

SEMICONDUCTOR Products Catalog



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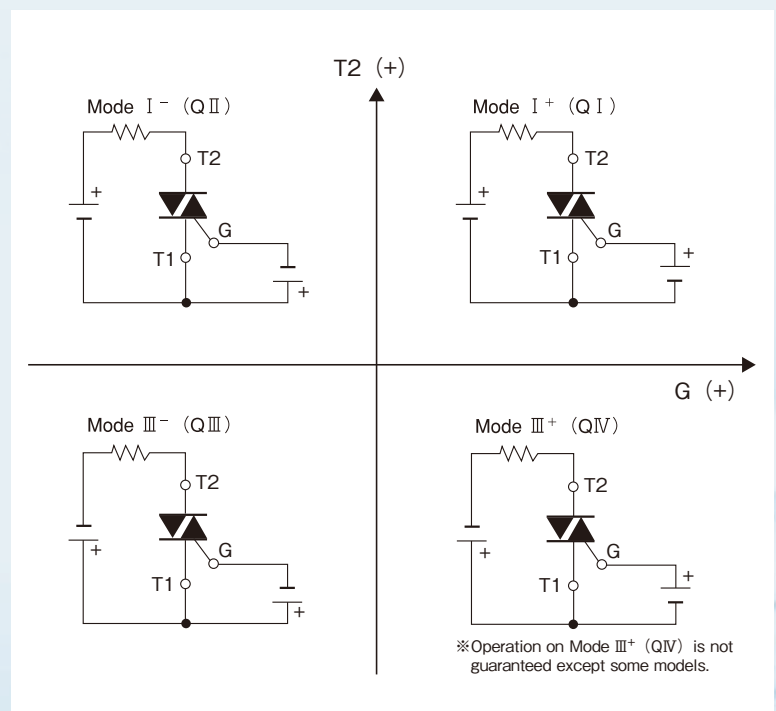
SYMBOLS & TERMS

FRD		DIODE		THYRISTOR		TRIAC	
Symbol	Terminology	Symbol	Terminology	Symbol	Terminology	Symbol	Terminology
V_{RRM}	Repetitive Peak Reverse Voltage	V_{RRM}	Repetitive Peak Reverse Voltage	V_{DRM}	Repetitive Peak Off-State Voltage	V_{DRM}	Repetitive Peak Off-State Voltage
$I_F (AV)$	Average Forward Current	$I_F (AV)$	Average Forward Current	V_{RRM}	Repetitive Peak Reverse Voltage	$I_T (RMS)$	RMS On-State Current
I_{FSM}	Surge Forward Current	I_D	Output Current (D.C.)	$I_T (AV)$	Average On-State Current	I_D	Repetitive Peak Off-State Current
I^2t	I^2t (for fusing)	I_{FSM}	Surge Forward Current	$I_T (RMS)$	RMS On-State Current	V_T	Peak On-State Voltage
V_F	Forward Voltage	I^2t	I^2t (for fusing)	I_{TSM}	Surge On-State Current	I_{GT}	Gate Trigger Current
I_R	Reverse Current	V_F	Forward Voltage	I^2t	I^2t (for fusing)	V_{GT}	Gate Trigger Voltage
t_{rr}	Reverse Recovery Time	I_R	Reverse Current	I_{GT}	Gate Trigger Current	T_j	Operating Junction Temperature
T_j	Operating Junction Temperature	T_j	Operating Junction Temperature	V_{GT}	Gate Trigger Voltage	$[dv/dt] (c)$	Critical Rate of Rise of Off-State Voltage at Commutation
$R_{th} (j-c)$	Thermal Resistance	$R_{th} (j-c)$	Thermal Resistance	I_D	Off-State Current	$R_{th} (j-c)$	熱抵抗
				I_R	Reverse Current		
				dv/dt	Critical Rate of Rise of Off-State Voltage		
				di/dt	Critical Rate of Rise of On-State Current		
				T_j	Operating Junction Temperature		
				$R_{th} (j-c)$	Thermal Resistance		

IGBT		
Symbol	Terminology	
IGBT	V_{CES}	Collector-Emitter Voltage
	V_{GES}	Gate-Emitter Voltage
	I_c	Collector Current
	$V_{CE (sat)}$	Collector-Emitter Saturation Voltage
	$V_{GE (th)}$	Gate-Source Threshold Voltage
	t_{on}	Turn-On Time: $t_d(on) + t_r$
	t_{off}	Turn-Off Time: $t_d(off) + t_r$
FWD	t_{rr}	Reverse Recovery Time

SiC MOSFET		
Symbol	Terminology	
MOSFET	V_{DSS}	Drain-Source Breakdown Voltage
	I_D	Continuous Drain-Source Current
	V_{GSS}	Gate-Source Voltage
	$R_{DS (on)}$	Drain-Source On-State Resistance
	$V_{GS (th)}$	Gate Threshold Voltage
Channel Diode	I_S	Continuous Diode Forward Current
	V_{SD}	Diode Forward Voltage
$R_{th} (j-c)$		Thermal Resistance

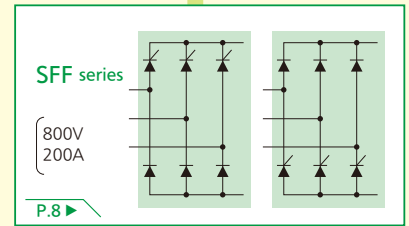
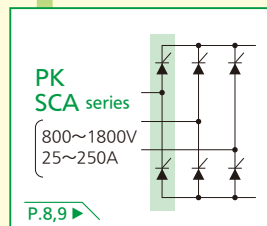
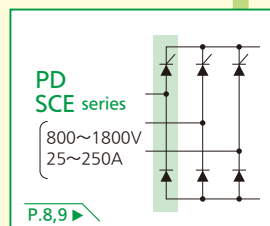
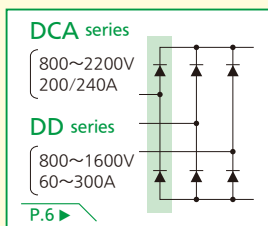
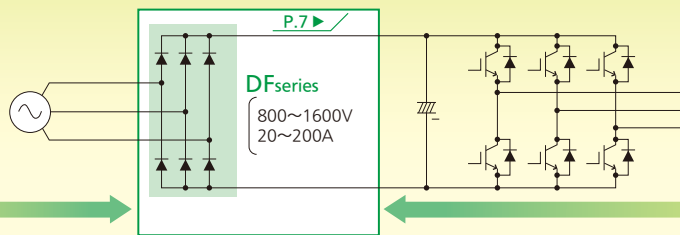
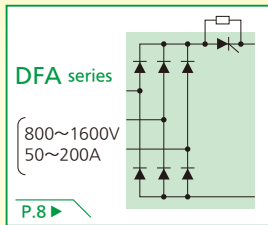
◆ GATE TRIGGER MODE for TRIACS (Quadrant definitions)



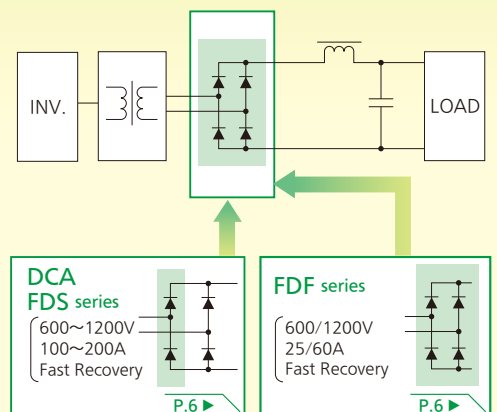
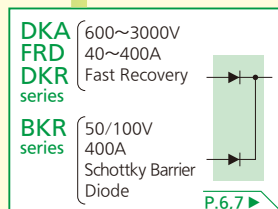
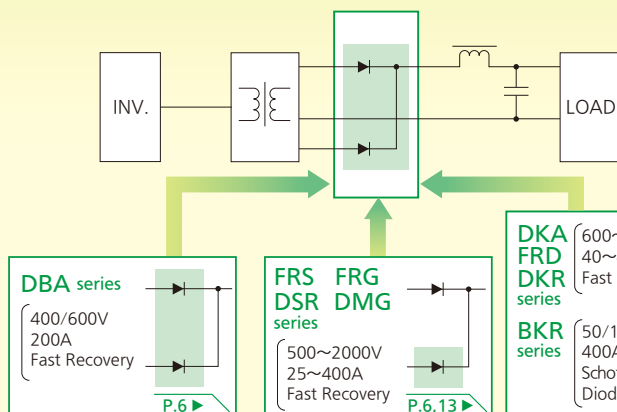


SELECTION GUIDE

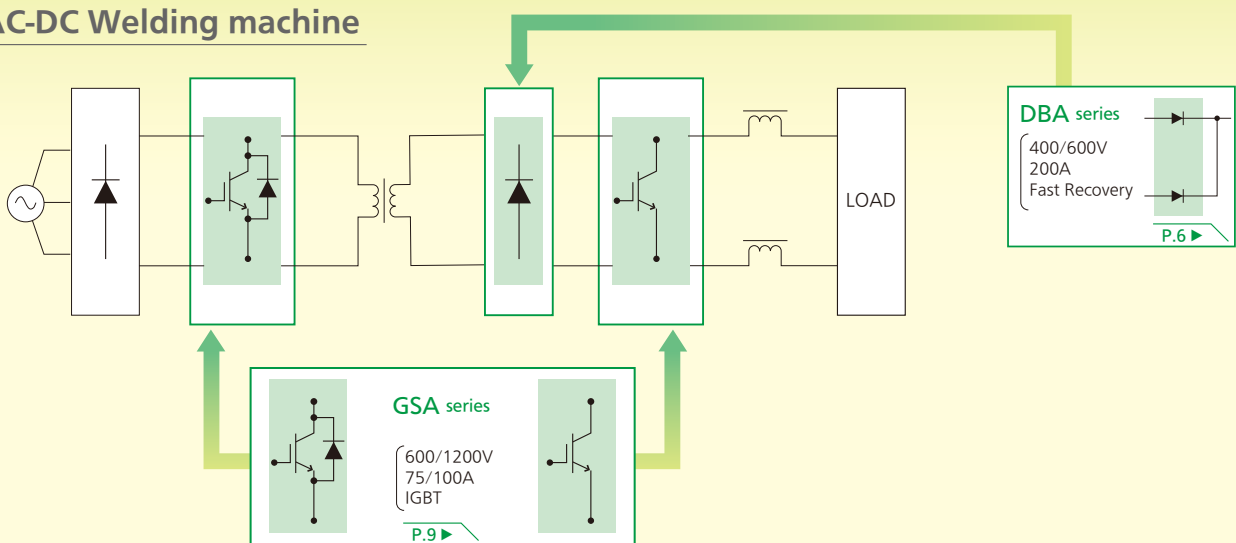
Converter Bridge



Secondary Rectifier

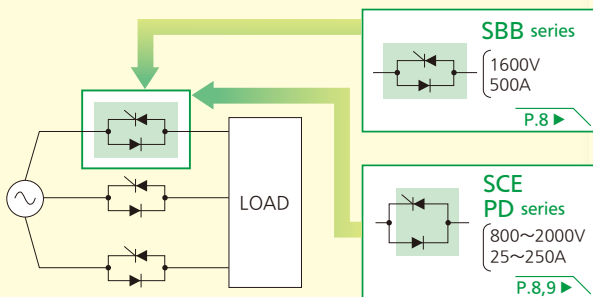
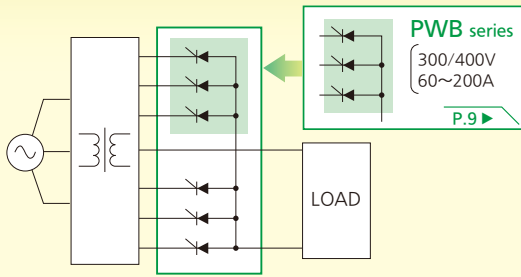


AC-DC Welding machine

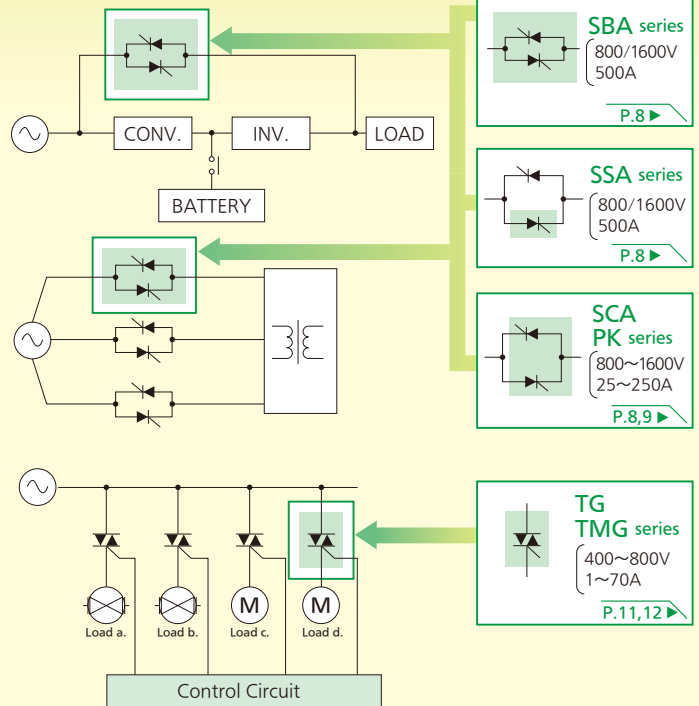




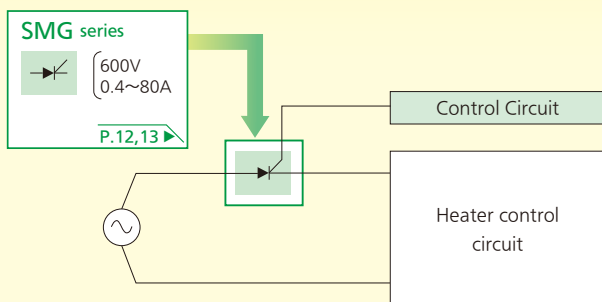
3-Phase Control



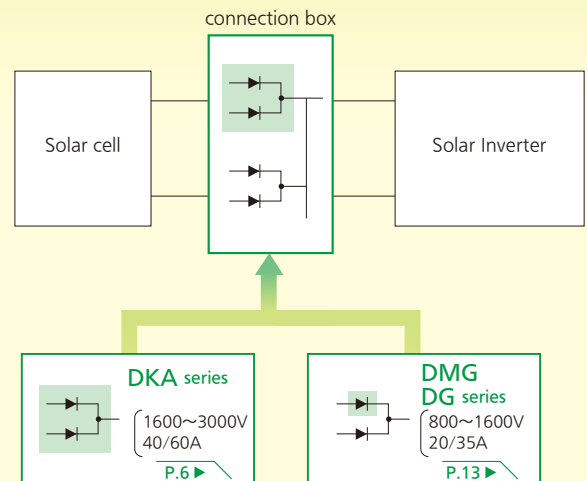
AC Control



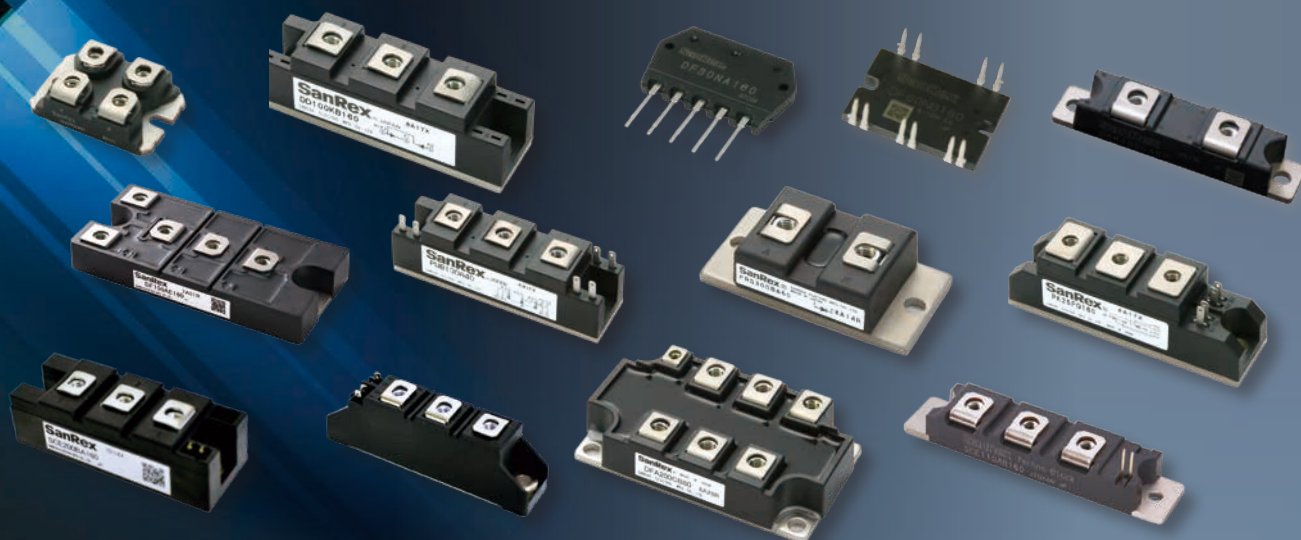
Heating System



Solar (PV) power generation system



POWER MODULE



PRODUCT FEATURES

Fast Recovery Diode

Our products are designed to minimize switching losses. We added low-noise soft recovery diode models to the lineup, and can meet any requirement for high efficiency and sustainability in your applications.

