700V Super-Junction Power MOSFET

DESCRIPTION

700V super-junction Power MOSFET

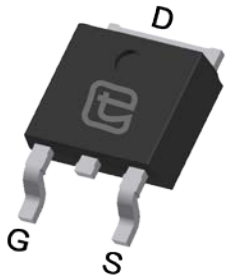
Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFETs，designed according to the SJ principle. The SJ MOSFET is a price-performance optimized product enabling to target cost sensitive applications in Consumer and Lighting markets，designed by Wuxi Unigroup Microelectronics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

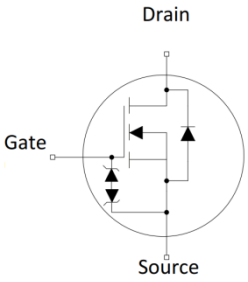
FEATURES

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

APPLICATIONS

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





RoHS

Device Marking and Package Information

Device	Package	Marking
TPD70R1K5M	TO-252	70R1K5M

Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	700	V
$R_{DS(on),max}$	1.5	Ω
I_D	3	A
$Q_{g,typ}$	7	nC
I_{DM}	9	A
ESD class（HBM）	1C	

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted				
Parameter		**Symbol**	**Value**	**Unit**
Drain-Source Voltage (V_{GS} = 0V)		V_{DSS}	700	V
Continuous Drain Current	T_C = 25ºC	I_D	3	A
	TC = 100ºC		1.8	
Pulsed Drain Current (note1)		I_{DM}	9	A
Gate-Source Voltage		V_{GSS}	±20	V
Single Pulse Avalanche Energy (note2)		E_{AS}	26	mJ
Repetitive Avalanche Energy (note2)		E_{AR}	0.10	mJ
Avalanche Current		I_{AR}	0.6	A
MOSFET dv/dt ruggedness, V_{DS} = 0...480V		dv/dt	50	V/ns
Power Dissipation		P_D	28	W
Continuous Body Diode Current		I_S	2.5	A
Pulsed Diode Forward Current (note1)		I_{SM}	33	
Reverse diode dv/dt (note3)		dv/dt	15	V/ns
Maximum diode commutation speed (note3)		di_f/dt	500	A/us
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150	ºC

Thermal Resistance			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	4.4	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	160	

Specifications T_J = 25ºC, 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 = 250μA	700	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 700V, V_{GS} = 0V, T_J = 25ºC	--	--	1	μA
		V_{DS} = 700V, V_{GS} = 0V, T_J = 150ºC	--	--	100	
Gate-Source Leakage	I_{GSS}	V_{GS} = ±20V	--	--	±1	μA
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250μA	2.5	--	4.0	V
Drain-Source On-Resistance	$R_{DS(on)}$	V_{GS} = 10V, I_D = 1.5A	--	1.3	1.5	Ω
Gate resistance	R_G	f = 1.0MHz open drain	--	5.5	--	Ω
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 100V, f = 1.0MHz	--	225	--	pF
Output Capacitance	C_{oss}		--	10	--	
Reverse Transfer Capacitance	C_{rss}		--	0.4	--	
Total Gate Charge	Q_g	V_{DD} = 560V, I_D = 3A, V_{GS} = 10V	--	7	--	nC
Gate-Source Charge	Q_{gs}		--	1.3	--	
Gate-Drain Charge	Q_{gd}		--	3.5	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 400V, I_D = 3A, R_G = 25Ω	--	8.5	--	ns
Turn-on Rise Time	t_r		--	7.7	--	
Turn-off Delay Time	$t_{d(off)}$		--	19.0	--	
Turn-off Fall Time	t_f		--	16.5	--	
Drain-Source Body Diode Characteristics						
Body Diode Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 1.5A, V_{GS} = 0V	--	0.9	1.2	V
Reverse Recovery Time	t_{rr}	V_R = 400V, I_F = 3A, di_F/dt = 100A/μs	--	155	--	ns
Reverse Recovery Charge	Q_{rr}		--	0.85	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	11	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 0.6A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. Identical low side and high side switch with identical R_G

Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 1. Output Characteristics

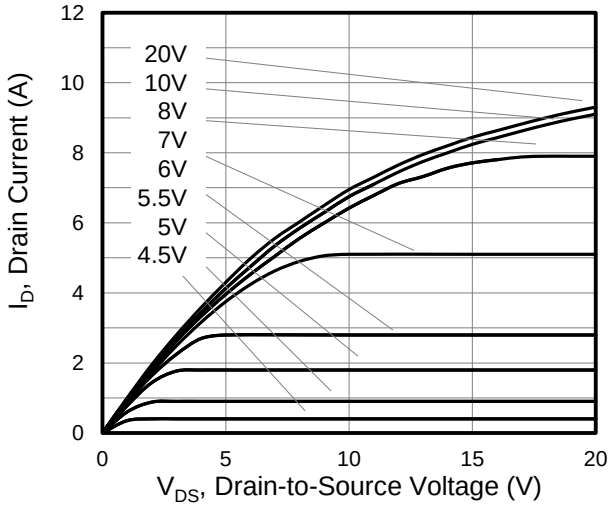


Figure 2. Transfer Characteristics

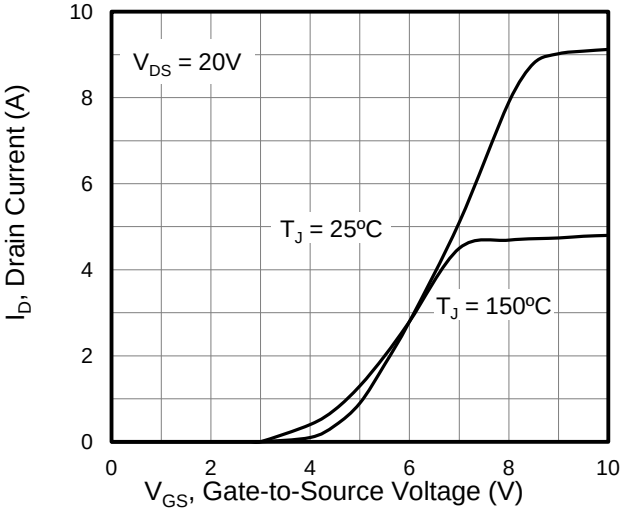


Figure 3. On-Resistance vs. Drain Current

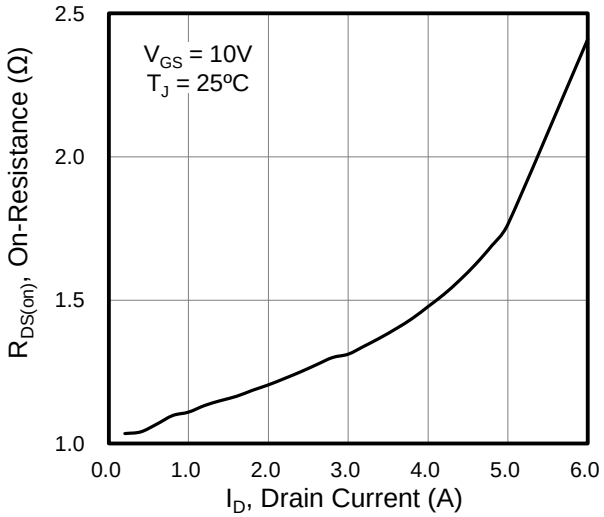


