

31N65M5-VB TO247 Datasheet

N-Channel 650V(D-S) Super Junction Power MOSFET

PRODUCT SUMMARY

V_{DS} (V) at T_J max.	700	
$R_{DS(on)}$ at 25 °C (Ω)	$V_{GS} = 10$ V	0.06
Q_g max. (nC)	273	
Q_{gs} (nC)	46	
Q_{gd} (nC)	79	
Configuration	Single	

FEATURES

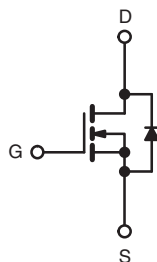
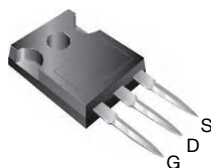
- Low figure-of-merit (FOM) $R_{on} \times Q_g$
- Low input capacitance (C_{iss})
- Reduced switching and conduction losses
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)


RoHS
 COMPLIANT

APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
 - High-intensity discharge (HID)
 - Fluorescent ballast lighting
- Industrial
 - Welding
 - Induction heating
 - Motor drives
 - Battery chargers
 - Renewable energy
 - Solar (PV inverters)

TO-247AC



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V _{DS}	650	V
Gate-Source Voltage			V _{GS}	± 30	
Continuous Drain Current (T _J = 150 °C)	V _{GS} at 10 V	T _C = 25 °C	I _D	47	A
		T _C = 100 °C		30	
Pulsed Drain Current ^a			I _{DM}	142	
Linear Derating Factor				3.3	W/°C
Single Pulse Avalanche Energy ^b			E _{AS}	1410	mJ
Maximum Power Dissipation			P _D	415	W
Operating Junction and Storage Temperature Range			T _J , T _{stg}	-55 to +150	°C
Drain-Source Voltage Slope	T _J = 125 °C		dV/dt	37	V/ns
Reverse Diode dV/dt ^d		9			
Soldering Recommendations (Peak Temperature) ^c	for 10 s			300	°C

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DS} = 50$ V, starting $T_J = 25$ °C, $L = 28.2$ mH, $R_g = 25$ Ω , $I_{AS} = 10$ A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, starting $T_J = 25$ °C.

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	40	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.3	

SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		650	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-	0.70	-	V/°C
Gate-Source Threshold Voltage (N)	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		2	-	4	V
Gate-Source Leakage	I _{GSS}	V _{GS} = ± 20 V		-	-	± 100	nA
		V _{GS} = ± 30 V		-	-	± 1	μA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 650 V, V _{GS} = 0 V		-	-	1	μA
		V _{DS} = 520 V, V _{GS} = 0 V, T _J = 125 °C		-	-	25	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 24 A	-	0.06	-	Ω
Forward Transconductance	g _{fs}	V _{DS} = 30 V, I _D = 24 A		-	16.7	-	S
Dynamic							
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 100 V, f = 1 MHz		-	5682	-	pF
Output Capacitance	C _{oss}			-	251	-	
Reverse Transfer Capacitance	C _{rss}			-	1	-	
Effective Output Capacitance, Energy Related ^a	C _{o(er)}	V _{DS} = 0 V to 520 V, V _{GS} = 0 V		-	192	-	pF
Effective Output Capacitance, Time Related ^b	C _{o(tr)}			-	665	-	
Total Gate Charge	Q _g	V _{GS} = 10 V	I _D = 24 A, V _{DS} = 520 V	-	182	273	nC
Gate-Source Charge	Q _{gs}			-	46	-	
Gate-Drain Charge	Q _{gd}			-	79	-	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 520 V, I _D = 6 A, V _{GS} = 10 V, R _g = 9.1 Ω		-	47	94	ns
Rise Time	t _r			-	87	131	
Turn-Off Delay Time	t _{d(off)}			-	156	234	
Fall Time	t _f			-	103	206	
Gate Input Resistance	R _g	f = 1 MHz, open drain		-	0.64	-	Ω
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	47	A
Pulsed Diode Forward Current	I _{SM}			-	-	139	
Diode Forward Voltage	V _{SD}	T _J = 25 °C, I _S = 24 A, V _{GS} = 0 V		-	0.9	1.2	V
Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = I _S = 24 A, di/dt = 100 A/μs, V _R = 25 V		-	753	1506	ns
Reverse Recovery Charge	Q _{rr}			-	14	28	μC
Reverse Recovery Current	I _{RRM}			-	28	-	A

Notes

- a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .
 b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

