60V N-Channel Power MOSFET

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

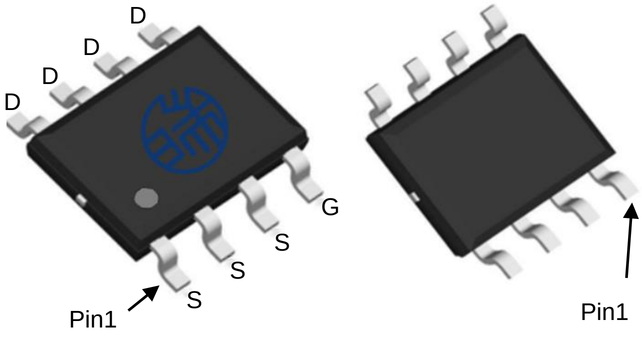
HRT60N20E Data Sheet

Rev. 2020 V1.0

60V N-Channel Power MOSFET

Description

N-Channel Power MOSFET designed by HR-Micro Semiconductor Company,according to the advanced Trench Technology. This devices provide an excellent Gate charge and R_{DS}(on), which leads to extremely communication and conduction losses. So it is very suitable for AC/DC power conversion, load switch and industrial power applications.

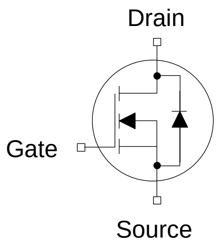


Features

- Low FOM $R_{DS(on)} \times Q_{gd}$
- 100% avalanche tested
- Easy to use/drive
- RoHS compliant

Applications

- DC/DC Converter
- Battery Protection Charge/Discharge
- Load Switch
- Synchronous Rectification



RoHS

Key Performance Parameters

Parameter	Value	Unit
$V_{DS@\ TA=25℃}$	60	V
$R_{DS(on),max@10V}$	14	mΩ
$R_{DS(on),max@4.5V}$	18.5	mΩ
$Q_{g,typ}$	45	nC
$I_{D@TA=25℃}$	11	A
$I_{D,pulse}$	44	A
E_{AS} 1)	124	mJ

Device Marking and Package Information

Device	Package	Marking
HRT60N20E	SOP-8	60N20E

Absolute Maximum Ratings T_A = 25ºC, unless otherwise noted				
Parameter		**Symbol**	**Values**	**Unit**
Drain-Source voltage(V_{GS}=0V)		V_{DS}	60	V
Continuous Drain Current[2]	T_A = 25ºC	I_D	11	A
	T_A = 100ºC		6.9	
Pulsed Drain Current[3]		$I_{D,pulse}$	44	A
Gate-Source Voltage		V_{GSS}	±20	V
Single Pulse Avalanche Energy[1]		E_{AS}	124	mJ
Power Dissipation		P_D	2.9	W
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150	ºC

Thermal Resistance			
Parameter	**Symbol**	**Max.**	**Unit**
Thermal Resistance, Junction-to-Ambient	R_{thJA}	42	ºC/W

Notes

1) L=0.5mH,V_{DD}=30V, Start T_J=25℃.

2) Limited by maximum junction temperature.

3) Repetitive Rating: Pulse width limited by maximum junction temperature.

Electrical Characteristics T_J = 25ºC, 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 = 250μA	60	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 60V V_{GS} = 0V, T_J = 25ºC	--	--	1	μA
		V_{DS} = 48V, V_{GS} = 0V, T_J = 125ºC	--	--	100	
Gate-Source Leakage Current	I_{GSS}	V_{GS} = ±20V	--	--	±100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250μA	1	1.8	3	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	V_{GS} = 10V, I_D = 11A	--	11.2	14	mΩ
Drain-Source On-State-Resistance	$R_{DS(on)}$	V_{GS} = 4.5V, I_D = 8A	--	14.5	18.5	mΩ
Gate Resistance	R_G	f = 1.0MHz open drain	--	1.2	--	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 30V f = 1.0MHz	--	1739	--	pF
Output Capacitance	C_{oss}		--	124	--	
Reverse Transfer Capacitance	C_{rss}		--	110	--	
Total Gate Charge	Q_g	V_{DS} = 30V, I_D = 20A V_{GS} = 10V	--	46	--	nC
Gate-Source Charge	Q_{gs}		--	9.7	--	
Gate-Drain Charge	Q_{gd}		--	12.5	--	
Gate Plateau Voltage	$V_{Plateau}$		--	4.1	--	V
Turn-on Delay Time	$t_{d(on)}$	V_{DS} = 30V, V_{GS} =10V R_G = 3Ω, I_D =20	--	8	--	ns
Turn-on Rise Time	t_r		--	6	--	
Turn-off Delay Time	$t_{d(off)}$		--	27	--	
Turn-off Fall Time	t_f		--	5	--	
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 20A, V_{GS} = 0V	--	--	1.2	V
Continuous Diode Forward Current	I_S		--	--	11	A
Reverse Recovery Time	t_{rr}	I_F = 20A, di_F/dt = 100A/μs	--	25	--	ns
Reverse Recovery Charge	Q_{rr}		--	34	--	nC

