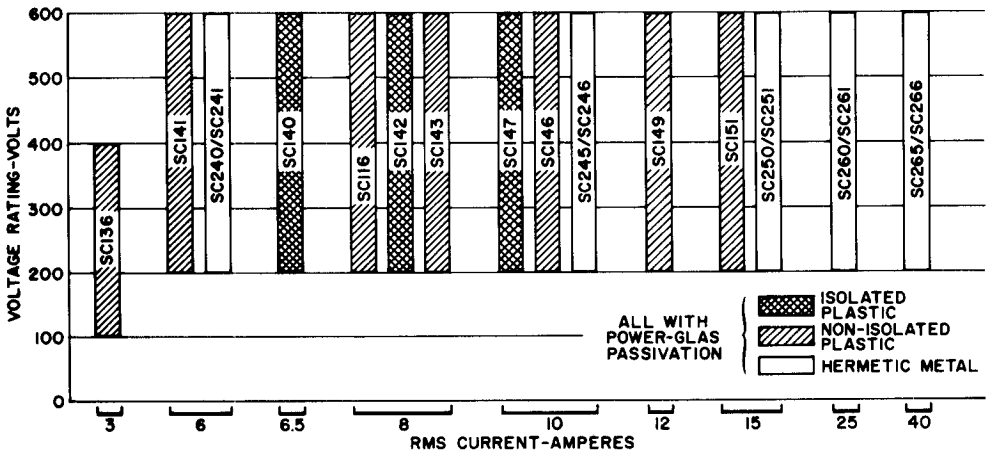
TRIAC SELECTOR GUIDE



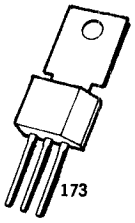
TRIAC TRIGGERS

The ST2 (diac) is a silicon bi-directional diode which may be used for triggering triacs or SCR's. It has a three layer structure with negative resistance switching characteristics in both directions.

The ST4 is an asymmetrical AC trigger integrated circuit for use in triac phase control applications. This device reduces the snap-on effects that are present in conventional trigger circuits by eliminating control circuit hystersis. This performance is possible with a single RC time constant where as a symmetrical circuit of comparable performance would require at least three more passive components.

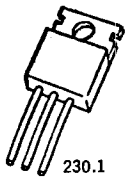
GE Type	V_{S2} Switching Voltage Min. (V)	V_{S2} Switching Voltage Max. (V)	V_{S1} Switching Voltage Min. (V)	V_{S1} Switching Voltage Max. (V)	I_{S2}, I_{S1} Switching Current Max. (μA)	Pulse Output Min. (V)	Package Outline No.
ST2	28[1]	36[1]	28[1]	36[1]	200	3.0	8
ST4	7	9	14	18	80	3.5	A

