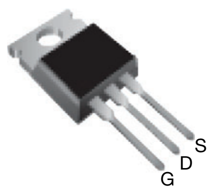
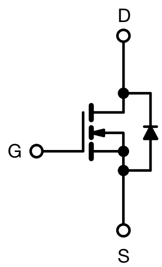
Power MOSFET

TO-220AB





N-Channel MOSFET

FEATURES

- Ultra low gate charge
- Reduced gate drive requirement
- Enhanced 30 V V_{GS} rating
- Reduced C_{iss}, C_{oss}, C_{rss}
- Extremely high frequency operation
- Repetitive avalanche rated
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb Available
RoHS* Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

PRODUCT SUMMARY		
V_{DS} (V)	500	
$R_{DS(on)}$ (Ω)	V_{GS} = 10 V	0.85
Q_g max. (nC)	39	
Q_{gs} (nC)	10	
Q_{gd} (nC)	19	
Configuration	Single	

DESCRIPTION

This new series of low charge power MOSFETs achieve significantly lower gate charge over conventional MOSFETs. Utilizing the new LCDMOS technology, the device improvements are achieved without added product cost, allowing for reduced gate drive requirements and total system savings. In addition, reduced switching losses and improved efficiency are achievable in a variety of high frequency applications. Frequencies of a few MHz at high current are possible using the new low charge MOSFETs.

These device improvements combined with the proven ruggedness and reliability that are characteristic of Power MOSFETs offer the designer a new standard in power transistors for switching applications.

ORDERING INFORMATION	
Package	TO-220AB
Lead (Pb)-free	IRF840LCPbF
Lead (Pb)-free and halogen-free	IRF840LCPbF-BE3

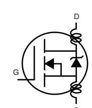
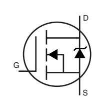
ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			V_{DS}	500	V
Gate-source voltage			V_{GS}	± 30	
Continuous drain current	V_{GS} at 10 V	T_C = 25 °C	I_D	8.0	A
		T_C = 100 °C		5.1	
Pulsed drain current [a]			I_{DM}	28	
Linear derating factor				1.0	W/°C
Single pulse avalanche energy [b]			E_{AS}	510	mJ
Repetitive avalanche current [a]			I_{AR}	8.0	A
Repetitive avalanche energy [a]			E_{AR}	13	mJ
Maximum power dissipation	T_C = 25 °C		P_D	125	W
Peak diode recovery dV/dt [c]			dV/dt	3.5	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	
Mounting torque	6-32 or M3 screw			10	lbf · in
				1.1	N · m

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 = 14 mH, R_g = 25 Ω, I_{AS} = 8.0 A (see fig. 12)
c. $I_{SD} \leq 8.0$ A, dI/dt ≤ 100 A/μs, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °C
d. 1.6 mm from case

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}	-	1.0	

SPECIFICATIONS (T_J = 25 °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	500	-	-	V
V_{DS} temperature coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA	-	0.63	-	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} = 500 V, V_{GS} = 0 V	-	-	25	μA
		V_{DS} = 400V, V_{GS} = 0 V, T_J = 125 °C	-	-	250	
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS} = 10 V; I_D = 4.8 A [b]	-	-	0.85	Ω
Forward transconductance	g_{fs}	V_{DS} = 50 V, I_D = 4.8 A [b]	4.0	-	-	S
Dynamic						
Drain-source breakdown voltage	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5	-	1100	-	pF
V_{DS} temperature coefficient	C_{oss}		-	170	-	
Gate-source threshold voltage	C_{rss}		-	18	-	
Gate-source leakage	Q_g	V_{GS} = 10 V; I_D = 8.0 A, V_{DS} = 400 V see fig. 6 and 13 [b]	-	-	39	nC
Zero gate voltage drain current	Q_{gs}		-	-	10	
	Q_{gd}		-	-	19	
Drain-source on-state resistance	$t_{d(on)}$	V_{DD} = 250 V, I_D = 8.0 A, R_g = 9.1 Ω, R_D= 30 Ω see fig. 10 [b]	-	12	-	ns
Forward transconductance	t_r		-	25	-	
Drain-source breakdown voltage	$t_{d(off)}$		-	27	-	
V_{DS} temperature coefficient	t_f		-	19	-	
Gate input resistance	R_g	f = 1 MHz, open drain	0.7	-	3.7	Ω
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	-	
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	8.0	A
Pulsed diode forward current [a]	I_{SM}		-	-	28	
Body diode voltage	V_{SD}	T_J = 25 °C, I_S = 8.0 A, V_{GS} = 0 V [b]	-	-	2.0	V
Body diode reverse recovery time	t_{rr}	T_J = 25 °C, I_F = 8.0 A, dI/dt = 100 A/μs [b]	-	490	740	ns
Body diode reverse recovery charge	Q_{rr}		-	3.0	4.5	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 ≤ 300 μs; duty cycle ≤ 2 %

