650V Enhancement mode GaN HEMT

GNP3120TEC-Z

EcoGaN™

Features

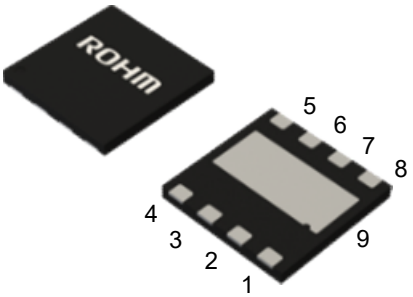
- 650V E-mode GaN HEMT
- 120mΩ Resistance
- 2.1nC Gate Charge
- HBM ESD Class 1C (JEDEC standard)

Package Information

W (Typ) × D (Typ) × H (Max)

8.0mm × 8.0mm × 1.0mm

DFN8080CK



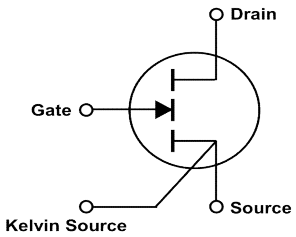
Application

- High Switching Frequency Converter
- High Density Converter

Key Performance Parameters

Symbol	Values	Unit
$V_{DS,max}$	650	V
I_D	16	A
$I_{D,pulse}$	31	A
$R_{DS(on),typ}$	120	mΩ
Q_g	2.1	nC
Q_{oss} @400V	20	nC
Q_{rr}	0	nC

Gate	8
Kelvin Source	7
Drain	1,2,3,4
Source	5,6,9



Ordering Information

Ordering Code	Package	Ordering Unit (pcs)	Marking
GNP3120TEC-ZE2	DFN8080CK	3,500	GNP3120TEC

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Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Drain to Source Voltage Continuous	V_{DSS}	650	V	-
Transient Drain to Source Voltage *1	$V_{DS(transient)}$	800	V	-
Gate to Source Voltage	V_{GSS}	-5 to +7	V	-
Transient Gate to Source Voltage *2	$V_{GS(transient)}$	8.5	V	-
Continuous Drain Current *3	I_D	16	A	T_c = 25°C
		7		T_c = 125°C
Pulse Drain Current *3*4	$I_{D,pulse}$	31	A	T_c = 25°C
		14		T_c = 125°C
Power Dissipation	P_{tot}	86	W	T_c = 25°C
Operation Temperature	T_j	-55 to +150	°C	-
Range of Storage Temperature	T_{stg}	-55 to +150	°C	-

*1 t_{pulse}=1μs, <10 hrs of total time.

*2 $t_{pulse<}$20ns, <0.5 hrs of total time

*3 Limited and calculated by maximum temperature allowed.

*4 V_{GS}=6V,Duty=0.1, t_{pulse}=1μs.

Please note especially when using driver source
that $V_{GSS_}$surge must be in the range of absolute maximum rating.

Thermal Resistance

Parameter	Symbol	Values			Unit	Conditions
		Min	Typ	Max		
Thermal Resistance, Junction to Ambient	R_{thJA}	-	-	42.8	°C/W	Device on JEDEC Standard Board for Thermal Resistance
Thermal Resistance, Junction to Case	R_{thJC}	-	1.45	1.88	°C/W	-
Reflow Soldering Temperature	T_{solder}	-	-	260	°C	MSL 3

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Static Characteristic (T_j = 25°C)

Parameter	Symbol	Values			Unit	Conditions
		Min	Typ	Max		
Gate Threshold Voltage	$V_{GS(th)}$	1.0	1.7	2.5	V	V_{DS} = 60mV, I_D = 4.6mA
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	650	-	-	V	V_{GS} = 0V, T_j = 25°C
Zero Gate Voltage Drain Current	I_{DSS}	-	0.4	40	μA	V_{GS} = 0V V_{DS} = 650V T_j = 25°C
		-	8.0	-		V_{GS} = 0V V_{DS} = 650V T_j = 150°C
Gate to Source Leakage Current	I_{GSS}	-	0.4	4.0	mA	V_{GS} = 7.0V, V_{DS} = 0V
Static Drain to Source On State Resistance	$R_{DS(on)}$	-	125	175	mΩ	V_{GS} = 5.0V I_D = 6A T_j = 25°C
		-	263	-		V_{GS} = 5.0V I_D = 6A T_j = 150°C
		-	120	168		V_{GS} = 6.0V I_D = 6A T_j = 25°C
		-	252	-		V_{GS} = 6.0V I_D = 6A T_j = 150°C
Gate Input Resistance	R_G	-	1.39	-	Ω	f = 100MHz, Open Drain

