



# STE40NC60

## N-CHANNEL 600V - 0.098Ω - 40A ISOTOP

### PowerMesh™II MOSFET

TYPE	V <sub>DS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STE40NC60	600V	< 0.13Ω	40 A

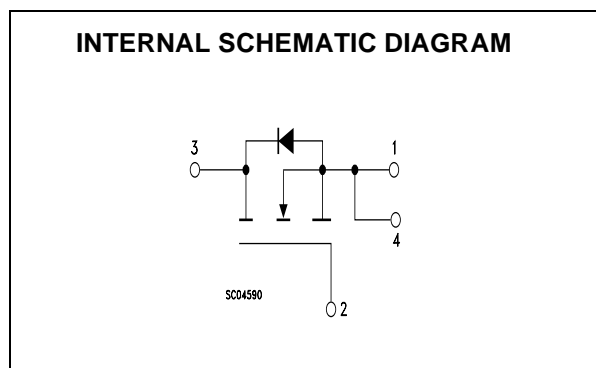
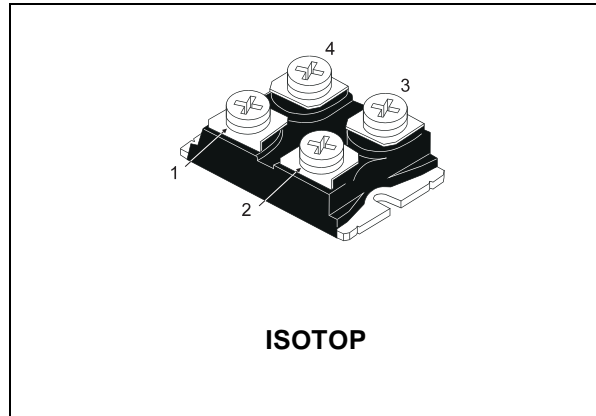
- TYPICAL R<sub>DS(on)</sub> = 0.098 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- NEW HIGH VOLTAGE BENCHMARK
- GATE CHARGE MINIMIZED

#### DESCRIPTION

The PowerMESH™II is the evolution of the first generation of MESH OVERLAY™. The layout refinements introduced greatly improve the Ron\*area figure of merit while keeping the device at the leading edge for what concerns swithing speed, gate charge and ruggedness.

#### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVER



#### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	600	V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)	600	V
V <sub>GS</sub>	Gate- source Voltage	±30	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	40	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	23	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	160	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	460	W
	Derating Factor	3.68	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	3	V/ns
V <sub>ISO</sub>	Insulation Withstand Voltage (AC-RMS)	2500	V
T <sub>stg</sub>	Storage Temperature	-65 to 150	°C
T <sub>j</sub>	Max. Operating Junction Temperature	150	°C

(•) Pulse width limited by safe operating area  
May 2002

(1) I<sub>SD</sub> ≤ 40A, di/dt ≤ 100 A/μs, V<sub>DD</sub> ≤ 24V, T<sub>j</sub> ≤ T<sub>jMAX</sub>

## STE40NC60

### THERMAL DATA

Rthj-case	Thermal Resistance Junction-case	Max	0.272	°C/W
Rthc-h	Thermal Resistance Case-heatsink with Conductive Grease Applied		0.05	°C/W

### AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max)	40	A
E <sub>AS</sub>	Single Pulse Avalanche Energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V)	1150	mJ

### ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED) OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0	600			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max Rating V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C			10 100	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 30V			±100	nA

### ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2	3	4	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 20A		0.098	0.130	Ω

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> (1)	Forward Transconductance	V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> , I <sub>D</sub> = 15 A		42		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0		11.1		nF
C <sub>oss</sub>	Output Capacitance			1190		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			100		pF

Note: 1. Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %.

