

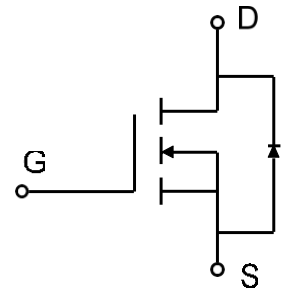
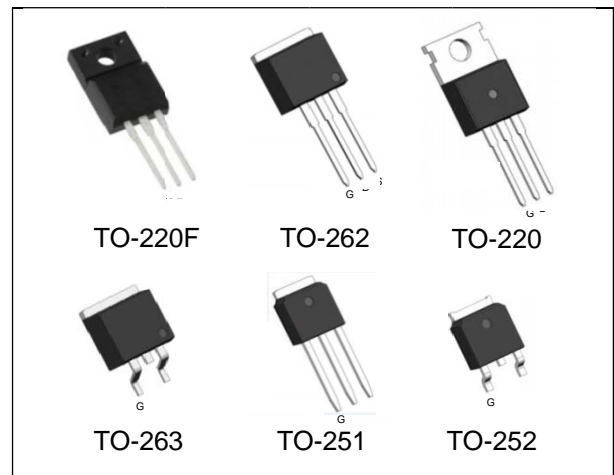
650V 0.35Ω Super Junction Power MOSFET

Description

WMOS™ EM is Wayon's 3rd generation super junction MOSFET family that is utilizing charge balance technology for extremely low on-resistance and low gate charge performance. WMOS™ EM is suitable for applications which require superior power density and outstanding efficiency.

Features

- $V_{DS}=700V @ T_{j,max}$
- Typ. $R_{DS(on)}=0.35\Omega$
- 100% UIS tested
- Pb-free plating, Halogen free



Applications

LED Lighting, Charger, Adapter, PC, LCD TV, Server

Absolute Maximum Ratings

Parameter	Symbol	WMK/WMM/WMO/WMP/WMN	WML	Unit
Drain-source voltage	V_{DSS}	650		V
Continuous drain current ¹⁾ ($T_C = 25^\circ C$)	I_D	11		A
		6.5		A
Pulsed drain current ²⁾	I_{DM}	35		A
Gate-source voltage	V_{GS}	± 30		V
Avalanche energy, single pulse ³⁾	E_{AS}	145		mJ
Avalanche energy, repetitive ²⁾	E_{AR}	0.21		mJ
Avalanche current, repetitive ²⁾	I_{AR}	2		A
Power dissipation ($T_C = 25^\circ C$) - Derate above $25^\circ C$	P_D	85	31	W
		0.68	0.25	W/ $^\circ C$
Operating and storage temperature range	T_j, T_{stg}	-55 to +150		$^\circ C$
Continuous diode forward current	I_S	11		A
Diode pulse current	$I_{S,pulse}$	35		A
MOSFET dv/dt ruggedness	dv/dt	50		V/ns
Peak diode recovery voltage slope	dv/dt	15		V/ns



WML13N65EM

Thermal Characteristics

Parameter	Symbol	WMK/WMM/WMO/WMP/WMN	WML	Unit
Thermal resistance, junction-to-case	$R_{\theta JC}$	1.47	4	$^{\circ}\text{C/W}$
Thermal resistance, junction-to-ambient	$R_{\theta A}$	62	80	$^{\circ}\text{C/W}$