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Dynamic Characteristics （T_j = 25°C）

Parameter	Symbol	Values			Unit	Conditions
		Min	Typ	Max		
Input Capacitance	C_{iss}	-	102	-	pF	V_{GS} = 0V
Output Capacitance	C_{oss}	-	24	-		V_{DS} = 400V
Reverse Transfer Capacitance	C_{rss}	-	0.4	-		f = 1MHz
Effective Output Capacitance, Energy Related	$C_{o(er)}$	-	35	-	pF	V_{GS} = 0V, V_{DS} = 0V to 400V
Effective Output Capacitance, Time Related	$C_{o(tr)}$	-	49	-		V_{GS} = 0V, V_{DS} = 0V to 400V
Output Charge	Q_{oss}	-	20	-	nC	V_{GS} = 0V, V_{DS} = 0V to 400V
Turn - On Delay Time	$t_{d(on)}$	-	4.3	-	ns	V_{DS} = 400V
Rise Time	t_r	-	5.3	-		I_D = 4A
Turn - Off Delay Time	$t_{d(off)}$	-	6.1	-		V_{GS} = 7V / -1.5V
Fall Time	t_f	-	8.6	-		$R_{g(on)}$ = 10Ω, $R_{g(off)}$ = 2Ω
Total Gate Charge	Q_g	-	2.1	-	nC	V_{DS} = 400V
Gate to Source Charge	Q_{gs}	-	0.2	-		I_D = 4A
Gate to Drain Charge	Q_{gd}		0.3	-		V_{GS} = 6V / 0V
Gate Plateau Voltage	V_{plat}	-	2.1	-	V	

Reverse Conduction Electrical Characteristics （T_j = 25°C）

Parameter	Symbol	Values			Unit	Conditions
		Min	Typ	Max		
Source to Drain Reverse Voltage	V_{SD}	-	2.8	-	V	V_{GS} = 0V, I_{SD} = 6A
Reverse Recovery Time	t_{rr}	-	0	-	ns	
Reverse Recovery Charge	Q_{rr}	-	0	-	nC	
Peak Reverse Recovery Current	I_{rrm}	-	0	-	A	

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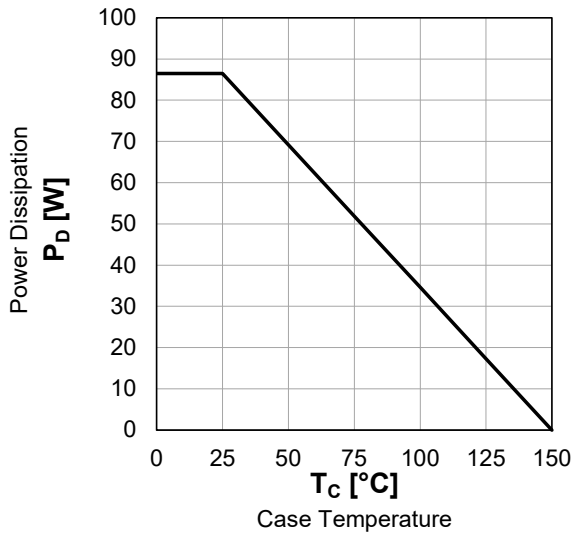
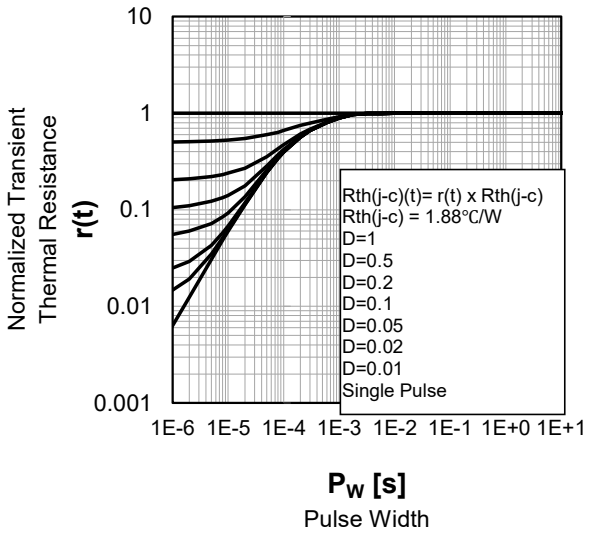
Electrical Characteristic Curves

