

Features

- High Blocking Voltage with Low On- Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Avalanche Ruggedness
- Halogen Free, RoHS Compliant

Applications

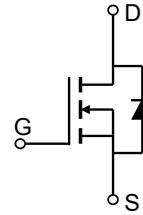
- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC Converters
- Battery Chargers

Product Summary

Parameters	Value	Unit
V_{DS}	850	V
$V_{GS(th_Typ)}$	3.6	V
$I_D(@V_{GS}=15V)$	20	A
$R_{DS(ON_Max)}(@V_{GS}=18V)$	160	mΩ
$R_{DS(ON_Typ)}(@V_{GS}=15V)$	180	mΩ



TO-220F



Schematic Diagram

Ordering Information

Device	Marking	MSL	Form	Package	Reel Size	Reel(pcs)	Per Carton (pcs)
HMM20TN80F		3	Tape&Reel	TO-220F	13"	2500	25000

Absolute Maximum Ratings (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit
V_{DS}	Drain-to-Source Voltage	850	V
V_{GS}	Gate-to-Source Voltage	0/15	V
I_D	Continuous Drain Current	$T_C = 25^\circ\text{C}$ 20 $T_C = 175^\circ\text{C}$ 12	A
I_{DM}	Pulsed Drain Current ⁽¹⁾	Refer to Fig.4	A
E_{AS}	Single Pulsed Avalanche Energy ⁽²⁾	220	mJ
P_D	Power Dissipation	$T_C = 25^\circ\text{C}$ 123 $T_C = 175^\circ\text{C}$ 91	W
T_J, T_{STG}	Junction & Storage Temperature Range	-55 to 175	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Typ.	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient ⁽³⁾	36	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	2.1	

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
V _{(BR)DSS}	Drain-Source Breakdown Voltage	I _D = 250μA, V _{GS} = 0V	850	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 850V, V _{GS} = 0V	-	-	1.0	μA
I _{GSS}	Gate-Body Leakage Current	V _{DS} = 0V, V _{GS} = ±15V	-	-	±100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	2.4	3.2	4.5	V
R _{DS(ON)}	Static Drain-Source ON-Resistance ⁽⁴⁾	V _{GS} = 15V, I _D = 10A	-	180	230	mΩ
		V _{GS} = 18V, I _D = 10A	-	160	200	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{GS} = 0V, V _{DS} = 400V, f = 1MHz	-	1400	-	pF
C _{oss}	Output Capacitance		-	120	-	pF
C _{rss}	Reverse Transfer Capacitance		-	21	-	pF
Q _g	Total Gate Charge	V _{GS} = 0 to 10V V _{DS} = 15V, I _D = 20A	-	12	-	nC
Q _{gs}	Gate Source Charge		-	8	-	nC
Q _{gd}	Gate Drain("Miller") Charge		-	5.8	-	nC
Switching Characteristics						
t _{d(on)}	Turn-On DelayTime	V _{GS} = 10V, V _{DD} = 400V I _D = 20A, R _{GEN} = 3Ω	-	162	-	ns
t _r	Turn-On Rise Time		-	60	-	ns
t _{d(off)}	Turn-Off DelayTime		-	252	-	ns
t _f	Turn-Off Fall Time		-	37	-	ns
Drain-Source Diode Characteristics						
I _S	Maximum Continuous Drain to Source Diode Forward Current		-	-	20	A
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	160	A
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} = 0V, I _S =20A	-	-	3.8	V
trr	Body Diode Reverse Recovery Time	I _F = 20A, di/dt = 100A/us	-	11	-	ns
Qrr	Body Diode Reverse Recovery Charge		-	2.3	-	nC

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
 2. E_{AS} condition: Starting $T_J = 25^\circ\text{C}$, $V_{DD} = 50\text{V}$, $V_G = 10\text{V}$, $R_G = 25\text{ohm}$, $L = 0.5\text{mH}$, $I_{AS} = 25\text{A}$
 3. $R_{\theta JA}$ is measured with the device mounted on a 1inch^2 pad of 2oz copper FR4 PCB
 4. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 0.5\%$.

