700V 210mΩ SolidGaN with Gate Clamp and DESAT

1. Features

- Latest High-Voltage G3.0 GaN Technology
- 210mΩ E-Mode GaN with Built-In Gate Clamp
- 700V Continuous, 750V Pulsed Voltage Rating
- Wide 8V to 20V Gate Input Voltage Range
- Self-Powered Technology, No Peripheral Power Required
- Adjustable Turn-On Slew Rate by External Gate Resistors
- Zero Reverse Recovery Charge
- Ultra-High Switching Frequency
- Suitable for Conventional PWM Controllers
- Available in 3-Lead TO-252 Package

2. Applications

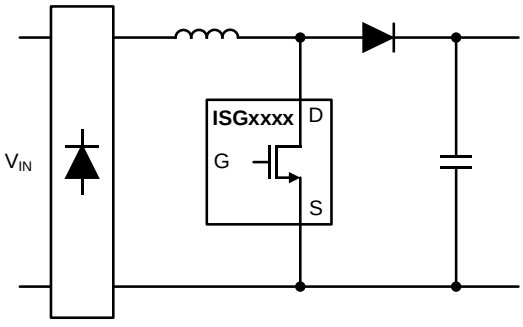
- Boost PFC, QR Flyback Topology
- AHB, LLC Topology
- AC-DC Power Adaptor, LED Lighting
- TV Power, Home Appliance Power

3. Description

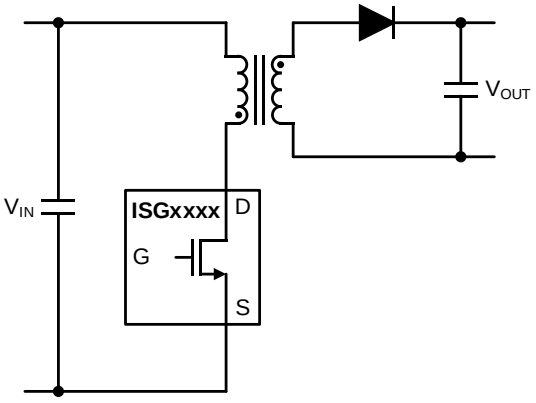
The ISG6134A SolidGaN IC seamlessly integrates a 700V enhanced mode Gallium Nitride (GaN) FET with a built-in gate clamp and DESAT protection in a conventional TO-252 package, establishing a new standard for performance, ease of use, and reliability in power electronics. It provides self-powered features without requiring a sustainable supply voltage for internal supply, ensuring consistent driving of GaN FET. With built-in DESAT protection, the ISG6134A further ensures device robustness and system safety.

The ISG6134A offers the ability to adjust the turn-on slew rate of the GaN FET using external gate resistors, allowing users to optimize efficiency and EMI performance. The ISG6134A's high integration level with a GaN FET and robust protection makes it suitable for a range of applications, from simple setups with low component counts to high-frequency and high-power applications.

4. Typical Application



< Boost PFC>



<QR Flyback>

Table of Contents

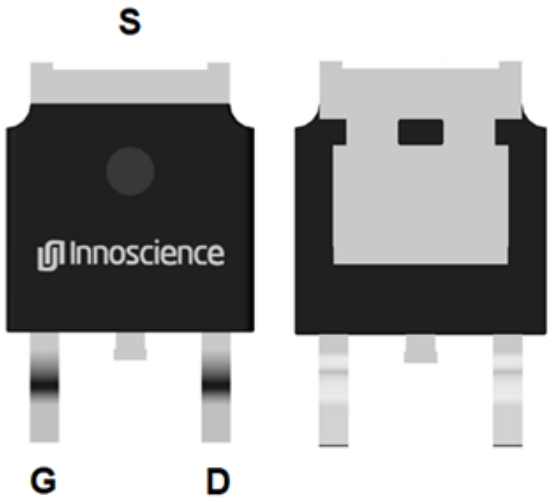
1. Features 1
2. Applications 1
3. Description 1
4. Typical Application 1
5. Revision History 2
6. Pin Configuration and Functions 3
7. Absolute Maximum Ratings 4
8. ESD Ratings 4
9. Recommended Operating Conditions 4
10. Thermal Information 4
11. Electrical Characteristics 5
12. Switching Characteristics 5
13. Typical Characteristics 6
14. Block Diagram 7
15. Function Description 7
16. Package Information 10
17. Tape and Reel Information 11
18. Recommended Land Pattern 12
19. Order Information 12

