DataSheet No.: E20004
Version: V0
Date: 2023/05/21

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TPAN0220

50W TO-220 Non-Inductive High-Power Resistor

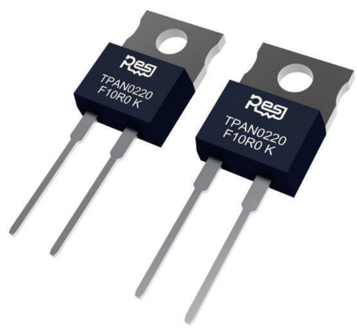
Resistance	0.5Ω~10KΩ
Tolerance	±0.5%
TCR	≤±100ppm/℃
Rated Power	50W

Applications

Testing Instrumentation
Industrial Power Equipment
Automotive Electronics
Motor Control & Drive Circuits

Better Solution for Sustainable High End Manufacturing

High Power with Excellent Reliability & Stability



AEC-Q200

Introduction

TPAN0220 is a TO-220 non-inductive high-power resistor. The TO-220 transistor outline package is a through hole package, commonly used for high-power transistors, small to medium-sized integrated circuits, power resistors, etc.

The rated power of TPAN0220 series is 50W. TPAN0220 adopts a flange for its better heat dissipation to balance the thermal characteristics of the circuit. It is usually designed for current measurement, energy absorption, discharge, RC absorption, high-speed switching, high-frequency transmission circuits, voltage regulation, constant power loads, and low-energy pulse loads. Its industry applications include industrial lasers, welding equipment, testing equipment, instrumentation, UPS, automobiles, switching power supplies, etc.

TPAN0220 series high-power molded resistor has excellent long-term stability, low TCR, high heat dissipation, low thermal resistance and low current noise, applying for a wide range. From raw materials, core production equipment, to process technology, TPAN0220 production is independent and controllable and achieves stable quality and timely delivery.

Electrical Parameters

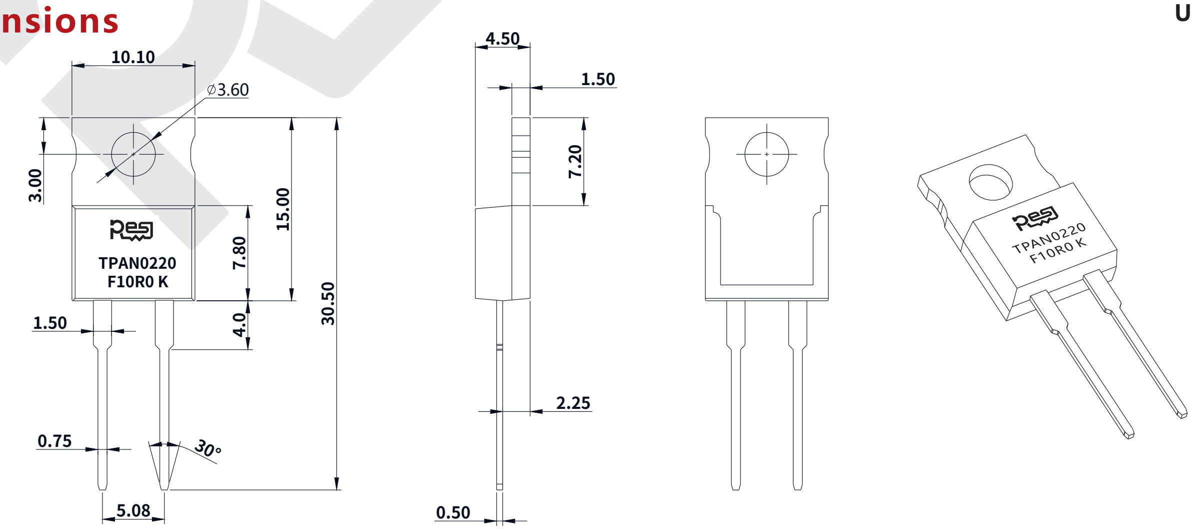
Series	Resistance Ω	TCR ppm/℃	Tolerance %	Max. Operating Voltage*(1)	Rated Power*(2) With Heat Sink. Flange ≤ 25℃	Without Heat Sink	Operating Temperature
TPAN0220	0.5≤R≤10K	±100	±0.5, ±1, ±5	500V	50W	2.5W	-55~+150℃

*(1) According to P=UI, combined with power and the maximum operating voltage, calculate the maximum current value (P and U whichever is less).
*(2) If the actual operating power is greater than 2.5W, it must be used with a heat sink. The recommended heat sink and installation method refer to pages 5 and 6.

