

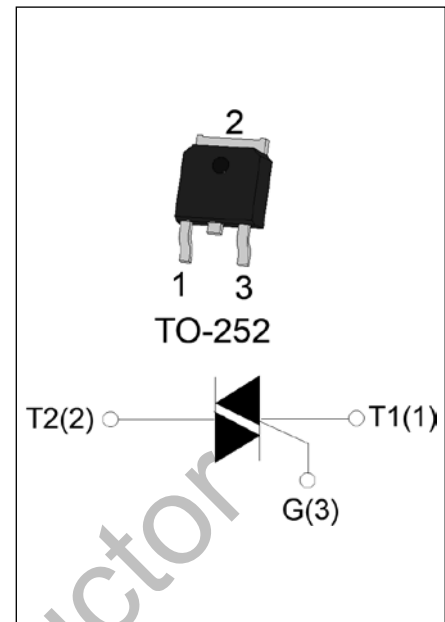
## BT138S-800D 12A TRIAC

### DESCRIPTION:

The BT138S-800D triac is suitable for general purpose AC switching. It can be used as an ON/OFF function in applications such as heating regulation, induction motor starting circuits, for phase control operation in light dimmers, motor speed controllers. Package TO-252 is RoHS compliant.

### MAIN FEATURES

Symbol	Value	Unit
$I_{T(RMS)}$	12	A
$V_{DRM}/V_{RRM}$	800	V
$I_{GT\ I/II/III/IV}$	5/5/5/10	mA



### ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Value	Unit
Storage junction temperature range		$T_{stg}$	-40-150	°C
Operating junction temperature range		$T_j$	-40-125	°C
Repetitive peak off-state voltage ( $T_j=25^\circ\text{C}$ )		$V_{DRM}$	800	V
Repetitive peak reverse voltage ( $T_j=25^\circ\text{C}$ )		$V_{RRM}$	800	V
RMS on-state current ( $T_c \leq 98^\circ\text{C}$ )		$I_{T(RMS)}$	12	A
Non repetitive surge peak on-state current (full cycle , $t_p=20\text{ms}$ , $T_j=25^\circ\text{C}$ )		$I_{TSM}$	95	A
Non repetitive surge peak on-state current (full cycle , $t_p=16.6\text{ms}$ , $T_j=25^\circ\text{C}$ )			105	
$I^2t$ value for fusing ( $t_p=10\text{ms}$ , $T_j=25^\circ\text{C}$ )		$I^2t$	45	$\text{A}^2\text{s}$
Critical rate of rise of on-state current ( $I_G=2 \times I_{GT}$ , $f=100\text{Hz}$ , $T_j=125^\circ\text{C}$ )	I - II	$di/dt$	50	$\text{A}/\mu\text{s}$
	III-IV		20	
Peak gate current ( $t_p=20\mu\text{s}$ , $T_j=125^\circ\text{C}$ )		$I_{GM}$	4	A
Average gate power dissipation ( $T_j=125^\circ\text{C}$ )		$P_{G(AV)}$	0.5	W
Peak gate power		$P_{GM}$	10	W
Peak pulse voltage ( $T_j=25^\circ\text{C}$ ; non-repetitive, off-state; FIG.8)		$V_{pp}$	3	kV

## ELECTRICAL CHARACTERISTICS (T<sub>j</sub>=25°C unless otherwise specified)

Symbol	Test Condition	Quadrant	Value		Unit
I <sub>GT</sub>	V <sub>D</sub> =12V R <sub>L</sub> =33Ω	I - II - III	MAX.	5	mA
		IV		10	
V <sub>GT</sub>		ALL	MAX.	1	V
V <sub>GD</sub>	V <sub>D</sub> =V <sub>DRM</sub> T <sub>j</sub> =125°C R <sub>L</sub> =3.3kΩ	ALL	MIN.	0.2	V
I <sub>L</sub>	I <sub>G</sub> =1.2I <sub>GT</sub>	I - III - IV	MAX.	15	mA
		II		20	
I <sub>H</sub>	I <sub>T</sub> =500mA		MAX.	10	mA
dV/dt	V <sub>D</sub> =540V Gate Open T <sub>j</sub> =125°C		MIN.	40	V/μs
(dV/dt) <sub>c</sub>	(dI/dt) <sub>c</sub> =5A/ms, T <sub>j</sub> =110°C		MIN.	2	V/μs
t <sub>on</sub>	I <sub>G</sub> =20mA I <sub>A</sub> =200mA I <sub>R</sub> =20mA		TYP.	3	μs
t <sub>off</sub>	T <sub>j</sub> =25°C			30	