Typical Characteristics T_J = 25ºC, unless otherwise noted

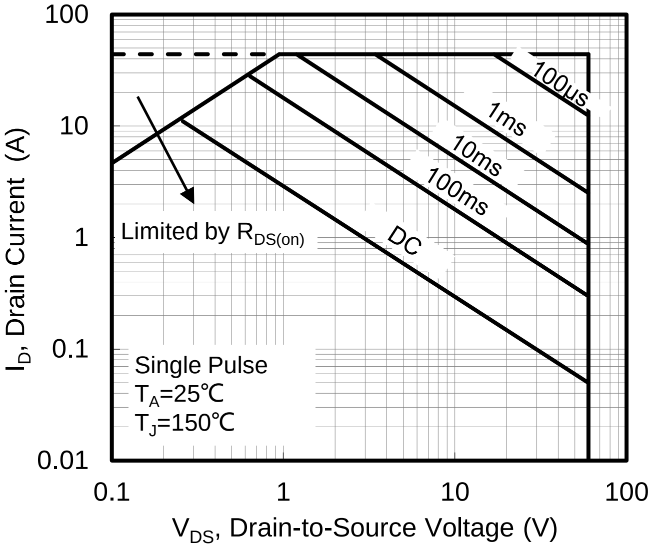


Figure 1. Maximum Safe Operating Area

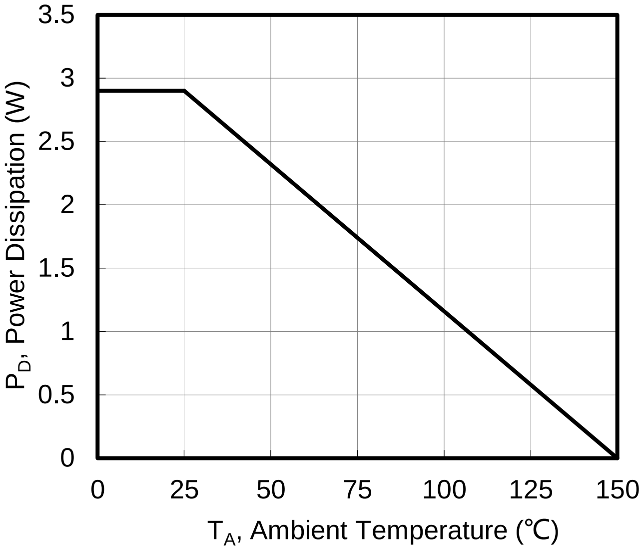


Figure 2. Maximum Power Dissipation vs Ambient Temperature

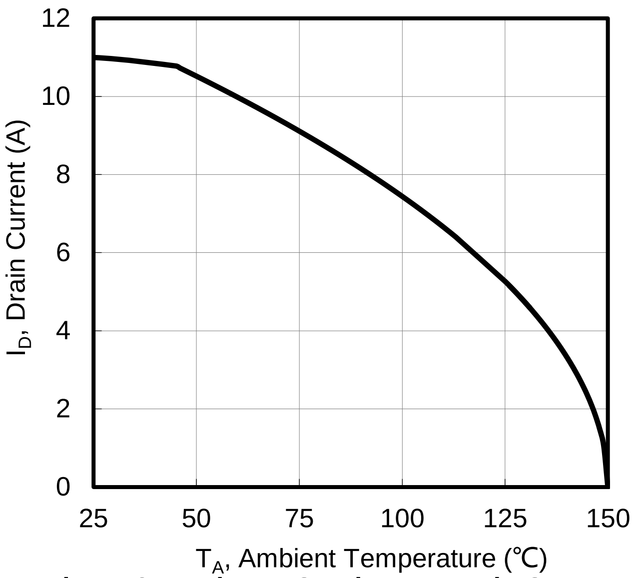