Soft Recovery Series

- DCA Series** Two recovery times
- DBA Series** Three recovery times
- DKA Series** Common cathode type

Fast Recovery Series

- FDF Series** Single phase bridge rectifier
- FRS Series** High current diode up to 400A
- DBA Series** High speed type
- DKR Series** Compact non-isolated package, dual diode common cathode
- FRD FDS Series** Dual diode module

Diode / Thyristor rectifier

Thyristor: available in 800V, 1600V and 1800V.
The characteristics of dv/dt and surge current are suitable for 200V/400V input rectification.
3-phase bridge rectifiers are available in different package heights to meet virtually all customers' requirements in design.

DF Series

Various configurations for 3-phase bridge rectifiers
DF_AA/BA : Standard models
DF_CA : High surge current withstand models
DF_NA/NB : Compact SIP (=Single-In-line Package) /DIP (=Dual-In-line Package) modules
DF_AC/AE : 17mm low profile modules
DF_LA/LB : Choose between LA type (without partition) and LB type (partitioned terminals for increased creepage distance).

DFA Series

3-phase bridge rectifier with built-in thyristor for inrush protection at the positive DC terminal

DD KD DKA Series

Standard dual diode modules, in series (DD), and common cathode (KD)

BAK BKR Series

Schottky barrier diode

SFF Series

Diode/Thyristor 3-phase bridge modules

PK/SCA PD/SCE Series

Standard dual thyristor and thyristor-diode modules

PWB Series

Standard 3-phase thyristor module

IGBT

Includes high-speed model for high-speed operation, and a low $V_{ce(sat)}$ model for low conduction loss.

GSA Series

SiC

We achieved high reliability and perfect switching by combining our original packaging technology with Panasonic Corporation's SiC-MOSFET chip.

FCA Series

2in1 SiC MOSFET module

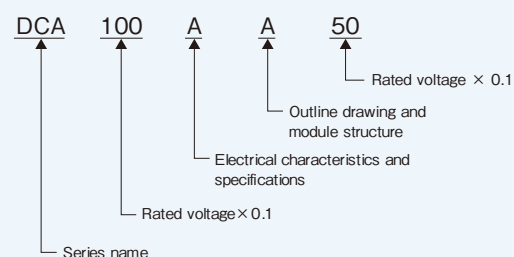
RoHS Compliance

All the modules presented in this catalog are RoHS compliant.

UL Recognized Component

Except for the modules "Non Isolated Type", "DKA40AA220" and "DKA40BA300", all the modules presented in this catalog comply with UL standard.
File No.E76102

TYPE DESIGNATION



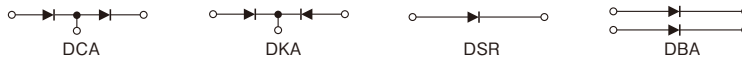
DIODE / FRD / SBD

Soft Recovery Diode

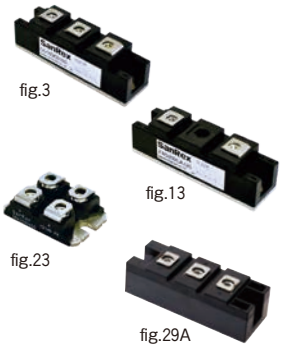
Viso : 2500V (RMS) Tj (max) : 150°C

Type	VRRM V	IF (AV)		IFSM A (60Hz)	I ² t A ² s	VFM V (25°C)	IRRM mA (125°C)	trr ns	Rthj-c °C / W	Fig No.
		A	°C							
DCA100AA60	600	100	85	2000	16700	1.3	100	300	0.5	3
DCA150AA60	600	150	72	2500	26000	1.3	150	300	0.4	3
DCA100BA60	600	100	80	1350	7500	1.55	100	200	0.45	3
DCA150BA65	650	150	63	1500	9300	1.7	150	200	0.34	3
DCA200UA65	650	200	85	1350	7500	1.7	50 (150°C)	360	0.19	29A
DKA200AA60	600	100	85	2000	16700	1.3	100	300	0.5	3
DKA300AA60	600	150	72	2500	26000	1.3	150	300	0.4	3
DSR200BA60	600	200	85	3300	45000	1.3	200	300	0.25	13
DBA200UA40	400	100	96	700	2100	1.2	100 (150°C)	130	0.45	23
DBA200UA60	600	100	89	700	2100	1.35	100 (150°C)	250	0.45	23
DBA200WA40	400	100	96	700	2100	1.2	4	110	0.45	23
DBA200WA60	600	100	89	700	2100	1.5	4	130	0.45	23

Connections



Package



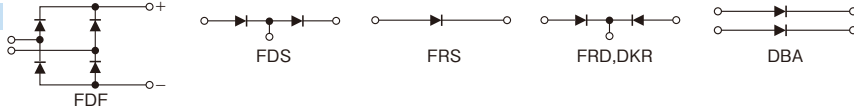
Fast Recovery Diode

Viso : 2500V (RMS) Tj (max) : 150°C

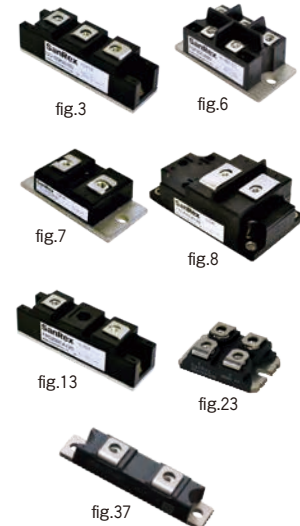
Type	VRRM V	IF (AV)		IFSM A (60Hz)	I ² t A ² s	VFM V (25°C)	IRRM mA (125°C)	trr ns	Rthj-c °C / W	Fig No.
		A	°C							
FDF25CA120	1200	25	114	400	660	1.8	2 (150°C)	200	0.4	6
FDF60BA60	600	60	80	600	1490	1.6	60	100	0.36	6
FRD100CA120	1200	100	78	2000	16600	1.8	5 (150°C)	300	0.4	3
FDS100CA120	1200	100	78	2000	16600	1.8	5 (150°C)	300	0.4	3
FRS150BA50	500	150	85	3000	37500	1.3	150	200	0.33	7
FRS200CA120	1200	200	78	3300	45000	1.8	10 (150°C)	350	0.2	13
FRS300BA50	500	300	85	4000	66600	1.3	300	200	0.165	7
FRS300BA60	600	300	85	4000	66600	1.3	300	200	0.165	7
FRS400BA60	600	400	94	4000	66640	1.4	400	200	0.1	8
FRS400CA120	1200	400	78	4000	66640	1.8	20 (150°C)	400	0.1	8
FRS400EA200	2000	400	79	5000	104000	2.2 (125°C)	100 (150°C)	700	0.08	8
DKR400CA60*	600	200	105	5600	130000	1.6	100	200	0.14	37
DBA200YA40	400	100	89	1100	5000	1.35	6 (150°C)	85	0.45	23

*Non isolated type

Connections



Package



Rectifier Diode

Viso : 2500V (RMS) Tj (max) : 150°C

Type	VRRM V	IF (AV)		IFSM A (60Hz)	I ² t A ² s	VFM V (25°C)	IRRM mA (150°C)	Rthj-c °C / W	Fig No.
		A	°C						
DKA40AA220	2200	20	125	1080	4860	1.15	10	0.65	31
DKA40BA300	3000	20	125	910	3440	1.15	10	0.09	38
DD60KB80/160	800, 1600	60	110	1200	6000	1.35	20	0.52	3
KD60GB80	800	60	114	1200	6000	1.25	20	0.5	3
KD60HB160	1600	60	111	1200	6000	1.35	20	0.5	3
DKA60KB80/160	800, 1600	60	110	1200	6000	1.35	20	0.52	3
DD100KB80/160	800, 1600	100	105	2000	16500	1.35	30	0.35	3
DD160KB80/160	800, 1600	160	90	3200	42600	1.35	30	0.3	3
KD160KB80/160	800, 1600	160	90	3200	42600	1.35	30	0.3	3
DAF160AA40*	400	160	90	3200	42600	1.3	30	0.29	35
DCA200DB80/160	800, 1600	200	113	5500	125000	1.3	50	0.15	29C
DCA200DB220	2200	200	113	5500	125000	1.4	50	0.15	29C
DCA240DB80/160	800, 1600	240	110	5500	125000	1.35	50	0.15	29C
DCA240EB80/160	800, 1600	240	110	5500	125000	1.35	50	0.12	29C
DD300KB80/160	800, 1600	300	91	6000	150000	1.5	50	0.14	4

*Non isolated type

Connections



Package





Schottky Barrier Diode

Viso : 2500V (RMS) Tj (max) : 150°C

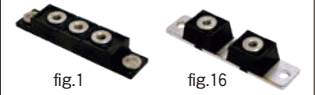
Type	VRRM V	IF (AV)		IFSM A (60Hz)	I ² t A ² s	VFM V (25°C)	IRRM mA (125°C)	Rthj-c °C / W	Fig No.
		A	°C						
BKR400ABZ50*	50	200	127	7600	240000	0.57	2000	0.2	16
BKR400AB10*	100	200	112	3620	54450	0.82	40	0.2	16
BAK400AA10	100	200	83	3620	54450	0.82	140	0.4	1

*Non isolated type

Connections



Package



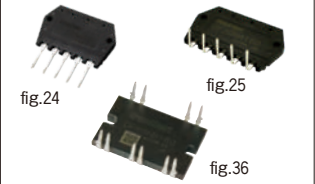
3-Phase Diode DF-NA/NB Series

Viso : 2500V (RMS) Tj (max) : 150°C

Type	VRRM V	ID		IFSM A (60Hz)	I ² t A ² s	VF V (25°C)	IR mA (150°C)	Rthj-c °C / W	Fig No.
		A	°C						
DF20NA80/160 S	800, 1600	20	111	350	500	1.2	4/8	0.8	24
DF20NA80/160 F1	800, 1600	20	111	350	500	1.2	4/8	0.8	25
DF30NA80/160 S	800, 1600	30	92	400	660	1.2	5/14	0.8	24
DF30NA80/160 F1	800, 1600	30	92	400	660	1.2	5/14	0.8	25
DF60NB160	1600	60	110	800	2600	1.3	8	0.25	36
DF75NB160	1600	75	112	1000	4100	1.3	8	0.2	36
DF100NB160	1600	100	98	1000	4100	1.3	8	0.2	36

New
New
New

Package



3-Phase Diode DF-AC/AE Series

Viso : 2500V (RMS) Tj (max) : 150°C

Type	VRRM V	ID		IFSM A (60Hz)	I ² t A ² s	VF V (25°C)	IR mA (150°C)	Rthj-c °C / W	Fig No.
		A	°C						
DF75AC80/160	800, 1600	75	100	1000	4100	1.4	10	0.24	26
DF100AC80/160	800, 1600	100	102	1300	7000	1.2	15	0.2	26
DF150AE80/160	800, 1600	150	106	2000	17000	1.31	15	0.11	34A
DF200AE80/160	800, 1600	200	106	2500	26000	1.32	20	0.08	34A

Package

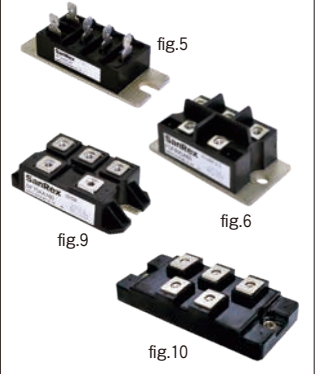


3-Phase Diode DF-AA/BA/CA Series

Viso : 2500V (RMS) Tj (max) : 150°C

Type	VRRM V	ID		IFSM A (60Hz)	VF V (25°C)	IR mA (150°C)	Rthj-c °C / W	Fig No.
		A	°C					
DF20CA80/160	800, 1600	20	123	600	1.1	8	0.6	5
DF20AA120/160	1200, 1600	20	119	240	1.25	3	0.6	5
DF30CA80/160	800, 1600	30	122	850	1.1	12	0.42	5
DF30AA120/160	1200, 1600	30	117	300	1.3	3	0.42	5
DF40BA80	800	40	119	700	1.2	4	0.32	6
DF40AA120/160	1200, 1600	40	116	700	1.3	3	0.32	6
DF50BA80	800	50	114	700	1.2	4	0.3	9
DF50AA120/160	1200, 1600	50	114	700	1.2	8	0.3	9
DF60BA80	800	60	115	1000	1.2	6	0.24	6
DF60AA120/160	1200, 1600	60	112	1000	1.3	12	0.24	6
DF75BA80	800	75	107	1000	1.2	10	0.24	9
DF75AA120/160	1200, 1600	75	100	1000	1.4	10	0.24	9
DF100BA80	800	100	102	1000	1.2	15	0.2	9
DF100AA120/160	1200, 1600	100	102	1000	1.2	15	0.2	9
DF150AB80/160	800, 1600	150	100	1200	1.2	15	0.14	10
DF200AB80/160	800, 1600	200	102	2000	1.2	20	0.1	10

Package

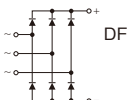


3-Phase Diode DF-LA/LB Series

Viso : 2500V (RMS) Tj (max) : 150°C

Type	VRRM V	ID		IFSM A (60Hz)	VF V (25°C)	IR mA (150°C)	Rthj-c °C / W	Fig No.
		A	°C					
DF60LA80/160	800, 1600	60	111	800	1.3	8	0.25	19
DF60LB80/160	800, 1600	60	111	800	1.3	8	0.25	20
DF75LA80/160	800, 1600	75	101	1000	1.3	8	0.25	19
DF75LB80/160	800, 1600	75	101	1000	1.3	8	0.25	20
DF100LA80/160	800, 1600	100	90	1300	1.3	12	0.23	19
DF100LB80/160	800, 1600	100	90	1300	1.3	12	0.23	20

Connections



Package

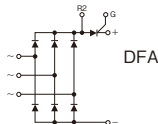


3-Phase Diode+Thyristor

V_{ISO} : 2500V (RMS)

Type	V _{DRM} / V _{RRM} V	I _D		I _{FSM} A (60Hz)	I ² _t A ² s	V _{FM} (D) V (25°C)	I _{RRM} (D) mA (150°C)	R _{thj-c} (D) °C / W	V _{TM} (THY) V (25°C)	I _{RRM} (THY) mA (135°C)	R _{thj-c} (THY) °C / W	T _j (max)		Fig No.
		A	°C									(thy)	(Diode)	
DFA50BA80/160	800, 1600	50	117	800	2660	1.3	8	0.25	1.25	50	0.8	135°C	150°C	15
DFA75BA80/160	800, 1600	75	101	1000	4150	1.3	8	0.25	1.2	60	0.4	135°C	150°C	15
DFA100BA80/160	800, 1600	100	98	1300	7030	1.3	12	0.2	1.2	70	0.36	135°C	150°C	15
DFA150BA80/160	800, 1600	150	105	1600	10670	1.35	15	0.09	1.35	100	0.22	150°C	150°C	15
DFA150AA80/160	800, 1600	150	93	1600	10670	1.35	15	0.14	1.35	100	0.21	135°C	150°C	28
DFA200AA80/160	800, 1600	200	96	2000	17000	1.35	20	0.1	1.15	50	0.18	135°C	150°C	28
DFA250AA80/160	800, 1600	250	96	2000	17000	1.4	20	0.077	1.25	100	0.132	135°C	150°C	28
DFA150CB80/160	800, 1600	150	113	1600	10670	1.35	15	0.09	1.35	100	0.18	150°C	150°C	17
DFA200CB80/160	800, 1600	200	96	2000	17000	1.35	20	0.1	1.15	50	0.15	150°C	150°C	17

