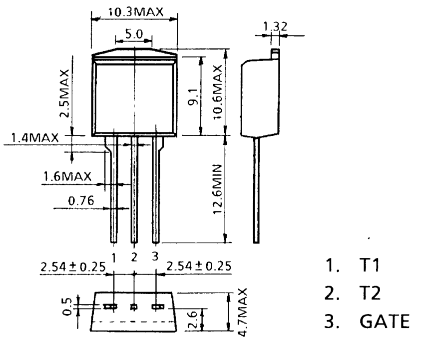
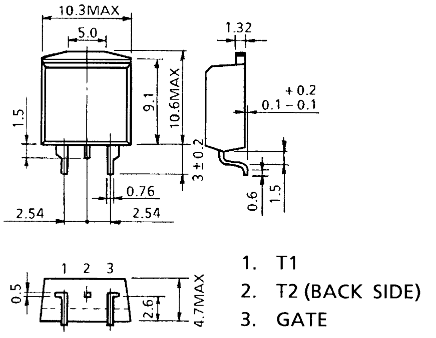
TOSHIBA BIDIRECTIONAL TRIODE THYRISTOR SILICON PLANAR TYPE

SM6G48, USM6G48, SM6J48, USM6J48
SM6G48A, USM6G48A, SM6J48A, USM6J48A

AC POWER CONTROL APPLICATIONS

- Repetitive Peak Off−State Voltage : V_{DRM} = 400V, 600V
- R.M.S On−State Current : $I_{T\ (RMS)}$ = 6A
- Gate Trigger Current
  : I_{GT} = 30mA Max.
  : I_{GT} = 20mA Max. ("A" Type)

Unit: mm

SM6G48, SM6J48, SM6G48A, SM6J48A		USM6G48, USM6J48, USM6G48A, USM6J48A	
			
JEDEC	―	JEDEC	―
JEITA	―	JEITA	―
TOSHIBA	13−10J1A	TOSHIBA	13−10J2A

Weight: 1.7g

ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off−State Voltage	(U)SM6G48 (U)SM6G48A	V_{DRM}	400	V
	(U)SM6J48 (U)SM6J48A		600	
R.M.S On−State Current		$I_{T\ (RMS)}$	6	A
Peak One Cycle Surge On−State Current (Non-Repetitive)		I_{TSM}	60 (50Hz)	A
			66 (60Hz)	
I^2t Limit Value		I^2t	18	A^2s
Critical Rate of Rise of On−State Current (Note 1)		di / dt	50	A / μs
Peak Gate Power Dissipation		P_{GM}	5	W
Average Gate Power Dissipation		$P_{G\ (AV)}$	0.5	W
Peak Forward Gate Voltage		V_{GM}	10	V
Peak Forward Gate Current		I_{GM}	2	A
Junction Temperature		T_j	−40~125	°C
Storage Temperature Range		T_{stg}	−40~125	°C

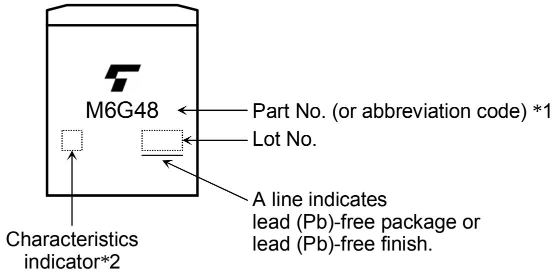
Note 1: V_{DRM}=0.5×Rated
$I_{TM} \leq 9A$
$t_{gw} \geq 10\mu s$
$t_{gr} \leq 250ns$
$i_{gp} = I_{GT} \times 2.0$

Note 2: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/Derating Concept and Methods) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

