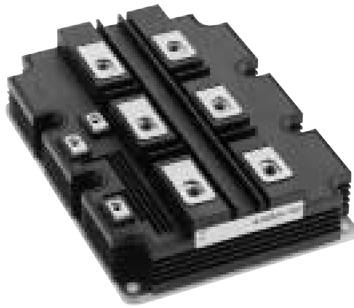
MITSUBISHI HVIGBT MODULES

CM600HG-130H

HIGH POWER SWITCHING USE
INSULATED TYPE

3rd-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

CM600HG-130H

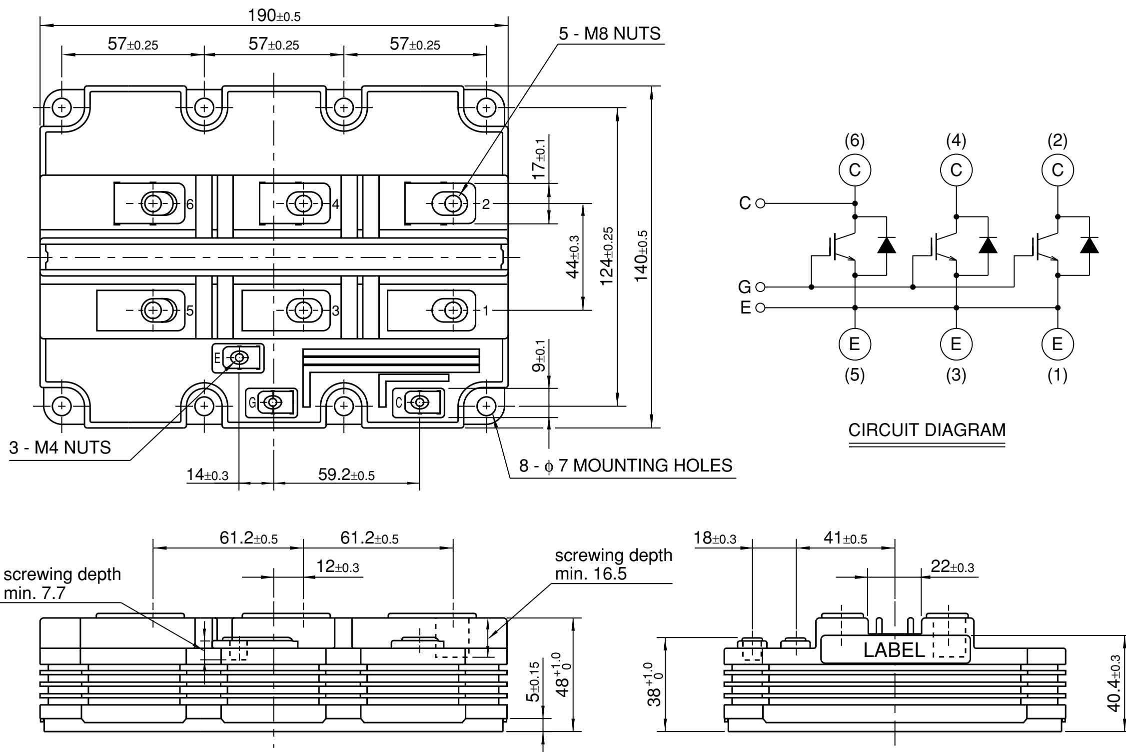


- I_C 600A
- V_{CES} 6500V
- High Insulated Type
- 1-element in a Pack
- AISiC Baseplate

