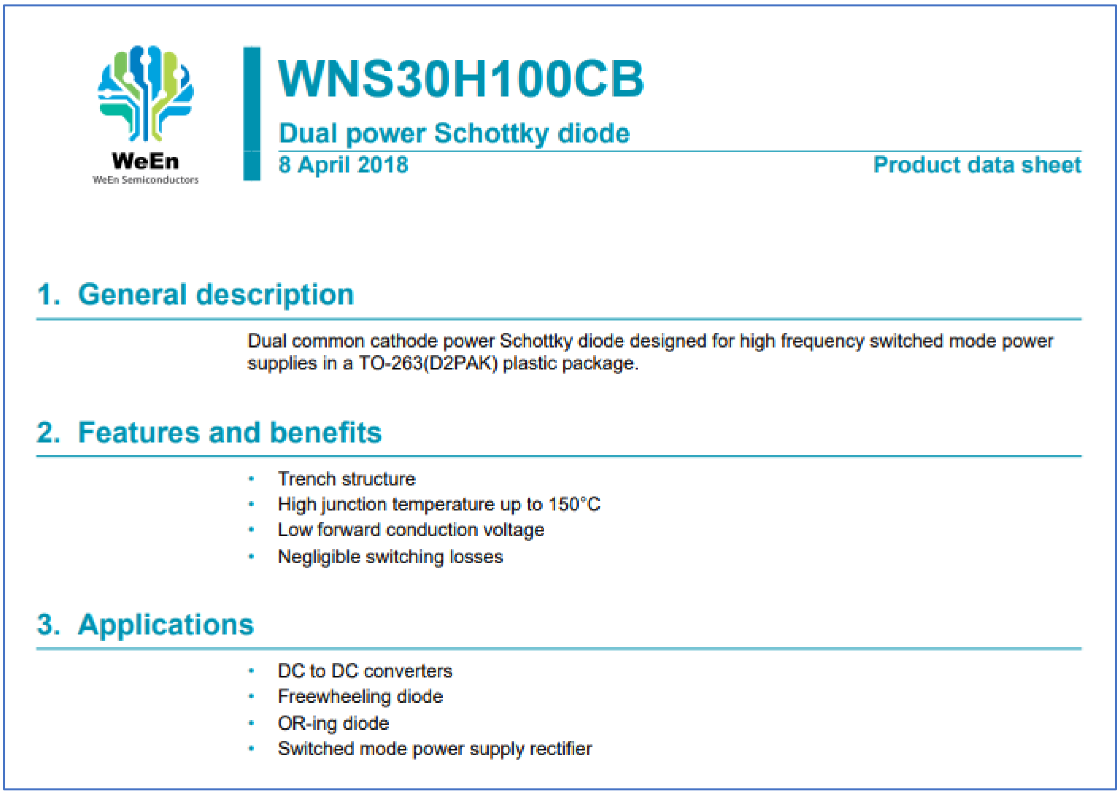
1. Introduction

Datasheets are not required to be created to a fixed international standard. This means datasheets must be read and interpreted carefully to ensure that parameter descriptions and values are correctly understood.

This datasheet note looks at the parameters defined and described in WeEn datasheets for diodes.

2. Datasheet product profile

All WeEn's datasheets have the product name and type, revision number and publication date on the first page heading. This is followed by three sections, "General description", "Features and benefits" and "Applications". These sections describe the product to allow the reader to quickly understand its technology, main advantages and uses. There are product datasheets for single and dual diodes for differing technology platforms: Silicon diodes (hyperfast, ultrafast etc.,), Schottky diodes and Silicon Carbide diodes.



WeEn
WeEn Semiconductors

WNS30H100CB

Dual power Schottky diode

8 April 2018 Product data sheet

1. General description

Dual common cathode power Schottky diode designed for high frequency switched mode power supplies in a TO-263(D2PAK) plastic package.

2. Features and benefits

- Trench structure
- High junction temperature up to 150°C
- Low forward conduction voltage
- Negligible switching losses

3. Applications

- DC to DC converters
- Freewheeling diode
- OR-ing diode
- Switched mode power supply rectifier

Fig. 1 Example of a Schottky diode datasheet product profile (WNS30H100CB)

The “Quick reference data” section highlights some important parameters for the product found in the main body of the datasheet.

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{RRM}	repetitive peak reverse voltage			-	-	100	V
$I_{F(AV)}$	average forward current	δ = 0.5 ; T_{mb} ≤ 134 °C; square-wave pulse; per diode; Fig. 1; Fig. 2; Fig. 3		-	-	15	A
$I_{O(AV)}$	average output current	δ = 0.5 ; T_{mb} ≤ 133 °C; square-wave pulse; both diodes conducting		-	-	30	A
Static characteristics							
V_F	forward voltage	I_F = 5 A; T_j = 25 °C; Fig. 6; per diode		-	0.48	0.55	V
		I_F = 5 A; T_j = 125 °C; Fig. 6; per diode		-	0.41	0.48	V
		I_F = 10 A; T_j = 25 °C; Fig. 6; per diode		-	0.56	0.63	V
		I_F = 10 A; T_j = 125 °C; Fig. 6; per diode		-	0.53	0.6	V
		I_F = 15 A; T_j = 25 °C; Fig. 6; per diode		-	0.64	0.71	V
		I_F = 15 A; T_j = 125 °C; Fig. 6; per diode		-	0.6	0.67	V
I_R	reverse current	V_R = 100 V; T_j = 25 °C; Fig. 7; Fig. 8; per diode		-	-	50	µA
		V_R = 100 V; T_j = 125 °C; Fig. 7; Fig. 8; per diode		-	-	30	mA

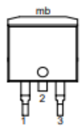
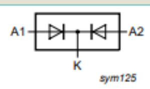
Fig. 2 Example of a datasheet product profile (WNS30H100CB)

“Pinning information” contains a table and diagram to aid the correct identification of the product’s electrical terminals and package type.

“Ordering information” gives the product’s part number and package version. Sometimes there is a “Marking information” section. This gives data on the labelling printed on the device and data on the packing method.

