

N-channel 650V, 20A, 0.19Ω Super-Junction Power MOSFET

Features

- ◆ Very low FOM $R_{DS(on)} \times Q_g$
- ◆ 100% UIS tested
- ◆ RoHS compliant

Applications

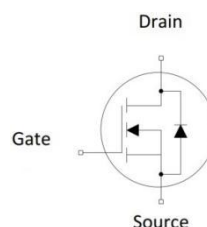
- ◆ Power factor correction (PFC).
- ◆ Switched mode power supplies (SMPS).
- ◆ Uninterrupted power supply (UPS).

Product Summary

$V_{DS} @ T_{j,25^\circ C}$	650V
$R_{DS(on),max}$	0.19Ω
I_D	20A
$Q_{g,typ}$	27 nC



TO-252



N-Channel MOSFET

Marking information

Product	Package	Marking	Packing method
IPD60R180P7S	TO-252	60R180	Tube

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	650	V
Continuous drain current ($T_C = 25^\circ C$) ($T_C = 100^\circ C$)	I_D	20 13	A A
Pulsed drain current ¹⁾	I_{DM}	60	A
Gate-Source voltage	V_{GSS}	± 30	V
Avalanche energy, single pulse ²⁾	E_{AS}	235	mJ
Power Dissipation TO-252 ($T_C = 25^\circ C$) - Derate above $25^\circ C$	P_D	140 1.1	W W/°C
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	°C
Continuous diode forward current	I_S	20	A
Diode pulse current	$I_{S,pulse}$	60	A
MOSFET dv/dt ruggedness, $V_{DS}=0 \dots 480V$	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS}=0 \dots 480V$	dv/dt	15	V/ns

Thermal Characteristics

Parameter	Symbol	Value	Unit
		TO-252	
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.89	$^{\circ}\text{C/W}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	56	$^{\circ}\text{C/W}$
Soldering temperature, wave soldering only allowed at leads. (1.6mm from case for 10s)	T_{sold}	260	$^{\circ}\text{C}$

Electrical Characteristics

 $T_c = 25^{\circ}\text{C}$ unless otherwise noted

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static characteristics						
Drain-source breakdown voltage	BV _{DSS}	V _{GS} =0 V, I _D =250uA	650	-	-	V
Gate threshold voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250uA	2.5		4.0	V
Drain cut-off current	I _{DSS}	V _{DS} =650 V, V _{GS} =0 V, T _j = 25°C T _j = 125°C	- -	- 10	5	μA
Gate leakage current, Forward	I _{GSSF}	V _{GS} =30 V, V _{DS} =0 V	-	-	100	nA
Gate leakage current, Reverse	I _{GSSR}	V _{GS} =-30 V, V _{DS} =0 V	-	-	-100	nA
Drain-source on-state resistance	R _{DS(on)}	V _{GS} =10 V, I _D =10 A T _j = 25°C	- - -	0.16	0.19	Ω
Dynamic characteristics						
Input capacitance	C _{iss}	V _{DS} = 100 V, V _{GS} = 0 V, f = 1MHz	-	1303	-	pF
Output capacitance	C _{oss}		-	52.7	-	
Reverse transfer capacitance	C _{rss}		-	2.3	-	
Turn-on delay time	t _{d(on)}	V _{DD} = 400V, I _D = 10A R _G = 10Ω, V _{GS} =10V	-	19	-	ns
Rise time	t _r		-	16	-	
Turn-off delay time	t _{d(off)}		-	92	-	
Fall time	t _f		-	26	-	
Gate charge characteristics						
Gate to source charge	Q _{gs}	V _{DD} =520 V, I _D =10A, V _{GS} =0 to 10 V	-	8.4	-	nC
Gate to drain charge	Q _{gd}		-	8.2	-	
Gate charge total	Q _g		-	27	-	
Gate plateau voltage	V _{plateau}		-	5.8	-	V
Reverse diode characteristics						
Diode forward voltage	V _{SD}	V _{GS} =0 V, I _F =10A	-	-	1.2	V
Reverse recovery time	t _{rr}	V _R =400 V, I _F =10A, dI _F /dt=100 A/μs	-	224.3	-	ns
Reverse recovery charge	Q _{rr}		-	2.8	-	μC
Peak reverse recovery current	I _{rrm}		-	23.9	-	A

Notes:

- Limited by maximum junction temperature, maximum duty cycle is 0.75.
- $I_{AS} = 2.8\text{ A}$, $V_{DD} = 50\text{ V}$, Starting $T_J = 25^{\circ}\text{C}$.

