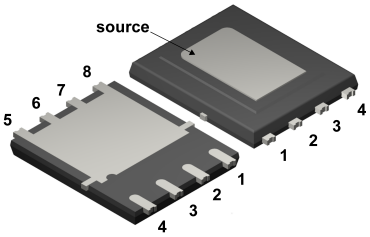
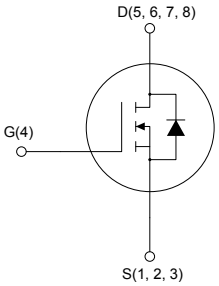
STLD257N4F7AG

Datasheet

Automotive-grade N-channel 40 V, 0.82 mΩ typ., 120 A, STripFET™ F7 Power MOSFET in a PowerFLAT™ 5x6 DSC package



PowerFLAT™ 5x6 dual side cooling



AM15540v4

Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STLD257N4F7AG	40 V	1.1 mΩ	120 A

- AEC-Q101 qualified
- Among the lowest $R_{DS(on)}$ on the market
- Excellent FoM (figure of merit)
- Low C_{rss}/C_{iss} ratio for EMI immunity
- High avalanche ruggedness
- Wettable flank package

Applications

- Switching applications

Description

This N-channel Power MOSFET utilizes STripFET™ F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Product status link
STLD257N4F7AG

Product summary	
Order code	STLD257N4F7AG
Marking	257
Package	PowerFLAT™ 5x6 dual side cooling
Packing	Tape and reel

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	40	V
V_{GS}	Gate-source voltage	±20	V
I_D[(1)(2)]	Drain current (continuous) at T_C = 25 °C	120	A
I_D[(1)(2)]	Drain current (continuous) at T_C = 100 °C	120	A
I_{DM}[(2)(3)]	Drain current (pulsed)	480	A
P_{TOT}[(2)]	Total power dissipation at T_C = 25 °C	158	W
T_J	Operating junction temperature range	-55 to 175	°C
T_{stg}	Storage temperature range		

1. *Limited by package*
2. *The value is rated according to $R_{thj\text{-}case\ bottom\ side}$.*
3. *Pulse width limited by safe operating area*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}c\ top\ side}$	Thermal resistance junction-case top side	2.90	°C/W
$R_{thj\text{-}c\ bottom\ side}$	Thermal resistance junction-case bottom side	0.95	
$R_{thj\text{-}pcb}$[(1)]	Thermal resistance junction-pcb	31.3	

1. *When mounted on an 1-inch² 2 Oz, Cu board, t ≤ 10 s*

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AV}	Avalanche current, repetitive or not repetitive (pulse width limited by maximum junction temperature)	50	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AV}, V_{DD} = 25 V)	608	mJ

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V, I_D = 1 mA	40			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 40 V			1	µA
		V_{GS} = 0 V, V_{DS} = 16 V, Tj = 125 °C(1)			300	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = 20 V			100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2.0		4.0	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 60 A		0.82	1.1	mΩ
		V_{GS} = 6.5 V, I_D = 60 A		3.1	4.8	

1. *Defined by design, not subject to production test.*

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS}= 25 V, f = 1 MHz, V_{GS} = 0 V	-	5400	-	pF
C_{oss}	Output capacitance		-	1870	-	pF
C_{rss}	Reverse transfer capacitance		-	45	-	pF
Q_g	Total gate charge	V_{DD} = 20 V, I_D = 120 A, V_{GS} = 0 to 10 V (see Figure 13. Test circuit for gate charge behavior)	-	66.5	-	nC
Q_{gs}	Gate-source charge		-	33.5	-	nC
Q_{gd}	Gate-drain charge		-	13	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 20 V, I_D = 60 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 12. Test circuit for resistive load switching times and Figure 17. Switching time waveform)	-	28	-	ns
t_r	Rise time		-	19	-	ns
$t_{d(off)}$	Turn-off delay time		-	58	-	ns
t_f	Fall time		-	32	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} (1)	Source-drain current		-		120	A
I_{SDM} (1)(2)	Source-drain current (pulsed)		-		480	A
V_{SD} (3)	Forward on voltage	V_{GS} = 0 V, I_{SD} = 90 A	-		1.1	V
t_{rr}	Reverse recovery time	I_{SD} = 120 A, di/dt = 100 A/µs, V_{DD} = 20 V (see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	54		ns
Q_{rr}	Reverse recovery charge		-	53		nC
I_{RRM}	Reverse recovery current		-	1.9		A

