



Description

The SPP04N60C3HKSA1 can be used in various power switching circuit for system miniaturization and higher efficiency. The package form is TO-220H, which accords with the RoHS standard.

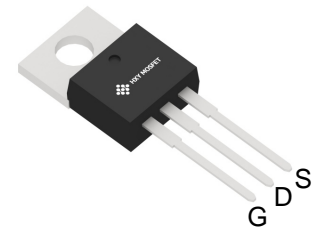
General Features

$V_{DS} = 650V, I_D = 10A$

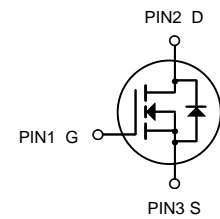
$R_{DS(ON)} < 1.05\Omega @ V_{GS}=10V$

Application

- Power switch circuit of adaptor and charger.



TO-220H



N-Channel MOSFET

Ordering Information

Product ID	Pack	Brand	Units Tube
SPP04N60C3HKSA1	TO-220H	HXY MOSFET	50

Absolute Maximum Ratings @ $T_j=25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Rating	Units
V _{DS}	Drain-Source Voltage	650	V
V _{GS}	Gate-Source Voltage	±30	V
I _D @T _C =25°C	Drain Current, V _{GS} @ 10V	10	A
I _D @T _C =100°C	Drain Current, V _{GS} @ 10V	6.3	A
I _{DM}	Pulsed Drain Current ¹	38	A
P _D @T _C =25°C	Total Power Dissipation	130	W
T _{STG}	Storage Temperature Range	-55 to 150	°C
T _J	Operating Junction Temperature Range	-55 to 150	°C



Electrical Characteristics (Tc= 25°C unless otherwise specified):

OFF Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
V_{DSS}	Drain to Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	650	--	--	V
I_{DSS}	Drain to Source Leakage Current	$V_{DS}=650V, V_{GS}=0V, T_a=25^\circ C$	--	--	1	μA
		$V_{DS}=520V, V_{GS}=0V, T_a=125^\circ C$	--	--	100	μA
$I_{GSS(F)}$	Gate to Source Forward Leakage	$V_{GS}=+30V$	--	--	100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	$V_{GS}=-30V$	--	--	-100	nA

ON Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$R_{DS(ON)}$	Drain-to-Source On-Resistance	$V_{GS}=10V, I_D=1A$	--	0.8	1.05	Ω
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	--	4.0	V
Pulse width $t_p \leq 300\mu s, \delta \leq 2\%$						

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
C_{iss}	Input Capacitance	$V_{GS}=0V, V_{DS}=25V, f=1.0MHz$	--	1570	--	pF
C_{oss}	Output Capacitance		--	136	--	
C_{riss}	Reverse Transfer Capacitance		--	10.5	--	

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	$I_D=10A, V_{DD}=325V, R_G=25\Omega$	--	23	--	ns
t_r	Rise Time		--	25	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	64	--	
t_f	Fall Time		--	28	--	
Q_g	Total Gate Charge	$I_D=10A, V_{DD}=520V, V_{GS}=10V$	--	44	--	nC
Q_{gs}	Gate to Source Charge		--	6.7	--	
Q_{gd}	Gate to Drain ("Miller") Charge		--	18.5	--	



Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)		--	--	10	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	38	A
V_{SD}	Diode Forward Voltage	$I_S=10A, V_{GS}=0V$	--	--	1.4	V
Pulse width $t_p \leq 300\mu s, \delta \leq 2\%$						

Symbol	Parameter	Typ.	Units
$R_{\theta JC}$	Junction-to-Case	0.96	°C/W
$R_{\theta JA}$	Junction-to-Ambient	62.5	°C/W

^{a1}: Repetitive rating; pulse width limited by maximum junction temperature

^{a2}: $L=10mH, I_D=6.3A, \text{Start } T_J=25^\circ C$

^{a3}: $I_{SD}=4A, di/dt \leq 100A/\mu s, V_{DD} \leq BV_{DS}, \text{Start } T_J=25^\circ C$



