

# Power MOSFET Stage for Boost Converters

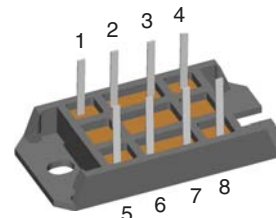
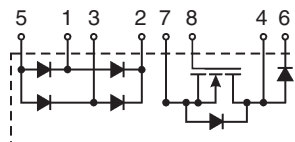
Module for Power Factor Correction

$$I_{D25} = 47 \text{ A}$$

$$V_{DSS} = 500 \text{ V}$$

$$R_{DS(on)} = 0.12 \Omega$$

$V_{RRM(Diode)}$	$V_{DSS}$	Type
V	V	
600	500	VUM 33-05N



Symbol	Conditions	Maximum Ratings		
$V_{DSS}$	$T_{VJ} = 25^{\circ}\text{C}$ to $150^{\circ}\text{C}$	500	V	
$V_{DGR}$	$T_{VJ} = 25^{\circ}\text{C}$ to $150^{\circ}\text{C}$ ; $R_{GS} = 10 \text{ k}\Omega$	500	V	
$V_{GS}$	Continuous	$\pm 20$	V	
$I_D$	<b>MOSFET</b> $T_S = 85^{\circ}\text{C}$	33	A	
$I_D$		$T_S = 25^{\circ}\text{C}$	47	A
$I_{DM}$		$T_S = 25^{\circ}\text{C}$ , $t_p = \textcircled{1}$	130	A
$P_D$	$T_S = 85^{\circ}\text{C}$	310	W	
$I_S$	$V_{GS} = 0 \text{ V}$ , $T_S = 25^{\circ}\text{C}$	33	A	
$I_{SM}$	$V_{GS} = 0 \text{ V}$ , $T_S = 25^{\circ}\text{C}$ , $t_p = \textcircled{1}$	130	A	
$V_{RRM}$	<b>Boost Diode</b> $T_S = 85^{\circ}\text{C}$ , rectangular $\delta = 0.5$	600	V	
$I_{FAV}$		33	A	
$I_{FSM}$		$T_{VJ} = 45^{\circ}\text{C}$ , $t = 10 \text{ ms}$ (50 Hz)	300	A
	$t = 8.3 \text{ ms}$ (60 Hz)	320	A	
	$T_{VJ} = 150^{\circ}\text{C}$ , $t = 10 \text{ ms}$ (50 Hz)	260	A	
	$t = 8.3 \text{ ms}$ (60 Hz)	280	A	
<b>P</b>	$T_S = 85^{\circ}\text{C}$	59	W	
$V_{RRM}$	<b>Rectifier Diodes</b> $T_S = 85^{\circ}\text{C}$ , sinus $180^{\circ}$	1200	V	
$I_{dAV}$		54	A	
$I_{FSM}$		$T_{VJ} = 45^{\circ}\text{C}$ , $t = 10 \text{ ms}$ (50 Hz)	300	A
	$t = 8.3 \text{ ms}$ (60 Hz)	320	A	
	$T_{VJ} = 150^{\circ}\text{C}$ , $t = 10 \text{ ms}$ (50 Hz)	260	A	
	$t = 8.3 \text{ ms}$ (60 Hz)	280	A	
<b>P</b>	$T_S = 85^{\circ}\text{C}$	50	W	
$T_{VJ}$	<b>Module</b>	-40...+150	$^{\circ}\text{C}$	
$T_{JM}$		150	$^{\circ}\text{C}$	
$T_{stg}$		-40...+150	$^{\circ}\text{C}$	
$V_{ISOL}$	50/60 Hz	$t = 1 \text{ min}$	3000	V~
	$I_{ISOL} \leq 1 \text{ mA}$	$t = 1 \text{ s}$	3600	V~
$M_d$	Mounting torque (M5)	2-2.5/18-22	Nm/lb.in.	
<b>Weight</b>		28	g	

$\textcircled{1}$  Pulse width limited by  $T_{VJ}$

## Features

- Package with DCB ceramic base plate
- Soldering connections for PCB mounting
- Isolation voltage 3600 V~
- Low  $R_{DS(on)}$  HDMOS™ process
- Low package inductance for high speed switching
- Ultrafast boost diode
- Kelvin source for easy drive

## Applications

- Power factor pre-conditioner for SMPS, UPS, battery chargers and inverters
- Boost topology for SMPS including 1~ rectifier bridge
- Power supply for welding equipment

