

## Silicon N-Channel Planar Power MOSFET

### Description

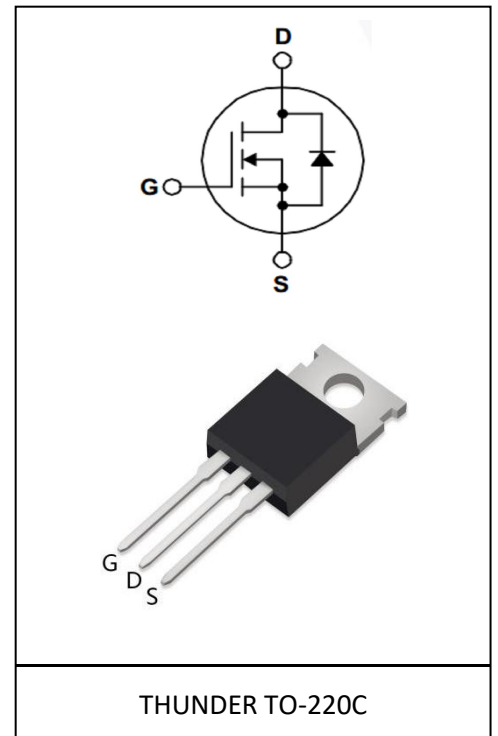
The TH13N50PC utilizes the latest processing techniques to achieve low on-resistance per silicon area. Additional features of this MOSFET are 150°C operating junction temperature and high repetitive peak current capability. These features combine to make this MOSFET a highly efficient, robust and reliable device for PDP driving applications. It can be used in a wide variety of applications.

### General Features

- $V_{DS}=500V, I_D=13A$
- Low ON Resistance,  $R_{DS(ON)}=338m\Omega @ V_{GS}=10V, I_D=6.5A$
- Low reverse transfer capacitance
- Low Qg for fast response
- Short fall & rise times for fast switching
- 100% single pulse avalanche energy Test

### Application

- Power switching application
- Digital amplifier
- Adapter and charger



### Product Summary

$V_{DS}$	500V
$R_{DS(on)}$	338m $\Omega$
$I_D$	13A

### Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	$V_{DS}$	500	V
Continuous drain current $T_C = 25^\circ C$ (Silicon limit)	$I_D$	13	A
Pulsed drain current ( $T_C = 25^\circ C$ , $t_p$ limited by $T_{jmax}$ )	$I_{DM}$	52	A
Avalanche energy, single pulse ( $L=10mH$ , $R_g=25\Omega$ )	$E_{AS}$	957	mJ
Gate-Source voltage	$V_{GS}$	$\pm 30$	V
Power dissipation ( $T_C = 25^\circ C$ )	$P_D$	179	W
Operating junction and storage temperature	$T_j, T_{stg}$	-55...+150	$^\circ C$

### Thermal Resistance

Parameter	Symbol	Max	Unit
Thermal resistance, junction – case.	$R_{thJC}$	0.7	°C/W
Thermal resistance, junction – ambient(min. footprint)	$R_{thJA}$	0.5	

### Electrical Characteristic (at $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		

### Static Characteristic

Drain-source breakdown voltage	$BV_{DSS}$	500	-	-	V	$V_{GS}=0V, I_D=250\mu A$
Gate threshold voltage	$V_{GS(th)}$	2.0	-	4.0	V	$V_{DS}=V_{GS}, I_D=250\mu A$
Zero gate voltage drain current	$I_{DSS}$	-	-	1	$\mu A$	$V_{DS}=500V, V_{GS}=0V$ $T_j=25\text{ }^\circ\text{C}$
		-	-	10	$\mu A$	$V_{DS}=400V, V_{GS}=0V$ $T_j=125\text{ }^\circ\text{C}$
Gate-source leakage current	$I_{GSS}$	-	-	$\pm 100$	nA	$V_{GS}=\pm 30V, V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	338	405	m $\Omega$	$V_{GS}=10V, I_D=6.5A$
Transconductance	$g_{fs}$	-	10	-	S	$V_{DS}=50V, I_D=6.5A$

