

# MT40012T

## N-Channel Power MOSFET

40V, 250A, 1.7mΩ



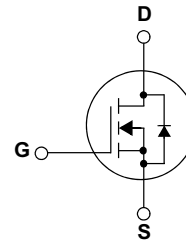
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### Features

- Trench Power MV MOSFET technology
- Low RDS(ON)
- Low Gate Charge
- Optimized Ruggedness
- RoHS and Halogen-Free Compliant

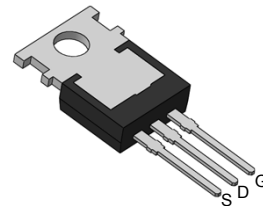
### Simplified Schematic



### Applications

- DC Motor Driver
- Synchronous Rectification in DC/DC and AC/DC Converters

### MARKING DIAGRAM & PIN ASSIGNMENT



### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

TO-220

#### Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current <sup>E</sup>	$T_C=25^\circ\text{C}$	250	A
	$T_C=25^\circ\text{C}$		
	$T_C=100^\circ\text{C}$		
Pulsed Drain Current <sup>C</sup>	$I_{DM}$	772	
Continuous Drain Current	$T_A=25^\circ\text{C}$	44	A
	$T_A=70^\circ\text{C}$	35	
Avalanche Current <sup>C</sup>	$I_{AS}$	47	A
Avalanche energy $L=0.3\text{mH}$ <sup>C</sup>	$E_{AS}$	331	mJ
Power Dissipation <sup>B</sup>	$T_C=25^\circ\text{C}$	187	W
	$T_C=100^\circ\text{C}$	93	
Power Dissipation <sup>A</sup>	$T_A=25^\circ\text{C}$	8.3	W
	$T_A=70^\circ\text{C}$	5.3	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 175	$^\circ\text{C}$

Electrical Characteristics ( $T_J=25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$	40			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=32\text{V}$ , $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			1 5	$\mu\text{A}$
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 20\text{V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$	1.0	1.7	2.4	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}$ , $I_D=20\text{A}$ $T_J=125^\circ\text{C}$		1.7	2.0	m $\Omega$
		$V_{GS}=4.5\text{V}$ , $I_D=20\text{A}$		2.5	3.8	
$g_{FS}$	Forward Transconductance	$V_{DS}=5\text{V}$ , $I_D=20\text{A}$		100		S
$V_{SD}$	Diode Forward Voltage	$I_S=1\text{A}$ , $V_{GS}=0\text{V}$		0.7	1	V
$I_S$	Maximum Body-Diode Continuous Current <sup>G</sup>				120	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=20\text{V}$ , $f=1\text{MHz}$		6225		pF
$C_{oss}$	Output Capacitance			895		pF
$C_{rss}$	Reverse Transfer Capacitance			55		pF
$R_g$	Gate resistance	$f=1\text{MHz}$	1	2	3.1	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=10\text{V}$ , $V_{DS}=20\text{V}$ , $I_D=20\text{A}$		68	95	nC
$Q_g(4.5\text{V})$	Total Gate Charge			28	40	
$Q_{gs}$	Gate Source Charge			16.5		
$Q_{gd}$	Gate Drain Charge			4.5		
$Q_{oss}$	Output Charge	$V_{GS}=0\text{V}$ , $V_{DS}=20\text{V}$		37		nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=10\text{V}$ , $V_{DS}=20\text{V}$ , $R_L=1\Omega$ , $R_{GEN}=3\Omega$		12.5		ns
$t_r$	Turn-On Rise Time			9.5		
$t_{D(off)}$	Turn-Off DelayTime			57.5		
$t_f$	Turn-Off Fall Time			10.5		
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F=20\text{A}$ , $di/dt=500\text{A}/\mu\text{s}$		20		ns
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=20\text{A}$ , $di/dt=500\text{A}/\mu\text{s}$		60		nC

