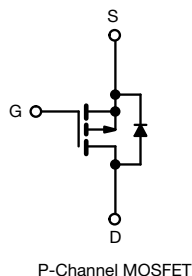
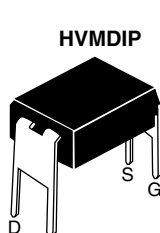


Power MOSFET

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	



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



DESCRIPTION

Third generation power MOSFETs from Vishay provides 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 serves as a thermal link to the mounting surface for power dissipation levels up to 1 W.

ORDERING INFORMATION

Package	HVMDIP
Lead (Pb)-Free	IRFD9020PbF

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
Repetitive 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) ^d	For 10 s			300	

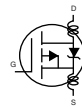

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = -25$ V, starting $T_J = 25$ °C, $L = 15$ mH, $R_g = 25$ Ω , $I_{AS} = -3.2$ A (see fig. 12).
- $I_{SD} \leq -11$ A, $dI/dt \leq -140$ A/ms, $V_{DD} \leq V_{DS}$, $T_J \leq 175$ °C.
- 1.6 mm from case.

THERMAL RESISTANCE RATINGS

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

SPECIFICATIONS ($T_J = 25\text{ °C}$, 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	ΔV _{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 = -1 μA		-2.0	-	-4.0	V
Gate-Source Leakage	I _{GSS}	V _{GS} = ± 20		-	-	± 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 = - 11A, 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 $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

