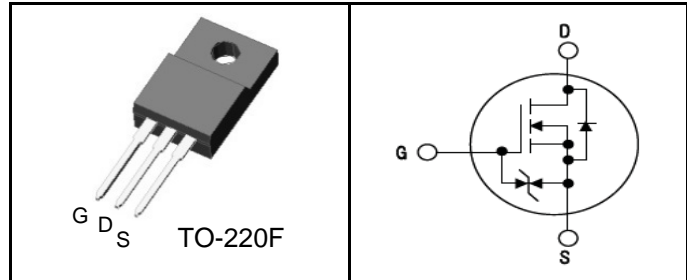


## 650V Super-Junction Power MOSFET

### Features

- $BV_{DSS}=650\text{ V}$ ,  $I_D=3\text{ A}$
- $R_{DS(on)}: 1.5\ \Omega$  (Max) @  $V_{GS}=10\text{V}$
- Very Low FOM ( $R_{DS(on)} \times Q_g$ )
- 100% Avalanche Tested
- RoHS compliant



### Application

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

### Device Marking and Package Information

Device	Package	Marking
MPSA65M1K5	TO-220F	MP65M1K5

### Absolute Maximum Ratings $T_J=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain-Source Voltage	650	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D^{(1)}$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	3.0	A
	Drain Current - Continuous ( $T_C = 100^\circ\text{C}$ )	1.9	A
$I_{DM}^{(2)}$	Drain Current - Pulsed	8.4	A
$E_{AS}^{(3)}$	Single Pulsed Avalanche Energy	43	mJ
$I_{AR}$	Avalanche Current	1	A
dv/dt	MOSFET dv/dt ruggedness, $V_{DS}=0\dots 520\text{V}$	50	V/ns
dv/dt	Reverse diode dv/dt, $V_{DS}=0\dots 520\text{V}$ , $I_{DS} \leq I_D$	15	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	20	W
$V_{ESD(G-S)}$	Gate source ESD(HBM-C=100pF, R=1.5K $\Omega$ )	2500	V
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}$	Junction-to-Case	-	6	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient	-	80	$^\circ\text{C}/\text{W}$



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# MPSA65M1K5

## Power MOSFET

### Electrical Characteristics T<sub>J</sub>=25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>On Characteristics</b>						
V <sub>GS</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 60 μA	2.5	-	3.5	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 1.1 A	-	1.35	1.5	Ω
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	650	-	-	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 650 V, V <sub>GS</sub> = 0 V, T <sub>C</sub> = 25°C	-	-	1	μA
		V <sub>DS</sub> = 650 V, V <sub>GS</sub> = 0 V, T <sub>C</sub> = 150°C	-	-	100	μA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V	-	-	±1	μA
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	-	245	-	pF
C <sub>oss</sub>	Output Capacitance		-	13	-	pF
C <sub>riss</sub>	Reverse Transfer Capacitance		-	1.7	-	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Time	V <sub>DS</sub> = 350 V, I <sub>D</sub> = 1.5 A, R <sub>G</sub> = 25 Ω (Note 4,5)	-	20	-	ns
t <sub>r</sub>	Turn-On Rise Time		-	18	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	50	-	ns
t <sub>f</sub>	Turn-Off Fall Time		-	20	-	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 520 V, I <sub>D</sub> = 1.5 A, V <sub>GS</sub> = 10 V (Note 4,5)	-	5.5	-	nC
Q <sub>gs</sub>	Gate-Source Charge		-	1.1	-	nC
Q <sub>gd</sub>	Gate-Drain Charge		-	2.2	-	nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		-	-	3.0	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		-	-	8.4	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 3.0 A	-	-	1.3	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 1.5 A	-	135	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	di <sub>F</sub> /dt = 100 A/μs	-	0.6	-	μC

**Notes :**

- Limited by T<sub>J</sub> max. Maximum duty cycle D=0.50
- Repetitive Rating : Pulse width limited by maximum junction temperature
- I<sub>AS</sub>=1A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub> =25°C
- Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%
- Essentially Independent of Operating Temperature