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

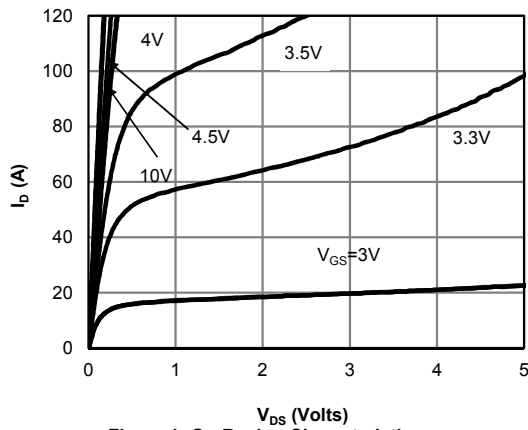


Figure 1: On-Region Characteristics

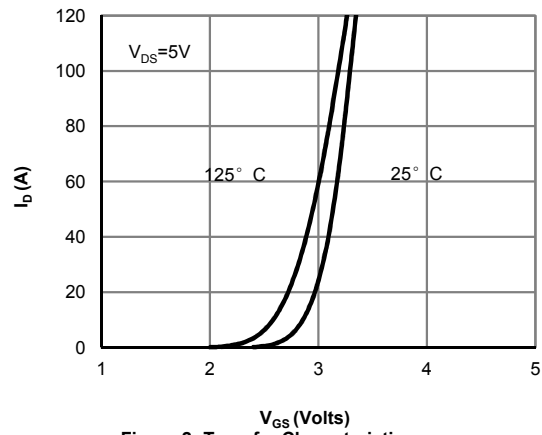


Figure 2: Transfer Characteristics

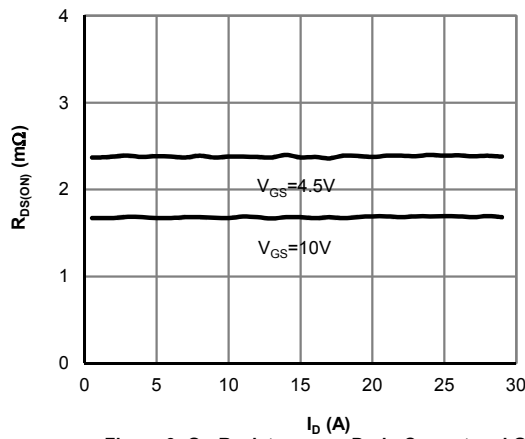


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

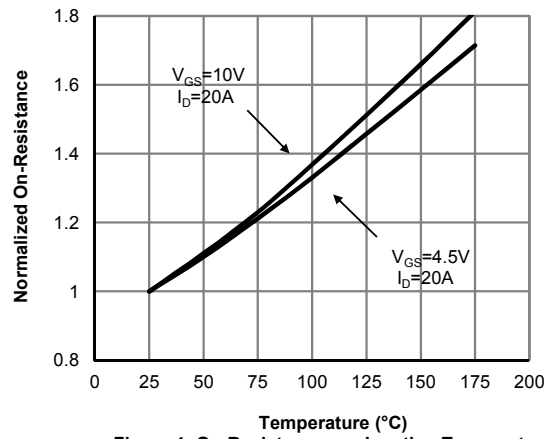


Figure 4: On-Resistance vs. Junction Temperature

