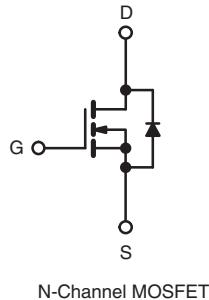
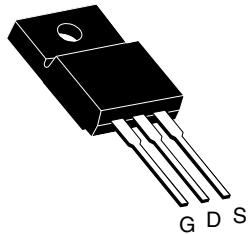


## E Series Power MOSFET

PRODUCT SUMMARY	
$V_{DS}$ (V) at $T_J$ max.	700
$R_{DS(on)}$ max. at 25 °C (Ω)	$V_{GS} = 10$ V 0.18
$Q_g$ max. (nC)	110
$Q_{gs}$ (nC)	15
$Q_{gd}$ (nC)	32
Configuration	Single

**TO-220 FULLPAK**


### ORDERING INFORMATION

Package	TO-220 FULLPAK
Lead (Pb)-free	SiHF22N65E-E3
Lead (Pb)-free and Halogen-free	SiHF22N65E-GE3

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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	650	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	
Continuous Drain Current ( $T_J = 150$ °C)	$V_{GS}$ at 10 V	22	A
		14	
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	56	
Linear Derating Factor		1.8	W/°C
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	691	mJ
Maximum Power Dissipation	$P_D$	35	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	°C
Drain-Source Voltage Slope	$T_J = 125$ °C	70	V/ns
Reverse Diode dV/dt <sup>d</sup>		26	
Soldering Recommendations (Peak Temperature) <sup>c</sup>	for 10 s	300	°C

**Notes**

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50$  V, starting  $T_J = 25$  °C,  $L = 28.2$  mH,  $R_g = 25$  Ω,  $I_{AS} = 7$  A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$ ,  $dI/dt = 100$  A/μs, starting  $T_J = 25$  °C.


**RoHS\***  
Available

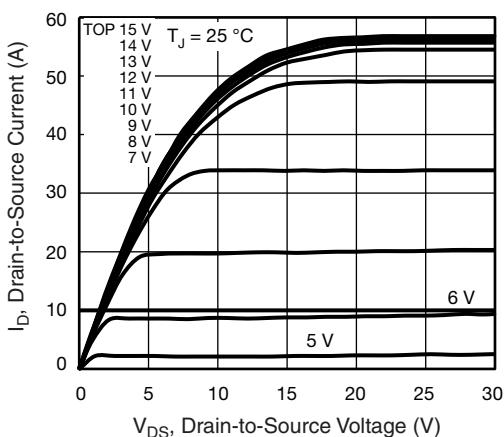
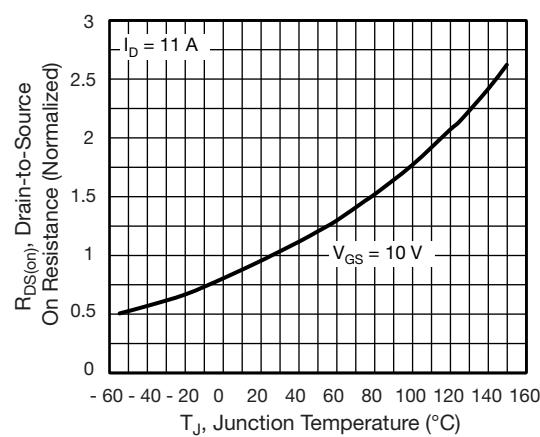
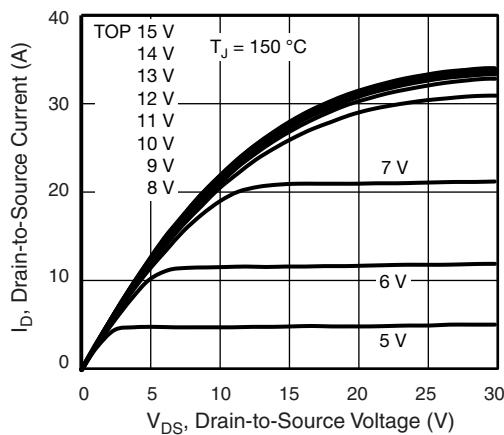
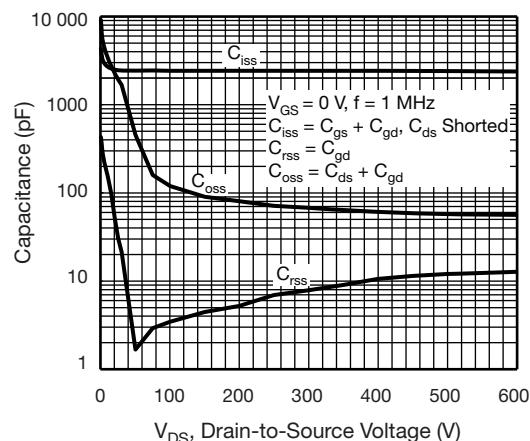
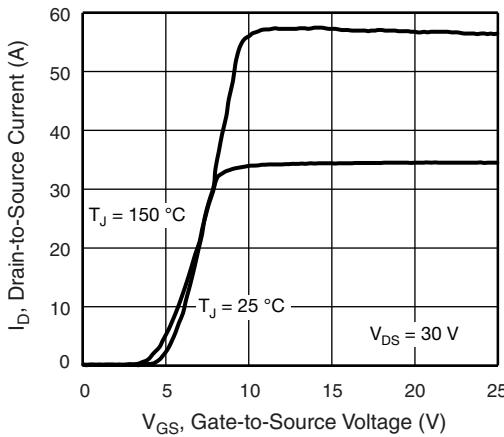
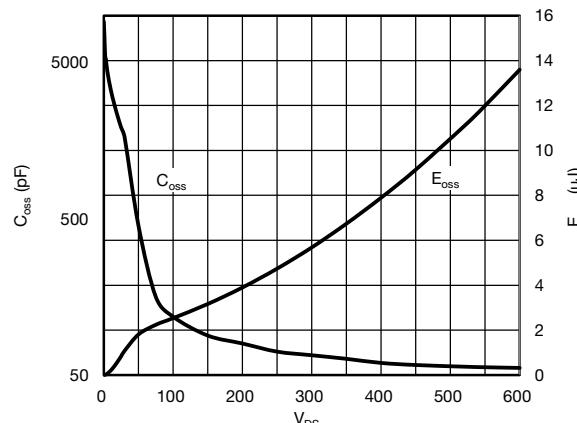
**HALOGEN  
FREE**  
Available

