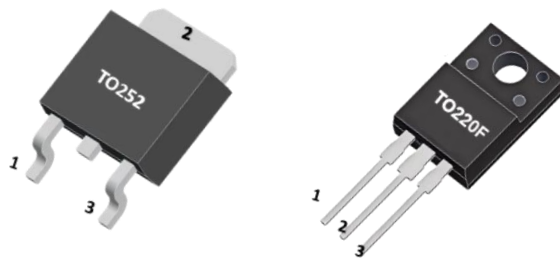


DESCRIPTION

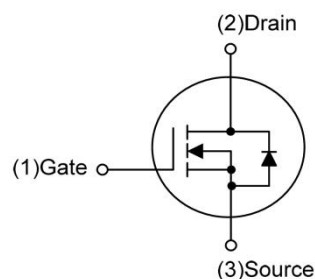
The WTM04N65VD/F is a high voltage power MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristic. This power MOSFET is usually used in high speed switching applications including power supplies, PWM motor controls, high efficient AC to DC converters and bridge circuits.



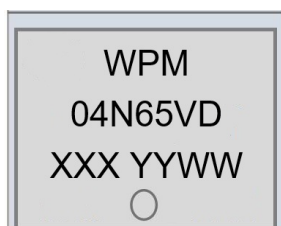
FEATURES

- * $R_{DS(ON)} \leq 3\Omega$ @ $V_{GS}=10V$, $I_D=3A$
- *Fast Switching Capability
- *Avalanche Energy Specified
- *Improved dv/dt Capability, High Ruggedness

SYMBOL



MARKING



WPM : LOGO
04N65VD=Device Code (TO-252)
04N65VF=Device Code (TO-220F)
XXX YYWW=Date Code

ABSOLUTE MAXIMUM RATINGS($T_A=25^\circ C$, unless otherwise specified.)

SYMBOL	PARAMETER		VALUE	UNIT
V_{DS}	Drain-Source Voltage		650	V
V_{GS}	Gate Source Voltage		± 30	V
I_{AR}	Avalanche Current (Note 2)		4	A
I_D	Continuous Drain Current		4.0	A
I_{DM}	Pulsed Drain Current (Note 2)		10	A
E_{AS}	Avalanche Energy Single Pulsed (Note 3)		37	mJ
E_{AR}	Avalanche Energy Repetitive (Note2)		10.6	mJ
P_D	Power Dissipation (Note 1)	TO-220F	30	W
		TO-252	36	W
T_J	Junction Temperature		150	$^\circ C$
T_{STG}	Storage Temperature		-40 to 150	$^\circ C$
R_{θJC}	Thermal Resistance from Junction to Case	TO-220F	4.2	$^\circ C/W$
		TO-252	3.5	

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. Repetitive Rating: Pulse width limited by maximum junction temperature.
3. L = 20mH, IAS = 2A, VDD = 50V, RG = 25 Ω, Starting TJ = 25°C
4. ISD ≤ 4A, di/dt ≤ 200A/μs, VDD ≤ BVDS, Starting TJ = 25°C