Electrical Characteristics Diagrams

Figure 1. Output Characteristics

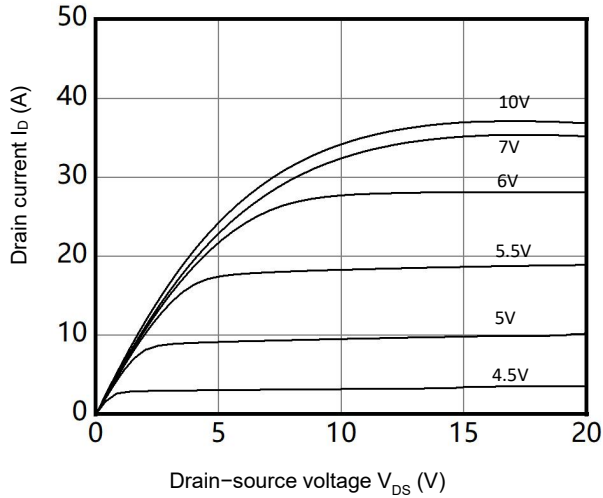


Figure 2. Transfer Characteristics

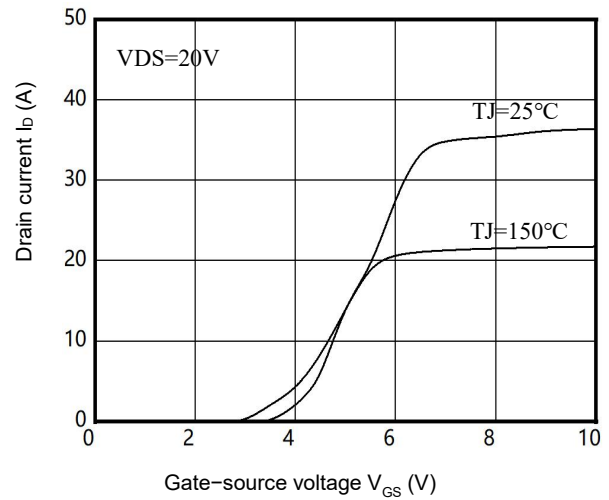


Figure 3. On-Resistance vs. Drain Current

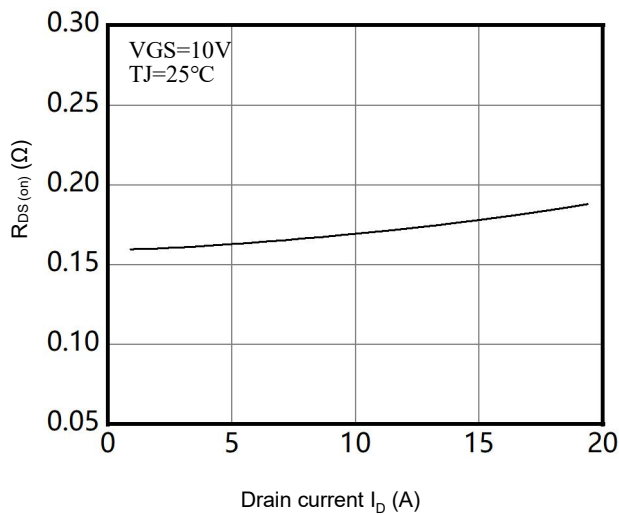


