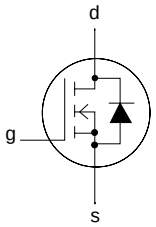
N-channel TrenchMOS™ transistor PHW35NQ20T

FEATURES

- **'Trench'** technology
- Very low on-state resistance
- Fast switching
- Low thermal resistance

SYMBOL



QUICK REFERENCE DATA

V_{DSS} = 200 V

I_D = 35 A

$R_{DS(ON)} \leq 70\ m\Omega$

GENERAL DESCRIPTION

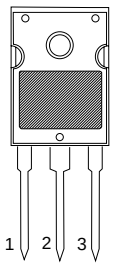
N-channel enhancement mode field-effect power transistor in a plastic envelope using '**trench**' technology. The device has very low on-state resistance. It is intended for use in dc to dc converters and general purpose switching applications.

The PHW35NQ20T is supplied in the SOT429 (TO247) conventional leaded package.

PINNING

PIN	DESCRIPTION
1	gate
2	drain
3	source
tab	drain

SOT429 (TO247)



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DSS}	Drain-source voltage	T_j = 25 ˚C to 175˚C	-	200	V
V_{DGR}	Drain-gate voltage	T_j = 25 ˚C to 175˚C; R_{GS} = 20 kΩ	-	200	V
V_{GS}	Gate-source voltage		-	± 20	V
I_D	Continuous drain current	T_{mb} = 25 ˚C	-	35	A
		T_{mb} = 100 ˚C	-	25	A
I_{DM}	Pulsed drain current	T_{mb} = 25 ˚C	-	140	A
P_D	Total power dissipation	T_{mb} = 25 ˚C	-	250	W
T_j, T_{stg}	Operating junction and storage temperature		- 55	175	˚C

AVALANCHE ENERGY LIMITING VALUES

Limiting values in accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
E_{AS}	Non-repetitive avalanche energy	Unclamped inductive load, I_{AS} = 35 A; t_p = 100 µs; T_j prior to avalanche = 25˚C; $V_{DD} \leq$ 50 V; R_{GS} = 50 Ω; V_{GS} = 10 V; refer to fig:15	-	462	mJ
I_{AS}	Non-repetitive avalanche current		-	35	A

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Thermal resistance junction to mounting base		-	0.6	K/W
$R_{th\ j\text{-}a}$	Thermal resistance junction to ambient	in free air	45	-	K/W

ELECTRICAL CHARACTERISTICS

T_j= 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V; I_D = 0.25 mA;	200	-	-	V
		T_j = -55˚C	178	-	-	V
$V_{GS(TO)}$	Gate threshold voltage	V_{DS} = V_{GS}; I_D = 1 mA	2.0	3.0	4.0	V
		T_j = 175˚C	1.0	-	-	V
		T_j = -55˚C	-	-	6	V
$R_{DS(ON)}$	Drain-source on-state resistance	V_{GS} = 10 V; I_D = 17 A	-	60	70	mΩ
		V_{GS} = 10 V; I_D = 17 A; T_j = 175˚C	-	-	203	mΩ
I_{GSS}	Gate source leakage current	V_{GS} = ±10 V; V_{DS} = 0 V	-	2	100	nA
I_{DSS}	Zero gate voltage drain current	V_{DS} = 200 V; V_{GS} = 0 V;	-	0.05	10	µA
		T_j = 175˚C	-	-	500	µA
$Q_{g(tot)}$	Total gate charge	I_D = 35 A; V_{DD} = 160 V; V_{GS} = 10 V	-	77	-	nC
Q_{gs}	Gate-source charge		-	16	-	nC
Q_{gd}	Gate-drain (Miller) charge		-	28	-	nC
$t_{d\ on}$	Turn-on delay time	V_{DD} = 100 V; R_D = 2.7 Ω;	-	22	-	ns
t_r	Turn-on rise time	V_{GS} = 10 V; R_G = 5.6 Ω	-	100	-	ns
$t_{d\ off}$	Turn-off delay time	Resistive load	-	80	-	ns
t_f	Turn-off fall time		-	90	-	ns
L_d	Internal drain inductance	Measured from tab to centre of die	-	3.5	-	nH
L_d	Internal drain inductance	Measured from drain lead to centre of die	-	4.5	-	nH
L_s	Internal source inductance	Measured from source lead to source bond pad	-	7.5	-	nH
C_{iss}	Input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz	-	4570	-	pF
C_{oss}	Output capacitance		-	370	-	pF
C_{rss}	Feedback capacitance		-	160	-	pF

