

Letter Symbols and Terms

a	Maximum acceleration under vibration	I_{CSat}	Collector current for V_{CEsat} test
b	Width of the module base	I_{CRM}	Repetitive peak collector current
B2	Two-pulse bridge connection	I_d	Direct output current (of a rectifier connection)
B6	Six-pulse bridge connection	I_D	(Direct) off-state current (thyristors)
C_{CHC}	Capacitance chip-case (baseplate)	I_D	Maximum direct output current of the complete circuit (bridge circuits)
C_{ies}	Input capacitance, output short-circuited (IGBT)	I_D	Continuous drain current (MOSFETs)
C_{iss}	Input capacitance, output short-circuited (MOS)	I_{DC}	Continuous direct current (diode)
C_j	Junction capacitance	I_{DCL}	Direct output current with capacitive load (limiting value)
C_{max}	Maximum value of reservoir capacitor (for greater values of capacitance the recommended current must be reduced)	I_{DD}	Direct off-state current
cont	Continuous direct current	I_{DM}	Peak value of a pulsed drain current
$C_{oes}; C_{oss}$	Output capacitance, input shorted (IGBT, MOS)	I_{DR}	Continuous reverse drain current (inverse diode forward current)
C_{ps}	Coupling capacitance between the primary winding and each secondary winding	I_{DRM}	Pulsed reverse drain current, peak value (pulsed inverse diode forward current)
$C_{res}; C_{rss}$	Reverse transfer capacitance (Miller capacitance) (IGBT; MOSFET)	I_{DSS}	Zero gate voltage drain current (gate shorted)
D	Duty cycle. $D = f \cdot t_p$	I_E	Continuous emitter current
$\varnothing D$	Contact diameter of capsule devices	i_F	Forward current (instantaneous value)
$(di/dt)_{cr}$	Critical rate of rise of on-state current	I_F	Forward current
$- di_D/dt$	Rate of fall of the drain current (MOSFET)	$I_{F(OV)}$	Overload forward current
$- di_F/dt$	Rate of fall of the forward current (diode)	I_{FAV}	Mean forward current
di_G/dt	Rate of rise of gate current	$I_{FAV(B)}$	Mean basic load current
$- di_T/dt$	Rate of fall of the on-state current (thyr.)	I_{FCL}	Mean forward current with capacitive load
di_T/dt	Rate of rise of on-state current (thyr.)	I_{FM}	Peak forward current
$(dv/dt)_{cr}$	Critical rate of rise of off-state voltage	I_{FN}	Recommended mean forward current
DSC	Double sided cooling	I_{FRM}	Repetitive peak forward current
E_{cond}	Energy dissipation during conduction time	I_{FRMS}	RMS forward current
ED	Intermittend duty	I_{FSM}	Surge forward current
e.m.f.	Electromotoric force (back e.m.f.) = generated voltage of a rotating machine	I_{FWM}	Peak forward working current
E_{off}	Energy dissipation during turn-off time	I_G	Gate current
E_{on}	Energy dissipation during turn-on time	I_{GD}	Gate non-trigger current
E_{rr}	Energy dissipation during reverse recovery (diode)	I_{GES}	Gate-emitter leakage current, collector emitter short-circuited
f	Operating frequency, pulse frequency	I_{Goff}	Output current (peak) max. for switch-off (driver)
f_G	Maximum frequency	I_{Gon}	Output current (peak) max. for switch-on (driver)
F	Mounting force	I_{GSS}	Gate-source leakage current, drain-source short-circuited
Fu	Recommended fuse (fast acting)	I_{GT}	Gate trigger current
g_{fs}	Forward transconductance	I_H	Holding current
I_{AOmax}	Max. output current (driver)	I_{iH}	Input signal current (HiGH)
I_C	Continuous collector current	I_L	Latching current
I_{CES}	Collector-emitter cut-off current with gate-emitter short-circuited	I_M	Highest peak current obtainable at a rise time lower than 1 μs (pulse transformers)
$I_{CETRIIP}$	Max. I_{CE} to trip ERROR (SKiiP)	I_N	Recommended direct output current with resistive load
I_{CM}	Peak collector current	I_{NCL}	Recommended direct output current with capacitive load
