RECTIFIERS

High Efficiency, 16A Center-Tap

SES5401C-SES5404C

FEATURES

- Low Forward Voltage
- Fast Recovery Times
- Economical, Convenient TO-220AB Package
- Low Thermal Resistance
- Mechanically Rugged
- PIV up to 200V

DESCRIPTION

The SES5401C Series in the economical, convenient TO-220AB package, is specifically designed for operation in power switching circuits to frequencies in excess of 100kHz. The series combines two high efficiency devices into one package, simplifying installation, reducing heatsink requirements and the need to purchase matched components.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, SES5401C 50V
Peak Inverse Voltage, SES5402C 100V
Peak Inverse Voltage, SES5403C 150V
Peak Inverse Voltage, SES5404C 200V
Maximum Average D.C. Output Current
@ T_C = 125°C 16A
@ T_A = 25°C 3A
@ T_A = 25°C (Note 1) 10A
Non-Repetitive Sinusoidal Surge Current, 8.3mS 70A
Thermal Resistance, Junction to Case, $\Theta_{J\text{-}C}$ .... 1.75°C/W
Thermal Resistance, Junction to Ambient, $\Theta_{J\text{-}A}$ .... 60°C/W
Operating and Storage Temperature Range .... −55°C to +150°C

NOTE 1. Using Wakefield Type 295 heatsink with convection cooling. For more definitive data refer to the Output Current vs. Temperature Curves on this datasheet.

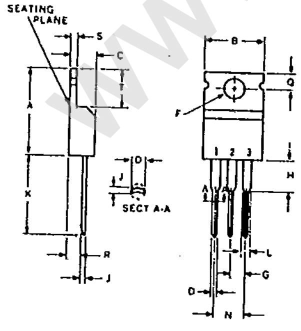
ELECTRICAL SPECIFICATIONS

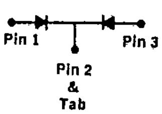
Type	PIV	Maximum Forward Voltage (V_F) @		Maximum Reverse Current (I_R) @ PIV		Maximum Reverse Recovery Time*	Typical Forward Recovery Voltage @ 1A t_r = 8ns
		T_J = 25°C	T_J = 100°C	@ T_J = 25°C	@ T_J = 100°C		
SES5401C	50V	1.025V @ 8A	0.945V @ 8A	5μA	150μA	100ns	1.4V
SES5402C	100V				150μA		
SES5403C	150V				150μA		
SES5404C	200V				500μA		

*Measured in circuit I_F = 0.50A, I_R = 1.0A, I_{REC} = 0.25A

MECHANICAL SPECIFICATIONS

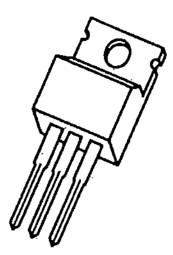
SES5401C-SES5404C





	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.560	0.625	14.23	15.87
B	0.380	0.420	9.66	10.66
C	0.140	0.190	3.56	4.82
D	0.020	0.045	0.51	1.14
F	0.139	0.147	3.531	3.733
G	0.090	0.110	2.29	2.79
H	—	0.250	—	6.35
J	0.015	0.025	0.38	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.070	1.14	1.77
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.115	2.04	2.92
S	0.045	0.055	1.14	1.39
T	0.230	0.270	5.85	6.85

TO-220AB



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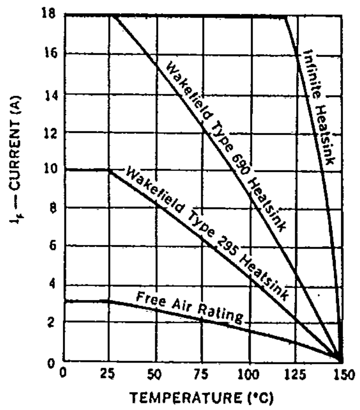
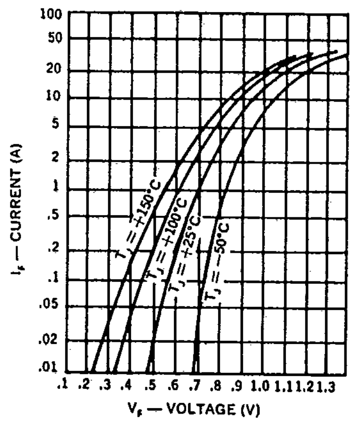
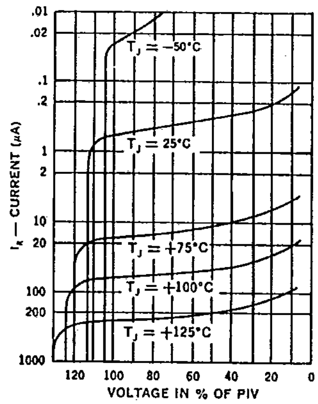
Output Current vs. Temperature



