

N-Channel 200 V (D-S) MOSFET

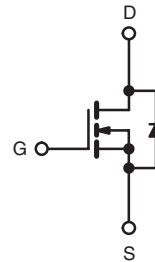
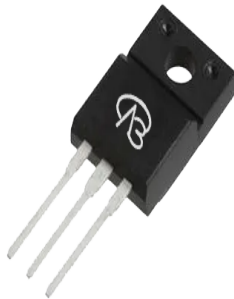
PRODUCT SUMMARY		
V _{DS} (V)	200	
R _{DS(on)} (Ω)	V _{GS} = 10 V	0.265
Q _g (Max.) (nC)	16	
Q _{gs} (nC)	5	
Q _{gd} (nC)	8	
Configuration	Single	

FEATURES

- Isolated Package
- High Voltage Isolation = 2.5 kV_{RMS} (t = 60 s; f = 60 Hz)
- Sink to Lead Creepage Distance = 4.8 mm
- 175 °C Operating Temperature
- Dynamic dV/dt Rating
- Low Thermal Resistance
- Lead (Pb)-free Available



TO-220 FULLPAK



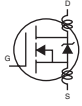

N-Channel MOSFET

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	10	A	
		T _C = 100 °C	6.5		
Pulsed Drain Current ^a	I _{DM}		32		
Linear Derating Factor			0.24	W/°C	
Single Pulse Avalanche Energy ^b	E _{AS}		36	mJ	
Repetitive Avalanche Current ^a	I _{AR}		7.2	A	
Repetitive Avalanche Energy ^a	E _{AR}		3.7	mJ	
Maximum Power Dissipation	T _C = 25 °C		P _D	37	W
Peak Diode Recovery dV/dt ^c			dV/dt	5.5	V/ns
Operating Junction and Storage Temperature Range			T _J , T _{stg}	- 55 to + 175	°C
Soldering Recommendations (Peak Temperature)	for 10 s			300 ^d	
Mounting Torque	6-32 or M3 screw			10	lbf · in
				1.1	N · m

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- V_{DD} = 25 V, starting T_J = 25 °C, L = 1.0 mH, R_G = 25 Ω, I_{AS} = 7.2 A (see fig. 12).
- I_{SD} ≤ 9.2 A, dI/dt ≤ 110 A/μs, V_{DD} ≤ V_{DS}, T_J ≤ 175 °C.
- 1.6 mm from case.

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	65	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	4.1	

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}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	200	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$	-	0.13	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	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}	$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$	-	-	25	μA
		$V_{DS} = 160\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$ $I_D = 4.3\text{ A}^b$	-	0.265	-	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 4.3\text{ A}^b$	2.3	-	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V},$ $V_{DS} = 25\text{ V},$ $f = 1.0\text{ MHz}$, see fig. 5	-	560	-	pF
Output Capacitance	C_{oss}		-	260	-	
Reverse Transfer Capacitance	C_{rss}		-	110	-	
Drain to Sink Capacitance	C		$f = 1.0\text{ MHz}$	-	12	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$ $I_D = 9.2\text{ A}, V_{DS} = 80\text{ V},$ see fig. 6 and 13 ^b	-	-	16	nC
Gate-Source Charge	Q_{gs}		-	-	4.4	
Gate-Drain Charge	Q_{gd}		-	-	7.7	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 100\text{ V}, I_D = 9.2\text{ A},$ $R_G = 18\text{ }\Omega, R_D = 5.2\text{ }\Omega,$ see fig. 10 ^b	-	8.8	-	ns
Rise Time	t_r		-	30	-	
Turn-Off Delay Time	$t_{d(off)}$		-	19	-	
Fall Time	t_f		-	20	-	
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 	-	10	-	A
Pulsed Diode Forward Current ^a	I_{SM}		-	32	-	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 7.2\text{ A}, V_{GS} = 0\text{ V}^b$	-	-	2.5	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 9.2\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$	-	130	260	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	0.65	1.3	μC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)				

