RCA
Solid State
Division

Thyristors

S6431M

JEDEC TO-48 H-1601

Silicon Controlled Rectifier for High-Current Pulse Applications

Features:

- Up to 900 Amperes Peak Forward Current Pulses
- 30 Watts Maximum Average Dissipation
- Forward Current of 35 Amperes (rms value)
- Shorted-Emitter Design
- All-Diffused Construction — Assures Exceptional Uniformity and Stability
- Direct Soldered Internal Construction — Assures Exceptional Resistance to Fatigue

The S6431M (formerly RCA type 40216) is an all-diffused, three-junction silicon controlled rectifier (SCR) designed especially for use in radar pulse modulators, inverters, switching regulators, and other applications requiring a large ratio of peak to average current. It is especially constructed for rapid spread of forward current over the full junction area to achieve a high rate of change of forward current (di/dt) capability and low switching dissipation.

Absolute-Maximum Ratings

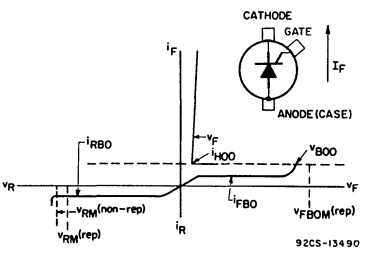
RATINGS	CONTROLLED-RECTIFIER TYPE S6431M	UNITS
Transient Peak Reverse Voltage (Non-Repetitive), v_{RM} (non-rep)	720	volts
Peak Reverse Voltage (Repetitive), v_{RM} (rep)	600	volts
Peak Forward Blocking Voltage (Repetitive), v_{FBOM} (rep)	600	volts
Forward Current:		
For case temperature of +65°C, RMS value, I_{FRMS}	35	amperes
Peak Pulse Current (See *Fig.7*)	900	amperes
Rate of Change of Forward Current, di/dt	See *Fig.7*	
Dynamic Dissipation:		
For case temperature of +65° C	30	watts
For other case temperatures	See *Fig.4*	
Gate Power*:		
Peak, Forward or Reverse, for 10 μs duration, P_{GM} (See *Figs.10 and 11*)	40	watts
Average, P_{GAV}	0.5	watt
Temperature:		
Storage, T_{stg}	−65 to +150	°C
Operating (Case), T_C	−65 to +125	°C

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

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

CHARACTERISTICS	CONTROLLED-RECTIFIER TYPE S6431M			UNITS
	Min.	*Typ.*	*Max.*	
Forward Breakover Voltage, v_{BOO} At T_C = +125° C	600	–	–	volts
Instantaneous Blocking Current, At T_C = +125° C				
Forward, i_{FBO}	–	–	10	mA
Reverse, i_{RBO}	–	–	10	mA
Forward Voltage Drop, v_F		See *Fig.5*		
DC Gate-Trigger Current, I_{GT}: At T_C = +25° C (See *Fig.10*)	1	25	80	mA(dc)
DC Gate-Trigger Voltage, V_{GT}: At T_C = +25° C (See *Fig.10*)	–	1.1	2	volts(dc)
Holding Current, i_{HOO}: At T_C = +25° C	0.5	20	70	mA
Critical Rate of Applied Forward Voltage, Critical dv/dt	20	50	–	volts/ microsecond
V_{FB} = v_{BOO} (min. value), exponential rise, and T_C = +125° C (See waveshape of *Fig.1*)				
Turn-On Time, t_{on}, (Delay Time + Rise Time)	–	1.25	–	microsecond
V_{FB} = v_{BOO} (min. value), i_F = 30 A, I_{GT} = 200 mA, 0.1 μs min. rise time, and T_C = +25° C (See waveshapes of *Fig.2*)				
Turn-Off Time, t_{off}, (Reverse Recovery Time + Gate Recovery Time)	15	20	40	microseconds
i_F = 18 A, 50 μs pulse width, dv_{FB}/dt = 20 V/μs, di_r/dt = 30 A/μs, I_{GT} = 200 mA, and T_C = +80° C (See waveshapes of *Fig.3*)				
Thermal Resistance, Junction-to-Case	–	–	2	°C/W

TYPICAL E-I CHARACTERISTIC OF SILICON CONTROLLED-RECTIFIER



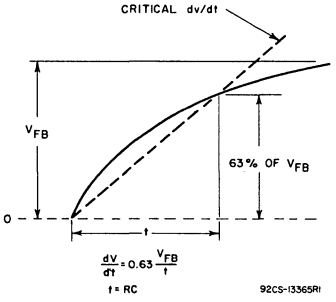


Fig. 1—Waveshape of critical dv/dt rating test.

