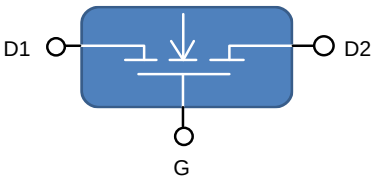
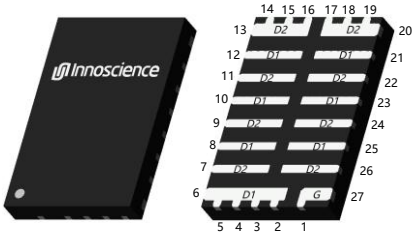
INV030FQ012A

1. General Description

Bi-directional GaN-on-Silicon enhancement mode high-electron-mobility-transistor (HEMT) in FCQFN with 6 mm x 4 mm package size.

2. Features





- Bi-directional blocking capability
- GaN-on-Silicon E-mode HEMT technology
- Ultra-low on resistance

3. Applications

- High side load switch
- OVP protection
- Switch circuits in multiple power suppliers system

4. Key Performance Parameters

Table 1 Key performance parameters at T_J = 25 ˚C

Parameter	Value	Unit
$V_{DD,max}$	30	V
$R_{D1D2(on),max}$ @ V_G = 5 V	1.2	mΩ
$Q_{G,typ}$ @ V_{DD} = 15 V	44	nC
$I_{D,DC}$ (T_A = 25˚C)	80	A

5. Pin Information

Table 2 Pin information

Pin	Pin description	Pin function
1,27	Gate	Driver Gate
2-6,8,10,12,21,23,25	Drain1	Power Drain1
7,9,11,13-20,22,24,26	Drain2	Power Drain2

Table 3 Ordering information

Type/Ordering Code	Package	Product Code
INV030FQ012A	FCQFN 6mm X 4mm	C09

Table of contents

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_{DD}	Drain1-to-Drain2 Voltage or Drain2-to-Drain1 Voltage	30	V
$V_{DD(tr)}$	Drain1-to-Drain2 Voltage or Drain2-to-Drain1 Voltage (up to 300,000 5ms pulse at 150 ˚C)	36	V
V_{DG}	Drain-to-Gate Voltage	30	V
V_{GD}	Gate-to-Drain Voltage	6	V
I_D	Continuous Drain Current (T_A = 25 ˚C)	80	A
I_{DM}	Pulsed Drain Current (T_A = 25 ˚C, T_{Pulse} = 300 μs)	400	A
P_{tot}	Power Dissipation (T_B = 25 ˚C)	73	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
$R_{\theta JC}$	Thermal Resistance, Junction to Case	16.12	˚C/W	
$R_{\theta JB}$	Thermal Resistance, Junction to Board	1.71	˚C/W	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient [1]	57.45	˚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_{D1D2S}	Drain1-to-Drain2 Breakdown Voltage	30	-	-	V	V_{D2} = V_G = 0 V, I_{D1D2} = 500 µA
BV_{D2D1S}	Drain2-to-Drain1 Breakdown Voltage	30	-	-	V	V_{D1} = V_G = 0 V, I_{D2D1} = 500 µA
I_{D1D2S}	Zero Gate Voltage Drain Current	-	-	50	µA	V_{D2} = V_G = 0 V, V_{D1} = 30 V
I_{D2D1S}	Zero Gate Voltage Drain Current	-	-	50	µA	V_{D1} = V_G = 0 V, V_{D2} = 30 V
I_{GDS}	Gate-to-Drain Leakage	-	0.5	5	µA	V_{D1} = V_{D2} = 0 V, V_G = 5 V
	Gate-to-Drain Leakage	-	-	-10	µA	V_{D1} = V_{D2} = 0 V, V_G = -5 V
I_{GDS}	Gate-to-Drain Leakage	-	5	30	µA	V_{D1} = V_{D2} = 0 V, V_G = 6 V
	Gate-to-Drain Leakage	-	-	-10	µA	V_{D1} = V_{D2} = 0 V, V_G = -6 V
$V_{GD1(TH)}$	Gate Threshold Voltage	1.0	-	2.4	V	V_{D1} = 0 V, V_{D2} = V_G, I_{D2D1} = 1 mA
$V_{GD2(TH)}$	Gate Threshold Voltage	1.0	-	2.4	V	V_{D2} = 0 V, V_{D1} = V_G, I_{D1D2} = 1 mA
$R_{D1D2(on)}$	Drain1-to-Drain2 On-state Resistance	-	0.9	1.2	mΩ	V_{D2} = 0 V, V_{GD} = 5 V, I_{D1D2} = 10 A
$R_{D2D1(on)}$	Drain2-to-Drain1 On-state Resistance	-	0.9	1.2	mΩ	V_{D1} = 0 V, V_{GD} = 5 V, I_{D2D1} = 10 A

