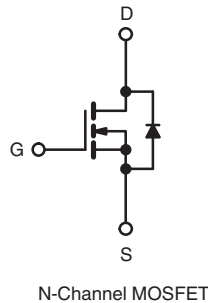
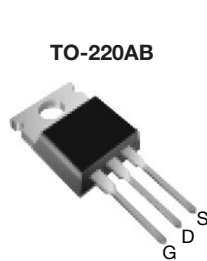


## Power MOSFET

PRODUCT SUMMARY		
$V_{DS}$ (V)	500	
$R_{DS(on)}$ ( $\Omega$ )	$V_{GS} = 10$ V	3.0
$Q_g$ (Max.) (nC)	17	
$Q_{gs}$ (nC)	4.3	
$Q_{gd}$ (nC)	8.5	
Configuration	Single	



### FEATURES

- Low Gate Charge  $Q_g$  Results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic  $dV/dt$  Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and current
- Effective  $C_{oss}$  Specified
- Compliant to RoHS Directive 2002/95/EC


**RoHS\***  
COMPLIANT

### APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptable Power Supply
- High Speed Power Switching

### TYPICAL SMPS TOPOLOGIES

- Two Transistor Forward
- Half bridge
- Full bridge

ORDERING INFORMATION	
Package	TO-220AB
Lead (Pb)-free	IRF820APbF SiHF820A-E3
SnPb	IRF820A SiHF820A


ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ , unless otherwise noted)				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	$V_{DS}$	500	V	
Gate-Source Voltage	$V_{GS}$	$\pm 30$		
Continuous Drain Current	$V_{GS}$ at 10 V	$T_C = 25^\circ\text{C}$	A	
		$T_C = 100^\circ\text{C}$		
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	10		
Linear Derating Factor		0.40	W/ $^\circ\text{C}$	
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	140	mJ	
Repetitive Avalanche Current <sup>a</sup>	$I_{AR}$	2.5	A	
Repetitive Avalanche Energy <sup>a</sup>	$E_{AR}$	5.0	mJ	
Maximum Power Dissipation	$T_C = 25^\circ\text{C}$	$P_D$	50	W
Peak Diode Recovery $dV/dt^c$		$dV/dt$	3.4	V/ns
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	- 55 to + 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature)	for 10 s		300 <sup>d</sup>	
Mounting Torque	6-32 or M3 screw		10	
			1.1	N · m

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting  $T_J = 25^\circ\text{C}$ ,  $L = 45$  mH,  $R_g = 25 \Omega$ ,  $I_{AS} = 2.5$  A (see fig. 12).
- $I_{SD} \leq 2.5$  A,  $dI/dt \leq 270$  A/ $\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150^\circ\text{C}$ .
- 1.6 mm from case.

\* Pb containing terminations are not RoHS compliant, exemptions may apply

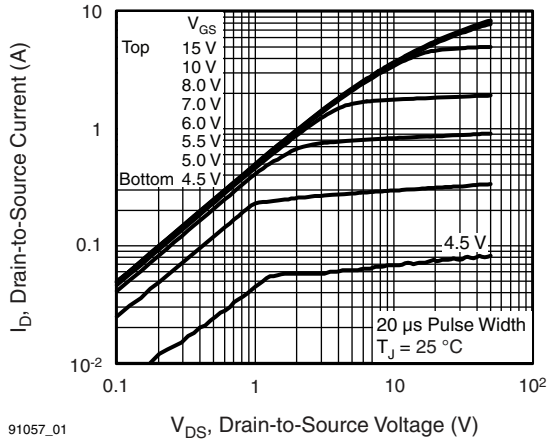
THERMAL RESISTANCE RATINGS						
PARAMETER	SYMBOL	TYP.	MAX.	UNIT		
Maximum Junction-to-Ambient	$R_{thJA}$	-	62	°C/W		
Case-to-Sink, Flat, Greased Surface	$R_{thCS}$	0.50	-			
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	2.5			

