

P-Channel Enhancement Mode MOSFET

Feature

- 100V AEA
- R_{DS(on)} 42mΩ (Typ) @ V_{GS} = 10V
- R_{DS(on)} 48mΩ (Typ) @ V_{GS} = 4.5V
- 100% Avalanche Tested
- Reliable and Rugged
- Halogen Free and Green Devices Available (RoHS Compliant)

Pin Description

Applications

- Portable equipment and battery powered systems
- DC-DC Converters
- Motor control

Ordering and Marking Information

D	U	V	Package Code	U
G400P10	G400P10	G400P10	D: TO-252-ZL	U: TO-251-3L
XXXXXXXX	XXXXXXXX	XXXXXXXX	V: TO-251-3S	
			Marking Code	XXXXXXXX

Note: HJAYI lead-free products contain molting compounds for attach materials and 100% matte in plain Termi-Nation finish, which are fully compliant with RoHS. HJAYI lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020 for MSL classification at lead-free peak reflow temperature. HJAYI defines "Green" to mean lead-free (RoHS compliant) and halogen free (Br & Cl does not exceed 800ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight).

HJAYI reserves the right to make changes, corrections, enhancements, modifications, and improvements to this product and/or to this document at any time without notice.

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Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
Common Ratings (Tc=25°C Unless Otherwise Noted)			
V _{DS}	Drain-Source Voltage	-100	V
V _{GS}	Gate-Source Voltage	-6.0	V
T _J	Maximum Junction Temperature	175	°C
T _{stg}	Storage Temperature Range	-55 to 175	°C
Source Current (Continuous/Body Diode)			
I _{SM}	Pulsed Drain Current *	Tc=25°C	-145 A
I _S	Continuous Drain Current	Tc=25°C	-40 A
P _D	Maximum Power Dissipation	Tc=100°C	-25.3 W
		Tc=25°C	-100 W
R _{θJC}	Thermal Resistance, Junction-to-Case	1.5	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient	170	°C/W
E _{AS}	Single-Pulse Avalanche Energy **	140-304†	mJ

Note: * Repetitive rating, pulse width limited by max junction temperature.
 ** Surface mounted on 1x2 FR-4 board.
 † Limited by T_{max}, starting Tc=25°C, L = 0.3cm, V_{DS}=80V, V_{GS}=10V

Electrical Characteristics (Tc=25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	HYG400P10LR1			Unit
			Min	Typ	Max	
Static Characteristics						
BV _{DS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =250μA	-100	-	-	V
I _{SS}	Drain-Source Leakage Current	V _{GS} =0V, V _{DS} =10V	-	-	-1	μA
I _{GS}	Gate-Source Leakage Current	V _{GS} =10V, V _{DS} =0V	-	-	-1	μA
V _{GS(th)}	Gate Threshold Voltage	V _{GS} =V _{DS} , I _{DS} =250μA	-1	-2	-3	V
I _{GS(off)}	Gate-Source Leakage Current	V _{GS} =20V, V _{DS} =0V	-	-	±100	μA
R _{DS(on)}	Drain-Source On-State Resistance	V _{GS} =10V, I _{DS} =20A	-	42	55	mΩ
Diode Characteristics						
V _{SD}	Diode Forward Voltage	I _{SM} =-20A, V _{GS} =0V	-	-0.8	-1.3	V
t _{rr}	Reverse Recovery Time	I _{SM} =-20A, I _{FSM} =100A, μs	-	80	-	ns
Q _r	Reverse-Recovery Charge		-	70	-	nC

