IRXF5210STRL

PPD-98017B

Power MOSFET
Surface Mount (D²PAK (TO-263))
100V, -38A, P-channel Technology

Features

- Advanced Process Technology
- Ultra Low On-Resistance
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead solder dipped

Product Summary

- **BV_{DSS}:** -100V
- **I_D:** -38A
- **$R_{DS\ (on),\ max}$:** 60mΩ
- **$Q_{G,\ max}$:** 230nC

(D2PAK (TO-263))

Potential Applications

- Brushed Motor drive applications
- BLDC Motor drive applications
- PWM Inverterized topologies

Product Validation

JESD-22 Qualification

Description

IR HiRel technology provides high performance power MOSFETs. The combination of low $R_{DS(on)}$ and low gate charge reduces the power losses in switching applications such as DC-DC converters and motor controllers. These devices retain all of the well-established advantages of MOSFETs such as voltage control, fast switching and temperature stability of electrical parameters. The package is offered in lead solder dipped.

Ordering Information

Table 1 Ordering options

Part number	Package	Part Marking	Standard Pack	
			Form	Quantity
IRXF5210STRL	D2 PAK(TO-263)	XF5210S	Tape and Reel	500

Table of contents

1 Absolute Maximum Ratings

Table 2 Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
I_D @ V_{GS} = -10V, T_C = 25°C	Continuous Drain Current	-38	A
I_D @ V_{GS} = -10V, T_C = 100°C	Continuous Drain Current	-24	A
I_{DM} @ T_C = 25°C	Pulsed Drain Current [1]	-140	A
P_D @ T_A = 25°C	Maximum Power Dissipation	3.1	W
P_D @ T_C = 25°C	Maximum Power Dissipation	170	W
	Linear Derating Factor	1.3	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy [2], [4]	120	mJ
I_{AR}	Avalanche Current [1]	-23	A
E_{AR}	Repetitive Avalanche Energy [1]	17	mJ
dv/dt	Peak Diode Reverse Recovery [3]	-7.4	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C
	Lead Temperature	300 (0.063 in. /1.6 mm from case for 10s)	

[1] Repetitive rating: Pulse width limited by maximum junction temperature.

[2] Starting T_J = 25°C, L = 0.46mH, R_G=25Ω, I_{AS} =-23A, V_{GS} = 10V

[3] I_{SD} ≤ -23A, di/dt ≤ -650A/µs, V_{DD} ≤ -100V, T_J ≤ 150°C

[4] 100% tested in final test production.

2 Device Characteristics

2.1 Electrical Characteristics

Table 3 Static and Dynamic Electrical Characteristics @ T_j = 25°C (Unless Otherwise Specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage [2]	-100	—	—	V	V_{GS} = 0V, I_D = -250µA
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	-0.11	—	V/°C	Reference to 25°C, I_D = -1.0mA
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance [2]	—		60	mΩ	V_{GS} = -10V, I_D = -38A [1]
$V_{GS(th)}$	Gate Threshold Voltage [2]	-2.0	—	-4.0	V	V_{DS} = V_{GS}, I_D = -250µA
Gfs	Forward Transconductance	9.5	—	—	S	V_{DS} = -50V, I_D = -23A
I_{DSS}	Zero Gate Voltage Drain Current	—	—	-50	µA	V_{DS} = -100V, V_{GS} = 0V [2]
		—	—	-250		V_{DS} = -80V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Leakage Forward [2]	—	—	-100	nA	V_{GS} = -20V
	Gate-to-Source Leakage Reverse [2]	—	—	100		V_{GS} = 20V
Q_G	Total Gate Charge	—	150	230	nC	I_D = -23A V_{DS} = -80V V_{GS} = -10V
Q_{GS}	Gate-to-Source Charge	—	22	33		
Q_{GD}	Gate-to-Drain ('Miller') Charge	—	81	120		
$t_{d(on)}$	Turn-On Delay Time	—	14	—	ns	I_{D1} = -23A ** V_{DD} = -50V R_G = 2.4Ω V_{GS} =- 10V
t_r	Rise Time	—	63	—		
$t_{d(off)}$	Turn-Off Delay Time	—	72	—		
t_f	Fall Time	—	55	—		
C_{iss}	Input Capacitance	—	2780	—	pF	V_{GS} = 0V V_{DS} = -25V f = 1.0MHz
C_{oss}	Output Capacitance	—	800	—		
C_{rss}	Reverse Transfer Capacitance	—	430	—		

** Switching speed maximum limits are based on manufacturing test equipment and capability.

[1] Pulse width ≤ 300 µs; Duty Cycle ≤ 2%

[2] 100% tested in final test production.

2.2 Source-Drain Diode Ratings and Characteristics

Table 4 Source-Drain Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
I_S	Continuous Source Current (Body Diode)	—	—	-38	A	
I_{SM}	Pulsed Source Current (Body Diode) [1]	—	—	-140	A	
V_{SD}	Diode Forward Voltage [4]	—		-1.6	V	T_J = 25°C, I_S = -23A, V_{GS} = 0V [2]
t_{rr}	Reverse Recovery Time	—	170	260	ns	T_J = 25°C, I_F = -23A, V_{DD} ≤ -25V di/dt = -100A/µs
Q_{rr}	Reverse Recovery Charge	—	1180	1770	nC	
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible				

2.3 Thermal Characteristics

Table 5 Thermal Resistance

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{\theta JC}$	Junction-to-Case	—	—	0.75	°C/W
$R_{\theta JA}$	Junction-to- Ambient (Typical socket mount) [3]	—	—	40	

[1] Repetitive rating; Pulse width limited by maximum junction temperature.

[2] Pulse width ≤ 300 µs; Duty Cycle ≤ 2%

[3] When mounted on 1" square PCB (FR -4for G-10 Material). For recommended footprint and soldering techniques refere to application note # AN-994

[4] 100% tested in final test production.

