

# QH05TZ600, QH05BZ600

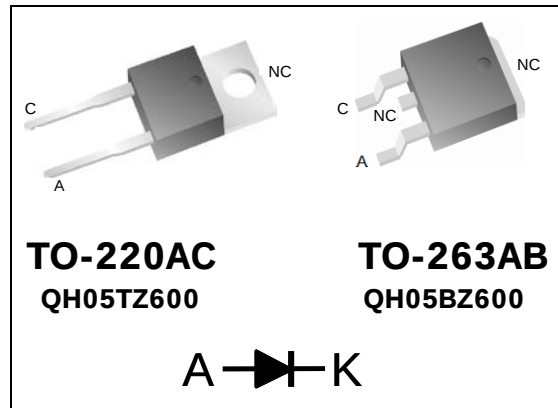
## Qspeed™ Family

600 V, 5 A H-Series PFC Diode

### Product Summary

|                                    |      |    |
|------------------------------------|------|----|
| $I_{F(AVG)}$                       | 5    | A  |
| $V_{RRM}$                          | 600  | V  |
| $Q_{RR}$ (Typ at 125 °C)           | 18.9 | nC |
| $I_{RRM}$ (Typ at 125 °C)          | 1.59 | A  |
| Softness $t_B/t_A$ (Typ at 125 °C) | 0.86 |    |

### Pin Assignment



### RoHS Compliant

Package uses Lead-free plating and  
Green mold compound.  
Halogen free per IEC 61249-2-21.

### General Description

This device has the lowest  $Q_{RR}$  of any 600 V silicon diode. Its recovery characteristics increase efficiency, reduce EMI and eliminate snubbers.

### Applications

- Power Factor Correction (PFC) boost diode
- Motor drive circuits
- DC-AC inverters

### Features

- Low  $Q_{RR}$ , low  $I_{RRM}$ , low  $t_{RR}$
- High  $dI_F/dt$  capable (1000 A /  $\mu$ s)
- Soft recovery

### Benefits

- Increases efficiency
  - Eliminates need for snubber circuits
  - Reduces EMI filter component size & count
- Enables extremely fast switching

### Absolute Maximum Ratings

Absolute maximum ratings are the values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

| Symbol       | Parameter                            | Conditions                                                                  | Rating     | Units |
|--------------|--------------------------------------|-----------------------------------------------------------------------------|------------|-------|
| $V_{RRM}$    | Peak repetitive reverse voltage      | $T_J = 25\text{ °C}$                                                        | 600        | V     |
| $I_{F(AVG)}$ | Average forward current              | $T_J = 150\text{ °C}$ , $T_C = 109\text{ °C}$                               | 5          | A     |
| $I_{FSM}$    | Non-repetitive peak surge current    | 60 Hz, $\frac{1}{2}$ cycle, $T_C = 25\text{ °C}$                            | 50         | A     |
| $I_{FSM}$    | Non-repetitive peak surge current    | $\frac{1}{2}$ cycle of $t = 28\text{ }\mu$ s Sinusoid, $T_C = 25\text{ °C}$ | 350        | A     |
| $T_J$        | Operating junction temperature range |                                                                             | -55 to 150 | °C    |
| $T_{STG}$    | Storage temperature                  |                                                                             | -55 to 150 | °C    |
|              | Lead soldering temperature           | Leads at 1.6 mm from case, 10 sec                                           | 300        | °C    |
| $V_{ISOL}$   | Isolation voltage (leads-to-tab)     | AC, TO-220                                                                  | 2500       | V     |
| $V_{ISOL}$   | Isolation voltage (leads-to-tab)     | AC, TO-263                                                                  | 1500       | V     |
| $P_D$        | Power dissipation                    | $T_C = 25\text{ °C}$                                                        | 36.8       | W     |

## Thermal Resistance

| Symbol          | Resistance from:    | Conditions    | Rating | Units                       |
|-----------------|---------------------|---------------|--------|-----------------------------|
| $R_{\theta JA}$ | Junction to ambient | TO-220 (only) | 62     | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JC}$ | Junction to case    |               | 3.4    | $^{\circ}\text{C}/\text{W}$ |

