



600V Super-junction Power MOSFET

Description

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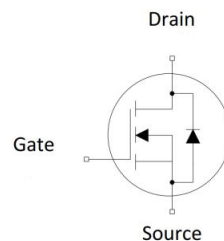
Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFETs, designed according to the SJ principle. The deep trench SJ MOSFET provide an extremely low switching, commutation and conduction losses device with highest robustness make especially resonant switching applications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

Features

- 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

TO-247

Device Marking and Package Information

Device	Package	Marking
TPW60R028DFD	TO-247	60R028DFD

Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	650	V
$R_{DS(on),max}$	0.028	Ω
$Q_{g,typ}$	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 $T_C = 25^\circ\text{C}$, unless otherwise noted				
Parameter		Symbol	Values	Unit
Continuous Drain Current	$T_C = 25^\circ\text{C}$	I_D	80	A
	$T_C = 100^\circ\text{C}$		48	
Pulsed Drain Current	(note1)	$I_{D,pulse}$	240	A
Gate-Source Voltage		V_{GSS}	$\pm 30\text{V}$	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, $V_{DS} = 0 \dots 650\text{V}$		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	$^\circ\text{C}$

Thermal Resistance For TO-247			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	0.28	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62	



Electrical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static Characteristics						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	650	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 600V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	10	μA
		$V_{DS} = 600V, V_{GS} = 0V, T_J = 150^\circ\text{C}$	--	--	500	
Gate-Source Leakage Current	I_{GSS}	$V_{GS} = \pm 30V$	--	--	± 100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.5	--	4.5	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 40A$	--	0.026	0.028	Ω
Gate Resistance	R_G	$f = 1.0\text{MHz}$ open drain	--	0.89	--	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{GS} = 0V,$ $V_{DS} = 50V,$ $f = 1.0\text{MHz}$	--	8911	--	μF
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	$t_{d(on)}$	$V_{DD} = 400V, I_D = 40A,$ $R_G = 2\Omega$	--	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}	$T_J = 25^\circ\text{C}, I_{SD} = 40A, V_{GS} = 0V$	--	0.9	1.3	V
Reverse Recovery Time	t_{rr}	$V_R = 400V, I_S = 40A,$ $di_F/dt = 100A/\mu s$	--	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. $I_D = 40A, V_{DD} = 50V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
3. Identical low side and high side switch with identical R_G