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM — Dimensions in mm



MAXIMUM RATINGS

Symbol	Item	Conditions	Ratings	Unit
V_{CES}	Collector-emitter voltage	V_{GE} = 0V, T_j = –40°C	5800	V
		V_{GE} = 0V, T_j = 25°C	6300	
		V_{GE} = 0V, T_j = 125°C	6500	
V_{GES}	Gate-emitter voltage	V_{CE} = 0V, T_j = 25°C	±20	V
I_C	Collector current	T_C = 80°C	600	A
I_{CM}		Pulse (Note 1)	1200	A
I_E (Note 2)	Emitter current		600	A
I_{EM} (Note 2)		Pulse (Note 1)	1200	A
P_C (Note 3)	Maximum power dissipation	T_C = 25°C, IGBT part	8900	W
T_j	Junction temperature		–40 ~ +150	°C
T_{op}	Operating temperature		–40 ~ +125	°C
T_{stg}	Storage temperature		–40 ~ +125	°C
V_{iso}	Isolation voltage	RMS, sinusoidal, f = 60Hz, t = 1min.	10200	V
Q_{pd}	Partial discharge	V1 = 6900V_{rms}, V2 = 5100V_{rms} f = 60Hz (acc. to IEC 1287)	10	pC
t_{psc}	Maximum short circuit pulse width	V_{CC} = 4500V, V_{CES} ≤ 6500V, V_{GE} = 15V T_j = 125°C	10	µs

ELECTRICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
I_{CES}	Collector cut-off current	V_{CE} = V_{CES}, V_{GE} = 0V, T_j = 25°C	—	—	10	mA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C = 60mA, V_{CE} = 10V, T_j = 25°C	5.0	6.0	7.0	V
I_{GES}	Gate leakage current	V_{GE} = V_{GES}, V_{CE} = 0V, T_j = 25°C	—	—	0.5	µA
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_C = 600A, V_{GE} = 15V, T_j = 25°C (Note 4)	—	5.10	—	V
		I_C = 600A, V_{GE} = 15V, T_j = 125°C (Note 4)	—	5.00	—	
C_{ies}	Input capacitance	V_{CE} = 10V, f = 100kHz V_{GE} = 0V, T_j = 25°C	—	124	—	nF
C_{oes}	Output capacitance		—	7.6	—	nF
C_{res}	Reverse transfer capacitance		—	2.2	—	nF
Q_g	Total gate charge	V_{CC} = 3600V, I_C = 600A, V_{GE} = 15V, T_j = 25°C	—	9.9	—	µC
V_{EC} (Note 2)	Emitter-collector voltage	I_E = 600A, V_{GE} = 0V, T_j = 25°C (Note 4)	—	4.00	—	V
		I_E = 600A, V_{GE} = 0V, T_j = 125°C (Note 4)	—	3.60	—	
$t_{d(on)}$	Turn-on delay time	V_{CC} = 3600V, I_C = 600A, V_{GE} = ±15V $R_{G(on)}$ = 10Ω, T_j = 125°C, L_s = 150nH $t_{(IGBT_off)}$ = 60µs, Inductive load	—	1.20	—	µs
t_r	Turn-on rise time		—	0.35	—	µs
E_{on}	Turn-on switching energy		—	4.50	—	J/pulse
$t_{d(off)}$	Turn-off delay time	V_{CC} = 3600V, I_C = 600A, V_{GE} = ±15V $R_{G(off)}$ = 24Ω, T_j = 125°C, L_s = 150nH $t_{(IGBT_off)}$ = 60µs, Inductive load	—	6.60	—	µs
t_f	Turn-off fall time		—	3.30	—	µs
E_{off}	Turn-off switching energy		—	3.50	—	J/pulse
t_{rr} (Note 2)	Reverse recovery time	V_{CC} = 3600V, I_C = 600A, V_{GE} = ±15V $R_{G(on)}$ = 10Ω, T_j = 125°C, L_s = 150nH $t_{(IGBT_off)}$ = 60µs, Inductive load	—	2.40	—	µs
Q_{rr} (Note 2)	Reverse recovery charge		—	1100	—	µC
E_{rec} (Note 2)	Reverse recovery energy		—	2.00	—	J/pulse

Note 1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed T_{opmax} rating (125°C).
2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWDi).
3. Junction temperature (T_j) should not exceed T_{jmax} rating (150°C).
4. Pulse width and repetition rate should be such as to cause negligible temperature rise.

