

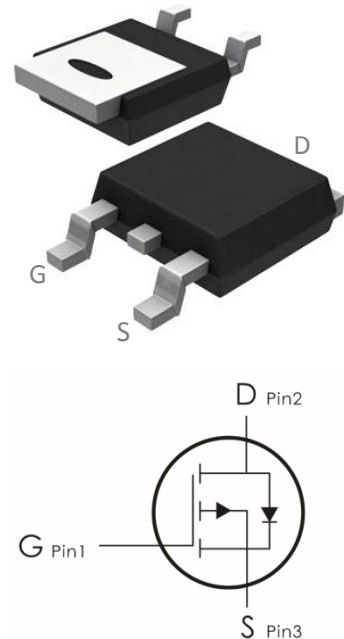
Description:

This P-Channel MOSFET uses advanced trench technology and design to provide excellent $R_{DS(on)}$ with low gate charge.

It can be used in a wide variety of applications.

Features:

- 1) $V_{DS}=-40V, I_D=-23A, R_{DS(on)}<40m\Omega @V_{GS}=-10V$
- 2) Low gate charge.
- 3) Green device available.
- 4) Advanced high cell density trench technology for ultra $R_{DS(on)}$.
- 5) Excellent package for good heat dissipation.



Package Marking and Ordering Information:

Part NO.	Marking	Package	Packing
DOD413A	D413A	TO- 252	2500 pcs/Reel

Absolute Maximum Ratings: ($T_C=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Ratings	Units
V_{DS}	Drain-Source Voltage	-40	V
V_{GS}	Gate-Source Voltage	± 20	V
I_D	Continuous Drain Current- $T_C=25^\circ\text{C}$	-23	A
	Continuous Drain Current- $T_C=100^\circ\text{C}$	-15	
	Pulsed Drain Current ¹	-88	
E_{AS}	Single Pulse Avalanche Energy ²	40.9	mJ
P_D	Power Dissipation($T_C=25^\circ\text{C}$)	34.7	W
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

Thermal Characteristics:

Symbol	Parameter	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.6	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62	

Electrical Characteristics: ($T_C=25^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Off Characteristics						
BV _{DSS}	Drain-Sourtce Breakdown Voltage	V _{GS} =0V, I _D =250 μ A	-40	---	---	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{GS} =0V, V _{DS} =-40V	---	---	-1	μ A
I _{GSS}	Gate-Source Leakage Current	V _{GS} =± 20V, V _{DS} =0A	---	---	± 100	nA
On Characteristics						
V _{GS(th)}	GATE-Source Threshold Voltage	V _{GS} =V _{DS} , I _D =250 μ A	-1	-1.5	-2.5	V
R _{DS(ON)}	Drain-Source On Resistance ³	V _{GS} =-10V, I _D =-10A	---	30	40	m Ω
		V _{GS} =-4.5V, I _D =-5A	---	35	50	m Ω
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} =-20V, V _{GS} =0V, f=1MHz	---	1033	---	pF
C _{oss}	Output Capacitance		---	106	--	
C _{rss}	Reverse Transfer Capacitance		---	79.4	---	
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DS} =-20V, I _D =-5A, R _L =2.4 Ω ,V _{GS} =-10V	---	9	---	ns
t _r	Rise Time		---	21	---	ns
t _{d(off)}	Turn-Off Delay Time		---	26	---	ns
t _f	Fall Time		---	34	---	ns
Q _g	Total Gate Charge	V _{GS} =-10V, V _{DS} =-20V, I _D =-5A	---	19	---	nc
Q _{gs}	Gate-Source Charge		---	3	---	nc
Q _{gd}	Gate-Drain “Miller” Charge		---	2	---	nc
Drain-Source Diode Characteristics						
V _{SD}	Diode Forward Voltage	V _{GS} =0V, I _{SD} =-6A	---	---	-1.2	V
I _S	Continuous Drain Curren	VD=VG=0V	---	---	-23	A
I _{SM}	Pulsed Drain Current		---	---	-15	A
Trr	Reverse Recovery Time	I _F =-5A, T _J =25	---	14	---	ns
Qrr	Reverse Recovery Charge	dl/dt=100A/us	---	9	---	nc

Notes:

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. EAS condition: $T_J = 25^\circ\text{C}$, $V_{DD} = -20\text{V}$, $V_{GS} = -10\text{V}$, $L = 0.5\text{mH}$, $R_G = 25\Omega$, $I_{AS} = -10\text{A}$
3. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$

Typical Characteristics: ($T_C = 25^\circ\text{C}$ unless otherwise noted)