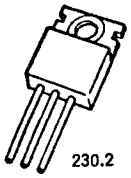
[1] For ST2, $V_{S2} = V_{S1} \pm 10\%$



TRIACS – ENCAPSULATED PACKAGE

POWER GLAS™ PASSIVATED PELLETS





			POWER TAB™		ISOLATED POWER PAC™			NON-ISOLATED POWER PAC™				
GE TYPE			**SC136**	**SC116**	**SC140**	**SC142**	**SC147**	**SC141**	**SC143**	**SC146**	**SC149**	**SC151**
ELECTRICAL SPECIFICATIONS												
VOLTAGE CHARACTERISTICS												
V_{DRM}	Repetitive Peak Off-State Voltage @ T_C = -40°C to +100°C											
	100 V		SC136A	–	–	–	–	–	–	–	–	–
	200 V		SC136B	SC116B	SC140B	SC142B	SC147B	SC141B	SC143B	SC146B	SC149B	SC151B
	400 V		SC136D	SC116D	SC140D	SC142D	SC147D	SC141D	SC143D	SC146D	SC149D	SC151D
	500 V		–	SC116E	SC140E	SC142E	SC147E	SC141E	SC142E	SC146E	SC149E	SC151E
	600 V		–	SC116M	SC140M	SC142M	SC147M	SC141M	SC142M	SC146M	SC149M	SC151M
V_{TM}	Max. On-State Voltage at Peak of RMS Current Rating (V)		1.8	1.63	1.85	1.75	1.50	1.63	1.55	1.65	1.65	1.52
CURRENT CHARACTERISTICS												
$I_{T(RMS)}$	Max. RMS On-State Current (A)		3	8	6.5	8	10	6	8	10	12	15
$T_{C(MAX)}$	Max. Case Temperature at Rated RMS Current (°C)		65	32	80	75	80	80	80	80	75	80
I_{TSM}	Max. Peak One Cycle Non-Repetitive Surge Current (A)											
	@ 50 Hz		–	90	74	104	104	74	110	110	110	110
	@ 60 Hz		30	100	80	110	110	80	120	120	120	120
I_{DRM}	Max. Leakage Current at T_C = 25°C (mA)		.01	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
I_H	Max. DC Holding Current (mAdc)											
	@ +25°C		50	50	50	50	50	50	50	50	50	50
	@ -40°C		100	100	100	100	100	100	100	100	100	100
I_L	Max. DC Latching Current (mAdc)											
	@ T_C = +25°C	MT2+ Gate +	50	100	100	100	100	100	100	100	100	100
		MT2 – Gate –	50	100	100	100	100	100	100	100	100	100
		MT2+ Gate –	100	200	200	200	200	200	200	200	200	200
	@ T_C = -40°C	MT2+ Gate +	100	200	200	200	200	200	200	200	200	200
		MT2 – Gate –	100	200	200	200	200	200	200	200	200	200
		MT2+ Gate –	200	400	400	400	400	400	400	400	400	400
BLOCKING												
dv/dt	Typical Static dv/dt at Rated V_{DRM}, Gate Open Circuited (V/μsec)											
	@ T_C = 100°C		–	150	100	150	150	100	150	150	200	200
	@ T_C = 110°C		50	–	–	–	–	–	–	–	–	–
$dv/dt_{(c)}$	Min. Commutating dv/dt at Rated V_{DRM} and di/dt = (0.54) $I_{T(RMS)}$ A/msec. Gate Open Circuited, (V/μsec).		5	4	4	4	4	4	4	4	4	4
TRIGGERING												
I_{GT}	Max. Required DC Gate Current (mAdc) to Trigger, @ V_D = 12 Vdc											
	@ T_C = +25°C	MT2+ Gate +	25	50	50	50	50	50	50	50	50	50
		MT2 – Gate –	25	50	50	50	50	50	50	50	50	50
		MT2+ Gate –	25	80	50	50	50	50	50	50	50	50
	@ T_C = -40°C	MT2+ Gate +	50	80	80	80	80	80	80	80	80	80
		MT2 – Gate –	50	80	80	80	80	80	80	80	80	80
		MT2+ Gate –	50	130	80	80	80	80	80	80	80	80
V_{GT}	Max. Required DC Gate Voltage to Trigger, MT2+ Gate +, MT2 – Gate –, MT2+ Gate –. @ V_D = 12 Vdc, (V).											
	@ T_C = +25°C		2.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	@ T_C = -40°C		3.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
MECHANICAL SPECIFICATIONS												
PACKAGE OUTLINE NO.												
	Non-Isolated Tab		173	173	–	–	–	230.2 ←				→ 230.2
	Isolated Tab		–	–	230.1	230.1	230.1	–	–	–	–	–

Triac

Bi-Directional Triode Thyristor

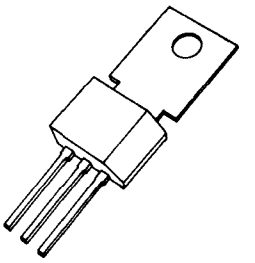
SC136

3A RMS **Up to 400 Volts**

General Electric's Triac is a bi-directional triode thyristor which may be gate triggered from blocking to a conducting state for either polarity of applied voltage. This device will perform most of the functions of two SCR's (silicon controlled rectifiers) connected in inverse parallel.

The GE SC136 series Triac is designed for 120 and 240 volt, 50 and 60 Hz AC switching and control applications such as lamp dimming, motor speed and temperature controlling, and static switching. The device is able to withstand the inrush surge of any parallel combination of tungsten lamp loads totaling 150 watts on a 120-volt line or 300 watts on a 240-volt line.

An important feature of the SC136 is its ability to switch into the conducting state should a breakover voltage in either polarity be exceeded, thus providing inherent immunity from transient voltage damage which generally eliminates the need for auxiliary protective devices.



