Nch 600V 24A Power MOSFET

V _{DSS}	600V
R _{DS(on)} (Max.)	0.165Ω
I _D	±24A
P_D	245W

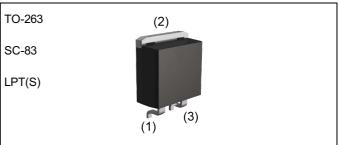
Features

- 1) Low on-resistance.
- 2) Fast switching speed.
- 3) Gate-source voltage (V_{GSS}) guaranteed to be ±20V.
- 4) Drive circuits can be simple.
- 5) Parallel use is easy.
- 6) Pb-free lead plating; RoHS compliant

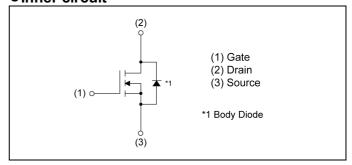
Application

Switching

Outline



•Inner circuit



Packaging specifications

•	Packing	Embossed Tape
	Reel size (mm)	330
Туре	Tape width (mm)	24
, , , , , , , , , , , , , , , , , , ,	Basic ordering unit (pcs)	1000
	Taping code	TL
	Marking	R6024ENJ

● **Absolute maximum ratings** (T_a = 25°C ,unless otherwise specified)

Parameter	Symbol	Value	Unit	
Drain - Source voltage		V_{DSS}	600	V
Continuous dusin summent	T _C = 25°C	I _D *1	±24	Α
Continuous drain current	T _C = 100°C	I _D *1	±13.0	Α
Pulsed drain current		I _{DP} *2	±72	Α
Cata Cauraa valtaga	static	V	±20	V
Gate - Source voltage	AC(f>1Hz)	V_{GSS}	±30	V
Avalanche current, repetitive	·	I _{AR}	4.1	А
Avalanche energy, single pulse		E _{AS} *3	497	mJ
Avalanche energy, repetitive		E _{AR} *3	0.75	mJ
Power dissipation (T _C = 25°C)	P _D *4	245	W	
Junction temperature	T _j	150	°C	
Operating junction and storage ter	nperature range	T _{stg}	-55 ~ +150	°C

● **Absolute maximum ratings** (T_a = 25°C)

Parameter	Symbol	Conditions	Values	Unit
Reverse diode dv/dt	dv/dt	-	15	V/ns
Drain - Source voltage slope	dv/dt	V _{DS} = 480V, T _j = 25°C	50	V/ns

●Thermal resistance

Doromotor	Cumb of	Values			Lleit
Parameter	Symbol	Min.	Тур.	Max.	Unit
Thermal resistance, junction - case	R _{thJC}	-	-	0.51	°C/W
Thermal resistance, junction - ambient	R _{thJA} *5	-	-	80	°C/W
Soldering temperature, wavesoldering for 10s	T _{sold}	1	-	265	°C

● Electrical characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit	
r al al lie te l	Symbol	Conditions	Min.	Тур.	Max.	Orill	
Drain - Source breakdown voltage	V _{(BR)DSS}	$V_{GS} = 0V$, $I_D = 1mA$	600	-	-	V	
		V _{DS} = 600V, V _{GS} = 0V					
Zero gate voltage drain current	I _{DSS}	T _j = 25°C	-	0.1	100	μΑ	
		T _j = 125°C	-	-	1000		
Gate - Source leakage current	I _{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	±100	nA	
Gate threshold voltage	$V_{GS(th)}$	V _{DS} = 10V, I _D = 1mA	2	-	4	V	
		V _{GS} = 10V, I _D = 11.3A					
Static drain - source on - state resistance	R _{DS(on)} *6	T _j = 25°C	-	0.150	0.165	Ω	
on state regionality		T _j = 125°C	-	0.320	-		
Gate resistance	R _G	f =1MHz, open drain	-	6.1	-	Ω	

● Electrical characteristics (T_a = 25°C)