Figure 4. Capacitance

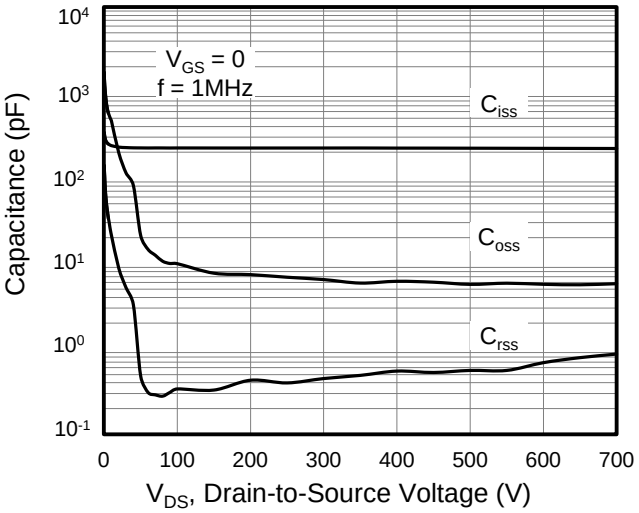


Figure 5. Gate Charge

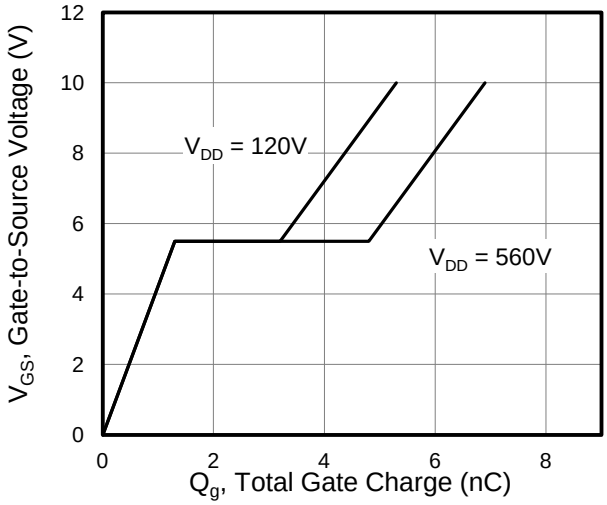
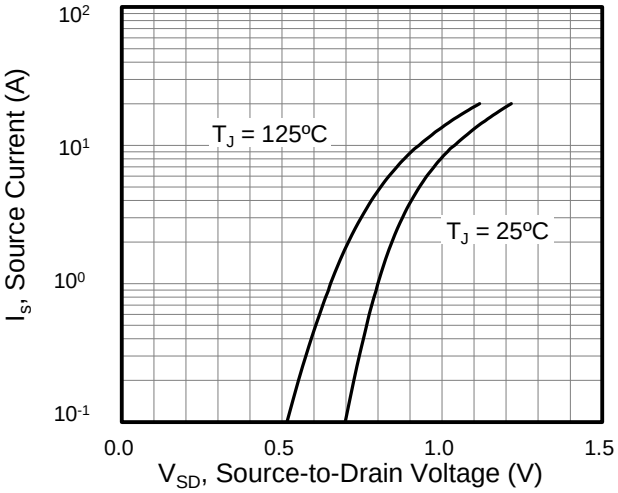


Figure 6. Body Diode Forward Voltage



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 7. On-Resistance vs. Junction Temperature