Blue Silicone Leads Can Be Formed To A TO-5 Pin Configuration

Features:

- Inherent immunity from transient voltage damage (can be broken over safely in either direction)
- Improved commutating dv/dt (5V/μs min)
- No maximum torque limit on mounting screw
- Narrow leads greatly simplifies customer assembly
- Four standard lead forming configurations available from factory (including TO-5 compatability)
- Special selections for non-standard gate requirements available upon request

TYPICAL TRIAC APPLICATIONS

	GENERAL FUNCTIONS				
TYPES OF EQUIPMENT	Heat Control	Motor Speed Control	Light Control	Solid State Contractors and Relays	Power Regulation
Photographic Dev. Equip	X	X	X		
Process Control	X	X	X	X	X
Reproduction Equipment	X	X	X	X	
Blenders, Mixers		X			
Computer Tape Decks		X			
Fans		X			
Hand Tools		X			
Machine Tools/Misc. Mfg.		X		X	
Sewing Machines		X			
Laundry				X	
Farm Equipment	X	X	X	X	
Light Dimmers			X		
Photographic Equipment	X		X	X	
Outdoor Signs			X	X	
Clutches/Brakes				X	
Industrial Timers				X	
Vending Machines	X	X		X	
Computer Power Supplies					X
Home Entertainment	X	X	X	X	X

SC136

MAXIMUM ALLOWABLE RATINGS

TYPE	RMS On-State Current 360° Conduction, T_{TAB} = 65°C $I_{T\ (RMS)}$	Repetitive Peak Off-State Voltage T_j = -40°C to + 110°C V_{DRM} Notes 1, 2	Peak One Full Cycle Surge (Non-rep) On-State Current T_j = -40°C to + 110°C I_{TSM}
	Amperes	Volts	Amps
SC136B	3.0	200	30
SC136D	3.0	400	30

Critical Rate-Of-Rise of On-State Current, di/dt: (2) (4)
Breakover voltage triggered operation 5A/μS
Peak Gate Power Dissipation, P_{GM} (3) . . . . . 5.0 Watts
Average Gate Power Dissipation, $P_{G(AV)}$ (3) . . . . . 0.1 Watts
Storage Temperature, T_{stg} . . . . . −40°C to +150°C
Operating Temperature, T_J . . . . . −40°C to +110° C

NOTES:
1. Ratings apply for zero gate voltage only.
2. Ratings apply for either polarity of main terminal 2 referenced to main terminal 1.
3. Ratings apply for either polarity of gate terminal referenced to main terminal 1.
4. di/dt rating is established in accordance with EIA Standard RS397, Recommended Standards for Thyristors, Section 5.2.2.6.