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

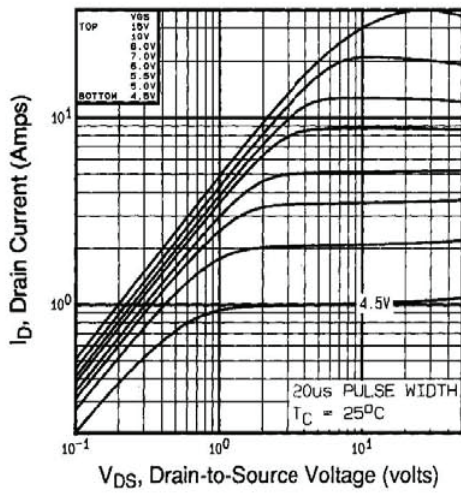


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$

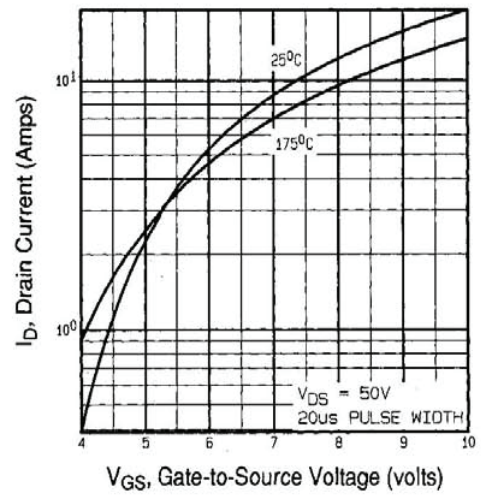


Fig. 3 - Typical Transfer Characteristics

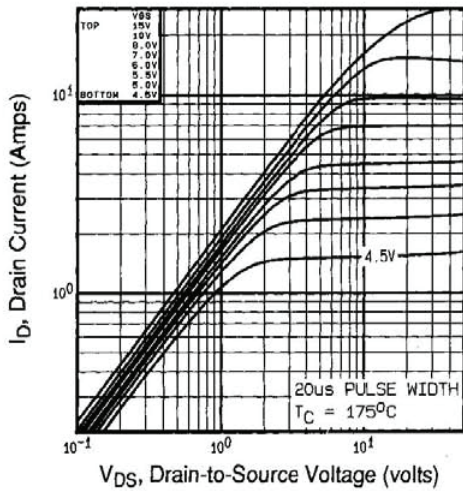


Fig. 2 - Typical Output Characteristics, $T_C = 175\text{ }^\circ\text{C}$

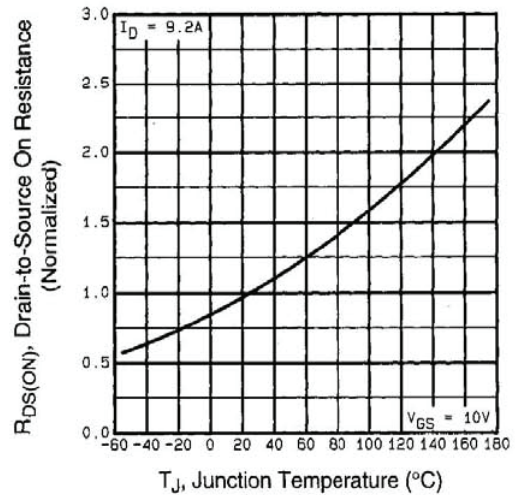


Fig. 4 - Normalized On-Resistance vs. Temperature

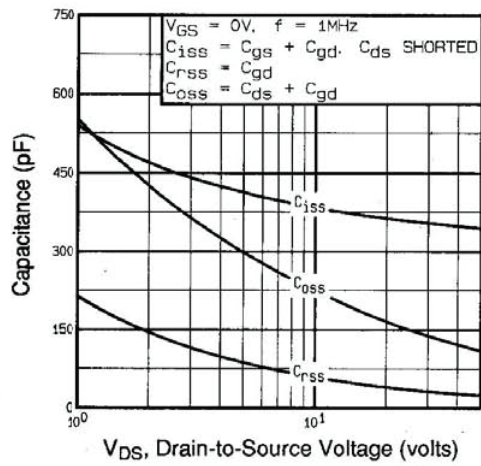


