# DG858DW45

## Gate Turn-Off Thyristor

Replaces July 1999 version, DS4334-4.0

DS4334-4.1 May 2000

### FEATURES

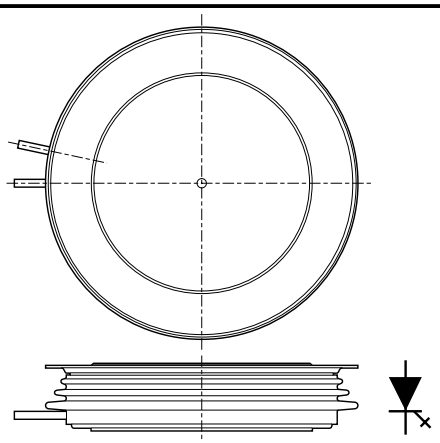
- Double Side Cooling
- High Reliability In Service
- High Voltage Capability
- Fault Protection Without Fuses
- High Surge Current Capability
- Turn-off Capability Allows Reduction In Equipment Size And Weight. Low Noise Emission Reduces Acoustic Cladding Necessary For Environmental Requirements

### KEY PARAMETERS

| | |
|---|---|
| $I_{TCM}$ | 3000A |
| $V_{DRM}$ | 4500V |
| $I_{T(AV)}$ | 1100A |
| $dV_D/dt$ | 750V/μs |
| $dI_T/dt$ | 300A/μs |

### APPLICATIONS

- Variable speed A.C. motor drive inverters (VSD-AC).
- Uninterruptable Power Supplies
- High Voltage Converters.
- Choppers.
- Welding.
- Induction Heating.
- DC/DC Converters.



**Package outline type code : W**
See Package Details for further information.

**Fig.1 Package outline**

### VOLTAGE RATINGS

| Type Number | Repetitive Peak Off-state Voltage $V_{DRM}$ V | Repetitive Peak Reverse Voltage $V_{RRM}$ V | Conditions |
|---|---|---|---|
| DG858DW45 | 4500 | 16 | $T_{vj}$ = 125°C, $I_{DRM}$ =100mA, $I_{RRM}$ = 50mA |

### CURRENT RATINGS

| Symbol | Parameter | Conditions | Max. | Units |
|---|---|---|---|---|
| $I_{TCM}$ | Repetitive peak controllable on-state current | $V_D = V_{DRM}$, $T_j$ = 125°C, $di_{GQ}/dt$ = 40A/μs, Cs = 4.0μF, $L_S \leq$ 200nH | 3000 | A |
| $I_{T(AV)}$ | Mean on-state current | $T_{HS}$ = 80°C. Double side cooled, half sine 50Hz. | 1100 | A |
| $I_{T(RMS)}$ | RMS on-state current | $T_{HS}$ = 80°C. Double side cooled, half sine 50Hz. | 1720 | A |

## SURGE RATINGS

| Symbol | Parameter | Conditions | Max. | Units |
|---|---|---|---|---|
| $I_{TSM}$ | Surge (non-repetitive) on-state current | 10ms half sine. $T_j$ = 125°C | 20.0 | kA |
| $I^2t$ | $I^2t$ for fusing | 10ms half sine. $T_j$ =125°C | $2.0 \times 10^6$ | $A^2s$ |
| $di_T/dt$ | Critical rate of rise of on-state current | $V_D$ = 3000V, $I_T$ = 3000A, $T_j$ =125°C<br>$I_{FG}$ > 40A, Rise time < 1.0µs | 300 | A/µs |
| $dV_D/dt$ | Rate of rise of off-state voltage | To 66% $V_{DRM}$; $R_{GK} \leq 22\Omega$, $T_j$ = 125°C | 20 | V/µs |
| | | To 66% $V_{DRM}$; $V_{RG}$ = -2V, $T_j$ = 125°C | 750 | V/µs |
| $L_S$ | Peak stray inductance in snubber circuit | $I_T$ = 3000A, $V_D$ = $V_{DRM}$, $T_j$ = 125˚C,<br>$di_{GQ}/dt$ = 40A/µs, Cs = 4.0µF | 200 | nH |

