STGW20NB60KD

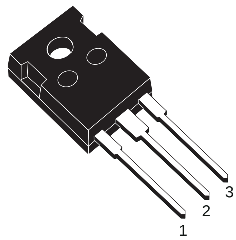
N-CHANNEL 20A - 600V TO-247
SHORT CIRCUIT PROOF PowerMESH™ IGBT

Table 1: General Features

TYPE	V_{CES}	$V_{CE(sat)}$ (Max) @25°C	I_C @100°C
STGW20NB60KD	600 V	< 2.8 V	25 A

- OFF LOSSES INCLUDE TAIL CURRENT
- HIGH CURRENT CAPABILITY
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V_{cesat})
- LOW ON-LOSSES
- LOW GATE CHARGE
- VERY HIGH FREQUENCY OPERATION
- SHORT CIRCUIT RATED
- LATCH CURRENT FREE OPERATION

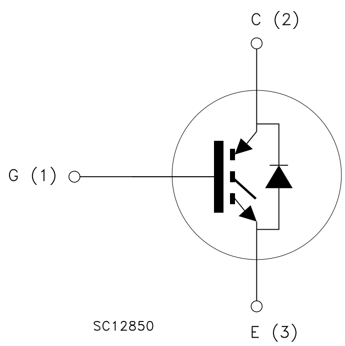
Figure 1: Package



TO-247

Weight: 4.41gr ± 0.01
Max Clip Pressure: 150 N/mm²

Figure 2: Internal Schematic Diagram



DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "K" identifies a family optimized for high frequency motor control applications with short circuit withstand capability.

APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- U.P.S
- WELDING EQUIPMENTS

Table 2: Order Codes

SALES TYPE	MARKING	PACKAGE	PACKAGING
STGW20NB60KD	GW20NB60KD	TO-247	TUBE

Rev. 3

Table 3: Absolute Maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-Emitter Voltage (V_{GS} = 0)	600	V
V_{ECR}	Reverse Battery Protection	20	V
V_{GE}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current (continuous) at 25°C (#)	50	A
I_C	Collector Current (continuous) at 100°C (#)	25	A
I_{CM} (1)	Collector Current (pulsed)	100	A
T_{SC}	Short Circuit Withstand	10	µs
P_{TOT}	Total Dissipation at T_C = 25°C	170	W
	Derating Factor	1.2	W/°C
T_{stg}	Storage Temperature	– 55 to 150	°C
T_j	Operating Junction Temperature		

(1)Pulse width limited by max. junction temperature.

Table 4: Thermal Data

		Min.	Typ.	Max.	
Rthj-case	Thermal Resistance Junction-case	--	--	0.73	°C/W
Rthj-amb	Thermal Resistance Junction-ambient	--	--	50	°C/W

Electrical Characteristics (T_{case} =25°C unless otherwise specified)

Table 5: Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collectro-Emitter Breakdown Voltage	I_C = 250 µA, V_{GE} = 0	600			V
I_{CES}	Collector-Emitter Leakage Current (V_{CE} = 0)	V_{GE} = Max Rating Tc=25°C Tc=125°C			 10 100	 µA µA
I_{GES}	Gate-Emitter Leakage Current (V_{CE} = 0)	V_{GE} = ± 20 V , V_{CE} = 0			± 100	nA

Table 6: On

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Threshold Voltage	V_{CE}= V_{GE}, I_C= 250 µA	5		7	V
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	V_{GE}= 15 V, I_C= 20A, Tj= 25°C V_{GE}= 15 V, I_C= 20A, Tj= 125°C		2.3 1.9	2.8	V V

(#) Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{JMAX} - T_C}{R_{THJ-C} \times V_{CESAT(MAX)}(T_C, I_C)}$$

ELECTRICAL CHARACTERISTICS (CONTINUED)

Table 7: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs}	Forward Transconductance	V_{CE} = 25 V, I_C= 20 A		8		S
C_{ies} C_{oes} C_{res}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{CE} = 25V, f = 1 MHz, V_{GE} = 0		1560 190 38		pF pF pF
Q_g Q_{ge} Q_{gc}	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	V_{CE} = 480 V, I_C = 20 A, V_{GE} = 15V, (see Figure 19)		85 14.4 51	115	nC nC nC
tscw	Short Circuit Withstand Time	V_{ce} = 0.5 BV_{ces} , Tj = 125°C R_G = 10 Ω, V_{GE}= 15V	10			µs

