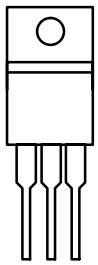
N-Channel 40-V (D-S) 175°C MOSFET

PRODUCT SUMMARY		
$V_{(BR)DSS}$ (V)	$r_{DS(on)}$ (Ω)	I_D (A)
40	0.004 @ V_{GS} = 10 V	85 [a]

175°C Rated
Maximum Junction Temperature
TrenchFET®
Power MOSFETs

TO-220AB

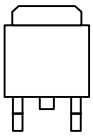


G D S
Top View

DRAIN connected to TAB

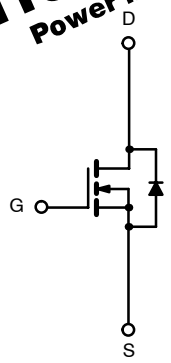
Ordering Information
SUP85N04-04
SUP85N04-04—E3 (Lead (Pb)-Free)

TO-263



G D S
Top View

Ordering Information
SUB85N04-04
SUB85N04-04—E3 (Lead (Pb)-Free)



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C UNLESS OTHERWISE NOTED)				
Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V_{DS}	40	V
Gate-Source Voltage		V_{GS}	20	
Continuous Drain Current (T_J = 175°C)	T_C = 25°C	I_D	85[a]	A
	T_C = 125°C		85[a]	
Pulsed Drain Current		I_{DM}	240	
Avalanche Current		I_{AR}	70	
Repetitive Avalanche Energy[b]	L = 0.1 mH	E_{AR}	211	mJ
Maximum Power Dissipation[b]	T_C = 25°C (TO-220AB and TO-263)	P_D	250[c]	W
	T_A = 25°C (TO-263)[d]		3.75	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	–55 to 175	°C

THERMAL RESISTANCE RATINGS				
Parameter		Symbol	Limit	Unit
Junction-to-Ambient	PCB Mount (TO-263)[d]	R_{thJA}	40	°C/W
	Free Air (TO-220AB)		62.5	
Junction-to-Case		R_{thJC}	0.6	

Notes
a. Package limited.
b. Duty cycle ≤ 1%.
c. See SOA curve for voltage derating.
d. When mounted on 1" square PCB (FR-4 material).

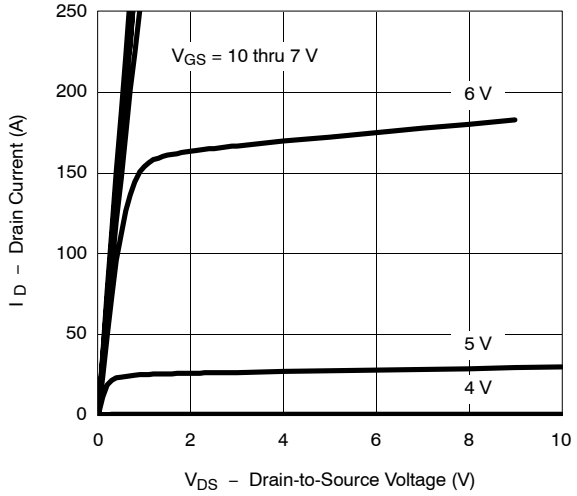
SPECIFICATIONS (T_J =25°C UNLESS OTHERWISE NOTED)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{DS} = 0 V, I_D = 250 μA	40			V
Gate-Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 μA	2		4	
Gate-Body 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 = 125°C			50	
		V_{DS} = 40 V, V_{GS} = 0 V, T_J = 175°C			250	
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		0.0031	0.004	Ω
		V_{GS} = 10 V, I_D = 30 A, T_J = 125°C			0.0055	
		V_{GS} = 10 V, I_D = 30 A, T_J = 175°C			0.007	
Forward Transconductance[a]	g_{fs}	V_{DS} = 15 V, I_D = 30 A	30			S
Dynamic[b]						
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz		7620		pF
Output Capacitance	C_{oss}			1325		
Reverse Transfer Capacitance	C_{rss}			710		
Total Gate Charge[c]	Q_g	V_{DS} = 30 V, V_{GS} = 10 V, I_D = 85 A		160	250	nC
Gate-Source Charge[c]	Q_{gs}			40		
Gate-Drain Charge[c]	Q_{gd}			55		
Turn-On Delay Time[c]	$t_{d(on)}$	V_{DD} = 30 V, R_L = 0.47 Ω I_D ≅ 85 A, V_{GEN} = 10 V, R_g = 2.5 Ω		20	35	ns
Rise Time[c]	t_r			115	175	
Turn-Off Delay Time[c]	$t_{d(off)}$			75	115	
Fall Time[c]	t_f			85	130	
Source-Drain Diode Ratings and Characteristics (T_C = 25°C)[b]						
Continuous Current	I_S				85	A
Pulsed Current	I_{SM}				240	
Forward Voltage[a]	V_{SD}	I_F = 85 A, V_{GS} = 0 V		1.1	1.4	V
Reverse Recovery Time	t_{rr}	I_F = 85 A, di/dt = 100 A/μs		60	90	ns
Peak Reverse Recovery Current	$I_{RM(REC)}$			2.6	4	A
Reverse Recovery Charge	Q_{rr}			0.08	0.15	μC

