

F9610-VB Datasheet

Power MOSFET

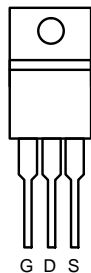
PRODUCT SUMMARY		
V _{DS} (V)	-200	
R _{DS(on)} (Ω)	V _{GS} = -10 V	0.8
Q _g max. (nC)	29	
Q _{gs} (nC)	5.4	
Q _{gd} (nC)	15	
Configuration	Single	

FEATURES

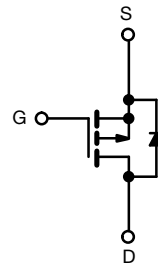
- Surface mount
- Available in tape and reel
- Dynamic dV/dt rating
- Repetitive avalanche rated
- P-channel
- Fast switching
- Ease of paralleling



TO-220AB



G D S
Top View



P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T _C = 25 °C, unless otherwise noted)				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	V _{DS}	-200	V	
Gate-Source Voltage	V _{GS}	± 20		
Continuous Drain Current	V _{GS} at -10 V	T _C = 25 °C	-5.0	A
		T _C = 100 °C	-3.5	
Pulsed Drain Current ^a	I _{DM}	-26	W/°C	
Linear Derating Factor		0.59		
Linear Derating Factor (PCB mount) ^e		0.025		
Single Pulse Avalanche Energy ^b	E _{AS}	500	mJ	
Avalanche Current ^a	I _{AR}	-6.4	A	
Repetitive Avalanche Energy ^a	E _{AR}	7.4	mJ	
Maximum Power Dissipation	P _D	T _C = 25 °C	74	W
		T _A = 25 °C	3.0	
Peak Diode Recovery dV/dt ^c	dV/dt	-5.0	V/ns	
Operating Junction and Storage Temperature Range	T _J , T _{stg}	-55 to +150	°C	
Soldering Recommendations (Peak temperature) ^d	for 10 s	300		

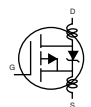

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- b. V_{DD} = -50 V, starting T_J = 25 °C, L = 17 mH, R_g = 25 Ω, I_{AS} = -6.5 A (see fig. 12).
- c. I_{SD} ≤ -6.5 A, di/dt ≤ 120 A/μs, V_{DD} ≤ V_{DS}, T_J ≤ 150 °C.
- d. 1.6 mm from case.
- e. When mounted on 1" square PCB (FR-4 or G-10 material).

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	62	°C/W
Maximum Junction-to-Ambient (PCB mount) ^a	R_{thJA}	-	40	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	1.7	

Note

a. When mounted on 1" square PCB (FR-4 or G-10 material).

SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0, I_D = -250\ \mu\text{A}$	-200	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = -1\ \text{mA}$	-	-0.24	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-2.0	-	-4.0	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 20\ \text{V}$	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -200\ \text{V}, V_{GS} = 0\ \text{V}$	-	-	-100	μA
		$V_{DS} = -160\ \text{V}, V_{GS} = 0\ \text{V}, T_J = 125\text{ }^\circ\text{C}$	-	-	-500	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = -10\ \text{V}, I_D = -3.9\ \text{A}^b$	-	0.80	-	Ω
Forward Transconductance	g_{fs}	$V_{DS} = -50\ \text{V}, I_D = -3.9\ \text{A}^b$	2.8	-	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\ \text{V}, V_{DS} = -25\ \text{V}, f = 1.0\ \text{MHz}$, see fig. 5	-	700	-	μF
Output Capacitance	C_{oss}		-	200	-	
Reverse Transfer Capacitance	C_{rss}		-	40	-	
Total Gate Charge	Q_g	$V_{GS} = -10\ \text{V}, I_D = -6.5\ \text{A}, V_{DS} = -160\ \text{V}$, see fig. 6 and 13 ^b	-	-	29	nC
Gate-Source Charge	Q_{gs}		-	-	5.4	
Gate-Drain Charge	Q_{gd}		-	-	15	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -100\ \text{V}, I_D = -6.5\ \text{A}, R_g = 12\ \Omega, R_D = 15\ \Omega$, see fig. 10 ^b	-	12	-	ns
Rise Time	t_r		-	27	-	
Turn-Off Delay Time	$t_{d(off)}$		-	28	-	
Fall Time	t_f		-	24	-	
Internal Drain Inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact 	-	4.5	-	nH
Internal Source Inductance	L_S		-	7.5	-	
Gate Input Resistance	R_g	$f = 1\ \text{MHz}$, open drain	0.6	-	3.7	Ω
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	-6.5	A
Pulsed Diode Forward Current ^a	I_{SM}		-	-	-26	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = -6.5\ \text{A}, V_{GS} = 0\ \text{V}^b$	-	-	-6.5	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = -6.5\ \text{A}, dI/dt = 100\ \text{A}/\mu\text{s}^b$	-	200	300	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	1.9	2.9	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 $\leq 300\ \mu\text{s}$; duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