Figure 4. Capacitance Characteristics

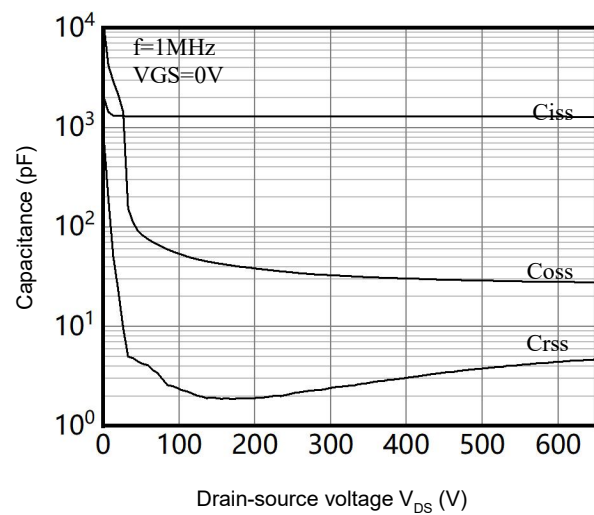


Figure 5. Gate Charge Characteristics

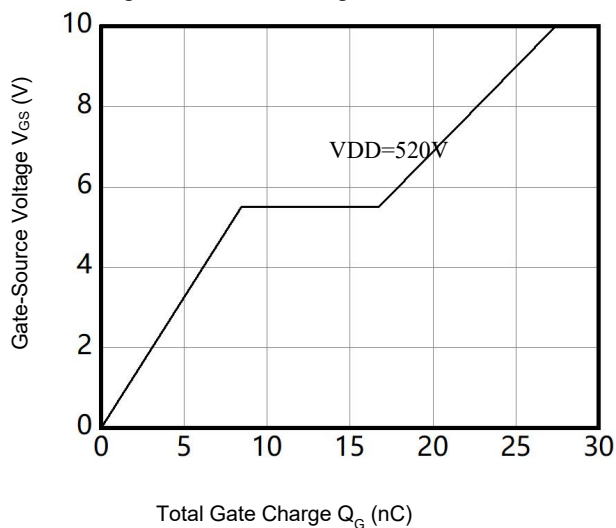


Figure 6. Body Diode Forward Voltage

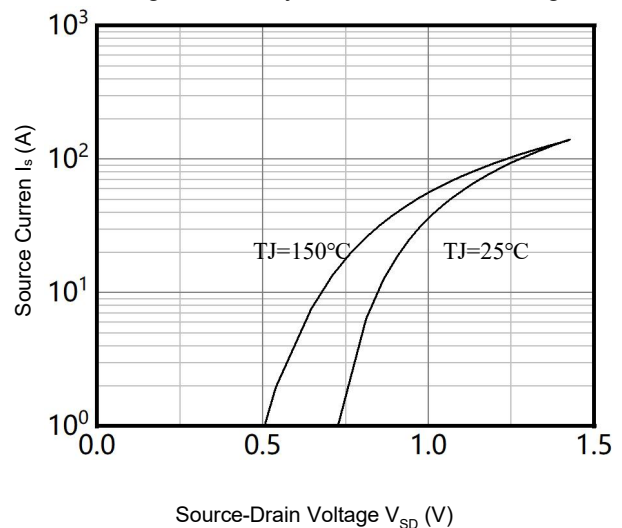


Figure 7. Breakdown Voltage vs. Temperature

