



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 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 Tongxin Microelectronics Company.

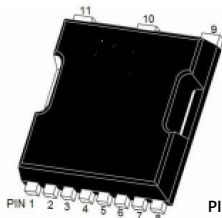
Features

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

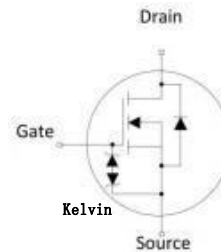
Applications

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

TOLL



PIN1 : Gate
PIN2 : Kelvin Source
PIN3-8 : Source
PIN9-11 : Drain



Device Marking and Package Information

Device	Package	Form	Marking
TPL65R044NFD	TOLL	Tape & Reel	65R044NFD

Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	700	V
$R_{DS(on),max}$	44	mΩ
$Q_{g,typ}$	94	nC
I_D	60	A
$I_{D,pulse}$	202	A
$E_{OSS} @ 400V$	9.4	μJ
Body Diode di_f/dt	850	A/μs

**Absolute Maximum Ratings** $T_C = 25^\circ\text{C}$, unless otherwise noted

Parameter		Symbol	Value	Unit
Continuous Drain Current	$T_C = 25^\circ\text{C}$	I_D	60	A
	$T_C = 100^\circ\text{C}$		36	
Pulsed Drain Current	(note1)	$I_{D,pulse}$	202	A
Gate-Source Voltage		V_{GSS}	± 30	V
Single Pulse Avalanche Energy	(note2)	E_{AS}	980	mJ
Repetitive Avalanche Energy	(note2)	E_{AR}	1.06	mJ
Avalanche current, single pulse		I_{AS}	14	A
MOSFET dv/dt Ruggedness, $V_{DS} = 0 \dots 400\text{V}$		dv/dt	72	V/ns
Power Dissipation For TO-247		P_D	199	W
Continuous Diode Forward Current		I_S	60	A
Diode Pulsed Current	(note1)	$I_{S,pulse}$	202	
Reverse Diode dv/dt	(note3)	dv/dt	50	V/ns
Maximum Diode Commutation Speed	(note3)	di/dt	850	A/ μs
Operating Junction and Storage Temperature Range		T_J, T_{stg}	$-55 \sim +150$	$^\circ\text{C}$

Thermal Resistance

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	0.32	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62	



Electrical Characteristics T _J = 25°C, 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 = 25°C	--	--	1	μA
		V _{DS} = 650V, V _{GS} = 0V, T _J = 150°C	--	--	100	
Gate-Source Leakage Current	I _{GSS}	V _{GS} = ±30V	--	--	±500	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 = 30A	--	38	44	mΩ
Gate Resistance	R _G	f = 1.0MHz open drain	--	33.5	--	Ω
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{GS} = 0V, V _{DS} = 400V, f = 250kHz	--	5925	--	pF
Output Capacitance	C _{oss}		--	75.9	--	
Reverse Transfer Capacitance	C _{rss}		--	1.18	--	
Total Gate Charge	Q _g	V _{DD} = 400V, I _D = 30A, V _{GS} = 10V	--	101	--	nC
Gate-Source Charge	Q _{gs}		--	32	--	
Gate-Drain Charge	Q _{gd}		--	23	--	
Turn-on Delay Time	t _{d(on)}	V _{DD} = 400V, I _D = 30A, R _G = 3.0Ω	--	10.5	--	ns
Turn-on Rise Time	t _r		--	7	--	
Turn-off Delay Time	t _{d(off)}		--	77	--	
Turn-off Fall Time	t _f		--	3.1	--	
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V _{SD}	T _J = 25°C, I _{SD} = 30A, V _{GS} = 0V	--	0.9	1.2	V
Reverse Recovery Time	t _{rr}	V _R = 400V, I _F = 8A, di _F /dt = 100A/μs	--	102	--	ns
Reverse Recovery Charge	Q _{rr}		--	4.1	--	μC
Peak Reverse Recovery Current	I _{rrm}		--	32	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 14A, V_{DD} = 50V, R_G = 22\Omega$, Starting $T_J = 25^\circ\text{C}$
3. Identical low side and high side switch with identical R_G , $V_{DS} = 0 \dots 400V, I_{SD} \leq 30A, T_J = 25^\circ\text{C}$



