

# QH20TZ650

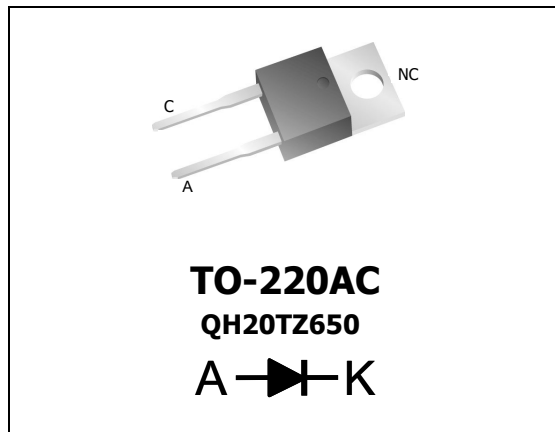
## Qspeed™ Family

650 V, 20 A H-Series PFC Diode

### Product Summary

$I_{F(AVG)}$	20	A
$V_{RRM}$	650	V
$Q_{RR}$ (Typ at 125 °C)	140	nC
$I_{RRM}$ (Typ at 125 °C)	5.0	A
Softness $t_B/t_A$ (Typ at 125 °C)	0.4	

### 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 650 V silicon diode. Its recovery characteristics increase efficiency, reduce EMI and eliminate snubbers. Replaces SiC diodes for similar efficiency performance in high switching frequency applications.

### Applications

- Power Factor Correction boost diode
- Server power supplies
- Motor drive circuits
- DC-AC inverters
- Output rectifier

### Features

- 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	$T_J = 25\text{ °C}$	650	V
$I_{F(AVG)}$	Average forward current	$T_J = 150\text{ °C}, T_C = 42\text{ °C}$	20	A
$I_{FSM}$	Non-repetitive peak surge current	60 Hz, 1/2 cycle, $T_C = 25\text{ °C}$	105	A
$I_{FSM}$	Non-repetitive peak surge current	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
$P_D$	Power dissipation	$T_C = 25\text{ °C}$	60	W

## Thermal Resistance

Symbol	Resistance from:	Conditions	Rating	Units
$R_{\theta JA}$	Junction to ambient	TO-220	62	$^{\circ}\text{C}/\text{W}$
$R_{\theta JC}$	Junction to case		2.1	$^{\circ}\text{C}/\text{W}$

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units	
<b>DC Characteristics</b>							
$I_R$	Reverse current	$V_R = 650\text{ V}, T_J = 25^{\circ}\text{C}$	-	-	250	$\mu\text{A}$	
		$V_R = 650\text{ V}, T_J = 125^{\circ}\text{C}$	-	3	-	$\text{mA}$	
$V_F$	Forward voltage	$I_F = 20\text{ A}, T_J = 25^{\circ}\text{C}$	-	2.65	3.15	$\text{V}$	
		$I_F = 20\text{ A}, T_J = 150^{\circ}\text{C}$	-	2.35	-	$\text{V}$	
$C_J$	Junction capacitance	$V_R = 10\text{ V}, 1\text{ MHz}$	-	92	-	$\text{pF}$	
<b>Dynamic Characteristics</b>							
$t_{RR}$	Reverse recovery time	$dI/dt = 200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}, I_F = 20\text{ A}$	$T_J = 25^{\circ}\text{C}$	-	26.5	-	$\text{ns}$
			$T_J = 125^{\circ}\text{C}$	-	41.3	-	$\text{ns}$
$Q_{RR}$	Reverse recovery charge	$dI/dt = 200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}, I_F = 20\text{ A}$	$T_J = 25^{\circ}\text{C}$	-	51	80	$\text{nC}$
			$T_J = 125^{\circ}\text{C}$	-	140	-	$\text{nC}$
$I_{RRM}$	Maximum reverse recovery current	$dI/dt = 200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}, I_F = 20\text{ A}$	$T_J = 25^{\circ}\text{C}$	-	3	4	$\text{A}$
			$T_J = 125^{\circ}\text{C}$	-	5.0	-	$\text{A}$
$S$	Softness factor = $\frac{t_B}{t_A}$	$dI/dt = 200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}, I_F = 20\text{ A}$	$T_J = 25^{\circ}\text{C}$	-	0.7	-	
			$T_J = 125^{\circ}\text{C}$	-	0.4	-	

