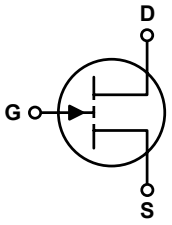
INN040FQ043A

1. General Description

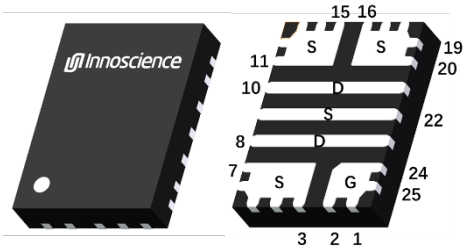
GaN-on-Silicon enhancement mode high-electron-mobility-transistor (HEMT) in FCQFN with 3 mm x 4 mm package size.

2. Features



- GaN-on-Silicon E-mode HEMT technology
- Very low gate charge
- Ultra-low on resistance
- Very small footprint

3. Applications



- High frequency DC-DC converter
- Point of Load
- RF envelope tracking
- PC charger
- Mobile power bank
- Motor driver

4. Key Performance Parameters

Table 1 Key performance parameters at T_J = 25 °C

Parameter	Value	Unit
$V_{DS,max}$	40	V
$R_{DS(on),max}$ @ V_{GS} = 5 V	4.3	mΩ
$Q_{G,typ}$ @ V_{DS} = 20V	6.2	nC
$I_{DS,Pulse}$	160	A
Q_{OSS}@ V_{DS} = 20V	14	nC

5. Pin Information

Table 2 Pin information

Pin	Pin description	Pin function
1, 2, 24, 25	Gate	Driver Gate
3-7, 9, 11-20, 22	Source	Source
8, 10, 21, 23	Drain	Power Drain

Table 3 Ordering information

Type/Ordering Code	Package	Product Code
INN040FQ043A	FCQFN 3x4	D17

Table of contents

1. General Description 1
2. Features 1
3. Applications 1
4. Key Performance Parameters 1
5. Pin Information 1
6. Maximum Ratings 3
7. Thermal Characteristics 4
8. Electric Characteristics 5
9. Electric Characteristics Diagrams 7
10. Package Outlines 12
11. Reel Information 13
12. Land Pattern 14
13. Revision History 15

6. Maximum Ratings

at T_J = 25 °C unless otherwise specified.

Continuous application of maximum ratings can deteriorate transistor lifetime. For further information, contact Innoscience sales office.

Table 4 Maximum ratings

SYMBOL	PARAMETER	MAX	UNIT
V_{DS}	Drain-to-Source Voltage (Continuous)	40	V
I_D	Continuous current	24	A
	Pulsed (25˚C, T_{Pulse} = 300 μs)	160	A
V_{GS}	Gate-to-Source Voltage	6	V
	Gate-to-Source Voltage	-4	V
P_{tot}	Power dissipation ($T_{c,\ bottom}$ = 25°C)	43	W
T_J	Operating Temperature	-40 to 150	˚C
T_{STG}	Storage Temperature	-40 to 150	˚C

7. Thermal Characteristics

Table 5 Thermal characteristics

SYMBOL	PARAMETER	TYP	UNIT	Note/Test Condition
$R_{\theta JC_top}$	Thermal Resistance, Junction to Case (top)	26.2	˚C/W	
$R_{\theta JC_bot}$	Thermal Resistance, Junction to Case (bottom)	2.9	˚C/W	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient [1]	45.9	˚C/W	
T_{sold}	Maximum reflow soldering temperature	260	°C	MSL3

Note 1: $R_{\theta JA}$ is determined with the device mounted on one square inch of copper pad, single layer 2 oz copper on FR4 board.

8. Electric Characteristics

at T_J = 25 °C, unless specified otherwise

Table 6 Static characteristics

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	TEST CONDITIONS
BV_{DSS}	Drain-to-Source Voltage	40			V	V_{GS} = 0 V, I_D = 500 µA
I_{DSS}	Drain Source Leakage			100	µA	V_{GS} = 0 V, V_{DS} = 32 V
I_{GSS}	Gate-to-Source Forward Leakage		3	80	µA	V_{GS} = 5 V
	Gate-to-Source Forward Leakage		50	500	µA	V_{GS} = 5 V, T_j = 125 °C
	Gate-to-Source Reverse Leakage		1	20	µA	V_{GS} = -4 V
$V_{GS(TH)}$	Gate Threshold Voltage	0.7		2.4	V	V_{DS} = V_{GS}, I_D = 7 mA
$R_{DS(on)}$	Drain-Source On-state Resistance		3	4.3	mΩ	V_{GS} = 5 V, I_D = 15 A
V_{SD}	Source-Drain Forward Voltage		1.9		V	I_S = 0.5 A, V_{GS} = 0 V