Table 7 Dynamic characteristics

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	TEST CONDITIONS
C_{ISS}	Input Capacitance	-	3.0	-	nF	V_G = 0 V, V_D = 15 V
C_{OSS}	Output Capacitance	-	1.3	-		
C_{RSS}	Reverse Transfer Capacitance	-	0.8	-		
R_G	Gate Resistance	-	8.6	-	Ω	f = 1 MHz
Q_G	Total Gate Charge	-	44	-	nC	V_D = 15 V, V_G = 5 V, I_D = 10 A
Q_{GD1}	Gate-to-Drain1 Charge (V_{D2D1}=15V)	-	5.0	-		V_{D1} = 0, V_{D2} = 15 V, I_{D2D1} = 10 A
Q_{GD1}	Gate-to-Drain1 Charge (V_{D1D2}=15V)	-	23	-		V_{D2} = 0, V_{D1} = 15 V, I_{D1D2} = 10 A
Q_{GD2}	Gate-to-Drain2 Charge (V_{D1D2}=15V)	-	5.0	-		V_{D2} = 0, V_{D1} = 15 V, I_{D1D2} = 10 A
Q_{GD2}	Gate-to-Drain2 Charge (V_{D2D1}=15V)	-	23	-		V_{D1} = 0, V_{D2} = 15 V, I_{D2D1} = 10 A
Q_{OSS}	Output Charge	-	30	-		V_G = 0 V, V_D = 15 V

9. Electric Characteristics Diagrams

at T_J = 25 ˚C, unless specified otherwise

Note: In Charts, VD1D2 can be VD2D1 with same characteristic chart due to Bi-directional feature.

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

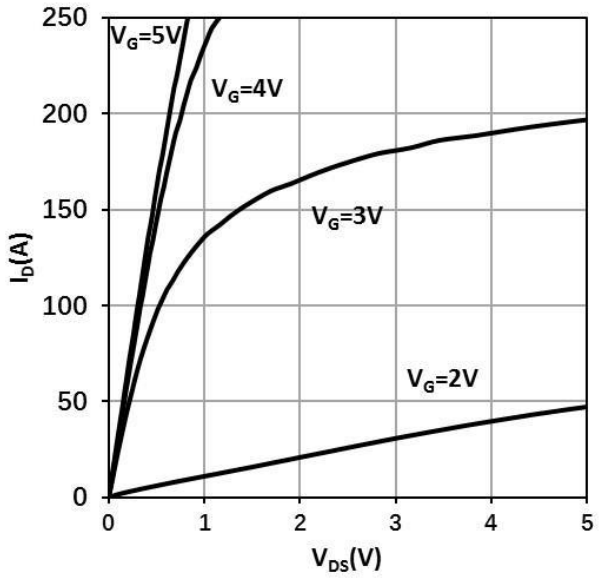


Figure 2 Typical Output Characteristics (T_J = 125 ˚C)

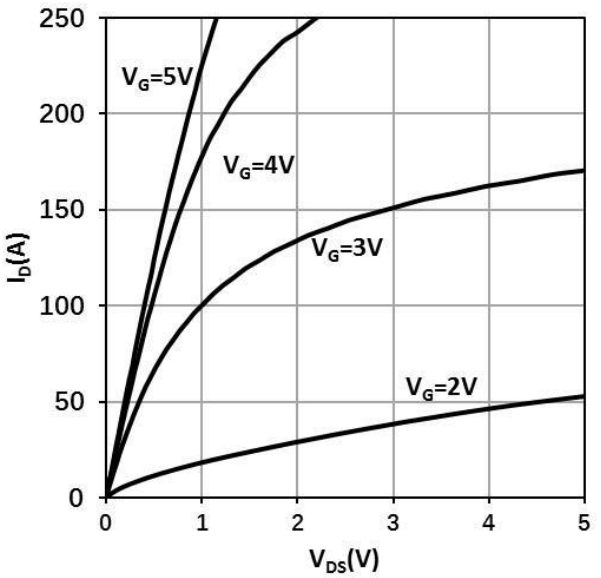


Figure 3 Typical Drain On-state Resistance (T_J = 25 ˚C)

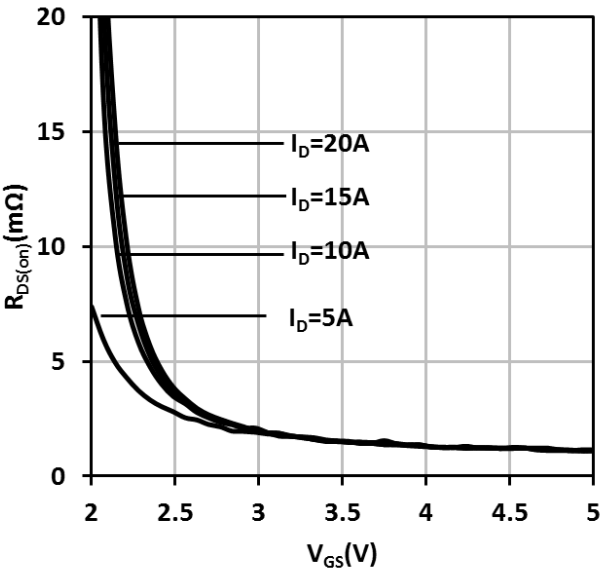


Figure 4 Typical Drain On-state Resistance (T_J = 125 ˚C)