Figure 3. Maximum Continuous Drain Current vs Ambient Temperature

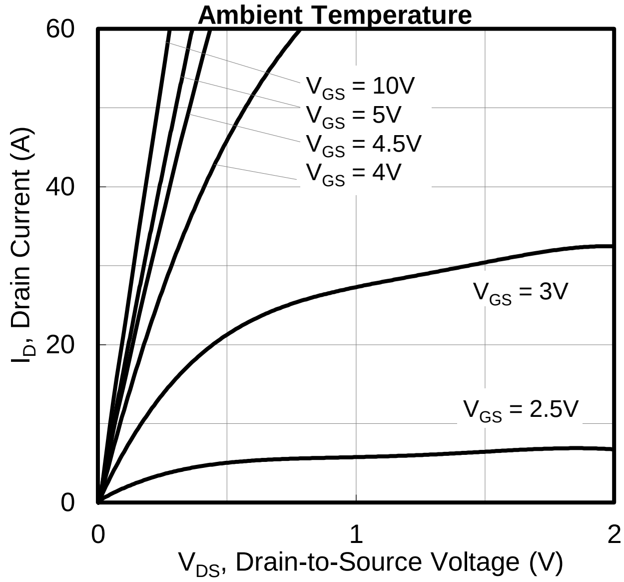


Figure 4. Typical output Characteristics

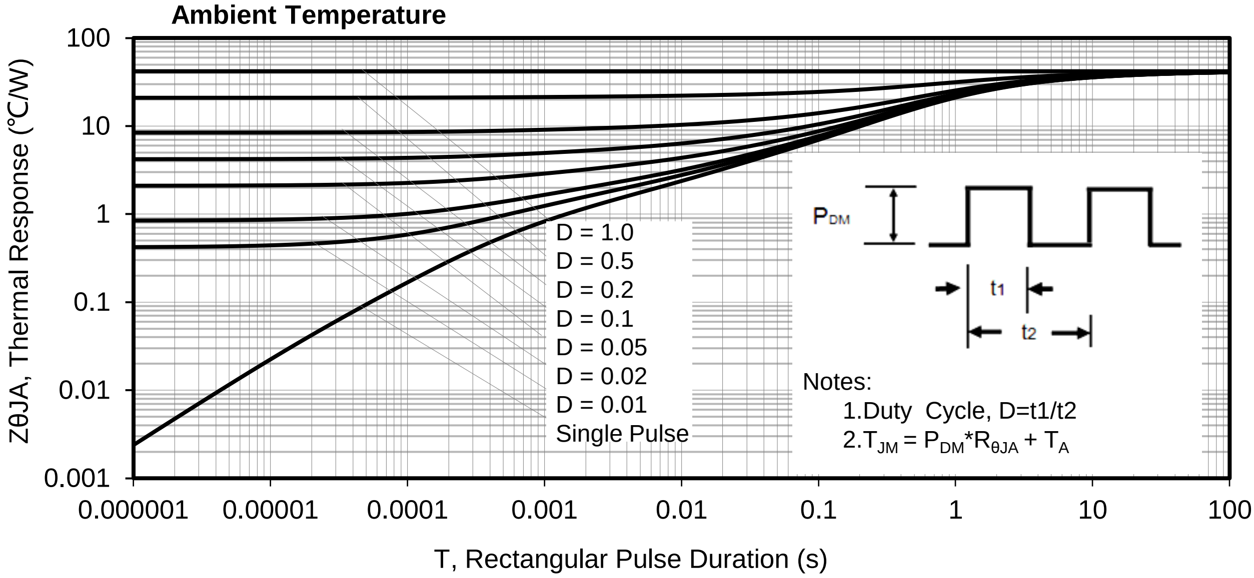


Figure 5. Maximum Effective Thermal Impedance, Junction to Ambient

