

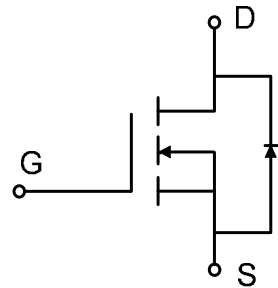
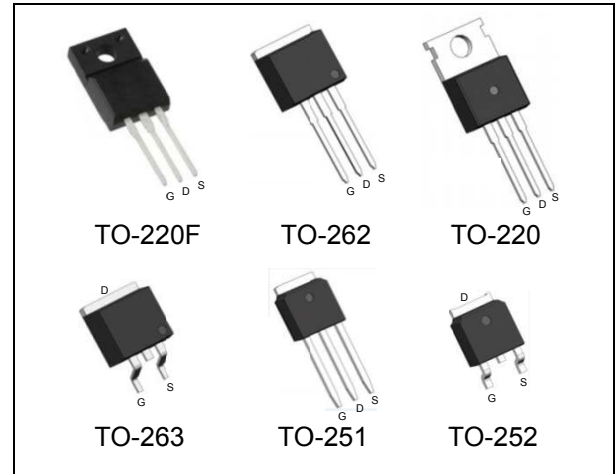
650V 0.35Ω Super Junction Power MOSFET

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_{DS}	650		V
Continuous drain current ¹⁾ ($T_C = 25^\circ C$)	I_D	11		A
($T_C = 100^\circ C$)		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 ($T_C = 25^\circ C$)	P_D	85	31	W
- Derate above $25^\circ C$		0.68	0.25	W/ $^\circ C$
Operating and storage temperature range	T_i, 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

Thermal Characteristics

Parameter	Symbol	WMK/WMW/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	$R_{\theta JA}$	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 V, I _D =0.25 mA	650	-	-	V
Gate threshold voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =0.25mA	2	3	4	V
Drain cut-off current	I _{DSS}	V _{DS} =650 V, V _{GS} =0 V, T _J = 25°C T _J = 125°C	- -	- 50	1 -	μA
Gate leakage current, forward	I _{GSSF}	V _{GS} =20 V, V _{DS} =0 V	-	-	100	nA
Gate leakage current, reverse	I _{GSSR}	V _{GS} = -20 V, V _{DS} =0 V	-	-	-100	nA
Drain-source on-state resistance	R _{DS(on)}	V _{GS} =10 V, I _D =2 A	--	0.35	0.39	Ω
Dynamic characteristics						
Input capacitance	C _{iss}	V _{DS} = 100 V, V _{GS} = 0 V, f = 1 MHz	-	710	-	pF
Output capacitance	C _{oss}		-	25	-	
Reverse transfer capacitance	C _{rss}		-	2	-	
Turn-on delay time	t _{d(on)}	V _{DD} = 300V, I _D = 5A R _G = 25Ω, V _{GS} =10V	-	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 V, I _D =5A, V _{GS} =0 to 10 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 V, I _F =2A	-	-	1.2	V
Reverse recovery time	t _{rr}	V _R =50 V, I _F =5A, dI _F /dt=100 A/μs	-	213	-	ns
Reverse recovery charge	Q _{rr}		-	2.1	-	μC
Peak reverse recovery current	I _{rrm}		-	20	-	A

Notes:

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

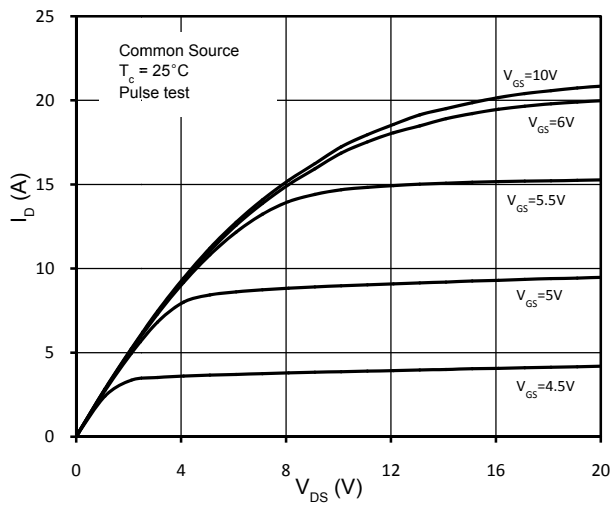


Figure 1. On-Region Characteristics

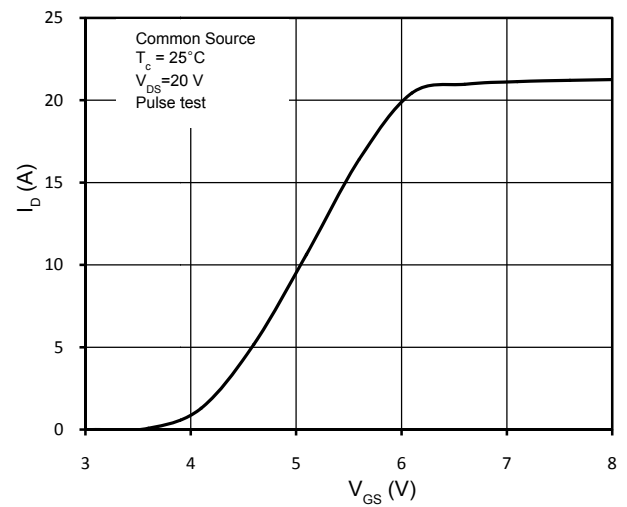


Figure 2. Transfer Characteristics

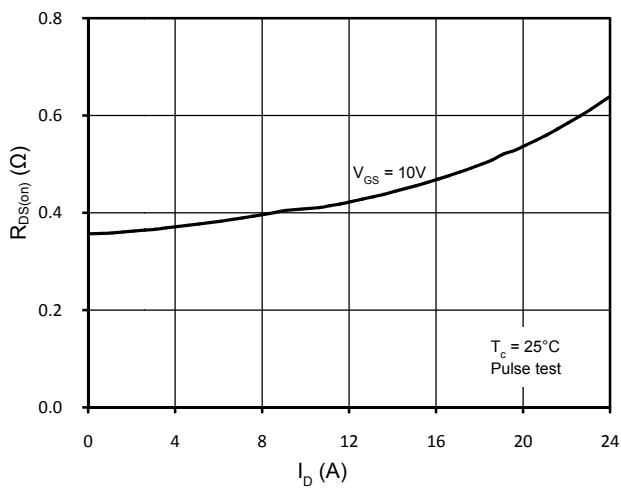


Figure 3. Static Drain-Source On Resistance

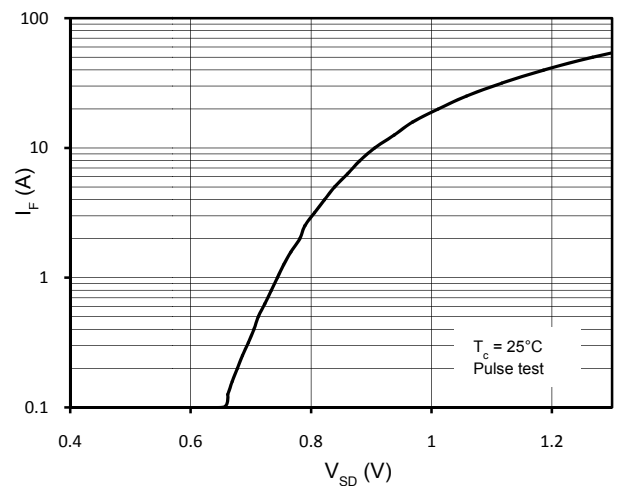
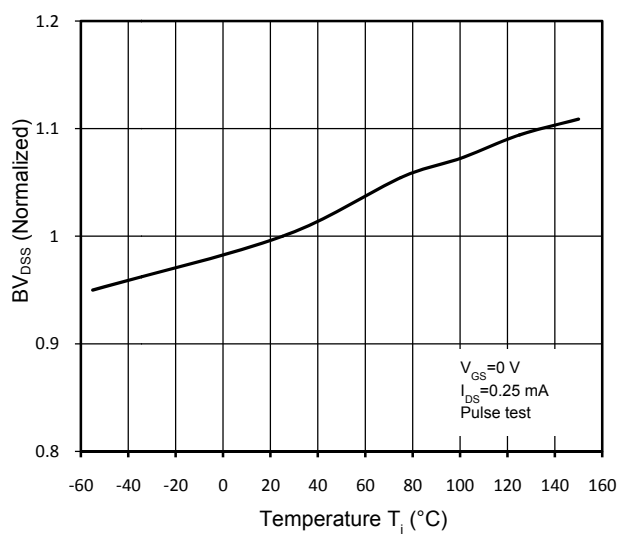
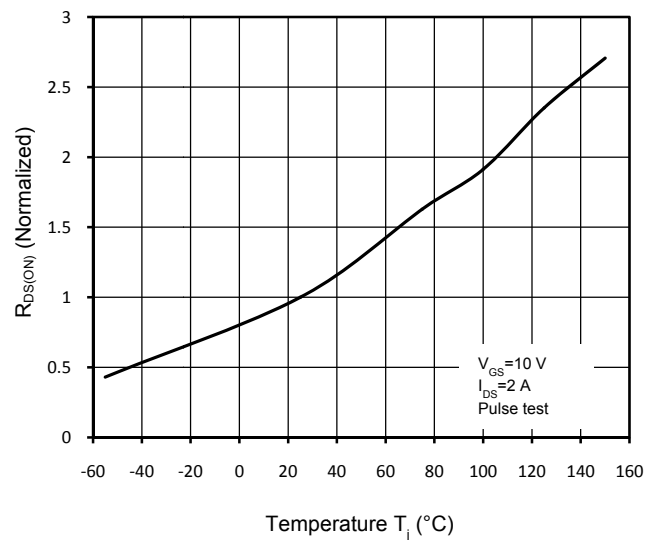