Table 7 Dynamic characteristics

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	TEST CONDITIONS
C_{iss}	Input Capacitance		805		pF	V_{GS} = 0 V, V_{DS} = 20 V
C_{oss}	Output Capacitance		428			
C_{rss}	Reverse Transfer Capacitance		13			
$C_{oss(er)}$	Energy Related Coss		600			V_{GS} = 5 V, V_{DS} = 20 V, I_D=15 A
$C_{oss(tr)}$	Time Related Coss		703			
R_G	Gate resistance		1.7		Ω	f = 1 MHz
Q_G	Total Gate Charge		6.2	8.5	nC	V_{GS} = 5 V, V_{DS} = 20 V, I_D=15 A
Q_{GS}	Gate to Source Charge		1.4			V_{DS} = 20 V, I_D =15 A
Q_{GD}	Gate to Drain Charge		0.8			
$Q_{G(TH)}$	Gate Charge at Threshold		0.9			
Q_{OSS}	Output Charge		14			V_{GS} = 0 V, V_{DS} = 0 V to 20 V

9. Electric Characteristics Diagrams

at T_J = 25 °C, unless specified otherwise

Figure 1 Typical Output Characteristics (T_J = 25 °C)

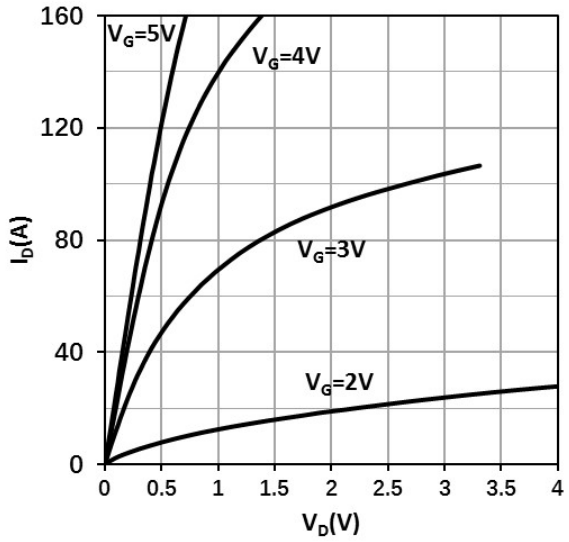


Figure 2 Typical Output Characteristics (T_J = 125 °C)

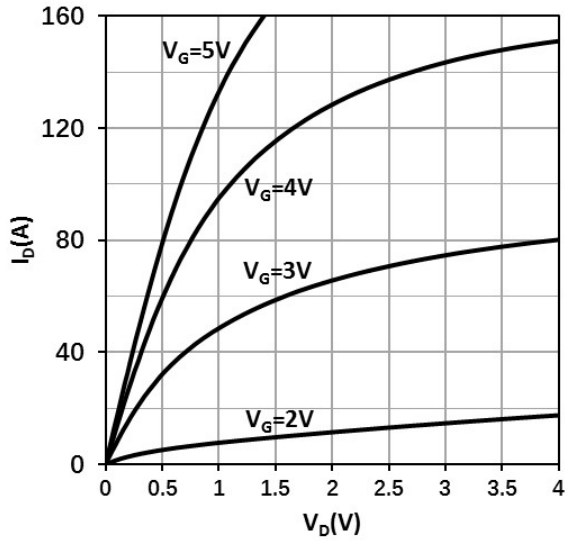


Figure 3 Typ. Drain On-state Resistance(T_J = 25 °C)

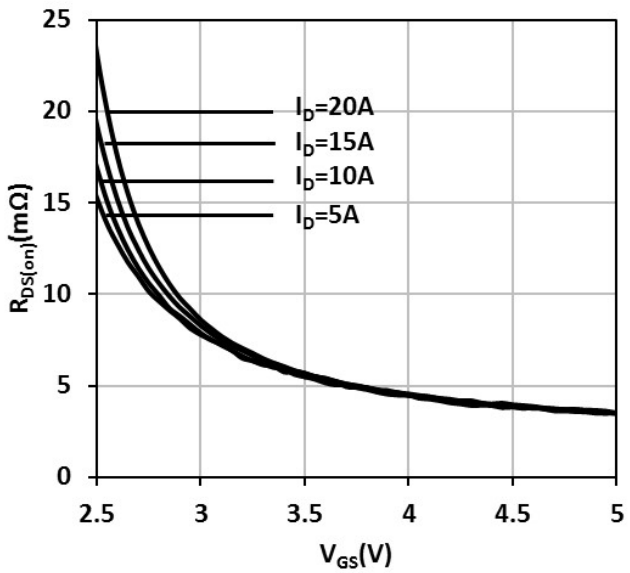


Figure 4 Typ. Drain On-state Resistance (T_J = 125 °C)