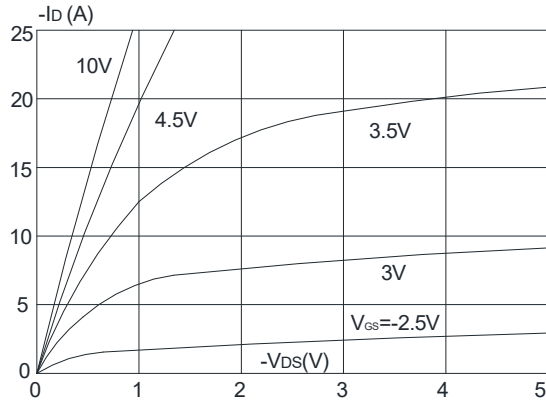


Figure 1: Output Characteristics

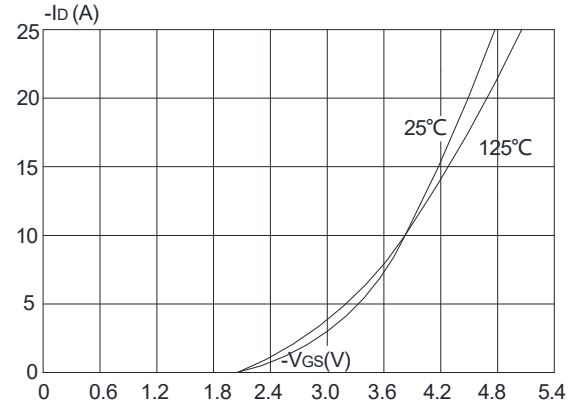


Figure 2: Typical Transfer Characteristics

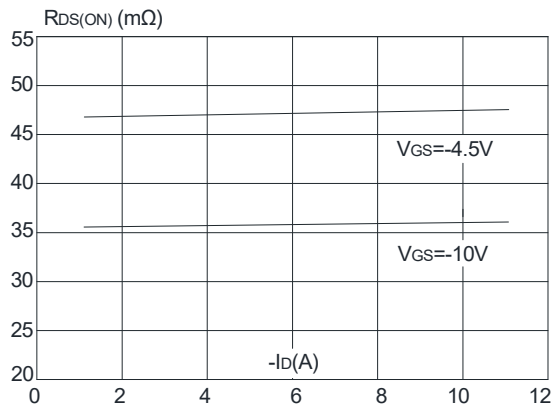


Figure 3: On-resistance vs. Drain Current

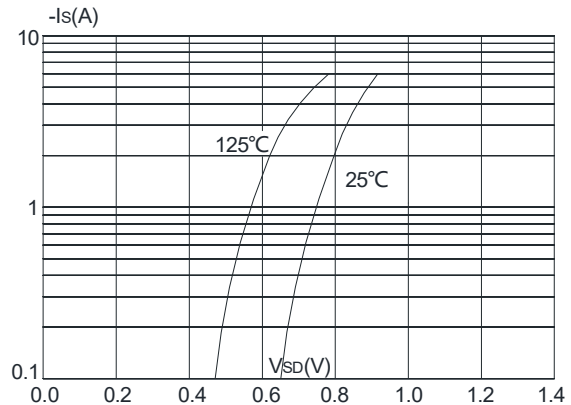


Figure 4: Body Diode Characteristics

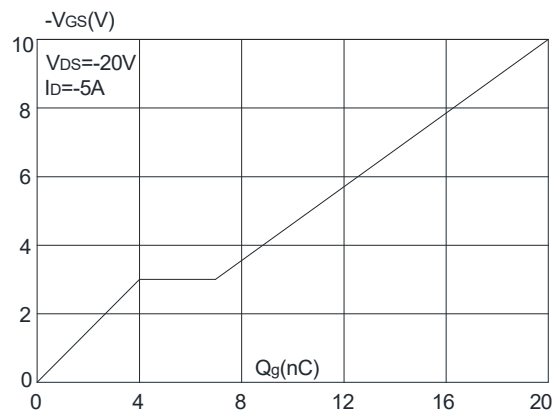


Figure 5: Gate Charge Characteristics

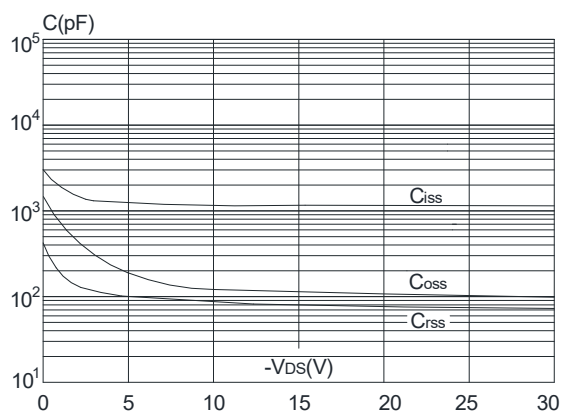


Figure 6: Capacitance Characteristics