5. Revision History

Major changes since the last revision

Revision	Date	Description of Changes
0.1	2025-02-14	Preliminary datasheet

6. Pin Configuration and Functions



3-Lead TO-252 Package

Pin Number	Pin Name	Description
1	G	Gate Input. Connect to the drive output of controller or gate driver.
2	S	Source of Power GaN FET.
3	D	Drain of Power GaN FET.

7. Absolute Maximum Ratings

All pins are referred to S pin, unless otherwise specified. Stress beyond the absolute maximum ratings can cause permanent damage or deteriorate device lifetime.

Parameter	Value	Unit
Drain Voltage, Continuous	700	V
Drain Voltage, Pulsed (1)	750	V
Drain Current, Continuous (T_C = 25°C)	11.5	A
Drain Current, Pulsed (10us @ T_C = 25°C)	20.5	A
Drain Current, Pulsed (10us @ T_C = 125°C)	11.5	A
Gate Voltage, Continuous	-0.6 to 22	V
Gate Voltage, Pulsed (1)	-5 to 24	V
Power Dissipation	TBD	W
Operating Junction Temperature T_J	-40 to 150	˚C
Storage Temperature	-55 to 150	˚C

(1) Intended for repetitive events, t_{PULSE} <100ns.

8. ESD Ratings

T_J = 25°C unless otherwise specified.

Parameter	Value	Unit
Human Body Model (HBM), per ANSI/ESDA/JEDEC JS-001	±2000	V
Charged Device Model (CDM), per ANSI/ESDA/JEDEC JS-002	±1000	V

9. Recommended Operating Conditions

Parameter	Min	Max	Unit
Gate Input High Voltage	8	20	V
Gate Input Low Voltage	-0.3	0.3	V
Operating Junction Temperature	-40	125	˚C

10. Thermal Information

Symbol	Parameter	ISG6134ATK	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	TBD	˚C/W
$R_{\theta JC}$	Thermal Resistance, Junction to Case	TBD	˚C/W

According to standards defined in JESD51 and JESD51-1, thermal characteristics of the package are simulated. $R_{\theta JA}$ is determined with the device mounted on one square inch of copper pad, single layer 2 oz copper on FR4 board.

11. Electrical Characteristics

T_J = 25°C, V_{GS} = 12V, unless otherwise noted.

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Gate Characteristic						
Gate input threshold voltage	V_{GS_TH}	3.6	4	4.4	V	
Gate quiescent current	I_{GON_Q}		200		uA	V_{GS} = 12V
Protection						
DESAT protection threshold (2)	V_{DS_DESAT}		5.3		V	
DESAT blanking time (2)	t_{BLK_DESAT}		600		ns	
Power GaN FET						
Drain-source leakage current	I_{DSS}		0.4 4	TBD	uA uA	V_{GS}=0V, V_{DS}=700V, T_J=25°C V_{GS}=0V, V_{DS}=700V, T_J=150°C
Drain-source resistance	$R_{DS(ON)}$		160 378	210	mΩ	V_{GS}=12V, I_{DS}=3A; T_J=25°C V_{GS}=12V, I_{DS}=3A; T_J=150°C
Source-drain reverse voltage	V_{SD}		2.4		V	V_{GS}=0V, I_{SD}=3A
Total gate charge (2)	Q_G		1.71		nC	V_{GS}=0V, V_{DS}=0 to 400V
Output charge (2)	Q_{OSS}		16.5		nC	V_{GS}=0V, V_{DS}=0 to 400V
Reverse recovery charge (2)	Q_{RR}		0		nC	V_{DS}=400V, I_{DS}=3A
Input capacitance (2)	C_{ISS}		65		pF	V_{GS}=0V, V_{DS}=400V, f=100kHz
Output capacitance (2)	C_{OSS}		23.6		pF	V_{GS}=0V, V_{DS}=400V, f=100kHz
Effective output capacitance, energy related (2)	$C_{O(er)}$		32		pF	V_{GS}=0V, V_{DS}=0 to 400V
Effective output capacitance, time related (2)	$C_{O(tr)}$		42		pF	V_{GS}=0V, V_{DS}=0 to 400V