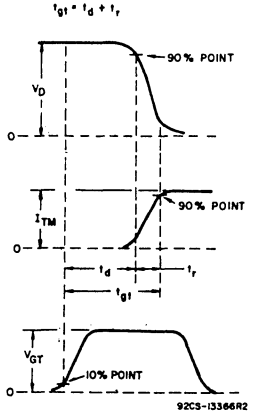


Fig. 2—Waveshape of t_{on} rating test.

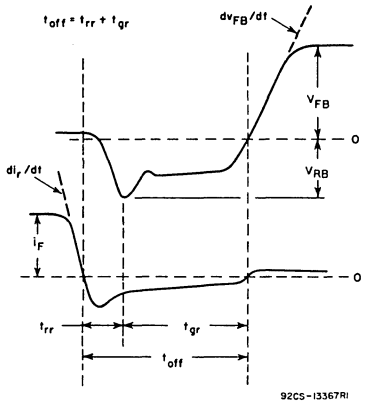


Fig. 3—Waveshape of t_{off} rating test.

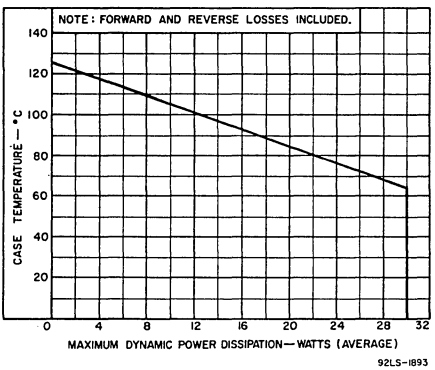


Fig. 4—Maximum average total power dissipation as a function of case temperature.

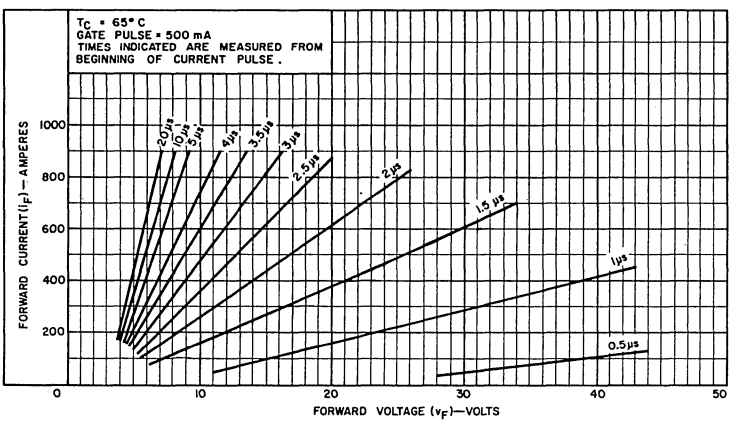


Fig. 5—Forward voltage-current characteristics as a function of time.

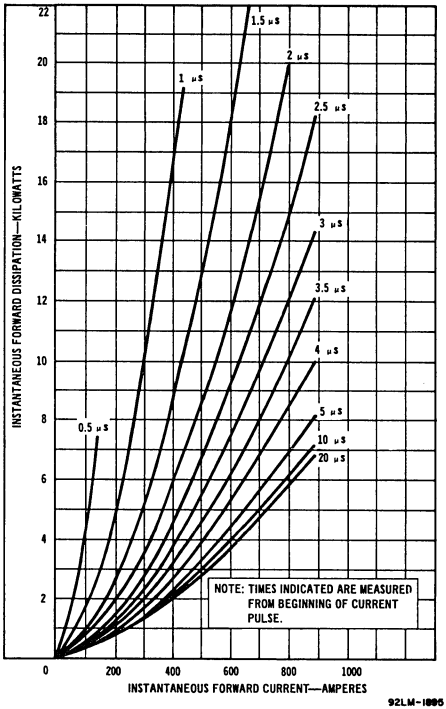


Fig. 6—Instantaneous forward dissipation-forward current characteristics as a function of time.