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# MPSA65M1K5

Power MOSFET

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

Figure 1. On Region Characteristics

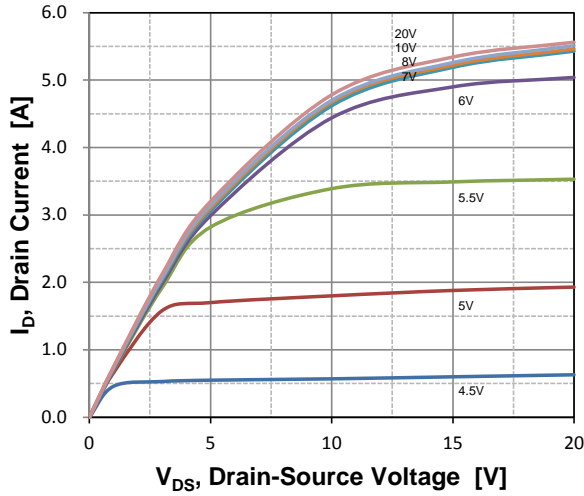


Figure 2. Transfer Characteristics

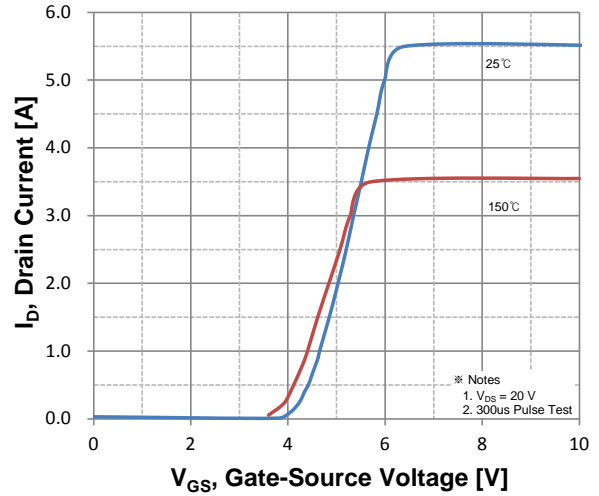


