650V Super-junction Power MOSFET

Description

650V Super-junction Power MOSFET

Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFETs，designed according to the SJ principle. The Multi-EPI SJ MOSFET provide an extremely low switching, communication and conduction losses device with highest robustness make especially resonant switching applications more reliable, more efficient, lighter and cooler, designed by Wuxi Unigroup Microelectronics Company.

Features

- Very low FOM RDS(on)×Qg
- 100% avalanche tested
- Easy to use/drive
- RoHS compliant

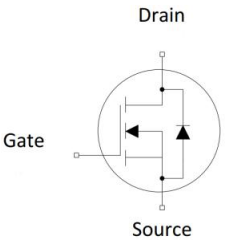
Applications

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

TO-220F

TO-263

TO-252



RoHS

Device Marking and Package Information

Device	Package	Marking
TPA65R950M	TO-220F	65R950M
TPB65R950M	TO-263	65R950M
TPD65R950M	TO-252	65R950M

Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	700	V
$R_{DS(on),max}$	0.95	Ω
$Q_{g,typ}$	9.6	nC
I_D	4.5	A
$I_{D,pulse}$	13.5	A
E_{OSS} @ 400V	1.04	μJ
Body Diode di_F/dt	500	A/μs

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted				
Parameter		**Symbol**	**Value**	**Unit**
Continuous Drain Current	T_C = 25ºC	I_D	4.5	A
	T_C = 100ºC		2.7	
Pulsed Drain Current (note1)		$I_{D,pulse}$	13.5	A
Gate-Source Voltage		V_{GSS}	±30	V
Single Pulse Avalanche Energy (note2)		E_{AS}	50	mJ
Repetitive Avalanche Energy (note2)		E_{AR}	0.15	mJ
Avalanche Current		I_{AR}	1.0	A
MOSFET dv/dt Ruggedness, V_{DS} = 0...480V		dv/dt	50	V/ns
Power Dissipation For TO-220F		P_D	26	W
Power Dissipation For TO-263,TO-252			37	
Continuous Diode Forward Current		I_S	3.8	A
Diode Pulsed Current (note1)		$I_{S,pulse}$	13.5	
Reverse Diode dv/dt (note3)		dv/dt	15	V/ns
Maximum Diode Commutation Speed (note3)		di_f/dt	500	A/μs
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150	ºC

Thermal Resistance For TO-220F			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	4.9	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	80	

Thermal Resistance For TO-263,TO-252			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	3.4	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62	

Electrical Characteristics T_J = 25ºC, unless otherwise noted						
Parameter	**Symbol**	**Test Conditions**	**Value**			**Unit**
			Min.	**Typ.**	**Max.**	
Static Characteristics						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 250μA	650	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 650V, V_{GS} = 0V, T_J = 25ºC	--	--	1	μA
		V_{DS} = 650V, V_{GS} = 0V, T_J = 150ºC	--	--	100	
Gate-Source Leakage Current	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-State-Resistance	$R_{DS(on)}$	V_{GS} = 10V, I_D = 2A	--	0.87	0.95	Ω
Gate Resistance	R_G	f = 1.0MHz open drain	--	5	--	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 100V, f = 1.0MHz	--	320	--	pF
Output Capacitance	C_{oss}		--	18	--	
Reverse Transfer Capacitance	C_{rss}		--	2.1	--	
Total Gate Charge	Q_g	V_{DD} = 520V, I_D = 4.5A, V_{GS} = 10V	--	9.6	--	nC
Gate-Source Charge	Q_{gs}		--	1.9	--	
Gate-Drain Charge	Q_{gd}		--	4.3	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 400V, I_D = 4.5A, R_G = 25Ω	--	54	--	ns
Turn-on Rise Time	t_r		--	62	--	
Turn-off Delay Time	$t_{d(off)}$		--	86	--	
Turn-off Fall Time	t_f		--	51	--	
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 2A, V_{GS} = 0V	--	0.9	1.2	V
Reverse Recovery Time	t_{rr}	V_R = 400V, I_F = 4.5A, di_F/dt = 100A/μs	--	271	--	ns
Reverse Recovery Charge	Q_{rr}		--	3.1	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	23	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 1.0A, 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

