

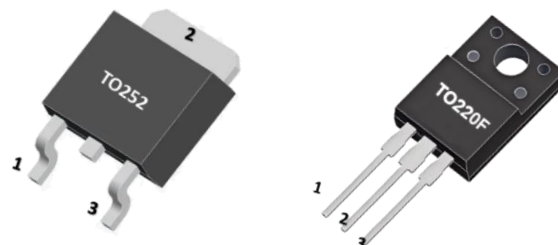
HY4N60

N-CHANNEL POWER MOSFET

4A, 600V N-CHANNEL POWER MOSFET

DESCRIPTION

The HY4N60A is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient AC to DC converters and bridge circuits.



FEATURES

- * $R_{DS(ON)} \leq 2.5\Omega$ @ $V_{GS} = 10V$, $I_D = 2.2A$
- * Fast Switching Capability
- * Avalanche Energy Specified
- * Improved dv/dt Capability, high Ruggedness

MARKING

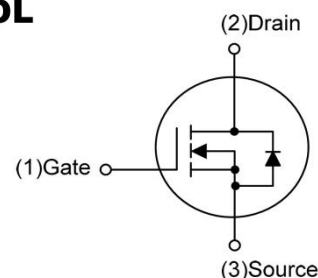


HY4N60A=Device Code

XXXX=Date Code

Solid Dot=Green molding compound

SYMBOL



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

SYMBOL	PARAMETER		VALUE	UNIT
V_{DS}	Drain-Source Voltage		600	V
V_{GS}	Gate Source Voltage		± 30	V
I_{AR}	Avalanche Current (Note 2)		4.4	A
I_D	Continuous Drain Current		4.0	A
I_{DM}	Pulsed Drain Current(Note 2)		16	A
E_{AS}	Avalanche Energy Single Pulsed (Note 3)		260	mJ
E_{AR}	Avalanche Energy Sepetitive (Note 2)		10.6	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 4)		4.5	V/ns
P_D	Power Dissipation	TO-220F	36	W
		TO-252	50	W
T_J	Junction Temperature		150	$^\circ C$
T_{STG}	Storage Temperature		-55 to 150	$^\circ C$
TOPR	Operating Temperature		-55 to 150	$^\circ C$

Notes: 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.



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2.Repetitive Rating : Pulse width limited by TJ.

3.L=30mH, IAS=4.0A, VDD=50V, RG=25 Ω, Starting TJ = 25°C

4.ISD≤4.4A, di/dt≤200A/μs, VDD ≤ BVDS, Starting TJ = 25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220F	θ_{JA}	62.5	°C/W
	TO-252		110	
Junction to Case	TO-220F	θ_{JC}	3.47	°C/W
	TO-252		2.5	

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

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250μA	600			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =600V, V _{GS} =0V			10	μA
			V _{DS} =480V, T _C = 125°C			100	
Gate-Source Leakage Current	Forward	I _{GSS}	V _{GS} =+30V, V _{DS} =0V			+100	nA
	Reverse		V _{GS} =-30V, V _{DS} =0V			-100	
Breakdown Voltage Temperature Coefficient		ΔBV _{DSS} /ΔT _J	I _D =250μA, Referenced to 25°C		0.6		V/°C
ON CHARACTERISTICS							
Drain-source on-state resistance		R _{DS(ON)}	V _{GS} =10V, I _D =2.2A		1.9	2.5	Ω
Gate Threshold Voltage		V _{GS(TH)}	V _{GS} =V _{DS} , I _D =250μA	2.0		4.0	V
DYNAMIC PARAMETERS							
Input Capacitance		C _{ISS}	V _{GS} =0V,V _{DS} =25V,f=1.0MHz		550	670	pF
Output Capacitance		C _{OSS}			80	100	pF
Reverse Transfer Capacitance		C _{RSS}			30	50	pF
SWITCHING PARAMETERS							
Total gate charge		Q _g	V _{DS} =480V,V _{GS} =10V,I _D =4.0A (Note 1, 2)		80	100	nC
Gate-source charge		Q _{gs}			5		
Gate-drain charge		Q _{gd}			20		
Turn-On Delay Time		td(on)	V _{DD} =300V,I _D =4.0A R _G =25Ω(Note 1, 2)		35	55	nS
Rise time		tr			80	110	
Turn-Off Delay Time		td(off)			160	200	
Fall time		tf			120	150	