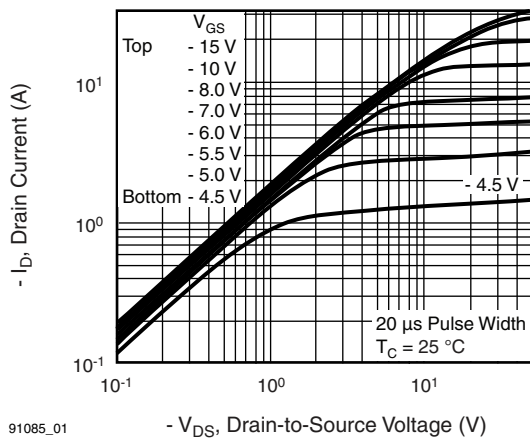


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ °C}$

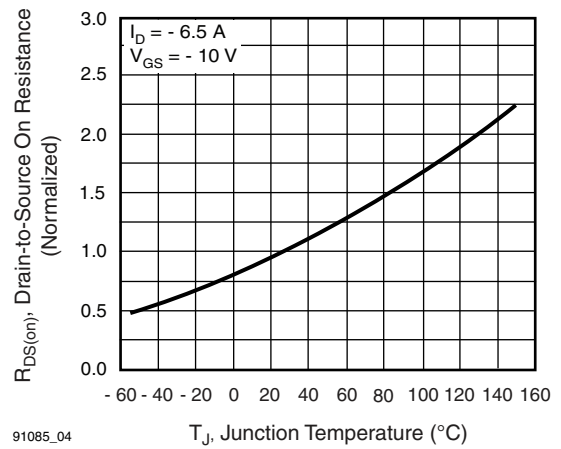


Fig. 4 - Normalized On-Resistance vs. Temperature

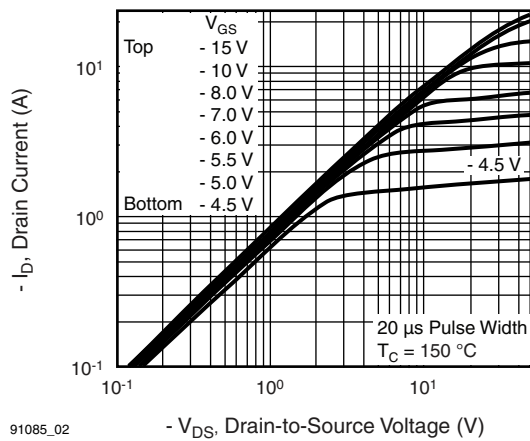


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ °C}$

