

## Power MOSFET

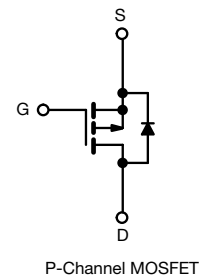
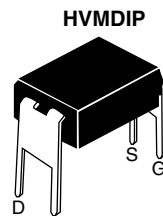
PRODUCT SUMMARY		
V <sub>DS</sub> (V)	-60	
R <sub>DS(on)</sub> (Ω)	V <sub>GS</sub> = -10 V	0.10
Q <sub>g</sub> max. (nC)	19	
Q <sub>gs</sub> (nC)	5.4	
Q <sub>gd</sub> (nC)	11	
Configuration	Single	

### FEATURES

- Dynamic dV/dt rating
- Repetitive avalanche rated
- For automatic insertion
- End stackable
- P-channel
- 175 °C operating temperature
- Fast switching



RoHS  
COMPLIANT

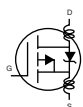



ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	V <sub>DS</sub>	-60	V	
Gate-Source Voltage	V <sub>GS</sub>	± 20		
Continuous Drain Current	V <sub>GS</sub> at -10 V	T <sub>A</sub> = 25 °C	A	
		T <sub>A</sub> = 100 °C		
Pulsed Drain Current <sup>a</sup>	I <sub>DM</sub>	-15		
Linear Derating Factor		0.0083	W/°C	
Single Pulse Avalanche Energy <sup>b</sup>	E <sub>AS</sub>	180	mJ	
Repetitive Avalanche Current <sup>a</sup>	I <sub>AR</sub>	-3.0	A	
Repetitive Avalanche Energy <sup>a</sup>	E <sub>AR</sub>	0.23	mJ	
Maximum Power Dissipation	T <sub>A</sub> = 25 °C	P <sub>D</sub>	2.3	W
Peak Diode Recovery dV/dt <sup>c</sup>	dV/dt	-4.5	V/ns	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C	
Soldering Recommendations (Peak temperature) <sup>d</sup>	For 10 s	300		

### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- V<sub>DD</sub> = -25 V, starting T<sub>J</sub> = 25 °C, L = 15 mH, R<sub>g</sub> = 25 Ω, I<sub>AS</sub> = -3.2 A (see fig. 12).
- I<sub>SD</sub> ≤ -11 A, dI/dt ≤ -140 A/ms, V<sub>DD</sub> ≤ V<sub>DS</sub>, T<sub>J</sub> ≤ 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 ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-60	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$ , $I_D = -1\text{ mA}$	-	-0.056	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -1\text{ }\mu\text{A}$	-2.0	-	-4.0	V
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 20$	-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$	-	-	-100	$\mu\text{A}$
		$V_{DS} = -48\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	-	-500	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -0.96\text{ A}^b$	-	0.10	-	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = -25\text{ V}, I_D = -0.96\text{ A}^b$	1.3	-	-	S
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = -25\text{ V}, f = 1.0\text{ MHz}$ , see fig. 5	-	570	-	$\mu\text{F}$
Output Capacitance	$C_{oss}$		-	360	-	
Reverse Transfer Capacitance	$C_{rss}$		-	65	-	
Total Gate Charge	$Q_g$	$V_{GS} = -10\text{ V}, I_D = -11\text{ A}, V_{DS} = -48\text{ V}$ , see fig. 6 and 13 <sup>b</sup>	-	-	19	nC
Gate-Source Charge	$Q_{gs}$		-	-	5.4	
Gate-Drain Charge	$Q_{gd}$		-	-	11	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -30\text{ V}, I_D = -11\text{ A}, R_g = 18\text{ }\Omega, R_D = 2.5\text{ }\Omega$ , see fig. 10 <sup>b</sup>	-	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	-	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	-1.6	A
Pulsed Diode Forward Current <sup>a</sup>	$I_{SM}$		-	-	-13	
Body Diode Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = -1.6\text{ A}, V_{GS} = 0\text{ V}^b$	-	-	-6.3	V
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = -11\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$	-	100	200	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$		-	0.32	0.64	$\mu\text{C}$
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  $\leq 2\text{ }\%$ .

