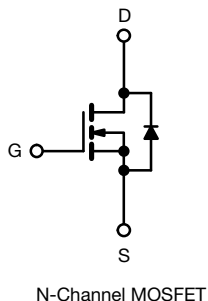
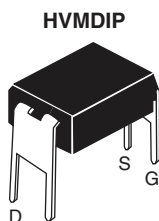


Power MOSFET



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



PRODUCT SUMMARY

V_{DS} (V)	400	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	3.6
Q_g (Max.) (nC)	17	
Q_{gs} (nC)	3.4	
Q_{gd} (nC)	8.5	
Configuration	Single	

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-insertible 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	IRFD310PbF

ABSOLUTE MAXIMUM RATINGS ($T_A = 25\text{ }^\circ\text{C}$, 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	0.35	A
		T _A = 100 °C		0.22	
Pulsed drain current ^a			I _{DM}	2.8	
Linear derating factor				0.0083	W/°C
Single pulse avalanche energy ^b			E _{AS}	46	mJ
Repetitive avalanche current ^a			I _{AR}	0.35	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 ^d	

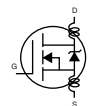
Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- $V_{DD} = 50\text{ V}$, starting $T_J = 25\text{ }^\circ\text{C}$, $L = 41\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 1.4\text{ A}$ (see fig. 12)
- $I_{SD} \leq 2.0\text{ A}$, $dI/dt \leq 40\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$
- 1.6 mm from case

THERMAL RESISTANCE RATINGS

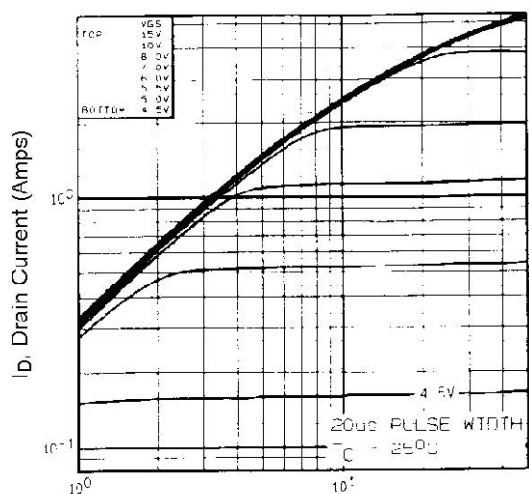
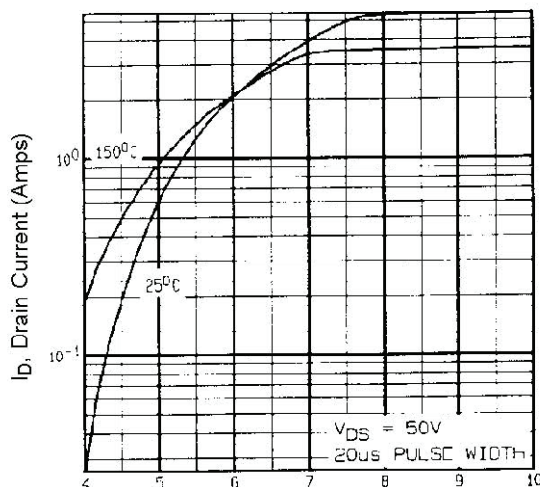
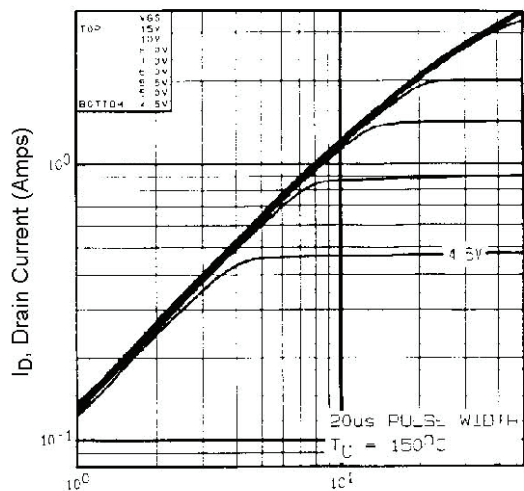
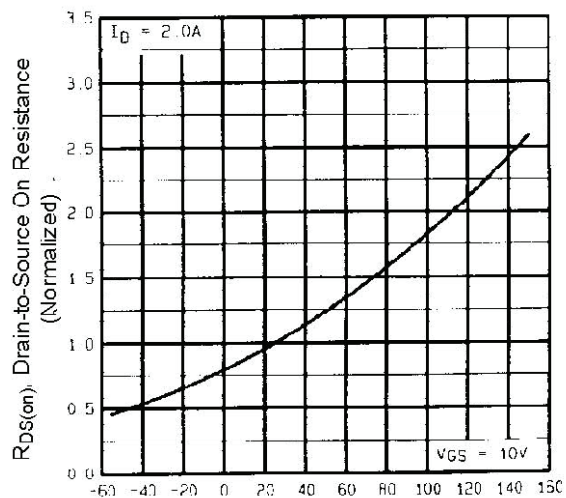
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	120	°C/W