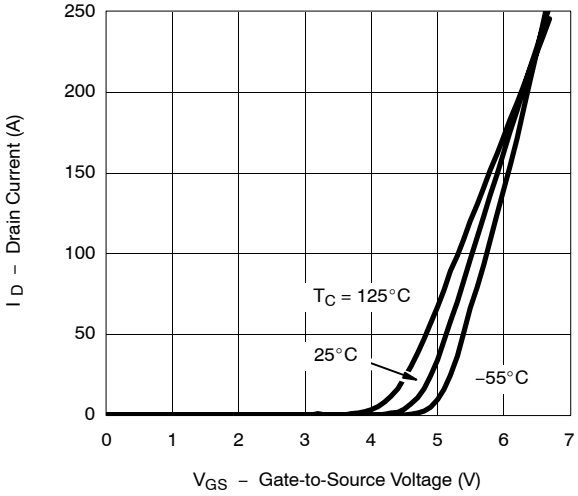
Notes
a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2%.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

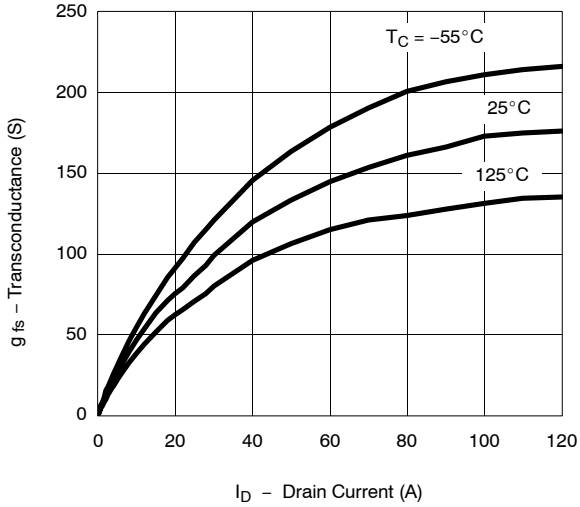
Output Characteristics



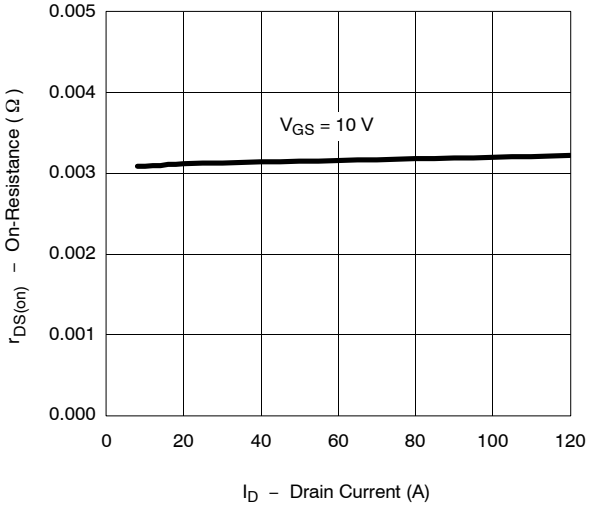
Transfer Characteristics



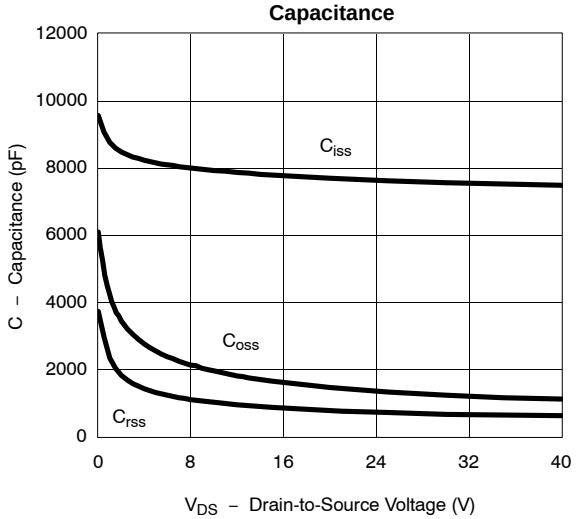
Transconductance