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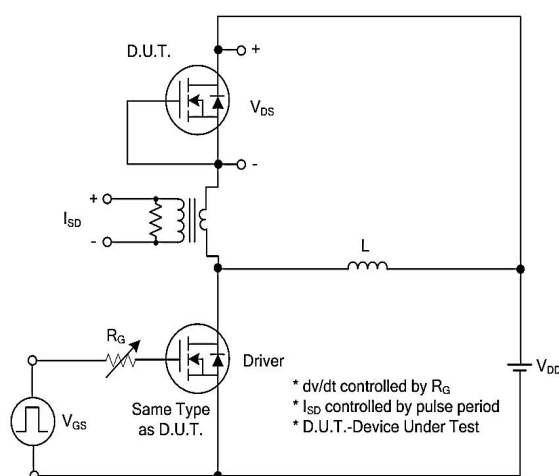
N-CHANNEL POWER MOSFET

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Continuous Drain-Source Diode Forward Current	I_S				4.4	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				17.6	A
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 4.4\text{ A}$			1.4	V
Reverse Recovery Time	t_{rr}	$V_{GS} = 0\text{ V}, I_S = 4.4\text{ A},$ $dI_F/dt = 100\text{ A}/\mu\text{s}$ (Note 1)		250		ns
Reverse Recovery Charge	Q_{rr}			1.5		μC

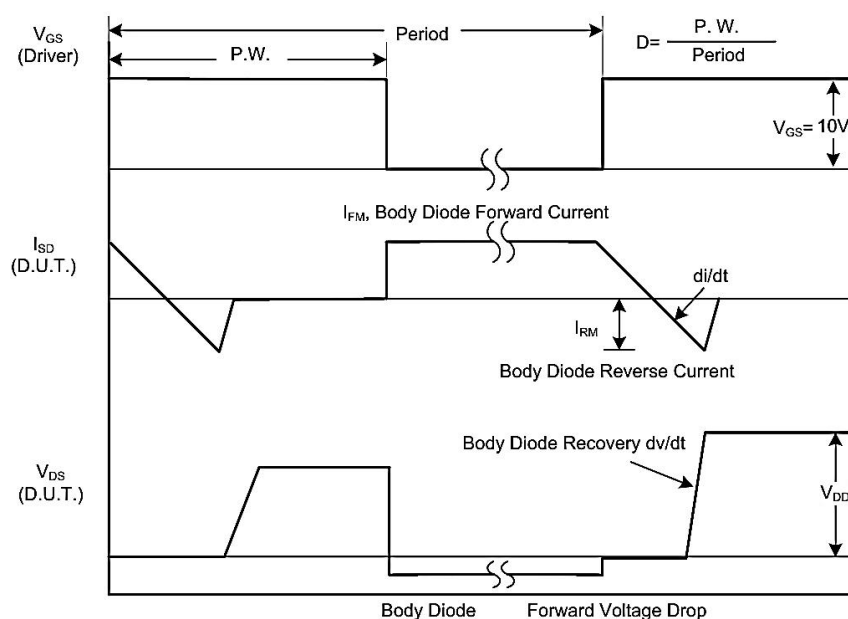
Notes:

- 1.Pulse test: pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$;
- 2.Guaranteed by design, not subject to production testing.

