iS20M028S1P

SuperQ™ 200-V N-Channel Power MOSFET

FEATURES

- Wide SOA and current capability
- Robustness under fault conditions
- 100% UIS tested in production
- Low switching losses, Q_{SW} and E_{OSS}
- Easier parallelling with ± 0.5V gate threshold

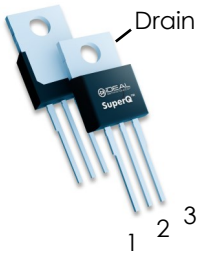
APPLICATIONS

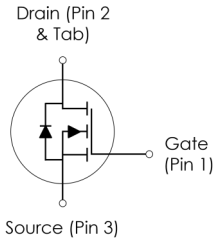
- Motor control
- Boost converters and SMPS control FETs
- Secondary side synchronous rectifier

DESCRIPTION

Engineered for SMPS and high-efficiency motor drives, this 200V SuperQ MOSFET delivers ultra-low conduction and switching losses in a robust TO-220 package. Featuring best-in-class $R_{DS(on)}$,Q_{SW} and E_{OSS}, it minimizes heat dissipation at both full and partial loads.

PRODUCT SUMMARY





TO-220

Parameter T_A = 25°C	Value	Unit
V_{DS}	200	V
$R_{DS(on),max}$	25	mΩ
I_D	40	A
Q_G	26.5	nC
Q_{SW}	2.7	nC
E_{OSS}	1	µJ

ORDERING INFORMATION			
Part Number	**Package**	**Marking**	**Packaging**
iS20M028S1P	TO-220	iS20M028S1	50pc Tube

