



500V Super-Junction Power MOSFET

DESCRIPTION

500V super-junction Power MOSFET

Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFETs, designed according to the SJ principle. The SJ MOSFET is a price-performance optimized product enabling to target cost sensitive applications in Consumer and Lighting markets, designed by Wuxi Unigroup Microelectronics Company.

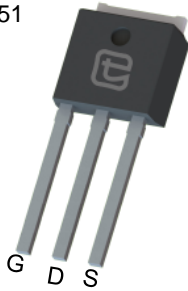
FEATURES

- Very low FOM $R_{DS(on)} \times Q_g$
- 100% avalanche tested
- RoHS compliant

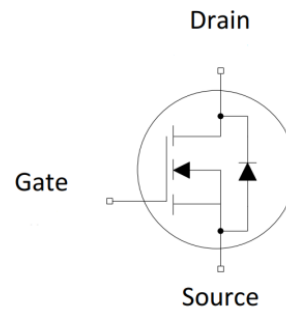
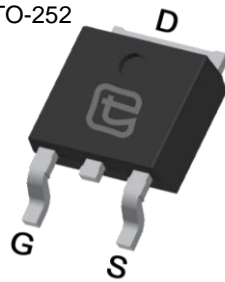
APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)

TO-251



TO-252



Device Marking and Package Information

Device	Package	Marking
TPU50R5K4CT	TO-251	50R5K4CT
TPD50R5K4CT	TO-252	50R5K4CT

Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	500	V
$R_{DS(on),max}$	5.4	Ω
I_D	1	A
$Q_{g,typ}$	1.4	nC
I_{DM}	3	A



Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, unless otherwise noted				
Parameter	Symbol	Value	Unit	
		TO-251,TO-252		
Drain-Source Voltage ($V_{GS} = 0\text{V}$)	V_{DSS}	500	V	
Continuous Drain Current	I_D	$T_C = 25^\circ\text{C}$	1	A
		$T_C = 100^\circ\text{C}$	0.6	
Pulsed Drain Current (note1)	I_{DM}	3	A	
Gate-Source Voltage	V_{GSS}	± 30	V	
Single Pulse Avalanche Energy (note2)	E_{AS}	0.45	mJ	
Avalanche Current	I_{AS}	0.3	A	
Power Dissipation	P_D	5.4	W	
Continuous Body Diode Current	I_S	1	A	
Pulsed Diode Forward Current (note1)	I_{SM}	3		
MOSFET dv/dt ruggedness, $V_{DS} = 0 \dots 400\text{V}$	dv/dt	50	V/ns	
Reverse diode dv/dt, $V_{DS} = 0 \dots 400\text{V}$, $I_{SD} \leq I_D$	dv/dt	5	A/us	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150	$^\circ\text{C}$	

Thermal Resistance			
Parameter	Symbol	Value	Unit
		TO-251,TO-252	
Thermal Resistance, Junction-to-Case	R_{thJC}	23	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62	



Specifications $T_J = 25^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	500	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 500V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	μA
		$V_{DS} = 500V, V_{GS} = 0V, T_J = 150^\circ\text{C}$	--	--	100	
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30V$	--	--	± 100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	1	--	2.5	V
Drain-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 0.3A$	--	4.9	5.4	Ω
Forward Transconductance (Note3)	g_{fs}	$V_{DS} = 10V, I_D = 0.3A$	--	0.5	--	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0V,$ $V_{DS} = 50V,$ $f = 1.0\text{MHz}$	--	52	--	μF
Output Capacitance	C_{oss}		--	21	--	
Reverse Transfer Capacitance	C_{rss}		--	4	--	
Total Gate Charge	Q_g	$V_{DD} = 400V, I_D = 11A,$ $V_{GS} = 10V$	--	1.4	--	nC
Gate-Source Charge	Q_{gs}		--	0.28	--	
Gate-Drain Charge	Q_{gd}		--	0.6	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 400V, I_D = 11A,$ $R_G = 25\Omega$	--	16	--	ns
Turn-on Rise Time	t_r		--	31	--	
Turn-off Delay Time	$t_{d(off)}$		--	22	--	
Turn-off Fall Time	t_f		--	36	--	
Drain-Source Body Diode Characteristics						
Body Diode Voltage	V_{SD}	$T_J = 25^\circ\text{C}, I_{SD} = 1A, V_{GS} = 0V$	--	0.9	1.2	V
Reverse Recovery Time	t_{rr}	$V_R = 400V, I_F = I_S,$ $di_F/dt = 100A/\mu s$	--	34	--	ns
Reverse Recovery Charge	Q_{rr}		--	0.1	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	1.4	--	A

