Features

- 650V Super-junction MOSFET
- Ultra fast body diode: trr=202ns(typ.)
- Low drain-source On-resistance: $R_{DS(on)}$=0.099Ω (Max.)
- 100% avalanche tested
- RoHS compliant device

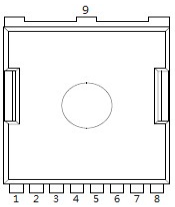
Pin Description

Pin	Description
1	Gate(G)
2,3,4,5,6,7,8	Source(S)
9	Drain(D)

Ordering Information

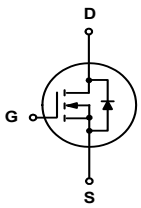
Part Number	Marking	Package
WTM40N65FTL	WPM 40N65FTL XXX YYWW	TOLL-8L

Simplified Outline

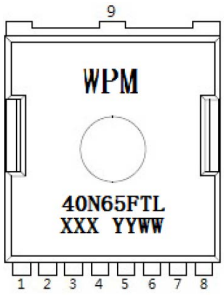


Top View
TOLL

Symbol



Marking Information



Absolute maximum ratings (T_C=25°C unless otherwise noted)

Characteristic	Symbol		Rating	Unit
Drain-source voltage	V_{DSS}		650	V
Gate-source voltage	V_{GSS}		±30	V
Drain current (DC) (Note 1)	I_D	T_c=25°C	40	A
		T_c=100°C	25	A
Drain current (Pulsed) (Note 1)	I_{DM}		160	A
Single pulsed avalanche energy (Note 2)	E_{AS}		470	mJ
Repetitive avalanche current (Note 1)	I_{AR}		9	A
Repetitive avalanche energy (Note 1)	E_{AR}		2.3	mJ
Power dissipation	P_D		230	W
Diode dv/dt ruggedness (Note 3)	dv/dt		50	V/ns
MOSFET dv/dt ruggedness (Note 4)	dv/dt		50	V/ns
Junction temperature	T_J		150	°C
Storage temperature range	T_{stg}		-55~150	°C

Thermal Characteristics

Characteristic	Symbol	Rating	Unit
Thermal resistance, junction to case	$R_{th(j-c)}$	Max. 0.543	°C/W
Thermal resistance, junction to ambient	$R_{th(j-a)}$	Max. 50	

Electrical Characteristics (T_C=25°C unless otherwise noted)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DSS}	I_D=250uA, V_{GS}=0	650	-	-	V
Gate threshold voltage	$V_{GS(th)}$	I_D=250uA, V_{DS}=V_{GS}	3	4	5	V
Drain-source cut-off current	I_{DSS}	V_{DS}=650V, V_{GS}=0V	-	-	10	uA
Gate leakage current	I_{GSS}	V_{DS}=0V, V_{GS}=±30V	-	-	1000	nA
Drain-source on-resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=15.4A	-	0.081	0.099	Ω
Internal gate resistance	R_g	F=1MHz, open drain	-	10	-	Ω
Input capacitance	C_{iss}	V_{DS}=100V, V_{GS}=0V, f=1MHz	-	3596	-	pF
Output capacitance	C_{oss}		-	122	-	
Reverse transfer capacitance	C_{rss}		-	3.7	-	
Turn-on delay time (Note 5)	$t_{d(on)}$	V_{DS}=400V, I_D=15.4A, R_G=10Ω	-	120	-	ns
Rise time (Note 5)	t_r		-	80	-	
Turn-off delay time (Note 5)	$t_{d(off)}$		-	165	-	
Fall time (Note 5)	t_f		-	8.5	-	
Total gate charge (Note 6)	Q_g	V_{DS}=400V, V_{GS}=10V, I_D=30.8A	-	74	-	nC
Gate-source charge (Note 6)	Q_{gs}		-	26.5	-	
Gate-drain charge (Note 6)	Q_{gd}		-	27.5	-	
Gate plateau voltage (Note 6)	$V_{plateau}$		-	7.2	-	V

