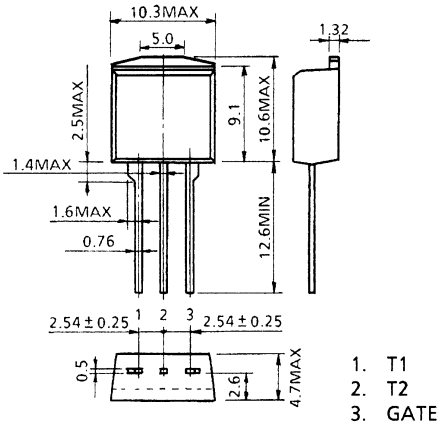
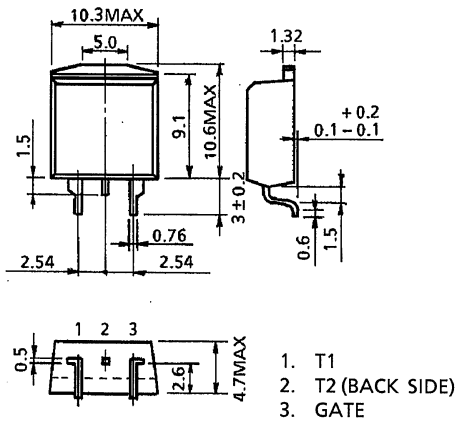
TOSHIBA BI-DIRECTIONAL TRIODE THYRISTOR SILICON PLANAR TYPE

# SM16G48, USM16G48, SM16J48, USM16J48
# SM16G48A, USM16G48A, SM16J48A, USM16J48A

## AC POWER CONTROL APPLICATIONS

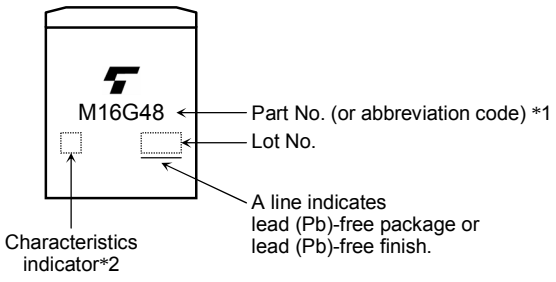
- Repetitive Peak Off-State Voltage :$V_{DRM}$=400V, 600V
- R.M.S On-State Current :$I_{T\ (RMS)}$=16A
- Gate Trigger Current :$I_{GT}$=30mA Max.
  :$I_{GT}$=20mA Max. ("A"Type)

Unit in mm

| SM16G48, SM16J48, SM16G48A, SM16J48A | USM16G48, USM16J48, USM16G48A, USM16J48A |
|---|---|
|  |  |
| JEDEC — | JEDEC — |
| JEITA — | JEITA — |
| TOSHIBA 13-10J1A | TOSHIBA 13-10J2A |

Weight : 1.7g

### MARKING




| | Part No. (or abbreviation code) | Part No. |
|---|---|---|
| *1 | M16G48 | SM16G48, SM16G48A |
| | | USM16G48, USM16G48A |
| | M16J48 | SM16J48, SM16J48A |
| | | USM16J48, USM16J48A |
| *2 | Nothing | SM16G48, SM16J48 |
| | | USM16G48, USM16J48 |
| | A | SM16G48A, SM16J48A |
| | | USM16J48, USM16J48A |

## ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

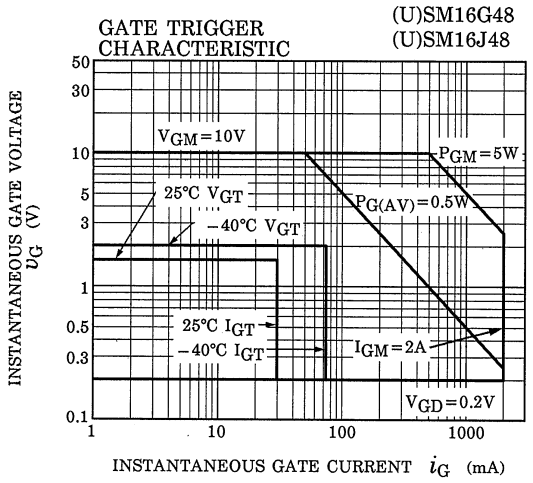
| CHARACTERISTIC | | SYMBOL | RATING | UNIT |
|---|---|---|---|---|
| Repetitive Peak Off-State Voltage | (U)SM12G48 (U)SM12G48A | $V_{DRM}$ | 400 | V |
| | (U)SM12J48 (U)SM12J48A | | 600 | |
| R.M.S On-State Current | | $I_{T\ (RMS)}$ | 16 | A |
| Peak One Cycle Surge On-State Current (Non-Repetitive) | | $I_{TSM}$ | 150 (50Hz) | A |
| | | | 165 (60Hz) | |
| $I^2t$ Limit Value | | $I^2t$ | 112.5 | $A^2s$ |
| 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 |