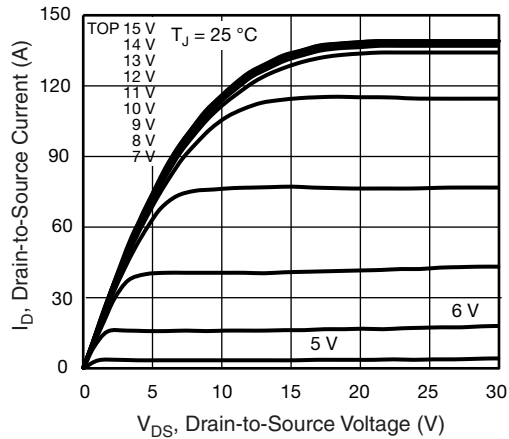


Fig. 1 - Typical Output Characteristics

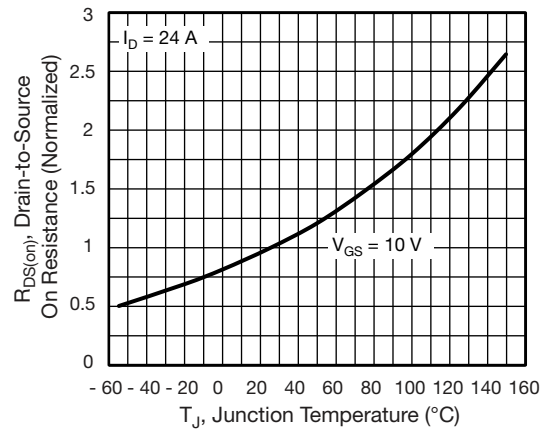


Fig. 4 - Normalized On-Resistance vs. Temperature

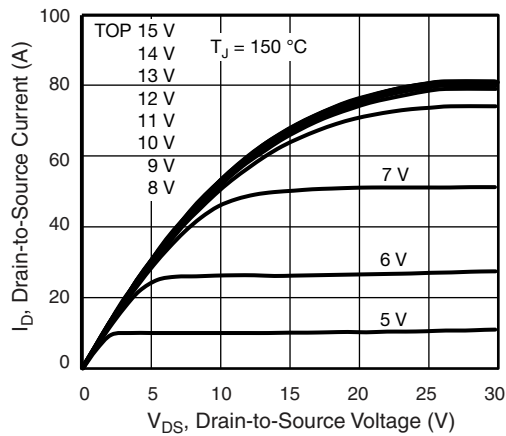


Fig. 2 - Typical Output Characteristics

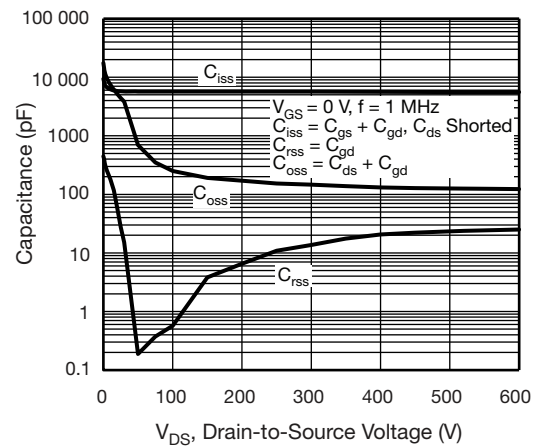


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

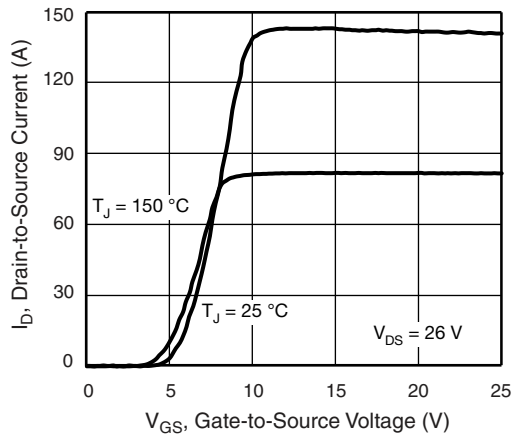


Fig. 3 - Typical Transfer Characteristics

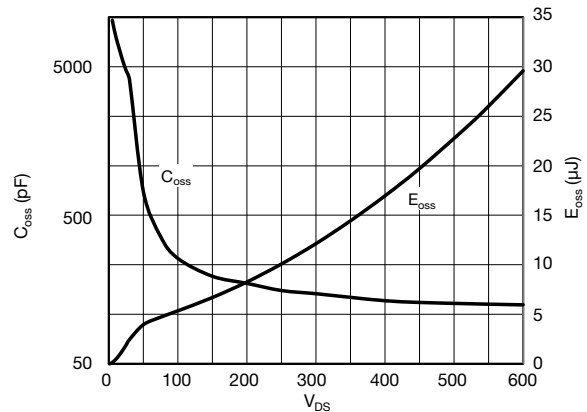