<b>THERMAL RESISTANCE RATINGS</b>				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	65	
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	3.6	°C/W

<b>SPECIFICATIONS</b> ( $T_J = 25$ °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0$ V, $I_D = 250$ μA		650	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, $I_D = 1$ mA		-	0.74	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 250$ μA		2	-	4	V
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 20$ V		-	-	± 100	nA
		$V_{GS} = \pm 30$ V		-	-	± 1	μA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 650$ V, $V_{GS} = 0$ V		-	-	1	
		$V_{DS} = 520$ V, $V_{GS} = 0$ V, $T_J = 125$ °C		-	-	10	μA
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10$ V	$I_D = 11$ A	-	0.15	0.18	Ω
Forward Transconductance	$g_{fs}$	$V_{DS} = 8$ V, $I_D = 5$ A		-	6.7	-	S
<b>Dynamic</b>							
Input Capacitance	$C_{iss}$	$V_{GS} = 0$ V, $V_{DS} = 100$ V, $f = 1$ MHz		-	2415	-	pF
Output Capacitance	$C_{oss}$			-	118	-	
Reverse Transfer Capacitance	$C_{rss}$			-	4	-	
Effective Output Capacitance, Energy Related <sup>a</sup>	$C_{o(er)}$	$V_{DS} = 0$ V to 520 V, $V_{GS} = 0$ V		-	89	-	
Effective Output Capacitance, Time Related <sup>b</sup>	$C_{o(tr)}$			-	307	-	
Total Gate Charge	$Q_g$			-	73	110	nC
Gate-Source Charge	$Q_{gs}$	$V_{GS} = 10$ V	$I_D = 11$ A, $V_{DS} = 520$ V	-	15	-	
Gate-Drain Charge	$Q_{gd}$			-	32	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 520$ V, $I_D = 11$ A, $V_{GS} = 10$ V, $R_g = 9.1$ Ω		-	22	45	ns
Rise Time	$t_r$			-	33	66	
Turn-Off Delay Time	$t_{d(off)}$			-	73	110	
Fall Time	$t_f$			-	38	76	
Gate Input Resistance	$R_g$	$f = 1$ MHz, open drain		-	0.64	-	Ω
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode		-	-	22	A
Pulsed Diode Forward Current	$I_{SM}$			-	-	56	
Diode Forward Voltage	$V_{SD}$	$T_J = 25$ °C, $I_S = 11$ A, $V_{GS} = 0$ V		-	-	1.2	V
Reverse Recovery Time	$t_{rr}$	$T_J = 25$ °C, $I_F = I_S = 11$ A, $dI/dt = 100$ A/μs, $V_R = 400$ V		-	400	-	ns
Reverse Recovery Charge	$Q_{rr}$			-	5.9	-	μC
Reverse Recovery Current	$I_{RRM}$			-	20	-	A

