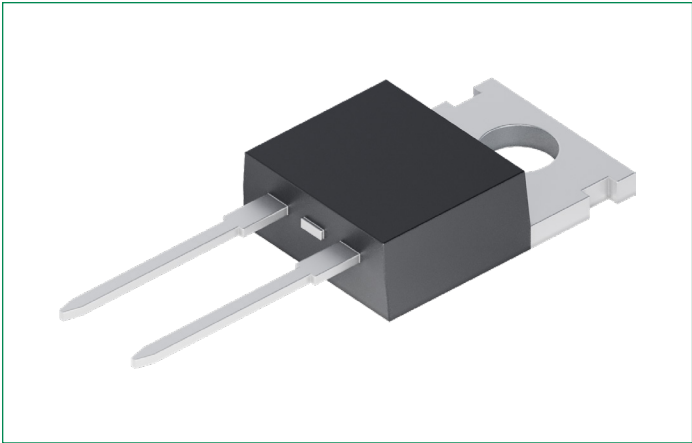


# DCK10I650PA

650 V, 14.4 A SiC Schottky Diode

RoHS

HF



## Features

- Maximum virtual junction temperature of 175 °C
- High surge current capacity
- Extremely short reverse recovery time
- High-frequency operation
- Temperature independent switching behavior
- Positive temperature coefficient on  $V_F$

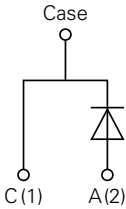
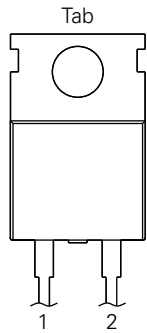
## Applications

- PV microinverter
- Power adapter
- Power factor correction
- Switch mode power supply

## Product Summary

| Characteristic              | Value | Unit |
|-----------------------------|-------|------|
| $V_{RRM}$                   | 650   | V    |
| $I_F (T_c = 135\text{ °C})$ | 14.4  | A    |
| $Q_c$                       | 25.5  | nC   |

## Pinout Diagram TO-220-2L



1: Cathode; 2: Anode; Tab: Case

**Maximum Ratings** ( $T_c = 25\text{ }^{\circ}\text{C}$  unless otherwise specified)

| Symbol    | Characteristic                               | Conditions                                                                                                  | Value                               | Unit               |
|-----------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------|
| $V_{RRM}$ | Repetitive peak reverse voltage              | –                                                                                                           | 650                                 | V                  |
| $V_{DC}$  | DC blocking voltage                          | –                                                                                                           | 650                                 | V                  |
| $I_F$     | Continuous forward current                   | –                                                                                                           | $T_c = 25\text{ }^{\circ}\text{C}$  | A                  |
|           |                                              |                                                                                                             | $T_c = 135\text{ }^{\circ}\text{C}$ |                    |
|           |                                              |                                                                                                             | $T_c = 151\text{ }^{\circ}\text{C}$ |                    |
| $I_{FSM}$ | Non-repetitive surge forward current         | Sine halfwave @ $T_c = 25\text{ }^{\circ}\text{C}$ , $t_p = 10\text{ ms}$                                   | 60                                  | A                  |
| $I_{FRM}$ | Repetitive peak forward current              | Frequency = 0.1 Hz, 100 cycles<br>sine halfwave @ $T_c = 25\text{ }^{\circ}\text{C}$ , $t_p = 10\text{ ms}$ | 48                                  | A                  |
| $P_{tot}$ | Total power dissipation                      | –                                                                                                           | $T_c = 25\text{ }^{\circ}\text{C}$  | W                  |
|           |                                              |                                                                                                             | $T_c = 150\text{ }^{\circ}\text{C}$ |                    |
| $I^2t$    | $I^2t$                                       | $T_c = 25\text{ }^{\circ}\text{C}$ , $t_p = 10\text{ ms}$                                                   | 18                                  | A <sup>2</sup> s   |
| $T_{vj}$  | Virtual operating junction temperature range | –                                                                                                           | –55 to 175                          | $^{\circ}\text{C}$ |
| $T_{stg}$ | Storage temperature range                    | –                                                                                                           | –55 to 175                          | $^{\circ}\text{C}$ |
| M         | Mounting torque                              | M3 screw                                                                                                    | 0.7                                 | Nm                 |