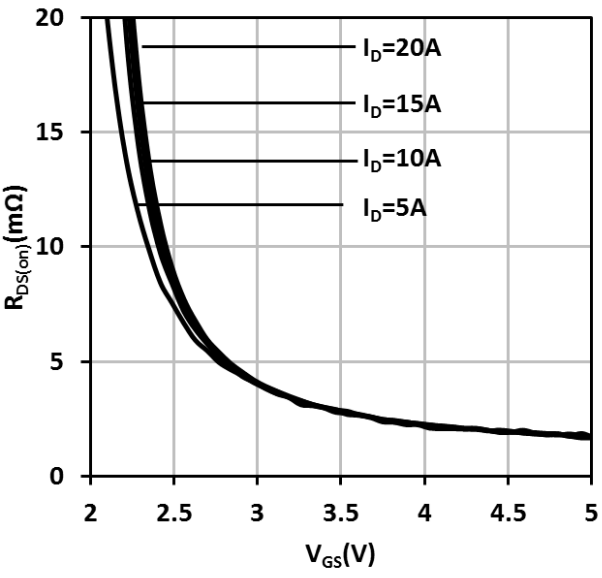


Figure 5 Typical On Resistance vs. Temperature

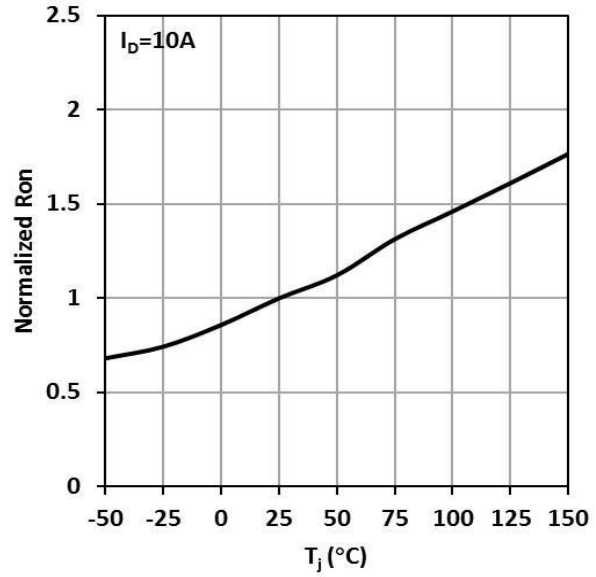


Figure 6 Typical Transfer Characteristics

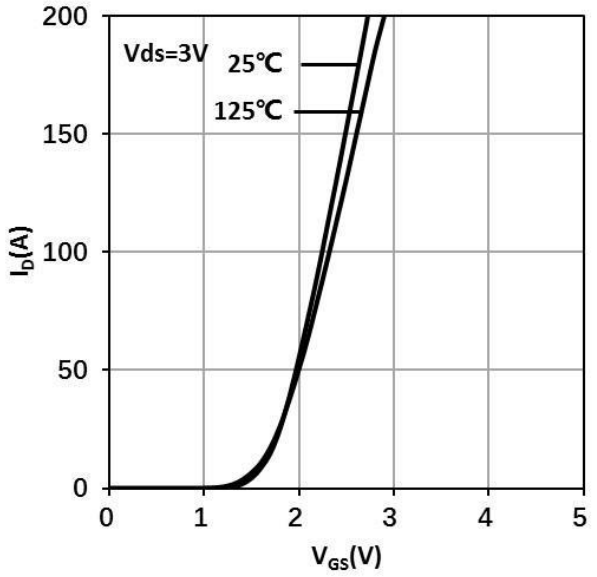


Figure 7 Typ. Reverse Drain1- Drain2 Characteristics (V_{GD2}≤0V, T_J = 25 ˚C)

