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

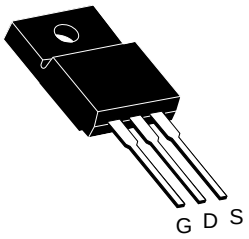
Available

RoHS* COMPLIANT

TO-220 Pin Configuration

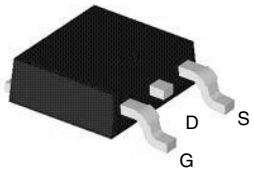
Top View

TO-220 FULLPAK



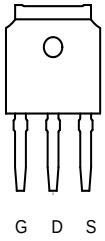
Top View

TO-252 Pin Configuration

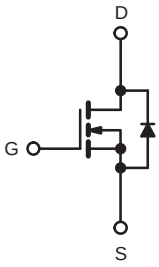


Top View

TO-251



Top View



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	T_C = 25 °C	I_D	5	A
Continuous Drain Current		T_C = 100 °C		4	
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

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. Starting T_J = 25 °C, L = 24 mH, R_G = 25 Ω, I_{AS} = 3.2 A (see fig. 12).
c. I_{SD} ≤ 3.2 A, dI/dt ≤ 90 A/µs, V_{DD} ≤ V_{DS}, T_J ≤ 150 °C.
d. 1.6 mm from case.
e. 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 °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		650	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA[d]		-	0.6	-	mV/°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} = ± 30 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 650 V, V_{GS} = 0 V		-	-	10	µA
		V_{DS} = 520 V, V_{GS} = 0 V, T_J = 125 °C		-	-	100	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 2.5 A[b]	-	0.95	-	Ω
Forward Transconductance	g_{fs}	V_{DS} = 50 V, I_D = 2.5 A		8	-	-	S
Dynamic							
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5		-	320	-	pF
Output Capacitance	C_{oss}			-	75	-	
Reverse Transfer Capacitance	C_{rss}			-	4	-	
Output Capacitance	C_{oss}	V_{GS} = 0 V	V_{DS} = 1.0 V, f = 1.0 MHz	-	500	-	
			V_{DS} = 520 V, f = 1.0 MHz	-	83	-	
Effective Output Capacitance	C_{oss} eff.		V_{DS} = 0 V to 520 V[c]	-	14	-	
Total Gate Charge	Q_g	V_{GS} = 10 V	I_D = 2.5 A, V_{DS} = 400 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 V, I_D = 3.2 A, R_G = 9.1 Ω, R_D = 62 Ω, 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 °C, I_S = 3.2 A, V_{GS} = 0 V[b]		-	-	1.5	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = 3.2 A, dI/dt = 100 A/µs[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

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. Pulse width ≤ 300 µs; duty cycle ≤ 2 %.
c. C_{oss} 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}.
d. t = 60 s, f = 60 Hz.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

