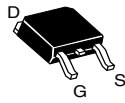
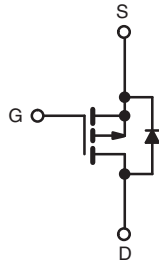
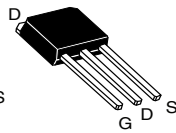


Power MOSFET

PRODUCT SUMMARY	
V_{DS} (V)	- 250
$R_{DS(on)}$ (Ω)	$V_{GS} = - 10$ V 3.0
Q_g (Max.) (nC)	14
Q_{gs} (nC)	3.1
Q_{gd} (nC)	6.8
Configuration	Single

 DPAK
(TO-252)

 IPAK
(TO-251)


P-Channel MOSFET

FEATURES

- P-Channel
- Surface Mount (IRFR9214, SiHFR9214)
- Straight Lead (IRFU9214, SiHFU9214)
- Advanced Process Technology
- Fast Switching
- Fully Avalanche Rated
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
Available

DESCRIPTION

Third generation power MOSFETs from Vishay utilize advanced processing techniques to achieve low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

The DPAK is designed for surface mounting using vapor phase, infrared, or wave soldering techniques. The straight lead version (IRFU, SiHFU 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)	DPAK (TO-252)	IPAK (TO-251)
Lead (Pb)-free and Halogen-free	SiHFR9214-GE3	SiHFR9214TRL-GE3	SiHFR9214TR-GE3	SiHFU9214-GE3
Lead (Pb)-free	IRFR9214PbF	IRFR9214TRLPbF ^a	IRFR9214TRPbF ^a	IRFU9214PbF
	SiHFR9214-E3	SiHFR9214TL-E3 ^a	SiHFR9214T-E3 ^a	SiHFU9214-E3

Note

- a. See device orientation.

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)					
PARAMETER	SYMBOL		LIMIT	UNIT	
Drain-Source Voltage	V_{DS}		- 250	V	
Gate-Source Voltage	V_{GS}		± 20		
Continuous Drain Current	V_{GS} at - 10 V	$T_C = 25$ °C	- 2.7	A	
		$T_C = 100$ °C	- 1.7		
Pulsed Drain Current ^a	I_{DM}		- 11		
Linear Derating Factor			0.40	W/°C	
Single Pulse Avalanche Energy ^b	E_{AS}		100	mJ	
Repetitive Avalanche Current ^a	I_{AR}		- 2.7	A	
Repetitive Avalanche Energy ^a	E_{AR}		5.0	mJ	
Maximum Power Dissipation	$T_C = 25$ °C		P_D	50	W
Peak Diode Recovery dV/dt ^c	dV/dt		- 5.0	V/ns	
Operating Junction and Storage Temperature Range	T_J, T_{stg}		- 55 to + 150	°C	
Soldering Recommendations (Peak Temperature) ^d	for 10 s		260		

Notes



- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
 b. Starting $T_J = 25$ °C, $L = 27$ mH, $R_g = 25$ Ω , $I_{AS} = - 2.7$ A (see fig. 12).
 c. $I_{SD} \leq - 2.7$ A, $dI/dt \leq 600$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °C.
 d. 1.6 mm from case.



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}	-	-	2.5	

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}	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$		-250	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = -1\text{ mA}$		-	-0.25	-	V/°C
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}	$V_{GS} = \pm 20\text{ V}$		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -250\text{ V}, V_{GS} = 0\text{ V}$		-	-	-100	μA
		$V_{DS} = -200\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	-500	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$	$I_D = -1.7\text{ A}^b$	-	-	3.0	Ω
Forward Transconductance	g_{fs}	$V_{DS} = -50\text{ V}, I_D = -1.7\text{ A}$		0.9	-	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = -25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5		-	220	-	pF
Output Capacitance	C_{oss}			-	75	-	
Reverse Transfer Capacitance	C_{rss}			-	11	-	
Total Gate Charge	Q_g	$V_{GS} = -10\text{ V}$	$I_D = -1.7\text{ A}, V_{DS} = -200\text{ V}$, see fig. 6 and 13 ^b	-	-	14	nC
Gate-Source Charge	Q_{gs}			-	-	3.1	
Gate-Drain Charge	Q_{gd}			-	-	6.8	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -125\text{ V}, I_D = -1.7\text{ A}, R_g = 21\text{ }\Omega, R_D = 70\text{ }\Omega$, see fig. 10 ^b		-	11	-	ns
Rise Time	t_r			-	14	-	
Turn-Off Delay Time	$t_{d(off)}$			-	20	-	
Fall Time	t_f			-	17	-	
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	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p-n junction diode 		-	-	-2.7	A
Pulsed Diode Forward Current ^a	I_{SM}			-	-	-11	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = -2.7\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	-5.8	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = -1.7\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}^b$		-	150	220	ns
Body Diode Reverse Recovery Charge	Q_{rr}			-	870	1300	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. 11).
- b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

