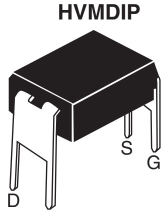
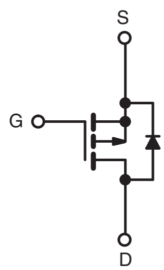
Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	- 60	
$R_{DS(on)}$ (Ω)	V_{GS} = - 10 V	0.28
Q_g (Max.) (nC)	19	
Q_{gs} (nC)	5.4	
Q_{gd} (nC)	11	
Configuration	Single	

HVMDIP





P-Channel MOSFET

FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- For Automatic Insertion
- End Stackable
- P-Channel
- Fast Switching
- 175 °C Operating Temperature
- Compliant to RoHS Directive 2002/95/EC

Pb 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 4 pin DIP package is a low cost machine-insertable case style which can be stacked in multiple combinations on standard 0.1" pin centers. The dual drain servers as a thermal link to the mounting surface for power dissipation levels up to 1 W.

ORDERING INFORMATION	
Package	HVMDIP
Lead (Pb)-free	IRFD9024PbF
	SiHFD9024-E3
SnPb	IRFD9024
	SiHFD9024

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V_{DS}	- 60	V
Gate-Source Voltage			V_{GS}	± 20	
Continuous Drain Current	V_{GS} at - 10 V	T_A = 25 °C	I_D	- 1.6	A
		T_A = 100 °C		- 1.1	
Pulsed Drain Current[a]			I_{DM}	- 13	
Linear Derating Factor				0.0083	W/°C
Single Pulse Avalanche Energy[b]			E_{AS}	140	mJ
Avalanche Current[a]			I_{AR}	- 1.6	A
Repetitive Avalanche Energy[a]			E_{AR}	0.13	mJ
Maximum Power Dissipation	T_A = 25 °C		P_D	1.3	W
Peak Diode Recovery dV/dt[c]			dV/dt	- 4.5	V/ns
Operating Junction and Storage Temperature Range			T_J, T_{stg}	- 55 to + 175	°C
Soldering Recommendations (Peak Temperature)	for 10 s			300[d]	

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).

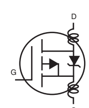
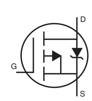
b. V_{DD} = - 25 V, starting T_J = 25 °C, L = 15 mH, R_g = 25 Ω, I_{AS} = - 3.2 A (see fig. 12).

c. $I_{SD} \leq$ - 11 A, dI/dt ≤ 140 A/μs, $V_{DD} \leq V_{DS}$, $T_J \leq$ 175 °C.

d. 1.6 mm from case.

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

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum Junction-to-Ambient	R_{thJA}	-	120	°C/W

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static							
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = - 250 μA		- 60	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = - 1 mA		-	- 0.056	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = - 250 μA		- 2.0	-	- 4.0	V
Gate-Source Leakage	I_{GSS}	V_{GS} = ± 20 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = - 60 V, V_{GS} = 0 V		-	-	- 100	μA
		V_{DS} = - 48 V, V_{GS} = 0 V, T_J = 150 °C		-	-	- 500	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = - 10 V	I_D = - 0.96 A[b]	-	-	0.28	Ω
Forward Transconductance	g_{fs}	V_{DS} = - 25 V, I_D = - 0.96 A[b]		1.3	-	-	S
Dynamic							
Input Capacitance	C_{iss}	V_{GS} = 0 V V_{DS} = - 25 V f = 1.0 MHz, see fig. 5		-	570	-	pF
Output Capacitance	C_{oss}			-	360	-	
Reverse Transfer Capacitance	C_{rss}			-	65	-	
Total Gate Charge	Q_g	V_{GS} = - 10 V	I_D = - 11 A, V_{DS} = - 48 V see fig. 6 and 13[b]	-	-	19	nC
Gate-Source Charge	Q_{gs}			-	-	5.4	
Gate-Drain Charge	Q_{gd}			-	-	11	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = - 30 V, I_D = - 11 A R_g = 18 Ω, R_D = 2.5 Ω, see fig. 10[b]		-	13	-	ns
Rise Time	t_r			-	68	-	
Turn-Off Delay Time	$t_{d(off)}$			-	15	-	
Fall Time	t_f			-	29	-	
Internal Drain Inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact		-	4.0	-	nH
Internal Source Inductance	L_S			-	6.0	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode		-	-	- 1.6	A
Pulsed Diode Forward Current[a]	I_{SM}			-	-	- 13	
Body Diode Voltage	V_{SD}	T_J = 25 °C, I_S = - 1.6 A, V_{GS} = 0 V[b]		-	-	- 6.3	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = - 11 A, dI/dt = 100 A/μs[b]		-	100	200	ns
Body Diode Reverse Recovery Charge	Q_{rr}			-	0.32	0.64	μC
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 ≤ 300 μs; duty cycle ≤ 2 %