Table 8: Switching On

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Delay Time Current Rise Time	V_{CC} = 480 V, I_C = 20 A R_G= 10Ω, V_{GE}= 15V, Tj= 25°C (see Figure 17)		39 35		ns ns
$(di/dt)_{on}$ Eon (2)	Turn-on Current Slope Turn-on Switching Losses	V_{CC} = 480 V, I_C = 20 A R_G= 10Ω, V_{GE}= 15V, Tj= 125°C (see Figure 17)		453 675		A/µs µJ

2) Eon is the turn-on losses when a typical diode is used in the test circuit in Figure 17. If the IGBT is offered in a package with a co-pack diode, the co-pack diode is used as external diode.

Table 9: Switching Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ t_c $t_d(_{off})$ t_f E_{off} (3) E_{ts}	Off Voltage Rise Time Cross-over Time Turn-off Delay Time Current Fall Time Turn-off Switching Loss Total Switching Loss	V_{cc} = 480 V, I_C = 20 A, R_{GE} = 10 Ω , V_{GE} = 15 V T_J = 25 °C (see Figure 17)		25 160 105 95 0.5 0.9		ns ns ns ns mJ mJ
$t_r(V_{off})$ t_c $t_d(_{off})$ t_f E_{off} (3) E_{ts}	Off Voltage Rise Time Cross-over Time Turn-off Delay Time Current Fall Time Turn-off Switching Loss Total Switching Loss	V_{cc} = 480 V, I_C = 20 A, R_{GE} = 10 Ω , V_{GE} = 15 V Tj = 125 °C (see Figure 17)		46 175 130 150 0.70 1.35		ns ns ns ns mJ mJ

(3)Turn-off losses include also the tail of the collector current.

Table 10: Collector-Emitter Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_f I_{fm}	Forward Current Forward Current pulsed				20 80	A A
V_f	Forward On-Voltage	I_f = 10 A I_f = 10 A, Tj = 125 °C		1.27 1	2.0	V V
t_{rr} Q_{rr} I_{rrm}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_f = 10 A ,V_R = 27 V, Tj =125°C, di/dt = 100 A/µs (see Figure 20)		80.5 181 4.5		ns nC A

