

# QSD50HCS120U: 1200V, 50A Homogeneous Current SiC Schottky Diode



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## 1200V, 50A Homogeneous-current SiC Schottky diode

### Description

Homogeneous-current SiC Schottky diode with low  $V_F$ , high repetitive surge current, low leakage, no reverse or forward recovery, and high-temperature operation.

### Package

TO220-2L



### Features

- Temperature-independent fast switching
- Low reverse leakage current
- Low  $V_F$  at high temperatures
- Easy paralleling (positive temperature coefficient of  $V_F$ )
- Essentially no switching losses
- Subject to AEC-Q101 qualification
- High repetitive surge current

### Typical applications

- High-frequency power converters
- Industrial motor drives
- Switch-mode power supplies
- Electric vehicles and battery chargers
- Solar inverters
- Power factor correction
- Free-wheeling diode

### Maximum ratings

| Parameter   | Symbol         | Test conditions  | Value      | Unit             | Note   |
|---|----------------|--|------------|------------------|--------|
| Repetitive peak reverse voltage   | $V_{RRM}$      |  | 1200       | V                |        |
| DC peak reverse voltage   | $V_R$          |  | 1200       | V                |        |
| Continuous forward current  | $I_F$          | $T_C=25^\circ\text{C}$                                       | 149        | A                | Fig. 3 |
|   |                | $T_C=135^\circ\text{C}$                                      | 72         |                  |        |
|   |                | $T_C=150^\circ\text{C}$                                      | 53         |                  |        |
| Power dissipation   | $P_{TOT}$      | $T_C=25^\circ\text{C}$                                       | 682        | W                | Fig. 4 |
|   |                | $T_C=110^\circ\text{C}$                                      | 295        |                  |        |
| Repetitive peak forward surge current, which limits the chip temperature to $175^\circ\text{C}$ | $I_{FRM}$      | $T_C=25^\circ\text{C}$ , $t_P=10\text{ms}$ , half sine pulse | 210        | A                | Fig. 5 |
| Non-repetitive forward square-pulse surge current   | $I_{F,MAX}$    | $T_C=25^\circ\text{C}$ , $t_P=10\mu\text{s}$                 | 963        | A                |        |
|   |                | $T_C=115^\circ\text{C}$ , $t_P=10\mu\text{s}$                | 871        | A                |        |
| Operating junction and storage temperature  | $T_j, T_{stg}$ |  | -55 to 175 | $^\circ\text{C}$ |        |

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**Electrical characteristics**

| Parameter                 | Symbol   | Typ.                | Max. | Unit          | Test conditions   | Note   |
|---------------------------|----------|---------------------|------|---------------|---|--------|
| Forward voltage           | $V_F$    | 1.5<br>1.9          | 1.7  | V             | $I_F=50\text{ A } T_J=25^\circ\text{C}$<br>$I_F=50\text{ A } T_J=175^\circ\text{C}$                             | Fig. 1 |
| Reverse current           | $I_R$    | 10<br>70            | 40   | $\mu\text{A}$ | $V_R=1200\text{ V } T_J=25^\circ\text{C}$<br>$V_R=1200\text{ V } T_J=175^\circ\text{C}$                         | Fig. 2 |
| Reverse recovery charge   | $Q_{rr}$ | 0                   |      | nC            | Note: Majority-carrier diode  |        |
| Total capacitance         | $C$      | 2,380<br>186<br>181 |      | nF            | $V_R=0\text{ V, } f=1\text{ MHz}$<br>$V_R=400\text{ V, } f=1\text{ MHz}$<br>$V_R=800\text{ V, } f=1\text{ MHz}$ | Fig. 6 |
| Total capacitive charge   | $Q_C$    | 206                 |      | nC            | $V_R=800\text{ V, } T_J=25^\circ\text{C}$   | Fig. 7 |
| Capacitance stored energy | $E_C$    | 51                  |      | $\mu\text{J}$ | $V_R=800\text{ V}$  | Fig. 8 |