Fig.1 Power Dissipation Derating Curve



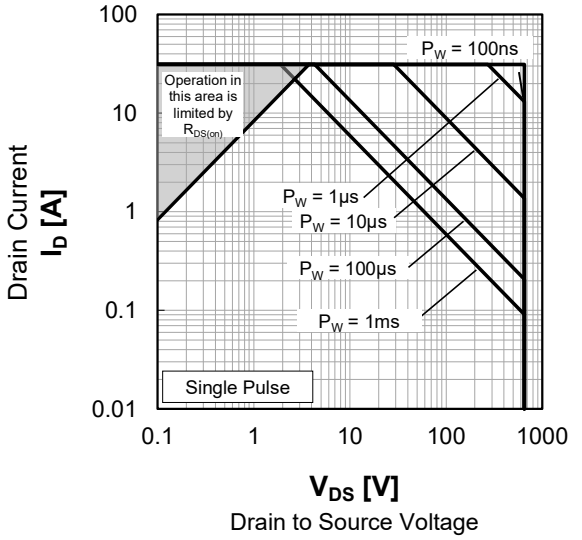
$P_D = f(T_c)$

Fig.2 Normalized Transient Thermal Resistance vs. Pulse Width



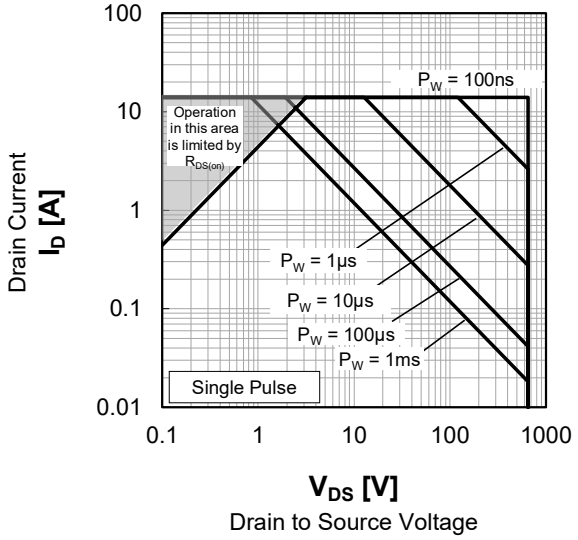
$r(t) = f(P_W, D)$; $T_c = 25°C$

Fig.3 Max. Safe Operating Area



$I_D = f(V_{DS}, P_W)$; $T_c = 25°C$

Fig.4 Max. Safe Operating Area



$I_D = f(V_{DS}, P_W)$; $T_c = 125°C$

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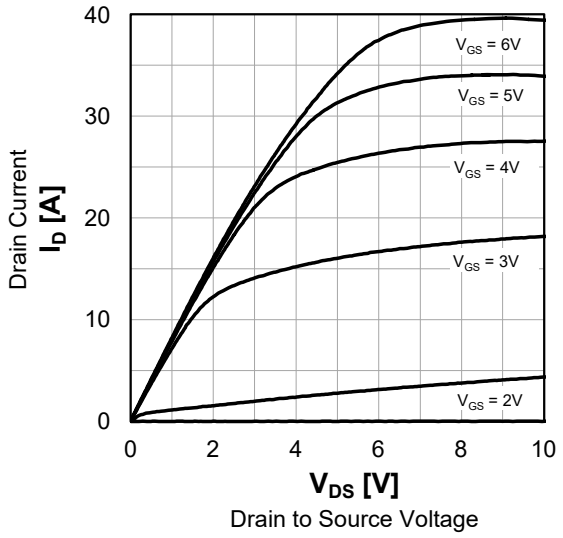
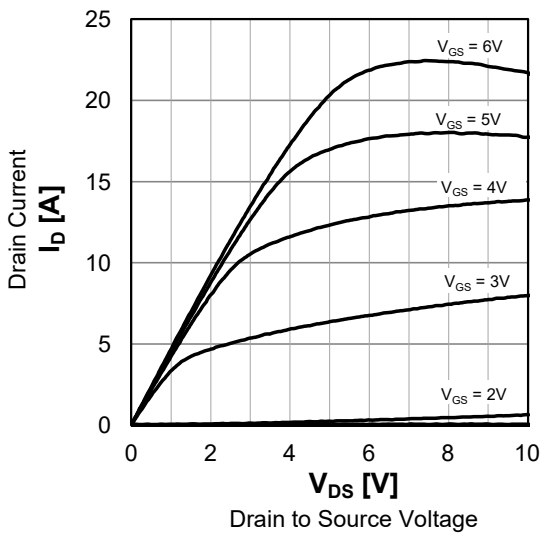
Electrical Characteristic Curves