Galvanic Isolation	Insulation Resistance	Thermal Resistance	Inductance	E-Series Value	Technology	Housing	Unit Weight
2000VAC	$\geq 10^4$MΩ	2.1℃/W	≤0.1μH	E24	Thick Film	Epoxy Molded	2.2±0.5g

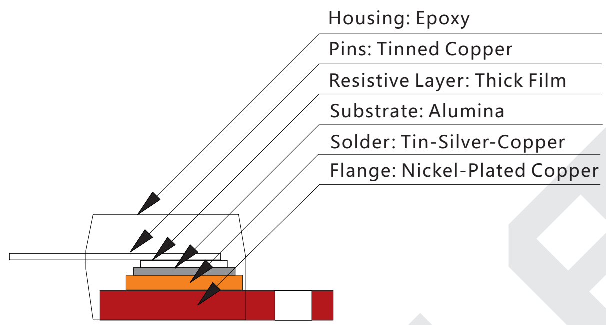
Dimensions

Unit: mm



Note: The above dimensional tolerance is ±0.3mm.

Construction



Marking

The first line (four digits) represents brand.
The second line (eight digits) represents product series and package.
The third line (six digits) represents tolerance, resistance and TCR.

Series	Illustration	E-Series Value	Demonstration
TPAN0220		E24	RESI: Brand TPAN0220: Series & Package F: Tolerance 10R0: Resistance K: TCR

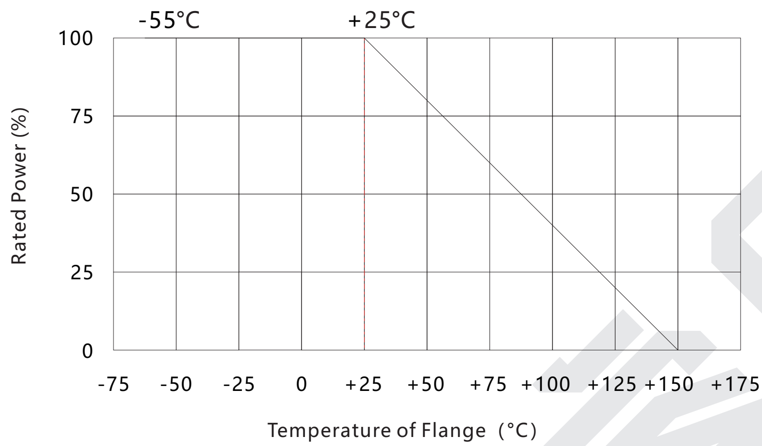
Part Number Information

Example: TPAN0220F10R0K9 (TPAN 0220 Series ±1% 10Ω ±100ppm/°C Standard)

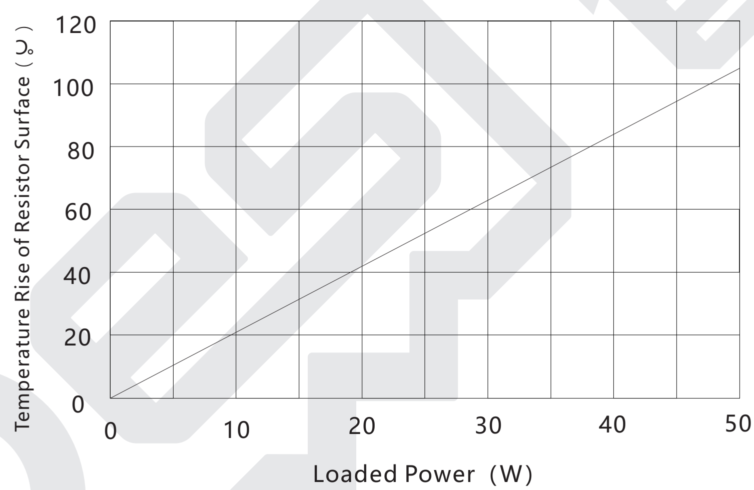
T	P	A	N	0	2	2	0	F	1	0	R	0	K	9

Series	Package	Tolerance	Resistance	TCR	Code
TPAN	0220	D=±0.5% F=±1% J=±5%	R500=0.5Ω 10R0=10Ω 1K00=1KΩ 10K0=10KΩ	K=±100ppm/℃	9=Standard 0-8=Custom

