

4A 650V N-Channel Power MOSFET

Description:

KINGWELL has series planar power MOSFET , platforms for voltage up to 600 volts, both with design service and manufacturing capability, including cell, termination design and simulation. This power MOSFET is a high voltage N channel power MOSFET with advanced technology to have better characteristics.

TO-251



Features:

- Fast switching
- Low Ciss and Crss
- Low on resistance
- Excellent avalanche characteristics

Mechanical Data:

- Case:TO-251 Package

Application:

- Switching applications

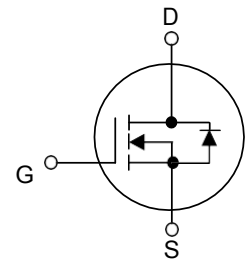
Product Summary

V _{DS}	R _{DS(on)} (Q)Typ	I _D (A)	Q _g (Typ)
650V	2.0 @ 10V,2A	4	27nc

Block Diagram

Pin Definition:

- 1.Gate
- 2.Drain
- 3.Source



Ordering Information

Part No.	Package Type	Package	Quality(box)
KPM04N603D1-L	TO-251	Tube	1000

Table1 Absolute Maximum Ratings (T_C=25°C, unless otherwise specified)

Parameter	Symbol	KPM04N603D1-L	Unit
Drain-Source Voltage	V _{DS}	650	V
Gate-Source Voltage	V _{GS}	±30	V
Continuous Drain Current	I _D	T _C =25°C	4
		T _C =100°C	2.5
Pulsed Drain Current (Note 1)	I _{DM}	16	A
Single Pulse Avalanche Energy(Note 2)	E _{AS}	240	mJ
Avalanche Current(Note 1)	I _{AR}	4.0	A
Repetitive Avalanche Energy(Note 1)	E _{AR}	10	mJ
Power Dissipation T _C =25°C	P _D	100	W
Operating Junction and Storage Temperature	T _J /T _{STG}	-55 ~ +150	°C

Table 2. Thermal Characteristics

Parameter	Symbol	KPM04N603D1-L	Unit
Thermal resistance Junction to Ambient	$R_{\theta JA}$	62.5	$^{\circ}\text{C/W}$
Thermal resistance Junction to Case	$R_{\theta JC}$	1.25	$^{\circ}\text{C/W}$

Table 3. Electrical Characteristics ($T_J=25^{\circ}\text{C}$, unless otherwise specified)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Off Characteristics							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V,I _D =250μA	650			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =600V,V _{GS} =0V			10	μA
Gate- Source Leakage Current	Forward	I _{GSS}	V _{GS} =30V,V _{DS} =0V			100	nA
	Reverse		V _{GS} =-30V,V _{DS} =0V			-100	nA
On Characteristics(Note 4)							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =5V,I _D =250mA	2		4	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =10V,I _D =2.0A		2.0	2.5	Ω
Dynamic Characteristics(Note 5)							
Input Capacitance		C _{ISS}	V _{DS} =25V,V _{GS} =0V,f=1MHz		710		pF
Output Capacitance		C _{OSS}			65		pF
Reverse Transfer Capacitance		C _{RSS}			14		pF
Switching Characteristics (Note 5)							
Turn-On Delay Time		t _{d(on)}	V _{DD} =300V,I _D =4A, V _{GS} =10V,R _G =25Ω		20		ns
Turn-On Rise Time		t _r			55		ns
Turn-Off Delay Time		t _{d(off)}			70		ns
Turn-Off Fall Time		t _f			55		ns
Total Gate Charge		Q _G	V _{DS} =480V,I _D =4A, V _{GS} =10V		27		nC
Gate-Source Charge		Q _{GS}			3.6		nC
Gate-Drain Charge		Q _{GD}			13.1		nC
Drain-Source Diode Characteristics and Maximum Ratings							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V,I _S =1A		0.82	1.4	V
Maximum Continuous Drain-Source Diode Forward Current		I _S			4		A
Reverse Recovery Time		t _{rr}	V _{DS} =100V,I _F =4A		330		ns
Reverse Recovery Charge		Q _{RR}	dI _F /dt=100A/μs(Note 1)		2.67		μC

Notes : 1 Repetitive Rating:Pulse width limited by maximum junction temperature

2 $L=25\text{ mH}, I_{AS}=4A, V_{DD}=50V, R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$

