



# INDUSTRIAL POWER SEMICONDUCTOR GUIDE

Inverter SCRs | Phase Control SCRs | Diodes | Heatsinks



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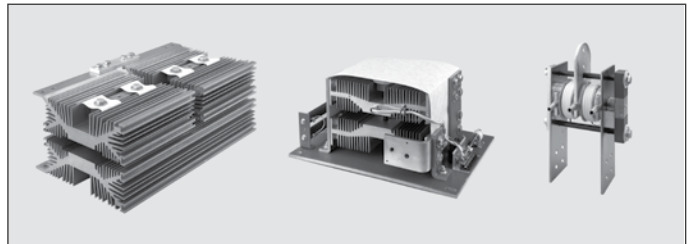
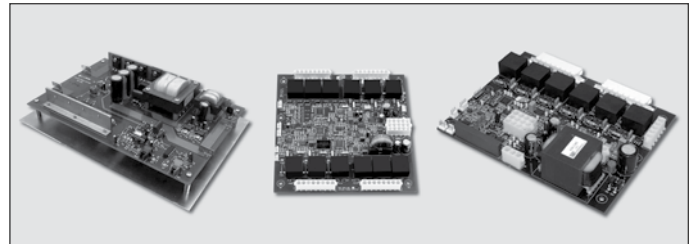
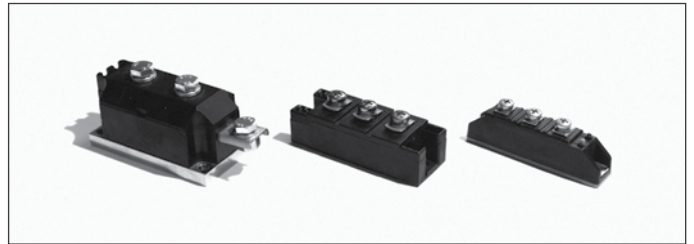
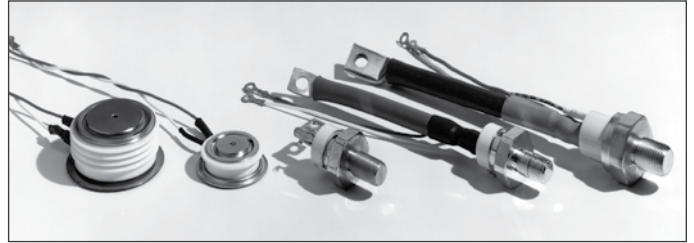
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# Inverter SCRs



National Type No.	C144	C148	C149	C154 C156	C155 C157	C158 C159	
Voltage range	200-1000	200-1200	200-600	200-600	200-600	600-1200	
$I_{T(RMS)}$ , RMS on-state current	35	63	63	110	110	110	
$I_{T(AV)}$ , Amps @ 180° conduction @ Tc	22.5 @ 65	40 @ 65	40 @ 65	70 @ 65	70 @ 65	70 @ 65	
$I_{TSM}$ , Peak one cycle surge (A)	250	700	700	1800	1800	1600	
$I^2t$ , (for fusing) 8.3mSec (A <sup>2</sup> sec)	165	2000	2000	13500	13500	10500	
$I_{DRM}/I_{RRM}$ , Peak reverse & off-state current @ 125°C (mA)	10	12	12	20	20	20	
$V_{TM}$ , Peak on-state volts at peak amps @ 25°C	3 @ 100	4 @ 500	4 @ 500	3 @ 500	3 @ 500	3.5 @ 500	
di/dt, Rate of rise of on-state current (A/μSec)	100	100	100	500	500	500	
dv/dt, Rate of rise of off-state voltage (V/μSec)	200	200	200	200	200	200	
$t_q$ , Turn-off time (μSec)	20	30	10	10	20	40	
$I_{GT}$ , Gate trigger current (mA)	150	150	150	150	150	150	
$V_{GT}$ , Gate trigger voltage (V)	3.0	3.0	3.0	3.0	3.0	3.0	
$R_{\theta IC}$ , Thermal resistance junction-case (°C/W)	1.00	0.45	0.45	0.30	0.30	0.30	
$T_J$ , Max. junction temperature (°C)	125	125	125	125	125	125	
$V_{DRM}$ Repetitive peak forward voltage  <i>and</i>  $V_{RRM}$ Repetitive peak reverse voltage	200 B	C144B	C148B	C149B	C154B C156B	C155B C157B	—
	400 D	C144D	C148D	C149D	C154D C156D	C155D C157D	—
	600 M	C144M	C148M	C149M	C154M C156M	C155M C157M	C158M C159M
	800 N	C144N	C148N	—	—	—	C158N C159N
	1000 P	C144P	C148P	—	—	—	C158P C159P
	1200 PB	—	C148PB	—	—	—	C158PB C159PB
	1400 PD	—	—	—	—	—	C158PD C159PD
Stud torque (in-lbs)	30	30	30	150	150	150	
Mounting force (lbs)	—	—	—	—	—	—	
Package type	TO-65	TO-65	TO-65	TO-94/TO-83	TO-94/TO-83	TO-94/TO-83	



# Inverter SCRs



National Type No.		<b>C164 C164-2</b>	<b>C165 C165-2</b>	<b>C184 C185</b>	<b>C354 C355</b>	<b>C358</b>	<b>C364 C365</b>
Voltage range		200-600	200-800	200-800	200-600	200-1200	200-800
$I_{T(RMS)}$ , RMS on-state current		110	110	300	275	225	275
$I_{T(AV)}$ , Amps @ 180° conduction @ Tc		70 @ 65	70 @ 65	190 @ 65	175 @ 65	140 @ 65	175 @ 65
$I_{TSM}$ , Peak one cycle surge (A)		1800	1800	3500	1800	1600	1800
$I^2t$ , (for fusing) 8.3mSec (A <sup>2</sup> sec)		13500	13500	50000	13500	10500	13500
$I_{DRM}/I_{RRM}$ , Peak reverse & off-state current @ 125°C (mA)		20	20	30	30	20	20
$V_{TM}$ , Peak on-state volts at peak amps @ 25°C		2.6 @ 500	2.6 @ 500	2.85 @ 1500	3 @ 500	3.5 @ 500	2.6 @ 500
di/dt, Rate of rise of on-state current (A/μSec)		500	500	500	500	500	500
dv/dt, Rate of rise of off-state voltage (V/μSec)		200	200	200	100	200	200
$t_q$ , Turn-off time (μSec)		10	20	10/20	10/20	40	10/20
$I_{GT}$ , Gate trigger current (mA)		250	250	300	150	150	250
$V_{GT}$ , Gate trigger voltage (V)		3.0	3.0	3.0	3.0	3.0	3.0
$R_{\theta IC}$ , Thermal resistance junction-case (°C/W)		0.30	0.30	0.15	0.13	0.135	0.135
$T_J$ , Max. junction temperature (°C)		125	125	125	125	125	125
$V_{DRM}$ Repetitive peak forward voltage  <i>and</i>  $V_{RRM}$ Repetitive peak reverse voltage	200 B	C164B C164B2	C165B C165B2	C184B C185B	C354B C355B	C358B	C364B C365B
	400 D	C164D C164D2	C165D C165D2	C184D C185D	C354D C355D	C358D	C364D C365D
	600 M	C164M C164M2	C165M C165M2	C184M C185M	C354M C355M	C358M	C364M C365M
	800 N	—	C165N C165N2	C184N C185N	—	C358N	C364N C365N
	1000 P	—	—	—	—	C358P	—
	1200 PB	—	—	—	—	C358PB	—
Stud torque (in-lbs)		150	150	300	—	—	—
Mounting force (lbs)		—	—	—	800	800	800
Package type		TO-94/TO-83	TO-94/TO-83	TO-93	TO-200AB	TO-200AB	TO-200AB

# Inverter SCRs

National Type No.	C376	C377	C378	C384 C385	C387 C388	C392 C393	
Voltage range	600-1400	600-1400	600-1400	200-800	600-1200	200-600	
$I_{T(RMS)}$ , RMS on-state current	500	700	700	400	500	500	
$I_{T(AV)}$ , Amps @ 180° conduction @ Tc	315 @ 65	445 @ 65	445 @ 65	250 @ 65	315 @ 65	315 @ 65	
$I_{TSM}$ , Peak one cycle surge (A)	6000	7500	7500	3500	5500	5500	
$I^2t$ , (for fusing) 8.3mSec (A <sup>2</sup> sec)	150000	230000	230000	50000	120000	120000	
$I_{DRM}/I_{RRM}$ , Peak reverse & off-state current @ 125°C (ma)	45	45	45	30	45	45	
$V_{TM}$ , Peak on-state volts at peak amps @ 25°C	2.2 @ 1000	1.8 @ 1000	1.8 @ 1000	2.85 @ 1500	4.2 @ 3000	4.2 @ 3000	
di/dt, Rate of rise of on-state current (A/μSec)	500	500	500	500	500	500	
dv/dt, Rate of rise of off-state voltage (V/μSec)	200	200	200	200	200	200	
$t_q$ , Turn-off time (μSec)	20	40	30	10 / 20	40 / 30	15 / 20	
$I_{GT}$ , Gate trigger current (mA)	300	300	300	300	150	200	
$V_{GT}$ , Gate trigger voltage (V)	3.0	3.0	3.0	3.0	3.0	3.0	
$R_{\theta JC}$ , Thermal resistance junction-case (°C/W)	0.060	0.060	0.060	0.095	0.060	0.060	
$T_J$ , Max. junction temperature (°C)	125	125	125	125	125	125	
$V_{DRM}$ Repetitive peak forward voltage  and  $V_{RRM}$ Repetitive peak reverse voltage	200 B	—	—	—	C384B C385B	—	C392B C393B
	400 D	—	—	—	C384D C385D	—	C392D C393D
	600 M	C376M	C377M	C378M	C384M C385M	C387M C388M	C392M C393M
	800 N	C376N	C377N	C378N	C384N C385N	C387N C388N	—
	1000 P	C376P	C377P	C378P	—	C387P C388P	—
	1200 PB	C376PB	C377PB	C378PB	—	C387PB C388PB	—
	1400 PD	C376PD	C377PD	C378PD	—	—	—
Stud torque (in-lbs)	—	—	—	—	—	—	
Mounting force (lbs)	2000	2000	2000	800	2000	2000	
Package type	TO-200AC	TO-200AC	TO-200AC	TO-200AB	TO-200AC	TO-200AC	

# Inverter SCRs



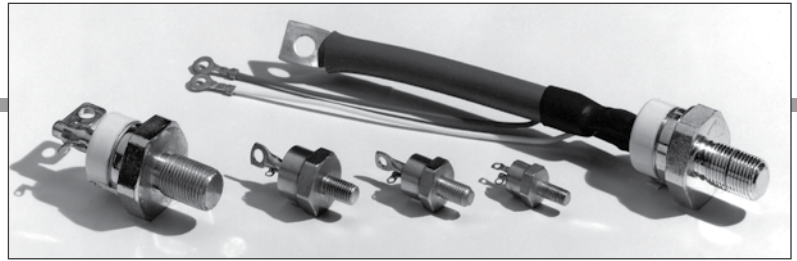
National Type No.		C394 C395	C398	C434 C435	C436	C437 C438	C447 C448
Voltage range		200-600	200-1400	200-600	600-1400	600-1400	600-1400
$I_{T(RMS)}$ , RMS on-state current		700	650	600	650	650	1000
$I_{T(AV)}$ , Amps @ 180° conduction @ Tc		445 @ 65	410 @ 65	380 @ 65	410 @ 65	410 @ 65	635 @ 65
$I_{TSM}$ , Peak one cycle surge (A)		8000	7500	8000	5500	7500	9000
$I^2t$ , (for fusing) 8.3mSec (A <sup>2</sup> sec)		250000	230000	250000	120000	230000	410000
$I_{DRM}/I_{RRM}$ , Peak reverse & off-state current @ 125°C (mA)		45	45	60	60	60	70
$V_{TM}$ , Peak on-state volts at peak amps @ 25°C		2.5 @ 3000	3 @ 3000	2.1 @ 1000	2.6 @ 1000	2.2 @ 1000	2.9 @ 2000
di/dt, Rate of rise of on-state current (A/μSec)		500	500	500	500	500	500
dv/dt, Rate of rise of off-state voltage (V/μSec)		200	200	200	200	200	200
$t_{qr}$ , Turn-off time (μSec)		15 / 20	40	15 / 20	30	60 / 40	40 / 25
$I_{GT}$ , Gate trigger current (mA)		200	150	200	200	200	300
$V_{GT}$ , Gate trigger voltage (V)		3.0	3.0	3.0	3.0	3.0	3.0
$R_{\theta IC}$ , Thermal resistance junction-case (°C/W)		0.060	0.060	0.040	0.060	0.040	0.040
$T_J$ , Max. junction temperature (°C)		125	125	125	125	125	125
$V_{DRM}$ Repetitive peak forward voltage  <i>and</i>  $V_{RRM}$ Repetitive peak reverse voltage	200 B	C394B C395B	C398B	C434B C435B	—	—	—
	400 D	C394D C395D	C398D	C434D C435D	—	—	—
	600 M	C394M C395M	C398M	C434M C435M	C436M	C437M C438M	C447M C448M
	800 N	—	C398N	—	C436N	C437N C438N	C447N C448N
	1000 P	—	C398P	—	C436P	C437P C438P	C447P C448P
	1200 PB	—	C398PB	—	C436PB	C437PB C438PB	C447PB C448PB
	1400 PD	—	C398PD	—	C436PD	C437PD C438PD	C447PD C448PD
Stud torque (in-lbs)		—	—	—	—	—	—
Mounting force (lbs)		2000	2000	2000	2000	2000	4000
Package type		TO-200AC	TO-200AC	TO-200AB-2	TO-200AB-2	TO-200AB-2	TO-200AC

# Inverter SCRs

National Type No.		C457	C458	C612	C648	C712	C770
Voltage range		600-1400	600-1400	1200-2000	600-1200	1400-2000	1400-1800
$I_{T(RMS)}$ , RMS on-state current		2000	1600	1150	1150	1570	3250
$I_{T(AV)}$ , Amps @ 180° conduction @ Tc		1250 @ 65	1000 @ 65	730 @ 65	730 @ 65	1000 @ 65	2100 @ 70
$I_{TSM}$ , Peak one cycle surge (A)		18700	16000	8000	10000	14300	38000
$I^2t$ , (for fusing) 8.3mSec (A <sup>2</sup> sec)		1451000	1060000	320000	415000	1065500	5500000
$I_{DRM}/I_{RRM}$ , Peak reverse & off-state current @ 125°C (mA)		150	150	70	45	150	100
$V_{TM}$ , Peak on-state volts at peak amps @ 25°C		2 @ 3000	2.6 @ 3000	2 @ 1000	1.7 @ 1000	1.9 @ 1000	1.5 @ 2000
di/dt, Rate of rise of on-state current (A/μSec)		500	500	500	500	800	300
dv/dt, Rate of rise of off-state voltage (V/μSec)		200	200	200	400	200	500
$t_{q}$ , Turn-off time (μSec)		40	25	60	40	60	100
$I_{GT}$ , Gate trigger current (mA)		300	300	300	150	300	300
$V_{GT}$ , Gate trigger voltage (V)		3.0	3.0	3.0	3.0	3.0	3.0
$R_{\theta JC}$ , Thermal resistance junction-case (°C/W)		0.023	0.025	0.045	0.040	0.024	0.012
$T_J$ , Max. junction temperature (°C)		125	125	125	125	125	125
$V_{DRM}$ Repetitive peak forward voltage  <i>and</i>  $V_{RRM}$ Repetitive peak reverse voltage	600 M	C457M	C458M	—	C648M	—	—
	800 N	C457N	C458N	—	C648N	—	—
	1000 P	C457P	C458P	—	C648P	—	—
	1200 PB	C457PB	C458PB	C612PB	C648PB	—	—
	1400 PD	C457PD	C458PD	C612PD	—	C712PD	C770PD
	1600 PM	—	—	C612PM	—	C712PM	C770PM
	1800 PN	—	—	C612PN	—	C712PN	C770PN
	2000 L	—	—	C612L	—	C712L	—
Stud torque (in-lbs)		—	—	—	—	—	—
Mounting force (lbs)		5500	5500	4000	3000	5000	8500
Package type		P-4	P-4	TO-200AC	TO-200AC	P-4	P-7



