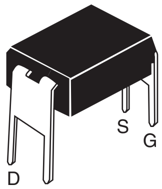
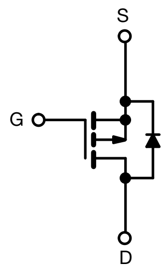
Power MOSFET

HVMDIP





P-Channel MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	-60	
$R_{DS(on)}$ (Ω)	V_{GS} = -10 V	0.50
Q_g (Max.) (nC)	12	
Q_{gs} (nC)	3.8	
Q_{gd} (nC)	5.1	
Configuration	Single	

FEATURES

- Dynamic dV/dt rating
- Repetitive avalanche rated
- For automatic Insertion
- End stackable
- P-channel
- 175 °C operating temperature
- Fast switching
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

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	IRFD9014PbF

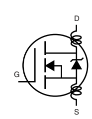
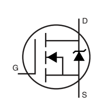
ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)

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	-1.1	A
		T_A = 100 °C		-0.80	
Pulsed drain current [a]			I_{DM}	-8.8	
Linear derating factor				0.0083	W/°C
Single pulse avalanche energy [b]			E_{AS}	140	mJ
Repetitive avalanche current [a]			I_{AR}	-1.1	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 = 33 mH, R_g = 25 Ω, I_{AS} = -2.2 A (see fig. 12)
c. $I_{SD} \leq$ -6.7 A, dI/dt $\leq$ 90 A/μs, $V_{DD} \leq V_{DS}$, $T_J \leq$ 175 °C
d. 1.6 mm from case

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	-	-0.060	-	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 = -0.66 A[b]	-	-	0.50	Ω
Forward Transconductance	g_{fs}	V_{DS} = -25 V, I_D = -0.66 A[b]	0.70	-	-	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = -25 V, f = 1.0 MHz, see fig. 5	-	270	-	pF
Output Capacitance	C_{oss}		-	170	-	
Reverse Transfer Capacitance	C_{rss}		-	31	-	
Total Gate Charge	Q_g	V_{GS} = -10 V; I_D = -6.7 A, V_{DS} = -48 V, see fig. 6 and 13[b]	-	-	12	nC
Gate-Source Charge	Q_{gs}		-	-	3.8	
Gate-Drain Charge	Q_{gd}		-	-	5.1	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = -30 V, I_D = -6.7 A, R_g = 24 Ω, R_D = 4.0 Ω, see fig. 10[b]	-	11	-	ns
Rise Time	t_r		-	63	-	
Turn-Off Delay Time	$t_{d(off)}$		-	10	-	
Fall Time	t_f		-	31	-	
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 	-	-	-1.1	A
Pulsed Diode Forward Current[a]	I_{SM}		-	-	-8.8	
Body Diode Voltage	V_{SD}	T_J = 25 °C, I_S = -1.1 A, V_{GS} = 0 V[b]	-	-	-5.5	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = -6.7 A, dI/dt = 100 A/μs[b]	-	80	160	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	0.096	0.19	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)