Figure 3. On Resistance Variation vs. Drain Current and Gate Voltage

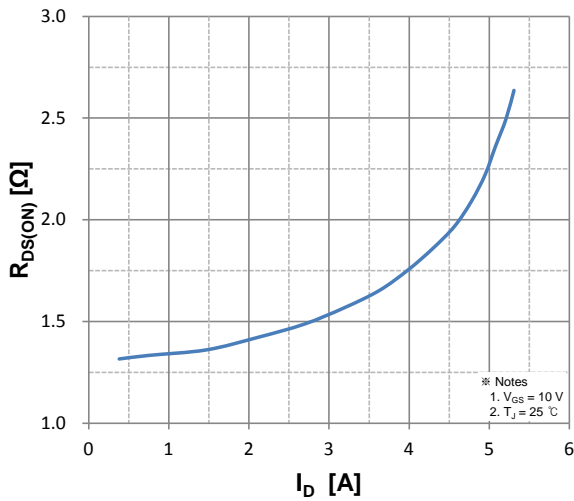


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

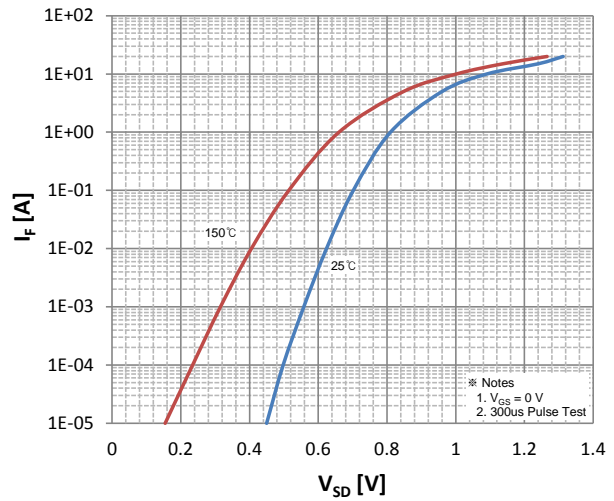


Figure 5. Capacitance Characteristics

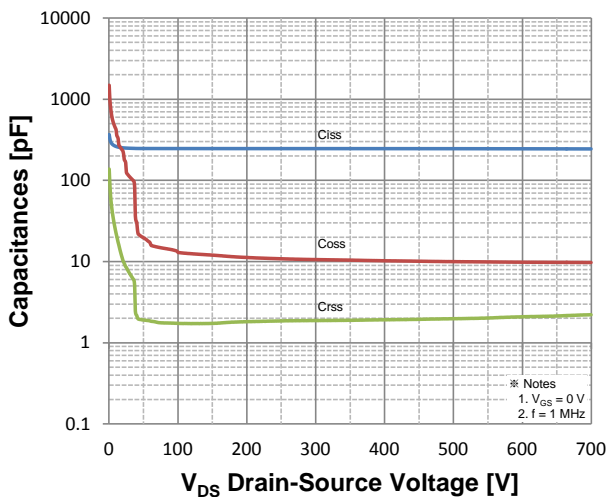
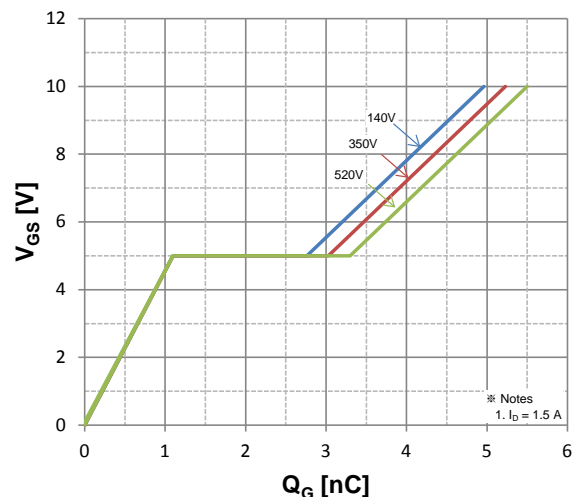


