MBL1600E17F

Silicon N-channel IGBT 1700V F version

FEATURES

* Soft switching behavior & low conduction loss:
  Soft low-injection punch-through with trench gate IGBT.
* Low driving power:
  Low input capacitance with advanced trench gate.
* Low noise recovery: Ultra soft fast recovery diode.

ABSOLUTE MAXIMUM RATINGS (T_C=25ºC)

Item		Symbol	Unit	MBL1600E17F
Collector Emitter Voltage		V_{CES}	V	1,700
Gate Emitter Voltage		V_{GES}	V	±20
Collector Current	DC	I_C	A	1,600
	1ms	I_{CRM}		3,200
Forward Current (Free wheel Diode)	DC	$I_{F(FWD)}$	A	1,200
	1ms	$I_{FRM(FWD)}$		2,400
Forward Current (Chopper Diode)	DC	$I_{F(chopper)}$	A	1,200
	1ms	$I_{FRM(chopper)}$		2,400
Operating Junction Temperature		$T_{vj\ op}$	ºC	-50 ~ +150
Maximum Junction Temperature (3)		$T_{vj\ max}$	ºC	175
Storage Temperature		T_{stg}	ºC	-55 ~ +125
Isolation Voltage		V_{ISO}	V_{RMS}	4,000(AC 1 minute)
Screw Torque	Terminals (M4/M8)	-	N·m	2/15 (1)
	Mounting (M6)	-		6 (2)

Notes: (1) Recommended Value 1.8±0.2/15$^{+0}_{-3}$N·m (2) Recommended Value 5.5±0.5N·m
(3) Regarding the definition of Tvj max for each operation mode, please refer to LD-ES-130737.

ELECTRICAL CHARACTERISTICS

1) IGBT+FWD

Item		Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Collector Emitter Cut-Off Current		I_{CES}	mA	-	-	5	V_{CE}=1,700V, V_{GE}=0V, T_{vj}=25ºC
				-	20	80	V_{CE}=1,700V, V_{GE}=0V, T_{vj}=150ºC
Gate Emitter Leakage Current		I_{GES}	nA	-500	-	+500	V_{GE}=±20V, V_{CE}=0V, T_{vj}=25ºC
Collector Emitter Saturation Voltage		V_{CEsat}	V	-	2.0	-	I_C=1,600A, V_{GE}=15V, T_{vj}=25ºC
				2.0	2.4	2.8	I_C=1,600A, V_{GE}=15V, T_{vj}=150ºC
Gate Emitter Threshold Voltage		$V_{GE(th)}$	V	4.1	5.5	7.1	V_{CE}=10V, I_C=160mA, T_{vj}=25ºC
Input Capacitance		C_{ies}	nF	-	87	-	V_{CE}=10V, V_{GE}=0V, f=100kHz, T_{vj}=25ºC
Internal Gate Resistance		$R_{G(int)}$	Ω	-	2.3	-	V_{CE}=10V, V_{GE}=0V, f=100kHz, T_{vj}=25ºC
Turn On Delay Time		$t_{d(on)}$	μs	-	0.6	1.2	V_{CC}=900V, I_C=1,600A L_S=120nH R_G(on/off)=3.9/3.9Ω (4) V_{GE}=±15V, T_{vj}=150ºC
Rise Time		t_r		-	0.4	0.8	
Turn Off Delay Time		$t_{d(off)}$		-	1.8	3.6	
Fall Time		t_f		-	1.4	2.8	
Turn On Loss		E_{on}	J/P	-	0.5	-	
Turn Off Loss		E_{off}	J/P	-	1.4	-	
Forward Voltage Drop		V_F	V	-	2.0	-	I_F=1,200A, V_{GE}=0V, T_{vj}=25ºC Measured at auxiliary terminals
				-	2.3	-	I_F=1,200A, V_{GE}=0V, T_{vj}=150ºC Measured at auxiliary terminals
Thermal Impedance	IGBT	$R_{th(j-c)}$	K/W	-	-	0.015	Junction to case
	FWD	$R_{th(j-c)}$		-		0.033	
Contact Thermal Impedance		$R_{th(c-f)}$	K/W	-	0.008	-	Case to fin (λgrease=1W/(m·K), heat-sink flatness ≤50um)

MBL1600E17F

2) Chopper Diode

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Repetitive Reverse Current	I_{RRM}	mA	-	-	2.5	V_R=1,700V, T_{vj}=25°C
			-	10	40	V_R=1,700V, T_{vj}=150°C
Forward Voltage Drop (Between main terminals)	V_F	V	-	2.1	-	I_F=1,200A, T_{vj}=25°C Measured at main terminals
			-	2.4	-	I_F=1,200A, T_{vj}=150°C Measured at main terminals
Reverse Recovery Time	t_{rr}	μs	-	0.6	-	V_{CC}=900V, I_F=1,200A
Reverse Recovery Loss	E_{rr}	J/P	-	0.5	-	L_S=120nH, R_G(on)=3.9Ω (4) V_{GE}=±15V, T_{vj}=150°C
Thermal Impedance	$R_{th(j-c)}$	K/W	-	-	0.033	Junction to case
Contact Thermal Impedance	$R_{th(c-f)}$	K/W	-	0.016	-	Case to fin (at Chopper Diode part)