REVERSE DIODE LIMITING VALUES AND CHARACTERISTICS

T_j = 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_S	Continuous source current (body diode)		-	-	35	A
I_{SM}	Pulsed source current (body diode)		-	-	140	A
V_{SD}	Diode forward voltage	I_F = 35 A; V_{GS} = 0 V	-	0.85	1.2	V
t_{rr}	Reverse recovery time	I_F = 20 A; -dI_F/dt = 100 A/µs;	-	160	-	ns
Q_{rr}	Reverse recovery charge	V_{GS} = 0 V; V_R = 30 V	-	1.0	-	µC

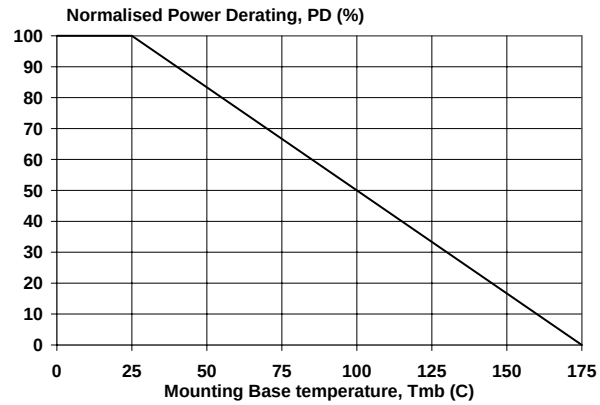


Fig.1. Normalised power dissipation.
PD% = 100·P_D/$P_{D\ 25\ ^\circ C}$ = f(T_{mb})

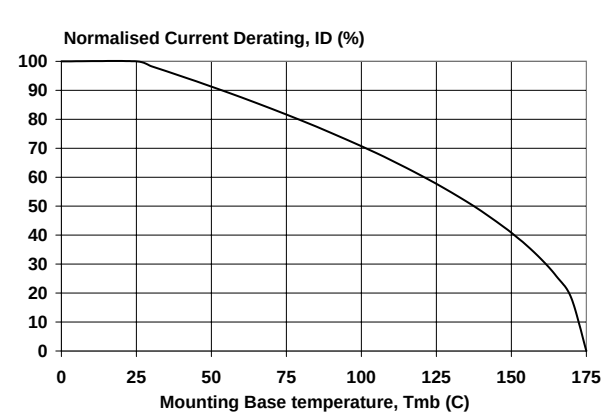


Fig.2. Normalised continuous drain current.
ID% = 100·I_D/$I_{D\ 25\ ^\circ C}$ = f(T_{mb}); $V_{GS} \geq 10$ V

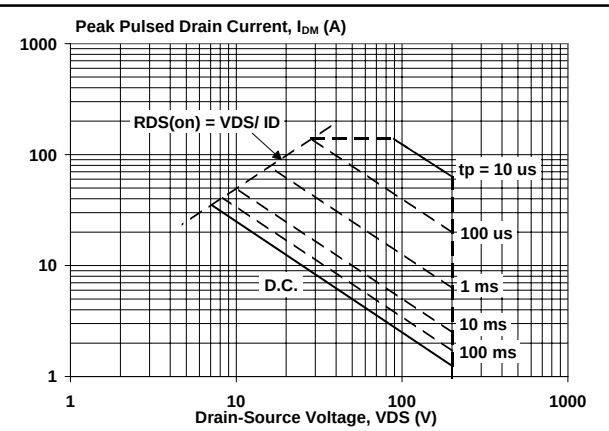


Fig.3. Safe operating area
I_D & I_{DM} = f(V_{DS}); I_{DM} single pulse; parameter t_p

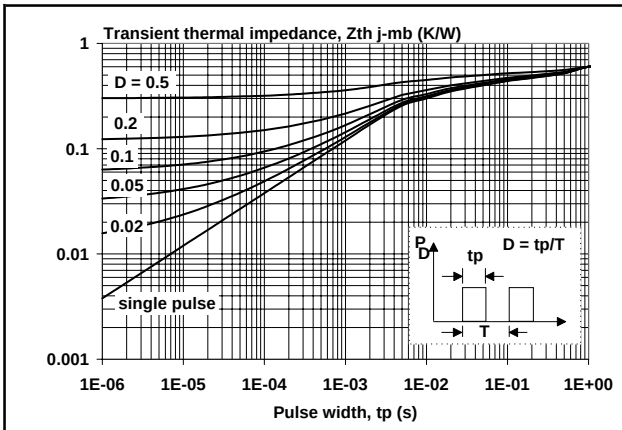


Fig.4. Transient thermal impedance.
$Z_{th\ j\text{-}mb}$ = f(t); parameter D = t_p/T