**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.)

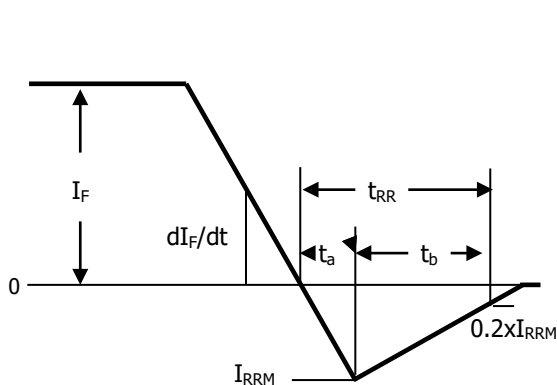
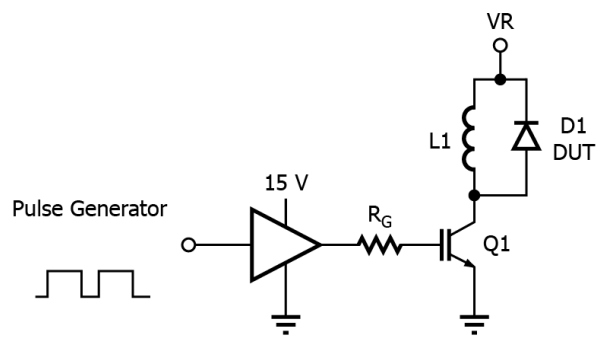


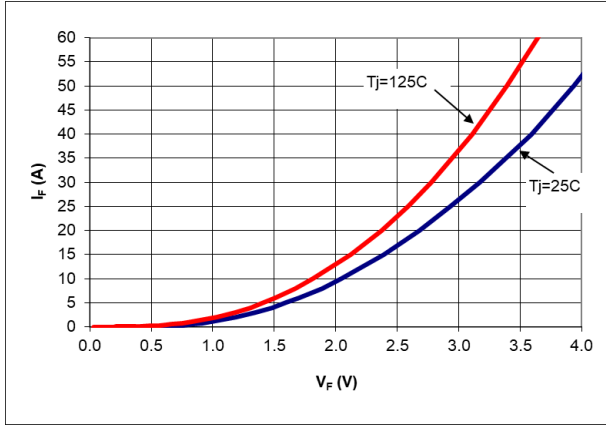
Figure 1. Reverse Recovery Definitions



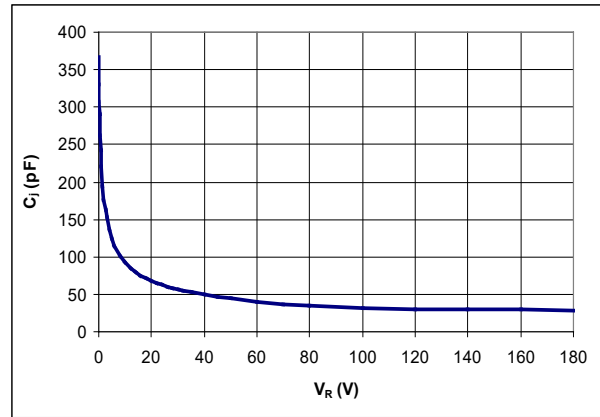
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Figure 2. Reverse Recovery Test Circuit

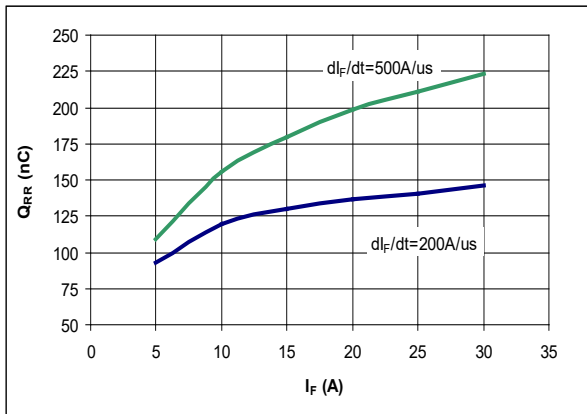
**Electrical Specifications at  $T_J = 25\text{ }^\circ\text{C}$  (unless otherwise specified)**



