

# MBL1600E17F

Silicon N-channel IGBT 1700V F version

## FEATURES

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

## ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub>=25°C)

Item	Symbol	Unit	MBL1600E17F	
Collector Emitter Voltage	V <sub>CEs</sub>	V	1,700	
Gate Emitter Voltage	V <sub>GES</sub>	V	±20	
Collector Current	DC	I <sub>C</sub>	1,600	
	1ms	I <sub>Cp</sub>	3,200	
Forward Current (Free wheel Diode)	DC	I <sub>F(FWD)</sub>	1,200	
	1ms	I <sub>FM(FWD)</sub>	2,400	
Forward Current (Chopper Diode)	DC	I <sub>F(chopper)</sub>	1,200	
	1ms	I <sub>FM(chopper)</sub>	2,400	
Junction Temperature	T <sub>j op</sub>	°C	-50 ~ +150	
Maximum Junction Temperature(3)	T <sub>vj max</sub>	°C	175	
Storage Temperature	T <sub>stg</sub>	°C	-50 ~ +125	
Isolation Voltage	V <sub>ISO</sub>	V <sub>RMS</sub>	4,000(AC 1 minute)	
Screw Torque	Terminals (M4/M8)	-	2/15	(1)
	Mounting (M6)	-	6	(2)

Notes: (1) Recommended Value  $1.8 \pm 0.2/15^{+0}_{-3}$  N·m (2) Recommended Value  $5.5 \pm 0.5$  N·m

(3) Regarding the definition of T<sub>vj max</sub> 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 <sub>CEs</sub>	mA	-	-	5	V <sub>CE</sub> =1,700V, V <sub>GE</sub> =0V, T <sub>j</sub> =25°C
			-	20	80	V <sub>CE</sub> =1,700V, V <sub>GE</sub> =0V, T <sub>j</sub> =150°C
Gate Emitter Leakage Current	I <sub>GES</sub>	nA	-500	-	+500	V <sub>GE</sub> =±20V, V <sub>CE</sub> =0V, T <sub>j</sub> =25°C
Collector Emitter Saturation Voltage	V <sub>CE(sat)</sub>	V	-	2.0	-	I <sub>C</sub> =1,600A, V <sub>GE</sub> =15V, T <sub>j</sub> =25°C
			2.0	2.4	2.8	I <sub>C</sub> =1,600A, V <sub>GE</sub> =15V, T <sub>j</sub> =150°C
Gate Emitter Threshold Voltage	V <sub>GE(TO)</sub>	V	4.1	5.5	7.1	V <sub>CE</sub> =10V, I <sub>C</sub> =160mA, T <sub>j</sub> =25°C
Input Capacitance	C <sub>ies</sub>	nF	-	87	-	V <sub>CE</sub> =10V, V <sub>GE</sub> =0V, f=100kHz, T <sub>j</sub> =25°C
Internal Gate Resistance	R <sub>ge</sub>	Ω	-	2.3	-	V <sub>CE</sub> =10V, V <sub>GE</sub> =0V, f=100kHz, T <sub>j</sub> =25°C
Switching Times	Rise Time	t <sub>r</sub>	-	0.4	0.8	V <sub>CC</sub> =900V, I <sub>C</sub> =1,600A
	Turn On Time	t <sub>on</sub>	-	1.0	2.0	L <sub>S</sub> =120nH (4)
	Fall Time	t <sub>f</sub>	-	1.4	2.8	R <sub>G(on/off)</sub> =3.9/3.9Ω (4)
	Turn Off Time	t <sub>off</sub>	-	3.2	6.4	V <sub>GE</sub> =±15V, T <sub>j</sub> =150°C
Peak Forward Voltage Drop	V <sub>FM</sub>	V	-	2.0	-	I <sub>F</sub> =1,200A, V <sub>GE</sub> =0V, T <sub>j</sub> =25°C Measured at auxiliary terminals
			-	2.3	-	I <sub>F</sub> =1,200A, V <sub>GE</sub> =0V, T <sub>j</sub> =150°C Measured at auxiliary terminals
Turn On Loss	E <sub>on</sub>	J/P	-	0.5	-	V <sub>CC</sub> =900V, I <sub>C</sub> =1,600A L <sub>S</sub> =120nH (4)
Turn Off Loss	E <sub>off</sub>	J/P	-	1.4	-	R <sub>G(on/off)</sub> = 3.9/3.9Ω (4) V <sub>GE</sub> =±15V, T <sub>j</sub> =150°C
Stray inductance in module	L <sub>SCE</sub>	nH	-	12	-	
Thermal Impedance	IGBT	R <sub>th(j-c)</sub>	-	-	0.015	Junction to case
	FWD	R <sub>th(j-c)</sub>	-	-	0.033	
Contact Thermal Impedance	R <sub>th(c-f)</sub>	K/W	-	0.008	-	Case to fin (λgrease=1W/(m·K), heat-sink flatness ≤50um)

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## 2) Chopper DIODE

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Repetitive Reverse Current	I <sub>RRM</sub>	mA	-	-	2.5	V <sub>R</sub> =1,700V, T <sub>j</sub> =25°C
			-	10	40	V <sub>R</sub> =1,700V, T <sub>j</sub> =150°C
Peak Forward Voltage Drop (Between main terminals)	V <sub>F</sub>	V	-	2.1	-	I <sub>F</sub> =1,200A, T <sub>j</sub> =25°C Measured at main terminals
			-	2.4	-	I <sub>F</sub> =1,200A, T <sub>j</sub> =150°C Measured at main terminals
Reverse Recovery Time	t <sub>rr</sub>	μs	-	0.6	-	V <sub>CC</sub> =900V, I <sub>F</sub> =1,200A, L <sub>s</sub> =120nH, R <sub>G</sub> (on)=3.9Ω (4)
Reverse Recovery Loss	E <sub>rr</sub>	J/P	-	0.5	-	V <sub>GE</sub> =±15V, T <sub>j</sub> =150°C
Thermal Impedance	R <sub>th(j-c)</sub>	K/W	-	-	0.033	Junction to case
Contact Thermal Impedance	R <sub>th(c-f)</sub>	K/W	-	0.016	-	Case to fin (at Chopper Diode part)

Notes:(4) L<sub>s</sub> and R<sub>G</sub> are the test condition's values for evaluation of the switching times, not recommended value.