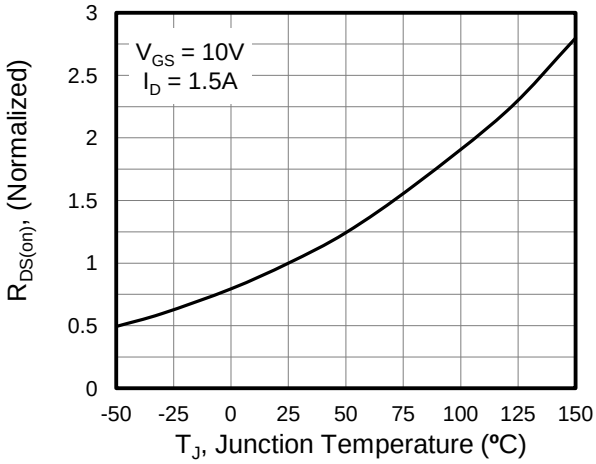


Figure 8. Breakdown voltage vs. Junction Temperature

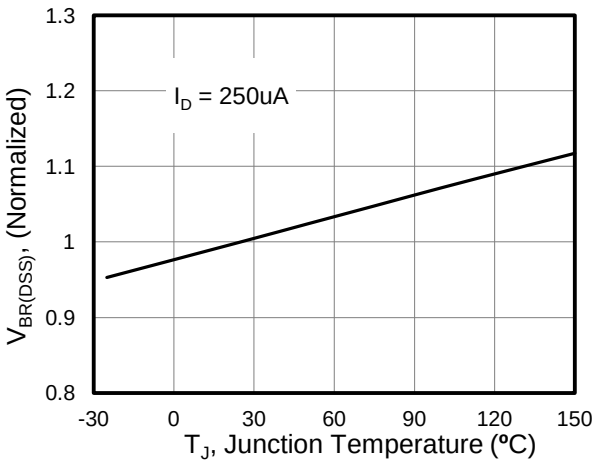


Figure 9. Transient Thermal Impedance for TO-252

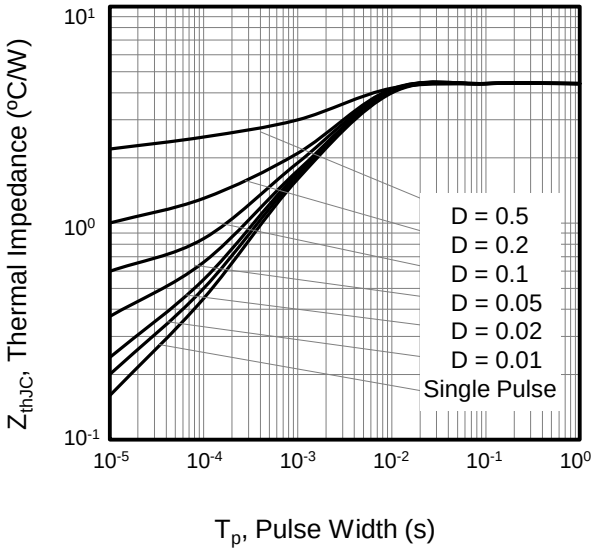


Figure 10. Safe operation area for TO-252

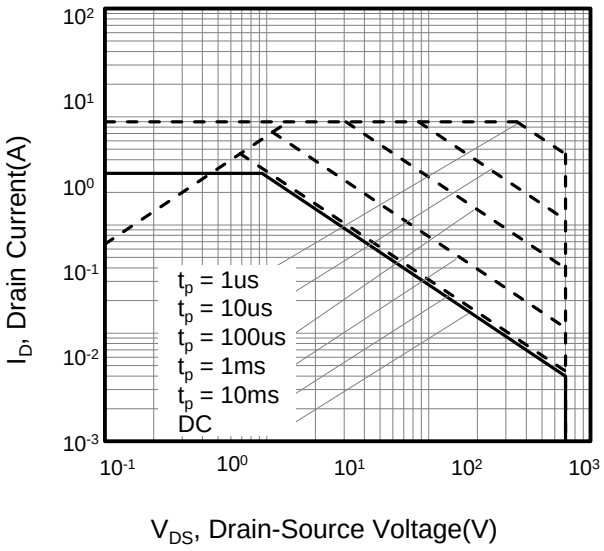


Figure A：Gate Charge Test Circuit and Waveform

