Preferred Device

# **Silicon Controlled Rectifiers**Reverse Blocking Thyristors

Designed primarily for half-wave ac control applications, such as motor controls, heating controls and power supplies.

#### **Features**

- Glass Passivated Junctions with Center Gate Geometry for Greater Parameter Uniformity and Stability
- Small, Rugged, Thermowatt Construction for Low Thermal Resistance, High Heat Dissipation and Durability
- Blocking Voltage to 800 V
- Pb-Free Packages are Available\*

# **MAXIMUM RATINGS**<sup>†</sup> ( $T_J = 25^{\circ}C$ unless otherwise noted)

<u></u>			
Rating	Symbol	Value	Unit
Peak Repetitive Off-State Voltage (Note 1) (T <sub>J</sub> = -40 to 125°C, Sine Wave, 50 to 60 Hz, Gate Open) 2N6394 2N6395 2N6397 2N6399	V <sub>DRM</sub> , V <sub>RRM</sub>	50 100 400 800	V
On-State RMS Current (180° Conduction Angles; T <sub>C</sub> = 90°C)	I <sub>T(RMS)</sub>	12	А
Peak Non-Repetitive Surge Current (1/2 Cycle, Sine Wave, 60 Hz, T <sub>J</sub> = 90°C)	I <sub>TSM</sub>	100	А
Circuit Fusing (t = 8.3 ms)	I <sup>2</sup> t	40	A <sup>2</sup> s
Forward Peak Gate Power (Pulse Width $\leq$ 1.0 $\mu$ s, T <sub>C</sub> = 90°C)	$P_{GM}$	20	W
Forward Average Gate Power (t = 8.3 ms, T <sub>C</sub> = 90°C)	P <sub>G(AV)</sub>	0.5	W
Forward Peak Gate Current (Pulse Width $\leq$ 1.0 $\mu$ s, T <sub>C</sub> = 90°C)	I <sub>GM</sub>	2.0	А
Operating Junction Temperature Range	TJ	-40 to +125	°C
Storage Temperature Range	T <sub>stg</sub>	-40 to +150	°C

# **MAXIMUM RATINGS**<sup>†</sup> ( $T_J = 25^{\circ}$ C unless otherwise noted)

Rating	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	2.0	°C/W
Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 10 Seconds	T <sub>L</sub>	260	°C

†Indicates JEDEC Registered Data

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

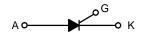
 V<sub>DRM</sub> and V<sub>RRM</sub> for all types can be applied on a continuous basis. Ratings apply for zero or negative gate voltage; however, positive gate voltage shall not be applied concurrent with negative potential on the anode. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.



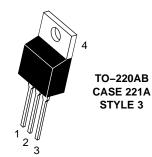
#### ON Semiconductor®

http://onsemi.com

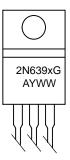
# SCRs 12 AMPERES RMS 50 thru 800 VOLTS



#### MARKING DIAGRAM



WW



2N639x = Device Code x = 4, 5, 7, or 9 G = Pb-Free Package A = Assembly Location Y = Year

= Work Week

PIN ASSIGNMENT			
1	Cathode		
2	Anode		
3	Gate		
4	Anode		

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

**Preferred** devices are recommended choices for future use and best overall value.

<sup>\*</sup>For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

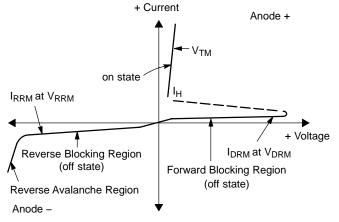
#### **ELECTRICAL CHARACTERISTICS** (T<sub>C</sub> = 25°C unless otherwise noted.)