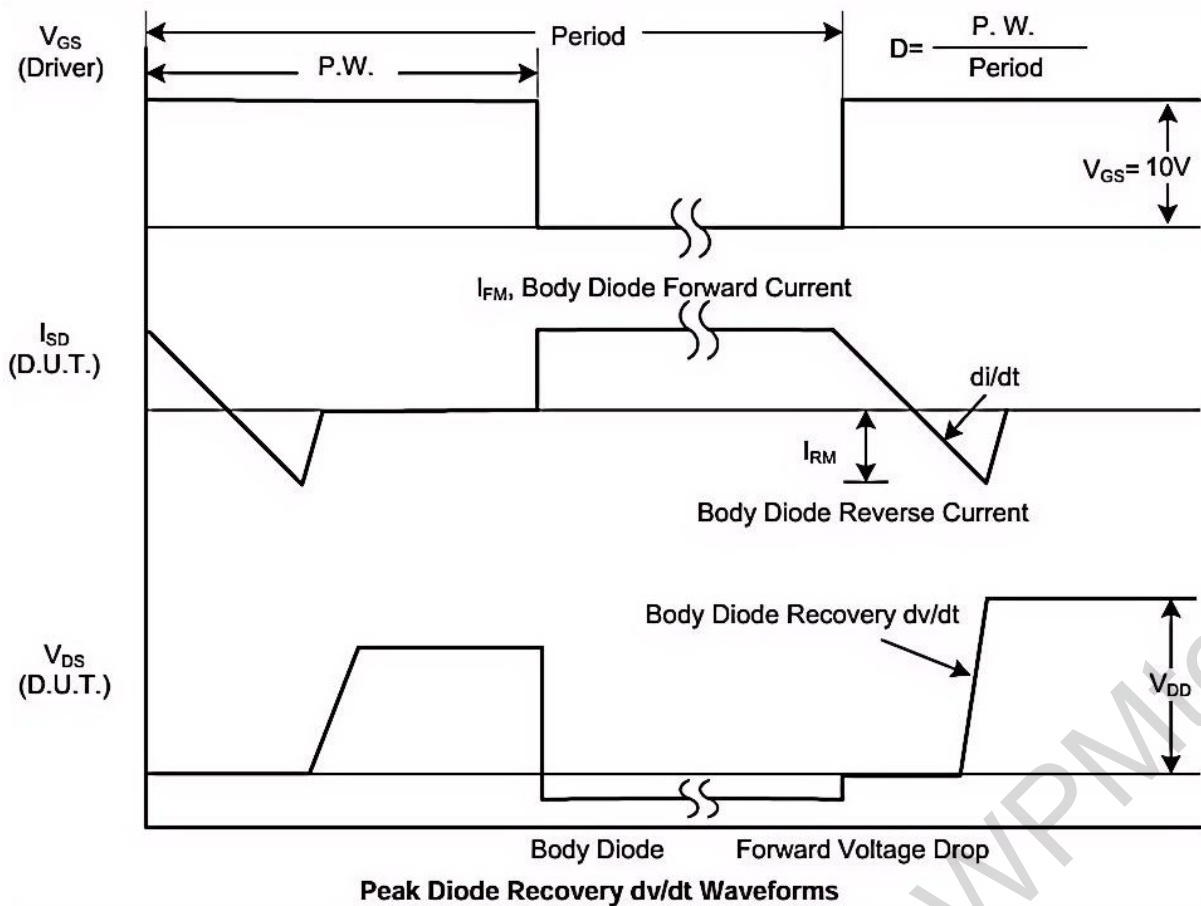
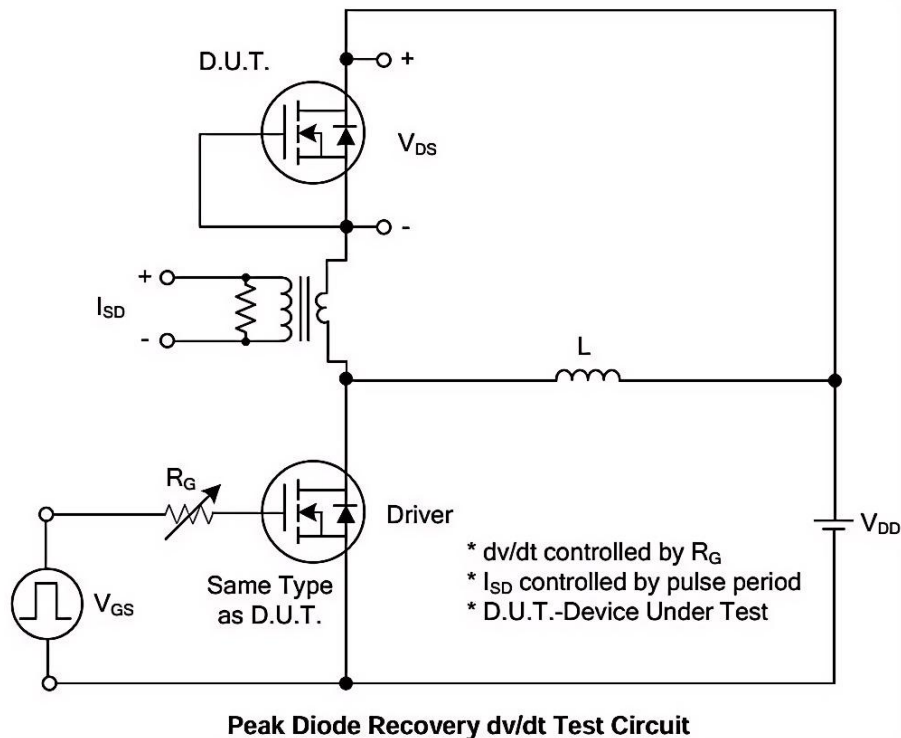
ELECTRICAL CHARACTERISTICS (TA=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	V(BR)DSS	VGS=0V, ID=250μA	650			V
Drain-Source Leakage Current	IDSS	VDS=650V, VGS=0V			1	μA
		VDS=480V, Tc=125°C			100	μA
Gate-Source Leakage Current	IGSS	VGS = ± 30V, VDS=0V			± 100	nA
Breakdown Voltage Temperature Coefficient	ΔBVDS / ΔTJ	ID=250μA Referenced to 25°C		0.6		V/°C
ON CHARACTERISTICS						
Drain-source on-state resistance	RDS(ON)	VGS=10V, ID=3A		2.8	3.5	Ω
Gate Threshold Voltage	VGS(TH)	VGS=VDS,ID=250μA	2.0		4.0	V
DYNAMIC PARAMETERS						
Input Capacitance	CISS	VGS=0V,VDS=25V,f=1.0MHz		570	750	pF
Output Capacitance	COSS			40	90	
Reverse Transfer Capacitance	CRSS			5	26	
SWITCHING PARAMETERS						
Total gate charge	Qg	VDS=520V,VGS=10V,ID=4.0A (Note 1, 2)		100	120	nC
Gate-source charge	Qgs			17	19	
Gate-drain charge	Qgd			20	26	
Turn-On Delay Time	td(on)	VDD=325V,RG=25Ω,ID=4.0A (Note 1, 2)		45	85	nS
Rise time	tr			100	140	
Turn-Off Delay Time	td(off)			200	240	
Fall time	tf			130	150	
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Continuous Drain-Source Current	IS				4	A
Pulsed drain-source current	ISM				10	A
Drain-Source Diode Forward Voltage	VSD	VGS = 0 V, IS = 4A			1.4	V
Reverse Recovery Time	trr	dIF/dt = 100A/μs, IS = 4.4A		250		ns
Reverse Recovery Charge	Qrr	VGS = 0V (Note 1)		1.5		μC