# Phase Control SCRs

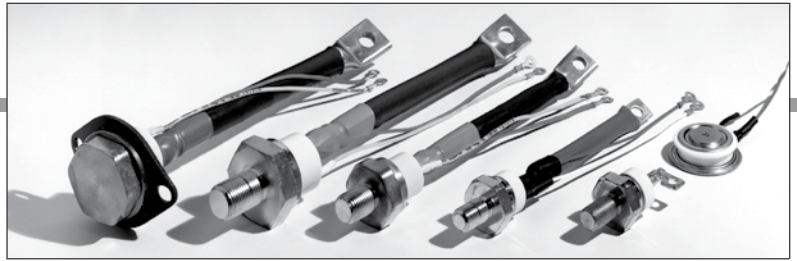


National Type No.		C15	2N685-90	C137	C147	C45 C46	C50 C52	C50X500 C52X500
Voltage range		200-600	200-600	200-1400	200-1400	200-1200	600-1200	200-600
$I_{T(RMS)}$ , RMS on-state current		8	25	35	63	80	110	110
$I_{T(AV)}$ , Amps @ 180° conduction @ Tc		5 @ 75	16 @ 65	22.3 @ 66	40 @ 102	52 @ 75	70 @ 62	70 @ 95
$I_{TSM}$ , Peak one cycle surge (A)		60	150	360	1000	800	1000	1500
$I^2t$ , (for fusing) 8.3mSec (A <sup>2</sup> sec)		15	90	540	4150	2600	4150	9340
$I_{DRM}/I_{RRM}$ , Peak reverse & off-state current @ 125°C (mA)		6	5	5	10	10	10	10
$V_{TM}$ , Peak on-state volts at peak amps @ 25°C		1.85 @ 15	2 @ 50	2.3 @ 70	3 @ 500	3.1 @ 500	2.5 @ 500	1.8 @ 500
di/dt, Rate of rise of on-state current (A/μSec)		—	10	150	100	100	100	100
dv/dt, Rate of rise of off-state voltage (V/μSec)		—	100	100	200	100	200	200
$I_{GT}$ , Gate trigger current (mA)		25	40	100	150	75	75	150
$V_{GT}$ , Gate trigger voltage (V)		2.5	3.0	3.0	3.0	3.0	3.0	3.0
$R_{\theta JC}$ , Thermal resistance junction-case (°C/W)		3.10	1.80	1.00	0.35	0.40	0.40	0.30
$T_J$ , Max. junction temperature (°C)		105	110	125	125	125	125	125
$V_{DRM}$ Repetitive peak forward voltage  <i>and</i> $V_{RRM}$ Repetitive peak reverse voltage	200 B	C15B	2N685	C137B	C147B	C45B C46B	— —	C50BX500 C52BX500
	400 D	C15D	2N688	C137D	C147D	C45D C46D	— —	C50DX500 C52DX500
	600 M	C15M	2N690	C137M	C147M	C45M C46M	C50M C52M	C50MX500 C52MX500
	800 N	—	—	C137N	C147N	C45N C46N	C50N C52N	—
	1000 P	—	—	C137P	C147P	C45P C46P	C50P C52P	—
	1200 PB	—	—	C137PB	C147PB	C45PB C46PB	C50PB C52PB	—
	1400 PD	—	—	C137PD	C147PD	—	—	—
Stud torque (in-lbs)		15	30	30	30	150	150	150
Mounting force (lbs)								
Package type		TO-64	TO-48	TO-48	TO-65	TO-83/TO-94	TO-94/TO-83	TO-94/TO-83

# Phase Control SCRs

National Type No.		C150 C152	C180	C180X500	C290	C291	C350	C380
Voltage range		200-1200	200-1400	200-600	400-1600	400-1600	200-1200	200-1600
$I_{T(RMS)}$ , RMS on-state current		100	235	300	470	470	180	400
$I_{T(AV)}$ , Amps @ 180° conduction @ Tc		70 @ 80	150 @ 90	190 @ 92	300 @ 75	300 @ 75	115 @ 89	250 @ 74
$I_{TSM}$ , Peak one cycle surge (A)		1200	3500	5500	5500	5500	1600	3500
$I^2t$ , (for fusing) 8.3mSec (A <sup>2</sup> sec)		6000	50800	125000	120000	120000	10600	50000
$I_{DRM}/I_{RRM}$ , Peak reverse & off-state current @ 125°C (mA)		20	20	20	30	30	20	20
$V_{TM}$ , Peak on-state volts at peak amps @ 25°C		2.6 @ 15	2.85 @ 1500	1.75 @ 900	1.4 @ 500	1.4 @ 500	2.6 @ 500	2.85 @ 1500
di/dt, Rate of rise of on-state current (A/μSec)		100	150	150	100	100	500	500
dv/dt, Rate of rise of off-state voltage (V/μSec)		200	200	200	200	200	200	200
$I_{GT}$ , Gate trigger current (mA)		150	150	150	200	200	150	150
$V_{GT}$ , Gate trigger voltage (V)		3.0	3.0	3.0	3.0	3.0	3.0	3.0
$R_{\theta JC}$ , Thermal resistance junction-case (°C/W)		0.32	0.14	0.14	0.11	0.11	0.14	0.10
$T_J$ , Max. junction temperature (°C)		125	125	125	125	125	125	125
$V_{DRM}$ Repetitive peak forward voltage  and $V_{RRM}$ Repetitive peak reverse voltage	200 B	C150B C152B	C180B	C180BX500	—	—	C350B	C380B
	400 D	C150D C152D	C180D	C180DX500	C290D	C291D	C350D	C380D
	600 M	C150M C152M	C180M	C180MX500	C290M	C291M	C350M	C380M
	800 N	C150N C152N	C180N	—	C290N	C291N	C350N	C380N
	1000 P	C150P C152P	C180P	—	C290P	C291P	C350P	C380P
	1200 PB	C150PB C152PB	C180PB	—	C290PB	C291PB	C350PB	C380PB
	1400 PD	—	C180PD	—	C290PD	C291PD	—	C380PD
	1600 PM	—	—	—	C290PM	C291PM	—	C380PM
Stud torque (in-lbs)		150	300	300	300	300	—	—
Mounting force (lbs)		—	—	—	—	—	800	800
Package type		TO-94/TO-83	TO-93	TO-93	TO-118	F-1	TO-200AB	TO-200AB

# Phase Control SCRs



National Type No.	C380X555	C380X500	C390	C390X555	C390X500	C391	
Voltage range	200-1200	200-600	200-1200	600-1200	200-600	600-1800	
$I_{T(RMS)}$ , RMS on-state current	450	500	700	925	975	770	
$I_{T(AV)}$ , Amps @ 180° conduction @ Tc	300 @ 85	310 @ 83	450 @ 73	590 @ 80	620 @ 65	490 @ 64	
$I_{TSM}$ , Peak one cycle surge (A)	3200	5500	8000	8000	10000	8000	
$I^2t$ , (for fusing) 8.3mSec (A <sup>2</sup> sec)	42000	125000	265000	266500	416500	265000	
$I_{DRM}/I_{RRM}$ , Peak reverse & off-state current @ 125°C (mA)	45	20	45	65	50	45	
$V_{TM}$ , Peak on-state volts at peak amps @ 25°C	2.85 @ 1500	2.0 @ 1500	2.4 @ 3000	2.6 @ 3000	1.9 @ 3000	2.65 @ 3000	
di/dt, Rate of rise of on-state current (A/μSec)	300	500	500	500	150	75	
dv/dt, Rate of rise of off-state voltage (V/μSec)	200	200	200	200	200	200	
$I_{GT}$ , Gate trigger current (mA)	150	150	150	150	200	150	
$V_{GT}$ , Gate trigger voltage (V)	3.0	3.0	3.5	3.5	3.5	3.5	
$R_{\theta JC}$ , Thermal resistance junction-case (°C/W)	0.10	0.10	0.06	0.06	0.06	0.06	
$T_J$ , Max. junction temperature (°C)	150	125	125	150	125	125	
$V_{DRM}$ Repetitive peak forward voltage and $V_{RRM}$ Repetitive peak reverse voltage	200 B	C380BX555	C380BX500	C390B	—	C390BX500	—
	400 D	C380DX555	C380DX500	C390D	—	C390DX500	—
	600 M	C380MX555	C380MX500	C390M	C390MX555	C390MX500	C391M
	800 N	C380NX555	—	C390N	C390NX555	—	C391N
	1000 P	C380PX555	—	C390P	C390PX555	—	C391P
	1200 PB	C380PBX555	—	C390PB	C390PBX555	—	C391PB
	1400 PD	—	—	—	—	—	C391PD
	1600 PM	—	—	—	—	—	C391PM
	1800 PN	—	—	—	—	—	C391PN
Stud torque (in-lbs)	—	—	—	—	—	—	
Mounting force (lbs)	800	800	2000	2000	2000	2000	
Package type	TO-200AB	TO-200AB	TO-200AC	TO-200AC	TO-200AC	TO-200AC	

# Phase Control SCRs



National Type No.		C501	C502	C602	C430	C430X555	C430X500
Voltage range		200-1800	1600-2200	1800-2600	200-1600	200-1200	200-600
$I_{T(RMS)}$ , RMS on-state current		850	700	950	1000	1000	1200
$I_{T(AV)}$ , Amps @ 180° conduction @ Tc		550 @ 65	450 @ 65	600 @ 73	700 @ 65	700 @ 75	700 @ 76
$I_{TSM}$ , Peak one cycle surge (A)		8000	8000	10000	8000	8000	10000
$I^2t$ , (for fusing) 8.3mSec (A <sup>2</sup> sec)		260000	265000	415000	265000	266500	415000
$I_{DRM}/I_{RRM}$ , Peak reverse & off-state current @ 125°C (mA)		60	60	60	45	45	45
$V_{TM}$ , Peak on-state volts at peak amps @ 25°C		1.53 @ 1000	1.6 @ 625	1.9 @ 1000	2.4 @ 3000	2.4 @ 2200	1.9 @ 2000
di/dt, Rate of rise of on-state current (A/μSec)		100	100	100	100	100	100
dv/dt, Rate of rise of off-state voltage (V/μSec)		200	200	200	200	200	200
$I_{GT}$ , Gate trigger current (mA)		300	150	300	150	200	150
$V_{GT}$ , Gate trigger voltage (V)		3.0	3.5	3.5	3.5	3.5	3.5
$R_{θJC}$ , Thermal resistance junction-case (°C/W)		0.06	0.06	0.04	0.04	0.05	0.04
$T_J$ , Max. junction temperature (°C)		125	125	125	125	150	125
$V_{DRM}$ Repetitive peak forward voltage  <i>and</i>  $V_{RRM}$ Repetitive peak reverse voltage	200 B	C501B	—	—	C430B	C430BX555	C430BX500
	400 D	C501D	—	—	C430D	C430DX555	C430DX500
	600 M	C501M	—	—	C430M	C430MX555	C430MX500
	800 N	C501N	—	—	C430N	C430NX555	—
	1000 P	C501P	—	—	C430P	C430PX555	—
	1200 PB	C501PB	—	—	C430PB	C430PBX555	—
	1400 PD	C501PD	—	—	C430PD	—	—
	1600 PM	C501PM	C502PM	—	C430PM	—	—
	1800 PN	C501PN	C502PN	C602PN	—	—	—
	2000 L	—	C502L	C602L	—	—	—
	2200 LB	—	C502LB	C602LB	—	—	—
	2400 LD	—	—	C602LD	—	—	—
	2500 LE	—	—	C602LE	—	—	—
	2600 LM	—	—	C602LM	—	—	—
Stud torque (in-lbs)		—	—	—	—	—	—
Mounting force (lbs)		2000	2000	3500	2000	2000	2000
Package type		TO-200AC	TO-200AC	TO-200AC	TO-200AB-2	TO-200AB-2	TO-200AB-2

# Phase Control SCRs

National Type No.	C431	C441	C601	C440	C701	C702	
Voltage range	600-1800	600-1800	200-1600	200-1200	1200-2000	2400-3200	
$I_{T(RMS)}$ , RMS on-state current	1000	1175	1100	1400	2000	1570	
$I_{T(AV)}$ , Amps @ 180° conduction @ Tc	670 @ 65	750 @ 65	750 @ 72	900 @ 67	1300 @ 70	1050 @ 74	
$I_{TSM}$ , Peak one cycle surge (A)	8000	11000	11000	13000	20000	15000	
$I^2t$ , (for fusing) 8.3mSec (A <sup>2</sup> sec)	265000	500000	516000	700000	1660000	933000	
$I_{DRM}/I_{RRM}$ , Peak reverse & off-state current @ 125°C (mA)	45	35	60	35	65	65	
$V_{TM}$ , Peak on-state volts at peak amps @ 25°C	2.65 @ 3000	2.0 @ 3000	2.1 @ 3000	1.65 @ 3000	1.7 @ 3000	2.1 @ 3000	
di/dt, Rate of rise of on-state current (A/μSec)	100	150	100	150	100	25	
dv/dt, Rate of rise of off-state voltage (V/μSec)	200	200	200	200	500	200	
$I_{GT}$ , Gate trigger current (mA)	300	150	200	150	150	200	
$V_{GT}$ , Gate trigger voltage (V)	3.5	3.0	3.5	3.0	3.0	3.0	
$R_{\theta JC}$ , Thermal resistance junction-case (°C/W)	0.04	0.04	0.04	0.04	0.02	0.02	
$T_J$ , Max. junction temperature (°C)	125	125	125	125	125	125	
$V_{DRM}$ Repetitive peak forward voltage  and  $V_{RRM}$ Repetitive peak reverse voltage	200 B	—	—	C601B	C440B	—	—
	400 D	—	—	C601D	C440D	—	—
	600 M	C431M	C441M	C601M	C440M	—	—
	800 N	C431N	C441N	C601N	C440N	—	—
	1000 P	C431P	C441P	C601P	C440P	—	—
	1200 PB	C431PB	C441PB	C601PB	C440PB	C701PB	—
	1400 PD	C431PD	C441PD	C601PD	—	C701PD	—
	1600 PM	C431PM	C441PM	C601PM	—	C701PM	—
	1800 PN	C431PN	C441PN	—	—	C701PN	—
	2000 L	—	—	—	—	C701L	—
	2400 LD	—	—	—	—	—	C702LD
	2600 LM	—	—	—	—	—	C702LM
	2800 LN	—	—	—	—	—	C702LN
	3000 LP	—	—	—	—	—	C702LP
3200 CB	—	—	—	—	—	C702CB	
Stud torque (in-lbs)	—	—	—	—	—	—	
Mounting force (lbs)	2000	3500	3500	3500	5500	5500	
Package type	TO-200AB-2	TO-200AC	TO-200AC	TO-200AC	P-4	P-4	