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

Figure 1. Output Characteristics

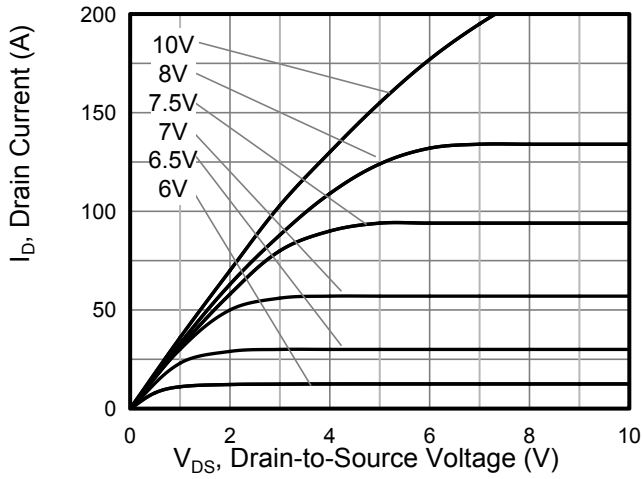


Figure 2. Transfer Characteristics

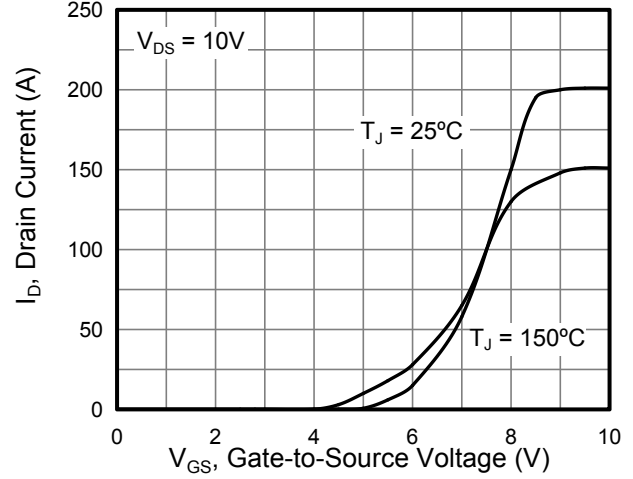


Figure 3. On-Resistance vs. Drain Current

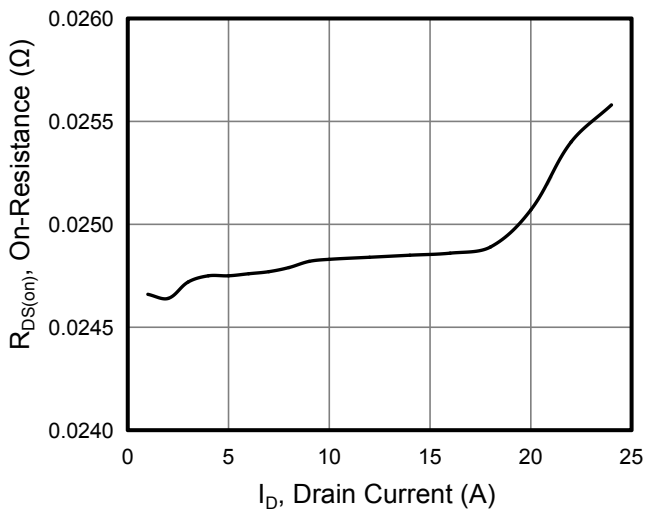


Figure 4. Capacitance