**Notes**

a.  $C_{oss(er)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$ .  
b.  $C_{oss(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$ .

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

**Fig. 1 - Typical Output Characteristics**

**Fig. 4 - Normalized On-Resistance vs. Temperature**

**Fig. 2 - Typical Output Characteristics**

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

**Fig. 3 - Typical Transfer Characteristics**

**Fig. 6 -  $C_{oss}$  and  $E_{oss}$  vs.  $V_{DS}$**

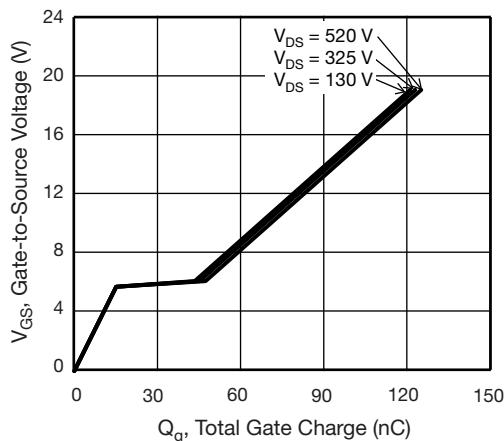


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

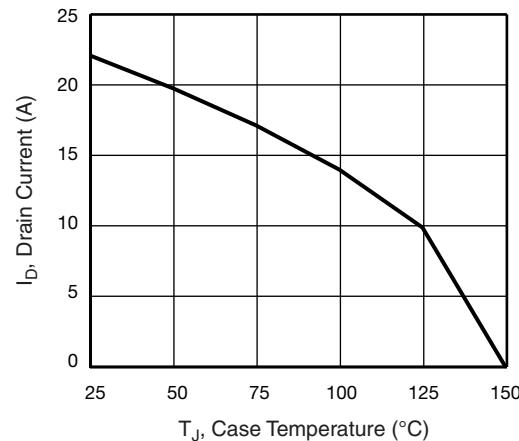


Fig. 10 - Maximum Drain Current vs. Case Temperature

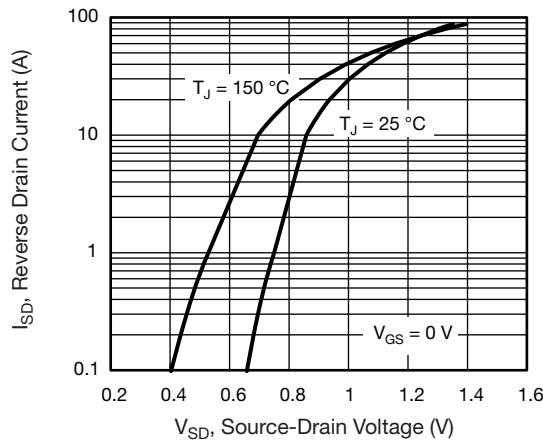


Fig. 8 - Typical Source-Drain Diode Forward Voltage

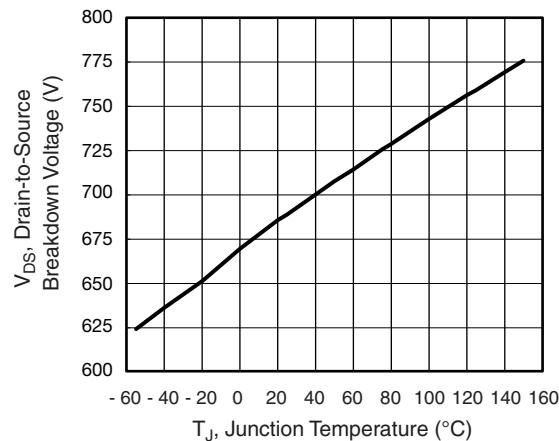


Fig. 11 - Temperature vs. Drain-to-Source Voltage

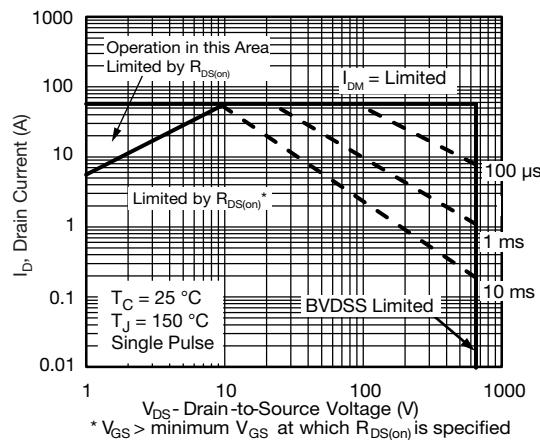
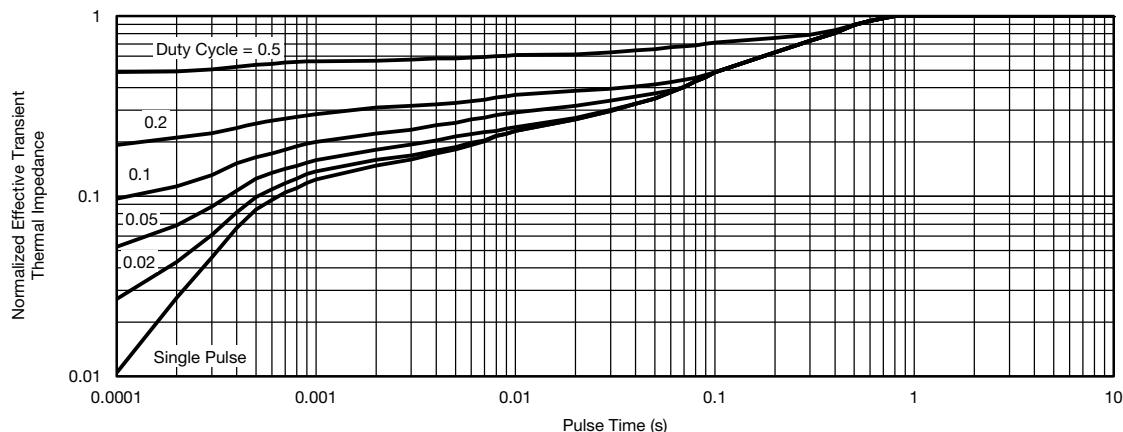
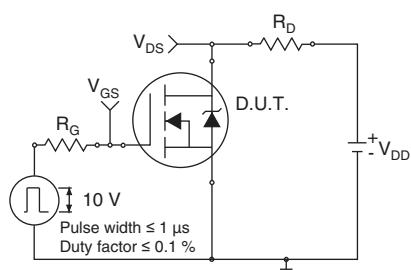


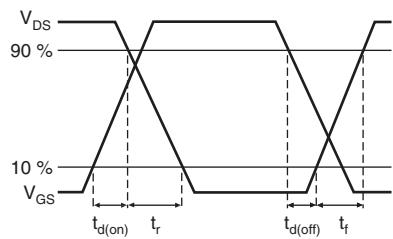
Fig. 9 - Maximum Safe Operating Area



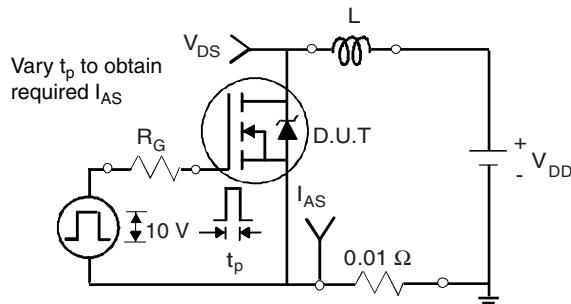
**Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case**