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	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		500	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$		-	0.60	-	$V/^\circ\text{C}$
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2.0	-	4.5	V
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 30\text{ V}$		-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$		-	-	25	$\mu\text{A}$
		$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 1.5\text{ A}^b$	-	-	3.0	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 50\text{ V}, I_D = 1.5\text{ A}^b$		1.4	-	-	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		-	340	-	pF
Output Capacitance	$C_{oss}$			-	53	-	
Reverse Transfer Capacitance	$C_{rss}$			-	2.7	-	
Output Capacitance	$C_{oss}$	$V_{GS} = 0\text{ V}; V_{DS} = 1.0\text{ V}, f = 1.0\text{ MHz}$		-	490	-	
Output Capacitance	$C_{oss}$	$V_{GS} = 0\text{ V}; V_{DS} = 400\text{ V}, f = 1.0\text{ MHz}$		-	15	-	
Effective Output Capacitance	$C_{oss\text{ eff.}}$	$V_{GS} = 0\text{ V}; V_{DS} = 0\text{ V to } 400\text{ V}^c$		-	28	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}$	$I_D = 2.5\text{ A}, V_{DS} = 400\text{ V}$ , see fig. 6 and 13 <sup>b</sup>	-	-	17	nC
Gate-Source Charge	$Q_{gs}$			-	-	4.3	
Gate-Drain Charge	$Q_{gd}$			-	-	8.5	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 250\text{ V}, I_D = 2.5\text{ A}, R_g = 21\text{ }\Omega, R_D = 97\text{ }\Omega$ , see fig. 10 <sup>b</sup>		-	8.1	-	ns
Rise Time	$t_r$			-	12	-	
Turn-Off Delay Time	$t_{d(off)}$			-	16	-	
Fall Time	$t_f$			-	13	-	
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	2.5	A	
Pulsed Diode Forward Current <sup>a</sup>	$I_{SM}$		-	-	10		
Body Diode Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = 2.5\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	1.6	V
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = 2.5\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}^b$		-	330	500	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			-	760	1140	nC
Forward Turn-On Time	$t_{on}$	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$ )					

**Notes**

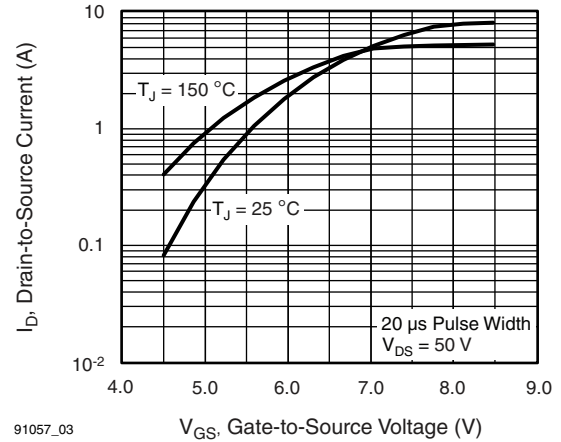
- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- b. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- c.  $C_{oss\text{ eff.}}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DS}$ .