Figure 4. Body-Diode Forward Characteristics

Figure 5. Normalized BV_{DS} vs. TemperatureFigure 6. Normalized $R_{DS(on)}$ vs. Temperature

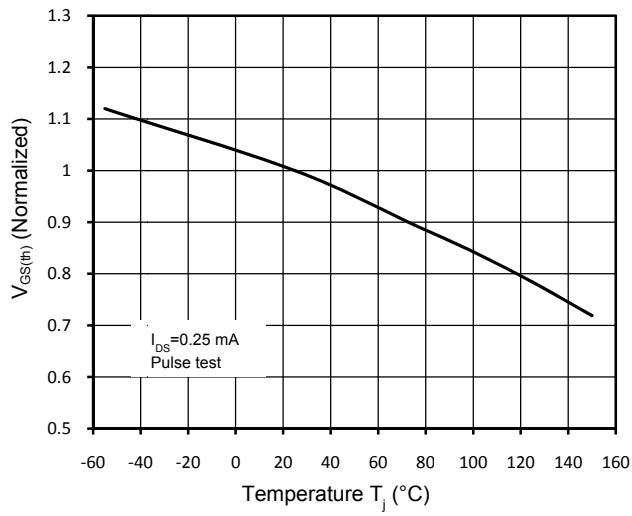


Figure 7. Threshold Voltage vs. Temperature

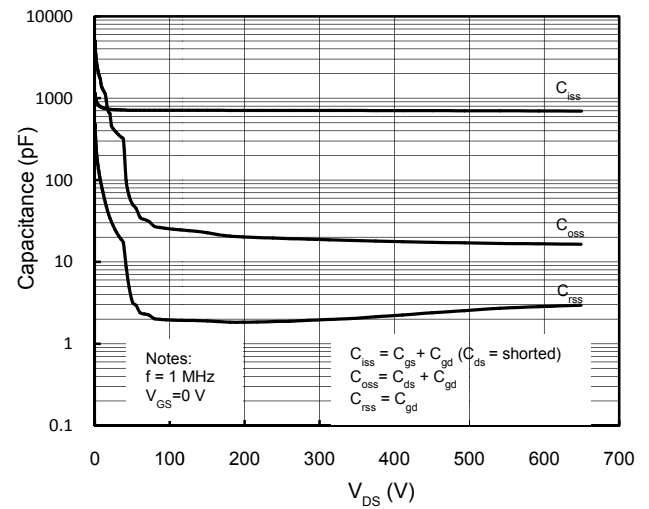


Figure 8. Capacitance Characteristics