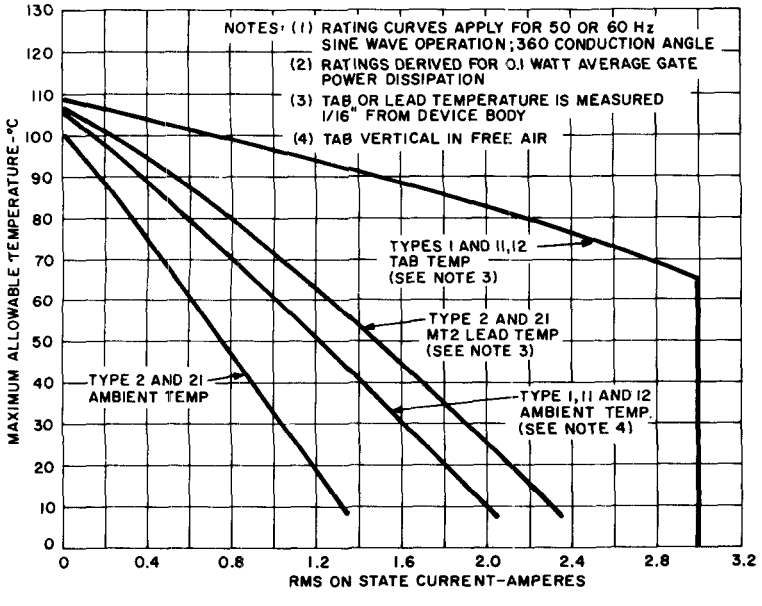


FIGURE 1:
MAXIMUM ALLOWABLE TEMPERATURES VS. RMS ON-STATE CURRENT

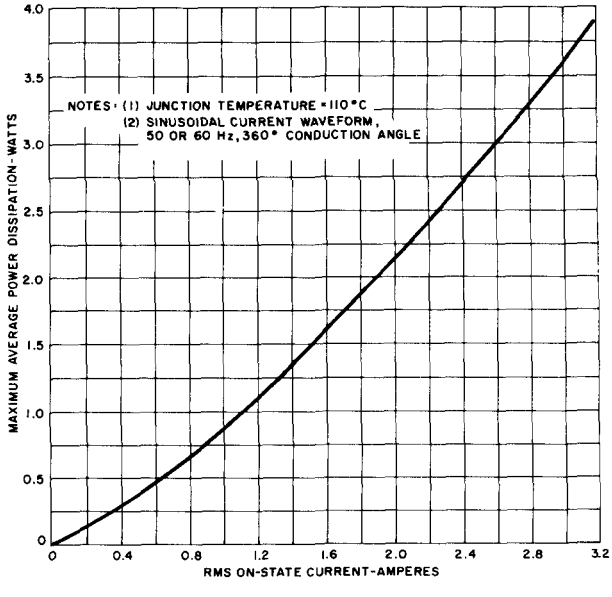


FIGURE 2:
MAXIMUM AVERAGE POWER DISSIPATION VS. RMS ON-STATE CURRENT

CHARACTERISTICS

SC136

Test	Symbol	Min.	Typ.	Max.	Units	Test Conditions	Reference Note
Peak Off-State Current	I_{DRM}				μA	V_{DRM} = Maximum Allowable Peak Off-State Voltage, Gate Open Circuited	1, 5
		–	–	10		T_L = +25°C	
		–	–	500		T_L = +110°C	
Peak On-State Voltage	V_{TM}	–	–	1.8	Volts	T_L = +25°C, I_{TM} = 5A peak, 1 msec Wide pulse, duty cycle ≦ 2%	1, 5
Critical Rate of Rise of Off-State Voltage (Higher values may cause device switching)	dv/dt	10	–	–	Volts/μsec	T_L = +110°C, Rated V_{DRM}, Gate Open Circuited, Exponential Waveform	1, 5
Critical Rate of Rise of Commutating Off-State Voltage (Commutating dv/dt)	$dv/dt_{(c)}$	5	–	–	Volts/μsec	T_L = +65°C, $I_{T(RMS)}$ = 3.0 A, V_{DRM} = Rated Max. Allowable Peak Off-State Voltage, Gate Open Circuited, Commutating di/dt = 1.6A/msec	1, 5
DC Gate Trigger Current	I_{GT}				mAdc	R_L = 50 ohms; Trigger Mode / V_D / T_L	2, 4, 5
		–	–	25		MT2+ Gate+ / 6 V_{dc} / +25°C	
		–	–	25		MT2– Gate– / 6 V_{dc} / +25°C	
		–	–	25		MT2+ Gate– / 6 V_{dc} / +25°C	
		–	–	50		MT2+ Gate + / 12 V_{dc} / –40°C	
		–	–	50		MT2– Gate– / 12 V_{dc} / –40°C	
		–	–	50		MT2+ Gate– / 12 V_{dc} / –40°C	
DC Gate Trigger Voltage	V_{GT}				Vdc	Trigger Mode / V_D / R_L / T_L	2, 5
		–	–	2.0		MT2+ Gate+ / 6 Vdc / 50 ohms / +25°C	