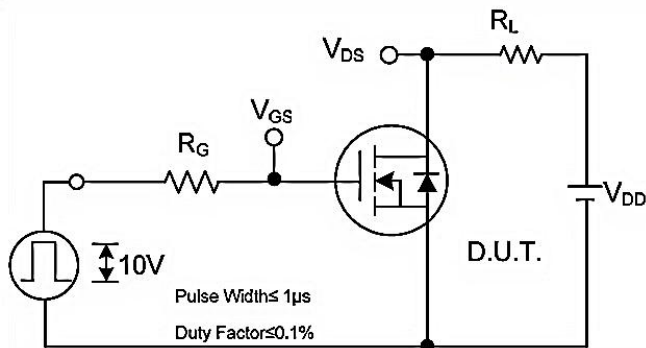
Notes:

1. Pulse Test : Pulse Width ≤ 300μs, duty cycle ≤ 2%.
2. Essentially independent of operating temperature.

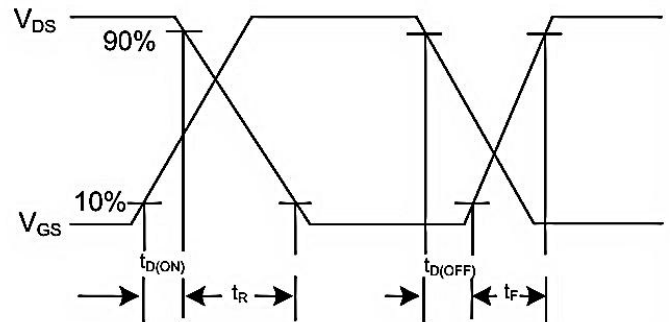
TEST CIRCUITS AND WAVEFORMS



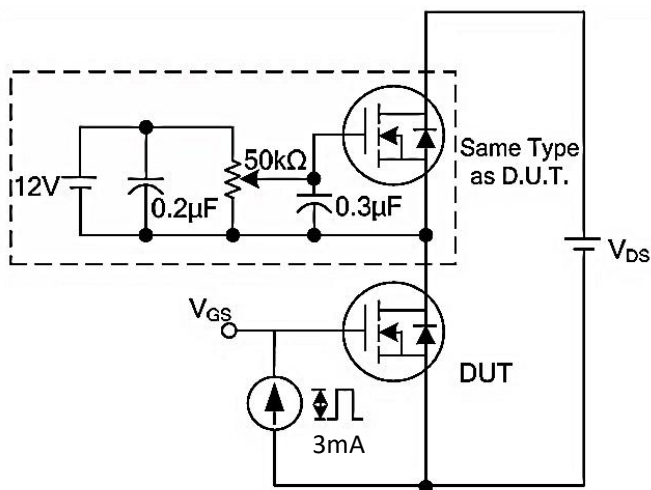
TEST CIRCUITS AND WAVEFORMS(Con.t)