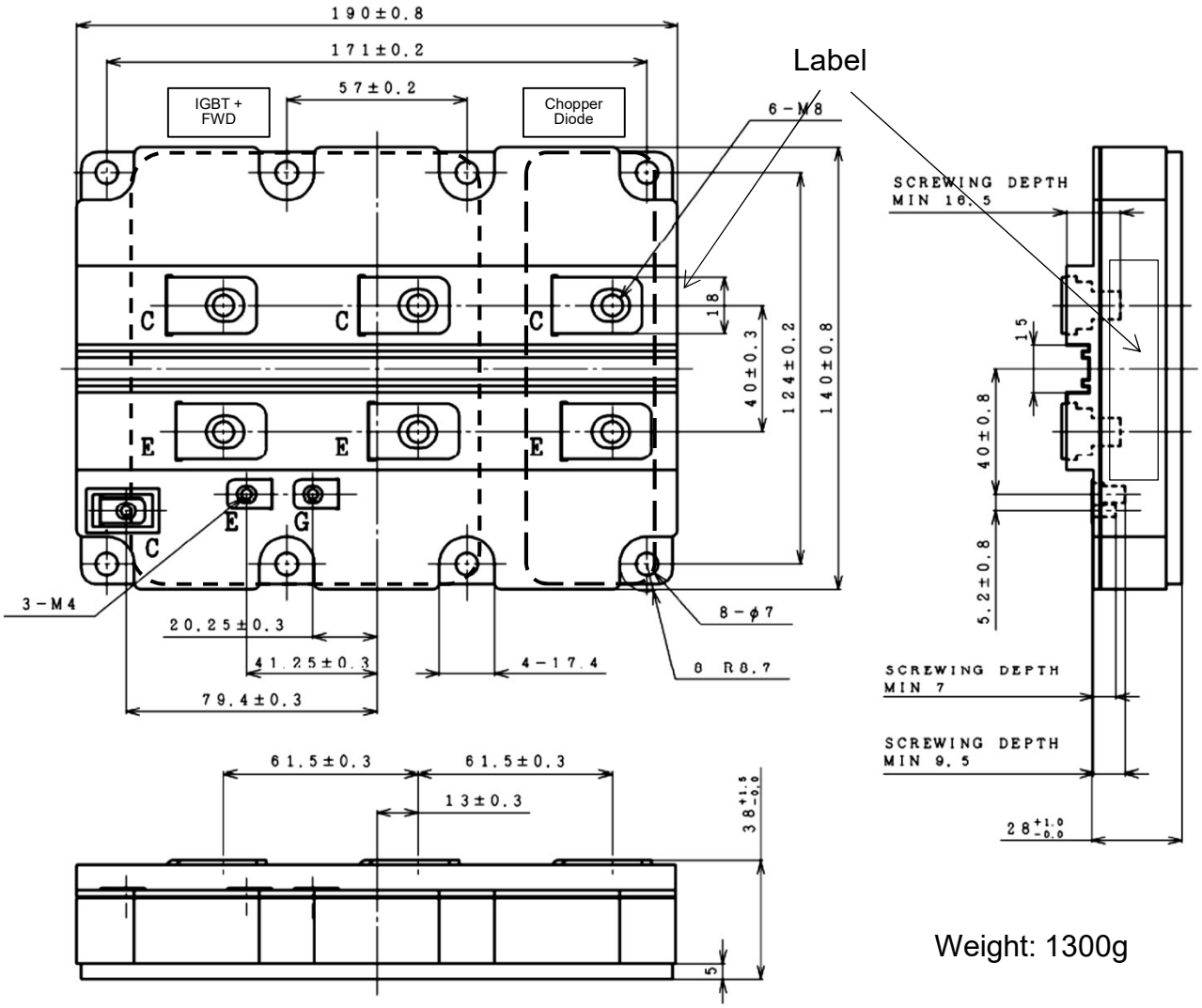
Notes: (4) Ls and R_G are the test condition's values for evaluation of the switching times, not recommended value. Please, determine the suitable R_G value after the measurement of switching waveforms (overshoot voltage, etc.) with appliance mounted.

* Please contact our representatives at order.
* For improvement, specifications are subject to change without notice.
* For actual application, please confirm this spec sheet is the newest revision.
* ELECTRICAL CHARACTERISTIC items shown in above table are according to IEC 60747–2 and IEC 60747–9.

MBL1600E17F

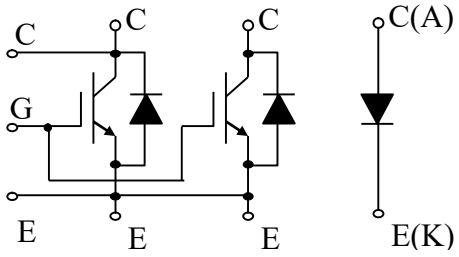
OUTLINE DRAWING

Unit in mm



Weight: 1300g

CIRCUIT DIAGRAM



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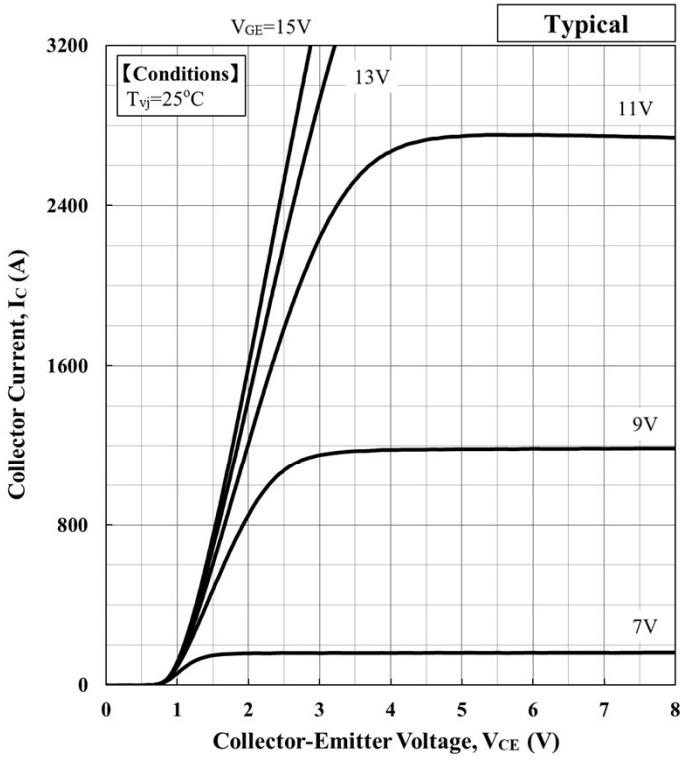
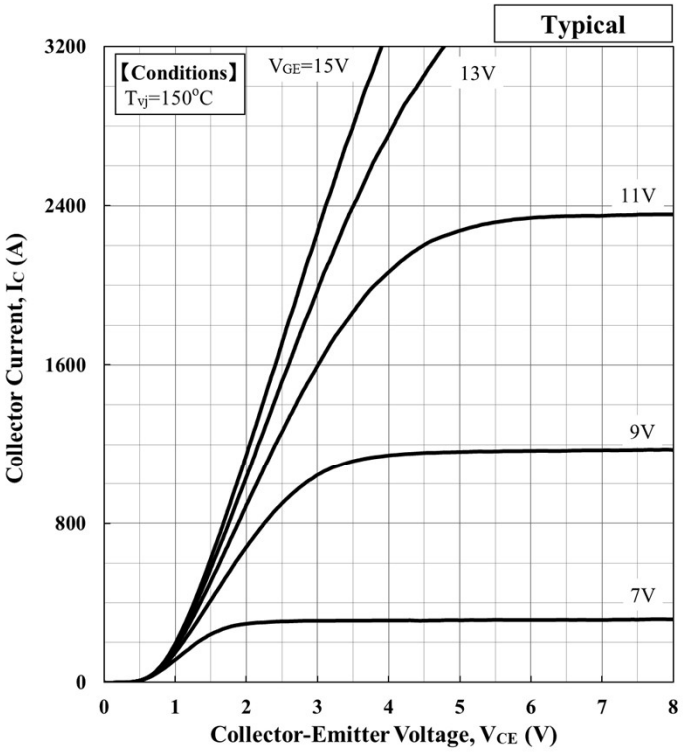