TEST CIRCUITS AND WAVEFORMS



Peak Diode Recovery dv/dt Test Circuit

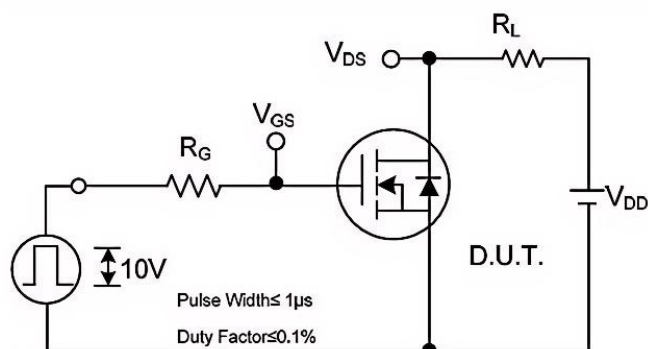


Peak Diode Recovery dv/dt Waveforms

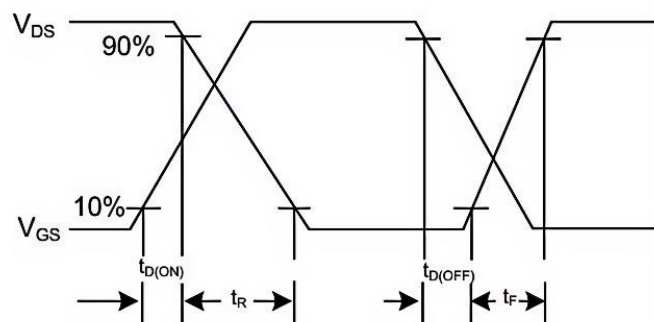
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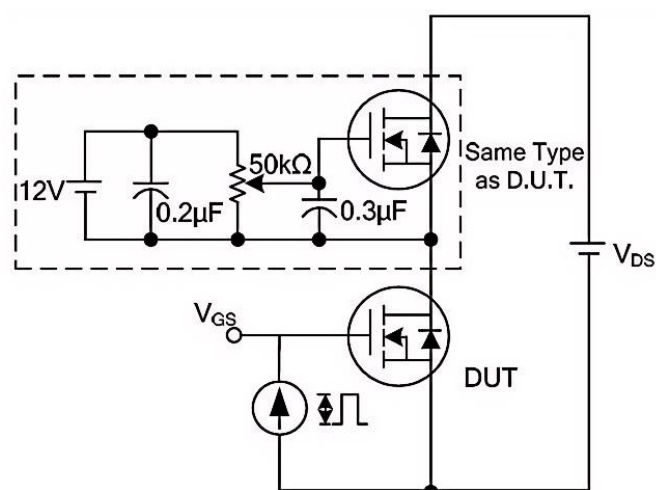
■ TEST CIRCUITS AND WAVEFORMS(Con.t)



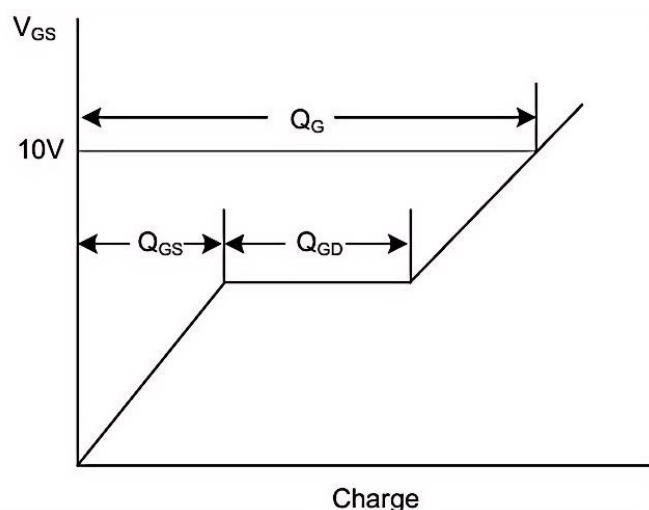
Switching Test Circuit



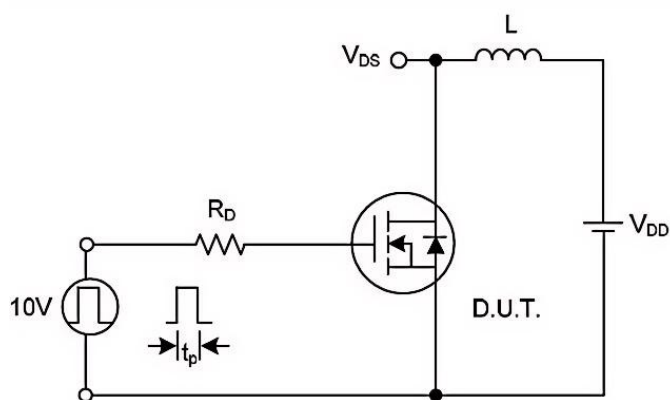
Switching Waveforms



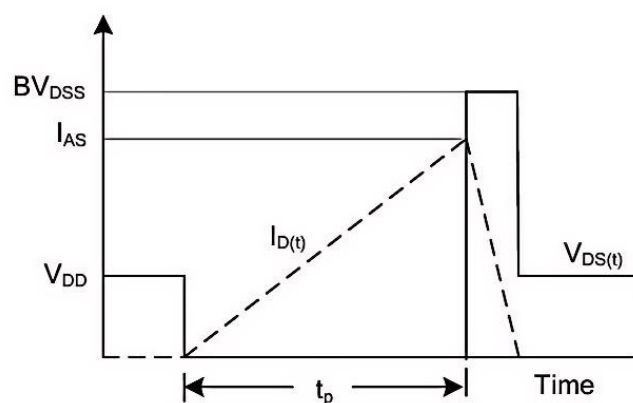
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