Characteristics Curve

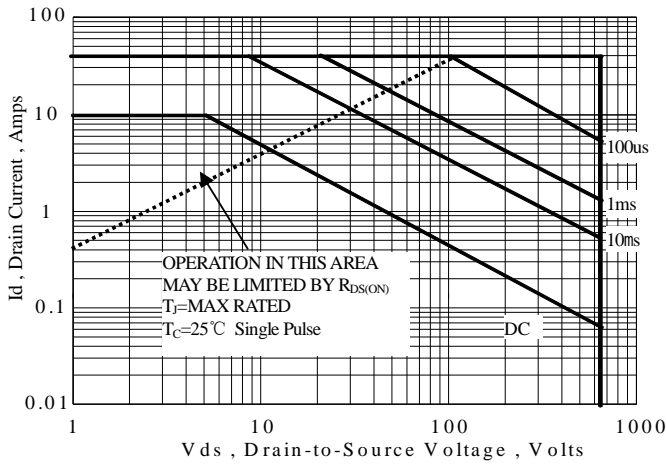


Figure 1 Maximum Forward Bias Safe Operating Area

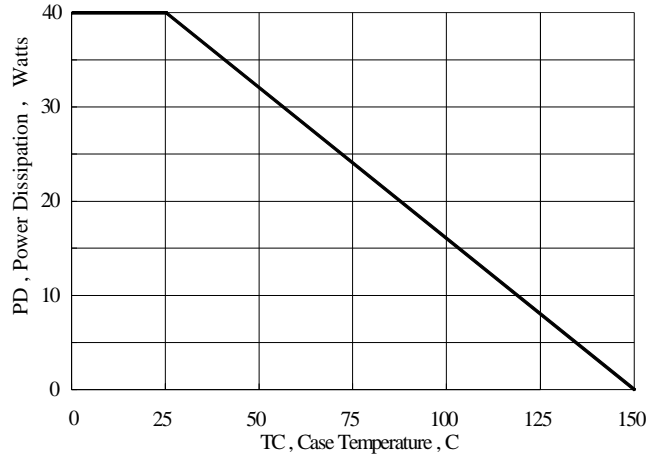


Figure 2 Maximum Power Dissipation vs Case Temperature

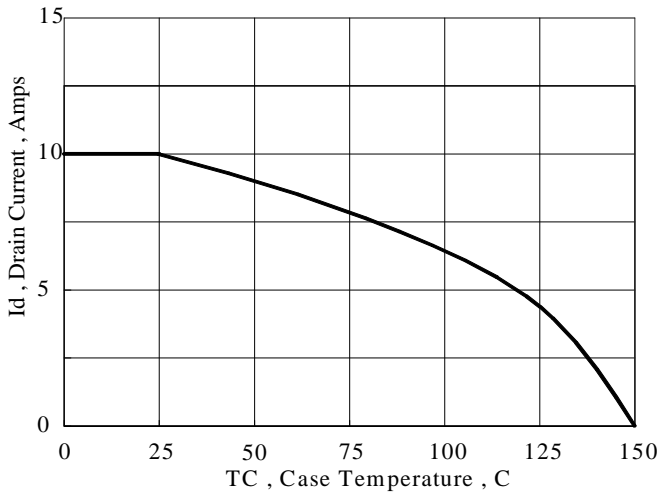


Figure 3 Maximum Continuous Drain Current vs Case Temperature

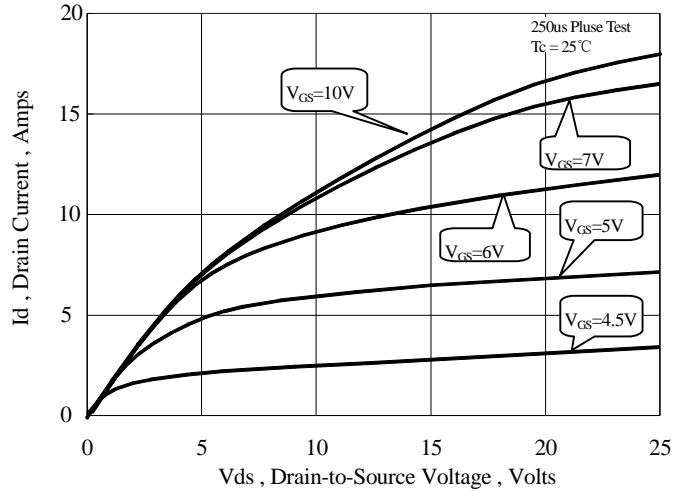


Figure 4 Typical Output Characteristics

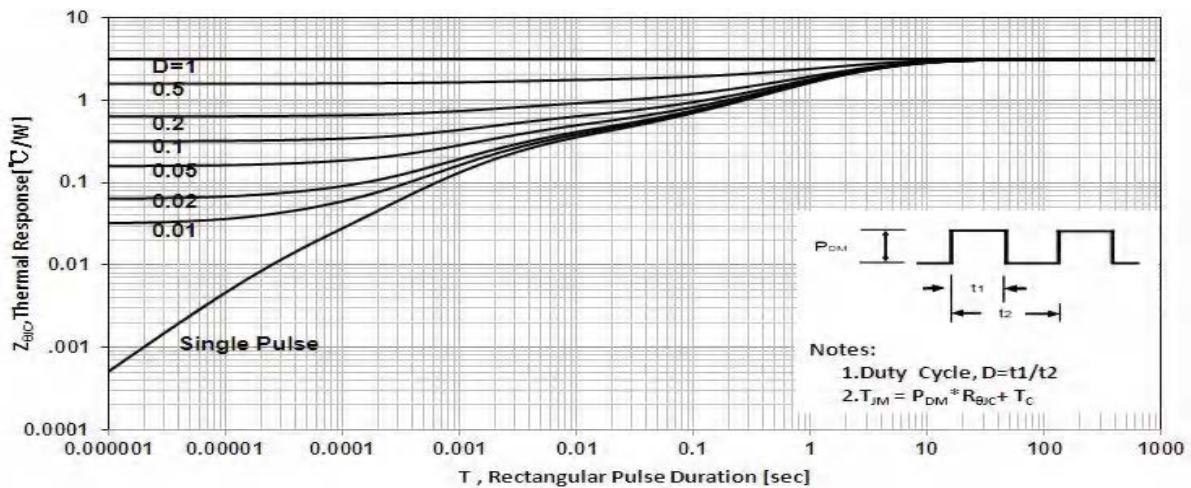


Figure 5 Maximum Effective Thermal Impedance, Junction to Case

