

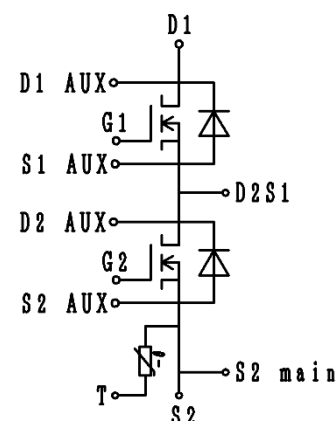
MSM1350GS17CLT

Preliminary Specification

SiC MOSFET 1700V

FEATURES

- * Ultra low switching loss with SiC MOSFET
- * High current density package
- * Low stray inductance & low $R_{th(j-c)}$
- * Half-bridge (2in1)
- * Built in temperature sensor
- * Scalable large current easily handled by paralleling
- * Equipped with current sensing terminals
- * Sintered copper bonding technology
- * SBD-less SiC module

**ABSOLUTE MAXIMUM RATINGS** ($T_c=25^\circ\text{C}$)

Item		Symbol	Unit	MSM1350GS17CLT
Drain Source Voltage		V_{DSS}	V	1,700
Gate Source Voltage		V_{GSS}	V	+20/-15
Drain Current	DC	I_D	A	1,150 ($T_c=25^\circ\text{C}$) (1)
	Pulse	I_{DM}		2,700 (1)
Source Current	DC	I_S	A	1,270 ($T_c=25^\circ\text{C}$) (1)
	Pulse	I_{SM}		2,700 (1)
Junction Temperature		$T_{vj\ op}$	$^\circ\text{C}$	-40 ~ +175
Storage Temperature		T_{stg}	$^\circ\text{C}$	-40 ~ +150
Isolation Voltage		V_{ISO}	V_{RMS}	6,000 (AC 1 minute)
Screw Torque	Terminals (M3/M8)	M	N·m	0.8/15
	Mounting (M6)	M		6.0 (2)

Notes: (1) Please control heat dissipation conditions so that the junction temperature does not exceed the maximum rating. (T_c : Case temperature)

(2) Recommended Value $5.5 \pm 0.5 \text{ N} \cdot \text{m}$

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ELECTRICAL CHARACTERISTICS

Item		Symbol	Unit	Min.	Typ.	Max.	Test conditions
Drain Source Cut-Off Current		I_{DSS}	mA	-	-	0.05	$V_{DS}=1,700V, V_{GS}=0V, T_{vj}=25^{\circ}C$
				-	-	1	$V_{DS}=1,700V, V_{GS}=0V, T_{vj}=175^{\circ}C$
Gate Source Leakage Current		I_{GSS}	nA	-	-	+100	$V_{GS}=+20V, V_{DS}=0V, T_{vj}=25^{\circ}C$
				-100			$V_{GS}=-15V, V_{DS}=0V, T_{vj}=25^{\circ}C$
Drain Source On-state Voltage		$V_{DS(on)}$	V	-	2.3	-	$I_D=1,350A, V_{GS}=17V, T_{vj}=25^{\circ}C$
				-	3.3	4.6	$I_D=1,350A, V_{GS}=17V, T_{vj}=175^{\circ}C$
Gate Source Threshold Voltage		$V_{GS(th)}$	V	-	3.0	-	$V_{DS}=10V, I_D=1,350mA, T_{vj}=25^{\circ}C$
Input Capacitance		C_{iss}	nF	-	173	-	$V_{DS}=10V, V_{GS}=0V, f=100kHz,$
Internal Gate Resistance		$R_{g(int)}$	Ω	-	1.75	-	$T_{vj}=25^{\circ}C$
Switching Time	Rise Time	t_r	μs	-	0.18	-	$V_{DD}=900V, I_D=1,350A, L_S=25nH,$ $R_{G(on/off)}=1.0/1.5\Omega (3),$ $V_{GS}=+17/-10V, T_{vj}=175^{\circ}C$
	Turn On Delay Time	$t_{d(on)}$		-	0.38	-	
	Fall Time	t_f		-	0.10	-	
	Turn Off Delay Time	$t_{d(off)}$		-	0.95	-	
Source Drain Voltage		V_{SD}	V	-	1.6	-	$I_S=1,350A, V_{GS}=+17V, T_{vj}=25^{\circ}C$
				-	2.8	3.8	$I_S=1,350A, V_{GS}=+17V, T_{vj}=175^{\circ}C$
				-	9.4	-	$I_S=1,350A, V_{GS}=-10V, T_{vj}=25^{\circ}C$
				-	7.3	-	$I_S=1,350A, V_{GS}=-10V, T_{vj}=175^{\circ}C$
Reverse Recovery Time		t_{rr}	μs	-	0.15	-	$V_{DD}=900V, I_D=1,350A, L_S=25nH,$ $R_{G(on/off)}=1.0/1.5\Omega (3),$ $V_{GS}=+17/-10V, T_{vj}=175^{\circ}C$
Turn-on Loss		E_{on}	J/P	-	0.28	-	
Turn-off Loss		E_{off}	J/P	-	0.21	-	
Reverse Recovery Loss		E_{rr}	J/P	-	0.01	-	
Stray Inductance Module		L_{SCE}	nH	-	9	-	Between D1(main) and S2(main)
NTC-Thermistor	Resistance	R_{25}	k Ω	-	5	-	$T_c=25^{\circ}C$
	Deviation	$\Delta R/R$	%	-5	-	5	$T_c=25^{\circ}C$
	B-constant	$B_{(25/50)}$	K	-	3375	-	Between 25°C and 50°C
Thermal Impedance	MOSFET	$R_{th(j-c)}$	K/W	-	-	0.033	Junction to case
Contact Thermal Impedance		$R_{th(c-f)}$	K/W	-	0.02	-	Case to fin (per 1 arm)

Notes: (3) R_G value is a test condition value for evaluation, not recommended value.

Please, determine the suitable R_G value by measuring switching behavior and checking results with the respective SOA.

* Please contact our representatives at order.