I_{Cp}	Non-repetitive peak collector current		

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I_{NRMS}	Nominal r.m.s. current (of a fuse)	Δ_p	Pressure drop
I_{outAV}	Output average current (driver)	P	Power dissipation of one component
I_R	Reverse current	P_{AV}	Maximum permissible permanent power dissipation average value
I_{RO}	Reverse current for calculating the reverse power dissipation	P_D	Power dissipation
I_{RD}	Direct reverse current	P_{FAV}	Mean forward power dissipation (diodes)
I_{RM}	Peak reverse recovery current	P_{FM}	Peak forward power dissipation
I_{rms}	Alternating output current (of an a.c. controller connection)	P_G	Peak gate power dissipation
I_{RMS}	Maximum rated r.m.s. current of a complete a.c. controller connection	P_R	Reverse power dissipation
i_{rr}	Reverse recovery current (measuring condition for t_f and t_{rr})	P_{RAV}	Mean reverse power dissipation (thyr.)
I_{RRM}	Peak reverse recovery current	P_{RRM}	Peak repetitive reverse power dissipation
I_{RSM}	Maximum permissible non-repetitive peak reverse current (avalanche diodes)	P_{RSM}	Non-repetitive peak reverse power dissipation
I_S	Supply current primary side	P_{TAV}	Mean on-state power dissipation (thyristor)
I_{SO}	Supply current primary side (driver) at no load	P_{TOT}	} Total power dissipation
i_T	On-state current (instantaneous value)	P_{VTOT}	
I_T	(Direct) on-state current	p_w	
I_{TAV}	Mean on-state current	Q_f	Charge recovered during the reverse current fall time
I_{TM}	Peak on-state current	Q_{gel}	Gate charge (IGBT)
$I_{T(OV)}$	Overload on-state current	Q_{gsl}	Gate-source charge (MOSFET)
I_{TRMS}	RMS on-state current	Q_{rr}	Recovered charge
I_{TSM}	Surge on-state current	R	Number of rows of heatsinks one on top of the other
i^2t	i^2t value	RC	Recommended snubber network
\hat{I}	Peak pulse current (IEC standard pulse 8 x 20 μ s)	r_{CE}	On-state slope resistance (IGBT)
I_Z	Tail current (IGBT)	R_{CE}	Resistor for V_{CE} monitoring
K	Factor from the relation $Z_{thjc} \cdot R_{thjc}$	$R_{DS(on)}$	Drain-source on-resistance (MOSFET)
L	External collector inductance	rec ...	Rectangular current waveform
l	Length of the heatsink profile	rec. 120	Rectangular pulses, 120° conduction angle
L_{CE}	Parasitic collector-emitter inductance	R_{EX}	Auxiliary emitter series resistor (parallel IGBT)
L_{DS}	Parasitic drain-source inductance	R_G	Gate circuit resistance
L_{ext}	External circuit inductance (short circuit)	R_{Goff}	External gate series resistor at switch-off (MOSFET, IGBT)
L_p	Inductance of the primary winding at 1 kHz	R_{Gon}	External gate series resistor at switch-on (MOSFET, IGBT)
L_{SS}	Parasitic inductance (sec. stray inductance)	R_{GS}	Gate-source resistance (MOSFET)
M	Mounting torque	R_L	Load resistance for measuring t_r and I_M (pulse transformer)
M_1	Torque for mounting the semiconductor to the heatsink	R_{min}	Recommended series resistor for capacitive loads (source resistance included in this value)
M_2	Torque for mounting the busbars to the semiconductor	R_p	Recommended parallel resistor for use with series connection
M_{ac}	Mounting torque for AC terminals	R_p	D.C. resistance of the primary winding
M_{dc}	Mounting torque for DC terminals	rpm	Revolutions per minute
n	Number of semiconductor components (modules) on a common heatsink	RS	D.C. resistance of each secondary winding
n	Number of load cycles	r_T	On-state slope resistance, forward slope resistance (thyristor, diodes)
N	Maximum number of series connected silicon elements	R_{TD}	Resistor for interlock dead time (driver)
N_p/N_s	Ratio of windings primary to secondary		

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R_{thca}	Thermal resistance case to ambient air	$t_{pdon-err}$	Propagation delay time on ERROR