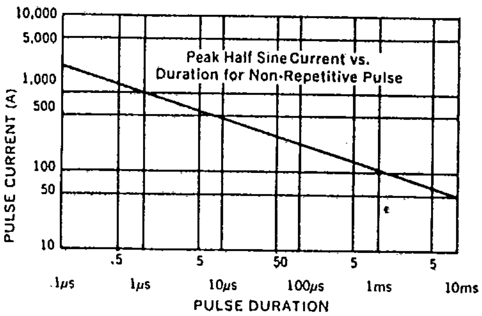
Typical Forward Current vs. Forward Voltage



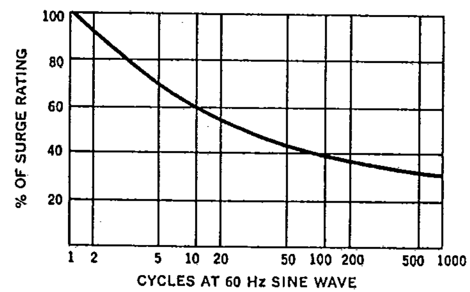
Typical Reverse Current vs. Voltage



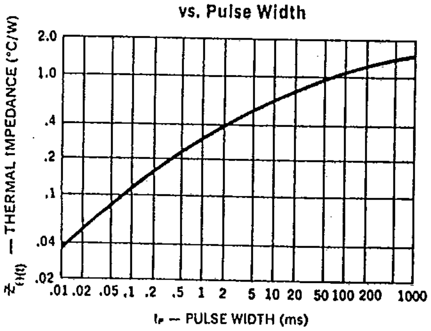
Forward Pulse Current vs. Duration



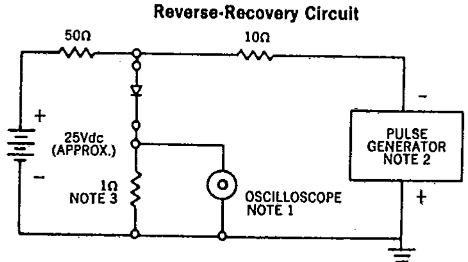
Multiple Surge Current vs. Duration



Thermal Impedance vs. Pulse Width



Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

TO-220 PACKAGE MOUNTING AND THERMAL CONSIDERATIONS

TH-1

T-90-20

The leads of the TO-220 rectifiers and Schottky diodes may be formed, but they are not intended to be flexible or ductile enough for unrestrained lead wrapping.

The figures show the typical device and hardware recommended. Several typical configurations of lead forming are illustrated.

The advantages of mounting the flange to the printed circuit board is that improved thermal heat transfer allows operating at higher levels of power dissipation. The individual specification sheets give the safe operating area as a function of a case temperature.

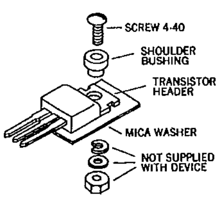


Figure A. Device and Hardware for Insulated Mounting.

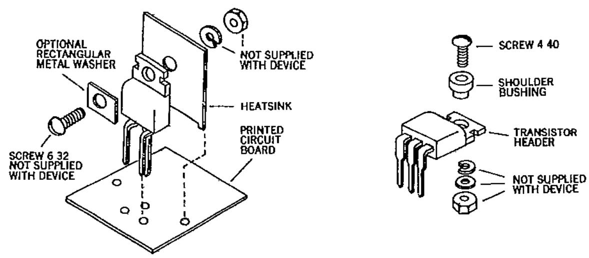


Figure B. Two Alternative Configurations for Axial Strain Relief and Electrical Isolation.