Electrical Characteristics $T_c = 25^{\circ}\text{C}$, unless otherwise noted

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static characteristics						
Drain-source breakdown voltage	BV_{DSS}	$V_{GS}=0\text{ V}, I_D=0.25\text{ mA}$	650	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=0.25\text{ mA}$	2	3	4	V
Drain cut-off current	I_{DSS}	$V_{DS}=650\text{ V}, V_{GS}=0\text{ V},$ $T_j = 25^{\circ}\text{C}$ $T_j = 125^{\circ}\text{C}$	- -	- 50	1 -	μA
Gate leakage current, forward	I_{GSSF}	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	-	100	nA
Gate leakage current, reverse	I_{GSSR}	$V_{GS}=-20\text{ V}, V_{DS}=0\text{ V}$	-	-	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=2\text{ A}$	--	0.35	0.39	Ω
Dynamic characteristics						
Input capacitance	C_{iss}	$V_{DS}=100\text{ V}, V_{GS}=0\text{ V},$ $f = 1\text{ MHz}$	-	710	-	pF
Output capacitance	C_{oss}		-	25	-	
Reverse transfer capacitance	C_{rss}		-	2	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=300\text{ V}, I_D=5\text{ A}$ $R_G=25\Omega, V_{GS}=10\text{ V}$	-	20	-	ns
Rise time	t_r		-	16	-	
Turn-off delay time	$t_{d(off)}$		-	61	-	
Fall time	t_f		-	17	-	
Gate charge characteristics						
Gate to source charge	Q_{gs}	$V_{DD}=480\text{ V}, I_D=5\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	3.4	-	nC
Gate to drain charge	Q_{gd}		-	10.1	-	
Gate charge total	Q_g		-	20.3	-	
Gate plateau voltage	$V_{plateau}$		-	4.7	-	V
Reverse diode characteristics						
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=2\text{ A}$	-	-	1.2	V
Reverse recovery time	t_{rr}	$V_R=50\text{ V}, I_F=5\text{ A},$ $dI_F/dt=100\text{ A}/\mu\text{s}$	-	213	-	ns
Reverse recovery charge	Q_{rr}		-	2.1	-	μC
Peak reverse recovery current	I_{rrm}		-	20	-	A

Notes:

- Limited by $T_{j\text{max}}$. Maximum duty cycle $D=0.5$.
- Repetitive rating: pulse width limited by maximum junction temperature.
- $I_{AS}=2\text{ A}, V_{DD}=50\text{ V}, R_G=25\Omega$, starting $T_j=25^{\circ}\text{C}$.