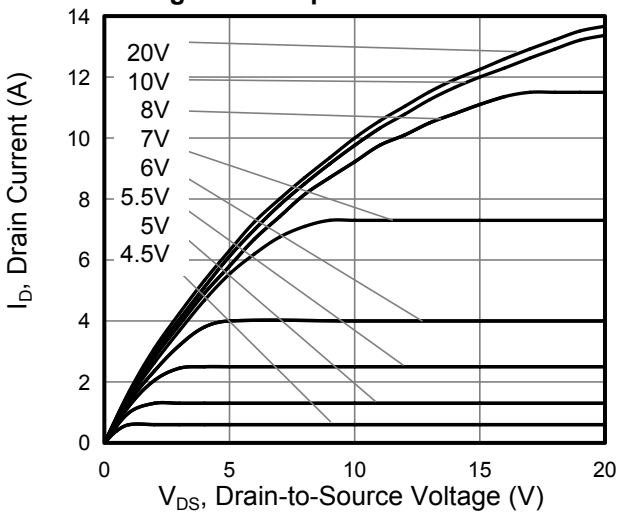


Figure 2. Transfer Characteristics

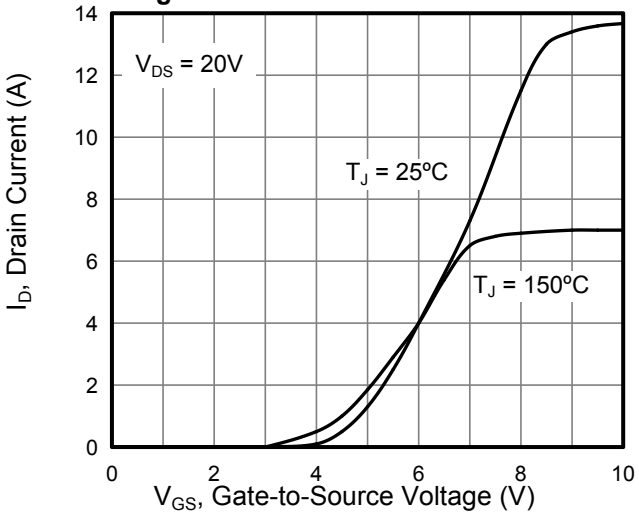


Figure 3. On-Resistance vs. Drain Current

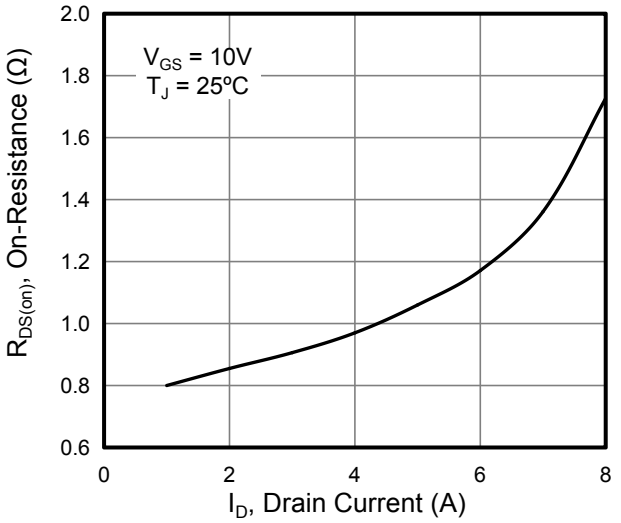


Figure 4. Capacitance

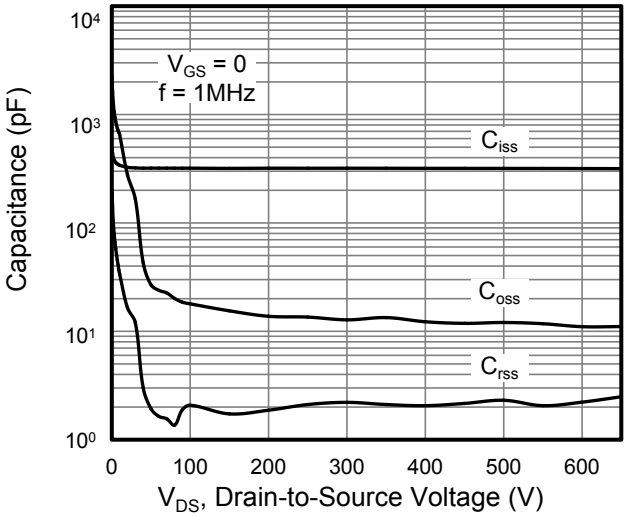


Figure 5. Gate Charge

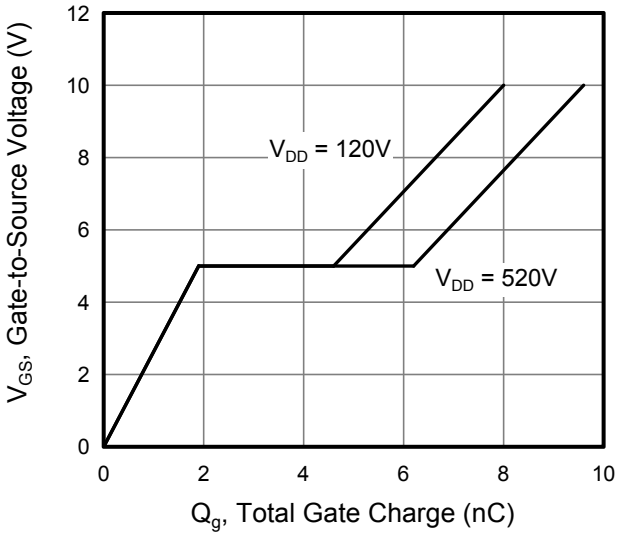
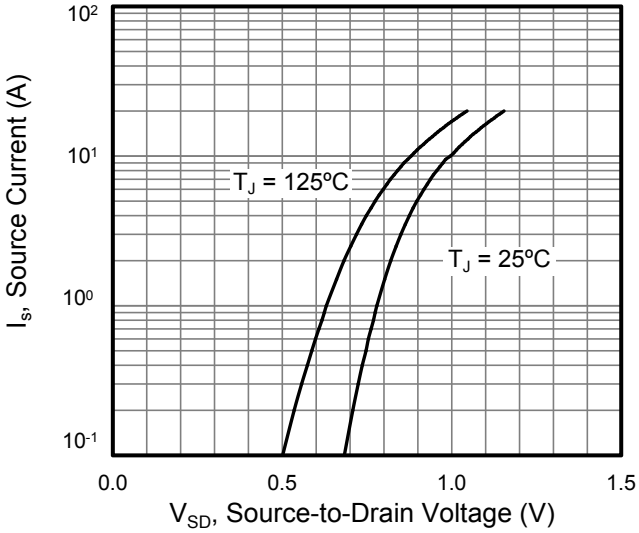