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



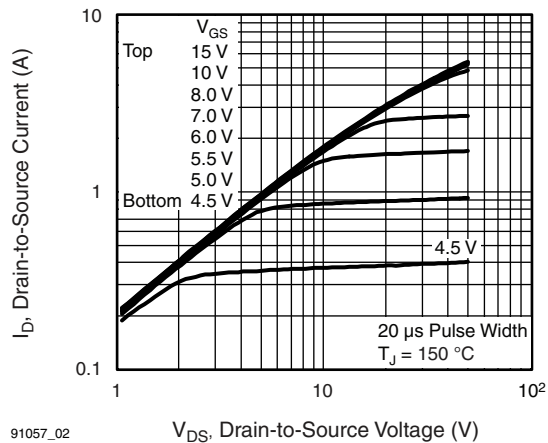
91057\_01

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



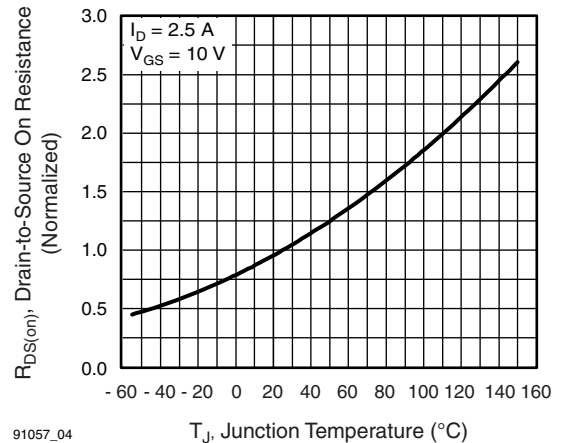
91057\_03

Fig. 3 - Typical Transfer Characteristics



91057\_02

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



91057\_04

Fig. 4 - Normalized On-Resistance vs. Temperature

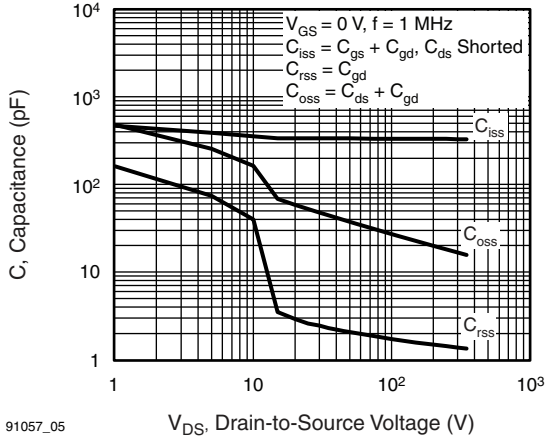


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

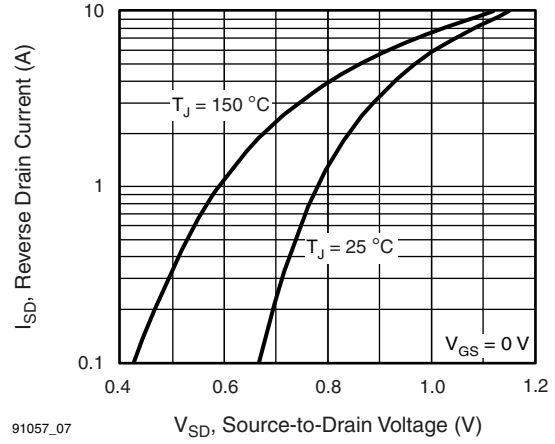


Fig. 7 - Typical Source-Drain Diode Forward Voltage

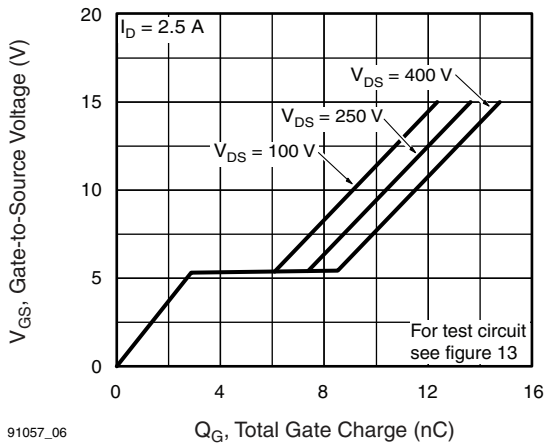


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

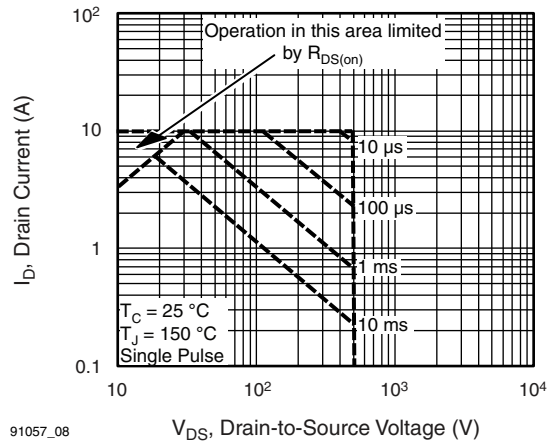
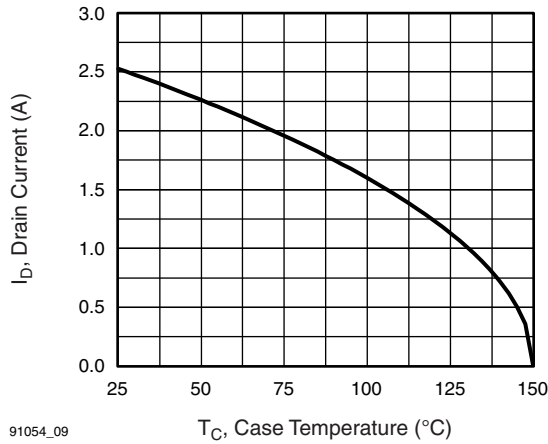
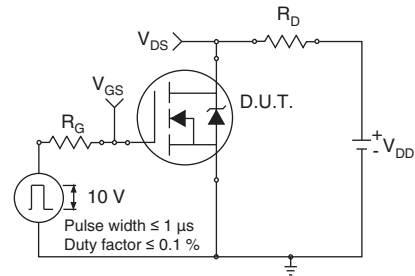