**Note:** Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**Thermal Characteristics**

| Symbol        | Characteristic                             | Value |      |      | Unit |
|---------------|--------------------------------------------|-------|------|------|------|
|               |                                            | Min.  | Typ. | Max. |      |
| $R_{th(j-c)}$ | Thermal resistance, junction to case Fig.7 | –     | 1.4  | –    | K/W  |

**Electrical Characteristics** ( $T_{vj} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified)

| Symbol         | Characteristic                  | Conditions                                                                                                           |                          | Value |      |      | Unit |
|----------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------------|-------|------|------|------|
|                |                                 |                                                                                                                      |                          | Min.  | Typ. | Max. |      |
| V <sub>F</sub> | Forward voltage Fig.1           | I <sub>F</sub> = 10 A                                                                                                | T <sub>vj</sub> = 25 °C  | –     | 1.37 | 1.55 | V    |
|                |                                 |                                                                                                                      | T <sub>vj</sub> = 175 °C | –     | 1.70 | 2.00 |      |
| I <sub>R</sub> | Reverse current Fig.2           | V <sub>R</sub> = 650 V                                                                                               | T <sub>vj</sub> = 25 °C  | –     | 1    | 10   | μA   |
|                |                                 |                                                                                                                      | T <sub>vj</sub> = 175 °C | –     | 10   | 100  |      |
| C              | Total capacitance Fig.3         | V <sub>R</sub> = 1 V, f = 1 MHz                                                                                      |                          | –     | 398  | –    | pF   |
|                |                                 | V <sub>R</sub> = 200 V, f = 1 MHz                                                                                    |                          | –     | 476  | –    |      |
|                |                                 | V <sub>R</sub> = 400 V, f = 1 MHz                                                                                    |                          | –     | 41.9 | –    |      |
| Q <sub>c</sub> | Total capacitive charge Fig.4   | V <sub>R</sub> = 400 V, T <sub>vj</sub> = 25 °C, Q <sub>c</sub> = ∫ <sub>0</sub> <sup>V<sub>R</sub></sup> C(V)dV     |                          | –     | 25.5 | –    | nC   |
| E <sub>c</sub> | Capacitance stored energy Fig.5 | V <sub>R</sub> = 400 V, T <sub>vj</sub> = 25 °C, E <sub>c</sub> = ∫ <sub>0</sub> <sup>V<sub>R</sub></sup> C(V) · VdV |                          | –     | 3.80 | –    | μJ   |