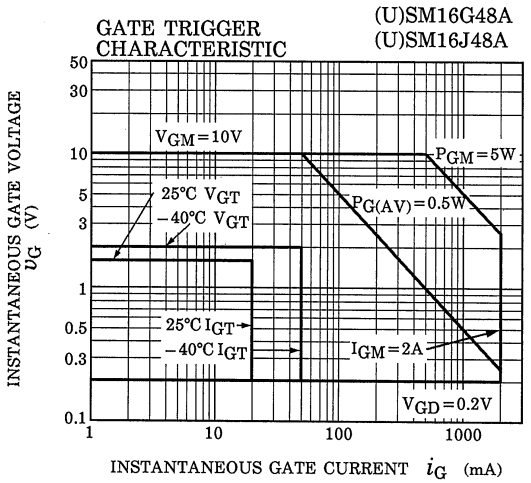
Note 1 : $V_{DRM}$=0.5×Rated
$I_{TM}$≤25A
$t_{gw}$≥10μs
$t_{gr}$≤250ns
$i_{gp}$=$I_{GT}$×2.0

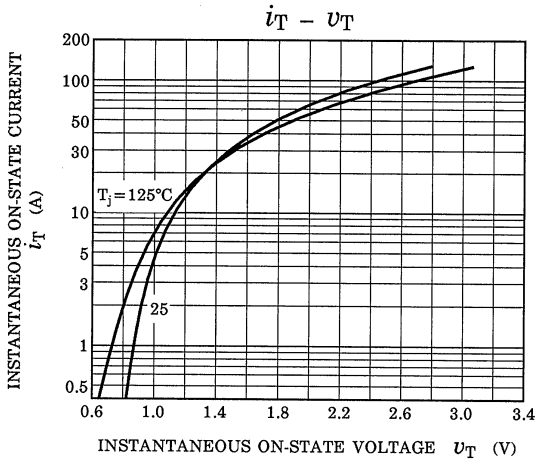
Note 2: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

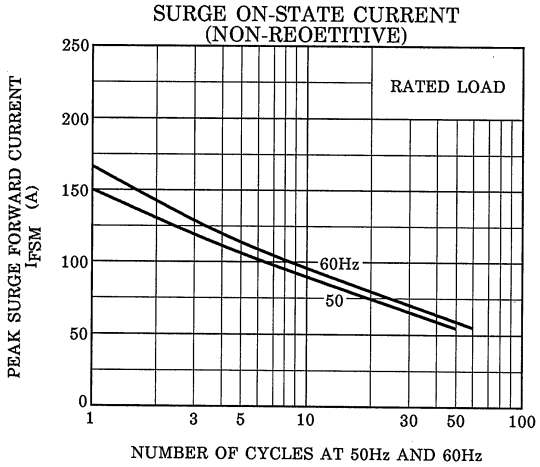
## ELECTRICAL CHARACTERISTICS (Ta=25°C)