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

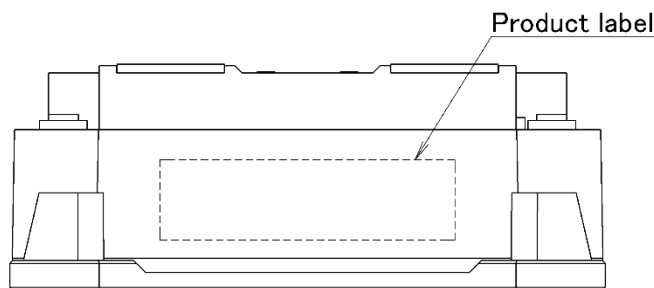
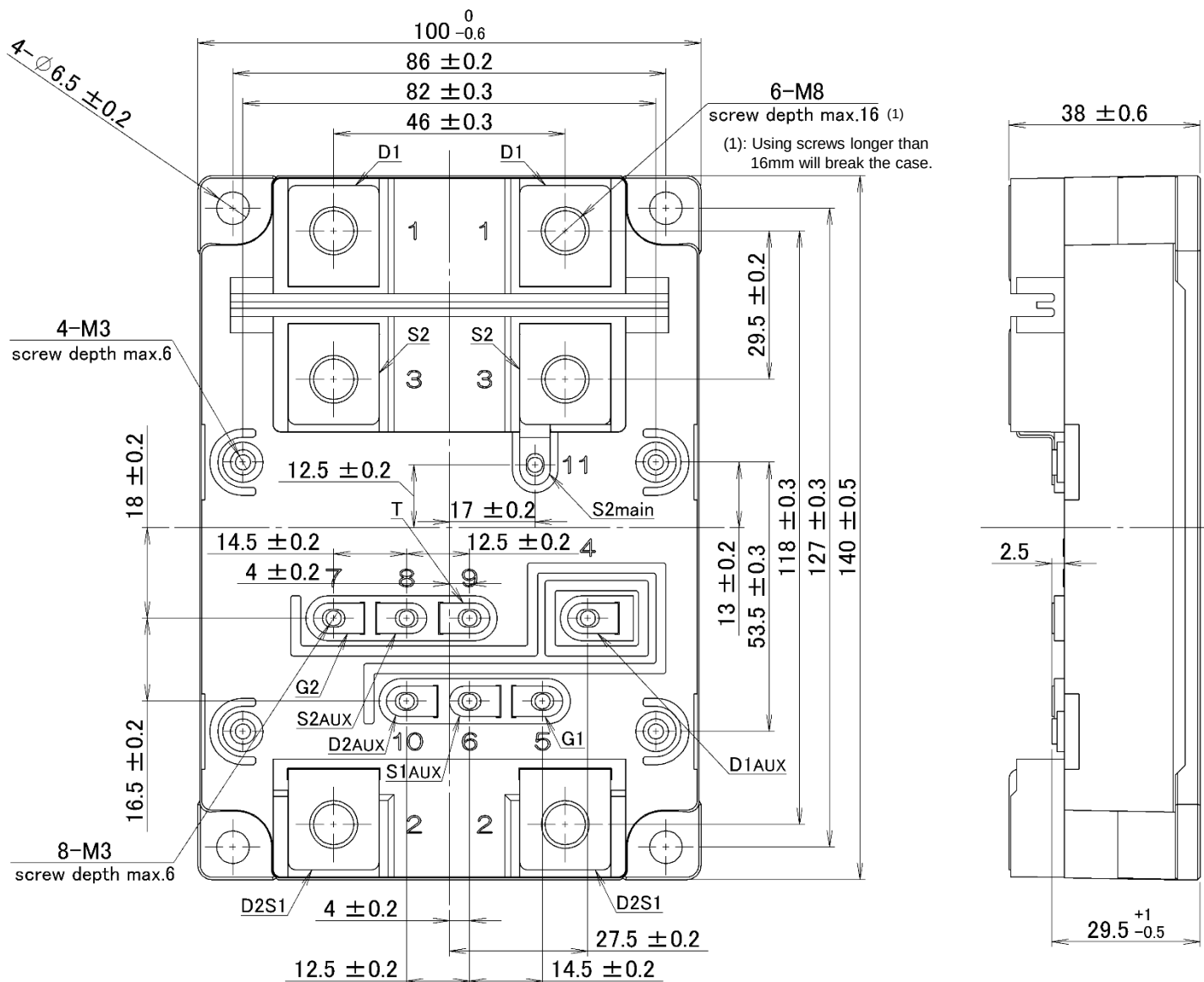
* For actual application, please confirm this spec sheet is the newest revision.

* ELECTRICAL CHARACTERISTIC items shown in above table are according to IEC 60747-2 and IEC 60747-9.

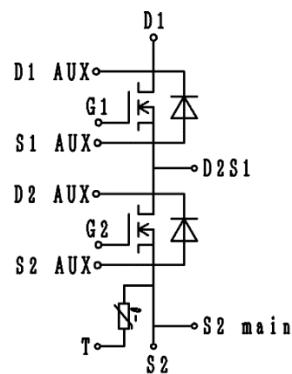
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OUTLINE DRAWING(unit in mm)



- 1 : D1
- 2 : D2S1
- 3 : S2
- 4 : D1AUX
- 5 : G1
- 6 : S1AUX
- 7 : G2
- 8 : S2AUX
- 9 : T
- 10 : D2AUX
- 11 : S2main



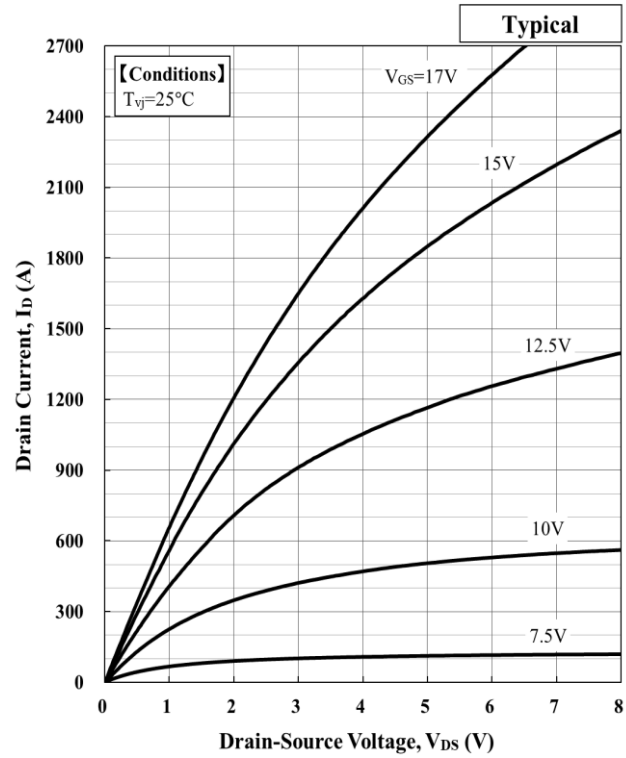
Weight: 770(g)