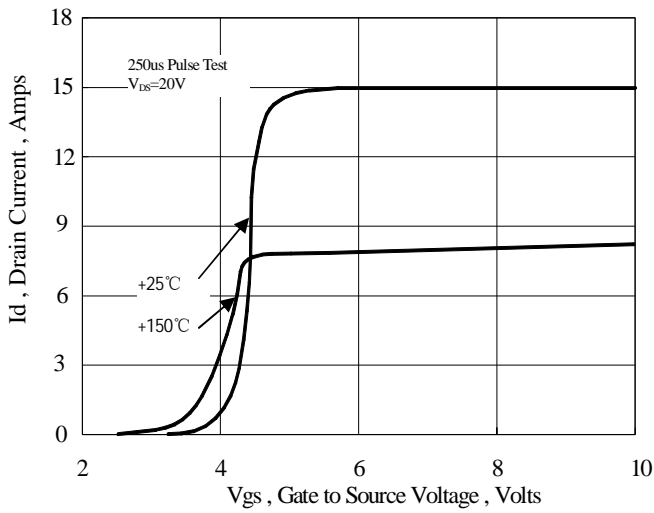


Figure 6 Typical Transfer Characteristics

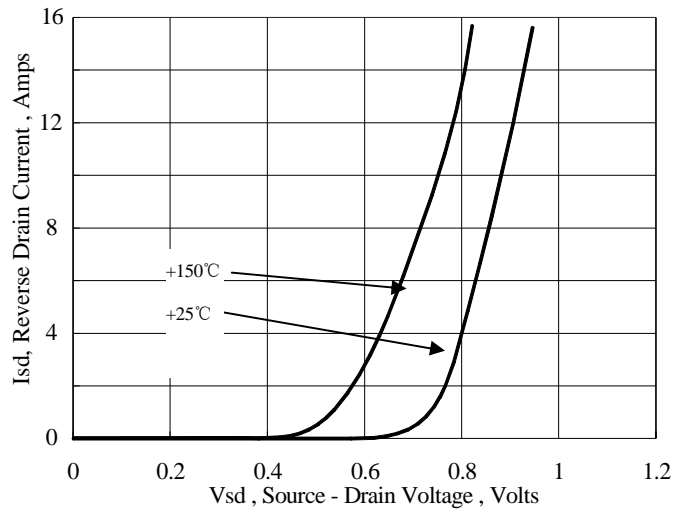


Figure 7 Typical Body Diode Transfer Characteristics

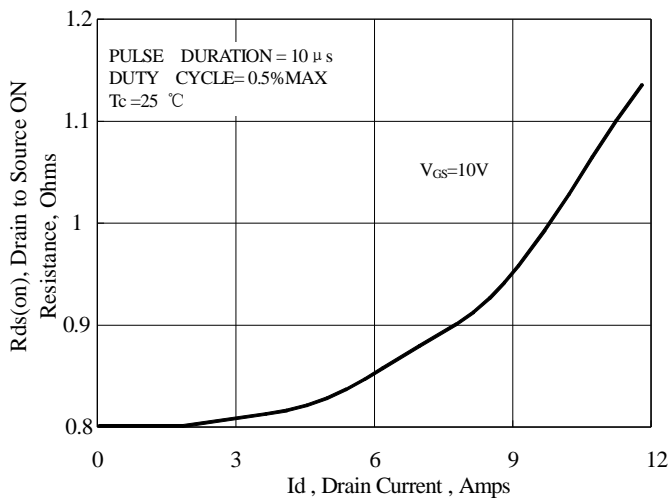


Figure 8 Typical Drain to Source ON Resistance vs Drain Current

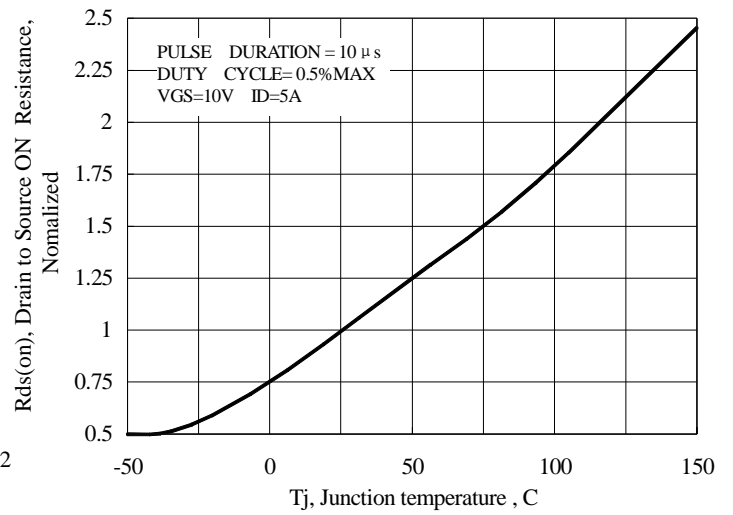


Figure 9 Typical Drain to Source on Resistance vs Junction Temperature

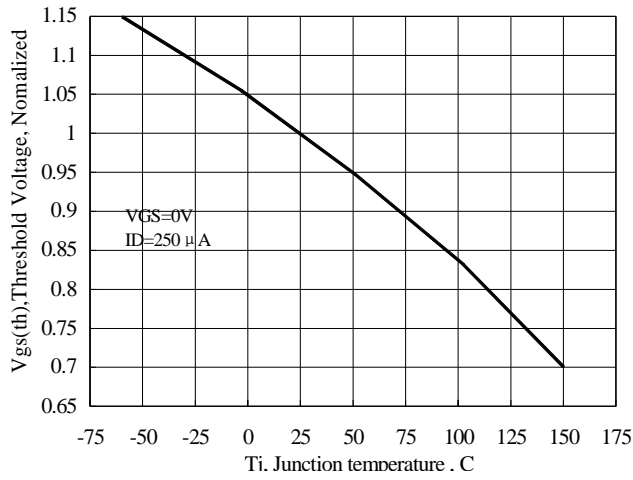


Figure 10 Typical Theshold Voltage vs Junction Temperature