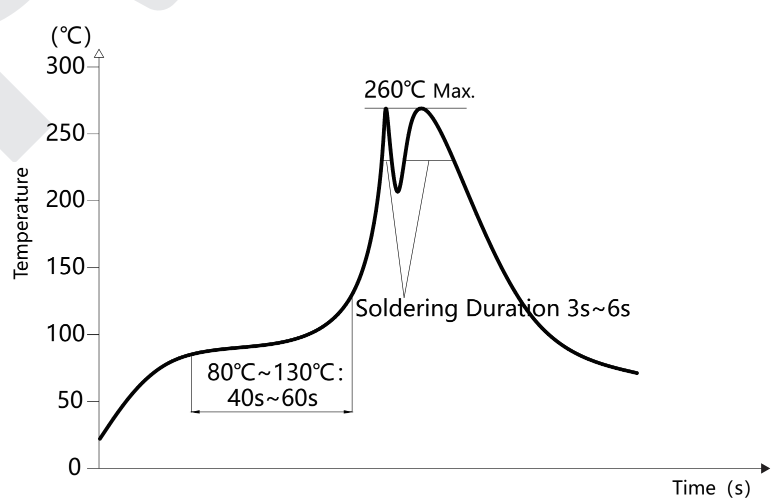
Derating Curve



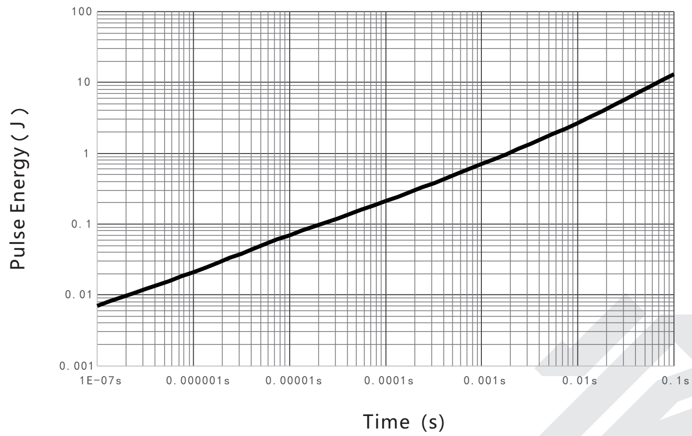
Power - Temperature Rise Curve



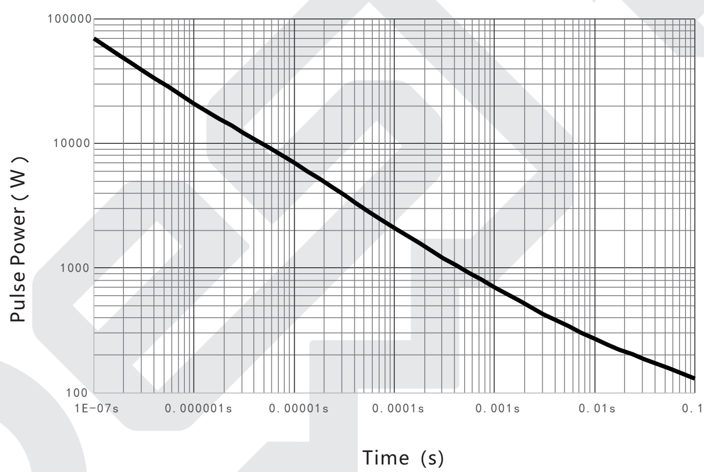
Suggested Lead-Free Wave Soldering Curve