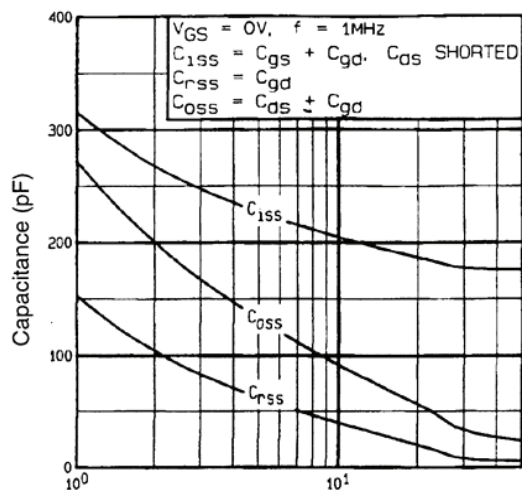
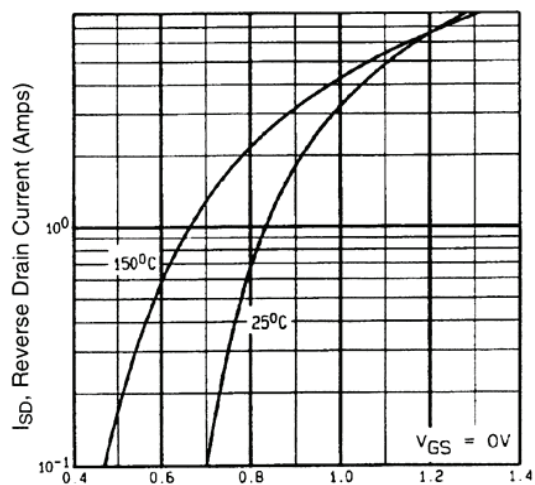
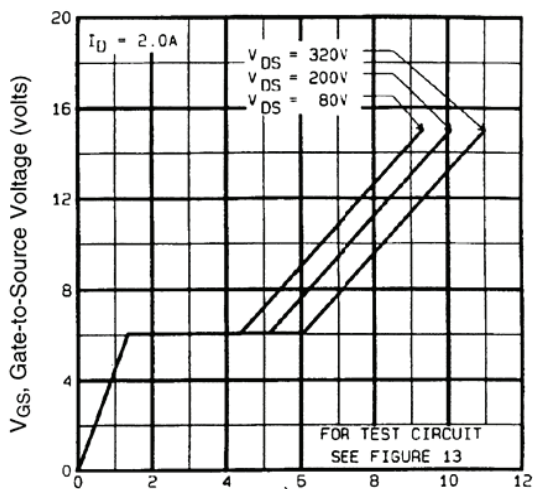
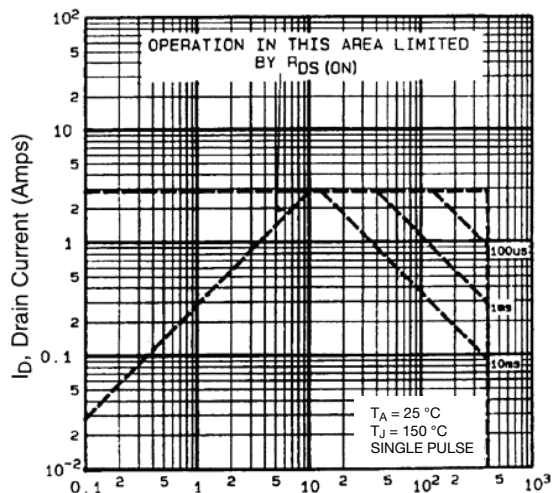
SPECIFICATIONS ($T_J = 25\text{ °C}$, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		400	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-	0.47	-	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	-	-	3.6	Ω
Forward Transconductance	g _{fs}	V _{DS} = 50 V, I _D = 1.2 A		1.0	-	-	S
Dynamic							
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5		-	170	-	pF
Output Capacitance	C _{oss}			-	34	-	
Reverse Transfer Capacitance	C _{rss}			-	6.3	-	
Total Gate Charge	Q _g	V _{GS} = 10 V	I _D = 2.0 A, V _{DS} = 320 V, see fig. 6 and 13 ^b	-	-	17	nC
Gate-Source Charge	Q _{gs}			-	-	3.4	
Gate-Drain Charge	Q _{gd}			-	-	8.5	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 200 V, I _D = 2.0 A, R _g = 24 Ω, R _D = 95 Ω, see fig. 10 ^b		-	8.0	-	ns
Rise Time	t _r			-	9.9	-	
Turn-Off Delay Time	t _{d(off)}			-	21	-	
Fall Time	t _f			-	11	-	
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 		-	-	0.35	A
Pulsed Diode Forward Current ^a	I _{SM}			-	-	2.8	
Body Diode Voltage	V _{SD}	T _J = 25 °C, I _S = 0.35 A, V _{GS} = 0 V ^b		-	-	1.6	V
Body Diode Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = 2.0 A, dI/dt = 100 A/μs ^b		-	240	540	ns
Body Diode Reverse Recovery Charge	Q _{rr}			-	0.85	1.6	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, $T_A = 25^\circ\text{C}$