**Thermal characteristics**

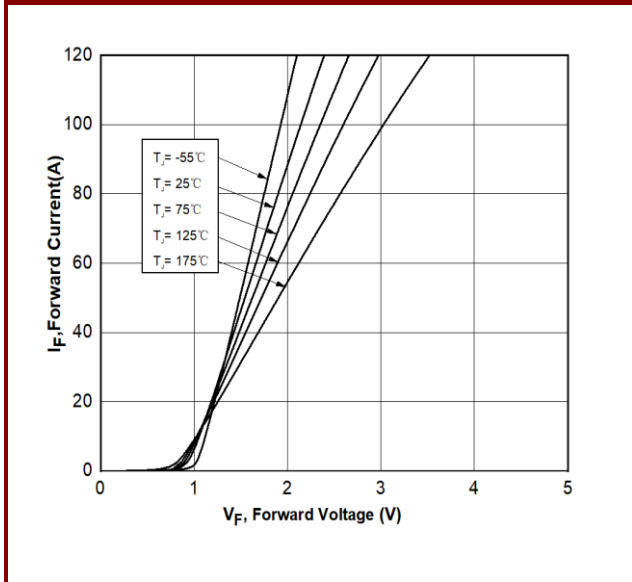
| Parameter                                | Symbol          | Typ. | Unit               | Note   |
|--|-----------------|------|--------------------|--------|
| Thermal resistance from junction to case | $R_{\theta JC}$ | 0.22 | $^\circ\text{C/W}$ | Fig. 9 |

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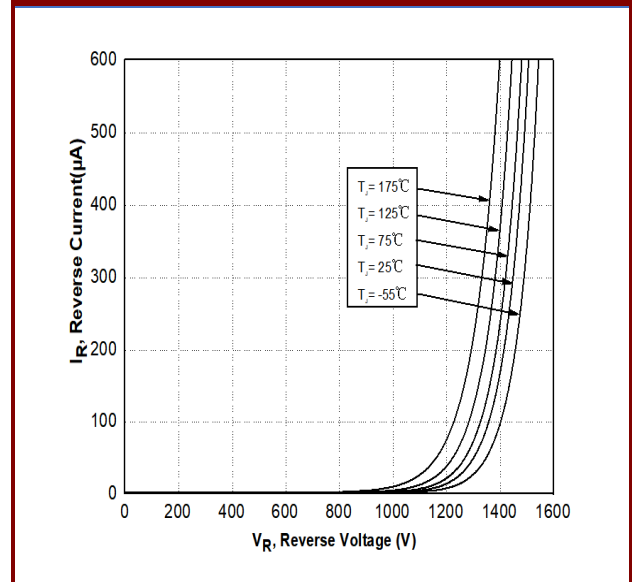


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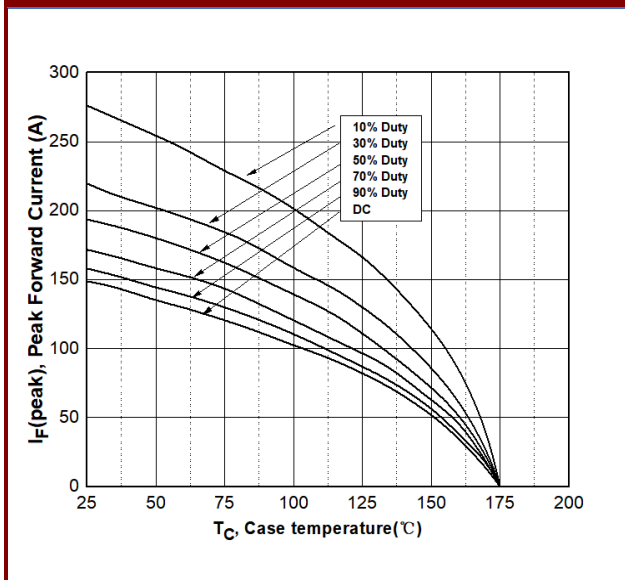
**Fig. 1: Typical forward characteristics**



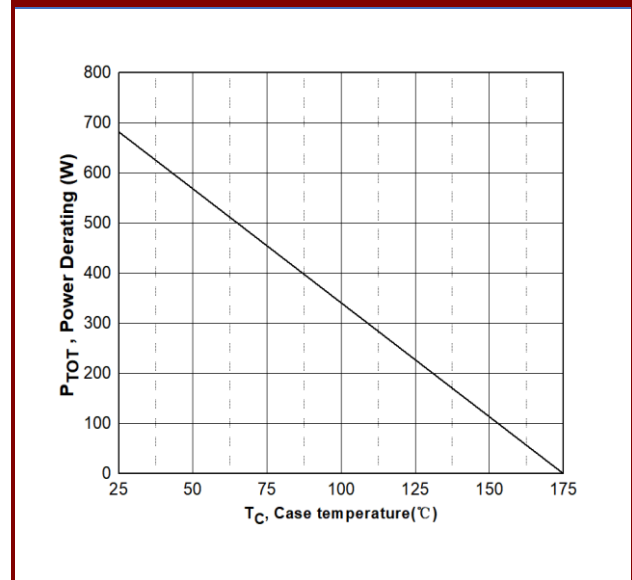
**Fig.2: Typical reverse characteristics**



