

IPI80N04S4-03-VB Datasheet

N-Channel 45-V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^{a, c}	Q_g (Typ.)
45	0.0057 at $V_{GS} = 10$ V	75	240 nC
	0.0060 at $V_{GS} = 4.5$ V	70	

FEATURES

- Trench Power MOSFET
- 100 % R_g and UIS Tested

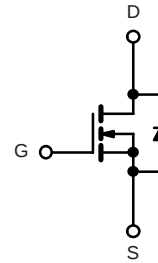
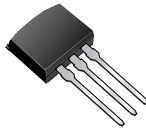
APPLICATIONS

- Synchronous Rectification
- Power Supplies



RoHS
COMPLIANT

I²PAK
(TO-262)



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS $T_A = 25^\circ\text{C}$, unless otherwise noted

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V_{DS}	45	V
Gate-Source Voltage		V_{GS}	± 25	
Continuous Drain Current ($T_J = 175^\circ\text{C}$)	$T_C = 25^\circ\text{C}$	I_D	75 ^{a, c}	A
	$T_C = 70^\circ\text{C}$		70 ^c	
	$T_A = 25^\circ\text{C}$		29 ^b	
	$T_A = 70^\circ\text{C}$		23 ^b	
Pulsed Drain Current		I_{DM}	250	
Avalanche Current Pulse		I_{AS}	80	
Single Pulse Avalanche Energy		E_{AS}	320	V
Continuous Source-Drain Diode Current	$T_C = 25^\circ\text{C}$	I_S	110 ^{a, c}	A
	$T_A = 25^\circ\text{C}$		2.6 ^b	
Maximum Power Dissipation	$T_C = 25^\circ\text{C}$	P_D	312 ^a	W
	$T_C = 70^\circ\text{C}$		200	
	$T_A = 25^\circ\text{C}$		3.13 ^b	
	$T_A = 70^\circ\text{C}$		2.0 ^b	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150	$^\circ\text{C}$

THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^b	Steady State	R_{thJA}	32	40	$^\circ\text{C/W}$
	Steady State	R_{thJC}	0.33	0.4	

Notes:

a. Based on $T_C = 25^\circ\text{C}$.

b. Surface Mounted on 1" x 1" FR4 board.

c. Calculated based on maximum junction temperature. Package limitation current is 110 A.

SPECIFICATIONS T _J = 25 °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	40			V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA		41		mV/°C
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J			- 8		
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	1.2		2.5	V
Gate-Source Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 40 V, V _{GS} = 0 V			1	μA
		V _{DS} = 40 V, V _{GS} = 0 V, T _J = 55 °C			10	
On-State Drain Current ^a	I _{D(on)}	V _{DS} ≥ 5 V, V _{GS} = 10 V	120			A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 10 V, I _D = 30 A		0.0057		Ω
		V _{GS} = 4.5 V, I _D = 20 A		0.0060		
Forward Transconductance ^a	g _{fs}	V _{DS} = 15 V, I _D = 30 A		180		S
Dynamic ^b						
Input Capacitance	C _{iss}	V _{DS} = 20 V, V _{GS} = 0 V, f = 1 MHz		18800		pF
Output Capacitance	C _{oss}			1550		
Reverse Transfer Capacitance	C _{rss}			850		
Total Gate Charge	Q _g	V _{DS} = 20 V, V _{GS} = 10 V, I _D = 20 A		240	360	nC
Gate-Source Charge	Q _{gs}			40		
Gate-Drain Charge	Q _{gd}			22		
Gate Resistance	R _g	f = 1 MHz		0.85	1.3	Ω
Turn-On Delay Time	t _{d(on)}	V _{DD} = 20 V, R _L = 1.0 Ω I _D ≅ 20 A, V _{GEN} = 10 V, R _g = 1 Ω		20	30	ns
Rise Time	t _r			11	17	
Turn-Off Delay Time	t _{d(off)}			77	115	
Fall Time	t _f			10	15	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 20 V, R _L = 1.0 Ω I _D ≅ 20 A, V _{GEN} = 4.5 V, R _g = 1 Ω		102	155	
Rise Time	t _r			62	95	
Turn-Off Delay Time	t _{d(off)}			180	270	
Fall Time	t _f			60	90	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C			110	A
Pulse Diode Forward Current ^a	I _{SM}				200	
Body Diode Voltage	V _{SD}	I _S = 20 A		0.8	1.2	V
Body Diode Reverse Recovery Time	t _{rr}	I _F = 20 A, di/dt = 100 A/μs, T _J = 25 °C		50	75	ns
Body Diode Reverse Recovery Charge	Q _{rr}			70	105	nC
Reverse Recovery Fall Time	t _a			30		ns
Reverse Recovery Rise Time	t _b			20		