Pulse Energy Curve



Pulse Power Curve



Performance

Test	Test Method	Standards	Test Limits
High Temperature Storage	1000h@+150°C, unpowered	AEC-Q200 TEST 3 MIL-STD-202 Method 108	△R≤±1%
Bias Humidity	+85°C, 85%RH, powered 10% rated power for 1000h. Inspect within 24±4 hours after the test	AEC-Q200 TEST 7 MIL-STD-202 Method 103	△R±≤0.5%
Load Life	+25°C, 1000h, rated power, not exceeding maximum operating voltage, 90 min on, 30 min off	AEC-Q200 TEST 8 MIL-STD-202 Method 108	△R≤±1%
Resistance to Solvent	Immerse in IPA at 20 °C~25 °C, hold for 5 min	AEC-Q200 TEST 12 MIL-STD-202 Method 215	Clear marking. No visible damage
Mechanical Shock	Half Sine Wave, peak acceleration 100g's, pulse duration 6ms, 3 times in each of six directions, on three different axes	AEC-Q200 TEST 13 MIL-STD-202 Method 213	△R≤±0.25%
Vibration	10-2KHz, 5g's, 20min/cycle, 12 cycles in each directions of X Y Z	AEC-Q200 TEST 14 MIL-STD-202 Method 204	△R≤±0.25%
Resistance to Solder Heat	+270°C tin bath for 10s	AEC-Q200 TEST 15 MIL-STD-202 Method 210	△R≤±0.25%
Thermal Shock	-55°C, 15min~ambient temperature<20s~+150°C, 15min, 1000 cycles	AEC-Q200 TEST 16 MIL-STD-202 Method 107	△R≤±0.5%
Solderability	+245°C tin bath for 3s	AEC-Q200 TEST 18 IEC 60115-1 4.17	No visible damage. 95% minimum coverage
TCR	-55℃ and +125℃, +20℃ Ref.	AEC-Q200 TEST 19 IEC 60115-1 4.8	Within the nominal value range
Flammability	Flame the sample for 10 seconds, twice	AEC-Q200 TEST 20 UL-94 V-0 or V-1 is acceptable and does not require electrical testing	Incomplete burnout, thin pad paper not ignited, pine board not charred
Terminal Strength	Apply force 2.5N.M for 60s	AEC-Q200 TEST 22 AEC-Q200-006	△R≤±0.2%
Withstand Voltage	Apply an effective 2000VAC between the terminal and flange for 60 seconds	IEC 60115-1 4.7	No breakdown or flashover, △R≤±0.25%
Short Time Overload	2x rated power for 5 s, not exceeding 1.5x maximum operating voltage	IEC 60115-1 4.13	△R≤±0.5%
Low Temperature Operation	-55 ℃, unpowered for 1 h, powered rated voltage for 15 min, unpowered for 15 min	IEC 60115-1 4.36	△R≤±0.5%

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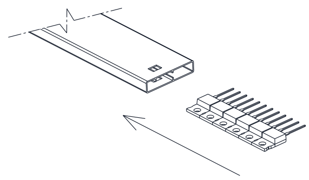
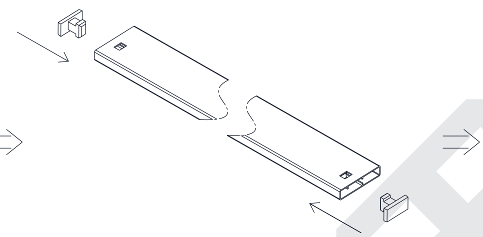
TPAN0220

50W TO-220 Non-Inductive High-Power Resistor

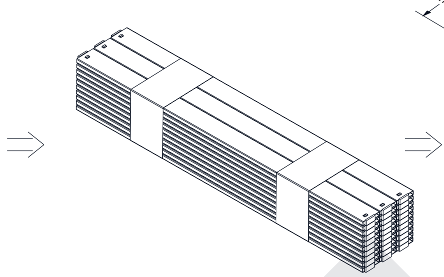
Packaging



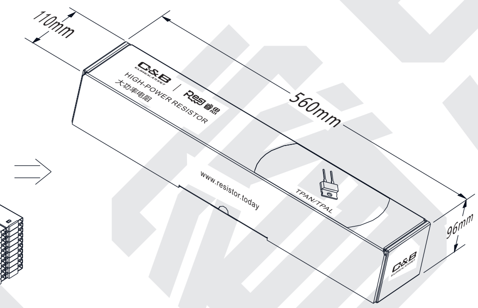
1. 50 pcs./tube.