12. Switching Characteristics

T_J = 25°C, V_{GS} = 12V, unless otherwise noted.

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Turn-on propagation delay	t_{ON_PD}		100		ns	
Turn-off propagation delay	t_{OFF_PD}		100		ns	

(2) Not 100% tested and guaranteed by design.

13. Typical Characteristics

14. Block Diagram

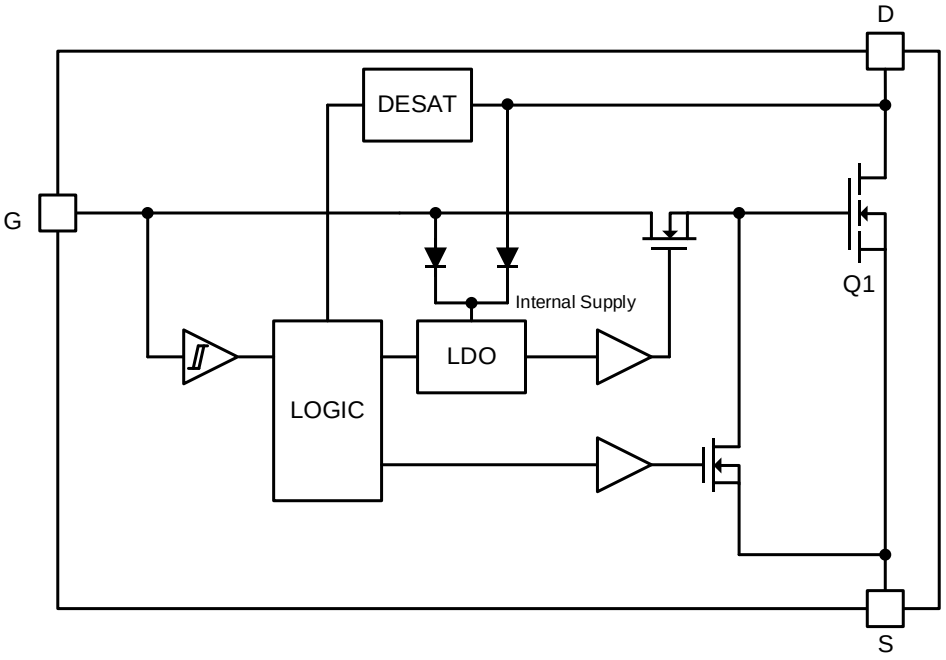


Figure 13. Functional Block Diagram

15. Function Description

The ISG6134A SolidGaN IC in a 3-lead TO-252 package contains high performance E-mode GaN FET with a built-in gate clamp and DESAT protection. It incorporates a self-powered feature without specified supply voltage for internal circuitry, converting supply either G or D pin corresponding its operation. This ensures consistent driving of GaN FET with easy-of-use and reliable operation.

The ISG6134A enables the independent adjustment of turn-on slew rate for driver by an external gate resistor, optimizing both EMI performance and efficiency. With the high integration level of GaN FET and robust protection, the ISG6134A offers a simple setup with a low component count, ensuring it is suitable for high-frequency and high-power applications.