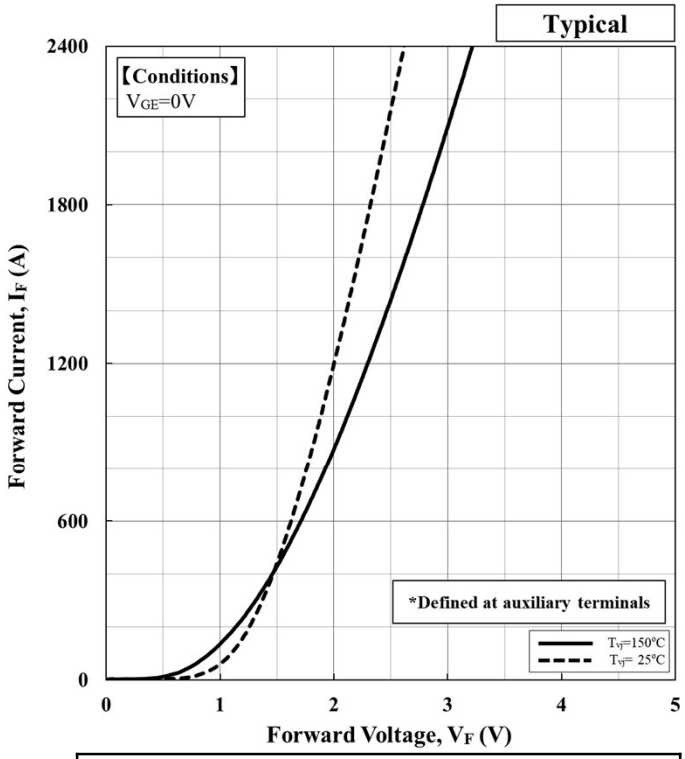
$V_{CE}(sat)[V] = a_3 \cdot \lvert I_c \rvert^3 + a_2 \cdot \lvert I_c \rvert^2 + a_1 \cdot \lvert I_c \rvert + a_0$					
Temp.[°C]	V_{GE}[V]	a_3	a_2	a_1	a_0
25	15	2.10.E-11	-1.40.E-07	8.38.E-04	9.41.E-01

Collector Current vs. Collector Emitter Voltage



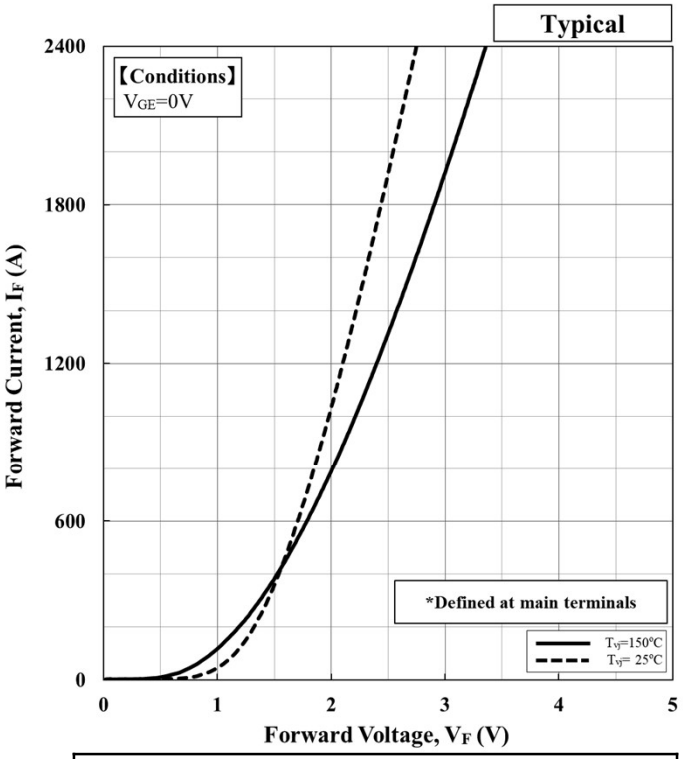
$V_{CE}(sat)[V] = a_3 \cdot \lvert I_c \rvert^3 + a_2 \cdot \lvert I_c \rvert^2 + a_1 \cdot \lvert I_c \rvert + a_0$					
Temp.[°C]	V_{GE}[V]	a_3	a_2	a_1	a_0
150	15	4.11.E-11	-2.26.E-07	1.28.E-03	7.65.E-01

Collector Current vs. Collector Emitter Voltage



$V_F[V] = a_3 \cdot \lvert I_F \rvert^3 + a_2 \cdot \lvert I_F \rvert^2 + a_1 \cdot \lvert I_F \rvert + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	6.88.E-11	-3.70.E-07	1.15.E-03	1.04.E+00
150	1.03.E-10	-5.77.E-07	1.80.E-03	8.06.E-01

