

## General Description:

The LWD4004AD5 uses trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications. The package form is PDFN5\*6-8L, which accords with the ROHS standard and Halogen Free standard.

## Features:

- Fast Switching
- Low Gate Charge and  $R_{DS(ON)}$
- Low Reverse transfer capacitances

## Applications:

- DC-DC Converter
- Portable Equipment
- Power Management

**100% DVDS Tested**

**100% Avalanche Tested**



## Package Marking and Ordering Information:

Marking	Part Number	Package	Packing	Qty.
D4004A/LW D5/D.C.	LWD4004AD5	PDFN5*6-8L	Reel	5000 Pcs

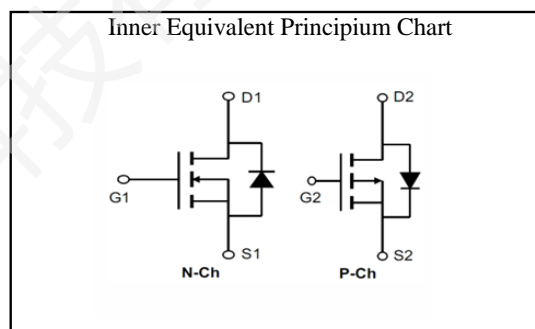
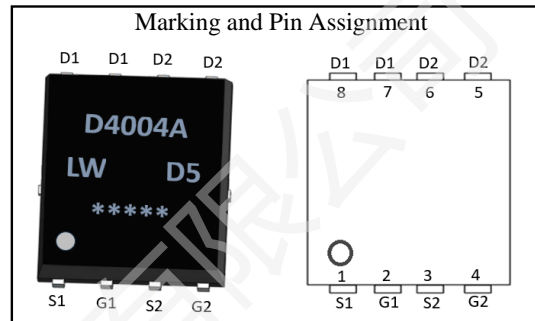
## Absolute Maximum Ratings:

Symbol	Parameter	Value		Units	
		N-Ch	P-Ch		
$V_{DSS}$	Drain-to-Source Voltage	40	-40	V	
$I_D$	Continuous Drain Current	$T_C=25^\circ C$	40	-35	A
	Continuous Drain Current	$T_C=100^\circ C$	25	-22	A
$I_{DM}^{a1}$	Pulsed Drain Current		160	-140	A
$E_{AS}^{a2}$	Single pulse avalanche energy		54	92	mJ
$V_{GS}$	Gate-to-Source Voltage		$\pm 20$	$\pm 20$	V
$P_D$	Power Dissipation		32	36	W
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range		150, -55 to 150		$^\circ C$
$T_L$	Maximum Temperature for Soldering		260		$^\circ C$

## Thermal Characteristics:

Symbol	Parameter	Value		Units
		N-Ch	P-Ch	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	3.91	3.45	$^\circ C/W$
$R_{\theta JA}^{a3}$	Thermal Resistance, Junction-to-Ambient	68	62.5	$^\circ C/W$

Symbol	N-Ch	P-Ch	Units
$V_{DSS}$	40	-40	V
$I_D$	40	-35	A
$R_{DS(ON) \text{ TYPE}}$	10	13.5	$m\Omega$



**N-Channel Electrical Characteristic** ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise specified):

Static Characteristics						
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
$V_{DSS}$	Drain to Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	40	--	--	V
$I_{DSS}$	Drain to Source Leakage Current	$V_{DS}=40V, V_{GS}=0V$	--	--	1.0	$\mu A$
$I_{GSS(F)}$	Gate to Source Forward Leakage	$V_{GS}=+20V, V_{DS}=0V$	--	--	100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	$V_{GS}=-20V, V_{DS}=0V$	--	--	-100	nA
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1.2	1.6	2.0	V
$R_{DS(ON)1}$	Drain-to-Source On-Resistance	$V_{GS}=10V, I_D=15A$	--	10	13	$m\Omega$
$R_{DS(ON)2}$	Drain-to-Source On-Resistance	$V_{GS}=4.5V, I_D=10A$	--	12.5	18	$m\Omega$

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
$C_{iss}$	Input Capacitance	$V_{GS}=0V$	--	1201	--	pF
$C_{oss}$	Output Capacitance	$V_{DS}=20V$	--	94	--	
$C_{riss}$	Reverse Transfer Capacitance	$f=1.0MHz$	--	88	--	
$R_G$	Gate resistance	$V_{GS}=0V, V_{DS}=0V, f=1MHz$	--	1.7	--	$\Omega$

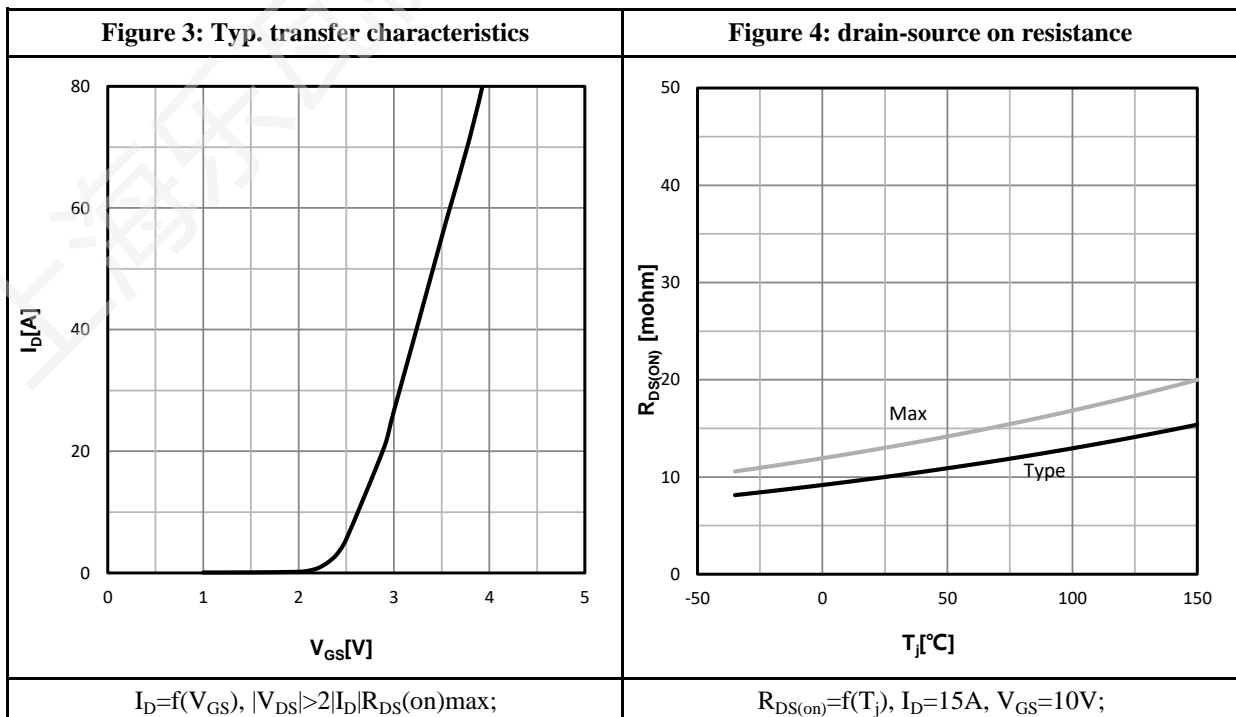
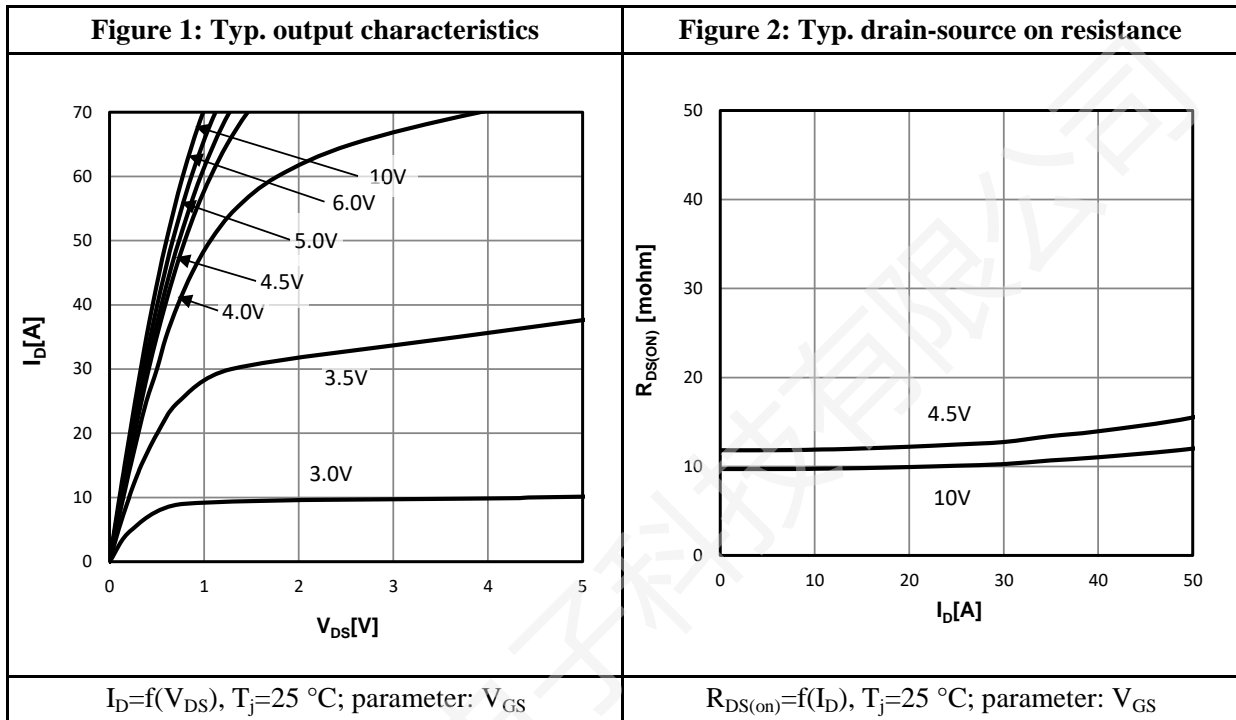
Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	$I_D=15A$	--	5.0	--	ns
$t_r$	Rise Time	$V_{DS}=20V$	--	12	--	
$t_{d(OFF)}$	Turn-Off Delay Time	$V_{GS}=10V$	--	23	--	
$t_f$	Fall Time	$R_G=3.0\Omega$	--	13	--	
$Q_g$	Total Gate Charge	$V_{GS}=10V$	--	27.6	--	nC
$Q_{gs}$	Gate to Source Charge	$V_{DS}=20V$	--	3.5	--	
$Q_{gd}$	Gate to Drain Charge	$I_D=15A$	--	5.8	--	