Notes

1. Repetitive Rating: Pulse Width limited by maximum junction temperature
2. $I_{AS}=0.3A, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 1\%$



Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

Figure 1. Output Characteristics

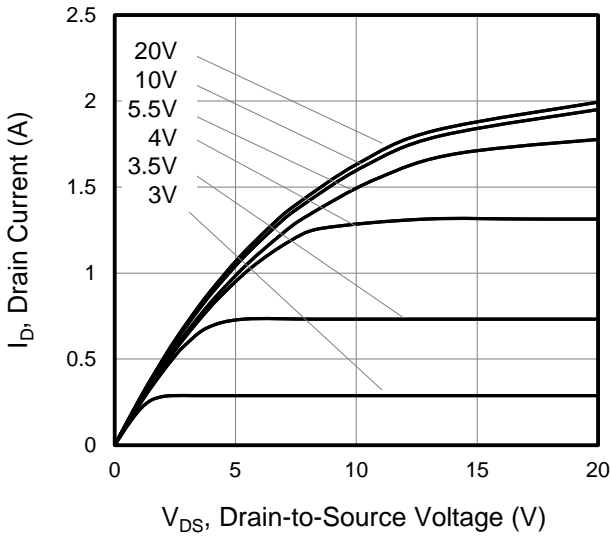


Figure 2. Transfer Characteristics