### Dynamic Characteristic

Input Capacitance	$C_{iss}$	-	2233	-	pF	$V_{GS}=0V, V_{DS}=25V,$ $f=1\text{MHz}$
Output Capacitance	$C_{oss}$	-	186	-		
Reverse Transfer Capacitance	$C_{rss}$	-	4489	-		
Gate Total Charge	$Q_g$	-	48	-	nC	$V_{GS}=10V, V_{DS}=400V,$ $I_D=13A$
Gate-Source charge	$Q_{gs}$	-	12	-		
Gate-Drain charge	$Q_{gd}$	-	20	-		
Turn-on delay time	$t_{d(on)}$	-	45	-	ns	$V_{DD}=250V, I_D=13A,$ $R_G=25\Omega$
Rise time	$t_r$	-	150	-		
Turn-off delay time	$t_{d(off)}$	-	105	-		
Fall time	$t_f$	-	80	-		
Gate resistance	$R_G$	-	1.19	-	$\Omega$	$V_{GS}=0V, V_{DS}=0V,$ $f=1\text{MHz}$

### Body Diode Characteristic

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Body Diode Forward Voltage	$V_{SD}$	-	-	1.4	V	$V_{GS}=0V, I_{DS}=13A$
Body Diode Continuous Forward Current	$I_S$	-	-	13	A	$T_C=25^\circ C$
Body Diode Reverse Recovery Time	$t_{rr}$	-	295	-	ns	$T_C=25^\circ C, I_S=13A,$ $di/dt=100A/us$
Body Diode Reverse Recovery Charge	$Q_{rr}$	-	2.8	-	$\mu C$	

