

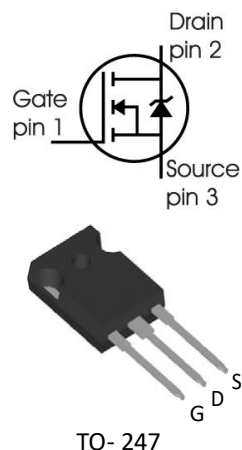
Multi-Epi Super Junction MOSFETs

■ Features

- New revolutionary high voltage technology
- Better $R_{DS(on)}$, $R_{DS(on)}=0.07\Omega$ @ $V_{GS} = 10V$
- Ultra Low gate charge
- Periodic avalanche rated
- Extreme dv/dt rated
- Ultra low effective capacitances

■ APPLICATIONS

- Consumer
- EV Charger
- PFC stages for server & telecom
- SMPS
- UPS
- Solar
- Lighting



Maximum Rating $T_j = 25^\circ\text{C}$, unless otherwise specified

Symbol	Parameter	Value	Unit
V_{DS}	Drain-Source Voltage	600	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$)	47* 29*	A
I_{DM}	Drain Current - Pulsed (Note 1)	140	A
V_{GS}	Gate-Source voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	1160	mJ
I_{AR}	Repetitive Avalanche Current (Note 1)	10	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	1.72	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15	V/ns
dV_{ds}/dt	Drain Source voltage slope ($V_{ds}=480V$)	50	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	391	W
T_j, T_{STG}	Operating and Storage Temperature Range	55 to +150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

1) Limited by T_j, max . Maximum duty cycle $D=0.75$

2) Pulse width t_p limited by T_j, max

3) Identical low side and high side switch with identical RG; $V_{peak} < V(BR)_{DSS}$; $T_j < T_j, \text{max}$

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.32	$^\circ\text{C/W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62	$^\circ\text{C/W}$