Connections



Package

fig.15

fig.17

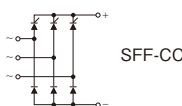
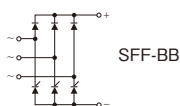
fig.28

Diode/Thyristor 3-Phase Bridge

V_{ISO} : 2500V (RMS) dv/dt : 500V/μs T_j (max) : 125°C

Type	V _{DRM} / V _{RRM} V	I _D		I _{TSM} A (60Hz)	I ² _t A ² s	I _{GT} mA (25°C)	V _{GT} V (25°C)	V _T V (25°C)	I _D /I _R mA	R _{thj-c} °C/W	T _j (max) °C	Fig No.
		A	°C									
SFF200BB80	800	200	92	2300	22000	150	3	1.35	15	0.06	125	34B
SFF200CC80	800	200	92	2300	22000	150	3	1.35	15	0.06	125	34B

Connections



Package

fig.34B

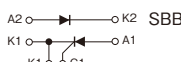
THYRISTOR

High Current Thyristor

V_{ISO} : 2500V (RMS) dv/dt : 500V/μs T_j (max) : 125°C

Type	V _{DRM} / V _{RRM} V	I _T (AV)		I _{TSM} A (60Hz)	I ² _t A ² s	I _{GT} mA (25°C)	V _{GT} V (25°C)	V _{TM} V (25°C)	I _{DRM} /I _{RRM} mA (125°C)	R _{thj-c} °C/W	Fig No.
		A	°C								
SBA500AA80/160	800, 1600	500	66	10000	4.16 × 10 ⁵	200	3	1.45	150	0.085	14
SBB500AA160	1600	500	66	10000	4.16 × 10 ⁵	200	3	1.45	150	0.085	14
SSA500AA80/160	800, 1600	500	66	10000	4.16 × 10 ⁵	200	3	1.45	150	0.085	22

Connections



Package

fig.14

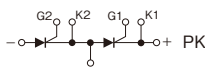
fig.22

Thyristor PK/PD Series

V_{ISO} : 2500V (RMS) dv/dt : 500V/μs T_j (max) : 125°C

Type	V _{DRM} / V _{RRM} V	I _T (AV)		I _{TSM} A (60Hz)	I ² _t A ² s	I _{GT} mA (25°C)	V _{GT} V (25°C)	V _{TM} V (25°C)	I _{DRM} /I _{RRM} mA (125°C)	R _{thj-c} °C/W	Fig No.
		A	°C								
PK25FG80/160	800, 1600	25	81	700	2870	50	3	1.6	5	1.1	2
PD25FG80/160	800, 1600	25	81	700	2870	50	3	1.6	5	1.1	2
PK40FG80/160	800, 1600	40	83	950	3760	50	3	1.6	10	0.65	2
PD40FG80/160	800, 1600	40	83	950	3760	50	3	1.6	10	0.65	2
PK55FG80/160	800, 1600	55	81	1300	7040	50	3	1.6	15	0.5	2
PD55FG80/160	800, 1600	55	81	1300	7040	50	3	1.6	15	0.5	2
PK70FG80/160	800, 1600	70	84	1600	10660	50	3	1.6	20	0.37	2
PD70FG80/160	800, 1600	70	84	1600	10660	50	3	1.6	20	0.37	2
PK90FG80/160	800, 1600	90	82	2300	22040	50	3	1.6	25	0.3	2
PD90FG80/160	800, 1600	90	82	2300	22040	50	3	1.6	25	0.3	2
PK110FG80/160	800, 1600	110	81	3000	37500	50	3	1.6	30	0.25	2
PD110FG80/160	800, 1600	110	81	3000	37500	50	3	1.6	30	0.25	2
PK130FG80/160	800, 1600	130	83	3500	51040	50	3	1.6	35	0.2	2
PD130FG80/160	800, 1600	130	83	3500	51040	50	3	1.6	35	0.2	2
PK160FG80/160	800, 1600	160	84	5400	125000	100	3	1.5	100	0.18	21
PD160FG80/160	800, 1600	160	84	5400	125000	100	3	1.5	100	0.18	21
PK200FG80/160	800, 1600	200	73	6500	180000	100	3	1.5	100	0.167	21
PD200FG80/160	800, 1600	200	73	6500	180000	100	3	1.5	100	0.167	21
PK250GB80/HB160	800, 1600	250	72	5500	125000	100	3	1.6	50	0.14	4
PD250GB80/HB160	800, 1600	250	72	5500	125000	100	3	1.6	50	0.14	4

Connections



Package

fig.2

fig.4

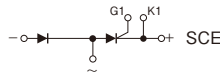
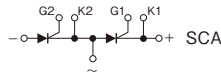
fig.21

Thyristor SCA/SCE Series

 $V_{ISO} : 2500V/3000V \text{ (RMS)}$ $dv/dt : 1000V/\mu s$

Type	V _{DRM} / V _{RRM} V	I _T (A _V)		I _{TSM} A (60Hz)	I ² _t A ² s	I _{GT} mA (25°C)	V _{GT} V (25°C)	V _{TM} V (25°C)	I _{DRM} /I _{RRM} mA	R _{thj-c} °C/W	T _{j(max)} °C	Fig No.
		A	°C									
SCA55AA160	1600	55	95	1500	9380	100	2.5	1.65	20(130°C)	0.4	130	30
SCE55AA160	1600	55	95	1500	9380	100	2.5	1.65	20(130°C)	0.4	130	30
SCA70AA160	1600	70	101	1750	12800	100	2.5	1.7	20(130°C)	0.25	130	30
SCE70AA160	1600	70	101	1750	12800	100	2.5	1.7	20(130°C)	0.25	130	30
SCA90AA160	1600	90	100	2300	22040	100	2.5	1.7	20(130°C)	0.2	130	30
SCE90AA160	1600	90	100	2300	22040	100	2.5	1.7	20(130°C)	0.2	130	30
SCA110AA160	1600	110	95	2500	25000	100	2.5	1.7	20(130°C)	0.19	130	30
SCE110AA160	1600	110	95	2500	25000	100	2.5	1.7	20(130°C)	0.19	130	30
SCE110AB160	1600	110	89	2300	22000	150	3.2	2.0	70(150°C)	0.28	150	32
SCA160DB80/160	800, 1600	160	88	5900	145000	100	3	1.4	100(125°C)	0.17	125	29C
SCE160CA200	2000	160	85	4500	84000	100	3	1.65	40(130°C)	0.17	130	29B
SCE160DB80/160	800, 1600	160	88	5900	145000	100	3	1.4	100(125°C)	0.17	125	29C
SCA200DB80/160	800, 1600	200	83	6500	180000	100	3	1.34	100(125°C)	0.155	125	29C
SCE200CA200	2000	200	76	5500	125000	100	3	1.7	50(130°C)	0.155	130	29B
SCE200DB80/160	800, 1600	200	83	6500	180000	100	3	1.34	100(125°C)	0.155	125	29C
SCA240DA160	1600	240	86	6500	180000	100	3	1.5	100(125°C)	0.105	125	29B
SCE240DA160	1600	240	86	6500	180000	100	3	1.5	100(125°C)	0.105	125	29B

Connections



Package



fig.29B



fig.29C



fig.30



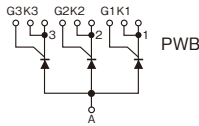
fig.32

Thyristor

 Non isolated type $di/dt : 50A/\mu s$, $V_{GT} : 2V \text{ (25°C)}$, $T_{j(max)} : 150°C$

Type	V _{DRM} / V _{RRM} V	I _T (A _V)		I _T (RMS)		I _{TSM} A (60Hz)	I ² _t A ² s	dv/dt V/μs(150°C)	I _{GT} mA (25°C)	V _{TM} V (25°C)	I _{DRM} /I _{RRM} mA (150°C)	R _{thj-c} °C/W	Fig No.
		A	°C	A	°C								
PWB60AA30/40	300, 400	60	123	94	123	1800	13500	50	150	1.25	10	0.35	11
PWB80AA30/40	300, 400	80	116	125	116	2500	26000	50	150	1.2	12	0.35	11
PWB100AA30/40	300, 400	100	114	157	114	3500	51000	50	150	1.2	15	0.3	11
PWB130AA30/40	300, 400	130	120	204	112	3500	51000	50	150	1.2	30	0.2	11
PWB150AA30/40	300, 400	150	121	230	121	3500	51000	200	100	1.2	40	0.15	12
PWB200AA40	400	200	121	314	121	6000	149940	200	150	1.2	60	0.12	12

Connections



Package



fig.11



fig.12

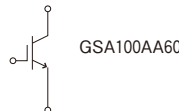
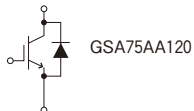
IGBT/SiC MOSFET

IGBT GSA Series

 $T_{j(max)} : 150°C$

Type	V _{CEs} V	V _{GES} V	I _C		V _{CE(sat)} V	V _{GE(th)} V	ton μs	toff μs	FWD trr ns	R _{thj-c} °C/W	Fig No.
			A	°C							
GSA75AA120	1200	±20	75	57	3.90	6.3	115	275	125	0.25 (IGBT)	23
GSA100AA60	600	±20	100	113	1.50	6.7	1260	8780	-	0.25	23

Connections



Package



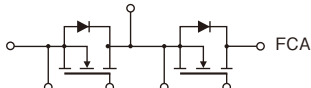
fig.23

SiC MOSFET FCA Series

 $V_{ISO} : 2500V \text{ (RMS)}$, $T_{j(max)} : 150°C$

Type	V _{DSS} V	I _T (A _V)		V _{GSS} V	R _{DS(on)} mΩ	V _{GS(th)} V	Channel Diode		V _{SD} V	R _{thj-c} °C/W	Fig No.
		A	°C				I _S	°C			
FCA100AC120	1200	100	100	-7~22	14.0	3~5	100	100	2.90	0.16	39
FCA150AC120	1200	150	90	-7~22	9.3	3~5	150	90	2.90	0.11	39

Connections

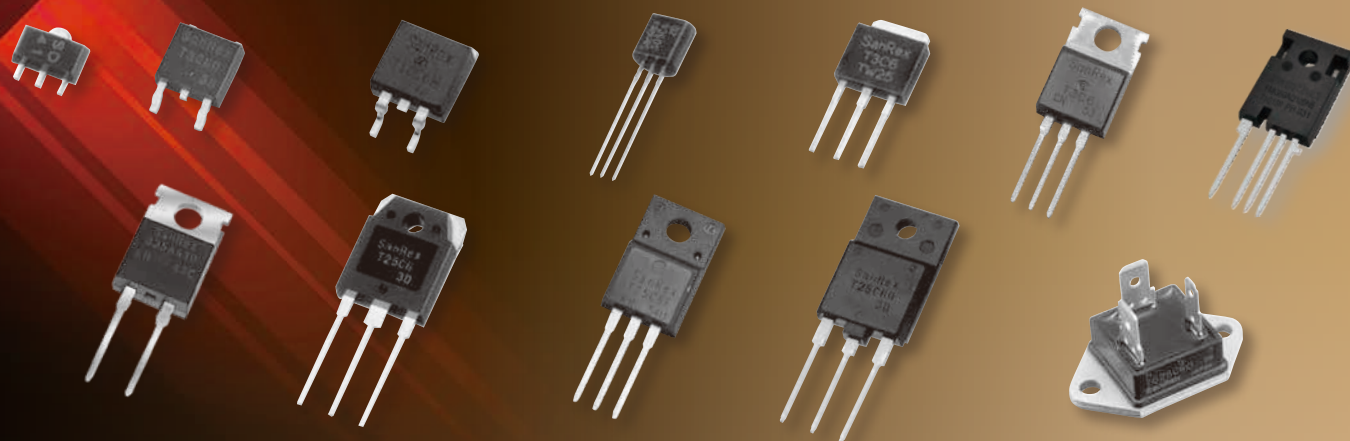


Package



fig.39

DISCRETE



PRODUCT FEATURES

Triac	TMG TG Series
Thyristor	SMG SG Series
DIODE	DMG DG FRG Series
SiC MOSFET	FMG Series

Broad Product Lineup

8 models of Through Hole type

TO-92, TO-251, TO-220AB, TO-220AB-2L, TO-220F, TO-3P, TO-3PF, TO-247, TO-247-4L

3 models of Surface Mount type

SOT-89, TO-252, TO-263

1 Tab Terminal package

TO-3

Triac	Standard Gate		Sensitive Gate	
	I ⁺ , I ⁻ , III ⁻	III ⁺	I ⁺ , I ⁻ , III ⁻	III ⁺
TMG1C_			5	10
TMG2C_	15	—		
TMG2D_			5	10
TMG3C_	15	—		
TMG3D_			5	10
TMG5C_	20	—		
TMG8/12/16/20/25C_	30	—		
TMG5/8/12/16/20/25D_			10	—
TMG40C_	50	—		

(mA)

Triac / Thyristor - High sensitivity models lineup

RoHS Compliance

All the products presented in this catalog are RoHS compliant.

Low loss ($V_T=1.4V$) models available

Triac - Q series : Guaranteed $T_{jmax}=150^{\circ}C$

You can reduce total cost thanks to smaller heatsink or no heatsink design.

SiC MOSFET

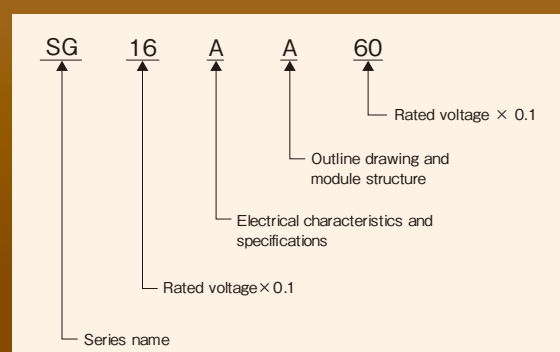
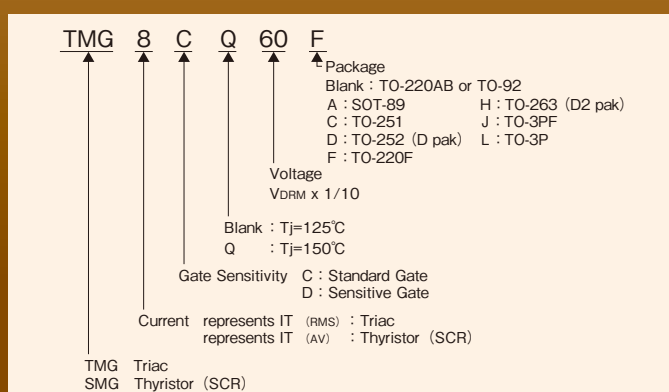
Isolated package with good heat dissipation.

Thyristor	Standard Gate	Sensitive Gate
SMG04/05/08C_		0.1
SMG3D_		0.2
SMG5/8C_	10	
SMG12/16C_	30	
SMG5F_		0.2

(mA)

Operate with logic circuit output directly.