Fig.5 Typ. Output Characteristics



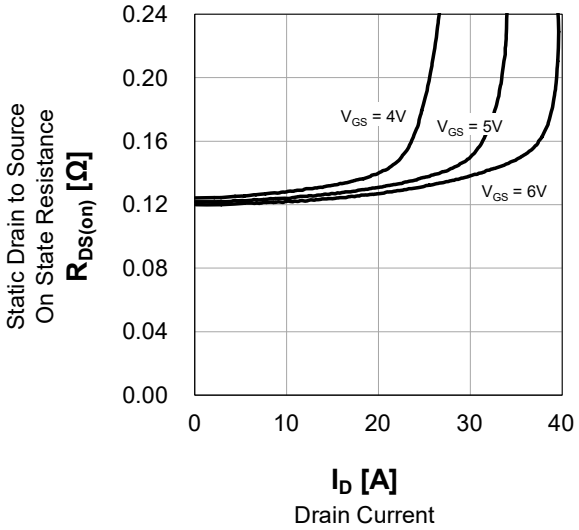
$I_D = f(V_{DS}, V_{GS})$; $T_j = 25°C$

Fig.6 Typ. Output Characteristics



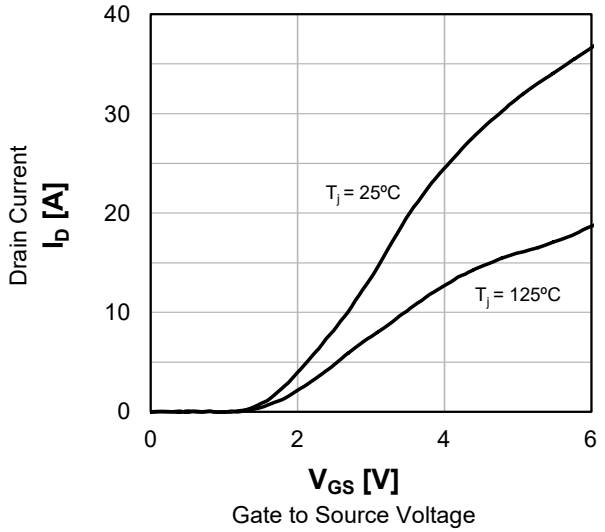
$I_D = f(V_{DS}, V_{GS})$; $T_j = 125°C$

Fig.7 Static Drain to Source On State Resistance vs. Drain to Source Current



$R_{DS(on)} = f(I_D, V_{GS})$; $T_j = 25°C$

Fig.8 Typ. Transfer Characteristics



$I_D = f(V_{GS}, T_j)$; $V_{DS} = 10$ V; $T_j = 25°C, 125°C$

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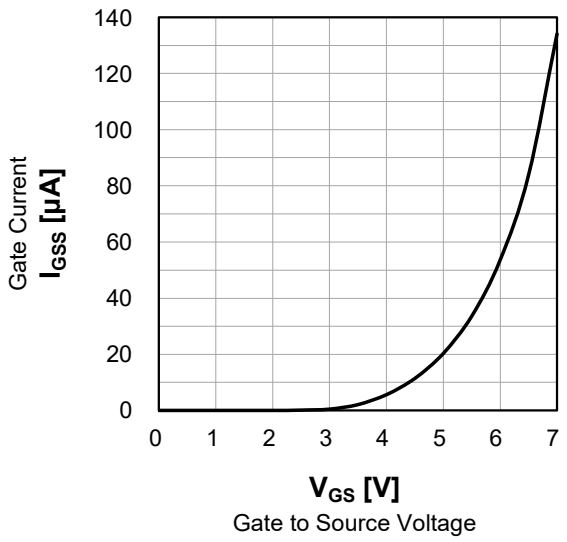
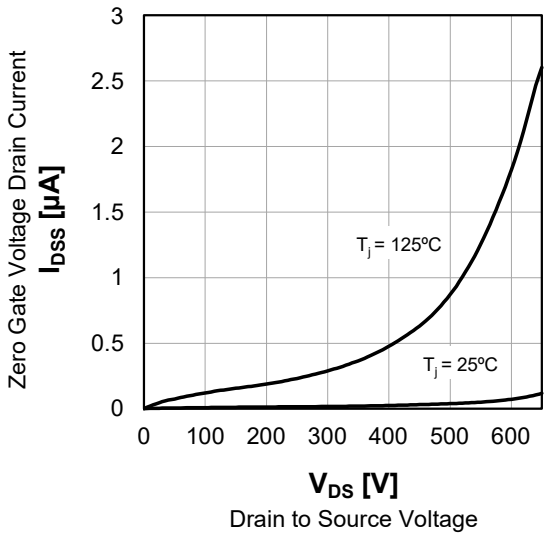
Electrical Characteristic Curves