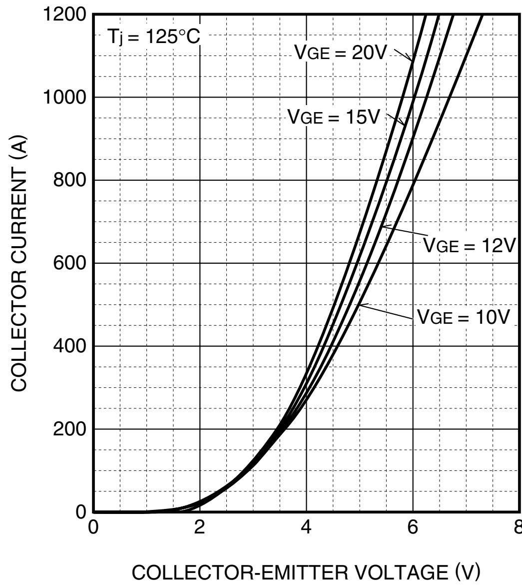
THERMAL CHARACTERISTICS

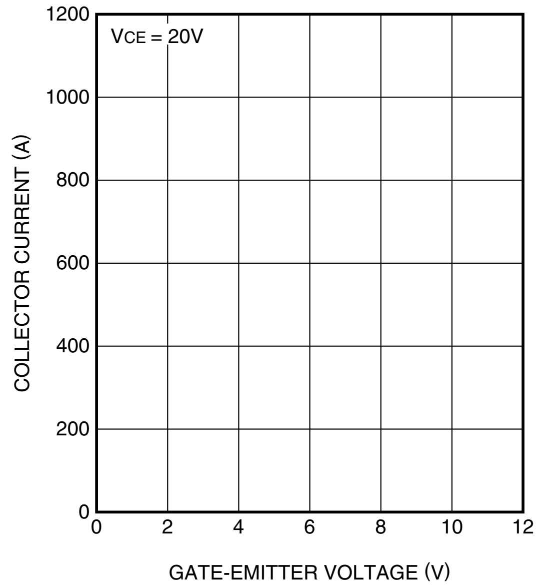
Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part	—	—	14.0	K/kW
$R_{th(j-c)R}$		Junction to Case, FWDi part	—	—	22.0	K/kW
$R_{th(c-f)}$	Contact thermal resistance	Case to Fin, λ_{grease} = 1W/m·K	—	6.0	—	K/kW

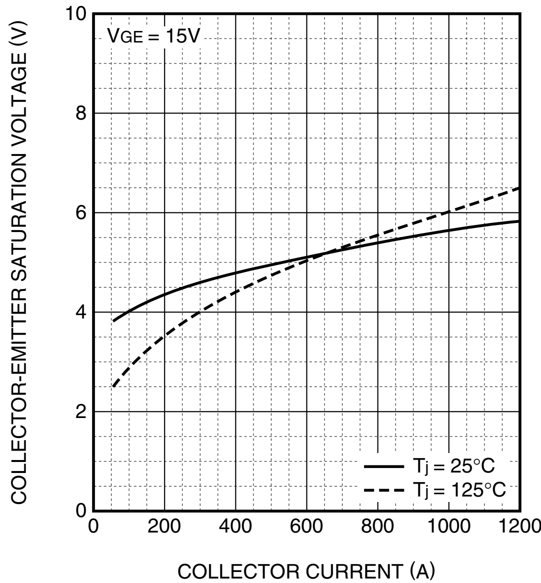
MECHANICAL CHARACTERISTICS

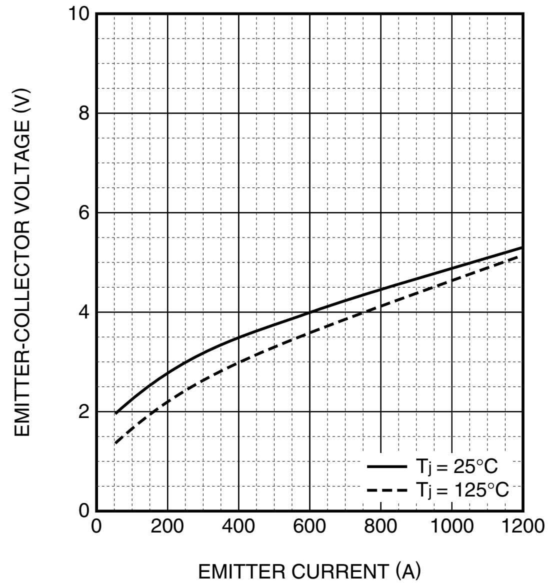
Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
M	Mounting torque	M8 : Main terminals screw	7.0	—	15.0	N·m
		M6 : Mounting screw	3.0	—	6.0	
		M4 : Auxiliary terminals screw	1.0	—	3.0	
—	Mass		—	1.35	—	kg
CTI	Comparative tracking index		600	—	—	—
d_a	Clearance distance in air		26.0	—	—	mm
d_s	Creepage distance along surface		56.0	—	—	mm
$L_{C-E(int)}$	Internal inductance	IGBT part	—	18	—	nH
$R_{C-E(int)}$	Internal lead resistance	T_C = 25°C	—	0.18	—	mΩ