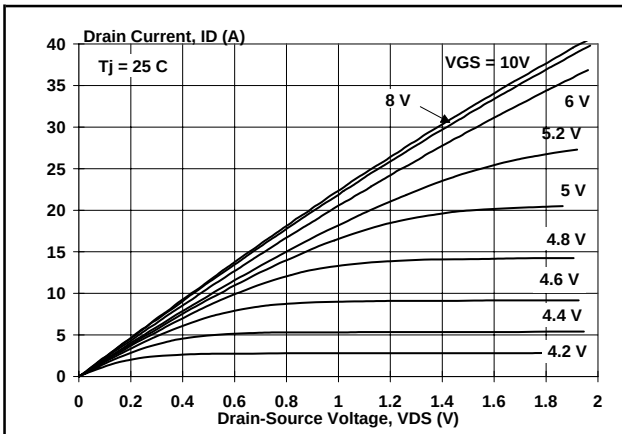


Fig.5. Typical output characteristics, T_j = 25 ˚C.
I_D = f(V_{DS})

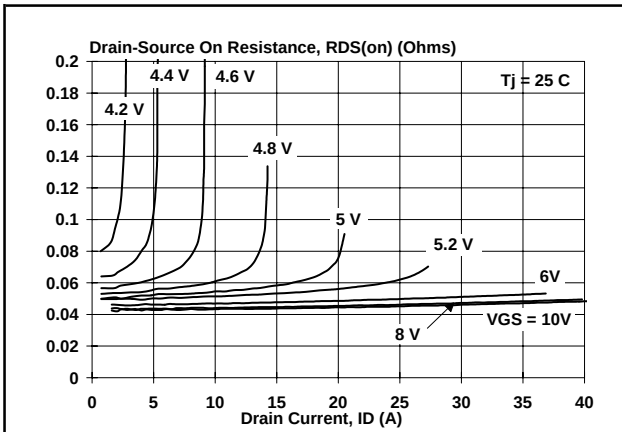


Fig.6. Typical on-state resistance, T_j = 25 ˚C.
$R_{DS(ON)}$ = f(I_D)

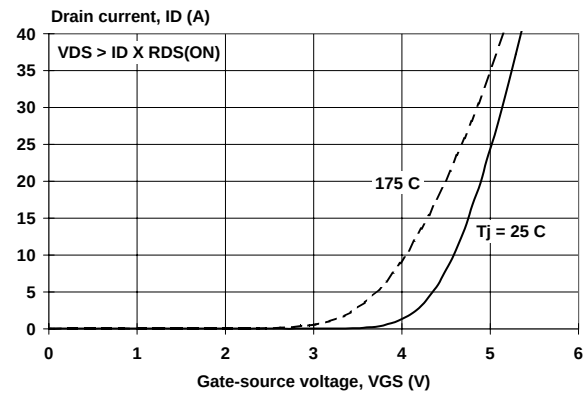


Fig.7. Typical transfer characteristics.
$I_D = f(V_{GS})$

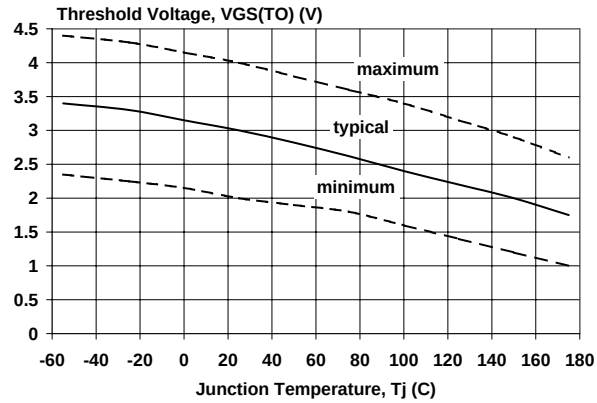


Fig.10. Gate threshold voltage.
$V_{GS(TO)} = f(T_j)$; conditions: I_D = 1 mA; $V_{DS} = V_{GS}$