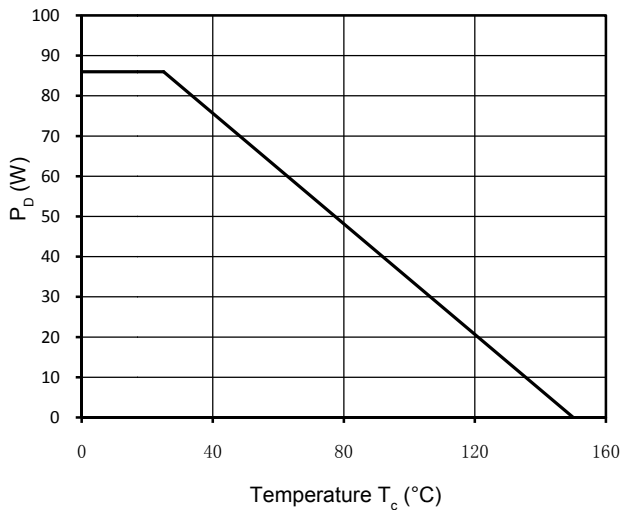


Figure 9. Power Dissipation

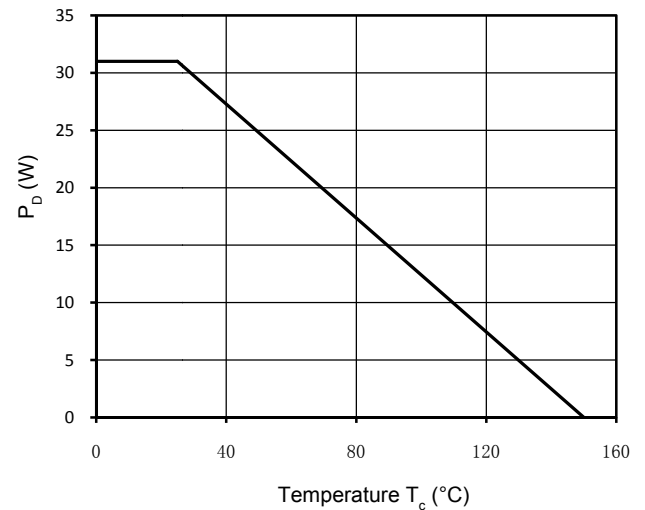


Figure 10. Power Dissipation (TO-220F)

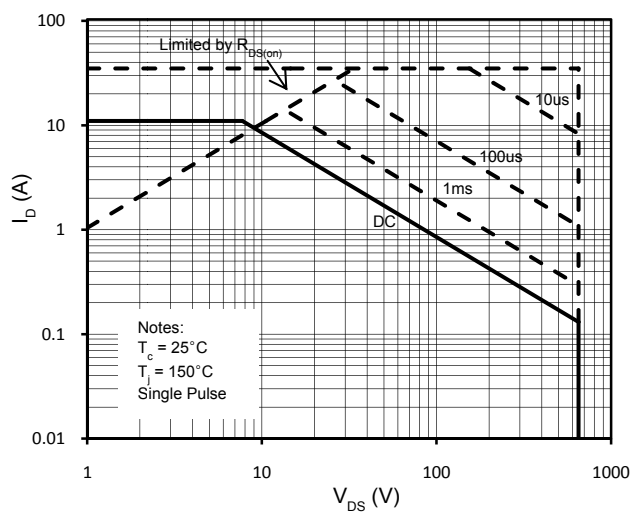


Figure 11. Maximum Safe Operating Area

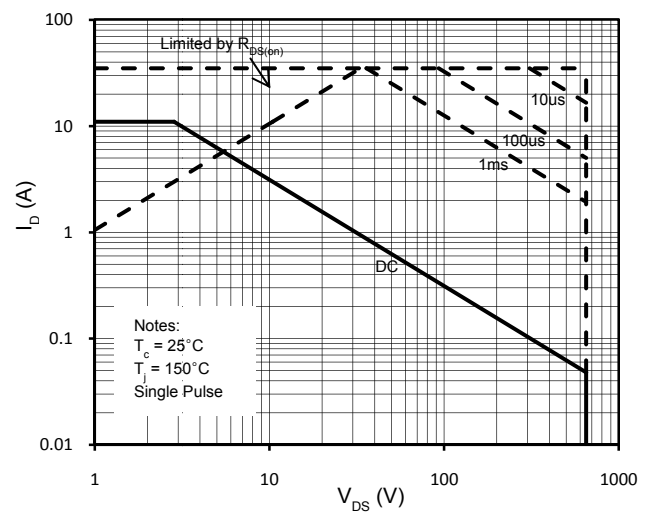


Figure 12. Maximum Safe Operating Area (TO-220F)