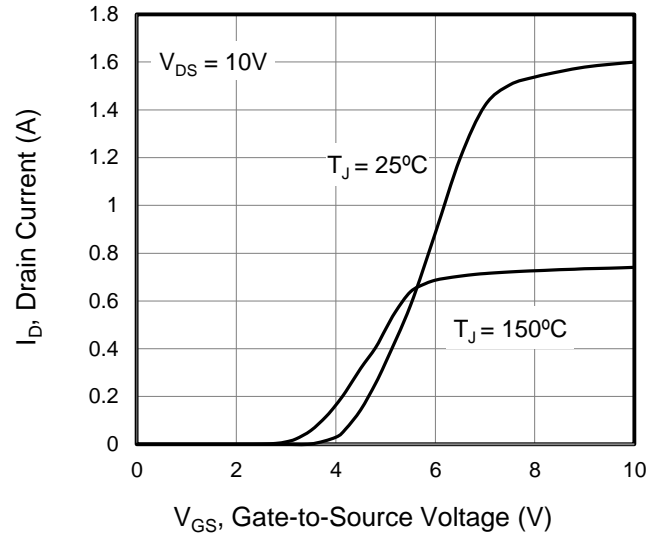


Figure 3. On-Resistance vs. Drain Current

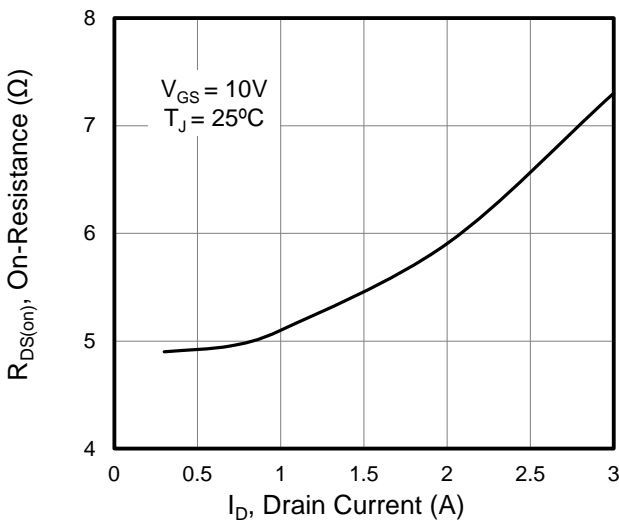


Figure 4. Capacitance

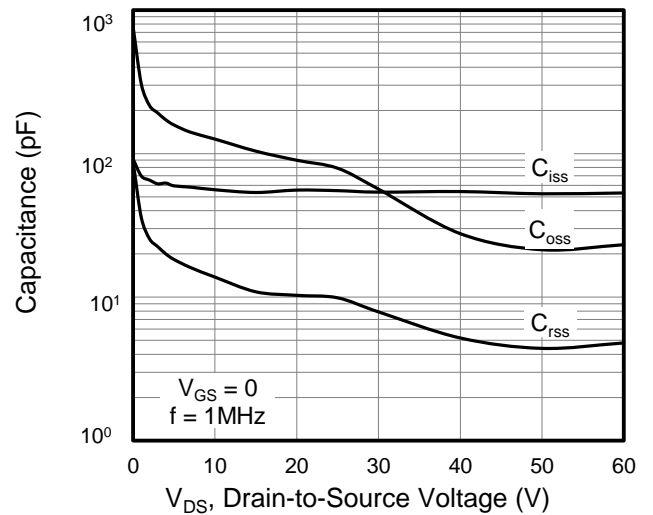


Figure 5. Gate Charge

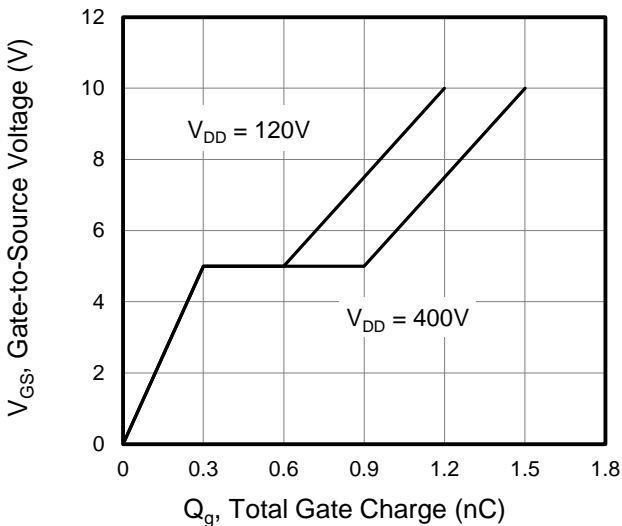
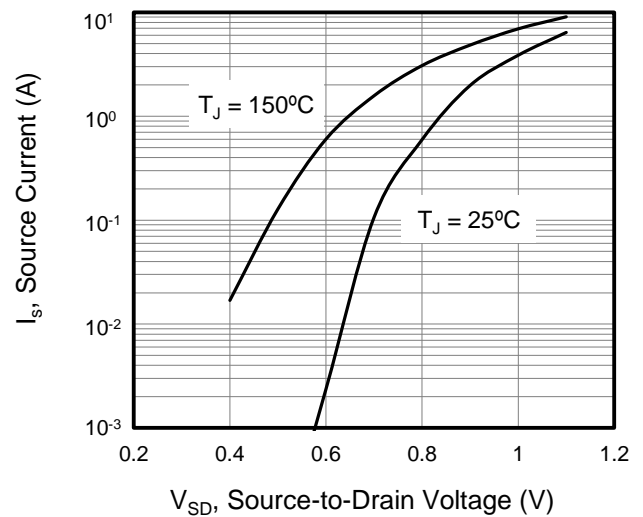