Notes:

a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

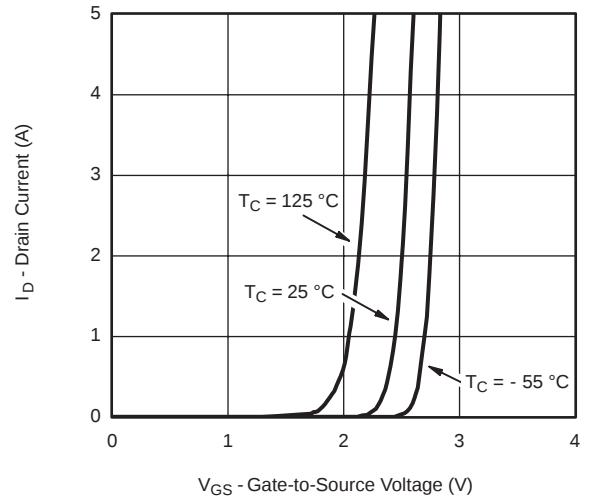
b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

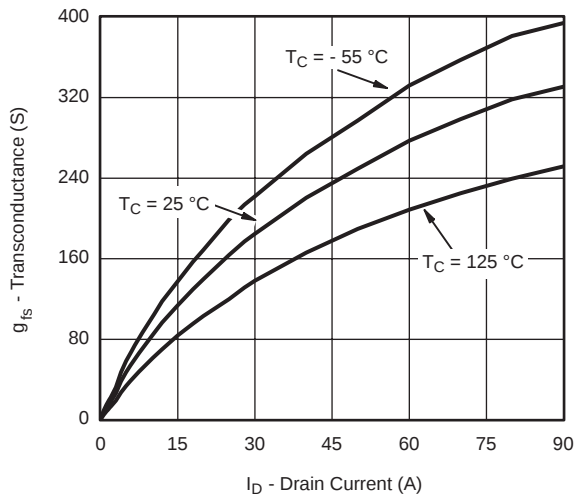
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Output Characteristics