## GATE RATINGS

| Symbol | Parameter | Conditions | Min. | Max. | Units |
|---|---|---|---|---|---|
| $V_{RGM}$ | Peak reverse gate voltage | This value maybe exceeded during turn-off | - | 16 | V |
| $I_{FGM}$ | Peak forward gate current | | 20 | 100 | A |
| $P_{FG(AV)}$ | Average forward gate power | | - | 20 | W |
| $P_{RGM}$ | Peak reverse gate power | | - | 24 | kW |
| $di_{GQ}/dt$ | Rate of rise of reverse gate current | | 20 | 60 | A/µs |
| $t_{ON(min)}$ | Minimum permissable on time | | 50 | - | µs |
| $t_{OFF(min)}$ | Minimum permissable off time | | 100 | - | µs |

## THERMAL AND MECHANICAL DATA

| Symbol | Parameter | Conditions | | Min. | Max. | Units |
|---|---|---|---|---|---|---|
| $R_{th(j-hs)}$ | DC thermal resistance - junction to heatsink surface | Double side cooled | | - | 0.011 | °C/W |
| | | Anode side cooled | | - | 0.017 | °C/W |
| | | Cathode side cooled | | - | 0.03 | °C/W |
| $R_{th(c-hs)}$ | Contact thermal resistance | Clamping force 40kN<br>With mounting compound | per contact | - | 0.0021 | °C/W |
| $T_{vj}$ | Virtual junction temperature | | | -40 | 125 | °C |
| $T_{OP}/T_{stg}$ | Operating junction/storage temperature range | | | -40 | 125 | °C |
| - | Clamping force | | | 36.0 | 44.0 | kN |

## CHARACTERISTICS

| $T_j$ = 125°C unless stated otherwise | | | | | |
|---|---|---|---|---|---|
| **Symbol** | **Parameter** | **Conditions** | **Min.** | **Max.** | **Units** |
| $V_{TM}$ | On-state voltage | At 3000A peak, $I_{G(ON)}$ = 10A d.c. | - | 3.85 | V |
| $I_{DM}$ | Peak off-state current | $V_{DRM}$ = 4500V, $V_{RG}$ = 2V | - | 100 | mA |
| $I_{RRM}$ | Peak reverse current | At $V_{RRM}$ | - | 50 | mA |
| $V_{GT}$ | Gate trigger voltage | $V_D$ = 24V, $I_T$ = 100A, $T_j$ = 25°C | - | 1.2 | V |
| $I_{GT}$ | Gate trigger current | $V_D$ = 24V, $I_T$ = 100A, $T_j$ = 25°C | - | 4.0 | A |
| $I_{RGM}$ | Reverse gate cathode current | $V_{RGM}$ = 16V, No gate/cathode resistor | - | 50 | mA |
| $E_{ON}$ | Turn-on energy | $V_D$ = 2000V | - | 4400 | mJ |
| $t_d$ | Delay time | $I_T$ = 3000A, $dI_T/dt$ = 300A/µs | - | 2.0 | µs |
| $t_r$ | Rise time | $I_{FG}$ = 40A, rise time < 1.0µs | - | 6.0 | µs |
| $E_{OFF}$ | Turn-off energy | | - | 12500 | mJ |
| $t_{gs}$ | Storage time | | - | 26 | µs |
| $t_{gf}$ | Fall time | $I_T$ = 3000A, $V_{DM}$ = 4200V | - | 2.5 | µs |
| $t_{gq}$ | Gate controlled turn-off time | Snubber Cap Cs = 4.0µF, | - | 28.5 | µs |
| $Q_{GQ}$ | Turn-off gate charge | $di_{GQ}/dt$ = 40/µs | - | 12500 | µC |
| $Q_{GQT}$ | Total turn-off gate charge | | - | 25000 | µC |
| $I_{GQM}$ | Peak reverse gate current | | - | 950 | A |

## RELIABILITY

| | **Conditions** | **Limit** | **Units** |
|---|---|---|---|
| DC blocking reliability | $V_{dc}$ = 3500V, $T_j$ = -40 to + 125°C, ambient cosmic radiation at sea level, in open air, 100% duty cycle. | 100 | FIT |