1. *Limited by package.*
2. *Pulse width is limited by safe operating area.*
3. *Pulse test: pulse duration = 300 µs, duty cycle 1.5%*

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

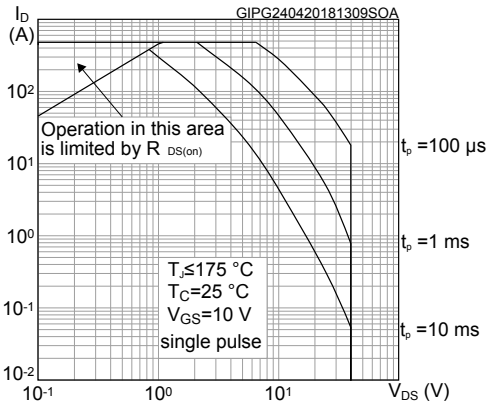


Figure 2. Thermal impedance

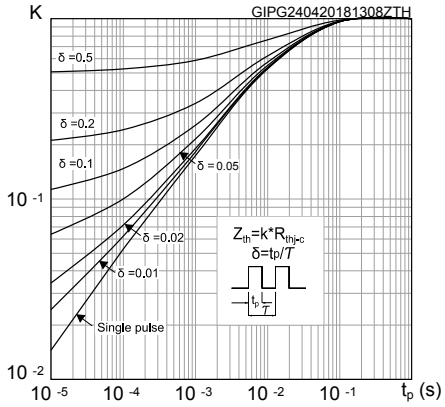


Figure 3. Output characteristics

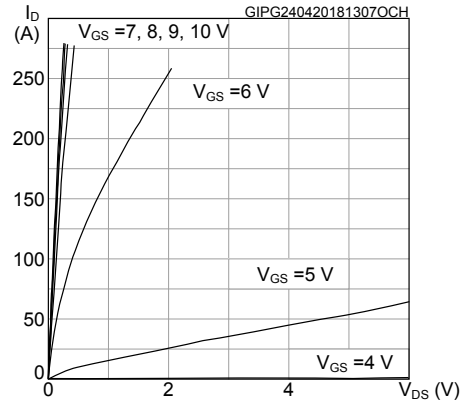


Figure 4. Transfer characteristics

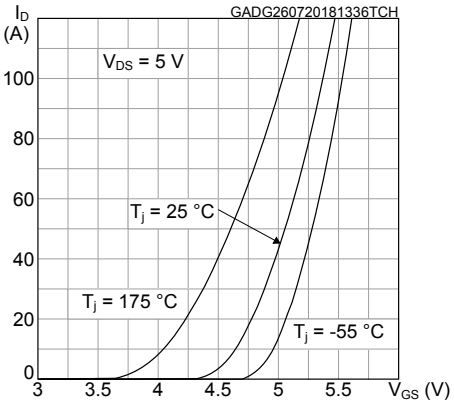


Figure 5. Gate charge vs gate-source voltage

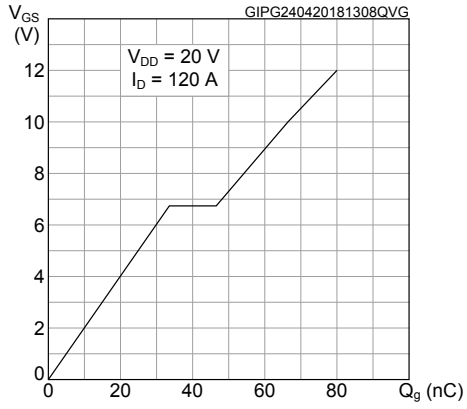


