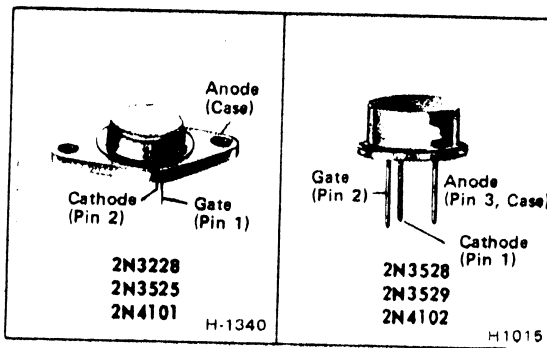


## Thyristors

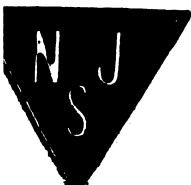
2N3228    2N3529  
 2N3525    2N4101  
 2N3528    2N4102



JEDEC TO-66

JEDEC TO-8

Current → Voltage ↓	Average Forward Amperes r 3.2	Average Forward Amperes 1.3
For 120-Volt Line Operation	2N3228	2N3528
For 240-Volt Line Operation	2N3525	2N3529
For High- Voltage Power Supplies	2N4101	2N4102



2N3228, 2N3525, 2N3528, 2N3529, 2N4101, 2N4102

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

CHARACTERISTICS	CONTROLLED-RECTIFIER TYPES									UNITS
	2N3228, 2N3528			2N3525, 2N3529			2N4101, 2N4102			
	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
$V_{FBOP} = V_{BO}$ (min. value) Reverse, $I_{RBOM}$ .....	—	0.05	0.75	—	0.10	1.5	—	0.20	2.0	mA
$V_{RBOP} = V_{RM}$ (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 $T_C = +25^\circ\text{C}$ (See Fig. 5) .....	—	8	15	—	8	15	—	8	15	mA(dc)
Gate-Trigger Voltage, $V_{GT}$ At $T_C = +25^\circ\text{C}$ (See Fig. 5) .....	—	1.2	2.0	—	1.2	2.0	—	1.2	2.0	volts(dc)
Holding Current, $I_{HO}$ 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, $T_C = +100^\circ\text{C}$ (See waveshape of Fig. 2) Turn-On Time, $t_{on}$ , (Delay Time + Rise Time) .....	0.75	1.5	—	0.75	1.5	—	0.75	1.5	—	microseconds
$V_{FB} = V_{BO}$ (min. value), $I_F = 4.5$ amperes, $I_{GT} = 200$ mA, 0.1 $\mu$ s rise time, $T_C = +25^\circ\text{C}$ (See waveshapes of Fig. 3) Turn-Off Time, $t_{off}$ .....	—	15	50	—	15	50	—	15	50	microseconds
$I_F = 2$ amperes, 50 $\mu$ s pulse width, $dv_{FB}/dt = 20$ v/ $\mu$ s, $di_F/dt = 30$ A/ $\mu$ s, $I_{GT} = 200$ mA, $T_C = +75^\circ\text{C}$ (See waveshapes of Fig. 4)										
	2N3228, 2N3525, 2N4101			2N3528, 2N3529, 2N4102						
	Min.	Typ.	Max.	Min.	Typ.	Max.				
Thermal Resistance: Junction-to-case .....	—	—	4	—	—	5				$^\circ\text{C}/\text{W}$
Junction-to-ambient .....	—	—	40	—	—	40				$^\circ\text{C}/\text{W}$

RATINGS	CONTROLLED-RECTIFIER TYPES						UNITS
	2N3228	2N3525	2N4101	2N3528	2N3529	2N4102	
Transient Peak Reverse Voltage (Non-Replicative), $v_{RM}(non-rep)$ . . . . .	330	660	700	330	660	700	volts
Peak Reverse Voltage (Repetitive), $v_{RM}(rep)$ . . . . .	200	400	600	200	400	600	volts
Peak Forward Blocking Voltage (Repetitive), $v_{FBOM}(rep)$ . . . . .	200	400	600	200	400	600	volts
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	—	—	—	amperes
RMS value, $I_{FRMS}$ . . . . .	5.0	5.0	5.0	—	—	—	amperes
For other conditions, See Fig. 8							
For free-air temperature ( $T_{FA}$ ) of 25°C, and with no heat sink employed—							
Average DC value at a conduction angle of 180°, $I_{FAV}$ . . . . .	—	—	—	1.3	1.3	1.3	amperes
RMS value, $I_{FRMS}$ . . . . .	—	—	—	2.0	2.0	2.0	amperes
For other conditions, See Fig. 9							
Peak Surge Current, $I_{FM}(surge)$ :							
For one cycle of applied principal voltage.							
60 Hz (sinusoidal), $T_C = 75^\circ C$ . . . . .		60			60		amperes
50 Hz (sinusoidal), $T_C = 75^\circ C$ . . . . .		50			50		amperes
For more than one cycle of applied voltage. . . . .		See Fig. 13			See Fig. 13		
Fusing Current (for SCR protection): $T_J = -40$ to $100^\circ C$ , $t = 1$ to $8.3$ ns, $I^2t$		15			15		ampere <sup>2</sup> second
Rate of Change of Forward Current, $di/dt$ . . . . .		200			200		amperes/ microsecond
$V_{FB} = v_{B00}$ (min. value) $I_{GT} = 200$ mA, $0.5 \mu s$ rise time (See waveshapes of Fig. 1)							
Gate Power*:							
Peak, Forward or Reverse, for $10 \mu s$ duration, $P_{GM}$ . (See Figs. 5 and 6)		13			13		watts
Average, $P_{GAV}$ . . . . .		0.5			0.5		watt
Temperature:							
Storage, $T_{stg}$ . . . . .		-40 to +125			-40 to +125		°C
Operating (Case), $T_C$ . . . . .		-40 to +100			-40 to +100		°C