2. Install rubber plugs at both ends.

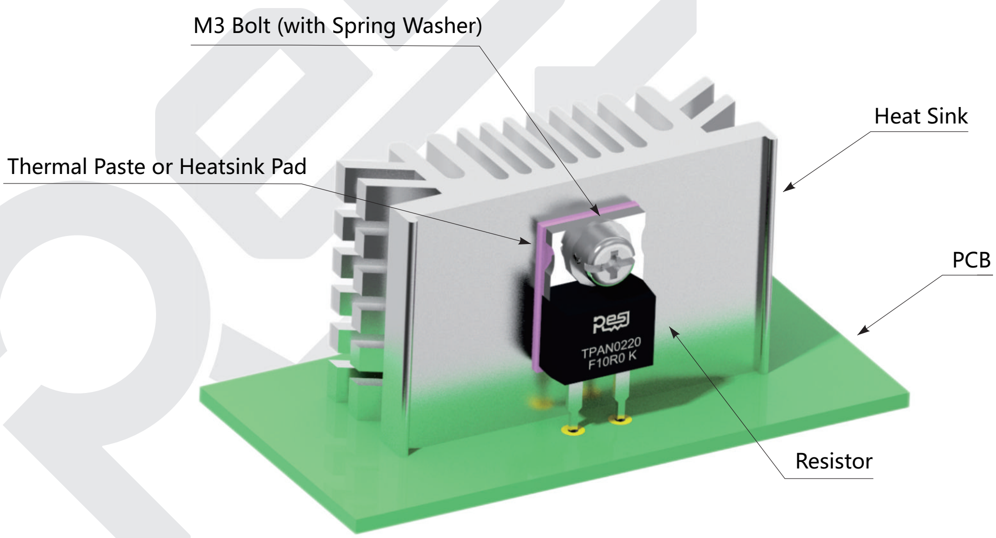


3. Pack every 30 tubes into a bundle.



4. The bundle box size is 560*110*96 mm

Installation



(1) The general installation of TO220 resistors is shown in the figure above. For good thermal conductivity, thermal paste or heatsink pads must be used at the contact position between the bottom of the resistor flange and the heat sink, to ensure contact area for heat dissipation.

(2) The bolt connecting the flange with the heat sink should be of a specification with spring washers to prevent looseness and sliding during long-term use, which may cause gaps and affect the thermal conductivity.

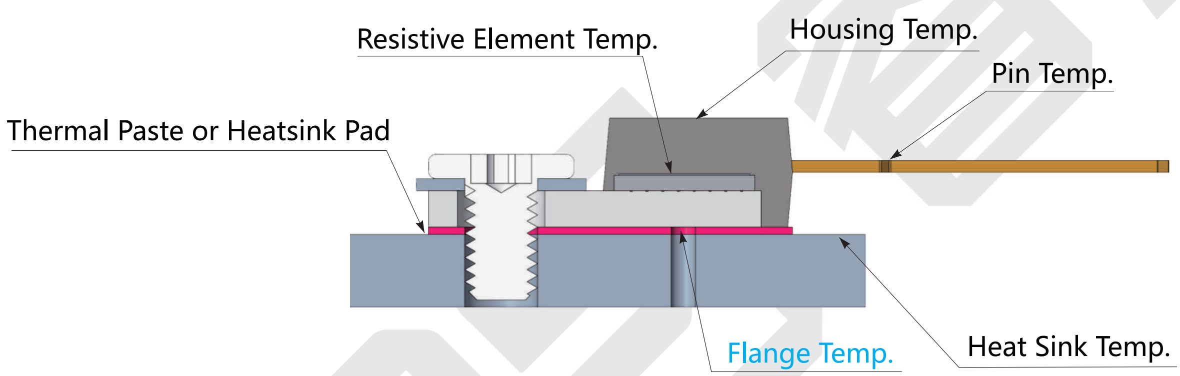
(3) The recommended torque is no greater than 0.9N.m, to avoid cracks or warping deformation of the product caused by excessive torque.