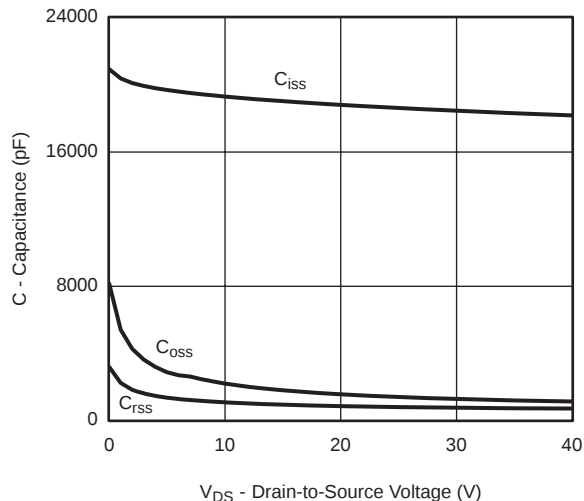
Transfer Characteristics



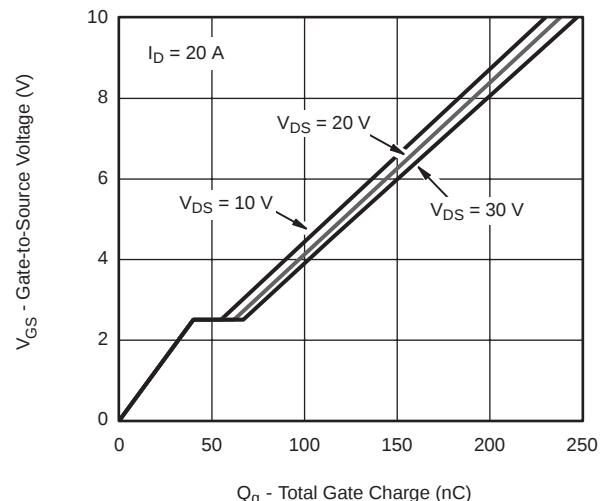
Transconductance



On-Resistance vs. Drain Current

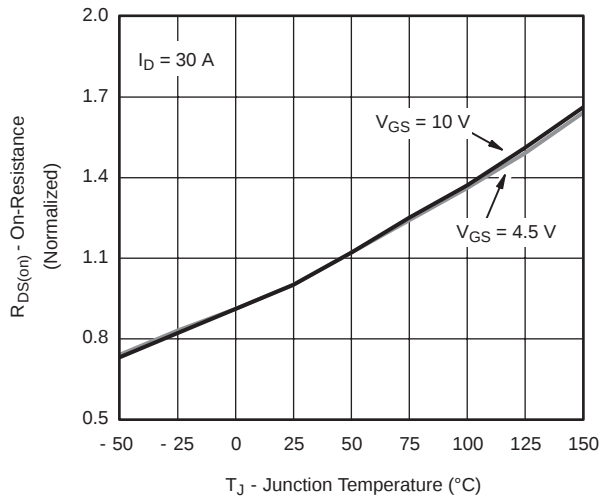


Capacitance

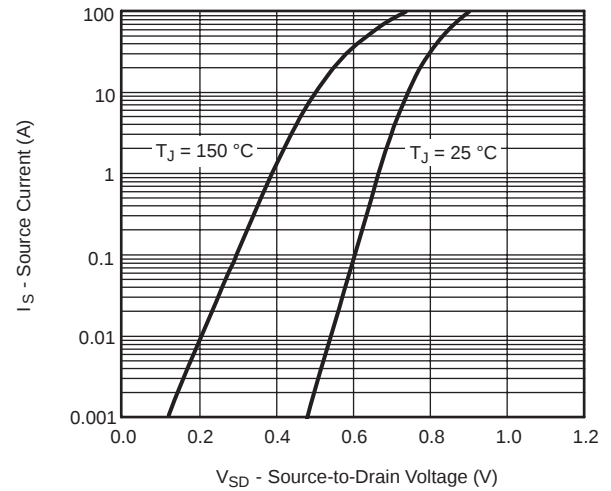


Gate Charge

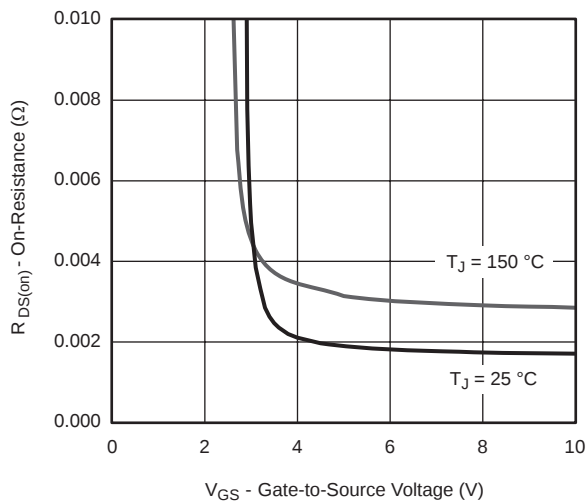
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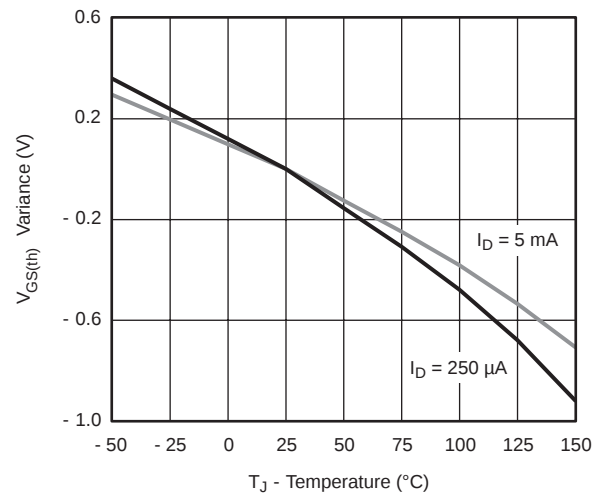
On-Resistance vs. Junction Temperature



