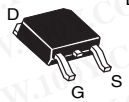


勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
 Http://www.100y.com.tw

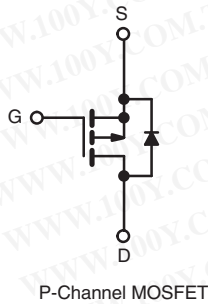
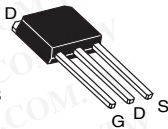
Power MOSFET

PRODUCT SUMMARY	
V_{DS} (V)	- 50
$R_{DS(on)}$ (Ω)	$V_{GS} = - 10$ V 0.28
Q_g (Max.) (nC)	14
Q_{gs} (nC)	6.5
Q_{gd} (nC)	6.5
Configuration	Single

DPAK (TO-252)



IPAK (TO-251)



FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Surface Mountable (Order As IRFR9020, SiHFR9020)
- Straight Lead Option (Order As IRFU9020, SiHFU9020)
- Repetitive Avalanche Ratings
- Dynamic dV/dt Rating
- Simple Drive Requirements
- Ease of Paralleling
- Compliant to RoHS Directive 2002/95/EC



DESCRIPTION

The Power MOSFET technology is the key to Vishay's advanced line of Power MOSFET transistors. The efficient geometry and unique processing of this latest "State of the Art" design achieves: very low on-state resistance combined with high transconductance; superior reverse energy and diode recovery dV/dt .

The Power MOSFET transistors also feature all of the well established advantages of MOSFET'S such as voltage control, very fast switching, ease of paralleling and temperature stability of the electrical parameters.

Surface mount packages enhance circuit performance by reducing stray inductances and capacitance. The TO-252 surface mount package brings the advantages of Power MOSFET's to high volume applications where PC Board surface mounting is desirable. The surface mount option IRFR9020, SiHFR9020 is provided on 16mm tape. The straight lead option IRFU9020, SiHFU9020 of the device is called the IPAK (TO-251).

They are well suited for applications where limited heat dissipation is required such as, computers and peripherals, telecommunication equipment, dc-to-dc converters, and a wide range of consumer products.

ORDERING INFORMATION				
Package	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)	IPAK (TO-251)
Lead (Pb)-free and Halogen-free	SiHFR9020-GE3	SiHFR9020TR-GE3 ^a	SiHFR9020TRL-GE3 ^a	SiHFU9020-GE3
Lead (Pb)-free	IRFR9020PbF	IRFR9020TRPbF ^a	IRFR9020TRLPbF ^a	IRFU9020PbF
	SiHFR9020-E3	SiHFR9020T-E3 ^a	SiHFR9020TL-E3 ^a	SiHFU9020-E3
SnPb	IRFR9020	IRFR9020TR ^a	IRFR9020TRL ^a	IRFU9020
	SiHFR9020	SiHFR9020T ^a	SiHFR9020TL ^a	SiHFU9020

Note

a. See device orientation.

ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V_{DS}	- 50	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current	V_{GS} at - 10 V	$T_C = 25$ °C	- 9.9
		$T_C = 100$ °C	- 6.3
Pulsed Drain Current ^a		I_{DM}	- 40
Linear Derating Factor			0.33
			W/°C

* Pb containing terminations are not RoHS compliant, exemptions may apply

IRFR9020, IRFU9020, SiHFR9020, SiHFU9020

Vishay Siliconix



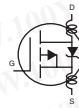
ABSOLUTE MAXIMUM RATINGS $T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted			
PARAMETER	SYMBOL	LIMIT	UNIT
Single Pulse Avalanche Energy ^b	E_{AS}	250	mJ
Repetitive Avalanche Current ^a	I_{AR}	- 9.9	A
Repetitive Avalanche Energy ^a	E_{AR}	4.2	mJ
Maximum Power Dissipation	P_D	42	W
Peak Diode Recovery dV/dt^c	dV/dt	5.8	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature)	for 10 s	300 ^d	


Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 14).
- b. $V_{DD} = - 25\text{ V}$, Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 5.1\text{ mH}$, $R_g = 25\text{ }\Omega$, Peak $I_L = - 9.9\text{ A}$
- c. $I_{SD} \leq - 9.9\text{ A}$, $dI/dt \leq - 120\text{ A}/\mu\text{s}$, $V_{DD} \leq 40\text{ V}$, $T_J \leq 150\text{ }^\circ\text{C}$.
- d. 0.063" (1.6 mm) from case.
- e. When mounted on 1" square PCB (FR-4 or G-10 material).

