650V Super-junction Power MOSFET

Description

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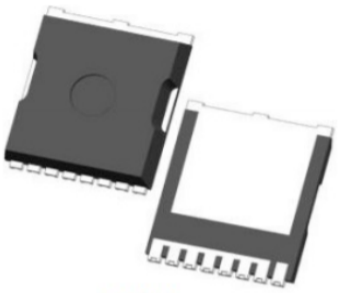
Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFETs，designed according to the SJ principle. The deep trench SJ MOSFET provide an extremely low switching, communication and conduction losses device with highest robustness make especially resonant switching applications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

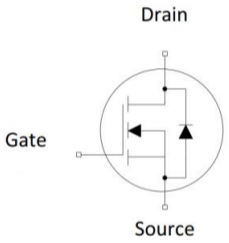
Features

- Ultra-fast body diode
- Very low FOM $R_{DS(on)} \times Q_g$
- Easy to use/drive
- 100% avalanche tested
- RoHS compliant



Applications

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



Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	27	mΩ
$Q_{g,typ}$	149	nC
I_D	80	A
$I_{D,pulse}$	240	A
E_{OSS} @ 400V	20.76	μJ
t_{rr}	209.9	ns
Q_{rr}	1.55	μC
I_{rrm}	14.3	A

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted				
Parameter		**Symbol**	**Values**	**Unit**
Continuous Drain Current	T_C = 25ºC	I_D	80	A
	T_C = 100ºC		48	
Pulsed Drain Current (note1)		$I_{D,pulse}$	240	A
Gate-Source Voltage		V_{GSS}	±30V	V
Single Pulse Avalanche Energy (note2)		E_{AS}	980	mJ
Repetitive Avalanche Energy (note2)		E_{AR}	2.12	mJ
Avalanche Current		I_{AS}	14	A
MOSFET dv/dt Ruggedness, V_{DS} = 0...650V		dv/dt	50	V/ns
Power Dissipation For TO-247		P_D	450	W
Continuous Diode Forward Current		I_S	80	A
Diode Pulsed Current (note1)		$I_{S,pulse}$	240	
Reverse Diode dv/dt (note3)		dv/dt	50	V/ns
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150	ºC

Thermal Resistance For TO-247			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	0.28	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} = 600V, V_{GS} = 0V, T_J = 25ºC	--	--	10	μA
		V_{DS} = 600V, V_{GS} = 0V, T_J = 150ºC	--	--	500	
Gate-Source Leakage Current	I_{GSS}	V_{GS} = ±30V	--	--	±100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250μA	2.5	--	4.5	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	V_{GS} = 10V, I_D = 40A	--	25	27	mΩ
Gate Resistance	R_G	f = 1.0MHz open drain	--	890	--	mΩ
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 50V, f = 1.0MHz	--	8911	--	pF
Output Capacitance	C_{oss}		--	390	--	
Reverse Transfer Capacitance	C_{rss}		--	1.38	--	
Total Gate Charge	Q_g	V_{DD} = 400V, I_D = 40A, V_{GS} = 10V	--	149	--	nC
Gate-Source Charge	Q_{gs}		--	38.7	--	
Gate-Drain Charge	Q_{gd}		--	33.5	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 400V, I_D = 40A, R_G = 2Ω	--	81	--	ns
Turn-on Rise Time	t_r		--	124.3	--	
Turn-off Delay Time	$t_{d(off)}$		--	213.1	--	
Turn-off Fall Time	t_f		--	158	--	
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 40A, V_{GS} = 0V	--	0.9	1.3	V
Reverse Recovery Time	t_{rr}	V_R = 400V, I_S= 40A, di_F/dt = 100A/μs	--	209.9	--	ns
Reverse Recovery Charge	Q_{rr}		--	1.55	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	14.3	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_D = 40A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25ºC
3. Identical low side and high side switch with identical R_G

Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 1. Output Characteristics

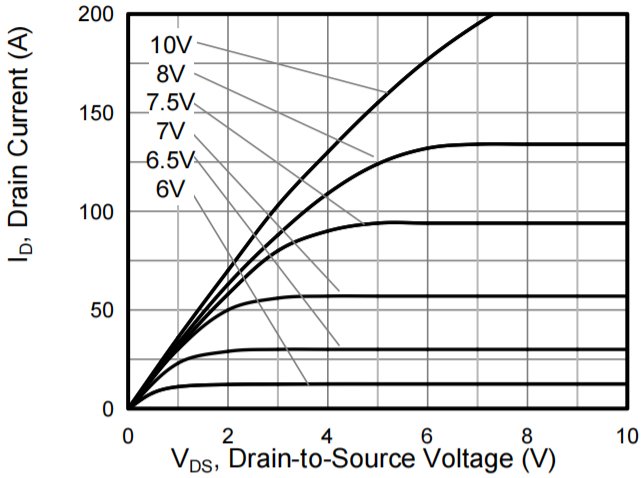


Figure 2. Transfer Characteristics

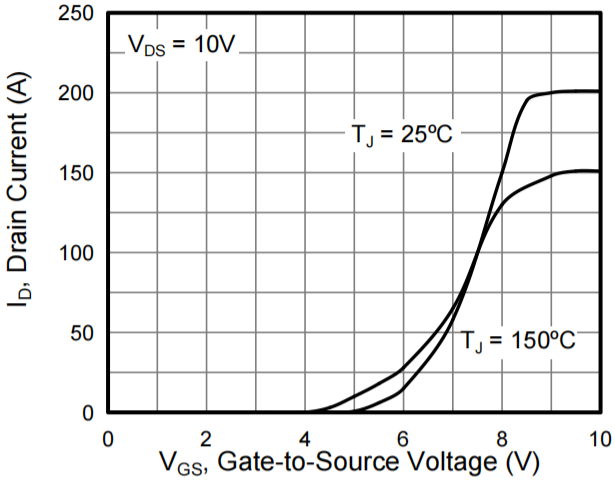


Figure 3 .On-Resistance vs. Drain Current

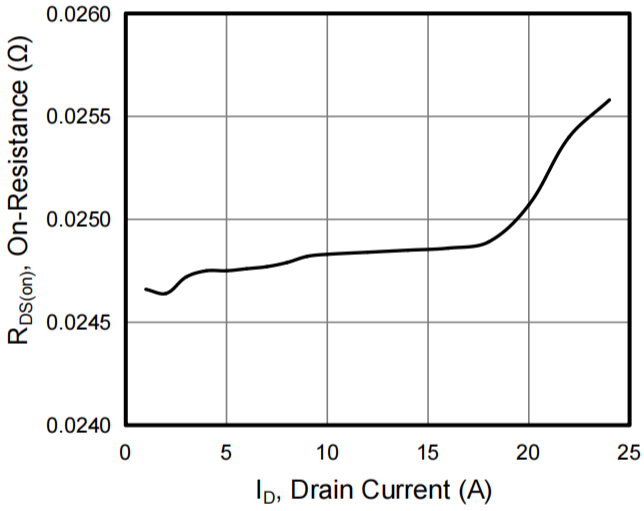


Figure 4. Capacitance

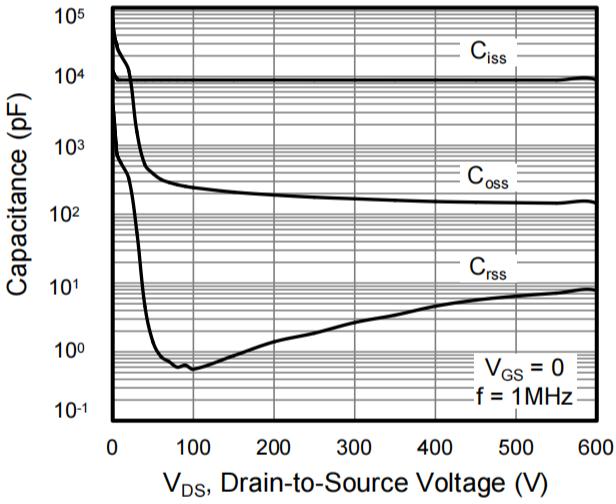