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

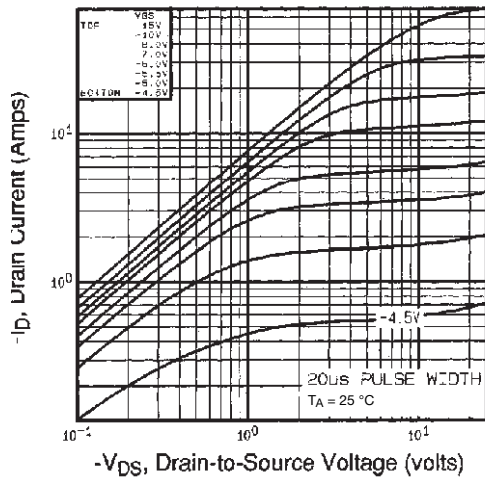


Fig. 1 - Typical Output Characteristics,  $T_A = 25\text{ °C}$

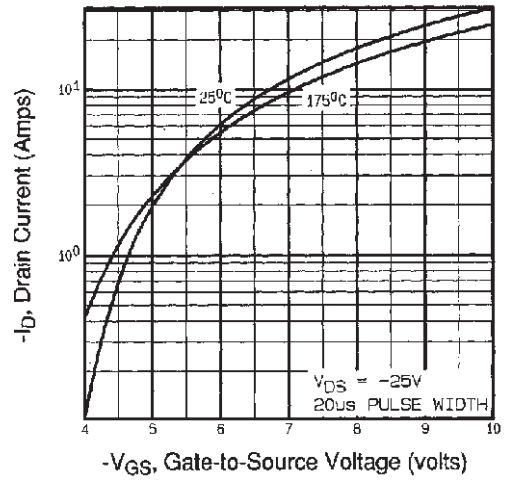


Fig. 3 - Typical Transfer Characteristics

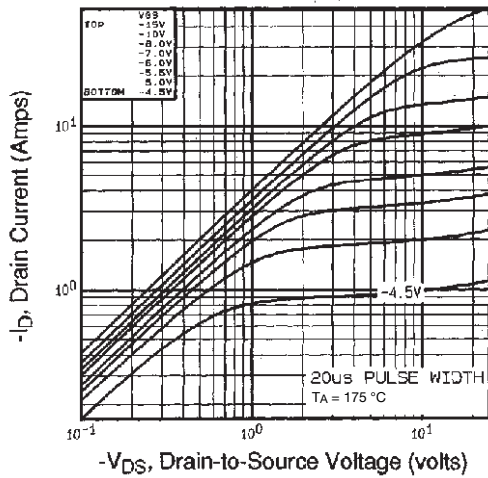


Fig. 2 - Typical Output Characteristics,  $T_A = 175\text{ °C}$

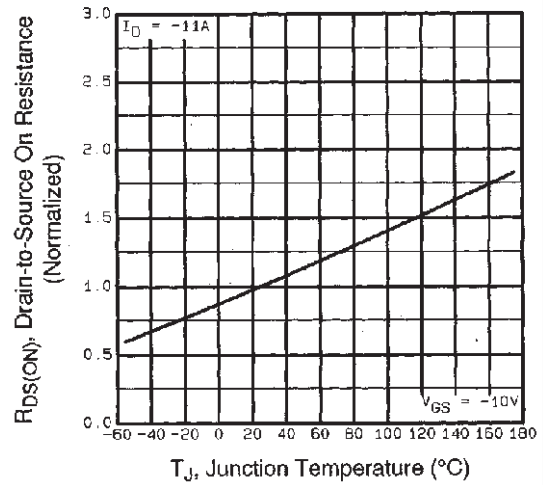