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

Figure 1: Output Characteristics

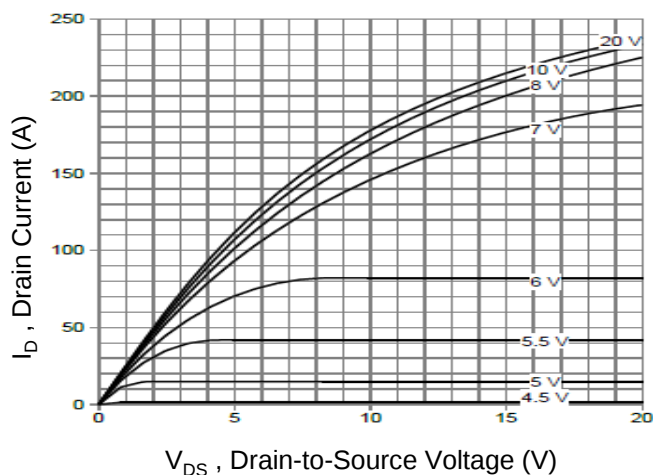


Figure 2: Transfer Characteristics

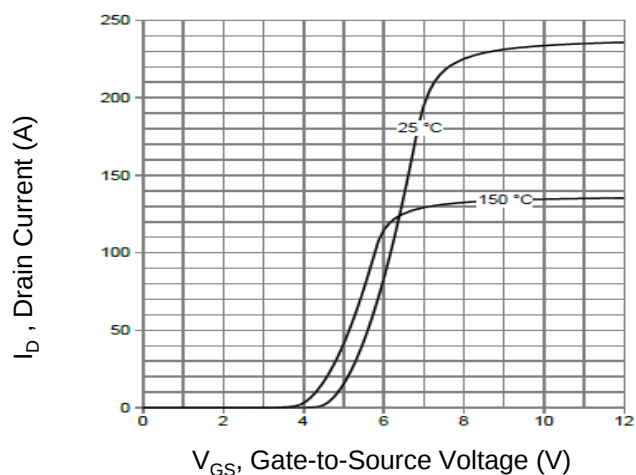


Figure 3: On-Resistance vs. Drain Current

