20N65F N-Channel mode Power MOSFET

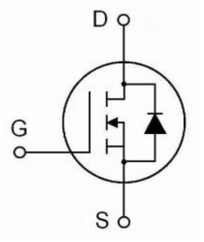
General Description

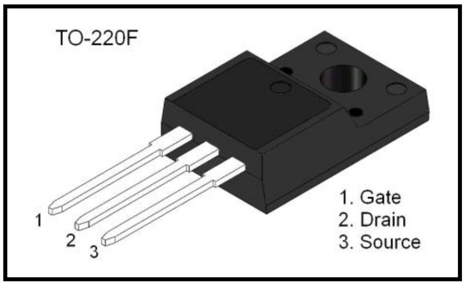
The 20N65F is a high voltage power MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristic. This power MOSFET is usually used in high speed switching applications including power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits

Features

● V_{DS}	650V
● I_D	20A
● $R_{DS(ON)}$ (V_{GS} = 10V)	< 0.19Ω

- ● Fast Switching Capability
- ● Avalanche Energy Specified
- ● Improved dv/dt Capability, High Ruggedness





Absolute Maximum Ratings (T$_A$ = 25℃)

Parameter		Symbol	Ratings	Units
Gate-drain voltage		V_{DSS}	650	V
Gate-source voltage		V_{GSS}	±30	V
Drain current	Continuous T_C=25 °C (Note 2)	I_D	20	A
	Pulsed (Note 3)	I_{DM}	80	
Avalanche energy	Single pulsed (Note 4)	E_{AS}	690	mJ
Avalanche current (Note 1)		I_{AR}	20	A
Peak diode recovery dv/dt (Note 5)		dv/dt	50	V/ns
Power dissipation		P_D	60	W
Junction temperature		T_J	150	°C
Storage temperature		T_{STG}	-55～155	°C

Note: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Drain current limited by maximum junction temperature.
3. Repetitive Rating: Pulse width limited by maximum junction temperature.
4. L = 5mH, I_{AS} = 20A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25 °C .
5. I_{SD} ≤ 20A, di/dt ≤ 200A/μs, V_{DD}= 480V , Starting T_J = 25 °C.

Thermal Characteristic

Parameter	Symbol	Value	Units
Maximum Thermal Resistance, Junction-case	$R_{\theta JC}$	3.6	°C/W
Maximum Thermal Resistance, Junction-Ambient	$R_{\theta JA}$	62.5	°C/W

Electrical Characteristics (T_j = 25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min.	Typ	Max.	Units
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} = 0V,I_D = 250μA	650			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}= 650V, V_{GS}= 0V			1	μA
		V_{DS}= 650V, T_j = 125°C			100	μA
Gate Leakage Current	I_{GSS}	V_{DS}=0V,V_{GS} = ±30V			±100	nA
On Characteristics						
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=250μA	2.5		4.5	V
Drain-source On-Resistance	$R_{DS(ON)}$	V_{GS} = 10V,I_D = 10A			0.19	Ω
Forward Transconductance	g_{FS}	V_{DS} = 20V,I_D =10A		17.5		S
Dynamic Characteristics						
Input Capacitance	Ciss	V_{DS} = 100V,V_{GS} = 0V, f = 1MHz		2200		pF
Output Capacitance	Coss			95		
Reverse Transfer Capacitance	Crss			7		
Switching Characteristics)						
Turn-On Delay Time	$t_{d(on)}$	V_{DS} = 380V, I_D = 20A R_G = 3.6Ω, V_{GS} = 0V (Note 6, 7)		10		ns
Turn-on Rise Time	t_r			5		
Turn-Off elay Time	$t_{d(off)}$			67		
Turn-Off Fall	t_f			4		
Total Gate Charge	Q_g	V_{DS} = 480V, I_D = 20A V_{GS} = 10V (Note 6,7)		85		nC
Gate-Source Charge	Q_{gs}			11		
Gate-Drain Charge	Q_{gd}			33		
Drain-Source Diode Characteristics						
Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_S =20A			1.3	V
Diode Forward Current	I_{SD}				20	A
Pulsed Diode Forward Current	I_{SM}				60	A
Reverse Recovery Time	t_{rr}	I_S = 20A, V_{GS} = 0V dI_F/dt =100A/μs		500		ns
Reverse Recovery Charge	Q_{rr}			44		μC