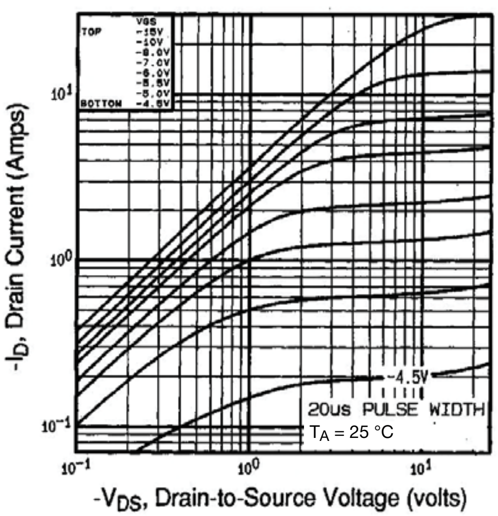


Fig. 1 - Typical Output Characteristics, T_A = 25 °C

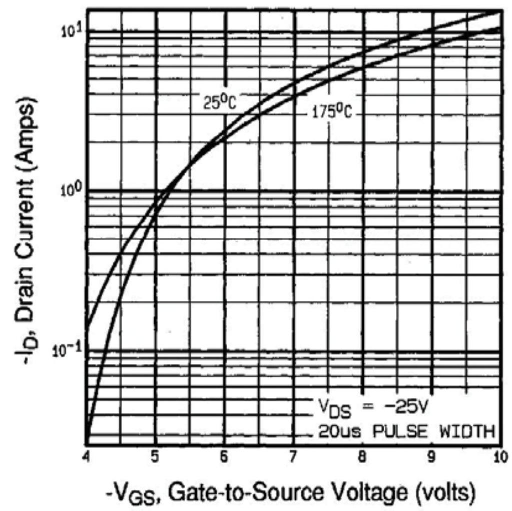


Fig. 2 - Typical Transfer Characteristics

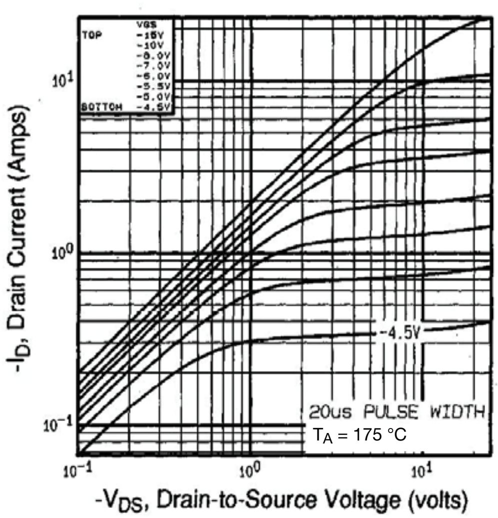


Fig. 1 - Typical Output Characteristics, T_A = 175 °C

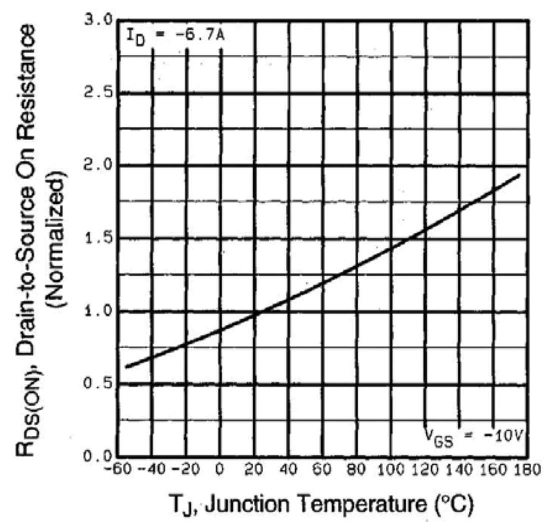


Fig. 3 - Normalized On-Resistance vs. Temperature

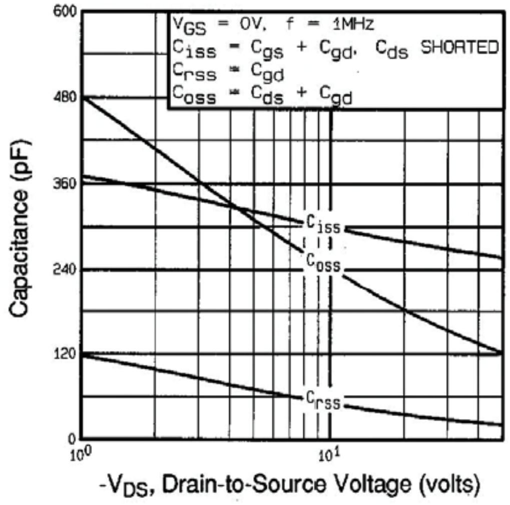