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	A1	anode 1	 D2PAK (TO-263E)	
2	K	cathode		
3	A2	anode 2		
mb	K	mounting base; connected to cathode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
WNS30H100CB	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	TO-263E

Fig. 3 Example of a datasheet product profile (WNS30H100CB)

3. Datasheet “Limiting Values”

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Fig. 4 Example of “Limiting Values” table heading

“Limiting Values” describe the limiting conditions that can be applied by a circuit without risk of damage to the diode, and these limiting values reflect the diode’s capability. These are the absolute maximum ratings for *the operating and environmental conditions* and circuit designers should ensure these are not exceeded. These values may be maximum or minimum. “Limiting” means that the value specified in the table must not be exceeded otherwise the product may malfunction or even be permanently damaged. A limiting value is defined in accordance with the IEC-60134 international standard, known as the “Absolute Maximum Rating System”.

3.1 V_{RRM}, V_{RWM} and V_R

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{RRM}	repetitive peak reverse voltage			-	100	V
V_{RWM}	limiting crest working reverse voltage			-	100	V
V_R	limiting reverse voltage	DC		-	100	V

Fig. 5 Example of diode voltage ratings (WNS30H100CB)

V_{RRM} is the maximum allowable instantaneous repetitive peak reverse voltage (including transients) that the circuit can apply to the diode. “RRM” describes the voltage as “Reverse”, “Repetitive” and “Maximum”. Similarly, V_{RWM} is the maximum allowable repetitive crest working voltage including transients with “RWM” meaning “Reverse”, “Working” and “Maximum”. V_{RSM} is the maximum allowable non-repetitive peak reverse voltage including all non-repetitive transients. V_R is the maximum allowable constant reverse voltage.

The rated values of $V_{RRM(max)}$, $V_{RWM(max)}$ and $V_{R(max)}$ may be applied continuously over the entire operating junction temperature range, provided that the thermal resistance between junction and ambient is low enough to avoid the possibility of thermal runaway.

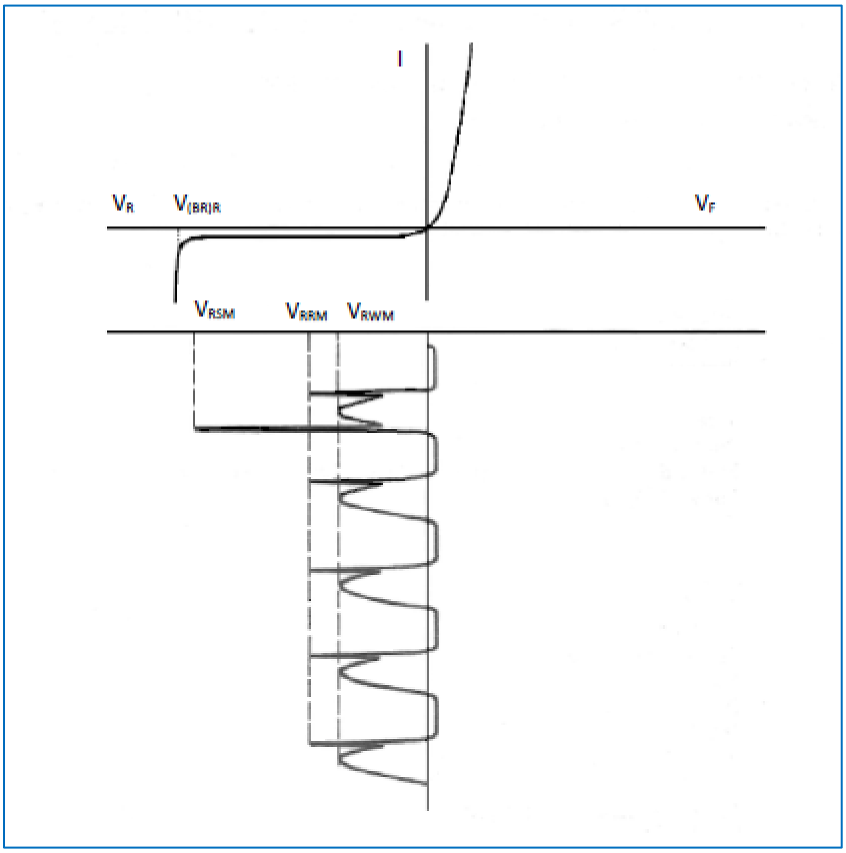


Fig. 6 Diode voltage definitions

3.2 $I_{F(AV)}$ and $I_{O(AV)}$

$I_{F(AV)}$	average forward current	$\delta = 0.5$; $T_{mb} \leq$ 134 °C; square-wave pulse; per diode; Fig. 1; Fig. 2; Fig. 3		-	15	A
$I_{O(AV)}$	average output current	$\delta = 0.5$; $T_{mb} \leq$ 133 °C; square-wave pulse; both diodes conducting		-	30	A

Fig. 7 Example of current ratings (WNS30H100CB)

$I_{F(AV)}$ is the value of current for the diode which under steady state conditions results in the rated temperature $T_{j(max)}$ being reached for a given package-related temperature condition. This temperature condition is specified as T_{mb} for “mounting-base” or “tab” type packages, T_h for plastic packages for “heatsink” mounting, T_{lead} for smaller plastic packages that cannot be heatsink mounted or T_{sp} for the solder point of surface mounted packages. $I_{F(AV)}$ is related to the $I_{F(RMS)}$ current parameter by the equation, $I_{F(RMS)}$ / $I_{F(AV)}$ = form factor.

$I_{O(AV)}$ shows the average output current with the two diodes conducting alternatively. With each diode conducting at 15A with a duty cycle d = 0.5, this means each diode conducts alternatively with a square wave peak of 30A.

A graph relating the average forward current to the package-related temperature condition – the derating graphic is usually found in WeEn diode datasheets. Power dissipation graphics for square and sinusoidal conditions are also shown. (See Fig. 8 and Fig.9).

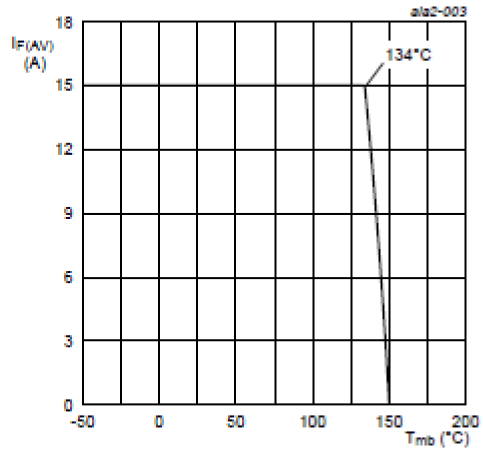


Fig. 3. Average forward current as a function of mounting base temperature; maximum values; per diode

Fig. 8 Example of $I_{F(AV)}$ vs T_{mb} graphics (WNS30H100CB)

This derating graph (Fig. 8) indicates the reduction of the maximum current recommended for temperatures that may exceed T_{mb} = 134 °C (for this WNS30H100CB example).