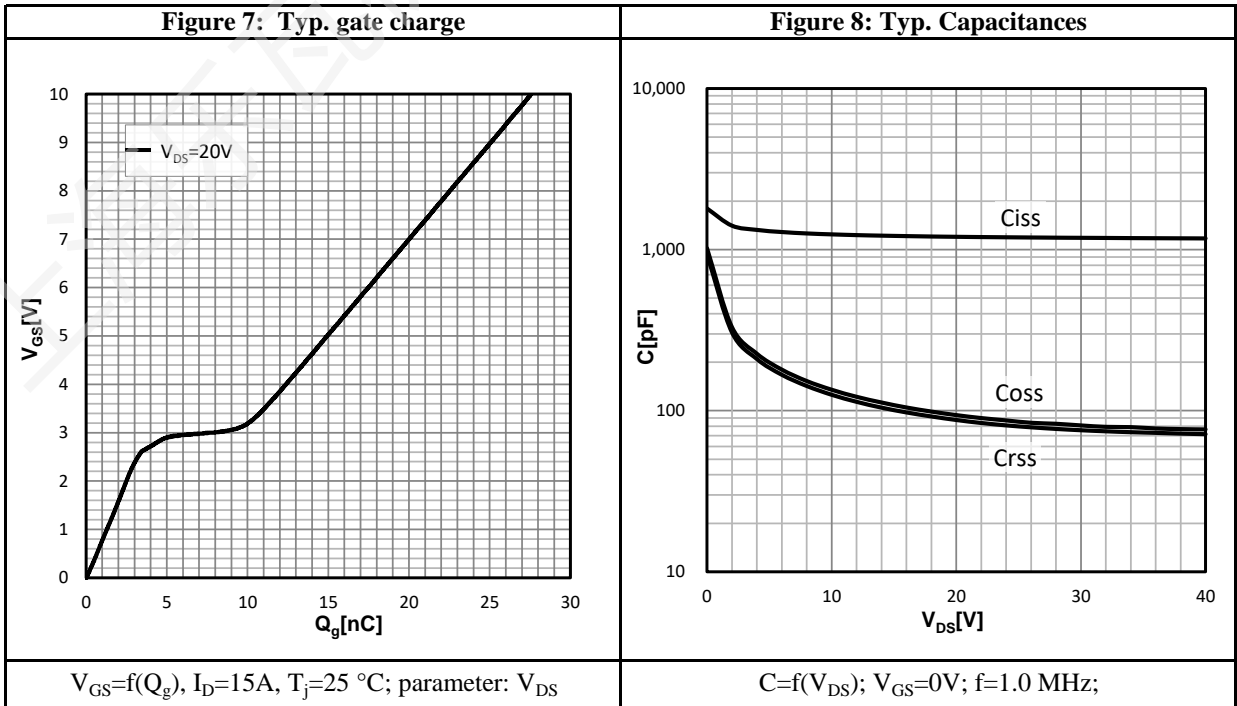
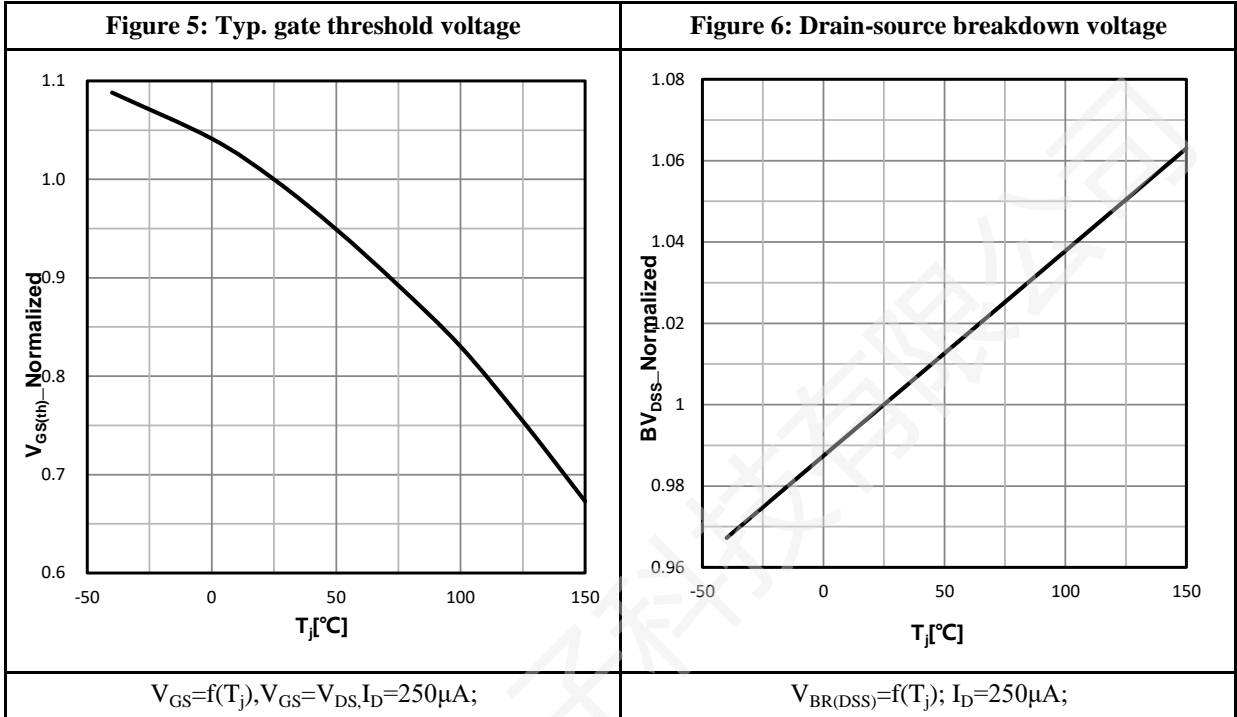
Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
$I_S$	Diode Forward Current	$T_C=25\text{ }^\circ\text{C}$	--	--	40	A
$V_{SD}$	Diode Forward Voltage	$I_S=15A, V_{GS}=0V$	--	--	1.2	V