Typical Performance Characteristics

Figure 1: Maximum Power Dissipation Derating vs. Case Temperature

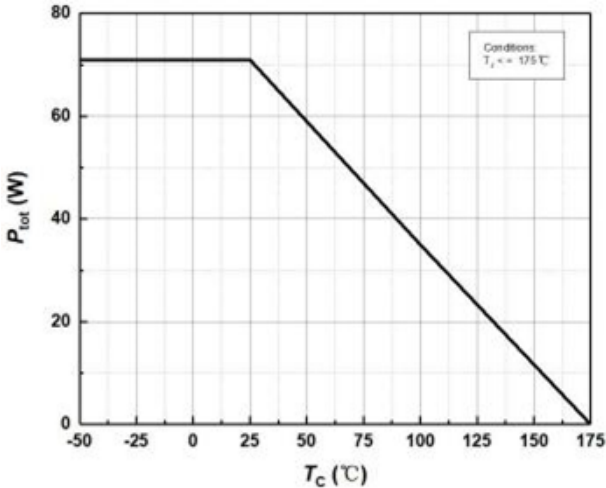


Figure 2: Continuous Drain Current Derating vs Case Temperature

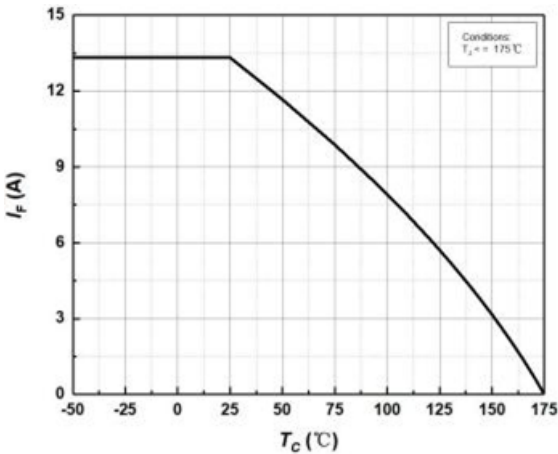


Figure 3: Normalized Maximum Transient Thermal Impedance

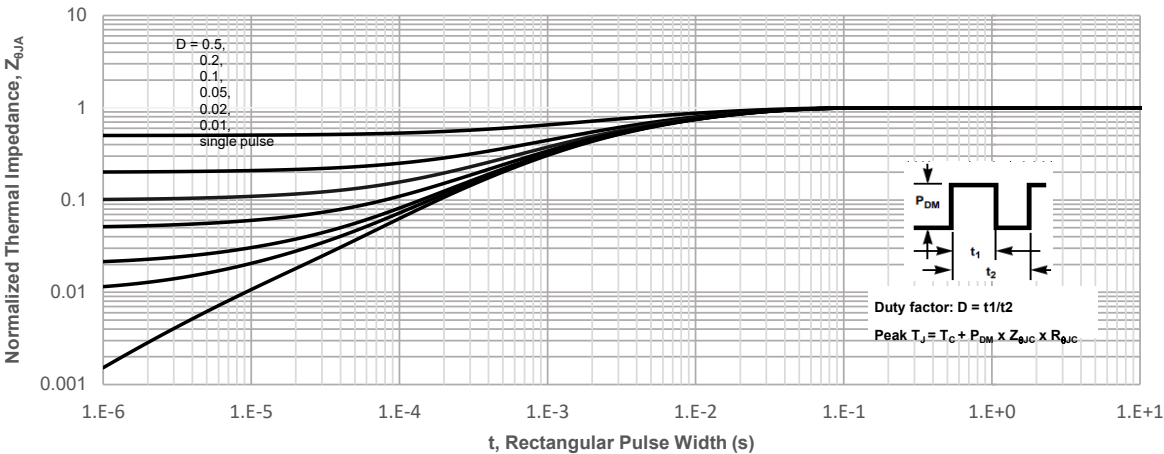
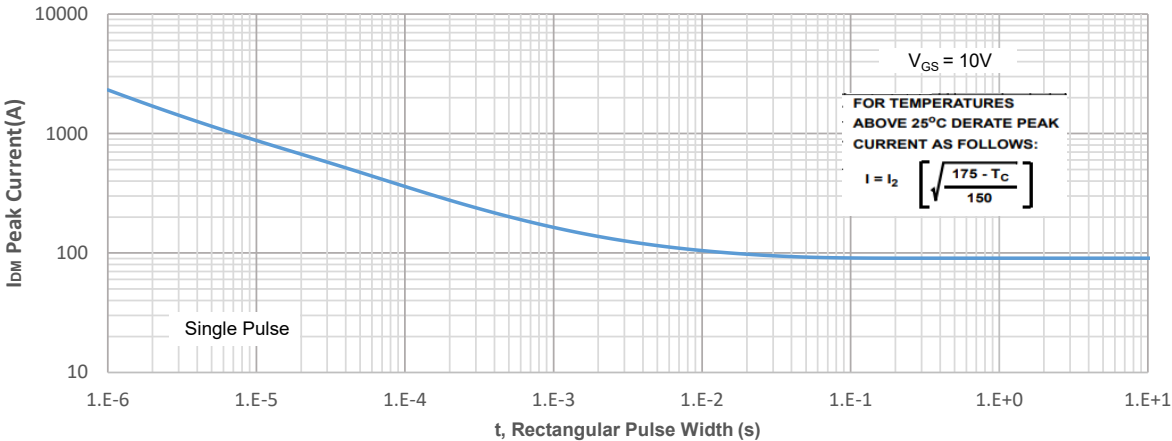