TYPE DESIGNATION



Through Hole/Standard Gate

Package	Type	V _{DRM} V	I _{T(RMS)} A	I _{DRM} mA	V _{TM} V	I _{GT} mA		V _{GT} V		T _j °C	[dv/dt] c		R _{thj-c} °C/W	Fig No.
						I+, I-, II-	III +	I+, I-, II-	III +		V/μs (T _j =125°C)	-A/ms [-di/dt] c		
TO-251	TMG3C60/80C*	600, 800	3	1	1.4	15	—	1.5	—	125	5	1.5	3.8	D2
TO-220AB	TMG5C60*	600	5	1	1.4	20	—	1.5	—	125	5	2.5	3	D3
	TMG8C60*	600	8	2	1.4	30	—	1.5	—	125	10	4	2	
	TMG12C60*	600	12	2	1.4	30	—	1.5	—	125	10	6	1.8	
	TMG16C60*	600	16	2	1.4	30	—	1.5	—	125	10	8	1.4	
TO-220AB2	TMG20C60*	600	20	2	1.4	30	—	1.5	—	125	10	8	1	D5
TO-220F	TMG2C80F5	800	2	1	1.6	15	—	1.5	—	125	3	1	7.5	* D6B
	TMG3C80F5	800	3	1	1.4	15	—	1.5	—	125	5	1.5	5	
	TMG5C80F5	800	5	1	1.4	20	—	1.5	—	125	5	2.5	4	
	TMG8C80F5	800	8	2	1.4	30	—	1.5	—	125	10	4	3.7	
	TMG10C80F5	800	10	2	1.4	30	—	1.5	—	125	10	5	3.5	
	TMG12C80F5	800	12	2	1.4	30	—	1.5	—	125	10	6	3.3	
	TMG16C80F5	800	16	2	1.4	30	—	1.5	—	125	10	8	3	
	TMG20C80F5	800	20	2	1.4	30	—	1.5	—	125	10	8	2.5	
TO-3P	TMG25C60/80F	600, 800	25	5	1.4	30	—	1.5	—	125	10	12.5	1.9	* D6C
	TMG40C60/80L*	600, 800	40	5	1.4	50	—	1.5	—	125	10	20	0.6	D7
TO-3PF	TMG25C60/80J	600, 800	25	5	1.4	30	—	1.5	—	125	10	12.5	1.4	* D8
	TMG40C60/80J	600, 800	40	5	1.4	50	—	1.5	—	125	10	20	1.1	

*Non isolated type

*UL File No.E76102

Through Hole/Sensitive Gate

Package	Type	V _{DRM} V	I _{T(RMS)} A	I _{DRM} mA	V _{TM} V	I _{GT} mA		V _{GT} V		T _j °C	[dv/dt] c		R _{thj-c} °C/W	Fig No.
						I+, I-, II-	III +	I+, I-, II-	III +		V/μs (T _j =125°C)	-A/ms [-di/dt] c		
TO-92	TMG1C60/80 5	600/800	1	0.5	1.6	5	10	1.8	2	125	2	0.5	50	D1B
TO-251	TMG3D60/80C*	600, 800	3	1	1.4	5	10	1.5	2	125	5	1.5	3.8	D2
TO-220F	TMG2D60F5	600	2	1	1.6	5	10	1.5	2	125	3	1	7.5	* D6B
	TMG2DQ60F5	600	2	1	1.6	5	—	1.5	—	150	1	1	7.5	
	TMG3D60F5	600	3	1	1.4	5	10	1.5	2	125	5	1.5	5	
	TMG5D60F5	600	5	1	1.4	10	—	1.5	—	125	5	2.5	4	
	TMG8D60F5	600	8	2	1.4	10	—	1.5	—	125	10	4	3.7	
	TMG10D60F5	600	10	2	1.4	10	—	1.5	—	125	10	5	3.5	
	TMG12D60F5	600	12	2	1.4	10	—	1.5	—	125	10	6	3.3	
	TMG16D60F5	600	16	2	1.4	10	—	1.5	—	125	10	8	3	
	TMG20D60F5	600	20	2	1.4	10	—	1.5	—	125	10	8	2.5	

*Non isolated type

*UL File No.E76102 **R_{th}(j-a)

Through Hole/T_j=150°C

Package	Type	V _{DRM} V	I _{T(RMS)} A	I _{DRM} mA	V _{TM} V	I _{GT} mA		V _{GT} V		T _j °C	[dv/dt] c		R _{thj-c} °C/W	Fig No.
						I+, I-, II-	III +	I+, I-, II-	III +		V/μs (T _j =150°C)	-A/ms [-di/dt] c		
TO-220AB	TMG16CQ60*	600	16	3	1.4	30	—	1.5	—	150	5	8	1.4	D3
TO-220AB2	TMG20CQ60*	600	20	3	1.4	30	—	1.5	—	150	5	10	1	D5
TO-220F	TMG2CQ60F5	600	2	1	1.6	15	—	1.5	—	150	1	1	7.5	* D6B
	TMG3CQ60F5	600	3	2	1.4	15	—	1.5	—	150	1	1.5	5	
	TMG5CQ60F5	600	5	2	1.4	20	—	1.5	—	150	2	2.5	4	
	TMG8CQ60F5	600	8	2	1.4	30	—	1.5	—	150	5	4	3.7	
	TMG10CQ60F5	600	10	2	1.4	30	—	1.5	—	150	5	5	3.5	
	TMG12CQ60F5	600	12	2	1.4	30	—	1.5	—	150	5	6	3.3	
	TMG16CQ60F5	600	16	3	1.4	30	—	1.5	—	150	5	8	3	
	TMG20CQ60F5	600	20	3	1.4	30	—	1.5	—	150	5	10	2.5	
	TMG2DQ60F5	600	2	1	1.6	5	—	1.5	—	150	1	1	7.5	
	TMG3DQ60F5	600	3	2	1.4	5	10	1.5	2	150	1	1.5	5	
TO-3P	TMG25CQ60F	600	25	5	1.4	30	—	1.5	—	150	5	12.5	1.9	* D6C
	TMG40CQ60L*	600	40	8	1.4	50	—	1.5	—	150	5	20	0.6	D7
TO-3PF	TMG25CQ60J	600	25	5	1.4	30	—	1.5	—	150	5	12.5	1.4	* D8
	TMG40CQ60J	600	40	8	1.4	50	—	1.5	—	150	5	20	1.1	

*Non isolated type

*UL File No.E76102

SMD (Surface Mount Device) / Standard Gate

Package	Type	V _{DRM} V	I _{T(RMS)} A	I _{DRM} mA	V _{TM} V	I _{GT} mA		V _{GT} V		T _j °C	[dv/dt] c		R _{thj-c} °C/W	Fig No.
						I+, I-, II-	III +	I+, I-, II-	III +		V/μs (T _j =125°C)	-A/ms [-di/dt] c		
TO-252 (D pak)	TMG3C60D*	600	3	1	1.4	15	—	1.5	—	125	5	1.5	3.8	D10
	TMG5C60D*	600	5	1	1.4	20	—	1.5	—	125	5	2.5	3	
TO-263 (D2 pak)	TMG16C60H*	600	16	2	1.4	30	—	1.5	—	125	10	8	1.4	D11
TO-92	TMG1D60 5	600	1	0.5	1.75	20	—	1.5	—	125	4	0.5	50	D1B

*Non isolated type

SMD (Surface Mount Device) / Sensitive Gate

Package	Type	V _{DRM} V	I _{T(RMS)} A	I _{DRM} mA	V _{TM} V	I _{GT} mA		V _{GT} V		T _j °C	[dv/dt] c		R _{thj-c} °C/W	Fig No.
						I+, I-, II-	III +	I+, I-, II-	III +		V/μs (T _j =125°C)	-A/ms [-di/dt] c		
SOT-89	TMG1C60A 5*	600	1	0.5	1.6	5	10	1.8	2	125	2	0.5	**65	D9A
TO-252 (D pak)	TMG3D60D*	600	3	1	1.4	5	10	1.5	2	125	5	1.5	3.8	D10
	TMG5D60D*	600	5	1	1.4	10	—	1.5	—	125	5	2.5	3	

*Non isolated type

** R_{th} (j-a)

SMD (Surface Mount Device) / T_j=150°C

Package	Type	V _{DRM} V	I _{T(RMS)} A	I _{DRM} mA	V _{TM} V	I _{GT} mA		V _{GT} V		T _j °C	[dv/dt] c		R _{thj-c} °C/W	Fig No.
						I+, I-, II-	III +	I+, I-, II-	III +		V/μs (T _j =125°C)	-A/ms [-di/dt] c		
TO-252 (D pak)	TMG3CQ60D*	600	3	2	1.4	15	—	1.5	—	150	1	1.5	3.8	D10
	TMG5CQ60D*	600	5	2	1.4	20	—	1.5	—	150	2	2.5	3	

*Non isolated type

* UL File No.E76102

Tab Terminal / Standard Gate

Package	Type	V _{DRM} V	I _{T(RMS)} A	I _{DRM} mA	V _{TM} V	I _{GT} mA		V _{GT} V		T _j °C	[dv/dt] c		R _{thj-c} °C/W	Fig No.
						I+, I-, II-	III +	I+, I-, II-	III +		V/μs (T _j =125°C)	-A/ms [-di/dt] c		
TO-3	TG16C40/60	400, 600	16	3	1.5	50	—	3	—	125	6	8	2	* D12
	TG25C40/60	400, 600	25	5	1.4	50	—	3	—	125	6	15	1.6	
	TG35C60	600	35	5	1.4	50	—	3	—	125	5	15	1.5	
	TG40E60/80	600, 800	40	5	1.4	50	—	1.5	—	125	6	10	1.3	* D15
not standard	TG70AA40/60	400, 600	70	10	1.35	50	—	3	—	125	6	8	0.83	D14

* UL File No.E76102

THYRISTOR

Through Hole / Standard Gate

Package	Type	V _{DRM} V	I _{T(AV)} A	I _{T(RMS)} A	I _{DRM} mA	V _{TM} V	I _{GT} mA	V _{GT} V	T _j °C	R _{thj-c} °C/W	Fig No.
TO-220AB	SMG16C60*	600	16	25.1	2	1.5	30	1.4	125	1.4	D3
TO-220F	SMG5C60F5	600	5	7.8	2	1.5	10	1.4	125	4	* D6B
	SMG8C60F5	600	8	12.6	2	1.5	10	1.4	125	3.7	
	SMG12C60F5	600	12	18.8	2	1.5	30	1.4	125	3.3	
	SMG16C60F5	600	16	25.1	2	1.5	30	1.4	125	3	
TO-247	SMG50A160M*	1600	50	79	10	1.86	100	1.5	125	0.25	D16
	SMG80A160M*	1600	80	126	15	1.87	100	1.5	125	0.17	

*Non isolated type

* UL File No.E76102

SMD (Surface Mount Device) / Sensitive Gate

Package	Type	V _{DRM} V	I _{T(AV)} A	I _{T(RMS)} A	I _{DRM} mA	V _{TM} V	I _{GT} mA	V _{GT} V	T _j °C	R _{thj-c} °C/W	Fig No.
TO-92	SMG04C60 5	600	0.4	0.63	0.5	1.2	0.1	0.8	125	**150	D1B
	SMG05C60 5	600	0.5	0.78	0.5	1.2	0.1	0.8	125	**150	
TO-251	SMG3D60C*	600	3	4.7	1	1.5	0.2	0.8	125	3.8	D2

*Non isolated type

** R_{th} (j-a)

SMD (Surface Mount Device) / Standard Gate

Package	Type	V _{DRM} V	I _{T(AV)} A	I _{T(RMS)} A	I _{DRM} mA	V _{TM} V	I _{GT} mA	V _{GT} V	T _j °C	R _{thj-c} °C/W	Fig No.
TO-263 (D2 pak)	SMG5C60H*	600	5	7.8	2	1.5	10	1.4	125	3	D11

*Non isolated type

SMD (Surface Mount Device) / Sensitive Gate

Package	Type	V _{DRM} V	I _T (AV) A	I _T (RMS) A	I _{DRM} mA	V _{TM} V	I _{GT} mA	V _{GT} V	T _j °C	R _{thj-c} °C/W	Fig No.
SOT-89	SMG08C60A 5*	600	0.8	1.3	0.5	1.5	0.1	0.8	125	* * 65	D9A
TO-252 (D pak)	SMG3D60D*	600	3	4.7	1	1.5	0.2	0.8	125	3.8	D10
	SMG5F60D*	600	5	7.8	2	1.8	0.2	0.8	125	3	

*Non isolated type

* * R_{th}(j-a)

Tab Terminal / Standard Gate

Package	Type	V _{DRM} V	I _T (AV) A	I _T (RMS) A	I _{DRM} mA	V _{TM} V	I _{GT} mA	V _{GT} V	T _j °C	R _{thj-c} °C/W	Fig No.
TO-3	SG16AA40/60	400, 600	16	25	3	1.5	40	3	125	2	* D12
	SG25AA40/60	400, 600	25	39	5	1.4	40	3	125	1.6	

* UL File No.E76102

FRD

Through Hole

Package	Type	V _{RRM} V	I _F (AV)		I _{FSM} A (60Hz)	I ² _t A ² s	V _{FM} V (25°C)	I _{RRM} mA (125°C)	t _{rr} ns	R _{thj-c} °C/W	Fig No.
			A	°C							
TO-3P	DMG60UL20*	200	60	105	900	3375	1.05	2.0 (150°C)	60	0.7	D7

*Non isolated type

Tab Terminal

Package	Type	V _{RRM} V	I _F (AV)		I _{FSM} A (60Hz)	I ² _t A ² s	V _{FM} V (25°C)	I _{RRM} mA (125°C)	t _{rr} ns	R _{thj-c} °C/W	Fig No.
			A	°C							
TO-3	FRG25BA60	600	25	94	450	840	1.3	30 (150°C)	100	1.6	* D13
	FRG25CA120	1200	25	78	400	660	1.8	1 (150°C)	200	1.6	

* UL File No.E76102

DIODE

Through Hole

Package	Type	V _{RRM} V	I _F (AV) A	I _{FSM} A (60Hz)	I ² _t A ² s	V _{FM} V (25°C)	I _{RRM} mA (125°C)	T _j °C	R _{thj-c} °C/W	Fig No.
TO-220AB-2L	DMG35AA100*	1000	35	300	380	1.2	100	180	1.0	D4

*Non isolated type

Tab Terminal

Package	Type	V _{RRM} V	I _F (AV)		I _{FSM} A (60Hz)	I ² _t A ² s	V _{FM} V (25°C)	I _{RRM} mA (150°C)	R _{thj-c} °C/W	Fig No.
			A	°C						
TO-3	DG20AA80/120/160	800, 1200, 1600	20	101	450	840	1.65	8	1.6	* D13

* UL File No.E76102

SiC MOSFET

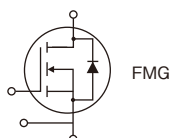
SiC MOSFET FMG Series

V_{iso} : 2500V (RMS), T_j (max) : 150°C

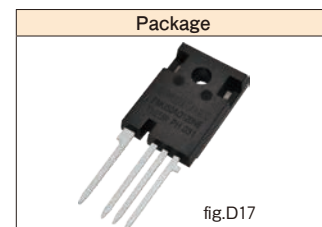
Package	Type	MOSFET						Channel Diode			R _{thj-c} °C/W	Fig No.
		V _{DSS} V	I _T (AV)		V _{GSS} V	R _{DS(on)} mΩ	V _{GS(th)} V	I _S		V _{SD} V		
			A	°C				A	°C			
TO-247-4	FMG50AQ120N6	1200	50	108	-7~22	28.0	3~5	50	108	2.90	0.28	*D17