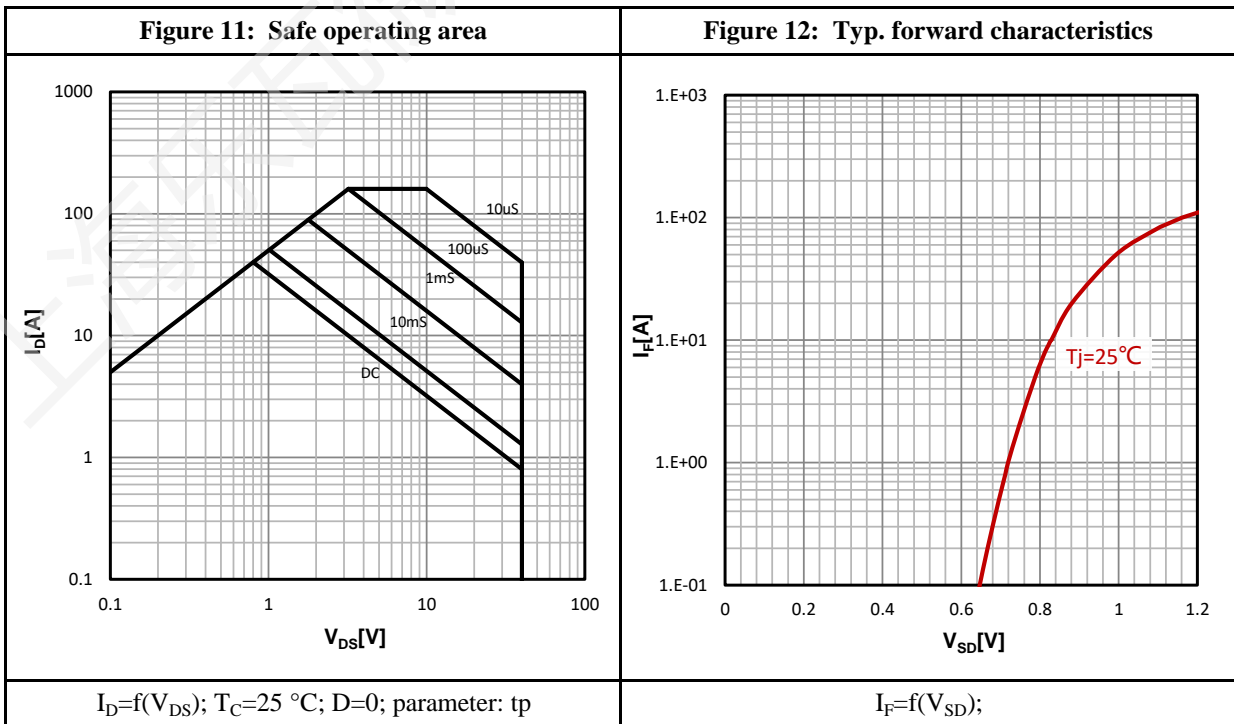
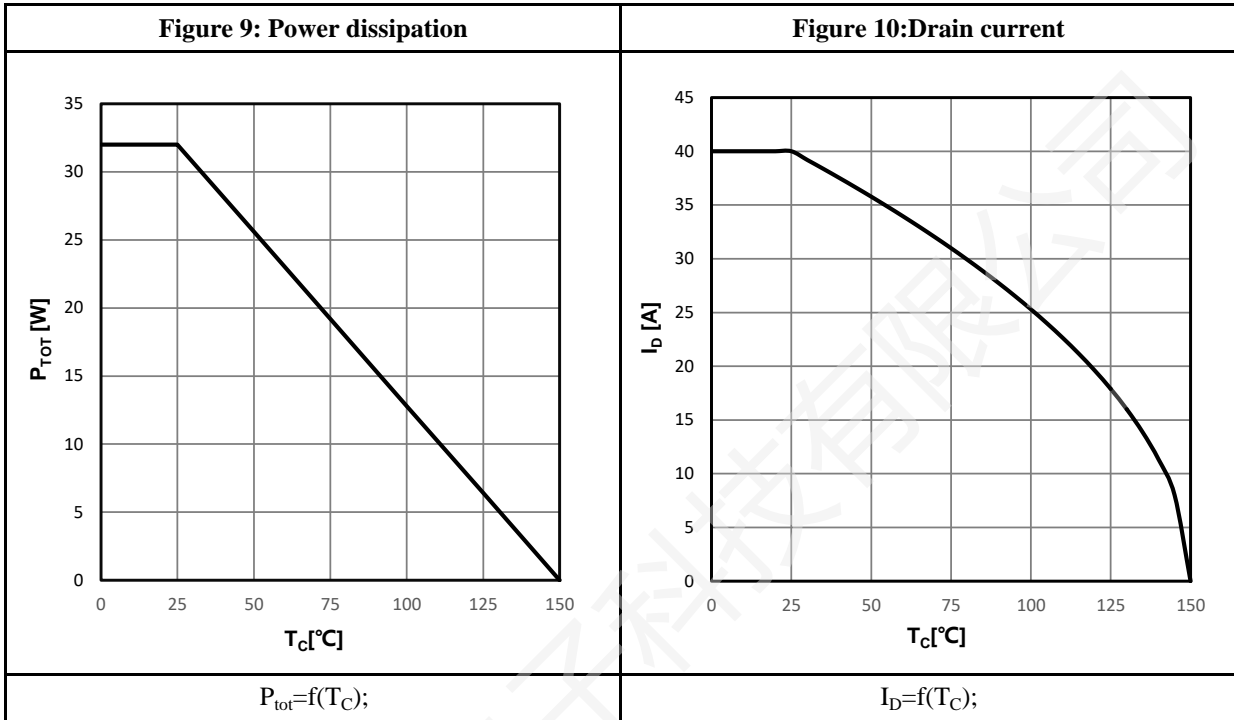
a1: Repetitive rating; pulse width limited by maximum junction temperature