Fig. 6 - C_{oss} and E_{oss} vs. V_{DS}



Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage



Fig. 10 - Maximum Drain Current vs. Case Temperature

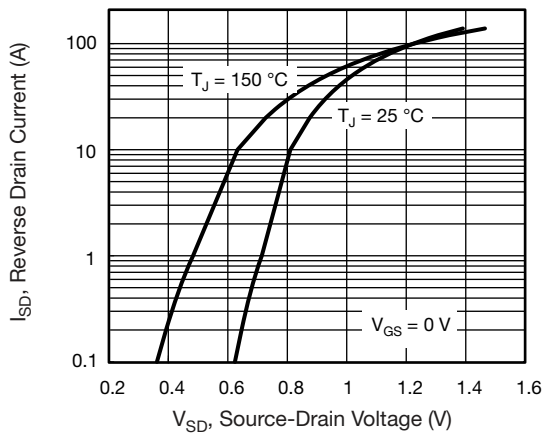


Fig. 8 - Typical Source-Drain Diode Forward Voltage

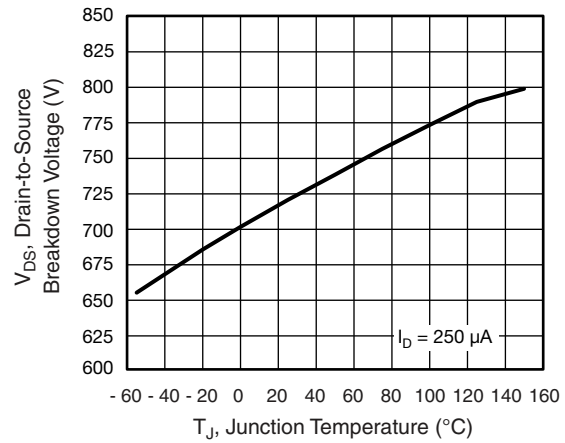


Fig. 11 - Temperature vs. Drain-to-Source Voltage



Fig. 9 - Maximum Safe Operating Area



Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case



Fig. 13 - Switching Time Test Circuit