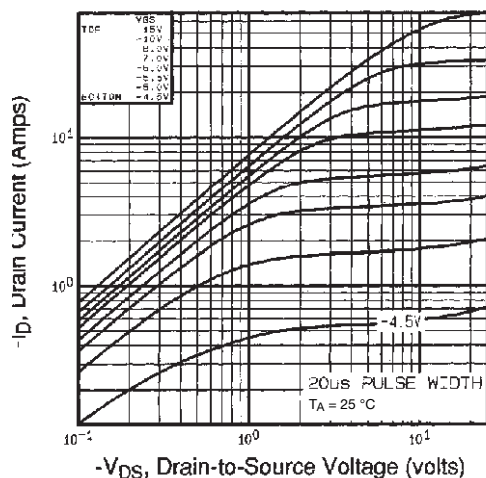


Fig. 1 - Typical Output Characteristics, $T_A = 25\text{ }^{\circ}\text{C}$

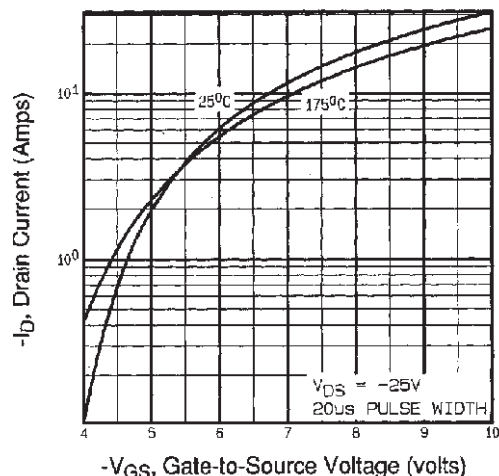


Fig. 3 - Typical Transfer Characteristics

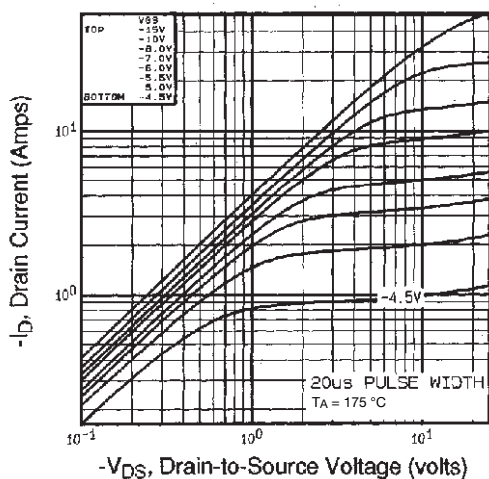


Fig. 2 - Typical Output Characteristics, $T_A = 175\text{ }^{\circ}\text{C}$

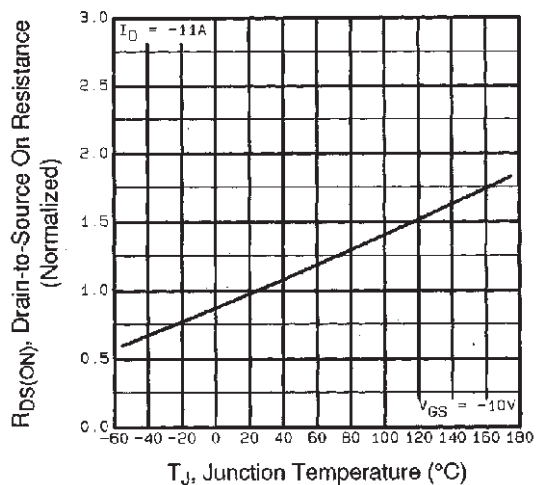
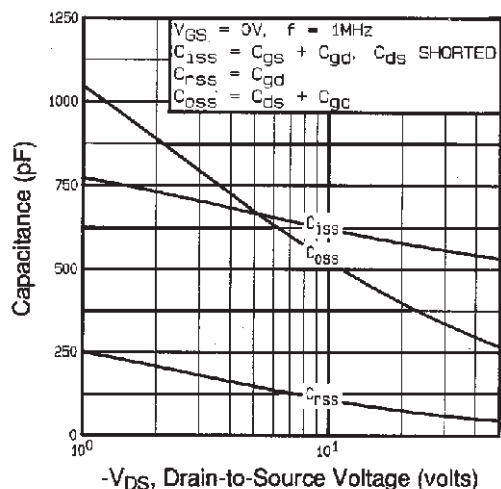