Power-On-Sequence and Self-Powered Operation

The ISG6134A offers the self-powered feature without sustainable supply voltage for internal supply (VDD). It converts supply either G or D pin according to operation states to guarantee consistent driving of GaN FET.

Figure 14 shows the switching characteristics of the G and D. When the system is powered on, D pin is pulled high, the internal supply is powered from the D pin. The D voltage exceeding 30V is required for proper power supply typically. When G pin voltage goes above 4.0V, the internal GaN FET turns on with a time delay, t_{ON_PD}, and the D is pulled down to ground, powering the internal supply from G pin. When the G pin voltage goes below 4.0V, the internal GaN FET turns off with a time delay, t_{OFF_PD}.

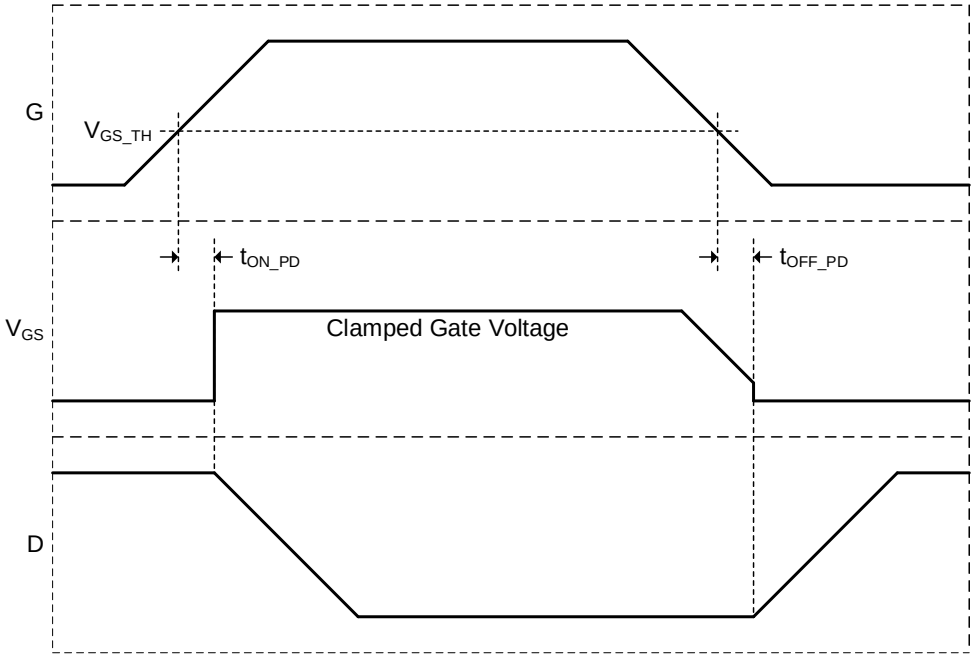


Figure 14. Timing Diagram of Input and Output

Adjustable Turn-On and Turn-Off Slew Rate

The ISG6134A supports users the ability to adjust both turn-on and turn-off slew rate of the GaN FET independently. This is achieved by adding external gate resistors and diode between the driver output and G pin of ISG6134A as shown in Figure 15, targeting optimization of efficiency, reliability, and EMI performance.

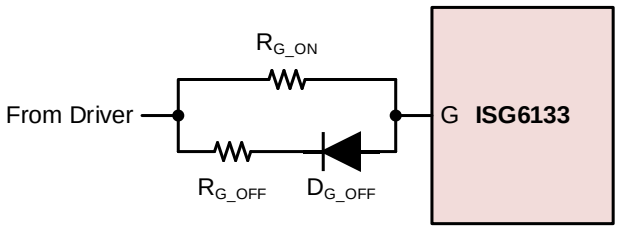


Figure 15. Configuration of Adjustable Turn-On Slew Rate

DESAT Protection

The ISG6134A provides cycle-by-cycle DESAT protection by monitoring the drain-source voltage, V_{DS}, to protect the GaN FET from potential damage in the desaturation region. As illustrated in the timing diagram of Figure 16, when the V_{DS} exceeds the DESAT protection threshold (5.9V typical), the GaN FET is turned off. The GaN FET will be turned on again at the next rising edge of G signal. The blanking time of 600ns (typical) is added to prevent false triggering during the GaN FET turn-on.