Note 6. Pulse Test: Pulse Width ≤ 300μs,Duty Cycle ≤ 2%

7. Essentially independent of operating temperature

Typical Characteristics

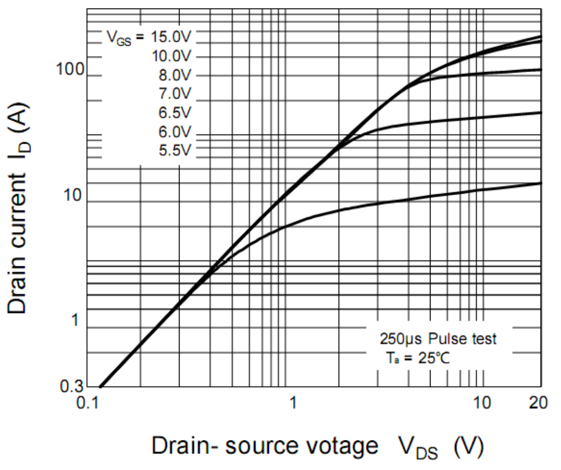


Figure 1 Output Characteristics

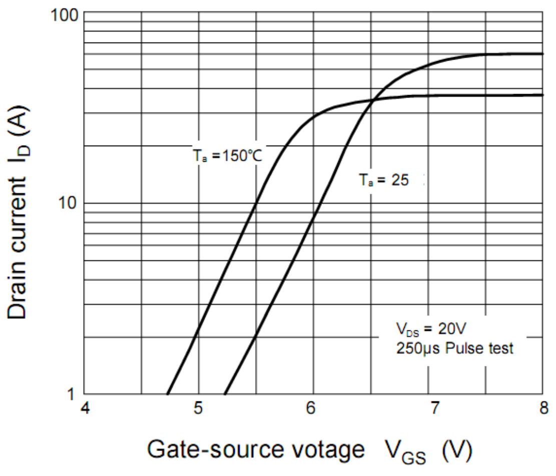


Figure 2. Transfer Characteristics

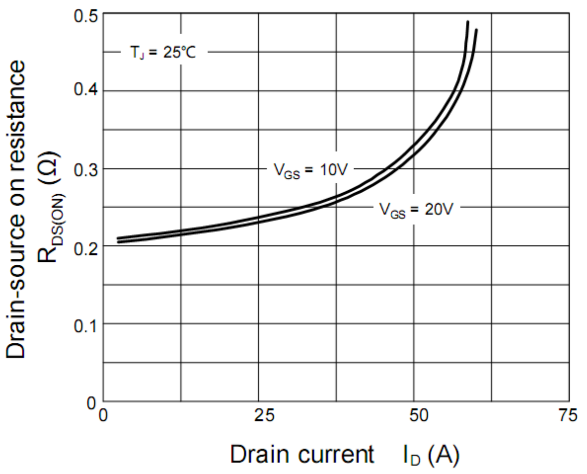


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

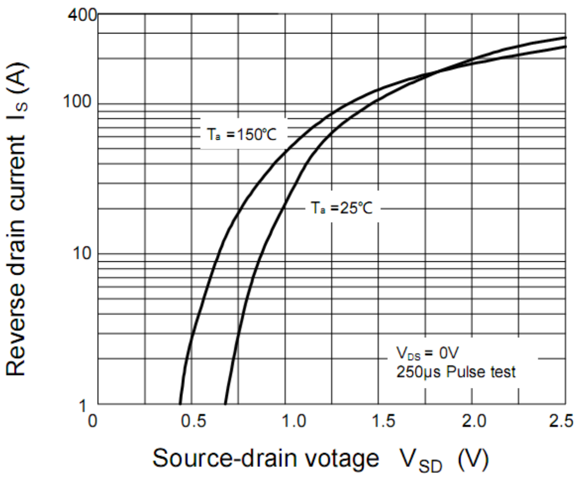


