650V Super Junction Power MOSFET

Features

- Low drain-source on-resistance:$R_{DS(ON)}$=0.55Ω(typ)
- Easy to control gate switching
- Enhancement mode: V_{th} = 2 to 4V
- 100% avalanche tested
- RoHS compliant
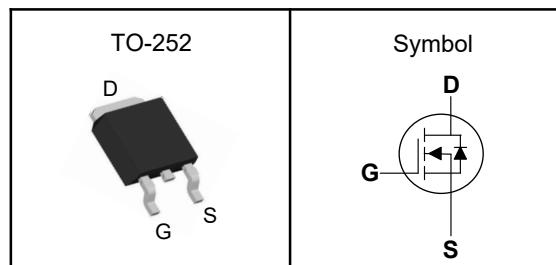
Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- Charger,Lighting

Pin Description

TO-252	Symbol

V_{DSS}	650	V
$R_{DS(ON)-Typ}$	550	mΩ
I_D	8	A

Absolute Maximum Ratings(T$_C$=25℃, Unless Otherwise Noted)

Symbol	Parameter	Rating	Unit
V_{DSS}	Drain-Source Voltage	650	V
V_{GSS}	Gate-Source Voltage	±30	V
T_J	Maximum Junction Temperature	-55 to 150	℃
T_{STG}	Storage Temperature Range	-55 to 150	℃
E_{AS}	Single Pulse Avalanche Energy[3]	106	mJ
I_{DM}[①]	300µs Pulse Drain Current Tested	31.2	A
I_D	Continuous Drain Current	8	A
P_D	Maximum Power Dissipation	80	W
I_{AS}	Avalanche Current	2.7	A
dv/dt	MOSFET dv/dt ruggedness, V_{DS} = 0...400V	50	V/ns
	Reverse diode dv/dt[3] V_{DS}=0...400V, I_{SD}≤I_D	15	

Thermal Characteristics

Symbol	Parameter	Rating	Unit
$R_{θJA}$ [③]	Thermal Resistance Junction-Ambient[1]	62	℃/W
$R_{θJC}$	Thermal Resistance Junction-Case[1]	1.55	℃/W

Note ① : Max. current is limited by bonding wire.

Note ② : UIS tested and pulse width are limited by maximum junction temperature 150℃.

Note ③ : Surface Mounted on 1in² FR-4 board with 1oz.

650V Super Junction Power MOSFET

Electrical Characteristics $(T_J=25℃$, Unless Otherwise Noted)

| Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Static Electrical Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V$, $I_D=250uA$	650	---	---	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=650V$, $V_{GS}=0V$	---	---	1	uA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=250uA$	2.0	---	4.0	V
I_{GSS}	Gate Leakage Current	$V_{GS}=±30V$, $V_{DS}=0V$	---	---	$±100$	nA
$R_{DS(ON)}$	Drain-Source On-state Resistance	$V_{GS}=10V$, $I_D=3.5A$	---	550	650	mΩ
Dynamic Characteristics[5]						
C_{iss}	Input Capacitance	$V_{GS}=0V$, $V_{DS}=100V$, Freq.=1.0MHz	---	480	---	pF
C_{oss}	Output Capacitance		---	22	---	pF
C_{rss}	Reverse Transfer Capacitance		---	1.1	---	pF
$T_{d(on)}$	Turn-on Delay Time	$V_{GS}=10V,V_{DD}=400V$, $I_D=3.9A,R_G=10Ω$	---	11	---	nS
T_r	Turn-on Rise Time		---	21	---	nS
$T_{d(off)}$	Turn-off Delay Time		---	40	---	nS
T_f	Turn-off Fall Time		---	31	---	nS
Q_g	Total Gate Charge	$V_{GS}=10V,V_{DD}=400V$, $I_D=7.8A$	---	14	---	nC
Q_{gs}	Gate-Source Charge		---	3.2	---	nC
Q_{gd}	Gate-Drain Charge		---	5.6	---	nC
Rg	Gate resistance	f=1 MHz, open drain	---	9.6	---	Ω
Source-Drain Characteristics						
I_S	Continuous Source Current		---	---	7.8	A
ISM	Maximum Pulsed Drain-Source Diode Forward Current		---	---	31.2	A
V_{SD}	Diode Forward Voltage	$I_S=7.8A$, $V_{GS}=0V$	---	---	1.4	V
t_{rr}	Reverse recovery time	$Is=3.9A,V_{GS}=0V$ diF/dt=100A/μs	---	205	---	ns
Q_{rr}	Reverse recovery charge		---	1.4	---	nC
Irm	Peak Reverse Recovery Current		---	12	---	A

Note ④: Pulse test (pulse width≤300us, duty cycle≤2%).