WML13N65EM

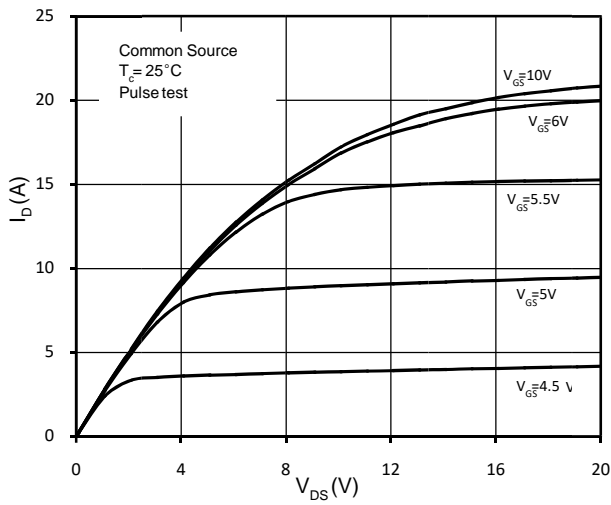


Figure 1. On-Region Characteristics

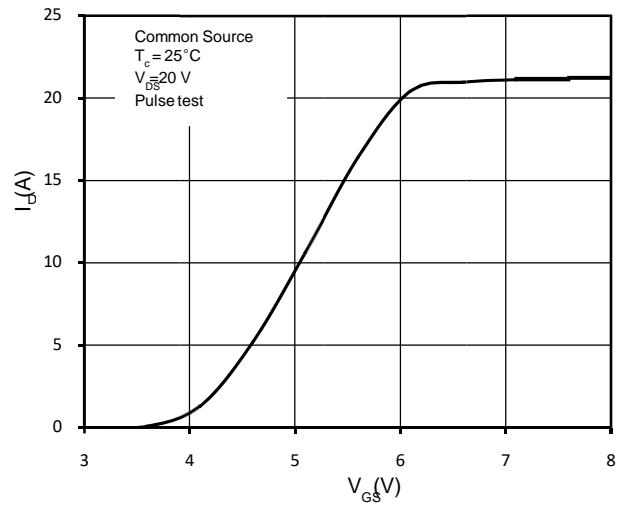


Figure 2. Transfer Characteristics

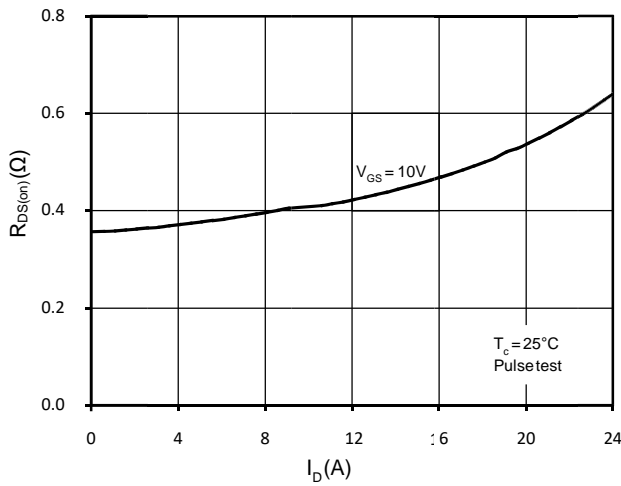


Figure 3. Static Drain-Source On Resistance

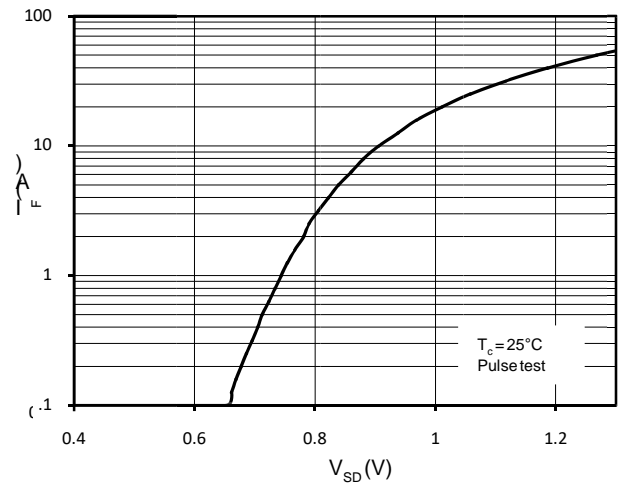


Figure 4. Body-Diode Forward Characteristics

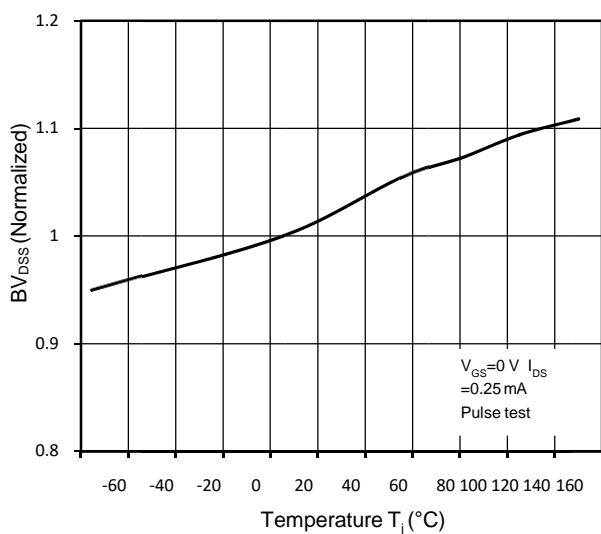


Figure 5. Normalized BV_{DS} vs. Temperature

