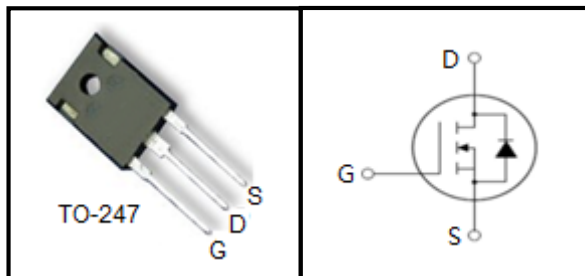




## 650V Super-Junction Power MOSFET

### FEATURES

- $BV_{DSS}=650\text{ V}$ ,  $I_D=41\text{ A}$
- $R_{DS(on)}:0.092\Omega$  (Max) @  $V_{GS}=10\text{ V}$
- Very low FOM  $R_{DS(on)} \times Q_g$
- 100% avalanche tested
- RoHS compliant
- Ultra-fast body diode
- Very high commutation ruggedness



### APPLICATIONS

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



Device Marking and Package Information		
Device	Package	Marking
MPSW65M092CFD	TO-247	MP65M092CFD

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ , unless otherwise noted			
Parameter	Symbol	Value	Unit
Drain-Source Voltage ( $V_{GS} = 0\text{V}$ )	$V_{DSS}$	650	V
Continuous Drain Current	$I_D$	41	A
Pulsed Drain Current (note1)	$I_{DM}$	125	A
Gate-Source Voltage	$V_{GSS}$	$\pm 30$	V
Single Pulse Avalanche Energy (note2)	$E_{AS}$	1280	mJ
Avalanche Current (note1)	$I_{AR}$	10.5	A
Repetitive Avalanche Energy (note1)	$E_{AR}$	1.7	mJ
MOSFET dv/dt ruggedness, $V_{DS}=0\dots 400\text{ V}$	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS}=0\dots 400\text{ V}$ , $I_{SD} \leq I_D$	dv/dt	50	V/ns
Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_D$	391	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55~+150	$^\circ\text{C}$

Thermal Resistance			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case, Max.	$R_{thJC}$	0.32	K/W
Thermal Resistance, Junction-to-Ambient, Max.	$R_{thJA}$	62	



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# MPSW65M092CFD

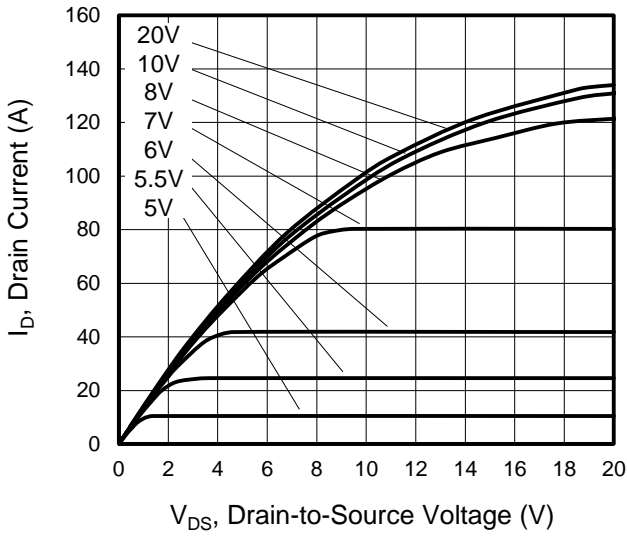
Specifications $T_J = 25^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	600	--	--	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 650V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	5	$\mu A$
		$V_{DS} = 650V, V_{GS} = 0V, T_J = 150^\circ\text{C}$	--	--	1000	
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 30V$	--	--	$\pm 100$	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 0.25mA$	3.0	--	5.0	V
Drain-Source On-Resistance (Note3)	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 23.5A$	--	0.080	0.092	$\Omega$
Gate Resistance	$R_G$	$f = 1.0MHz, \text{open drain}$	--	1.95	--	$\Omega$
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0V, V_{DS} = 50V, f = 1.0MHz$	--	3680	--	$\mu F$
Output Capacitance	$C_{oss}$		--	390	--	
Reverse Transfer Capacitance	$C_{rss}$		--	15	--	
Effective output capacitance, energy related	$C_{o(er)}$	$V_{GS}=0V, V_{DS}=0...400V$	--	131	--	
Effective output capacitance, time related	$C_{o(tr)}$	$I_D=\text{constant}, V_{GS}=0V, V_{DS}=0...400V$	--	675	--	
Total Gate Charge	$Q_g$	$V_{DD} = 480V, I_D = 41A, V_{GS} = 10V$	--	72	--	nC
Gate-Source Charge	$Q_{gs}$		--	14	--	
Gate-Drain Charge	$Q_{gd}$		--	24	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 400V, I_D = 25.8A, V_{GS} = 10V, R_G = 1.9\Omega$	--	15	--	ns
Turn-on Rise Time	$t_r$		--	12	--	
Turn-off Delay Time	$t_{d(off)}$		--	80	--	
Turn-off Fall Time	$t_f$		--	6	--	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Body Diode Current	$I_S$	$T_C = 25^\circ\text{C}$	--	--	41	A
Pulsed Diode Forward Current	$I_{SM}$		--	--	125	
Body Diode Voltage	$V_{SD}$	$T_J = 25^\circ\text{C}, I_{SD} = 41A, V_{GS} = 0V$	--	0.9	1.2	V
Reverse Recovery Time	$t_{rr}$	$V_R = 400V, I_F = 41A, di_F/dt = 100A/\mu s$	--	140	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	0.7	--	$\mu C$
Peak Reverse Recovery Current	$I_{rrm}$		--	11	--	A

