MOTOROLA
SEMICONDUCTOR TECHNICAL DATA

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Designer's™ Data Sheet

SWITCHMODE™ Power Rectifier

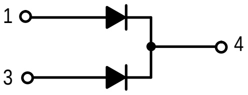
D2PAK Power Surface Mount Package

Designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Package Designed for Power Surface Mount Applications
- Ultrafast 28 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Epoxy Meets UL94, V_O @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability
- Low Leakage Specified @ 150°C Case Temperature
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to Industry Standard TO–220 Package

Mechanical Characteristics

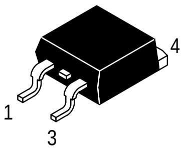
- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per reel by adding a "T4" suffix to the part number
- Marking: UH840



MURHB840CT

Motorola Preferred Device

**ULTRAFAST RECTIFIER
8.0 AMPERES
400 VOLTS**



**CASE 418B–02
D2PAK**

MAXIMUM RATINGS, PER LEG

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	400	Volts
Average Rectified Forward Current (Rated V_R), T_C = 120°C Total Device	$I_{F(AV)}$	4.0 8.0	Amps
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz), T_C = 120°C	I_{FM}	8	Amps
Non–repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	100	Amps
Controlled Avalanche Energy	W_{AVAL}	20	mJ
Operating Junction Temperature and Storage Temperature	T_J, T_{stg}	–65 to +175	°C

THERMAL CHARACTERISTICS, PER LEG

Maximum Thermal Resistance — Junction to Case — Junction to Ambient (1)	$R_{\theta JC}$ $R_{\theta JA}$	3.0 50	°C/W

(1) See Chapter 7 for mounting conditions

Designer's Data for "Worst Case" Conditions — The Designer's Data Sheet permits the design of most circuits entirely from the information presented. SOA Limit curves — representing boundaries on device characteristics — are given to facilitate "worst case" design.

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Thermal Clad is a trademark of the Bergquist Company

Preferred devices are Motorola recommended choices for future use and best overall value.

Rev 1

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ELECTRICAL CHARACTERISTICS, PER LEG

Characteristic		Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (2)	(i_F = 4.0 Amps, T_C = 150°C) (i_F = 4.0 Amps, T_C = 25°C)	v_F	1.9 2.2	Volts
Maximum Instantaneous Reverse Current (2)	(Rated dc Voltage, T_C = 150°C) (Rated dc Voltage, T_C = 25°C)	i_R	500 10	µA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/µs)		t_{rr}	28	ns