## Electrical Specifications at $T_J = 25^{\circ}\text{C}$ (unless otherwise specified)

| Symbol                  | Parameter                           | Conditions                                                       | Min                     | Typ  | Max  | Units |    |
|-------------------------|-------------------------------------|------------------------------------------------------------------|-------------------------|------|------|-------|----|
| DC Characteristics      |                                     |                                                                  |                         |      |      |       |    |
| I <sub>R</sub>          | Reverse current                     | V <sub>R</sub> = 600 V, T <sub>J</sub> = 25 °C                   | -                       | -    | 250  | μA    |    |
|                         |                                     | V <sub>R</sub> = 600 V, T <sub>J</sub> = 125 °C                  | -                       | 0.31 | -    | mA    |    |
| V <sub>F</sub>          | Forward voltage                     | I <sub>F</sub> = 5 A, T <sub>J</sub> = 25 °C                     | -                       | 2.6  | 3.1  | V     |    |
|                         |                                     | I <sub>F</sub> = 5 A, T <sub>J</sub> = 150 °C                    | -                       | 2.2  | -    | V     |    |
| C <sub>J</sub>          | Junction capacitance                | V <sub>R</sub> = 10 V, 1 MHz                                     | -                       | 17   | -    | pF    |    |
| Dynamic Characteristics |                                     |                                                                  |                         |      |      |       |    |
| t <sub>RR</sub>         | Reverse recovery time               | dI/dt = 200 A/μs<br>V <sub>R</sub> = 400 V, I <sub>F</sub> = 5 A | T <sub>J</sub> = 25 °C  | -    | 10   | -     | ns |
|                         |                                     |                                                                  | T <sub>J</sub> = 125 °C | -    | 17.4 | -     | ns |
| Q <sub>RR</sub>         | Reverse recovery charge             | dI/dt = 200 A/μs<br>V <sub>R</sub> = 400 V, I <sub>F</sub> = 5 A | T <sub>J</sub> = 25 °C  | -    | 6.5  | 12    | nC |
|                         |                                     |                                                                  | T <sub>J</sub> = 125 °C | -    | 18.9 | -     | nC |
| I <sub>RRM</sub>        | Maximum reverse recovery current    | dI/dt = 200 A/μs<br>V <sub>R</sub> = 400 V, I <sub>F</sub> = 5 A | T <sub>J</sub> = 25 °C  | -    | 1.0  | 1.55  | A  |
|                         |                                     |                                                                  | T <sub>J</sub> = 125 °C | -    | 1.59 | -     | A  |
| S                       | Softness factor = $\frac{t_B}{t_A}$ | dI/dt = 200 A/μs<br>V <sub>R</sub> = 400 V, I <sub>F</sub> = 5 A | T <sub>J</sub> = 25 °C  | -    | 0.8  | -     |    |
|                         |                                     |                                                                  | T <sub>J</sub> = 125 °C | -    | 0.86 | -     |    |

**Note to component engineers:** H-Series diodes employ Schottky technologies in their design and construction. Therefore, Component Engineers should plan their test setups to be similar to those for traditional Schottky test setups. (For additional details, see Application Note AN-300.)

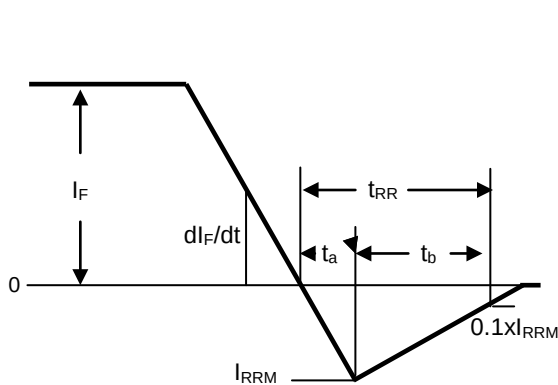
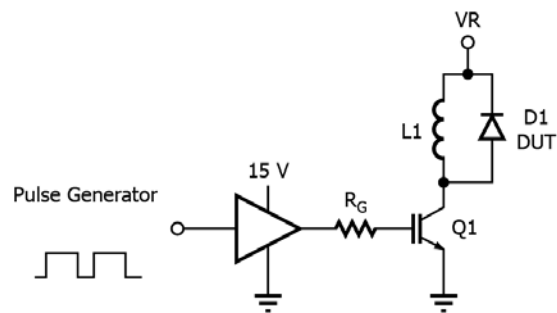


Figure 1. Reverse Recovery Definitions.



PI-7614-041315

Figure 2. Reverse Recovery Test Circuit.