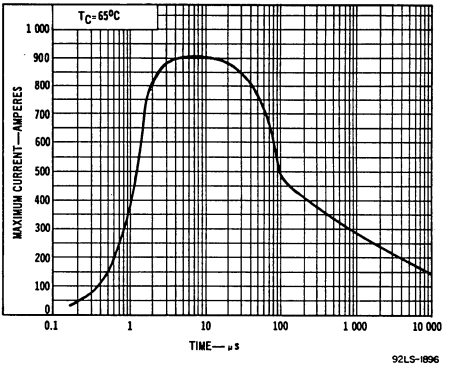


Fig. 7—Maximum current as a function of time.

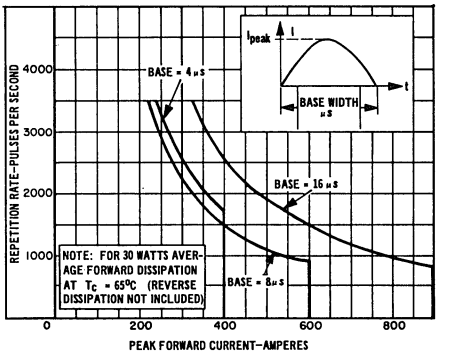


Fig. 8—Peak current as a function of maximum repetition rate for sine-wave pulse shapes.

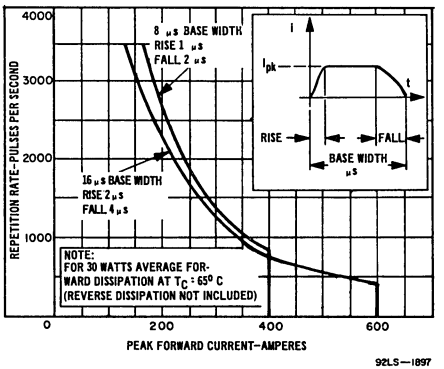


Fig. 9—Peak current as a function of maximum repetition rate for square-wave pulse shapes.

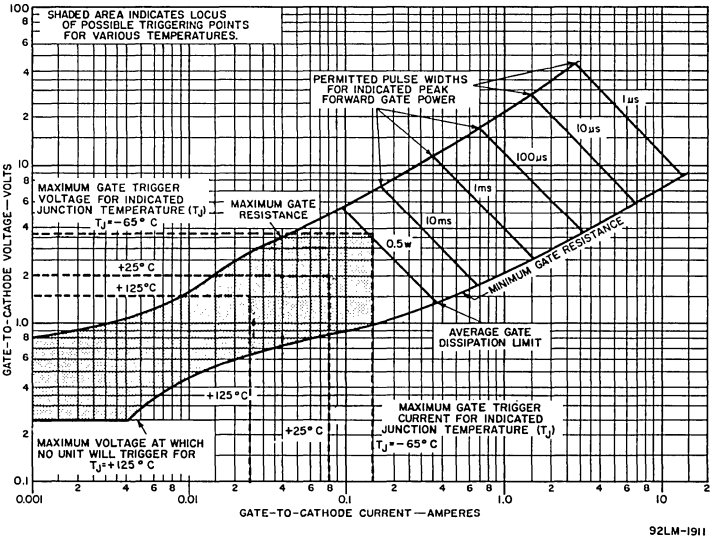


Fig. 10—Forward gate characteristics.

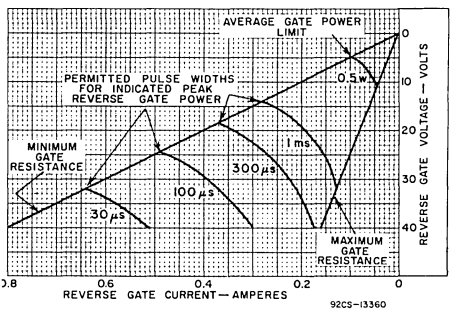


Fig. 11—Reverse gate characteristics.

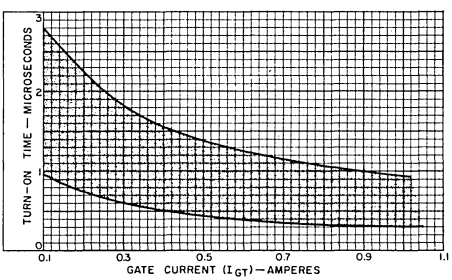


Fig. 12—Turn-on time characteristics.

TERMINAL CONNECTIONS

No. 1 — Gate
No. 2 — Cathode
No. 3 — Anode