(4) For full power application, it is necessary to refer to the derating curve diagram and ensure that the temperature of the bottom flange is ≤ 25 ℃ by using water cooling or oil cooling to ensure the load life and reliability of the resistor.

Statement of Rated Power and Temperature

The maximum rated power of TPAN0220 series high-power resistor is 50W, which is based on 25 ℃ operating ambient temperature of the flange. The temperature measurement point is in the center of the back of the flange, which is below the resistive element. The temperature of the resistor flange is different from the temperature of the housing, pin or ambient temperature. The heat dissipation effect of the resistor can be reflected by the flange temperature. Heat dissipation effect is a crucial factor.When equipment or resistor fails, please investigate the heat dissipation of the resistor first. If the flange is overtemperature, it usually indicates that the heat dissipation effect has not achieved the conditions specified in the datasheet, which means the installation of the heat sink or the heat dissipation capacity of the applied heat sink does not meet the requirements. Long-term use can lead to drift of the resistance, thereby reducing the load life of the resistor. When using resistors, it is recommended to apply appropriate thermal design, calculation, and temperature measurement or finite element analysis to verify the feasibility of the design and avoid resistor failure due to poor heat dissipation.

Temperature Diagram of Product Assembly



Heat Sink Selection

Users must choose a suitable heat sink based on the usage conditions of the resistors (e.g. power, ambient temperature, etc.). The maximum operating temperature of TPAN0220 series is 150 ℃. TPAN0220 power calculation is as follows:

$$P = \frac{\Delta T}{R_{TH\,(j-c)} + R_{TH\,(c-h)} + R_{TH\,(h-a)}}$$

P: The operating power of the resistor;

ΔT: The difference of the maximum operating temperature of the resistor and the ambient temperature;

$R_{TH\,(j-c)}$: The thermal resistance between the resistive layer and the outer part of the resistor, i.e. the thermal resistance of the resistor;

$R_{TH\,(c-h)}$: The thermal resistance between the outer part of the resistor and the upper part of the heat sink, i.e. the thermal resistance at the contact interface;

$R_{TH\,(h-a)}$: The thermal resistance of the heat sink.

Example:

$R_{TH\,(h-a)}$: Determine an operating power of 15W and an ambient temperature of +25 ℃ for TPAN0200;

Referring to the datasheet, the thermal resistance $R_{TH\,(j-c)}$ of TPAN0200 series is 2.1 ℃/W;

The calculation is as follows:

$\Delta T = 150℃ - 25℃ = 125℃$

$R_{TH\,(j-c)} + R_{TH\,(c-h)} + R_{TH\,(h-a)} = \Delta T/P = 8.33℃/W$

$R_{TH\,(c-h)} + R_{TH\,(h-a)} = 8.33 - 2.1 = 6.23℃/W$

The thermal resistance at the contact interface, $R_{TH\,(c-h)}$, can be concluded, based on the operating condition. If $R_{TH\,(c-h)}$ is 1 ℃/W, a heat sink with $R_{TH\,(h-a)}$ less than 5.23 ℃/W is needed.