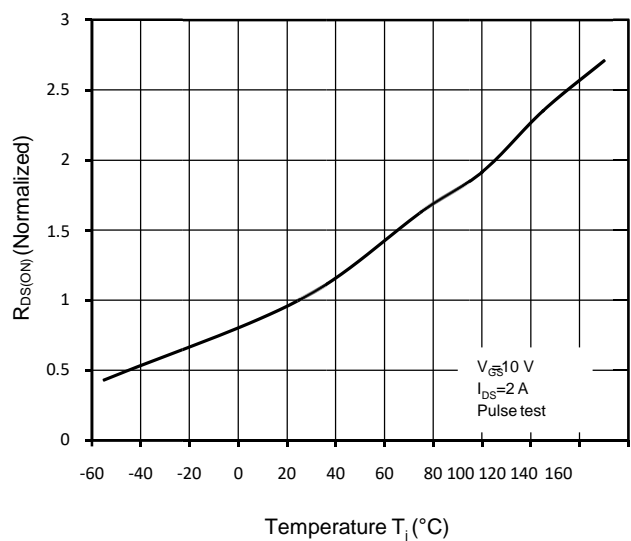


Figure 6. Normalized $R_{DS(on)}$ vs. Temperature

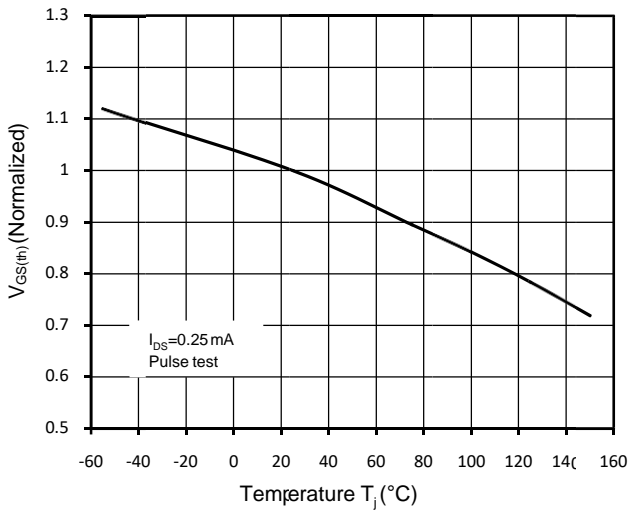


Figure 7. Threshold Voltage vs. Temperature

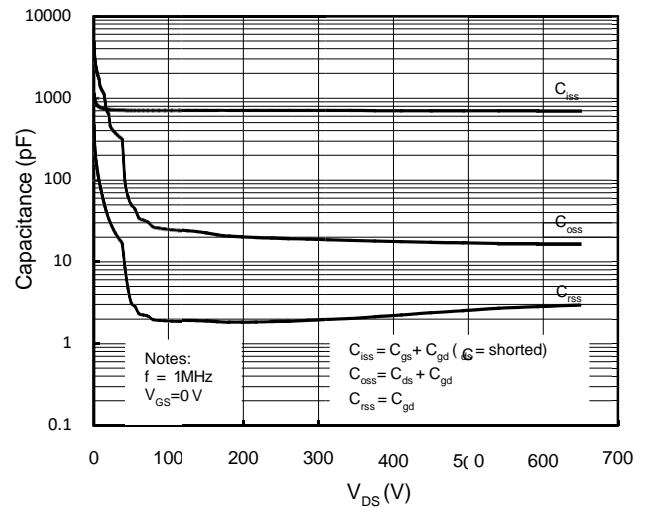


Figure 8. Capacitance Characteristics

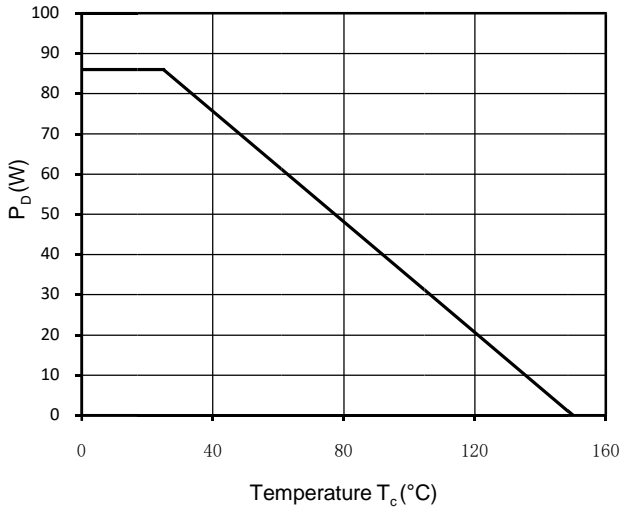


Figure 9. Power Dissipation

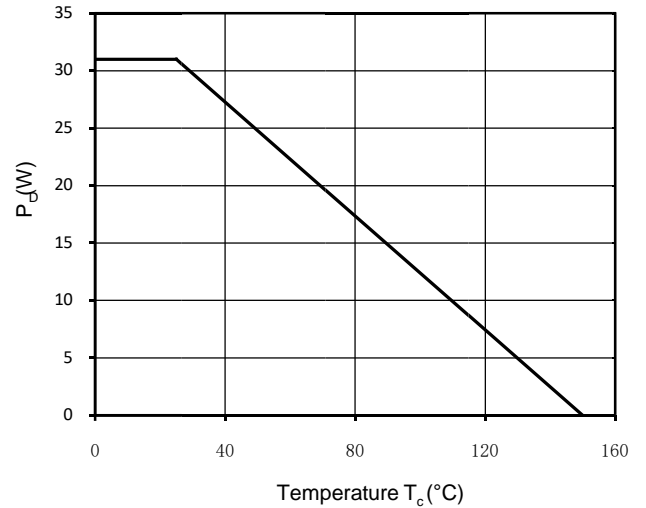


Figure 10. Power Dissipation (TO-220F)