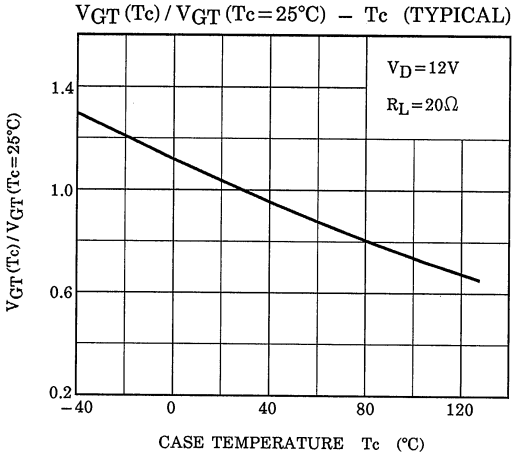
| CHARACTERISTIC | | | SYMBOL | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| Repetitive Peak Off-State Current | | | $I_{DRM}$ | $V_{DRM}$=Rated | | — | — | 20 | μA |
| Gate Trigger Voltage | | I | $V_{GT}$ | $V_D$=12V<br>$R_L$=20Ω | T2 (+) , Gate (+) | — | — | 1.5 | V |
| | | II | | | T2 (+) , Gate (–) | — | — | 1.5 | |
| | | III | | | T2 (–) , Gate (–) | — | — | 1.5 | |
| | | IV | | | T2 (–) , Gate (+) | — | — | — | |
| Gate Trigger Current | (U)SM16G48<br>(U)SM16J48 | I | $I_{GT}$ | $V_D$=12V<br>$R_L$=20Ω | T2 (+) , Gate (+) | — | — | 30 | mA |
| | | II | | | T2 (+) , Gate (–) | — | — | 30 | |
| | | III | | | T2 (–) , Gate (–) | — | — | 30 | |
| | | IV | | | T2 (–) , Gate (+) | — | 50 | — | |
| | (U)SM16G48A<br>(U)SM16J48A | I | | | T2 (+) , Gate (+) | — | — | 20 | |
| | | II | | | T2 (+) , Gate (–) | — | — | 20 | |
| | | III | | | T2 (–) , Gate (–) | — | — | 20 | |
| | | IV | | | T2 (–) , Gate (+) | — | — | — | |
| Peak On-State Voltage | | | $V_{TM}$ | $I_{TM}$=17A | | — | — | 1.5 | — |
| 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 | | — | — | 2.0 | °C / W |
| Critical Rate of Rise of Off-State Voltage | (U)SM16G48<br>(U)SM16J48 | | dv / dt | $V_{DRM}$=Rated, $T_j$=125°C<br>Exponential Rise | | — | 300 | — | V / μs |
| | (U)SM16G48A<br>(U)SM16J48A | | | | | — | 200 | — | |
| Critical Rate of Rise of Off-State Voltage at Commutation | (U)SM16G48<br>(U)SM16J48 | | (dv / dt) c | $V_{DRM}$=400V, $T_j$=125°C<br>(di / dt) c=−8.7A / ms | | 10 | — | — | V / μs |
| | (U)SM16G48A<br>(U)SM16J48A | | | | | 4 | — | — | |

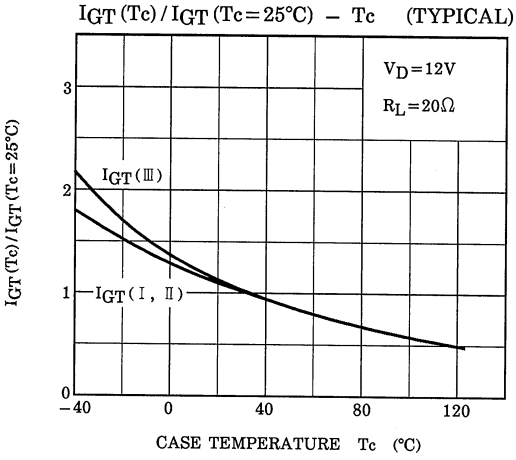

GATE TRIGGER CHARACTERISTIC
(U)SM16G48
(U)SM16J48
INSTANTANEOUS GATE VOLTAGE $v_G$ (V)
$V_{GM}$=10V
$P_{GM}$=5W
$P_{G(AV)}$=0.5W
25°C $V_{GT}$
−40°C $V_{GT}$
25°C $I_{GT}$
−40°C $I_{GT}$
$I_{GM}$=2A
$V_{GD}$=0.2V
INSTANTANEOUS GATE CURRENT $i_G$ (mA)


GATE TRIGGER CHARACTERISTIC
(U)SM16G48A
(U)SM16J48A
INSTANTANEOUS GATE VOLTAGE $v_G$ (V)
$V_{GM}$=10V
$P_{GM}$=5W
$P_{G(AV)}$=0.5W
25°C $V_{GT}$
−40°C $V_{GT}$
25°C $I_{GT}$
−40°C $I_{GT}$
$I_{GM}$=2A
$V_{GD}$=0.2V
INSTANTANEOUS GATE CURRENT $i_G$ (mA)

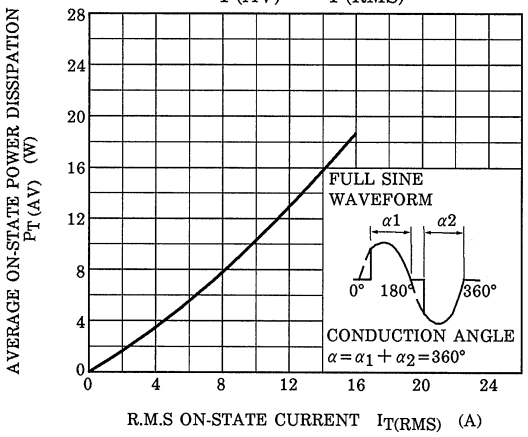

$i_T - v_T$
INSTANTANEOUS ON-STATE CURRENT $i_T$ (A)
$T_j$=125°C
25
INSTANTANEOUS ON-STATE VOLTAGE $v_T$ (V)