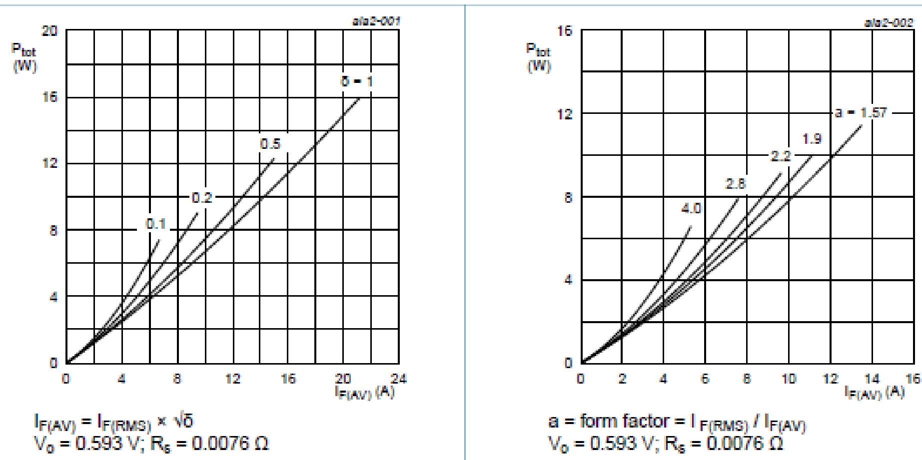


Fig. 1. Forward power dissipation as a function of average forward current; square waveform; maximum values; per diode

Fig. 2. Forward power dissipation as a function of average forward current; sinusoidal waveform; maximum values; per diode

Fig. 9 Example of power dissipation graphics

These graphs show forward power dissipation as a function of average current for square waveforms over a range of duty cycles and similarly for sinusoidal waveforms over a range of form factors. Operating the diode at $I_{FAV)}$ values above the rated limiting value will lead to exceeding the maximum allowable junction temperature $T_{j(max)}$.

The average junction temperature rise can be calculated by multiplying the power dissipation at the rated average current by the thermal resistance (e.g. $R_{th(j-mb)}$ or $R_{th(j-h)}$ for single or two diodes conducting). By subtracting this average junction temperature rise from the maximum allowable temperature, $T_{j(max)}$, the maximum allowable mounting base or heatsink temperature is obtained. This is the value shown in the datasheet text and value indicated on the derating graphic.

It should be remembered that to operate the diode(s) under these conditions means the external heatsinking and cooling arrangements need to dissipate the generated power to the ambient surroundings. This may mean devices in real applications are derated from the maximum $I_{F(AV)}$ conditions in the datasheet, especially devices surface-mounted on PCBs which usually have high $R_{th(mb-amb)}$ values.

3.3 I_{FSM} and I_{FRM}

I_{FRM}	repetitive peak forward current	δ = 0.5 ; t_p = 25 µs; $T_{mb} \leq$ 115 °C; square-wave pulse		-	60	A
I_{FSM}	non-repetitive peak forward current	t_p = 10 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; Fig. 4		-	270	A
		t_p = 8.3 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; Fig. 4		-	300	A

Fig. 10 Example of peak forward current ratings (BYC30WT-600P)

I_{FSM} is the maximum non-repetitive peak forward surge current that may be applied to the diode. It is specified for a one half-sine wave pulse at an initial junction temperature of 25 °C before surge with an AC mains frequency of 50 or 60Hz. The shorter the time period of the surge (higher frequency) the higher the I_{FSM} capability. Exceeding the I_{FSM} rating may damage the diode.

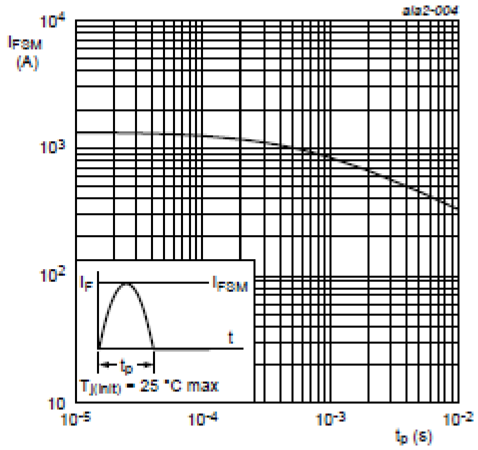


Fig. 4. Non-repetitive peak forward current as a function of pulse width; sinusoidal waveform; maximum values; per diode

Fig. 11 Example of I_{FSM} versus pulse width graphic (WNS30H100CB)

In WeEn datasheets the I_{FRM} rating is defined such that it is an ***additional clarification*** of the $I_{F(AV)}$ rating in the continuous current conduction condition. I_{FRM} is the maximum allowable repetitive peak forward current including transients which occur every cycle. The junction temperature should not exceed $T_{j(max)}$ during repetitive current transients.

The I_{FRM} rating and its definition is discussed further in the WDN001 datasheet note, "Understanding IFRM for power diodes". This parameter is defined differently by different manufacturers.

3.4 T_{stg} and T_j

T_{stg}	storage temperature			-40	150	°C
T_j	junction temperature			-	150	°C

Fig. 12 Example of temperature ratings (WNS30H100CB)

T_{stg} gives the values for the range of temperature allowable for storage (dispatching, handling, warehousing) of the diode. $T_{j(max)}$ is the maximum operating junction temperature for the diode in the on-state or blocking state. Although the junction temperature may transiently exceed $T_{j(max)}$ without damage, (e.g. during exceptional, brief, non-repetitive overload or fault conditions), for repetitive operation the peak junction temperature must remain below the absolute maximum rating.

4. Datasheet “Characteristics”

“Characteristics” are the inherent measurable parameters for the diode and are often stated with minimum or maximum values or both. Sometimes typical values are given. The limits define a range of values for the diode inherent parameter characteristics. These values are useful to the designer for optimizing the circuit and ensuring reliable operation.