## Advantages

- 3 functions in one package
- Output power up to 8 kW
- No external isolation
- Easy to mount with two screws
- Suitable for wave soldering
- High temperature and power cycling capability
- Fits easily to all available PFC controller ICs

Symbol	Conditions	Characteristic Values ( $T_{VJ} = 25^{\circ}\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$V_{DSS}$	$V_{GS} = 0\text{ V}, I_D = 2\text{ mA}$	500		V
$V_{GS(th)}$	$V_{DS} = 20\text{ V}, I_D = 20\text{ mA}$	2		V
$I_{GSS}$	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$			$\pm 500\text{ nA}$
$I_{DSS}$	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$			2 mA
$R_{DS(on)}$	$T_{VJ} = 25^{\circ}\text{C}$			0.12 $\Omega$
$R_{Gint}$	$T_{VJ} = 25^{\circ}\text{C}$			1.5 $\Omega$
$g_{fs}$	$V_{DS} = 15\text{ V}, I_{DS} = 12\text{ A}$	30		S
$V_{DS}$	$I_{DS} = 24\text{ A}, V_{GS} = 0\text{ V}$			1.5 V
$t_{d(on)}$	} $V_{DS} = 250\text{ V}, I_{DS} = 12\text{ A}, V_{GS} = 10\text{ V}$ } $Z_{gen} = 1\ \Omega, L\text{-load}$			100 ns
$t_{d(off)}$				220 ns
$C_{iss}$	} $V_{DS} = 25\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$		8.5	nF
$C_{oss}$			0.9	nF
$C_{rss}$			0.3	nF
$Q_g$	$V_{DS} = 250\text{ V}, I_D = 12\text{ A}, V_{GS} = 10\text{ V}$	350		nC
$R_{thJH}$	with heat transfer paste			0.21 K/W
$V_F$	$I_F = 33\text{ A}; T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 150^{\circ}\text{C}$			1.75 V
				1.5 V
$I_R$	$V_R = 600\text{ V}, T_{VJ} = 25^{\circ}\text{C}$ $V_R = 480\text{ V}, T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			1.5 mA
				0.25 mA
				7 mA
$V_{T0}$	For power-loss calculations only $T_{VJ} = 125^{\circ}\text{C}$			1.21 V
$r_T$				9 m $\Omega$
$I_{RM}$	$I_F = 30\text{ A}; -di_F/dt = 240\text{ A}/\mu\text{s}$ $V_R = 350\text{ V}, T_{VJ} = 100^{\circ}\text{C}$	10		11 A
$R_{thJH}$	with heat transfer paste			1.1 K/W
$V_F$	$I_F = 20\text{ A}, T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			1.5 V
				1.5 V
$I_R$	$V_R = 1200\text{ V}, T_{VJ} = 25^{\circ}\text{C}$ $V_R = 0.8 \cdot V_{RRM}, T_{VJ} = 125^{\circ}\text{C}$			0.25 mA
				2 mA
$V_{T0}$	For power-loss calculations only $T_{VJ} = 125^{\circ}\text{C}$			1.18 V
$r_T$				12 m $\Omega$
$R_{thJH}$	with heat transfer paste			1.3 K/W

Dimensions in mm (1 mm = 0.0394")

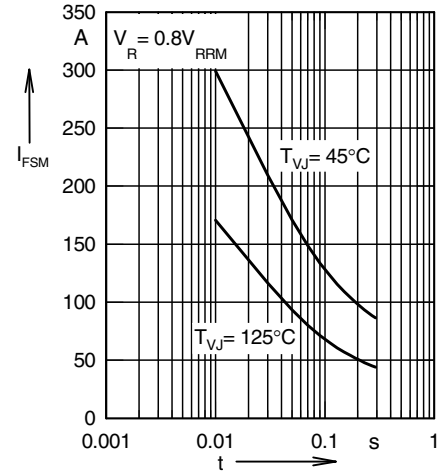
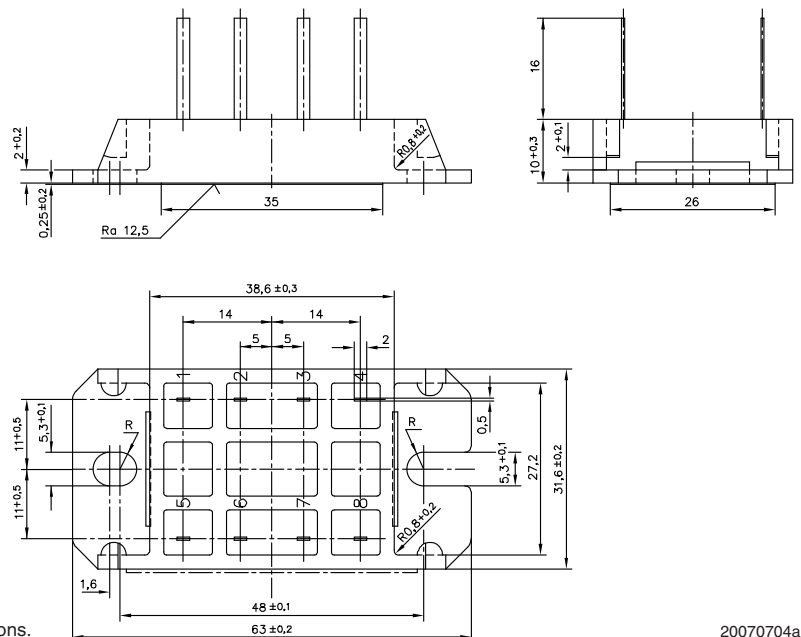