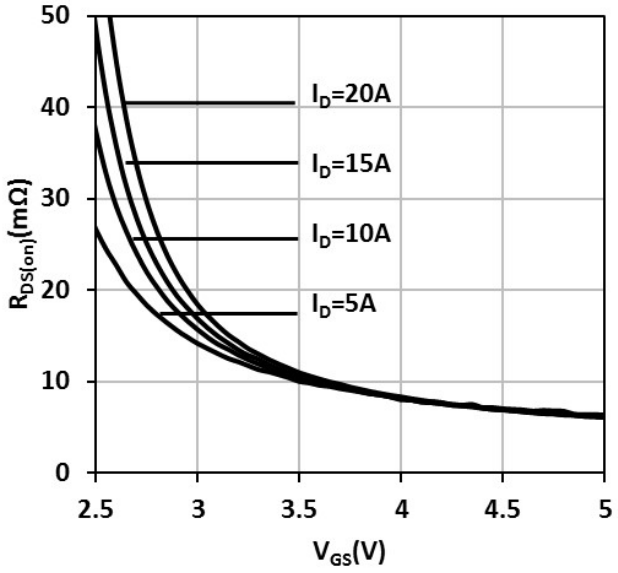


Figure 5 Typical On Resistance vs. Temperature

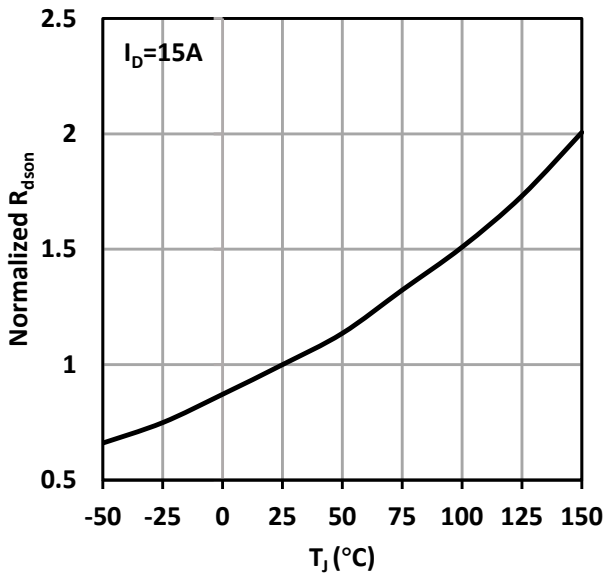


Figure 6 Typical Transfer Characteristics

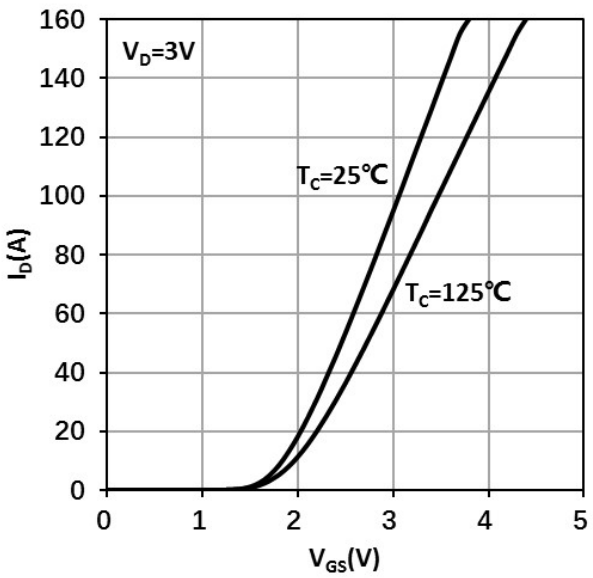


Figure 7 Typ. Reverse Drain-Source Characteristics (V_{GS}≤0, T_J = 25 °C)

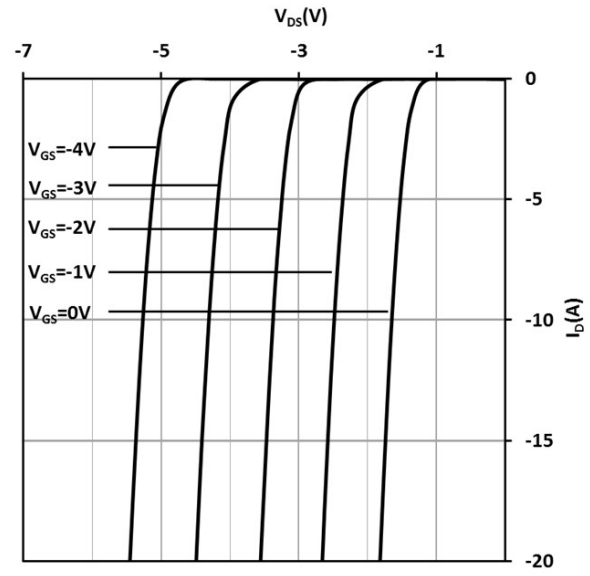


Figure 8 Typ. Reverse Drain-Source Characteristics (V_{GS}≥0, T_J = 25 °C)