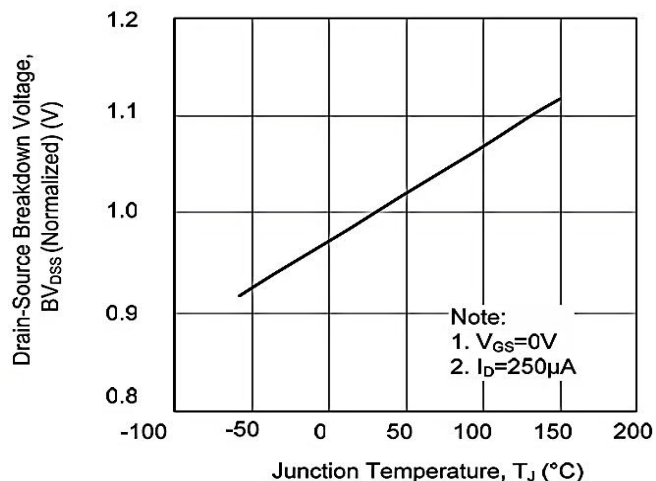
Unclamped Inductive Switching Waveforms

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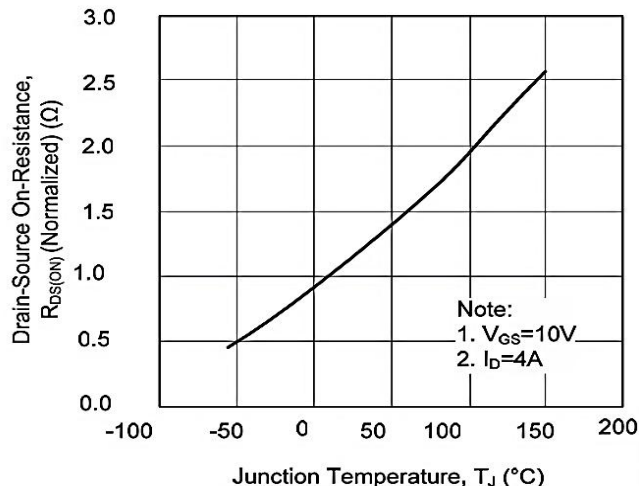
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TYPICAL CHARACTERISTICS

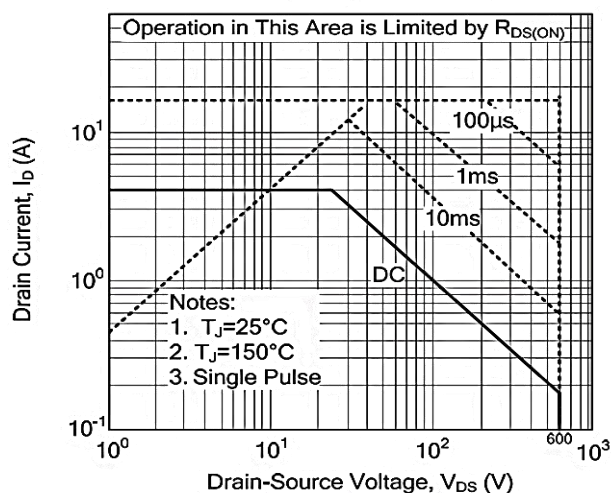
Breakdown Voltage Variation vs. Temperature