Figure 6. Gate Charge Characteristics



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

Figure 7. Breakdown Voltage Variation vs. Temperature

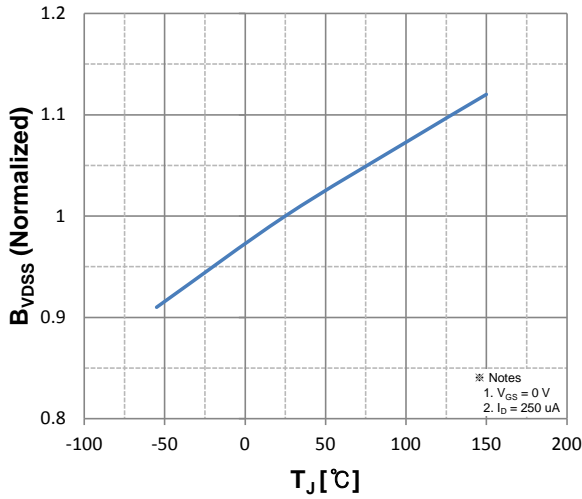


Figure 8. On-Resistance Variation vs. Temperature

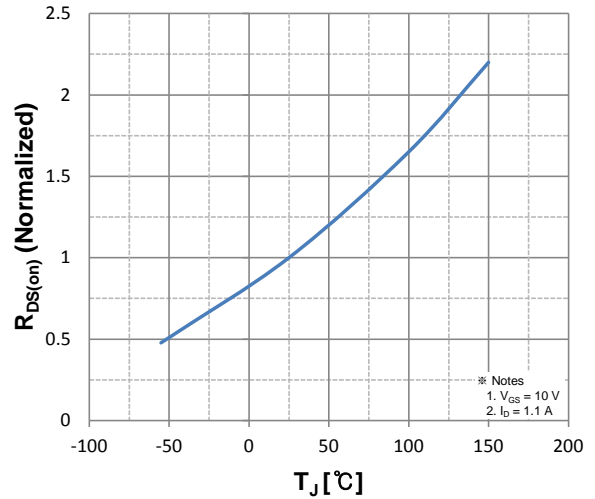


Figure 9. Maximum Safe Operating Area

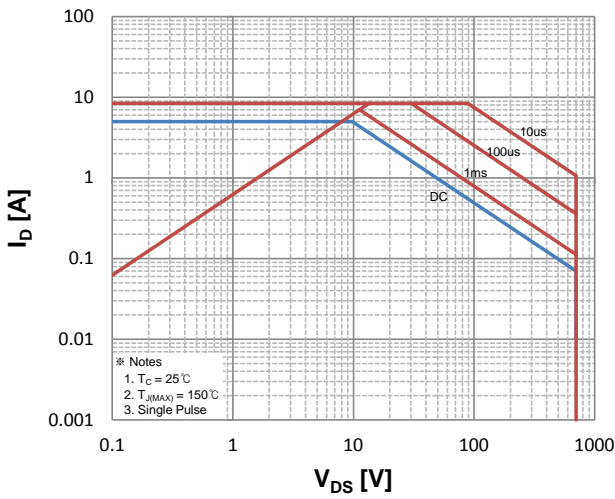


Figure 10. Maximum Drain Current vs. Temperature

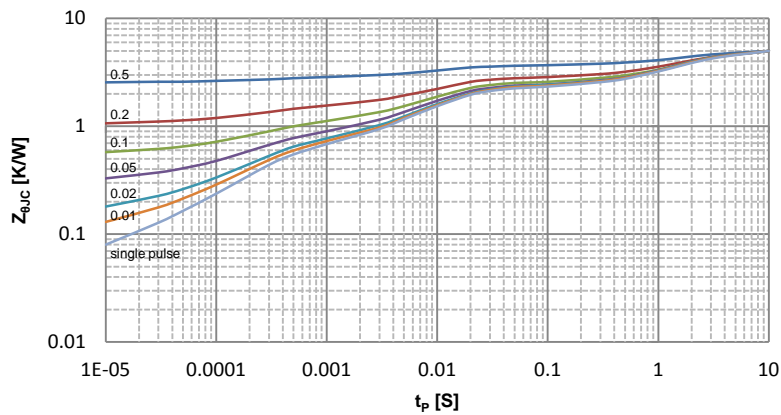
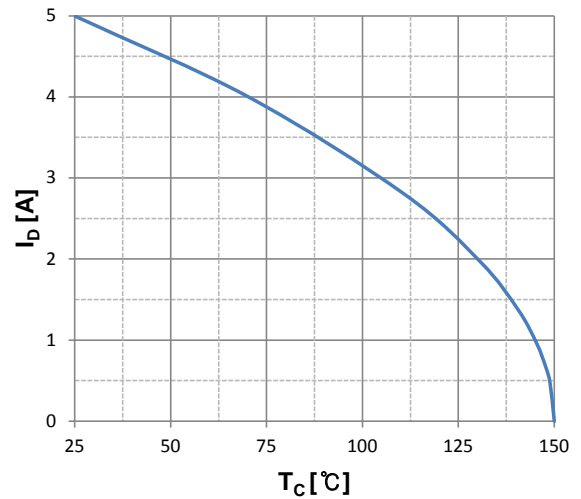