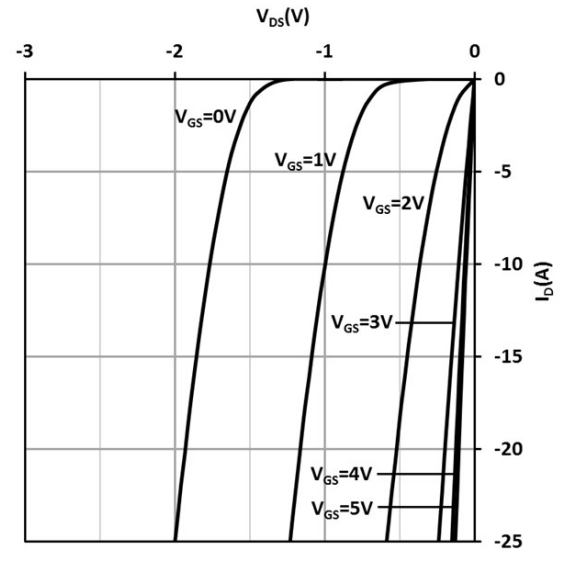


Figure 9 Typ. Reverse Drain-Source Characteristics (V_{GS}≤0, T_J = 125 °C)

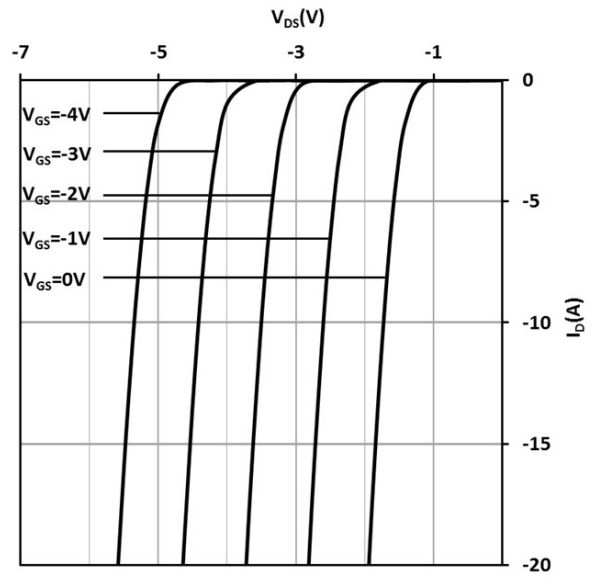


Figure 10 Typ. Reverse Drain-Source Characteristics (V_{GS}≥0, T_J = 125 °C)