**Fig. 3: Current derating**

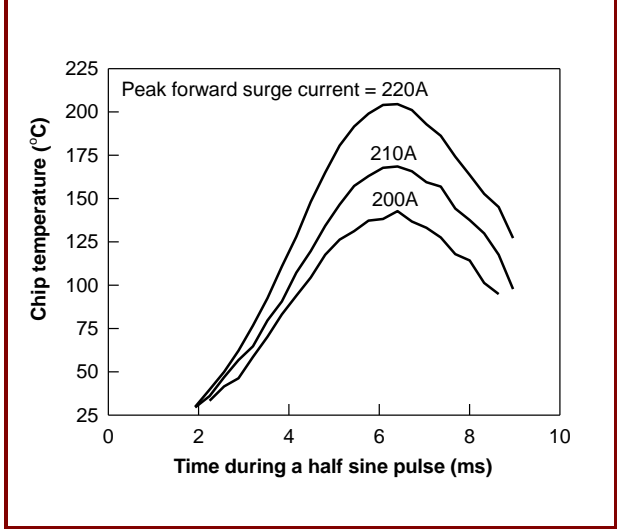


**Fig. 4: Power derating**

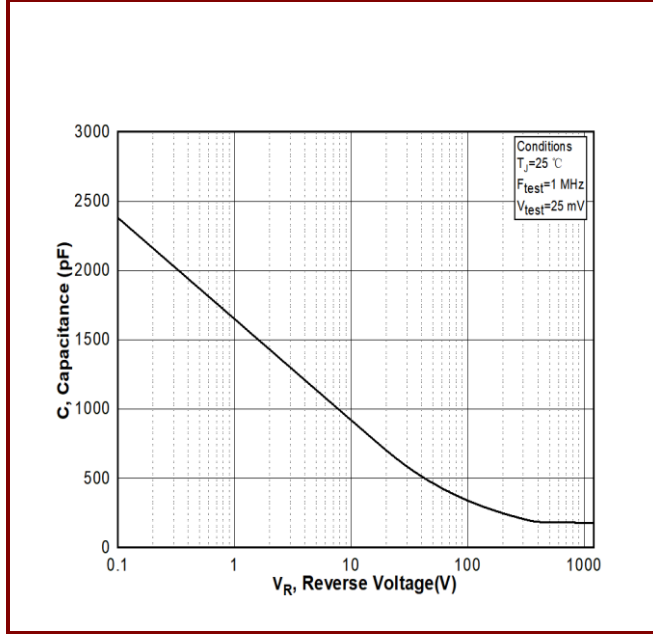


**Fig. 5: Chip temperature during repetitive peak forward surge currents**

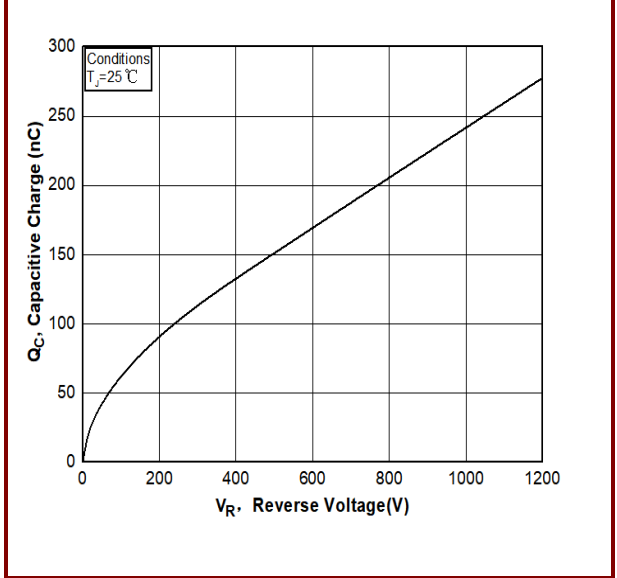
[ref.: J. Damcevska, S. Dimitrijevic, D. Haasmann, and P. Tanner, *Scientific Reports*, 13:19189, 2023; <https://doi.org/10.1038/s41598-023-46538-6>]



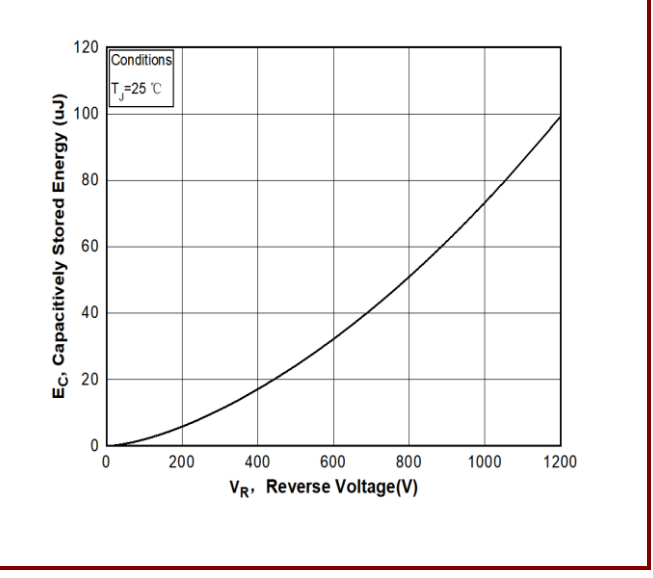
**Fig. 6: Capacitance vs reverse voltage**



