

Data sheet TS-MT/339/21 Jun 22

5SEG 0540T1820

60Pak phase control thyristor / rectifier diode module

- $V_{DRM}, V_{RRM} = 1800\text{ V}$
- $I_{TAVm} = 522\text{ A}$
- $I_{TSM} = 14000\text{ A}$
- $V_{T0} = 0.867\text{ V}$
- $r_T = 0.420\text{ m}\Omega$
- Insulated baseplate by AlN ceramic
- Precision pressure contacts for high reliability
- Industry standard housing



Maximum rated values ¹⁾

Parameter	Symbol	Conditions	Min.	Max.	Unit
Repetitive peak off-state and reverse voltage	V_{DRM}, V_{RRM}	$T_j = -40 \div 135\text{ }^\circ\text{C}$ ²⁾		1800	V
Peak off-state current	I_{DM}	$V_D = V_{DRM}$		100	mA
Peak reverse current	I_{RM}	$V_R = V_{RRM}$		100	mA
Average on-state current	I_{TAVm}	half sine waveform, $f = 50\text{ Hz}$	$T_c = 70\text{ }^\circ\text{C}$	630	A
			$T_c = 85\text{ }^\circ\text{C}$	522	A
			$T_c = 100\text{ }^\circ\text{C}$	401	A
RMS on-state current	I_{TRMS}	half sine waveform, $f = 50\text{ Hz}$	$T_c = 70\text{ }^\circ\text{C}$	989	A
			$T_c = 85\text{ }^\circ\text{C}$	821	A
			$T_c = 100\text{ }^\circ\text{C}$	631	A
Non repetitive peak surge current	I_{TSM}	half sine pulse, $V_D = V_R = 0\text{ V}$	$t_p = 8.3\text{ ms}$	15000	A
			$t_p = 10\text{ ms}$	14000	A
Limiting load integral	I^2t	half sine pulse, $V_D = V_R = 0\text{ V}$	$t_p = 8.3\text{ ms}$	928000	A^2s
			$t_p = 10\text{ ms}$	980000	A^2s
Critical rate of rise of on-state current	$(di_T/dt)_{cr}$	$I_T = I_{TAVm}$, half sine waveform, $f = 50\text{ Hz}$, $V_D = 2/3 V_{DRM}$, $I_{GM} = 2\text{ A}$, $t_r = 0.3\text{ }\mu\text{s}$		200	$\text{A}/\mu\text{s}$
Critical rate of rise of off-state voltage	$(dv_D/dt)_{cr}$	$V_D = 2/3 V_{DRM}$		1000	$\text{V}/\mu\text{s}$
Isolation voltage	V_{isol}	RMS (base – terminals), sine waveform, $f = 50\text{ Hz}$, $T_j = 25\text{ }^\circ\text{C}$, $t = 1\text{ min}$		3600	V
Operating temperature range	$T_{jmin} - T_{jmax}$		-40	135	$^\circ\text{C}$
Storage temperature range	T_{STG}		-40	125	$^\circ\text{C}$

Unless otherwise specified $T_j = 135\text{ }^\circ\text{C}$

¹⁾ Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747

²⁾ De-rating factor of 0.13% V_{RRM} or V_{DRM} per $^\circ\text{C}$ is applicable for T_j below $25\text{ }^\circ\text{C}$

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	Min.	Max.	Unit
Maximum average gate power losses	P_{GAVm}			3	W
Peak gate current	I_{FGM}			10	A
Peak gate voltage	V_{FGM}			12	V
Reverse peak gate voltage	V_{RGM}			10	V

Unless otherwise specified $T_j = 135\text{ °C}$

¹⁾ Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747

Characteristic values

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Threshold voltage	V_{T0}				0.867	V
Slope resistance	r_T	$I_{T1} = 848\text{ A}, I_{T2} = 2545\text{ A}$			0.420	mΩ
Maximum peak on-state voltage	V_{TM}		$I_{TM} = 1\ 000\text{ A}$		1.290	V
			$I_{TM} = 1\ 500\text{ A}$		1.520	V
Holding current	I_H		$T_j = 25\text{ °C}$	120		mA
			$T_j = 135\text{ °C}$	100		mA
Latching current	I_L		$T_j = 25\text{ °C}$	700		mA
			$T_j = 135\text{ °C}$	400		mA
Gate trigger voltage	V_{GT}		$T_j = -40\text{ °C}$		4	V
			$T_j = 25\text{ °C}$		3	V
			$T_j = 135\text{ °C}$	0.25	2	V
Gate trigger current	I_{GT}	$V_D = 12\text{ V}, I_T = 4\text{ A}$	$T_j = -40\text{ °C}$		1000	mA
			$T_j = 25\text{ °C}$		500	mA
			$T_j = 135\text{ °C}$	10	300	mA
Delay time	t_{gd}	$T_j = 25\text{ °C}, V_D = 0.4\ V_{DRM}, I_{TM} = I_{TAVm}, I_{GM} = 2\text{ A}, t_r = 0.3\ \mu\text{s}$			2.0	μs
Turn-off time	t_q	$I_T = 1\ 000\text{ A}, di_T/dt = -10\text{ A}/\mu\text{s}, V_R = 100\text{ V}, V_D = 2/3\ V_{DRM}, dv_D/dt = 50\text{ V}/\mu\text{s}$		250		μs
Recovered charge	Q_{rr}	the same conditions as at t_q		2000		μC
Reverse recovery maximum current	I_{rRM}	the same conditions as at t_q		180		A