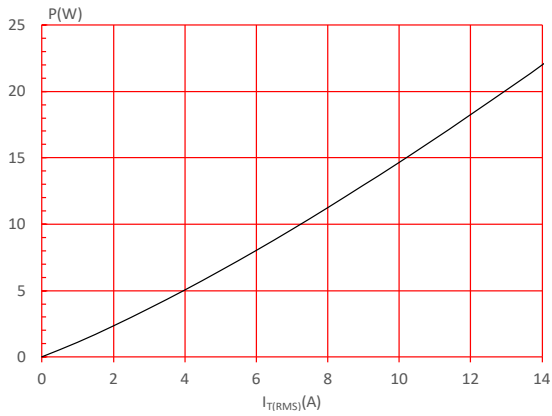
## STATIC CHARACTERISTICS

Symbol	Parameter		Value(MAX.)	Unit
V <sub>TM</sub>	I <sub>TM</sub> =15A t <sub>p</sub> =380μs	T <sub>j</sub> =25°C	1.6	V
V <sub>TO</sub>	Threshold voltage	T <sub>j</sub> =125°C	0.8	V
R <sub>D</sub>	Dynamic resistance	T <sub>j</sub> =125°C	41	mΩ
I <sub>DRM</sub>	V <sub>D</sub> =V <sub>DRM</sub> V <sub>R</sub> =V <sub>R</sub> RM	T <sub>j</sub> =25°C	5	μA
I <sub>R</sub> RM		T <sub>j</sub> =125°C	0.5	mA

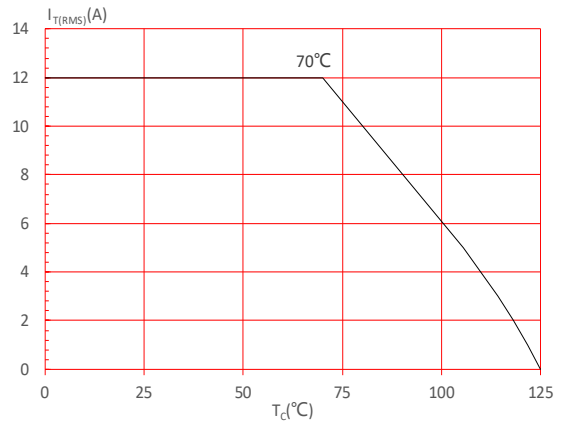
## THERMAL RESISTANCES

Symbol	Parameter	Value	Unit
R <sub>th(j-c)</sub>	junction to case (AC)	3	°C/W
R <sub>th(j-a)</sub>	junction to ambient (AC)	100	°C/W

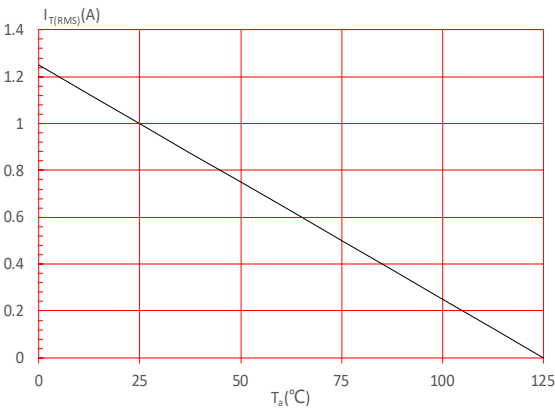
**FIG.1:** Maximum power dissipation versus RMS on-state current