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

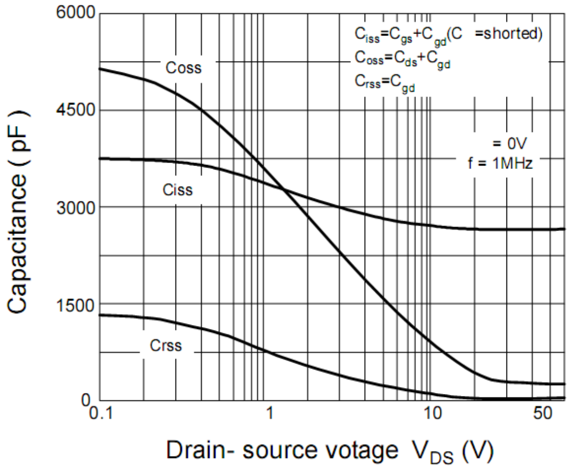


Figure 5. Capacitance Characteristics

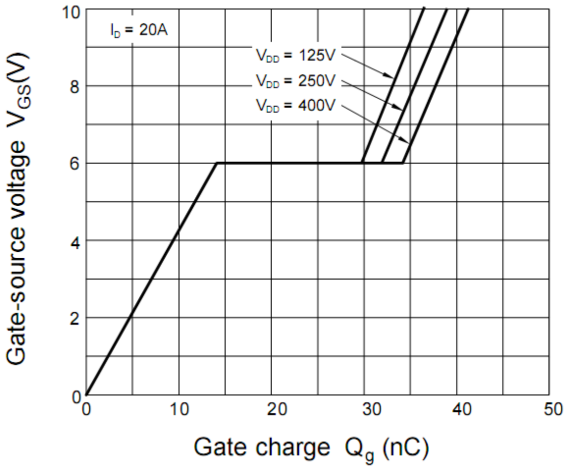


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

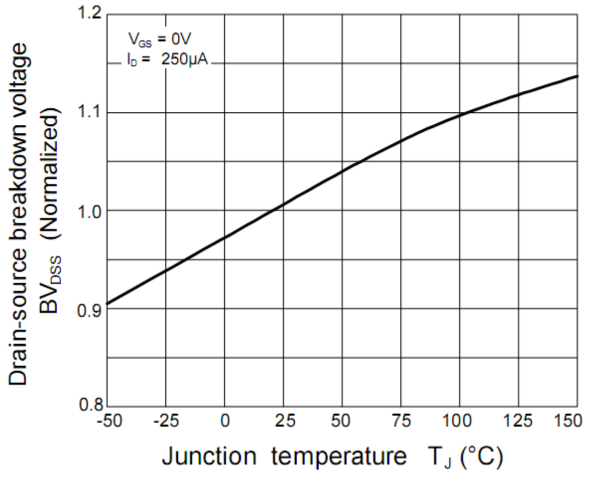


Figure 7. Breakdown Voltage Variation vs Temperature

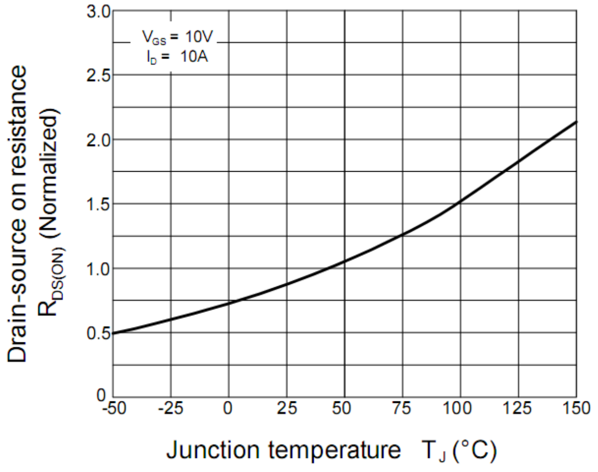


Figure 8. On-Resistance Variation vs Temperature

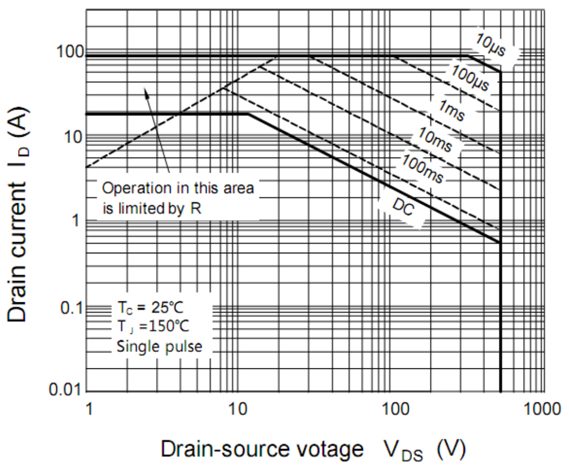