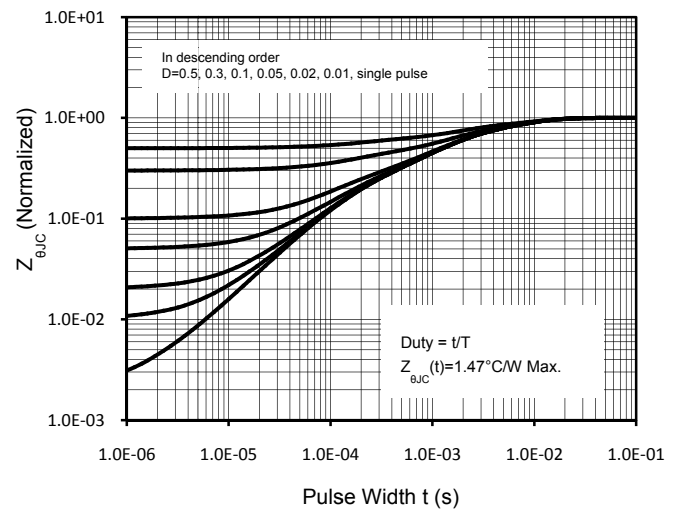
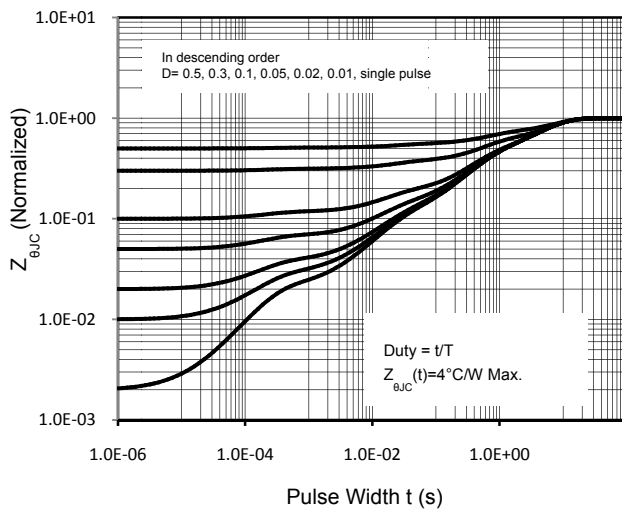


Figure 13. Transient Thermal Response Curve (TO-220F) Figure 14. Transient Thermal Response Curve

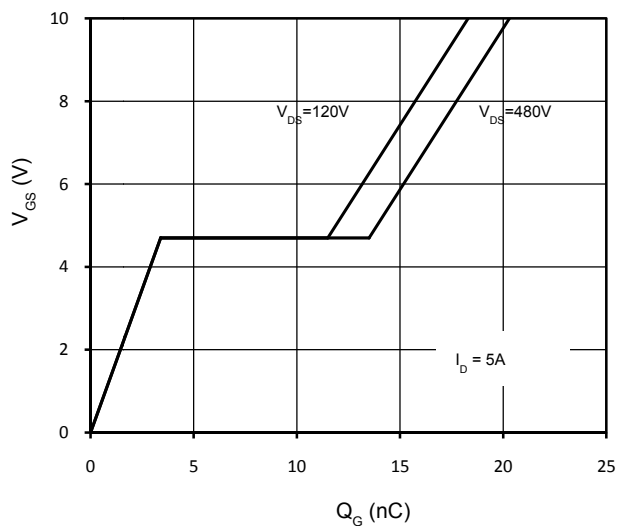
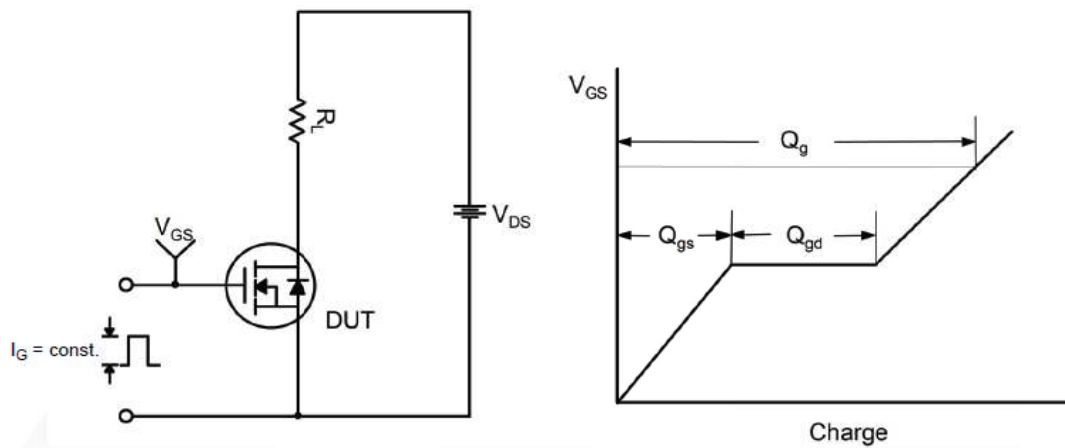
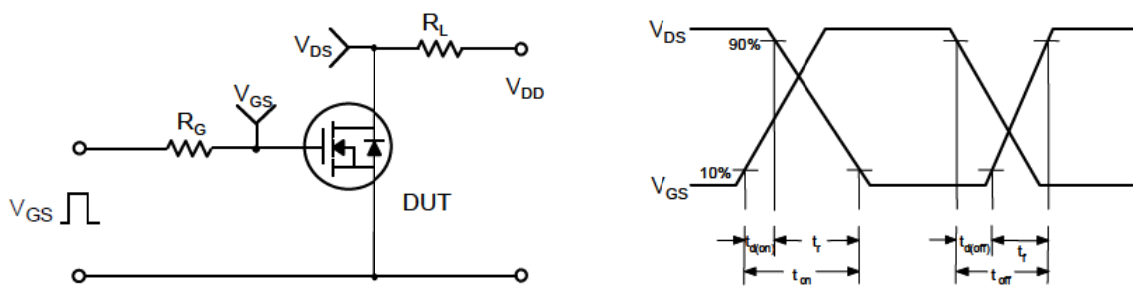