Figure 6. Body Diode Forward Voltage



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 7. On-Resistance vs. Temperature

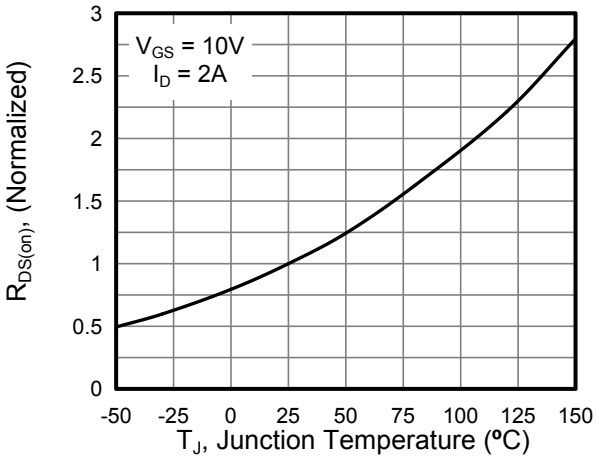


Figure 8. Breakdown voltage vs. Junction Temperature

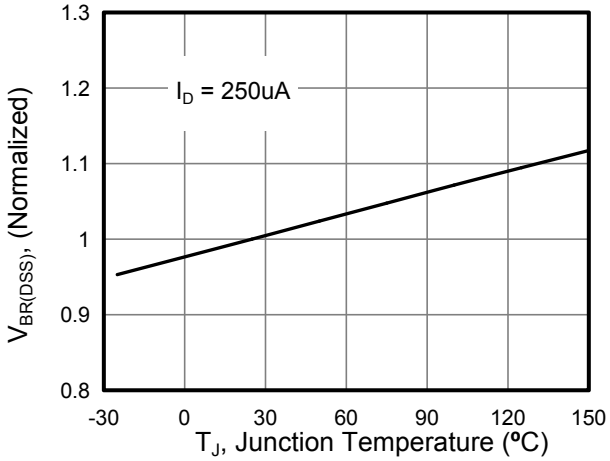


Figure 9. Transient Thermal Impedance For TO-263/TO-252

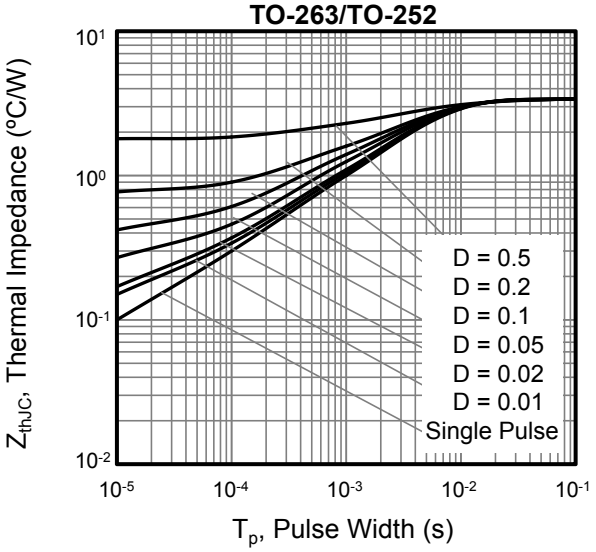


Figure 10. Transient Thermal Impedance For TO-220F

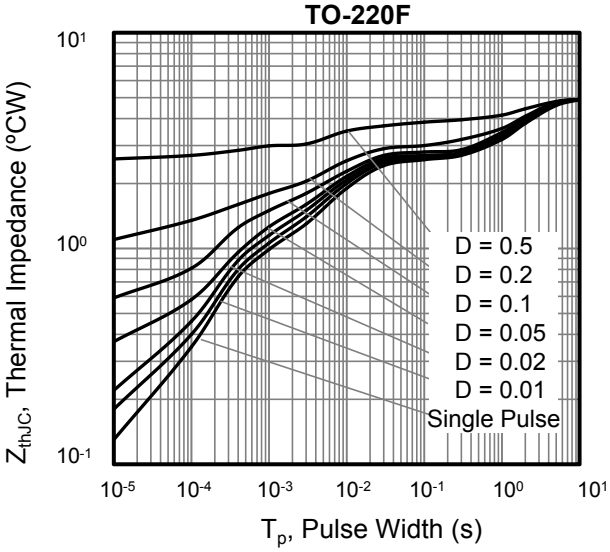


Figure 11. Safe Operation Area For TO-263/TO-252

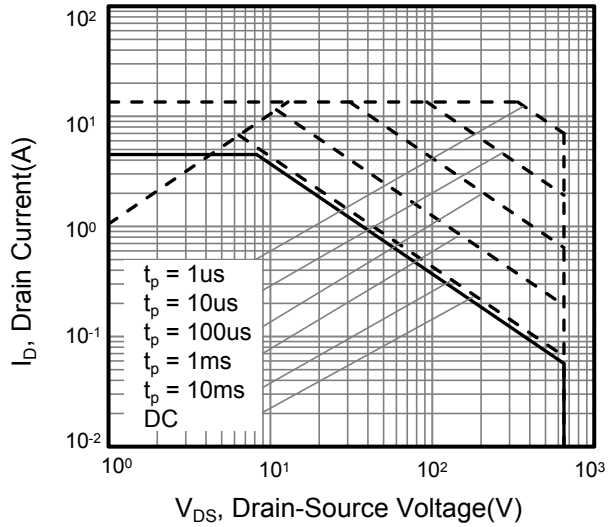
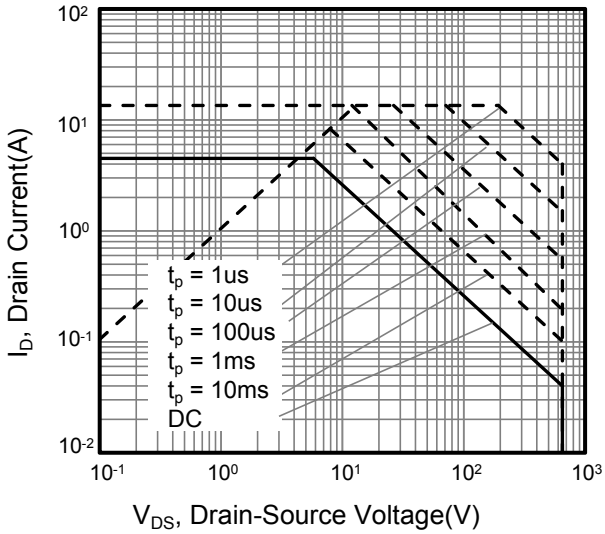


Figure 12. Safe Operation Area For TO-220F



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 13. Typ. Coss Stored Energy