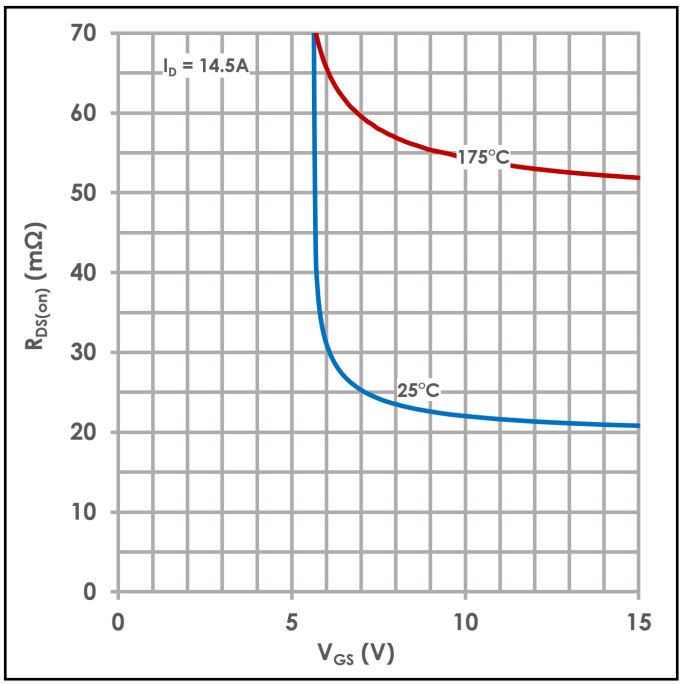


Figure 1: Typical Drain-Source On Resistance

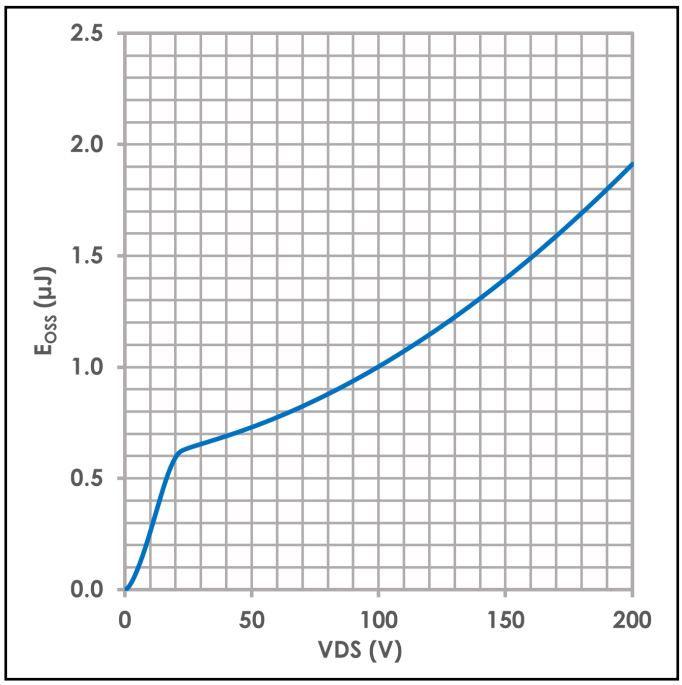


Figure 2: Typical C_{OSS} Stored Energy

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ABSOLUTE MAXIMUM RATINGS			
SYMBOL	**PARAMETER** (T_A = 25°C unless otherwise specified)	**VALUE**	**UNIT**
V_{GS}	Gate-to-source voltage	± 20	V
I_D	Continuous drain current (silicon limited), T_C = 25°C	40	A
	Continuous drain current (silicon limited), T_C = 100°C	28	
I_{DM}	Pulsed drain current	154	A
P_D	Power dissipation, T_C = 25°C	100	W
T_J, T_{stg}	Operating junction, storage temperature	-55 to 175	°C
E_{AS}	Avalanche energy, single pulse I_D = 17.8A, R_{GS} = 25Ω	159	mJ

THERMAL CHARACTERISTICS					
SYMBOL	**PARAMETER** (T_A = 25°C unless otherwise specified)	**VALUE**			**UNIT**
		MIN	**TYP**	**MAX**	
$R_{\theta JC}$	Junction-to-case thermal resistance - TO-220	-	-	1.5	°C/W
$R_{\theta JA}$	Junction-to-ambient thermal resistance (1)	-	-	40	°C/W
$R_{\theta JA}$	Junction-to-ambient thermal resistance, minimal footprint	-	-	62	°C/W

(1) 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm^2 (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise specified)						
SYMBOL	PARAMETER	TEST CONDITIONS	VALUE			UNIT
			MIN	TYP	MAX	
STATIC CHARACTERISTICS						
BV_{DSS}	Drain-to-source voltage	V_{GS} = 0V, I_D = 1mA	200	-	-	V
I_{DSS}	Drain-to-source leakage current	V_{GS} = 0V, V_{DS} = 160V, T_J = 25°C	-	0.03	1	µA
