



20V P-Channel Power MOSFET

MOSFET

Metal Oixde Semiconductor Field Effect Transistor

HRTK20P035G Data Sheet

Rev. 2020 V1.0





20V P-Channel Power MOSFET

<p>Description</p> <p>P-Channel Power MOSFET designed by HR-Micro Semiconductor Company, according to the advanced Trench Technology. This device provides an excellent Gate charge and $R_{DS(on)}$, which leads to extremely low communication and conduction losses. So it is very suitable for load switch and battery protection applications. The package form is DFN5x6_8L which accords with the RoHS standard.</p>	<p style="text-align: center;">DFN5x6</p>  <p style="text-align: center;">Top View Bottom View</p>	
<p>Features</p> <ul style="list-style-type: none"> • Low FOM $R_{DS(on)} \times Q_{gd}$ • 100% avalanche tested • Easy to use/drive • RoHS compliant 	<p>Applications</p> <ul style="list-style-type: none"> • Power Switch Circuit of Adaptor and Charger • Battery Protection Charge/Discharge  	
<p>Key Performance Parameters</p>		
<p>Parameter</p>	<p>Value</p>	<p>Unit</p>
<p>$V_{DS@ T_c=25^{\circ}C}$</p>	<p>-20</p>	<p>V</p>
<p>$R_{DS(on),max@-4.5V}$</p>	<p>2.6</p>	<p>mΩ</p>
<p>$R_{DS(on),max@-2.5V}$</p>	<p>3.5</p>	<p>mΩ</p>
<p>$Q_{g,typ}$</p>	<p>373</p>	<p>nC</p>
<p>$I_D@T_c=25^{\circ}C$</p>	<p>-85</p>	<p>A</p>
<p>$I_{D,pulse}$</p>	<p>-340</p>	<p>A</p>
<p>$E_{AS}^{1)}$</p>	<p>320</p>	<p>mJ</p>
<p>$PD@ T_c=25^{\circ}C$</p>	<p>104</p>	<p>W</p>
<p>T_J, T_{STG}</p>	<p>-55 to 150</p>	<p>$^{\circ}C$</p>
<p>Device Marking and Package Information</p>		
<p>Device</p>	<p>Package</p>	<p>Marking</p>
<p>HRTK20P035G</p>	<p>DFN5x6_8L</p>	<p>20P035G</p>
<p></p>	<p></p>	<p></p>



Absolute Maximum Ratings $T_A = 25^\circ\text{C}$, unless otherwise noted			
Parameter	Symbol	Values	Unit
Drain-Source voltage($V_{GS}=0V$)	V_{DS}	-20	V
Continuous Drain Current ²⁾	I_D	$T_C = 25^\circ\text{C}$	-85
		$T_C = 100^\circ\text{C}$	-53.5
Pulsed Drain Current ³⁾	$I_{D,pulse}$	-340	A
Gate-Source Voltage	V_{GSS}	$\pm 10V$	V
Single Pulse Avalanche Energy	E_{AS}	320	mJ
Power Dissipation	P_D	104	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150	$^\circ\text{C}$

Thermal Resistance			
Parameter	Symbol	Max.	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	1.2	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	35	$^\circ\text{C/W}$

Notes

- 1) $L=0.5\text{mH}$, $V_{DD}=-15V$, Start $T_J=25^\circ\text{C}$
- 2) Limited by maximum junction temperature.
- 3) Repetitive Rating: Pulse width limited by maximum junction temperature.



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	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = -250\mu A$	-20	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -20V$ $V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	-1	μA
		$V_{DS} = -16V$, $V_{GS} = 0V, T_J = 125^\circ\text{C}$	--	--	-100	
Gate-Source Leakage Current	I_{GSS}	$V_{GS} = \pm 10V$	--	--	± 100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\mu A$	-0.4	-0.65	-1.0	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	$V_{GS} = -4.5V, I_D = -20A$	--	2.1	2.6	$m\Omega$
		$V_{GS} = -2.5V, I_D = -20A$	--	2.8	3.5	$m\Omega$
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{GS} = 0V$, $V_{DS} = -10V$ $f = 1.0\text{MHz}$	--	11371	--	pF
Output Capacitance	C_{oss}		--	1910	--	
Reverse Transfer Capacitance	C_{rss}		--	1302	--	
Total Gate Charge	Q_g	$V_{DS} = -10V, I_D = -20A$ $V_{GS} = -10V$	--	373	--	nC
Gate-Source Charge	Q_{gs}		--	24	--	
Gate-Drain Charge	Q_{gd}		--	40	--	
Gate Plateau Voltage	$V_{plateau}$		--	1.4	--	V
Turn-on Delay Time	$t_{d(on)}$	$V_{DS} = -10V, V_{GS} = -10V$ $R_G = 3\Omega, I_D = -20A$	--	13	--	ns
Turn-on Rise Time	t_r		--	12	--	
Turn-off Delay Time	$t_{d(off)}$		--	350	--	
Turn-off Fall Time	t_f		--	136	--	
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V_{SD}	$T_J = 25^\circ\text{C}, I_{SD} = -20A$, $V_{GS} = 0V$	--	--	-1.2	V
Continuous Diode Forward Current	I_S		--	--	-85	A
Reverse Recovery Time	t_{rr}	$I_F = -20A, di_F/dt = 100A/\mu s$	--	75	--	ns
Reverse Recovery Charge	Q_{rr}		--	61	--	nC