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

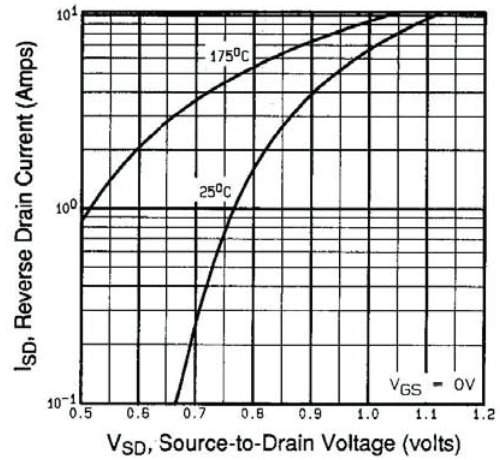


Fig. 7 - Typical Source-Drain Diode Forward Voltage

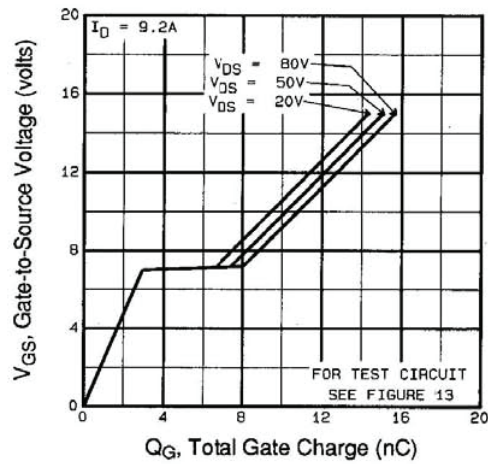


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

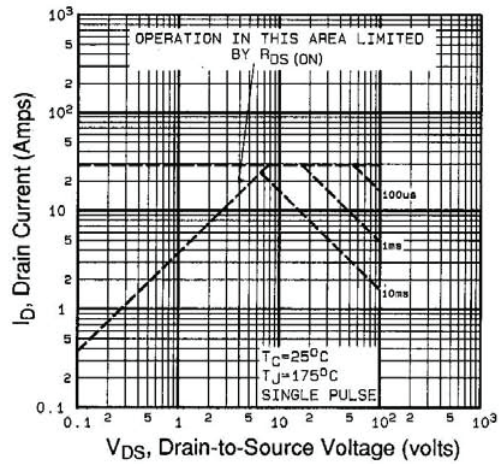


Fig. 5 - Fig. 8 - Maximum Safe Operating Area

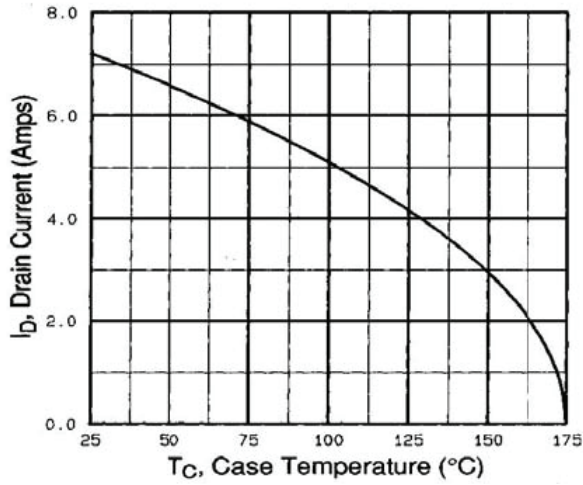


Fig. 9 - Maximum Drain Current vs. Case Temperature

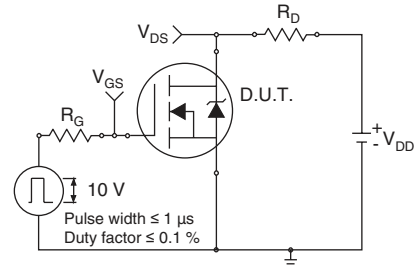


Fig. 10a - Switching Time Test Circuit