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

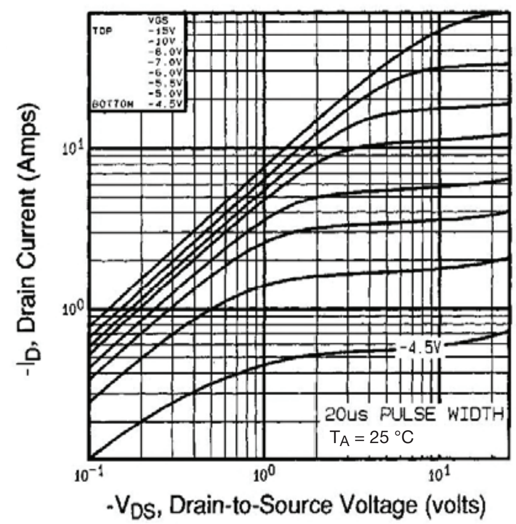


Fig. 1 - Typical Output Characteristics, T_A = 25 °C

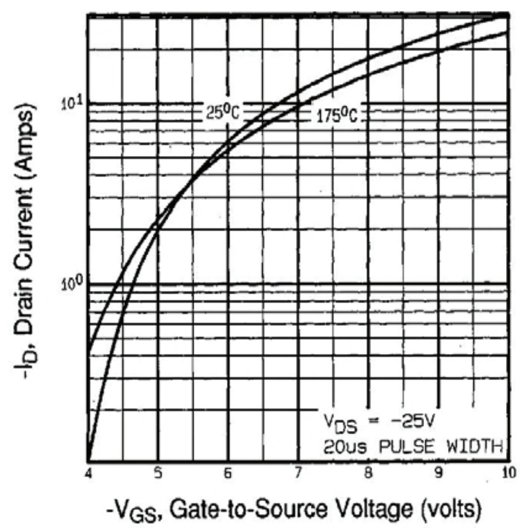


Fig. 3 - Typical Transfer Characteristics

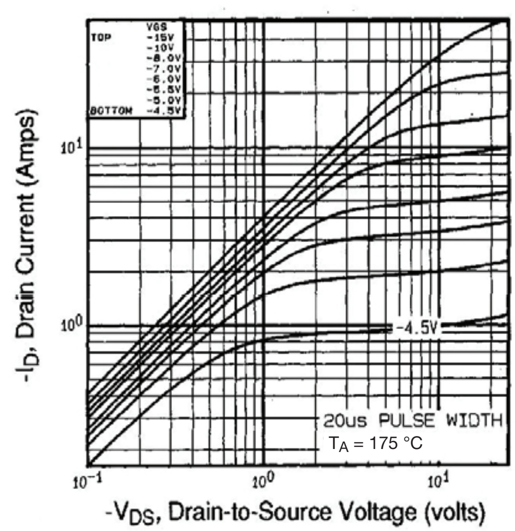


Fig. 2 - Typical Output Characteristics, T_A = 175 °C

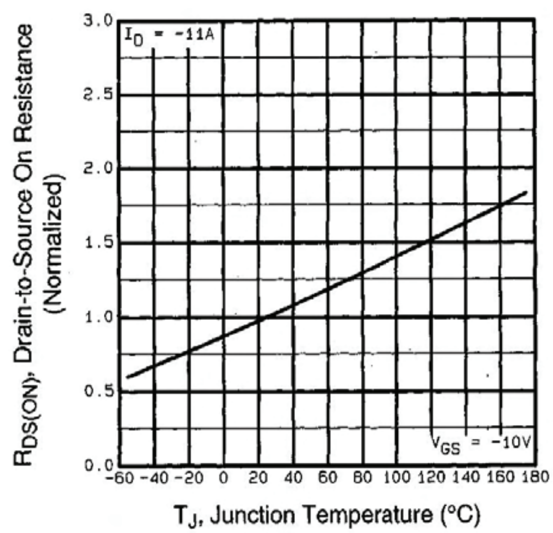


Fig. 4 - Normalized On-Resistance vs. Temperature