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

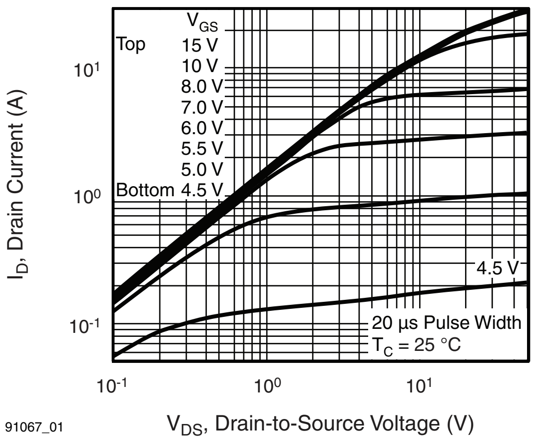


Fig. 1 - Typical Output Characteristics, T_C = 25 °C

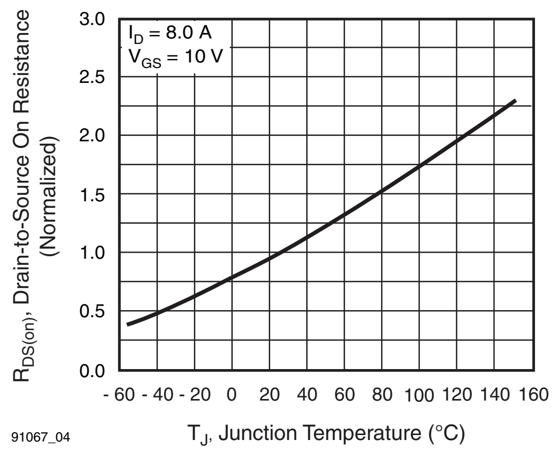


Fig. 4 - Normalized On-Resistance vs. Temperature

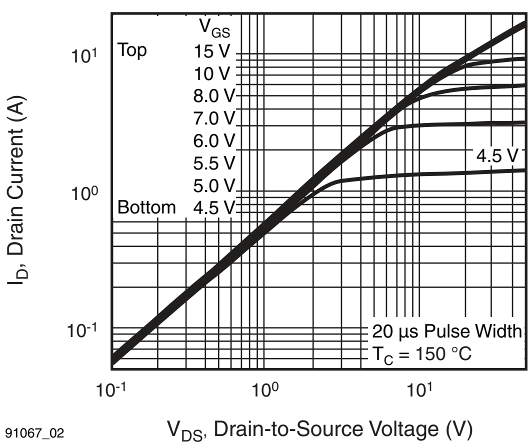


Fig. 2 - Typical Output Characteristics, T_C = 150 °C

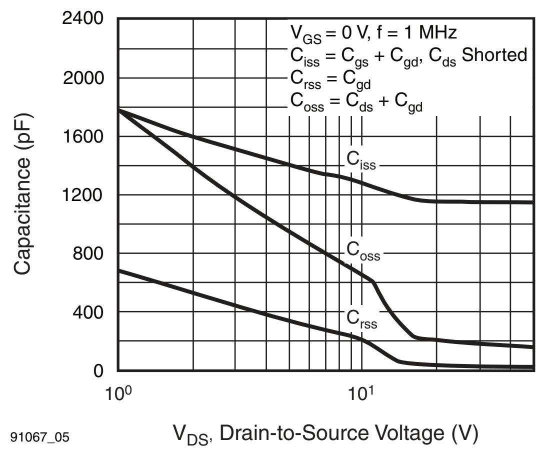