Figure 3: Output Characteristics

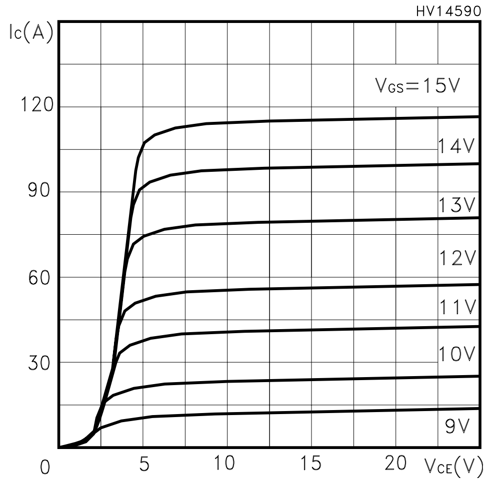


Figure 6: Transfer Characteristics

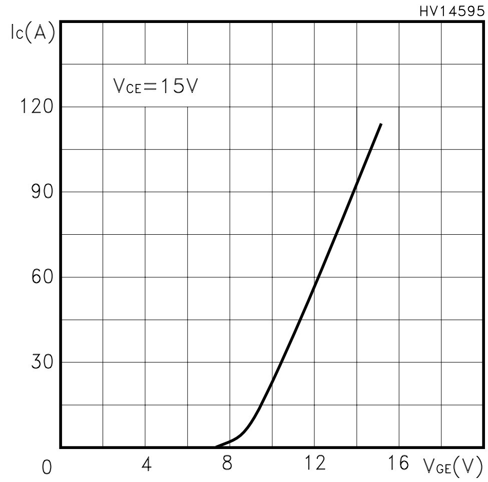


Figure 4: Transconductance

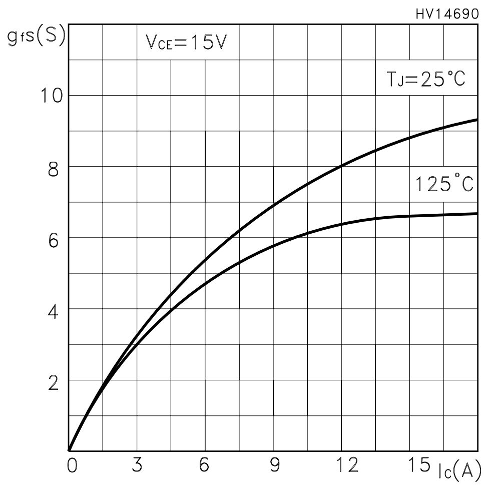


Figure 7: Collector-Emitter On Voltage vs Temperature

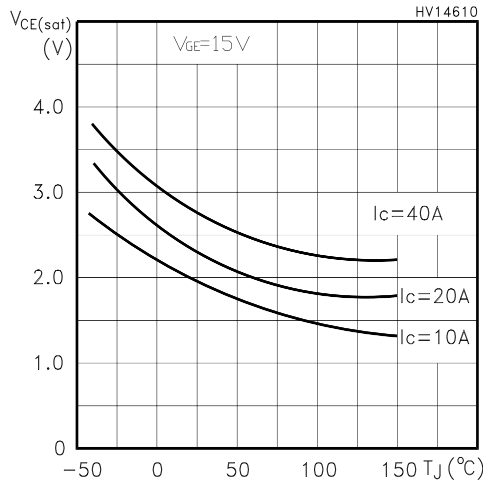


Figure 5: Collector-Emitter On Voltage vs Collector Current

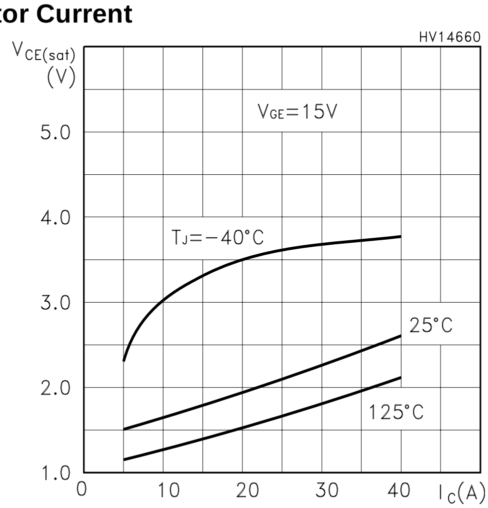


Figure 8: Normalized Gate Threshold vs Temperature

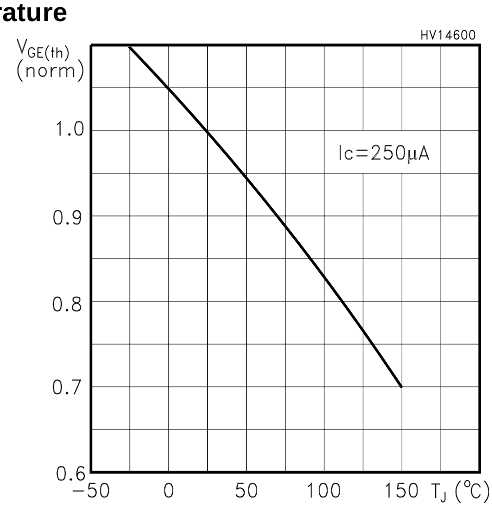