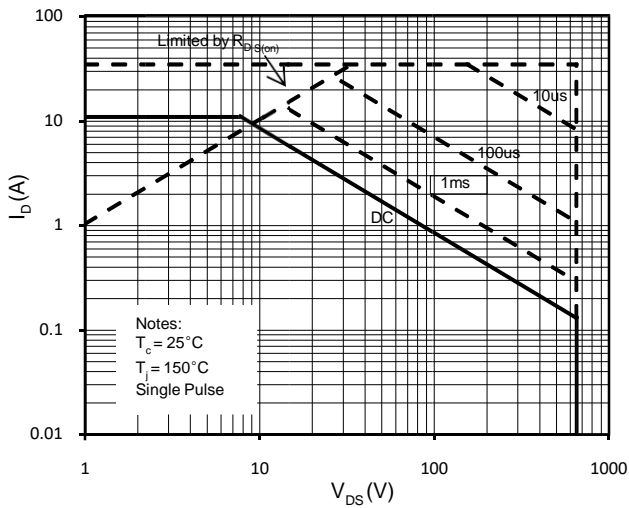


Figure 11. Maximum Safe Operating Area

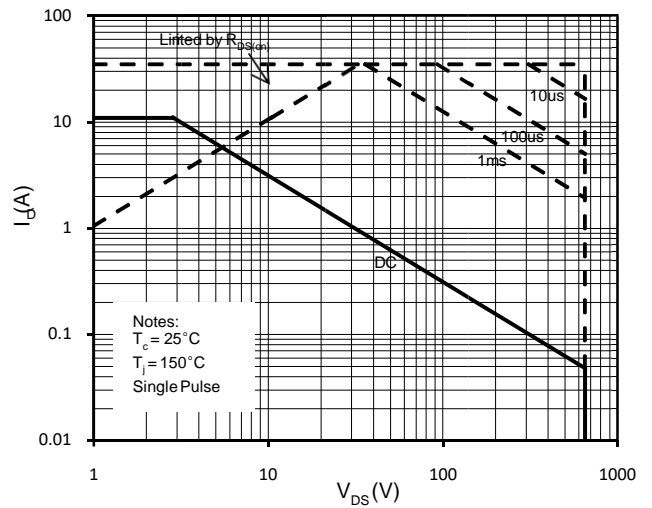


Figure 12. Maximum Safe Operating Area (TO-220F)

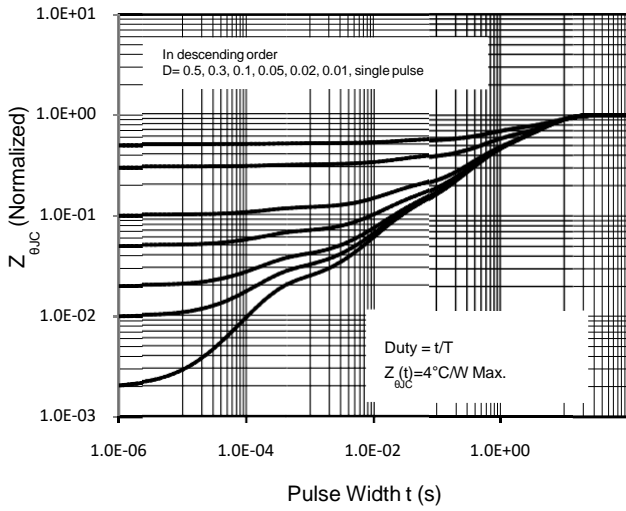


Figure 13. Transient Thermal Response Curve (TO-220F)