Fig. 2 - Typical Transfer Characteristics

Fig. 1 - Typical Output Characteristics, $T_A = 150^\circ\text{C}$

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

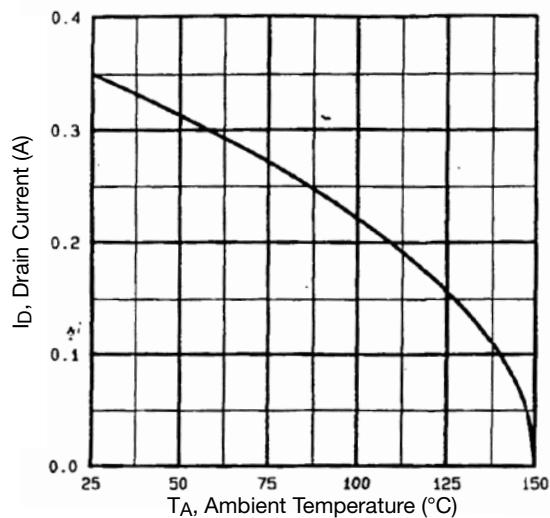


Fig. 8 - Maximum Drain Current vs. Ambient Temperature

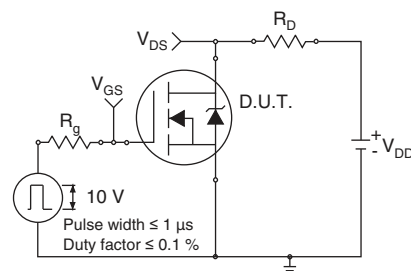


Fig. 10a - Switching Time Test Circuit

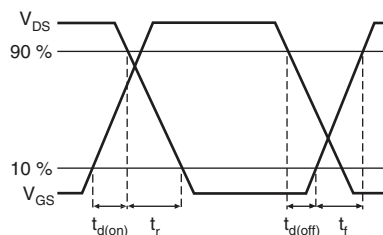


Fig. 10b - Switching Time Waveforms