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

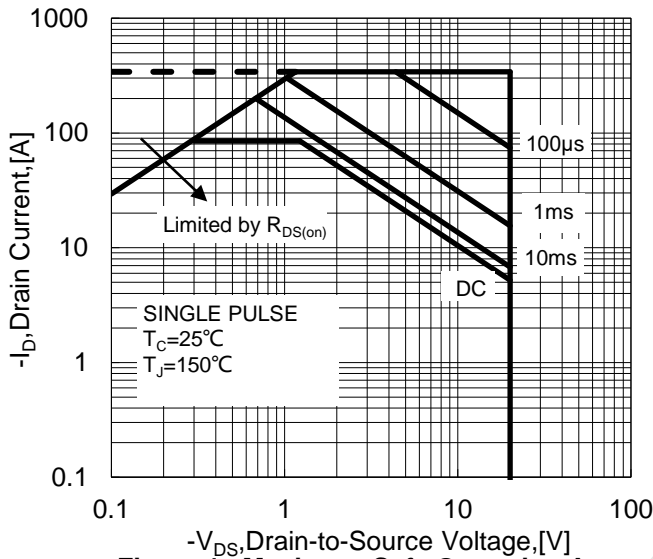


Figure 1. Maximum Safe Operating Area

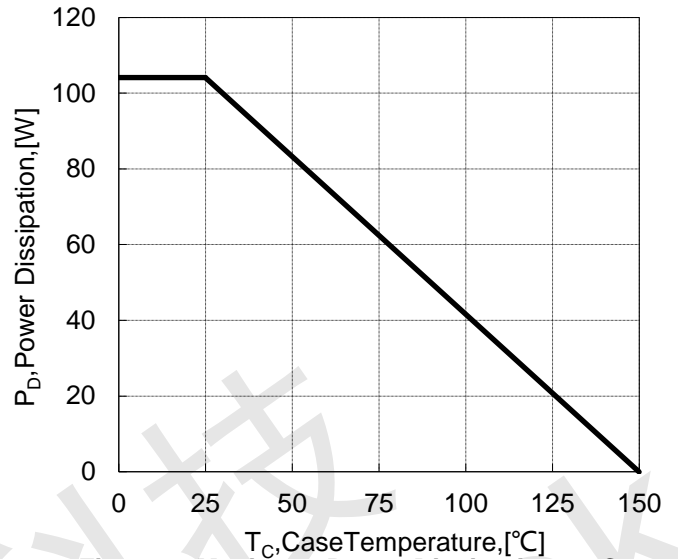


Figure 2. Maximum Power Dissipation vs Case Temperature

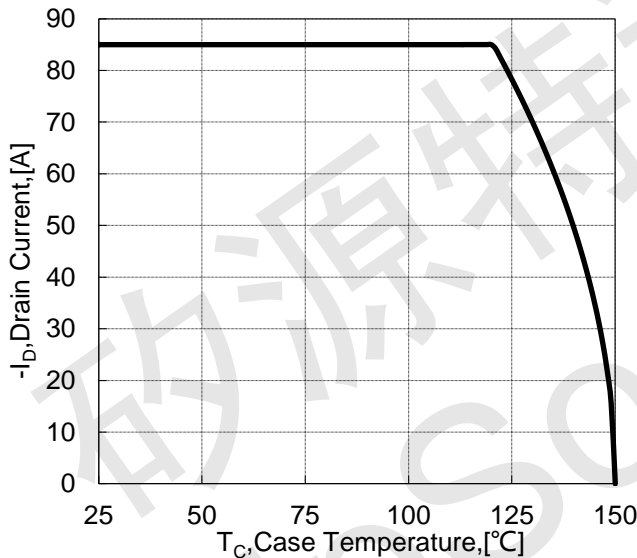


Figure 3. Maximum Continuous Drain Current vs Case Temperature