Figure 6. Static drain-source on-resistance

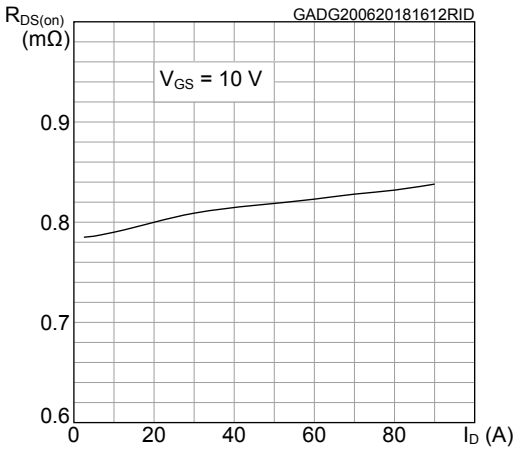


Figure 7. Capacitance variations

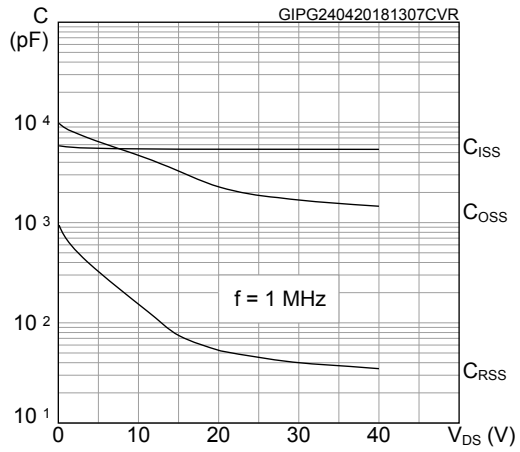


Figure 8. Normalized gate threshold voltage vs temperature

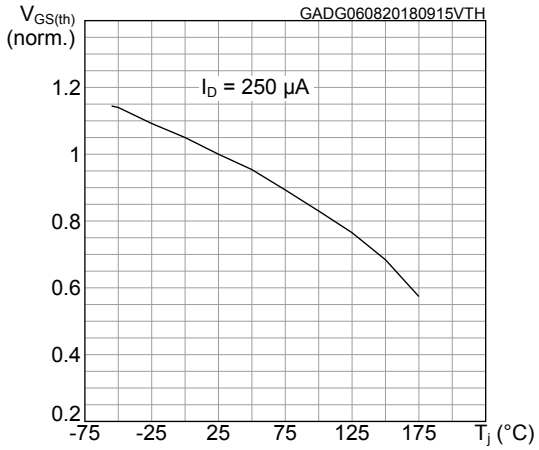


Figure 9. Normalized on-resistance vs temperature

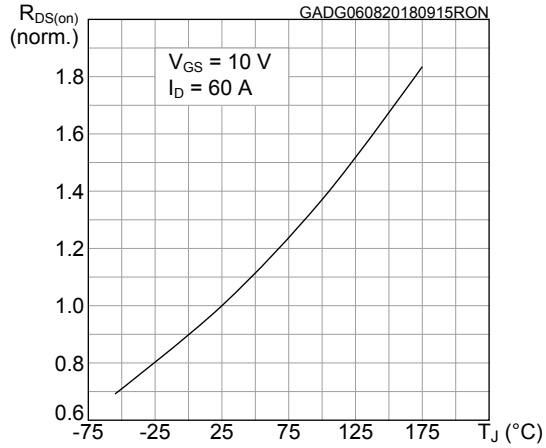


Figure 10. Normalized $V_{(BR)DSS}$ vs temperature

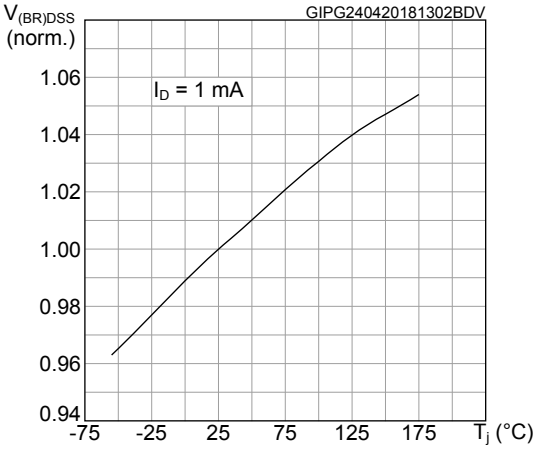
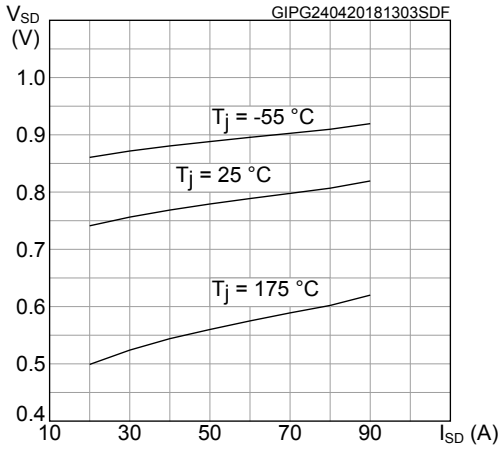


Figure 11. Source-drain diode forward characteristics