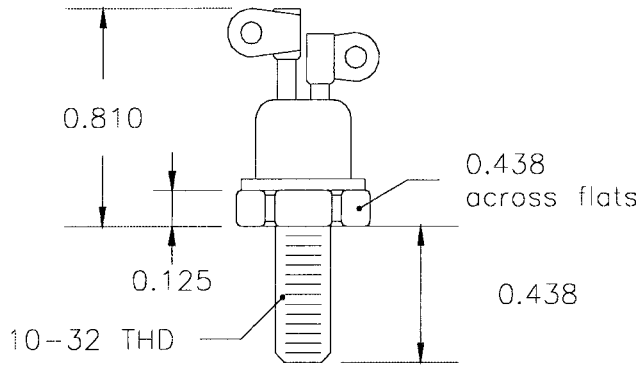
# Phase Control SCRs

National Type No.	C451	C450	C784	C783	C782	C781
Voltage range	1400-2600	200-1600	3600-4400	3000-3600	2000-2500	1600-2000
$I_{T(RMS)}$ , RMS on-state current	2350	2400	2590	2826	4240	3925
$I_{T(AV)}$ , Amps @ 180° conduction @ Tc	1300 @ 65	1500 @ 66	1930 @ 55	1800 @ 70	2300 @ 70	2500 @ 72
$I_{TSM}$ , Peak one cycle surge (A)	20000	28500	26000	29000	35000	45000
$I^2t$ , (for fusing) 8.3mSec (A <sup>2</sup> sec)	1660000	3400000	2750000	3500000	5000000	8500000
$I_{DRM}/I_{RRM}$ , Peak reverse & off-state current @ 125°C (mA)	100	100	300	150	200	150
$V_{TM}$ , Peak on-state volts at peak amps @ 25°C	1.95 @ 3000	1.5 @ 3000	1.85 @ 2000	1.71 @ 2000 (125°C)	1.35 @ 2000 (125°C)	1.2 @ 2000 (125°C)
di/dt, Rate of rise of on-state current (A/μSec)	100	400	100	100	100	100
dv/dt, Rate of rise of off-state voltage (V/μSec)	200	200	1000	500	200	500
$I_{GT}$ , Gate trigger current (mA)	300	300	300	250	250	250
$V_{GT}$ , Gate trigger voltage (V)	3.5	3.5	4.5	4.5	4.5	4.2
$R_{\theta JC}$ , Thermal resistance junction-case (°C/W)	0.03	0.03	0.01	0.01	0.01	0.01
$T_j$ , Max. junction temperature (°C)	125	125	125	125	125	125
$V_{DRM}$ Repetitive peak forward voltage <i>and</i> $V_{RRM}$ Repetitive peak reverse voltage	200 B	—	C450B	—	—	—
	400 D	—	C450D	—	—	—
	600 M	—	C450M	—	—	—
	800 N	—	C450N	—	—	—
	1000 P	—	C450P	—	—	—
	1200 PB	—	C450PB	—	—	—
	1400 PD	C451PD	C450PD	—	—	—
	1600 PM	C451PM	C450PM	—	—	C781PM
	1800 PN	C451PN	—	—	—	C781PN
	2000 L	C451L	—	—	C782L	C781L
	2200 LB	C451LB	—	—	C782LB	—
	2400 LD	C451LD	—	—	C782LD	—
	2500 LE	C451LE	—	—	C782LE	—
	2600 LM	C451LM	—	—	—	—
	2800 LN	—	—	—	—	—
	3000 LP	—	—	—	C783LP	—
	3200 CB	—	—	—	C783CB	—
	3400 CD	—	—	—	C783CD	—
	3600 CM	—	—	C784CM	C783CM	—
	3800 CN	—	—	C784CN	—	—
4000 DP	—	—	C784DP	—	—	
4200 DB	—	—	C784DB	—	—	
4400 DD	—	—	C784DD	—	—	
Stud torque (in-lbs)	—	—	—	—	—	—
Mounting force (lbs)	5500	5500	9500	9500	9500	9500
Package type	P-4	P-4	P-7	P-7	P-7	P-7

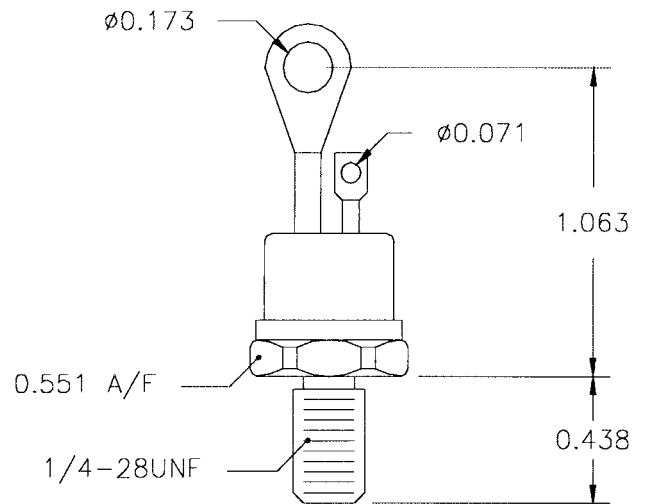


# SCR Outline Drawings

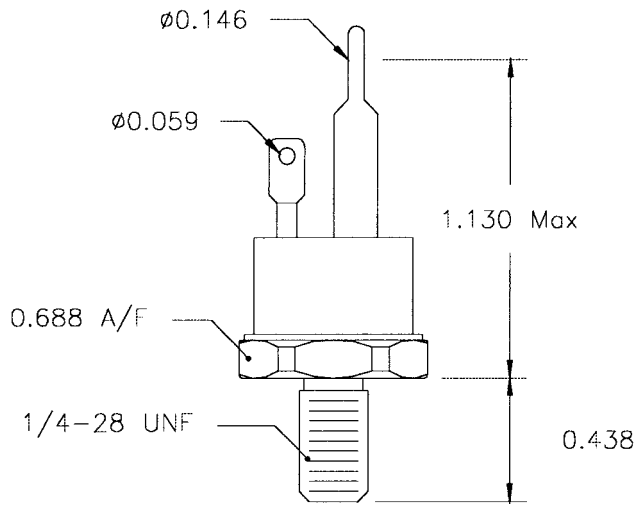
\* Dimensions in inches unless otherwise noted.



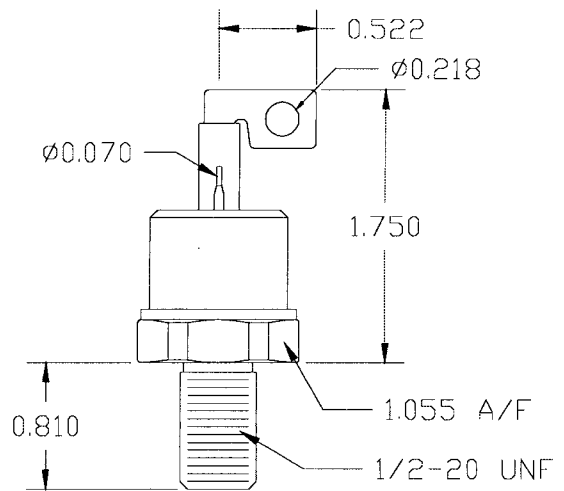
**TO-64**



**TO-48**



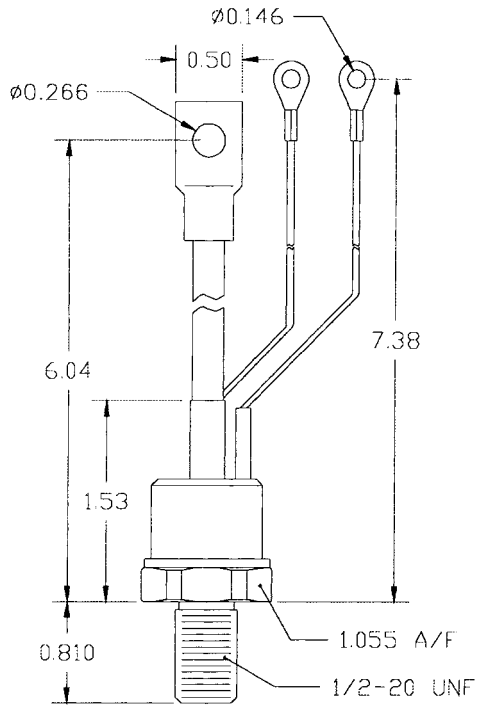
**TO-65**



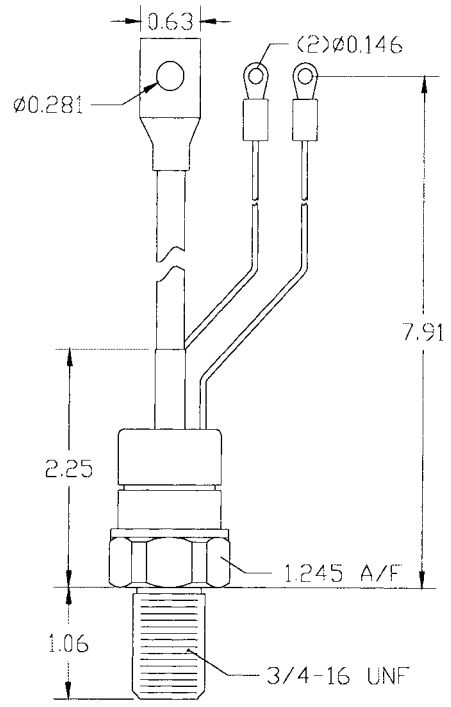
**TO-83**

# SCR Outline Drawings

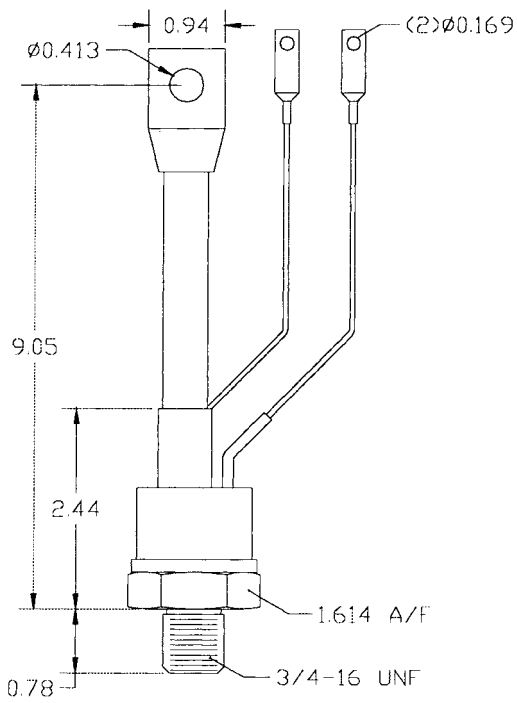
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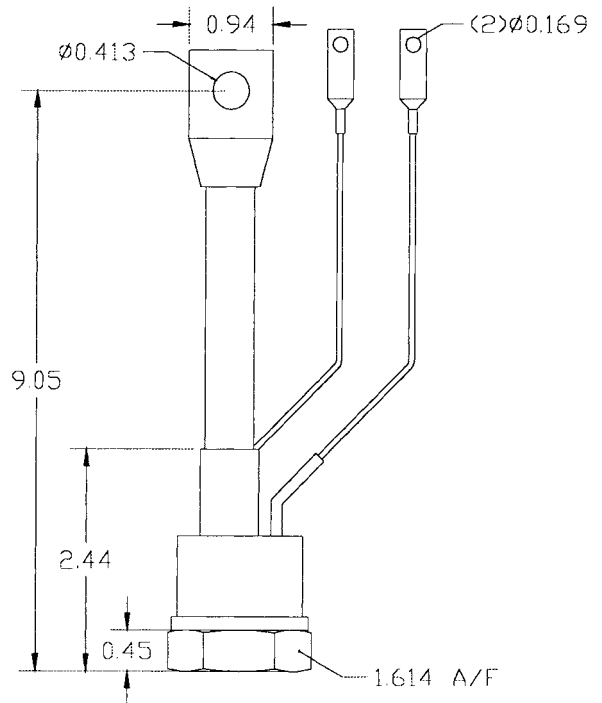
**TO-94**



**TO-93**



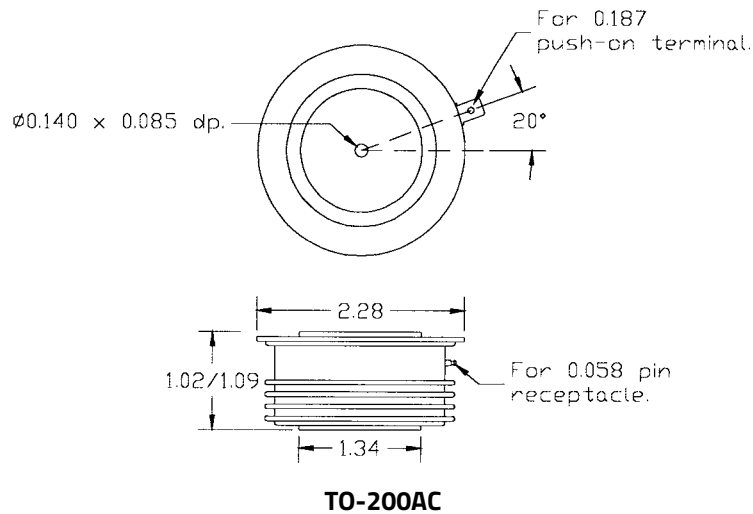
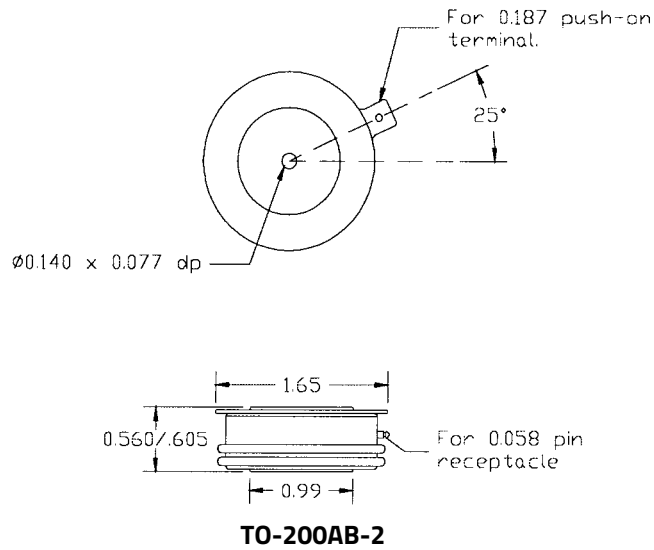
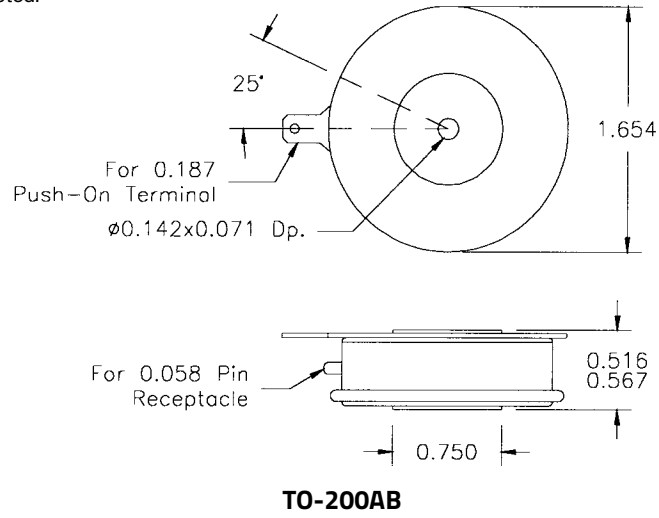
**TO-118**