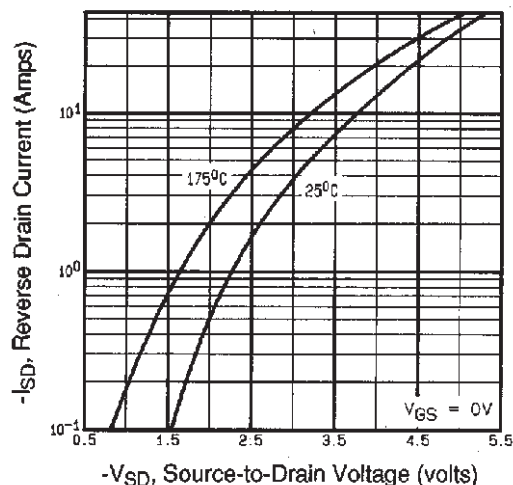
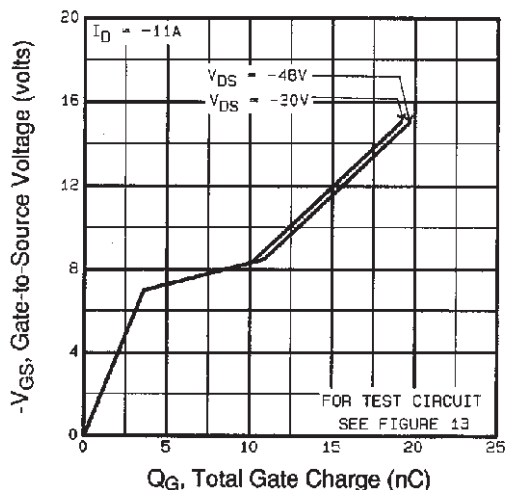
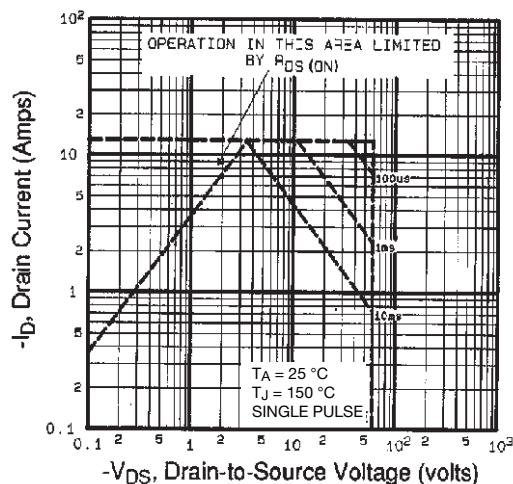
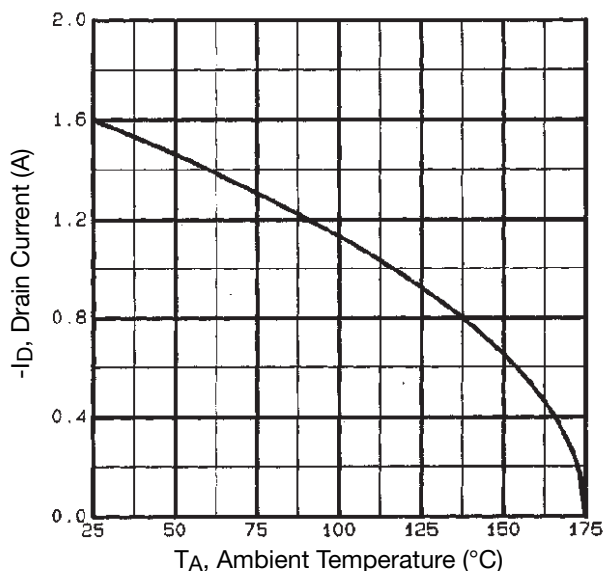
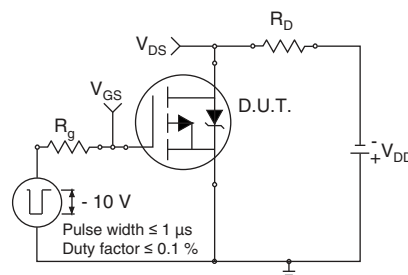
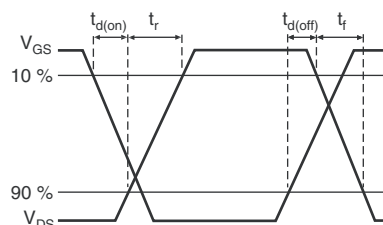
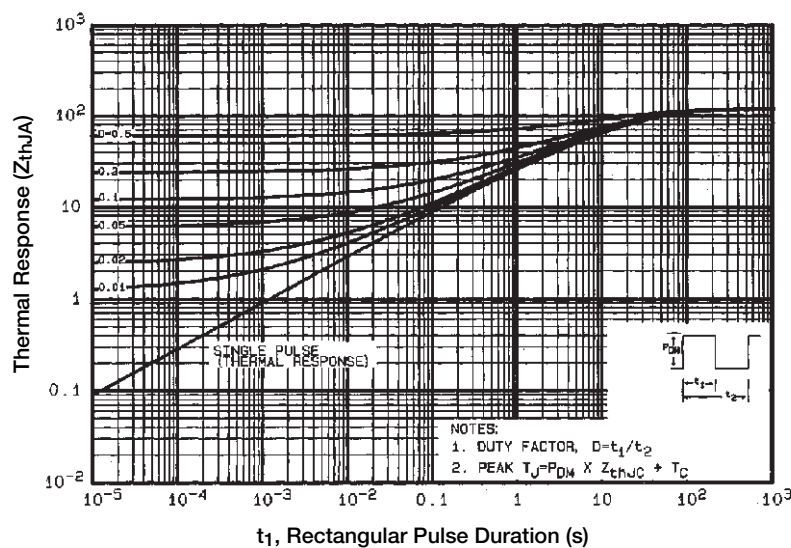
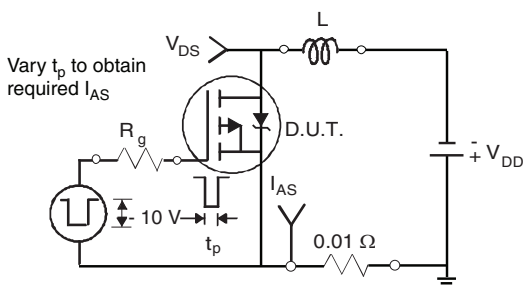
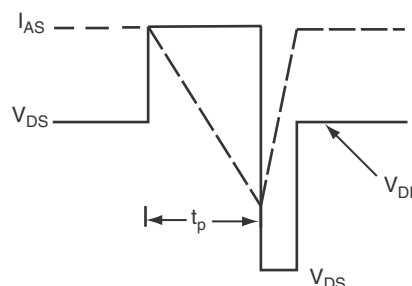