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

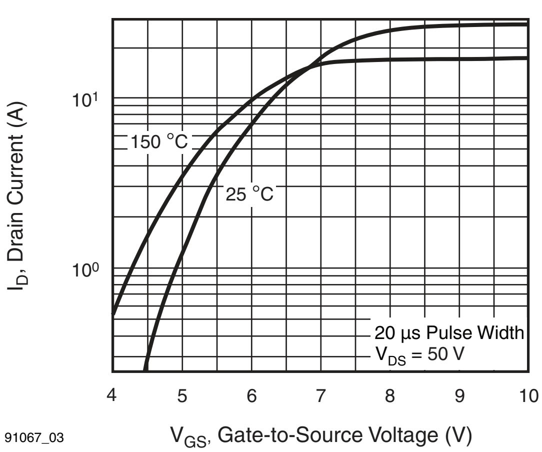


Fig. 3 - Typical Transfer Characteristics

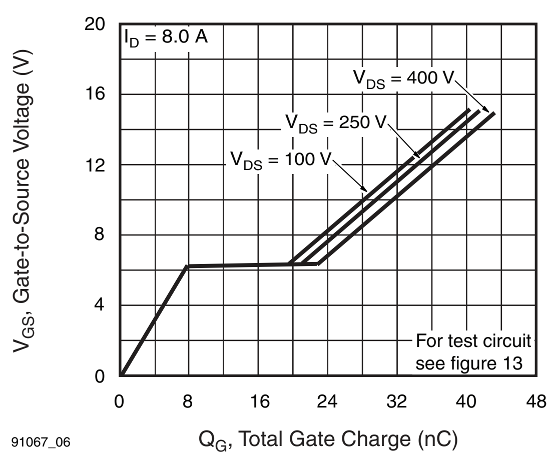


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

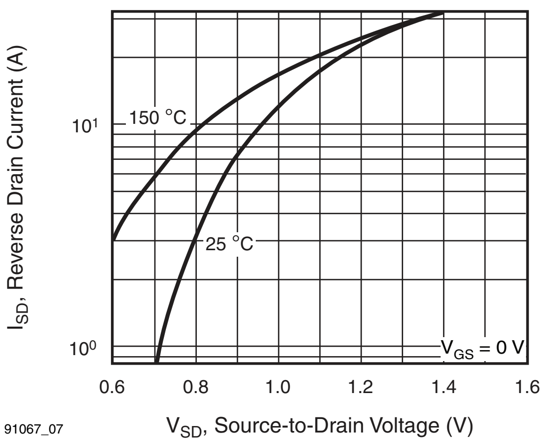


Fig. 7 - Typical Source-Drain Diode Forward Voltage

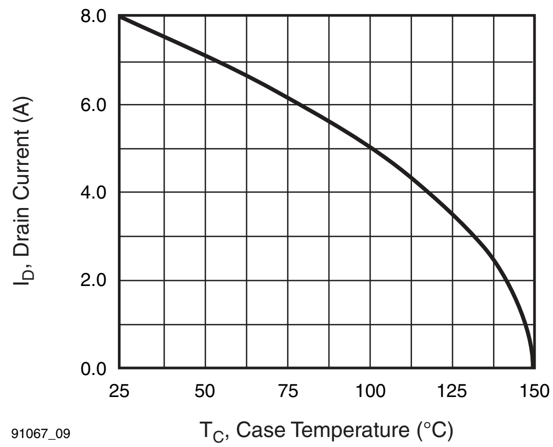


Fig. 9 - Maximum Drain Current vs. Case Temperature