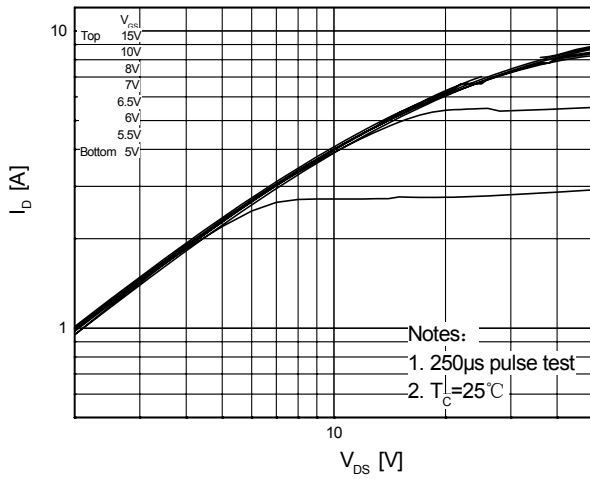
3 $I_{SD}\leq 4A, di/dt\leq 200A/\mu s, V_{DD}\leq BV_{DSS}$, starting $T_J=25^{\circ}\text{C}$

4 Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$

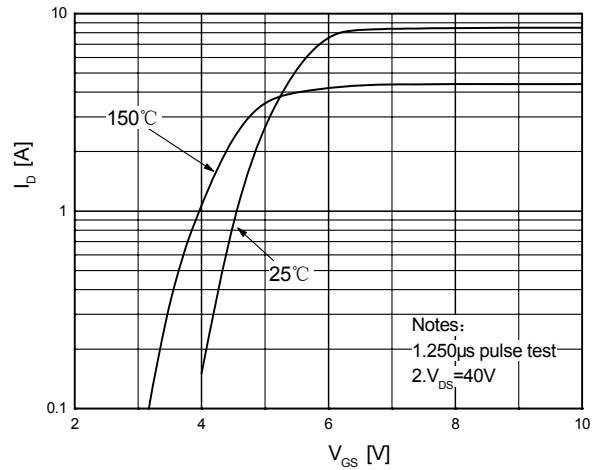
5 Guaranteed by design, not subject to production