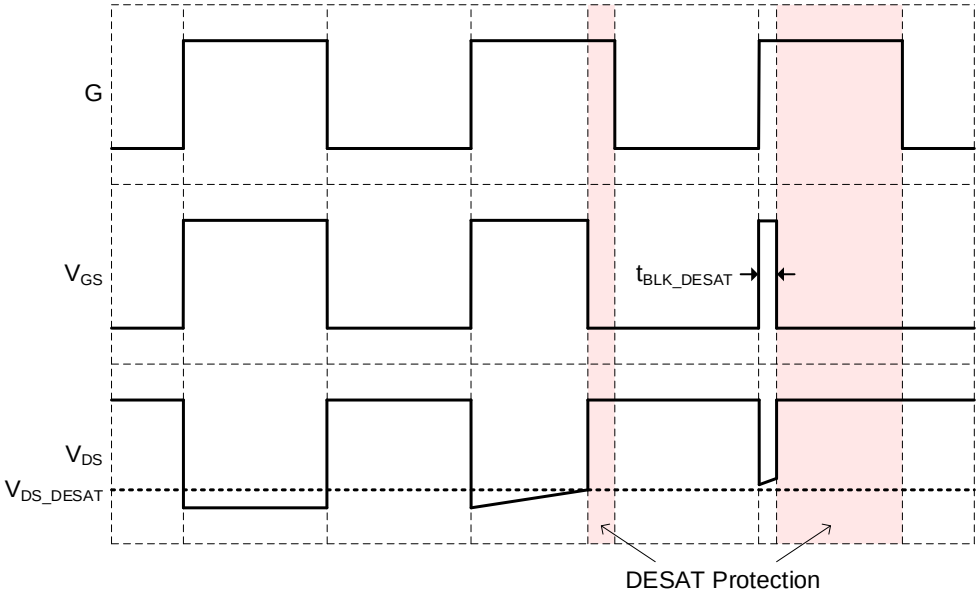
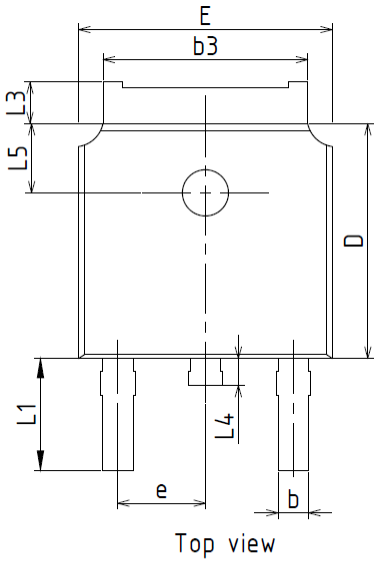
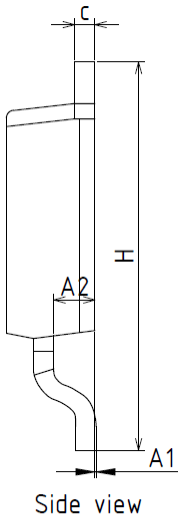
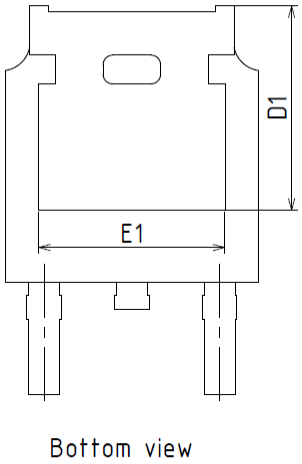