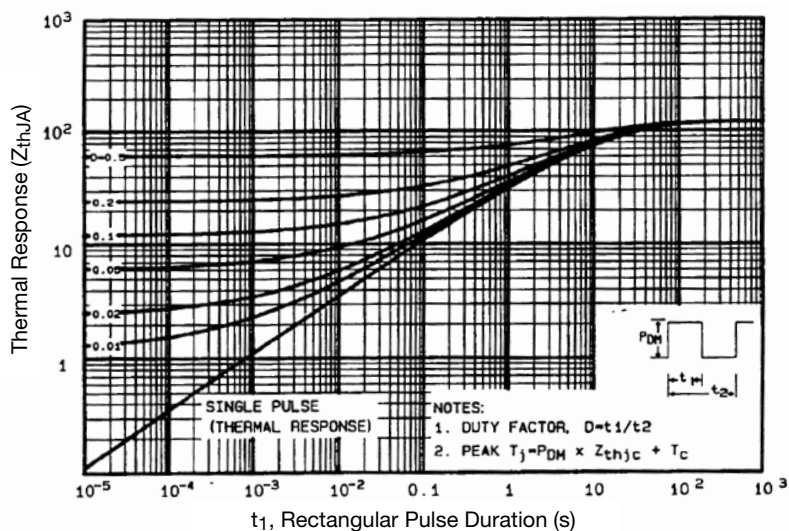


Fig. 9 - Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

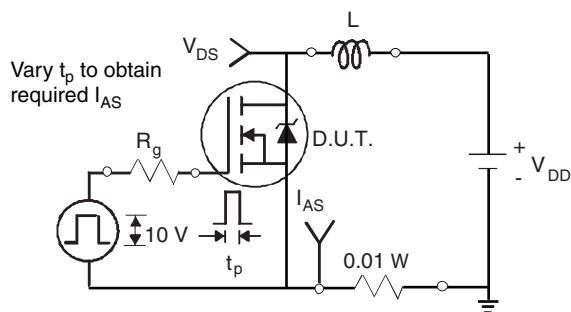


Fig. 12a - Unclamped Inductive Test Circuit

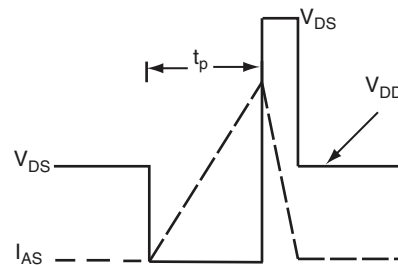


Fig. 12b - Unclamped Inductive Waveforms

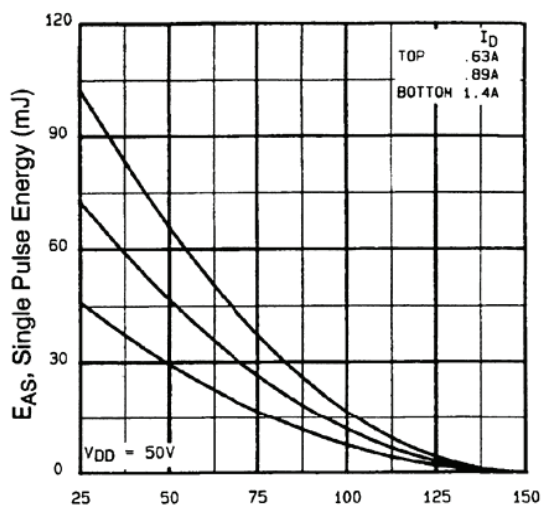


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

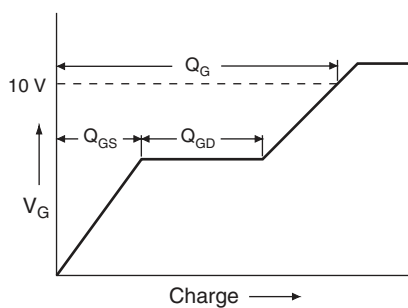