		V_{GS} = 0V, V_{DS} = 160V, T_J = 125°C (2)	-	13	100	
I_{GSS}	Gate-to-source leakage current	V_{DS} = 0V, V_{GS} = 20V	-	0.4	100	nA
$V_{GS(th)}$	Gate-to-source threshold voltage	V_{DS} = V_{GS}, I_D = 70µA	3.1	3.6	4.1	V
$R_{DS(on)}$	Drain-to-source on-resistance	V_{GS} = 10V, I_D = 14.5A	-	22	25	mΩ
g_{fs}	Transconductance (2)	V_{DS} = 10V, I_D = 14.5A	16	31	-	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input capacitance (2)	V_{GS} = 0V, V_{DS} = 100V, f = 100kHz	-	1,865	2,425	pF
C_{rss}	Reverse transfer capacitance (2)		-	12	16	
C_{oss}	Output capacitance (2)		-	67	86	
$C_{o(er)}$	Effective output capacitance	V_{DS} = 0 to 100V, V_{GS} = 0V	-	197	-	
R_G	Series gate resistance	f = 1MHz	-	4.5	6.8	Ω
$t_{d(on)}$	Turn-on delay time	V_{DS} = 100V, V_{GS} = 10V, I_{DS} = 14.5A, $R_{G,EXT}$ = 0 Ω	-	8.5	-	ns
t_r	Rise time		-	1.9	-	
$t_{d(off)}$	Turn-off delay time		-	24.7	-	
t_f	Fall time		-	11.3	-	
GATE CHARGE CHARACTERISTICS						
Q_g	Gate charge total (2)	V_{DS} = 100V, I_D = 14.5A, V_{GS} = 0 to 10V	-	26.5	34	nC
Q_{sw}	Switching charge (3)		-	2.7	-	
Q_{gd}	Gate to drain charge (2)		-	1.4	1.8	
$V_{plateau}$	Gate plateau voltage		-	5.7	-	V
Q_{oss}	Output charge (2)	V_{DS} = 0 to 100V, V_{GS} = 0V	-	95	108	nC
E_{oss}	Capacitive stored energy		-	1	-	µJ
DIODE CHARACTERISTICS						
V_{SD}	Diode forward voltage	I_{SD} = 14.5A, V_{GS} = 0V	-	1.0	1.2	V
Q_{rr}	Reverse recovery charge	V_{DS} = 100V, I_F = 14.5A, di/dt = 100A/µs	-	425	-	nC
t_{rr}	Reverse recovery time		-	107	-	ns