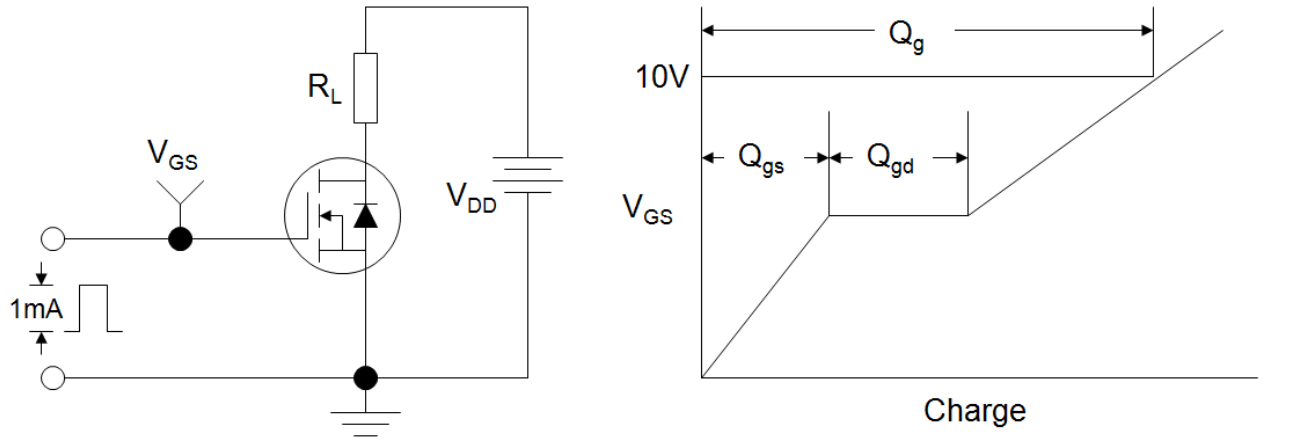


Figure B：Resistive Switching Test Circuit and Waveform

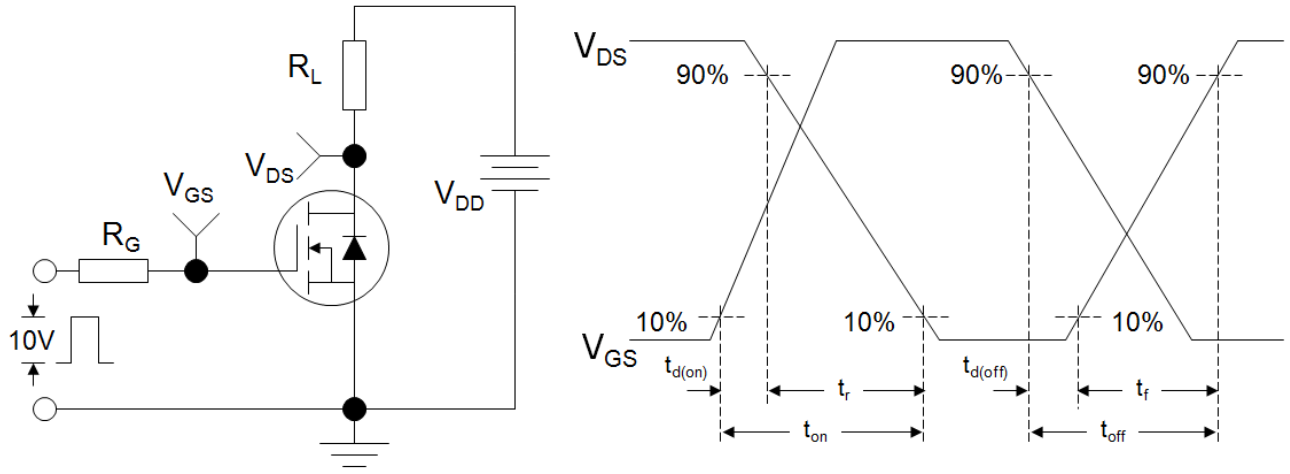
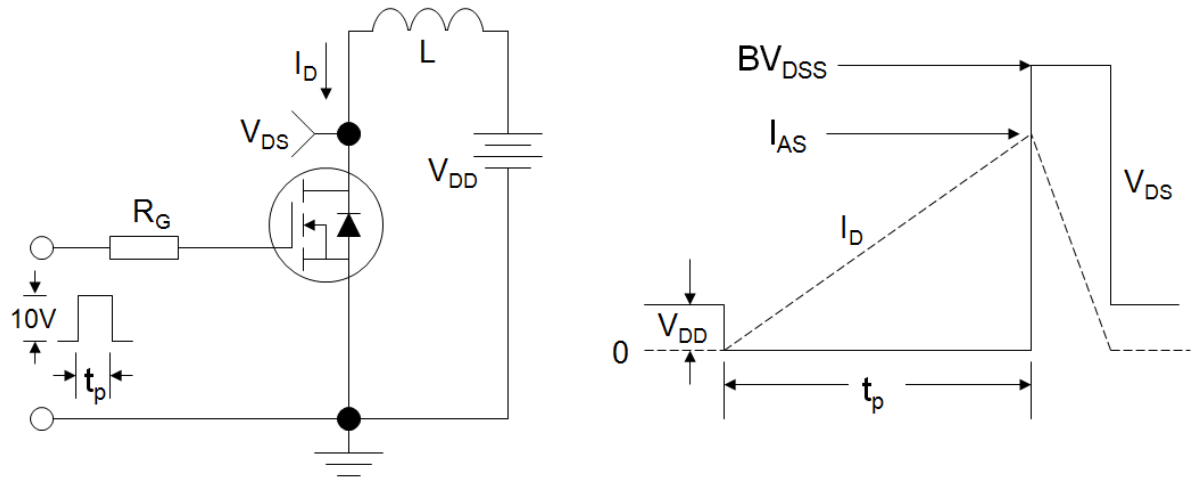
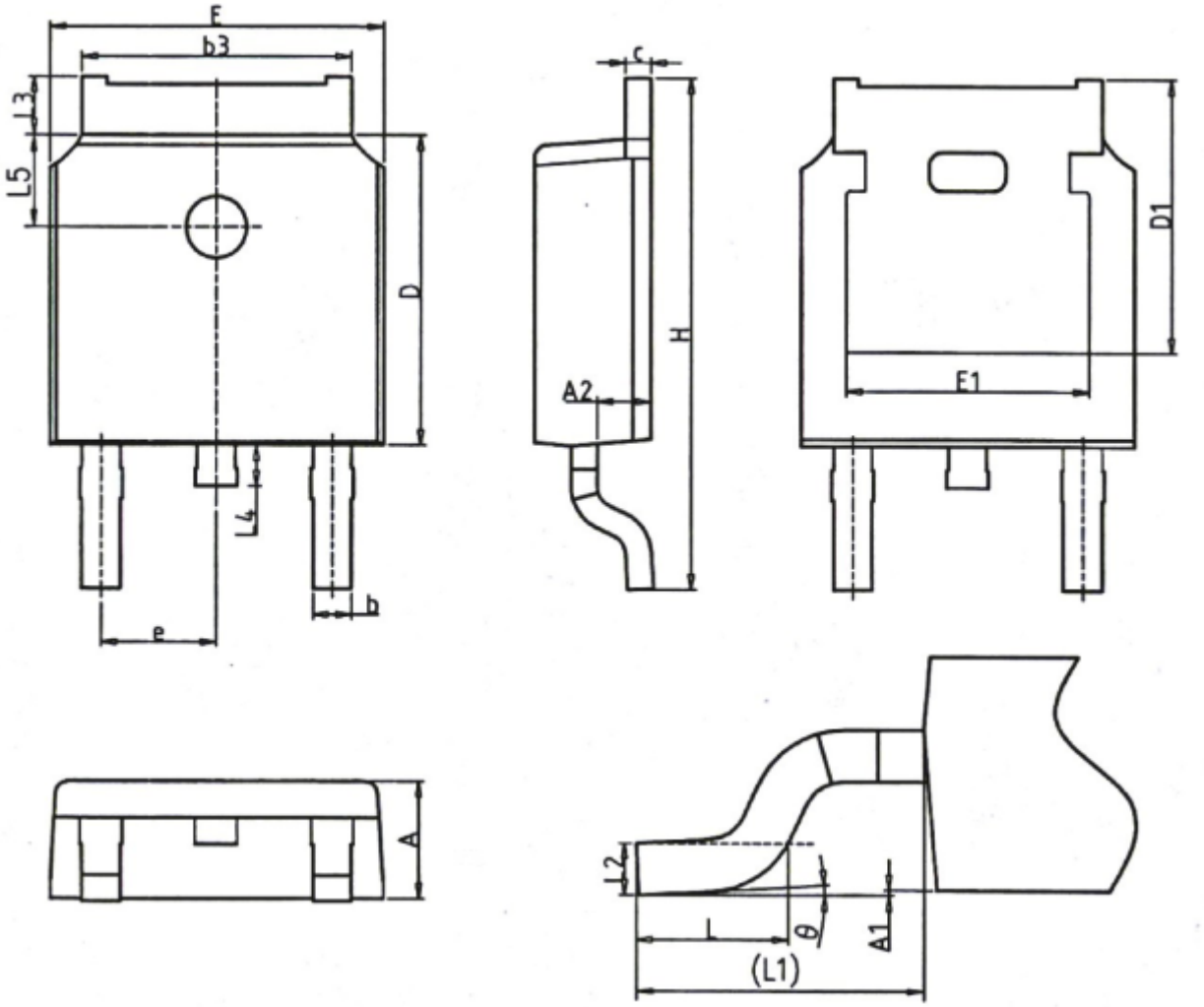


Figure C：Unclamped Inductive Switching Test Circuit and Waveform



TO-252



Unit:mm			
Symbol	Min.	Nom	Max.
A	2.20	2.30	2.40
A1	0.00	-	0.20
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.50
c	0.43	0.53	0.63
D	5.98	6.10	6.22
D1	5.30 REF		
E	6.40	6.60	6.80
E1	4.63	-	-

Unit:mm			
Symbol	Min.	Nom	Max.
e	2.286 BSC		
H	9.40	10.10	10.50
L	1.38	1.50	1.75
L1	2.90 REF		
L2	0.51 BSC		
L3	0.88	-	1.28
L4	-	-	1.00
L5	1.65	1.80	1.95
θ	0°	-	8°

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