

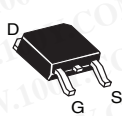


勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
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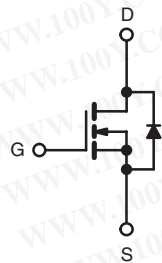
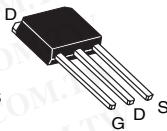
Power MOSFET

PRODUCT SUMMARY	
V _{DS} (V)	60
R _{DS(on)} (Ω)	V _{GS} = 5.0 V 0.10
Q _g (Max.) (nC)	18
Q _{gs} (nC)	4.5
Q _{gd} (nC)	12
Configuration	Single

DPAK (TO-252)



IPAK (TO-251)



N-Channel MOSFET

FEATURES

- Dynamic dV/dt Rating
- Surface Mount (IRLR024/SiHLR024)
- Straight Lead (IRLU024/SiHLU024)
- Available in Tape and Reel
- Logic-Level Gate Drive
- R_{DS(on)} Specified at V_{GS} = 4 V and 5 V
- Fast Switching
- Lead (Pb)-free Available



Available
RoHS*
 COMPLIANT

DESCRIPTION

Third generation Power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness. The DPAK is designed for surface mounting using vapor phase, infrared, or wave soldering techniques. The straight lead version (IRLU/SiHLU series) is for through-hole mounting applications. Power dissipation levels up to 1.5 W are possible in typical surface mount applications.

ORDERING INFORMATION			
Package	DPAK (TO-252)	DPAK (TO-252)	IPAK (TO-251)
Lead (Pb)-free	IRLR024PbF	IRLR024TRPbF ^a	IRLU024PbF
	SiHLR024-E3	SiHLR024T-E3 ^a	SiHLU024-E3
SnPb	IRLR024	IRLR024TR ^a	IRLU024
	SiHLR024	SiHLR024T ^a	SiHLU024

Note

a. See device orientation.

ABSOLUTE MAXIMUM RATINGS T _C = 25 °C, unless otherwise noted				
PARAMETER	SYMBOL		LIMIT	UNIT
Drain-Source Voltage	V _{DS}		60	V
Gate-Source Voltage	V _{GS}		± 10	
Continuous Drain Current	V _{GS} at 5.0 V	T _C = 25 °C	14	A
		T _C = 100 °C	9.2	
Pulsed Drain Current ^a	I _{DM}		56	W/°C
Linear Derating Factor			0.33	
Linear Derating Factor (PCB Mount) ^e			0.020	
Single Pulse Avalanche Energy ^b	E _{AS}		91	mJ
Maximum Power Dissipation	T _C = 25 °C		42	W
Maximum Power Dissipation (PCB Mount) ^e	T _A = 25 °C		2.5	
Peak Diode Recovery dV/dt ^c	dV/dt		4.5	V/ns
Operating Junction and Storage Temperature Range	T _J , T _{stg}		- 55 to + 150	°C
Soldering Recommendations (Peak Temperature)	for 10 s		260 ^d	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- V_{DD} = 25 V, starting T_J = 25 °C, L = 541 μH, R_G = 25 Ω, I_{AS} = 14 A (see fig. 12).
- I_{SD} ≤ 17 A, di/dt ≤ 140 A/μs, V_{DD} ≤ V_{DS}, T_J ≤ 150 °C.
- 1.6 mm from case.
- When mounted on 1" square PCB (FR-4 or G-10 material).

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

THERMAL RESISTANCE RATINGS					
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	-	110	°C/W
Maximum Junction-to-Ambient (PCB Mount) ^a	R_{thJA}	-	-	50	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	-	3.0	

Note

a. When mounted on 1" square PCB (FR-4 or G-10 material).