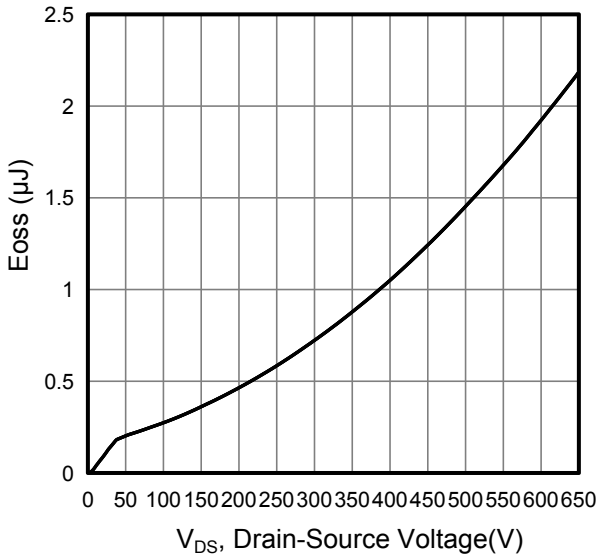


Figure A：Gate Charge Test Circuit and Waveform

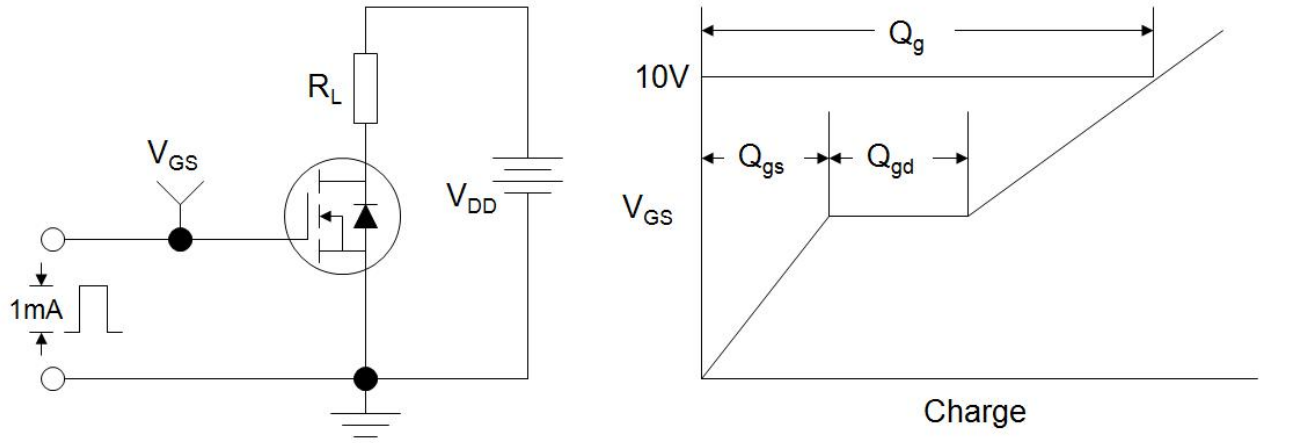