Terminal Number

Circuit Diagram

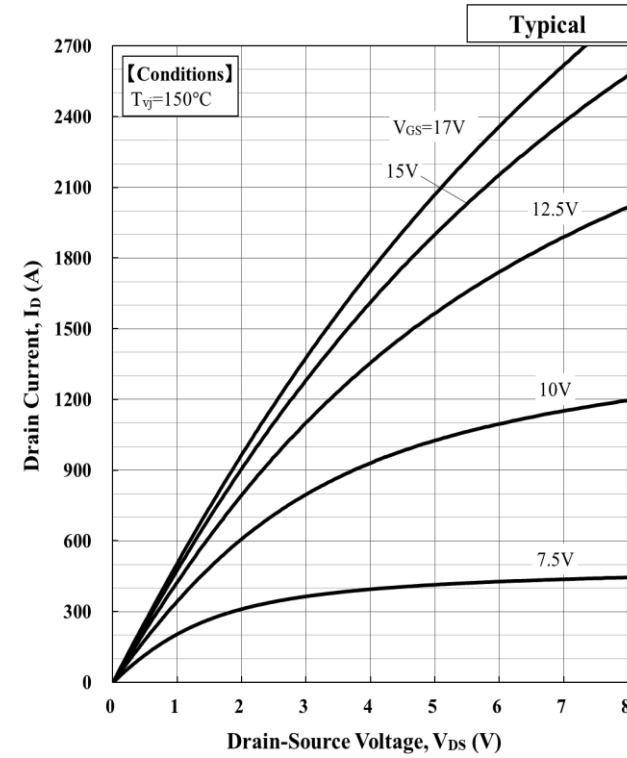
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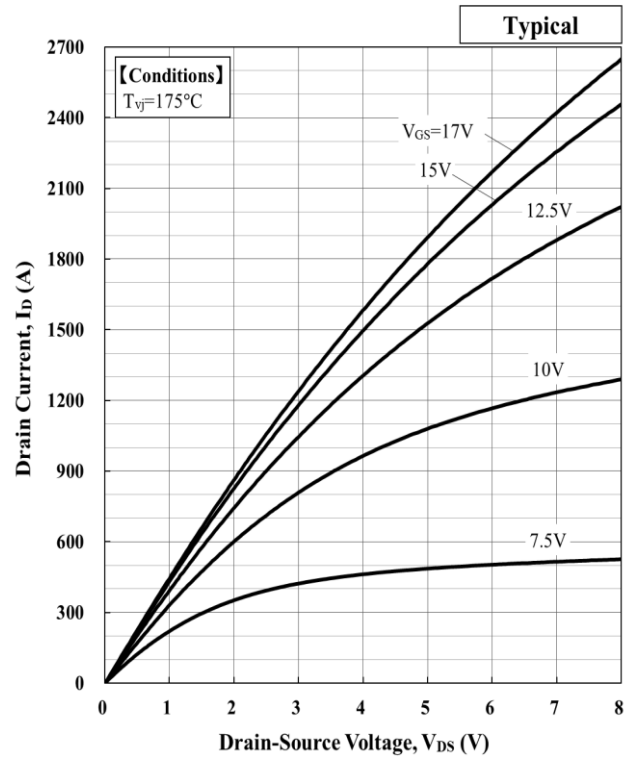
$V_{DS}[V] = a_3 \cdot I_D ^3 + a_2 \cdot I_D ^2 + a_1 \cdot I_D + a_0$					
Temp. [°C]	V_{GS} [V]	a_3	a_2	a_1	a_0
25	17	1.37E-10	-3.15E-08	1.50E-03	-1.02E-02

Drain Current vs. Drain - Source Voltage



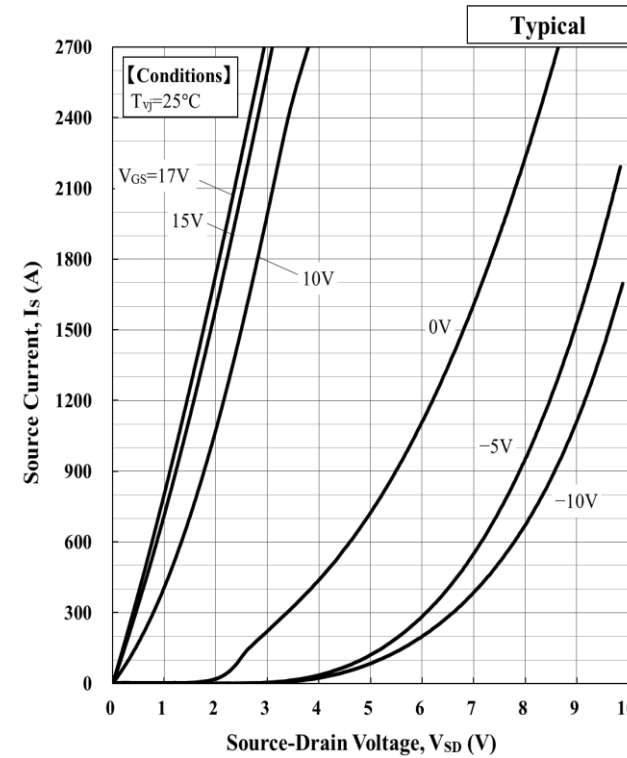
$V_{DS}[V] = a_3 \cdot I_D ^3 + a_2 \cdot I_D ^2 + a_1 \cdot I_D + a_0$					
Temp. [°C]	V_{GS} [V]	a_3	a_2	a_1	a_0
150	17	9.52E-11	1.55E-08	1.98E-03	-1.19E-02

Drain Current vs. Drain - Source Voltage



$V_{DS}[V] = a_3 \cdot I_D ^3 + a_2 \cdot I_D ^2 + a_1 \cdot I_D + a_0$					
Temp. [°C]	V_{GS} [V]	a_3	a_2	a_1	a_0
175	17	1.07E-10	7.88E-09	2.25E-03	-1.56E-02