Characteristic		Symbol	Min	Тур	Max	Unit
OFF CHARACTERISTICS						
†Peak Repetitive Forward or Reverse Blocking Current (V <sub>AK</sub> = Rated V <sub>DRM</sub> or V <sub>RRM</sub> , Gate Open)	T <sub>J</sub> = 25°C	I <sub>DRM</sub> , I <sub>RRM</sub>	_	_	10	μΑ
	$T_J = 125^{\circ}C$		-	_	2.0	mΑ
ON CHARACTERISTICS						
†Peak Forward On–State Voltage (Note 2) (I <sub>TM</sub> = 24 A Peak)		$V_{TM}$	-	1.7	2.2	V
†Gate Trigger Current (Continuous dc) ( $V_D = 12 \text{ Vdc}, R_L = 100 \text{ Ohr}$	ns)	I <sub>GT</sub>	-	5.0	30	mA
†Gate Trigger Voltage (Continuous dc) ( $V_D = 12 \text{ Vdc}$ , $R_L = 100 \text{ Ohr}$	ns)	V <sub>GT</sub>	1	0.7	1.5	V
Gate Non-Trigger Voltage ( $V_D = 12 \text{ Vdc}$ , $R_L = 100 \text{ Ohms}$ , $T_J = 125 \text{ Comp}$	°C)	$V_{GD}$	0.2	_	-	V
†Holding Current (V <sub>D</sub> = 12 Vdc, Initiating Current = 200 mA, Gate C	pen)	I <sub>H</sub>	-	6.0	50	mA
Turn-On Time ( $I_{TM}$ = 12 A, $I_{GT}$ = 40 mAdc, $V_D$ = Rated $V_{DRM}$ )		t <sub>gt</sub>	١	1.0	2.0	μs
	12 A, I <sub>R</sub> = 12 A)	tq	-	15	-	μs
(I <sub>TM</sub> = 12 A, I <sub>R</sub> = 12	$2 A, T_J = 125^{\circ}C$		-	35	_	
DYNAMIC CHARACTERISTICS						
Critical Rate-of-Rise of Off-State Voltage Exponential $(V_D = Rated V_D)$	<sub>RM</sub> , T <sub>J</sub> = 125°C)	dv/dt	-	50	-	V/μs

†Indicates JEDEC Registered Data

# **Voltage Current Characteristic of SCR**

Symbol	Parameter
V <sub>DRM</sub>	Peak Repetitive Off State Forward Voltage
I <sub>DRM</sub>	Peak Forward Blocking Current
$V_{RRM}$	Peak Repetitive Off State Reverse Voltage
I <sub>RRM</sub>	Peak Reverse Blocking Current
V <sub>TM</sub>	Peak On State Voltage
I <sub>H</sub>	Holding Current



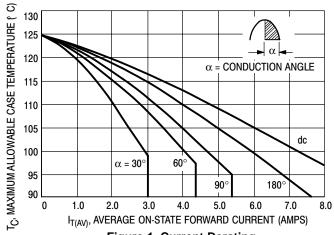


Figure 1. Current Derating

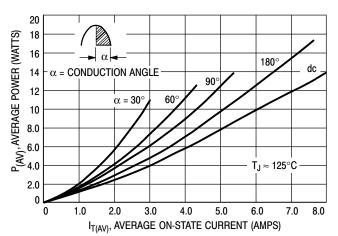


Figure 2. Maximum On-State Power Dissipation

<sup>2.</sup> Pulse Test: Pulse Width  $\leq$  300 µsec, Duty Cycle  $\leq$  2%.

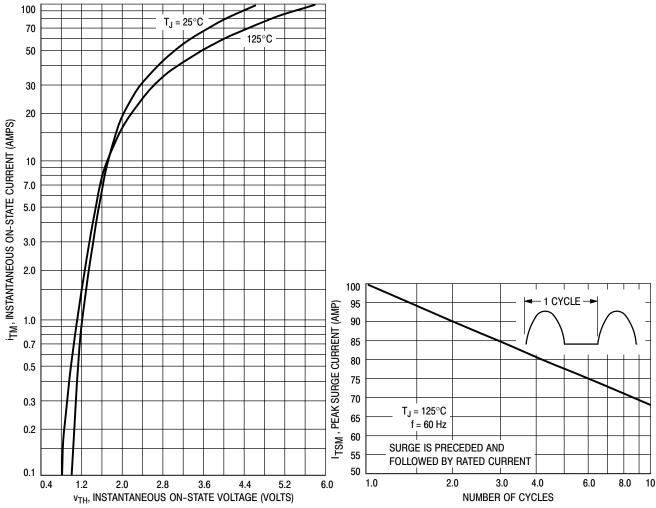


Figure 3. On-State Characteristics Figure 4. Maximum Non-Repetitive Surge Current