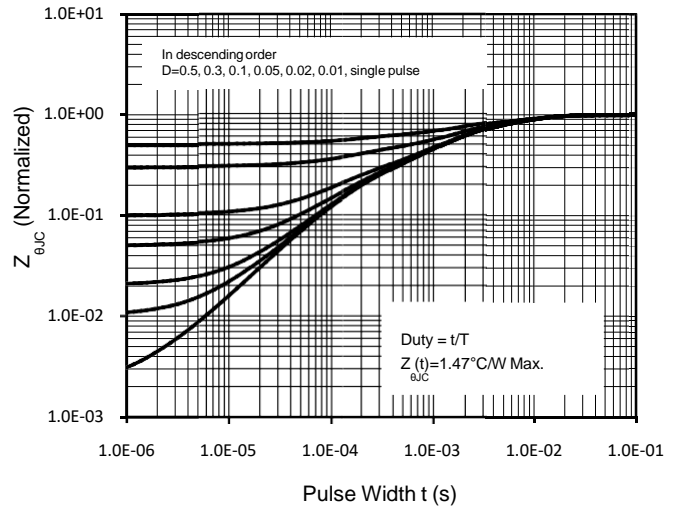


Figure 14. Transient Thermal Response Curve

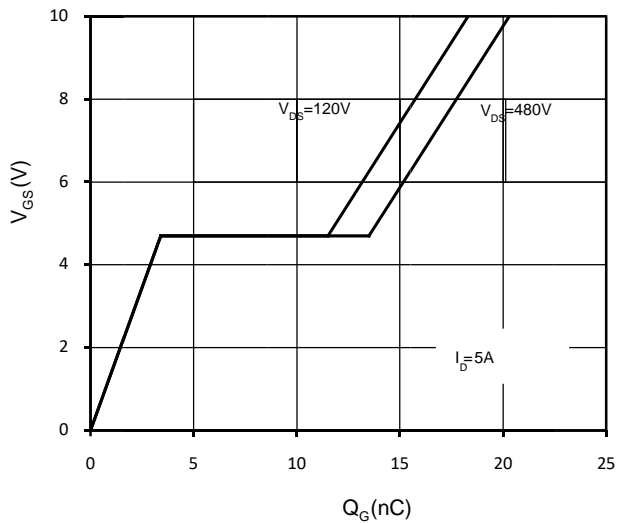
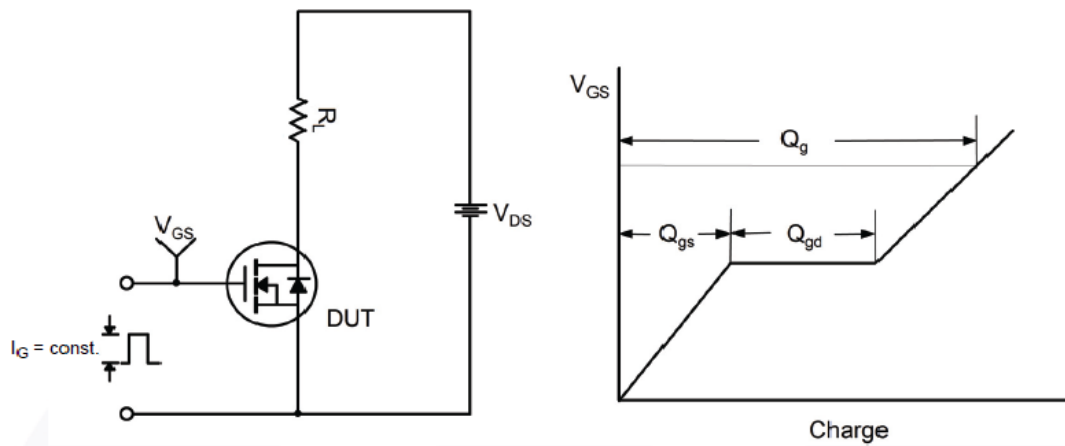
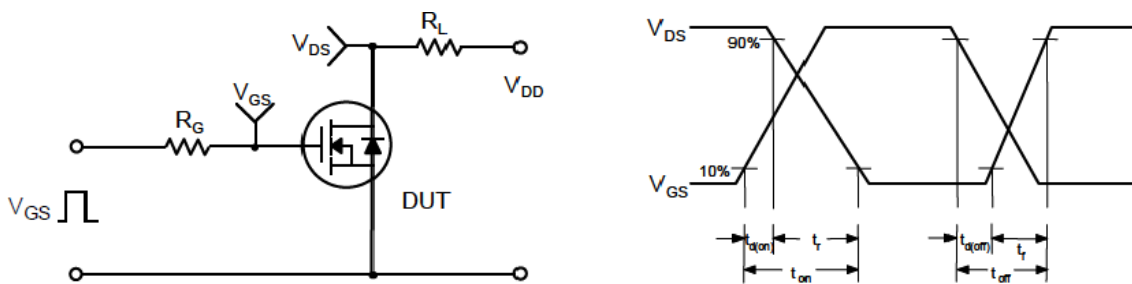