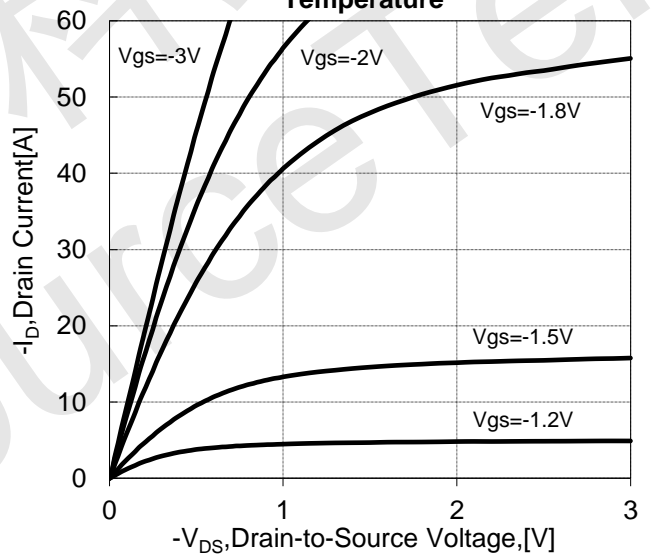


Figure 4. Typical output Characteristics

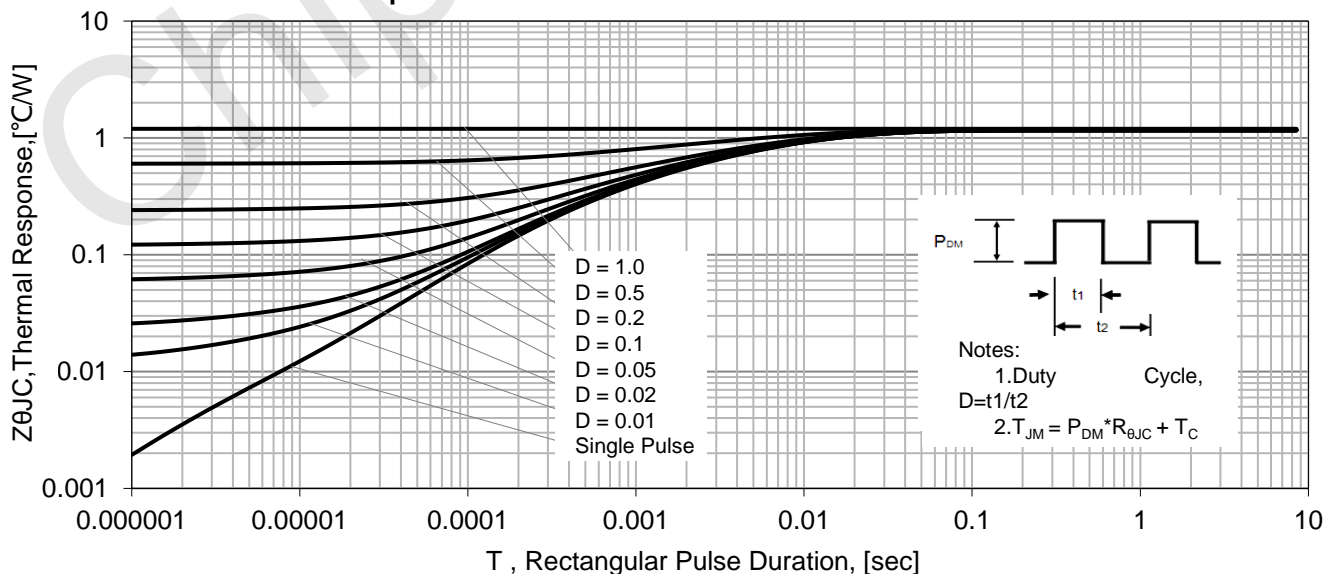


Figure 5 Maximum Effective Thermal Impedance , Junction to Case



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

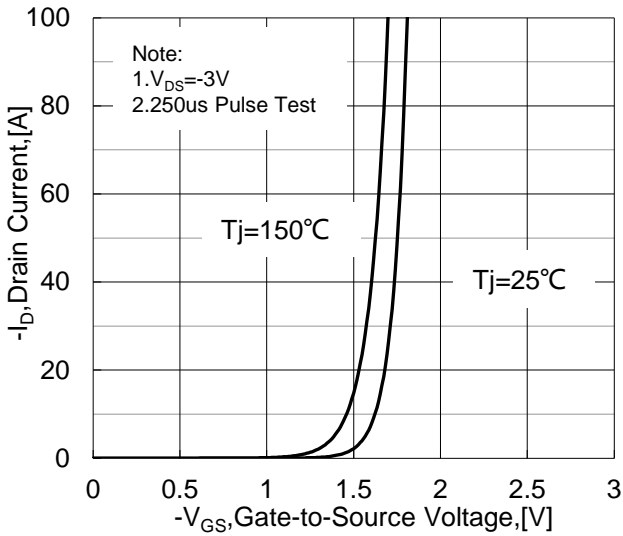


Figure 6 Typical Transfer Characteristics