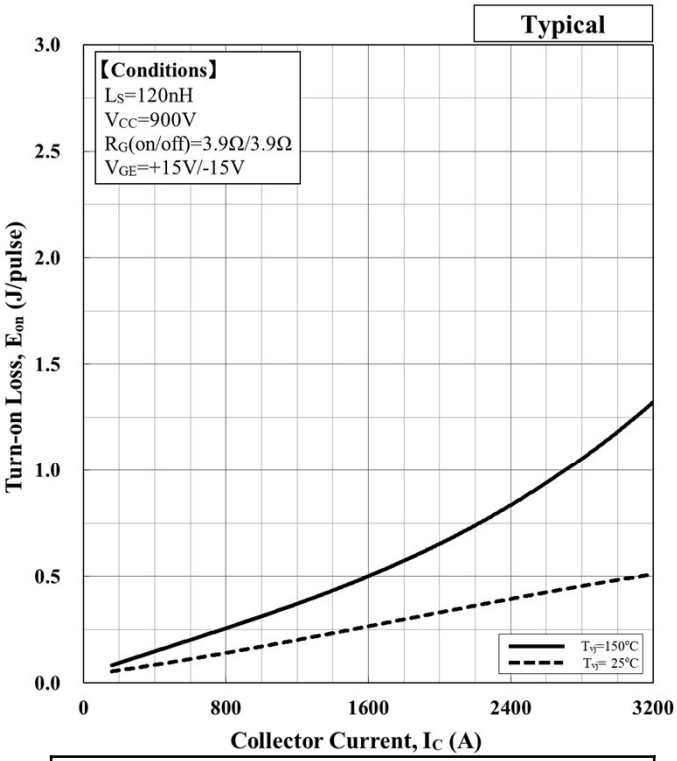
Forward Voltage of free-wheeling diode



$V_F[V] = a_3 \cdot \lvert I_F \rvert^3 + a_2 \cdot \lvert I_F \rvert^2 + a_1 \cdot \lvert I_F \rvert + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	7.22.E-11	-3.88.E-07	1.21.E-03	1.10.E+00
150	1.08.E-10	-6.02.E-07	1.87.E-03	8.41.E-01

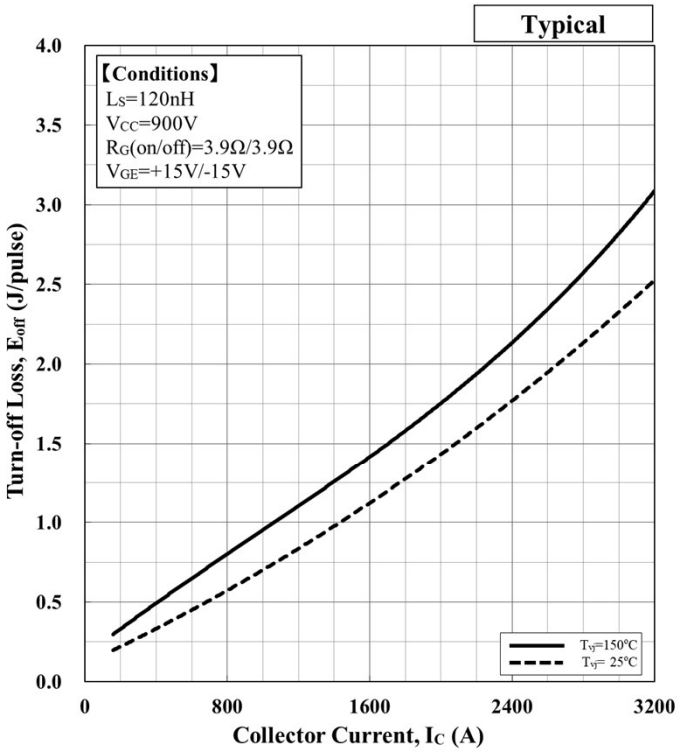
Forward Voltage of Chopper diode

MBL1600E17F



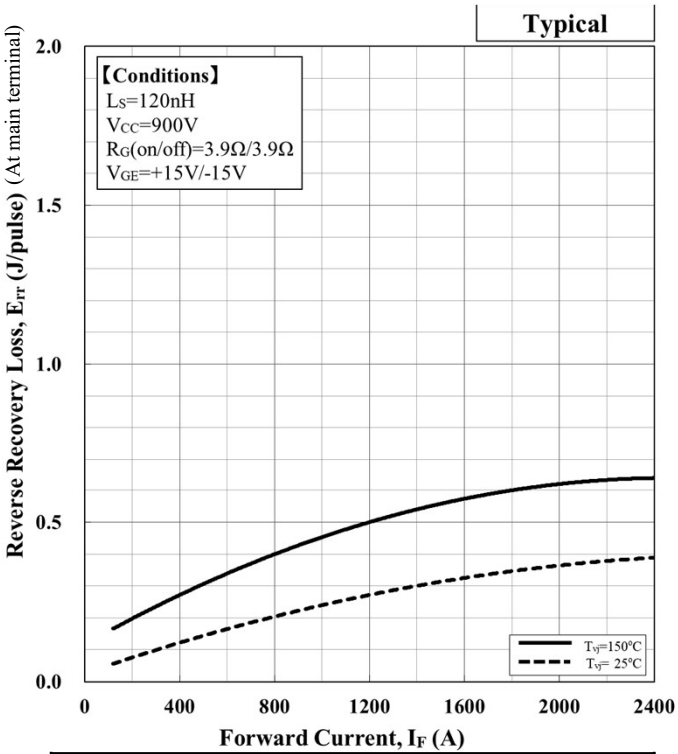
$E\,[J] = a_3 \cdot \lvert I_c \rvert^3 + a_2 \cdot \lvert I_c \rvert^2 + a_1 \cdot \lvert I_c \rvert + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	-5.40E-12	2.86E-08	1.12E-04	3.64E-02
150	2.10E-11	-3.07E-08	2.85E-04	3.82E-02