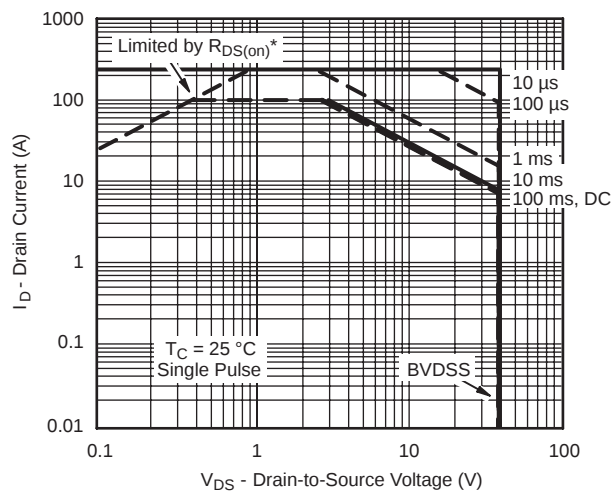
Forward Diode Voltage vs. Temperature



On-Resistance vs. Gate-to-Source Voltage



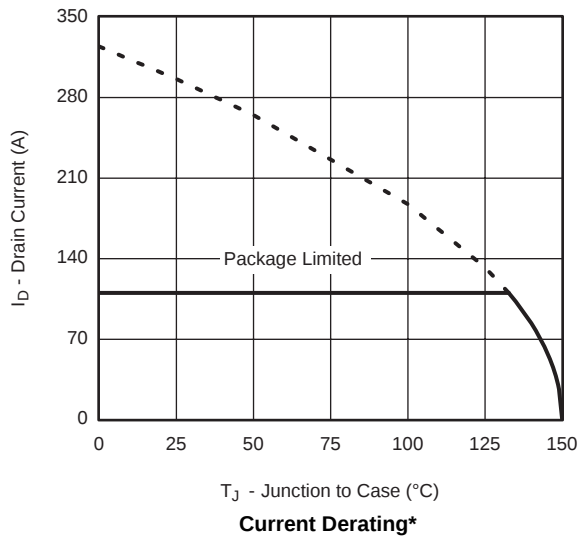
Threshold Voltage



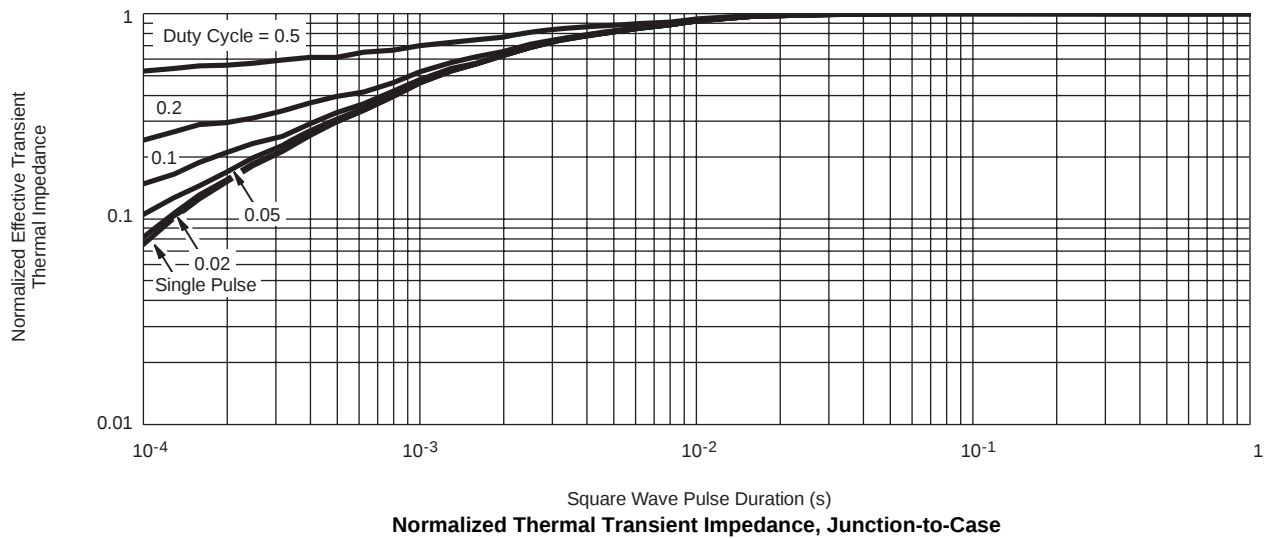
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



* The power dissipation P_D is based on $T_{J(max)} = 150\text{ °C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



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