Typical Characteristics Diagrams

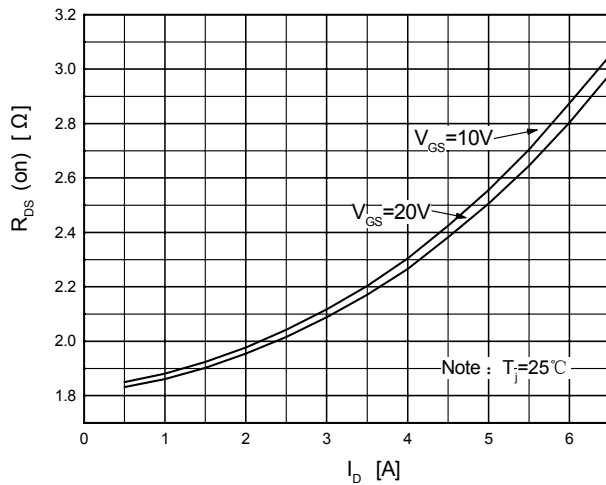
On-Region Characteristics



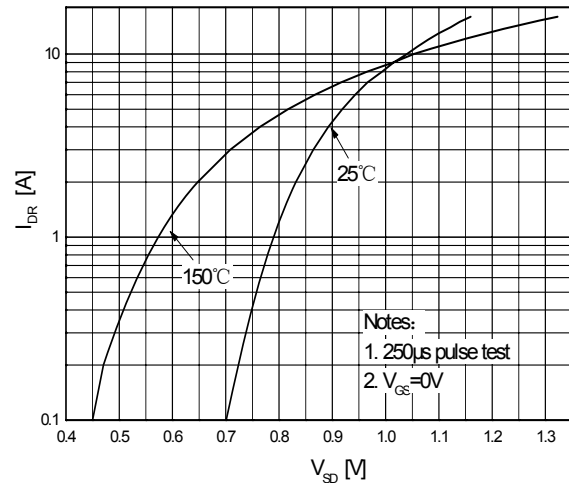
Transfer Characteristics



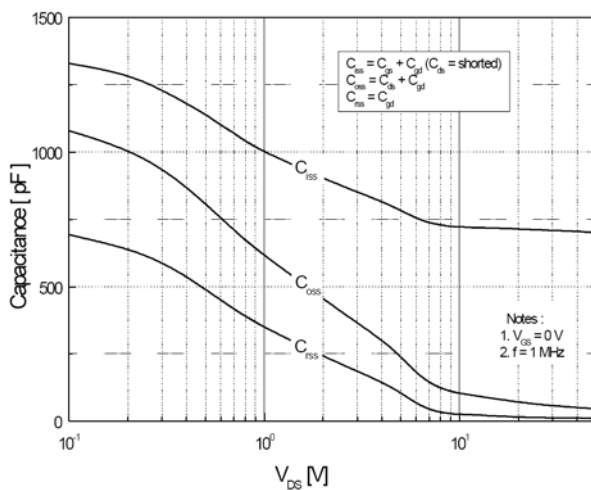
On-Resistance Variation vs. Drain Current and Gate Voltage



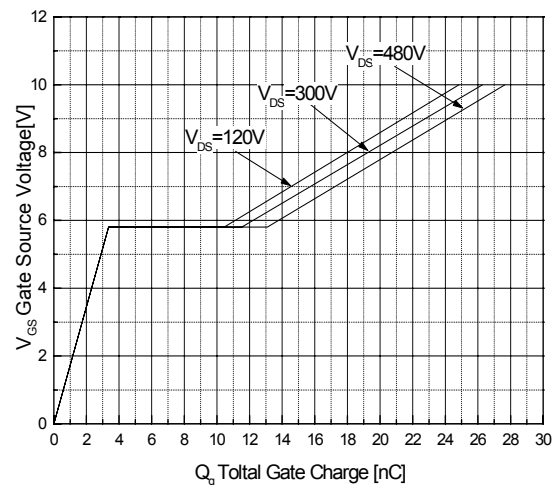
Body Diode Forward Voltage Variation vs. Source Current and Temperature



Capacitance Characteristics

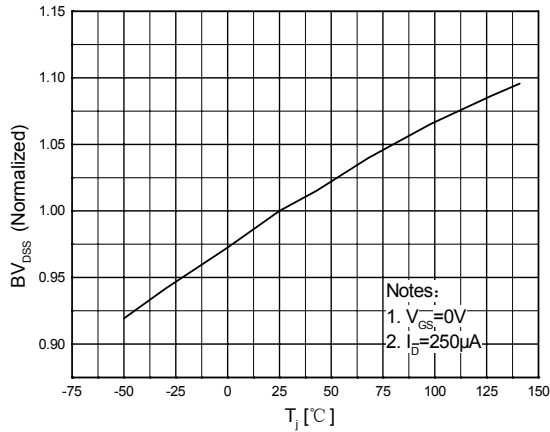


Gate Charge Characteristics

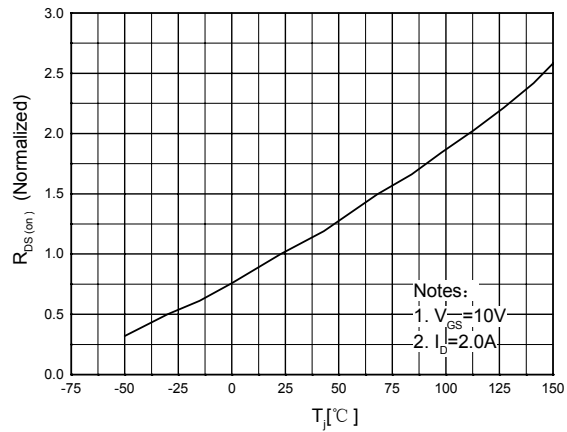


Typical Characteristics Diagrams

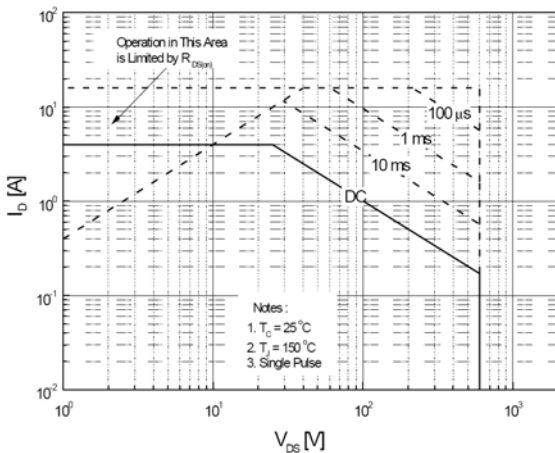
**Breakdown Voltage Variation
vs. Temperature**



