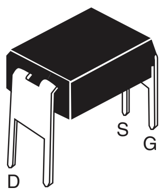
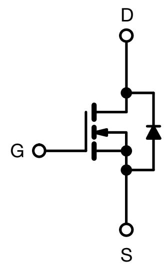
Power MOSFET

HVMDIP





N-Channel MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	400	
$R_{DS(on)}$ (Ω)	V_{GS} = 10 V	1.8
Q_g (Max.) (nC)	20	
Q_{gs} (nC)	3.3	
Q_{gd} (nC)	11	
Configuration	Single	

FEATURES

- Dynamic dV/dt rating
- Repetitive avalanche rated
- For automatic insertion
- End stackable
- Fast switching
- Ease of paralleling
- Simple drive requirements
- 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-insertiable 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	IRFD320PbF

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

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			V_{DS}	400	V
Gate-source voltage			V_{GS}	± 20	
Continuous drain current	V_{GS} at 10 V	T_A = 25 °C	I_D	0.49	A
		T_A = 100 °C		0.31	
Pulsed drain current [a]			I_{DM}	3.9	
Linear derating factor				0.0083	W/°C
Single pulse avalanche energy [b]			E_{AS}	48	mJ
Repetitive avalanche current [a]			I_{AR}	0.49	A
Repetitive avalanche energy [a]			E_{AR}	0.10	mJ
Maximum power dissipation	T_A = 25 °C		P_D	1.0	W
Peak diode recovery dV/dt [c]			dV/dt	4.0	V/ns
Operating junction and storage temperature range			T_J, T_{stg}	-55 to +150	°C
Soldering recommendations (peak temperature)	For 10 s			300	

Notes

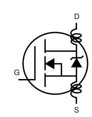
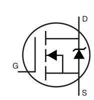
a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)

b. V_{DD} = 50 V, starting T_J = 25 °C, L = 21 mH, R_g = 25 Ω, I_{AS} = 2.0 A (see fig. 12)

c. $I_{SD} \leq 2.0$ A, dI/dt ≤ 40 A/μs, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °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		400	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA		-	0.51	-	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} = 400 V, V_{GS} = 0 V		-	-	25	μA
		V_{DS} = 320 V, V_{GS} = 0 V, T_J = 125 °C		-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 0.21 A [b]	-	-	1.8	Ω
Forward Transconductance	g_{fs}	V_{DS} = 50 V, I_D = 1.2 A		1.7	-	-	S
Dynamic							
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5		-	410	-	pF
Output Capacitance	C_{oss}			-	120	-	
Reverse Transfer Capacitance	C_{rss}			-	47	-	
Total Gate Charge	Q_g	V_{GS} = 10 V	I_D = 2.0 A, V_{DS} = 320 V, see fig. 6 and 13 [b]	-	-	20	nC
Gate-Source Charge	Q_{gs}			-	-	3.3	
Gate-Drain Charge	Q_{gd}			-	-	11	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 200 V, I_D = 3.3 A, R_g = 18 Ω, R_D = 56 Ω, see fig. 10 [b]		-	10	-	ns
Rise Time	t_r			-	14	-	
Turn-Off Delay Time	$t_{d(off)}$			-	30	-	
Fall Time	t_f			-	13	-	
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 		-	-	0.49	A
Pulsed Diode Forward Current[a]	I_{SM}			-	-	3.9	
Body Diode Voltage	V_{SD}	T_J = 25 °C, I_S = 0.49 A, V_{GS} = 0 V [b]		-	-	1.6	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = 3.3 A, dI/dt = 100 A/μs [b]		-	270	600	ns
Body Diode Reverse Recovery Charge	Q_{rr}			-	1.4	3.0	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)