Figure 6. Body Diode Forward Voltage





Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

Figure 7. On-Resistance vs. Junction Temperature

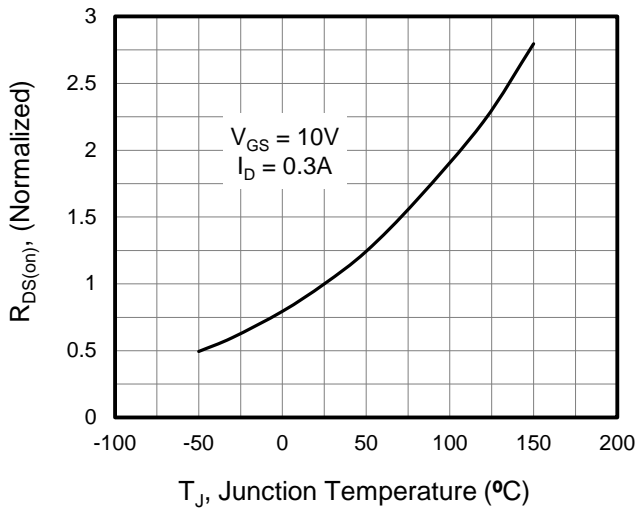


Figure 8. Breakdown voltage vs. Junction Temperature

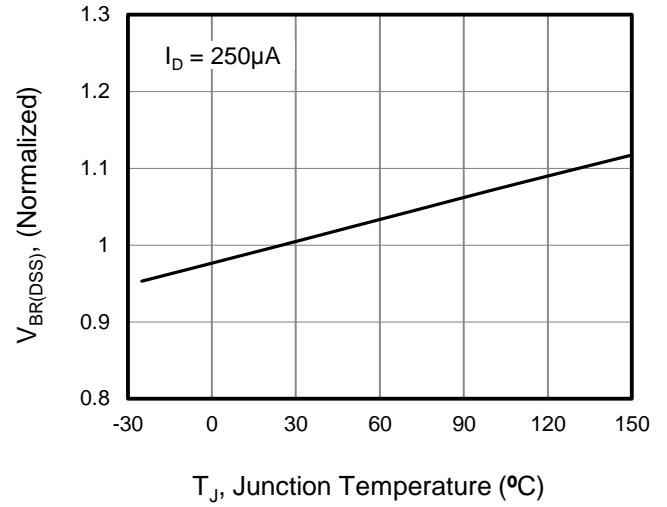


Figure 9. Transient Thermal Impedance TO-251/TO-252

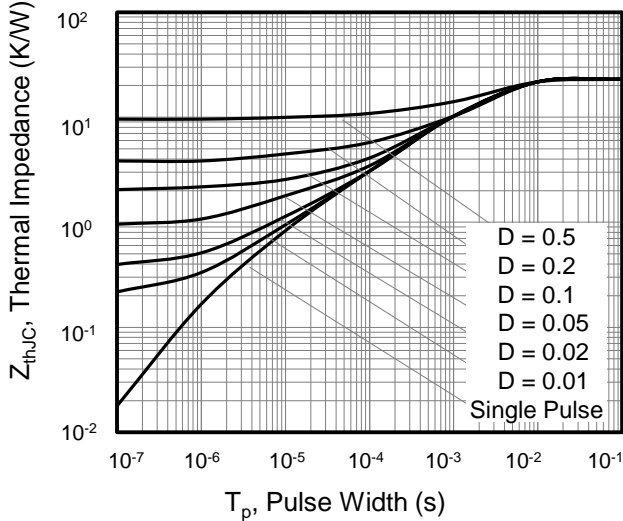


Figure 10. Safe operation area for TO-251/TO-252

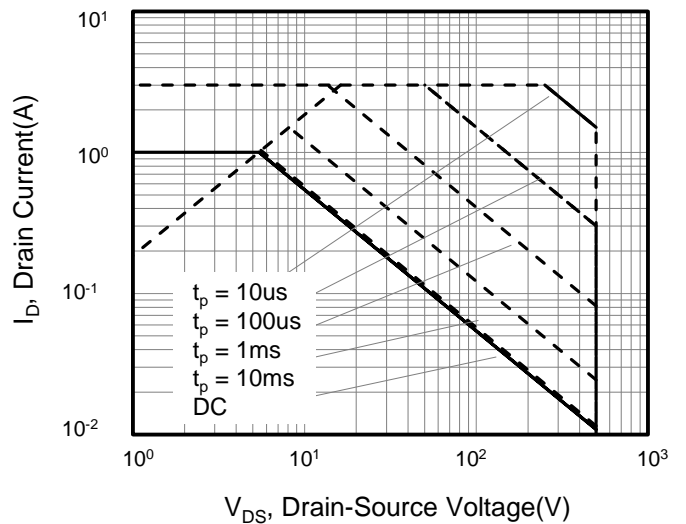