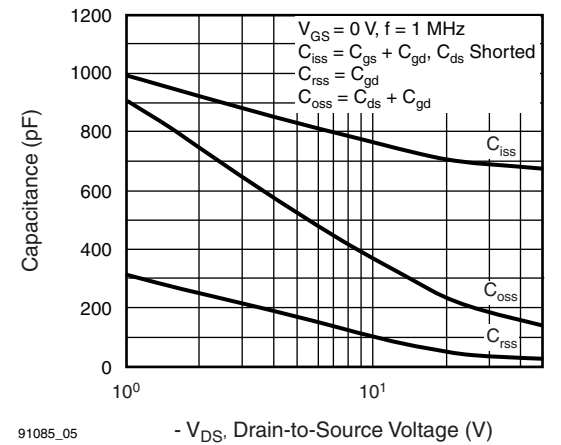


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

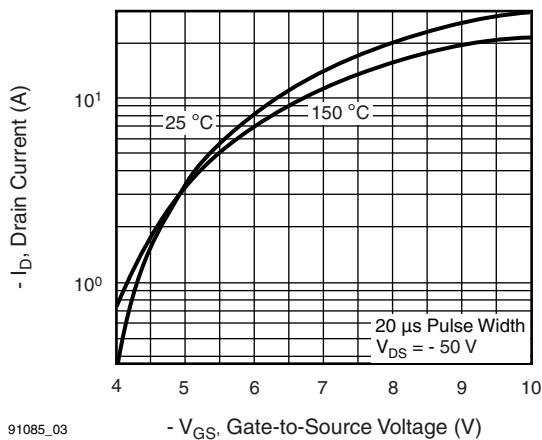


Fig. 3 - Typical Transfer Characteristics

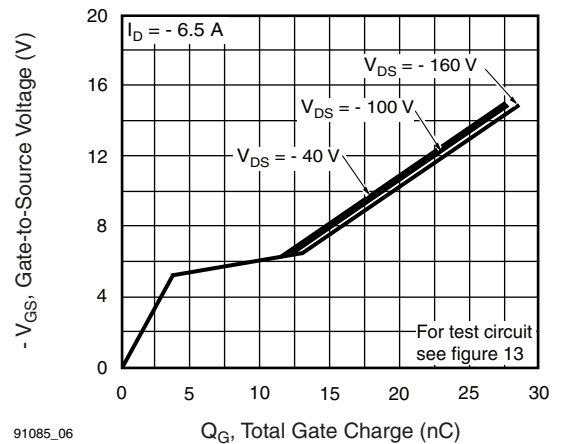
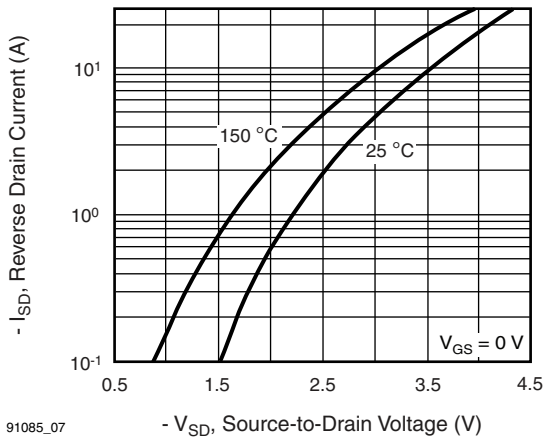
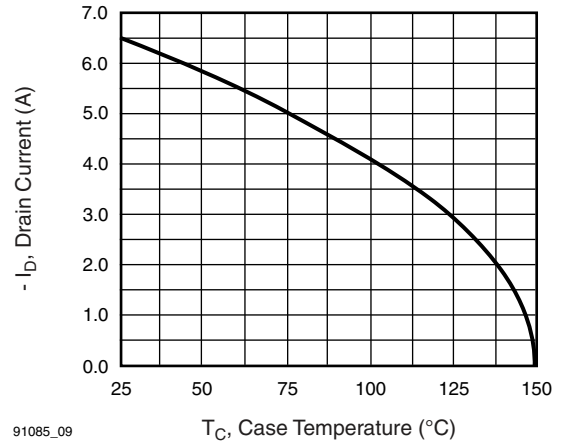