Source-Drain Diode Ratings and Characteristics (T_C=25°C unless otherwise noted)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Source current (DC)	I_S	Integral reverse diode in the MOSFET	-	-	40	A
Source current (Pulsed)	I_{SM}		-	-	160	A
Forward voltage	V_{SD}	V_{GS}=0V, I_S=30.8A	-	-	1.5	V
Reverse recovery time (Note 5, 6)	t_{rr}	I_S=15.4A, V_{GS}=0V, dI_S/dt=100A/us	-	200		ns
Reverse recovery charge (Note 5, 6)	Q_{rr}		-	0.51	-	uC

Note:
1. Calculated continuous current based on maximum allowable junction temperature
2. L=10mH, I_{AS}=9A, V_{DD}=90V, Starting T_J=25°C
3. I_S≤9A, V_{DS}≤400V, dIs/dt≤100A/us, T_J=25°C
4. V_{DS}≤400V, T_J=25°C
5. Guaranteed by design, not subject to production testing
6. Pulse test: Pulse width≤300us, Duty cycle≤2%

Typical Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

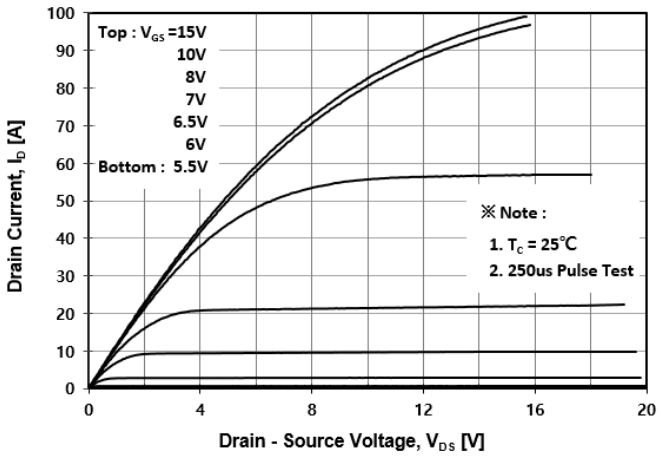


Fig. 2 Typical Transfer Characteristics

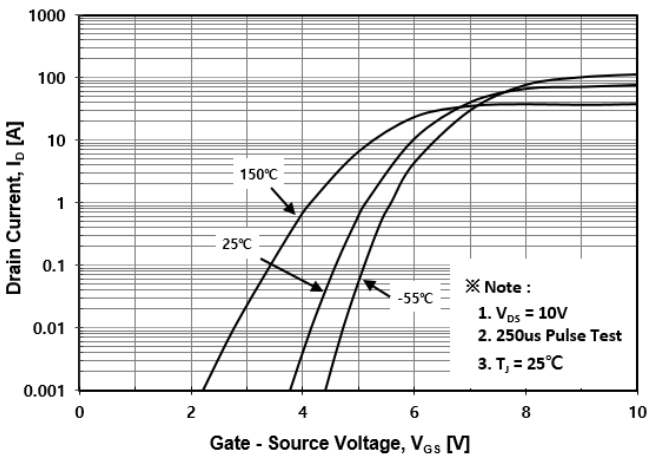