Fig. 4 - Normalized On-Resistance vs. Temperature

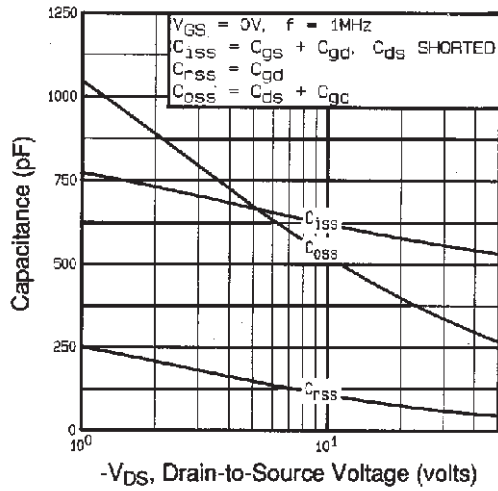


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

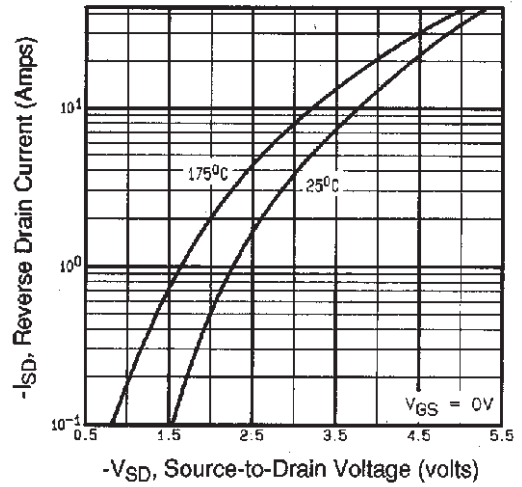


Fig. 7 - Typical Source-Drain Diode Forward Voltage

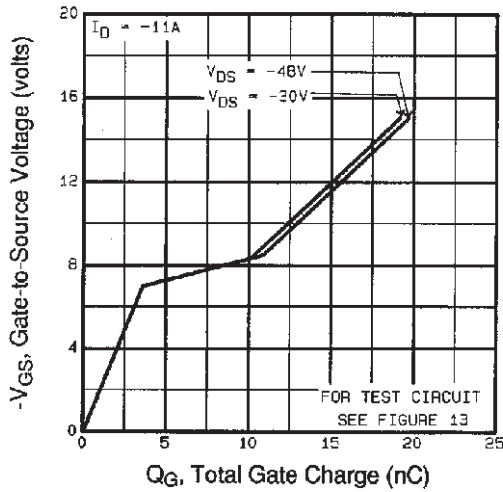


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

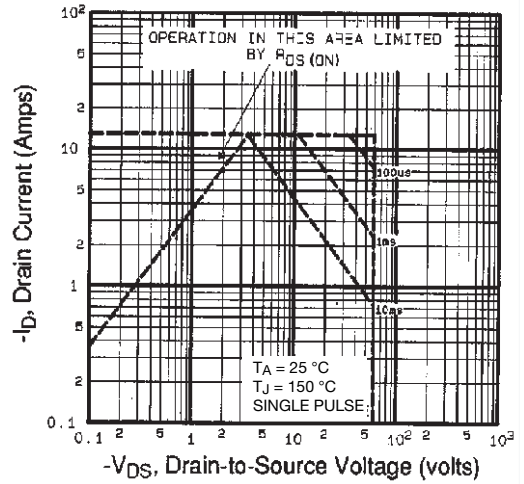


Fig. 8 - Maximum Safe Operating Area