R_{thch}	Contact thermal resistance case to heatsink ¹⁾	t_{pRESET}	Min. pulse width ERROR memory RESET time
R_{thcw}	Thermal resistance case to cooling water	t_q	Circuit commutated turn-off time (thyristor)
R_{thha}	Thermal resistance heatsink to ambient air	t_r	Rise time
R_{thja}	Thermal resistance junction to ambient air	t_R	Reverse blocking time: $t_R = t_c - t_p$
R_{thjc}	Thermal resistance junction to case	T_{ref}	Reference point temperature
$R_{(thjc)p}$	Thermal resistance junction to case under pulse conditions	t_{rr}	Reverse recovery time
R_{thjr}	Thermal resistance junction to reference point	t_{sp}	Cycle time
R_{thjoi}	Thermal resistance junction to oil	T_{stg}	Storage temperature range
R_{thjw}	Thermal resistance junction to cooling water	T_{tp}	Over temperature protection (SKiiP)
R_{thmw}	Thermal resistance thermal trip-cooling water	T_{vj}	Virtual junction temperature
sin...	Sinusoidal current waveform	T_w	Water temperature
sin. 180	Half sinewaves, 180° conduction angle	t_z	Tail time (IGBT)
SSC	Single sided cooling	$\int vdt$	Voltage-time integral at no load
t	Time	v_{air}	Air velocity
T_{amb}	Ambient temperature	V_{air}	Air volume
T_{btt}	Switching temperature of the attached bimetal thermal trip	$V_{air/t}$	Air flow
t_c	Period (cycle) duration	$V_{(BR)}$	Avalanche breakdown voltage
T_{case}	Case temperature	$V_{(BR)CES}$	Collector-emitter breakdown voltage, gate-emitter short circuited
t_{cond}	Conducting time	$V_{(BR)DSS}$	Drain-source breakdown voltage, gate-source short circuited
t_d	Delay time	V_{CC}	Collector-emitter supply voltage
$t_{d(err)}$	ERROR input-output propagation delay time (driver)	V_{CE}	Collector-emitter (direct) voltage
$t_{d(off)}$	Turn-off delay time	$V_{CEclamp}$	Collector-emitter clamping voltage during turn-off
$t_{d(off)io}$	Input-output turn-off propagation delay time (driver)	V_{CES}	Collector-emitter (direct) voltage with base-(gate-)emitter short-circuited
$t_{d(on)}$	Turn-on delay time	V_{CEsat}	Collector-emitter saturation voltage
$t_{d(on)io}$	Input-output turn-on propagation delay time (driver)	$V_{CE(TO)}$	Collector-emitter threshold voltage (static)
T_{err}	Max. temperature for setting ERROR	V_{CEstat}	Collector-emitter threshold static monitoring voltage
t_e	On-time	V_{CEdyn}	Collector-emitter threshold dynamic monitoring voltage
t_f	Reverse current fall time (diode)	V_{cond}	Drain-source (collector-emitter-)voltage in the conducting state
t_f	Fall time	V_D	Direct output voltage (bridge rectifier)
t_{fr}	Forward recovery time	V_D	(Direct) off-state voltage (thyristor)
t_{gd}	Gate controlled delay time	V_{DD}	Direct off-state voltage (thyristor)
t_{gr}	Gate controlled rise time	V_{DD}	Drain-source supply voltage (MOSFET)
T_h	Heatsink temperature	V_{DGR}	Drain-gate voltage with specified input resistance
t_{if}	current fall time	V_{DRM}	Repetitive peak off-state voltage
t_{ir}	current rise time	V_{DS}	Drain-source voltage
T_j	Junction temperature	V_{EE}	Emitter supply voltage
T_{oil}	Oil temperature (at the hottest place) during operating in insulating oil	v_F	Forward voltage (instantaneous value)
t_{off}	Turn-off time	V_F	(Direct) forward voltage
t_{on}	Turn-on time	V_G	Gate voltage
T_{op}	Operating temperature range	V_{GD}	Gate non-trigger voltage
t_p	Pulse duration		

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V_{GE}	Gate-emitter voltage	$V_{(TO)}$	} Threshold voltage
V_{GES}	Gate-emitter voltage, collector-emitter short-circuited	$V_{T(TO)}$	
$V_{GE(th)}$	Gate-emitter threshold voltage	V_{UVS}	
$V_{G(off)}$	Turn-off gate voltage output	V_v	Alternating line voltage (r.m.s.)