THERMAL RESISTANCE RATINGS					
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	-	110	$^\circ\text{C}/\text{W}$
Case-to-Sink	R_{thCS}	-	1.7	-	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	-	3.0	

SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}$, $I_D = - 250\text{ }\mu\text{A}$	- 50	-	-	V
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = - 250\text{ }\mu\text{A}$	- 2.0	-	- 4.0	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$	-	-	± 500	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = \text{max. rating}$, $V_{GS} = 0\text{ V}$	-	-	250	μA
		$V_{DS} = 0.8 \times \text{max. rating}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$	-	-	1000	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = - 10\text{ V}$, $I_D = 5.7\text{ A}^b$	-	0.20	0.28	Ω
Forward Transconductance	g_{fs}	$V_{DS} \leq - 50\text{ V}$, $I_{DS} = - 5.7\text{ A}$	2.3	3.5	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = - 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 9	-	490	-	pF
Output Capacitance	C_{oss}		-	320	-	
Reverse Transfer Capacitance	C_{rss}		-	70	-	
Total Gate Charge	Q_g	$V_{GS} = - 10\text{ V}$, $I_D = - 9.7\text{ A}$, $V_{DS} = 0.8 \times \text{max. rating}$, see fig. 16 (Independent operating temperature)	-	9.4	14	nC
Gate-Source Charge	Q_{gs}		-	4.3	6.5	
Gate-Drain Charge	Q_{gd}		-	4.3	6.5	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = - 25\text{ V}$, $I_D = - 9.7\text{ A}$, $R_g = 18\text{ }\Omega$, $R_D = 2.4\text{ }\Omega$, see fig. 15 (Independent operating temperature)	-	8.2	12	ns
Rise Time	t_r		-	57	66	
Turn-Off Delay Time	$t_{d(off)}$		-	12	18	
Fall Time	t_f		-	25	38	
Internal Drain Inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact.	-	4.5	-	nH
Internal Source Inductance	L_S		-	7.5	-	



SPECIFICATIONS $T_J = 25^\circ\text{C}$, unless otherwise noted							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	- 9.9	A	
Pulsed Diode Forward Current ^a	I_{SM}		-	-	- 40		
Body Diode Voltage	V_{SD}	$T_J = 25^\circ\text{C}$, $I_S = -9.9\text{ A}$, $V_{GS} = 0\text{ V}^b$	-	-	- 6.3	V	
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25^\circ\text{C}$, $I_F = -9.7\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}^b$	56	110	280	ns	
Body Diode Reverse Recovery Charge	Q_{rr}		0.17	0.34	0.85	nC	
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)					

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 14).
- b. Pulse width $\leq 300\ \mu\text{s}$; duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS 25°C , unless otherwise noted