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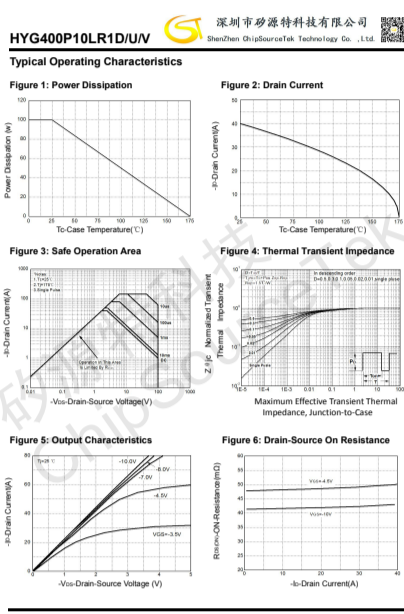
Electrical Characteristics (Cont.) (Tc=25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	HYG400P10LR1			Unit
			Min	Typ	Max	
Dynamic Characteristics						
R _g	Gate Resistance	V _{GS} =0V, V _{DS} =0V, f=10kHz	-	9.4	-	Ω
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =0V	-	3000	-	pF
C _{oss}	Output Capacitance	V _{GS} =10V, V _{DS} =10V	-	180	-	pF
C _{rs}	Reverse Transfer Capacitance	Frequency=1.0MHz	-	111	-	pF
t _{on}	Turn-on Delay Time	V _{GS} =10V, V _{DS} =0V, I _{DS} =20A	-	22	-	ns
t _r	Rise Time	V _{GS} =10V, V _{DS} =0V, I _{DS} =20A	-	28	-	ns
t _{off}	Turn-off Delay Time	V _{GS} =10V, V _{DS} =0V, I _{DS} =20A	-	74	-	ns
t _f	Fall Time	V _{GS} =10V, V _{DS} =0V, I _{DS} =20A	-	66	-	ns
Gate Charge Characteristics						
Q _g	Total Gate Charge	V _{GS} =10V, V _{DS} =10V, I _{DS} =20A	-	83.1	-	nC
Q _{gs}	Gate-Source Charge	I _{DS} =15A	-	16.8	-	nC
Q _{gd}	Gate-Drain Charge		-	52	-	nC

Note: ** Pulse test, pulse width is 300μs, duty cycle is 5.2%

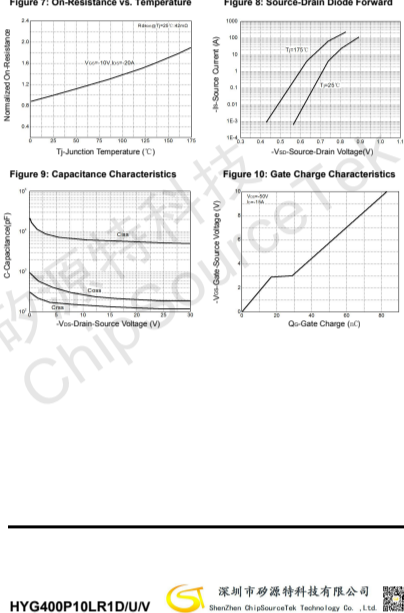
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Typical Operating Characteristics



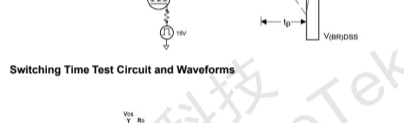
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Typical Operating Characteristics(Cont.)

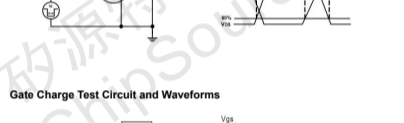


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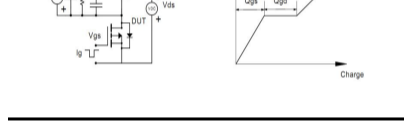
Avalanche Test Circuit and Waveforms