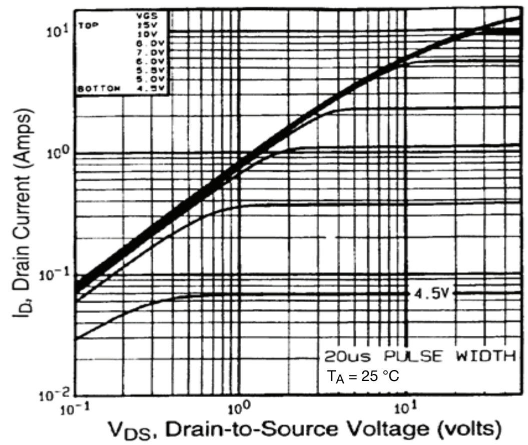


Fig. 1 - Typical Output Characteristics, T_A = 25 °C

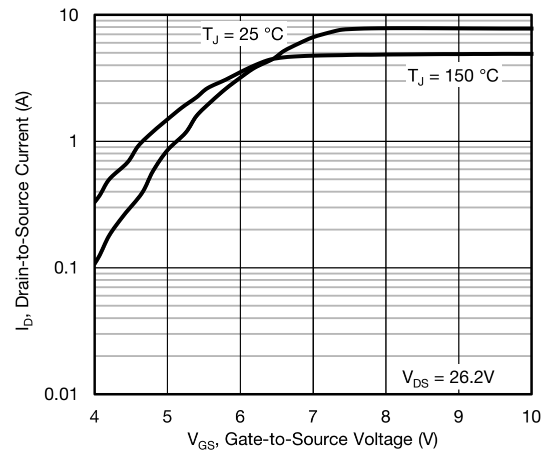


Fig. 3 - Typical Transfer Characteristics

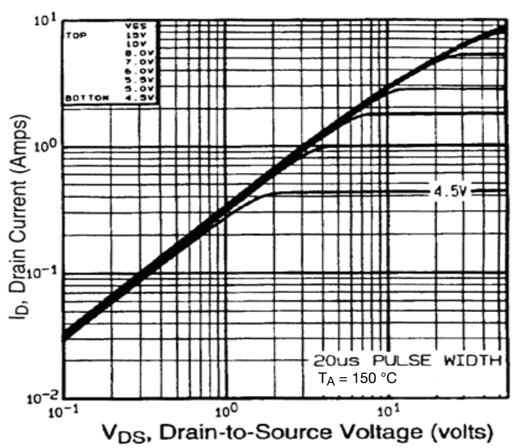


Fig. 2 - Typical Output Characteristics, T_A = 150 °C

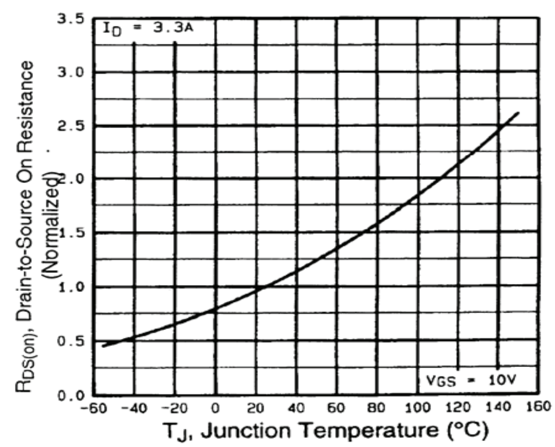


Fig. 4 - Normalized On-Resistance vs. Temperature

For technical questions, contact: hvm@vishay.com

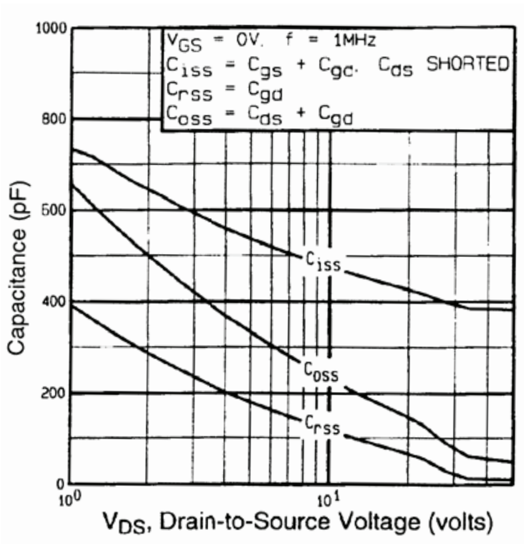


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