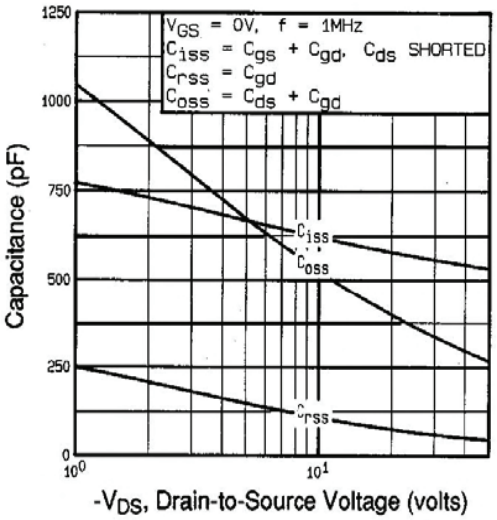


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

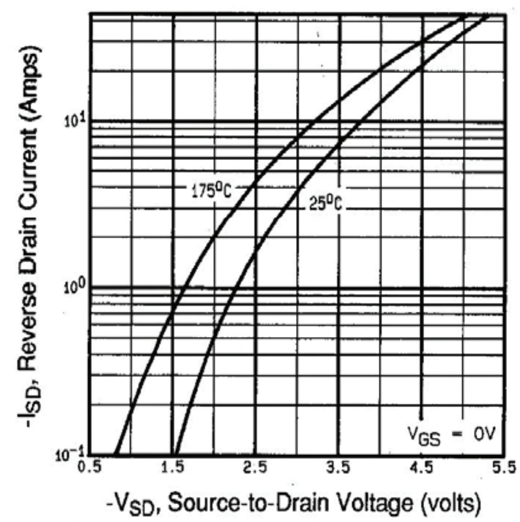


Fig. 7 - Typical Source-Drain Diode Forward Voltage

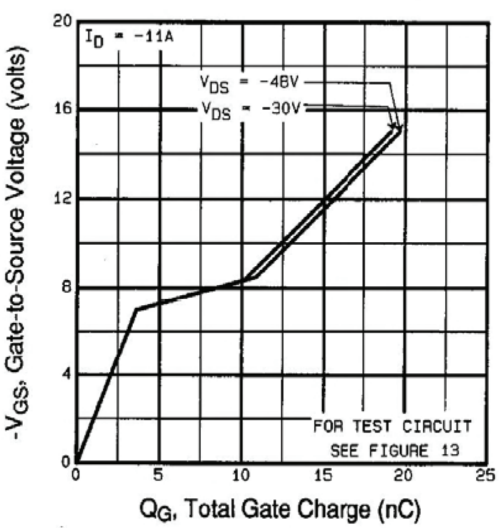


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

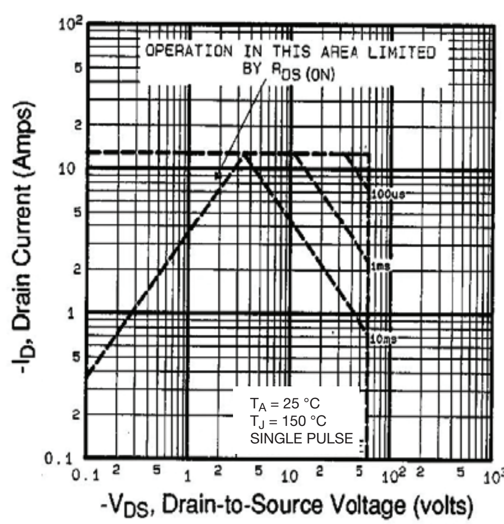


Fig. 8 - Maximum Safe Operating Area