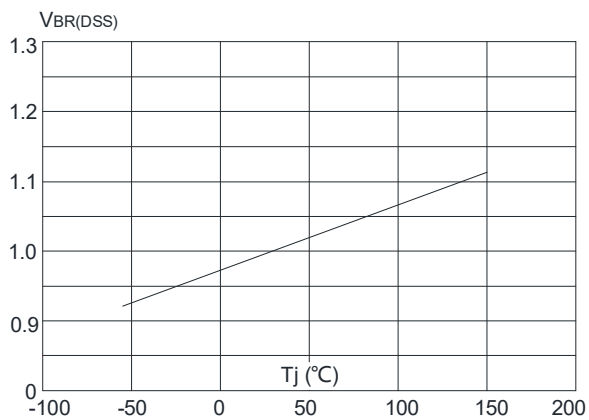


Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

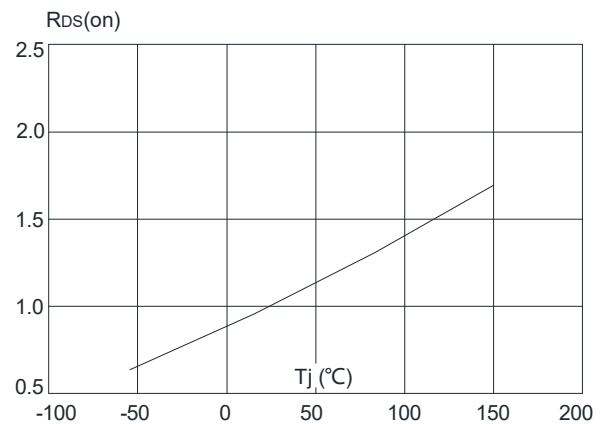


Figure 8: Normalized on Resistance vs. Junction Temperature

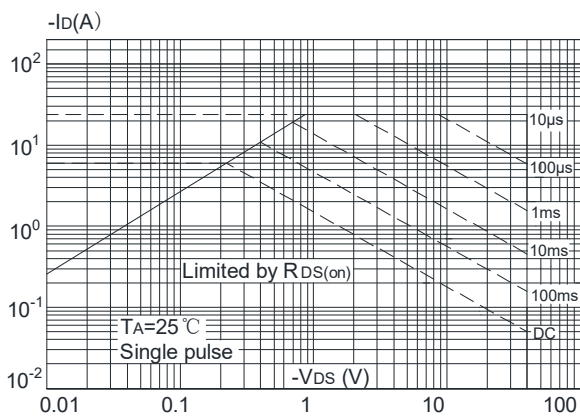


Figure 9: Maximum Safe Operating Area

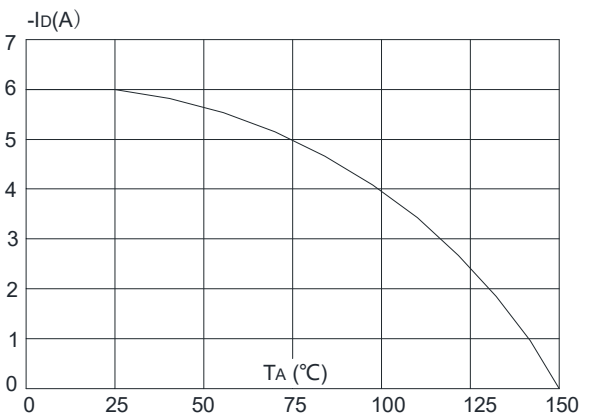


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

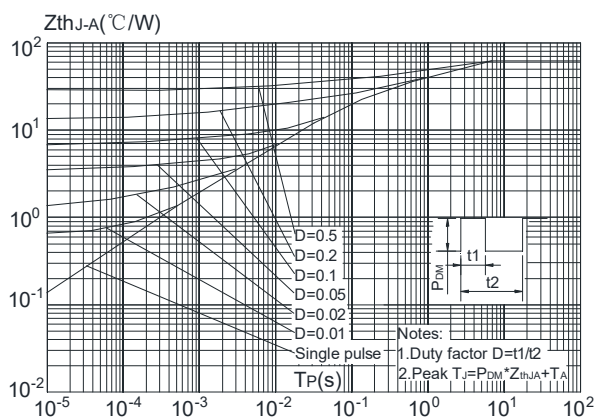
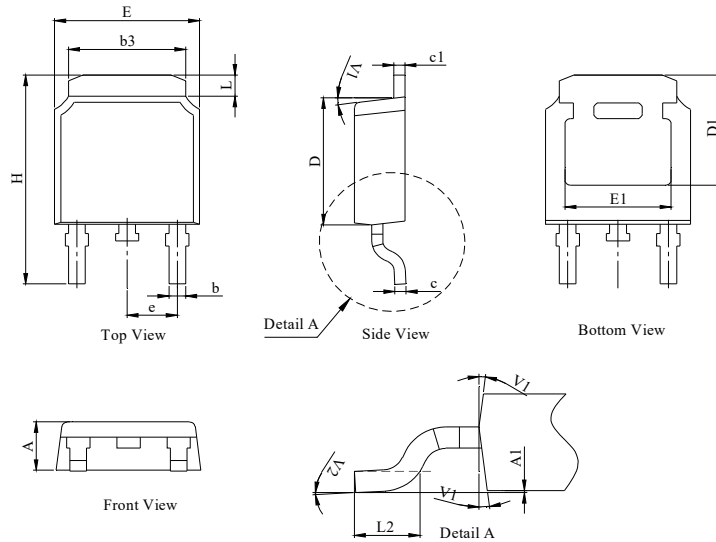