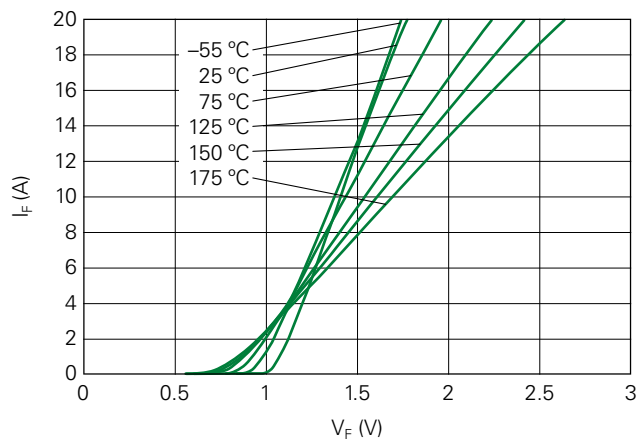
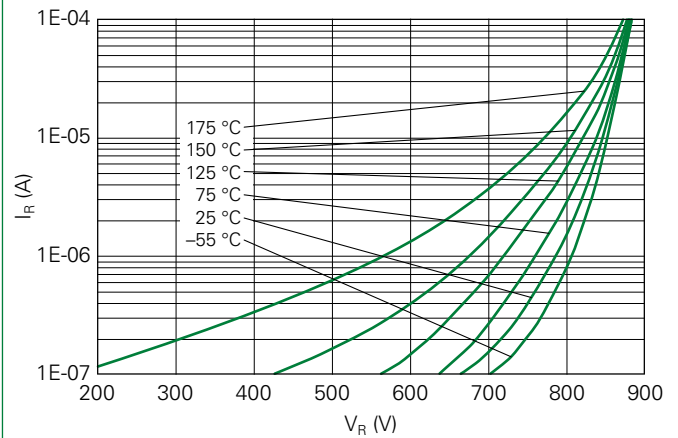
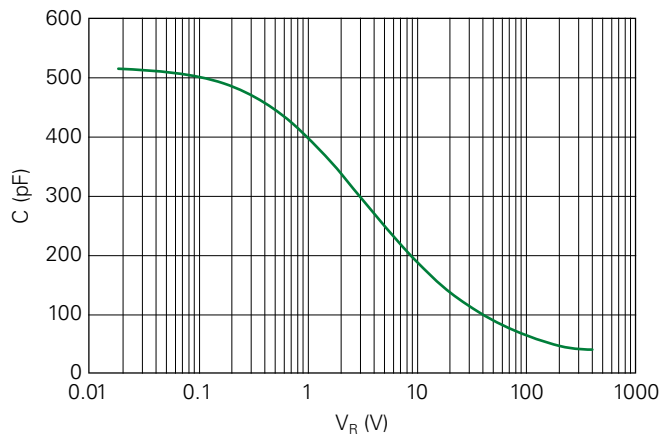
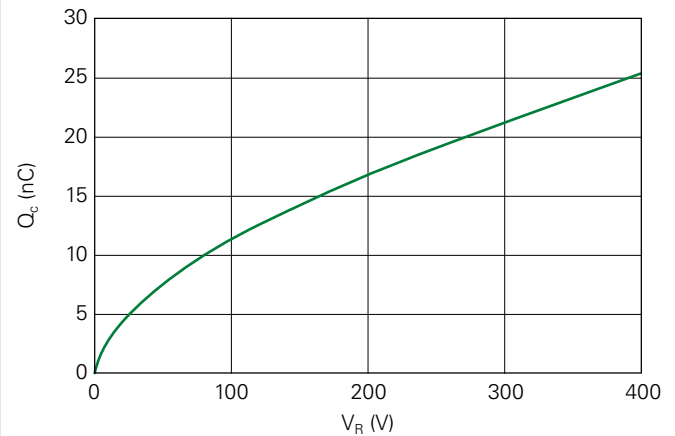
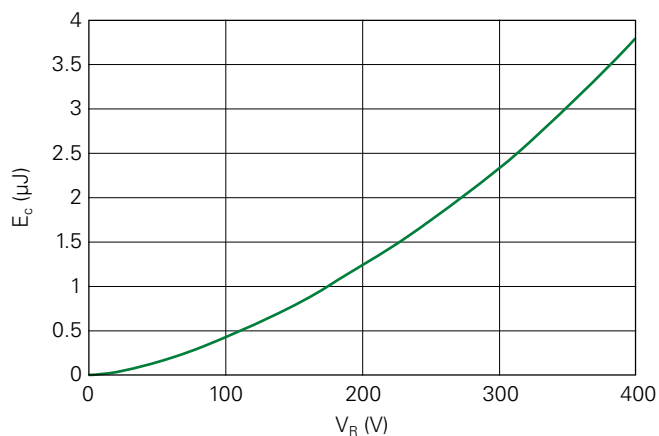
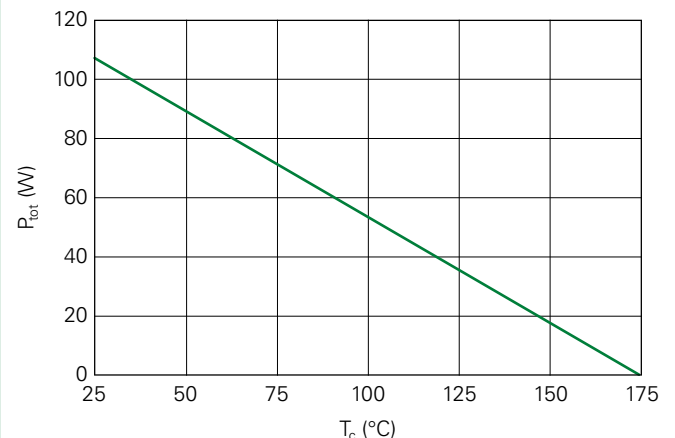
**Characteristic Curves****Fig. 1. Typical Forward Characteristics****Fig. 2. Typical Reverse Characteristics****Fig. 3. Capacitance vs. Reverse Voltage****Fig. 4. Total Capacitive Charge vs. Reverse Voltage****Fig. 5. Capacitance Stored Energy****Fig. 6. Power Derating**