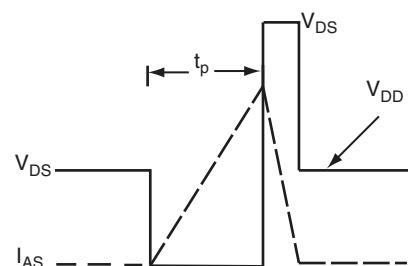
**Fig. 13 - Switching Time Test Circuit**



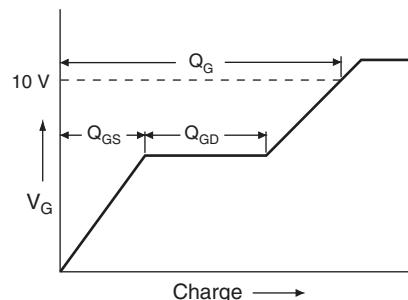
**Fig. 14 - Switching Time Waveforms**



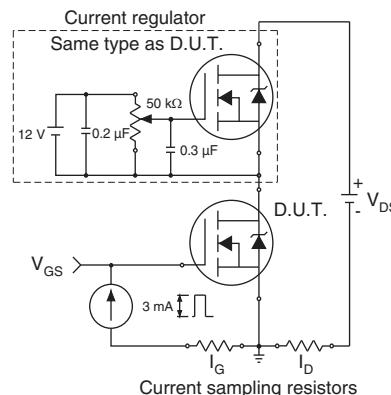
**Fig. 15 - Unclamped Inductive Test Circuit**



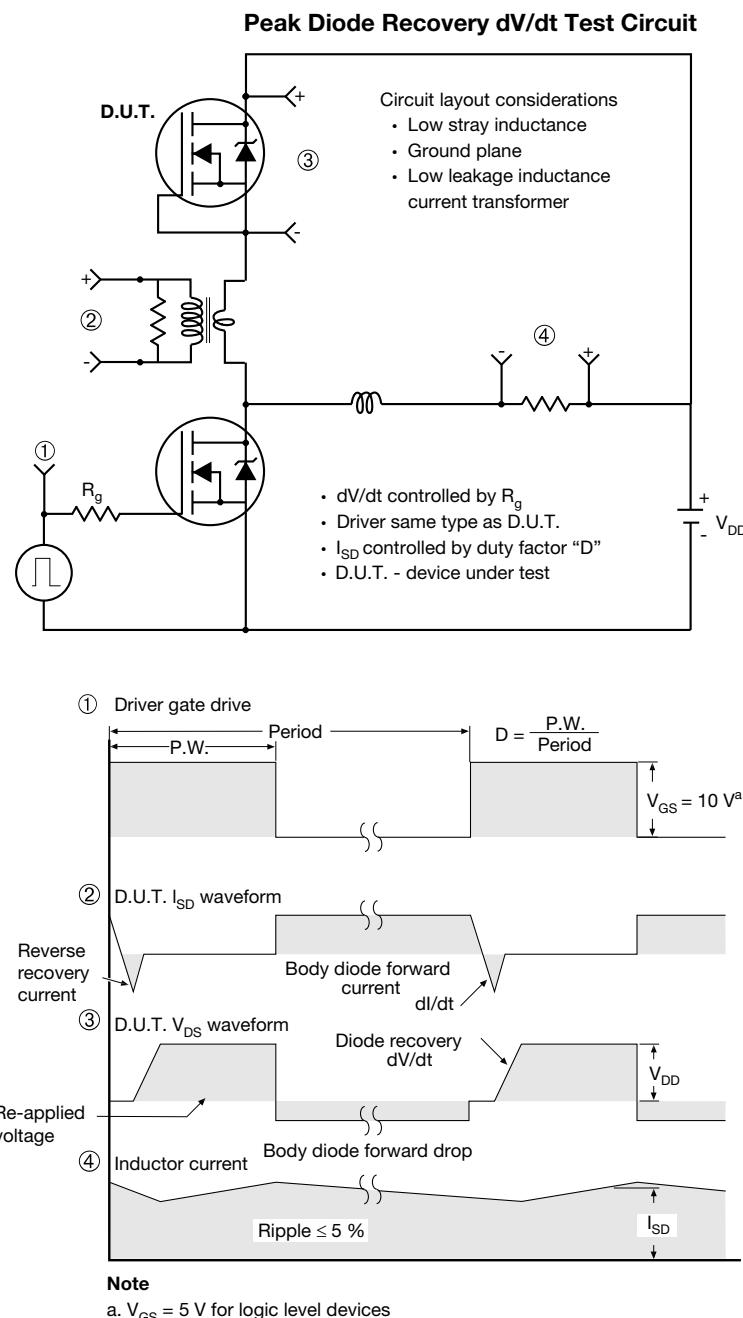
**Fig. 16 - Unclamped Inductive Waveforms**



