

5R520P-VB TO251 Datasheet

N-Channel 650V (D-S) Super Junction Power MOSFET

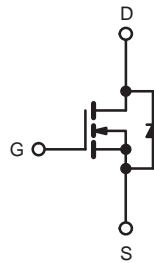
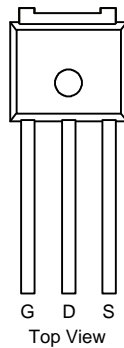
PRODUCT SUMMARY		
V_{DS} (V)	650	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10$ V	0.95
Q_g (Max.) (nC)	15	
Q_{gs} (nC)	3	
Q_{gd} (nC)	6	
Configuration	Single	

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
- Compliant to RoHS directive 2002/95/EC


RoHS*
 COMPLIANT

TO-251



N-Channel MOSFET

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}	± 30	
Continuous Drain Current ^e	V_{GS} at 10 V	I_D	$T_C = 25$ °C	A
Continuous Drain Current			$T_C = 100$ °C	
Pulsed Drain Current ^a		I_{DM}	16	
Linear Derating Factor			1.67/0.8/0.3	W/°C
Single Pulse Avalanche Energy ^b		E_{AS}	120	mJ
Repetitive Avalanche Current ^a		I_{AR}	34	A
Repetitive Avalanche Energy ^a		E_{AR}	17	mJ
Maximum Power Dissipation	$T_C = 25$ °C	P_D	205/35/30	W
Peak Diode Recovery dV/dt ^c		dV/dt	4.5	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

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting $T_J = 25$ °C, $L = 24$ mH, $R_G = 25$ Ω , $I_{AS} = 3.2$ A (see fig. 12).
- $I_{SD} \leq 3.2$ A, $dI/dt \leq 90$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °C.
- 1.6 mm from case.
- Drain current limited by maximum junction temperature.

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	62	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	3.6/1.2/0.6	

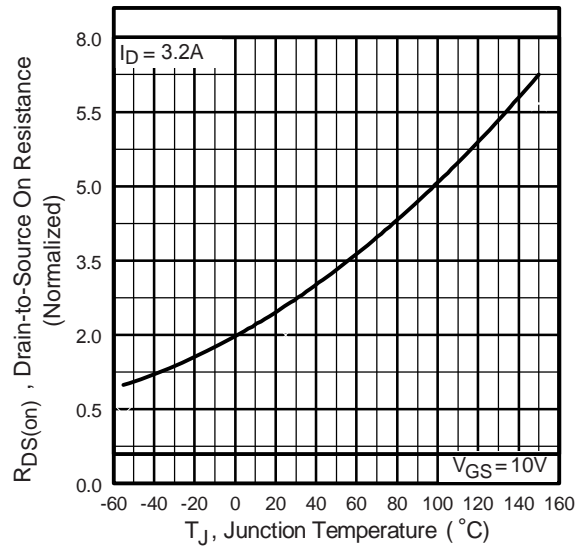
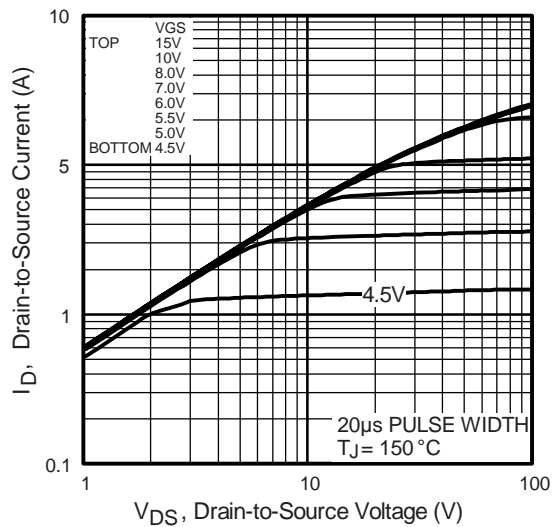
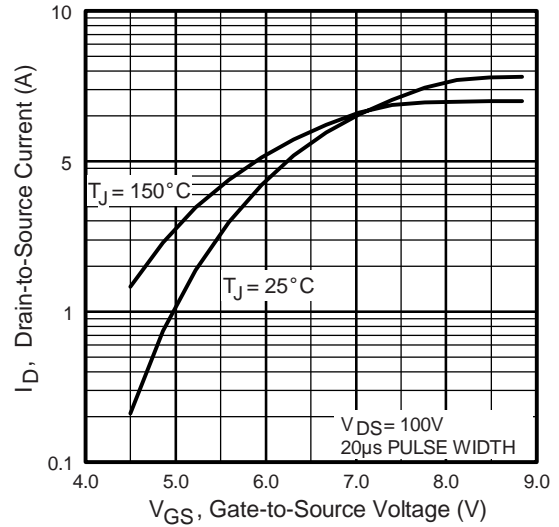
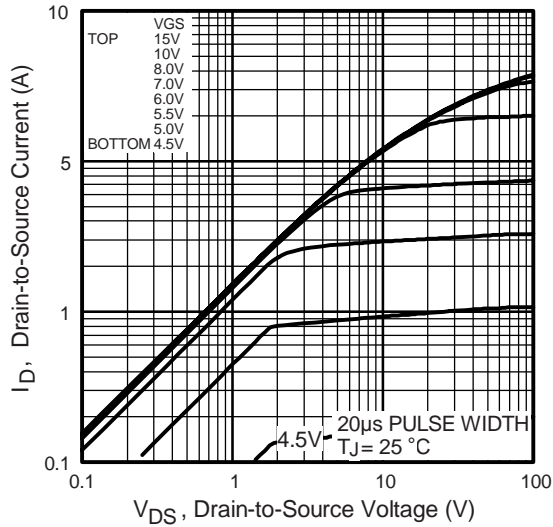
SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted

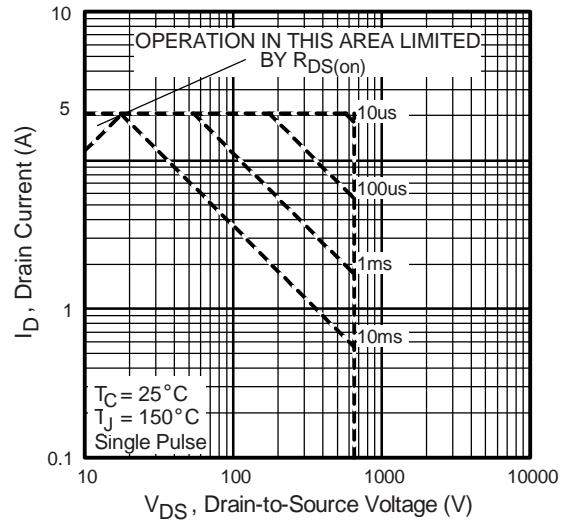
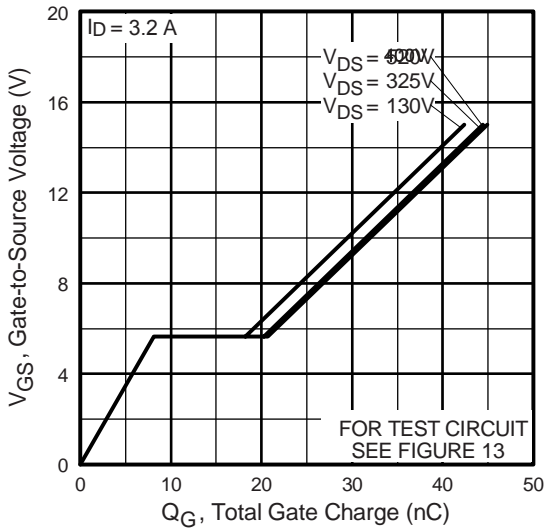
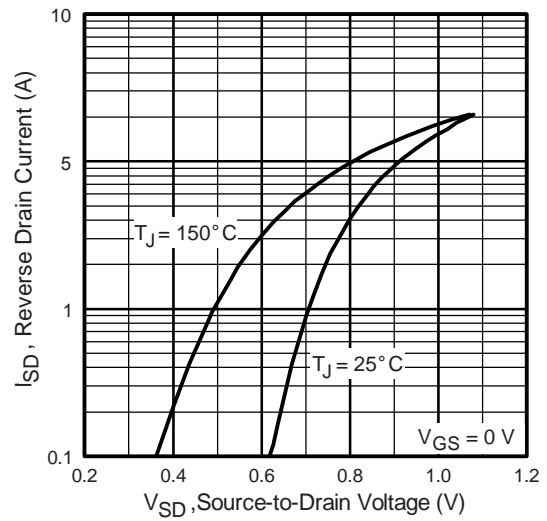
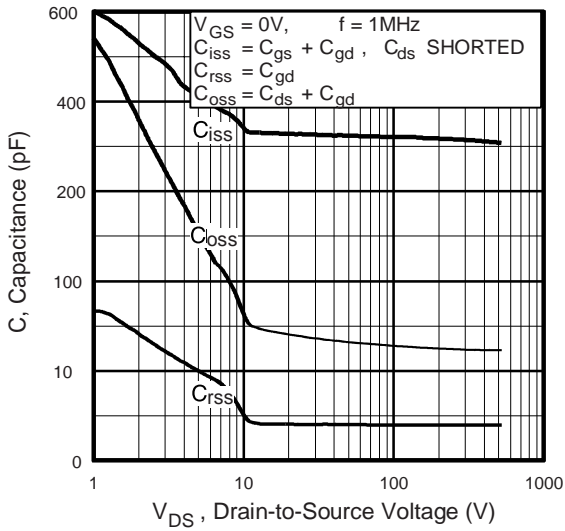
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	650	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}^d$	-	0.6	-	mV/°C
Gate-Source 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}	$V_{GS} = \pm 30\text{ V}$	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	-	-	10	μA
		$V_{DS} = 520\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	100	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$ $I_D = 2.5\text{ A}^b$	-	0.95	-	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 2.5\text{ A}$	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	-	320	-	pF
Output Capacitance	C_{oss}		-	75	-	
Reverse Transfer Capacitance	C_{rss}		-	4	-	
Output Capacitance	C_{oss}	$V_{GS} = 0\text{ V}$	$V_{DS} = 1.0\text{ V}, f = 1.0\text{ MHz}$	-	500	-
			$V_{DS} = 520\text{ V}, f = 1.0\text{ MHz}$	-	83	-
Effective Output Capacitance	$C_{oss\text{ eff.}}$	$V_{DS} = 0\text{ V to } 520\text{ V}^c$	-	14	-	
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 ^b	-	-	15	nC
Gate-Source Charge	Q_{gs}		-	-	3	
Gate-Drain Charge	Q_{gd}		-	-	6	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 325\text{ V}, I_D = 3.2\text{ A}$ $R_G = 9.1\text{ }\Omega, R_D = 62\text{ }\Omega,$ see fig. 10 ^b	-	18	-	ns
Rise Time	t_r		-	40	-	
Turn-Off Delay Time	$t_{d(off)}$		-	50	-	
Fall Time	t_f		-	30	-	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	5	A
Pulsed Diode Forward Current ^a	I_{SM}		-	-	16	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 3.2\text{ A}, V_{GS} = 0\text{ V}^b$	-	-	1.5	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 3.2\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$	-	180	-	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	2.1	3.2	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 $\leq 2\%$.
- $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS} .
- $t = 60\text{ s}, f = 60\text{ Hz}$.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted





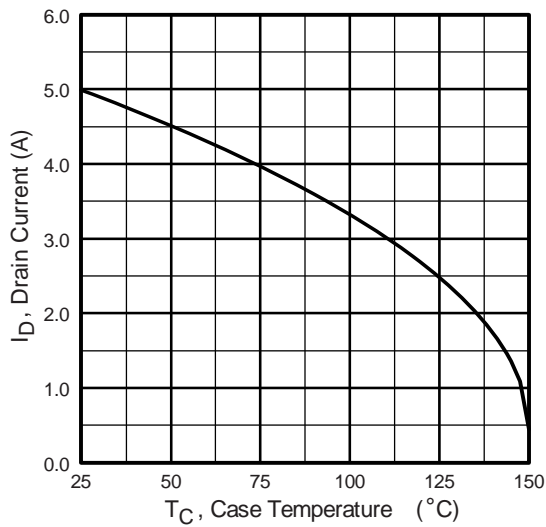


Fig. 9 - Maximum Drain Current vs. Case Temperature

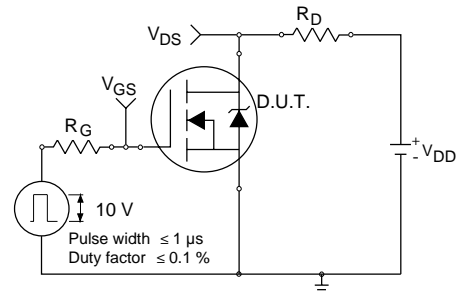


Fig. 10a - Switching Time Test Circuit

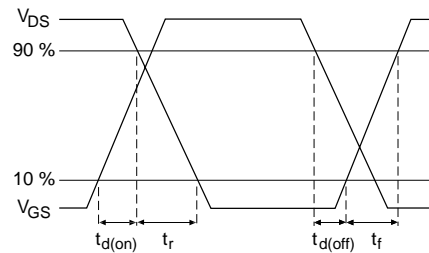


Fig. 10b - Switching Time Waveforms

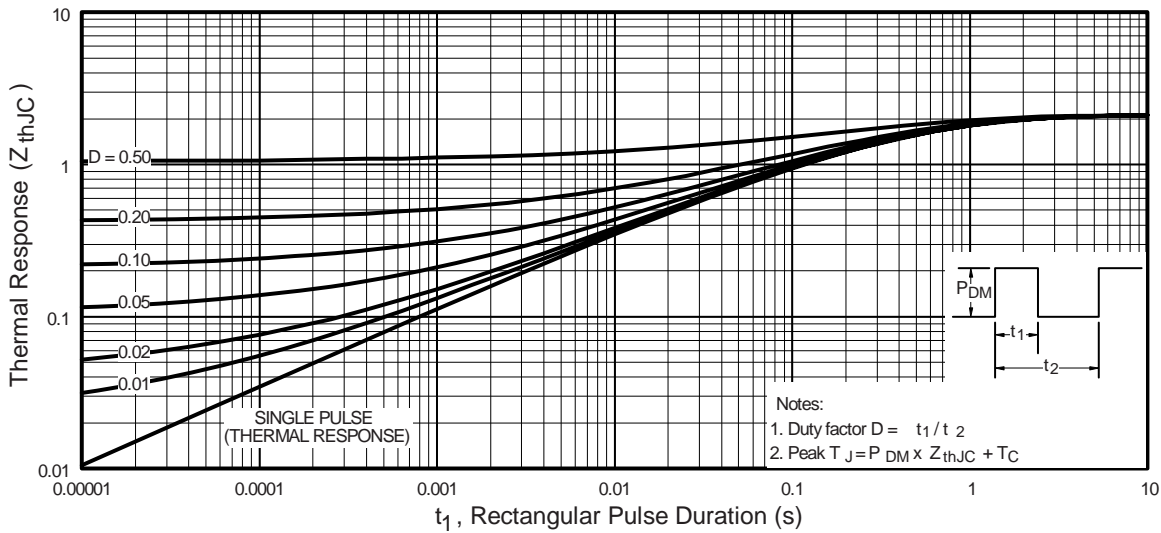


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

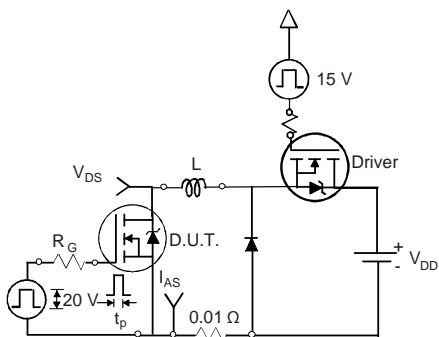


Fig. 12a - Unclamped Inductive Test Circuit

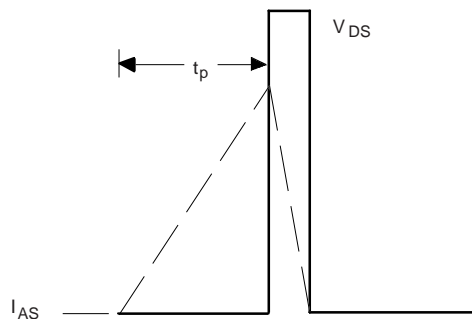


Fig. 12b - Unclamped Inductive Waveforms

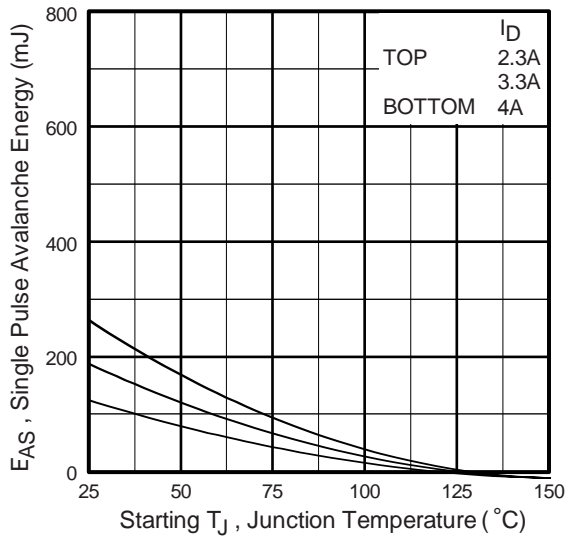