3 Test circuits

Figure 12. Test circuit for resistive load switching times

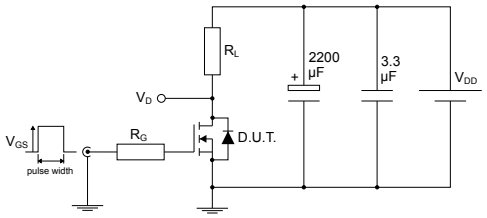


Figure 13. Test circuit for gate charge behavior

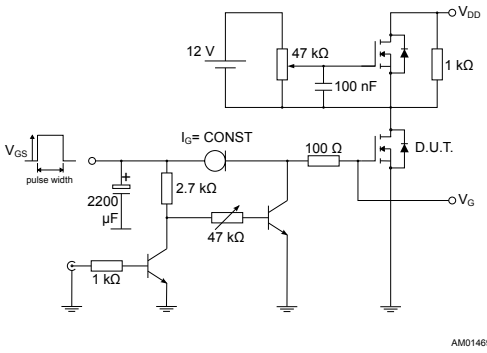


Figure 14. Test circuit for inductive load switching and diode recovery times

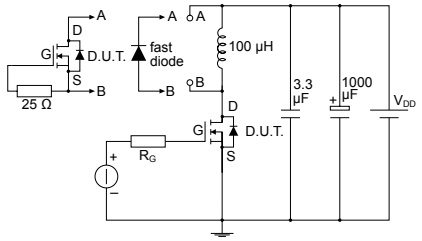


Figure 15. Unclamped inductive load test circuit

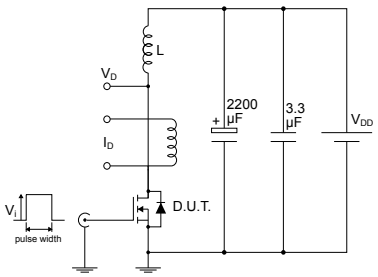


Figure 16. Unclamped inductive waveform

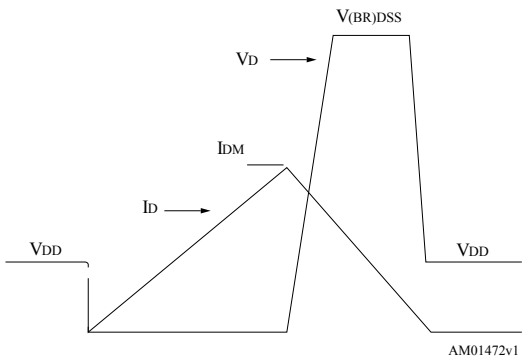
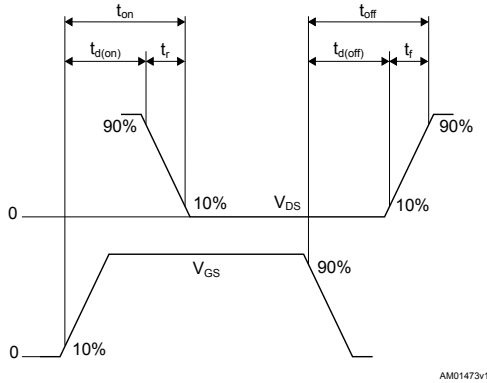