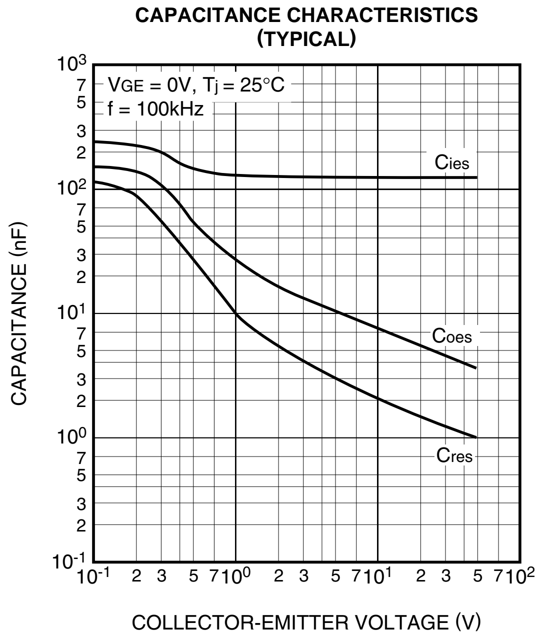
PERFORMANCE CURVES

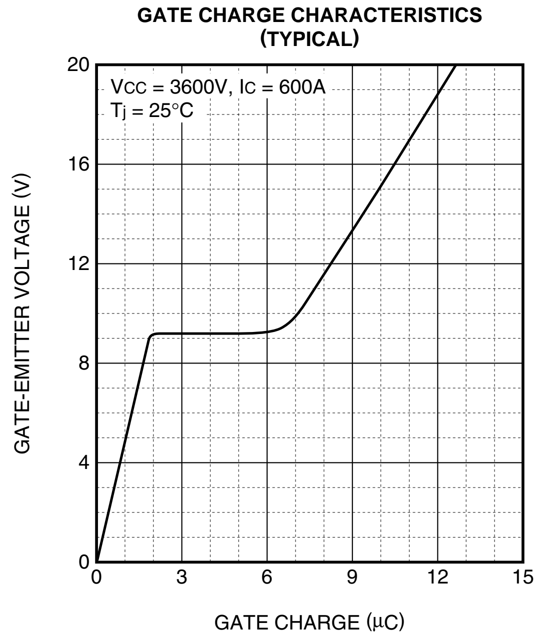


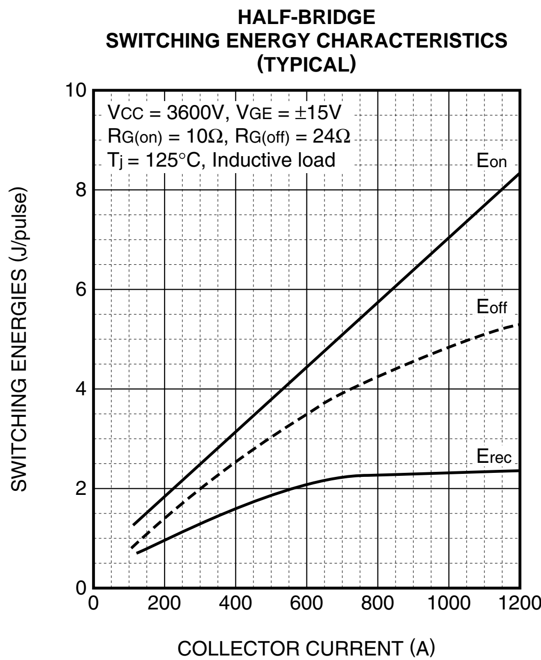


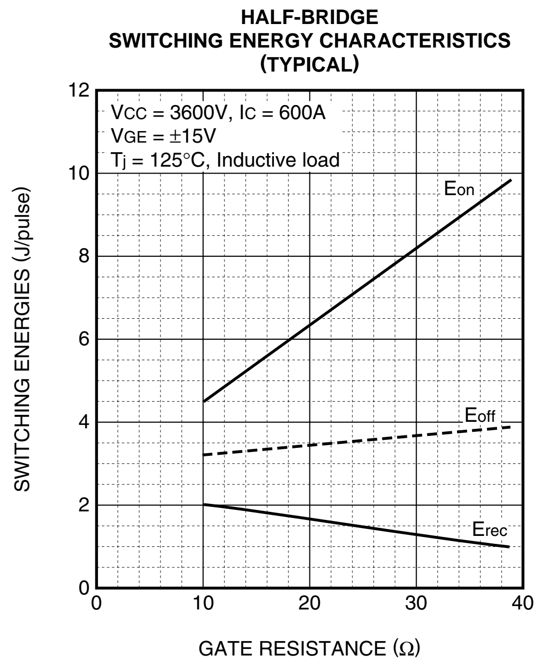