Typical Characteristics T_J = 25ºC, unless otherwise noted

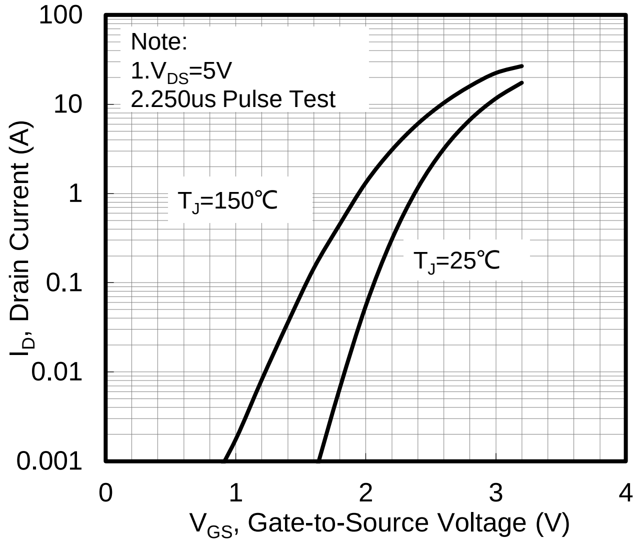


Figure 6. Typical Transfer Characteristics

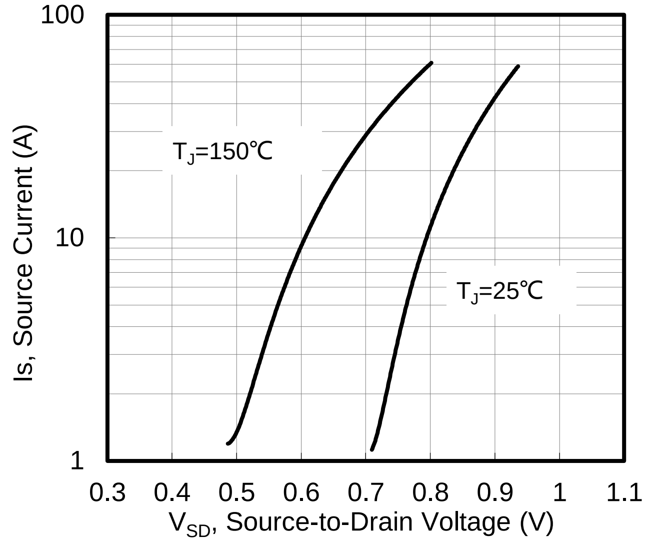


Figure 7. Typical Body Diode Transfer Characteristics

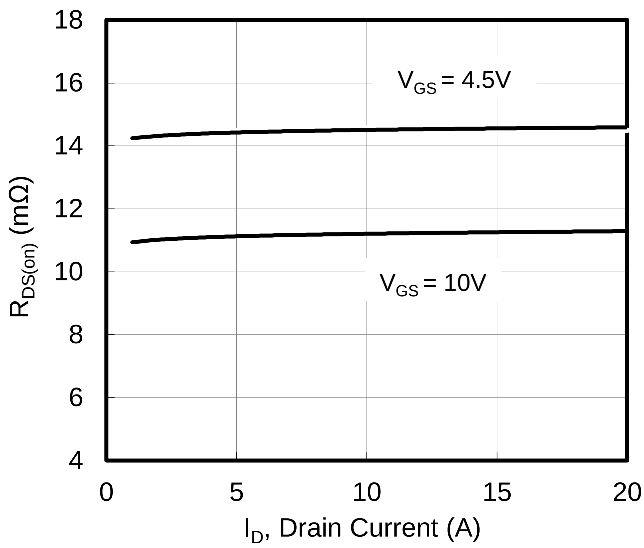