Fig. 4 - Typical Capacitance vs. Drain-to-Source Voltage

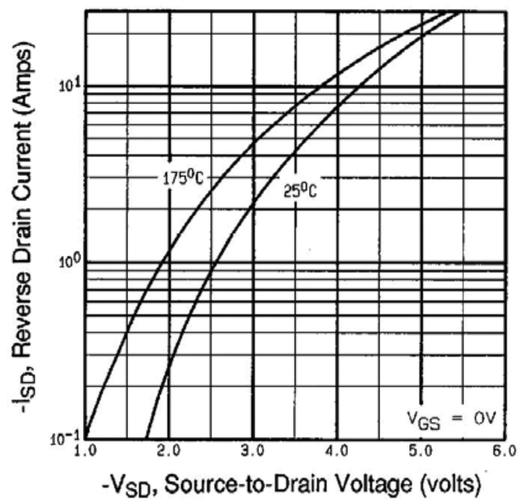


Fig. 6 - Typical Source-Drain Diode Forward Voltage

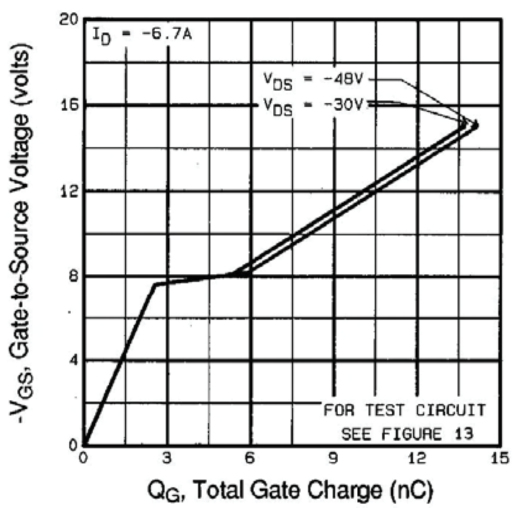


Fig. 5 - Typical Gate Charge vs. Gate-to-Source Voltage

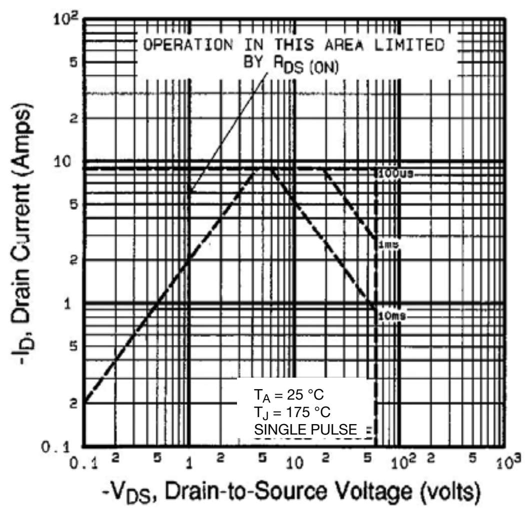


Fig. 7 - Maximum Safe Operating Area

For technical questions, contact: hvm@vishay.com