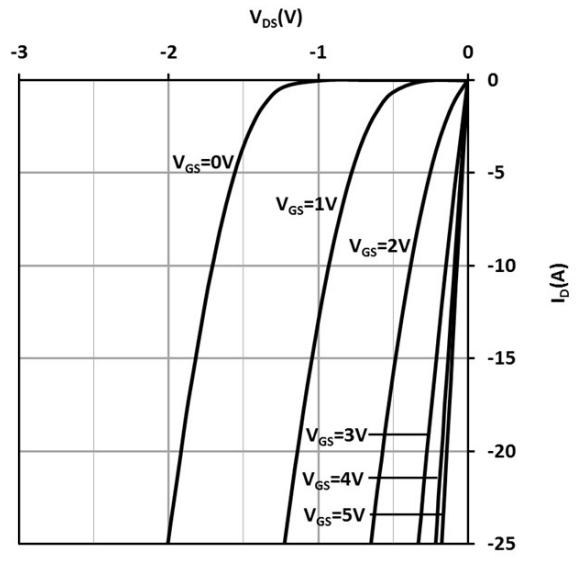


Figure 11 Typ. Capacitances Characteristics

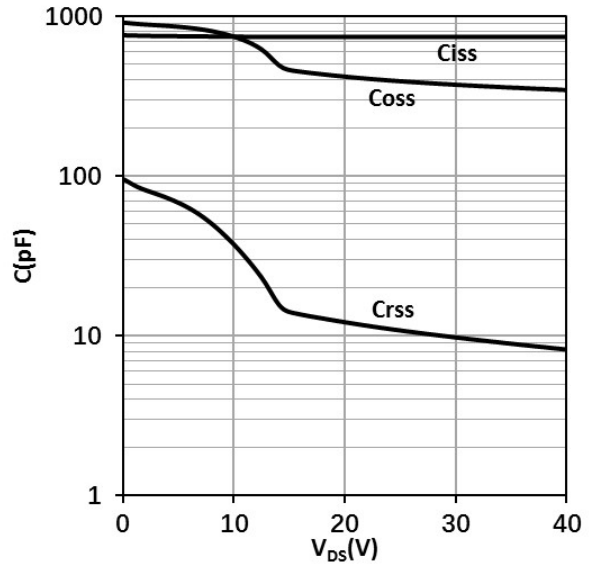


Figure 12 Typ. Gate Charge

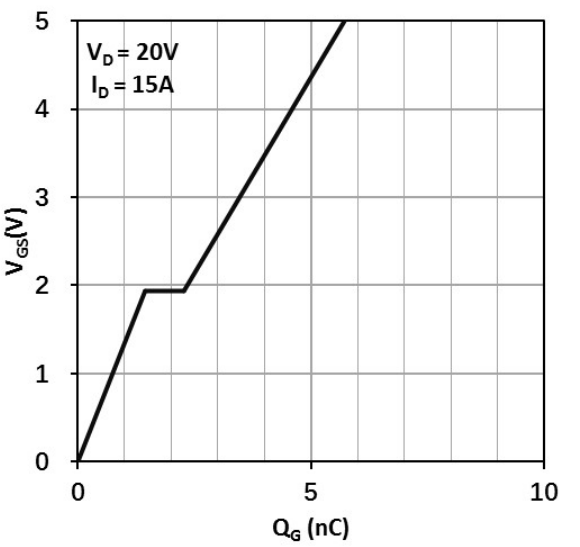


Figure 13 Normalized Threshold Voltage vs. Temp.