Figure 8. Drain-to-Source On Resistance vs Drain Current

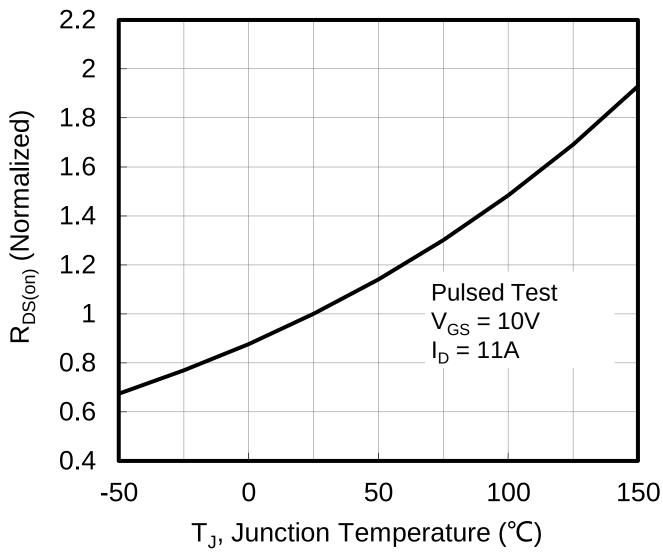


Figure 9. Normalized On Resistance vs Junction Temperature

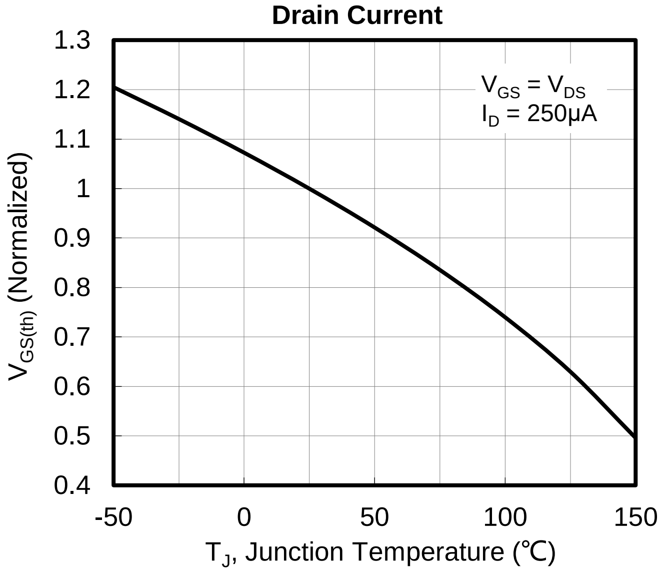


Figure10. Normalized Threshold Voltage vs Junction Temperature

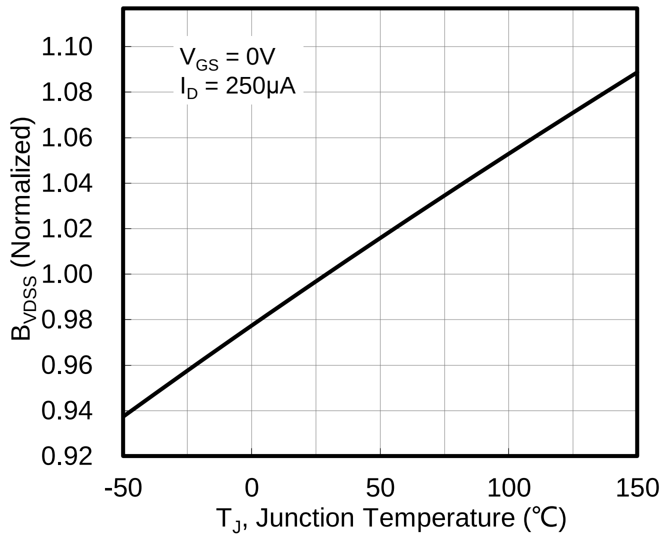