Figure B：Resistive Switching Test Circuit and Waveform

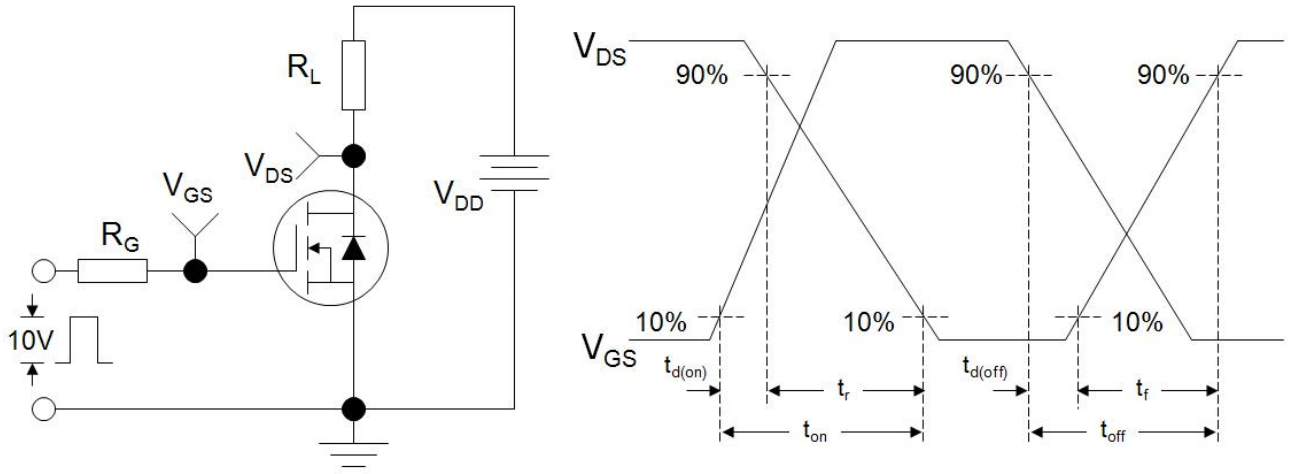
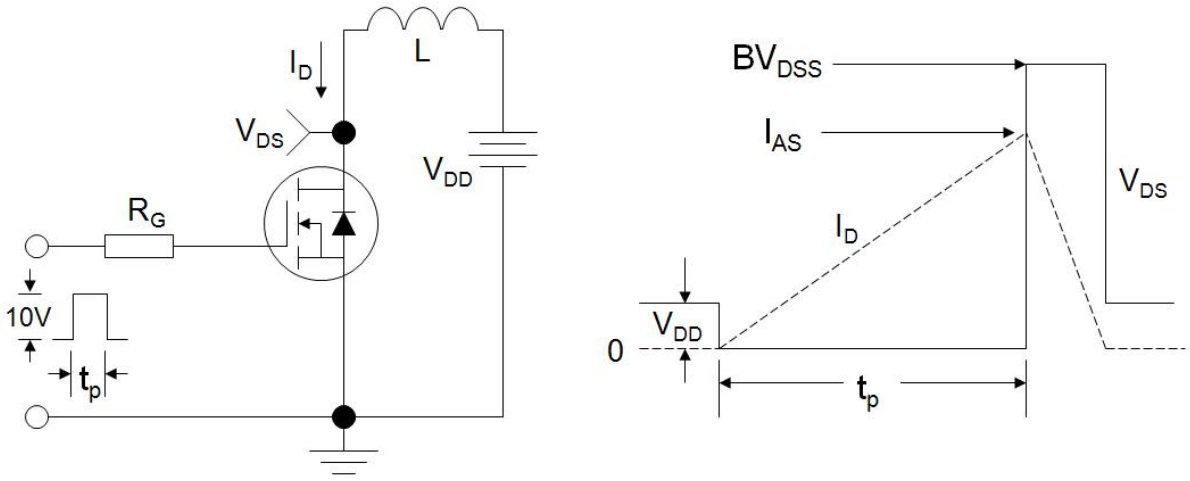
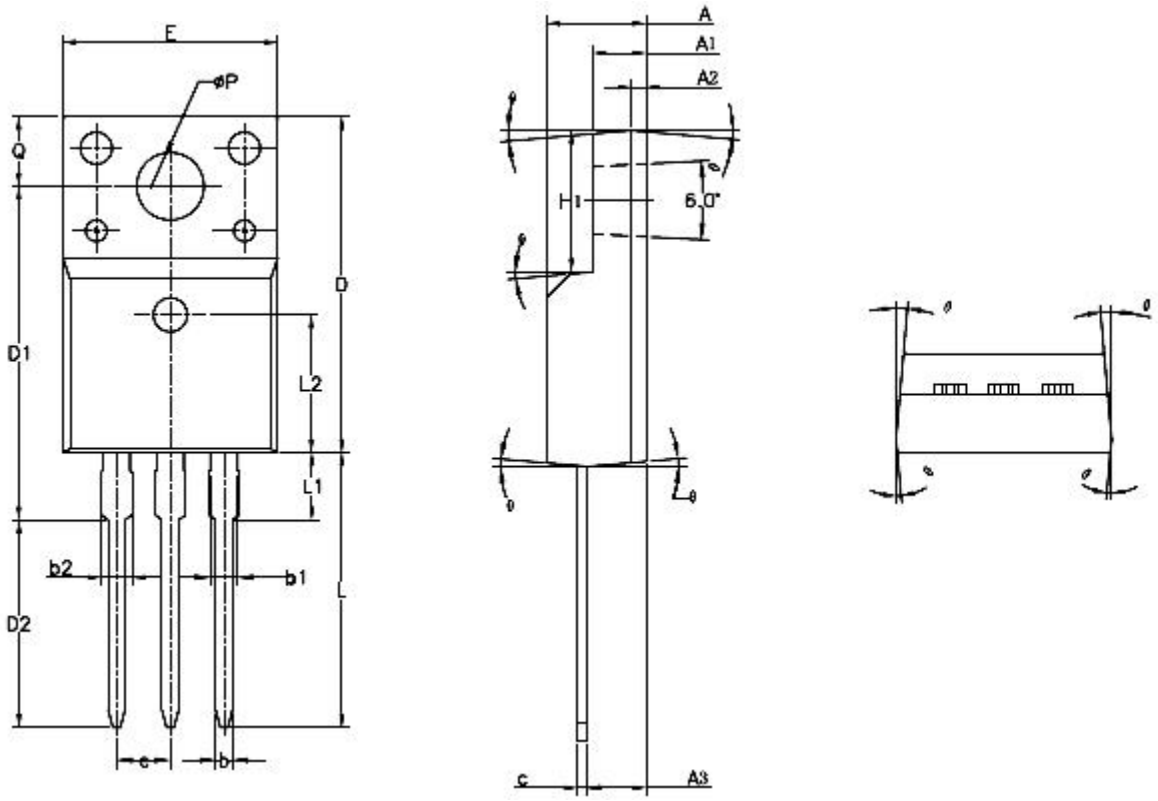