Figure 9: Normalized Breakdown Voltage vs Temperature

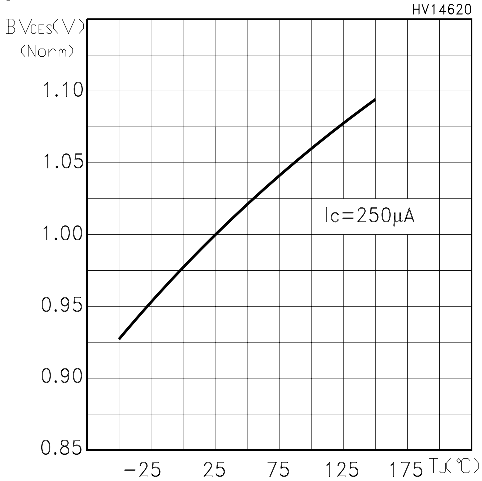


Figure 10: Capacitance Variations

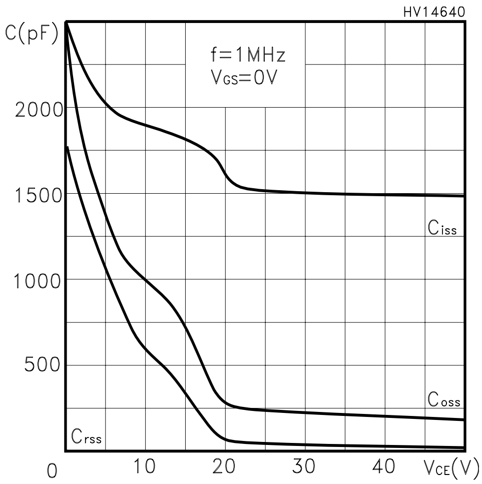


Figure 11: Turn-Off Energy Losses vs Temperature

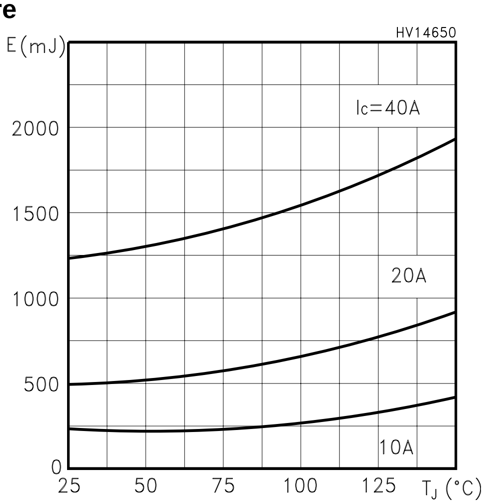


Figure 12: Gate Charge vs Gate-Emitter Voltage

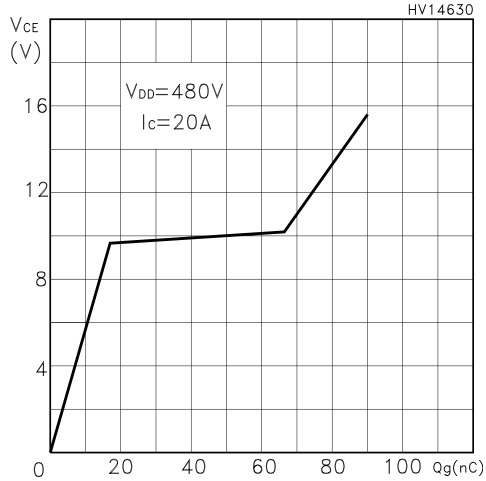


Figure 13: Diode Forward Voltage

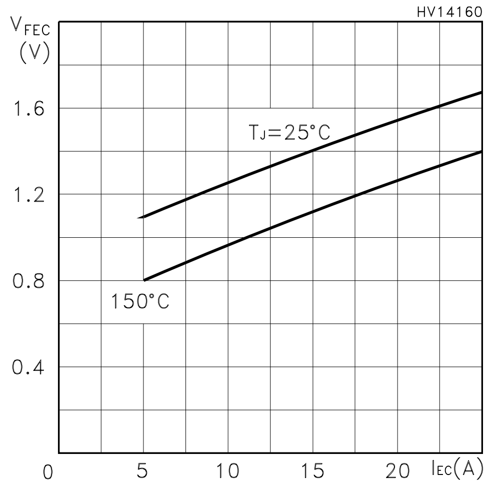


Figure 14: Total Switching Losses vs Collector Current

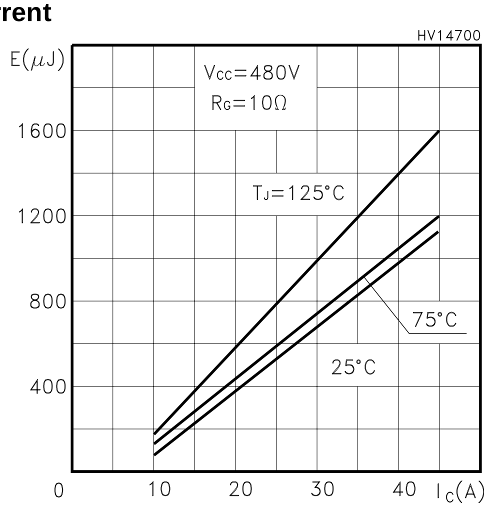


Figure 15: Thermal Impedance