Unless otherwise specified $T_j = 135\text{ °C}$

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Mechanical properties

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Dimensions	L x W x H	Typical		150 x 60 x 52		mm
Mass	m			1.4		kg
Acceleration resistance	a				50	m/s ²
Mounting torques	M _s	Mounting torque (base - heatsink), M6 screws	5	6	7	Nm
	M _t	Mounting torque (main terminals), M10 screws	10	12	14	Nm
UL recognized		file no. E500543				

Electrical configuration, mechanical drawing

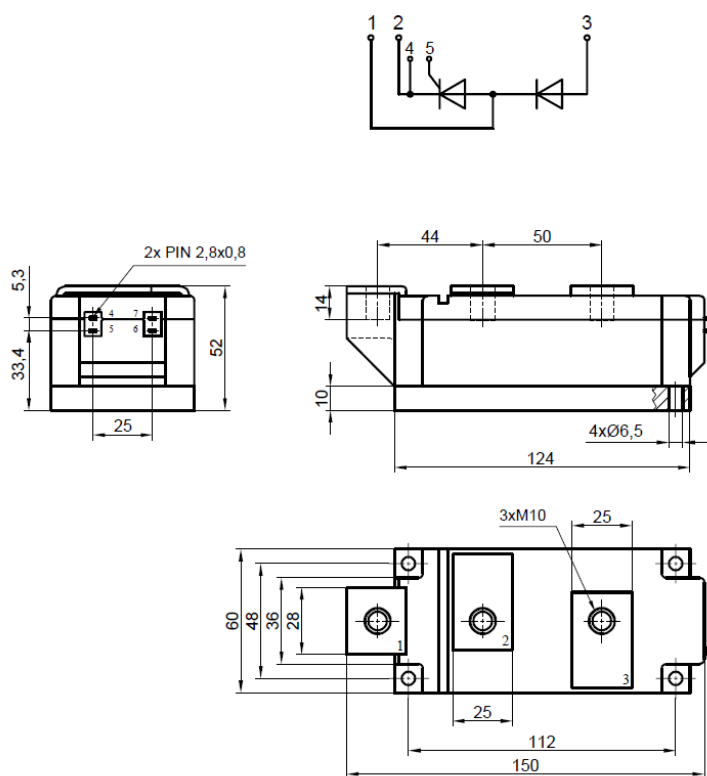


Fig. 1 Case

Note: all dimensions are shown in millimeters

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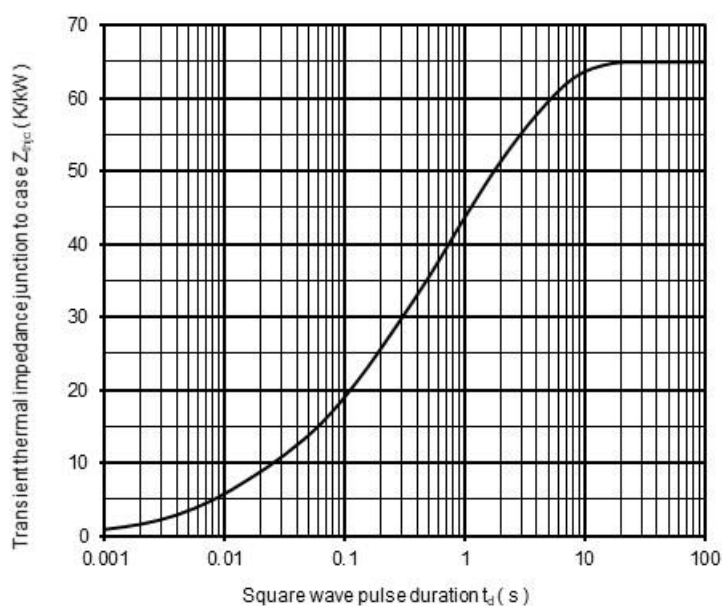
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Thermal properties