Figure 4: Peak Current Capacity



Typical Performance Characteristics

Figure 5: Output Characteristics

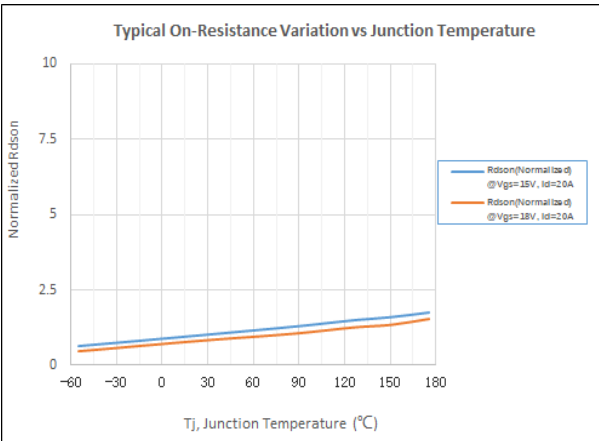
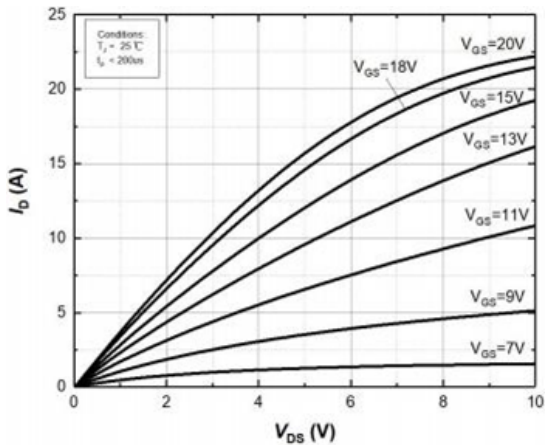