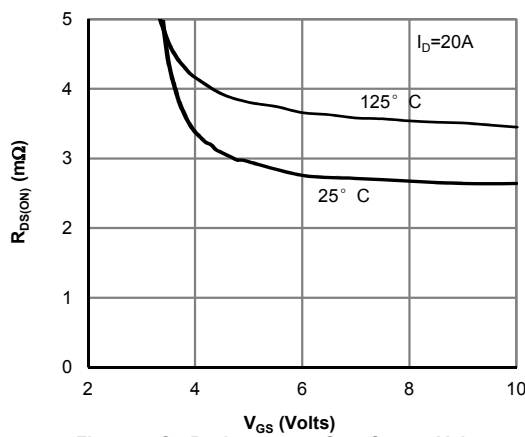


Figure 5: On-Resistance vs. Gate-Source Voltage

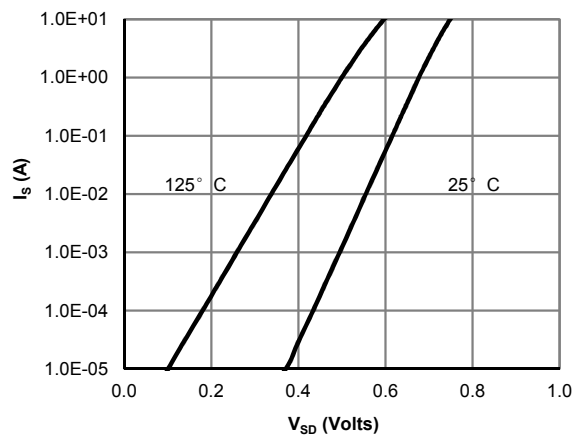


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

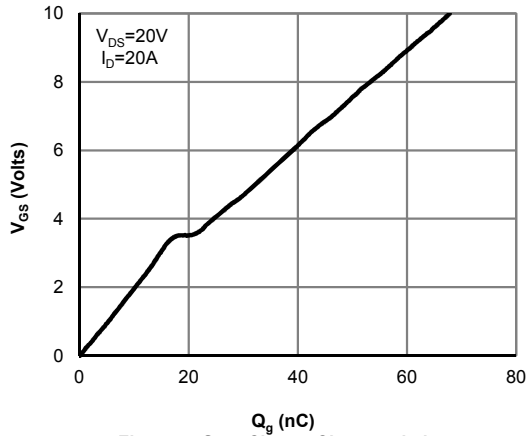


Figure 7: Gate-Charge Characteristics

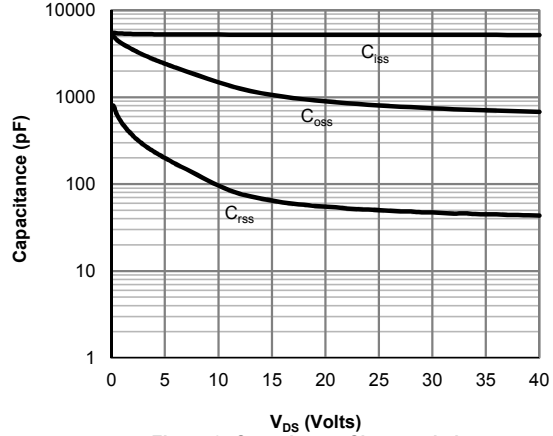


Figure 8: Capacitance Characteristics

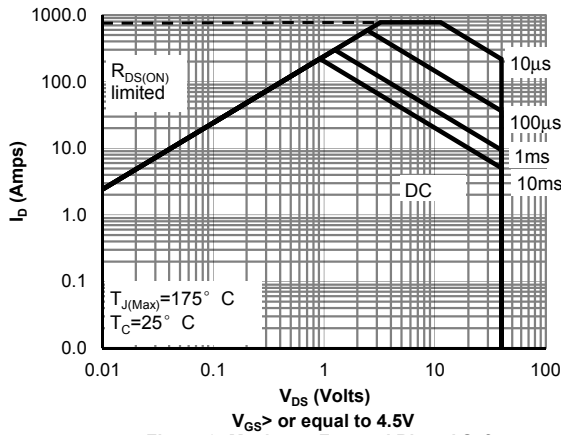