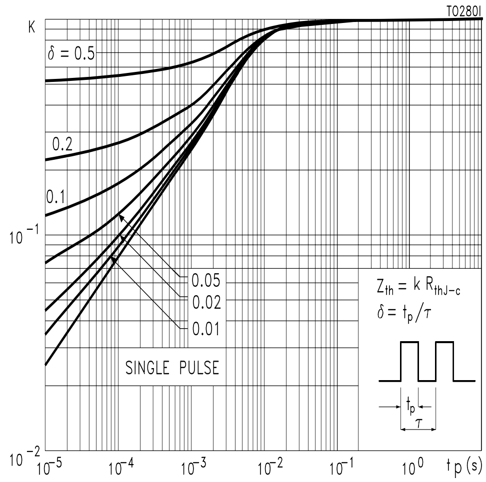


Figure 16: Turn-Off SOA

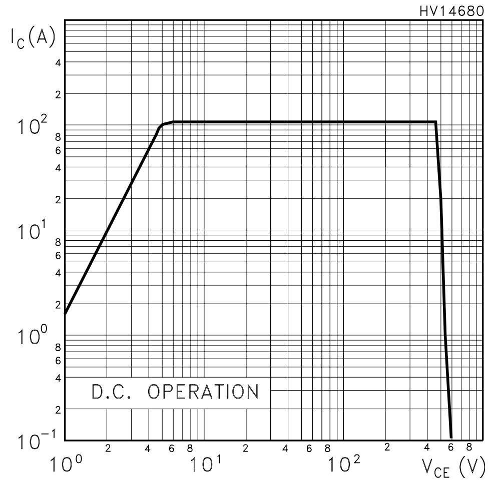


Figure 17: Test Circuit for Inductive Load Switching

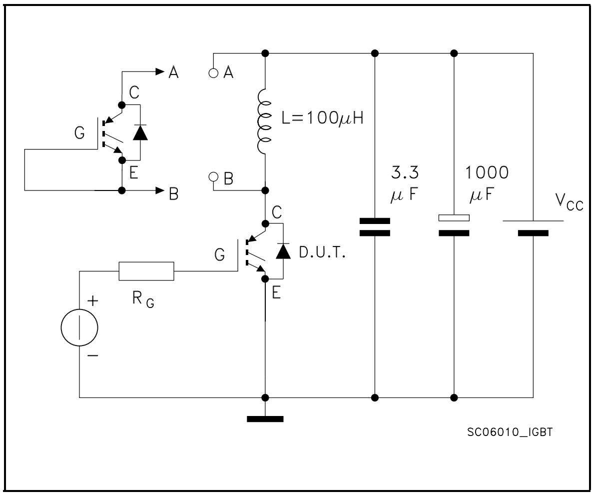


Figure 18: Switching Waveforms

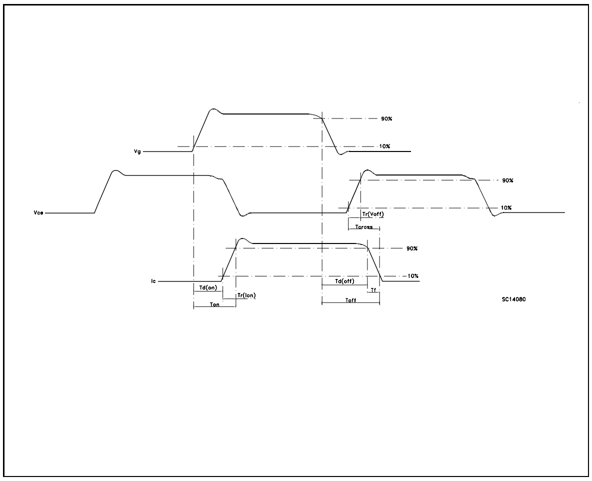


Figure 19: Gate Charge Test Circuit

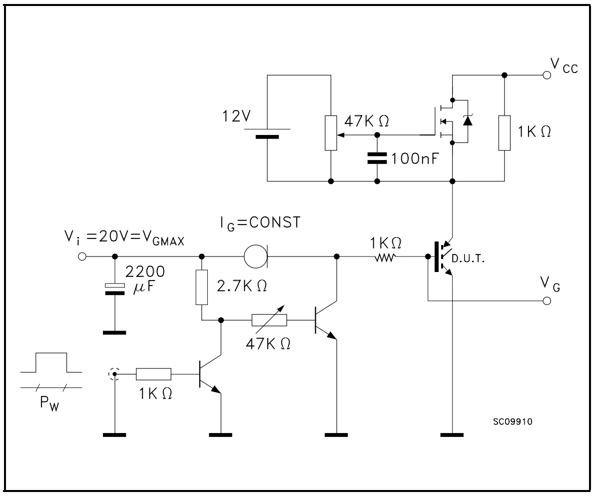
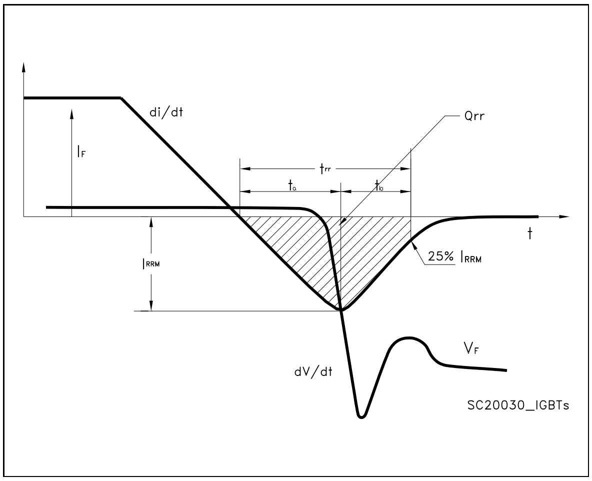


Figure 20: Diode Recovery Times Waveform



TO-247 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
A1	2.20		2.60	0.086		0.102
