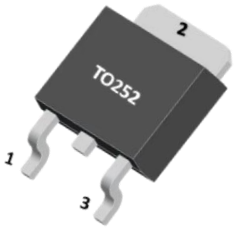
-40A, -40V P-CHANNEL ENHANCEMENT MODE POWER MOSFET

■ DESCRIPTION

The HY40P04A uses advanced trench technology and design to provide excellent RDS(ON) with low gate charge. This device is well suited for high current load applications.

The HY40P04 meet the ROHS and Green Product requirement with full function reliability approved.



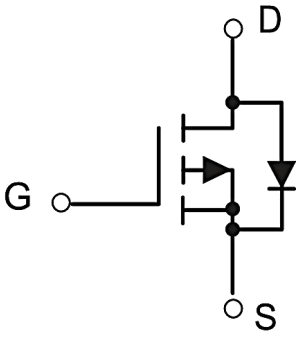
■ FEATURES

*High density cell design for ultra low RDS(ON)
*Fully characterized Avalanche voltage
*Good stability and uniformity with high EAS
*Excellent package for good heat dissipation
*Special process technology for high ESD capability
*Uninterruptible Power Supply

■ APPLICATIONS

*High density cell design for ultra low RDS(ON)
*Hard switched and high frequency circuits

SYMBOL



■ MARKING

: HY LOGO
HY40P04A=Device Code
XXXX=Date Code
Solid Dot=Green molding compound

■ ABSOLUTE MAXIMUM RATINGS(TA=25°C, unless otherwise specified.)

SYMBOL	PARAMETER		VALUE	UNIT
VDSS	Drain-Source Voltage		-40	V
VGSS	Gate Source Voltage		±20	V
ID	Continuous Drain Current		-40	A
IDM	Pulsed Drain Current (Note 2)		-80	A
EAS	Single Pulsed Avalanche Energy (Note 3)		71	mJ
PD	Maximum Power Dissipation	TO-220F	31	W
		TO-252	46	
TJ	Storage Temperature		150	°C
TSTG	Thermal Resistance Fr .0om Junction To Ambient		-55~150	°C

Notes: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 = 0.1mH, IAS = -37.8A, VDD = -20V, RG = 25Ω, Starting TJ = 25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220F	θJA	62.5	°C/W
	TO-252		110 (Note)	
Junction to Case	TO-220F	θJC	4	°C/W
	TO-252		2.7 (Note)	
Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.				

