

# Single Silicon Switching Diode

This Silicon Epitaxial Planar Diode is designed for use in ultra high speed switching applications. This device is housed in the SC-70 package which is designed for low power surface mount applications.

- Fast  $t_{rr}$ , < 3.0 ns
- Low  $C_D$ , < 2.0 pF
- Available in 8 mm Tape and Reel
  - Use M1MA141/2KT1 to order the 7 inch/3000 unit reel.
  - Use M1MA141/2KT3 to order the 13 inch/10,000 unit reel.

## MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

| Rating                     |            | Symbol          | Value | Unit |
|----------------------------|------------|-----------------|-------|------|
| Reverse Voltage            | M1MA141KT1 | $V_R$           | 40    | Vdc  |
|                            | M1MA142KT1 |                 | 80    |      |
| Peak Reverse Voltage       | M1MA141KT1 | $V_{RM}$        | 40    | Vdc  |
|                            | M1MA142KT1 |                 | 80    |      |
| Forward Current            |            | $I_F$           | 100   | mAdc |
| Peak Forward Current       |            | $I_{FM}$        | 225   | mAdc |
| Peak Forward Surge Current |            | $I_{FSM}^{(1)}$ | 500   | mAdc |

## THERMAL CHARACTERISTICS

| Rating               | Symbol    | Max        | Unit             |
|----------------------|-----------|------------|------------------|
| Power Dissipation    | $P_D$     | 150        | mW               |
| Junction Temperature | $T_J$     | 150        | $^\circ\text{C}$ |
| Storage Temperature  | $T_{stg}$ | -55 ~ +150 | $^\circ\text{C}$ |

## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

| Characteristic                   |            | Symbol         | Condition                                                                           | Min | Max | Unit            |
|----------------------------------|------------|----------------|-------------------------------------------------------------------------------------|-----|-----|-----------------|
| Reverse Voltage Leakage Current  | M1MA141KT1 | $I_R$          | $V_R = 35\text{ V}$                                                                 | —   | 0.1 | $\mu\text{Adc}$ |
|                                  | M1MA142KT1 |                | $V_R = 75\text{ V}$                                                                 | —   | 0.1 |                 |
| Forward Voltage                  |            | $V_F$          | $I_F = 100\text{ mA}$                                                               | —   | 1.2 | Vdc             |
| Reverse Breakdown Voltage        | M1MA141KT1 | $V_R$          | $I_R = 100\text{ }\mu\text{A}$                                                      | 40  | —   | Vdc             |
|                                  | M1MA142KT1 |                |                                                                                     | 80  | —   |                 |
| Diode Capacitance                |            | $C_D$          | $V_R = 0, f = 1.0\text{ MHz}$                                                       | —   | 2.0 | pF              |
| Reverse Recovery Time (Figure 1) |            | $t_{rr}^{(2)}$ | $I_F = 10\text{ mA}, V_R = 6.0\text{ V}, R_L = 100\text{ }\Omega, I_{rr} = 0.1 I_R$ | —   | 3.0 | ns              |

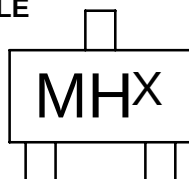
1.  $t = 1\text{ SEC}$

2.  $t_{rr}$  Test Circuit

## DEVICE MARKING — EXAMPLE

### Marking Symbol

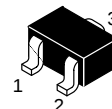
| Type No. | 141K | 142K |
|----------|------|------|
| Symbol   | MH   | MI   |



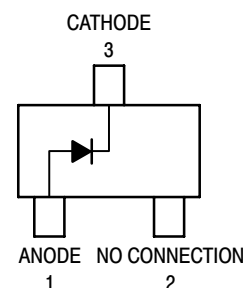
The "X" represents a smaller alpha digit Date Code. The Date Code indicates the actual month in which the part was manufactured.

## M1MA141KT1 M1MA142KT1

ON Semiconductor Preferred Devices



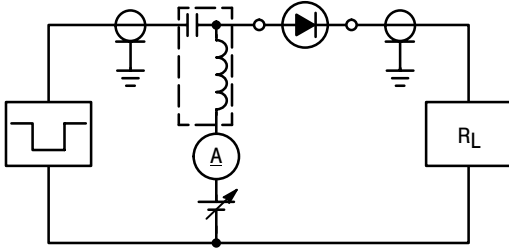
CASE 419-04, STYLE 2  
SC-70/SOT-323



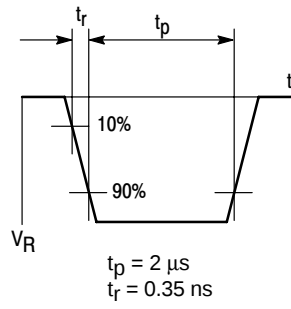
**Preferred** devices are ON Semiconductor recommended choices for future use and best overall value.