b	1.0		1.40	0.039		0.055
b1	2.0		2.40	0.079		0.094
b2	3.0		3.40	0.118		0.134
c	0.40		0.80	0.015		0.03
D	19.85		20.15	0.781		0.793
E	15.45		15.75	0.608		0.620
e		5.45			0.214	
L	14.20		14.80	0.560		0.582
L1	3.70		4.30	0.14		0.17
L2		18.50			0.728	
øP	3.55		3.65	0.140		0.143
øR	4.50		5.50	0.177		0.216
S		5.50			0.216	

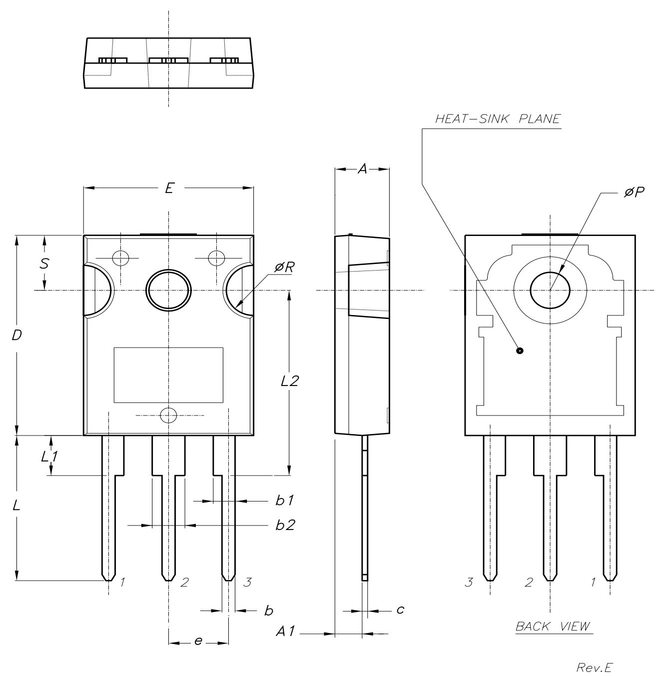


Table 11: Revision History

Date	Revision	Description of Changes
21-Mar-2005	2	New stylesheet. Some value changed on Table 3 and 4
05-Apr-2005	3	New updated values in table 3