Note ⑤: Guaranteed by design, not subject to production testing.

650V Super Junction Power MOSFET

Typical Characteristics

Typ. transfer characteristics

$V_{DS}=20V$

I_{DS} -Drian to Source Current(A)

V_{GS} -Gate to Source Voltage(V)

$T=150^{\circ}C$

$T=25^{\circ}C$
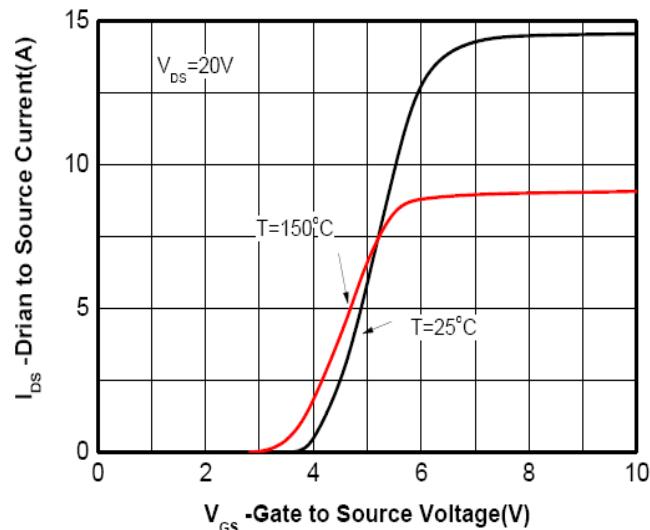
Typ. output characteristics $T_j=25\,^{\circ}C$

I_D -Drain-to-Source Current (A)

$V_{GS}=7V$

$V_{GS}=10V$

$V_{GS}=6.0V$

$V_{GS}=5.5V$

$V_{GS}=5.0V$

V_{DS} -Drain-to-Source Voltage (V)

Typ. drain-source on-state resistance

$R_{DS(ON)}$ -Resistance (Ω)

$V_{GS}=6.0V$

$V_{GS}=10V$

I_{DS} -Drian to Source Current(A)
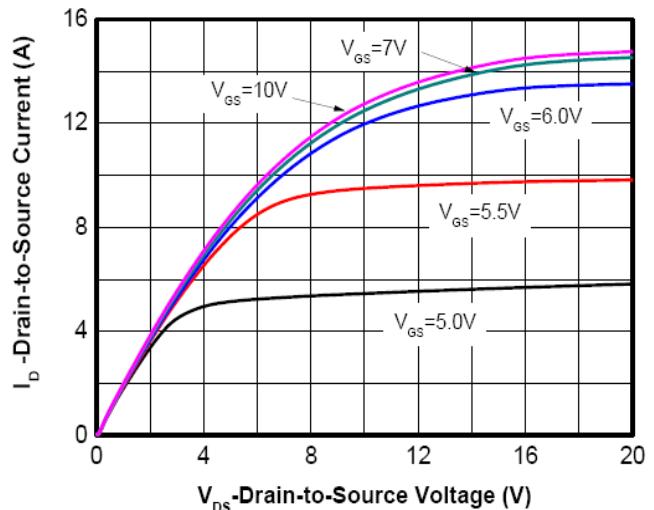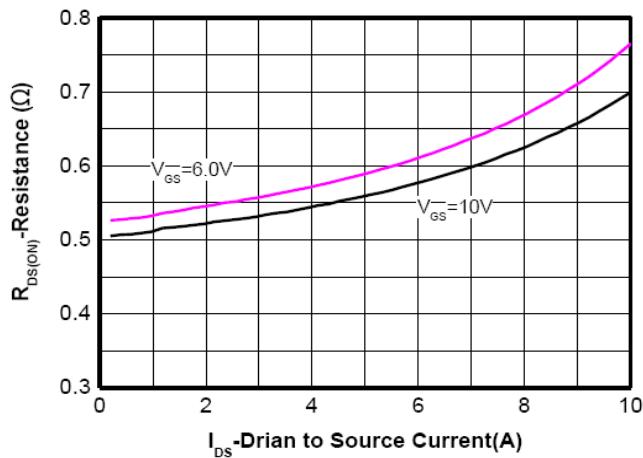
Typ. gate charge characteristics

V_{GS} -Gate to Source Voltage(V)

$V_{DD}=400V$，$I_D=7.8A$

Q_g(nC)