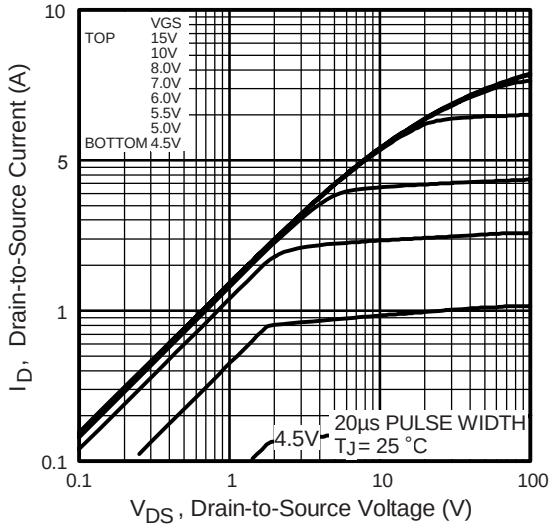


Fig. 1 - Typical Output Characteristics

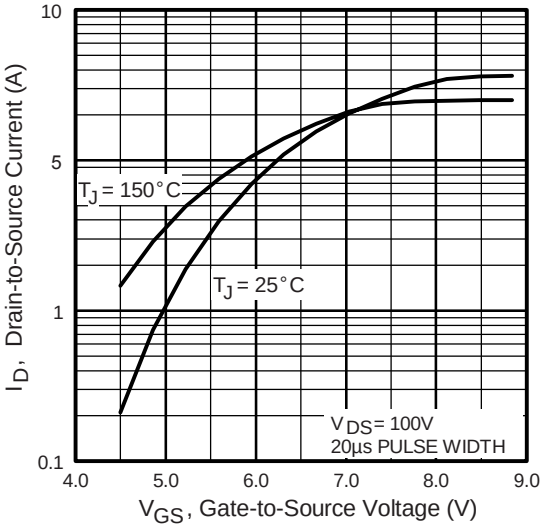


Fig. 3 - Typical Transfer Characteristics

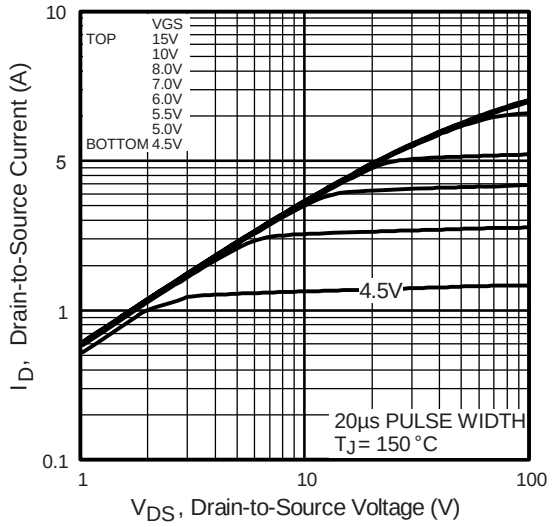


Fig. 2 - Typical Output Characteristics

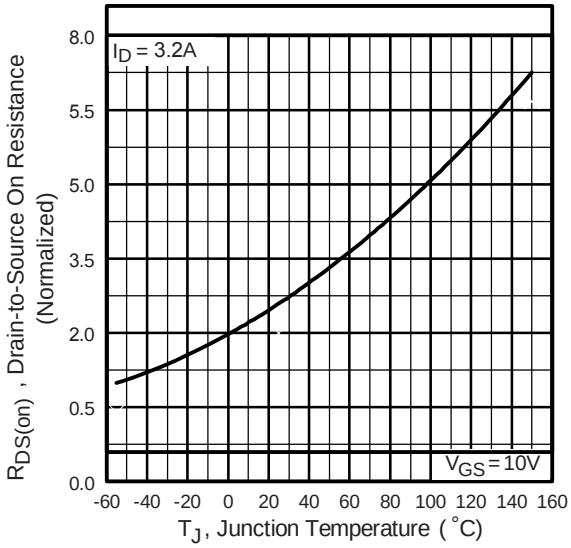


Fig. 4 - Normalized On-Resistance vs. Temperature

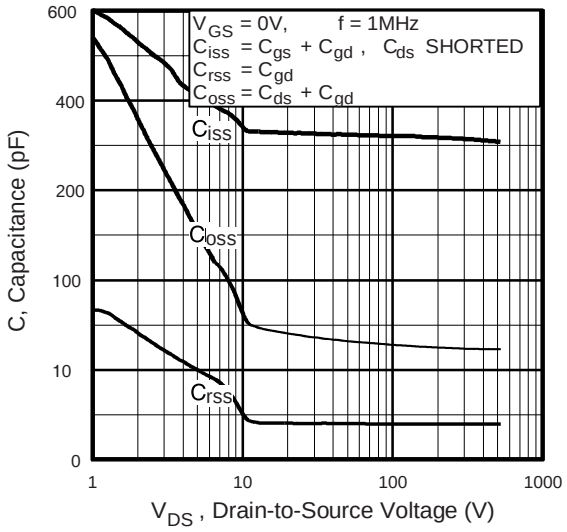


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

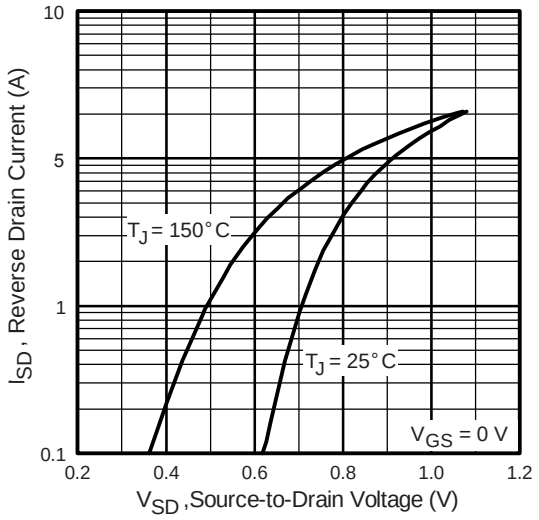


Fig. 7 - Typical Source-Drain Diode Forward Voltage

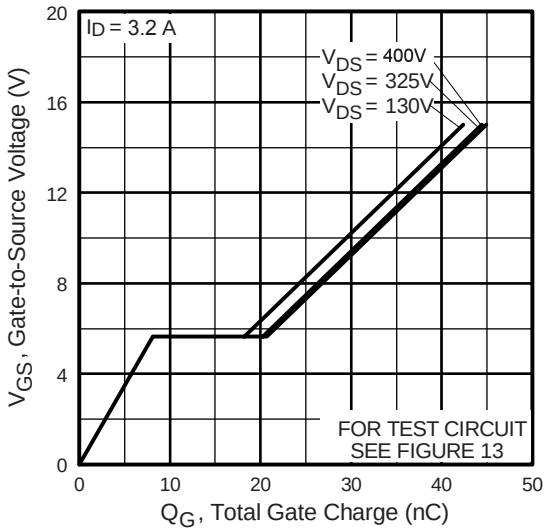


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

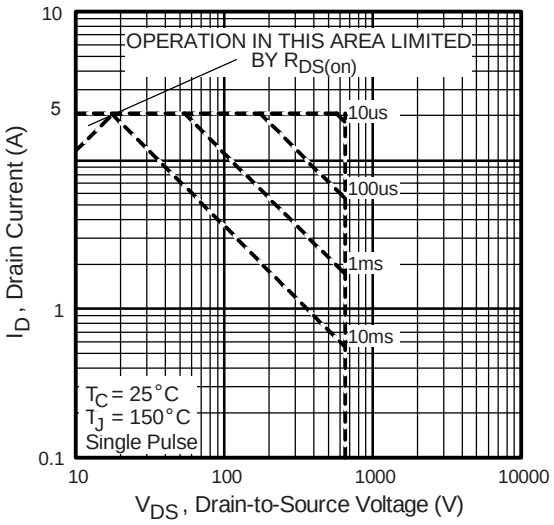


Fig. 8 - Maximum Safe Operating Area

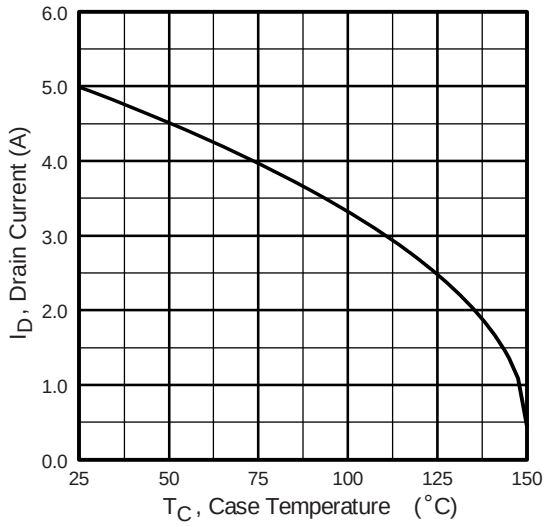