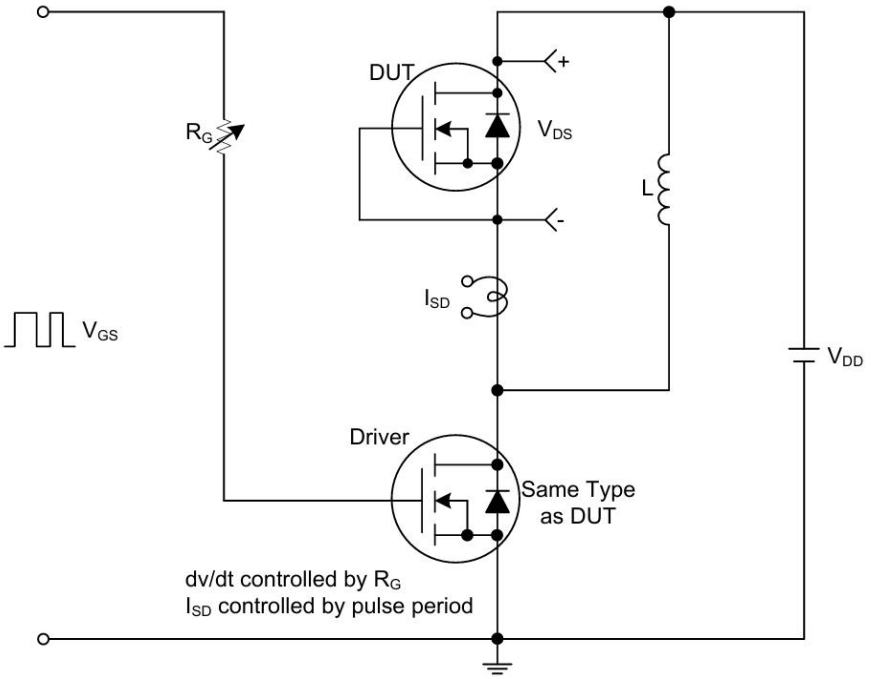
■ ELECTRICAL CHARACTERISTICS (TA=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	$V_{(BR)\ DSS}$	V_{GS}=0V, I_D=-250μA	-40			V
Zero gate voltage drain current	I_{DSS}	V_{DS}=-32V,V_{GS}=0V			-1	μA
Gate-Source Leakage Current	I_{GSS}	V_{GS}=±20V, V_{DS}=0V			±100	nA
ON CHARACTERISTICS						
Drain-source on-state resistance	$R_{DS(ON)}$	V_{GS}=-10V, I_D=-20A			20	mΩ
		V_{GS}=-4.5V, I_D=-20A			30	mΩ
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS}=V_{DS},I_D=-250μA	-1.0		-3.0	V
DYNAMIC PARAMETERS						
Input Capacitance	C_{ISS}	V_{GS}=0V,V_{DS}=-20V f=1.0MHz		2400		pF
Output Capacitance	C_{OSS}			270		
Reverse Transfer Capacitance	C_{RSS}			240		
SWITCHING PARAMETERS						
Total gate charge	Qg	V_{DS}=-32V,V_{GS}=-10V I_D=-40A,I_G=-1mA (Note 1, 2)		55		nC
Gate-source charge	Qgs			8		
Gate-drain charge	Qgd			14		
Turn-On Delay Time	td(on)	V_{DD}=-20V,I_D=-40A V_{GS}=-10V, R_G=3Ω (Note 1, 2)		10		nS
Rise time	tr			18		
Turn-Off Delay Time	td(off)			88		
Fall time	tf			46		
DRAIN-SOURCE DIODE CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V_{SD}	I_S=-40A,V_{GS}=0V(Note 1)			-1.4	V
Body Diode Reverse Recovery Time	trr	I_F=-30A, di/dt=100A/μs		92		ns
Body Diode Reverse Recovery Charge	Qrr			400		μC

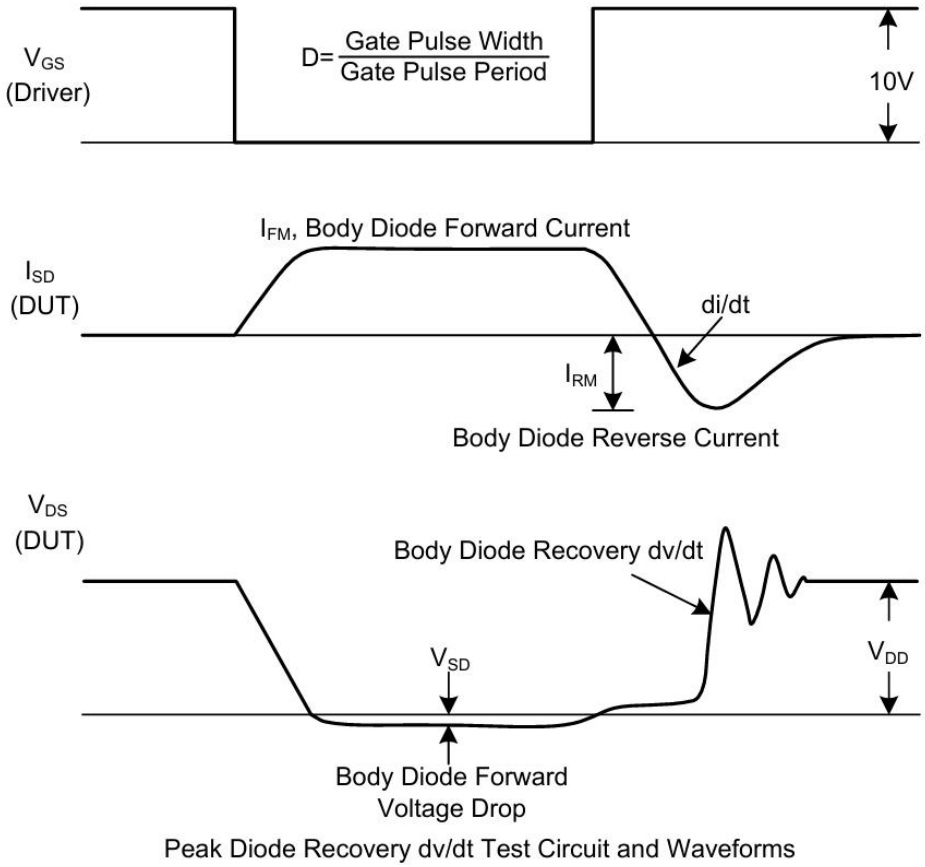
Notes:

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

■ TEST CIRCUITS AND WAVEFORMS



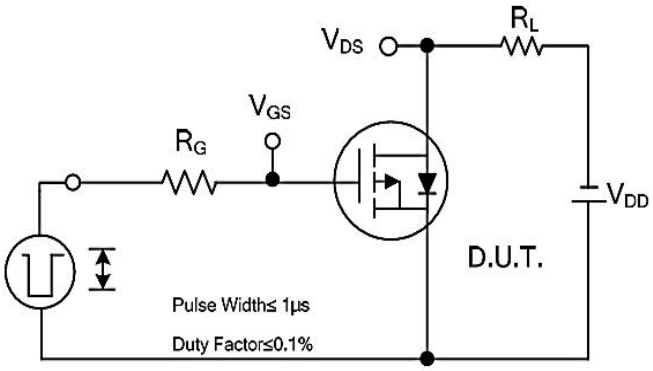
Peak Diode Recovery dv/dt Test Circuit



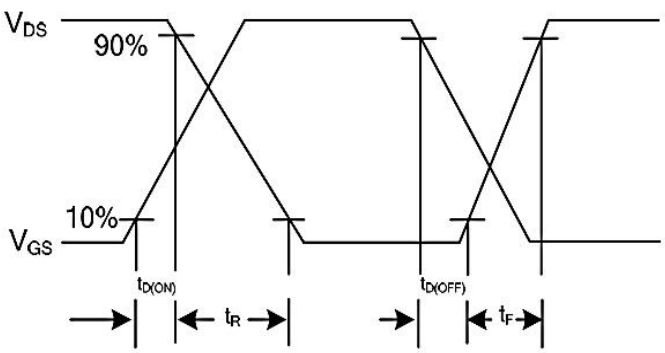
Peak Diode Recovery dv/dt Test Circuit and Waveforms

Peak Diode Recovery dv/dt Waveforms

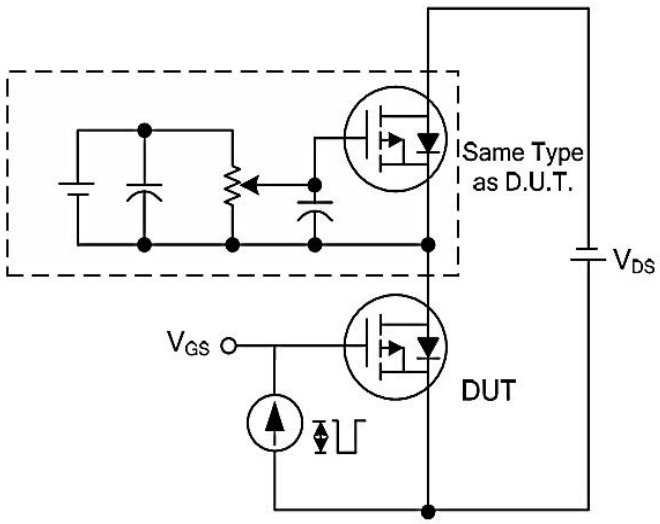
■ TEST CIRCUITS AND WAVEFORMS(Con.t)