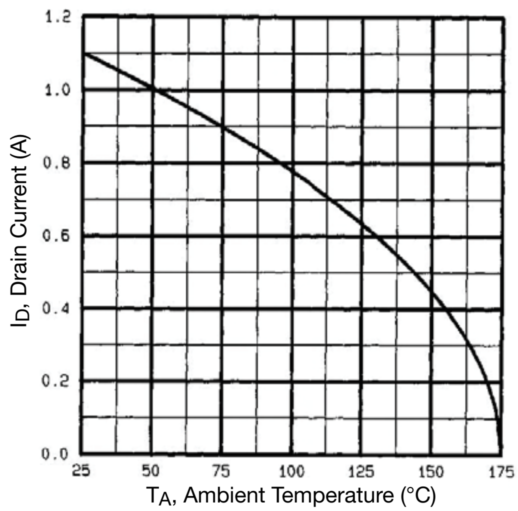


Fig. 8 - Maximum Drain Current vs. Ambient Temperature

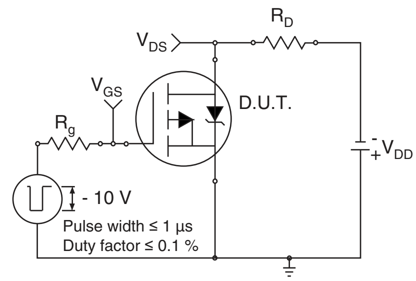


Fig. 10a - Switching Time Test Circuit

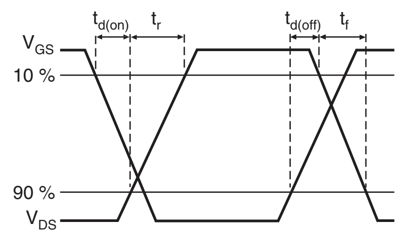


Fig. 10b - Switching Time Waveforms

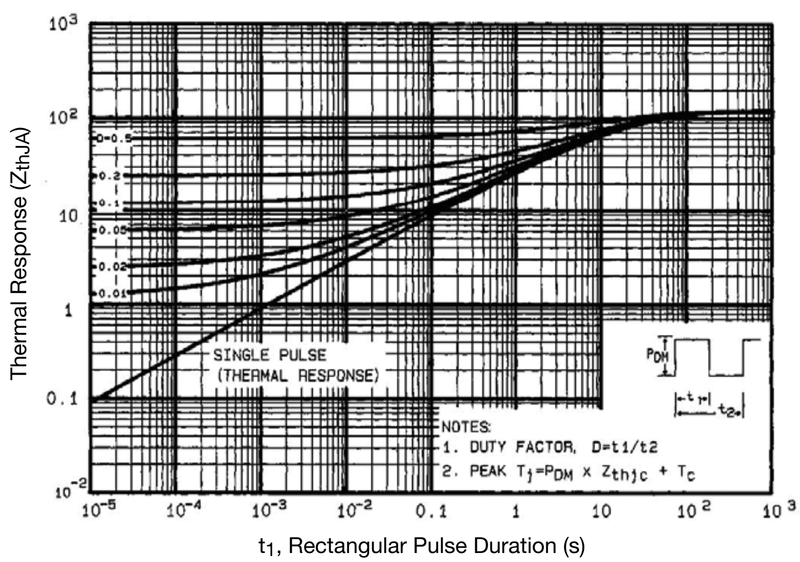


Fig. 9 - Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

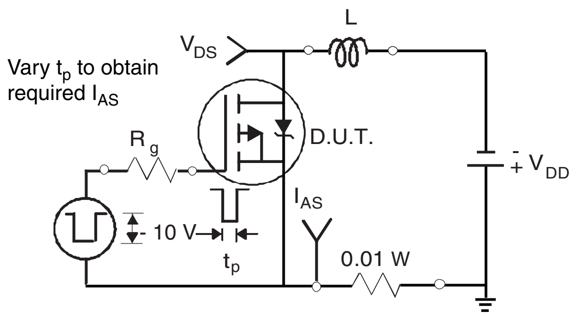


Fig. 12a - Unclamped Inductive Test Circuit