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage



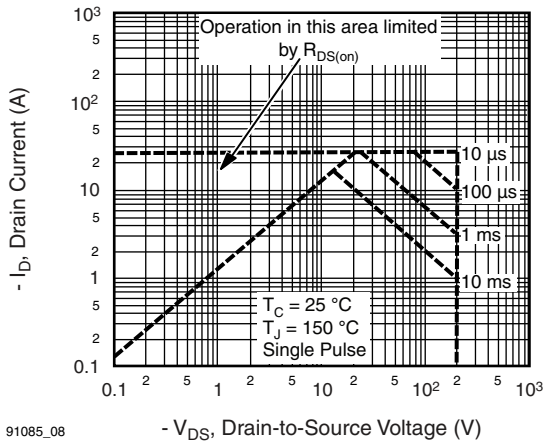
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Fig. 7 - Typical Source-Drain Diode Forward Voltage



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Fig. 9 - Maximum Drain Current vs. Case Temperature



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Fig. 8 - Maximum Safe Operating Area

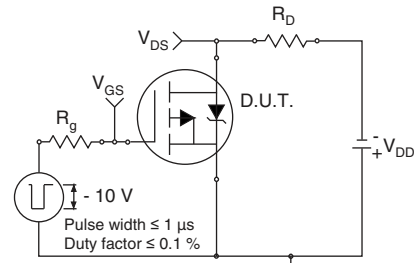


Fig. 10a - Switching Time Test Circuit

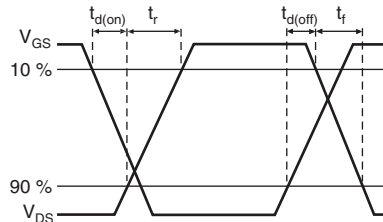
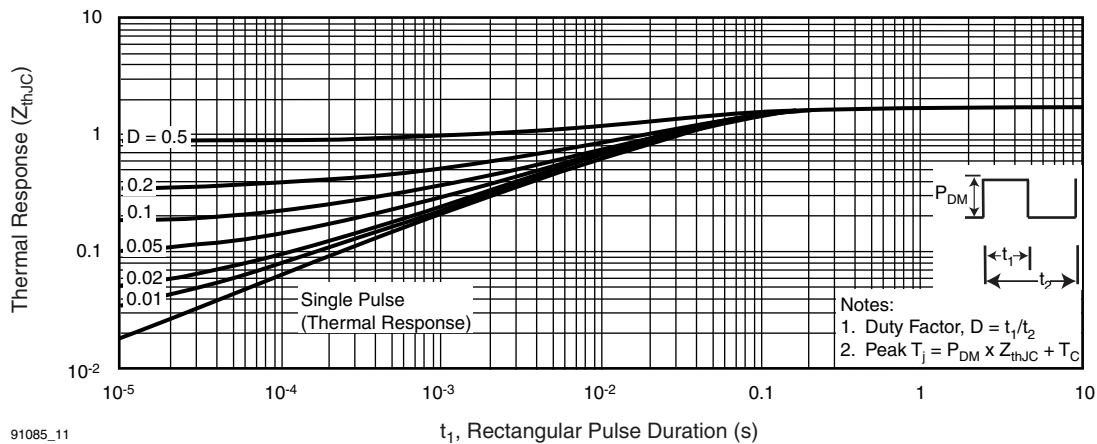