4.1 Thermal characteristics, R_{th} and Z_{th}

Table 5. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j\text{-}mb)}$	thermal resistance from junction to mounting base	per diode; Fig. 5		-	-	1.3	K/W
		both diodes conducting		-	-	0.7	K/W
$R_{th(j\text{-}a)}$	thermal resistance from junction to ambient	in free air		-	60	-	K/W

Fig. 13 Example of thermal characteristics (WNS30H100CB)

Maximum steady-state thermal resistance values are given in the datasheet and are used to specify the diode’s current and power ratings. As previously mentioned, the average junction temperature rise for a given power dissipation is the mathematical product of the average dissipation and the thermal resistance.

A typical value of junction to ambient thermal resistance is given which assumes that through-hole leaded devices are mounted vertically on a PCB in free air. The value for surface mount packages is for a device soldered to a pad area on a given PCB material.

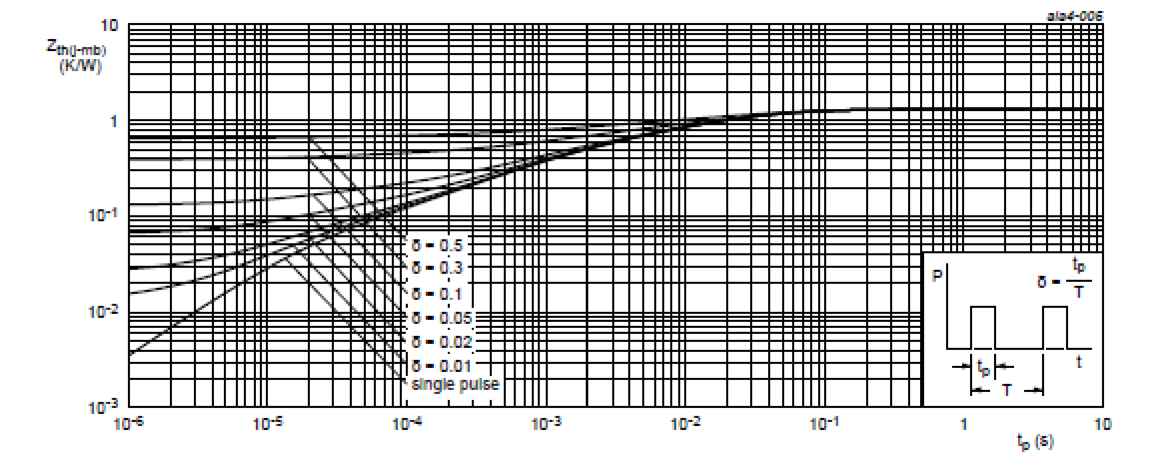


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration; maximum values; per diode

Fig. 14 Example of transient thermal impedance graphic (WNS30H100CB)

Although average junction temperature rise may be calculated from the thermal resistance value, the peak junction temperature calculation requires knowledge of the current waveform and the transient thermal impedance curve. This curve in the datasheet is based on rectangular power pulses. Increasing the pulse duration results in higher transient thermal impedance (Z_{th}) until the steady-state, thermal resistance (R_{th}) is reached. If the application operates under transient (pulse) conditions, Z_{th} instead of R_{th} should be considered since R_{th} is applicable only to steady state, continuous operation. The temperature rise is calculated as the mathematical product of peak dissipation during the pulse by the thermal impedance for the given pulse width.

In practice, a power device must frequently handle composite waveforms rather than a simple rectangular pulse. This type of pulse can be simulated by superimposing several rectangular pulses which have a common time period but with both positive and negative amplitudes. Similarly, a burst of pulses can be treated as a composite waveform. Triangular, trapezoidal and sinusoidal waveforms can also be approximated by a series of rectangles. This analysis is covered elsewhere.

4.2 V_F

Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
V_F	forward voltage	I_F = 5 A; T_j = 25 °C; Fig. 6; per diode		-	0.48	0.55	V
		I_F = 5 A; T_j = 125 °C; Fig. 6; per diode		-	0.41	0.48	V
		I_F = 10 A; T_j = 25 °C; Fig. 6; per diode		-	0.56	0.63	V
		I_F = 10 A; T_j = 125 °C; Fig. 6; per diode		-	0.53	0.6	V
		I_F = 15 A; T_j = 25 °C; Fig. 6; per diode		-	0.64	0.71	V
		I_F = 15 A; T_j = 125 °C; Fig. 6; per diode		-	0.6	0.67	V

Fig. 15 Example of V_F characteristics (WNS30H100CB)

V_F is the forward voltage for the diode at a specified load current and junction temperature condition. This is the maximum instantaneous forward voltage measured under pulse conditions to avoid excessive power dissipation. It is important to check the specified current and temperature values and whether these are typical or maximum. These values along with V_F / I_F curves at 25 °C and $T_{j(max)}$, enable fair comparison of device specifications between manufacturers. V_F is lower at smaller current values and usually lower at higher temperatures. V_F is an important parameter to consider for DCM PFC circuit applications.

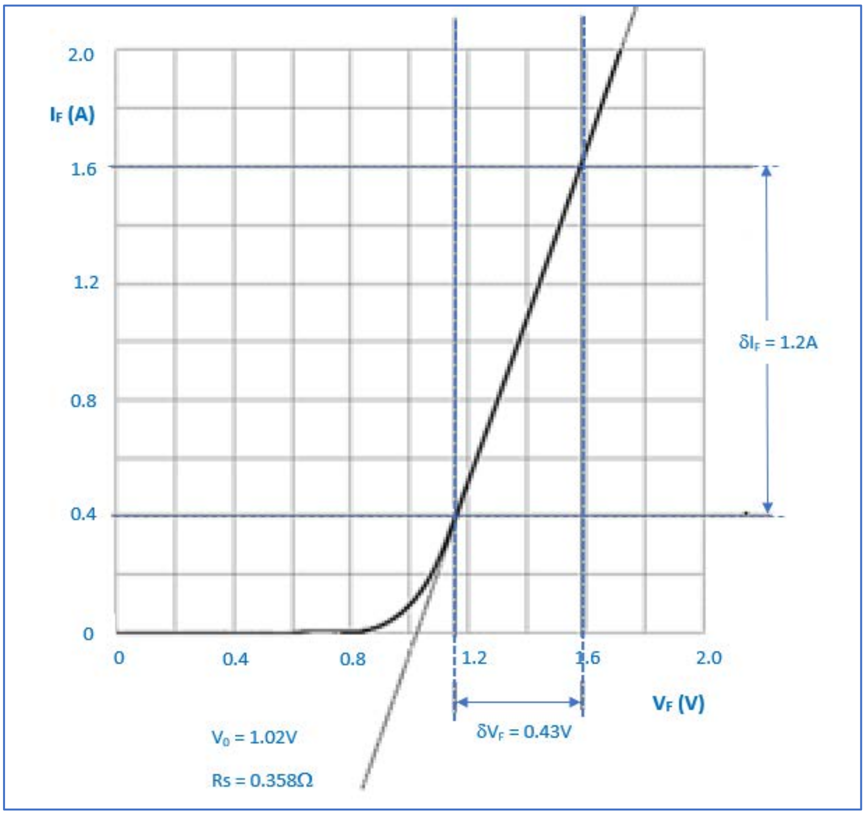


Fig. 16 Example graphic showing V_0 and R_s approximation

V_0 is the “knee voltage” and R_s is the slope resistance and their values are usually shown in the VF / IF graphic in the datasheet (See Fig 17). These values are sometimes also shown in the power dissipation graphics.