Fig.9 Gate to Source Leakage Characteristics



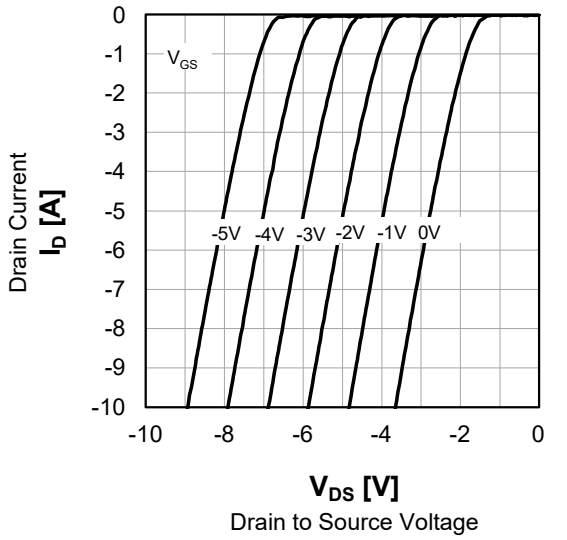
$I_{GSS} = f(V_{GS})$; $T_j = 25°C$

Fig.10 Drain to Source Leakage Characteristics



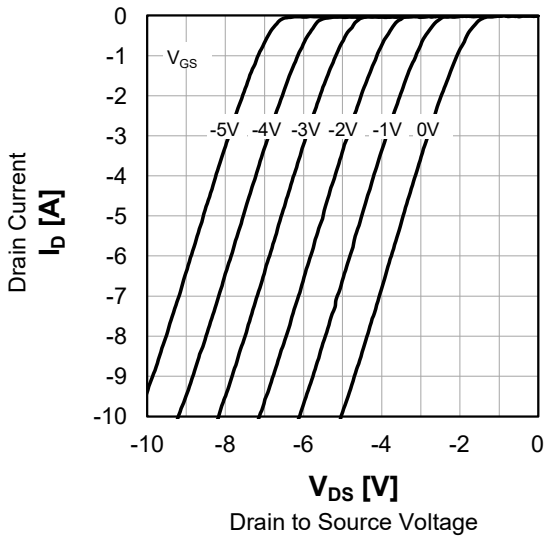
$I_{DSS} = f(V_{DS}, T_j)$; $V_{GS} = 0$ V; $T_j = 25°C, 125°C$

Fig.11 Channel Reverse Characteristics



$I_D = f(V_{DS}, V_{GS})$; $T_j = 25°C$

Fig.12 Channel Reverse Characteristics



$I_D = f(V_{DS}, V_{GS})$; $T_j = 125°C$

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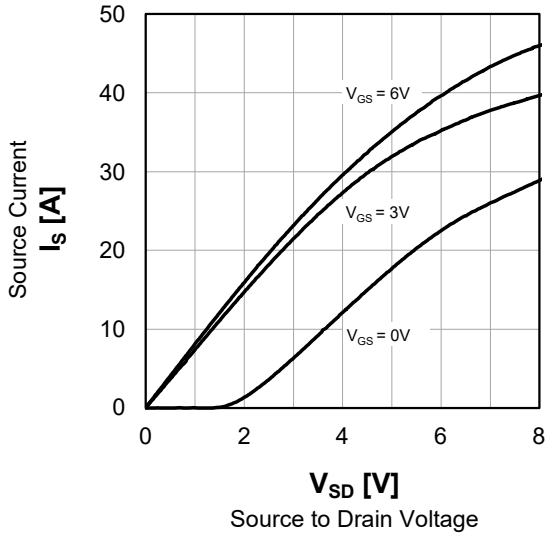
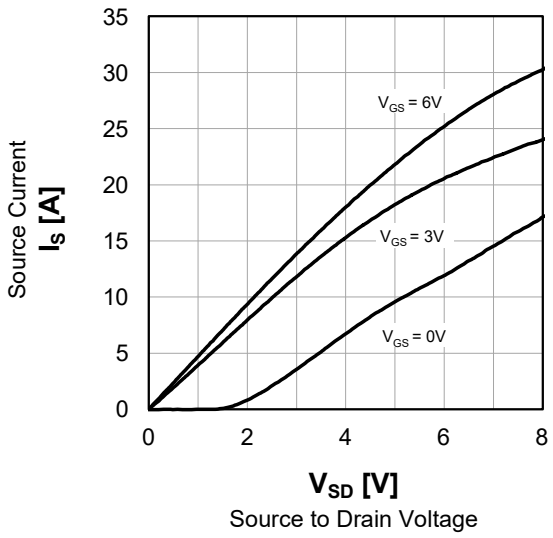
Electrical Characteristic Curves