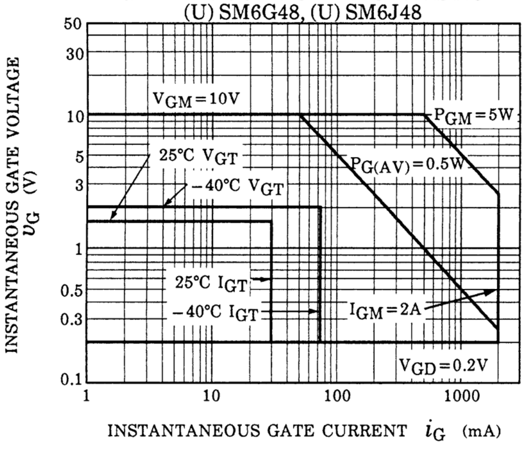
CHARACTERISTIC			SYMBOL	TEST CONDITION		MIN	TYP.	MAX	UNIT
Repetitive Peak Off−State Current			I_{DRM}	V_{DRM} = Rated		—	—	20	μA
Gate Trigger Voltage		I	V_{GT}	V_D = 12V R_L = 20Ω	T2 (+), Gate (+)	—	—	1.5	V
		II			T2 (+), Gate (−)	—	—	1.5	
		III			T2 (−), Gate (−)	—	—	1.5	
		IV			T2 (−), Gate (+)	—	—	—	
Gate Trigger Current	(U)SM6G48 (U)SM6J48	I	I_{GT}	V_D = 12V R_L = 20Ω	T2 (+), Gate (+)	—	—	30	mA
		II			T2 (+), Gate (−)	—	—	30	
		III			T2 (−), Gate (−)	—	—	30	
		IV			T2 (−), Gate (+)	—	—	—	
	(U)SM6G48A (U)SM6J48A	I			T2 (+), Gate (+)	—	—	20	
		II			T2 (+), Gate (−)	—	—	20	
		III			T2 (−), Gate (−)	—	—	20	
		IV			T2 (−), Gate (+)	—	—	—	
Peak On−State Voltage			V_{TM}	I_{TM} = 9A		—	—	1.5	V
Gate Non−Trigger Voltage			V_{GD}	V_D = Rated, Tc = 125°C		0.2	—	—	V
Holding Current			I_H	V_D = 12V, I_{TM} = 1A		—	—	50	mA
Thermal Resistance			$R_{th\ (j-c)}$	Junction to Case, AC		—	—	3.2	°C / W
Critical Rate of Rise of Off−State Voltage	(U)SM6G48 (U)SM6J48		dv / dt	V_{DRM} = Rated, T_j = 125°C Exponential Rise		—	300	—	V / μs
	(U)SM6G48A (U)SM6J48A					—	200	—	
Critical Rate of Rise of Off−State Voltage at Commutation	(U)SM6G48 (U)SM6J48		(dv / dt) c	V_{DRM} = 400V, T_j = 125°C (di / dt) c = −3.3A / ms		10	—	—	V / μs
	(U)SM6G48A (U)SM6J48A					4	—	—	

MARKING

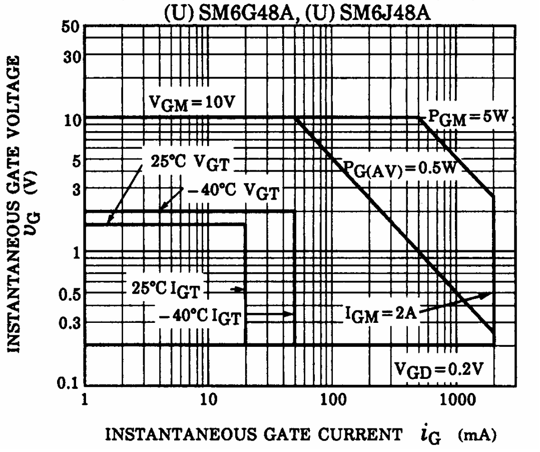


	Part No. (or abbreviation code)	Part No.
*1	M6G48	SM6G48, SM6G48A
		USM6G48, USM6G48A
	M6J48	SM6J48, SM6J48A
		USM6J48, USM6J48A
*2	Nothing	SM6G48, SM6J48
		USM6G48, USM6J48
	A	SM6G48A,SM6J48A
		USM6G48A, USM6J48A

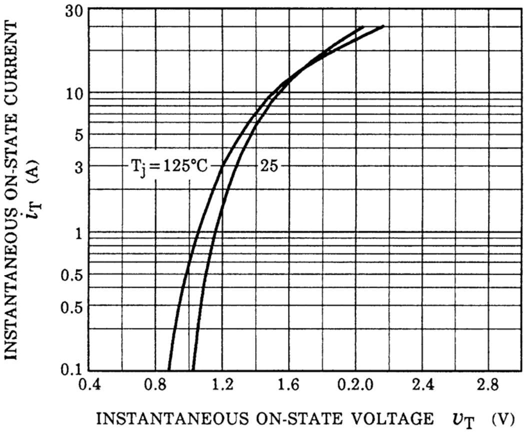
GATE TRIGGER CHARACTERISTIC
(U) SM6G48, (U) SM6J48