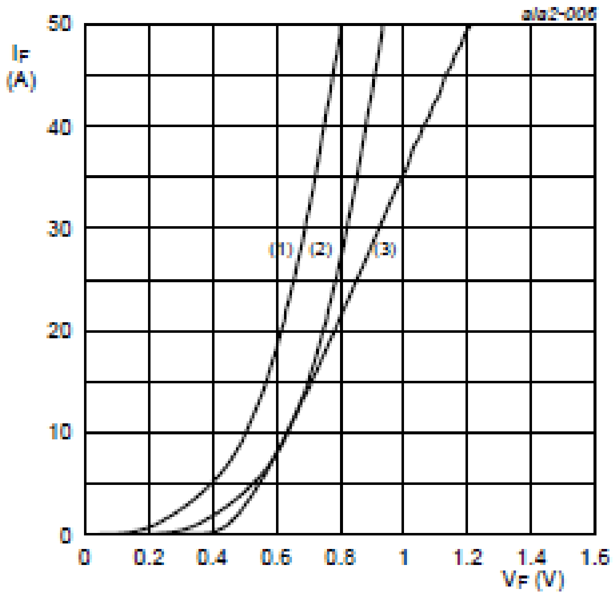
If values for V_0 and R_s are not given in the datasheet, these can be approximated using the method illustrated in Fig 16.

The forward characteristic may be approximated by a linear model and the forward voltage is then given by the equation: $V_F = V_0 + I_F.R_s$ and the instantaneous power dissipation is given by $P_F = V_0.\ I_F + I_F^2.R_s$ where I_F is the instantaneous forward current.

It can be shown mathematically that the average forward dissipation for any current waveform is given by the equation, $P_{F(AV)} = V_0.\ I_{F(AV)} + I_{F(RMS)}{}^2.R_s$, where $I_{F(AV)}$ is the forward average current and $I_{F(RMS)}$ is the RMS value of the forward current.

Therefore, in diode datasheets, the graph for forward dissipation can be calculated as a function of average current. Sinusoidal waveforms are assumed, and the graphs usually show the dissipation over a range of conduction angles. (See Fig. 9).

Similar details for the derivation of V_0, R_s and power calculations are presented in WeEn Application Note WAN004.



V_0 = 0.593 V; R_S = 0.0076 Ω
(1) T_j = 150 °C; typical values
(2) T_j = 150 °C; maximum values
(3) T_j = 25 °C; maximum values

Fig. 6. Forward current as a function of forward voltage; per diode

Fig. 17 Example V_F and I_F graphic (WNS30H100CB)

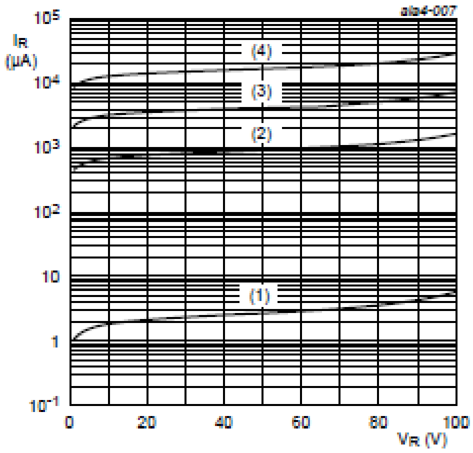
The datasheet V_F / I_F graphic has maximum and typical curves measured at the rated operating temperature (150 °C in this example) and at 25 °C. The "maximum" curve is used to calculate the power dissipation for a given average current.

4.3 I_R

I_R	reverse current	V_R = 100 V; T_j = 25 °C; Fig. 7; Fig. 8; per diode		-	-	50	µA
		V_R = 100 V; T_j = 125 °C; Fig. 7; Fig. 8; per diode		-	-	30	mA

Fig. 18 Example of I_R characteristic (WNS30H100CB)

The maximum reverse leakage currents are at maximum operating junction temperature and maximum reverse voltage. These are shown in Fig 19 (for this WNS30H100CB example).



(1) T_j = 25 °C; typical values
(2) T_j = 100 °C; typical values
(3) T_j = 125 °C; typical values
(4) T_j = 150 °C; typical values

Fig. 7. Reverse leakage current as a function of reverse voltage; per diode; typical values

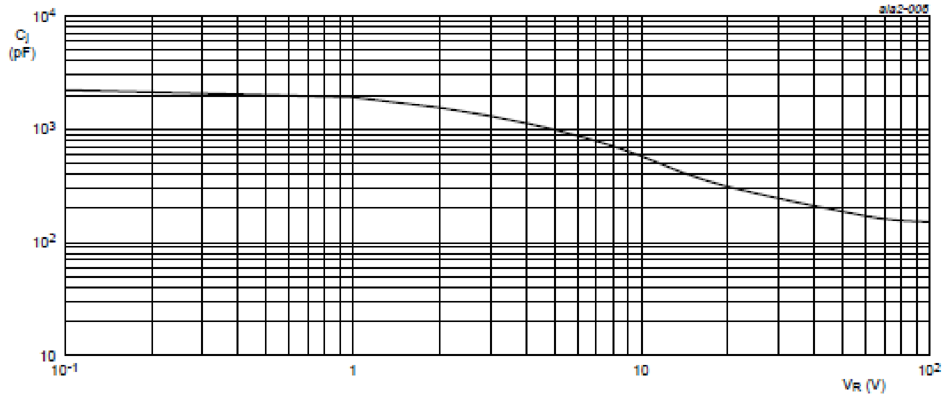
Fig. 19 Example of I_R graphic (WNS30H100CB)

