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Silicon Controlled Rectifiers

File Number 114

2N3228, 2N3525, 2N4101

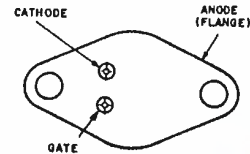
### 5-A Silicon Controlled Rectifiers

For Low-Cost Power-Control and Power-Switching Applications

**Features**

- High di/dt and dv/dt capabilities
- Low leakage currents, both forward and reverse
- Low forward voltage drop at high current levels
- Low thermal resistance

**TERMINAL DESIGNATIONS**



JEDEC TO-213AA

RCA 2N3228\*, 2N3525\*, and 2N4101\* are all-diffused, three-junction, silicon controlled rectifiers (SCR's) intended for use in power-control and power-switching applications.

Types 2N3228, 2N3525, and 2N4101 use the JEDEC TO-66 package and have a blocking voltage capability of up to 600 volts and a forward current rating of 5 amperes (rms value) at a case temperature of 75°C.

\*Formerly Dev. Types TA1222, TA1225, and TA2773, respectively.

**ABSOLUTE-MAXIMUM RATINGS, for Operation with Sinusoidal AC Supply Voltage at a Frequency between 50 and 400 Hz, and with Resistive or Inductive Load.**

	2N3228	2N3525	2N4101	
Transient Peak Reverse Voltage (Non-Repulsive), $V_{RM}$ (non-rep)	330	660	700	V
Peak Reverse Voltage (Repulsive), $V_{RM}$ (rep)	200	400	600	V
Peak Forward Blocking Voltage (Repulsive), $V_{FBO}$ (rep)	200	400	600	V
Forward Current: For case temperature ( $T_C$ ) of +75°C, and unit mounted on heat sink				
Average DC value at a conduction angle of 180°, $I_{FAV}$	3.2	3.2	3.2	A
RMS value, $I_{FRMS}$	5.0	5.0	5.0	A
For free-air temperature ( $T_{FA}$ ) of 25°C, and with no heat sink employed—				
Average DC value at a conduction angle of 180°, $I_{FAV}$	1.7	1.7	1.7	A
For other conditions, See Fig. 2				
Peak Surge Current, $I_{FM}$ (surge): For one cycle of applied principal voltage.				
60 Hz (sinusoidal), $T_C = 75^\circ\text{C}$		60		A
50 Hz (sinusoidal), $T_C = 75^\circ\text{C}$		50		A
For more than one cycle of applied voltage, See Fig. 5				
Fusing Current (for SCR protection):				
$T_J = -40$ to $100^\circ\text{C}$ , $t = 1$ to $8.3$ ns, $I^2t$		15		A <sup>2</sup> s
Rate of Change of Forward Current, di/dt		200*		A/ $\mu$ s
$I_{GT} = 200$ mA, 0.5 $\mu$ s rise time				
Gate Power*: Peak, Forward or Reverse, for 10 $\mu$ s duration, $P_{GM}$		13		W
Average, $P_{GAV}$		0.5		W
Temperature:				
Storage, $T_{stg}$		-40 to +125		°C
Operating (Case), $T_C$		-40 to +100		°C

\*Any values of peak gate current or peak gate voltage to give the maximum gate power is permissible.



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**2N3228, 2N3525, 2N4101**

Characteristics at Maximum Ratings (unless otherwise specified), and at Indicated Case Temperature ( $T_C$ )