(2) Defined by design. Not subject to production test.
(3) Q_{sw} should be used for switching loss calculations. See Figure 16 and Q_{sw} application note on www.idealsemi.com

Ratings and Characteristics Curves

(T_A = 25°C unless otherwise specified)

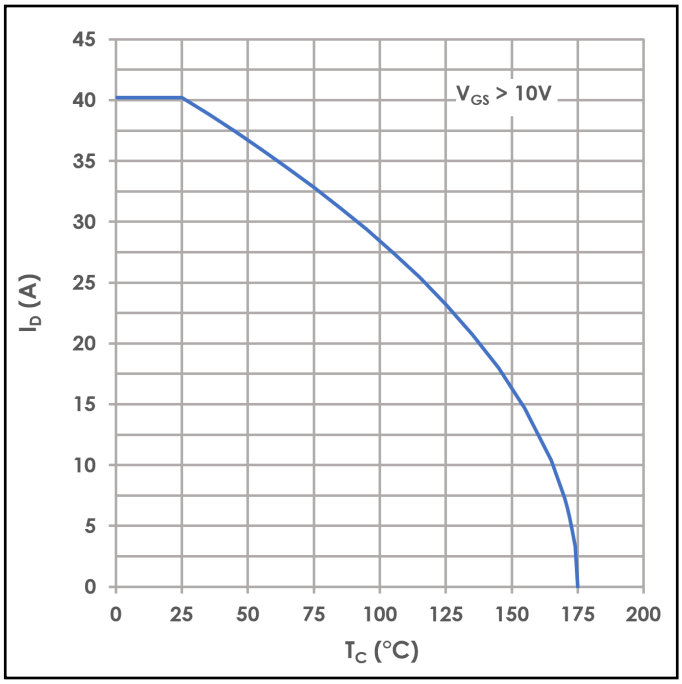


Figure 3: Drain Current