(2) Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤2.0%

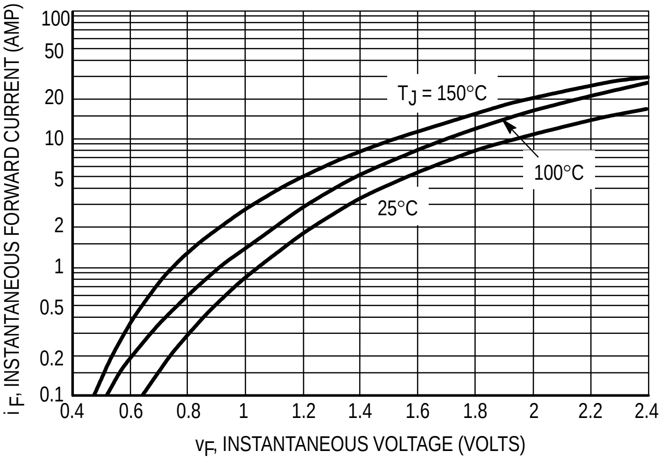


Figure 1. Typical Forward Voltage

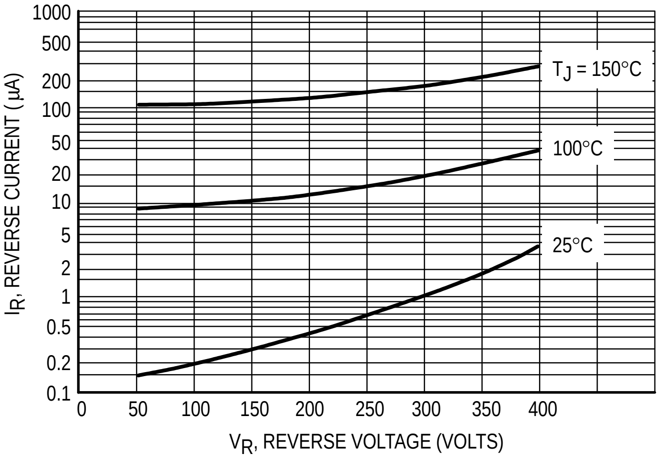


Figure 2. Typical Reverse Current, Per Leg

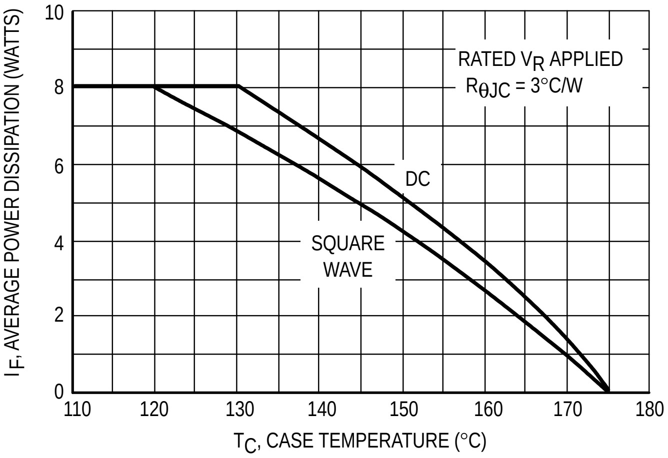


Figure 3. Current Derating, Case

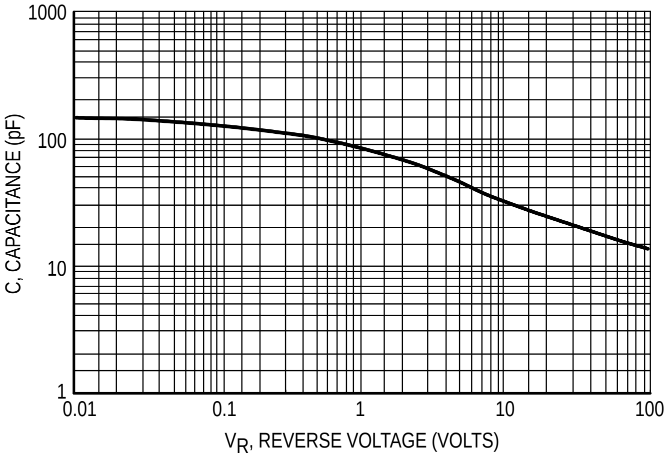


Figure 4. Typical Capacitance, Per Leg

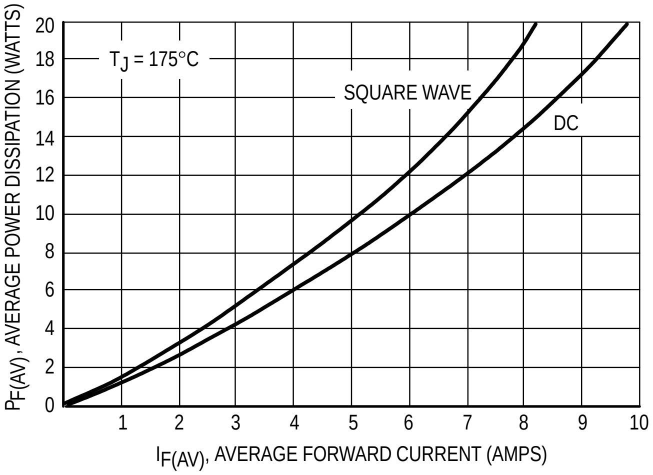
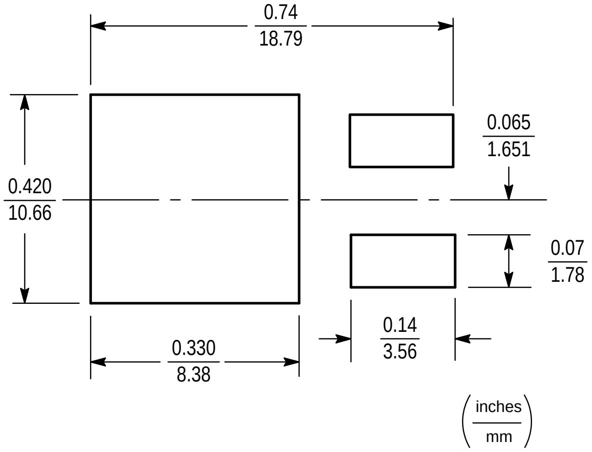