## CURVES

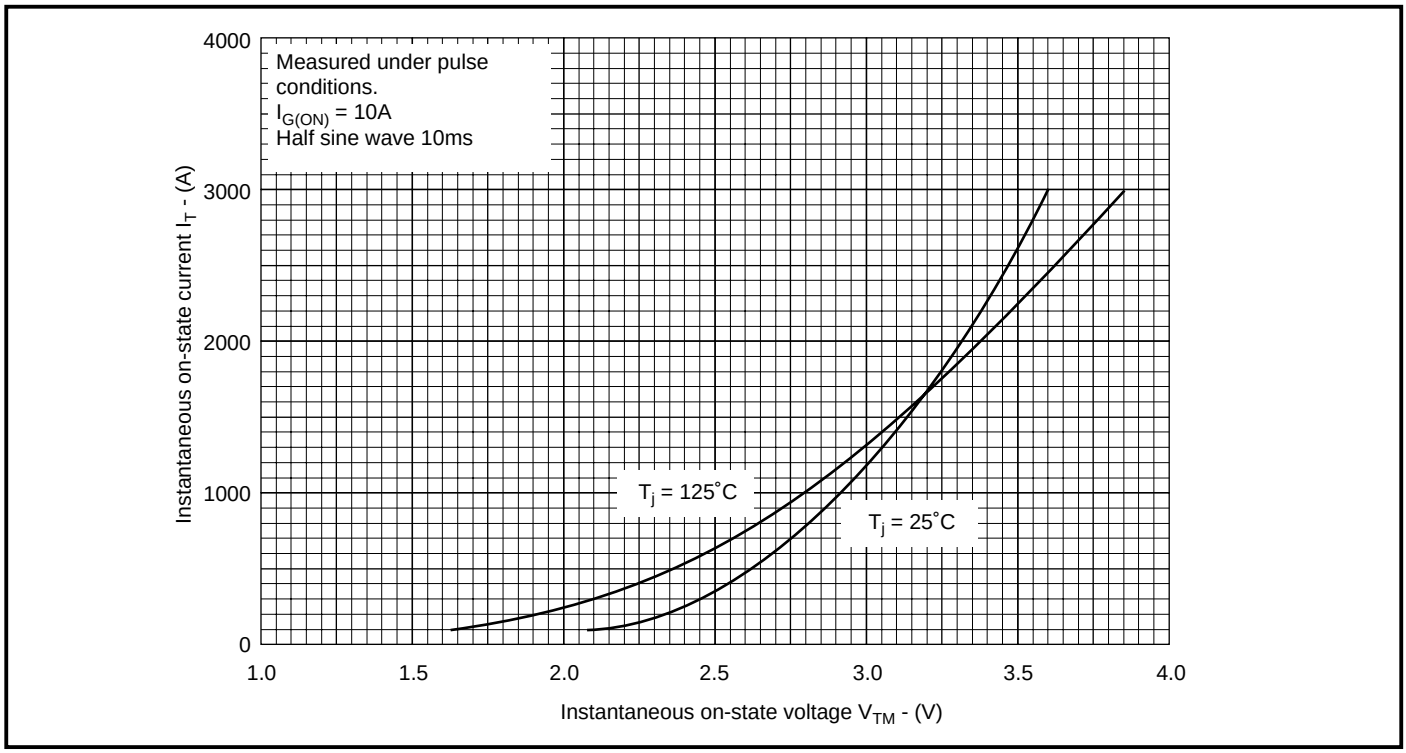