Figure 7: Body Diode Characteristics at $T_J=25^\circ\text{C}$

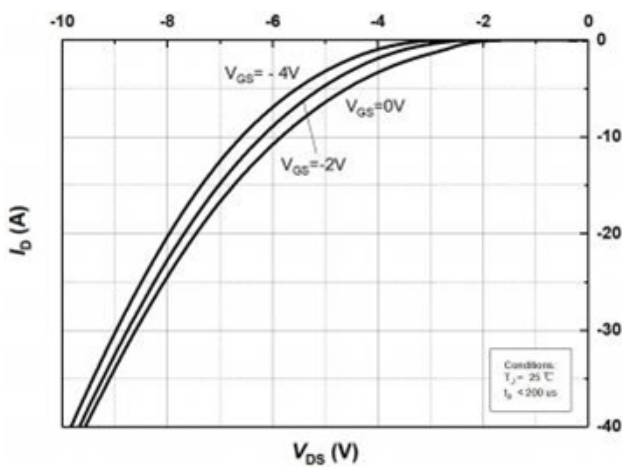


Figure 8: Body Diode Characteristics at $T_J=175^\circ\text{C}$

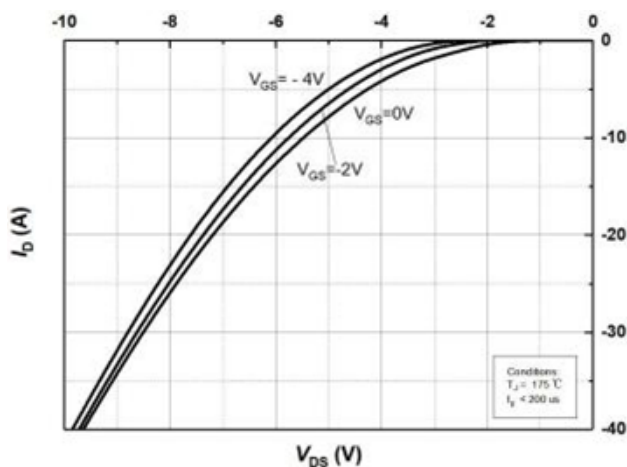


Figure 9: Gate Charge Characteristics

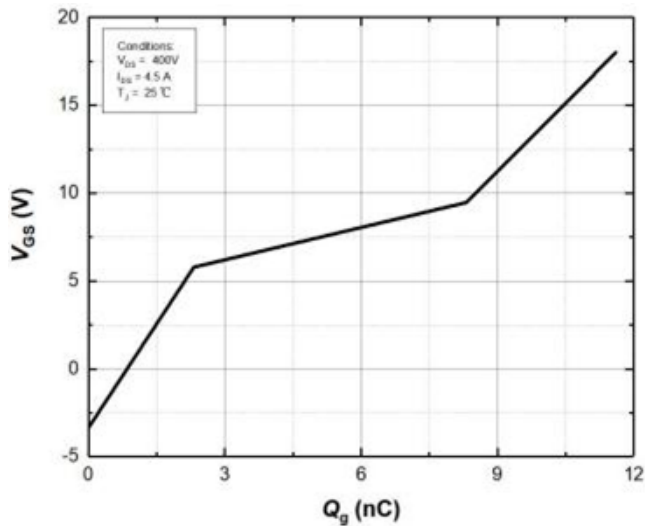
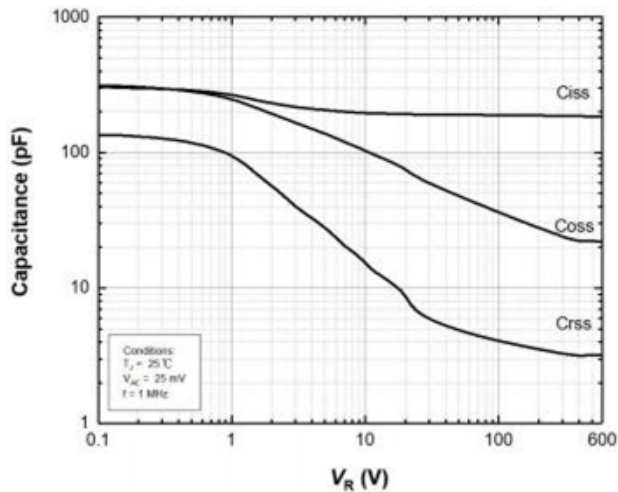