Figure 5. Gate Charge

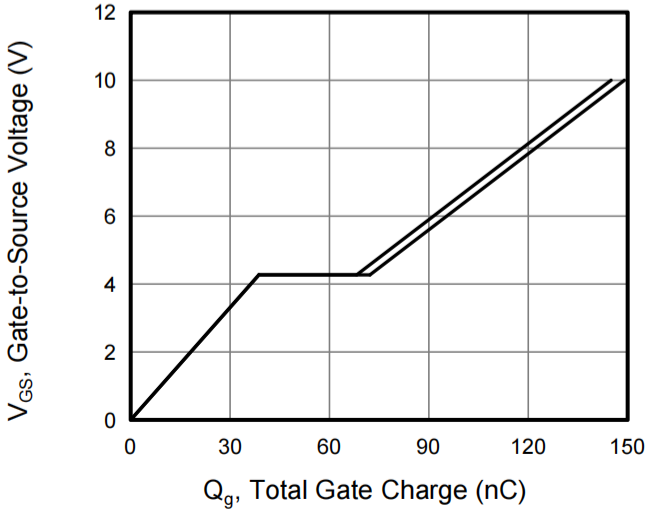


Figure 6. Body Diode Forward Voltage

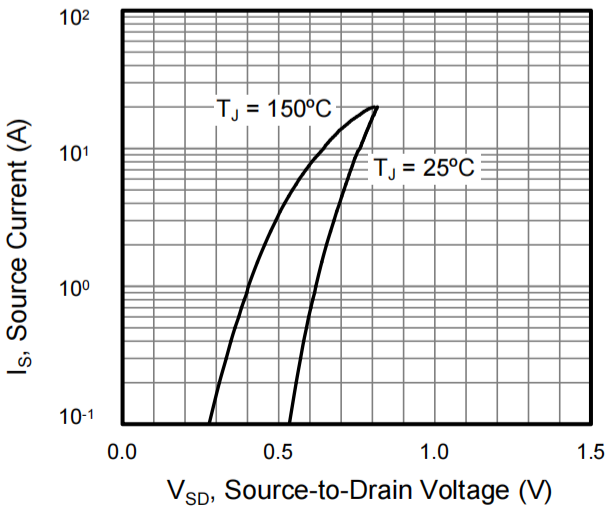


Figure 7. On-Resistance vs. Temperature

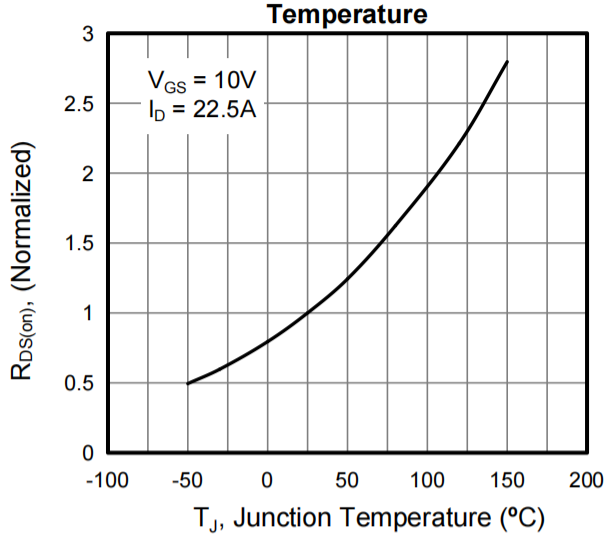


Figure 8. Breakdown voltage vs. Junction Temperature

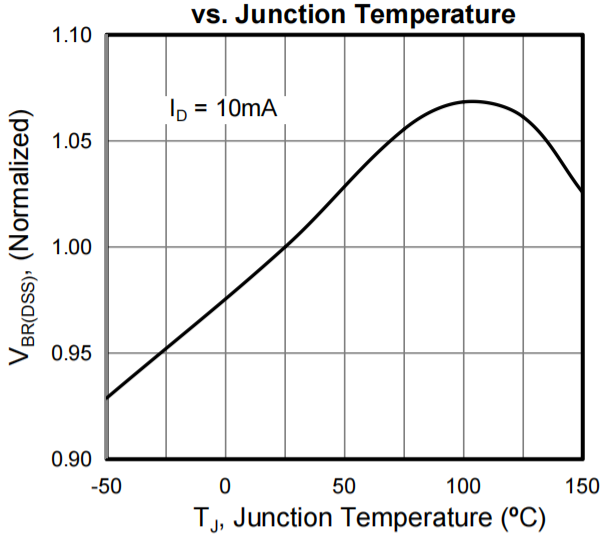