Figure 9: Maximum Forward Biased Safe Operating Area

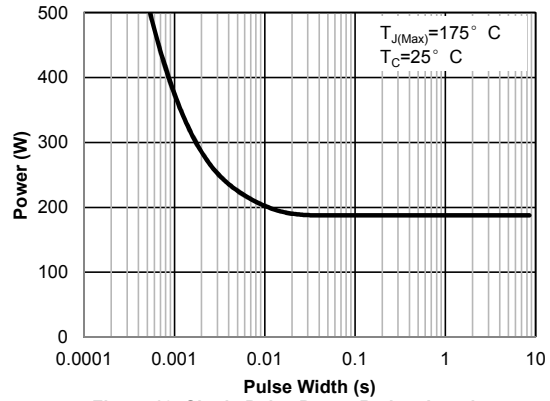


Figure 10: Single Pulse Power Rating Junction-to-Case

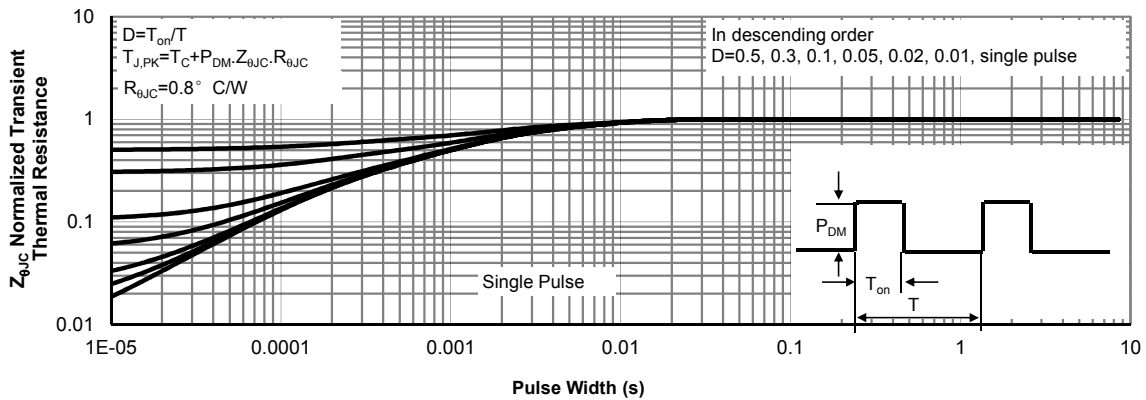


Figure 11: Normalized Maximum Transient Thermal Imp

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

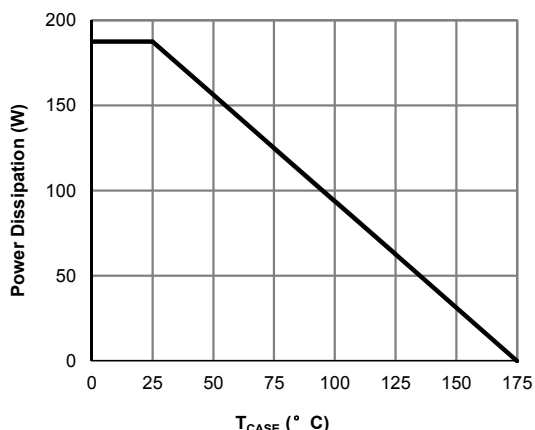


Figure 12: Power De-rating