Davanatav	Corrects and	Conditions	Values			Linit
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Unit
Forward Transfer Admittance	Y _{fs} *6	V _{DS} = 10V, I _D = 12A	6.5	13.0	-	S
Input capacitance	C _{iss}	V _{GS} = 0V	-	1650	-	
Output capacitance	C _{oss}	V _{DS} = 25V	-	1350	-	pF
Reverse transfer capacitance	C _{rss}	f = 1MHz	-	160	-	
Effective output capacitance, energy related	C _{o(er)}	V _{GS} = 0V	-	66	-	
Effective output capacitance, time related	C _{o(tr)}	V _{DS} = 0V to 480V	-	314	-	pF
Turn - on delay time	t _{d(on)} *6	V _{DD} ≃ 300V,V _{GS} = 10V	-	35	-	
Rise time	t _r *6	I _D = 12A	-	50	-	
Turn - off delay time	t _{d(off)} *6	R _L ≃ 27.4Ω	-	180	-	ns
Fall time	t _f *6	$R_G = 10\Omega$	-	50	-	

● Gate charge characteristics (T_a = 25°C)

Doromotor	Cymbol	Conditions	Values			Unit
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Offic
Total gate charge	Q _g *6	V _{DD} ≈ 300V,	1	70	-	
Gate - Source charge	Q _{gs} *6	I _D = 24A,	-	10	-	nC
Gate - Drain charge	Q _{gd} *6	V _{GS} = 10V	-	35	-	
Gate plateau voltage	V _(plateau)	V _{DD} = 300V, I _D = 24A	-	6.4	-	V

^{*1} Limited only by maximum channel temperature allowed.

^{*2} Pw ≤ 10µs, Duty cycle ≤ 1%

^{*3} L \doteqdot 70mH, V_{DD}=50V, R_G=25 Ω , STARTING T_i=25 $^{\circ}$ C

^{*4} T_C=25°C

^{*5} Mounted on a epoxy PCB FR4 (25mm x 27mm x 0.8mm)

^{*6} Pulsed

● Body diode electrical characteristics (Source-Drain) (T_a = 25°C)

Darameter	Symbol	Conditions			Values		
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Unit	
Continuous forward current	I _S *1	T _c = 25°C	1	-	24	А	
Pulse forward current	I _{SP} *2	1 _c - 25 C	-	-	72	А	
Forward voltage	V _{SD} *6	V _{GS} = 0V, I _S = 24A	-	-	1.5	V	
Reverse recovery time	t _{rr} *6		-	625	-	ns	
Reverse recovery charge	Q _{rr} *6	I _S = 24A, V _{GS} =0V di/dt = 100A/µs	1	13.3	1	μC	
Peak reverse recovery current	I _{mm} *6	α,, ατ 100, τρο	-	42	-	Α	

● Typical Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
R _{th1}	0.0578		C _{th1}	0.00248	
R _{th2}	0.218	K/W	C _{th2}	0.00916	Ws/K
R _{th3}	0.604		C _{th3}	0.209	

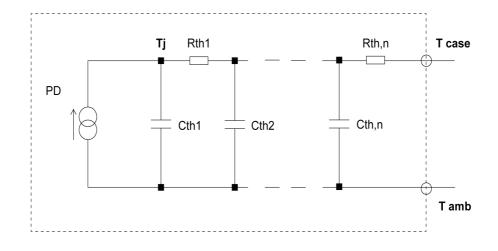


Fig.1 Power Dissipation Derating Curve

120

100

80

60

40

20

0 50 100 150 200

Junction Temperature : T_i [°C]

Fig.2 Normalized Transient Thermal Resistance vs. Pulse Width

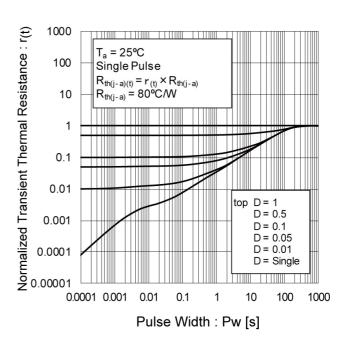


Fig.3 Avalanche Energy Derating
Curve vs. Junction Temperature

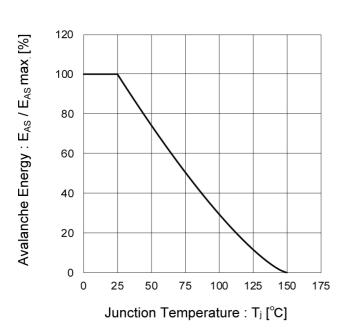
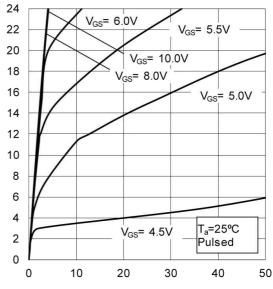


Fig.4 Typical Output Characteristics(I)