4.4 Junction capacitance, C_j or C_d

C_d	diode capacitance	f = 1 MHz; V_R = 1 V; T_j = 25 °C		-	510	-	pF
		f = 1 MHz; V_R = 400 V; T_j = 25 °C		-	48	-	pF
		f = 1 MHz; V_R = 800 V; T_j = 25 °C		-	41	-	pF

Fig. 20 Example of junction capacitance data (WNSC201200CW)

C_j or C_d is the junction small signal capacitance of the diode at a specified reverse voltage. Typical values may be given for differing values of V_R (Fig. 20) or a graphic may be supplied as shown in Fig. 21. The higher the current rating of the diode (usually a larger chip) the larger the junction capacitance.



f = 1 MHz; T_j = 25 °C

Fig. 8. Junction capacitance as a function of applied reverse voltage; per diode; typical values

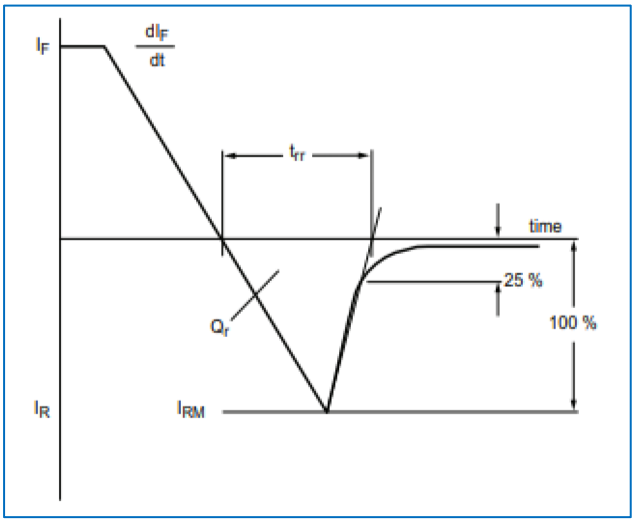
Fig. 21 Example of junction capacitance graphic (WNS30H100CB)

4.5 Reverse recovery characteristics: Q_r, t_{rr}, and I_{RM}

Dynamic characteristics show how diodes cope with fast-changing conditions in a circuit. These are not to be mistakenly understood as limiting values. "Dynamic" means continuous changes in voltage and current.

Q_r	reverse charge	I_F = 50 A; V_R = 400 V; dI_F/dt = 500 A/µs; T_j = 25 °C; Fig. 7		-	952	-	nC
		I_F = 50 A; V_R = 400 V; dI_F/dt = 500 A/µs; T_j = 125 °C; Fig. 7		-	2920	-	nC
		I_F = 50 A; V_R = 400 V; dI_F/dt = 500 A/µs; T_j = 150 °C; Fig. 7		-	3425	-	nC
t_{rr}	reverse recovery time	I_F = 1 A; V_R = 30 V; dI_F/dt = 100 A/µs; T_j = 25 °C; Fig. 7		-	55	-	ns
		I_F = 50 A; V_R = 400 V; dI_F/dt = 500 A/µs; T_j = 25 °C; Fig. 7		-	96	-	ns
		I_F = 50 A; V_R = 400 V; dI_F/dt = 500 A/µs; T_j = 125 °C; Fig. 7		-	194	-	ns
		I_F = 50 A; V_R = 400 V; dI_F/dt = 500 A/µs; T_j = 150 °C; Fig. 7		-	212	-	ns
I_{RM}	peak reverse recovery current	I_F = 50 A; V_R = 400 V; dI_F/dt = 500 A/µs; T_j = 25 °C; Fig. 7		-	20	-	A
		I_F = 50 A; V_R = 400 V; dI_F/dt = 500 A/µs; T_j = 125 °C; Fig. 7		-	30.2	-	A
		I_F = 50 A; V_R = 400 V; dI_F/dt = 500 A/µs; T_j = 150 °C; Fig. 7		-	32.3	-	A

Fig. 22 Example of reverse recovery characteristics for hyperfast diode (BYC60W-1200P)



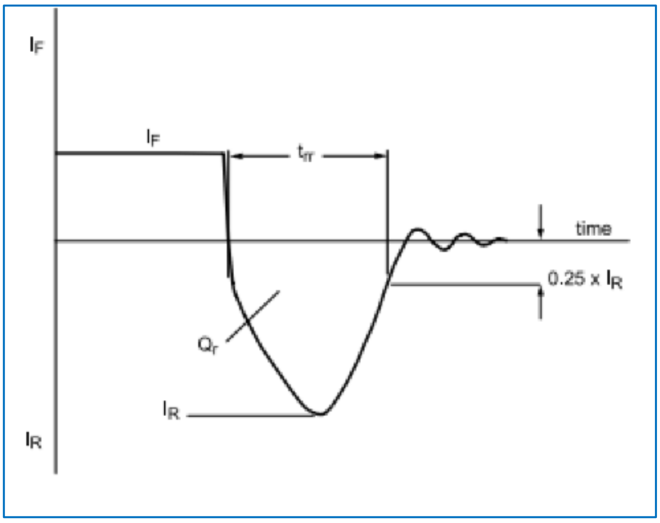


Fig. 23 "Ramp recovery" and "Step recovery" definitions for Q_r, t_{rr} and I_{RM}

Ramp ("Jedec") and "step recovery" refer to the current conditions applied when measuring the recovery parameters. Step recovery methods often yield a smaller value for reverse recovery time whereas "Ramp recovery" is more representative of real circuit conditions. For bipolar PN diodes t_{rr} has a much smaller value at 25 ^{o}C than 150 ^{o}C and lower values for smaller starting measurement currents and faster rate of change of the ramp dI_F/dt.

When a bipolar PN diode has been conducting current in the forward direction sufficiently long enough to establish steady-state, there will be an internal stored charge will have built up due to minority carriers present. Before the diode can block voltage in the reverse direction this charge must be extracted. This extraction causes a transient reverse current and this current along with the reverse bias voltage brings about additional power dissipation which reduces the rectification efficiency. For sine-wave frequencies up to 400Hz these effects can often be ignored but at higher frequencies and for square waves the switching losses must be considered. The parameters for reverse recovery are t_{rr}, Q_r (sometimes referred to as Q_{rr} or Q_S) and I_{RM}. The reverse recovery time, t_{rr} is an important parameter in CCM PFC circuit applications.