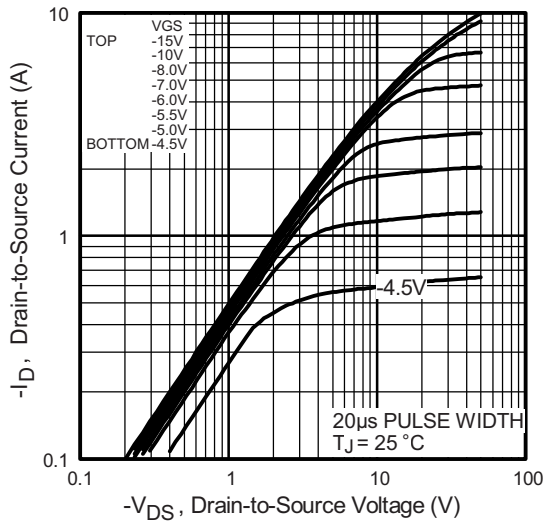


Fig. 1 - Typical Output Characteristics, T_C = 25 °C

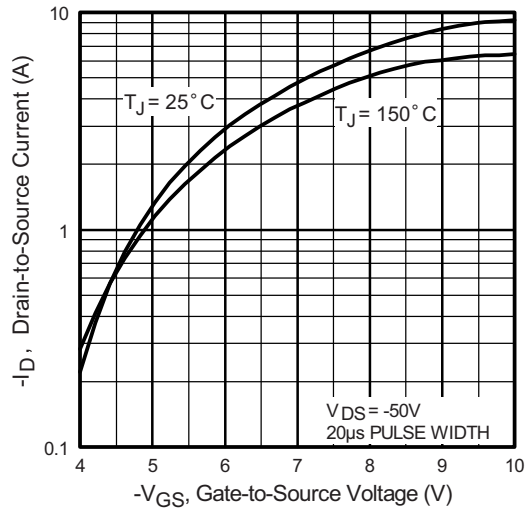


Fig. 3 - Typical Transfer Characteristics

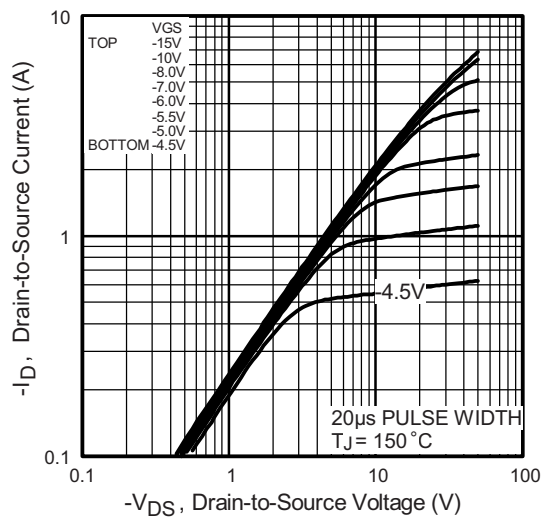


Fig. 2 - Typical Output Characteristics, T_C = 150 °C

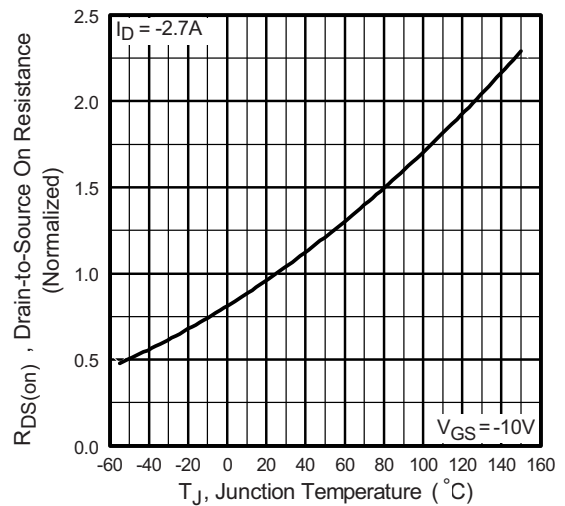


Fig. 4 - Normalized On-Resistance vs. Temperature

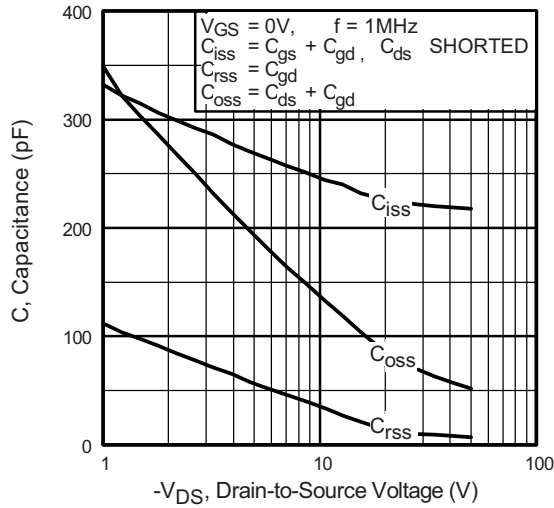


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