Please, determine the suitable R<sub>G</sub> value after the measurement of switching waveforms (overshoot voltage, etc.) with appliance mounted.

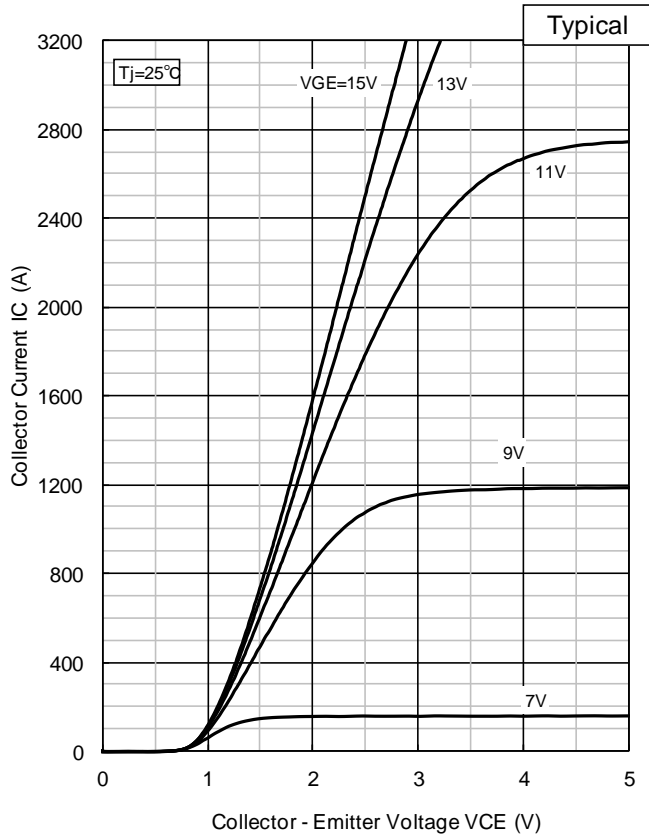
\* Please contact our representatives at order.

\* For improvement, specifications are subject to change without notice.

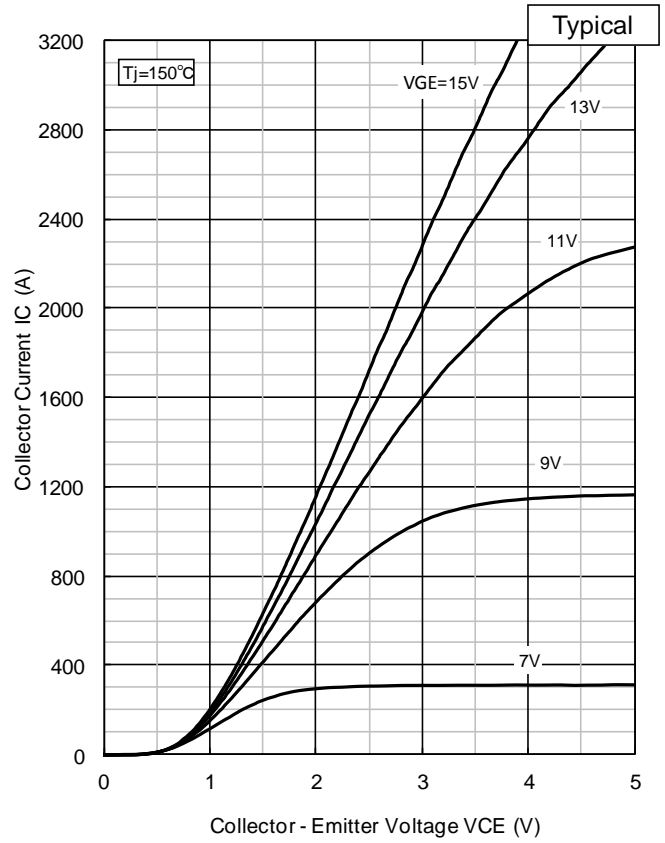
\* For actual application, please confirm this spec sheet is the newest revision.

\* ELECTRICAL CHARACTERISTICS values are according to IEC 60747-2 and IEC 60747-9.