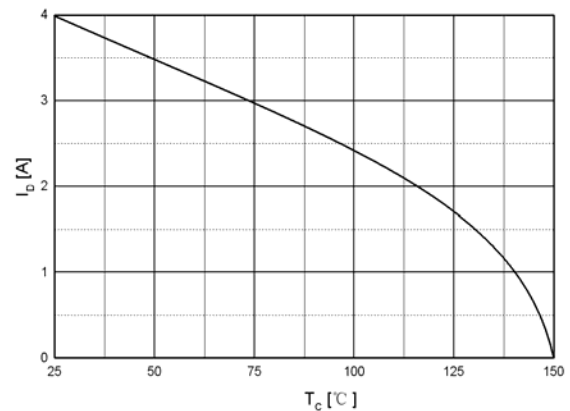
**On-Resistance Variation
vs. Temperature**



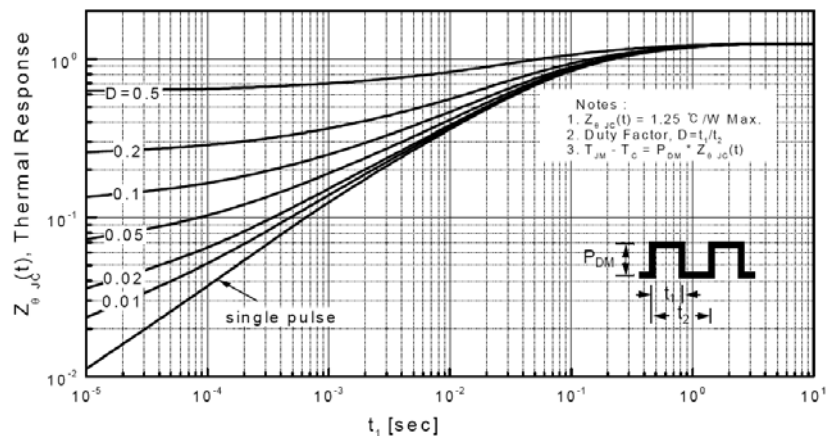
Maximum Safe Operating Area



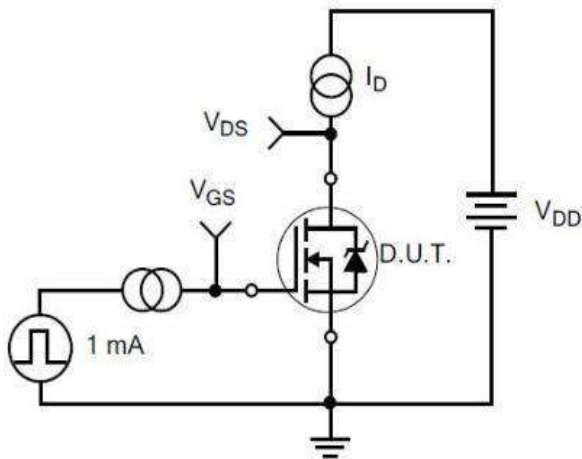
**Maximum Drain Current
vs. Case Temperature**