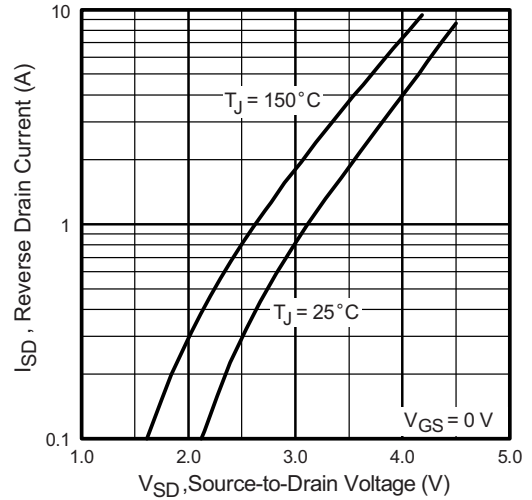


Fig. 7 - Typical Source-Drain Diode Forward Voltage

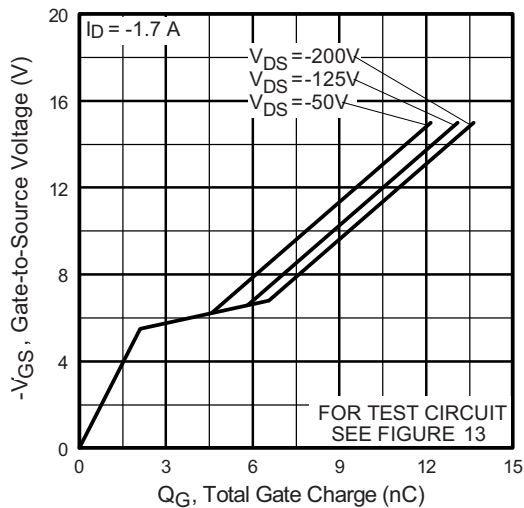


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

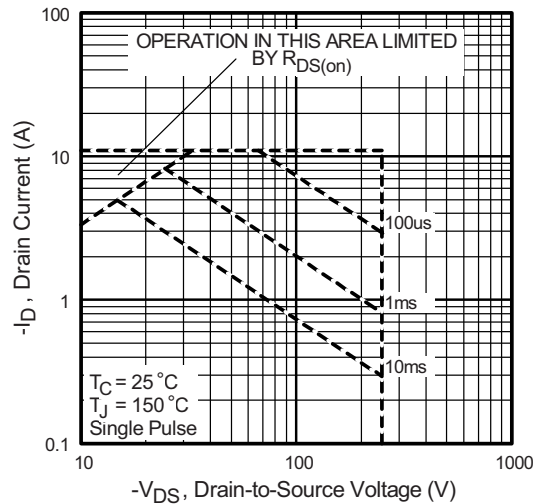


Fig. 8 - Maximum Safe Operating Area

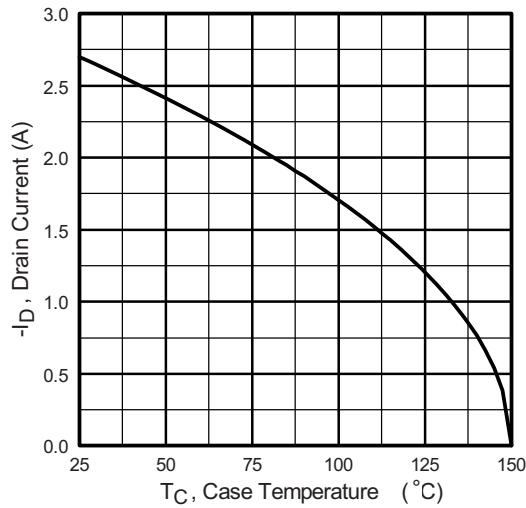


Fig. 9 - Maximum Drain Current vs. Case Temperature



Fig. 10a - Switching Time Test Circuit



Fig. 10b - Switching Time Waveforms