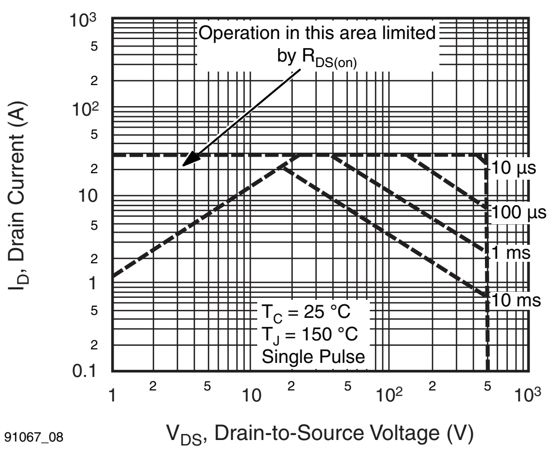


Fig. 8 - Maximum Safe Operating Area

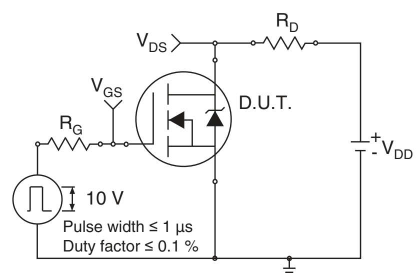


Fig. 10a - Switching Time Test Circuit

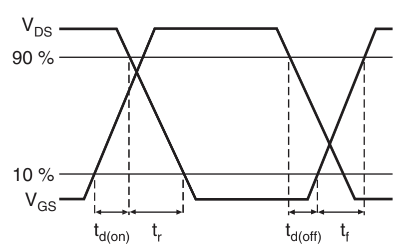


Fig. 10b - Switching Time Waveforms

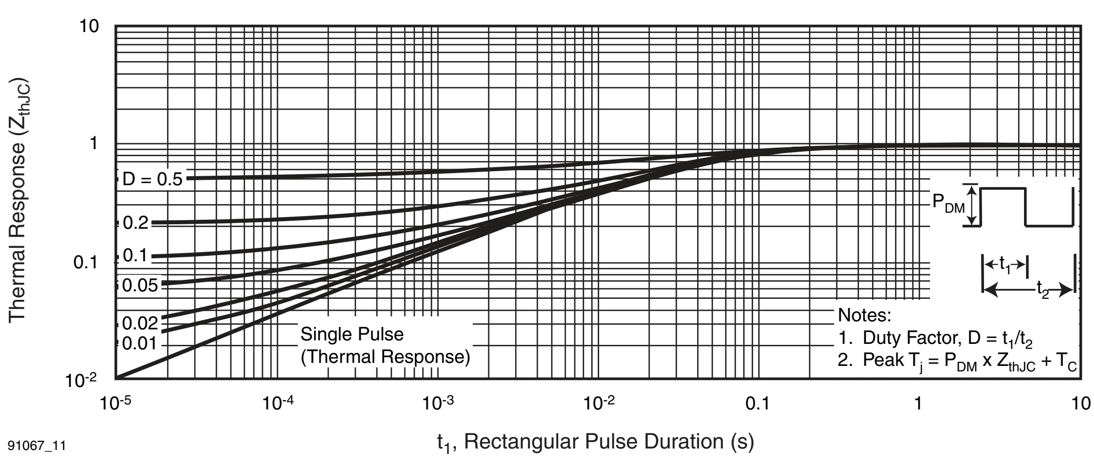


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

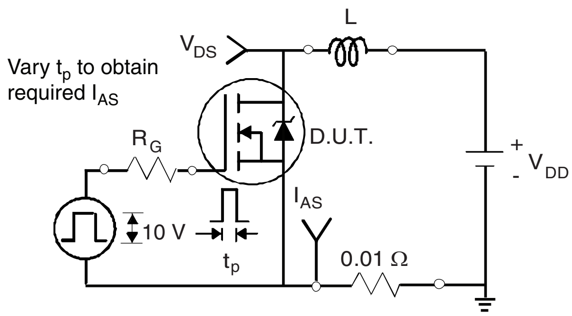