Figure 10: Capacitance Characteristics



Typical Performance Characteristics

Figure 11: Normalized On-Resistance vs. Temperature

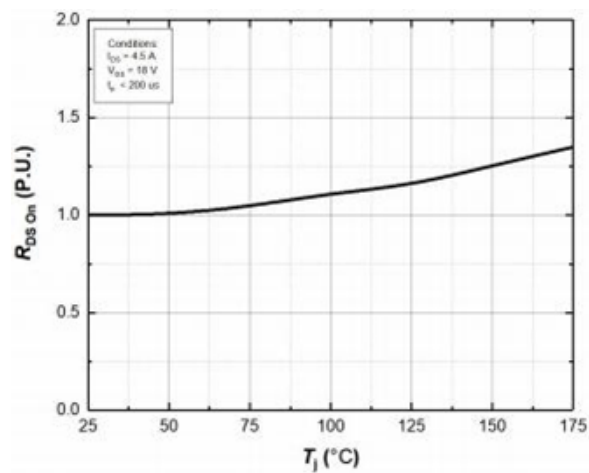


Figure 12: On-Resistance vs. Drain current for Various Temperature

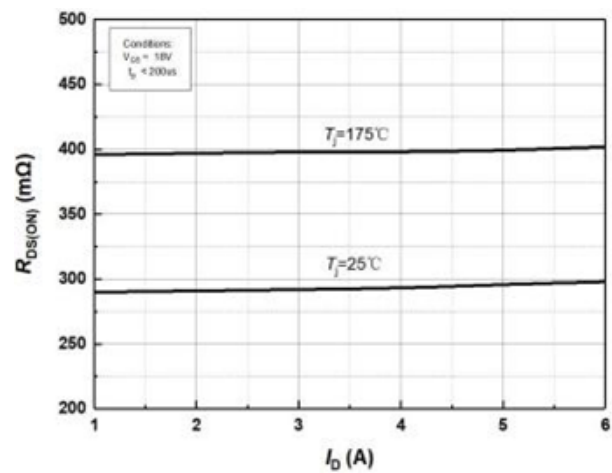
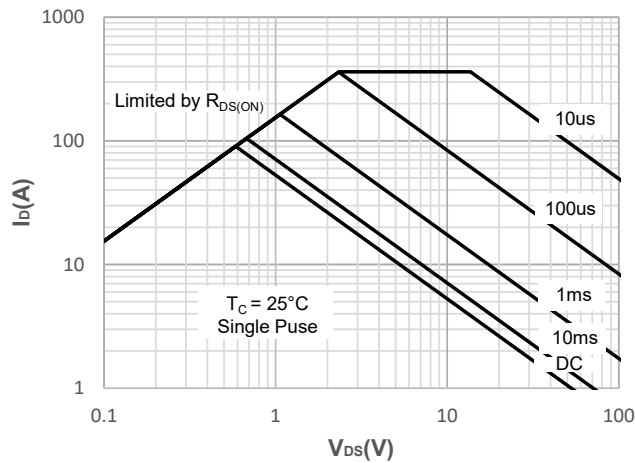