Figure C：Unclamped Inductive Switching Test Circuit and Waveform

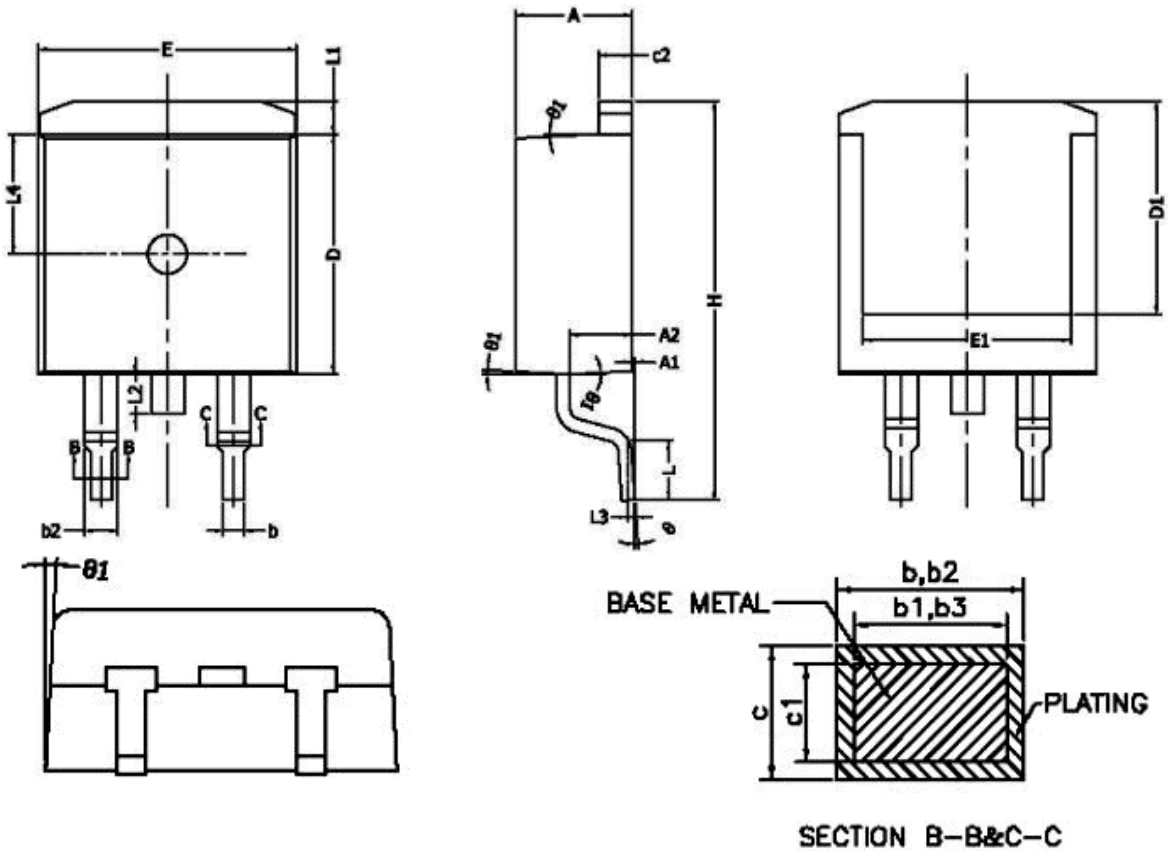


TO-220F（封装厂 I）



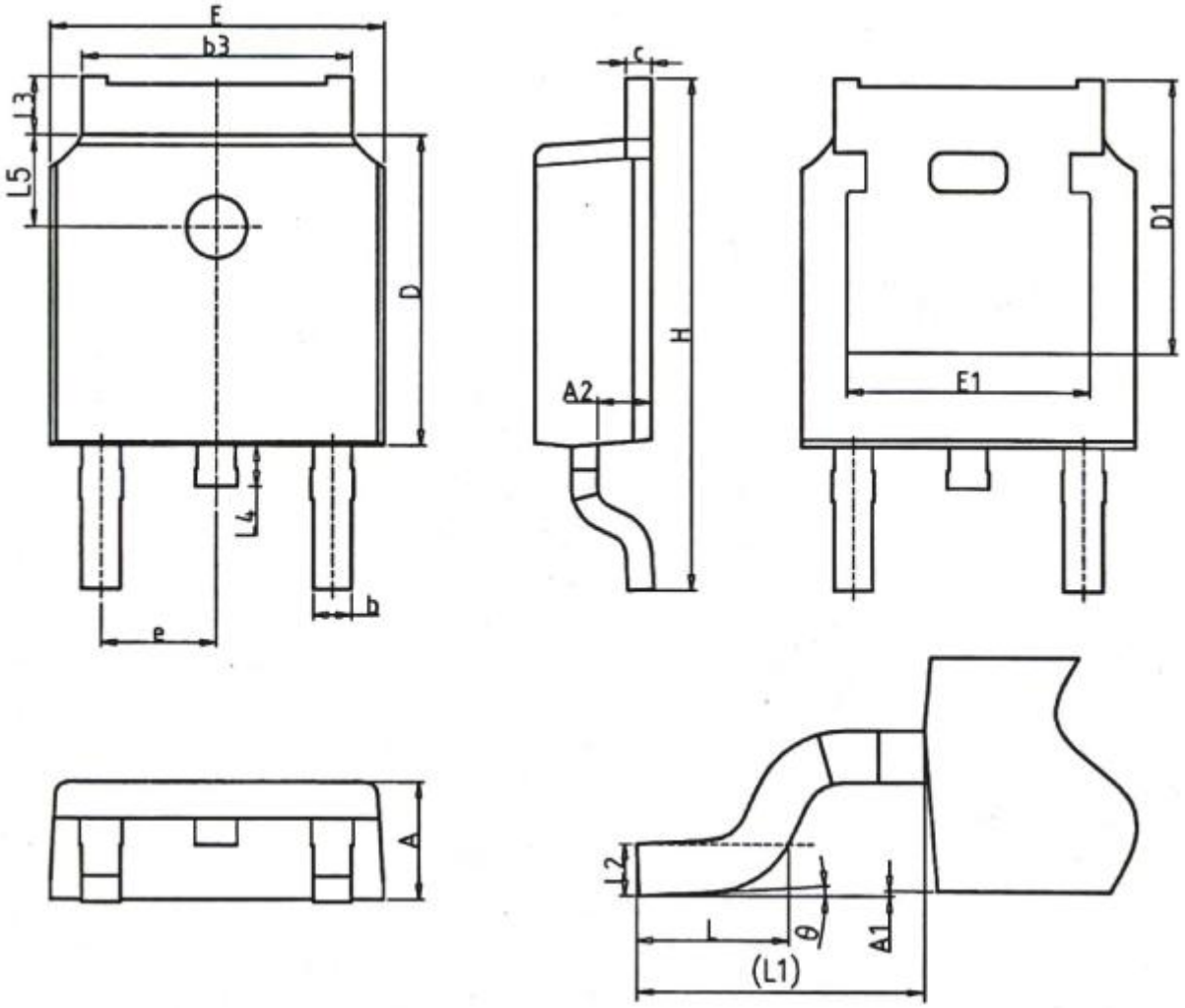
SYMBOL	MIN	NOM	MAX
A	4.50	4.70	4.83
A1	2.34	2.54	2.74
A2		0.70 REF	
A3	2.56	2.76	2.93
b	0.70	–	0.90
b1	1.18	–	1.38
b2	–	–	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95
D2	9.60	9.80	10.0
E	9.96	10.16	10.36
e		2.54BSC	
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	–	–	3.50
L2		6.50REF	
øP	3.08	3.18	3.28
Q	3.20	–	3.40
θ1	1°	3°	5°