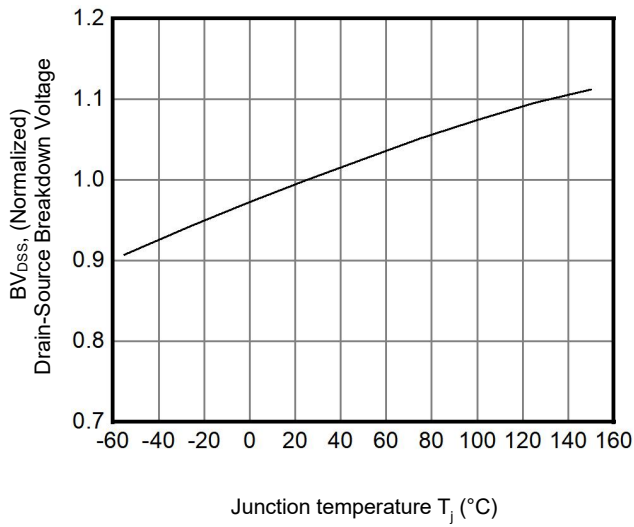


Figure 8. On-Resistance vs. Temperature

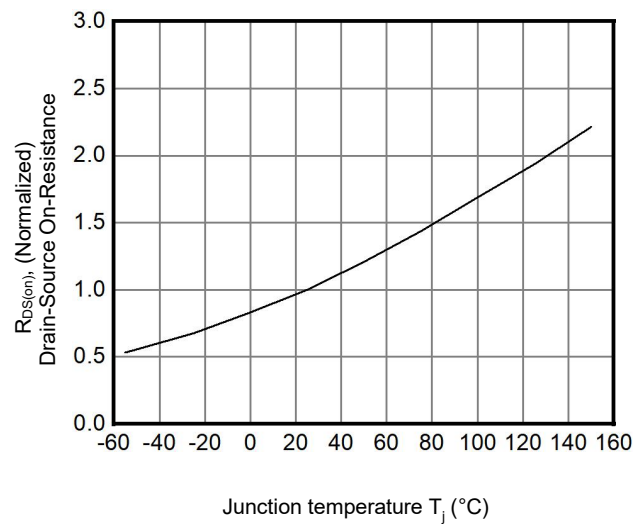


Figure 9. Transient Thermal Impedance

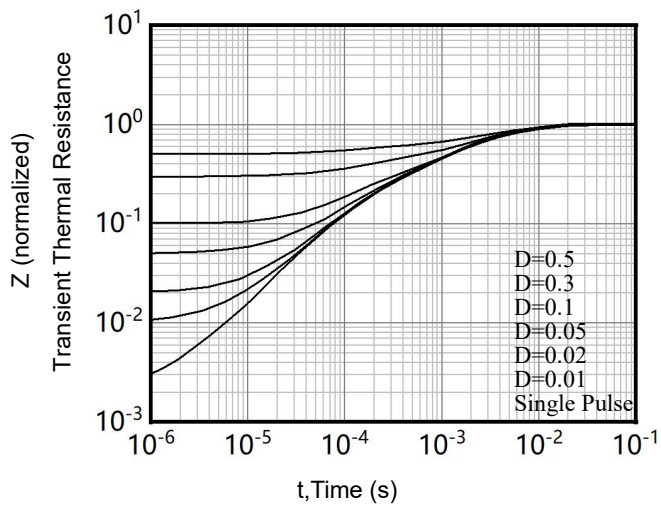


Figure 10. Maximum Safe Operating Area