## Electrical Specifications at $T_J = 25\text{ }^{\circ}\text{C}$ (unless otherwise specified)

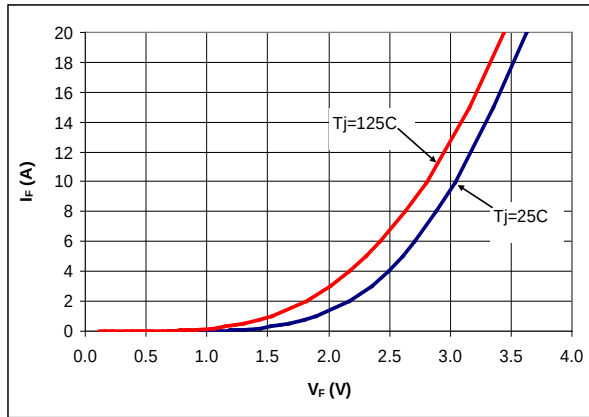


Figure 3. Typical  $I_F$  vs.  $V_F$ .

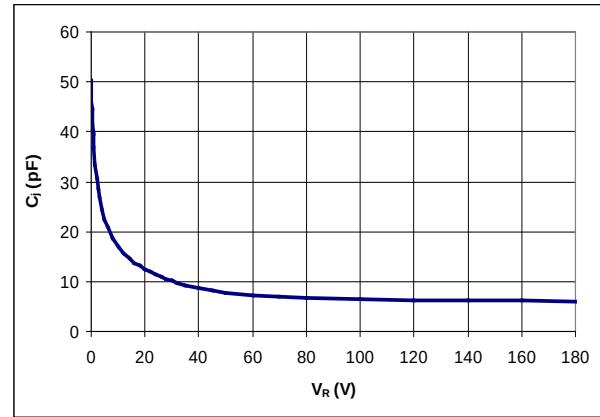


Figure 4. Typical  $C_J$  vs.  $V_R$ .

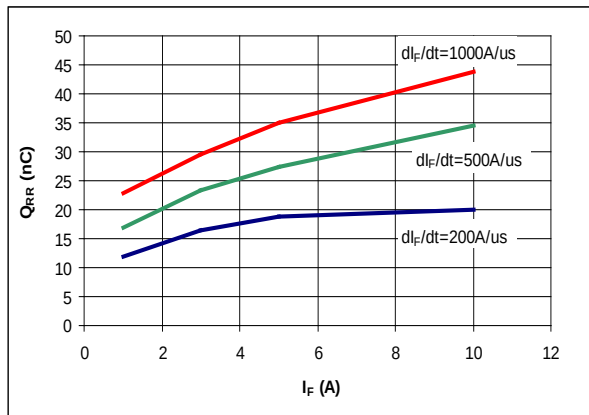


Figure 5. Typical  $Q_{RR}$  vs.  $I_F$  at  $T_J = 125\text{ }^{\circ}\text{C}$ .

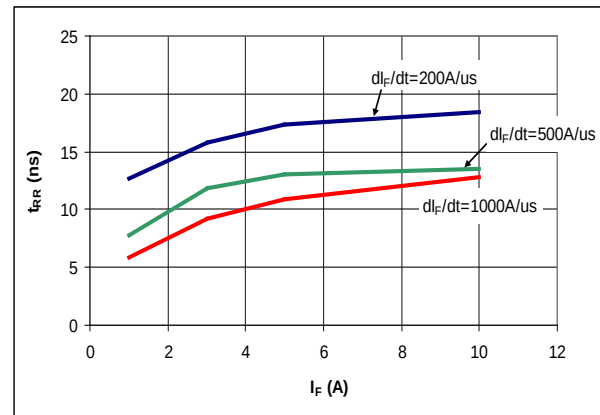


Figure 6. Typical  $t_{RR}$  vs.  $I_F$  at  $T_J = 125\text{ }^{\circ}\text{C}$ .

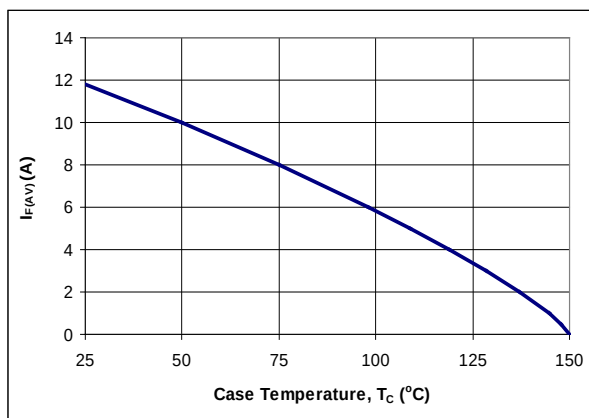


Figure 7. DC Current Derating Curve.