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal resistance junction to case	R_{thjc}	per arm			65.0	K/kW
		per module			32.5	K/kW
Thermal resistance case to heatsink	R_{thch}	per arm			20.0	K/kW
		per module			10.0	K/kW

Analytical function for transient thermal impedance

$$Z_{th(j-c)}(t) = \sum_{i=1}^n R_i (1 - e^{-t/\tau_i})$$



i	1	2	3	4
τ_i (s)	3.40	0.60	0.10	0.01
R_i (K/kW)	23.00	22.00	13.70	6.30

Correction for periodic waveforms

180°	sine	3.0	K/kW
120°	sine	4.7	K/kW
60°	sine	7.0	K/kW
180°	rectangular	4.8	K/kW
120°	rectangular	7.4	K/kW
60°	rectangular	12.0	K/kW

Fig. 2 Dependence transient thermal impedance junction to case on square pulse

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On-state and surge characteristics

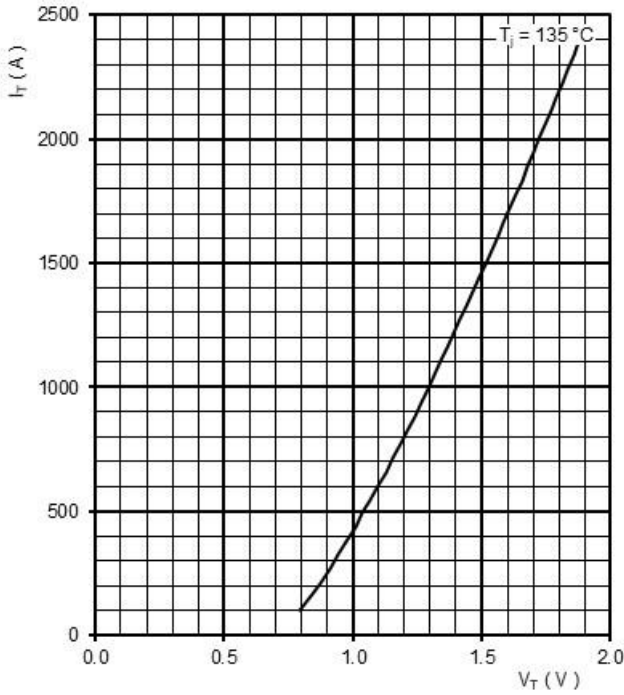


Fig. 3 Maximum on-state characteristics

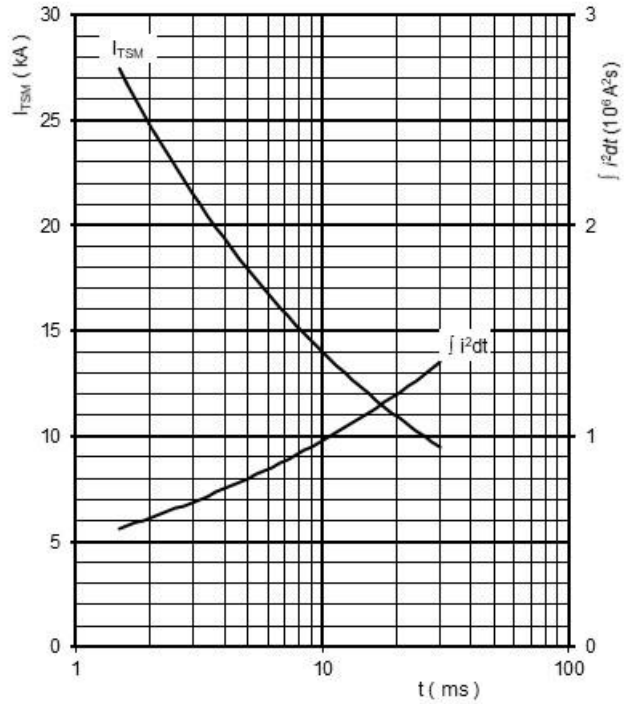


Fig. 4 Surge on-state current vs. pulse length, half sine wave, single pulse, $V_D = V_R = 0 \text{ V}$, $T_j = T_{jmax}$