Fig.3 On-Resistance Variation with Drain Current and Gate Voltage

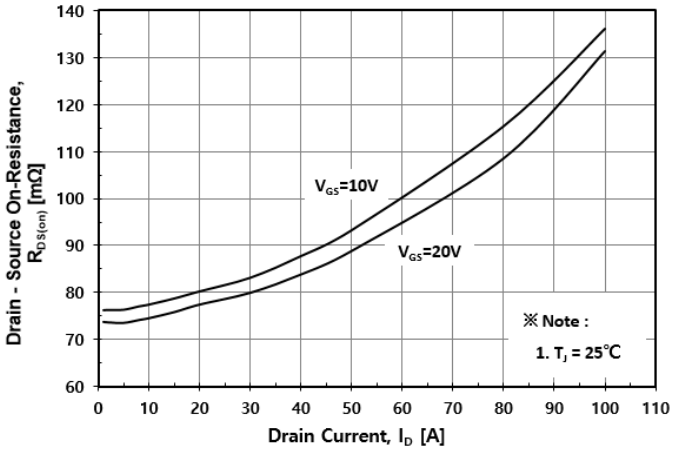


Fig. 4 Body Diode Forward Voltage Variation with Source Current

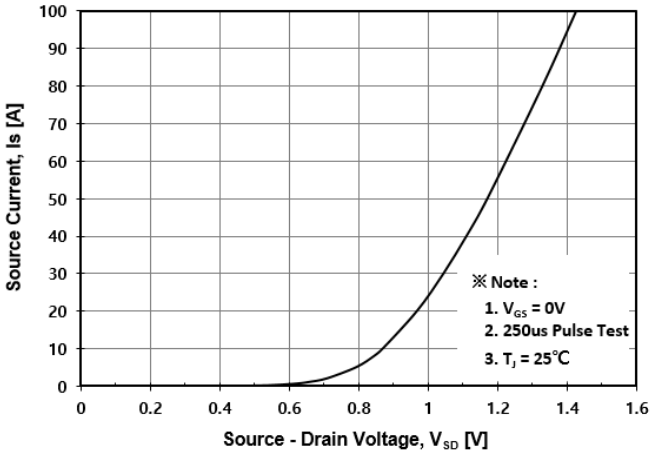


Fig. 5 Typical Capacitance Characteristics

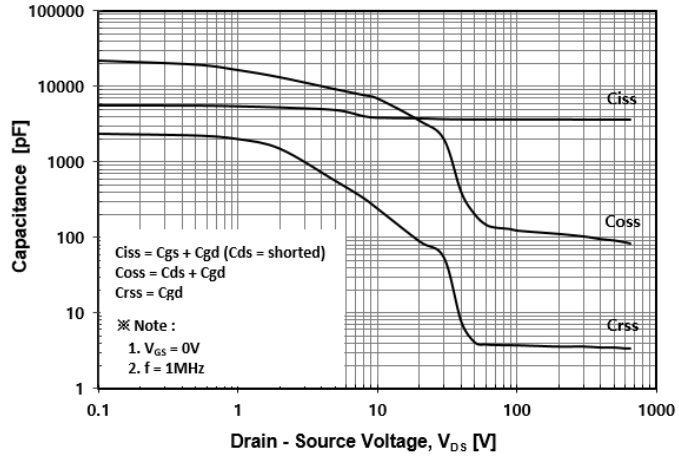


Fig. 6 Typical Total Gate Charge Characteristics

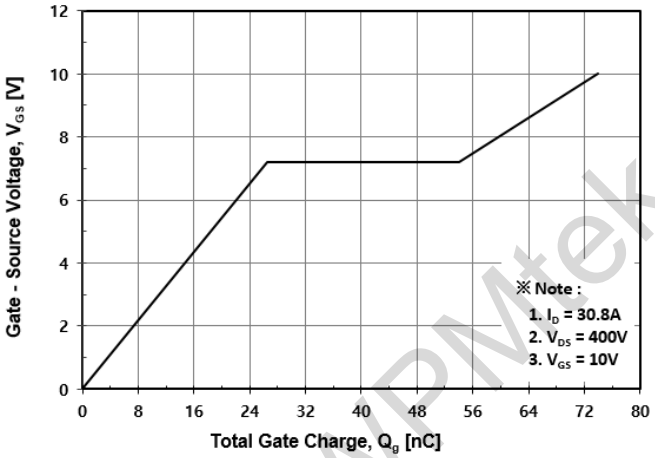


Fig. 7 Breakdown Voltage Variation vs. Temperature

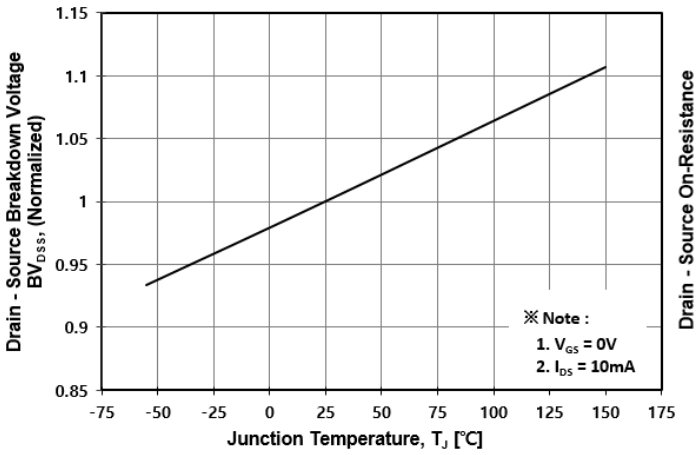


Fig. 8 On-Resistance Variation vs. Temperature