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

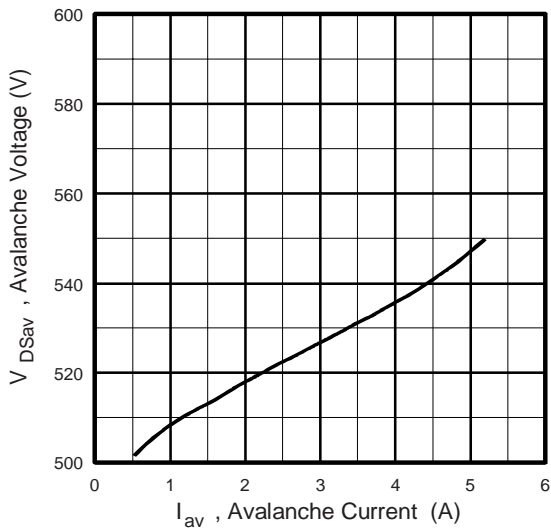


Fig. 12d - Typical Drain-to Source Voltage vs. Avalanche Current

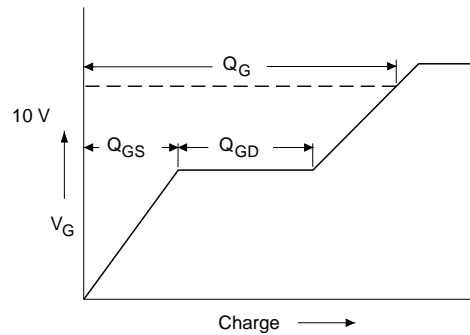


Fig. 13a - Basic Gate Charge Waveform

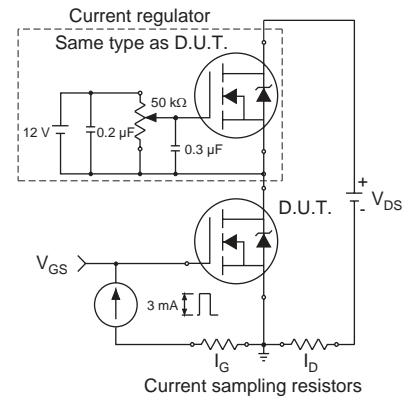
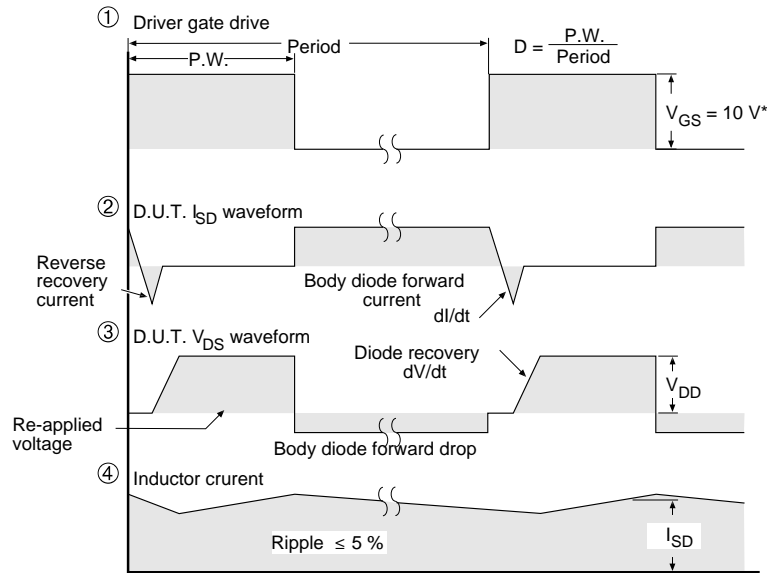
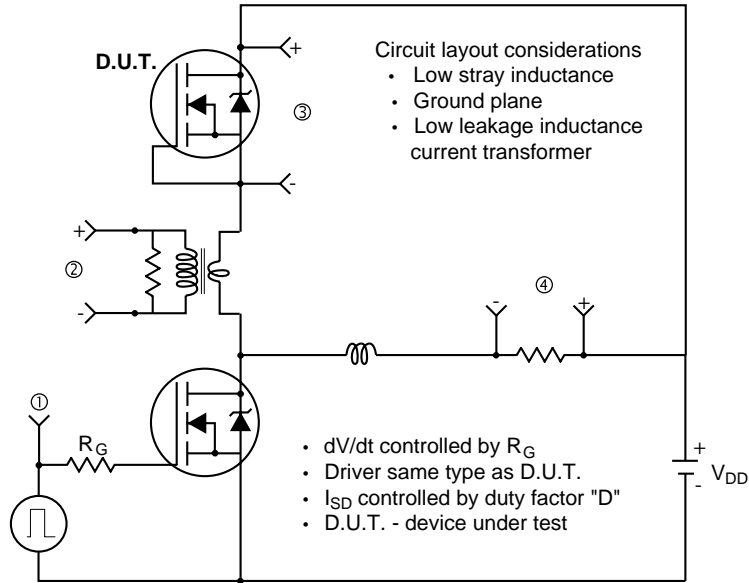


Fig. 13b - Gate Charge Test Circuit

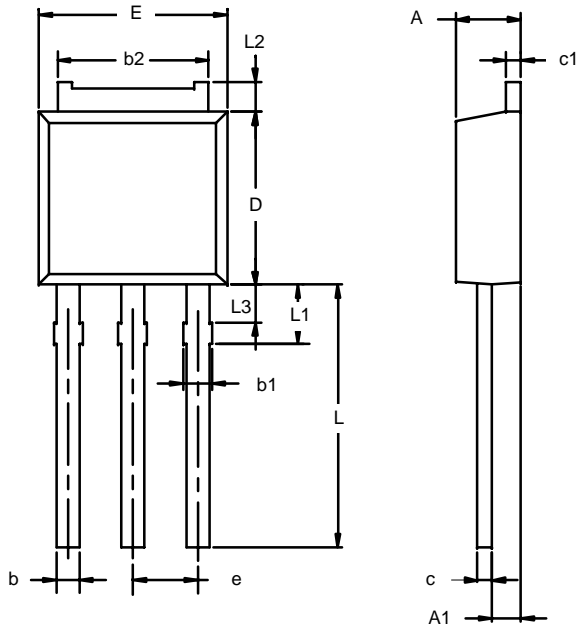
Peak Diode Recovery dV/dt Test Circuit



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

Fig. 14 - For N-Channel

TO-251AA (DPAK)



Note: Dimension L3 is for reference only.

Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	2.21	2.38	0.087	0.094
A1	0.89	1.14	0.035	0.045
b	0.71	0.89	0.028	0.035
b1	0.76	1.14	0.030	0.045
b2	5.23	5.43	0.206	0.214
c	0.46	0.58	0.018	0.023
c1	0.46	0.58	0.018	0.023
D	5.97	6.22	0.235	0.245
E	6.48	6.73	0.255	0.265
e	2.28 BSC		0.090 BSC	
L	8.89	9.53	0.350	0.375
L1	1.91	2.28	0.075	0.090
L2	0.89	1.27	0.035	0.050
L3	1.15	1.52	0.045	0.060
ECN: S-03946—Rev. E, 09-Jul-01 DWG: 5346				

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