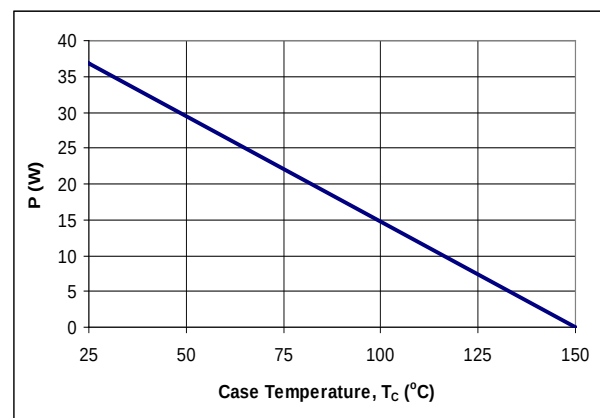


Figure 8. Power Derating Curve.

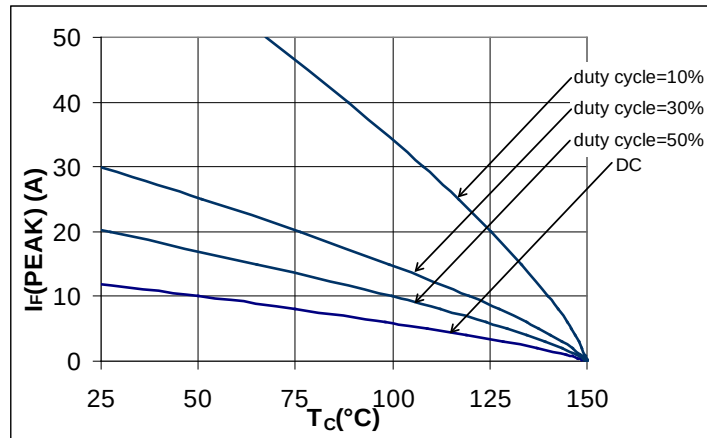


Figure 9.  $I_F$  (PEAK) vs.  $T_C$ ,  $f = 70$  kHz.