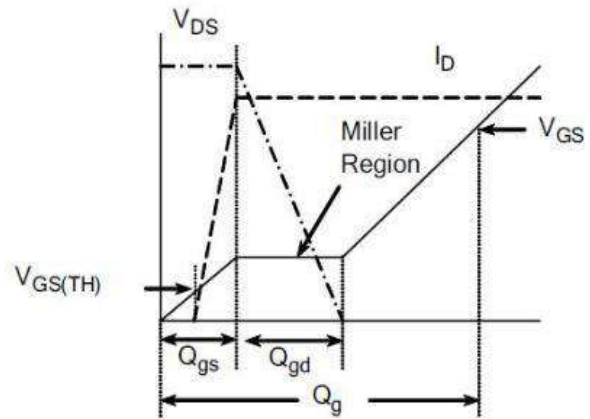
Transient Thermal Response Curve



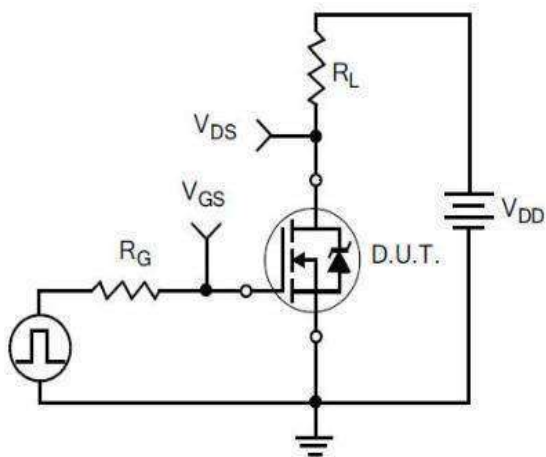
Typical Test Circuit



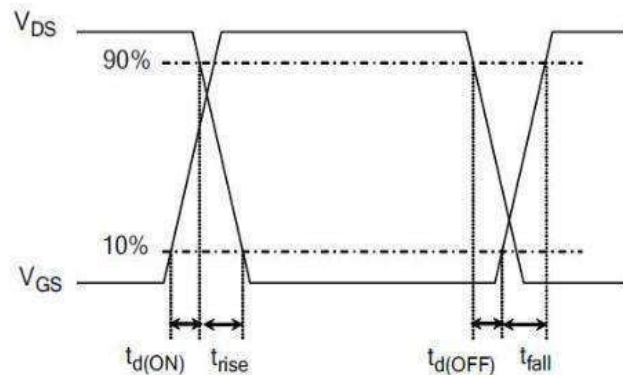
1) Gate Charge Test Circuit



2) Gate Charge Waveform

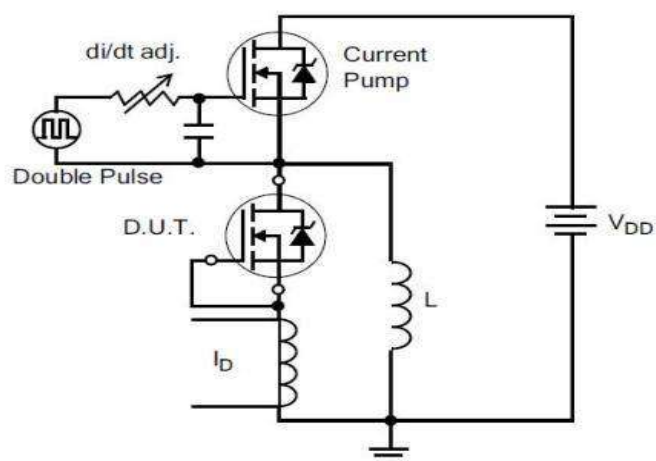


3) Resistive Switching Test Circuit