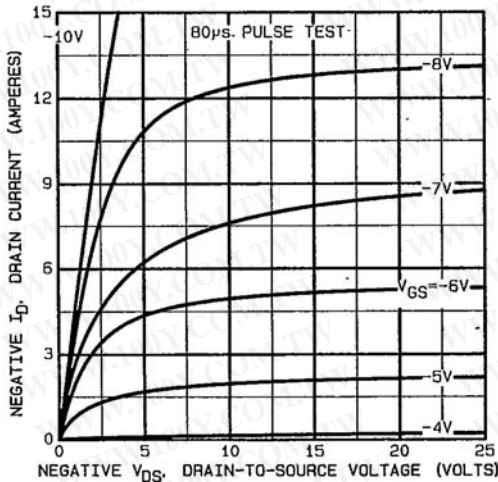


Fig. 1 - Typical Output Characteristics

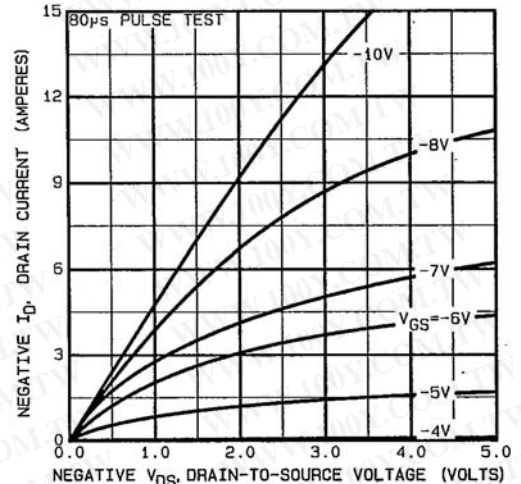


Fig. 3 - Typical Saturation Characteristics

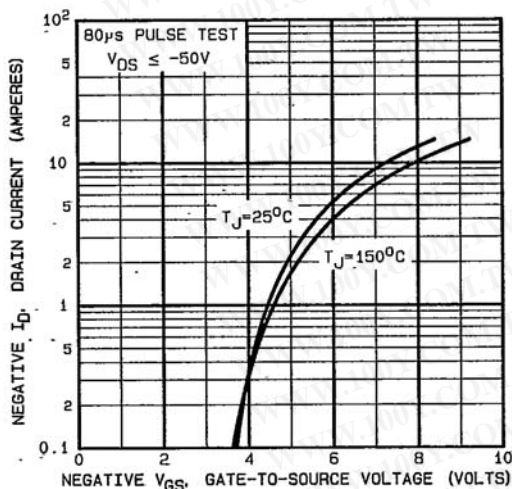


Fig. 2 - Typical Transfer Characteristics

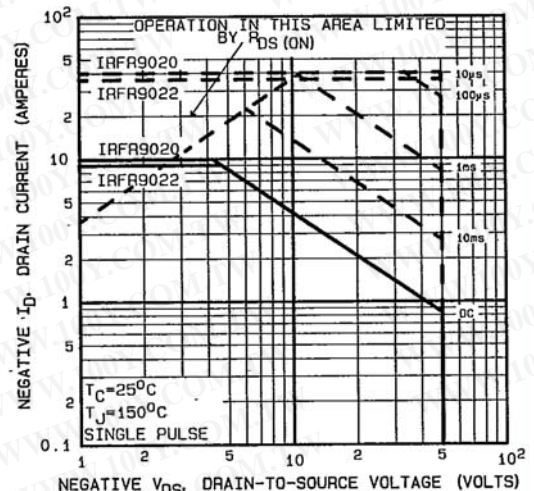


Fig. 4 - Maximum Safe Operating Area

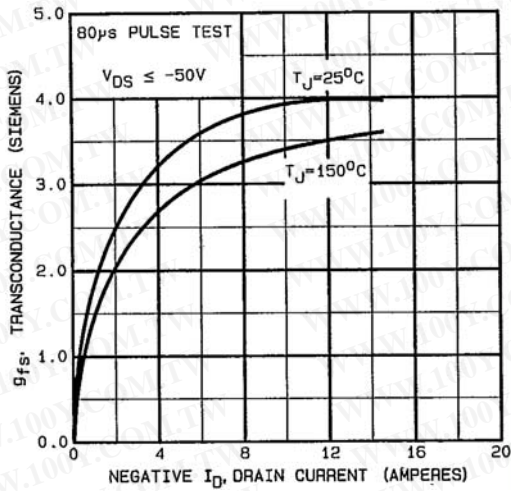


Fig. 5 - Typical Transconductance vs. Drain Current

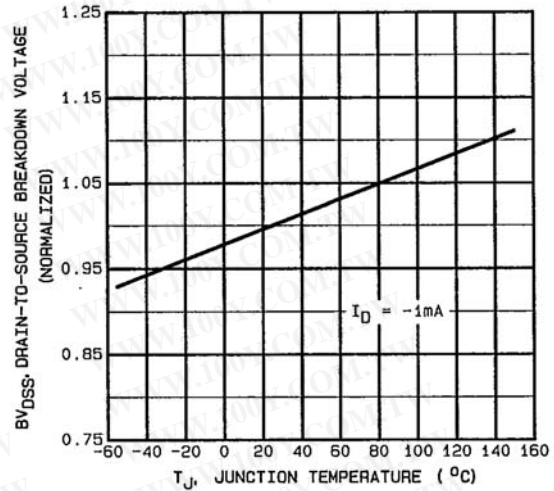


Fig. 7 - Breakdown Voltage vs. Temperature