**ELECTRICAL CHARACTERISTICS (CONTINUED)**  
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 300\text{ V}, I_D = 20\text{ A}$		49		ns
$t_r$	Rise Time	$R_G = 4.7\Omega, V_{GS} = 10\text{ V}$ (see test circuit, Figure 3)		42		ns
$Q_g$	Total Gate Charge	$V_{DD} = 480\text{ V}, I_D = 40\text{ A},$ $V_{GS} = 10\text{ V}$		307.5	430	nC
$Q_{gs}$	Gate-Source Charge			48		nC
$Q_{gd}$	Gate-Drain Charge			146.5		nC

SWITCHING OFF

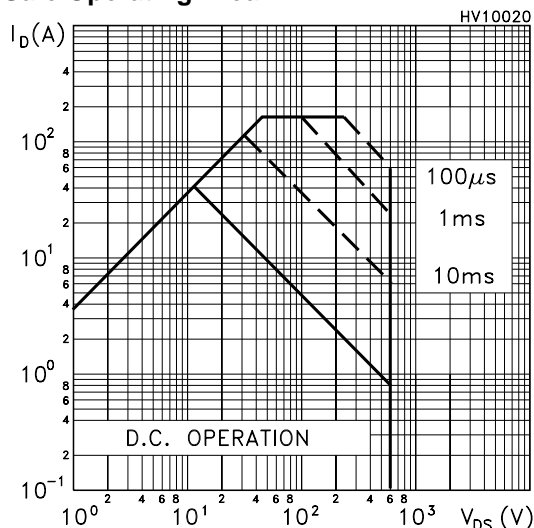
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 480\text{ V}, I_D = 40\text{ A},$ $R_G = 4.7\Omega, V_{GS} = 10\text{ V}$ (see test circuit, Figure 5)		41		ns
$t_f$	Fall Time			26		ns
$t_c$	Cross-over Time			74		ns

SOURCE DRAIN DIODE

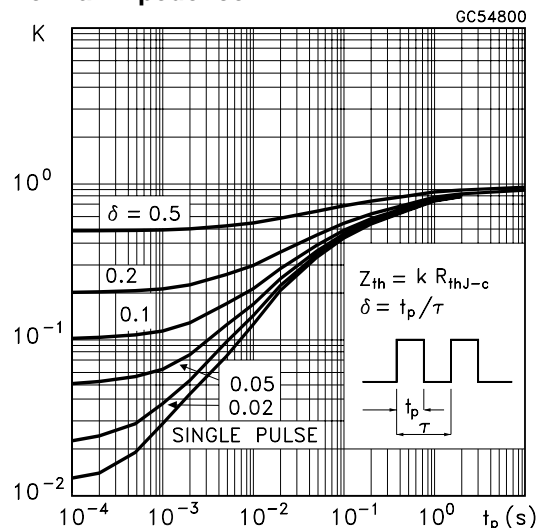
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				40	A
$I_{SDM(2)}$	Source-drain Current (pulsed)				160	A
$V_{SD(1)}$	Forward On Voltage	$I_{SD} = 40\text{ A}, V_{GS} = 0$			1.6	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 40\text{ A}, di/dt = 100\text{ A}/\mu\text{s},$ $V_{DD} = 40\text{ V}, T_J = 150\text{ }^\circ\text{C}$ (see test circuit, Figure 5)		685		ns
$Q_{rr}$	Reverse Recovery Charge			15		$\mu\text{C}$
$I_{RRM}$	Reverse Recovery Current			44		A

Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
2. Pulse width limited by safe operating area.