Fig. 16 - Unclamped Inductive Waveforms



Fig. 14 - Switching Time Waveforms

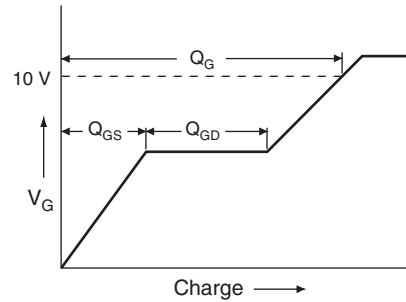


Fig. 17 - Basic Gate Charge Waveform

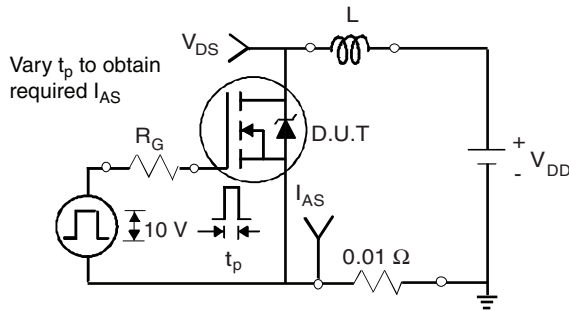
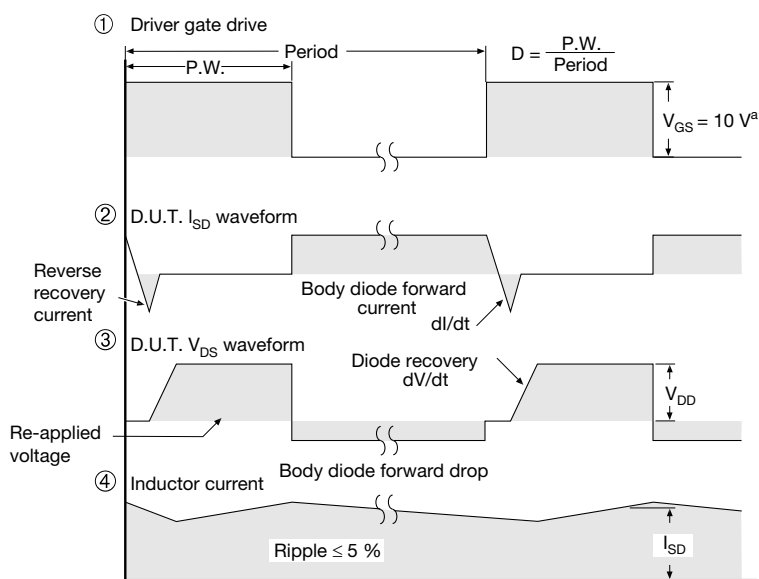
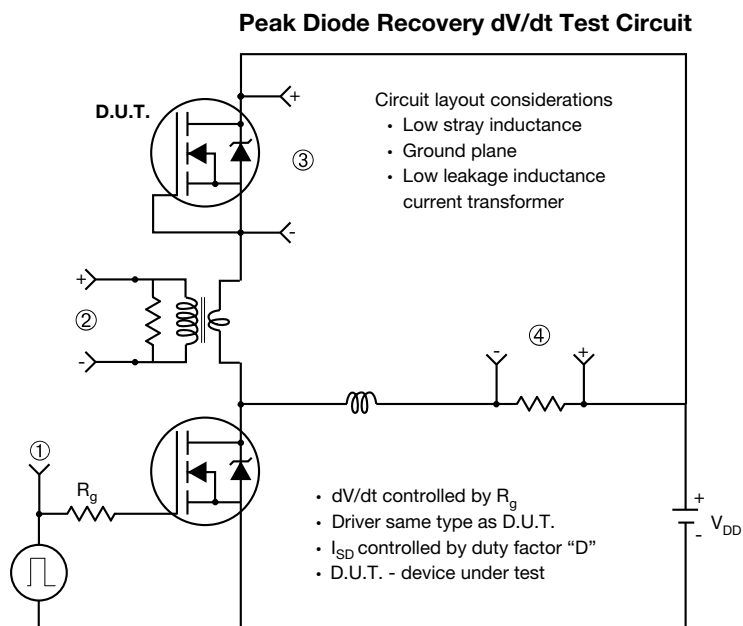


Fig. 15 - Unclamped Inductive Test Circuit



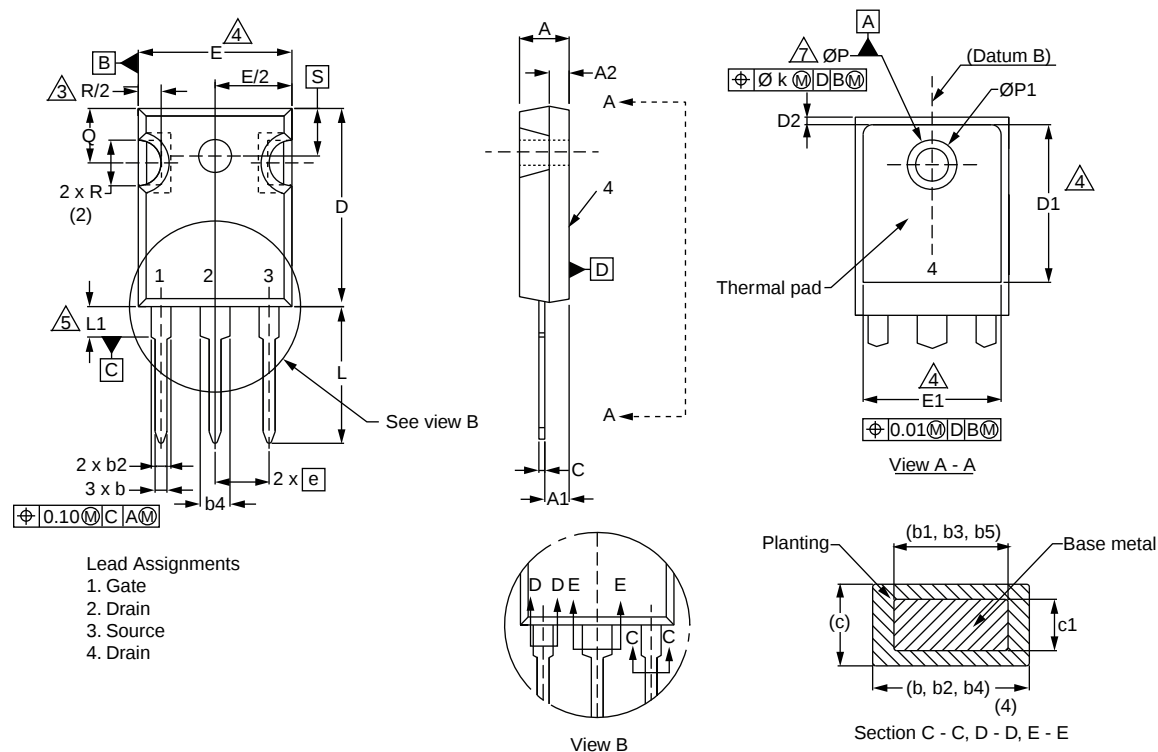
Fig. 18 - Gate Charge Test Circuit

**Note**

a. $V_{GS} = 5\text{ V}$ for logic level devices

Fig. 19 - For N-Channel

TO-247AC (High Voltage)