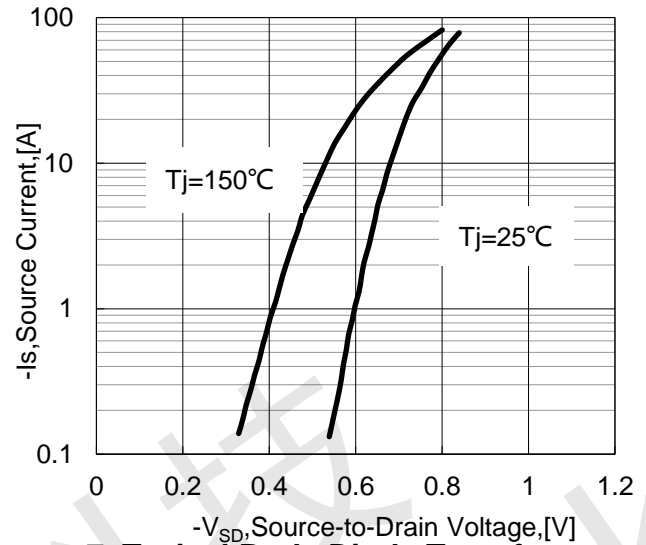


Figure 7 Typical Body Diode Transfer Characteristics

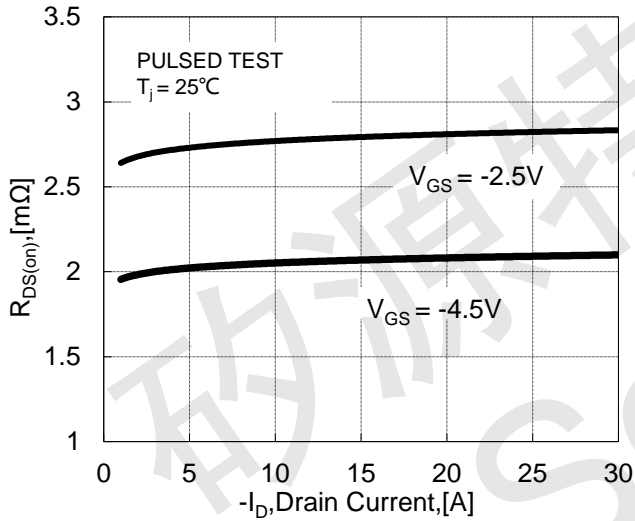


Figure 8. Drain-to-Source On Resistance vs Drain Current

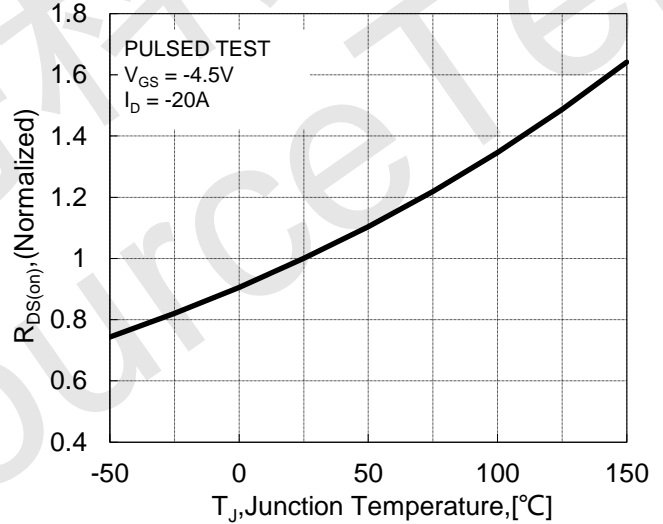


Figure 9. Normalized On Resistance vs Junction Temperature

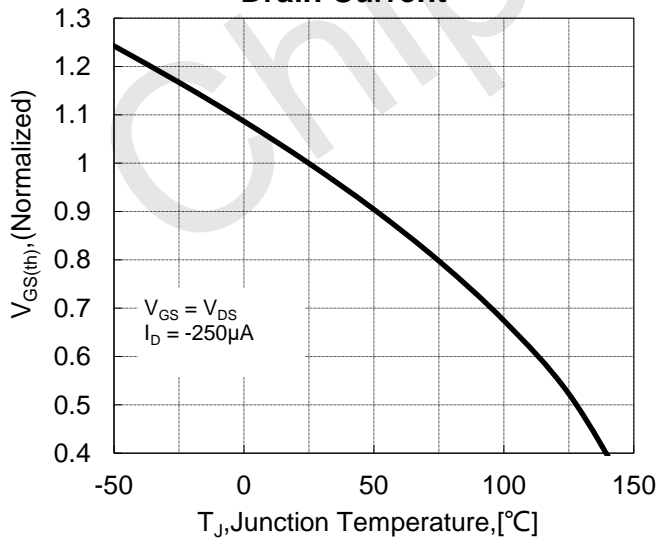