### Typical Performance Characteristics

Fig 1: On-Region Characteristics

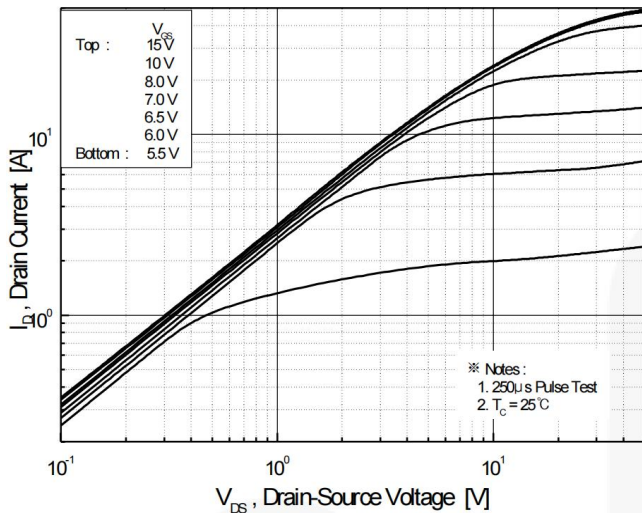


Fig 2: Transfer Characteristics

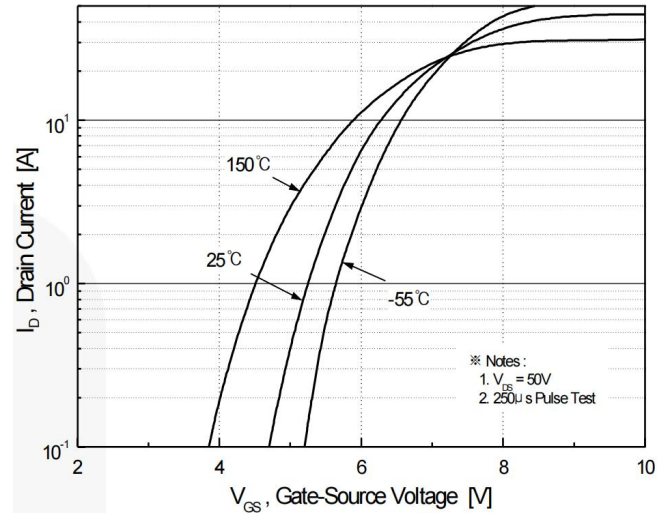


Fig 3: On-Resistance Variation vs. Drain Current and Gate Voltage