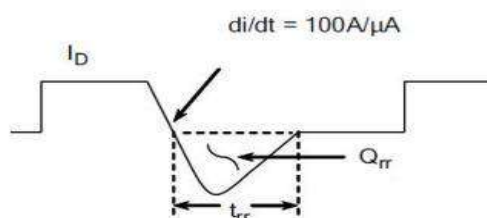


4) Resistive Switching Waveforms

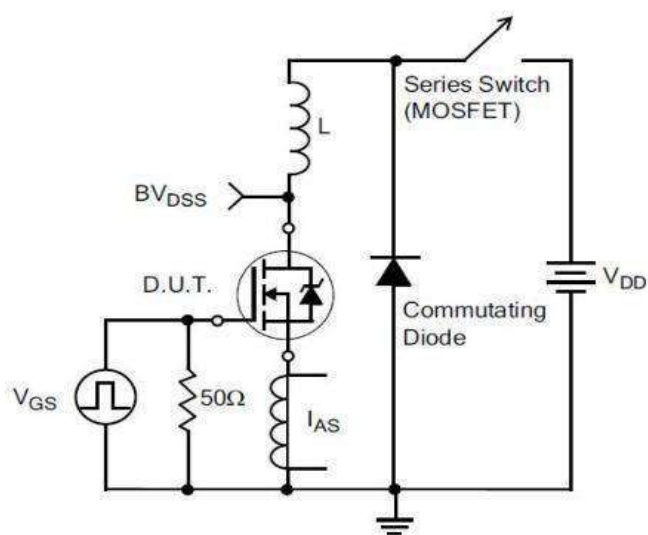
Typical Test Circuit



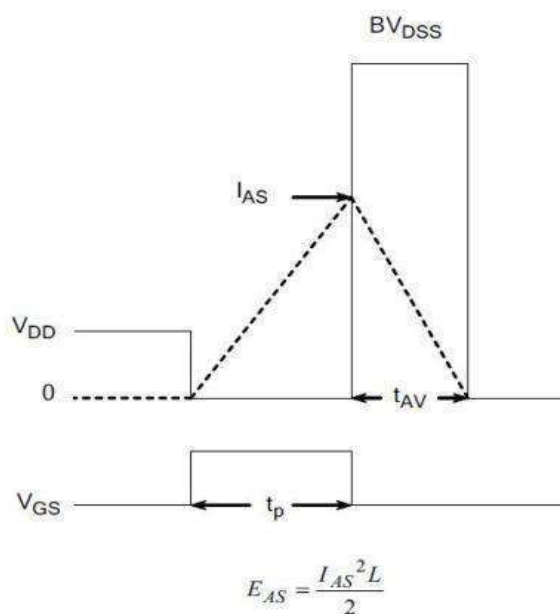
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform



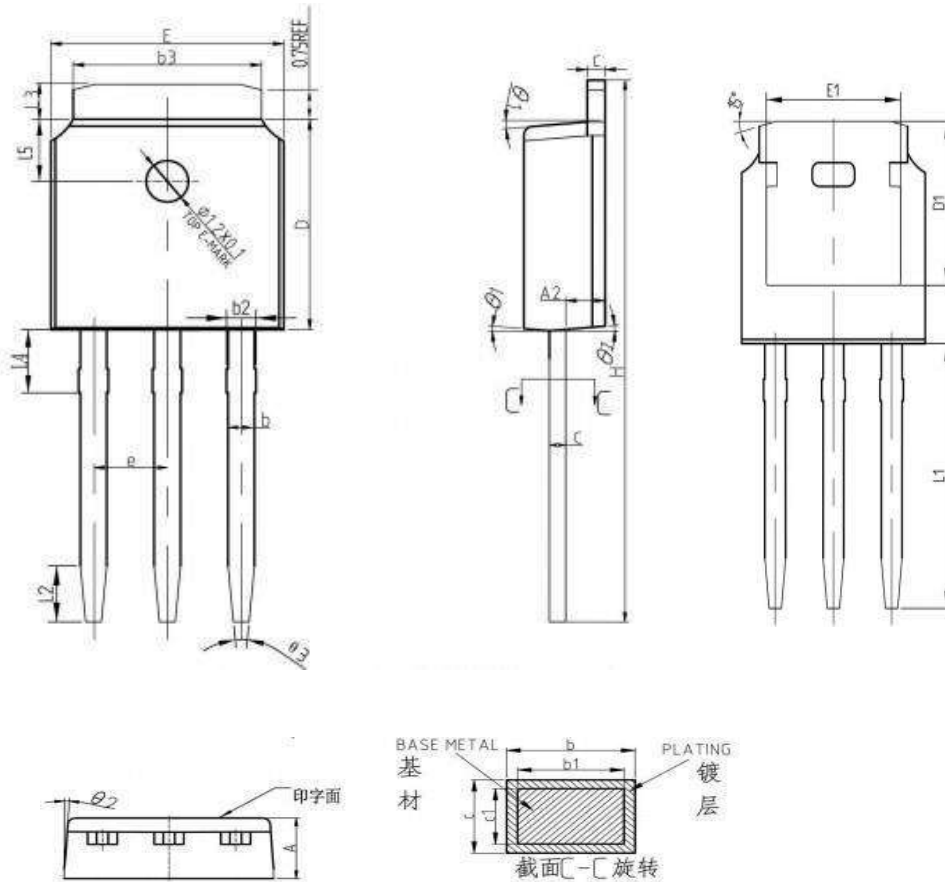
7) . Unclamped Inductive Switching Test Circuit