Figure 10. Normalized Threshold Voltage vs Junction Temperature

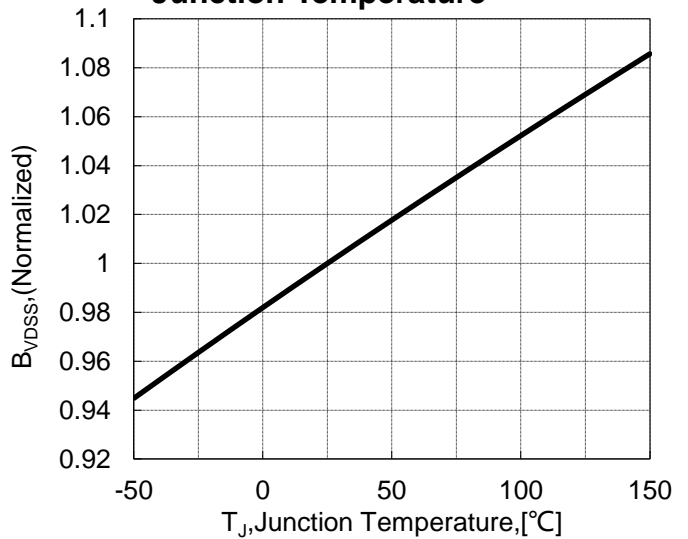


Figure 11. Normalized Breakdown Voltage vs Junction Temperature



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

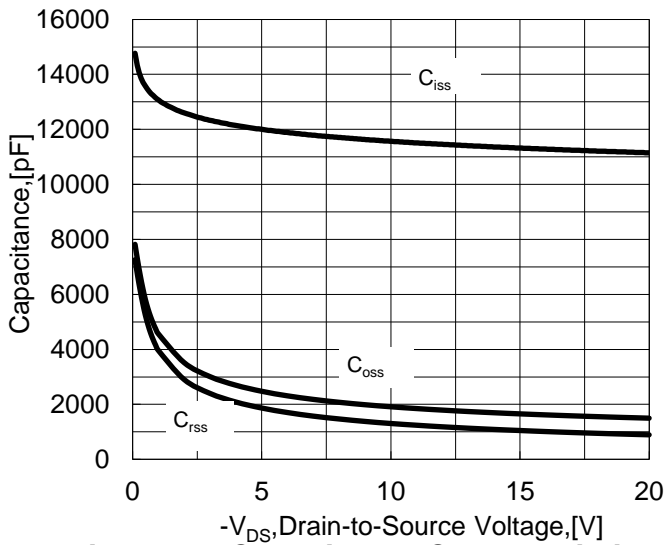


Figure 12. Capacitance Characteristics