## Notes

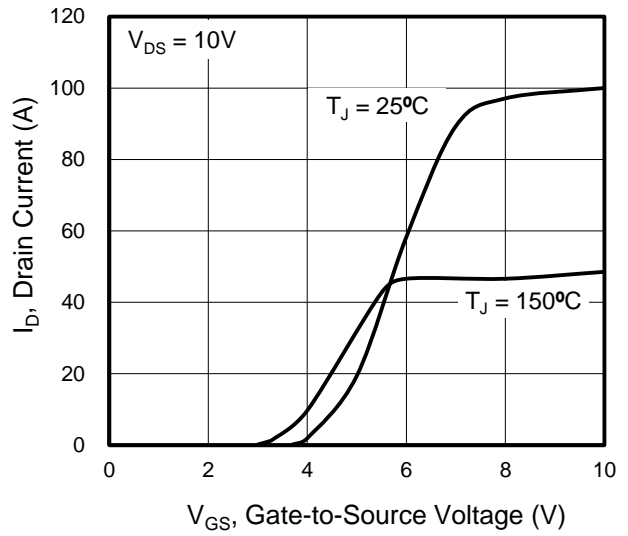
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_{AS} = 10.5A, V_{DD} = 50V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse width  $\leq 300\mu s, \text{Duty Cycle } \leq 1\%$