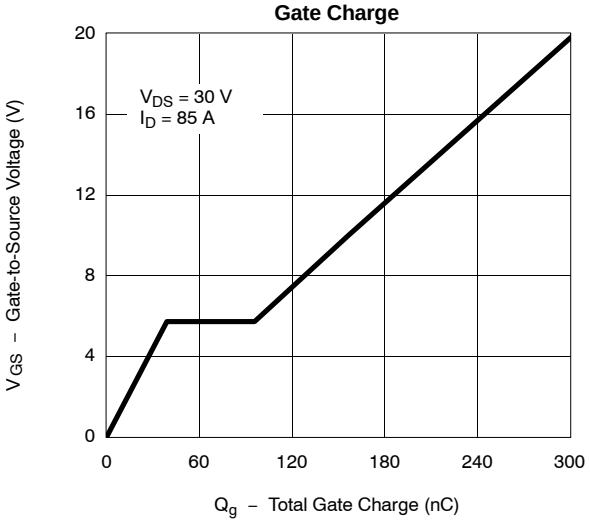
On-Resistance vs. Drain Current



Capacitance

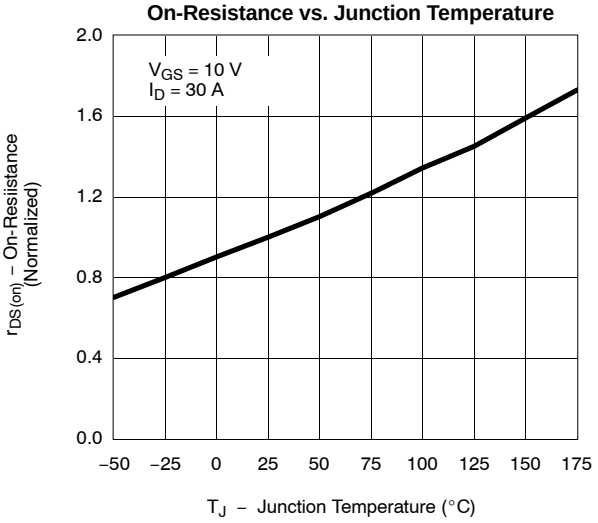


Gate Charge

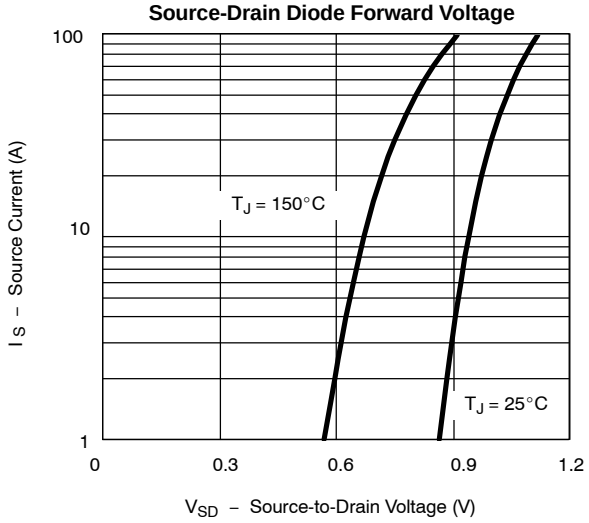


TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

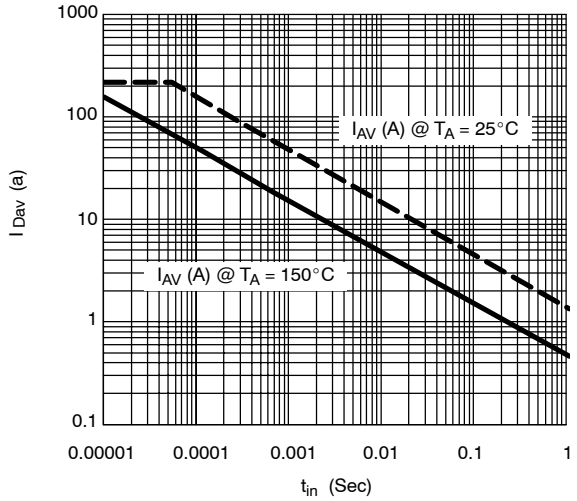
On-Resistance vs. Junction Temperature



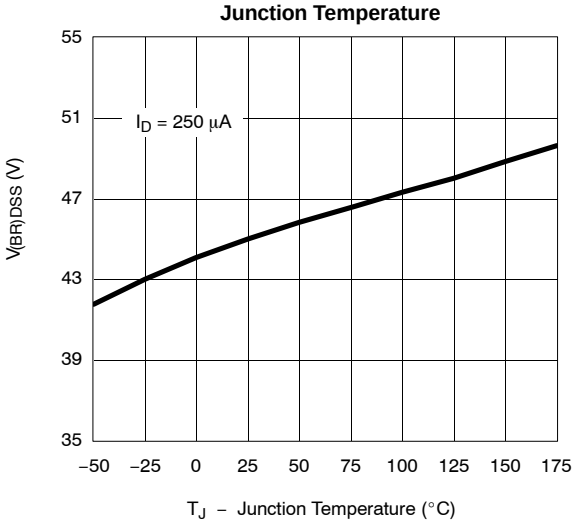