Fig. 4 - Normalized On-Resistance vs. Temperature


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. 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

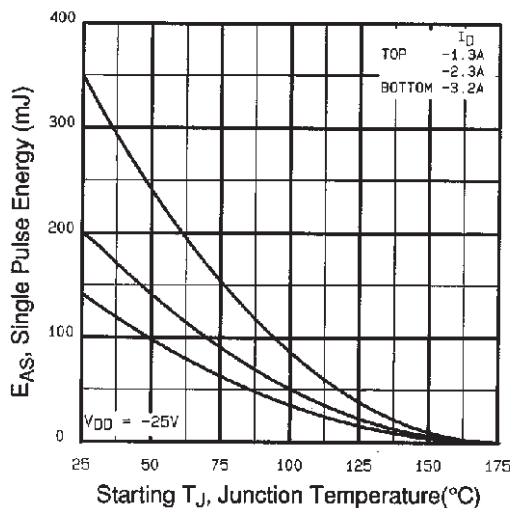


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

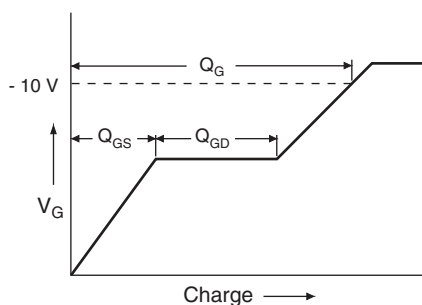


Fig. 13a - Basic Gate Charge Waveform

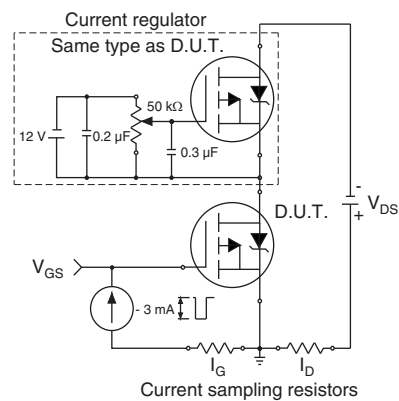


Fig. 13b - Gate Charge Test Circuit