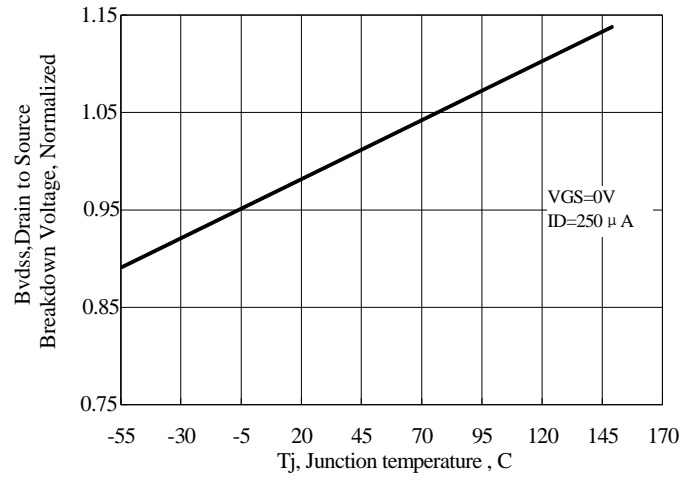


Figure 11 Typical Breakdown Voltage vs Junction Temperature

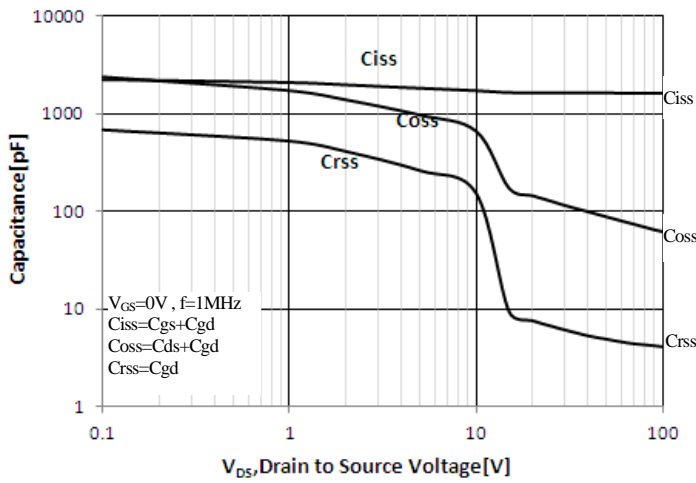


Figure 12 Typical Capacitance vs Drain to Source Voltage

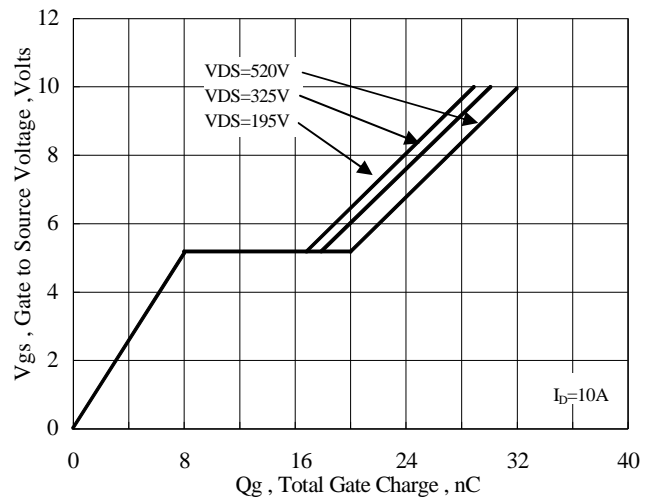


Figure 13 Typical Gate Charge vs Gate to Source Voltage



Test Circuit and Waveform

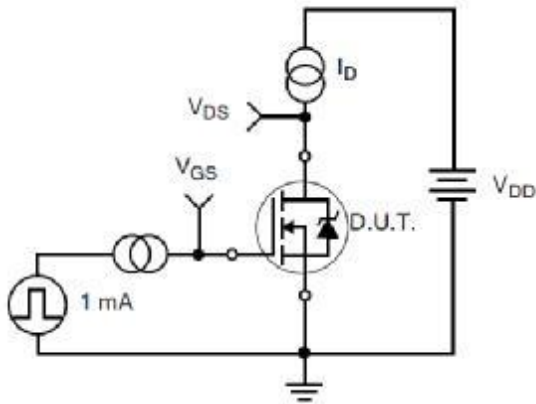


Figure 17. Gate Charge Test Circuit

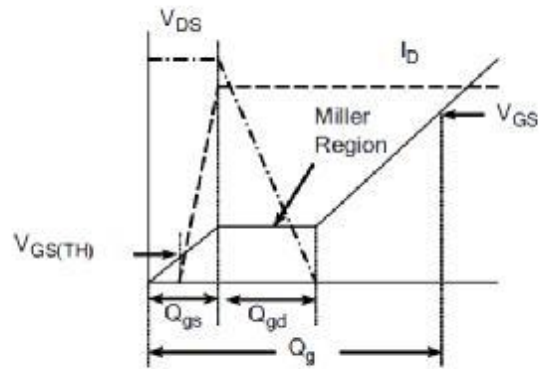


Figure 18. Gate Charge Waveform