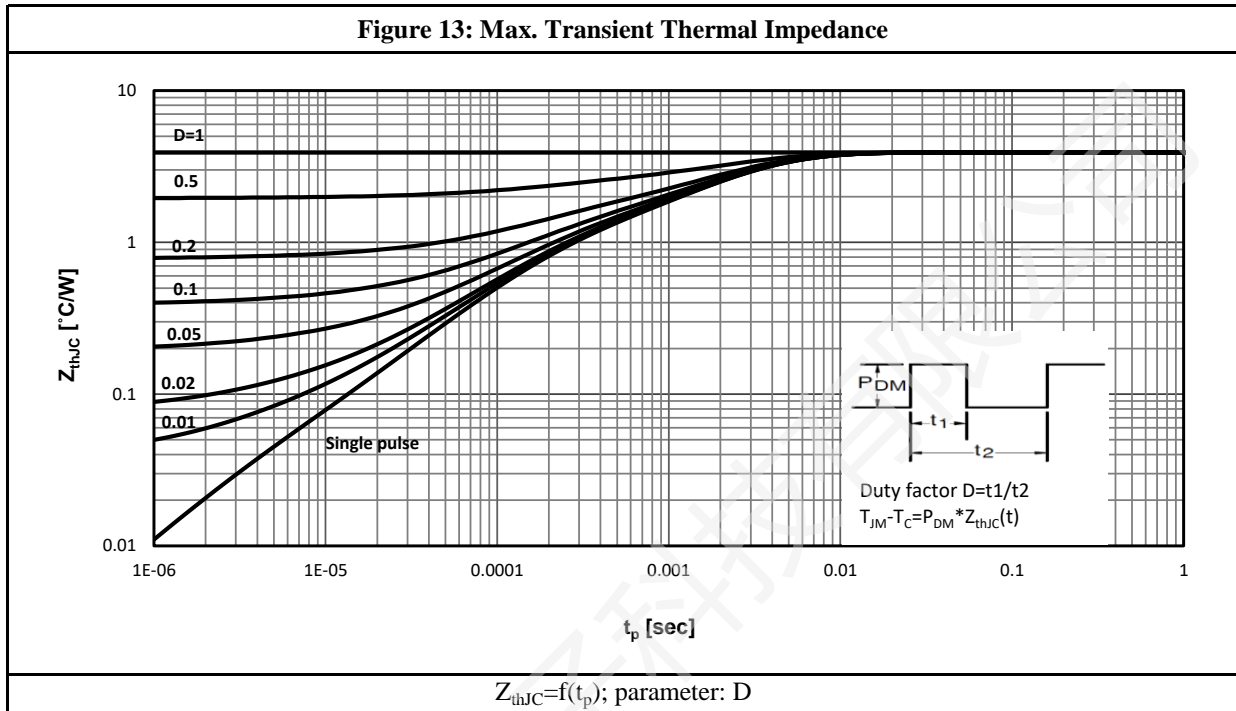
a2:  $V_{DD}=20V, L=0.1mH, R_G=25\Omega$ , Starting  $T_J=25\text{ }^\circ\text{C}$

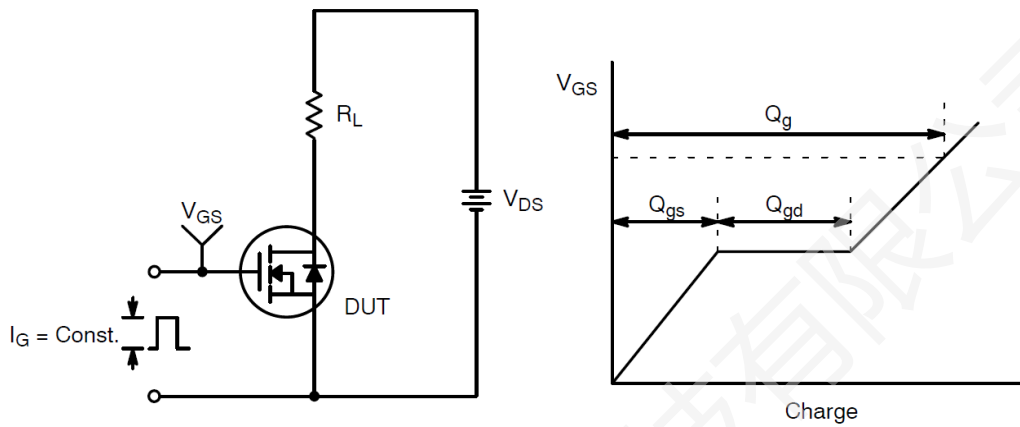
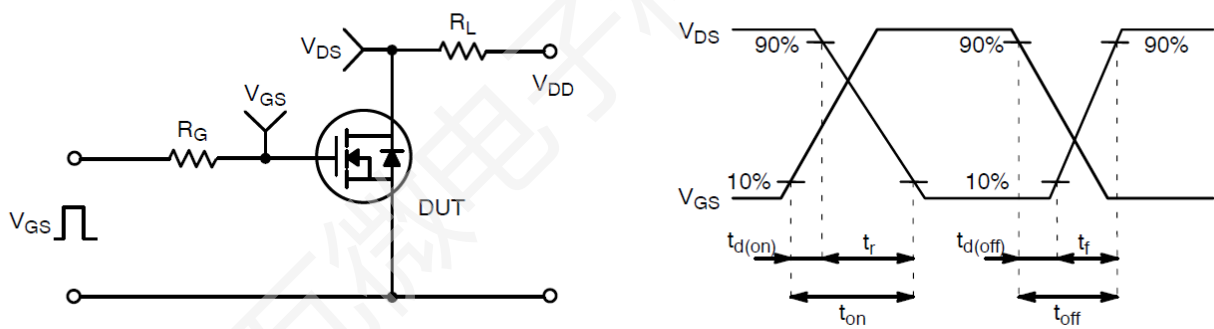
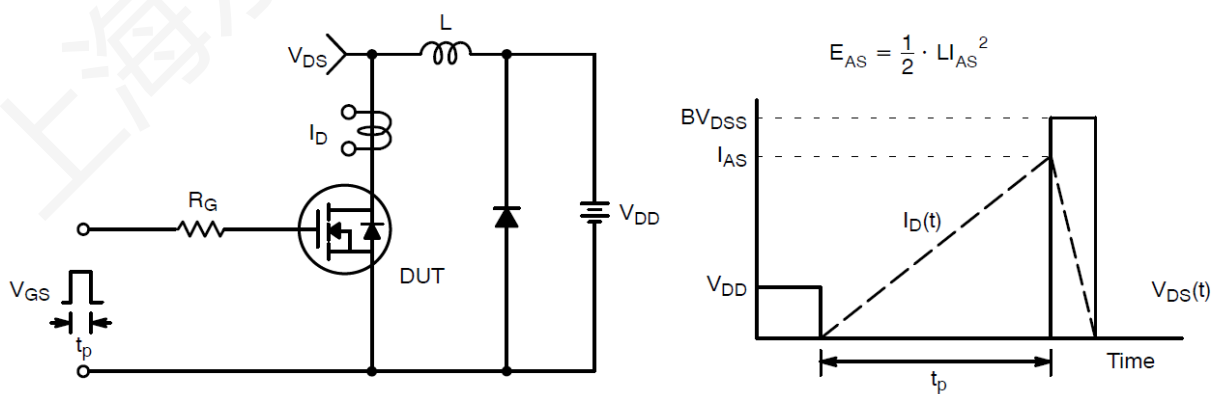
a3: Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70  $\mu m$  thick) copper area for drain connection.