Turn-on loss vs. Collector current



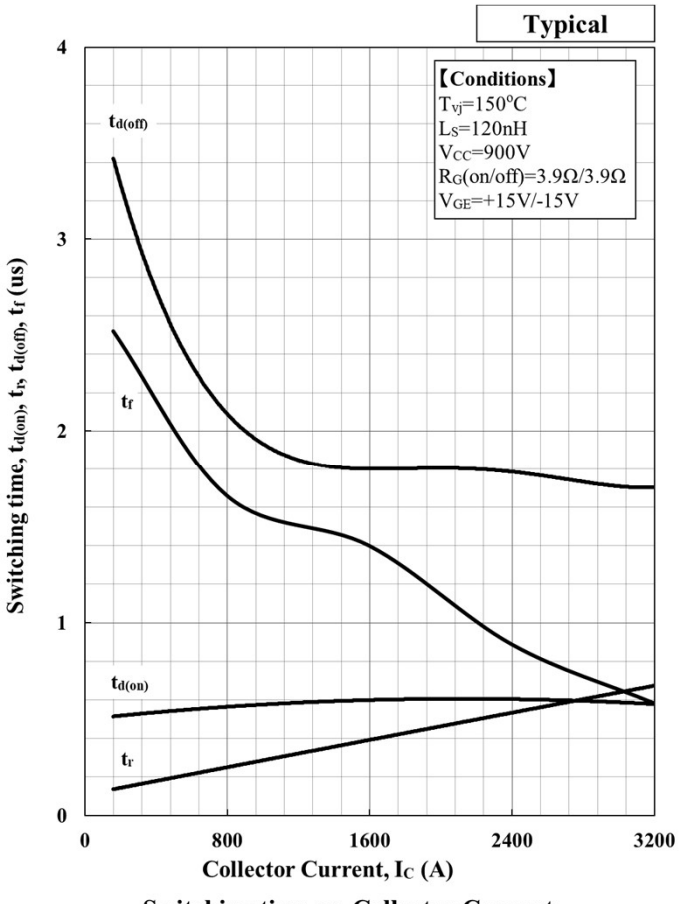
$E\,[J] = a_3 \cdot \lvert I_c \rvert^3 + a_2 \cdot \lvert I_c \rvert^2 + a_1 \cdot \lvert I_c \rvert + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	3.08E-12	6.24E-08	5.23E-04	1.14E-01
150	4.17E-11	-1.19E-07	8.67E-04	1.63E-01

Turn-off loss vs. Collector current



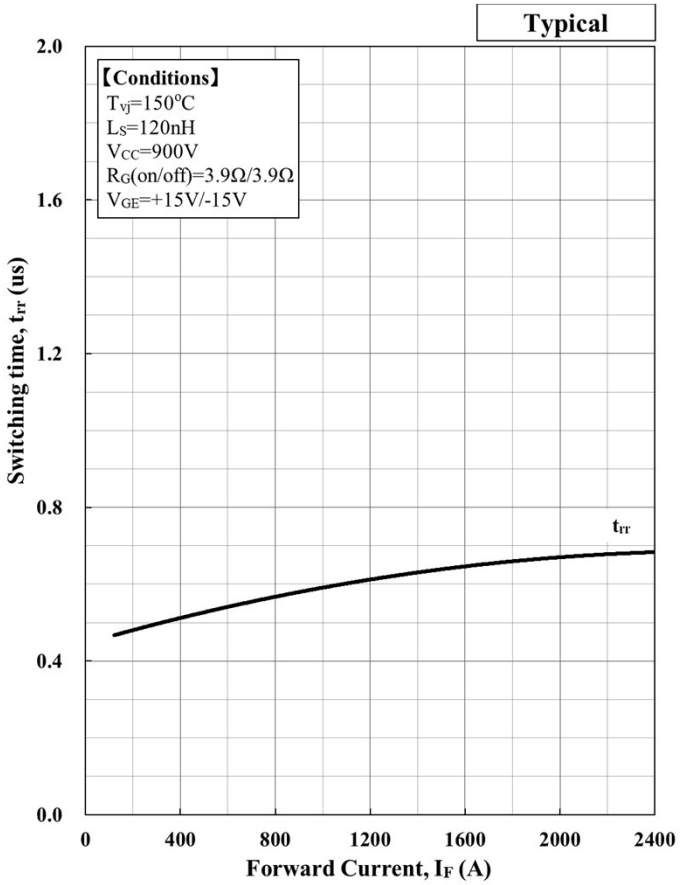
$E\,[J] = a_3 \cdot \lvert I_F \rvert^3 + a_2 \cdot \lvert I_F \rvert^2 + a_1 \cdot \lvert I_F \rvert + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	-	-4.50E-08	2.59E-04	2.57E-02
150	-	-8.51E-08	4.22E-04	1.17E-01