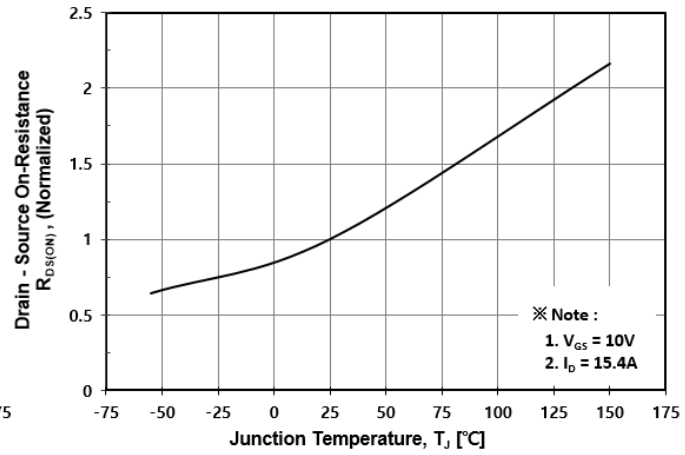


Fig. 9 Maximum Drain Current vs. Case Temperature

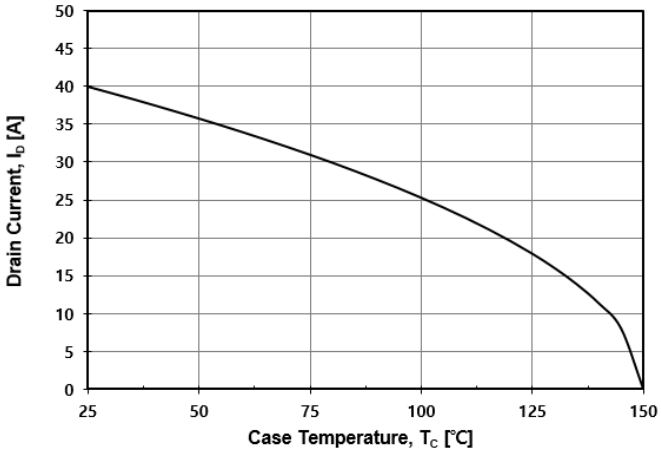


Fig. 10 Maximum Safe Operating Area

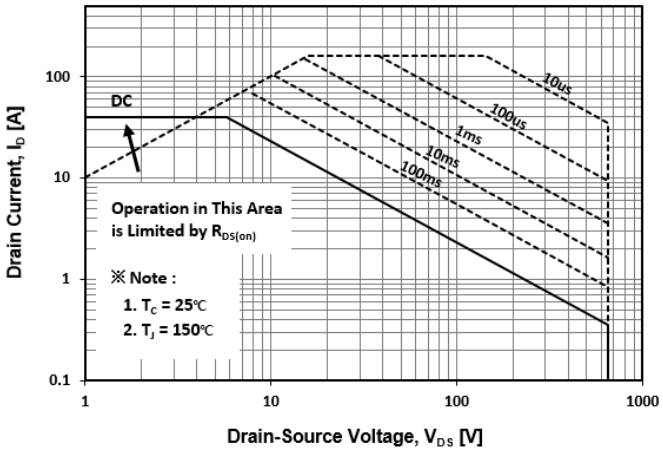


Fig. 11 Transient Thermal Impedance

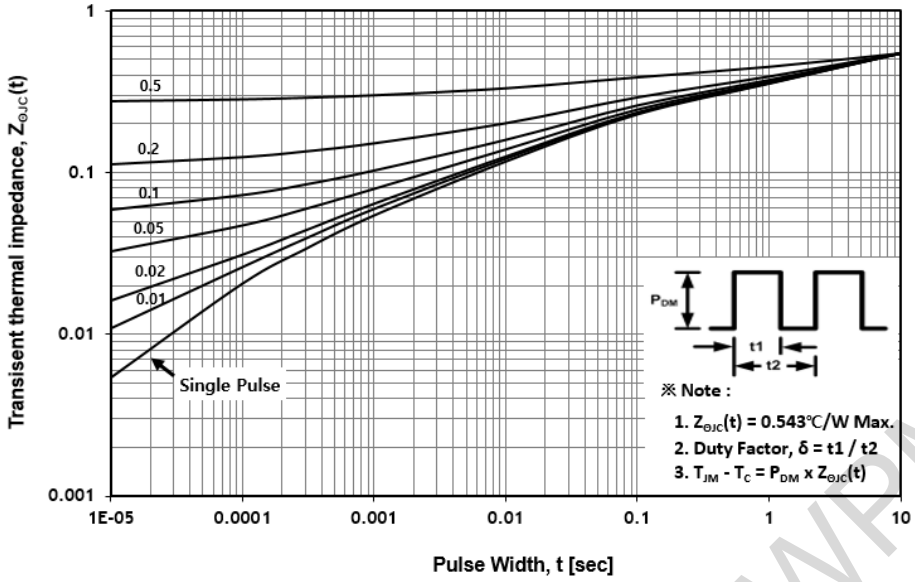
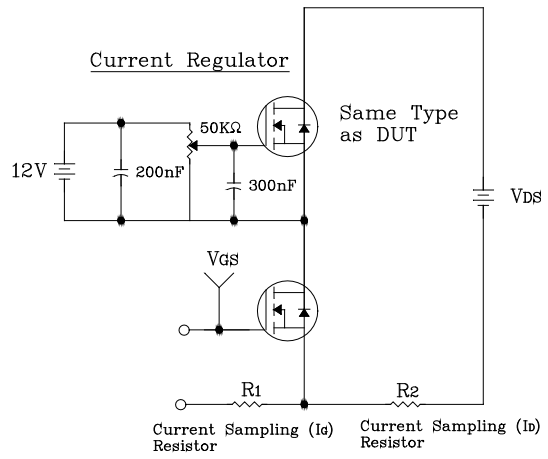


Fig. 12 Gate Charge Test Circuit & Waveform



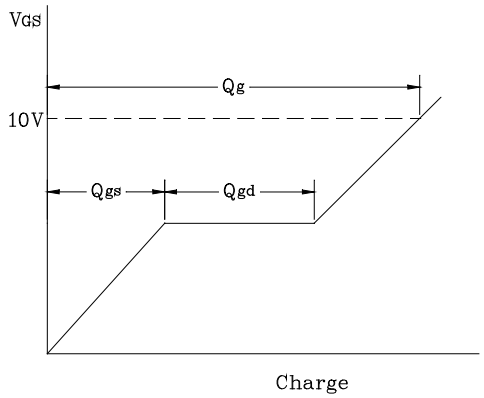
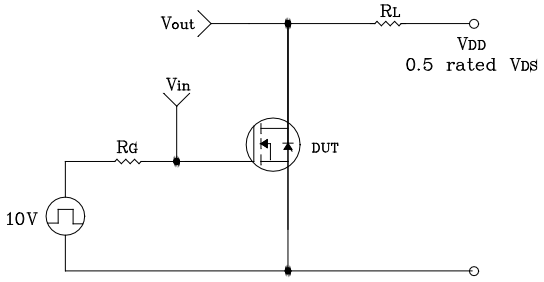