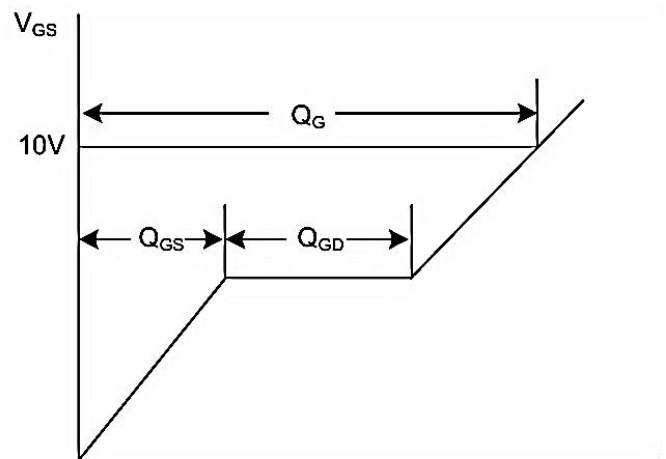
Switching Test Circuit



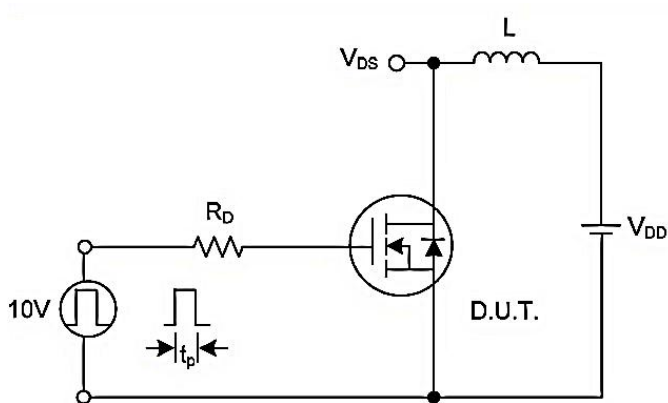
Switching Waveforms



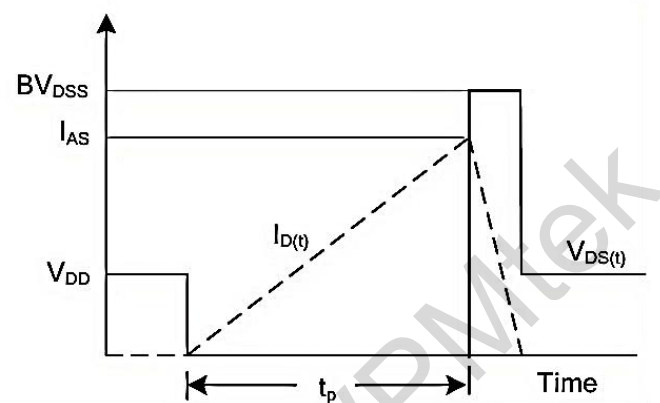
Gate Charge Test Circuit



Gate Charge Waveform

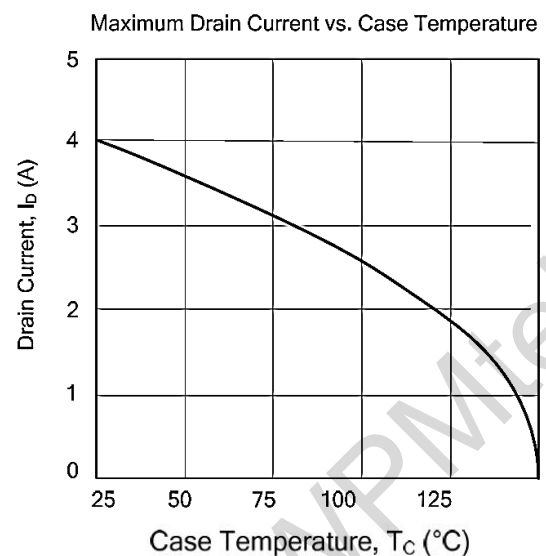
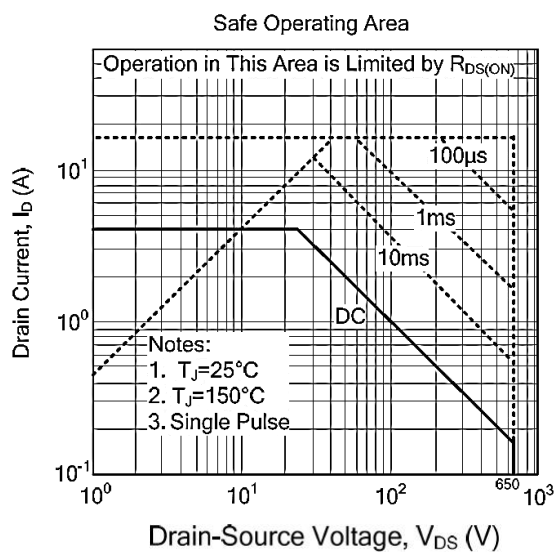