Typ. capacitances

C-Capacitance(pF)

$V_{GS}=0$
f=1MHz

C_{iss}

C_{oss}

C_{rss}

V_{DS} -Source to Source Voltage(V)
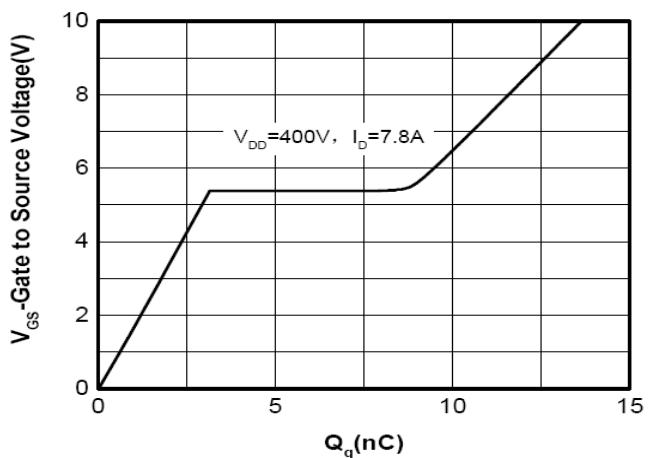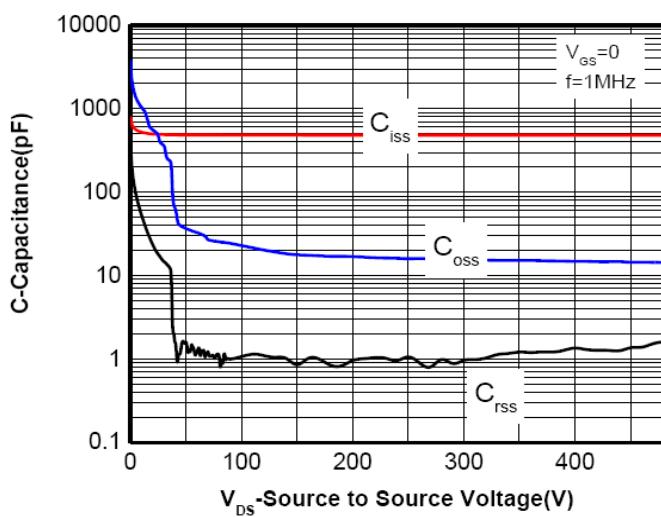
Normalized $V_{GS(th)}$ characteristics

Gate Threshold Normalized

$I_D=250uA$

Junction Temperature ($^{\circ}C$)
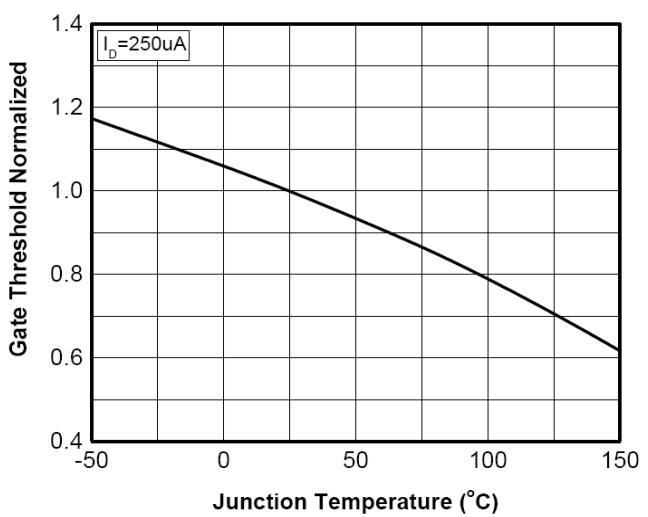
## 650V Super Junction Power MOSFET