BENDING THE LEADS

Whenever the leads of the T-220 are to be formed, whether by a special fixture or by the use of long-nosed pliers, several important considerations must be followed. Internal damage to the device or lead damage may result if any or all of these precautions are not considered.

1. Minimum bend distance between the plastic body and the bend is ⅛ inch.
2. The minimum radius of the bend is $\frac{1}{16}$ inch.
3. Avoid repeating bending at the same flexure point.
4. Whenever possible, use one of the lead forming configurations which relieve strain induced by mechanical or thermal loads.
5. Leads should not be bent greater than 90 degrees.
6. Avoid axial pulling or bending that would induce axial strain. The maximum axial component is 4 pounds.
7. Forming fixtures or pliers should not touch the plastic case because axial strain of $\simeq$.005" could cause irreversible internal damage.
8. The leads must be fully restrained during the lead forming operation to prevent relative movement between the body and the leads.

SOLDERING INTO THE CIRCUIT

The leads on the TO-220 are solderable; however, there are a few precautions that must be observed.

1. Soldering temperature must not exceed 270°C.
2. Maximum soldering temperature must not be applied for more than 5 seconds.
3. Maximum soldering temperature should not be applied closer than ⅛ inch from the plastic body of the device.

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TO-220 PACKAGE MOUNTING AND THERMAL CONSIDERATIONS

MOUNTING THE FLANGE

Flange mounting is recommended for maximum power handling applications. A 6-32 machine screw is recommended. Eyeletting (hollow rivet) is acceptable if care is taken not to distort the flange. For insulated mount, a 4-40 screw and a shoulder bushing is recommended (see figure). Suggested material for bushings are: Diallphthalate, fiber-glass-filled nylon, or fiber-glass-filled polycarbonate. Note unfilled nylon should be avoided. The flange should not be directly soldered because the use of lead-tin could produce temperatures in excess of the maximum storage temperature. See the individual specification for the device.

Check list and summary for flange mounting:

1. Use recommended hardware.
2. Always fasten the flange prior to lead soldering.
3. Do not allow the forming tool to come in contact with the plastic body.
4. Maximum mounting torque is 8 inch-pounds.
5. Avoid modifying the flange by machining and do not use oversized screws.
6. Provide axial and transverse strain relief of the leads.
7. Use recommended insulation bushings. Avoid materials that exhibit hot-creep problems.

Thermal Considerations TO-220 Power Diodes

Thermal Resistance, Case to Ambient;
Free Air, No Heatsink............ 60°C/W typical
Thermal Capacitance
of Package................. 4.8 watt-seconds/°C
Thermal Time Constant............. 305 seconds

Device Type	$I_{F(AV)}$	Thermal Resistance Junction Case °C/W
UES1401-4	8	2.5
UES1501-4	16	1.5
USD635-50	6	3.0
USD835-50	12	2.4
USD935-50	16	2.0

Note: When using a 2 mil MICA washer for electrical isolation, add 0.4°C/W to heatsink thermal resistance.

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Thermal joint compound should be used at the interface of the TO-220 flange and the heatsink to which it is attached.

Consider a TO-220 power rectifier with a thermal resistance junction to case of 1.5°C/W. The junction temperature produced depends upon the mounting conditions and power dissipated in the circuit. The table shows junction temperature resulting from 15W of dissipation when mounted on an infinite heatsink at 100°C with different methods of interfacing.

Interface Condition Between Case and Heatsink	Thermal Resistance Case-Heatsink °C/W	Junction Temperature °C
Assumed direct, ideal metallic contact (no interference)	0.0	122
1 mil air gap*	1.2	140
Thermal compound; Tab screw torqued at 8 inch-pound	0.09	124
2 mil mica washer with thermal compound applied to both surfaces; tab screw torqued at 8 inch pound	0.58	131

* A film of air one mil in length has the thermal resistance of ≃ 1.2°C/W.

When using a small heat sink in free air one must consider the additional thermal resistance of the heat sink to ambient and operate at an appropriate power level. For example with an 18°C/W rated sink and thermal compound as above the device will have a junction temperature of 123°C when operating at 5W in an ambient of 25°C free air.

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