Fig. 13a - Basic Gate Charge Waveform

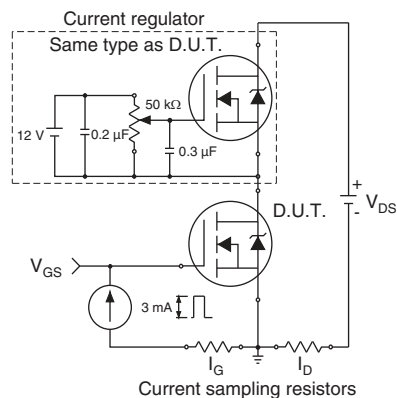
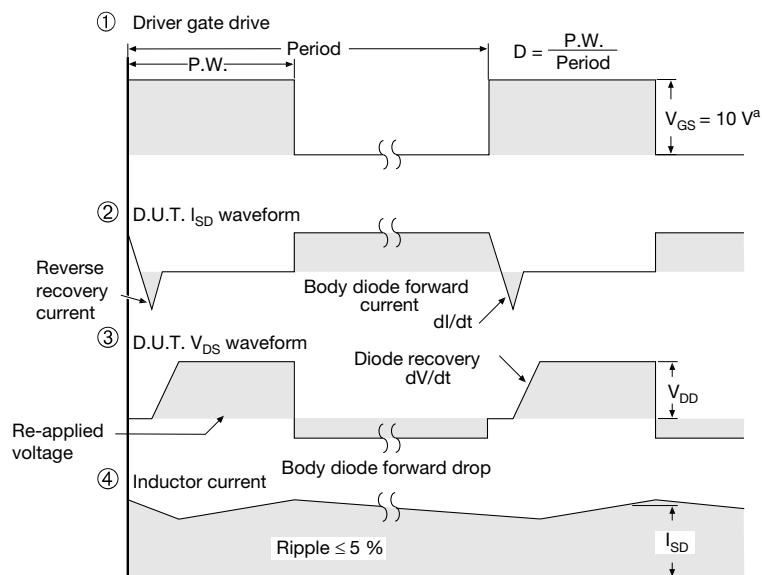
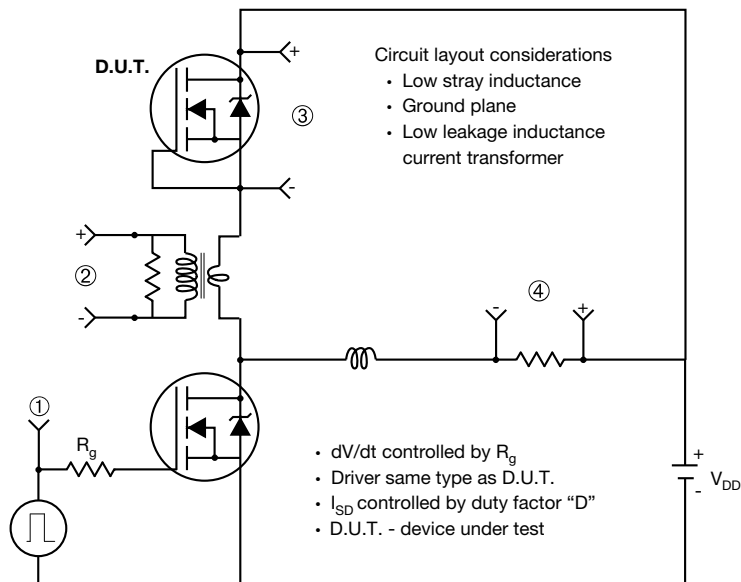


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



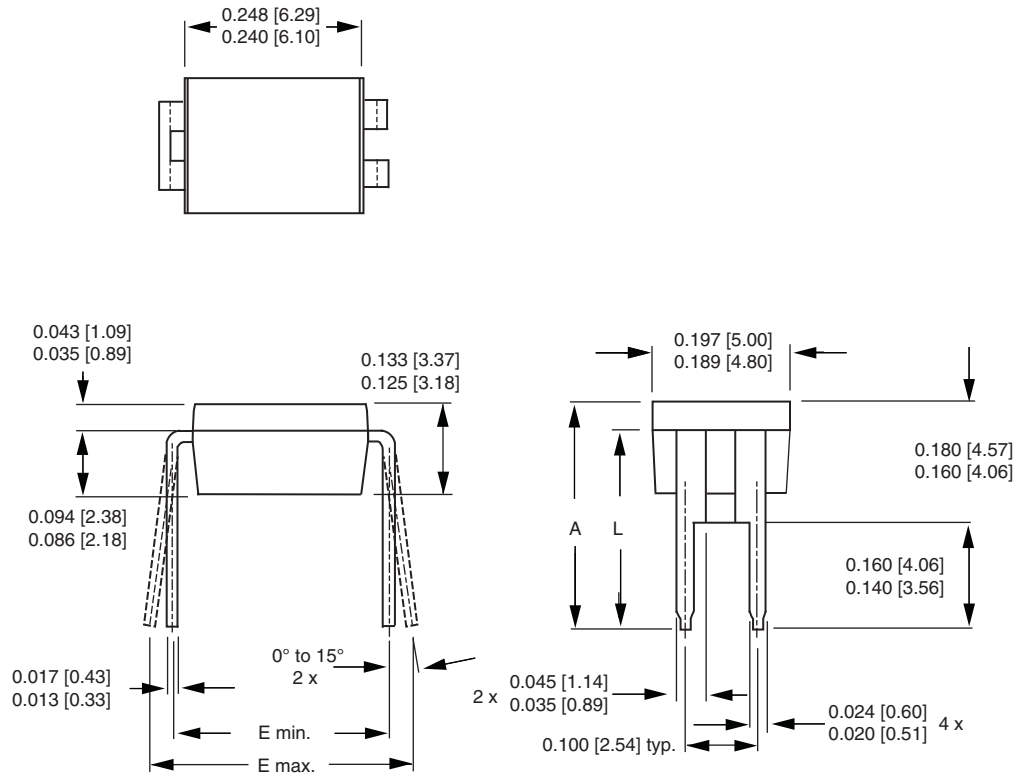
Note

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

Fig. 10 - For N-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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