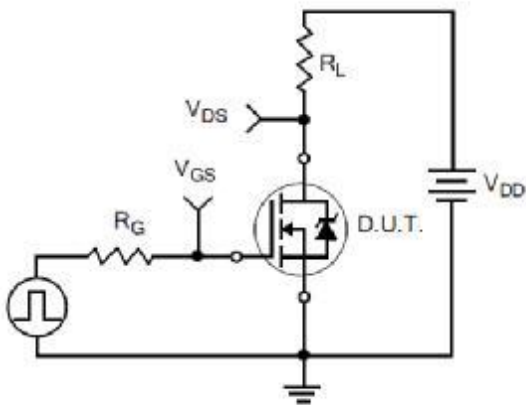


Figure 19. Resistive Switching Test Circuit

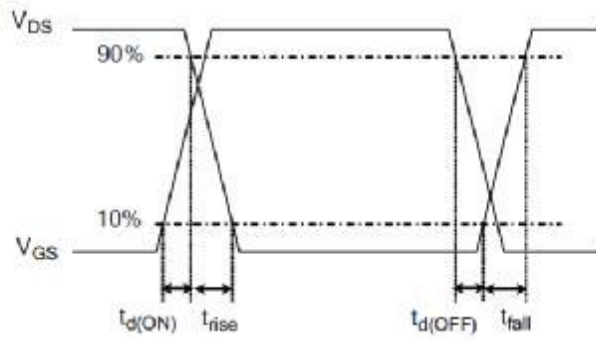


Figure 20. Resistive Switching Waveforms

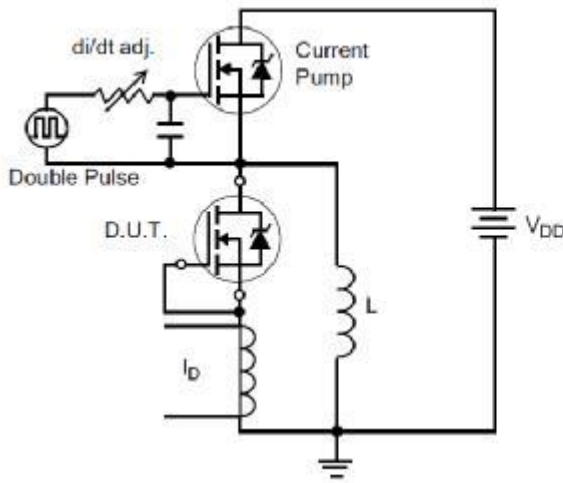


Figure 21. Diode Reverse Recovery Test Circuit

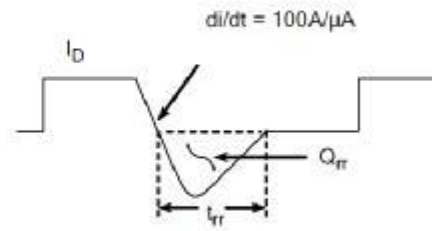


Figure 22. Diode Reverse Recovery Waveform

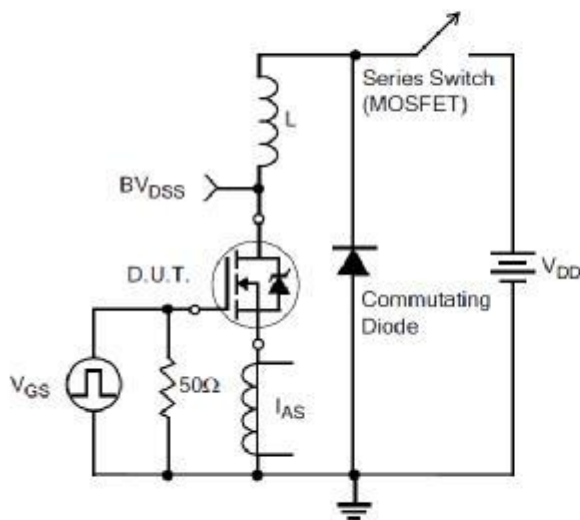


Figure 23. Unclamped Inductive Switching Test Circuit

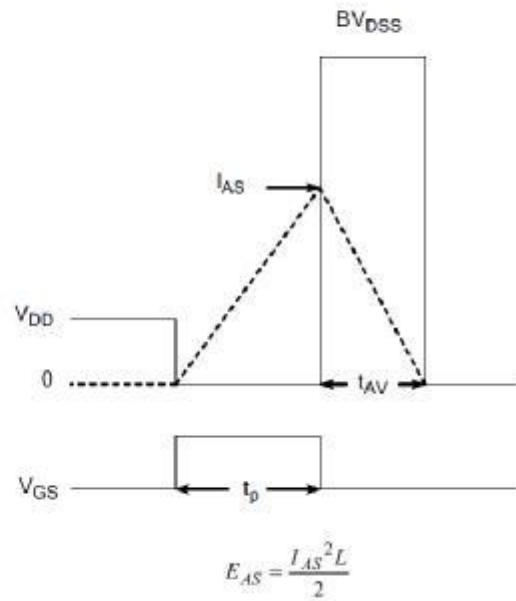
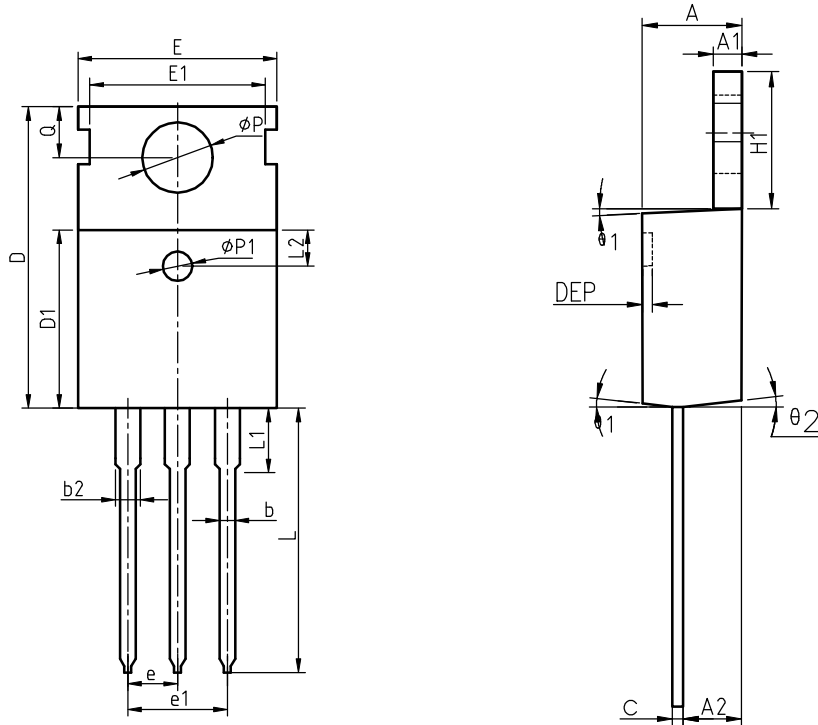