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

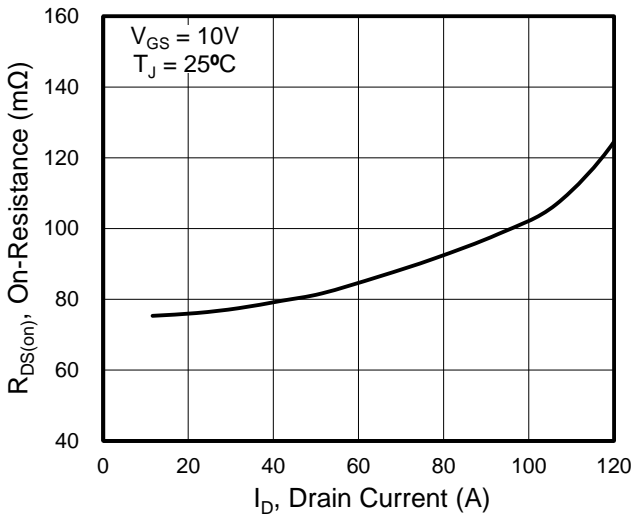
**Figure 1. Output Characteristics**



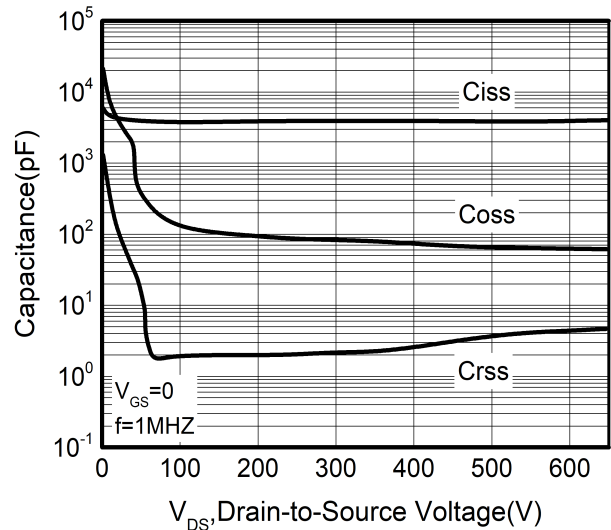
**Figure 2. Transfer Characteristics**



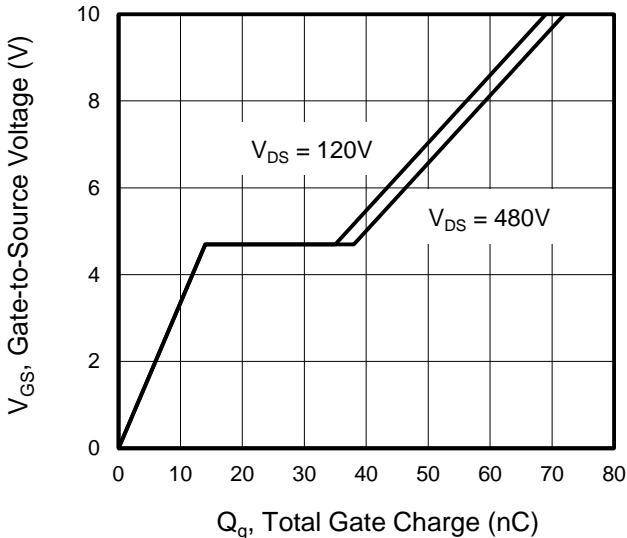
**Figure 3. On-Resistance vs. Drain Current**