Recovery loss vs. Forward current of Chopper Diode



Switching time vs. Collector Current

MBL1600E17F



Switching time vs. Forward current of Chopper diode

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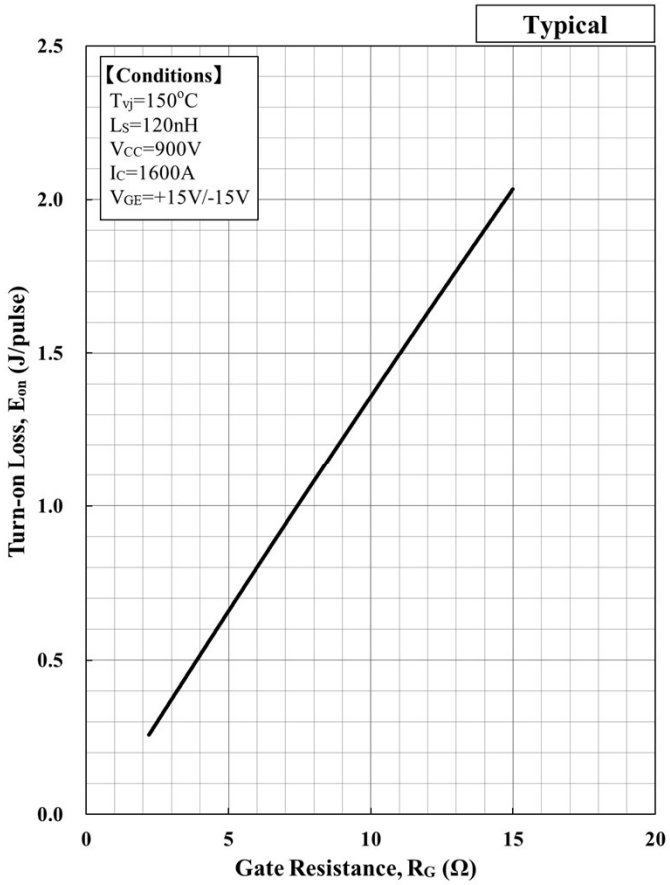
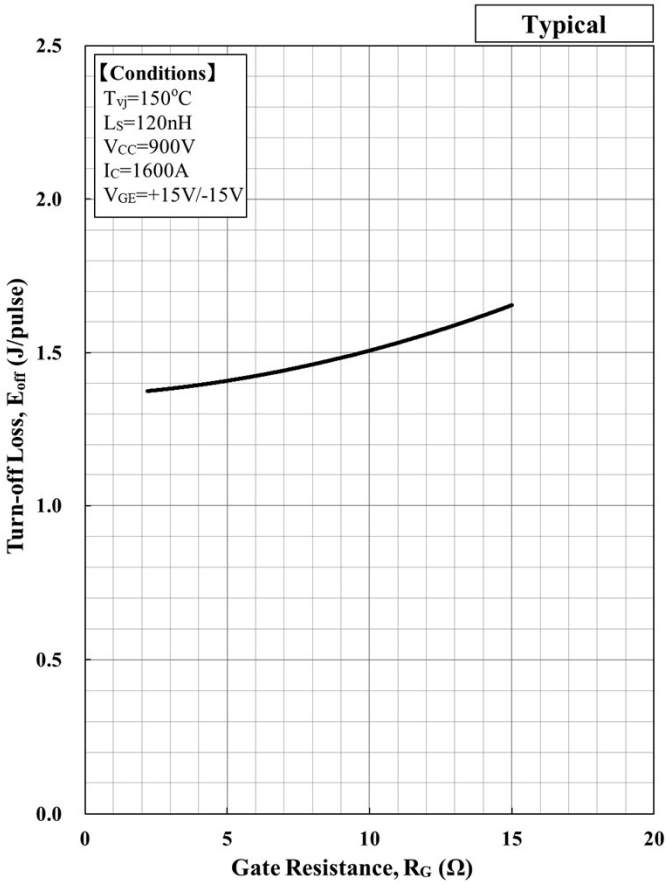
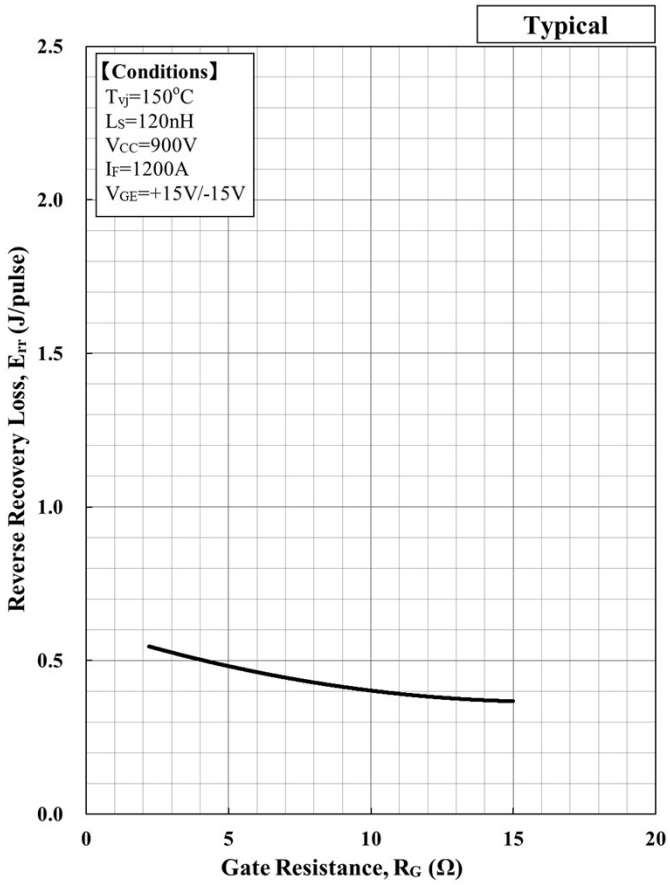