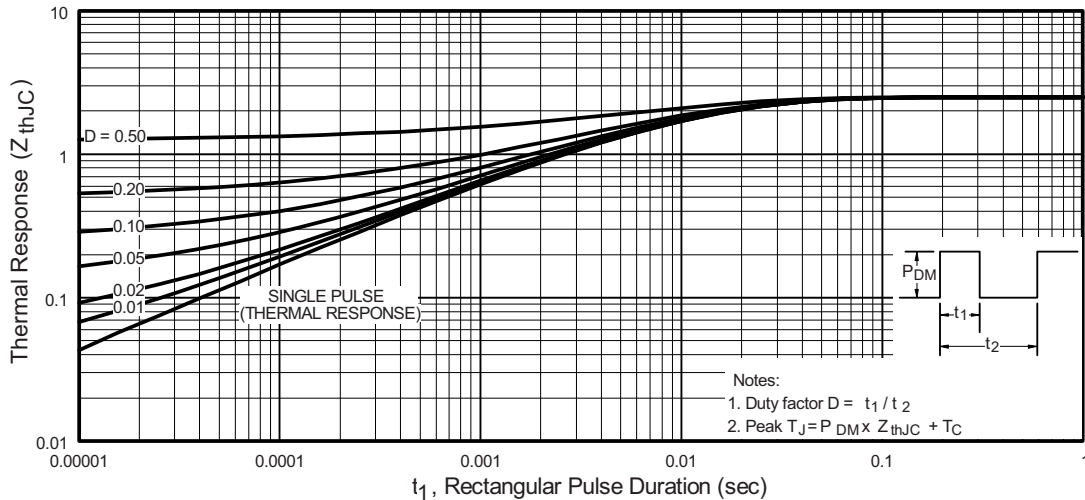
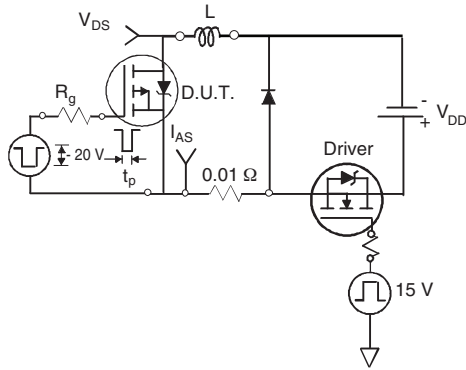
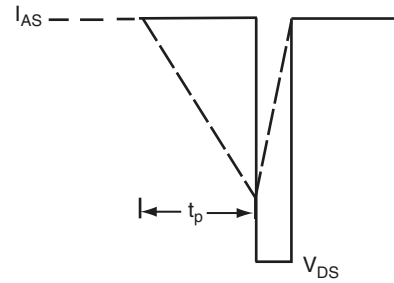
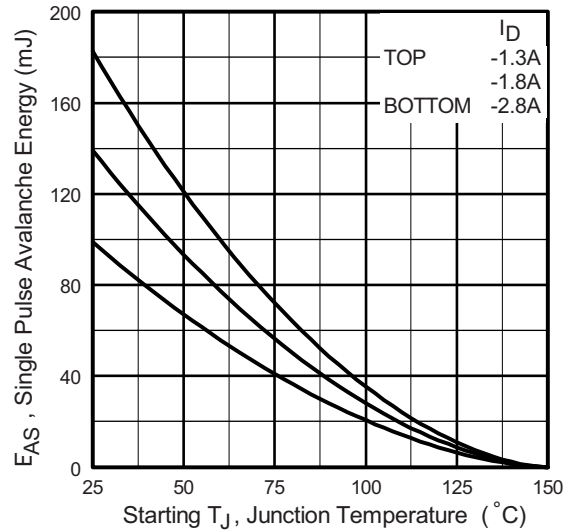
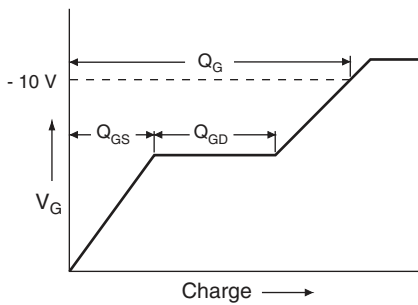
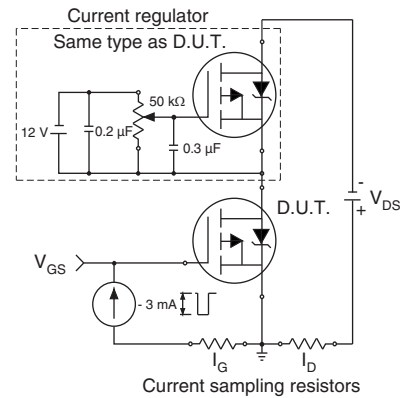
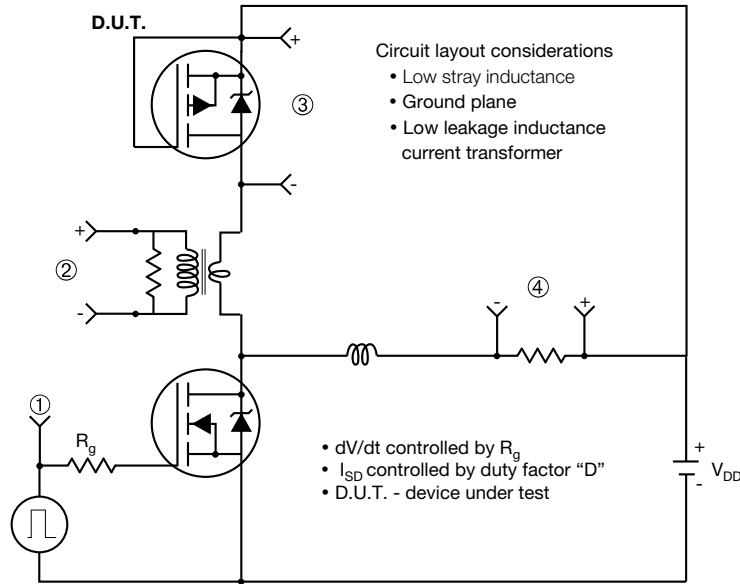


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case


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



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



Fig. 14 - For P-Channel

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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
theta1	0'	15'	0'	15'
theta2	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.

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads
Dimensions in Inches/(mm)

[Return to Index](#)



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Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.