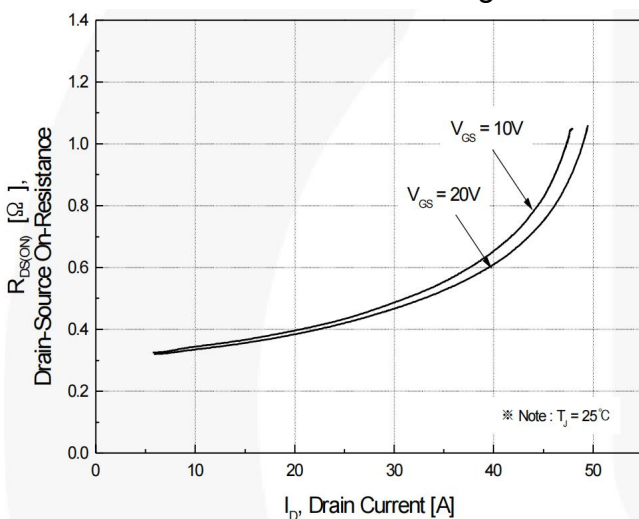


Fig 4: Body Diode Forward Voltage Variation vs. Source Current and Temperature

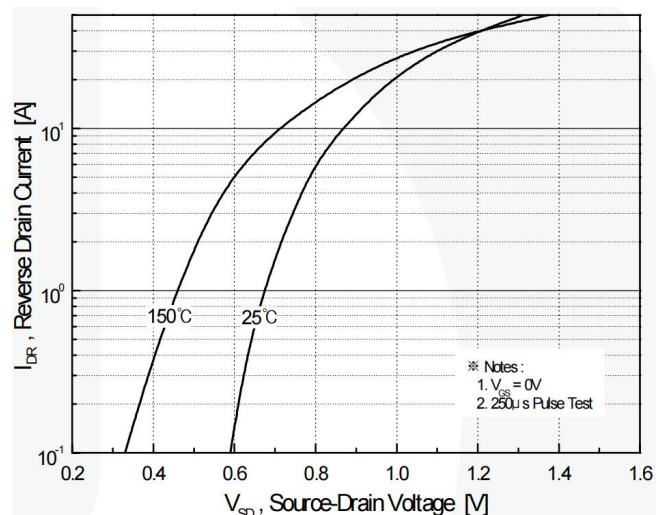


Fig 5: Gate Charge Characteristics

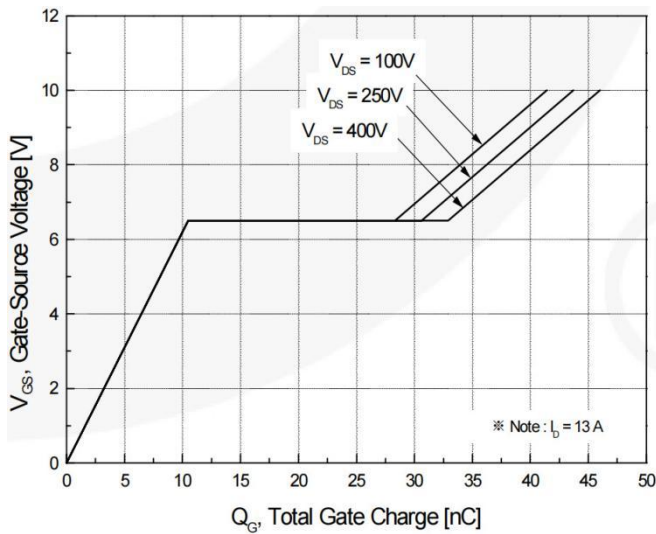