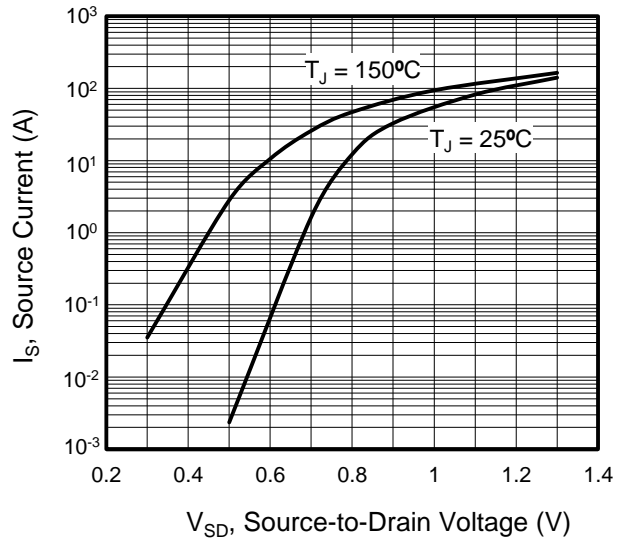
**Figure 4. Capacitance**



**Figure 5. Gate Charge**



**Figure 6. Body Diode Forward Voltage**



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

Figure 7. On-Resistance vs. Temperature

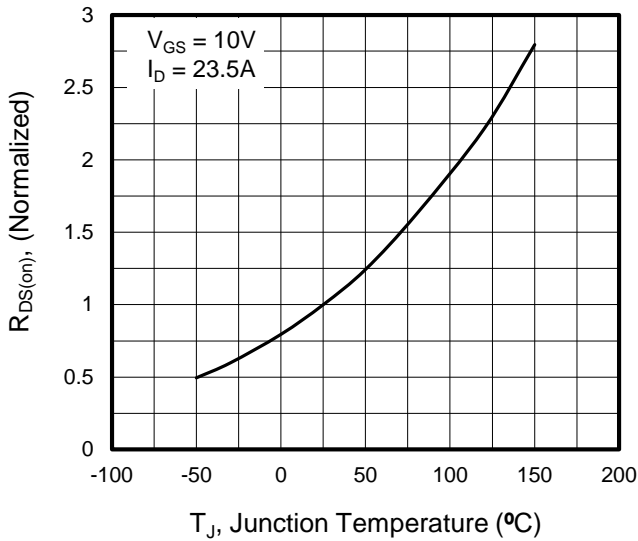


Figure 8. Threshold Voltage vs. Temperature