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

TO-252 Package Information

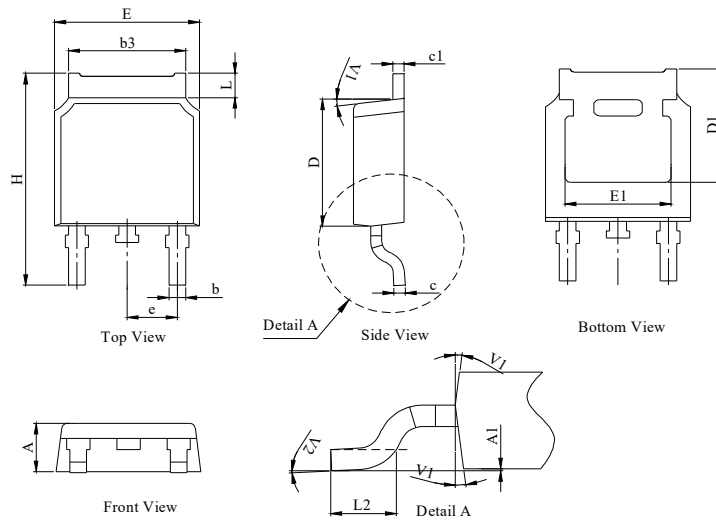
Package Outline Type-A

UNIT: mm



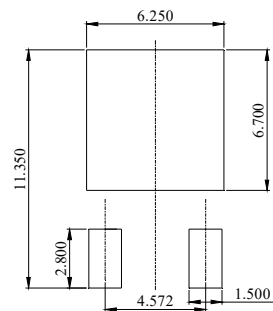
DIM.	MILLIMETER		
	MIN.	NOM.	MAX.
A	2.18	2.30	2.39
A1	0	--	0.13
b	0.64	0.76	0.89
c	0.40	0.50	0.61
c1	0.46	0.50	0.58
D	5.97	6.10	6.23
D1	5.05	--	--
E	6.35	6.60	6.73
E1	4.32	--	--
b3	5.21	5.38	5.55
e	2.29 BSC		
H	9.40	10.00	10.40
L	0.89	--	1.27
L2	1.40	--	1.78
V1	7° REF		
V2	0°	--	6°

Package Outline Type-B



DIM.	MILLIMETER		
	MIN.	NOM.	MAX.
A	2.10	2.30	2.40
A1	0	--	0.13
b	0.66	0.76	0.86
b3	5.21	5.38	5.55
c	0.40	0.50	0.60
c1	0.44	0.50	0.58
D	5.90	6.10	6.30
D1	5.30REF		
E	6.40	6.60	6.80
E1	4.63	-	-
e	2.29 BSC		
H	9.50	10.00	10.70
L	1.09	--	1.21
L2	1.35	--	1.65
V1	7° REF		
V2	0°	--	6°

Recommended Soldering Footprint



Marking Information:

①. Doingter LOGO

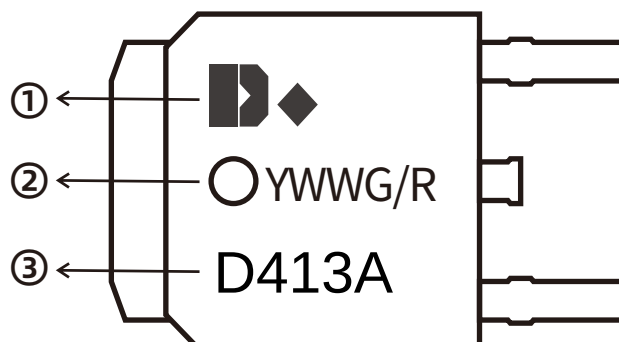
②. Date Code(YWWG / R)

Y : Year Code , last digit of the year

WW : Week Code(01-53)

G/R : G(Green) /R(Lead Free)

③. Part NO.



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