Fig 6: Capacitance Characteristics

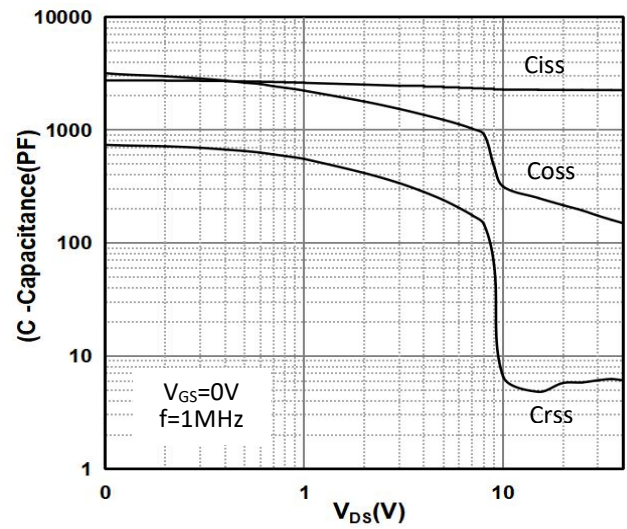


Fig 7: Power Dissipation

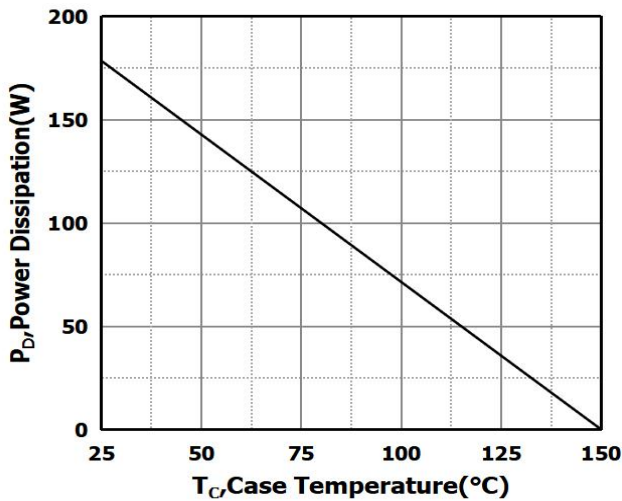


Fig 8: Drain Current Derating

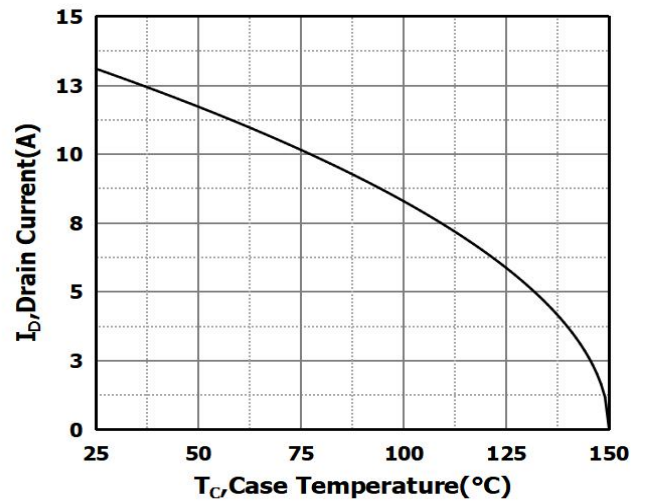


