95.0
BGRV40TQW		10~100	5.1~9.1	—	—				
BSRV3	3W	430~27k	—	3.9	5.9	—	—	—	—
BSRV5	5W	430~51k	—	5.1	7.2	6.2	—	—	—
BSRV7	7W	430~56k	—	7.5	10.8	7.9	—	—	—
BSRV10	10W	430~75k	—	10.2	15.0	10.7	14.5	—	—
BSRV15	15W	430~56k	—	18.8	—	18.6	24.6	—	—
BSRV20	20W	430~56k	—	23.3	—	22.1	28.1	—	—

* S Style and N Style lead terminal products are not compatible with the AEC-Q200 vibration test by only soldered PCB mounting.
When using the product, please take into account vibration measures such as fixing the product with silicone resin.

Type	Power Rating	Rated Ambient Temp.	Max. Working Voltage (V)			Max. Overload Voltage (V)			T.C.R. (x10^{-6}/K)			Operating Temperature Range
			BGRV	BWRV	BSRV	BGRV	BWRV	BSRV	BGRV	BWRV	BSRV	
B☐RV3	3W	+70°C	—	$E=\sqrt{P•R}$	300	—	$E=\sqrt{P•R•10}$	600	—	±250	±300	-40°C to +155°C
B☐RV5	5W		$E=\sqrt{P•R}$		350	$E=\sqrt{P•R•10}$		700	±250			
B☐RV7	7W				500			1000				
B☐RV10	10W				700			1400				
B☐RV15	15W	+25°C			700			1400				
B☐RV20	20W				750			1500				
BGRV30	30W			—	—		—	—		—	—	
BGRV40	40W											
BWRV40	40W (60W)**		—	$E=\sqrt{P•R}$		—	$E=\sqrt{P•R•10}$		—	±250		

Rated voltage= $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.
Please consult with us in advance about custom-made products.
** Please note that when used at a rated power of 60W, the surface temperature of the product will reach approximately 300°C.

Applications & Ratings

Pulse Resistant
Surge Resistant

HPC
PCF

Part Designation	Power Rating @ 40°C	Resistance Range (Ω) K: ±10% E-12	Resistance Range (Ω) M: ±20% E-6	T.C.R. (x10^{-6}/K)	Maximum Working Voltage	Maximum Overload Voltage	Rated Ambient Temp.	Operating Temp. Range
HPC1/2	0.5W	10 - 390K	3.3 - 330K	-500 ~ -1300: 3.3Ω≤R<10Ω -600 ~ -1500: 10Ω≤R<100Ω -700 ~ -1800: 100Ω≤R<1kΩ -900 ~ -1900: 1kΩ≤R<100kΩ -900 ~ -2000: 100kΩ≤R<200kΩ -900 ~ -2200: 200kΩ≤R≤390kΩ	200V	400V	+40°C	-40°C to +200°C
HPC1	1.0W				300V	600V		
HPC2	2.0W				400V	800V		
HPC3	3.0W				450V	900V		
HPC4	4.0W				500V	1000V		
HPC5	5.0W				550V	1100V		

Rated voltage = $\sqrt{\text{Power Rating X Resistance Value}}$ or Max. working voltage, whichever is lower.

Part Designation	Power Rating @ 70°C	Resistance Range (Ω) K: ±10% E-12	Resistance Range (Ω) M: ±20% E-6	T.C.R. (x10^{-6}/K)	Maximum Working Voltage	Maximum Overload Voltage	Dielectric Withstanding Voltage	Rated Ambient Temp.	Operating Temp. Range
PCF1/2	0.5W	4.7 - 100K	4.7 - 100K	-500 ~ -1300: 3.3Ω≤R<10Ω -600 ~ -1500: 10Ω≤R<100Ω -700 ~ -1800: 100Ω≤R<1kΩ -900 ~ -1900: 1kΩ≤R<100kΩ -900 ~ -2000: 100kΩ≤R<200kΩ -900 ~ -2200: 200kΩ≤R≤390kΩ	200V	400V	500V	+70°C	-40°C to +200°C
PCF1	1.0W	3.3 - 390K	3.3 - 330K		300V	600V			
PCF2	2.0W				400V	800V	700V		

Rated Voltage = $\sqrt{\text{Power Rating x Resistance Value}}$ or Max. working voltage, whichever is lower.

Small Size
Flame Retardant

MOS

Part Designation	Power Rating @ 70°C	Minimum Dielectric Withstanding Voltage	T.C.R. (ppm/°C) Max.	Resistance Range E-24, E-96* (F±1%)	Resistance Range E-24* (G±2%)	Resistance Range E-24 (J±5%)	Absolute Maximum Working Voltage	Absolute Maximum Overload Voltage	Operating Temperature Range
MOS1/2	0.5W	400V	±300	10Ω - 47kΩ	10Ω - 47kΩ	10Ω - 47kΩ	$E = \sqrt{P \times R(V)}$	600V	-55°C to +200°C
MOS1	1.0W	500V		10Ω - 68kΩ	10Ω - 68kΩ	10Ω - 100kΩ			
MOS2	2.0W			10Ω - 100kΩ	10Ω - 100kΩ		350V	700V	
MOS3	3.0W	700V		—					
MOS5	5.0W	800V					500V	1000V	
MOSX1/2	0.5W	400V		1Ω - 9.1Ω	0.22Ω - 9.1Ω	0.1Ω - 9.1Ω	$E = \sqrt{P \times R(V)}$	E x 2.5(V)	
MOSX1	1.0W	500V							
MOSX2	2.0W								
MOSX3	3.0W	700V		—	0.22Ω - 9.1Ω				
MOSX5	5.0W	800V							

Rated Ambient Temperature: +70°C

Rated voltage= $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$ or Max. working voltage, whichever is lower.

* Please consult with us for resistance other than catalog specification (tol.F/G).

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