Figure 16. Timing Diagram of DESAT Protection

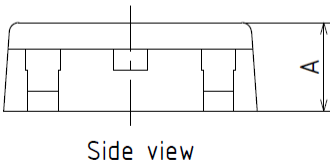
16. Package Information

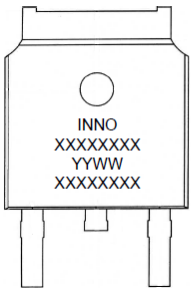






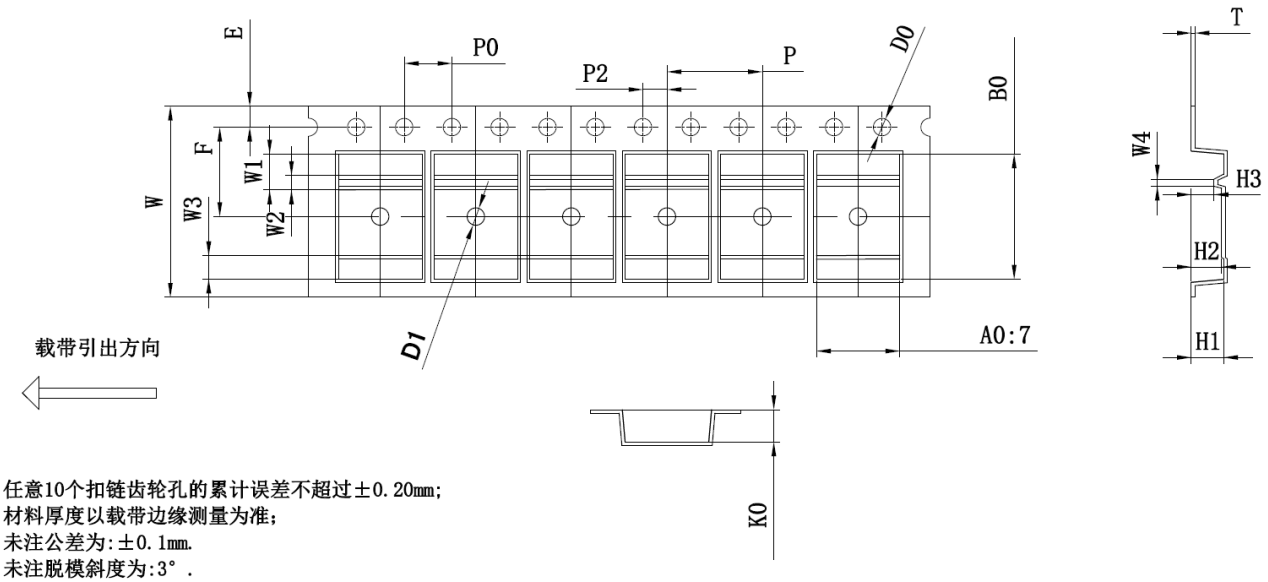
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0.00	-	0.12
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.46
c	0.43	0.53	0.61
D	5.98	6.10	6.22
D1	5.30REF		
E	6.40	6.60	6.73
E1	4.63	-	-
e	2.286BSC		
H	9.40	10.10	10.50
L	1.38	1.50	1.75
L1	2.90BSC		
L3	0.88	-	1.28
L4	0.50	-	1.00
L5	1.65	1.80	1.95