		–	–	2.0		MT2– Gate– / 6 Vdc / 50 ohms / +25°C	
		–	–	2.0		MT2+ Gate– / 6 Vdc / 50 ohms / +25°C	
		–	–	3.0		MT2+ Gate+ / 12 Vdc / 50 ohms / –40°C	
		–	–	3.0		MT2– Gate– / 12 Vdc / 50 ohms / –40°C	
		–	–	3.0		MT2+ Gate – / 12 Vdc / 50 ohms / –40°C	
		0.20	–	–		MT2+ Gate+ / Rated V_{DRM} / 1000 ohms / +110°C	
						MT2– Gate– / Rated V_{DRM} / 1000 ohms / +110°C	
						MT2+ Gate– / Rated V_{DRM} / 1000 ohms / +110°C	
						MT2– Gate+ / Rated V_{DRM} / 1000 ohms / +110°C	
DC Holding Current	I_H				mAdc	Main Terminal Source Voltage = 24 Vdc, Peak initiating on-state current = 0.1A 0.1 milliseconds to 10 milliseconds wide pulse, Gate trigger pulse width = 100 μsec	1, 5
		–	–	50		T_L = +25°C, Gate trigger source = 5V, 50Ω	
		–	–	100		T_L = –40°C, Gate trigger source = 10V, 50Ω	
DC Latching Current	I_L				mAdc	Main Terminal Source Voltage = 24 Vdc, Gate trigger pulse width = 100 μsec; Trigger Mode / Trigger Source / T_L	2, 5
		–	–	50		MT2+ Gate+ / 5V, 50Ω / +25°C	
		–	–	50		MT2– Gate– / 5V, 50Ω / +25°C	
		–	–	100		MT2+ Gate– / 5V, 50Ω / +25°C	
		–	–	100		MT2+ Gate+ / 10V, 50Ω / –40°C	
		–	–	100		MT2– Gate– / 10V, 50Ω / –40°C	
		–	–	200		MT2+ Gate– / 10V, 50Ω / –40°C	
Steady-State Thermal Resistance	$R_{\theta JA}$	–	–	75	°C/Watt	Junction to Ambient, tab types 1, 11, 12	3, 5
	$R_{\theta JA}$	–	–	100		Junction to Ambient, no tab types 2, 21	
	$R_{\theta J\text{-}TAB}$	–	–	10		Junction to tab, types 1, 11, 12	
	$R_{\theta JL}$	–	–	35		Junction to MT2 lead, no tab types 2, 21	