Fig.13 Channel Reverse Characteristics



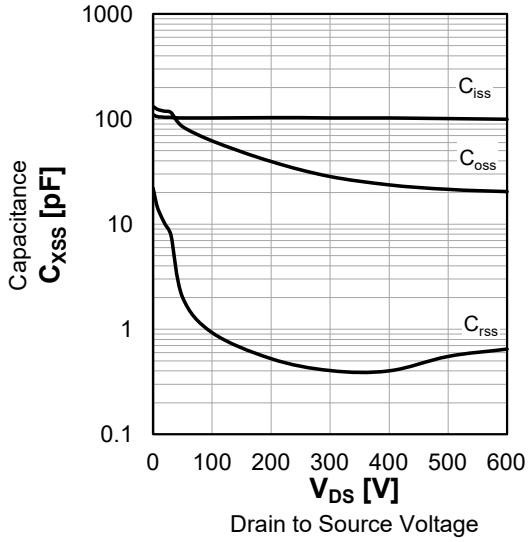
$I_S = f(V_{SD}, V_{GS})$; $T_j = 25°C$

Fig.14 Channel Reverse Characteristics



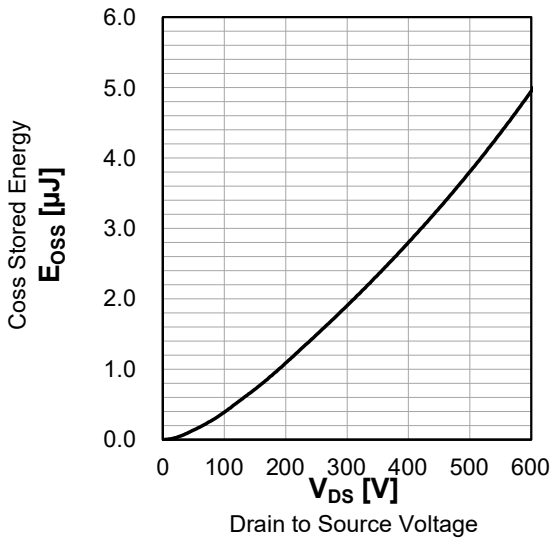
$I_S = f(V_{SD}, V_{GS})$; $T_j = 125°C$

Fig.15 Typ. Capacitance



$C_{XSS} = f(V_{DS})$; $V_{GS} = 0V$; f = 1MHz; $T_j = 25°C$

Fig.16 Typ. Coss Stored Energy



$E_{oss} = f(V_{DS})$; $T_j = 25°C$

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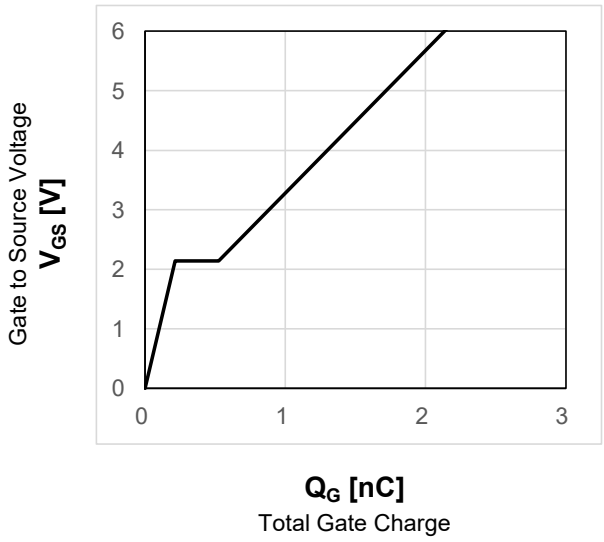
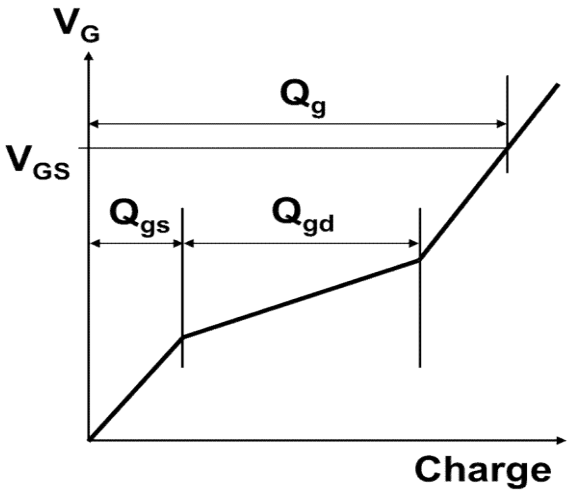
Electrical Characteristic Curves