Fig. 10b - Switching Time Waveforms



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

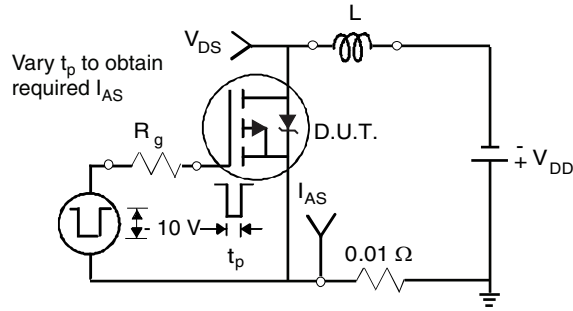


Fig. 12a - Unclamped Inductive Test Circuit

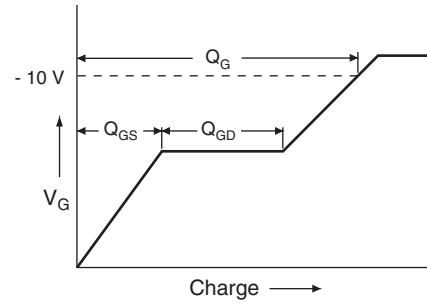


Fig. 13a - Basic Gate Charge Waveform

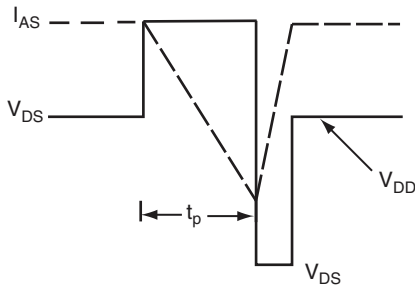


Fig. 12b - Unclamped Inductive Waveforms

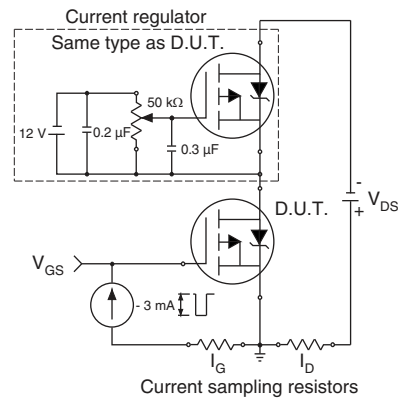


Fig. 13b - Gate Charge Test Circuit

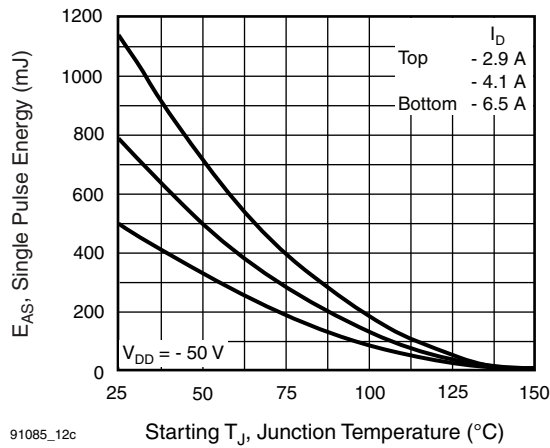
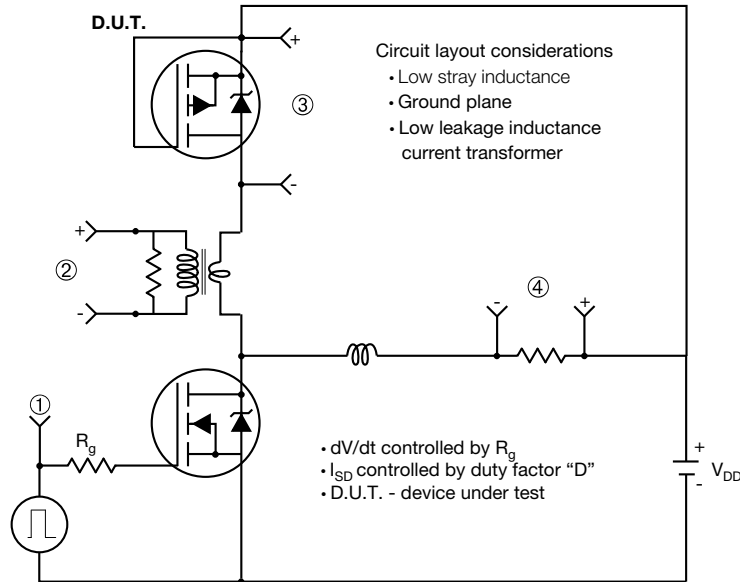
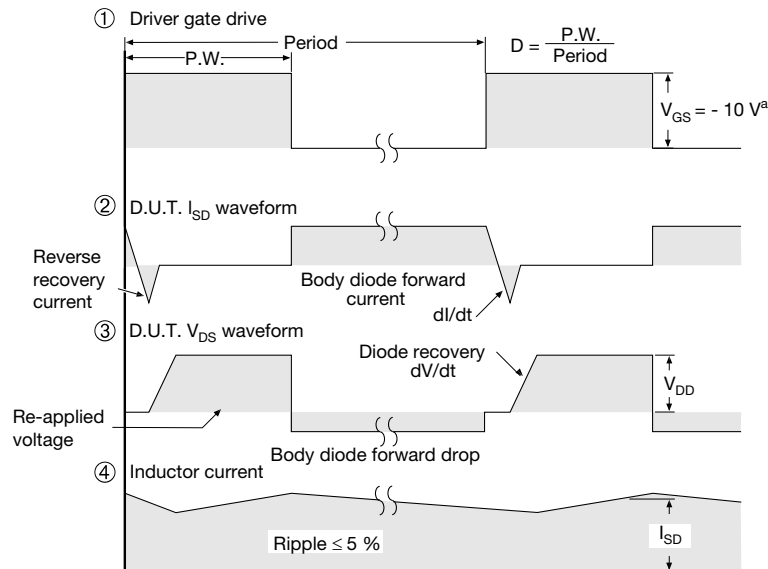