* UL File No.E76102

Connections



Package



OUTLINE DRAWINGS POWER MODULE

fig.
1

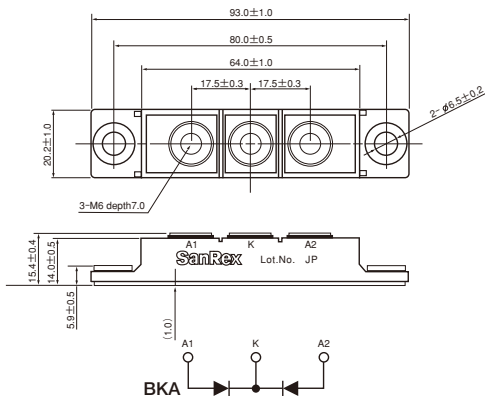


fig.
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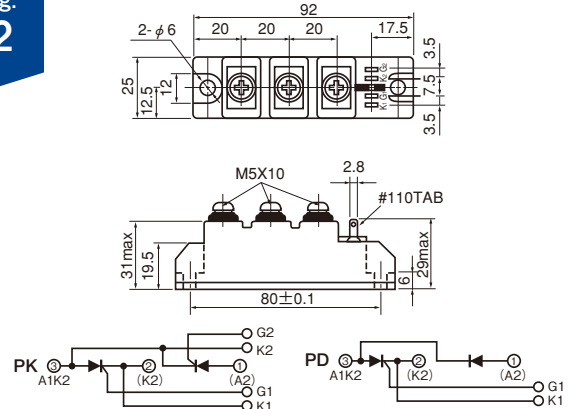


fig.
3

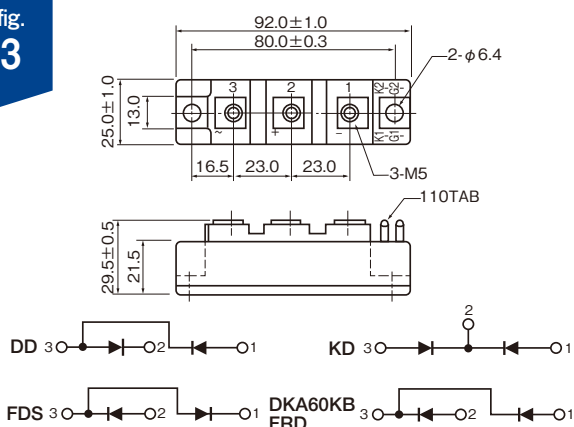


fig.
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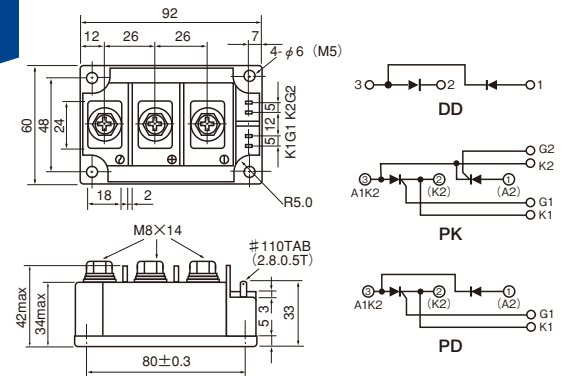


fig.
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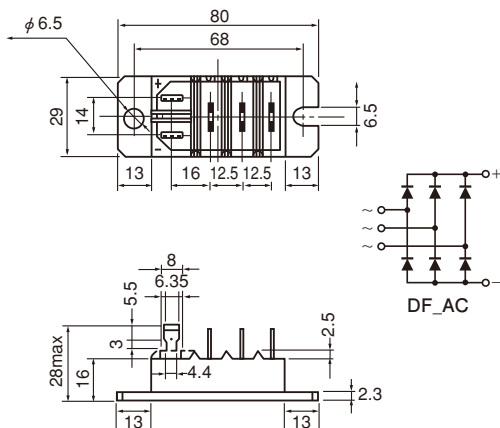


fig.
6

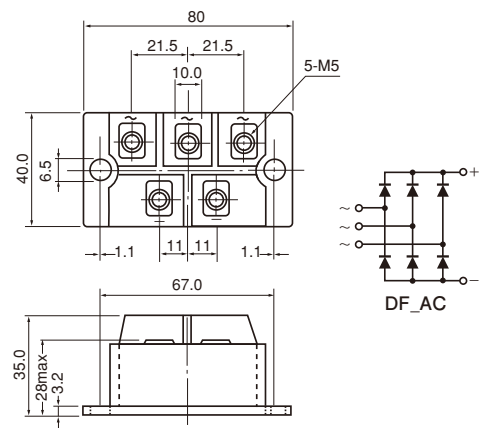


fig.
7

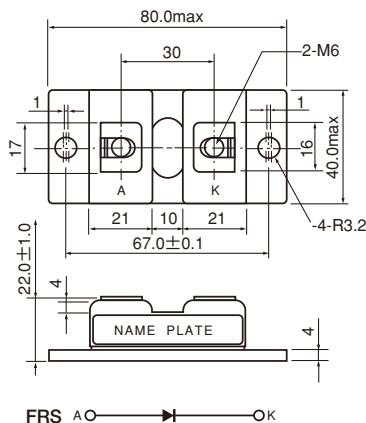


fig.
8

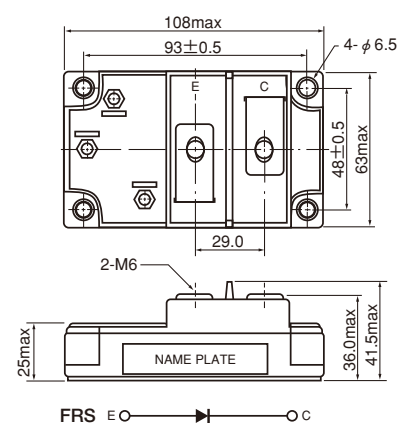


fig.
9

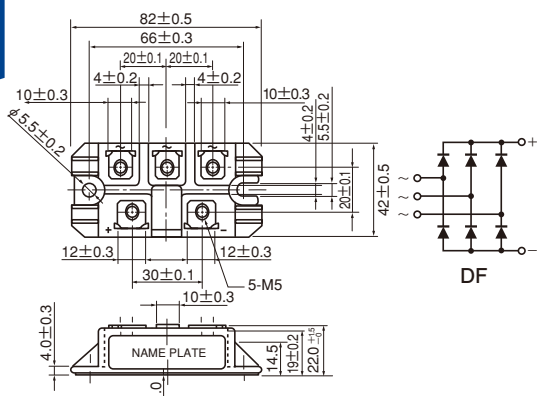


fig.
10

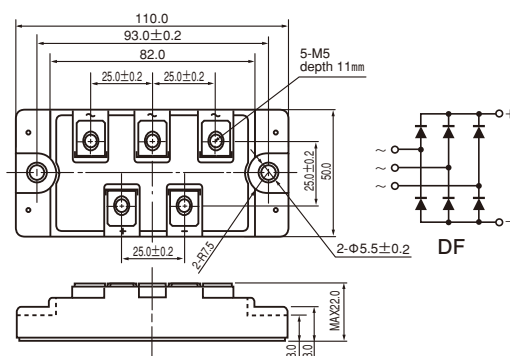


fig.
11

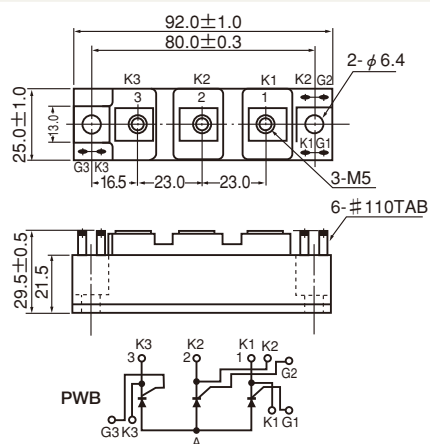


fig.
12

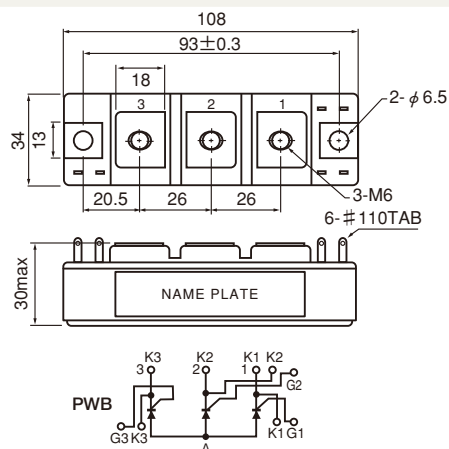


fig.
13

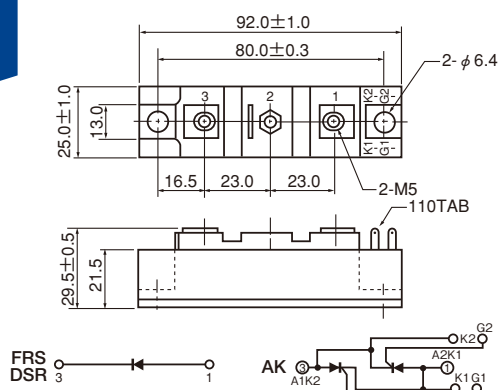


fig.
14

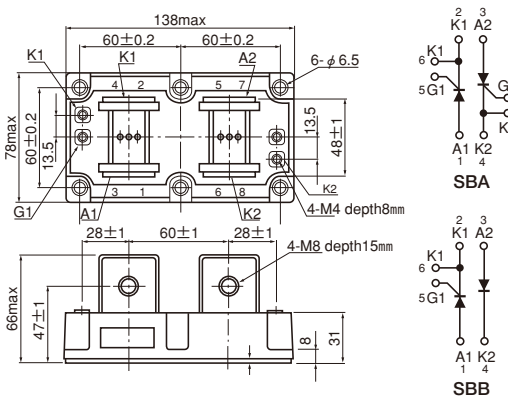


fig.
15

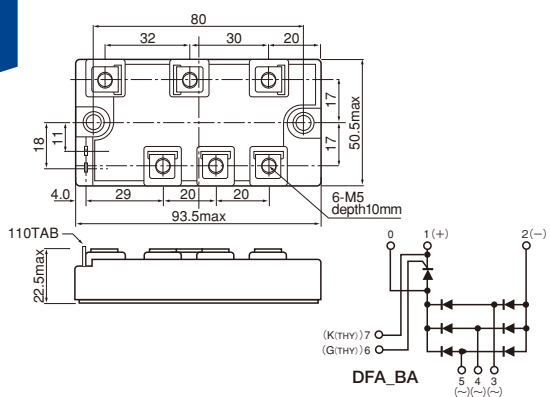


fig.
16

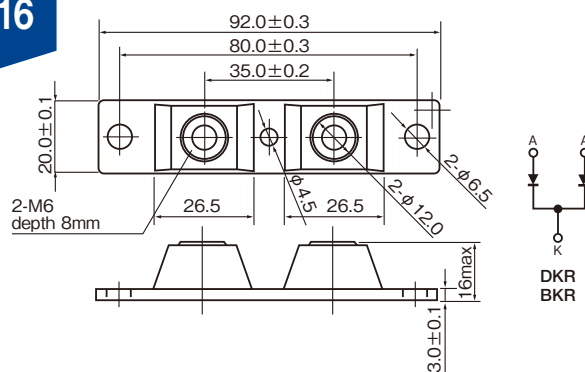


fig.
17

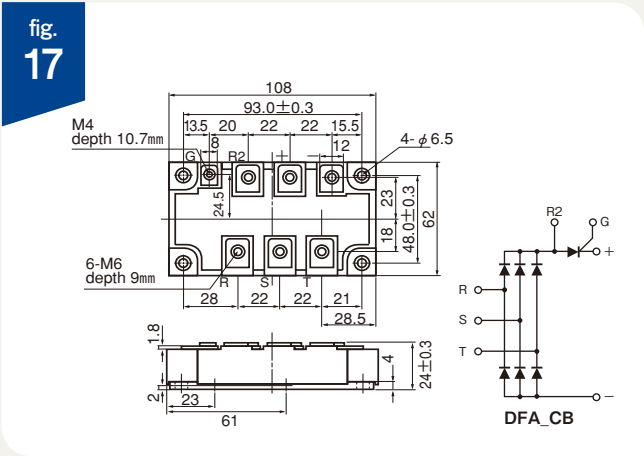


fig.
18

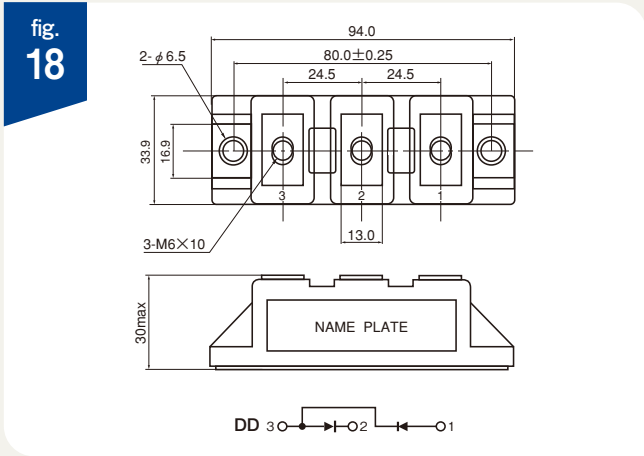


fig.
19

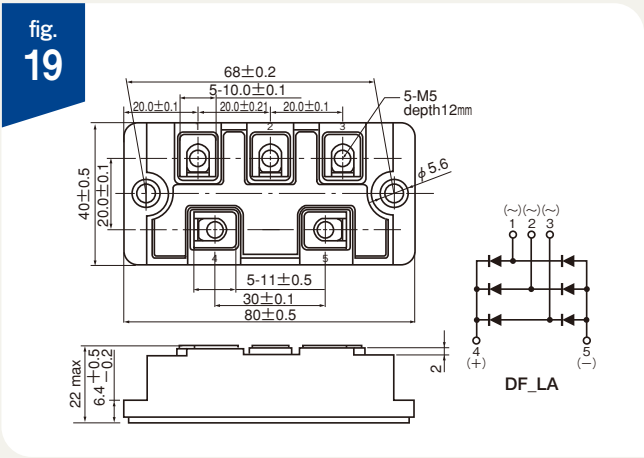


fig.
20

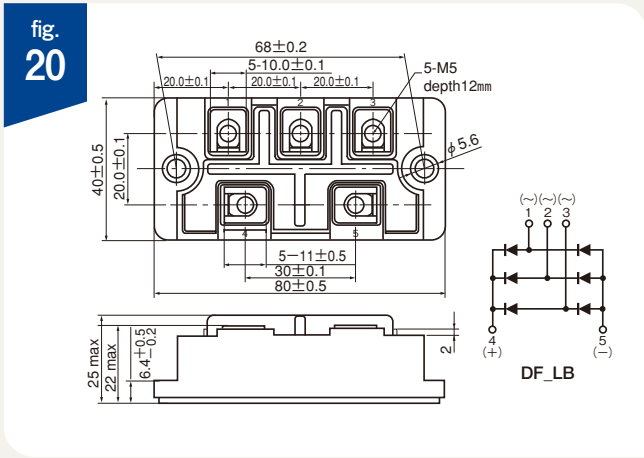


fig.
21

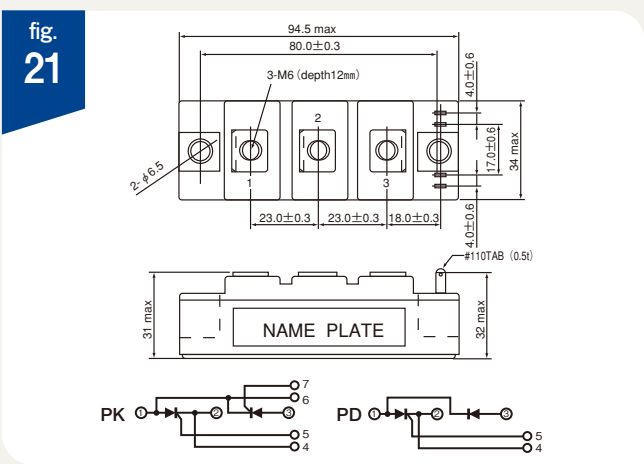


fig.
22

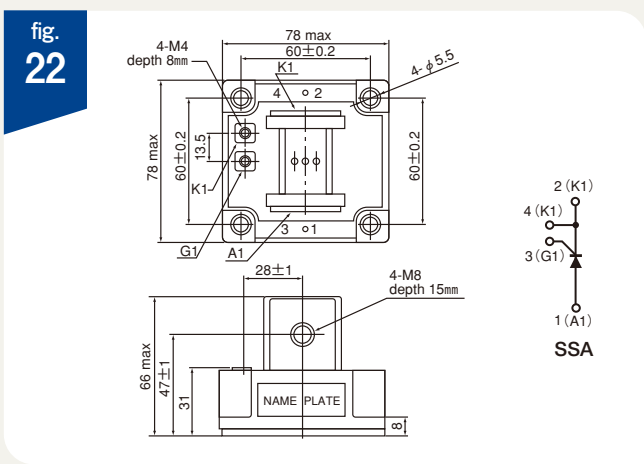


fig.
23

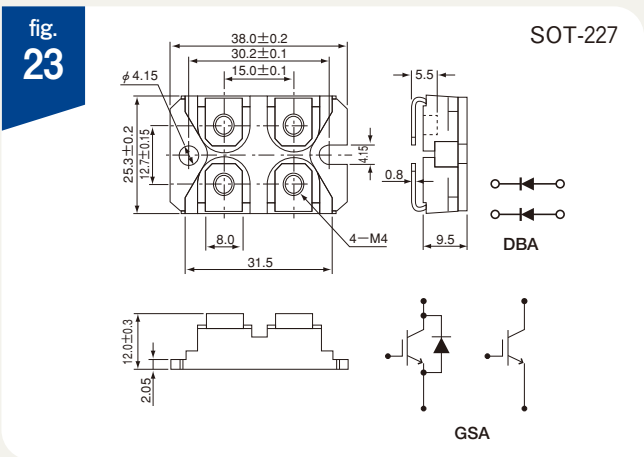
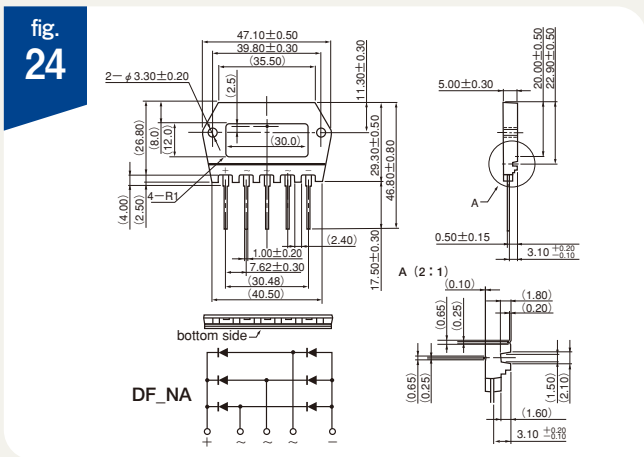
fig.
24