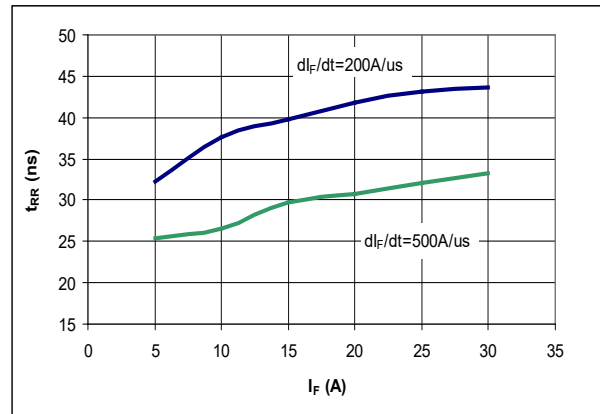
**Figure 3. Typical  $I_F$  vs  $V_F$**



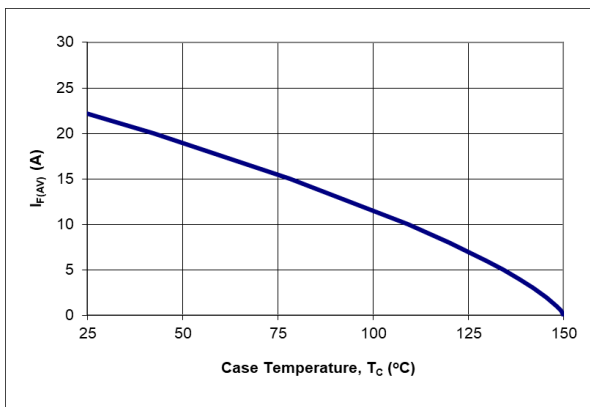
**Figure 4. Typical  $C_j$  vs  $V_R$**



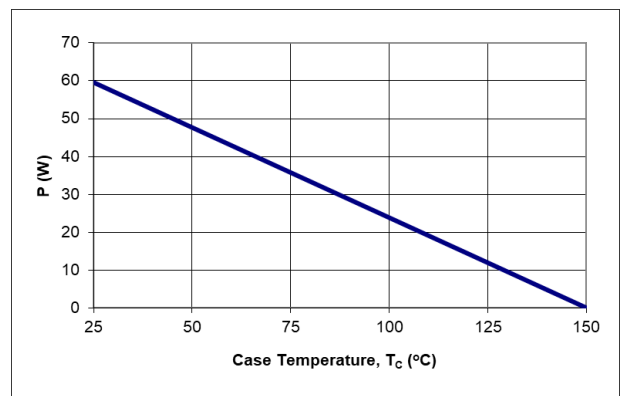
**Figure 5. Typical  $Q_{RR}$  vs  $I_F$  at  $T_J = 125\text{ }^\circ\text{C}$**



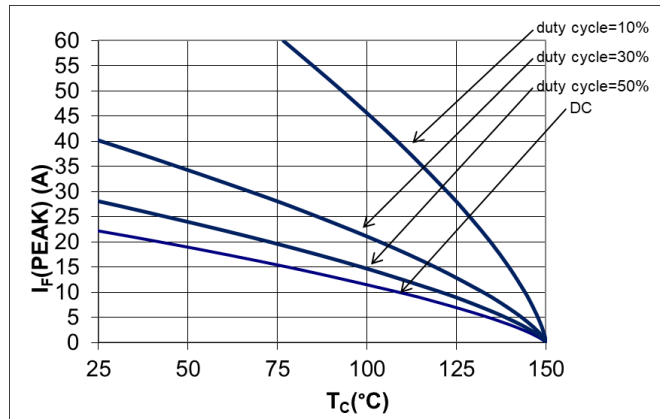
**Figure 6. Typical  $t_{RR}$  vs  $I_F$  at  $T_J = 125\text{ }^\circ\text{C}$**



