

N-Channel 650 V (D-S) Super Junction Power MOSFET

PRODUCT SUMMARY

V_{DS} (V) at T_J max.	650	
$R_{DS(on)}$ typ. (Ω) at 25 °C	$V_{GS} = 10$ V	0.950

FEATURES

- Low figure-of-merit (FOM) $R_{on} \times Q_g$
- Low input capacitance (C_{iss})
- Reduced switching and conduction losses
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)

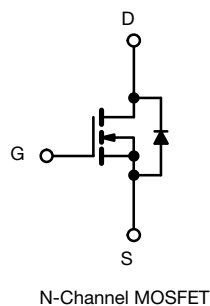
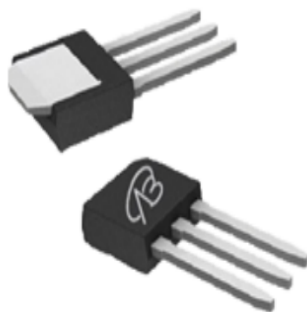


RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
 - High-intensity discharge (HID)
 - Fluorescent ballast lighting
- Industrial
 - Welding
 - Induction heating
 - Motor drives
 - Battery chargers
 - Renewable energy
 - Solar (PV inverters)

TO-251



ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			V_{DS}	650	V
Gate-source voltage			V_{GS}	± 30	
Continuous drain current ($T_J = 150\text{ }^{\circ}\text{C}$)	V_{GS} at 10 V	$T_C = 25\text{ }^{\circ}\text{C}$	I_D	4	A
		$T_C = 100\text{ }^{\circ}\text{C}$		3	
Pulsed drain current ^a			I_{DM}	12	
Linear derating factor				1.7	W/ $^{\circ}\text{C}$
Single pulse avalanche energy ^b			E_{AS}	240	mJ
Maximum power dissipation			P_D	140	W
Operating junction and storage temperature range			T_J, T_{stg}	-55 to +150	$^{\circ}\text{C}$
Drain-source voltage slope	$T_J = 125\text{ }^{\circ}\text{C}$		dV/dt	50	V/ns
Reverse diode dV/dt ^d				5.1	
Soldering recommendations (peak temperature) ^c	For 10 s			260	$^{\circ}\text{C}$

Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 100$ V, starting $T_J = 25$ °C, $L = 30$ mH, $R_g = 25$ Ω , $I_{AS} = 8.0$ A
- 1.6 mm from case
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, starting $T_J = 25$ °C

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	R_{thJA}	-	62	°C/W
Maximum junction-to-case (drain)	R_{thJC}	-	0.65	

SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

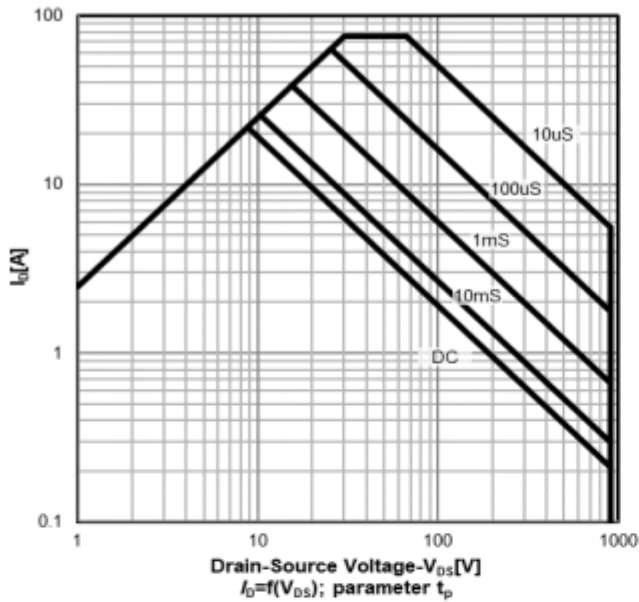
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-source breakdown voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		650	-	-	V
V _{DS} temperature coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-	1.08	-	V/°C
Gate-source threshold Voltage (N)	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		2.0	-	4.0	V
Gate-source leakage	I _{GSS}	V _{GS} = ± 20 V		-	-	± 100	nA
		V _{GS} = ± 30 V		-	-	± 1	μA
Zero gate voltage drain current	I _{DSS}	V _{DS} = 650 V, V _{GS} = 0 V		-	-	1	μA
		V _{DS} = 520 V, V _{GS} = 0 V, T _J = 125 °C		-	-	10	
Drain-source on-state resistance	R _{DS(on)}	V _{GS} = 10 V	I _D =2.5 A	-	0.950	-	Ω
Forward transconductance	g _{fs}	V _{DS} = 30 V, I _D = 2.5A		-	8.7	-	S
Dynamic							
Input capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 100 V, f = 1 MHz		-	600	-	pF
Output capacitance	C _{oss}			-	81	-	
Reverse transfer capacitance	C _{rss}			-	9	-	
Effective output capacitance, energy related ^a	C _{o(er)}	V _{DS} = 0 V to 480 V, V _{GS} = 0 V		-	58	-	
Effective output capacitance, time related ^b	C _{o(tr)}			-	296	-	
Total gate charge	Q _g	V _{GS} = 10 V	I _D = 5 A, V _{DS} = 480 V	-	40	122	nC
Gate-source charge	Q _{gs}			-	16	-	
Gate-drain charge	Q _{gd}			-	20	-	
Turn-on delay time	t _{d(on)}	V _{DD} = 480 V, I _D = 5 A, V _{GS} = 10 V, R _g = 9.1 Ω		-	22	44	ns
Rise time	t _r			-	24	48	
Turn-off delay time	t _{d(off)}			-	71	142	
Fall time	t _f			-	26	52	
Gate input resistance	R _g	f = 1 MHz, open drain		0.3	0.7	1.4	Ω
Drain-Source Body Diode Characteristics							
Continuous source-drain diode current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	4	A
Pulsed diode forward current	I _{SM}			-	-	12	
Diode forward voltage	V _{SD}	T _J = 25 °C, I _S = 5 A, V _{GS} = 0 V		-	-	1.2	V
Reverse recovery time	t _{rr}	T _J = 25 °C, I _F = I _S = 5 A, dI/dt = 100 A/μs, V _R = 25 V		-	80	-	ns
Reverse recovery charge	Q _{rr}			-	6.4	12.8	μC
Reverse recovery current	I _{RRM}			-	27	-	A

Notes

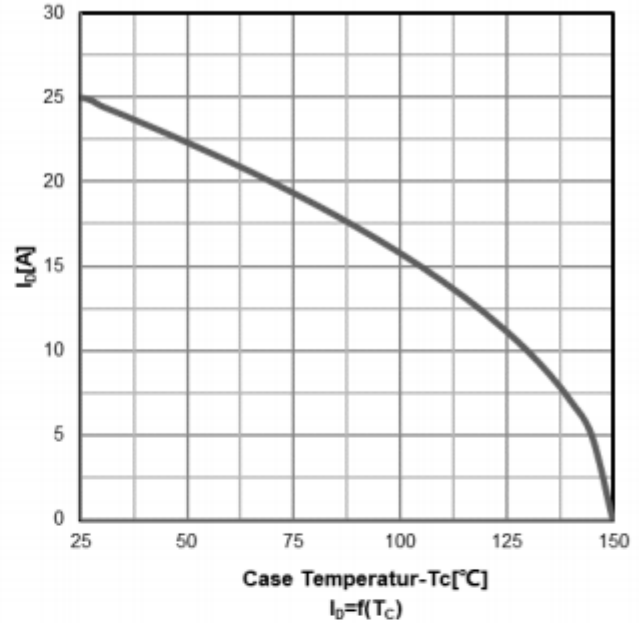
- a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS}
 b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS}

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

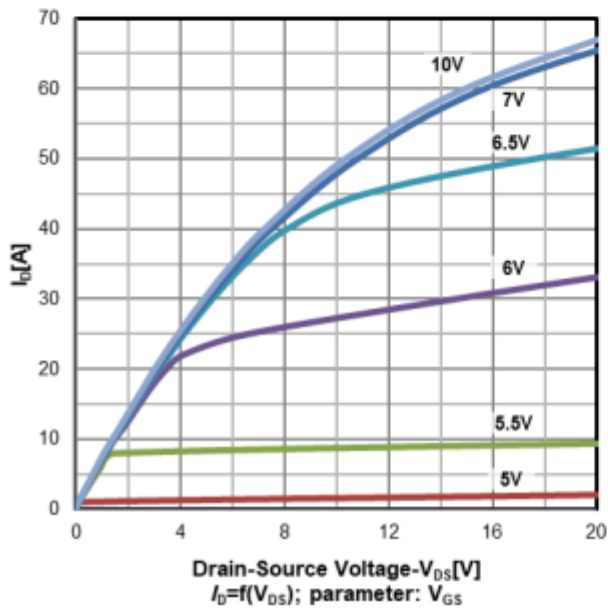
Safe operating area TC=25 °C
Non FullPAK