Figure 15. Gate Charge Characteristics

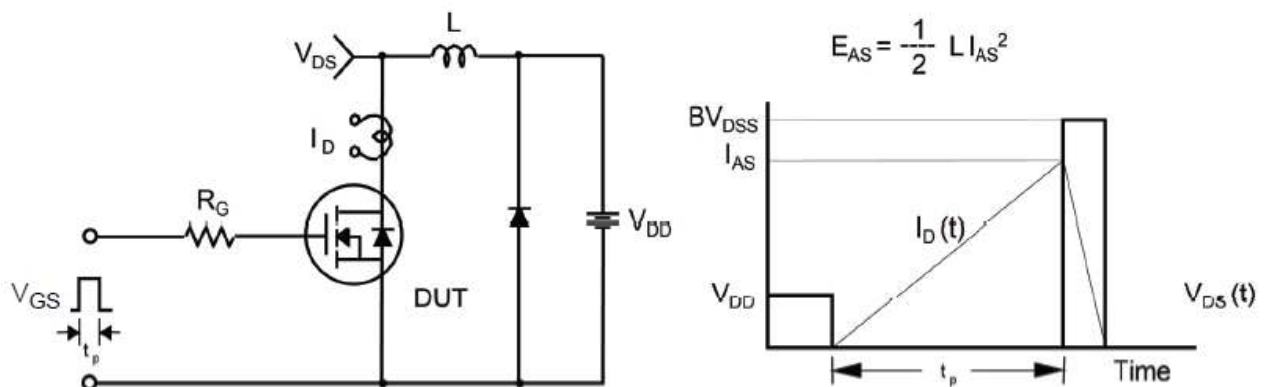
Gate Charge Test Circuit & Waveform



Switching Test Circuit & Waveforms

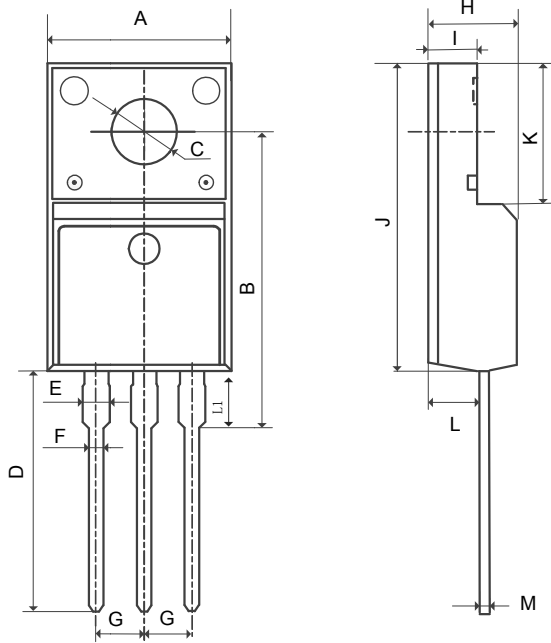


Unclamped Inductive Switching Test Circuit & Waveforms



Mechanical Dimensions for TO-220F

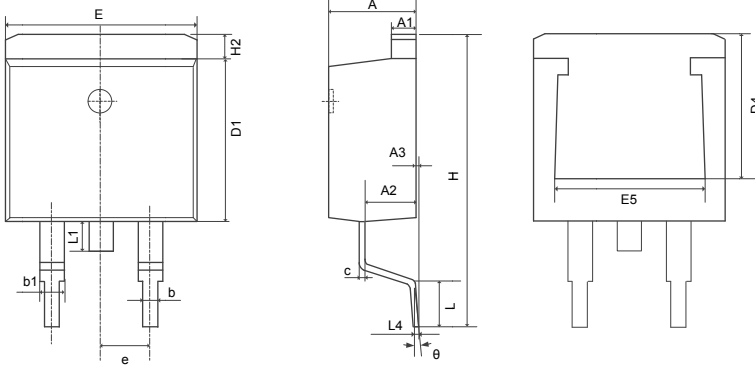
COMMON DIMENSIONS



SYMBOL	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

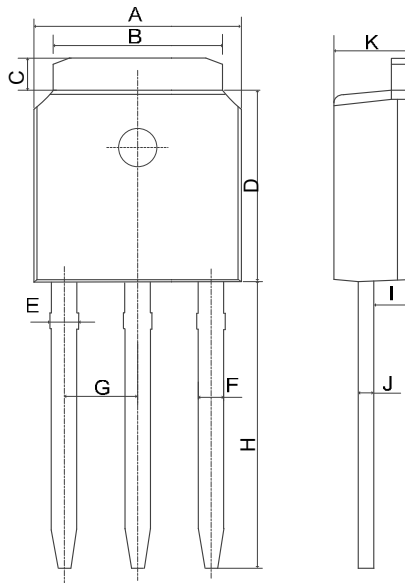
Mechanical Dimensions for TO-263

COMMON DIMENSIONS



SYMBOL	MM		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
b	0.70	0.81	0.96
b1	1.17	1.27	1.47
c	0.30	0.38	0.53
D1	8.50	8.70	8.90
D4	6.60	—	—
E	9.86	10.16	10.36
E5	7.06	—	—
e	2.54BSC		