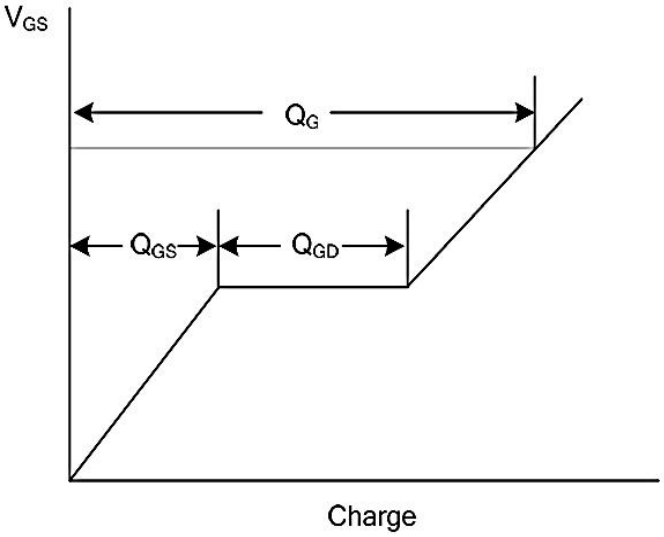
Switching Test Circuit



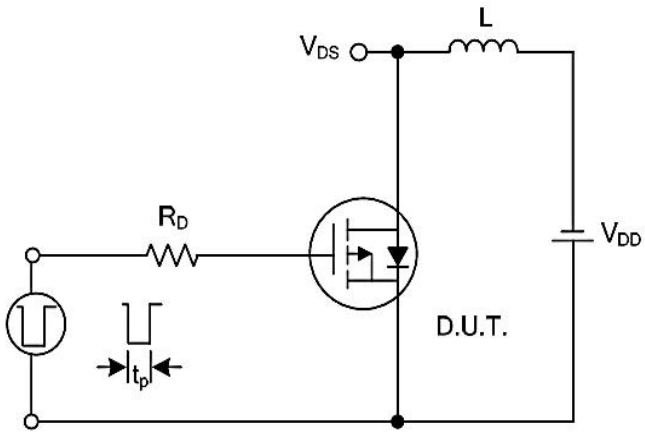
Switching Waveforms



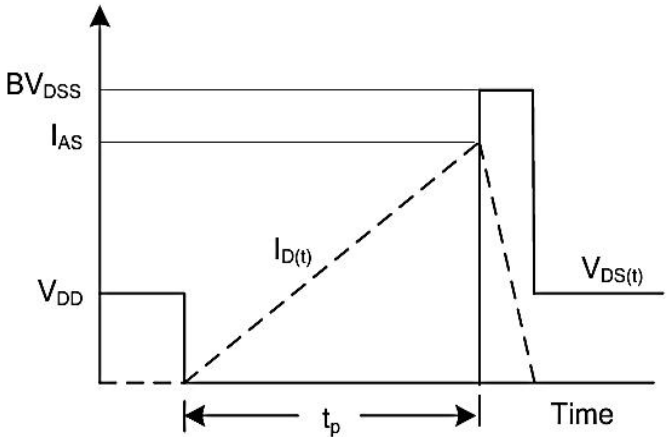
Gate Charge Test Circuit



Gate Charge Waveform



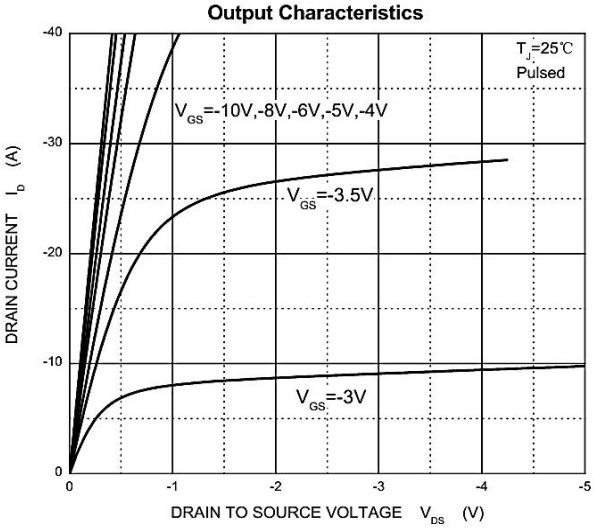
Unclamped Inductive Switching Test Circuit