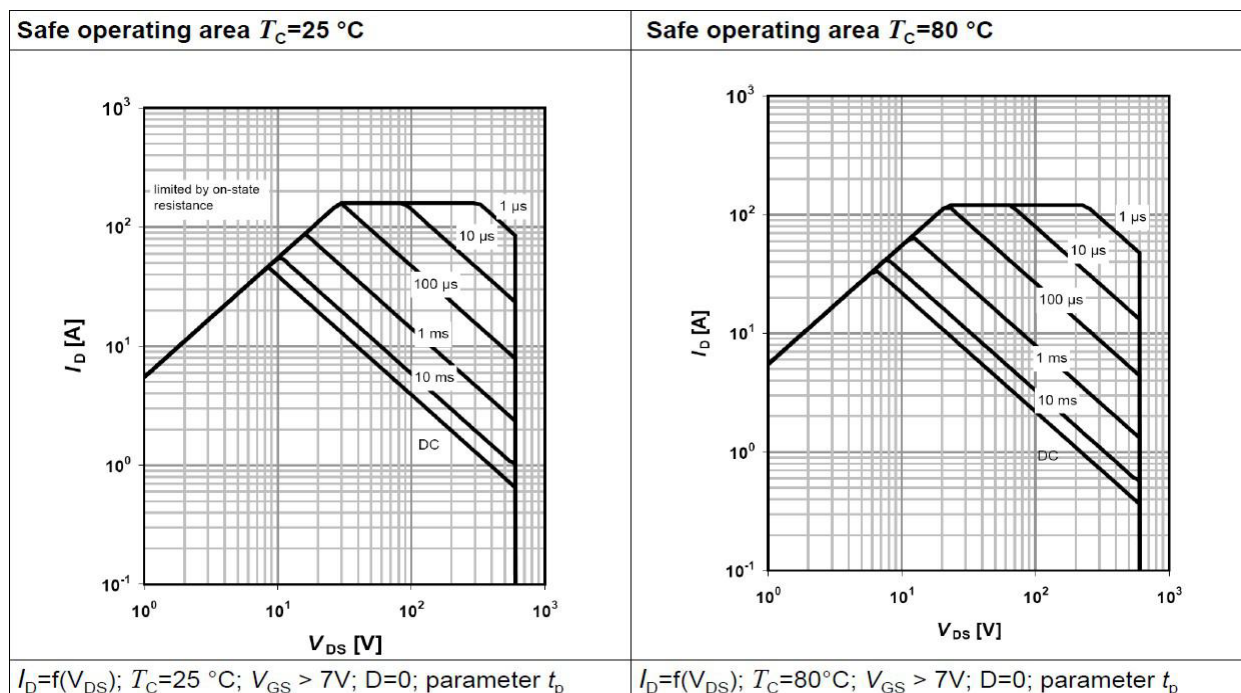
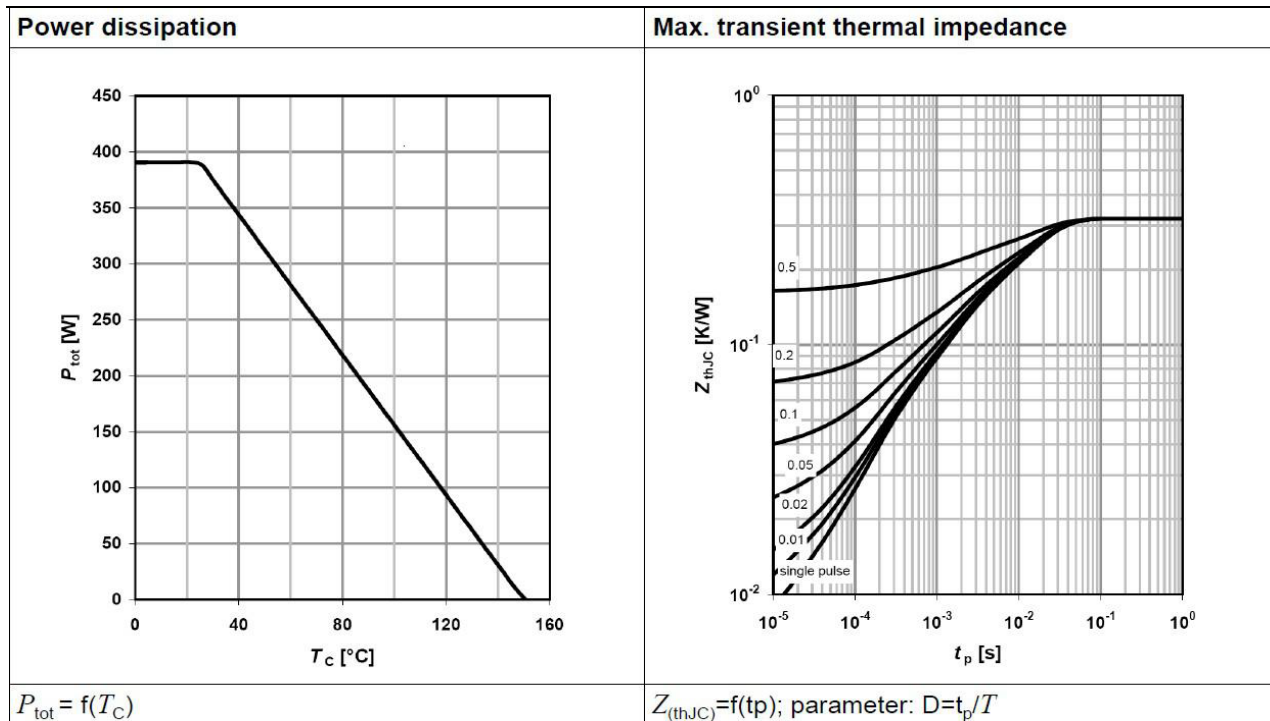