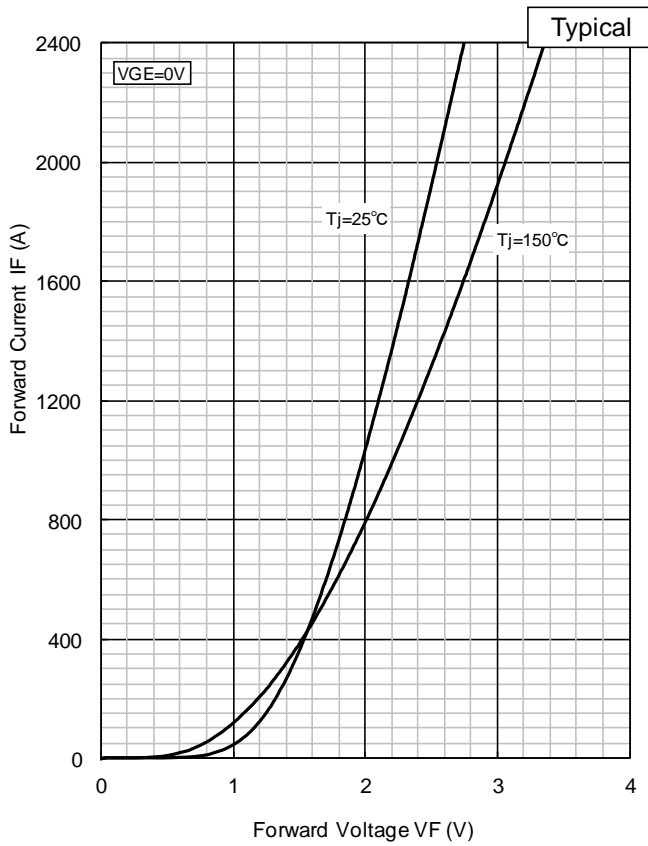
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IC vs. VCE ( $T_j=25^\circ\text{C}$ )

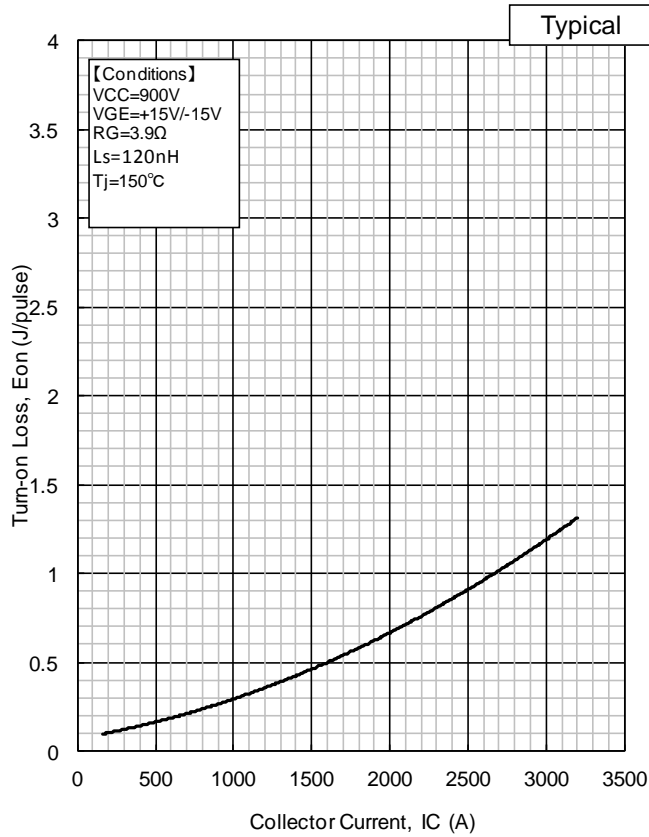


IC vs. VCE ( $T_j=150^\circ\text{C}$ )