Figure 14: Maximum Safe Operating Area



Test Circuit

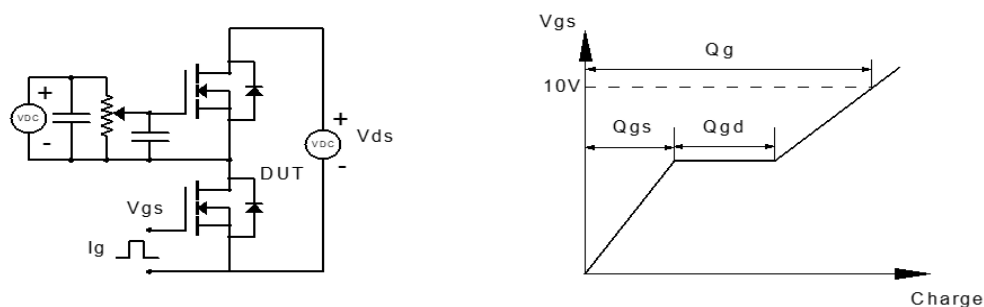


Figure 1: Gate Charge Test Circuit & Waveform

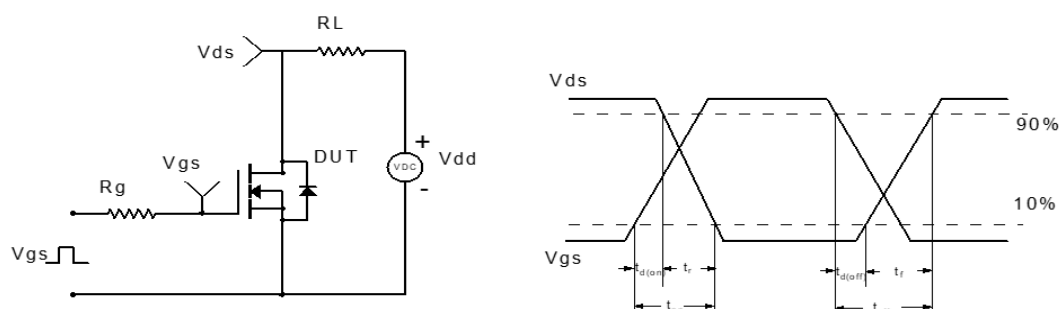


Figure 2: Resistive Switching Test Circuit & Waveform

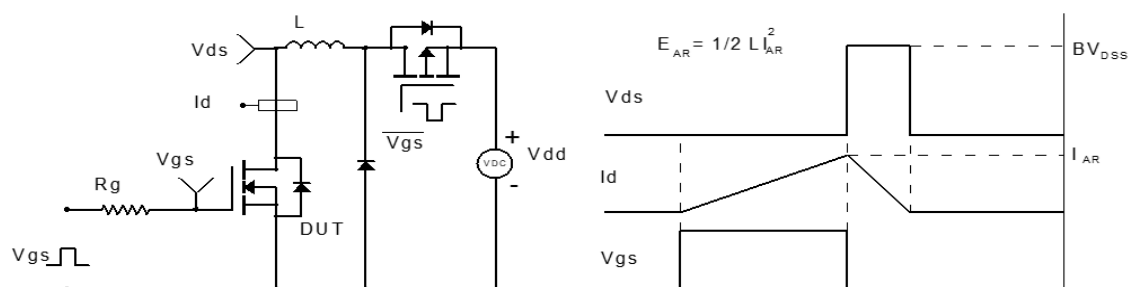


Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

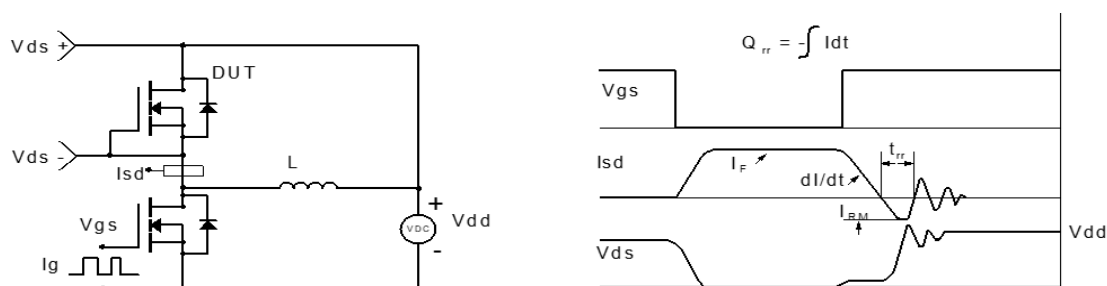


Figure 4: Diode Recovery Test Circuit & Waveform

Test Circuit

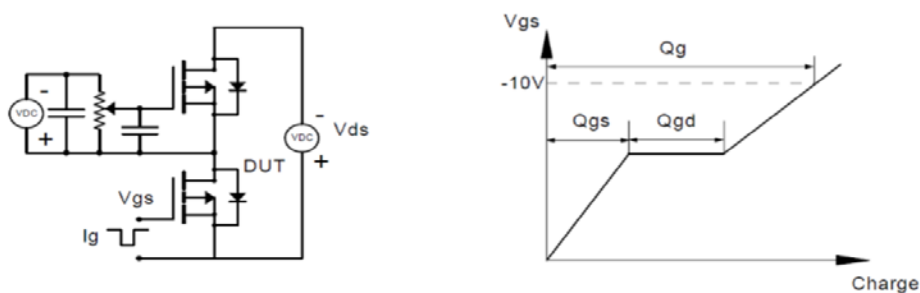


Figure 1: Gate Charge Test Circuit & Waveform