Figure 24. Unclamped Inductive Switching Waveforms



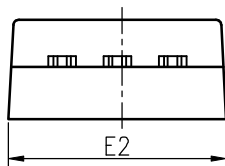
Package Information

TO-220H



COMMON DIMENSIONS

SYMBOL	MIN	NOM	MAX	MIN	NOM	MAX
A	4.40	4.57	4.70	0.173	0.180	0.185
A1	1.27	1.30	1.33	0.050	0.051	0.052
A2	2.35	2.40	2.50	0.093	0.094	0.098
b	0.77	0.80	0.90	0.030	0.031	0.035
b2	1.17	1.27	1.36	0.046	0.050	0.054
c	0.48	0.50	0.56	0.019	0.020	0.022
D	15.40	15.60	15.80	0.606	0.614	0.622
D1	9.00	9.10	9.20	0.354	0.358	0.362
DEP	0.05	0.10	0.20	0.002	0.004	0.008
E	9.80	10.00	10.20	0.386	0.394	0.402
E1	-	8.70	-	-	0.343	-
E2	9.80	10.00	10.20	0.386	0.394	0.402
e		2.54	BSC		0.100	BSC
e1		5.08	BSC		0.200	BSC
H1	6.40	6.50	6.60	0.252	0.256	0.260
L	12.75	13.50	13.65	0.502	0.531	0.537
L1	-	3.10	3.30	-	0.122	0.130
L2		2.50	REF		0.098	REF
P	3.50	3.60	3.63	0.138	0.142	0.143
P1	3.50	3.60	3.63	0.138	0.142	0.143
Q	2.73	2.80	2.87	0.107	0.110	0.113
theta 1	5°	7°	9°	5°	7°	9°
theta 2	1°	3°	5°	1°	3°	5°
theta 3	1°	3°	5°	1°	3°	5°





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