Figure 5. Forward Power Dissipation, Per Leg

INFORMATION FOR USING THE D2PAK SURFACE MOUNT PACKAGE

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to insure proper solder connection interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.



D2PAK POWER DISSIPATION

The power dissipation of the D2PAK is a function of the drain pad size. This can vary from the minimum pad size for soldering to a pad size given for maximum power dissipation. Power dissipation for a surface mount device is determined by $T_{J(max)}$, the maximum rated junction temperature of the die, $R_{\theta JA}$, the thermal resistance from the device junction to ambient; and the operating temperature, T_A. Using the values provided on the data sheet for the D2PAK package, P_D can be calculated as follows:

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

The values for the equation are found in the maximum ratings table on the data sheet. Substituting these values into the equation for an ambient temperature T_A of 25°C, one can calculate the power dissipation of the device which in this case is 3.0 watts.

$$P_D = \frac{175°C - 25°C}{50°C/W} = 3.0 \text{ watts}$$

The 50°C/W for the D2PAK package assumes the recommended drain pad area of 158K mil^2 on FR–4 glass epoxy printed circuit board to achieve a power dissipation of 3.0 watts using the footprint shown. Another alternative is to use a ceramic substrate or an aluminum core board such as Thermal Clad™. By using an aluminum core board material such as Thermal Clad, the power dissipation can be doubled using the same footprint.

GENERAL SOLDERING PRECAUTIONS

The melting temperature of solder is higher than the rated temperature of the device. When the entire device is heated to a high temperature, failure to complete soldering within a short time could result in device failure. Therefore, the following items should always be observed in order to minimize the thermal stress to which the devices are subjected.

- Always preheat the device.
- The delta temperature between the preheat and soldering should be 100°C or less.*
- When preheating and soldering, the temperature of the leads and the case must not exceed the maximum temperature ratings as shown on the data sheet. When using infrared heating with the reflow soldering method, the difference shall be a maximum of 10°C.
- The soldering temperature and time shall not exceed 260°C for more than 5 seconds.
- When shifting from preheating to soldering, the maximum temperature gradient shall be 5°C or less.
- After soldering has been completed, the device should be allowed to cool naturally for at least three minutes. Gradual cooling should be used as the use of forced cooling will increase the temperature gradient and result in latent failure due to mechanical stress.
- Mechanical stress or shock should not be applied during cooling

* Soldering a device without preheating can cause excessive thermal shock and stress which can result in damage to the device.

* Due to shadowing and the inability to set the wave height to incorporate other surface mount components, the D^{2}PAK is not recommended for wave soldering.