Fig. 1 Non-repetitive peak surge current (Rectifier Diodes)

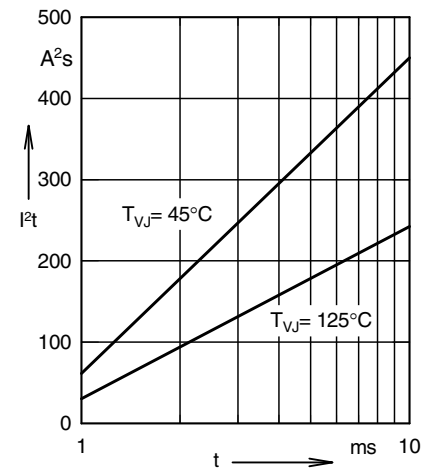


Fig. 2  $I^2t$  for fusing (Rectifier Diodes)

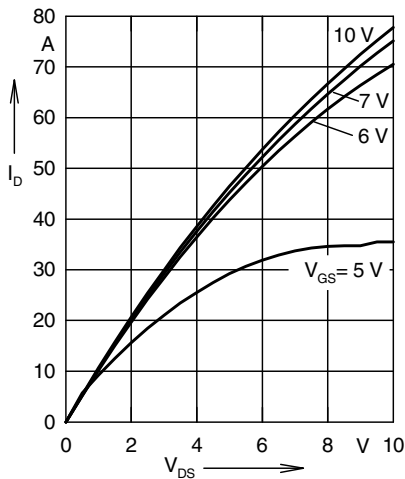


Fig. 3 Typ. output characteristic  $I_D = f(V_{DS})$  (MOSFET)

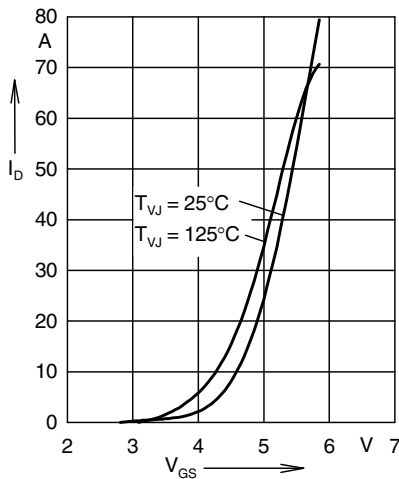


Fig. 4 Typ. transfer characteristics  $I_D = f(V_{GS})$  (MOSFET)

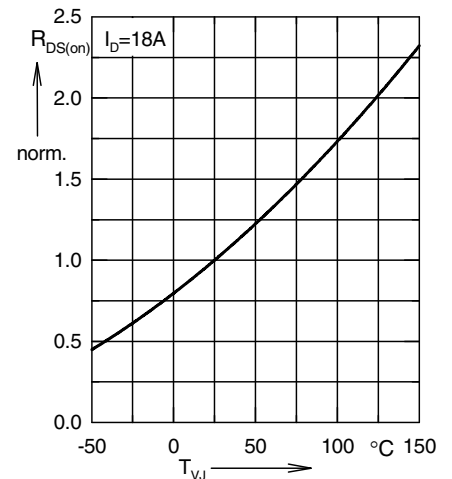


Fig. 5 Typ. normalized  $R_{DS(on)} = f(T_{VJ})$  (MOSFET)