Fig. 13 Resistive Switching Test Circuit & Waveform



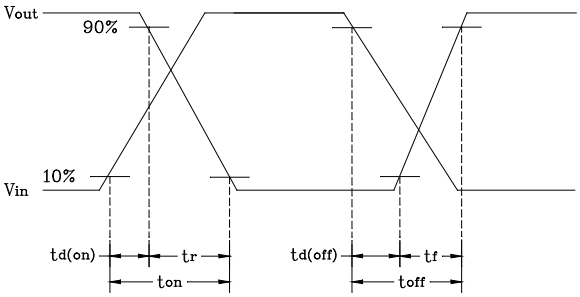
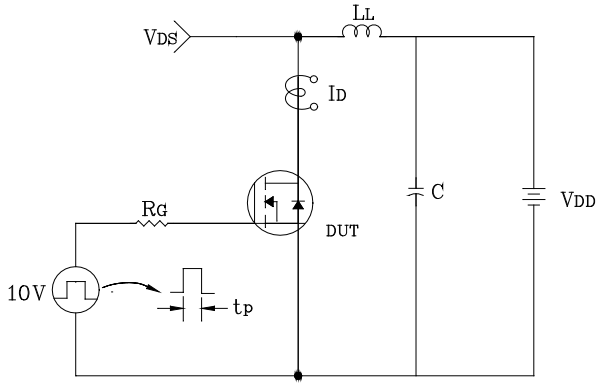
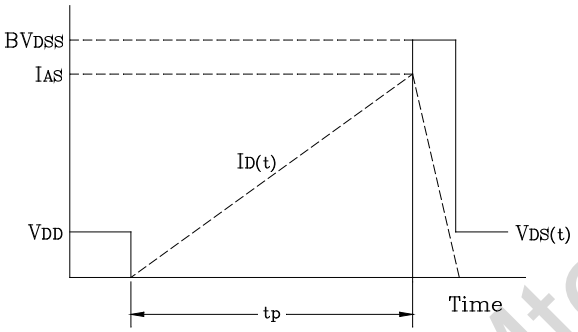
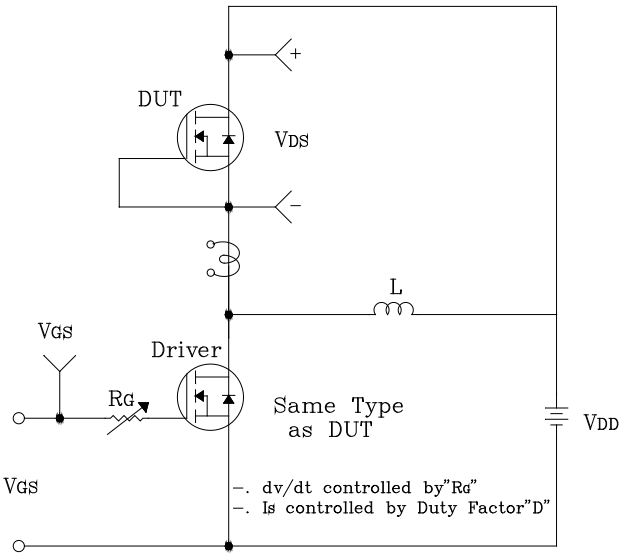
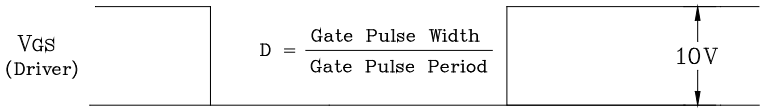