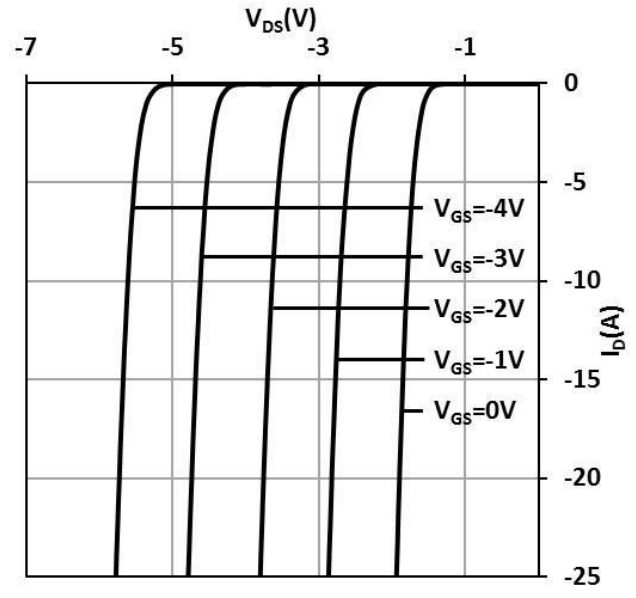


Figure 8 Typ. Reverse Drain1- Drain2 Characteristics (V_{GD2}≥0V, T_J = 25 ˚C)

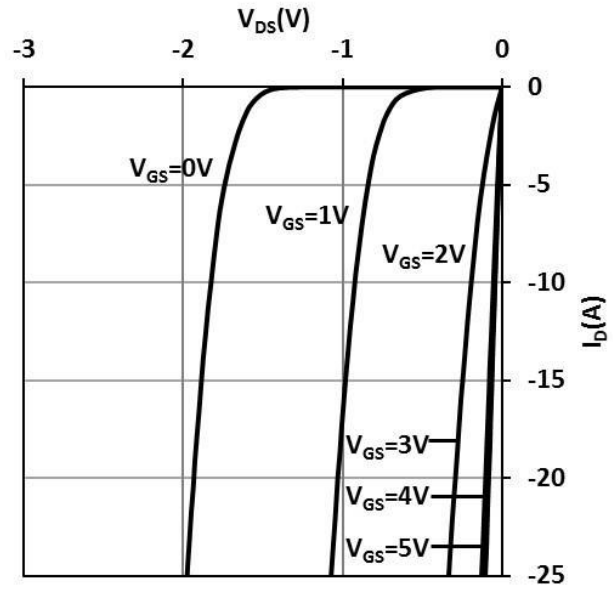


Figure 9 Typ. Reverse Drain1- Drain2 Characteristics ($V_{GD2} \leqslant 0V$, T_J = 125 ˚C)

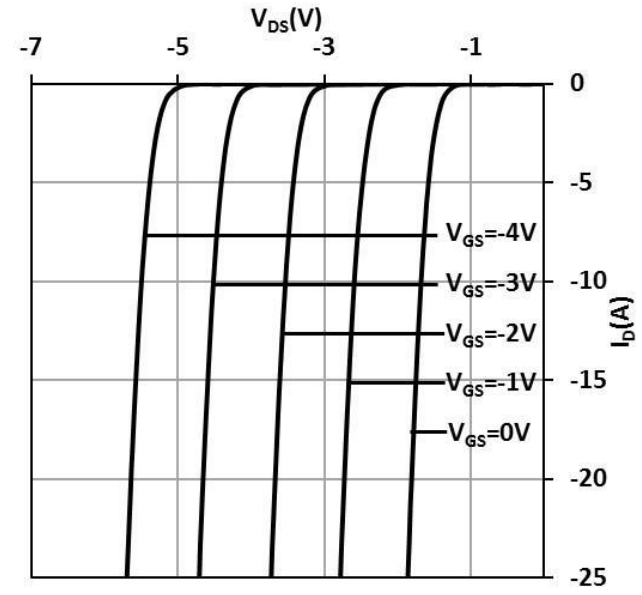


Figure 10 Typ. Reverse Drain1-Drain2 Characteristics ($V_{GD2} \geqslant 0V$, T_J = 125 ˚C)