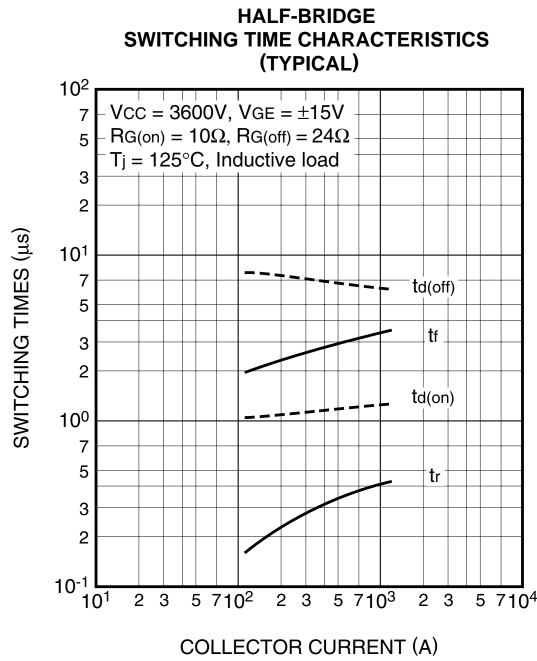


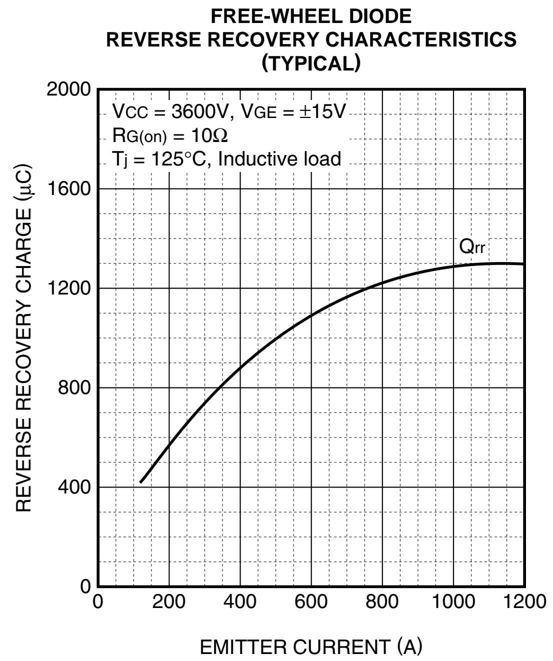

CAPACITANCE CHARACTERISTICS
(TYPICAL)
VGE = 0V, Tj = 25°C
f = 100kHz
Cies
Coes
Cres
CAPACITANCE (nF)
COLLECTOR-EMITTER VOLTAGE (V)