MS47N60MT

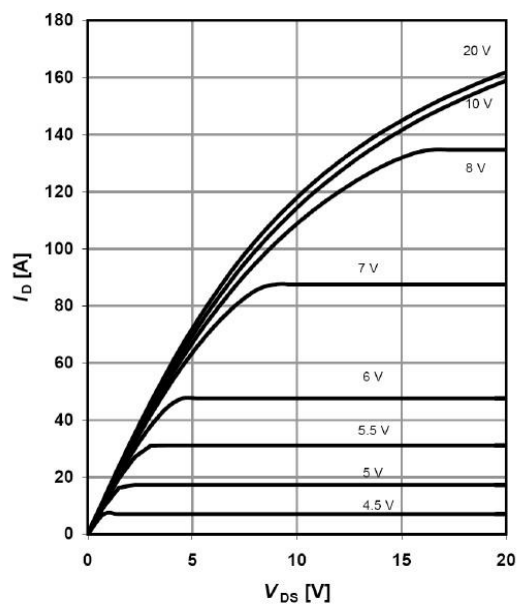
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA, T _J = 25°C	600	--	- -	V
		V _{GS} = 0V, I _D = 250μA, T _J = 150°C	--	650	- -	V
ΔBV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25°C	--	0.6	- -	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 600V, V _{GS} = 0V 25°C -T _J = 150°C		10	1 -	μA μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30V, V _{DS} = 0V	--	--	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30V, V _{DS} = 0V	--	--	-100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	3.5	--	5	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10V, I _D = 23A	--	65	75	mΩ
g _{FS}	Forward Transconductance	V _{DS} = 40V, I _D = 25A	--	30	-	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25V , V _{GS} = 0V, f = 1.0MHz	--	3100	-	pF
C _{oss}	Output Capacitance		--	148	-	pF
C _{rss}	Reverse Transfer Capacitance		--	5	-	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 480V, I _D = 23A R _G = 20Ω (Note 4)	--	19	-	ns
t _r	Turn-On Rise Time		--	10	-	ns
t _{d(off)}	Turn-Off Delay Time		--	87	-	ns
t _f	Turn-Off Fall Time		--	5	-	ns
Q _g	Total Gate Charge	V _{DS} = 480V, I _D = 23A V _{GS} = 10V (Note 4)	--	190	-	nC
Q _{gs}	Gate-Source Charge		--	30	-	nC
Q _{gd}	Gate-Drain Charge		--	95	-	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	47	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	140	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0V, I _S = 23A	--	0.9	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _S = 23A dI _F /dt =100A/μs	--	210	-	ns
Q _{rr}	Reverse Recovery Charge		--	19	-	μC

1) Co(er) is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V(BR)_{DSS}

2) Co(tr) is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V(BR)_{DSS}

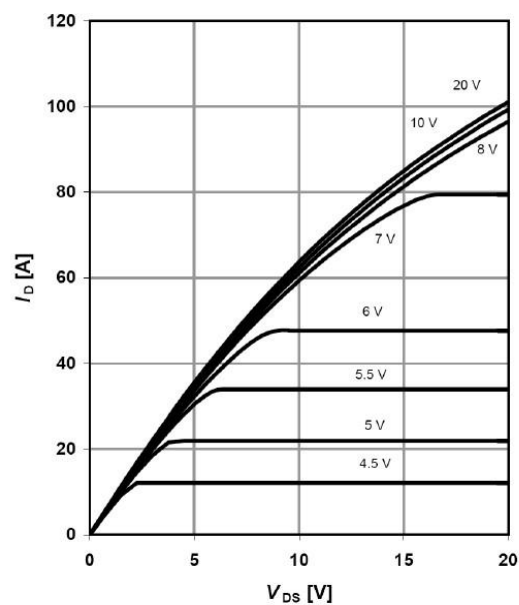


Typ. output characteristics $T_j=25\text{ }^{\circ}\text{C}$



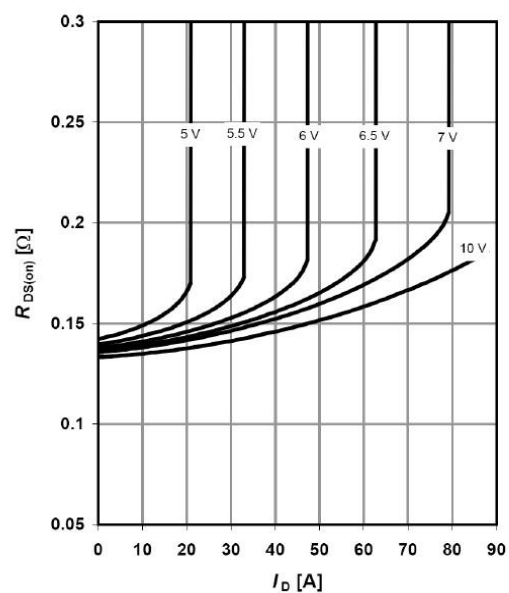
$$I_D = f(V_{DS}); T_j = 25\text{ }^{\circ}\text{C}; \text{parameter: } V_{GS}$$