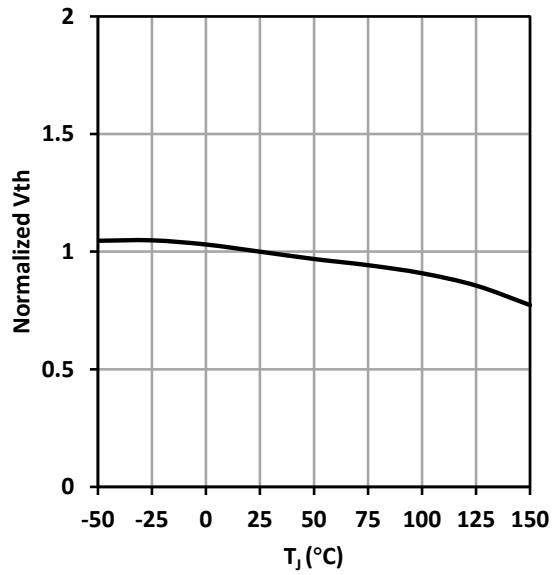


Figure 14 Output Charge

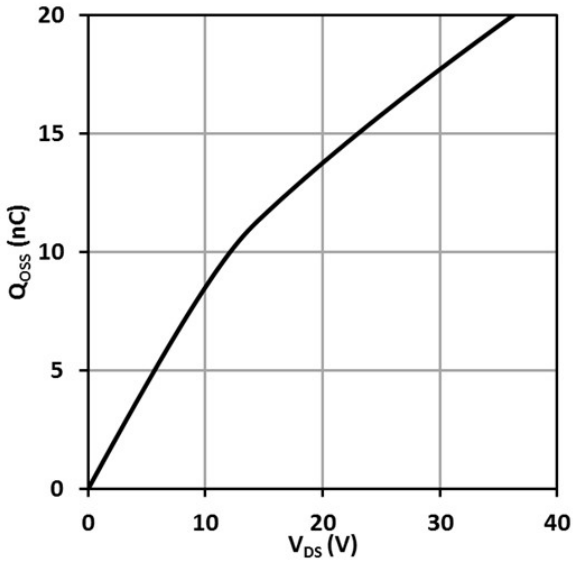


Figure 15 Output Capacitance Stored Energy

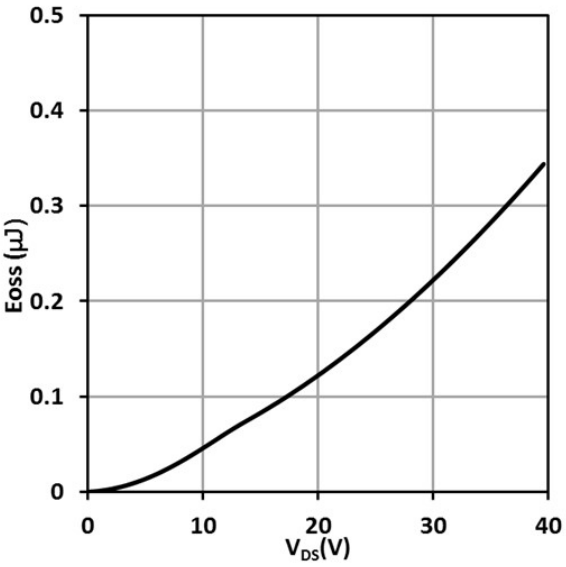


Figure 16 Power Dissipation

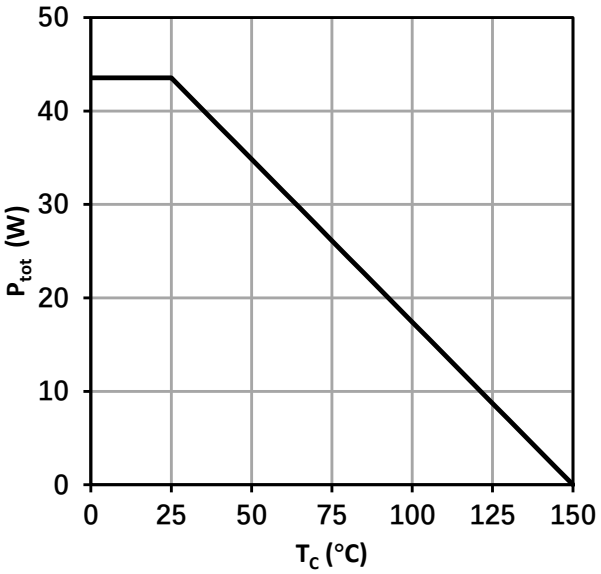


Figure 17 Safe Operating Area

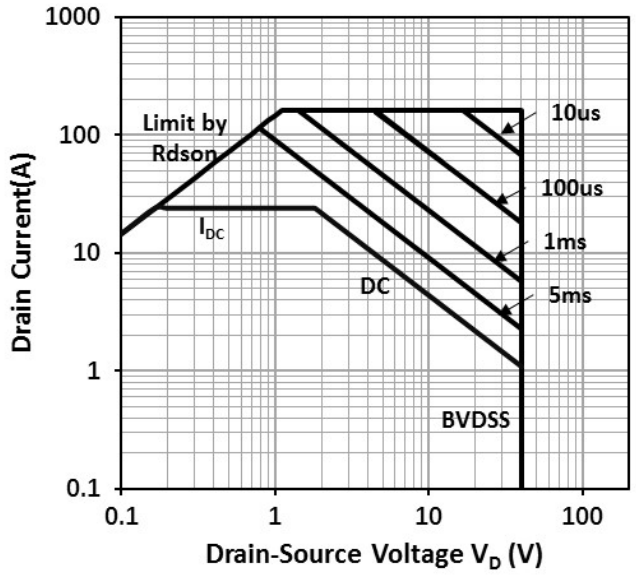
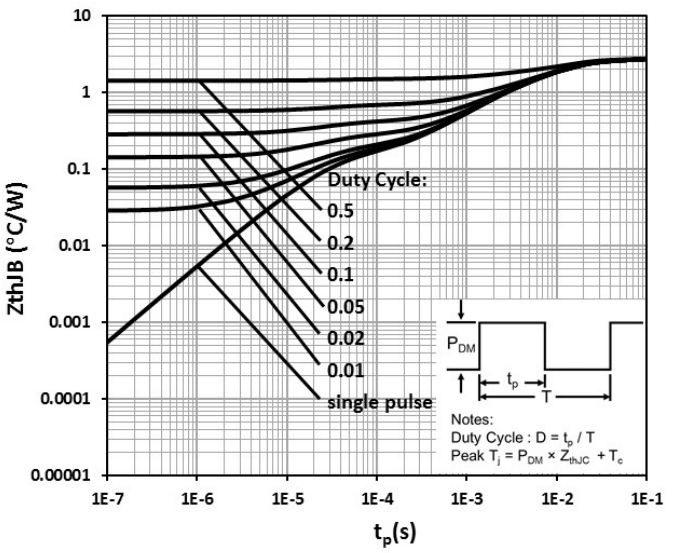
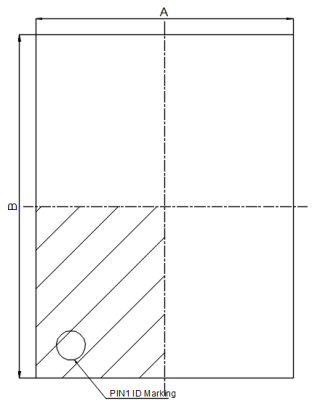