Figure A: Gate Charge Test Circuit and Waveform

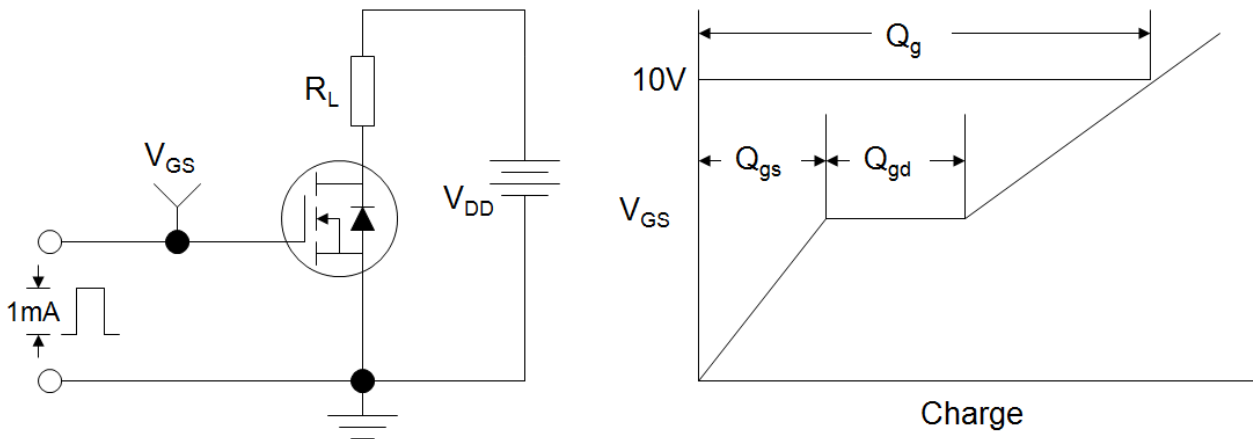


Figure B: Resistive Switching Test Circuit and Waveform

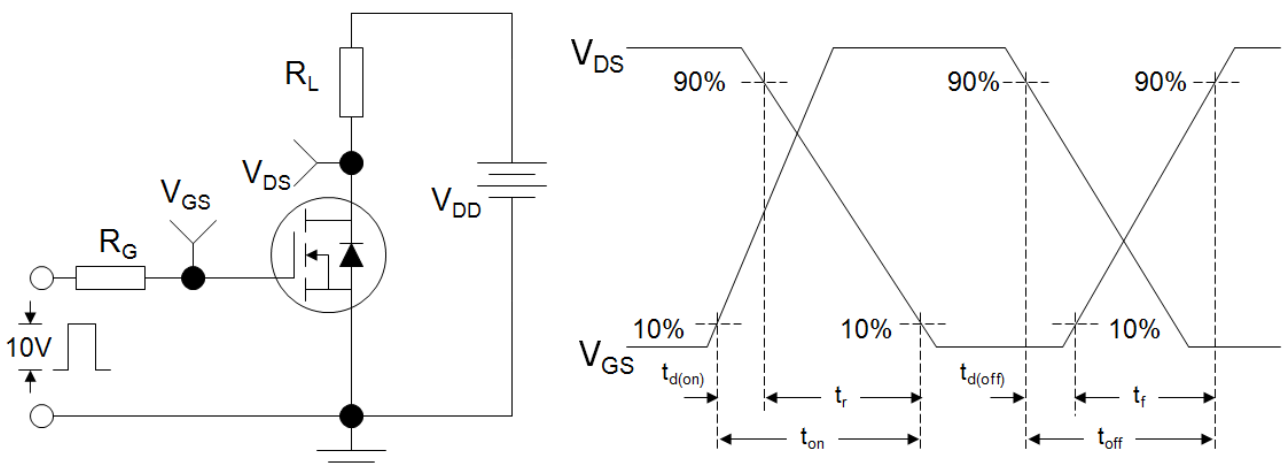
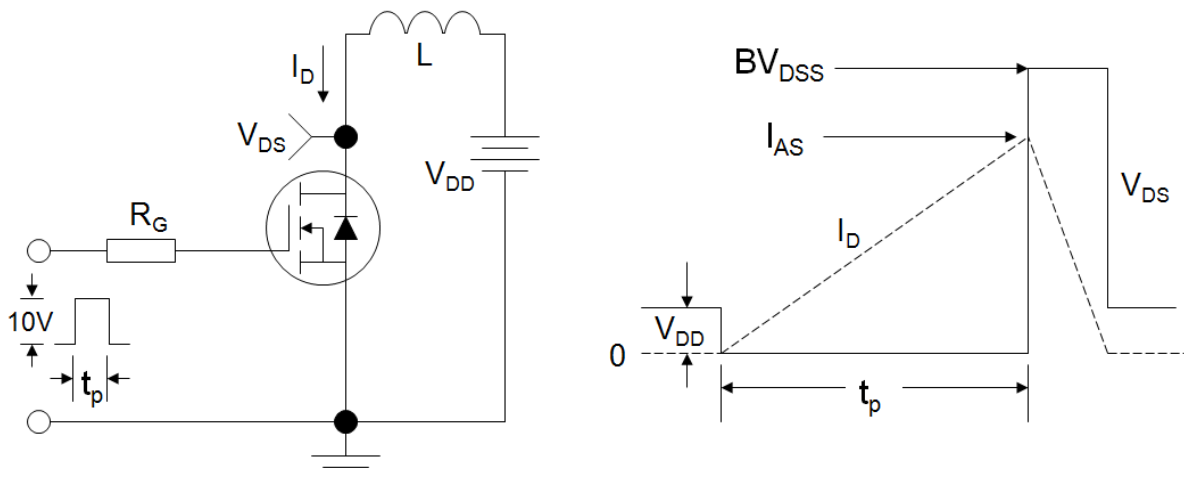
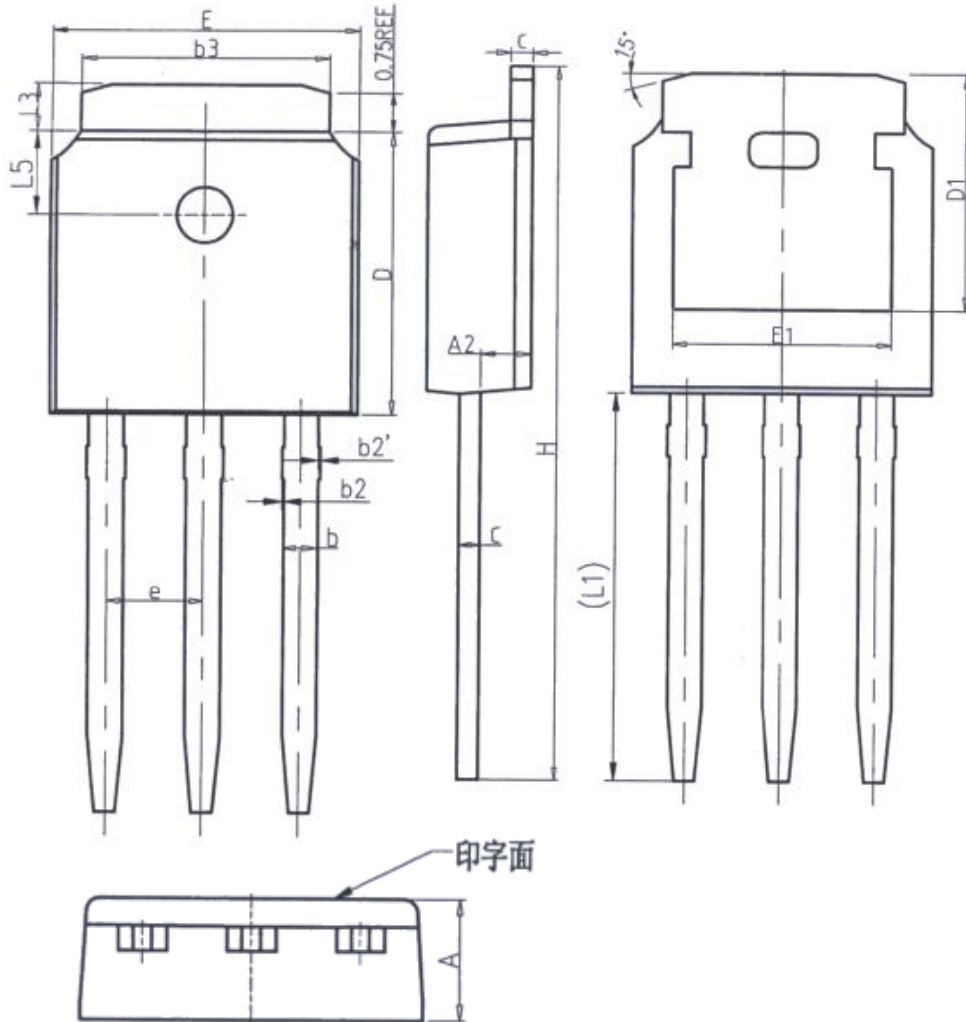