**F1**

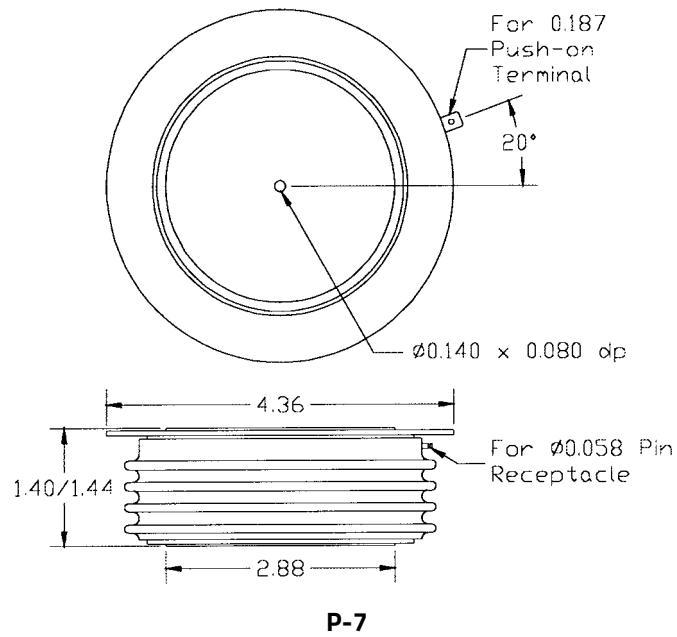
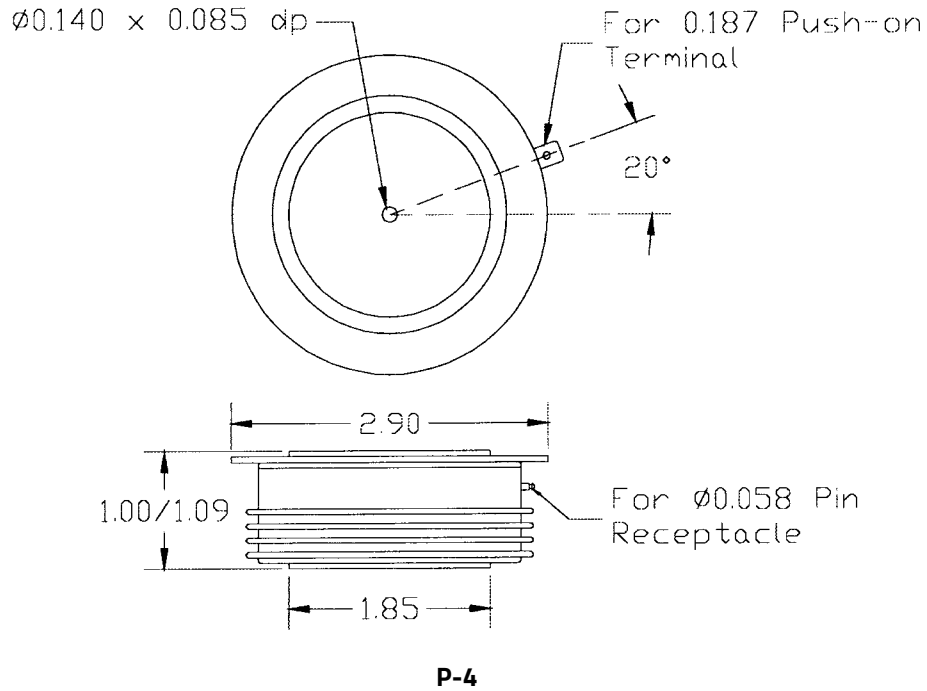
# SCR Outline Drawings

\* Dimensions in inches unless otherwise noted.

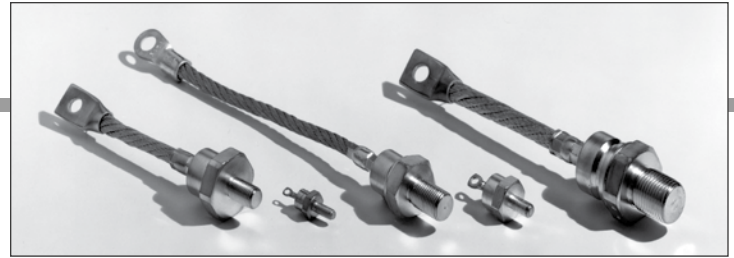


# SCR Outline Drawings

\* Dimensions in inches unless otherwise noted.

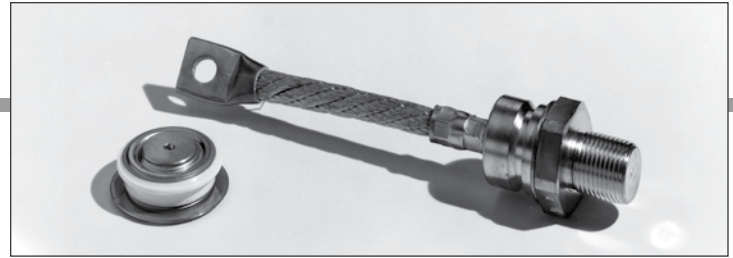


# Diodes



National Type No.	1N1202-1N1206A 1N1202R-1N1206RA	1N3891-1N3893 1N3891R-1N3893R	A25 A25R	1N3911-1N3913 1N3911R-1N3913R	A139 A139R	1N1186A-1N1190A 1N1186RA-1N1190RA	A77 A77R	
Voltage range	200-600	200-400	200-1200	200-400	600-1000	200-600	200-1000	
$I_{F(RMS)}$ , RMS forward current	18	18	40	47	40	63	118	
$I_{F(AV)}$ , Average forward current @ $T_c$	12 @ 150	12 @ 100	25 @ 100	30 @ 100	25 @ 75	40 @ 115	70 @ 75	
$I_{TSM}$ , Peak one cycle surge (A)	240	150	300	300	400	800	730	
$I^2t$ , (for fusing) 8.3mSec ( $A^2sec$ )	240	94	375	375	500	2650	2300	
$I_{RRM}$ , Peak reverse current @ $T_j$ °C (mA)	3	3	3	15	15	15	20	
$V_{FM}$ , Forward voltage drop at peak amps @ 25 °C	1.2 @ 40	1.6 @ 20	1.2 @ 50	1.4 @ 30	1.95 @ 100	1.1 @ 100	2.0 @ 200	
$t_{rr}$ , Typical reverse recovery time ( $\mu$ Sec)	—	200 nSec	—	200 nSec	500 nSec	—	1.0	
$R_{\theta JC}$ , Thermal resistance junction-case (°C/W)	2.50	2.00	1.50	1.00	1.00	1.10	0.40	
$T_j$ , Max, junction temperature (°C)	175	150	175	150	125	200	125	
$V_{RRM}$ Repetitive peak reverse voltage	200 B	1N1202A 1N1202RA	1N3891 1N3891R	A25B A25BR	1N3911 1N3911R	— —	1N1186A 1N1186RA	A77B A77BR
	400 D	1N1204A 1N1204RA	1N3893 1N3893R	A25D A25DR	1N3913 1N3913R	— —	1N1188A 1N1188RA	A77D A77DR
	600 M	1N1206A 1N1206RA	—	A25M A25MR	—	A139M A139MR	1N1190A 1N1190RA	A77M A77MR
	800 N	—	—	A25N A25NR	—	A139N A139NR	—	A77N A77NR
	1000 P	—	—	A25P A25PR	—	A139P A139PR	—	A77P A77PR
	1200 PB	—	—	A25PB A25PBR	—	—	—	—
Stud torque (in-lbs)	15	15	15	30	30	30	30	
Mounting force (lbs)	—	—	—	—	—	—	—	
Package type	DO-4	DO-4	DO-4	DO-5	DO-5	DO-5	DO-5	

# Diodes



National Type No.	A72 A72R	A177 A177R	A180 A180R	1N3086-1N3092 1N3086R-1N3092R	A197 A197R	1N3736-1N3744 1N3736R-1N3744R	
Voltage range	200-1200	200-1400	200-1400	200-1000	200-1400	200-1400	
$I_{F(RMS)}$ , RMS forward current	118	175	236	236	40	390	
$I_{F(AV)}$ , Average forward current @ $T_c$	70 @ 110	100 @ 85	150 @ 135	150 @ 150	250 @ 103	250 @ 130	
$I_{TSM}$ , Peak one cycle surge (A)	1000	2500	2500	3000	5000	4500	
$I^2t$ , (for fusing) 8.3mSec ( $A^2sec$ )	4000	13500	22000	37500	100000	84000	
$I_{RRM}$ , Peak reverse current @ $T_j$ °C (mA)	10	20	20	20	20	15	
$V_{FM}$ , Forward voltage drop at peak amps @ 25°C	1.35 @ 220	1.75 @ 500	1.3 @ 500	1.2 @ 470	1.7 @ 1000	1.3 @ 785	
$t_{rr}$ , Typical reverse recovery time ( $\mu$ Sec)	—	2.3	—	—	2.8	—	
$R_{\theta JC}$ , Thermal resistance junction-case (°C/W)	0.45	0.40	0.35	0.25	0.18	0.18	
$T_j$ , Max. junction temperature (°C)	150	125	200	200	125	200	
$V_{RRM}$ Repetitive peak reverse voltage  Note: R: Reverse polarity, anode to stud	200 B	A72B A72BR	A177B A177RB	A180B A180RB	1N3086 1N3086R	A197B A197RB	1N3736 1N3736R
	400 D	A72D A72DR	A177D A177RD	A180D A180RD	1N3088 1N3088R	A197D A197RD	1N3738 1N3738R
	600 M	A72M A72MR	A177M A177RM	A180M A180RM	1N3090 1N3090R	A197M A197RM	1N3740 1N3740R
	800 N	A72N A72NR	A177N A177RN	A180N A180RN	1N3091 1N3091R	A197N A197RN	1N3741 1N3741R
	1000 P	A72P A72PR	A177P A177RP	A180P A180RP	1N3092 1N3092R	A197P A197RP	1N3742 1N3742R
	1200 PB	A72PB A72PBR	A177PB A177RPB	A180PB A180RPB	—	A197PB A197RPB	1N3743 1N3743R
	1400 PD	—	A177PD A177RPD	A180PD A180RPD	—	A197PD A197RPD	1N3744 1N3744R
Stud torque (in-lbs)	30	100	100	150	300	300	
Mounting force (lbs)	—	—	—	—	—	—	
Package type	DO-5	DO-8	DO-8	DO-30	DO-9	DO-9	



# Diodes

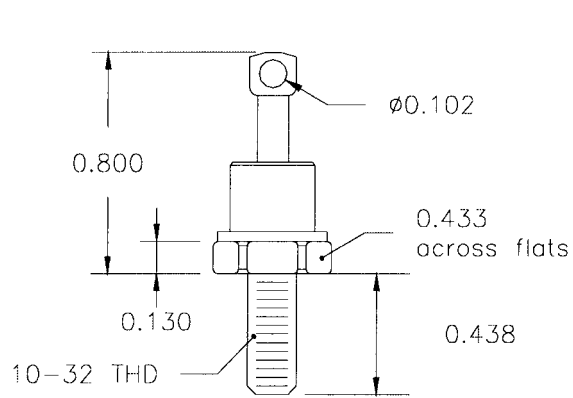


National Type No.		1N4047-1N4056 1N4047R-1N4056R	NL1931 NL1931R	A390	A397	A398	A437
Voltage range		200-1000	200-1600	200-1400	200-1400	200-1400	600-1400
$I_{F(RMS)}$ , RMS forward current		435	470	628	628	628	1175
$I_{F(AV)}$ , Average forward current @ $T_c$		275 @ 120	300 @ 120	400 @ 145	400 @ 110	400 @ 90	750 @ 65
$I_{TSM}$ , Peak one cycle surge (A)		5000	5500	6450	5000	7000	10000
$I^2t$ , (for fusing) 8.3mSec ( $A^2sec$ )		104000	125990	80000	100000	200000	415000
$I_{RRM}$ , Peak reverse current @ $T_j$ °C (mA)		15	10	25	50	50	50
$V_{FM}$ , Forward voltage drop at peak amps @ 25°C		1.35 @ 860	1.4 @ 950	1.4 @ 1260	1.8 @ 1000	1.7 @ 1000	1.6 @ 1000
$t_{rr}$ , Typical reverse recovery time ( $\mu$ Sec)		—	—	—	2.8	1.5	3.5
$R_{\theta JC}$ , Thermal resistance junction-case (°C/W)		0.17	0.18	0.09	0.09	0.09	0.05
$T_j$ , Max. junction temperature (°C)		190	200	180	125	175	125
$V_{RRM}$ Repetitive peak reverse voltage	200 B	1N4047 1N4047R	NL1931B NL1931BR	A390B	A397B	A398B	—
	400 D	1N4050 1N4050R	NL1931D NL1931DR	A390D	A397D	A398D	—
	600 M	1N4052 1N4052R	NL1931M NL1931MR	A390M	A397M	A398M	A437M
	800 N	1N4054 1N4054R	NL1931N NL1931NR	A390N	A397N	A398N	A437N
	1000 P	1N4056 1N4056R	NL1931P NL1931PR	A390P	A397P	A398P	A437P
	1200 PB	—	NL1931PB NL1931PBR	A390PB	A397PB	A398PB	A437PB
	1400 PD	—	NL1931PD NL1931PDR	A390PD	A397PD	A398PD	A437PD
	1600 PM	—	NL1931PM NL1931PMR	—	—	—	—
Stud torque (in-lbs)		300	300	—	—	—	—
Mounting force (lbs)		—	—	800	800	800	2000
Package type		DO-9	DO-9	DO-200AA	DO-200AA	DO-200AA	DO-200AB