Fig. 12a - Unclamped Inductive Test Circuit

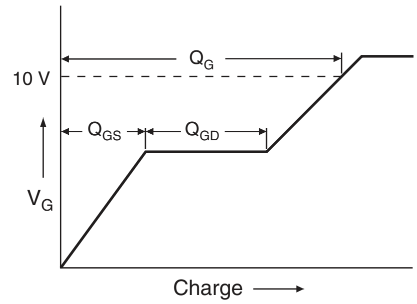


Fig. 13a - Basic Gate Charge Waveform

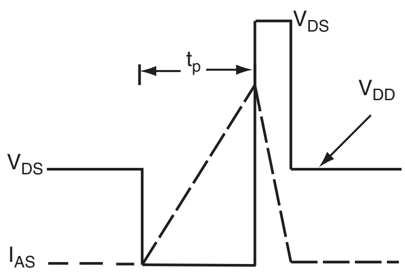


Fig. 12b - Unclamped Inductive Waveforms

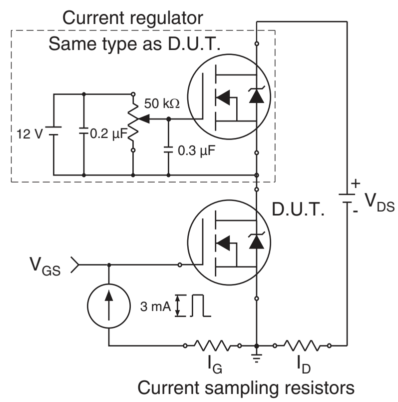


Fig. 13b - Gate Charge Test Circuit

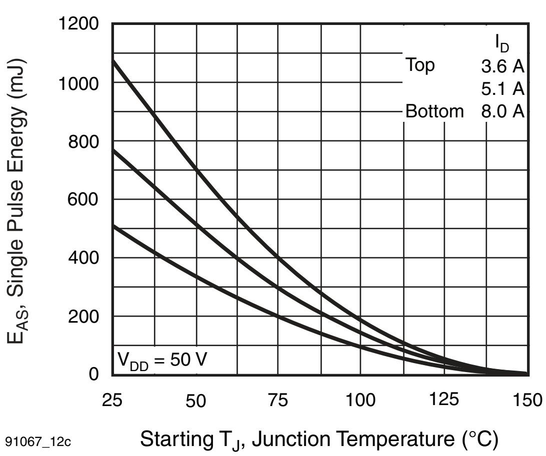
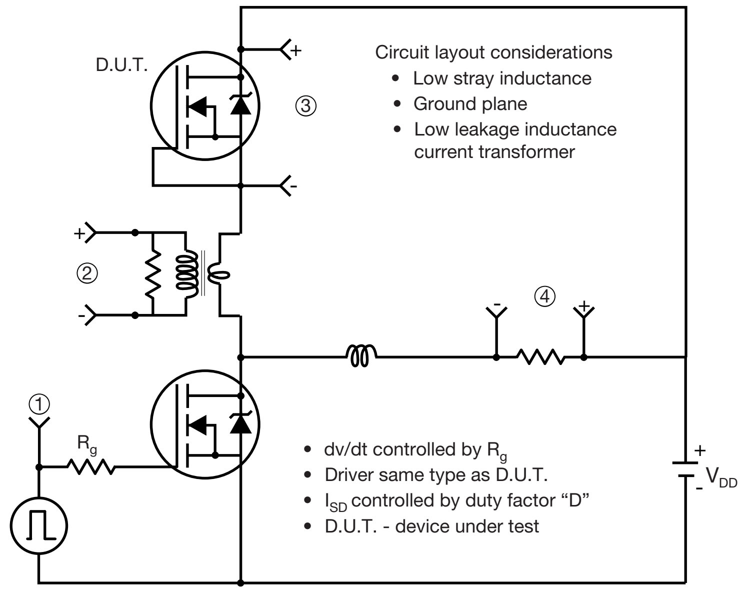
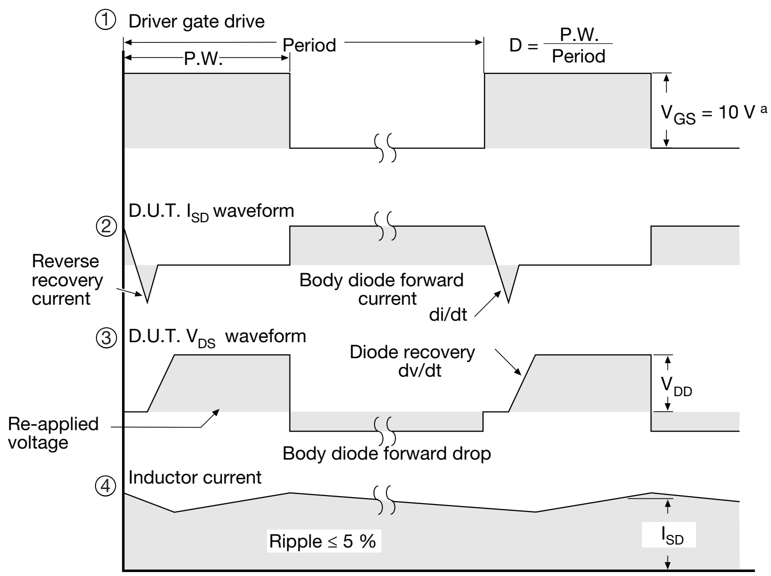