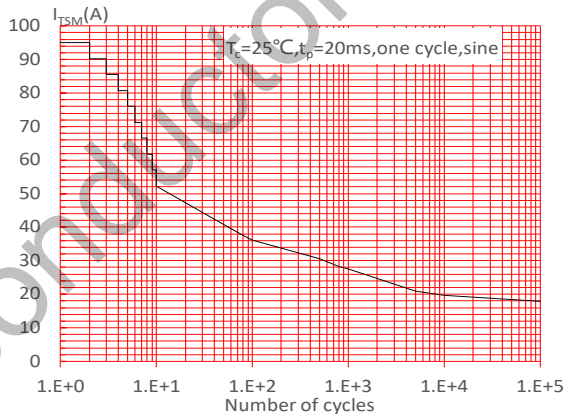
**FIG.2:** RMS on-state current versus case temperature



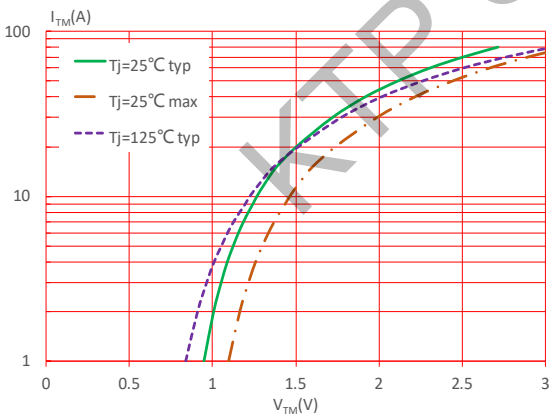
**FIG.3:** RMS on-state current versus ambient temperature (printed circuit board FR4,copper thickness:35 $\mu$ m)(full cycle)



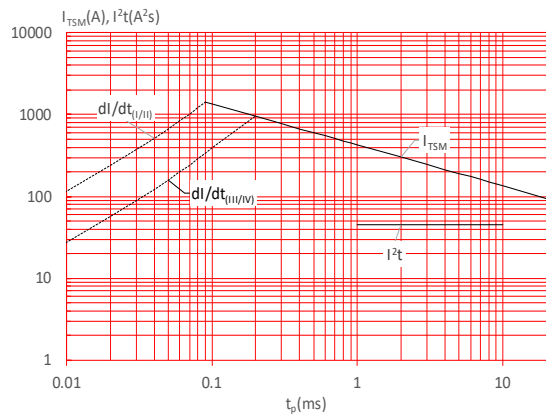
**FIG.4:** Surge peak on-state current versus number of cycles



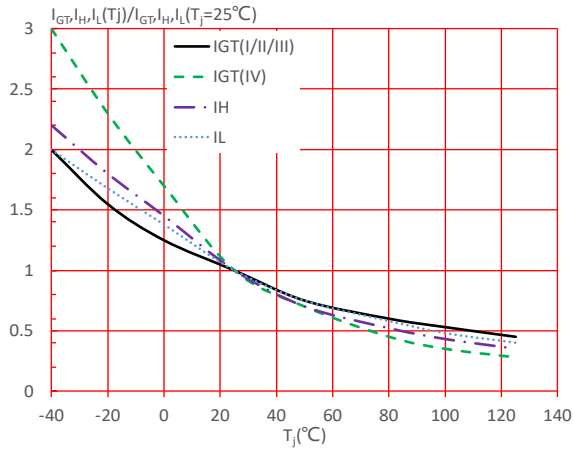
**FIG.5:** On-state characteristics



**FIG.6:** Non-repetitive surge peak on-state current for a sinusoidal pulse with width  $t_p < 20\text{ms}$ , and corresponding value of  $I^2t$  ( I - II:  $di/dt < 50\text{A}/\mu\text{s}$ ; III-IV:  $di/dt < 20\text{A}/\mu\text{s}$ )