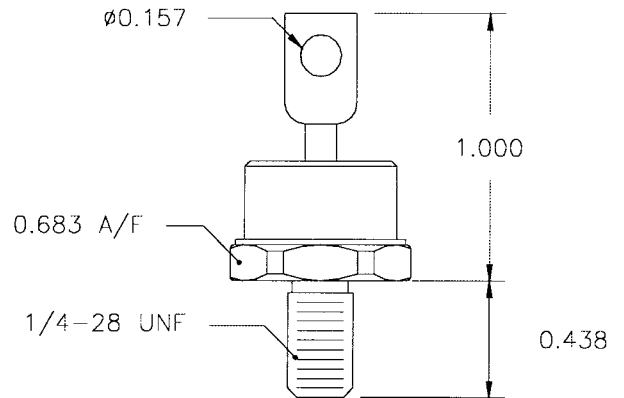
National Type No.	A430	A641	A621	A730	A740	A451	
Voltage range	200-1400	1400-2200	200-1200	1600-2400	200-1800	1400-2200	
$I_{F(RMS)}$ , RMS forward current	1570	2355	3140	2825	3765	3925	
$I_{F(AV)}$ , Average forward current @ $T_c$	1000 @ 124	1500 @ 65	2000 @ 65	1800 @ 100	2400 @ 100	2500 @ 88	
$I_{TSM}$ , Peak one cycle surge (A)	10000	17000	20000	25000	32000	30000	
$I^2t$ , (for fusing) 8.3mSec ( $A^2sec$ )	415000	1200000	2000000	2600000	4200000	1892250	
$I_{RRM}$ , Peak reverse current @ $T_j$ °C (mA)	50	30	50	50	50	50	
$V_{FM}$ , Forward voltage drop at peak amps @ 25°C	1.2 @ 1000	1.1 @ 1000	1.3 @ 1800	1.3 @ 3000	1.3 @ 4000	1.4 @ 5000	
$t_{rr}$ , Typical reverse recovery time ( $\mu$ Sec)	—	—	—	—	—	—	
$R_{\theta JC}$ , Thermal resistance junction-case (°C/W)	0.06	0.04	0.04	0.02	0.02	0.03	
$T_j$ , Max. junction temperature (°C)	200	175	175	160	175	175	
$V_{RRM}$ Repetitive peak reverse voltage	200 B	A430B	—	A621B	—	A740B	—
	400 D	A430D	—	A621D	—	A740D	—
	600 M	A430M	—	A621M	—	A740M	—
	800 N	A430N	—	A621N	—	A740N	—
	1000 P	A430P	—	A621P	—	A740P	—
	1200 PB	A430PB	—	A621PB	—	A740PB	—
	1400 PD	A430PD	A641PD	—	—	A740PD	A451PD
	1600 PM	—	A641PM	—	A730PM	A740PM	A451PM
	1800 PN	—	A641PN	—	A730PN	A740PN	A451PN
	2000 L	—	A641L	—	A730L	—	A451L
	2200 LB	—	A641LB	—	A730LB	—	A451LB
	2400 LD	—	—	—	A730LD	—	—
Stud torque (in-lbs)	—	—	—	—	—	—	
Mounting force (lbs)	2000	4000	4000	5000	5000	5000	
Package type	DO-200AB	DO-200AB	DO-200AB	DO-200AC	DO-200AC	DO-200AC	

# Diode Outline Drawings

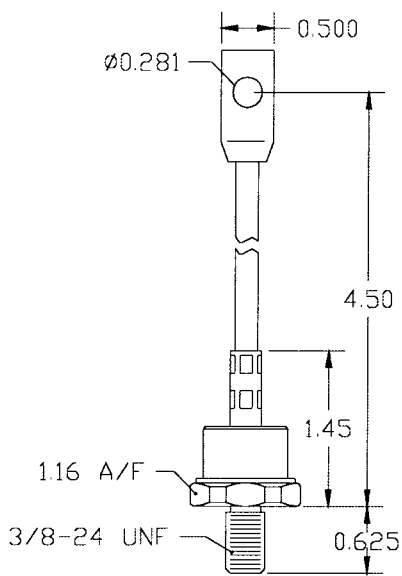
\* Dimensions in inches unless otherwise noted.



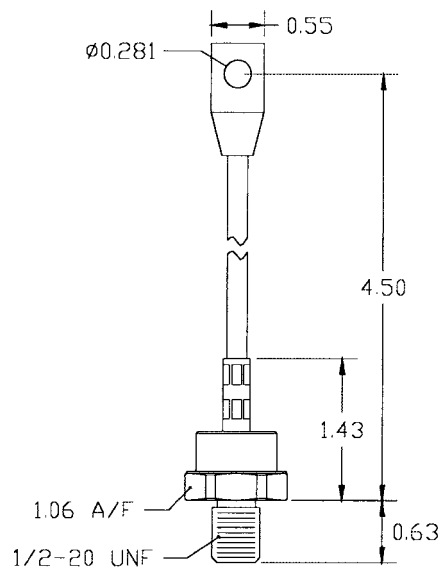
**DO-4**



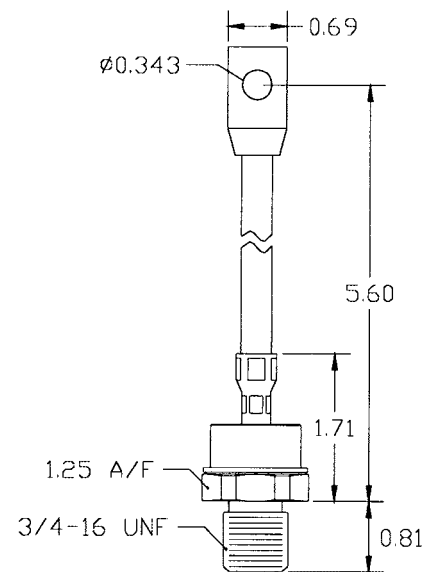
**DO-5**



**DO-8**



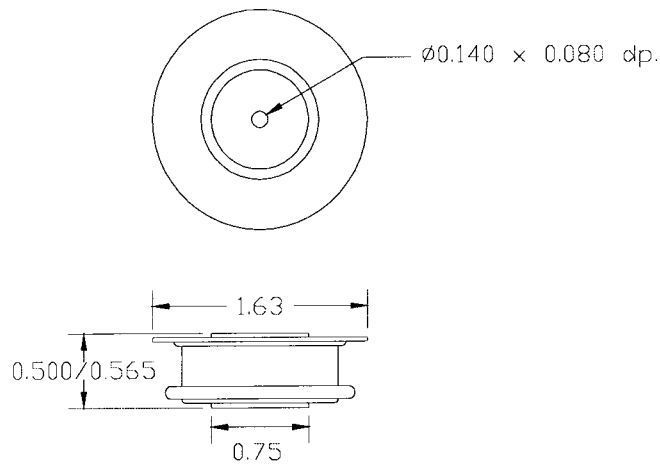
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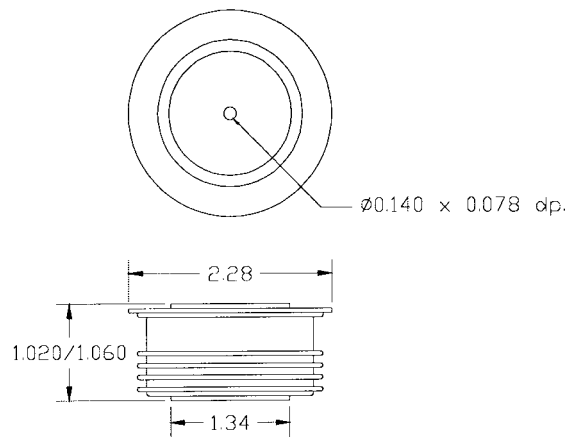
**DO-9**

# Diode Outline Drawings

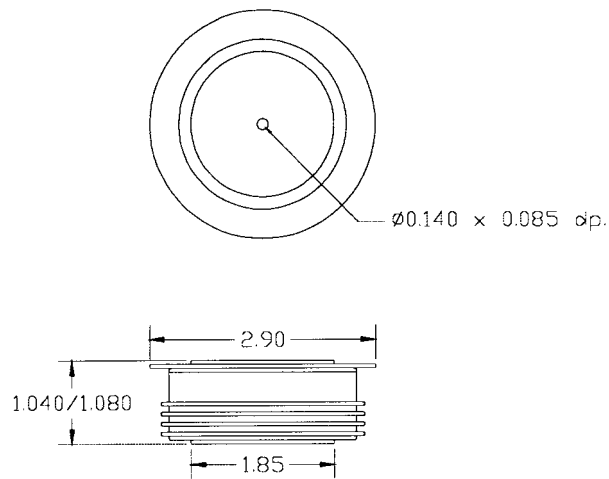
\* Dimensions in inches unless otherwise noted.



**DO-200AA**

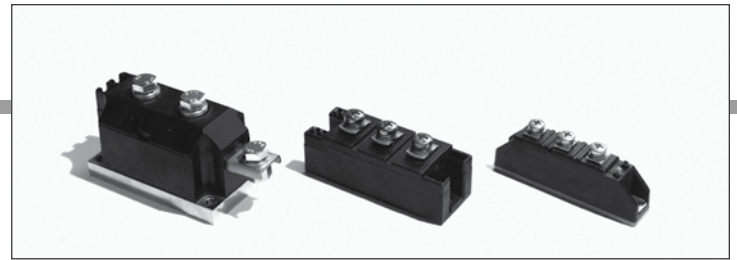


**DO-200AB**



**DO-200AC**

# Power Modules



## Power Modules - Thyristor / Thyristor, Thyristor / Diode

Type No.	$I_{T(AV)}$ $I_{F(AV)}$ A	@T <sub>C</sub> °C	V <sub>RRM</sub> RANGE V	I <sub>TSM</sub> I <sub>FSM</sub> A	V <sub>TM</sub> V <sub>FM</sub> V	@I <sub>TM</sub> 1 <sub>FM</sub> A	V <sub>0</sub> T <sub>J=T<sub>J</sub> max</sub> V	r mΩ	V <sub>GT</sub> V	I <sub>GT</sub> mA	dv/dt V/μsec	di/dt A/μSec	R <sub>thJC</sub> °C/W	R <sub>thcs</sub> °C/W	Ti Max °C	Ref. Fig
IRKx26	27	85	400 to 1600	595	1.95	85	0.91	12.4	2.5	150	500	100	0.310	0.10	125	1
IRKx41	45	85	400 to 1600	850	1.81	141	0.90	6.58	2.5	150	500	100	0.230	0.10	125	1
IRKx56	60	85	400 to 1600	1310	1.54	188	0.81	3.35	2.5	150	500	100	0.200	0.10	125	1
IRKx71	75	85	400 to 1600	1665	1.59	235	0.76	2.98	2.5	150	500	100	0.165	0.10	125	1
IRKx91	95	85	400 to 1600	1785	1.58	298	0.78	5.00	2.5	150	500	100	0.135	0.10	125	1
IRKx105	105	85	400 to 1600	1785	1.64	330	0.80	2.37	2.5	150	500	100	0.135	0.10	125	1
IRKx136	135	85	400 to 1600	3200	1.66	424	0.98	1.62	3.0	200	500	100	0.200	0.035	125	2
IRKx142	140	85	400 to 1600	4750	1.32	440	1.14	1.29	3.0	200	500	100	0.170	0.035	125	2
IRKx162	160	85	400 to 1600	5100	1.26	503	0.88	1.20	3.0	200	500	100	0.170	0.035	125	2
IRKx170	170	85	400 to 1600	5100	1.60	534	0.89	1.34	3.0	200	500	100	0.170	0.020	125	3
IRKx230	230	85	400 to 1600	7500	1.59	722	1.03	0.77	3.0	200	500	100	0.125	0.020	125	3
IRKx250	250	85	400 to 1600	8500	1.44	785	0.97	0.60	3.0	200	500	100	0.125	0.020	125	3
IRKx280	280	79	400 to 2200	7500	1.55	750	0.90	0.75	3.0	200	500	100	0.110	0.020	125	3
IRKx330	330	85	400 to 1800	8000	1.44	1036	0.80	0.45	2.0	200	500	100	0.110	0.020	125	3
IRKx500	540	85	400 to 1800	15000	1.60	1500	0.92	0.24	3.0	200	500	100	0.062	0.020	125	4
IRKx570	570	85	400 to 1800	15500	1.44	1700	0.78	0.20	3.0	200	500	100	0.069	0.020	125	4
IRKx650	650	85	1000 to 1200	14000	1.40	1978	0.85	0.10	2.5	250	500	100	0.065	0.020	125	4
IRKx715	715	85	1000 to 1800	28000	1.45	2512	0.85	0.20	2.5	250	500	100	0.050	0.016	125	5
IRKx800	800	78	1000 to 1800	28000	1.45	2512	0.85	0.20	2.5	250	500	100	0.050	0.016	125	5
IRKx1000	1000	77	1000 to 1200	32000	1.25	3140	0.90	0.04	2.5	250	500	100	0.050	0.016	125	5

Note: dv/dt 100v/us is available upon request.

## High Voltage - Thyristor / Thyristor, Thyristor / Diode

Type No.	$I_{T(AV)}$ $I_{F(AV)}$ A	@T <sub>C</sub> °C	V <sub>RRM</sub> RANGE V	I <sub>TSM</sub> I <sub>FSM</sub> A	V <sub>TM</sub> V <sub>FM</sub> V	@I <sub>TM</sub> 1 <sub>FM</sub> A	V <sub>0</sub> T <sub>J=T<sub>J</sub> max</sub> V	r mΩ	V <sub>GT</sub> V	I <sub>GT</sub> mA	dv/dt V/μsec	di/dt A/μSec	R <sub>thJC</sub> °C/W	R <sub>thcs</sub> °C/W	Ti Max °C	Ref. Fig
IRKx136	130	85	1400 to 2600	3200	1.66	408	0.98	1.62	3.03	200	500	100	0.2	0.035	125	2
IRKx160	160	85	2000 to 3600	4000	2.6	1000	1.2	2.3	2	200	500	100	0.125	0.04	125	3
IRKx185	185	85	1500 to 3000	7500	2.6	1000	1.14	0.78	2	200	500	100	0.125	0.04	125	3
IRKx240	240	85	2800 to 3600	5400	3.43	1200	1.17	1.7	2	200	500	100	0.078	0.02	125	4

# Power Modules

## Power Modules - Diode / Diode

Type No.	$I_{F(AV)}$ A	@ $T_c$ °C	$V_{RRM}$ RANGE V	$I_{FSM}$ 10ms A	$V_{FM}$ V	@ $I_{FM}$ A	$V_o$ $T_j = T_j \text{ max}$ V	$r$ mΩ	$R_{thJC}$ °C/W	$R_{thCS}$ °C/W	$T_j \text{ Max}$ °C	Ref. Fig.
IRKx41	40	85	400 to 1600	850	1.65	126	0.88	5.90	0.230	0.100	135	1
IRKx56	55	100	400 to 1600	1600	1.35	173	0.71	3.76	0.325	0.100	135	1
IRKx71	70	100	400 to 1600	1790	1.30	220	0.61	2.80	0.285	0.100	135	1
IRKx91	90	100	400 to 1600	2020	1.30	283	0.66	1.81	0.220	0.100	135	1
IRKx105	105	87	400 to 1600	2020	1.34	330	0.66	1.81	0.220	0.100	135	1
IRKx166	165	100	400 to 1600	4000	1.57	518	0.70	1.69	0.200	0.035	135	2
IRKx196	195	100	400 to 1600	4750	1.32	612	0.75	0.92	0.200	0.035	135	2
IRKx236	230	100	400 to 1600	6540	1.26	722	0.79	0.64	0.170	0.035	135	2
IRKx250	250	100	400 to 1600	7015	1.29	785	0.79	0.63	0.160	0.020	135	3
IRKx270	270	100	400 to 1600	8920	1.48	848	0.74	0.94	0.125	0.020	135	3
IRKx320	320	100	400 to 1600	10110	1.28	1005	0.69	0.59	0.125	0.020	135	3
IRKx350	350	100	400 to 1600	10110	1.25	1100	0.69	0.59	0.125	0.035	135	3
IRKx570	570	100	1200 to 2800	15000	1.30	1700	0.80	0.38	0.065	0.020	135	4
IRKx700	701	100	1200 to 2200	22500	1.30	2000	0.70	0.15	0.072	0.020	135	4
IRKx1000	1000	100	400 to 1600	31000	1.41	4000	0.85	0.15	0.042	0.020	135	5
IRKx95F	95	75	400 to 600	1080	2.05	300	1.01	3.5	0.450	0.550	125	1
IRKx196F	195	100	400 to 600	4750	1.65	612	0.75	0.92	0.200	0.035	125	2