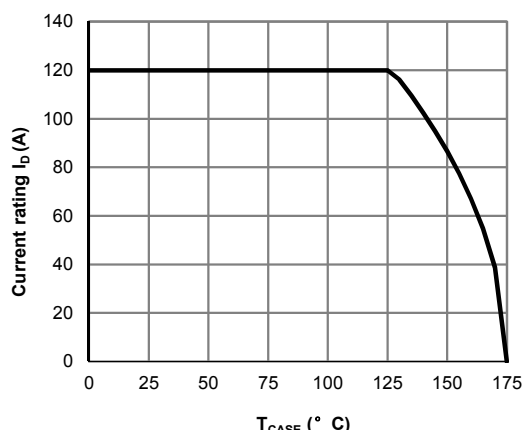


Figure 13: Current De-rating

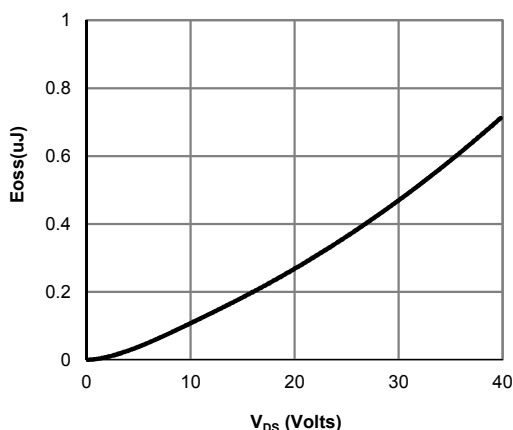


Figure 14: Coss stored Energy

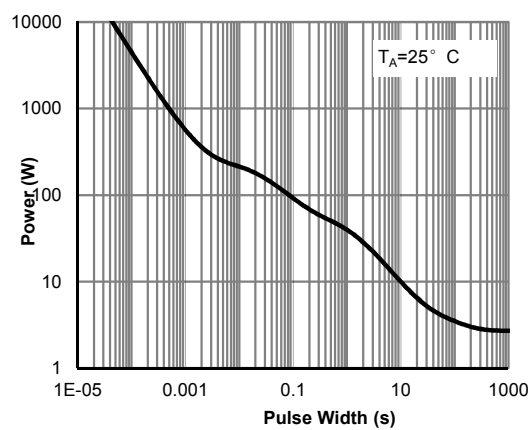


Figure 15: Single Pulse Power Rating Junction-to-Ambient

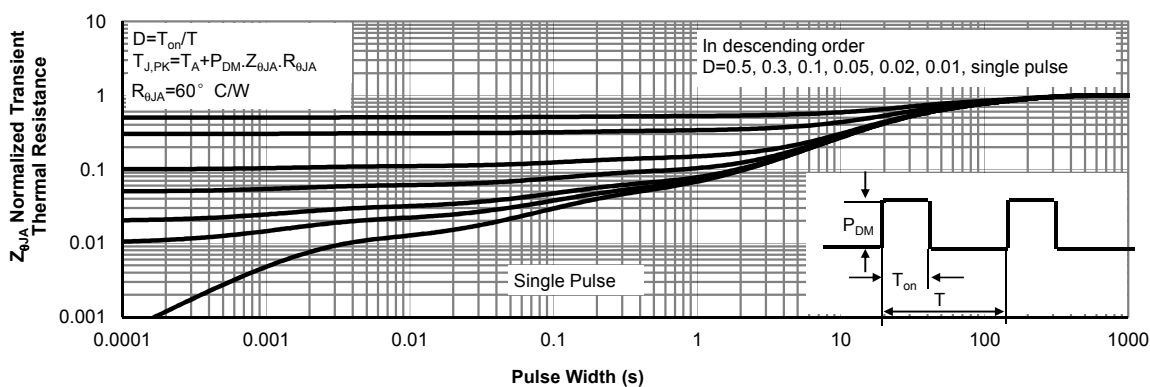


Figure 16: Normalized Maximum Transient Thermal Imp

Figure A: Gate Charge Test Circuit & Waveforms