Figure 9. Safe Operating Area

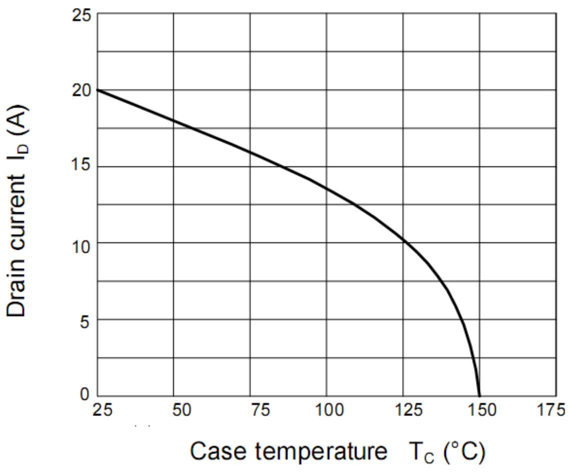


Figure 10. Maximum Drain Current vs Case Temperature

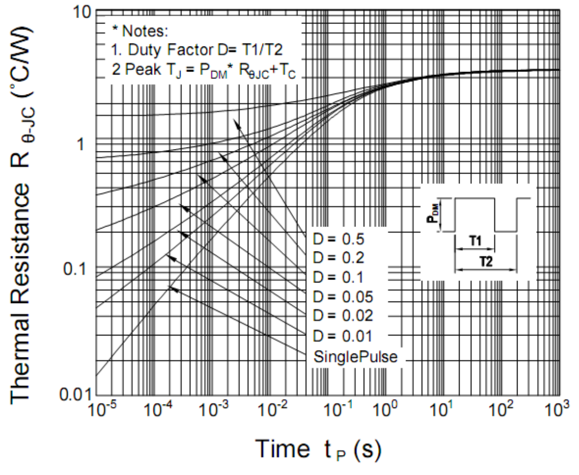


Figure 11. Transient Thermal Response Curve

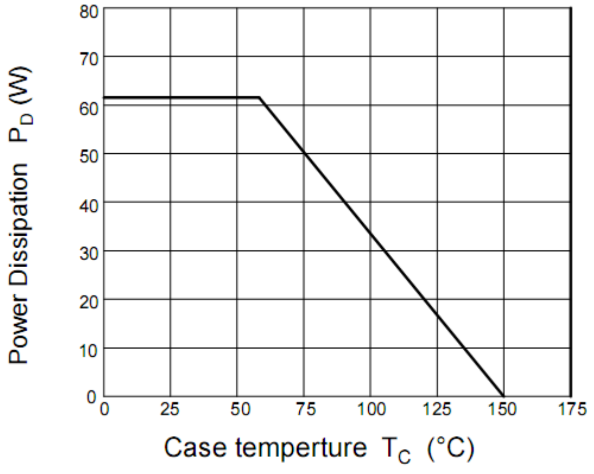


Figure 12. Power Derating

Test Circuits and Waveforms

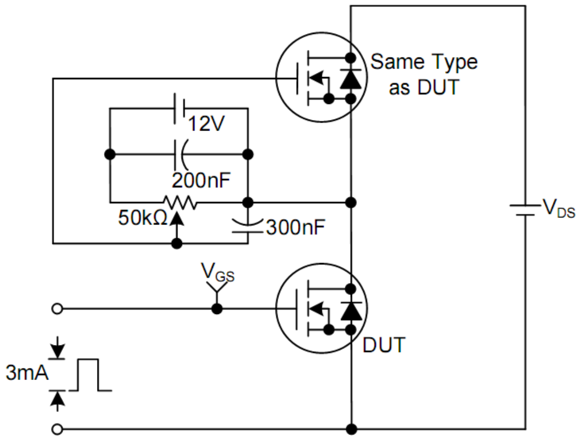


Figure 13. Gate Charge Test Circuit

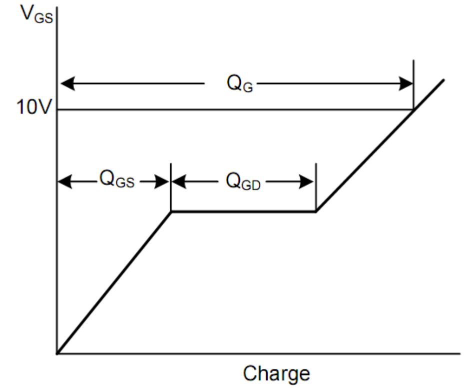