Figure 9. Transient Thermal Impedance For TO-247

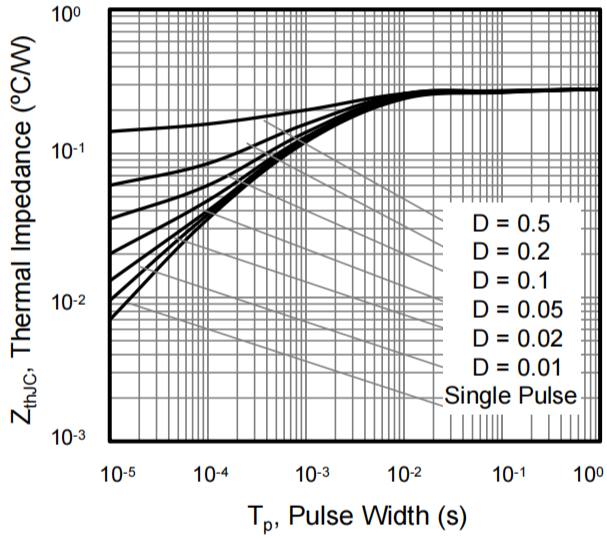


Figure 10. Safe Operation Area For TO-247

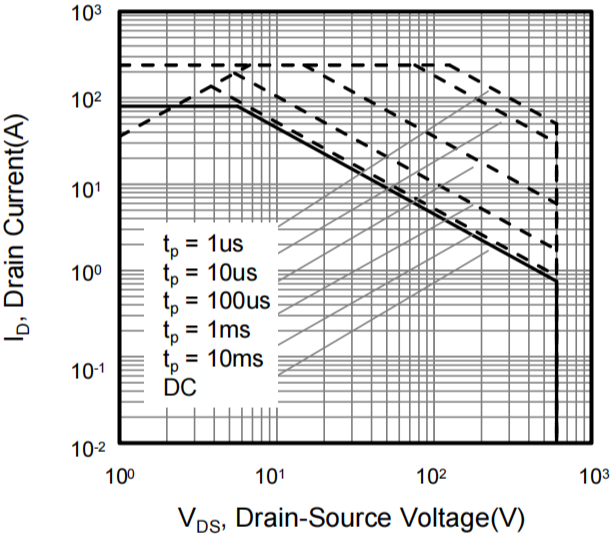


Figure 11. Typ. Coss Stored Energy

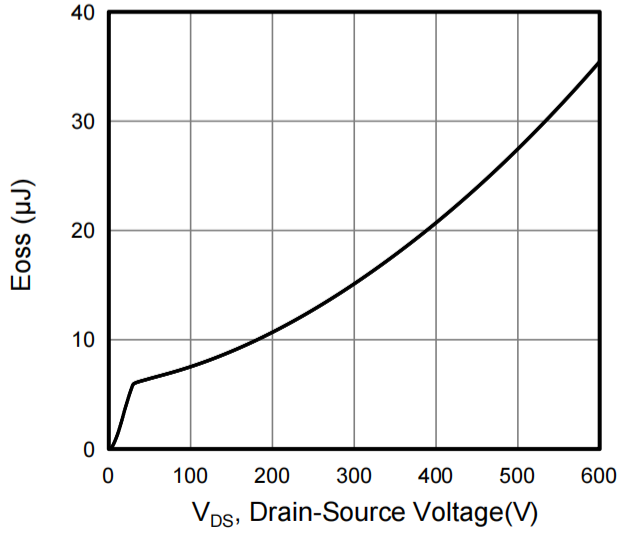


Figure A：Gate Charge Test Circuit and Waveform

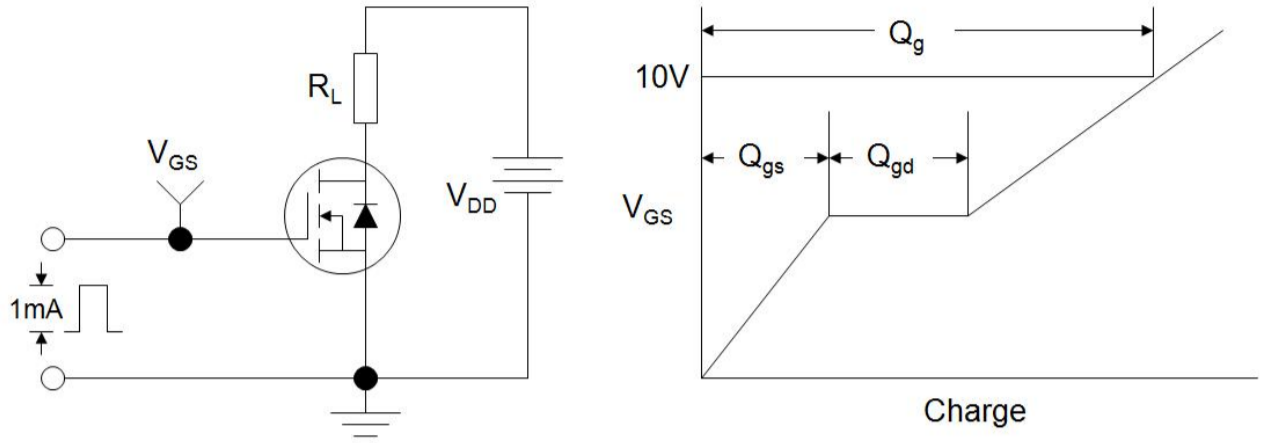