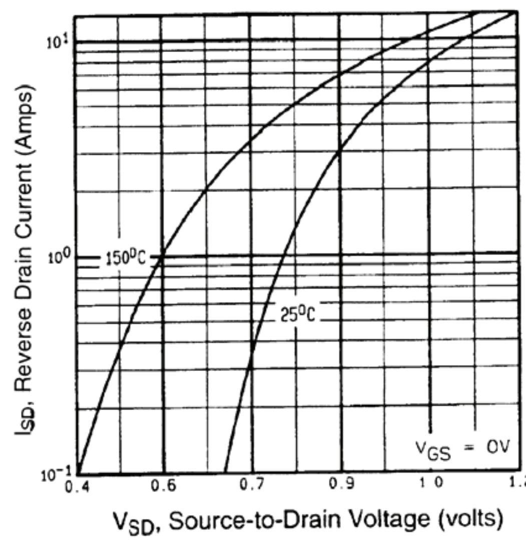


Fig. 7 - Typical Source-Drain Diode Forward Voltage

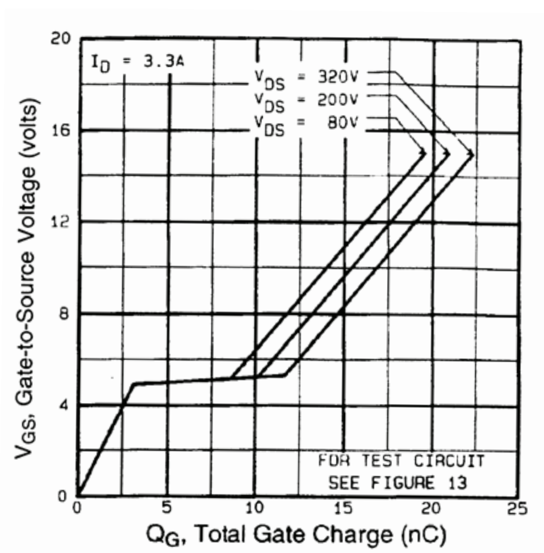


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

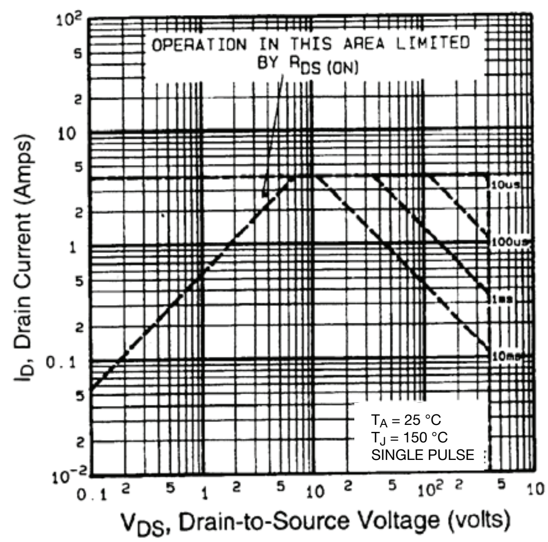


Fig. 8 - Maximum Safe Operating Area

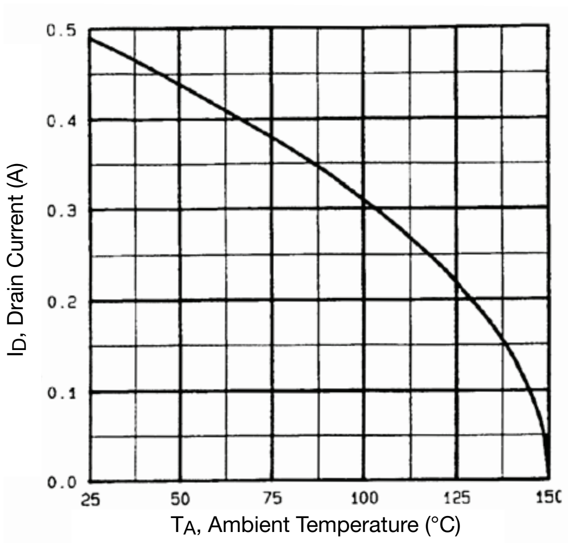


Fig. 9 - Maximum Drain Current vs. Ambient Temperature

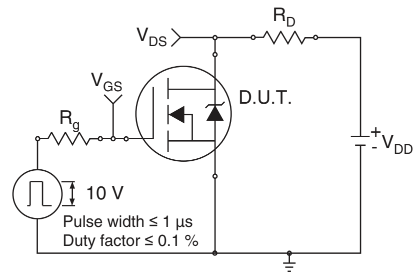


Fig. 10a - Switching Time Test Circuit

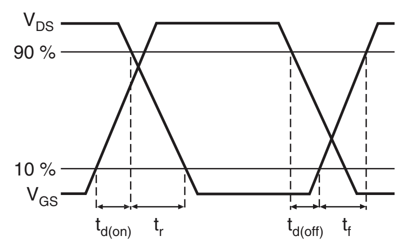