# M1MA141KT1 M1MA142KT1

RECOVERY TIME EQUIVALENT TEST CIRCUIT



INPUT PULSE



OUTPUT PULSE

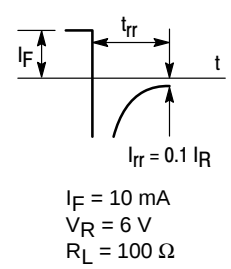


Figure 1. Recovery Time Equivalent Test Circuit

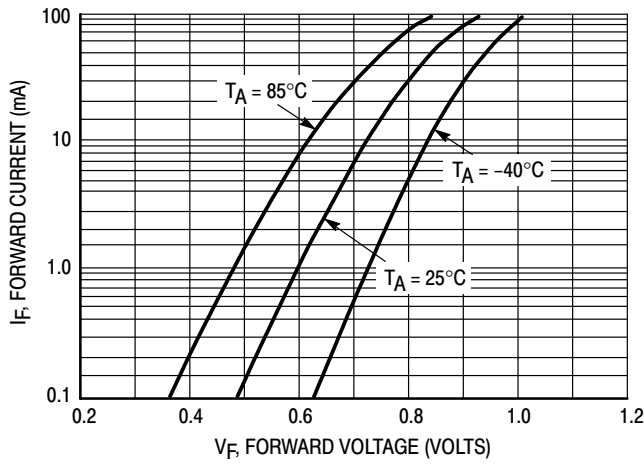


Figure 2. Forward Voltage

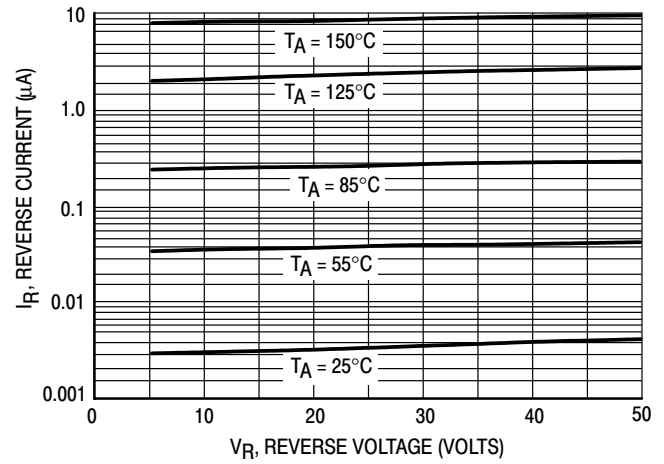


Figure 3. Reverse Current

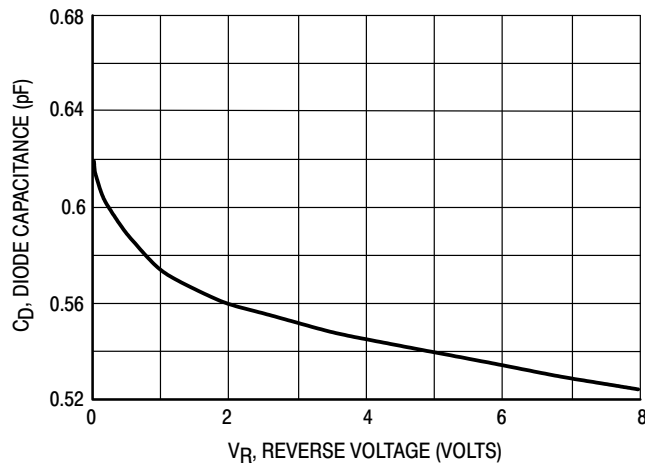


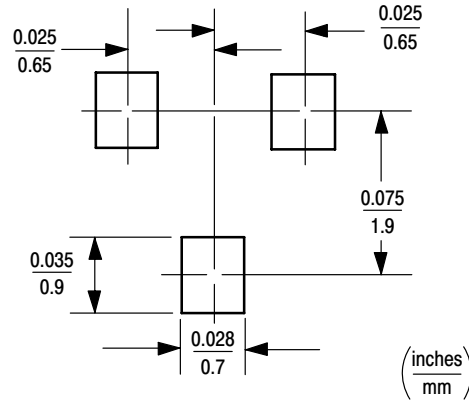
Figure 4. Diode Capacitance

## INFORMATION FOR USING THE SC-70/SOT-323 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.



### SC-70/SOT-323 POWER DISSIPATION

The power dissipation of the SC-70/SOT-323 is a function of the pad size. This can vary from the minimum pad size for soldering to the 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,  $P_D$  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 200 milliwatts.

$$P_D = \frac{150^\circ\text{C} - 25^\circ\text{C}}{0.625^\circ\text{C/W}} = 200 \text{ milliwatts}$$

The 0.625°C/W assumes the use of the recommended footprint on a glass epoxy printed circuit board to achieve a power dissipation of 200 milliwatts. Another alternative would be to use a ceramic substrate or an aluminum core board such as Thermal Clad™. Using a board material such as Thermal Clad, a higher power dissipation of 300 milliwatts can be achieved using the same footprint.