Fig.17 Typ. Gate Charge	※ Gate Charge Waveform
	
$V_{GS} = f(Q_G)$; V_{DCLINK} = 400V; I_D=4A; T_j = 25°C	

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Measurement Circuits and Waveforms

Fig.18 Gate Charge Measurement Circuit

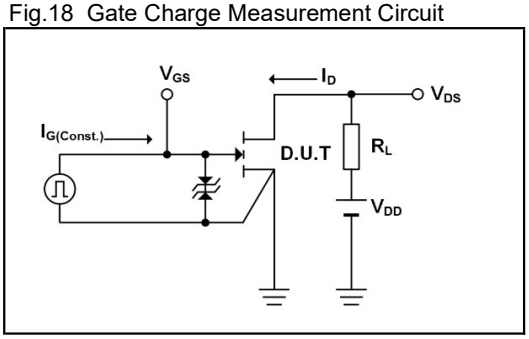


Fig.19 Switching Characteristics Measurement Circuit

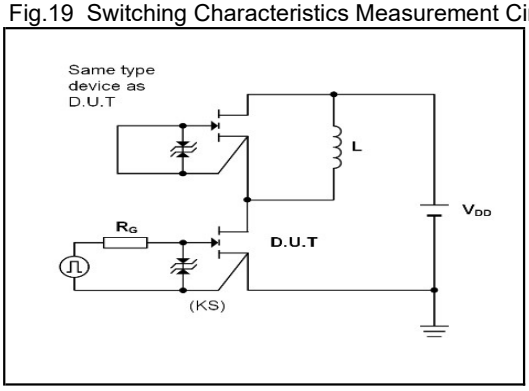
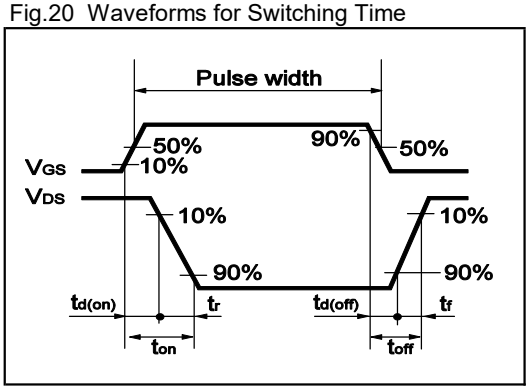


Fig.20 Waveforms for Switching Time



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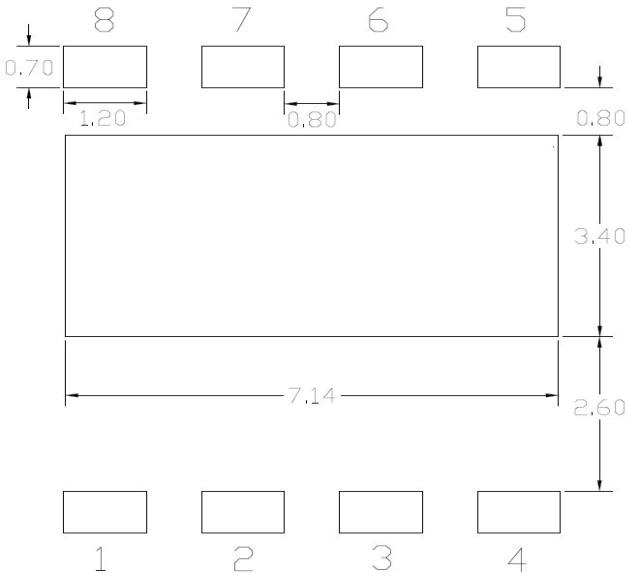
Ordering Information