Gate trigger characteristics

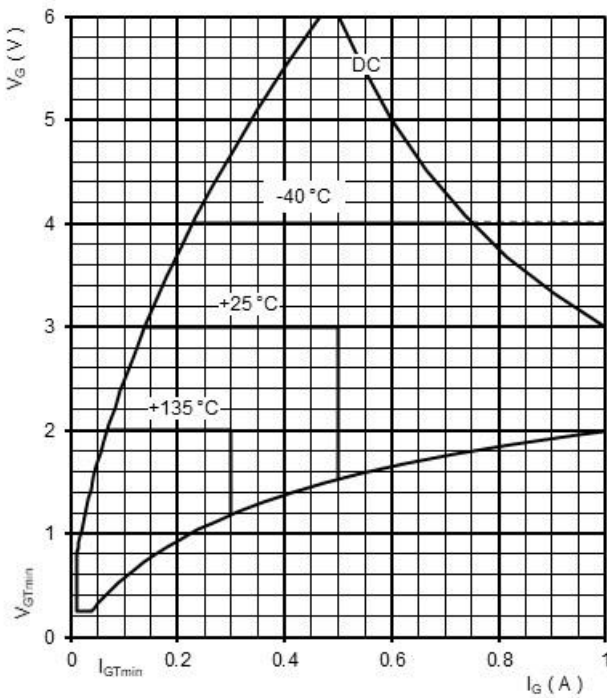


Fig. 5 Gate trigger characteristics

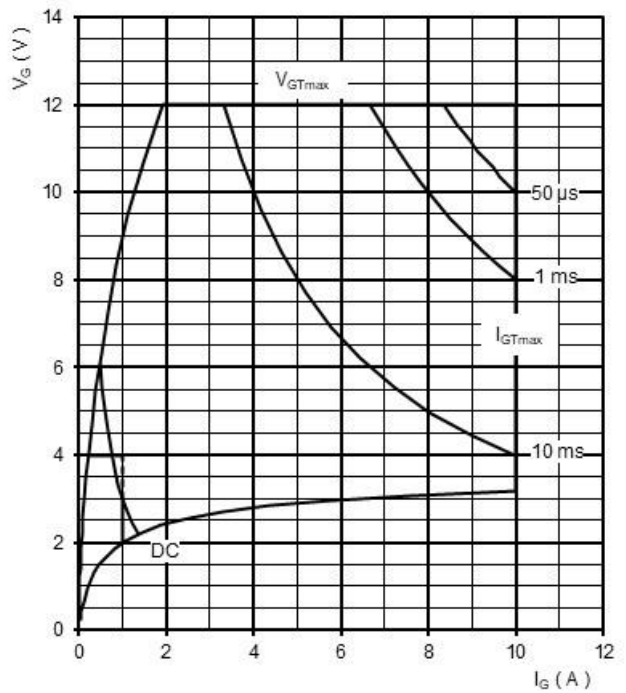


Fig. 6 Maximum peak gate power loss

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Power loss and maximum case temperature characteristics per arm

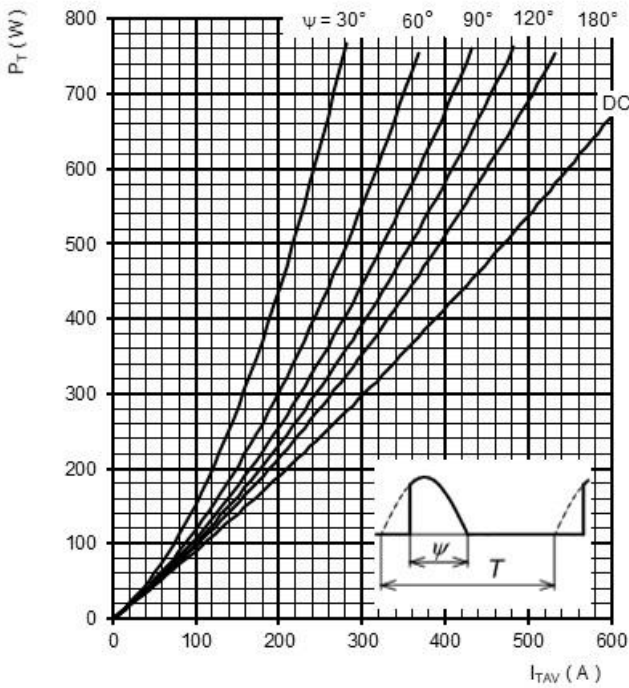


Fig. 7 On-state power loss vs. average on-state current, sine waveform, $f = 50 \text{ Hz}$, $T = 1/f$