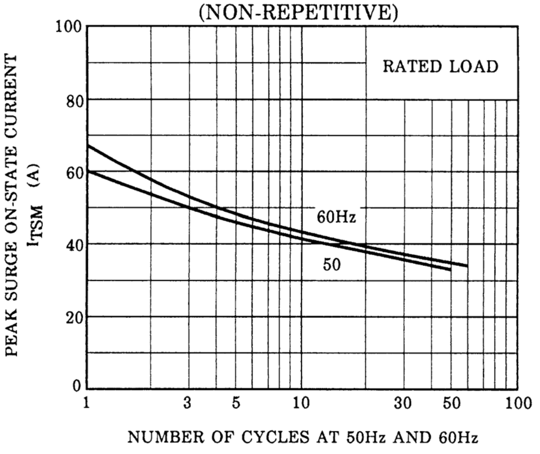
GATE TRIGGER CHARACTERISTIC
(U) SM6G48A, (U) SM6J48A



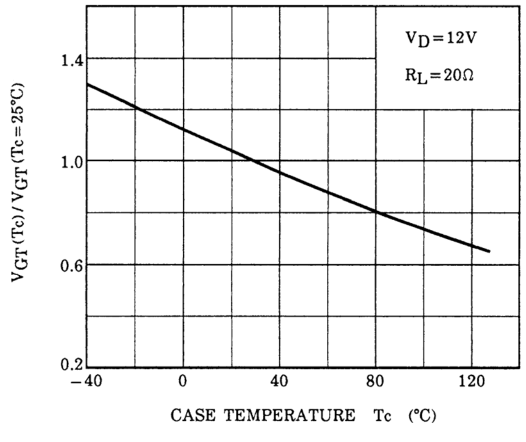
$i_T - v_T$



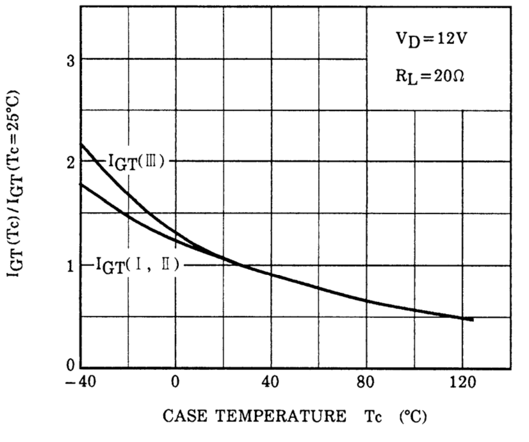
SURGE ON-STATE CURRENT
(NON-REPETITIVE)

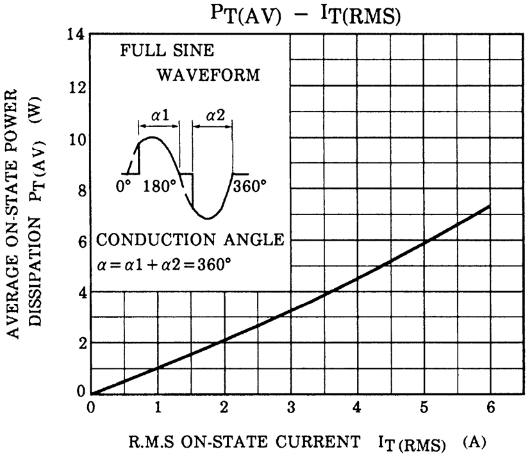


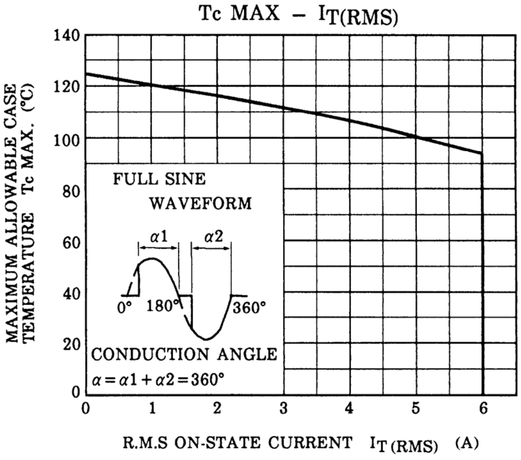
V_{GT} (Tc) / V_{GT} (Tc = 25°C) – Tc (TYPICAL)