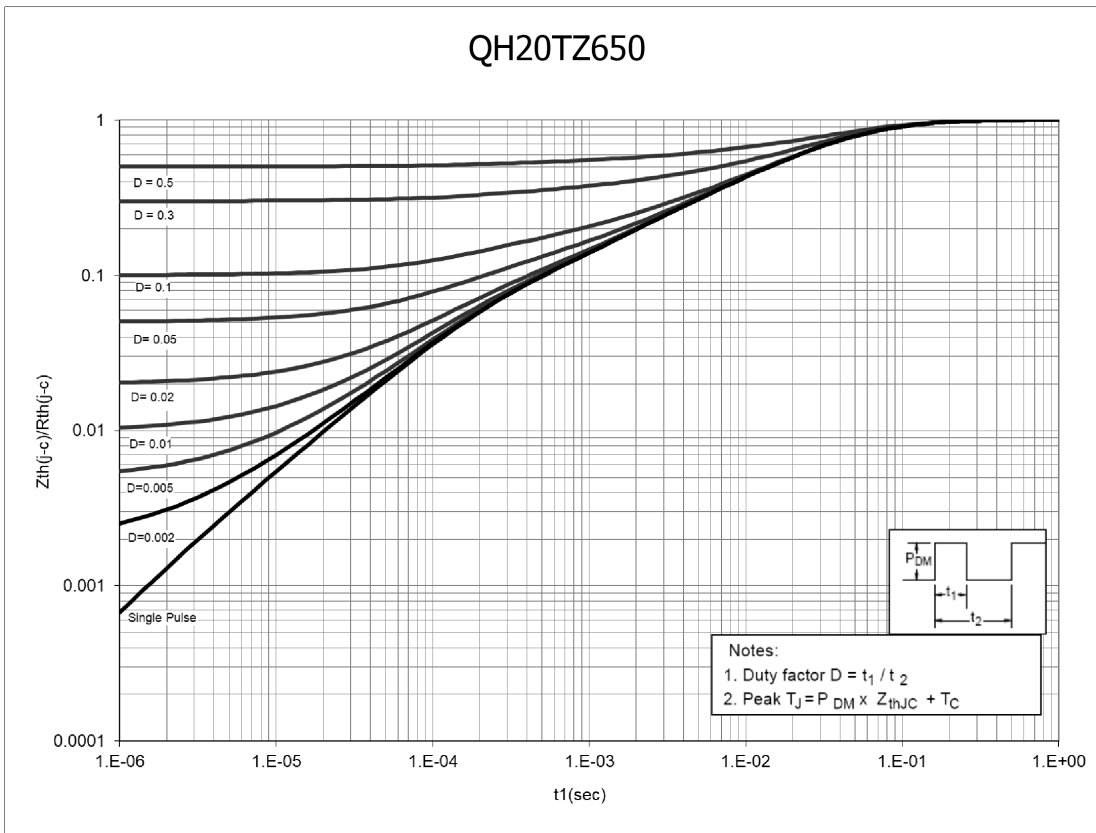
**Figure 7. DC Current Derating Curve**



**Figure 8. Power Derating Curve**



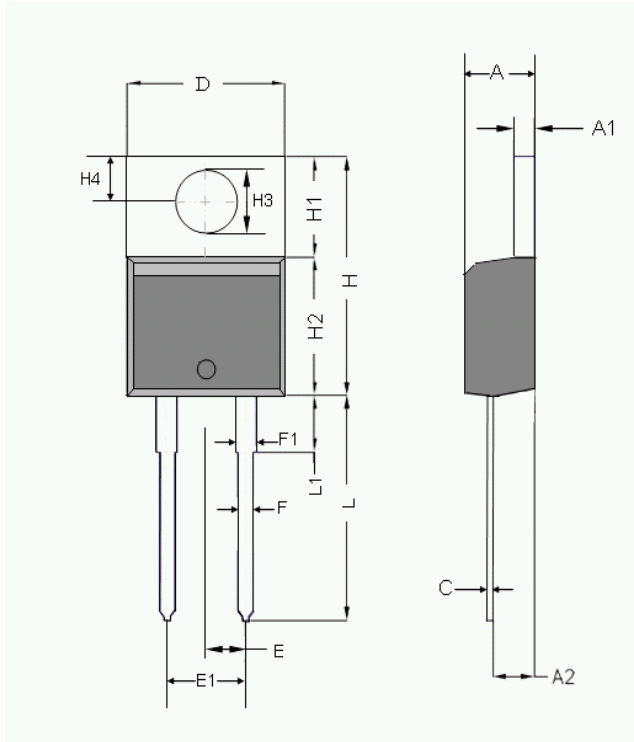
**Figure 9.  $I_F(\text{PEAK})$  vs  $T_C$ ,  $f = 70 \text{ kHz}$**



**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

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>

**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
QH20TZ650	TO-220AC	50 units/tube

The information contained in this document is subject to change without notice.

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<b>Revision</b>	<b>Notes</b>	<b>Date</b>
1.0	Production release.	08/24

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