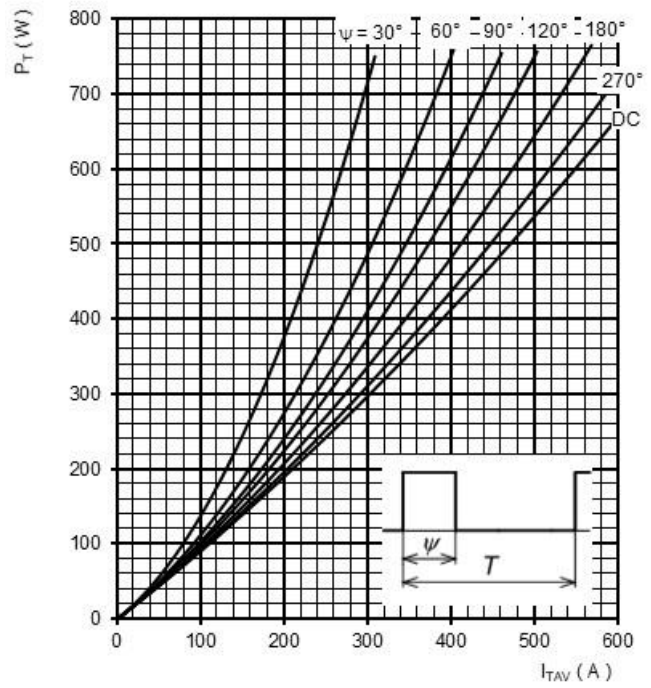


Fig. 8 On-state power loss vs. average on-state current, square waveform, $f = 50 \text{ Hz}$, $T = 1/f$

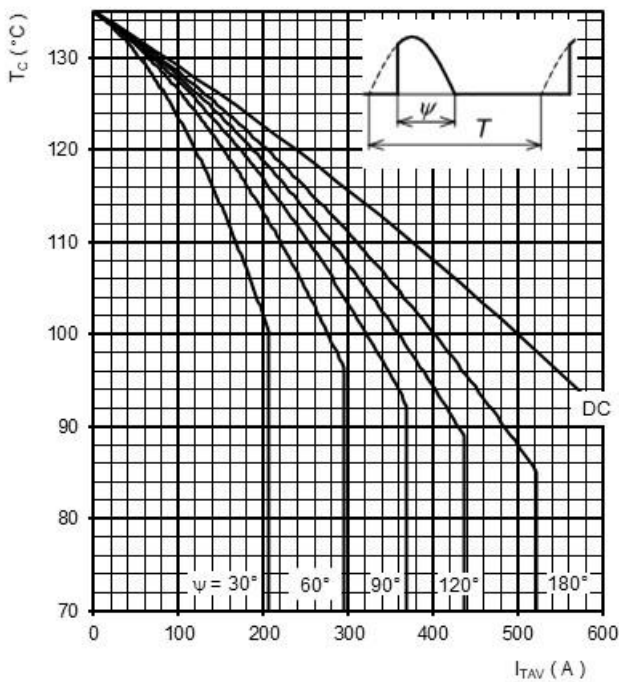


Fig. 9 Max. case temperature vs. aver. on-state current, sine waveform, $f = 50 \text{ Hz}$, $T = 1/f$

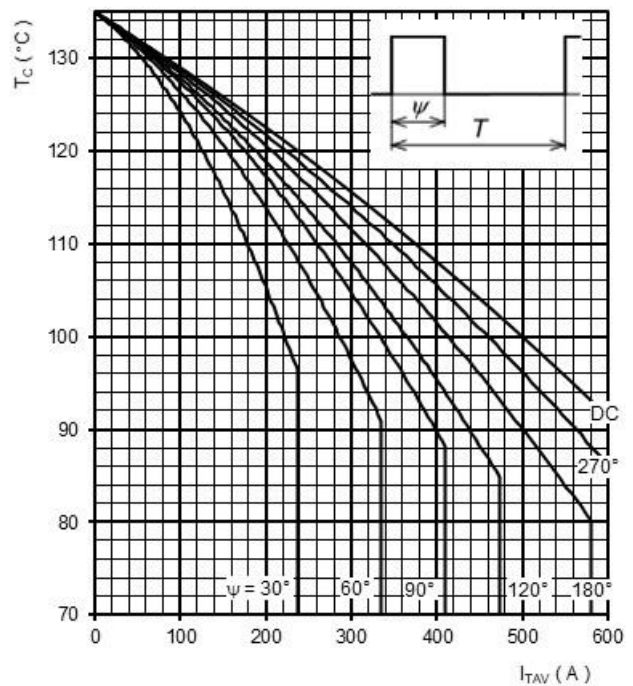


Fig. 10 Max. case temperature vs. aver. on-state current, square waveform, $f = 50 \text{ Hz}$, $T = 1/f$

Note: Figures number 7 ÷ 10 have been calculated without considering any turn-on and turn-off losses. They are valid for $f = 50$ or 60 Hz operation.

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