Fig 9: Maximum Safe Operating Area

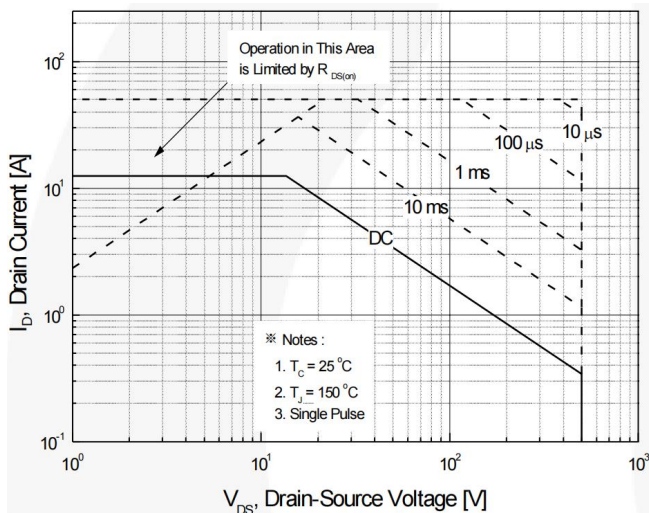


Fig 10: On-Resistance Variation vs. Temperature

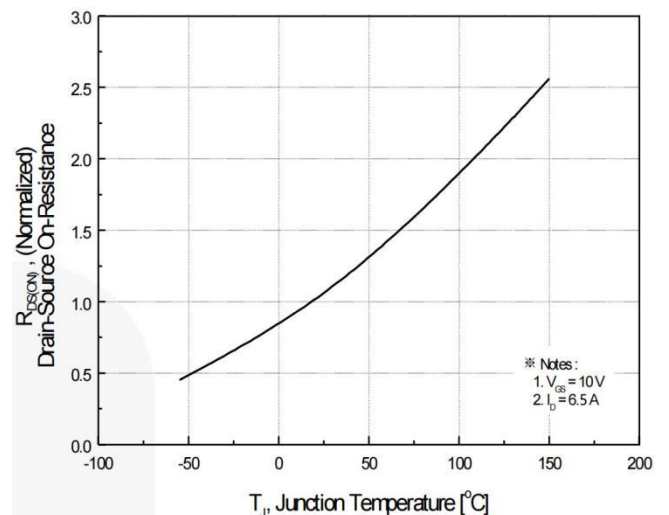
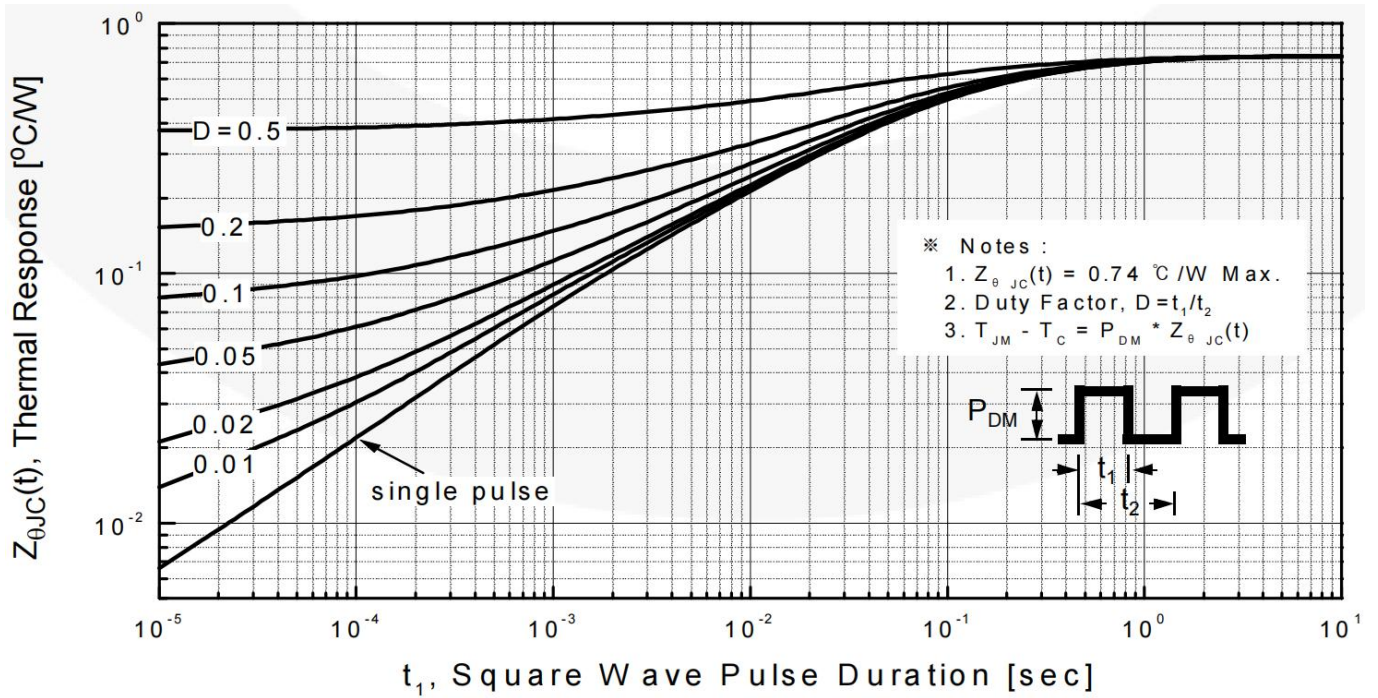
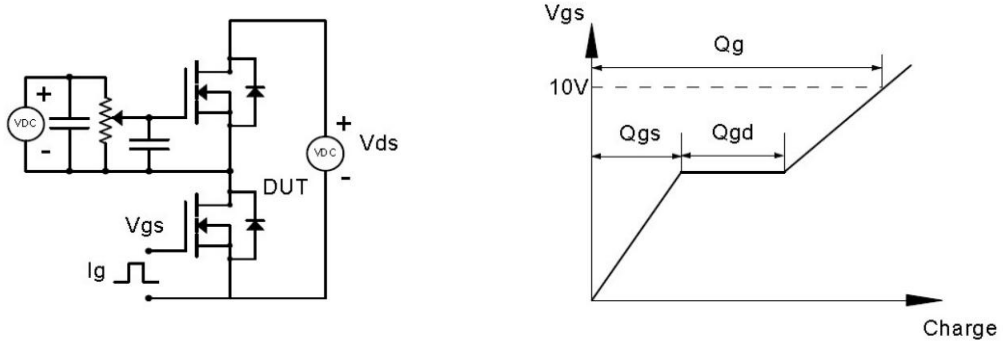