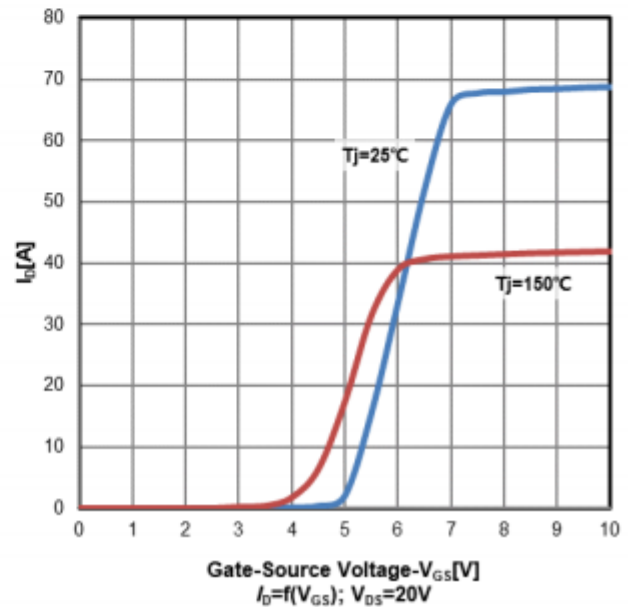
Drain current vs temperature



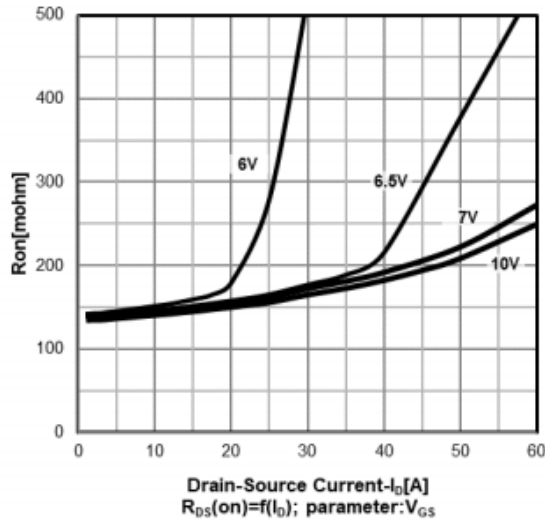
Typ. output characteristics $T_J=25\text{ °C}$