3 Electrical Characteristics Curves

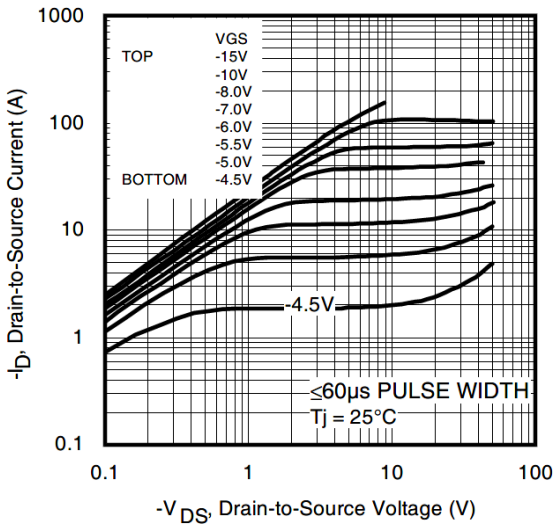


Figure 1 Typical Output Characteristics

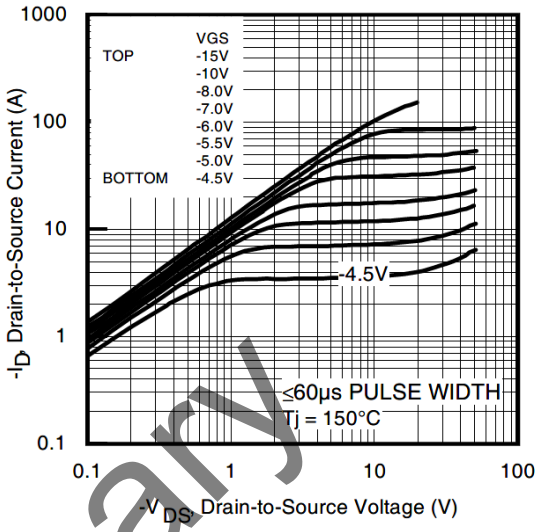


Figure 2 Typical Output Characteristics

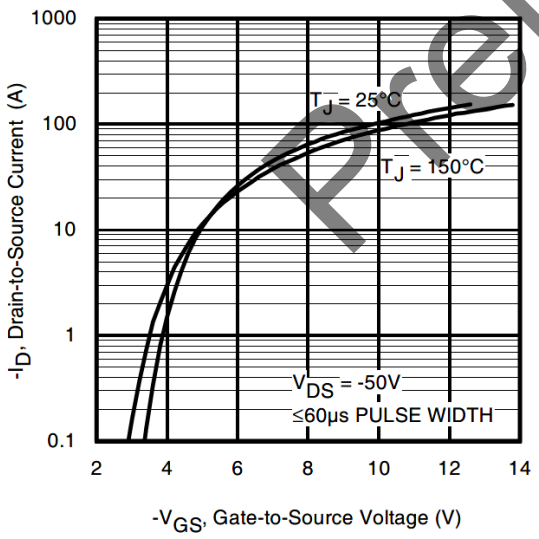


Figure 3 Typical Transfer Characteristics

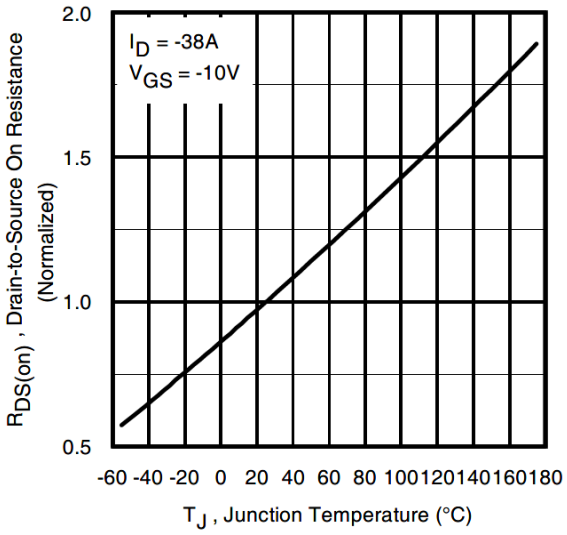


Figure 4 Normalized On-Resistance Vs. Temperature

Electrical Characteristics Curves

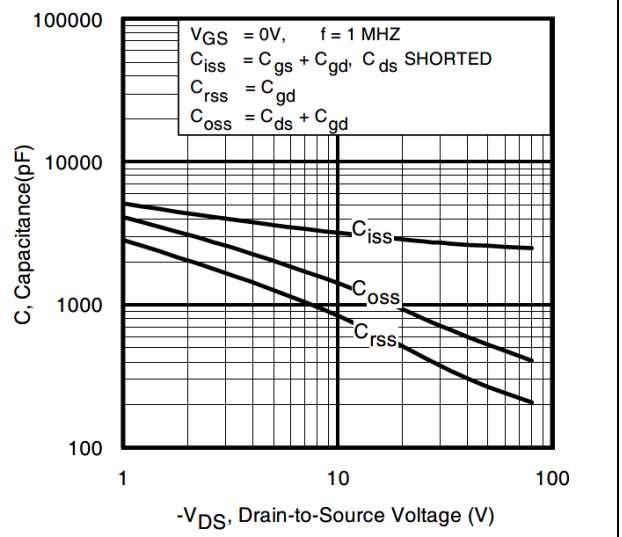