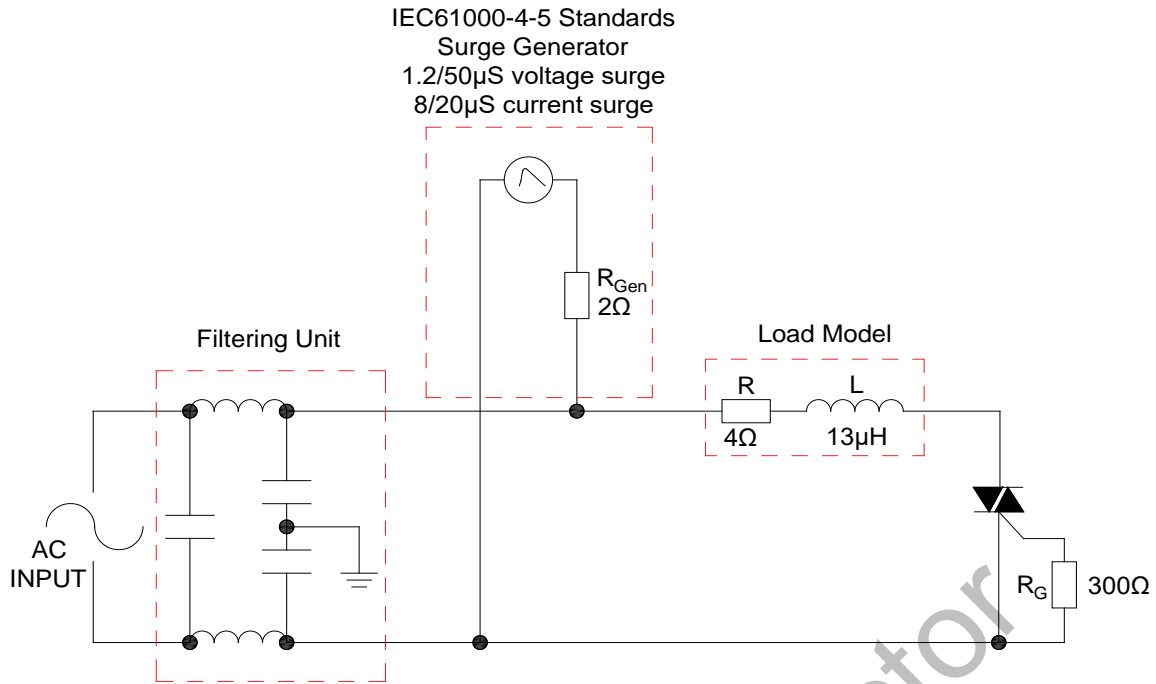


**FIG.7:** Relative variations of gate trigger current, holding current and latching current versus junction temperature



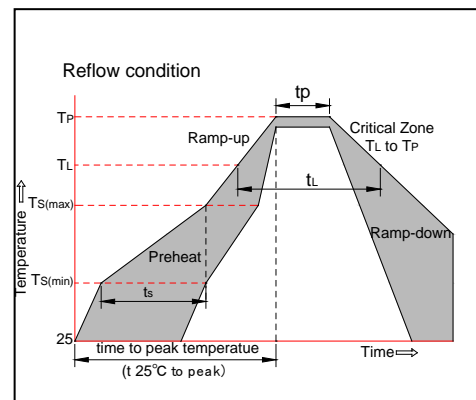
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FIG.8: Test circuit for inductive and resistive loads to IEC-61000-4-5 standards