Fig. 7. Transient Thermal Impedance

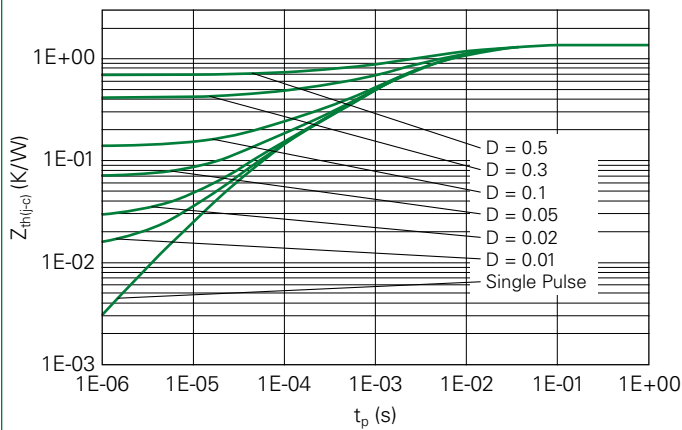
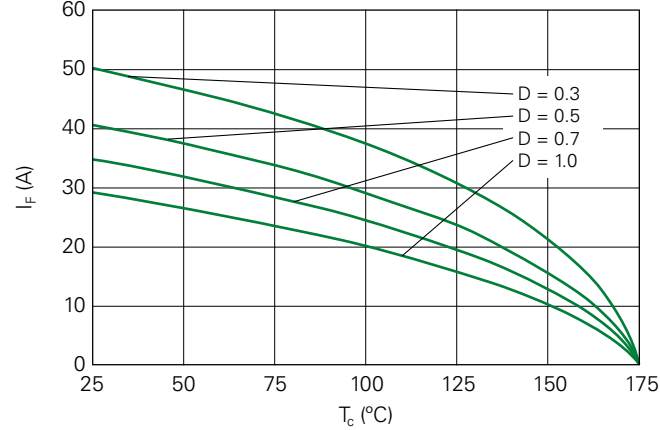
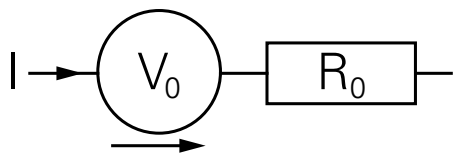


Fig. 8. Forward Current vs. Case Temperature



Diode  $V_F$  Model for Simulation



$$V_F(T_{vj}) = V_0 + I R_0$$
$$V_0 = -1 \times 10^{-6} \cdot T_{vj}^2 - 0.0014 \cdot T_{vj} + 0.9415$$
$$R_0 = 1 \times 10^{-6} \cdot T_{vj}^2 - 0.0001 \cdot T_{vj} + 0.0384$$

Notes

- $T_{vj}$  is the virtual junction temperature in °C
- Range valid from 25 °C to 175 °C
- Model represents performance of a typical chart