Drain Current vs. Drain - Source Voltage

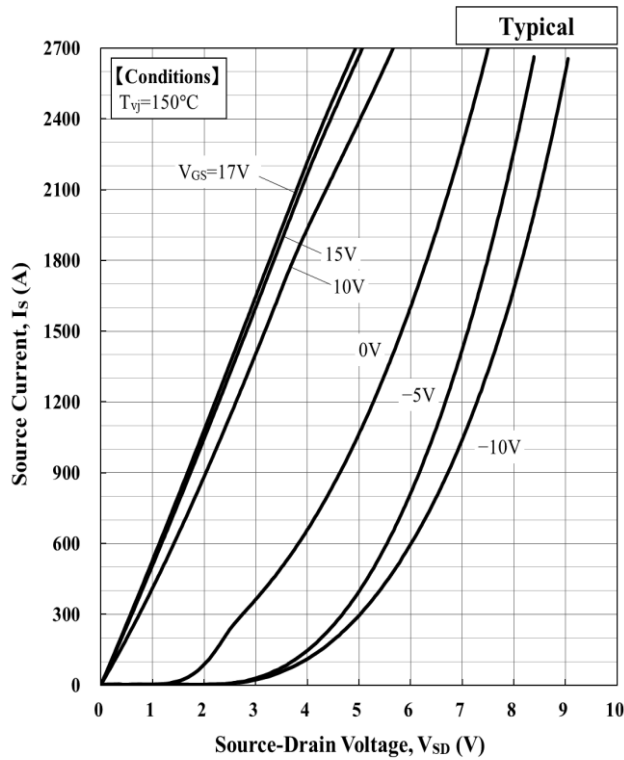


$V_{SD}[V] = a_3 \cdot I_S ^3 + a_2 \cdot I_S ^2 + a_1 \cdot I_S + a_0$					
Temp. [°C]	V_{GS} [V]	a_3	a_2	a_1	a_0
25	17	1.67E-11	-1.39E-07	1.34E-03	1.19E-03

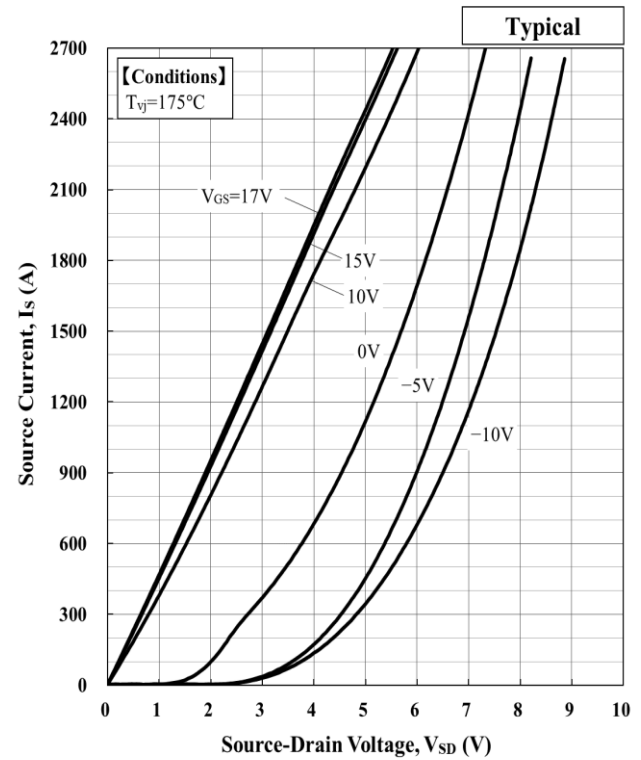
Source Current vs. Source - Drain Voltage

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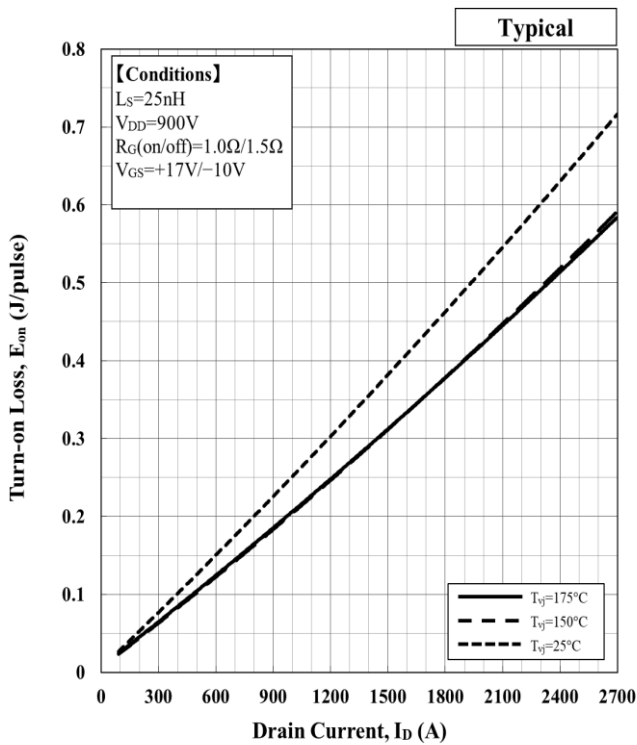
$V_{SD}[V] = a_3 \cdot I_s ^3 + a_2 \cdot I_s ^2 + a_1 \cdot I_s + a_0$					
Temp. [$^{\circ}\text{C}$]	V_{GS} [V]	a_3	a_2	a_1	a_0
150	17	4.37E-11	-1.89E-07	2.02E-03	-2.27E-02



$V_{SD}[V] = a_3 \cdot I_s ^3 + a_2 \cdot I_s ^2 + a_1 \cdot I_s + a_0$					
Temp. [$^{\circ}\text{C}$]	V_{GS} [V]	a_3	a_2	a_1	a_0
175	17	2.89E-11	-1.38E-07	2.22E-03	-1.05E-02

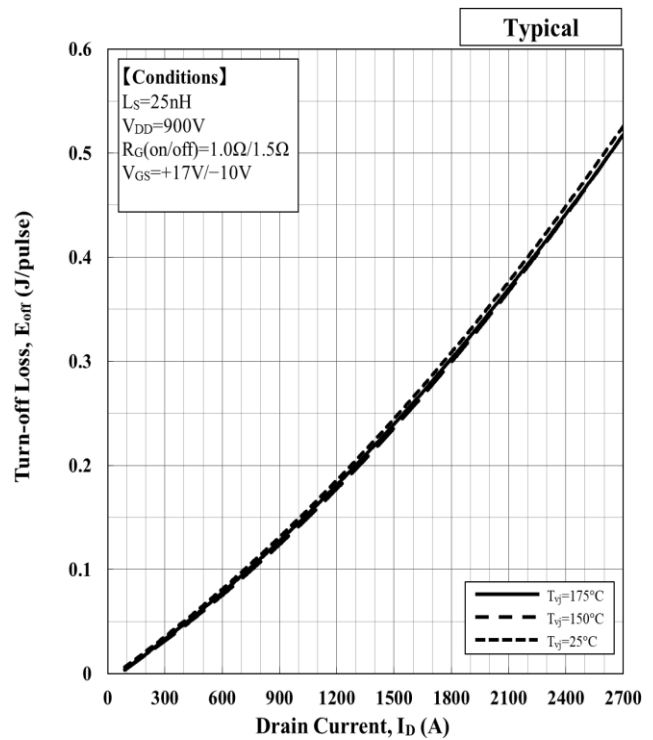
Source Current vs. Source - Drain Voltage