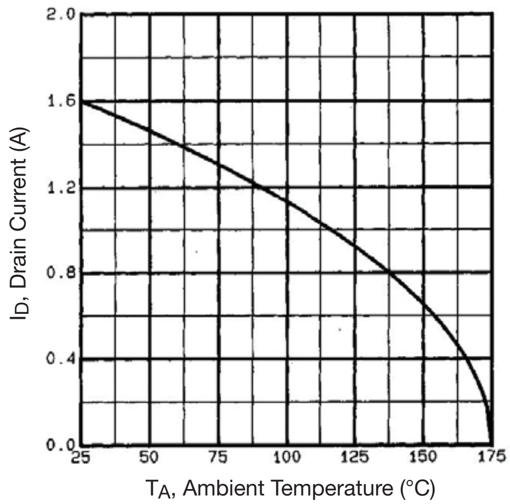


Fig. 9 - Maximum Drain Current vs. Ambient Temperature

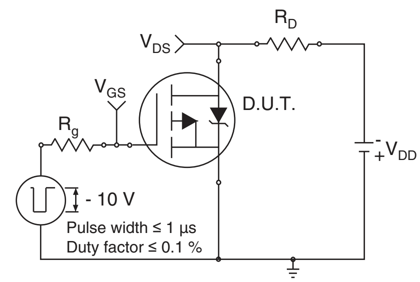


Fig. 10a - Switching Time Test Circuit

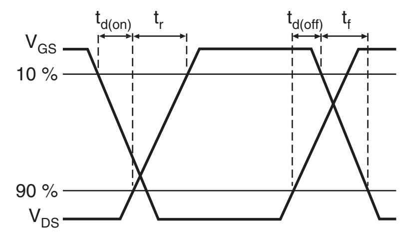


Fig. 10b - Switching Time Waveforms

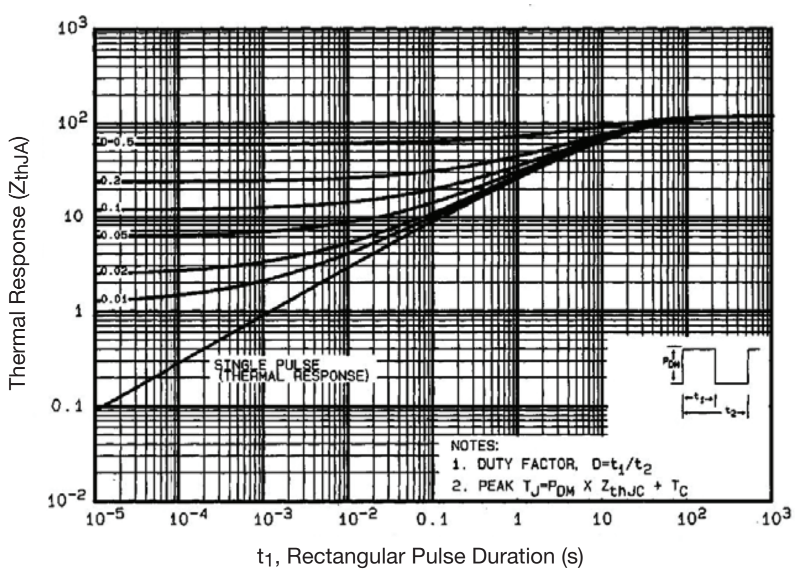


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

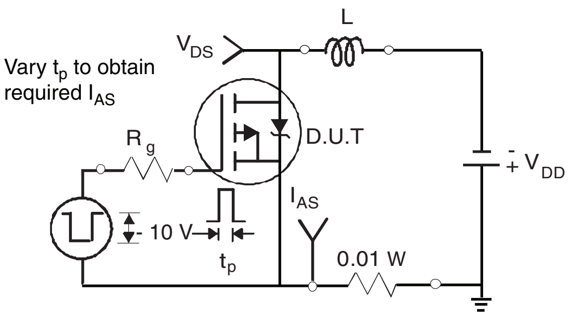


Fig. 12a - Unclamped Inductive Test Circuit