$V_{G(on)}$	Turn-on gate voltage output	V_{VRMS}	Alternating input voltage (r.m.s. value)
V_{GS}	Gate-source voltage	V_w	Water volume
$V_{GS(th)}$	Gate-source threshold voltage	V_{WW}	Maximum alternating working voltage between windings (r.m.s. value) (pulse transformer)
V_{GT}	Gate trigger voltage		
V_{iH}	Input signal voltage (HIGH) max.	w	Weight
V_{ISOL}	Insulation test voltage (r.m.s.)	W1	Single phase a.c. controller connection
$V_{ISOL_{IO}}$	Isolation test voltage (r.m.s. / 1 min.) input-output (driver)	W3	Three phase a.c. controller connection
$V_{ISOL_{12}}$	Isolation test voltage (r.m.s. / 1 min.) output1 - output 2 (driver)	W_{cond}	Energy dissipation during the conducting time
V_{iT+}	Input threshold voltage (HIGH) min.	W_F, E_F	Forward energy dissipation
V_{iT-}	Input threshold voltage (LOW) max.	W_{off}, E_{off}	Energy dissipation during the turn-off time
V_{ol_w}	Water volume per unit time	W_{on}, E_{on}	Energy dissipation during the turn-on time
V_{oH}	Logic HIGH output voltage (driver)	\hat{W}_p, \hat{E}_p	Maximum permissible non-repetitive peak pulse energy (rectangular pulse 2 ms)
V_{oL}	Logic LOW output voltage (driver)	Z_{th}	Transient thermal impedance
\hat{V}_p	Peak pulse voltage	Z_{thca}	Transient thermal impedance case to ambient
V_R	(Direct) reverse voltage	Z_{thjc}	Transient thermal impedance junction to case
V_{RD}	Direct reverse voltage	Z_{thjcD}	Transient thermal impedance junction to case of the freewheeling diode (brake chopper IGBT module)
V_{RGM}	Peak reverse gate voltage	Z_{thjh}	Transient thermal impedance junction to heatsink
V_{RGO}	No-load reverse gate voltage	Z_{thha}	Transient thermal impedance heatsink to ambient air
V_{RRM}	Repetitive peak reverse voltage	$Z_{(th)p}$	Transient thermal impedance under pulse conditions
V_{RSM}	Non-repetitive peak reverse voltage	$Z_{(th)t}$	Transient thermal impedance
V_{RWM}	Crest working reverse voltage	$Z_{(th)z}$	Supplementary transient thermal impedance
V_S	Supply voltage primary (for gate driver)	Θ	Conduction angle
V_{S1}	Supply voltage stabilized		
V_{S2}	Supply voltage non stabilized		
V_{SD}	Negative source-drain voltage (inverse diode forward voltage)		
V_T	On-state voltage (instantaneous value)		
V_T	(Direct) on-state voltage (thyr.)		