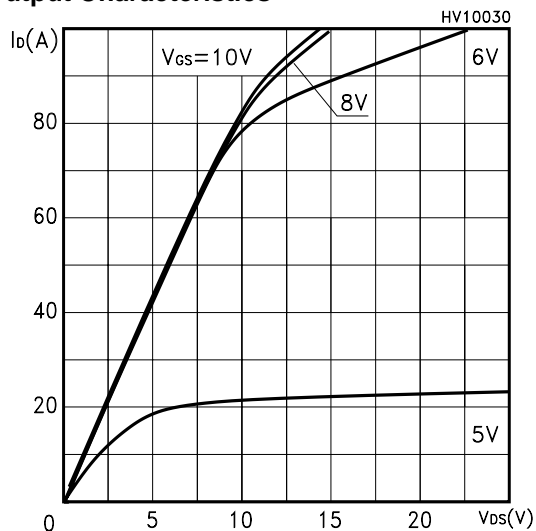
Safe Operating Area



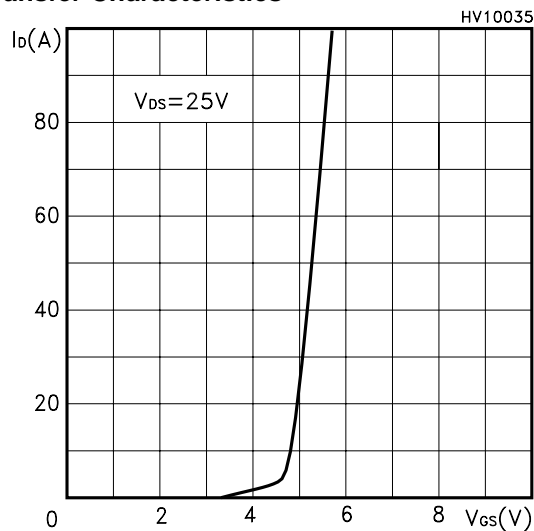
Thermal Impedance



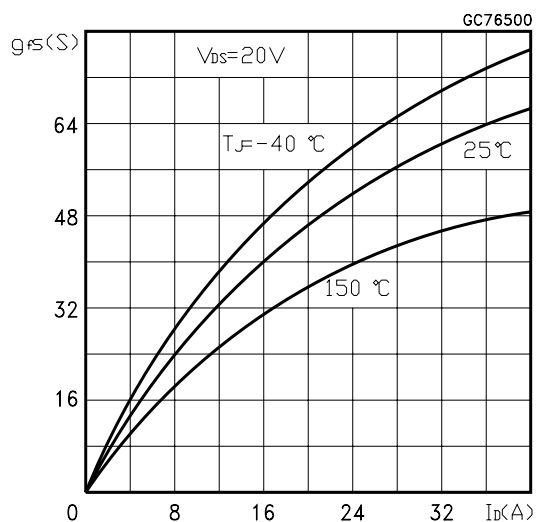
Output Characteristics



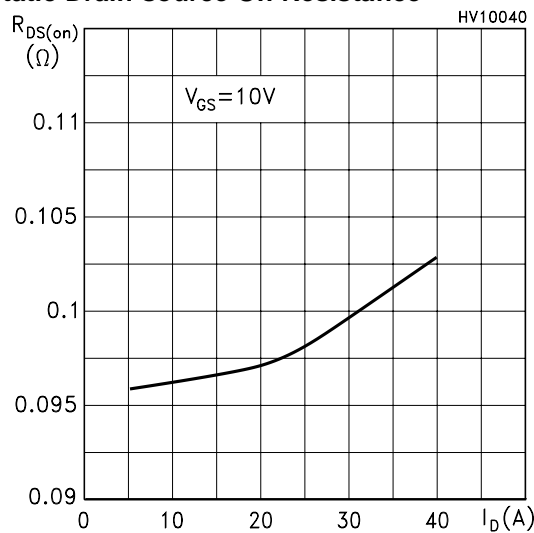
Transfer Characteristics



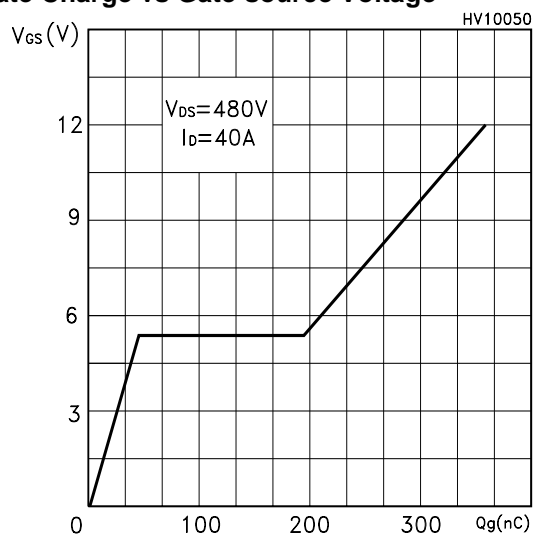
Transconductance



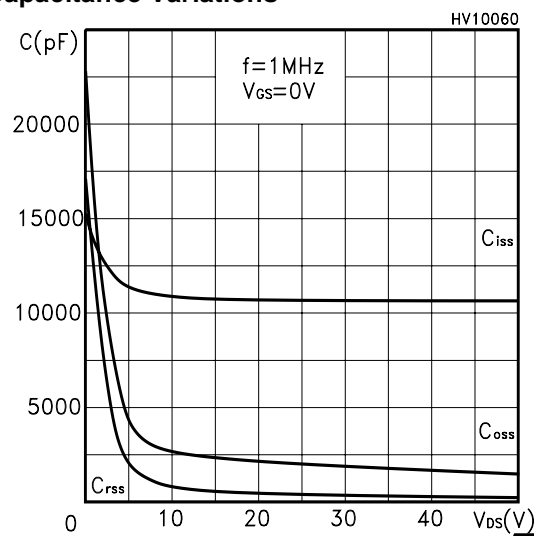
Static Drain-source On Resistance



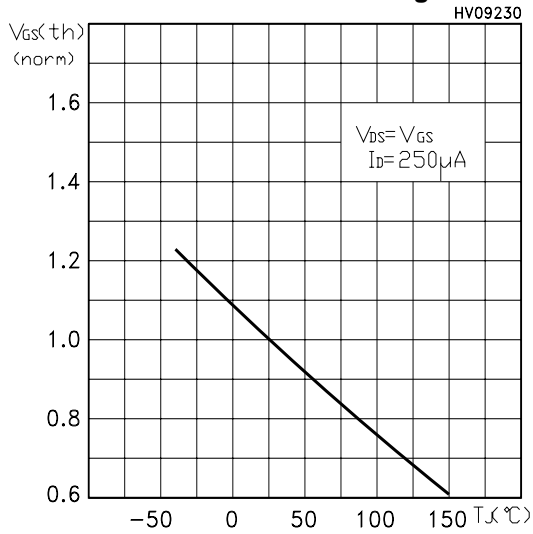