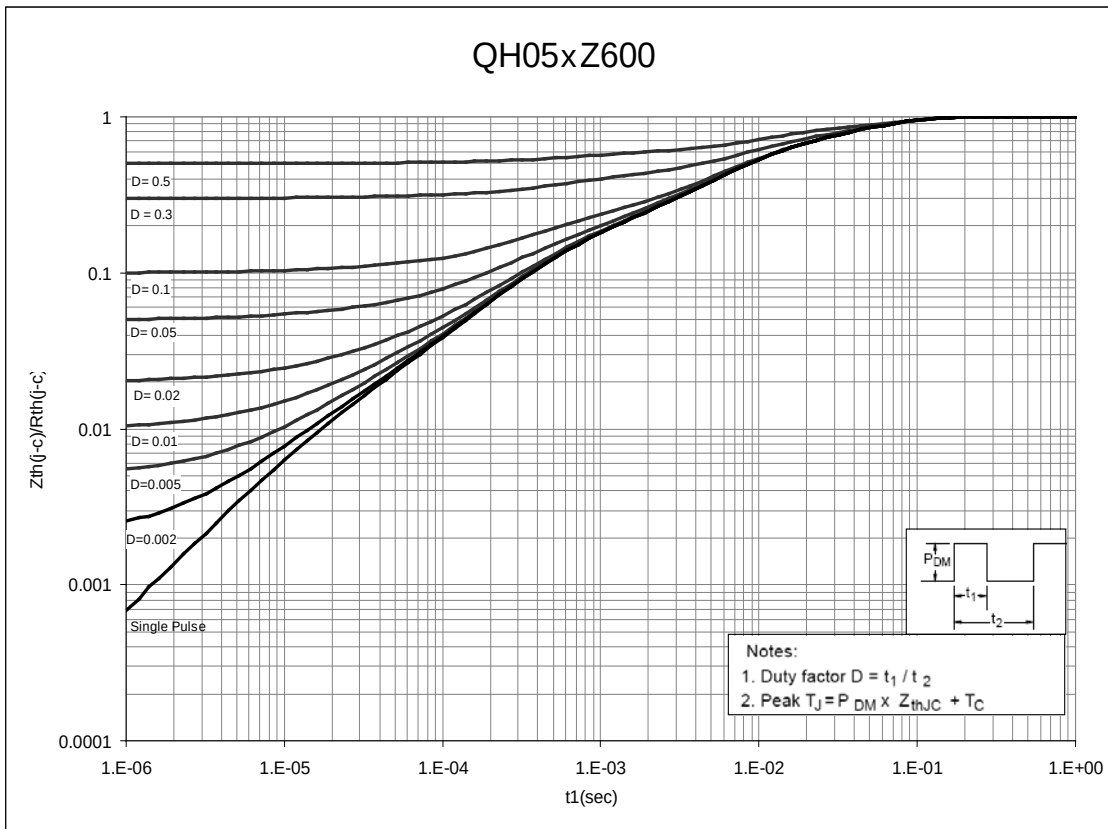
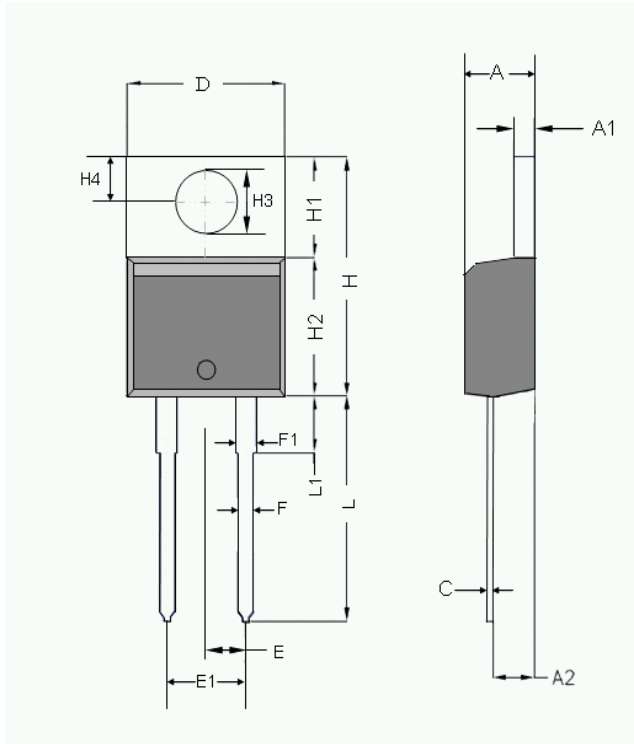


Figure 10. Normalized Maximum Transient Thermal Impedance.

## Dimensional Outline Drawings

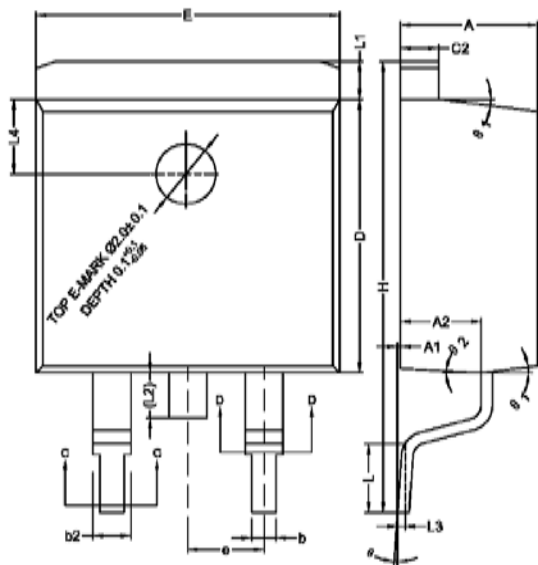
TO-220AC



| Dim | Millimeters |       |
|-----|-------------|-------|
|     | MIN         | MAX   |
| A   | 4.32        | 4.70  |
| A1  | 1.14        | 1.40  |
| A2  | 2.03        | 2.79  |
| C   | 0.34        | 0.610 |
| D   | 9.65        | 10.67 |
| E   | 2.49        | 2.59  |
| E1  | 4.98        | 5.18  |
| F   | 0.508       | 1.016 |
| F1  | 1.14        | 1.78  |
| H   | 14.71       | 16.51 |
| H1  | 5.84        | 6.795 |
| H2  | 8.40        | 9.00  |
| H3  | 3.53        | 3.96  |
| H4  | 2.54        | 3.05  |
| L   | 12.70       | 14.22 |
| L1  | -           | 6.35  |