Source Current vs. Source - Drain Voltage



$E_{on} [J] = a_2 \cdot I_D ^2 + a_1 \cdot I_D + a_0$			
Temp. [$^{\circ}\text{C}$]	a_2	a_1	a_0
25	1.02E-08	2.36E-04	5.13E-03
150	1.10E-08	1.87E-04	6.13E-03
175	8.45E-09	1.91E-04	6.72E-03

Turn-on loss vs. Drain current

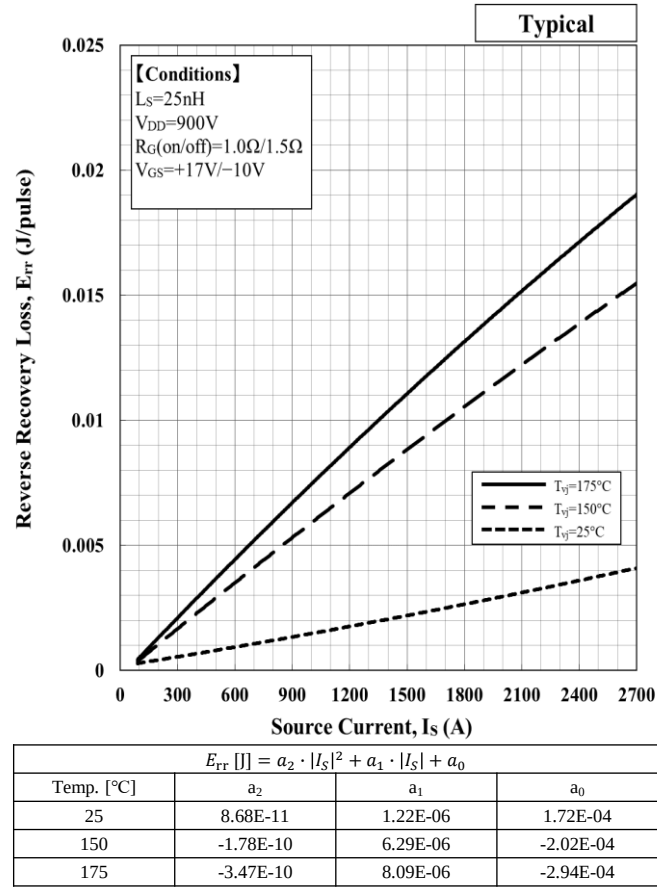


$E_{off} [J] = a_2 \cdot I_D ^2 + a_1 \cdot I_D + a_0$			
Temp. [$^{\circ}\text{C}$]	a_2	a_1	a_0
25	2.49E-08	1.30E-04	-5.56E-03
150	2.68E-08	1.22E-04	-7.70E-03
175	2.47E-08	1.28E-04	-7.68E-03