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.58	5.31	0.180	0.209
A1	2.21	2.59	0.087	0.102
A2	1.17	2.49	0.046	0.098
b	0.99	1.40	0.039	0.055
b1	0.99	1.35	0.039	0.053
b2	1.53	2.39	0.060	0.094
b3	1.65	2.37	0.065	0.093
b4	2.42	3.43	0.095	0.135
b5	2.59	3.38	0.102	0.133
c	0.38	0.86	0.015	0.034
c1	0.38	0.76	0.015	0.030
D	19.71	20.82	0.776	0.820
D1	13.08	-	0.515	-

DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
D2	0.51	1.30	0.020	0.051
E	15.29	15.87	0.602	0.625
E1	13.72	-	0.540	-
e	5.46 BSC		0.215 BSC	
Ø k	0.254		0.010	
L	14.20	16.25	0.559	0.640
L1	3.71	4.29	0.146	0.169
N	7.62 BSC		0.300 BSC	
Ø P	3.51	3.66	0.138	0.144
Ø P1	-	7.39	-	0.291
Q	5.31	5.69	0.209	0.224
R	4.52	5.49	0.178	0.216
S	5.51 BSC		0.217 BSC	

Disclaimer

All products due to improve reliability, function or design or for other reasons, product specifications and data are subject to change without notice.

Taiwan VBsemi Electronics Co., Ltd., branches, agents, employees, and all persons acting on its or their representatives (collectively, the "Taiwan VBsemi"), assumes no responsibility for any errors, inaccuracies or incomplete data contained in the table or any other any disclosure of any information related to the product.(www.VBsemi.com)

Taiwan VBsemi makes no guarantee, representation or warranty on the product for any particular purpose of any goods or continuous production. To the maximum extent permitted by applicable law on Taiwan VBsemi relinquished: (1) any application and all liability arising out of or use of any products; (2) any and all liability, including but not limited to special, consequential damages or incidental ; (3) any and all implied warranties, including a particular purpose, non-infringement and merchantability guarantee.

Statement on certain types of applications are based on knowledge of the product is often used in a typical application of the general product VBsemi Taiwan demand that the Taiwan VBsemi of. Statement on whether the product is suitable for a particular application is non-binding. It is the customer's responsibility to verify specific product features in the products described in the specification is appropriate for use in a particular application. Parameter data sheets and technical specifications can be provided may vary depending on the application and performance over time. All operating parameters, including typical parameters must be made by customer's technical experts validated for each customer application. Product specifications do not expand or modify Taiwan VBsemi purchasing terms and conditions, including but not limited to warranty herein.

Unless expressly stated in writing, Taiwan VBsemi products are not intended for use in medical, life saving, or life sustaining applications or any other application. Wherein VBsemi product failure could lead to personal injury or death, use or sale of products used in Taiwan VBsemi such applications using client did not express their own risk. Contact your authorized Taiwan VBsemi people who are related to product design applications and other terms and conditions in writing.

The information provided in this document and the company's products without a license, express or implied, by estoppel or otherwise, to any intellectual property rights granted to the VBsemi act or document. Product names and trademarks referred to herein are trademarks of their respective representatives will be all.

Material Category Policy

Taiwan VBsemi Electronics Co., Ltd., hereby certify that all of the products are determined to be oHS compliant and meets the definition of restrictions under Directive of the European Parliament 2011/65 / EU, 2011 Nian. 6. 8 Ri Yue restrict the use of certain hazardous substances in electrical and electronic equipment (EEE) - modification, unless otherwise specified as inconsistent.(www.VBsemi.com)

Please note that some documents may still refer to Taiwan VBsemi RoHS Directive 2002/95 / EC. We confirm that all products identified as consistent with the Directive 2002/95 / EC European Directive 2011/65 /.

Taiwan VBsemi Electronics Co., Ltd. hereby certify that all of its products comply identified as halogen-free halogen-free standards required by the JEDEC JS709A. Please note that some Taiwanese VBsemi documents still refer to the definition of IEC 61249-2-21, and we are sure that all products conform to confirm compliance with IEC 61249-2-21 standard level JS709A.