

SYMBOLLOGY

1. Power semiconductor devices, general use

Symbol	Parameter	Definition/description
R _{th}	Thermal resistance	Defined when junction power dissipation results in a balanced state of thermal flow. Specifies the degree of temperature rise per unit of power, measuring junction temperature from a specified external point.
R _{th(j-a)}	Thermal resistance (junction to ambient)	The thermal resistance between the junction and ambient atmosphere.
R _{th(j-c)}	Thermal resistance (junction to case)	The thermal resistance between the junction and surface of the case.
R _{th(j-f)}	Thermal resistance (junction to fin)	The thermal resistance between the junction and the fin.
R _{th(c-f)}	Thermal resistance (case to fin) (Contact thermal resistance)	The thermal resistance between the surface of the case and the fin.
Z _{th(t)}	Transient thermal impedance	Defined when case temperature (stud temperature) is constant, and power dissipation at the junction is pulsating. Specifies the degree of temperature rise per unit of power, measuring junction temperature from a specified external point.
Z _{th(j-a)}	Transient thermal impedance (junction to ambient)	The transient thermal impedance between the junction and ambient atmosphere.
Z _{th(j-c)}	Transient thermal impedance (junction to case)	The transient thermal impedance between the junction and surface of the case.
Z _{th(j-f)}	Transient thermal impedance (junction to fin)	The transient thermal impedance between the junction and the fin.
T _a	Ambient temperature	When used in the natural cooling or forced-air cooling, it is the temperature of the surrounding atmosphere of a device which is dependent on geographical location and season, and is not influenced by heat dissipation of the device.
T _f	Fin temperature	The temperature at a specified point of the device heatsink.
T _c	Case temperature	The temperature at a specified point of the device case.
T _j	Junction temperature rating	The device junction temperature rating. Indicates the maximum and minimum allowable operation temperatures.
T _{stg}	Storage temperature rating	The device storage temperature (with no electrical connection). Indicates the maximum and minimum allowable temperatures.
—	Mounting torque rating	The maximum allowable torque specification for mounting the heatsink to the stud type device.
—	Mounting force required rating	The maximum allowable pressure applicable when mounting the heatsink to the press pack type device.

2. Rectifier diodes

Symbol	Parameter	Definition/description
V _{RRM}	Repetitive peak reverse voltage	Within the rated junction temperature range, specifies the repetitive peak reverse voltage applicable for each cycle. Includes the maximum instantaneous value for repetitive transient reverse voltage, but excludes non-repetitive transient reverse voltage.
V _{RSM}	Non-repetitive peak reverse voltage	Within the rated junction temperature range, specifies the non-repetitive peak reverse voltage applicable for a time width equivalent to less than a half of a sine wave at commercial frequency. Indicates the maximum instantaneous value for non-repetitive transient reverse voltage.
V _{R(DC)}	DC reverse voltage	The maximum value for DC voltage applicable in the reverse direction, specified within the rated junction temperature range.
V _{FM}	Forward voltage	At specified case (or point) temperature, and when forward current (commercial frequency, sine wave of specified amplitude) is applied to the device, indicates the peak-value for the resulting voltage drop.
I _{F(RMS)}	RMS forward current	At specified case (or point) temperature, indicates the RMS value for forward current that can be continuously applied to the device.
I _{F(AV)}	Average forward current	At specified case (or point) temperature, and with the device connected to a resistive or inductive load, indicates the average value for forward current (sine half wave, commercial frequency) that can be continuously applied to the device.
I _{FSM}	Surge forward current	Within the rated junction temperature range, indicates the peak value for non-repetitive forward current (sine half wave, commercial frequency), this value is defined at one cycle or the function of cycles.
I ² _t	Current-squared, time integration	Indicates peak value for surge forward current rating as the square of a half of a current sine wave, time integrated over a half of a cycle. $I^2_t = \int_0^{\frac{\pi}{\omega}} I_{FSM}^2 \sin^2 \omega t \, dt$
I _{RRM}	Repetitive peak reverse current	At maximum rated junction temperature, indicates the peak-value for repetitive current flow when a voltage (sine half wave commercial frequency, and having a peak-value as specified for repetitive peak reverse voltage) is applied in a reverse direction to the device.

Symbol	Parameter	Definition/description
QRR	Reverse recovery charge	Indicates the total amount of reverse recovery charge due to current integrated time in a reverse direction (as part of the internally stored charge). Specified at a certain junction temperature, and current which has decreased at a specified rate of decrease, from the forward state to reverse after a certain forward current are applied.