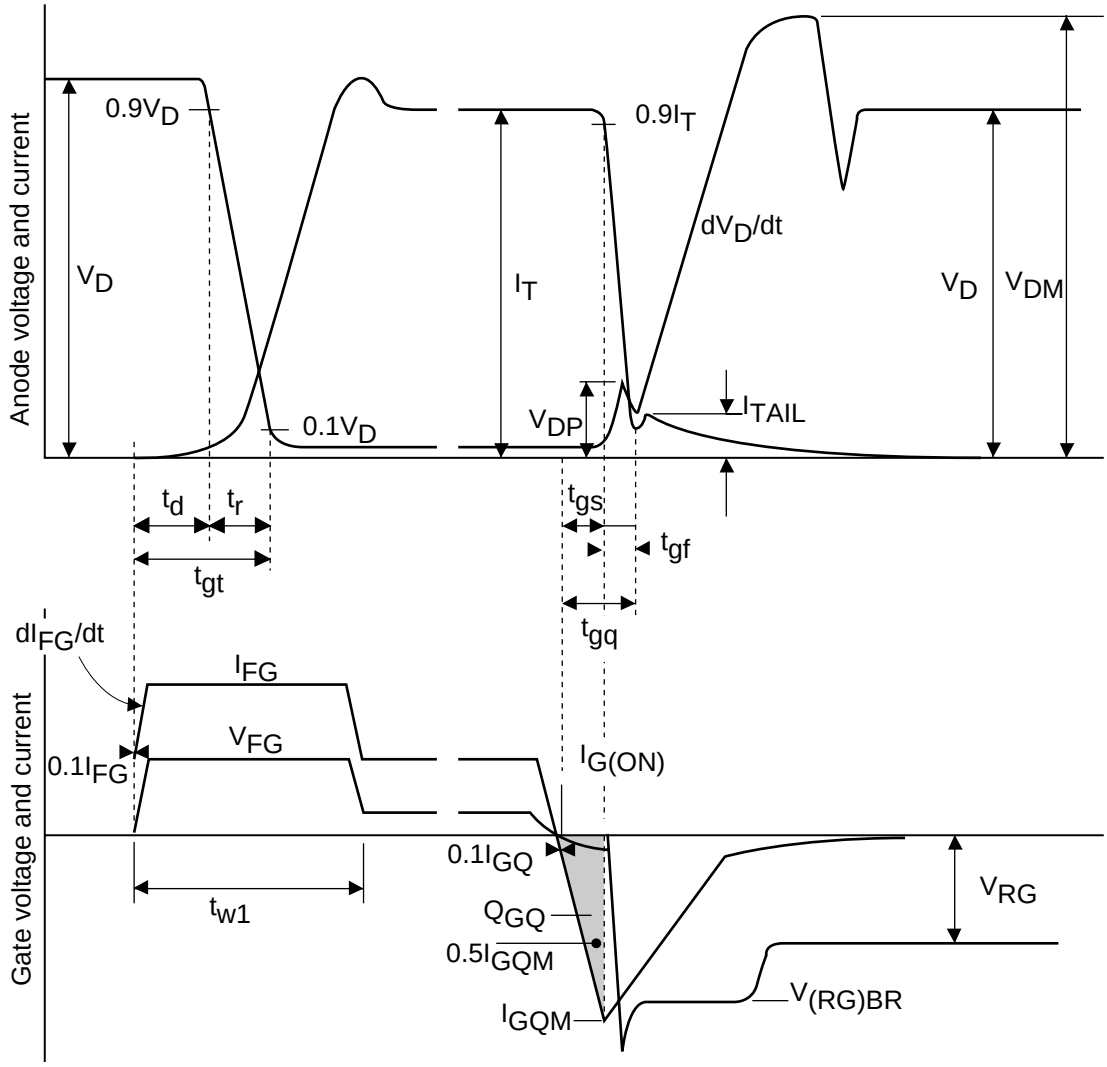