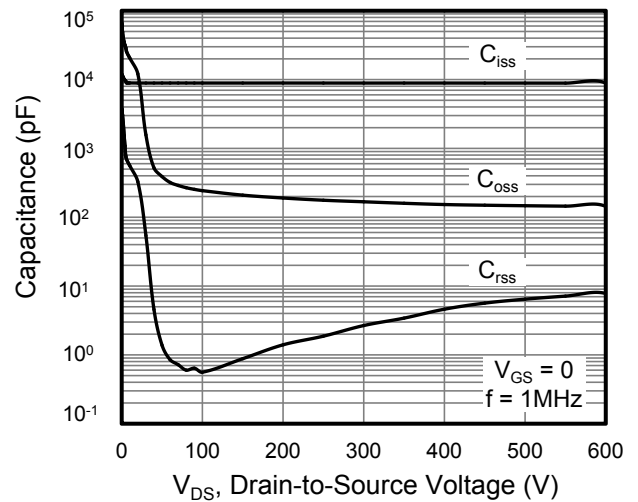


Figure 5. Gate Charge

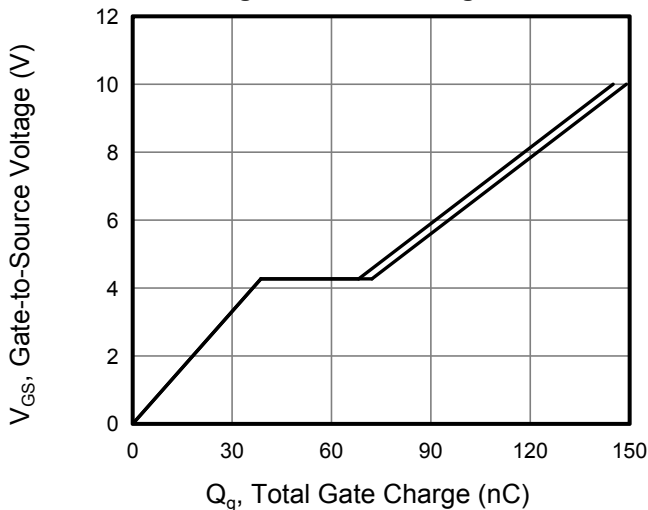


Figure 6. Body Diode Forward Voltage

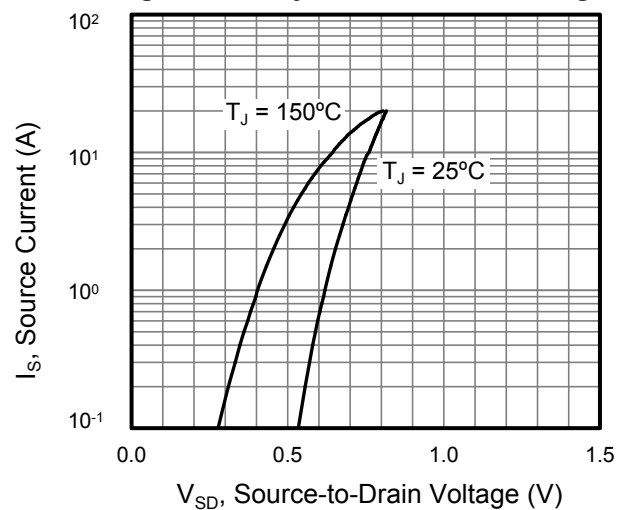




Figure 7. On-Resistance vs. Temperature

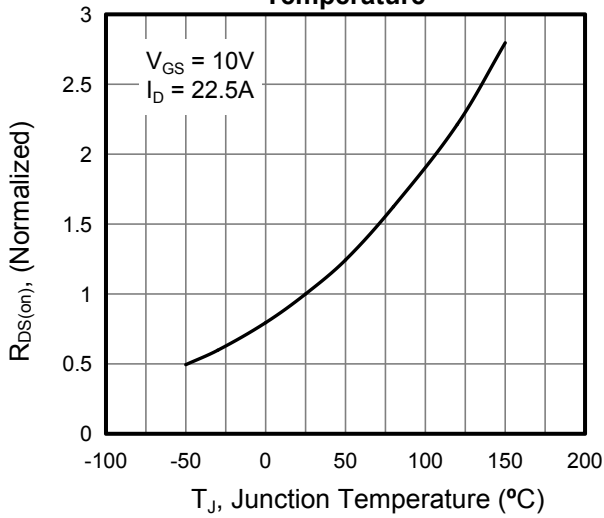


Figure 8. Breakdown voltage vs. Junction Temperature