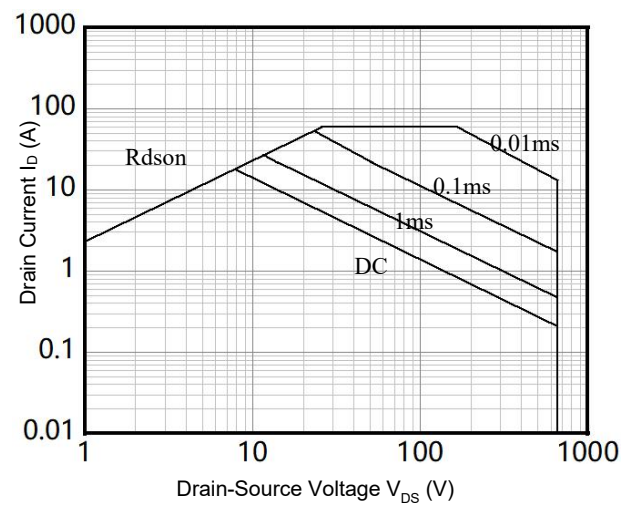
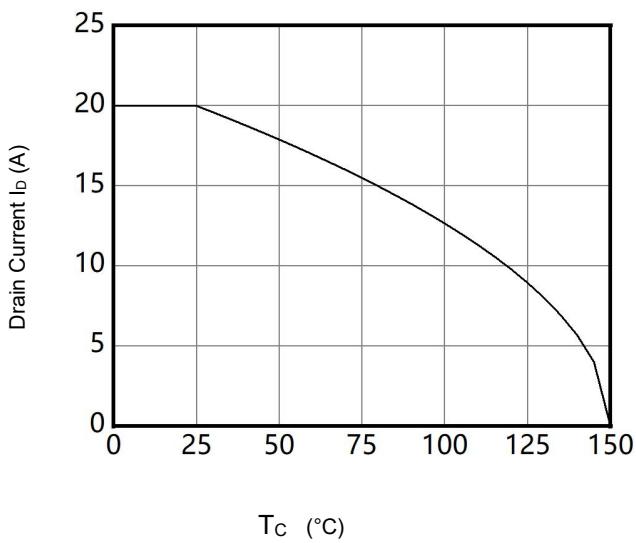
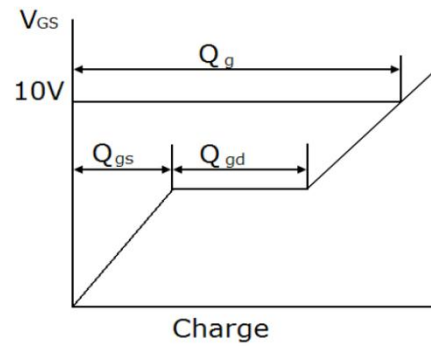
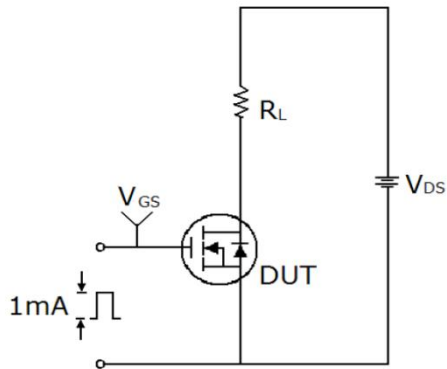


Figure11. Drain Current vs. Temperature

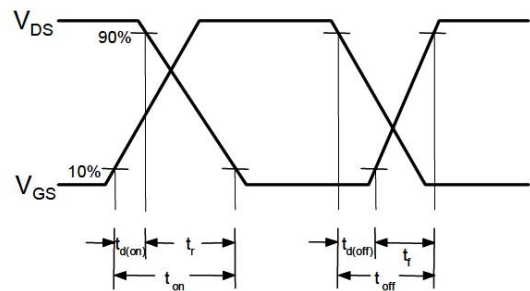
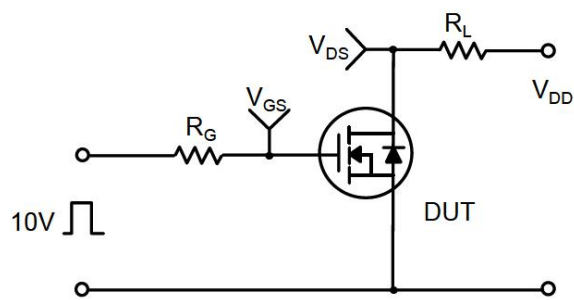