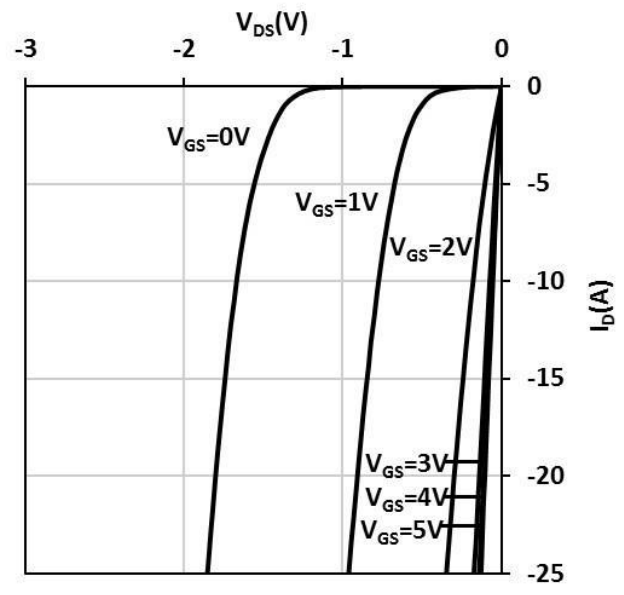


Figure 11 Typical Capacitances Characteristics

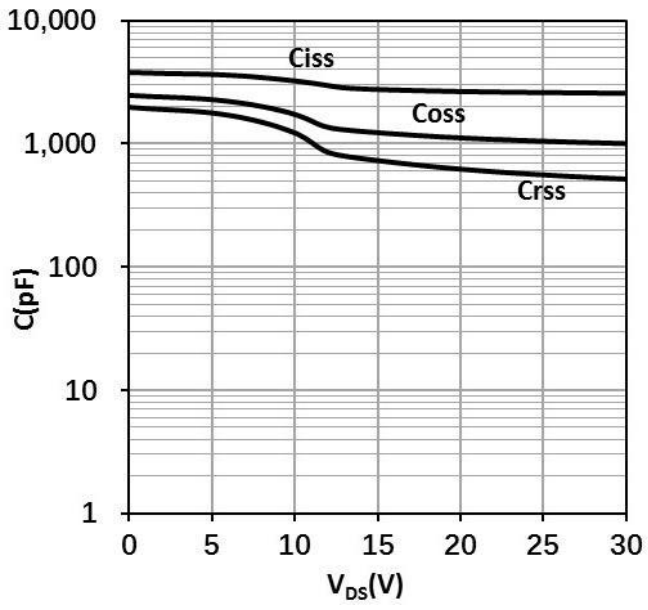


Figure 12 Typical Gate Charge

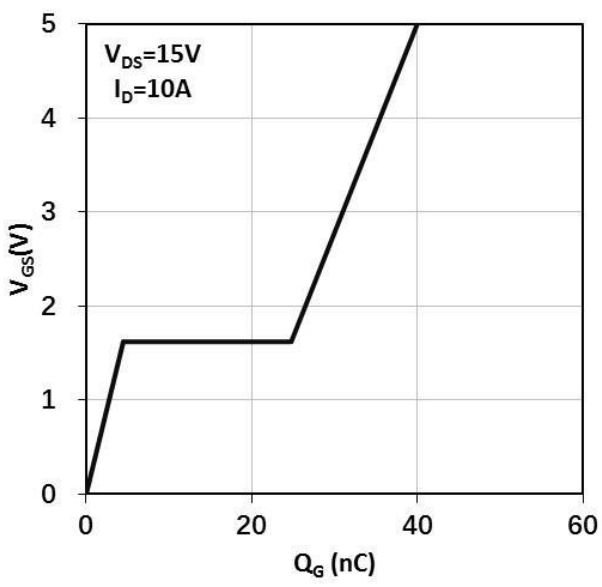


Figure 13 Normalized Threshold Voltage vs. Temp.