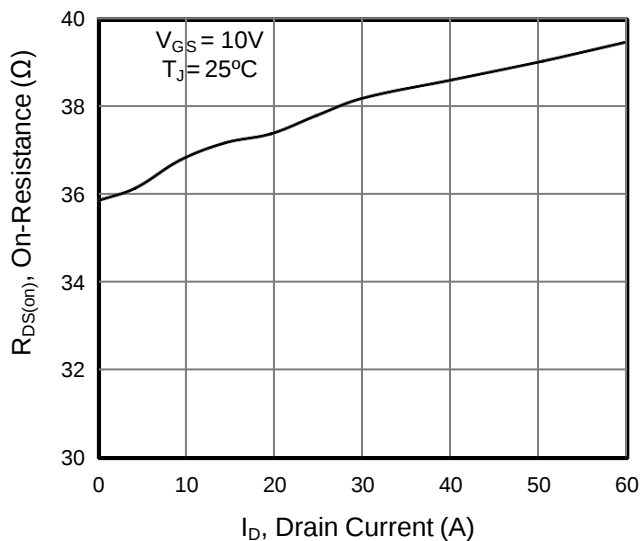


Figure 4: Capacitance

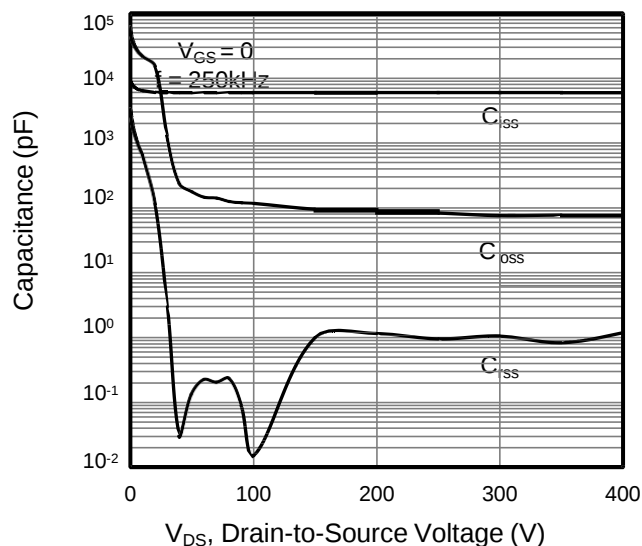


Figure 5: On-Resistance vs. Temperature

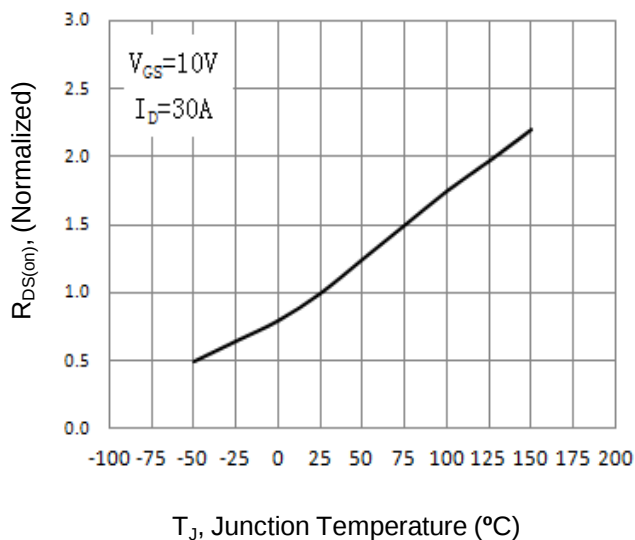
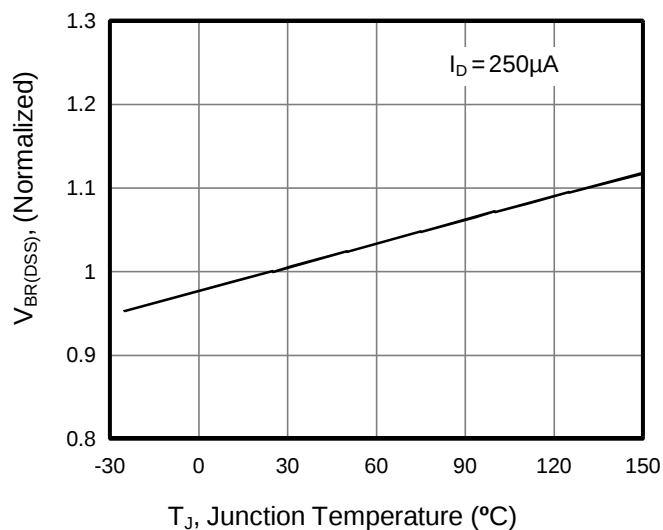