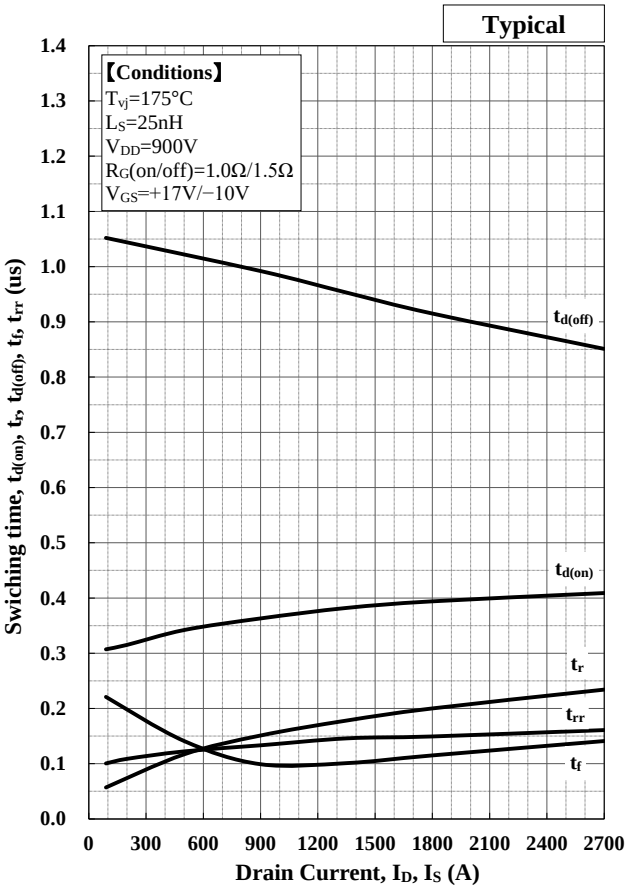
Turn-off loss vs. Drain current

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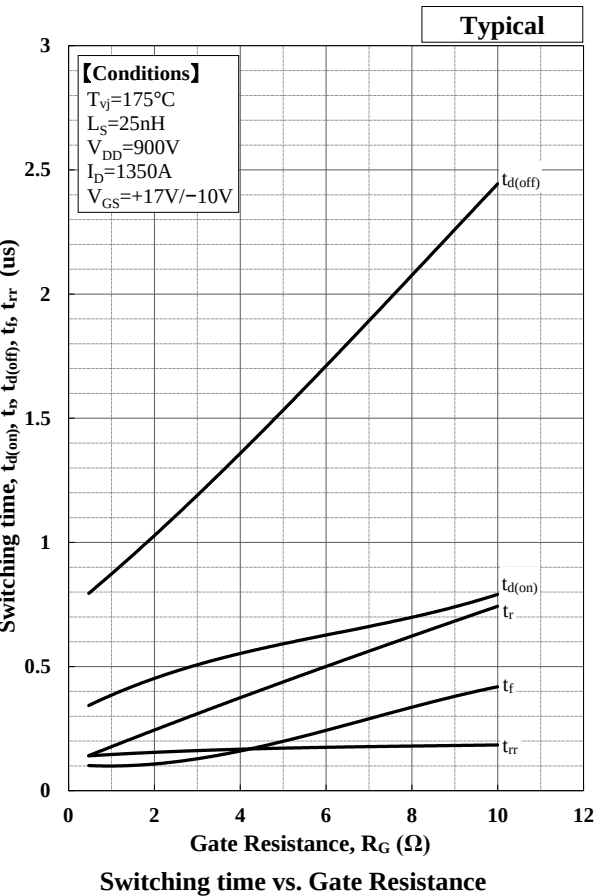
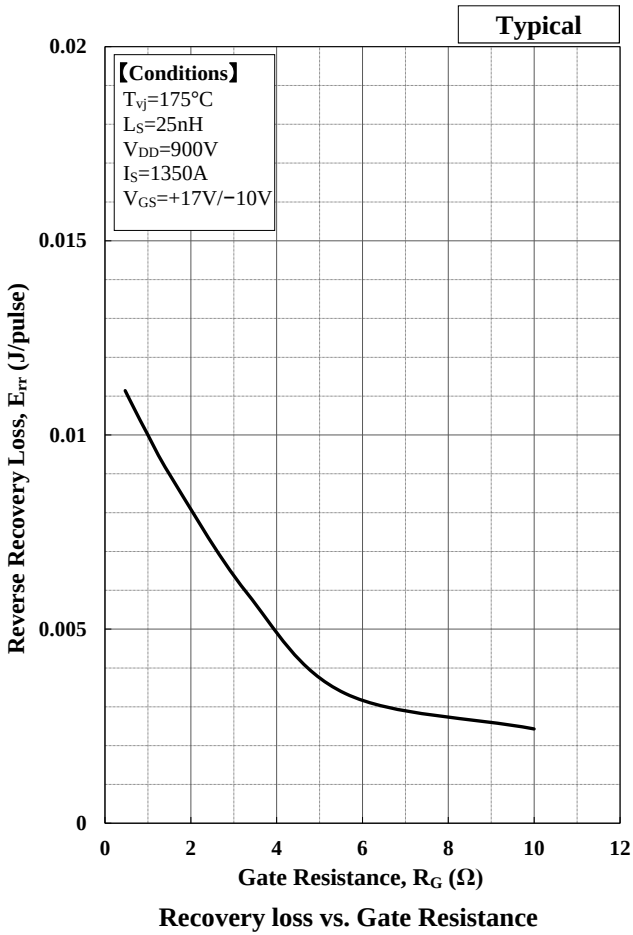
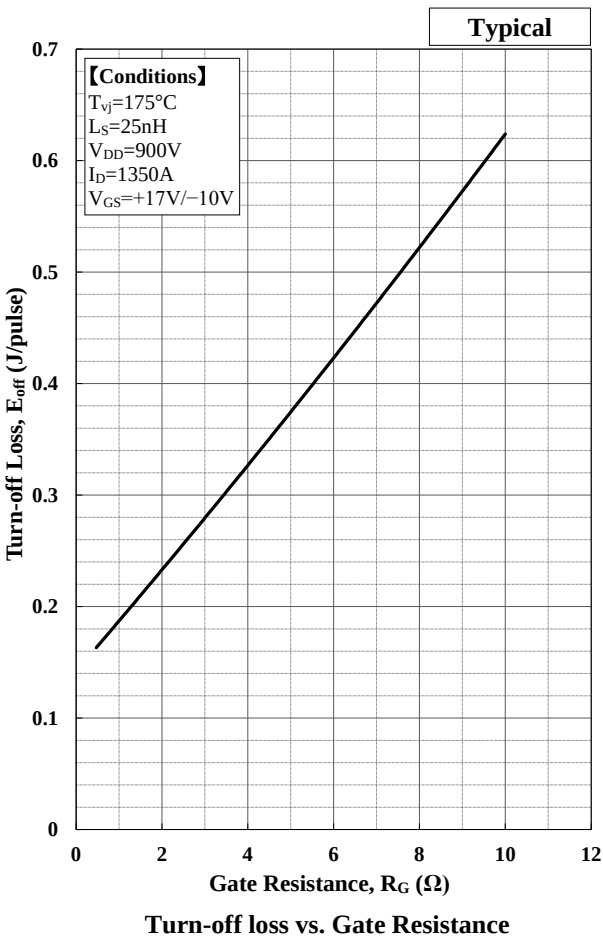
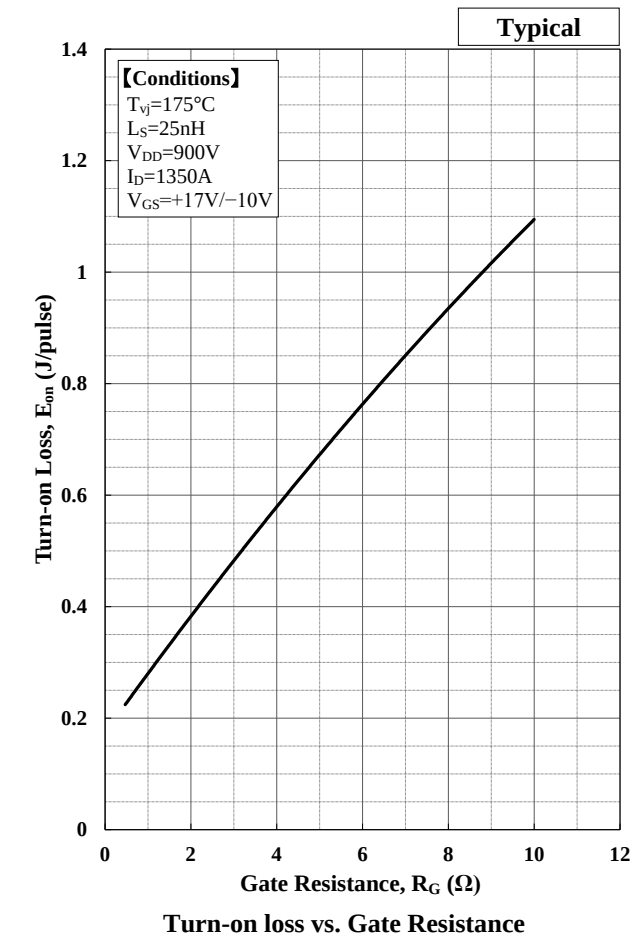
Recovery loss vs. Source current