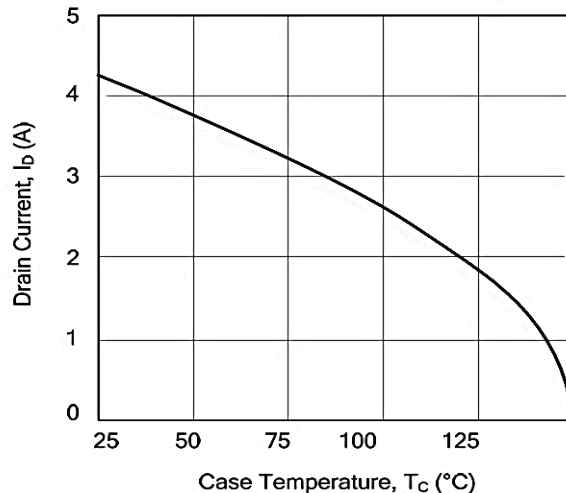
On-Resistance Junction Temperature



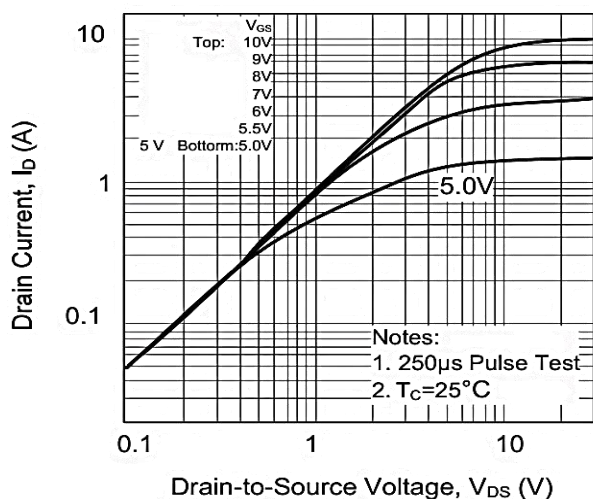
Safe Operating Area - 600V



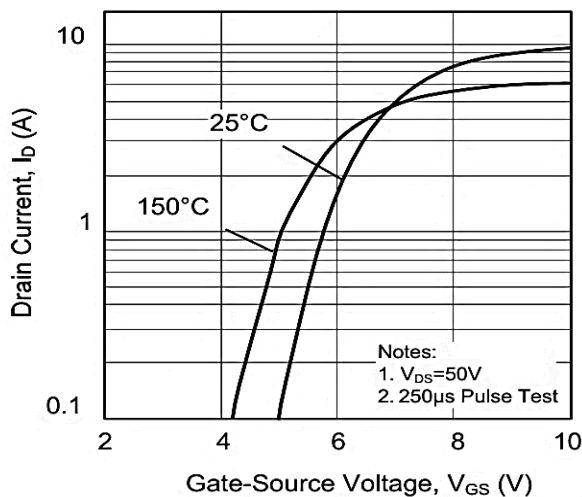
Maximum Drain Current vs. Case Temperature



On-State Characteristics

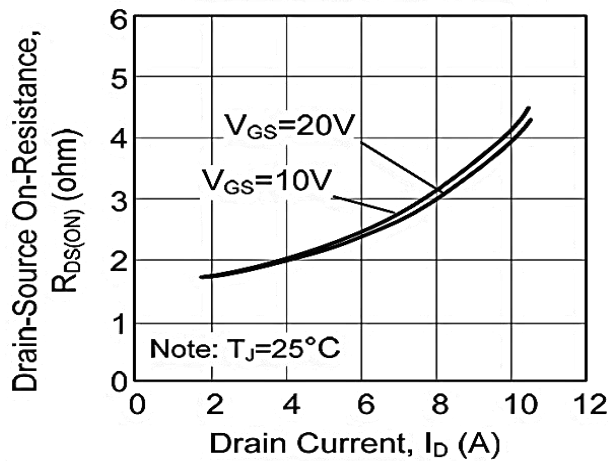


Transfer Characteristics

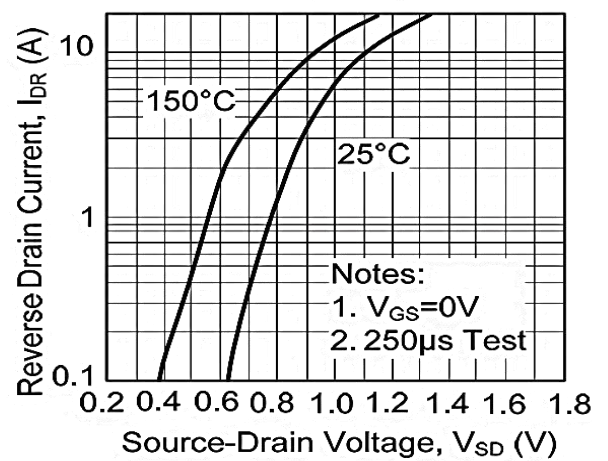


■ TYPICAL CHARACTERISTICS(Con.t)