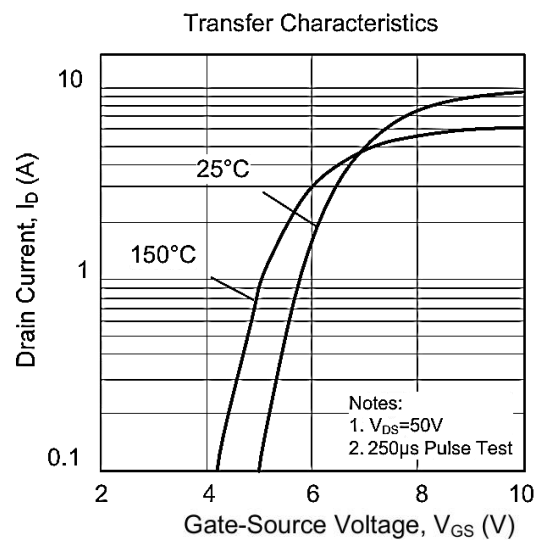
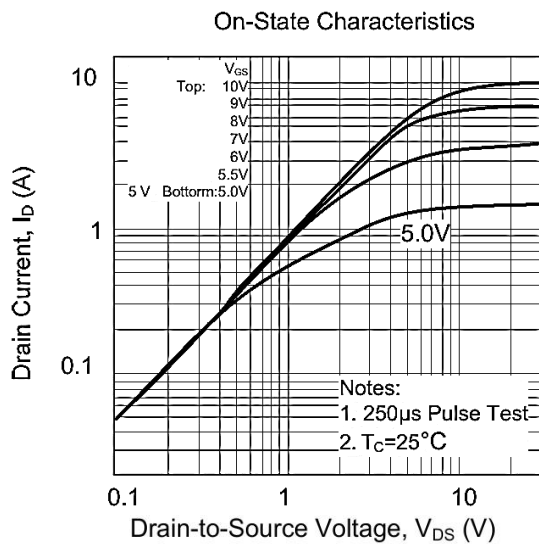
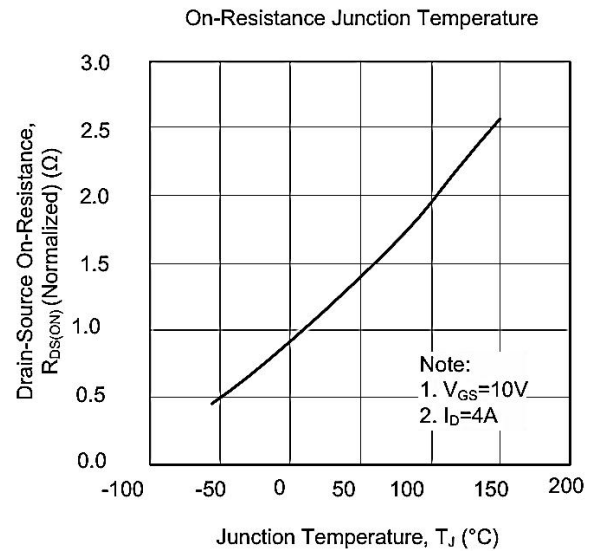
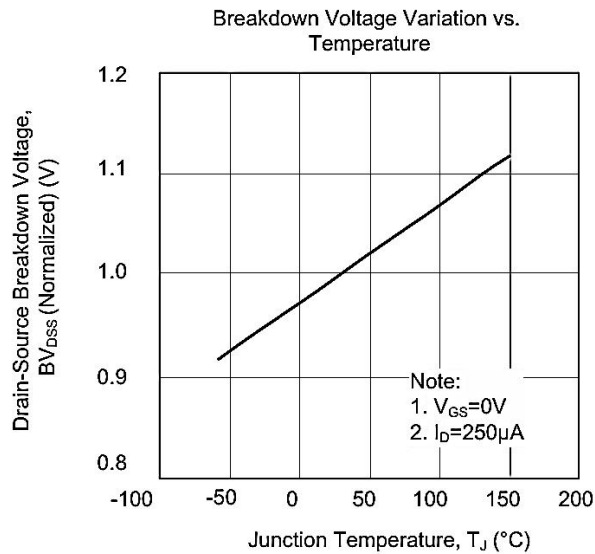


Unclamped Inductive Switching Test Circuit



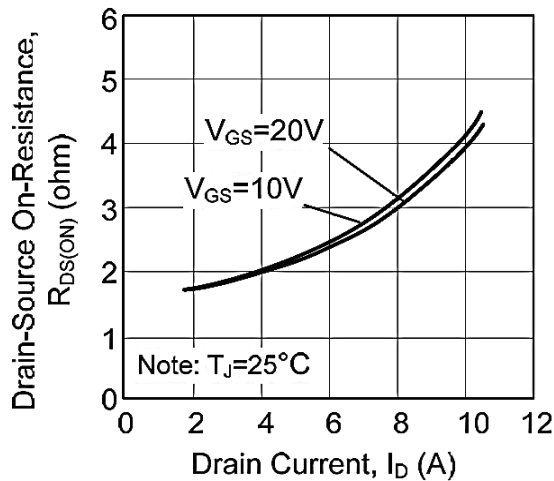
Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS

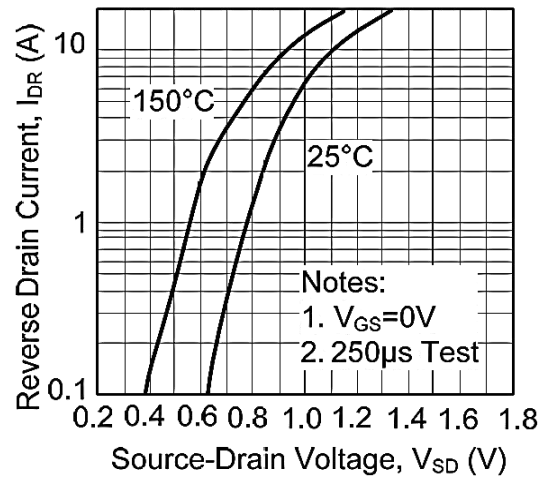


TYPICAL CHARACTERISTICS(Con.t)

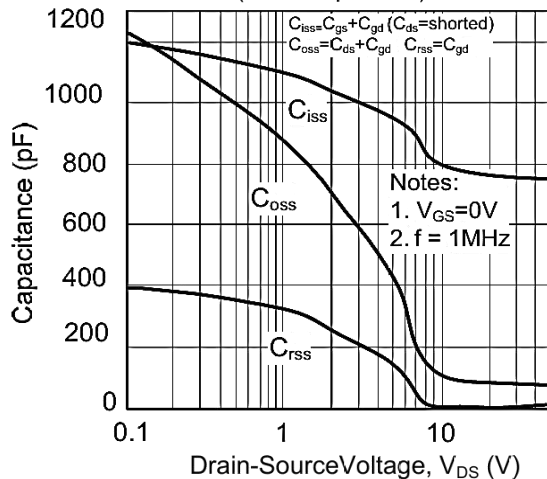
On-Resistance Variation vs. Drain Current and Gate Voltage



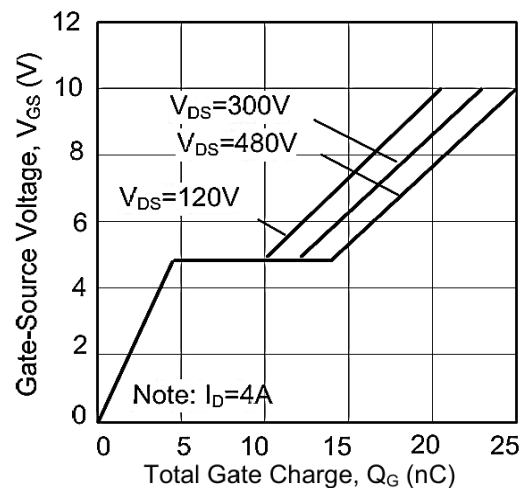
On State Current vs. Allowable Case Temperature



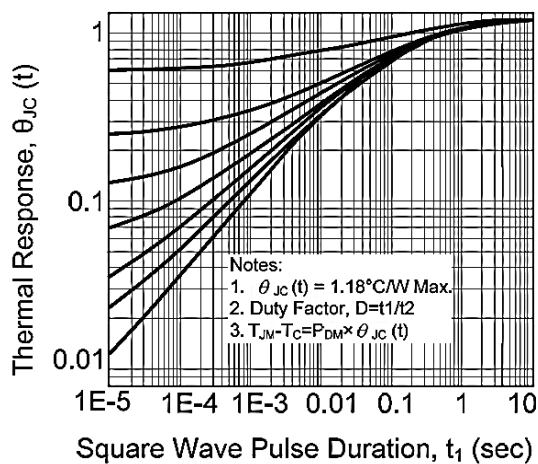
Capacitance Characteristics (Non-Repetitive)