Switching time vs. Drain Curre

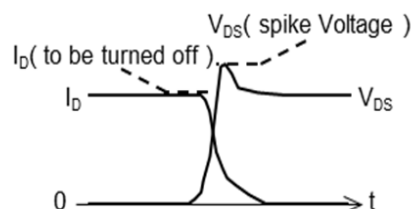
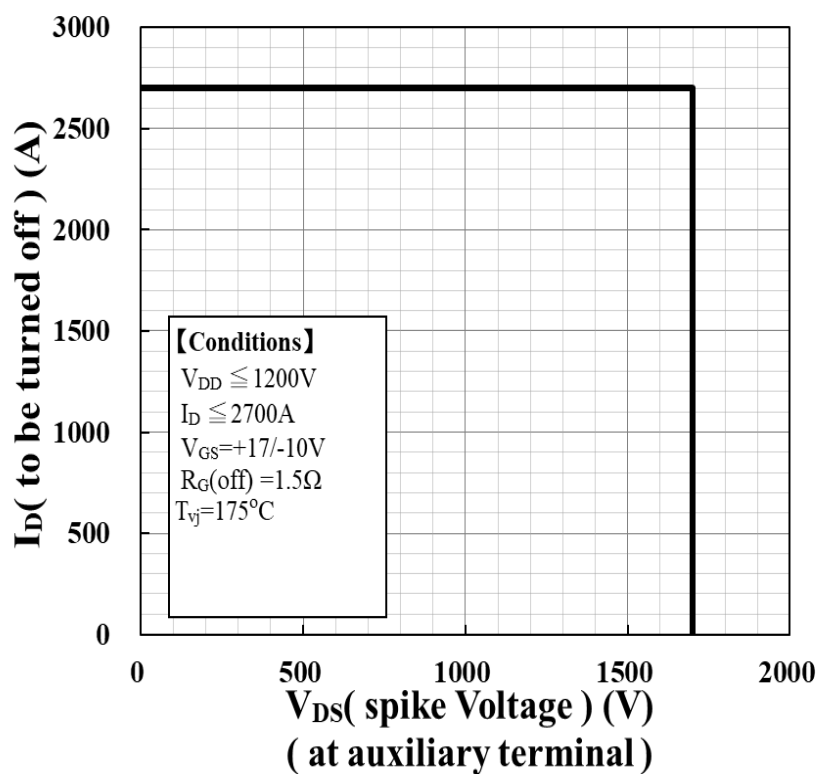
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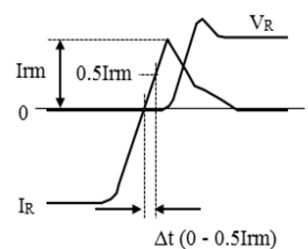
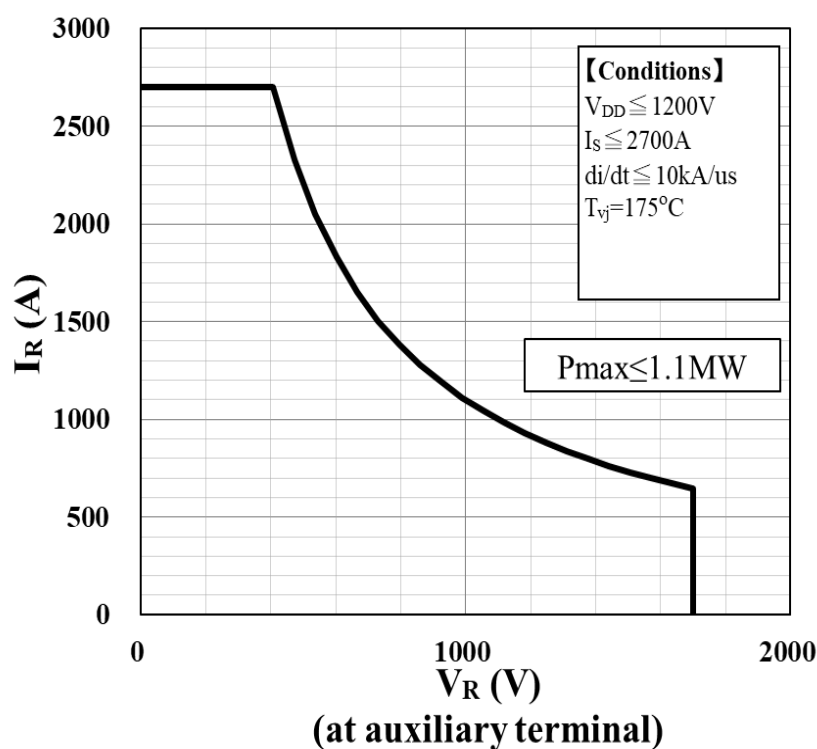
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Definition of RBSOA waveform

Reverse Bias Safe Operation Area (RBSOA)