**N-Channel Characteristics Curve:**








**Test Circuit & Waveform:**

**Figure 14: Gate Charge Test Circuit & Waveform**

**Figure 15: Resistive Switching Test Circuit & Waveforms**

**Figure 16: Unclamped Inductive Switching Test Circuit & Waveforms**

**P-Channel Electrical Characteristic** ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise specified):

Static Characteristics						
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
$V_{DSS}$	Drain to Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-40	--	--	V
$I_{DSS}$	Drain to Source Leakage Current	$V_{DS}=-40V, V_{GS}=0V$	--	--	-1.0	$\mu A$
$I_{GSS(F)}$	Gate to Source Forward Leakage	$V_{GS}=-20V, V_{DS}=0V$	--	--	-100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	$V_{GS}=+20V, V_{DS}=0V$	--	--	100	nA
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.2	-1.7	-2.3	V
$R_{DS(ON)1}$	Drain-to-Source On-Resistance	$V_{GS}=-10V, I_D=-15A$	--	13.5	17	$m\Omega$
$R_{DS(ON)2}$	Drain-to-Source On-Resistance	$V_{GS}=-4.5V, I_D=-10A$	--	18	26	$m\Omega$

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
$C_{iss}$	Input Capacitance	$V_{GS}=0V$	--	1862	--	pF
$C_{oss}$	Output Capacitance	$V_{DS}=-20V$	--	207	--	
$C_{rss}$	Reverse Transfer Capacitance	$f=1.0MHz$	--	188	--	
$R_G$	Gate resistance	$V_{GS}=0V, V_{DS}=0V, f=1MHz$	--	7.5	--	$\Omega$

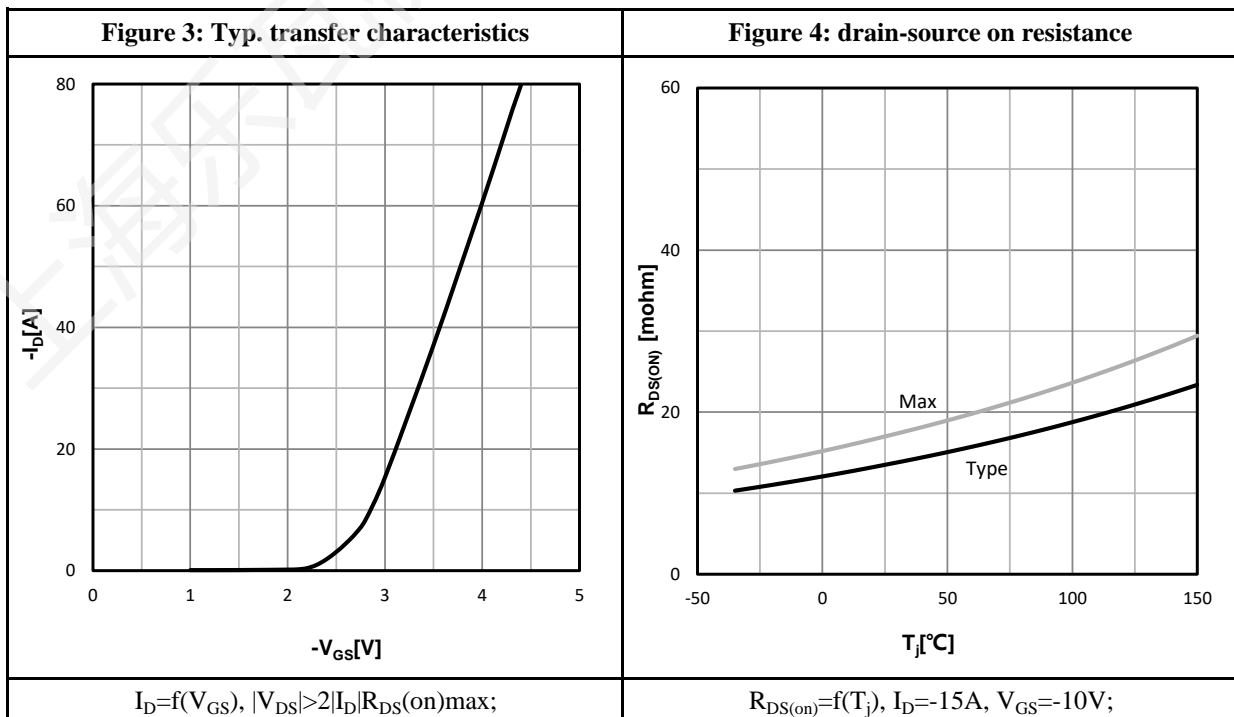
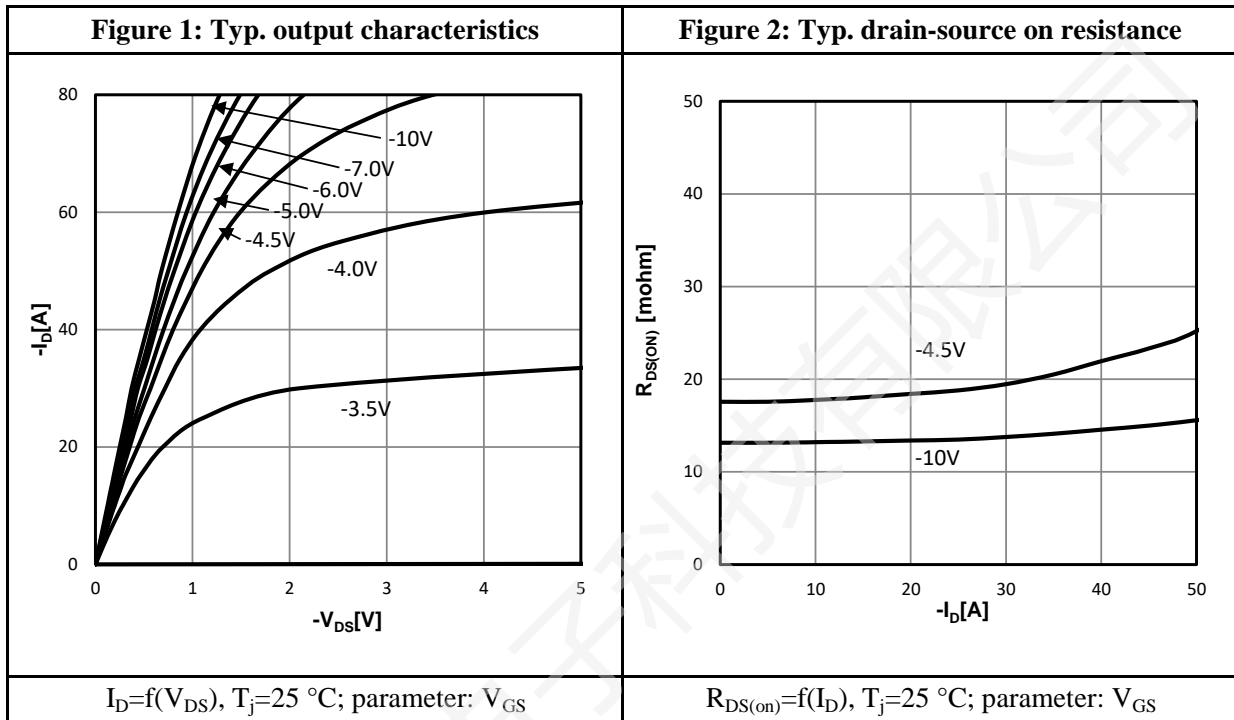
Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	$I_D=-15A$ $V_{DS}=-20V$ $V_{GS}=-10V$ $R_G=3.0\Omega$	--	11	--	ns
$t_r$	Rise Time		--	10	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	28	--	
$t_f$	Fall Time		--	16	--	
$Q_g$	Total Gate Charge	$V_{GS}=-10V$	--	41.6	--	nC
$Q_{gs}$	Gate to Source Charge	$V_{DS}=-20V$	--	5.5	--	
$Q_{gd}$	Gate to Drain Charge	$I_D=-15A$	--	9.1	--	