Figure 11. Transient Thermal Response Curve

Figure 12. Gate Charge Test Circuit and Waveform

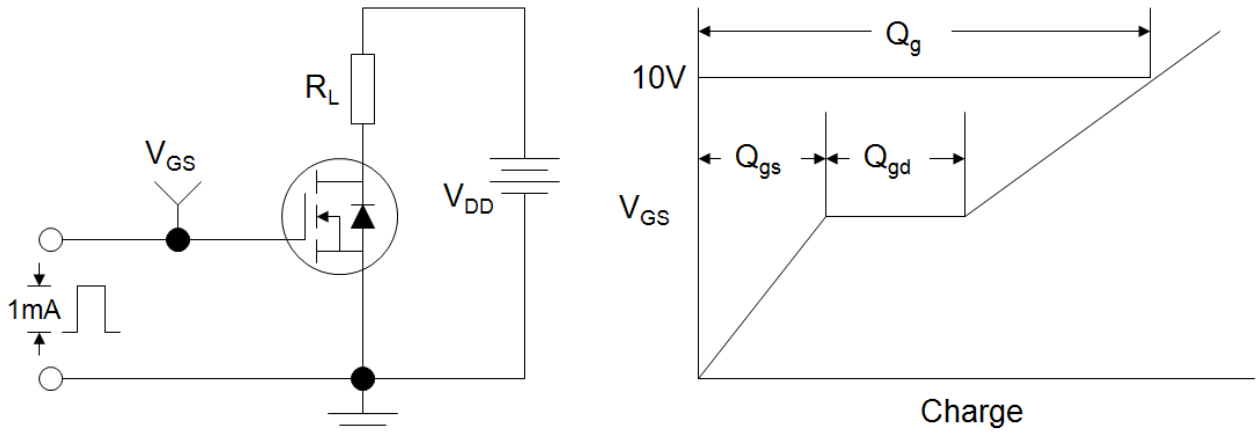


Figure 13. Resistive Switching Test Circuit and Waveform

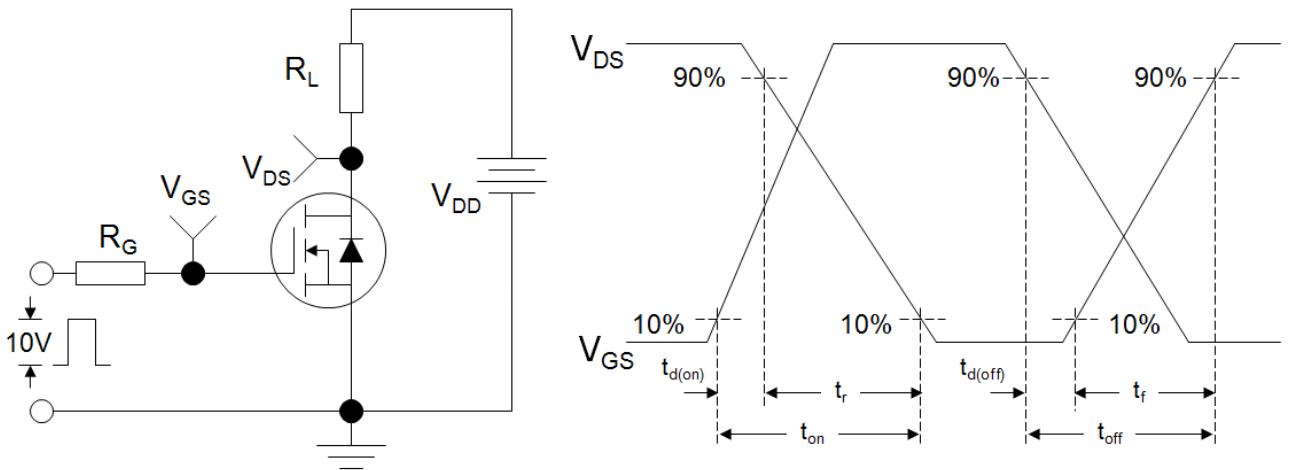
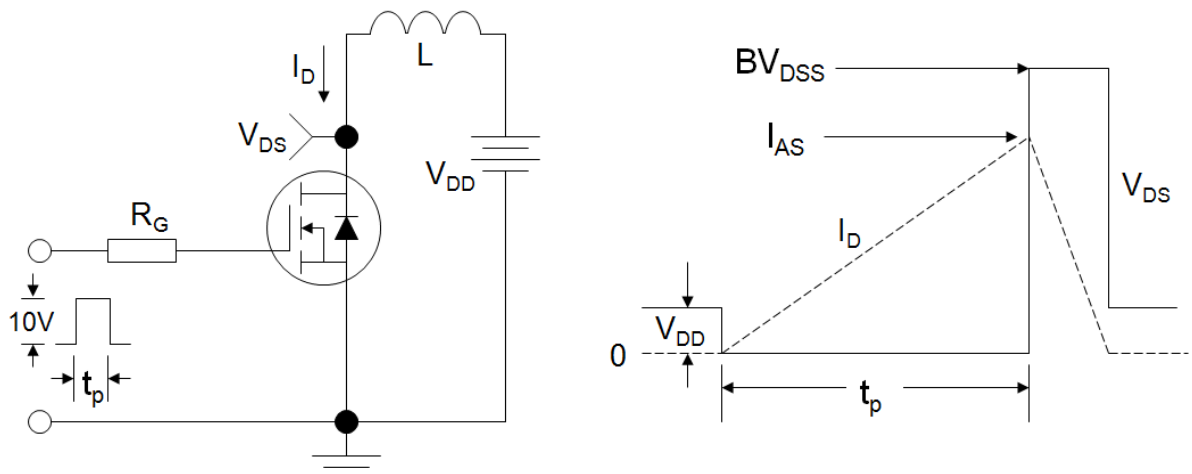
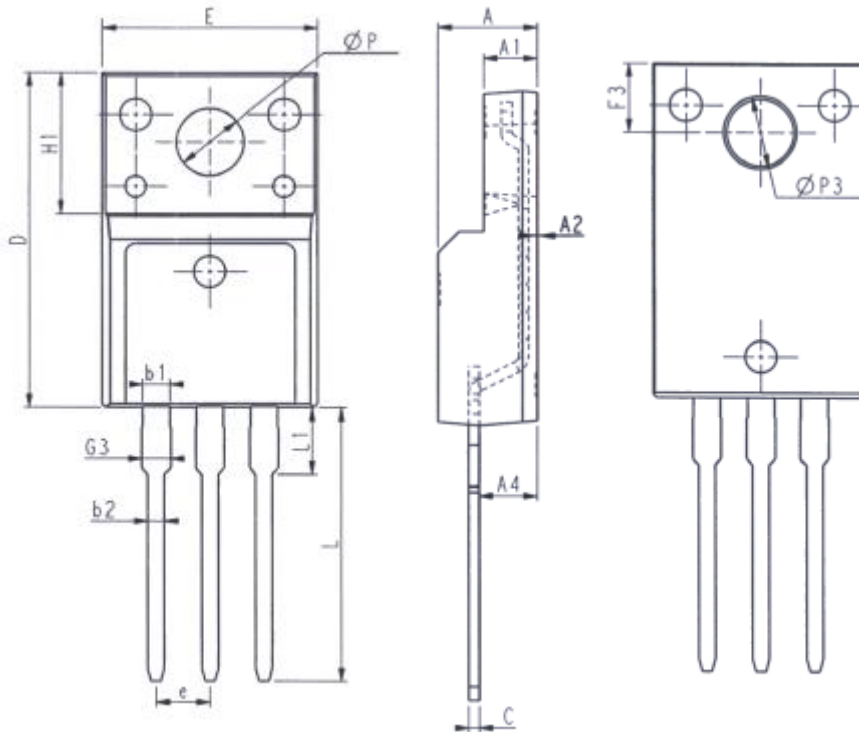


Figure 14. Unclamped Inductive Switching Test Circuit and Waveform





## TO-220F



Unit: mm			Unit: mm		
Symbol	Min.	Max.	Symbol	Min.	Max.
E	9.96	10.36	L	12.68	13.28
A	4.50	4.90	L1	2.93	3.13
A1	2.34	2.74	P	3.03	3.38
A2	0.30	0.60	P3	3.15	3.65
A4	2.56	2.96	F3	3.15	3.45
c	0.40	0.65	G3	1.25	1.55
D	15.57	16.17	b1	1.18	1.43
H1	6.70REF		b2	0.70	0.95
e	2.54BSC				