Figure 11. Normalized Breakdown Voltage vs Junction Temperature

Typical Characteristics T_J = 25ºC, unless otherwise noted

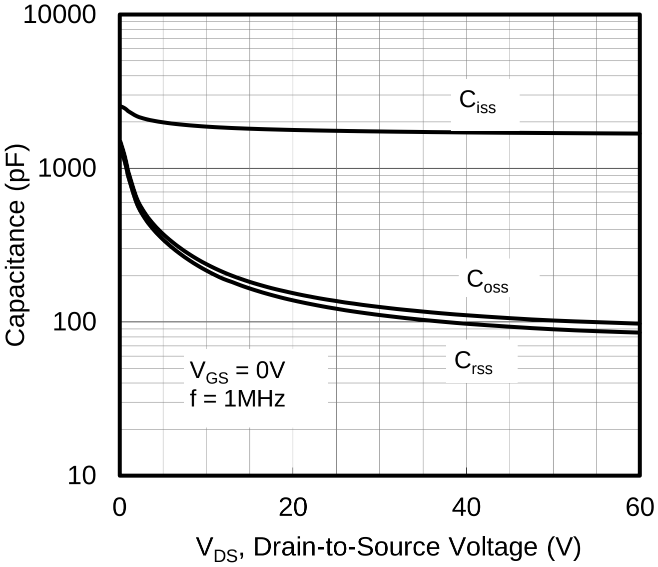


Figure 12. Capacitance Characteristics

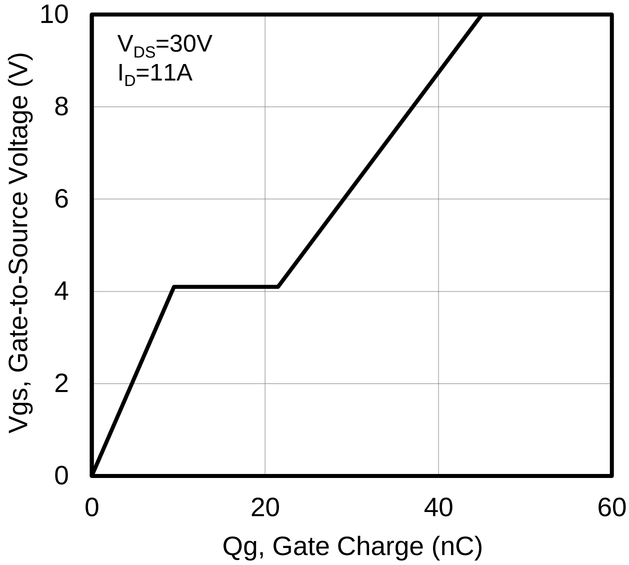


Figure 13. Typical Gate Charge vs Gate to Source Voltage