Figure 14. Gate Charge Waveforms

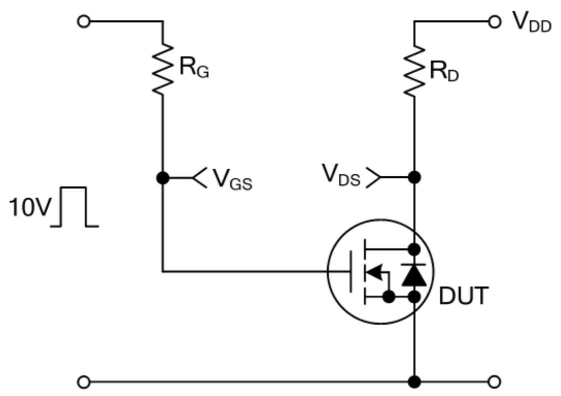


Figure15. Resistive Switching Circuit

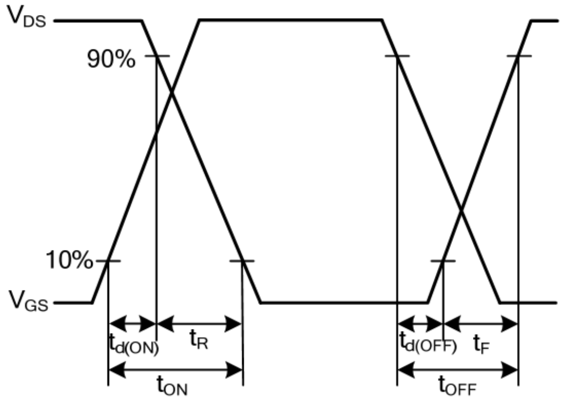


Figure 16. Resistive Switching Waveforms

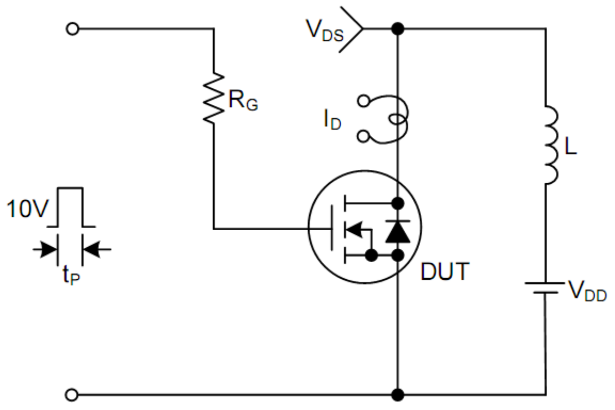


Figure 17. Unclamped Inductive Switching Test Circuit

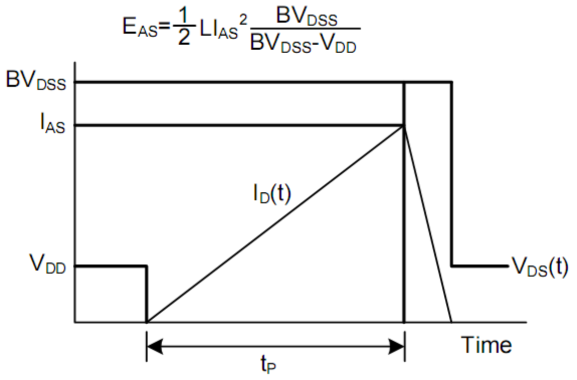


Figure 18. Unclamped Inductive Switching Waveforms

Test Circuits and Waveforms (Continued)