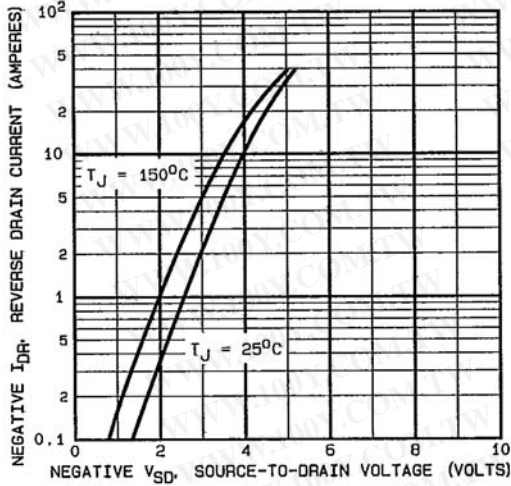


Fig. 6 - Typical Source-Drain Diode Forward Voltage

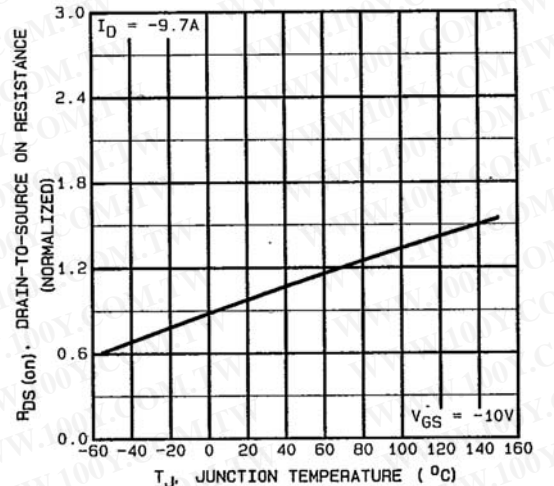


Fig. 8 - Normalized On-Resistance vs. Temperature

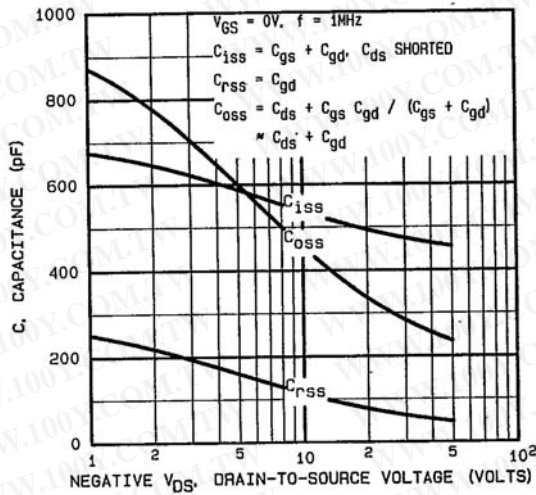


Fig. 9 - Typical Capacitance vs. Drain-to-Source Voltage

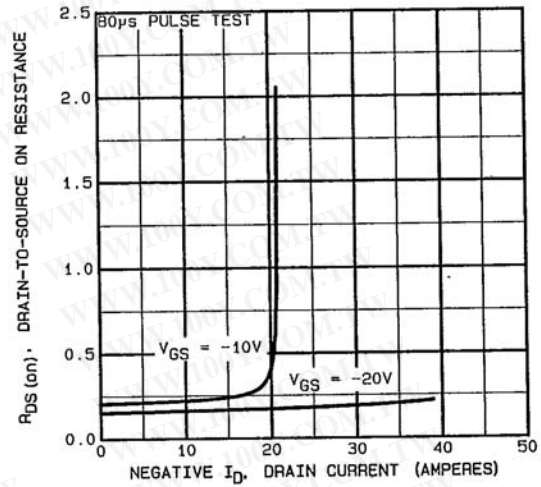


Fig. 11 - Typical On-Resistance vs. Drain Current

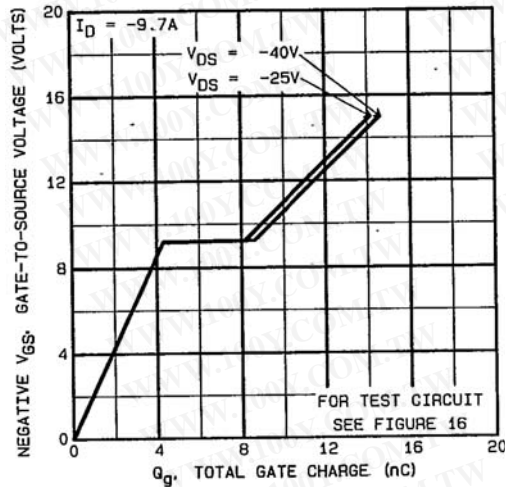


Fig. 10 - Typical Gate Charge vs. Gate-to-Source Voltage