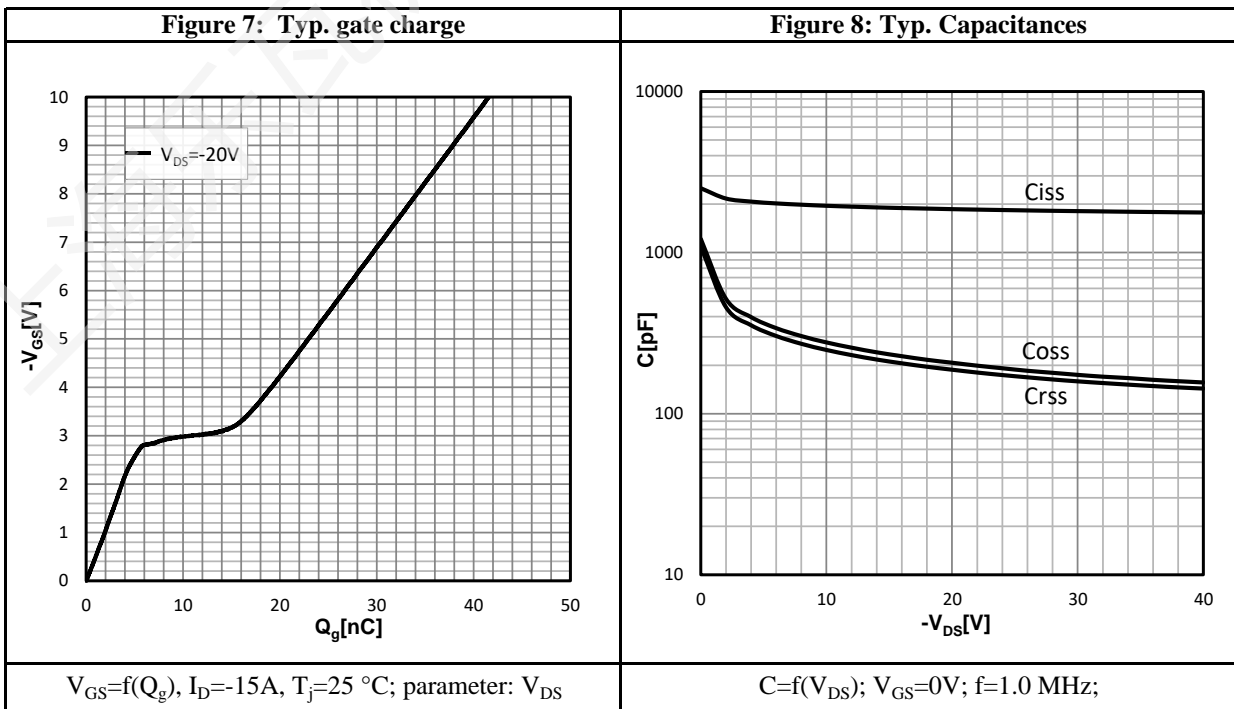
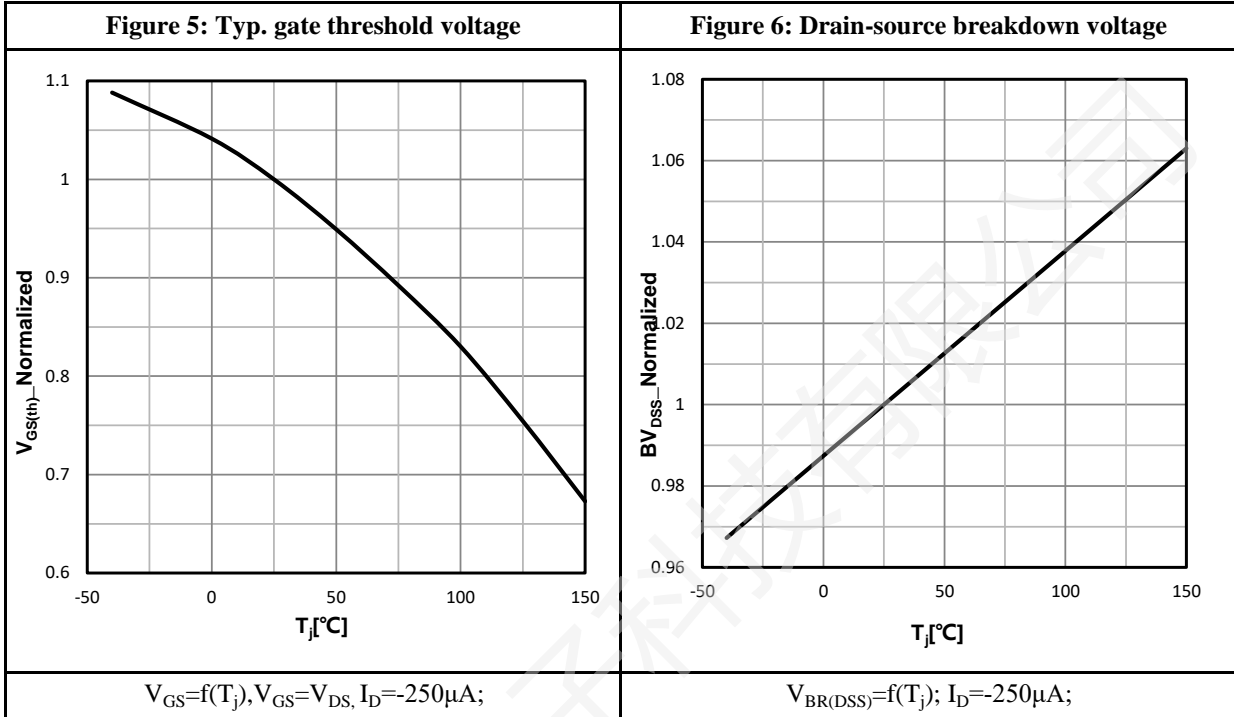
Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
$I_S$	Diode Forward Current	$T_C=25\text{ }^\circ\text{C}$	--	--	-35	A
$V_{SD}$	Diode Forward Voltage	$I_S=-15A, V_{GS}=0V$	--	--	-1.2	V