8) Unclamped Inductive Switching Waveforms

Dimensions

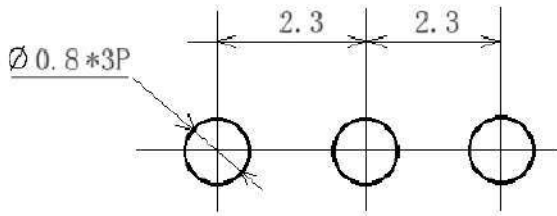
TO-251 PACKAGE OUTLINE DIMENSIONS



SYMBOL	mm		
	MIN	NOM	MAX
*A	2.20	2.30	2.38
*A2	0.97	1.07	1.17
*b	0.72	0.78	0.85
b1	0.71	0.76	0.81
*b2	0.72	0.88	0.95
*b3	5.23	5.33	5.46
*c	0.47	0.53	0.58
c1	0.46	0.51	0.56
*D	6.00	6.10	6.20
D1	5.30REF		
*E	6.50	6.60	6.70
E1	4.70	4.83	4.92
*e	2.286BSC		
*H	16.10	16.40	16.60
*L1	9.20	9.40	9.60
L2	1.25	1.35	1.45
*L3	0.90	1.02	1.22
L4	0.95	1.05	1.15
L5	1.70	1.80	1.90
$\theta 1$	5°	7°	9°
$\theta 2$	5°	7°	9°
$\theta 3$	11°	13°	15°
带*为检验尺寸			

Packaging Specifications of Tube Pack for TO-251

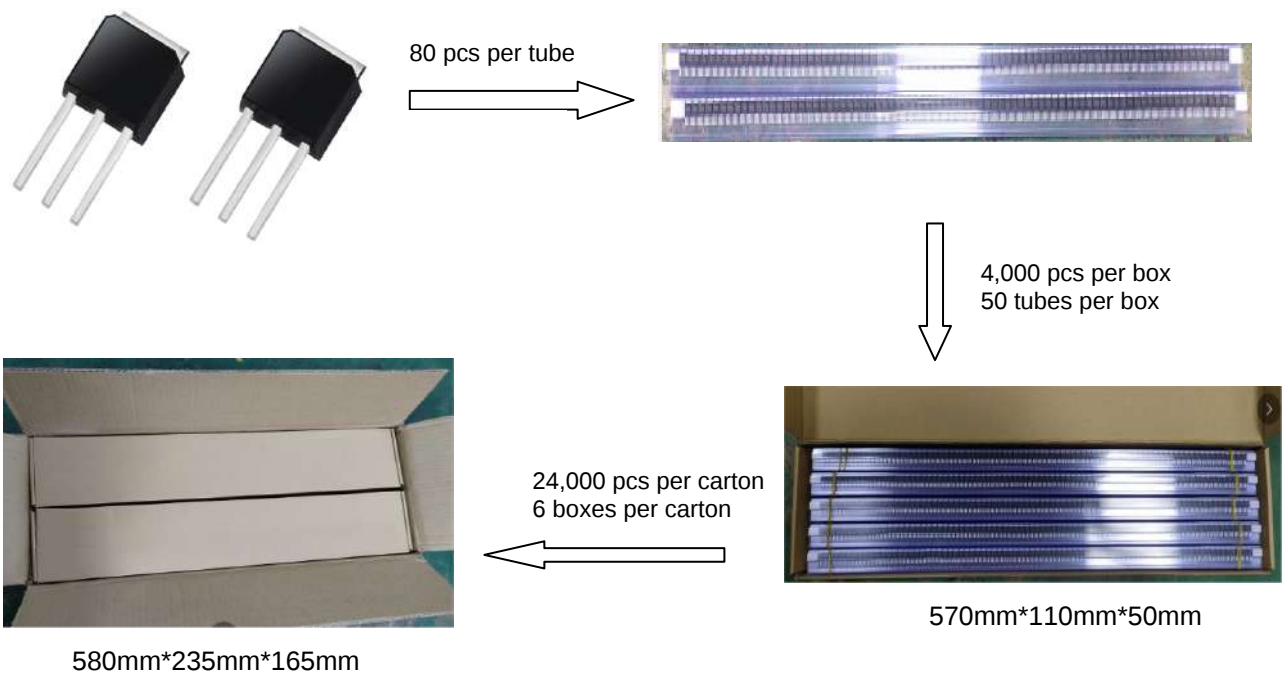
TO-251 Suggested Pad Layout



Note:

1. Controlling dimension: in millimeters.
2. General tolerance: $\pm 0.05\text{mm}$.
3. The pad layout is for reference purposes only.

1. The method of packaging and dimension are shown as below figure. (Dimension in mm)



Storage

1 It is recommended to store the products in the following conditions:

Humidity: 75% R.H. Max.

Temperature : $0^{\circ}\text{C} \sim 35^{\circ}\text{C}$ ($32^{\circ}\text{F} \sim 95^{\circ}\text{F}$)

2 Shelf life : 12 month at $< 0^{\circ}\text{C} \sim 35^{\circ}\text{C}$ ($32^{\circ}\text{F} \sim 95^{\circ}\text{F}$) and $< 75\%$ R.H.