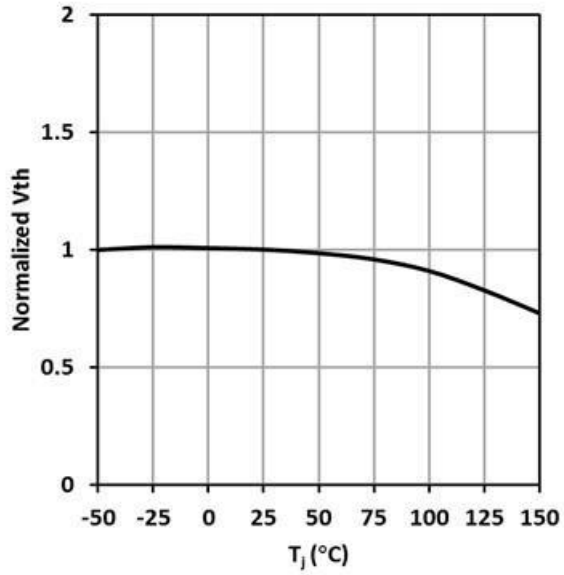


Figure 14 Output Charge

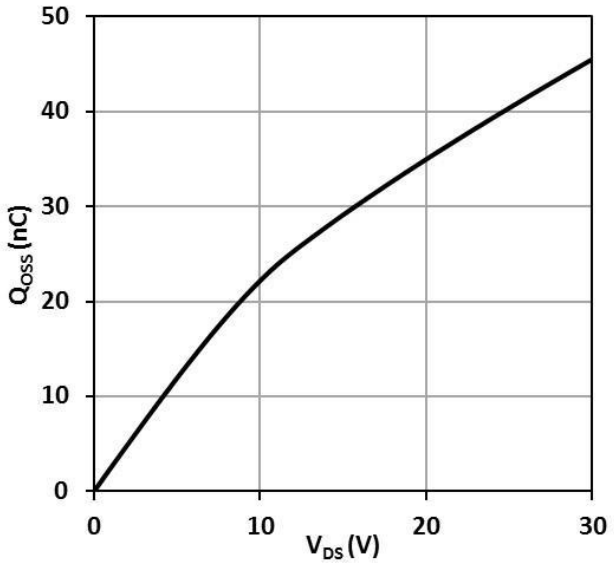


Figure 15 Output Capacitance Stored Energy

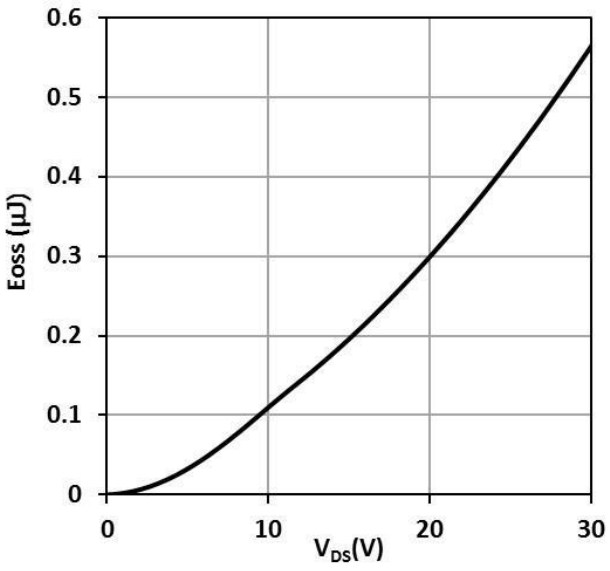


Figure 16 Power Dissipation

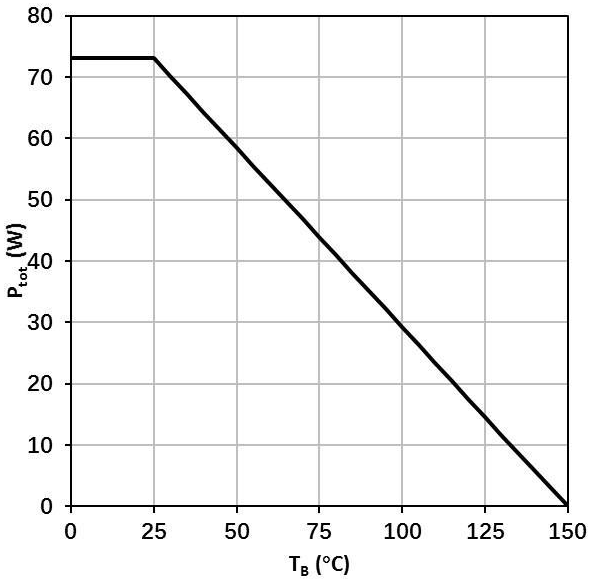


Figure 17 Safe Operating Area

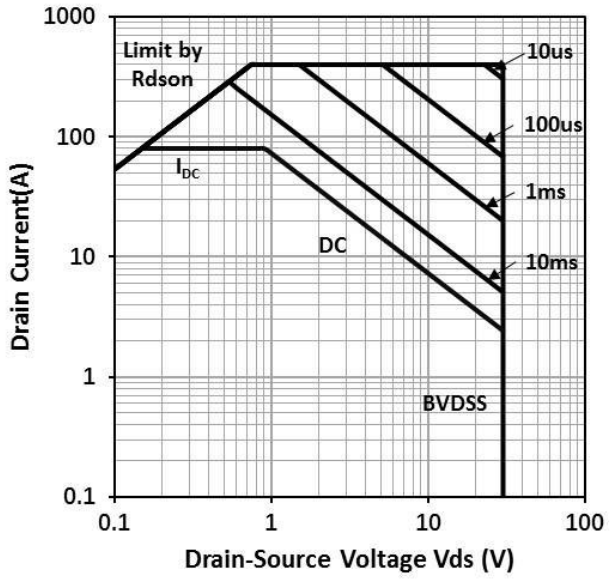
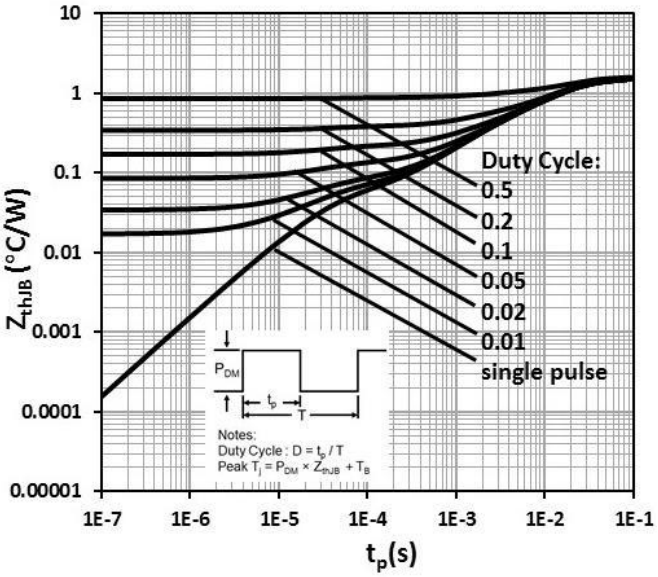
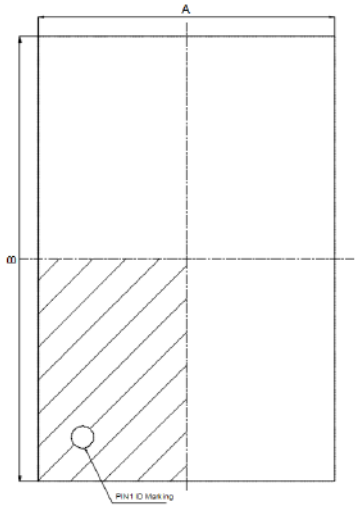