Figure A：Gate Charge Test Circuit and Waveform

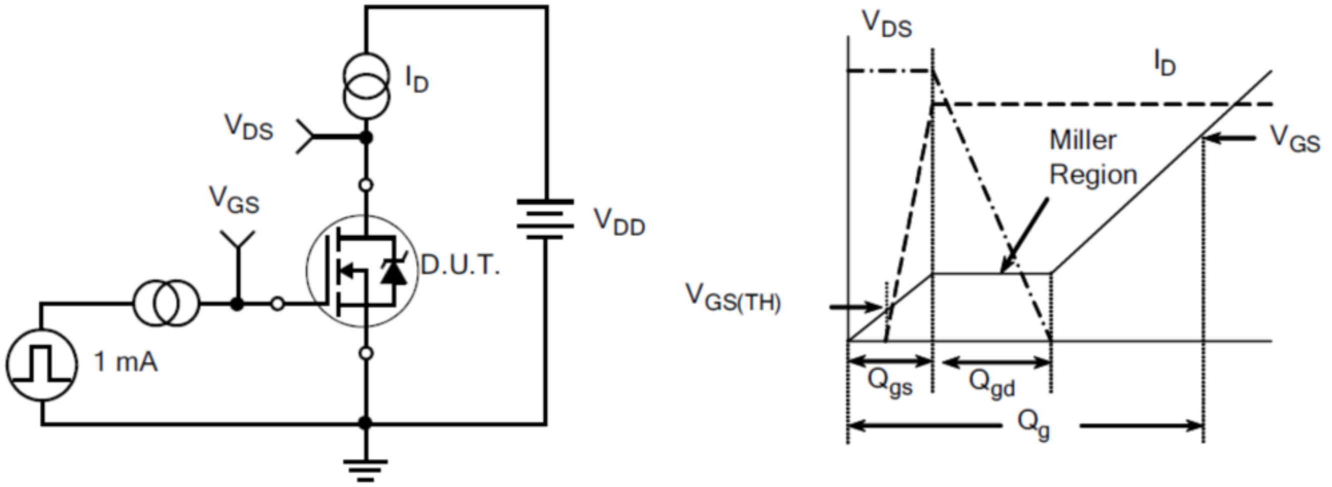


Figure B：Resistive Switching Test Circuit and Waveform

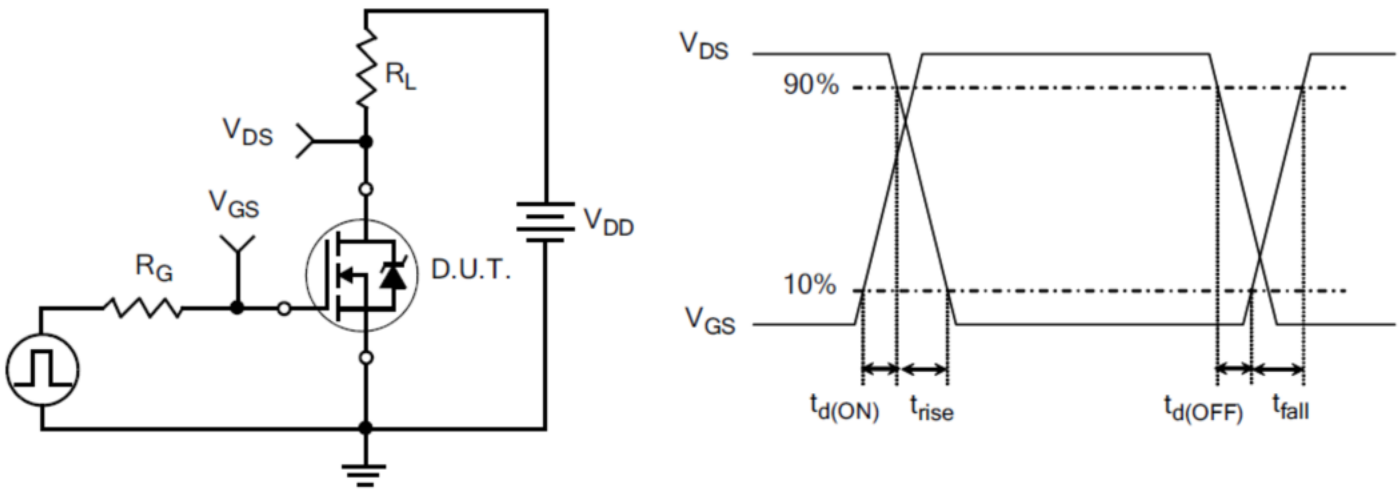
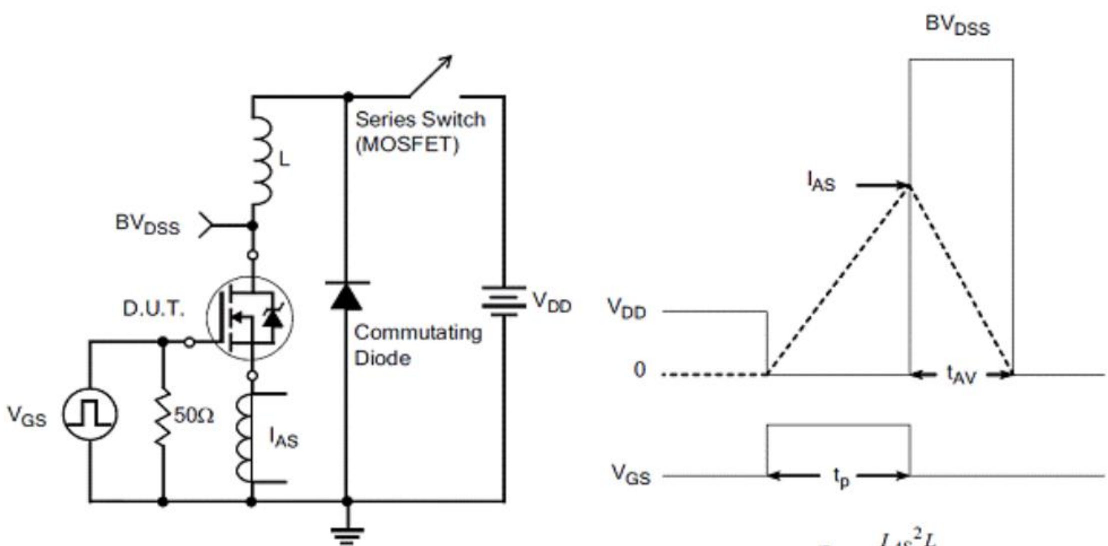
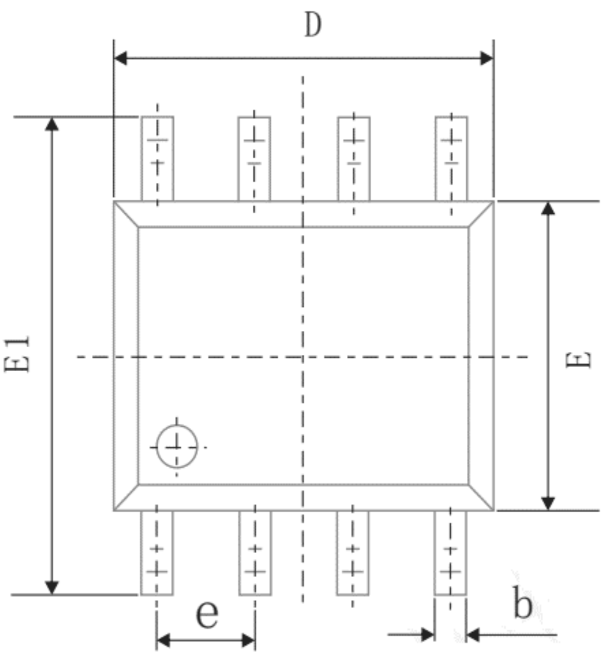