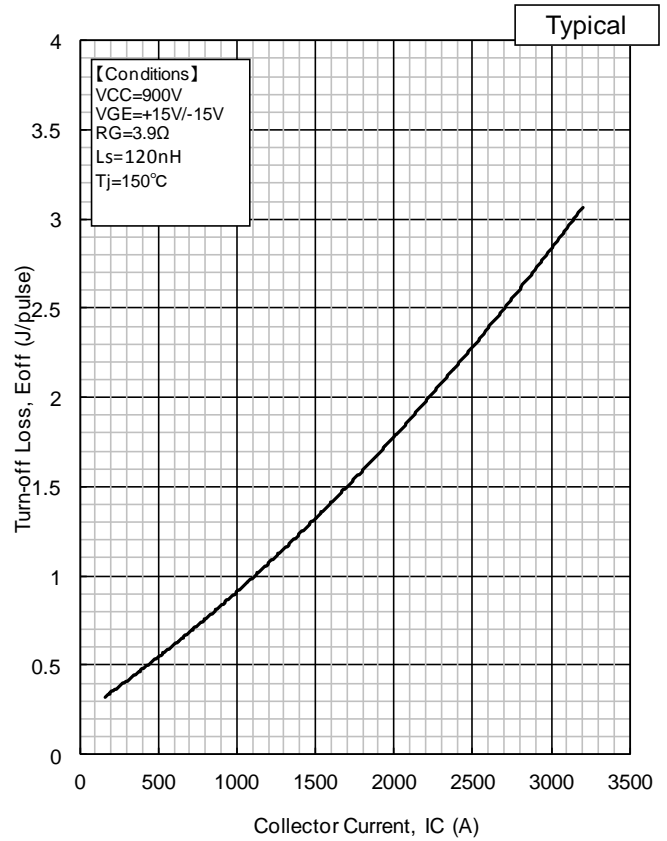


IF vs. VF of Chopper Diode

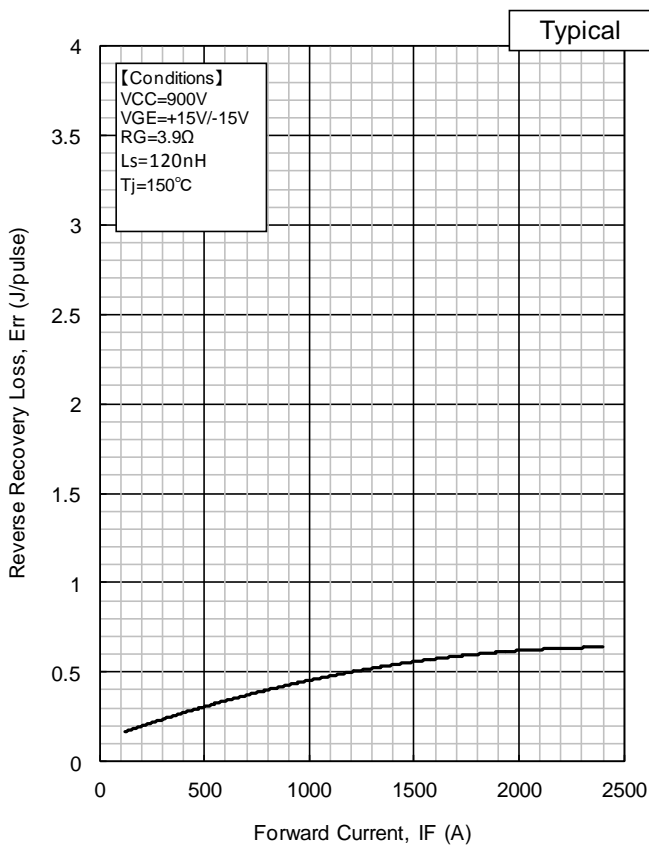
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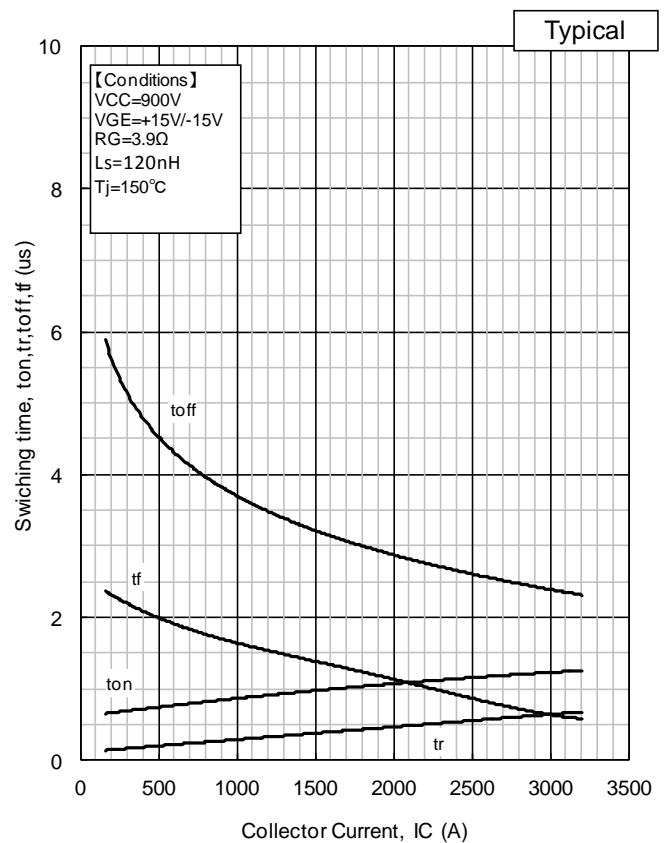
Turn-on loss vs. Collector current