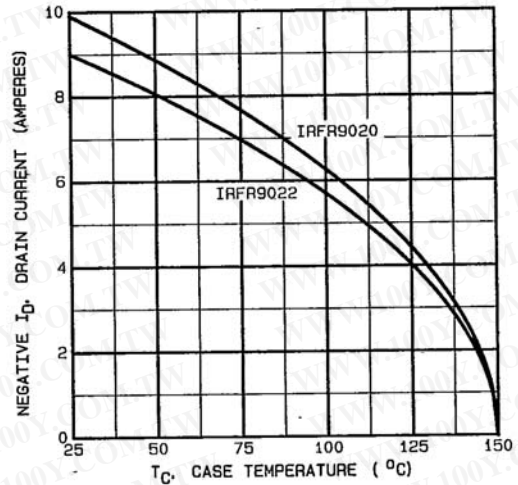


Fig. 12 - Maximum Drain Current vs. Case Temperature

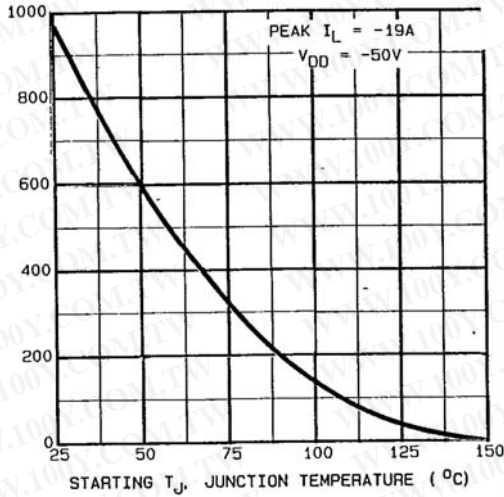


Fig. 13a - Maximum Avalanche vs. Starting Junction Temperature

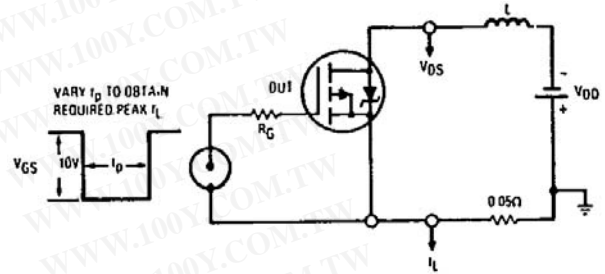


Fig. 13b - Unclamped Inductive Test Circuit

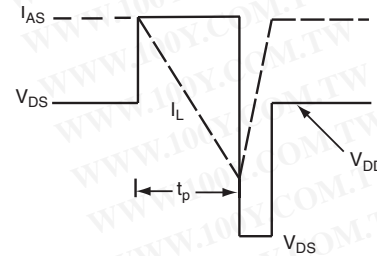


Fig. 13c - Unclamped Inductive Waveforms

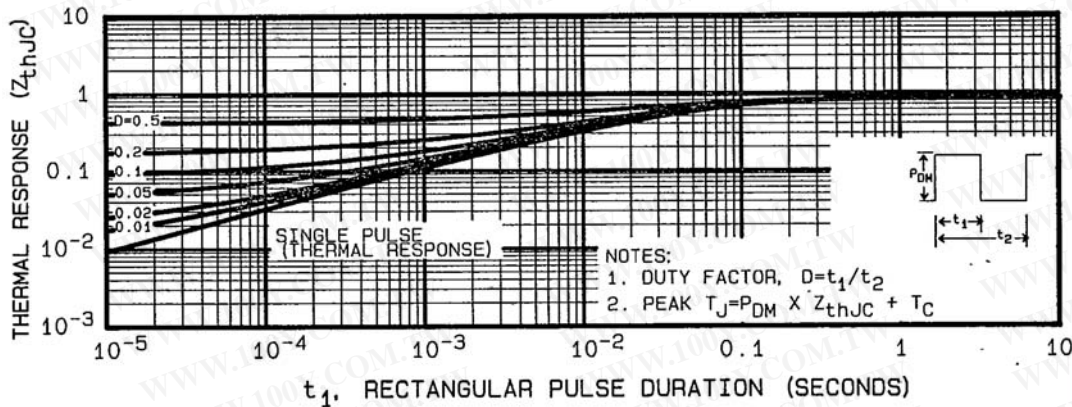


Fig. 14 - Maximum Effective Transient Thermal Impedance, Junction-to-Case vs. Pulse Duration