### 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 should be a maximum of 10°C.

- The soldering temperature and time should not exceed 260°C for more than 10 seconds.
- When shifting from preheating to soldering, the maximum temperature gradient should 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.

## SOLDER STENCIL GUIDELINES

Prior to placing surface mount components onto a printed circuit board, solder paste must be applied to the pads. A solder stencil is required to screen the optimum amount of solder paste onto the footprint. The stencil is made of brass or stainless steel with a typical thickness of 0.008 inches.

The stencil opening size for the surface mounted package should be the same as the pad size on the printed circuit board, i.e., a 1:1 registration.

## TYPICAL SOLDER HEATING PROFILE

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 7 shows a typical heating profile for use when soldering a surface mount device 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.

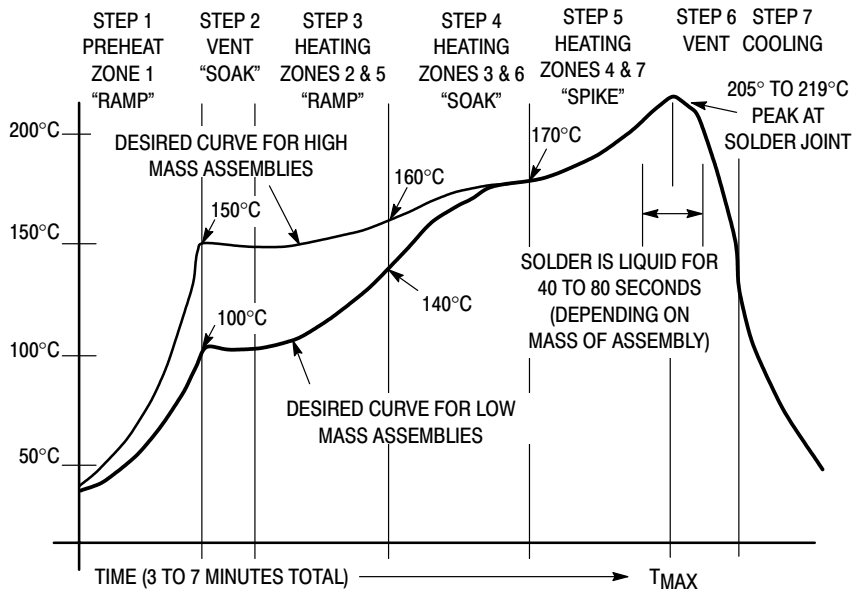
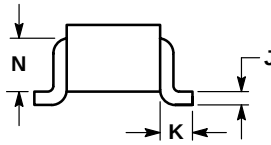
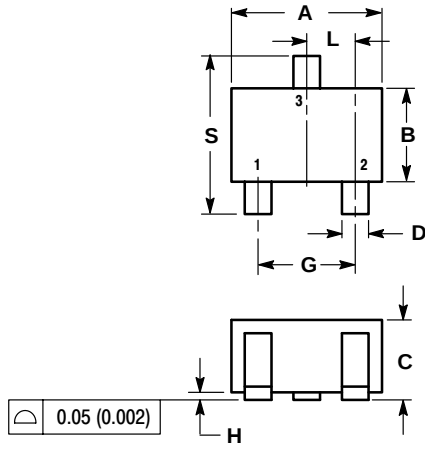


Figure 5. Typical Solder Heating Profile

# M1MA141KT1 M1MA142KT1

## PACKAGE DIMENSIONS

SC-70 (SOT-323)  
CASE 419-04  
ISSUE L



STYLE 2:  
PIN 1. ANODE  
2. N.C.  
3. CATHODE

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

| DIM | INCHES |       | MILLIMETERS |      |
|-----|--------|-------|-------------|------|
|     | MIN    | MAX   | MIN         | MAX  |
| A   | 0.071  | 0.087 | 1.80        | 2.20 |
| B   | 0.045  | 0.053 | 1.15        | 1.35 |
| C   | 0.032  | 0.040 | 0.80        | 1.00 |
| D   | 0.012  | 0.016 | 0.30        | 0.40 |
| G   | 0.047  | 0.055 | 1.20        | 1.40 |
| H   | 0.000  | 0.004 | 0.00        | 0.10 |
| J   | 0.004  | 0.010 | 0.10        | 0.25 |
| K   | 0.017  | REF   | 0.425       | REF  |
| L   | 0.026  | BSC   | 0.650       | BSC  |
| N   | 0.028  | REF   | 0.700       | REF  |
| S   | 0.079  | 0.095 | 2.00        | 2.40 |

## **Notes**

## **Notes**

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