Part Number and Marking



DCK10I650PA = Part Material Number

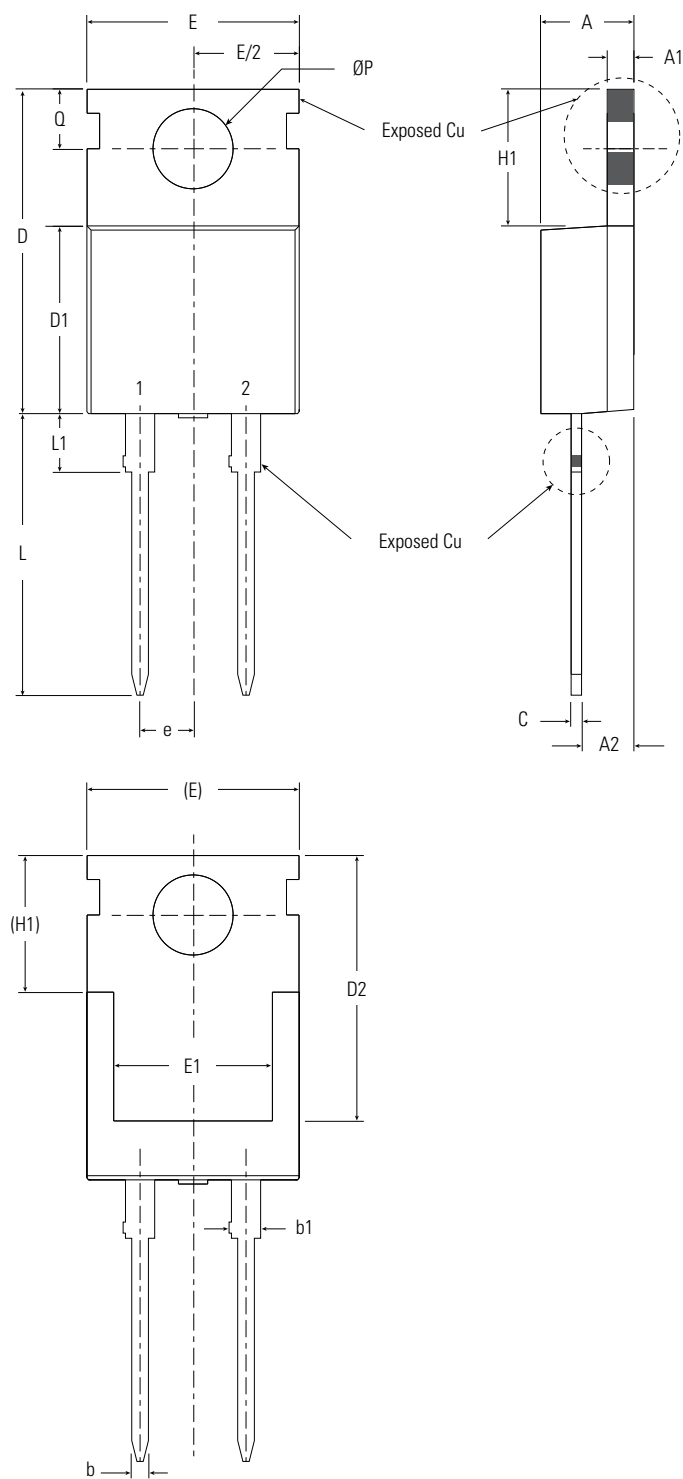
YY = Year

WW = Work Week

Z = Assembly Location

XXXX = Lot Traceability

Part Outline Drawing TO-220-2L



| Symbol          | Inches    |         |       | Millimeters |         |       |
|-----------------|-----------|---------|-------|-------------|---------|-------|
|                 | Min.      | Typical | Max.  | Min.        | Typical | Max   |
| A               | 0.167     | –       | 0.183 | 4.24        | –       | 4.64  |
| A1              | 0.046     | –       | 0.055 | 1.16        | –       | 1.40  |
| A2              | 0.089     | –       | 0.106 | 2.25        | –       | 2.70  |
| b               | 0.028     | –       | 0.036 | 0.70        | –       | 0.91  |
| b1              | 0.046     | –       | 0.069 | 1.17        | –       | 1.75  |
| C               | 0.013     | –       | 0.026 | 0.33        | –       | 0.65  |
| D               | 0.579     | –       | 0.630 | 14.70       | –       | 16.00 |
| D1              | 0.347     | –       | 0.372 | 8.82        | –       | 9.45  |
| D2              | 0.497     | –       | 0.533 | 12.63       | –       | 13.55 |
| E               | 0.390     | –       | 0.408 | 9.91        | –       | 10.36 |
| E1              | 0.270     | –       | 0.350 | 6.86        | –       | 8.89  |
| e               | 0.100 BSC |         |       | 2.54 BSC    |         |       |
| H1              | 0.248     | –       | 0.262 | 6.30        | –       | 6.65  |
| L               | 0.508     | –       | 0.550 | 12.90       | –       | 13.97 |
| L1              | 0.112     | –       | 0.157 | 2.85        | –       | 4.00  |
| $\varnothing P$ | 0.134     | –       | 0.155 | 3.40        | –       | 3.93  |
| Q               | 0.102     | –       | 0.118 | 2.60        | –       | 3.00  |

- Note:**
- 1. Package Reference: JEDEC TO220, Variation AB
  - 2. Slot required, notch may be rounded or rectangular
  - 3. Dimension D&E do not include mold flash
  - 4. Subject to change without notice

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