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}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		60	-	- V	
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$		-	0.068	- V/°C	
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		1.0	-	2.0 V	
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 10\text{ V}$		-	-	$\pm 100\text{ nA}$	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$		-	-	25 μA	
		$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	250 μA	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 5.0\text{ V}$	$I_D = 8.4\text{ A}^b$	-	-	0.10 Ω	
		$V_{GS} = 4.0\text{ V}$	$I_D = 7.0\text{ A}^b$	-	-	0.14 Ω	
Forward Transconductance	g_{fs}	$V_{DS} = 25\text{ V}, I_D = 8.4\text{ A}^b$		7.3	-	- S	
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5		-	870	-	
Output Capacitance	C_{oss}			-	360	-	pF
Reverse Transfer Capacitance	C_{rss}			-	53	-	pF
Total Gate Charge	Q_g	$V_{GS} = 5.0\text{ V}$	$I_D = 17\text{ A}, V_{DS} = 48\text{ V}$, see fig. 6 and 13 ^b	-	-	18	
Gate-Source Charge	Q_{gs}			-	-	4.5	nC
Gate-Drain Charge	Q_{gd}			-	-	12	nC
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, I_D = 17\text{ A}, R_G = 9.0\text{ }\Omega, R_D = 1.7\text{ }\Omega$, see fig. 10 ^b		-	11	-	
Rise Time	t_r			-	110	-	ns
Turn-Off Delay Time	$t_{d(off)}$			-	23	-	ns
Fall Time	t_f			-	41	-	ns
Internal Drain Inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact ^c		-	4.5	-	
Internal Source Inductance	L_S			-	7.5	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p-n junction diode		-	-	14	
Pulsed Diode Forward Current ^a	I_{SM}			-	-	56	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 14\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	1.5 V	
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 17\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$		-	130	260 ns	
Body Diode Reverse Recovery Charge	Q_{rr}			-	0.75	1.5 μC	
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)					