Turn-off loss vs. Collector current

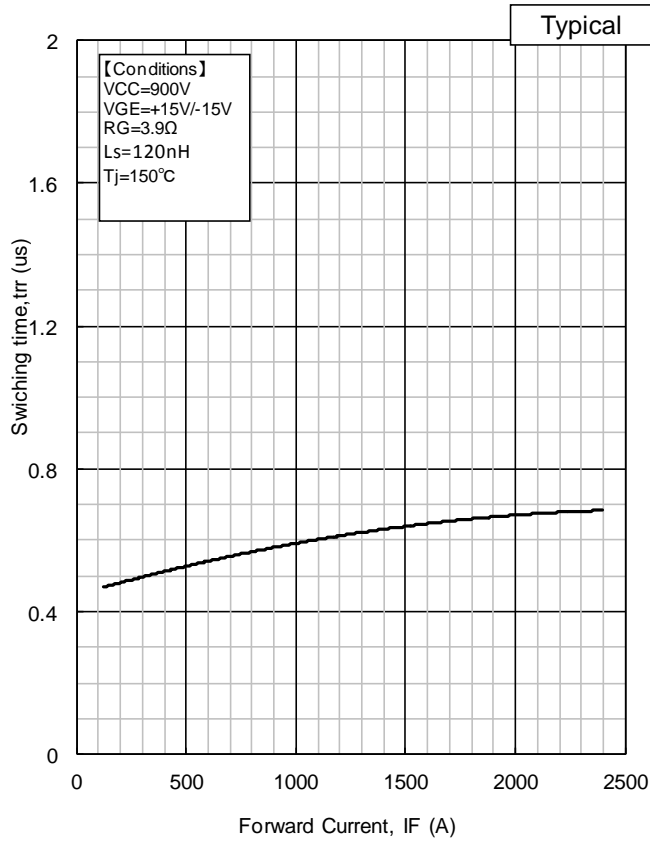


Recovery loss vs. Forward current of chopper diode



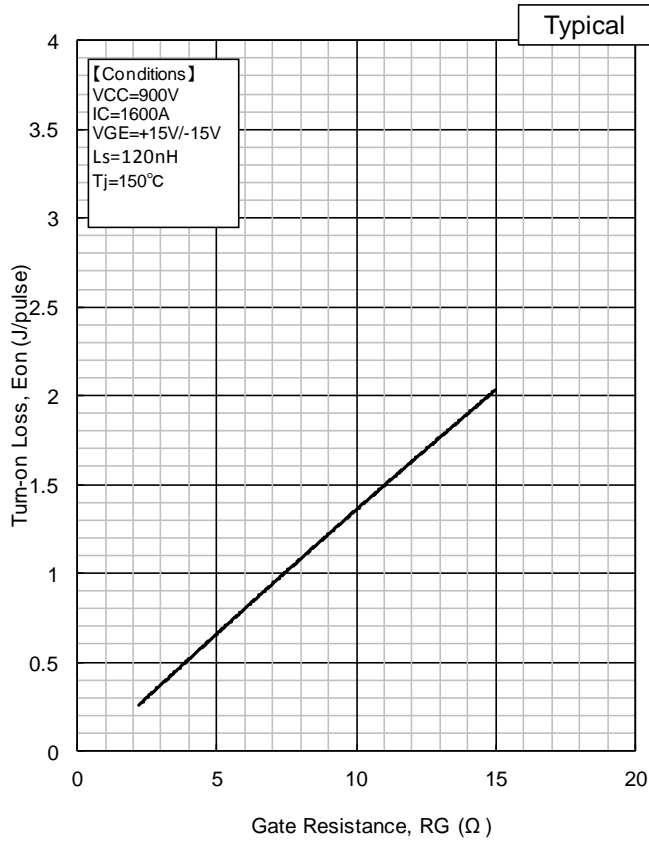
Switching time vs. Collector current

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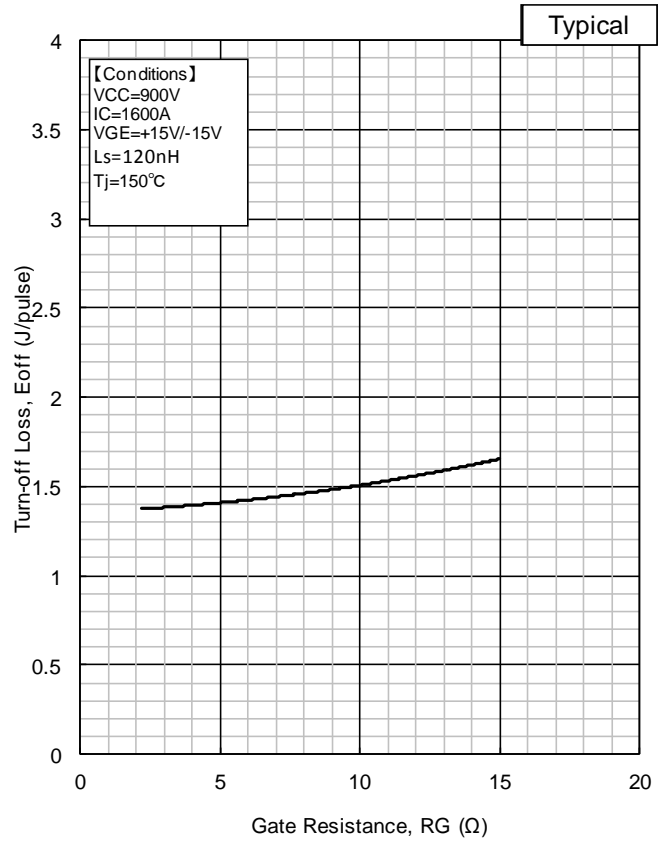


Switching time vs. Forward current of chopper diode

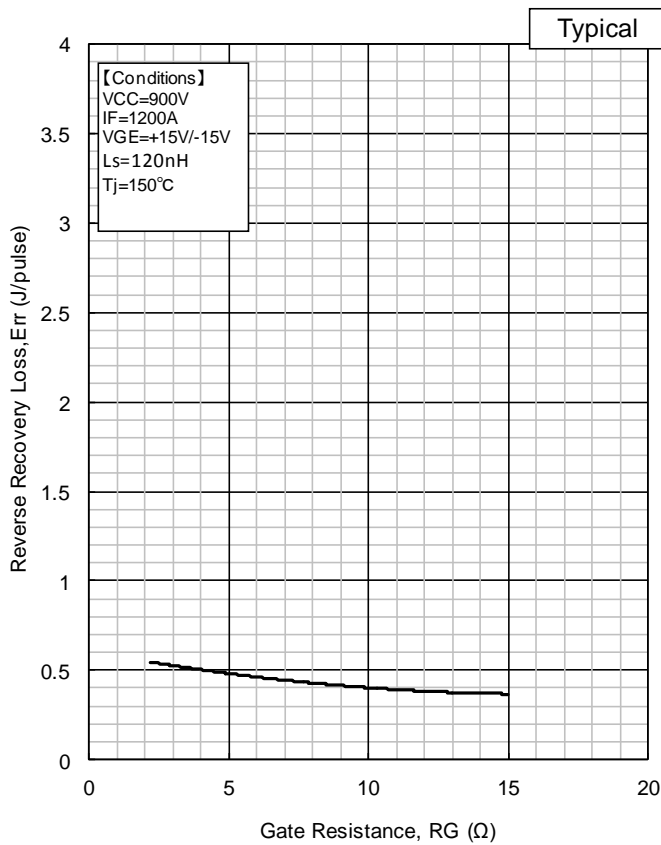
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Turn-on loss vs. Gate Resistance