Fig. 9 - Maximum Drain Current vs. Case Temperature

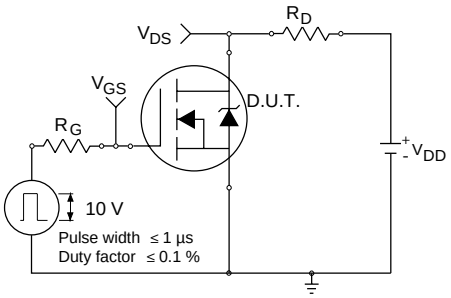


Fig. 10a - Switching Time Test Circuit

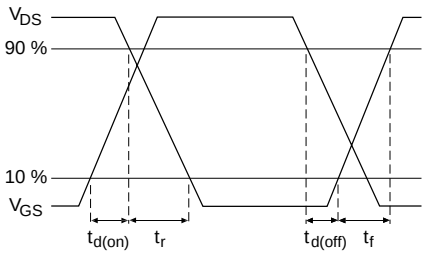


Fig. 10b - Switching Time Waveforms

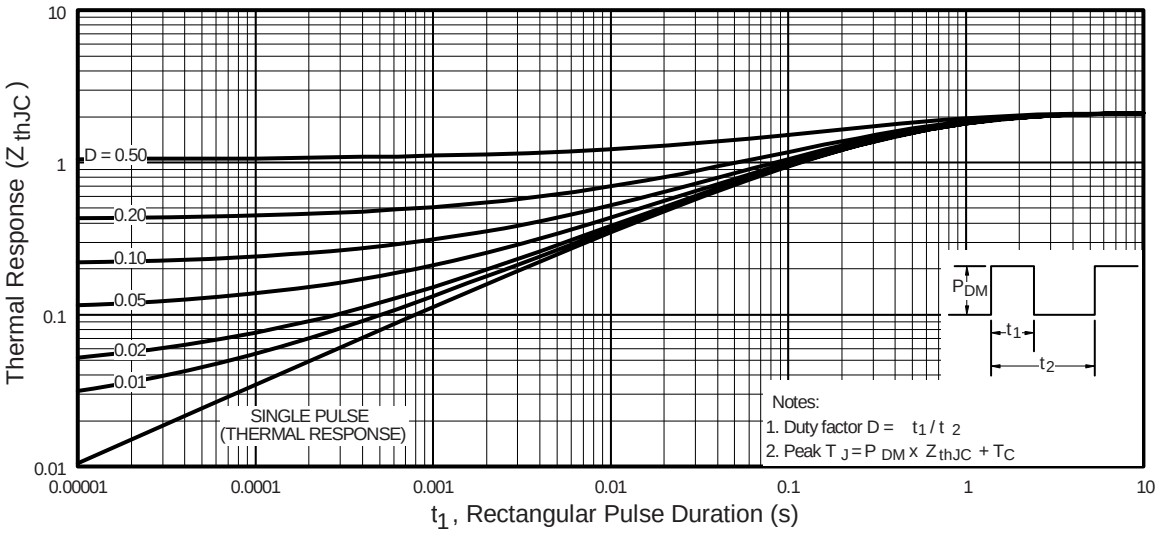


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

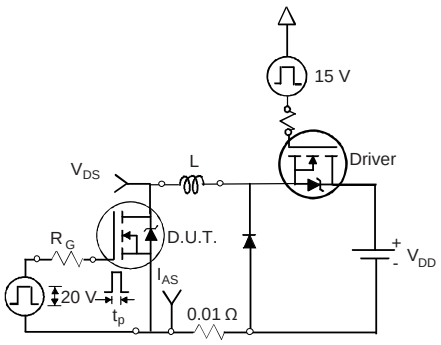


Fig. 12a - Unclamped Inductive Test Circuit

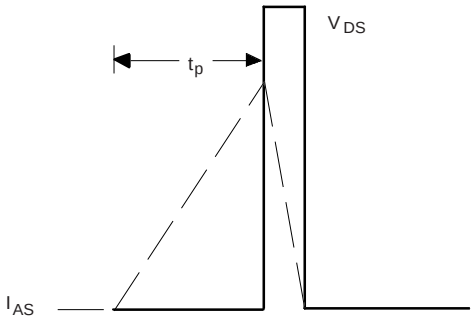


Fig. 12b - Unclamped Inductive Waveforms

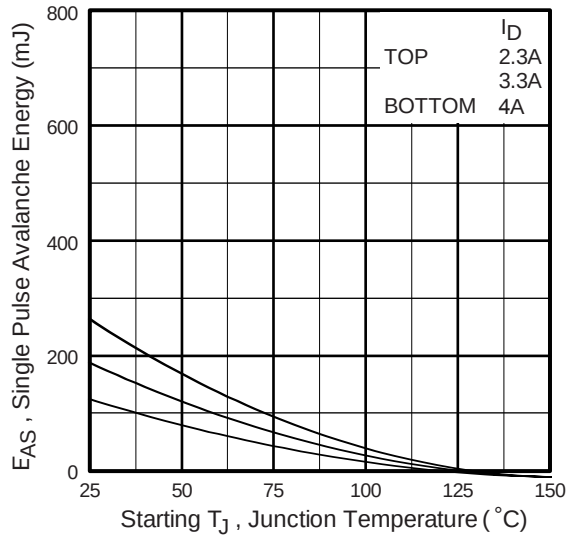


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

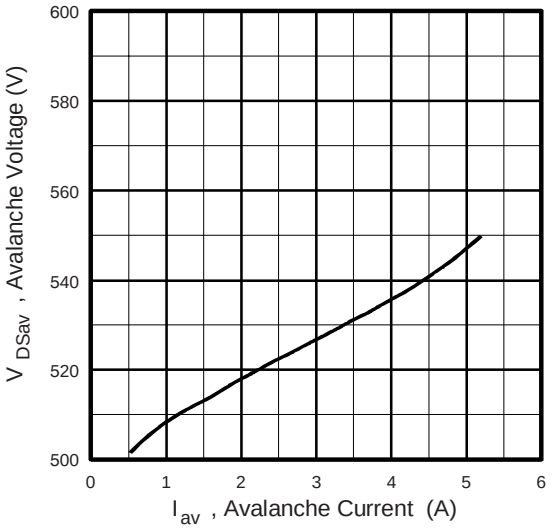


Fig. 12d - Typical Drain-to Source Voltage vs. Avalanche Current

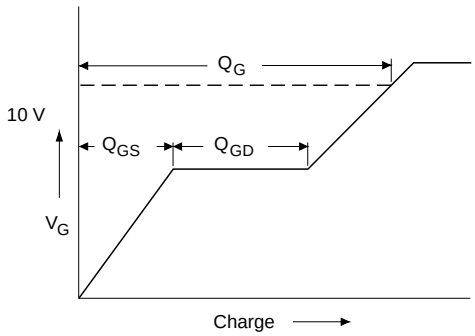