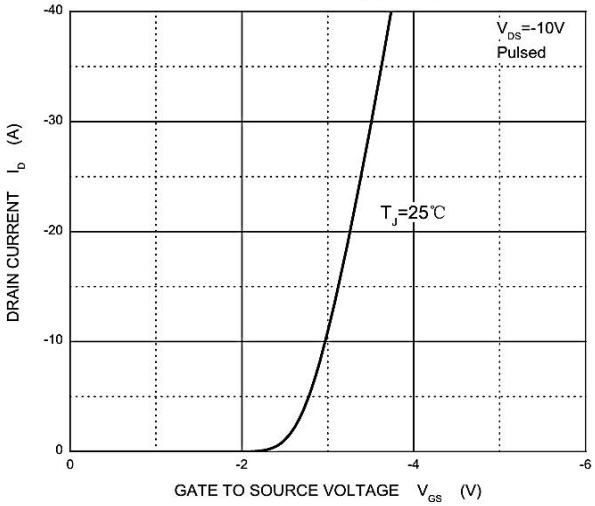
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

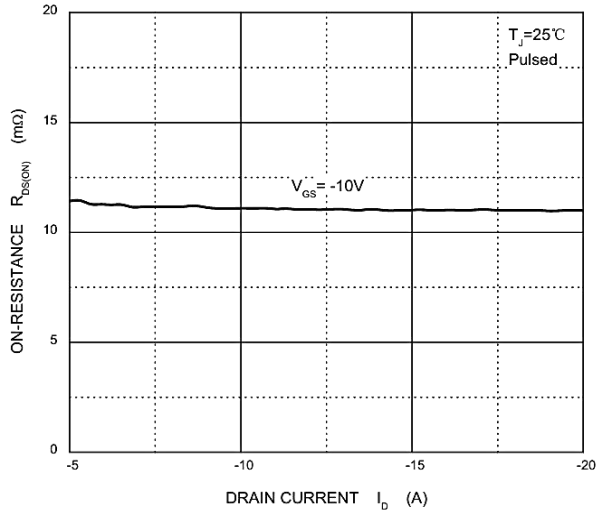
Output Characteristics



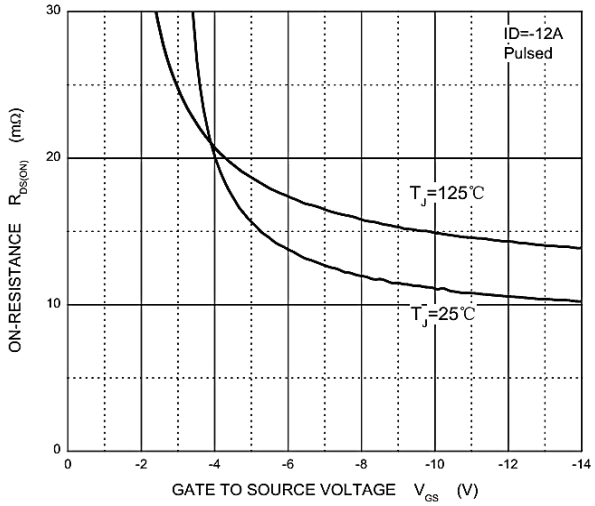
Transfer Characteristics



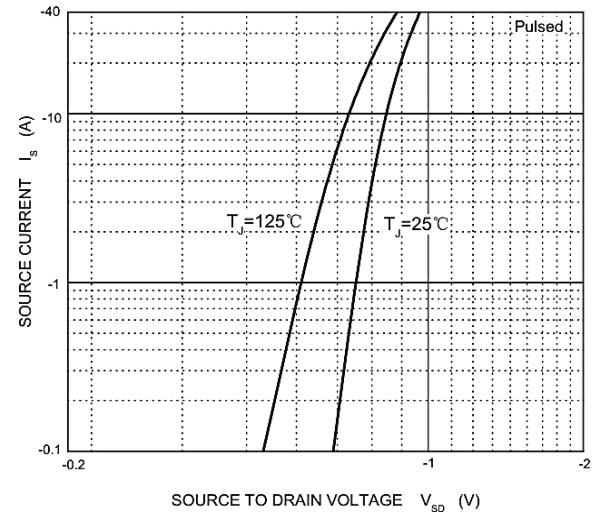
$R_{DS(ON)}$ —— I_D



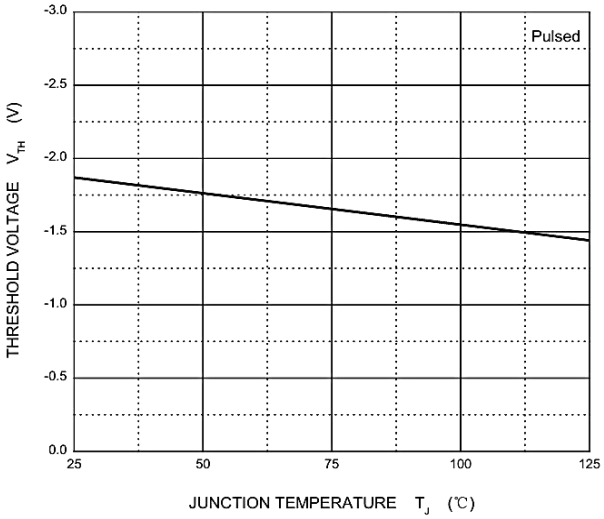