Figure 18 Max. Transient Thermal Impedance

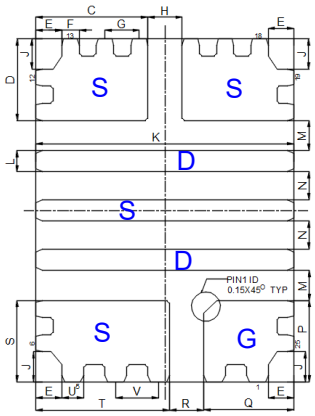


10. Package Outlines

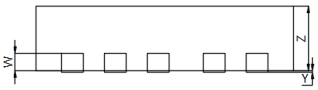
Package Reference



TOP VIEW



BOTTOM VIEW

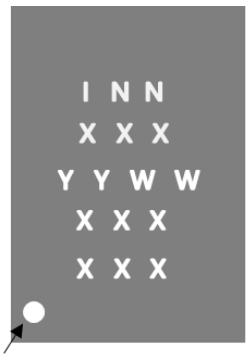


SIDE VIEW

NOTE:
1)ALL DIMENSION ARE IN MILLIMETERS.
2)BOTTOM VIEW IS FT TESTER SIDE VIEW.
3)LEAD COPLANARITY SHALL BE 0.08 MILLIMETERS MAX.
4)COMPLIES WITH JEDEC MO-220.
5)DRAWING IS NOT TO SCALE.

SYMBOL	MILLIMETER			NOTE
	MIN	NOM	MAX	
A	2.9	3.0	3.1	
B	3.9	4.0	4.1	
C	1.2	1.3	1.4	2X
D	0.85	0.95	1.05	2X
E		0.3 REF		4X
F	0.15	0.2	0.25	14X
G		0.4 BASIC		8X
H	0.35	0.4	0.45	
J		0.35 REF		4X
K	2.9	3.0	3.1	3X
L	0.20	0.25	0.30	3X
M	0.3	0.35	0.4	4X
N	0.275	0.325	0.375	2X
P	0.85	0.95	1.05	
Q	0.95	1.05	1.15	
R	0.35	0.4	0.45	
S	0.85	0.95	1.05	
T	1.45	1.55	1.65	
U	0.2	0.25	0.3	5X
V		0.5 BASIC		3X
W		0.203 REF		
Y	0	0.02	0.05	
Z	0.65	0.75	0.85	

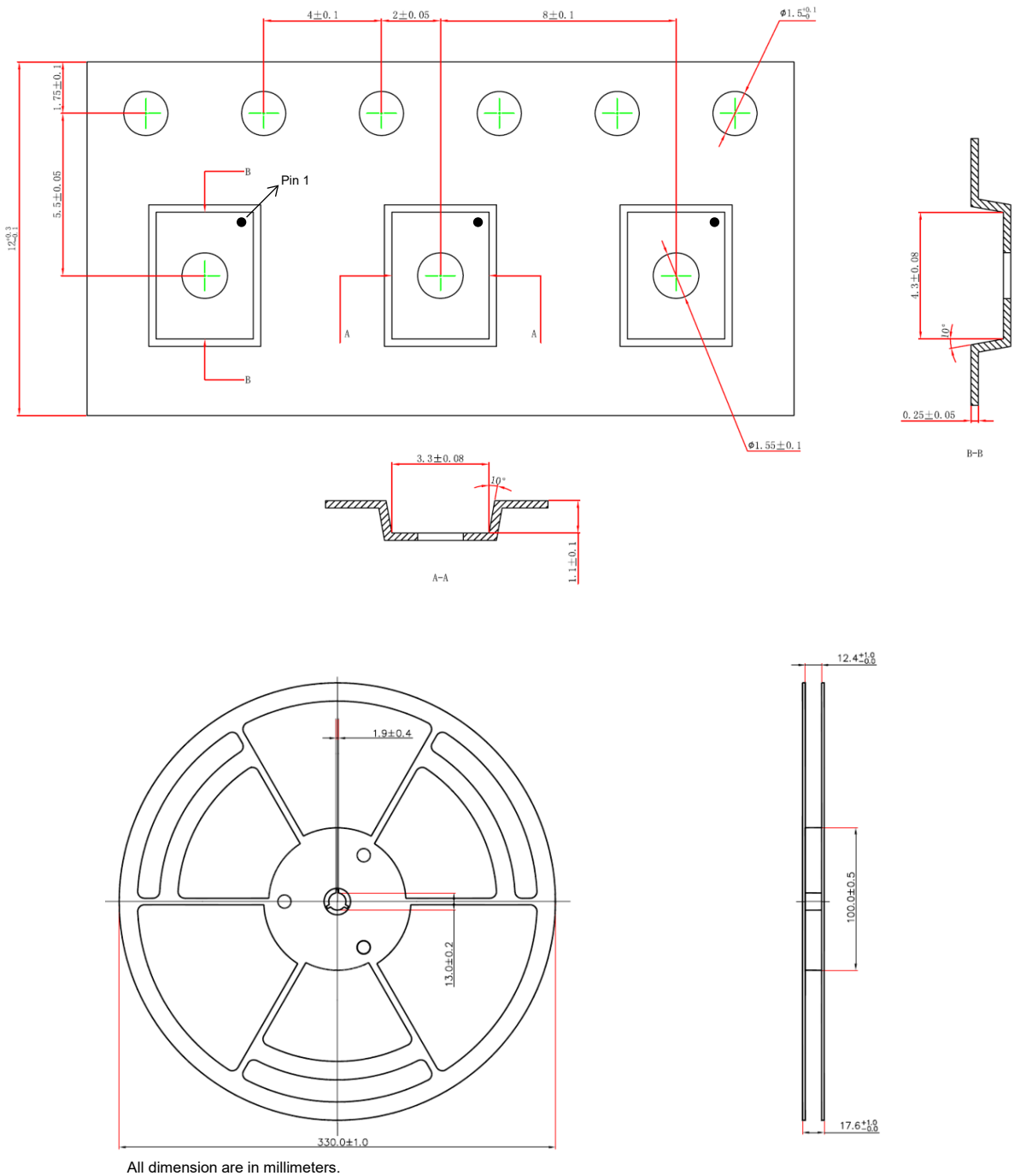
Marking Reference:



Die Orientation Dot
&Gate Position

Row	Description	Example
Row 1	Company name	INN
Row 2	Product code	XXX
Row 3	Date code	YYWW
Row 4	Lot No	XXX
Row 5	Lot No	XXX

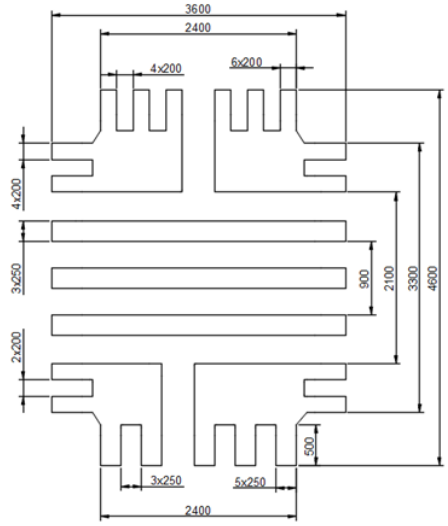
11. Reel Information



All dimension are in millimeters.

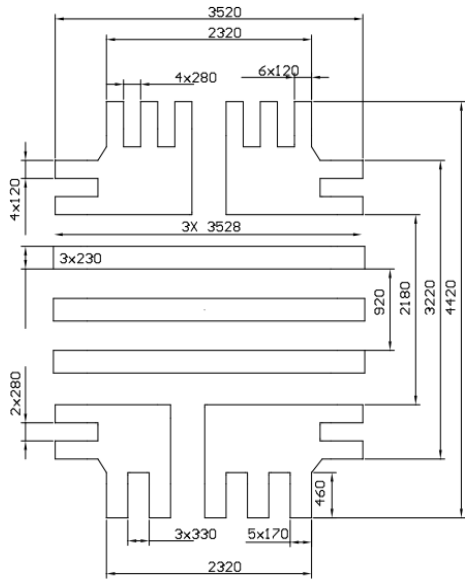
12. Land Pattern

Recommended Land Pattern



TOP VIEW Unit: µm

Recommended Stencil Drawing



TOP VIEW Unit: µm

13. Revision History

Major changes since the last revision

Revision	Date	Description of changes
1.0	2022-12-12	1.0 version release
1.1	2022-12-22	Update package marking information
1.2	2023-07-21	Tighten I_{DSS} spec to 100uA from 200uA
1.3	2023-10-07	1. Corrected typos 2. Update package rendering on page1 3. Add Q_G max spec in Electric Characteristics
1.31	2023-11-08	Corrected typos
1.32	2024-06-18	1. Corrected typos 2. Update Pin 1 position in Reel Information on page13

Important Notice

The information provided in this document is intended as a guide only and shall not in any event be regarded as a guarantee of conditions, characteristics or performance. Innoscience does not assume any liability arising out of the application or use of any product described herein, including but not limited to any personal injury, death, or property or environmental damage. No licenses, patent rights, or any other intellectual property rights is granted or conveyed. Innoscience reserves the right to modify without notice. All rights reserved.