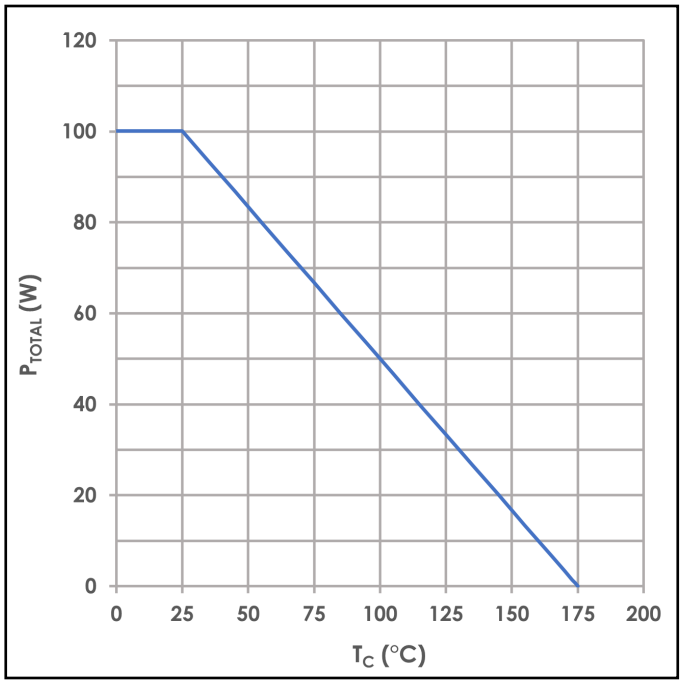


Figure 4: Power Dissipation

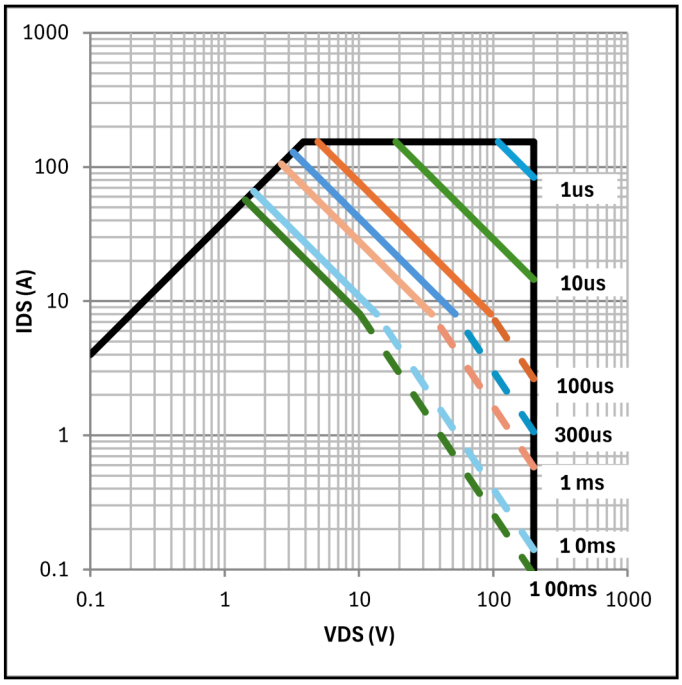


Figure 5: Safe Operating Area

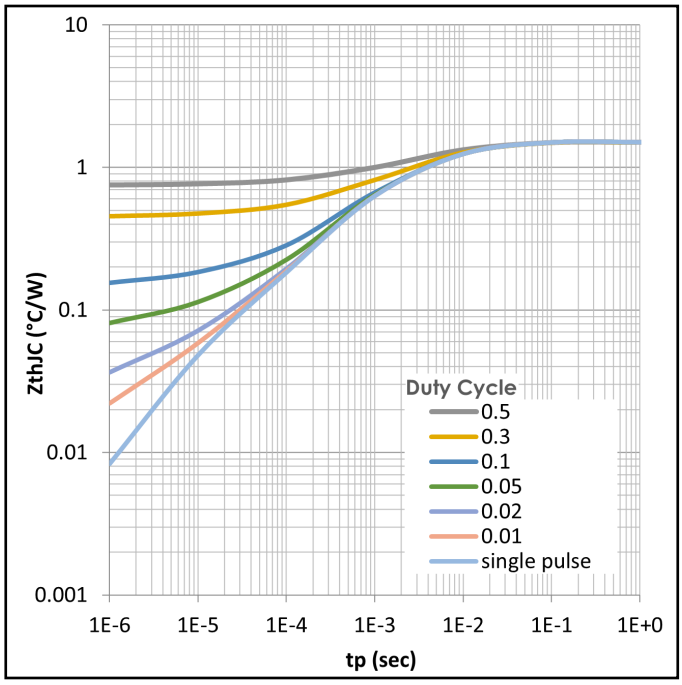


Figure 6: Max Transient Thermal Impedance

Ratings and Characteristics Curves

(T_A = 25°C unless otherwise specified)