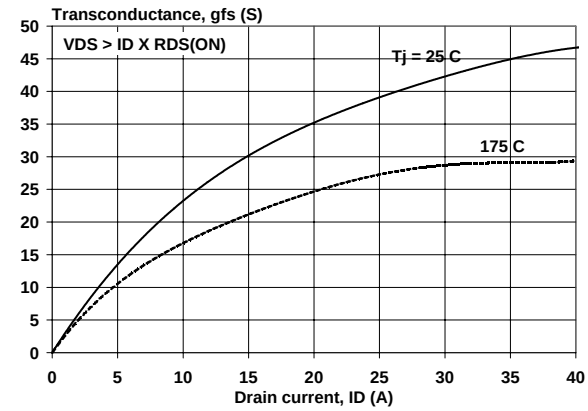


Fig.8. Typical transconductance, T_j = 25 ˚C.
$g_{fs} = f(I_D)$

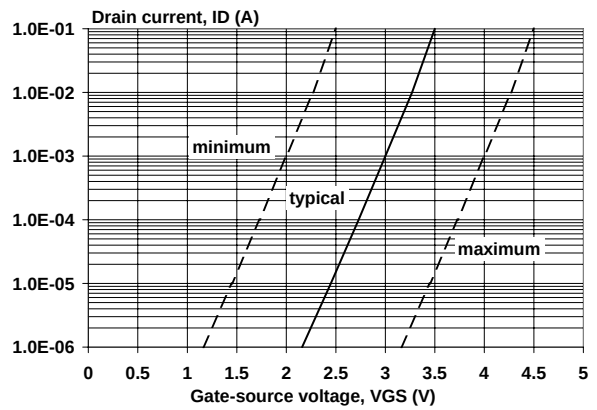


Fig.11. Sub-threshold drain current.
$I_D = f(V_{GS})$; conditions: T_j = 25 ˚C

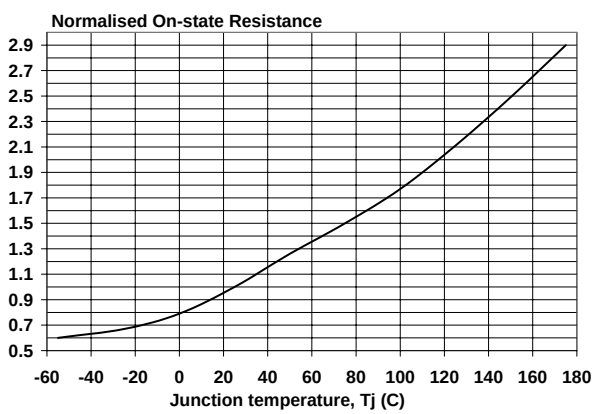


Fig.9. Normalised drain-source on-state resistance.
$R_{DS(ON)}/R_{DS(ON)25\ ^\circ C} = f(T_j)$

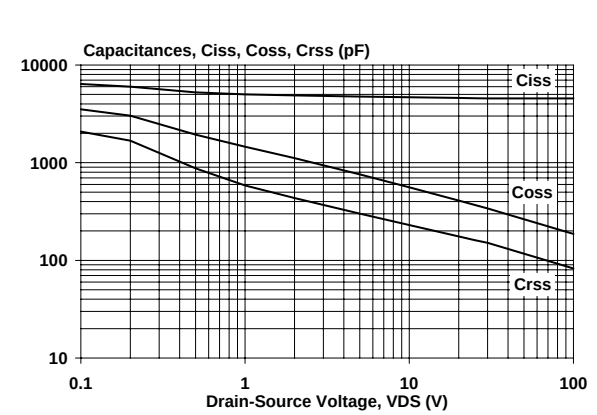


Fig.12. Typical capacitances, C_{iss}, C_{oss}, C_{rss}.
$C = f(V_{DS})$; conditions: V_{GS} = 0 V; f = 1 MHz