## Dimensional Outline Drawings

TO-263AB

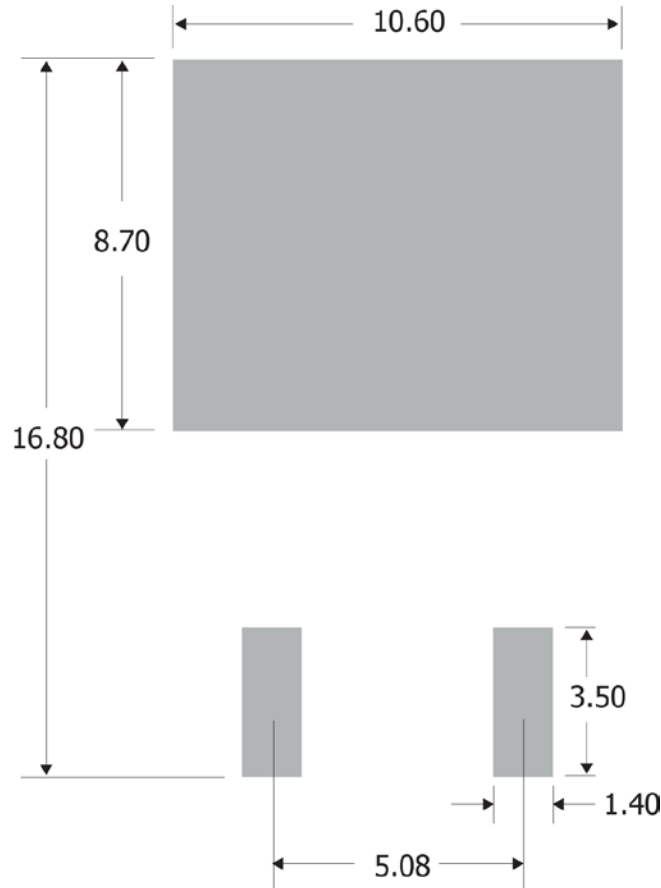


| Dim | Millimeters |          |
|-----|-------------|----------|
|     | MIN         | MAX      |
| A   | 4.40        | 4.70     |
| A1  | 0.00        | 0.25     |
| A2  | 2.59        | 2.79     |
| b   | 0.77        | 0.90     |
| b2  | 1.23        | 1.36     |
| c2  | 1.22        | 1.32     |
| D   | 9.05        | 9.25     |
| E   | 10.06       | 10.26    |
| e   | 2.54 BSC    | 2.54 BSC |
| H   | 14.70       | 15.50    |
| L   | 2.00        | 2.60     |
| L1  | 1.17        | 1.40     |
| L2  | —           | 1.75     |
| L3  | 0.25 BSC    | 0.25 BSC |
| L4  | 2.00 BSC    | 2.00 BSC |
| θ   | 0°          | 8°       |
| θ1  | 5°          | 9°       |
| θ2  | 1°          | 5°       |

| Mechanical Mounting Method        | Maximum Torque / Pressure specification                                                     |
|-----------------------------------|---------------------------------------------------------------------------------------------|
| Screw through hole in package tab | 1 Newton Meter (nm) or 8.8 inch-pounds (lb-in)                                              |
| Clamp against package body        | 12.3 kilogram-force per square centimeter (kgf/cm <sup>2</sup> ) or 175 lbf/in <sup>2</sup> |

## Footprint and Solder Pad Dimensions

Pad Dimensions in mm:  
TO-263AB



**Soldering time and temperature:** This product has been designed for use with high-temperature, lead-free solder. The component leads can be subjected to a maximum temperature of 300 °C, for up to 10 seconds. See Application Note AN-303, for more details.

## Ordering Information

| Part Number | Package  | Packing        |
|-------------|----------|----------------|
| QH05TZ600   | TO-220AC | 50 units/tube  |
| QH05BZ600   | TO-263AB | 800 units/reel |

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| Revision | Notes                                                                                        | Date  |
|----------|----------------------------------------------------------------------------------------------|-------|
| 1.0      | Released by Qspeed                                                                           | 01/10 |
| 1.1      | Converted to Power Integrations Document                                                     | 01/11 |
| 1.2      | Added QH05BZ600                                                                              | 02/13 |
| 1.3      | Updated with new Brand Style. Added footprint and solder pad dimension for TO-263AB package. | 11/15 |

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