TO-263（封装厂 I）



SYMBOL	MIN	NOM	MAX
A	4.40	4.50	4.60
A1	0	0.10	0.25
A2	2.20	2.40	2.60
b	0.76	---	0.89
b1	0.75	0.80	0.85
b2	1.23	---	1.37
b3	1.22	1.27	1.32
c	0.47	---	0.60
c1	0.46	0.51	0.56
c2	1.25	1.30	1.35
D	9.10	9.20	9.30
D1	8.00	---	---
E	9.80	9.90	10.00
E1	7.80	---	---
e	2.54 BSC		
H	14.90	15.30	15.70
L	2.00	2.30	2.60
L1	1.17	1.27	1.40
L2	---	---	1.75
L3	0.25BSC		
L4	4.60 REF		
θ	0°	---	8°
θ1	1°	3°	5°

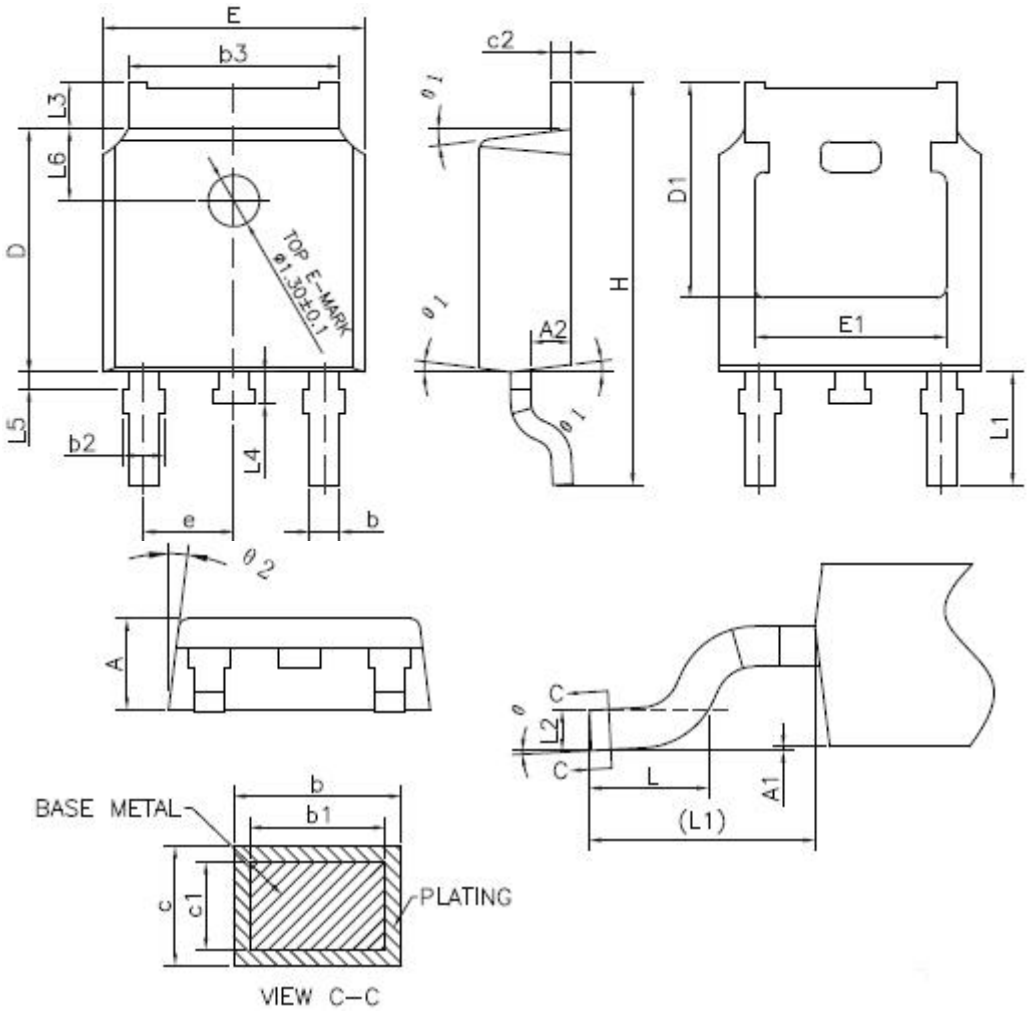
TO-252（封装厂 H）



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°

TO-252（封装厂 I）



SYMBOL	MIN	NOM	MAX
A	2,20	2,30	2,38
A1	0	—	0,10
A2	0,90	1,01	1,10
b	0.72	—	0.85
b1	0.71	0.76	0.81
b2	0.72	—	0.90
b3	5.13	5.33	5.46
c	0,47	—	0,60
c1	0,46	0,51	0,56
c2	0,47	—	0,60
D	6,00	6,10	6,20
D1	5,25	—	—
E	6.50	6.60	6.70
E1	4.70	—	—
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1,40	1,50	1,70
L1	2,90 REF		
L2	0,508 BSC		
L3	0,90	—	1,25
L4	0,60	0,80	1,00
L5	0.15	—	0.75
L6	1.80 REF		
θ	0°	—	8°
θ1	5°	7°	9°
θ2	5°	7°	9°

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