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

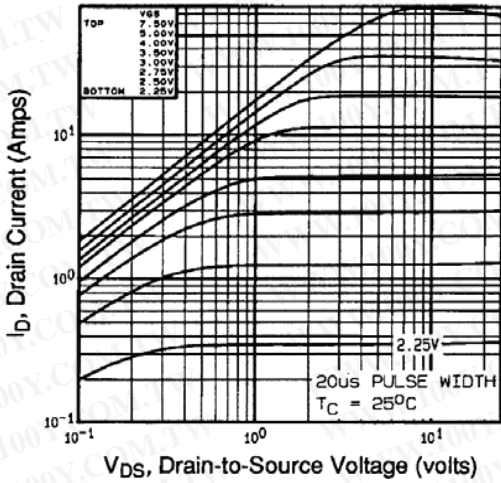


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$

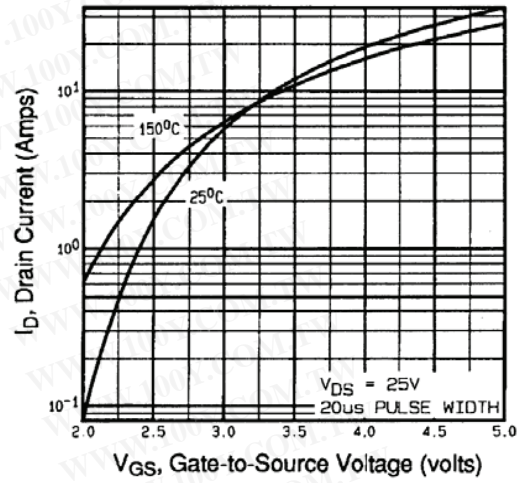


Fig. 3 - Typical Transfer Characteristics

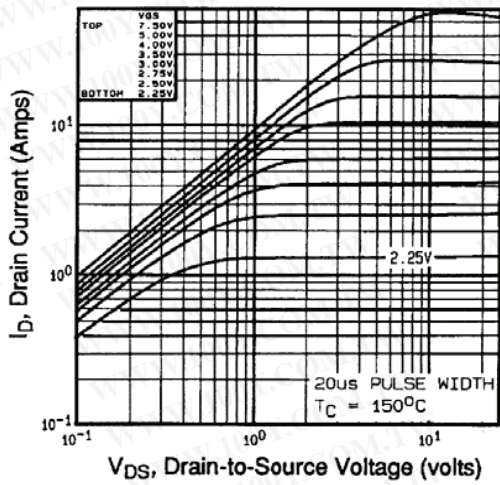


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^\circ\text{C}$

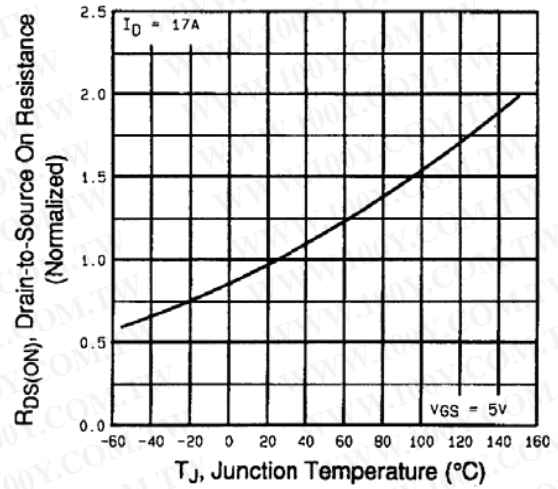


Fig. 4 - Normalized On-Resistance vs. Temperature

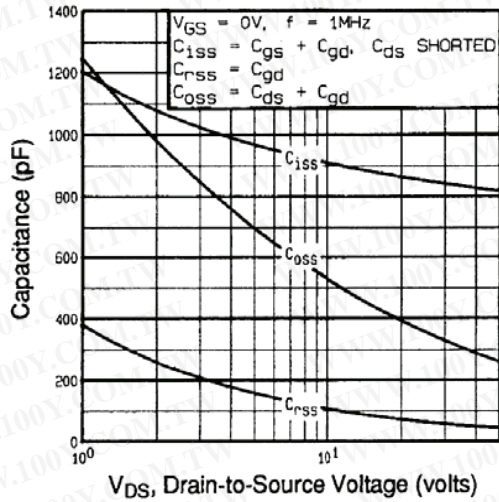


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