## SOLDERING PARAMETERS

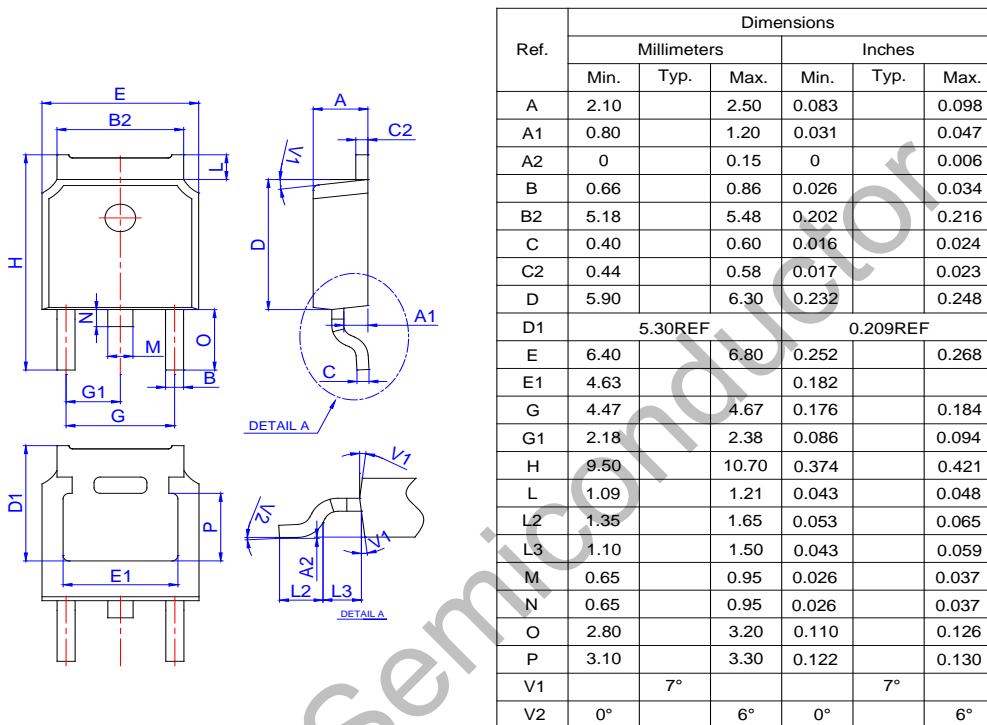
Reflow Condition		Pb-Free assembly (see figure at right)
Pre Heat	-Temperature Min ( $T_{s(min)}$ )	+150°C
	-Temperature Max( $T_{s(max)}$ )	+200°C
	-Time (Min to Max) (ts)	60-180 secs.
Average ramp up rate (Liquidus Temp ( $T_L$ ) to peak)		3°C/sec. Max
$T_{s(max)}$ to $T_L$ - Ramp-up Rate		3°C/sec. Max
Reflow	-Temperature( $T_L$ ) (Liquidus)	+217°C
	-Temperature( $t_L$ )	60-150 secs.
Peak Temp ( $T_p$ )		+260(+0/-5)°C
Time within 5°C of actual Peak Temp ( $t_p$ )		20-40secs.
Ramp-down Rate		6°C/sec. Max
Time 25°C to Peak Temp ( $T_p$ )		8 min. Max
Do not exceed		+260°C



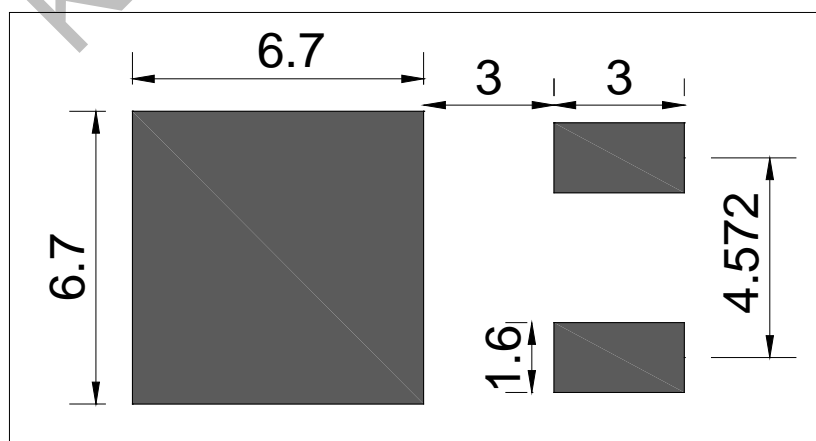
## ORDERING INFORMATION

Order code	Voltage $V_{DRM}/V_{RRM}$ (V)	IGT(mA)		Package	Base qty. (pcs)	Delivery mode
		I - II - III	IV			
BT138S-800D	800	5	10	TO-252	80	Tube
BT138S-800D-TR					2,500	Tape & Reel