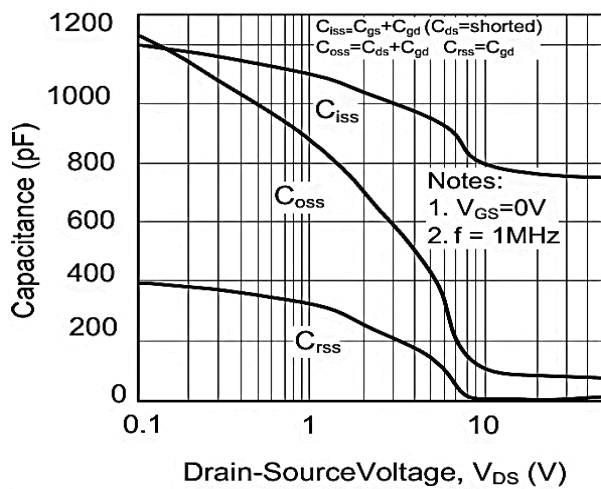
On-Resistance Variation vs. Drain Current and Gate Voltage



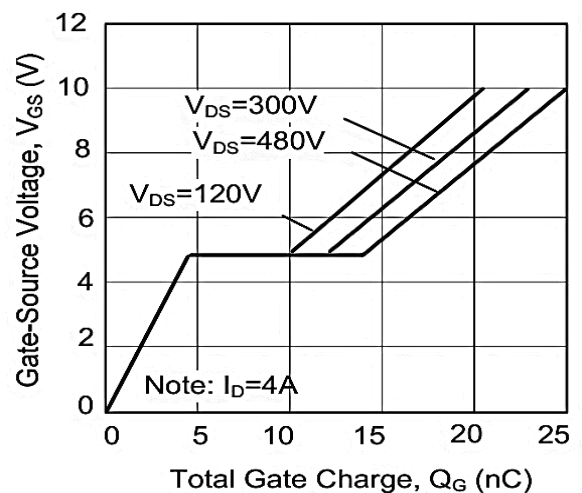
On State Current vs. Allowable Case Temperature



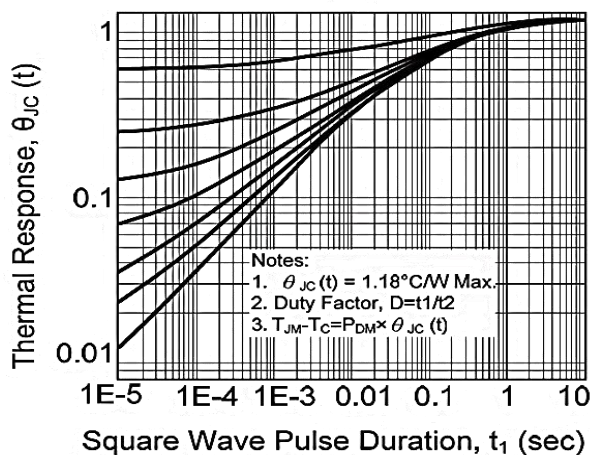
Capacitance Characteristics (Non-Repetitive)