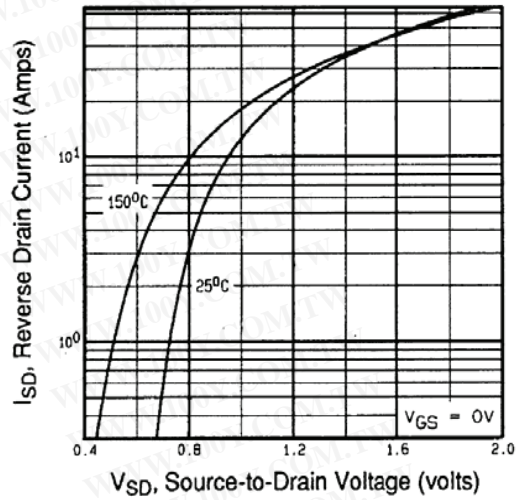


Fig. 7 - Typical Source-Drain Diode Forward Voltage

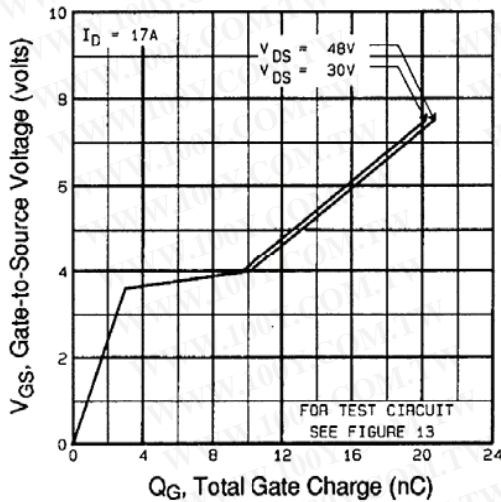


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

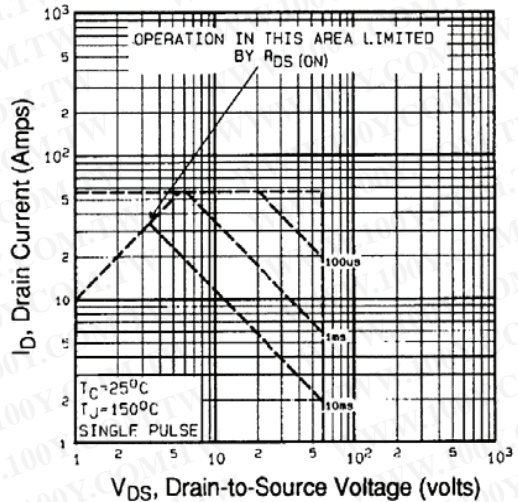


Fig. 8 - Maximum Safe Operating Area

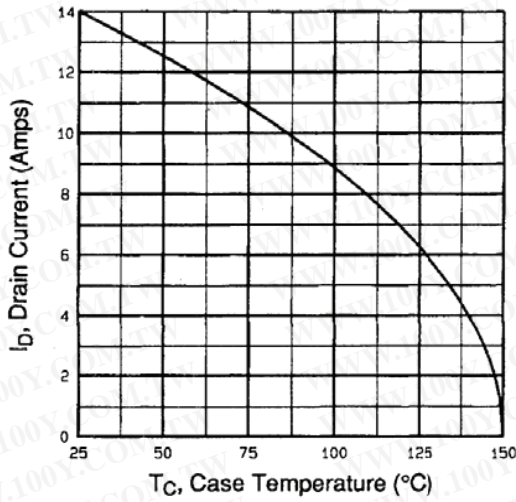


Fig. 9 - Maximum Drain Current vs. Case Temperature

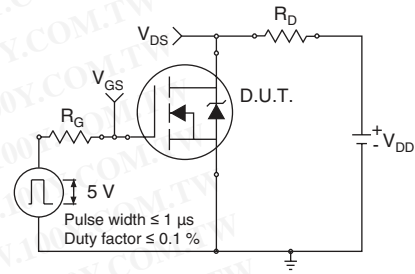


Fig. 10a - Switching Time Test Circuit

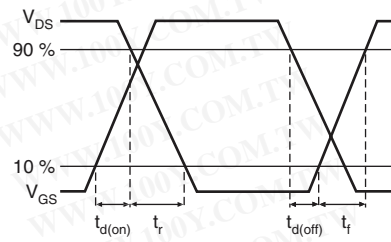


Fig. 10b - Switching Time Waveforms

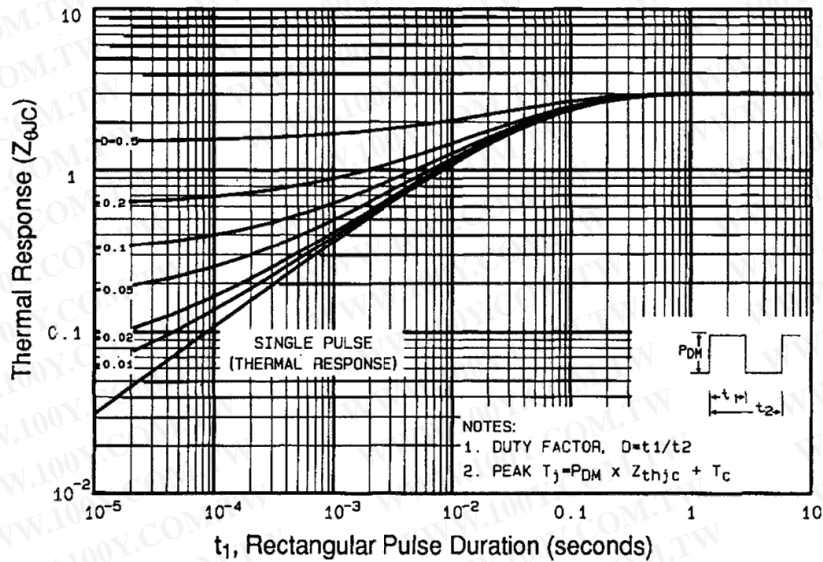