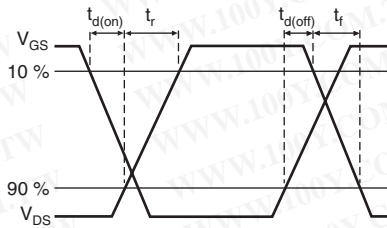


Fig. 15a - Switching Time Waveforms

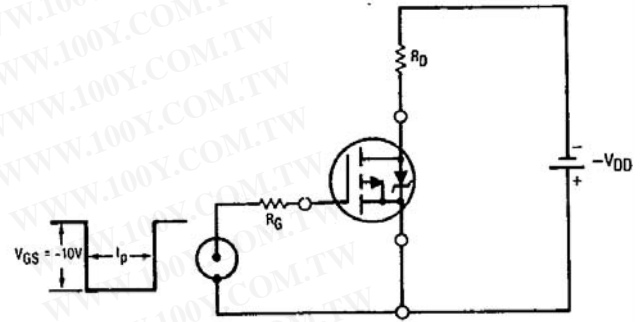


Fig. 15b - Switching Time Test Circuit

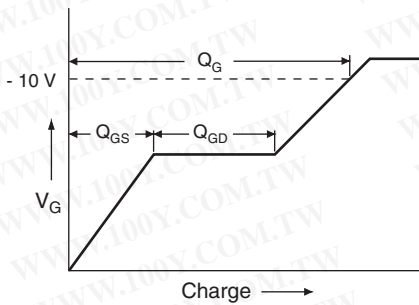


Fig. 16a - Basic Gate Charge Waveform

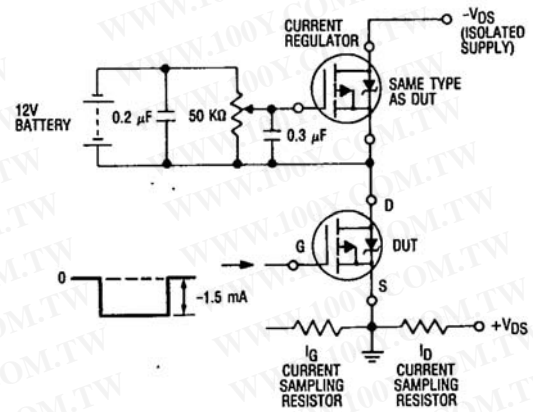
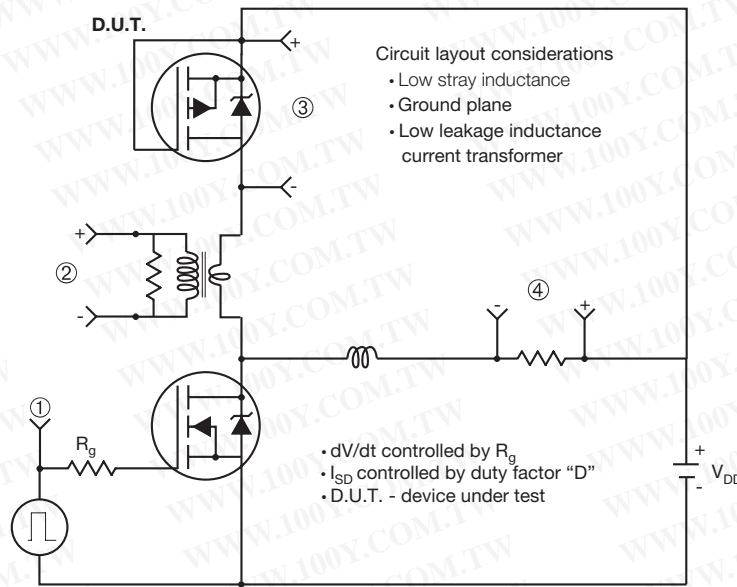
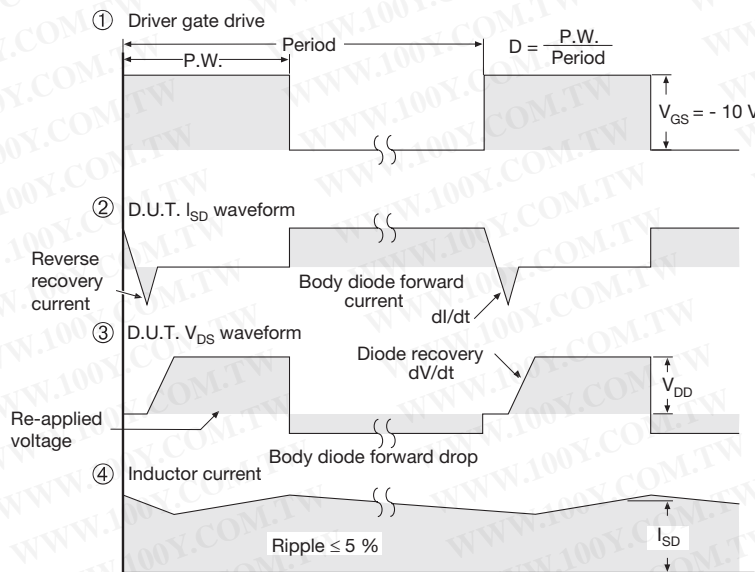