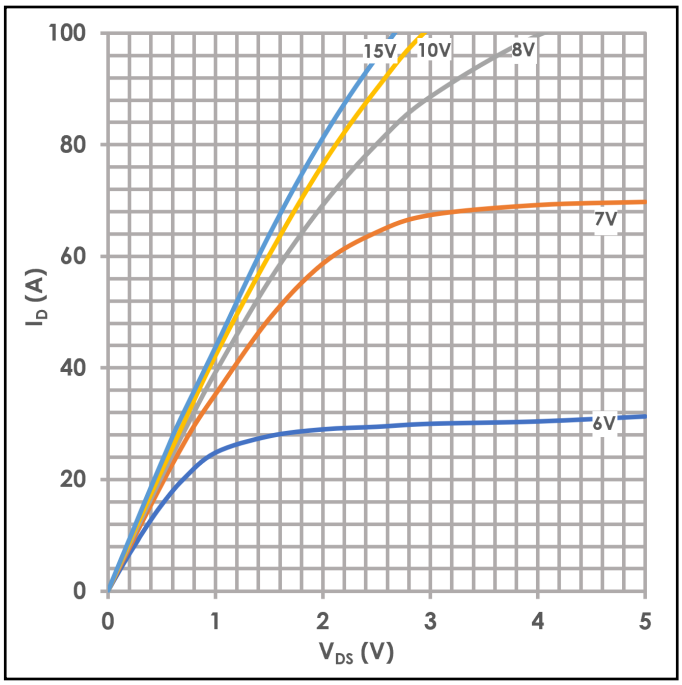


Figure 7: Typical Output Characteristics

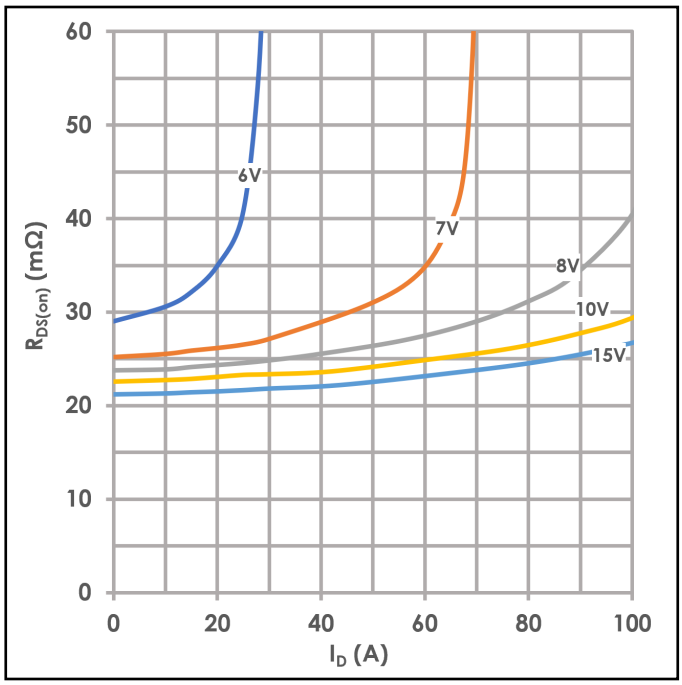


Figure 8: Typical Drain-Source On-Resistance

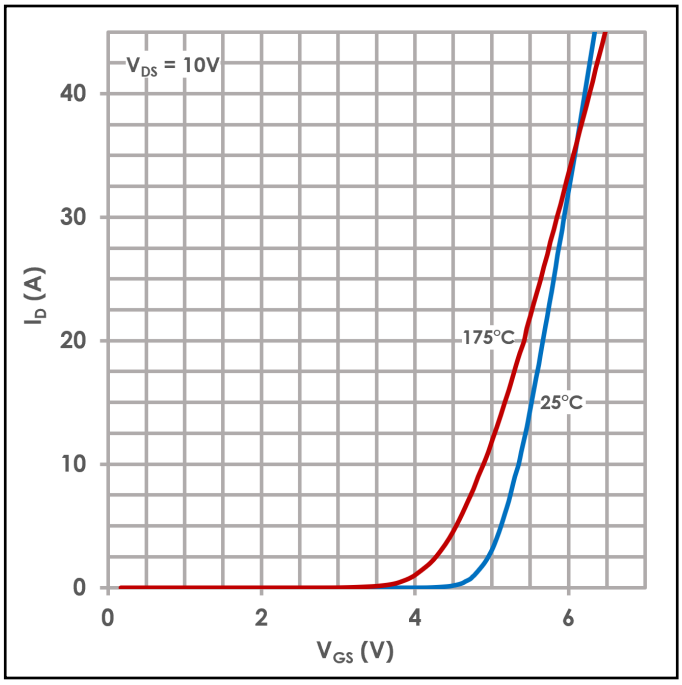


Figure 9: Typical Transfer Characteristics

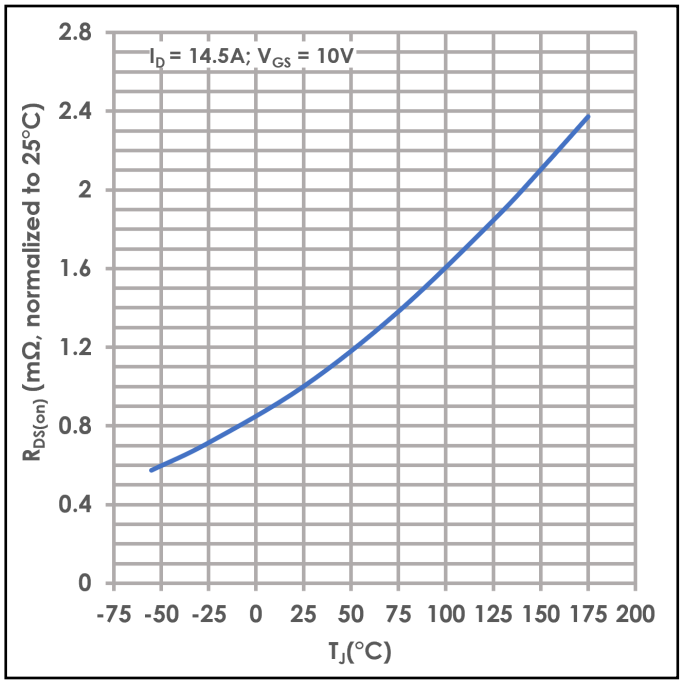


Figure 10: Normalized On-State Resistance vs. Temperature

Ratings and Characteristics Curves

(T_A = 25°C unless otherwise specified)