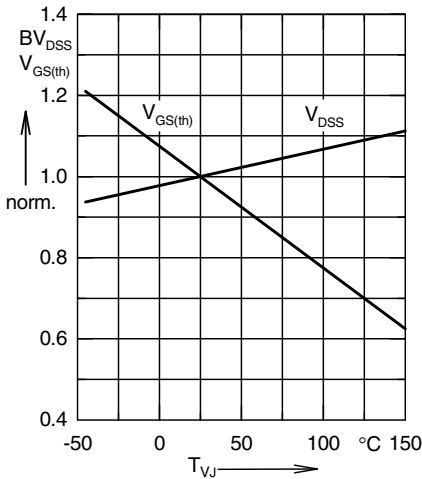


Fig. 6 Typ. normalized  $BV_{DS(sat)} = f(T_{VJ})$   
 $V_{GS(th)} = f(T_{VJ})$  (MOSFET)

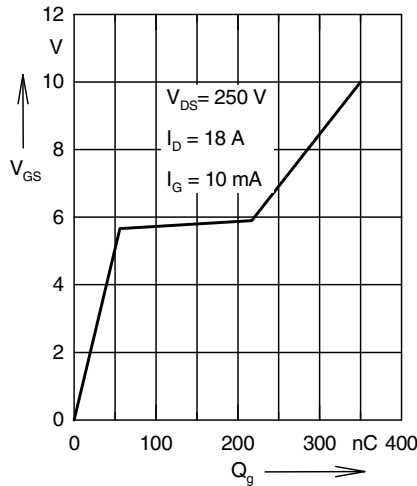


Fig. 7 Typ. turn-on gate charge characteristics,  $V_{GS} = f(Q_g)$  (MOSFET)

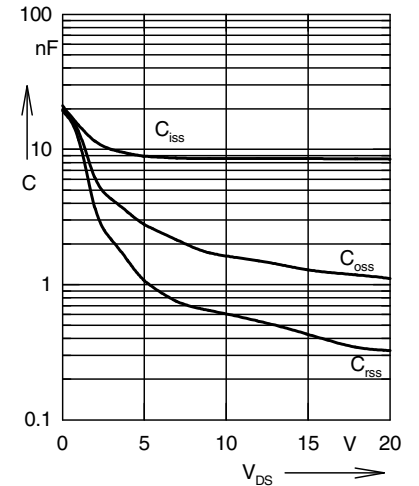


Fig. 8 Typ. capacitances  $C = f(V_{DS})$ ,  $f = 1 \text{ MHz}$  (MOSFET)

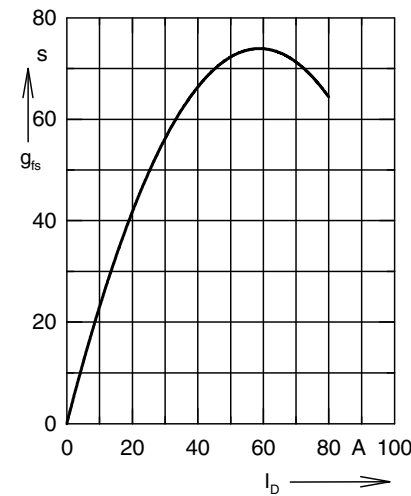


Fig. 9 Typ. transconductance,  $g_{fs} = f(I_D)$  (MOSFET)

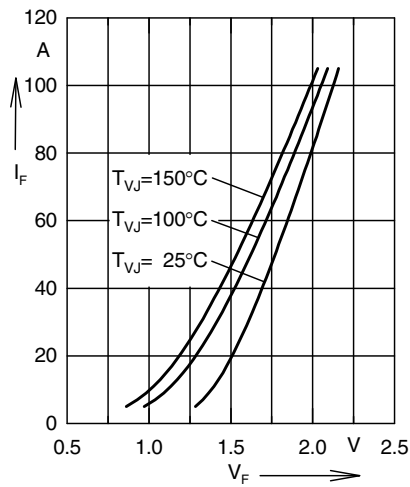


Fig. 10 Forward current versus voltage drop (Boost Diode)

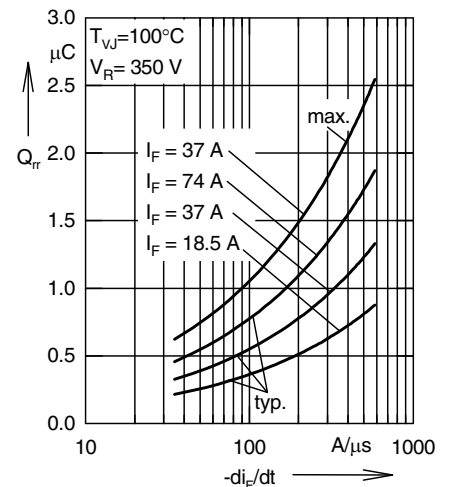


Fig. 11 Recovery charge versus  $-di_F/dt$  (Boost Diode)