Fig. 16b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note
• Compliment N-Channel of D.U.T. for driver



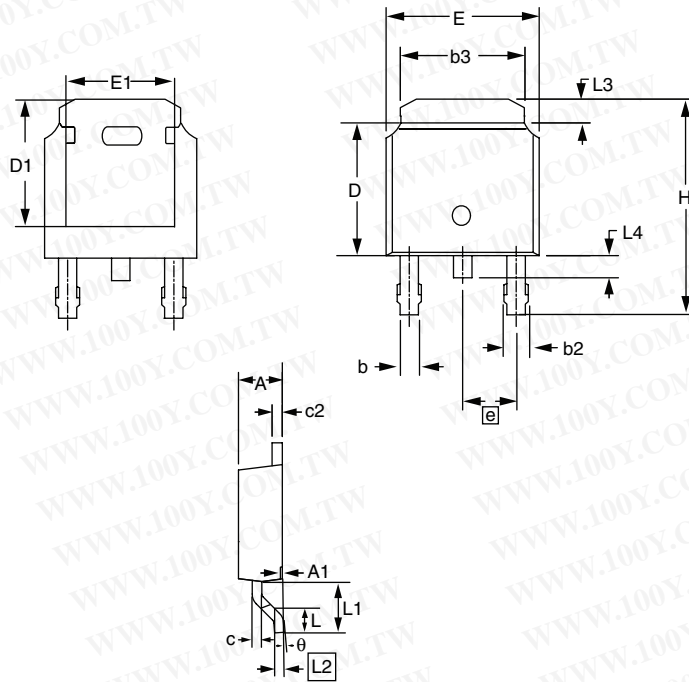
Note
a. $V_{GS} = -5 V$ for logic level and $-3 V$ drive devices

Fig. 17 - For P-Channel

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg290350.



TO-252AA (HIGH VOLTAGE)