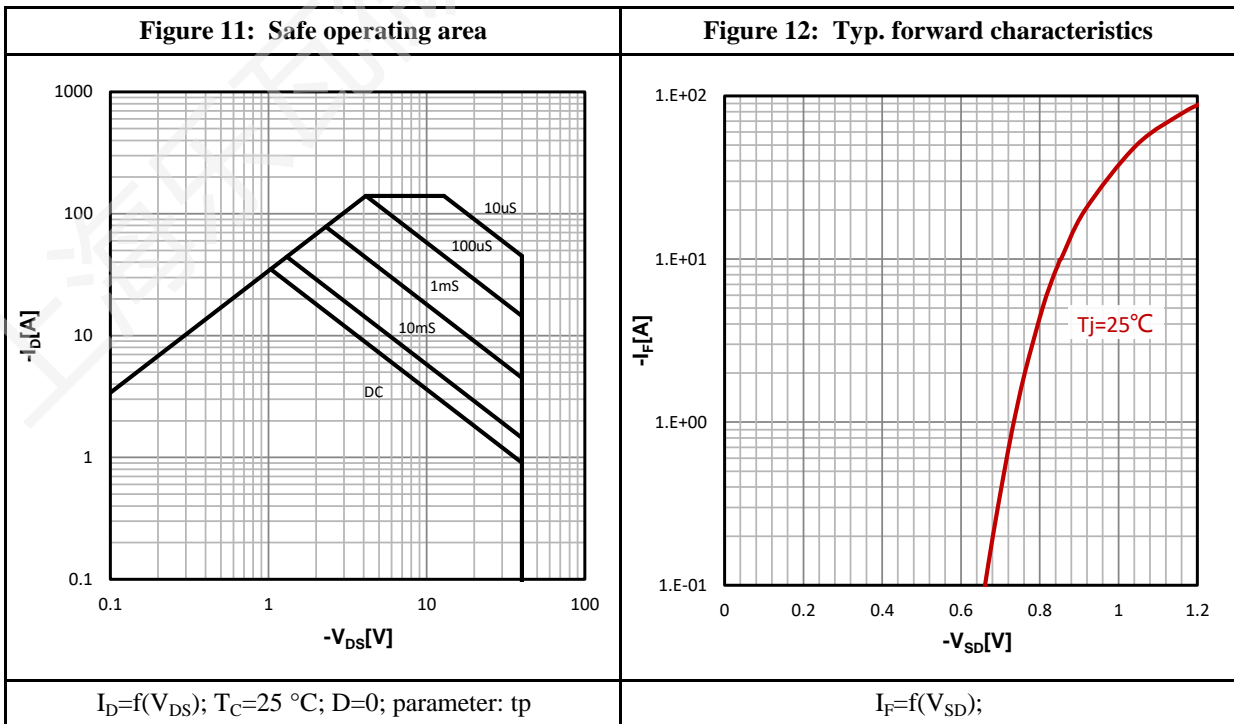
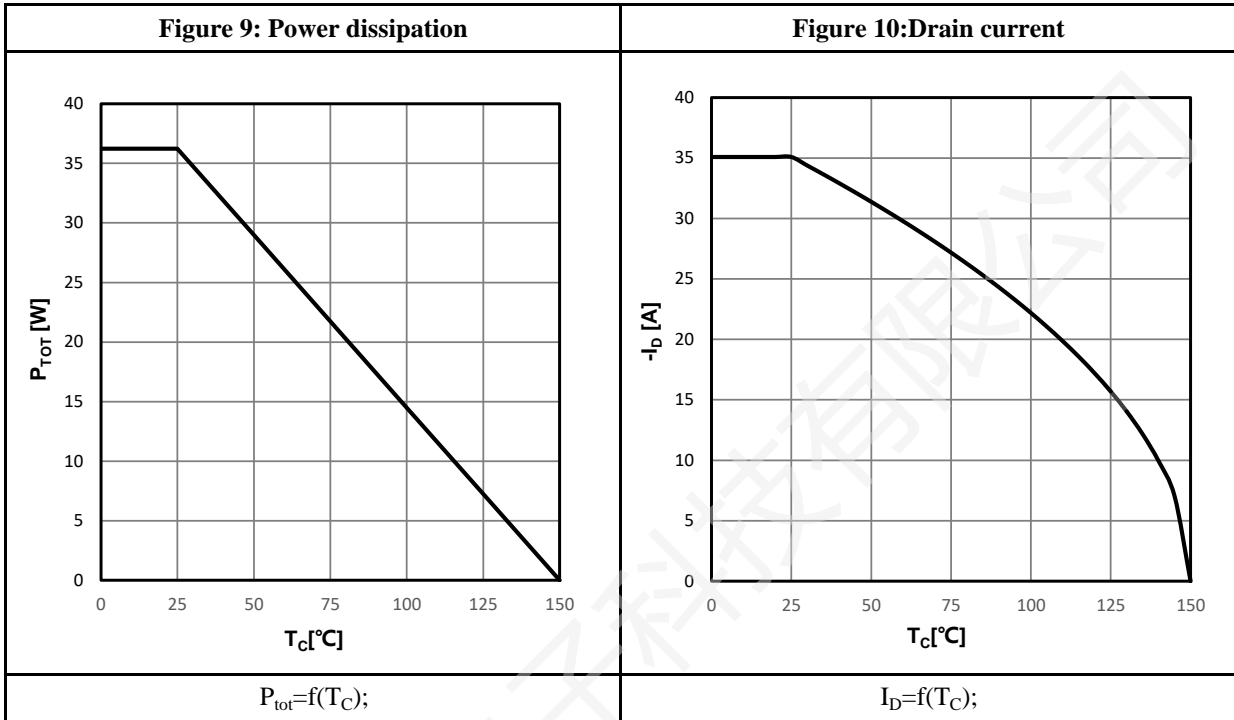
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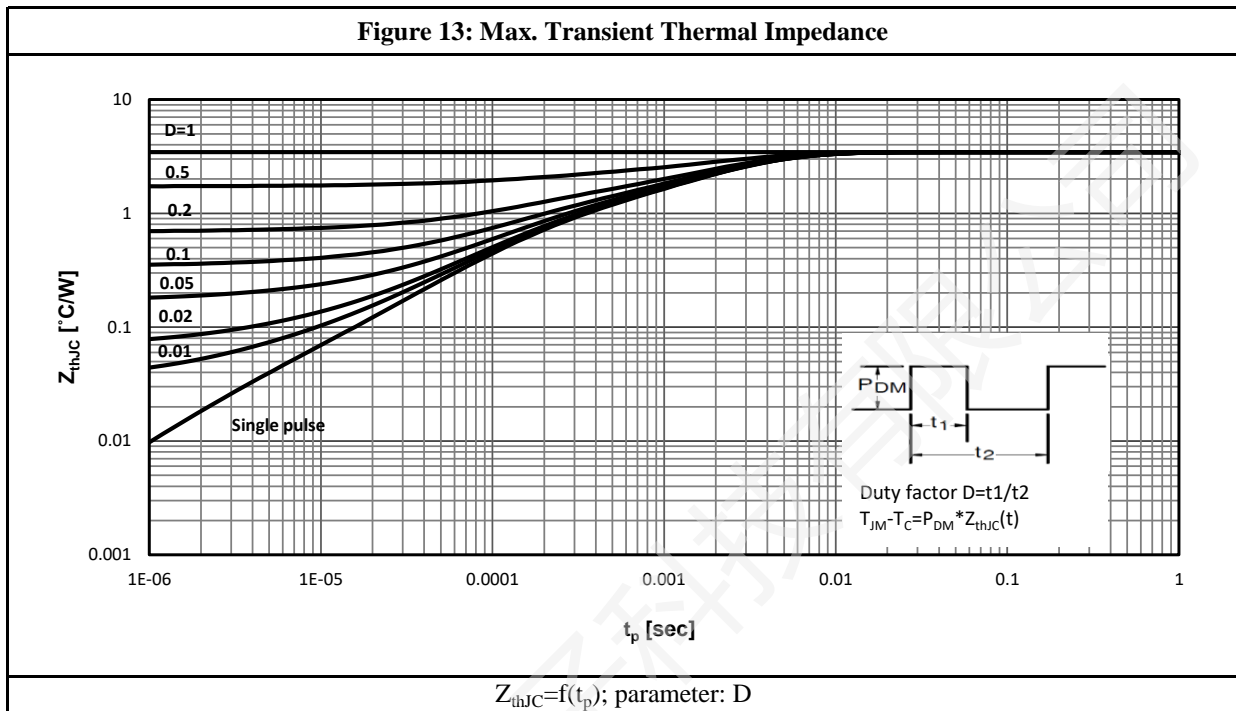
a2:  $V_{DD}=-20V, L=0.1mH, R_G=25\Omega$ , Starting  $T_J=25\text{ }^\circ\text{C}$