Figure 5 Typical Capacitance Vs. Drain-to-Source Voltage

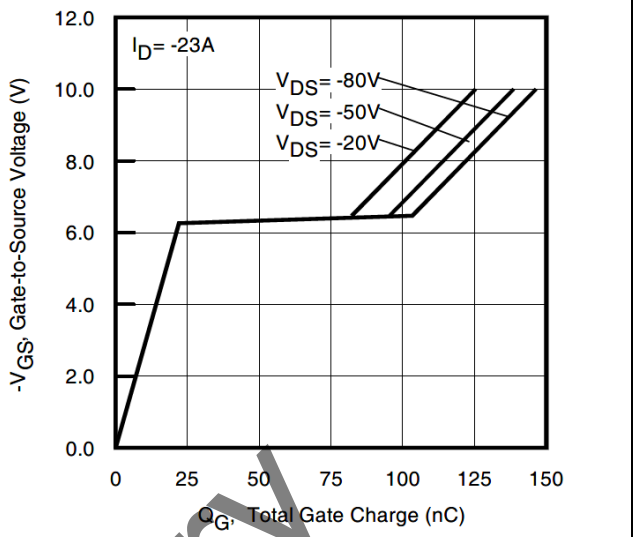


Figure 6 Typical Gate Charge Vs. Gate -to -Source Voltage

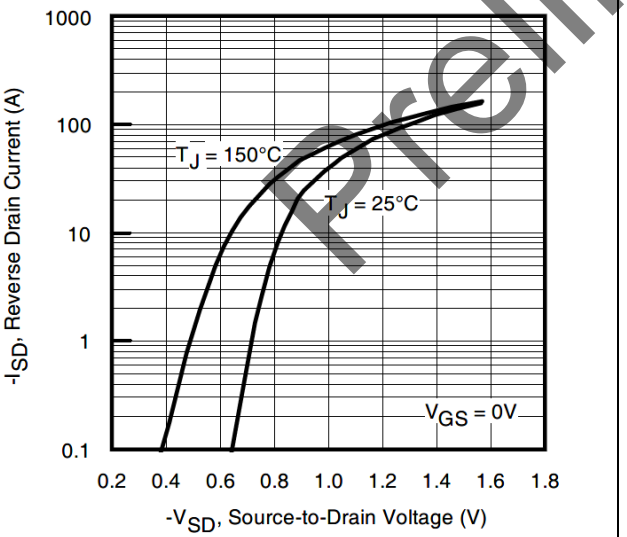


Figure 7 Typical Source-Drain Current Vs. Diode Forward Voltage

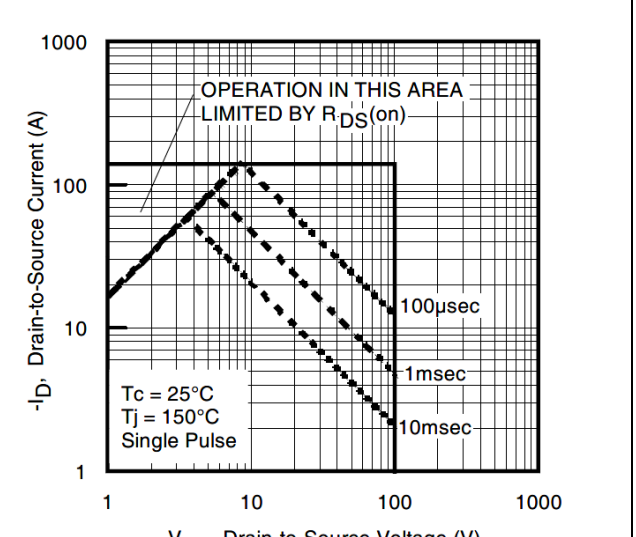


Figure 8 Maximum Safe Operating Area

Electrical Characteristics Curves

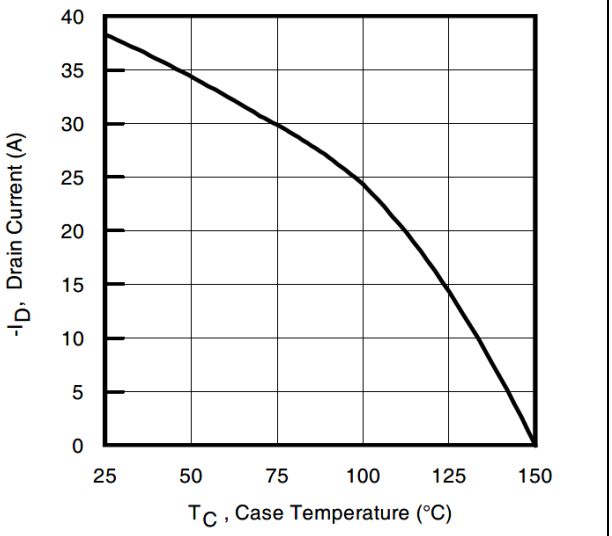


Figure 9 Maximum Drain Curent Vs. Case Temperature