Figure 17. Switching time waveform



4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

4.1 PowerFLAT™ 5x6 dual side cooling package information

Figure 18. PowerFLAT™ 5x6 dual side cooling package outline

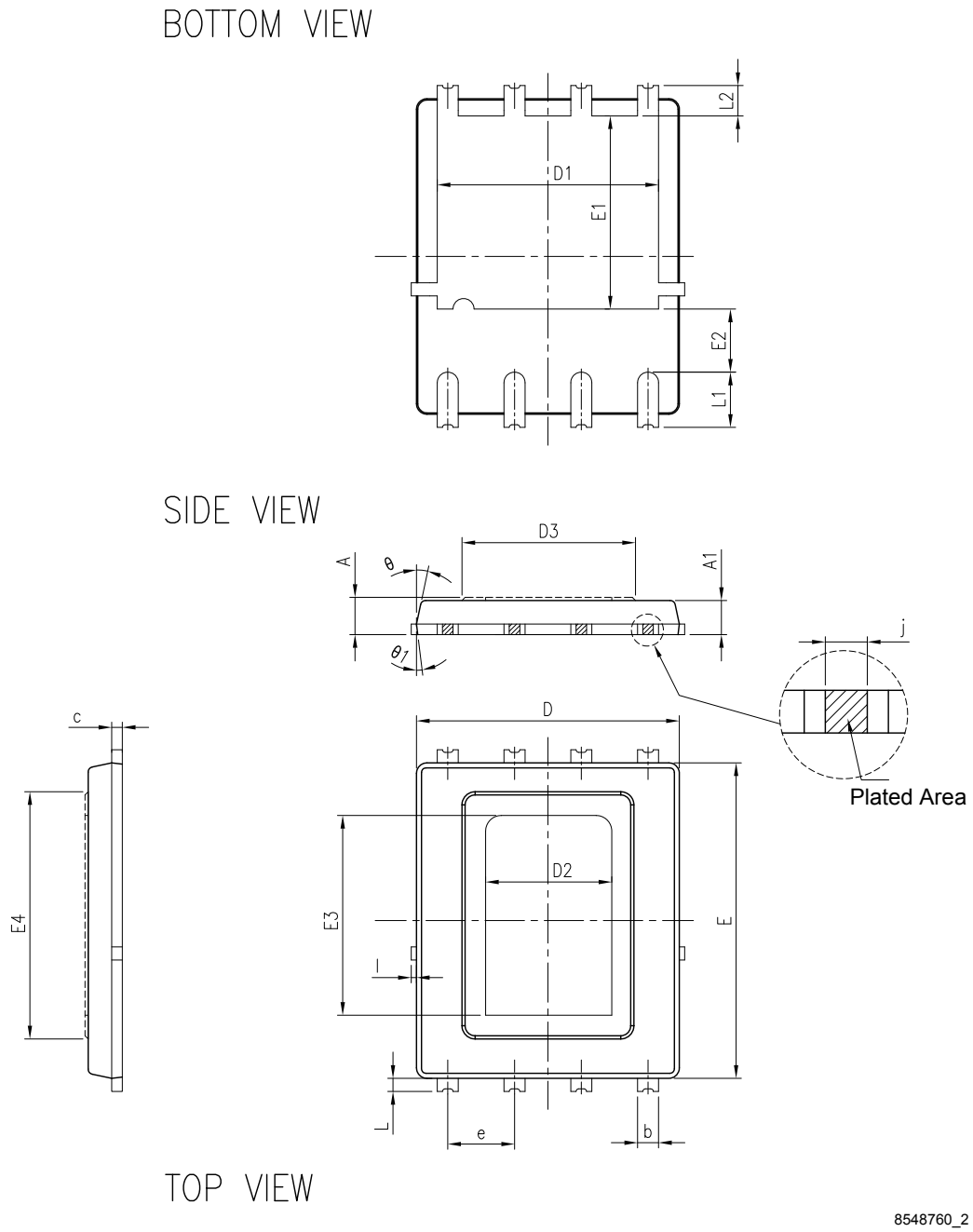
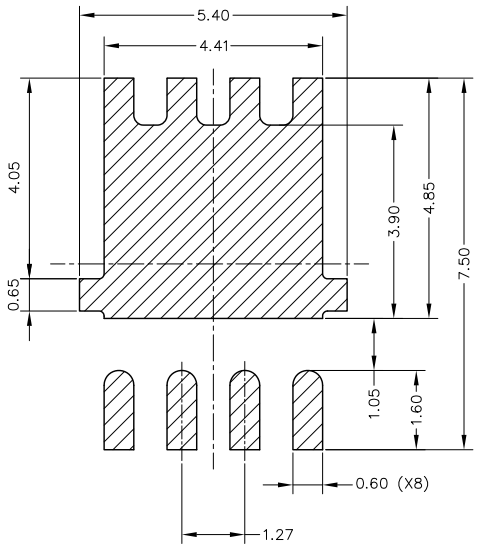