Typ. output characteristics $T_j=125\text{ }^{\circ}\text{C}$



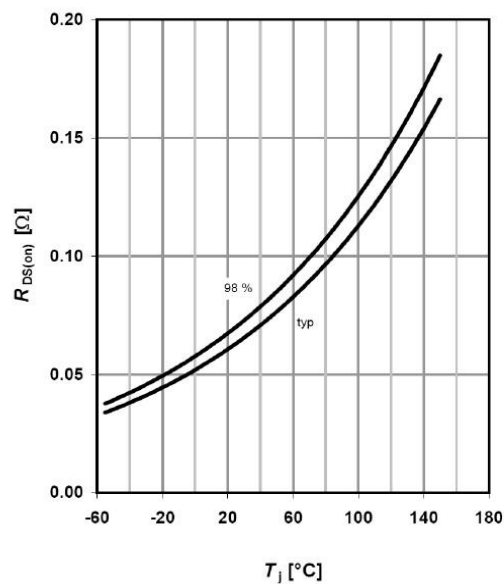
$$I_D = f(V_{DS}); T_j = 125\text{ }^{\circ}\text{C}; \text{parameter: } V_{GS}$$

Typ. drain-source on-state resistance



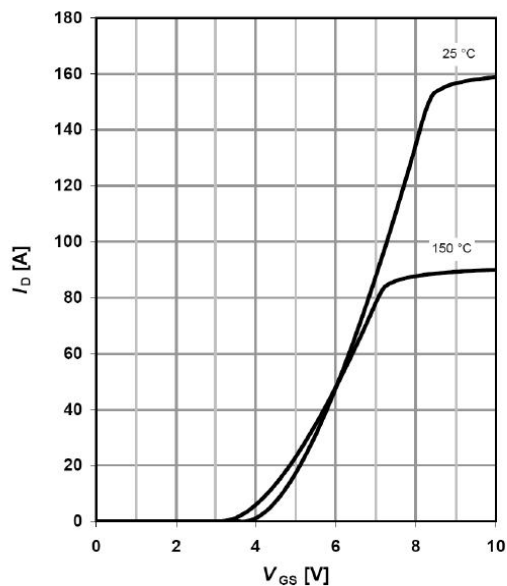
$$R_{DS(on)} = f(I_D); T_j = 125\text{ }^{\circ}\text{C}; \text{parameter: } V_{GS}$$

Drain-source on-state resistance



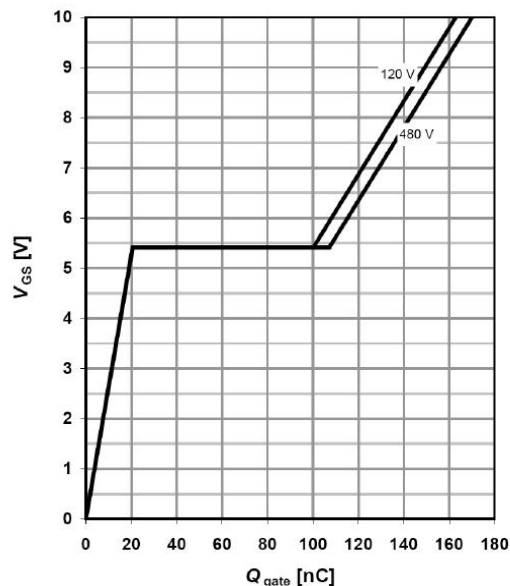
$$R_{DS(on)} = f(T_j); I_D = 17.6\text{ A}; V_{GS} = 10\text{ V}$$