fig.
25

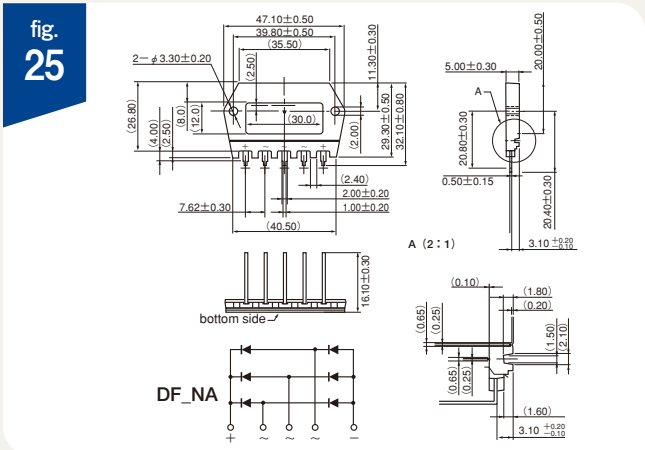


fig.
26

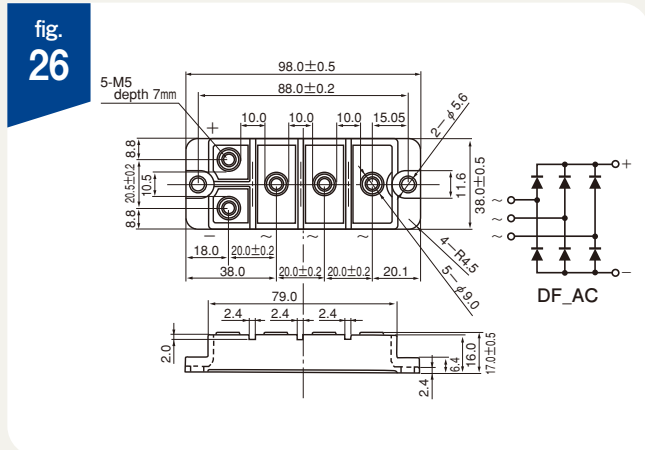


fig.
28

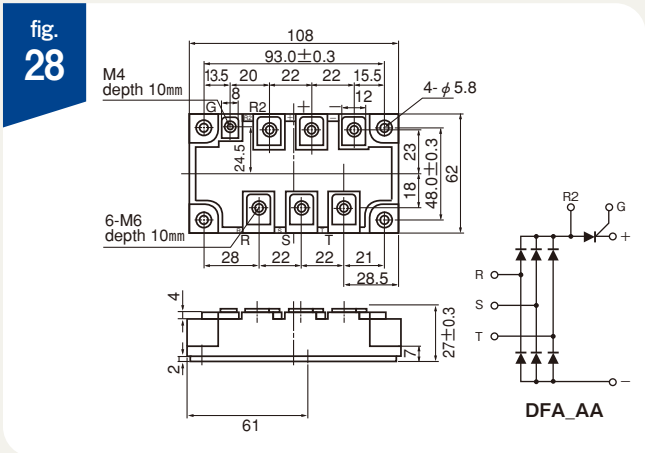


fig.
29A

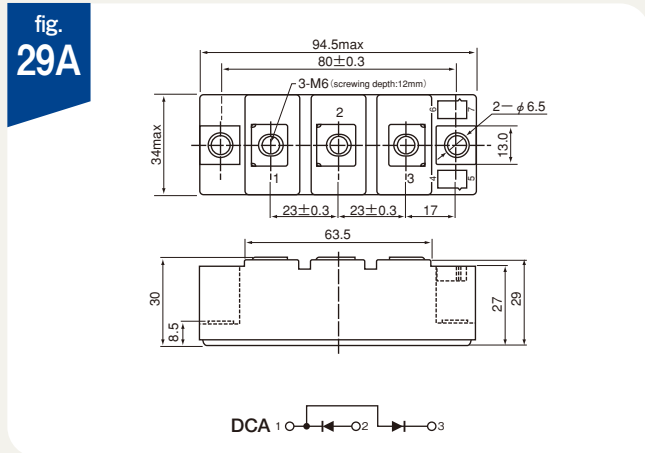


fig.
29B

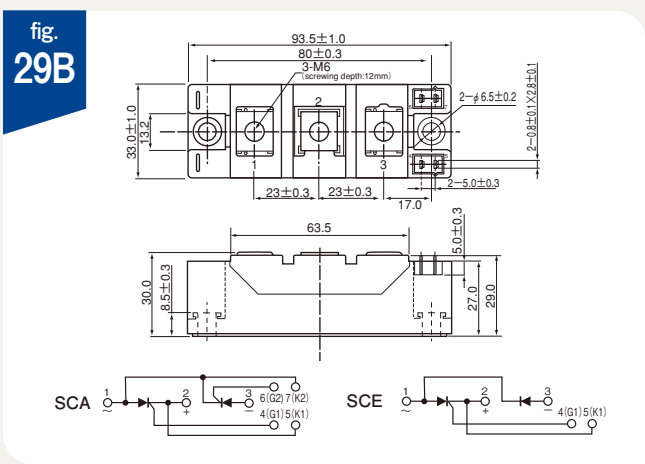


fig.
29C

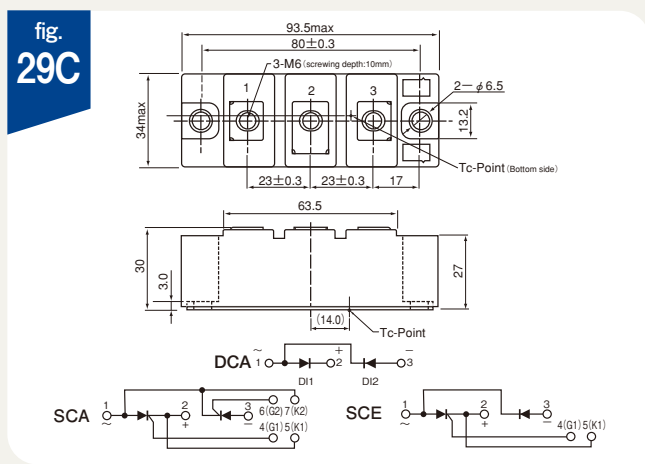


fig.
30

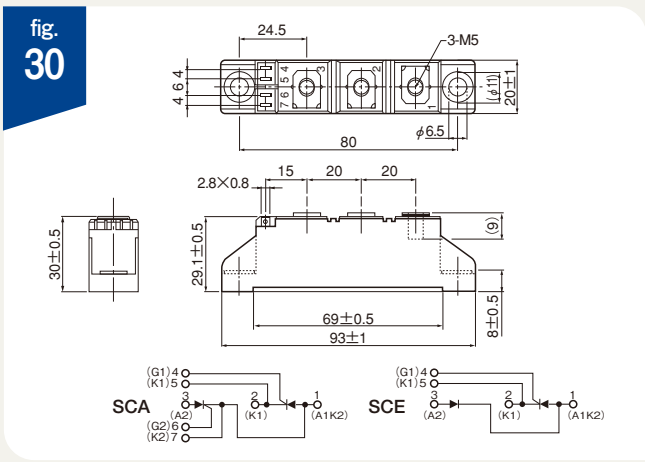


fig. 31

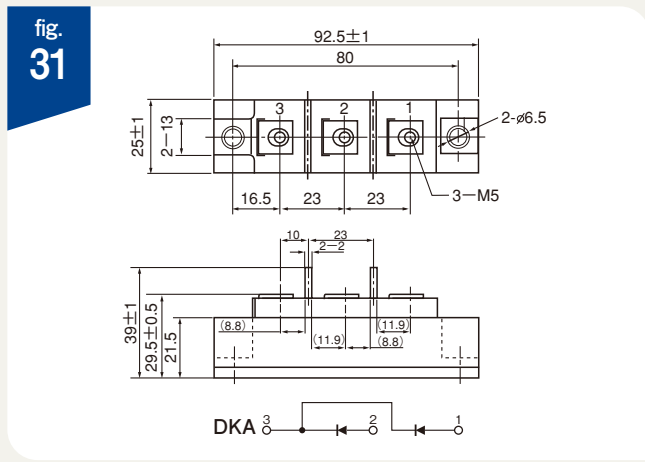


fig.
32

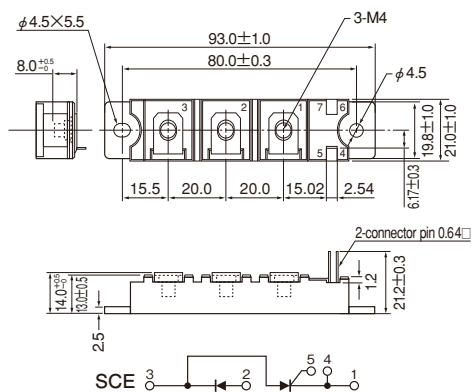


fig.
34A

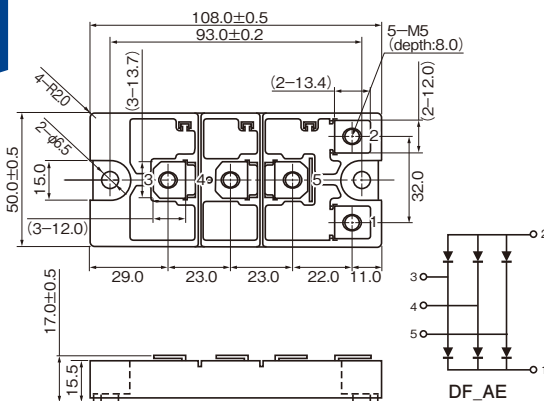


fig.
34B

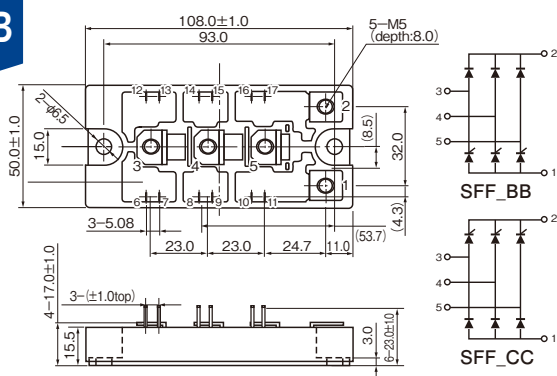


fig.
35

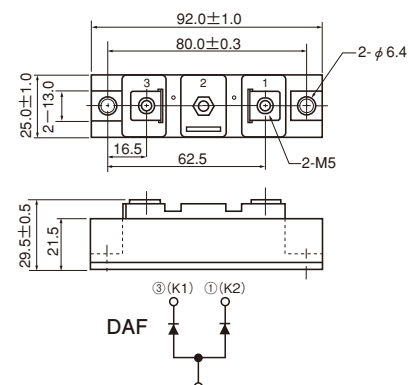


fig.
36

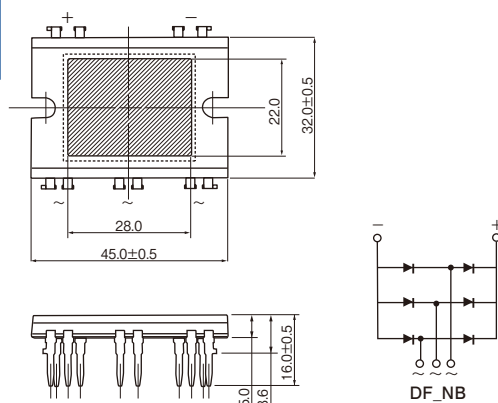


fig. 37

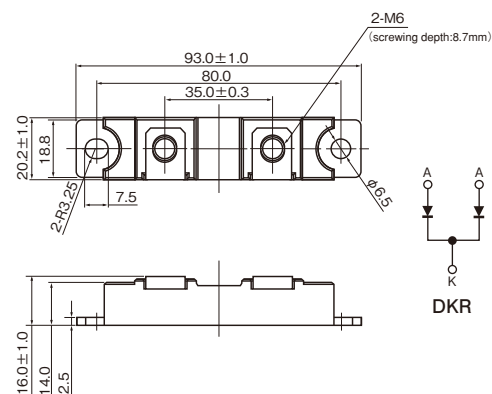


fig.
38

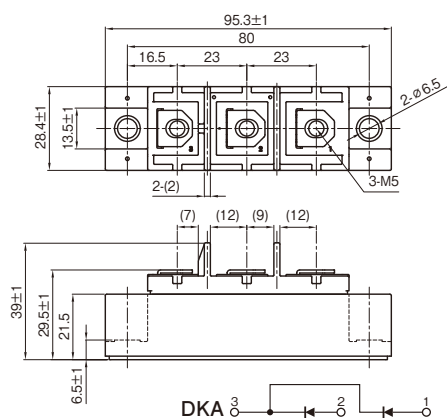
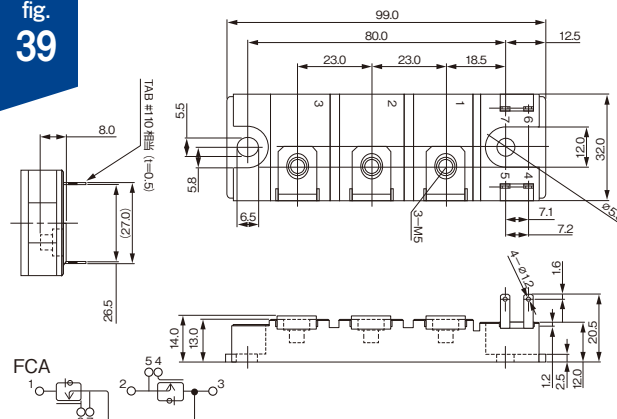