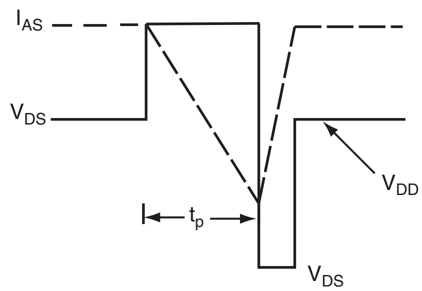


Fig. 12b - Unclamped Inductive Waveforms

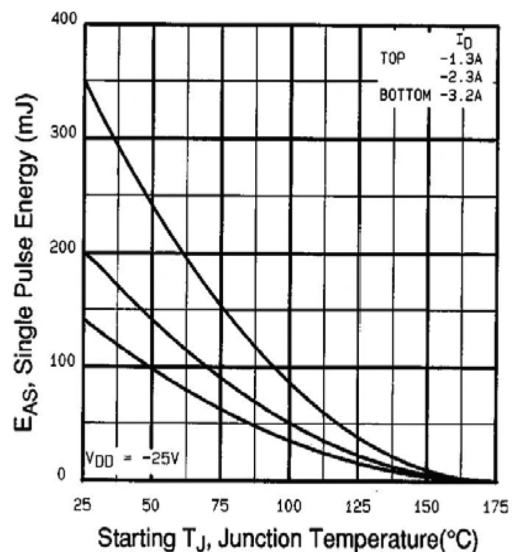


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

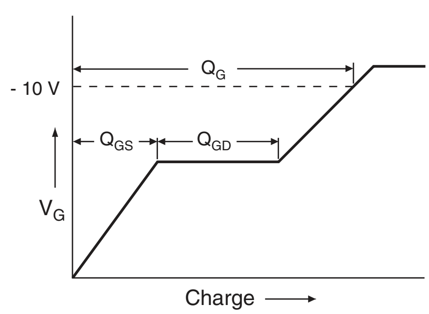


Fig. 13a - Basic Gate Charge Waveform

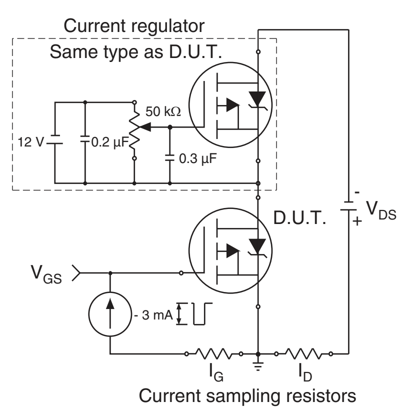
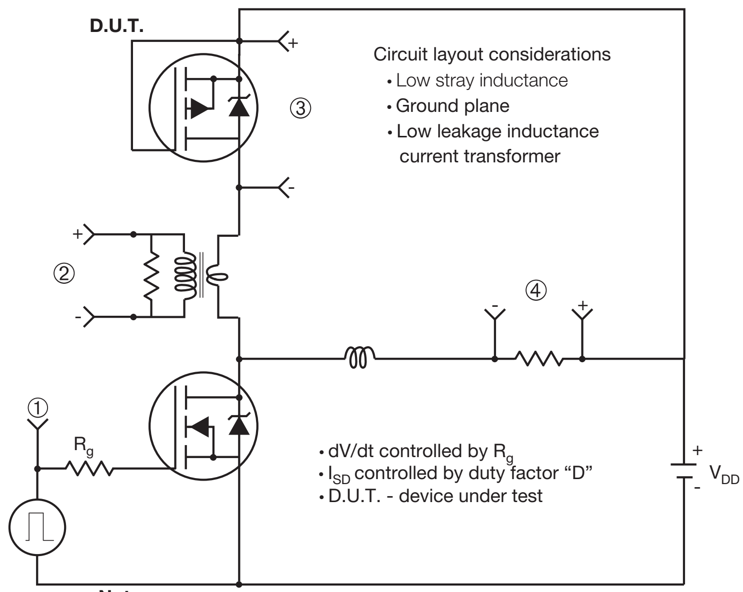
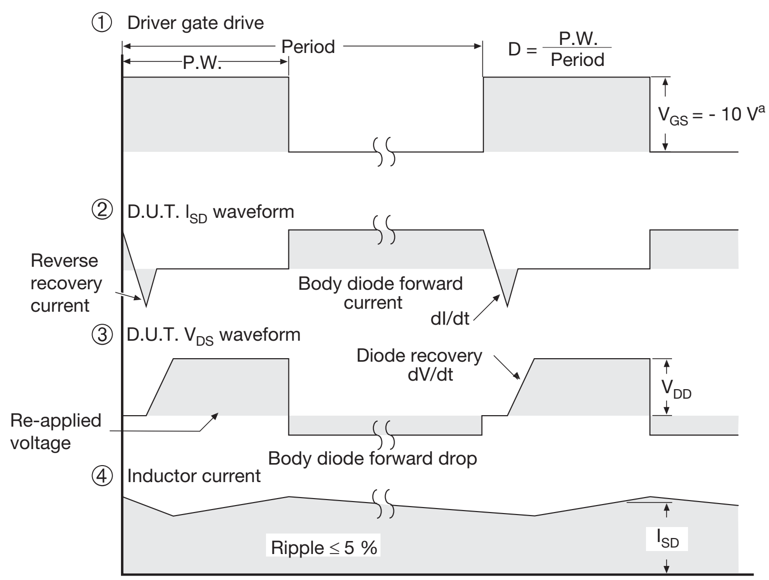