Fig. 13a - Basic Gate Charge Waveform

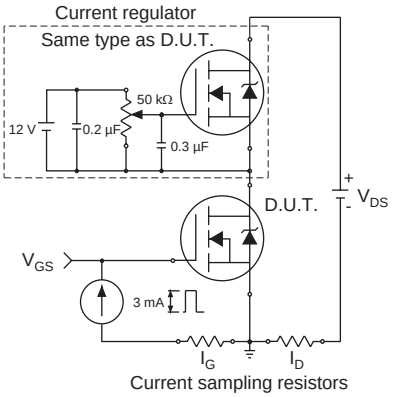
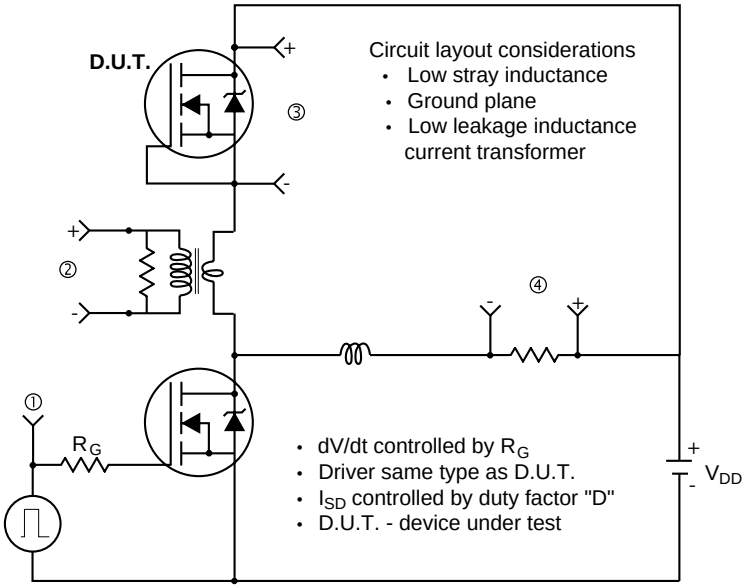
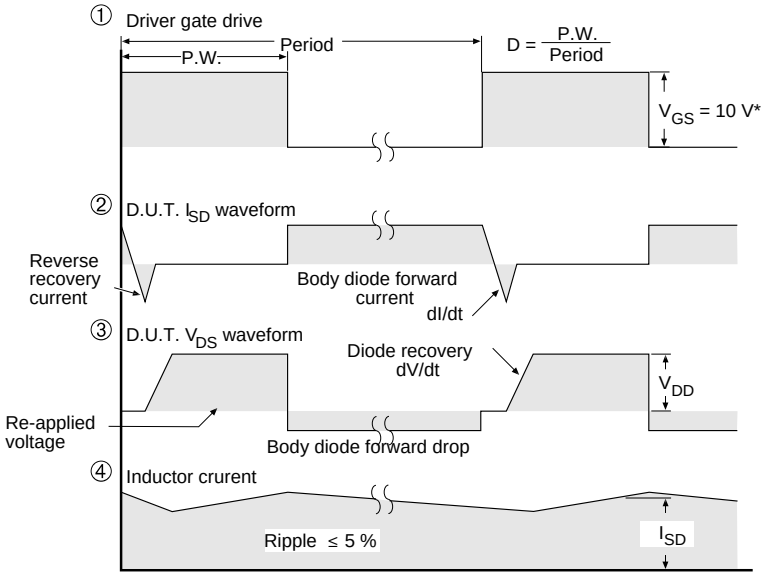


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit





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

Fig. 14 - For N-Channel

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Din-Tek Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Din-Tek"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Din-Tek makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Din-Tek disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Din-Tek's knowledge of typical requirements that are often placed on Din-Tek products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Din-Tek's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Din-Tek products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Din-Tek product could result in personal injury or death. Customers using or selling Din-Tek products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Din-Tek personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Din-Tek. Product names and markings noted herein may be trademarks of their respective owners.

Material Category Policy

Din-Tek Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Din-Tek documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.

Din-Tek Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Din-Tek documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.