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

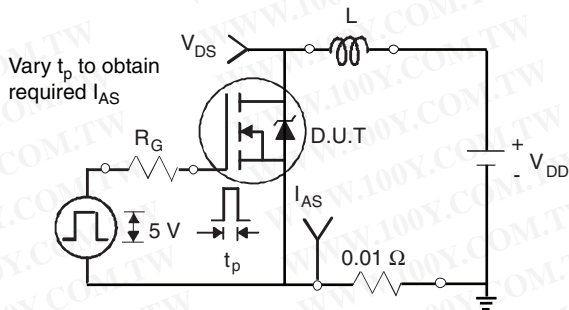


Fig. 12a - Unclamped Inductive Test Circuit

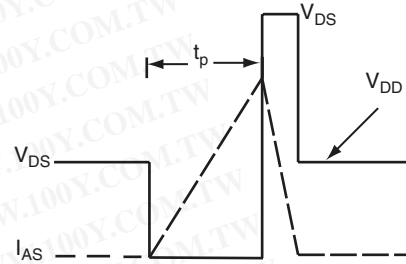


Fig. 12b - Unclamped Inductive Waveforms

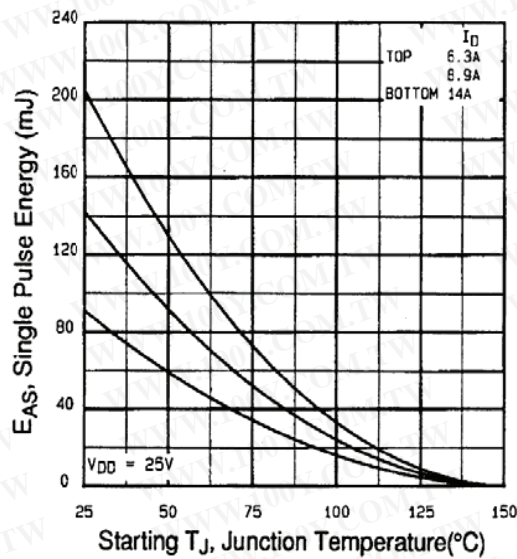


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

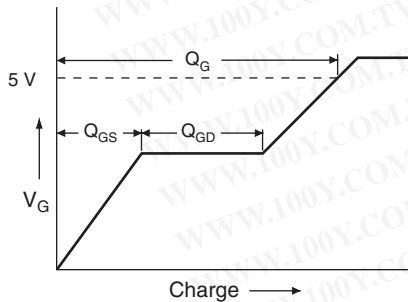


Fig. 13a - Basic Gate Charge Waveform

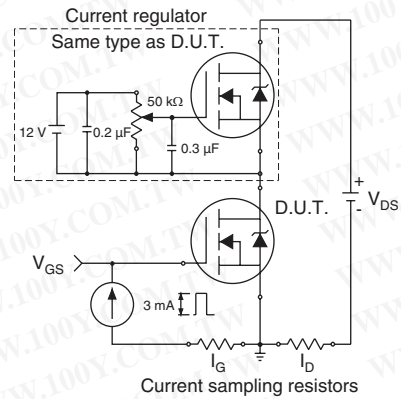
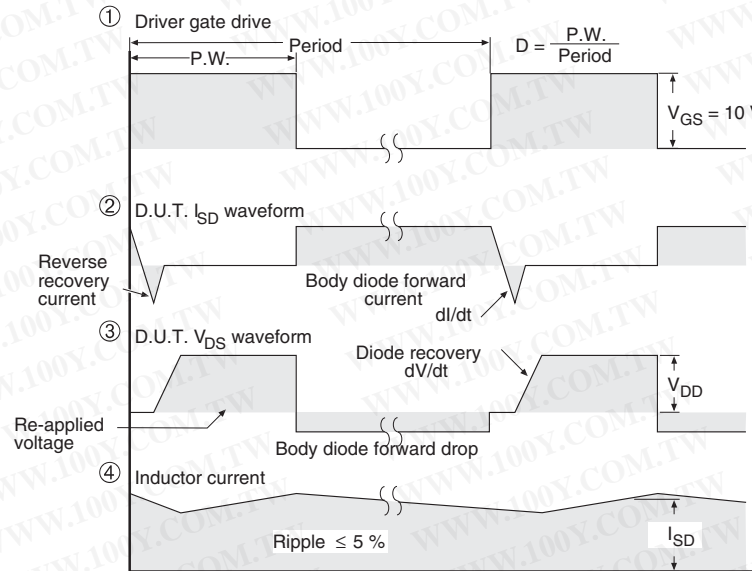
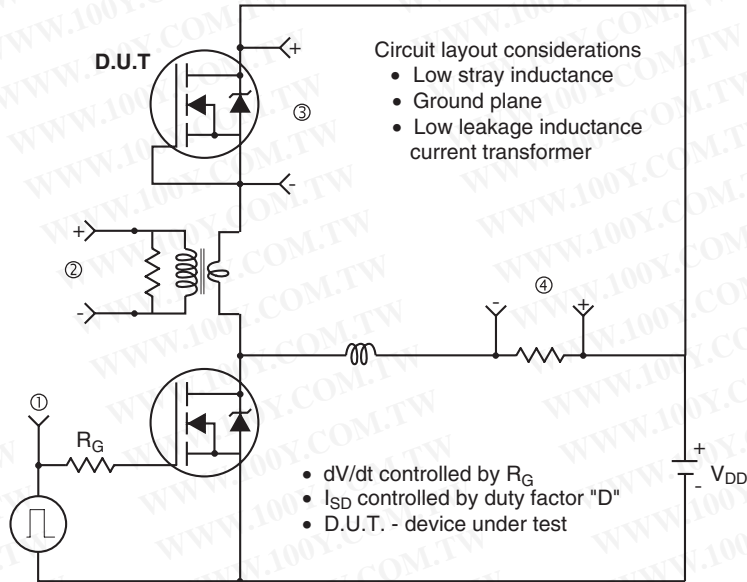