**Fig. 7: Capacitive charge vs reverse voltage**



**Fig. 8: Capacitance stored energy**

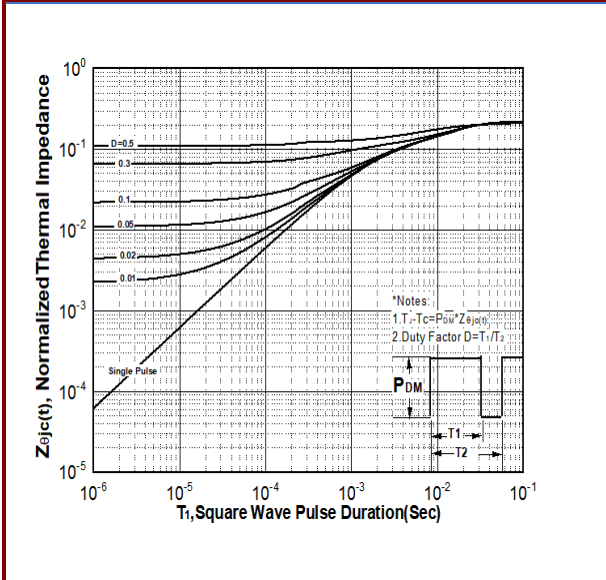


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**Fig. 9: Transient thermal-response curve (junction to case)**



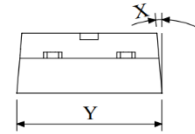
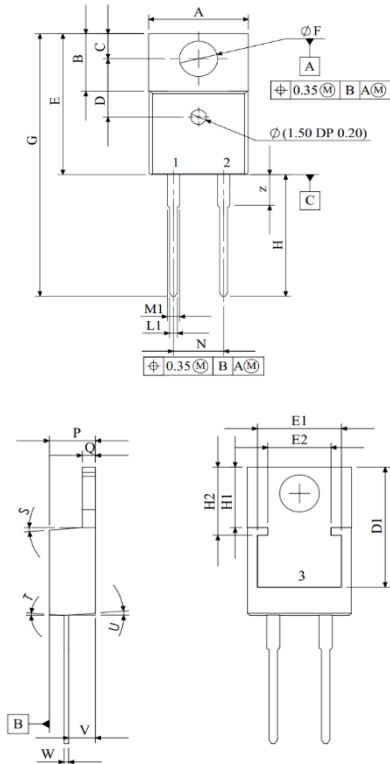
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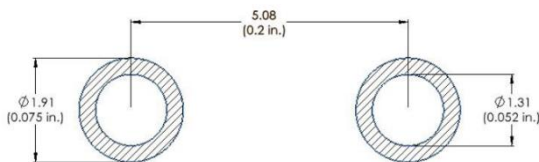
**Package Dimensions**

**Package TO-220-2L**



| SYMBOL | MIN (mm)   | MAX (mm) |
|--------|------------|----------|
| A      | 9.677      | 10.414   |
| B      | 5.969      | 6.477    |
| C      | 2.540      | 3.048    |
| D      | 5.664      | 8.560    |
| D1     | 12.450 REF |          |
| E      | 14.986     | 15.621   |
| E1     | 8.120 REF  |          |
| E2     | 6.100 REF  |          |
| F      | 3.632      | 3.886    |
| G      | 28.067     | 29.134   |
| H      | 12.700     | 13.970   |
| H1     | 6.223 REF  |          |
| H2     | 7.040 REF  |          |
| L1     | 0.635      | 0.914    |
| M1     | 1.143      | 1.397    |
| N      | 4.953      | 5.207    |
| P      | 4.191      | 4.699    |
| Q      | 1.219      | 1.372    |
| S      | 3°         | 6°       |
| T      | 3°         | 6°       |
| U      | 3°         | 6°       |
| V      | 2.388      | 2.794    |
| W      | 0.356      | 0.635    |
| W1     | 0.356      | 0.520    |
| X      | 3°         | 5.5°     |
| Y      | 9.779      | 10.414   |
| Z      | 3.302      | 3.810    |

**Recommended Solder Pad Layout**



**TO-220-2L**

| Part Number  | Package   | Marking |
|--------------|-----------|---------|
| QSD50HCS120U | TO-220-2L | Q       |