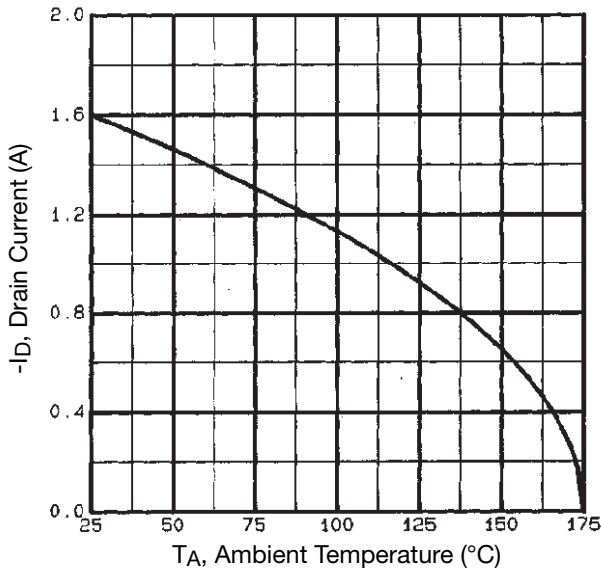


Fig. 9 - Maximum Drain Current vs. Ambient Temperature

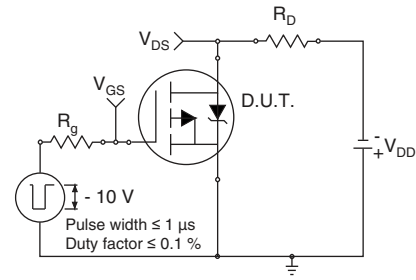


Fig. 10a - Switching Time Test Circuit

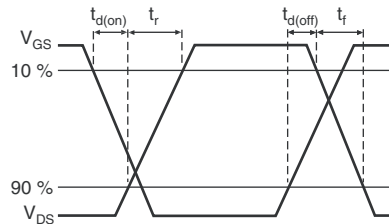


Fig. 10b - Switching Time Waveforms

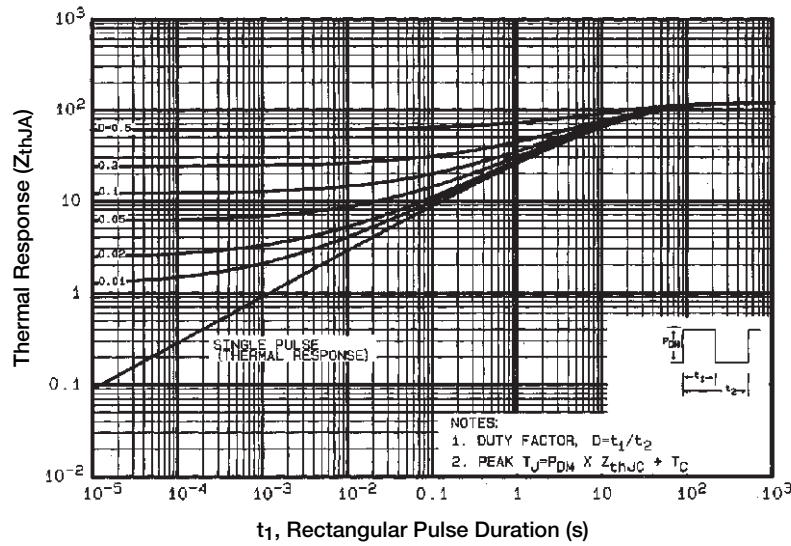


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

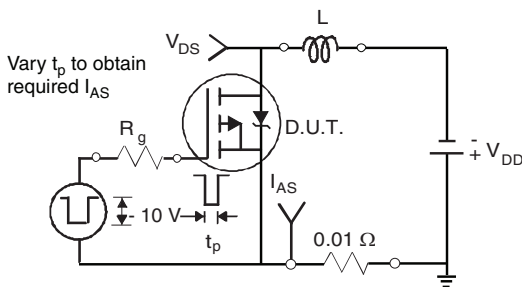