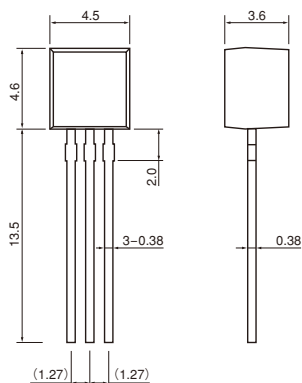
fig. 39



Please refer to specifications for details

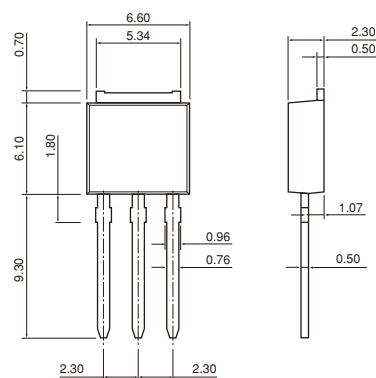
DISCRETE

fig.
D1B



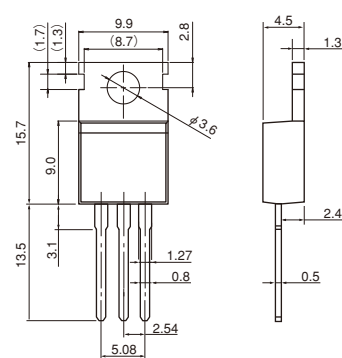
TO-92 5

fig.
D2



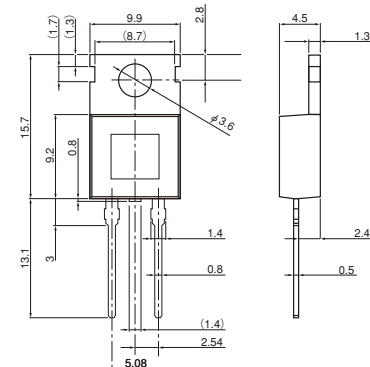
TO-251

fig.
D3



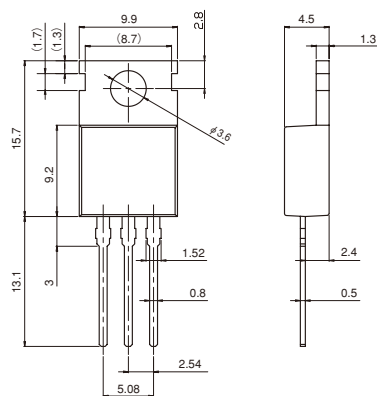
TO-220AB

fig.
D1A



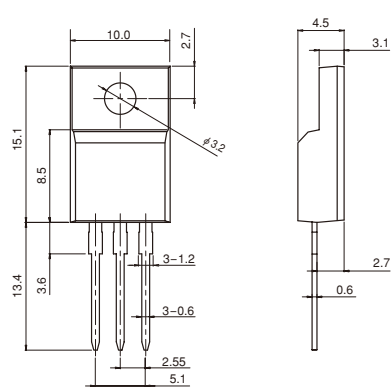
TO-220AB-2L

fig.
D5



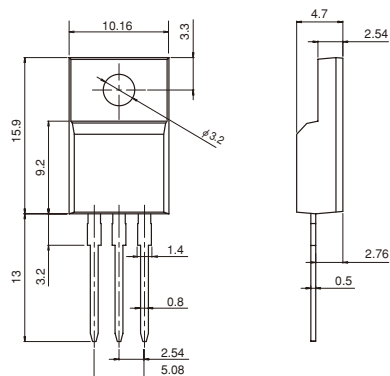
TO-220AB2

fig.
D6B



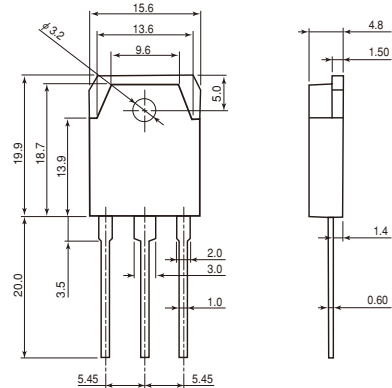
TO-220F5

fig.
D6C



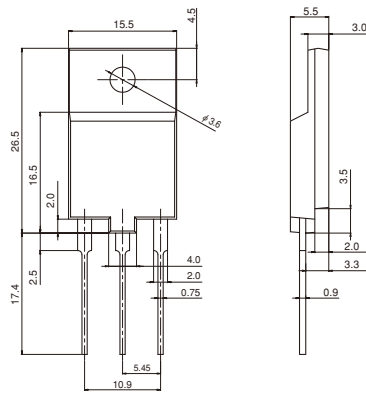
TO-220F2

fig.
D7



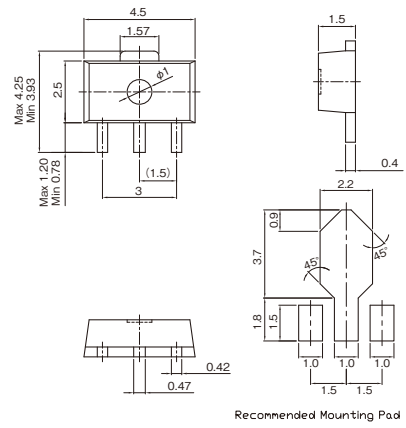
TO-3P

fig.
D8



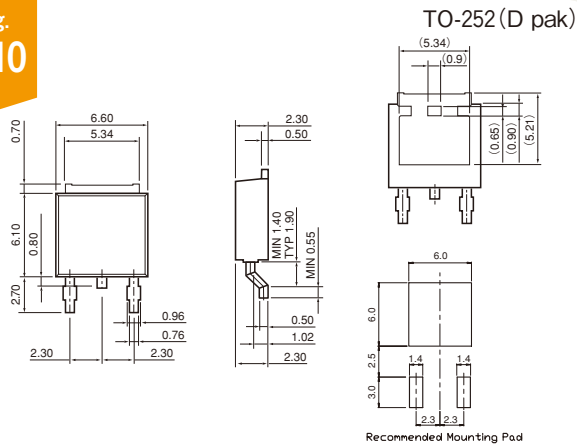
TO-3PF

fig.
D9A



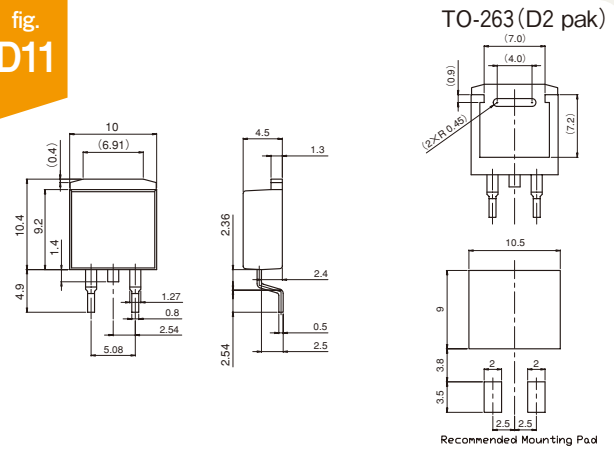
SOT 89 5

fig.
D10



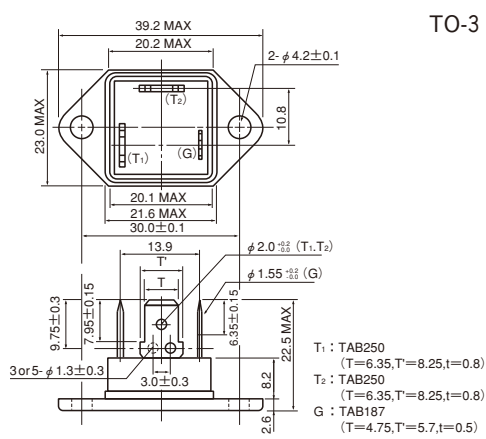
TO-252 (D pak)

fig.
D11



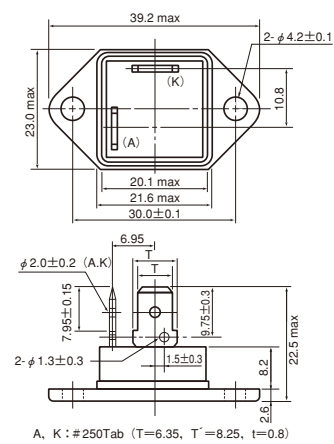
TO-263 (D2 pak)

fig.
D12



TO-3

fig.
D13



TO-3

fig.
D14

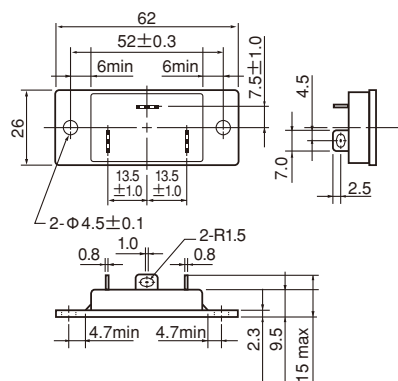
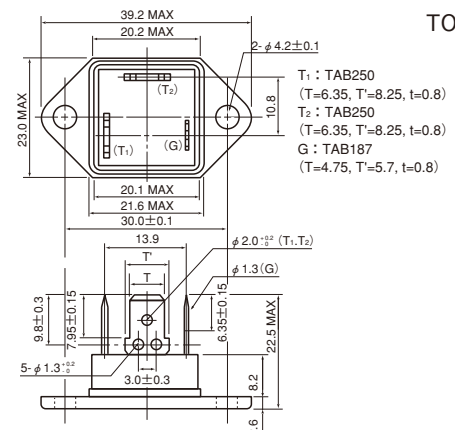
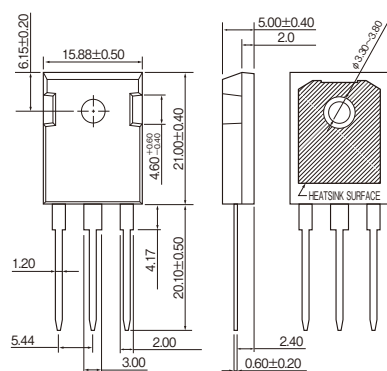


fig.
D15



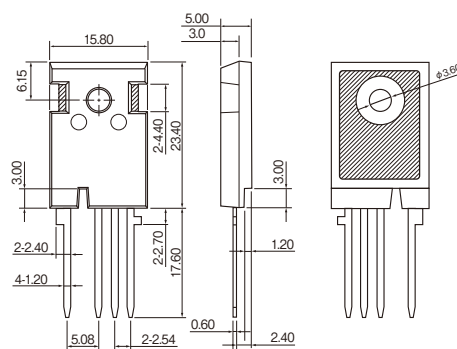
TO-3

fig.
D16



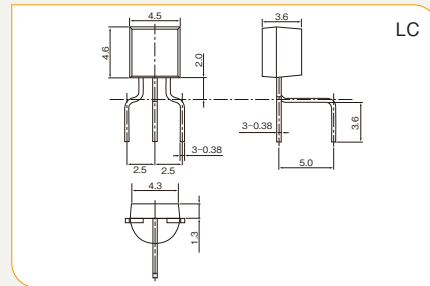
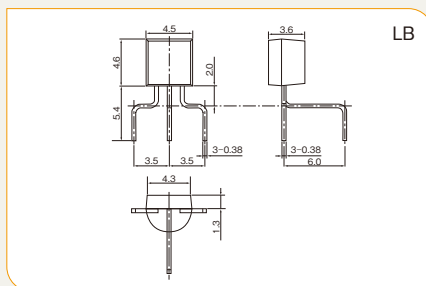
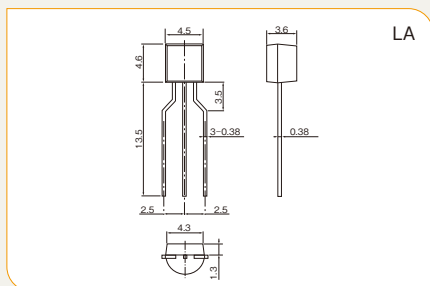
TO-247

fig.
D17

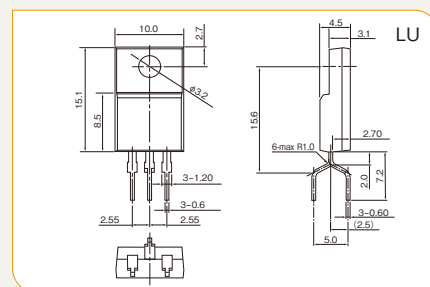
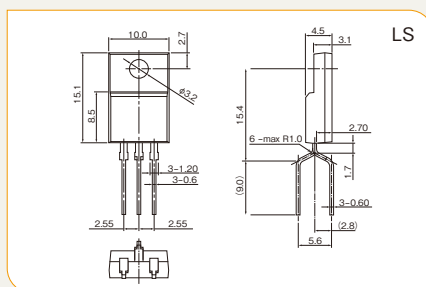
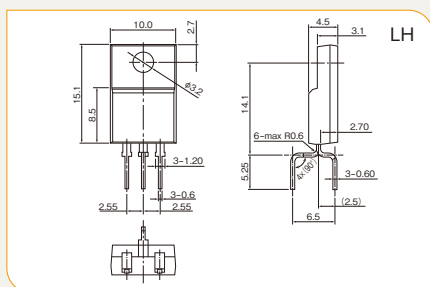
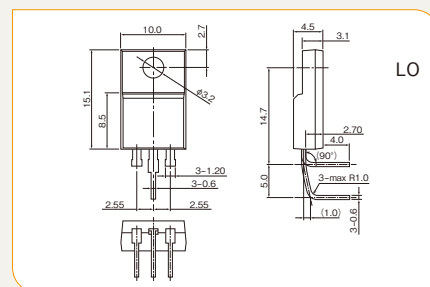
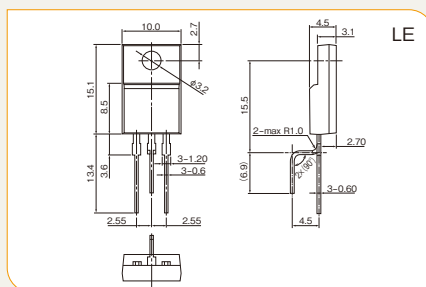
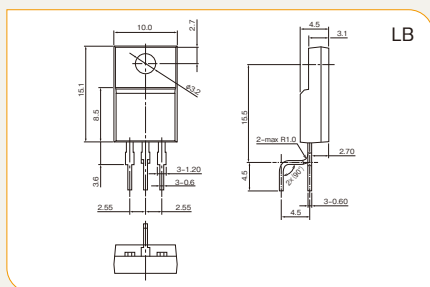


TO-247 4

● TO-92 5 LEAD FORMING



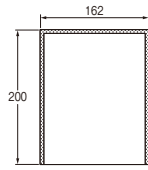
● TO-220F5 LEAD FORMING



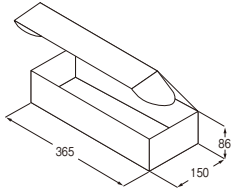
Please refer to specifications for details

PACKAGING SPECIFICATIONS Through Hole

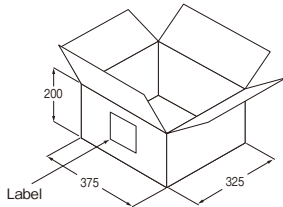
TO-92_5 (Straight Lead)



Bag (Polyethylene)
1,000 pcs per bag



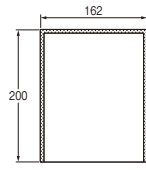
Inner box (Corrugated card board)
6 bags (6,000 pcs) per inner box



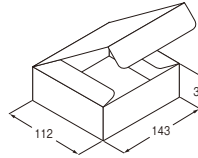
Outer box (Corrugated card board)
4 inner boxes (24,000 pcs) per outer box

Note) Type and quantity are indicated on the outer box.

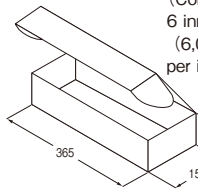
TO-92_5 (Formed Lead)



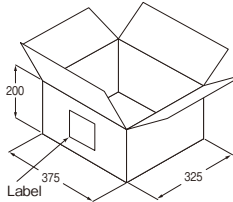
Bag (Polyethylene)
1,000 pcs per bag



Inner box 1
(Card board)
1 bag (1,000 pcs)
per inner box 1



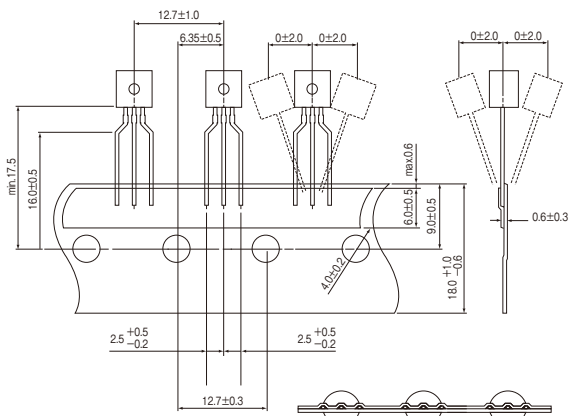
Inner box 2
(Corrugated card board)
6 inner box 1
(6,000 pcs)
per inner box 2



Outer box
(Corrugated card board)
4 inner box 2
(24,000 pcs)
per outer box

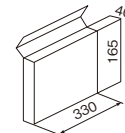
Note) Type and quantity are indicated on the outer box.

TO-92_5 (Taping)

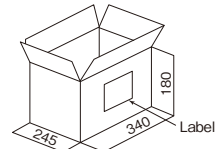


P0 : Cumulative feedhole pitch $\pm 1.0/20$ pitch

Packing box
2,000 pcs per box
(Corrugated card board)

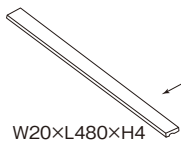


Carton box
5 packing boxes (10,000 pcs) per box
(Corrugated card board)

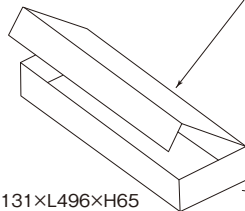


Note) Type and quantity are indicated on the carton box.