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



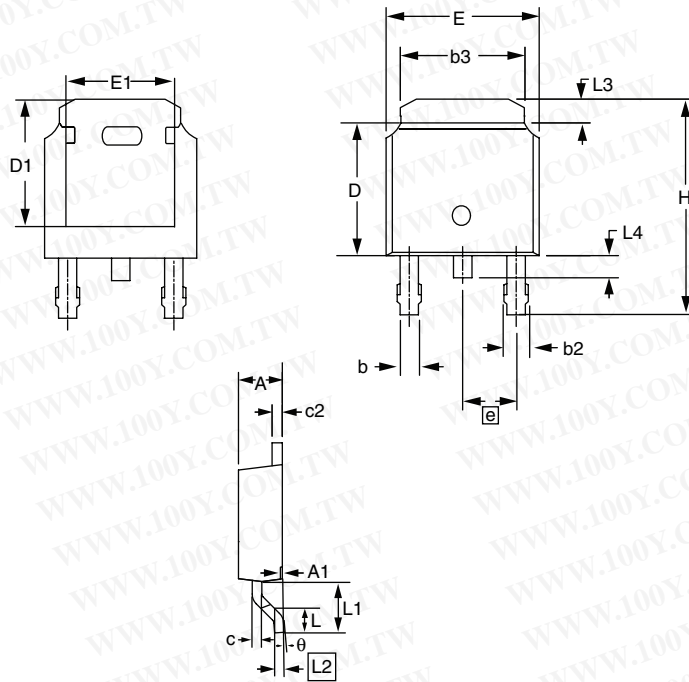
* $V_{GS} = 5 V$ for logic level and $3 V$ drive devices

Fig. 14 - For N-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/ppg291322.



TO-252AA (HIGH VOLTAGE)



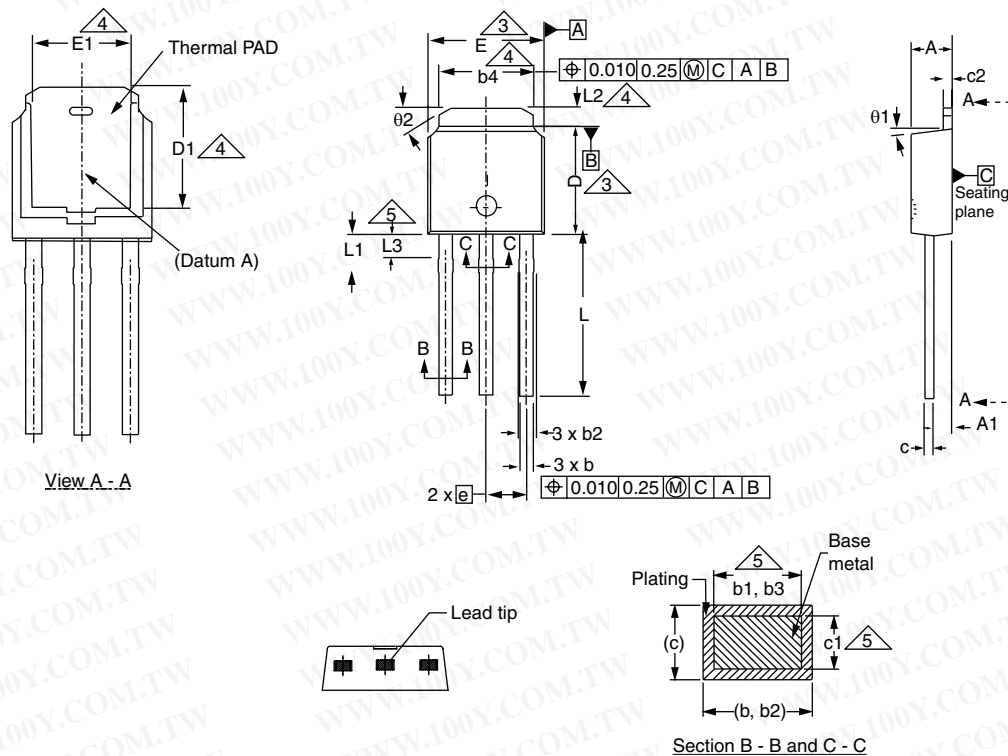
DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
E	6.40	6.73	0.252	0.265
L	1.40	1.77	0.055	0.070
L1	2.743 REF		0.108 REF	
L2	0.508 BSC		0.020 BSC	
L3	0.89	1.27	0.035	0.050
L4	0.64	1.01	0.025	0.040
D	6.00	6.22	0.236	0.245
H	9.40	10.40	0.370	0.409
b	0.64	0.88	0.025	0.035
b2	0.77	1.14	0.030	0.045
b3	5.21	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
$\theta 1$	0'	15'	0'	15'
$\theta 2$	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.



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