Fig. 12a - Unclamped Inductive Test Circuit

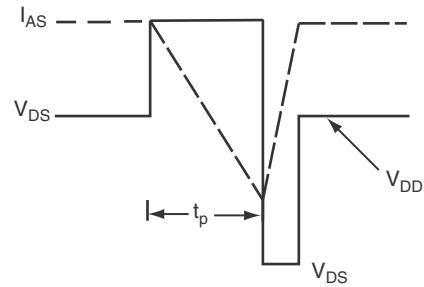


Fig. 12b - Unclamped Inductive Waveforms

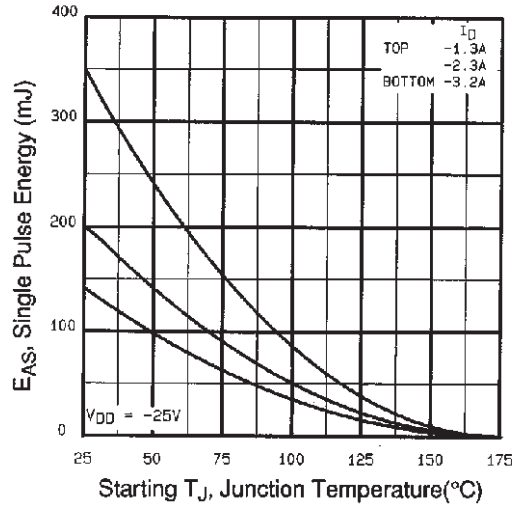


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

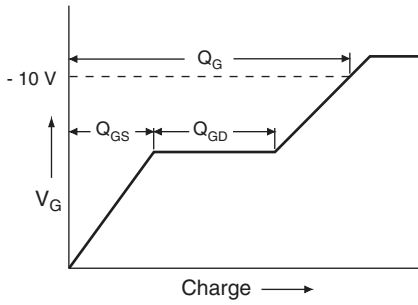


Fig. 13a - Basic Gate Charge Waveform

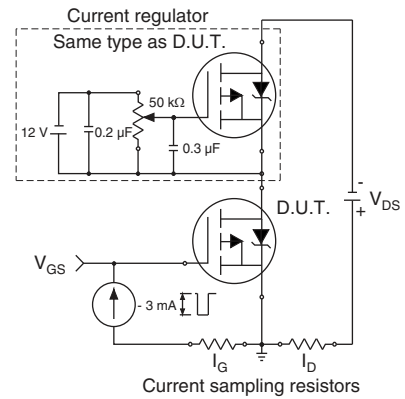
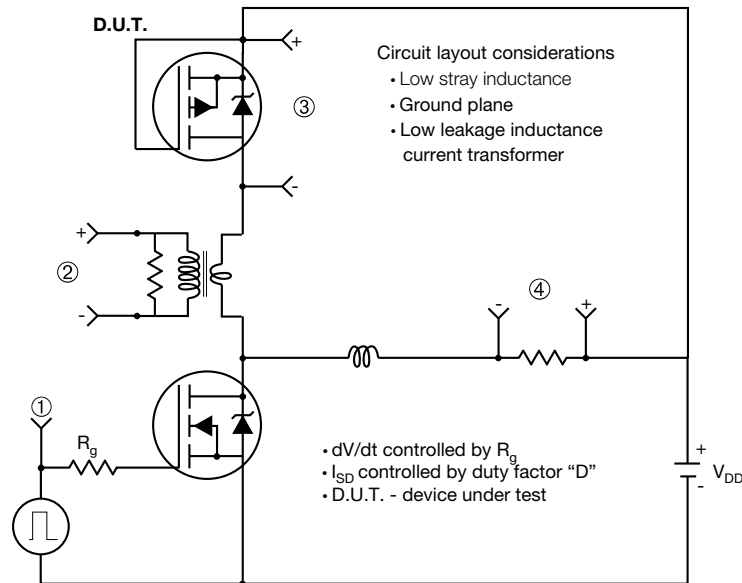
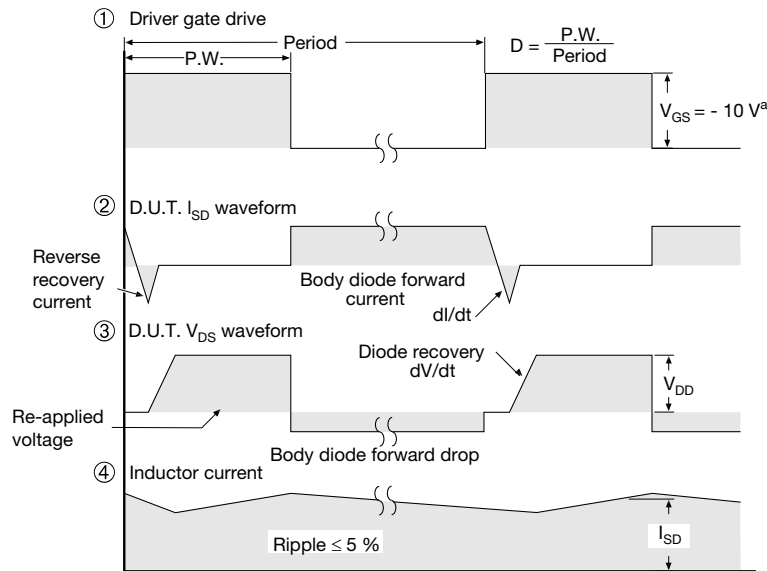