Figure 6: Breakdown voltage vs. Junction Temperature





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

Figure 7: Gate Charge Characteristics

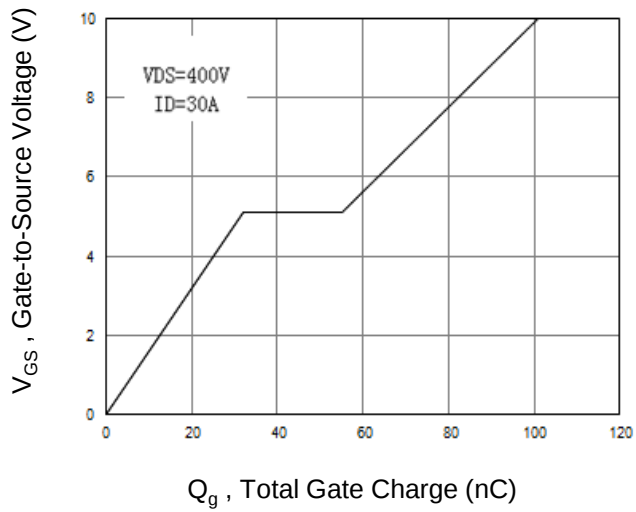


Figure 8: Body Diode Forward Voltage

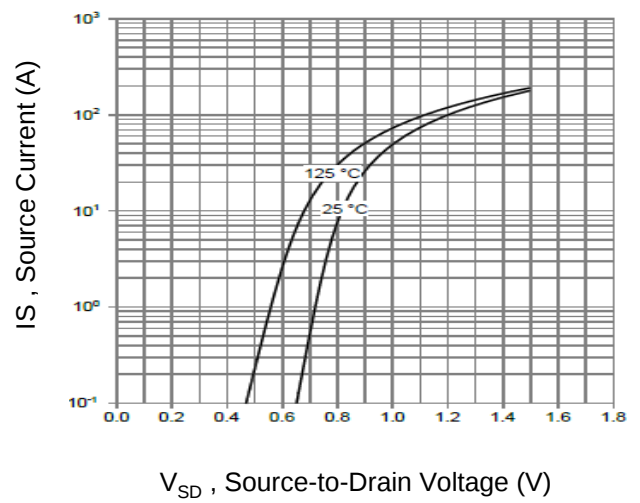


Figure 9: Safe Operating Area

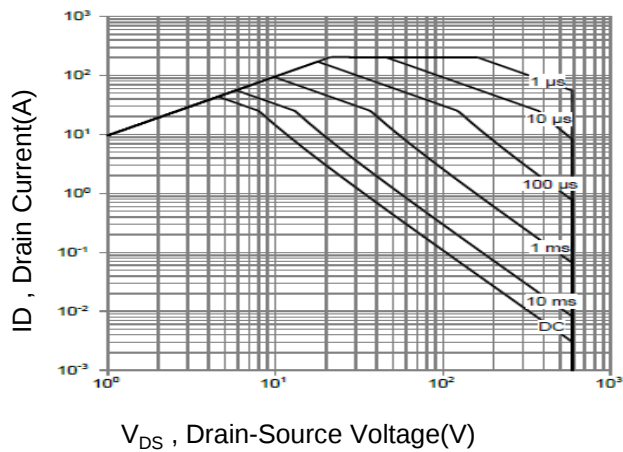
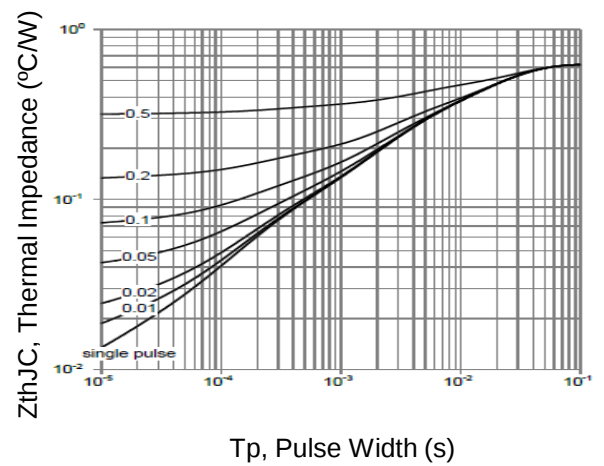
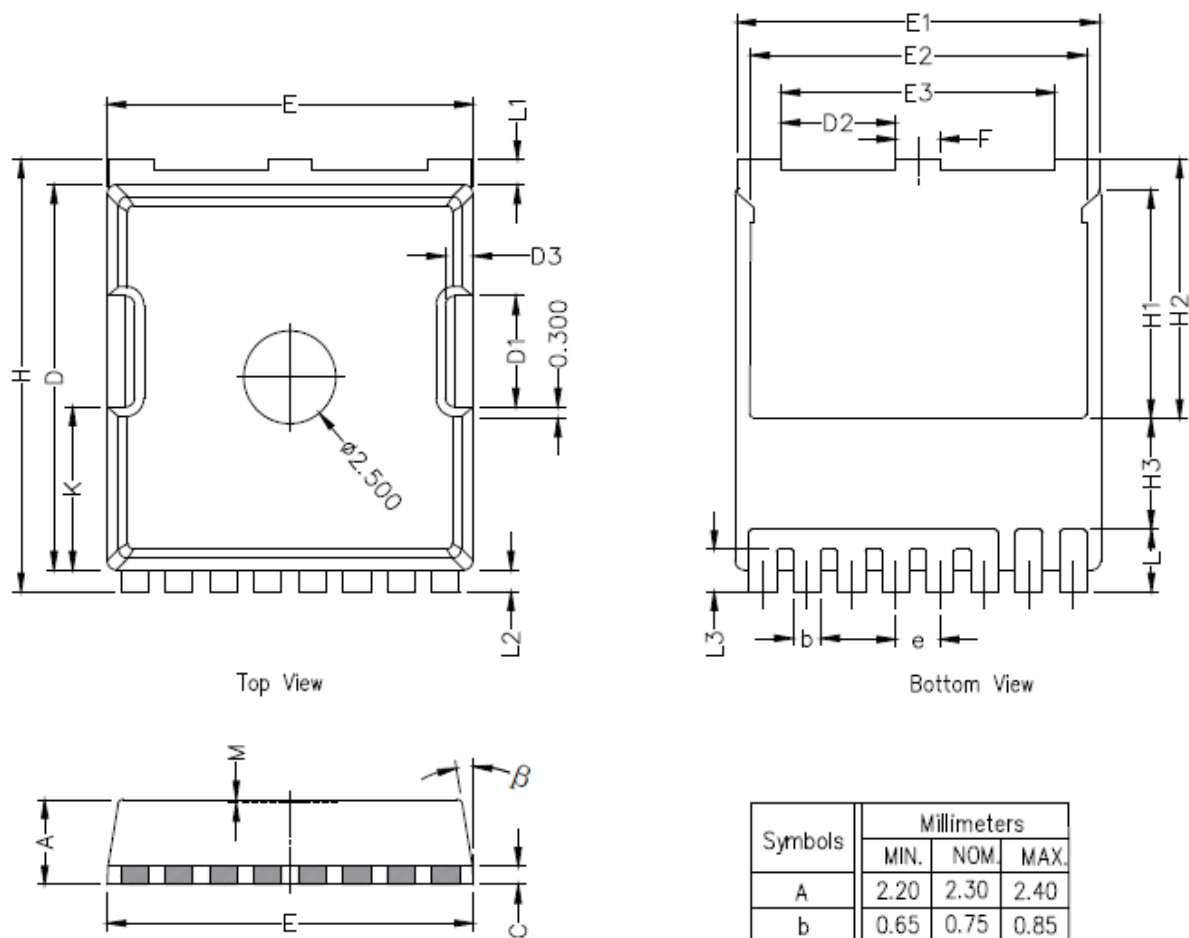