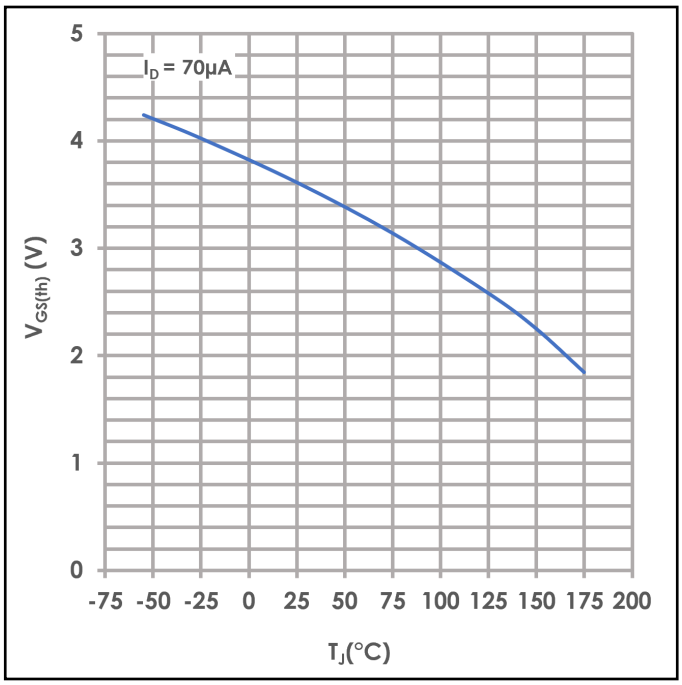


Figure 11: Typical Threshold Voltage

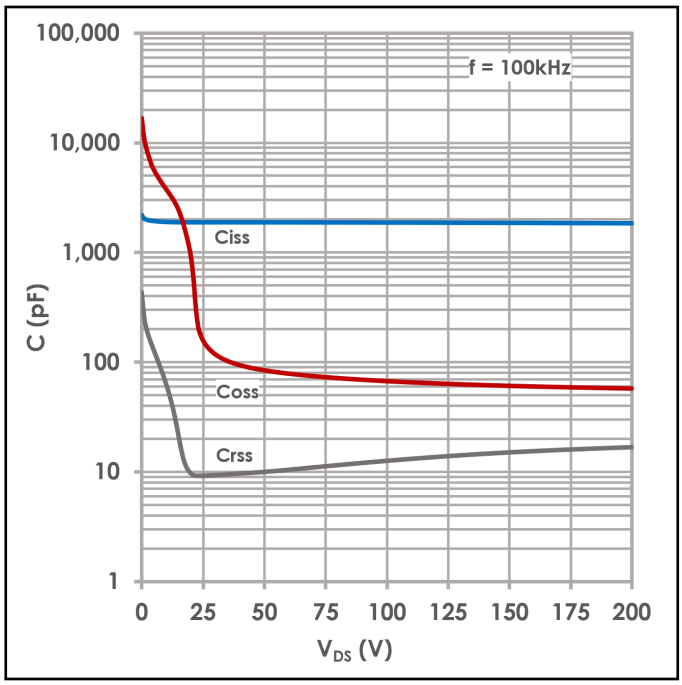


Figure 12: Typical Capacitances

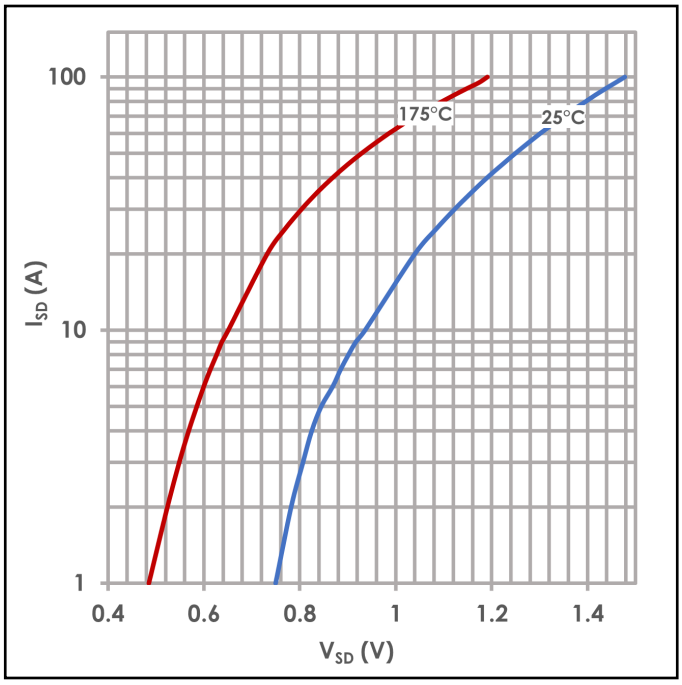


Figure 13: Typical Diode Forward Voltage

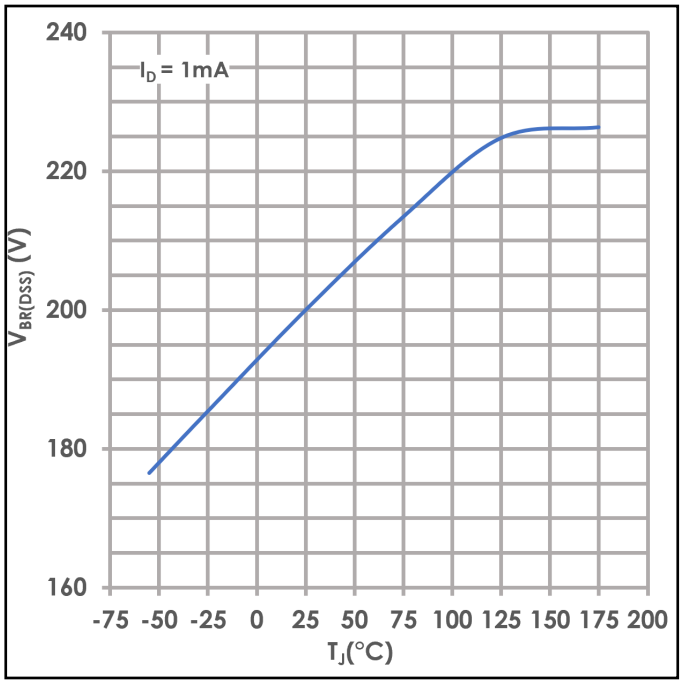


Figure 14: Min Drain-Source Breakdown Voltage

Ratings and Characteristics Curves

(T_A = 25°C unless otherwise specified)