The characteristics shown in Fig. 22 are measured under various specified conditions, including some at maximum operating junction temperature. Bipolar PN diodes whether hyperfast, ultrafast etc., have significant storage charge to be extracted after conducting forward current and so these reverse recovery characteristics are stated in their datasheets.

In contrast, Schottky and Silicon Carbide diodes are majority carrier devices and as such do not have storage charge that needs to be extracted like bipolar PN diodes. Consequently, these characteristics are not stated in Schottky or SiC diode datasheets. Fig. 24 illustrates the different switching behaviour for the different diodes.

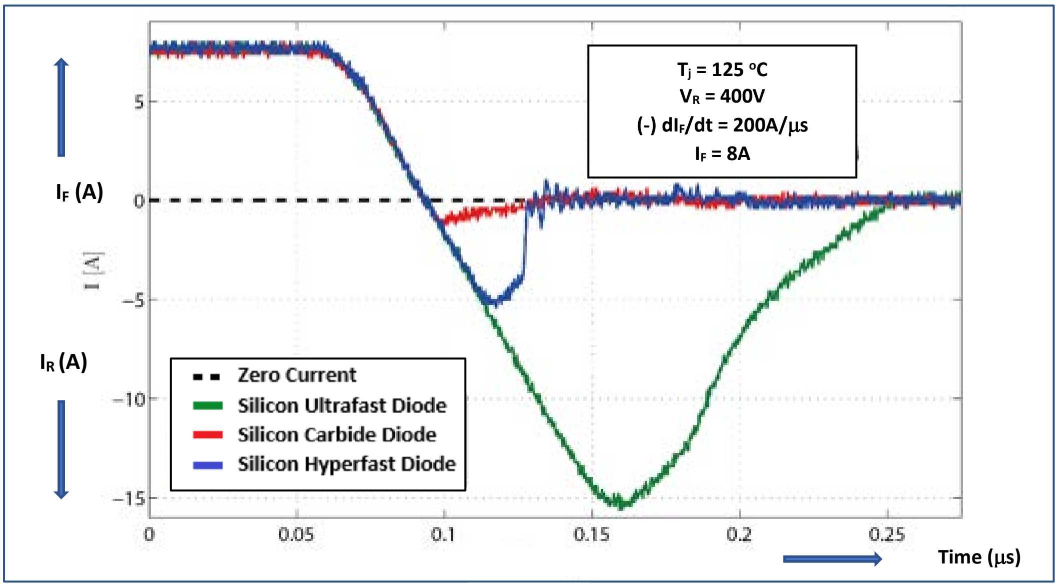


Fig. 24 Graphic comparing reverse recovery for diodes of differing technology

The stored charge, Q_r is normally quoted in nanocoulombs. Low stored charge is preferred for fast switching applications. The speed of a rectifier diode is also measured by the t_{rr} value under certain measurement conditions. Low reverse recovery times are associated with low stored charge.

The peak reverse recovery current, I_{RM} is an important characteristic in many switched-mode power supply circuits. The high transient current produced by a diode with high peak I_{RM} can be interpreted as a short circuit fault which may cause the power supply to shut down or have poor load regulation.

Just as with Q_r and t_{rr}, the peak reverse current, I_{RM} increases with increasing temperature for bipolar PN diodes., so the effects on a circuit may only become apparent when the application becomes hot. I_{RM} correlates with stored charge, Q_{rr}.

In many switching circuits not only the magnitude of the reverse recovery characteristic but also its shape is important. If the positively rising current edge of the characteristic has a fast rise time (a so called “snappy device”) this may cause conducted or radio frequency interference or generate high voltages across inductors which may be in series with the diode. The maximum slope of the reverse recovery current dI_R/dt is a measure of the “softness” of the characteristic and the smaller the better to reduce current ringing (oscillations) in the circuit and EMI.

The mathematical product of the transient reverse current and the reverse voltage results in a value of power dissipation for this scenario. Mostly this occurs whilst the current is decreasing from the peak value, I_{RM} to zero. In repetitive operation an average power can be calculated and added to the forward dissipation to give the total power dissipation. The peak value of the transient current, I_{RM} is known as I_{RRM} (Fig. 24).

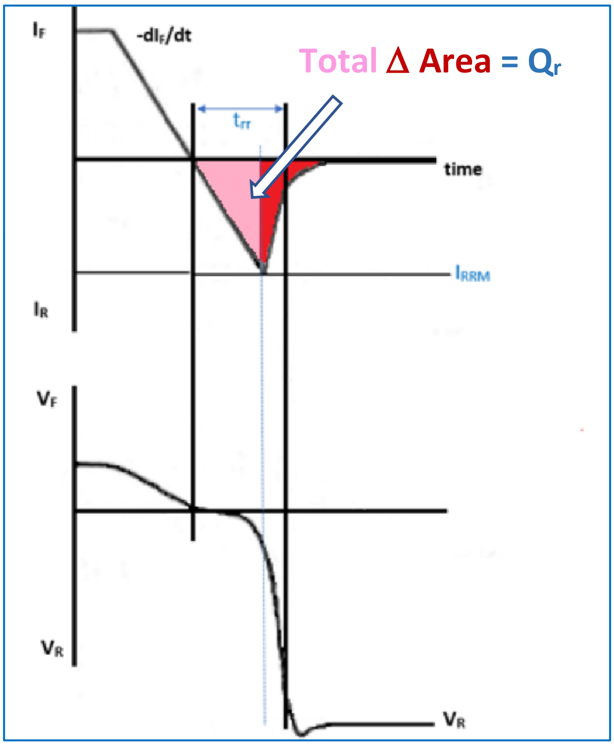


Fig. 25 Graphic showing the origin of reverse switching losses in bipolar PN diodes

4.6 Forward recovery characteristics: V_{fr}, t_{fr}

V_{FR}	forward recovery voltage	I_F = 10 A; dI_F/dt = 100 A/µs; T_j = 25 °C; Fig. 6		-	8	11	V

Fig. 26 Example of V_{fr} characteristic (BYC10X-600)

V_F	Forward voltage	I_F = 15 A; T_j = 150˚C	-	0.95	1.12	V
		I_F = 15 A	-	1.08	1.25	V
		I_F = 30 A	-	1.15	1.36	V
I_R	Reverse current	$V_R = V_{RRM}$	-	10	50	µA
		$V_R = V_{RRM}$; T_j = 100 ˚C	-	0.3	0.8	mA
Q_s	Reverse recovery charge	I_F = 2 A to $V_R \geq$ 30 V; dI_F/dt = 20 A/µs	-	40	60	nC
t_{rr}	Reverse recovery time	I_F = 1 A to $V_R \geq$ 30 V; dI_F/dt = 100 A/µs	-	50	60	ns
I_{rrm}	Peak reverse recovery current	I_F = 10 A to $V_R \geq$ 30 V; dI_F/dt = 50 A/µs; T_j = 100˚C	-	4.2	5.2	A
V_{fr}	Forward recovery voltage	I_F = 10 A; dI_F/dt = 10 A/µs	-	2.5	-	V