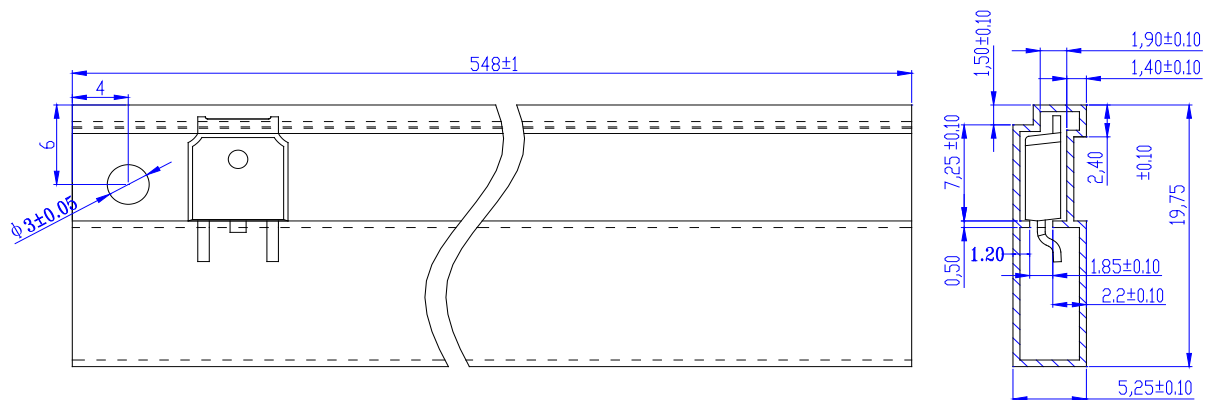
## PACKAGE MECHANICAL DATA



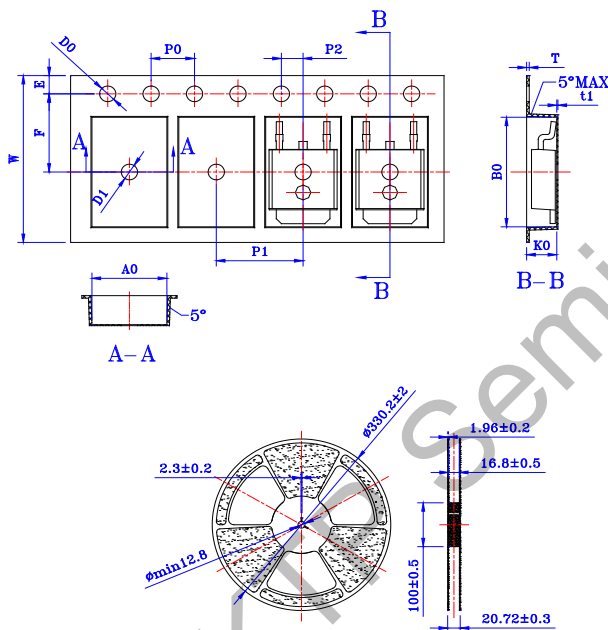
## FOOTPRINT-TO-252 (dimensions in mm)



## DELIVERY MODE



PACKAGE	OUTLINE	TUBE (PCS)	INNER BOX (PCS)	PER CARTON
TO-252	TUBE	80	4,000	20,000



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
W	15.90	16.00	16.10	0.626	0.630	0.634
E	1.65	1.75	1.85	0.065	0.069	0.073
F	7.40	7.50	7.60	0.291	0.295	0.299
D0	1.50	1.55	1.60	0.059	0.060	0.063
D1	1.50	-	-	0.059	-	-
P0	3.90	4.00	4.10	0.154	0.157	0.161
P1	7.90	8.00	8.10	0.311	0.315	0.319
P2	1.90	2.00	2.10	0.075	0.079	0.083
10P0	39.80	40.00	40.20	1.567	1.575	1.583
A0	6.80	6.90	7.00	0.267	0.272	0.276
B0	10.40	10.50	10.60	0.408	0.413	0.417
K0	2.60	2.70	2.80	0.102	0.106	0.110
T	0.25	0.30	0.35	0.010	0.012	0.014
t1	0.10	-	-	0.004	-	-

PACKAGE	OUTLINE	REEL (PCS)	PER CARTON (PCS)	TAPE & REEL
TO-252	TAPING	2,500	25,000	13 inch