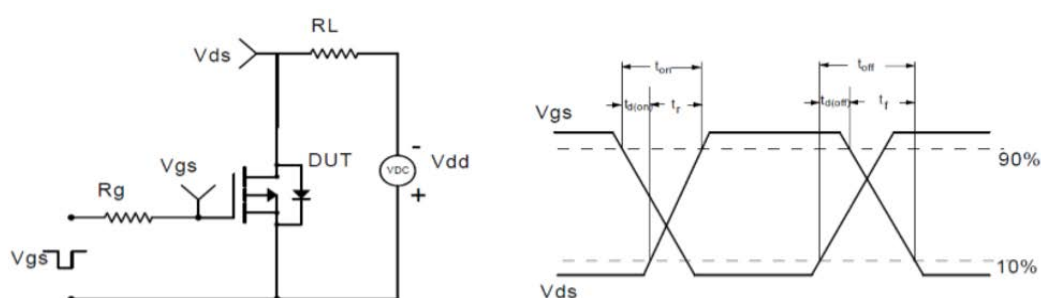


Figure 2: Resistive Switching Test Circuit & Waveform

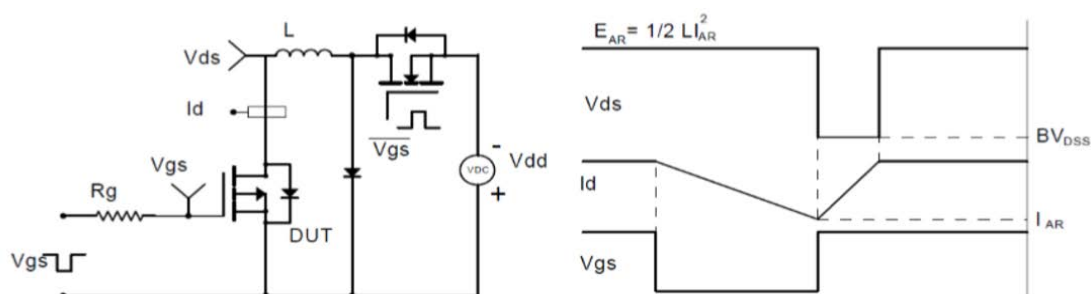


Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

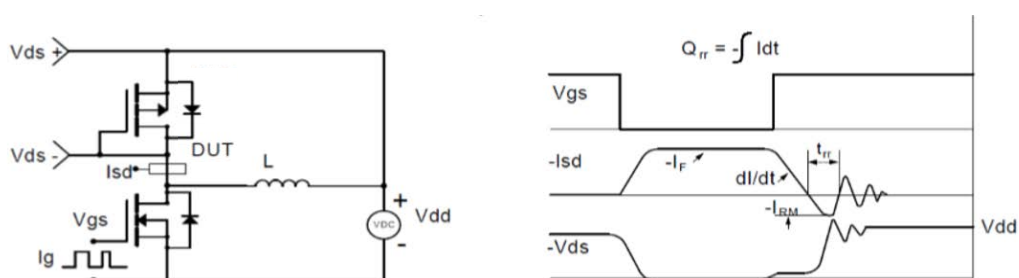
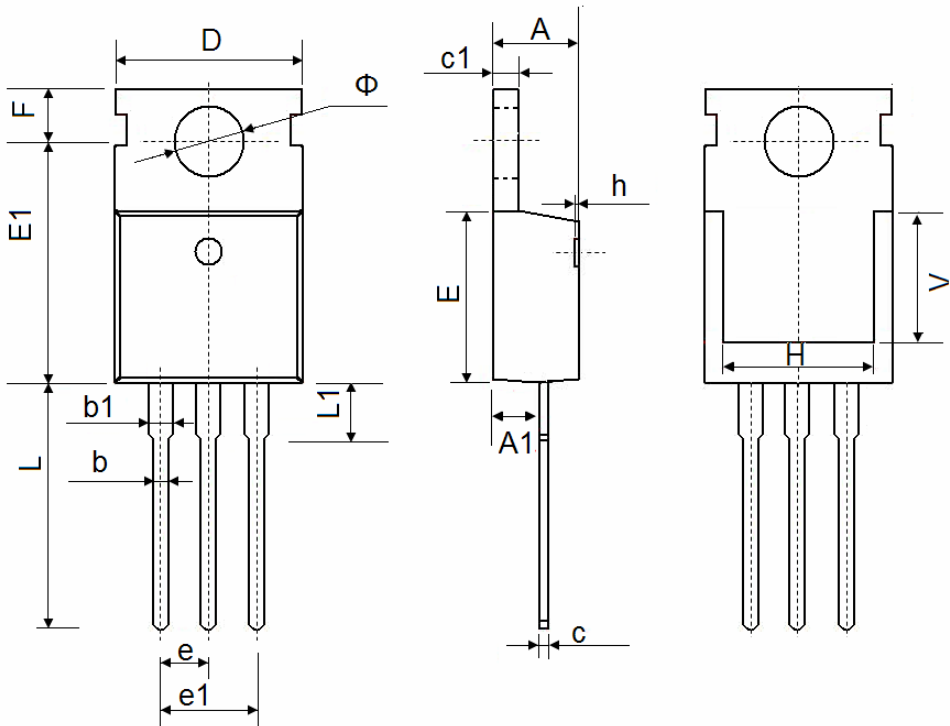


Figure 4: Diode Recovery Test Circuit & Waveform

TO-220-3L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.9500	9.750	0.352	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.900	13.400	0.508	0.528
L1	2.850	3.250	0.112	0.128
V	6.900 REF.		0.276 REF.	
Φ	3.400	3.800	0.134	0.150