Typ. transfer characteristics



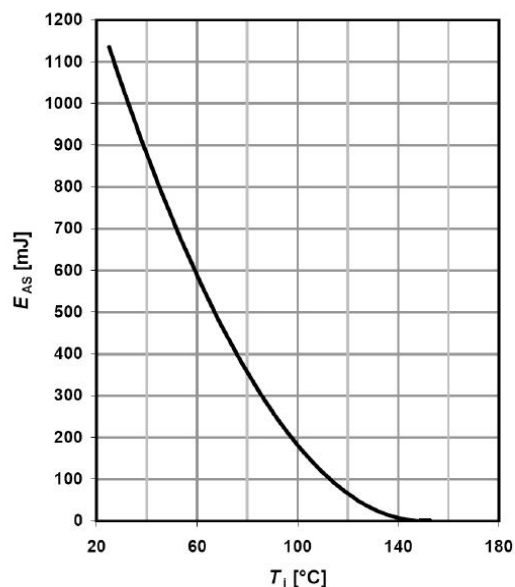
$$I_D = f(V_{GS}); V_{DS} = 20V$$

Typ. gate charge



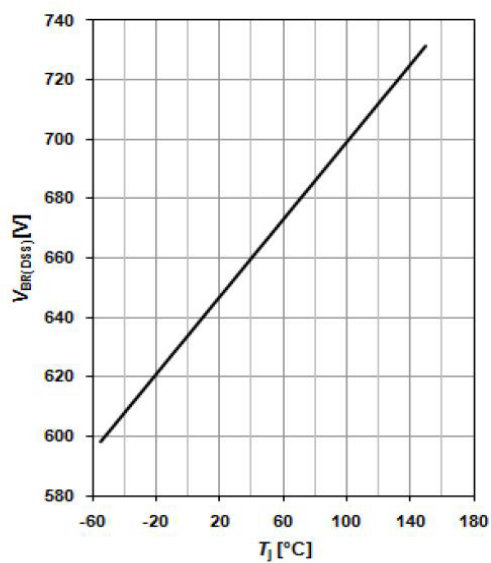
$$V_{GS} = f(Q_{gate}), I_D = 26.3 \text{ A pulsed}$$

Avalanche energy



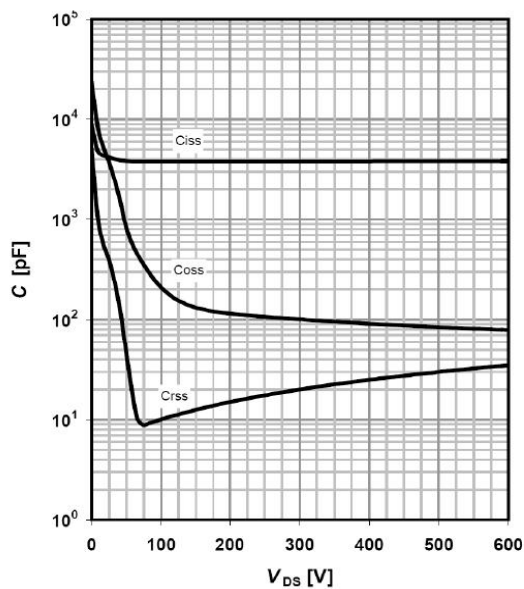
$$E_{AS} = f(T_j); I_D = 9.3 \text{ A}; V_{DD} = 50 \text{ V}$$

Drain-source breakdown voltage



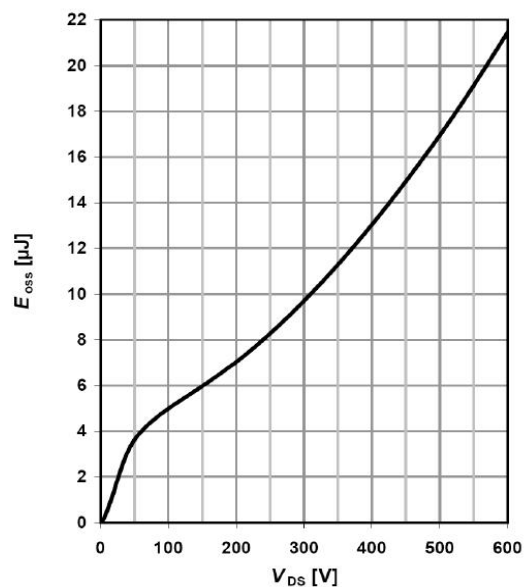
$$V_{BR(DSS)} = f(T_j); I_D = 1.0 \text{ mA}$$