H	14.70	15.10	15.50
H2	1.07	1.27	1.47
L	2.00	2.3	2.60
L1	1.40	1.55	1.70
L4	0.25BSC		
θ	0°	5°	9°

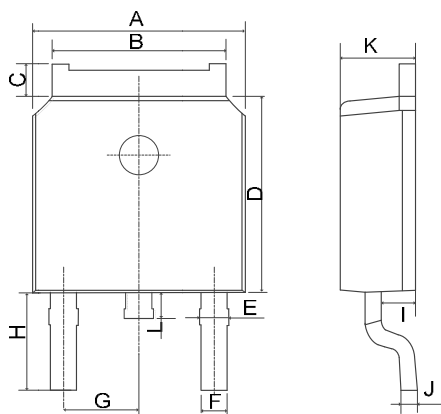
Mechanical Dimensions for TO-251



COMMON DIMENSIONS

SYMBOL	MM		
	MIN	NOM	MAX
A	6.40	6.60	6.80
B	5.13	5.30	5.46
C	0.88	1.02	1.28
D	5.90	6.06	6.22
E	0.68	0.89	1.10
F	0.68	0.78	0.91
G	2.29REF		
H	9.00	9.40	9.65
I	0.90	1.04	1.17
J	0.40	0.51	0.61
K	2.10	2.30	2.50

Mechanical Dimensions for TO-252

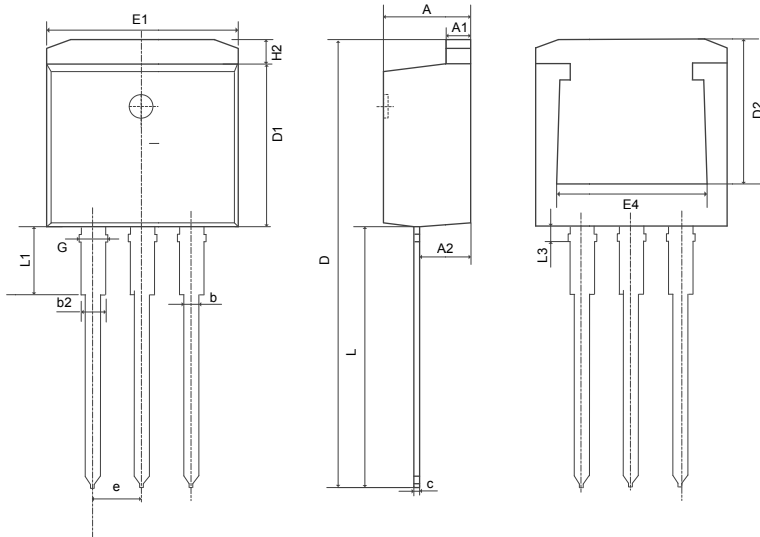


COMMON DIMENSIONS

SYMBOL	MM		
	MIN	NOM	MAX
A	6.40	6.60	6.80
B	5.13	5.33	5.50
C	0.88	—	1.28
D	5.90	6.10	6.22
E	0.68	0.89	1.10
F	0.68	0.78	0.91
G	2.29REF		
H	2.90REF		
I	0.85	1.07	1.17
J	0.51REF		
K	2.10	2.30	2.50
L	0.40	—	1.00