## Power Modules - Diode / Diode

IRKx231	230	100	1400-2600	7015	1.29	722	0.79	0.63	0.160	0.035	135	3
IRKx320	320	100	4600-6500	7000	2.40	1570	0.95	1.10	0.068	0.020	135	4
IRKx435	435	85	3000-4200	12000	2.30	2100	0.85	0.33	0.065	0.020	135	4

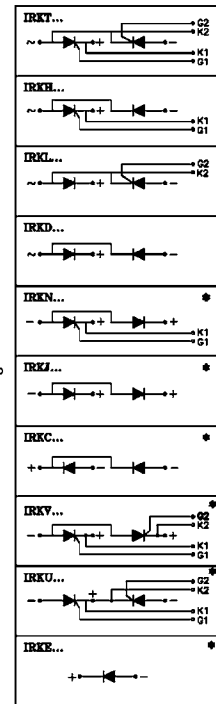
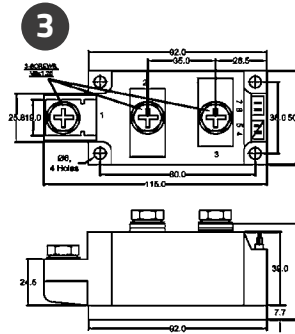
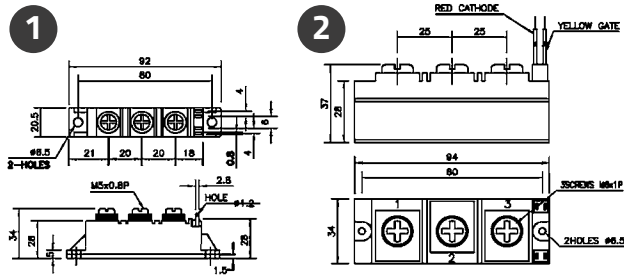
## Power Modules - Non-Isolated (3 Thyristor)

Type No.	$I_{T(AV)}$ A	@ $T_c$ °C	$I_{RMS}$ A	$V_{RRM}$ V	$I_{TSM}$ 10ms A	$I^2t$ A <sup>2</sup> Sec.	$V_{TM}$ V	@ $I_{TM}$ A	$V_{GT}$ V	$I_{GT}$ mA	$dv/dt$ V/μSec	$di/dt$ A/μSec	$R_{thJC}$ °C/W	$T_1 \text{ Max.}$ °C	Ref. Fig.
RHTT60A40	60	123	94	400	1640	13500	1.25	180	2.0	150	50	50	0.35	150	6
RHTT80A40	80	116	125	400	2280	26000	1.20	240	2.0	150	50	50	0.35	150	6
RHTT100A40	100	114	157	400	3200	51000	1.20	314	2.0	150	50	50	0.30	150	6
RHTT130A40	130	112	204	400	3200	51000	1.20	410	2.0	150	50	50	0.20	150	6
RHTT200A40	200	121	314	400	5400	1499400	1.20	630	2.0	150	200	50	0.12	150	7

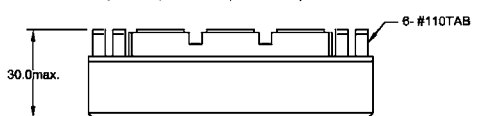
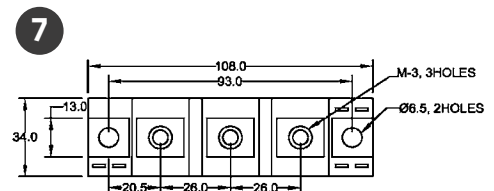
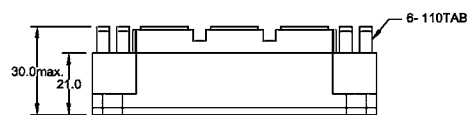
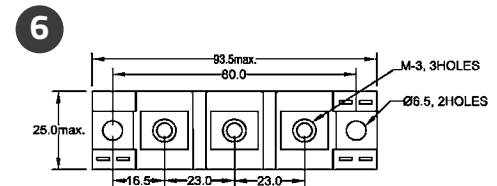
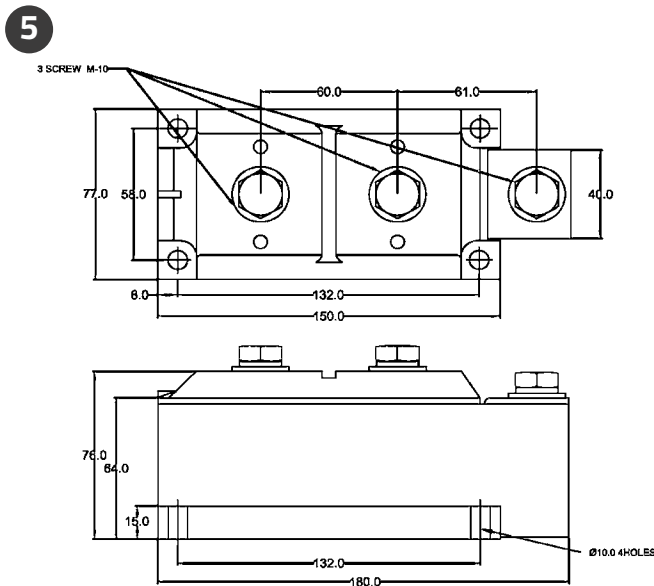
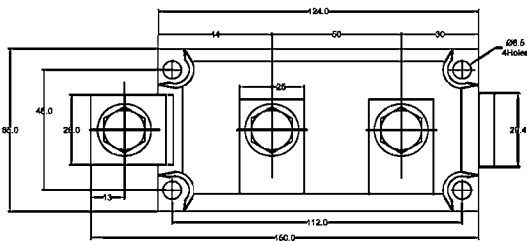
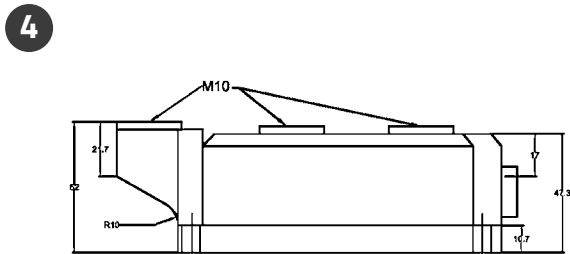


# Power Module Outline Drawings

\* Dimensions in millimeters unless otherwise noted.



\* ON REQUEST



## High-Power IGBT Inverter Stacks

**VOLTAGE:** 100V to 3,300V

**CURRENT:** 50A TO 3,300A

### Applications

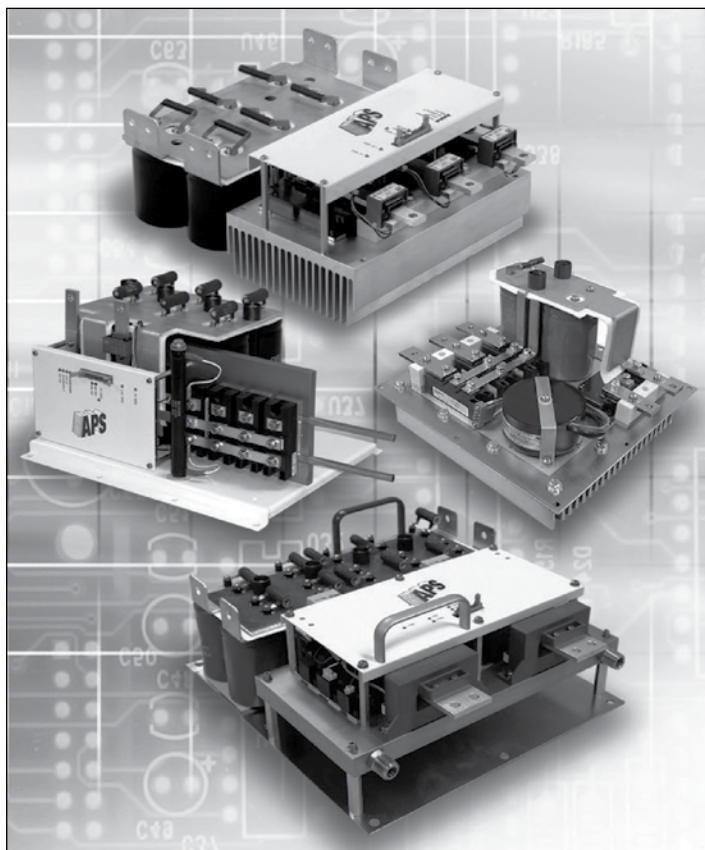
- Inverters
- UPS
- Motor Drives
- Battery Chargers
- Power Factor Correction
- Power Supplies
- Motor Starters
- Alternative Energy
- Traction Inverters
- Electric Vehicles
- Rail

### Circuit Configurations

- Full-Bridge
- Half-Bridge
- 3-Phase Bridge
- Chopper
- Soft Start

### Available Options

- Air- or Liquid-Cooled
- Voltage Feedback
- Current Feedback
- Thermal Feedback
- Snubbers
- Laminated Bus
- DC Filter Capacitors
- Fuses
- Blowers/Fans



## AC-to-DC Converters / AC-to-AC Controllers, Air-Cooled / Liquid-Cooled

**VOLTAGE:** 50V to 5,000V

**CURRENT:** 30A TO 30,000A

### Applications

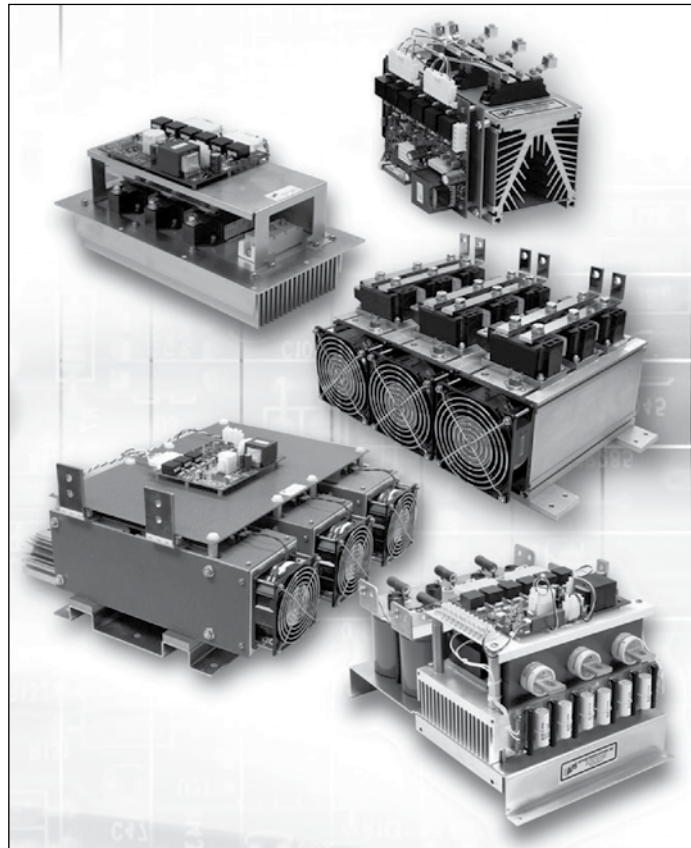
- AC/DC Converters
- AC Phase Controllers
- Power Supplies
- UPS
- Static Converter
- Soft Start
- Induction Heating
- Welding

### Circuit Configurations

- Single-Phase
- Three-Phase
- Poly-Phase
- AC Switch
- Parallel Configuration
- Static Switches

### Available Options

- Air- or Liquid-Cooled
- Voltage Feedback
- Current Feedback
- Thermal Feedback
- Snubbers
- Laminated Bus
- DC Filter Capacitors
- Output Bus Bars
- Blowers/Fans



## Drivers for IGBTs and MOSFETs

### Custom versions available

#### Applications

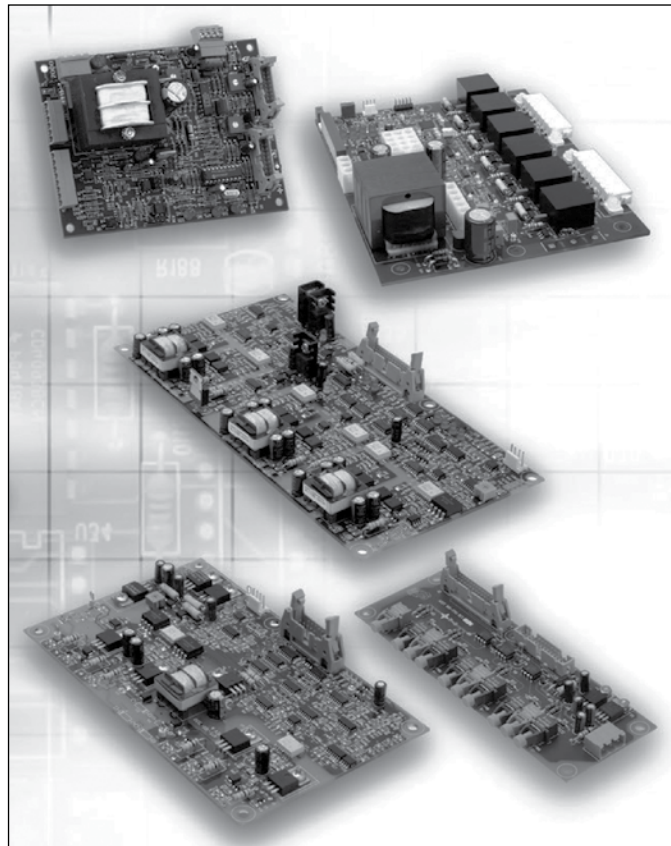
- Inverters
- UPS
- Motor Drives
- Battery Chargers
- Motor Brakes
- Power Supplies
- HV Pulse Switches
- Transportation
- Induction Heating
- Welding
- Rail

#### Circuit Configurations

- Full-Bridge
- Half-Bridge
- 3-Phase Bridge
- Single
- Doubler
- Twelve-Pulse
- AC Switch
- High-Voltage Driver

#### Available Options

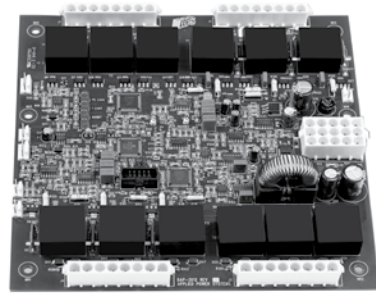
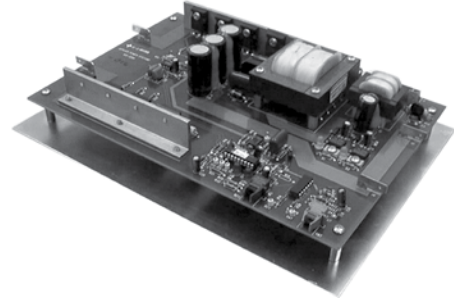
- Voltage Feedback
- Current Feedback
- Thermal Feedback
- Device Fault Protection
- Circuit Protection
- Fiber Optic Interface



## SCR GATE FIRING BOARDS

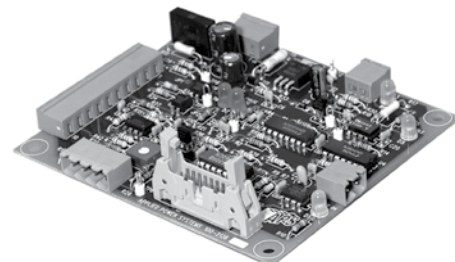
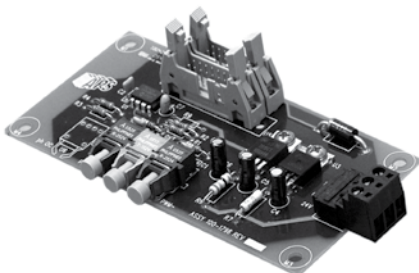
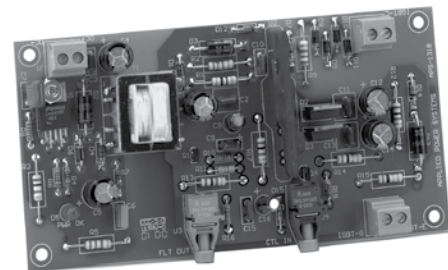
From a single SCR to 12-Pulse and beyond, these SCR controllers are configurable for any application. All of these controllers use DC gate drives for improved performance.