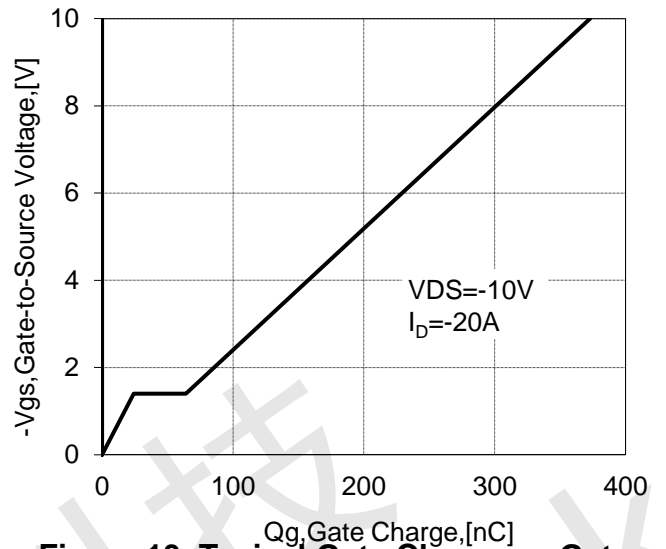


Figure 13 Typical Gate Charge vs Gate to Source Voltage



Figure A: Gate Charge Test Circuit and Waveform

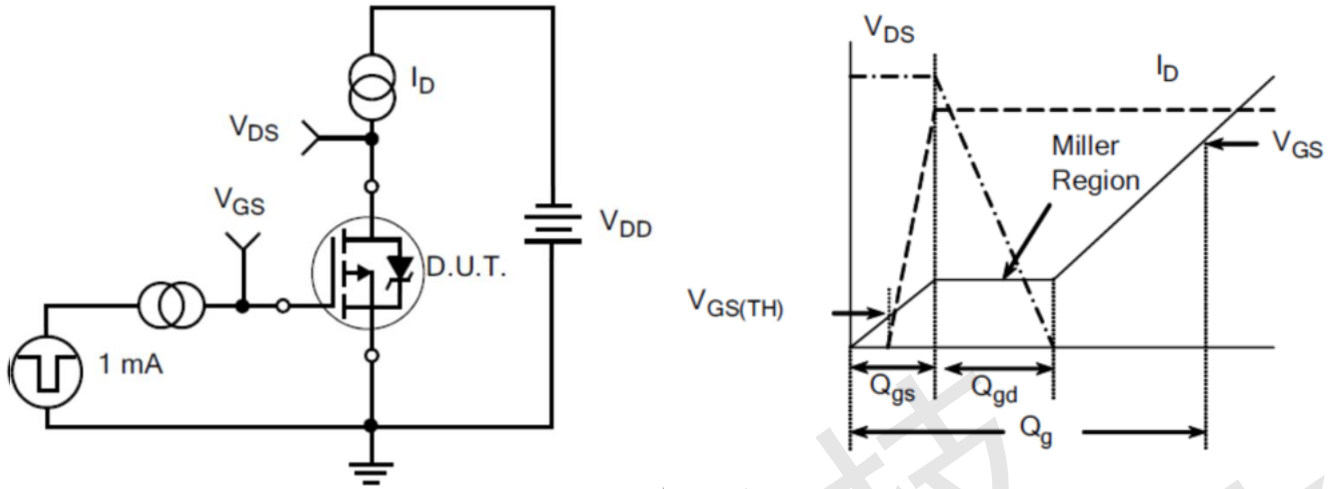


Figure B: Resistive Switching Test Circuit and Waveform

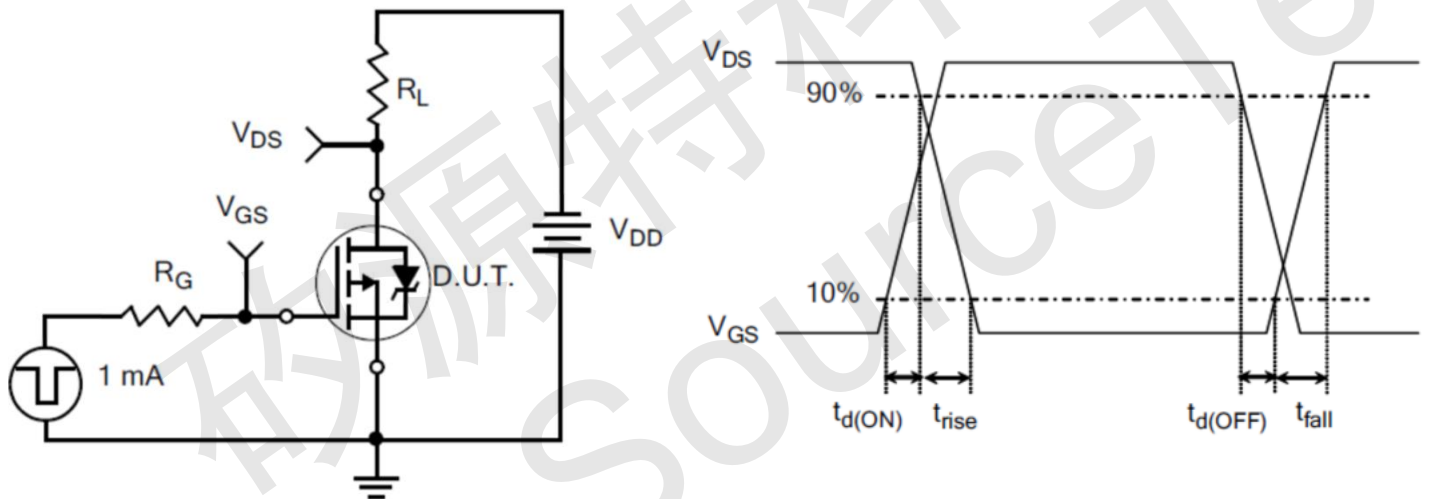
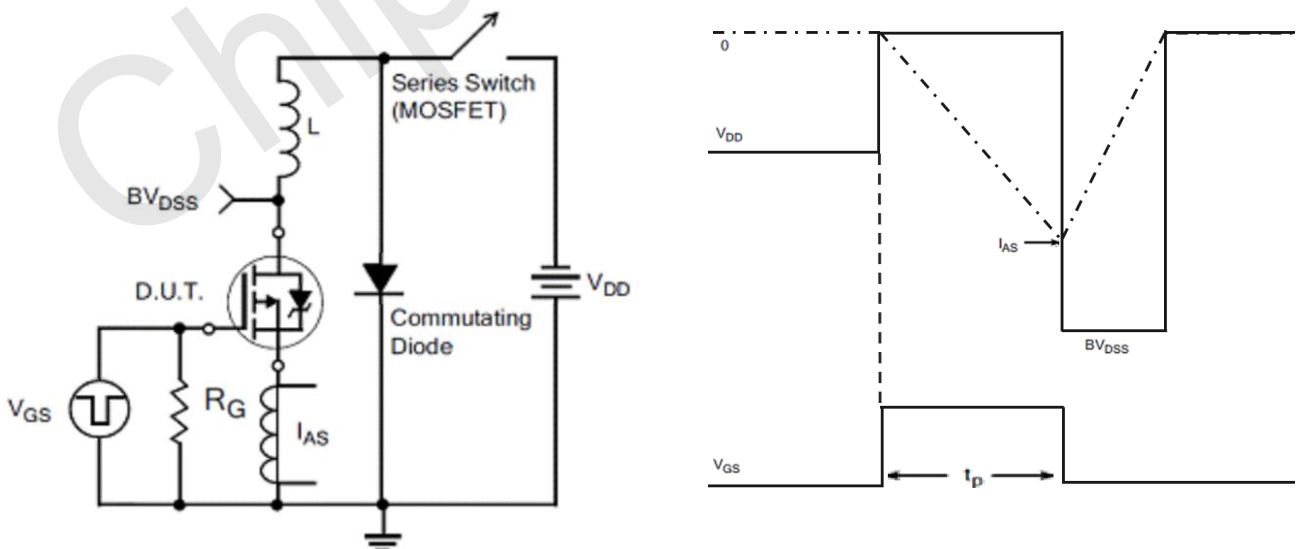