Fig. 8 - Maximum Safe Operating Area

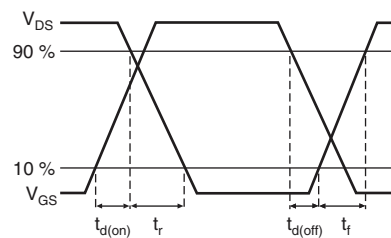


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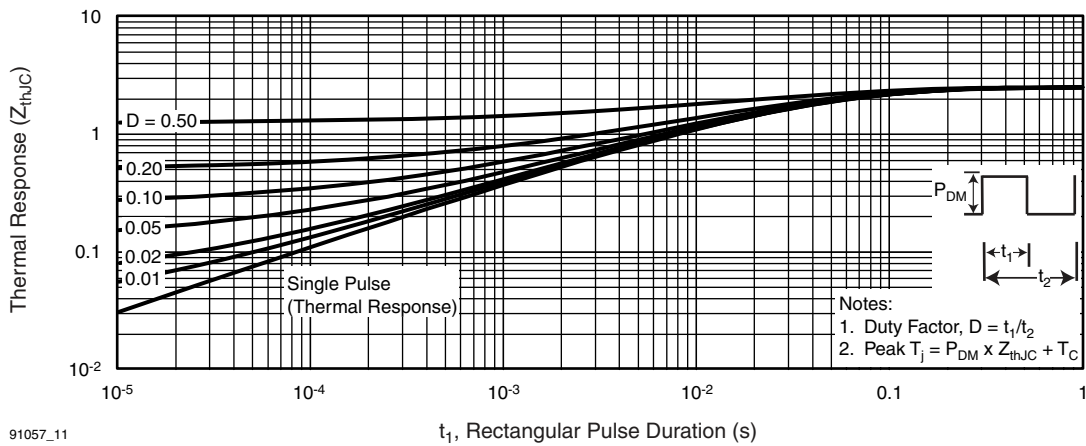
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



**Fig. 10a - Switching Time Test Circuit**



**Fig. 10b - Switching Time Waveforms**



91057\_11

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

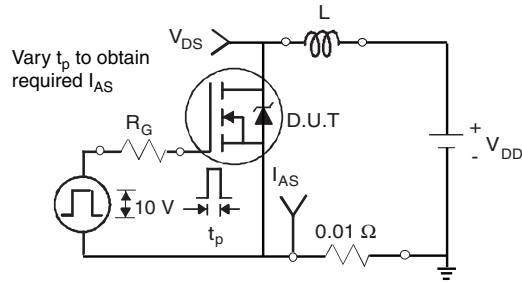


Fig. 12a - Unclamped Inductive Test Circuit

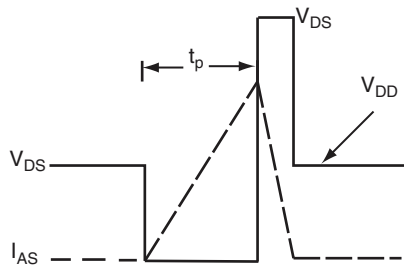
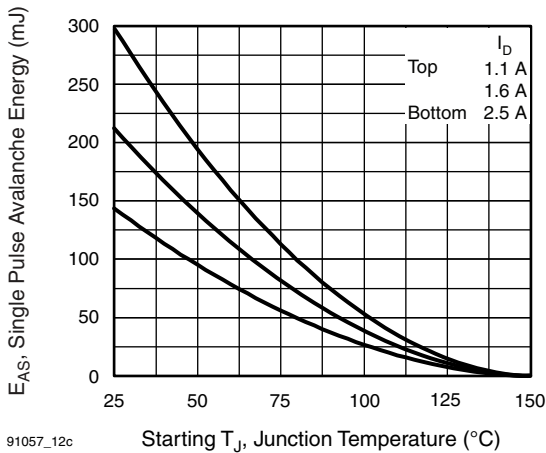