Test Circuits

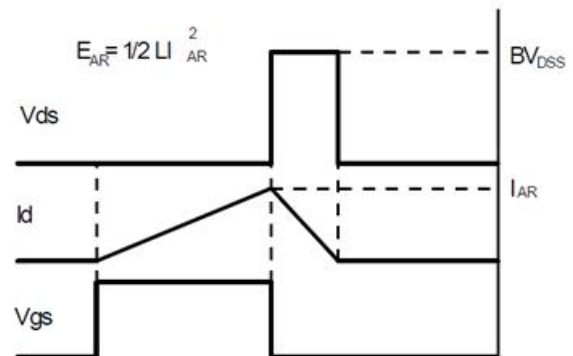
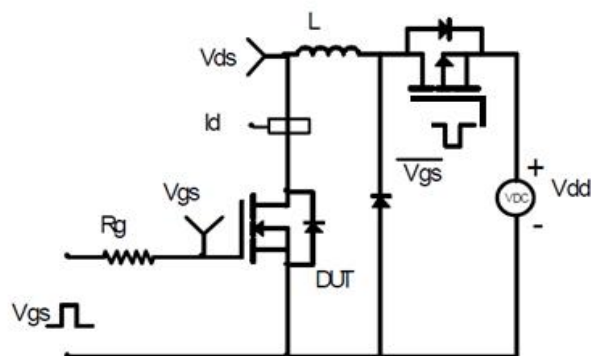
Gate Charge Test Circuit & Waveform



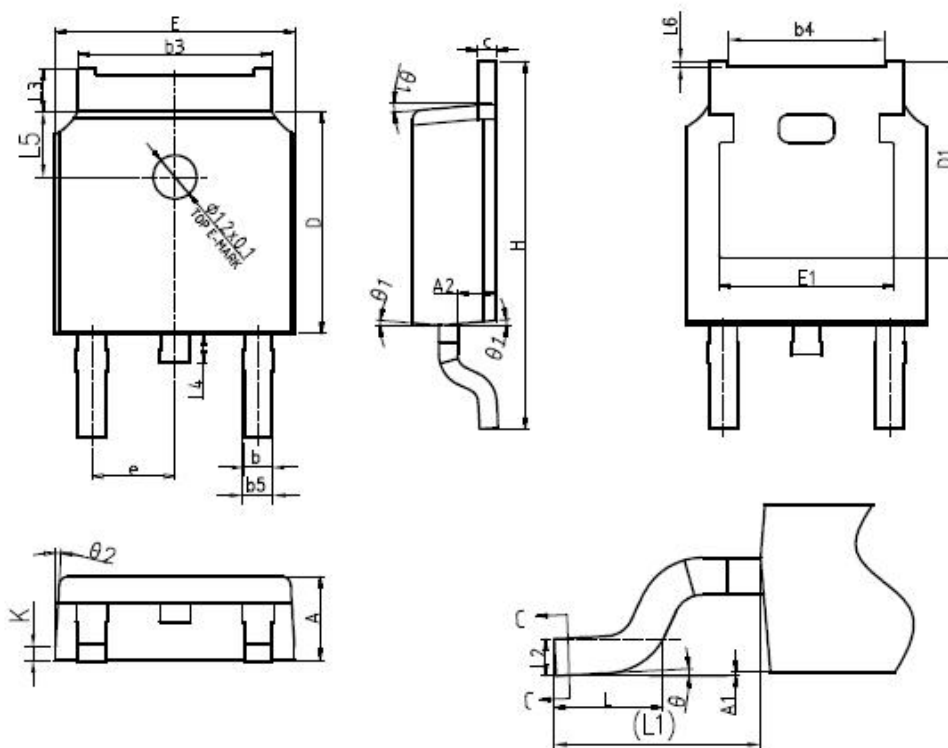
Switching Test Circuit & Waveform



Unclamped Inductive Switching Test Circuit & Waveform



Mechanical Dimensions for TO-252



単位: mm

SYMBOL	mm		E1	4.63	—
	MIN	MAX	e	2.286BSC	
A	2.20	2.40	L	1.25	1.75
A1	0.00	0.20	L1	2.90REF	
A2	0.97	1.17	L2	0.51BSC	
b	0.50	0.90	L3	0.88	1.28
b3	5.10	5.50	L4	0.50	1.00
b4	4.27	4.37	L5	1.65	1.95
b5	0.72	0.93	L6	0	0.123
c	0.43	0.61	θ	0°	8°
D	5.95	6.25	θ 1	5°	9°
D1	5.30REF		θ 2	5°	9°
H	9.40	10.50	K	0.40REF	
E	6.40	6.75			