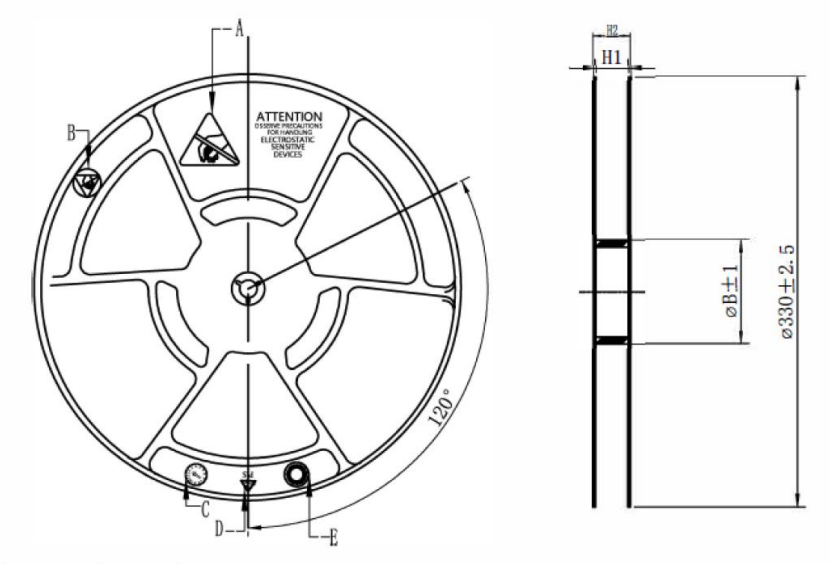
ROW	Description	Example
Row1	Company name	INNO
Row2	Product code	XXXXXXXX
Row3	Date code	YYWW
Row4	ASSY lot No.	XXXXXXXX

17. Tape and Reel Information



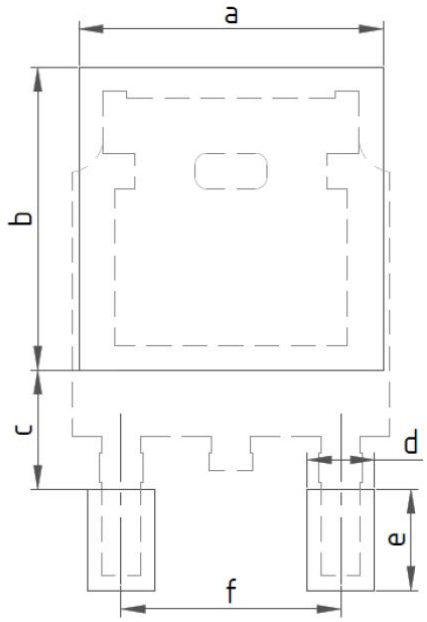
(1)任意10个扣链齿轮孔的累计误差不超过±0.20mm;
(2)材料厚度以载带边缘测量为准;
(3)未注公差为:±0.1mm.
(4)未注脱模斜度为:3°.
(5)所有尺寸符合EIA-481-D版本.
(6)材料：ABS-A0.

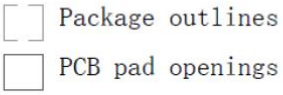
DATA	16.0 +0.40 -0.20	0.30 ±0.05	8.00 ±0.15	7.00 ±0.20	10.50 ±0.15	2.70 ±0.15	0.00 +0.10 -0.10	1.75 ±0.15	7.50 ±0.15	4.00 ±0.15	2.00 ±0.15	1.55 ±0.15	1.50 ±0.25	3.0 ±0.15	1.2 ±0.15	2.0 ±0.15	2.7 ±0.15	2.5 ±0.15	1.7 ±0.15	0.6 ±0.15
	W	T	P	A0	B0	K0	K1	E	F	P0	P2	D0	D1	W1	W2	W3	H1	H2	H3	W4



Unit:	mm
Tape Width	16
H1	16.4±0.1
H2MAX	22.4

18. Recommended Land Pattern





SYMBOL	DIMENSION	SYMBOL	DIMENSION
a	6.33	d	1.40
b	6.30	e	2.10
c	2.48	f	4.57

Notes:
(1)All dimension are in millimeters.
(2)Drawing is not to scale.

19. Order Information

Ordering Code	Package	Product Code	MSL	Packing (Tape & Reel)
ISG6134ATK	TO-252-3L	6133ATK	MSL3	13” 2500PCS/reel

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.