Fig 11: Transient Thermal Response Curve

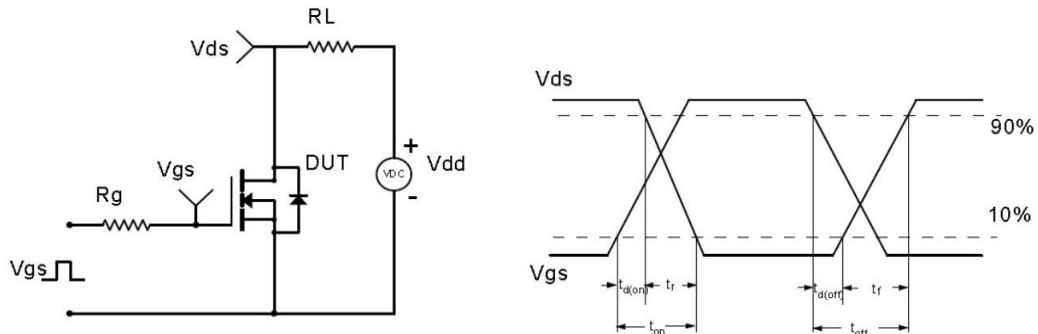


## Test Circuit & Waveform

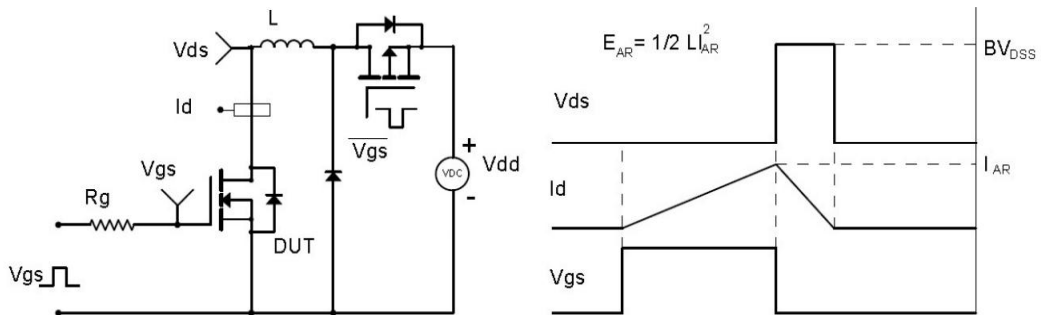
Gate Charge Test Circuit & Waveform



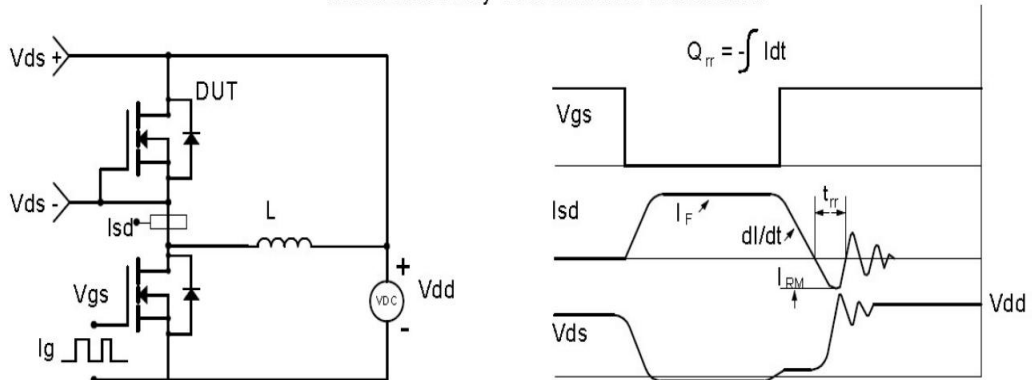
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

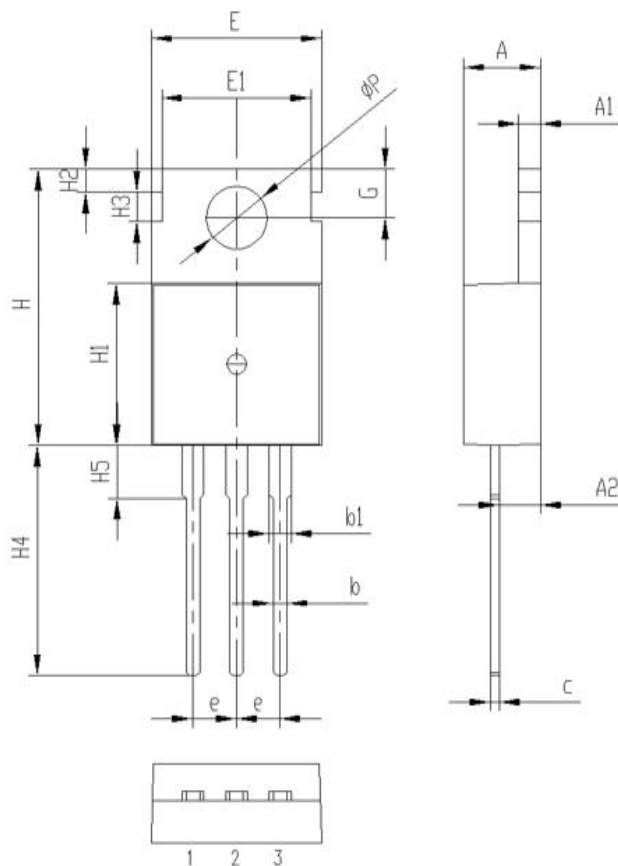


Diode Recovery Test Circuit & Waveforms



## Package Information

### TO-220C PACKAGE



Symbol	单位 mm		
	Min	Nom	Max
A	4.30	4.5	4.70
A1	1.20	1.30	1.40
A2	2.20	2.4	2.60
b	0.60	0.8	1.00
b1	1.20	1.30	1.40
c	0.40	0.5	0.60
e	2.44	2.54	2.64
E	9.80	10.0	10.2
E1	8.50	8.70	8.90
H	15.5	15.7	15.9
H1	9.00	9.2	9.40
H2	1.10	1.34	1.50
H3	1.50	1.7	1.90
H4	12.9	13.3	13.7
H5	2.80	3.0	3.20
G	2.60	2.8	3.00
$\Phi P$	3.40	3.6	3.80

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