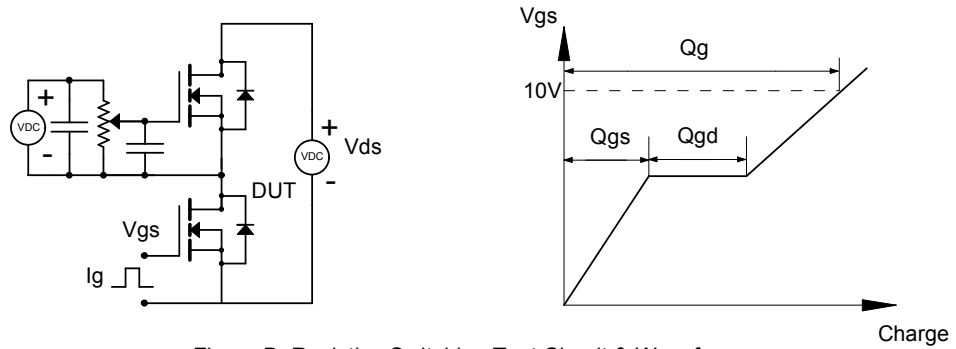


Figure B: Resistive Switching Test Circuit & Waveforms

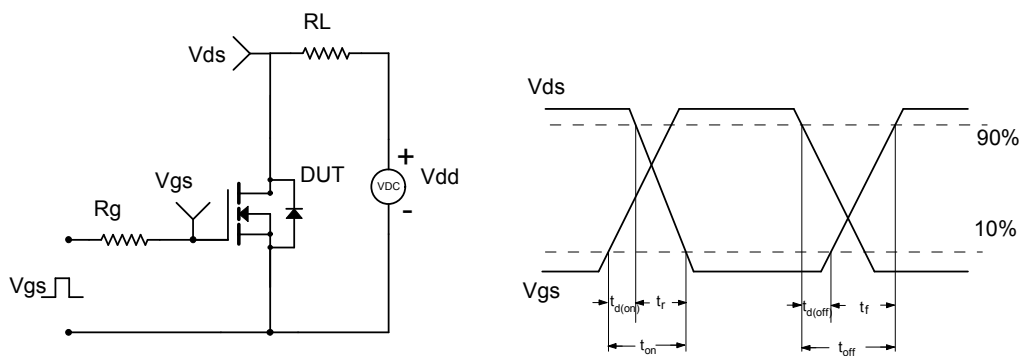


Figure C: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

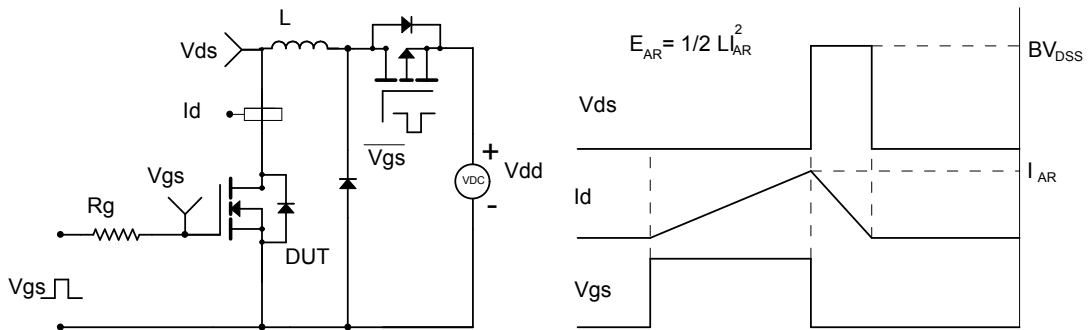
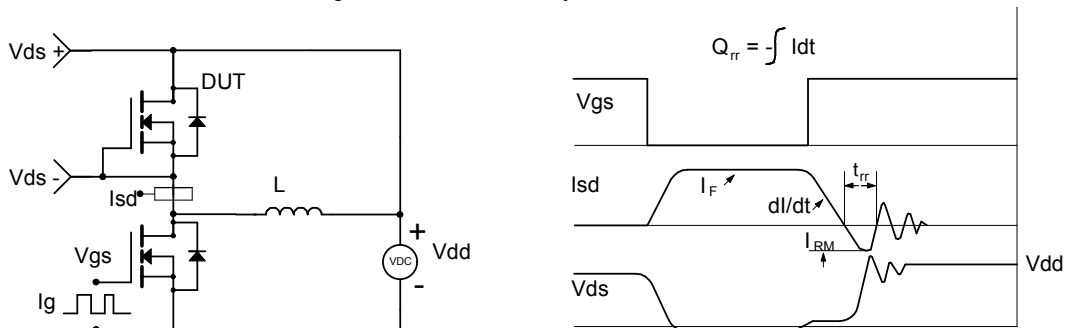


Figure D: Diode Recovery Test Circuit & Waveforms



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