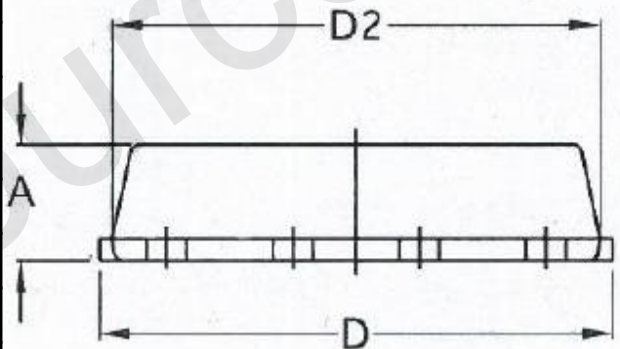
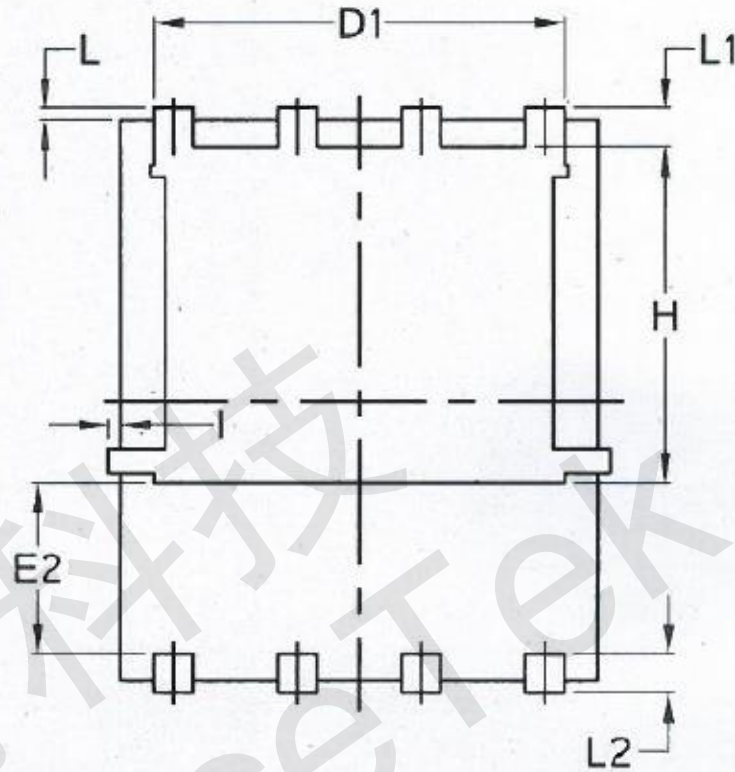
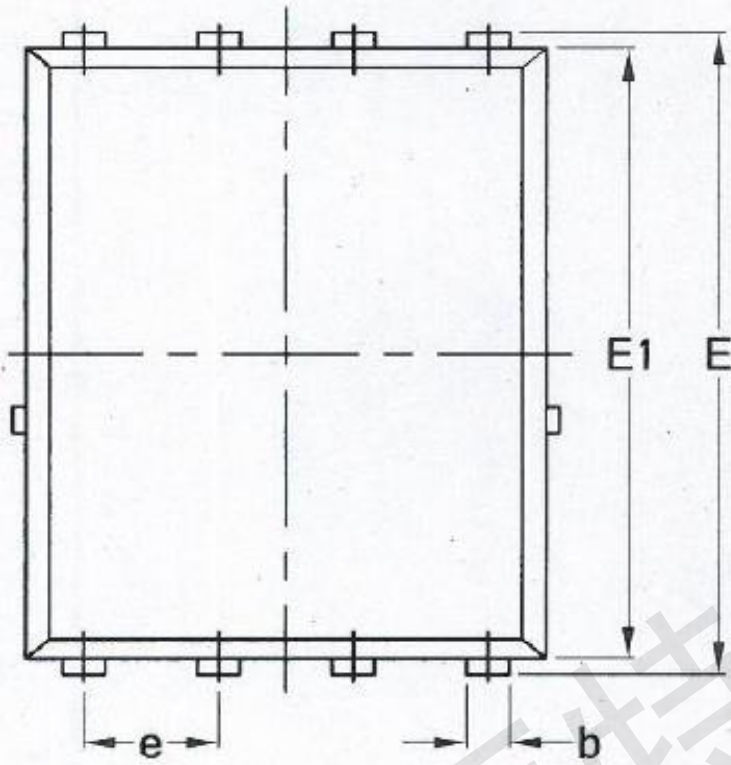


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





DFN5x6 Package



S Y M B O L	COMMON			
	MM		INCN	
	MIN	MAX	MIN	MAX
A	1.03	1.17	0.0406	0.0461
B	0.34	0.48	0.0134	0.0189
C	0.824	0.970	0.0324	0.0382
D	4.80	5.40	0.1890	0.2126
D1	4.11	4.31	0.1618	0.1697
D2	4.80	5.00	0.1890	0.1969
E	5.95	6.15	0.2343	0.2421
E1	5.65	5.85	0.2224	0.2303
E2	1.60	—	0.0630	—
e	1.27 BSC		0.05 BSC	
L	0.05	0.25	0.0020	0.0098
L1	0.38	0.50	0.0150	0.0197
L2	0.38	0.50	0.0150	0.0197
H	3.30	3.50	0.1299	0.1378
I	—	0.18	—	0.0070



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