Popular Part Numbers

Part Number	Package	Tolerance	Resistance	TCR	Power	Max. Operating Voltage
TPAN0220DR500K9	TO-220	±0.5%	0.5Ω	±100ppm/℃	50W	500V
TPAN0220D1R00K9	TO-220	±0.5%	1Ω	±100ppm/℃	50W	500V
TPAN0220D1R50K9	TO-220	±0.5%	1.5Ω	±100ppm/℃	50W	500V
TPAN0220D2R00K9	TO-220	±0.5%	2Ω	±100ppm/℃	50W	500V
TPAN0220D3R00K9	TO-220	±0.5%	3Ω	±100ppm/℃	50W	500V
TPAN0220D3R30K9	TO-220	±0.5%	3.3Ω	±100ppm/℃	50W	500V
TPAN0220D3R90K9	TO-220	±0.5%	3.9Ω	±100ppm/℃	50W	500V
TPAN0220D4R00K9	TO-220	±0.5%	4Ω	±100ppm/℃	50W	500V
TPAN0220D4R70K9	TO-220	±0.5%	4.7Ω	±100ppm/℃	50W	500V
TPAN0220D5R00K9	TO-220	±0.5%	5Ω	±100ppm/℃	50W	500V
TPAN0220D5R10K9	TO-220	±0.5%	5.1Ω	±100ppm/℃	50W	500V
TPAN0220D5R60K9	TO-220	±0.5%	5.6Ω	±100ppm/℃	50W	500V
TPAN0220D6R80K9	TO-220	±0.5%	6.8Ω	±100ppm/℃	50W	500V
TPAN0220D7R50K9	TO-220	±0.5%	7.5Ω	±100ppm/℃	50W	500V
TPAN0220D10R0K9	TO-220	±0.5%	10Ω	±100ppm/℃	50W	500V
TPAN0220D15R0K9	TO-220	±0.5%	15Ω	±100ppm/℃	50W	500V
TPAN0220D20R0K9	TO-220	±0.5%	20Ω	±100ppm/℃	50W	500V
TPAN0220D25R0K9	TO-220	±0.5%	25Ω	±100ppm/℃	50W	500V
TPAN0220D33R0K9	TO-220	±0.5%	33Ω	±100ppm/℃	50W	500V
TPAN0220D47R0K9	TO-220	±0.5%	47Ω	±100ppm/℃	50W	500V
TPAN0220D50R0K9	TO-220	±0.5%	50Ω	±100ppm/℃	50W	500V
TPAN0220D100RK9	TO-220	±0.5%	100Ω	±100ppm/℃	50W	500V
TPAN0220D200RK9	TO-220	±0.5%	200Ω	±100ppm/℃	50W	500V
TPAN0220D500RK9	TO-220	±0.5%	500Ω	±100ppm/℃	50W	500V
TPAN0220D1K00K9	TO-220	±0.5%	1KΩ	±100ppm/℃	50W	500V
TPAN0220D2K00K9	TO-220	±0.5%	2KΩ	±100ppm/℃	50W	500V
TPAN0220D5K00K9	TO-220	±0.5%	5KΩ	±100ppm/℃	50W	500V
TPAN0220D10K0K9	TO-220	±0.5%	10KΩ	±100ppm/℃	50W	500V
TPAN0220FR500K9	TO-220	±1%	0.5Ω	±100ppm/℃	50W	500V
TPAN0220F1R00K9	TO-220	±1%	1Ω	±100ppm/℃	50W	500V
TPAN0220F1R50K9	TO-220	±1%	1.5Ω	±100ppm/℃	50W	500V
TPAN0220F2R00K9	TO-220	±1%	2Ω	±100ppm/℃	50W	500V
TPAN0220F3R00K9	TO-220	±1%	3Ω	±100ppm/℃	50W	500V
TPAN0220F3R30K9	TO-220	±1%	3.3Ω	±100ppm/℃	50W	500V
TPAN0220F3R90K9	TO-220	±1%	3.9Ω	±100ppm/℃	50W	500V
TPAN0220F4R00K9	TO-220	±1%	4Ω	±100ppm/℃	50W	500V
TPAN0220F4R70K9	TO-220	±1%	4.7Ω	±100ppm/℃	50W	500V
TPAN0220F5R00K9	TO-220	±1%	5Ω	±100ppm/℃	50W	500V
TPAN0220F5R10K9	TO-220	±1%	5.1Ω	±100ppm/℃	50W	500V
TPAN0220F5R60K9	TO-220	±1%	5.6Ω	±100ppm/℃	50W	500V
TPAN0220F6R80K9	TO-220	±1%	6.8Ω	±100ppm/℃	50W	500V
TPAN0220F7R50K9	TO-220	±1%	7.5Ω	±100ppm/℃	50W	500V
TPAN0220F10R0K9	TO-220	±1%	10Ω	±100ppm/℃	50W	500V
TPAN0220F15R0K9	TO-220	±1%	15Ω	±100ppm/℃	50W	500V
TPAN0220F20R0K9	TO-220	±1%	20Ω	±100ppm/℃	50W	500V
TPAN0220F25R0K9	TO-220	±1%	25Ω	±100ppm/℃	50W	500V
TPAN0220F33R0K9	TO-220	±1%	33Ω	±100ppm/℃	50W	500V
TPAN0220F47R0K9	TO-220	±1%	47Ω	±100ppm/℃	50W	500V
TPAN0220F50R0K9	TO-220	±1%	50Ω	±100ppm/℃	50W	500V
TPAN0220F100RK9	TO-220	±1%	100Ω	±100ppm/℃	50W	500V
TPAN0220F200RK9	TO-220	±1%	200Ω	±100ppm/℃	50W	500V