CHARACTERISTICS	CONTROLLED-RECTIFIER TYPES									UNITS
	2N3228			2N3525			2N4101			
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Forward Breakover Voltage, $V_{BO}$ : At $T_C = +100^\circ\text{C}$ .....	200	—	—	400	—	—	600	—	—	volts
Peak Blocking Current, at $T_C = +100^\circ\text{C}$ :										
Forward, $I_{FBOM}$ .....	—	0.10	1.5	—	0.20	3.0	—	0.40	4.0	mA
$V_{FB0} = V_{BO}$ (min. value)										
Reverse, $I_{RBOM}$ .....	—	0.05	0.75	—	0.10	1.5	—	0.20	2.0	mA
$V_{RB0} = V_{RM}$ (rep) value										
Forward Voltage Drop, $v_f$ At a Forward Current of 30 amperes and a $T_C = +25^\circ\text{C}$	—	2.15	2.8	—	2.15	2.8	—	2.15	2.8	volts
DC Gate-Trigger Current, $I_{GT}$ At $T_C = +25^\circ\text{C}$ .....	—	8	15	—	8	15	—	8	15	mA(dc)
Gate-Trigger Voltage, $V_{GT}$ At $T_C = +25^\circ\text{C}$ .....	—	1.2	2.0	—	1.2	2.0	—	1.2	2.0	volts(dc)
Holding Current, $I_{H00}$ At $T_C = +25^\circ\text{C}$ .....	—	10	20	—	10	20	—	10	20	mA
Critical Rate of Applied Forward Voltage, Critical $dv/dt$ .....	10	200	—	10	200	—	10	200	—	volts/ microsecond
$V_{FB} = V_{BO}$ (min. value), exponential rise, $T_C = +100^\circ\text{C}$										
Turn-On Time, $t_{on}$ , (Delay Time + Rise Time) $V_{FB} = V_{BO}$ (min. value), $i_F = 4.5$ amperes, $I_{GT} = 200$ mA, $0.1 \mu\text{s}$ rise time, $T_C = +25^\circ\text{C}$	0.75	1.5	—	0.75	1.5	—	0.75	1.5	—	microseconds
Turn-Off Time, $t_{off}$ .....	—	15	50	—	15	50	—	15	50	microseconds
$i_F = 2$ amperes, $50 \mu\text{s}$ pulse width, $dv_f/dt = 20 \text{v}/\mu\text{s}$ , $di_f/dt = 30 \text{A}/\mu\text{s}$ , $I_{GT} = 200$ mA, $T_C = +75^\circ\text{C}$										
Thermal Resistance: Junction-to-case .....	—	—	4	—	—	4	—	—	4	$^\circ\text{C}/\text{W}$
Junction-to-ambient .....	—	—	40	—	—	40	—	—	40	$^\circ\text{C}/\text{W}$

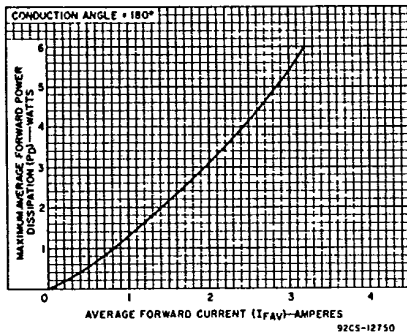


Fig. 1 — Power dissipation chart for all types.

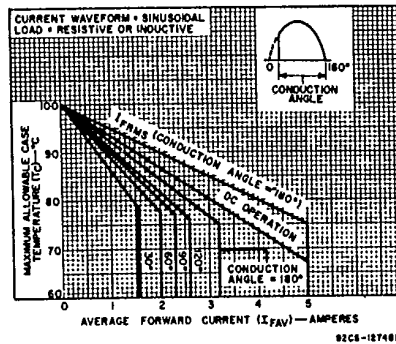


Fig. 2 — Rating chart (case temperature).

**2N3228, 2N3525, 2N4101**

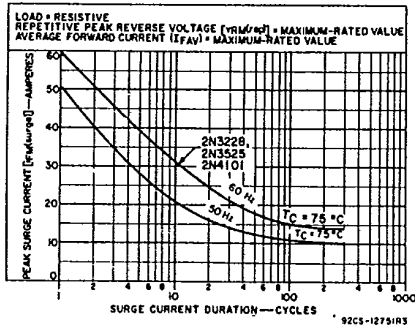


Fig. 3 — Surge-current rating chart.

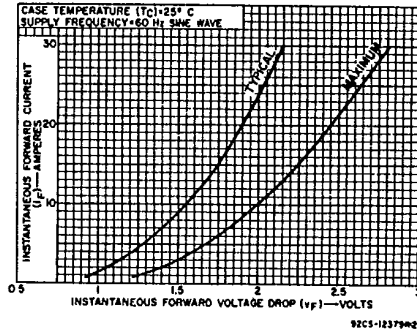


Fig. 4 — Forward characteristics for all types.

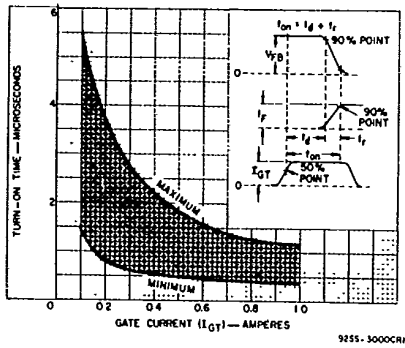


Fig. 5 — Turn-on time characteristics.

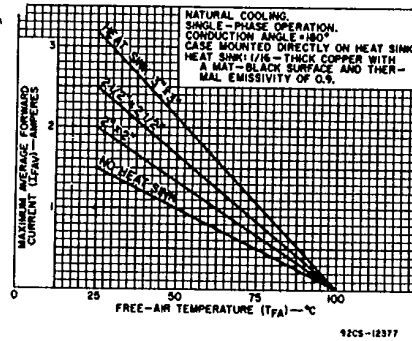


Fig. 6 — Operation guidance chart for types 2N3228, 2N3525, and 2N4101.