Fig. 10b - Switching Time Waveforms

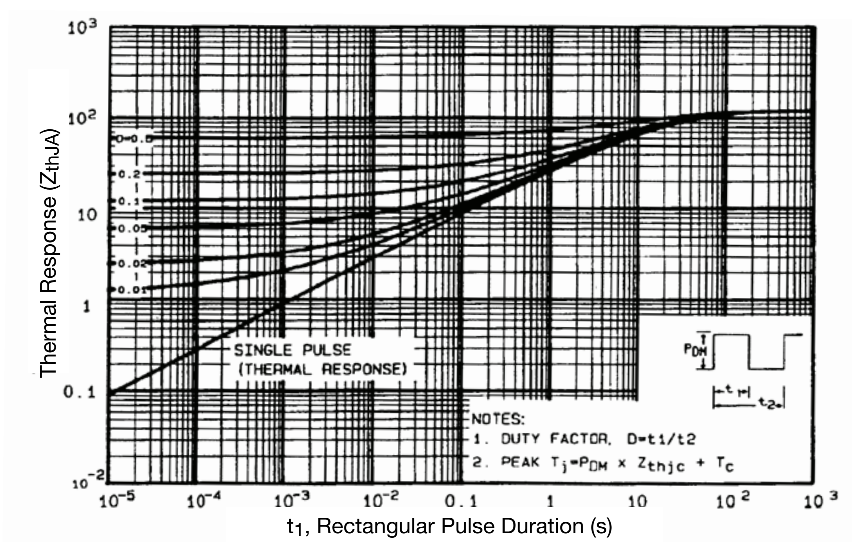


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

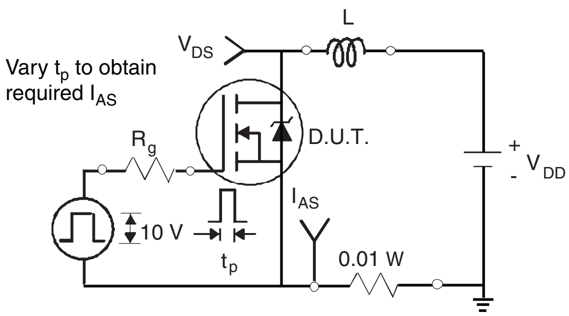


Fig. 12a - Unclamped Inductive Test Circuit

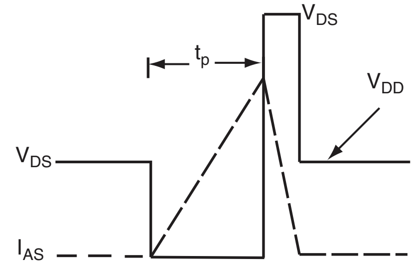


Fig. 12b - Unclamped Inductive Waveforms

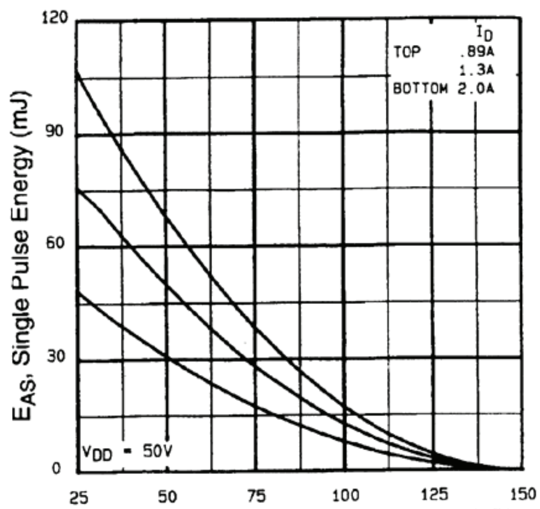


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

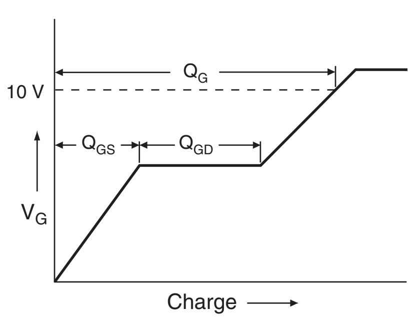


Fig. 13a - Basic Gate Charge Waveform