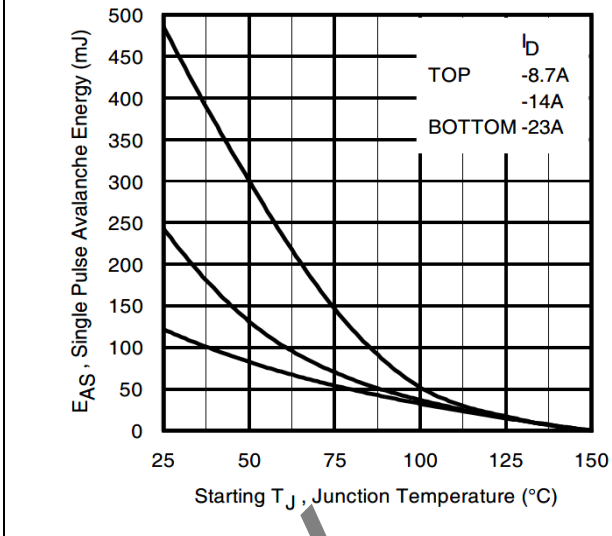


Figure 10 Maximum Avalanche Energy vs. Temperature

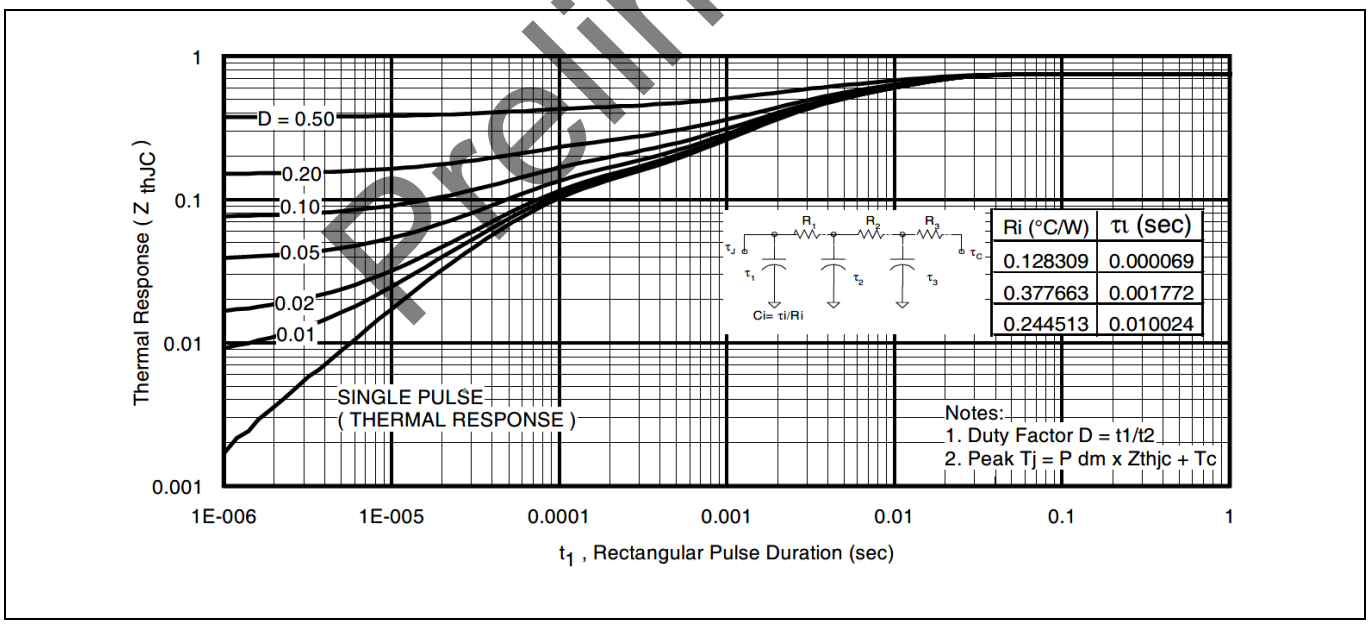


Figure 11 Maximum Effective Transient Thermal Impedance, Junction-to-Case

4 Test Circuits

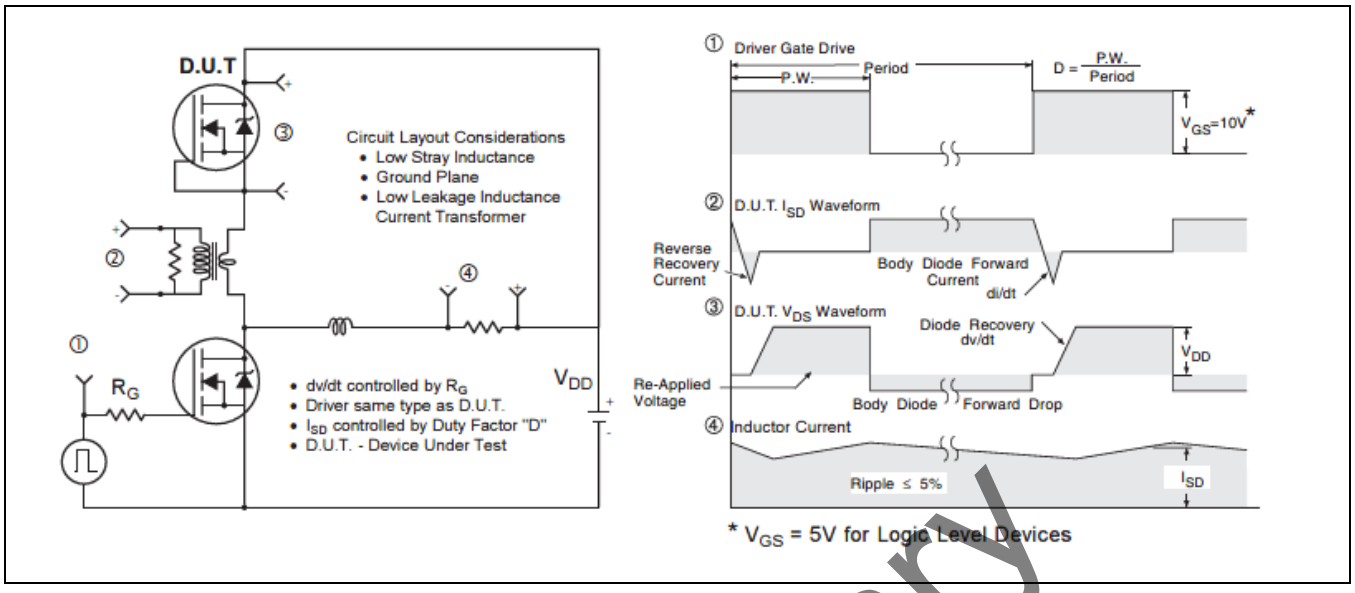


Figure 12 Peak Diode Recovery dv/dt Test Circuit for P -Channel

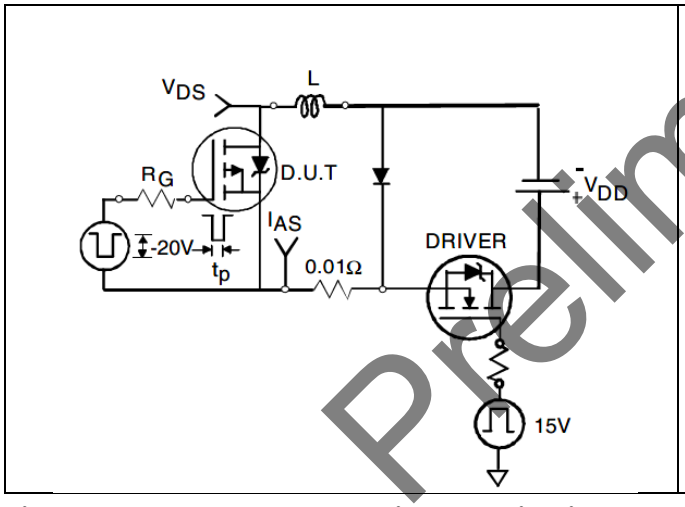


Figure 13 Unclamped Inductive Test Circuit

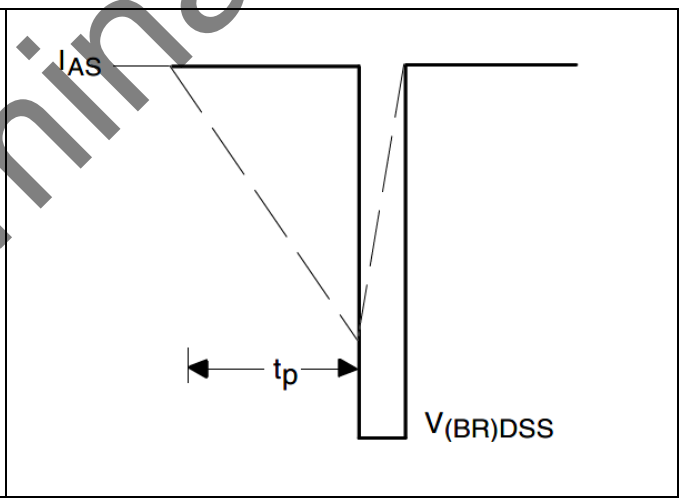