Mechanical Dimensions for TO-262

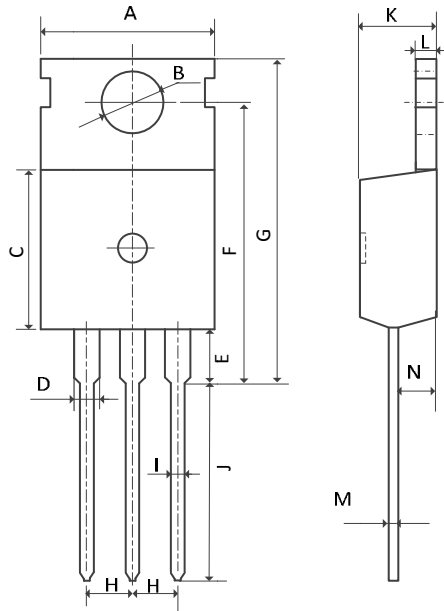
COMMON DIMENSIONS



SYMBOL	MM		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
b	0.71	0.81	0.96
b2	1.17	1.27	1.42
c	0.28	0.38	0.53
D	23.20	23.70	24.02
D1	8.50	8.7	8.90
D2	6.00	—	—
E1	9.86	10.16	10.36
E4	7.06	—	—
e	2.54BSC		
G	1.25	1.35	1.50
H2	—	—	1.50
L	13.33	13.73	14.13
L1	3.50	3.75	4.00
L3	1.28	1.43	1.58

Mechanical Dimensions for TO-220

COMMON DIMENSIONS

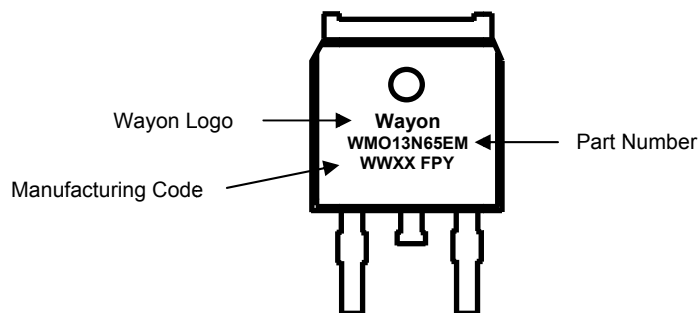


SYMBOL	MM		
	MIN	NOM	MAX
A	9.70	10.00	10.20
B	3.40	3.60	3.80
C	8.90	9.10	9.40
D	1.17	1.27	1.47
E	2.60	3.10	3.40
F	15.10	15.80	16.70
G	19.55MAX		
H	2.54REF		
I	0.70	0.80	0.95
J	9.35	10.30	11.00
K	4.30	4.57	4.77
L	1.20	1.30	1.45
M	0.40	0.50	0.65
N	2.20	2.40	2.60

Ordering Information

Part	Package	Marking	Packing method
WML13N65EM	TO-220F	WML13N65EM	Tube
WMK13N65EM	TO-220	WMK13N65EM	Tube
WMN13N65EM	TO-262	WMN13N65EM	Tube
WMM13N65EM	TO-263	WMM13N65EM	Tape and Reel
WMO13N65EM	TO-252	WMO13N65EM	Tape and Reel
WMP13N65EM	TO-251	WMP13N65EM	Tube

Marking Information



Contact Information

No.1001, Shiwan(7) Road, Pudong District, Shanghai, P.R.China.201202

Tel: 86-21-50310888 Fax: 86-21-50757680 Email: market@way-on.com

WAYON website: <http://www.way-on.com>

For additional information, please contact your local Sales Representative.

 ® is registered trademarks of Wayon Corporation.

Disclaimer

WAYON reserves the right to make changes without further notice to any Products herein to improve reliability, function, or design. The Products are not designed for use in hostile environments, including, without limitation, aircraft, nuclear power generation, medical appliances, and devices or systems in which malfunction of any Product can reasonably be expected to result in a personal injury. The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. WAYON does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Products or technical information described in this document.