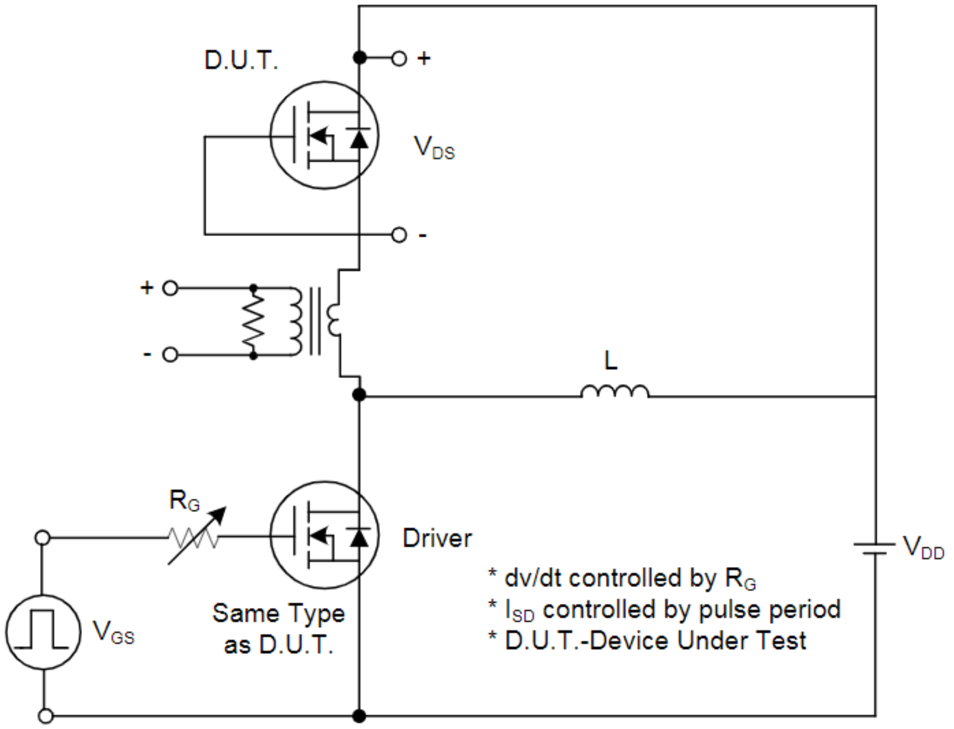


Figure 19. Peak Diode Recovery dv/dt Test Circuit

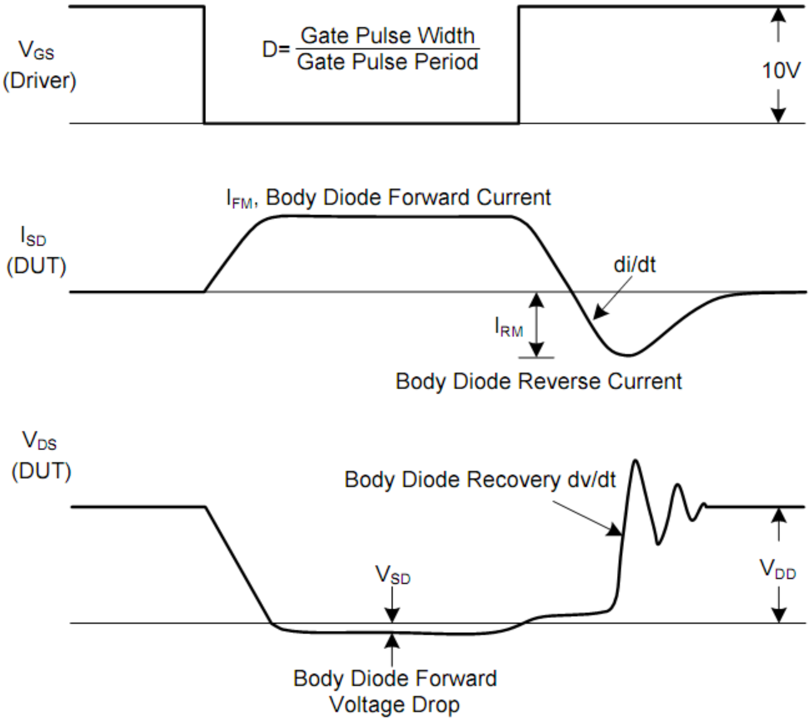
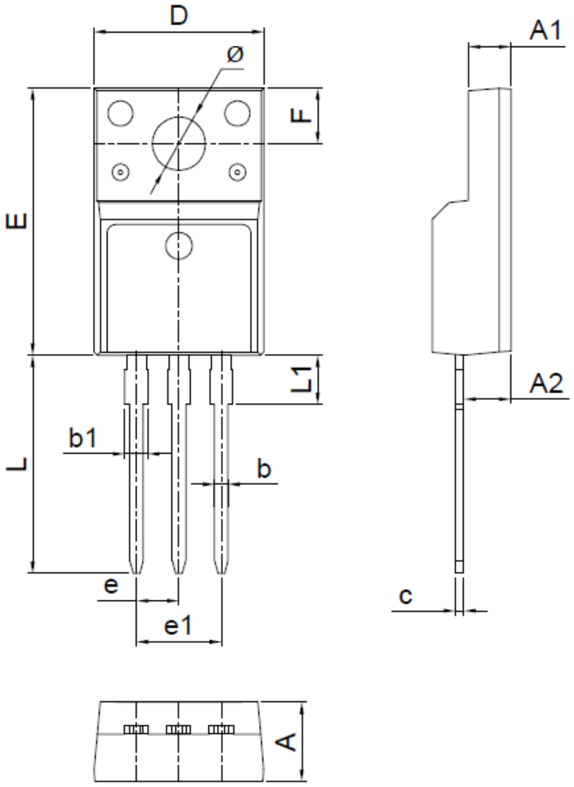


Figure 20. Peak Diode Recovery dv/dt Waveforms

Package Dimensions



Dim	Millimeter		Inches	
	Min.	**Max.**	**Min.**	**Max.**
A	4.50	4.90	0.177	0.193
A1	2.34	2.74	0.092	0.108
A2	2.66	2.86	0.105	0.113
b	0.75	0.85	0.030	0.033
b1	1.24	1.44	0.049	0.057
c	0.40	0.60	0.016	0.024
D	10.00	10.32	0.394	0.406
E	15.75	16.05	0.620	0.632
e	2.44	2.64	0.096	0.104
e1	4.88	5.28	0.192	0.208
F	3.10	3.5	0.122	0.138
L	12.90	13.50	0.508	0.531
L1	2.90	3.30	0.114	0.130
Φ	3.10	3.30	0.122	0.130