RECOMMENDED PROFILE FOR REFLOW SOLDERING

For any given circuit board, there will be a group of control settings that will give the desired heat pattern. The operator must set temperatures for several heating zones, and a figure for belt speed. Taken together, these control settings make up a heating “profile” for that particular circuit board. On machines controlled by a computer, the computer remembers these profiles from one operating session to the next. Figure 6 shows a typical heating profile for use when soldering the D^{2}PAK to a printed circuit board. This profile will vary among soldering systems but it is a good starting point. Factors that can affect the profile include the type of soldering system in use, density and types of components on the board, type of solder used, and the type of board or substrate material being used. This profile shows temperature versus time. The line on the graph shows the actual temperature that might be experienced on the surface of a test board at or near a central solder joint. The two profiles are based on a high density and a low density board. The Vitronics SMD310 convection/infrared reflow soldering system was used to generate this profile. The type of solder used was 62/36/2 Tin Lead Silver with a melting point between 177–189°C. When this type of furnace is used for solder reflow work, the circuit boards and solder joints tend to heat first. The components on the board are then heated by conduction. The circuit board, because it has a large surface area, absorbs the thermal energy more efficiently, then distributes this energy to the components. Because of this effect, the main body of a component may be up to 30 degrees cooler than the adjacent solder joints.

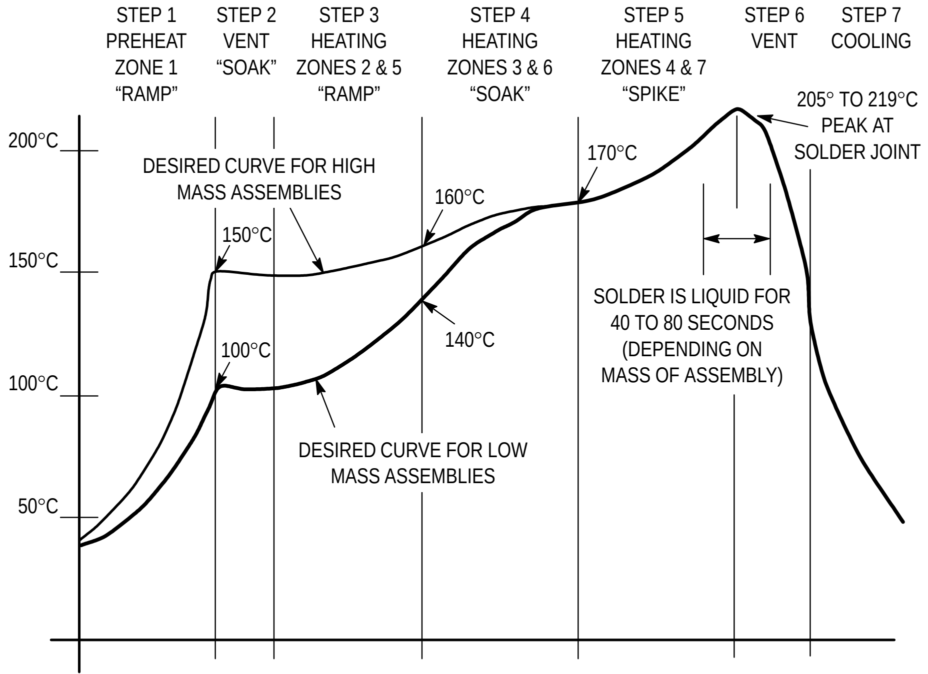
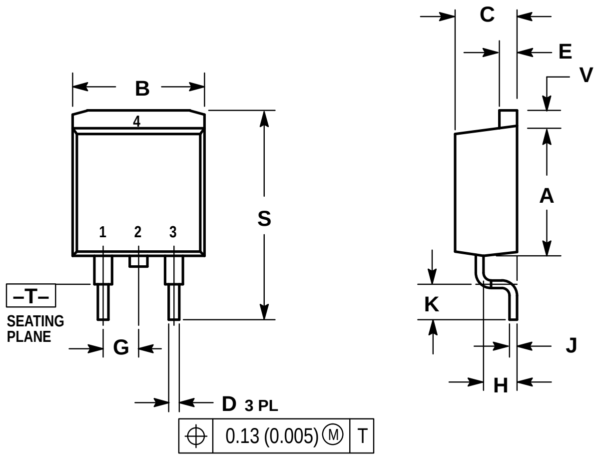


Figure 6. Typical Solder Heating Profile for D^{2}PAK

PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

CASE 418B–02
ISSUE B

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