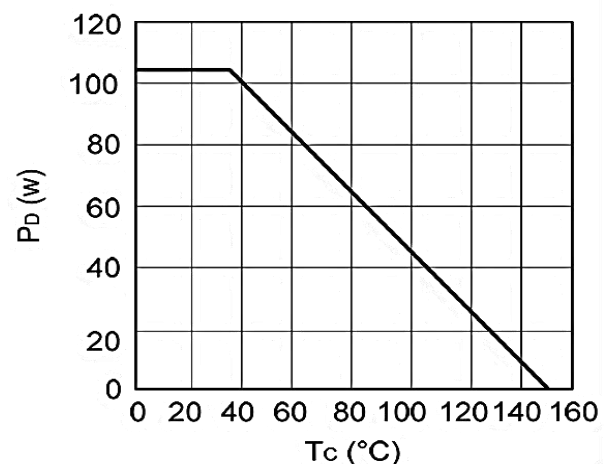
Gate Charge Characteristics



Transient Thermal Response Curve



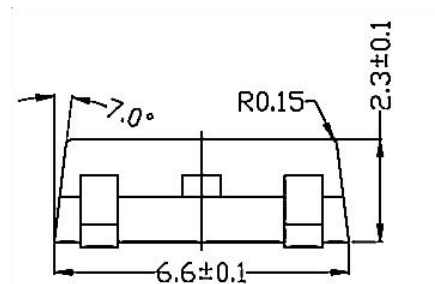
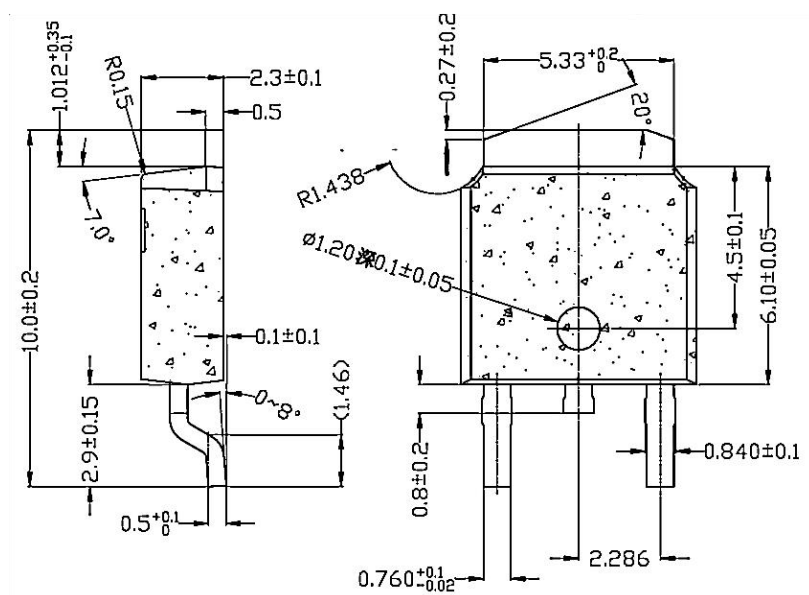
Power Dissipation



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TO - 252 PACKAGE OUTLINE DIMENSIONS



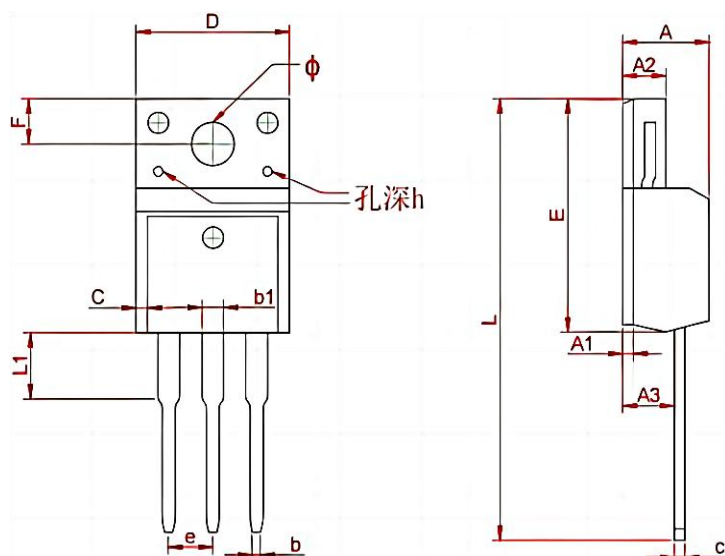
TO - 252 PACKING INFORMATION

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)
T0-252	$\Phi 330 \times 20$	2500	2	360*340*50	25000	375*375*280

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TO-220F PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters	
	Min	Max
A	4.300	4.750
A1	0.7 REF	
A2	2.300	2.850
A3	2.500	2.900
b	0.380	0.420
b1	1.220	1.280
C	1.08	1.200
c	0.480	0.520
D	10.15	10.450
E	15.700	15.950
e	2.574 TYP	
F	3.470 REF	
y	3.200 REF	
h	0.000	0.800
L	28.780	28.900
L1	2.990	3.100

TO - 220F PACKING INFORMATION

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