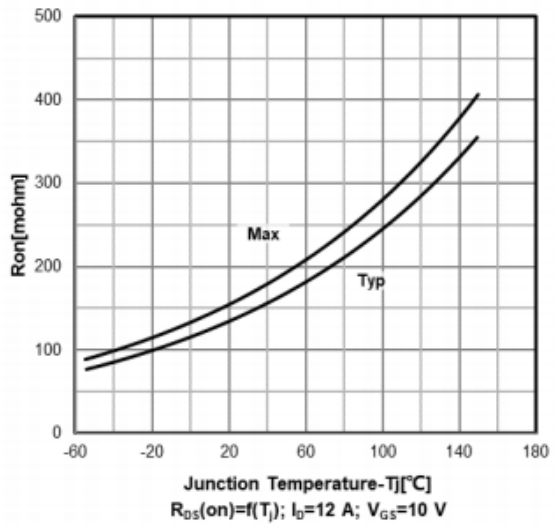
Typ. transfer characteristics



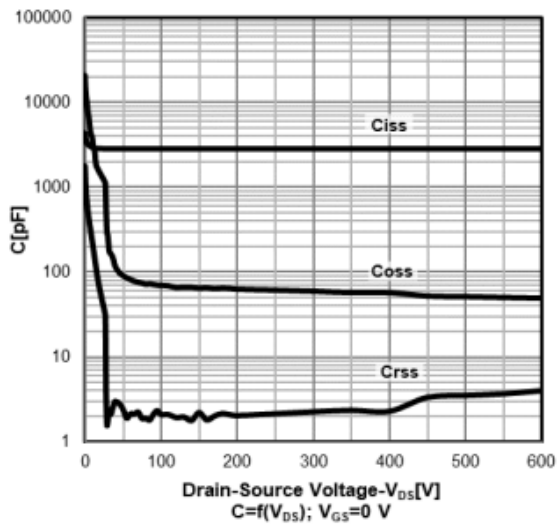
Typ. drain-source on-state resistance



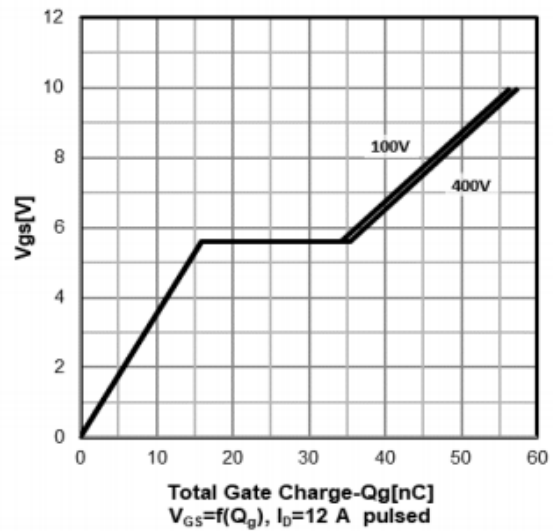
On resistance vs temperature



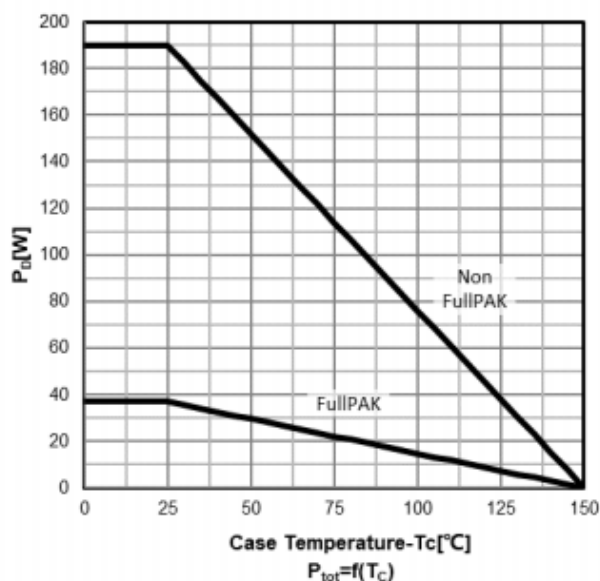
Typ. capacitances



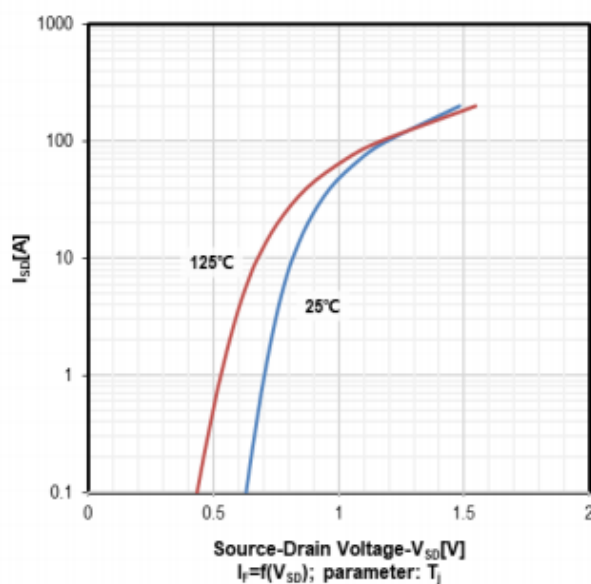
Typ. gate charge characteristics



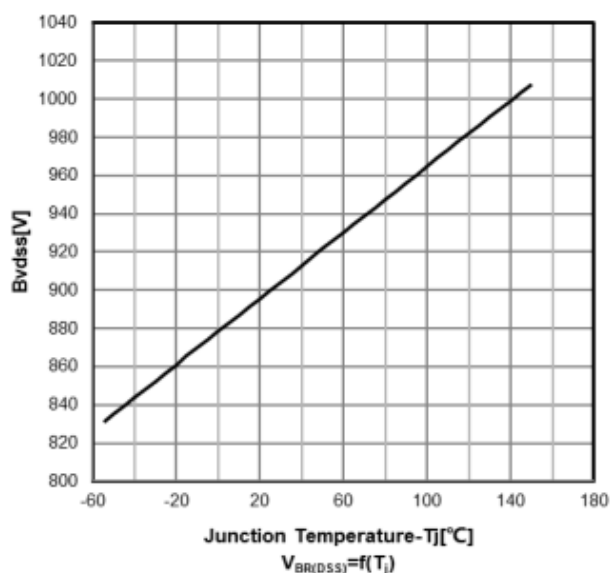
Power dissipation



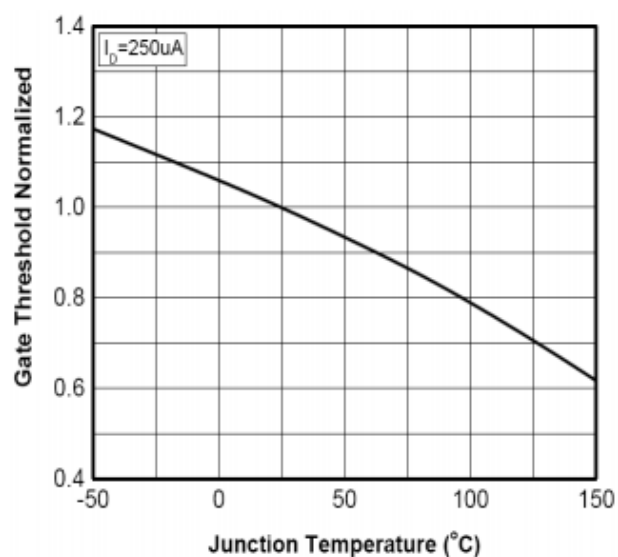
Forward characteristics of reverse diode



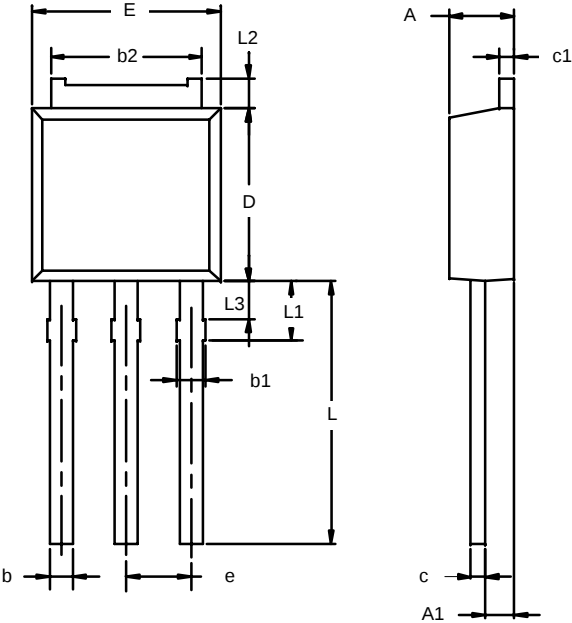
Drain-source breakdown voltage



Normalized $V_{GS(th)}$ characteristics



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Note: Dimension L3 is for reference only.

Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	2.21	2.38	0.087	0.094
A1	0.89	1.14	0.035	0.045
b	0.71	0.89	0.028	0.035
b1	0.76	1.14	0.030	0.045
b2	5.23	5.43	0.206	0.214
c	0.46	0.58	0.018	0.023
c1	0.46	0.58	0.018	0.023
D	5.97	6.22	0.235	0.245
E	6.48	6.73	0.255	0.265
e	2.28 BSC		0.090 BSC	
L	8.89	9.53	0.350	0.375
L1	1.91	2.28	0.075	0.090
L2	0.89	1.27	0.035	0.050
L3	1.15	1.52	0.045	0.060

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