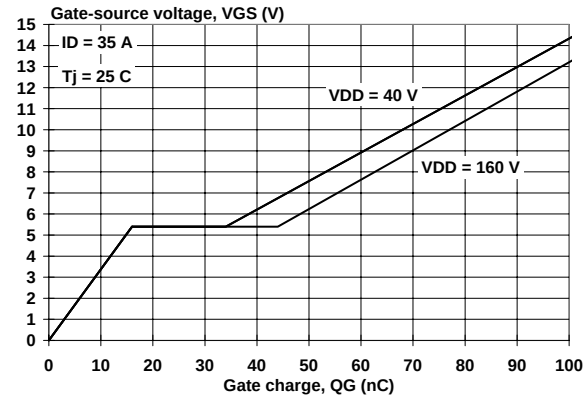


Fig.13. Typical turn-on gate-charge characteristics. $V_{GS} = f(Q_G)$

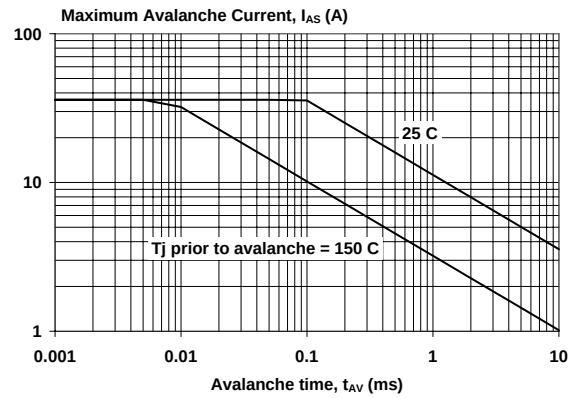


Fig.15. Maximum permissible non-repetitive avalanche current (I_{AS}) versus avalanche time (t_{AV}); unclamped inductive load

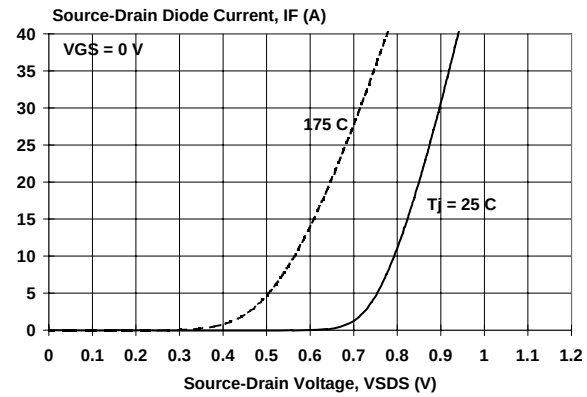
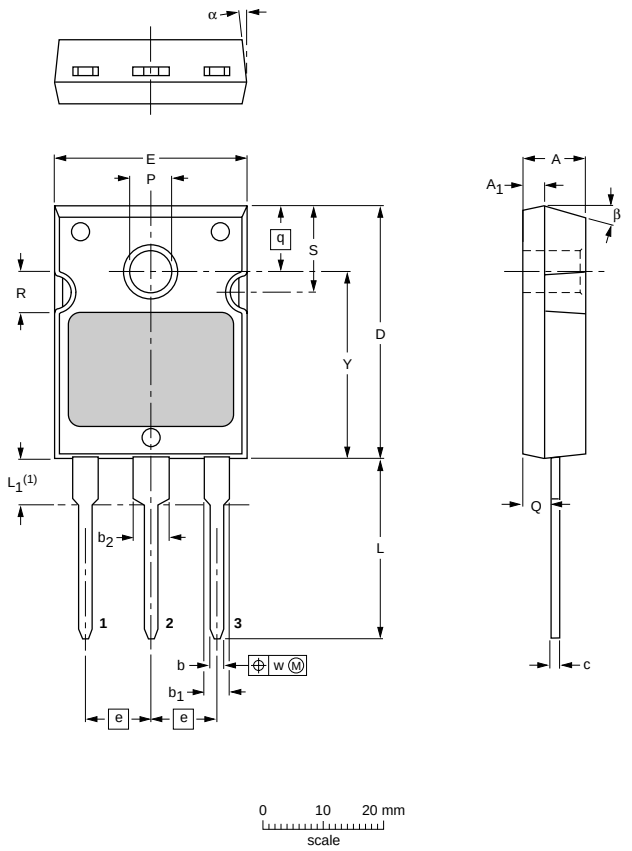


Fig.14. Typical reverse diode current. $I_F = f(V_{SDS})$; conditions: $V_{GS} = 0$ V; parameter T_j

MECHANICAL DATA

Plastic single-ended through-hole package; heatsink mounted; 1 mounting hole; 3-lead TO-247 **SOT429**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1	b_2	c	D	E	e	L	L_1(1)	P	Q	q	R	S	w	Y	α	β
mm	5.3 4.7	1.9 1.7	1.2 0.9	2.2 1.8	3.2 2.8	0.9 0.6	21 20	16 15	5.45	16 15	4.0 3.6	3.7 3.3	2.6 2.4	5.3	3.5 3.3	7.5 7.1	0.4	15.7 15.3	6° 4°	17° 13°

Note

1. Tinning of terminals are uncontrolled within zone L_1.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT429		TO-247				~~98-04-07~~ 99-08-04

Fig.16. SOT429; pin 2 connected to mounting base

Notes

1. Observe the general handling precautions for electrostatic-discharge sensitive devices (ESDs) to prevent damage to MOS gate oxide.
2. Refer to mounting instructions for SOT429 envelope.
3. Epoxy meets UL94 V0 at 1/8".

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values are given in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of this specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

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