- BAP3550 Single-Phase SCR Gate Firing Board
- BAP3012 Twelve-Pulse SCR Gate Firing Board
- BAP1950A Three-Phase SCR Gate Firing Board
- BAP1367 Quad SCR Driver - Transfer Switch
- BAP1289 High-Voltage SCR Driver
- BAP1135 SCR Crowbar Driver
- BAP1106 Single SCR Gate Driver



## AUXILIARY CONTROL BOARDS

- BAP2161A Temperature Sensor
- BAP2136B IGBT Shunt Regulator Control Board
- BAP3542 SCR Poly-Phase Regulator Control Board





## Power Semiconductor Assemblies, Heatsink Kits and Clamps

**VOLTAGE:** 100V to 20,000V

**CURRENT:** 30A TO 3,000A

### Applications

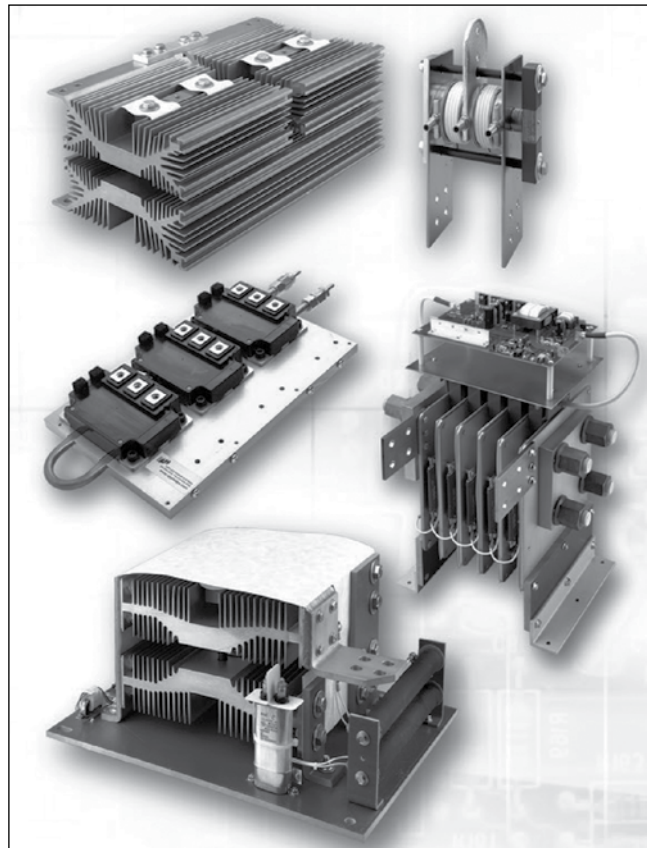
- Power Supplies
- AC Phase Controllers
- Motor Starters
- UPS
- AC/DC Converters
- Soft Start
- Motor Drives
- Static Converter
- Induction Heating
- Welding
- Pulsed Power
- Traction

### Circuit Configurations

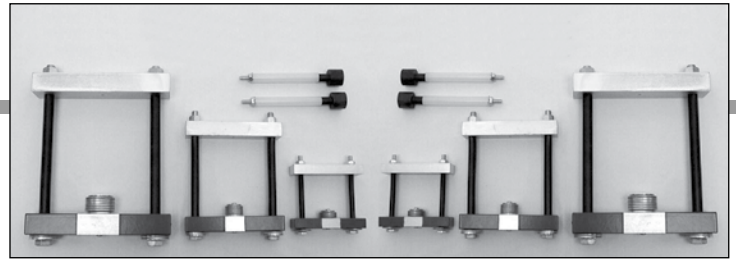
- Single
- Doubler
- Three-Phase
- Full Bridge
- Series Stacks
- Parallel Configuration
- AC Switch
- Static Switches
- Common Anode / Common Cathode

### Available Options

- Air- or Liquid-Cooled
- Bus Bars
- Gate Firing Circuits
- Fuses
- Snubbers
- Blowers/Fans
- Thermal Switches
- Insulated Mounting
- Fiber Optic Interface



# Clamps



**Clamping systems for air and liquid cooled power semiconductor assemblies from 1,000 pounds to over 20,000 pounds.** With a unique force gauge built into the clamp and center loaded force, these clamps will maintain the proper pressure required by any semiconductor manufacturer.

### 3,000-LB Clamp Distances and Dimensions

Bolt Length	Allowable "E" Dim	XX	Dimensions		
			Dim.	Inches	mm
6.00	3.00 - 3.75	01	A1	2.75	69.8
6.50	3.50 - 4.25	02	A2	2.37	60.2
7.00	4.00 - 4.75	03	B1	3.77	95.8
7.50	4.50 - 5.25	04	B2	3.75	95.3
8.00	5.00 - 5.75	05	C1	0.52	13.2
8.50	6.00 - 6.75	06	C2	0.50	12.7
9.00	6.00 - 6.75	07	D	1.02	25.9
9.50	6.50 - 7.25	08			
10.00	7.00 - 7.75	09			

### 5,000-LB Clamp Distances and Dimensions

Bolt Length	Allowable "E" Dim	XX	Dimensions		
			Dim.	Inches	mm
6.00	2.75 - 3.50	01	A1	4.00	101.8
6.50	3.25 - 4.00	02	A2	3.50	88.9
7.00	3.75 - 4.50	03	B1	5.02	127.5
7.50	4.25 - 5.00	04	B2	5.00	127.0
8.00	4.75 - 5.50	05	C1	0.77	19.8
8.50	5.25 - 6.00	06	C2	0.75	19.1
9.00	5.75 - 6.50	07	D	1.02	25.9
9.50	6.25 - 7.00	08			
10.00	6.75 - 7.50	09			

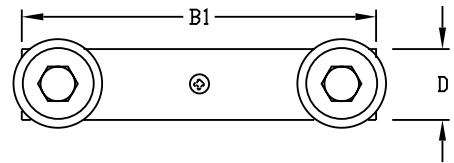
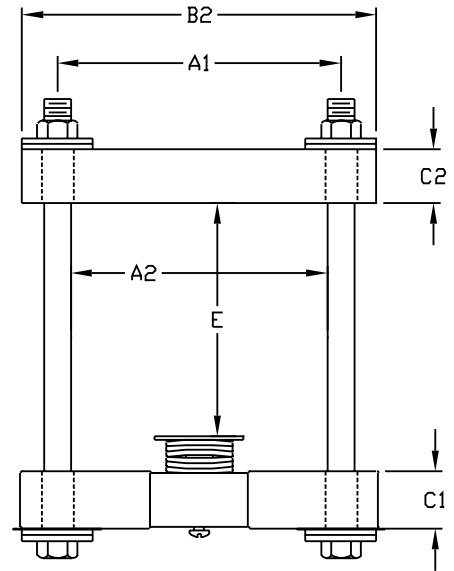
### 10,000-LB Clamp Distances and Dimensions

Bolt Length	Allowable "E" Dim	XX	Dimensions		
			Dim.	Inches	mm
7.00	2.25 - 3.25	01	A1	5.50	139.7
8.00	3.25 - 4.25	02	A2	4.94	125.5
9.00	4.25 - 5.25	03	B1	7.04	178.8
10.00	5.25 - 6.25	04	B2	7.00	177.8
11.00	6.25 - 7.25	05	C1	1.04	26.4
12.00	7.25 - 8.25	06	C2	1.00	25.4
13.00	8.25 - 9.25	07	D	1.54	39.1
14.00	9.25 - 10.25	08			
15.00	10.25 - 11.25	09			
16.00	11.25 - 12.25	10			

### 20,000-LB Clamp Distances and Dimensions

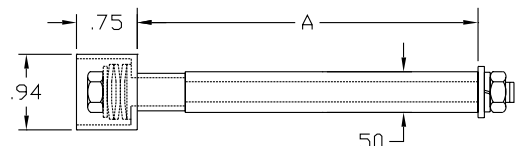
Bolt Length	Allowable "E" Dim	XX	Dimensions		
			Dim.	Inches	mm
9.00	2.75 - 3.75	01	A1	7.50	190.5
10.00	3.75 - 4.75	02	A2	6.81	173.0
11.00	4.75 - 5.75	03	B1	95.4	242.3
12.00	5.75 - 6.75	04	B2	9.50	241.3
13.00	6.75 - 7.75	05	C1	1.54	39.1
14.00	7.75 - 8.75	06	C2	1.50	38.1
15.00	8.75 - 9.75	07	D	2.04	51.8
16.00	9.75 - 10.75	08			
17.00	10.75 - 11.75	09			
18.00	11.75 - 12.75	10			

### PRESS PACK CLAMP



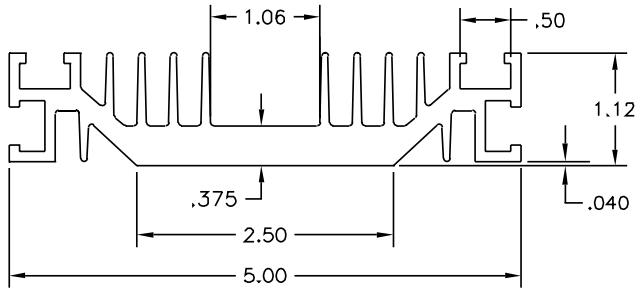
Clamp Size (Force)	Force Gauge Displacement
3,000-pound	0.024"
5,000-pound	0.027"
10,000-pound	0.044"
20,000-pound	0.035"

### POST CLAMP

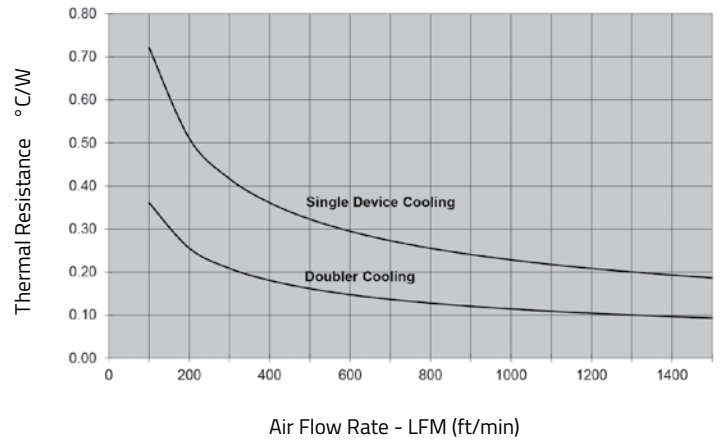


# Heatsinks

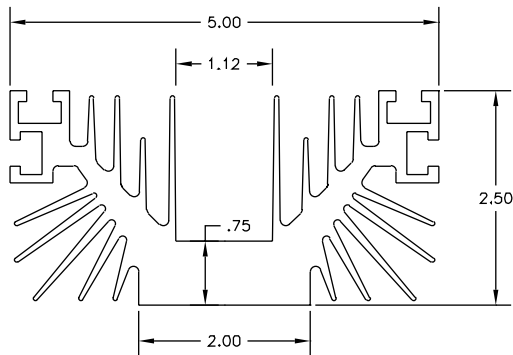
## A4 Heatsink



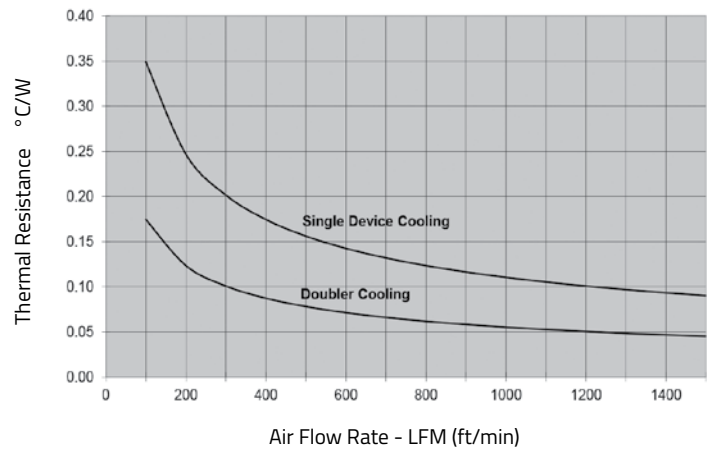
Perimeter	31.2	in.
Weight	2.98	lb. / ft.
Thermal Res.	2.20	°C / W / 3"



## A6 Heatsink

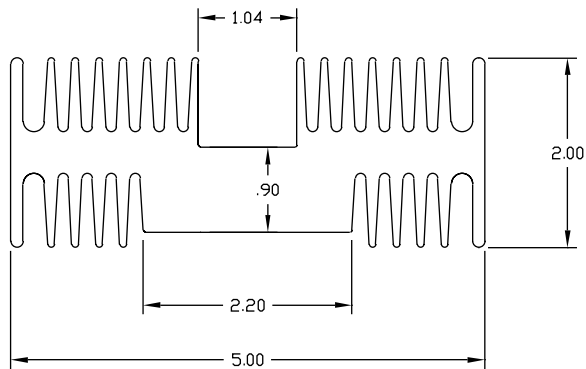


Perimeter	55.87	in.
Weight	5.56	lb. / ft.
Thermal Res.	1.38	°C / W / 3"