### Normalized on-resistance vs temperature
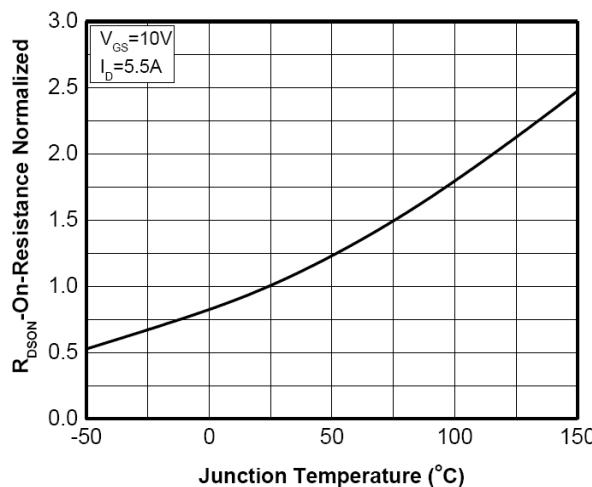
Forward characteristics of reverse diode
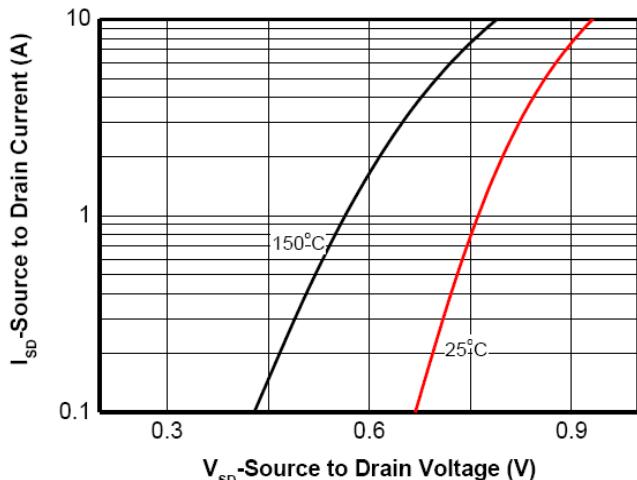

Drain-source breakdown voltage
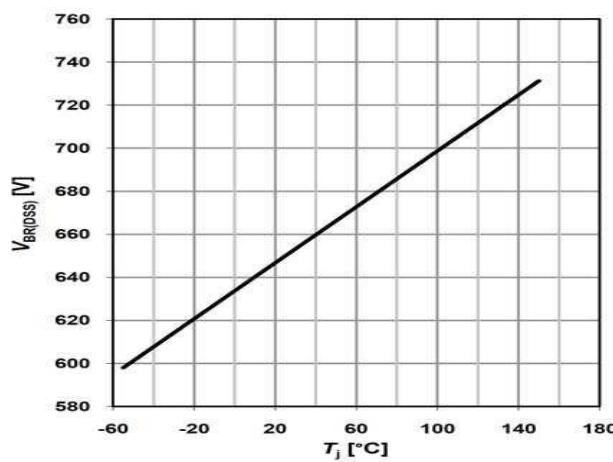
### Safe operating area TC=25 ℃
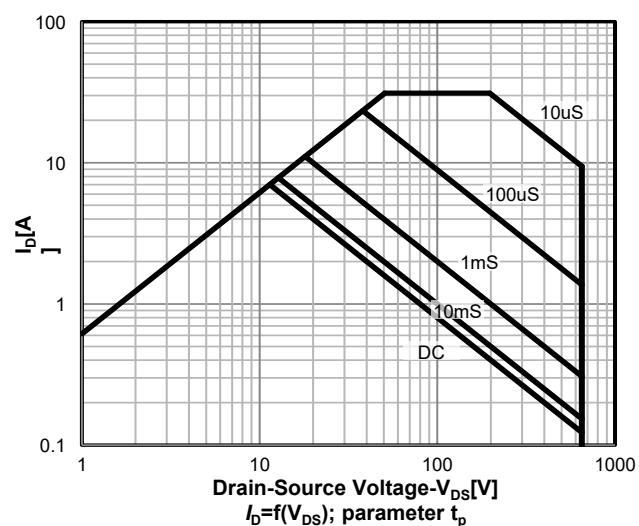
Max. transient thermal impedance
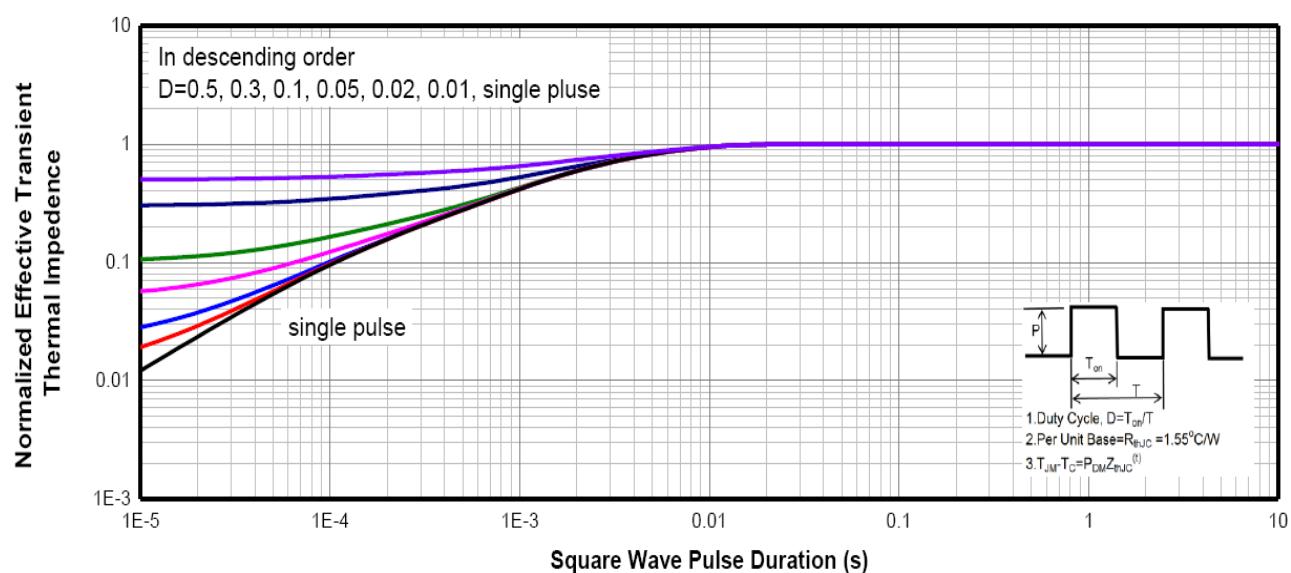
650V Super Junction Power MOSFET