SURGE ON-STATE CURRENT (NON-REOETITIVE)
RATED LOAD
PEAK SURGE FORWARD CURRENT $I_{FSM}$ (A)
60Hz
50
NUMBER OF CYCLES AT 50Hz AND 60Hz

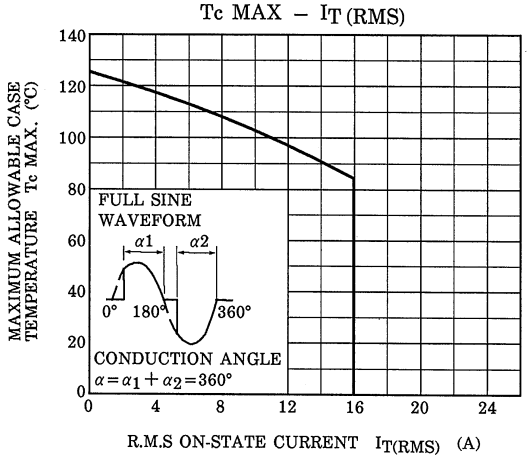

$V_{GT}$ (Tc) / $V_{GT}$ (Tc=25°C) − Tc (TYPICAL)
$V_D$=12V
$R_L$=20Ω
$V_{GT}$ (Tc) / $V_{GT}$ (Tc=25°C)
CASE TEMPERATURE Tc (°C)


$I_{GT}$ (Tc) / $I_{GT}$ (Tc=25°C) − Tc (TYPICAL)
$V_D$=12V
$R_L$=20Ω
$I_{GT}$(Ⅲ)
$I_{GT}$(Ⅰ, Ⅱ)
$I_{GT}$ (Tc) / $I_{GT}$ (Tc=25°C)
CASE TEMPERATURE Tc (°C)

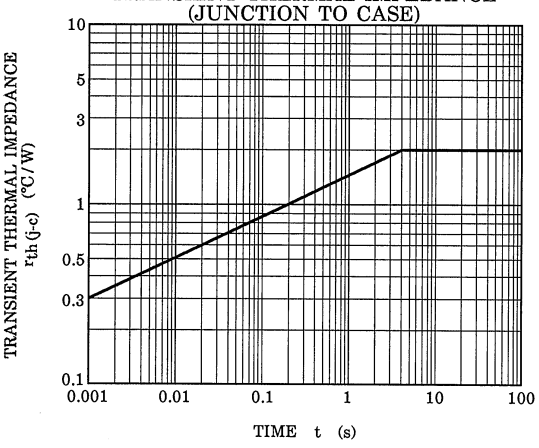
$P_{T\,(AV)}$ – $I_{T\,(RMS)}$



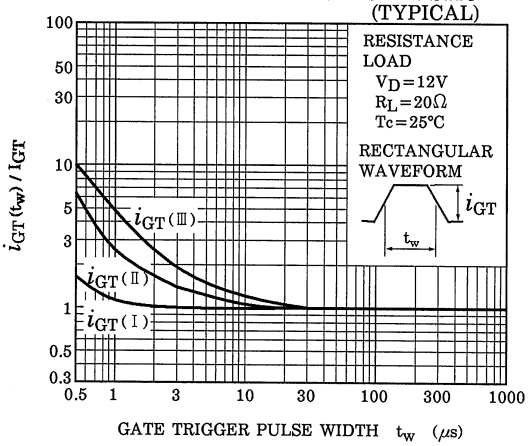

Tc MAX – $I_{T\,(RMS)}$



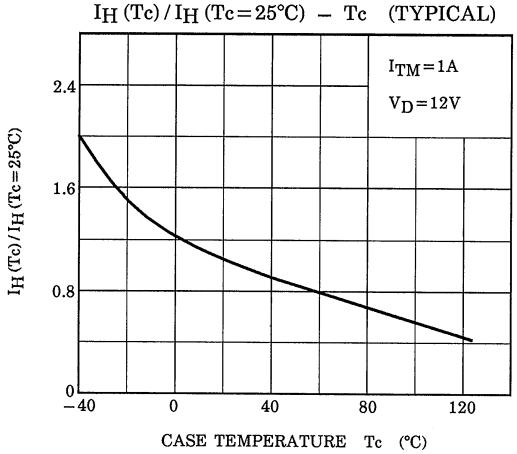

TRANSIENT THERMAL IMPEDANCE (JUNCTION TO CASE)




PULSE TRIGGER CHARACTERISTIC (TYPICAL)




$I_H$ (Tc) / $I_H$ (Tc = 25°C) – Tc (TYPICAL)



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