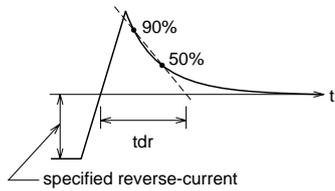
3. Gate turn-off thyristors

Symbol	Parameter	Definition/description
VRRM	Repetitive peak reverse voltage	Within the rated junction temperature range, and when there is no signal between the gate and cathode, specifies the repetitive peak reverse voltage applicable on each cycle.
VRSM	Non-repetitive peak reverse voltage	Within the rated junction temperature range, and when there is no signal between the gate and cathode, specifies the non-repetitive peak reverse voltage applicable for time width equivalent to less than a half of a sine wave at commercial frequency.
VR(DC)	DC reverse voltage	Within the rated junction temperature range, and when there is specified reverse bias conditions between the gate and cathode, specifies the maximum value for DC voltage applicable in reverse direction.
VDRM	Repetitive peak off-state voltage	Within the rated junction temperature range, and when there is specified reverse bias conditions between the gate and cathode, specifies the repetitive peak off-state voltage applicable for each cycle. Includes the maximum instantaneous value for repetitive transient off-state voltage.
VDSM	Non-repetitive peak off-state voltage	Within the rated junction temperature range, and when there is specified reverse bias conditions between the gate and cathode, specifies the non-repetitive peak off-state voltage applicable for time width equivalent to less than a half of a sine wave at commercial frequency. Indicates the maximum instantaneous value for non-repetitive transient off-state voltage.
VD(DC)	DC off-state voltage	Within the rated junction temperature range, and when there is specified reverse bias conditions between the gate and cathode, specifies the maximum value for DC voltage applicable in forward direction.
dv/dt	Critical rate of rise of off-state voltage	At maximum rated junction temperature, and when there is specified reverse bias conditions between the gate and cathode, specifies the maximum rate-of-rise of off-state voltage that will not cause the device change from an off-state to an on-state when an exponential function waveform off-state voltage of specified amplitude is applied to the device, $\frac{dv}{dt} = \frac{0.632V_D}{\tau}$ Here, V_D : Specified off-state voltage τ : Time constant for the exponential function waveform
V _{TM}	On-state voltage	At specified case (or point) temperature, and when on-state current (commercial frequency, half sine wave of specified amplitude) is applied to the device, indicates peak value for the resulting voltage drop.
I _{T(RMS)}	RMS on-state current	At specified case (or point) temperature, indicates the RMS value for on-state current that can be continuously applied to the device.
I _{T(AV)}	Average on-state current	At specified case (or point) temperature, and with the device connected to a resistive or inductive load, indicates the average value for forward current (sine half wave, commercial frequency) that can be continuously applied to the device.
I _{TSM}	Surge (non-repetitive) on-state current	Within the rated junction temperature range, indicates the peak value for non-repetitive on-state current (sine half wave, commercial frequency). This value is defined at one cycle, or as a function of multiple cycles.
I _{T²}	Current-squared, time integration	Indicates peak value for surge-on current as the square of a half of a current sine wave, time integrated over a half of a cycle. $I_{T^2} = \int_0^{\frac{\pi}{\omega}} I_{TSM}^2 \sin^2 \omega t dt$
I _{TM(OV)}	Overload on-state current	Tested under specified cooling conditions, and after the device is continuously conducting an on-state current of specified value, but less than that of the average on-state current rating. The value indicated is the average overload on-state current (commercial frequency, sine half wave) conducted for a specified time immediately after attaining the above conditions, when the test current is removed, and the device is allowed to regain thermal balance, with rated operating voltage applied, it should again conducted the overload current.
diT/dt	Critical rate-of-rise of on-state current	At specified case (or point) temperature, specified off-state voltage, specified gate conditions, and at a frequency of less than 60Hz, indicates the maximum rate-of-rise of on-state current which the thyristor will withstand after switching from an off-state to an on-state.
I _H	Holding current	At specified junction temperature, gate conditions and off-state voltage, indicates the minimum anode current required to hold the thyristor in an on-state.
I _L	Latching current	At specified junction temperature, off-state voltage and gate conditions, and when the gate trigger current is lifted immediately following switching from an off-to on-state, indicates the minimum anode current required to hold the thyristor in an on-state.