Figure 18 Max. Transient Thermal Impedance

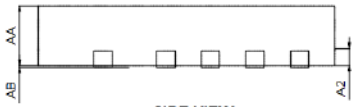


10. Package Outlines

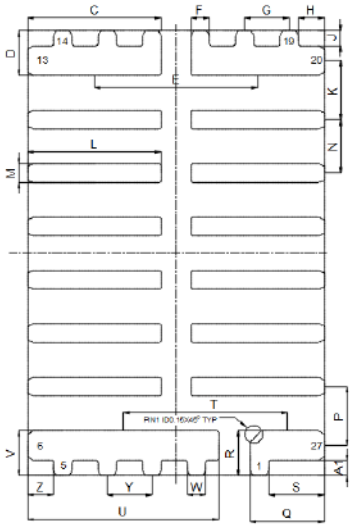
Package Reference



TOP VIEW



SIDE VIEW

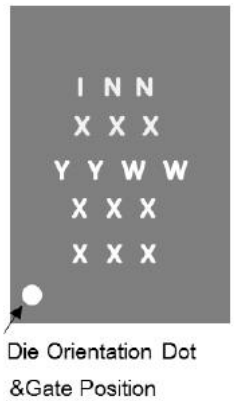


BOTTOM VIEW

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	3.90	4.00	4.10	
B	5.90	6.00	6.10	
C	1.700	1.800	1.900	2X
D	0.505	0.605	0.705	2X
E		2.200 BASIC		7X
F	0.200	0.250	0.300	6X
G		0.600 BASIC		4X
H		0.350 REF		2X
J		0.205 REF		6X
K		0.795 BASIC		2X
L	1.700	1.800	1.900	12X
M	0.200	0.250	0.300	12X
N		0.720 BASIC		10X
P		0.795 BASIC		2X
Q	0.900	1.000	1.100	
R	0.505	0.605	0.705	
S		0.750 REF		
T		2.213 BASIC		
U	2.475	2.575	2.675	
V	0.505	0.605	0.705	
W	0.200	0.250	0.300	5X
Y		0.600 BASIC		3X
Z		0.350 REF		
A1		0.205 REF		6X
A2		0.203 REF		
AA	0.75	0.85	0.95	
AB	0	0.02	0.05	

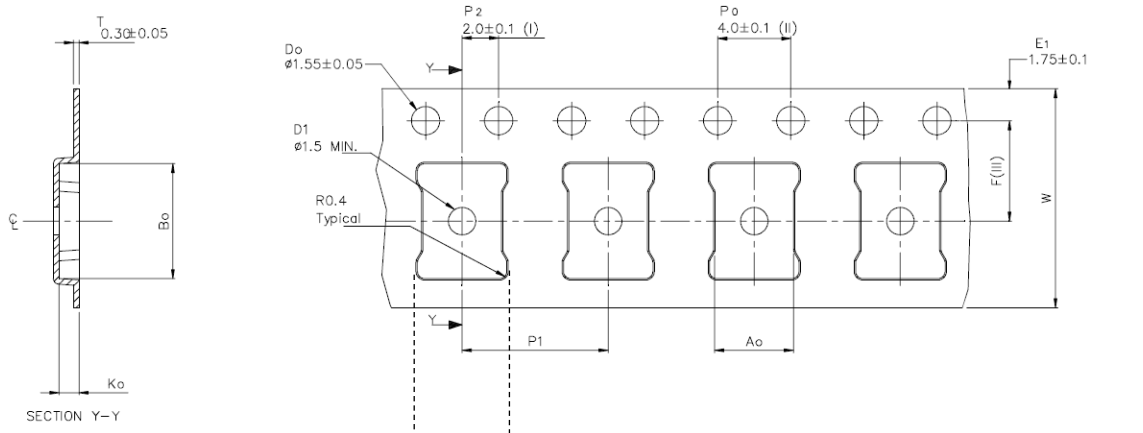
Marking Reference:



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 Code	XXX
Row 5		XXX

11. Reel Information

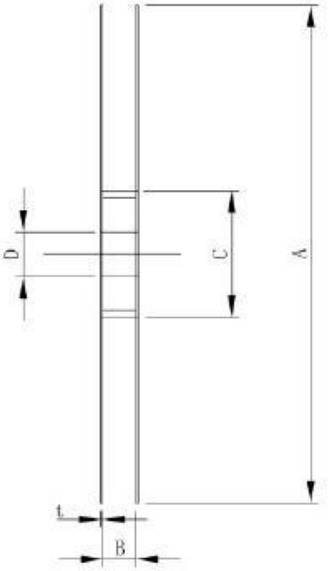


Ao	4.30 +/− 0.1
Bo	6.30 +/− 0.1
Ko	1.10 +/− 0.1
F	5.50 +/− 0.1
P1	8.00 +/− 0.1
W	12.00 +/− 0.3

(I) Measured from centreline of sprocket hole to centreline of pocket.
(II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
(III) Measured from centreline of sprocket hole to centreline of pocket.
(IV) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

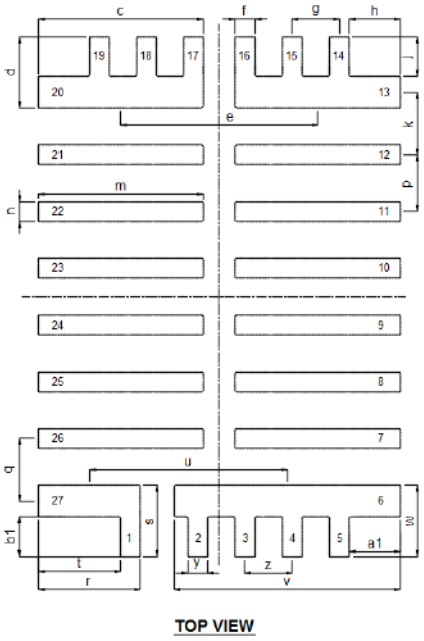
Unit: mm



Value & Tolerance				
A	B	C	D	t
Ø329±1	$12.4^{+2.0}_{-0.0}$	Ø100±1	Ø13.3±0.3	2.0±0.3

12. Land Pattern

Recommended Land Pattern



TOP VIEW

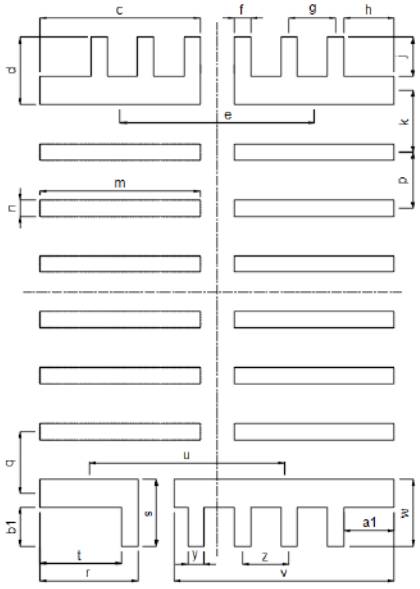
SYMBOL	MILLIMETER NOM	NOTE
c	2.100	2X
d	0.905	2X
e	2.500	7X
f	0.250	6X
g	0.600	4X
h	0.650	2X
j	0.505	6X
k	0.795	2X
m	2.100	12X
n	0.250	12X
p	0.720	10X
q	0.795	2X
r	1.300	
s	0.905	
t	1.050	
u	2.513	
v	2.875	
w	0.905	
y	0.250	5X
z	0.600	3X
a1	0.650	
b1	0.505	6X

NOTE:

1) LAND PATTERN IS SOLDER MASK DEFINED.

2) IT IS RECOMMENDED TO HAVE ON-CU TRACE PCB VIAS.

Recommended Stencil Drawling



TOP VIEW

SYMBOL	MILLIMETER NOM	NOTE
c	2.060	2X
d	0.865	2X
e	2.500	7X
f	0.210	6X
g	0.600	4X
h	0.650	2X
j	0.505	6X
k	0.795	2X
m	2.060	12X
n	0.210	12X
p	0.720	10X
q	0.795	2X
r	1.260	
s	0.865	
t	1.050	
u	2.513	
v	2.835	
w	0.865	
y	0.210	5X
z	0.600	3X
a1	0.650	
b1	0.505	6X

13. Revision History

Major changes since the last revision

Revision	Date	Description of changes
1.0	2024-08-15	1.0 Version Setup

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.