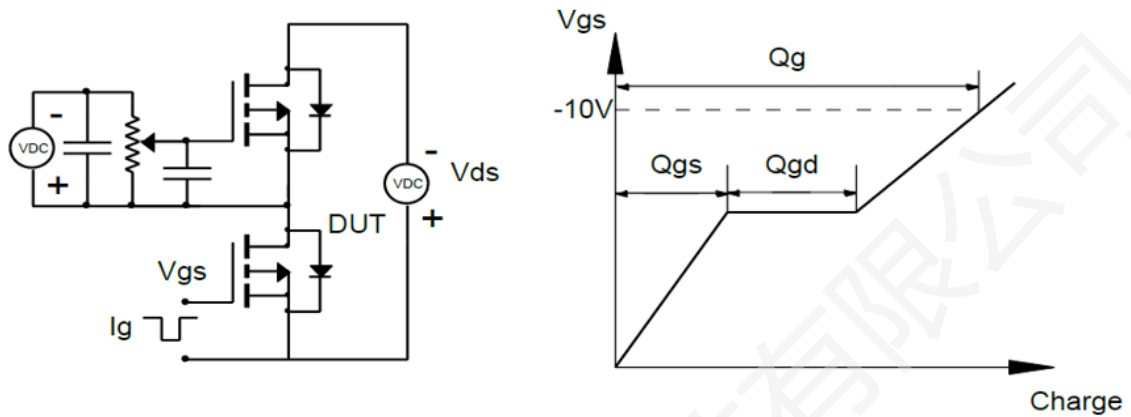
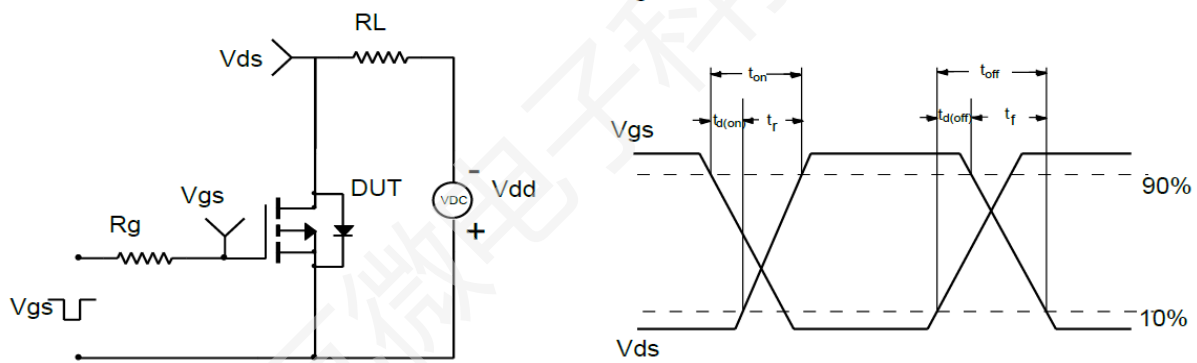
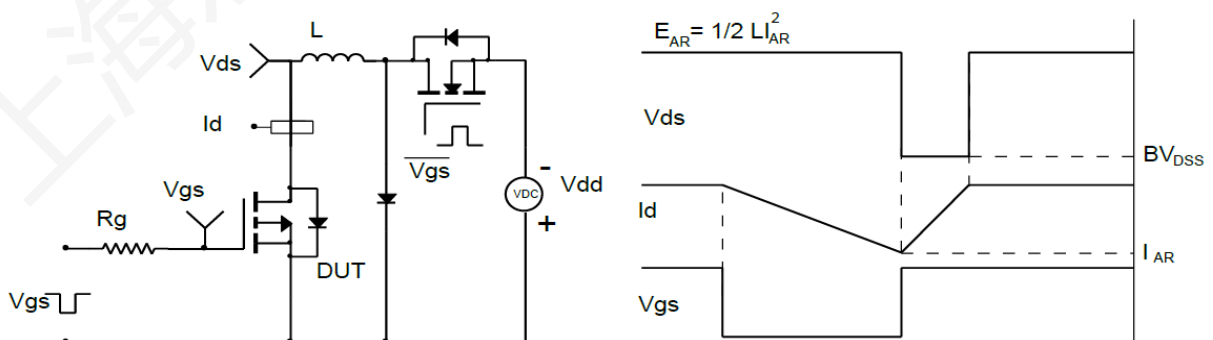
a3: Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70  $\mu m$  thick) copper area for drain connection.

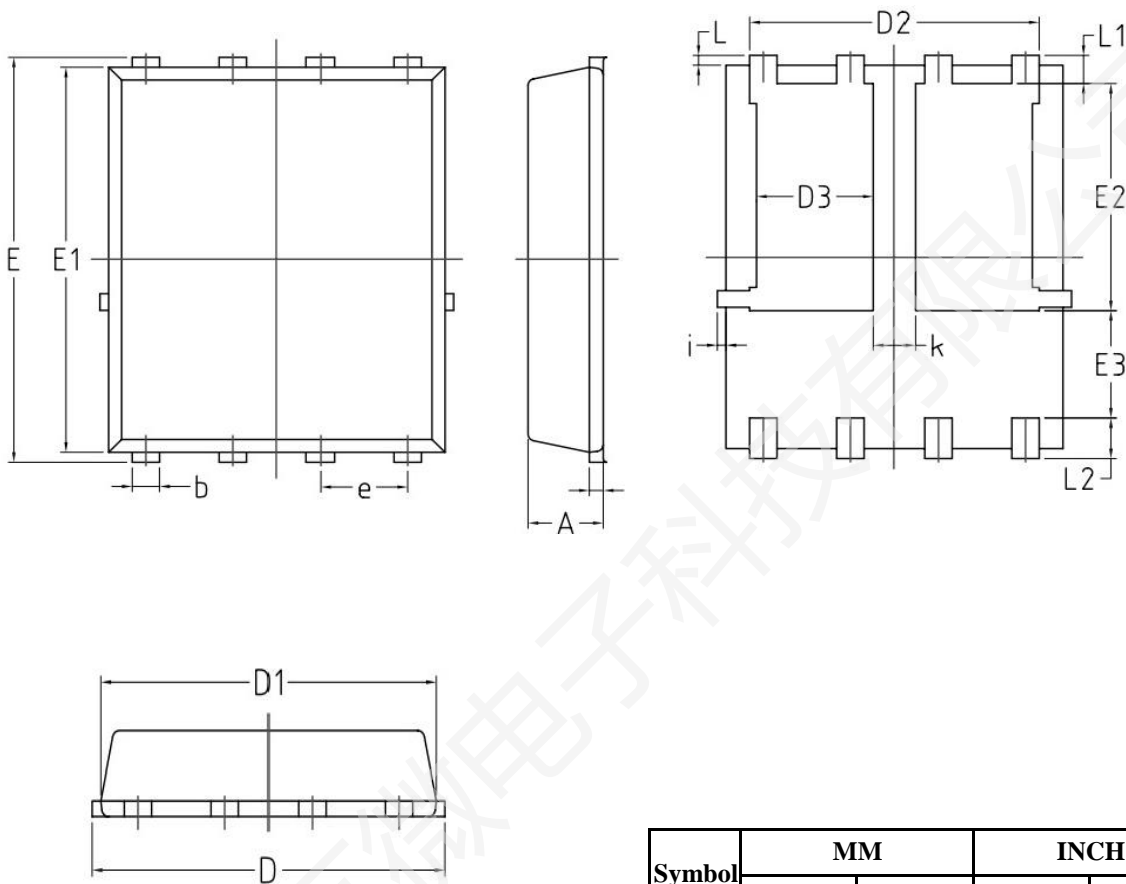
**P-Channel Characteristics Curve:**








**P-Channel Test Circuit & Waveform:**

**Figure 14: Gate Charge Test Circuit & Waveform**

**Figure 15: Resistive Switching Test Circuit & Waveforms**

**Figure 16: Unclamped Inductive Switching Test Circuit & Waveforms**

**Package Outline:**


Symbol	MM		INCH	
	MIN	MAX	MIN	MAX
<b>A</b>	0.90	1.20	0.0354	0.0472
<b>b</b>	0.34	0.48	0.0134	0.0189
<b>C</b>	0.203 BSC		0.0080 BSC	
<b>D</b>	4.80	5.40	0.1890	0.2126
<b>D1</b>	4.80	5.00	0.1890	0.1969
<b>D2</b>	4.11	4.31	0.1620	0.1700
<b>D3</b>	1.60	1.80	0.0629	0.0708
<b>E</b>	5.90	6.15	0.2323	0.2421
<b>E1</b>	5.65	5.85	0.2224	0.2303
<b>E2</b>	3.30	3.60	0.1300	0.1417
<b>E3</b>	1.40	/	0.0551	/
<b>e</b>	1.27 BSC		0.05 BSC	
<b>L</b>	0.05	0.28	0.0019	0.0110
<b>L1</b>	0.38	0.58	0.0150	0.0228
<b>L2</b>	0.38	0.71	0.0150	0.0280
<b>l</b>	/	0.18	/	0.0070
<b>k</b>	0.50	0.70	0.0197	0.0276

**Revision History:**

<b>Revison</b>	<b>Date</b>	<b>Descriptions</b>
Rev 1.1	July.2025	Initial Version

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