NOTES:
1. Values apply for either polarity of main terminal 2 characteristics referenced to main terminal 1.
2. Main terminal 1 is the reference terminal for main terminal 2 and gate terminal.
3. Junction to case values tested in accordance with JEDEC Semiconductor device registration #JC-22 (RDF-2), VA, Note 6, which states, "Thermal characteristics are to be measured with the device operating in only one direction. The values registered are to be the limiting value for either direction." The junction to ambient value is with the device inserted in a socket (unsoldered) and natural convection. See outline drawing for tab and lead temperature measurement points.
4. Special selections for non-standard gate requirements available upon request.
5. The lead temperature (T_L) is measured in the center of the tab, 1/16 inch from the body on Type 1, 11 and 12 devices, and in the center of the MT_2 lead, 1/16 inch from the body on Type 2 and 21 devices.

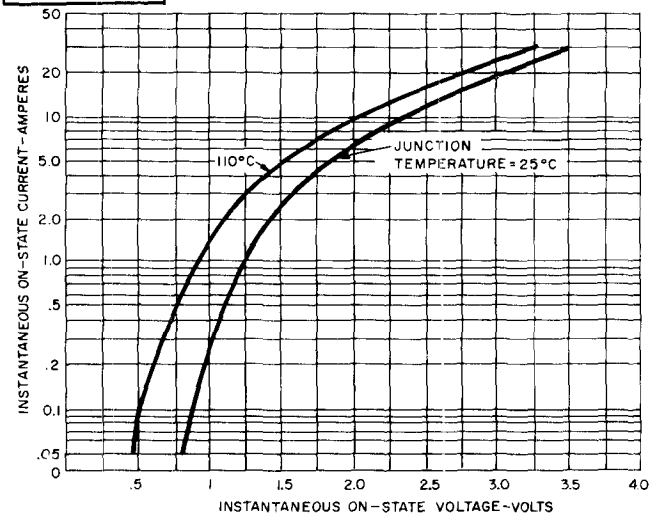


FIGURE 3: MAXIMUM ON-STATE CHARACTERISTICS

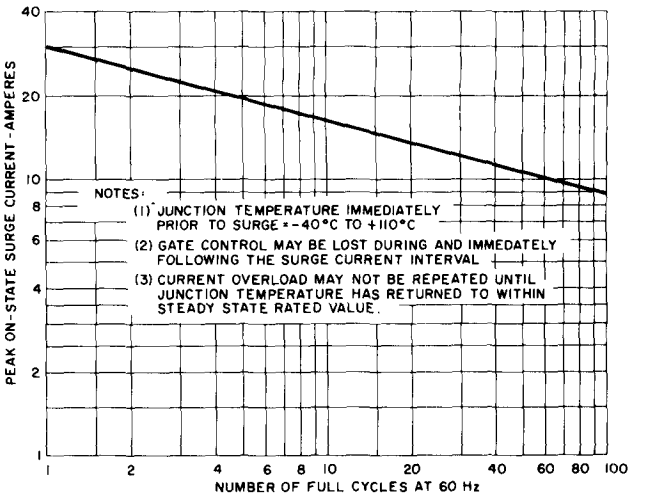
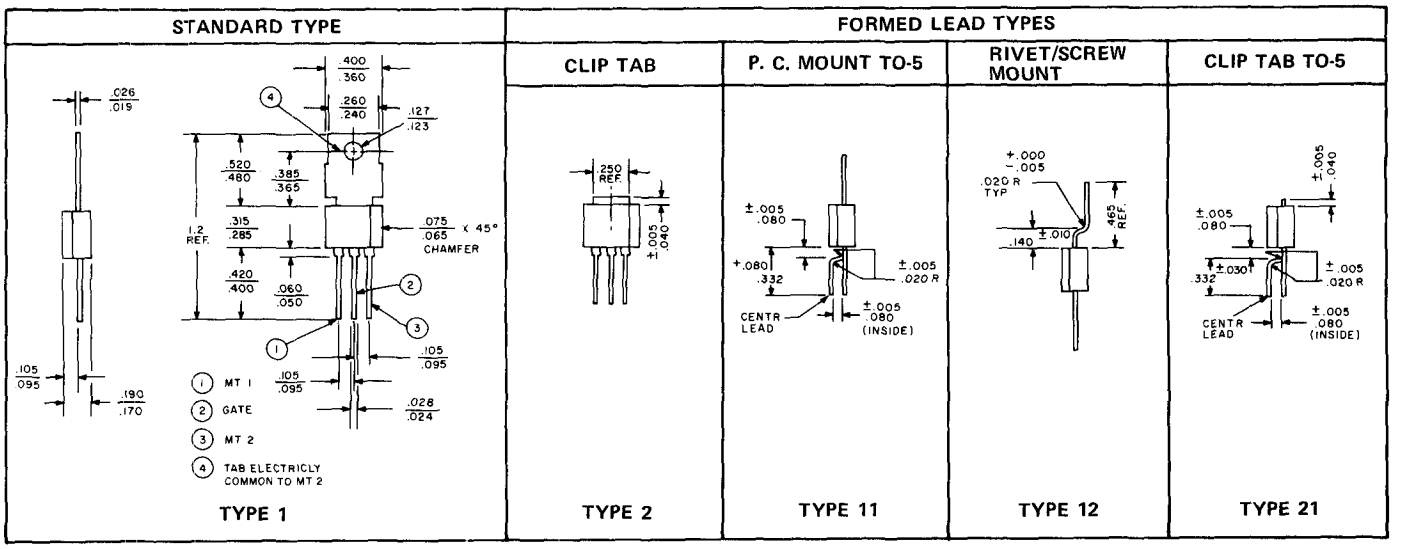


FIGURE 4: MAXIMUM ALLOWABLE FULL CYCLE SURGE CURRENT FOLLOWING RATED LOAD CONDITIONS

OUTLINE DRAWINGS



OTHER TRIAC AND APPLICATION INFORMATION AVAILABLE FROM GENERAL ELECTRIC

Publication Number	Specification Sheets	
175.13	SC136	(3 Amp in plastic package)
175.14	SC142	(8 Amp in plastic package with isolated tab)
175.15	SC141/146	(6, 10 Amp in plastic package)
175.16	SC240/241	(6 Amp)
175.17	SC245/246	(10 Amp)
175.18	SC250/251	(15 Amp)
175.29	SC260/261	(25 Amp)
175.30	ST2	(Diac)
175.32	ST4	(Asymmetrical A.C. Switch)

Publication Number	Application Notes
200.35	Using the Triac for Control of AC Power
200.51	Better Room Conditioning Via Solid State Controls
200.53	Solid State Incandescent Lighting Controls
200.61	A Zero Voltage Switching Temperature Control
200.70	Low Resistance Sensor–Zero Voltage Switching Temperature Control
201.12	500 Watt AC Line Voltage and Power Regulator
201.19	RF Filter Considerations for Triac & SCR Circuits
200.55	Handling and Thermal Considerations for General Electric Plastic Power Devices
201.24	Thyristor Selection for Incandescent Lamp Loads

All of these referred to may be ordered by publication number from General Electric Company, Distribution Services, Bldg. 6-208, Schenectady, New York 12305.