Figure 15. Gate Charge Characteristics

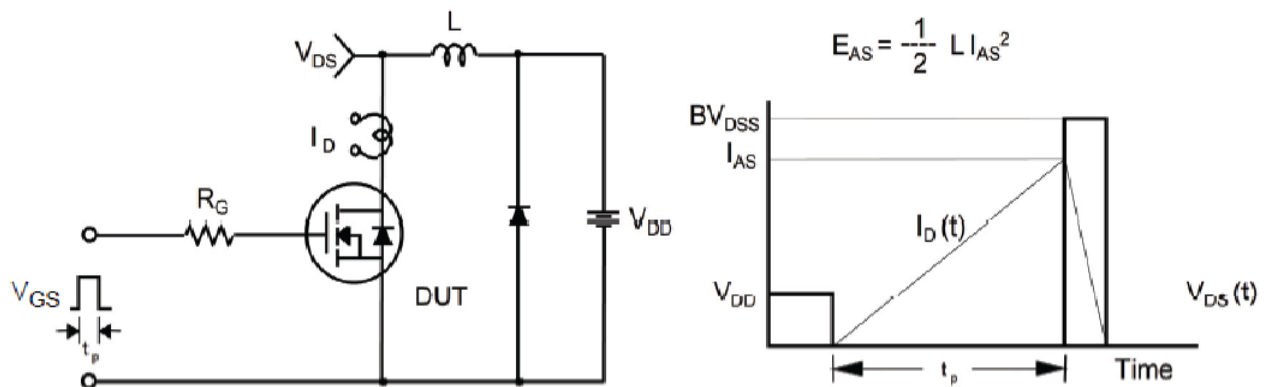
Gate Charge Test Circuit & Waveform



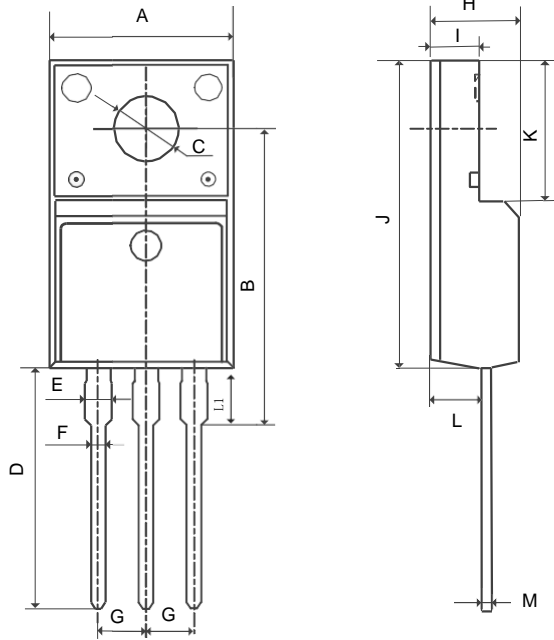
Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



Mechanical Dimensions for TO-220F



COMMON DIMENSIONS

SYME	MM		
	MIN	NOM	MAX
A	9.96	10.16	10.36
B	15.10	15.60	16.10
C	3.03	3.20	3.38
D	12.64	12.96	13.28
E	1.18	1.38	1.58
F	0.70	0.81	0.95
G	2.54REF		
H	4.50	4.70	4.90
I	2.34	2.54	2.74
J	15.57	15.87	16.17
K	6.70REF		
L	2.56	2.76	2.96
M	0.40	0.52	0.65
L1	2.85	3.10	3.45