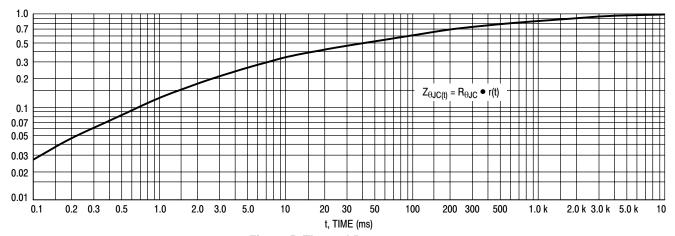
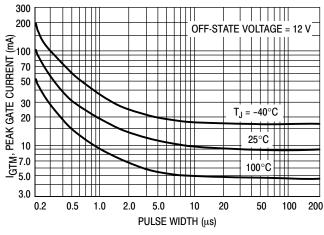


Figure 5. Thermal Response

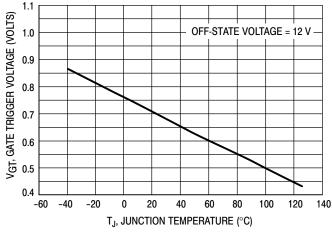
# **TYPICAL CHARACTERISTICS**



0.5 0.3 -40 -20 0 20 40 60 80 100 120 140 160 T<sub>J</sub>, JUNCTION TEMPERATURE (°C)

Figure 6. Typical Gate Trigger Current versus Pulse Width

Figure 7. Typical Gate Trigger Current versus Temperature



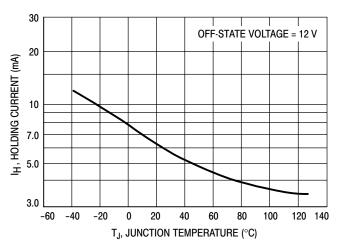


Figure 8. Typical Gate Trigger Voltage versus Temperature

Figure 9. Typical Holding Current versus Temperature

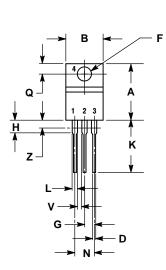
## **ORDERING INFORMATION**

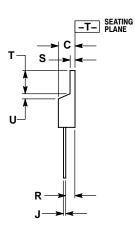
Device	Package	Shipping**
2N6394	TO-220AB	500 Units / Bulk
2N6394G	TO-220AB (Pb-Free)	500 Units / Bulk
2N6395	TO-220AB	500 Units / Bulk
2N6395G	TO-220AB (Pb-Free)	500 Units / Bulk
2N6397	TO-220AB	500 Units / Bulk
2N6397G	TO-220AB (Pb-Free)	500 Units / Bulk
2N6399	TO-220AB	500 Units / Bulk
2N6399G	TO-220AB (Pb-Free)	500 Units / Bulk

<sup>\*\*</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

#### PACKAGE DIMENSIONS

TO-220AB CASE 221A-09 **ISSUE AD** 





#### NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982
- CONTROLLING DIMENSION: INCH.
- DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED

	INCHES		MILLIN	IETERS
DIM	MIN	MAX	MIN	MAX
Α	0.570	0.620	14.48	15.75
В	0.380	0.405	9.66	10.28
С	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
Н	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
٧	0.045		1.15	
Z		0.080		2.04

#### STYLE 3:

PIN 1. CATHODE

- 2. ANODE 3. GATE
- ANODE

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