TO-251

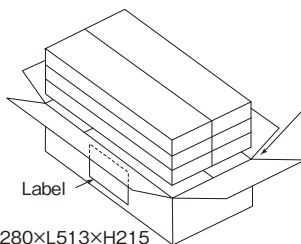
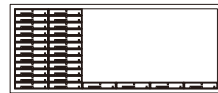


Tube (PVC plastic)
70 pcs per tube



Inner box (Corrugated card board)
72 tubes (5,040 pcs) per inner box

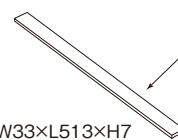
6 rows 12 levels



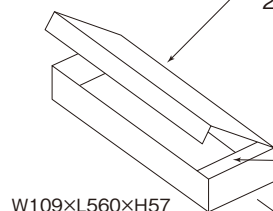
Outer box
(Corrugated card board)
6 inner boxes (30,240 pcs)
per outer box

Note) Type and Quantity are indicated on the outer box.

TO-220AB / TO-220AB-2L

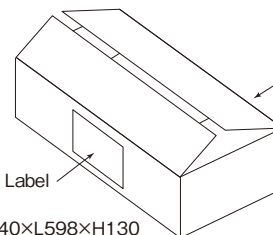
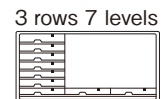


Tube (PVC plastic)
50 pcs per tube



Inner box (Corrugated card board)
20 tubes (1,000 pcs) per inner box

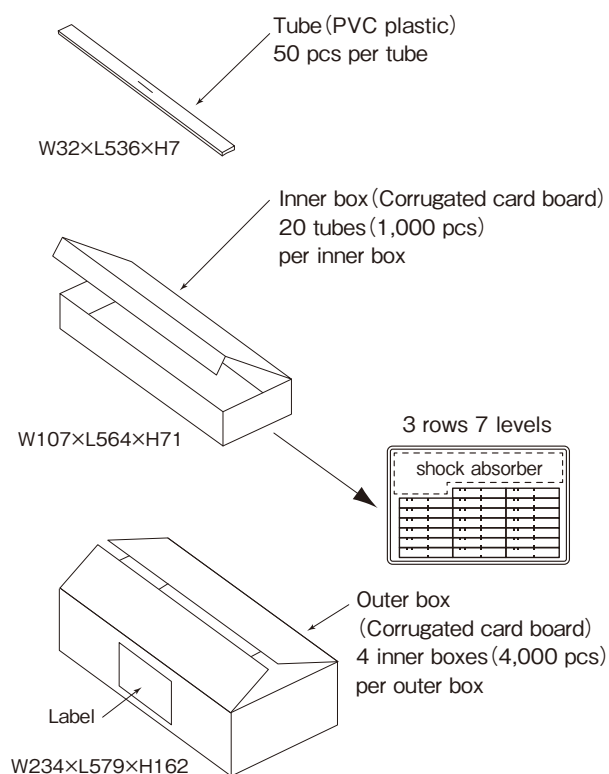
Cushioning material
(Corrugated card board)



Outer box (Corrugated card board)
4 inner boxes (4,000 pcs)
per outer box

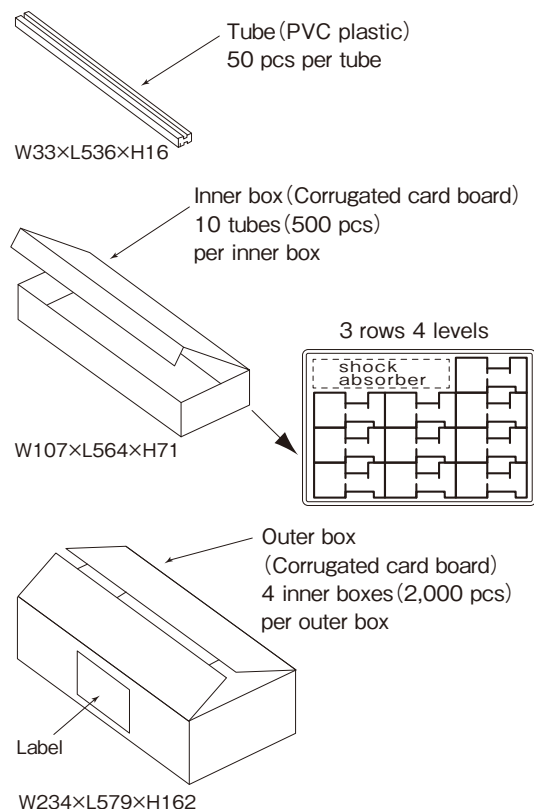
Note) Type and quantity are indicated on the outer box.

TO-220F5 (Straight Lead)



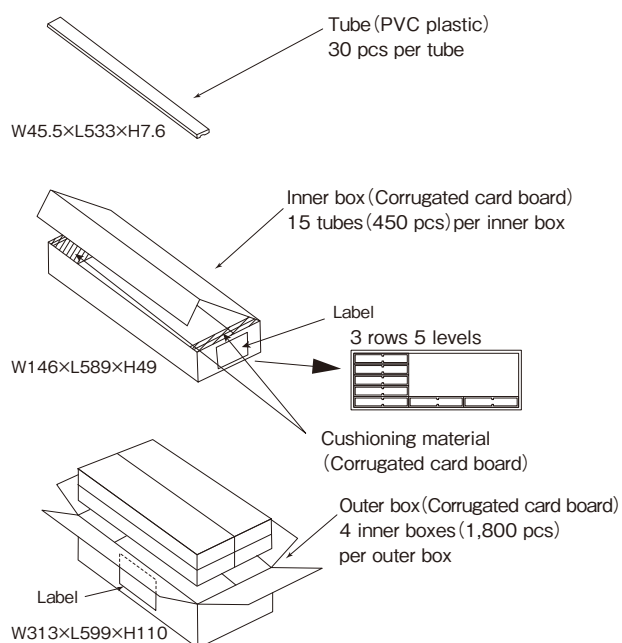
Note) Type and quantity are indicated on the outer box.

TO-220F5 (Formed Lead)



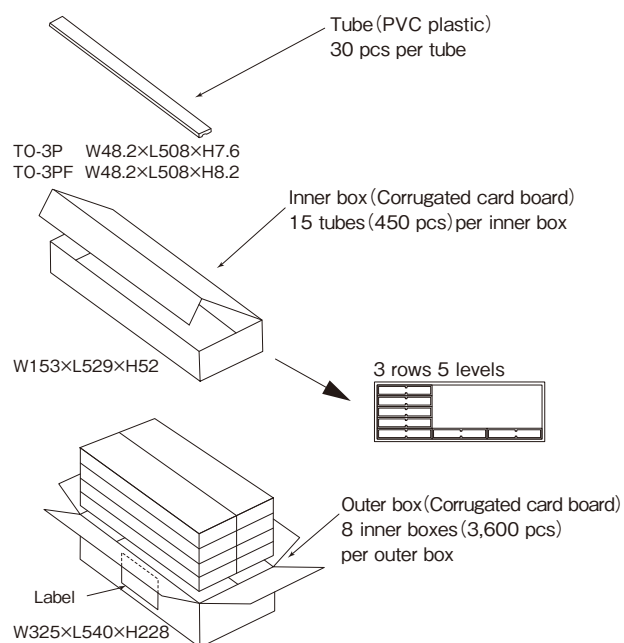
Note) Type and quantity are indicated on the outer box.

TO-247



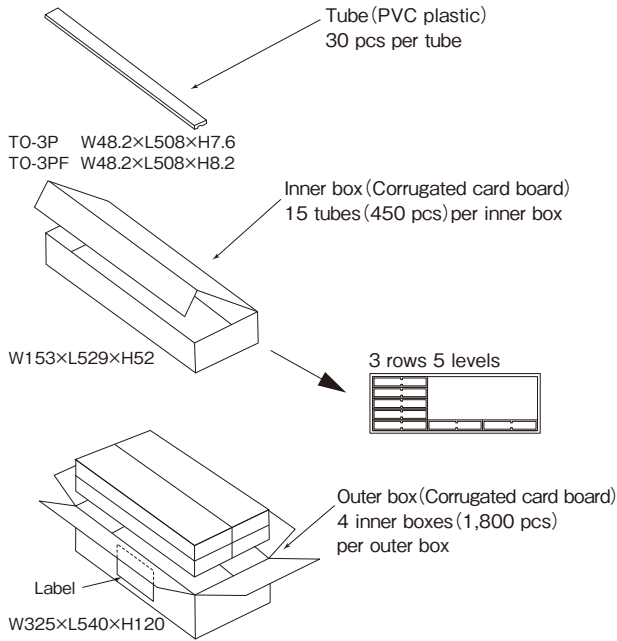
Note) Type and quantity are indicated on the outer box.

TO-247-4L



Note) Type and quantity are indicated on the outer box.

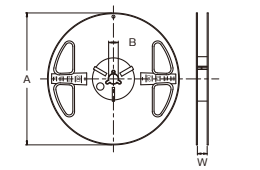
TO-3P / TO-3PF



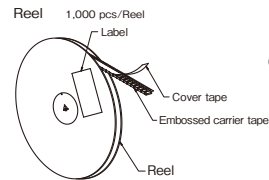
Note) Type and quantity are indicated on the outer box.

SOT-89 5

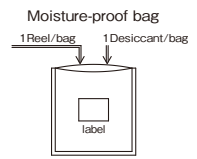
SOT-89 5 Reel outline



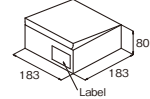
Dimensions are in millimeter			
Tape Size	A	B	W
12mm	178 $\pm$ 1.0	13.0 $\pm$ 1.2	13.2 $\pm$ 1.5



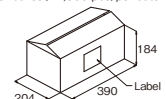
Notes Type, lot number and quantity are indicated on the reel, moisture-proof bag, inner box and outer box.



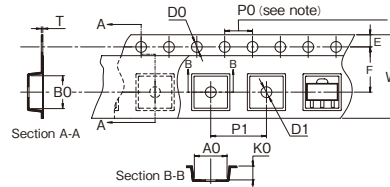
Inner box (Corrugated card board)
3 Reels (3,000 pcs) per inner box



Outer box (Corrugated card board)
4 inner boxes (12,000 pcs) per outer box



SOT-89 5 Embossed carrier tape outline

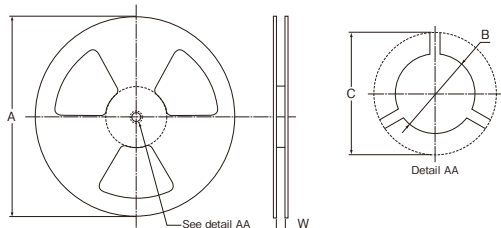


Dimensions are in millimeter												
	A0	B0	W	D0	D1	E	F	P0	P1	K0	T	
SOT-89 5 (12mm)	4.9	4.5	12.0	1.55	1.6	1.5	5.65	4.0	8.0	1.8	0.25	
	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.2	$\pm$ 0.05	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.05	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.05	

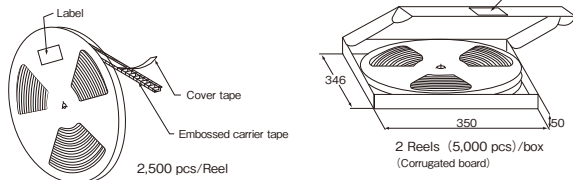
Notes 10 sprocket hole pitch cumulative tolerance $\pm$ 0.2.

TO-252

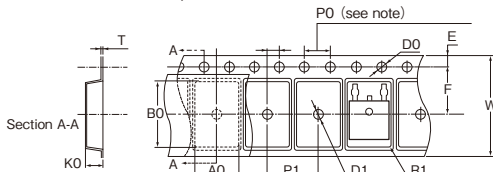
TO-252 Reel outline



Dimensions are in millimeter				
Tape Size	A	B	C	W
16mm	330	13.0 $\pm$ 0.5	20.2	16.4 $\pm$ 2.0
		$\pm$ 0.2		$\pm$ 0



TO-252 Embossed carrier tape outline

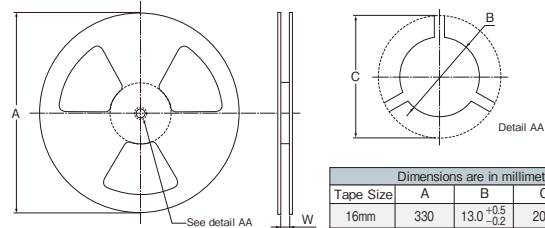


Dimensions are in millimeter												
	A0	B0	W	D0	D1	E	F	P0	P1	K0	T	
TO-252 (16mm)	7.1	10.5	16.0	1.5	1.7	1.75	7.5	4.0	8.0	2.85	0.30	
	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.3	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.10	$\pm$ 0.05	

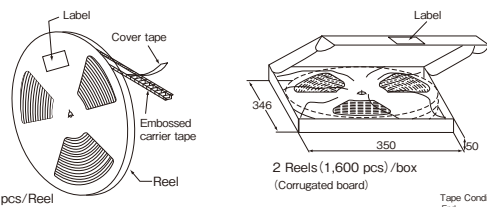
Notes 10 sprocket hole pitch cumulative tolerance $\pm$ 0.2.

TO-263

TO-263 Reel outline



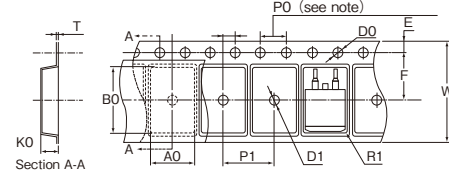
Dimensions are in millimeter			
Tape Size	A	B	W
16mm	330	13.0 $\pm$ 0.5	20.2
		$\pm$ 0.2	24.4 $\pm$ 2.0
			$\pm$ 0



800 pcs/Reel

2 Reels (1,600 pcs) /box
(Corrugated board)

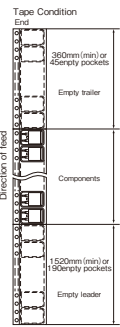
TO-263 Embossed carrier tape outline



Dimensions are in millimeter												
	A0	B0	W	D0	D1	E	F	P0	P1	K0	T	
TO-263 (24mm)	10.6	15.8	24.0	1.5	1.6	1.75	11.5	4.0	16.0	4.90	0.30	
	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.3	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.1	$\pm$ 0.10	$\pm$ 0.05	

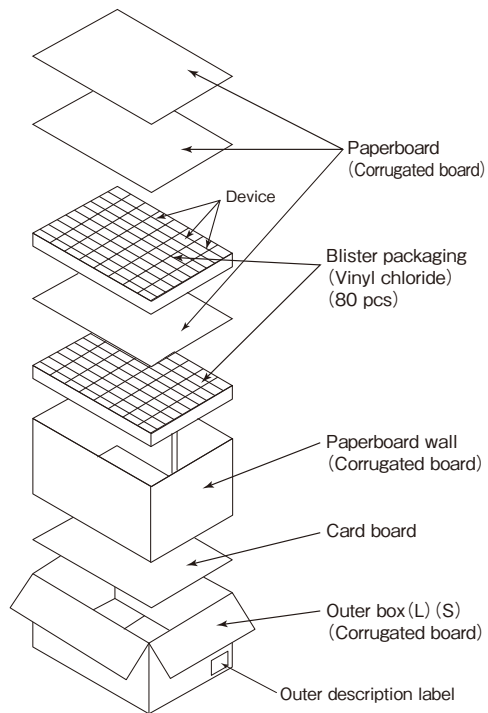
Notes

- 10 sprocket hole pitch cumulative tolerance $\pm$ 0.2.
- A0, B0 and K0 dimensions are determined with respect to EIA RS-481.
- K0 measured from the inside bottom of the pocket to the top surface of the carrier.



Tab Terminal

TO-3



- For Outer carton (L) ; Maximum 5 stacks of partition tray (400 pcs)
W395×L295×H185mm
- For Outer carton (S) ; Maximum 2 stacks of partition tray (160 pcs)
W395×L295×H105mm

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When using this product, safety measures should be taken for the equipment on which the product will be used, such as redundancy design, design for prevention of the spread of fire, design for prevention of malfunction, etc. in which safety is taken into consideration, so that no accident resulting in personal injury or death, or no damages due to fire, will occur.

- We will not be held responsible for any accidents or damages that have occurred due to use exceeding the rated values or non-observance of precautions.
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