Fig. 27 Example of V_{fr} characteristic (BY44 series)

V_{FR}	forward recovery voltage	I_F = 1 A; dI_F/dt = 10 A/µs; T_j = 25 °C; Fig. 7		-	-	1	V

Fig. 28 Example of V_{fr} characteristic (BY32E-200)

Some WeEn diode datasheets include forward recovery characteristics: for bipolar PN diodes, at the instant of switch-on into forward conduction there are no carriers present at the junction and the forward voltage, V_F, may be instantaneously at a higher value than normal. As the stored charge builds up, conductivity modulation in these bipolar diodes occurs which ensures that the forward voltage rapidly falls to the steady-state value. The peak value of forward voltage, V_F, is known as the forward recovery voltage V_{fr}. The time from the instant the forward current is 10% of its steady-state value to the time that the forward voltage drops below a certain value is known as the forward recovery time, t_{fr}.
These definitions are shown in Figure 29.

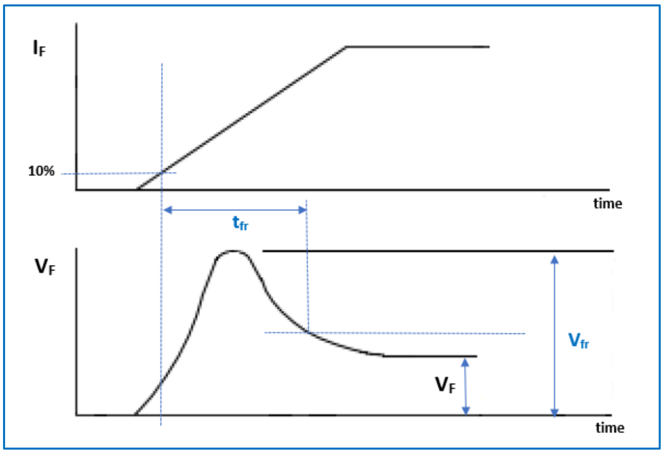


Fig. 29 Graphic showing forward recovery characteristics for bipolar PN diodes

4.7 Reverse avalanche energy, E_{as}

E_{AS}	non-repetitive avalanche energy	$T_{j(init)}$ = 25 °C		50	-	-	mJ

Fig. 30 E_{AS} data (BYC60W-1200P)

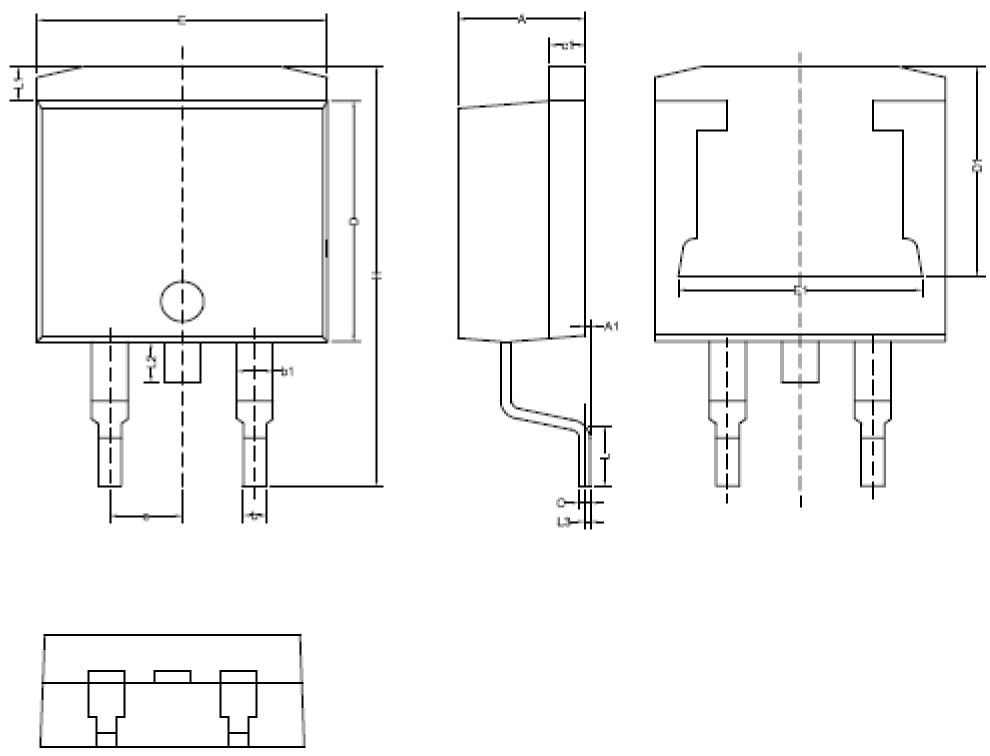
Some WeEn datasheets include reverse avalanche data This data is helpful in designing circuits which use a diode in free-wheeling mode with an inductive load. As the reverse voltage across a diode is increased a critical value or breakdown voltage is reached which results in an avalanche effect for the leakage current. The reverse energy capability of the diode is specified at 25 °C and this capability may reduce if the diode is at a higher junction temperature just before the avalanche effect begins.

5. Package outline drawing

The datasheet contains a package outline drawing of the device. If a surface mount package is described a soldering pad drawing may also be included.

10. Package outline

Plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped) TO263



Unit		A	A1	b	b1	c	c1	D	D1	E	E1	e	H	L	L1	L2	L3
MM	min	4.35	0.00	0.69	1.14	0.38	1.14	8.50	7.50	10.00	8.25	2.54 (BSC)	14.60	2.50	1.00	1.27	0.25 (BSC)
	max	4.75	0.15	0.99	1.73	0.61	1.40	9.02	8.00	10.40	8.80		15.60	2.79	1.65	1.78	

Fig. 9. Package outline D2PAK (TO-263E)

Fig. 31 Example package outline drawing (WNS30H100CB)

Revision history

Rev	Date	Description
v.01	20191211	initial version

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