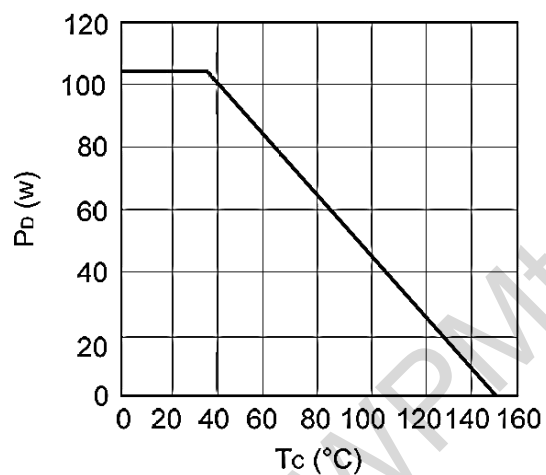
Gate Charge Characteristics



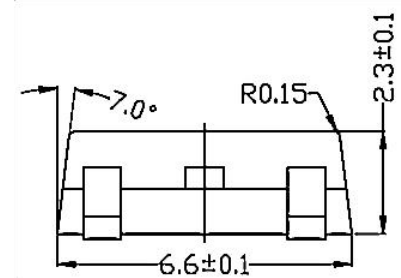
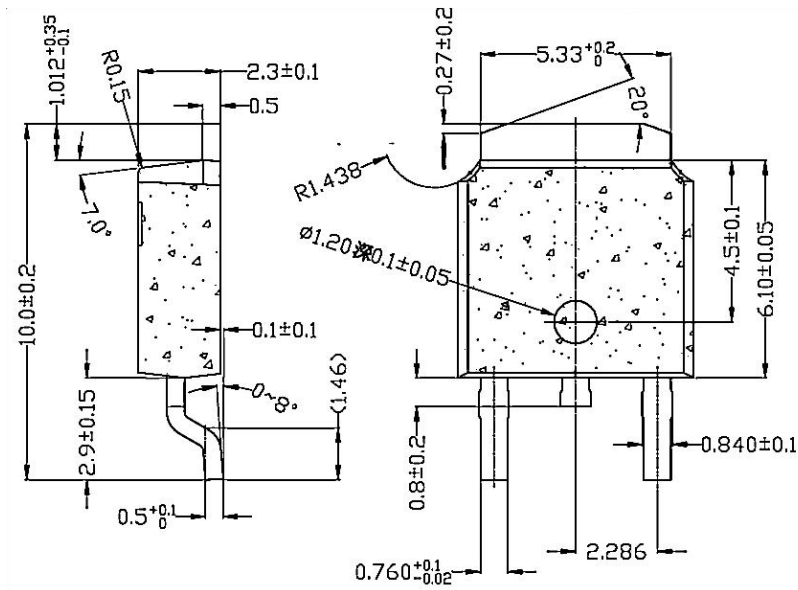
Transient Thermal Response Curve