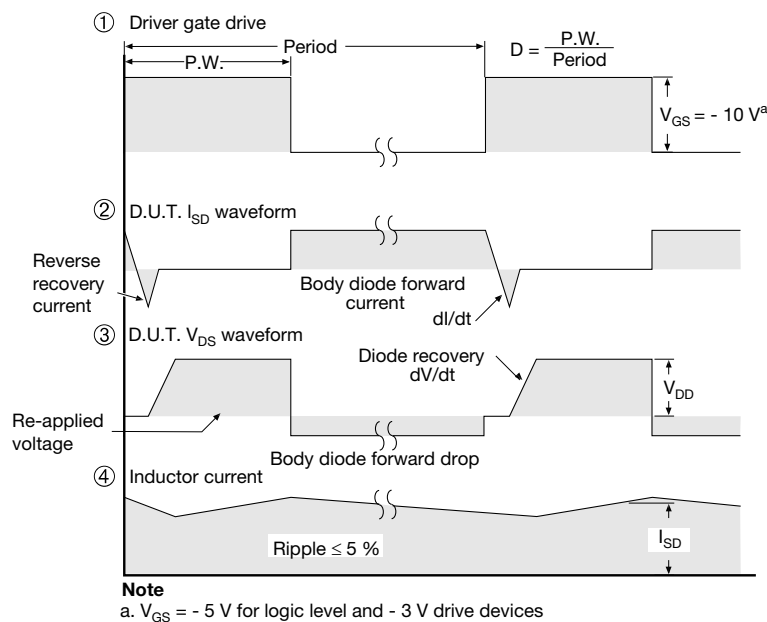
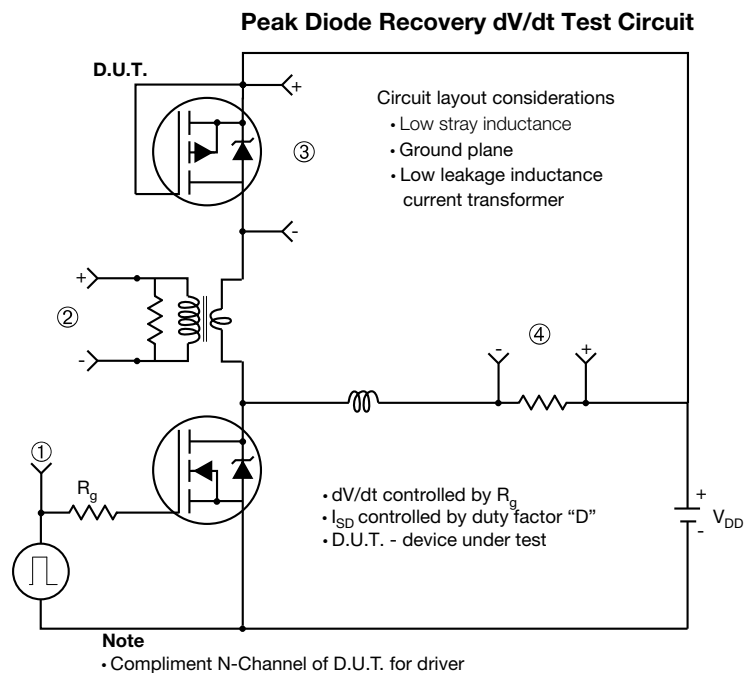
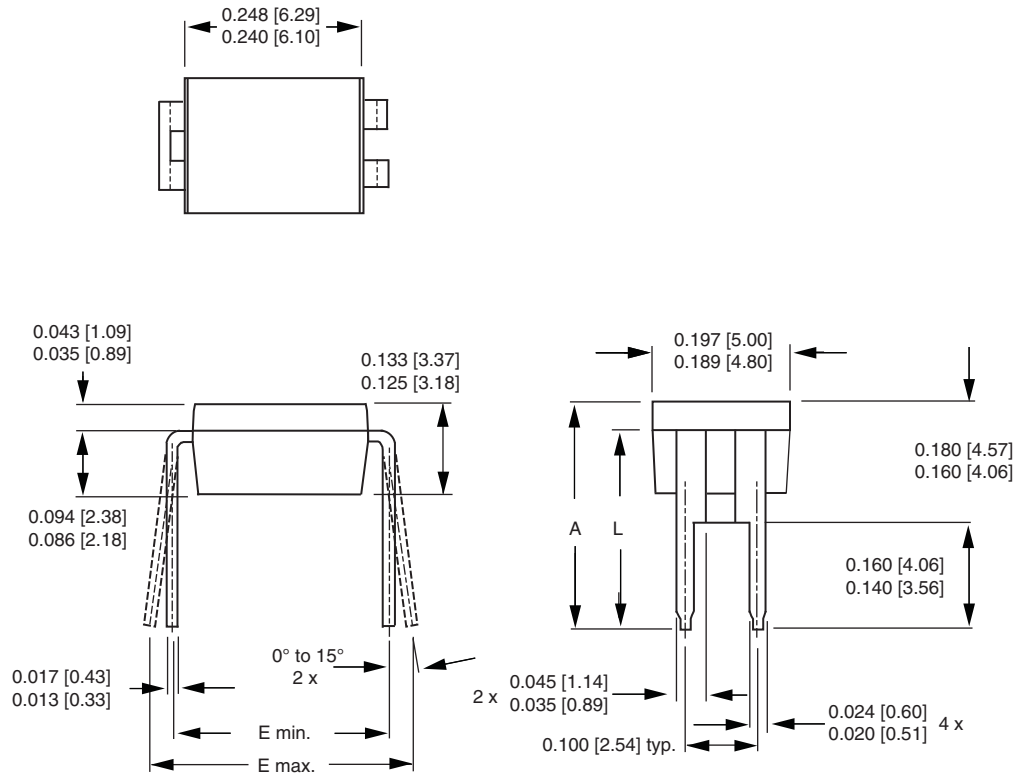


Fig. 14 - For P-Channel

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HVM DIP (High voltage)



DIM.	INCHES		MILLIMETERS	
	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

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



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