TO-252 Package Outline Dimensions
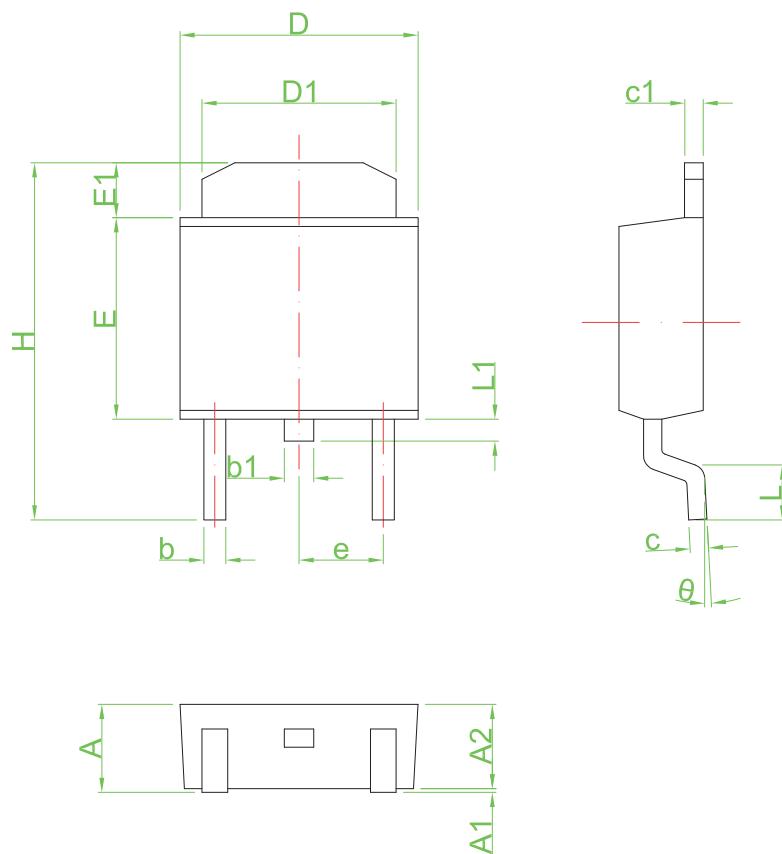
Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	2.25	2.65	0.089	0.104
A1	0.00	0.15	0.000	0.006
A2	2.20	2.40	0.087	0.094
b	0.50	0.70	0.020	0.028
b1	0.70	0.90	0.028	0.035
c	0.46	0.66	0.018	0.026
c1	0.46	0.66	0.018	0.026
D	6.30	6.70	0.248	0.264
D1	5.20	5.40	0.205	0.213
E	5.30	5.70	0.209	0.224
E1	1.40	1.60	0.055	0.063
H	9.40	9.90	0.370	0.390
e	2.30 TYP		0.09 TYP	
L	1.40	1.77	0.055	0.070
L1	0.50	0.70	0.020	0.028
θ	0°	8°	0°	8°