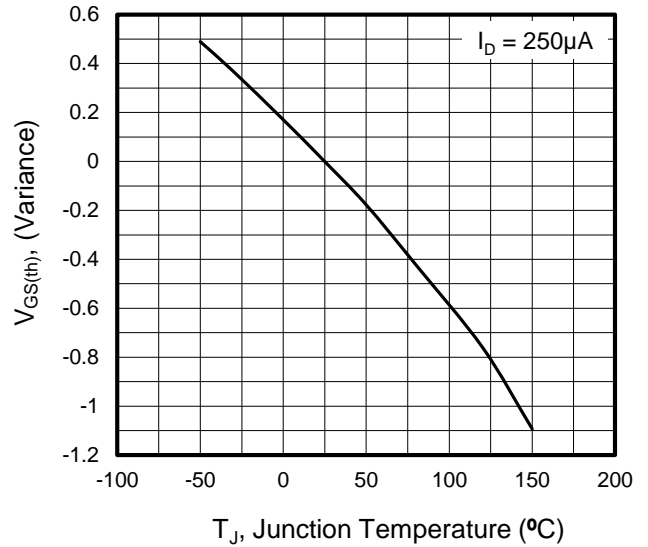


Figure 9. Transient Thermal Impedance

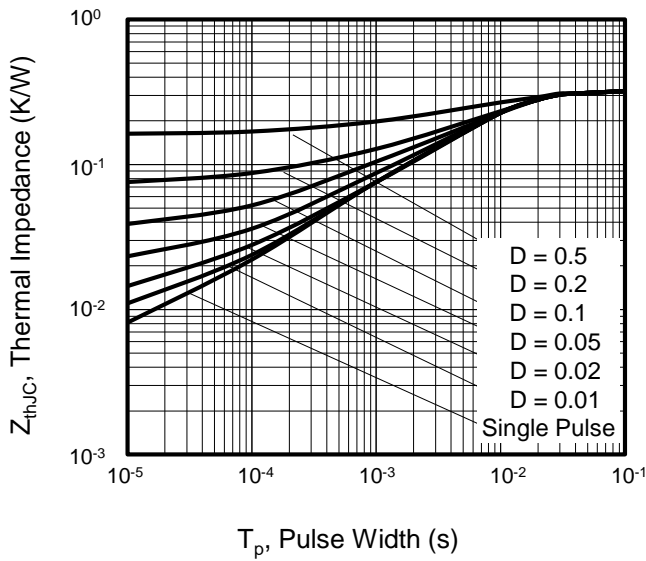


Figure 10.  $C_{oss}$  stored energy

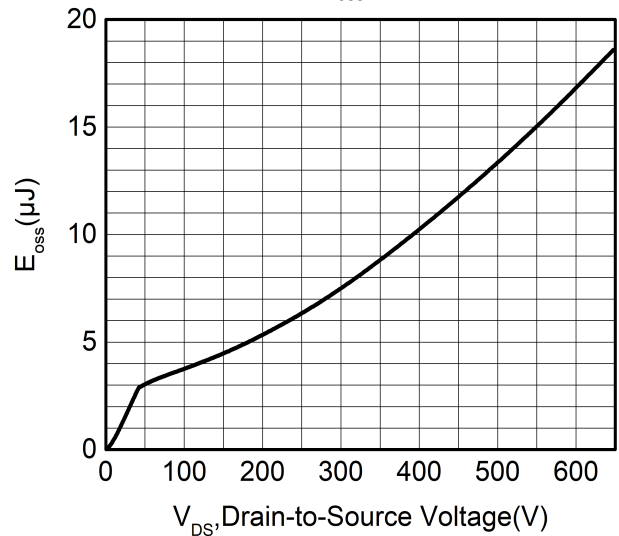
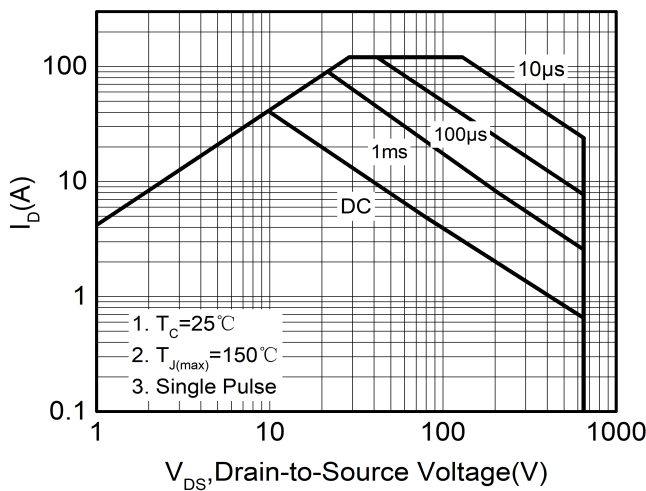
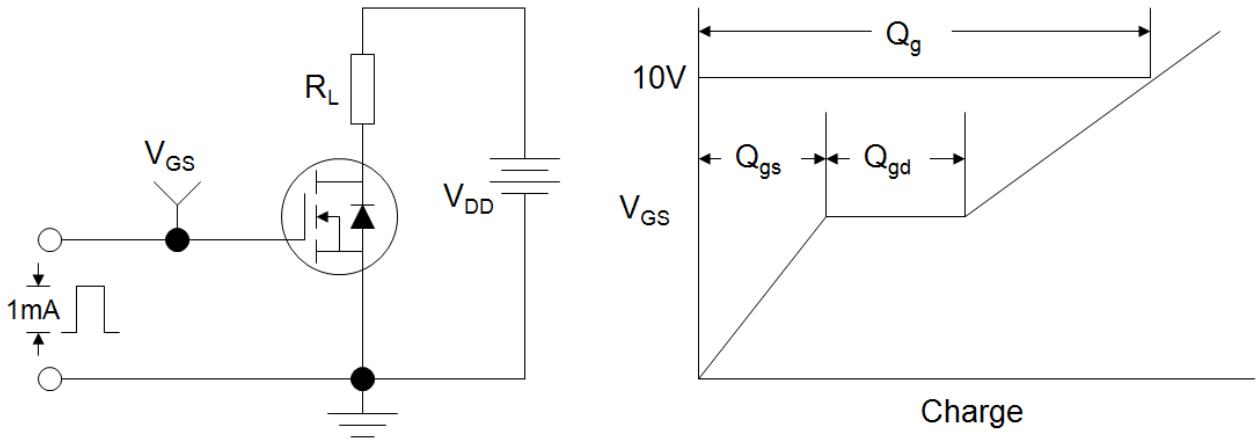