**Fig. 17 - Basic Gate Charge Waveform**



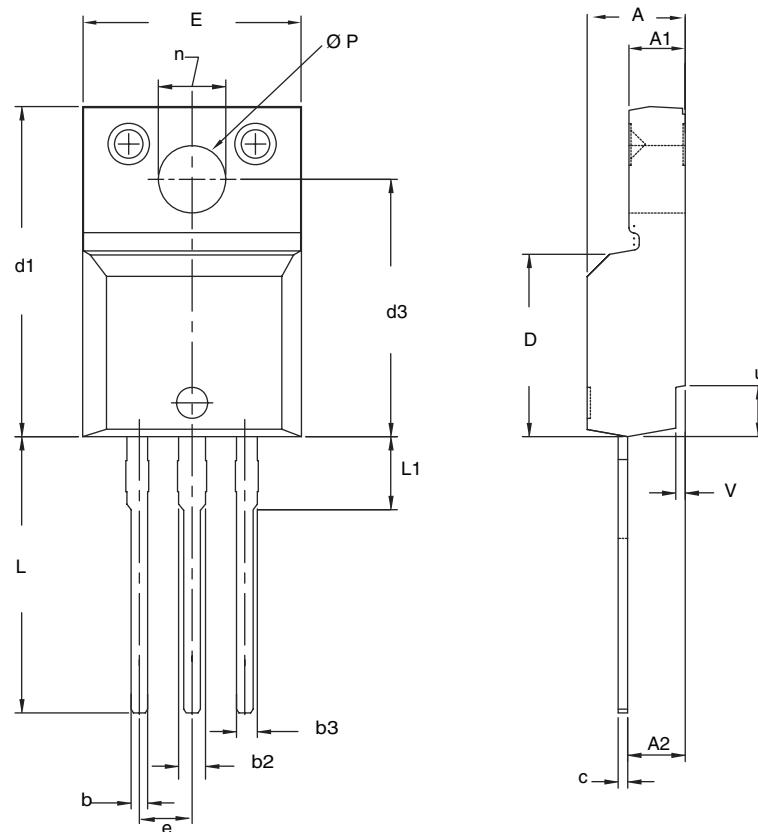
**Fig. 18 - Gate Charge Test Circuit**



**Fig. 19 - For N-Channel**

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### TO-220 FULLPAK (HIGH VOLTAGE)



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.570	4.830	0.180	0.190
A1	2.570	2.830	0.101	0.111
A2	2.510	2.850	0.099	0.112
b	0.622	0.890	0.024	0.035
b2	1.229	1.400	0.048	0.055
b3	1.229	1.400	0.048	0.055
c	0.440	0.629	0.017	0.025
D	8.650	9.800	0.341	0.386
d1	15.88	16.120	0.622	0.635
d3	12.300	12.920	0.484	0.509
E	10.360	10.630	0.408	0.419
e	2.54 BSC		0.100 BSC	
L	13.200	13.730	0.520	0.541
L1	3.100	3.500	0.122	0.138
n	6.050	6.150	0.238	0.242
ØP	3.050	3.450	0.120	0.136
u	2.400	2.500	0.094	0.098
v	0.400	0.500	0.016	0.020

ECN: X09-0126-Rev. B, 26-Oct-09  
DWG: 5972

#### Notes

1. To be used only for process drawing.
2. These dimensions apply to all TO-220, FULLPAK leadframe versions 3 leads.
3. All critical dimensions should C meet  $C_{pk} > 1.33$ .
4. All dimensions include burrs and plating thickness.
5. No chipping or package damage.

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