Fig. 12b - Unclamped Inductive Waveforms



91057\_12c

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

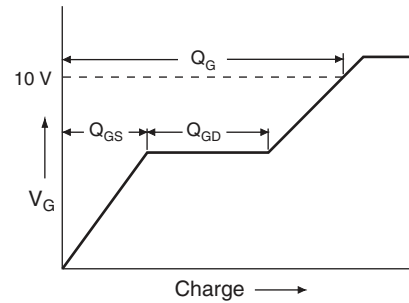
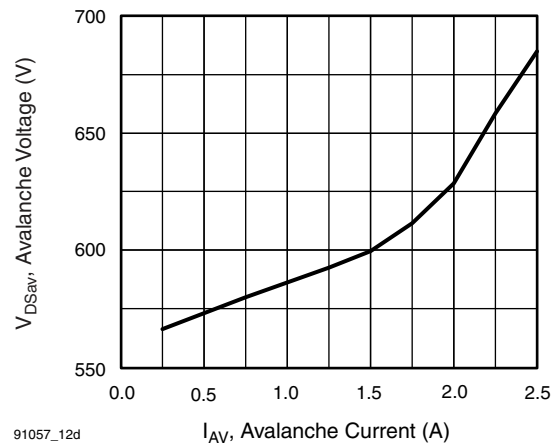


Fig. 12d - Basic Gate Charge Waveform



91057\_12d

Fig. 13a - Typical Drain-to-Source Voltage vs. Avalanche Current

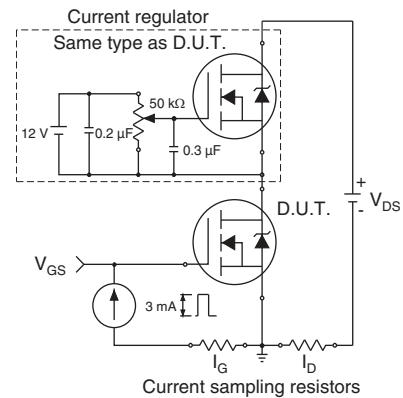
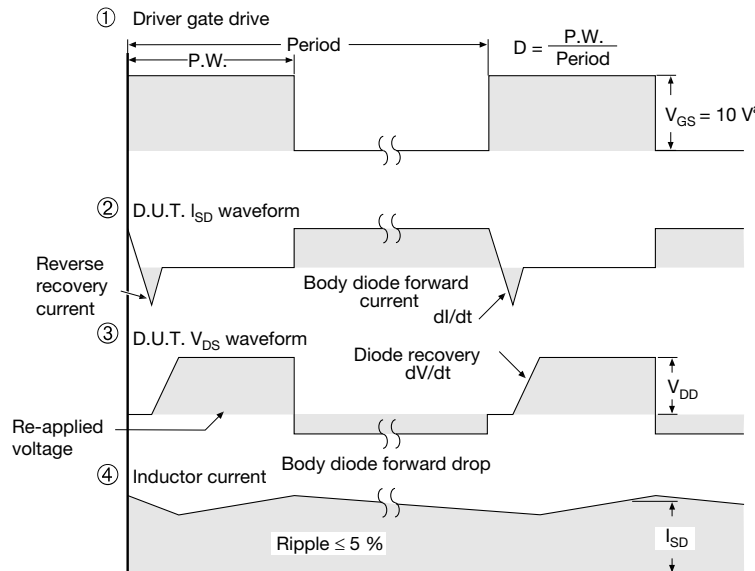