Figure 10: Transient Thermal Impedance





TOLL



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



Figure A: Gate Charge Test Circuit and Waveform

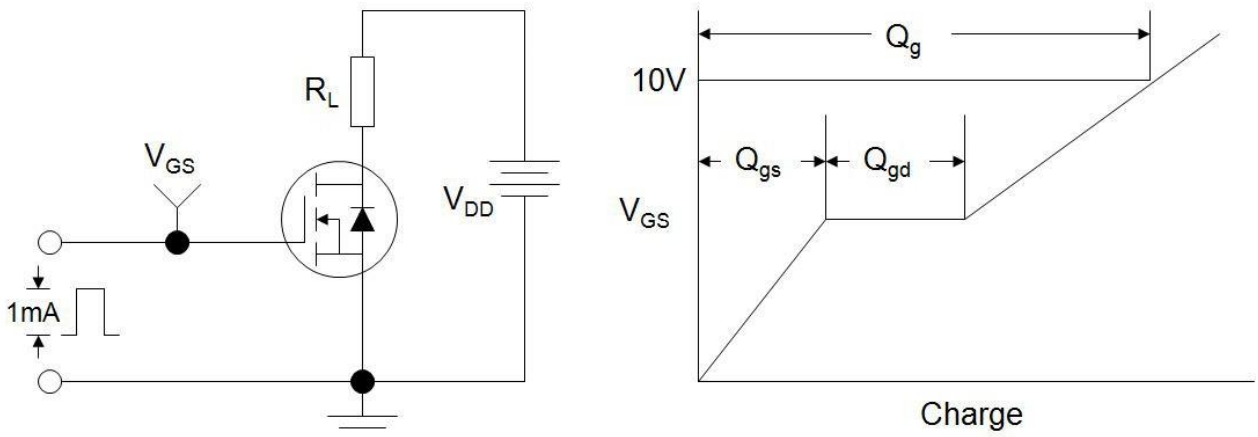


Figure B: Resistive Switching Test Circuit and Waveform

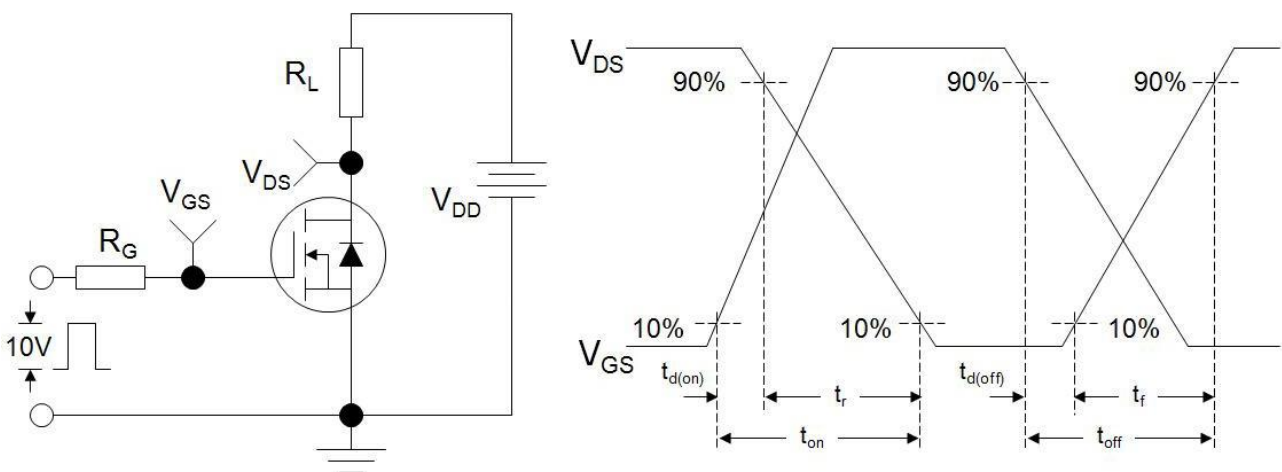
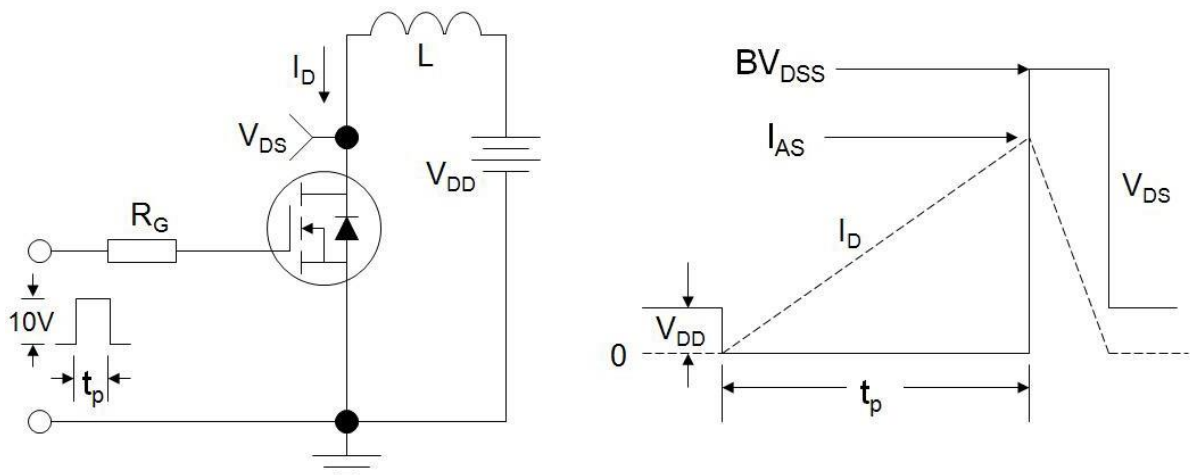


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





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