Popular Part Numbers

Part Number	Package	Tolerance	Resistance	TCR	Power	Max. Operating Voltage
TPAN0220F500RK9	TO-220	±1%	500Ω	±100ppm/℃	50W	500V
TPAN0220F1K00K9	TO-220	±1%	1KΩ	±100ppm/℃	50W	500V
TPAN0220F2K00K9	TO-220	±1%	2KΩ	±100ppm/℃	50W	500V
TPAN0220F5K00K9	TO-220	±1%	5KΩ	±100ppm/℃	50W	500V
TPAN0220F10K0K9	TO-220	±1%	10KΩ	±100ppm/℃	50W	500V
TPAN0220JR500K9	TO-220	±5%	0.5Ω	±100ppm/℃	50W	500V
TPAN0220J1R00K9	TO-220	±5%	1Ω	±100ppm/℃	50W	500V
TPAN0220J1R50K9	TO-220	±5%	1.5Ω	±100ppm/℃	50W	500V
TPAN0220J2R00K9	TO-220	±5%	2Ω	±100ppm/℃	50W	500V
TPAN0220J3R00K9	TO-220	±5%	3Ω	±100ppm/℃	50W	500V
TPAN0220J3R30K9	TO-220	±5%	3.3Ω	±100ppm/℃	50W	500V
TPAN0220J3R90K9	TO-220	±5%	3.9Ω	±100ppm/℃	50W	500V
TPAN0220J4R00K9	TO-220	±5%	4Ω	±100ppm/℃	50W	500V
TPAN0220J4R70K9	TO-220	±5%	4.7Ω	±100ppm/℃	50W	500V
TPAN0220J5R00K9	TO-220	±5%	5Ω	±100ppm/℃	50W	500V
TPAN0220J5R10K9	TO-220	±5%	5.1Ω	±100ppm/℃	50W	500V
TPAN0220J5R60K9	TO-220	±5%	5.6Ω	±100ppm/℃	50W	500V
TPAN0220J6R80K9	TO-220	±5%	6.8Ω	±100ppm/℃	50W	500V
TPAN0220J7R50K9	TO-220	±5%	7.5Ω	±100ppm/℃	50W	500V
TPAN0220J10R0K9	TO-220	±5%	10Ω	±100ppm/℃	50W	500V
TPAN0220J15R0K9	TO-220	±5%	15Ω	±100ppm/℃	50W	500V
TPAN0220J20R0K9	TO-220	±5%	20Ω	±100ppm/℃	50W	500V
TPAN0220J25R0K9	TO-220	±5%	25Ω	±100ppm/℃	50W	500V
TPAN0220J33R0K9	TO-220	±5%	33Ω	±100ppm/℃	50W	500V
TPAN0220J47R0K9	TO-220	±5%	47Ω	±100ppm/℃	50W	500V
TPAN0220J50R0K9	TO-220	±5%	50Ω	±100ppm/℃	50W	500V
TPAN0220J100RK9	TO-220	±5%	100Ω	±100ppm/℃	50W	500V
TPAN0220J200RK9	TO-220	±5%	200Ω	±100ppm/℃	50W	500V
TPAN0220J500RK9	TO-220	±5%	500Ω	±100ppm/℃	50W	500V
TPAN0220J1K00K9	TO-220	±5%	1KΩ	±100ppm/℃	50W	500V
TPAN0220J2K00K9	TO-220	±5%	2KΩ	±100ppm/℃	50W	500V
TPAN0220J5K00K9	TO-220	±5%	5KΩ	±100ppm/℃	50W	500V
TPAN0220J10K0K9	TO-220	±5%	10KΩ	±100ppm/℃	50W	500V

Revision

Version	Revised Content	Date	Approver
V0	Initial Issue	2023.5.21	LWW

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