Figure 14 Unclamped Inductive Waveform

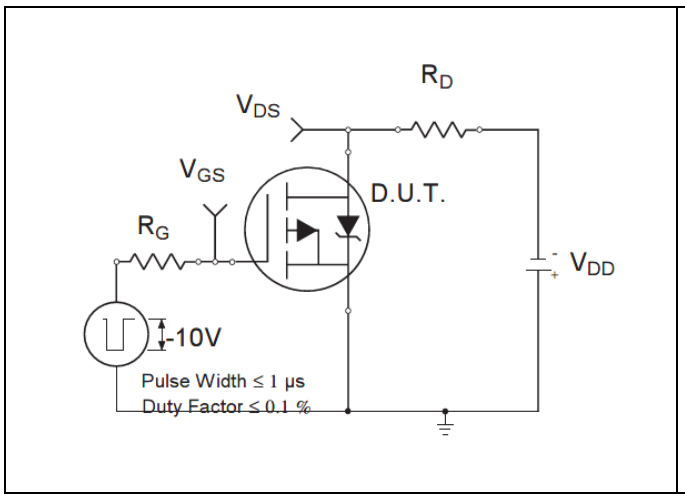


Figure 15 Switching Time Test Circuit

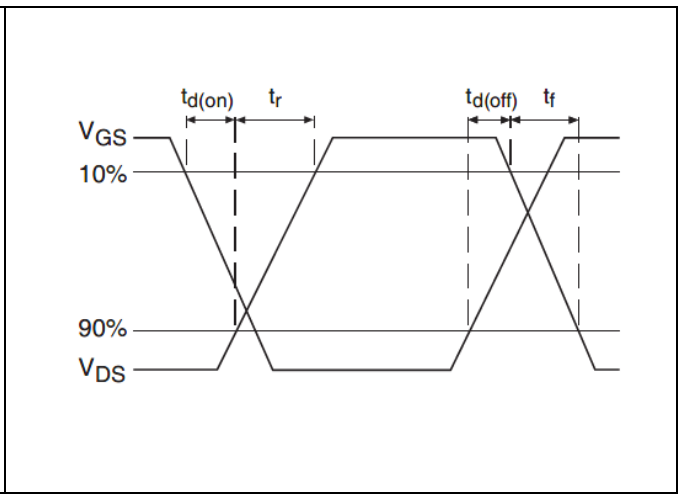


Figure 16 Switching Time Waveforms

Test Circuits

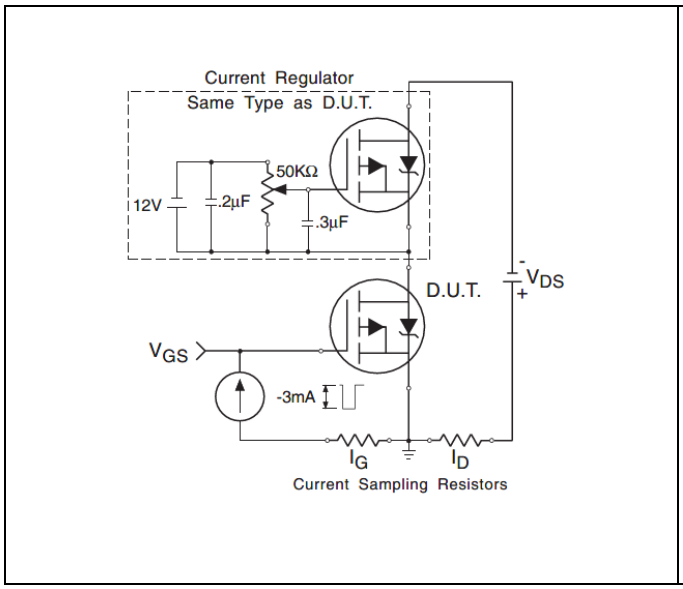


Figure 17 Gate Charge Test Circuit

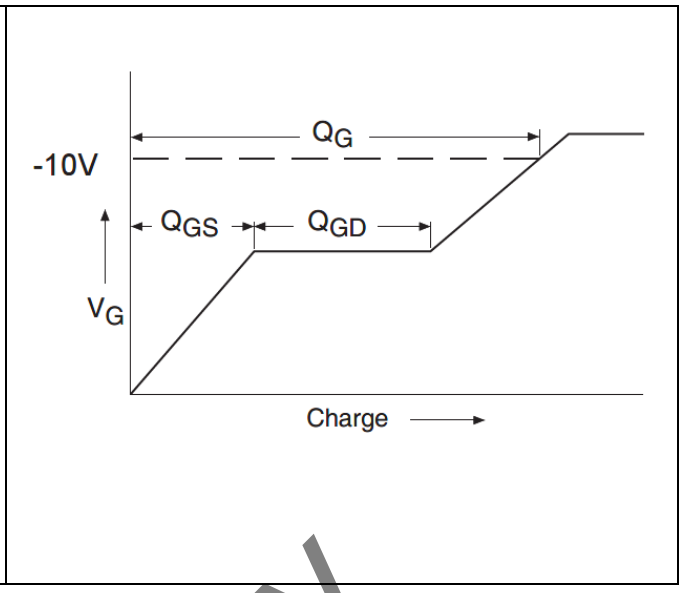
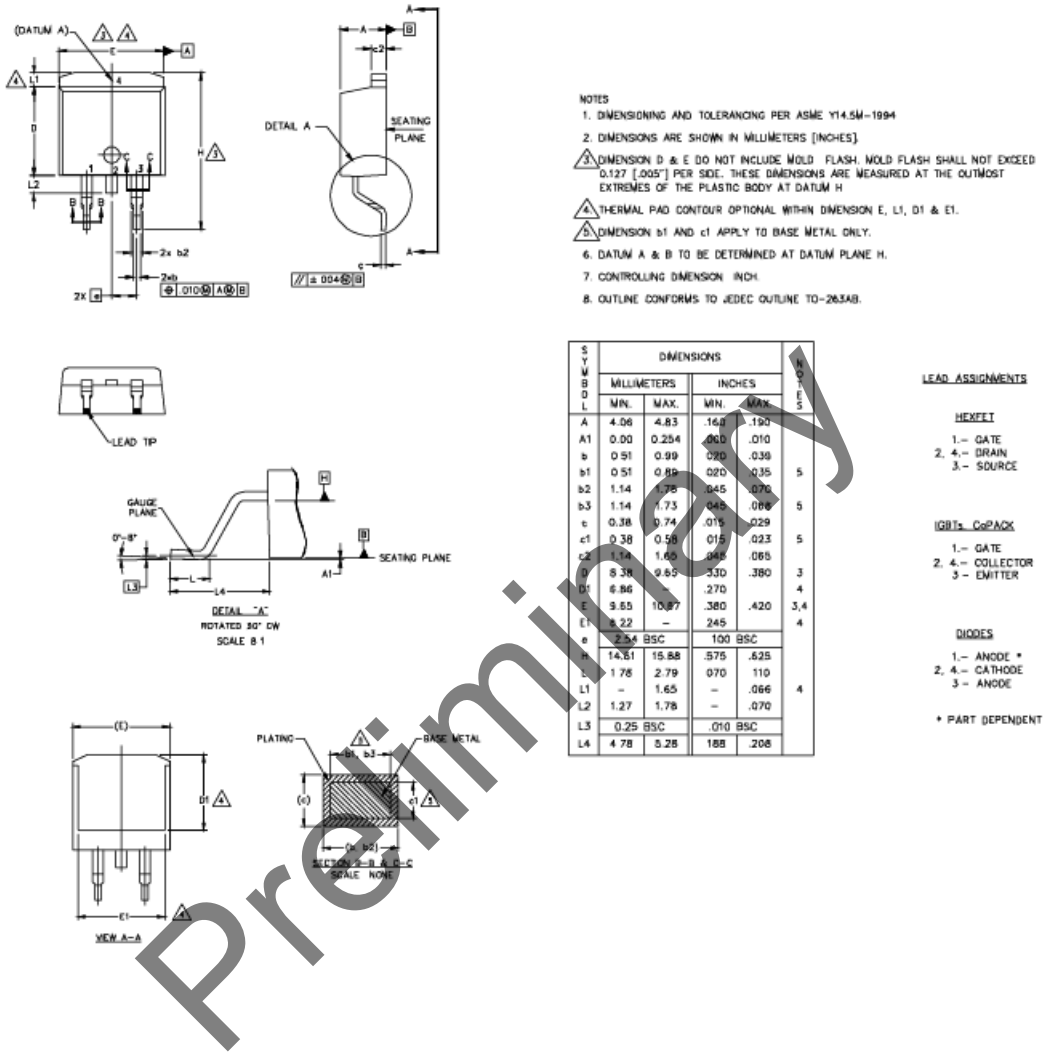


Figure 18 Gate Charge Waveform

5 Package Outline

Note: For the most updated package outline, please see the website: D² Pak (TO263AB)



NOTES
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
7. CONTROLLING DIMENSION: INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263AB.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	3
D1	6.86		.270		4
E	9.65	10.67	.380	.420	3,4
E1	6.22	–	.245		4
e	2.54 BSC		100 BSC		
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1	–	1.65	–	.066	4
L2	1.27	1.78	–	.070	
L3	0.25 BSC		.010 BSC		
L4	4.78	5.28	.188	.208	