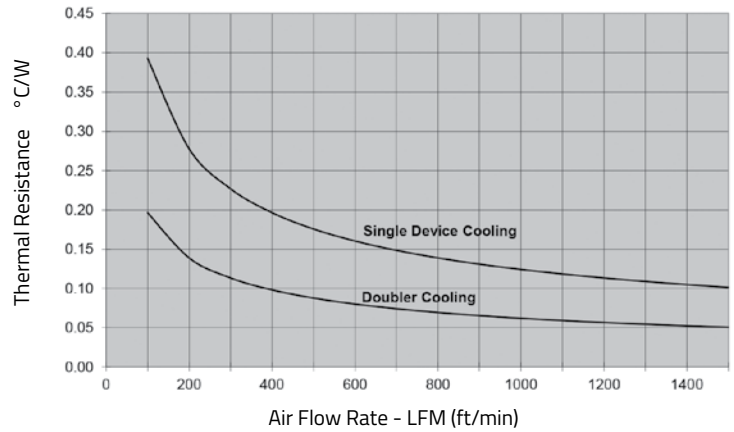




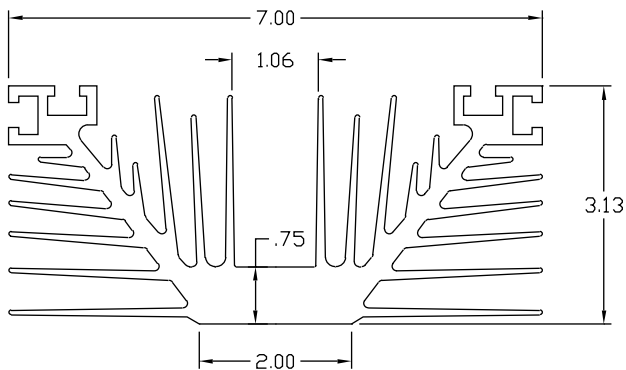
## A65 Heatsink



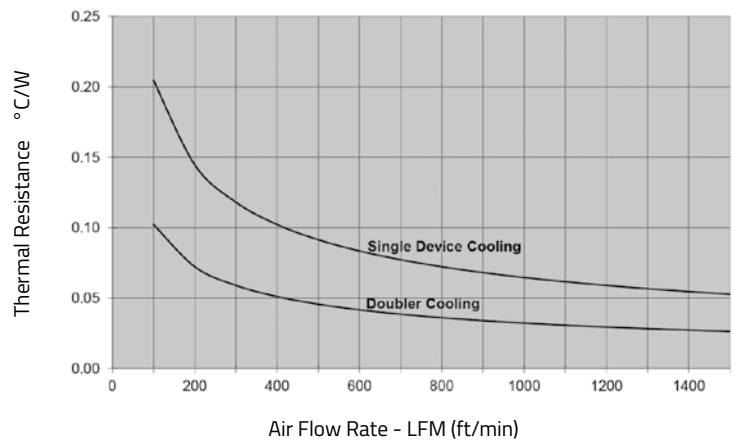
Perimeter	49.60	in.
Weight	6.53	lb. / ft.
Thermal Res.	1.30	°C / W / 3"



## A7 Heatsink

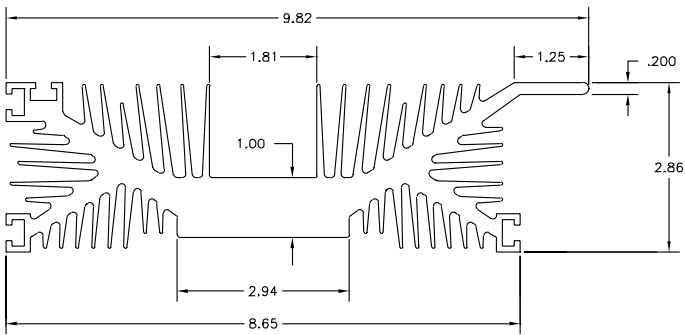


Perimeter	88.15	in.
Weight	8.42	lb. / ft.
Thermal Res.	.88	°C / W / 3"

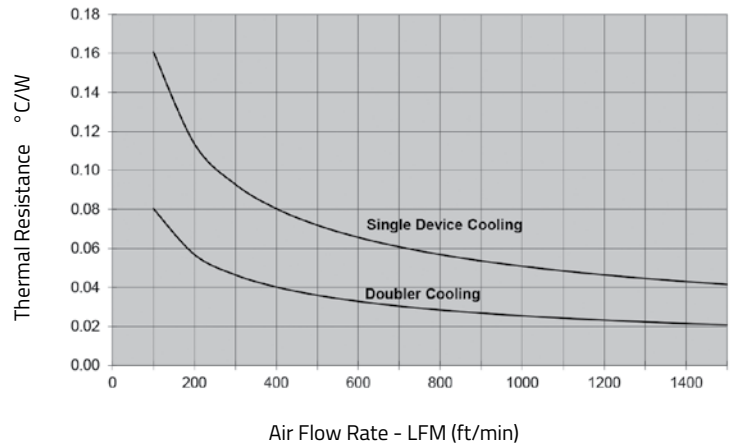


# Heatsinks

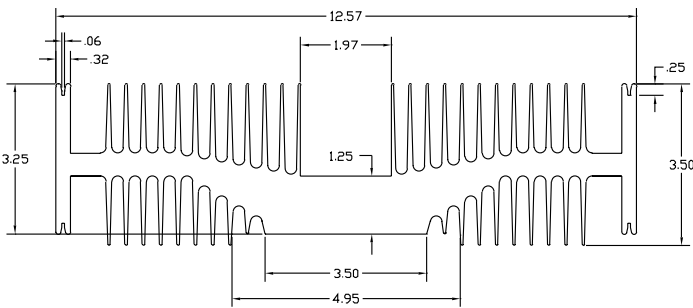
## A9 Heatsink



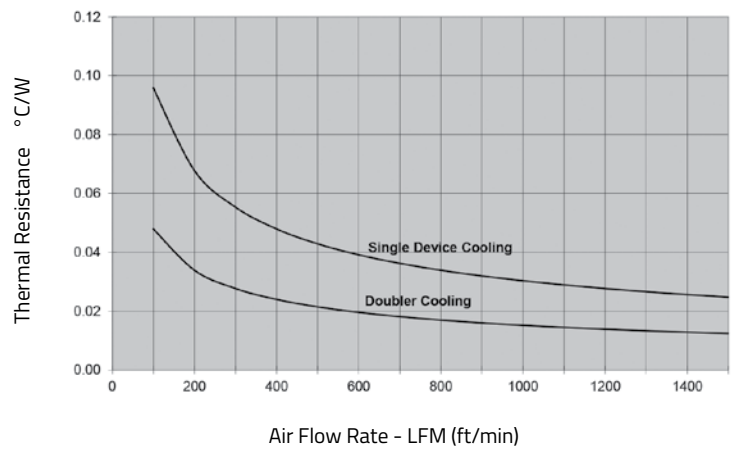
Perimeter	105.0	in.
Weight	12.80	lb. / ft.
Thermal Res.	.75	°C / W / 3"



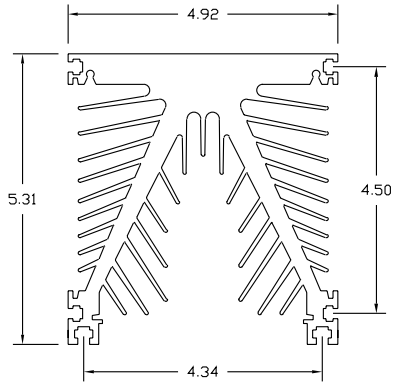
## AA Heatsink



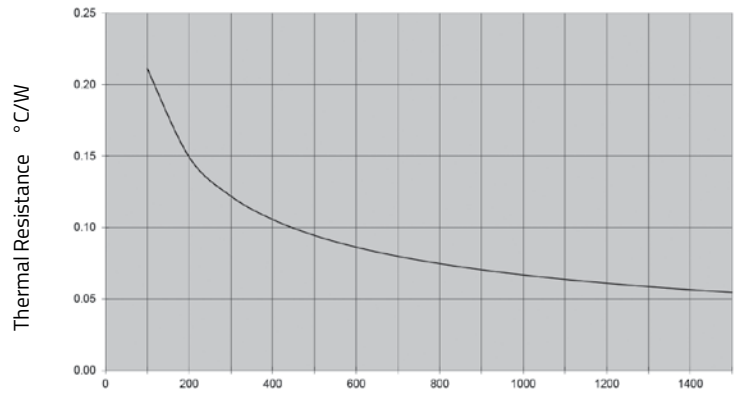
Perimeter	157.5	in.
Weight	21.10	lb. / ft.
Thermal Res.	.65	°C / W / 3"



## XM5 Heatsink

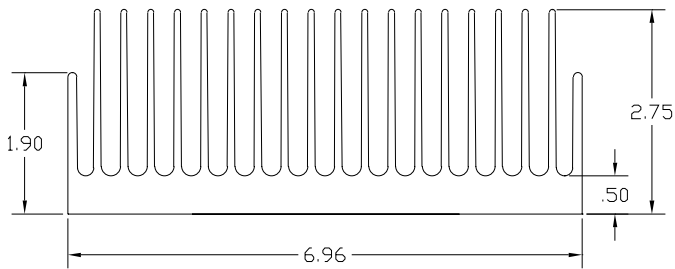


Perimeter	105.0	in.
Weight	12.80	lb. / ft.
Thermal Res.	.75	°C / W / 3"

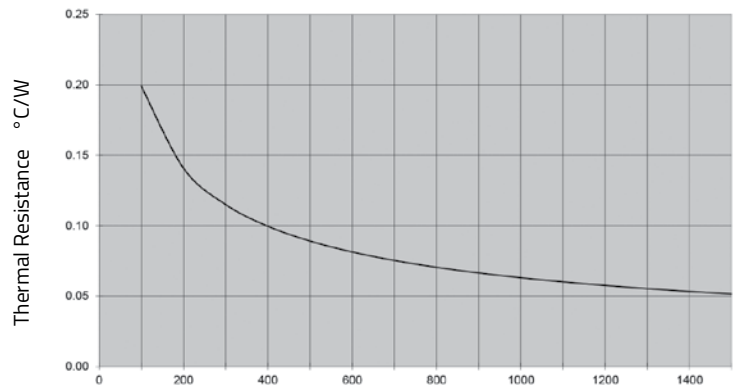


Air Flow Rate - LFM (ft/min)

## XM7 Heatsink

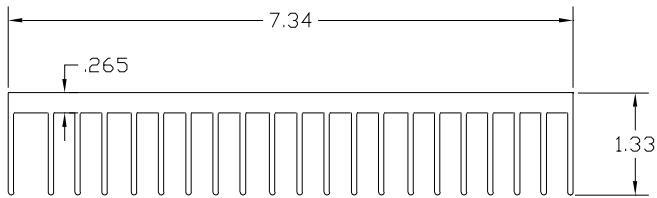


Perimeter	157.5	in.
Weight	21.10	lb. / ft.
Thermal Res.	.65	°C / W / 3"

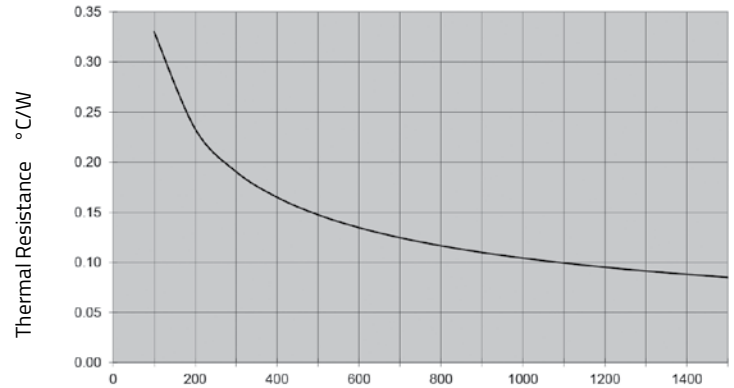


Air Flow Rate - LFM (ft/min)

## XM75 Heatsink

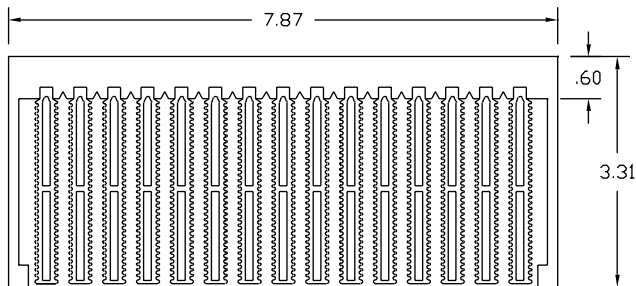


Perimeter	59.06	in.
Weight	4.08	lb. / ft.
Thermal Res.	1.20	°C / W / 3"

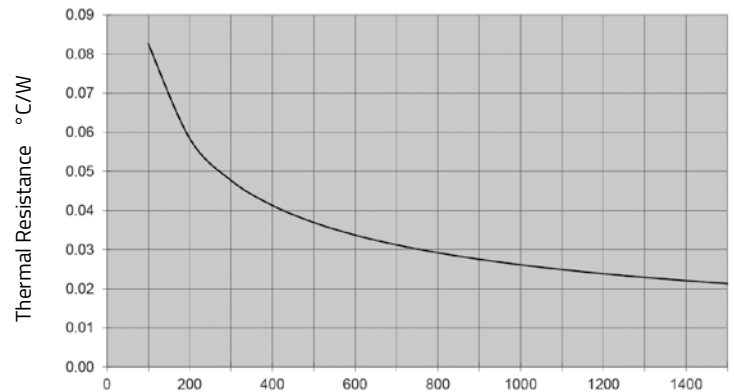


Air Flow Rate - LFM (ft/min)

## XM8 Heatsink



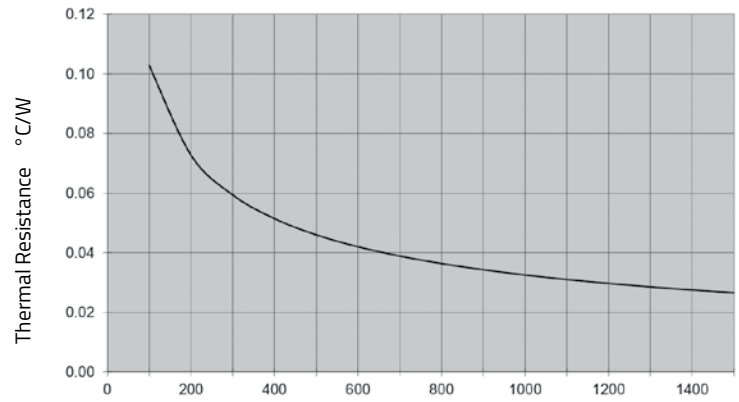
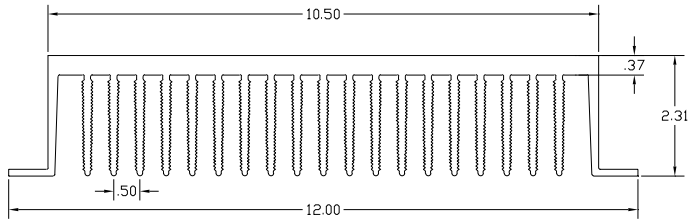
Perimeter	13.47	in.
Weight	236	lb. / ft.
Thermal Res.	0.036	°C / W / 12" @ 1000 LFM



Air Flow Rate - LFM (ft/min)

# Heatsinks

## XM12 Heatsink



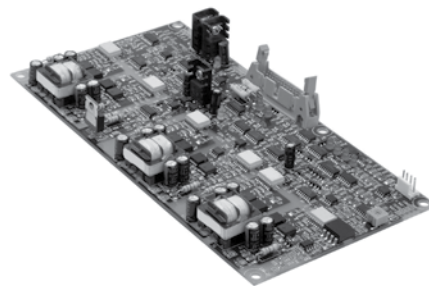
Perimeter	189.5	in.
Weight	12.12	lb. / ft.
Thermal Res.	.60	°C / W / 3"

Air Flow Rate - LFM (ft/min)

## Accessories

### SNUBBER BOARDS

- BAP1363A/B      1-Phase R-C (MOV) Snubber
- BAP1823          Dual R-C Module Snubber
- BAP1926          3-Phase R-C Snubber
- BAP2479          Dual R-C Module Snubber (D1.0 case)
- BAP2561          R-D-MOV Snubber
- BAP3323          C-D Snubber
- BAP1505          1-Phase RC Snubber



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