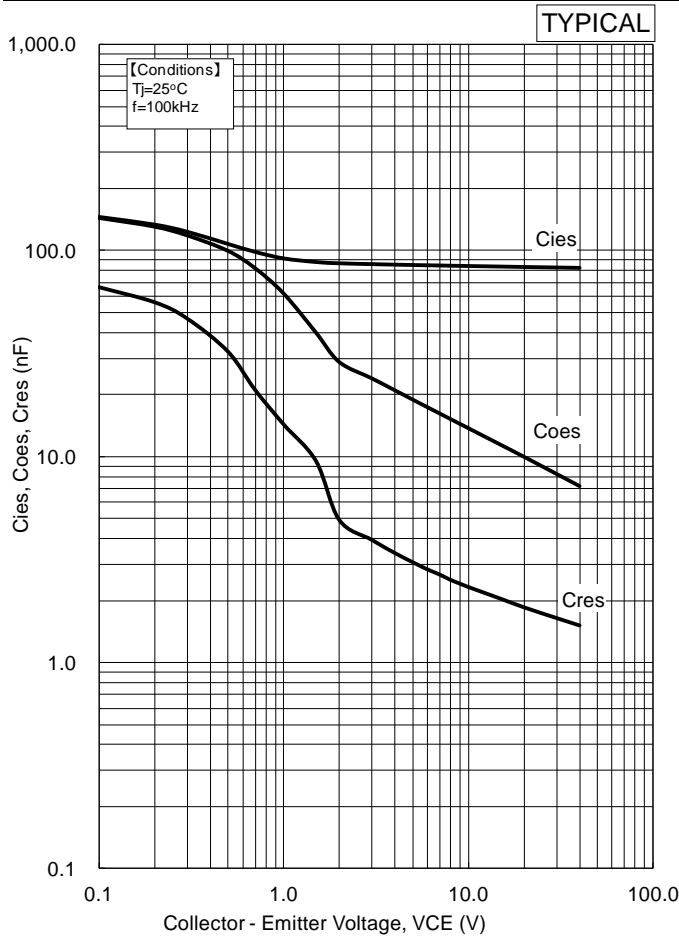


Turn-off loss vs. Gate Resistance

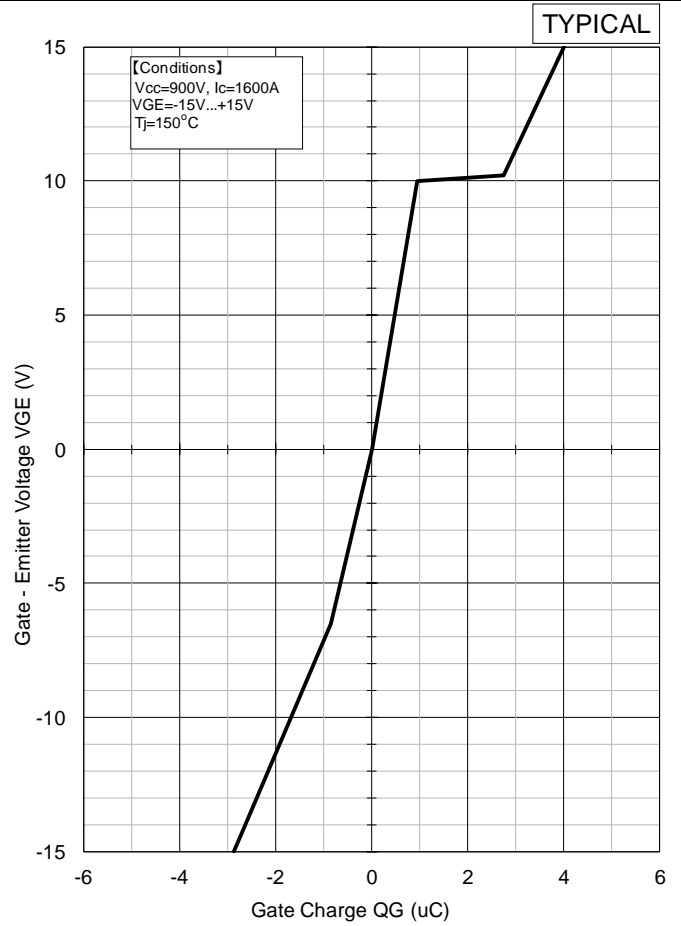


Recovery loss vs. Gate Resistance of chopper diode

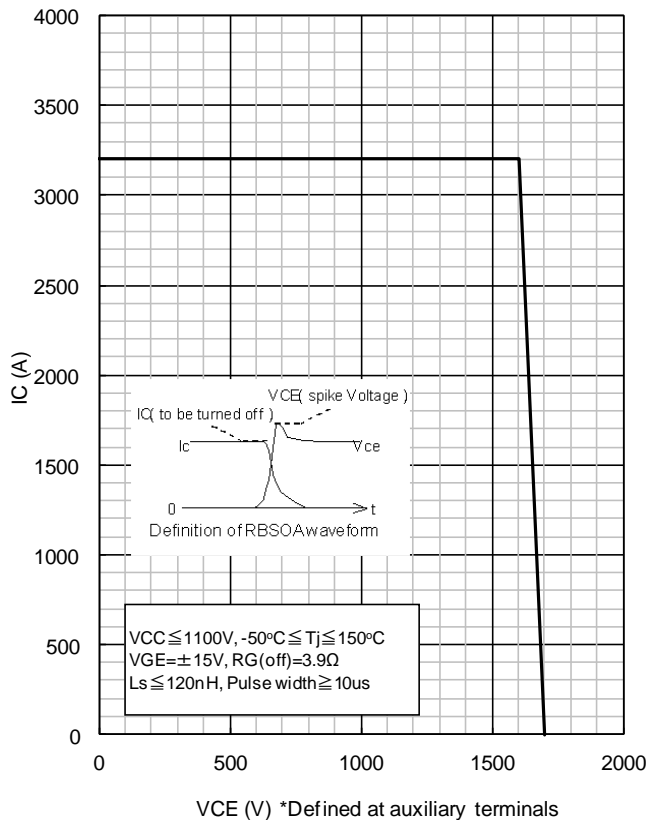
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