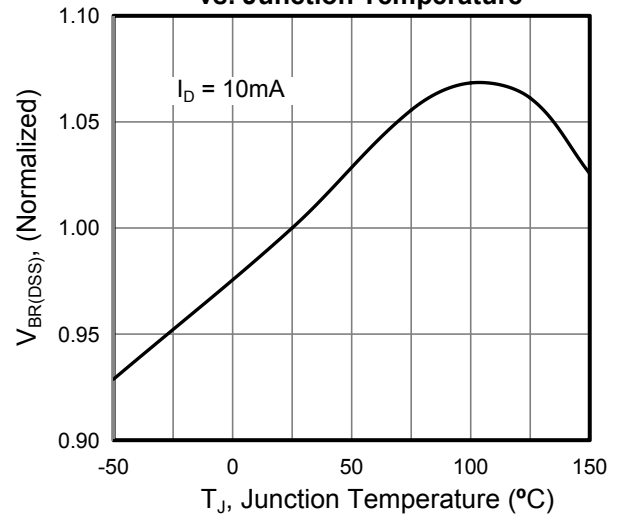


Figure 9. Transient Thermal Impedance For TO-247

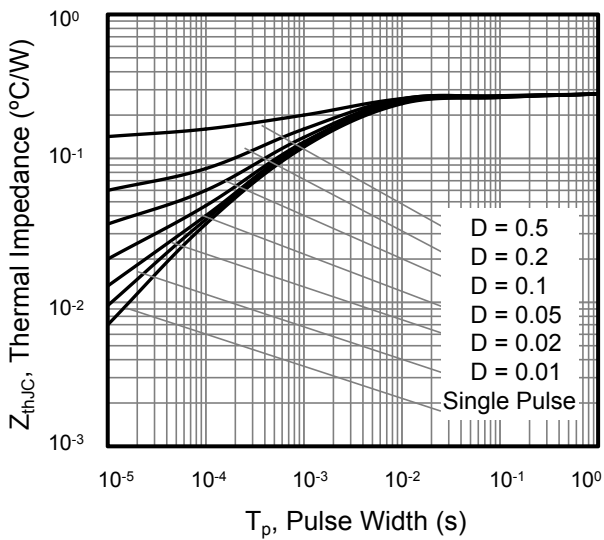


Figure 10. Safe Operation Area For TO-247

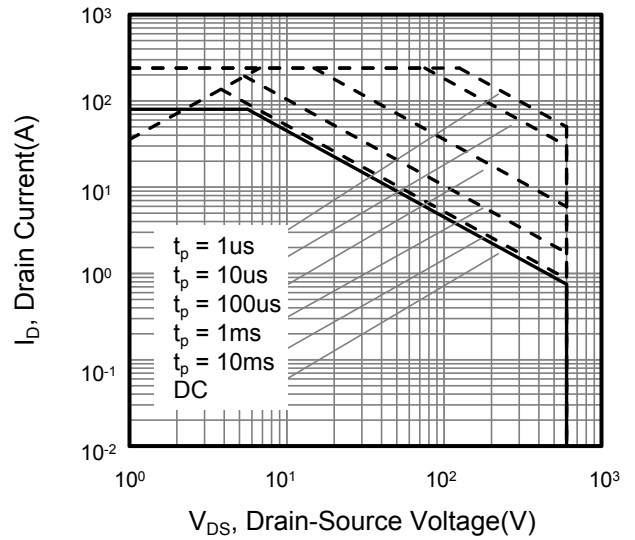


Figure 11. Typ. Coss Stored Energy

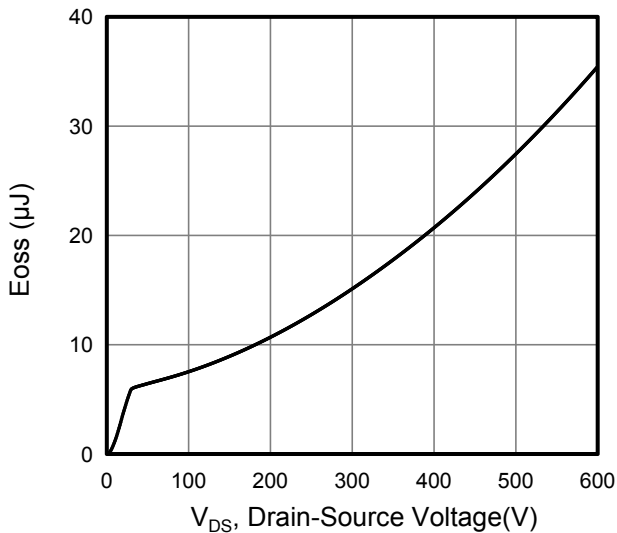




Figure A: Gate Charge Test Circuit and Waveform