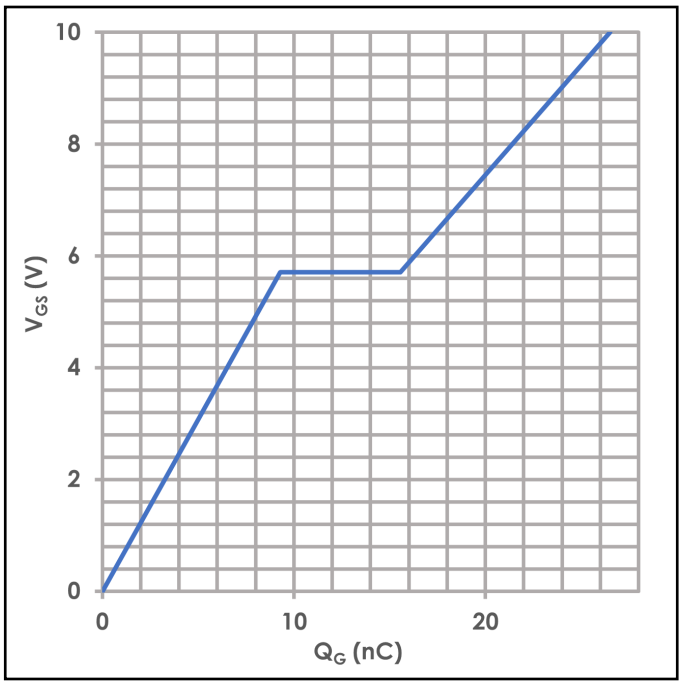


Figure 15: Typical Gate Charge

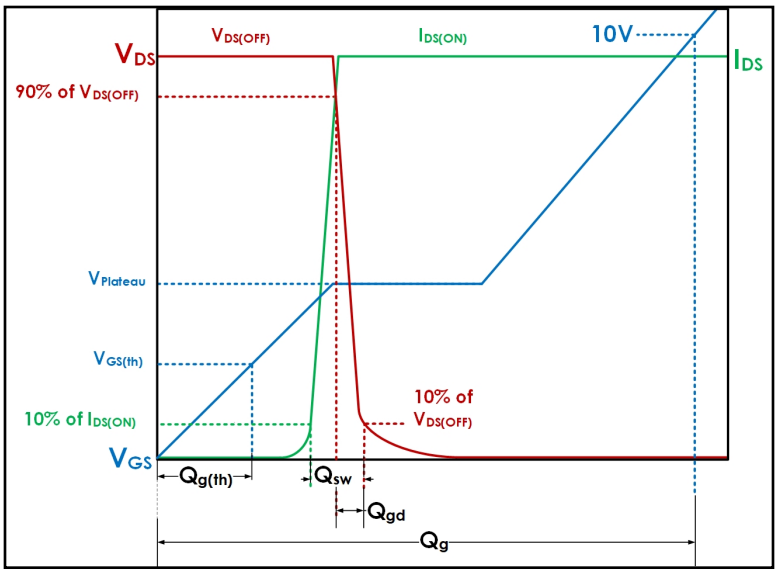
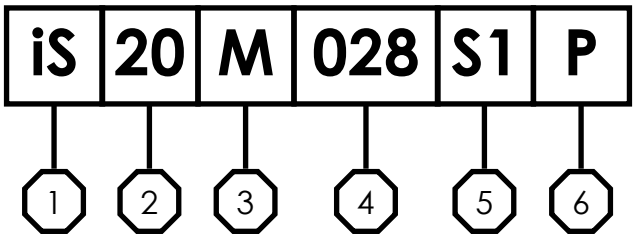


Figure 16: Gate Charge Definitions

DEVICE DECODER RING

Device Code



1 – iDEAL Semiconductor product

2 – Voltage rating divided by 10 (200V)

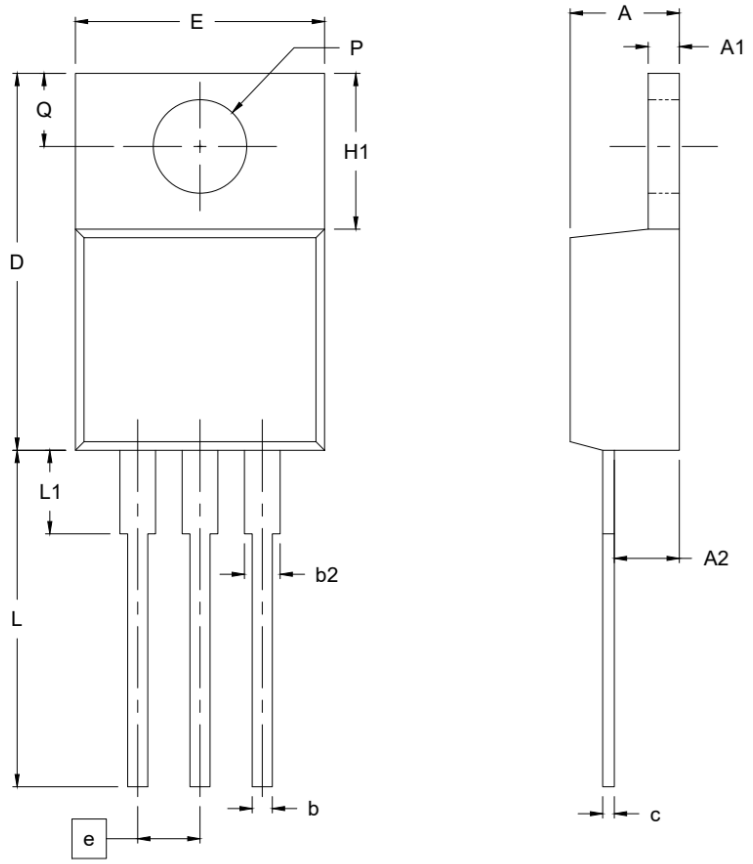
3 – M = N-Channel MOSFET, Standard Threshold

4 – Maximum drain-to-source resistance

5 – SuperQ™ Generation

6 – P = TO-220

TO-220 Package Drawing



SYMBOL	MIN	MAX
A	4.19	4.82
A1	1.14	1.40
A2	2.38	2.92
b	0.63	1.01
b2	1.13	1.78
c	0.31	0.64
D	14.22	16.51
E	9.66	10.66
e	2.54 BSC	
H1	5.85	6.85
L	12.70	14.73
L1	2.39	4.42
P	3.54	4.08
Q	2.54	3.42

Notes:
1. All linear dimensions in millimeters
2. Dimensions D and E do not include mold flash or protrusions

Revision History		
Version	**Date**	**Comments**
1.0	July 2025	Initial Release
1.1	September 2025	Gate charge characteristics table updated. Figure 16 added

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