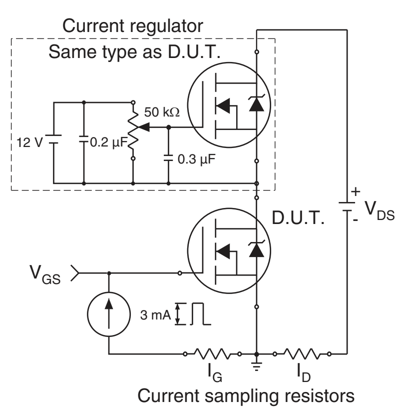
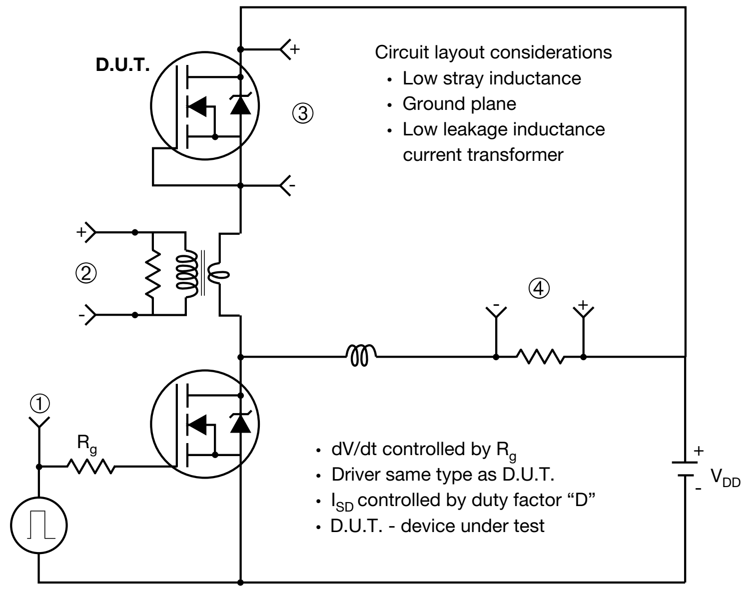
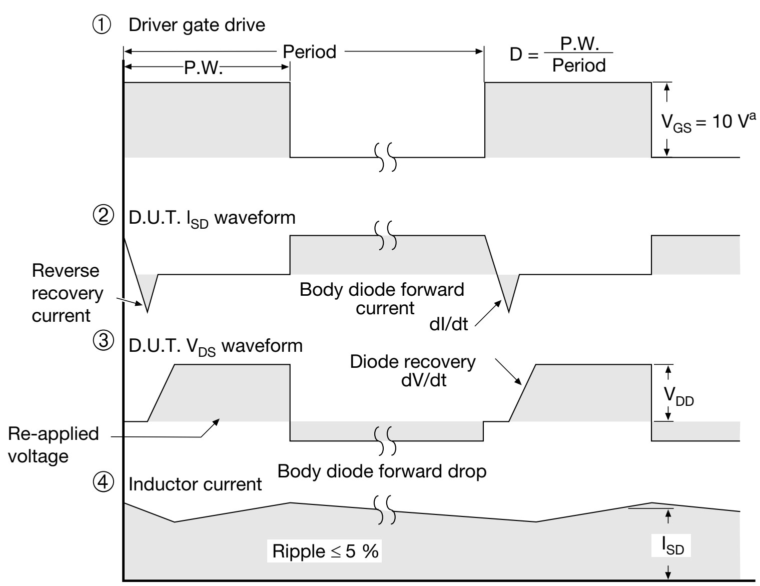


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit





Note

a. V_{GS} = 5 V for logic level devices

Fig. 14 - For N-Channel

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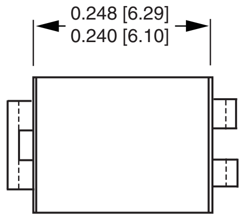
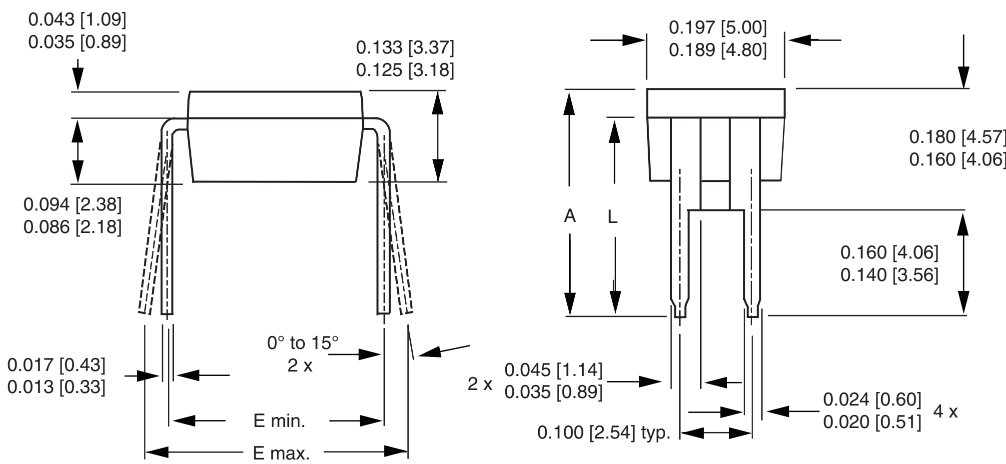
HVM DIP (High voltage)





	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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