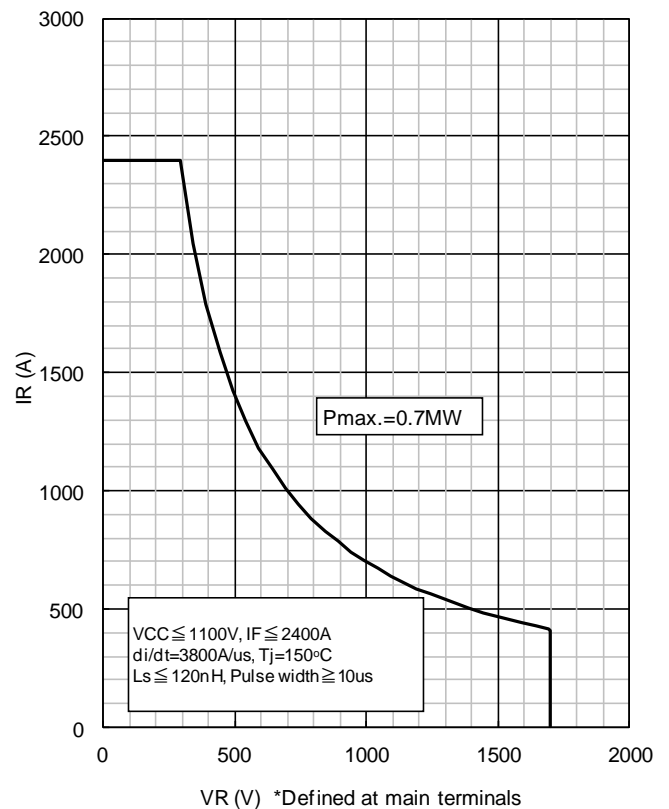
**Cies, Coes, Cres - VCE**



**QG-VGE Curve**



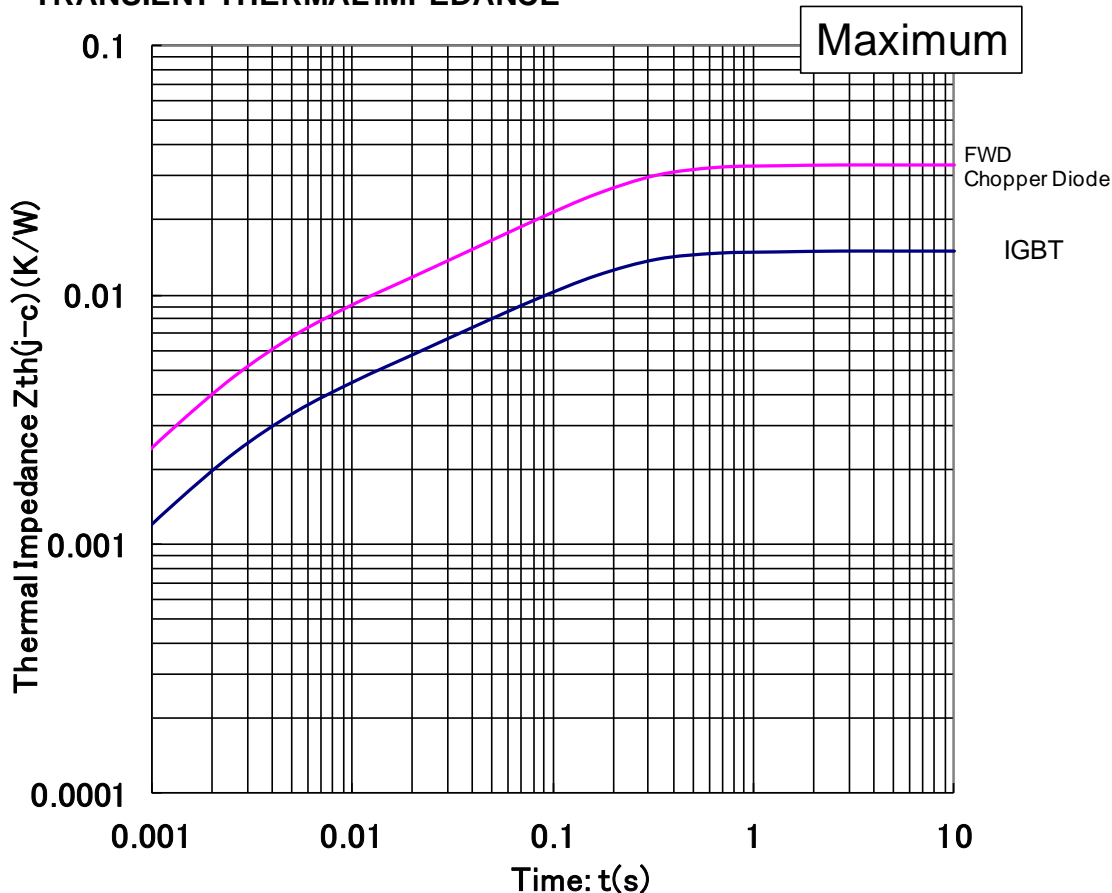
**RBSOA**



**RecSOA of chopper diode**

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## TRANSIENT THERMAL IMPEDANCE