LEAD ASSIGNMENTS

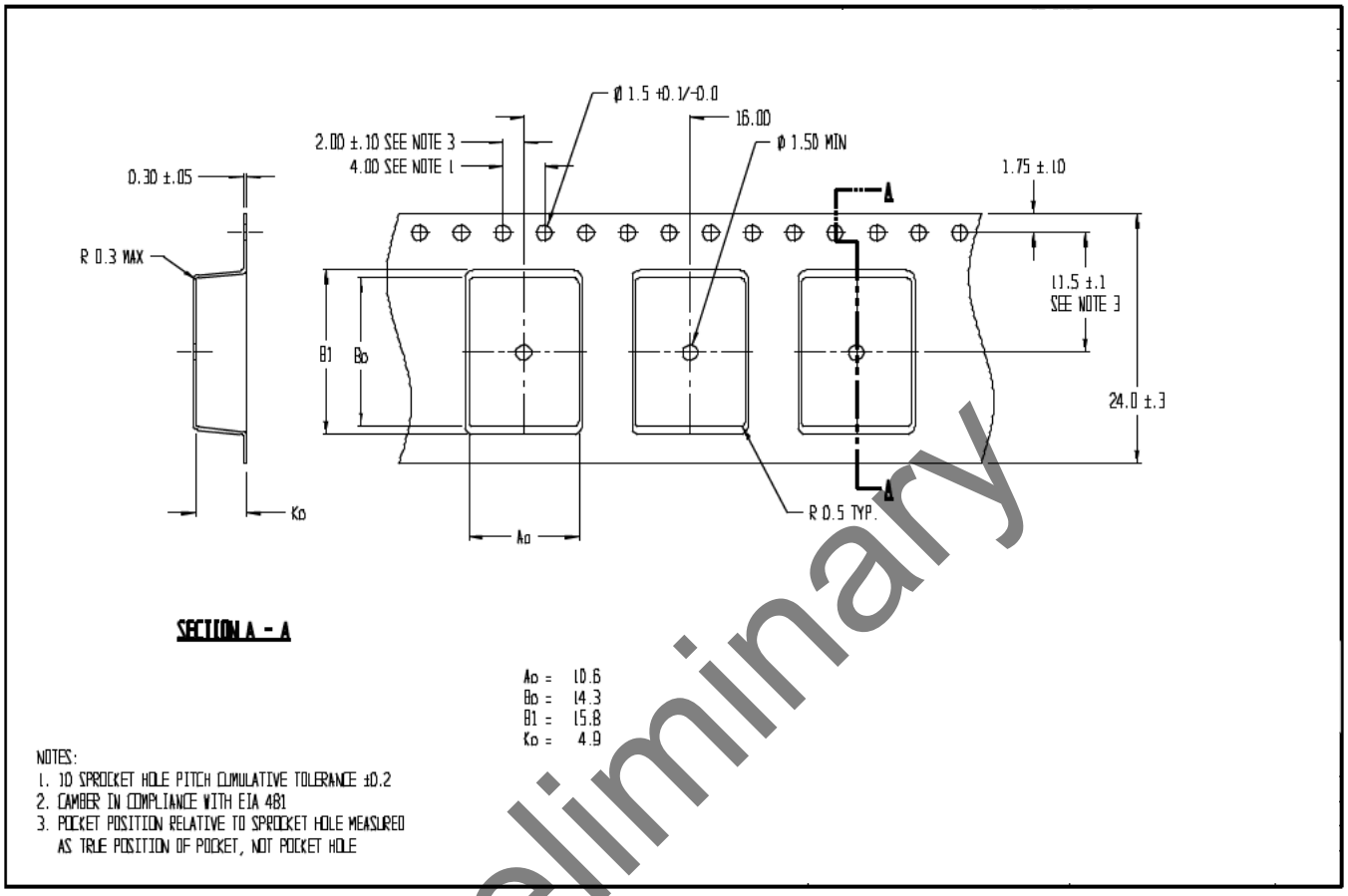
HEXFET
1.– GATE
2, 4.– DRAIN
3.– SOURCE

IGBTs, CoPACK
1.– GATE
2, 4.– COLLECTOR
3 – EMITTER

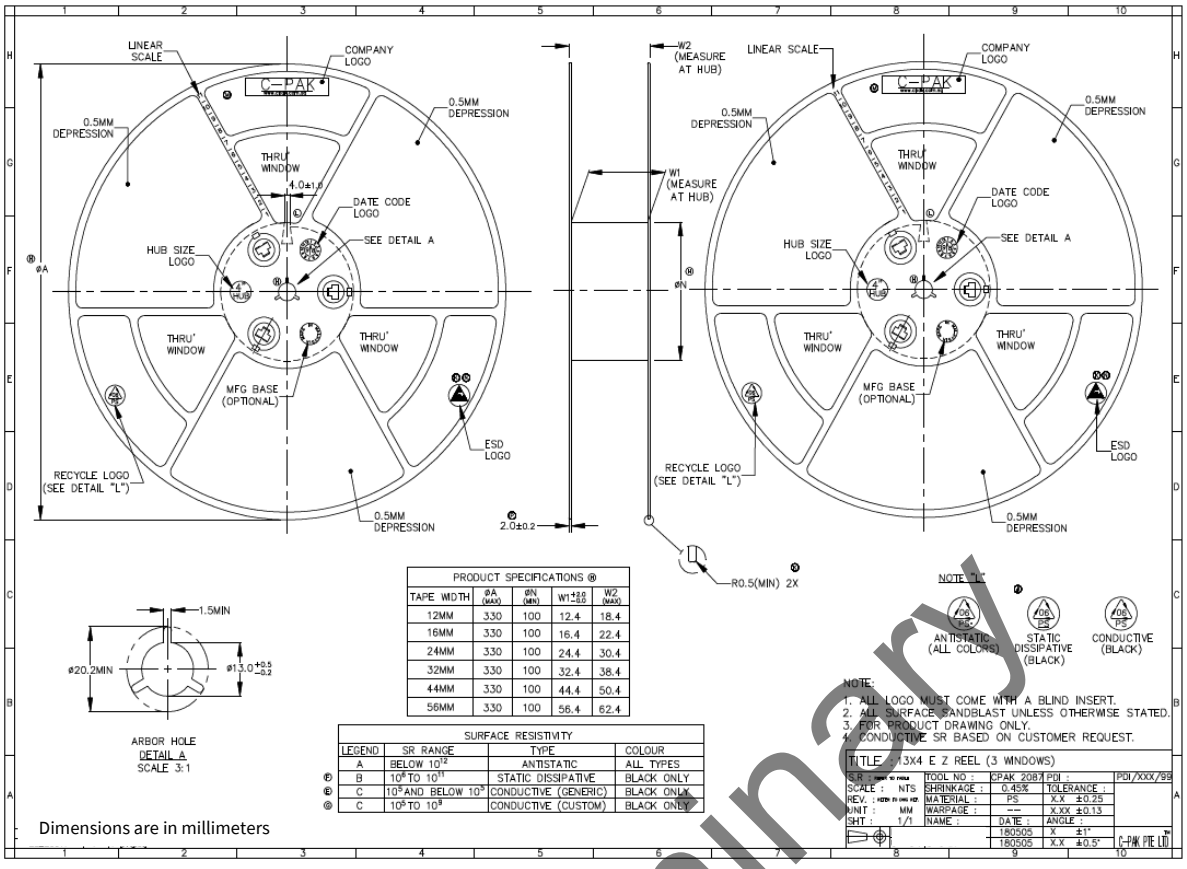
DIODES
1.– ANODE *
2, 4.– CATHODE
3 – ANODE

* PART DEPENDENT

6 Tape and Reel Information



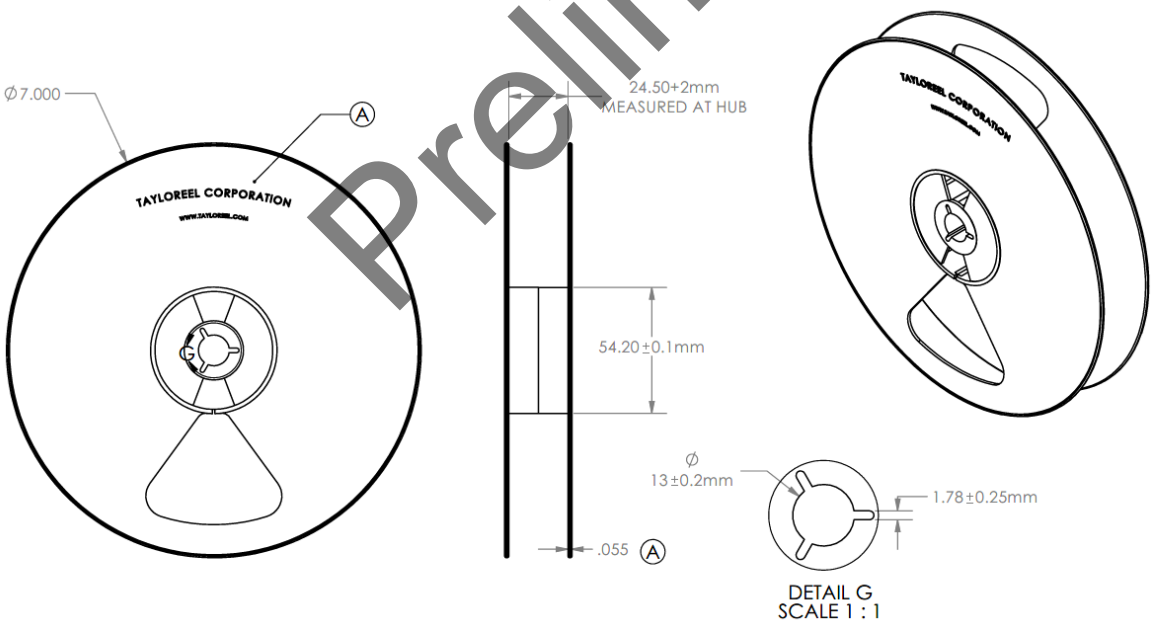
Tape and Reel Information



PRODUCT SPECIFICATIONS ⓑ				
TAPE WIDTH	øA (MAX)	øN (MIN)	W1 +2.0 -0.0	W2 (MAX)
12MM	330	100	12.4	18.4
16MM	330	100	16.4	22.4
24MM	330	100	24.4	30.4
32MM	330	100	32.4	38.4
44MM	330	100	44.4	50.4
56MM	330	100	56.4	62.4

SURFACE RESISTIVITY			
LEGEND	SR RANGE	TYPE	COLOUR
A	BELOW 10^{12}	ANTISTATIC	ALL TYPES
ⓑ B	10^{6} TO 10^{11}	STATIC DISSIPATIVE	BLACK ONLY
ⓒ C	10^{5} AND BELOW 10^{5}	CONDUCTIVE (GENERIC)	BLACK ONLY
ⓓ C	10^{5} TO 10^{9}	CONDUCTIVE (CUSTOM)	BLACK ONLY

Dimensions are in millimeters



Unless otherwise specified dimensions are in Inches

Revision history

Document version	Date of release	Description of changes
	06/03/2024	Preliminary datasheet with PPD number (PPD-98017)
Rev. A	06/21/2024	Added foot notes- 100% tested in final test production.
Rev. B	01/26/2026	Added Tape and Reel -page 12 -13

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Document reference

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