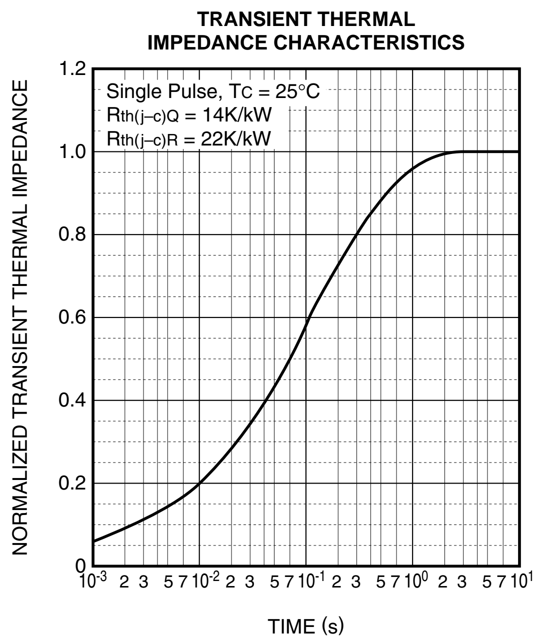

GATE CHARGE CHARACTERISTICS
(TYPICAL)
VCC = 3600V, IC = 600A
Tj = 25°C
GATE-EMITTER VOLTAGE (V)
GATE CHARGE (μC)


HALF-BRIDGE
SWITCHING ENERGY CHARACTERISTICS
(TYPICAL)
VCC = 3600V, VGE = ±15V
RG(on) = 10Ω, RG(off) = 24Ω
Tj = 125°C, Inductive load
Eon
Eoff
Erec
SWITCHING ENERGIES (J/pulse)
COLLECTOR CURRENT (A)

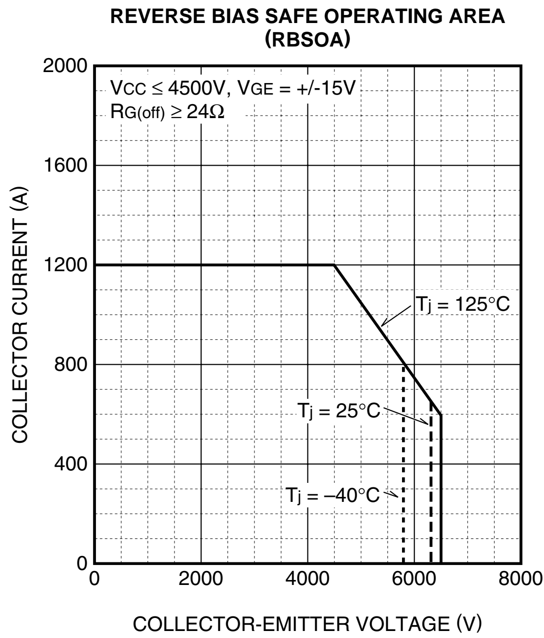

HALF-BRIDGE
SWITCHING ENERGY CHARACTERISTICS
(TYPICAL)
VCC = 3600V, IC = 600A
VGE = ±15V
Tj = 125°C, Inductive load
Eon
Eoff
Erec
SWITCHING ENERGIES (J/pulse)
GATE RESISTANCE (Ω)


HALF-BRIDGE
SWITCHING TIME CHARACTERISTICS
(TYPICAL)
VCC = 3600V, VGE = ±15V
RG(on) = 10Ω, RG(off) = 24Ω
Tj = 125°C, Inductive load
td(off)
tf
td(on)
tr
SWITCHING TIMES (μs)
COLLECTOR CURRENT (A)


FREE-WHEEL DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)
VCC = 3600V, VGE = ±15V
RG(on) = 10Ω
Tj = 125°C, Inductive load
Qrr
REVERSE RECOVERY CHARGE (μC)
EMITTER CURRENT (A)


TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS
Single Pulse, TC = 25°C
Rth(j–c)Q = 14K/kW
Rth(j–c)R = 22K/kW
NORMALIZED TRANSIENT THERMAL IMPEDANCE
TIME (s)

REVERSE BIAS SAFE OPERATING AREA (RBSOA)



FREE-WHEEL DIODE REVERSE RECOVERY SAFE OPERATING AREA (RRSOA)