**Figure 2. On-state characteristics**



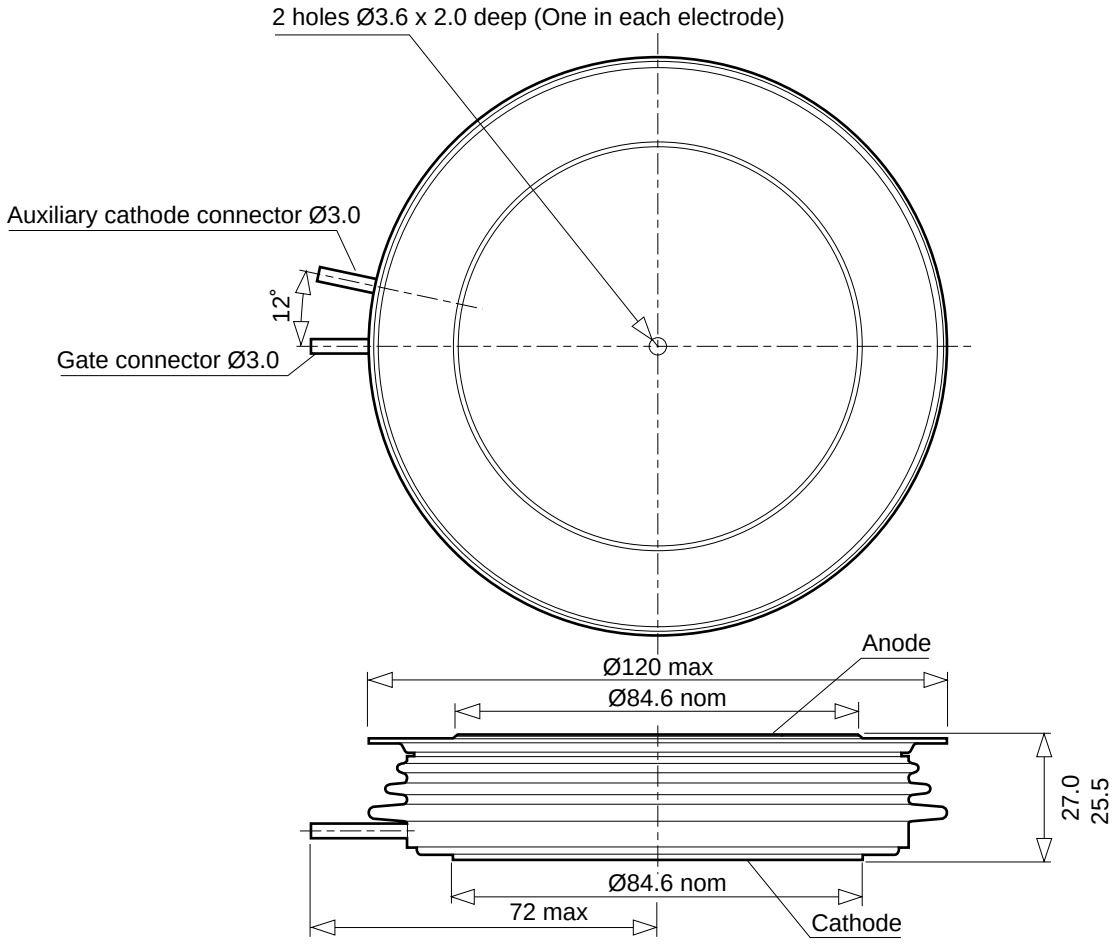

Recommended gate conditions:
$I_{TCM}$ = 3000A
$I_{FG}$ = 40A
$I_{G(ON)}$ = 10A d.c.
$t_{w1(min)}$ = 20µs
$I_{GQM}$ = 1200A
$di_{GQ}/dt$ = 40A/µs
$Q_{GQ}$ = 12500µC
$V_{RG(min)}$ = 2V
$V_{RG(max)}$ = 18V

These are recommended Dynex Semiconductor conditions. Other conditions are permitted according to users gate drive specifications.

**Figure 3. General switching waveforms**

## PACKAGE DETAILS

For further package information, please contact Customer Services. All dimensions in mm, unless stated otherwise. DO NOT SCALE.




Nominal weight: 1700g

**Package outline type code: W**

## POWER ASSEMBLY CAPABILITY

The Power Assembly group was set up to provide a support service for those customers requiring more than the basic semiconductor, and has developed a flexible range of heatsink and clamping systems in line with advances in device voltages and current capability of our semiconductors.

We offer an extensive range of air and liquid cooled assemblies covering the full range of circuit designs in general use today. The Assembly group offers high quality engineering support dedicated to designing new units to satisfy the growing needs of our customers.

Using the latest CAD methods our team of design and applications engineers aim to provide the Power Assembly Complete Solution (PACs).

## HEATSINKS

The Power Assembly group has its own proprietary range of extruded aluminium heatsinks which have been designed to optimise the performance of Dynex semiconductors. Data with respect to air natural, forced air and liquid cooling (with flow rates) is available on request.

For further information on device clamps, heatsinks and assemblies, please contact your nearest sales representative or Customer Services.

Stresses above those listed in this data sheet may cause permanent damage to the device. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture of the package. Appropriate safety precautions should always be followed.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