12 V_{GS}= 10.0V V_{GS}= 8.0V 10 V_{GS}= 6.0V Drain Current : I_D [A] V_{GS}= 5.5V 8 V_{GS}= 5.0V 6 4 V_{GS}= 4.5V 2 T_a=25℃ Pulsed 0 2 3 Drain - Source Voltage: V_{DS}[V]

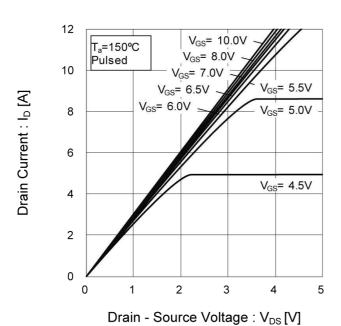
Fig.5 Typical Output Characteristics(II)



Drain Current : I_D [A]

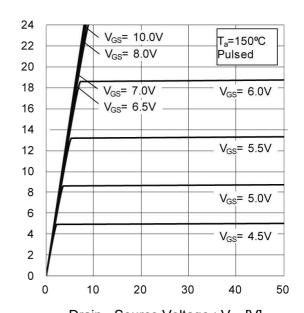
Drain - Source Voltage : V_{DS} [V]

Fig.6 Tj = 150°C Typical Output Characteristics (I)



Drain Current : I_D [A]

Fig.7 Tj = 150°C Typical Output Characteristics (II)



Drain - Source Voltage : $V_{DS}[V]$

Fig.8 Breakdown Voltage vs.

Junction Temperature

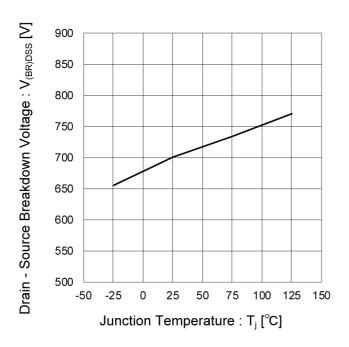


Fig.9 Typical Transfer Characteristics

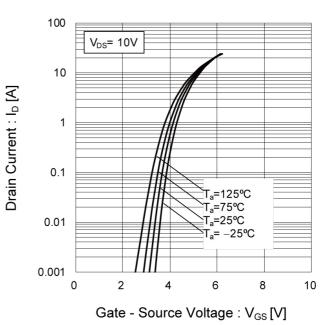


Fig.10 Gate Threshold Voltage vs. Junction Temperature

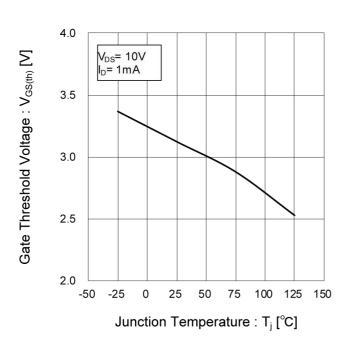


Fig.11 Forward Transfer Admittance vs.
Drain Current

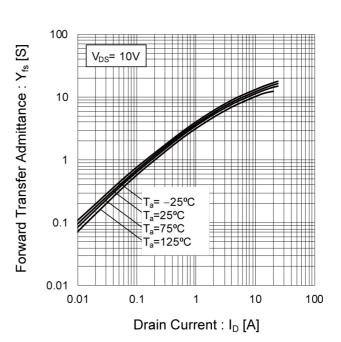


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

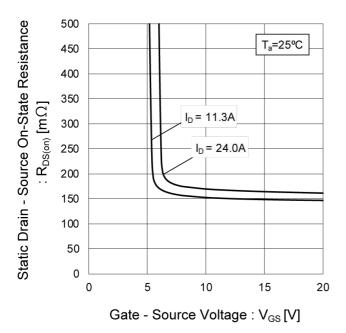


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature

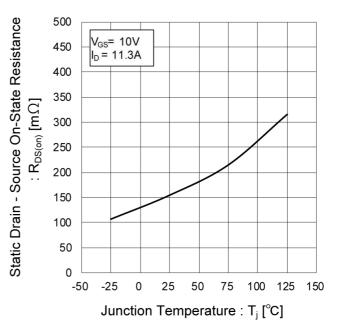


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current(I)