Source-Drain Diode Forward Voltage



Avalanche Current vs. Time

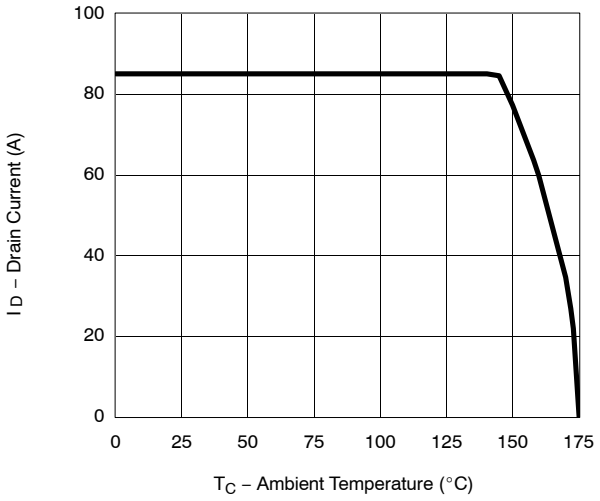


Drain Source Breakdown vs. Junction Temperature

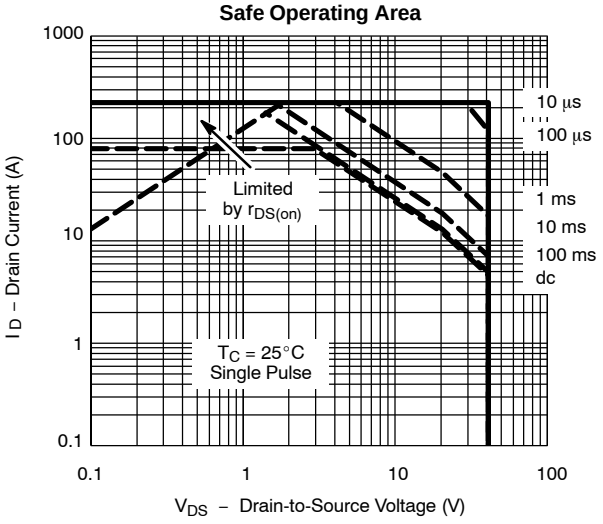


THERMAL RATINGS

Maximum Avalanche and Drain Current vs. Case Temperature



Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case