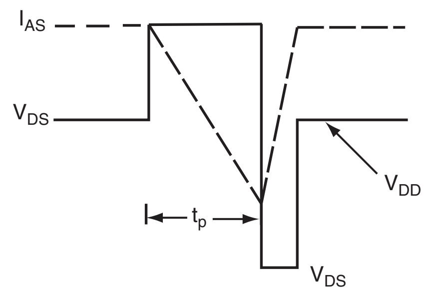


Fig. 12b - Unclamped Inductive Waveforms

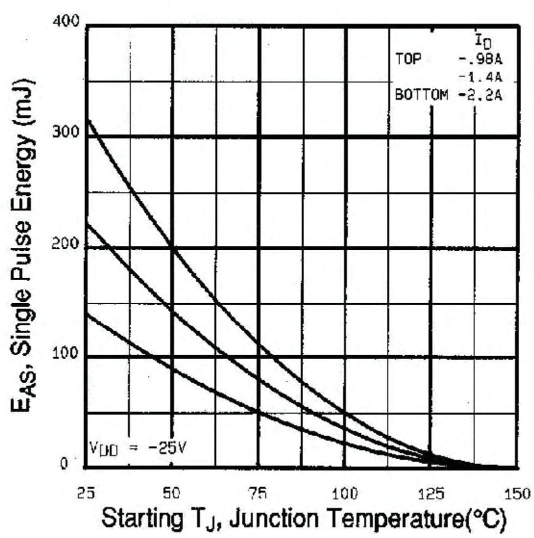


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

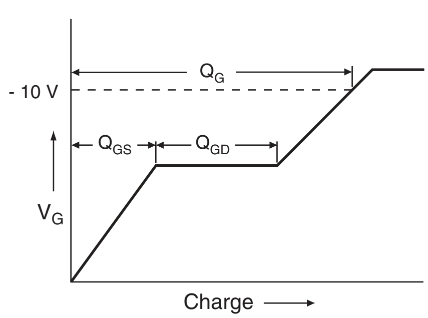


Fig. 13a - Basic Gate Charge Waveform

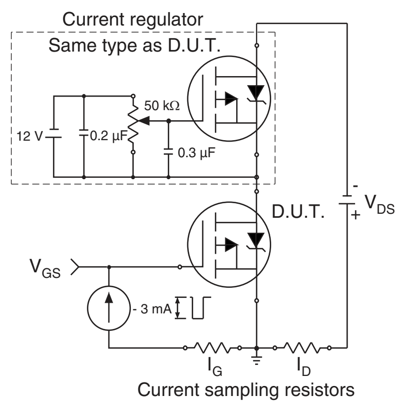
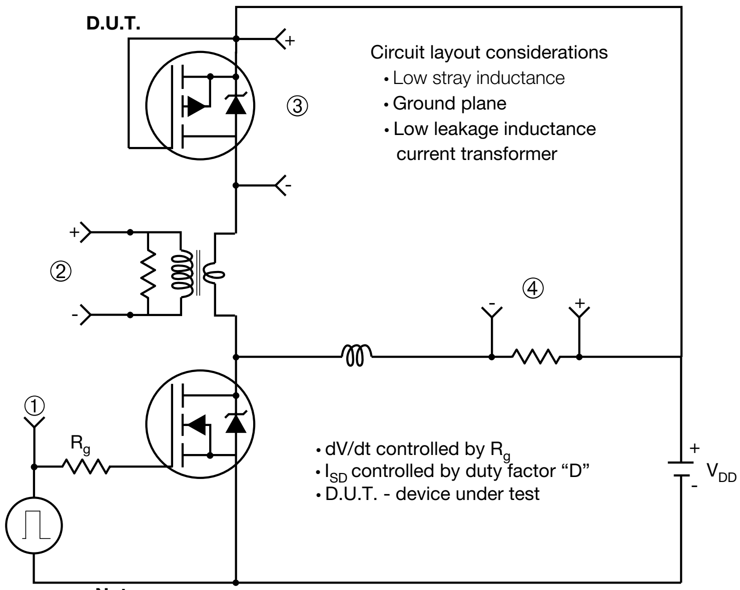
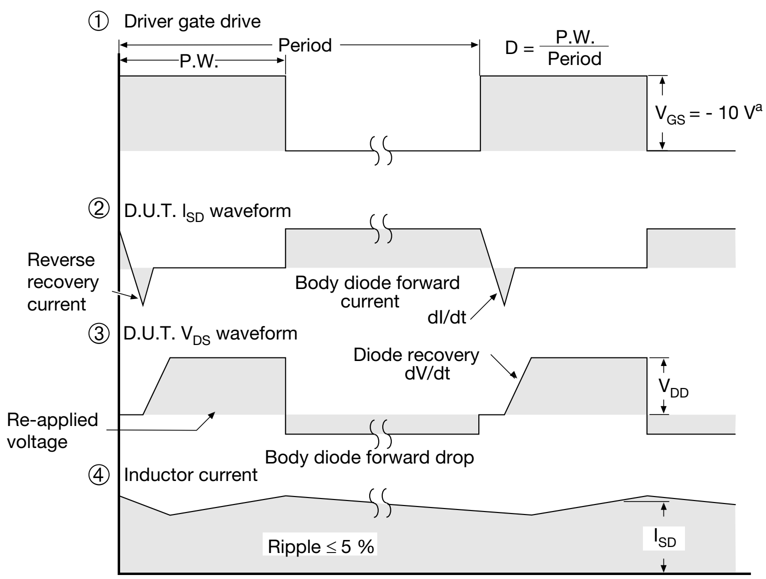