Transient Thermal Impedance Curve

### Curve Approximation Model

$$\sum r_{th}[n] * (1 - \exp(-t/\tau_{th}[n]))$$

n	1	2	3	4	Unit
$\tau_{th}[n]$	1.50E-01	2.58E-02	3.09E-03	5.61E-04	sec
$r_{th}[n,IGBT]$	8.97E-03	2.93E-03	2.70E-03	3.97E-04	K/W
$r_{th}[n,Diode]$	2.15E-02	5.30E-03	5.43E-03	8.00E-04	K/W

### Material declaration

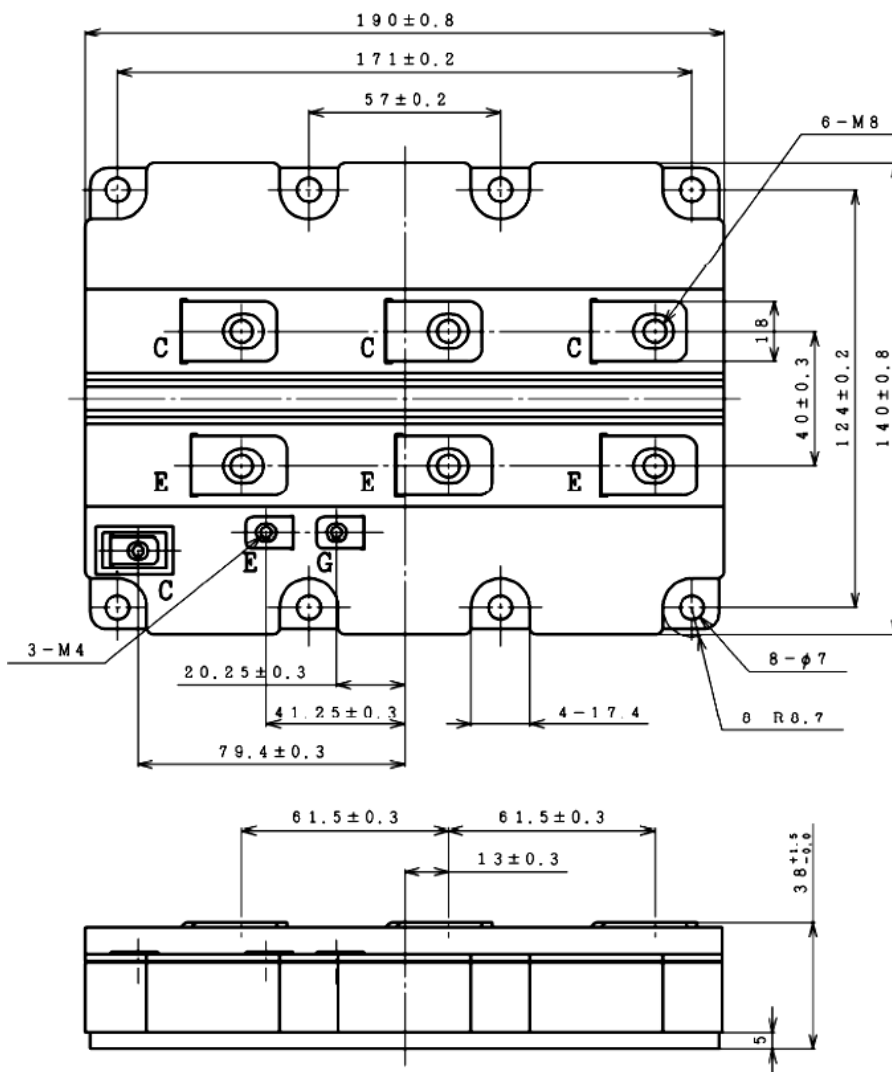
Please note the following materials are contained in the product, in order to keep characteristic and reliability level.

Material	Contained part
Lead (Pb) and its compounds	Solder

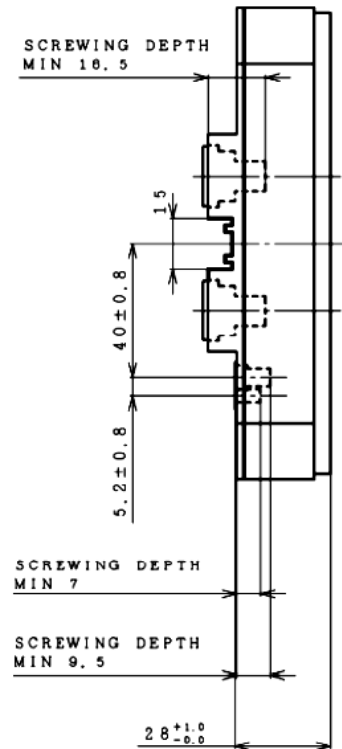


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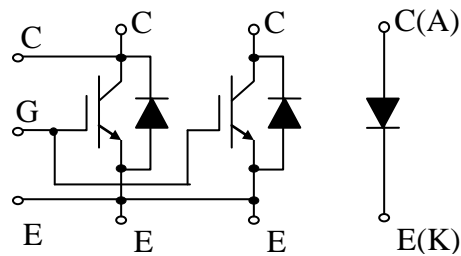
## Outline Drawing



Unit in mm



Weight: 1300g



Circuit diagram

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## HITACHI POWER SEMICONDUCTORS

### Notices

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