Turn-on loss vs. Gate Resistance



Turn-off loss vs. Gate Resistance



Reverse Recovery loss vs. Gate Resistance of Chopper Diode

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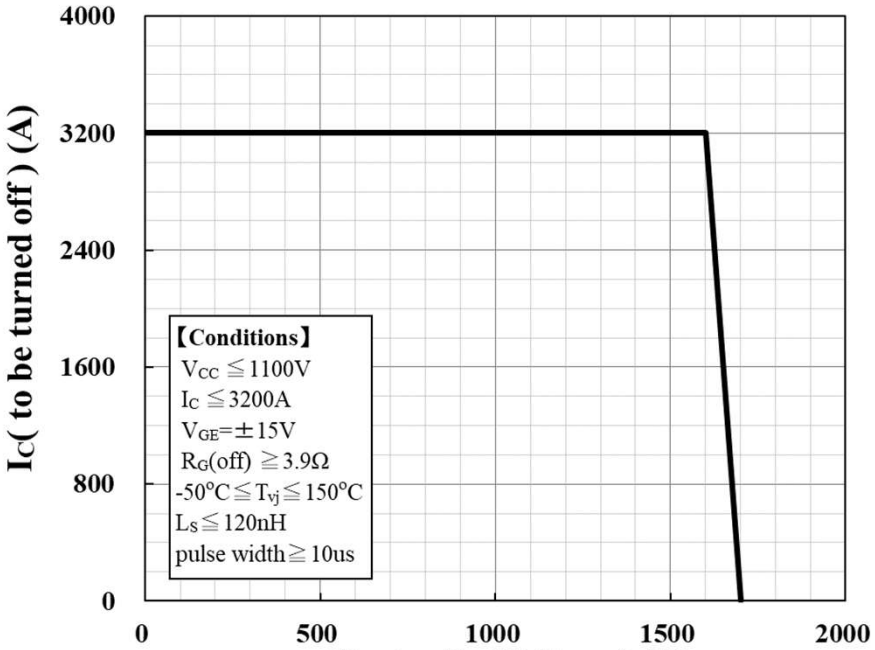
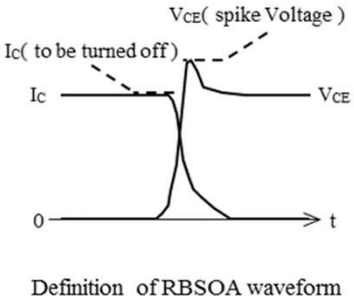
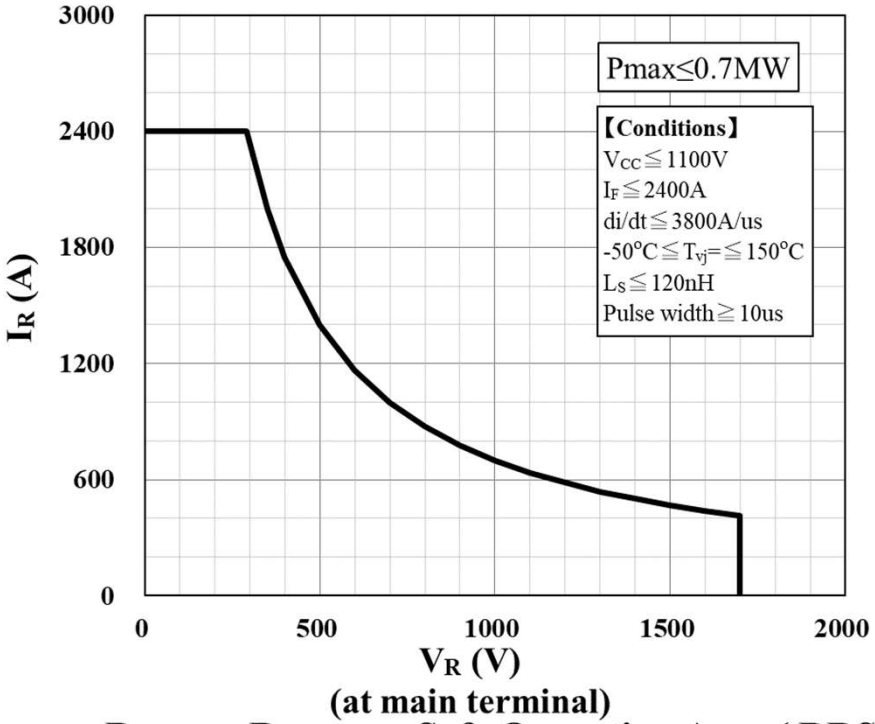


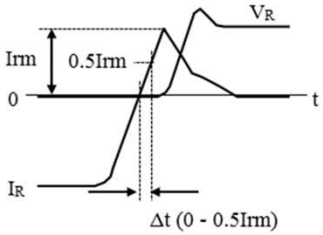
Reverse Bias Safe Operation Area (RBSOA)



Definition of RBSOA waveform



Reverse Recovery Safe Operation Area (RRSOA) of chopper diode



$$di/dt = \frac{0.5Irm}{\Delta t}$$

Definition of Recovery di/dt

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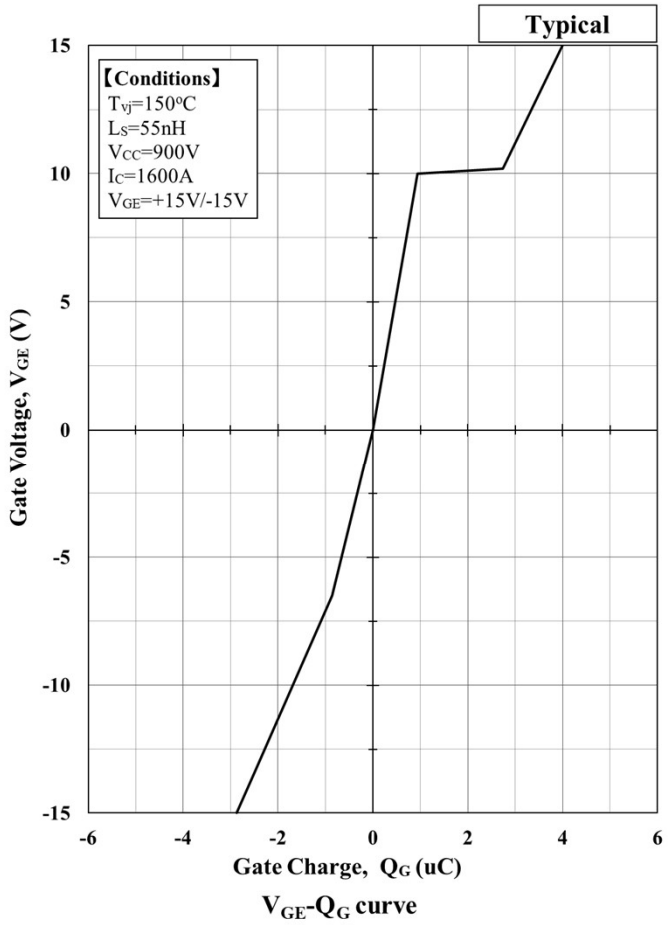
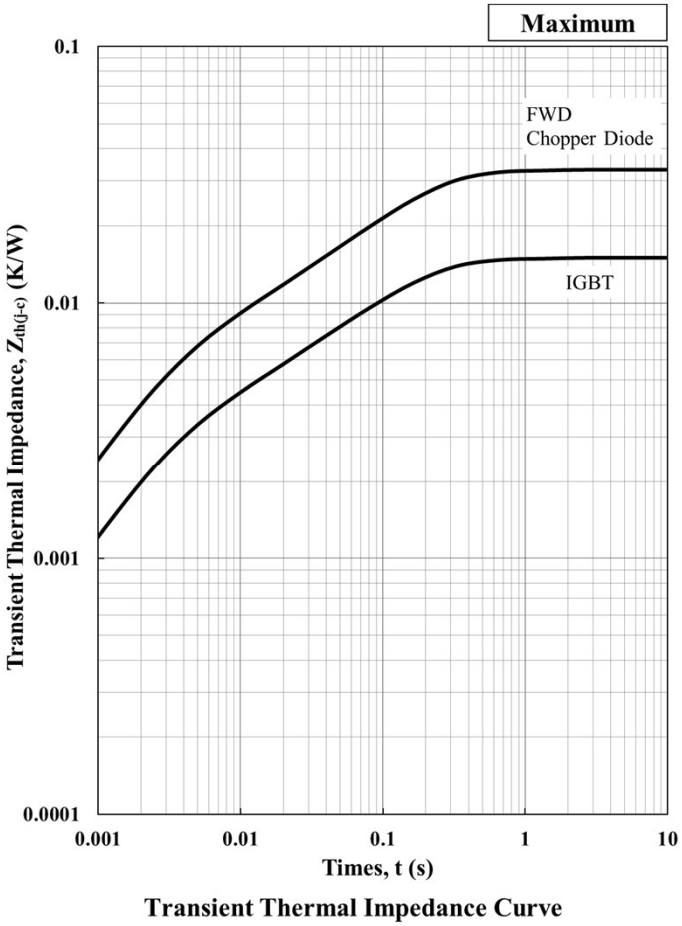