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





TO-251

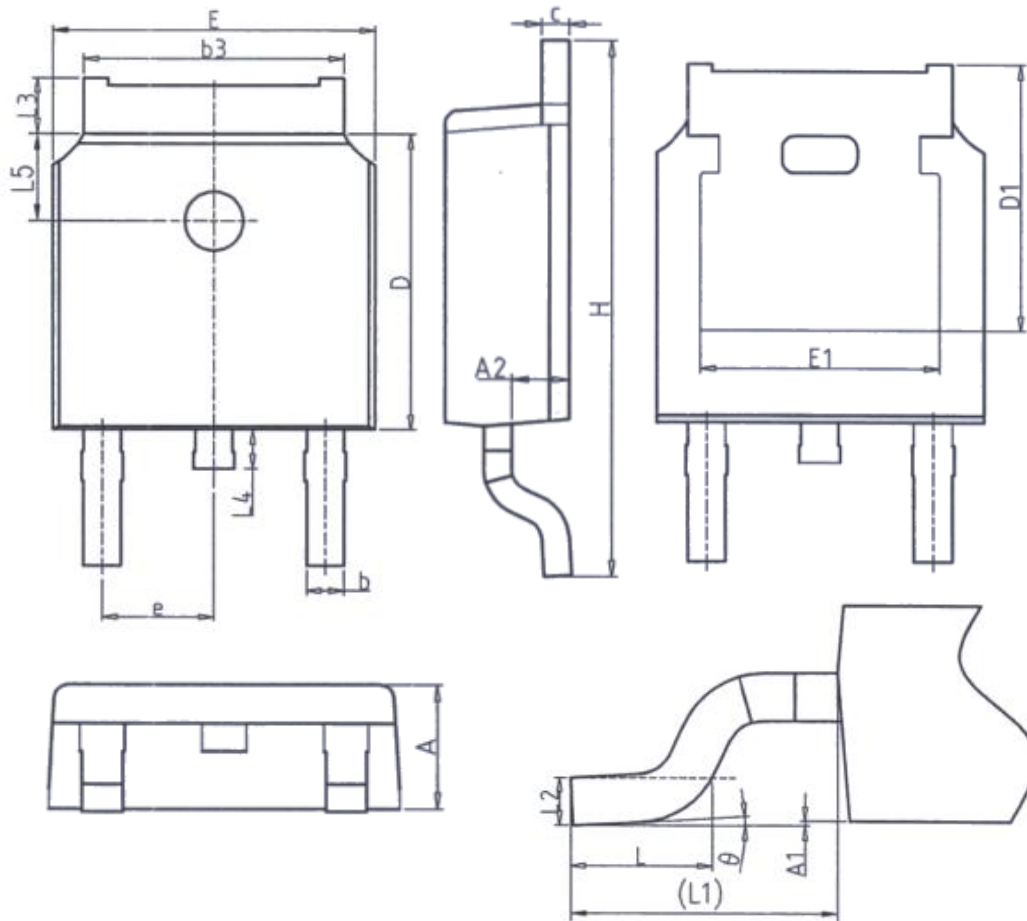


Unit: mm		
Symbol	Min.	Max.
A	2.20	2.40
A2	0.97	1.17
b	0.68	0.90
b2	0.00	0.10
b2'	0.00	0.10
b3	5.20	5.50
c	0.43	0.63
D	5.98	6.22

Unit: mm		
Symbol	Min.	Max.
D1	5.30REF	
E	6.40	6.80
E1	4.63	-
e	2.286BSC	
H	16.22	16.82
L1	9.15	9.65
L3	0.88	1.28
L5	1.65	1.95



TO-252



Unit: mm		
Symbol	Min.	Max.
A	2.20	2.40
A1	0.00	0.20
A2	0.97	1.17
b	0.68	0.90
b3	5.20	5.50
c	0.43	0.63
D	5.98	6.22
D1	5.30REF	
E	6.40	6.80
E1	4.63	-

Unit: mm		
Symbol	Min.	Max.
e	2.286BSC	
H	9.40	10.50
L	1.38	1.75
L1	2.90REF	
L2	0.51BSC	
L3	0.88	1.28
L4	-	1.00
L5	1.65	1.95
θ	0°	8°



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