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



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



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

Fig. 14 - For P-Channel

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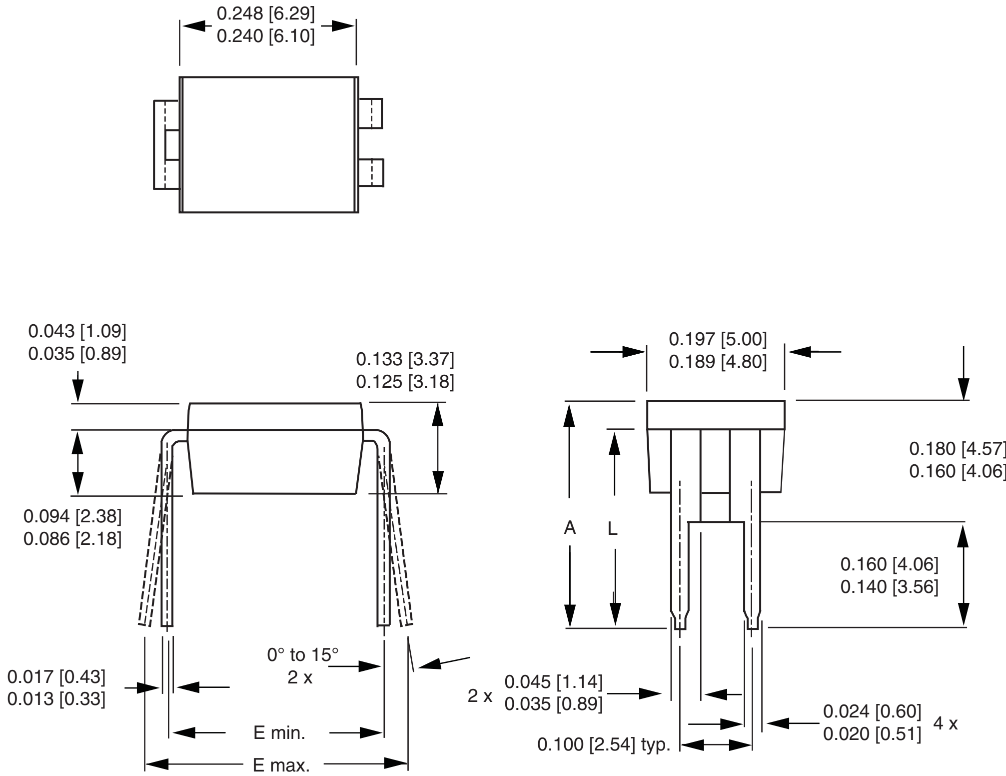
HVM DIP (High voltage)



	INCHES		MILLIMETERS	
DIM.	MIN.	MAX.	MIN.	MAX.
A	0.310	0.330	7.87	8.38
E	0.300	0.425	7.62	10.79
L	0.270	0.290	6.86	7.36
ECN: X10-0386-Rev. B, 06-Sep-10 DWG: 5974				

Note

1. Package length does not include mold flash, protrusions or gate burrs. Package width does not include interlead flash or protrusions.

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