G	N	P	3	1	2	0	T	E	C	-	Z	E	2

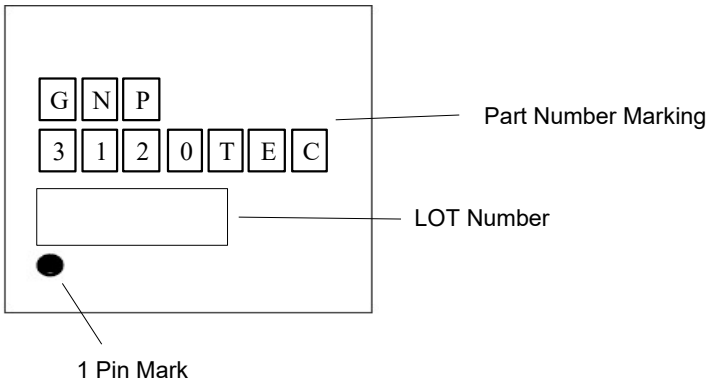
Part Name	Package	Product Class
	EC: DFN8080CK	E2: Embossed Tape and Reel

Recommended Footprint

(mm)



Marking Diagram



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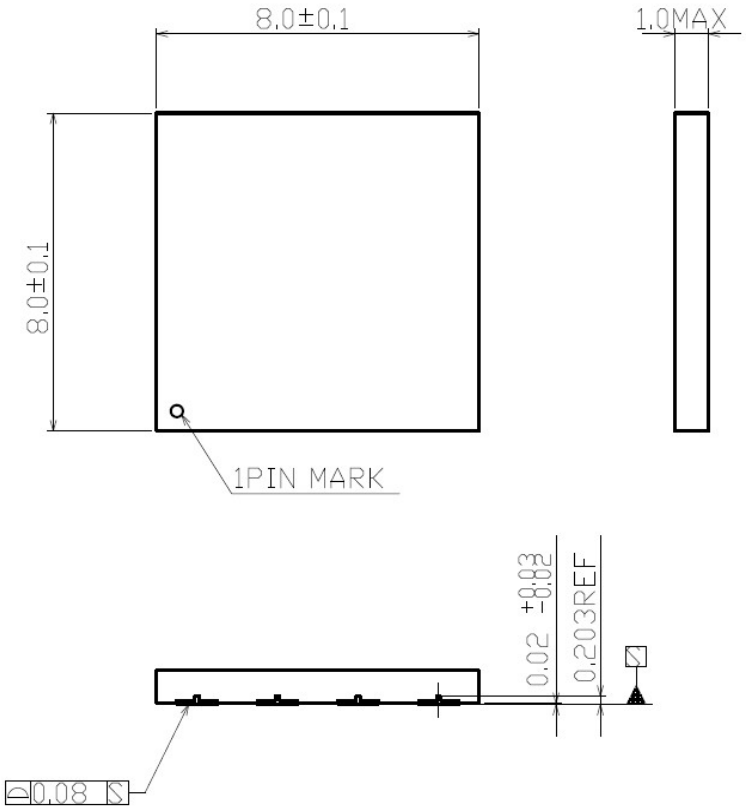
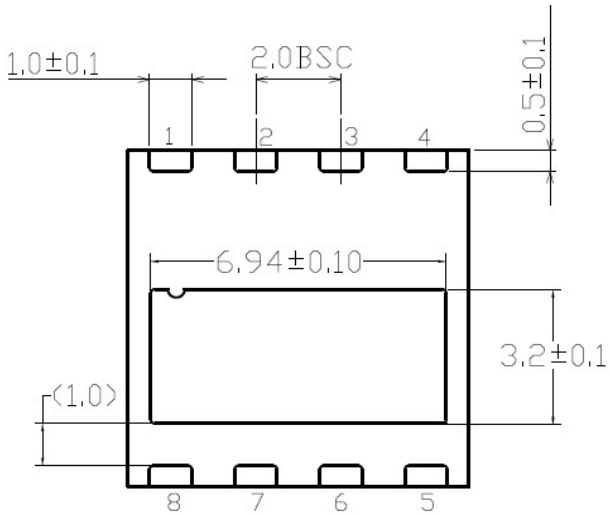
Physical Dimension

(mm)



(mm)



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Notice

Precaution on using ROHM Products

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.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [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 (Exclude cases where no-clean type fluxes is used. However, recommend sufficiently about the residue.); 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.

Precaution for Mounting / Circuit board design

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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Precautions Regarding Application Examples and External Circuits

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 examples, their constants, software, 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 Ionizer, 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.

Precaution for Product Label

A two-dimensional barcode printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act

Since concerned goods might be fallen under listed items of export control prescribed by Foreign exchange and Foreign trade act, please consult with ROHM in case of export.

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