Table 8. PowerFLAT™ 5x6 dual side cooling mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.66	0.71	0.76
A1	0.60		0.75
b	0.33	0.43	0.53
c	0.15	0.203	0.30
D		5.00 BSC	
D1	4.06	4.21	4.36
D2		2.40 BSC	
D3	2.80	3.30	3.80
E		6.00 BSC	
E1	3.525	3.675	3.825
E2	1.05	1.20	1.35
E3		3.80 BSC	
E4	4.20	4.70	5.20
e		1.27 BSC	
I			0.15
L	0.15	0.25	0.35
L1	0.925	1.05	1.175
L2	0.45	0.575	0.70
ϑ		12° BSC	
ϑ1		7° BSC	
j		0.20 BSC	

Figure 19. PowerFLAT™ 5x6 dual side cooling recommended footprint (dimensions are in mm)



4.2 PowerFLAT™ 5x6 dual side cooling packing information

Figure 20. PowerFLAT™ 5x6 dual side cooling tape (dimensions are in mm)

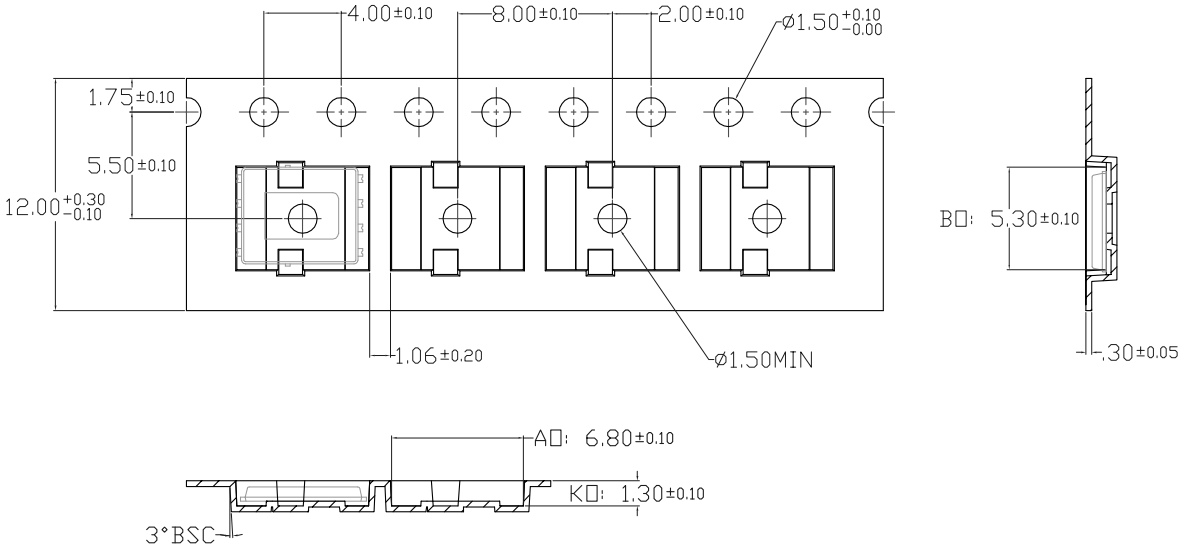


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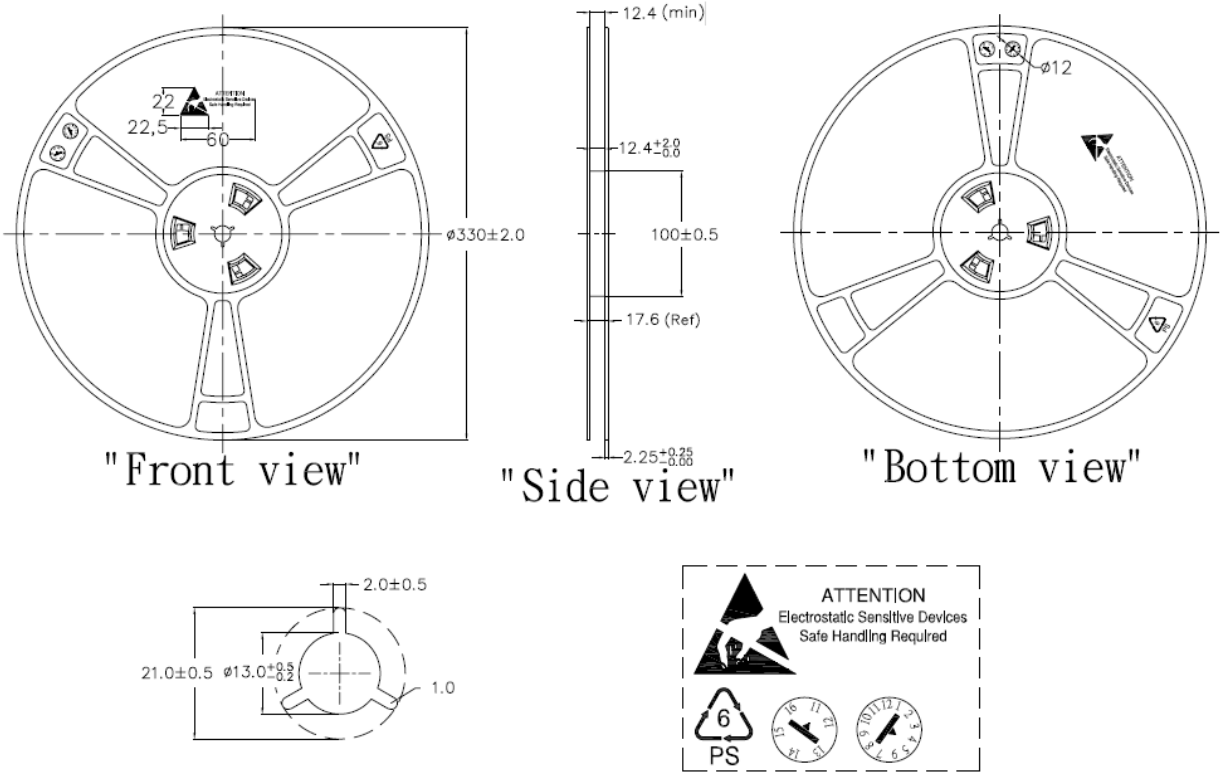
Figure 21. PowerFLAT™ 5x6 dual side cooling reel (dimensions are in mm)



Revision history

Table 9. Document revision history

Date	Revision	Changes
02-May-2018	1	Initial release.
26-Jul-2018	2	Document status promoted from preliminary to production data. Updated *Table 4. On/off states*. Updated *Section 2.1 Electrical characteristics (curves)*. Minor text changes
6-Aug-2018	3	Updated *Table 5. Dynamic*. Updated *Section 2.1 Electrical characteristics (curves)* Minor text changes
21-Mar-2019	4	Modified Table 4. On/off states. Modified Figure 1. Safe operating area, Figure 4. Transfer characteristics, Figure 6. Static drain-source on-resistance and Figure 9. Normalized on-resistance vs temperature. Minor text changes.

Contents