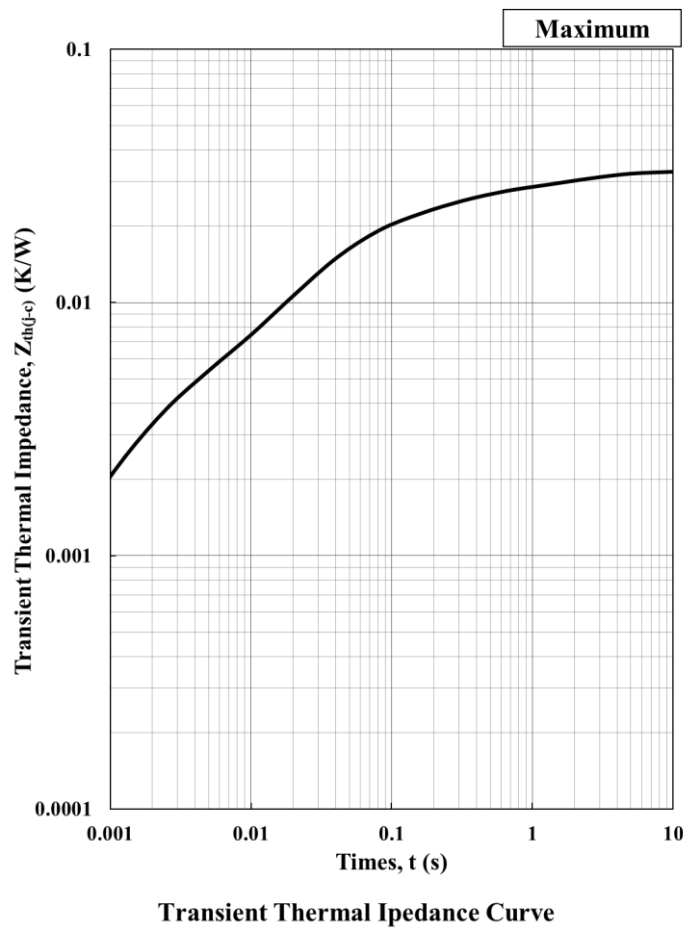
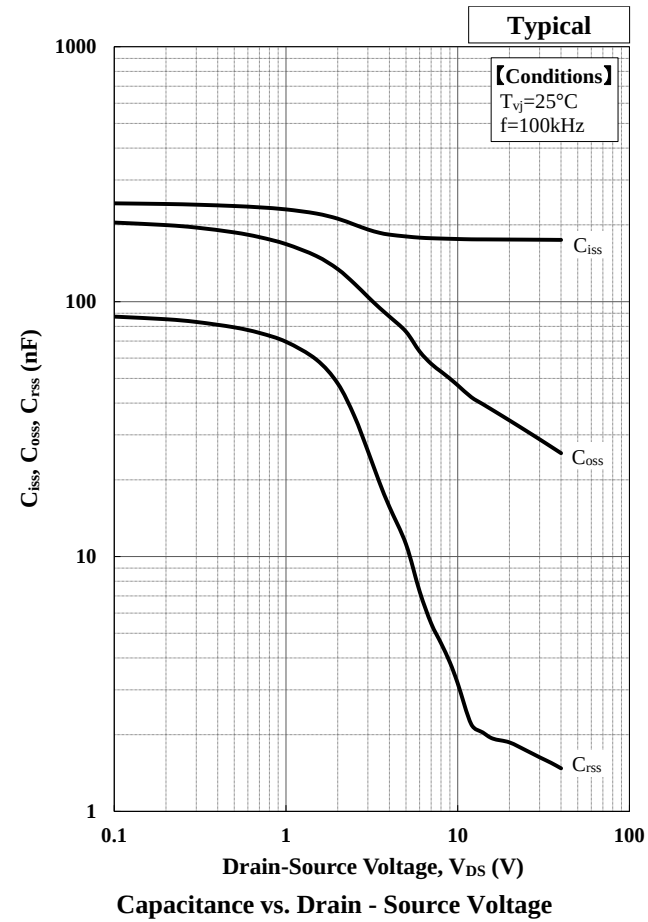
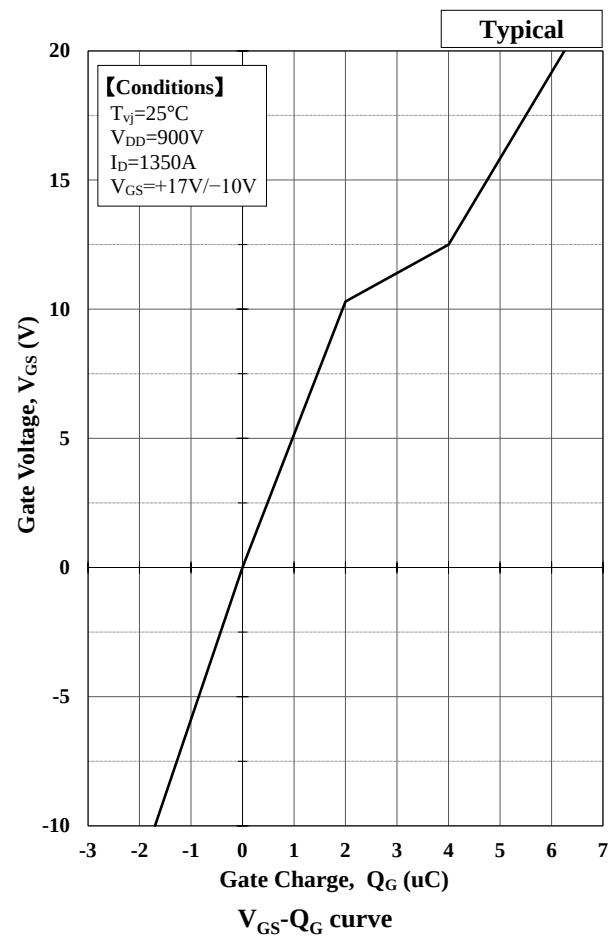
$$\frac{di}{dt} = \frac{0.5I_{rm}}{\Delta t}$$

Definition of Recovery di/dt

Reverse Recovery Safe Operation Area (RRSOA)

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Foster model lumped circuit constant

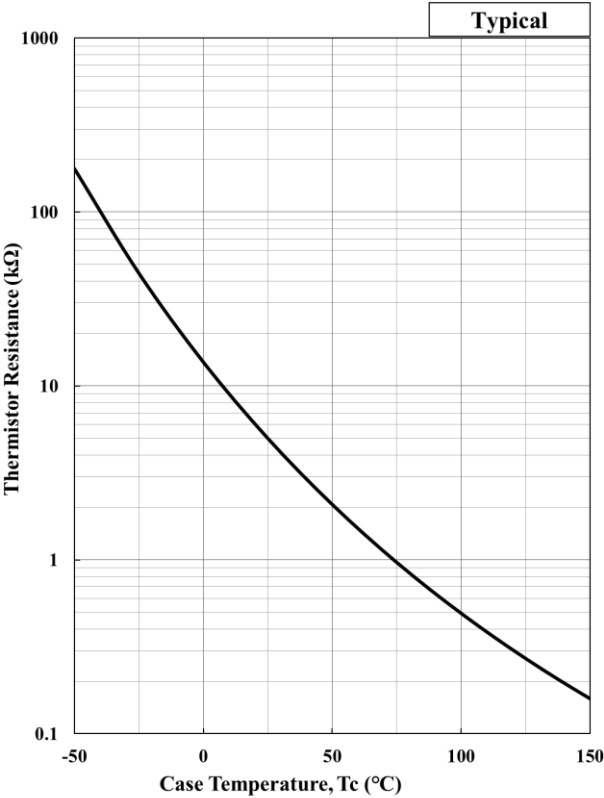
n	1	2	3	4
Rth, MOS [n]	6.87E-03	9.09E-03	1.38E-02	3.24E-03
Cth, MOS [n]	3.03E+02	2.18E+01	2.29E+00	4.65E-01

Cauer model lumped circuit constant

n	1	2	3	4
Rth, MOS [n]	4.81E-03	1.53E-02	7.45E-03	5.39E-03
Cth, MOS [n]	3.79E-01	1.87E+00	2.63E+01	3.55E+02

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Thermistor Resistance vs. Temperature

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Minebea POWER SEMICONDUCTORS

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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.
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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 MPSPD'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).
9. In this module, the maximum depth of the screw holes on the main terminals is 16mm. Using screws longer than 16mm will break the case.

■ 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

URL : <https://www.minebea-psd.com/en>

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