$R_{DS(ON)}$ —— V_{GS}



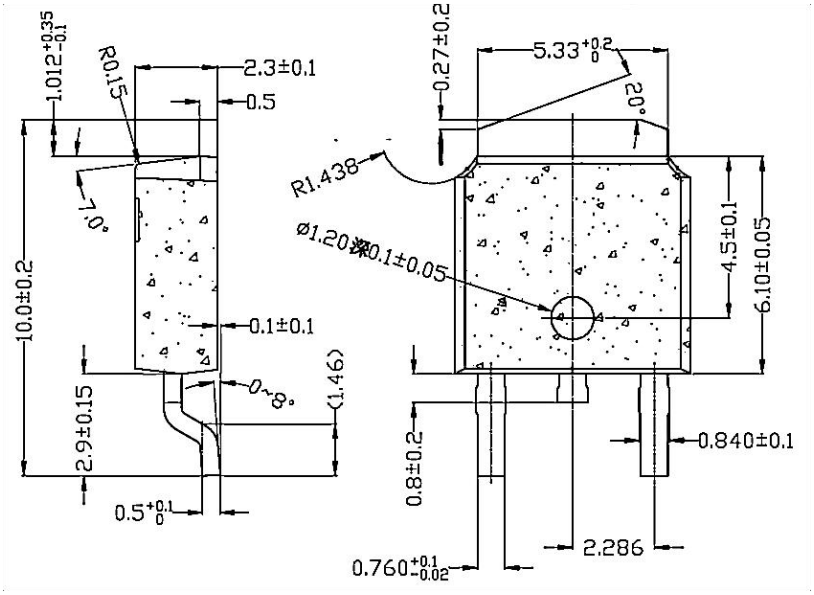
I_S —— V_{SD}

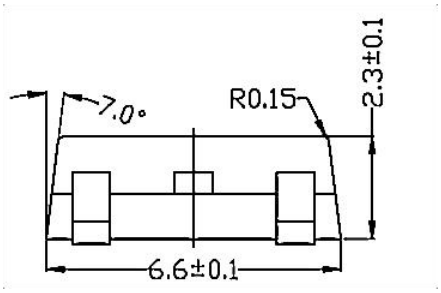


Threshold Voltage

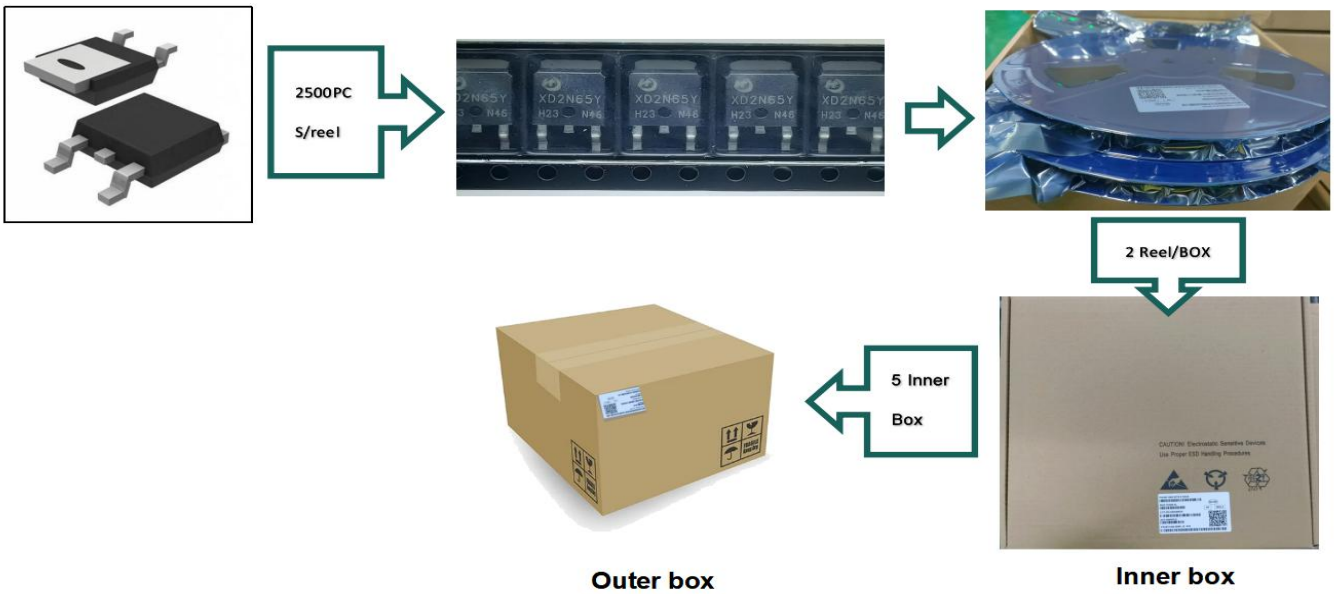


■ TO - 252 PACKAGE OUTLINE DIMENSIONS



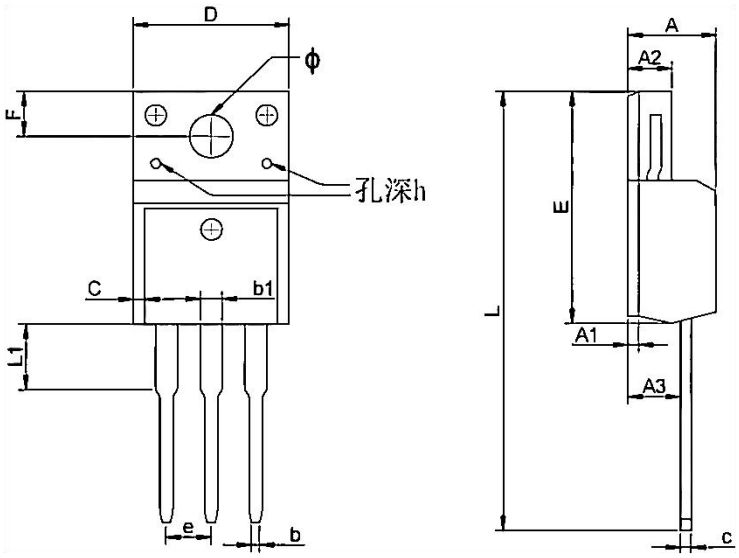


■ TO - 252 PACKING INFORMATION



Package version	Reel dimensions Φ×H (mm)	Per Reel (pcs)	Reels per box	Inner box dimensions L×W×H(mm)	Outer box (pcs)	Outer box dimensions L×W×H (mm)
TO-252	Φ330*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

50PCS

20 Tube

5 Inner Box

Outer Box

Inner Box

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