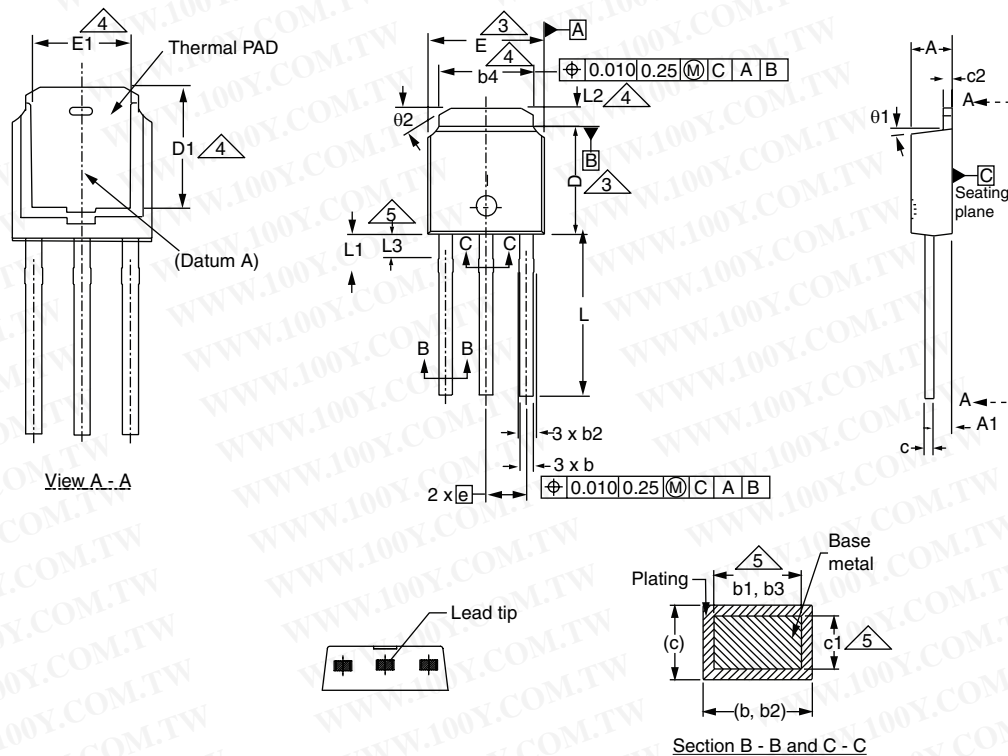
DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
E	6.40	6.73	0.252	0.265
L	1.40	1.77	0.055	0.070
L1	2.743 REF		0.108 REF	
L2	0.508 BSC		0.020 BSC	
L3	0.89	1.27	0.035	0.050
L4	0.64	1.01	0.025	0.040
D	6.00	6.22	0.236	0.245
H	9.40	10.40	0.370	0.409
b	0.64	0.88	0.025	0.035
b2	0.77	1.14	0.030	0.045
b3	5.21	5.46	0.205	0.215
e	2.286 BSC		0.090 BSC	
A	2.20	2.38	0.087	0.094
A1	0.00	0.13	0.000	0.005
c	0.45	0.60	0.018	0.024
c2	0.45	0.58	0.018	0.023
D1	5.30	-	0.209	-
E1	4.40	-	0.173	-
θ	0°	10°	0°	10°

ECN: S-81965-Rev. A, 15-Sep-08
DWG: 5973

Notes

1. Package body sizes exclude mold flash, protrusion or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 0.10 mm per side.
2. Package body sizes determined at the outermost extremes of the plastic body exclusive of mold flash, gate burrs and interlead flash, but including any mismatch between the top and bottom of the plastic body.
3. The package top may be smaller than the package bottom.
4. Dimension "b" does not include dambar protrusion. Allowable dambar protrusion shall be 0.10 mm total in excess of "b" dimension at maximum material condition. The dambar cannot be located on the lower radius of the foot.

TO-251AA (HIGH VOLTAGE)



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.39	0.086	0.094
A1	0.89	1.14	0.035	0.045
b	0.64	0.89	0.025	0.035
b1	0.65	0.79	0.026	0.031
b2	0.76	1.14	0.030	0.045
b3	0.76	1.04	0.030	0.041
b4	4.95	5.46	0.195	0.215
c	0.46	0.61	0.018	0.024
c1	0.41	0.56	0.016	0.022
c2	0.46	0.86	0.018	0.034
D	5.97	6.22	0.235	0.245

DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
D1	5.21	-	0.205	-
E	6.35	6.73	0.250	0.265
E1	4.32	-	0.170	-
e	2.29 BSC		2.29 BSC	
L	8.89	9.65	0.350	0.380
L1	1.91	2.29	0.075	0.090
L2	0.89	1.27	0.035	0.050
L3	1.14	1.52	0.045	0.060
θ1	0°	15°	0°	15°
θ2	25°	35°	25°	35°

ECN: S-82111-Rev. A, 15-Sep-08
DWG: 5968

Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimension are shown in inches and millimeters.
3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.13 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body.
4. Thermal pad contour optional with dimensions b4, L2, E1 and D1.
5. Lead dimension uncontrolled in L3.
6. Dimension b1, b3 and c1 apply to base metal only.
7. Outline conforms to JEDEC outline TO-251AA.



勝特力材料 886-3-5753170
勝特力电子(上海) 86-21-34970699
勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk and agree to fully indemnify and hold Vishay and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Vishay or its distributor was negligent regarding the design or manufacture of the part. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.