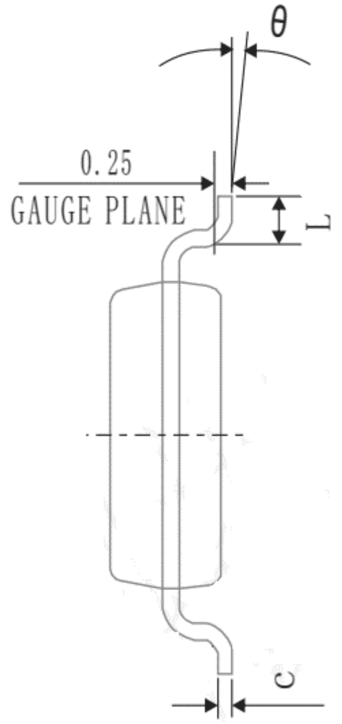
Figure C：Unclamped Inductive Switching Test Circuit and Waveform

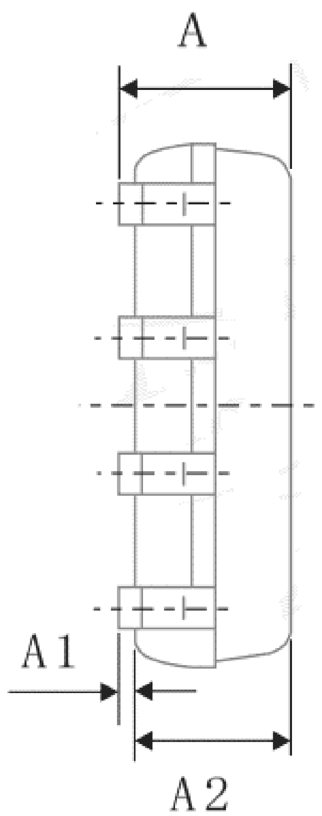


$$E_{AS} = \frac{I_{AS}^2 L}{2}$$

Outlines SOP-8 Package







COMMON DIMENSIONS

(UNITS OF MEASURE=mm)

SYMBOL	MIN	NOM	MAX
A	1.35	1.575	1.8
A1	0.05	0.165	0.25
A2	1.25	1.4125	1.55
b	0.3	0.425	0.51
c	0.153	0.2115	0.253
D	4.8	4.9	5
E	3.8	3.9	4
E1	5.8	6	6.2
L	0.45	0.71	1
θ	0°	4°	8°
e	1.27 BSC		

Disclaimer

HRM has made reasonable commercial efforts to ensure that the information given in this datasheet is correct. However, it must clearly be understood that such information is for guidance only and does not constitute any representation or form part of any offer or contract.

For documents and material available from this datasheet, HRM does not warrant or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, product, technology or process disclosed hereunder.

HRM reserves the rights to at its own discretion to make any changes or improvements to this datasheet. Unless said datasheet is incorporated into the formal contract, any customer should not rely on the information as any specification or product parameters duly committed by HRM. Customers are hereby advised to verify that the information contained herein is current and complete before the entering of any contract or acknowledgement of any purchase order. Accordingly, all products specified hereunder shall be sold subject to HRM’s terms and conditions supplied at the time of order acknowledgement. Except where agreed upon by contractual agreement, testing of all parameters of each product is not necessarily performed.

HRM does not warrant or convey any license either expressed or implied under its patent rights, nor the rights of others. Reproduction of information contained herein shall be only permissible if such reproduction is without any modification or alteration. Reproduction of this information with any alteration is an unfair and deceptive business practice. HRM is not responsible or liable for such altered documentation.

Resale of HRM’s products with statements different from or beyond the parameters stated by HRM for that product or service voids all express or implied warrantees for the associated HRM’s product or service and is unfair and deceptive business practice. HRM is not responsible or liable for any such statements.

HRM’s products are not authorized for use as critical components in life support devices or systems without the express written approval of HRM. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.