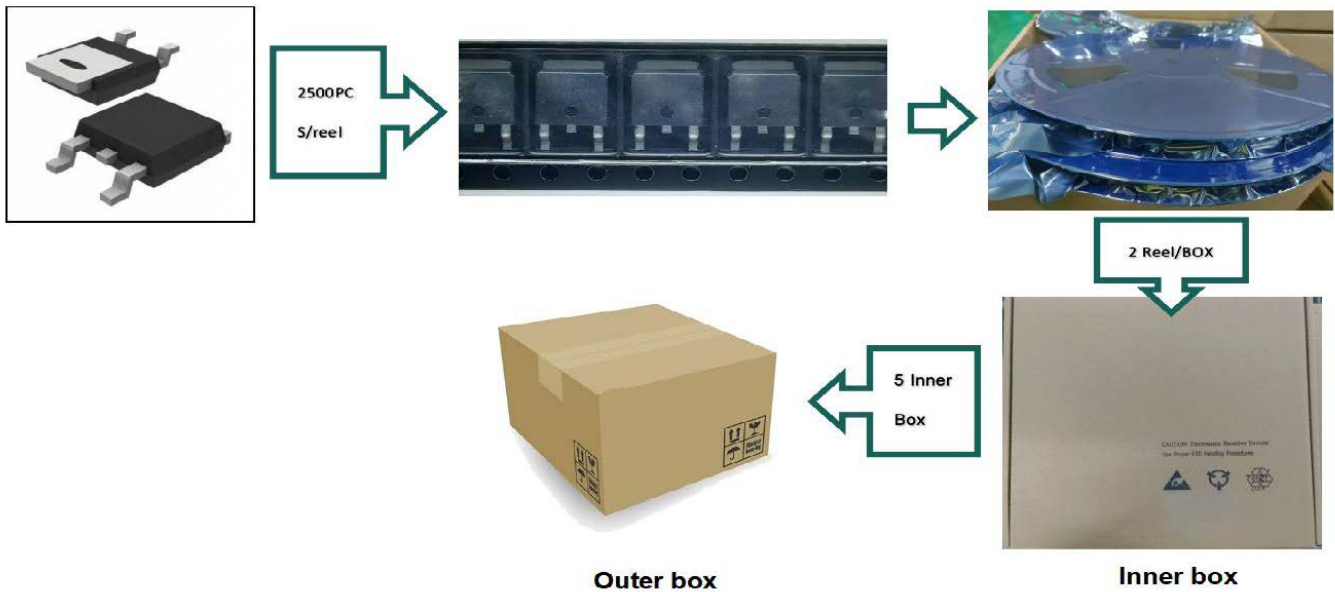
Power Dissipation



TO - 252 PACKAGE OUTLINE DIMENSIONS

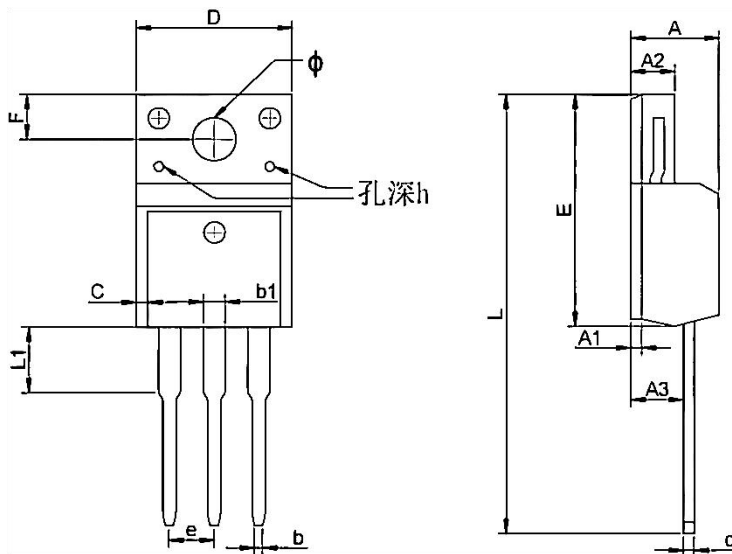


TO - 252 PACKING INFORMATION



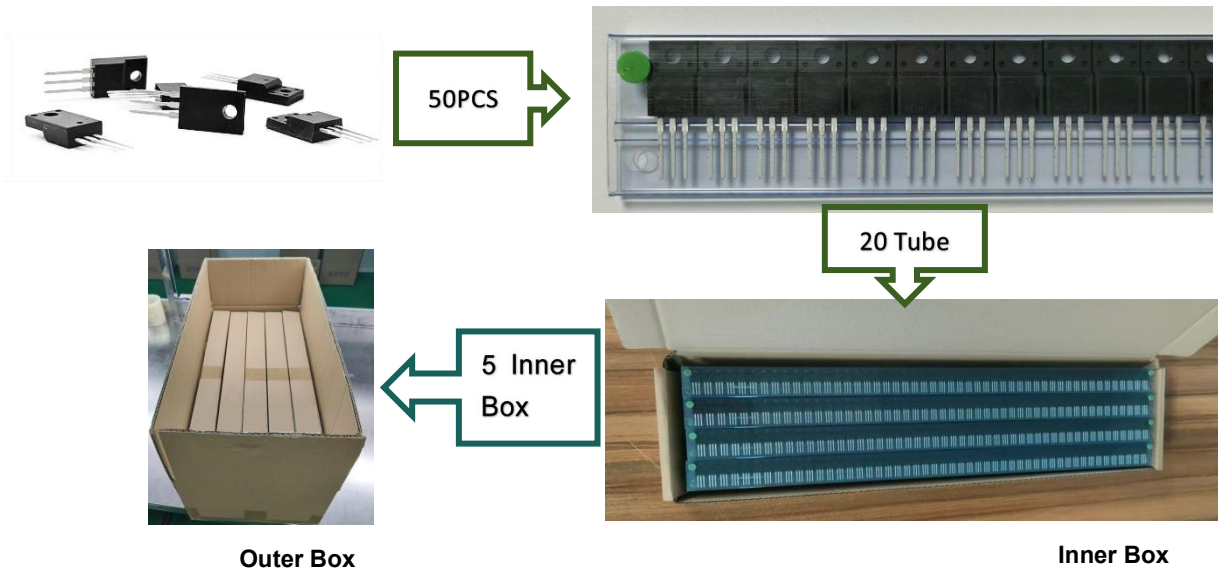
Package version	Reel dimensions $\Phi \times H$ (mm)	Per Reel (pcs)	Reels per box	Inner box dimensions $L \times W \times H$ (mm)	Outer box (pcs)	Outer box dimensions $L \times W \times H$ (mm)
TO-252	$\Phi 330 \times 20$	2500	2	360*340*50	25000	375*375*280

TO- 220F PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max	Min	Max
A	4.300	4.750	0.169	0.185
A1	1.830 REF		0.072 REF	
A2	2.300	2.850	0.090	0.112
A3	2.500	2.900	0.098	0.114
b	0.400	0.420	0.016	0.016
b1	1.220	1.280	0.048	0.050
C	0.690	0.720	0.027	0.028
c	0.490	0.510	0.019	0.020
D	9.960	10.200	0.392	0.400
E	15.000	15.950	0.588	0.625
e	2.574 TYP		0.101TYP	
F	3.470 REF		0.136 REF	
y	3.200 REF		0.125 REF	
h	0.000	0.300	0.000	0.012
L	28.780	28.900	1.128	1.133
L1	2.990	3.100	0.117	0.122

TO - 220F PACKING INFORMATION



Outer Box

Inner Box

Package version	Tube dimensions LxWxH (mm)	Per Tube (pcs)	Tube per box	Inner box dimensions LxWxH (mm)	PCS/ Inner box	Outer box dimensions LxWxH(mm)	PCS/ Outer box
TO-220F	530*32*7	50	20	580*155*50	1000	602*277*188	5000

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