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



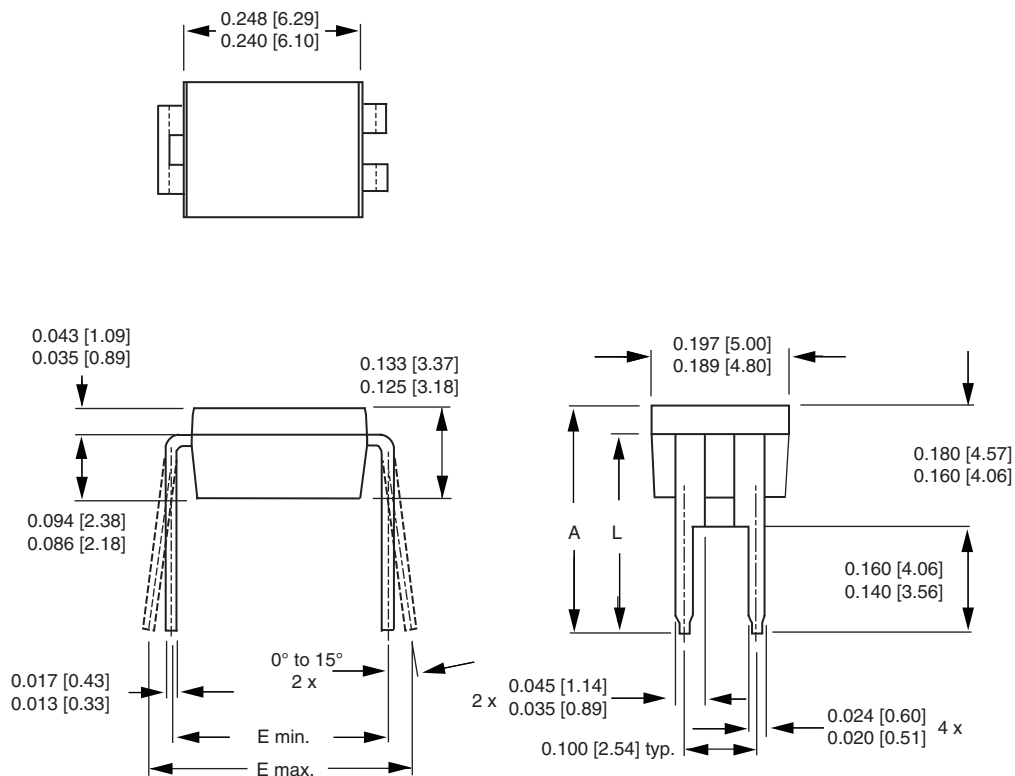
**Note**  
• Compliment N-Channel of D.U.T. for driver



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

Fig. 14 - For P-Channel

**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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