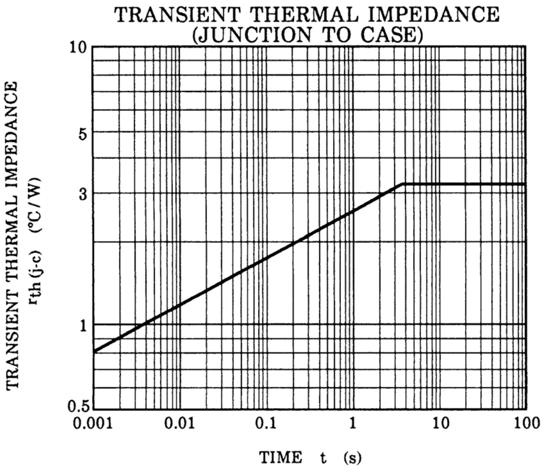


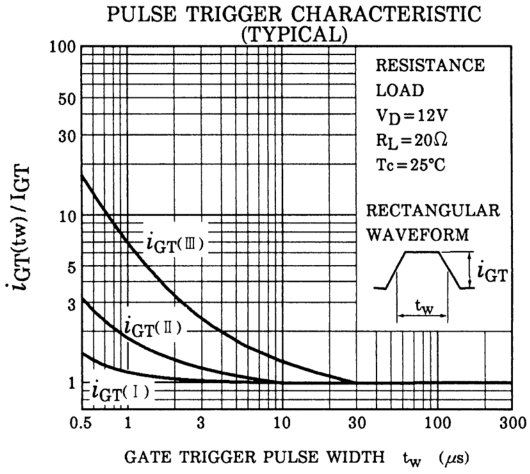
I_{GT} (Tc) / I_{GT} (Tc = 25°C) – Tc (TYPICAL)

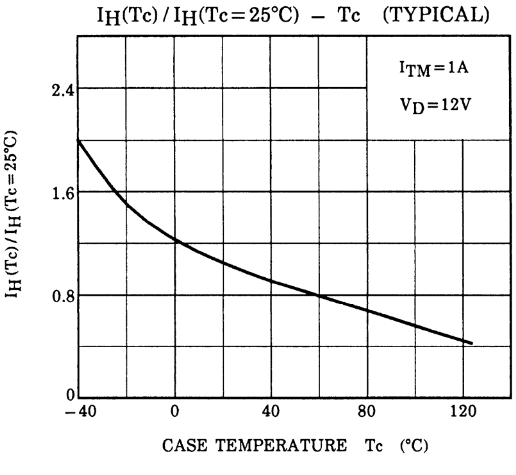



$P_{T(AV)}$ – $I_{T(RMS)}$
FULL SINE WAVEFORM
α1
α2
0°
180°
360°
CONDUCTION ANGLE
α = α1 + α2 = 360°
AVERAGE ON-STATE POWER DISSIPATION $P_{T(AV)}$ (W)
0
2
4
6
8
10
12
14
0
1
2
3
4
5
6
R.M.S ON-STATE CURRENT $I_{T(RMS)}$ (A)


Tc MAX – $I_{T(RMS)}$
FULL SINE WAVEFORM
α1
α2
0°
180°
360°
CONDUCTION ANGLE
α = α1 + α2 = 360°
MAXIMUM ALLOWABLE CASE TEMPERATURE Tc MAX. (°C)
0
20
40
60
80
100
120
140
0
1
2
3
4
5
6
R.M.S ON-STATE CURRENT $I_{T(RMS)}$ (A)


TRANSIENT THERMAL IMPEDANCE (JUNCTION TO CASE)
TRANSIENT THERMAL IMPEDANCE $r_{th(j-c)}$ (°C/W)
0.5
1
3
5
10
0.001
0.01
0.1
1
10
100
TIME t (s)


PULSE TRIGGER CHARACTERISTIC (TYPICAL)
RESISTANCE LOAD
V_D = 12V
R_L = 20Ω
Tc = 25°C
RECTANGULAR WAVEFORM
i_{GT}
t_w
$i_{GT(III)}$
$i_{GT(II)}$
$i_{GT(I)}$
$i_{GT}(t_w) / I_{GT}$
1
3
5
10
30
50
100
0.5
1
3
10
30
100
300
GATE TRIGGER PULSE WIDTH t_w (μs)


I_H(Tc) / I_H(Tc = 25°C) – Tc (TYPICAL)
I_{TM} = 1A
V_D = 12V
I_H (Tc) / I_H (Tc = 25°C)
0
0.8
1.6
2.4
−40
0
40
80
120
CASE TEMPERATURE Tc (°C)

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