Figure B：Resistive Switching Test Circuit and Waveform

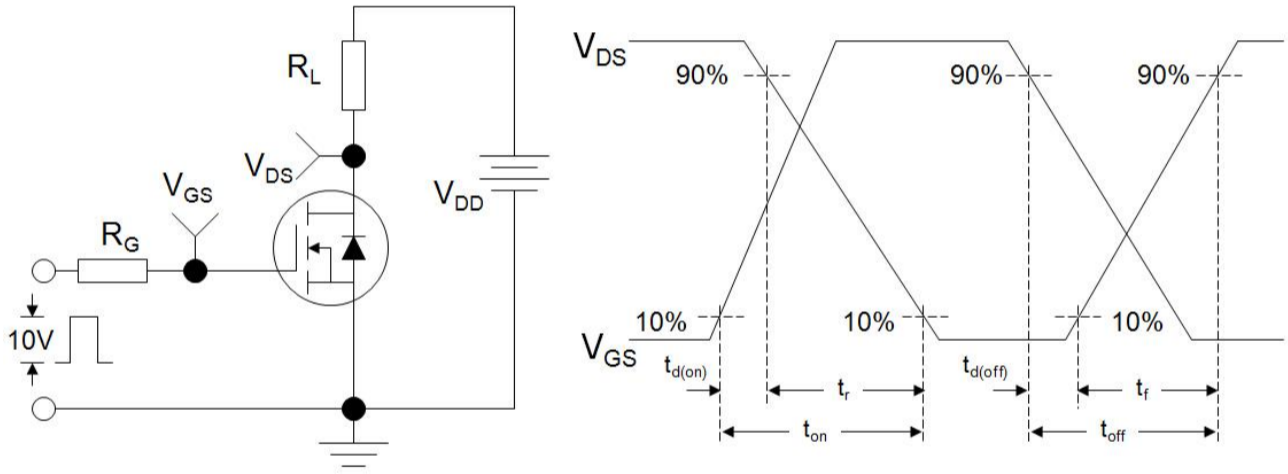
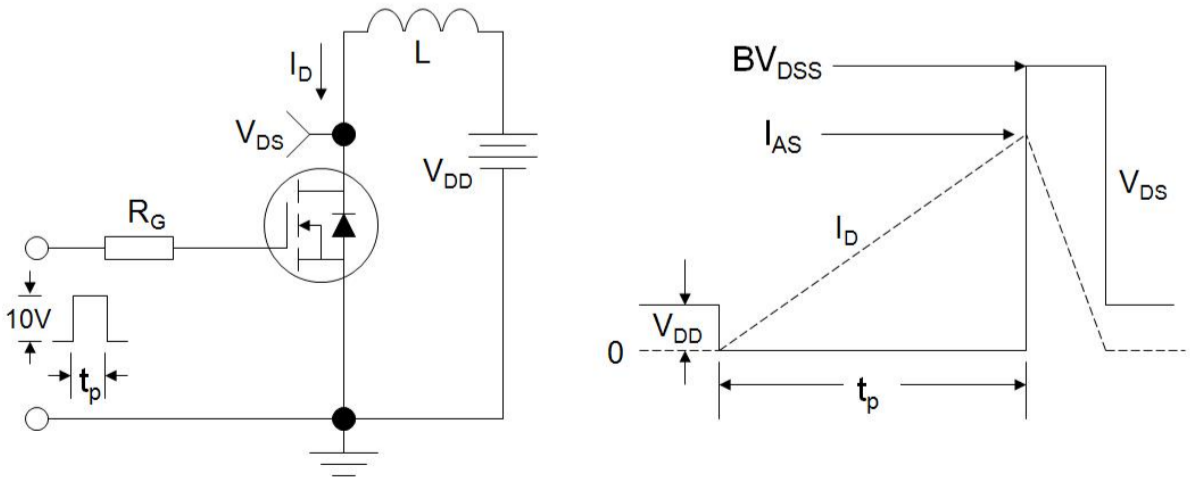
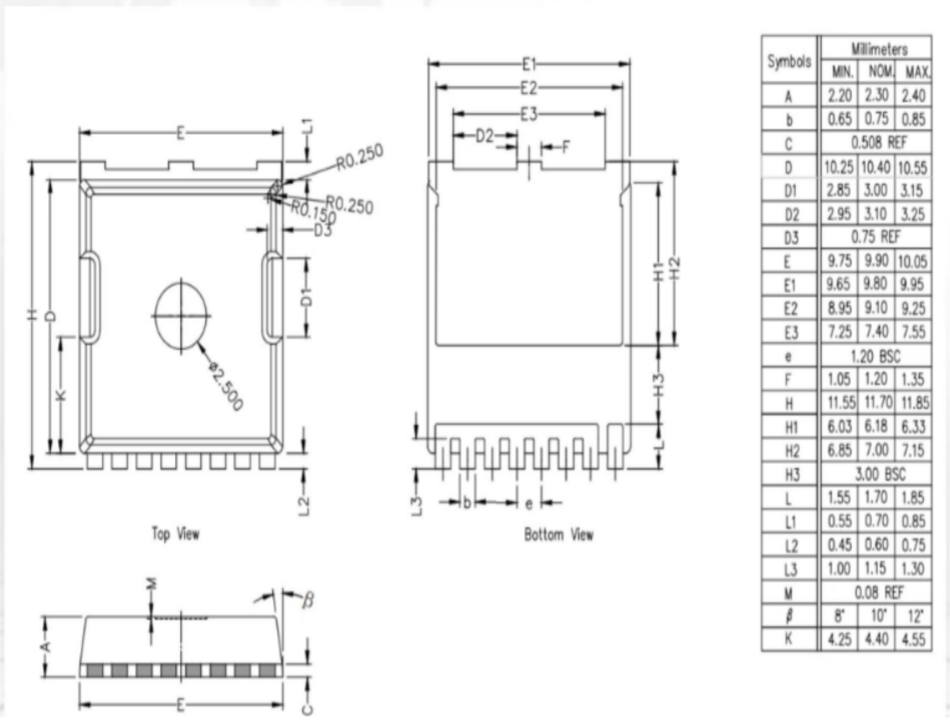


Figure C：Unclamped Inductive Switching Test Circuit and Waveform





Symbols	Millimeters		
	MIN.	NOM.	MAX.
A	2.20	2.30	2.40
b	0.65	0.75	0.85
C	0.508 REF		
D	10.25	10.40	10.55
D1	2.85	3.00	3.15
D2	2.95	3.10	3.25
D3	0.75 REF		
E	9.75	9.90	10.05
E1	9.65	9.80	9.95
E2	8.95	9.10	9.25
E3	7.25	7.40	7.55
e	1.20 BSC		
F	1.05	1.20	1.35
H	11.55	11.70	11.85
H1	6.03	6.18	6.33
H2	6.85	7.00	7.15
H3	3.00 BSC		
L	1.55	1.70	1.85
L1	0.55	0.70	0.85
L2	0.45	0.60	0.75
L3	1.00	1.15	1.30
M	0.08 REF		
β	8°	10°	12°
K	4.25	4.40	4.55