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

Peak Diode Recovery dV/dt Test Circuit



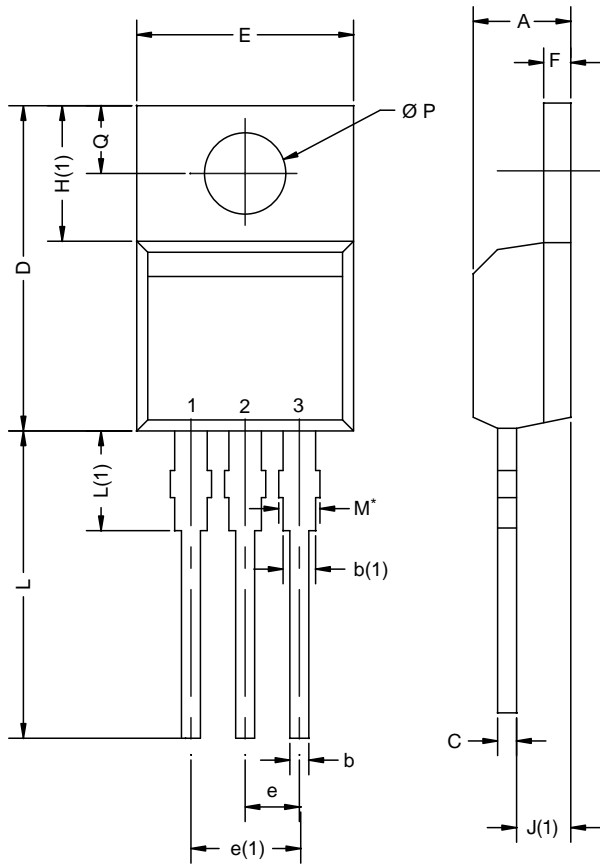
Note
• Compliment N-Channel of D.U.T. for driver



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

Fig. 14 - For P-Channel

TO-220AB



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
Ø P	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118

ECN: X12-0208-Rev. N, 08-Oct-12
DWG: 5471

Notes

* M = 1.32 mm to 1.62 mm (dimension including protrusion)
Heatsink hole for HVM

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