Switching Time Test Circuit and Waveforms



Gate Charge Test Circuit and Waveforms

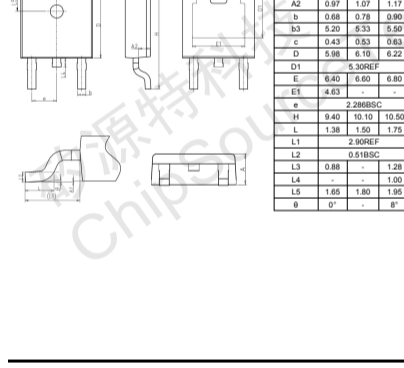


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Device Per Unit

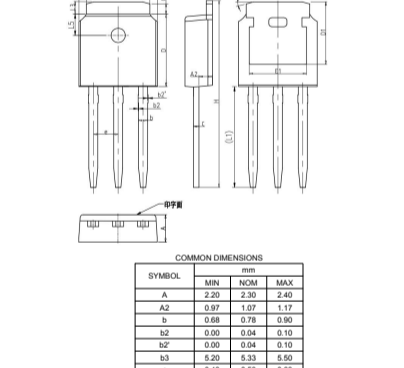
Package Type	Unit	Quantity
TO-252-ZL	Tape	75
TO-251-3L	Tape	75
TO-251-3S	Tube	75

Package Information



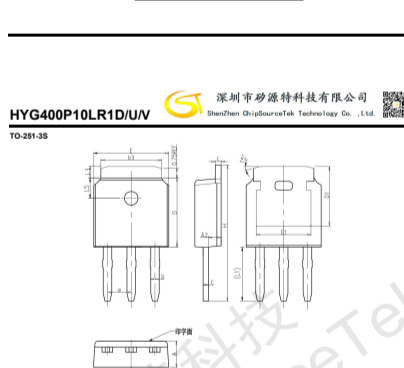
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TO-251-3L



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Classification Profile



Classification Reflow Profiles

Profile	Preheat & Solder	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Temperature min (T _{min})	100°C	150°C	150°C
Temperature max (T _{max})	260°C	260°C	260°C
Time (T _{min} to T _{max})	60-120 seconds	60-120 seconds	60-120 seconds
Average ramp-up (T _{min} to T _{max})	3°C/second max.	3°C/second max.	3°C/second max.
Underflow temperature (T _u)	60-150 seconds	60-150 seconds	60-150 seconds
Time at liquidus (L)	60-150 seconds	60-150 seconds	60-150 seconds
Peak package body temperature (T _p)	See Classification Temp in table 1	See Classification Temp in table 2	See Classification Temp in table 2
Time to T _p within 5°C of the specified classification temperature (T ₁)	30" seconds	30" seconds	30" seconds
Average ramp-down with T _p to T _{min}	6°C/second max.	6°C/second max.	6°C/second max.
Time 25°C to peak temperature	6 minutes max.	6 minutes max.	6 minutes max.

*Tolerance for peak profile Temperature (T_p) is defined as a supplier minimum and a user maximum.
 **Tolerance for time at peak profile temperature (L) is defined as a supplier minimum and a user maximum.

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Table 1 Sn-Pb Eutectic Process - Classification Temperatures (°C)

Package	Volume mm ³	Volume mm ³	Volume mm ³
Thickness	<350	350-2000	>2000
<2.5 mm	200 °C	200 °C	200 °C
≥2.5 mm	250 °C	245 °C	245 °C

Table 2 Pb-Free Process - Classification Temperatures (°C)

Package	Volume mm ³	Volume mm ³	Volume mm ³
Thickness	<350	350-2000	>2000
<1.6 mm < 2.5 mm	260 °C	260 °C	260 °C
≥ 2.5 mm	260 °C	245 °C	245 °C

Reliability Test Program

Test Item	Method	Description
SOLDERABILITY	JESD-22, A102	3 Sec, 240°C
PROGON	JESD-22, A113	30"/2000"/100hrs
HTRF	JESD-22, A108	168 hrs/500hr/1000hr, Bias @ 150°C
HTG	JESD-22, A106	168 hrs/500hr/1000hr, V _{GS} =100V @ 150°C
PCT	JESD-22, A102	80 hrs, 100%RH, Case, 21°C
TCT	JESD-22, A104	500 Cycles, 55°C-130°C