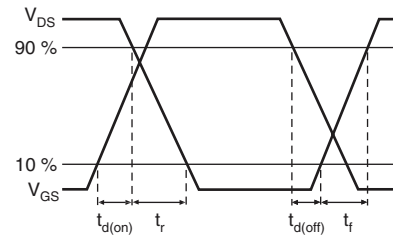


Fig. 10b - Switching Time Waveforms

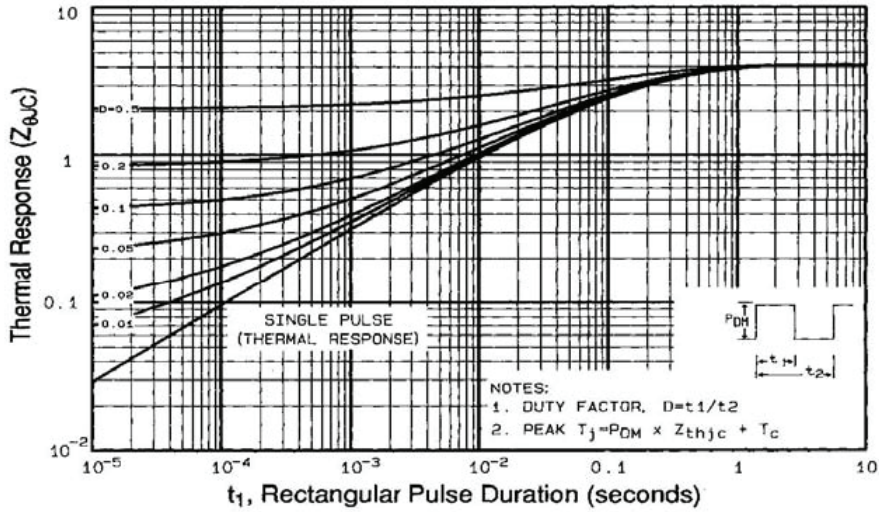


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

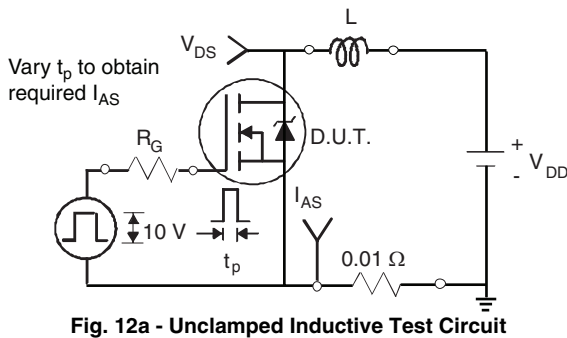


Fig. 12a - Unclamped Inductive Test Circuit

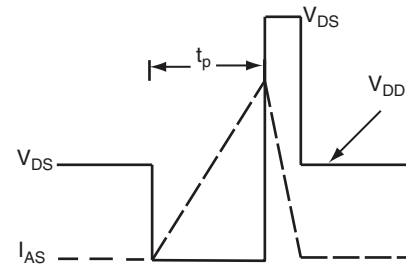


Fig. 12b - Unclamped Inductive Waveforms

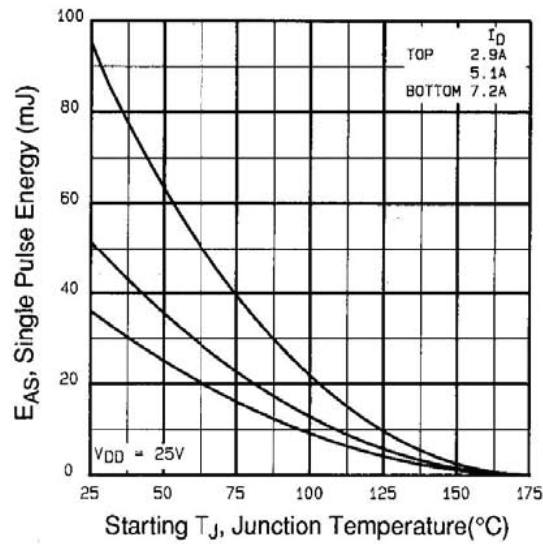


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

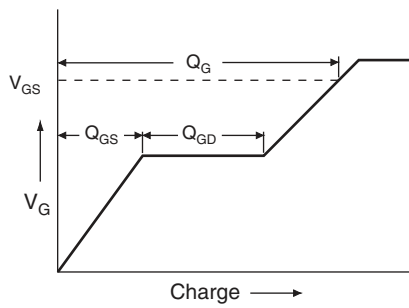