Fig. 13b - Gate Charge Test Circuit

### Peak Diode Recovery dV/dt Test Circuit



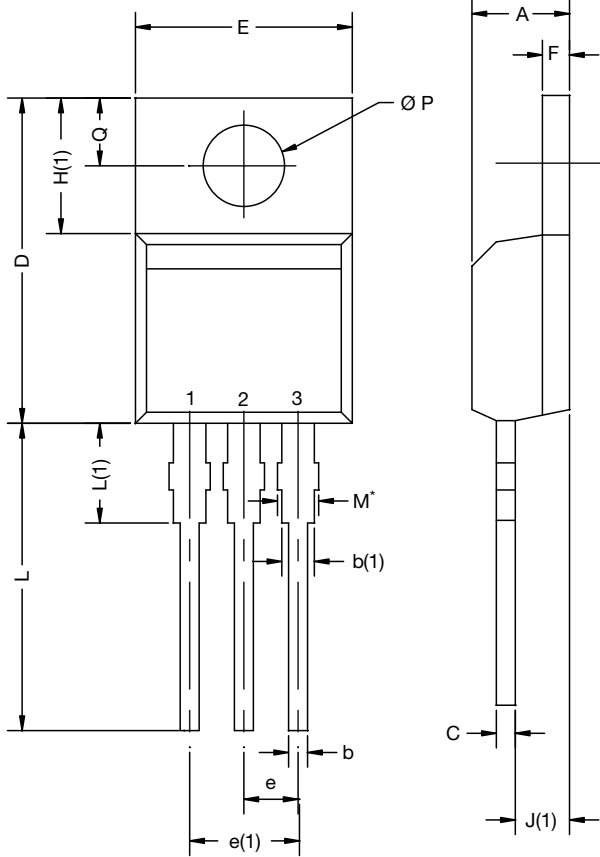
**Note**

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

**Fig. 14 - For N-Channel**

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## TO-220-1

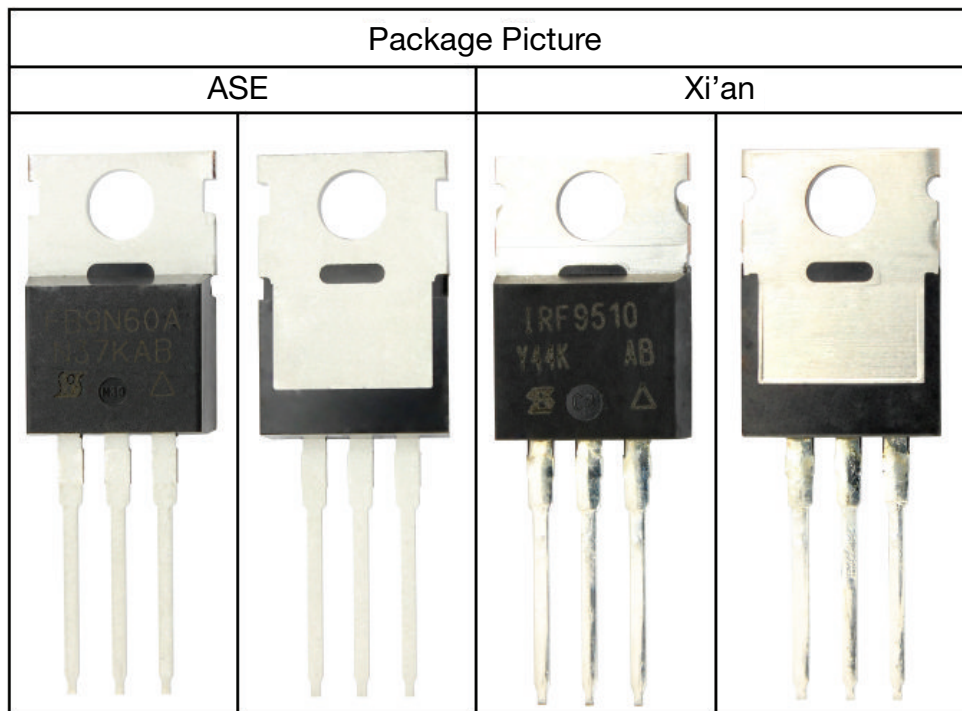


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.24	4.65	0.167	0.183
b	0.69	1.02	0.027	0.040
b(1)	1.14	1.78	0.045	0.070
c	0.36	0.61	0.014	0.024
D	14.33	15.85	0.564	0.624
E	9.96	10.52	0.392	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.10	6.71	0.240	0.264
J(1)	2.41	2.92	0.095	0.115
L	13.36	14.40	0.526	0.567
L(1)	3.33	4.04	0.131	0.159
$\varnothing P$	3.53	3.94	0.139	0.155
Q	2.54	3.00	0.100	0.118

ECN: X15-0364-Rev. C, 14-Dec-15  
DWG: 6031

**Note**

- $M^*$  = 0.052 inches to 0.064 inches (dimension including protrusion), heatsink hole for HVM







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