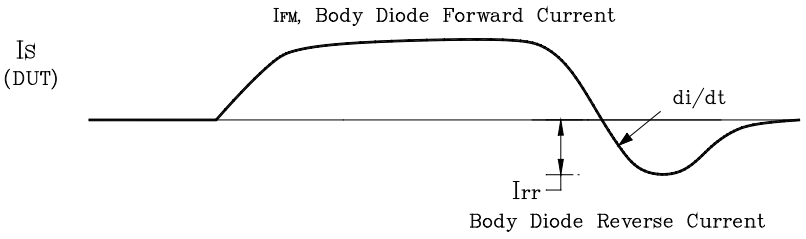
Fig. 14 E_{AS} Test Circuit & Waveform

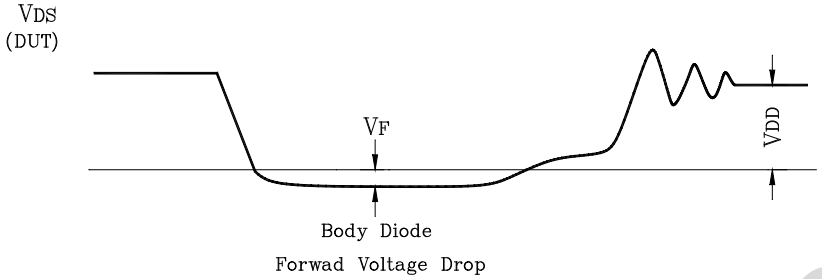




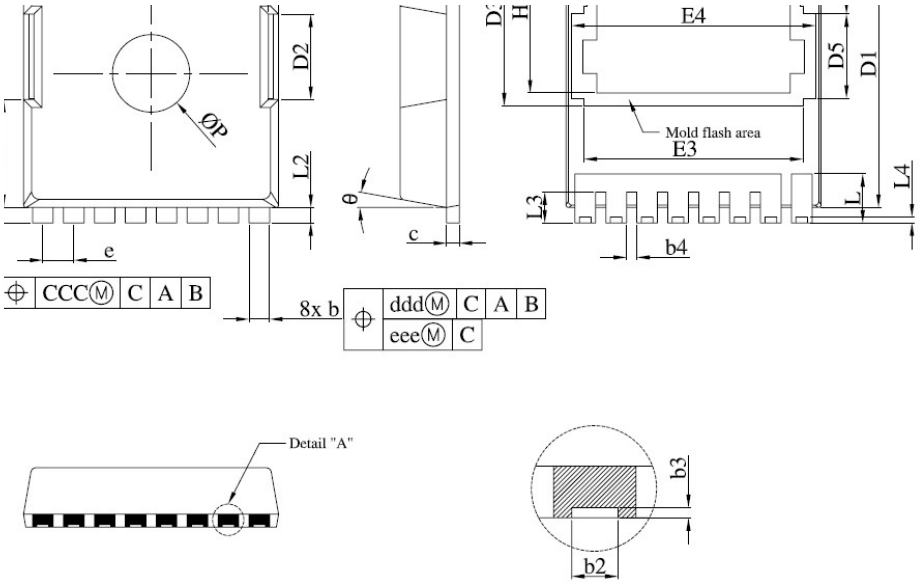

DUT
VDS
L
VGS
Driver
RG
Same Type
as DUT
VDD
VGS
–. dv/dt controlled by"RG"
–. Is controlled by Duty Factor"D"


VGS
(Driver)
D = Gate Pulse Width / Gate Pulse Period
10V


IFM, Body Diode Forward Current
IS
(DUT)
di/dt
Irr
Body Diode Reverse Current


VDS
(DUT)
VF
VDD
Body Diode
Forwad Voltage Drop

8. Package Dimensions TOLL-8L Package



Symbol	Dimensions In Millimeters	
	MIN.	MAX.
b	0.70	0.90
b3	0.05	/
b6	3.00	3.20
D1	10.98	11.18
D4	3.59	
E	9.80	10.00

Symbol	Dimensions In Millimeters	
	MIN.	MAX.
E3	8.50	
H1	6.55	6.75
L1	0.50	0.90
L4	0.13	0.33
θ	10°REF	
ccc	0.20	
ddd	0.25	