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

Peak Diode Recovery dv/dt Test Circuit



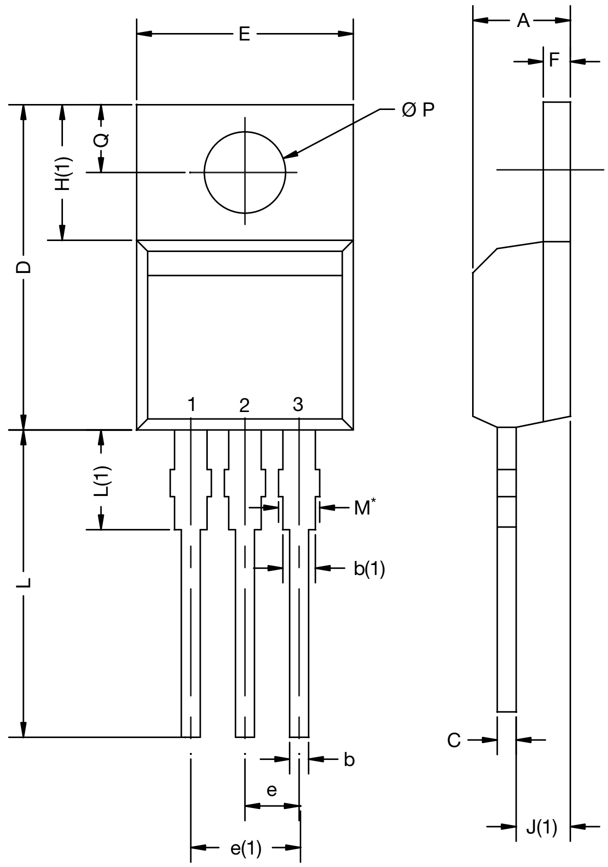


Note

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

Fig. 14 - For N-Channel

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
Ø P	3.53	3.94	0.139	0.155
Q	2.54	3.00	0.100	0.118
ECN: E21-0621-Rev. D, 04-Nov-2021 DWG: 6031				

Note

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

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