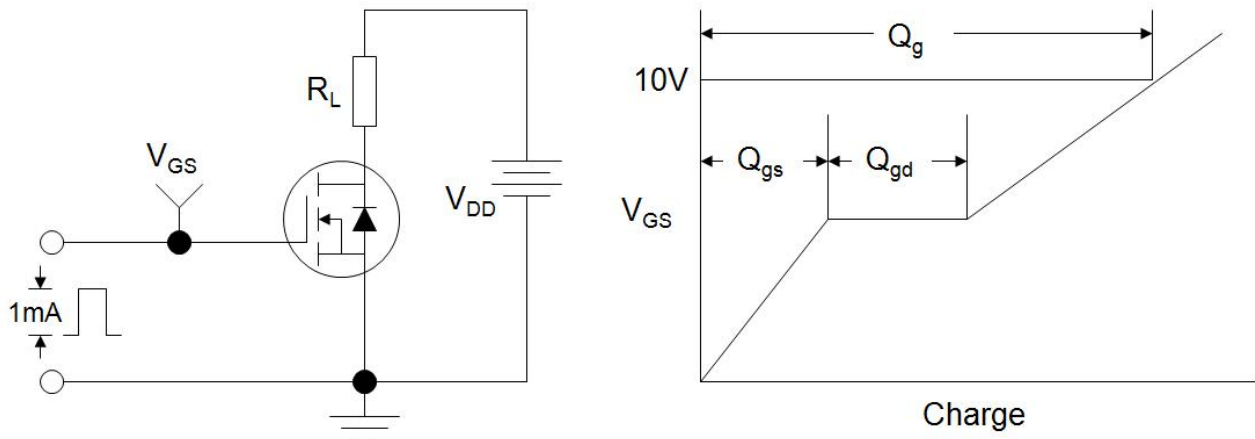


Figure B: Resistive Switching Test Circuit and Waveform

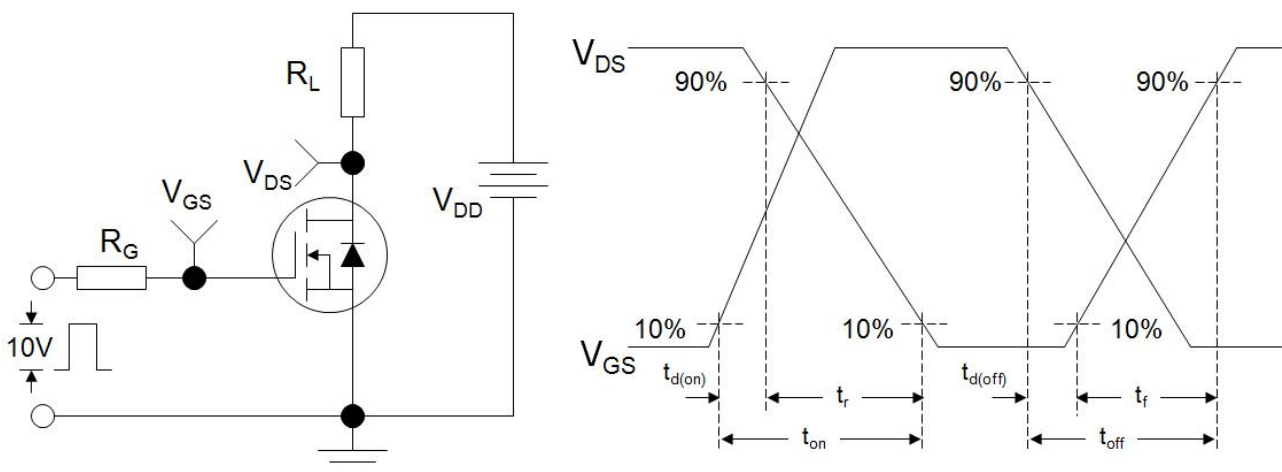
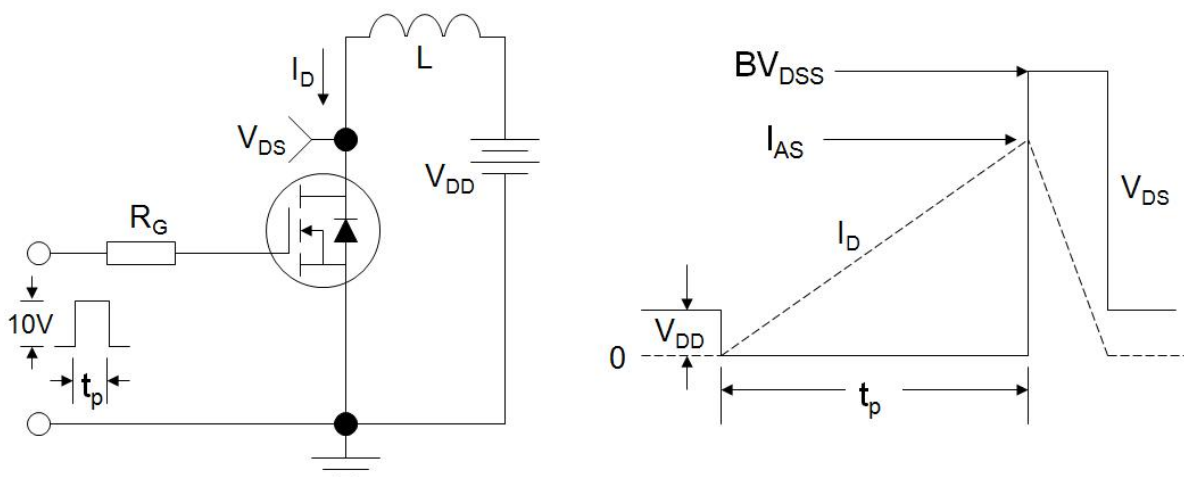
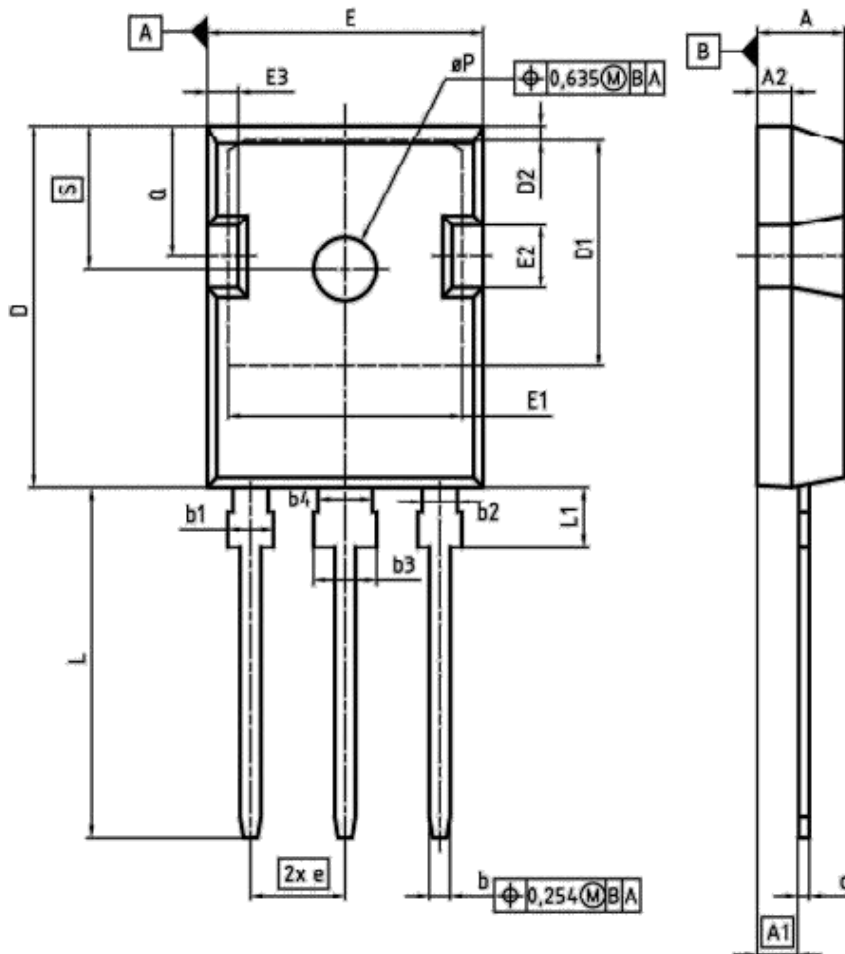


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





TO-247 (封装厂 E)



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.076	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	2.60	0.039	0.102
e	5.44 (BSC)		0.214 (BSC)	
N	3		3	
L	19.80	20.32	0.780	0.800
L1	4.10	4.47	0.161	0.176
ϕP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248



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