Gate turn-off thyristors

Symbol	Parameter	Definition/description
IRRM	Repetitive peak reverse current	At maximum rated junction temperature, indicates the peak value for reverse current flow when a voltage (sine half wave, commercial frequency, and with a peak value as specified for repetitive peak reverse voltage rating) is applied in a reverse direction to the device.
IDRM	Repetitive peak off-state current	At maximum rated junction temperature, indicates the peak value for off-state current flow when a voltage (sine half wave, commercial frequency, and with a peak value as specified for repetitive peak off-state voltage rating) is applied in a forward direction to the device, at specified reverse bias conditions between the gate and cathode.
PFGM	Peak forward gate power dissipation	Within the rated junction temperature range, indicates the peak-value for maximum allowable power dissipation over a specified time period, when the device is forward-conducting between the gate and cathode.
PFG (AV)	Average forward gate power dissipation	Within the rated junction temperature range, indicates the peak-value for maximum allowable power dissipation when the device is forward-conducting between the gate and cathode.
IFGM	Peak forward gate current	Within the rated junction temperature range, indicates the peak-value for forward-current flow between the gate and cathode.
IRGM	Peak gate reverse current	At maximum rated junction temperature, indicates the peak-value for reverse gate current when the specified voltage is applied in a reverse direction between the gate and cathode.
VFGM	Peak forward gate voltage	Within the rated junction temperature range, indicates the peak-value for forward-voltage applied between the gate and cathode.
VRGM	Peak reverse gate voltage	Within the rated junction temperature range, indicates the peak-value for reverse-voltage applied between the gate and cathode.
IGT	Gate trigger current	At a junction temperature of 25°C, and with an off-voltage of 6V, and a specified load resistance, indicates the minimum gate DC current required to switch the thyristor from an off-state to an on-state. For small power devices, does not include current flow through the connected gate resistor.
VGT	Gate trigger voltage	At a junction temperature of 25°C, and with an off-voltage of 6V, and a specified load resistance, indicates the minimum gate DC voltage required to switch the thyristor from an off-state to an on-state.
VGD	Gate non-trigger voltage	At maximum rated junction temperature, and with a specified off-state voltage applied to the device, indicates the maximum gate DC voltage which will not switch the device from an off-state to an on-state.
PT	On-state power dissipation	At a specified conducting angle, and with on-current of specified waveform applied to the device, indicates the average value for internal power dissipation occurring over a one-cycle interval.
PRGM	Peak reverse gate power dissipation	Within the rated junction temperature range, indicates the peak-value for maximum allowable power dissipation in the reverse direction between the gate and cathode, over a specified time period.
PRG	Average reverse gate power dissipation	Within the rated junction temperature range, indicates the average value for maximum allowable power dissipation in the reverse direction between the gate and cathode.
IRG	Reverse gate current	Within the rated junction temperature range, indicates peak-value for reverse-current that can be conducted between the gate and cathode.
ITQRM	Repetitive controllable on-state current	Under specified conditions, indicates the instantaneous value for on-current usable in gate control, specified immediately prior to device turn-off.
IGQM	Peak gate turn-off current	Indicates the maximum instantaneous gate reverse-current required to switch the device from an on-state to an off-state.
tgt	Turn-on time	When applying forward-current to the gate, indicates the time required to switch the thyristor from an off-state to an on-state.
tgq	Turn-off time	When applying reverse-current to the gate, indicates the time required to switch the thyristor from an on-state to an off-state.
QGQ	Gate turn-off charge	The charge of turn off gate current calculated as an integrated time value from the initiation up the peak value of gate current.
Goff	Turn-off gain	The ratio of controllable on state current to gate reverse-current required for gate turn-off.
Eon	Turn on switching energy	Indicates the integration of multiplying anode current by anode voltage during the turn on period.
Eoff	Turn off switching energy	Indicates the integration of multiplying anode current by anode voltage during the turn off period (tail time included).
IR (AV)	Average reverse current	At a specified case (or point) temperature, and connected to a resistive or inductive load, indicates the average value for reverse-current (commercial frequency, sine half wave), Note that no on-state current is allowed.
IR (rms)	RMS reverse current	At specified case (or point) temperature, indicates the rms value for reverse-current that the device can continuously conduct. Note that no on-state current is allowed.
IRSM	Surge reverse current	Within the rated junction temperature range, indicates the peak-value for a non-repetitive reverse-current (commercial frequency, half sine wave) . This value indicated for one cycle, or as a function of a number of cycles. Note that no on-state current is allowed.

Gate turn-off thyristors (continued)

Symbol	Parameter	Definition/description
I_{R^2t}	Reverse current-squared, time integration	Indicates peak-value for reverse current rating as the square of a half of a current sine wave, time integrated over a-half of a current sine wave, time integrated over a half of a cycle. Note that no on-state current is allowed. $I_{R^2t} = \int_0^{\frac{\pi}{\omega}} I_{RSM}^2 \sin^2 \omega t dt$
R_{thj-f} (diode)	Thermal resistance	The thermal resistance between the junction and fin of diode part.
V_{RM}	Reverse voltage	At specified case (or point) temperature, and when reverse current (commercial frequency, half sine wave of specified peak value) is applied to the device, indicates peak value for the resulting voltage drop for RC-GTO.
Q_{dr}	Off state recovery charge	At maximum rated junction temperature, and conducting a specified reverse-current, indicated as the integrated time value of off-state recovery current foow in the positive direction at the time the device is forced into an off-state by the reverse-current decreaseing at specified rate-of-fall of reverse current.
t_{dr}	Off state recovery time	At maximum rated junction temperature, and conducting the specified reverse-current, indicates following time. 
E_{dr}	Off state recovery energy	At maximum rated junction temperature, and conducting the specified reverse-current, indicates the integration of multiplying off-state current by off state voltage at the time the device is forced into an off-state.