Fig. 13b - Gate Charge Test Circuit

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. 10 - For P-Channel

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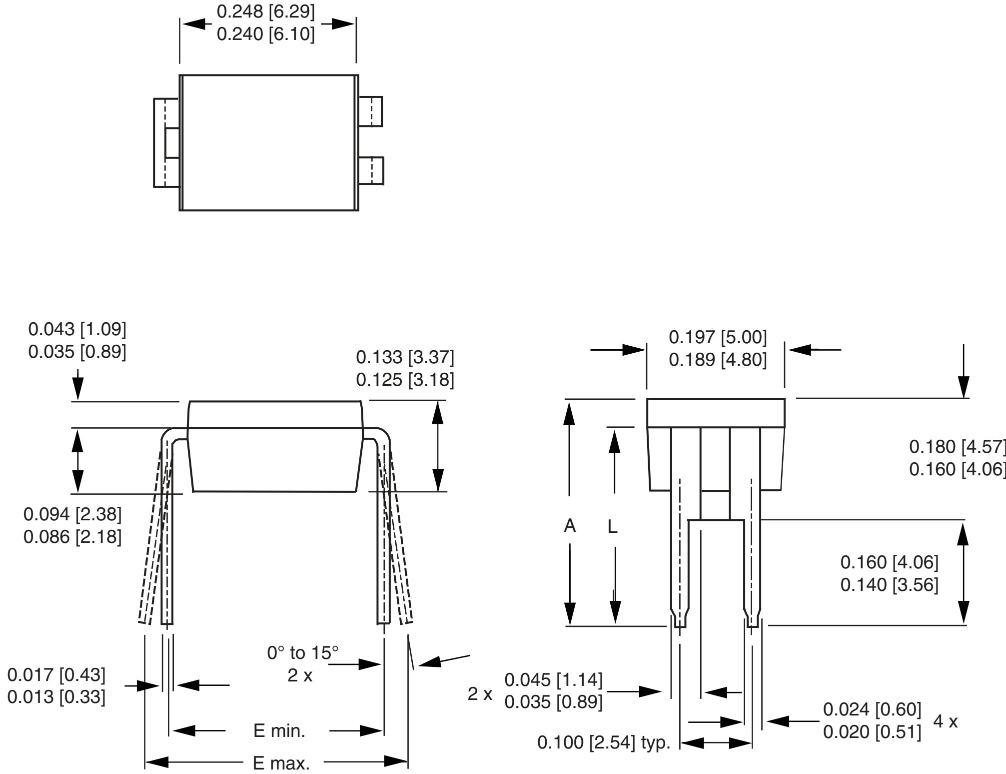
HVM DIP (High voltage)



	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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