Fig. 13a - Basic Gate Charge Waveform

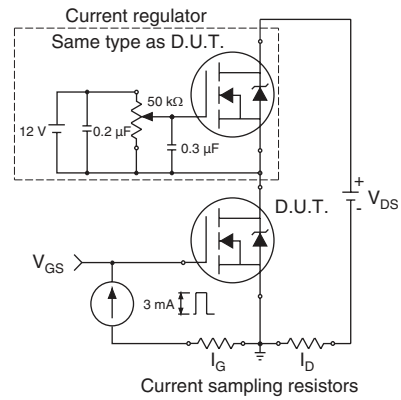
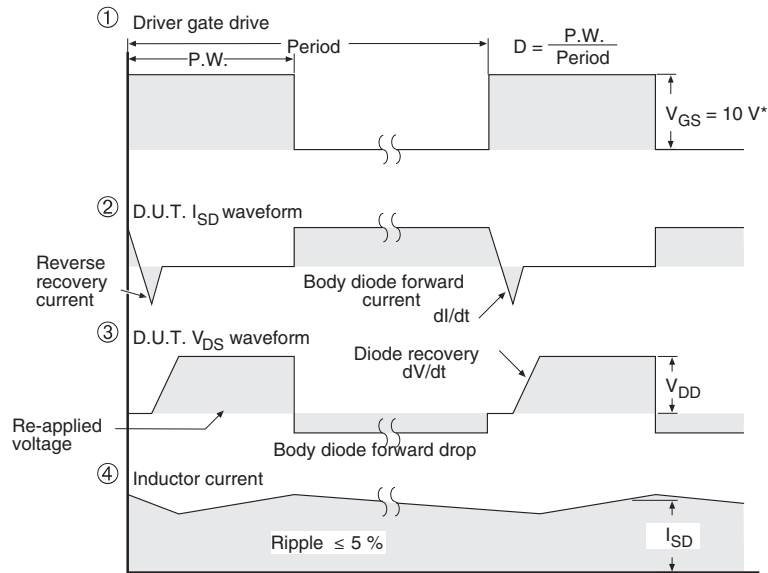
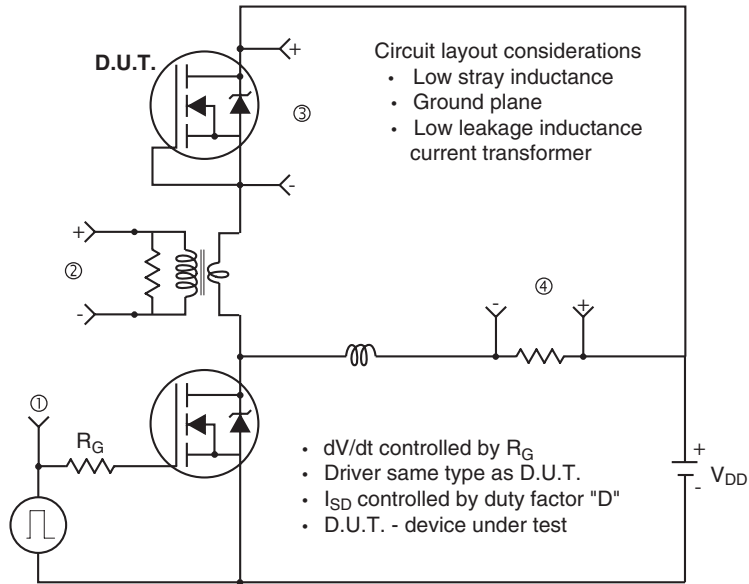


Fig. 13b - Gate Charge Test Circuit

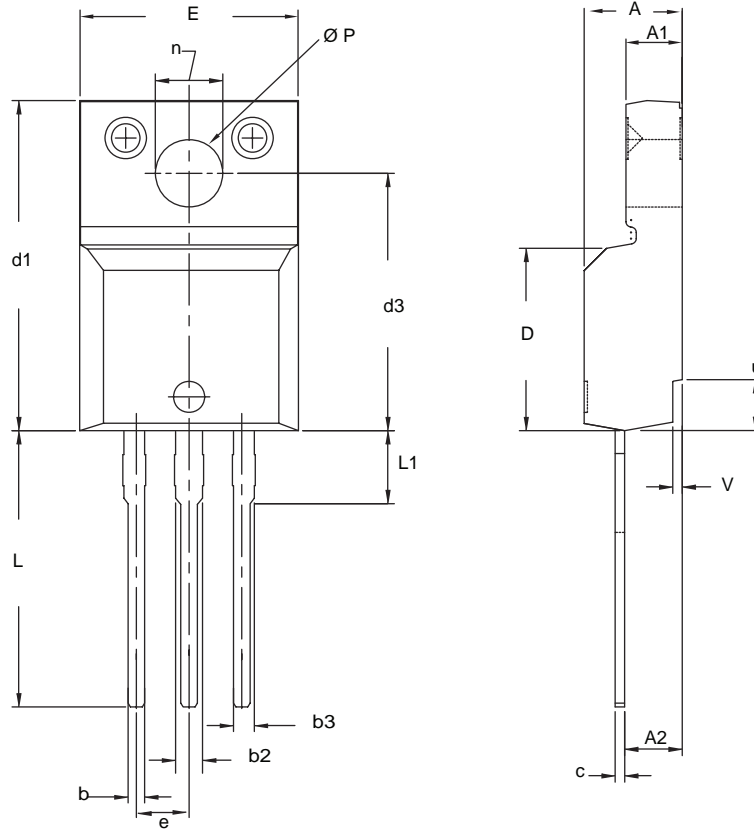
Peak Diode Recovery dV/dt Test Circuit



* $V_{GS} = 5 V$ for logic level devices

Fig. 14 - For N-Channel

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
Ø P	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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