V_{GE}-Q_G curve



Transient Thermal Impedance Curve

Foster model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	8.97E-03	2.93E-03	2.70E-03	3.97E-04	[K/W]
C th, IGBT [n]	1.68E+01	8.80E+00	1.15E+00	1.41E+00	[J/K]
R th, Diode [n]	2.15E-02	5.30E-03	5.43E-03	8.00E-04	[K/W]
C th, Diode [n]	7.00E+00	4.87E+00	5.69E-01	7.01E-01	[J/K]

Cauer model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	1.99E-03	2.42E-03	5.35E-03	5.25E-03	[K/W]
C th, IGBT [n]	5.71E-01	8.02E-01	5.73E+00	1.91E+01	[J/K]
R th, Diode [n]	4.00E-03	4.88E-03	1.20E-02	1.21E-02	[K/W]
C th, Diode [n]	2.83E-01	3.98E-01	2.79E+00	7.53E+00	[J/K]

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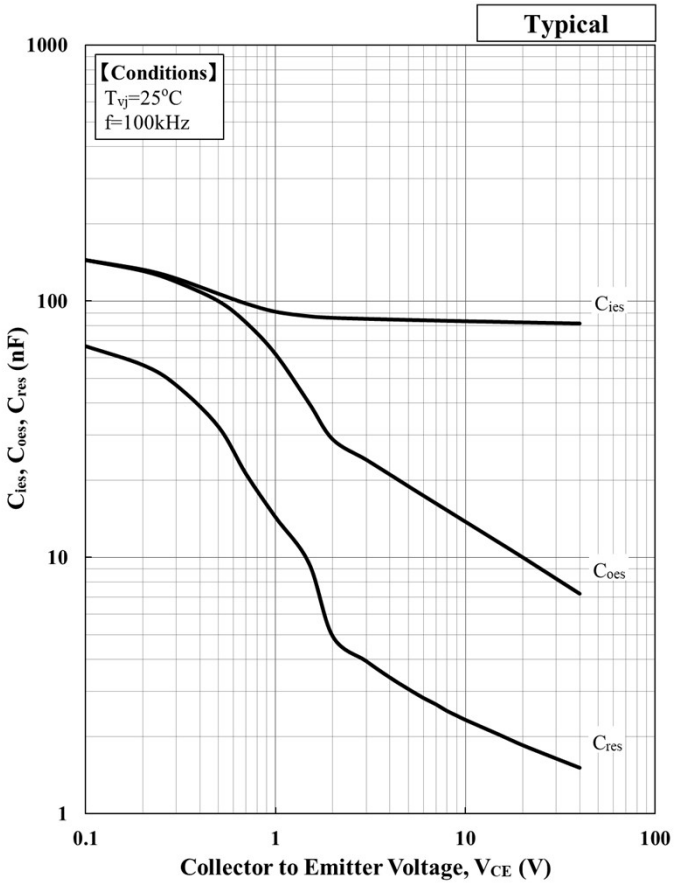

Capacitance vs. Collector to Emitter Voltage

Material declaration

Please note the following materials are contained in the product, in order to keep characteristic and reliability level.

Material	Contained part
Lead (Pb) and its compounds	Solder

MBL1600E17F

Minebea POWER SEMICONDUCTORS

Notices

1. Since mishandling of semiconductor devices may cause malfunctions, please be sure to read "Precautions for Safe Use and Notices" in the individual brochure before use.
2. When designing an electronic circuit using semiconductor devices, please do not exceed the absolute maximum rating specified for the device under any external fluctuations. And for pulse applications, please also do not exceed the "Safe Operating Area (SOA)".
3. Semiconductor devices may sometimes break down by accidental or unexpected surge voltage, so please be careful about the safety design such as redundant design and malfunction prevention design which don't cause the damage expand even if they break down.
4. In cases where extremely high reliability is required (such as use in nuclear power control, aerospace and aviation, traffic equipment, life-support-related medical equipment, fuel control equipment and various kinds of safety equipment), safety should be ensured by using semiconductor devices that feature assured safety or by means of users' fail-safe precautions or other arrangement. Or consult with MPSD's sales department staff. (When semiconductor devices fail, as a result the semiconductor devices or wiring, wiring pattern may smoke, ignite, or the semiconductor devices themselves may burst.)
5. A semi-processed article is done now using solder which contains lead inside the semiconductor devices. There is possibility of the regulation substance depend on the applied models, so please check before using.
6. This specification is a material for component selection, which describes specifications of power semiconductor devices (hereinafter referred to as products), characteristic charts, and external dimension drawings.
7. The information given herein, including the specifications and dimensions, is subject to change without prior notice to improve product characteristics. Before ordering, purchasers are advised to contact with Minebea power semiconductor sales department for the latest version of this data sheets.
8. For handling other than described in this manual, follow the handling instructions (IGBT-HI-00002).

■ For inquiries relating to the products, please contact nearest representatives that is located "Inquiry" portion on the top page of a home page.

Minebea power semiconductor home page address
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https://www.minebea-psd.com/en/

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Minebea POWER SEMICONDUCTORS

Usage

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