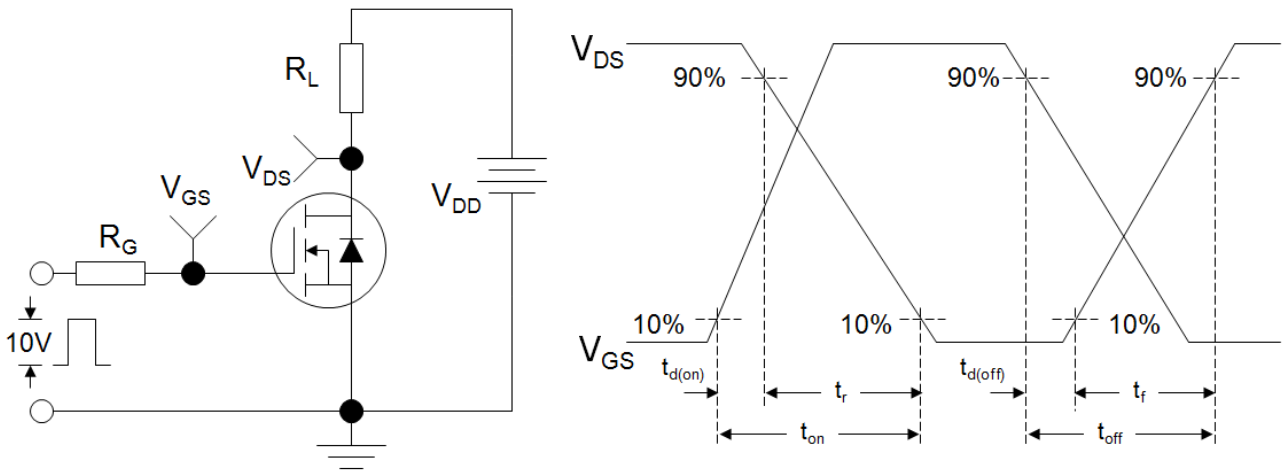
Figure 11. Safe Operating Area



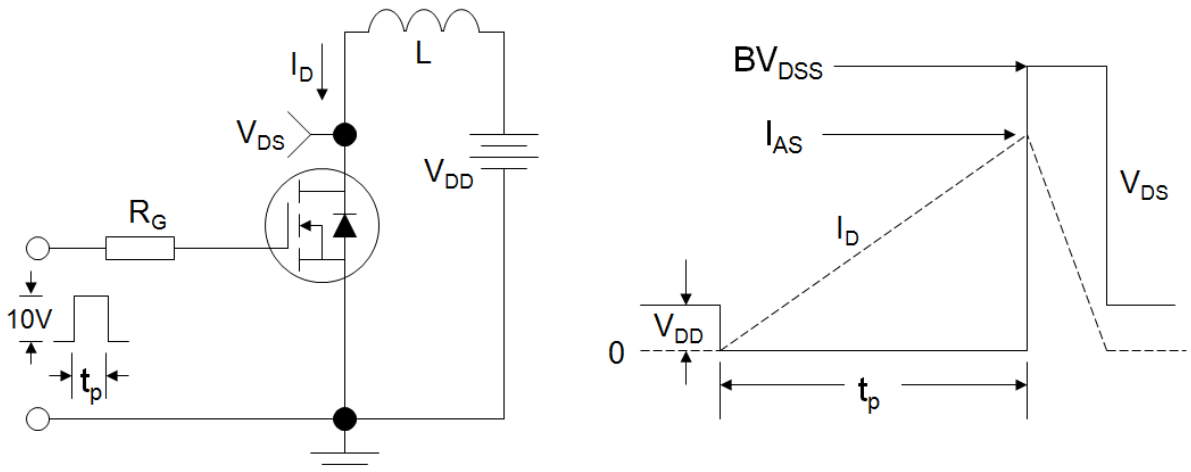
**Figure A: Gate Charge Test Circuit and Waveform**



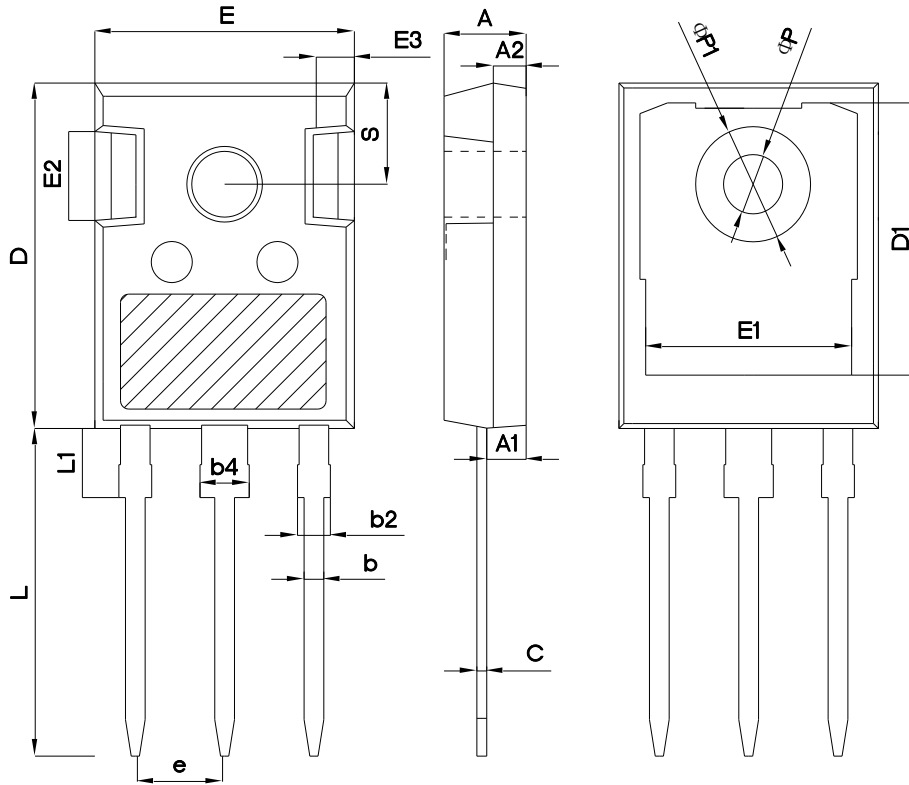
**Figure B: Resistive Switching Test Circuit and Waveform**



**Figure C: Unclamped Inductive Switching Test Circuit and Waveform**



## TO-247



SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.80	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.82	19.92	20.22
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S	6.15BSC		



## Revision: 2021-10-18, Ver 1.3

Revision	Date	Subjects (major changes since last revision)
1.2	2019-02-30	Initial version
1.3	2021-10-18	Parameters and fig