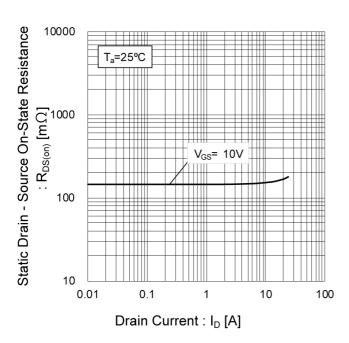


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

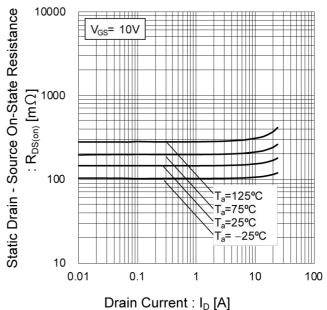


Fig.16 Typical Capacitance vs.

Drain - Source Voltage

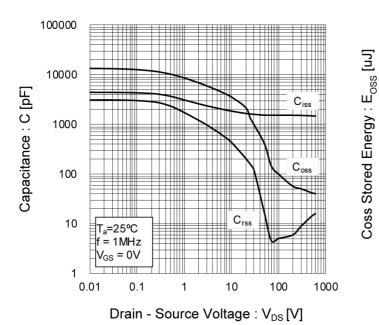


Fig.17 Coss Stored Energy

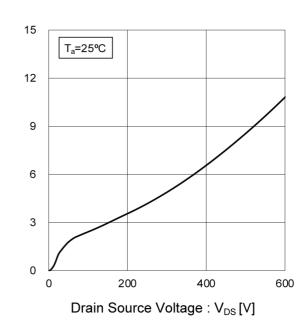


Fig.18 Switching Characteristics

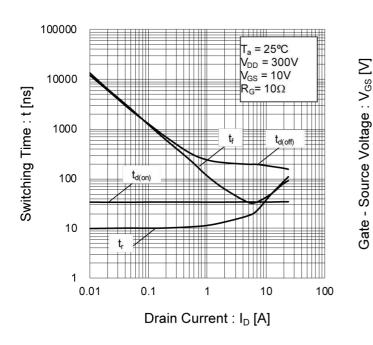
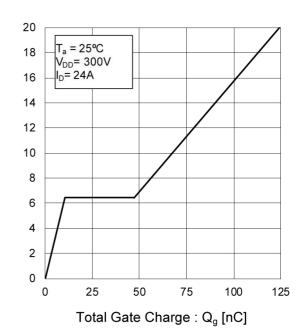
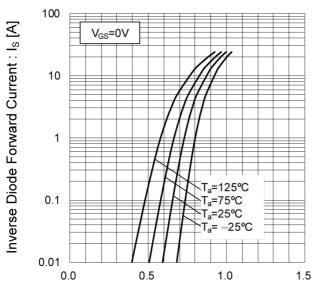


Fig.19 Dynamic Input Characteristics



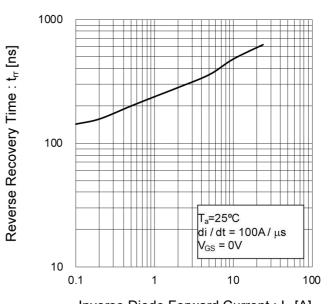
R6024ENJ

Fig.20 Inverse Diode Forward Current vs. Source - Drain Voltage



Source - Drain Voltage : V_{SD} [V]

Fig.21 Reverse Recovery Time vs.
Inverse Diode Forward Current



Inverse Diode Forward Current : I_S [A]

Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

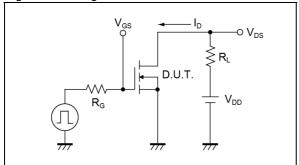


Fig.2-1 Gate Charge Measurement Circuit

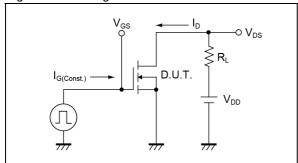


Fig.3-1 Avalanche Measurement Circuit

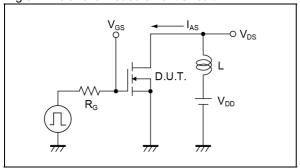


Fig.4-1 dv/dt Measurement Circuit

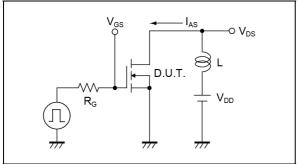


Fig.5-1 dv/dt Measurement Circuit

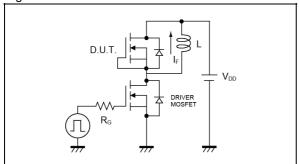


Fig.1-2 Switching Waveforms

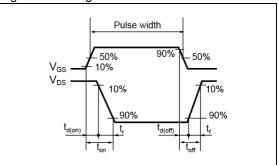


Fig.2-2 Gate Charge Waveform

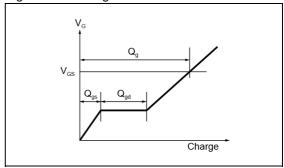


Fig.3-2 Avalanche Waveform

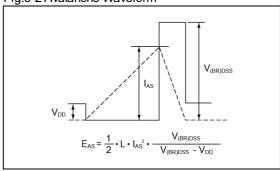


Fig.4-2 dv/dt Waveform

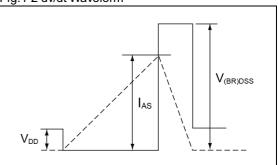
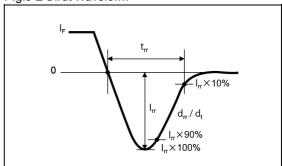
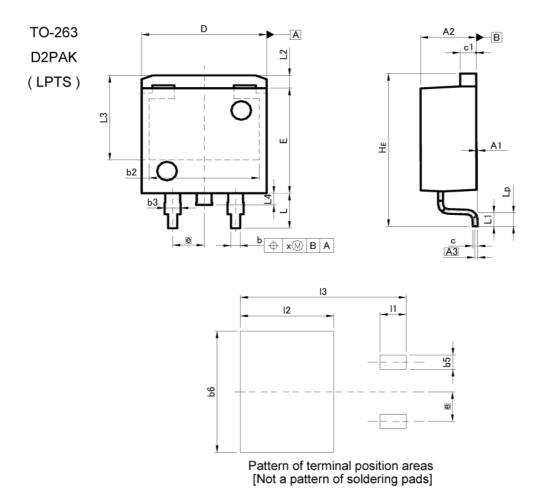


Fig.5-2 dv/dt Waveform

11/12



Dimensions



DIM -	MILIMETERS		INC	HES	
DIM L	MIN	MAX	MIN	MAX	
A1	0.00	0.30	0.000	0.012	
A2	4.30	4.70	0.169	0.185	
A3	0	25	0.0	10	
b	0.68	0.98	0.027	0.039	
b2	8.9	90	0.3	50	
b3	1.14	1.44	0.045	0.057	
С	0.30	0.60	0.012	0.024	
c1	1.10	1.50	0.043	0.059	
D	9.80	10,40	0.386	0,409	
E	8.80	9.20	0.346	0.362	
е	2.	54	0.1	00	
HE	12.80	13.40	0.504	0.528	
L	2.70	3.30	0.106	0.130	
L1	1.	20	0.0	047	
L2	1.	1.10		43	
L3	7.25		0.2	85	
L4	1.0	00	0.0	39	
Lp	0.90	1.50	0.035	0.059	
X	=	0.25	_	0.010	

 DIM
 MILIMETERS
 INCHES

 MIN
 MAX
 MIN
 MAX

 b5
 1,23
 0,049

 b6
 10,40
 0,409

 11
 2,10
 0,083

 12
 7,55
 0,297

 13
 13,40
 0,528

Dimension in mm/inches



Notice

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1. Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

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JÁPAN	USA	EU	CHINA
CLASSⅢ	ОГУООШ	CLASS II b	CL ACCIII
CLASSIV	CLASSⅢ	CLASSⅢ	CLASSⅢ

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 - [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂
 - [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
 - [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
 - [f] Sealing or coating our Products with resin or other coating materials
 - [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
 - [h] Use of the Products in places subject to dew condensation
- 4. The Products are not subject to radiation-proof design.
- 5. Please verify and confirm characteristics of the final or mounted products in using the Products.
- 6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
- 7. De-rate Power Dissipation depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction temperature.
- 8. Confirm that operation temperature is within the specified range described in the product specification.
- 9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

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- 1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.
- 2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

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- 1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.
- 2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of lonizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

- 1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
 - [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
 - [b] the temperature or humidity exceeds those recommended by ROHM
 - [c] the Products are exposed to direct sunshine or condensation
 - [d] the Products are exposed to high Electrostatic
- 2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.
- 3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.
- 4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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