Gate Charge vs Gate-source Voltage



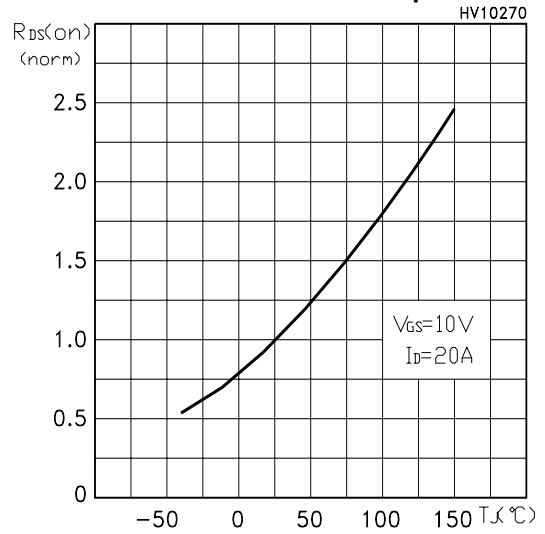
Capacitance Variations



Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

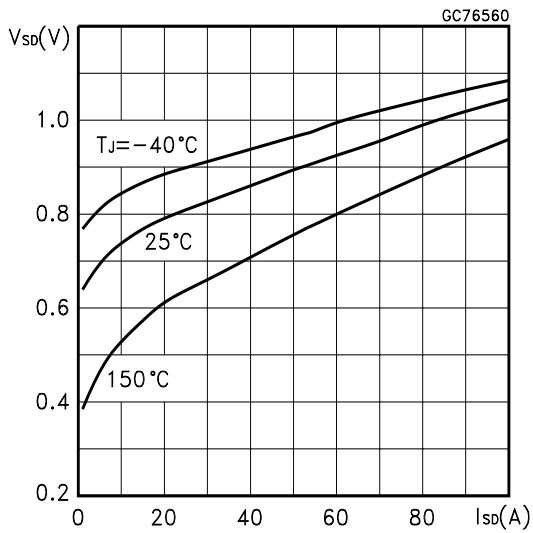


Fig. 1: Unclamped Inductive Load Test Circuit



Fig. 2: Unclamped Inductive Waveform



Fig. 3: Switching Times Test Circuit For Resistive Load



Fig. 4: Gate Charge test Circuit

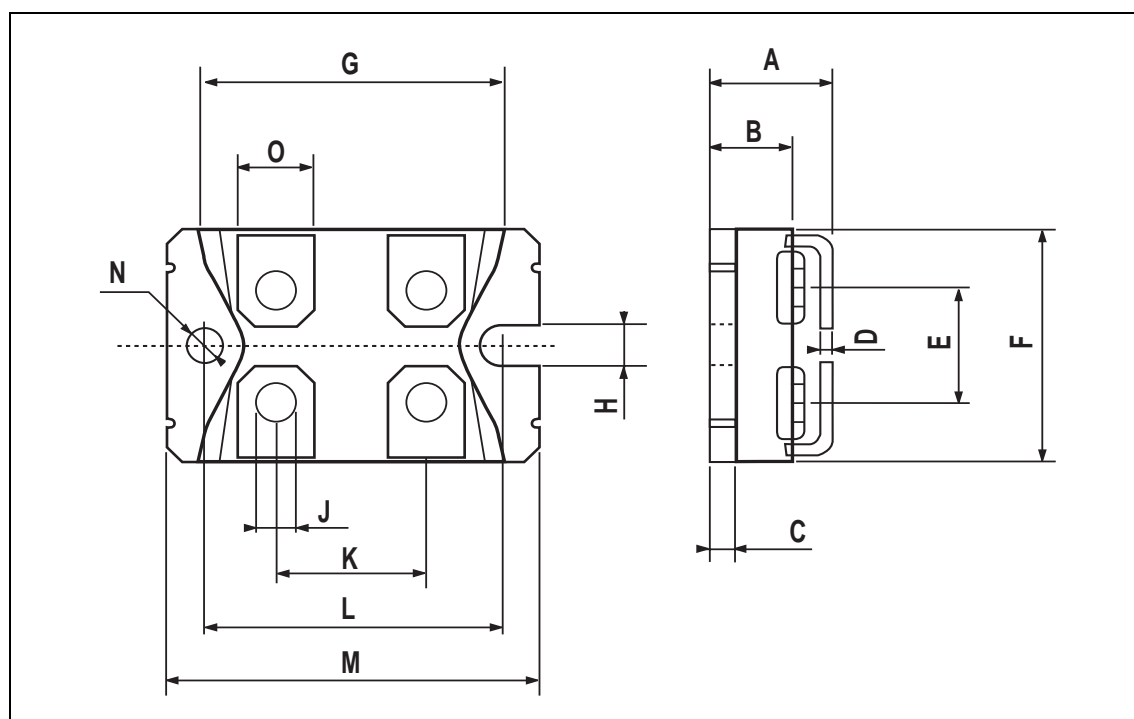


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



## ISOTOP MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	11.8		12.2	0.466		0.480
B	8.9		9.1	0.350		0.358
C	1.95		2.05	0.076		0.080
D	0.75		0.85	0.029		0.033
E	12.6		12.8	0.496		0.503
F	25.15		25.5	0.990		1.003
G	31.5		31.7	1.240		1.248
H	4			0.157		
J	4.1		4.3	0.161		0.169
K	14.9		15.1	0.586		0.594
L	30.1		30.3	1.185		1.193
M	37.8		38.2	1.488		1.503
N	4			0.157		
O	7.8		8.2	0.307		0.322



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