Typ. capacitances



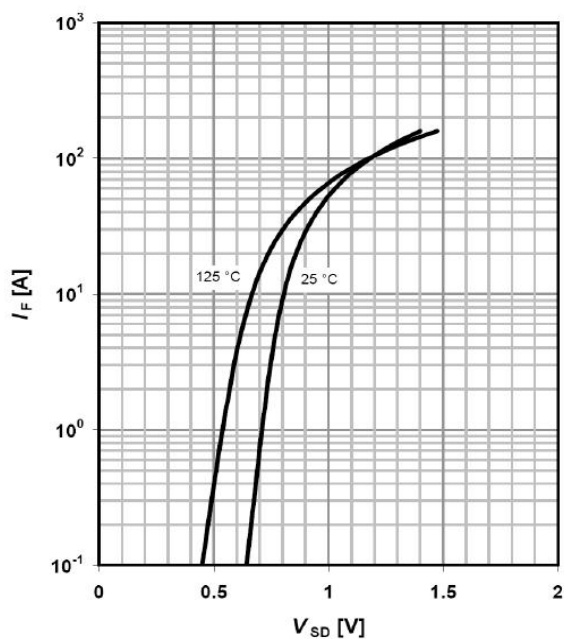
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$

Typ. C_{oss} stored energy



$E_{oss}=f(V_{DS})$

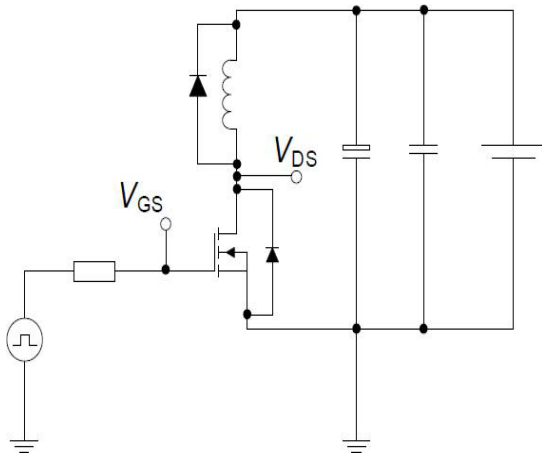
Forward characteristics of reverse diode



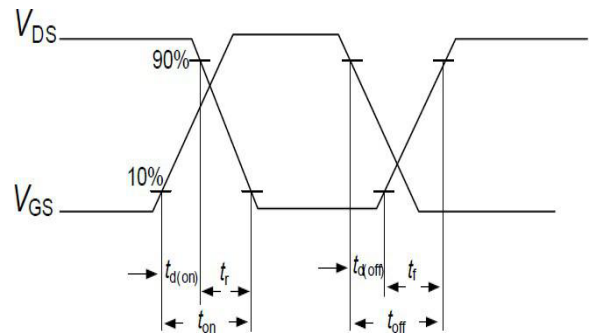
$I_F=f(V_{SD}); \text{parameter: } T_j$

Switching times test circuit and waveform for inductive load

Switching times test circuit for inductive load

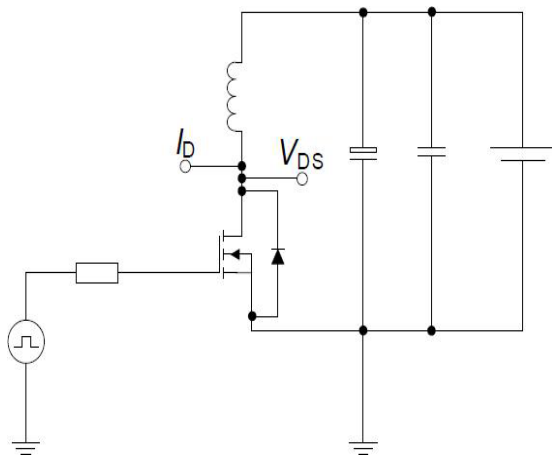


Switching time waveform

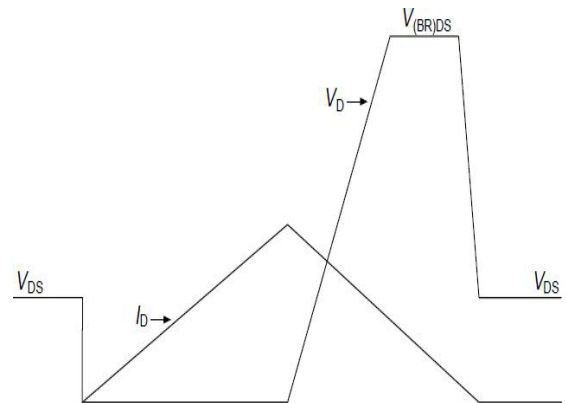


Unclamped inductive load test circuit and waveform

Unclamped inductive load test circuit



Unclamped inductive waveform



Test circuit and waveform for diode characteristics

